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**Digital cellular telecommunication system (Phase 2);  
Interworking of GSM Network Management (NM) procedures  
and messages at the Base Station Controller (BSC)  
(GSM 12.22)**

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## Foreword

This European Telecommunication Standard (ETS) was produced by the Special Mobile Group (SMG) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This ETS describes the BSC interworking within the Digital cellular telecommunications system. This ETS corresponds to GSM technical specification, GSM 12.22, version 4.1.4.

The specification from which this ETS has been derived was originally based on GSM Phase 1 documentation, hence the presentation of this ETS is not entirely in accordance with the ETSI/PNE rules.

NOTE: TC-SMG has produced documents which give technical specifications for the implementation of the Digital cellular telecommunications system. Historically, these documents have been identified as GSM Technical Specifications (GSM-TSs). These specifications may subsequently become I-ETSS (Phase 1), or European Telecommunication Standards (ETSS)(Phase 2), whilst others may become ETSI Technical Reports (ETRs). These ETSI-GSM Technical Specifications are, for editorial reasons, still referred to in this ETS.

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## Introduction

This ETS is structured as follows;

- 1) Scope;
- 2) Normative references;
- 3) Abbreviations;
- 4) Common interworking aspects;
- 5) Specific interworking aspects;
- 6) Related A-bis structured procedures;

Annex A (informative)    Some interworking issues;  
Annex B (informative)    Reconfiguration procedures;  
Annex C (informative)    List of attributes.

Clause 4 describes the aspects common to all the managed object classes that cause interworking between the Q3 and Qx interfaces. Objects and their naming and addressing on the OMC-BSC and A-bis Qx interfaces are briefly described. General requirements for Q3/Qx interworking for CMIP operations including error handling are given. Q3/Qx interworking of general functions, i.e. state management and alarm reporting, are also specified.

Clause 5 specifies the aspects, specific to each object class, that cause interworking. This clause contains the requirements on mapping between the GSM 12.20 specified and GSM 12.21 specified objects, their attributes, and object specific interworking procedures for different CMIP operations.

Clause 6 defines the A-bis structured procedures used in clause 3.

Annex A describes the structured procedures at a high level which are used in managing the BTS from the OMC. Annex B contains example procedures for BCCH and SDCCH reconfiguration. Annex C contains the list of GSM 12.20 and GSM 12.21 attributes that are referenced in this specification.

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## 1 Scope

To ensure management of different manufacturers' BTSs from the OMC through the BSC in a standardized way, this BSC interworking ETS relates the OMC-BSC interface (Q3) as specified in GSM 12.20 and the BSC-BTS interface (A-bis Qx) as specified in GSM 12.21. In GSM 12.01 it is required that the BSC performs the Mediation Function between the OMC and the BTS. This ETS defines the requirements for this Mediation Function.

## 2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- [1] CCITT Recommendation X.710: "Information technology - Open Systems Interconnection - Common Management Information Service Definition for CCITT Applications".
- [2] CCITT Recommendation X.711: "Information technology - Open Systems Interconnection - Common Management Information Protocol specification for CCITT Applications".
- [3] CCITT Recommendation X.721 (ISO 10165-2): "Information technology - Open Systems Interconnection - Structure of management information: Definition Of Management Information".
- [4] CCITT Recommendation X.731 (ISO 10164-2): "Information technology - Open Systems Interconnection - Systems Management: State Management".
- [5] CCITT Recommendation X.733 (ISO 10164-4): "Information technology - Open Systems Interconnection - Systems Management: Alarm Reporting".
- [6] CCITT Recommendation X.734 (ISO 10164-5): "Information technology - Open Systems Interconnection - Systems Management: Event Report Management Function".
- [7] CCITT Recommendation X.735 (ISO 10164-6): "Information technology - Open Systems Interconnection - Systems Management: Log Control Function".
- [8] GSM 04.08 (ETS 300 557): "Digital cellular telecommunication system (Phase 2); Mobile radio interface layer 3 specification".
- [9] GSM 08.56 (ETS 300 595): "Digital cellular telecommunication system (Phase 2); Base Station Controller - Base Transceiver Station (BSC - BTS) interface Layer 2 specification".
- [10] GSM 08.58 (ETS 300 596): "Digital cellular telecommunication system (Phase 2); Base Station Controller - Base Transceiver Station (BSC - BTS) interface Layer 3 specification".
- [11] GSM 12.00 (ETS 300 612-1): "Digital cellular telecommunication system (Phase 2); Objectives and structure of Network Management (NM)".
- [12] GSM 12.01 (ETS 300 612-2): "Digital cellular telecommunication system (Phase 2); Common aspects of GSM Network Management (NM)".
- [13] GSM 12.20 (ETS 300 622): "Digital cellular telecommunication system (Phase 2); Base Station System (BSS) Management Information".

- [14] GSM 12.21 (ETS 300 623): "Digital cellular telecommunication system (Phase 2); Network Management (NM) procedures and message on the A-bis interface".

### 3 Abbreviations

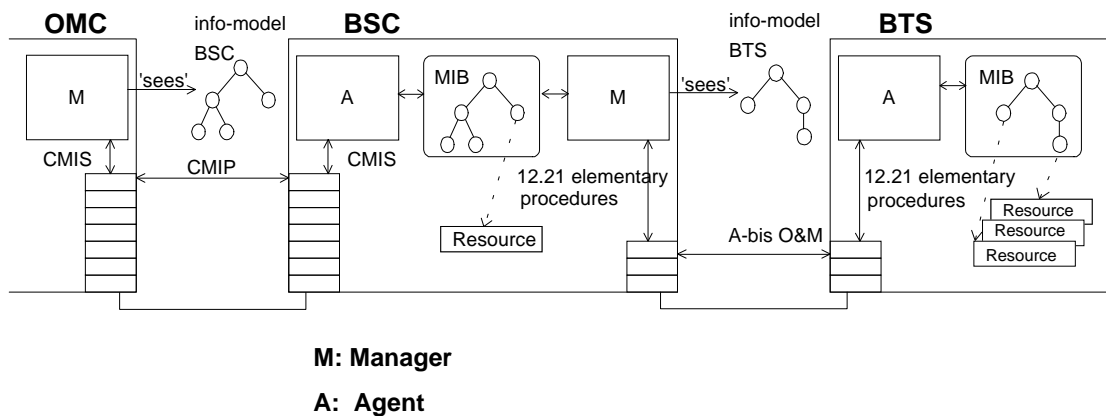
Abbreviations used in this ETS are listed in GSM 01.04.

## 4 Common Interworking aspects

### 4.1 General considerations

#### 4.1.1 Interworking tasks

Figure 1 illustrates differences between Q3 and A-bis Qx interfaces and the object models in the BSC and the BTS.



**Figure 1: Mapping of information models**

In the A-bis interface, layers 1 and 2 are common with telecommunication signalling specified in GSM 08.5X. Network management messages and procedures on the A-bis interface are based on the layer 3 transport mechanism specified in GSM 12.21 and are consistent with the telecommunications signalling on layers 3 as specified in GSM 08.58.

The protocol profiles for the Q3 interface are specified in GSM 12.01.

For network management purposes, the BSC is responsible for the following interworking tasks:

- bi-directional protocol conversion so as to provide mapping between Q3 and A-bis Qx interfaces which consists of mapping of GSM 12.20 objects onto GSM 12.21 objects, mapping of CMIS services onto GSM 12.21 procedures and association of GSM 12.20 attributes to GSM 12.21 attributes;
- management of interworking functions activated by the OMC and terminated within the BTS and vice versa;
- handling of interworking errors, i.e., reporting errors in case of failure in interworking procedures.

NOTE: The functions activated by the OMC and terminated within the BSC or functions activated by the BTS and terminated within the BSC are not specified here. This applies also to the vice versa situations.

#### 4.1.2 Mapping between GSM 12.20 specified and GSM 12.21 specified Object Classes

Q3 and A-bis Qx interfaces use different object models. The specification of the interworking procedures between these interfaces requires mapping the object classes and instances between the Q3 interface and the A-bis Qx interface and vice versa. The following table contains BTS related object classes specified in GSM 12.20 and the corresponding object classes specified in GSM 12.21.

**Table 1: BTS related object classes in GSM 12.20 and GSM 12.21.**

GSM 12.20 BTS related object classes	GSM 12.21 object classes
btsSiteManager	Site Manager
bts	BTS
basebandTransceiver	Baseband Transceiver
radioCarrier	Radio Carrier
frequencyHoppingSystem	1)Channel
channel	Channel
lapdLink	2)

NOTE 1: GSM 12.21 does not specify the frequency hopping system as an object class. The corresponding information is included in the attributes of the channel class.

NOTE 2: The information about the signalling links of the BTS side (PCM port numbers and timeslots in the BTS) is included in the attributes of Site Manager, BTS and Baseband Transceiver classes. In GSM 12.20 the corresponding object classes have references to LAPD links which are either O&M links (in Site Manager, bts or basebandTransceiver) or telecom signalling links (only to basebandTransceiver).

#### 4.1.3 Addressing Objects at the BTS Site and handling different BTS configurations

The BCF (Base Control Function) mentioned in GSM 08.52 and GSM 08.56 is the agent at the BTS end of the A-bis Qx interface. There could be one or more of these agents at the site and the GSM 12.21 objects and attributes that each agent can manage depend on the implementation. Each agent is connected to the manager at the BSC via a LAPD link which is identified by a physical link address (i.e. PCM circuit and (sub)timeslot), TEI (Terminal Endpoint Identifier) and SAPI (Service Access Point Identifier). In order to address the various BTS objects over the A-bis Qx interface it is required that the BSC contain associations between BTS related objects defined in GSM 12.20 and the agents (i.e. O&M links) that manage the corresponding GSM 12.21 objects at the BTS site.

The procedures that relate to the A-bis interface management are optional in GSM 12.21 and therefore not all the BTSs have to support them. However, it is required that these are implemented in the BSC so that it can support all the BTS implementations that are made according to GSM 12.21. In this case the BSC must have the information per each BTS whether the A-bis interface management option is supported or not.

### 4.2 CMIP Operations

#### 4.2.1 Creation of BTS related Object instances

The M-CREATE service is used by the OMC to request a peer CMISE-service-user (i.e., the agent) at the BSC to create an object instance, complete with its identification. The corresponding physical resource may or may not exist at the BTS site.

Normally the initialization of the physical resource via A-bis Qx interface will be started immediately after the creation if the corresponding physical resource at the BTS site has been installed. Initialization might include several steps, such as, setting up O&M (and telecommunications) signalling links, downloading and activation of the software, setting various O&M attributes by GSM 12.21 messages and setting the system information to be broadcasted from the BTS by GSM 08.58 procedures. Some of these steps are not relevant for some object classes.

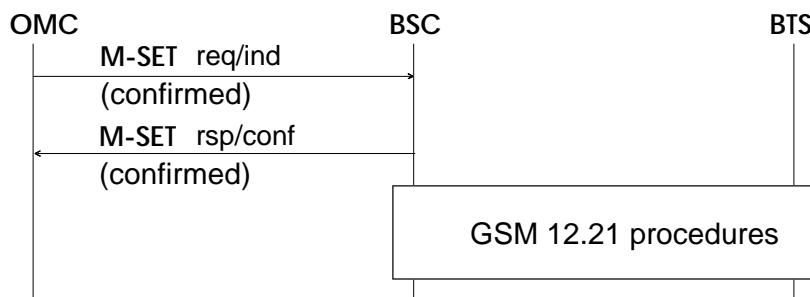
Object creation to the BSC should be possible before any resources are installed at the BTS site. If the resource for the object to be created has not been installed at the BTS site, the agent at the BTS site will not respond or it will respond with a NACK message with the NACK cause set to "Resource not available". In these cases the object shall be created to the BSC MIB but the operational state shall be set to Disabled. If the needed resource is installed later the corresponding GSM 12.21 object will send a Changed State Event Report (reference. subclause 4.4) or a SW Activate Request and the initialization will be tried again. Also setting the administrative state of a disabled object to Unlocked state may trigger the initialization.

There is one exception to the rule stated above and it is the creation of the channel objects. Eight instances of the channel are automatically created when a basebandTransceiver is created. These channel instances have initially NULL values in some of their attributes. These initial NULL values of the channels shall not be automatically set to the corresponding GSM 12.21 Channels. In this case the BSC has to wait the OMC manager to set the correct values to the channels and then unlock them before the attributes are set by the GSM 12.21 procedures (see channel initialization procedure in subclause 5.4.2).

#### 4.2.2 Setting attributes of BTS related Objects

The M-SET service is used by the OMC to request a peer CMISE-service-user to modify attribute values of an object instance. In the GSM 12.20 context, only the attributes defined as GET-REPLACE can be modified using the M-SET service.

Normally the corresponding GSM 12.21 object at the BTS site is immediately modified by interworking procedure defined in clause 5 for the M-SET service. In the interworking procedures, the BSC database shall be updated before any GSM 12.21 procedures are invoked, and, if the M-SET service is used in the confirmed mode, a response to M-SET shall also be sent to the OMC before any GSM 12.21 procedures are invoked. Errors in the GSM 12.21 procedures shall be handled as specified in subclause 4.3.



**Figure 2: General M-SET interworking**

The following attributes defined in GSM 12.20 require that the administrative state of the object instance has to be Locked before the attribute can be modified:

- bsc (bts);
- channelCombination (channel);
- tsc (channel).

In these cases the administrative state of the object shall be checked and if the administrative state is not Locked a CMIS error shall be sent and the interworking procedure shall not be executed.

### 4.2.3 Getting attributes of BTS related Objects

The M-GET service is used by the OMC to retrieve the values of attributes of an object instance from a peer CMISE-service-user located in the BSC. The requested attribute values are communicated to the OMC in the response.

M-GET does not normally cause any interworking procedures because it is assumed that the BSC is responsible for its database consistency.

GSM 12.21 defines the Get Attributes procedure. Its use is not required in response to an M-GET operation. However it may be used. If this option is implemented the best-effort synchronization shall be used. It means that the BSC tries to read all the attributes listed in the M-GET request regardless errors in some parameters. If a NACK message is received from the BTS CMIS error response shall be sent with a list of the parameters which had errors and a list of the parameters which could be read.

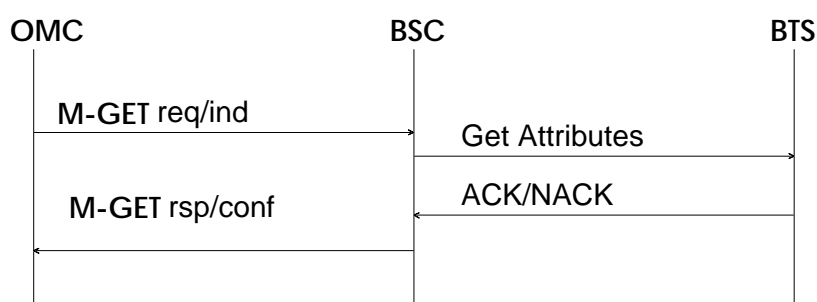


Figure 3: Optional M-GET interworking

### 4.2.4 Deletion of BTS related Objects

The M-DELETE service is used by the OMC to request a peer CMISE-service-user to delete an object and to deregister its identification in the BSC.

Rules for deletion of contained or related objects are specified in GSM 12.20.

M-DELETE does not normally cause any interworking procedures. However in some cases disconnecting of links is required. In these cases interworking is described in clause 5.

### 4.2.5 Actions on BTS related Objects

The M-ACTION service is used by the OMC to request a peer CMISE-service-user to perform an action at the BSC. The service may be requested in a confirmed or a non-confirmed mode. In confirmed mode a reply is expected.

Actions are specific to the object classes and therefore a general rule how the interworking procedure is executed cannot be defined. The interworking procedures for actions are described within the relevant object classes in clause 5.

### 4.2.6 Event Reports sent by BTS related Objects

The M-EVENT-REPORT service is invoked by a CMISE-service user (the BSC in this case) to report an event about a managed object to a peer CMISE-service-user (the OMC). The service may be requested in a confirmed or a non-confirmed mode. In confirmed mode a reply is expected.

All GSM 12.21 event reports sent by the BTS will generate local notifications at the BSC. These notifications are then subject to logging (reference. CCITT Recommendation. X.735) and event forwarding discrimination (reference. CCITT Recommendation. X.734) processes. Those notifications that pass the discriminators can be forwarded to the OMC as event reports. Potentially any GSM 12.21 event report can generate an event report from the BSC to the OMC.

#### 4.2.7 CMIS Parameters

The following parameters could be used in M-SET, M-GET and M-DELETE services to handle multiple objects at the same time (if multiple object selection and filter functional units of CMIS are used):

- Scope parameter identifies a subtree rooted in (i.e. starting from) the object indicated by the Base object class and Base object instance parameters.
- Filter parameter specifies the conditions to be checked on the managed objects within the Scope in order to identify which ones are to be selected.
- Synchronization parameter controls the way for modifying objects (either none or as many as possible) in the subtree when at least one unsuccessful setting occurs.

If multiple object instances are selected with Scope and Filter parameters BSC has to execute separate interworking procedures for each object instance.

Error handling is determined with Synchronization parameter as follows:

- If best-effort synchronization is used and an error occurs each interworking procedure shall be executed to the end. The possible attribute value modifications shall be left as they are.
- If atomic synchronization is used and an error occurs each interworking procedure shall be stopped and the operations executed so far shall be rolled back (no attribute value modifications are accepted) in the BSC and in the BTS.

#### 4.3 Error handling

Errors in the interworking procedures can be divided to two categories:

- 1) General errors detected in the Q3 interface (see CMIS errors in CCITT Recommendation. X.711: access denied, invalid object class etc.)  
Handling of general errors will not be specified in this ETS.
- 2) Errors detected in the A-bis Qx interface

An interworking procedure in the A-bis Qx interface includes a sequence of elementary procedures. If the BTS agent detects an error in a GSM 12.21 procedure a NACK message will be returned to the BSC manager. Another kind of error is that BTS agent does not respond within layer 3 time-out which will be detected by the BSC manager. These errors have to be mapped to the Q3 interface. Handling of the A-bis errors in the interworking procedures has the following general principles:

- If a GSM 12.21 elementary procedure fails, the current interworking procedure between the BSC manager and the BTS agent shall be stopped.
- If the procedure fails due to a received NACK message a processingErrorAlarm notification shall be generated by the object that was going to be initialized.

The probableCause attribute of the processingErrorAlarm notification shall be set to the value that indicates the type of the error (e.g. Configuration or customization error, Underlying resource unavailable, Software error. Reference. CCITT Recommendation. X.733). The additionalText attribute contains an error message which may be displayed to the OMC operator. The message has to be filled with the information about the NACK message.

- If the procedure fails due to a LAPD link failure (i.e., if a timeout occurs) a communicationsAlarm notification shall be generated by the lapdLink object that represents the link that was going to be used in the interworking procedure.

The probableCause attribute of the communicationsAlarm notification shall be set to the value that indicates the type of the error.

If there exist some object class specific error handling mechanisms these will be specified in clause 5.

#### 4.4 State management of BTS related objects

This subclause describes the interworking related to the state management (reference. GSM 12.20 and CCITT Recommendation. X.731). Management of the state is an important aspect in the interworking procedures because execution of the interworking procedures depends on the state of the BTS related objects. The interworking of the state management concerns only the administrativeState and operationalState attributes.

The state management of BTS related objects is specified partly in the behaviour definitions of GSM 12.20. This ETS defines only the interworking aspect of the state management.

**Table 2: State management attributes in X.721 and GSM 12.21**

GSM 12.20/CCITT Rec. X.731 state attributes	GSM 12.21 attributes
administrativeState	Administrative State
operationalState	Operational State

##### 4.4.1 Initial states

When a BTS related object instance is created its administrative state shall be by default Locked. No traffic is allowed through the resource that the object instance represents. The initial operational state shall be Disabled. After a successful initialization the operational state of the object will become Enabled.

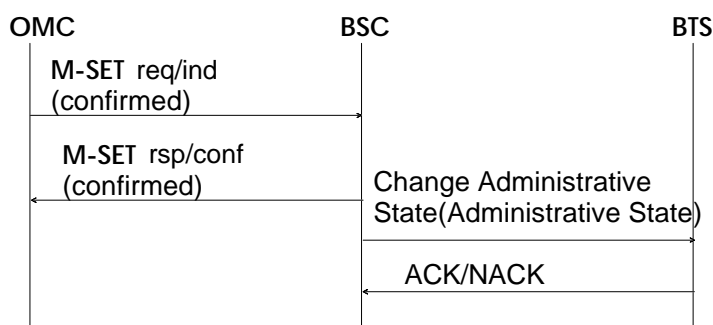
##### 4.4.2 Setting administrative state

The administrative state attribute of an object instance is changed, e.g. when the resource presented by an object instance is put available or unavailable for use. The administrative state attribute can be modified with the M-SET service invoked remotely from the OMC or locally from the BTS or BSC site.

The changes in the administrative state attributes of contained object instances shall be done independently, i.e. setting the administrative state of an object instance to Locked shall not cause any changes in the administrative states of the contained objects.

The effects of the different values of the administrative states of each BTS related object class are specified in more detail in GSM 12.20.

The general interworking procedure for setting the administrativeState attribute with M-SET is presented in the following figure.



**Figure 4: M-SET administrativeState**

#### **4.4.2.1          Setting administrative state to Unlocked**

When a resource is put available for use the administrative state of the related object instance(s) is set to Unlocked. If the operational state of the object instance is Disabled the full initialization procedure of that object instance shall be tried. Failure in this initialization procedure shall not prevent the object becoming Unlocked but the operational state will remain Disabled. The initialization may be tried again with locking and then unlocking the object. The initialization procedures for each BTS related object class are described in clause 5.

#### **4.4.2.2          Setting administrative state to Locked**

All the traffic from the resources represented by the object instance to be locked is disconnected and no new traffic is accepted through the resources.

#### **4.4.2.3          Setting administrative state to Shutting Down**

If the object has no traffic the administrative state is immediately set to Locked.

If the object has traffic the BSC will have to wait until the last user has quitted before locking the object. No new traffic shall be accepted through the resources.

#### **4.4.3          Getting state Attributes**

Normally M-GET does not cause any interworking. The implementation of this interworking procedure is an option as specified in subclause 4.2.3.

#### **4.4.4          Notifications about State Changes**

When the operational state of a BTS related object instance changes a Changed State Event Report is generated by the BTS. Then the operational state of the corresponding GSM 12.20 object shall be appropriately modified and, if applicable, a stateChange notification shall be generated by the corresponding GSM 12.20 object. This notification can result in an event report to be sent to the OMC (see Figure 5). If the Changed State Event Report indicates a BCCH or SDCCH failure (i.e. a Baseband Transceiver, a Radio Carrier or a Channel that is related to BCCH or SDCCH fails) automatic recovery shall be attempted by the BSC on the following conditions:

- The attributes in the Changed State Event Report have the following values:  
Operational state = Disabled, Availability status = Failed.
- The object sending the Changed State Event Report is unlocked.
- The objects containing the failed objects are Enabled and Unlocked.
- Automatic recovery has not been disabled by the operator.

Example procedures are described in annex B.

The administrative state can be requested to be set from the BTS via local MMI commands. In this case the BTS requests the BSC to make the state change. If the state change request is accepted then the administrative state change scenario will follow. The interworking procedure for this case is described in Figure 6.



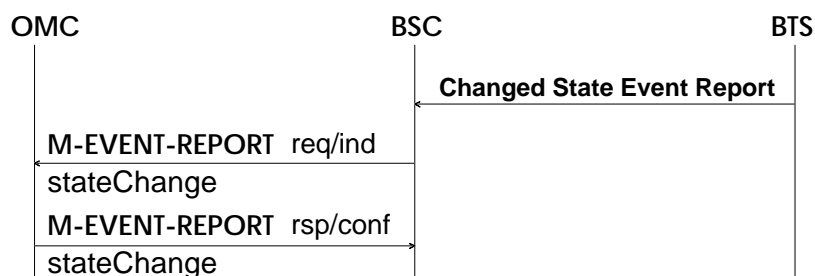
**Table 3: Mapping of the GSM 12.21 Changed State Event Report attributes to the GSM 12.20 stateChange notification**

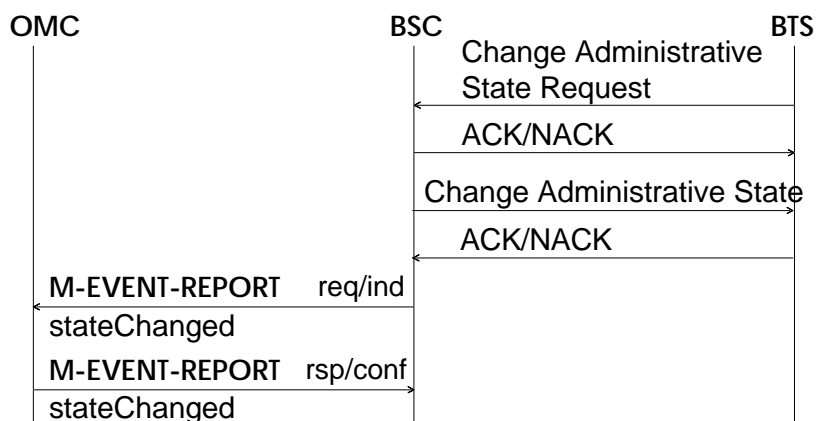
The attributes of the GSM 12.21 Changed State Event Report	The attributes of the GSM 12.20/CCITT Rec. X.721 stateChange notification	M(andatory)/O(ptional)
	1) sourceIndicator	O
	1) attributeIdentifierList	O
Operational State	2) stateChangeDefinition	M
	1) notificationIdentifier	O
	1) correlatedNotifications	O
	1) additionalText	O
	1) additionalInformation	O

NOTE 1: This value is provided by the BSC, if needed.

NOTE 2: In addition to the changes in the operational state which are reported by the Changed State Event Report also the local changes of the administrative state shall be notified. Either the operationalState or administrativeState, or both change.

The attributes shall be mapped from the A-bis Changed State Event Report to the stateChange notification according to the previous table. Note that the Changed State Event Report message transported on the A-bis Qx interface contains the new operational state value while the subsequent message on the Q3 interface could contain both old and new operational state values. The BSC shall have to fill the produced notification with the old operational state value in this case.

**Figure 5: Interworking when Changed State Event Report is sent from the BTS**



**Figure 6: Interworking when Change Administrative state Request is sent from the BTS**

#### 4.5 Alarm reporting

This subclause describes the interworking requirements related to the alarm reporting (reference. GSM 12.20, CCITT Recommendation. X.733 and X.721).

The original alarm information is produced in the BTS and transmitted to the BSC by means of a Failure Event Report message. This report shall be mapped to one of five alarm notification types (i.e. communications, processing error, equipment, environmental or quality of service alarm) based on the Event Type attribute received from the BTS. The following table defines the mapping between the attributes contained in the GSM 12.21 Failure Event Report and GSM 12.20 alarm notifications. The alarm attributes of GSM 12.20 alarm notifications are carried in the AlarmInfo SEQUENCE as specified in the CCITT Recommendation. X.721. The semantics of these attributes is defined in the CCITT Recommendation. X.733.

If a Failure Event Report sent by a GSM 12.21 defined object contains the HW Description parameter a corresponding equipment object of the Q3 information model may generate an alarm notification. The related functional object shall also generate an alarm notification with equipment parameters as defined in Note 4 of Table 4.

If a Failure Event Report contains the SW Description parameter a corresponding operatingSoftwareUnit object instance shall generate an alarm notification. The correspondence between GSM 12.21 File Ids (SW Description is a list of File Ids) and operatingSoftwareUnits is specified in subclause 5.6 "Software objects".

**Table 4: Mapping of the GSM 12.21 Failure Event Report attributes to the AlarmInfo of the GSM 12.20 alarm notifications.**

The attributes of the GSM 12.21 Failure Event Report	CCITT Recommendation. X.721 (AlarmInfo)	M(andatory)/O(ptional)
1) Probable cause	probableCause	M
Specific problems	2) specificProblems	O
3) Perceived Severity	perceivedSeverity	M
	4) backedUpStatus	O
	4) backUpObject	O
	4) trendIndication	O
	4) thresholdInfo	O
	4) notificationIdentifier	O
	4) correlatedNotifications	O
	4) genericStateChange	O
	4) monitoredAttributes	O
	4) proposedRepairActions	O
Additional Text	additionalText	O
5) HW Description	additionalInformation	O

NOTE 1: This attribute shall be mapped to OBJECT IDENTIFIERS defined for the probable-Cause attribute.

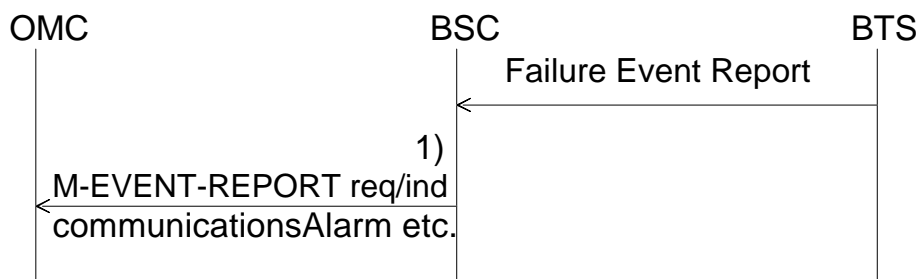
NOTE 2: The mapping is to the INTEGER syntax of the specificProblems attribute.

NOTE 3: The BSC may support alarm severity reassignment based on the values of Probable causes (or Specific problems), in which case. e.g. Perceived Severity Indeterminate may be mapped to values critical, major, minor or warning of the perceivedSeverity attribute.

NOTE 4: This is managed only by the BSC.

NOTE 5: The fields Equipment Id, Equipment Type, Equipment Version and Location of the Hardware Description parameter (if present) shall be mapped to the following corresponding parameters defined in GSM 12.20: relatedGSMEquipNameParam, relatedGSMEquipTypeParam, relatedGSMEquipVersParam, relatedGSMEquipLocParam.

The following figure presents the situation, when Failure Event Report is sent on the A-bis Qx interface.



NOTE: A local alarm notification shall be created from the Failure Event Report. The type of alarm notification (qualityOfServiceAlarm, equipmentAlarm, etc.) shall be properly set by the BSC on the basis of the Event Type. If the created alarm notification passes the event discrimination process a M-EVENT-REPORT shall be sent to the OMC.

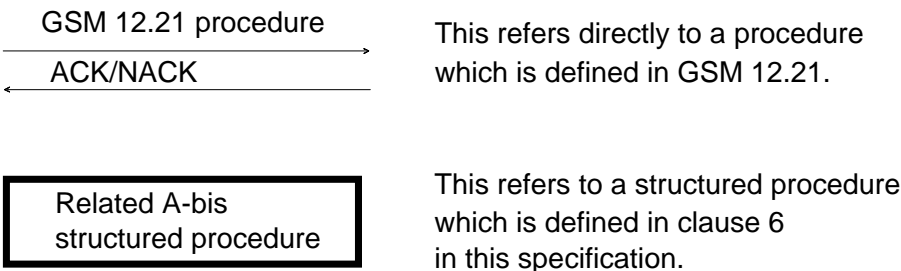
**Figure 7: Interworking procedure for alarm notifications**

5      **Specific interworking aspects**

This clause of the ETS presents the interworking requirements that are specific to each GSM 12.20 specified, BTS related object class. These requirements include:

- The mapping between GSM 12.20 and GSM 12.21 specified object classes.
- The mapping between GSM 12.20 specified attributes, actions and notifications and GSM 12.21 specified attributes, event reports and procedures.
- The interworking procedures for CMIS services.

An interworking procedure includes a sequence chart describing the CMIS services (GSM 12.21 procedures) that activate the procedure and the consequent procedures executed on the A-bis Qx interface. The presentation format of these A-bis procedures is as follows:



5.1      **BasebandTransceiver Object Class**

An instance of the GSM 12.20 object class basebandTransceiver shall be mapped to an instance of the GSM 12.21 object class Baseband Transceiver.

5.1.1      **Information Mapping between GSM 12.20 basebandTransceiver and GSM 12.21 Baseband Transceiver**

5.1.1.1      **Mapping of Attributes**

The following table includes the required mapping between GSM 12.20 basebandTransceiver attributes and GSM 12.21 Baseband Transceiver attributes. In normal operation the values of these attributes shall be kept consistent.

**Table 5: The mapping of GSM 12.20 basebandTransceiver attributes to GSM 12.21 Baseband Transceiver attributes**

GSM 12.20 baseband-Transceiver attributes	GSM 12.21 Baseband Transceiver attributes
basebandTransceiver Package (mandatory)	
basebandTransceiverID	Baseband Transceiver number
relatedGSMEquipment	1)HW Configuration
relatedOAMLapdLink	2)Abis Channel
relatedRadioCarrier	3)
relatedTelecomLapdLink	4) Abis Channel
administrativeState	5)Administrative State
alarmStatus	3)
operationalState	5)Operational State
unknownStatus	3)

NOTE 1: The HW Configuration attribute contains only a part of the information that is present in the equipment objects pointed by the GSM 12.20 attribute relatedGSMEquipments. The HW Configuration attribute is not changeable by standard GSM 12.21 procedures.

NOTE 2: The relatedOAMLapdLink attribute presents the related A-bis signalling link that is used to carry the A-bis O&M messages defined in the interworking procedures. Whether or not the end-point (i.e. the Abis Channel attribute of the Baseband Transceiver) of this link is manageable at the BTS side is implementation dependant. Therefore management of the Abis Channel attribute may be optional.

NOTE 3: This is managed only by the BSC.

NOTE 4: The relatedTelecomLapdLink attribute represents the related A-bis signalling link that is used to carry the A-bis telecom messages defined in GSM 08.58. Whether or not the end-point (i.e. the Abis Channel attribute of the transceiver) of this link is manageable at the BTS side is implementation dependant.

NOTE 5: See subclause 4.4 for state management requirements.

#### **5.1.1.2 Mapping of GSM 12.21 Event Reports to GSM 12.20 Notifications**

The following table includes the required mapping between GSM 12.21 Baseband Transceiver event reports and GSM 12.20 basebandTransceiver notifications. The common interworking requirements specified in subclauses 4.4 and 4.5 apply to these event reports and notifications.

**Table 6: The mapping of GSM 12.21 Baseband Transceiver Event Reports to GSM 12.20 basebandTransceiver notifications.**

GSM 12.21 Baseband Transceiver Event Reports	GSM 12.20 baseband-Transceiver notifications
Changed State Event Report	stateChange
Failure Event Report	1)qualityOfServiceAlarm communicationsAlarm processingErrorAlarm environmentalAlarm equipmentAlarm

NOTE: The type of the alarm notification shall be determined by the BSC based on the contents (e.g. Probable cause) of the GSM 12.21 Failure Event Report.

### **5.1.1.3 Mapping of GSM 12.20 Actions to GSM 12.21 procedures**

The basebandTransceiver object class includes the action forcedHO. The interworking procedure for this action is specified in subclause 5.1.2.5.

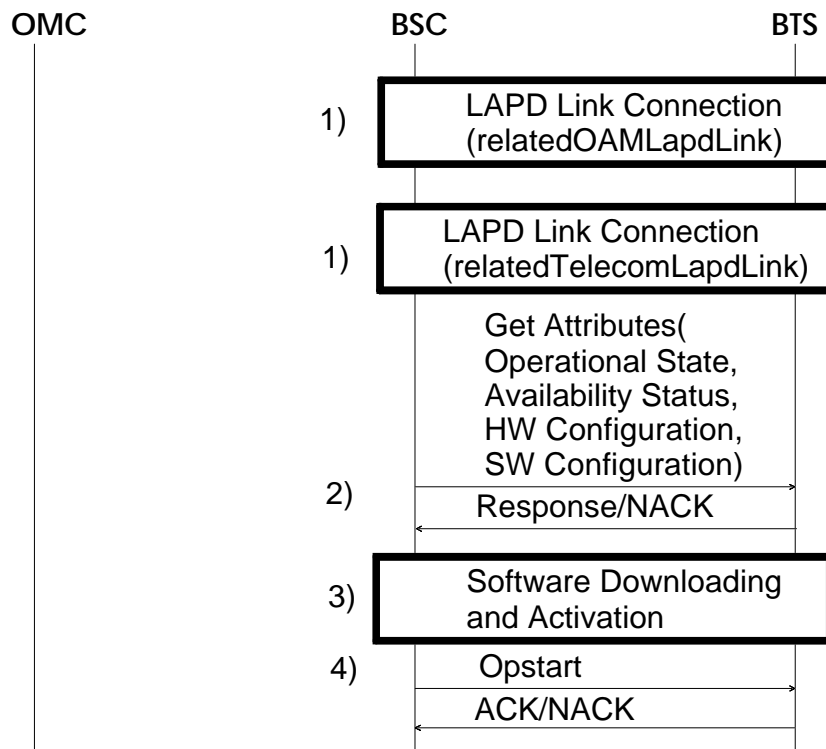
## **5.1.2 The Specific Interworking Procedures of the basebandTransceiver Object Class**

### **5.1.2.1 Initialization Procedure for the basebandTransceiver Object Class**

The following procedure shall be executed on the A-bis Qx interface when a basebandTransceiver object instance is to be initialized. The initialization may be triggered by the following events:

- The basebandTransceiver object instance is created in the BSC by the M-CREATE-service.
- The GSM 12.21 Baseband Transceiver object instance sends a Changed State Event Report or Software Activate Request as specified in GSM 12.21 after the corresponding GSM 12.20 object instance has been created in the BSC.
- The basebandTransceiver object instance is unlocked with M-SET service and the operational state of this object instance is Disabled.

In normal operation the operational state of the basebandTransceiver should change to Enabled as a result of this procedure. Errors and changes in the operational state during the initialization shall be reported as specified in subclauses 4.3 and 4.4.



**NOTE 1:** These procedures shall be executed only if this specific GSM 12.21 implementation supports A-bis interface management and the signalling link has not yet been connected and/or the TEI has not been established. If the relatedOAMLapdLink and relatedTelecomLapdLink share the same physical timeslot and TEI, the lapdLink initialization procedure shall be executed only once.

**NOTE 2:** The state and configuration information related to this Baseband Transceiver instance shall be read from the BTS agent. If the Operational State attribute has value Disabled, the Availability Status attribute will further refine the operational state as specified in GSM 12.21. The HW Configuration attribute shall correspond to the equipment object instances in the GSM 12.20 specified management information base (e.g. the contents of the HW Configuration attribute may be used to populate the information base). The SW Configuration attribute will list the files that are available locally at the BTS site.

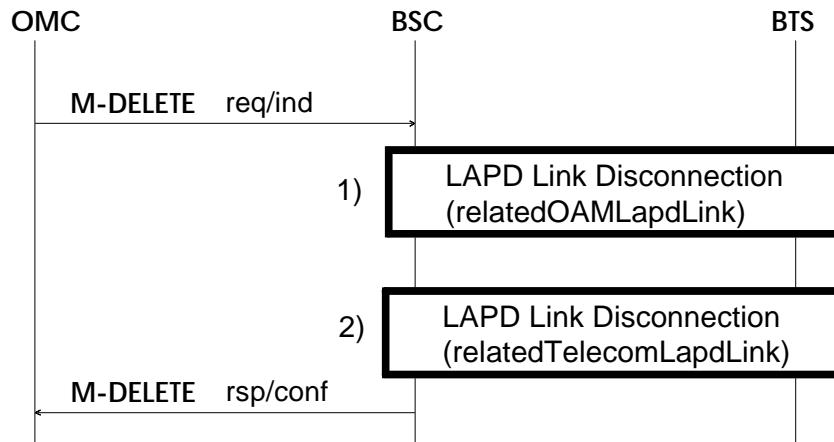
**NOTE 3:** The Software Downloading and Activation procedure is executed only if this specific basebandTransceiver object instance has related software, i.e. there are instances of the operatingSoftwareUnit that are contained within this basebandTransceiver object instance or the gsmEquipment object instances pointed by the relatedGSMEquipment attribute of this basebandTransceiver object instance. All the files related to the running version of the basebandTransceiver software shall be downloaded and activated. The SW Configuration attribute contains the files that have been already downloaded to the site. If the Availability Status attribute had value Off line the activation has already been done or it is not needed because there is no related software. Note that software activation is possible only if the administrative state of the operatingSoftwareUnit is Unlocked. The errors in the software downloading and activation shall be notified by the corresponding operatingSoftwareUnit object instance as processingErrorAlarms.

**Figure 8: The initialization procedure of the basebandTransceiver object class**



### 5.1.2.2 M-DELETE

The following figure presents message sequence that is needed in order to delete a basebandTransceiver object instance.



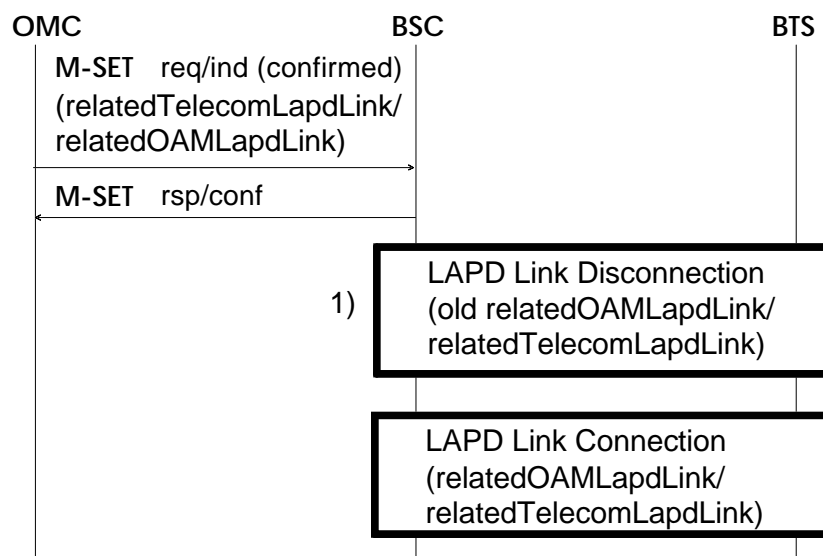
NOTE 1: This procedure is executed only if the lapdLink initialization procedure was executed in the basebandTransceiver initialization procedure and the lapdLink is not referred to by some other object instance(s).

NOTE 2: The second lapdLink disconnection procedure shall be executed only if the relatedTelecomLapdLink was connected with a separate lapdLink connection procedure during the basebandTransceiver initialization.

**Figure 9: The M-DELETE interworking procedure of the basebandTransceiver object class**

### 5.1.2.3 M-SET

The following procedure shall be executed when the relatedOAMLapdLink or related relatedTelecomLapdLink attributes of a basebandTransceiver object instance are modified with M-SET service. The interworking is required only if this specific GSM 12.21 implementation supports A-bis interface management.



NOTE: The old link(s) referred to by the old value(s) of the relatedOAMLapdLink and/or relatedTelecomLapdLink attributes shall be disconnected first.

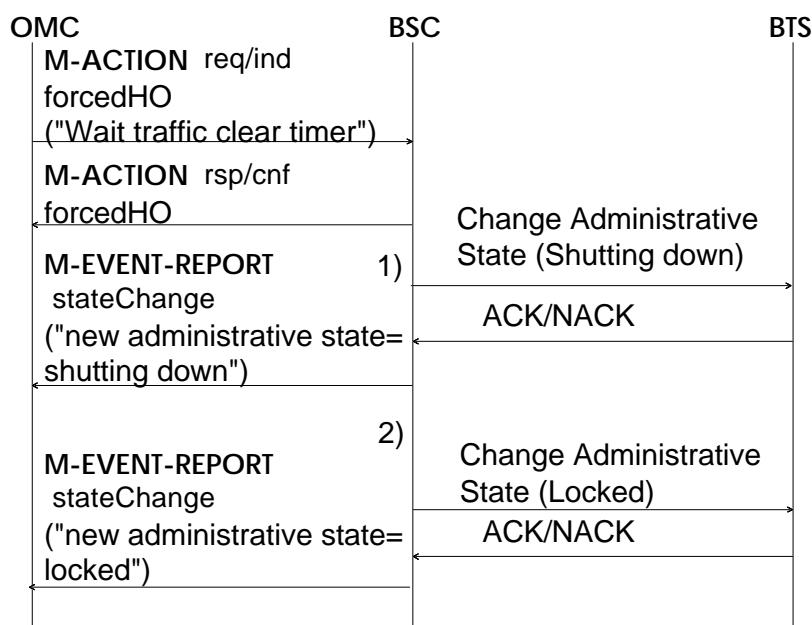
**Figure 10: The M-SET (relatedOAMLapdLink and/or relatedTelecomLapdLink attributes) interworking procedure of the basebandTransceiver object class**

#### 5.1.2.4 M-GET

Get Attributes elementary procedure may be optionally used to read the attributes from the BTS as specified in subclause 4.2.3.

#### 5.1.2.5 M-ACTION, forcedHO

This action provides with a graceful close of the resources related to a basebandTransceiver object instance.



NOTE 1: If the basebandTransceiver has no active users the administrative state is set directly to locked and only the last three messages of this sequence chart are sent.

If there are active users in this basebandTransceiver a timer is started with the value that was sent in the parameters of the forcedHO action request. The administrative state of the basebandTransceiver is set to shutting down which prevents new calls through this basebandTransceiver.

NOTE 2: Handover is tried continuously for all the active calls. Also intracell handovers are allowed and they are preferred. If timer expires all the calls are immediately disconnected. When all the channels are released or the timer has expired the administrative state of the basebandTransceiver is set to locked.

**Figure 11: The M-ACTION forcedHO interworking procedure of the basebandTransceiver object class**

## 5.2 BTS Object Class

An instance of the GSM 12.20 object class bts shall be mapped to an instance of the GSM 12.21 object class BTS.

### 5.2.1 Information Mapping between GSM 12.20 bts Object and GSM 12.21 BTS Object

#### 5.2.1.1 Attribute Mapping

The following table includes the required mapping between GSM 12.20 bts attributes and GSM 12.21 BTS attributes. In normal operation the values of these attributes shall be kept consistent.

**Table 7. The mapping of GSM 12.20 bts attributes to GSM 12.21 BTS attributes.**

<b>GSM 12.20 bts attributes</b>	<b>GSM 12.21 BTS attributes</b>
btsBasicPackage (mandatory)	
bCCHAllocationNumber	1)
bsIdentityCode	BSIC
btsID	BTS number
cellAllocation	2)BCCH ARFCN
cellAllocationNumber	1)
cellGlobalIdentity	3)
cellReselectHysteresis	3)
mSTxPwrMax	3)
periodCCCHLoadIndication	CCCH Load Indication Period
plmnPermitted	3)
rACHBusyThreshold	RACH Busy Threshold
rACHLoadAveragingSlot	RACH Load Averaging Slots
radioLinkTimeout	3)
relatedGSMEquipment	4)HW Configuration
relatedOAMlapdLink	Abis Channel
relatedTranscoder	1)
rxLevAccessMin	3)
thresholdCCCHLoad	CCCH Load Threshold Indication
administrativeState	5)Administrative State
alarmStatus	1)
operationalState	5)Operational State
unknownStatus	1)
usageState	1)
btsCCCHConfigurationPackage (mandatory)	
maxNumberRetransmissions	3)
mSTxPwrMaxCCH	3)
numberOfSlotsSpreadTrans	3)
ny1	Ny1
noOfBlocksForAccessGrant	3)
noOfMultiframesBetweenPaging	3)
btsOptionsPackage (mandatory)	
allowIMSIAttachDetach	3)
callReestablishmentAllowed	3)
cellBarred	3)
dtxDownlink	1)
dtxUpLink	1)
emergencyCallRestricted	3)
notAllowedAccessClasses	3)
timerPeriodUpdateMS	3)
btsTimerPackage attributes (mandatory)	
t200	T200
t31xx	6)BTS Air Timer

Notes to table 7:

- NOTE 1: This is implemented only in the BSC
- NOTE 2: The cellAllocation defines the sequence of radio frequencies allocated and available to the cell. The first element sets the BCCH frequency.
- NOTE 3: The corresponding information shall be sent in a relevant GSM 08.58 procedure (BCCH INFO or SACCH FILL) within the System Information (reference. GSM 12.20 and GSM 04.08).

NOTE 4: The HW Configuration attribute contains a part of the information that is present in the equipment objects pointed by the GSM 12.20 attribute relatedGSMEquipments. The HW Configuration attribute is not changeable by standard GSM 12.21 procedures.

NOTE 5: See subclause 4.4 for state management requirements.

NOTE 6: BTS Air Timer corresponds only timer t3105. Other timers are internal to the BSC.

### 5.2.1.2 Mapping of GSM 12.21 Event Reports to GSM 12.20 Notifications

The following table includes the required mapping between GSM 12.21 BTS Event Reports and GSM 12.20 bts notifications. The common interworking requirements specified in subclauses 4.4 and 4.5 apply to these event reports and notifications.

**Table 8: The mapping of GSM 12.21 BTS Event Reports to GSM 12.20 bts**

GSM 12.21 BTS Event Reports	GSM 12.20 bts notifications
Changed State Event Report	stateChange
Failure Event Report	1)qualityOfServiceAlarm communicationsAlarm processingErrorAlarm environmentalAlarm equipmentAlarm

NOTE: The type of the alarm notification shall be determined by the BSC based on the contents (e.g. Probable cause) of the GSM 12.21 Failure Event Report.

### 5.2.1.3 Mapping of GSM 12.20 actions to GSM 12.21 procedures

The basebandTransceiver object class includes the actions forcedHO and channelConfigurationModification. The interworking procedures for these actions are specified in subclauses 5.1.2.5. and 5.1.2.6.

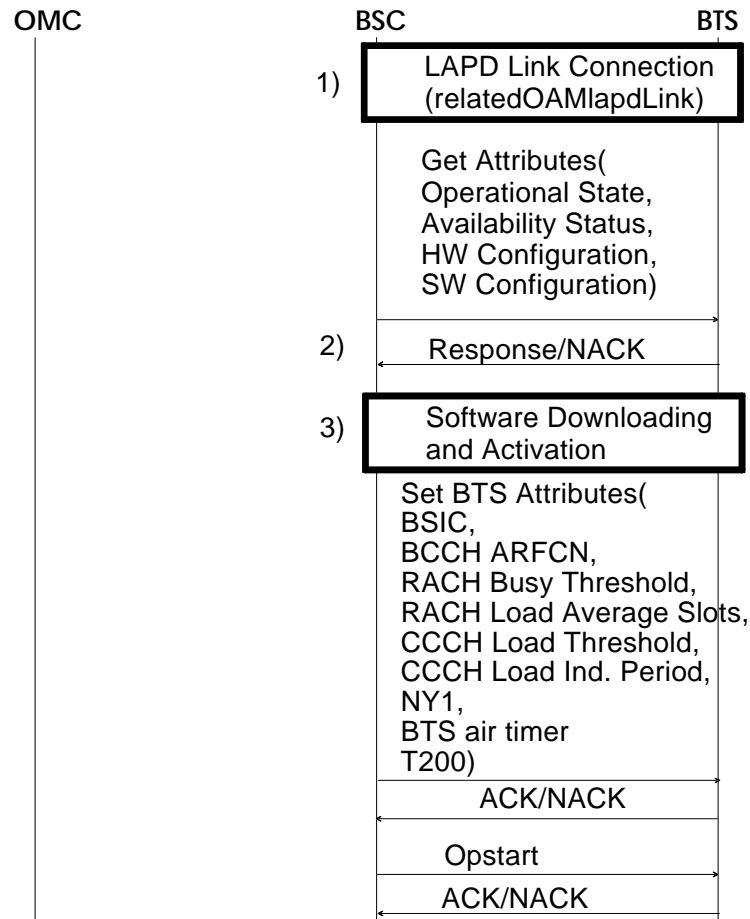
## 5.2.2 The specific interworking procedures of the bts Object Class

### 5.2.2.1 Initialization procedure for the bts Object Class

The following procedure shall be executed on the A-bis Qx interface when a bts object instance is to be initialized. The initialization may be triggered by the following events:

- The bts object instance is created in the BSC by the M-CREATE-service.
- The GSM 12.21 BTS object instance sends a Changed State Event Report or Software Activate Request as specified in GSM 12.21 after the corresponding GSM 12.20 object instance has been created in the BSC.
- The bts object instance is unlocked with M-SET service and the operational state of this object instance is Disabled.

In normal operation the operational state of the bts should change to Enabled as a result of this procedure. Errors and changes in the operational state during the initialization shall be reported as specified in the subclauses 4.3 and 4.4 respectively.



NOTE 1: This procedure shall be executed only if this specific BTS implementation supports A-bis interface management and the O&M signalling link has not yet been connected and/or the TEI has not been established.

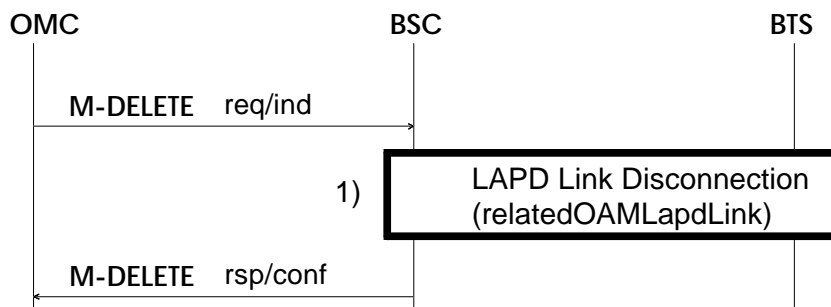
NOTE 2: The state and configuration information related to this BTS instance shall be read from the BTS agent. If the Operational State attribute has value Disabled, the Availability Status attribute will further refine the operational state as specified in GSM 12.21. The HW Configuration attribute shall correspond to the equipment object instances in the GSM 12.20 specified management information base (e.g. the contents of the HW Configuration attribute may be used to populate the information base). The SW Configuration attribute will list the files that are available locally at the BTS site.

NOTE 3: Software downloading and activation procedure is executed only if this bts object instance has related software, i.e. there are instances of the operatingSoftwareUnit that are contained within this bts object instance or the gsmEquipment object instances pointed by the relatedGSMEquipment attribute of this bts object instance. All the files related to the running version of the BTS software shall be downloaded and activated. The SW Configuration attribute contains the files that have been already downloaded to the site. If the Availability Status attribute had value Off line the activation has already been done or it is not needed because there is no related software. Note that software activation is possible only if the administrative state of the operatingSoftwareUnit is Unlocked. The errors in the software downloading and activation shall be notified by the corresponding operatingSoftwareUnit object instance as processingErrorAlarms.

**Figure 12: The initialization procedure of the bts object class**

### 5.2.2.2 M-DELETE

The following figure presents the interworking procedure that is needed in order to delete a bts object instance.

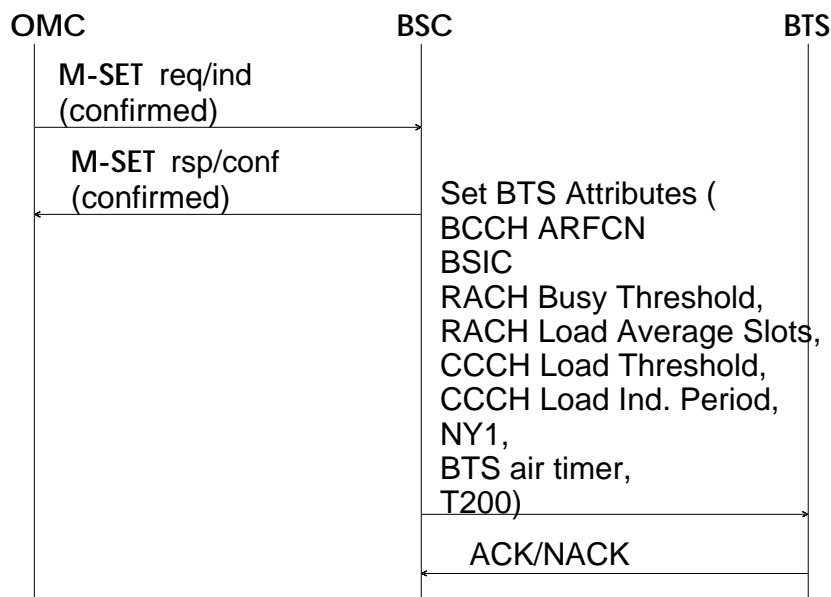


NOTE: This procedure is executed only if the lapdLink initialization procedure was executed in the bts initialization procedure and the lapdLink is not referred to by some other object instance(s).

**Figure 13: The M-DELETE interworking procedure of the basebandTransceiver object class**

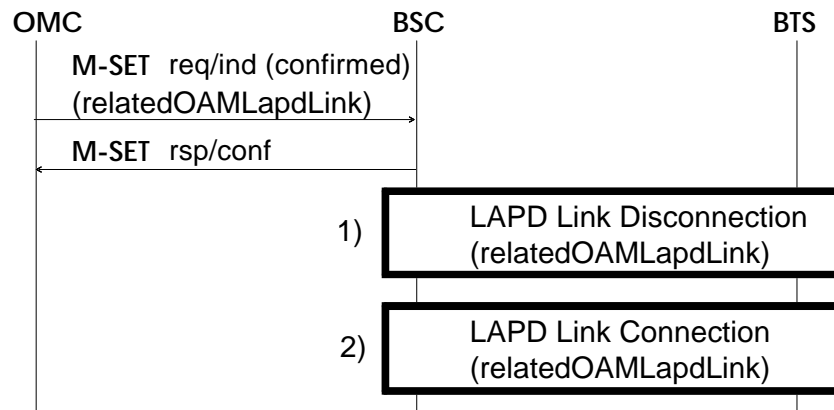
### 5.2.2.3 M-SET

The following procedure shall be executed when the attributes, except the relatedOAMLapdLink attribute, of a bts object instance are modified with the M-SET service. If the bsic or cellAllocation attributes are to be modified the administrative state of the bts shall be locked.



**Figure 14: The M-SET interworking procedure of the bts object class**

The following procedure shall be executed when the relatedOAMLapdLink of a bts object instance is modified with M-SET service. The interworking is required only if this specific GSM 12.21 implementation supports A-bis interface management.



NOTE: The old link referred to by the old value of the relatedOAMLapdLink relatedTelecomLapdLink attribute shall be disconnected first.

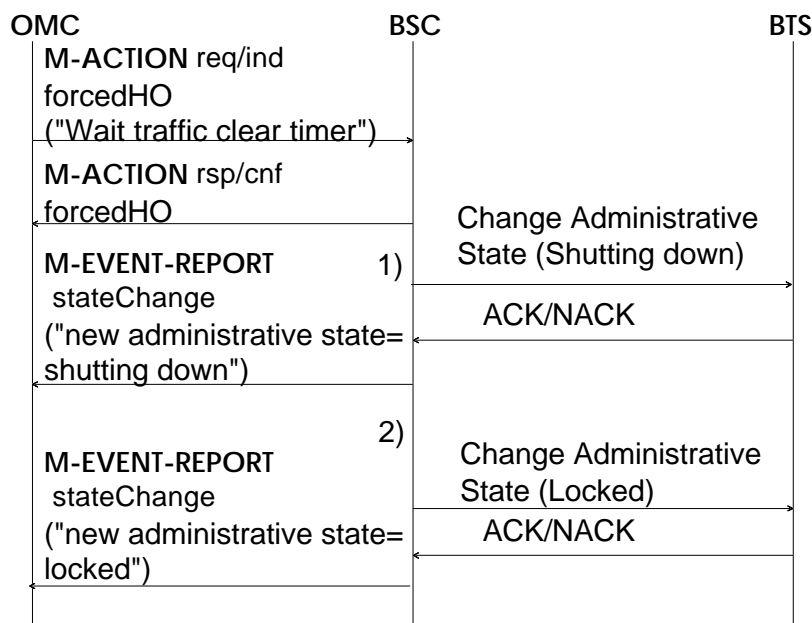
**Figure 15: The M-SET relatedOAMLapdLink Interworking procedure of the bts object class**

#### 5.2.2.4 M-GET

Get Attributes elementary procedure may be optionally used to read the attributes from the BTS as specified in subclause 4.2.3.

### 5.2.2.5 M-ACTION, forcedHO

This action provides with a graceful close of the resources related to a bts object instance.



NOTE 1: BTS is barred which means that no new call setups can be made through this BTS. The cellBarred attribute is set to True. Then there are two cases:

1) If the BTS has no active users the administrative state is set directly to locked and only the last three messages of this sequence chart are sent.

2) If there are active users in this BTS a timer is started with the value that was sent in the parameters of the forcedHO action request. The administrative state of the BTS is set to shutting down which prevents incoming handovers to this BTS.

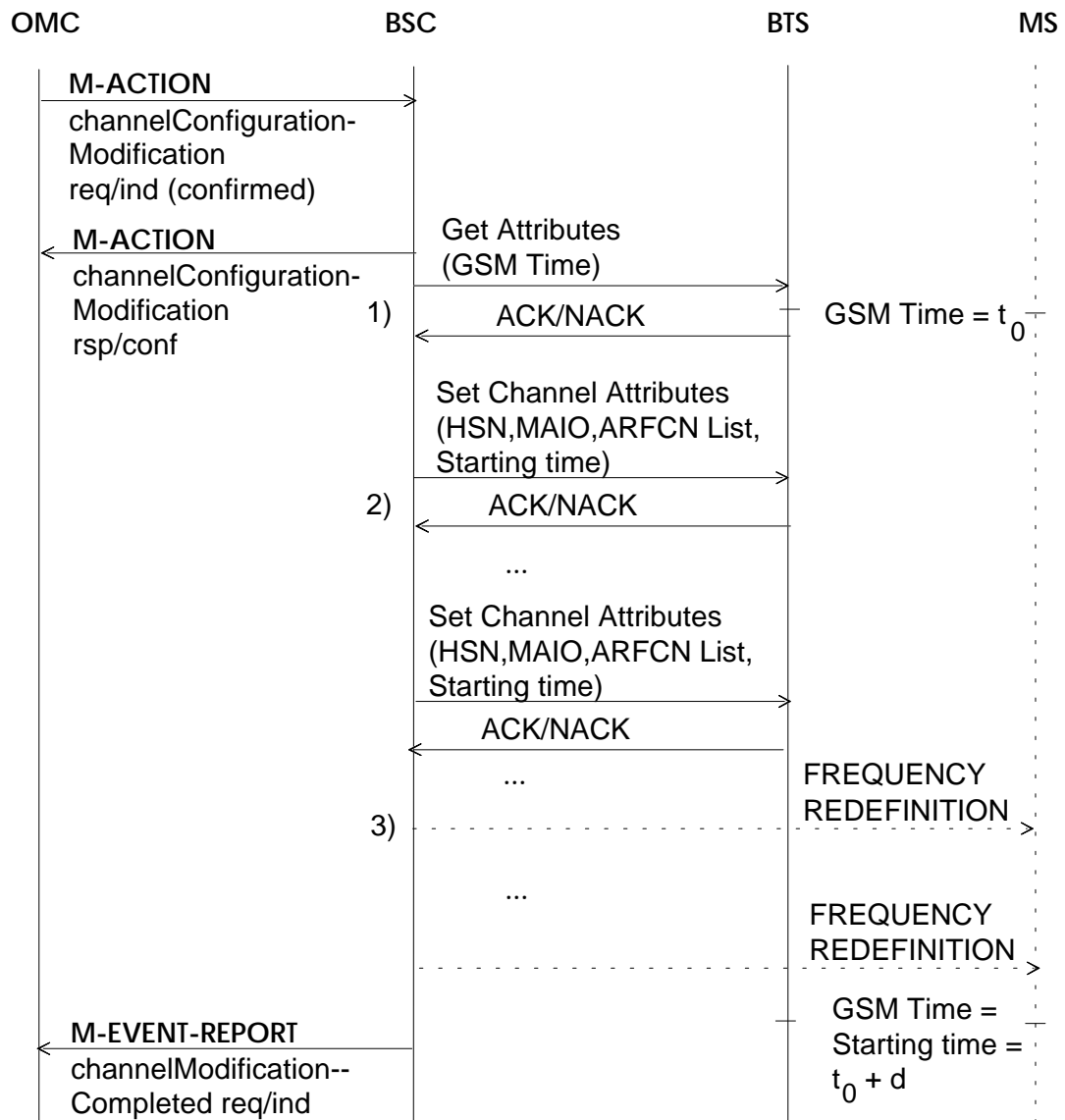
NOTE 2: Handover is attempted continuously for all the active calls. If timer expires all the calls are immediately disconnected. When all the channels are released or the timer has expired the administrative state of the BTS is set to locked.

**Figure 16: The M-ACTION forcedHO interworking procedure of the bts object class**

### 5.2.2.6 M-ACTION, channelConfigurationModification

The following sequence chart presents the frequency redefinition procedure which is started by the M-ACTION channelConfigurationModification send by the OMC. This action operates on a bts object instance and defines the new frequency configuration for all the objects (i.e. channels) below it. This action is usually needed when an operator decides to change the frequency hopping sequences at the BTS and does not want to cause calls to be disconnected. GSM 04.08 specifies a procedure called FREQUENCY REDEFINITION that supports this.





NOTE 1: The GSM time attribute (it is a read-only attribute) contains the current frame number known by both the BTS and the MSs that are connected to that BTS. The starting time will define the frame number when the new configuration will be put into use. In the sequence chart above the GSM Time attribute has value  $t_0$  when it is read in the beginning. The Starting time parameter will be set to value  $t_0+d$ , where  $d$  is the delay needed to execute the whole procedure.

NOTE 2: A failure to set attributes of a channel will cause the whole sequence to be rolled back (the old values will be reset to the modified channels) and a channelConfigurationCompleted notification to be generated with the successIndicator attribute indicating the failure.

NOTE 3: The FREQUENCY REDEFINITION messages (reference. GSM 04.08) are sent as transparent messages by the BSC (in GSM 08.58 DATA REQUEST or UNIT DATA REQUEST messages) to the MSs via the BTS. These messages are needed only for the channels that are allocated.

**Figure 17: The M-ACTION channelConfigurationModification interworking procedure of the bts object class**

### 5.3 BTS SiteManager Object Class

An instance of the GSM 12.20 object class `btsSiteManager` shall be mapped to an instance of the GSM 12.21 object class Site Manager.

#### 5.3.1 Information mapping between GSM 12.20 `btsSiteManager` and GSM 12.21 Site Manager

##### 5.3.1.1 Mapping of attributes

The following table includes the mapping between the GSM 12.20 `btsSiteManager` attributes and the GSM 12.21 attributes.

**Table 9: The mapping between GSM 12.20 specified `btsSiteManager` attributes and GSM 12.21 specified Site Manager attributes.**

GSM 12.20 <code>btsSiteManager</code> attributes	GSM 12.21 Site Manager attributes
<code>btsSiteManagerBasic-Package</code>	
<code>btsSiteManagerID</code>	1)
<code>relatedGSMEquipment</code>	2)HW Configuration
<code>relatedOAMLapdLink</code>	3)Abis Channel

NOTE 1: This is implemented only in the BSC.

NOTE 2: The HW Configuration attribute contains a part of the information that is present in the equipment objects pointed by the GSM 12.20 attribute `relatedGSMEquipments`. The HW Configuration attribute is not changeable by GSM 12.21 procedures.

NOTE 3: The related `lapdLink` is the A-bis signalling link used for A-bis O&M (GSM 12.21) messages. The link connected to the `btsSiteManager` is the default link (reference. GSM 12.21).

##### 5.3.1.2 Mapping of GSM 12.21 Event Reports to GSM 12.20 Notifications

The following table includes the required mapping between GSM 12.21 Site Manager Event Reports and GSM 12.20 `btsSiteManager` notifications. The common interworking requirements specified in subclauses 4.4 and 4.5 apply to these event reports and notifications.

**Table 10: The mapping of GSM 12.21 Site Manager Event Reports to GSM 12.20 `btsSiteManager` notifications**

GSM 12.21 Site Manager Event Reports	GSM 12.20 <code>btsSiteManager</code> notifications
Failure Event Report	1)environmentalAlarm equipmentAlarm

NOTE: The type of the alarm notification shall be determined by the BSC based on the contents (e.g. Probable cause) of the GSM 12.21 Failure Event Report.

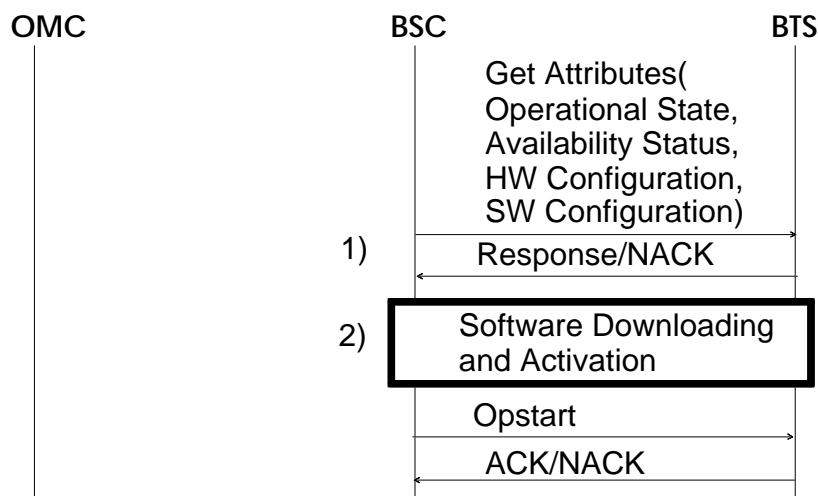
### **5.3.2        The specific interworking procedures of the btsSiteManager Object Class**

#### **5.3.2.1        Initialization procedure for the btsSiteManager Object Class**

The following procedure shall be executed on the A-bis Qx interface when a btsSiteManager object instance is to be initialized. The initialization may be triggered by the following events:

- The btsSiteManager object instance is created in the BSC by the M-CREATE-service.
- The GSM 12.21 Site Manager object instance sends a Changed State Event Report or Software Activate Request as specified in GSM 12.21 after the corresponding GSM 12.20 object instance has been created in the BSC.

Errors during the initialization shall be reported as specified in clause 4.



NOTE 1: The state and configuration information related to this Site Manager instance shall be read from the BTS agent. If the Operational State attribute has value Disabled, the Availability Status attribute will further refine the operational state as specified in GSM 12.21. The HW Configuration attribute shall correspond to the equipment object instances in the GSM 12.20 specified management information base (e.g. the contents of the HW Configuration attribute may be used to populate the information base). The SW Configuration attribute will list the files that are available locally at the BTS site.

NOTE 2: Software downloading and activation procedure shall be executed only if this `btsSiteManager` object instance has related software, i.e. there are instances of the `operatingSoftwareUnit` that are contained within this `btsSiteManager` object instance or the `gsmEquipment` object instances pointed by the `relatedGSMEquipment` attribute of this `btsSiteManager` object instance. All the files related to the running version of the Site Manager software shall be downloaded and activated. The SW Configuration attribute contains the files that have been already downloaded to the site. If the Availability Status attribute had value Off line the activation has already been done or it is not needed because there is no related software. Note that software activation is possible only if the administrative state of `operatingSoftwareUnit` is Unlocked. The errors in the software downloading and activation shall be notified by the corresponding `operatingSoftwareUnit` object instance as `processingErrorAlarms`.

**Figure 18: Initialization procedure for the `btsSiteManager` object class**

### 5.3.2.2 M-DELETE

There are no requirements on interworking.

### 5.3.2.3 M-SET

There are no requirements on interworking.

### 5.3.2.4 M-GET

Get Attributes elementary procedure may be optionally used to read the attributes from the BTS as specified in subclause 4.2.3.

## 5.4 Channel Object Class

An instance of the GSM 12.20 object class channel and the frequencyHoppingSystem instance that is related to that channel instance shall be mapped to an instance of the GSM 12.21 object class Channel.

### 5.4.1 Information mapping between GSM 12.20 channel and GSM 12.21 Channel

### 5.4.2 Mapping of attributes

The following table includes the required mapping between GSM 12.20 channel and GSM 12.21 Channel attributes. In normal operation the values of these attributes shall be kept consistent.

**Table 11: The mapping of GSM 12.20 channel attributes to GSM 12.21 Channel attributes**

GSM 12.20 Channel Attributes	GSM 12.21 Channel attributes
channelPackage (mandatory)	
channelID	Radio Timeslot number
channelCombination	Channel Combination
frequencyUsage	1)ARFCN List HSN MAIO
terrTrafChannel	2)AbisChannel Radio Sub Channel
tsc	Tsc
administrativeState	3)Administrative State
operationalState	3)Operational State

NOTE 1: The frequencyUsage attribute corresponds to a single element ARFCN (Absolute Radio Frequency Number) List in a non-hopping configuration or ARFCN List, HSN and MAIO in a hopping configuration (the frequencyUsage attribute refers to a frequencyHoppingSystem object in this case).

NOTE 2: The correspondence shall exist only if this specific BTS implementation supports A-bis interface management. The terrTrafChannel attribute shall then contain the identification of the terrestrial channels as seen by the agent managing them at the BTS site. This identification shall be included in the TerrTrafChannel type in the trafficChannel field that is of type AbisChannel. The btsTimeslot optional field shall then be present in this type. In case of half rate channels (the channelCombination is either tCHHalf or tCHHalf2) there are two radio sub-channels associated to a single channel object instance.

NOTE 3: See subclause 4.4 for state management requirements.

#### 5.4.2.1 Mapping of GSM 12.21 event reports to GSM 12.20 notifications

The following table includes the required mapping between GSM 12.21 Channel event reports and GSM 12.20 channel notifications. The common interworking requirements specified in subclauses 4.4 and 4.5 apply to these event reports and notifications.

**Table 12: The mapping of GSM 12.21 Channel Event Reports to GSM 12.20 channel notifications**

GSM 12.21 Channel Event Reports	GSM 12.20 channel notifications
Changed State Event Report	stateChange
Failure Event Report	1)qualityOfServiceAlarm communicationsAlarm processingErrorAlarm environmentalAlarm equipmentAlarm

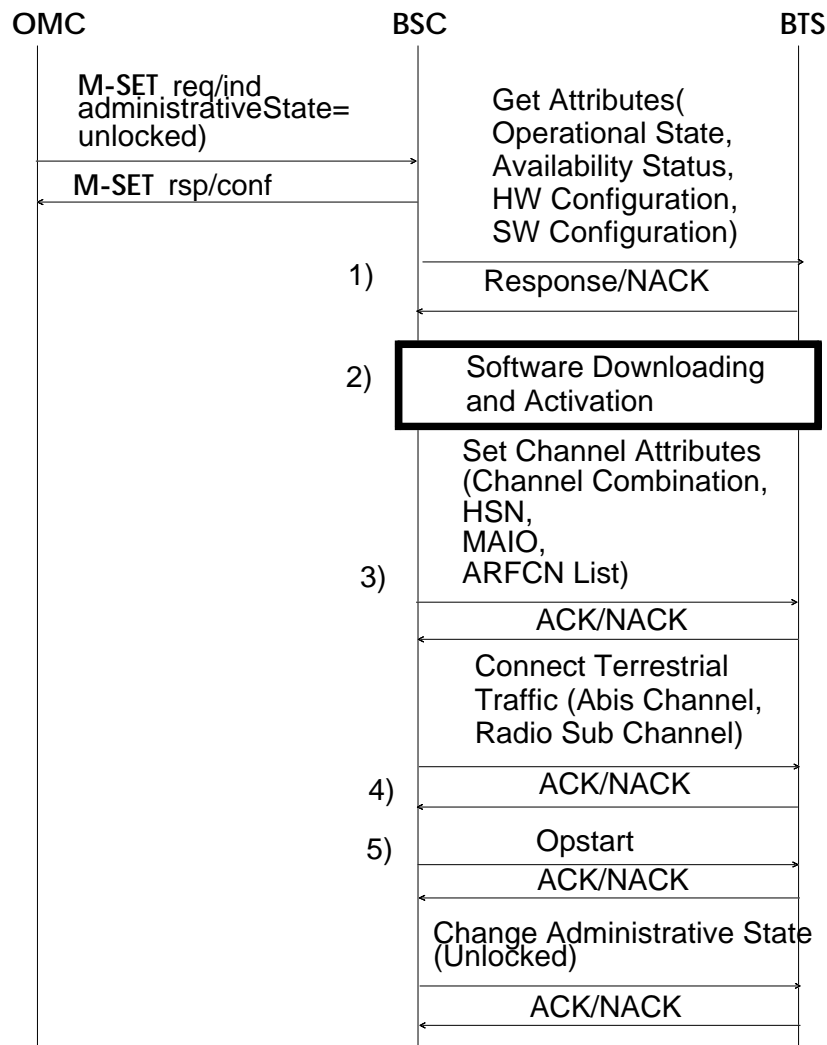
NOTE: The type of the alarm notification shall be determined by the BSC based on the contents (e.g. Probable cause) of the GSM 12.21 Failure Event Report.

#### 5.4.3 The specific interworking procedures of the channel Object Class

##### 5.4.3.1 Initialization procedure for the channel Object Class

Eight instances of the channel class are created automatically when an instance of a basebandTransceiver is created. The initial (NULL) values are set to the channelCombination, frequencyUsage, relatedGSMEquipment, terrTrafChannel and tsc attributes of the channels. These values have to be with the M-SET service before the initialization procedure on the A-bis Qx interface can be executed. Therefore the initialization procedure on the A-bis Qx interface shall be started only by setting the administrative state of the channel instance to Unlocked. The following figure describes this initialization procedure.

In normal operation the operational state of the channel should change to Enabled as a result of this procedure. Errors and changes in the operational state during the initialization shall be reported as specified in the subclauses 4.3 and 4.4.



**Figure 19: The initialization procedure of the channel object class**

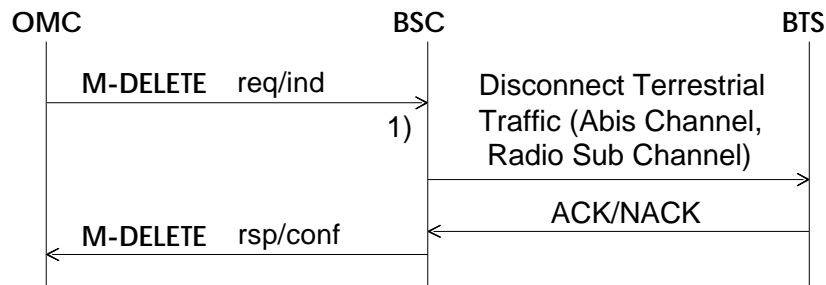
Notes to Figure 19:

- NOTE 1: The state and configuration information related to this Channel instance shall be read from the BTS agent. If the Operational State attribute has value Disabled, the Availability Status attribute will further refine the operational state as specified in GSM 12.21. The HW Configuration attribute shall correspond to the equipment object instances in the GSM 12.20 specified management information base (e.g. the contents of the HW Configuration attribute may be used to populate the information base). The SW Configuration attribute will list the files that are available locally at the BTS site.
- NOTE 2: Software downloading and activation procedure is executed only if this channel object instance has related software, i.e. there are instances of the operatingSoftwareUnit that are contained within this channel object instance or the gsmEquipment object instances pointed by the relatedGSMEquipment attribute of this channel object instance. All the files related to the running version of the channel software shall be downloaded and activated. The SW Configuration attribute contains the files that have been already downloaded to the site. If the Availability Status attribute had value Off line the activation has already been done or it is not needed because there is no related software. Note that software activation is possible only if the administrative state of the operatingSoftwareUnit is Unlocked. The errors in the software downloading and activation shall be notified by the corresponding operatingSoftwareUnit object instance as processingErrorAlarms

- NOTE 3: If the channel instance does not refer to a frequencyHoppingSystem instance, the attributes HSN and MAIO shall be absent and the ARFCN list shall be represented by a single ARFCN element.
- NOTE 4: The Connect Terrestrial Traffic shall be present when the channel represents a traffic channel and this BTS implementation supports A-bis interface management. Besides, in case of half rate radio channels mapped on a channel object with the channelCombination set to the value tCHHalf or tCHHalf2, **two** Connect Terrestrial Traffic messages shall be transmitted in order to associate two distinct connections on the A-bis interface to the same Channel.
- NOTE 5: Relevant information from the GSM 08.58 BCCH INFO and SACCH FILL must be available to the related Baseband Transceiver before the Channel is available for use, i.e. before the Opstart procedure is executed.

#### 5.4.3.2 M-DELETE

The following figure presents the message sequence that is needed in order to delete Channel in a Transceiver.



- NOTE: The Disconnect Terrestrial Traffic shall present when the channel represents a traffic channel and this BTS implementation supports A-bis interface management. Besides, in case of half rate radio channels mapped on a channel object with the channelCombination attribute set to the value tCHHalf or tCHHalf2, **two** Disconnect Terrestrial Traffic messages shall be transmitted in order to disconnect two distinct connections on the A-bis interface to the same Channel.

**Figure 20: The M-DELETE interworking procedure of the channel object class**

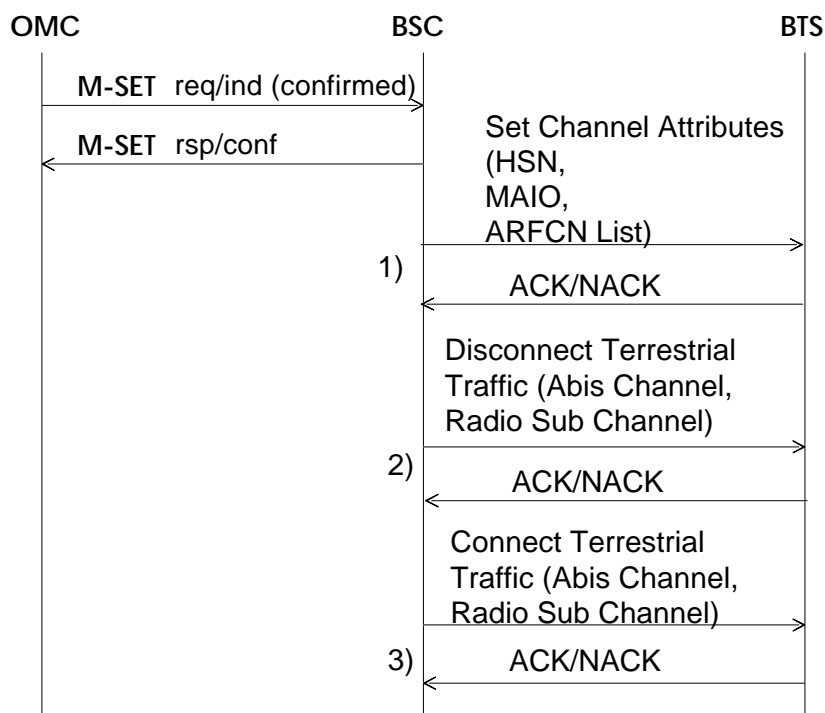
#### 5.4.3.3 M-SET

The attributes that can be modified directly with M-SET service without locking the channel first are described in the following sequence chart.

- NOTE: Modifying the tsc (training sequence code) or channelCombination attributes requires that the administrative state of the channel is locked. If the channel to be modified is BCCH then the whole bts has to be locked before the frequencyUsage attribute could be changed. All the attributes can be modified when the channel object is locked. Modified values are sent to the BTS when the channel object is unlocked.

The following figure presents the procedures that are needed in order to set attributes value in a channel instance with M-SET service.





NOTE 1: If the channel instance does not refer to a frequencyHoppingSystem instance the attributes HSN and MAIO are absent, while the ARFCN list is represented by a single ARFCN element.

NOTE 2: If the terrTrafChannel attribute is modified and this BTS implementation supports A-bis interface management the old terrestrial traffic channel shall be disconnected first. In case of half rate radio channels mapped on a channel object with the (old) channelCombination attribute set to the value tCHHalf or tCHHalf2, **two** Disconnect Terrestrial Traffic messages must be transmitted in order to disconnect two distinct connections on the A-bis interface to the same Channel.

NOTE 3: This procedure shall be executed only if the terrTrafChannel attribute is modified; this BTS implementation supports A-bis interface management and the channel is a traffic channel. Besides, in case of half rate radio channels mapped on a channel object with the channelCombination set to the value tCHFull, **two** Connect Terrestrial Traffic messages shall be transmitted in order to associate two distinct connections on the A-bis interface to the same channel.

**Figure 21: The M-SET interworking procedure of the channel object class**

#### 5.4.3.4 M-GET

Get Attributes elementary procedure may be optionally used to read the attributes from the BTS as specified in subclause 4.2.3.

### 5.5 FrequencyHoppingSystem Object Class

The GSM 12.20 object class frequencyHoppingSystem has no corresponding object class in GSM 12.21. The instances of the frequencyHoppingSystem that are referred to by the instances of the GSM 12.20 channel class have corresponding attributes in the instances of the GSM 12.21 Channel class.

#### 5.5.1 Information mapping between GSM 12.20 frequencyHoppingSystem attributes and GSM 12.21 Channel

##### 5.5.1.1 Mapping of Attributes

The following table includes the required mapping between GSM 12.20 frequencyHoppingSystem attributes and GSM 12.21 Channel attributes. Note that the correspondence exists only if the frequencyHoppingSystem is related to a channel object instance. In normal operation the values of these attributes shall be kept consistent.

**Table 13: The mapping of GSM 12.20 frequencyHoppingSystem attributes to GSM 12.21 Channel attributes.**

GSM 12.20 frequencyHoppingSystem attributes	GSM 12.21 Channel attributes
frequencyHoppingSystem Package	
frequencyHoppingSyste mID	1)
hoppingSequence- Number	HSN
mobileAllocation	ARFCN-List

NOTE: An instance of the channel class should refer to this frequencyHoppingSystemID (i.e. object instance). Otherwise the interworking is not required.

## 5.5.2 The interworking procedures of the frequencyHoppingSystem Object Class

### 5.5.2.1 Initialization procedure for the frequencyHoppingSystem Object Class

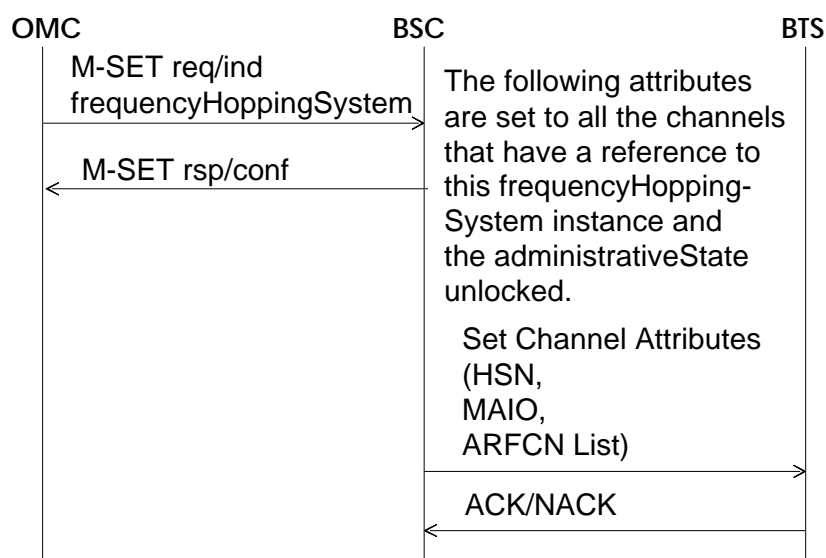
Initialization of the instances of the frequencyHoppingSystem object class that are referred to by channel instances shall be part of the corresponding channel initialization procedures.

### 5.5.2.2 M-DELETE

Deletion is not allowed if the object instance to be deleted is referenced by a channel object instance.

### 5.5.2.3 M-SET

If hoppingSequenceNumber or mobileAllocation attributes are changed all the channels that refer to this frequencyHoppingSystem has to be updated at the BTS. The following sequence chart describes that. Note that the channelConfigurationModification action of the bts object class is recommended to be used in frequency redefinitions rather than the direct modifications to the attributes of the frequencyHoppingSystems objects. The direct modifications can result losing ongoing traffic on the channels that are referring to that specific frequencyHoppingSystem instance.

**Figure 22: The M-SET interworking procedure of the frequencyHoppingSystem object class**

#### 5.5.2.4 M-GET

This shall always be a local procedure of the BSC.

### 5.6 LapdLink Object Class

The object class lapdLink models the LAPD signalling links on the A-bis interface. Both telecom and O&M signalling links are covered by the lapdLink object class. The lapdLink object used for A-bis telecom signalling is referred to by a basebandTransceiver object (the relatedTelecomLapdLink attribute) and the lapdLink used for A-bis O&M signalling by a btsSitemanager, bts or basebandTransceiver (the relatedOAMLapdLink attribute).

The administrative state of the lapdLink is used to control the activation of O&M links. When the lapdLink is in the Locked state the BSC will not accept anything from the BTS. When the lapdLink is unlocked it is activated and the BSC may start receiving SW activate requests, event reports, etc. sent by the BTS.

It depends on the presence of object instances in the MIB of the BSC whether the BSC will finally accept the requests and reports coming from an unlocked lapdLink. If the GSM 12.20 object that corresponds to a GSM 12.21 object had been created the BSC should handle the GSM 12.21 messages concerning that object. Otherwise messages are not handled.

The operational state of a lapdLink object will be Disabled if the A-bis interface management procedures of GSM 12.21 are supported and the signalling link has not been connected to the BTS/and or TEI establishment procedure has not been executed.

#### 5.6.1 Information mapping between GSM 12.20 lapdLink and GSM 12.21 Objects

##### 5.6.1.1 Mapping of attributes

The following table includes the required mapping between GSM 12.20 lapdLink attributes and GSM 12.21 attributes. In normal operation the values of these attributes shall be kept consistent.

**Table 14: The mapping between lapdLink object class and GSM 12.21 attributes**

GSM 12.20 lapdLink attributes	GSM 12.21 attributes in Site Manager, BTS and Baseband Transceiver
lapdLinkPackage	
abisSigChannel	1) Abis Channel
lapdLinkID	2)
sapi	3)
tei	TEI
administrativeState	4)
alarmStatus	4)
operationalState	4)
unknownStatus	4)

NOTE 1: GSM 12.21 does not specify lapdLink objects. Site manager, BTS and Baseband Transceiver objects contain, however, Abis Channel attribute which points to the related LAPD link as seen from the BTS site. The syntax of the GSM 12.20 attribute abisSigChannel contains optionally the btsTimeSlot field. If this field is implemented it shall correspond to the Abis Channel attribute.

NOTE 2: This naming attribute is used in the BSC. The instances of the btsSiteManager, bts or basebandTransceiver that refer to this lapdLink shall use the value of this attribute in the reference.

NOTE 3: This is a predefined constant (0 for telecom signalling link and 62 for O&M signalling link).

NOTE 4: These attributes are implemented only in the BSC.

## 5.6.2 Interworking procedures for the lapdLink Object Class

### 5.6.2.1 Initialization procedure for the lapdLink Object Class

The initialization of the lapdLink instances shall be executed on the A-bis Qx interface when an (GSM 12.20) object instance that has related lapdLinks is initialized. The following object classes may have related lapdLinks:

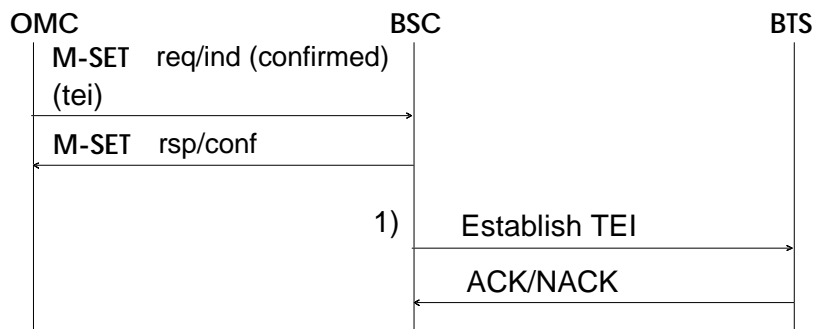
- The btsSiteManager has one related O&M link. The link connected to the btsSiteManager is a default link and it is used to initialize the other links.
- The bts object class has one related O&M link. The initialization of this link may be part of the bts initialization procedure.
- The basebandTransceiver has one related O&M and telecom link. The initialization of these links may be part of the basebandTransceiver initialization procedure.

### 5.6.2.2 M-DELETE

The M-DELETE service shall get an error response (processing failure error) if there is a reference(s) to this instance of the lapdLink that has not been removed. The M-DELETE service itself does not require any interworking since removing the reference from the related object causes disconnection of the link (reference. M-DELETE and M-SET interworking procedures of the bts and basebandTransceiver classes).

### 5.6.2.3 M-SET

The following procedure shall be executed when the tei attributes of a lapdLink instance is modified with M-SET service. The interworking is required only if this specific GSM 12.21 implementation supports A-bis interface management.



NOTE: The existing TEI shall be removed with the Remove TEI procedure as specified in GSM 08.56 before the new TEI is established. The Establish TEI message shall be addressed to the GSM 12.21 object whose corresponding GSM 12.20 object has a reference to this lapdLink object instance.

**Figure 23: The M-SET interworking procedure of the lapdLink object class**

### 5.6.2.4 M-GET

This shall always be a local procedure in the BSC.

## 5.7 radioCarrier Object Class

### 5.7.1 Information mapping between GSM 12.20 radioCarrier and GSM 12.21 Radio Carrier

An instance of the GSM 12.20 object class radioCarrier shall be mapped to an instance of the GSM 12.21 object class Radio Carrier.

#### 5.7.1.1 Mapping of attributes

The following table includes the required mapping between GSM 12.20 radioCarrier attributes and GSM 12.21 Radio Carrier attributes. In normal operation the values of these attributes shall be kept consistent.

**Table 15: The mapping of GSM 12.20 radioCarrier attributes to GSM 12.21 Radio Carrier attributes.**

GSM 12.20 radioCarrier attributes	GSM 12.21 Radio Carrier attributes
radioCarrierPackage (mandatory)	
carrierFrequencyList	ARFCN List
powerClass	Power Class
radioCarrierID	Radio Carrier number
relatedGSMEquipment	1)HW Configuration
txPwrMaxReduction	RF Max PowerReduction
administrativeState	2)Administrative State
alarmStatus	3)
operationalState	2)Operational State
unknownStatus	3)

NOTE 1: The HW Configuration attribute contains a part of the information that is present in the equipment objects pointed by the GSM 12.20 attribute relatedGSMEquipments. The HW Configuration attribute is not changeable via GSM 12.21 procedures.

NOTE 2: See subclause 4.4. for general state management requirements.

NOTE 3: This is implemented only in the BSC.

#### 5.7.1.2 Mapping of GSM 12.21 Event Reports to GSM 12.20 notifications

The following table includes the required mapping between GSM 12.21 Radio Carrier event reports and GSM 12.20 radioCarrier notifications. The common interworking requirements specified in subclauses 4.4 and 4.5 apply to these event reports and notifications.

**Table 16: The mapping of GSM 12.21 Radio Carrier Event Reports to GSM 12.20 radioCarrier notifications**

GSM 12.21 Radio Carrier Event Reports	GSM 12.20 radioCarrier notifications
Changed State Event Report	stateChange
Failure Event Report	<sup>1)</sup> qualityOfServiceAlarm communicationsAlarm processingErrorAlarm environmentalAlarm equipmentAlarm

NOTE: The type of the alarm notification shall be determined by the BSC based on the contents (e.g. Probable cause) of the GSM 12.21 Failure Event Report.

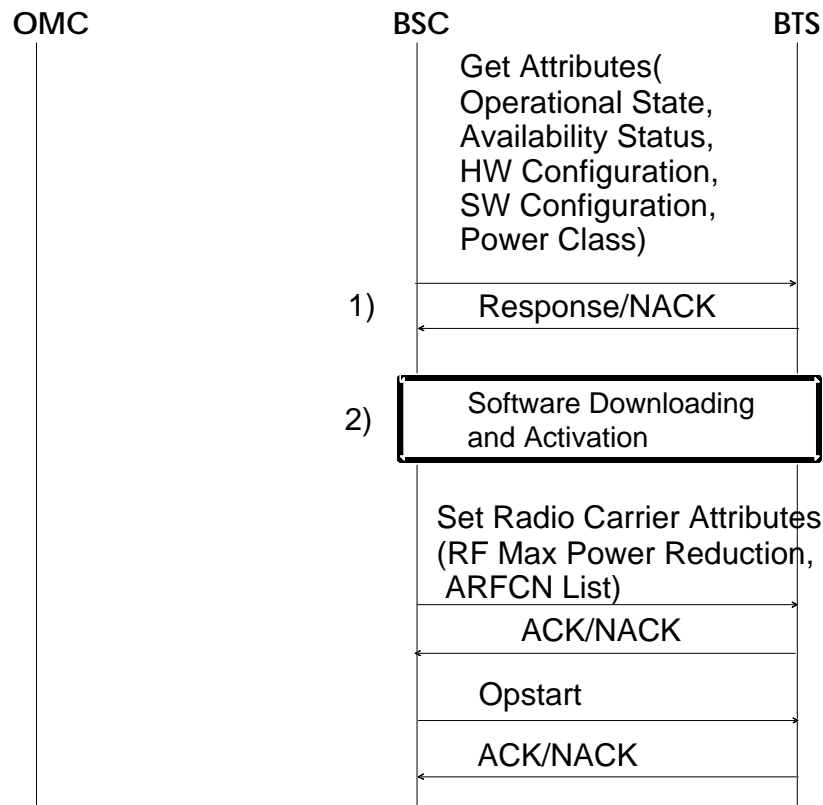
## **5.7.2 The interworking procedures of the radioCarrier Object Class**

### **5.7.2.1 The Initialization procedure for the radioCarrier Object Class**

The following procedure shall be executed on the A-bis interface when a radioCarrier object instance is to be initialized. The initialization may be triggered by the following events:

- The object instance is created in the BSC by the M-CREATE-service.
- The GSM 12.21 Radio Carrier object instance sends a Changed State Event Report or SW Activate Request as specified in GSM 12.21 after the corresponding GSM 12.20 object instance has been created in the BSC.
- The radioCarrier object instance is unlocked with M-SET service and the operational state of this object instance is Disabled.

In normal operation the operational state of the radioCarrier should change to Enabled as a result of this procedure. Errors and changes in the operational state during the initialization shall be reported as specified in the general requirements.



NOTE 1: The state and configuration information related to this Radio CarrierBaseband Transceiver instance shall be read from the BTS agent. If the Operational State attribute has value Disabled, the Availability Status attribute will further refine the operational state as specified in GSM 12.21. The HW Configuration attribute shall correspond to the equipment object instances in the GSM 12.20 specified management information base (e.g. the contents of the HW Configuration attribute may be used to populate the information base). The SW Configuration attribute will list the files that are available locally at the BTS site. The value of the Power Class attribute shall also be read from the BTS site and the corresponding GSM 12.20 specified radioCarrier object instance shall be updated accordingly.

NOTE 2: Software downloading and activation procedure is executed only if this radioCarrier object instance has related software, i.e. there are instances of the operatingSoftwareUnit that are contained within this radioCarrier object instance or the gsmEquipment object instances pointed by the relatedGSMEquipment attribute of this radioCarrier object instance. All the files related to the running version of the radioCarrier software shall be downloaded and activated. The SW Configuration attribute contains the files that have been already downloaded to the site. If the Availability Status attribute had value Off line the activation has already been done or it is not needed because there is no related software. Note that software activation is possible only if the administrative state of the operatingSoftwareUnit is Unlocked. The errors in the software downloading and activation shall be notified by the corresponding operatingSoftwareUnit object instance as processingErrorAlarms.

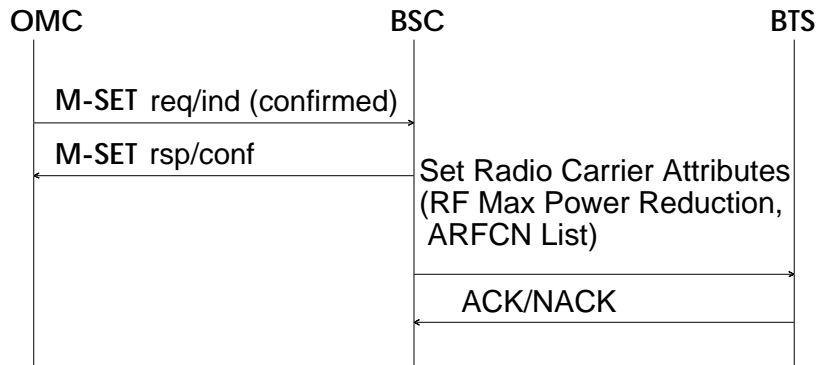
**Figure 24: The initialization procedure of the radioCarrier object class**

#### 5.7.2.2 M-DELETE

M-DELETE does not cause any interworking.

#### 5.7.2.3 M-SET

The following figure presents the procedure that is needed in order to set attribute values in a radioCarrier object instance.



**Figure 25: The M-SET interworking procedure of the radioCarrier object class**

#### 5.7.2.4 M-GET

Get Attributes elementary procedure may be optionally used to read the attributes from the BTS as specified in subclause 4.2.3.

### 5.8 Software Objects

#### 5.8.1 Introduction

Software interworking involves the following GSM 12.20 object classes:

- replaceableSoftwareUnit (RSU):

This class represents a unit of software that needs to be separately identifiable and/or replaceable on the system. When the resource represented by an instance of this class is able to be downloaded or exists locally (at the BSC), the relatedFiles attribute may be set to indicate the one or more files that make up this unit. The replaceableSoftwareUnit object instances may be contained in the instances of the managedElement or gsmEquipment object classes.

- executableSoftwareUnit (ESU):

This class represents a unit of software that is separately identifiable and is ready to be used by the system. When the resource represented by an instance of this class is made up of one or more separately identifiable and/or replaceable units, the relatedRSUs attribute may be set to identify these replaceableSoftwareUnit object instances. The executableSoftwareUnit object instances may be contained in the object instances of the managedElement class, the gsmEquipment class or the class that represents some functional unit.

- operatingSoftwareUnit (OSU):

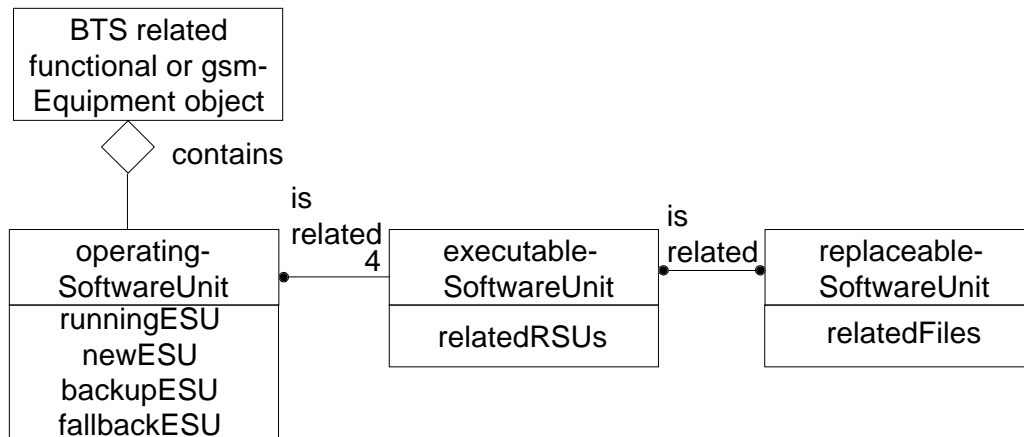
This class represents the operating software resource for an instance of equipment or functionality and is associated with the related equipment or functional unit through containment. The currently running software resource is represented by the runningESU attribute that identifies an object instance of an executableSoftwareUnit. If the automatic restart of the software is supported the backupESU attribute will identify an instance of the executableSoftwareUnit that will be started if the currently running software fails. Additional related executableSoftwareUnits may be identified by the newESU and fallbackESU attributes.

The interworking requirements apply to the instances of the operatingSoftwareUnit that are contained within any BTS related functional (i.e. btsSiteManager, bts, basebandTransceiver, channel or radioCarrier) or gsmEquipment object instance, and to instances of the executableSoftwareUnit that are referred to by the aforementioned operatingSoftwareUnits (with the attributes runningESU, newESU or backupESU) and finally to the instances of the replaceableSoftwareUnit that are referred to by the aforementioned executableSoftwareUnits (with the attribute relatedRSUs). An instance of the gsmEquipment is BTS related when it is pointed to by the relatedGSMEquipment attribute in a btsSiteManager, bts, basebandTransceiver, channel or radioCarrier object instance. Some implementations may not support



replaceable software units and therefore the interworking requirements on the replaceableSoftwareUnit object class do not apply to them.

The interworking between Q3 and Qx interfaces results from the modifications of the BTS related operatingSoftwareUnits (creation, attribute modifications) or from the modifications of the relationship attributes in the related executableSoftwareUnits (the relatedRSUs attribute) or in the replaceableSoftwareUnits (the relatedFiles attribute). The following figure presents the relationships that are important from the interworking point of view.



**Figure 26: The relationships between BTS related functional or gsmEquipment objects and software objects**

There do not exist any object classes representing software in the GSM 12.21 object model. However there exist relationships between the instances of the GSM 12.20 specified software objects and the files downloaded and activated at the BTS site. The SW Configuration attribute in the GSM 12.21 object model represents the files that have been downloaded to the BTS site.

GSM 12.21 does not specify any association between the files and the equipments at the BTS site (the SW Configuration attribute is contained within the functional objects). Therefore it is assumed that the files themselves contain information about the necessary associations between the files and the equipments (or equipment types) that the files are destined for.

The specific requirements on the interworking between the GSM 12.20 specified software objects and GSM 12.21 objects are given in the following subclauses.

## 5.8.2 Replaceable Software Unit Object Class

The following interworking requirements apply only to those implementations that support replaceable software units.

### 5.8.2.1 Information mapping between GSM 12.20 replaceableSoftwareUnit and GSM 12.21 objects

#### 5.8.2.1.1 Mapping of attributes

The following table specifies the required mapping between the attributes of a replaceableSoftwareUnit object instance and the attributes used in the GSM 12.21 procedures to manage the file that corresponds to that replaceableSoftwareUnit. When the file has been downloaded and exists at the BTS site, the SW Configuration attribute shall contain the information about the file (File Id and File Version).

**Table 17: The mapping between the replaceableSoftwareUnit object class and GSM 12.21 attributes**

GSM 12.20 replaceableSoftwareUnit attributes	GSM 12.21 attributes in software management procedures
replaceableSoftwareUnitPackage	
relatedFiles <sup>1)</sup>	2)
softwarePackage	
softwareID	2)
userLabelPackage	
userLabel	File Id
vendorNamePackage	
vendorName	2)
versionPackage	
version	File Version
currentProblemListPackage	
currentProblemList	2)

NOTE 1: This attribute may contain references to the related files that are downloaded from the OMC to the BSC. This list shall contain only one file to make the interworking between Q3 and Qx interfaces possible. The file name given in this attribute is used only by the BSC and the OMC in the FTAM transfer.

NOTE 2: This is implemented only in the BSC.

## **5.8.2.2 Interworking procedures**

### **5.8.2.2.1 M-CREATE**

There are no requirements on interworking since it is assumed that a replaceableSoftwareUnit object instance may not be referred to by an executableSoftwareUnit object instance before the replaceableSoftwareUnit object instance itself has been created.

### **5.8.2.2.2 M-DELETE**

There are no requirements on interworking.

### **5.8.2.2.3 M-SET**

If the relatedFiles attribute of a replaceableSoftwareUnit is modified while there are instances of the executableSoftwareUnit (directly) and operatingSoftwareUnit (via an executableSoftwareUnit) referring to this specific replaceableSoftwareUnit, file downloading and possibly activation shall be executed as specified in the interworking requirements of the operatingSoftwareUnit object class.

### **5.8.2.2.4 M-GET**

There are no requirements on interworking.

### **5.8.3 Executable Software Unit Object Class**

#### **5.8.3.1 Information mapping between GSM 12.20 executableSoftwareUnit and GSM 12.21 objects**

There is no direct mapping between the information contained in an instance of this object class and information contained in a GSM 12.21 object. The direct mapping is defined between an instance of the replaceableSoftwareUnit object class and the file related to a GSM 12.21 object.

#### **5.8.3.2 Interworking procedures**

##### **5.8.3.2.1 M-CREATE**

There are no requirements on interworking since it is assumed that an executableSoftwareUnit object instance may not be referred to by an operatingSoftwareUnit object instance before the executableSoftwareUnit object instance itself has been created.

##### **5.8.3.2.2 M-DELETE**

There are no requirements on interworking.

##### **5.8.3.2.3 M-SET**

If the relatedRSUs attribute of an executableSoftwareUnit is modified while there are instances of the operatingSoftwareUnit referring to that specific executableSoftwareUnit, file downloading and possibly activation shall be executed as specified in the interworking requirements of the operatingSoftwareUnit object class.

##### **5.8.3.2.4 M-GET**

No requirements on interworking.

### **5.8.4 Operating Software Unit Object Class**

#### **5.8.4.1 Information Mapping between GSM 12.20 operatingSoftwareUnit and GSM 12.21 objects**

There does not exist direct mapping from the attributes of the operatingSoftwareUnit to GSM 12.21 attributes. Instead, as specified in the previous subclauses, the attributes of the replaceableSoftwareUnits shall be mapped to the GSM 12.21 attributes.

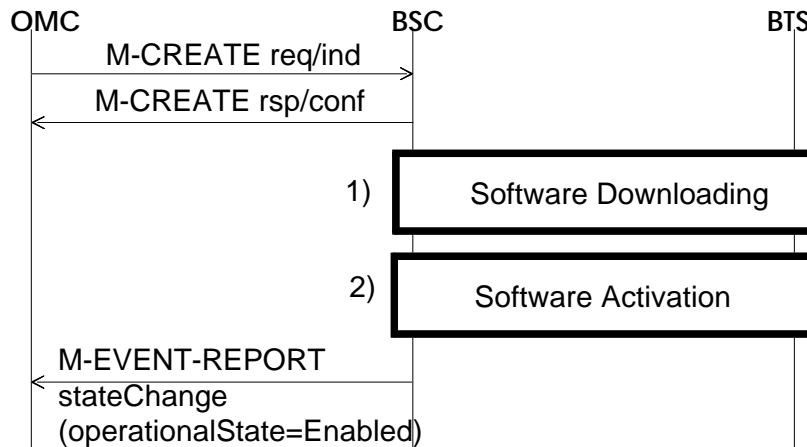
## 5.8.4.2 Interworking procedures

### 5.8.4.2.1 M-CREATE

The procedure specified in this subclause shall be executed on the following conditions:

- All the required related objects exist with the attribute values set appropriately.
- The relatedOAMLapdLink attribute of the related btsSiteManager, bts or basebandTransceiver object points to a lapdLink object that is Unlocked and Enabled.

The software initialization may also be part of a btsSiteManager, bts, basebandTransceiver, channel or radioCarrier object initialization as specified earlier in this chapter.



NOTE 1: The files corresponding to the several versions (i.e., running, new, backup, fallback) of the software may be downloaded to the BTS site at the same time. The running version shall be downloaded and activated before any other versions are downloaded.

NOTE 2: The software activation shall be executed on the file(s) that corresponds to the runningESU attribute of the operatingSoftwareUnit object instance if the administrative state of the object instance is Unlocked. If the software activation is successful (a SW Activated message is received) the operational state of the operatingSoftwareUnit shall change to Enabled.

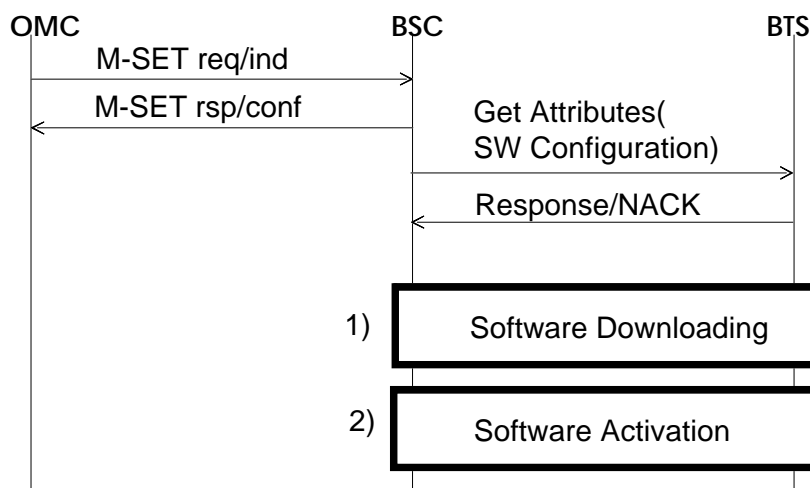
**Figure 27: Interworking when creating an operatingSoftwareUnit with M-CREATE**

### 5.8.4.2.2 M-DELETE

There are no requirements on interworking.

### 5.8.4.2.3 M-SET

The following procedure shall be executed when the runningESU attribute is changed . This procedure may be also executed if the relatedRSUs attribute in the executableSoftwareUnit (pointed by the runningESU attribute) is modified or the relatedFiles attribute in the replaceableSoftwareUnit is modified.

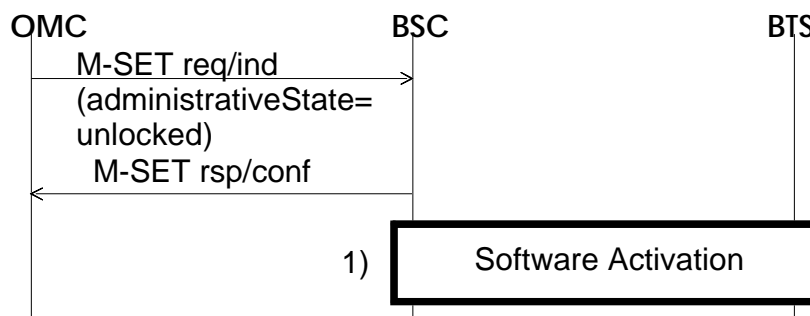


NOTE 1: The file(s) corresponding to the executableSoftwareUnit pointed by the runningESU attribute shall be downloaded to the destinations related to this operatingSoftwareUnit instance if they do not already exist (this is checked from the SW Configuration attribute) at the BTS site.

NOTE 2: The software activation shall be executed only if the administrative state is Unlocked.

**Figure 28: Interworking when setting the runningESU attribute with M-SET**

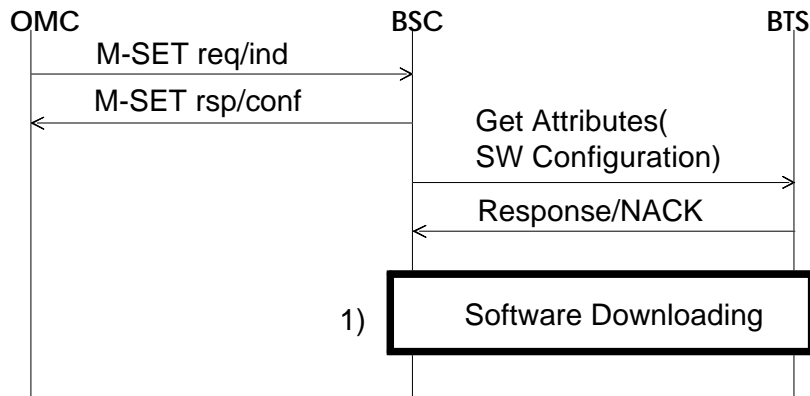
The following procedure shall be executed when the administrativeState of the operatingSoftwareUnit is changed to Unlocked. It is assumed that the files related to the operatingSoftwareUnit have been downloaded to the destination and only software activation is needed.



NOTE: The file(s) related to the executableSoftwareUnit pointed by the runningESU attribute shall be activated.

**Figure 29: Interworking when setting the administrativeState attribute with M-SET**

The following procedure may be executed when the backupESU, fallbackESU or newESU attribute is changed with M-SET service. This procedure may be executed also if the relatedRSUs attribute in the executableSoftwareUnit (backupESU, fallbackESU or newESU) is modified or the relatedFiles attribute in the replaceableSoftwareUnit is modified.



NOTE: The file(s) corresponding to the executableSoftwareUnit pointed by the backupESU, fallbackESU or newESU attribute shall be downloaded to the destinations related to this operatingSoftwareUnit instance.

**Figure 30: Interworking when setting the backupESU, fallback or newESU attribute with M-SET**

#### 5.8.4.2.4 M-GET

There are no requirements on interworking.

## 6 Related A-Bis Structured Procedures

This clause of the ETS presents the A-bis structured procedures that are used as part of the interworking procedures defined in the previous subclause. These structured procedures implement functions common to several object classes, as follows:

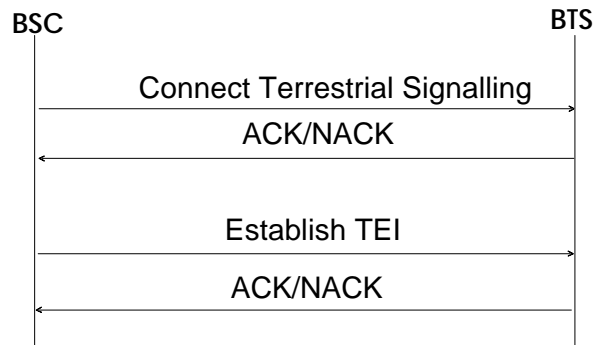
- A-bis signalling link management;
- Software management.

### 6.1 LAPD Link Connection

The following procedure shall be executed on the A-bis interface when an object instance that has related lapdLinks is initialized. The following object classes may have related lapdLinks:

- The btsSiteManager has one related O&M link. The link connected to the btsSiteManager is a default link and it is used to initialize the other links. The initialization procedure is not used for the initial link.
- The bts object class has one related O&M link. The initialization of this link may be part of the bts initialization procedure.
- The basebandTransceiver has one related O&M and telecom link. The initialization of these links may be part of the basebandTransceiver initialization procedure.

The following figure presents the GSM 12.21 procedures needed in the LAPD link initialization.

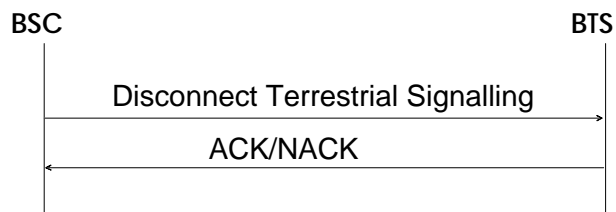


NOTE: The procedures shall be executed on the default link.

**Figure 31: LAPD Link Connection procedure**

## 6.2 LAPD Link Disconnection

The following figure presents the procedure that is needed in the lapdLink disconnection.



NOTE: The TEI shall be removed with the Remove TEI procedure as specified in GSM 08.56 before the timeslot is disconnected with the Disconnect Terrestrial Signalling procedure.

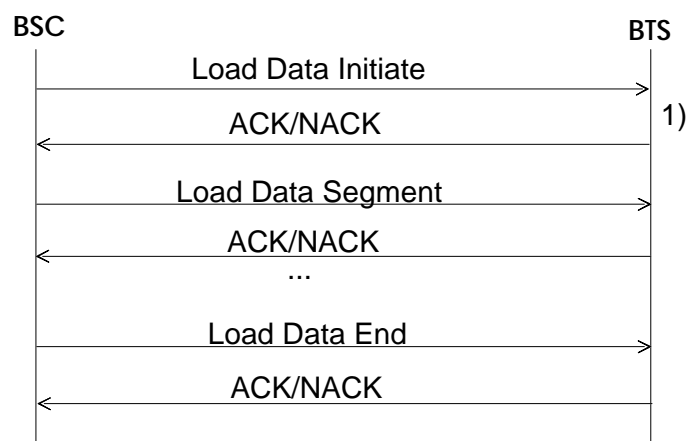
**Figure 32: LAPD Link Disconnection procedure**

## 6.3 Software Downloading and Activation

This subclause specifies the structured procedures to be used in software downloading and activation. These procedures can be used either combined (Software Downloading is immediately followed by Software Activation) or separately. The GSM 12.21 specified destination objects for these procedures can be either Site Manager, BTS, Baseband Transceiver, Channel or Radio Carrier.

### 6.3.1 Software Downloading

The following procedure shall be executed on the A-bis interface when a file is downloaded for a destination object at the BTS site.

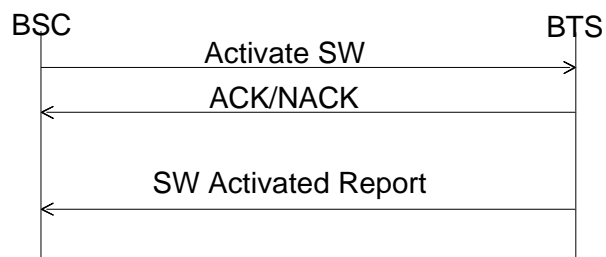


NOTE: If the file specified in the Load Data Initiate message (identified with File Id and File version attributes) already exists in the BTS destination object, it will be replaced by the downloaded file.

**Figure 33: Software Downloading procedure**

### 6.3.2 Software Activation

The following procedure shall be used to activate the file(s) for execution. A precondition for the usage of this procedure is that software has already been downloaded to the BTS site. The Activate SW message will be directed to one destination object and it includes the file(s) to be activated. Only one SW Activated Report message will be sent by the destination object when it has activated the file(s).



**Figure 34: Software Activation procedure**



## Annex A (informative): Some interworking issues

### A.1 Structured procedures on Q3 Interface

There are several preconditions before the interworking procedures defined in this ETS can be successfully executed. Naturally the behaviour requirements defined in GSM 12.20 regarding, e.g. name bindings have to be followed. The following objects should be created before the BTS related objects can be initialized:

- A-bis interface related objects i.e. pcmCircuit and lapdLink objects. The lapdLink objects referred to by the btsSitemanager, bts or basebandTransceiver objects are the most important ones because the interworking procedures will be executed on these links.
- Equipment objects (i.e. instances of gsmEquipments or subclasses of gsmEquipment) referred to by the BTS related objects.
- Software objects (instances of replaceableSoftwareUnits, executableSoftwareUnits and operatingSoftwareUnits) contained in or referred to by BTS related objects

After this there are several possible scenarios that apply to the creation and activation of BTS related objects:

- 1) The BTS related objects are created while the related lapdLink objects are locked:  
The resources (i.e. GSM 12.21 objects) are not initialized until the lapdLink objects are unlocked. When the resources have been installed at the BTS site the related lapdLink objects are unlocked and the initialization of the GSM 12.21 objects starts.
- 2) The objects are created while the related lapdLink objects are unlocked and the resources have not been installed at the BTS site:  
There are two subcases (actually there could be a mixture of these subcases; the approach can vary from the object class to another):
  - 2.1) The GSM 12.21 objects are capable of sending Changed State Event Reports when the related resources have been installed  
The BSC will initialize the GSM 12.21 objects after receiving information about their operational state. GSM 12.21 describes this in the subclause 5.3.
  - 2.2) The GSM 12.21 objects are not capable of sending Changed State Event Reports (or the event reports were lost at the BSC) when the related resources have been installed  
The BSC will initialize the GSM 12.21 object when the GSM 12.20 objects are unlocked for the first time. The operational state Disabled of the GSM 12.20 object will tell that this object has not been initialized yet (or the related resource has failed). Unlocking can be initialized either from the OMC (M-SET), the BSC or BTS (with GSM 12.21 procedure Change Administrative State Request).
- 3) The BTS related objects are created while the related lapdLink objects are unlocked and the resources have been installed at the BTS site  
The BSC will initialize the GSM 12.21 objects immediately after creation of the corresponding GSM 12.20 objects. Note that the channel objects cannot be initialized like this because they are created automatically when the baseBandTransceivers are created and their attributes have only initial NULL values.

## Annex B (informative): Reconfiguration procedures

### B.1 Assumptions

This annex contains example procedures for BCCH and SDCCH reconfiguration.

The following assumptions have been made when writing these procedures:

- BCCH reconfiguration is executed simply by swapping the failed basebandTransceiver-radioCarrier pair with enabled and unlocked one. A basebandTransceiver and a radioCarrier are related via the object instance identifiers.
- The software of a BCCH transceiver (radio carrier or baseband transceiver) is not different from the software of a transceiver that is carrying only traffic i.e. no software downloading or activation is therefore necessary when the configurations are swapped.
- No locking of the objects is necessary.
- It is assumed that the Changed State Event Reports are always sent in correct order and/or with correct status. It means that a Radio Carrier or a Baseband Transceiver does not report a state change before the BTS has reported the state change if the whole BTS became disabled. Otherwise the procedures would be executed in vain.

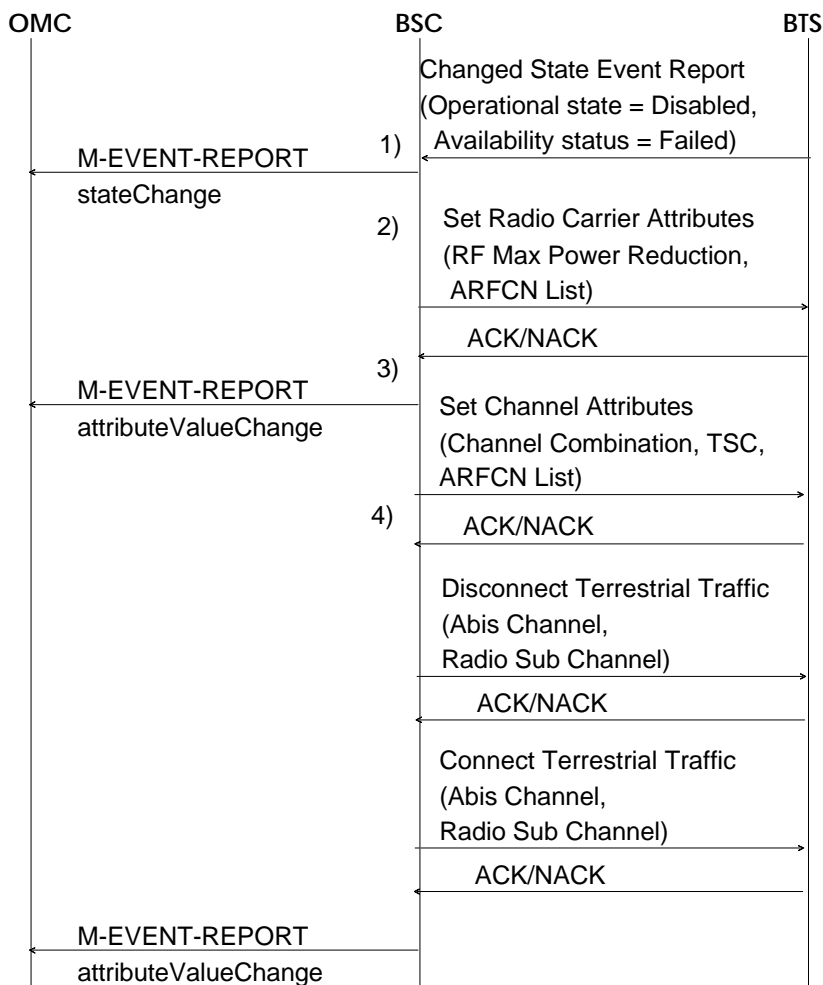
### B.2 Implementation specific issues

The following issues are considered implementation specific and are left for manufacturers to be specified:

- If frequency hopping is implemented as baseband hopping a failure of a radioCarrier means that a frequency is lost from a hopping sequence and this should be reflected to the Q3 object model somehow. Naturally there are corresponding procedures on the A-bis Qx interface after the Q3 model has been modified. There are several possibilities how to modify the Q3 object model:
  - 1) The BTS is put in a non-hopping mode. Only the channel objects need to be modified in this case. The frequencyUsage attributes of the channels are modified to contain a single frequency.
  - 2) A new frequencyHoppingSystem without the failed frequency is created and the channels using the old frequencyHoppingSystem are set to point to the new one. Also the MAIOs of the channels have to be adjusted so that the reduced size of the mobile allocation list is taken into account and two channels with the same timeslot number do not use the same MAIO.
  - 3) The failed frequency is removed from the existing frequencyHoppingSystem. Also in this case the MAIOs of the channels that point to that frequencyHoppingSystem have to be adjusted so that the reduced size of the mobile allocation list is taken into account and two channels with the same timeslot number do not use the same MAIO.
- Returning the original or some other configuration after a transient fault or fault correction depends on the implementation. The agent system i.e. BSC may be able to automatically reconfigure the frequencyHoppingSystems and channels so that the most optimal configuration is always available. Note that frequency redefinition procedures may be needed to avoid disconnection of traffic.
- In the synthesized hopping implementation a failure of a basebandTransceiver and/or a radioCarrier means that some timeslots sent on the BCCH frequency may be lost if the BCCH frequency was included in the frequencyHoppingSystem(s) of the associated channels. If the channels of the failed basebandTransceiver used a single frequency (i.e. BCCH frequency) this problem does not exist. There is a strict requirement that the BCCH frequency must be emitted continuously to facilitate handover measurement and cell selection processes. The frequencyHoppingSystems and channels have to be modified so that the BCCH frequency is sent in every timeslot. This means that one frequency has to be removed from the relevant frequencyHoppingSystems and the MAIOs of the associated channels are adjusted. Note that frequency redefinition procedures may be needed to avoid disconnection of traffic.

### B.3 Reconfiguration when BCCH is lost

This interworking procedure presents the actions to be used when the BCCH of the BTS is lost as a result of a baseband transceiver, radio carrier or channel failure.



**Figure 35: BCCH recovery procedure**

Notes to figure 35:

NOTE 1: Changed State Event Report starts the procedure.

The attributes in the Changed State Event Report has the following values: Operational state = Disabled, Availability status = (Failed)

The Availability status attribute may contain also some other status values in addition to the Failed status. The change in the operational state is notified also to the OMC. In some cases this might be delayed until the reconfiguration has been executed.

Note that this procedure is executed only for an unlocked object.

NOTE 2: A new basebandTransceiver/radioCarrier pair (i.e. combination of a baseband-Transceiver and a radioCarrier with the same instance id) that will contain the BCCH is selected.

The new pair that is selected is in Enabled and Unlocked state. If there does not exist such a pair the procedure is stopped.

When selecting the pair the following preferences are followed if possible:

The new basebandTransceiver has no SDCCH channels.

The new basebandTransceiver or radioCarrier is not transmitting traffic currently. If this preference can not be followed an attempt is made not to disconnect on-going calls (i.e. a forced handover may be tried to these calls).

NOTE 3: The information of the radio carriers is swapped (both Q3 and A-bis Qx objects). The txPwrMaxReduction attributes are adjusted so that the resulting output power levels are swapped. The carrier frequencies are swapped.

In case of a basebandTransceiver or radioCarrie failure when synthesized hopping was used and the BCCH frequency was generated by several radioCarriers, one frequency is removed from the frequencyHoppingSystem in order to guarantee a continuous BCCH transmission (reference. clause "Problems to be solved by manufacturers").

The changes in the attribute values are notified to the OMC.

NOTE 4: The channel objects contained within the basebandTransceivers are swapped.

The channel attributes are swapped (combination, tsc, ARFCN List,). If in the new configuration a SDDCH would be replaced by a traffic channel, the swapping is executed only for the other channel attributes than the channel combination.

In case of a basebandTransceiver failure when synthesized hopping was used and the BCCH frequency was generated by several radioCarriers, one frequency is removed from hopping groups in order to guarantee a continuous BCCH transmission (reference. clause "Problems to be solved by manufacturers").

In case of a radio carrier failure when baseband hopping is used the frequency which was replaced by the BCCH frequency is removed from the hopping groups. If there are on-going calls in the same BTS using the related frequencyHoppingSystem, frequency redefinition is needed for these calls (reference. clause "Problems to be solved by manufacturers").

Old terrestrial traffic channels are disconnected if in the new configuration the corresponding radio channels are used for telecom signalling instead of traffic.

The old disconnected terrestrial traffic channels are connected to the new basebandTransceiver if in the new configuration a signalling channel is replaced by a traffic channel.

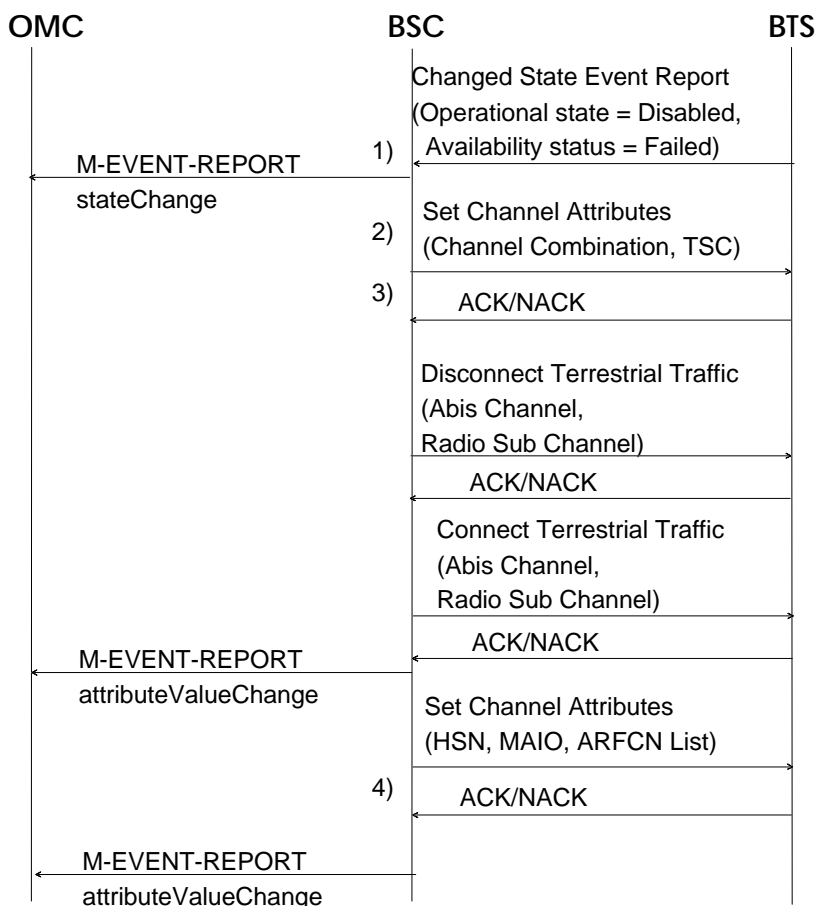
BCCH Information is sent to the new basebandTransceiver containing the BCCH.

## B.4 Reconfiguration when SDCCH is lost

This interworking procedure presents the required actions to be used when a SDCCH of the BTS is lost as a result of a baseband transceiver, radio carrier or channel failure.

Note that in case a baseband transceiver failure, a SDCCH would be recovered automatically as a result of the BCCH reconfiguration procedure, if the BCCH and the SDCCH channel combinations were defined within the same baseband transceiver. A baseband transceiver or radio carrier failure may also result to loss of several SDCCHs simultaneously. In this case all the SDCCHs shall be recovered as a part of the same procedure. A BCCH reconfiguration procedure may result to a SDDCH to be located to a failed baseband transceiver (radio carrier). In this case SDCCH reconfiguration procedure will be necessary after the BCCH reconfiguration procedure without a separate Changed State Event Report sent by the BTS.

Sometimes SDCCH reconfiguration is not necessary because there has to be a balance between the number of SDCCHs and TCHs in the BTS and therefore an excessive number of SDCCHs is not desired. However, reconfiguration is always required for those SDCCHs that include a CBCH.



**Figure 36: SDCCH recovery procedure**

Notes to figure 36:

**NOTE 1:** Changed State Event Report, sent by a Baseband Transceiver, Radio Carrier or Channel starts the procedure. No that the BCCH reconfiguration procedure is executed before any SDCCH reconfigurations if they were triggered by the same GSM 12.21 procedure. The procedure is not executed at all for an locked object.

The attributes in the Changed State Event Report have the following values. Operational state = Disabled, Availability status = (Failed)

The Availability status attribute may contain also some other status values in addition to the Failed status. The change in the operational state is notified also to the OMC.

If several SDCCHs are lost as a result of the same failure (Radio Carrier or Baseband Transceiver failure) the following steps of the procedure are executed for each failed SDCCH.

**NOTE 2:** A traffic channel that will be reconfigured to contain the SDCCH that was lost is selected.

The new channel that is selected is in Enabled and Unlocked state and preferably it is not transmitting traffic currently. If there does not exist such a channel the procedure is stopped.

NOTE 3: The information of the channel objects is swapped

The TSC and Channel combination attributes of the channels are swapped.

Old terrestrial traffic channel is disconnected from the radio timeslot that now contains the SDCCH and reconnected to the radio timeslot that now contains the traffic channel.

NOTE 4: If the fault relates to a radio carrier and the baseband hopping implementation is used, the frequency of the radio carrier must be removed from the hopping groups in timeslots 0..7 or the BTS must reconfigured to the non-hopping mode. One baseband transceiver shall be put out of service to balance the capacity of the radio carriers and baseband transceivers.

## Annex C (informative): List of attributes

### GSM 12.20

#### A-bis O&M

- additionalInformation, 17
- administrativeState, 15; 22; 27; 37; 43; 45
- basebandTransceiverID, 22
- bsIdentityCode, 27
- btsID, 27
- carrierFrequencyList, 45
- cellAllocation, 27
- channelCombination, 37
- channelID, 37
- frequencyUsage, 37
- hoppingSequenceNumber, 42
- mobileAllocation, 42
- ny1, 27
- operationalState, 15; 22; 27; 37; 43; 45
- perceivedSeverity, 19
- periodCCCHLoadIndication, 27
- powerClass, 45
- rACHBusyThreshold, 27
- rACHLoadAveragingSlot, 27
- radioCarrierID, 45
- relatedGSMEquipment, 22; 27; 34; 45
- relatedOAMLapdLink, 22; 27; 34
- relatedTelecomLapdLink, 22
- sapi, 43
- stateChangeDefinition, 17
- t200, 27
- t31xx, 27
- tei, 43
- terrTrafChannel, 37
- thresholdCCCHLoad, 27
- tsc, 37
- txPwrMaxReduction, 45
- userLabel, 50
- version, 50

#### A-bis telecomm

- allowIMSIAttachDetach, 27
- callReestablishmentAllowed, 27
- cellBarred, 27
- cellGlobalIdentity, 27
- cellReselectHysteresis, 27
- dtxUpLink, 27
- emergencyCallRestricted, 27
- maxNumberRetransmissions, 27
- mSTxPwrMax, 27
- mSTxPwrMaxCCH, 27
- noOfBlocksForAccessGrant, 27
- noOfMultiframesBetweenPaging, 27
- notAllowedAccessClasses, 27
- numberOfSlotsSpreadTrans, 27
- plmnPermitted, 27
- radioLinkTimeout, 27
- rxLevAccessMin, 27
- timerPeriodUpdateMS, 27

#### BSC internal

- additionalInformation, 19
- additionalText, 17; 19
- alarmStatus, 22; 27; 43; 45
- attributeIdentifierList, 17
- backedUpStatus, 19

- backUpObject, 19
- bCCHAllocationNumber, 27
- btsSiteManagerID, 34
- cellAllocationNumber, 27
- correlatedNotifications, 17; 19
- currentProblemList, 50
- dtxDownlink, 27
- frequencyHoppingSystemID, 42
- genericStateChange, 19
- lapdLinkID, 43
- monitoredAttributes, 19
- notificationIdentifier, 17
- proposedRepairActions, 19
- relatedFiles, 50
- relatedRadioCarrier, 22
- relatedTranscoder, 27
- softwareID, 50
- sourceIndicator, 17
- specificProblems, 19
- thresholdInfo, 19
- trendIndication, 19
- unknownStatus, 22; 27; 43; 45
- usageState, 27
- vendorName, 50

#### GSM 12.21

- Abis Channel, 22; 27; 34; 37; 43
- Additional Info, 19
- Additional Text, 19
- Administrative State, 15; 27; 37; 45
- ARFCN List, 37; 42; 45
- Baseband Transceiver number, 22
- BCCH ARFCN, 27
- BSIC, 27
- BTS Air Timer, 27
- BTS number, 27
- CCCH Load Indication Period, 27
- CCCH Load Threshold Indication, 27
- Channel Combination, 37
- File Id, 50
- File Version, 50
- HSN, 37; 42
- HW Configuration, 22; 27; 34; 45
- HW Description, 19
- MAIO, 37
- Ny1, 27
- Operational State, 15; 27; 37; 45
- Power Class, 45
- Probable cause, 19
- RACH Busy Threshold, 27
- RACH Load Averaging Slots, 27
- Radio Carrier number, 45
- Radio Sub Channel, 37
- Radio Timeslot number, 37
- RF Max Power Reduction, 45
- Specific problems, 19
- T200, 27
- TEI, 43
- Tsc, 37



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