Draft ETSI EN 301 126-2-5 V1.1.1 (2000-03)

European Standard (Telecommunications series)

Fixed Radio Systems;
Conformance testing;
Part 2-5: Point-to-Multipoint equipment;
Test procedures for DS-CDMA systems

Reference

DEN/TM-04026-2-5

Keywords

DRRS, FWA, multipoint, radio, RLL, SDH,
testing, transmission

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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM), and is now submitted for the Public Enquiry phase of ETSI standards Two-step Approval Procedure.

The present document is part 2, sub-part 5 of a multi-part EN covering the Fixed Radio Systems; Conformance testing, as identified below:

Part 1: "Point-to-point equipment; Definitions, general requirements and test procedures";

Part 2-1: "Point-to-Multipoint equipment; Definitions and general requirements";

Part 2-2: "Point-to-Multipoint equipment; Test procedures for FDMA systems";

Part 2-3: "Point-to-Multipoint equipment; Test procedures for TDMA systems";

Part 2-4: "Point-to-Multipoint equipment; Test procedures for FH-CDMA systems";

Part 2-5: "Point-to-Multipoint equipment; Test procedures for DS-CDMA systems";

Part 3-1: "Point-to-Point antennas; Definitions, general requirements and test procedures";

Part 3-2: "Point-to-Multipoint antennas; Defintions, general requirements and test procedures".

It is recommended that where a clarification of a test procedure or an agreed test procedure is required, this should be described on the final page of the test report titled "Additional information supplementary to the test report".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document details standardized test procedures for conformance testing of equipment for Point-to-Multipoint (P-MP) digital radio relay systems applying direct sequence code division multiple access method (DS-CDMA).

Standardized procedures are required in order to fulfil CEPT/ERC/DEC/(97)10 [1] on the mutual recognition, within CEPT, of the results of conformance tests on equipment carried out in individual CEPT Countries. Further more the procedures described in the present document are relevant to be able to fulfil the Conformance assessment procedure described in Chapter II of the R&TTE Directive 1999/5/EC [3] in order to demonstrate the compliance of the DRRS with the relevant essential requirements identified in Article 3 of the R&TTE Directive 1999/5/EC [3].

The present document is intended to be applied in conjunction with EN 301 126-2-1 [2] and in conjunction with the individual equipment ENs/ETSs describing DS-CDMA methods and will enable commonality of test results, irrespective of the Accredited Body carrying out the test.

The conformance tests described in the present document are those related to radio specific parameters required directly by the relevant radio relay ENs/ETSs. Conformance tests to other boundary EN/ETS (e.g. those for system input/output interfaces and related base band process) are outside the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] CEPT/ERC/DEC/(97)10 On the Procedures for Mutual Recognition of Type Approval of Radio (terminal) Equipment.

[2] ETSI EN 301 126-2-1: "Fixed Radio Systems; Conformance testing; Part 2-1: Point-to-Multipoint equipment; Definitions and general requirements".

[3] Directive 1999/5/EC of the european parliament and of the council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

[4] EN 60835: "Methods of Measurement for Equipment used in Digital Microwave Radio Transmission Systems".

[5] CEPT/ERC/REC 74-01: "Spurious emissions".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document see definitions given in EN 301126-2-1 [2].

3.2 Symbols

For the purposes of the present document see symbols given in EN 301126-2-1 [2].

3.3 Abbreviations

For the purposes of the present document see abbreviation given in EN 301126-2-1 [2]

4 General characteristics

Where necessary, for better understanding of the application of test methods, reference is made to EN 60835 [4] (Test methods).

4.1 Equipment Configuration

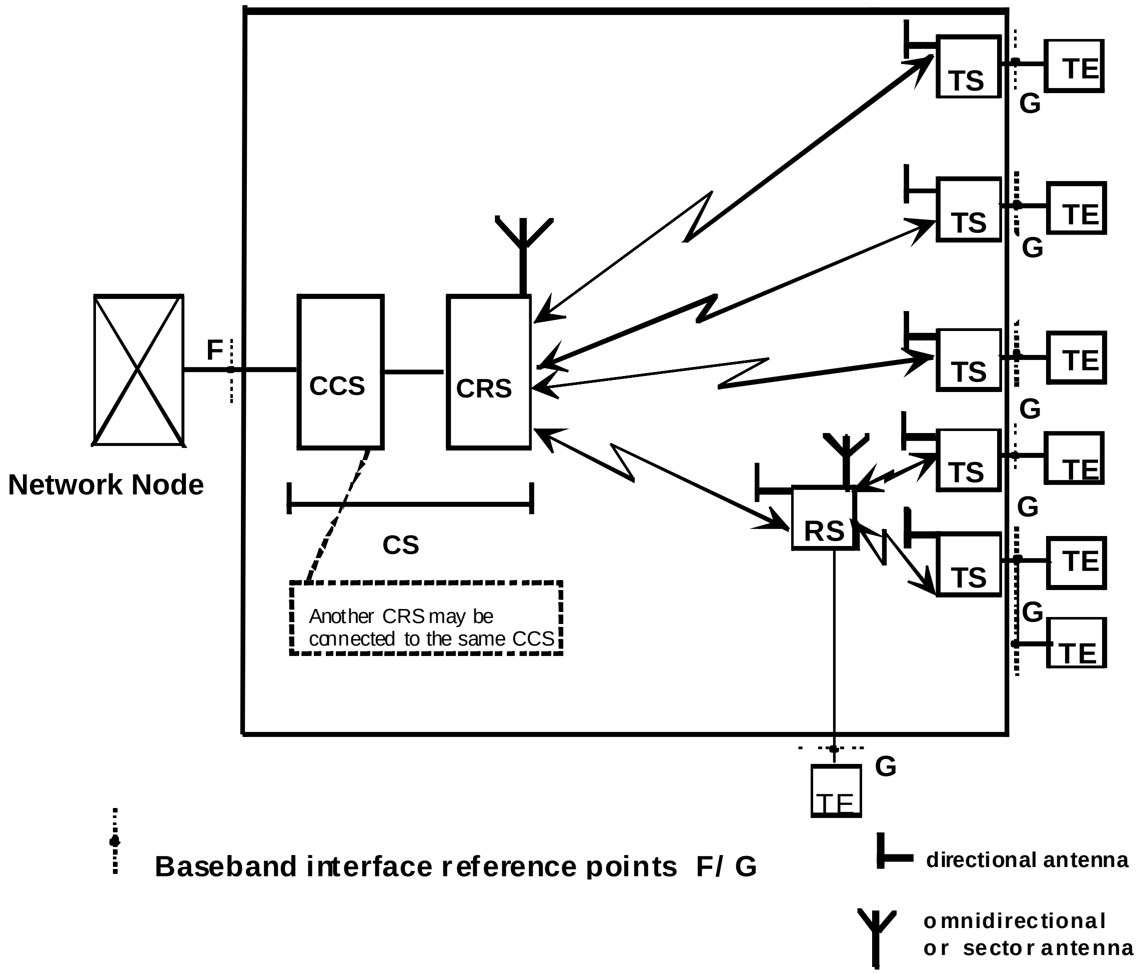


Figure 1: General System Architecture

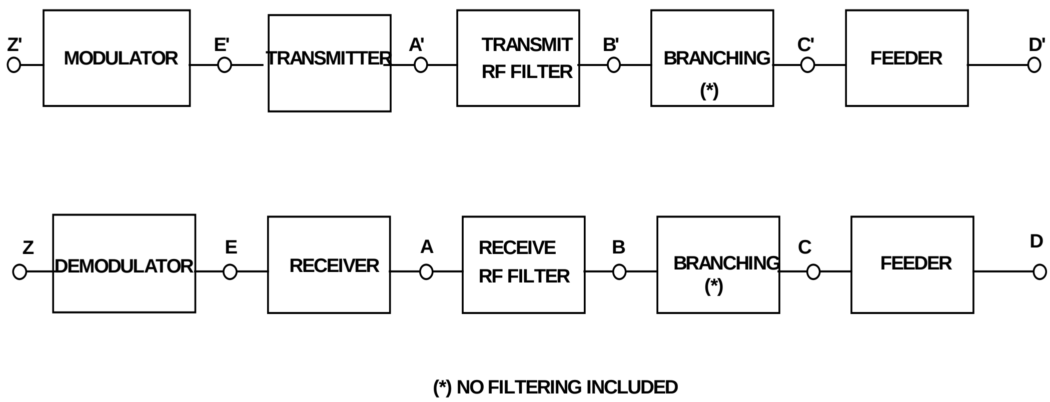


Figure 2: RF System Block diagram

4.1.1 System Configuration

P-MP equipment is designed to operate as an access system connected to a network node (e.g. local switch) and user terminal equipments (figure 1). The individual conformance tests are made in a single link direction (figure 2) but for certain tests, e.g. for equipment to set up signalling, both forward and reverse links have to operate, the minimum equipment arrangement for tests with only one subscriber is shown in figure 3 below, where the forward and return RF paths are separated by a pair of duplexers and separate attenuators are inserted in each path. In the absence of any more specific instructions from the supplier it is suggested that the links are operated at threshold (RSL)+ n dB where n is half of the link dynamic range except when the receiver is being tested. The other receiver(s) should continue to be operated at threshold (RSL) +n dB.

Calibrated splitters or directional couplers will be inserted at points A, B, C and D (figure 3) as required for the individual tests, either to provide test points or sources of interfering signals.

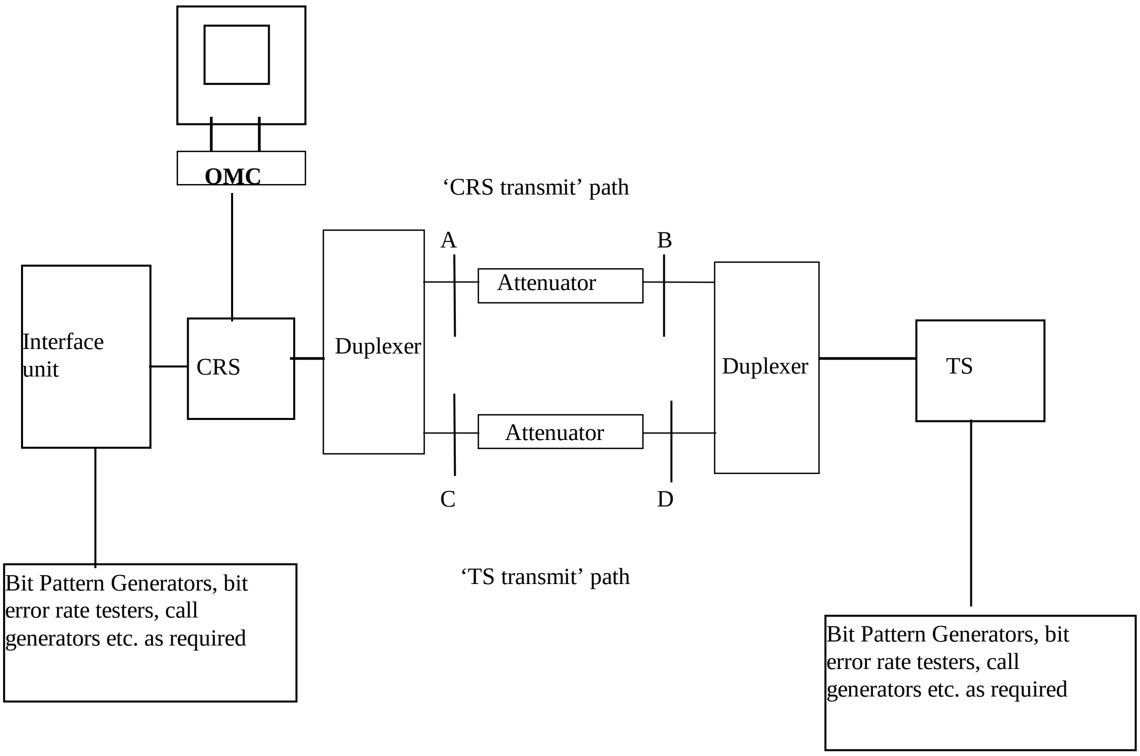


Figure 3: Test configuration for a single Terminal Station

NOTE 1: Calibrated splitters or directional couplers will be inserted at points A, B, C and D as required for the individual tests, either as test points or as sources of interfering signals.

NOTE 2: When measuring the TS transmitter to demonstrate that it meets the emission mask and spurious emissions limits, the splitter network will have only one TS connected and this network may be removed.

NOTE 3: The P-MP systems to be tested are duplex systems and features such as time/frequency synchronization and APC require both paths to be functioning correctly. To ensure that the results of measurements on either the forward or return paths, e.g. receiver RSL, are not influenced by conditions in the other path it may be necessary to provide lower attenuation, or raise the transmitter power, in this other path. In the absence of any more specific instructions from the suppliers it is suggested that this other path is operated at threshold (RSL) +n dB, where n is half the linear dynamic range.

All the test procedures, presented in the following sub-sections below, shall apply to both CRS(s) and TS(s), unless otherwise stated. Unless otherwise stated, all essential requirements (ER) tests shall be undertaken at the nominal and extremes of power supply and environmental parameters and at maximum output power. RF power, spectrum and frequency measurements shall be undertaken at low, medium and high frequencies within the declared range of frequencies. These RF frequencies may be selected by remote control or otherwise.

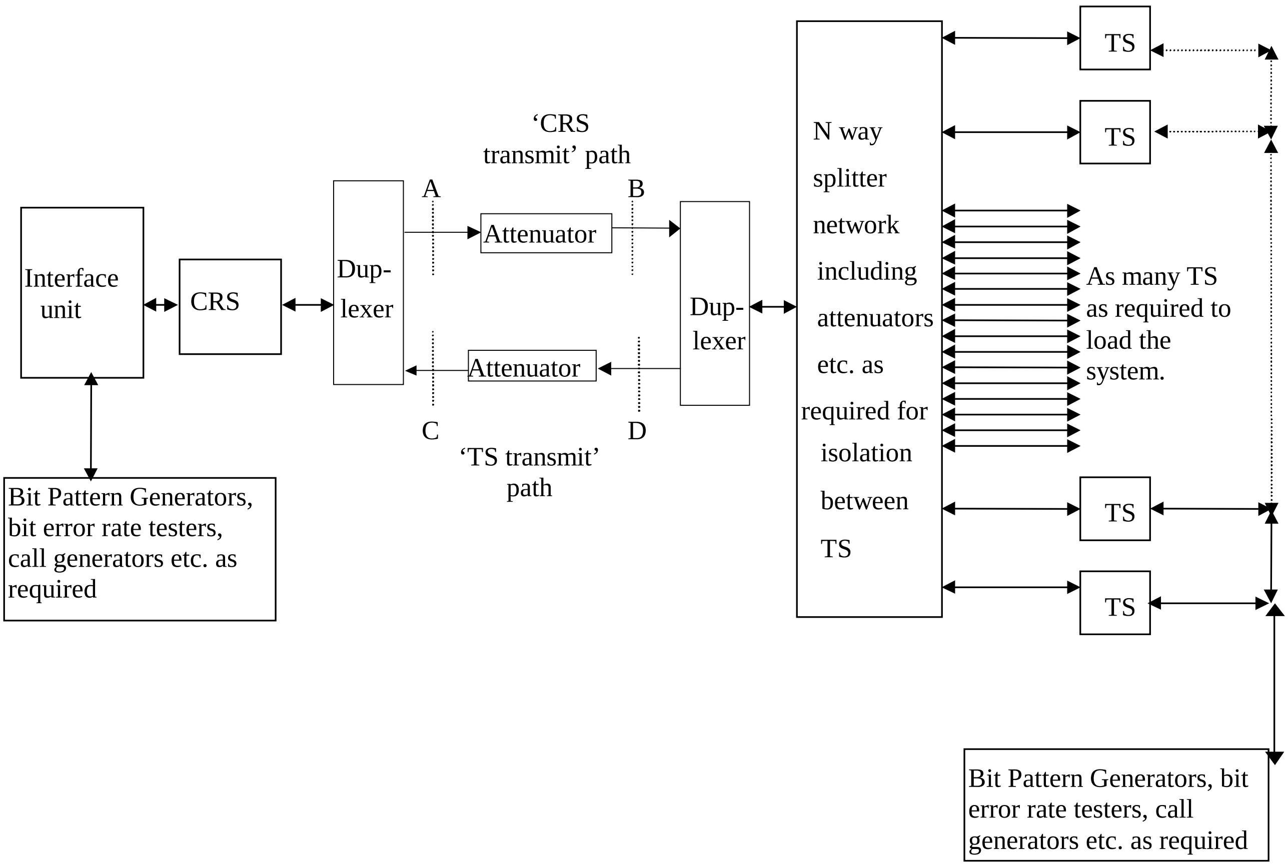
Central or remote stations incorporating integral antennas shall be provided with an appropriate coaxial or waveguide transition by the supplier in order to facilitate the measurements described.

For tests where the simultaneous use of several TSs is necessary, then an arrangement similar to that shown figure 4 is required. To enable communication the traffic load may be simulated and facilities such as remote loop back may be used to route traffic through the system.

This arrangement ensures that the system operates in a normal manner similar to its configuration for measurements such as transmitter mask and RSL.

For systems where it is necessary to load the system then an arrangement similar to that shown in figure 4 will be necessary. Calls are initiated through the switch (interface unit) and facilities such as remote loop back may be used to route traffic through the system. In general the same test pattern may be used on all of the calls since it will be normal for the data to be either scrambled or encrypted before passing over the air interface.

This is to ensure that the system is operating in a normal operating configuration for measurements such as Transmitter mask and threshold (RSL) are being examined.



NOTE 1: See appropriate notes under figure 3.
NOTE 2: TDD systems may only require a single path with one attenuator.

Figure 4: Test Configuration for multiple TS and CRS

4.2 Transmitter Characteristics

4.2.1 Maximum RF Output Power

Objective

Verify that the highest average RF output power measured during a transmission burst at reference point B' or C' (figure 5) is within the supplier's declared value, plus / minus the EN/ETS tolerance, and does not exceed the EN/ETS maximum value.

Test instruments

1) Average Power Meter or an appropriate alternative.

Test Configuration:

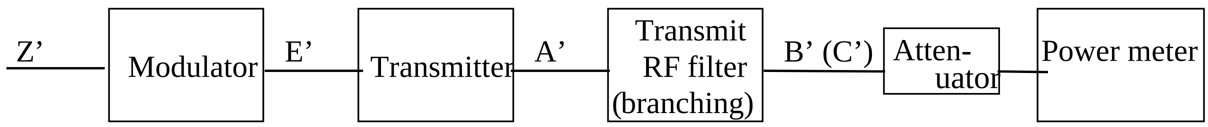


Figure 5: Test configuration for maximum RF output power

A calibrated directional coupler is inserted at reference point B' in the test configuration of figure 5. The transmitter may be operated in a single ended stand alone configuration if the support hardware and software can be used to ensure a set of typical signals at the maximum output power.

Measurement procedures for transmitter characteristics in the CRS → TS direction

For the purposes of the tests below, the equipment (CRS) shall provide the maximum output power stated by the supplier, or another output power appropriate to the applied test. The CRS is modulated with the number of traffic channels N corresponding to the class of operation declared by the supplier.

Each traffic channel shall provide an output power equal to 1/N of the maximum output power, less the power in any signalling and synchronization channels, declared by the supplier.

NOTE: To support the power level measurements, it may be useful to include two definitions:

Average Power:

- The in-phase (dissipative) component of the instantaneous complex product of voltage and current, averaged over a sequence of cycles of the wave.

Maximum Average Power:

- The highest value of average power.

<u>Test Procedure:</u>

With the transmitter power level set to maximum, the average output power of the transmitter at point B’ or C’ is to be measured. The number of traffic channels (N) shall correspond to the class of operation declared by the supplier. All systems should be tested at 3 frequencies; top, middle and bottom frequencies of the available range.

Measurement procedures for transmitter characteristics in the TS → CRS direction

For the purposes of the tests below, the equipment (TS) shall provide the maximum output power stated by the supplier.

<u>Test Configuration</u>

A calibrated directional coupler is inserted at reference point D in the test configuration of figure 4.

<u>Test Procedure</u>

The TS transmitter is modulated with a PRBS signal. The output power of the TS at point B’ or C’ (figure 5) shall not exceed the maximum output power specified by the relevant standard. All systems should be tested at 3 frequencies; top, middle and bottom frequencies of the available range.

4.2.2 Minimum RF Output power

<u>Objective:</u>

Verify that the minimum RF output average power of equipment, fitted with power control circuitry, measured at reference point B’ or C’ (figure 5) is within the specified limit of the declared value.

<u>Test Instruments:</u>

As for maximum power test.

<u>Test Configuration:</u>

As for maximum power test.

<u>Test Procedure:</u>

With the transmitter power level set to minimum the transmitter output at B’ or C’ (see figure 5) is to be measured. All systems should be tested at 3 frequencies; top, middle and bottom frequencies of the available range.

4.2.3 Automatic Transmit Power Control (ATPC)

Objective:

When ATPC is implemented, the control loop is to be checked for satisfactory operation i.e. Tx output power is related to the input level at the far receiver.

Test Instruments:

As for maximum power test.

Test Configuration (Automatic):

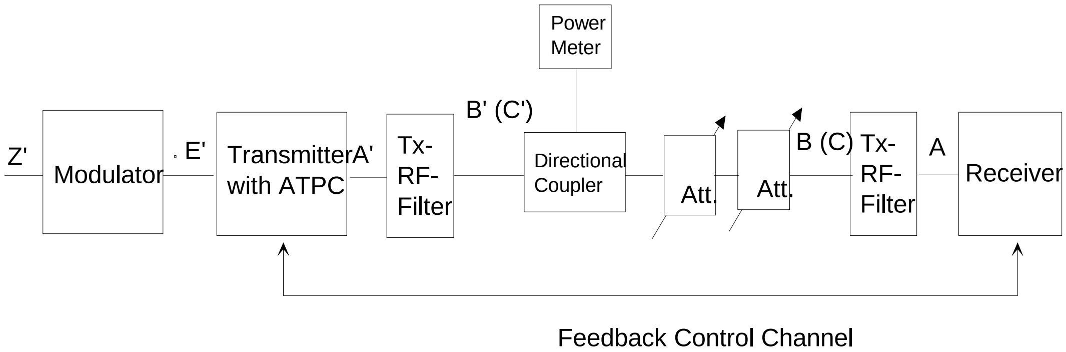


Figure 6: Test configuration for ATPC

Test Procedure:

With the maximum transmitter output level selected the average power level at point B'(C') is to be measured. The test is to be repeated with minimum transmitter output power selected. The transmitter output level is measured at point B'.

Attenuator B (figure 6), initially set to produce the minimum transmitter output level is to be adjusted until the transmitter reaches its maximum output level. Throughout the transmitter's power range the receiver input level is to be maintained within the limits stated in the relevant standard or supplier's guaranteed operating criteria. The test is to be repeated to verify that the automatic power control performance, between maximum transmitter power and minimum transmitter power meets the standard or supplier's performance limits.

4.2.4 Remote Transmit Power Control (RTPC)

Where remote transmit power control is an available management function (e.g. for re-configuring networks) it is to be checked and recorded during the transmitter output power test.

Repeat tests of subclauses 4.2.1 and 4.2.2 with remote transmit power control.

The maximum power shall not exceed that applied in subclause 4.2.1 as an essential requirement.

4.2.5 Frequency Accuracy

Objective:

To verify the transmitter output frequency is within the limits specified in the relevant standard. Where transmitters cannot be placed in the CW condition the supplier is to seek an agreement with the accredited laboratory on the frequency accuracy test method. Options which may be considered include zero bearers, modified software to reduce modulation and measuring the carrier breakthrough with a minimum number of bearers.

NOTE: For systems that do not shut down on loss of synchronization, frequency accuracy should also be measured in the non-sysnchronized condition.

The supplier has to declare the method by which the CRS and the TS are synchronized.

Test Instruments:

1) Typically Frequency Counter

Test Configuration:

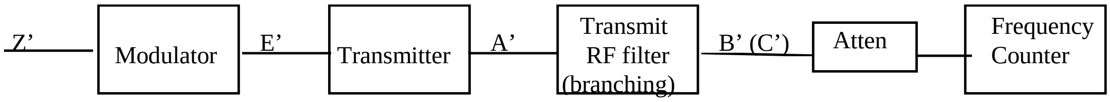


Figure 7: Test configuration for frequency accuracy

Test Procedure:

The transmitter is to be operated in the CW condition and frequency measurements conducted on the channel previously selected by the test house. Where this cannot be done other procedures would be acceptable with the agreement of the Type Approval Laboratory. The measured frequency is to be within the tolerance stated in the relevant EN/ETS.

All systems should be tested at 3 frequencies (high, medium and low).

4.2.6 RF spectrum mask

RF spectrum mask measurements are to be conducted at the lowest, mid-band and highest channel of the unit under test.

Objective:

To verify that the output frequency spectrum is within the specified limits of the relevant EN/ETS.

Test Instruments:

1) Spectrum Analyzer.

2) Plotter.

3) Pattern generator/bulk call generator.

Test Configuration:

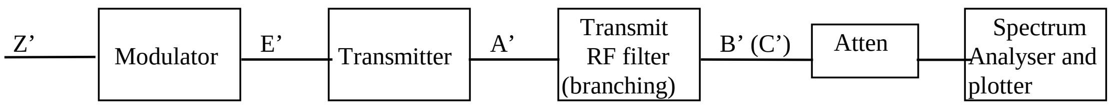


Figure 8: Test configuration for spectrum mask

A calibrated directional coupler is inserted at reference point B‘ or C‘ in the test configurations of figure 8 or 4 as appropriate if the equipment cannot be operated in single-ended configuration.

Measurement procedure for spectrum mask in the CRS->TS direction.

Test Procedure

The measurement shall be made with a suitable Spectrum Analyzer connected to the transmitter port via a suitable attenuator.

Where practicable, RF spectrum mask measurements are to be conducted at the lowest, mid-band and highest channel of the unit under test.

With the CRS transmitter modulated with a test signal corresponding to the class of operation declared by the supplier, the signal spectrum at point B' (C') in figure 8 is observed via the directional coupler port or antenna port on a spectrum analyzer and plotted. The 0 dB level is set to the top of the modulated spectrum ignoring any residual carrier. Where not otherwise specified, the spectrum analyzer settings shown in table 1 should be used for this test.

Measurement procedure for spectrum mask in the TS->CRS direction.

Test Procedure

The transmitter of one TS is modulated with a PRBS generator test signal. The signal from the directional coupler or antenna port shall be observed on a spectrum analyzer and plotted. The 0 dB level is set to the top of the modulated spectrum. Where not otherwise specified, the spectrum analyzer settings shown in table 1 should be used for this test.

Table 1: Spectrum Analyzer Settings for RF Power Spectrum Measurement

RF channel spacing (MHz)	<1,75	1,75 to 20	>20
Centre frequency	actual	actual	actual
Sweep width (MHz)	Note	Note	Note
Scan time	auto	auto	auto
IF bandwidth (kHz)	30	30	100
Video bandwidth (kHz)	0,1	0,3	0,3
NOTE: 5 x channel spacing < sweep width <7 x channel spacing.			

4.2.7 Remote Frequency Control

Remote frequency control is an optional feature. However, when fitted the function must be tested during the frequency accuracy test. If necessary, repeat test subclause 4.2.5 with frequency settings controlled using the remote frequency control option.

4.2.8 Spectral lines at the symbol rate

The test for spectral lines at the symbol rate are performed at the same time as the RF spectrum mask, see subclause 4.2.6. if applicable to the standard.

4.2.9 Spurious emissions

Objective:

To verify that any spurious emissions generated by the transmitter, [including the spectral lines at the symbol rate if stated in the EN/ETS], are within the limits quoted in the relevant EN/ETS. Spurious emissions are emissions outside the bandwidth necessary to transfer the input data at the transmitter to the receiver of which level may be reduced without affecting the corresponding transfer of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products.

Test Instruments:

1) Spectrum Analyzer.
2) Spectrum Analyzer Mixer Units - as required.
3) Plotter.
4) Pattern generator / bulk call generator.

Test Configuration:

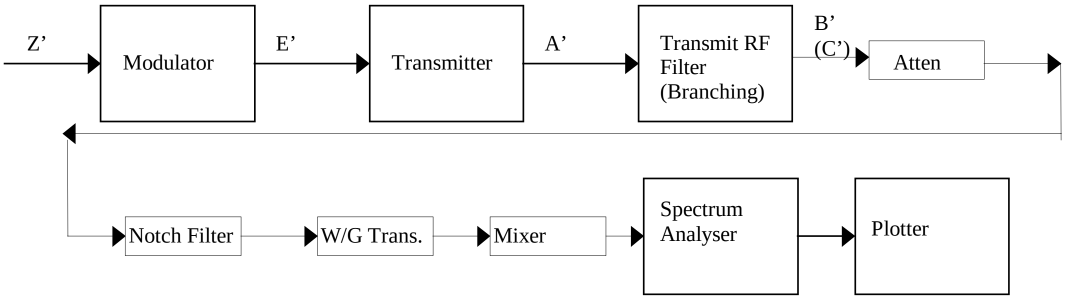


Figure 9: Test configuration for conducted antenna port spurious emissions

Test Procedure:

The transmitter output port shall be connected to a spectrum analyser via a suitable attenuator and/or notch filter to limit the power into the front end of the analyser. In some cases, where the upper frequency limit exceeds the basic operating range of the analyser, a suitable mixer will be required.

The transmitter is to be operated at the supplier's maximum rated output power and the level and frequency of all significant signals are to be measured and plotted throughout the frequency band quoted in the relevant specification.

NOTE 1: Where a specification states that the spurious emission test is to be conducted with the equipment in the modulated condition, the resolution bandwidth of the Spectrum Analyzer is to be set to the level quoted in the standard.

NOTE 2: Measurement of spurious emission levels from equipment operating in the CW condition should be carried out with resolution bandwidth, frequency span and scan rates which maintain the Spectrum Analyzer in the calibrated condition while keeping the difference between noise floor and limit line at least 10 dB.

NOTE 3: Due to the low levels of RF signal and the wideband modulation used in this type of equipment, radiated RF power measurements are imprecise compared to conducted measurements. Therefore where equipment is normally fitted with an integral antenna, the supplier shall make provision for connection to a standard waveguide or coaxial 50 ohm termination.

NOTE 4: The RF conducted signal shall be measured into a 50 Ohm coaxial line to the spectrum analyser for all frequencies below the operating frequency if below 26,5 GHz. This is to prevent any external waveguide acting as a high pass filter.

Where the equipment standard refers to CEPT/ERC recommendation 74-01 [5], then the measurements are taken for the mean power of the spurious emissions during the transmission burst. For spurious emission measurement's on the TS it may not be possible to complete a Spectrum Analyser frequency scan during a synchronized pulse. (i.e. the sweep time of the spectrum analyser is much greater than the pulse time of the TS). In this case it shall be deemed that if the peak power over a statistically sufficient number of spectrum analyser sweeps is below the mean power limit, that the mean power limit is met. If this cannot be shown, then alternatives may be used as long as they detail the rational behind the measurements in the report.

Measurements shall be made in accordance to the Published standard. Any variations shall be detailed and agreed with each Nation Regulator.

4.3 Receiver Characteristics

4.3.1 Calculation of the per-bearer power of a CDMA signal

In the measurement of CDMA power levels, the per-bearer power level must be calculated. Two examples are given below, where the bit rate is not necessarily 64 kbit/s:

4.3.1.1 Example (1) Reverse sensitivity measurement

A power meter with an average power sensor should be connected to the TS via a splitter such that the TS power may be continuously monitored during the test.

An ISDN 2B+D at 144kb/s call is used to measure the BER , where all the ISDN channels are at the same power level.

The power at the power meter is measured as P1. The power at the TS is given by Pt=P1+L1, where L1 is the loss from the power meter to the TS.

The test is looking at the BER for a single 64kb/s call, therefore the contribution of the wanted power from the TS is given by:

$$P_{64kb/s}(dBm) = Pt(dBm) - 10\log\left(\frac{144}{64}\right) = Pt(dBm) - 3.5$$

The received power at the CS is given by:

$$\Pr = P_{64kb/s}(dBm) - L2$$

Where L2 is the loss from the TS to the CS.

4.3.1.2 Example (2) Forward sensitivity measurement

The forward link in this example contains management information that is continuously transmitted. This is declared by the supplier to be equivalent to be equivalent to 6.3 x 64kb/s traffic bearers.

As ATPC is switched off, and all bearers are declared to be at a determinable level, the per-bearer output power may be calculated from a test mode in the system that places one traffic bearer onto the system.

This bearer power may then be verified by loading the system with traffic and by using the following relationship:

$$P_{64kb/s} = P_{out} - 10\log\left(6.3 + N_{64kb/s}\right)$$

Where $N_{64kb/s}$ is the equivalent number of 64kb/s traffic channels (which is not necessarily and integer), $P_{64kb/s}$ is the per-bearer output power and P_{out} is the total output power.

The received signal level is given by:

$$\Pr = P_{64kb/s} - L1$$

Where L1 is the loss between the CS and TS.

4.3.2 Power control

Automatic transmit power control should be disabled during the measurement period of the test. When the power control is disabled, the wanted signal should be within ±1dB of the mean per-bearer power of all the other bearers.

4.3.3 Input level range (If applicable)

Objective:

To verify that the receiver meets the BER criteria, given in the relevant specification, over a defined range of receiver input levels.

See subclause 4.3.3.1 (Dynamic level range.)

4.3.4 Spurious emissions

The same test method as described in subclause 4.2.9 is applicable. Spurious emission levels from a transmitter and receiver of duplex equipment using a common port are measured simultaneously and the test only needs to be conducted once.

Objective:

To verify that spurious emissions from the receiver are within the limits (where applicable).

The same test method as described in subclause 4.2.9 is applicable.

4.3.5 System Characteristics

4.3.5.1 Dynamic level range (If applicable)

Objective:

To verify that the system, with ATPC operating (where applicable) meets the BER criteria, given in the relevant specification, over a defined range of input levels.

Test Instruments:

1) Power Sensor and Meter.

2) Pattern Generator/Error Detector.

Test Configuration:

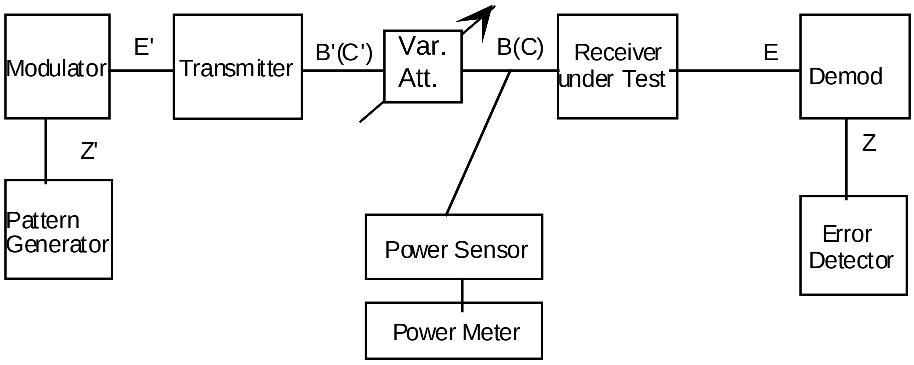


Figure 10: Test configuration for Dynamic level range

Test Procedure:

Transmission direction CRS->TS: The procedure for determining the threshold level (referred to point C in figure 10) is described in subclause 4.3.3.2. In order to determine the dynamic range of the TS receiver, the received signal level is increased in steps of no greater than 10 dB up to the limit stated in the standard by adjusting the attenuation in the path AB (figure 4). The measured BER should not rise above 10^{-3} for each setting of the attenuator. At each measurement level, adequate time should be allowed for re-acquisition before the measurement is made.

Transmission direction TS->CRS: The procedure for determining the threshold level (referred to point C in figure 10) is described in subclause 4.3.3.2. In order to determine the dynamic range of the CRS receiver, the received signal level is increased in steps of no greater than 10 dB up to the limit stated in the standard by adjusting the attenuation in the path CD (figure 4). The measured BER should rise above below 10^{-3}. At each measurement level adequate time should be allowed for re acquisition before the measurement is made.

NOTE 1: When the baseband interface precludes the use of a BER detector, e.g. in a packet data system, another measure of error performance may be specified by the supplier provided that its numerical equivalence to the BER test can be shown. This proof of equivalence should be recorded in the report.

NOTE 2: As a minimum the input level to the Rx shall be set to the upper and lower levels specified in the relevant ETS/EN or declared by the manufacturer, which ever is the greater, and the BER at those RSLs recorded.

4.3.5.2 BER as a function of input receiver signal level (RSL)

4.3.5.2.1 Measurement procedure for BER performance in the direction CRS->TS for a single traffic channel

Objective

To verify that the received signal levels versus BER thresholds are within the limits specified, (at a minimum of two BER levels), in the relevant EN/ETS.

Test instruments:

1) Pattern generator(s) / bulk call generator.

2) Bit error rate detector.

3) Power sensor and meter.

Test Configuration:

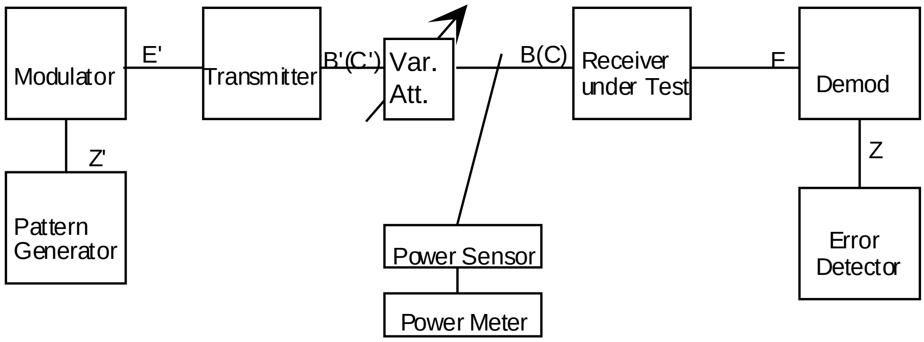


Figure 11: Test configuration for BER as a function of RSL

The test configuration is as shown in figure 11. A calibrated coupler or a suitable splitter is inserted at reference point A in the test configuration of figure 4.

Test Procedure:

To measure the BER performance of a single traffic channel as specified in the relevant standard, one TS is used in the test configuration shown in figure 4. The CRS is modulated with a PRBS test signal (as specified in the relevant standard) from a pattern generator. The attenuation in path A - B is adjusted such that the signal level at point C (figure 11) is as specified in the standard. For this received signal level the measured BER at the TS shall be 10^{-3} or lower.

Repeat the above procedure for a BER of 10^{-6}.

4.3.5.2.2 Measurement procedure for loaded BER performance in the direction CRS->TS

Objective:

To verify that the received signal levels versus BER thresholds are within the limits specified, (at a minimum of two BER levels), in the relevant EN/ETS.

Test Instruments:

1) Pattern generator(s) / bulk call generator.
2) Bit error rate detector.
3) Power sensor and meter.

Test Configuration:

The test configuration is as shown in figure 11. A calibrated directional coupler or a suitable splitter is inserted at reference point A in the test configuration of figure 4.

Test Procedure:

To measure the BER performance of a fully loaded system (as specified in the relevant standard), one TS is used in the test configuration shown in figure 4. The CRS is modulated with a test signal representing traffic corresponding to class of operation declared by the supplier. The attenuation in path A-B is adjusted such that the RSL at point C (figure 11) is as specified in the standard. For this RSL the measured BER at the TS shall be 10^{-3} or lower.

Repeat the above process for a BER of 10^{-6}.

4.3.5.2.3 Measurement procedure for BER performance for a single traffic channel in the direction TS->CRS

Objective

To verify that the received signal levels versus BER thresholds are within the limits specified, (at a minimum of two BER levels), in the relevant EN/ETS.

Test instruments:

1) Pattern generator / bulk call generator.
2) Bit error rate detector.
3) Power sensor and meter.

Test Configuration:

The test configuration is shown in figure 11.

Test Procedure:

To measure the BER performance of a single traffic channel as specified in the standard, one TS is used in the test configuration shown in figure 11. The TS transmitter is modulated with a PRBS test signal (at a bit rate specified in the relevant standard) from a pattern generator. The attenuator is adjusted such that the RSL level at point C (figure 11) is at a level specified in the standard. The measured BER at the CRS shall be 10^{-3} or lower.

Repeat the above process for a BER of 10^{-6}. The minimum signal level at reference point C shall be at a level specified in the standard.

4.3.5.2.4 Measurement procedures for BER performance in the direction TS->CRS for a loaded system

Objective:

To verify that the received signal levels versus BER thresholds are within the limits specified, (at a minimum of two BER levels), in the relevant EN/ETS when the system is loaded with traffic as declared by the supplier.

Test Instruments:

1) Pattern generator(s) / bulk call generator.
2) Bit error rate detector.
3) Power sensor and meter.

Test Configuration:

The test configuration is shown in figure 4.

Test procedure:

To measure the BER performance of a single traffic channel when the CRS is loaded with traffic signals as declared by the supplier, one TS is used in the test configuration of figure 4. The TS transmitter is modulated with a PRBS test signal at a bit rate specified in the standard. The CRS is loaded with traffic (as declared by the supplier) from additional TS's (minimum of 4). The attenuation in the path CD is adjusted such that the RSL at point C is at the level specified in the standard. The measured BER shall be 10^{-3} or lower. Repeat the above process for a BER of 10^{-6}.

4.3.5.3 Equipment Background BER

Objective:

To verify that the equipment background BER is below the value specified in the relevant EN/ETS.

Test Instruments:

1) Pattern Generator/Error Detector.
2) Power Meter.

Test Configuration:

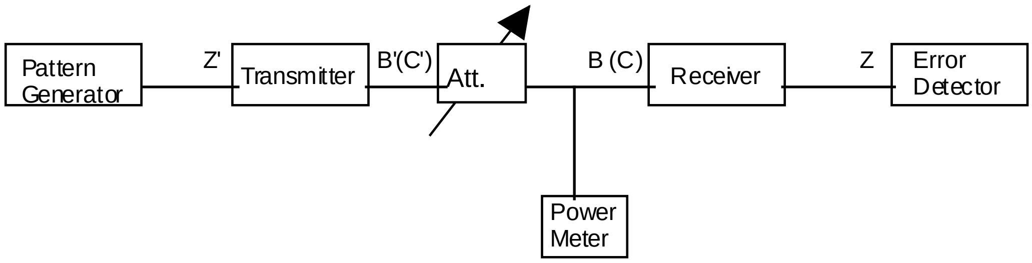


Figure 12: Test configuration for background BER

Test Procedure:

Follow the test procedure described in subclause 4.3.3.2.4. The signal level into the receiver is adjusted to n dB (where n is half of the declared dynamic range) above the threshold, and the test is run for a sufficient duration to demonstrate compliance with the relevant EN/ETS performance requirements.

4.3.6 Interference sensitivity tests

The following test procedures shall be used for measuring interference sensitivities in both the CRS to TS and TS to CRS directions.

4.3.6.1 Co-channel Interference Sensitivity

Objective

The objective is to verify co-channel interference sensitivity of the system to the levels as stated in the relevant standard.

Maximum (Nx 64 kbit/s) channel loading in TS's->CRS direction

Test instruments:

1) 2 Bit pattern generators / bulk call generator.
2) Bit error rate detector.
3) Power sensor and meter.

Test Configuration

For co-channel interference sensitivity assessment the test configuration shown in figure 4 is used. A calibrated directional coupler is inserted at reference point C in order to allow injection of co-channel interference signal. Note that the interfering signal should be as specified in the standard.

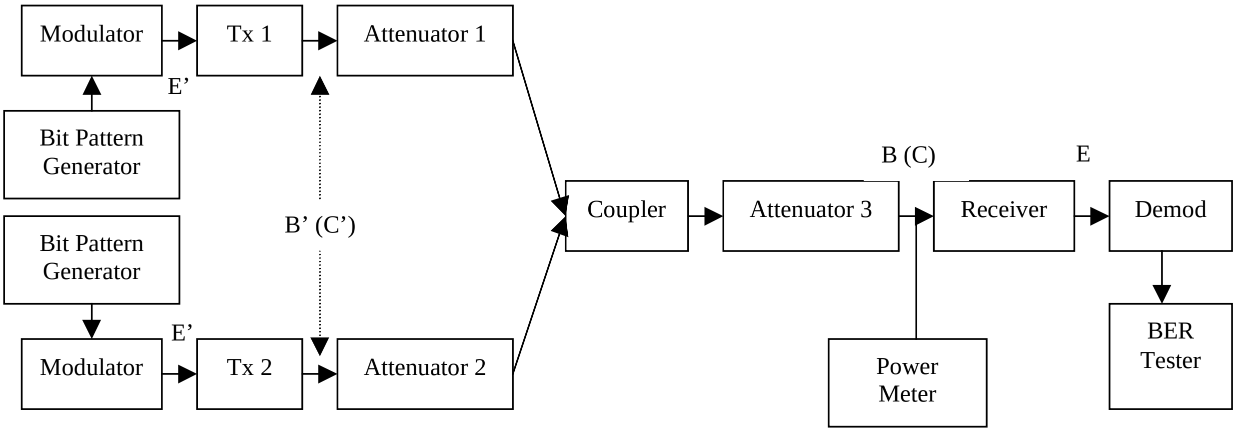


Figure 13: Test configuration for Co-channel Interference Sensitivity - external

Test Procedure

An appropriate number of TS's are used to load the system to the supplier's declared system loading (in terms of the number of traffic channels, N). The signal level into the receiver is adjusted to the level stated in the standard.

The attenuation in path CD is reduced by the amount stated in the standard. Modulating a supplementary TS transmitter with a different spreading sequence at the same frequency as all of the TS's in the victim system generates co-channel interference. Adjusting the attenuation in its path then increases the level of the interfering signal until the signal level of the interferer at reference point C is at the level stated in the standard.

The measured BER shall be better or equal to that stated in the standard.

Maximum (Nx 64 kbit/s) channel loading in CRS-> TS direction

Test instruments:

1) 2 Bit pattern generators.
2) Bit error rate detector.
3) Power sensor and meter.
4) Bulk call generator.

Test Configuration

For co-channel interference sensitivity assessment the test configuration shown in figure 4 is also used. A calibrated directional coupler is inserted at reference point B in order to allow injection of co-channel interference signal.

Test Procedure

The CRS transmitter is modulated with a test signal corresponding to the maximum system load declared by the supplier. The signal level into the receiver is adjusted to the level stated in the standard.

An appropriate number of TS's (minimum of 4) are used to load the system to the supplier's declared maximum system loading (in terms of the number of traffic channels, N). The signal level into the receiver is adjusted to the level stated in the standard.

The attenuation in path AB is reduced by the amount stated in the standard. Co-channel interference is generated by modulating a separate CRS transmitter with a different spreading sequence on the same frequency as the victim system.

The interfering signal is then increased by decreasing the attenuation in its path until the signal level of the interferer at reference point C is at the level stated in the standard.

The measured BER should be better or equal to that stated in the standard.

4.3.6.2 Adjacent RF Channel Interference Sensitivity

Objective

The objective is to verify that adjacent RF channel interference sensitivity is as stated in the relevant standard.

Maximum (Nx 64 kbit/s) channel loading in TS's->CRS direction

Test instruments:

1) 2 Bit pattern generators / bulk call generator.
2) Bit error rate detector.
3) Power sensor and meter.

Test Configuration

For adjacent channel interference sensitivity assessment the test configuration shown in figure 4 is used. A calibrated directional coupler is inserted at reference point C in order to allow injection of adjacent channel interference signal.

Test Procedure

An appropriate number of TS's (minimum of 4) are used to load the system to the supplier's declared maximum system loading (in terms of the number of traffic channels, N). The signal level into the receiver is adjusted to the level stated in the standard.

The attenuation in path CD is reduced by the amount stated in the standard. Adjacent channel interference signal is generated by modulating a separate TS transmitter with a different spreading sequence on the adjacent channel frequency as all of the TS's in the victim system.

The interfering signal is then increased by decreasing the attenuation in its path until the signal level of the interferer at the reference point C is at the level stated in the standard.

The measured BER shall be better or equal to that stated in the standard.

Maximum (Nx 64 kbit/s) channel loading in CRS->TS direction

Test instruments:

1) 2 Bit pattern generators.
2) Bit error rate detector.
3) Power sensor and meter.
4) Bulk call generator.

Test Configuration

For adjacent channel interference sensitivity assessment the test configuration shown in figure 4 is used. A calibrated directional coupler is inserted at reference point B in order to allow injection of adjacent channel interference signal.

Test Procedure

The CRS transmitter is modulated with a test signal corresponding to the maximum system load declared by the supplier. The signal level into the receiver is adjusted to the level stated in the standard.

The attenuation in the path AB is reduced by the amount stated in the standard. Adjacent channel interference is generated by modulating a separate CRS transmitter with a different spreading sequence on the adjacent channel frequency to the victim system.

The interfering signal is then increased by adjusting the attenuation in its path until the signal level of the interferer at the reference point C is at the level stated in the standard.

The measured BER shall be better or equal to that stated in the standard.

4.3.6.3 CW Spurious Interference

Objective:

This test is designed to identify specific frequencies at which the receiver may have a spurious response e.g. image frequency, harmonic response of the receive filter etc. The frequency range of the test should be in accordance with the relevant specification.

Test Instruments:

1) Pattern Generator.
2) Error Detector.
3) Signal Generator.
4) Power Sensor and Meter.

Test Configuration:

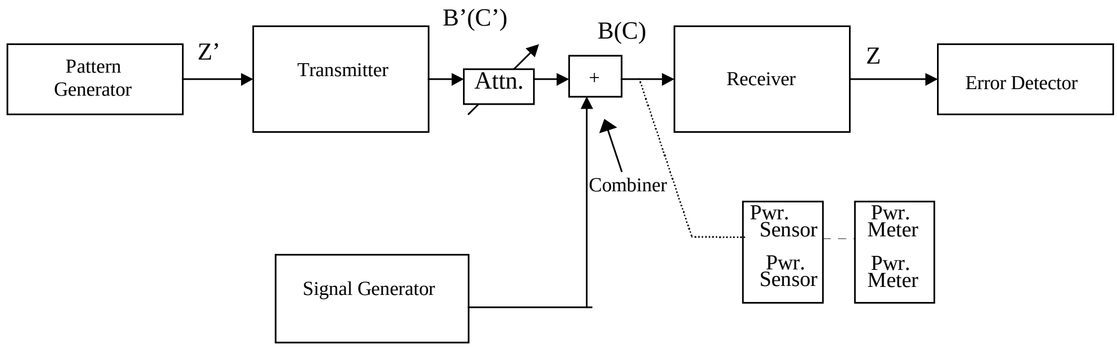


Figure 14: Test configuration for CW spurious interference

Test Procedure:

This test method applies for TS and CRS receivers.

With the signal generator output turned off, measure the transmitter RF output power at point B(C) using a suitable power sensor, with a known level of attenuation. Replace the power sensor with the receiver under test, and increase the level of attenuation to set the signal level to that specified in the standard. Calculate and record the receiver level (dBm).

Switch off the transmitter, replace the receiver under test with a power sensor. Calibrate the signal generator across the frequency range required by the ETS/EN at a level x dB above the level (dBm), where x is the required increase in level for the interfering CW signal.

Replace the power sensor with the receiver under test and confirm the BER level has not changed. Sweep the signal generator through the required frequency range at the calibrated level, taking into account any exclusion band stated in the standard.

Any frequencies which cause the BER to exceed the level stated in the standard shall be recorded. It is recommended that the calibration be re-checked at these frequencies.

NOTE 1: The use of a stepped signal generator is permitted provided that the step size is not greater than one third of the bandwidth of the receiver under test unless otherwise stated in the standard.

NOTE 2: This test may require the use of low pass filters on the output of the signal generator to prevent harmonics of the signal generator falling into the receiver's exclusion band.

NOTE 3: If the total sweep time makes the test very time consuming, it may be acceptable to calibrate the level of the CW spurious interferer at x+3 dB and look for an increased maximum BER (e.g.: 10^{-3} instead of 10^{-6}). If the increased maximum BER limit is exceeded at any points then a slower sweep shall be performed across those frequency points with the CW interferer calibrated to x dB and the lower BER requirement. Either requirement may be met for any frequency point.

History

Document history		
V1.1.1	March 2000	Public Enquiry PE 20000714: 2000-03-15 to 2000-07-14