ETSI-GSM

Technical

Specification

GSM 11.20

Version 3.19.0

UDC: 621.396.21

Key words: European Digital Cellular Telecommunications System, Global System for Mobile Communications (GSM)

GSM

Base Station System

Equipment Specification

PREFATORY NOTE

ETSI has constituted stable and consistent documents which give specifications for the implementation of the European Cellular Telecommunications System. Historically, these documents have been identified as "GSM recommendations".

Some of these recommendations may subsequently become Interim European Telecommunications Standards (I-ETSs) or European Telecommunications Standards (ETSs), whilst some continue with the status of ETSI-GSM Technical Specifications. These ETSI-GSM Technical Specifications are for editorial reasons still referred to as GSM recommendations in some current GSM documents.

The numbering and version control system is the same for ETSI-GSM Technical Specifications as for "GSM recommendations".

ETSI / TC SMG
Released by: ETSI/PT12/48V
Date : December 1995

Title : **ETSI TECHNICAL SPECIFICATION GSM 11.20**
THE GSM BASE STATION SYSTEM: EQUIPMENT SPECIFICATION
Version 3.19.0

Contents :

Language of original: English
Number of pages in total: 416

This page is intentionally left blank !

Detailed contents list
****

5. BASE STATION SYSTEM NETWORK ASPECTS

5.1. BASE STATION SYSTEM NETWORK FUNCTIONS
5.1.1. General
5.1.2. Testing of the DTAP
5.1.2.1. Messages from MSC to MS
5.1.2.2. Messages from MS to MSC
5.1.3. Testing of the BSSMAP and RR functions
5.1.3.1. System information
5.1.3.2. Service requests in SABM frames
5.1.3.3. Random access by MS and immediate assignment
5.1.3.4. Paging
5.1.3.5. Measurement reporting
5.1.3.6. Assignment
5.1.3.7. External handover as seen from the old BSS
5.1.3.8. External handover as seen from the new BSS
5.1.3.8.1. Non-synchronized network
5.1.3.8.2. Synchronized network
5.1.3.9. Internal handover
5.1.3.9.1. Internal inter-cell handover
5.1.3.9.2. Internal intra-cell handover
5.1.3.9.2.1. Intra-cell handover by the assignment procedure
5.1.3.9.2.2. Intra-cell handover by the handover procedure
5.1.3.10. Frequency redefinition
5.1.3.11. Transmission mode change
5.1.3.12. Ciphering mode setting
5.1.3.13. Additional assignment
5.1.3.14. Partial release
5.1.3.15. Classmark change
5.1.3.16. Channel release
5.1.3.17. Radio link failure
5.1.3.18. Blocking
5.1.3.19. Resource indication
5.1.3.20. Reset
5.1.3.20.1. Global reset
5.1.3.20.1.1. Global reset at the BSS
5.1.3.20.1.2. Global reset at the MSC

6. BASE STATION CONTROLLER NETWORK ASPECTS

6.1. BASE STATION CONTROLLER NETWORK FUNCTIONS
6.1.1. General
6.1.2. Transparent messages
6.1.3. Non-transparent messages
6.1.3.1. Link establishment indication
6.1.3.2. Link establishment request
6.1.3.3. Link release indication
6.1.3.4. Link release request
6.1.3.5. Transmission of transparent L3-message in acknowledged mode
6.1.3.6. Reception of transparent L3-message in acknowledged mode
6.1.3.7. Transmission of transparent L3-message in unacknowledged mode
6.1.3.8. Reception of transparent L3-message in unacknowledged mode
6.1.3.9. Link error indication
6.1.3.10. Channel activation
6.1.3.11. Channel mode modify
6.1.3.12. Handover detection
6.1.3.13. Start of encryption
6.1.3.14. Measurement reporting
6.1.3.14.1. Basic measurement reporting
6.1.3.14.2. Preprocessed measurement reporting (optional)
6.1.3.14.3. Preprocessing configuration (optional)
6.1.3.15. Deactivate SACCH
6.1.3.16. Radio channel release
6.1.3.17. MS power control
6.1.3.18. Transmission power control (optional)
6.1.3.19. Connection failure
6.1.3.20. Physical context request (optional)
6.1.3.21. Channel request by MS
6.1.3.22. Paging
6.1.3.23. Delete indication
6.1.3.24. CCCH load indication
6.1.3.25. Broadcast information modify
6.1.3.26. Immediate assignment
6.1.3.27. Short Message Service Cell Broadcast (SMSCB)
6.1.3.28. Radio resource indication
6.1.3.29. SACCH filling information modify
6.1.3.30. Flow control
6.1.3.31. Error reporting

1. GENERAL

1.1. SCOPE

This specification contains the technical specifications for the testing of the Base Station System (BSS) of the Pan European Digital Mobile Radio System (GSM), meeting Phase 1 GSM requirements.
This specification does not contain EMC requirements for the BSS. This is specified in ETS 300 342-2, "Electromagnetic compatibility (EMC) for European digital cellular telecommunication system (GSM 900MHz and DCS1800MHz) Part2: Base station radio and ancillary equipment. ETS 300 342-2 contains extracts from, and references to, parts of GSM 11.20 for the following EMC requirements:

- radiated emissions
- emissions, antenna ports (conducted spurious emissions from transmitter and receiver antenna connectors)
- Immunity, receiver antenna port (blocking)

These technical specifications may be used as a basis for procurement and acceptance of BSSs by administrations and GSM Operators.
They do not necessarily include all the characteristics which may be required, nor do they necessarily represent the optimum performance achievable. The national administrations or GSM operators may set additional requirements.
The standardized tests in this specification are performed without any traffic load. Testing of a GSM Base Station System under traffic load conditions are outside the scope of this specification. Load testing of a BSS is a national or operator specific matter. The load testing of a BSS under traffic load may differ depending on the internal structure of a BSS. It should be noted, however, that verification of a BSS under traffic load conditions is very important.
The specifications are produced such that BSSs of different manufacturers can be connected to Mobile services Switching Centres (MSCs) of different manufacturers.
In the case of a BSS consisting of separate Base Station Controller (BSC) and one or several Base Transceiver Stations (BTSs), also these shall be interconnectable even if they are produced by different manufacturers.
It is the aim that the tests described in this specification shall be possible to perform in an automated manner with a minimum of man-machine interventions, however, such that no restrictions are placed upon the test method.
The tests in this equipment specification are based upon the full set of specifications in the GSM-series of specifications. In case of any inconsistency between this specification and the source specifications, the source specifications shall prevail.

The tests are for guidance to GSM operators for acceptance testing of Base Station Systems. It is a national or operator specific matter whether or not to perform the full set of tests. However, all the requirements are intended as mandatory unless otherwise stated. Some tests are only to be carried out if a specific option is implemented in the BSS and some requirements are included for guidance only. Some sections are also included for guidance only.

1.2. INTRODUCTION

The Base Station Systems (BSSs) specified in these specifications have to interface with:

- the Mobile Stations (MSs) over the radio interface as by the GSM 04 and 05-series of specifications,
- the Mobile Switching Centre (MSC) over the A-interface (MSC/BSS-interface) given in the GSM 08.0x-series of specifications,
- the Operation and Maintenance Centre (OMC) over the OMC-interface given in the GSM 08.0x and GSM 12.xx-series of specifications,
- the power supply,
- the environment.

In addition to these interfacing requirements the GSM Base Station systems are also defined by:

- the network and network management functions to be performed in the Base Station Systems as given in the GSM 04, 08 and 12-series of specifications,
- the transmission requirements through the Base Station System from the radio interface to a 64 kbit/s interface according to GSM 03.50 and the GSM 06-series of specificatons,
- the internal BSC/BTS-interface (A-bis-interface), if used, as given in the GSM 08.5x and 08.6x-series of specifications.

The general structure of a GSM Public Land Mobile Network (PLMN) is illustrated in GSM 01.02.
A Base Station System (BSS) communicates with a number of Mobile Stations over a set of logical channels being constructed of physical channels over the radio path. The total number of logical channels in a BSS depends on the capacity needed in the BSS. The logical channel structures and access capabilities on the radio interface in a BSS are described in GSM 04.03.

A BSS communicates on the network side with the Mobile services Switching Centre (MSC) by passing the various logical channels over the A-interface (MSC/BSS-interface) as described in the GSM 08.0x-series of specifications. The BSS also communicates with an Operations and Maintenance Centre (OMC), which performs remote network management functions, over the A-interface. Optionally a separate OMC-interface may also be provided. Irrespective of whether the A-interface or separate OMC-interface is used, throughout this specification the interface towards the OMC is referred to as the OMC-interface.

This equipment specification is structured as follows:

Section 1 includes definitions of BSS types and BSS related entities.

Section 2 contains the tests for the air interface including basic RF tests and generally tests of Layer 1 and Layer 2 functions.

Section 3 defines the Layer 1 and Layer 2 tests for the internal A-bis-interface.

Section 4 defines the Layer 1 and Layer 2 tests for the A-interface.

Section 5 verifies the network functions and transmission requirements for the integrated BSS. The network functions include the Layer 3 tests for the air interface and A-interface as well as transcoding and rate adaptation tests.

Section 6 verifies the network functions and transmission requirements for the BSC. The network functions include the Layer 3 tests for the A-bis-interface and A-interface as well as transcoding and rate adaptation tests.

Section 7 verifies the network functions and transmission requirements for the BTS. The network functions include the Layer 3 tests for the air interface and A-bis-interface as well as transcoding and rate adaptation tests.

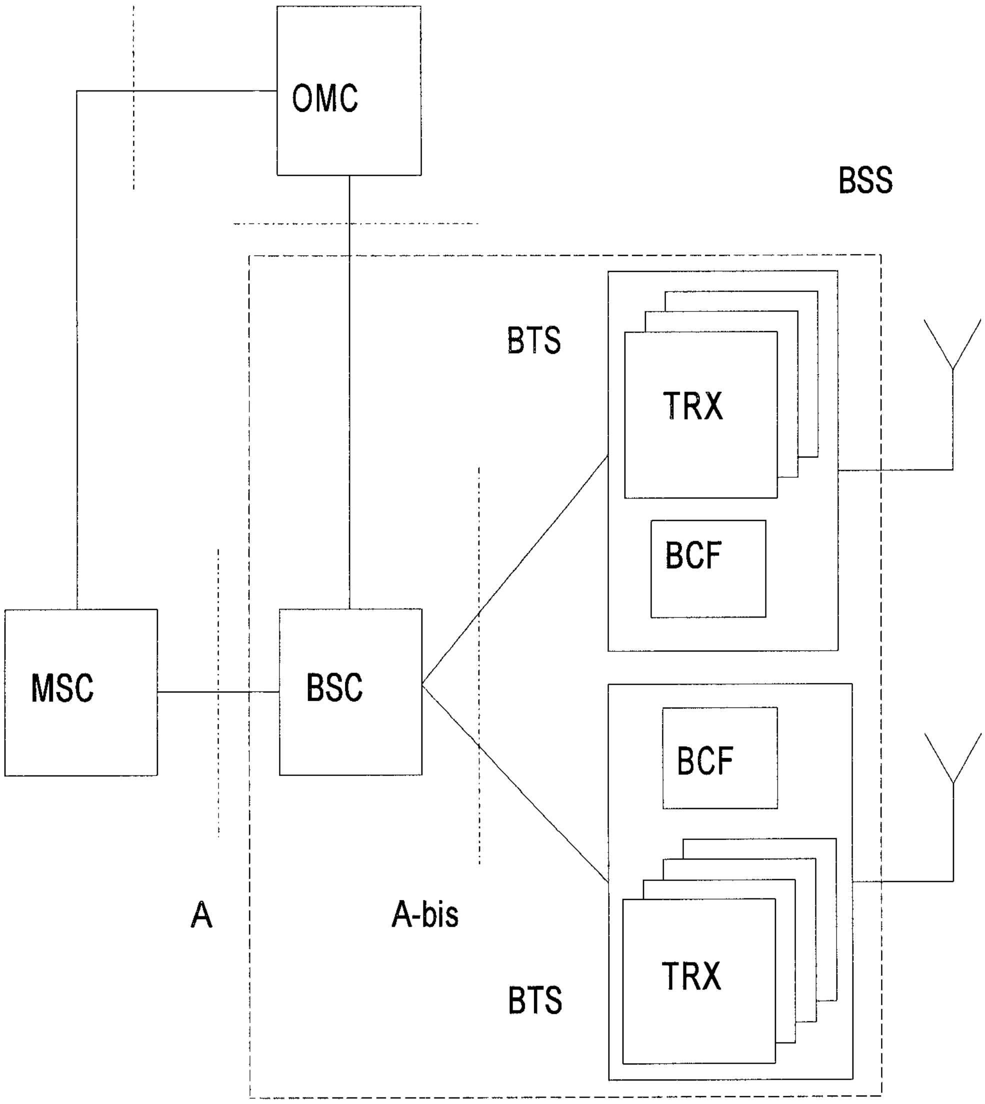
Section 8 contains the lower layer aspects of Network Management interfacing for an integrated BSS, ie interfacing with the OMC. The Network Management functions at the application layer are tested in GSM 11.21.

Section 9 contains the lower layer aspects of Network Management interfacing for a BSC, ie interfacing with the OMC. The Network Management functions at the application layer are tested in GSM 11.21.

Section 10 contains the lower layer aspects of Network Management interfacing for a BTS, ie O&M interfacing with the OMC via the A-bis-interface. The Network Management functions at the application layer are tested in GSM 11.21.
Section 11 summarizes the test points and interfaces which are required in the BSS for operation and for acceptance testing.
Annex 1 gives general requirements on the test methods.
Annex 2 gives a list of relevant specificationsfor this BSS equipment specification.
Annex 3 gives physical and test parameters for fixed GSM and co-located equipment.
Annex 4 shows the elementary Layer 3 procedures for Radio Resource management (RR) and gives background information for the Layer 3 tests of the various BSS parts, BSC or BTS or the BSS as a whole.

1.3. DEFINITION OF BASE STATION SYSTEM TYPES

The BSS includes normally one set of transceivers covering the same radio coverage area consisting of a set of adjacent cells, ie an integrated BSS at one site, but may also consist of several sets of transceivers covering several radio coverage areas. In this case the functional structure in fig 1-1 applies. A set of Transceivers (TRXs) covering the same radio coverage area, ie a cell as seen by the MSs and by the network, is referred to as a Base Transceiver Station (BTS). The BTS includes in addition to the TRXs a Base Control Function (BCF) which performs common control functions in the BTS. The BTS is controlled by a Base Station Controller (BSC) over the A-bis-interface, which is optional for implementation by GSM network operators. A BSC may control several BTSs.
The location of the equipment performing the transcoding function to 64 kbit/s can also optionally be located internally or externally (ie colocated with the MSC) to the BSS equipment. A complete BSS, as defined by the radio interface and the A-interface, includes, however, functionally the transcoding equipment. If the transcoding is performed in the BSC, four 16 kbit/s channels may be multiplexed into one 64 kbit/s channel. This multiplexing is, however, up to the operator.



BSS=Base Station System
BSC=Base Station Controller
BTS=Base Transceiver Station
BCF=Base Control Function
TRX=Transceiver
OMC=Operations and Maintenance Centre

Figure 1-1: Configuration of the Base Station System (BSS) when the A-bis-interface and the separate OMC-interface are implemented

The possible Base Station System types in the GSM system are consequently as indicated below and in Table 1-1:

- BSS type 1: BSS with internally located transcoding and no internal BSC/BTS-interfaces
- BSS type 2: BSS with externally located transcoding and no internal BSC/BTS-interfaces
- BSS type 3: BSS with transcoding in BTSs and internal BSC/BTS-interfaces (64 kbit/s A-bis-interface)
- BSS type 4: BSS with transcoding in BSC and internal BSC/BTS-interfaces using multiplexing of four 16 kbit/s channels into 64 kbit/s (16 kbit/s A-bis-interface)
- BSS type 5: BSS with transcoding in BSC and internal BSC/BTS-interfaces without multiplexing of 16 kbit/s channels (16/64 kbit/s A-bis-interface)
- BSS type 6: BSS with externally located transcoding and internal BSC/BTS-interfaces using multiplexing of four 16 kbit/s channels into 64 kbit/s (16 kbit/s A-bis-interface)
- BSS type 7: BSS with externally located transcoding and internal BSC/BTS-interfaces without multiplexing of 16 kbit/s channels (16/64 kbit/s A-bis-interface)

BSS type:	Integr./ distr. BSS:	A-bis-int. net bit rate:	Int./ext. transc. to BSC:	Multiplexed/ rate adapted A-bis-int.:
1	Int.	-	Int.	-
2	Int.	-	Ext.	-
3	Distr.	64	-	-
4	Distr.	16	Int.	Mult.
5	Distr.	16	Int.	Rate
6	Distr.	16	Ext.	Mult.
7	Distr.	16	Ext.	Rate

Table 1-1: Overview of BSS types in GSM

It should be noted that BBS types 5 and 7 may be modified to BSS types 4 and 6, respectively, simply by adding external multiplex equipment to them on each side of the A-bis-interface.

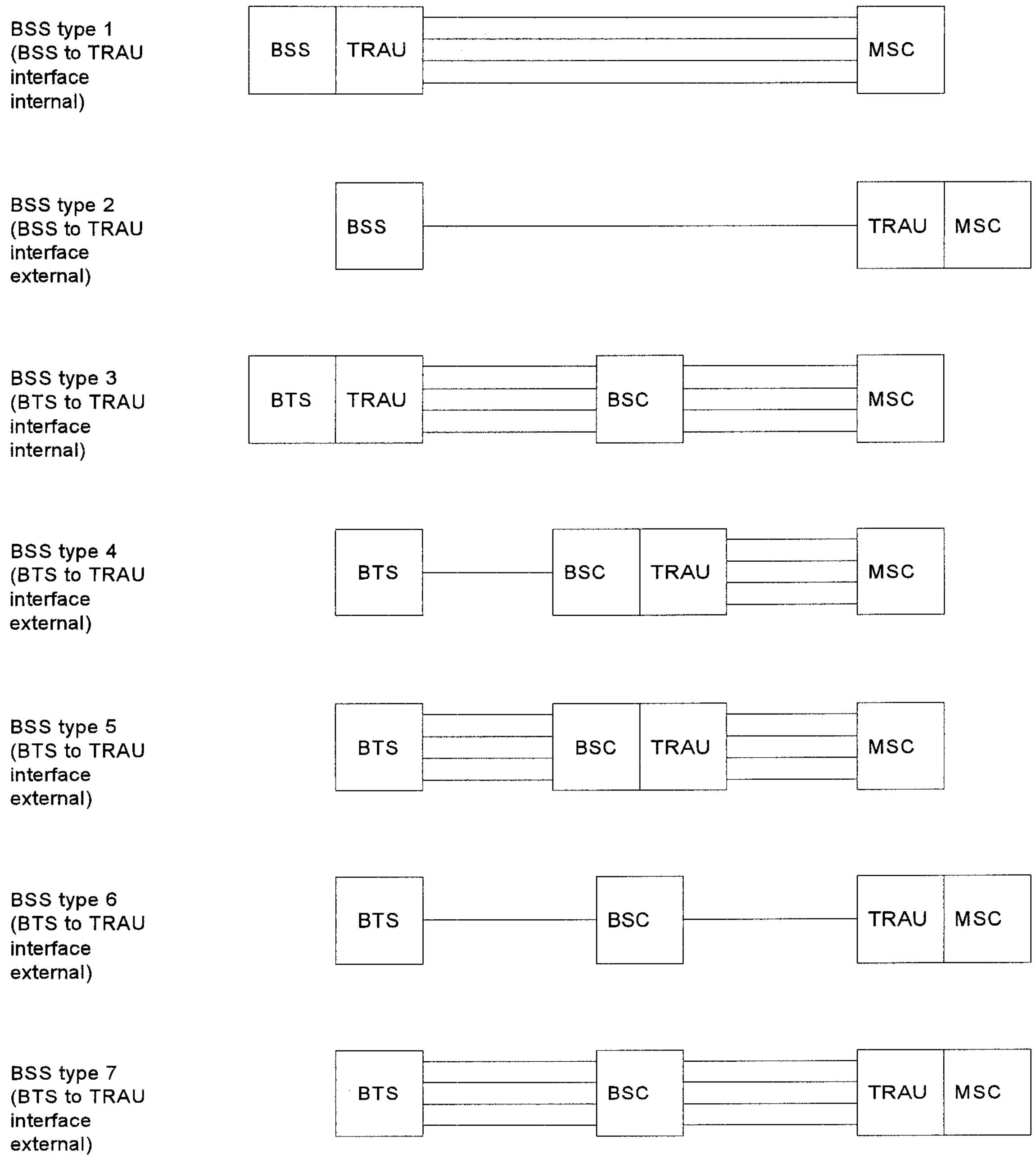


Figure 1-2: Supporting 4 TCHs in each GSM BSS type

Figure 1-2 is drawn to show the number of 64 kbit/s links required for each BSS type in order to support 4 traffic channels. However, the main message it conveys is to show whether the interface between the transcoder and the BSS and the transcoder and the BTS is internal (proprietary) or the inband remote control interface defined in GSM 08.60. For the lower layers, the BSC performs only a switching / routing function and hence its interface is driven by that of the BTS and the location of the transcoder.

The text that follows in the next two paragraphs is tabulated for quick reference in Table 1-2.

If the transcoder to BSS / BTS interface is internal, then in the case of the BSS, the BSS and the transcoder are tested using section 5. However, in the case of the BTS, the transcoder is tested using sections 5.1.4 and 5.2 and the BTS is tested using section 6, except for the transcoder tests in the sections 6.1.4, 6.2, 6.3 and 6.4, which are now not performed. When using sections 5.1.5 and 5.2 to test a transcoder internal to a BTS, occurrences of the word BSS shall be interpreted as the BTS internal interface to the transcoder.

If the transcoder to BSS / BTS interface is external due to the location of the transcoder at either the BSC site or the MSC site, then the inband remote control interface will exist as defined in GSM 08.60 between the transcoder and the BSS / BTS (BSC only switches). In these cases, the transcoder is always tested using sections 6.1.4, 6.2, 6.3 and 6.4. In the case of a BTS, it is tested using sectin 7. In the case of a BSS, it is tested using section 5, expect the transcoder tests in sectins 5.1.4 and 5.2, are now replaced by tests which check correct operation of the BSS to transcoder remote control interface i.e., those found in sections 7.1.4, 7.2, 7.3 and 7.4. When using sections 7.1.4, 7.2, 7.3 and 7.4 to test the BSS transcoder interface, occurrences of the word BTS shall be interpreted as the BSS interface to the external transcoder.

BSS type	section	applies to	section	applies to	
1	5-5.1.3	BSS		5.1.4-5.2	transcoder
2	5-5.1.3	BSS		6.1.4-6.4	transcoder
	7.1.4-7.4	BSS			
3	6-6.1.3	BSC		5.1.4-5.2	transcoder
	7-7.1.3	BTS			
4	6-6.1.3	BSC		6.1.4-6.4	transcoder
	7	BTS			
5	6-6.1.3	BSC		6.1.4-6.4	transcoder
	7	BTS			
6	6-6.1.3	BSC		6.1.4-6.4	transcoder
	7	BTS			
7	6-6.1.3	BSC		6.1.4-6.4	transcoder
	7	BTS			

Table 1-2: Transcoding testing reference table

In addition several classes of Base Station Systems are defined by the fact that Slow Frequency Hopping (SFH), downlink Discontinuous Transmission (DTX) and downlink RF power control are optional for implementation in the BSS:

- BSS class 1: No SFH, no power control, no downlink DTX
- BSS class 2: No SFH, power control, no downlink DTX
- BSS class 3: SFH, no power control, no downlink DTX
- BSS class 4: SFH, power control, no downlink DTX
- BSS class 5: No SFH, no power control, downlink DTX
- BSS class 6: No SFH, power control, downlink DTX
- BSS class 7: SFH, no power control, downlink DTX
- BSS class 8: SFH, power control, downlink DTX

1.4. DEFINITIONS AND ABBREVIATIONS

A comprehensive list of defined terms used in the GSM specificationscan be found in GSM 01.04. The following definitions and abbreviations are also included in this recommendation.

1) Base Station System (BSS)
The system of Base Station equipments (transceivers, controllers etc) which is viewed by the MSC through a single interface as defined by the GSM 08.0x-series of specificationsbeing the entity responsible for communicating with Mobile Stations in a certain area.
The radio equipment in a BSS may cover one or more cells. If an internal A-bis-interface according to the GSM 08.5x-series and GSM 08.6x-series of specificationsis implemented, the BSS shall consist of one Base Station Controller (BSC) and several Base Transceiver Stations (BTSs). The functionality of a BSS is given in GSM 08.02.
2) Base Station Controller (BSC)
A network component in the PLMN with the functions for control of one or more Base Transceiver Stations (BTSs).
3) Base Transceiver Station (BTS)
A network component which serves one cell in the cellular network and is controlled by a Base Station Controller (BSC). The BTS contains ore or more Transceivers (TRXs).
4) Integrated Base Station System (BSS)
A BSS without any internal A-bis-interfaces.

5) Base Control Function (BCF)
A functional entity which handles common control functions within a Base Transceiver Station (BTS).

6) Transceiver (TRX)
A network component which can serve full duplex communication on 8 full-rate traffic channels according to recommendation GSM 05.02. If SFH is not used, the TRX serves the communication on one RF carrier.

7) Mobile services Switching Centre (MSC)
The MSC provides the interface between the PLMN and the PSTN. The MSC interfaces the PSTN on one side and the BSSs on the other side and performs all necessary functions in order to handle the calls to and from the Mobile Stations.

8) Mobile Station (MS)
A station in the mobile service intended to be used while in motion (quoted from the radio regulations no 67).

9) Operations and Maintenance Centre (OMC)
A network management entity used for remote operations and maintenance of the PLMN. The network management functions for the PLMN need to be monitored and controlled by one or more OMCs.

10) Base Station System Test Equipment (BSSTE)
A functional unit which may be used for acceptance testing of GSM Base Station Systems.

11) Cell
The area of radio coverage locally defined as seen by the Mobile Stations with a Base Station Identity Code (BSIC) and uniquely defined as seen by the network with a global Cell Identity (CI).

2. RADIO INTERFACING

The tests in this section apply to an integrated BSS as well as to a BTS.

2.1. PHYSICAL INTERFACE

The physical radio interface, Layer 1, is specified in the GSM 05 series of specifications. The physical channels consist of a sequence of timeslots and a sequence of RF carriers as described in GSM 05.02 resulting in a modulation rate of 270.833 kbit/s (1625/6) accommodating 8 full rate users of speech or data. The modulation is according to GSM 05.04 and results in a carrier spacing of 200 kHz according to GSM 05.05. The interworking with the Layers 2 and 3 of the OSI model is described in GSM 04.04.

2.1.1. Frequency bands

The frequency band for the Base Station System is given in Table 2-1.

TX:	RX:
935-960 MHz	890-915 MHz

Table 2-1: Frequency bands for GSM Base Station Systems

It is up to the GSM PLMN operator to choose any subset of the carrier frequencies in this band (or the complete set) on a location basis.

2.1.2. Channels and channel numbering

The carrier frequencies (RF channels) have the following numbers and frequencies according to GSM 05.05 (n = carrier number, n = 1 to 124):

$Fl(n) = 890.200$ MHz $+ (n-1) \times 0.200$ MHz (lower band = RX)

$Fu(n) = Fl(n) + 45.000$ MHz (upper band = TX)

Many tests in section 2.1 shall be performed with appropriate frequencies in the bottom, middle and top of the operating frequency band specified by the operator or by the manufacturer. These are denoted as RF channels B, M and T.

2.1.3. Frequency hopping

Slow frequency hopping (SFH) may optionally be implemented in each Base Station System as an operator choice. The BSS shall be able to switch to any frequency in the GSM band allocated to this BSS on a timeslot per timeslot basis.
The detailed description of the frequency hopping scheme is described in GSM 05.02. The switching requirements for SFH appears in section 2.1.6 and 2.1.7 in accordance with GSM 05.05.

2.1.4. RF power control

RF power control functions may optionally be implemented in GSM Base Station Systems according to GSM 05.08. If applicable, the BSS shall be able to hop between any defined power level on a timeslot per timeslot basis. The switching and stability requirements appear in section 2.1.6 in this specification. Other requirements in this specification apply whether RF power control is supported or not.

2.1.5. Downlink discontinuous transmission (DTX)

Downlink discontinuous transmission (DTX), as defined in the GSM 06-series of specifications for full-rate speech channels and in GSM 04.22 and GSM 08.20 for non-transparent data, may optionally be implemented in the downlink BSS (transmitter). All requirements in this specification, unless otherwise stated, apply whether downlink DTX is used or not.

2.1.6. Transmitters

All tests in this section shall be conducted on Base Station Systems fitted with a full complement of Transceivers for the configuration. Measurements shall be made at the BSS Tx antenna connector (including any TX combiner) or at internal test points and interfaces as defined in section 11.2 in this specification, unless otherwise stated.
Unless otherwise stated the tests in this section shall be performed under normal and extreme test conditions.
Power levels are expressed in dBm, assuming a 50 ohms impedance.

2.1.6.1. Static Layer 1 functions

DEFINITION
The static Layer 1 transmitter functions verified in these tests are the RF parts, the multiplexing and multiple access functions, the enciphering functions, the interleaving and the channel encoding on the transmit side. For further information see GSM 05.01, GSM 05.02, GSM 05.03 and GSM 05.05.

METHOD OF MEASUREMENT
If Slow Frequency Hopping (SFH) is supported by the BSS, the BSS shall be hopping over the maximum range and number of carriers possible for the test environment and which are available in the BSS configuration. If SFH is not supported, the test shall be performed for the radio frequency channels B, M and T. In both cases the tests shall be repeated with varying RF equipment until all the RF equipment in the BSS configuration is tested on all available carrier frequencies.
The BSS shall be transmitting a normal GSM modulated signal and the signal shall be received in the BSSTE. A known bit sequence exceeding a length of a superframe (1326 TDMA-frames) shall be input before channel encoding in the BSS and a bit sequence shall be output after channel decoding in the BSSTE. The propagation conditions shall be static and non-limiting for the measurement.
All channel types shall be tested.

REQUIREMENTS
The output bit sequence shall be bit exact for all channel types.

2.1.6.2. Modulation, phase error and mean frequency error

DEFINITION
The GSM modulation scheme is Gaussian Minimum Shift Keying (GMSK) with normalized bandwidth BT=0.3. This measurement verifies the correct implementation of the GMSK pulse shaping filtering (equivalent premodulation filter) and the suppression of all contributions to frequency error and phase error during the active part of a timeslot.
For further information see GSM 05.04, GSM 05.05 and GSM 05.10.

METHOD OF MEASUREMENT

All carriers in the configuration shall be switched on transmitting full power in all timeslots for 1 hour. Then the following measurement shall be carried out.

If Slow Frequency Hopping (SFH) is supported by the BSS, the BSS shall be hopping over the maximum range and number of carriers possible for the test environment and which are available in the configuration. If SFH is not supported, the test shall be performed for the radio frequency channels B, M and T. In both cases the test shall be repeated for each RF equipment existing in the configuration.

The transmitted signal from the BSS shall be extracted in the BSSTE for a pseudo-random known bitstream of encrypted bits into the BSS modulator. The pseudo-random bitstream shall be any 148 bit subsequence of the 511 bit pseudo-random bitstream defined in recommendation CCITT V.52. This pseudo-random bitstream may be generated by another pseudo-random bitstream inserted before channel encoding in the BSS and shall generate at least 200 different bursts. The phase trajectory (phase versus time) for the useful part of the timeslots (147 bits in the centre of the burst - see GSM 05.04 and GSM 05.10 for further information) shall be extracted with a resolution of at least 2 samples per modulating bit. The RF receiver parts of the BSSTE are assumed not to be limiting the measurement.

The theoretical phase trajectory from the known pseudo-random bitstream shall be calculated in the BSSTE for a GMSK pulse shaping.

The phase difference trajectory shall be calculated as the difference between the measured and the theoretical phase trajectory. The mean frequency error across the burst shall then be calculated as the derivative of the regression line of the phase difference trajectory. The regression line shall be calculated using the Mean Square Error (MSE) method.

The phase error is then finally the difference between the phase difference trajectory and its linear regression line.

REQUIREMENTS
The phase error shall not exceed:
5 degrees rms
20 degrees peak
The mean frequency error across the burst shall not exceed:
0.05 ppm
The requirements apply whether Slow Frequency Hopping (SFH) is used or not in the BSS. The requirements apply to each burst under normal and extreme test conditions and exposed to vibration (see Annex 1).

2.1.6.3. Mean transmitted RF carrier power

DEFINITION
The mean transmitted RF carrier power is the power delivered to the TX combiner on the radio frequency channel under test. This test verifies the power step accuracy across the frequency range.
For further information see recs GSM 05.05 and GSM 05.08.

METHOD OF MEASUREMENT
For this specific measurement the power shall be measured at the input of the TX combiner. However, the measurement method can be directly applied also to the output of the TX combiner, but in that case it is up to the network operator to specify the power level requirements. If measured at the output of the TX combiner, the TX combiner shall have the maximum number of carriers connected to it so that the measurement can be used as a reference for the measurement of transmitted carrier power versus time in section 2.1.6.4.
All carriers in the configuration shall be switched on transmitting full power in all timeslots for 1 hour. Then the following measurement shall be carried out.
The BSS shall be configured with the radio frequency channels B, M and T. If SFH is supported by the BSS, the BSS shall be hopping over these 3 frequencies.
The BSS under test shall be set to transmit 3 adjacent timeslots in a TDMA-frame at the same power level. The power level shall then be measured on a timeslot basis over the useful part of the middle timeslot averaged over more than 1000 timeslots. Only timeslots with a power level higher than -40 dB relative to the expected value shall be included in the averaging process.
Whether SFH is supported or not, the measurement shall be carried out on all of the 3 frequencies in turn.

For the definition of useful part of the timeslot see Figure 2-1, and for further details GSM 05.04 and GSM 05.10. For timing on a per timeslot basis each timeslot may contain 156.25 modulating bits, or 2 timeslots may contain 157 and 6 timeslots 156 modulating bits according to GSM 05.10.
The power shall be measured at each nominal power level as specified below or by the manufacturer or by the operator. The test shall be repeated with varying RF equipment until each RF equipment in the configuration is tested.
The BCCH carrier shall specifically be tested over its specified power levels.

REQUIREMENTS

TRX power class:	Maximum peak power:	Tolerance (dB):
1	320 W	-0,+3
2	160 W	"
3	80 W	"
4	40 W	"
5	20 W	"
6	10 W	"
7	5 W	"
8	2.5 W	"

Table 2-2: Power level classes for a GSM BSS

The BSS shall always be able to use the maximum peak power corresponding to its TRX power class given in Table 2-2 with its tolerances, and at least 6 power steps of 2 +/- 0.5 dB down.
As an option, the BSS can use downlink RF power control. In this case up to 15 power level steps for RF power control may be used starting from the measured power level (level 0) corresponding to the TRX power class and the more than 6 power steps defined above and down to level 15.
If downlink RF power control is used, then from the minimum power level for the BSS equipment the increasing power levels shall form an increasing monotonic sequence and the step size between 2 adjacent levels shall be 2 dB +/- 1.5 dB.
If downlink RF power control is used, the absolute power level accuracy shall be better than +/- 3 dB under normal test conditions and +/- 4 dB under extreme test conditions for all RF power control levels, starting from power level 1.

2.1.6.4. Transmitted RF carrier power versus time

DEFINITION

This section defines:

1) The time during which the transmitted power envelope must be stable (the useful part of the timeslot).
2) The stability limits.
3) The maximum output power when nominally off between time slots.

It does not attempt to measure the detail of the power ramps, this is measured as adjacent channel power in section 2.1.6.5. For further information see GSM 05.02, GSM 05.04, GSM 05.05 and GSM 05.08.

METHOD OF MEASUREMENT

The BSS shall be configured with the radio frequency channels B, M and T. Three adjacent timeslots in a TDMA-frame shall be used. All other timeslots in the TDMA-frame shall be off.

Power measurements are made with a detector bandwidth of BW, where BW shall be at least 1 MHz when measuring the top portion of the burst and at least 300 kHz when measuring the rising and falling transitions. Power is measured continuously at the antenna connector of the combined transmitters for the maximum RF carrier configuration defined by the manufacturer or the operator at each of the 3 frequencies in turn. Timing is related to T0 which is the transition time from bit 13 to bit 14 of the midamble training sequence for each timeslot. For timing on a per timeslot basis each timeslot may contain 156.25 modulating bits, or 2 timeslots may contain 157 and 6 timeslots 156 modulating bits according to GSM 05.10. On a per timeslot basis also, the 0 dB reference point in Figure 2-1 is defined as the average power during the useful part of the burst.

All 3 timeslots shall be configured with the same power (Pmin or Pmax, in turn) and the timeslot power sequence (TS1, TS2, TS3) = (Poff, Pmax, Poff) and (Poff, Pmin, Poff) shall be displayed or stored for at least 100 complete cycles of the timeslot power sequence on each of the 3 frequencies. In the case of SFH, all 3 timeslots need to be active and hopping, while in the case of no SFH, only the middle timeslot (TS2) needs to be active.

Pmax, Pmin and Poff are the maximum power level (level 0), the minimum power level (level 1-15) and the power when a timeslot is idle for the BSS configuration (see also Figure 2-2).

The measurement shall be repeated for each RF equipment existing in the configuration.

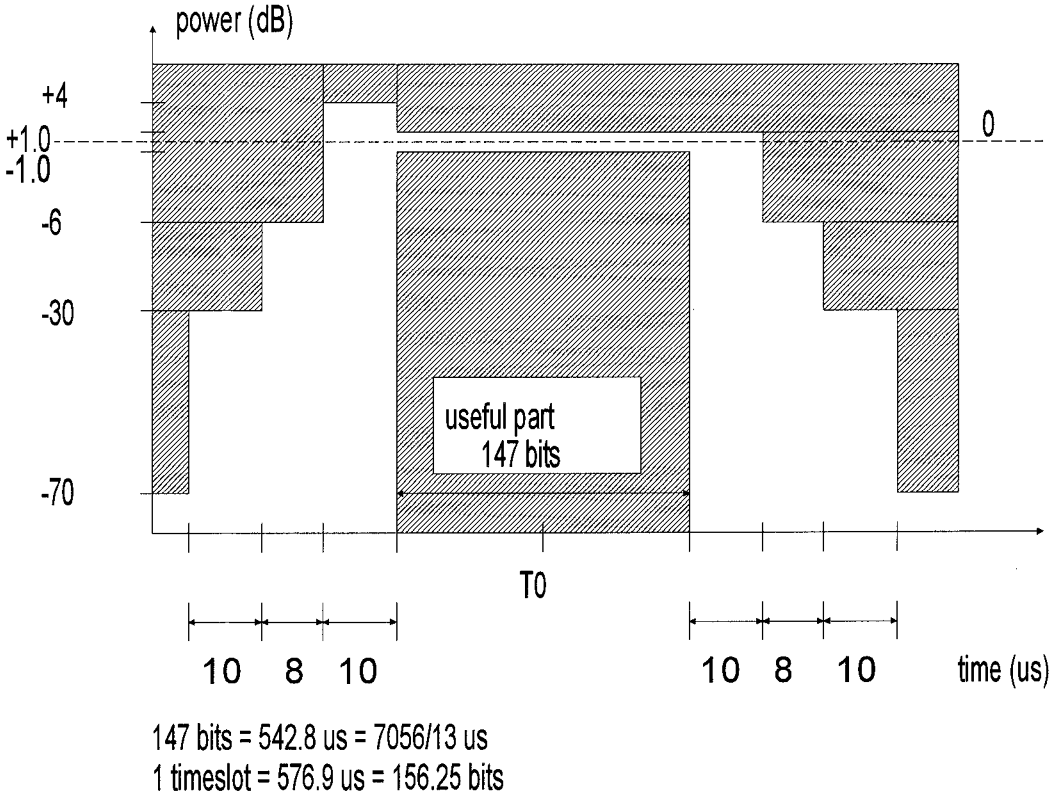


Figure 2-1: Power/time mask for power ramping of normal bursts

REQUIREMENTS
The power/time profile Figure 2-1 under normal test conditions shall be met. No requirements are given for any other transitions.
If RF power control is supported by the BSS, the value Pmin of Figure 2-1 shall be within the limits defined in section 2.1.6.3 over the useful part of the timeslot.
For the timeslot "off" condition the power level shall remain at the Poff value for all timeslots. In case the power level being very low, ie when the Poff value of -70 dB results in a lower absolute value than -36 dBm, then Poff shall be -36 dBm.

NOTE: The time mask in Figure 2-1 exceeds the timeslot length. In case consecutive timeslots are active, there are other requirements like phase trajectory, adjacent channel spectrum etc which will guarantee satisfactory operation.

2.1.6.5. Adjacent channel power

DEFINITION

The modulation and power level switching spectra can produce significant interference in the GSM and adjacent bands. The effect on the spectrum due to the continuous modulation spectrum and due to the switching transients do not occur at the same time and are therefore specified separately:

1) Continuous modulation spectrum
2) Switching transients spectrum

For further information see GSM 05.05.

2.1.6.5.1. Continuous modulation spectrum

METHOD OF MEASUREMENT

The BSS shall be configured with the radio frequency channels B, M and T.

a) One timeslot shall be set up to transmit full power modulated with a pseudo-random bit sequence of encrypted bits. The pseudo-random bit sequence may be generated by another pseudo-random bit sequence inserted before channel encoding in the BSS. The other timeslots shall be off. In the case of SFH, any carrier may be used. In case of no SFH, the carrier actually transmitted shall be used. The power shall be measured such that the video signal of the measuring spectrum analyser is "gated" so that the spectrum generated by 50 - 90 % of the useful part of the timeslot (excluding midamble) is measured. Only measurements where the power exceeding -40 dB relative to the expected value shall be included. The spectrum analyser shall average over the gated period and over at least 500 timeslots, using video and/or numerical averaging. This average shall be calculated by measuring the powers in dBm and then averaging those values.

   The spectrum analyser settings are adjusted as follows:

   Resolution bandwidth: 30 kHz
   Video bandwidth : 30 kHz
   Zero frequency scan
   Averaging : As described above

   The power shall also be measured with the following offsets from the carrier frequency:

   100, 200, 250, 400 kHz and
   600 to 1800 kHz in steps of 200 kHz.

b) With all timeslots at the same power level, step a) shall be repeated for all nominal power levels defined by the manufacturer or by the operator for the BSS.
c) Step a) shall be repeated, except that the resolution bandwidth shall be set to 30 kHz, and the power level shall be measured over the frequency range 890 to 915 MHz in 200 kHz steps.
d) The whole measurement shall be performed sequentially for all the 3 carriers in the configuration and the test shall be repeated until all the RF equipment in the BSS configuration is tested on all the 3 frequencies.

REQUIREMENTS
The power measured shall in all above cases never exceed the limits shown in Table 2-3 under normal test conditions.
If the resulting absolute value from Table 2-3 is below -36 dBm, the requirement shall be replaced by -36 dBm for offsets of 400 to 1800 kHz inclusive.
The figures in the table below, at the listed frequencies from carrier (kHz), are the maximum level (dB) relative to a measurement in a 30 kHz bandwidth on the carrier.

Power level (dBm):	Maximum relative level (dB) at carrier offsets (kHz):					
	0	100	200	250	400	600-1800
>=43	0	+0.5	-30	-33	-60	-70
41	0	+0.5	-30	-33	-60	-68
39	0	+0.5	-30	-33	-60	-66
37	0	+0.5	-30	-33	-60	-64
35	0	+0.5	-30	-33	-60	-62
<=33	0	+0.5	-30	-33	-60	-60

Table 2-3: Continuous modulation spectrum - maximum limits

For all power levels tested the maximum power measured at step c) in the range 890 to 915 MHz shall be -103 dBm.

2.1.6.5.2. Switching transients spectrum

METHOD OF MEASUREMENT

The BSS shall be configured with the radio frequency channels B, M and T.

a) All timeslots shall be set up to transmit full power modulated with a pseudo-random bit sequence. The power shall then be measured continuously at the offsets listed below from one of the carriers in the configuration with the test equipment parameters below. In case of SFH, any of the carriers may be used. In case of no SFH, the actually transmitted carrier must be used.

   Resolution bandwidth: 30 kHz
   Video bandwidth : 100 kHz
   Zero frequency scan
   Peak hold enabled

   The following offsets from the carrier frequency shall be used:

   400, 600, 1200, and 1800 kHz

b) If no RF power control is supported by the BSS, the test in step a) shall be repeated with the power/timeslot profile of Figure 2-3, and if supported, with the power/timeslot profile of Figure 2-2. The test shall be carried out with SFH disabled and enabled, if supported.

c) With all timeslots at the same power level, step a) shall be repeated for all nominal power levels defined by the manufacturer or by the operator for the BSS.

d) The whole measurement shall be performed sequentially for all the 3 carriers in the configuration and the test shall be repeated until all the RF equipment in the BSS configuration is tested on all the 3 frequencies.

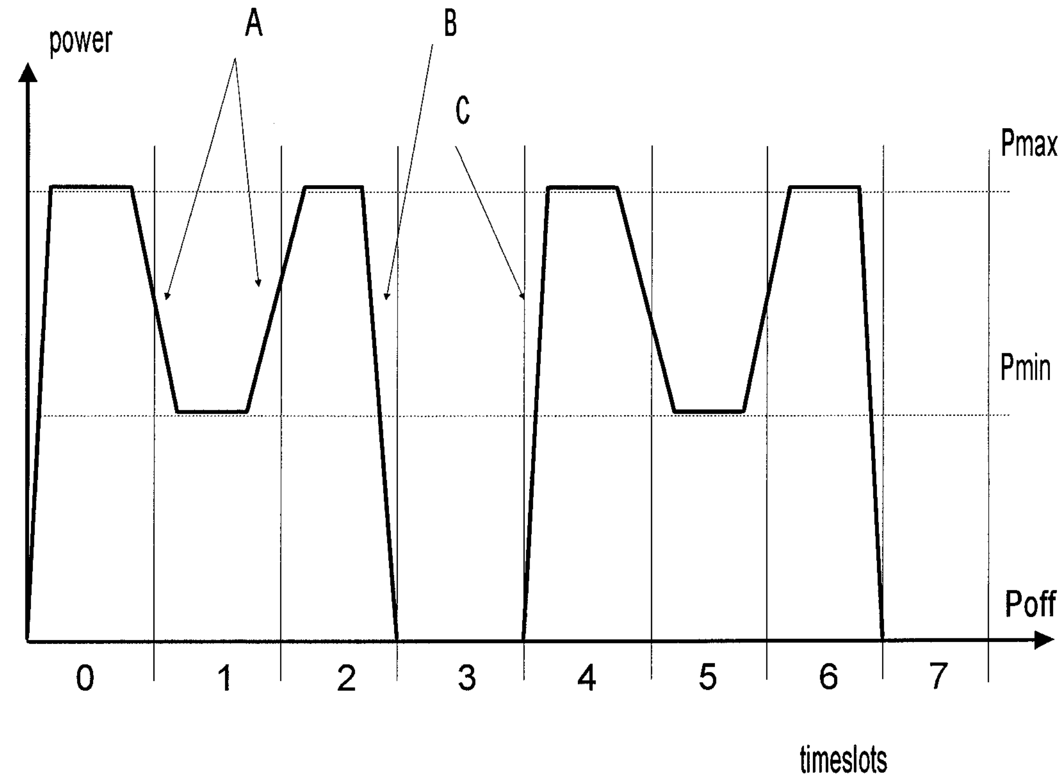


Figure 2-2: Power/timeslot configuration (RF power control)

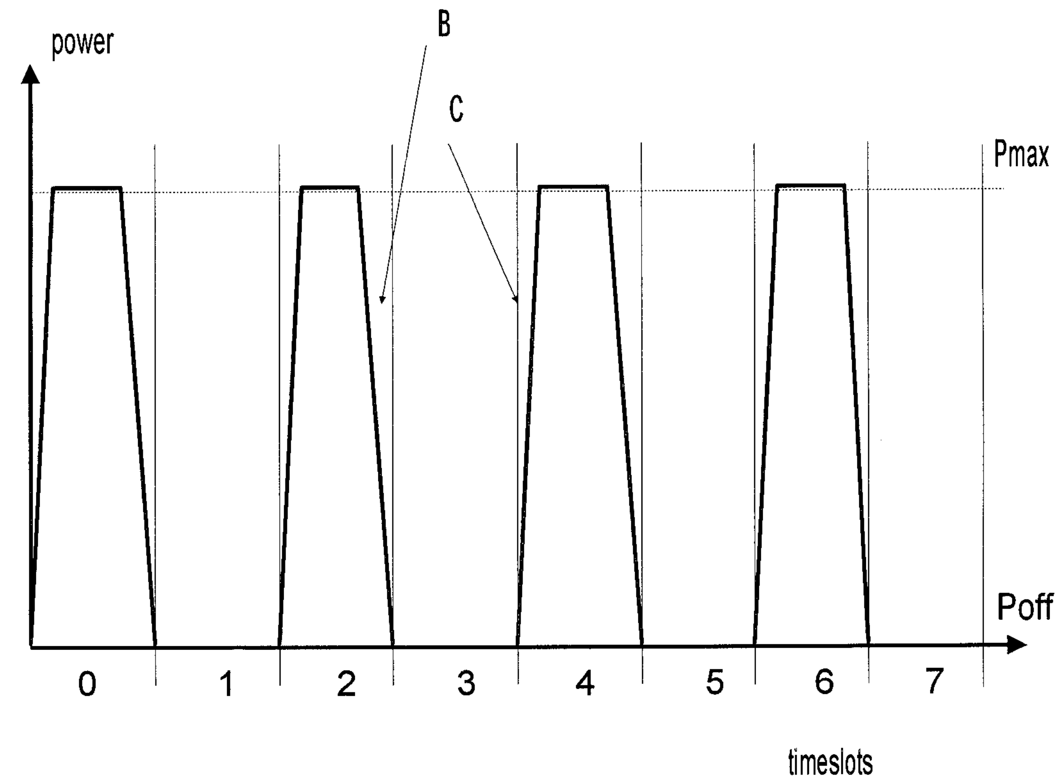


Figure 2-3: Power/timeslot configuration (no RF power control)

REQUIREMENTS
The power measured shall in any case never exceed the limits shown in Table 2-4 under normal test conditions, or -36 dBm, whichever value is highest. These requirements shall in no case be more stringent than 3 dB above the figures given in Table 2-3 for the relevant power level. (Note that for the table below "dBc" means relative to the maximum BSS peak power.)

Offset (kHz):	Power (dBc):
400	- 60
600	- 69
1200	- 75
1800	- 79

Table 2-4: Switching transients spectrum - maximum limits

NOTE: For a high-power BSS/BTS, the value in Table 2-4 will always exceed -36 dBm. In such a case, the measurement in section 2.1.6.6 of TX spurious emissions may be unnecessary in the BSS TX band close to the carrier.

2.1.6.6. Spurious emissions from the transmitters

DEFINITION
Spurious emissions are emissions at frequencies other than those of the carrier, sidebands and adjacent channels associated with normal modulation and switching covered in 2.1.6.5, radiated by the equipment (cabinet radiation), at the antenna connector or into the power leads (conducted spurious emissions). This measurement covers the spurious emissions conducted from the BSS transmitter connectors or radiated from the BSS transmitters while in operation covering also switching transients close to the carrier.
For further information see GSM 05.05.
NOTE: The requirement for conducted spurious emissions from power leads is contained in ETS 300 342-2.
METHOD OF MEASUREMENT
Spurious emissions shall be measured as:
a) The power level of any discrete signal measured in a 50 ohms load at the antenna socket (conducted spurious emissions).
b) The effective radiated power radiated by the cabinet and structure of the equipment (cabinet radiation).

The BSS shall be operated in Slow Frequency Hopping (SFH) mode, if applicable. The radio frequency channels B, M and T shall be allocated to the BSS and every other timeslot in the 3 carriers shall be transmitting full power. If no SFH is supported by the BSS, each of these frequencies shall be tested in turn. If SFH is supported, the BSS shall hop on these 3 frequencies. The test shall be repeated until all the RF equipment in the BSS configuration is tested on all the 3 frequencies.
The measurements shall be performed in accordance with Table 2-5 with peak hold enabled.

Frequency band:	Frequency offset:	Resolution bandwidth:
935 - 960 MHz	(offset from carrier)	
(BSS TX band)	>= 600 kHz	10 kHz
	>= 1.8 MHz	30 kHz
	>= 6.0 MHz	100 kHz
890 - 915 MHz	all	30 kHz
otherwise	(offset from BSS TX band)	
	>= 2 MHz	30 kHz
	>= 5 MHz	100 kHz
	>= 10 MHz	300 kHz
	>= 20 MHz	1 MHz
	>= 30 MHz	3 MHz

Table 2-5: Spurious emissions measurements

For a swept measurement, with a continuous max hold, a single sweep shall be performed, which shall meet the following requirement:
Resolution bandwidth (kHz) >= 4.615 ms
Sweep rate (kHz/ms)
If the max hold function is sampled (i.e. not continuous in time), then the number of samples made for each frequency interval equal to the resolution bandwidth shall be at least 1250 (the number of bit periods in the frame). The samples shall be either evenly or randomly distributed thoughout the TDMA frame period.
For a stepped measurement, the increment in frequency shall not exceed the resolution bandwidth.
If the max hold is continuous, the measurement period on each frequency shall be at least 4.615 ms.
If the max hold function is sampled (i.e. not continuous in time), then the number of samples made for each frequency shall be at least 1250 (the number of bit periods in the frame). The samples shall be either evenly or randomly distributed thoughout the TDMA frame period.

NOTE: For low search frequencies, the resolution bandwidth must be lower than the search frequency.
In the range 9 kHz - 100 kHz, the resolution bandwidth shall be 1 kHz, and in the range 100 kHz - 10 MHz it shall be 10 kHz. The requirements shall be unchanged.

METHOD OF MEASURING CONDUCTED SPURIOUS AT THE ANTENNA CONNECTOR
The antenna output connector shall be connected to a spectrum analyser or selective voltmeter, having an input impedance of 50 ohms. If the detecting device is not calibrated in terms of power input, the level of any detected components shall be determined by a substitution method using a signal generator.
In the BSS RX band the measurement technique shall be that in 2.1.6.5.1, continuous modulation, step c.

METHOD OF MEASURING THE EFFECTIVE RADIATED POWER
A test site fulfilling the requirements in recommendation CEPT T/R 24-01 annex 1 (Technical characteristics and test conditions for radio equipment in the land mobile service intended primarily for analogue speech) shall be used. The BSS shall be placed at the specified height on a non-conducting support and shall be operated from a power source via a RF filter to avoid radiation from the power leads.
Radiation of any spurious components shall be detected by the test antenna and receiver and cover the frequency range 30 MHz to 12.75 GHz.
At each frequency at which a component is detected, the sample shall be rotated to obtain maximum response and the effective radiated power of that component determined by a substitution measurement. The measurement shall be repeated with the test antenna in the orthogonal polarisation plane.
In order to simplify the test, the rotation is only required for the actual BSS configured with 1 active Transceiver (TRX). If an A-bis-interface is used, both the BSC and the BTS shall be tested.

REQUIREMENTS

The power level of the conducted spurious emissions or the effective radiated power shall not exceed the levels in Table 2-6 under normal test conditions.

Frequency Band:	Maximum Level:
Radiated:	
30 MHz - 1000 MHz	-36 dBm
1000 MHz - 12.75 GHz	-30 dBm
Antenna connector:	
9 kHz - 1000 MHz	-36 dBm
1000 MHz - 12.75 GHz	-30 dBm

Table 2-6: Maximum level of TX spurious emissions

This requirement shall be met for every frequency for at least one out of up to three measurements.

NOTE: for spurious emissions of Gaussian noise, there is a finite probability that the requirement may not be met due to the statistical distribution of amplitude with a low probability of occurance of an amplitude many times the mean value (a "high peak"). With a peak hold measurement, this cannot be distinguished from a discrete spurious emission which is present continuously. The test may therefore be performed up to three times, and the requirement must be met at each frequency at least once. If the requirement is not met at a particular frequency for any of three measurements, the probability of this being due to a "high peak" is extremely low.

NOTE: For the filter bandwidth quoted in the test method some difficulties may be experienced with the noise floor above the required measurement limit. This will depend on the gain of the test antenna, and adjustment of the measuring system bandwidth is permissable.

2.1.6.7. Intermodulation attenuation

DEFINITION

The intermodulation attenuation is a measure of the capability of an RF transmit equipment to inhibit the generation of signals in its non-linear elements caused by the presence of the carrier and an interfering signal reaching the equipment via its antenna.
For further information see GSM 05.05.

METHOD OF MEASUREMENT

If SFH is supported by the BSS, it shall be disabled during this measurement.
The antenna output of the RF transmit equipment under test, including the combiner, shall be connected to a coupling device, presenting to the RF equipment a load with an impedance of 50 ohms.
The unwanted test signal shall be unmodulated and the frequency shall be x MHz above the frequency of the RF transmit equipment under test. The carrier power level transmitted by the RF transmit equipment shall be the maximum power specified for the equipment and the unwanted test signal power level shall be adjusted 30 dB below. The test signals are indicated in Figure 2-4.
The power level of the test signal shall be measured at the antenna output end of the coaxial cable, when disconnected from the RF transmit equipment and then correctly matched into 50 ohms. The antenna output power of the RF transmit equipment shall be measured directly at the antenna output terminal connected to an artificial antenna.
Any intermodulation components shall then be measured in the band indicated in Tables 2-7a and 2.7b by means of a selective measuring device. The length of the coaxial cable between the antenna output and the coupling device shall be varied until the maximum level of the intermodulation component considered is obtained.
This measurement shall be repeated with the test signal at a frequency below the transmitted frequency.
When the above measurements are performed precautions must be taken, so that non-linearities in the selective measuring device do not influence the results appreciably. Furthermore it should be ensured that intermodulation components which may be generated by non-linear elements in the test equipment (eg signal generator, coupling device, selective measuring device) are sufficiently reduced. The RF transmit equipment under test and the test signal source shall be physically separated in such a way that the measurement is not influenced by direct radiation.

A possible measurement set-up is shown in Annex 1.7.
The intermodulation attenuation is expressed as the ratio in dB of the output power level of the transmitter under test to the power level of the highest intermodulation component.
The tests shall be repeated until all the RF equipment in the BSS configuration has been tested on all the frequencies given in Tables 2-7a and 2.7b.

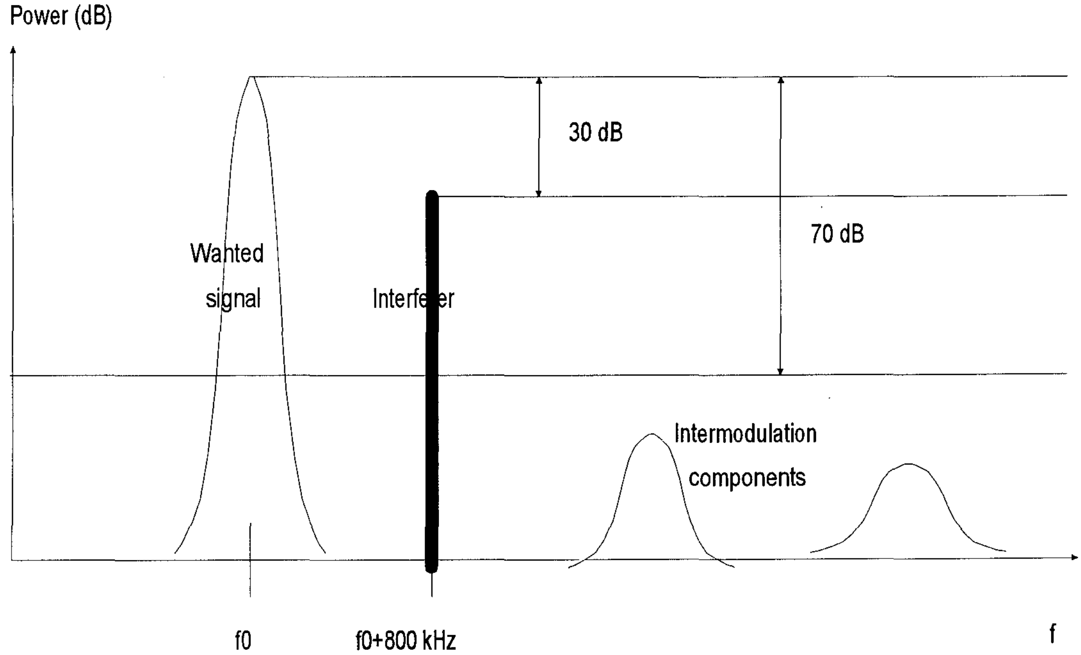


Figure 2-4: Example of TX intermodulation attenuation

REQUIREMENTS
Under normal test conditions, at frequencies offset from the wanted signal carrier frequency by more than 6 MHz, the measured intermodulation components shall never exceed the limits given in Table 2.7a. These limits apply to all the RF transmitting equipment in the BSS configuration.

NOTE 1: In the BSS Rx band the measurement technique shall be that in 2.1.6.5.1, Continuous Modulation Spectrum, step c.
NOTE 2: The value Y should be chosen such that the 3rd, 5th or 7th order intermodulation product falls on the RX band.
NOTE 3: In some cases, the level of acceptable spurious emission outside of the BSS receive band may be greater than the specified intermodulation limit. In these cases, the intermodulation components shall not exceed the limits specified in test 2.1.6.6 using the same measurement settings. The level of specified spurious emission is not constant over the whole band.

Tx RF Channel	Test Signal displacement (x)	Limit	Frequency Band	Measurement Bandwidth
B, M, T	0.8 MHz	-70 dBc	100 kHz - 12.75 GHz	300 kHz
M	Y MHz	-103 dBm	890 - 915 MHz	30 kHz

Table 2-7a: Maximum transmitter intermodulation limits for frequencies greater than 6 MHz offset from TX RF carrier frequency

Under normal test conditions, at frequencies offset from the wanted signal carrier frequency by less than 6 MHz, the measure intermodulation components shall never exceed those given in Table 2-7b. These limits apply to all the RF transmitting equipment in the BSS configuration.

NOTE 4: At frequencies offset from the carrier frequency by less than 1.8 MHz the modulation mask will dominate. In this case the level of intermodulation components shall not exceed the limits specified in test 2.1.6.5 using the same measurement settings.

NOTE 5: In some cases, the level of acceptable radiated spurious may be greater than the specified intermodulation limit. In these cases, the intermodulation components shall not exceed the limits specified in test 2.1.6.6 using the same measurement settings.

Tx RF Channel	Test Signal displacement (x)	Limit	Measurement Bandwidth	Frequency Band
B, M, T	0.8 MHz	-70 dBc	30 kHz	1.8 MHz - 6 MHz
B, M, T	0.8 MHz	see NOTE 4		< 1.8 MHz

Table 2-7b: Maximum transmitter intermodulation limits for frequencies less than 6 MHz offset from TX RF channel carrier frequency

2.1.6.8. Intra Base Station System intermodulation attenuation

DEFINITION

When transmitters and carriers are combined to feed a single antenna, or are operating in the close vicinity of each other, the leakage of each carrier into the other transmitters and the presence of non-linear elements will cause intermodulation products to appear. The level of these spurious must be controlled.

Outside of the GSM Band, intermodulation products are included in the spurious emissions tests of section 2.1.6.6. This specification and test refers to intermodulation products inside the GSM Base Station System Tx Band of 935-960 MHz and BSS Rx Band of 890-915 MHz.

NOTE: Individual administrations may require that this band be reduced to that part of the spectrum allocated to a single network operator, and for the spurious emissions test of section 2.1.6.6 to be extended accordingly.

For further information see GSM 05.05.

METHOD OF MEASUREMENT

If SFH is supported by the BSS, it shall be disabled during this measurement.

The BTS shall be configured with a full compliment of transceivers. Each RF transmit equipment shall be operated at the maximum power specified and with modulation applied.

For the measurement in the transmit band the equipment shall be operated at equal and minimum frequency spacings specified for the BSS configuration under test.

For the measurement in the receive band the equipment shall be operated with such a channel configuration that at least 3rd order intermodulation products fall into the receive band. Only these intermodulation frequencies have to be measured.

The measurement shall be carried out at the antenna connector of the Base Station System, using a frequency selective instrument which shall provide a 50 ohm termination to the Base Station System.

A possible measurement setup for this test is given in Annex 1.7.

The power of any intermodulation product shall be measured by a peak measuring equipment except for the receive band where the measurement conditions described in 2.1.6.5.1 step c, continuous modulation spectrum, shall be used. The measurement bandwidth shall be either 30 kHz or 300 kHz as specified in Tables 2-8a and 2-8b.

In the transmit band, the intermodulation components shall be measured at frequency offsets above the uppermost and below the lowermost carriers.

REQUIREMENTS

In the receive band the measured intermodulation components shall never exceed the values given in Table 2-8a under normal test conditions.

Frequency Band	Measurement BW	Limit
890 - 915 MHz	30 kHz	-103 dBm

Table 2-8a: Maximum intra-BSS Receive Band transmitter intermodulation limits

In the transmit band (935 - 960 MHz), at offsets greater than 1.8 MHz, the measured intermodulation components shall never exceed the greater of the limits given in Table 2-8b, under normal test conditions.

Frequency Band	Measurement BW	Limit
1.8 MHz - 6.0 MHz	30 kHz	-36 dBm / -70 dBc
> 6.0 MHz	300 kHz	-36 dBm / -70 dBc

Table 2-8b: Maximum intra-BSS Transmit Band transmitter intermodulation limits

At a frequency offset of less than 1.8 MHz the modulation mask will dominate. The level of intermodulation components shall not exceed the levels specified in test 2.1.6.5 using the same measurement settings.

NOTE: -36 dBm corresponds to the value for spurious emissions. However, the measurement BW is not necessarily the same.

NOTE: The value of -103 dBm is based on a receiver sensitivity of -104 dBm, a cochannel rejection of 9 dB, a TX-RX antenna coupling loss of 30 dB, a multiple interference margin of 10 dB and a measurement bandwidth expansion factor of 10 dB.

2.1.7. Receivers

All tests in this section shall be conducted on Base Station Systems fitted with a full complement of Transceivers for the configuration. Measurements shall be made at the BSS Rx antenna connector or at internal test points and interfaces as defined in section 11.2 in this specification, and include any Rx multicoupler.

Where noted Rx measurements are to be made with all transmitters operated at full configuration power. A Tx-Rx coupling loss of 30 dB is assumed throughout this section. It is up to the operator or the manufacturer to use other values. If other values are used, some of the requirements in this section might need modification.
All tests in this section are compliance tests. The measurement of any real parameters is a national or operator specific matter. If some real values are wanted, eg the static reference sensitivity level (section 2.1.7.3) and receiver intermodulation rejection (section 2.1.7.7) could together give a good view of the quality of the receiver and of the quality of the signal processing parts and the RF parts of it, respectively.
The tests in this section assume that the receiver is not equipped with diversity. For receivers with diversity, the tests may be performed by applying the specified signals to one of the receiver inputs, and terminating or disabling the other(s). The tests and requirements are otherwise unchanged.

NOTE: The GSM recommendations do not specify the performance of diversity receivers. The specification of alternative or additional tests on diversity reception is therefore a national or operator specific matter.

In all the relevant subsections in this section all Bit Error Ratio (BER), Residual BER (RBER) and Frame Erasure Ratio (FER) measurements shall be carried out according to the general rules for statistical testing in Annex 1.
Where error ratios are given, "4.0 E-3" means "4.0 times 10 to the power of -3".
The power level values given in the text assume a load impedance of 50 ohms for power quoted in dBm and (dBuV(emf)).
Unless otherwise stated the tests in this section shall be performed under normal and extreme test conditions.

2.1.7.1. Static Layer 1 receiver functions (nominal error ratios)

DEFINITION

The static Layer 1 receiver functions verified in these tests are the RF parts, the multiplexing and multiple access functions, any existing equalizer, the deciphering functions, the deinterleaving and the channel decoding on the receive side. Also the maximum input level of the receiver is verifed.
The measurements are recorded as nominal error ratios (Bit Error Ratio - BER) at a logical reference point that represents the performance before channel decoding. This measurement shall be performed for TCH/FS only using unprotected class II bits extracted after channel decoding, but before any extrapolation. Therefore, the results obtained are representative of the logical reference point before channel decoding. For further information see GSM 05.01, GSM 05.02, GSM 05.03 and GSM 05.05.

METHOD OF MEASUREMENT

If Slow Frequency Hopping (SFH) is supported by the BSS, the BSS shall be hopping over the maximum range and number of carriers possible for the test environment and which are available in the BSS configuration. If SFH is not supported, the test shall be performed for the radio frequency channels B, M and T. In both cases the tests shall be repeated until all the RF equipment in the BSS configuration is tested on all specified carrier frequencies and all available TCH/FS timeslots.

A test signal with normal modulation originating from the BSSTE shall be applied to the BSS receiver input. The unprotected class II bits obtained from the BSS receiver after channel decoding and before any extrapolation shall be compared with the unprotected class II bits originating from the BSSTE. The level of the test signal shall be varied between -85 dBm (28 dBuV(emf)) and A inclusive. A is -10 dBm (103 dBuV(emf)) for static propagation conditions and -40 dBm (73 dBuV(emf)) for the multipath conditions listed below.

REQUIREMENTS

Multipath condition:	BER:
Static	1.0 E-4
EQ50	3.0 E-2

Table 2-9: Nominal error ratios before channel decoding

The nominal error ratios shall not exceed the values given in Table 2-9 under normal test conditions.

2.1.7.2. Error detection mechanisms

DEFINITION

In GSM 05.03 a Cyclic Redundancy Check (CRC) is defined for detection of erroneous Layer 2 frames or speech frames. For full-rate speech channels also additional error detecting capabilities using some soft information are needed due to DTX operation when no useful signal is transmitted to the receiver. This test verifies the reliability of the overall Bad Frame Indication (BFI) presented to the full-rate speech decoder and the Frame Erasure Indication (FEI) used on control channels. For further information see also GSM 05.05.

METHOD OF MEASUREMENT

1. A signal as specified in section 2.1.7.5 for the interferer shall be input with a level of -85 dBm (28 dBuV(emf)) on the channels TCH/FS and SDCCH with their Associated Control Channels (SACCH and FACCH), and RACH in turn. The BSS must be configured to receive these channels and the resulting bitstream in the BSS after channel decoding, including the BFI or FEI as appropriate, shall be recorded for each channel type.
2. Step 1 shall be repeated without any signal on the channel under test.

REQUIREMENTS

For the TCH/FS, less than 1 undetected bad speech frame (BFI=0) shall occur on average in a period of 10 s.
For the RACH, less than 0.02% of the frames shall be detected as error free (FEI=0).
On the TCH/FS and SDCCH with their ACCHs, for those frames believed to be FACCH, SACCH or SDCCH frames, less than 0.002% of these frames shall be detected as error free (FEI=0).

2.1.7.3. Static reference sensitivity level

DEFINITION

The static reference sensitivity level of the receiver is the level of signal at the receiver input with a standard test signal at which the receiver will produce after demodulation and channel decoding data with a Frame Erasure Ratio (FER), Residual Bit Error Ratio (RBER) or Bit Error Ratio (BER) better than or equal to that specified for a specific channel type under static propagation conditions. For further information see GSM 05.05.

METHOD OF MEASUREMENT

If Slow Frequency Hopping (SFH) is supported by the BSS, the BSS shall be hopping over the maximum range and number of carriers possible for the test environment and which are available in the BSS configuration. If SFH is not supported, the test shall be performed for the radio frequency channels B, M and T. In both cases the tests shall be repeated until all the RF equipment in the BSS configuration is tested on all available carrier frequencies.
All carriers in the BSS configuration shall be on and transmitting full power in all timeslots other than the one used in the test.

A test signal with normal GSM modulation shall be applied to the BSS RX antenna connector on a chosen timeslot. The input signal before channel encoding in the BSSTE is compared with the signal which is obtained from the BSS receiver after channel decoding. The level of the test signal shall be -104 dBm (9 dBuV(emf)). The 2 adjacent timeslots to the wanted shall have a level 30 dB above the wanted signal. All other timeslots shall be off.

REQUIREMENTS

The error performance given in Table 2-10 shall be met for all channel types under normal and extreme test conditions. For the measurement on the TCH/FS using class II bits the BSS shall also be exposed to vibration.

NOTE: The only control channel listed in Table 2-10 is the SDCCH since the performance of this channel is basically the same as BCCH, AGCH and PCH, and worse than that of SACCH and FACCH. The requirement to be used for the FACCH and the SACCH is consequently the same as for the SDCCH.

Channel type:	FER:	BER:	RBER:
SDCCH	0.10 %	-	-
RACH	0.50 %	-	-
TCH/F9.6	-	1.0 E-5	-
TCH/F4.8	-	-	-
TCH/F2.4	-	-	-
TCH/H4.8	-	1.0 E-5	-
TCH/H2.4	-	-	-
TCH/FS	0.10 Â %	-	-
- class Ib	-	-	0.40/Â %
- class II	-	-	2.0 %
TCH/HS	[tbd]	[tbd]	[tbd]

Table 2-10: Static error performance limits at RX sensitivity level

NOTE: The value of Â in Table 2-10 may be between 1 and 1.6, but must be the same for both occurrences.

2.1.7.4. Multipath reference sensitivity level

DEFINITION

The multipath reference sensitivity level of the receiver is the level of signal at the receiver input with a standard test signal at which the receiver will produce after demodulation and channel decoding data with a Frame Erasure Ratio (FER), Residual Bit Error Ratio (RBER) or Bit Error Ratio (BER) better than or equal to that specified for a specific channel type under multipath propagation conditions. For further information see GSM 05.05.

METHOD OF MEASUREMENT
As for static reference sensitivity level in section 2.1.7.4, but with SFH disabled if supported by the BSS.
The level of the test signal shall be -104 dBm (9 dBuV(emf)), but in this case the test signal is applied to the BSS RX antenna connector through a Multipath Fading Simulator (MFS). The power level of the test signal is referred to the output of the Multipath Fading Simulator (the BSS RX antenna input) in accordance with the measurement of the 0 dB reference point for the transmitted carrier power versus time in section 2.1.6.4 without interfering timeslots and excluding the hard limit of -40 dB. The measurement shall be performed for all channel types in Table 2-11.

REQUIREMENTS
The error performance given in Table 2-11 shall be met for all channel types and for all the multipath propagation profiles given in Table 2-11 under normal test conditions.
NOTE: The only control channel listed in Table 2-11 is the SDCCH since the performance of this channel is basically the same as BCCH, AGCH and PCH, and worse than that of SACCH and FACCH. The requirement to be used for the FACCH and the SACCH is consequently the same as for the SDCCH.

Channel type / error measure:		Error ratios (%): TU50:	RA250:	HT100:
SDCCH	(FER)	13 %	8.0 %	12.0 %
RACH	(FER)	13 %	12 %	13 %
TCH/F9.6	(BER)	0.50 %	0.10 %	0.70 %
TCH/F4.8	(BER)	1.0 E-4	1.0 E-4	1.0 E-4
TCH/F2.4	(BER)	2.0 E-4	1.0 E-5	1.0 E-5
TCH/H4.8	(BER)	0.50 %	0.10 %	0.70 %
TCH/H2.4	(BER)	2.0 E-4	1.0 E-4	1.0 E-4
TCH/FS	(FER)	6.0 Â %	2.0 Â %	7.0 Â %
- class Ib	(RBER)	0.40/Â %	0.20/Â %	0.50/Â %
- class II	(RBER)	8.0 %	7.0 %	9.0 %
TCH/HS	(tbd)	[tbd]	[tbd]	[tbd]

Table 2-11: Multipath error performance limits at RX sensitivity level

NOTE: The value of Â in Table 2-11 may be between 1 and 1.6, but must be the same for both occurrences in each channel condition; it may be different for different channel conditions.

2.1.7.5. Reference interference level

DEFINITION

The reference interference level is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal at the same carrier frequency (cochannel interference) or at any adjacent carrier frequencies (adjacent channel interference). For further information see GSM 05.05.

METHOD OF MEASUREMENT

If Slow Frequency Hopping (SFH) is supported by the BSS, it shall be disabled during this measurement. Only for the test of the multipath condition TU3 SFH shall be enabled.

When SFH is used in the test, the BSS shall be hopping over the maximum range and number of carriers possible for the test environment and which are available in the BSS configuration. If SFH is not supported, the test shall be performed for the radio frequency channels B, M and T. In both cases the tests shall be repeated until all the RF equipment in the BSS configuration is tested on all specified carrier frequencies. All carriers in the BSS configuration shall be on and transmitting full power in all timeslots other than the one used in the test.

a) The two input signals shall be connected to the receiver via a combining network. When testing each signal shall be connected through a Multipath Fading Simulator (MFS) as described in Annex 1. The 2 multipath fading channels shall be uncorrelated.

   The wanted signal shall have normal GSM modulation, and the interfering signal shall be continuous and have GSM modulation without midamble. The interferer shall be modulated with a pseudo-random bitstream.

   The interfering signal shall have an offset to the wanted signal as given in Table 2-12. In the case of Slow Frequency Hopping (SFH) the interfering signal shall be on the same frequency channel as the wanted signal over the useful part of the timeslot burst. The referred power level for both signals shall be the average power into the BSS RX antenna connector. This average power can be determined by using an integration period, as defined in Annex 1 Table A1-2, as appropriate for the channel.

b) The wanted signal shall have the power level -85 dBm (28 dBuV(emf)).

   NOTE: The level of -85 dBm (28 dBuV(emf)) is used in order to clearly distinguish the effects of noise from the effect of interference.

c) The unwanted signal shall then be switched on with an input level relative to the wanted signal as given in Table 2-12. For offsets greater than 0 kHz only the multipath propagation condition TU50 need to be tested.

Interferers offset:	Relative level:
0 kHz	-9 dB
200 kHz	9 dB
400 kHz	41 dB

Table 2-12: Cochannel and adjacent channel interference rejections

REQUIREMENTS

Channel type / error measure:		Error ratios (%): TU3 (no SFH):	TU3 (SFH):	TU50:	RA250:
SDCCH	(FER)	22 %	9.0 %	13 %	8.0 %
RACH	(FER)	15 %	15 %	16 %	13 %
TCH/F9.6	(BER)	8.0 %	0.30 %	0.80 %	0.20 %
TCH/F4.8	(BER)	3.0 %	1.0 E-4	1.0 E-4	1.0 E-4
TCH/F2.4	(BER)	3.0 %	1.0 E-5	3.0 E-5	1.0 E-5
TCH/H4.8	(BER)	8.0 %	0.30 %	0.80 %	0.20 %
TCH/H2.4	(BER)	4.0 %	1.0 E-4	2.0 E-4	1.0 E-4
TCH/FS	(FER)	21 Â %	3.0 Â %	6.0 Â %	3.0 Â %
- class Ib	(RBER)	2.0/Â %	0.20/Â %	0.40/Â %	0.20/Â %
- class II	(RBER)	4.0 %	8.0 %	8.0 %	8.0 %
TCH/HS	(tbd)	[tbd]	[tbd]	[tbd]	[tbd]

Table 2-13: Multipath error performance limits at RX interference level

NOTE: The value of Â in Table 2-13 may be between 1 and 1.6, but must be the same for both occurrences in each channel condition; it may be different for different channel conditions.

The error performance of any channel type for any multipath propagation condition given in Table 2-13 shall not be worse than the error ratios given in Table 2-13 under normal test conditions. For control channels not listed in Table 2-13 the requirements for the SDCCH apply.

2.1.7.6. Blocking and spurious response rejection

DEFINITION

Blocking and spurious response rejection is a measure of the ability of a BSS receiver to receive a wanted GSM modulated signal in the presence of an interfering signal; the level of the interfering signal is higher for the test of blocking than for spurious response.

METHOD OF MEASUREMENT

1) This measurement is carried out in three stages:
   i) an optional preliminary test to identify frequencies of interfering signal which require more detailed investigation.
   ii) measurement of blocking performance.
   iii) measurement of spurious response performance; this test need only be performed at those frequencies of interfering signal at which the specification for blocking is not met.
2) The BSS shall be configured to operate as close to the centre of the band as is possible. If Slow frequency hopping is supported by the BSS, it shall be disabled during these measurements.
3) The two RF signals shall be fed into the receiver antenna connector of the BSS using a combining network. One of the signals shall be at the operating frequency of the receiver, shall be modulated with normal GSM modulation, and shall be at a level of -101dBm (12dBuV(emf)).The measurement is only performed under static propagation conditions.

NOTE: Care should be taken to ensure that spurious outputs or broadband noise from the signal generator used for the interfering signal do not affect the measurements.

PRELIMINARY TEST

4) This optional test may be performed to reduce the number of measurements required in step 8. If it is performed, this shall be at the frequencies specified below.

5) The test shall be performed for an interfering signal at all frequencies which are integer multiples of 200kHz , and which fall within one or more of the frequency ranges listed below, but excluding frequencies which exceed 12.75GHz or are less than 600kHz from the wanted signal:
   i) from 790MHz to 1015MHz inclusive.
   ii) from Flo - (IF1 + IF2 + ... + IFn + 12.5MHz) to
   Flo + (IF1 + IF2 + ... + IFn + 12.5MHz).
   iii) from IF1 - 400kHz to IF1 + 400kHz.
   iv) All of the ranges:
   mFlo - IF1 - 200kHz to mFlo - IF1 + 200kHz
   and
   mFlo + IF1 - 200kHz to mFlo + IF1 + 200kHz

   v) All integer multiples of 10MHz
   Where:-
   Flo - is the frequency of the local oscillator applied to the first receiver mixer.
   IF1 ... IFn - are the n intermediate frequencies.
   m - is all positive integers.

NOTE: The frequency ranges defined above align with ETS 300 086.
To reduce test time, a shortened test procedure according to Annex 1 of this specification may be used, with an upper limit of measurement of 4GHz.

6) The interfering signal shall be frequency modulated with a modulation frequency of 2kHz and a peak deviation of +/-100kHz.

NOTE: This is to produce a dense spectrum inside the receiver bandwidth, to maximise the probability of detecting a response from data clocks etc.

7) For separations between the wanted and interfering signals of 45MHz or less, the level of the interfering signal at the receiver input shall be -3dBm (110dBuv(emf)). For greater separations, the level of the interfering signal shall be +10dBm (123dBuv(emf)).
The Residual Bit Error Ratio (RBER) for the TCH/FS channel using class II bits shall be measured. All frequencies at which the RBER exceeds 10% shall be recorded for further study. A relaxed statistical significance may be used for this measurement, compared to that of step 9).

BLOCKING TEST

8) If the preliminary test has been performed, this test shall be performed at all frequencies which have been recorded at step 7. If the preliminary test has not been performed, this test shall be performed at all frequencies specified in step 5. The interfering signal shall be unmodulated, and shall have a level at the receiver input as specified in Table 2-14.

9) The RBER for the TCH/FS channel using class II bits shall be measured. All frequencies at which the RBER exceeds the value of Table 2-10 shall be recorded.

NOTE: The methodology for the measurement of BER is described in Annex 1.

Frequency of interfering signal	Level dBm	(dBuV (emf))
868.8 MHz or less 935.2 MHz or greater	0	(113)
870MHz to (fo - 800kHz) (fo + 800kHz) to 935MHz	-13	(100)
(fo - 600kHz) and (fo + 600kHz)	-23	(90)

fo is the frequency of the wanted signal

Table 2-14: Level of interfering signal for blocking

SPURIOUS RESPONSE

10) This test shall be performed at all frequencies which have been recorded at step 8. The interfering signal shall be unmodulated, and shall have a level of -43dBm (70dBuV (EMF)).

11) The RBER for TCH/FS channel using class II bits shall be measured.

REQUIREMENTS
For step 9) (blocking), the recorded frequencies shall meet all of the following requirements :

i) For measurement frequencies which are 45MHz or less from the wanted signal, the total number does not exceed six.
ii) For measurement frequencies which are 45MHz or less from the wanted signal, no more than three are consecutive.
iii) For measurement frequencies which are more than 45MHz from the wanted signal, the total number does not exceed twenty four.
iv) For measurement frequencies which are more than 45MHz below the wanted signal, no more than three are consecutive.

For step 11) (spurious response), the RBER shall never exceed the value of Table 2-10.

2.1.7.7. Intermodulation rejection

DEFINITION
The intermodulation rejection is a measure of the linearity of the receiver RF parts. It expresses the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency. For the worst case the third order intermodulation rejection should be regarded only.
For further information see GSM 05.05.

METHOD OF MEASUREMENT
If SFH is supported by the BSS, it shall be disabled during this measurement. The measurement is performed only under static conditions for the TCH/FS using class II bits. The measurement shall be performed for the radio frequency channels B, M and T and until all the RF equipment in the BSS configuration has been tested on all 3 frequencies.
Three signal generators shall be applied to the receiver via a combining network. The first signal generator is an unwanted signal and shall be adjusted to a frequency separated by 8 channel separations above the wanted signal frequency and shall be continuous and modulated by a pseudo-random bit sequence with a periodicity greater than or equal to 511 bits. The second generator is also an unwanted signal and shall be unmodulated. It shall be adjusted to a frequency separated by 4 channel separations above the wanted signal frequency. The third signal is the wanted signal and shall be modulated with another pseudo-random bitstream. The various signals are illustrated in Figure 2-5.
The wanted signal shall have a power level of -101 dBm (12 dBuV(emf)). The two unwanted signal generators shall have the same power level being -49 dBm (64 dBuV(emf)). The RBER of the TCH/FS class II bits shall then be measured.
The measurement shall be repeated with the unwanted signal frequencies below the carrier of the wanted signal.

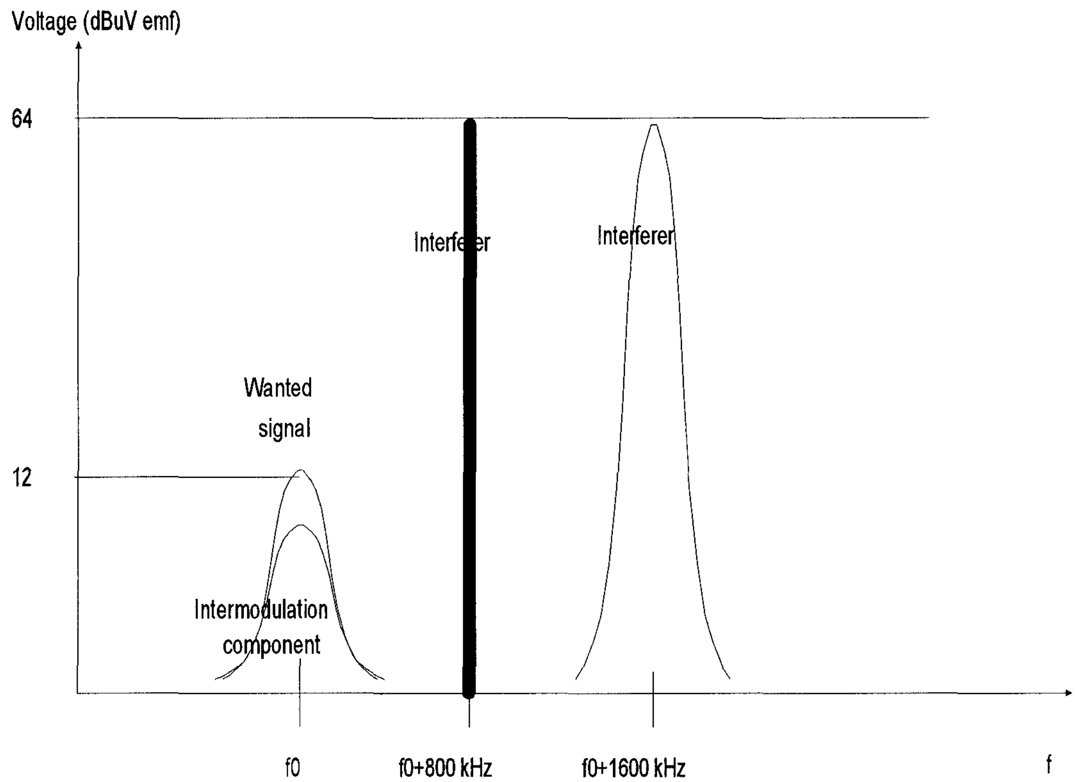


Figure 2-5: Example of RX intermodulation rejection

REQUIREMENTS
The error performance in Table 2-10 shall always be met.

2.1.7.8. Spurious emissions from the BSS receivers

DEFINITION
Spurious emissions are emissions at frequencies other than those of the carrier, sidebands and adjacent channels associated with normal modulation and switching covered in 2.1.6.5, radiated by the equipment (cabinet radiation), at the antenna connector or into the power leads (conducted spurious emissions). This specification covers spurious emissions from the BSS receivers only when no transmitters are active.
For further information see GSM 05.05.

METHOD OF MEASUREMENT
Spurious emissions shall be measured as in section 2.1.6.6 (spurious emissions from the BSS transmitters), but with the BCCH carrier switched off and no signals applied to the BSS receivers.
The BSS shall be operated in Slow Frequency Hopping (SFH) mode, if applicable. The radio frequency channels B, M and T shall be allocated to the BSS. If no SFH is supported by the BSS, each of these frequencies shall be tested in turn. If SFH is supported, the BSS shall hop on these 3 frequencies. The test shall be repeated until all the RF equipment in the BSS configuration is tested on all the 3 frequencies.

REQUIREMENTS
The power level of the conducted spurious emissions or the effective radiated power shall never exceed the levels in Table 2-15 under normal test conditions.

Frequency Band:	Maximum Level:
Power leads:	
9 kHz - 10 MHz	72 dBuV(pd)
10 MHz - 30 MHz	72 dBuV(pd)
Radiated:	
30 MHz - 1000 MHz	-57 dBm
1000 MHz - 12.75 GHz	-47 dBm
Antenna connector:	
9 kHz - 1000 MHz	-57 dBm
1000 MHz - 12.75 GHz	-47 dBm

Table 2-15: Maximum level of RX spurious emissions

NOTE: 72 dBuV(pd) corresponds to 4mV. This is the limit given in the recommendation CEPT T/TR 02-02.

2.1.8. Radio Link Management

The tests in this section shall be performed under normal test conditions unless otherwise stated.

2.1.8.1. General

This section describes the functions of the BSS which gain, maintain and release access to the radio link, the main objective being to provide a stable link for the higher protocol layers whilst hiding, as far as possible, the properties of the radiopath.
The detailed operation of these functions can be found in GSM 05.08 and GSM 05.10. Some requirements are also found in GSM 05.02.

2.1.8.2. Synchronisation

The BSS shall provide control information to the MS so that its transmissions arrive at the BSS within the allocated timeslot window and within the correct frequency tolerance.

2.1.8.2.1. Absolute Frequency Tolerance

The BSS carrier frequency generated for any channel shall have an absolute frequency tolerance better than 0.05 ppm. This is measured in terms of the mean frequency error in section 2.1.6.2.

2.1.8.2.2. Relative Frequency Tolerance

The different carriers transmitted by a BSS shall all be derived from the same frequency source.

2.1.8.2.3. Timing Tolerance

DEFINITION
The timing tolerance between channels or different carriers of the BSS is the relative time between bits of the same bit number (BN) in timeslots of the same timeslot number (TN) and frame number (FN) transmitted simultaneously from one BSS on two different radio frequency channels.

METHOD OF MEASUREMENT
If SFH is supported by the BSS, it shall be disabled during this test.
The BCCH shall be used as the reference channel to measure the relative timing of a channel on all other carriers which may be transmitted simultaneously. The results shall be analyzed to ensure that the relative timing between any of the channels which are transmitted simultaneously meets the requirement.
The number of RF channels which may be transmitted simultaneously is dependent on the BSS configuration.

1) The BSSTE shall establish a TCH using timeslot 0 in the TDMA frame structure (TN=0) on a specific frequency.
2) The relative timing between this frequency and the BCCH frequency shall be measured at the leading edge of bit 14 of the training sequence (BN=74) and the result shall be recorded. TDMA-frames carrying Frequency Correction bursts or Synchronization bursts (T3=0,1,10,11,20,21,30,31,40,41) shall be excluded.
3) Steps 1 and 2 shall be carried out with the TCH at the RF channels B, M and T, but avoiding the use of the same frequency as the BCCH.
4) Step 3 shall be carried out with the BCCH at the RF channels B, M and T, but avoiding the use of the same frequency as the TCH. The BCCH frequency shall be offset to the closest used RF channel in case they coincide.
5) Step 4 shall be carried out for all the carriers that may be transmitted simultaneously with the BCCH until all the RF equipment in the BSS configuration has been tested.

6) The timing measurement shall be used to establish the maximum time difference between any two channels.

REQUIREMENTS

The timing difference (as established in step 6) between the different carriers transmitted by a BSS/BTS shall be less than 1/4 bit, measured at the BSS/BTS antenna connector.

2.1.8.2.4. Synchronisation of Data Clocks

The BSS clocking and timebase shall be derived from the same frequency source used for RF generation. It is optional for a BSS to be able to transmit and receive synchronization signals for network synchronization.

2.1.8.3. Frame structure

This section verifies that the BSS correctly generates TDMA frames and is capable of receiving transmitted bursts from Mobile Stations generated according to GSM recommendations. For further information see GSM 05.02.
Only certain specified combinations of logical channels are permitted. These are tested implicitly in other parts of this recommendation.

2.1.8.3.1. BCCH Multiframe

DEFINITION

The BCCH multiframe consist of 51 TDMA frames. This channel broadcasts general information on a BSS per BSS basis. The frequency information is carried on the Frequency Correction Channel (FCCH) and the synchronisation is transmitted on the Synchronisation Channel (SCH). For further information see GSM 05.02.

METHOD OF MEASUREMENT

The BSS is configured with a BCCH carrier. This is monitored in the BSSTE.
The BSSTE shall search for the Frequency Correction burst.
The BSSTE shall then search for the Synchronisation burst.

REQUIREMENTS
The BSSTE shall detect Frequency Correction bursts at T3 = 0, 10, 20, 30 and 40 and for no other T3 (T3 = FN mod 51, FN = TDMA frame number).
The BSSTE shall also detect synchronization bursts at T3 = 1, 11, 21, 31, and 41 and for no other T3.
At the SCH the BSSTE shall detect the BSIC set up for the BTS/BSS. This applies to any BSIC. The BSSTE shall also detect the correct RFN for the various T3s.

2.1.8.3.2. Transmit-receive delay

At the MS the start of the frame on the uplink is delayed by a fixed period of 3 timeslots from the start of the TDMA frame on the downlink. This is regarded to be tested implicitly during other tests.

2.1.8.3.3. TDMA-frame structure

DEFINITION
One TDMA frame consists of eight timeslots, with an average length of 156.25 bit periods. This may be achieved by setting all timeslots to be 156.25 bit periods or setting timeslots 0 and 4 to 157 bit periods and the remaining (1, 2, 3, 5, 6, 7) to 156 bit periods. This section will test that the BSS conforms to the declared frame structure.

METHOD OF MEASUREMENT
The BSS shall be configured to generate multiframes with a channel combination which gives a contiguous stream of normal or dummy bursts as defined in GSM 05.02 for more than one frame. If SFH is supported by the BSS, it shall be disabled during this measurement.
The slot lengths will be measured between the leading edge of the 14th bit of the training sequence for that slot and the leading edge of the 14th bit of the training sequence for the next slot.

REQUIREMENTS
The measurements shall conform to the frame structure a) or b) stated by the manufacturer.

a) The length of each timeslot shall be 156.25 bit periods.
b) The length of timeslots 0 and 4 shall be 157 bit periods and the length of the remaining (1, 2, 3, 5, 6, 7) shall be 156 bit periods.

2.1.8.3.4. SACCH multiframe

A SACCH multiframe consists on Layer 1 of 26 TDMA frames used for full-rate or half-rate traffic channels. The detailed definition of a SACCH multiframe is in GSM 05.02.
The SACCH multiframe is considered implicitly tested by other tests.

2.1.8.4. Radio link measurements

Whilst calls are being established and for their duration, the reception quality shall be continuously assessed in the BSS as criteria for handover and RF power control algorithms. The following criteria may be employed in order to perform this assessment:

- Signal strength (RXLEV)
- Signal quality (RXQUAL)
- MS-BSS distance
- Idle channel level.

The strategy used for making the decision to initiate handover based on above parameters is up to the operator. However, the BSS shall be able to report the measured results as a response to a specific O&M-message as defined by the operator or the manufacturer, if used in the RF power control and handover algorithm.
For the tests in this section the BSS shall be hopping over the maximum range and number of carriers possible for the test environment and which are available in the BSS configuration, if Slow Frequency Hopping (SFH) is supported by the BSS. If SFH is not supported, the tests in this section shall be performed for the radio frequency channels B, M and T. In both cases the tests shall be repeated until all the RF equipment in the BSS configuration is tested on all specified carrier frequencies.

2.1.8.4.1. Signal Strength

DEFINITION

The received signal level (RXLEV) shall be available as a criterion for the RF power control and handover process. When measured in the BSS the RXLEV will be based upon received signal levels from TCH's and DCCH's measured over a range of -110 dBm to -48 dBm sampled and averaged for the duration of one SACCH multiframe. The RXLEV shall be measured for all timeslots and radio frequencies assigned to a BSS in order to measure both signal levels and interference levels for channel assignment and handover.

METHOD OF MEASUREMENT

The BSSTE shall establish a call setup with the BSS and the RXLEV of the assigned channel shall be output from the BSS in the O&M-message.
The signal level from the BSSTE shall be adjusted over the level range -110.5 dBm to -47.5 dBm in 1 dB steps.
The measurement shall be performed under static propagation conditions only.

REQUIREMENTS

For any 20 dB portion of the range -110 dBm to -48 dBm no measured values shall deviate more than +/- 1 dB from the regression line of that 20 dB portion.
The absolute accuracy of any value between -110 dBm and -70 dBm shall be better than +/- 4 dB under normal test conditions.
From -110 dBm to -48 dBm the absolute accuracy shall be within +/- 6 dB under normal and extreme test conditions.
The RXLEV value shall nominally be mapped to the received signal level as in Table 2-16.
It is optional for the BSS to be able to report values below the reference sensitivity of -104 dBm.

RXLEV	Power level:
0	less than -110 dBm
1	-110 dBm to -109 dBm
2	-109 dBm to -108 dBm
.	.
.	.
62	-49 dBm to -48 dBm
63	greater than -48 dBm

Table 2-16: Signal level estimation requirements

2.1.8.4.2. Signal quality

DEFINITION

The signal quality is a Bit Error Ratio (BER) related quality estimate of the channel quality on a TCH or SDCCH. This estimate shall be derived in the BSS and may be used in the handover and RF power control algorithms. For further information see GSM 05.08.

METHOD OF MEASUREMENT

A call shall be set up between the BSSTE and the BSS.
A pseudo-random known bit sequence shall be input before channel encoding in the BSSTE and received in the BSS.
The signal level shall be varied such that the BER on the wanted TCH measured at the logical interface point before channel decoding in the BSS are within all the BER ranges for the RXQUAL values in Table 2-17 in turn.
The logical reference point before channel decoding may be obtained by using the unprotected class II bits after channel decoding before any extrapolation is applied. Half-rate channels are measured by first establishing a full-rate channel, measuring the error ratio and then establishing a half-rate channel and checking the indicated error ratio.
For each BER range an O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface after a few seconds and periodically once every SACCH multiframe (480 ms) requesting the signal quality level for the TCH/FS. The test shall be carried out using more than 1000 reports per BER range and with and without uplink DTX.
The measurement shall be performed under the propagation conditions static and TU50.

RXQUAL:	BER range:	Mean value:
0	< 0.2 %	0.14 %
1	0.2 % - 0.4 %	0.28 %
2	0.4 % - 0.8 %	0.57 %
3	0.8 % - 1.6 %	1.13 %
4	1.6 % - 3.2 %	2.26 %
5	3.2 % - 6.4 %	4.53 %
6	6.4 % - 12.8%	9.05 %
7	> 12.8	18.10 %

Table 2-17: Signal quality estimation requirements

REQUIREMENTS
The RXQUAL levels shall be mapped to the actual BER as listed in Table 2-18 in the relative number of cases shown in Table 2-18.
Table 2-18a shows the minimum probability that a specified value of RXQUAL shall be reported for a BER within the range as indicated in the table under static propagation conditions.
Table 2-18b shows the minimum probability that a specified value of RXQUAL or an adjacent value shall be reported for a BER within the range as indicated in the table under TU50 multipath propagation conditions.

		Relative number of cases on correct RXQUAL value:		
RXQUAL:	BER range:	Full rate:	Half rate:	DTX:
0	< 0.10%	90 %	90 %	65 %
1	0.26% - 0.30 %	75 %	60 %	35 %
2	0.51% - 0.64 %	85 %	70 %	45 %
3	1.0% - 1.3 %	90 %	85 %	45 %
4	1.9% - 2.7 %	90 %	85 %	60 %
5	3.8% - 5.4 %	95 %	95 %	70 %
6	7.6% - 11.0%	95 %	95 %	80 %
7	> 15.0	95 %	95 %	85 %

Table 2-18a: Signal quality estimation requirements (static)

		Rel. number of cases on correct or 2 adjacent RXQUAL values:		
RXQUAL:	BER range:	Full rate:	Half rate:	DTX:
0	< 0.10%	85 %	85 %	85 %
1	0.26% - 0.30 %	85 %	75 %	75 %
2	0.51% - 0.64 %	85 %	70 %	25 %
3	1.0% - 1.3 %	90 %	80 %	35 %
4	1.9% - 2.7 %	90 %	85 %	50 %
5	3.8% - 5.4 %	90 %	90 %	65 %
6	7.6% - 11.0%	90 %	90 %	80 %
7	> 15.0	90 %	90 %	90 %

Table 2-18b: Signal quality estimation requirements (TU50)

2.1.8.4.3. MS-BSS distance

The BSS shall be able to continuously monitor the delay in the transmission from the MS relative to the expected signal from an MS at zero range. This is required to give Timing Advance information to the MS. For further information see GSM 05.10. This information of the delay (up to 63 bits) may also be used as a criteria for initiating handover at the cell boundary (MAX_MS_RANGE). For further information see GSM 05.08.
The MS-BSS distance assessment is considered tested by the tests of adaptive Time Alignment in section 2.1.8.6.

2.1.8.4.4. Idle channel signal level

As in section 2.1.8.4.1 but no call shall be set up. However, a normal GSM modulated signal is output from the BSSTE on the relevant idle channel. The test shall only be performed under normal test conditions and without SFH.

2.1.8.5. RF power control and handover

Adaptive RF power control is an optional requirement employed to minimise the transmitted power of the BSS whilst maintaining the quality of the radio link, thus minimising interference to cochannel MSs.
The RF power level employed in the BSS may be based upon the measurements reported by the MS and/or the measurements carried out by the BSS.
The strategy employed for RF power control and handover is to be determined by the network operator.

2.1.8.5.1. BCCH power level

The power level of the BCCH shall remain constant at all times and shall be monitored during other tests. However, ramping between timeslots is allowed (see sections 2.1.6.3 and 2.1.6.4).

2.1.8.6. Adaptive frame alignment

DEFINITION
Adaptive frame alignment is the mechanism by which the timeslots transmitted by the MS are initially and dynamically adjusted in time so that the received timeslots in the BSS always fall within the correct time window. This mechanism is controlled by the BSS.
The adaptive frame alignment mechanism is needed since the guard time between timeslots in the timeslot structure is not long enough to cope with MS-BSS propagation delays due to absolute distance. The MS timing is initially adjusted (initial alignment) when accessing the BSS, and is then continuously adjusted for relative distance variations during the call (dynamic alignment). See GSM 05.10 and GSM 03.30 for further information.

METHOD OF MEASUREMENT
If Slow Frequency Hopping (SFH) is supported by the BSS, it shall be disabled during this measurement. The tests shall be performed for the radio frequency channels B, M and T.
During the tests timeslots 0 and 1 (and 1 and 2) on the same carrier shall be considered simultaneously, and the Timing Advance (TA) value signalled to the 2 Mobile Stations concerning adjacent timeslots shall be monitored and compared.
Both the 2 adjacent timeslots shall be exposed to the following propagation conditions in turn:

a) Static,
b) TU50,
c) HT100,
d) RA250.

The propagation conditions for the 2 timeslots shall be independent.

For each propagation condition (except static) and for each MS emulated the signal strength shall be -107 dBm or the C/I shall be 6 dB in turn. For static propagation conditions only a signal strength of -107 dBm is applicable. To avoid a radio link timeout during the tests, the BSSTE must generate an upllink SACCH with a non-limiting signal strength including MEASUREMENT REPORT messages signalling high RXLEV and RXQUAL values. This applies to both emulated MS's when configured with an SACCH, ie configured with a dedicated channel.

1. First, a call shall be set up on a TCH/FS with MS1 using timeslot 1 on the CCCH carrier.
2. Initial alignment: Random access bursts shall be input on the RACH (timeslot 0) as often as possible using different random references (MS0). The emulated round-trip propagation delay of MS0 shall be 3 different values corresponding to TA-values from 0 to 63 in turn (low, medium and high), and for MS1 it shall vary corresponding to the vehicle speed starting from maximum MS-BSS distance moving close to the BSS and back.
3. The random access bursts shall result in a 2nd TCH/FS being established with MS2 using timeslot 2 on the CCCH carrier.
4. Dynamic alignment: The emulated round-trip propagation delay of MS2 shall be as for MS1 in step 2, and for MS1 it shall vary in the opposite direction (ie from 0 distance to maximum and back).

REQUIREMENTS

The difference DELTAx between the emulated round-trip propagation delay and the signalled TA-value shall be evaluated in bits rounded to the nearest integer for at least 1000 pairs of timeslots for both the 2 adjacent timeslots, and shall have the following properties:

1. For static propagation conditions the mean of DELTA1 as well as of DELTA2 shall be 0 +/- 1 bit.
2. Under all propagation conditions the mean of (DELTA1-DELTA2) shall be 0 +/- 1 bit.
3. Under all propagation conditions the standard deviation of DELTA1 as well as of DELTA2 shall be less than 1 bit.

NOTE: +/- 1 bit tolerance is +/- 1/2 bit for assessment error and +/- 1/2 bit for quantization error.

NOTE: Requirement 1 above may need 1 additional bit of tolerance if the BSS has an RX-TX delay tolerance of +/- 1 bit.

The requirements for initial alignment apply only if there is a response to the MS. Whether or not there is a response to the MS is a BSS internal matter decided by upper layers and depending on the configuration of the BSS. The maximum allowed TA-value signalled to the MS is always 63 bits. All requirements apply under normal and extreme test conditions.

2.1.8.7. BCCH Data

The BCCH broadcasts information to the Mobile Stations. This broadcasting is tested by Layer 3 tests in sections 5.1.3 and 7.1.3.

2.2. SIGNALLING ON THE RADIO INTERFACE

2.2.1. Layer 1 functions

The following functions are included in Layer 1:

1. Receive and transmit on radio slots of GSM TDMA carrier
   Layer 1 simultaneously transmits on a carrier and receives on another (see GSM 05.05) and modulates and demodulates information streams on the carrier (see GSM 05.04).
2. Combine radio slots to become physical channels
   Layer 1 is able to handle the Time Multiplexed structure on a carrier. The Time Multiplexed stream of a physical resource is coded and decoded, and blocked and segmented in order to create physical channels. For further details see GSM 05.03 and GSM 05.02. The function results in the offering of links for "traffic data blocks" or "signalling data blocks" from respectively traffic channels and control channels to other Layer 1 entities.
3. Multiplexing and demultiplexing
   A physical channel uses Time Division Multiplexing (TDM) and is defined as a sequence of time slots. A given physical channel shall always use the same time slot number in every TDMA frame. Therefore a time slot sequence is defined by a time slot number (TN) and a TDMA frame number (FN) sequence. For further details see GSM 05.02. In some cases frequency hopping is used, then TDM is combined with Frequency Division Multiplexing (FDM). The radio frequency channel sequence for multiplexing is determined by a certain function described in GSM 05.02 that maps the TDMA frame number onto a radio frequency channel.

4. Radio link management
   Layer 1 performs synchronization in frequency and in time as defined in GSM 05.10, and supervises and measures the physical channels for use in the handover and RF power control algorithms in accordance with GSM 05.08.

On the interface to Layer 2 as described in GSM 04.06 control channels are supported. The service is offered via Service Access Points (SAP) to Layer 2. For further details see GSM 04.04. A SAP is defined for each type of control channel. In the BSS multiple SAPs for one type of control channel may be present for different dedicated connections.

The services provided by Layer 1 are summarized in the following. For further details see GSM 04.04.

1. Physical layer connection for transparent transmission of bits. The bits are to be delivered to the peer data link entity in the same order in which they were submitted to the physical layer;
2. Indication of the physical status of the signalling channel;
3. Transmission of the Layer 2 message units according to their respective Layer 2 priority;
4. Provision of synchronisation and transparency mechanisms;
5. Provision of error protection to ensure a low residual bit error ratio at Layer 2;
6. Reception of random access frames.

The RF transmitter and receiver parts are tested in sections 2.1.6 and 2.1.7, respectively, as well as the static Layer 1 functions which are verified implicitly. The dynamic Layer 1 functions are verified in section 2.1.8.

2.2.2. Layer 2 functions, LAPDm

2.2.2.1. General

Layer 2 functions are described in detail in GSM 04.05 and GSM 04.06 and include the following:

1. Message transfer according to priority indicated by Layer 3.
2. Segmentation or concatenation of information when needed.
3. Handling of acknowledged and unacknowledged information transfer.

These functions are performed by means of procedures. The interworking between these procedures and the adjacent layers is shown in Figure 2-6.

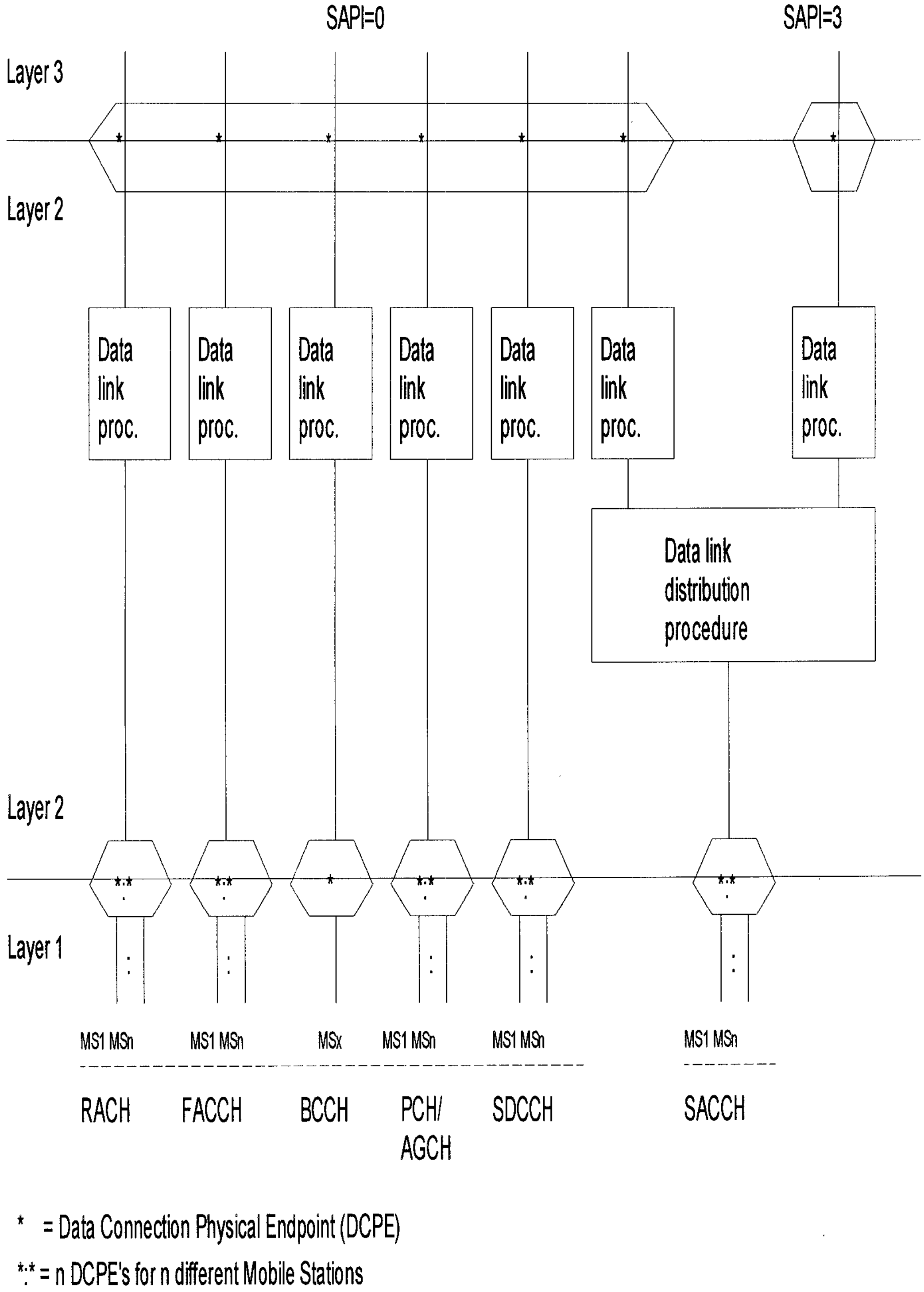


Fig 2-6. Example of layer 2 configuration in the BSS

The following services are provided to the Layer 3:

a) Priority,
b) Segmentation and concatenation,
c) Unacknowledged information transfer service,
d) Acknowledged information transfer service.

a) Priority

Layer 3 messages are sent accordingly to their priority at Layer 3 where:

Highest priority:	SAPI =	0.
Lowest priority:	SAPI =	3.

b) Segmentation and concatenation

For the acknowledged mode of information transfer the data link layer offers segmentation at the transmitter of Layer 3 message units if the message unit is longer than the information field of the data link layer frames. At the receiver the segmented Layer 3 message units are concatenated such that the integrity of the Layer 3 message unit is restored.

For unacknowledged operation the data link layer does not offer segmentation or concatenation services.

c) Unacknowledged information transfer services

The characteristics are summarized in the following. For further details see GSM 04.06.

1. Provision of a data link connection between Layer 3 entities for unacknowleged information transfer of Layer 3 units;
2. Identification of data link connection endpoints to permit a Layer 3 entity to identify another Layer 3 entity;
3. Sending of frames according to the priority given to the message;
4. No verification of message arrival within the data link layer.

d) Acknowledged information transfer services

The characteristics of this services are summarized in the following. For further details see GSM 04.06.

1. Provision of a data link connection between Layer 3 entities for acknowledged information transfer of Layer 3 message units;
2. Identification of data link connection endpoints to permit a Layer 3 entity to identify another Layer 3 entity;
3. Sequence integrity of data link layer message units in the absence of machine malfunctions;
4. Notification to the peer entity in the case of machine errors, for example, loss of sequence;
5. Notification to the mobile managment entity of unrecoverable errors detected by the data link layer;
6. Sending of frames in accordance with the priority;
7. Segmentation and concatenation control functions.

2.2.2.2. Testing of Layer 2 (LAPDm) functions

2.2.2.2.1. Scope

The tests in this section apply to an integrated BSS as well as to a BTS.
The tests in this section are intended to verify the correct operation of the Layer 2 on the radio interface (LAPDm) on a per channel basis. The tests cover only the simplified protocol as described in GSM 04.06. Any interactions between Layer 2 on the radio interface and Layer 2 on the A-interface, or the A-bis-interface if supported by the BSS, as well as the performance under traffic load, are outside the scope of the tests described in this section.
The Layer 2 tests described in this section for the BSS are to great extent similar to the radio interface Layer 2 conformance tests for the Mobile Station (see GSM 11.10).
It should be noted that tests under traffic load, eg when the BSS is exposed to a high number of MS-originated or network originated calls or when Mobile Stations are performing handover at a high rate, are important to verify. It is, as also in the case of the MSC, up to the manufacturer to guarantee the operation of the BSS under a certain traffic load. It is a national or operator specific matter as to whether this shall be verified or not and how to verify it. The verification of the operation under traffic load conditions may differ depending of the internal structure of the BSS.
Tests of other than the simplified LAPDm protocol are a national or operator specific matter.
Only multiple frame operation will be tested. Transfer of unnumbered information is considered as tested implicitly by Layer 1 and Layer 3 tests.

2.2.2.2.2. Introduction

Before the LAPDm functions are tested, the Layer 1 functions of section 2.1 must be verified in advance and T200 initialized. The logical channels SDCCH, FACCH and SACCH all have to be tested in turn with the appropriate tests.
The tests in this section are mostly carried out using the radio interface exclusively, and the tests are described for an integrated BSS. In some cases a message is input on the MSC-interface or the recording of a message on the MSC-interface is of importance to the test. In those case DTAP messages are used.
Although all the tests in this section are described for an integrated BSS, it is also possible to connect the test equipment directly to the BTS and fulfill the test requirements by emulating the actions of both the BSC and MSC, on the test equipment, by sending the required primitives and data on the A-Bis interface.
In the case of testing of a BTS, the DTAP messages used will be mapped on to a DATA REQUEST or DATA INDICATION message containing the DTAP message. It should also be noted that for a BTS there will be additional messages occurring at the A-bis-interface, like ESTABLISHMENT INDICATION, RELEASE INDICATION, ERROR INDICATION etc. These messages are of no importance to the tests only when testing in a complete BSS environment.

2.2.2.2.3. Layer 2 test frames

The Layer 2 tests are accomplished by sequences of those frames which are contained in GSM 04.06 (Layer 2 frame repertoire etc).
These frame sequences are under control of the BSSTE and are related to the state that the BSSTE perceives the BSS to be in as a result of frames transferred across the air interface.
These frame sequences shall comply with the following rules:

1. The test sequences exchanged between the BSSTE and BSS are assumed to be free from transmission errors.
2. The BSSTE may introduce errors in the direction BSSTE to BSS by inserting wrong parameters in the address, control and length indication field.
3. The BSSTE may simulate errors in the direction BSS to BSSTE by ignoring the receipt of frames.
4. The BSSTE may violate the protocol rules related to the control of state variables to provoke sequence gaps.
5. There is no contention on the Dm channel at Layer 1 (Layer 1 point-to-point).

6. With respect to contention on the Dm channel at Layer 2, two distinct situations are defined:
   i) Test of the protocol procedure supported by a single entity. In this case there is no contention on the Dm channel (one peer-to-peer information transfer invoked at a time). This test applies to all BSSs and is performed for SAPI=0 and SAPI=3.
   ii) Test of Layer 2 multiplexing and BSS processing capacity in terms of the number of SAPs and links which a BSS is able to support simultaneously. In this case there is contention on the Dm channel at Layer 2 and this contention is resolved within Layer 2 based on the SAPI. This is considered part of the load testing of a BSS and is not defined in this specification. Load testing of a BSS is a national or operator specific matter.

2.2.2.2.4. General requirements

1) Timing requirement:
   The BSS shall respond to a command or repeat a command within T200 as defined in GSM 04.06 section 5.8.1.
2) Constant bit values:
   In each frame from the BSS the following shall be checked:
   - bits 6 through 8 of the address field shall be set to zero as defined in GSM 04.06 section 3.3.3.
   - except for tests 2.2.2.2.8.11 and 2.2.2.2.9.12, the address extension bit (EA bit) shall be set to 1 as defined in GSM 04.06 section 3.3.1.
   - except for tests 2.2.2.2.8.11 and 2.2.2.2.9.12, the length indicator field extension bit (EL bit) shall be set to 1 as defined in GSM 04.06 section 3.7.1.
3) Fill bits:
   The fill bits transmitted/received with each frame from/to the BSS whose length indicator L is less than N201 as defined in GSM 04.06 section 5.8.3 shall be set as defined in GSM 04.06 section 2.2. It should be noted that the fill frames to be received by the BSS may occur in two different formats (see GSM 04.06).

4) Frame format description:
The simplified LAPDm protocol does not utilize all Layer 2 frames defined in GSM 04.06. The simplified LAPDm set of Layer 2 frames are listed in the following with their parameters:
SABM (C, P, M = 0, L = 0)
SABM (C, P, M = 0, L > 0)
DISC (C, P, M = 0, L = 0)
UA (R, F, M = 0, L = 0)
UA (R, F, M = 0, L > 0)
DM (R, F, M = 0, L = 0)
RR (C, P, M = 0, L = 0, N(R))
RR (R, F, M = 0, L = 0, N(R))
REJ(C, P, M = 0, L = 0, N(R))
REJ(R, F, M = 0, L = 0, N(R))
I (C, P, M = 0, L < N201, N(S), N(R))
I (C, P, M = 1, L = N201, N(S), N(R))
UI (C, P = 0, M = 0, L = 0)
UI (C, P = 0, M = 0, L < N201)

SABM = Set Asynchronous Balanced Mode	(Command)
DISC = DISConnect	(Command)
UA = Unnumbered Acknowledge	(Response)
DM = Disconnect Mode	(Response)
RR = Receive Ready	(Command/Response)
REJ = Reject	(Command/Response)
I = Information transfer	(Command)
UI = Unnumbered Information	(Command)

C = Command
R = Response
P = Poll
F = Final
M = More data bit
L = Length indicator
N(S) = Send sequence number
N(R) = Receive sequence number.

NOTE: If L=0 in a LAPDm frame, this means that there is no information field in it. If 0 < L <= N201, the frame contains a Layer 3 message.

5) Unnumbered Information (UI frames):
The BSS shall at any instant during each of the tests described in this section be able to transmit and receive Unnumbered Information (UI) frames without influence on the multiple frame operation.

6) Fill frames
In periods when no other frames are scheduled for transission on an SDCCH, or on the TCH/FACCH when configured for signalling only, fill frames shall be sent by the BSS. A fill frame is a UI command frame, P=0, for SAPI=0 with an information field of 0 octets length.

2.2.2.2.5. Establishment of the dedicated physical resource

2.2.2.2.5.1. MS-originated

For tests on the Main Signalling Link (MSL) with contention resolution, ie the FACCH or the SDCCH, the BSSTE shall input a CHANNEL REQUEST message on the radio interface of the BSS. The BSS should then respond with an IMMEDIATE ASSIGN message in order to assign either a FACCH or an SDCCH, and expect an SABM frame with information element (contention resolution) from the BSSTE. The BSSTE shall then input an SABM frame (SAPI=0) with contention resolution.
For tests on the main signalling link without contention resolution the above procedure shall be performed and acknowledged, and then the BSSTE shall input a second SABM frame without information element (without contention resolution).
For tests on the SACCH the above procedure on the main signalling link with contention resolution shall be performed and acknowledged, and then an SABM frame without contention resolution indicating SAPI=3 concerning a Short Message Service (SMS) shall be input from the BSSTE. The state of the BSSTE shall be as if an SMS service request has been accepted.

2.2.2.2.5.2. BSS-originated

This establishment applies only to Short Message Services (SMS) on the SACCH or on the SDCCH with SAPI=3.
The establishment procedure on the main signalling link with contention resolution in section 2.2.2.2.5.1 shall be performed and acknowledged, and then any DTAP message indicating SAPI=3 concerning a Short Message Service (SMS) shall be input on the MSC-interface of the BSS. Then an SABM frame without contention resolution shall be expected from the BSS.

2.2.2.2.6. Release of the dedicated physical resource

2.2.2.2.6.1. MS-originated

After a test has been performed the BSSTE shall initiate the release of the SDCCH or FACCH by sending a LAPDm DISC frame to the BSS.

2.2.2.2.6.2. BSS-originated

This release applies only to Short Message Services (SMS) on the SACCH with SAPI=3.
After a test has been performed the BSSTE shall initiate the release of the SACCH by inputting a SAPI "n" CLEAR COMMAND message indicating SAPI=3 on the MSC-interface of the BSS. A LAPDm DISC frame indicating SAPI=3 shall then be expected from the BSS.

2.2.2.2.7. The LAPDm idle state

PURPOSE
To test that the BSS responds correctly to received frames when in the idle state. The operation of this is described in GSM 04.06 section 5.4.5.

METHOD OF TEST
The BSS shall be in the LAPDm idle state. This is obtained by carrying out the MS-originated link establishment in the first paragraph of section 2.2.2.2.5.1, but without inputting the SABM frame. This applies to the main signalling link as well as to the SACCH. The BSSTE shall then in turn input:

- a DISC frame
- an I frame with P=1
- an RR frame with P=1

In all cases the BSS should respond with a DM frame with F=1.
Further, the BSSTE shall in turn input:

- a UA frame
- a DM frame with F=1
- an RR frame with F=1
- an I frame with P=0

In all cases the BSS shall not respond and the timer T200 shall expire in the BSSTE.

NOTE: Due to a timeout of timer T3101 at Layer 3 (see GSM 04.08), it may not be possible to perform the complete test in one row. In this case, the MS-originated link establishment shall be repeated and the test continued from when it was interrupted by T3101.

NOTE: This test also tests the reception of incorrect sequence numbers in the idle state. These are represented by events 7 and 8 in the test itself.

EXPECTED SEQUENCE

```
BSSTE (MS)                                                     BSS
 1 ---------------DISC (SAPI, C, P, M, L)-------------------->
 <----------------DM (SAPI, R, F, M, L)--------------------- 2
 3 ---------------I (SAPI, C, P, M, L, N (R), N(S))---------->
 <----------------DM (SAPI, R, F, M, L)--------------------- 2
 4 ---------------RR (SAPI, C, P, M, L, N (R))--------------->
 <----------------DM (SAPI, R, F, M, L)--------------------- 2
 5 ---------------UA (SAPI, R, F, M, L)---------------------->
   Timeout of T200
 6 ---------------DM (SAPI, R, F, M, L)---------------------->
   Timeout of T200
 7 ---------------RR (SAPI, R, F, M, L, N(R))---------------->
   Timeout of T200
 8 ---------------I (SAPI, C, P, M, L, N(R),N(S))------------>
   Timeout of T200
```

The frames from the BSSTE will be:

1. DISC frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0
3. I frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, 0 <= L <= N201
   N(R)=0, N(S)=0
4. RR frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0
   N(R)=0
5. UA frame containing:
   SAPI = 0, R = 1, F = 1, M = 0, L = 0
6. DM frame containing:
   SAPI = 0, R = 1, F = 1, M = 0, L = 0
7. RR frame containing:
   SAPI = 0, R = 1, F = 1, M = 0, L = 0
   N(R)=1
8. I frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, 0 <= L <= N201
   N(R)=1, N(S)=1

REQUIREMENTS
The frames from the BSS shall be:
2. DM frame containing:
SAPI = 0, R = 0, F = 1, M = 0, L = 0

2.2.2.2.8. Signalling connections (SAPI=0)

The signalling for Call Control (CC), Mobility Management (MM), Radio Resource management (RR) and Supplementary Services support (SS) as defined in GSM 04.08 and GSM 04.10 is characterized on Layer 2 by:

- SAPI=0
- The LAPDm signalling link is always established by MS
- Contention resolution may be required.

Hence, only MS-originated link establishment is tested in this section.
All the tests in this section shall be performed on a FACCH and on an SDCCH. The test on the FACCH shall be carried out twice, if both possibilities are supported by the BSS/BTS as an operator or manufacturer choice, once when the TCH/FACCH is used for signalling only and once when the TCH/FACCH is used for speech/data and signalling.
For tests without contention resolution, as an alternative to the establishment procedure in section 2.2.2.2.5.1, the FACCH or SDCCH may also be established by using the dedicated assignment procedure of section 5.1.3.6 assigning either any traffic channel or only signalling channels, respectively.

2.2.2.2.8.1. Link establishment

2.2.2.2.8.1.1. Normal initialisation (contention resolution)

PURPOSE
To test the normal establishment of multiple frame operation between the BSS and the MS when contention resolution is required. The operation of this is described in GSM 04.06 section 5.4.1.4.

METHOD OF TEST
The signalling link is set up according to section 2.2.2.2.5.1 ending with an SABM frame from the BSSTE.
The BSS shall respond with a UA frame.
The BSS is returned to the idle state as described in section 2.2.2.2.6.1.

EXPECTED SEQUENCE

```
BSS                                                        BSSTE (MS)
 <-----------------SABM (SAPI, C, P, M, L)------------------1
 2------------------UA (SAPI, R, F, M, L)------------------->
```

The frames from the BSSTE will be:
1. SABM frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, 0 < L <= N201
   information field = CM SERVICE REQUEST

REQUIREMENTS
The frames from the BSS shall be:
2. UA frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = L of SABM
   information field = information field of SABM

2.2.2.2.8.1.2. Initialisation failure (contention resolution)

2.2.2.2.8.1.2.1. Repeated SABM (loss of UA frame)

PURPOSE
To test that the BSS can properly handle a repeated SABM frame with contention resolution due to loss of the UA frame sent to the MS. The operation of this is described in GSM 04.06 section 5.4.1.4.

METHOD OF TEST
The signalling link is set up according to section 2.2.2.2.5.1 ending with an SABM frame from the BSSTE.
The BSS should respond with a UA frame.
The BSSTE shall then simulate the loss of the UA frame by repeating the SABM frame after T200.
The BSS should again respond with a UA frame.
The link shall then be released as described in section 2.2.2.2.6.1.

EXPECTED SEQUENCE

```
BSS                                                   BSSTE (MS)
 <----------------SABM (SAPI, C, P, M, L)---------------1  -
                                                           |
 2-----------------UA (SAPI, R, F, M, L)----------------> T200
                                                           |
 <----------------SABM (SAPI, C, P, M, L)---------------1  -
 2-----------------UA (SAPI, R, F, M, L)---------------->
```

The frames from the BSSTE will be:
1. SABM frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, 0 < L <= N201
   information field = CM SERVICE REQUEST

REQUIREMENTS
The frames from the BSS shall be:
2. UA frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = L of SABM
   information field = information field of SABM

2.2.2.2.8.1.2.2. SABMs with different information fields

PURPOSE

To test that the BSS will ignore an SABM frame with contention resolution when another SABM frame with contention resolution is already received but unacknowledged, and when the information contents in the 2 are different. It is also tested that new SABMs with contention resolution are ignored when received in the multiple frame established state.

NOTE: Concerning a re-establishment of the link, an SABM frame without contention resolution will be used. Otherwise the SABM with contention resolution will occur from the idle state.

The operation of this is described in GSM 04.06 section 5.4.1.4.

METHOD OF TEST

The signalling link is set up according to section 2.2.2.2.5.1 ending with a SABM frame with contention resolution (info=I1) from the BSSTE. After the BSS has sent a UA frame with contention resolution (info=I1), another SABM frame with contention resolution, but with different information field (info=I2) shall be input.

The BSS should ignore the 2nd SABM frame and timer T200 shall expire in the BSSTE.

Then another SABM frame without contention resolution (no information field) shall be input by the BSSTE.

The BSS should ignore this SABM frame and timer T200 shall expire in the BSSTE.

Another SABM frame with contention resolution (info=I1) shall be input by the BSSTE.

The BSS should respond with a UA frame with contention resolution (info=I1).

The BSSTE shall then input a correct I frame and the BSS should respond with an RR frame.

Another SABM frame with contention resolution (info=I1) shall be input by the BSSTE.

The BSS should ignore this SABM frame and timer T200 shall expire in the BSSTE.

Another SABM frame without contention resolution (no information field) shall be input by the BSSTE. The BSS should respond with a UA frame.

The BSS is returned to the idle state as described in section 2.2.2.6.1.

EXPECTED SEQUENCE

```
BSS                                                      BSSTE (MS)
 <-----------------SABM (SAPI, C, P, M, L)-----------------1
 2-----------------UA (SAPI, R, F, M, L)------------------>
 <-----------------SABM (SAPI, C, P, M, L)-----------------3
                                                Timeout of T200
 <-----------------SABM (SAPI, C, P, M, L)-----------------4
                                                Timeout of T200
 <-----------------SABM (SAPI, C, P, M, L)-----------------1
 2-----------------UA (SAPI, R, F, M, L)------------------>
 <------------I (SAPI, C, P, M, L, N (R), N(S))-----------5
 6------------RR (SAPI, R, F, M, L, N(R))----------------->
 <-----------------SABM (SAPI, C, P, M, L)-----------------1
                                                Timeout of T200
 <-----------------SABM (SAPI, C, P, M, L)-----------------4
 2-----------------UA (SAPI, R, F, M, L)------------------>
```

The frames from the BSSTE will be:

1. SABM frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, 0 < L <= N201
   information field = CM SERVICE REQUEST
3. SABM frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, 0 < L <= N201
   information field = PAGING RESPONSE
4. SABM frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0
5. I frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, 0 <= L <= N201
   N(R)=0, N(S)=0

REQUIREMENTS
The frames from the BSS shall be:
2. UA frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = L of SABM
   information field = information field of SABM
6. RR frame containing:
   SAPI = 0, R = 0, F = 1, M = 0
   N(R)=1

2.2.2.2.8.1.3. Normal initialisation (no contention resolution)

PURPOSE
To test the normal initialisation of multiple-frame operation when contention resolution is not required. This procedure is used after a data link once has been established with contention resolution and a new data link is established on a new channel, eg handover or dedicated channel assignment.
The operation of this is described in GSM 04.06 section 5.4.1.2.

METHOD OF TEST
The data link is set up between the BSSTE and the BSS as in test 2.2.2.2.5.1 paragraph 2 ending with an SABM frame without contention resolution from the BSSTE.
The BSS shall respond with a UA frame.
The link shall then be released according to section 2.2.2.2.6.1.

EXPECTED SEQUENCE
```
BSS                                                   BSSTE (MS)
 <-----------------SABM (SAPI, C, P, M, L)----------------1
 2-----------------UA (SAPI, R, F, M, L)------------------>
```

The frames from the BSSTE will be:
1. SABM frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0

REQUIREMENTS
The frames from the BSS shall be:
2. UA frame containing:
SAPI = 0, R = 0, F = 1, M = 0, L = 0

2.2.2.2.8.2. Normal information transfer

2.2.2.2.8.2.1. Sequence counting and I frame acknowledgements

PURPOSE
To test the operation of Layer 2 sequence numbering and transferring Layer 2 acknowledgments in I frames ("piggy-backing"). Since there are 8 sequence numbers, the test cycles through 9 information frame transfers.
The non-interfering reception of a UI frame is also tested since this might imply extra RR frames depending on time constraints. Otherwise the non-interfering reception of a UI frame should be verified at any time during other tests.

METHOD OF TEST
The BSS is brought into the multiple frame established state as described in test 2.2.2.2.8.1.1. This will include the establishment of the corresponding SCCP connection on the MSC-interface of the BSS.
On the radio interface the BSSTE shall input a series of 9 I frames, each containing the CONNECT ACKNOWLEDGE message, as rapidly as the LAPDm protocol with window size 1 will allow.
NOTE: Any other DTAP message with SAPI=0 will also serve the purpose, as long as it is short enough not to need segmentation on the radio interface, ie at most 20 octets.
After the 3rd I frame, the BSSTE shall input a UI frame into the series of I frames.
During the same time the BSSTE shall input 9 CONNECT ACKNOWLEDGE messages on the MSC-interface as rapidly as the protocol on the SS7 link will allow. The output of the BSS on the MSC-interface will not be evaluated in this test. The BSSTE will, however, have to perform all MSC-interface functions needed to make the BSS transmit on the MSC-interface.

NOTE: It is assumed that:

- DTAP messages on the MSC-interface can be input at a rate of at least one message every 235 ms (recurrence rate of the SDCCH).
- The transfer of a DTAP message through the BSS does not take longer than 235 ms.

If one of the assumptions is not valid, then the BSS will be found using RR frames for acknowledging I frames instead of piggy-backing acknowledgements into its own I frames.

The BSS should acknowledge the I frames which it received from the BSSTE with first 1 RR frame and with I frames thereafter. Even the first RR frame might be substituted by an I frame if DTAP messages are routed through the BSS fast enough. After the UI frame from the BSSTE, the BSS shall repeat its last I frame, but with the P bit set to 1 this time. The BSSTE shall respond with an RR response, F=1. Thereafter the transmission of I frames shall be resumed on both sides.

NOTE: On the FACCH the sequence of frames might be quite different. Depending on the transfer time through the BSS and on the speed with which DTAP messages can be input on the MSC-interface, the BSS may always have to use RR frames for acknowledgements.

After all I frames have been sent and acknowledged, UI fill frames shall be transmitted by both the BSS and the BSSTE (only during signalling only - not on the TCH/FACCH during speech/data and signalling). The BSSTE shall stop transmitting UI fill frames after 3 UI frames.

EXPECTED SEQUENCE

```
                                                           BSSTE
BSSTE (MS)                                          BSS    (MSC)
                                                       CONN ACK
 1--------I (SAPI, C, P, M, L, N(S), N(R))--------> <-----------
                                                       CONN ACK
 <--------RR (SAPI, R, M, L, N(R), F)-------------2 <-----------
                                                       CONN ACK
 3--------I (SAPI, C, P, M, L, N(S), N(R))--------> <-----------
                                                       CONN ACK
 <--------I (SAPI, C, P, M, L, N(S), N(R))--------4 <-----------
                                                       CONN ACK
 5--------I (SAPI, C, P, M, L, N(S), N(R))--------> <-----------
                                                       CONN ACK
 <--------I (SAPI, C, P, M, L, N(S), N(R))--------6 <-----------
                                                       CONN ACK
 7--------UI (SAPI, C, P, M, L)-------------------> <-----------
                                                       CONN ACK
 <--------I (SAPI, C, P, M, L, N(S), N(R))--------8 <-----------
                                                       CONN ACK
 9--------RR (SAPI, R, P, M, L, N(R))-------------> <-----------
```

```
<--------I (SAPI, C, P, M, L, N(S), N(R))-------10
11-------I (SAPI, C, P, M, L, N(S), N(R))-------->
<--------I (SAPI, C, P, M, L, N(S), N(R))-------12
13-------I (SAPI, C, P, M, L, N(S), N(R))-------->
<--------I (SAPI, C, P, M, L, N(S), N(R))-------14
15-------I (SAPI, C, P, M, L, N(S), N(R))-------->
<--------I (SAPI, C, P, M, L, N(S), N(R))-------16
17-------I (SAPI, C, P, M, L, N(S), N(R))-------->
<--------I (SAPI, C, P, M, L, N(S), N(R))-------18
19-------I (SAPI, C, P, M, L, N(S), N(R))-------->
<--------I (SAPI, C, P, M, L, N(S), N(R))-------20
21-------I (SAPI, C, P, M, L, N(S), N(R))-------->
<--------I (SAPI, C, P, M, L, N(S), N(R))-------22
23-------RR (SAPI, R, P, M, L, N(R))------------->
                              Not during speech/data
<--------UI (SAPI, C, P, M, L)------------------24
                              Not during speech/data
25-------UI (SAPI, C, P, M, L)------------------->
                           .
                           .
```

The frames from the BSSTE will be:
1,3,5,11,13,15,17,19,21:
   I frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, L = 2
   N(S) = 0, 1, 2, 3....7, 0
   N(R) = 0, 0, 1, 3....7, 0
   information field = CONNECT ACKNOWLEDGE
7,25:
   UI frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, L = 0
9:
   RR frame containing:
   SAPI = 0, R = 1, F = 1, M = 0, L = 0, N(R) = 2
23:
   RR frame containing:
   SAPI = 0, R = 1, F = 0, M = 0, L = 0, N(R) = 1

REQUIREMENTS
The frames from the BSS shall be:
2:
RR frame containing:
SAPI = 0, R = 0, F = 0, M = 0, N(R) = 1
4,6,10,12,14,16,18,20,22:
I frame containing:
SAPI = 0, C = 1, P = 0, M = 0, L = 2
N(S) = 0,1,2,3,4....6,7,0
N(R) = 2,3,3,4,5....7,0,1
information field = CONNECT ACKNOWLEDGE
8:
I frame containing:
SAPI = 0, C = 1, P = 1, M = 0, L = 2
N(S) = 1
N(R) = 3
information field = CONNECT ACKNOWLEDGE
24:
UI frame (fill frame) containing:
SAPI = 0, C = 1, P = 0, M = 0, L = 0

2.2.2.2.8.2.2. Receipt of an I frame in the timer recovery state

PURPOSE
To test that the BSS is able to respond to I frames also while in the timer recovery state.
METHOD OF TEST
The link shall be established according to section 2.2.2.2.8.1.1.
The BSSTE shall input an AUTHENTICATION REJECT message to the BSS on the MSC-interface. The BSS should then respond with an I frame on the radio interface.
The BSSTE shall not respond, and the BSS should either repeat the I frame or reply with a RR frame after the expiry of timer T200.
Before the expiry of T200 again, the BSSTE shall input an I frame on the radio interface containing the message CONNECT ACKNOWLEDGE, but not acknowledging the received I frame from the BSS.
After the expiry of T200, the BSS should repeat the I frame or the RR once again, but acknowledging the I frame received from the BSSTE.
The test is stopped by the BSSTE with an RR frame acknowledging the I frame recived from the BSS.

EXPECTED SEQUENCE

```
                                                                 BSSTE
BSSTE (MS)                                                  BSS  (MSC)
                                                              AUTH REJ
                                                             <---------
 <---------I (SAPI, C, P, M, L, N(S), N(R))---------1    -
                                                         |
                                                        T200
                                                         |
 <---------I (SAPI, C, P, M, L, N(S), N(R))---------2    |
                          or                             |
 <---------RR (SAPI, C, P, M, L, N(R))--------------2    -
                                                         |
 3---------I (SAPI, C, P, M, L, N(S), N(R))--------->   T200
                                                         |
 <---------I (SAPI, C, P, M, L, N(S), N(R))---------4    |
                          or                             |
 <---------RR (SAPI, C, P, M, L, N(R))--------------4    -
 5---------RR (SAPI, R, F, M, L, N(R))-------------->
```

The frames from the BSSTE will be:

3:

I frame containing:
SAPI = 0, C = 0, P = 0, M = 0, 0<= L <= N201 (L = 2)
N(S) = 0
N(R) = 0
information field = CONNECT ACKNOWLEDGE

5:

RR frame containing:
SAPI = 0, R = 1, F = 1, M = 0, L = 0
N(R) = 1

REQUIREMENTS

The frames from the BSS shall be:

1:

I frame containing:
SAPI = 0, C = 1, P = 0, M = 0, 0<= L <= N201 (L = 2)
N(S) = 0
N(R) = 0
information field = AUTHENTICATION REJECT

2,4:

I frame containing:
SAPI = 0, C = 1, P = 1, M = 0, 0<= L <= N201 (L = 2)
N(S) = 0
N(R) = 0,1
information field = AUTHENTICATION REJECT

or

RR frame containing:
SAPI = 0, C = 1, P = 1, M = 0, L = 0
N(R) = 0,1

2.2.2.2.8.2.3. Segmentation and Concatenation

PURPOSE
To test the proper use of segmentation and concatenation.

METHOD OF TEST
The link shall be established according to section 2.2.2.2.8.1.1. Then the BSSTE shall input a SETUP message exceeding 22 and less than 37 octets to the BSS on the MSC-interface. The BSS should then output this message on the radio interface in two I frames.
NOTE: Any other DTAP message which is longer than 18-22 octets depending on the signalling channel used would also serve the purpose.
The BSSTE shall acknowledge each of the two I frames received from the BSS with an RR frame.
The BSSTE shall now input a SETUP message on the radio interface, length between 23 and 36 octets, in two I frames. The BSS should acknowledge both I frames with two RR frames and should output the SETUP message on the MSC-interface.
Then both sides may start transmitting UI fill frames if the test is of an SDCCH or on the FACCH during signalling only (not on a TCH/FACCH during speech/data and signalling).

EXPECTED SEQUENCE

```
                                                                    BSSTE
BSSTE (MS)                                                   BSS    (MSC)
                                                                SETUP
                                                              <---------
 <---------I (SAPI, C, P, M, L, N(S), N(R))--------1
 2---------RR (SAPI, R, F, M, L, N(R))------------->
 <---------I (SAPI, C, P, M, L, N(S), N(R))--------3
 4---------RR (SAPI, R, F, M, L, N(R))------------->
                               Not during speech/data
 <---------UI (SAPI, C, P, M, L)-------------------5
 6---------I (SAPI, C, P, M, L, N(S), N(R))-------->
 <---------RR (SAPI, R, F, M, L, N(R))-------------7
 8---------I (SAPI, C, P, M, L, N(S), N(R))-------->
 <---------RR (SAPI, R, F, M, L, N(R))-------------7
                                                                SETUP
                                                              --------->
```

The frames from the BSSTE will be:
2,4:
RR frame containing:
SAPI = 0, R = 1, F = 0, M = 0, L = 0
N(R) = 1,2
6:
I frame containing:
SAPI = 0, C = 0, P = 0, L = 20
N(S) = 0, N(R) = 2
Information field = SETUP (part 1)
8:
I frame containing:
SAPI = 0, C = 0, P = 0, 0 < L <= 20
N(S) = 1, N(R) = 2
Information field = SETUP (part 2)

REQUIREMENTS
The frames from the BSS shall be:
1:
I frame containing:
SAPI = 0, C = 1, P = 0, M = 1, L = 20
N(S) = 0
N(R) = 0
information field = SETUP (part 1)
3:
I frame containing:
SAPI = 0, C = 1, P = 0, M = 0, 0 < L <= 20
N(S) = 1
N(R) = 0
information field = SETUP (part 2)
5:
UI frame (fill frame) containing:
SAPI = 0, C = 1, P = 0, M = 0, L = 0
7:
RR frame containing:
SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1,2

2.2.2.2.8.3. Normal Layer 2 release by MS

PURPOSE
To test the normal data link disconnection sequences.

METHOD OF TEST
The BSS is brought to the multiple frame established state as in section 2.2.2.2.8.1.1.
The BSSTE shall send a Layer 2 DISC frame to the BSS as defined in section 2.2.2.2.6.1. The BSS should respond with a UA frame and return to the idle state.
The BSSTE confirms that that the BSS has returned to the idle state by performing test 2.2.2.2.8.1.1 successfully.

EXPECTED SEQUENCE

```
BSSTE (MS)                                              BSS
 1-----------------DISC (SAPI, C, P, M, L)------------------>
 <-----------------UA (SAPI, R, M, L, F)--------------------2
```

The frames from the BSSTE will be:
1. DISC frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0

REQUIREMENTS
The frames from the BSS shall be:
2. UA frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = 0

2.2.2.2.8.4. Normal Layer 2 release by BSS

Normal Layer 2 disconnection by the BSS does not apply to signalling connections using SAPI=0. Signalling connections are always disconnected by the Mobile Station or by abnormal release.

2.2.2.2.8.5. Abnormal release

PURPOSE

To test the abnormal data link release procedure. The procedure is specified in GSM 04.06 section 5.6.4.

METHOD OF TEST

The BSS is brought into the multiple frame established state as described in test 2.2.2.2.8.1.1.
The BSSTE shall input a DM frame with F=0.
The BSS should then respond in one of the 2 following ways:

1) Local end release

   The BSS should go to the idle state without transmitting any DISC frames. After 4 times T200 the BSSTE will have to verify the idle state by sending a DISC frame.
   The BSS may then respond with a DM frame.

   NOTE: It is assumed that the Layer 3 reaction time in the BSS in order to command abnormal release is shorter than 4 x T200.

   NOTE: Local end release may in some cases be carried out in the BSS by disconnecting the channels. In such a case there will be no DM frame as a response to the DISC frame input.

2) Normal release

   The BSS should respond with a DISC frame. The BSSTE shall then stop the procedure by sending a UA frame.

EXPECTED SEQUENCE

1) Local end release

```
BSSTE (MS)                                                   BSS
 1------------------DM (SAPI, R, F, M, L)---------------------->
 2------------------DISC (SAPI, C, P, M, L)-------------------->
 <------------------DM (SAPI, R, F, M, L)----------------------3
```

2) Normal release

```
BSSTE (MS)                                                    BSS
 1------------------DM (SAPI, R, F, M, L)--------------------->
 <------------------DISC (SAPI, C, P, M, L)-------------------2
 3------------------UA (SAPI, R, F, M, L)--------------------->
```

The frames from the BSSTE will be:

1) Local end release
   1. DM frame containing:
      SAPI = 0, R = 1, F = 0, M = 0, L = 0
   2. DISC frame containing:
      SAPI = 0, C = 0, P = 1, M = 0, L = 0
2) Normal release
   1. DM frame containing:
      SAPI = 0, R = 1, F = 0, M = 0, L = 0
   3. UA frame containing:
      SAPI = 0, R = 1, F = 1, M = 0, L = 0

REQUIREMENTS

The frames from the BSS shall be:

1) Local end release
   3. DM frame containing:
      SAPI = 0, R = 0, F = 1, M = 0, L = 0
2) Normal release
   2. DISC frame containing:
      SAPI = 0, C = 1, P = 1, M = 0, L = 0

2.2.2.2.8.6. Frame loss

2.2.2.2.8.6.1. I Frame loss (BSS to BSSTE)

This is covered by the test in section 2.2.2.2.8.2.2 on receipt of I frames in the timer recovery state.

2.2.2.2.8.6.2. RR Response frame loss (BSSTE to BSS)

This is covered by the test in section 2.2.2.2.8.2.2 on receipt of I frames in the timer recovery state.

2.2.2.2.8.6.3. RR response frame loss (BSS to BSSTE)

PURPOSE
To test the Layer 2 recovery mechanism in the event of RR frame loss.
METHOD OF TEST
The BSS is brought into the multiple frame established state as described in test 2.2.2.2.8.1.1, with the additional exchange of an I frame and an RR frame.
The BSSTE sends a I frame with 0 < L <= N201 to the BSS. The BSS should respond with an RR frame.
The BSSTE ignores the RR frame from the BSS, but after T200 from the I frame sent by the BSSTE the BSSTE repeats the I frame but with the P bit set to 1. This simulates loss of the RR from the BSS.
The BSS shall send a REJ frame acknowledging the I frame.
EXPECTED SEQUENCE

```
BSSTE (MS)                                                BSS
 1-------------I (SAPI, C, P, M, L, N(S), N(R))----------->

 <-------------RR (SAPI, R, M, L, N(R), F)----------------2
 3-------------I (SAPI, C, P, M, L, N(S), N(R))----------->  -
                                                             |
 <-------------RR (SAPI, R, M, L, N(R), F)----------------4 T200
                                                             |
 5-------------I (SAPI, C, P, M, L, N(S), N(R))----------->  -
 <-------------REJ (SAPI, R, M, L, N(R), F)---------------6
```

The frames from the BSSTE will be:
1. I frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, 0 < L <= N201
   N(S) = 0, N(R) = 0
3. I frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, 0 < L <= N201
   N(S) = 1, N(R) = 0
5. I frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, 0 < L <= N201
   N(S) = 1, N(R) = 0

REQUIREMENTS
The frames from the BSS shall be:
2. RR frame containing:
   SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1
4. RR frame containing:
   SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 2
6. REJ frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = 0, N(R) = 2

2.2.2.2.8.7. Reception of REJ frames

2.2.2.2.8.7.1. Data link layer not in the timer recovery state

PURPOSE
To test the REJ frame reception sequence when the data link layer entity is not in a timer recovery state. The operation is described in GSM 04.06.
METHOD OF TEST
The data link is set up between the BSS and the BSSTE as in section 2.2.2.2.8.1.1.
The BSSTE shall input a Layer 3 DTAP message, eg IDENTITY REQUEST, on the MSC-interface, that should result in the transmission of an I frame with P=0 from the BSS.
The BSSTE shall input a REJ command frame with P=1. The BSS should then respond with a supervisory RR frame with F=1 and then the I frame with P=0.
The BSSTE shall input a normal supervisory RR frame indicating satisfactory reception of the I frame.

EXPECTED SEQUENCE

```
                                                                BSSTE
BSSTE (MS)                                                 BSS  (MSC)
                                                              ID REQ
                                                            <--------
 <------------I (SAPI, C, P, M, L, N(S), N(R))-------- 1
 2 -----------REJ (SAPI, C, P, M, L, N(R))------------->
 <------------RR (SAPI, R, F, M, L, N(R))------------- 3
 <------------I (SAPI, C, P, M, L, N(S), N(R))-------- 1
 4 -----------RR (SAPI, R, F, M, L, N(R))-------------->
```

The frames from the BSSTE will be:

2. REJ frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0
   N(R) = 0
4. RR frame containing:
   SAPI = 0, R = 1, F = 0, M = 0, L = 0
   N(R) = 1

REQUIREMENTS

The frames from the BSS shall be:

1. I frame containing:
   SAPI = 0, C = 1, P = 0, M = 0, 0 < L <= N201,
   N(S = 0, N(R) = 0,
   information field = IDENTITY REQUEST
3. RR frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = 0,
   N(R) = 0

2.2.2.2.8.7.2. Data link layer in the timer recovery state, reception of a REJ response frame

PURPOSE

To test the REJ response frame reception sequence when the data link layer entity is in a timer recovery state. The operation is described in GSM 04.06.

METHOD OF TEST

The data link is set up between the BSS and the BSSTE as in section 2.2.2.2.8.1.1.

The BSSTE shall input a Layer 3 DTAP message, eg IDENTITY REQUEST, on the MSC-interface, that should result in the transmission of an I frame with P=0 from the BSS.

The BSSTE shall not respond. After T200, the BSS should repeat the I frame with P=1 or reply with a RR frame, and then enter into the timer recovery state.

The BSSTE shall input a REJ response frame with F=1. The BSS should then exit the timer recovery state and transmit the I frame with P=0.

The BSSTE shall input a normal supervisory RR frame indicating satisfactory reception of the I frame.

EXPECTED SEQUENCE

```
                                                           BSSTE
BSSTE (MS)                                            BSS  (MSC)
                                                         ID REQ
                                                       <--------
 <------------I (SAPI, C, P, M, L, N(S), N(R))-------- 1
                                              Timeout of T200
 <------------I (SAPI, C, P, M, L, N(S), N(R))-------- 3
                        or
 <------------RR (SAPI, C, P, M, L, N(R))------------- 3
 4 -----------REJ (SAPI, R, F, M, L, N(R))------------->
 <------------I (SAPI, C, P, M, L, N(S), N(R))-------- 1
 5 -----------RR (SAPI, R, F, M, L, N(R))-------------->
```

The frames from the BSSTE will be:
4. REJ frame containing:
   SAPI = 0, R = 1, F = 1, M = 0, L = 0
   N(R) = 0
5. RR frame containing:
   SAPI = 0, R = 1, F = 0, M = 0, L = 0
   N(R) = 1

REQUIREMENTS
The frames from the BSS shall be:
1. I frame containing:
   SAPI = 0, C = 1, P = 0, M = 0, 0 < L <= N201,
   N(S) = 0, N(R) = 0,
   information field = IDENTITY REQUEST
3. I frame containing:
   SAPI = 0, C = 1, P = 1, M = 0, 0 < L <= N201,
   N(S) = 0, N(R) = 0,
   information field = IDENTITY REQUEST

or

   RR frame containing:
   SAPI = 0, C = 1, P = 1, M = 0, L = 0
   N(R) = 0

2.2.2.2.8.7.3. Data link layer in the timer recovery state, reception of a REJ command frame

PURPOSE
To test the REJ command frame reception sequence when the data link layer entity is in a timer recovery state. The operation is described in GSM 04.06.

METHOD OF TEST
The data link is set up between the BSS and the BSSTE as in section 2.2.2.2.8.1.1.
The BSSTE shall input a Layer 3 DTAP message, eg IDENTITY REQUEST, on the MSC-interface, that should result in the transmission of an I frame with P=0 from the BSS.
The BSSTE shall not respond. After T200, the BSS should repeat the I frame with P=1 or reply with a RR frame, and then enter into the timer recovery state.
The BSSTE shall input a REJ command frame with P=1. The BSS should not exit the timer recovery state, but transmit a supervisory RR frame with F=1 and then transmit the I frame with P=1.
The BSSTE shall input a normal supervisory RR frame indicating satisfactory reception of the I frame.

EXPECTED SEQUENCE

```
                                                                BSSTE
BSSTE (MS)                                                 BSS  (MSC)
                                                              ID REQ
                                                            <--------
 <------------I (SAPI, C, P, M, L, N(S), N(R))-------- 1
                                               Timeout of T200
 <------------I (SAPI, C, P, M, L, N(S), N(R))-------- 3
                          or
 <------------RR (SAPI, C, P, M, L, N(R))------------- 3
 4 -----------REJ (SAPI, C, P, M, L, N(R))------------->
 <------------RR (SAPI, R, F, M, L, N(R))------------- 5
 <------------I (SAPI, C, P, M, L, N(S), N(R))-------- 6
 7 -----------RR (SAPI, R, F, M, L, N(R))-------------->
```

The frames from the BSSTE will be:
4. REJ frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0
   N(R) = 0
7. RR frame containing:
   SAPI = 0, R = 1, F = 1, M = 0, L = 0
   N(R) = 1

REQUIREMENTS
The frames from the BSS shall be:
1. I frame containing:
   SAPI = 0, C = 1, P = 0, M = 0, 0 < L <= N201,
   N(S) = 0, N(R) = 0,
   information field = IDENTITY REQUEST
3. I frame containing:
   SAPI = 0, C = 1, P = 1, M = 0, 0 < L <= N201,
   N(S) = 0, N(R) = 0,
   information field = IDENTITY REQUEST
or
   RR frame containing:
   SAPI = 0, C = 1, P = 1, M = 0, L = 0
   N(R) = 0
5. RR frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = 0,
   N(R) = 0,
6. I frame containing:
   SAPI = 0, C = 1, P = 1, M = 0, 0 < L <= N201,
   N(S) = 0, N(R) = 0,
   information field = IDENTITY REQUEST

2.2.2.2.8.8. Frame transmission with incorrect C/R values

2.2.2.2.8.8.1. I frame with C bit set to one

PURPOSE
To test that the BSS will take no action when it receives an I frame with the C bit set to one. The operation of this is described in GSM 04.06.
METHOD OF TEST
The data link is set up between the BSS and the BSSTE as in test 2.2.2.2.8.1.1.
The BSSTE shall send an I frame with C=1 and 0 < L <= N201 to the BSS.
The BSSTE shall then wait for at least 4 times T200 to make sure that the BSS does not respond to that I frame, but that the BSS keeps sending UI fill frames if the test is being performed on the SDCCH. On the FACCH the BSS shall respond if used for signalling only, otherwise not.
The BSSTE shall after 4 times T200 send a RR command, P bit set to 1.
The BSS shall respond with an RR response, F bit set to 1.

EXPECTED SEQUENCE

```
BSSTE (MS)                                                  BSS
 1---------------I (SAPI, C, P, M, L, N(S), N(R))------------->
                                 Not during speech/data
 <---------------UI (SAPI, C, P, M, L)------------------------2
 3---------------RR (SAPI, C, M, L, N(R), P)------------------>
 <---------------RR (SAPI, R, M, L, N(R), F)------------------4
```

The frames from the BSSTE will be:
1. I frame containing:
   SAPI = 0, C = 1, P = 1, M = 0, 0 < L <= N201
   N(R) = 0, N(S) = 0
3. RR frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0, N(R) = 0

REQUIREMENTS
The frames from the BSS shall be:
2. UI fill frame containing:
   SAPI = 0, C = 1, F = 0, M = 0, L = 0
4. RR frame containing:
   SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 0

2.2.2.2.8.8.2. <u>SABM frame with C bit set to one</u>

PURPOSE
To test that the BSS will take no action when it receives an SABM frame with the C bit set to one. The operation of this is described in GSM 04.06.

METHOD OF TEST
The link shall be established according to section 2.2.2.2.8.1.1.
The BSSTE shall send a valid I frame including CONNECT ACKNOWLEDGE in order to raise V(R) in the BSS to 1.
The BSS shall acknowledge this by the appropriate RR frame.
The BSSTE sends SABM with C=1.
The BSS shall send a UI fill frame if the test is being performed on the SDCCH. On the FACCH the BSS shall respond only if during signalling only, otherwise not.

The BSSTE shall after T200 send an RR command, P bit set to 1. The BSS shall respond with an RR response, F bit set to 1.
The BSS is returned to the idle state as described in 2.2.2.2.6.1.

EXPECTED SEQUENCE

```
BSSTE (MS)                                                      BSS
 1---------------I (SAPI, C, P, M, L, N(S), N(R))------------->
 <---------------RR (SAPI, R, F, M, L, N(R))------------------2
 3---------------SABM (SAPI, C, P, M, L)--------------------->
                                Not during speech/data
 <---------------UI (SAPI, C, P, M, L)-----------------------4
 5---------------RR (SAPI, C, P, M, L, N(R))----------------->
 <---------------RR (SAPI, R, F, M, L, N(R))------------------6
```

The frames from the BSSTE will be:
1. I frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, 0 < L <= N201
   N(S) = 0, N(R) = 0
   information field = CONNECT ACKNOWLEDGE
3. SABM frame containing:
   SAPI = 0, C = 1, P = 1, M = 0, L = 0
5. RR frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0, N(R) = 0

REQUIREMENTS
The frames from the BSS shall be:
2. RR frame containing:
   SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1
4. UI fill frame containing:
   SAPI = 0, C = 1, P = 0, M = 0, L = 0
6. RR frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = 0, N(R) = 1

2.2.2.2.8.9. Link failure

PURPOSE

To test that the BSS while in the multiple frame established state and after T200 has expired N200 times in a row will either release or re-establish the link. The procedure is specified in GSM 04.06 section 5.5.7.

NOTE: The choice between releasing or re-establishing the link is left to the manufacturer by GSM 04.06.

METHOD OF TEST

The BSS is brought into the multiple frame established state as described in test 2.2.2.2.8.1.1.

Over the MSC interface the BSSTE shall input any DTAP message (length less than 23 octets). The BSS should then transmit an I frame with the P bit set to 0 on the radio interface.

The BSSTE shall not respond.

After T200 the BSS should repeat the I frame, but with the P bit set to 1.

The BSSTE shall not respond

The last two steps shall reoccur (N200 - 1) times.

The BSS may now proceed in either of 3 ways: local end release, normal release or link re-establishment.

1) Local end release
   As in section 2.2.2.2.8.5 (local end release).
2) Normal release
   As in section 2.2.2.2.8.5 (normal release).
3) Link re-establishment
   After approximately 4 times T200 the BSS shall transmit an SABM frame without contention resolution.
   The BSSTE shall answer with a UA frame.

EXPECTED SEQUENCE

```
                                                                    BSSTE
BSSTE (MS)                                                  BSS     (MSC)
                                                                 DTAP
                                                              <---------
 <--------I (SAPI, C, P, M, L, N(S), N(R))---------1
                                   Timeout of T200
 <--------I (SAPI, C, P, M, L, N(S), N(R))---------1
                                   Timeout of T200
 <--------I (SAPI, C, P, M, L, N(S), N(R))---------1
                                   Timeout of T200
                          .                                    N200
                          .
 <--------I (SAPI, C, P, M, L, N(S), N(R))---------1
3) Link re-establishment
BSSTE (MS)                                                     BSS
 <---------------SABM(SAPI, C, P, M, L)--------------------2
 3----------------UA(SAPI, R, F, M, L)--------------------->
```

The frames from the BSSTE will be:
3) Link re-establishment
   3: UA frame containing:
      SAPI = 0, R = 1, F = 1, M = 0, L = 0

REQUIREMENTS
The frames from the BSS shall be:
1: I frame containing:
   SAPI = 0, C = 1, P = 1, M = 0, 0 < L <= N201
   N(S) = 0, N(R) = 0
   Information field = DTAP message
3) Link re-establishment
   2: SABM frame containing:
      SAPI = 0, C = 1, P = 1, M = 0, L = 0

2.2.2.2.8.10. Errors in the Control Field

2.2.2.2.8.10.1. N(S) sequence error

PURPOSE
To test that the BSS will ignore the contents of the I field of an out-of-sequence I frame from the BSSTE, and also to test that the BSS will make use of and react to the N(R) and/or P/F bit contained in an I frame causing an N(S) sequence error. The operation of this is described in GSM 04.06 section 5.7.1 and 5.7.2. Three answers are possible, therefore this tests allows the BSS to use any of them.

METHOD OF TEST
The link shall be established according to section 2.2.2.2.8.1.1.
The BSSTE shall send a correct I frame containing CONNECT ACKNOWLEDGE on the radio interface and input an AUTHENTICATION REJECT message on the MSC-interface.
The BSS shall acknowledge the I frame in an RR frame or piggy back the acknowledgement into the I frame carrying AUTHENTICATION REJECT.
The BSSTE shall first send an RR frame acknowledging the I frame received from the BSS (in order to avoid the problem of timer recovery conditions) and then send an I frame containing CONNECT ACKNOWLEDGE with incorrect N(S), but correctly acknowledging the BSS's I frame (P bit set to zero). The BSS shall <u>not</u> output a CONNECT ACKNOWLEDGE message on the MSC-interface.
The BSS should, however, respond either with a REJ command frame, P=0, or P = 1 or ignore the out of sequence frame. If a REJ frame with P = 1 is sent, the BSSTE shall respond with an RR frame with F = 1.
The BSSTE shall, after T200, retransmit its last I frame (with the incorrect N(S) sequence number), but with the P bit set to 1 this time. The BSS shall respond with a REJ response frame, F=1 or an RR frame with the F bit set to 1.
The BSSTE shall now transmit an I frame with correct N(S) sequence number.
The BSS should acknowledge this by an RR frame.

EXPECTED SEQUENCE

```
                                                                          BSSTE
BSSTE (MS)                                                        BSS     (MSC)
                                                                     AUTH REQ
                                                                    <---------
 1---------I (SAPI, C, P, M, L, N(S), N(R))---------->
 <---------RR (SAPI, R, F, M, L, N(R))---------------2
                                            May be one frame
 <---------I (SAPI, C, P, M, L, N(S), N(R))----------3
 1bis------RR (SAPI, R, P, M, L, N(R))--------------->
 4---------I (SAPI, C, P, M, L, N(S), N(R))---------->

The following frame is optional:
 <---------REJ (SAPI, C, P, M, L, N(R))--------------5

 4bis------RR (SAPI, R, F, M, L, N(R))---------------> (see Note)
 6---------I (SAPI, C, P, M, L, N(S), N(R))---------->
The following frame is optional:
 <---------REJ (SAPI, R, F, M, L, N(R))--------------7
 8---------I (SAPI, C, P, M, L, N(S), N(R))---------->
 <---------RR (SAPI, R, F, M, L, N(R))---------------9
```

Note: This frame is only used by the BSSTE to acknowledge the REJ frame with P bit set to 1. In the other cases this frame is not used.

The frames from the BSSTE will be:

1. I frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, 0 <= L <= N201
   N(S) = 0, N(R) = 0
   information field = CONNECT ACKNOWLEDGE

1bis. RR frame containing
   SAPI = 0, R = 1, P = 0, M = 0, L = 0, N(R) = 1.

4. I frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, 0 <= L <= N201
   N(S) = 2, N(R) = 1
   information field = CONNECT ACKNOWLEDGE

4bis. RR frame containing
   SAPI = 0, C = 0, F = 1, M = 0, L = 0, N(R) = 1.

6. I frame containing:
   SAPI = 0, C = 0, P = 1, M = 0, 0 <= L <= N201
   N(S) = 2, N(R) = 1
   information field = CONNECT ACKNOWLEDGE

8. I frame containing:
   SAPI = 0, C = 0, P = 0, M = 0, 0 <= L <= N201
   N(S) = 1, N(R) = 1
   information field = CONNECT ACKNOWLEDGE

REQUIREMENTS
The frames from the BSS shall be:
2. RR frame containing:
   SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 1
3. I frame containing:
   SAPI = 0, C = 1, P = 0, M = 0, 0 <= L <= N201
   N(R) = 1, N(S) = 0
   information field = AUTHENTICATION REJECT
5. REJ frame containing (optional):
   SAPI = 0, C = 1, P = 0 or P = 1, M = 0, L = 0, N(R) = 1
7. REJ or RR frame containing:
   SAPI = 0, R = 0, F = 1, M = 0, L = 0, N(R) = 1
9. RR frame containing:
   SAPI = 0, R = 0, F = 0, M = 0, L = 0, N(R) = 2

2.2.2.2.8.10.2. N(R) sequence error

PURPOSE
To test that the BSS will detect a N(R) sequence error and react in the proper way to it, in particular, that the BSS will react to a P bit set to 1 before performing abnormal link release and that the information field contained in an I frame causing the N(R) sequence error is passed on to higher layers if N(S) was correct. The operation of this is outlined in GSM 04.06 section 5.7.4.

METHOD OF TEST
The link shall be established according to section 2.2.2.2.8.1.1.
The BSSTE shall input an AUTHENTICATION REJECT message on the MSC-interface of the BSS. The BSS should then transmit an I frame on the radio interface.
The BSSTE shall send an I frame containing CONNECT ACKNOWLEDGE, a correct send sequence number N(S) and a faulty receive sequence number N(R).

Depending on the processing speed and on the implementation of LAPDm in the BSS the BSS may send a UI fill frame if the test is being performed on the SDCCH. On the FACCH, a UI fill frame may also be sent if the TCH/FACCH is configured for signalling only, otherwise not. Then the BSS shall perform abnormal release (see section 2.2.2.2.8.5) and the CONNECT ACKNOWLEDGE message may be output on the MSC-interface.

NOTE: It is assumed that the Layer 3 reaction time within the BSS to command abnormal release is less than 4 times T200.

EXPECTED SEQUENCE

```
                                                                  BSSTE
BSSTE (MS)                                                 BSS    (MSC)
                                                               AUTH REJ
                                                             <----------
<--------I (SAPI, C, P, M, L, N (R), N (S))--------1
2--------I (SAPI, C, P, M, L, N (R), N (S))-------->
                              Not during speech/data
<--------UI (SAPI, C, P, M, L)---------------------3
                                   .                           CONN ACK
                                   .                         ---------->
                Abnormal release
```

The frames from the BSSTE are:

2. I frame:
   SAPI = 0, C = 0, P = 0, M = 0, 0 < L < N 201 (L = 2)
   N (R) = 5, N (S) = 0
   information field = CONNECT ACKNOWLEDGE

REQUIREMENTS

The frames from the BSS shall be:

1. I frame:
   SAPI = 0, C = 1, P = 0, M = 0, 0 <= L <= N 201 (L = 2)
   N (S) = 0, N (R) = 0
   information field = AUTHENTICATION REJECT
3. UI frame (fill frame):
   SAPI = 0, C = 1, P = 0, M = 0, L = 0

2.2.2.2.8.10.3. Improper F bit

PURPOSE
To test that the BSS, being in the timer recovery state, will return to the multiple frame established state only after having received an RR response with the F bit set to 1. This test is described in GSM 04.06 section 5.5.7.

METHOD OF TEST
The data link is set up between the BSS and the BSSTE as in test 2.2.2.2.8.1.1.
The BSSTE shall input an AUTHENTICATION REJECT message to the BSS on the MSC interface. The BSS should respond with an I frame on the radio interface.
The BSSTE shall not respond, timer T200 shall expire in the BSS and the BSS shall repeat its I frame, with the P bit set to 1 this time or reply with a RR frame.
The BSSTE shall respond with a RR response, acknowledging the I frame from the BSS but with the F bit set to 0. Timer T200 should expire again in the BSS and the BSS should repeat its I frame, with the P bit set to 1 again, or repeat its RR frame.
The BSSTE shall now input a RR response frame with the F bit set to 1, acknowledging the I frame again. The BSS should accept the acknowledge. It should start transmitting fill frames (on the SDCCH or FACCH during signalling only) or send no further frames (on the TCH/FACCH during speech/data and signalling).

EXPECTED SEQUENCE

```
                                                                    BSSTE
BSSTE (MS)                                          BSS             (MSC)
                                                               AUTH REJ
 <------I (SAPI, C, P, M, L, N(S), N(R))-------1  - <--------
                                                   |
                                                  T200
                                                   |
 <------I (SAPI, C, P, M, L, N(S), N(R))-------2  -
                         or                        |
 <---------RR (SAPI, C, P, M, L, N(R))---------2  -
                                                   |
 3--------RR (SAPI, R, F, M, L, N(R))----------> T200
                                                   |
 <------I (SAPI, C, P, M, L, N(S), N(R))-------2  -
                         or                        |
 <---------RR (SAPI, C, P, M, L, N(R))---------2  -
 4--------RR (SAPI, R, F, M, L, N(R))---------->
                         Not during speech/data
 <----------UI (SAPI, C, P, M, L)--------------5
```

The frames from the BSSTE will be:
3: RR frame containing:
SAPI = 0, R = 1, F = 0, M = 0, L = 0
N(R) = 1
4: RR frame containing:
SAPI = 0, R = 1, F = 1, M = 0, L = 0
N(R) = 1
REQUIREMENTS
The frames from the BSS shall be:
1: I frame containing:
SAPI = 0, C = 1, P = 0, M = 0, 0 < L <= N201
N(S) = 0
N(R) = 0
information field = AUTHENTICATION REJECT
2: I frame containing:
SAPI = 0, C = 1, P = 1, M = 0, 0 < L <= N201
N(S) = 0
N(R) = 0
information field = AUTHENTICATION REJECT
or
RR frame containing:
SAPI = 0, C = 1, P = 1, M = 0, L = 0
N(R) = 0
5: UI frame (fill frame) containing:
SAPI = 0, C = 1, P = 0, M = 0, L = 0

2.2.2.2.8.11. Receipt of invalid frames

PURPOSE
To test that the BSS will ignore all invalid frames. The definition of invalidity and the operation of this test is described in GSM 04.06 section 5.7.3.

METHOD OF TEST
The data link is set up between the BSS and the BSSTE as in test 2.2.2.2.8.1.1. The BSSTE shall then transmit:
- SABM frame with the EL bit set to zero;
- DM frame with the Length Indicator greater than zero;
- DISC frame with the M bit set to 1;
- UA frame with the EA bit set to zero;
- I frame with the Length Indicator greater than N201;
- I frame with the M bit set to 1 and the Length Indicator less than N201;
- Command frames with correct Address and Length Indicator field and a non-implemented control field.

To all those frames the BSS shall respond by sending a UI fill frame, if the test is being performed on the SDCCH. On the FACCH, a UI fill frame may be sent if the TCH/FACCH is configured for signalling only, otherwise not.

After T200 the BSSTE shall in every case transmit an RR command, P bit set to 1.

The BSS shall respond with RR response, F bit set to 1.

NOTE: GSM 04.06 only specifies that any contents of invalid frames (control parameters or information fields) are to be discarded and that an error indication to Layer 3 has to be given. The actions thereafter by Layer 3 are not specified. One conceivable reaction of Layer 3 to the reception of an invalid frame could be an abnormal release of the data link. In such a case the tests outlined in this section could not be performed in a row. Instead, the link would have to be established again and again from scratch (starting with the CHANNEL REQUEST message from the BSSTE on the RACH).

EXPECTED SEQUENCE

```
BSSTE (MS)                                                    BSS
5 -------------SABM (SAPI, C, P, M, L)---------------------->
                                            Not during speech/data
<--------------UI (SAPI, C, P, M, L)----------------------- 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
6 -------------DM (SAPI, R, P, M, L)------------------------>
                                            Not during speech/data
<--------------UI (SAPI, C, P, M, L)----------------------- 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
7 -------------DISC (SAPI, C, P, M, L)---------------------->
                                            Not during speech/data
<--------------UI (SAPI, C, P, M, L)----------------------- 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
8 -------------UA (SAPI, R, F, M, L)------------------------>
                                            Not during speech/data
<--------------UI (SAPI, C, P, M, L)----------------------- 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
```

```
9 -------------I (SAPI, C, P, M, L, N (R), N (S))----------->
                                         Not during speech/data
<--------------UI (SAPI, C, P, M, L)----------------------- 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
10 ------------I (SAPI, C, P, M, L, N (R), N (S))----------->
                                         Not during speech/data
<--------------UI (SAPI, C, P, M, L)----------------------- 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<---------------RR (SAPI, R, F, M, L, N (R))----------------12
13 ------------------------------------------------------------>
                                         Not during speech/data
<--------------UI (SAPI, C, P, M, L)-----------------------2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
14 ------------------------------------------------------------>
                                         Not during speech/data
<--------------UI(SAPI, C, P, M, L)------------------------ 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
15 ------------------------------------------------------------>
                                         Not during speech/data
<--------------UI(SAPI, C, P, M, L)------------------------ 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
16 ------------------------------------------------------------>
                                         Not during speech/data
<--------------UI(SAPI, C, P, M, L)------------------------ 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
17 ------------------------------------------------------------>
                                         Not during speech/data
<--------------UI(SAPI, C, P, M, L)------------------------ 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
```

```
18 ---------------------------------------------------------->
                                        Not during speech/data
<--------------UI(SAPI, C, P, M, L)------------------------ 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
19 ---------------------------------------------------------->
                                        Not during speech/data
<--------------UI(SAPI, C, P, M, L)------------------------ 2
11 ------------RR (SAPI, C, P, M, L, N (R))----------------->
<--------------RR (SAPI, R, F, M, L, N (R))----------------12
```

The frames from the BSSTE are:

5. SABM frame:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0, EL = 0
6. DM frame:
   SAPI = 0, R = 1, F = 1, M = 0, L > 0
7. DISC frame:
   SAPI = 0, C = 0, P = 1, M = 1, L = 0,
8. UA frame:
   SAPI = 0, R = 1, F = 0, M = 0, L = 0, EA = 0
9. I frame:
   SAPI = 0, C = 0, P = 0, M = 0, L > N201, N(R) = 0, N(S) = 0
10. I frame:
   SAPI = 0, C = 0, P = 0, M = 1, L < N201, N(R) = 0, N(S) = 0
11. RR frame:
   SAPI = 0, C = 0, P = 1, M = 0, L = 0, N(R) = 0
13. A command frame with
   Control Field = XXX1 1101
14. A command frame with
   Control field = XXX1 1011
15. A command frame with
   Control field = XXX1 0111
16. A command frame with
   Control field = 01X1 1111
17. A command frame with
   Control field = 1XX1 1111
18. A command frame with
   Control field = 0011 0011

19. A command frame with
    Control field = 1XX1 0011

NOTE: An "X" stands for an arbitrary bit value.

REQUIREMENTS

The frames from the BSS shall be:

2. UI fill frame:
   SAPI = 0, C = 1, P = 0, M = 0, L = 0

12. RR frame:
   SAPI = 0, R = 0, F = 1, M = 0, L = 0, N (R) = 0

2.2.2.2.9. Short Message Services (SMS) (SAPI=3)

The Short Message Services support (SMS) as defined in GSM 04.11 is characterized on Layer 2 by:

- SAPI=3
- SMS exists on the SACCH if a TCH is allocated. If no TCH is allocated, SMS exists on the SDCCH. Consequently, all tests described below shall be carried out once on an SACCH (of a TCH) and once on an SDCCH.
- The LAPDm signalling link may be established by MS or by BSS.
- Contention resolution is not required.
- A data link for SAPI=3 can only be established and maintained while a data link for SAPI=0 is existing. Consequently, it will be assumed throughout this section that a data link for SAPI=0 exists.
- Timer T200 for SAPI=3 is not necessarily the same as for SAPI=0 and depends on the logical channel used.

2.2.2.2.9.1. MS-originated link establishment

The tests shall be performed as in section 2.2.2.2.9, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.1.

2.2.2.2.9.2. BSS-originated link establishment

2.2.2.2.9.2.1. Normal initialisation (no contention resolution)

PURPOSE
To test the normal initialisation of multiple-frame operation when contention resolution is not required. This procedure is used after a data link has been established with contention resolution and an additional data link is established for a Short Message Service (SMS) using SAPI=3.
The operation of this is described in GSM 04.06 section 5.4.1.2.

METHOD OF TEST
The data link shall be established on a SACCH according to section 2.2.2.2.5.2 ending with an SABM frame without contention resolution from the BSS.
The BSSTE responds with a UA frame.
The test shall be repeated on an SDCCH.

EXPECTED SEQUENCE

```
BSSTE (MS)                                                  BSS
 <-----------------SABM (SAPI, C, P, M, L)------------------1
 2-----------------UA (SAPI, R, F, M, L)-------------------->
```

The frames from the BSSTE will be:
2. UA frame containing:
   SAPI = 3, R = 1, F = 1, M = 0, L = 0

REQUIREMENTS
The frames from the BSS shall be:
1. SABM frame containing:
   SAPI = 3, C = 1, P = 1, M = 0, L = 0

2.2.2.2.9.2.2. Initialisation failure (no contention resolution)

PURPOSE
To test the BSS response to the loss of a Layer 2 UA frame during initialisation. Also the fact that numbered frames and wrong DM and UA frames (F=0) are ignored is tested.

METHOD OF TEST
The data link shall be established on a SACCH according to section 2.2.2.2.5.2 ending with an SABM frame without contention resolution from the BSS.
The BSSTE shall ignore the first SABM frame from the BSS. The BSS should wait for timeout of timer T200 and then send a second SABM frame.
The BSSTE shall before T200 expires send an I frame, with 0 < L <= N201.
The BSS should ignore the I frame and repeat the SABM frame after T200.
The BSSTE shall before T200 expires send a UA frame with F=0. The BSS should ignore the UA frame and repeat the SABM frame after T200.
The BSSTE shall before T200 expires send a DM frame with F=0.
The BSS should ignore the DM frame and repeat the SABM frame after T200. The BSSTE shall respond with a UA frame with F=1 to finish the procedure.
The BSS is returned to the idle state as described in 2.2.2.2.6.1.
The test shall be repeated on an SDCCH.

EXPECTED SEQUENCE

```
BSSTE (MS)                                                BSS
 <---------------SABM (SAPI, C, P, M, L)------------------1
                                        Timeout of T200
 <---------------SABM (SAPI, C, P, M, L)------------------1  -
                                                             |
 2---------------I (SAPI, C, P, M, L, N(R), N(S))---------> T200
                                                             |
 <---------------SABM (SAPI, C, P, M, L)------------------1  -
                                                             |
 3---------------UA (SAPI, R, F, M, L)--------------------> T200
                                                             |
 <---------------SABM (SAPI, C, P, M, L)------------------1  -
                                                             |
 4---------------DM (SAPI, R, F, M, L)--------------------> T200
                                                             |
 <---------------SABM (SAPI, C, P, M, L)------------------1  -
 5---------------UA (SAPI, R, F, M, L)-------------------->
```

The frames from the BSSTE will be:

2. I frame containing:
   SAPI = 3, C = 0, P = 1, M = 0, 0 < L <= N201
   N(S)=0, N(R)=0
3. UA frame containing:
   SAPI = 3, R = 1, F = 0, M = 0, L = 0
4. DM frame containing:
   SAPI = 3, R = 1, F = 0, M = 0, L = 0
5. UA frame containing:
   SAPI = 3, R = 1, F = 1, M = 0, L = 0

REQUIREMENTS

The frames from the BSS shall be:

1. SABM frame containing:
   SAPI = 3, C = 1, P = 1, M = 0, L = 0

2.2.2.2.9.2.3. Initialisation denial (no contention resolution)

PURPOSE

To test that the BSS takes appropriate action if the data link can not be initialised if the network side indicates the Layer 3 process is busy.

METHOD OF TEST
The data link shall be established on a SACCH according to section 2.2.2.2.5.2 ending with an SABM frame without contention resolution from the BSS.
The BSSTE responds with a DM frame.
The BSSTE then waits at least T200.
The BSS shall not repeat the SABM frame.
The test shall be repeated on an SDCCH.

EXPECTED SEQUENCE

```
BSSTE (MS)                                                    BSS
 <-----------------SABM (SAPI, C, P, M, L)------------------1
 2-----------------DM (SAPI, C, P, M, L)-------------------->
```

The frames from the BSSTE will be:
2. DM frame containing:
   SAPI = 3, R = 1, F = 1, M = 0, L = 0

REQUIREMENTS
The frames from the BSS shall be:
1. SABM frame containing:
   SAPI = 3, C = 1, P = 1, M = 0, L = 0

2.2.2.2.9.2.4. Total initialisation failure (no contention resolution)

PURPOSE
To test the BSS response to the lack of the system to respond to requests to initialise the data link.

METHOD OF TEST
The data link shall be established on a SACCH according to section 2.2.2.2.5.2 ending with an SABM frame without contention resolution from the BSS.
The BSSTE ignores the first SABM frame from the BSS.

The BSS shall wait for timeout of timer T200 and then send a second SABM frame.
This is repeated until the BSS has sent the SABM frame N200+1 times. The BSS shall not send the SABM more than N200+1 times.
The test shall be repeated on an SDCCH.

EXPECTED SEQUENCE

```
BSSTE (MS)                                                    BSS
 <-----------------SABM (SAPI, C, P, M, L)--------------------1
                                          Timeout of T200
 <-----------------SABM (SAPI, C, P, M, L)--------------------1
                                          Timeout of T200
 <-----------------SABM (SAPI, C, P, M, L)--------------------1
                                          Timeout of T200
 <-----------------SABM (SAPI, C, P, M, L)--------------------1
                             .
                             .
                             .            Timeout of T200
 <-----------------SABM (SAPI, C, P, M, L)--------------------1
                                          Timeout of T200
 <-----------------SABM (SAPI, C, P, M, L)--------------------1
  (N200+1 SABM frames)
```

REQUIREMENTS
The frames from the BSS shall be:
1. SABM frame containing:
   SAPI = 3, C = 1, P = 1, M = 0, L = 0

2.2.2.2.9.3. Normal information transfer

The tests shall be performed as in section 2.2.2.2.8.2, with the following modifications:
- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.
- A relevant short message shall be used instead of the DTAP messages with SAPI=0 for the test of signalling connections (either a message which is short enough to avoid segmentation or long enough to need it).

2.2.2.2.9.4. Normal Layer 2 release by MS

The tests shall be performed as in section 2.2.2.2.8.3, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.
- The idle state shall be checked by carrying out the establishment test of section 2.2.2.2.5.2.

2.2.2.2.9.5. Normal Layer 2 release by BSS

The tests shall be performed as in section 2.2.2.2.8.5 (abnormal release), with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.
- The disconnection shall be triggered by a SAPI "n" CLEAR COMMAND message indicating SAPI=3 on the MSC-interface of the BSS rather than the erroneous DM frame.

2.2.2.2.9.6. Abnormal release

The tests shall be performed as in section 2.2.2.2.8.5, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.

2.2.2.2.9.7. Frame loss

The tests shall be performed as in section 2.2.2.2.8.6, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.

2.2.2.2.9.8. Reception of REJ frames

The tests shall be performed as in section 2.2.2.2.8.7, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.

2.2.2.2.9.9. Frame transmission with incorrect C/R values

The tests shall be performed as in section 2.2.2.2.8.8, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.

2.2.2.2.9.10. Link failure

The tests shall be performed as in section 2.2.2.2.8.9, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.
- The DTAP message shall be an SMS message.

2.2.2.2.9.11. Errors in the Control Field

The tests shall be performed as in section 2.2.2.2.8.10, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.

2.2.2.2.9.12. Receipt of invalid frames

The tests shall be performed as in section 2.2.2.2.8.11, with the following modifications:

- SAPI=3
- The link shall in each case be established on the SACCH and on the SDCCH in turn as in section 2.2.2.2.5.2.

2.2.3. Layer 3 functions

The functions of the Layer 3 are partitioned into the following 3 sublayer entities according to GSM 04.07 and GSM 04.08:

1. Connection Management (CM)
   This entity is further split into the 3 following independent Layer 3 sub-entities:
   a) Call Control (CC)
      The CC entity contains elementary procedures which are necessary for establishment and clearing of mobile originated or mobile terminated circuit switched calls. For details see GSM 04.08.
   b) Supplementary Services support (SS)
      The SS entity contains elementary procedures for support of supplementary services. The procedures concern administration of calls, like call forwarding and charging. For details see GSM 04.10.
   c) Short Message Services support (SMS)
      The SMS entity contains elementary procedures to relay a short message between the MS and MSC over the radio path. For details see GSM 04.11.
2. Mobility Management (MM)
   The MM entity contains procedures which support the mobility of user terminals. The purpose of these functions is to inform the network when a Mobile Station is activated and deactivated or changing location area, and also to take care of the security aspects that are related to the open radio path. For details see GSM 04.08.
3. Radio Resource management (RR)
   The RR entity contains elementary procedures for radio resource management, eg establishing and maintaining physical channels. This includes handover upon request by the network and re-establishment in case of a lost channel. For details see GSM 04.08.

The Layer 3 on the radio interface shall be according to the detailed descriptions given in GSM 04.08, GSM 04.10, GSM 04.11 and the GSM 04.8x-series.
For testing of the radio interface Layer 3 functions see sections 5.1 and 7.1 in this specification. The Layer 3 functions of the radio interface are tested together with Layer 3 on the A-interface (BSS network functions). The radio interface Layer 3 is also tested together with the Layer 3 on the A-bis-interface, if used (BTS network functions).

2.2.4. Short Message Service Cell Broadcast (SMSCB)

The SMSCB function is specific in that it uses its own physical channel, CBCH, where complete 24 octets Layer 1 blocks are transmitted as defined in GSM 04.12, 05.02, 05.03 and 04.06. No LAPDm functionality is used.
The testing of this transmission and the corresponding functions within the the BSS are included in sections 5.1.3, 6.1.3 and 7.1.3.

3. INTERNAL A-BIS-INTERFACING

The use of the A-bis-interface is optional for a GSM PLMN operator. However, if one or more transceiver units of a BSS are not colocated with the control functions of the BSS, the BSS shall be split into the 2 functional entities Base Station Controller (BSC) and Base Transceiver Station(s) (BTS(s)). See also section 1 in this specification. This section tests the A-bis-interface, if used, and applies to a BSC as well as to a BTS.
The interface between the Base Station Controller (BSC) and the Base Transceiver Station (BTS) is defined in GSM 08.5x and 08.6x.

3.1. LAYER 1

This section applies to a BSC as well as to a BTS.
Layer 1 shall utilize digital transmission at a rate of 2048 kbit/s with a frame structure of 32 x 64 kbit/s timeslots or at a rate of 64 kbit/s. The detailed structure of Layer 1 on the A-bis-interface shall be according to GSM 08.54.
The Layer 1 testing of a 64 kbit/s or 2048 kbit/s PCM link is a national or operator specific matter.

3.2. SIGNALLING TRANSPORT MECHANISM, LAYER 2

3.2.1. Base Station Controller

Layer 2 on the A-bis-interfac is based on the modified LAPD protocol as specified in recommendation CEPT T/S 46-20. The detailed Layer 2 specification is given in GSM 08.56.
Layer 2 shall be tested according to the relevant parts of the Layer 2 testing in:

NET 3 (Norme Europeenne de Telecommunications):
Approval requirements for terminal equipment to connect to Integrated Services Digital Network (ISDN) using basic ISDN access, part 1 (layers 1 and 2 aspects)

Testing of parts of LAPD to which the Layer 2 testing in NET 3 does not apply, is a national or operator specific matter.

NOTE: NET 3 applies to the terminal equipment side of LAPD, while in GSM the BSC represents the network side.

In the GSM system the LAPD protocol on the A-bis-interface has been slightly modified. The modifications to the LAPD protocol have to be tested explicitly. Other modifications to the LAPD protocol have to be taken into account while applying the tests given in NET3.
Additional tests for the modified parts of LAPD according to GSM 08.56 are defined in the following. The following tests replace the corresponding tests in NET3.
Before carrying out any of the following tests the timer T201 shall be set globally by an O&M message as defined by the operator or the manufacturer over the OMC-interface.

3.2.1.1. Successful TEI allocation - fixed TEI

PURPOSE

To check that the BSC correctly initiates the TEI identity check procedure during TEI allocation and correctly assigns the requested TEI when no identity responses occur within a certain guard period. The TEI shall be in the range 0-63.

METHOD OF TEST

A UI frame shall be input to the BSC containing the message IDENTITY REQUEST and an Action Indicator (AI). The AI shall be 50.
The BSC should respond with a UI frame containing the message IDENTITY CHECK REQUEST and AI=50, followed by a UI frame containing the message IDENTITY ASSIGN and AI=50 after the expiry of T201 twice.

EXPECTED SEQUENCE

```
   BSSTE                                                 BSC
                          UI (ID REQ, AI)
     1 ---------------------------------------------------->
                        UI (ID CHK REQ, AI)
     <--------------------------------------------------- 2  -
                                                            T201
                                                             -
                         UI (ID ASS, AI)                    T201
     <--------------------------------------------------- 3  -
```

The frames from the BSSTE will be:

1. UI frame with:
   SAPI=63, C=0, P=0, TEI=127
   Info=IDENTITY REQUEST
   AI=50, RI=0 (not used)

REQUIREMENTS

The frames from the BSC shall be:

2. UI frame with:
   SAPI=63, C=1, P=0, TEI=127
   Info=IDENTITY CHECK REQUEST
   AI=50, RI=0 (not used)
3. UI frame with:
   SAPI=63, C=1, P=0, TEI=127
   Info=IDENTITY ASSIGN
   AI=50, RI=0 (not used)

3.2.1.2. Denied TEI allocation - fixed TEI

PURPOSE

To check that the BSC correctly omits to assign a TEI when another TRX responds to the identity check within a certain guard period. The TEI shall be in the range 0-63.

METHOD OF TEST

A UI frame shall be input to the BSC containing the message IDENTITY REQUEST and AI=50.
The BSC should respond with a UI frame containing the message IDENTITY CHECK REQUEST and AI=50.
Within twice the expiry of T201 a UI frame containing the message IDENTITY CHECK RESPONSE and AI=50 shall be input to the BSC emulating a response from another TRX.
The BSC shall not respond with any further frames.

EXPECTED SEQUENCE

```
BSSTE                                                     BSC
                     UI (ID REQ, AI)
  1 ----------------------------------------------------->
                   UI (ID CHK REQ, AI)
  <---------------------------------------------------- 2  -
                                                          T201
                   UI (ID CHK RES, AI)                     -
  3 -----------------------------------------------------> T201
                                                           -
```

The frames from the BSSTE will be:

1. UI frame with:
   SAPI=63, C=0, P=0, TEI=127
   Info=IDENTITY REQUEST
   AI=50, RI=0 (not used)
3. UI frame with:
   SAPI=63, C=0, P=0, TEI=127
   Info=IDENTITY CHECK REQUEST
   AI=50, RI=0 (not used)

REQUIREMENTS

The frames from the BSC shall be:

2. UI frame with:
   SAPI=63, C=1, P=0, TEI=127
   Info=IDENTITY CHECK RESPONSE
   AI=50, RI=0 (not used)

3.2.1.3. Successful TEI allocation - additional TEI

The test shall be carried out as for the fixed TEI in section 3.2.1.1, but the additional TEI shall be in the range 64-126 and must first be assigned to the relevant physical connection with a O&M-message as defined by the operator or the manufacturer over the OMC-interface of the BSC. The BSC should then respond with a corresponding O&M-message over the A-bis-interface.

3.2.1.4. Denied TEI allocation - additional TEI

The test shall be carried out as for the fixed TEI in section 3.2.1.2, but the additional TEI shall be in the range 64-126 and must first be assigned to the relevant physical connection with a O&M-message as defined by the operator or the manufacturer over the OMC-interface of the BSC. The BSC should then respond with a corresponding O&M-message over the A-bis-interface.

3.2.2. Base Transceiver Station

Layer 2 on the A-bis-interfac is based on the modified LAPD protocol as specified in recommendation CEPT T/S 46-20. The detailed Layer 2 specification is given in GSM 08.56.
Layer 2 shall be tested according to the relevant parts of the Layer 2 testing in:

NET 3 (Norme Europeenne de Telecommunications):
Approval requirements for terminal equipment to connect to Integrated Services Digital Network (ISDN) using basic ISDN access, part 1 (layers 1 and 2 aspects)

In the GSM system the LAPD protocol on the A-bis-interface has been slightly modified. The modifications to the LAPD protocol have to be tested explicitly. Other modifications to the LAPD protocol have to be taken into account while applying the tests given in NET3.
Additional tests for the modified parts of LAPD according to GSM 08.56 are defined in the following. The following tests replace the corresponding tests in NET3.
Before carrying out any of the following tests the timer T202 shall be set globally by O&M, manually or with an O&M-message as defined by the operator or the manufacturer over the A-bis-interface.

3.2.2.1. Successful TEI allocation - fixed TEI

PURPOSE

To check the correct TEI identity request by the TRX when a message needs to be passed over the A-bis-interface to the BSC. The TEI shall be in the range 0-63.

METHOD OF TEST

The TRX shall be in the TEI unassigned state. Then, conditions triggering the TEI assignment procedure shall be set up.
The TRX should respond with a UI frame containing the message IDENTITY REQUEST and an AI in the range 0-63 to start initializing the link for acknowledged mode of operation.
A UI frame containing the message IDENTITY CHECK REQUEST and the AI-value received from the TRX shall be input from the BSSTE, followed by a UI frame containing the message IDENTITY ASSIGN and the same AI after twice the expiry of T201.
The TRX should then proceed with a multiple frame establishment in the normal way.

EXPECTED SEQUENCE

```
    TRX                                                    BSSTE
                          UI (ID REQ, AI)
     1 --------------------------------------------------->
                        UI (ID CHK REQ, AI)
     <-------------------------------------------------- 2  -
                                                           T201
                                                            -
                          UI (ID ASS, AI)                  T201
     <-------------------------------------------------- 3  -
```

The frames from the BSSTE will be:

2. UI frame with:
   SAPI=63, C=1, P=0, TEI=127
   Info=IDENTITY CHECK REQUEST
   AI=0-63, RI=0 (not used)
3. UI frame with:
   SAPI=63, C=1, P=0, TEI=127
   Info=IDENTITY ASSIGN
   AI=0-63, RI=0 (not used)

REQUIREMENTS

The frames from the TRX shall be:

1. UI frame with:
   SAPI=63, C=0, P=0, TEI=127
   Info=IDENTITY REQUEST
   AI=0-63, RI=0 (not used)

3.2.2.2. Denied TEI allocation - fixed TEI

PURPOSE

To check that the TRX correctly retransmits the TEI identity request after a given guard period. The TEI shall be in the range 0-63.

NOTE: GSM 08.56 states that the parameter N202 is not used. This means that the retransmission shall occur an infinite number of times.

METHOD OF TEST

The TRX shall be in the TEI unassigned state. Then, conditions triggering the TEI assignment procedure shall be set up.
The TRX should respond with a UI frame on the A-bis-interface containing the message IDENTITY REQUEST and an AI in the range 0-63 to start initializing the link for acknowledged mode of operation.
The BSSTE shall not respond.
After the expiry of T202 the UI frame last sent from the TRX shall be repeated by the TRX with the same content.
At the expiry of T202 (started at the last UI frame sent by the TRX), the TRX should then repeat the last UI frame again.
Before the expiry of T202 again, the BSSTE shall input a UI frame containing the message IDENTITY ASSIGN and the AI-value received from the TRX.
The TRX should then proceed with a multiple frame establishment in the normal way.

EXPECTED SEQUENCE

```
    TRX                                                     BSSTE
                    UI (ID REQ, AI)
     1 --------------------------------------------------->  -
                                                              |
                                                            T202
                    UI (ID REQ, AI)                           |
     2 --------------------------------------------------->  -
                    UI (ID REQ, AI)                           |
     3 --------------------------------------------------->  -
                    UI (ID ASS, AI)
     <------------------------------------------------- 4
```

The frames from the BSSTE will be:

4. UI frame with:
   SAPI=63, C=1, P=0, TEI=127
   Info=IDENTITY ASSIGN
   AI=0-63, RI=0 (not used)

REQUIREMENTS

The frames from the TRX shall be:

1,2,3. UI frame with:
   SAPI=63, C=0, P=0, TEI=127
   Info=IDENTITY REQUEST
   AI=0-63, RI=0 (not used)

3.2.2.3. Successful TEI allocation - additional TEI

The test shall be carried out as for the fixed TEI in section 3.2.2.1, but the additional TEI shall be in the range 64-126 and must first be assigned to the relevant physical connection via O&M, manually or with an O&M-message as defined by the operator or the manufacturer over the A-bis-interface on an already verified O&M link.

3.2.2.4. Denied TEI allocation - additional TEI

The test shall be carried out as for the fixed TEI in section 3.2.2.2, but the additional TEI shall be in the range 64-126 and must first be assigned to the relevant physical connection via O&M, manually or with an O&M-message as defined by the operator or the manufacturer over the A-bis-interface on an already verified O&M link.

3.3. LAYER 3

Concerning the BSC, the Layer 3 on the A-bis-interface is tested in connection with Layer 3 on the A-interface as BSC network functions in section 6.1 in this equipment specification.
Concerning the BTS, the Layer 3 on the A-bis-interface is tested in connection with Layer 3 on the radio interface as BTS network functions in section 7.1 in this equipment specification.

4. INTERFACING WITH THE MOBILE SERVICES SWITCHING CENTRE

This section specifies the interface between the Mobile services Switching Centre (MSC) and the Base Station System (BSS) as described in the GSM 08.0x-series of specifications, the BSS/MSC-interface. The interface is referred to as the A-interface or the MSC-interface as seen from the BSS. See section 1 for further information. This section tests the A-interface, and applies to an integrated BSS as well as to a BSC.

4.1. PHYSICAL INTERFACE, LAYER 1

Layer 1 shall utilize digital transmission at a rate of 2048 kbit/s with a frame structure of 32 x 64 kbit/s time slots. The detailed structure of the Layer 1 on the A-interface shall be according to GSM 08.04.
The Layer 1 testing of a 2048 kbit/s PCM link is a national or operator specific matter.

4.2. SIGNALLING TRANSPORT MECHANISM, LAYER 2

Layer 2 on the A-interface is based on the CCITT signalling system no 7 Message Transfer Part (MTP) and the Signalling Connection Control Part (SCCP). The detailed Layer 2 specification is given in GSM 08.06.
MTP shall be tested according to the relevant parts of the following CCITT recommendations.

- Q.780 (Signalling System no 7 test specification - general description)
- Q.781 (MTP level 2 test specification)
- Q.782 (MTP level 3 test specification)

Testing of SCCP is a national or operator specific matter.

4.3. LAYER 3 PROTOCOL

The functional split of network functions between the BSS and the MSC is given in GSM 08.02. The BSS's main responsibility on Layer 3 is the management of the local radio resources (Radio Resource management - RR). The detailed specifications for the Layer 3 procedures used on the A-interface are given in GSM 08.08.
The Layer 3 on the A-interface is tested in connection with Layer 3 on the radio interface or the A-bis-interface as BSS or BSC network functions in sections 5.1 and 6.1 in this specification, respectively.

5. BASE STATION SYSTEM NETWORK ASPECTS

This section applies to an integrated BSS.

5.1. BASE STATION SYSTEM NETWORK FUNCTIONS

5.1.1. General

The signalling network functions provided by the GSM system are described in GSM 03.01. The Layer 3 protocol on the radio interface is specified in GSM 04.08. For the MSC-interface the Layer 3 protocol is specified in GSM 08.08.

Of the Layer 3 network functions in the BSS this section tests the network functions which are performed in the BSS in operation with a radio interface and an MSC-interface, ie the BSS being a black box with 2 interfaces and some processing inside. This section tests then the relations between the Layer 3 messages occuring at the 2 interfaces.
The functional split between the MSC and the BSS is given in GSM 08.02. The functions to be performed in the BSS consist mainly of:

- management of radio channels
- management of terrestrial channels
- mapping between radio and terrestrial channels
- channel coding/decoding
- transcoding/rate adaptation
- enciphering/deciphering

The logical functions which can be tested at Layer 3, ie the management of radio and terrestrial channels and the mapping between them are tested in sections 5.1.2 and 5.1.3, the transcoding/rate adaptation functions are tested in section 5.1.4. The channel coding/decoding functions and the ciphering functions are tested implicitly in sections 2.1.6 and 2.1.7.
According to GSM 08.08 the BSS Layer 3 (or in fact layers 4-7) functions are split into the following functional entities on the MSC side:

- BSSAP (BSS Application Part)
  - BSSMAP (BSS Management Application Part)
  - DTAP (Direct Transfer Application Part)
- BSSOMAP (BSS Operation and Maintenance Application Part)

In this section, only the BSSAP (BSSMAP + DTAP) is tested. The BSSOMAP is tested in sections 8 and 9 in this specification. This section also tests the internal functions in the BSS addressed by the BSSAP. All tests are carried out under perfect transmission conditions and under no limiting conditions.
Internal BSC/BTS-interfaces in the BSS may exist as an option for the GSM operator. In case such interfaces exist, the functional split between the 2 different functional entities is defined in GSM 08.52.
Seen from the radio interface (see GSM 04.07), the Layer 3 (or in fact layers 3-7) is divided into the following functional entities:

- Radio Resource management (RR)
- Mobility Management (MM)
- Connection Management (CM)
  - Call Control (CC)
  - Supplementary Services support (SS)
  - Short Message Services support (SMS)

Of these network functions only the Radio Resource management (RR) is executed in the BSS and may interact with BSSMAP. All other radio interface Layer 3 messages are DTAP messages.
The Layer 3 network functions of the BSS are tested mainly as BSSMAP and RR functions in terms of elementary procedures according to GSM 04.08 and GSM 08.08. DTAP messages are tested for transparency. The elementary procedures are sub-procedures of the structured procedures which will normally occur between a Mobile Station and the network. Of the structured procedures are:

1. Location updating
2. Mobile originated call establishment
3. Mobile terminated call establishment
4. Call clearing
5. DTMF protocol control
6. Handover
7. In-call modification
8. Mobile originated call re-establishment

Examples of such structured procedures can be found in GSM 04.08.

The BSSMAP and RR tests as a whole are intended to cover all normal and abnormal cases of significance within each elementary procedure. However, all possible error causes are not tested, normally only if they imply different message sequences.
Structured procedures are not tested due to their optional nature and because testing of abnormal cases in structured procedures would be enormous. It is, however, of major importance to verify the correct functioning of the implemented structured procedures in addition to the verification of the elementary procedures before putting a BSS into operation.
The term Main Signalling Link (MSL) used in the following tests is defined in GSM 04.08 and can be either a FACCH or an SDCCH.

5.1.2. Testing of the DTAP

The DTAP protocol provides transparent messages through the BSS from the radio interface to the MSC-interface and from the MSC-interface to the radio interface. The messages are defined in GSM 04.08. The tests in this section are performed under perfect transmission conditions and under no limiting load conditions.
The main signalling link on the radio interface and the SCCP connection on the MSC-interface shall be established prior to the tests defined in this section.

5.1.2.1. Messages from MSC to MS

All downlink messages listed in GSM 04.10 (Supplementary Services - SS) and GSM 04.11 (Point-to-point Short Message Service - SMS), and all messages listed in GSM 04.08 of the types:

- Packet switched call control messages
- Circuit switched call control messages
- Mobility management messages

are DTAP messages and may be tested for transparency from the MSC to the MS when the main signalling link is set up. There may be additional messages in the future.

METHOD OF MEASUREMENT

A message shall be applied on the MSC-interface from the BSSTE. The message shall be a DTAP message. The response on the radio interface shall be recorded in the BSSTE.
The test shall be repeated at least until one MM message and one CC message have been tested.

REQUIREMENTS

Each message input on the MSC-interface shall also be output on the appropriate signalling link on the radio interface.

5.1.2.2. Messages from MS to MSC

All uplink messages listed in GSM 04.10 (Supplementary Services - SS) and GSM 04.11 (Point-to-point Short Message Service - SMS), and all messages listed in GSM 04.08 of the types:

- Packet switched call control messages
- Circuit switched call control messages
- Mobility management messages

are DTAP messages and may be tested for transparency from the MS to the MSC when the main signalling link is set up. There may be additional messages in the future.

METHOD OF MEASUREMENT

A message shall be input on the appropriate signalling link on the radio interface from the BSSTE. The message shall have a protocol discriminator indicating that the message is not an RR message. The response on the MSC-interface shall be recorded in the BSSTE.
The test shall be repeated at least until one MM message and one CC message have been tested.

REQUIREMENTS

Each message input on the radio interface shall also be output on the MSC-interface.

5.1.3. Testing of the BSSMAP and RR functions

The tests described in this section are to verify that messages sent to the Base Station System using the BSSMAP/RR have the correct consequential actions, and that combinations of certain events cause the correct messages to be sent using the BSSMAP/RR on the radio interface or the A-interface by the BSS. Time constraints have to be met.
The following procedures are to be tested:
RR/BSSMAP:

1. System information
2. Service requests in SABM frames
3. Random access by MS and immediate assignment
4. Paging
5. Measurement report
6. Assignment
7. External handover as seen from the old BSS
8. External handover as seen from the new BSS
9. Internal handover
10. Frequency redefinition
11. Transmission mode change
12. Ciphering mode setting
13. Additional assignment
14. Partial release
15. Classmark change
16. Channel release
17. Radio link failure

BSSMAP:

18. Blocking
19. Resource indication
20. Reset
21. Handover candidate enquiry
22. Trace invocation
23. Flow control
24. Data link control for SAPI not equal to 0
25. Queuing indication

Short message cell broadcast:

26. Short message cell broadcast

NOTE: The Short Message Service Cell Broadcast (SMSCB) messages defined in GSM 04.12 are excluded from the protocol model defined in GSM 04.07, and are consequently neither DTAP messages nor BSSMAP messages, but may generally have to be treated as BSSMAP messages.

Details of the correct operation of these procedures are to be found in GSM 04.08 and GSM 08.08.

For each of the procedures a figure showing the message exchange between MS, BSS and MSC under normal conditions is included, ie under no abnormal or failure conditions. It should be noted that a single arrow from MS to MSC through the BSS, or vice versa, indicates a transparent DTAP message and if a message is split into 2 parts, this indicates a non-transparent BSSMAP or RR message.

The detailed message contents are also indicated, but only parameters of importance for the test are specified. If not specified, the parameters are either not included in the message or are "don't care". The parameters shall, however, always be relevant to the procedure. It should be noted that all mandatory and optional information fields are indicated for the overview, whereas in an implementation some of the optional fields may occur or not depending on the context or on operator choices. Some optional fields may also be mutually exclusive.

In this section, timers at Layer 3 as defined in GSM 04.08 or GSM 08.08 are only tested for functionality, ie that different actions are taken by the BSS if a timer expires or not. Testing of the timing accuracy of timers are outside the scope of this recommendation. For testing of timer accuracy, see GSM 11.21.

Concerning erroneous messages (ie with undefined protocol discriminators, undefined messages types, or too short messages, or with undefined contents etc) some optional procedures are defined for the radio interface in GSM 04.08. For the A-interface no procedures are defined in GSM 08.08. Handling of erroneous messages are generally a national or operator specific matter, and are not explicitly tested.

5.1.3.1. System information

DEFINITION

The system information procedure is used by the BSS to modify the information contents to be transmitted on the SACCH when a dedicated resource has been set up or on the BCCH when no dedicated resource has been set up (or in fact always). The BSS will send SYSTEM INFORMATION messages type 1-4 or the BCCH and SYSTEM INFORMATION messages type 5-6 on the SACCH. The system information is always controlled by O&M. The timing requirements for when to send the different SYSTEM INFORMATION messages are described in GSM 05.02.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface commanding the BSS to modify the broadcast information to go on the BCCH or SACCH. The response on any interface shall be recorded.
2. A dedicated resource shall be set up between the radio interface and the MSC-interface. The response on any interface shall be recorded.
3. The dedicated resource shall be released, and steps 1 and 2 shall be repeated until all the SYSTEM INFORMATION messages type 1-6 are verified.

```
MS                          BSS                          MSC
                                          O&M
          SYS INFO
<------------------------------
          SYS INFO
<------------------------------
                .
                .
```

Figure 5-1: System information - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES

REQUIREMENTS

In the case of step 1, SYSTEM INFORMATION messages of the type 1 to 4 shall occur on the radio interface on the BCCH. The information contents shall correspond to what is set by O&M.
In the case of step 2, SYSTEM INFORMATION messages of the type 5 to 6 shall occur on the radio interface on the SACCH, and the SYSTEM INFORMATION messages of the type 1 to 4 shall continue to occur on the radio interface on the BCCH. The information contents shall correspond to what is set by O&M.
In the case of step 3, the requirements in steps 1 and 2 apply.
The messages from the BSS shall be:

1-3. SYSTEM INFORMATION TYPE 1
- Cell channel description
- RACH control parameters

1-3. SYSTEM INFORMATION TYPE 2
- Neighbour cells description
- PLMN permitted
- RACH control parameters

1-3. SYSTEM INFORMATION TYPE 3
- Cell identity
- Location area identification
- Control channel descriptions
- Cell options
- Cell selection parameters
- RACH control parameters

1-3. SYSTEM INFORMATION TYPE 4
- Location area identification
- Cell selection parameters
- RACH control parameters
- (CBCH) channel description
- (CBCH) mobile allocation

1-3. SYSTEM INFORMATION TYPE 5
- Neighbour cells descriptions

1-3. SYSTEM INFORMATION TYPE 6
- Cell identity
- Location area identification
- Cell options
- PLMN permitted
- Cell description

5.1.3.2. Service requests in SABM frames

DEFINITION

When the MS first accesses the network on a signalling link, it is in order to request a kind of service. The requests can be one of the following Layer 3 messages:

- LOCATION UPDATING
- CM SERVICE REQUEST
- PAGING RESPONSE
- IMSI DETACH
- CM REESTABLISHMENT REQUEST

These Layer 3 messages are transferred in the LAPDm SABM frame setting up the LAPDm signalling link. The CM SERVICE REQUEST may concern a normal call or eg a Short Message Service (SMS).

METHOD OF TEST

1. The random access by MS and immediate assignment procedure in section 5.1.3.3 shall be carried out to assign a dedicated resource. Then a LAPDm SABM frame shall be input on the radio interface with an information field as given above. The response on any interface shall be recorded.
2. Step 1 shall be repeated for all the Layer 3 messages indicated above.
3. Step 1 shall be repeated with a message not defined above.

```
   MS                              BSS                          MSC
          SABM(L3 message)
    - - - - - - - - - - - - - - - >
           UA(L3 message)
   < - - - - - - - - - - - - - - -
                                     COMPL L3 INFO (L3 message)
                                   ---------------------------->
```

Figure 5-2: Service requests in SABM frames - normal case

The messages from the BSSTE will be:

1,2.SABM(LOCATION UPDATING REQUEST)
    Location updating type
    Ciphering key sequence number
    Location area identification
    Mobile Station classmark 1
    Mobile identity
1,2.SABM(CM SERVICE REQUEST)
    CM service type
    Ciphering key sequence number
    Mobile Station classmark 2
    Mobile identity
1,2.SABM(PAGING RESPONSE)
    Ciphering key sequence number
    Mobile Station classmark 2
    Mobile identity
1,2.SABM(IMSI DETACH INDICATION)
    Mobile Station classmark 1
    Mobile identity
1,2.SABM(CM REESTABLISHMENT REQUEST)
    Ciphering key sequence number
    Location area identification
    Mobile Station classmark 2
    Mobile identity
3. LAYER 3 MESSAGE

REQUIREMENTS

In the case of steps 1 and 2, the exact Layer 3 message contained in the SABM frame shall occur also contained in a COMPLETE LAYER 3 INFORMATION message on the MSC-interface, and a LAPDm UA frame acknowledging the SABM shall occur on the radio interface.
In the case of step 3, a LAPDm UA frame acknowledging the SABM shall occur on the radio interface and no message shall occur on any other interface.
The messages from the BSS shall be:

1,2.COMPLETE LAYER 3 INFORMATION (LOCATION UPDATING REQUEST)
Cell identifier
Complete Layer 3 information = LOC UPD REQ
(Location updating type
Ciphering key sequence number
Location area identification
Mobile Station classmark 1
Mobile identity)

1,2.COMPLETE LAYER 3 INFORMATION (CM SERVICE REQUEST)
Cell identifier
Complete Layer 3 information = CM SERV REQ
(CM service type
Ciphering key sequence number
Mobile Station classmark 2
Mobile identity)

1,2.COMPLETE LAYER 3 INFORMATION (PAGING RESPONSE)
Cell identifier
Complete Layer 3 information = PAG RES
(Ciphering key sequence number
Mobile Station classmark 2
Mobile identity)

1,2.COMPLETE LAYER 3 INFORMATION (IMSI DETACH INDICATION)
Cell identifier
Complete Layer 3 information = IMSI DET IND

(Mobile Station classmark 1
Mobile identity)

1,2.COMPLETE LAYER 3 INFORMATION (CM REESTABLISHMENT REQUEST)
Cell identifer
Complete Layer 3 information = CM REEST REQ
(Ciphering key sequence number
Location area identification
Mobile Station classmark 2
Mobile identity)

5.1.3.3. Random access by MS and immediate assignment

DEFINITION

The random access by MS and immediate assignment procedure is used to transfer an MS, requiring service by a random mode channel request, to a dedicated channel, typically an SDCCH or a FACCH (the main signalling link). The procedure is always triggered by the MS, and can be triggered by a paging request or a mobile originated transaction.

NOTE: The immediate assignment procedure triggered by a paging request is not tested explicitly.
NOTE: The extended immediate assignment procedure is not tested explicitly because it is not specified when the BSS may use it.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface commanding the BSS to set the timer T3101 to an appropriate value A. The BSS shall be configured to use the SDCCH as the main signalling link.
2. The BSSTE shall input a CHANNEL REQUEST messsage on the radio interface on the RACH. The response on any interface shall be recorded.
3. If an IMMEDIATE ASSIGNMENT message is received from the BSS on the CCCH, a LAPDm SABM frame containing CM SERVICE REQUEST shall be input on the radio interface on the main signalling link by the BSSTE before the time T3101. The response on any interface shall be recorded.

4. If supported by the BSS as an operator or manufacturer option, steps 1-3 shall be repeated, but using the TCH/FACCH this time. Then, an ASSIGNMENT REQUEST message shall be input on the MSC-interface requesting a TCH/FACCH for the use of speech and signalling. The response on any interface shall be recorded.
5. Following after step 4 if applicable, a CHANNEL MODE MODIFY AKNOWLEDGE message shall be input on the radio interface on the FACCH.
6. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface commanding the BSS to clear all assigned channels. When all assigned channels are cleared, steps 1-3 shall be repeated, but the SABM frame shall be input after the expiry of timer T3101 (T3101=A). The response on any interface shall be recorded.
7. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface by the BSSTE requesting the BSS to take all radio resources out of service. Step 2 shall then be repeated. The response on any interface shall be recorded.

```
MS                         BSS                          MSC
          CH REQ
----------------------------->
         IMM ASS
<-----------------------------   -
     SABM(CM SERV REQ)           |
- - - - - - - - - - - - - - - - >T3101
      UA(CM SERV REQ)            |
< - - - - - - - - - - - - - - -  -
                                       SCCP establishment
                             COMPL L3 INFO (CM SERV REQ)
                             --------------------------->
```

Figure 5-3: Random access by MS and immediate assignment - normal case

The messages from the BSSTE will be:

1,4. O&M MESSAGES

2,4. CHANNEL REQUEST
Establishment cause = originating call
Random reference = PAR1

3,4. SABM(CM SERVICE REQUEST)
CM service type
Ciphering key sequence number
Mobile Station classmark 2
Mobile identity

4. ASSIGNMENT REQUEST
Channel type = TCH
Layer 3 header information
Priority
Circuit identity code
Radio channel identity
Downlink DTX flag
Interference band to be used

5. CHANNEL MODE MODIFY ACKNOWLEDGE
Channel description
Channel mode = TCH

6,7. O&M MESSAGES

REQUIREMENTS

In the case of step 2, an IMMEDIATE ASSIGNMENT message shall occur on the radio interface on the CCCH including relevant channel assignment information. The channel assigned shall be an SDCCH.

In the case of step 3, a LAPDm UA frame acknowledging the SABM shall occur on the radio interface on the SDCCH. Then an SCCP connection shall be established and the exact CM SERVICE REQUEST message contained in the SABM shall occur on the MSC-interface and LAPDm UI fill frames shall occur continuously on the radio interface on the SDCCH.

In the case of step 4, after the ASSIGNMENT REQUEST message a CHANNEL MODE MODIFY message shall occur on the radio interface on the FACCH requesting a change to speech and signalling. The transmission of LAPDm UI fill frames shall stop.

In the case of step 5, an ASSIGNMENT COMPLETE message shall occur on the MSC-interface.
In the case of step 6, nomessages shall occur on any interface.
In the case of step 7, an IMMEDIATE ASSIGNMENT REJECT message <u>may</u> occur on the radio interface on the CCCH. Nothing shall occur on the MSC-interface.

The messages from the BSS shall be:

2,4. IMMEDIATE ASSIGNMENT
    Page mode
    Channel description = SDCCH, TCH
    Request reference = PAR1
    Timing advance
    Mobile allocation
    Starting time

3,4. CM SERVICE REQUEST
    CM service type
    Ciphering key sequence number
    Mobile Station classmark 2
    Mobile identity

4. CHANNEL MODE MODIFY
    Channel description
    Channel mode = TCH

5. ASSIGNMENT COMPLETE

    RR cause
    Radio channel identity
    Cell identifier

7. IMMEDIATE ASSIGNMENT REJECT
    Page mode
    Request reference = PAR1
    Wait indication
    Request reference
    Wait indication
    Request reference
    Wait indication
    Request reference
    Wait indication

5.1.3.4. Paging

DEFINITION

The paging procedure is used to trigger a channel access by a Mobile Station. This procedure is used for Mobile terminating calls and is initiated by the MSC.

NOTE: The PAGING messages from the MSC concern one single Mobile Station, but the PAGING REQUEST messages from the BSS may concern several. The grouping of pagings in the BSS is not specified and is therefore not tested.

METHOD OF TEST

1. An O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface commanding configuring a certain control channel configuration.
2. 9 PAGING messages, 1 with an IMSI and 8 with a TMSI, for 9 Mobile Stations belonging to the same paging group shall be input on the MSC-interface for a cell relevant to the BSS. The response on any interface shall be recorded.

```
MS                           BSS                          MSC
                                       PAGING (IMSI)
                             <-----------------------------
          PAG REQ                      PAGING (TMSI)
<--------------------------- <-----------------------------
          PAG REQ                      PAGING (TMSI)
<--------------------------- <-----------------------------
          PAG REQ                          .
<---------------------------               .
                .                          .
                .
```

Figure 5-4: Paging - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
2. PAGING
   IMSI
   TMSI
   Cell identifier list

REQUIREMENTS

In the case of step 2, PAGING REQUEST messages type 1, 2 or 3 shall occur on the radio interface of the addressed cell on the paging subchannel on the PCH corresponding to the MS. On all other paging subchannels, in the same cell as well as in other cells, fill PAGING REQUEST messages (type of identity = no identity) or other valid Layer 3 messages shall occur on the radio interface.

The messages from the BSS shall be:

2. PAGING REQUEST TYPE 1
   Page mode
   Mobile identity
   Mobile identity
2. PAGING REQUEST TYPE 2
   Page mode
   TMSI
   TMSI
   Mobile identity
2. PAGING REQUEST TYPE 3
   Page mode
   TMSI
   TMSI
   TMSI
   TMSI

5.1.3.5. Measurement reporting

The measurement report procedure provides the information required by the BSS from the MS in order to perform RF power control and handover decisions. For further information see GSM 04.08.
The procedures for handover and RF power control are national or operator specific matters and are not tested explicitly.

5.1.3.6. Assignment

DEFINITION

The purpose of the assignment task is to ensure that the correct dedicated radio resource can be allocated to a Mobile Station that requires it.

METHOD OF TEST

1. A dedicated resource shall be established between the radio interface and the MSC-interface. The resource shall not be a TCH.
2. O&M-messages as defined by the operator or the manufacturer shall be input on the OMC-interface setting the timer T10 to an appropriate value A, restricting the BSS to choose only one dedicated channel and disabling queuing of assignemt requests, if supported.
3. An ASSIGNMENT REQUEST message shall be input on the MSC-interface by the BSSTE requesting a TCH. The response on any interface shall be recorded.
4. A LAPDm SABM frame shall be input on the radio interface on the new main signalling link. The response on any interface shall be recorded.
5. After the receipt of the ASSIGNMENT COMMAND message on the radio interface, the BSSTE inputs an ASSIGNMENT COMPLETE message on the radio interface on the main signalling link within a time A. The response on any interface shall be recorded.
6. The steps 3-4 shall be repeated, but the ASSIGNMENT COMPLETE response from the BSSTE shall be delayed more than a time A.
7. Step 3 shall be repeated, but the terrestrial resource requested by the MSC shall be already allocated to another call. The response on any interface shall be recorded.
8. Steps 3-5 shall be repeated, but in step 4 the link shall be established on the old main signalling link and the ASSIGNMENT COMPLETE message in step 5 shall be replaced by an ASSIGNMENT FAILURE message with an appropriate cause value.

```
   MS                          BSS                          MSC
                                           ASS REQ
                               <----------------------------
           ASS CMD
   <----------------------------  -
            SABM                   |
   - - - - - - - - - - - - - - >   |
             UA                   T10
   < - - - - - - - - - - - - - -   |
           ASS COM                 |
   ---------------------------->  -
                                          ASS COM
                               ---------------------------->
```

Figure 5-6: Assignment - normal case

The messages from the BSSTE will be:
2. O&M MESSAGES
3. ASSIGNMENT REQUEST
    Channel type = TCH
    Layer 3 header information
    Priority
    Circuit identity code
    Radio channel identity
    Downlink DTX flag
    Interference band to be used
5,6. ASSIGNMENT COMPLETE
    RR cause
8. ASSIGNMENT FAILURE
    RR cause

REQUIREMENTS

In the case of step 3, an ASSIGNMENT COMMAND message shall occur at the radio interface on the main signalling link. The assigned channel indicated shall correspond to the restrictions set by O&M.
In the case of step 4, a LAPDm UA frame shall occur on the radio interface on the new main signalling link.
In the case of step 5, an ASSIGNMENT COMPLETE message shall occur on the MSC-interface.

In the case of step 6, an ASSIGNMENT FAILURE message shall occur at the MSC-interface with the cause value: "radio interface message failure".
In the case of step 7, an ASSIGNMENT FAILURE message shall occur at the MSC-interface with the cause value: "terrestrial resource already allocated".
In the case of step 8, an ASSIGNMENT FAILURE message shall occur at the MSC-interface with the cause value: "radio interface failure, reversion to old channel".

NOTE: In step 6, the ASS FAIL message triggers exactly the same function in the MSC as a CLEAR REQ message.

The messages from the BSS shall be:

3. ASSIGNMENT COMMAND
   Channel description = TCH
   Power command
   Cell channel description
   Channel mode
   Channel description
   Channel mode 2
   Mobile allocation
   Starting time
5. ASSIGNMENT COMPLETE
   RR cause
   Radio channel identity
   Cell identifier
6. ASSIGNMENT FAILURE
   Cause = as in text
   RR cause

7-8.ASSIGNMENT FAILURE
   Cause = as in text
   RR cause

5.1.3.7. External handover as seen from the old BSS

DEFINITION

The handover procedure for a BSS where a call is established allows an MS to continue the call in a new BSS. The test in this section concerns the old BSS and covers the procedures defined in GSM 08.08 as:

- handover required indication
- handover execution

METHOD OF TEST

1. A call shall be set up between the radio interface and the MSC-interface.
2. One or two O&M-messages as defined by the operator or the manufacturer shall be input on the OMC-interface setting the thresholds for handover required, and requiring response request.
3. One or two O&M-messages as defined by the operator or the manufacturer shall be input on the OMC-interface by the BSSTE setting the timer T7 to an appropriate value A and the timer T8 to an appropriate value B.
4. Conditions triggering an external handover decision in the BSS shall be established. The response on any interface shall be recorded.
5. After 3 occurrences of the HANDOVER REQUIRED message on the MSC-interface a HANDOVER COMMAND shall be input on the MSC-interface. The response on any interface shall be recorded.
6. Before the time B has elapsed after the input HANDOVER COMMAND on the MSC-interface the BSSTE shall input a CLEAR COMMAND message with the cause value "handover successful" on the MSC-interface. The response on any interface shall be recorded.
7. Steps 4 and 5 shall be repeated, and after the time B has elapsed the response on any interface shall be recorded.
8. Steps 4 and 5 shall be repeated, and then the BSSTE shall re-establish the main signalling link and input a HANDOVER FAILURE message on the radio interface. The response on any interface shall be recorded.

```
MS                          BSS                          MSC
                                      HAND RQD
                          -   ----------------------------->
                         T7           HAND RQD
                          -   ----------------------------->
                                          .
                                          .
                                      HAND RQD
                              ----------------------------->
                                      HAND CMD
                              <-----------------------------
          HAND CMD
<-----------------------------
                         T8          CLEAR CMD
                          -   <-----------------------------
                                     CLEAR COM
                              ----------------------------->
```

Figure 5-7: Handover as seen from the old BSS - normal case

The messages from the BSSTE will be:
2,3.O&M MESSAGES
5. HANDOVER COMMAND
   Layer 3 information = HAND CMD
6. CLEAR COMMAND
   Layer 3 header information
   Cause = as in text
8. HANDOVER FAILURE
   RR cause = PAR1

REQUIREMENTS

In the case of step 4, HANDOVER REQUIRED messages shall occur repeatedly with an interval T7=A on the MSC-interface. The message shall contain the correct cause, and the preferred list of target cells and the radio environment information corresponding to what has been simulated by the BSSTE.
In the case of step 5, no more HANDOVER REQUIRED messages shall occur on the MSC-interface after receiving the HANDOVER COMMAND and a HANDOVER COMMAND message shall occur on the radio interface on the main signalling link.

In the case of step 6, a CLEAR COMPLETE message shall occur on the MSC-interface and the radio resources in the BSS shall be available for use by other calls.
In the case of step 7, a CLEAR REQUEST message shall occur on the MSC-interface with the cause value "radio interface message failure".

NOTE: There are indications that the cause value in the CLEAR REQUEST message in step 7 may change !!

In the case of step 8, a HANDOVER FAILURE message shall occur on the MSC-interface with the cause value "radio interface failure, reversion to old channel".

The messages from the BSS shall be:

4. HANDOVER REQUIRED
    Cause
    Response request = yes
    Cell identifier list preferred
    Current radio environment
    Environment of BS "n"
5. HANDOVER COMMAND
    Cell description
    Channel description
    Handover reference
    Power command
    Synchronization indication
    Cell channel description
    Channel mode
    Channel description
    Channel mode 2
    Frequency channel sequence
    Mobile allocation
    Starting time
6. CLEAR COMPLETE
    --

7. CLEAR REQUEST
    Cause = as in text
8. HANDOVER FAILURE
    Cause = as in text
    RR cause = PAR1

5.1.3.8. External handover as seen from the new BSS

5.1.3.8.1. Non-synchronized network

DEFINITION

This procedure allows the MSC to request resources from a BSS in a manner similar to that used for the assignment case and terminates the handover seen from the MS. It is used during handover with the new BSS for allocation of the necesssary resources before the MS accesses the BSS and covers the procedure defined in GSM 08.08 as:

- handover resource allocation

METHOD OF TEST

1. O&M-messages as defined by the operator or the manufacturer shall be input on the OMC-interface setting the timer T3105 to an appropriate value B, the parameter Ny1 to an appropriate value C, restricting the BSS to choose only one dedicated channel and disabling queuing on handover requests, if supported.
2. A HANDOVER REQUEST message shall be input on the MSC-interface. The message shall contain an indication of the type of channel needed and the terrestrial resource to be used. The channel shall be a TCH and the terrestrial resource to be used shall be A. The response on any interface shall be recorded.
3. An O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface commanding the BSS to block the terrestrial resource A. Then the step 2 shall be repeated concerning the terrestrial resource A.
4. An O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface commanding the BSS to put all TCHs out of service. Then step 2 shall be repeated. The response on any interface shall be recorded.
5. Step 2 shall be repeated, and then HANDOVER ACCESS messages shall be input on the radio interface on the main signalling link (the correct physical channel) with the same handover reference number as in the HANDOVER REQUEST ACKNOWLEDGE message output in step 2. The response on any interface shall be recorded. No further messages shall be input.

6. Steps 5 shall be repeated, and then a LAPDm SABM frame shall be input on the radio interface on the main signalling link before the time C x B. The response on any interface shall be recorded.
7. A HANDOVER COMPLETE message shall be input on the radio interface on the main signalling link. The response on any interface shall be recorded.
8. Steps 2 and 5 shall be repeated, but the handover reference number shall be different in steps 2 and 5. The response on any interface shall then be recorded.
9. Step 2 shall be repeated, and after the HANDOVER REQUEST ACKNOWLEDGE message from the BSS a CLEAR COMMAND message with the cause value "call control" shall be input on the MSC-interface. The response on any interface shall be recorded.
10. Step 2 shall be repeated, and then HANDOVER ACCESS messages shall be input on the radio interface, but on the wrong physical channel according to the HANDOVER REQUEST ACKNOWLEDGE message output in step 2. The response on any interface shall be recorded. No further messages shall be input.

```
 MS                         BSS                         MSC
                                      HAND REQ
                            <-----------------------------
                                    HAND REQ ACK
                            ---------------------------->
          HAND ACC
 ---------------------------->
          HAND ACC
 ---------------------------->
             .
             .
         PHYS INFO                    HAND DET
 <---------------------------*---------------------------->
         PHYS INFO           T3105
 <----------------------------  -
             .
             .                Ny1
         PHYS INFO
 <----------------------------
            SABM
 - - - - - - - - - - - - - - >
             UA
 < - - - - - - - - - - - - - -
          HAND COM
 ---------------------------->
                                      HAND COM
                            ---------------------------->
```

Figure 5-8: Handover as seen from the new BSS - normal case

The messages from the BSSTE will be:
1. O&M MESSAGES
2. HANDOVER REQUEST
   Channel type = TCH
   Encryption information
   Classmark information 1 or 2
   Cell identifier (serving)
   Priority
   Circuit identity code = A
   Radio channel identity
   Downlink DTX flag
   Cell identifier (target)
   Interference band to be used
3,4.O&M MESSAGES
5,8.HANDOVER ACCESS
   Handover reference = PAR1, PAR2

7. HANDOVER COMPLETE
   RR cause
9. CLEAR COMMAND
   Layer 3 header information
   Cause = as in text

REQUIREMENTS

In the case of step 2, a HANDOVER REQUEST ACKNOWLEDGE message shall occur at the MSC-interface. No messages shall occur on the radio interface.
In the case of step 3, a HANDOVER FAILURE message shall occur on the MSC-interface with the cause value: "Terrestrial resource unavailable".
In the case of step 4, a HANDOVER FAILURE message shall occur on the MSC-interface with the cause value: "No radio resource available".
In the case of step 5, a HANDOVER DETECT message shall occur on the MSC-interface and C+1 PHYSICAL INFORMATION messages shall occur on the radio interface on the main signalling link with an interval of B. Then, a CLEAR REQUEST message shall occur on the MSC-interface with the cause value "radio interface message failure".
In the case of step 6, a LAPDm UA frame shall occur on the radio interface on the main signalling link.
In the case of step 7, a HANDOVER COMPLETE message shall occur on the MSC-interface.
In the case of step 8, the BSS shall ignore the incoming HANDOVER ACCESS messages and no messages shall occur on any interface.
In the case of step 9, a CLEAR COMPLETE message shall occur on the MSC-interface.
In the case of step 10, no message shall occur on any interface.

The messages from the BSS shall be:

2. HANDOVER REQUEST ACKNOWLEDGE
   Layer 3 information = HAND CMD
   (Cell description
   Channel description
   Handover reference
   Power command
   Synchronization indication
   Cell channel description
   Channel mode
   Channel description
   Channel mode 2
   Frequency channel sequence
   Mobile allocation
   Starting time)

3,4. HANDOVER FAILURE
   Cause = as in text
   RR cause

5. HANDOVER DETECT
   --

5. PHYSICAL INFORMATION
   Timing advance

5. HANDOVER COMPLETE
   RR cause

7. HANDOVER COMPLETE
   RR cause

9. CLEAR COMPLETE
   --

5.1.3.8.2. Synchronized network

This test is the same as for the non-synchronized network. However, the PHYSICAL INFORMATION messages and the CLEAR REQUEST message from the BSS in step 5 are not needed. The number of HANDOVER ACCESS messages input in step 5 shall be 4.

5.1.3.9. Internal handover

5.1.3.9.1. Internal inter-cell handover

DEFINITION

The use of this handover mechanism is optional for the GSM PLMN operator. However, if used, conformance to this test is mandatory. It applies only to multi-cell Base Station Systems. The MSC may also invoke an internal inter-cell handover procedure. However, in that case the procedure is as for external handover.
Concerning synchronized or non-synchronized networks, the same applies to internal inter-cell handover as for external handover.

METHOD OF TEST

1. O&M-messages as defined by the operator or the manufacturer shall be input on the OMC-interface setting the timer T3105 to an appropriate value B, the timer T8 to an appropriate value D, the parameter Ny1 to an appropriate value C and restricting the BSS to choose only one dedicated channel.
2. A call shall be set up on a TCH between the radio interface and the MSC-interface.
3. Conditions triggering an internal inter-cell handover decision in the BSS shall be established. The conditions are up to the operator and the manufacturer. The response on any interface shall be recorded.
4. HANDOVER ACCESS messages shall be input on the radio interface (of the new cell) on the main signalling link. The response on any interface shall be recorded.
5. Steps 3 and 4 shall be repeated, and then a LAPDm SABM frame shall be input on the radio interface (of the new cell) on the main signalling link within a time B x C. The response on any interface shall be recorded.
6. Following immediately after step 5, a HANDOVER COMPLETE message shall be input on the radio interface on the main signalling link (of the new cell). The response on any interface shall be recorded.

```
MS                              BSS                             MSC
          HAND CMD
<-----------------------------           -
          HAND ACC                        |
----------------------------->            |
          HAND ACC                        |
----------------------------->            |
              .                           |
              .                           |
         PHYS INFO                        |
<-----------------------------   -        |
         PHYS INFO               T3105    |
<-----------------------------   -        |
              .                           | T8
              .                           |
                                  Ny1     |
         PHYS INFO                        |
<-----------------------------            |
           SABM                           |
- - - - - - - - - - - - - - - >           |
            UA                            |
< - - - - - - - - - - - - - - -           |
          HAND COM                        |
----------------------------->           -
                                             HAND PERF
                                 ----------------------------->
```

Figure 5-9a: Internal inter-cell handover - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
5. HANDOVER ACCESS
   Handover reference = PAR1

REQUIREMENTS

In the case of step 3, a HANDOVER COMMAND message shall occur on the radio interface (of the old cell) on the main signalling link.
In the case of step 4, a PHYSICAL INFORMATION message shall occur on the radio interface (of the new cell) on the main signalling link and repeatedly C times with an interval of B. After the expiry of T8 or Ny1 times T3105 (B x C) a CLEAR REQUEST message concerning the old channel or the new channel, respectively, shall occur on the MSC-interface with the cause value: "Radio interface message failure".

In the case of step 5, a LAPDm UA frame shall occur on the radio interface (of the new cell) on the main signalling link.
In the case of step 6, a HANDOVER PERFORMED message with an appropriate cause value shall occur on the MSC-interface.
The messages from the BSS shall be:

3. HANDOVER COMMAND
   Cell description
   Channel description
   Handover reference = PAR1
   Power command
   Synchronization indication
   Cell channel description
   Channel mode
   Channel description
   Channel mode 2
   Frequency channel sequence
   Mobile allocation
   Starting time
4. PHYSICAL INFORMATION
   Timing advance
4. CLEAR REQUEST
   Cause = as in text
6. HANDOVER PERFORMED
   Cause
   Cell identifier
   Radio channel identity

5.1.3.9.2. Internal intra-cell handover

The use of this handover mechanism is optional for the GSM PLMN operator. However, if used, conformance to this test is mandatory.

DEFINITION

The internal intra-cell handover procedure is used when a BSS for which ever internal reason decides to change the channel on which it communicates with an MS. In principle, internal intra-cell handover may be carried out in 2 ways:

1. As an assignment procedure
2. As a handover procedure

The choice of procedure is left to the manufacturer or the operator. The MSC may also invoke an internal intra-cell handover procedure. However, in that case the procedure is as for external handover.

5.1.3.9.2.1. Intra-cell handover by the assignment procedure

METHOD OF TEST

1. A call shall be set up on a TCH between the radio interface and the MSC-interface, and O&M-messages as defined by the operator or the manufacturer shall be input on the OMC-interface setting the timer T10 to an appropriate value A and restricting the BSS to choose only one dedicated channel.
2. Conditions triggering an internal intra-cell handover decision in the BSS shall be established. The conditions are up to the operator and the manufacturer. No further messages shall be input. The response on any interface shall be recorded.
3. A LAPDm I frame shall be input on the radio interface on the new main signalling link. The response on any interface shall be recorded.
4. Step 2 shall be repeated, and then a LAPDm SABM frame shall be input on the radio interface on the new main signalling link within a time T10. The response on any interface shall be recorded.

5. Following after step 4, an ASSIGNMENT COMPLETE message shall be input on the radio interface on the new main signalling link also before the time T10. The response on any interface shall be recorded.
6. Step 2 shall be repeated, and then a LAPDm SABM frame shall be input on the radio interface on the old main signalling link within a time T10. The response on any interface shall be recorded.
7. Following after step 6, an ASSIGNMENT FAILURE message with an appropriate cause value shall be input on the radio interface on the old main signalling link also before the time T10. The response on any interface shall be recorded.

```
MS                          BSS                          MSC
          ASS CMD
<----------------------------   -
           SABM                 |
- - - - - - - - - - - - - - >   |
            UA                  | T10
< - - - - - - - - - - - - - -   |
          ASS COM               |
---------------------------->   -
                                     HAND PERF
                            ---------------------------->
```

Figure 5-9b: Intra-cell handover by assignment - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
5. ASSIGNMENT COMPLETE
   RR cause
7. ASSIGNMENT FAILURE
   RR cause

REQUIREMENTS

In the case of step 2, an ASSIGNMENT COMMAND message shall occur on the radio interface on the main signalling link. Then, after the expiry of T10, a CLEAR REQUEST message shall occur on the MSC-interface with the cause value: "radio interface message failure".

In the case of step 3, no messages shall occur on any interface.
In the case of step 4, a LAPDm UA frame shall occur on the radio interface on the new main signalling link.
In the case of step 5, a HANDOVER PERFORMED message shall occur on the MSC-interface with an appropriate cause value.
In the case of step 6, a LAPDm UA frame shall occur on the radio interface on the old main signalling link.
In the case of step 7, no messages shall occur on any interface.
The messages from the BSS shall be:

2. ASSIGNMENT COMMAND
   Channel description = TCH
   Power command
   Cell channel description
   Channel mode
   Channel description
   Channel mode 2
   Mobile allocation
   Starting time
2. ASSIGNMENT FAILURE
   Cause = as in text
   RR cause
5. HANDOVER PERFORMED
   Cause
   Cell identifier
   Radio channel identity

5.1.3.9.2.2. Intra-cell handover by the handover procedure

METHOD OF TEST

1. A call shall be set up on a TCH between the radio interface and the MSC-interface, and O&M-messages as defined by the operator or the manufacturer shall be input on the OMC-interface setting the timer T8 to an appropriate value A and restricting the BSS to choose only one dedicated channel.
2. Conditions triggering an internal intra-cell handover decision in the BSS shall be established. The conditions are up to the operator and the manufacturer. No further messages shall be input. The response on any interface shall be recorded.

3. A LAPDm I frame shall be input on the radio interface on the new main signalling link. The response on any interface shall be recorded.
4. Step 2 shall be repeated, and then 4 HANDOVER ACCESS messages shall be input on the radio interface on the new main signalling link, followed by a LAPDm SABM frame within a time T8. The response on any interface shall be recorded.
5. Following after step 4, an HANDOVER COMPLETE message shall be input on the the radio interface on the new main signalling link also before the expiry of T8. The response on any interface shall be recorded.
6. Step 2 shall be repeated, and then a LAPDm SABM frame shall be input on the radio interface on the old main signalling link within a time T8. The response on any interface shall be recorded.
7. Following after step 6, a HANDOVER FAILURE message with an appropriate cause value shall be input on the radio interface on the old main signalling link also before the expiry of T8. The response on any interface shall be recorded.

```
MS                                BSS                             MSC
          HAND CMD
<----------------------------        -
          HAND ACC                   |
---------------------------->        |
          HAND ACC                   |
---------------------------->        |
          HAND ACC                   |
---------------------------->        |
          HAND ACC                   |  T8
---------------------------->        |
            SABM                     |
- - - - - - - - - - - - - - >        |
             UA                      |
< - - - - - - - - - - - - - -        |
          HAND COM                   |
---------------------------->        -
                                           HAND PERF
                                 ---------------------------->
```

Figure 5-9c: Intra-cell handover by handover - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
4. HANDOVER ACCESS
   Handover reference = PAR1
5. HANDOVER COMPLETE
   RR cause
7. HANDOVER FAILURE
   RR cause

REQUIREMENTS

In the case of step 2, a HANDOVER COMMAND message shall occur on the radio interface on the main signalling link. Then, after the expiry of T8, a CLEAR REQUEST message shall occur on the MSC-interface with the cause value: "radio interface message failure".
In the case of step 3, no messages shall occur on any interface.
In the case of step 4, a LAPDm UA frame shall occur on the radio interface on the new main signalling link.
In the case of step 5, a HANDOVER PERFORMED message shall occur on the MSC-interface with an appropriate cause value.
In the case of step 6, a LAPDm UA frame shall occur on the radio interface on the old main signalling link.
In the case of step 7, no messages shall occur on any interface.

The messages from the BSS shall be:

2. HANDOVER COMMAND
   Cell description
   Channel description
   Handover reference = PAR1
   Power command
   Synchronization indication
   Cell channel description
   Channel mode
   Channel description
   Channel mode 2
   Frequency channel sequence
   Mobile allocation
   Starting time
2. CLEAR REQUEST
   Cause = as in text
5. HANDOVER PERFORMED
   Cause
   Cell identifier
   Radio channel identity

5.1.3.10. Frequency redefinition

DEFINITION

The frequency redefinition procedure enables the BSS to change the frequencies and hopping sequences of the allocated channels. The procedure is used only in a BSS using Slow Frequency Hopping (SFH).

METHOD OF TEST

1. A call shall be established between the radio interface and the MSC-interface. SFH shall be enabled, if supported.
2. The BSSTE shall request the BSS to redefine the hopping sequences using the O&M message as defined by the operator or the manufacturer on the OMC-interface. The response on any interface shall be recorded.

```
     MS                          BSS                         MSC
                                              O&M
              FREQ REDEF
     <-----------------------------
```

Figure 5-10: Frequency redefinition - normal case

The messages from the BSSTE will be:
2. O&M MESSAGES

REQUIREMENTS

In the case of step 2, a FREQUENCY REDEFINITION message shall occur on the radio interface. The frequency list and hopping sequences of the message shall correspond to the new parameters commanded from O&M.
The messages from the BSS shall be:

2. *FREQUENCY REDEFINITION*
   Channel description
   Mobile allocation
   Starting time
   Cell channel description

5.1.3.11. Transmission mode change

DEFINITION

The transmission mode change procedure allows the network to request the Mobile Station to modify the transmission mode (channel coding, transcoding/rate adaptation) for a dedicated channel.

NOTE: In GSM 08.08 there are no defined cases for when the CHANNEL MODE MODIFY message shall be applied. The message is restricted to being mapped to ASSIGNMENT REQUEST messages on the A-interface, and it is a national or operator specific matter to define the cases when this mapping shall occur (eg when the needed RF channel or full/half-rate channel is the same, but with a different transcoding or rate adaptation). This test applies when such a mapping exists. Possibly the modes may be different.

METHOD OF TEST

1. The assignment procedure in section 5.1.3.6 shall first be performed with a full-rate data traffic channel using 9.6 kbit/s (TCH/F9.6). Then an ASSIGNMENT REQUEST message shall be input on the MSC-interface by the BSSTE assigning a full-rate data TCH using 4.8 kbit/s (TCH/F4.8) to the same Mobile Station. The response on any interface shall be recorded.
2. After the receipt of a CHANNEL MODE MODIFY message on the radio interface, the BSSTE shall input a CHANNEL MODE MODIFY ACKNOWLEDGE message on the radio interface on the main signalling link. The response on any interface shall be recorded.

NOTE: The abnormal cases are considered tested by the normal assignment procedure in section 5.1.3.6.

```
MS                             BSS                          MSC
                                          ASS REQ
                               <-----------------------------
        CH MODE MOD
<------------------------------
      CH MODE MOD ACK
------------------------------>
                                          ASS COM
                               ----------------------------->
```

Figure 5-11: Transmission mode change - normal case

The messages from the BSSTE will be:

1. ASSIGNMENT REQUEST
   Channel type = TCH/F4.8
   Layer 3 header information
   Priority
   Circuit identity code
   Radio channel identity
   Downlink DTX flag
   Interference band to be used
2. CHANNEL MODE MODIFY ACKNOWLEDGE
   Channel description
   Channel mode = TCH/F4.8

REQUIREMENTS

In the case of step 1, a CHANNEL MODE MODIFY message shall occur at the radio interface on the main signalling link requesting the TCH/F4.8.
In the case of step 2, an ASSIGNMENT COMPLETE message shall occur on the MSC-interface.
The messages from the BSS shall be:

1. CHANNEL MODE MODIFY
   Channel description
   Channel mode = TCH/F4.8
2. ASSIGNMENT COMPLETE
   RR cause
   Radio channel identity
   Cell identifier

5.1.3.12. Ciphering mode setting

DEFINITION

The purpose of the ciphermode control procedure is, after authentication, to initialize and synchronize the stream ciphering devices in the MS and BSS. The MS and the MSC know already from the authentication procedure the cipher key Kc, and in this procedure this key is passed to the BSS.

NOTE: Any failure during the ciphermode control procedure will be regarded as a lower layer failure and will therefore not be tested explicitly.

METHOD OF TEST

1. A dedicated resource shall be established between the radio interface and the MSC-interface. Ciphering shall not be activated.
2. A CIPHER MODE COMMAND message shall be input on the MSC-interface containing the key Kc. The response on any interface shall be recorded.

3. The BSSTE shall start deciphering and enciphering on the radio interface and then input a CIPHERING MODE COMPLETE message on the radio interface on the main signalling link. The response on any interface shall be recorded.
4. The BSSTE shall input any arbitrary DTAP message on the MSC-interface. The response on any interface shall be recorded.
5. Steps 1-3 shall be repeated, but replacing the CIPHERING MODE COMPLETE message in step 3 with a LAPDm I frame containing any DTAP message.

```
MS                            BSS                          MSC
                                     CIPHER MODE CMD
                              <----------------------------
       CIPH MODE CMD
<----------------------------   start deciphering BSS
       Layer 2 frame
---------------------------->   start enciphering BSS
       CIPH MODE COM
---------------------------->
                                     CIPHER MODE COM
                              ---------------------------->
```

Figure 5-12: Ciphering mode setting - normal case

The messages from the BSSTE will be:

2. CIPHER MODE COMMAND
   Layer 3 header information
   Encryption information
3. CIPHERING MODE COMPLETE
   --

4,5.DTAP MESSAGE

REQUIREMENTS

In the case of step 2, a CIPHERING MODE COMMAND message shall occur on the radio interface on the main signalling link. The message shall not be enciphered.
In the case of step 3, the CIPHER MODE COMPLETE message shall occur on the MSC-interface.

In the case of step 4, the chosen DTAP message shall occur on the radio interface on the main signalling link. The message shall be enciphered.
In the case of step 5, the chosen DTAP message shall occur on the MSC-interface. The message shall be deciphered.
The messages from the BSS shall be:

2. CIPHERING MODE COMMAND
   Cipher mode setting
3. CIPHER MODE COMPLETE
   --

4,5.DTAP MESSAGE

5.1.3.13. Additional assignment

The purpose of the additional assignment procedure is to allocate additional resources to a Mobile Station that is already communicating with the network, eg assigning another independent half-rate traffic channel. The procedure is always initiated by the network.
The additional assignment procedure is only intended for future evolution and may be enhanced in the future. The procedure is specified on the radio interface, but the support on the A-interface is for further study. Consequently, the procedure is not tested.

5.1.3.14. Partial release

The partial release procedure is used to release parts of the full assigned radio resources when they are no longer needed. The partial release procedure is used in connection with the additional assignment procedure as tested in section 5.1.3.6. The procedure is always initiated by the network.
The partial release procedure is only intended for future evolution and may be enhanced in the future. The procedure is specified on the radio interface, but the support on the A-interface is for further study. Cosequently, the procedure is not tested.

5.1.3.15. Classmark change

DEFINITION

The classmark change procedure is used by the MS to indicate to the network a change in its classmark, eg change in TX power capabilities due to addition of a power amplifier when a handportable MS is plugged into a car.

METHOD OF TEST

1. A call shall be set up between the radio interface and the MSC-interface.
2. A CLASSMARK CHANGE message shall be input on the radio interface with an appropriate new classmark. The response on any interface shall be recorded.

```
MS                          BSS                          MSC
         CLASS CH
------------------------------>
                                      CLASS UPD
                            ------------------------------>
```

Figure 5-15: Classmark change - normal case

The messages from the BSSTE will be:

2. CLASSMARK CHANGE
   Mobile Station classmark 2 = PAR1

REQUIREMENTS

In the case of step 2, a CLASSMARK UPDATE message shall occur on the MSC-interface with classmark information corresponding to the Mobile Station classmark 2 from the MS.
The messages from the BSS shall be:

2. CLASSMARK UPDATE
   Classmark information type 2 = PAR1

5.1.3.16. Channel release

DEFINITION

The channel release task is used to release the full assigned radio resource at the end of a call, or because of some Base Station System generated reason (maintenance, equipment failure etc).

METHOD OF TEST

1. One or two O&M-messages as defined by the operator or the manufacturer shall be input on the OMC-interface by the BSSTE setting the timer T3109 to an appropriate value A and the timer T3111 to an appropriate value B.
2. A dedicated resource shall be set up between the radio interface and the MSC-interface. There shall be no limiting radio conditions.
3. A CLEAR COMMAND with the cause value "call control" shall be input on the MSC-interface. The response on any interface shall be recorded. The BSSTE shall not release the main signalling link.
4. After the CHANNEL RELEASE message output in step 3, a LAPDm DISC frame shall be input on the radio interface on the main signalling link after a period T3109=A. The response on any interface shall be recorded.
5. Step 3 shall be repeated, and then LAPDm DISC frames shall continuously be input on the radio interface on the main signalling link. The response on any interface shall be recorded.
6. Steps 1 and 2 shall be repeated, and then an O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface taking the used radio resources out of service. The response on any interface shall be recorded.

```
      MS                          BSS                           MSC
                                              CLEAR CMD
                                   <-----------------------------
                CH REL                        CLEAR COM
      <----------------------------*---------------------------->
                  DISC                |
      - - - - - - - - - - - - - - - > T3109
                   UA                 |
      < - - - - - - - - - - - - - -   -
                                      |
                                    T3111
                                      |
                                      -
                              deactivate channels
```

Figure 5-16: Release - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
3. CLEAR COMMAND
   Layer 3 header information
   Cause = as in text
6. O&M MESSAGES

REQUIREMENTS

In the case of step 3, a CHANNEL RELEASE message shall occur on the radio interface on the main signalling link (the BSS shall then start its timer T3109) and a CLEAR COMPLETE message shall occur on the MSC-interface.
In the case of step 4, no messages shall occur on any interface.
In the case of step 5, a LAPDm UA frame shall occur on the radio interface on the main signalling link as a response to the first DISC frame, then a LAPDm DM frame as a response to all consequent DISC frames within a time T3111=B. After the time T3111=B no further responses shall occur.
In the case of step 6, a CLEAR REQUEST message shall occur on the MSC-interface with the cause value:"O&M intervention".

The messages from the BSS shall be:

3. CHANNEL RELEASE
   RR cause
3. CLEAR COMPLETE
   --
6. CLEAR REQUEST
   Cause = as in text

5.1.3.17. Radio link failure

DEFINITION

The radio link failure procedure is used when a failure is detected on the radio path by the BSS.

METHOD OF TEST

1. A dedicated resource shall be set up between the radio interface and the MSC-interface. Then conditions triggering a lower layer failure in the BSS shall be set up. The response on any interface shall be recorded.

```
MS                          BSS                          MSC
         failure
                                      CLEAR REQ
                            ---------------------------->
```

Figure 5-17: Radio link failure - normal case

NOTE: Examples of lower layer failures are the expiry of timer T100 (no SACCH reception) and a data link (Layer 2) failure on the radio interface.

REQUIREMENTS

In the case of step 1, a CLEAR REQUEST message with the cause value "radio interface failure" shall occur on the MSC-interface.

NOTE: On reception of the CLEAR REQUEST message, the MSC will invoke the normal channel release procedure in section 5.1.3.16. The BSS has then some flexibility with respect to commanding the MS to release or not.

The messages from the BSS shall be:

1. CLEAR REQUEST
   Cause = as in text

5.1.3.18. Blocking

DEFINITION

The assignment procedure depends upon the MSC choosing the terrestrial resource to be used. The MSC therefore needs to be informed of any terrestrial circuits that are out of service in the Base Station System. This is obtained by a simple block/unblock procedure. A block/unblock message is sent from the BSS to the MSC and concerns a single terrestrial circuit.

METHOD OF TEST

1. A call shall be set up between the radio interface and the MSC-interface using an appropriate terrestrial circuit A.
2. With an O&M-message as defined by the operator or the manufacturer on the OMC-interface the BSS shall be instructed to set the timer T1 to an appropriate value B.
3. With an O&M-message as defined by the operator or the manufacturer [tbd] on the OMC-interface the BSS shall be commanded to block the terrestrial circuit A. The response on any interface shall be recorded.
4. The call on the terrestrial circuit A shall be cleared. The response on any interface shall be recorded. No further messages shall be input on the MSC-interface.

5. A dedicated resource shall be established between the radio interface and the MSC interface.
   An ASSIGNMENT REQUEST message shall be input on the MSC-interface concerning the terrestrial circuit A. The response on any interface shall be recorded.
6. The step 3 shall be repeated, but the terrestrial circuit shall be C other than A. When a BLOCKING message occurs on the MSC-interface, a BLOCKING ACKNOWLEDGE message shall be input within a period T1=B on the MSC-interface. The response on any interface shall be recorded.
7. An ASSIGNMENT REQUEST message shall be input on the MSC-interface concerning the terrestrial circuit C. The response on any interface shall be recorded.
8. With an O&M-message as defined by the operator or the manufacturer from the BSSTE over the OMC-interface the BSS shall be commanded to unblock the terrestrial circuit C. The response on any interface shall be recorded.
9. Step 7 shall be repeated.
10. Step 8 shall be repeated, and then an UNBLOCKING ACKNOWLEDGE message input on the MSC-interface within a time T1=B. The response on any interface shall be recorded.
11. Step 7 shall be repeated.
12. The step 6 shall be repeated, but the BLOCKING ACKNOWLEDGE message of step 6 shall be replaced by a RESET message. The response on any interface shall be recorded.

```
MS                          BSS                         MSC
                                        BLOCK
                        -   ---------------------------->
                        T1          BLOCK ACK
                        -   <----------------------------

                                        UNBLOCK
                        -   ---------------------------->
                        T1          UNBLOCK ACK
                        -   <----------------------------
```

Figure 5-18: Blocking - normal case

The messages from the BSSTE will be:

2,3.O&M MESSAGES
5. BLOCKING ACKNOWLEDGE
   Circuit identity code = C

5,7.ASSIGNMENT REQUEST
    Channel type
    Layer 3 header information = A, C
    Priority
    Circuit identity code
    Radio channel identity
    Downlink DTX flag
    Interference band to be used
8. O&M MESSAGES
9-11.ASSIGNMENT REQUEST
    Channel type
    Layer 3 header information = C
    Priority
    Circuit identity code
    Radio channel identity
    Downlink DTX flag
    Interference band to be used
10. UNBLOCKING ACKNOWLEDGE
    Circuit identity code
12. RESET
    Cause

REQUIREMENTS

In the case of step 3, 2 BLOCKING messages with an interval of B between them and with correct blocking cause: "O&M intervention" for terrestrial circuit A shall occur at the MSC-interface. The call shall continue.
In the case of step 4, no BLOCKING messages shall occur on the MSC-interface after the call has been cleared.
In the case of step 5, an ASSIGNMENT FAILURE message with the cause value "terrestrial resource unavailable" followed by a BLOCKING message with the cause value "O&M intervention" for terrestrial circuit A shall occur on the MSC-interface.
In the case of step 6, a single BLOCKING message with correct blocking cause: "O&M intervention" shall occur for terrestrial circuit A on the MSC-interface. After the BLOCKING ACKNOWLEDGE no further BLOCKING messages shall occur.

In the case of step 7, an ASSIGNMENT FAILURE message with the cause value "terrestrial resource unavailable" followed by a BLOCKING message with the cause value "O&M intervention" for terrestrial circuit C shall occur on the MSC-interface.
In the case of step 8, 2 UNBLOCKING messages with an interval of B between them for terrestrial circuit C shall occur on the MSC-interface after the call has been cleared.
In the case of step 9, the same requirements as in step 7 apply.
In the case of step 10, a single UNBLOCKING message shall occur for terrestrial circuit C on the MSC-interface. After the BLOCKING ACKNOWLEDGE no further BLOCKING messages shall occur.
In the case of step 11, an ASSIGNMENT COMMAND message shall occur on the radio interface on the main signalling link.
In the case of step 12, 2 BLOCKING messages shall occur on the MSC-interface concerning the terrestrial circuit C and with correct blocking cause: "O&M intervention". After some seconds, given by the timer T2, after the input RESET message a RESET ACKNOWLEDGE message shall occur on the MSC-interface. Then no further BLOCKING messages shall occur. See also section 5.1.3.20 in this specification (reset).
The messages from the BSS shall be:

4-6.BLOCKING
    Circuit identiy code = A
    Cause = as in text
5,7,9.ASSIGNMENT FAILURE
    Cause = as in text
    RR cause
7,9,10.BLOCKING
    Circuit identiy code = C
    Cause = as in text
8,10.UNBLOCKING
    Circuit identity code = C

11. ASSIGNMENT COMMAND
    Channel description
    Power command
    Cell channel description
    Channel description
    Channel mode
    Mobile allocation
    Starting time
12. BLOCKING
    Circuit identiy code = C
    Cause = as in text
12. RESET ACKNOWLEDGE
    --

5.1.3.19. Resource indication

DEFINITION

The purpose of the resource indication task is to inform the MSC about the amount of idle channels in the BSS, separately for half rate and full rate TCHs, giving information about the interference level on the various channels.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface setting the thresholds for the RESOURCE INDICATION messages. Then a RESOURCE REQUEST message indicating "spontaneous indication" shall be input on the MSC-interface.
2. The environment shall be set up to trigger a spontaneous RESOURCE INDICATION message from the BSS. The response on any interface shall be recorded.
3. A RESOURCE REQUEST message indicating "one single indication" shall be input on the MSC-interface. The response on any interface shall be recorded.

4. A RESOURCE REQUEST message indicating "periodic indication" and a periodicity of T3=B>0 shall be input on the MSC-interface. The response on any interface shall be recorded.
5. A RESOURCE REQUEST message indicating "no indication" shall be input on the MSC-interface. The response on any interface shall be recorded.

```
MS                        BSS                        MSC
                                      RES REQ
                           <-----------------------------
                                      RES IND
                        -  ----------------------------->
                       T3             RES IND
                        -  ----------------------------->
                                         .
                                         .
```

Figure 5-19: Resource indication - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
1. RESOURCE REQUEST
    Periodicity
    Resource indication method = as in text
    Cell identifier
1-5. RESOURCE REQUEST
    Periodicity = none, B, none
    Resource indication method = as in text
    Cell identifier

REQUIREMENTS

In the case of step 2, a RESOURCE INDICATION message shall occur on the MSC-interface reflecting the environment simulated by the BSSTE.
In the case of step 3, a RESOURCE INDICATION message shall occur on the MSC-interface reflecting the environment simulated by the BSSTE.

In the case of step 4, RESOURCE INDICATION messages shall occur repeatedly on the MSC-interface with an interval T3=B reflecting the environment simulated by the BSSTE.
In the case of step 5, no further RESOURCE INDICATION messages shall occur on the MSC-interface.
The messages from the BSS shall be:

2-4.RESOURCE INDICATION
    Resource available
    Cell identifier

5.1.3.20. Reset

5.1.3.20.1. Global reset

In case of a failure such that transaction references are lost in the Base Station System or in the MSC, a reset message has to be sent to the other end so that all affected calls can be released in that end.

5.1.3.20.1.1. Global reset at the BSS

DEFINITION

In the event of a failure in the BSS which has resulted in the loss of transaction reference information, the BSS resets and the MSC is told to release all calls, to erase all references and to put all circuits into the idle state for the BSS in question.

METHOD OF TEST

1. A call shall be set up between the radio interface and the MSC-interface.
2. With an O&M-message as defined by the operator or the manufacturer on the OMC-interface the BSS shall be instructed to set the timer T4 to an appropriate value B.
3. Conditions triggering a RESET message to the MSC shall be set up. How to do it is up to the operator or to the manufacturer. Nothing shall be input on the MSC-interface, and the reset conditions shall seize. The BSSTE shall not release the dedicated resources of the established call. The response on any interface shall be recorded.

4. Within a time T4 after a RESET message from the BSS on the MSC-interface, a RESET ACKNOWLEDGE message shall be input on the MSC-interface. The response on any interface shall be recorded.
5. A DTAP message shall be input on the main signalling channel of the established call on the radio interface. The response on any interface shall be recorded.

```
MS                        BSS                        MSC
                                      RESET
                      -    ---------------------------->
                     T4             RESET ACK
                      -    <----------------------------
```

Figure 5-20a: Global reset at the BSS - normal case

The messages from the BSSTE will be:

2,3.O&M MESSAGES
4. RESET ACKNOWLEDGE
--
5. DTAP MESSAGE

REQUIREMENTS

In the case of step 3, RESET messages with an appropriate cause value shall occur repeatedly on the MSC-interface with an interval of B seconds. At least 3 messages shall be observed.
In the case of step 4, no more RESET messages shall occur from the BSS after the reception of the RESET ACKNOWLEDGE message.
In the case of step 5, no message shall occur on any interface.
The messages from the BSS shall be:

3. RESET
Cause = as in text

5.1.3.20.1.2. Global reset at the MSC

DEFINITION

In the event of a failure in the MSC which has resulted in the loss of transaction reference information, the MSC resets all transactions with the BSS, and the BSS is told to release all calls and to erase all references.

METHOD OF TEST

1. A call shall be set up between the radio interface and the MSC-interface.
2. An O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface instructing the BSS to set the timer T13 to an appropriate value A.
3. A RESET message shall be input on the MSC-interface. The BSSTE will not release the dedicated resources of the established call. The response on any interface shall be recorded.
4. A STATUS ENQUIRY message shall be input on the radio interface on the main signalling link of the established call. The response on any interface shall be recorded.

```
    MS                        BSS                        MSC
                                          RESET
                        -       <---------------------------
                        |
                    T13 |   release calls
                        |                 RESET ACK
                        -       ---------------------------->
```

Figure 5-20b: Global reset at the MSC - normal case

The messages from the BSSTE will be:

2. O&M MESSAGES
3. RESET
   Cause
4. STATUS ENQUIRY
   --

REQUIREMENTS

In the case of step 3, A seconds after the input RESET message a RESET ACKNOWLEDGE message shall occur at the MSC-interface. On the radio interface a CHANNEL RELEASE message may occur.
In the case of step 4, no messages shall occur on any interface.
The messages from the BSS shall be:

3. RESET ACKNOWLEDGE
   --
3. CHANNEL RELEASE
   RR cause

5.1.3.20.2. Reset circuit

The purpose of the reset circuit procedure is to restore the information in the MSC or BSS in case of a failure which has affected only a small part of the equipment, in case the SCCP connection has been released during the failure.

5.1.3.20.2.1. Reset circuit at the BSS

DEFINITION

If a circuit has to be set idle at the BSS due to abnormal SCCP connection release, the MSC is told to clear the possible call and to set its corresponding circuit idle.

METHOD OF TEST
1. A call shall be set up between the radio interface and the MSC-interface using the terrestrial circuit A.
2. With an O&M-message as defined by the operator or the manufacturer on the OMC-interface the BSS shall be instructed to set the timer T12 to an appropriate value B.
3. Conditions triggering a RESET CIRCUIT message to the MSC concerning the terrestrial circuit A shall be set up. How to do it is up to the operator or to the manufacturer. Nothing shall be input on the MSC-interface, and the reset conditions shall seize. The BSSTE will not release the dedicated resources of the established call. The response on any interface shall be recorded.

4. Within a time T12 after a RESET CIRCUIT message from the BSS on the MSC-interface, a RESET CIRCUIT ACKNOWLEDGE message shall be input on the MSC-interface concerning the terrestrial circuit A. The response on any interface shall be recorded.
5. A DTAP message shall be input on the radio interface on the main signalling channel of the established call. The response on any interface shall be recorded.

```
MS                          BSS                          MSC
                                      RESET CIRC
                         -  ---------------------------->
                        T12        RESET CIRC ACK
                         -  <----------------------------
```

Figure 5-20c: Reset circuit at the BSS - normal case

The messages from the BSSTE will be:

2,3.O&M MESSAGES

4. RESET CIRCUIT ACKNOWLEDGE
   Circuit identification code = A
5. DTAP MESSAGE

REQUIREMENTS

In the case of step 3, RESET CIRCUIT messages with the cause value "O&M intervention" shall occur repeatedly on the MSC-interface with an interval of B seconds. At least 3 messages shall be observed.
In the case of step 4, no more RESET CIRCUIT messages shall occur from the BSS after the reception of the RESET CIRCUIT ACKNOWLEDGE message.
In the case of step 5, no message shall occur on any interface.
The messages from the BSS shall be:

3. RESET CIRCUIT
   Circuit identification code = A
   Cause = as in text

5.1.3.20.2.2. Reset circuit at the MSC

DEFINITION

If a circuit has to be set idle at the MSC due to abnormal SCCP connection release, the BSS is told to clear the possible call and to set its corresponding circuit idle.

METHOD OF TEST

1. A call shall be set up between the radio interface and the MSC-interface using the terrestrial circuit A.
2. An O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface instructing the BSS to set the timer T1 to an appropriate value B.
3. A RESET CIRCUIT message shall be input on the MSC-interface concerning the terrestrial circuit A. The BSSTE will not release the dedicated resources of the established call. The response on any interface shall be recorded.
4. A STATUS ENQUIRY message shall be input on the radio interface on the main signalling link of the established call. The response on any interface shall be recorded.
5. An O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface instructing the BSS to block the terrestrial circuit A. Then step 3 shall be repeated.
6. The test is stopped by inputting a BLOCK ACKNOWLEDGE message concerning the terrestrial circuit A on the MSC-interface.

```
MS                           BSS                           MSC
                                       RESET CIRC
                             <-----------------------------
             release circuit
                                     RESET CIRC ACK
                             ----------------------------->
```

Figure 5-20d: Reset circuit at the MSC - normal case

The messages from the BSSTE will be:

2,5. O&M MESSAGES
3. RESET CIRCUIT
   Circuit identification code = A
   Cause
4. STATUS ENQUIRY
   --
6. BLOCK ACKNOWLEDGE
   Circuit identification code = A

REQUIREMENTS

In the case of step 3, a RESET CIRCUIT ACKNOWLEDGE message shall occur at the MSC-interface on the terrestrial circuit A.
In the case of step 4, a CHANNEL RELEASE message <u>may</u> occur on the radio interface on the main signalling link.
In the case of step 5, BLOCKING messages with the cause value "O&M intervention" shall occur continuously on the MSC-interface with an interval of T1=B concerning the terrestrial circuit A.
The messages from the BSS shall be:

3. RESET CIRCUIT ACKNOWLEDGE
   Circuit identification code = A
5. BLOCKING
   Circuit identification code = A
   Cause = as in text

5.1.3.21. Handover candidate enquiry

DEFINITION

The purpose of the handover candidate enquiry procedure is for the MSC to get information about MSs which are possible handover candidates to a given cell. This is useful for the MSC if it for a traffic reason should want to handover 1 or several MSs. The criteria for the choice of handover candidates by the BSS are, however, not specified. These are left to the operator or manufacturer.

METHOD OF TEST

1. 2 network originated calls shall be set up between the radio interface and the MSC-interface in cell A.
2. The measurement reports transmitted by the BSSTE in both calls shall emulate cell B as a possible handover candidate. Cell B shall be external to the BBS under test. The exact emulation is left to the manufacturer or the operator.
3. A HANDOVER CANDIDATE ENQUIRY regarding the cell B shall be input on the MSC-interface with a maximum number of MSs of 3. The response on any interface shall be recorded.
4. Step 3 shall be repeated, but the maximum number of MSs indicated shall be 1.
5. Step 3 shall be repeated, and directly after the first HANDOVER REQUIRED message occurring on the MSC-interface then another HANDOVER CANDIDATE ENQUIRY message shall be input on the MSC-interface. The response on any interface shall be recorded.

```
MS                          BSS                       MSC
                                    HAND CAND ENQ
                             <--------------------------
                                      HAND RQD             MS1
                             -------------------------->
                                      HAND RQD             MS2
                             -------------------------->
                                          .
                                          .
                                      HAND RQD             MSn
                             -------------------------->
                                    HAND CAND RES
                             -------------------------->
```

Figure 5-21: Handover candidate enquiry - normal case

The messages from the BSSTE will be:

3,4. HANDOVER CANDIDATE ENQUIRY
Number of MSs = 3, 1
Cell identifier list = B,..
Cell identifier = A

5. HANDOVER CANDIDATE ENQUIRY
Number of MSs = 3
Cell identifier list = B,..
Cell identifier = A

REQUIREMENTS

In the case of step 3, 2 HANDOVER REQUIRED messages with the cause value "response to MSC invocation" shall occur on the MSC-interface followed by a HANDOVER CANDIDATE RESPONSE message indicating 2 handover candidates.
In the case of step 4, 1 HANDOVER REQUIRED message with the cause value "response to MSC invocation" shall occur on the MSC-interface followed by a HANDOVER CANDIDATE RESPONSE message indicating 1 handover candidate.
In the case of step 5, 2 HANDOVER REQUIRED message with the cause value "response to MSC invocation" shall occur on the MSC-interface followed by a HANDOVER CANDIDATE RESPONSE message indicating 2 handover candidates.
The messages from the BSS shall be:

3-5. HANDOVER REQUIRED
Cause = as in text
Response request
Cell identifier list (preferred) = B,..
Current radio environment
Environment of BS "n"

3-5. HANDOVER CANDIDATE RESPONSE
Number of MSs = 2, 1, 2
Cell identifier = A

5.1.3.22. Trace invocation

The purpose of the trace invocation procedure is for the MSC, on behalf of the OMC, to request the BSS that it should start producing a trace record on a particular transaction, or vice versa.

5.1.3.22.1. Trace invoked by the MSC

The MSC may, on behalf of the OMC, request the BSS to start producing a trace record on a particular transaction. For further details see GSM 08.08 and GSM 12.20.
This procedure is not acknowledged and cannot be tested as a BSSMAP procedure.

NOTE: The procedure might, however, be tested as an O&M procedure concerning the SMAP in GSM 11.21.

5.1.3.22.2. Trace invoked by the BSS

DEFINITION

The BSS may, on behalf of the OMC, request the MSC to start producing a trace record on a particular transaction. For further details see GSM 08.08 and GSM 12.20.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface requesting the BSS to request the MSC to start producing a trace record on a transaction using the terrestrial circuit A. The response on any interface shall be recorded.

```
MS                        BSS                        MSC
                                      O&M
                                  TRACE INVOC
                                -------------------------->
```

Figure 5-22: Trace invocation by the BSS - normal case

The messages from the BSSTE will be:
1. O&M MESSAGE

REQUIREMENTS

In the case of step 1, a TRACE INVOCATION message shall occur on the MSC-interface on the terrestrial circuit A.
The messages from the BSS shall be:
1. TRACE INVOCATION
   Trace number

5.1.3.23. Flow control

Flow control in the BSS and MSC are supported by overload messages which result in some form of reduction of the traffic coming from the other side.

5.1.3.23.1. Overload in the MSC

When the MSC processor is overloaded, an overload message is sent to the BSS, and the BSS will try to reduce the load.
The method of reducing the load is a national or operator specific matter. Consequently, the procedure is not tested.

5.1.3.23.2. Overload in the BSS

When an overload situation occurs in the BSS, an overload message is sent to the MSC. The overload situation can be caused by processor overload, CCCH scheduling overload or MTP congestion. For further information see GSM 08.08.
This situation will take part of the load testing of a BSS and is outside the scope of the standardized acceptance tests in this specification. Load testing of the BSS is a national or operator specific matter.

5.1.3.24. Data link control for SAPI not equal to 0

In order to support radio interface data links with SAPI not equal to 0 (eg Short Message Services with SAPI=3), specific control of these links is needed between the BSS and the MSC. This does not apply to SAPI=0.

5.1.3.24.1. MSC-originated transaction

DEFINITION

When a Layer 3 message indicating a SAPI other than 0 originates from the network through the MSC, this will be transferred to the MS as a DTAP message through the BSS. The SAPI "n" signalling link will be established if it is not already. This procedure applies only to the Short Message service (SMS) on the SACCH with SAPI=3.

METHOD OF TEST

1. A call (SAPI=0) shall be set up between the radio interface and the MSC-interface.
2. A DTAP message shall be input on the MSC-interface indicating SAPI=3. No further messages shall be input. The response on any interface shall be recorded.
3. Step 2 shall be repeated, and then a LAPDm UA frame acknowledging the output SABM shall be input on the radio interface on the SACCH within a time T200. The response on any interface shall be recorded.
4. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface instructing the BSS to reject all SAPI=3 transactions. Then, step 2 shall be repeated.

```
MS                            BSS                          MSC
                                   DTAP message (SAPI=3)
                               <-----------------------------
        SABM (SAPI=3)
<- - - - - - - - - - - - - - - -
         UA (SAPI=3)
- - - - - - - - - - - - - - - ->
    DTAP message (SAPI=3)
<------------------------------
```

Figure 5-24a: MSC-originated transaction (SAPI=3) - normal case

The mesages from the BSSTE will be:
2,3.DTAP MESSAGE
4. O&M MESSAGE
5. DTAP MESSAGE

REQUIREMENTS

In the case of step 2, N200+1 LAPDm SABM frames indicating SAPI=3 shall occur on the radio interface on the SACCH with an interval of T200. Then a CLEAR REQUEST message concerning the whole call with the cause value "radio link message failure" shall occur on the MSC-interface.
In the case of step 3, the DTAP message shall occur on the radio interface on the SACCH.
In the case of step 4, a SAPI "n" REJECT message shall occur on the MSC-interface with the cause value "O&M intervention".
The messages from the BSS shall be:

2. CLEAR REQUEST
   Cause = as in text
3. DTAP MESSAGE
5. SAPI "n" REJECT
   DLCI
   Cause = as in text

5.1.3.24.2. MS-originated transaction

DEFINITION

When a Layer 3 message indicating a SAPI other than 0 originates from the MS, the MS will first send a CM SERVICE REQUEST on the main signalling link requesting the SAPI "n" service. Then, after the acceptance of the service from the network, the MS will establish the SAPI "n" link and send the Layer 3 message as a DTAP message. This procedure applies only to the Short Message Service (SMS) on the SACCH with SAPI=3.

METHOD OF TEST

1. A call (SAPI=0) shall be set up between the radio interface and the MSC-interface. The state of the BSSTE shall be as if a Short Message Service has been accepted.
2. A LAPDm SABM frame indicating SAPI=3 shall be input on the radio interface on the SACCH. The response on any interface shall be recorded.
3. A Short Message Service DTAP message with SAPI=3 shall be input on the radio interface. The response on any interface shall be recorded.

```
MS                          BSS                          MSC
        SABM (SAPI=3)
- - - - - - - - - - - - - - ->
         UA (SAPI=3)
<- - - - - - - - - - - - - - -
     DTAP message (SAPI=3)
----------------------------------------------------------->
```

Figure 5-24b: MS-originated transaction (SAPI=3) - normal case

The messages from the BSSTE will be:

3. DTAP MESSAGE

REQUIREMENTS

In the case of step 2, a LAPDm UA frame indicating SAPI=3 shall occur on the radio interface on the SACCH.
In the case of step 3, the DTAP message shall occur transparently on the MSC-interface.

5.1.3.24.3. MS-originated transaction completion

DEFINITION

The release of a SAPI other than 0 link on the radio interface by the MS requires specific messages between the BSS and the MSC. This procedure applies only to the Short Message Service (SMS) on the SACCH with SAPI=3.

METHOD OF TEST

1. A call and a Short Message Service (SAPI=3) shall be set up between the radio interface and the MSC-interface.
2. A LAPDm DISC frame indicating SAPI=3 shall be input on the radio interface on the SACCH. The response on any interface shall be recorded.
3. The test shall be stopped by inputting a SAPI "n" CLEAR COMPLETE message on the MSC-interface.

```
MS                            BSS                           MSC
        DISC (SAPI=3)
- - - - - - - - - - - - - - - ->
         UA (SAPI=3)
<- - - - - - - - - - - - - - - -
                                    SAPI "n" CLEAR CMD
                               ----------------------------->
                                    SAPI "n" CLEAR COM
                               <-----------------------------
```

Figure 5-24c: MS-originated transaction completion (SAPI=3) - normal case

The messages from the BSSTE will be:

3. SAPI "n" CLEAR COMPLETE
   DLCI

REQUIREMENTS

In the case of step 2, a LAPDm UA frame indicating SAPI=3 shall occur on the radio interface on the SACCH and a SAPI "n" CLEAR COMMAND message indicating SAPI=3 shall occur on the MSC-interface.
The messages from the BSS shall be:

2. SAPI "n" CLEAR COMMAND
   DLCI

5.1.3.24.4. MSC-originated transaction completion

DEFINITION

The release of a SAPI other than 0 link on the radio interface by the BSS requires specific messages between the BSS and the MSC. This procedure applies only to the Short Message Service (SMS) on the SACCH with SAPI=3.

METHOD OF TEST

1. A call and a Short Message Service (SAPI=3) shall be set up between the radio interface and the MSC-interface.
2. A SAPI "n" CLEAR COMMAND indicating SAPI=3 shall be input on the MSC-interface. The response on any interface shall be recorded.
3. A LAPDm UA frame indicating SAPI=3 shall be input on the radio interface on the SACCH. The response on any interface shall be recorded.

```
   MS                           BSS                           MSC
                                      SAPI "n" CLEAR CMD
                                 <-----------------------------
           DISC (SAPI=3)
   <- - - - - - - - - - - - - - - -
            UA (SAPI=3)
   - - - - - - - - - - - - - - - ->
                                      SAPI "n" CLEAR COM
                                 ----------------------------->
```

Figure 5-24d: MSC-originated transaction completion (SAPI=3) - normal case

The messages from the BSSTE will be:

2. SAPI "n" CLEAR COMMAND
   DLCI

REQUIREMENTS

In the case of step 2, a LAPDm DISC frame indicating SAPI=3 shall occur on the radio interface on the SACCH.
In the case of step 3, a SAPI "n" CLEAR COMPLETE message indicating SAPI=3 shall occur on the MSC-interface.
The messages from the BSS shall be:

3. SAPI "n" CLEAR COMPLETE
   DLCI

5.1.3.25. Queuing indication

The queuing indication is only used if the BSS uses a queuing mechanism for the assignment of TCHs. The use of such a queuing mechanism is a national or operator specific matter.

DEFINITION

If the BSS does not have an available TCH as requested by the MSC in the assignment or handover resource allocation procedures as tested in sections 5.1.3.6 and 5.1.3.8, the resource request is put into a queue, and an indication is given to the MSC.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface setting the timer T10 to an appropriate value A, the timer T11 to an appropriate value B and the timer Tqho to an appropriate value D.
2. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface configuring the BSS for "response request".
3. The BSS shall be put into a state so that an additional resource request (assignment or handover) for a specific channel will cause queuing. How to do it is up to the operator or to the manufacturer.
4. A call shall be set up between the radio interface and the MSC-interface.

5. A second dedicated resource shall be established between the radio interface and the MSC interface. An ASSIGNMENT REQUEST message shall be input on the MSC-interface requesting a traffic channel. The response on any interface shall be recorded.
6. The call established in step 4 shall be released, and then step 5 shall be repeated.
7. A HANDOVER REQUEST message shall be input on the MSC-interface. The response on any interface shall be recorded.
8. The second call shall be released, and then step 7 shall be repeated.

```
MS                            BSS                           MSC
                                         ASS REQ
                               <----------------------------
                                        QUEUE IND
                             - ---------------------------->
                             |
                            T11
                             |          CLEAR REQ
                             - ---------------------------->

                              or
                                         HAND REQ
                               <----------------------------
                                        QUEUE IND
                             - ---------------------------->
                             |
                           Tqho
                             |          HAND FAIL
                             - ---------------------------->
```

Figure 5-25: Queuing indication - normal case

The messages from the BSSTE will be:

1-3.O&M MESSAGE
5,6.ASSIGNMENT REQUEST
    Channel type
    Layer 3 header information
    Priority
    Circuit identity code
    Radio channel identity
    Downlink DTX flag
    Interference band to be used

7,8. HANDOVER REQUEST
Channel type
Encryption information
Classmark information 1 or 2
Cell identifier (serving)
Priority
Circuit identification code
Radio channel identity
Downlink DTX flag
Cell identifier (target)
Interference band to be used

REQUIREMENTS

In the case of step 5, a QUEUING INDICATION message shall occur on the MSC-interface concerning the requested TCH. After a time T11=B, a CLEAR REQUEST message shall occur on the MSC-interface concerning the queued resource request.

NOTE: The CLEAR REQUEST in step 5 has the same function as an ASSIGNMENT FAILURE with the cause value "no radio resource available".

In the case of step 6, an ASSIGNMENT COMMAND message shall occur on the radio interface on the main signalling link concerning the requested TCH. After a time T10=A, a CLEAR REQUEST message shall occur on the MSC-interface with the cause value "radio interface message failure".
In the case of step 7, a QUEUING INDICATION message shall occur on the MSC-interface concerning the requested TCH. After a time Tqho=B, a HANDOVER FAILURE message with the cause value "no radio resource available" shall occur on the MSC-interface.
In the case of step 8, a HANDOVER REQUEST ACKNOWLEDGE message shall occur on the MSC-interface concerning the requested TCH.
The messages from the BSS shall be:

5,7. QUEUING INDICATION
--

5.6. CLEAR REQUEST
Cause = as in text

6. ASSIGNMENT COMMAND
   Channel description
   Power command
   Cell channel description
   Channel mode
   Channel description
   Channel mode 2
   Mobile allocation
   Starting time
7. HANDOVER FAILURE
   Cause = as in text
   RR cause
8. HANDOVER REQUEST ACKNOWLEDGE
   Layer 3 information = HAND CMD

5.1.3.26. Short Message Service Cell Broadcast (SMSCB)

NOTE: As the procedure to initiate the SMS Cell Broadcast function in the BSS is not specified, this function will not be tested for the BSS as a whole.

5.1.4. Transcoding/rate adaptation functions

The interface at the MSC will have a per channel bit rate of 64 kbit/s, but the net radio path traffic is at a rate of less than 16 kbit/s. A transcoder or rate adapter function is thus needed for the rate conversion. The interface is designed such that the transcoding or rate adaptation function may be geographically situated either at the MSC site or the BSS site. However, the transcoder is considered to be part of the BSS.

5.1.4.1. Full-rate speech related transcoding functions

The full-rate speech transcoding in the GSM Base Station System transforms the 13 kbit/s net bit stream, which is transmitted over the radio path via the functions described in the GSM 05-series of specifications, to 64 kbit/s A-law PCM according to recommendation CCITT G.711 for switching in the PSTN, or vice versa.
The speech transcoding in the BSS consists of 2 steps. In the uplink the first step transforms the 13 kbit/s bitstream into 8 kHz linear 13 bit PCM (104 kbit/s). The second step transforms this 13 bit linear PCM into 8 bit A-law PCM. In the downlink the order is reversed. In addition, specific speech functions are needed to support Discontinuous Transmission (DTX).
For further information see GSM 06.01, GSM 06.10, GSM 06.11, GSM 06.12, GSM 06.31 and GSM 06.32.

5.1.4.1.1. Uplink speech transcoding - step 1

DEFINITION

This transcoding transforms the 13 kbit/s net radio path bit stream to 13 bit/8 kHz linear PCM.
For further information see GSM 06.10 and refer to the speech decoder parts.

METHOD OF TEST
At 13 kbit/s level in the BSS after channel decoding a test sequence shall be input synchronized to the channel/speech decoders interface frame structure. Alternatively, the test sequence may be input via the air interface before channel encoding at 13 kbit/s level in the BSSTE. In the latter case the Layer 1 functions of the BSS must already be verified and the test must be performed under perfect radio conditions.
The test sequences for speech transcoding are defined in GSM 06.10 section 5 and can be obtained from ETSI Secretariat (see GSM 06.10).
The sequences to be input in this test are contained in the files SEQxx.COD. The files contain 16 bit words for all speech encoded parameters and are justified as described in GSM 06.10 Table 5.1. 76 words must be input in a period of 20 ms and the speech decoder must be reset before the start of the test (ie exactly before the start of the test sequences).
At 104 kbit/s level in the BSS the output bit stream shall be recorded.
The transcoder may be put into test mode in order to accept the new input interface conditions (speech decoder reset), to generate output data at the test rate (104 kbit/s) and in order to disable the uplink dtx functions, which are not part of this test.

NOTE: The test sequences are stored on the diskettes as 16 bit words (2 bytes) where the least significant byte occurs first and the most significant byte occurs last (eg stored 10 0A hex is to be understood as 0A 10 hex).

REQUIREMENTS
The bit stream output shall be bit by bit exactly the same as the sequence given in the files SEQxx.OUT on the floppy disks. These files contain 16 bit words containing 13 bit linear PCM left justified. See also GSM 06.10 Table 5.1.
This requirement shall be applied to all files of the type SEQxx.COD.

5.1.4.1.2. Uplink speech transcoding - step 2

DEFINITION
This transcoding transforms 13 bit linear PCM to 8 bit A-law PCM. For further information see GSM 06.10.

METHOD OF TEST

A test sequence containing all possible 13 bit codewords shall be input at 104 kbit/s level in the BSS. At 64 kbit/s level in the BSS the output shall be recorded.
The transcoder may be put into test mode in order to enable the input test interface (104 kbit/s).

REQUIREMENTS

The correspondence between codewords at input and output shall be according to recommendation CCITT G.721 section 4.2.1 subblock COMPRESS. The parameter LAW=1 shall be used.

5.1.4.1.3. Uplink receiver DTX functions

DEFINITION

The DTX/VAD receiver functions consist of a SID-frame detector, comfort noise generation functions and speech extrapolation and muting functions.
Details about the overall DTX operation for full-rate speech traffic channels are given in GSM 06.31, the speech extrapolation and muting functions are described in GSM 06.11 and the comfort noise aspects in GSM 06.12.

METHOD OF TEST

At 13 kbit/s level in the BSSTE (before channel encoding) coded "speech" traffic frames containing a special test signal defined below shall be input and transmitted over an error-free radio path. All traffic frames shall be identical with the exception of some frames which are SID-frames as defined in GSM 06.31.
At 104 kbit/s level in the BSS (13 bit/8 kHz linear PCM), the signal shall be output and the signal energy of the PCM signal shall be evaluated (as a mean square average) and recorded for each block of 20 ms synchronized to the 20 ms speech frame structure.
The TDMA frames of the TCH/FS transmitted on the radio path shall be ramped "on" or "off" on a traffic frame by traffic frame basis, taking into account the block-diagonal interleaving scheme defined in GSM 05.03. The first traffic frame in step 1 shall occur one frame after the window of the SACCH multiframe allocated for the SID-frame. The SACCH shall be transmitted.

NOTE: 8 timeslots in 8 consecutive TCH/FS TDMA-frames shall be seen as one traffic frame and the next traffic frame starts in the middle of the previous one (ie after 4 TDMA-frames of the previous one) due to the block diagonal interleaving scheme defined in GSM 05.03.

The special test frame is an encoded "speech" traffic frame of 260 bits obtained from white Gaussian noise band limited to 300 - 3400 Hz. When repeated, the special test frame results in a humming sound with a fairly constant level when decoded, and is defined in Table 5-0:

Encoded parameter:	Value:
LARc(1)	38
LARc(2)	42
LARc(3)	24
LARc(4)	20
LARc(5)	10
LARc(6)	9
LARc(7)	5
LARc(8)	3

	Subblock no: 0	1	2	3
Grid position (Mc)	1	3	2	0
Block amplitude (xmaxc)	40	40	40	40
LTP gain (Bc)	0	0	0	0
LTP lag (Nc)	40	120	40	120
RPE pulses (xmc)				
- pulse no 1	4	6	6	6
- pulse no 2	4	5	4	3
- pulse no 3	2	1	3	4
- pulse no 4	6	2	1	3
- pulse no 5	3	6	4	1
- pulse no 6	5	1	6	3
- pulse no 7	5	2	5	5
- pulse no 8	5	6	2	1
- pulse no 9	1	3	4	4
- pulse no 10	3	2	4	3
- pulse no 11	5	5	4	5
- pulse no 12	6	1	2	2
- pulse no 13	1	3	4	3

Table 5-0: Special test traffic frame for receiver DTX tests

The level of the special test frame is controlled with the block amplitude parameter (xmaxc). Reducing xmaxc from 40 to 32 reduces the decoded level by 6 dB, and reducing xmaxc from 40 to 24 reduces the decoded level by 12 dB.
The sequence of frames shall be as follows:

1. 24 normal frames "on".
2. 20 frames "off".
3. 20 normal frames "on".
4. 1 SID-frame followed by 6 frames "off", another identical SID-frame and 23 normal frames "off". Except for the SID codeword, the SID-frames shall be identical to the special test frame.
5. 1 different SID-frame, however with 2 to 15 errors inserted in the SID codeword, followed by 23 frames "off".
6. 20 normal frames "on", but with the level parameter xmaxc=24.
7. 1 SID-frame followed by 50 frames "off". Except for the SID codeword, the SID-frames shall be identical to the special test frame.
8. The whole test shall be repeated, but the frames "off" shall be replaced by frames "on" with the FACCH flag set.

REQUIREMENTS
In the case of step 1, the signal energy shall be fairly constant within +/- [3] dB.
In the case of step 2, the signal energy shall decrease by greater than 40 dB within 17 frames.
In the case of step 3, the same requirements as in step 1 apply.
In the case of step 4, comfort noise shall be generated. The same requirements as in step 1 apply.
In the case of step 5, the same requirements as in step 4 apply.
In the case of step 6, the same requirements as in step 1 apply. However, the nominal signal energy shall be 12 dB lower.
In the case of step 7, the signal energy shall be fairly constant within +/- [3] dB for 28 frames. Then the signal energy shall decrease by greater than 40 dB within 16 frames.

In the case of step 8, the same requirements as in all previous steps apply.

5.1.4.1.4. Downlink speech transcoding - step 1

DEFINITION
This transcoding transforms 8 bit A-law PCM to 13 bit linear PCM. For further information see GSM 06.10.

METHOD OF TEST
A test sequence containing all possible 8 bit codewords shall be input at 64 kbit/s level in the BSS. At 104 kbit/s level in the BSS the output shall be recorded.
The transcoder may be put into test mode in order to enable the output test interface (104 kbit/s).

REQUIREMENTS
The correspondence between codewords at input and output shall be according to recommendation CCITT G.721 section 4.2.1 subblock EXPAND. The parameter LAW=1 shall be used.

5.1.4.1.5. Downlink speech transcoding - step 2

DEFINITION
This transcoding transforms 13 bit/8 kHz linear PCM to the 13 kbit/s net radio path bit stream.
For further information see GSM 06.10 and refer to the speech encoder parts.

METHOD OF TEST
At 104 kbit/s level in the BSS a test sequence shall be input synchronized to the speech encoder input interface frame structure. The test sequences for speech transcoding are defined in GSM 06.10 section 5 and can be obtained from ETSI Secretariat (see GSM 06.10).

The sequences to be input in this test are contained in the files SEQxx.INP. The files contain 16 bit words for 13 bit linear PCM left justifed. See also GSM 06.10 Table 5.1. The speech encoder must be reset before the start of the test (ie exactly before the start of the test sequences).
At 13 kbit/s level in the BSS the output bit stream shall be recorded. The output may be read directly via physical access in the BSS or via the air interface at 13 kbit/s level in the BSSTE. In the latter case the Layer 1 functions of the BSS must already be verified and the test must be performed under perfect radio conditions.
The transcoder may be put into test mode in order to enable the new input interface conditions (speech encoder reset and 104 kbit/s rate) and in order to disable the downlink dtx functions, which are not part of this test.

NOTE: The test sequences are stored on the diskettes as 16 bit words (2 bytes) where the least significant byte occurs first and the most significant byte occurs last (eg stored 10 0A hex is to be understood as 0A 10 hex).

REQUIREMENTS

The bit stream output shall be bit by bit exactly the same as the sequence given in the files SEQxx.COD on the floppy disks. These files contain 16 bit words of all the 76 parameters in a speech frame justified as in GSM 06.10 Table 5.1. 76 codewords shall occur in a frame of 20 ms.
This requirement shall be applied to all files of the type SEQxx.INP.

5.1.4.1.6. Downlink transmitter DTX/VAD functions

It is a national or operator specific matter whether or not to implement downlink DTX in a BSS.

DEFINITION

The DTX/VAD transmitter functions consist of a Voice Activity Detector (VAD) and a surrounding Discontinuous Transmission (DTX) system introducing additional "speech" traffic frames on the air compared to what the VAD itself would classify as speech frames containing real speech. The additional traffic frames on the air are introduced due to:

1. A "hangover" period at the end of speech bursts in order to be certain that the traffic frames contain only noise and to evaluate the background acoustic noise characteristics when no real speech is present.
2. Special traffic frames (SID-frames) added on the air at regular intervals containing only the evaluated background acoustic noise characteristics. These frames are used for generation of comfort noise in speaker silence periods on the receiving side.

Details about the overall DTX operation for full-rate speech traffic channels are given in GSM 06.31, the VAD is described in GSM 06.32 and the comfort noise aspects in GSM 06.12.

METHOD OF TEST

A call shall be set up on a full-rate speech TCH, and then a sequence of PCM samples, which are grouped into frames of 20 ms synchronized to the TDMA- and traffic frame structure on the radio path, shall be input on the A-interface or at 104 kbit/s level in the BSS (13 bit/8 kHz linear PCM). The start of the test sequences must be synchronized with the radio transmission on the air interface so that the first traffic frame on the air occurs just after the traffic frame allocated for the SID-frame (see GSM 05.02 and GSM 05.08).

NOTE: 8 timeslots in 8 consecutive TCH/FS TDMA-frames shall be seen as one traffic frame and the next traffic frame starts in the middle of the previous one (ie after 4 TDMA-frames of the previous one) due to the block diagonal interleaving scheme defined in GSM 05.03.

a) For this test the input frames shall be taken from all of the files *.INP defined in GSM 06.32 in turn and shall be input at 104 kbit/s level in the BSS.
After transmission over the radio path, it shall be detected whether or not there is any power transmitted over the radio path on a timeslot basis excluding SACCH frames. The speech frame by speech frame on/off transmission (on=1) shall be recorded.

b) For this test the input frames shall be in 3 categories and shall be input on the A-interface:

"On" : A 20 ms block of PCM samples clearly identifyable as speech and not noise.

"Off": A 20 ms block of zero PCM samples.

"Noise": A 20 ms block of PCM samples clearly identifyable as noise and not speech, with an energy greater than zero.

NOTE: The 3 kinds of frames may be derived from the test sequences in the files *.INP, *.COD and *.VAD, which can be obtained from ETSI Secretariat (see GSM 06.10). When choosing "on" and "noise" frames in particular, care must be taken so that they are consecutive on the files if they are intended to be consecutive in the test. Explicit repetition of "noise" frames from the source material must be avoided in order to prevent periodic components.

NOTE: The test sequences *.VAD are stored on the diskette in ASCII format, and the test sequences *.INP and *.COD as 16 bit words (2 bytes) where the least significant byte occurs first and the most significant byte last (eg stored 10 0A hex is to be understood as 0A 10 hex).

Upon reception over the radio path, the detailed contents of traffic frames shall be detected if these are SID-frames. This must be done by a SID-frame detector in the BSSTE receiver in accordance with the one described in GSM 06.12. The sequence of input frames shall be continuous and as follows:

1. 30 frames "on", followed by 114 frames "off".
2. 48 frames "noise", followed by 48 frames "off".
3. 5 frames "on", followed by 43 frames "noise".
4. 2 frames "on", followed by 46 frames "off".

REQUIREMENTS

In case a), the traffic frame on/off sequence recorded shall be bit-exact like the sequence of SP-flags stored as bit 15 of LAR(2) on the reference files *.COD defined in GSM 06.32, with the following exceptions:

1. The occurrence of a SID-frame in the middle of a SACCH multiframe as defined in GSM 05.08.
2. The occurrence of a SID-frame after 1 or more real speech frames consecutively transmitted on the air.

In case b), the recorded SID-frame contents shall be as follows, where the frame numbering refers locally to each of the steps:

1. A SID-frame shall be detected as the 40th frame with very low level parameters. Then, frame number 48 and every 24th traffic frame shall be SID-frames with very low level parameters (xmaxc).
2. Frame numbers 24 and 48 shall be SID-frames with higher level parameters, then frame numbers 72 and 96 shall be SID-frames with very low level parameters.
3. A SID-frame shall be detected as the 6th (5+1) frame with level parameters at the same level as the last in step 2. Then, frame numbers 24 and 48 shall be SID-frames with higher level parameters.
4. A SID-frame shall be detected 1 frame after the 2nd with level parameters at the same level as the last in step 3. Then, frame numbers 24 and 48 shall be SID-frames with very low level parameters.

5.1.4.2. Data rate adaptation functions

The rate adaptation functions in the BSS convert the radio interface data rates to the 64 kbit/s at the A-interface, and vice versa. The radio interface data rates may be 3.6, 6 or 12 kbit/s corresponding to user data of equal or less than 2.4 kbit/s, or 4.8 and 9.6 kbit/s, respectively.
The rate adaptation consists of 2 steps. The RA1/RA1' function adapts the radio interface data rates to an intermediate rate of 8 or 16 kbit/s, or vice versa. The RA2 function adapts this intermediate rate to 64 kbit/s at the A-interface, or vice versa.
Further details about the rate adaptation functions in the BSS can be found in GSM 08.20.

5.1.4.2.1. Uplink rate adaptation, transparent data

DEFINITION

For the radio interface data rate of 12, 6 and 3.6 kbit/s, the transcoder transforms the modified CCITT V.110 60 or 36 bit frames, via the CCITT V.110 80 bit frames at an intermediate data rate of 16 and 8 kbit/s, respectively, to the data rate of 64 kbit/s at the A-interface.

METHOD OF TEST

a) Radio interface data rate of 12 kbit/s:
   One radio interface frame consisting of a sequence of 4 modified CCITT V.110 60 bit frames according to Figure 3 in GSM 04.21 shall be input to the BSS on the dedicated TCH. The user data shall be pseudo-random. The received data on the A-interface shall be recorded.
b) Radio interface data rate of 6 kbit/s:
   One radio interface frame consisting of a sequence of 4 modified CCITT V.110 60 bit frames according to Figure 4 in GSM 04.21 shall be input to the BSS on the dedicated TCH. The user data shall be pseudo-random. The received data on the A-interface shall be recorded.
c) Radio interface data rate of 3.6 kbit/s:
   One radio interface frame consisting of a sequence of 4 modified CCITT V.110 36 bit frames according to Figure 5 in GSM 04.21 shall be input to the BSS on the dedicated TCH. The user data shall be pseudo-random. The received data on the A-interface shall be recorded.

REQUIREMENTS

a) The received data shall correspond to the transmitted data according to the CCITT V.110 80 bit frame as stated in section 5.1 in GSM 04.21. In the 64 kbit/s bitstream on the A-interface, bit positions 1 and 2 in each octet correspond to the received CCITT V.110 80 bit frame. All other "unused" bits shall be binary "1".

b) The received data shall correspond to the transmitted data according to the CCITT V.110 80 bit frame as stated in section 5.2 in GSM 04.21. In the 64 kbit/s bitstream on the A-interface, bit position 1 in each octet corresponds to the received CCITT V.110 80 bit frame. All other "unused" bits shall be binary "1".

c) As b) except that the received data shall correspond to the transmitted data according to section 5.3 in GSM 04.21.

In all cases the received user data shall be bit-exact.

5.1.4.2.2. Downlink rate adaptation, transparent data

DEFINITION

The 64 kbit/s bitstream on the A-interface is transformed via the CCITT V.110 80 bit frame at an intermediate rate of 16 or 8 kbit/s, to the modified CCITT V.110 60 bit frame or 36 bit frame at a radio interface data rate of 12, 6 or 3.6 kbit/s.

METHOD OF TEST

a) Radio interface data rate of 12 kbit/s:
A sequence of 4 CCITT V.110 80 bit frames according to Figure 1 in GSM 04.21 shall be input on the A-interface. The coding of data rates shall be according to Figure 2 in GSM 04.21. The bit positions 1 and 2 in each octet of the 64 kbit/s bitstream shall correspond to the content of the CCITT frame, and all the unused bits in the octet shall be set to binary "1". The user data shall be pseudo-random. The received data on the radio interface shall be recorded.
The test shall be repeated with the unused buts random.

b) Radio interface data rate of 6 kbit/s:
As a) except that only bit position 1 in each octet of the 64 kbit/s bitstream shall correspond to the CCITT frame, and all other unused bits shall be set to binary "1".

c) Radio interface data rate of 3.6 kbit/s:
As b) above.

REQUIREMENTS

a) The received data shall correspond to the modified CCITT V.110 60 bit frame according to section 5.1 in GSM 04.21 whatever the contents of the unused bits.
b) The received data shall correspond to the modified CCITT V.110 60 bit frame according to section 5.2 in GSM 04.21.
c) The received data shall correspond to the modified CCITT V.110 36 bit frame according to section 5.3 in GSM 04.21.

In all cases the received user data shall be bit-exact.

5.1.4.2.3. Uplink rate adaptation, non-transparent data

DEFINITION

In the case of non-transparent data services the RA1/RA1' function performs the same mapping as that used for transparent data, using 12 and 6 kbit/s radio interface data rates, with some modifications. For further details see GSM 08.20 and GSM 04.21.

METHOD OF TEST

Radio interface data rate of 12 or 6 kbit/s:
The same method as for transparent data shall be used. However the Radio Link Protocol (RLP) shall consist of four modified CCITT V.110 60 bit frames for non-transparent data according to Figure 3 in GSM 08.20.
The test shall be repeated with no radio input on the radio interface (uplink DTX).

REQUIREMENTS

The received data on the A-interface shall correspond to the transmitted data according to the modified CCITT V.110 80 bit frame for non-transparent data stated in Figure 2 in GSM 08.20, and the mapping stated in section 5.1/5.2 in GSM 04.21. The value of E2 E3 shall be 0 0, 0 1, 1 0 and 1 1 respectively for the first, second, third and fourth 80 bit frame in the RLP frame. The E1 bit shall have the value 0 in all the four consecutive 80 bit frames relating to the RLP frame, independent of DTX is applied or not.
The received user data shall be bit-exact.
In the case of uplink DTX being applied on the radio interface, the BSS will interprete whatever it receives as data. Therefore, the data bits in the modified V.110 frames shall be indeterminate.

5.1.4.2.4. Downlink rate adaptation, non-transparent data

METHOD OF TEST

The same method as for transparent data shall be used, however the transmitted RLP frame at the A-interface shall consist of four modified CCITT V.110 80 bit frames for non-transparent data according to Figure 2 in GSM 08.20.
If DTX is possible the test shall be repeated with DTX active in the BSS and setting the E1 bits to "1" in all 4 consecutive modified V.110 frames corresponding to 1 RLP frame to which DTX may be applied.

REQUIREMENTS

The received data on the radio interface shall correspond to the modified CCITT V.110 60 bit frame for non-transparent data according to Figure 3 in GSM 08.20.
The received user data shall be bit-exact.
In the case of DTX being active and the E1 bits are set to "1", no frame shall be transmitted on the radio interface.

NOTE: The RLP Layer 2 functionality is handled by a separate interworking function in the network and is not a part of this BSS specification.

5.2. TRANSMISSION REQUIREMENTS FOR THE BSS

This section includes the necessary transmission requirements for the transmission through the Base Station System (BSS) in principle from the radio interface to the 64 kbit/s (2048 kbit/s) output to the MSC (the A-interface), or in the opposite direction.
These requirements apply to the whole Base Station System without any internal BSC/BTS-interface only. If there is an internal A-bis-interface, the transmission requirements are given in sections 6 and 7 for the BSC and BTS, respectively. The overall transmission requirements for the GSM PLMN are given in GSM 03.50, of which the PLMN transmission delay objective has been distributed to the various system entities as illustrated in GSM 03.05. For speech channels the transmission through the BSS is completely digital and hence, the only relevant transmission requirement is the transmission delay through the BSS. The delay is specified for data channels as well as for speech channels.

5.2.1. Uplink TCH delay through the BSS

DEFINITION

The uplink delay is the time difference between the time of the end of the timeslot carrying the last burst with information from a defined frame over the radio interface and the time when the first bit of a defined frame has been received on the A-interface by the BSSTE.

METHOD OF MEASUREMENT

a) For the TCH/FS, the test shall be carried out in 2 steps. In the first step, the test sequences defined for the test of uplink speech transcoding step 1 in section 5.1.4.1.1 (SEQ0x.COD) shall be input at 13 kbit/s level in the BSSTE (after channel encoding) in accordance with the restrictions of that test (reset, synchronization etc). At the 104 kbit/s interface (13 bit/8 kHz PCM) the output shall be decoded.

The output sequences for uplink speech transcoding step 1 (SEQ0x.OUT) shall be identical to the sequences output on the 104 kbit/s interface. Only in that case can there be synchronization to the radio interface frame structure, and the output timing will then be known. The BSSTE will also know the mapping and timing between the bits input after channel encoding and the frames on the radio interface, and consequently the input timing. The time difference shall then be evaluated.

In the second step, a sequence of 13 bit linear PCM samples shall be input after speech decoding in the BSS (13 bit linear PCM). On the A-interface the output shall be recorded. The time difference shall then be evaluated between the last bit of a PCM sample input and the last bit of the corresponding PCM sample output.

The uplink delay is the sum of the 2 delays found in the 2 steps. The uplink speech transcoding functions must be verified in advance.

b) For data traffic channels, a unique bit sequence shall be input after channel encoding in the BSSTE. At the A-interface the output shall be recorded.

The input bit sequence shall consist of frames synchronized to the frame structure of channel encoded bits for the traffic channel type in question generated by channel coding of all zero bits followed by a frame generated by channel coding of a "1" followed by all zeros.

On the A-interface the corresponding output frame is defined by the frame structure for uncoded bits for the traffic channel in question (see GSM 03.05) and shall be identified as the first frame according to the A-interface rate adaptation scheme containing useful bits of a "1" followed by all zeros.

The delay shall then be evaluated according to the definition.

5.2.2. Downlink TCH delay through the BSS

DEFINITION

The downlink delay is the time difference between the time when the first bit of a defined frame has been transmitted on the A-interface and the time of the end of the timeslot carrying the last burst with information from a defined frame transmitted over the radio interface. This delay includes the interleaving/de-interleaving delay, which is known and according to GSM 03.05.

METHOD OF MEASUREMENT

a) For the TCH/FS, the test must be carried out in 2 steps. In the first step, the test sequences defined for the test of downlink speech transcoding step 2 in section 5.1.4.2.2 (SEQ0x.INP) shall be input at 104 kbit/s level in the BSS (13 bit/8 kHz PCM samples) in accordence with the restrictions of that test (reset, synchronization etc). At the 13 kbit/s interface in the BSSTE (before channel decoding) the output shall be recorded.
The output sequences for downlink speech transcoding step 2 (SEQ0x.COD) shall be identical to the sequences output on the 13 kbit/s interface. Only in that case can there be synchronization to the radio interface frame structure, and the input timing will then be known. The BSSTE will also know the mapping and timing between the bits output before channel decoding and the frames on the radio interface, and consequently the output timing. The time difference shall then be evaluated.
In the second step, a sequence of 8 bit A-law PCM samples shall be input on the A-interface. Before speech encoding in the BSS (13 bit linear PCM) the output shall be recorded. The time difference shall then be evaluated between the last bit of a PCM sample input and the last bit of the corresponding PCM sample output.
The downlink delay is the sum of the 2 delays found in the 2 steps. The downlink speech transcoding functions must be verified in advance.

b) For data traffic channels, a unique bit sequence shall be input on the A-interface. Before channel decoding in the BSSTE the output shall be recorded.
The input bit sequence shall consist of frames synchronized to the frame structure of uncoded bits for the traffic channel type in question (see GSM 03.05) according to the A-interface rate adaptation scheme of all zero useful bits followed by a frame containing useful bits of a "1" followed by all zeros.
The corresponding output frame in the BSSTE is defined by the frame structure of channel encoded bits for the traffic channel type in question and shall be identified as the first frame generated by channel coding of a "1" followed by all zeros.

5.2.3. Roundtrip TCH delay through the BSS

REQUIREMENTS

For the various traffic channel types indicated in Table 5-2 the roundtrip delay shall not exceed the values shown in Table 5-2. The roundtrip delay shall be evaluated as the sum of the uplink and downlink delays measured in sections 5.2.1 and 5.2.2, respectively.

NOTE: The figures indicated in this table are based on the delay budgets given in GSM 03.05, and are for guidance to network operators.

Channel:	Max delay (ms):
TCH/FS	85.4
TCH/HS	[tbd]
TCH/F9.6	171.6
TCH/F4.8	191.6
TCH/H4.8	302.6
TCH/F2.4	122.6
TCH/H2.4	302.6

Table 5-2: Maximum roundtrip TCH delay through BSS

6. BASE STATION CONTROLLER NETWORK ASPECTS

The use of the A-bis-interface is optional for a GSM PLMN operator. However, if one or more transceiver units of a BSS are not colocated with the control functions of the BSS, the BSS shall be split into the 2 functional entities Base Station Controller (BSC) and Base Transceiver Station(s) (BTS(s)). See also section 1 in this specification.
The tests in this section apply to the BSC, if used.

6.1. BASE STATION CONTROLLER NETWORK FUNCTIONS

6.1.1. General

The interface between the Base Station Controller (BSC) and the Base Transceiver Station (BTS) is defined in GSM 08.5x and 08.6x. The interface supports the transcoding/rate adaptation functions positioned in the BTS, or in the BSC or at the MSC site.
This section verifies the network functions of a BSC.
Specifically, the Layer 3 tests in this section verify mainly the Layer 3 protocols related to the A-bis-interface. In order to test the complete Layer 3 (3-7) protocols in a BSC, the complete set of tests of the BSS as a whole defined in section 5.1.3 shall therefore be carried out after the tests defined in this section with the modification that radio interface messages not existing on the A-bis-interface shall be replaced by the appropriate A-bis-interface messages according to the test descriptions for the BTS in section 7.1.3 and defined in GSM 08.58. See also Annex 4 describing the mapping of Radio Resource management procedures.
The functional split between the BSC and the BTS is defined in detail in GSM 08.52. Of the main BSS network functions listed in section 5.1.1 the BSC can roughly be defined to include the following:

Functions in the BSC:

- management of radio channels
- management of terrestrial channels
- mapping between radio and terrestrial channels
- handover execution

Functions in the BSC or BTS:
- transcoding/rate adaptation

The logical functions which can be tested at Layer 3 are tested in sections 6.1.2 and 6.1.3. The transcoding and rate adaptation functions are tested in section 6.1.4.
As for the BSS seen as a whole, the Layer 3 messages on each interface of the BSC can be divided into 2 categories:

- transparent messages
- non-transparent messages

All the messages which are transparent to the BSS as a whole (DTAP messages) are consequently transparent also to the BSC. Messages which are non-transparent to the BSS as a whole may also be transparent to the BSC.
As for the BSS as a whole (see section 5.1.3), the non-transparent Layer 3 procedures are tested as <u>elementary procedures</u>, not as structured procedures. The tests are intended to cover all normal and abnormal cases of significance within each elementary procedure. However, all possible error cases are not tested, normally only if they imply different message sequences. The tests in this section are performed under perfect transmission conditions and under no limiting conditions.

6.1.2. Transparent messages

On the A-bis-interface, "transparent" messages are treated in a specific way. See sections 6.1.3.5 and 6.1.3.6 (non-transparent messages) for testing of messages transparent to the BSC in the downlink (MSC to BTS) and uplink (BTS to MSC) directions, respectively.

6.1.3. Non-transparent messages

The tests described in this section are to verify that messages sent to the Base Station Controller (BSC) using the RR or A-bis-interface non-transparent Layer 3 procedures have the correct consequential actions, and that combinations of certain events cause the correct messages to be sent via the RR or A-bis-interface non-transparent Layer 3 procedures on the A-interface or A-bis-interface by the BSC. Time constraints have to be met.
BSSMAP procedures for the BSC are not tested explicitly here, but are tested using the tests for the BSS as whole and the radio interface to A-bis-interface message mapping given by the tests of the BTS in section 7.1.

The following non-transparent Layer 3 procedures are to be tested in the BSC:
Radio link layer management:

1. Link establishment indication
2. Link establishment request
3. Link release indication
4. Link release request
5. Transmission of transparent L3-message in acknowledged mode
6. Reception of transparent L3-message in acknowledged mode
7. Transmission of transparent L3-message in unacknowledged mode
8. Reception of transparent L3-message in unacknowledged mode
9. Link error indication

Dedicated channel management:

10. Channel activation
11. Channel mode modify
12. Handover detection
13. Start of encryption
14. Measurement reporting
15. Deactivate SACCH
16. Radio channel release
17. MS power control
18. Transmission power control
19. Connection failure
20. Physical context request

Common channel management:

21. Channel request by MS
22. Paging
23. Delete indication
24. CCCH load indication
25. Broadcast information modify
26. Immediate assignment
27. Short Message Service Cell Broadcast (SMSCB)

TRX management:

28. Radio resource indication
29. SACCH filling information modify
30. Flow control
31. Error reporting

Details of the correct operation of these procedures are to be found in GSM 08.08 and GSM 08.58. GSM 04.08 is also implicitly applicable.
The same overall requirements as for the tests of the BSS as a whole in section 5.1.3 apply.

6.1.3.1. Link establishment indication

DEFINITION

The link establishment indication procedure is used by the BTS to indicate to the BSC that a LAPDm Layer 2 link on the radio path has been established in a multi-frame mode on the initiative of an MS. The BSC can use this indication to set up an SCCP connection to the MSC.
The ESTABLISHMENT INDICATION messages may contain an information element. If there is an information element, this is one of the following Layer 3 service request messages:

LOCATION UPDATING REQUEST
CM SERVICE REQUEST
PAGING RESPONSE
IMSI DETACH INDICATION
CM REESTABLSIHMENT REQUEST

The CM SERVICE REQUEST message may concern a normal call or eg a Short Message Service (SMS).

METHOD OF TEST

1. An O&M-message as defined by the operator or the manufacturer shall be input over the OMC-interface by the BSSTE setting the timer T3101 to an appropriate value A.
2. The channel activation procedure in section 6.1.3.10 ending with an IMMEDIATE ASSIGNMENT COMMAND message shall be performed. When the BSC sends an IMMEDIATE ASSIGNMENT COMMAND message on the A-bis-interface, the BSC also starts timer T3101. Before a time T3101, the BSSTE shall input an ESTABLISHMENT INDICATION message on the A-bis-interface. The response on any interface shall be recorded.
3. Step 2 shall be repeated, but the ESTABLISHMENT INDICATION message shall not be generated by the BSSTE.
4. Step 2 shall be repeated, but with the ESTABLISHMENT INDICATION message containing each of the above service requests in turn.

```
   BTS                         BSC                        MSC
         IMM ASS CMD
    <---------------------------  -
           EST IND              T3101
    --------------------------->  -
                                    SCCP establishment
                              or
         IMM ASS CMD
    <---------------------------  -
       EST IND(L3 message)      T3101
    --------------------------->  -
                                    SCCP establishment
                                COMPL L3 INFO (L3 message)
                                --------------------------->
```

Figure 6-1: Link establishment indication - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
2. IMMEDIATE ASSIGNMENT COMMAND
   Channel number
   Immediate assignment information

2,4.ESTABLISHMENT INDICATION
   Channel number
   Link identifier
   Layer 3 information = none, LOC UPD REQ, CM SERV REQU, PAG RES, IMSI DET IND, CM REEST REQ

REQUIREMENTS

In the case of step 2, the mobile originated call setup shall proceed in a normal way, ie an SCCP connection shall be established by the BSC to the MSC and the dedicated channel allocated by the BSC shall be maintained.
In the case of step 3, an RF CHANNEL RELEASE message may occur on the A-bis-interface after the timeout of T3101=A. No messages shall be generated on the MSC-interface by the BSC and the SCCP connection shall not be established.
In the case of step 4, the mobile originated call setup shall proceed in a normal way, ie an SCCP connection shall be established by the BSC to the MSC and the relevant service request message shall occur on the MSC-interface exactly as contained in the ESTABLISHMENT INDICATION message.

The messages from the BSC shall be:

3. RF CHANNEL RELEASE
   Channel number
4. COMPLETE LAYER 3 INFORMATION (LOCATION UPDATING REQUEST)
   Cell identifier
   Complete Layer 3 information = LOC UPD REQ
   (Location updating type
   Ciphering key sequence number
   Location area identification
   Mobile Station classmark 1
   Mobile identity)
4. COMPLETE LAYER 3 INFORMATION (CM SERVICE REQUEST)
   Cell identifier
   Complete Layer 3 information = CM SERV REQ
   (CM service type
   Ciphering key sequence number
   Mobile Station classmark 2
   Mobile identity)
4. COMPLETE LAYER 3 INFORMATION (PAGING RESPONSE)
   Cell identifier
   Complete Layer 3 information = PAG RES
   (Ciphering key sequence number
   Mobile Station classmark 2
   Mobile identity)

4. COMPLETE LAYER 3 INFORMATION (IMSI DETACH INDICATION)
   Cell identifier
   Complete Layer 3 information = IMSI DET IND
   (Mobile Station classmark 1
   Mobile identity)
4. COMPLETE LAYER 3 INFORMATION (CM REESTABLISHMENT REQUEST)
   Cell identifier
   Complete Layer 3 information = CM REEST REQ
   (Ciphering key sequence number
   Location area identification
   Mobile Station classmark 2
   Mobile identity)

6.1.3.2. Link establishment request

DEFINITION

The link establishment request procedure is used by the BSC to request the establishment by the BTS of a LAPDm link over the radio path. This procedure applies only to the Short Message Service (SMS) with SAPI=3.

METHOD OF TEST

1. A dedicated resource shall be set up between the MSC-interface and the A-bis-interface without a SAPI 3 link established. Then any DTAP message indicating SAPI=3 shall be input on the MSC-interface. The response on any interface shall be recorded.
2. An ESTABLISHMENT CONFIRM message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
 BTS                            BSC                         MSC
                                   Any DTAP message (SAPI=3)
                                 <----------------------------
            EST REQ
  <-----------------------------
            EST CONF
  ----------------------------->
    Any DTAP message (SAPI=3)
  <-----------------------------
```

Figure 6-2: Link establishment request - normal case

The messages from the BSSTE will be:

1. DTAP MESSAGE
2. ESTABLISHMENT CONFIRM
   Channel number
   Link identifier

REQUIREMENTS

In the case of step 1, an ESTABLISHMENT REQUEST message shall occur on the A-bis-interface indicating SAPI=3.
In the case of step 2, the DTAP message indicating SAPI=3 shall occur transparently on the A-bis-interface.

The messages from the BSC shall be:

1. ESTABLISHMENT REQUEST
   Channel number
   Link identifier
2. DTAP MESSAGE

6.1.3.3. Link release indication

DEFINITION

The link release indication procedure is used by the BTS to indicate to the BSC that a Mobile Station has disconnected the LAPDm link on the radio interface.
Depending on the link affected (SAPI=0 or SAPI=3) and on the context the BSC's reaction will be different. The test is only performed for SAPI=3 concerning a Short Message Service (SMS).

METHOD OF TEST

1. A dedicated resource shall be set up between the A-bis-interface and the MSC-interface.
2. A RELEASE INDICATION message indicating SAPI=3 shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
  BTS                          BSC                          MSC
         REL IND (SAPI=3)
  ----------------------------->
                                     SAPI "n" CLEAR CMD
                               ----------------------------->
```

Figure 6-3: Link release indication - normal case

The messages from the BSSTE will be:

2. RELEASE INDICATION
   Channel number
   Link identifier

REQUIREMENTS

In the case of step 2, a SAPI "n" CLEAR COMMAND message indicating SAPI=3 shall occur on the MSC-interface for the relevant link.

The messages from the BSC shall be:

2. SAPI "n" CLEAR COMMAND
   DLCI

6.1.3.4. Link release request

DEFINITION

The link release request procedure is used by the BSC to request a BTS to disconnect the LAPDm link on the radio interface. This applies only to a Short Message Service (SMS) using SAPI=3.

METHOD OF TEST

1. A dedicated resource shall be set up between the MSC-interface and the A-bis-interface, and a Short Message Service shall be set up to the same Mobile Station. Then a SAPI "n" CLEAR COMMAND shall be input on the MSC-interface concerning the SAPI=3 link of the Short Message Service. The response on any interface shall be recorded.
2. A RELEASE CONFIRM message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
BTS                              BSC                             MSC
                                      SAPI "n" CLEAR COMMAND
                                  <-----------------------------
          REL REQ (SAPI=3)
 <------------------------------
         REL CONF (SAPI=3)
 ------------------------------>
                                     SAPI "n" CLEAR COMPLETE
                                  ----------------------------->
```

Figure 6-4: Link release request - normal case

The messages from the BSSTE will be:

1. SAPI "n" CLEAR COMMAND
   DLCI = PAR1
2. RELEASE CONFIRM
   Channel number
   Link identifier

REQUIREMENTS

In the case of step 1, a RELEASE REQUEST message indicating SAPI=3 shall occur on the A-bis-interface for the correct link.
In the case of step 2, a SAPI "n" CLEAR COMPLETE message indicating SAPI=3 shall occur on the MSC-interface for the correct link.
The messages from the BSC shall be:

1. RELEASE REQUEST
   Channel number
   Link identifier = PAR1, SACCH
   Release mode
2. SAPI "n" CLEAR COMPLETE
   DLCI

6.1.3.5. Transmission of transparent L3-message in acknowledged mode

This procedure is used to send a message which is transparent to the BTS over the radio path in acknowledged mode. The procedure applies to all downlink DTAP messages.
The test shall be carried out exctly as for the BSS as a whole in section 5.1.2.1, with the exception that the "transparent" messages on the A-bis-interface are coded into a DATA REQUEST message as defined below. See also Figure 6-5.

NOTE: Throughout the rest of the Layer 3 test descriptions of the BTS the downlink message transparent to the BTS is coded as such for simplicity, and is not included in the DATA REQUEST message.

```
 BTS                         BSC                         MSC
                                         AUTH REQ
                              <----------------------------
       DATA REQ (AUTH REQ)
 <-----------------------------
```

Figure 6-5: Transmission of transparent L3-message in acknowledged mode - normal case

The DATA REQUEST message is coded as follows:

DATA REQUEST
Channel number
Link identifier
Layer 3 information = AUTH REQ

6.1.3.6. Reception of transparent L3-message in acknowledged mode

This procedure is used to receive a message which is transparent to the BTS over the radio path in acknowledged mode. The procedure applies to all uplink DTAP messages.
The test shall be carried out exctly as for the BSS as a whole in section 5.1.2.2, with the exception that the "transparent" messages on the A-bis-interface are coded into a DATA INDICATION message as defined below. See also Figure 6-6.

NOTE: Throughout the rest of the Layer 3 test descriptions of the BTS the uplink message transparent to the BTS is coded as such for simplicity, and is not included in the DATA INDICATION message.

```
 BTS                           BSC                            MSC
         DATA IND (SETUP)
  ----------------------------->
                                           SETUP
                               ---------------------------->
```

Figure 6-6: Reception of transparent L3-message in acknowledged mode - normal case

The DATA INDICATION message is coded as follows:
DATA INDICATION
Channel number
Link identifier
Layer 3 information = SETUP

6.1.3.7. Transmission of transparent L3-message in unacknowledged mode

This procedure is used to send a message which is transparent to the BTS over the radio path in unacknowledged mode by coding it into a UNIT DATA REQUEST message on the A-bis-interface. The signalling procedure is given in GSM 08.58.

As there are no such messages defined, and there are no restrictions defined on how the BSC shall generate such messages towards the BTS, testing of such a procedure does not apply to the BSC.

6.1.3.8. Reception of transparent L3-message in unacknowledged mode

This procedure is used to receive a message which is transparent to the BTS over the radio path in unacknowledged mode by coding it into a UNIT DATA INDICATION message on the A-bis-interface. The signalling procedure is given in GSM 08.58.
As there are no such messages defined, and there are no restrictions defined on how the BSC shall react to such messages from the BTS, testing of such a procedure does not apply to the BSC.

6.1.3.9. Link error indication

The link error indication procedure is used by the BTS to indicate to the BSC abnormal situations, like protocol errors and complete lack of LAPDm acknowledgements. The signalling procedure is given in GSM 08.58.
The response of a BSC to an ERROR INDICATION message depends on the context and may be manufacturer dependent. Consequently his procedure is not tested.
NOTE: The CLEAR REQUEST message and the channel release procedure might be used.

6.1.3.10. Channel activation

DEFINITION
The channel activation procedure is used to activate a channel in the BTS for an MS which then will be commanded to the channel by an IMMEDIATE ASSIGNMENT, an ASSIGNMENT COMMAND, an ADDITIONAL ASSIGNMENT or a HANDOVER COMMAND message over the radio interface.
METHOD OF TEST
1. No channel shall be activated in the BSC. Then, a CHANNEL REQUIRED message shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded. No further messages shall be input.
2. A CHANNEL ACTIVATION ACKNOWLEDGE message shall then be input over the A-bis-interface. The response on any interface shall be recorded.

3. Steps 1 and 2 shall be repeated, but the CHANNEL ACTIVATION ACKNOWLEDGE message shall be replaced by a CHANNEL ACTIVATION NEGATIVE ACKNOWLEDGEMENT message with an appropriate cause value. The response on any interface shall be recorded.
4. Steps 1-3 shall be repeated, but the CHANNEL REQUIRED message shall be replaced by a HANDOVER REQUEST message on the MSC-interface.
5. An O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface taking all channels out of service. Then step 1 shall be repeated.

```
BTS                         BSC                        MSC
         CH RQD
 --------------------------->
        CH ACTIV
 <---------------------------
       CH ACTIV ACK
 --------------------------->
       IMM ASS CMD
 <---------------------------
```

Figure 6-10a: Channel activation - normal case (random access by MS)

```
BTS                         BSC                        MSC
                                      HAND REQ
                             <---------------------------
        CH ACTIV
 <---------------------------
       CH ACTIV ACK
 --------------------------->
                                     HAND REQ ACK
                             --------------------------->
```

Figure 6-10b: Channel activation - normal case (handover)

The messages from the BSSTE will be:

1. CHANNEL REQUIRED
   Channel number
   Request reference = PAR1
   Timing Advance
   Physical context
2. CHANNEL ACTIVATION ACKNOWLEDGE
   Channel number
   Frame number
3. CHANNEL ACTIVATION NEGATIVE ACKNOWLEDGE
   Channel number
   Cause

4. HANDOVER REQUEST
   Channel type
   Encryption information
   Classmark information
   Cell identifier (serving)
   Priority
   Circuit identity code
   Radio channel identity
   Downlink DTX flag
   Cell identifier (target)
   Interference band to be used
5. O&M MESSAGE

REQUIREMENTS

In the case of step 1, a CHANNEL ACTIVATION message shall occur on the A-bis-interface. No further messages shall occur on any interface.
In the case of step 2, an IMMEDIATE ASSIGNMENT COMMAND message shall occur on the A-bis-interface indicating normal or extended immediate assignment.
In the case of step 3, no IMMEDIATE ASSIGNMENT COMMAND message shall occur on the A-bis-interface.
In the case of step 4, a HANDOVER REQUEST ACKNOWLEDGE message shall occur on the MSC-interface instead of the IMMEDIATE ASSIGNMENT COMMAND message on the A-bis-interface. Otherwise the same requirements as in steps 1-3 apply.
In the case of step 5, an IMMEDIATE ASSIGNMENT COMMAND message may occur on the A-bis-interface indicating immediate assignment rejection. No message shall occur on the MSC-interface.
The messages from the BSC shall be:

1. CHANNEL ACTIVATION ACKNOWLEDGE
   Channel number
   Frame number

2,5. IMMEDIATE ASSIGNMENT COMMAND
   Channel number
   Immediate assignment information = as in text

4. HANDOVER REQUEST ACKNOWLEDGE
   Power level
   Radio channel identity
   Handover reference number

6.1.3.11. Channel mode modify

DEFINITION

The channel mode modify procedure is used by the BSC to request a change of the channel mode of an active channel. The channel mode is related to transcoding and rate adaptation functions and includes consequently also channel coding functions.

NOTE: The channel mode modify procedure is always invoked by an ASSIGNMENT REQUEST message from the MSC, but it is not specified in which cases the mapping shall be a channel mode modification rather than an assignment or handover. It is a national or operator spcific matter to define this mapping, and the test applies when this mapping exists, possibly with other modes than indicated here. See also note for the BSS as a whole in section 5.1.3.11.

METHOD OF TEST

1. A call shall be established between the A-bis-interface and the MSC-interface on a TCH/F9.6.
2. An ASSIGNMENT REQUEST message shall be input on the MSC-interface requesting a TCH/F4.8 for the call previously set up. The response on any interface shall be recorded.
3. A MODE MODIFY ACKNOWLEDGE message shall be input on the A-bis-interface. The response on any interface shall be recorded.
4. A CHANNEL MODE MODIFY ACKNOWLEDGE message shall be input on the A-bis-interface. The response on any interface shall be recorded.
5. Step 2 shall be repeated, but requesting a TCH/F2.4 and a MODE MODIFY NEGATIVE ACKNOWLEDGEMENT message with the cause value "radio resource not available" shall be input on the A-bis-interface. The response on any interface shall be recorded.

NOTE: The test is carried out with the assumption that the mode is first modified in the BTS and then in the MS. There are no restrictions on the order of these 2 procedures. It could also be imagined that the order is reversed, in which case steps 3 and 4 should be swapped, and also that the BSC does not wait for acknowledgement from eg the BTS before commanding the MS to modify the mode.

```
     BTS                         BSC                        MSC
                                            ASS REQ
                                 <----------------------------
               MODE MOD
     <----------------------------
             MODE MOD ACK
     ---------------------------->
              CH MODE MOD
     <----------------------------
            CH MODE MOD ACK
     ---------------------------->
                                            ASS COM
                                 ---------------------------->
```

Figure 6-11: Channel mode modify - normal case

The messages from the BSSTE will be:

2,5.ASSIGNMENT REQUEST
    Channel type = TCH/F4.8, TCH/F2.4
    Layer 3 header information
    Priority
    Circuit identity code
    Radio channel identity
    Downlink DTX flag
    Interference band to be used

3. MODE MODIFY ACKNOWLEDGE
    Channel number

4. CHANNEL MODE MODIFY ACKNOWLEDGE
    Channel description
    Channel mode = TCH/F4.8

5. MODE MODIFY NEGATIVE ACKNOWLEDGE
    Channel number
    Cause = as in text

REQUIREMENTS

In the case of step 2, a MODE MODIFY message shall occur on the A-bis-interface. The new mode shall be TCH/F4.8.
In the case of step 3, a CHANNEL MODE MODIFY message shall occur on the A-bis-interface. The new mode shall be TCH/F4.8.
In the case of step 4, an ASSIGNMENT COMPLETE message shall occur on the MSC-interface.
In the case of step 5, an ASSIGNMENT FAILURE message with the cause value "no radio resource available" shall occur on the MSC-interface.

The messages from the BSC shall be:

2,5.MODE MODIFY
    Channel number
    Channel mode = TCH/F4.8, TCH/F2.4

3. CHANNEL MODE MODIFY
    Channel description
    Channel mode = TCH/F4.8

4. ASSIGNMENT COMPLETE
    RR cause
    Radio channel identity
    Cell identifier

5. ASSIGNMENT FAILURE
    Cause = as in text
    RR cause

6.1.3.12. Handover detection

DEFINITION

This procedure is used between the target BTS and BSC when an MS which has been handed over accesses the new BTS. When a handover access is detected by the BTS, the BSC is notified. The MSC shall be notified as well.

METHOD OF TEST

1. The channel activation procedure concerning handover in section 6.1.3.10 shall be carried out.
2. After the HANDOVER REQUEST ACKNOWLEDGE message on the MSC-interface, a HANDOVER DETECTION message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
 BTS                          BSC                           MSC
        Channel actication
           (handover)
            HAND DET
  ----------------------------->
                                         HAND DETECT
                               ----------------------------->
```

Figure 6-12: Handover detection - normal case

The messages from the BSSTE will be:

2. HANDOVER DETECTION
   Channel number
   Access delay

REQUIREMENTS

In the case of step 2, a HANDOVER DETECT message shall occur on the MSC-interface.
The messages from the BSS shall be:

2. HANDOVER DETECT
   --

6.1.3.13. Start of encryption

DEFINITION

The purpose of the start of encryption procedure is after authentication to initialize and synchronize the stream ciphering devices in the BSS and in the MS. The MS and MSC already know the cipher key Kc from the authentication procedure.

NOTE: Any failure during the start of encryption procedure will be regarded as a lower layer failure and will therefore not be tested explicitly.

METHOD OF TEST

1. A dedicated resource shall be set up between the MSC-interface and the A-bis-interface. Ciphering shall not be activated.
2. A CIPHER MODE COMMAND message shall be input on the MSC-interface containg the key Kc. The response on the any interface shall be recorded.

3. The BSSTE shall input the CIPHERING MODE COMPLETE message on the A-bis-interface. The response on any interface shall be recorded.

```
BTS                         BSC                         MSC
                                    CIPHER MODE CMD
                             <----------------------------

          ENCR CMD
<----------------------------
       CIPH MODE COM
---------------------------->
                                    CIPHER MODE COM
                             ---------------------------->
```

Figure 6-13: Start of encryption - normal case

The messages from the BSSTE will be:

2. CIPHER MODE COMMAND
   Layer 3 header information
   Encryption information
3. CIPHERING MODE COMPLETE
   --

REQUIREMENTS

In the case of step 2, an ENCRYPTION COMMAND message shall occur on the A-bis-interface.
In the case of step 3, a CIPHER MODE COMPLETE message shall occur on the MSC-interface.
The messages from the BSC shall be:

2. ENCRYPTION COMMAND
   Channel number
   Encryption information
   Link identifier
   Layer 3 information (CIPHER MODE CMD)
3. CIPHER MODE COMPLETE
   --

6.1.3.14. Measurement reporting

The Mobile Station reports regularly on the SACCH to the BTS on measurements it has performed on the downlink radio channel. Similarly, the BTS measures the uplink radio channel. This information is signalled to the BSC and is used in the BSC in the handover and RF power control algorithms. Optionally, the BTS may preprocess the measurement results. The handover and RF power control algorithms are a national or operator specific matter.
Since the handover and power control algorithms are a national or operator specific matter, no test can be defined for the the BSC's response to the various measurement results received.
The fact that the MEASUREMENT RESULT (or PREPROCESSED MEASUREMENT RESULT) messages are registered in the BSC is implicitly verified in sections 6.1.3.17-18 (MS power control and transmission power control).

6.1.3.14.1. Basic measurement reporting

Testing of this procedure is not applicable to the BSC.

6.1.3.14.2. Preprocessed measurement reporting (optional)

Testing of this procedure is not applicable to the BSC.

6.1.3.14.2. Preprocessing configuration (optional)

DEFINITION
If the BTS shall utilize preprocessing, it must first be configured for this kind of operation.

METHOD OF TEST
1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface commanding measurement preprocessing in the BTS. The response on any interface shall be recorded.

```
     BTS                          BSC                          MSC
                                              O&M
           PREPROC CONFIG
     <----------------------------
```

Figure 6-14: Preprocessing configuration - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES

REQUIREMENTS

In the case of step 1, a PREPROCESSING CONFIGURE message shall occur on the A-bis-interface with appropriate preprocessing parameters.
The messages from the BSC shall be:

1. PREPROCESSING CONFIGURE
   Channel number
   Preprocessing parameters

6.1.3.15. Deactivate SACCH

DEFINITION

The deactivate SACCH procedure is used by the BSC to order the BTS to deactivate the SACCH.

METHOD OF TEST

1. A call shall be set up between the A-bis-interface and the MSC-interface. The radio conditions shall be non-limiting.
2. A CLEAR COMMAND message shall be input on the MSC-interface for the call in question. The response on any interface shall be recorded.
3. The test shall be stopped by inputting an RF CHANNEL RELEASE ACKNOWLEDGE message on the A-bis-interface.

4. A new call shall be set up between the MSC-interface and the A-bis-interface of the BSC. Then, the connection failure test in section 6.1.3.19 shall be carried out, and steps 2-3 shall be repeated.

```
  BTS                           BSC                           MSC
                                          CLEAR COMMAND
                                 <-----------------------------
            DEACT SACCH                   CLEAR COMPLETE
  <----------------------------*----------------------------->
              CH REL              |
  <----------------------------- |
                                T3109
                                  |
             RF CH REL            |
  <----------------------------- -
           RF CH REL ACK
  ----------------------------->
```

Figure 6-15: Deactivate SACCH - normal case

The messages from the BSSTE will be:

2,4.CLEAR COMMAND
    Layer 3 header information
    Cause
3,4.RF CHANNEL RELEASE ACKNOWLEDGE
    Channel number

REQUIREMENTS

In the case of step 2, a DEACTIVATE SACCH message and a CHANNEL RELEASE message shall occur on the A-bis-interface, and a CLEAR COMPLETE message shall occur on the MSC-interface. After the time T3109=A an RF CHANNEL RELEASE message shall occur on the A-bis-interface.
In the case of step 4, a DEACTIVATE SACCH message and optionally a CHANNEL RELEASE message shall occur on the A-bis-interface, and a CLEAR COMPLETE message shall occur on the MSC-interface. After the time T3109=A an RF CHANNEL RELEASE message shall occur on the A-bis-interface.

The messages from the BSC shall be:

2,4.DEACTIVATE SACCH
    Channel number
2,4.CHANNEL RELEASE
    RR cause
2,4.RF CHANNEL RELEASE
    Channel number

6.1.3.16. Radio channel release

DEFINITION

The radio channel release procedure is used to release a radio channel which is no longer needed (normally after a successful handover or a normal assignment).

NOTE: Only the case after a successful handover is tested explicitly.

METHOD OF TEST

1. A call shall be set up between the A-bis-interface and the MSC-interface.
2. A CLEAR COMMAND message with the cause value "handover successful" shall be input on the MSC-interface. The response on any interface shall be recorded.
3. An RF CHANNEL RELEASE ACKNOWLEDGE message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
   BTS                          BSC                           MSC
                                          CLEAR CMD
                                 <---------------------------
            RF CH REL
    <----------------------------
          RF CH REL ACK
    ---------------------------->
                                          CLEAR COM
                                 --------------------------->
```

Figure 6-16: Radio channel release - normal case

The messages from the BSSTE will be:

2. CLEAR COMMAND
   Layer 3 header information
   Cause = as in text
3. RF CHANNEL RELEASE ACKNOWLEDGE
   Channel number

REQUIREMENTS

In the case of step 2, an RF CHANNEL RELEASE message shall occur on the A-bis-interface, possibly followed by a CLEAR COMPLETE message on the MSC-interface.
In the case of step 3, if not already occurred in step 2, a CLEAR COMPLETE message shall occur on the MSC-interface.
The messages from the BSC shall be:

2. RF CHANNEL RELEASE
   Channel number
2/3.CLEAR COMPLETE

--

6.1.3.17. MS power control

DEFINITION

The MS power control procedure is used between BSC and BTS in order to set the MS output power.

METHOD OF TEST

1. A dedicated resource shall be set up between the MSC-interface and the A-bis-interface.

2. MEASUREMENT RESULT messages shall be input on the A-bis-interface. The parameters included in the MEASUREMENT RESULT messages, in downlink and uplink, shall be varied in such a way during the test that the MS power control algorithm, agreed between the manufacturer and the operator, is thoroughly tested. The response on any interface shall be recorded.

```
BTS                        BSC                        MSC
          MEAS RES
 --------------------------->
        MS POW CONTR
 <---------------------------
```

Figure 6-17: MS power control - normal case

The messages from the BSSTE will be:

2. MEASUREMENT RESULT
   Channel number
   Uplink measurements
   BS power
   Layer 1 information
   Layer 3 information (MEAS REP)

REQUIREMENTS

In the case of step 2, MS POWER CONTROL messages shall occur on the A-bis-interface containing information such that the requirements on the MS power control algorithm, agreed between the manufacturer and the operator, are fulfilled.
The messages from the BSC shall be:

2. MS POWER CONTROL
   Channel number
   MS power
   MS power parameters

6.1.3.18. Transmission power control (optional)

DEFINITION

This procedure is used between BSC and BTS to set the TRX power on a physical radio channel to the desired level.

METHOD OF TEST

1. An O&M-message as defined by the operator or the manufacturer shall be input on the OMC-interface setting the parameters for TRX power control in the BSC.
2. A call shall be set up between the A-bis-interface and MSC-interface.
3. A certain number of MEASUREMENT RESULT messages shall be input on the A-bis-interface with measurement values leading to a power change according to the RF power control and handover algorithm. The algorithms are a national or operator specific matter. The response on any interface shall be recorded.

```
BTS                              BSC                              MSC
           MEAS RES
 --------------------------->
          BS POW CONTR
 <---------------------------
```

Figure 6-18: Transmission power control - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
3. MEASUREMENT RESULT
   Channel number
   Uplink measurements
   BS power
   Layer 1 information
   Layer 3 information (MEAS REP)

REQUIREMENTS

In the case of step 3, no message shall be occur on the MSC-interface, but a BS POWER CONTROL message shall occur on the A-bis-interface with TRX power level parameters bringing the TRX power level within thresholds.
The messages from the BSC shall be:

3. BS POWER CONTROL
   Channel number
   BS power
   BS power parameters

6.1.3.19. Connection failure

DEFINITION

The connection failure procedure indicates to the BSC that a radio interface failure (or equipment failure etc) has occurred. The BSC takes then appropriate actions.

METHOD OF TEST

1. A dedicated resource shall be set up between the MSC-interface and the A-bis-interface.
2. A CONNECTION FAILURE INDICATION message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
   BTS                        BSC                        MSC
          CONN FAIL IND
    --------------------------->
                                     CLEAR REQ
                              --------------------------->
```

Figure 6-19: Connection failure - normal case

NOTE: Also when a data link error occurs (ERROR IND), an indication shall be given to the upper MM sublayer. The procedure may also be used in this case.

The messages from the BSSTE will be:

2. CONNECTION FAILURE INDICATION
   Channel number
   Cause

REQUIREMENTS

In the case of step 2, a CLEAR REQUEST message with the cause value "radio interface message failure" shall occur on the MSC-interface.

The messages from the BSC shall be:

2. CLEAR REQUEST
   Cause = as in text

6.1.3.20. Physical context request (optional)

DEFINITION

The physical context request procedure allows the BSC to obtain information on the transmission /reception process of a radio channel prior to a channel change. This information may be forwarded to a new TRX in a BTS controlled by the BSC. The physical context request procedure is internal to the BSS. The physical context request procedure is optional for implementation in the BSC.

METHOD OF TEST

1. A call shall be established between the A-bis-interface and the MSC-interface of the BSSTE.
2. The BSC shall be stimulated to send a PHYSICAL CONTEXT REQUEST message by eg initiating internal handover or using an O&M message as defined by the operator or the manufacturer over the OMC-interface. The response on any interface shall be recorded.
3. The test is stopped by inputting a PHYSICAL CONTEXT CONFIRM message on the A-bis-interface.

<u>NOTE</u>: According to GSM 08.58 the physical context of the old channel may be forwarded to the new TRX (no requirement). If this is the case, a test checking that the correct physical context is moved to the new TRX could be developed.

```
  BTS                      BSC                      MSC
         PHYS CONT REQ
   <-----------------------------
         PHYS CONT CONF
   ----------------------------->
```

Figure 6-20: Physical context request - normal case

The messages from the BSSTE will be:

3. PHYSICAL CONTEXT CONFIRM
   Channel number
   BS power
   MS power
   Timing Advance
   Physical context

REQUIREMENTS

In the case of step 2, a PHYSICAL CONTEXT REQUEST message concerning the correct channel shall occur on the A-bis-interface.
The messages from the BSC shall be:

2. PHYSICAL CONTEXT REQUEST
   Channel number

6.1.3.21. Channel request by MS

The response of a BSC to a channel request by MS is covered by the test of channel activation in section 6.1.3.10.

6.1.3.22. Paging

DEFINITION

The paging procedure is used to trigger a channel access by a Mobile Station. This procedure is used for mobile terminating calls and is initiated by the MSC via the BSC. The BSC determines the paging group to be used based on the IMSI of the MS to be paged. The paging group value is sent to the BTS together with the PAGING COMMAND message. Based on the paging group information the BTS will execute the transmission of the message in the correct paging block.

METHOD OF TEST

1. An O&M-message as defined by the operator or the manufacturer shall be input over the OMC-interface by the BSSTE instructing the BSC to configure a certain DRX paging mode of operation in the BSS.
2. A PAGING message for a specific Mobile Station shall be input on the MSC-interface. The response on any interface shall be recorded.

```
BTS                        BSC                        MSC
                                      PAGING
                           <---------------------------
          PAGING CMD
<---------------------------
```

Figure 6-22: Paging - normal case

The messages from the BSSTE will be:
1. O&M MESSAGE
2. PAGING
   IMSI
   TMSI
   Cell identifier list

REQUIREMENTS
In the case of step 2, a PAGING COMMAND message shall occur on the A-bis-interface with a mobile identity corresponding to the TMSI/IMSI in the PAGING message.
The messages from the BSC shall be:

2. PAGING COMMAND
   Channel number
   Paging group
   MS identity

6.1.3.23. Delete indication

The delete indication procedure is used by the BTS to indicate to the BSC that a UNIT DATA REQUEST message containing a message transparent to the BTS has been deleted due to overload on the downlink CCCH. For further information see GSM 08.58.
No such messages are specified, and the use of such an indication in the BSC is not specified. Consequently, the procedure is not tested.

6.1.3.24. CCCH load indication

The CCCH load indication procedure is used by the BTS to inform the BSC that the load on the CCCH exceeds a certain threshold. For further information see GSM 08.58.
The use of this information in the BSC is not specified,
and is not tested.

6.1.3.25. Broadcast information modify

DEFINITION
The broadcast information modify procedure is used by the BSC to set new BCCH parameters to be transmitted from the BTS.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface setting the system information to be sent on the SACCH or BCCH. The response on any interface shall be recorded. This shall be repeated until all SYSTEM INFORMATION types 1 to 4 are verified.

```
     BTS                        BSC                         MSC
                                            O&M
              BCCH INFO
      <-----------------------------
```

Figure 6-25: Broadcast information modify - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES

REQUIREMENTS
In the case of step 1, a BCCH INFORMATION message shall occur on the A-bis-interface with the new BCCH parameters.
The messages from the BSC shall be:

1. BCCH INFORMATION
   Channel number
   System information type = 1, 2, 3, 4
   Layer 3 information (SYS INFO)
   Starting time

6.1.3.26. Immediate assignment

When the MS initially accesses the BTS, the BSC immediately assigns a dedicated resource.
The immediate assignment procedure is seen as implicitly tested by the channel activation procedure (random access by MS) in section 6.1.3.10.

6.1.3.27. Short Message Service Cell Broadcast (SMSCB)

NOTE: As the procedure to initiate the SMS Cell Broadcast function in the BSC is not specified, this function will not be tested for the BSC.

6.1.3.28. Radio resource indication

DEFINITION
The radio resource indication procedure is used by the BTS to report to the BSC on the interference levels on idle channels.

METHOD OF TEST

1. The BSSTE shall continuosly input RF RESOURCE INDICATION messages to the BSC over the A-bis-interface with an interval of A.
2. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface setting the thresholds for the spontaneous RESOURCE INDICATION messages. Then a RESOURCE REQUEST message indicating "spontaneous indication" shall be input on the MSC-interface. The response on any interface shall be recorded.
3. The environment shall be set up to trigger a spontaneous RESOURCE INDICATION message from the BSC. The response on any interface shall be recorded.
4. A RESOURCE REQUEST message indicating "one single indication" shall be input on the MSC-interface. The response on any interface shall be recorded.
5. A RESOURCE REQUEST message indicating "periodic indication" and a periodicity of T3=B>0 shall be input on the MSC-interface. The response on any interface shall be recorded.
6. A RESOURCE REQUEST message indicating "no indication" shall be input on the MSC-interface. The response on any interface shall be recorded.

```
    BTS                         BSC                       MSC
              RF RES IND
    ----------------------------->
                   .                          RES REQ
                   .            <-----------------------------
                                              RES IND
              RF RES IND        ----------------------------->
    -----------------------------> |
  A           RF RES IND          T3
    -----------------------------> |         RES IND
  A           RF RES IND        ----------------------------->
    -----------------------------> |
  A           RF RES IND          T3
    -----------------------------> |          RES IND
                    .           ----------------------------->
                    .                          .
                                               .
```

Figure 6-28: Radio resource indication - normal case

The messages from the BSSTE will be:

1. RF RESOURCE INDICATION
   Resource information
2. O&M MESSAGES
2. RESOURCE REQUEST
   Periodicity
   Cell identifier
   Resource indication method = as in text

4-6.RESOURCE REQUEST
   Periodicity = none, B, none
   Cell identifier
   Resource indication method = as in text

REQUIREMENTS
In the case of step 3, a RESOURCE INDICATION message shall occur on the MSC-interface reflecting the information in the latest RF RESOURCE INDICATION message.
In the case of step 4, a RESOURCE INDICATION message shall occur immediately on the MSC-interface reflecting the information in the latest RF RESOURCE INDICATION message.
In the case of step 5, RESOURCE INDICATION messages shall occur repeatedly on the MSC-interface with an interval T3=B each reflecting the information in the latest RF RESOURCE INDICATION messages.
In the case of step 6, no further RESOURCE INDICATION messages shall occur on the MSC-interface.
The messages from the BSC shall be:

3-5.RESOURCE INDICATION
   Resource available
   Cell identifier

6.1.3.29. SACCH filling information modify

DEFINITION

The SACCH filling information modify procedure is used by the BSC to change the system information content generally to be transmitted on the SACCH.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface commanding the BSC to modify the system information to be transmitted on the BCCH or SACCH. The response on any interface shall be recorded. This shall be repeated until all the SYSTEM INFORMATION messages type 5 and 6 are verified.

```
  BTS                          BSC                          MSC
                                            O&M
            SACCH FILL
 <------------------------------
```

Figure 6-29: SACCH filling information modify - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES

REQUIREMENTS

In the case of step 1, a SACCH FILLING message shall occur on the A-bis-interface with the new system information to go in the SYSTEM INFORMATION messages type 5 and 6.
The messages from the BSC shall be:

2. SACCH FILLING
   System information type = 5, 6
   Layer 3 information (SYS INFO)
   Starting time

6.1.3.30. Flow control

The flow control procedure on the A-bis-interface is used to indicate to the BSC if there is some kind of overload situation in the BTS, eg on the TRX processor, on the downlink CCCH or on the ACCH, by sending an OVERLOAD message to the BSC. The BSC will then try to reduce the load on the BTS. The signalling procedure is given in GSM 08.58.
The method of reducing the load is a national or operator specific matter. Consequently, the procedure is not tested.

6.1.3.31. Error reporting

The error reporting procedure is used by the BTS in order to report to the BSC when it detects an erroneous message. The signalling procedure is given in GSM 08.58.
Testing of this procedure does not apply to the BSC.

6.1.4. Transcoding/rate adaptation functions

When multiplexing four speech/data channels to one 64 kbit/s link between BTS and BSC, the transcoder/rate adaptation functions as tested for the BSS as a whole in section 5.1.4 are put in the BSC with some additional A-interface specific functions in the BSC and BTS, resulting in an intermediate rate of 16 kbit/s per user channel at the A-bis-interface.
Otherwise (using a 64 kbit/s A-bis-interface) the transcoding and rate adaptation functions are all located in the BTS, and no tests are needed for the BSC.
This section applies only to a BSC using a 16 kbit/s A-bis-interface.

6.1.4.1. Full-rate speech related transcoding functions

Speech related transcoding functions are 2 stages of speech transcoding in uplink and downlink, and uplink and downlink functions for support of Discontinuous Transmission (DTX).
For further information see GSM 06.01, GSM 06.10, GSM 06.11, GSM 06.12, GSM 06.31 and GSM 06.32.

6.1.4.1.1. Uplink speech transcoding - step 1

If the speech transcoder is located in the BSC (16 kbit/s A-bis-interface), the tests of the BSC shall be performed as for the BSS as a whole in section 5.1.4.1.1, but using the traffic bits of the A-bis-interface frames instead of the 13 kbit/s interface point in the BSSTE.
The transcoder may be put into test mode in order to accept the new input interface conditions (speech decoder reset), to generate output data at the test rate (104 kbit/s) and in order to disable the uplink dtx functions, which are not part of this test.

6.1.4.1.2. Uplink speech transcoding - step 2

As in section 5.1.4.1.2.

6.1.4.1.3. Uplink receiver DTX functions

DEFINITION

The overall operation of the full rate DTX receiver functions are described in GSM 06.31, consisting of, apart from the speech decoder, a Comfort Noise (CN) generation function and an extrapolation and muting function for lost speech frames. These functions are parts of the remote Speech Handler in the BSC.
The side information to be received in the BSC with the speech frame over the A-bis-interface is a binary Bad Frame Indication (BFI) flag, a binary Time Alignment Flag (TAF) and a ternary Silence Descriptor (SID) flag.
The speech decoder is tested in sections 6.1.4.1.1-2.

METHOD OF TEST

A call shall be set up on a full rate speech TCH, and then TRAU frames containing traffic bits being the special test frame defined in section 5.1.4.1.3 shall be input on the A-bis-interface. All TRAU frames shall contain identical traffic bits. The continuous sequence of TRAU frames shall contain the following combinations of flags:

1. 50 frames with (BFI,SID)=(0,0) and TAF=0 (good speech frames).
2. 20 frames with (BFI,SID)=(1,0) and TAF=0 (unusable frames).
3. 50 frames with (BFI,SID)=(0,0) and TAF=0 (good speech frames).
4. 1 frame with (BFI,SID)=(0,2) and TAF=0 (valid SID frame) followed by 30 frames with (BFI,SID)=(1,0) and TAF=0 (unusable frames).
5. 1 frame with (BFI,SID)=(0,1) and TAF=0 (invalid SID frame) followed by 50 frames with (BFI,SID)=(1,0) and TAF=0 (unusable frames).
6. 1 frame with (BFI,SID)=(1,2) and TAF=0 (invalid SID frame) followed by 50 frames with (BFI,SID)=(1,0) and TAF=0 (unusable frames).
7. 1 frame with (BFI,SID)=(1,1) and TAF=0 (invalid SID frame) followed by 50 frames with (BFI,SID)=(1,0) and TAF=0 (unusable frames).
8. 50 frames with (BFI,SID)=(0,0) and TAF=0 (good speech frames), but with the level parameter xmaxc=24.
9. 1 frame with (BFI,SID)=(0,2) and TAF=0 (valid SID frame) followed by 30 frames with (BFI,SID)=(1,0) and TAF=0 (unusable frames).

10. 1 frame with (BFI,SID)=(1,0) and TAF=1 (unusable frame , but SID expected) followed by 20 frames with (BFI,SID)=(1,0) and TAF=0 (unusable frames).
11. Step 1 shall be repeated, and then 20 frames with (BFI,SID)= (0,0) and TAF=0 (good speech frames), but with errors in the control bits.
12. Step 1 shall be repeated, and then 20 frames with (BFI,SID)= (0,0) and TAF=0 (good speech frames), but each with at least one framing bit error.

At 104 kbit/s level in the BSC (13 bit/8 kHz linear PCM), the signal shall be output and the signal energy of the PCM signal shall be evaluated (as a mean square average, see section 5.1.4.1.3) and recorded for each block of 20 ms synchronized to the 20 ms speech frame structure.

The transcoder may be put into test mode in order to enable the test output interface (104 kbit/s).

REQUIREMENTS

In the case of step 1, PCM samples shall occur with a constant level on a 20 ms basis.

In the case of step 2, PCM samples shall occur . On a 20 ms basis the level shall decrease to zero
within 320 ms.

In the case of step 3, the same requirements as in step 1 apply.

In the case of steps 4-7, PCM samples shall occur with a level, evaluated as the mean square energy of the PCM samples within a block of 20 ms synchronized to the TRAU frame structure, which is constant within +/- [3] dB on a 20 ms basis. The detailed bit contents shall be different from the bit contents in step 1.

In the case of step 8, the same requirements as in step 1 apply, but the nominal level shall be 12 dB lower.

In the case of step 9, PCM samples shall occur with a constant level on a 20 ms basis. The detailed bit contents shall be different from the bit contents in step 8.

In the case of step 10, the same requirements as in step 2 apply.

In the case of step 11, the same requirements as in step 1 apply.

In the case of step 12, PCM samples shall occur. On a 20 ms basis the level shall decrease to zero within (320+60) ms = 380 ms. See also section 6.3.3.6.3 (frame synchronization monitoring and recovery).

6.1.4.1.4. Downlink speech transcoding - step 1

As in section 5.1.4.1.4.

6.1.4.1.5. Downlink speech transcoding - step 2

If the speech transcoder is located in the BSC (16 kbit/s A-bis-interface), the tests of the BSC shall be performed as for the BSS as a whole in section 5.1.4.1.5, but using the traffic bits of the A-bis-interface frames instead of the 13 kbit/s interface point in the BSSTE.

6.1.4.1.6. Downlink transmitter DTX/VAD functions

It is a national or operator specific matter whether or not to implement downlink DTX in a BSC.

DEFINITION

If implemented, the overall operation of the full rate DTX transmitter functions are described in GSM 06.31, consisting of, apart from the speech encoder, a Voice Activity Detector (VAD) and a TX DTX handler, in this case both being a part of the remote Speech Handler in the BSC.
The side information to be transmitted with the speech frame over the A-bis-interface is a binary flag Speech (SP). SP=1 indicates that the TRAU frame is a speech frame and SP=0 indicate that the TRAU frame is a special SID-frame. This flag is used in the BTS for control of the radio transmission.
The speech encoder is tested in section 6.1.4.1.4-5.

METHOD OF TEST

A call shall be set up on a full rate speech TCH, and then a sequence of PCM samples synchronized to the TRAU frame structure on a 20 ms frame basis, shall be input on the A-interface. On the A-bis-interface the traffic bits of the TRAU frames, as well as the SP-flag, shall be recorded.

1. The PCM samples shall be all of the test sequences *.INP as defined in GSM 06.32 in turn.
2. The PCM samples shall be a sequence of identical PCM input frames containing real speech clearly identifyable as speech and not noise. Then PCM input frames containing all zero samples shall be input, followed by a sequence of PCM input frames containing real noise clearly identifyable as noise and not speech, and an energy greater than zero.

3. Steps 1 and 2 shall be repeated with downlink DTX disabled.

NOTE: The 3 kinds of frames in step 2 may be derived from the test sequences in the files *.INP, *.COD and *.VAD, which can be obtained from ETSI Secretariat (see GSM 06.10). When choosing "on" and "noise" frames in particular, care must be taken so that they are consecutive on the files if they are intended to be consecutive in the test. Explicit repetition of "noise" frames from the source material must be avoided in order to prevent periodic components.

NOTE: The test sequences *.VAD are stored on the diskette in ASCII format, and the test sequences *.INP and *.COD as 16 bit words (2 bytes) where the least significant byte occurs first and the most significant byte last (eg stored 10 0A hex is to be understood as 0A 10 hex).

The transcoder may be put into test mode in order to activate the 104 kbit/s level input test interface in step 1 and also step 2, if linear PCM is chosen for input in step 2.

REQUIREMENTS

In case 1, the recorded SP-flag sequence shall be bit-exact compared to the sequence of SP-flags stored as bit 15 of LAR(2) on the reference files *.COD.

In case 2, when real speech is input, speech TRAU frames shall be output with SP=1 on the A-bis-interface. When silence is input, after a delay of 5 TRAU frames, speech TRAU frames containing SID frames shall be output with SP=0 and very low level parameters on the A-bis-interface. Finally, when noise is input, speech TRAU frames containing SID frames shall be output with SP=0 and higher level parameters on the A-bis-interface.

In case 3, all TRAU frames shall be marked with SP=1.

6.1.4.2. Data rate adaptation functions

If multiplexing of four data-channels to one 64 kbit/s link between BTS and BSC is applied, an intermediate rate adaptation function is needed. Hereby the radio interface data rates are converted via the standard CCITT V.110 80 bit frame to a modified CCITT V.110 72 bit frame at 16 kbit/s at the A-bis-interface, and vice versa. This function is performed by using the RA1/RA1' function and a new RAA function.
This intermediate modified CCITT V.110 72 bit frame at the A-bis interface is then further rate adapted in the BSC to 64 kbit/s at the A-interface by using the new RAA function and the RA2 function.
The additional coding of the "TRAU" frames for control of the remote transcoder/rate adaptation at the BSC/MSC site is tested in section 6.3.
The tests in this section apply only to a BSC using a 16 kbit/s A-bis-interface. If a 64 kbit/s A-bis-interface is used, no tests are needed.

6.1.4.2.1. Uplink rate adaptation in the BSC

DEFINITION
The modified CCITT V.110 72 bit frame at the A-bis-interface shall be transformed via the CCITT V.110 80 bit frame at an intermediate data rate of 16 or 8 kbit/s to the data rate of 64 kbit/s at the A-interface.
METHOD OF MEASUREMENT
The TRAU under test shall be put into the data mode appropriate for each test by setting the control bits in the uplink TRAU frames, whose user data content is described below, to values appropriate for the test being conducted. Further, one TRAU frame with no useful user data content will be required as the first frame of each test in order for the TRAU to gain synchronisation to test data and enter the data mode appropriate for each test. The control bits of this first frame must be the same as those in the test frame.

a-c) Transparent data
One modified CCITT V.110 72 bit frame as output from the BTS in the uplink according to the requirements in section 7.1.4.2.1 case a-c), shall be input to the BSC in turn on the A-bis-interface. The received data on the A-interface shall be recorded.
The control bits of each TRAU frame in this test shall be set to frame = data, channel = full rate, intermediate RA bit rate = 16k (for case a) and 8k (cases b & c).

d) Non-transparent data
One RLP frame consisting of four modified CCITT V.110 72 bit frame for non-transparent data as output from the BTS in the uplink according to the requirements in section 7.1.4.2.1 case d), shall be input to the BSC on the A-bis-interface. The received data on the A-interface shall be recorded.
The control bits of each TRAU frame shall be set to frame = data, channel = full rate, intermediate RA bit rate = 16k.

REQUIREMENTS

a-c) The received data shall correspond to the transmitted data according to the CCITT V.110 80 bit frame as stated in section 5.1-5.3 respectively in GSM 04.21. In the 64 kbit/s bitstream on the A-interface, bit positions 1 and 2 in each octet corresponds to the received CCITT V.110 80 bit frame in case a). All other "unused" bits shall be binary "1". In case b and c) bit position 1 in each octet corresponds to the received CCITT V.110 80 bit frame. All other "unused" bits shall be binary "1".

d) The received data at the A-interface shall correspond to the transmitted data according to the modified CCITT V.110 80 bit frame for non-transparent data stated in Figure 2 in GSM 08.20.

In all cases the received user data shall be bit-exact.

6.1.4.2.2. Downlink rate adaptation in the BSC

DEFINITION

The 64 kbit/s bitstream on the A-interface is transformed via the CCITT V.110 80 bit frame at an intermediate rate of 16 or 8 kbit/s, to the modified CCITT V.110 72 bit frame at the rate of 16 kbit/s at the A-bis-interface.

METHOD OF MEASUREMENT

The TRAU may be put into test mode in order to loose its uplink TRAU control elements. Alternatively, uplink TRAU frames with control bits set to frame = data, channel = full rate and intermediate RA bit rate = 16k (cases a & d) or 8k (cases b & c) may be sent before and during each test in order to place and maintain the TRAU in the data mode appropriate for each test.

a) Radio interface data rate of 12 kbit/s (transparent data)
A sequence of 4 CCITT V.110 80 bit frames according to Figure 3 in GSM 04.21 shall be input on the A-interface. The coding of data rates shall be according to Figure 4 in GSM 04.21. The bit positions 1 and 2 in each octet of the 64 kbit/s bitstream shall correspond to the content of the CCITT 80 bit frame, and all the unused bits in the octet shall be set to binary "1". The user data shall be pseudo-random. The received data on the A-bis-interface shall be recorded.

b) Radio interface data rate of 6 kbit/s (transparent data)
As case a) except that only bit position 1 in each octet of the 64 kbit/s bitstream shall correspond to the CCITT 80 bit frame, and all other unused bits shall be set to binary "1".

c) Radio interface data rate of 3.6 kbit/s (transparent data)
As case b) above.

d) Non-transparent data
The same method as for transparent data shall be used, however the transmitted RLP frame on the A-interface shall consist of four modified CCITT V.110 80 bit frames for non-transparent data according to Figure 2 in GSM 08.20.
If DTX is possible the test shall be repeated with DTX active in the BSC and setting the E1 bits to 1 in all 4 consecutive modified V.110 frames corresponding to 1 RLP frame to which DTX may be applied.

REQUIREMENTS

a-c) The received data shall correspond to the transmitted data according to the modified CCITT V.110 72 bit frame as stated in section 4.7.1 in GSM 08.60. The received user data shall be bit-exact. One TRAU frame contains 4 CCITT V.110 frames, of which all 4 are used for test a and the 1st and 3rd only are used for tests b & c..

d) As for a) except that the received modified CCITT V.110 72 bit frame shall be transformed via the modified 80 bit frame for non-transparent data as stated in Figure 2 in GSM 08.20. The E1 bits shall be transferred transparently independent of whether DTX is used or not.

6.2. TRANSMISSION REQUIREMENTS FOR THE BSC

This section includes the necessary transmission requirements for the transmission through the Base Station Controller (BSC) from the A-bis-interface input to the 64 kbit/s A-interface (2048 kbit/s) output to the MSC, or in the opposite direction. The overall transmission requirements for the GSM PLMN are given in GSM 03.50, of which the PLMN transmission delay objective has been distributed to the various system entities as illustrated in GSM 03.05.
For speech channels the transmission through the BSC is completely digital and hence, the only relevant transmission requirement is the transmission delay through the BSC. The delay is specified for data channels as well as for speech channels.

6.2.1. Uplink TCH delay through the BSC (64 kbit/s A-bis-interface)

DEFINITION

The uplink delay is the time difference between the time the last bit of a defined frame has been transmitted on the 64 kbit/s A-bis-interface and the time the last bit of a exactly the same frame has been received on the A-interface by the BSSTE.

METHOD OF MEASUREMENT

A bit sequence shall be input on the 64 kbit/s A-bis-interface.
At the 64 kbit/s A-interface the output shall be decoded.
The delay shall then be evaluated according to the definition.

6.2.2. Downlink TCH delay through the BSC (64 kbit/s A-bis-interface)

DEFINITION

The downlink delay is the time difference between the time the last bit of a defined frame has been transmitted on the A-interface and the time the last bit of exactly the same frame has been received on the 64 kbit/s A-bis-interface.

METHOD OF MEASUREMENT
A bit sequence shall be input on the 64 kbit/s A-interface. On the 64 kbit/s A-bis-interface the output shall be decoded. The delay shall then be evaluated according to the definition.

6.2.3. Roundtrip TCH delay through the BSC (64 kbit/s A-bis-interface)

REQUIREMENTS
For the various traffic channel types indicated in Table 6-1 the roundtrip delay shall not exceed the values shown in Table 6-1. The roundtrip delay shall be evaluated as the sum of the uplink and downlink delays measured in sections 6.2.1 and 6.2.2, respectively.
NOTE: The figures indicated in this table are based on the delay budgets given in GSM 03.05, and are for guidance to network operators.

Channel:	Max delay (ms):
TCH/FS	2.0
TCH/HS	2.0
TCH/FD	22.0
TCH/HD	22.0

Table 6-1: Maximum roundtrip TCH delay through BSC (64 kbit/s A-bis-interface)

6.2.4. Uplink TCH delay through the BSC (16 kbit/s A-bis-interface)

DEFINITION
The uplink delay is the time difference between the time the last bit of a defined TRAU frame has been transmitted on the 16 kbit/s A-bis-interface and the time the last bit of a defined frame has been received on the 64 kbit/s A-interface by the BSSTE.

METHOD OF MEASUREMENT

a. For the TCH/FS, the test shall be carried out in 2 steps. In the first step, the test sequences defined for the test of uplink speech transcoding step 1 in section 5.1.4.1.1 (SEQ0x.COD) shall be input as the traffic bits of the TRAU frames on the A-bis interface in accordance with the restrictions of that test (reset, synchronization etc). At the 104 kbit/s interface (13 bit/8 kHz PCM) the output shall be decoded.
The output sequences for uplink speech transcoding step 1 (SEQ0x.OUT) shall be identical to the sequences output on the 104 kbit/s interface, and the timing will be known. The time difference shall then be evaluated.
In the second step, a sequence of 13 bit linear PCM samples shall be input after speech decoding in the BSC. On the A-interface the output shall be recorded. The time difference shall then be evaluated between the last bit of a PCM sample input and the last bit of the corresponding PCM sample output.
The uplink delay is the sum of the 2 delays found in the 2 steps. The uplink speech transcoding functions must be verified in advance.

b. For data traffic channels, a bit sequence shall be input on the 16 kbit/s A-bis-interface. At the 64 kbit/s A-interface the output shall be decoded.
The input bit sequence shall consist of frames synchronized to the TRAU frame structure of the 16 kbit/s A-bis-interface of all zero useful bits followed by a frame with useful bits of a "1" followed by all zeros.
On the A-interface the corresponding output frame is defined by the frame structure for uncoded bits for the traffic channel in question (see GSM 03.05) and shall be identified as the first frame according to the A-interface rate adaptation scheme containing useful bits of a "1" followed by all zeros.

6.2.5. Downlink TCH delay through the BSC (16 kbit/s
A-bis interface)

DEFINITION

The downlink delay is the time difference between the time the first bit of a defined frame has been transmitted on the 64 kbit/s A-interface and the time the last bit of a defined TRAU frame has been received on the 16 kbit/s A-bis interface.

METHOD OF MEASUREMENT

a. For the TCH/FS, the test must be carried out in 2 steps. In the first step, the test sequences defined for the test of downlink speech transcoding step 2 in section 5.1.4.2.2 (SEQ0x.INP) shall be input at 104 kbit/s level in the BSC (13 bit/8 kHz PCM samples) in accordance with the restrictions of that test (reset, synchronization etc). At the A-bis interface the output shall be recorded.
   The output sequences for downlink speech transcoding step 2 (SEQ0x.COD) shall be identical to the sequences of traffic bits output on the A-bis interface, and the timing will then be known. The time difference shall then be evaluated.
   In the second step, a sequence of 8 bit A-law PCM samples shall be input on the A-interface. Before speech encoding (13 bit linear PCM) the output shall be recorded. The time difference shall then be evaluated between the last bit of a PCM sample input and the last bit of the corresponding PCM sample output.
   The downlink delay is the sum of the 2 delays found in the 2 steps. The downlink speech transcoding functions must be verified in advance.
b. For data traffic channels, a bit sequence shall be input on the 64 kbit/s A-interface. On the 16 kbit/s A-bis interface the output shall be recorded. The input bit sequence shall consist of frames synchronized to the frame structure of uncoded bits for the traffic channel type in question (see GSM 03.05) according to the A-interface rate adaptation scheme of all zero useful bits followed by a frame containing useful bits of a "1" followed by all zeros.
   The corresponding output frame on the A-bis interface is defined by the A-bis interface frame structure and shall be identified as the first frame with useful bits of a "1" followed by all zeros.

6.2.6. Roundtrip TCH delay through the BSC (16 kbit/s A-bis-interface)

REQUIREMENTS
For the various traffic channel types indicated in Table 6-2 the roundtrip delay allocated to the BSC according to GSM 03.05 is shown in Table 6-2.
For TCH/FS, the value in Table 6-2 needs some modifications due to the measuring method. Due to the uplink measurement, the value of Table 6-2 shall be increased with 5.8 ms due to the 28 + 64 TRAU frame bits needed before processing can start on the other end. Due to the downlink measurement, the value of Table 6-2 shall be increased with 0.6 ms due to the 9 last TRAU frame bits that are redundant for transmission over the A-bis-interface.
The TCH/FS roundtrip delay test requirement is therefore:

TCH/FS: 48.9 ms

For the various traffic channel types indicated in Table 6-2, with the exception of the TCH/FS requirement above, the roundtrip delay shall not exceed the values shown in Table 6-2. The roundtrip delay shall be evaluated as the sum of the uplink and downlink delays measured in sections 6.2.4 and 6.2.5, respectively.

NOTE: The figures indicated in this table are based on the delay budgets given in GSM 03.05, and are for guidance to network operators.

Channel:	Max delay (ms):
TCH/FS	42.5
TCH/HS	[tbd]
TCH/FD	22.0
TCH/HD	22.0

Table 6-2: Maximum roundtrip TCH delay through BSC (16 kbit/s A-bis-interface)

6.3. INBAND CONTROL OF REMOTE TRANSCODERS AND RATE ADAPTORS

The tests in this section apply only to a BTS or to a BSC if a 16 kbit/s A-bis-interface is used, ie to BSS types 4-7 according to section 1.3 in this specification. All functions tested in this section are described in detail in GSM 08.60.

6.3.1. General

When there is an internal A-bis-interface in the BSS and the transcoders and rate adaptors are located in the BSC, this interface uses a per channel rate of 16 kbit/s and the radio subsystem in the BTS needs to control the transcoders and rate adaptors in the BSC by inband remote control. Elements of control are:

1. Configuration aspects
2. Uplink DTX operation
3. Downlink DTX operation
4. O&M procedures

This section tests the procedures needed for the inband control over the 16 kbit/s traffic channels on the A-bis-interface. Full rate speech traffic and full rate and half rate data traffic are covered in these tests.
Due to the A-bis-interface itself some additional functions are needed and must be tested, like:

5. Time Alignment of A-bis-interface frames
6. Frame synchronization
7. Error protection on the A-bis-interface

When applying inband control of remote transcoders and rate adaptors, according to GSM 08.60 the radio subsystem functions in the BTS are referred to as the Channel Codec Unit (CCU) and the remote transcoders and rate adaptors in the BSC as the Transcoder and Rate Adaptor Unit (TRAU).

The functions of the CCU and the TRAU are indicated in the following. See also Figure 11-2 in this specification.

CCU (BTS):
- the channel codec
- the Speech Handler
- the RAA rate adaptation
- the RA1/RA1' rate adaptation
- a control function

TRAU (BSC):
- the speech transcoders
- the Remote Speech Handler
- the RAA rate adaptation
- the RA2 rate adaptation
- a remote control function

The channel codec is tested in section 2.1 and the full rate speech transcoder in section 6.1.4.1. Rate adaptation functions relating to the A-bis-interface (the RAA functions) are tested in section 6.1.4.2 together with other rate adaptation functions (RA1/RA1' and RA2). Of the functions listed above only the local and remote Speech Handlers and control functions, and the interactions between them, are tested in this section.
The frames transmitted over the A-bis-interface are transmitted as 320 bits every 20 ms (16 kbit/s) and are referred to as TRAU frames. For further information see GSM 08.60.

6.3.2. Coding of A-bis-interface TRAU frames

The following types of TRAU frames are transmitted over the 16 kbit/s A-bis-interface:

1. Speech frames
2. O&M frames
3. Data frames
4. Idle speech frames

The coding of these frames is defined in detail in GSM 08.60 and is seen as tested implicitly by other tests.

6.3.3. Controlled elements

6.3.3.1. Configuration aspects

6.3.3.1.1. Resource Allocation

DEFINITION

When a channel activation procedure as tested in section 6.1.3.10 is needed, eg an ASSIGNMENT REQUEST message is input to the BSC on the MSC-interface, the BSC allocates an appropriate TRAU to the circuit assigned between BSC and BTS and sends a CHANNEL ACTIVATION message to the BTS. The BTS allocates the appropriate radio resources and a CCU and instructs the CCU to start sending uplink frames of the appropriate type, and responds with a CHANNEL ACTIVATION ACKNOWLEDGE message.

<u>NOTE</u>: The Layer 3 procedure including normal and abnormal conditions is tested in section 6.1.3.10.

The TRAU responds by setting the mode of operation accordingly and sending downlink frames with the correct frame type as an acknowledgement. In the case of speech the time alignment bits are set to "no change". See also section 6.3.3.5.1 (Initial time alignment).

NOTE: It is understood that the TRAU and the CCU are logical units with logical addresses which each one in principle can allocate all modes of operation. This does not mean, however, that each one physically contains each mode. Resource sharing is applicable.

METHOD OF TEST

1. An ASSIGNMENT REQUEST message shall be sent to the BSC requesting a specific channel type. The response on the A-bis-interface shall be recorded.
2. The BSSTE shall input TRAU frames of the appropriate mode on the A-bis-interface. In the case of speech mode, the Time Alignment bits shall be set to "no change" and no speech information shall be input on the A-interface. The response on the A-bis-interface shall be recorded.
3. Steps 1 and 2 shall be repeated for each mode of operation available in the BSC.

REQUIREMENTS

In the case of step 1, a CHANNEL ACTIVATION message shall occur on the A-bis-interface.
In the case of step 2, the BSC shall respond with the same TRAU frame types as input on the A-bis-interface connection. In the case of speech mode, the BSC shall respond with idle speech frames on the A-bis-interface and shall then be in the initial Time Alignment state.
In the case of step 3, the same requirements as in steps 1 and 2 apply.

6.3.3.1.2. In-call modification

DEFINITION

When the channel mode modify procedure as tested in section 6.1.3.11 is needed, the CCU takes action by sending the new frame type, channel type uplink in the TRAU frames to the TRAU. The TRAU responds by changing the mode of operation and sets the same frame type in the downlink.

METHOD OF TEST

1. A full-rate traffic channel shall be activated on the A-bis-interface in one of the modes possible for full-rate channels and the BSSTE shall input uplink TRAU frames indicating the appropriate frame type and intermediate rate adaptation (RA) bit rate. The response on the A-bis-interface shall be recorded.
2. The BSSTE shall change the indicated frame type or intermediate RA rate in the uplink TRAU frames.
3. Step 2 shall be repeated until all modes possible for full-rate traffic channels have been tested.
4. Steps 1-3 shall be repeated with a half-rate traffic channel.

REQUIREMENTS

In all cases, the BSC shall respond with TRAU frames of the same mode as received from the BTS on the A-bis-interface connection.

NOTE: No requirements are specified for the allowed time for the TRAU/BSC to respond to a change of mode.

6.3.3.1.3. Resource release

When release of circuit switched resources, eg as tested in section 6.1.3.16 (radio channel release) or in section 6.1.3.18 (channel release) is needed, the BSC will initiate the release internally by indicating this to the TRAU. The way to carry out the release is a BSC internal matter and is not tested.

6.3.3.2. Uplink DTX operation

The overall operation of the full rate DTX receiver functions are described in GSM 06.31, consisting of, apart from the speech decoder, a Comfort Noise (CN) generation function and an extrapolation and muting function for lost speech frames. These functions are parts of the remote Speech Handler in the BSC.
The side information to be received in the BSC with the speech frame over the A-bis-interface is a binary Bad Frame Indication (BFI) flag, a binary Time Alignment Flag (TAF) and a ternary Silence Descriptor (SID) flag.
The uplink RX DTX functions are tested in section 6.1.4.1.3.

6.3.3.3. Downlink DTX operation

It is a national or operator specific matter whether or not to implement downlink DTX in a GSM Base Station Controller.
If implemented, the overall operation of the full rate DTX transmitter functions are described in GSM 06.31, consisting of, apart from the speech encoder, a Voice Activity Detector (VAD) and a TX DTX handler, in this case both being a part of the remote Speech Handler in the BSC.
The side information to be transmitted with the speech frame over the A-bis-interface is a binary flag Speech (SP). SP=1 indicates that the TRAU frame is a speech frame and SP=0 indicate that the TRAU frame is a special SID-frame. This flag is used in the BTS for control of the radio transmission.
The TX DTX functions are tested in sections 6.1.4.1.6.

6.3.3.4. O&M procedures

The transfer of O&M information between the BSC and the TRAU may be done in 2 ways:

1. The BSC treats the O&M information internally, either by manufacturer specific solutions internal to the BSC or using the O&M TRAU frames.
2. The BSC uses the BTS as a relay function using O&M TRAU frames.

The choice between the to methods might depend on the BSS type and is a national or operator specific matter.

6.3.3.4.1. O&M TRAU frames from TRAU to BTS

DEFINITION
When the TRAU in the BSC needs to transmit O&M TRAU frames to the CCU in the BTS, these frames are repeated until an acknowledgement is received from the CCU/BTS.

METHOD OF TEST

1. By appropriate O&M interventions, which could be BSC internal and manufacturer specific, the TRAU in the BSC shall be provoked to transmit an O&M TRAU frame on the A-bis-interface. Then no further inputs shall be given to the BSC. Any response on any interface shall be recorded.
2. An O&M TRAU frame different to the one received from the TRAU/BSC shall be input on the A-bis-interface. Any response on any interface shall be recorded.

3. An O&M TRAU frame identical to the one received from the TRAU/BSC shall be input on the A-bis-interface. Any response on any interface shall be recorded.

REQUIREMENTS
In the case of step 1, O&M TRAU frames shall continuously occur on the A-bis-interface with at least n other TRAU frames in between. The value of n is at least 63 and has to be set by O&M for the test.
In the case of step 2, the same requirements as in step 1 apply.
In the case of step 3, no further O&M TRAU frames shall occur on the A-bis-interface.

6.3.3.5. Time Alignment of A-bis-interface frames

Due to the A-bis-interface some specific problems arise:
1. The BSC will have no information about the timing on the radio interface in the BTS and will start sending TRAU frames at an arbitrary or default time which may be received in the BTS up to 319 bits out of phase (out of 320 bits).
2. The different timeslots in a TRX (ie a carrier in a BTS without SFH) are sent at different times.
3. The transmission between the BSC and the radio interface may use different routes and may take different times.

For the above reasons, since the BSC cannot know when to start transmitting and since any buffering in the BTS will add to the transmission delay, time alignment of downlink TRAU frames on the A-bis-interface is needed.
Time Alignment of TRAU frames applies only to the speech mode of operation.

6.3.3.5.1. Initial Time Alignment

DEFINITION
The TRAU shall enter the Initial Time Alignment state at switch-on of the BSC, or when it is in idle mode, or if loss of frame synchronisation is detected, or if BSS internal handover is detected.
On receipt of TRAU frames, the CCU calculates the required timing adjustment (delay only) and signals this delay back to the TRAU in the next uplink TRAU frame. During initial time alignment the TRAU frame timing in the downlink may be delayed by 250 us or by multiples of 500 us up to a maximum of 19.5 ms.

METHOD OF TEST

The following steps shall be carried out sequentially:

All TRAU frames used will have control bits set to frame = speech and channel = full rate.

1. The resource allocation procedure in section 6.3.3.1.1 shall be carried out, and then a TRAU frame shall be input to the BSC requesting a large timing delay. The response on the A-bis-interface shall be recorded.
2. A sequence of 4 TRAU frames requesting large timing delays shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded.
3. A sequence of 4 TRAU frames requesting a timing advance of 250 us shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded.
4. A sequence of at least 4 TRAU frames requesting timing delays less than 500 us shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded.
5. In order to verify that the TRAU has entered the static time alignment state, the test in section 6.3.3.5.2 shall be carried out.

REQUIREMENTS

In the case of step 1, the BSC shall respond with a TRAU frame echoing the Time Alignment command received followed by another TRAU frame which is delayed according to the Time Alignment command. The gap in between the 2 frames shall be filled with "1"s.

In the case of step 2, the BSC shall ignore the first 3 received Time Alignment commands after having sent the frame with adjusted timing, but shall continue to transmit its downlink TRAU frames with the same timing. The same requirements as those for step 1 apply to the 4th TRAU frame received by the BSC.

In the case of step 3, the BSC shall ignore the first 3 received Time Alignment commands, but shall continue to transmit its downlink TRAU frames with the same timing. After receipt of the 4th uplink TRAU frame, the BSC will respond with a TRAU frame with Time Alignment set to delay by 39 * 500 us followed by another TRAU frame delayed by this amount. The gap in between the 2 frames shall be filled with "1"s.

In the case of step 4, the BSC shall ignore the first 3 received timing advance commands, but shall continue to transmit its downlink TRAU frames with the same timing. After reception of the 4th uplink TRAU frame the BSC shall respond witha TRAU frame with timing advance set as commanded followed by another TRAU frame delayed by this amount. The gap between the 2 frames shall be filled with '1's. The TRAU shall enter the statis time alignment state.

6.3.3.5.2. Static Time Alignment

DEFINITION

The TRAU enters this state after initial Time Alignment when it has performed two consecutive timing adjustments of 250 µs or "no change". In this state the TRAU may advance or delay the timing by 250 µs or make no change.

METHOD OF TEST

The following steps shall be carried out sequentially:

1. The initial Time Alignment procedure in section 6.3.3.5.1 shall be carried out such that the TRAU is in the static Time Alignment state. Then at least four TRAU frames requesting a delay of 250 µs shall be input on the A-bis interface. The response on the A-bis interface shall be recorded.
2. At least four TRAU frames requesting no change shall be input on the A-bis interface. The response on the A-bis interface shall be recorded.
3. At least four TRAU frames requesting an advance of 250 µs shall be input on the A-bis interface. The response on the A-bis interface shall be recorded.
4. The TRAU shall be put back into the initial Time Alignment state, by inputting a TRAU frame commanding a delay of 250 µs, but input with a delay of more than 4 x 250 µs on the A-bis interface. Then, at least four TRAU frames commanding "no change" shall be input.
5. A TRAU frame requesting a large time alignment shall be input on the A-bis interface. The response on the A-bis interface shall be recorded.

REQUIREMENTS

NOTE: In this test, it is asssumed that the number of TRAU frames the TRAU has to wait between consecutive timing adjustments is 3. If this value is greater than 3, the periodicity of 4 indicated should be increased accordingly.

In the case of step 1, a TRAU frame shall occur on the A-bis interface with the same Time Alignment bits as commanded by the BTS. Then every 4th downlink TRAU frame after having sent the first frame with adjusted timing shall be delayed 250 µs (4 bits) and 4 "1"s shall be added in the gap between the previous and the delayed TRAU frames.

In the case of step 2, a TRAU frame shall occur on the A-bis-interface with the same Time Alignment bits as commanded by the BTS. Then every downlink TRAU frame shall have the same timing as the previous one.

In the case of step 3, a TRAU frame shall occur on the A-bis-interface with the same Time Alignment bits as commanded by the BTS. Then every 4th TRAU frame after having sent the first frame with adjusted timing shall be advanced 250 us (4 bits) and the 4 last bits of the previous downlink TRAU frame shall not be transferred.
In the case of step 4, a TRAU frame shall occur on the A-bis interface with the Time Alignment bits representing the detected step change in the uplink. Then the second downlink TRAU frame shall be delayed by the detected change in the uplink by adding the required number of "1"s in the gap between the previous and the delayed TRAU frame. The acknowledged Time Alignment bits in this second TRAU frame should indicate "no change". The TRAU shall enter the initial alignment state.
In the case of step 5, the BSC shall respond with a TRAU frame echoing the TIME Alignment Command received followed by another TRAU frame which is delayed according to the Time Alignment Command. The gap between the 2 frames shall be filled with "1"s.

6.3.3.5.3. Time Alignment during external handover

The Time Alignment during external handover procedure is covered by the procedures for resource allocation in section 6.3.3.1.1 and the procedure for initial Time Alignment in section 6.3.3.5.1.

6.3.3.5.4. Time Alignment during internal handover

After the BSS internal handover has been performed, the timing of the downlink frames may have to be adjusted in several steps of 250/500 µs. In order to speed up the Time Alignment of the downlink frames, this must be detected by the TRAU and the TRAU shall enter the initial Time Alignment state.
The Time Alignment during internal handover procedure is covered by the procedure for initial Time Alignment in section 6.3.3.5.1.

6.3.3.6. Frame synchronization

6.3.3.6.1. Search for Frame Synchronization

The search for frame synchronization is tested implicitly by other tests.

6.3.3.6.2. Frame Synchronisation After Performing Downlink Timing Adjustments

This procedure is not tested explicitly.

6.3.3.6.3. Frame synchronisation monitoring and recovery

DEFINITION
The frame synchronization monitoring is a contionuous process. Loss of frame synchronization is assumed when at least 3 consecutive frames, each with at least one framing bit error, are detected.
METHOD OF TEST
1. A call shall be set up. Speech frames shall be input continuously on the A-bis-interface.

2. 3 consecutive TRAU speech frames with one framing error per frame followed by correct frames shall be input on the A-bis-interface. Any message generated by the BSC shall be recorded for at least 1.5 s.
3. Continuous TRAU speech frames with one framing error per frame shall be input on the A-bis-interface. Any message generated by the BSC shall be recorded.
4. A new call shall be set up on a data channel. Then steps 2 and 3 shall be repeated.

REQUIREMENTS
In the case of step 2, the operation of the BSC/TRAU shall be unaffected. No messages shall be generated by the BSC.
In the case of step 3, the BSC/TRAU shall start sending the "urgent alarm" pattern on the A-bis-interface after 1 s.
In the case of step 4, the same requirements as in steps 2 and 3 apply.

6.3.3.7. Error protection on the A-bis-interface

6.3.3.7.1. Errors in the Time Alignment bits

DEFINITION
On receipt of a frame with errors in the bits for time alignment (C6-C11), the following procedure must be followed, depending on the state of the TRAU unit:

a) If the TRAU unit is in the initial or static time alignment state, and a time alignment command is received indicating an unused value (101000..111101), this value must be interpreted as "no change".

b) If the TRAU unit is in the static time alignment state, and a time alignment command is received indicating a delay in steps of 500 us (000001..100111) the next downlink frame should be delayed only one 250 us step.

METHOD OF TEST
All TRAU frames used in this test must have frame type set to speech and channel type set to full rate.

1. Initial Time Alignment: The equipment must be switched on and the Resource Allocation Procedure in section 6.3.3.1.1 carried out for a full rate speech channel. Then a frame with a value of the bits C6-C11 in the range 101000-111101 shall be input on the A-bis-interface. The answering downlink TRAU frame shall be recorded, and the time between the end of the frame and the beginning of the next frame shall be measured.
2. At least 3 normal frames shall be input on the A-bis-interface.
3. Static Time Alignment: A frame with a value the bits C6-C11 in the range 101000-111101 shall be input on the A-bis-interface. The uplink frame time alignment shall be recorded, and the answering downlink TRAU frame shall be recorded. The time between the end of the answering downlink frame and the beginning of the next downlink frame shall be measured.
4. Step 2 shall be repeated.
5. A frame with a value the bits C6-C11 in the range 000001-100111 shall be input on the A-bis-interface. The uplink frame and the answering downlink TRAU frame shall be recorded. The time between the end of the answering downlink frame and the beginning of the next downlink frame shall be measured.

REQUIREMENTS
In the case of steps 1 and 3, the TRAU shall make no change in the time alignment of the subsequent frame.
In the case of step 5, the TRAU shall delay the subsequent frame by 250 us.

6.3.3.7.2. Handling of frames received with errors

If a TRAU frame is received with detectable errors in the control bits (excluding the Time Alignment bits), then the control information is ignored. The speech or data bits are handled as if no error had been detected.
This is not explicitly tested.

6.4. SUBMULTIPLEXING OF TERRESTRIAL CHANNELS ON THE A-BIS-INTERFACE

If the transcoders and rate adaptors are located in the BSC or at the MSC-site, 16 kbit/s per user channels are used on the A-bis-interface. In this case the rate adapted bitsreams which have the rate of 16 kbit/s may be multiplexed on to a 64 kbit/s channel before passing over the A-bis-interface. Whether or not to include this multiplexing is, however, up to the operator.
The submultiplexing shall, if used, be done according to recommendation CCITT I.460 as defined in GSM 08.54 (ie using bits 1-2, 3-4, 5-6 or 7-8). The submultiplexing of channels is seen as tested implicitly by the rate adaptation tests and the appropriate Layer 1 tests in sections 6.1.4 and 3.1, respectively.

7. BASE TRANSCEIVER STATION NETWORK ASPECTS

The use of the A-bis-interface is optional for a GSM PLMN operator. However, if one or more transceiver units of a BSS are not colocated with the control functions of the BSS, the BSS shall be split into the 2 functional entities Base Station Controller (BSC) and Base Transceiver Station(s) (BTS(s)). See also section 1 in this specification.
The tests in this section apply to the BTS(s), if used.

7.1. BASE TRANSCEIVER STATION NETWORK FUNCTIONS

7.1.1. General

The interface between the Base Station Controller (BSC) and the Base Transceiver Station (BTS) is defined in GSM 08.5x and 08.6x. The interface supports the transcoding/rate adaptation functions positioned in the BTS, or in the BSC or at the MSC site.
This section verifies the network functions of a BTS.
The non-transparent part of Layer 3 shall be tested. The transparent part of Layer 3 shall simply be tested for transparency. See also annex 4 describing the mapping of Radio Resource management procedures.
The functional split between the BSC and the BTS is defined in detail in GSM 08.52. Of the main BSS network functions listed in section 5.1.1 the BTS can roughly be defined to include the following:

Functions in the BTS:
- channel coding/decoding
- enciphering/deciphering
- scheduling of paging messages

Functions in the BSC or BTS:
- transcoding/rate adaptation

As for the BSS seen as a whole, the Layer 3 messages on each interface of the BTS can be divided into 2 categories:

- transparent messages
- non-transparent messages

All the messages which are transparent to the BSS as a whole (DTAP messages) are consequently transparent also to the BTS. Messages which are non-transparent to the BSS as a whole may also be transparent to the BTS.
As for the BSS as a whole (see section 5.1.3), the non-transparent Layer 3 procedures are tested as elementary procedures, not as structured procedures. The tests are intended to cover all normal and abnormal cases of significance within each elementary procedure. However, all possible error cases are not tested, normally only if they imply different message sequences. The tests in this section are performed under perfect transmission conditions and under no limiting conditions.

7.1.2. Transparent messages

Messages which are "transparent" to the BTS are treated in a specific way on the A-bis-interface. See sections 7.1.3.5 and 7.1.3.6 (non-transparent messages) for downlink (BSC to MS) and uplink (MS to BSC) messages, respectively.

7.1.3. Non-transparent messages

The tests described in this section are to verify that messages sent to the Base Transceiver Station (BTS) using the RR or A-bis-interface non-transparent Layer 3 procedures have the correct consequential actions, and that combinations of certain events cause the correct messages to be sent via the RR or A-bis-interface non-transparent Layer 3 procedures on the radio interface or A-bis-interface by the BSC. Time constraints have to be met.

The following non-transparent Layer 3 procedures are to be tested in the BTS:
Radio link layer management:

1. Link establishment indication
2. Link establishment request
3. Link release indication
4. Link release request
5. Transmission of transparent L3-message in acknowledged mode
6. Reception of transparent L3-message in acknowledged mode
7. Transmission of transparent L3-message in unacknowledged mode
8. Reception of transparent L3-message in unacknowledged mode
9. Link error indication

Dedicated channel management:

10. Channel activation
11. Channel mode modify
12. Handover detection
13. Start of encryption
14. Measurement reporting
15. Deactivate SACCH
16. Radio channel release
17. MS power control
18. Transmission power control
19. Connection failure
20. Physical context request

Common channel management:

21. Channel request by MS
22. Paging
23. Delete indication
24. CCCH load indication
25. Broadcast information modify
26. Immediate assignment
27. Short Message Service Cell Broadcast (SMSCB)

TRX management:

28. Radio resource indication
29. SACCH filling information modify
30. Flow control
31. Error reporting

Details of the correct operation of these procedures are to be found in GSM 04.08 and GSM 08.58. GSM 08.08 is also implicitly applicable.
The same overall requirements as for the tests of the BSS as a whole in section 5.1.3 apply.

7.1.3.1. Link establishment indication

DEFINITION

The link establishment indication procedure is used by the BTS to indicate to the BSC that a Layer 2 link on the radio path has been established in a multi-frame mode at the initiative of the MS.
The establishment may be with or without contention resolution, ie with or without an information field in the SABM from the MS. The Layer 3 messages contained in the SABM information field may be one of the following:

LOCATION UPDATING
CM SERVICE REQUEST
PAGING RESPONSE
IMSI DETACH INDICATION
CM REESTABLISHMENT REQUEST

The CM SERVICE REQUEST may concern a normal call or eg a Short Message Service (SMS).

METHOD OF TEST

1. The channel activation procedure in section 7.1.3.10 shall be initiated requesting an SDCCH, and then an SABM frame indicating SAPI=0 containing LOCATION UPDATING REQUEST shall be input on the radio interface on the main signalling link (the SDCCH). The response on any interface shall be recorded.
2. If supported by the BTS as an operator or manufacturer choice, step 1 shall be repeated with a TCH/FACCH to be used for signalling only. Then, a MODE MODIFY message shall be input on the A-bis-interface requesting a TCH/FACCH, but for speech and signalling. The response on any interface shall be recorded.
3. Another LAPDm SABM frame, but with SAPI=3 concerning a Short Message Service (SMS) shall be input on the radio interface on the SACCH. The response on any interface shall be recorded.
4. Step 1 shall be repeated without an information field in the SABM, for an SDCCH or FACCH as appropriate.

5. Step 1 shall be repeated with an information field containing each of the other Layer 3 messages above in turn, for an SDCCH or FACCH as appropriate. Each of the Layer 3 messages shall concern different Mobile stations on different main signalling links.

```
MS                          BTS                          BSC
         first SABM
- - - - - - - - - - - - - - - >
             UA
< - - - - - - - - - - - - - - -
                                      EST IND
                             --------------------------->
```

Figure 7-1: Link establishment indication - normal case

The messages from the BSSTE will be:

1,2. SABM(LOCATION UPDATING REQUEST)
    Location updating type
    Ciphering key sequence number
    Location area identification
    Mobile Station classmark 1
    Mobile identity
2. MODE MODIFY
    Channel number
    Channel mode = TCH
5. SABM(CM SERVICE REQUEST)
    CM service type
    Ciphering key sequence number
    Mobile Station classmark 2
    Mobile identity
5. SABM(PAGING RESPONSE)
    Ciphering key sequence number
    Mobile Station classmark 2
    Mobile identity
5. SABM(IMSI DETACH INDICATION)
    Mobile Station classmark 1
    Mobile identity

5. SABM(CM REESTABLISHMENT REQUEST)
   Ciphering key sequence number
   Location area identification
   Mobile Station classmark 2
   Mobile identity

REQUIREMENTS

In the case of step 1, a LAPDm UA frame containing LOCATION UPDATING REQUEST shall occur on the radio interface on the main signalling link (SDCCH) acknowledging the SABM followed by an ESTABLISHMENT INDICATION message on the A-bis-interface containing LOCATION UPDATING REQUEST. Then, LAPDm UI fill frames shall occur continuously on the SDCCH.
In the case of step 2, exactly the same requirements as in step 1 apply, but on the TCH/FACCH on the radio interface. After the MODE MODIFY message, a MODE MODIFY ACKNOWLEDGE message shall occur on the A-bis-interface and the transmission of LAPDm UI fill frames on the TCH/FACCH shall stop.
In the case of step 3, a LAPDm UA frame without information field shall occur on the radio interface on the SACCH acknowledging the SABM followed by an ESTABLISHMENT INDICATION message indicating SAPI=3 on the A-bis-interface without information field.
In the case of step 4, a LAPDm UA frame without information field shall occur on the radio interface on the main signalling link acknowledging the SABM followed by an ESTABLISHMENT INDICATION message on the A-bis-interface without information field. Then, LAPDm UI fill frames shall occur continuously on the main signalling link.
In the case of step 5, for each information field of the SABM, a LAPDm UA frame containing the exact Layer 3 information field from the SABM shall occur on the radio interface on the relevant main signalling link acknowledging the SABM, and an ESTABLISHMENT INDICATION message containing the exact Layer 3 information field from the SABM shall occur on the A-bis-interface. Then, LAPDm UI fill frames shall occur continuously on the main signalling link.

The messages from the BTS shall be:

1-5. ESTABLISHMENT INDICATION
    Channel number
    Link identifier = as in text
    Layer 3 information = LOC UPD REQ, LOC UPD REQ, none,
                          none, CM SERV REQ,
                          PAG RES, IMSI DET IND, CM REEST REQ

2. MODE MODIFY ACKNOWLEDGE
    Channel number

7.1.3.2. Link establishment request

DEFINITION

The link establishment request procedure is used by the BSC to request the establishment by the BTS of a LAPDm link over the radio path. This procedure applies only to the Short Message Service (SMS) with SAPI=3.

METHOD OF TEST

1. A dedicated resource shall be set up between the radio interface and the A-bis-interface. Then an ESTABLISHMENT REQUEST message indicating SAPI=3 shall be input on the A-bis-interface. The response on any interface shall be recorded.
2. Step 1 shall be repeated, and then a UA frame with SAPI=3 shall be input on the radio interface before the time T200. The response on any interface shall be recorded.

```
MS                            BTS                           BSC
                                      EST REQ (SAPI=3)
                              <-----------------------------
        SABM (SAPI=3)
<- - - - - - - - - - - - - - -
         UA (SAPI=3)
- - - - - - - - - - - - - - ->
                                      EST CONF (SAPI=3)
                              ----------------------------->
```

Figure 7-2: Link establishment request - normal case

The messages from the BSSTE will be:

1,2.ESTABLISHMENT REQUEST
Channel number
Link identifier

REQUIREMENTS

In the case of step 1, N200+1 SABM frames with SAPI=3 shall occur on the radio interface with an interval of T200 followed by a RELEASE INDICATION message and an ERROR INDICATION message with the cause value "timer T200 expired N200+1 times" on the A-bis-interface.
In the case of step 2, an ESTABLISHMENT CONFIRM message indicating SAPI=3 shall occur on the A-bis-interface.
The messages from the BTS shall be:

1. RELEASE INDICATION
Channel number
Link identifier
1. ERROR INDICATION
Channel number
Link identifier
RLM cause = as in text
2. ESTABLISHMENT CONFIRM
Channel number
Link identifier

7.1.3.3. Link release indication

DEFINITION

The link release indication procedure is used by the BTS to indicate to the BSC that a Mobile Station has disconnected the LAPDm link on the radio interface.

METHOD OF TEST

1. A dedicated resource shall be set up between the radio interface and the A-bis-intrface. Then a LAPDm DISC frame shall be input on the radio interface on the main signalling link. The response on any interface shall be recorded.
2. Another DISC frame shall be input on the radio interface. The response on any interface shall be recorded.

NOTE: Any LAPDm frame or combination of LAPDm frames (collision cases) which is to be interpreted as a valid DISC frame according to GSM 04.06 shall be equivalent to a DISC frame also in this test.

```
MS                         BTS                         BSC
            DISC
- - - - - - - - - - - - - - ->
             UA
<- - - - - - - - - - - - - - -
                                      REL IND
                           ---------------------------->
```

Figure 7-3: Link release indication - normal case

REQUIREMENTS

In the case of step 1, a LAPDm UA frame shall occur on the radio interface on the main signalling link followed by a RELEASE INDICATION message on the A-bis-interface.
In the case of step 2, a LAPDm DM frame shall occur on the radio interface. Nothing shall occur on the A-bis-interface.
The messages from the BTS shall be:

1. RELEASE INDICATION
   Channel number
   Link identifier

7.1.3.4. Link release request

DEFINITION

The link release request procedure is used by the BSC to request a BTS to disconnect the LAPDm link on the radio interface. This applies only to Short Message Services (SMS) on the SACCH using SAPI=3.

METHOD OF TEST

1. A dedicated resource shall be set up between the radio interface and the A-bis-interface, and a Short Message Service (SAPI=3) shall be set up to the same Mobile Station. Then a RELEASE REQUEST message shall be input on the A-bis-interface concerning the SAPI=3 Short Message Service. The response on any interface shall be recorded.
2. Step 1 shall be repeated, and then a LAPDm UA frame shall be input on the radio interface on the SACCH within a time T200. The response on any interface shall be recorded.

```
MS                          BTS                         BSC
                                        REL REQ
                             <-----------------------------
             DISC
<- - - - - - - - - - - - - - -
              UA
- - - - - - - - - - - - - - ->
                                        REL CONF
                             ----------------------------->
```

Figure 7-4: Link release request - normal case

The messages from the BSSTE will be:

1. RELEASE REQUEST
   Channel number
   Link identifier
   Release mode = normal

REQUIREMENTS

In the case of step 1, N200+1 LAPDm DISC frames with SAPI=3 shall occur on the radio interface on the SACCH with an interval of T200 followed by a RELEASE INDICATION message and an ERROR INDICATION message with the cause value "timer T200 expired N200+1 times" on the A-bis-interface.
In the case of step 2, a RELEASE CONFIRM message shall occur on the A-bis-interface.
The messages from the BTS shall be:

1. RELEASE INDICATION
   Channel number
   Link identifier
1. ERROR INDICATION
   Channel number
   Link identifier
   RLM cause = as in text
2. RELEASE CONFIRM
   Channel number
   Link identifier

7.1.3.5. Transmission of transparent L3-message in acknowledged mode

----

This procedure is used to send a message which is transparent to the BTS over the radio path in acknowledged mode. The procedure applies at least to all downlink DTAP messages.
The test shall be carried out exactly as for the BSS as a whole in section 5.1.2.1, with the exception that the "transparent" message shall be mapped on to a DATA REQUEST message on the A-bis-interface containing the transparent message. The DATA REQUEST message is defined below. See also Figure 7-5.

NOTE: Throughout the rest of the Layer 3 test descriptions of the BTS the downlink message transparent to the BTS is coded as such for simplicity, and is not included in the DATA REQUEST message.

```
MS                              BTS                           BSC
                                    DATA REQ (AUTH REQ)
                               <-----------------------------
        I (AUTH REQ)
<- - - - - - - - - - - - - - - -
             RR
- - - - - - - - - - - - - - - ->
```

Figure 7-5: Transmission of transparent L3-message in
acknowledged mode - normal case

The DATA REQUEST message is coded as follows:

DATA REQUEST
Channel number
Link identifier
Layer 3 information = AUTH REQ

7.1.3.6. Reception of transparent L3-message in acknowledged mode

This procedure is used to receive a message which is transparent to the BTS over the radio path in acknowledged mode. The procedure applies at least to all uplink DTAP messages.
The test shall be carried out exactly as for the BSS as a whole in section 5.1.2.2, with the exception that the "transparent" message shall be mapped on to a DATA INDICATION message on the A-bis-interface containing the transparent message. The DATA INDICATION message is defined below. See also Figure 7-6.

<u>NOTE</u>: Throughout the rest of the Layer 3 test descriptions of the BTS the uplink message transparent to the BTS is coded as such for simplicity, and is not included in the DATA INDICATION message.

```
MS                              BTS                           BSC
         I (STATUS)
- - - - - - - - - - - - - - - ->
            RR
<- - - - - - - - - - - - - - - -
                                      DATA IND (STATUS)
                               ----------------------------->
```

Figure 7-6. Reception of transparent L3-message in
acknowledged mode - normal case

The DATA INDICATION message is coded as follows:

DATA INDICATION
Channel number
Link identifier
Layer 3 information = STATUS

7.1.3.7. Transmission of transparent L3-message in unacknowledged mode

DEFINITION

This procedure is used to send a message which is transparent to the BTS over the radio path in unacknowledged mode. The signalling procedure is given in GSM 08.58.

NOTE: There are not any such messages, ie downlink messages which are transparent to the BTS and unacknowledged.

METHOD OF TEST

1. A call shall be set up between the radio interface and the A-bis-interface.
2. A UNIT DATA REQUEST message containing a message [tbd], which is transparent to the BTS in the downlink and unacknowledged, shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
MS                           BTS                           BSC
                              UNIT DATA REQ (message [tbd])
                              <-----------------------------
      UI (message [tbd])
<- - - - - - - - - - - - - - -
```

Figure 7-7: Transmission of transparent L3-message in unacknowledged mode - normal case

The messages from the BSSTE will be:

2. UNIT DATA REQUEST
   Channel number
   Link identifier
   Layer 3 information = message [tbd]

REQUIREMENTS

In the case of step 2, a LAPDm UI frame containing the message [tbd] shall occur on the radio interface exactly as contained in the UNIT DATA REQUEST message.

7.1.3.8. Reception of transparent L3-message in unacknowledged mode

This procedure is used to receive a message which is transparent to the BTS over the radio path in unacknowledged mode. The signalling procedure is given in GSM 08.58.

NOTE: There are not any such messages, ie uplink messages transparent to the BTS and unacknowledged.

METHOD OF TEST

1. A call shall be set up between the radio interface and the A-bis-interface.
2. A LAPDm UI frame containing a message [tbd], which is transparent to the BTS in the uplink and unacknowledged, shall be input on the radio interface. The response on any interface shall be recorded.

```
MS                                 BTS                                BSC
      UI (message [tbd])
- - - - - - - - - - - - - - - - - ->
                                    UNIT DATA IND (message [tbd])
                                    ---------------------------->
```

Figure 7-8: Reception of transparent L3-message in unacknowledged mode - normal case

REQUIREMENTS

In the case of step 2, a UNIT DATA INDICATION message shall occur on the A-bis-interface containing the exact message [tbd] as input on the radio interface.
The messages from the BSS shall be:

2. UNIT DATA INDICATION
   Channel number
   Link identifier
   Layer 3 information = message [tbd]

7.1.3.9. Link error indication

The link error indication procedure is used by the BTS to indicate to the BSC abnormal situations by an ERROR INDICATION message, like protocol errors, complete lack of LAPDm acknowledgements or receipt of SABMs in the LAPDm multiple frame established state.
The link error indication procedure is tested implicitly by several other tests.

7.1.3.10. Channel activation

DEFINITION

The channel activation procedure is used to activate a channel in the BTS for an MS which then will be commanded to the channel by an IMMEDIATE ASSIGNMENT, an ASSIGNMENT COMMAND, an ADDITIONAL ASSIGNMENT or a HANDOVER COMMAND message.

METHOD OF TEST

1. No channels shall be activated in the BTS.
2. A CHANNEL ACTIVATION message shall be input on the A-bis-interface concerning the channel A. The response on any interface shall be recorded.
3. Step 2 shall be repeated for the same channel A.

```
   MS                          BTS                        BSC
                                          CH ACTIV
                                <----------------------------
                                        CH ACTIV ACK
                                ---------------------------->
```

Figure 7-10: Channel activation - normal case

The messages from the BSSTE will be:

2,3.CHANNEL ACTIVATION
    Channel number = A
    Activation type
    Channel mode
    Channel identification
    Encryption identification
    Handover reference
    BS power
    MS power
    Timing advance
    BS power parameters
    MS power parameters
    Physical context

REQUIREMENTS

In the case of step 2, a CHANNEL ACTIVATION ACKNOWLEDGE message shall occur on the A-bis-interface.
In the case of step 3, a CHANNEL ACTIVATION NEGATIVE ACKNOWLEDGE message shall occur on the A-bis-interface with the cause value "radio channel already activated/allocated".
The messages from the BTS shall be:

2. CHANNEL ACTIVATION ACKNOWLEDGE
    Channel number = A
    Frame number
3. CHANNEL ACTIVATION NEGATIVE ACKNOWLEDGE
    Channel number = A
    Cause = as in text

7.1.3.11. Channel mode modify

DEFINITION
The channel mode modify procedure is used by the BSC to request a change of the channel mode of an active channel in a BTS. The channel mode is related to transcoding and rate adaptation functions and includes consequently also channel coding functions.

METHOD OF TEST
1. A call shall be established between the A-bis-interface and the radio interface of the BSSTE on a TCH/F9.6.
2. A MODE MODIFY message shall be input on the A-bis-interface requesting a TCH/F4.8 for the call previously set up. The response on any interface shall be recorded.
3. Step 2 shall be repeated, but requesting a TCH/F2.4, but the BTS shall be unable to allocate such a channel. The response on any interface shall be recorded.

```
    MS                          BTS                          BSC
                                          MODE MOD
                                <-----------------------------
                                        MODE MOD ACK
                                ----------------------------->
```

Figure 7-11: Channel mode modify - normal case

The messages from the BSSTE will be:
2,3.MODE MODIFY
    Channel number
    Channel mode = TCH/F4.8, TCH/F2.4

REQUIREMENTS
In the case of step 2, a MODE MODIFY ACKNOWLEDGE message shall occur on the A-bis-interface.
In the case of step 3, a MODE MODIFY NEGATIVE ACKNOWLEDGE message shall occur on the A-bis-interface with an appropriate cause value.

The messages from the BTS shall be:

2. MODE MODIFY ACKNOWLEDGE
   Channel number
3. MODE MODIFY NEGATIVE ACKNOWLEDGE
   Channel number
   Cause = as in text

7.1.3.12. Handover detection

7.1.3.12.1. Non-synchronized case

DEFINITION
This procedure is used between the target BTS and BSC when an MS which has been handed over accesses the new BTS.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the OMC-interface setting the timer T3105 to an appropriate value A and the parameter Ny1 to an appropriate value B.
2. The BSSTE shall perform the channel activation procedure (handover) in section 7.1.3.10 specifying non-synchronized handover.
3. The BSSTE shall generate HANDOVER ACCESS messages with the expected handover reference number on the radio interface on the main signalling link. The response on any interface shall be recorded.

```
   MS                           BTS                           BSC
        Channel activation
            (handover)
            HAND ACC
   ----------------------------->
            HAND ACC
   ----------------------------->
                 .
                 .                        HAND DET
                                ---------------------------->
            PHYS INFO
   <-----------------------------   -
            PHYS INFO              T3105
   <-----------------------------   -
                 .
                 .                  Ny1
            PHYS INFO
   <-----------------------------
```

Figure 7-12: Handover detection - normal case

The messages from the BSSTE will be:
1. O&M MESSAGES
2. HANDOVER ACCESS
   Handover reference

REQUIREMENTS
In the case of step 2, a HANDOVER DETECTION message shall occur on the A-bis-interface followed by Ny1=B PHYSICAL INFORMATION messages with an interval of T3105=A on the radio interface on the main signalling link.

The messages from the BTS shall be:
3. HANDOVER DETECTION
   Channel number
   Access delay
3. PHYSICAL INFORMATION
   Timing advance

7.1.3.12.2. Synchronized case

This test is the same as for the non-synchronized case except that no PHYSICAL INFORMATION messages are needed, and the channel activation procedure specifies synchronized handover.

7.1.3.13. Start of encryption

DEFINITION

The purpose of the start of encryption procedure is after authentication to initialize and synchronize the stream ciphering devices in the BTS and in the MS. The MS and MSC already know the cipher key Kc from the authentication procedure.

NOTE: Any failure during the start of encryption procedure will be regarded as a lower layer failure and will therefore not be tested explicitly.

METHOD OF TEST

1. A dedicated resource shall be set up between the radio interface and the A-bis-interface. No ciphering shall be activated.
2. An ENCRYPTION COMMAND message shall be input on the A-bis-interface containing the key Kc. The response on any interface shall be recorded.
3. The BSSTE shall start deciphering and enciphering and send a CIPHERING MODE COMPLETE message on the radio interface in enciphered mode. The response on any interface shall be recorded.
4. A DTAP message shall be input on the A-bis-interface. The response on any interface shall be recorded.
5. Steps 1-3 shall be repeated, but the CIPHERING MODE COMPLETE message in step 3 shall be replaced by an I frame containing any uplink DTAP message.

```
   MS                          BTS                          BSC
                                         ENCR CMD
                                <----------------------------
          CIPH MODE CMD
   <-----------------------------  start deciphering BTS
          Layer 2 frame
   - - - - - - - - - - - - - - - >  start enciphering BTS
          CIPH MODE COM
   --------------------------------------------------------->
```

Figure 7-13: Start of encryption - normal case

The messages from the BSSTE will be:

2. ENCRYPTION COMMAND
   Channel number
   Encryption information
   Link identifier
   Layer 3 information (CIPHER MODE CMD)
3. CIPHERING MODE COMPLETE
   --

4,5.DTAP MESSAGE

REQUIREMENTS
In the case of step 2, a CIPHERING MODE COMMAND message shall occur on the radio interface. The message shall be unciphered.
In the case of step 3, a CIPHERING MODE COMPLETE message shall occur on the A-bis-interface. The message shall be deciphered.
In the case of step 4, the DTAP message shall occur on the radio interface. The message shall be enciphered.
In the case of step 5, the DTAP message shall occur on the A-bis-interface. The DTAP message shall be deciphered.

The messages from the BTS shall be:

2. CIPHERING MODE COMMAND
   Cipher mode setting
3. CIPHERING MODE COMPLETE
   --

4,5.DTAP MESSAGE

7.1.3.14. Measurement reporting

The Mobile Station reports regularly on the SACCH to the BTS on measurements it has performed on the downlink radio channel. Similarly, the BTS measures the uplink radio channel. This information is signalled to the BSC and is used in the BSC in the handover and RF power control algorithms. Optionally, the BTS may preprocess the measurement results. The handover and RF power control algorithms are a national or operator specific matter.

7.1.3.14.1. Basic masurement reporting

DEFINITION

This procedure is used by the BTS to report to the BSC raw measurement results received from an MS and results of measurements performed by the BTS on the corresponding uplink channel. This procedure shall always be implemented in a BTS.

METHOD OF TEST

1. A dedicated resource shall be established by the BSSTE between the radio interface and the A-bis-interface. A SAPI=3 link shall be set up on the SACCH.
2. The BSSTE shall input a MEASUREMENT REPORT message on the radio interface on the SACCH. The response on any interface shall be recorded.
3. An I frame indicating SAPI=3 shall be input on the radio interface on the SACCH. The response on any interface shall be recorded.
4. Step 2 shall be repeated.

```
   MS                        BTS                           BSC
             MEAS REP
 - ----------------------------->
 |                                        MEAS RES
SACCH multiframe          -    ---------------------------->
 |                        |
 -                SACCH multiframe
 |                        |               MEAS RES
SACCH multiframe          -    ---------------------------->
 |           MEAS REP
 - ----------------------------->
                                          MEAS RES
                               ---------------------------->
```

Figure 7-14a: Basic measurement reporting - normal case

The messages from the BSSTE will be:
2,4.MEASUREMENT REPORT
    Measurement results

REQUIREMENTS

In the case of step 2, a MEASUREMENT RESULT message shall occur on the A-bis-interface containing measurement results for the uplink performed in the BTS and the reported measurement results in the MEASUREMENT REPORT message from the MS.
In the case of step 3, a MEASUREMENT RESULT message shall occur on the A-bis-interface containing measurement results for the uplink performed by the BTS only.
In the case of step 4, a MEASUREMENT RESULT message shall occur on the A-bis-interface containing measurement results for the uplink performed in the BTS and the reported measurement results in the MEASUREMENT REPORT message from the MS.

The messages from the BTS shall be:
2-4.MEASUREMENT RESULT
    Channel number
    Measurement result number
    Uplink measurements = yes, no, yes
    BS power
    Layer 1 information
    Layer 3 information (MEAS REP)

7.1.3.14.2. Preprocessed masurement reporting (optional)

This procedure is used by the BTS to report to the BSC preprocessed measurement results received from an MS and performed by the BTS. This procedure is optional for implementation in a BTS.
The exact preprocessing parameters are not specified , but are a national or operator specific matter. Consequently, the procedure is not tested.

7.1.3.14.3. Preprocessing configuration (optional)

The preprocessing configuration procedure is used by the BSC to configure the BTS for a certain preprocessing procedure. This procedure is optional for implementation in a BTS.
The exact preprocessing parameters are not specified, but are a national or operator specific matter. Consequently, the procedure is not tested.

7.1.3.15. Deactivate SACCH

DEFINITION

The deactivate SACCH procedure is used by the BSC to order the BTS to deactivate the SACCH.

METHOD OF TEST

1. A dedicated resource shall be established between the radio interface and the A-bis-interface.
2. A DEACTIVATE SACCH message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
     MS                          BTS                          BSC
                                           DEACT SACCH
                                  <----------------------------

                stop SACCH
```

Figure 7-15: Deactivate SACCH - normal case

The messages from the BSSTE will be:

2. DEACTIVATE SACCH
   Channel number

REQUIREMENTS

In the case of step 2, no further RF transmissions shall occur on the SACCH.

7.1.3.16. Radio channel release

DEFINITION

The radio channel release procedure is used to release a radio channel which is no longer needed (eg after a successful handover or after a normal assignment).

METHOD OF TEST

1. A call shall be set up between the radio interface and the A-bis-interface.
2. An RF CHANNEL RELEASE message shall be input on the A-bis-interface. The response on any interface shall be recorded.
3. After some time a LAPDm I frame shall be input on the radio interface. The response on any interface shall be recorded.

```
   MS                        BTS                        BSC
                                       RF CH REL
                              <----------------------------
        dectivate channels
                                      RF CH REL ACK
                              ---------------------------->
```

Figure 7-16: Radio channel release - normal case

The messages from the BSSTE will be:

2. RF CHANNEL RELEASE
   Channel number

REQUIREMENTS

In the case of step 2, an RF CHANNEL RELEASE ACKNOWLEDGE message shall occur on the A-bis-interface.
In the case of step 3, no message shall occur on any interface.

2. RF CHANNEL RELEASE ACKNOWLEDGE
   Channel number

7.1.3.17. MS power control

DEFINITION

The MS power control procedure enables the BSC to control the MS output power.

METHOD OF TEST

NOTE: In this test there is no correlation between the measurement reports from the BTS and the actual power level values ordered by the BSSTE, acting as a BSC.

1. A dedicated resource shall be set up between the radio interface and the A-bis-interface.
2. An MS POWER CONTROL message with a given MS power level shall be input on the A-bis-interface. The response on any interface shall be recorded during at least the time needed by the BTS to transmit 10 SACCH downlink blocks on the radio interface.
3. Continuing from step 2, the BSSTE shall input a new MS POWER CONTROL message with a different MS power level on the A-bis-interface. The response on any interface shall be recorded during at least the time needed by the BTS to transmit 10 SACCH downlink blocks on the radio interface.

```
   MS                          BTS                          BSC
                                         MS POW CONTR
                                <----------------------------
        L1-header in SACCH
   < - - - - - - - - - - - - - - -
```

Figure 7-17: MS power control - normal case

The messages fom the BSSTE will be:

2,3.MS POWER CONTROL
Channel number
MS power
MS power parameters

REQUIREMENTS

In the case of step 2, the correct power level shall be included in each Layer 1 header of the SACCH downlink block transmitted by the BTS.
In the case of step 3, the correct power level shall be included in each Layer 1 header of the SACCH downlink block transmitted by the BTS.

7.1.3.18. Transmission power control (optional)

DEFINITION

This procedure is used between BSC and BTS to set the TRX power on a physical radio channel to the desired level.

METHOD OF TEST

1. A dedicated resource shall be set up between the radio interface and the A-bis-interface.
2. A BS POWER CONTROL message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
   MS                        BTS                          BSC
                                       BS POW CONTR
                             <----------------------------
         Adjust BSS power
```

Figure 7-18: Transmission power control - normal case

The messages from the BSSTE will be:

2. BS POWER CONTROL
   Channel number
   BS power
   BS power parameters

REQUIREMENTS

In the case of step 2, no message shall occur on any interface. The TRX power level on the radio interface shall be set according to the level in the BS POWER CONTROL message. This is also verified by the Layer 1 tests in section 2.1.8.

7.1.3.19. Connection failure

DEFINITION

The purpose of the connection failure procedure is to indicate to the BSC that a radio interface failure (or equipment failure etc) has occurred. The BSC will then take appropriate actions.

METHOD OF TEST

1. An O&M message as defined by the operator or the manufacturer shall be input on the A-bis-interface setting the thresholds for radio link failure (including T100).
2. A dedicated resource shall be set up between the A-bis-interface and the radio interface. Then no further inputs shall be made by the BSSTE for a period exceeding the timer T100. The response on any interface shall be recorded.

```
   MS                          BTS                           BSC
            failure
                                        CONN FAIL IND
                               ----------------------------->
```

Figure 7-19: Connection failure - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES

REQUIREMENTS

In the case of step 2, a CONNECTION FAILURE INDICATION message with the cause value "radio interface failure" shall occur on the A-bis-interface.
The messages from the BTS shall be:

2. CONNECTION FAILURE INDICATION
   Channel number
   Cause = as in text

7.1.3.20. Physical context request (optional)

DEFINITION

The physical context request procedure is an optional procedure which allows the BSC to obtain information on the transmission /reception process of a radio channel prior to a channel change. This information may be forwarded to a new TRX in a BTS controlled by the BSC. The physical context request procedure is internal to the BSS.

METHOD OF TEST

1. A call shall be established between the A-bis-interface and the radio interface.
2. A PHYSICAL CONTEXT REQUEST message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
     MS                          BTS                            BSC
                                         PHYS CONT REQ
                                 <-----------------------------
                                         PHYS CONT CONF
                                 ----------------------------->
```

Figure 7-20: Physical context request - normal case

The messages from the BSSTE will be:

2. PHYSICAL CONTEXT REQUEST
   Channel number

REQUIREMENTS

In the case of step 2, a PHYSICAL CONTEXT CONFIRM message concerning the correct channel shall occur on the A-bis-interface.
The messages from the BTS shall be:

2. PHYSICAL CONTEXT CONFORM
   Channel number
   BS power
   MS power
   Timing Advance
   Physical context

7.1.3.21. Channel request by MS

DEFINITION

The channel request by MS procedure is used when an MS performs random access by a CHANNEL REQUEST message on the radio interface.

METHOD OF TEST

1. A CHANNEL REQUEST message shall be input on the radio interface. The response on any interface shall be recorded.

```
   MS                          BTS                          BSC
             CH REQ
   ---------------------------->
                                          CH RQD
                               ---------------------------->
```

Figure 7-21: Channel request by MS - normal case

The messages from the BSSTE will be:

1. CHANNEL REQUEST
   Establishment cause
   Random reference = PAR1

REQUIREMENTS

In the case of step 1, a CHANNEL REQUIRED message shall occur on the A-bis-interface.
The messages from the BTS shall be:

1. CHANNEL REQUIRED
   Channel number
   Request reference = PAR1
   Access delay
   Physical context

7.1.3.22. Paging

DEFINITION

The paging procedure is used to trigger a channel access by a Mobile Station. This procedure is used for mobile terminating calls and is initiated by the MSC via the BSC. The BSC determines the paging group to be used based on the IMSI of the MS to be paged. The paging group value is sent to the BTS together with the PAGING COMMAND message. Based on the paging group information the BTS will execute the transmission of the message in the correct paging block.

NOTE: PAGING messages on the A-interface and PAGING COMMAND messages on the A-bis-interface relate to one Mobile Station only, but the PAGING REQUEST messages on the radio interface may relate to several.
The grouping of paging messages in the BTS is up to the manufacturer or the operator and is not tested explicitly.

METHOD OF TEST

1. An O&M-message as defined by the operator or the manufacturer shall be input on the A-bis-interface instructing the BTS to configure a certain control channel configuration.
2. 9 PAGING COMMAND messages, 1 with IMSI and 8 with TMSI, for 9 Mobile Stations belonging to the same paging group shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
MS                            BTS                          BSC
                                        PAG CMD (IMSI)
                               <----------------------------
          PAG REQ                       PAG CMD (TMSI)
<---------------------------- <----------------------------
          PAG REQ                       PAG CMD (TMSI)
<---------------------------- <----------------------------
          PAG REQ                          .
<----------------------------              .
             .                             .
             .
```

Figure 7-22: Paging - normal case

The messages from the BSSTE will be:

1. O&M MESSAGES
2. PAGING COMMAND
   Channel number
   Paging group
   MS identity = IMSI, TMSI, TMSI, TMSI, TMSI, TMSI, TMSI, TMSI, TMSI

REQUIREMENTS

In the case of step 2, PAGING REQUEST messages type 1, 2 or 3 shall occur on the radio interface on the correct paging
subchannel of the PCH. On all other paging subchannels fill PAGING REQUEST messages (type of identity = no identity) or other valid Layer 3 messages shall occur.
The messages from the BTS shall be:

2. PAGING REQUEST TYPE 1
   Page mode
   Mobile identity
   Mobile identity
2. PAGING REQUEST TYPE 2
   Page mode
   TMSI
   TMSI
   Mobile identity
2. PAGING REQUEST TYPE 3
   Page mode
   TMSI
   TMSI
   TMSI
   TMSI

7.1.3.23. Delete indication

The delete indication procedure is used by the BTS to indicate to the BSC that a UNIT DATA REQUEST message containing a message transparent to the BTS, ie IMMEDIATE ASSIGNMENT, has been deleted due to overload on the downlink CCCH. For further information see GSM 08.58.
This procedure may be tested generating an overload situation on the downlink CCCH. Load testing of a BTS is outside the scope of this specification. Load testing of a BTS is a national or operator specific matter.

7.1.3.24. CCCH load indication

The CCCH load indication procedure is used by the BTS to inform the BSC that the load on the CCCH exceeds a certain threshold. For further information see GSM 08.58.
The fact that the BTS is able to generate such a message may be tested by imposing a certain load on the CCCH. Load testing of the BTS is, however, outside the scope of this specification. Load testing of the BTS is a national or operator specific matter.

7.1.3.25. Broadcast information modify

DEFINITION

The broadcast information modify procedure is used by the BSC to set new BCCH parameters to be transmitted from the BTS. The signalling procedure is specified in GSM 08.58 and the timing requirements for the SYSTEM INFORMATION messages are specified in GSM 05.02.

METHOD OF TEST

1. A BCCH INFORMATION message shall be input on the A-bis-interface setting the system information to go on the BCCH. The message concerned shall be SYSTEM INFORMATION type 1. The response on any interface shall be recorded.
2. Step 1 shall be repeated for SYSTEM INFORMATION types 2-4.

```
MS                            BTS                          BSC
                                         BCCH INFO
                              <----------------------------
        SYS INFO 1-4
<----------------------------
        SYS INFO 1-4
<----------------------------
                 .
                 .
```

Figure 7-25: Broadcast information modify - normal case

The messages from the BSSTE will be:

1. BCCH INFORMATION
   Channel number
   System information type = 1
   Layer 3 information (SYS INFO)
   Starting time
2. BCCH INFORMATION
   Channel number
   System information type = 2, 3, 4
   Layer 3 information (SYS INFO)
   Starting time

REQUIREMENTS

In the case of step 1, a SYSTEM INFORMATION message of the type 1 shall occur continuously on the radio interface on the BCCH with the new system information parameters.
In the case of step 2, SYSTEM INFORMATION messages of the type 2-4 shall occur continuously on the radio interface on the BCCH with the new system information parameters.
The messages from the BTS shall be:

1. SYSTEM INFORMATION TYPE 1
   Cell channel description
   RACH control parameters
2. SYSTEM INFORMATION TYPE 2
   Neighbour cells description
   PLMN permitted
   RACH control parameters
2. SYSTEM INFORMATION TYPE 3
   Cell identity
   Location area identification
   Control channel descriptions
   Cell options
   Cell selection parameters
   RACH control parameters

2. SYSTEM INFORMATION TYPE 4
   Location area identification
   Cell selection parameters
   RACH control parameters
   (CBCH) channel description
   (CBCH) mobile allocation

7.1.3.26. Immediate assignment

DEFINITION

When the MS initially accesses the BTS, a dedicated resource is immediately allocated by the BSC.

METHOD OF TEST

1. An IMMEDIATE ASSIGNMENT COMMAND message shall be input on the A-bis-interface requesting a normal immediate assignment. The response on any interface shall be recorded.
2. Step 1 shall be repeated for the immediate assignment types "extended" and "rejection", in turn.

```
   MS                          BTS                          BSC
                                        IMM ASS CMD
                                <-----------------------------
             IMM ASS /
            IMM ASS EXT/
            IMM ASS REJ
    <-----------------------------
```

Figure 7-26: Immediate assignment - normal case

The messages from the BSSTE will be:

1. IMMEDIATE ASSIGNMENT COMMAND
   Channel number
   Immediate assignment information = IMM ASS
   MS identity
2. IMMEDIATE ASSIGNMENT COMMAND
   Channel number
   Immediate assignment information = IMM ASS EXT, IMM ASS REJ
   MS identity

REQUIREMENTS

In the case of step 1, an IMMEDIATE ASSIGNMENT message shall occur on the radio interface. The page mode may be set by the BTS.
In the case of step 2, an IMMEDIATE ASSIGNMENT EXTENDED message and an IMMEDIATE ASSIGNMENT REJECT shall occur on the radio interface. The page mode may in both cases be set by the BTS.
The messages from the BTS shall be:

1. IMMEDIATE ASSIGNMENT
   Page mode
   Channel description
   Request reference
   Timing advance
   Mobile allocation
   Starting time
2. IMMEDIATE ASSIGNMENT EXTENDED
   Page mode
   Channel description 1
   Request reference 1
   Timing advance 1
   Channel description 2
   Request reference 2
   Timing advance 2
   Mobile allocation
   Starting time
2. IMMEDIATE ASSIGNMENT REJECT
   Page mode
   Request reference
   Wait indication
   Request reference
   Wait indication
   Request reference
   Wait indication
   Request reference
   Wait indication

7.1.3.27. Short Message Service Cell Broadcast (SMSCB)

DEFINITION

This procedure is used by the BSC to request the transmission of an SMS Cell Broadcast block on the CBCH by the BTS. The signalling procedure is given in GSM 08.58.

METHOD OF TEST

1. The BTS shall be configured with a CBCH active with SDCCH/4 or SDCCH/8.
2. An SMS BROADCAST REQUEST message shall be input on the A-bis-interface. The response on any interface shall be recorded.

```
   MS                          BTS                         BSC
                                         SMS BC REQ
                                <---------------------------
          block on CBCH
   < - - - - - - - - - - - - - - -
```

Figure 7-27: SMS Cell Broadcast - normal case

The messages from the BSSTE will be:

2. SMS BROADCAST REQUEST
   Channel number
   SMSCB information

REQUIREMENTS

In the case of step 2, a block shall occur on the radio interface on the CBCH exactly as given in the SMSCB information element in the SMS BROADCAST REQUEST message input on the A-bis-interface.

7.1.3.28. Radio resource indication

DEFINITION

The radio resource indication procedure provides interference levels on idle channels in a BTS to the BSC. The periodicity with which this is reported is set by the OMC.

METHOD OF TEST

1. The BTS shall be configured with a set of half-rate channels and a set of full-rate channels.
2. An O&M-message as defined by the operator or the manufacturer over the A-bis-interface shall set the timer [tbd] to a value B. The response on any interface shall be recorded.

```
MS                          BTS                         BSC
                                      RF RES IND
                              -   --------------------------->
                          T[tbd]      RF RES IND
                              -   --------------------------->
                                             .
                                             .
```

Figure 7-28: Radio resource indication - normal case

The messages fom the BSSTE will be:

2. O&M MESSAGES

REQUIREMENTS

In the case of step 2, RF RESOURCE INDICATION messages shall occur repeatedly on the A-bis-interface with an interval B indicating the resources used for half-rate and full-rate channels.
The messages from the BTS shall be:

2. RF RESOURCE INDICATION
   Resource information = as in text

7.1.3.29. SACCH filling information modify

DEFINITION

The SACCH filling information modify procedure is used by the BSC to change the system information content to be transmitted on the SACCH to a specific Mobile Station.

METHOD OF TEST

1. A dedicated resource shall be set up between the radio interface and the A-bis-interface. Then a SACCH FILLING message modifying the system information to be transmitted on the SACCH shall be input on the A-bis-interface. The response on any interface shall be recorded until all the SYSTEM INFORMATION messages type 5-6 are verified.

```
MS                            BTS                           BSC
                                        SACCH FILLING
                              <-----------------------------
        SYS INFO 5-6
<------------------------------
        SYS INFO 5-6
<------------------------------
                 .
                 .
```

Figure 7-29: <u>SACCH filling information modify - normal case</u>

The messages from the BSSTE will be:

1. SACCH FILLING
   System information type = 5, 6
   Layer 3 information (SYS INFO)
   Starting time

REQUIREMENTS

In the case of step 1, a SYSTEM INFORMATION message of the type 5-6 shall occur on the radio interface on the SACCH.
The messages from the BTS shall be:

1. SYSTEM INFORMATION TYPE 5
   Neighbour cells descriptions
1. SYSTEM INFORMATION TYPE 6
   Cell identity
   Location area identification
   Cell options
   PLMN permitted
   Cell description

7.1.3.30. Flow control

The flow control procedure on the A-bis-interface is used to indicate to the BSC if there is some kind of overload situation in the BTS, eg on the TRX processor, on the downlink CCCH or on the ACCH. The BSC will then try to reduce the load on the BTS. The signalling procedure is given in GSM 08.58.
The overload situation will take part of the load testing of a BTS and is outside the scope of the standardized acceptance tests in this specification. Load testing of a BTS is a national or operator specific matter.

7.1.3.31. Error reporting

DEFINITION

The error reporting procedure is used by the BTS in order to report to the BSC when it detects an erroneous message. The erroneous messages are defined in GSM 08.58.

METHOD OF TEST

1. A dedicated resource shall be set up between the radio interface and the A-bis-interface.
2. An erroneous message shall be input on the A-bis-interface. The response on any interface shall be recorded.

NOTE: The test is carried out for the erroneous messages on the A-bis-interface only. It should be noted that the ERROR REPORT message might also be used for erroneous messages on the radio interface. It is not specified, however.

```
   MS                            BTS                         BSC
                                       erroneous message
                                 <----------------------------
                                           ERROR REP
                                 ---------------------------->
```

Figure 7-31: Error reporting - normal case

REQUIREMENTS

In the case of step 2, an ERROR REPORT message shall occur on the A-bis-interface with an appropriate cause value. The information elements of the message shall correspond to the erroneous message input.
The messages from the BTS shall be:

2. ERROR REPORT
   Cause
   Message identifier
   Channel number
   Link identifier
   Message indicator
   Erroneous message

7.1.4. Transcoding/rate adaptation functions

When multiplexing four speech/data channels to one 64 kbit/s link between BTS and BSC, the transcoder/rate adaptation functions as tested for the BSS as a whole in section 5.1.4 are put in the BSC with some additional A-interface specific functions in the BSC and BTS, resulting in an intermediate rate of 16 kbit/s per user channel at the A-bis-interface.
Otherwise (using a 64 kbit/s A-bis-interface) the transcoding and rate adaptation functions are all located in the BTS, and all tests of the BTS shall be carried out exactly as for the BSS as a whole using the A-bis-interface instead of the A-interface.
This section applies only to a BTS using a 16 kbit/s A-bis-interface.

7.1.4.1. Full-rate speech related transcoding functions

Speech related transcoding functions are 2 stages of speech transcoding in uplink and downlink, and uplink and downlink functions for support of Discontinuous Transmission (DTX).
For further information see GSM 06.01, GSM 06.10, GSM 06.11, GSM 06.12, GSM 06.31 and GSM 06.32.

7.1.4.1.1. Uplink speech transcoding - step 1

Not applicable to a BTS using a 16 kbit/s A-bis-interface.

7.1.4.1.2. Uplink speech transcoding - step 2

Not applicable to a BTS using a 16 kbit/s A-bis-interface.

7.1.4.1.3. Uplink receiver DTX functions

DEFINITION

The overall operation of the full rate DTX receiver functions are described in GSM 06.31, consisting of, apart from the channel decoder, a SID frame detection function which is part of the Speech Handler in the BTS.
The side information to be transmitted uplink from the BTS with the speech frame over the A-bis-interface is a binary Bad Frame Indication (BFI) flag, a binary Time Alignment Flag (TAF) and a ternary Silence Descriptor (SID) flag.
The channel decoder including the BFI is tested in section 2.1.

METHOD OF TEST

A call shall be set up on a full rate speech TCH, and then traffic frames being the special test frame defined in section 5.1.4.1.3 shall be input on the radio interface. The radio transmission conditions shall be non-limiting.
The test shall be repeated, but SID frames shall be input instead of the special test frames. The radio transmission conditions shall be non-limiting.
The test shall be repeated with SID frames, and the radio transmission conditions shall be varied until the SID flag on the A-bis-interface has been set to both 1 and 2.

REQUIREMENTS

When the special test frames are input on the radio interface, TRAU frames containing (BFI,SID)=(0,0) shall occur on the A-bis-interface.
When SID frames are input on the radio interface, TRAU frames containing (BFI,SID)=(0,2) shall occur on the A-bis-interface under non-limiting radio transmission conditions.
When SID frames are input on the radio interface under limiting radio transmission conditions, TRAU frames containing BFIs of 0 and 1 and SIDs of 0, 1 or 2 shall occur on the A-bis-interface.
Under all conditions, when the input test frame or SID frame on the radio interface comes in the middle of a SACCH multiframe according to GSM 05.08, the TAF flag shall be set to 1. Otherwise TAF=0.

7.1.4.1.4. Downlink speech transcoding - step 1

Not applicable to a BTS using a 16 kbit/s A-bis-interface.

7.1.4.1.5. Downlink speech transcoding - step 2

Not applicable to a BTS using a 16 kbit/s A-bis-interface.

7.1.4.1.6. Downlink transmitter DTX/VAD functions

It is a national or operator specific matter whether or not to implement downlink DTX in a BTS.

DEFINITION

If implemented, the overall operation of the full rate DTX transmitter functions are described in GSM 06.31, consisting of, apart from the channel encoder, an SP flag handling and monitoring function which in this case is the Speech Handler in the BTS.
The side information to be transmitted with the speech frame over the A-bis-interface is a binary flag Speech (SP). SP=1 indicates that the TRAU frame is a speech frame and SP=0 indicate that the TRAU frame is a special SID-frame. This flag is used in the BTS for control of the radio transmission.
The channel encoder is tested in section 2.1.

METHOD OF TEST

A call shall be set up on a full rate speech TCH, and then TRAU frames with random traffic bits accompanied with SP=0 or 1 in a random order shall be input on the A-bis-interface.

REQUIREMENTS

On the radio interface the following full rate "speech" traffic frames shall be transmitted on the air on the TCH/FS:

1. All frames with SP=1.
2. The first frame with SP=0 after one or more with SP=1.
3. Those marked with SP=0 and occurring in the middle of the SACCH multiframe as defined in GSM 05.08.

No other frames with SP=0 shall be transmitted on the air.

NOTE: Due to the block diagonal interleaving scheme defined for the TCH/FS, every traffic frame is transmitted in 8 TDMA frames. Since every TDMA frame contains 2 different traffic frames, there is not a one to one mapping between traffic frames "on" and TDMA frames transmitted on the air.

7.1.4.2. Data rate adaptation functions

If multiplexing of four data-channels to one 64 kbit/s link between BTS and BSC is applied, an intermediate rate adaptation function is needed. Hereby the radio interface data rates are converted via the standard CCITT V.110 80 bit frame to a modified CCITT V.110 72 bit frame at 16 kbit/s at the A-bis-interface, and vice versa. This function is performed by using the RA1/RA1' function and a new RAA function.
This intermediate modified CCITT V.110 72 bit frame at the A-bis interface is then further rate adapted in the BSC to 64 kbit/s at the A-interface by using the new RAA function and the RA2 function.
The additional coding of the "TRAU" frames for control of the remote transcoder/rate adaptation at the BSC/MSC site is tested in section 7.3.
The tests in this section apply only to a BTS using a 16 kbit/s A-bis-interface. If a 64 kbit/s A-bis-interface is used, the BTS shall be tested as the BSS as a whole in section 5.1.4.2 using the A-bis-interface instead of the A-interface.

7.1.4.2.1. Uplink rate adaptation in the BTS

DEFINITION

For the radio interface data rate of 12, 6 and 3.6 kbit/s, the modified CCITT V.110 60 or 36 bit frames shall be transformed via the CCITT V.110 80 bit frame to the modified CCITT V.110 72 bit frame at the rate of 16 kbit/s at the A-bis-interface.

METHOD OF TEST

a) Radio interface data rate of 12 kbit/s (transparent data)
   One radio interface frame consisting of a sequence of 4 modified CCITT V.110 60 bit frames according to Figure 3 in GSM 04.21 shall be input to the BTS on the dedicated TCH. The user data shall be pseudo-random. The received data on the A-bis-interface shall be recorded.
b) Radio interface data rate of 6 kbit/s (transparent data)
   One radio interface frame consisting of a sequence of 4 modified CCITT V.110 60 bit frames according to Figure 4 in GSM 04.21 shall be input to the BTS on the dedicated TCH. The user data shall be pseudo-random. The received data on the A-bis-interface shall be recorded.

c) Radio interface data rate of 3.6 kbit/s (transparent data)
   One radio interface frame consisting of a sequence of 4 modified CCITT V.110 36 bit frames according to Figure 5 in GSM 04.21 shall be input to the BTS on the dedicated TCH. The user data shall be pseudo-random. The received data on the A-bis-interface shall be recorded.
d) Non-transparent data
   One RLP frame consisting of a sequence of four modified CCITT V.110 60 bit frames for non-transparent data according to Figure 3 in GSM 08.20 shall be input to the BTS on the dedicated TCH. The user data shall be pseudo-random. The received data on the A-bis-interface shall be recorded.
   If DTX is possible the test shall be repeated with no radio input on the radio interface (uplink DTX).

REQUIREMENTS

a) The received data shall correspond to the transmitted data according to the modified CCITT V.110 72 bit frame, transformed via the CCITT V.110 80 bit frame, as stated in section 4.7.1 in 08.60. The mapping shall be as stated in section 5.1 in GSM 04.21. The received user data shall be bit-exact.
b) As for a) except that the mapping shall be as stated in section 5.2 and 5.3 respectively in GSM 04.21.
c) As b).
d) As for a) except that the received modified CCITT V.110 72 bit frame shall be transformed via the modified CCITT V.110 80 bit frame for non-transparent data as stated in Figure 2 in GSM 08.20.
In the case of uplink DTX being applied on the radio interface, the BTS will interprete whatever it receives as data. Therefore, the data bits in the TRAU frames will be indeterminate.

7.1.4.2.2. Downlink rate adaptation in the BTS

DEFINITION

The modified CCITT V.110 72 bit frame at the A-bis-interface at the rate of 16 kbit/s shall be transformed, via the CCITT V.110 80 bit frame, to the modified CCITT V.110 60 bit frame or 36 bit frame at a radio interface data rate of 12, 6 or 3.6 kbit/s.

METHOD OF MEASUREMENT

a-c) Transparent data

Four modified CCITT V.110 72 bit frames as output from the BSC in the downlink according to the requirements in section 6.1.4.2.1 case a-c), shall be input to the BTS in turn on the A-bis-interface. The received data on the radio interface shall be recorded.

d) Non-transparent data
One RLP frame (TRAU frame) consisting of four modified CCITT V.110 72 bit frames for non-transparent data as output from the BSC in the downlink according to the requirements in section 6.1.4.2.1 case d), shall be input to the BTS on the A-bis-interface. The received data on the radio interface shall be recorded.
If DTX is possible the test shall be repeated with DTX active in the BTS and setting all the E1 bits in the TRAU frames to 1.

REQUIREMENTS

a) The received data shall correspond to the modified CCITT V.110 60 bit frame according to section 5.1 in GSM 04.21.
b) The received data shall correspond to the modified CCITT V.110 60 bit frame according to section 5.2 in GSM 04.21.
c) The received data shall correspond to the modified CCITT V.110 36 bit frame according to section 5.3 in GSM 04.21.
d) The reveived data shall correspond to the modified CCITT V.110 60 bit frame for non-transparent data according to Figure 3 in GSM 08.20, and the mapping stated in sections 5.1/5.2 in GSM 04.21.
In the case of DTX being active in the BTS and the E1 bits are set to 1, no frame shall be transmitted on the radio interface.

In all cases the received user data shall be bit-exact.

7.2. TRANSMISSION REQUIREMENTS FOR THE BTS

This section includes the necessary transmission requirements for the transmission through the Base Transceiver Station (BTS) in principle from the radio interface to the A-bis-interface, or in the opposite direction. The overall transmission requirements for the GSM PLMN are given in GSM 03.50, of which the PLMN transmission delay objective has been distributed to the various system entities as illustrated in GSM 03.05.
For speech channels the transmission through the BTS is completely digital and hence, the only relevant transmission requirement is the transmission delay through the BTS. The delay is specified for data channels as well as for speech channels.

7.2.1. Uplink TCH delay through the BTS (64 kbit/s A-bis-interface)

DEFINITION

The uplink delay is the time difference between the time of the end of the timeslot carrying the last burst with information from a defined frame over the radio interface and the time when the first bit of a defined frame has been received on the 64 kbit/s A-bis-interface by the BSSTE.

METHOD OF MEASUREMENT

As for the BSS as a whole in section 5.2.1, but using the A-bis-interface and the above definition.

7.2.2. Downlink TCH delay through the BTS (64 kbit/s A-bis-interface)

DEFINITION
The downlink delay is the time difference between the time when the first bit of a defined frame has been transmitted on the 64 kbit/s A-bis interface and the time of the end of the timeslot carrying the last burst with information from a defined frame transmitted over the radio interface.
This delay includes the interleaving/de-interleaving delay, which is known and according to GSM 03.05.

METHOD OF MEASUREMENT
As for the BSS as a whole in section 5.2.2, but using the A-bis interface and the above definition.

7.2.3. Roundtrip TCH delay through the BTS (64 kbit/s A-bis interface)

REQUIREMENTS
For the various traffic channel types indicated in Table 7-1 the roundtrip delay shall not exceed the values shown in Table 7-1. The roundtrip delay shall be evaluated as the sum of the uplink and downlink delays measured in sections 7.2.1 and 7.2.2, respectively.

NOTE: The figures indicated in this table are based on the delay budgets given in GSM 03.05, and are for guidance to network operators.

Channel:	Max delay (ms):
TCH/FS	83.4
TCH/HS	[tbd]
TCH/F9.6	149.6
TCH/F4.8	169.6
TCH/H4.8	280.6
TCH/F2.4	100.6
TCH/H2.4	280.6

Table 7-1: Maximum roundtrip TCH delay through BTS (64 kbit/s A-bis interface)

7.2.4. Uplink TCH delay through the BTS (16 kbit/s A-bis-interface)

DEFINITION

The uplink delay is the time difference between the time of the end of the timeslot carrying the last burst with information from a defined frame over the radio interface and the time when the last bit of a defined frame has been received on the
A-bis-interface by the BSSTE.

METHOD OF MEASUREMENT

A bit sequence shall be input after channel encoding in the BSSTE. At the 16 kbit/s A-bis-interface the output shall be recorded.
The input bit sequence shall consist of frames synchronized to the frame structure of channel encoded bits for the traffic channel type in question generated by channel coding of all zero bits followed by a special frame as follows:

TCH/FS : A frame generated by channel coding of a "1" followed by all zeros
TCH/HS : [to be defined]
Data TCHs : A frame generated by channel coding of a "1" followed by all zeros

On the A-bis-interface the corresponding output frame is defined by the TRAU frame structure of the A-bis-interface and shall be identified as:

TCH/FS : The first frame containing useful bits of a "1" followed by all zeros
TCH/HS : [to be defined]
Data TCHs : The first frame containing useful bits of a "1" followed by all zeros

The delay shall then be evaluated according to the definition.

7.2.5. Downlink TCH delay through BTS (16 kbit/s A-bis interface)

DEFINITION

The downlink delay is the time difference between the time when the last bit of a defined TRAU frame has been transmitted on the A-bis interface and the time of the end of the timeslot carrying the last burst with information from a defined frame transmitted over the radio interface.
This delay includes the interleaving/de-interleaving delay, which is known and according to GSM 03.05.

METHOD OF MEASUREMENT

A bit sequence shall be input on the 16 kbit/s A-bis interface. Before channel decoding in the BSSTE the output shall be decoded.
The input bit sequence shall consist of frames synchronized to the frame structure of the A-bis interface of all zero useful bits followed by a special frame as follows:

TCH/FS	: A frame containing useful bits of a "1" followed by all zeros
TCH/HS	: [to be defined]
Data TCHs	: A frame containing useful bits of a "1" followed by all zeros

For the TCH/H4,8, two TRAU frames shall be input and shall be treated as one frame for the purpose of this test.
The corresponding output frame in the BSSTE is defined by the frame structure of channel encoded bits for the traffic channel type in question and shall be identified as:

TCH/FS	: The first frame generated by channel coding of a "1" followed by all zeros
TCH/HS	: [to be defined]
Data TCHs	: The first frame generated by channel coding of a "1" followed by all zeros

The delay shall then be evaluated according to the definition.

7.2.6. Roundtrip TCH delay through the BTS (16 kbit/s A-bis-interface)

REQUIREMENTS

For the various traffic channel types indicated in Table 7-2a the roundtrip delay allocated to the BTS according to GSM 03.05 is shown in Table 7-2a.
For TCH/FS, the value in Table 7-2a needs some modifications due to the measuring method. Due to the uplink measurement, the value of Table 7-2a shall be increased with 20 ms (a TRAU frame) and decreased with 4.0 ms (Tabisu) and 1.7 ms due to the 28 first TRAU frame bits that may be transmitted earlier over the A-bis-interface. Due to the downlink measurement, the value of Table 7-2a shall be decreased with 0.6 ms due to the 10 last TRAU frame bits that need not be received over the A-bis-interface before processing can start in the BTS.
Similarly, for all data channels, the values in Table 7-2a need to be increased with 20 ms due to the uplink measurement method. The resulting roundtrip delay test requirements are summarized in Table 7-2b.
For the various traffic channel types indicated in Table 7-2b the roundtrip delay shall not exceed the values shown in Table 7-2b . The roundtrip delay shall be evaluated as the sum of the uplink and downlink delays measured in sections 7.2.4 and 7.2.5, respectively.

NOTE: The figures indicated in this table are based on the delay budgets given in GSM 03.05, and are for guidance to network operators.

Channel:	Max delay (ms):
TCH/FS	56.6
TCH/HS	[tbd]
TCH/F9.6	149.6
TCH/F4.8	169.6
TCH/H4.8	280.6
TCH/F2.4	100.6
TCH/H2.4	280.6

Table 7-2a: Maximum roundtrip TCH delay through BTS (16 kbit/s A-bis-interface)

Channel:	Max delay (ms):
TCH/FS	70.3
TCH/HS	[tbd]
TCH/F9.6	169.6
TCH/F4.8	189.6
TCH/H4.8	300.6
TCH/F2.4	120.6
TCH/H2.4	300.6

Table 7-2b: Test requirement - BTS (16 kbit/s A-bis-interface)

7.3. INBAND CONTROL OF REMOTE TRANSCODERS AND RATE ADAPTORS

The tests in this section apply only to a BTS or to a BSC if a 16 kbit/s A-bis-interface is used, ie to BSS types 4-7 according to section 1.3 in this specification. All functions tested in this section are described in detail in GSM 08.60.

7.3.1. General

When there is an internal A-bis-interface in the BSS and the transcoders and rate adaptors are located in the BSC, this interface uses a per channel rate of 16 kbit/s and the radio subsystem in the BTS needs to control the transcoders and rate adaptors in the BSC by inband remote control. Elements of control are:

1. Configuration aspects
2. Uplink DTX operation
3. Downlink DTX operation
4. O&M procedures

This section tests the procedures needed for the inband control over the 16 kbit/s traffic channels on the A-bis-interface. Full rate speech traffic and full rate and half rate data traffic are covered in these tests.
Due to the A-bis-interface itself some additional functions are needed and must be tested, like:

5. Time Alignment of A-bis-interface frames
6. Frame synchronization
7. Error protection on the A-bis-interface

When applying inband control of remote transcoders and rate adaptors, according to GSM 08.60 the radio subsystem functions in the BTS are referred to as the Channel Codec Unit (CCU) and the remote transcoders and rate adaptors in the BSC as the Transcoder and Rate Adaptor Unit (TRAU).

The functions of the CCU and the TRAU are indicated in the following. See also Figure 11-2 in this specification.

CCU (BTS):
- the channel codec
- the Speech Handler
- the RAA rate adaptation
- the RA1/RA1' rate adaptation
- a control function

TRAU (BSC):
- the speech transcoders
- the Remote Speech Handler
- the RAA rate adaptation
- the RA2 rate adaptation
- a remote control function

The channel codec is tested in section 2.1 and the full rate speech transcoder in section 7.1.4.1. Rate adaptation functions relating to the A-bis-interface (the RAA functions) are tested in section 7.1.4.4 together with other rate adaptation functions (RA1/RA1' and RA2). Of the functions listed above only the local and remote Speech Handlers and control functions, and the interactions between them, are tested in this section.
The frames transmitted over the A-bis-interface are transmitted as 320 bits every 20 ms (16 kbit/s) and are referred to as TRAU frames. For further information see GSM 08.60.

7.3.2. Coding of A-bis-interface TRAU frames

The following types of TRAU frames are transmitted over the 16 kbit/s A-bis-interface:

1. Speech frames
2. O&M frames
3. Data frames
4. Idle speech frames

The coding of these frames is defined in detail in GSM 08.60 and is seen as tested implicitly by other tests.

7.3.3. Controlled elements

7.3.3.1. Configuration aspects

7.3.3.1.1. Resource Allocation

DEFINITION

When a channel activation procedure as tested in section 7.1.3.10 is needed, eg an ASSIGNMENT REQUEST message is input to the BSC on the MSC-interface, the BSC allocates an appropriate TRAU to the circuit assigned between BSC and BTS and sends a CHANNEL ACTIVATION message to the BTS. The BTS allocates the appropriate radio resources and a CCU and instructs the CCU to start sending uplink frames of the appropriate type, and responds with a CHANNEL ACTIVATION ACKNOWLEDGE message.

NOTE: The Layer 3 procedure including normal and abnormal conditions is tested in section 7.1.3.10.

The TRAU responds by setting the mode of operation accordingly and sending downlink frames with the correct frame type as an acknowledgement. In the case of speech the time alignment bits are set to "no change". See also section 7.3.3.5.1 (Initial time alignment).

NOTE: It is understood that the TRAU and the CCU are logical units with logical addresses which each one in principle can allocate all modes of operation. This does not mean, however, that each one physically contains each mode. Resource sharing is applicable.

METHOD OF TEST

1. A CHANNEL ACTIVATION message shall be sent to the BTS requesting a specific mode of operation. The response on the A-bis-interface shall be recorded.
2. Step 1 shall be repeated for each mode of operation available in the BTS.

REQUIREMENTS
In the case of step 1, a CHANNEL ACTIVATION ACKNOWLEDGE message and TRAU frames of the correct type shall occur on the A-bis-interface connection. In the case of speech mode, the frames shall be idle speech frames and the Time Alignment bits shall be set to "no change" and the BTS shall then be in the initial Time Alignment state.
In the case of step 2, the same requirements as in step 1 applies.

7.3.3.1.2. In-call Modification

DEFINITION

When the channel mode modify procedure as tested in section 7.1.3.11 is needed, the CCU takes action by sending the new frame type, channel type uplink in the TRAU frames to the TRAU. The TRAU responds by changing the mode of operation and sets the same frame type in the downlink.

METHOD OF TEST

1. A channel shall be activated on the A-bis-interface on a full-rate traffic channel in one of the modes possible for a full-rate traffic channel.
2. A MODE MODIFY message shall be input on the A-bis-interface requesting a specific mode of operation. The response on the A-bis-interface shall be recorded.
3. Step 2 shall be repeated until all modes possible for a full-rate traffic channel have been tested.
4. Steps 1-3 shall be repeated for a half-rate traffic channel.

REQUIREMENTS

In the case of step 2, the BTS shall respond with a MODE MODIFY ACKNOWLEDGE message and with TRAU frames of the same mode as indicated in the MODE MODIFY message on the A-bis-interface connection.
In the case of steps 3 and 4, the same requirements as in step 2 apply.

7.3.3.1.3. Resource release

When release of circuit switched resources, eg as tested in section 7.1.3.16 (radio channel release) or in section 7.1.3.18 (channel release) is needed, the BSC will initiate the release internally by indicating this to the TRAU.
Testing of this procedure does not apply to the BTS.

7.3.3.2. Uplink DTX operation

The overall operation of the full rate DTX receiver functions are described in GSM 06.31, consisting of, apart from the channel decoder, a SID frame detection function which is part of the Speech Handler in the BTS.
The side information to be transmitted uplink from the BTS with the speech frame over the A-bis-interface is a binary Bad Frame Indication (BFI) flag, a binary Time Alignment Flag (TAF) and a ternary Silence Descriptor (SID) flag.
The uplink RX DTX functions are tested in section 7.1.4.1.3.

7.3.3.3. Downlink DTX operation

It is a national or operator specific matter whether or not to implement downlink DTX in a GSM Base Transceiver Station.
If implemented, the overall operation of the full rate DTX transmitter functions are described in GSM 06.31, consisting of, apart from the channel encoder, an SP flag handling and monitoring function which in this case is the Speech Handler in the BTS.
The side information to be transmitted with the speech frame over the A-bis-interface is a binary flag Speech (SP). SP=1 indicates that the TRAU frame is a speech frame and SP=0 indicate that the TRAU frame is a special SID-frame. This flag is used in the BTS for control of the radio transmission.
The downlink TX DTX functions are tested in section 7.1.4.1.6.

7.3.3.4. O&M procedures

The transfer of O&M information between the BSC and the TRAU may be done in 2 ways:

1. The BSC treats the O&M information internally, either by manufacturer specific solutions internal to the BSC or using the O&M TRAU frames.
2. The BSC uses the BTS as a relay function using O&M TRAU frames.

The choice between the two methods might depend on the BSS type and is a national or operator specific matter.

7.3.3.4.1. O&M TRAU frames from TRAU to BTS

DEFINITION

If a CCU receives an O&M TRAU frame from the TRAU, the BTS shall send the identical frame back to the TRAU as acknowledgement, and put the 264 data bits from the received frame into an appropriate O&M message as defined by the operator or the manufacturer and send it to the BSC.

METHOD OF TEST

1. The BSSTE shall input an O&M TRAU frame to the BTS on the A-bis-interface. The response on the A-bis-interface shall be recorded.

REQUIREMENTS

In the case of step 1, an O&M TRAU frame identical to the one received shall occur on the A-bis-interface. Then, an appropriate O&M message as defined by the operator or the manufacturer containing the information of the received TRAU frame shall occur on the A-bis-interface.

7.3.3.4.2. O&M TRAU frames during a call

DEFINITION
If the CCU receives O&M TRAU frames during a call, the FACCH flag shall be set in the frames transmitted on the radio interface.

METHOD OF TEST
1. A call shall be set up between the radio interface and the A-bis-interface of the BTS.
2. An O&M TRAU frame shall be input on the A-bis-interface. The response on any interface shall be recorded.

REQUIREMENTS
In the case of step 2, the frame transmitted on the radio interface shall have the FACCH frame stealing flag set and should contain a LAPDm fill frame, and an O&M TRAU frame identical to the one received shall occur on the A-bis-interface. Then, an appropriate O&M message as defined by the Operator or the manufacturer containing the information of the received TRAU frame shall occur on the A-bis-interface.

7.3.3.4.3. O&M messages from the BSC

DEFINITION
If the BTS receives an O&M message as defined by the Operator or the manufacturer containing O&M TRAU information from the BSC, the BTS puts the 264 data bits from the received message into an O&M TRAU frame and then the CCU allocated to the addressed connection passes the frame on to the TRAU.

METHOD OF TEST

1. A call shall be set up and then an O&M message as defined by the operator or the manufacturer containing O&M TRAU information and with the repetition indicator set to "repeated sending" shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded.
2. Another O&M message as defined by the operator or the manufacturer addressing the same TRAU shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded.
3. If the repeated sending method is applied, the test is stopped by an O&M message as defined by the operator or the manufacturer returning the CCU to normal operation. The response on the A-bis-interface shall be recorded.

REQUIREMENTS

In the case of step 1, the 264 data bits received from the BSC shall be reconstructed on the A-bis-interface to the addressed TRAU every 20 ms in an O&M TRAU frame.
In the case of step 2, the same requirements as in step 1 apply, with a different information content.
In the case of step 3, no more O&M TRAU frames shall occur on the A-bis-interface.

7.3.3.5. Time Alignment of A-bis-interface frames

Due to the A-bis-interface some specific problems arise:

1. The BSC will have no information about the timing on the radio interface in the BTS and will start sending TRAU frames at an arbitrary or default time which may be received in the BTS up to 319 bits out of phase (out of 320 bits).
2. The different timeslots in a TRX (ie a carrier in a BTS without SFH) are sent at different times.
3. The transmission between the BSC and the radio interface may use different routes and may take different times.

For the above reasons, since the BSC cannot know when to start transmitting and since any buffering in the BTS will add to the transmission delay, time alignment of downlink TRAU frames on the A-bis-interface is needed.
Time Alignment of TRAU frames applies only to the speech mode of operation.

7.3.3.5.1. Initial Time Alignment

DEFINITION

The function of the CCU in the BTS is to detect the need for a Time Alignment and signal this to the TRAU in the BSC.

METHOD OF TEST

1. A CCU shall be allocated, and then TRAU frames with a large phase mismatch to the radio interface timing shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded.
2. TRAU frames with a phase mismatch (advance) less than 500 us to the radio interface timing shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded. Every 4th TRAU frame shall be aligned with whatever is received from the BSC and the gap between the previous frame and the delayed frame shall be filled with all "1"s.
3. TRAU frames with a phase mismatch less than or equal to 250 us (delay and advance) to the radio interface timing shall be input on the A-bis-interface. The response on the A-bis-interface shall be recorded. Every 4th TRAU frame shall be aligned with whatever is received from the BSC. If the aligned frame is delayed the gap between the previous frame and the delayed frame shall be filled with four "1"s. If the aligned frame is advanced the four last bits of the previous frame (the T-bits) shall not be sent.

REQUIREMENTS

In the case of step 1, a TRAU frame shall occur on the A-bis-interface commanding a large Time Alignment corresponding to the phase mismatch from the BSC.
In the case of step 2, TRAU frames shall occur on the A-bis-interface commanding Time Alignments (delays only) corresponding to the phase mismatch from the BSC or "no change".
In the case of step 3, TRAU frames shall occur on the A-bis-interface commanding Time Alignments (delays and advances) corresponding to the phase mismatch from the BSC or "no change".

7.3.3.5.2. Static Time Alignment

The static Time Alignment procedure in the BTS is covered by the test of the initial Time Alignment procedure in section 7.3.3.5.1.

7.3.3.5.3. Time Alignment during external handover

The Time Alignment procedure in the BTS during external handover is covered by the test of the initial Time Alignment procedure in section 7.3.3.5.1.

7.3.3.5.4. Time Alignment during internal handover

The Time Alignment procedure in the BTS during internal handover is covered by the test of the initial Time Alignment procedure in section 7.3.3.5.1.

7.3.3.6. Frame synchronization

7.3.3.6.1. Search for Frame Synchronisation

The search for frame synchronization is tested implicitly by other tests.

7.3.3.6.2. Frame Synchronisation After Performing Downlink Timing Adjustments

This procedure is not tested explicitly.

7.3.3.6.3. Frame synchronisation monitoring and recovery

DEFINITION

The frame synchronization monitoring is a contionuous process. Loss of frame synchronization is assumed when at least 3 consecutive frames, each with at least one framing bit error, are detected.

METHOD OF TEST

1. A call shall be set up. Speech frames shall be input continuously on the A-bis-interface.
2. 3 consecutive TRAU speech frames with one framing error per frame followed by correct frames shall be input on the A-bis-interface. Any message generated by the BTS shall be recorded.
3. Continuous TRAU speech frames with one framing error per frame shall be input on the A-bis-interface. Any message generated by the BTS shall be recorded.
4. A new call shall be set up using a data channel. Then steps 2 and 3 shall be repeated.

REQUIREMENTS

In the case of step 2, the operation of CCU in the BTS shall be unaffected. No messages shall be generated by the BTS.
In the case of step 3, the BTS shall initiate the release of the call after 1 s, and an O&M message as defined by the operator or the manufacturer shall occur on the A-bis-interface.
In the case of step 4, the same requirements as in steps 2 and 3 apply.

7.3.3.7. Error protection on the A-bis-interface

If a TRAU frame is received in the BTS with detectable errors in the control bits (undefined combinations), then the control information is ignored. The speech or data bits are handled as if no error had been detected.
This procedure is not tested explicitly.

7.4. SUBMULTIPLEXING OF TERRESTRIAL CHANNELS ON THE A-BIS-INTERFACE

If the transcoders and rate adaptors are located in the BSC or at the MSC-site, 16 kbit/s per user channels are used on the A-bis-interface. In this case the rate adapted bitsreams which have the rate of 16 kbit/s may be multiplexed on to a 64 kbit/s channel before passing over the A-bis-interface. Whether or not to include this multiplexing is, however, up to the operator.
The submultiplexing shall, if used, be done according to recommendation CCITT I.460 as defined in GSM 08.54 (ie using bits 1-2, 3-4, 5-6 or 7-8). The submultiplexing of channels is seen as tested implicitly by the rate adaptation tests and the appropriate Layer 1 tests in sections 7.1.4 and 3.1, respectively.

8. BASE STATION SYSTEM NETWORK MANAGEMENT ASPECTS

The Network Management (NM) aspects of the GSM PLMN are described in the GSM 12-series of specifications. For the BSS these consist of requirements for interfacing with the OMC and Operations and Maintenance (O&M) functions of the BSS.

8.1. INTERFACING WITH THE OPERATIONS AND MAINTENANCE CENTRE

All signalling for support of Network Management procedures for the BSS are supported over the A-interface between the BSS and the MSC as described in the GSM 08.0x-series of specifications, hence using the layers 1, 2 and 3 of that interface and the BSSOMAP (Base Station System Operations, Administration and Maintenance Application Part) for the layers 4-7. The handling and transfer of O&M information between the BSS and the OMC via the A-interface is described in GSM 08.09.

Optionally, X.25 may be used over the physical A-interface using a 64 kbit/s channel, or an additional physical OMC-interface directly from the OMC to the BSS, the separate OMC-interface, may be supported using X.25 for layers 1-3.

The general requirements for the BSSOMAP are described in GSM 12.01, GSM 12.04, GSM 12.06, GSM 12.07 and GSM 12.11. The detailed requirements for the BSSOMAP are described in GSM 12.20. The BSSOMAP is tested in sections 8.1.4-7 in this specification and in GSM 11.21.

Irrespective of the lower layer implementation of the interface to the OMC, the interface is referred to as the OMC-interface. In accordance with GSM 12.01, the protocol stack on the OMC-interface is illustrated in fig 8-1.

8.1.1. Physical Layer 1

Over the physical A-interface the Layer 1 shall be a 64 kbit/s channel of a 2048 kbit/s PCM link as defined in GSM 08.04. The Layer 1 testing is then covered by section 4.1 in this specification.

Over the separate OMC-interface, if used, the Layer 1 shall be according to recommendation CCITT X.25 as defined in GSM 08.09 and GSM 12.01. Layer 1 shall then be tested according to the relevant parts of the Layer 1 testing in:

NET 2 (Norme Europeenne de Telecommunication): Approval requirements for data terminal equipment to connect to packet switched public data networks using CCITT recommendation X.25 (1984) interface.

8.1.2. Link Layer 2

Over the physical A-interface the Layer 2 may use the MTP and SCCP of CCITT signalling system no 7 as defined in GSM 08.06. The Layer 2 testing is then covered by section 4.2 in this specification.
Optionally, the Layer 2 over the physical A-interface may be according to recommendation CCITT X.25 (LAPB) / ISO 7776 as defined in GSM 08.09 and GSM 12.01. Layer 2 shall then be tested according to the relevant parts of the Layer 2 testing in:

NET 2 (Norme Europeenne de Telecommunication): Approval requirements for data terminal equipment to connect to packet switched public data networks using CCITT recommendation X.25 (1984) interface.

Over the separate OMC-interface, if used, the Layer 2 shall be according to recommendation CCITT X.25 (LAPB) / ISO 7776 as defined in GSM 08.09. Layer 2 shall then be tested as for the physical A-interface using CCITT recommendation X.25.

8.1.3. Network Layer 3

Over the physical A-interface the Layer 3 protocol shall be based on the SCCP of CCITT signalling system no 7 as defined in GSM 08.08, GSM 08.09 and GSM 12.01. The Layer 3 testing is then covered by section 4.2 in this specification.

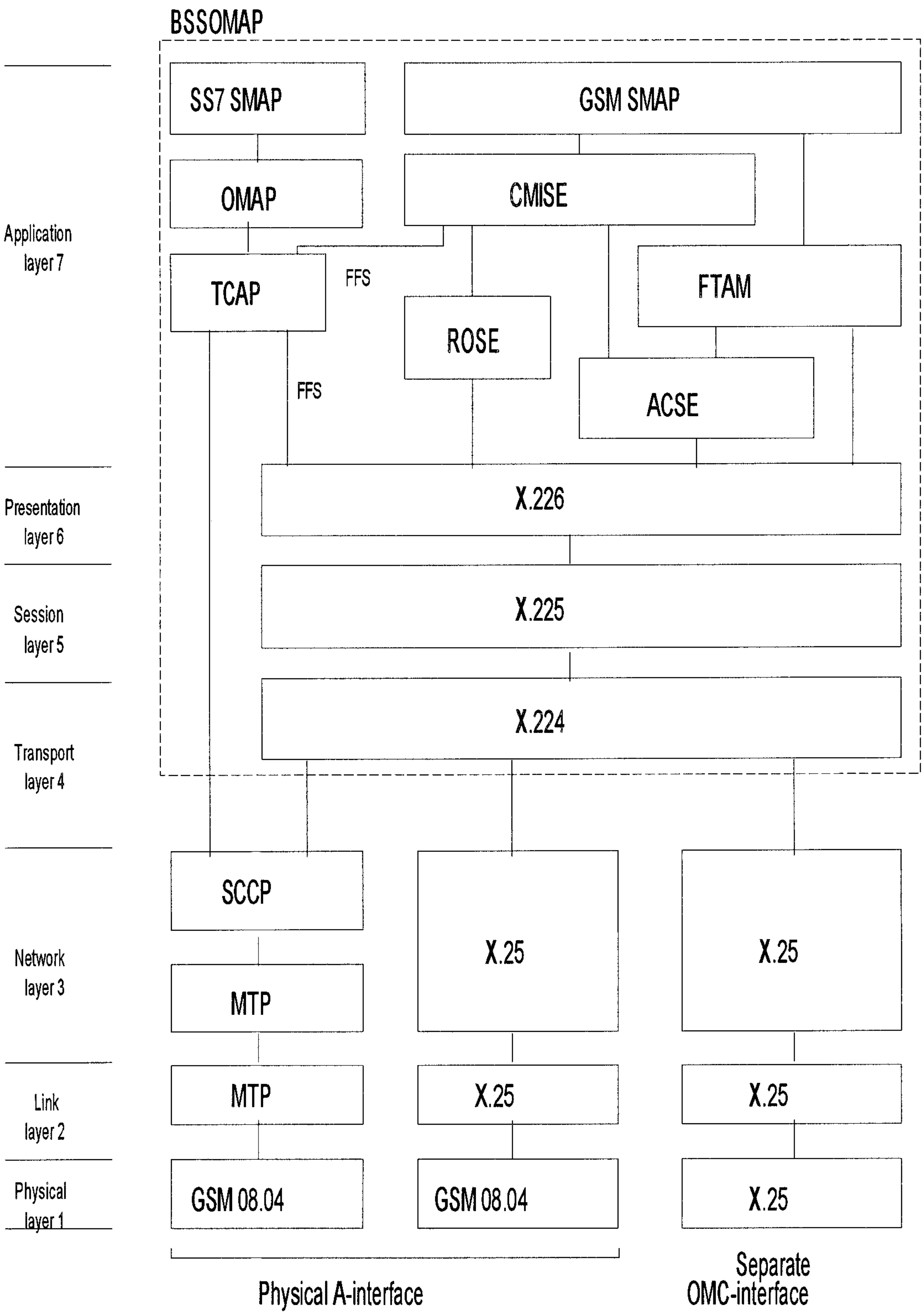


Fig 8-1. Protocol stack in the BSS for Network Management procedures on the OMC-interface

Optionally, the Layer 3 protocol over the physical A-interface may be based on recommendation CCITT X.25 / ISO 8208 as defined in GSM 08.09 and GSM 12.01. Layer 3 shall then be tested according to the relevant parts of the Layer 3 testing in:

NET 2 (Norme Europeenne de Telecommunication): Approval requirements for data terminal equipment to connect to packet switched public data networks using CCITT recommendation X.25 (1984) interface.

Over the separate OMC-interface, if used, the Layer 3 protocol shall be based on recommendation CCITT X.25 / ISO 8208 as defined in GSM 08.09. Layer 3 shall then be tested as for the physical A-interface using CCITT recommendation X.25.

8.1.4. Transport Layer 4

The Layer 4 protocol shall be based on CCITT recommendation X.224/ ISO 8073 as defined in GSM 12.01.
Testing of Layer 4 is a national or operator specific matter.

8.1.5. Session Layer 5

The Layer 5 protocol shall be based on CCITT recommendation X.225/ ISO 8327 as defined in GSM 12.01. Layer 5 shall be tested according to the relevant parts of recommendation:

ISO 10168 "Information processing systems - Open Systems Interconnection - Conformance test suite for the session protocol"

8.1.6. Presentation Layer 6

The Layer 6 protocol shall be based on CCITT recommendation X.226/ ISO 8823 as defined in GSM 12.01.
Testing of Layer 6 is a national or operator specific matter.

8.1.7. Application Layer 7

The Layer 7 protocol consists of a set of sublayers and service elements. As defined in GSM 12.01, Layer 7 shall be based on the recommendations:

- CCITT X.227 / ISO 8650 "ACSE (Association Control Service Element)"
- CCITT Q.711 / CCITT Q.775 "TCAP (Transaction Capabilities Application Part)"
- ISO 8571 "FTAM (File Transfer Access and Management)"
- CCITT X.229 / ISO 9072 "ROSE (Remote Operations Service Element)"
- CCITT Q.795 "OMAP (Operations, Administration and Maintenance Application Part)"
- ISO 9596 "CMISE (Common Management Information Service Element)"

and the GSM specific application procedures, the SMAP (System Management Application Procedures), are specified in GSM 12.20.
The SMAP is tested in GSM 11.21 section 2 as BSS Network Management functions.
The general purpose Layer 7 protocols described above shall be tested according to the relevant parts of the recommendations:

- ACSE : ISO 10169 "Information processing systems - Open Systems Interconnection - Conformance test suite for the ACSE protocol"
- TCAP : National or operator specific matter
- FTAM : ISO 10170 "Information processing systems - Open Systems Interconnection - Conformance test suite for the FTAM protocol"
- ROSE : National or operator specific matter
- OMAP : National or operator specific matter
- CMISE: National or operator specific matter

NOTE: Work on conformance testing for higher layer protocols above is currently going on in ISO. The status of the referenced documents may improve continuously and conformance tests for non-referenced test protocols may also emerge soon.

8.2. BSS NETWORK MANAGEMENT FUNCTIONS

See GSM 11.21 section 2.

9. BASE STATION CONTROLLER NETWORK MANAGEMENT ASPECTS

The Network Management (NM) aspects of the GSM PLMN are described in the GSM 12-series of specifications. For the BSC these consist of requirements for interfacing with the OMC and Operations and Maintenance (O&M) functions of the BSC.

9.1. INTERFACING WITH THE OPERATIONS AND MAINTENANCE CENTRE

The interfacing on layers 1-6 and the general layer 7 sublayers on the OMC-interface is covered by section 8.1 in this specification.

9.2. BSC NETWORK MANAGEMENT FUNCTIONS

See GSM 11.21 section 3.

10. BASE TRANSCEIVER STATION NETWORK MANAGEMENT ASPECTS

The Network Management (NM) aspects of the GSM PLMN are described in the GSM 12-series of specifications. For the BTS these consist of requirements for O&M interfacing with the BSC and Operations and Maintenance (O&M) functions of the BTS.

10.1. O&M INTERFACING WITH THE BASE STATION CONTROLLER

The O&M interfacing on layers 1 and 2 on the A-bis-interface is covered by section 3 in this specification.

10.2. BTS NETWORK MANAGEMENT FUNCTIONS

See GSM 11.21 section 4.

11. TEST POINTS AND INTERFACES

11.1. EXTERNAL INTERFACES

The mandatory external interfaces of the BSS according to Figure 1-1 are listed below:

1. The antenna connector.
2. The A-interface to the MSC.

An additional optional external interface may be required on a national basis:

3. The separate OMC-interface.

11.2. INTERNAL TEST POINTS AND INTERFACES

In addition to the external interfaces in section 11.1 the following internal logical interfaces shall as a minimum be accessible in the equipment in order to carry out the measurements in this specification:

1. Input and output bit access to 104 kbit/s level, 13 bit linear PCM for full rate speech channels (TCH/FS) in both directions of transmission and reset control of the speech encoder and decoder.
2. Output bit access after channel decoding including frame erasure information (FEI or BFI) for all channel types.
3. Input bit access before channel encoding for all channel types.
4. The optional internal A-bis interface, if used.

Where an internal access is required, the implementation of this is up to the manufacturer. However, in order to physically interface with the BSSTE, the implementation is restricted to the following options:

a. Direct physical access to the logical interface.
b. Physical access via a dedicated external interface adapter.
c. Physical access to bits (insertion and monitoring) before channel encoding/after channel decoding via a loop-back over the radio path as defined in GSM 11.10 for the Mobile Station.
d. Physical access to bits (insertion and monitoring) before channel encoding/after channel decoding from the A-interface using the A-interface rate adaptation functions.
e. Physical access to bits (insertion and monitoring) before channel encoding/after channel decoding from the A-bis-interface using the 16 kbit/s A-bis-interface rate adaptation and speech handling functions, if any.
f. Physical access to 13 bit/8 kHz PCM samples via a special combination of 2 A- or A-bis-interface 64 kbit/s channels.

A dedicated external adapter shall, if used, be supplied by the BSS manufacturer.
The internal test points or interfaces are illustrated in Figure 11-1, Figure 11-2 and Figure 11-3 for the various Base Station System types described in section 1 in this specification.

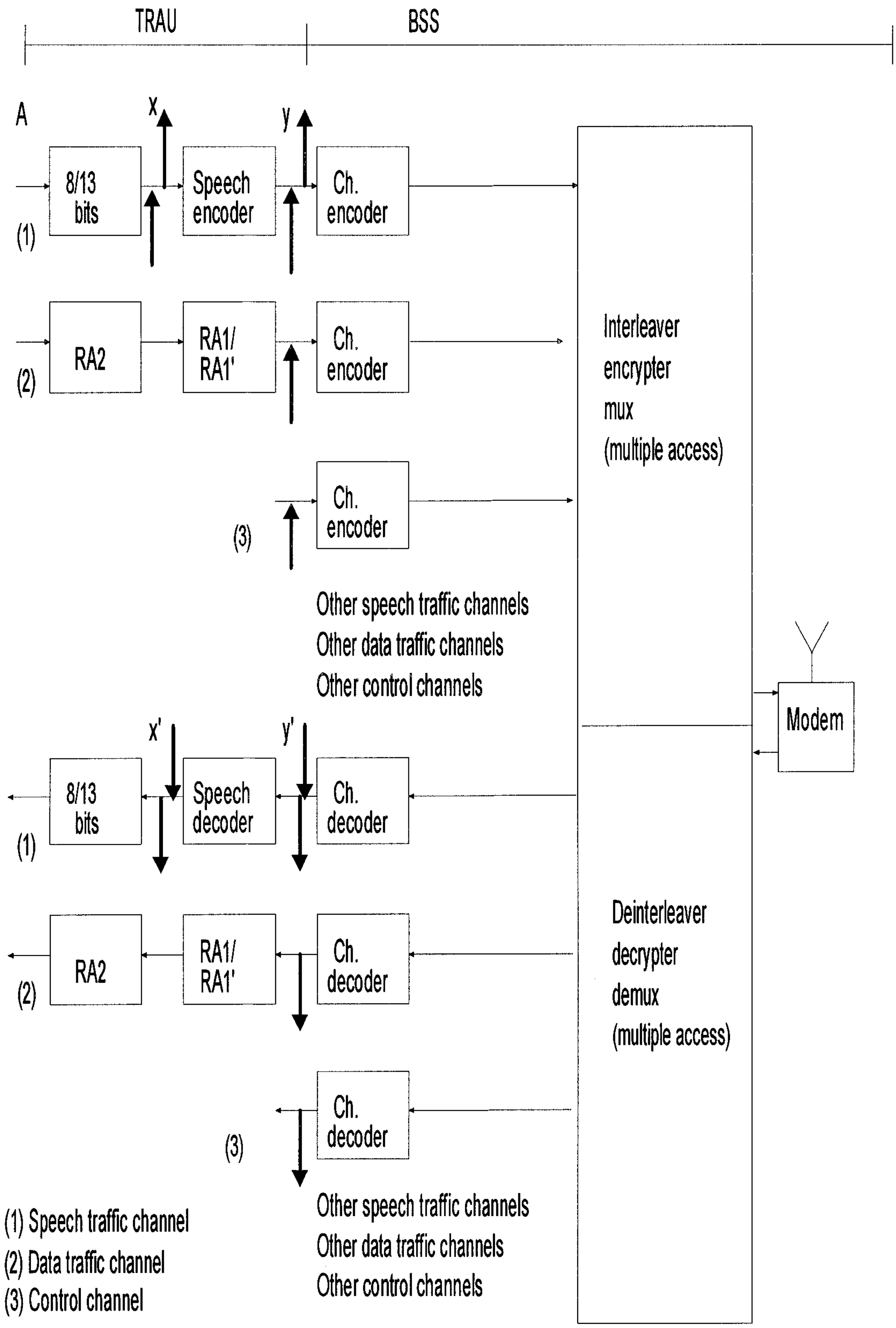


Fig 11-1. Test points or interfaces (BSS type 1)

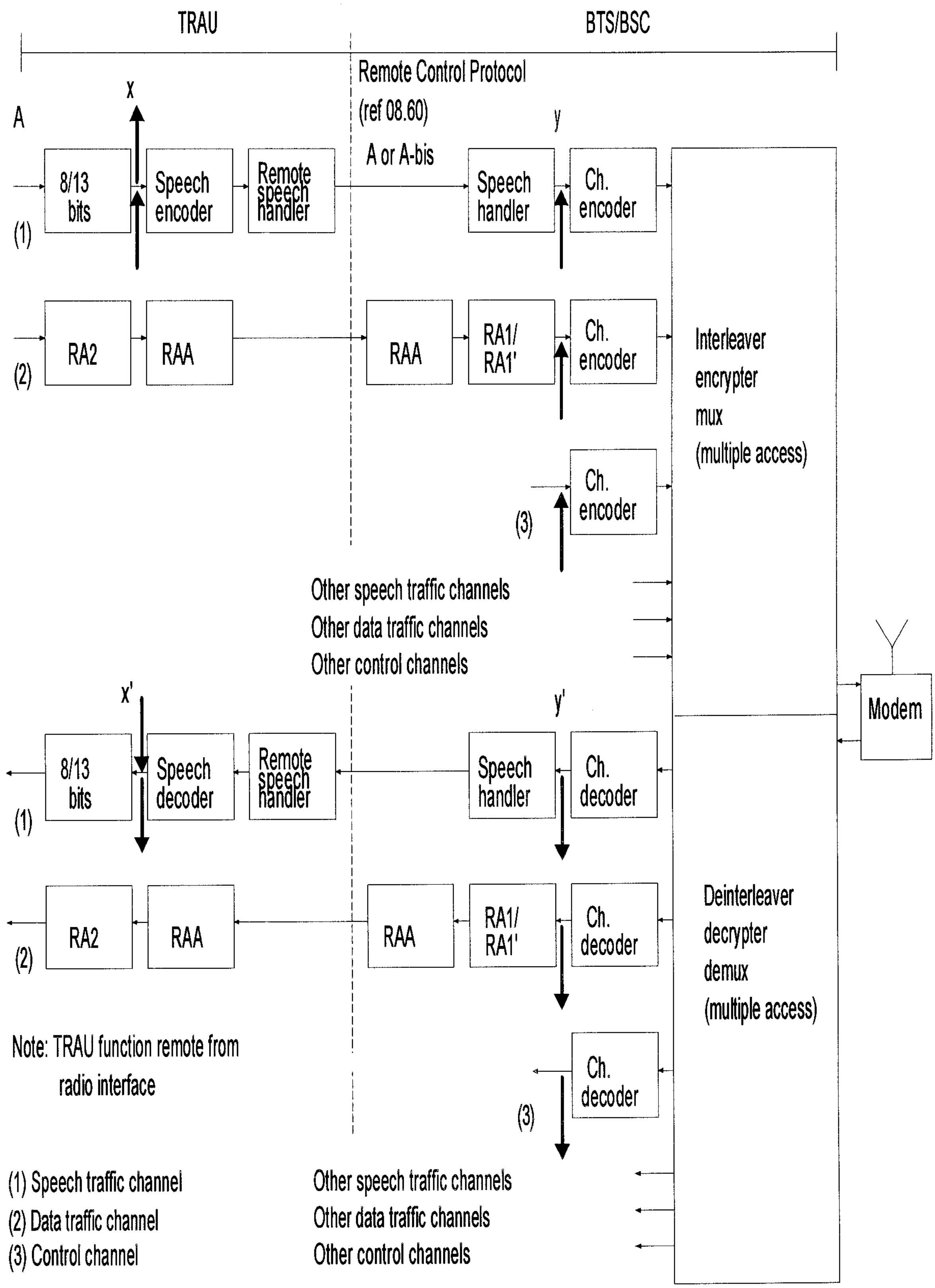


Fig 11-2. Test points or interfaces (BSS types 2, 4-7)

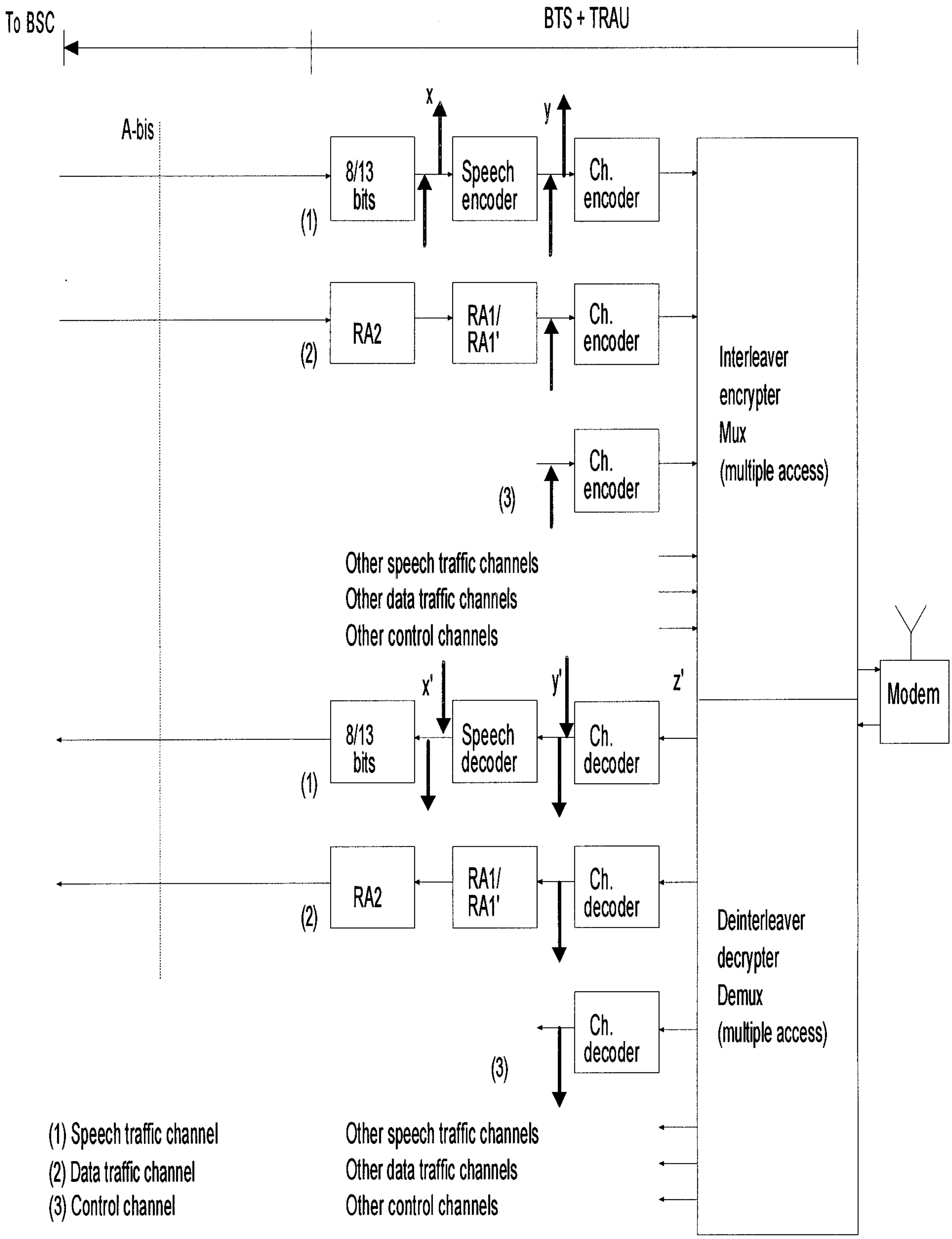


Fig 11-3. Test points or interfaces (BSS type 3)

The detailed specifications of the interface points are:

- Interface point x:
  - TCH/FS:
    - Input / output 104 kbit/s = 13 bit linear PCM at 8 kHz sampling rate
    - Reset control of the full rate speech encoder
  - TCH/HS:
    - Input / output [tbd] kbit/s = [tbd] bits every [tbd] ms
    - Reset control on the half rate speech encoder

  No other channels are applicable.
- Interface point x':
  - TCH/FS:
    - Input / output 104 kbit/s = 13 bit linear PCM at 8 kHz sampling rate
    - Reset control of the full rate speech decoder (or at interface point y')
  - TCH/HS:
    - Input / output [tbd] kbit/s = [tbd] bits every [tbd] ms
    - Reset control on the half rate speech decoder (or at interface point y')

  No other channels are applicable.
- Interface point y:

  Speech:

  TCH/FS: - Input 13 kbit/s = 260 bits every 20 ms

  TCH/HS: - Input [tbd] kbit/s = [tbd] bits every [tbd] ms

Note: For BSS types 4 - 7 input / output can be handled via the Abis interface

  Data:

  TCH/F9.6: - Input 12 kbit/s = 60 bits every 5 ms

  TCH/F4.8: - Input 6 kbit/s = 60 bits every 10 ms

  TCH/F2.4: - Input 3.6 kbit/s = 72 bits every 10 ms

  TCH/H4.8: - Input 6 kbit/s = 60 bits every 20 ms

  TCH/H2.4: - Input 3.6 kbit/s = 72 bits every 20 ms

  Signalling:

  FACCH/F: - Input 184 bits (23 octets) every 20 ms

  FACCH/H: - Input 184 bits (23 octets) every 40 ms

  SACCH/TF: - Input 184 bits (23 octets) every 480 ms

  SACCH/TH: - Input 184 bits (23 octets) every 480 ms

  SACCH/C8: - Input 184 bits (23 octets) every 470.77 ms

  SACCH/C4: - Input 184 bits (23 octets) every 470.77 ms

  SDCCH/8: - Input 184 bits (23 octets) every 235.38 ms

  SDCCH/4: - Input 184 bits (23 octets) every 235.38 ms

  BCCH: - Input 184 bits (23 octets) every 235.38 ms

  PCH: - Input 184 bits (23 octets) every 235.38 ms

  AGCH: - Input 184 bits (23 octets) every 235.38 ms

  RACH: - Not applicable

  SCH: - Input 5 x 25 = 125 bits every 235.38 ms

- Interface point y':

Speech:

TCH/FS: - Input/output 13 kbit/s = 260 bits every 20 ms
- Reset control of the full-rate speech decoder (or at interface point x')

TCH/HS: - Input/utput [tbd] kbit/s = [tbd] bits every [tbd] ms
- Reset control of the half rate speech decoder (or at interface point x')

All outputs of speech channels shall include the Bad Frame Indication (BFI). All bits shall be available, ie also bits in erased frames. No extrapolation shall be done.

Note: For BSS types 4 - 7 input / output can be handled via the Abis interface

Data:

TCH/F9.6: - Output 12 kbit/s = 60 bits every 5 ms
TCH/F4.8: - Output 6 kbit/s = 60 bits every 10 ms
TCH/F2.4: - Output 3.6 kbit/s = 72 bits every 10 ms
TCH/H4.8: - Output 6 kbit/s = 60 bits every 20 ms
TCH/H2.4: - Output 3.6 kbit/s = 72 bits every 20 ms

Signalling:

FACCH/F: - Output 184 bits (23 octets) every 20 ms
FACCH/H: - Output 184 bits (23 octets) every 40 ms
SACCH/TF: - Output 184 bits (23 octets) every 480 ms
SACCH/TH: - Output 184 bits (23 octets) every 480 ms
SACCH/C8: - Output 184 bits (23 octets) every 470.77 ms
SACCH/C4: - Output 184 bits (23 octets) every 470.77 ms
SDCCH/8: - Output 184 bits (23 octets) every 235.38 ms
SDCCH/4: - Output 184 bits (23 octets) every 235.38 ms
BCCH: - Not applicable
PCH: - Not applicable
AGCH: - Not applicable
RACH: - Output 8 bits every 4.62 ms
SCH: - Not applicable

All outputs of control channels shall include the Frame Erasure Indication (FEI). All bits shall be available, ie also bits in erased frames.

ANNEX 1. GENERAL TESTING METHODOLOGY

Tests shall be made under normal test conditions and also, where stated, under extreme test conditions as defined in section A1.2.
The requirements in this section apply to any BSS type or part of a BSS.

A1.1. GENERAL CONDITIONS

The general conditions during the tests shall be according to the relevant parts of recommendation CEPT T/R 24-01 annex 1 (Technical characteristics and test conditions for radio equipment in the land mobile service intended primarily for analogue speech) with the exceptions and additions defined in the subsections below.

A1.1.1. Test signals at the line input of the transmitting unit

The transmitting unit shall be supplied by the measuring equipment connected to the line input. The impedance of the line input circuit shall be according to CCITT recommendation G.703.

A1.1.2. Test signals at the line output of the receiving unit

A measuring equipment connected to line output of the receiving unit shall be able to verify the output signal. The nominal impedance of the line output circuit shall be according to CCITT recommendation G.703.

A1.2. TEST CONDITIONS, POWER SOURCES AND AMBIENT TEMPERATURES

The test conditions, test power sources and ambient temperatures during the tests shall be according to the relevant parts of recommendation CEPT T/R 24-01 annex 1 (Technical characteristics and test conditions for radio equipment in the land mobile service intended primarily for analogue speech) with the exceptions and additions defined in Annex 3.

A1.3. ACCEPTED UNCERTAINTY OF MEASUREMENT EQUIPMENT

The uncertainties of the measurement equipment indicated below are allowed. The uncertainties shall be taken into account in the test setup by correcting the setup with the relevant uncertainty values.
If the measurement equipment has better tolerances, the actual tolerance shall be used for the correction rather than the values indicated below.

1)	D.C. voltage	+/- 1 %
2)	A.C. mains voltage	+/- 1 %
3)	A.C. mains frequency	+/- 0.5 %
4)	Radio frequency	+/- 20 Hz
5)	Radio-frequency voltage	+/- 0.5 dB
6)	Radio-frequency power	+/- 0.5 dB
7)	Radio frequency carrier power	+/- 10 %
8)	Impedance of artificial loads, combining units, cable, plugs, attenuators, etc.	+/- 5 %
9)	Source impedance of generators and input impedance of measuring receivers	+/- 5 %
10)	Attenuation by attenuators	+/- 0.5 dB
11)	Temperature	+/- 1 deg C
12)	Humidity	+/- 5 %
13)	Transmission delay	+/- 0.1 ms
14)	Radio interface bit timing	+/- 0.1 us

A1.4. TESTING OF STATISTICAL PARAMETERS

When measuring statistical parameters like Bit Error Ratios (BERs) or Frame Erasure Ratios (FERs), the statistical nature of the error events may result in a natural variance in the observed test results. This variance will depend on the number of events observed. Consequently, due to such statistical limitations with the aim to reduce the test time to a minimum, some overall requirements should be met, indicating a certain confidence in the observed results.
Defining a "good" BSS as a BSS which on a long term basis (tested over an infinite time) meets the system requirement for an individual test, and a "bad" BSS as a BSS which on a long term basis fails the system requirement for an individual test, the overall requirements are the following:

1. The probability of passing a "good" BSS must be as high as possible.
2. The probability of passing a "bad" BSS must be as low as possible.

A1.4.1. General theoretical methodology

Statistical parameters are measured as a number of error events M within a set of observed events (or samples) N, and the ratio M/N is used as the estimated value. This estimate has a given uncertainty due to the limited statistical material, ie the number of samples N. The general methodology to ensure correct PASS / FAIL decisions is outlined in the following.
Given a random variable Xi output from a random process indicating error/no error, the probability of an error is p and consequently, the probability of no error is 1-p. The expected value E(Xi) and variance Var(Xi) as given in (A1.1), according to the binomial probability distribution.

$$E(Xi) = p \qquad \text{(A1.1a)}$$

$$Var(Xi) = p - p^2 \qquad \text{(A1.1b)}$$

If the number of samples of the event is N, the average X of the random variables Xi is of interest, which has the expected value E(X) and variance Var(X) given in (A1.2), assuming that the random variables Xi are independent.

$$E(X) = p \qquad \text{(A1.2a)}$$

$$Var(X) = (p - p^2)/N \qquad \text{(A1.2b)}$$

Assuming that the error probability p is small, the formula can be simplified as in (A1.3).

$$E(X) = p \qquad \text{(A1.3a)}$$

$$Var(X) = p/N \qquad \text{(A1.3b)}$$

Furthermore, if the number of samples N is great, the probability density of X may be assumed to be Gaussian and the confidence intervals needed to support the overall requirements in section A1.4 above can easily be found.

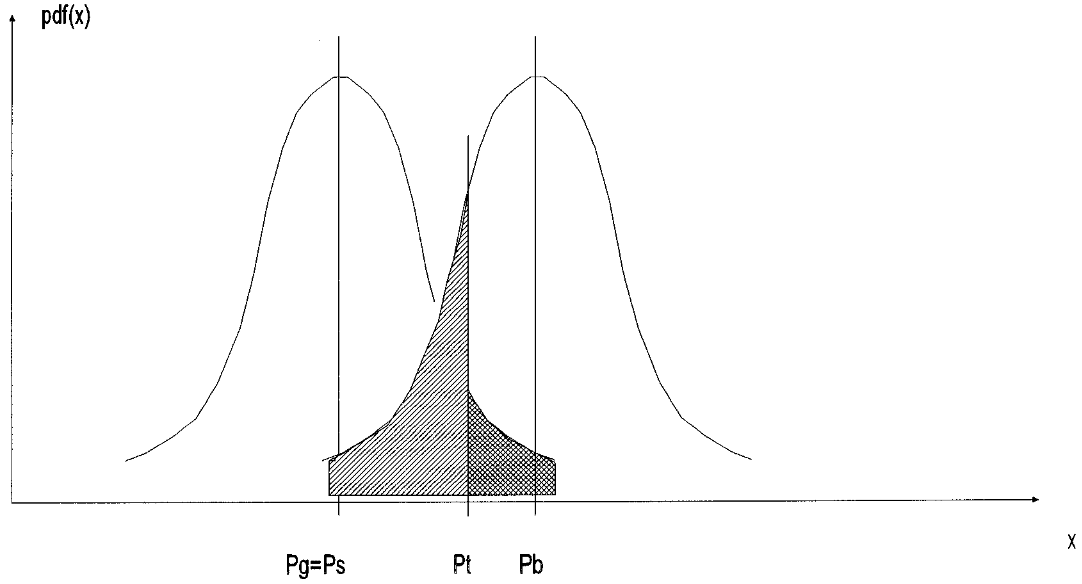
Assuming that a "good" BSS has the real performance Pg when measured over an infinite time and that a "bad" BSS has the corresponding performance Pb, the relationships to the system requirement Ps are the following:

Pg <= Ps (A1.4a)

Pb > Ps (A1.4b)

Irrespective of the values of Pg and Pb, the aim would ideally be to guarantee that the probabilities of passing a "good" BSS, P(PASS|Pg) and the probability of failing a "bad" BSS, P(FAIL|Pb) are as high as possible. Given a certain Pg and a certain Pb, this can be done by increasing the number of samples N until the distributions around Pg and Pb are "narrow" enough, ie the variances are sufficiently reduced, so that there is sufficient space in between for a test requirement Pt with the required confidence. The principle is illustrated in Figure A1-1 with Pg=Ps.

In practice, the above ideal approach can not be used since when Pg or Pb get very close to Ps, the needed number of samples to reduce the variances would be infinite. However, what can be done is to represent Pg by the worst-case Ps and to have a certain confidence of failing a BSS which is a given amount worse than Ps, ie with a fixed Pb. This will, however, give less confidence in failing a "bad" BSS which has a performance closer to Ps. This is the exact principle illustrated in Figure A1-1.



Ps=system requirement

Pt=test requirement

Pg=real performance of a "good" BSS

Pb=real performance of a "bad" BSS

Fig A1-1. Statistical testing

The test requirement Pt will then be as in equation (A1.5) for the overall requirements depending on Ps and Pb, and on the needed number of samples N:

$$Pt = Ps + G\,(Ps/N)^{1/2} \qquad \text{(A1.5a)}$$

$$Pt = Pb - B\,(Pb/N)^{1/2} \qquad \text{(A1.5b)}$$

G and B are the ordinates (in fact the inverse Gaussian Q-function) giving the normalized Gaussian distribution confidence intervals required for passing a "good" BSS and failing a "bad" BSS, respectively.
Finally, if the ratio Pb/Ps is fixed, the number of samples is given by the following equation (A1.6).

$$N = \frac{(G + K^{1/2} B)^2}{(K - 1)^2 Ps} \quad , Pb = K\,Ps \qquad \text{(A1.6)}$$

A1.4.2. Detailed theoretical methodology

The total number of statistical tests indicated in appendix 1 (excluding blocking, intermodulation etc) are 95, and the rules of the tests shall be as follows:

- In order to pass a BSS it must pass all tests.
- A single test which fails should be repeated once. If the BSS fails a 2nd time, the BSS has failed.

This means that the overall probability of passing a good BSS through all the tests is lower than for the individual tests. Taking into account the total of 95 tests, assuming that the outcomes of the tests are independent, and requiring that the total probability of passing a "good" BSS shall be equal to the total probability of failing a "bad" BSS, the overall confidence requirements in section A1.4 above shall ideally be as follows on a test by test basis:

P(PASS|Ps) >= 99.9% (ie G = 3.09)
P(FAIL|Pb) >= 95.0% (ie B = 1.65)

With the above assumptions, the total probabilities of passing a "good" BSS and failing a "bad" BSS will be around 91.0%.

NOTE: If for some reason not all 95 tests are carried out, then the probability of failing a "bad" BSS, P(FAIL|Pb), must be increased accordingly.

Since the test requirement Pt will lie somewhere in between the system requirement Ps and Pb, and that an uncertainty in test equipment resulting from imperfections in the randomness of pseudo-random generators etc can be expected to give errors of the order of +/- 5% , the ratio Pb/Ps should be 2.
Under idealized assumptions, the resulting minimum number of samples needed to meet the overall confidence requirements is indicated as a function of the system requirement Ps using (A1.6) in Table A1-1.
The ratio of the test requirement Pt to the system requirement Ps will in this case be:

Pt = 1.57 Ps

NOTE: It is possible to reduce the needed number of samples. In that case the ratio Pb/Ps must be increased, or the confidence levels must be reduced, see equation (A1.5). It is preferrable to keep the confidence and to increase Pb/Ps. However, the accepted error rate Pt, and Pb, should not deviate too much from the system requirement Ps, especially for high Ps. In order to have meaningful requirements it may even be desirable to reduce Pb/Ps for high Ps.

Error rate Ps:	Min no of samples:
1.0 E-1	300
1.0 E-2	3 000
1.0 E-3	30 000
1.0 E-4	300 000
1.0 E-5	3 000 000

Table A1-1: Minimum number of samples for statistical testing

A1.4.3. Limitations and corrections to the theoretical methodology

The idealized assumptions resulting in Table A1-1 are:

1. All random variables Xi (error events) are assumed to be independent.
2. The observed random variable X is assumed to have a Gaussian distribution.
3. All random variables Xi (error events) are assumed to be outputs of stationary random processes with identical distributions.
4. The system requirement Ps is assumed to be sufficiently small.

A1.4.3.1. Independent errors

The assumption that all error events are independent does not strictly hold. The fact that error events are mutually dependent, would increase the variance of the observed random variable X, and consequently, the number of samples needed for the confidence required should be multiplied by some factor indicating the number of error events which on average are completely correlated.

- For FERs the events occur so seldomly that the events may be regarded as independent (factor of 1), the exception being TCH/FS and FACCH which should have a factor of 2.
- Since a convolutional decoder on average will produce burst errors of the order of the constraint length, BERs and RBERs should have a factor of 5.

Generally, the situation will be such that a "good" BSS will have a performance Pg which is better than Ps. Consequently, the number of samples found in all cases by (A1.6) should be multiplied by an additional factor of 2.

A1.4.3.2. Gaussian distribution

The assumption of a Gaussian distribution for the observed random variable X should hold in most cases due to the high number of samples used.

A1.4.3.3. Stationary random processes

The assumption that the error events are outputs of stationary random processes with identical distributions holds generally for static propagation conditions. However, for multipath propagation conditions this is not true. On the other hand, the multipath radio channel may be assumed to be stationary for short periods of time. Taking into account the worst-case situation of flat fading where the distance between fades is a wavelength, the channel may be assumed to change eg 10 times per wavelength and to be short term stationary in between. This means that all the different random variables Xi (error events) have a different pi and consequently different E(Xi) and Var(Xi). Since all pi are unknown and only the random variable X, which is the average of all Xi, is observed against a system requirement Ps, the statistical parameters of (A1.7) result in the case of multipath propagation conditions assuming that all pi are independent.

$$E(X) = 1/N \sum_{i=1}^{N} p_i \overset{def}{=} p \qquad (A1.7a)$$

$$Var(X) = p/N - 1/N^2 \sum_{i=1}^{N} p_i^2 \qquad (A1.7b)$$

Also in this case the variance can (and must) be simplified to p/N if all pi are small. However, in this case the second term of (A1.7b) is dominated by the greatest pi and the simplification is less valid than for static propagation conditions. Nevertheless, the needed number of samples given by (A1.6) is conservative because the variance would ideally be lower. On the other hand, if the fact that the different pi are likely to be correlated with positive correlation is taken into account, Var(X) will increase and the simplification to p/N might be adequate.

Since under multipath conditions the observed random variable X results from an average of a set of random processes, we must ensure that the average takes into account a sufficient number of processes to get an overall stationary process. Requiring an average over 1000 wavelengths (or 10 000 processes if the channel is updated every 10th of a wavelength), the resulting observation period needed is indicated in Table A1-2 if the logical channel in question occupies the basic physical channel all the time. The percentage of the time "on the air" for the logical channel must also be taken into account and consequently, the observation period indicated in Table A1-2 will be increased by an inverse frame filling factor.

Multipath condition:	Time per Wavelength:	Req. observation period:
TU3	400 ms	400 s
TU50	24 ms	24 s
HT100	12 ms	12 s
RA250	5 ms	5 s

Table A1-2: Required observation periods under multipath

A1.4.3.4. Low error ratios

The assumption that the system requirement Ps is sufficiently small holds generally. However, when reaching a high Ps, eg around 10 E-1, the approximation in (A1.3) is not strictly accurate. However, using the correct variance would decrease the needed number of samples, so the assumptions give conservative results.

A1.4.3.5. Total corrections

As a conclusion, the various limitations of the assumptions discussed in the above sections all lead to different increases of the needed number of samples to obtain the required confidence. The different increases must all be taken into account by taking the highest increase, and calculated number of samples are indicated in appendix 1. The overall confidence resulting is possibly slightly lower than 99.9% and 95.0%, but it should be quite close. Considering as well that the different tests are likely to be correlated, will make the overall probabilities of passing a "good" BSS and failing a "bad" BSS higher than indicated.

NOTE: The worst case in terms of test time it is the static sensitivity performance for the SACCH/T, giving 7.9 hours. On average, the test times are around 35.6 min and range from 5.0 s.

A1.4.4. Alternative experimental methodology

The alternative experimental methodology indicated in this section could be used to verify, or possibly modify, the needed number of samples indicated in the previous sections. This would be most useful in the case of multipath propagation conditions where the statistics of the radio channel are very complicated and can not easily fit into simple formulae.
The approach is indicated in the following, and should be carried out once and for all for each multipath propagation condition, for each channel and for each type of error event according to section A1.4.5 to assess the needed number of samples. Then, it can be used ever after for any BSS.

1. Record the number of error events for Np periods of Ns samples (events) under static propagation conditions for an average system requirement Ps and for a given type of error event on a given channel.
2. Estimate the error ratio ERi = Mi/Ns for each of the Np periods.
3. Consider the average ER of all ERi and estimate the expected value E(ER) and the variance Var(ER):

   $$m = E(ER) = 1/Np \sum_{i=1}^{Np} ERi \qquad (A1.8a)$$

   $$s^2 = Var(ER) = 1/Np \sum_{i=1}^{Np} ERi^2 - m^2 \qquad (A1.8b)$$

   The test requirement Pt is found as follows:

   $$Pt = Ps + G\ s \qquad (A1.9a)$$

   and

   $$Pt = K\ Ps - B\ s \qquad (A1.9b)$$

4. The test shall be repeated with a different number of samples Ns until the test requirement Pt differs with less than +/- 5% in (A1.9a) and (A1.9b).

The initial number of samples Ns should be as indicated in appendix 1 and the number of tests Np should be 100.
The average system requirement Ps should be around 1.0 E-2. It can then be assumed that the needed number of samples Ns is inversely proportional to Ps.

A1.4.5. Detailed definition of error events

1) Frame Erasure Ratio (FER):
The frame is defined as erased if the error detection functions in accordance with GSM 05.03 indicate an error. For full-rate speech this is the result of a 3 bit Cyclic Redundancy Check (CRC), for signalling the result of the FIRE code or other block code used. For data traffic the FER is not defined.

    NOTE: For full-rate speech it would ideally be better if the Bad Frame Indication (BFI) is used as frame erasure indication since this is what is directly related to the subjective quality of the perceived speech. For the moment no requirements relate to the BFI, however.
    It is very difficult to assess what is subjectively the optimum combination of Frame Erasure Ratio (FER) and Residual Bit Error Ratio (RBER). This must therefore be avoided and it is essential that the BFI is optimized towards the ideal frame erasures independent of the processing to obtain it, and that the BFI is not biased towards BFI=0 or BFI=1.

2) Residual Bit Error Ratio (RBER):
The RBER is defined as the residual Bit Error Ratio (BER) in frames which have not been declared as erased.

3) Bit Error Ratio (BER):
The BER is the overall Bit Error Ratio (BER) independent of frame erasures or when erased frames are not defined.

A1.5. SHORTENED TEST PROCEDURES

Throughout this equipment specification the tests are described in such a way that each and every test should verify the relevant system requirement under all conditions of relevance to it. A limited effort has been made, however, to limit the testing to some extent. However, to fully characterize a BSS, it is necessary to carry out all the tests specified.
This section gives general guidance on how to limit the overall test time for all tests taking into account the relationship between the various system requirements themselves, and the relationship between the various system requirements concerning the various test parameters.
For tests not treated below, no specific guidance is given. However, intelligent sequencing of the tests can generally reduce test time. This sequencing has to some extent been carried out already.

A1.5.1. Radio Frequency (RF) tests

Most of the RF tests should be carried out under normal test conditions only.
Most RF tests should be carried out using frequencies B, M and T and with varying RF equipment until all the RF equipments in the configuration are tested. Generally, the testing of all the different RF equipments on the frequencies B, M and T could be distributed over all tests provided that an RF equipment is tested on all the 3 frequencies B, M and T some time during all tests. The number of RF equipments depends on the structure and the size of the BSS.

NOTE: If SFH is not supported by the BSS, the frequencies could be generated by a set of RF equipments which either all can dynamically be tuned to all TX frequencies, or which each have a fixed frequency during operation. In both cases all RF equipments must be tested on frequencies B, M and T.
If SFH is supported by the BSS, the testing depends on the TX frequency hopping scheme, whether the hopping is carried out on RF or on baseband. If baseband SFH is used, the BSS will consist of a set of RF equipments which will not change dynamically in frequency. In that case, all RF equipments must be tested on frequencies B, M and T. If RF SFH is used, each RF equipment will hop dynamically on B, M and T and only one test for each RF equipment is required.

Many of the receiver tests should be tested with a variety of multipath conditions for all logical channels. Provided the static reference sensitivity level is tested for all logical channels, testing of only one multipath condition per logical channel may be sufficient given that all multipath conditions are tested for some channels. This should at least verify the existence of appropriate equalization capabilities. For the reference interference level the same applies.

A1.6. DESCRIPTION OF SPECIAL TEST EQUIPMENT

A1.6.1. Base Station System Test Equipment (BSSTE)

The BSSTE is a functional tool for the purpose of acceptance testing of GSM Base Station Systems. The BSSTE functionally carries out all tests described in this equipment specification.

A1.6.2. Fading and multipath propagation simulator

A Multipath Fading Simulator (MFS) shall be included in the radio interface performance measurements to simulate realistic wideband multipath propagation over the mobile radio channel. The following set of standard multipath propagation conditions, as specified by COST 207 and described in GSM 05.05, shall be supported:

1. Typical Urban terrain (TU)
2. Rural terrain (RA)
3. Hilly terrain (HT)

In addition the MFS shall support a special multipath profile, designed to verify the equalization capabilities of the receiver:

4. Equalizer (EQU)

The multipath profiles shall all be simulated over a range of vehicle speeds from 3 km/h to 250 km/h. The speeds 3, 50, 100 and 250 km/h shall be used in particular.
The details of the multipath conditions and the corresponding requirements on the MFS itself are to be found in GSM 11.10 (Mobile Station Conformity Specification).
The MFS is functionally a part of the BSSTE as described in section A1.6.1 in this specification, but may physically be a separate piece of equipment.

A1.7. Measurement Set-Ups for TX-Intermodulation

The following test set-ups are examples for possible solutions for the measurements according to chap. 2.1.6.7 and 2.1.6.8. These measurements are very difficult to perform due to the extreme requirements of the dynamic range. To get reproducible measurements precautions must be taken, so that non-linearities in the test set-up do not influence the measurement results.

Note 1: Care must be exercised in creating the test set-up and good quality cables and connectors must be used. Cables should be physically secured and not disturbed unless necessary.

Note 2: Connectors shall be free of ferro-magnetic substances. Different surface materials on both connectors as well as the applied torque of the connection have an influence on the intermod-performance .

Note 3: Power attenuators normally have an insufficient intermod-performance at high power input levels. Therefore it is recommended to use long cables for attenuation where high power is applied.

A1.7.1. Test set-up for Intermodulation Attenuation (2.1.6.7.)

It is necessary to use different set-ups for the measurement of IM-products in the RX band and outside the RX band.

A1.7.1.1. RX-Band:

A recommended test set-up for the intermodulation attenuation in the receive band is illustrated in fig. A 1-2. A directional coupler is used with the measurement performed on the primary line connector. Sufficient filtering is provided by the duplexer so that the spectrum analyser operates in its linear range. The injected signal is amlpified and filtered to provide sufficient isolation to inhibit self generated intermodulation products in the test set-up.

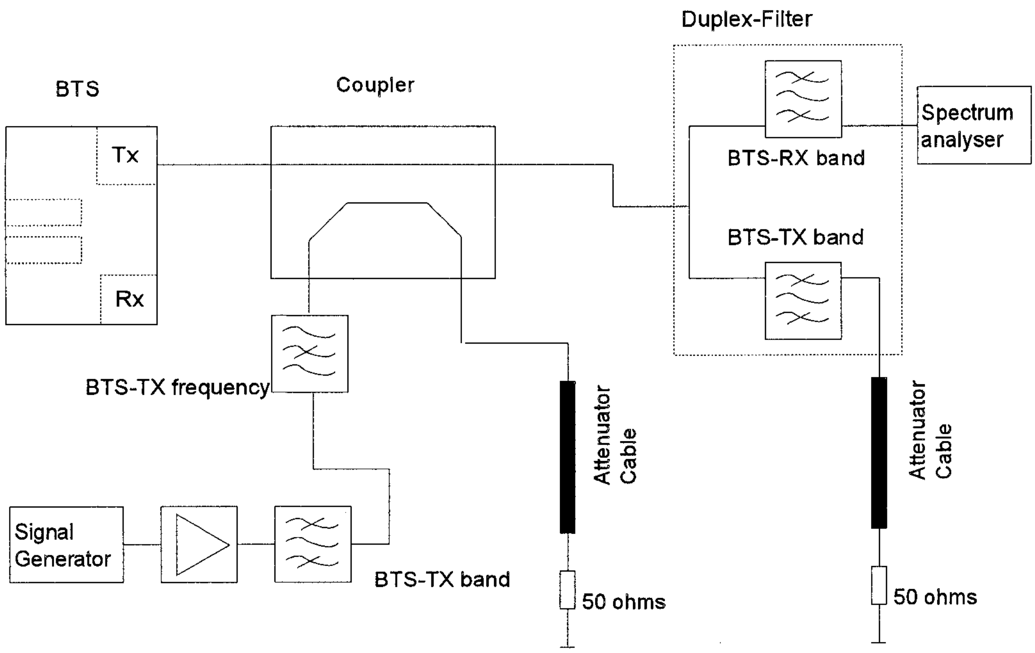


Fig A1-2: Test set-up for Intermodulation Attenuation (2.1.6.7.) RX-Band

A1.7.1.2. Outside RX Band:

A recommended test set-up for the intermodulation attenuation outside the receive band is illustrated in fig. A 1-3. The coupling device shall be specified to operate over sufficient bandwidth to comply with the measurement requirements.

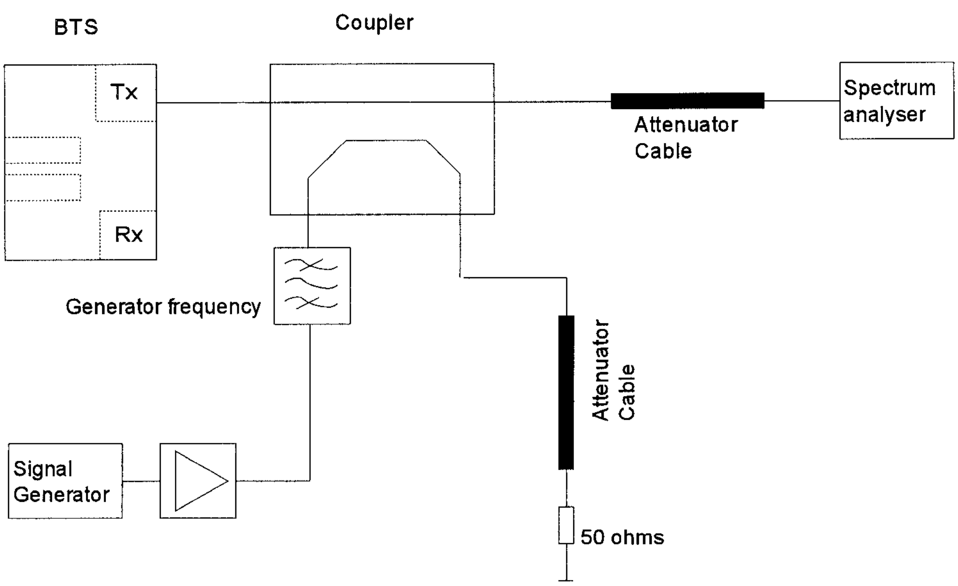


Fig A1-3: Test set-up for Intermodulation Attenuation (2.1.6.7.) outside RX-Band

A1.7.2. Test set-up for Intra BSS Intermodulation Attenuation (2.1.6.8.)

It is necessary to use different set-ups for the measurement of IM-products in the RX band and in the TX band.

A1.7.2.1. RX-Band:

A recommended test set-up for the intra base station intermodulation attenuation in the receive band is illustrated in fig. A 1-4.
The stop band attenuation of the duplex filter has to be high enough to guarantee that the spectrum analyser is working in its linear range.

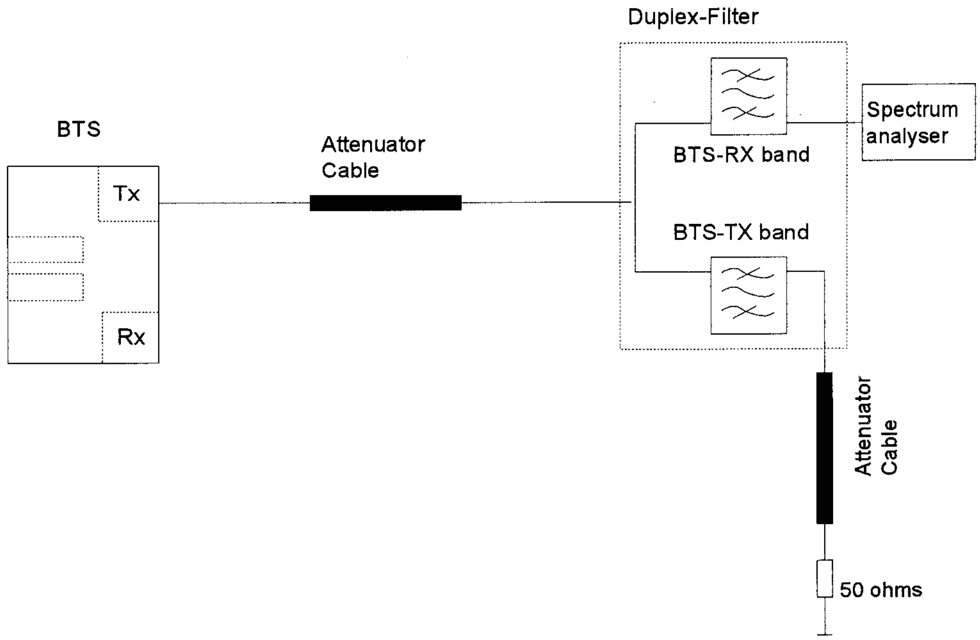


Fig A1-4: Test set-up for Intra Base station Intermodulation Attenuation (2.1.6.8.) RX-Band

A1.7.2.2. TX-Band:

A recommended test set-up for the intra base station intermodulation attenuation inside the transmit band is illustrated in fig. A 1-5. To decrease the dynamic range requirement of the spectrum analyser external filters should be used.

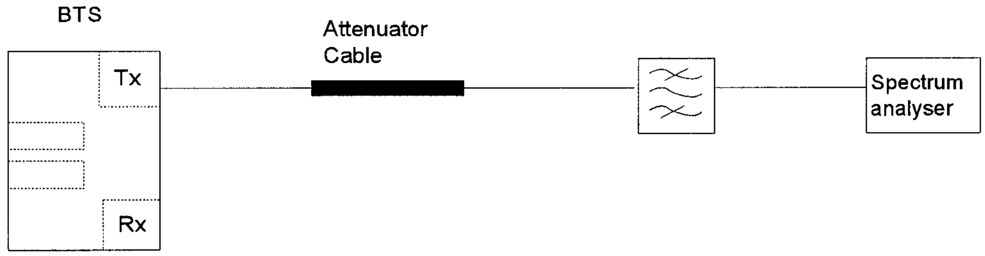


Fig A1-5: Test set-up for Intra Base station Intermodulation Attenuation (2.1.6.8.) TX-Band

ANNEX 2. LIST OF RELEVANT SPECIFICATIONS

A2.1. GSM SPECIFICATIONS

The complete set of GSM specifications is listed below. This list can also be found in GSM 01.01. The roughly estimated impact on this equipment specification (GSM 11.20) is indicated in the column "Influence" as "Low (L)", "Medium (M)" or "High (H)".

Number:	Title:	Influence:
00	Preamble	L
01.01	General Structure of GSM Recommendations	L
01.02	General Description of a GSM PLMN	M
01.04	Vocabulary in a GSM PLMN	M
01.06	Service Implementation Phases and Possible Further Phases in the GSM PLMN	L
01.07	Updating Procedure for GSM Recommendations	L
02.01	Principles of Telecommunication Services supported by a GSM PLMN	L
02.02	Bearer Services supported by a GSM PLMN	L
02.03	Teleservices supported by a GSM PLMN	L
02.04	General on supplementary services	L
02.05	Simultaneous and Alternate Use of Services	L
02.06	Types of Mobile Stations	L
02.07	Mobile Station Features	L
02.08	REPORT: Quality of service	L
02.09	Security Aspects	L
02.10	Provision of Telecommunication Services	L
02.11	Service Accessibility	L
02.12	Licensing	L
02.13	Subscription to the Services of a GSM PLMN	L
02.14	Service Directory	L
02.15	Circulation of Mobile Stations	L
02.16	International MS Equipment Identities	L
02.17	Subscriber Identity Modules, functional characteristics	L
02.20	Collection Charges	L
02.23	International Accounting for the Use of the SS7 Network	L
02.24	Description of Advice of Charge	L
02.30	Man-Machine Interface of the Mobile Station	L
02.40	Procedures for Call Progress Indications	L

02.80	Supplementary Services - general aspects	L
02.81	Number identification Supplementary Services	L
02.82	Call offering Supplementary Services	L
02.83	Call completion Supplementary Services	L
02.84	Multy-party Supplementary Services	L
02.85	Community of interest Supplementary Services	L
02.86	Charging Supplementary Services	L
02.87	Additional information transfer Supplementary Services	L
02.88	Call restriction Supplementary Services	L
03.01	Network Functions	M
03.02	Network Architecture	M
03.03	Numbering, Addressing and Identification	L
03.04	Signalling Requirements Relating to Routing of Calls to Mobile Subscribers	L
03.05	Technical Performance Objectives	L
03.07	Restoration Procedures	L
03.08	Organization of Subscriber Data	L
03.09	Hand-over Procedures	L
03.10	GSM PLMN connection types	M
03.11	Technical Realization of Supplementary Services - general aspects	L
03.12	Location Registration Procedures	L
03.13	Discontinuous Reception (DRX) in the GSM System	L
03.14	Support of DTMF via the GSM system	L
03.20	Security-Related Network Functions	M
03.30	Radio Network Planning Aspects	M
03.40	Technical Realization of the Point-to-point Short Message Service	L
03.41	Technical Realization of Short Message Service Cell Broadcast	M
03.42	REPORT: Technical Realization of advanced data MHS access	L
03.43	Technical Realization of Videotex	L
03.44	Support of Teletex in a GSM PLMN	L
03.45	Technical Realization of Facsimile Group 3 Service - transparent	L
03.46	Technical Realization of Facsimile Group 3 Service - non transparent	L
03.48	REPORT: GSM Short Message Service - Cell Broadcast	M
03.50	Transmission Planning aspects of the speech service in the GSM PLMN system	M
03.70	Routing of Calls to/from PDNs	L

03.81	Technical realization of Number identification Supplementary Services	L
03.82	Technical realization of Call offering Supplementary Services	L
03.83	Technical realization of Call completion Supplementary Services	L
03.84	Technical realization of Multy-party Supplementary Services	L
03.85	Technical realization of Community of interest Supplementary Services	L
03.86	Technical realization of Charging Supplementary Services	L
03.87	Technical realization of Additional information transfer Supplementary Services	L
03.88	Technical realization of Call restriction Supplementary Services	L
04.01	MS-BSS Interface - General Aspects and Principles	M
04.02	GSM PLMN Access Reference Configurations	M
04.03	MS-BSS Interface: Channel Structures and Access Capabilities	M
04.04	MS-BSS Layer 1 - General Requirements	M
04.05	MS-BSS Data Link Layer- General Aspects	M
04.06	MS-BSS Data Link Layer Specification	H
04.07	Mobile Radio Interface Signalling Layer 3 - General Aspects	H
04.08	Mobile Radio Interface Layer 3 Specification	H
04.10	Mobile Radio Interface Layer 3 - Supplemantary Services Specification - General aspects	L
04.11	Point-to-point Short Message Service Support on Mobile Radio Interface	L
04.12	Cell Broadcast Short Message Service support on Mobile radio interface	H
04.21	Rate Adaptation on the MS-BSS Interface	H
04.22	Radio Link Protocol for Data and Telematic Services on the MS-BSS Interface	L

04.80	Mobile radio interface layer 3 - Supplementary Services specification - formats and coding	L
04.81	Mobile radio interface layer 3 - Number identification Supplementary Services specification	L
04.82	Mobile radio interface layer 3 - Call offering Supplementary Services specification	L
04.83	Mobile radio interface layer 3 - Call completion Supplementary Services specification	L
04.84	Mobile radio interface layer 3 - Multy-party Supplementary Services specification	L
04.85	Mobile radio interface layer 3 - Community of interest Supplementary Services specification	L
04.86	Mobile radio interface layer 3 - Charging Supplementary Services specification	L
04.87	Mobile radio interface layer 3 - Additional information transfer Supplementary Services specification	L
04.88	Mobile radio interface layer 3 - Call restriction Supplementary Services specification	L
05.01	Physical Layer on the Radio Path (General Description)	M
05.02	Multiplexing and Multiple Access on the Radio Path	H
05.03	Channel Coding	H
05.04	Modulation	H
05.05	Radio Transmission and Reception	H
05.08	Radio Subsystem Link Control	H
05.10	Radio Subsystem Synchronization	H
06.01	Speech Processing Functions: General Description	H
06.10	GSM Full Rate Speech Transcoding	H
06.11	Substitution and muting of lost frames for full-rate speech traffic channels	H
06.12	Comfort Noise Aspects for full-rate speech traffic channels	H
06.20	Half Rate Speech transcoding	[H]
06.2y	Half Rate DTX aspects	[H]
06.31	Discontinuous Transmission (DTX) for Full Rate Speech Traffic Channels	H
06.32	Voice Activity Detection	H
07.01	General on Terminal Adaptation Functions for Mobile Stations	L
07.02	Terminal Adaptation Functions for Services Using Asynchronuous Bearer Capabilities	L
07.03	Terminal Adaptation Functions for Services Using Synchronuous Bearer Capabilities	L

08.01	General Aspects on the BSS-MSC Interface	M
08.02	BSS-MSC Interface Interface Principles	H
08.04	BSS-MSC Layer 1 Specification	H
08.06	Signalling Transport Mechanism Specification for the BSS-MSC Interface	H
08.08	BSS-MSC Layer 3 Specification	H
08.09	Network Management signalling support related to BSS	M
08.20	Rate adaptation on the BSS-MSC Interface	H
08.51	BSC-BTS Interface: General Aspects	M
08.52	BSC-BTS Interface Principles	H
08.54	BSC-TRX Layer 1: Structure of Physical Circuits	H
08.56	BSC-BTS Layer 2 Specification	H
08.58	BSC-BTS Layer 3 Specification	H
08.59	BSC-BTS O&M Signalling Transport	M
08.60	Inband Control of Remote Transcoders and Rate Adaptors	H
09.01	General Network Interworking Scenarios	L
09.02	Mobile Application Part Specification	L
09.03	Requirements on Interworking between the ISDN or PSTN and the PLMN	L
09.04	Interworking with CSPDN	L
09.05	Interworking between the PLMN and the PSPDN for PAD Access	L
09.06	Interworking between a PLMN and a PSPDN/ISDN for support of packet switched data transmission services	L
09.07	General Requirements on Interworking between the PLMN and the ISDN or PSTN	L
09.09	Detailed Signalling Interworking within the PLMN and with the PSTN/ISDN	M
09.10	Information Element Mapping between MS-BSS/BSS-MSC Signalling Procedures and the MAP	L
09.11	Signalling Interworking for Supplementary Services	L
10.01	General on Service Interworking	L
10.02	Service Interworking for Short Message Services	L
10.03	Service Interworking for Satellite Services	L

11.10	Mobile Station Conformity Specifications (NET 10)	M
11.11	Specification of the internal logical organization of the SIM and its interfaces	L
11.20	The GSM Base Station System: Equipment Specification	*
11.21	The GSM Base Station System: Test specification for Network Management functions	M
11.30	REPORT: Mobile Services Switching Centre	L
11.31	REPORT: Home Location Register Specification	L
11.32	REPORT: Visitor Location Register Specification	L
11.40	System Simulator Specification (MS Conformance Test System)	M
12.00	Objectives and Structure of Network Management	L
12.01	Common Aspects of Network Management	H
12.02	Subscriber and MS-Equipment Data Administration	L
12.03	Security Management	L
12.04	Performance Data Measurements	L
12.05	Subscriber related event and call data	L
12.06	GSM network change control	L
12.07	Operations and Performance Management	L
12.10	Maintenance provisions for operational integrity of Mobile Stations	L
12.11	Maintenance of the Base Station System	L
12.13	Maintenance of the Mobile services Switching Centre	L
12.14	Maintenance of Location Registers	L
12.20	Network management procedures and messages	L
12.21	Network management procedures and messages on the A-bis-interface	L

A2.2. CEPT RECOMMENDATIONS

The following CEPT recommendations are referenced directly in this equipment specification. It should be noted that this list does not cover CEPT recommendations which are referenced in any of the GSM recommendations above.

CEPT T/TR 02-02 Rack/Telecommunications centre power supply interfaces

A2.3. EUROPEAN TELECOMMUNICATIONS STANDARDS (NETs)

The following European Telecommunications Standards (NETs) are referenced directly in this equipment specification.

NET 2 (Norme Europeenne de Telecommunication): Approval requirements for data terminal equipment to connect to packet switched public data networks using CCITT recommendation X.25 (1984) interface.

NET 3 (Norme Europeenne de Telecommunication): Approval requirements for terminal equipment to connect to Integrated services Digital Network (ISDN) using basic ISDN access, part 1: Layers 1 and 2 aspects

A2.4. CCITT RECOMMENDATIONS AND OTHER

The following CCITT and other recommendations and documents other than GSM specifications and CEPT recommendations are referenced directly in this equipment specification. It should be noted that this list does not cover CCITT or other recommendations which are referenced in any of the GSM specifications listed in A2.1.

CCITT Q.780 Signalling System no 7 test specification - general description

CCITT Q.781 MTP level 2 test specification

CCITT Q.782 MTP level 3 test specification

IEC 65 Safety requirements for mains operated electronic and related equipment for domestic and similar general use

ISO 3743 Acoustics - Determination of sound power levels of noise sources - Engineering methods for special reverberating test rooms

ISO 10168 Information processing systems - Open Systems Interconnection - Conformance test suite for the session protocol

ISO 10169 Information processing systems - Open Systems Interconnection - Conformance test suite for the ACSE protocol

ISO 10170 Information processing systems - Open Systems Interconnection - Conformance test suite for the FTAM protocol

MIL-HDBK-217E Military handbook - Reliability prediction of electronic equipment

The latest revisions of these documents should be used:

- 89/336/EEC
- 92/31/EEC
- EN 60215
- EN 60950
- EN 41003
- prETS RES 0903
- ETS 300 019-1-1
- ETS 300 019-1-2
- ETS 300 019-1-3
- ETS 300 019-1-4
- ETS 300 019-2-1
- ETS 300 019-2-2
- ETS 300 019-2-3
- ETS 300 019-2-4
- ETS 300 119-2
- ETS 300 119-4
- ISO 1999
- ISO 3747
- ISO 3864

ANNEX 3. INFORMATIVE ANNEX

Physical and test parameters for fixed GSM and co-located equipment

This annex is for information only and should be used as a guide for the physical and test parameters of Base Station's, Base Station Controllers and other co-located equipment.
The text applies to any Base Station System type or part of a Base Station System and co-located equipment, unless otherwise stated.

A3.1 Acoustic noise

A3.1.1 The equipment generated noise should not exceed the safe value recommended in ISO 1999 - Method of test for estimating the risk of hearing handicap due to noise exposure.

A3.1.2 Acoustic noise limit For weather protected partly temperature controlled environments.
The emitted sound power level from the equipment should be classified for use in the given limits in the German Workplace Regulations (Ministry of Labour and Social Order), chapter 15, sections 1 (55 dB (A)) or 2 (70 dB (A)). The equipment should be tested in accordance to ISO 3743 "Engineering methods for determination of sound power level for sources in a special reverberation test rooms". The equipment should be tested at the standard test environment as quoted in EN 60950 and EN 60215.

A3.1.3 Acoustic noise limit for non weather protected environments.
The emitted sound level limit should be determined between the manufacturer and operator. The equipment should be tested in accordance with ISO 3747. "Survey method for determination of sound power levels of noise sources using a reference sound source".

A3.2 Construction

A3.2.1 For Stationary Use At Weather Protected Locations.

A3.2.1.1 The construction of the equipment should conform to prETS 300 119-2. Equipment Engineering, European telecommunication standard for equipment practice Part 2 Engineering requirements for racks and cabinets. This specification describes physical dimension, heat dissipation, floor loading, structural loading, temperature limits, electromagnetic compatibility and electrostatic discharge.

A3.2.1.2 The construction of the subracks should conform to ETS 300 119-4. Equipment Engineering, European telecommunication standard for equipment practice Part 4 Engineering requirements for subracks. This specification describes physical dimension, heat dissipation, temperature limits, electromagnetic compatibility and electrostatic discharge.

A3.2.1.3 The equipment housing or its enclosure should offer a degree of protection to and hazards from the operational equipment conform to IEC Publication 529, "Degrees of protection provided by enclosures (IP Code)".
This specification describes the levels of protection to object and moisture ingress given by the enclosure. For safety requirements IP20 is advised

A3.2.2 For Stationary Use At Non-Weather Protected Locations.

A3.2.2.1 The equipment housing or its enclosure should offer a degree of protection in a manner conforming to IEC Publication 529 "Degrees of protection provided by enclosures (IP Code)". This specification describes the levels of protection to object and moisture ingress given by the enclosure. For commercial requirements IP54 is advised

A3.3 Electromagnetic Compatibility

A3.3.1 The equipment should conform to the EC directive 89/336/EEC Council Directive Relating to Electromagnetic Compatibility 92/31/EEC and the Council Directive Amending 89/336/EEC.

Note: This is mandatory within the EC

A3.3.2 To show conformance to the directive, the equipment should be tested and show compliance to [ETS RES 0903] "EMC Standard for GSM Public Cellular Mobile Radio and Ancillary Equipment" and the sections 2.1.6.6 and 2.1.7.8 of GSM 11.20 "Test specification for GSM Base Stations". The limits for the GSM 11.20 tests are derived from GSM 05.05.

A3.4 Environment

A3.4.1 The equipment should be able to survive the storage conditions as described in ETS 300 019-1-1 : 1992 Class 1.2 without damage. This specification describes the environmental characteristics for climatic, biological, chemically active substances, mechanically active substances and mechanical conditions. The test method for this category is contained in prETS 300 019-2-1.

A3.4.2 The equipment should be able to survive the transport conditions as described in ETS 300 019-1-2 : 1992 Class 2.2 without damage. This specification describes the environmental characteristics for climatic, biological, chemically active substances, mechanically active substances and mechanical conditions. The test method for this category is contained in prETS 300 019-2-2.

A3.4.3 Equipment installed for Stationary Use At Weather Protected partly temperature controlled locations should operate in the specified limits as described in ETS 300 019-1-3 : 1992 Class 3.2. This specification describes the environmental characteristics for climatic, biological, chemically active substances, mechanically active substances and mechanical conditions. The test method for this category is contained in prETS 300 019-2-3.

A3.4.4 Equipment installed for Stationary Use At Weather Protected Not Tempreature Controlled Locations should operate in the specified limits as described in ETS 300 019-1-3 : 1992 Class 3.3. This specification describes the environmental characteristics for climatic, biological, chemically active substances, mechanically active substances and mechanical conditions. The test method for this category is contained in prETS 300 019-2-3 : Class 3.3.

Note: Due to the extremes of the climatic conditions it may be advisable for the operator to specify a band of conditions between the upper and lower limits.

A3.4.5 Equipment installed for Stationary Use At Non-Weather Protected Locations should operate in the specified limits as described in ETS 300 019-1-4 : 1992 Class 4.1. This specification describes the environmental characteristics for climatic, biological, chemically active substances, mechanically active substances and mechanical conditions. The test method for this category is contained in prETS 300 019-2-4.

Note: Due to the extremes of the climatic conditions it may be advisable for the operator to specify a band of conditions between the upper and lower limits.

A3.5 Power Supply conditions for Base Stations, Base Station Controller's and other co-located equipment.

A3.5.1 The Base Station, Base station Controller and co-located equipment should operate under the power supply conditions described in CEPT T/TR 02-02.

A3.5.2 The power supply to the Base Station, Base Station Controller and co-located equipment should conform to the characteristics in CEPT T/TR 02-02.

A3.6 Reliability

A3.6.1 The preferred reference for calculations of the Mean Time Between Failure (MTBF) for the equipment should be based on the principals of the latest edition of MIL-HDBK 217 (Ground Benign) and relates to optimum build and handling conditions. Other methods to calculate the MTBF may be used.

A3.6.2 For analogue components and integrated circuits with less than 1000 gates or equivalent complexity the formulae and data contained within MIL-HDBK 217 should be used.

A3.6.3 For digital components with more than 1000 gates or equivalent complexity, manufacturers FIT data (Failures In Time) should be used and inserted into the equations contained in MIL-HDBK 217.

A3.6.4 The climatic model for use in the equations should be defined as the maximum upper temperature that occurs in the 90% occurrence band of the temperature distribution model for a warm temperate climate as described in IEC publication 721-2-1, which covers the greater land mass of Europe (T = 30 Degrees Celsius External Ambient).

A3.6.5 The MTBF should be calculated for replaceable assemblies that are fitted within the overall base Station or Base Station Controller in the stated environment.

A3.6.6 The results of the MTBF calculations should be stated in values of years. The calculation should be valid for a period of 10 years from the point at which the equipment becomes operational and after the equipment has been installed and accepted by the operator.

A3.6.7 The manufacturer should identify and provide a schedule for service replaceable parts and recommendations for maintenance of the system to maintain proper function of the equipment with regard to its MTBF rating.

A3.7 Safety

A3.7.1 The equipment should fulfil the relevant requirements of and show compliance to the following specifications wherever applicable:

EN 60215	Safety Requirements for Radio Transmitting Equipment.
IEC 65	Safety Requirements For Mains Operated Electronic Apparatus Household and Similar General Use.
EN 60950	Safety of Information Technology Equipment Including Electrical Business Equipment.
EN 41003	Safety Requirements For Apparatus For Connections To Telecommunications Networks.

A3.7.2 The safety marking and labelling of the equipment should conform to ISO 3864 - Safety signs and colours.

ANNEX 4. MAPPING OF RADIO RESOURCE MANAGEMENT PROCEDURES

This section shows the Radio Resource management (RR) Layer 3 elementary procedures as defined in GSM 04.08, but seen in perspective including the Layer 3 procedures on the A-bis-interface and the A-interface. This section, hence, combines the procedures defined in GSM 04.08, GSM 08.58 and GSM 08.08 as background for the Layer 3 tests defined in sections 5.1, 6.1 and 7.1.
The various timers defined in the above specifications are allocated to the various network entitites. Those timers which do not appear, reside in the MS or in the MSC.
The RR Layer 3 procedures are the following:

1. System information
2. Service requests in SABM frames
3. Random access by MS and immediate assignment
4. Paging and immediate assignment
5. Measurement report
6. Assignment
7. External handover
8. Internal inter-cell handover
9. Internal intra-cell handover
10. Frequency redefinition
11. Transmission mode change
12. Ciphering mode setting
13. Classmark change
14. Channel release
15. Radio link failure

These elementary RR procedures are shown in the following in normal operation.
Pure BSSMAP, ie procedures not described in GSM 04.08, are not illustrated.

A4.1. SYSTEM INFORMATION

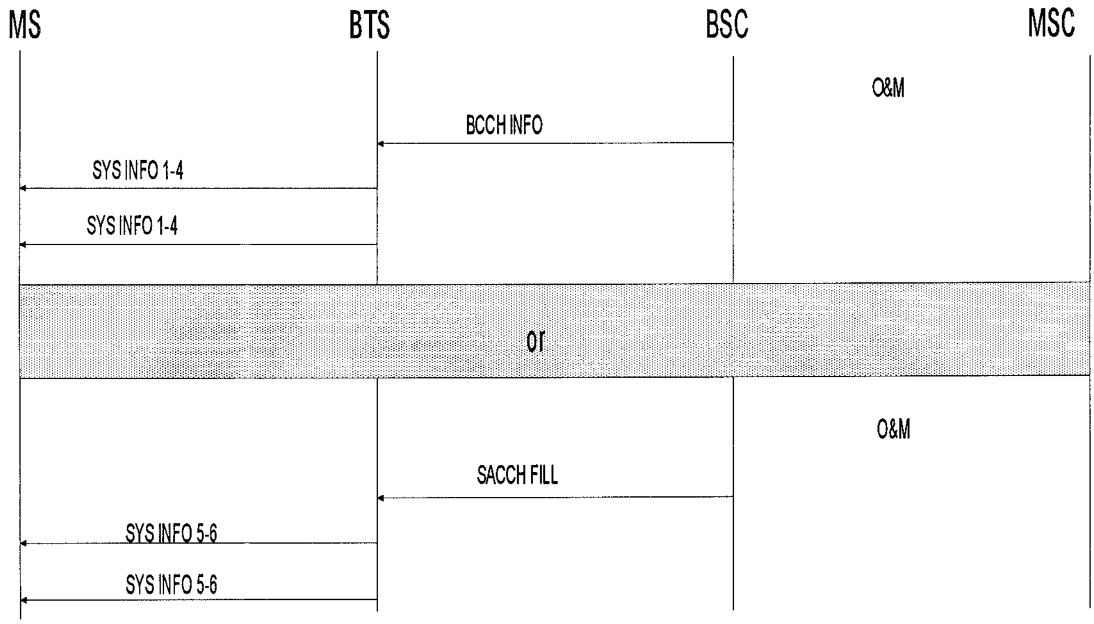


Fig A4-1. System information

A4.2. SERVICE REQUESTS IN SABM FRAMES

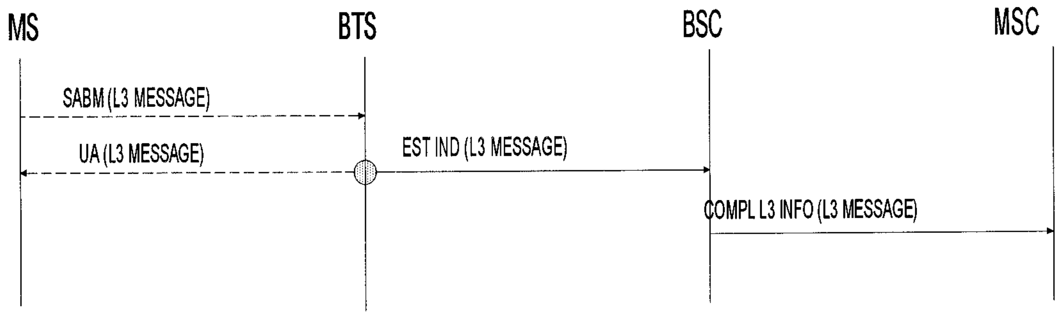


Fig A4-2. Service requests in SABM frames

A4.3. RANDOM ACCESS BY MS AND IMMEDIATE ASSIGNMENT

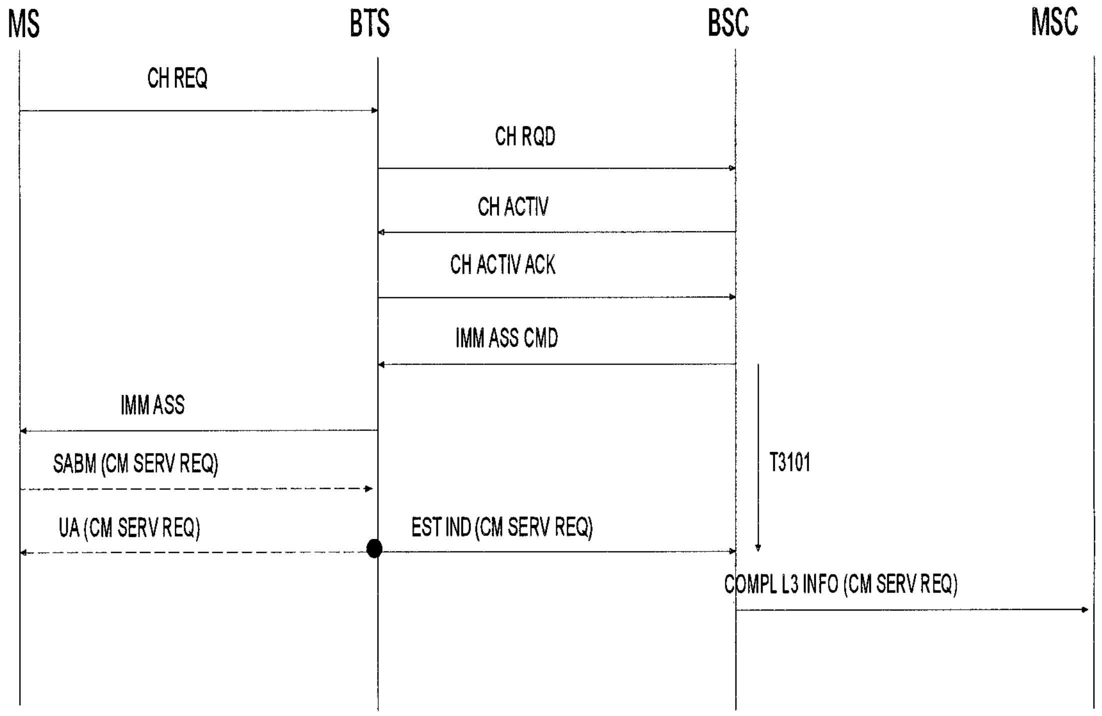


Fig A4-3. Random access by MS and immediate assignment

A4.4. PAGING AND IMMEDIATE ASSIGNMENT

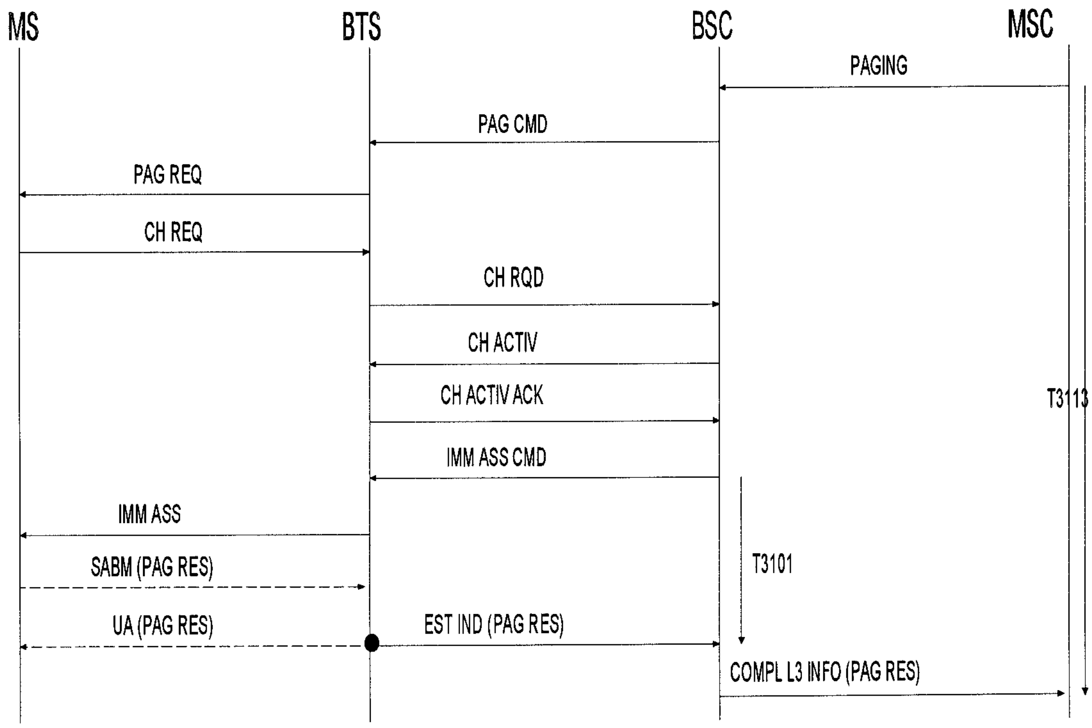


Fig A4-4. Paging and immediate assignment

A4.5. MEASUREMENT REPORT

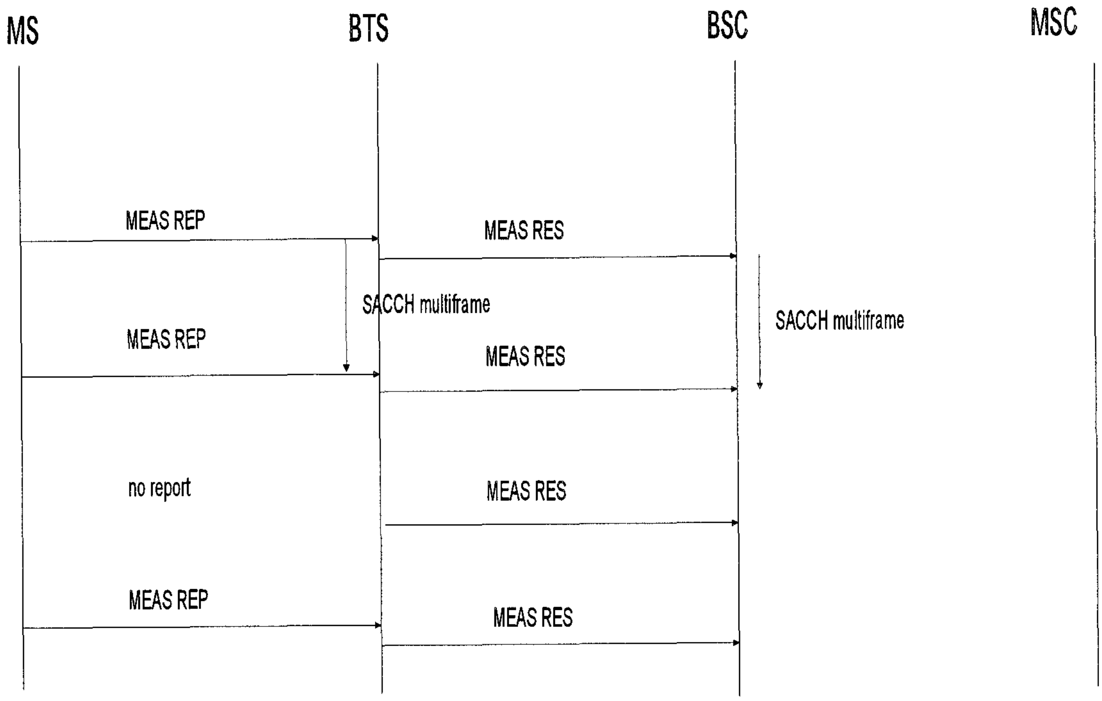


Fig A4-5. Measurement reporting (basic)

A4.6. ASSIGNMENT

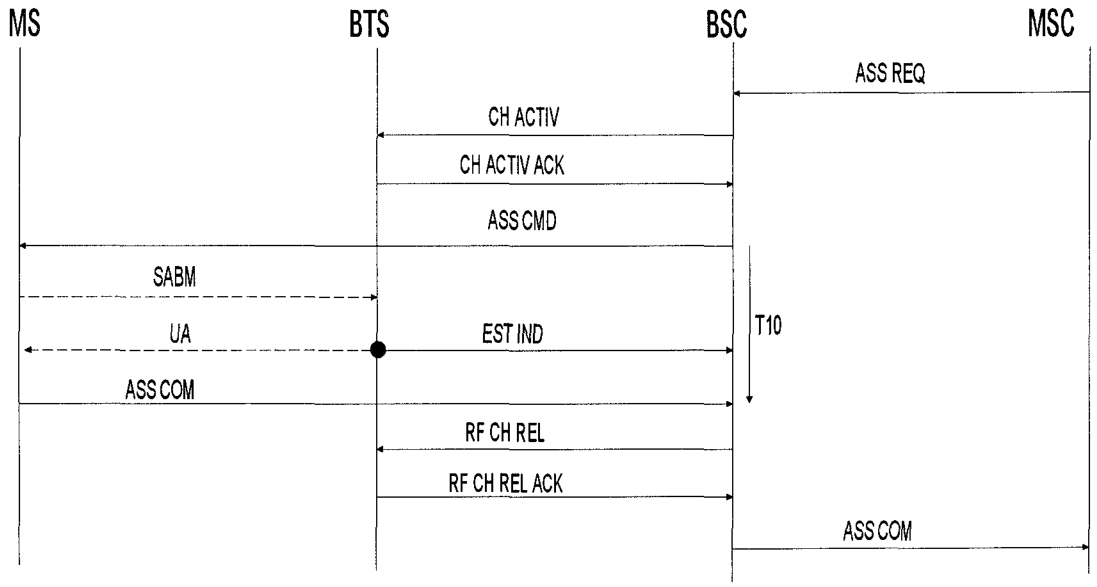


Fig A4-6. Assignment

NOTE: T10 may or may not be equal to T3107. If it is, T10 must be stopped by a CLEAR CMD from the MSC in case of re-establishment. If not, T3107 is located in the MSC and is irrelevant to the BSC.

A4.7. EXTERNAL HANDOVER (NON-SYNCHRONIZED NETWORK)

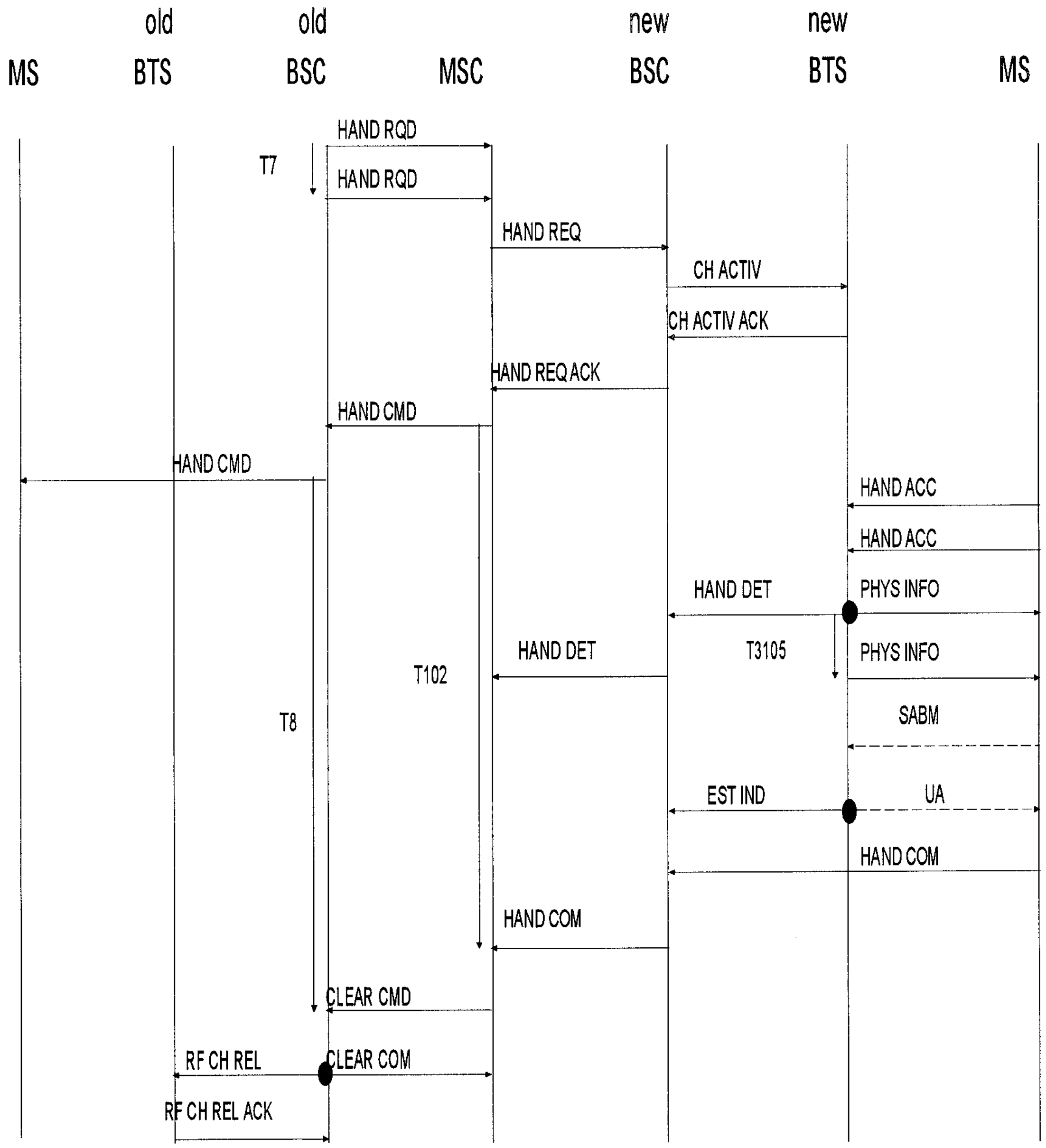


Fig A4-7. Handover between 2 BSC's (external)

NOTE: After a successful handover SYSTEM INFORMATION messages type 5-7 are sent to the MS as soon as possible on the SACCH to update the MS about its (possibly) new BTS/BSC, and are then continuously sent. These are, however, not indicated here.

NOTE: T8 may or may not be equal to T3103. If it is, it must be stopped by a CLEAR CMD from the MSC in case of a re-establishment (as for successful handover). If not, T3103 is located in the MSC and is irrelevant to the BSC.

A4.8. INTERNAL INTER-CELL HANDOVER (NON-SYNCHRONIZED NETWORK)

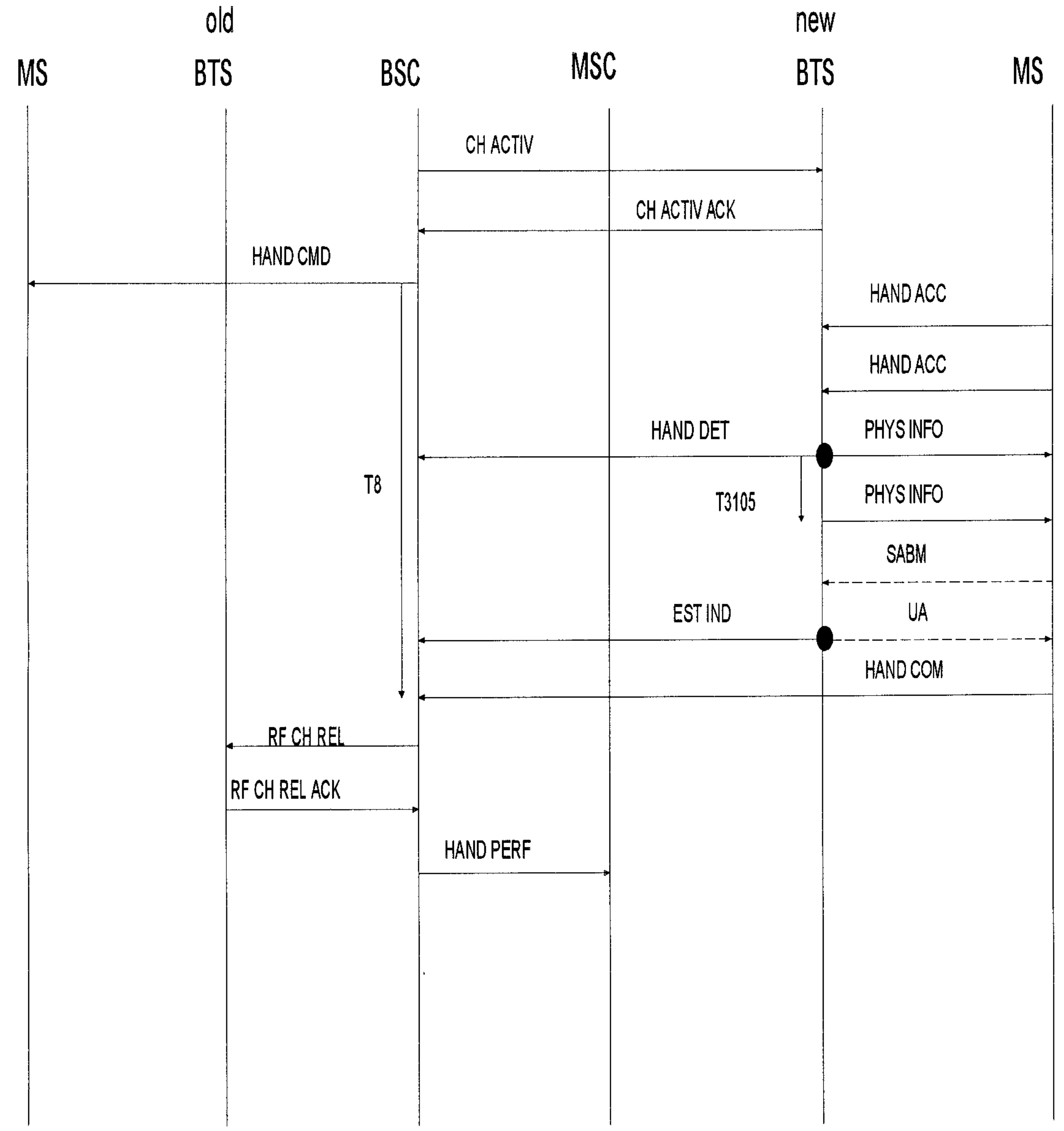


Fig A4-8. Handover between 2 BTS's (internal intercell)

NOTE: After a successful handover SYSTEM INFORMATION messages type 5-7 are sent to the MS as soon as possible to update the MS about its (possibly) new BTS/BSC, and are then continuously sent. These messages are, however, not indicated here.

NOTE: It is also possible that the MSC initiates an internal intercell handover. In that case the procedure is exactly as for external handover, but within one BSC.

A4.9. INTERNAL INTRA-CELL HANDOVER

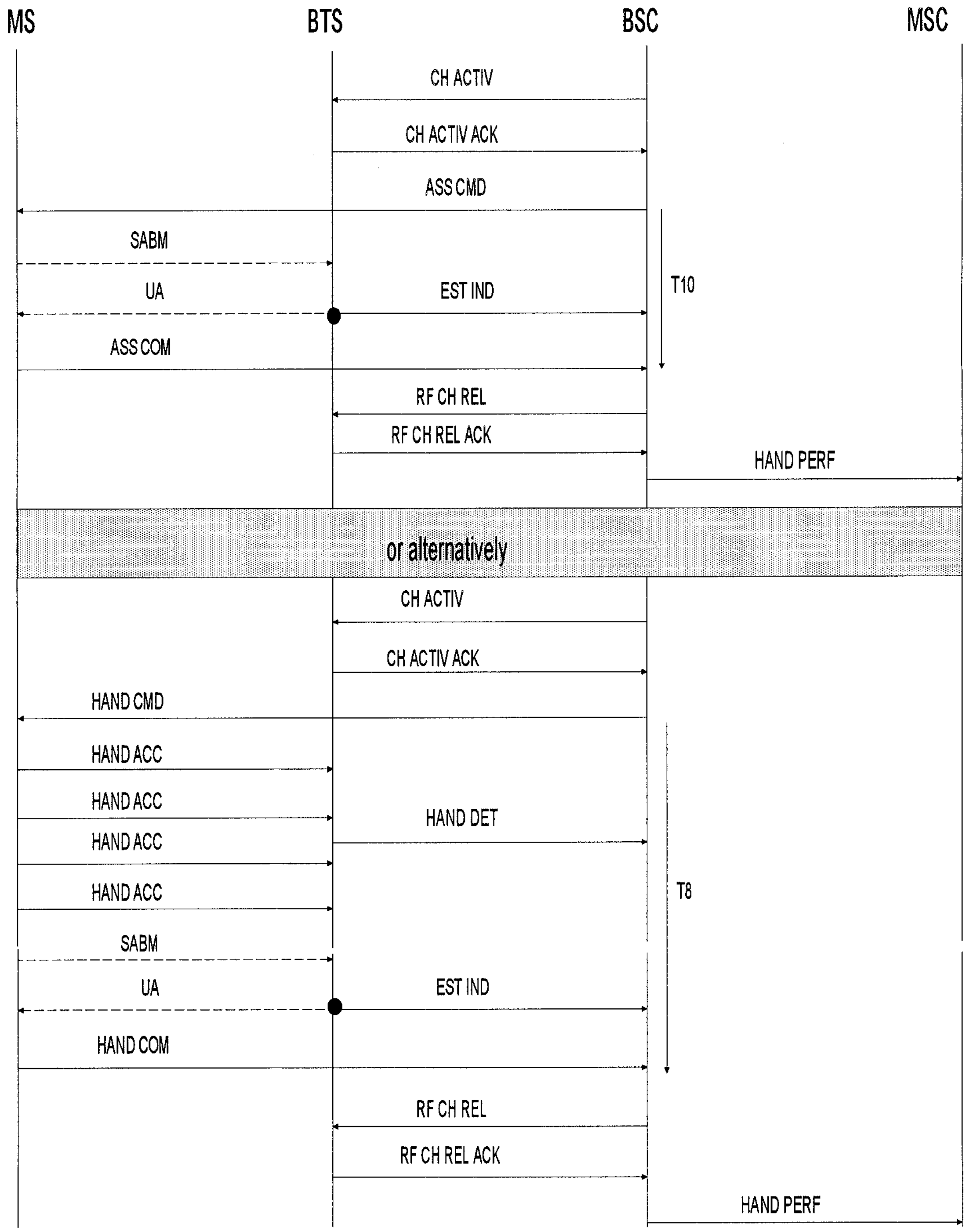


Fig A4-9. Handover within a BTS (internal intracell)

NOTE: It is also possible that the MSC initiates an internal intra-cell handover.
In that case the procedure is exactly as for external handover, but within one BSC/BTS.

A4.10. FREQUENCY REDEFINITION

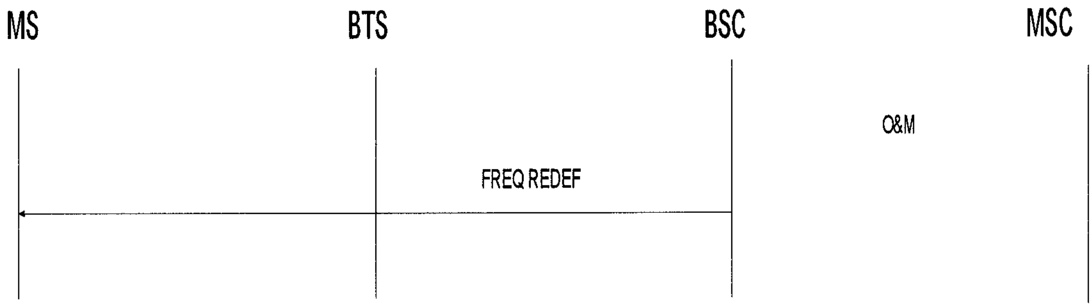


Fig A4-10. frequency redefinition

A4.11. TRANSMISSION MODE CHANGE

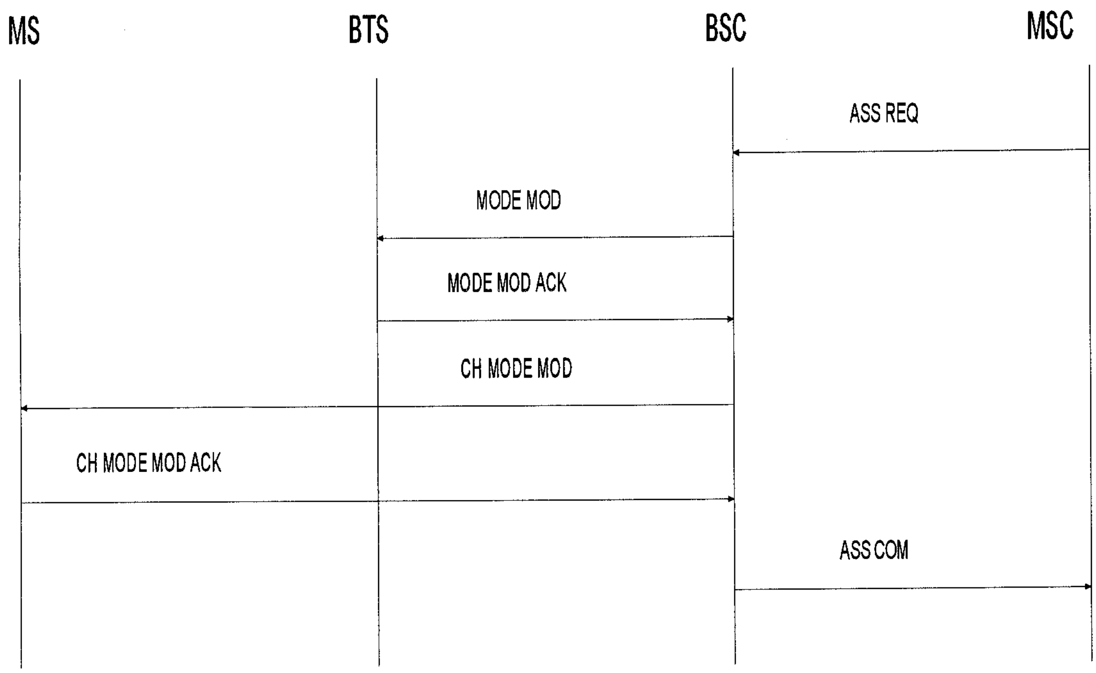


Fig A4-11. Transmission mode change

A4.12. CIPHERING MODE SETTING

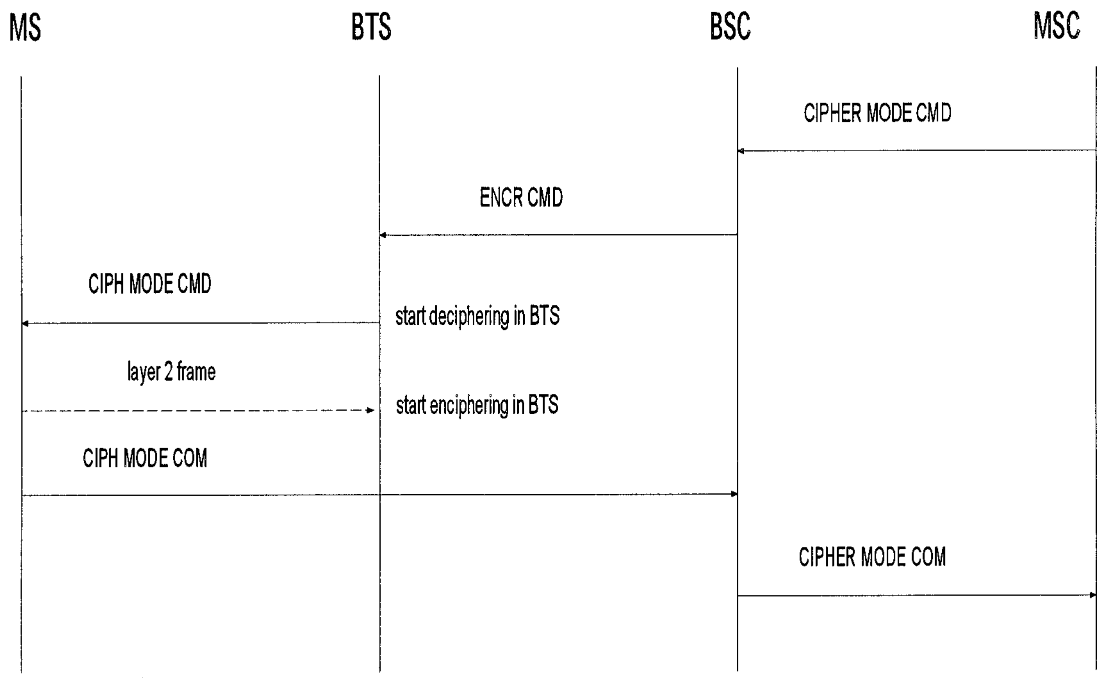


Fig A4-12. Ciphering mode setting

A4.13. CLASSMARK CHANGE

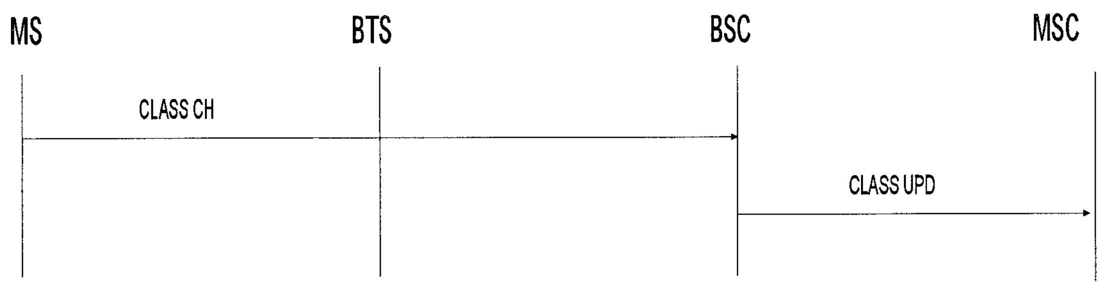


Fig A4-13. Classmark change

A4.14. CHANNEL RELEASE

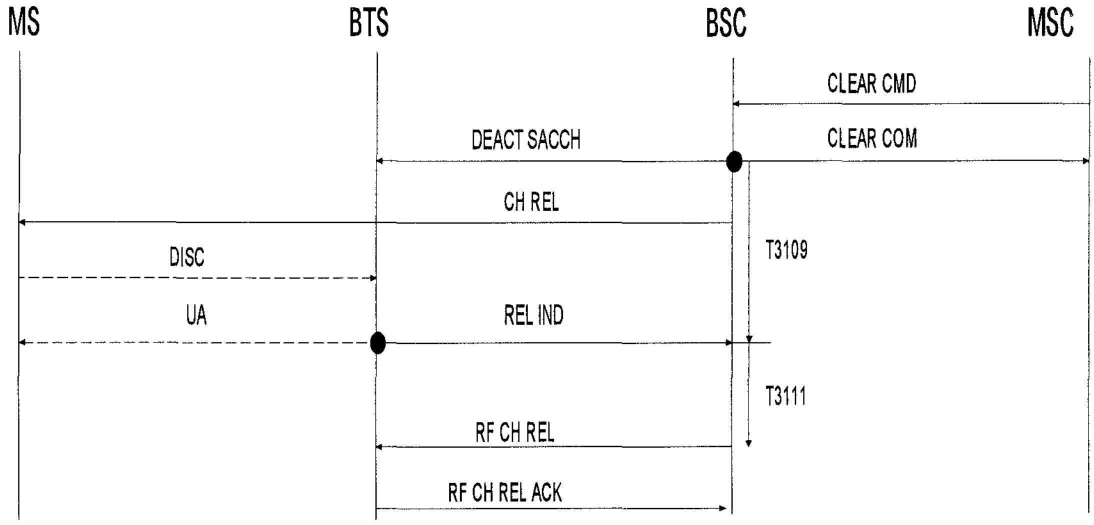


Fig A4-14. Channel release

NOTE: Depending on the reason for the CLEAR CMD from the MSC, the BSC has some flexibility whether or not to invoke any release over the radio interface.

NOTE: The CLEAR COM may occur any time from the CLEAR CMD to the RF CH REL ACK.

A4.15. RADIO LINK FAILURE

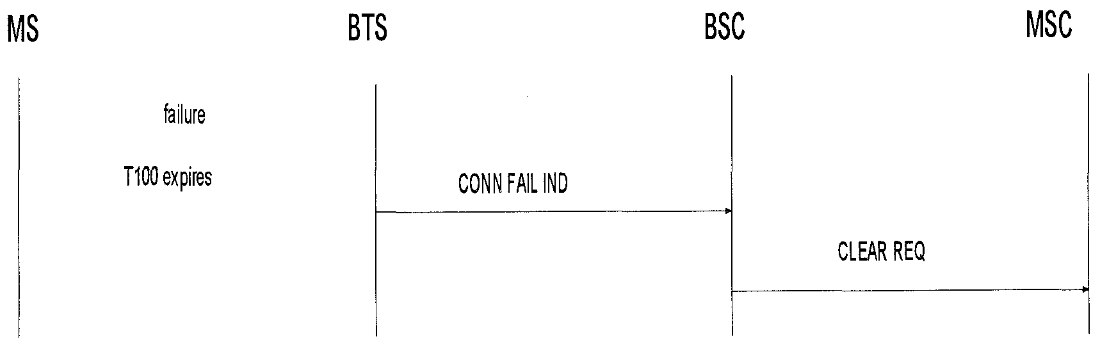


Fig A4-15. Radio link failure

NOTE: Also when a data link error occurs (ERROR IND), an indication shall be given to the upper MM sublayer. The procedure may also be used in this case.

NOTE: The MSC will invoke the normal channel release procedure in section A4.14 on receipt of the CLEAR REQ. The BSS will then have some flexibility whether or not to command the MS to release.

APPENDIX 1. NUMBER OF SAMPLES NEEDED FOR STATISTICAL TESTING

In the following, the needed number of samples and the resulting test time for 95 different tests defined in section 2 are given based on the theoretical methodology outlined in section A1.4.3. The total test time for these tests amounts to around 56.4 hours, and the average time per test is 35.6 min.
It should be noted that time consuming tests like the test for blocking and spurious response rejection are not included.

APP1.1. CONTROL CHANNELS

SDCCH:
(FER: 4.25 events/s, frame filling = 4/51)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static	FER=0.10%	30 000	2	-	60 000	14 117.6
TU50	FER=10%	300	2	1 301	1 301	306.1
RA250	FER=8.0%	375	2	271	750	176.5
HT100	FER=9.0%	333	2	651	666	156.7
TU3	FER=22%	136	2	21 675	21 675	5 100.0
TU3(SFH)	FER=4.0%	750	2	21 675	21 675	5 100.0
TU50	FER=10%	300	2	1 301	1 301	306.1
RA250	FER=8.0%	375	2	271	750	176.5

RACH:
(FER: 217 events/s, frame filling = 1)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static	FER=0.50%	6 000	2	-	12 000	55.3
TU50	FER=13%	231	2	5 208	5 208	24.0
RA250	FER=12%	250	2	1 085	1 085	5.0
HT100	FER=13%	231	2	2 604	2 604	12.0
TU3	FER=15%	200	2	86 800	86 800	400.0
TU3(SFH)	FER=15%	200	2	86 800	86 800	400.0
TU50	FER=16%	188	2	5 208	5 208	24.0
RA250	FER=13%	231	2	1 085	1 085	5.0

SACCH/T:
(FER: 2.1 events/s, frame filling = 1/26)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static	FER=0.10%	30 000	2	-	60 000	28 571.4
TU50	FER=10%	300	2	1 311	1 311	624.3
RA250	FER=8.0%	375	2	273	750	357.1
HT100	FER=9.0%	333	2	656	666	317.1
TU3	FER=22%	136	2	21 840	21 840	10 400.0
TU3(SFH)	FER=4.0%	750	2	21 840	21 840	10 400.0
TU50	FER=10%	300	2	1 311	1 311	624.3
RA250	FER=8.0%	375	2	273	750	357.1

SACCH/C:
(FER: 2.13 events/s, frame filling = 4/102)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static	FER=0.10%	30 000	2	-	60 000	28 169.0
TU50	FER=10%	300	2	1 304	1 304	612.2
RA250	FER=8.0%	375	2	272	750	352.1
HT100	FER=9.0%	333	2	652	666	312.7
TU3	FER=22%	136	2	21 726	21 726	10 200.0
TU3(SFH)	FER=4.0%	750	2	21 726	21 726	10 200.0
TU50	FER=10%	300	2	1 304	1 304	612.2
RA250	FER=8.0%	375	2	272	750	352.1

FACCH/F:
(FER: 50 events/s, frame filling = 24/26)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static	FER=0.10%	30 000	4	-	120 000	2 400.0
TU50	FER=10%	300	4	1 300	1 300	26.0
RA250	FER=8.0%	375	4	271	1 500	30.0
HT100	FER=9.0%	333	4	650	1 333	26.7
TU3	FER=22%	136	4	21 667	21 667	433.3
TU3(SFH)	FER=4.0%	750	4	21 667	21 667	433.3
TU50	FER=10%	300	4	1 300	1 300	26.0
RA250	FER=8.0%	375	4	271	1 500	30.0

FACCH/H:
(FER: 25 events/s, frame filling = 12/26)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static	FER=0.10%	30 000	4	-	120 000	4 800.0
TU50	FER=10%	300	4	1 300	1 300	52.0
RA250	FER=8.0%	375	4	271	1 500	60.0
HT100	FER=9.0%	333	4	650	1 333	53.3
TU3	FER=22%	136	4	21 667	21 667	866.7
TU3(SFH)	FER=4.0%	750	4	21 667	21 667	866.7
TU50	FER=10%	300	4	1 300	1 300	52.0
RA250	FER=8.0%	375	4	271	1 500	60.0

BCCH/AGCH/PCH/SCH:
Not applicable to the BSS !

APP1.2. DATA TRAFFIC CHANNELS

TCH/F9.6:
(BER: 12000 events/s, frame filling = 24/26)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static	BER=1.0E-5	3000 000	10	-	30000 000	2 500.0
TU50	BER=0.50%	6 000	10	312 000	312 000	26.0
RA250	BER=0.10%	30 000	10	65 000	300 000	25.0
HT100	BER=0.70%	4 286	10	156 000	156 000	13.0
TU3	BER=8.0%	375	10	5200 000	5200 000	433.3
TU3(SFH)	BER=0.30%	10 000	10	5200 000	5200 000	433.3
TU50	BER=0.30%	10 000	10	312 000	312 000	26.0
RA250	BER=0.20%	15 000	10	65 000	150 000	12.5

TCH/H4.8:
(BER: 6000 events/s, frame filling = 12/26)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static	BER=1.0E-5	3000 000	10	-	30000 000	5 000.0
TU50	BER=0.50%	6 000	10	312 000	312 000	52.0
RA250	BER=0.10%	30 000	10	65 000	300 000	50.0
HT100	BER=0.70%	4 286	10	156 000	156 000	26.0
TU3	BER=8.0%	375	10	5200 000	5200 000	866.7
TU3(SFH)	BER=0.30%	10 000	10	5200 000	5200 000	866.7
TU50	BER=0.30%	10 000	10	312 000	312 000	52.0
RA250	BER=0.20%	15 000	10	65 000	150 000	25.0

TCH/F4.8:
(BER: 6000 events/s, frame filling = 24/26)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
TU50	BER=1.0E-4	300 000	10	156 000	3000 000	500.0
RA250	BER=1.0E-4	300 000	10	32 500	3000 000	500.0
HT100	BER=1.0E-4	300 000	10	78 000	3000 000	500.0
TU3	BER=3.0%	1 000	10	2600 000	2600 000	433.3
TU3(SFH)	BER=1.0E-4	300 000	10	2600 000	3000 000	500.0
TU50	BER=1.0E-4	300 000	10	156 000	3000 000	500.0
RA250	BER=1.0E-4	300 000	10	32 500	3000 000	500.0

TCH/F2.4:
(BER: 3600 events/s, frame filling = 24/26)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
TU50	BER=2.0E-5	1500 000	10	93 600	15000 000	4 166.7
RA250	BER=1.0E-5	3000 000	10	3 900	30000 000	8 333.3
HT100	BER=1.0E-5	3000 000	10	46 800	30000 000	8 333.3
TU3	BER=3.0%	1 000	10	1560 000	1560 000	433.3
TU3(SFH)	BER=1.0E-5	3000 000	10	1560 000	30000 000	8 333.3
TU50	BER=3.0E-5	1000 000	10	93 600	10000 000	2 777.8
RA250	BER=1.0E-5	3000 000	10	3 900	30000 000	8 333.3

TCH/H2.4:
(BER: 3600 events/s, frame filling = 12/26)

Prop. cond.:	Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
TU50	BER=2.0E-4	150 000	10	187 200	1500 000	416.7
RA250	BER=1.0E-4	300 000	10	39 000	3000 000	833.3
HT100	BER=1.0E-4	300 000	10	93 600	3000 000	833.3
TU3	BER=4.0%	750	10	3120 000	3120 000	866.7
TU3(SFH)	BER=1.0E-4	300 000	10	3120 000	3120 000	866.7
TU50	BER=2.0E-4	150 000	10	187 200	1500 000	416.7
RA250	BER=1.0E-4	300 000	10	39 000	3000 000	833.3

APP1.3. SPEECH TRAFFIC CHANNELS

TCH/FS:

(*FER:* 50 events/s, RBER class Ib: 6600 events/s,
RBER class II: 3900 events/s, frame filling = 24/26)

Prop. cond.:		Error rate:	Stat. sign.:	Indep. sampl.:	Station. proc.:	Samples:	Time: (s)
static		FER=0.10%	30 000	4	-	120 000	2 400.0
	Ib	RBER=0.40%	7 500	10	-	75 000	11.4
	II	RBER=2.0%	1 500	10	-	15 000	3.8
TU50		FER=6.0%	500	4	1 300	2 000	40.0
	Ib	RBER=0.40%	7 500	10	171 600	171 600	26.0
	II	RBER=8.0%	375	10	101 400	101 400	26.0
RA250		FER=2.0%	1 500	4	271	6 000	120.0
	Ib	RBER=0.20%	15 000	10	35 750	150 000	22.7
	II	RBER=7.0%	429	10	21 125	21 125	5.4
HT100		FER=7.0%	429	4	650	1 716	34.3
	Ib	RBER=0.50%	6 000	10	85 800	85 800	13.0
	II	RBER=9.0%	333	10	50 700	50 700	13.0
TU3		FER=21%	143	4	21 667	21 667	433.3
	Ib	RBER=2.0%	1 500	10	2860 000	2860 000	433.3
	II	RBER=4.0%	750	10	1690 000	1690 000	433.3
TU3(SFH)		FER=3.0%	1 000	4	21 667	21 667	433.3
	Ib	RBER=0.20%	15 000	10	2860 000	2860 000	433.3
	II	RBER=8.0%	375	10	1690 000	1690 000	433.3
TU50		FER=6.0%	500	4	1 300	2 000	40.0
	Ib	RBER=0.40%	7 500	10	171 600	171 600	26.0
	II	RBER=8.0%	375	10	101 400	101 400	26.0
RA250		FER=3.0%	1 000	4	271	4 000	80.0
	Ib	RBER=0.20%	15 000	10	35 750	150 000	22.7
	II	RBER=8.0%	375	10	21 125	21 125	5.4
static	II	RBER=1.0E-4	300 000	10	-	3000 000	769.2
EQU50	II	RBER=3.0%	1 000	10	101 400	101 400	26.0

TCH/HS:

For further study.