Annex 1 (normative): Reference test methods

A1.1 General Conditions (GC)

A1.1.1 Outdoor test site and general arrangements for measurements involving the use of radiated fields (GC4)

The outdoor test site shall be on a reasonably level surface or ground. At one point on the site a ground plane of at least 5 m diameter shall be provided. In the middle of this ground plane a non-conducting support capable of rotation through 360 degrees in the horizontal plane shall be used to support the test sample at 1,5 m above the ground plane.

The test site shall be large enough to allow the erection of a measuring or transmitting antenna at a distance of half a wavelength or at least 3 m whichever is the greater. Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site and ground reflections do not degrade the measurement results.

The test antenna is used to detect the radiation from both the test sample and the substitution antenna, when the site is used for radiation measurements. Where necessary the substitution antenna is used as a transmitting antenna, when the site is used for the measurement of receiver characteristics. This antenna is mounted on a support such as to allow the antenna to be used in either the horizontal or vertical polarization and for the height of its centre above ground to be varied over the range 1 m to 4 m. Preferably test antennas with pronounced directivity should be used. The size of the test antenna along the measurement axis shall not exceed 20 % of the measuring distance.

For radiation measurements the test antenna is connected to a test receiver capable of being tuned to any frequency under investigation and of measuring accurately the relative levels of signals at its input. When necessary (for receiver measurements) the test receiver is replaced by a signal source.

The substitution antenna shall be a half wave dipole, resonant at the frequency under consideration, or a shortened dipole, or (in the range 1 GHz to 4 GHz) a horn radiator. Antennas other than a half wave dipole shall have been calibrated to the half wave dipole. The centre of this antenna shall coincide with the reference point of the test sample it has replaced. This reference point shall be the volume centre of the sample when its antenna is mounted inside the cabinet, or the point where an external antenna is connected to the cabinet. The distance between the lower extremity of the dipole and the ground shall be at least 30 cm.

The substitution antenna shall be connected to a calibrated signal generator when the site is used for radiation measurements and to a calibrated measuring receiver when the site is used for measurements of receiver characteristics. The signal generator and the receiver shall be operating at the frequencies under investigation and shall be connected to the antenna through suitable matching and balancing network.

A1.1.2 Anechoic shielded chamber (GC5)

As an alternative to the above mentioned outdoor test site an indoor test site, being a well shielded anechoic chamber simulating free space environment may be used. If such a chamber is used, this shall be recorded in the test report.

NOTE: The anechoic shielded chamber is the preferred test site for testing to the present document.

The measurement site may be an electrically shielded anechoic chamber being 10 m long, 5 m broad and 5 m high. Walls and ceiling should be coated with RF absorbers of 1 m height. The ground should be covered with absorbing material 1 m thick able to carry test equipment and operators. A measuring distance of 3 m to 5 m in the long middle axis of the chamber can be used for measurements up to at least 10 GHz.

The test antenna, test receiver, substitution antenna and calibrated signal generator are used in a way similar to that of the outdoor test site method with the exception that, because the floor absorbers reject floor reflections, the antenna height need not be changed and shall be at the same height as the test sample. In the range between 30 MHz and 100 MHz some additional calibration may be necessary.

A1.1.3 Temporary antenna connector (GC7)

If the MS to be tested does not normally have a permanent external 50 Ω connector then for test purposes only it may be modified to fit a temporary 50 Ω antenna connector.

The permanent integral antenna shall be used for measurement of:

- Transmitter effective radiated power (subclause 13.3).
- Radiated spurious emissions (clause 12).

For tests in the relevant MS Receive band:

- The temporary antenna coupling factor is determined using the procedure defined in annex 1, subclause 1.1.5. When using the temporary antenna connector, the temporary antenna coupling factor needs to be taken into consideration when determining a stimulus or measured level in the receive band.

For tests in the relevant MS Transmit band:

- The temporary antenna coupling factor is determined using the procedure defined in subclause 13.3.4.2 When using the temporary antenna connector, the temporary antenna coupling factor needs to be taken into consideration when determining a stimulus or measured level in the transmit band.

For frequencies outside the above mentioned relevant bands the temporary antenna coupling factor is assumed to be 0 dB.

NOTE 1: The uncertainty in the determined value of the temporary antenna coupling factor is directly related to the uncertainty of the field strength value measured in subclause 13.3.4.2 step n) and annex 1, subclause 1.1.5.2 (approximately ±[3 dB]). By mutual agreement, between the MS manufacturer and the testing authority, a value of 0 dB for the temporary antenna coupling factor could be used.

NOTE 2: The accommodation of the uncertainty in the temporary antenna coupling factor in the relevant MS receive band for the tests in clause 14 is for further study.

NOTE 3: The uncertainty in the temporary antenna coupling factor in the relevant MS transmit band can be accommodated with appropriate adjustment of the measured levels by the uncertainty.

Testing must be performed in the following order to ensure that all the free field measurements are performed before the MS is modified.

- Subclause 12.1.2.
- Annex 1, subclauses 1.1.5.1 and 1.1.5.2.
- Subclause 13.3.4.2 (during this step the MS is modified).
- Annex 1, subclause 1.1.5.3.
- All remaining tests of clauses 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22.

A1.1.4 Temporary antenna connector characteristics

The method of connection of the temporary connector shall allow secure and repeatable connections to be made to the device under test.

The antenna connector shall present a nominal 50 Ω impedance over the GSM receive and transmit frequency ranges. The maximum loss within the frequency range 100 kHz to 12,75 GHz shall be less than 1 dB.

The connection circuitry shall be maximally broadband and shall contain no non-linear or active devices.

The characteristics of the connector shall not be significantly affected by temperatures in the range -25° to +60° Celsius.

A1.1.5 Calibration of the temporary antenna connector

For equipments fitted with an integral antenna and not provided with a permanent means for connection to an external antenna a calibration procedure is required to allow subsequent measurements to be performed on the temporary antenna connector.

Once calibrated this temporary antenna connector enables all receiver test procedures to be identical for equipments with an integral antenna and for equipments with an antenna connector.

The calibration procedure shall be carried out at three frequencies, namely an ARFCN in the low mid and high ARFCN ranges. The procedure consists of three distinct stages as follows:

1) Establish the MS antenna radiation pattern for the three selected frequencies.

2) Calibrate the test range (or anechoic shielded chamber) for the conditions needed in 1).

3) Determine the temporary antenna connector coupling factor.

A1.1.5.1 Antenna radiation pattern

a) The MS shall be in the anechoic shielded chamber, or on an outdoor test site, on an isolated support in a vertical position at an orientation specified by the manufacturer. This position is the 0° position.

   A test antenna, connected to the SS shall be in the anechoic shielded chamber, or on the outdoor test site, at a distance of at least 3 m from the MS.

b) A call shall be originated by the SS to the MS on a frequency in the low ARFCN range. The MS shall be made to answer the call. The SS shall command the MS to maximum transmit power.

c) The SS shall, using estimated parameters for the outdoor test site or anechoic shielded chamber, set its output level "E" [see figure A1-1 to give an MS receiver input level of approximately 32 dBµVemf. This corresponds to a field strength of 55,5 dBµV/m at the MS position. The signal shall be the Standard Test Signal C1.

NOTE 1: The absolute value of the received signal level is not critical. The value suggested however will ensure that the MS receiver is operating essentially error free, yet is low enough to avoid any non linear effects in the receiver.

d) The SS shall use the RXLEV message from the MS to determine a measure of the received field strength. The procedure detailed in the flow chart of figure A1-1 shall now be followed.

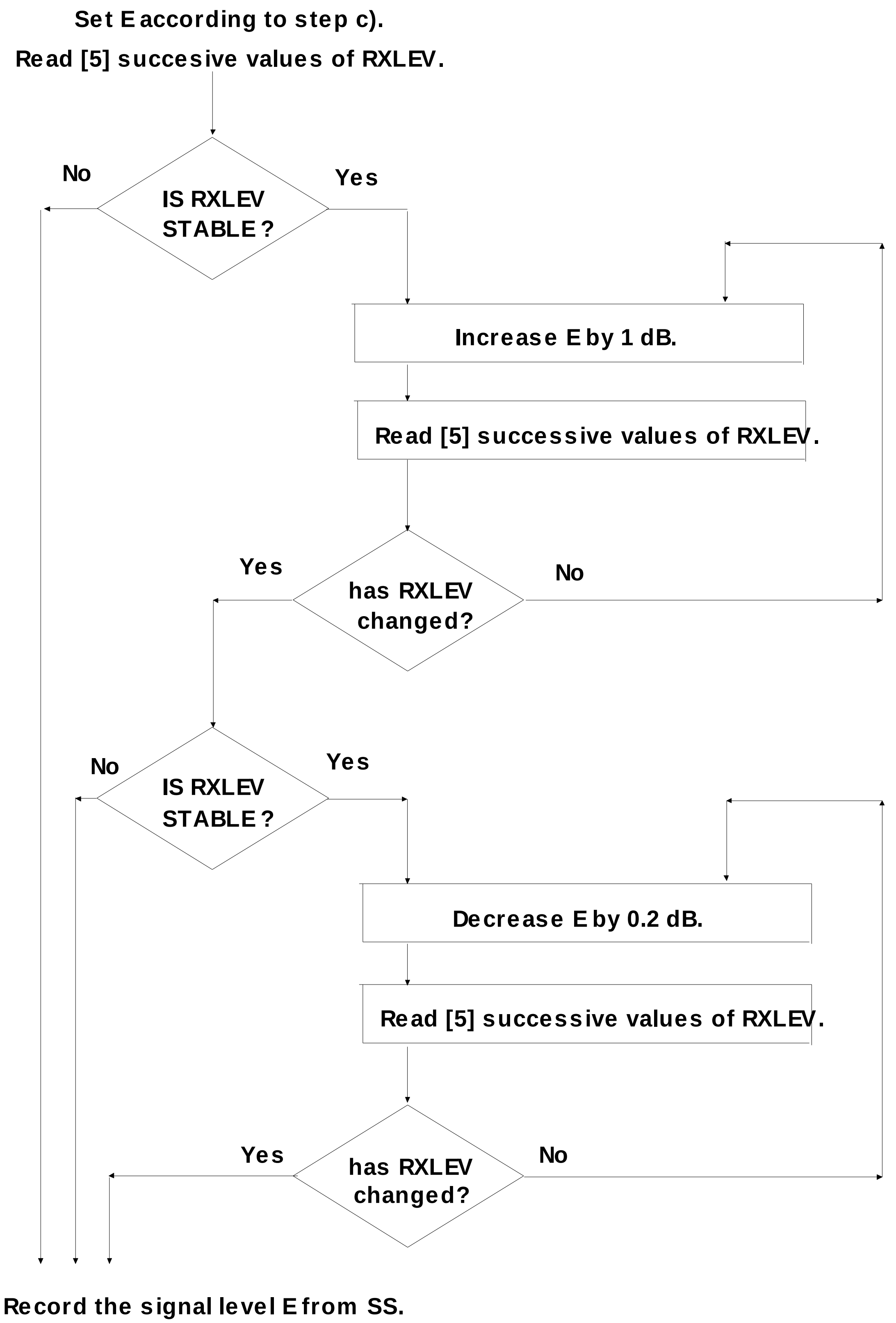


Figure A1-1

The signal level from the SS that just results in the transition from $RXLEV_a$ to $RXLEV_b$ shall be recorded as $E_{i.}$

NOTE 2: The actual values of $RXLEV_a$ and $RXLEV_b$ will need to be recorded, because this transition will be used as the reference point for all further stages of the calibration procedure.

e) Step d) shall be repeated after the MS has been rotated by n × 45° in the horizontal plane. Ensuring that the same RXLEV transition is used, the signal levels from the SS shall be recorded as E_{in}.

f) Calculate the effective mean signal level from the RMS value of the eight signal levels obtained in d) and e) above by using the following formula:

$$E_1 = \left[\frac{8}{\sum_{n=0}^{n=7} \frac{1}{E_{in}}} \right]^{1/2}$$

g) Repeat steps b) to f), except in step b) use an ARFCN in the mid ARFCN range to obtain a mean signal level E_2. Ensure the same RXLEV transition is used.

h) Repeat steps b) to f), except in step b) use an ARFCN in the high ARFCN range to obtain a mean signal level E_3.

Ensure the same RXLEV transition is used.

A1.1.5.2 Test range calibration

The objective of this step is to determine the actual field strength at the MS corresponding to the three signal levels E_1, E_2 and E_3 established in annex 1, subclause 1.1.5.1. The following procedure shall be used:

a) Replace the MS by a calibrated reception antenna connected to a measuring receiver.

b) For each frequency used in annex 1, subclause 1.1.5.1 measure the field strength E_{fr} corresponding to the respective signal levels E_r determined in steps f), g) and h) of annex 1, subclause 1.1.5.1 record these values as E_{f1}, E_{f2}, E_{f3}.

A1.1.5.3 Temporary antenna connector coupling factor

The coupling factor of the temporary antenna connector is the relationship expressed in dB, between the output signal of the SS and the effective receiver input signal for the MS.

The test sample MS is modified to fit a temporary antenna connector in accordance with annex 1, subclause 1.1.3. Or alternatively a second MS shall be provided, fitted with such a temporary antenna connector.

NOTE: If only one MS is supplied for testing, the tests of radiated spurious emissions (transmit and receive) and receiver sensitivity shall be performed before the MS is modified to accept a temporary antenna connector.

The calibration procedure shall be as follows:

a) The MS temporary connector is connected to the output of the SS.

b) A call shall be originated by the SS to the MS using a frequency in the low ARFCN range. The MS shall be made to answer the call. The SS shall command the MS to maximum transmit power, non hopping encrypted mode.

c) The SS shall, using the procedures of annex 1, subclause 1.1.5.1, adjust its output signal level to determine the $RXLEV_a$ to $RXLEV_b$ transition. This signal level shall be recorded as E_{c1}.

d) Repeat steps b) and c) for frequencies in the mid ARFCN range and the high ARFCN range. Record the RXLEV transitions as E_{c2} and E_{c3} respectively.

e) The temporary antenna connector coupling factor F is then calculated from:

$$F_n = 20\log_{10}\left[\frac{E_{cn}}{E_{fn} * K_n}\right]$$

where K_n = conversion factor of an isotropic antenna expressed as <u>µV</u> at the frequency µV/m corresponding to the ARCFN used.

f) The mean antenna coupling factor F_m to be used for measurements requiring hopping shall be calculated from the RMS value of all parameters in e) as follows:

$$E_{cm} = \left[\frac{3}{1/E_{c1} + 1/E_{c2} + 1/E_{c3}}\right]^{1/2}$$

$$E_{fm} = \left[\frac{3}{1/E_{f1} + 1/E_{f2} + 1/E_{f3}}\right]^{1/2}$$

$$k_m = \left[\frac{k_1 + k_2 + k_3}{3}\right]^{1/2}$$

$$F_m = 20\log_{10}\left[\frac{E_{cm}}{E_{fm} + k_m}\right]$$

g) In all tests in which a MS with integral antenna is the unit under test, the signal level at the temporary antenna connector is determined from:

- E_{in} = E_{req} + F;

where:

- E_{in} = signal level at coupling device (dBµVemf);
- E_{req} = signal level required by the test (dBµVemf);
- F = coupling factor at the respective ARFCN (dB).

This is indicated in the test procedures as E_{req}, dBµVemf( ), where the empty parenthesis is to be read as E_{in}.

For frequencies not in the receive band or the transmit band, 0dBi antenna gain shall be assumed.]

A1.1.6 Connection of devices with multiple antennae

Devices with multiple antennae must be connected in well defined manner in order for test requirements to be considered valid. This applies equally to those tests which are specifically testing these requirements associated with a device with multiple antennae, as those which are not.

A1.1.6.1 DARP phase 2 MS

For those tests which are specifically designed for DARP phase 2 MS, the SS must present signals to, and connect to the MS in a manner specified in TS 45.005 Annex N.2. Additionally, the SS must be able to accommodate the MS transmission being on either one or both or these antennae, or indeed an alternative antenna.

A1.2 Normal and extreme Test Conditions (TC)

A1.2.1 Power sources and ambient temperatures (TC2)

During type approval tests the power source of the equipment shall be replaced by a test power source, capable of producing normal and extreme test voltages as specified in subclauses 1.2.2 and 1.2.3. The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the purpose of tests, the voltage of the power source shall be measured at the input terminals of the equipment. If the equipment is provided with a permanently connected power cable, the test voltage shall be that measured at the point of connection of the power cable to the equipment. In equipment with incorporated batteries the test power source shall be applied as close to the battery terminals as practicable.

During tests the power source voltages shall be maintained within a tolerance of ±3 % relative to the voltage at the beginning of each test.

A1.2.2 Normal test conditions (TC2.1)

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- Temperature: +15°C to +35°C (degrees Celsius).

- Relative humidity: up to 75 %.

NOTE: When it is impracticable to carry out the tests under the conditions stated above, the actual temperature and relative humidity during the tests shall be recorded in the test report.

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of these specifications, the nominal voltage shall be the declared voltage or any of the declared voltages for which the equipment was designed. The frequency of the test power source corresponding to the mains shall be within 1 Hz of the nominal mains frequency.

When the radio equipment is intended for operation from the usual types of regulated lead-acid battery power source of vehicles, the normal test voltage shall be 1,1 times the nominal voltage of the battery (6 volts, 12 volts etc.).

For operation from other power sources or types of battery (primary or secondary) the normal test voltage shall be that declared by the equipment manufacturer.

A1.2.3 Extreme test conditions (TC2.2)

For tests under extreme test conditions the 4 combinations of extreme voltages and extreme temperatures in table A1.1 shall be applied.

Table A1.1

	1	2	3	4
Temperature Voltage	High High	High Low	Low High	Low Low

For tests at extreme ambient temperatures measurements shall be made at the temperatures given in table A1.2 (see 3GPP TS 45.005, D.2.1 for further details), following the testing procedures given in IEC publications 68-2-1 and 68-2-2 for the low and high temperature tests.

For tests at the high temperature, after thermal balance has been achieved, the MS is switched on in the transmit condition (non DTX) for a period of one minute followed by 4 minutes in the idle mode (non DRX) after which the MS shall meet the specified requirements.

For tests at the low temperature, after thermal balance has been achieved, the MS is switched to the idle mode (non DRX) for a period of one minute after which the MS shall meet the specified requirements.

Table A1.2

	Temperature (degrees Celsius)	
	Low	High
For small MS units	-10	+55
For other units	-20	+55
Note 1: Mobile phones, Tabs, Data cards, Embedded modules etc. are considerted belonging to the small MS category		

For tests at extreme voltages measurements shall be made at the lower and higher extreme voltages as declared by the MS manufacturer. For MS that can be operated from one or more of the power sources listed below, the lower extreme voltage shall not be higher, and the higher extreme voltage shall not be lower than that specified in table A1.3.

Table A1.3

	Voltage (relative to nominal)		
	Lower extreme	Higher extreme	Normal cond.
Power source:			
AC mains	0,9	1,1	1,0
Regulated lead acid battery	0,9	1,3	1,1
Non regulated batteries:			
Leclanché	0,85	1,0	1,0
lithium	0,95	1,10	1,10
mercury/ nickel cadmium	0.9	1,0	1,0

A1.2.4 Vibration requirements (TC4)

When the MS is to be tested under vibration, then random vibration is used, where the acceleration spectral densities (ASD) and the frequency ranges of 3GPP TS 05.05 [subclause D.2.3] apply. These are given in table A1.4.

Table A1.4

frequency in Hz	ASD in m^2/s^3
5- 20	0,96
20 - 500	0,96 at 20 Hz, thereafter -3 dB / octave

The test shall be performed as described in IEC publication 68-2-36.

Annex 2: Void

Annex 3: Protocol implementation information

General

The list of PICS and PIXIT gives all the information needed to perform the tests described in 3GPP TS 11.10.

A3.1 Protocol Implementation Conformance Statement (PICS)

For the points listed the manufacturer has the choice between different solutions in implementation. The manufacturer has to describe his choice if there is any consequence for the tests.

A3.1.1 LAPDm protocol (3GPP TS 04.05 and 04.06)

A3.1.1.1 Simplified protocol - 3GPP TS 04.06 clause 6

Statement about the choice made by the manufacturer.

A3.1.1.2 Management of SAPI = 3 - 3GPP TS 04.11 subclause 2.3

Statement about the handling of SAPI = 3 on the data link layer chosen by the manufacturer.

A3.1.2 Mobility management

A3.1.2.1 IMSI detach initiation by the MS - 3GPP TS 04.08 / 3GPP TS 24.008 subclause 4.3.4.1

During a location updating, if an IMSI detach has to be performed (SIM or power off), the IMSI detach can be delayed until the location updating is finished, or can be omitted.

A3.1.2.2 IMSI detach completion by the MS - 3GPP TS 04.08 / 3GPP TS 24.008 subclause 4.3.4.3

The MS should delay the local release of the channel to allow a normal release from the network after a detach by power off command, if possible.

If not possible the RR sub-layer on the MS side should be aborted without waiting for something from the network.

A3.1.2.3 MM specific procedures - 3GPP TS 04.08 / 3GPP TS 24.008 subclauses 4.4 and 4.5.1.1

During the lifetime of an MM specific procedure, if an MM connection establishment is required by a CM-entity, this request will either be rejected or delayed until the running MM specific procedure is terminated and, provided that the network has not sent a "follow-on proceed" indication, the RR connection is released.

If the LOCATION UPDATING REQUEST message has not been sent, the mobile station may include a "follow-on request" indicator in the message. The mobile station shall then delay the request until the MM specific procedure is completed, when it may be given the opportunity by the network to use the RR connection.

A3.1.2.4 Receiving an MM STATUS message - 3GPP TS 04.08 / 3GPP TS 24.008 subclause 4.6

If the MM-entity of the Mobile Station receives a MM-STATUS message no state transition and no specific action shall be taken as seen from the radio interface, i.e. local actions are possible.

A3.1.3 Call control

A3.1.3.1 Status enquiry procedures - 3GPP TS 04.08 / 3GPP TS 24.008 subclause 5.5.3.1

The MS may send a STATUS ENQUIRY and take the appropriate actions based on the answer (STATUS) of the network.

A3.1.3.2 Receiving a STATUS message by a CC entity - 3GPP TS 04.08 / 3GPP TS 24.008 subclause 5.5.3.2

The determination of which CC states are incompatible between the MS and the network is left as an implementation decision except in some particular cases.

A3.1.3.3 Called side compatibility checking - 3GPP TS 04.08 / 3GPP TS 24.008 clause B.3

Compatibility checking can be performed in various ways from the viewpoint of execution order and information to be checked, e.g. first DDI number, sub-address and then compatibility or vice versa.

A3.1.3.4 Disconnect on incoming call

The mobile equipment may or may not offer the possibility to disconnect an incoming call:

a) after having confirmed an incoming call, but before alerting;

b) after alerting, but before connecting.

3GPP TS 02.30 (subclause 5.2.3) allows the combination of SEND and END function in one key.

A3.1.4 Layer 1

A3.1.4.1 Optional storage of BCCH carrier information - 3GPP TS 05.08 subclause 6.3

The MS may include optional storage of BCCH carrier information. For instance, the MS may store the BCCH carriers in use by the PLMN accessed when it was last active in the GSM network, or it may store BCCH carriers for more than one PLMN.

A3.1.5 Autocalling - (ref.: 3GPP TS 02.07, annex 1)

Cause number 27 implemented in:

- category 2 (preferred);
- category 3.

A3.1.6 Transient states

The following call control states may be transient in the mobile station:

State U6

State U6 may be transient if the mobile station is not configured to support explicit refusal of an incoming call by the (human or non-human) user (e.g. via a terminal interface) before call confirmation.

If U6 is transient, there is an internal transition:

```
                CALL CONFIRMED
U6  ------------------------------------------------> U9
```

or an internal transition:

```
                RELEASE COMPLETE
U6  ------------------------------------------------> U0.
```

State U7:

State U7 is transient if the implementation allows for automatic connect after an implementation specific time T.

If U7 is transient, there is an internal transition:

```
                after T, CONNECT
U7  ------------------------------------------------> U8.
```

State U9:

State U9 is not transient if:

- the implementation does not support immediate connect;
- an appropriate TCH is not yet assigned;
- the signalling element has not been present in the SETUP.

If the implementation supports immediate connect, there is an internal transition:

```
                CONNECT
U9  ------------------------------------------------> U8.
```

If the appropriate TCH is available or the signalling element was present in SETUP, there is an internal transition:

```
                ALERTING
U9  ------------------------------------------------> U7.
```

State U12:

U12 is a stable state, if an appropriate speech traffic channel is connected and progress indicator #8 was present in the DISCONNECT message. Otherwise U12 is transient, and there is an internal transition:

A3.2 Protocol Implementation Extra Information for Testing (PIXIT)

A3.2.0 Introduction

Some of the features listed below are mandatory, others are not ; but in any case for each feature implemented the manufacturer must provide information to enable regulatory testing to be conducted.

A3.2.1 Basic characteristics

A3.2.1.1 Type of antenna

- Integrated without a connector.
- Position for normal use (if integrated without a connector).
- With a connector allowing the connection of an external antenna.
- If with a connector, declare in band impedance.

A3.2.1.2 Power supply

- Type of battery (if any).
- Type of power supply.
- Nominal voltage(s).
- End-point voltage(s) of battery(s) (if any).
- Details of MS shut-down voltage.

A3.2.1.3 Power class of the MS

- Different class declared.
- Class mark change: description of the means to change the RF power capabilities.

A3.2.1.4 Channel modes supported

- Speech full rate.
- Speech half rate.
- Data 14.5 kbit/s T/NT.
- Data 12 kbit/s full rate T/NT.
- Data 6 kbit/s full rate T/NT.
- Data 6 kbit/s half rate T/NT.
- Data 3,6 kbit/s full rate T.
- Data 3,6 kbit/s half rate T.

A3.2.1.5 Teleservices supported

11) Telephony.

12) Emergency calls.

21) Short message MT/PP.

22) Short message MO/PP.

23) Short message transmission cell broadcast.

61) Alternate speech and facsimile group 3 T/NT.

62) Automatic facsimile group 3 T/NT.

A3.2.1.6 Supplementary services supported

- Call forwarding.
- Call restriction.
- Handling of undefined GSM Supplementary Services.

A3.2.1.7 Bearer services supported

20)	Asynchronous General Bearer Service	see 3GPP TS 02.02 subclause 3.1
21)	Data circuit Duplex asynchronous	300 bit/s T/NT
22)	Data circuit Duplex asynchronous	1 200 bit/s T/NT

23)	Data circuit Duplex asynchronous	1 200/75 bit/s	T/NT
24)	Data circuit Duplex asynchronous	2 400 bit/s	T/NT
25)	Data circuit Duplex asynchronous	4 800 bit/s	T/NT
26)	Data circuit Duplex asynchronous	9 600 bit/s	T/NT
30)	Synchronous General Bearer Service	see 3GPP TS 02.02 subclause 3.1	
31)	Data circuit Duplex synchronous	1 200 bit/s	T
32)	Data circuit Duplex synchronous	2 400 bit/s	T/NT
33)	Data circuit Duplex synchronous	4 800 bit/s	T/NT
34)	Data circuit Duplex synchronous	9 600 bit/s	T/NT
40)	General PAD Access Bearer Service	see 3GPP TS 02.02 subclause 3.1	
41)	PAD Access circuit asynchronous	300 bit/s	T/NT
42)	PAD Access circuit asynchronous	1 200 bit/s	T/NT
43)	PAD Access circuit asynchronous	1 200/75 bit/s	T/NT
44)	PAD Access circuit asynchronous	2 400 bit/s	T/NT
45)	PAD Access circuit asynchronous	4 800 bit/s	T/NT
46)	PAD Access circuit asynchronous	9 600 bit/s	T/NT
50)	General Packet Access Bearer Service	see 3GPP TS 02.02 subclause 3.1	
51)	Data Packet Duplex synchronous	2 400 bit/s	NT
52)	Data Packet Duplex synchronous	4 800 bit/s	NT
53)	Data Packet Duplex synchronous	9 600 bit/s	NT

61) Alternate Speech/Date
(here Data offers the same service
as bearer services 21-34 with "3,1kHz" information transfer capability)

81) Speech followed by Data
(here Data offers the same service
as bearer services 21-34 with "3,1kHz" information transfer capability).

A3.2.1.8 SIM removal

- Removal of the SIM is possible without disconnection of the power supply (Y/N).

A3.2.1.9 Classmark

The coding of Mobile station classmark 1, 2, and 3 and the fact whether and under which conditions the classmark 3 information element is included in a CLASSMARK CHANGE message, has to be declared by the manufacturer. The declaration has to fulfil the following requirements:

- Mobile station classmark 1: Bits 4, 5 and 8 of the first (and only) octet of the value part of the information element shall be coded as "0". The "Revision level" and "RF power capability" field shall specify the value that is correct for the MS.

- Mobile station classmark 2: Bits 4, 5 and 8 of the first octet, bits 2, 3 and 8 of the second octet, bits 3 to 7 of the third octet of the value part of the information element shall be coded as "0". The "Revision level" field, "RF power capability" field, "PS capability" field, "SS Screening indicator" field, "SM capability" field, "Frequency capability" field, "Classmark 3" field, "A5/2 algorithm supported" field, and "A5/3 algorithm supported" field shall specify the value that is correct for the MS.

- Mobile station classmark 3: Bits 5 to 8 of the first octet of the value part of the information element shall be coded as "0". If the value part contains more octets, they shall be coded as "0000 0000". The "A5/4 algorithm supported" field, "A5/5 algorithm supported" field "A5/6 algorithm supported" field, and "A5/7 algorithm supported" field shall specify the value that is correct for the MS (that is, they shall be set to "0").

NOTE: The requirements to the classmark may be subject to changes. That is why test cases are expected to verify the manufacturer's declaration, whereas the correctness of the manufacturer's declaration is to be verified "off line".

A3.2.1.10 Type of SIM/ME interface (ref. 3GPP TS 11.11 and 3GPP TS 11.12)

- 5V SIM/ME interface (5V only ME).
- 3V SIM/ME interface (3V only ME).
- 5V/3V SIM/ME interface (3V technology ME).

A3.2.1.11 Multislot class

- Multislot class as defined in clause B.1 of 3GPP TS 05.02.

A3.2.2 Man machine interface

A3.2.2.1 Mobile station features

- Description of manual entry and display of a called number.
- Description of the basic way to send a call manually.
- Description of the basic way to take a call manually.
- Description of the basic way to end a call manually.
- Description of the basic way to send an emergency call manually.
- Description of the basic way to send DTMF manually.
- Description of the manual PLMN selector.
- Description of the automatic PLMN selector.
- Description of the indication of the country.
- Description of the indication of the available PLMN.
- Description of the indication of the automatic registration to a PLMN.
- Description of the service indicator.
- Description of the management of the SIM by the user:
  - keying PIN and changing PIN;
  - indication of acceptance or rejection of keyed PIN;
  - indication of blocked SIM;
  - indication of successful unblocking of the SIM;
  - storing an abbreviated number;
  - displaying an abbreviated number.
- Description of the selection of the hands free.
- Description of the volume control.
- Description of local barring of outgoing calls.
- Description of prevention of unauthorized calls.
- Description of the auto calling management:
  - selection of the auto calling;

  - indication that the call failed and a re-try is attempted;
  - indication that the call finally failed;
  - number of B-party numbers that can be stored in the list of blacklisted numbers.
- Description of the way in which the MS generates an MS originated NOTIFY, if possible. This feature may or may not be supported by the MS.
- Description of the way the MS indicates the identity of the current LSA to the human user (only applicable if the SoLSA MS has an interface to the human user).
- Description of the way the MS indicates the change of the current LSA to the human user (only applicable if the SoLSA MS has an interface to the human user).

NOTE: All the above description could be extracted from the user's manual.

A3.2.2.2 Short message service

- Description of the basic procedures to send a mobile originated short message.
- Description of the basic procedures to display a mobile terminated short message.
- Description of the basic procedures to display a cell broadcasted short message.
- Whether SMS messages are stored in the SIM and/or the ME.
- Maximum length (characters) of a mobile originated short message.

A3.2.2.3 Supplementary services

A3.2.2.3.1 Call forwarding

- Description of the user's commands and of the display of the answers from the network for:
  - registration;
  - erasure;
  - activation;
  - deactivation;
  - interrogation;
  - specific data request.
- Description of the display of:
  - notification of an incoming call to the "served" mobile or the "forwarded to" mobile;
  - notification during out-going call;
  - information to the calling mobile.

A3.2.2.3.2 Call restriction

- Description of the user's commands and the display of the answers from the network for:
  - registration;
  - change of the password;
  - activation;
  - deactivation;

  - interrogation.

- Description of the display of the indication of call barring.

A3.2.2.3.3 Handling of (undefined) GSM supplementary services

- Description of the user's commands and the display of the answer from the network.
- Identification of the short strings defining MS manufacturer defined procedure in idle mode (1 or 2 characters defined in the 3GPP TS 03.38 default alphabet followed by "SEND").

A3.2.3 Electrical Man Machine Interface (EMMI)

A3.2.3.1 Methods supported for activation/deactivation of EMMI

- All possibilities specified in 3GPP TS 11.10, subclause 36.2.2.
- All possibilities specified in 3GPP TS 11.10, subclause 36.2.2, except activation by inserting a test SIM (when the ME is already switched on).
- Activation/deactivation only via layer 3 messages on the radio interface according to 3GPP TS 11.10, subclause 36.2.2.

A3.2.3.2 Transmission rate supported by the ME on the EMMI

A3.2.3.3 Layer 3 messages supported on the EMMI

- Layer 3 messages as specified in 3GPP TS 11.10, subclause 36.3.5.3.2, except: (followed by the list of messages not supported).
- others than defined in 3GPP TS 11.10 subclause 36.3.5.3.1 table 9.

A3.2.3.4 Keystroke sequence messages

Non standard keystroke sequences to be used on the EMMI (in line with 3GPP TS 11.10, subclause 36.3.5.3.2):

- related to tests of the mobile station features (3GPP TS 11.10, clause 33);
- related to testing of the ME/SIM interface (3GPP TS 11.10, clause 27);
- related to tests of autocalling restrictions (3GPP TS 11.10, clause 28);
- related to tests of supplementary services (3GPP TS 11.10, clause 31);
- related to tests of data services (3GPP TS 11.10, clause 29);
- related to tests of short message service (3GPP TS 11.10, clause 34);
- related to other tests.

A3.2.3.5 Internal malfunction detected messages

List of the error indicators provided.

A3.2.4 Digital Audio Interface (DAI)

Description of the speech data routing:

- via the control lines; or
- via the test interface message.

A3.2.5 Characteristics related to bearer services or teleservices

A3.2.5.1 Access interface

Description of the access interface to connect the DTE (e.g. V series (V.24, V.28), X series, two wire analogue interface for use with fax group 3, I.420 (S-reference point).

In case of a proprietary interface to a DTE (non standard), description of this interface (hardware and software).

In case of a non standard connector provide a mechanical adapter.

A3.2.5.2 Configuration of the MT

Description of the configuration information to be selected in the MT to connect a terminal equipment to the mobile termination.

Description of the (different) configuration(s) of the MT for each bearer service and each teleservice supported, with the range or value for the parameters and the configuration procedure.

For the purpose of test of MOC, the manufacturer shall describe precisely how it is possible to put the MT in the different configurations to generate the capability information of the Mobile according to subclause 3.2.5.3, and described as supported by the MS.

For the purpose of test of MTC, the manufacturer shall describe how to verify the correct selection by the MT of the required function with regard to the capability information as described below, especially using the messages at the Um interface if there is no R or S interface available (case MTO). The description shall be made for every combination of the parameter value valid for the MT.

A3.2.5.3 Capability information

Description of the capability information, related to supported bearer services:

- bearer capabilities;
- higher layer capabilities;
- lower layer capabilities.

The manufacturer shall describe for every capability the associated terminal functions and their characteristics.

A3.2.5.4 Subaddress or DDI number

Subaddress or a DDI number of the MT.

Procedure to allocate or change DDI number or subaddress, if possible.

A3.2.5.5 User to user signalling

Description of the function and the user's access to it.

A3.2.5.6 Data call set-up and data call clearing

For each implemented transparent and non-transparent data service:

- Description of the data call establishment mechanism:
  - Terminal initiated (CT108) (if possible);
  - MT (MMI/EMMI) initiated;
  - Description of DCE provided information (MT to TE), if any;
  - Declaration of optimal function and procedure, services supported by the MT.
- Description of the data call clearing mechanism:

- Terminal initiated (CT109) (if possible);
- MT (MMI/EMMI) initiated;
- Description of DCE provided information (MT to TE) related to a mobile or network initiated call clearing, if any.

A3.2.5.7 Characteristics of non-transparent data services

Description of Radio Link Protocol (RLP) features supported.

Description of supported RLP parameters and how to modify these values (if possible):

`<iws>` IWF to MS window size

`<mws>` MS to IWF window size

`<T1>` acknowledgement timer T1

`<N2>` retransmission attempts N2

Ability to configure the MS to use non-default RLP parameters.

Description of flow control mechanism:

- INBAND (XON/XOFF);
- OUTBAND COPnoFICt (CT105 and CT106).

A3.2.5.8 Possible ways of setting-up a call from either an external interface or internally

Describe in detail all possible ways a call can be initiated from the MS or a connected terminal.

A3.2.5.9 Application layer causing automatic call termination

State whether the call termination facility can be disabled and if so, describe in detail how.

A3.2.5.10 Call re-establishment for MS not supporting speech

Applicability of call re-establishment.

A3.2.6 International mobile station equipment identity

IMEI of the MS.

A3.2.7 Receiver intermediate frequencies

F_{lo} - Local Oscillator frequency applied to first receiver mixer.

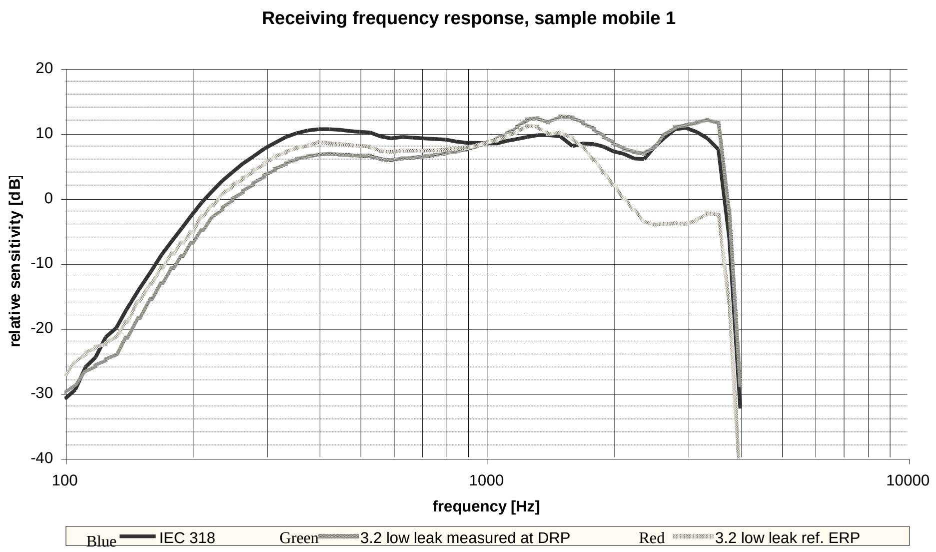
IF_1 ... IF_n - intermediate frequencies.

A3.2.8 Artificial ear

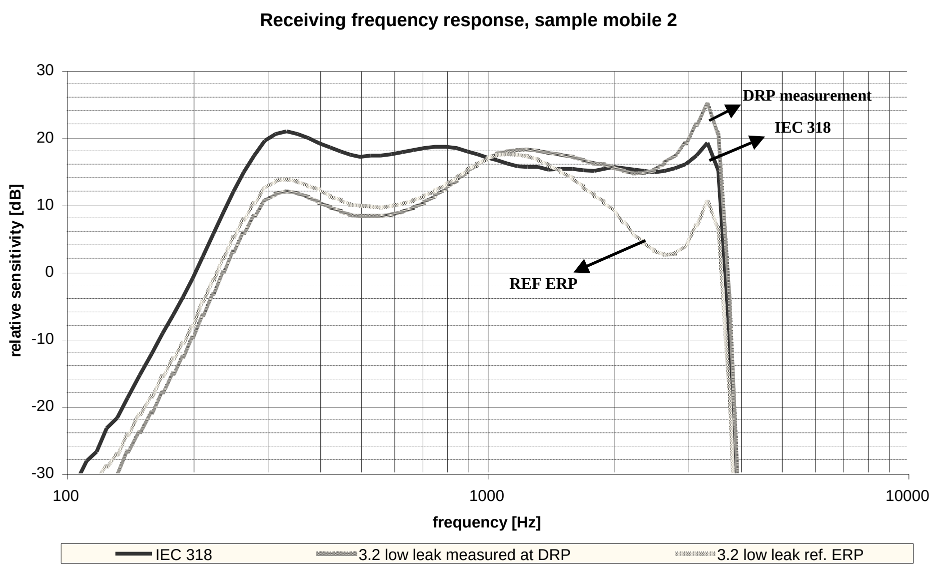
The manufacturer shall declare which type of artificial ear (type 1 or type 3.2 or type 3.4) is used for teleservices speech testing.

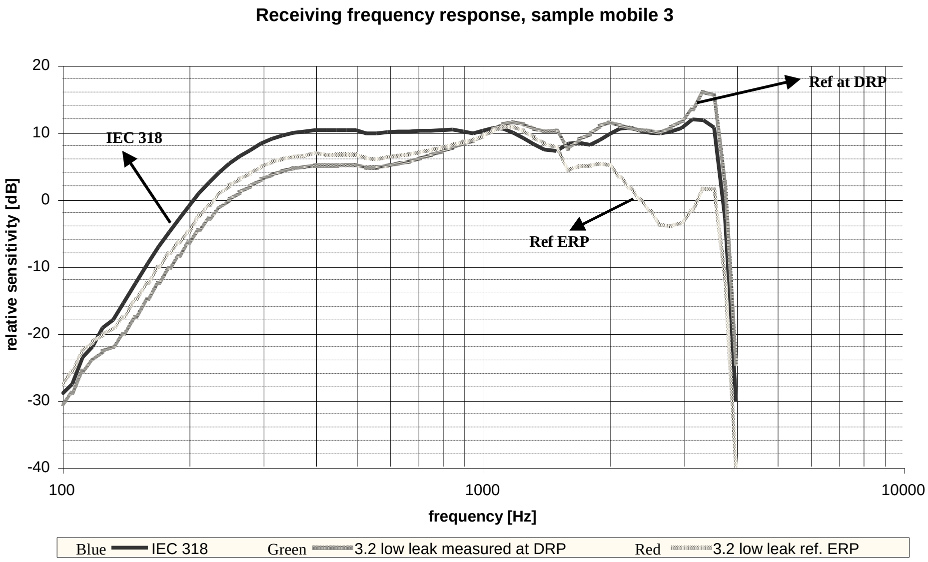
The following illustrate the results of both artificial ears when specified for acoustic receiving measurement.

Type 3.2 results are currently referred to ERP (as specified), but measured at DRP. When introducing DRP to ERP correction, a special frequency response is used which is obtained with the artificial ear in a free sound field. The overall result actually differs substantially from the transfer function under the IEC 318 test conditions. Referring the results to DRP instead avoids misleading interpretations.

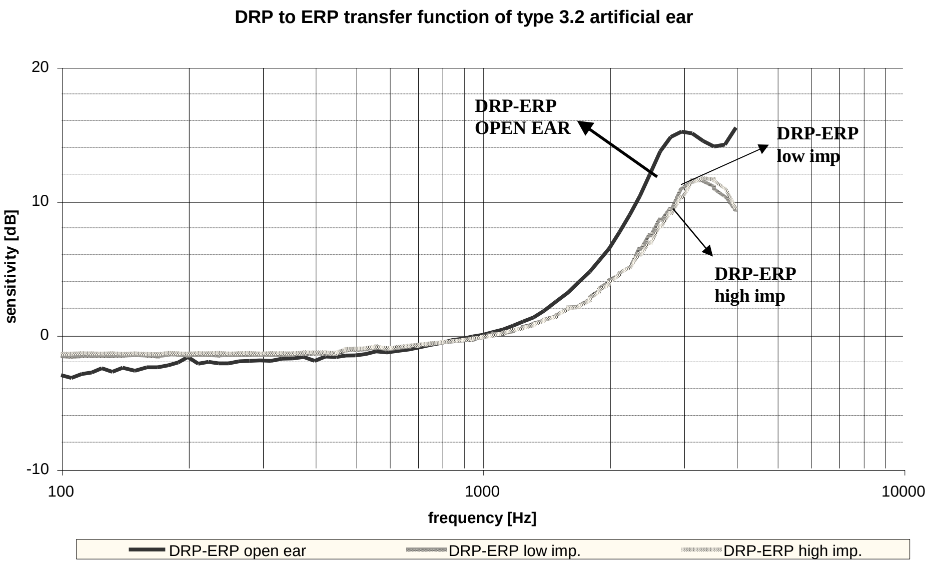


This slide as well as the following two shows results of three measurement and evaluation methods per each mobile sample. The blue curve is as measured sealed to IEC 318 closed coupler. The green curve is as measured with type 3.2 low leak coupler at DRP. The red curve shows the same measurement data corrected to ERP using the correction function provided by the manufacturer.

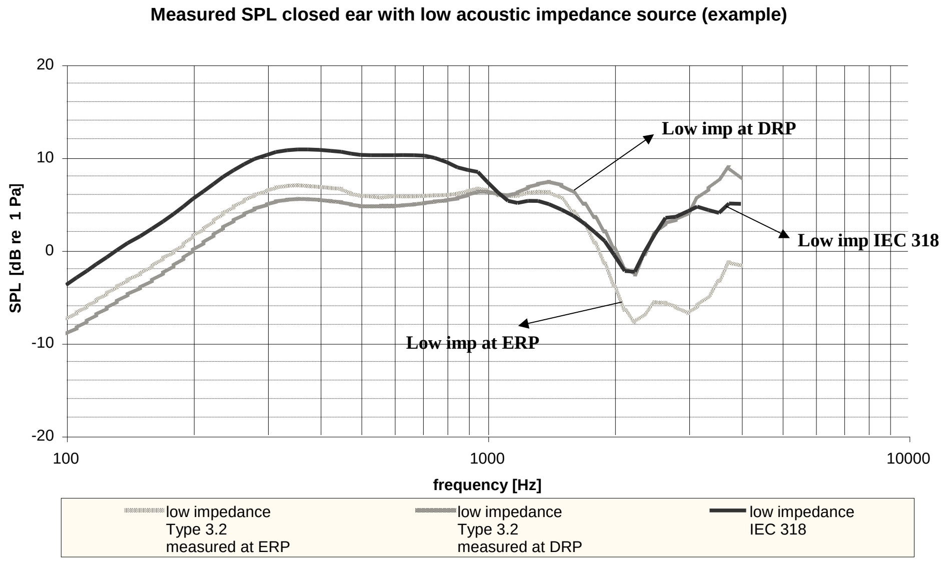




Below 1 KHz both type 3.2 curves are similar. The level decreases from IEC 318 to the type 3.2 results is due to the leak. At high frequencies the measured type 3.2 curve without DRP to ERP correction (green) clearly illustrates better compatibility towards IEC 318 results than the curve referred to ERP (red).



The three curves show the DRP to ERP transfer function for different source conditions. The blue line is obtained mounted in a baffle. The other two functions are measured with a probe microphone at ERP on two mobiles with different acoustic source impedance.



Contrary to the first three slides, the type 3.2 low leak response at ERP her is not calculated, but measured with a probe microphone. The relationship between the three curves is the same as in each of the first three slides.

The difference between the results of type 3.2 low leak artificial ear referred to DRP and ERP respectively is due to the acoustic input impedance of the artificial ear. The high acoustic impedance at DRP is transferred to a relatively low impedance at ERP for high frequencies according to the quarter wavelength distance between both points. This means that acoustic energy at ERP is more in terms of sound velocity, which is not measured with the used pressure microphone. The human ear is known to have its highest sensitivity around 5 KHz. Type 3.2 low leak measurement referred to ERP has particularly low sensitivity at this frequency. In order to account for compatibility between IEC 318 results and type 3.2 low leak results as well as for the sensitivity of the human ear, it is up to the choice of the terminal manufacturer, whether acoustic test results from the type 3.2 low leak artificial ear should be referred to ERP or to DRP.

Annex 4: Test SIM Parameters

A4.1 Introduction

This clause defines default parameters for programming the elementary files of the test SIM. The requirements of this annex do not apply to the SIM/ME tests of clause 27.

A4.1.1 Definitions

"Test SIM card":

A SIM card supporting the test algorithm for authentication, programmed with the parameters defined in this subclause. The electrical, mechanical and environmental requirements of the test SIM card are specified in 3GPP TS 11.11 / 3GPP TS 51.011.

"Test SIM":

Either a test SIM card or the SIM simulator programmed with the parameters defined in this subclause.

A4.1.2 Definition of the test algorithm for authentication

The following procedure employs bit wise modulo 2 addition ("XOR").

The following convention applies:

In all data transfer the most significant byte is the first byte to be sent; data is represented so that the left most bit is the most significant bit of the most significant byte.

Step 1:

XOR to the challenge RAND, a predefined number Ki, having the same bit length (128 bits) as RAND. The result RES1 of this is

RES1 = RAND XOR Ki

Step 2:

The most significant 32 bits of RES1 form SRES. The next 64 bits of RES1 form Kc. The remaining 32 bits are not used.

A4.2 Default Parameters for the test SIM

Ki:

The authentication key "Ki" will be chosen by the test house and will be non zero. The "Ki" value used by the SS will align with this value.

PIN Disabling

The PIN enabled / disabled flag will be set to "PIN Disabled". This ensures that when the Test SIM is inserted into a MS the user will not be prompted for PIN entry. This requires a specific card capability defined by the SIM service table (see subclause 2.9).

A4.3 Default settings for the Elementary Files (EFs)

The format and coding of elementary files of the SIM are defined in 3GPP TS 11.11 / 3GPP TS 51.011. The following subclauses define the default parameters to be programmed into each elementary file. Some files may be updated by the MS based on information received from the SS. These are identified in the following subclauses.

A4.3.1 EF_{ICCID} (ICC Identification)

The programming of this EF is a test house option.

A4.3.2 EF_{LP} (Language preference)

The programming of this EF is a test house option.

A4.3.3 EF_{IMSI} (IMSI)

The IMSI value will be chosen by the test house. The IMSI used by the SS will align this value.

File size: 9 bytes
Default values: Byte 1 (DEC): 8
Bytes 2-9 (DEC): 09 10 10 ** ** ** ** ** for GSM 400, GSM 900 and DCS 1 800
Bytes 2-9 (DEC): 09 10 10 *1 ** ** ** ** for GSM 700, GSM 850 and GSM 1 900

"*" indicates any number between 0 and 9 subject to the restriction that IMSI mod 1000 (i.e. the three boxed "*" digits number 13, 15 and 16) lies in one of the following ranges:

- 063-125, 189-251, 315-377, 441-503, 567-629, 693-755, 819-881 or 945-999.

NOTE: This ensures that the MS can listen to the second CCCH when more than one basic physical channel is configured for the CCCH. This is necessary for the test of "paging re-organization".

A4.3.4 EF_{Kc} (Ciphering key Kc)

File size: 9 Bytes

Default values (HEX): Bytes 1-8: Align with Kc used by SS
Byte 9: 07

Byte 9 is set to 07 to indicate that there is no key available at the start of a test.

The bytes within this elementary file may be updated by the MS as a result of a successful authentication attempt.

A4.3.5 $EF_{PLMNsel}$ (PLMN selector)

GSM 400, GSM 900 and DCS 1 800 begin

File size: 102 bytes
Default values (HEX): Bytes 1-3: 32 F4 10 (MCC, MNC) - Translates to 234, 01
Bytes 4-6: 32 F4 20 (MCC, MNC)
Bytes 7-9: 32 F4 30 (MCC, MNC)
....
....
....
Bytes 94-96: 32 F4 23 (MCC, MNC)
Bytes 97-99: 32 F4 33 (MCC, MNC)
Bytes 100-102: 32 F4 43 (MCC, MNC)

GSM 400, GSM 900 and DCS 1 800 end

GSM 700, GSM 850 and PCS 1900 begin

File size: 102 bytes
Default values (HEX): Bytes 1-3: 32 24 10 (MCC, MNC) - Translates to 234, 012
Bytes 4-6: 32 34 20 (MCC, MNC)
Bytes 7-9: 32 44 30 (MCC, MNC)
....
....
....
Bytes 94-96: 32 34 23 (MCC, MNC)

Bytes 97-99: 32 44 33 (MCC, MNC)
Bytes 100-102: 32 54 43 (MCC, MNC)

GSM 700, GSM 850 and PCS 1900 end

34 PLMNs are shown coded above since this is the largest number required for a test - see subclause 27.9.4.1. It is necessary to take this into account since the SIM cards must be dimensioned to cope with this number of records.

A4.3.6 EF_{HPLMN} (HPLMN search period)

File size: 1 byte

Default value (HEX): 00 (no HPLMN search attempts)

A4.3.7 EF_{ACMmax} (ACM maximum value)

File size: 3 bytes
Default: Byte 1: 00
Byte 2: 00
Byte 3: 00

The above translates to: "Not valid".

A4.3.8 EF_{SST} (SIM service table)

Services will be allocated and activated as follows:

Service	Allocated	Activated
No. 1: CHV1 disable function	Yes	Yes
No. 2: Abbreviated Dialling numbers (ADN)	Yes	Yes
No. 3: Fixed dialling numbers (FDN)	Yes	Optional
No. 4: Short Message Storage (SMS)	Yes	Yes
No. 5: Advice of Charge (AoC)	Yes	Yes
No. 6: Capability Configuration Parameters (CCP)	Yes	Yes
No. 7: PLMN Selector	Yes	Yes
No. 8: Reserved for future use	No	No
No. 9: MSISDN	Optional	Optional
No. 10: Extension 1	Yes	Optional
No. 11: Extension 2	Yes	Optional
No. 12: SMS Parameters	Yes	Yes
No. 13: Last Dialled Number (LND)	Yes	Yes
No. 14: Cell Broadcast Message Identifier	Yes	Yes
No. 15: Group identifier Level 1	Yes	Optional
No. 16: Group identifier Level 2	Yes	Optional
No. 17: Service Provider Name	Optional	Optional
No. 18: Service Dialling Numbers (SDN)	Optional	Optional
No. 19: Extension3	Optional	Optional
No. 20: RFU	Optional	Optional
No. 21: VGCS Group Identifier List (EF_{VGCS} , EF_{VGCSS})	Yes	Yes
No. 22: VBS Group Identifier List (EF_{VBS} , EF_{VBSS})	Yes	Yes
No. 23: eMLPP service	Yes	Yes
No. 24: Automatic answer for eMLPP	Yes	Yes
No. 25: Data download via SMS-CB	Optional	Optional
No. 26: Data download via SMS-PP	Optional	Optional
No. 27: Menu selection	Optional	Optional
No. 28: Call control	Optional	Optional
No. 29: Proactive SIM	Optional	Optional
No. 30: Cell Broadcast Message Identifier Ranges	Optional	Optional
No. 31: Barred Dialling Numbers (BDN)	Optional	Optional
No. 32: Extension4	Optional	Optional
No. 33: De-personalization Control Keys	Optional	Optional
No. 34: Co-operative Network List	Optional	Optional
No. 35: Short Message Status Reports	Optional	Optional
No. 36: Network's indication of alerting in the MS	Optional	Optional

Service	Allocated	Activated
No. 37: Mobile Originated Short Message control by SIM	Optional	Optional
No. 38: GPRS	Optional	NOTE 1
No. 39: Image (IMG)	Optional	Optional
No. 40: SoLSA (Support of Local Service Area)	Optional	Optional
No. 41: USSD string data object supported in Call Control	Optional	Optional
No. 42: RUN AT COMMAND command	Optional	Optional
No. 43: User controlled PLMN Selector with Access Technology	Optional	Optional
No. 44: Operator controlled PLMN Selector with Access Technology	Optional	NOTE 2
No. 45: HPLMN Selector with Access Technology	Optional	NOTE 2
No. 46: CPBCCH Information	Optional	Optional
No. 47: Investigation Scan	Optional	Optional
No. 48: Extended Capability Configuration Parameters	Optional	Optional
No. 49: MExE	Optional	Optional
No. 50: Reserved and shall be ignored	No	No
No. 51: PLMN Network Name	Optional	Optional
No. 52: Operator PLMN List	Optional	Optional
No. 53: Mailbox Dialling Numbers	Optional	Optional
No. 54: Message Waiting Indication Status	Optional	Optional
No. 55: Call Forwarding Indication Status	Optional	Optional
No. 56: Service Provider Display Information	Optional	Optional
No. 57: Multimedia Messaging Service (MMS)	Optional	Optional
No. 58: Extension 8	Optional	Optional
No. 59: MMS User Connectivity Parameters	Optional	Optional
NOTE 1: For GPRS tests the GPRS service shall be activated.		
NOTE 2: If allocated $EF_{PLMNwAcT}$, $EF_{OPLMNwAcT}$ are present on the SIM they shall have same settings as $EF_{PLMNsel}$.		

A4.3.9 EF_{ACM} (Accumulated call meter)

File size:		3 bytes
Default:	Byte 1:	00
	Byte 2:	00
	Byte 3:	00

The above translates to: "Not yet implemented".

A4.3.10 EF_{PUCT} (Price per unit and currency table)

File size:		5 bytes
Default:	Byte 1-3:	FF
	Byte 4-5:	00

A4.3.11 EF_{CBMI} (Cell broadcast Message Identifier Selection)

The programming of this EF is a test house option.

The file size is 2n bytes, where n is the number of Cell broadcast message identifier records - each record defining a type of Cell Broadcast message which may be accessed by the MS. Care should be taken when dimensioning the SIM to take into account the number of Cell Broadcast message identifier records required.

A4.3.12 EF_{BCCH} (Broadcast control channels)

File size:	16 Bytes	
Default values (BIN):	Bytes 1-2:	11111111 11111111
	Bytes 3-4:	11111111 11111111
	Bytes 5-6:	11111111 11111111
	Bytes 7-8:	11111111 11111111
	Bytes 9-10:	11111111 11111111
	Bytes 11-12:	11111111 11111111

Bytes 13-14:	11111111 11111111
Bytes 15-16:	11111111 11111111

This field may be updated dependent on the MS implementation.

A4.3.13 EF_{ACC} (Access control class)

File size:	2 Bytes	
Default values (BIN):	Byte 1:	00000000
	Byte 2:	********

The test house may set any single bit of byte 2 to "1". All remaining bits of byte 2 will be set to "0". This determines the access control class of the SIM.

A4.3.14 EF_{FPLMN} (Forbidden PLMNs)

Length:		12 Bytes
Format (HEX):	Bytes 1-3:	FF FF FF
	Bytes 4-6:	FF FF FF
	Bytes 7-9:	FF FF FF
	Bytes 10-12:	FF FF FF

This coding corresponds to an empty "forbidden PLMN list". The bytes within this file may be updated if a LOCATION UPDATE REJECT message is received by the MS with cause, "PLMN not allowed".

A4.3.15 EF_{LOCI} (Location information)

GSM 400, GSM 900 and DCS 1 800 begin

File size:	11 Bytes	
Default values:	Bytes 1-4 (HEX):	FF FF FF FF (TMSI)
	Bytes 5-9 (HEX):	42 F6 18 FF FE (LAI)
	Byte 10 (HEX):	FF (Periodic LU Time = "the timer is not running")
	Byte 11 (BIN):	00000001 (Location Update Status = "not updated")

Bytes 5-9: LAI-MCC = 246 (bytes 5-6) and LAI-MNC = 81 (byte 7) are frequently used in clause 27. The LAC (bytes 8-9) is set to "FF FE" since this, in conjunction with byte 11 setting of "01", is used to ensure that the MS performs a location update at the beginning of a test.

Bytes in this file (e.g. TMSI in bytes 1-4) may be updated as a result of a location update attempt by the MS.

GSM 400, GSM 900 and DCS 1 800 end

GSM 700, GSM 850 and PCS 1900 begin

File size:	11 Bytes	
Default values:	Bytes 1-4 (HEX):	FF FF FF FF (TMSI)
	Bytes 5-9 (HEX):	42 36 18 FF FE (LAI)
	Byte 10 (HEX):	FF (Periodic LU Time = "the timer is not running")
	Byte 11 (BIN):	00000001 (Location Update Status = "not updated")

Bytes 5-9: LAI-MCC = 246 (bytes 5-6) and LAI-MNC = 813 (bytes 6-7) are frequently used in clause 27. The LAC (bytes 8-9) is set to "FF FE" since this, in conjunction with byte 11 setting of "01", is used to ensure that the MS performs a location update at the beginning of a test.

Bytes in this file (e.g. TMSI in bytes 1-4) may be updated as a result of a location update attempt by the MS.

GSM 700, GSM 850 and PCS 1900 end

A4.3.16 EF_{AD} (Administrative data)

File size:	3 bytes	
Default values	Byte 1:	10000000 - (type approval operations)
	Byte 2:	11111111
	Byte 3:	11111111

A4.3.17 EF_{Phase} (Phase identification)

File size:	1 byte	
Default value (HEX):	02	Phase 2

A4.3.18 EF_{ADN} (Abbreviated dialling numbers)

The programming of this EF is a test house option. It should be noted that sufficient space should be provided on the SIM card for 101 records - see subclause 27.15.4.1.

A4.3.19 EF_{FDN} (Fixed dialling numbers)

Optional.

A4.3.20 EF_{SMS} (Short messages)

Default:	Records 1-5	Byte 1:	00
		Byte 2:	FF
		Bytes 3-14:	FF FF FF FF FF FF FF FF FF FF FF FF
		Bytes 15-26:	FF FF FF FF FF FF FF FF FF FF FF FF
		Byte 27:	FF
		Byte 28:	FF
		Bytes 29-35:	FF FF FF FF FF FF FF
		Byte 36:	FF
		Bytes 37-176:	All Bytes set to FF

A4.3.21 EF_{CCP} (Capability configuration parameters)

File size:	14 bytes	
Default values	Byte 1:	04
	Byte 2:	01
	Byte 3:	A0
	Bytes 4-14:	FF

The above translates to: "Full rate, GSM Standardized coding, circuit mode and speech".

A4.3.22 EF_{MSISDN} (MSISDN)

Optional.

A4.3.23 EF_{SMSP} (Short message service parameters)

The programming of this EF is a test house option.

Each record size is 28+Y bytes, where Y is the number of bytes in the Alpha Identifier. Care should be taken when dimensioning the SIM to take into account the number of Short message service parameter records required.

A4.3.24 EF_{SMSS} (SMS status)

File size:	2 bytes	
	Byte 1:	00
	Byte 2 (BIN):	11111111

The above translates to:

(a) Last Mobile Originated Short Message had a TP Message Reference parameter of "00".

(b) SMS Memory Capacity Exceeded, Notification Flag unset: memory capacity available.

A4.3.25 EF_{EXT1} (Extension 1)

Optional.

A4.3.26 EF_{EXT2} (Extension 2)

Optional.

A4.3.27 EF_{VGCS} (Voice Group Call Service)

This EF contains a list of the default VGCS group identifiers.

File size: Bytes 200

Default values:

Bytes	Group ID	Value	BCD encoding in the SIM card
1-4	1	12	21 FF FF FF
5-8	2	123	21 F3 FF FF
9-12	3	1234	21 43 FF FF
13-16	4	12348	21 43 F8 FF
17-20	5	123491	21 43 19 FF
21-24	6	1235029	21 53 20 F9
25-28	7	12351	21 53 F1 FF
29-32	8	12352	21 53 F2 FF
33-36	9	12353	21 53 F3 FF
37-40	10	12354	21 53 F4 FF
41-44	11	12355	21 53 F5 FF
45-48	12	12356	21 53 F6 FF
49-52	13	12357	21 53 F7 FF
53-56	14	12358	21 53 F8 FF
57-60	15	12359	21 53 F9 FF
61-64	16	20000	02 00 F0 FF
65-68	17	20001	02 00 F1 FF
69-72	18	20002	02 00 F2 FF
73-76	19	20003	02 00 F3 FF
77-80	20	20004	02 00 F4 FF
81-84	21	20005	02 00 F5 FF
85-88	22	20006	02 00 F6 FF
89-92	23	20007	02 00 F7 FF
93-96	24	20008	02 00 F8 FF
97-100	25	20009	02 00 F9 FF
101-104	26	20010	02 10 F0 FF
105-108	27	66660	66 66 F0 FF
109-112	28	66661	66 66 F1 FF
113-116	29	66662	66 66 F2 FF
117-120	30	666638	66 66 83 FF
121-124	31	66664	66 66 F4 FF
125-128	32	66665	66 66 F5 FF
129-132	33	66666	66 66 F6 FF
133-136	34	66667	66 66 F7 FF
137-140	35	66668	66 66 F8 FF
141-144	36	66669	66 66 F9 FF
145-148	37	66670	66 76 F0 FF
149-152	38	80120	08 21 F0 FF
153-156	39	80121	08 21 F1 FF
157-160	40	80122	08 21 F2 FF
161-164	41	80123	08 21 F3 FF

Bytes	Group ID	Value	BCD encoding in the SIM card
165-168	42	80124	08 21 F4 FF
169-172	43	80125	08 21 F5 FF
173-176	44	80126	08 21 F6 FF
177-180	45	80127	08 21 F7 FF
181-184	46	80128	08 21 F8 FF
185-188	47	80129	08 21 F9 FF
189-192	48	80130	08 31 F0 FF
193-196	49	99999	99 99 F9 FF
197-200	50	1111119	11 11 11 F9

A4.3.28 EF_{VGCSS} (Voice Group Call Service Status)

This EF contains the default activation of the VGCS group identifiers. The following list of group ID are activated: 1, 4, 20, 30, and 50.

File size: Bytes 7
Default values (HEX): Bytes 1-7: '09 00 08 20 00 00 FE'

A4.3.29 EF_{VBS} (Voice Broadcast Service)

This EF contains a list of the default VBS group identifiers.

File size: Bytes 200

Default values:

Bytes	Group ID	Value	BCD encoding in the SIM card
1-4	1	12	21 FF FF FF
5-8	2	123	21 F3 FF FF
9-12	3	1234	21 43 FF FF
13-16	4	12348	21 43 F8 FF
17-20	5	123491	21 43 19 FF
21-24	6	1235029	21 53 20 F9
25-28	7	12351	21 53 F1 FF
29-32	8	12352	21 53 F2 FF
33-36	9	12353	21 53 F3 FF
37-40	10	12354	21 53 F4 FF
41-44	11	12355	21 53 F5 FF
45-48	12	12356	21 53 F6 FF
49-52	13	12357	21 53 F7 FF
53-56	14	12358	21 53 F8 FF
57-60	15	12359	21 53 F9 FF
61-64	16	20000	02 00 F0 FF
65-68	17	20001	02 00 F1 FF
69-72	18	20002	02 00 F2 FF
73-76	19	20003	02 00 F3 FF
77-80	20	20004	02 00 F4 FF
81-84	21	20005	02 00 F5 FF
85-88	22	20006	02 00 F6 FF
89-92	23	20007	02 00 F7 FF
93-96	24	20008	02 00 F8 FF
97-100	25	20009	02 00 F9 FF
101-104	26	20010	02 10 F0 FF
105-108	27	66660	66 66 F0 FF
109-112	28	66661	66 66 F1 FF
113-116	29	66662	66 66 F2 FF
117-120	30	666638	66 66 83 FF
121-124	31	66664	66 66 F4 FF
125-128	32	66665	66 66 F5 FF
129-132	33	66666	66 66 F6 FF
133-136	34	66667	66 66 F7 FF
137-140	35	66668	66 66 F8 FF

Bytes	Group ID	Value	BCD encoding in the SIM card
141-144	36	66669	66 66 F9 FF
145-148	37	66670	66 76 F0 FF
149-152	38	80120	08 21 F0 FF
153-156	39	80121	08 21 F1 FF
157-160	40	80122	08 21 F2 FF
161-164	41	80123	08 21 F3 FF
165-168	42	80124	08 21 F4 FF
169-172	43	80125	08 21 F5 FF
173-176	44	80126	08 21 F6 FF
177-180	45	80127	08 21 F7 FF
181-184	46	80128	08 21 F8 FF
185-188	47	80129	08 21 F9 FF
189-192	48	80130	08 31 F0 FF
193-196	49	99999	99 99 F9 FF
197-200	50	1111119	11 11 11 F9

A4.3.30 EF_{VBSS} (Voice Broadcast Service Status)

This EF contains the default activation of the VBS group identifiers. The following list of group ID are activated: 1, 4, 20, 30, and 50.

File size: Bytes 7
Default values (HEX): Bytes 1-7: '09 00 08 20 00 00 FE'

A4.3.31 EF_{eMLPP} (enhanced Multi Level Pre-emption and Priority)

This EF contains default information about priority levels and fast call set-up conditions for the enhanced Multi Level Pre-emption and Priority service.

Length: 2 Bytes
Format (HEX): Byte 1 (Priority levels): '74'
Byte 2 (Fast call set-up conditions): '04'

The coding corresponds to available priority levels 2, 3, 4 and 0. For fast call setup, the coding corresponds to available priority level 0.

A4.3.32 EF_{AAeM} (Automatic Answer for eMLPP Service)

This EF contains the default priority levels (of the Multi Level Pre-emption and Priority service) for which the mobile station shall answer automatically to incoming calls.

Length: 1 Byte
Format (HEX): Byte 1: '0F'

The coding corresponds to the default capability of the MS to answer automatically to incoming calls that have a priority level higher than 2.

A4.3.33 EF_{KcGPRS} (GPRS Ciphering key KcGPRS)

Mandatory if GPRS shall be tested else optional.

File size: 9 bytes
Default values (HEX): Bytes 1-8: Align with KcGPRS used by SS
Byte 9: 07

Byte 9 is set to 07 to indicate that there is no key available at the start of a test unless other conditions follow from the definition of the initial conditions of the mobile.

The bytes within this elementary file may be updated by the MS as a result of a successful authentication attempt.

A4.3.34 $EF_{LOCIGPRS}$ (GPRS location information)

Mandatory if GPRS shall be tested else optional.

File size:	14 bytes	
Default values:	Bytes 1-4 (HEX):	FF FF FF FF (P-TMSI)
	Bytes 5-7 (HEX):	FF FF FF (P-TMSI signature value)
	Bytes 8-13 (HEX):	FF FF FF FF FF FF (RAI)
	Byte 14 (BIN):	00000001 (Routing Area Update Status = "not updated")

Bytes in this file (e.g. P-TMSI in bytes 1-4) may be updated as a result of a routing area update attempt by the MS.

Annex 4A: Test USIM Parameters

Test USIM is required for test cases of some GERAN features or Inter-RAT.

For test cases indicating Test USIM to be used, the default Test USIM parameters are specified in 3GPP TS 34.108 clause 8 “Test USIM Parameters” if not otherwise specified within the test case.

For UMTS Authentication Challenge (i.e. UMTS AKA using an USIM as defined in TS 33.102), the SS shall be able to handle vectors of AUTN, RAND, CK, IK, AUTS and XRES in the way as the MSC/BSS entities. The SS and Test USIM shall incorporate a test algorithm for generating RES and CK, IK from RAND, AUTN and IK which operates as described in TS 34.108 clause 8.1.2.

Annex 5:
Test equipment

A5.1 Introduction

A5.1.1 General

The test equipment is either an equipment or assembly of equipments which enables the tests described in the present document to be conducted.

This annex describes requirements for the test equipment which cannot be derived from and which are assumed in, the conformance test descriptions described in the present document.

Specifically stimulus setting and measurement uncertainties are defined.

A5.1.2 Test equipment terms

The term "System Simulator" (SS) is used to describe the complete suite of test equipment required to perform the tests in the present document when interacting with the following MS interfaces:

- Antenna (Connector or radiated);
- Acoustic;
- Data Port(s);
- Power supply;
- DAI.

NOTE: To perform a sub-set of tests, the SS may be simplified accordingly.

The term "SIM simulator" is used to describe the test equipment required to interact with the SIM/ME interface.

A "test SIM" has the physical characteristics of a standard SIM card, (see 3GPP TS 11.11) with specific parameters defined in annex 3.

A5.1.3 Confidence level

All uncertainty values stated in this annex are quoted for a Confidence Level of 95 %.

A5.2 Standard test signals

The Cx signals represent the wanted signals and the Ix signals represent the unwanted signals.

Signal C0 Unmodulated continuous carrier.

Signal C1 A standard signal with GMSK AQPSK, 8-PSK, 16-QAM or 32-QAM modulation as appropriate. The channel coder will depend on the test and the cipher mode shall be selectable by the test method. When using this signal in the non hopping mode, the unused seven time slots shall also contain dummy bursts, with power levels variable with respect to the used timeslot, see also DYNAMIC LEVEL SETTING in subclause A5.3.4.7.

Signal I0 Unmodulated continuous carrier.

Signal I1 A GMSK modulated carrier following the structure of the GSM signals, but with all modulating bits (including the midamble period) derived directly from a random or pseudo random data stream.

Signal I2 A standard GMSK modulated signal with valid midamble, different from C1. The data bits (including bits 58 and 59) shall be derived from a random or pseudo random data stream.

Signal I3 An Additive White Gaussian Noise (AWGN) signal having a minimum bandwidth of 1,5 times the symbol rate i.e. minimum 402,6kHz for a GSM channel. The AWGN power shall be measured over a noise bandwidth of 270,833 kHz. In the complex baseband, the AWGN signals shall be independent in the real and in the imaginary part, zero-mean and with equal power.

Signal I4 A GMSK modulated signal with valid training sequence code (TSC) randomly selected on a burst-by-burst basis from {TSC1,…,TSC7}. The interferer shall be a single slot wide, and shall apply power ramping according to the requirements in 3GPP TS 45.005. The interferer shall be delayed with respect to the wanted signal by an integer number of symbols in the range –1 to +4. Unless specified in a given test case, The delay shall be randomly chosen and shall remain fixed for the duration of the test.

Signal I5 A GMSK modulated signal following the structure of the GSM signals, but with all modulating bits (including the midamble period) derived directly from a random or pseudo random data stream. The interferer shall be a single slot wide, and shall apply power ramping according to the requirements in 3GPP TS 45.005. The interferer shall be delayed with respect to the wanted signal by 74 symbols.

NOTE: For multi-slot configuration the same number of active slots for test signal I4 and I5 shall be used.

A5.3 SS functional requirements

A5.3.1 Level setting range

It is assumed that the SS is capable of setting stimulus levels, at the MS interface, to those required in the test specification extended by the measurement uncertainty defined in this annex.

NOTE: This ensures that the SS is able adequately to stimulate the MS performance at and just beyond the limit requirement under all conditions.

A5.3.2 Level Measurement / operation range

It is assumed that the SS is capable of performing measurements, within the uncertainty defined in this annex, over a level range, at the MS interface, as required in the test specification extended by the SS measurement uncertainty defined in this annex and extended by a further 3dB on the MS conformity requirement.

NOTE: This ensures that the SS is able adequately to measure the MS performance at and just beyond the limit requirement under all conditions.

A5.3.3 MS power supply interface

Test DC power supply for MS:

Voltage setting uncertainty < 1 %.

Ripple < 10 mV RMS, 50 mV peak to peak.

Test AC power supply for MS:

Voltage setting uncertainty: < 1 %.

A5.3.4 MS antenna interface

The SS is assumed to offer a nominal 50 ohm impedance to the MS.

	GSM/DCS/PCS bands	< 4 GHz	< 10 GHz	< 12,75 GHz
VSWR	≤ 1,3	≤ 2,0	≤ 3,0	≤ 3,5

A5.3.4.1 Uplink receiver error

The SS receiver should be capable of performing the tests as specified in 3GPP TS 11.10 without the addition of bit errors in excess of 1 in 10E7 due to the receiver performance when operated with a MS which meets the transmitter requirements of 3GPP TS 05.05. This requirement shall apply for GMSK and 8PSK modulation.

NOTE: This requirement is based on a minimum BER measurement of 1 in 10E5.

A5.3.4.2 Power and Power versus time measurements

Measurement uncertainty of transmitter output power for GMSK and 8PSK signals: ±1 dB.

In the case of 8PSK, provision is made for power measurement by averaging over multiple bursts or by using an estimation method, see 3GPP TS 05.05, clause 4. The estimation method may be based on measurements of one or more bursts, or part of a burst.

If 8PSK power is measured by averaging over multiple bursts, allowance must be made for variations in burst power as a function of the data. This allowance must be included within the ±1 dB measurement limit. The allowance is related to the number of bursts taken in the average and shall be defined as follows:

Allowance for burst power variation = 2σ/SQRT(N)

Where: σ = the standard deviation of burst power variation for random data (0,2 dB).

(two standard deviations yield a 95 % confidence interval).

N = number of averages.

EXAMPLE: An average is calculated from 4 bursts. The allowance for burst power variation is 0,2 dB. The accuracy for the power meter should then be better than ±0,8 dB.

If 8PSK power is measured using an estimation method, it shall be demonstrated, using the method described below, that the accuracy of the estimation technique is also ±1 dB.

A test signal is established consisting of properly formatted bursts with midambles and random data in the payload. The long-term average power of this signal is determined by measuring the power over 200 bursts and taking the average (P_{avg}). The measurement uncertainty of the equipment used to determine the long-term average shall be noted (ΔP).

The same test signal is then measured using the estimation technique. The difference between the estimated value of long-term average power and the measured long-term average power is noted (P_{est}). The following inequality shall hold:

$$|\Delta P| + |(P_{avg} - P_{est})| \leq 1 \text{ dB}$$

For GMSK, measurement uncertainty of power level (relative to peak transmitter carrier power):

Power level	Measurement uncertainty
+6 dB to -7 dB	±0,25 dB
-7 dB to -20 dB	±1,0 dB
-20 dB to -32 dB	±2,0 dB
-32 dB to -45 dB	±5,0 dB
-45 dB to -71 dB	±1,0 dB
< -71 dB	±2,0 dB

For 8PSK, measurement uncertainty of power level (relative to output power):

Power level	Measurement uncertainty
+6 dB to -7 dB	±0,25 dB
-7 dB to -16 dB	±1,0 dB
-16 dB to -32 dB	±2,0 dB
-32 dB to -45 dB	±5,0 dB
-45 dB to -71 dB	±1,0 dB
< -71 dB	±2,0 dB

NOTE: Due to the method of measurement (downconversion to I/Q baseband / filtering / A/D conversion / postprocessing) several uncertainties occur. The sources are:

a) absolute level uncertainty;

b) filter ripple,
I/Q gain imbalance,
I/Q imperfect quadrature;

c) A/D conversion (resolution),
I/Q offset.

Items under b) and c) affect the individual samples and can be observed as a "ripple" in the horizontal part of the power time mask.

Items under b) are uncertainties which are proportional to the signal measured.

Items under c) are constant amounts of uncertainty, independent of the signal measured.

The item a) moves the entire power time template up or down.

The uncertainties b) and c) are added to the measured signal as an uncorrelated interferer.

The above mentioned absolute measurement uncertainty refers to a). The table covers uncertainties b) and c).

Uncertainty of time measurement

The relative timing uncertainty of the transition point:

- symbol 13 to 14 in the midamble (normal burst);
- end of the sync sequence (access burst);

is ±1/8 symbol.

Timing uncertainty of the measurement samples in the vertical part of the power time mask are displayed as marked fields in the figure A5.3-1.

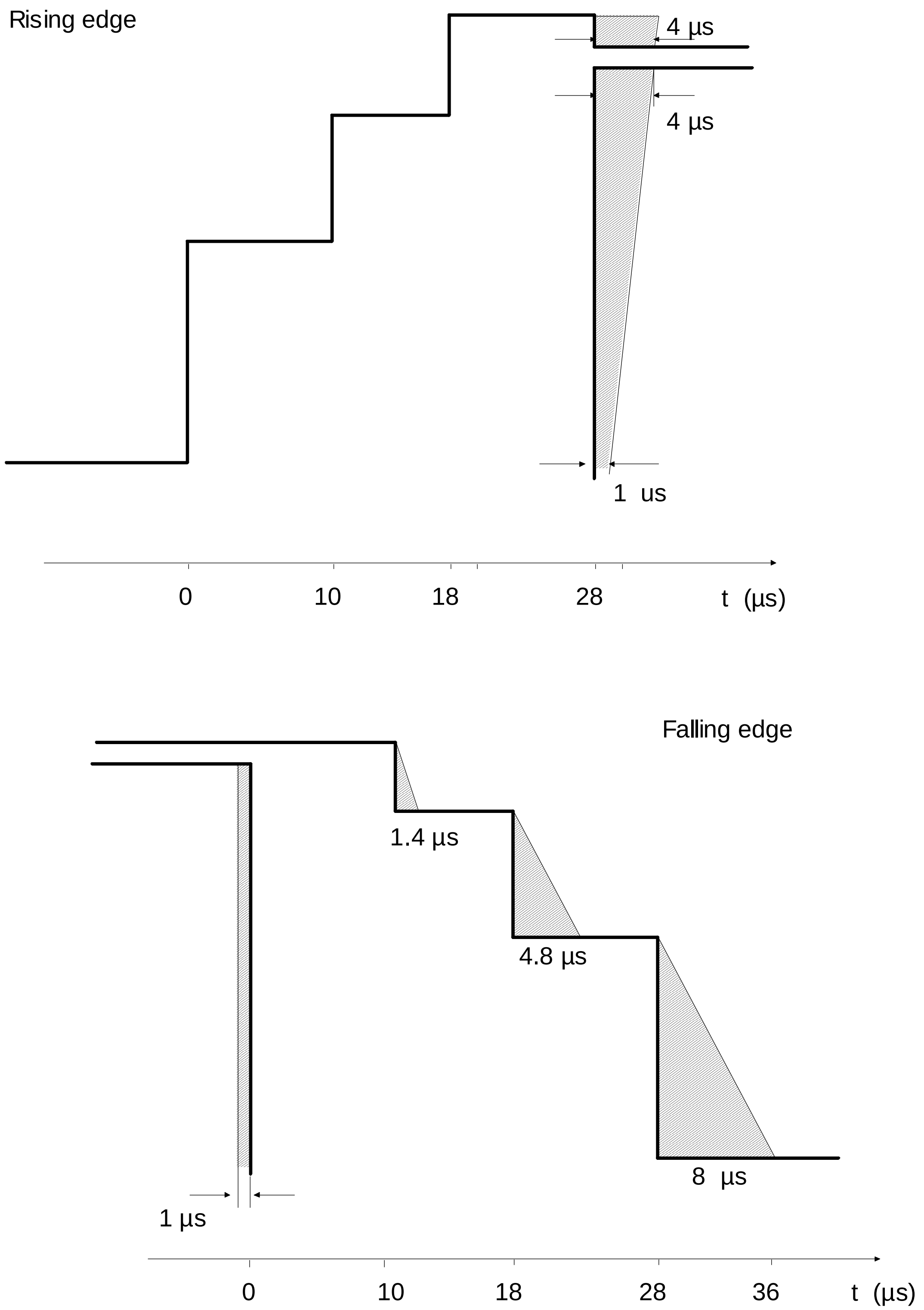


Figure A5.3-1: Time Measurement Uncertainty for the Power Time Mask

NOTE: With a real method of measurement one has to reckon on systematic measurement uncertainties in the vertical part of the power time template (figures 13-2 & 13-3). The reason for this is that the measurement is conducted through a filter which has to fulfil different requirements simultaneously, requirements in the frequency domain and in the time domain as well. The time behaviour of the filter causes the above mentioned measurement uncertainty. It occurs clearly when measuring the falling edge of the power burst. The measurement uncertainty, which in principle delays the actual performance, depends on the filter characteristics and on the signal shape. At favourable signal shapes the uncertainty is negligible, however, at unfavourable signal shapes it consumes the marked area in figure A5.3-1 (falling edge).

The underlying filter is:

- type inverse Chebycheff.
- passband ≤ ±200 kHz.
- stopband (40 dB stop att.) ≥ ±541,67 kHz.

To avoid aliasing with this filter the RF output spectrum must meet the requirements of subclause 13.4.

If the lowest limit line in the power time template is replaced by a -54 dBm line, measuring lower carrier powers, the area of measurement uncertainty is reduced equivalently.

The marked area in figure A5.3-1 describes the systematic measurement uncertainty of the test equipment and does not widen the design requirements.

Uncertainties associated with 13.3.5 requirement b) (power control levels, adjacent steps):

Repeatability	± 0,3 dB
Linearity	± 0,03 dB/dB
Combined uncertainty is:	± (0,3 + 0,03 dB/dB) dB

E.g. where the indicated value of the step size is 2,0 dB, the uncertainty is:

± (0,3 + 0,06) dB = ± 0,36 dB.

A5.3.4.3 Wideband selective power measurement

Power is to be measured selectively for spurious emissions without frequency hopping (ref.: clause 12).

Uncertainty conducted	100 kHz to 1GHz	±1,5 dB
	1 GHz to 12,75 GHz	±3,0 dB
Uncertainty radiated	30 MHz to 4 GHz	±6 dB

NOTE: The uncertainties include the effect of a worst case reflection from the MS of 0,7 for out of band signals.

It is acceptable to use a band stop filter in spurious emission measurements of the transceiver in order to fulfil the above requirements.

A5.3.4.4 Inband selective power measurements

Power is to be measured selectively for output RF spectrum.

The measurement is performed on a single frequency while the MS is frequency hopping (ref.: subclause 13.3).

Uncertainty < ±1,6 dB

NOTE: The video signal of the spectrum analyser is "gated" such that the spectrum generated by at least 40 of the bits 87 to 132 of the burst is the only spectrum measured. This gating may be analogue or numerical, dependent upon the design of the spectrum analyser.

A5.3.4.5 Modulation accuracy and frequency error measurements

GMSK modulation

Ref.: Subclauses 13.1 and 13.2 for definitions and methods of measurement.

Phase measurement uncertainty:

±1 degree RMS;

±4 degrees for individual phase measurement samples.

The phase measurement uncertainties above apply during the useful bits.

Frequency measurement uncertainty: ±5 Hz.

8PSK modulation

Ref.: Subclause 13.17.1 for definitions and methods of measurement.

EVM measurement uncertainty:

+(0,75 - 0,025RMS_EVM), -(0,75 + 0,025RMS_EVM) % RMS;

4% for individual EVM measurement samples.

NOTE 1: The value of the RMS EVM specification is a function of the value of RMS_EVM being measured. The asymmetric specification results from the RMS EVM minimisation method used for parameter estimation (see 3GPP TS 05.05, annex G). This method of measurement for RMS EVM always produces a result that is lower than the actual value of RMS EVM.

NOTE 2: The value for individual EVM samples assumes a Rayleigh distribution of measurement errors. It represents the maximum 95th percentile value test equipment should return when measuring a signal without error.

NOTE 3: If the test equipment demodulates the transmitted signal to derive the reference signal for the EVM measurement, the symbol error rate of the demodulation process must be less than 4.4×10E-4 for 95% confidence that no detection errors occur in a burst.

Origin Offset uncertainty (for a single burst) < ±1,5 dB for origin offset ≥ -35dBc.

Frequency measurement uncertainty < ±20 Hz.

A5.3.4.6 RF delay measurements relative to nominal times

Range -140 to +140 symbol periods.

Resolution 1/4 symbol period.

Uncertainty ±1/8 symbol period.

A5.3.4.7 The wanted signal or traffic channel of serving cell

The Wanted signal is used in most of the specified RF measurements. The traffic channel of the serving cell is used in most of the signalling tests.

FREQUENCY:

GMSK

Uncertainty: < ± 5*10E-9.

8PSK

Uncertainty: < ± 20*10E-9.

MODULATION (see 3GPP TS 05.04):

GMSK

Phase uncertainty: < ±1 degree RMS; and

< ±4 degrees peak(as defined in 3GPP TS 05.05).

8PSK

EVM uncertainty < 4 % RMS.

Origin offset suppression < -35 dBc.

LEVEL:

Uncertainty: < ±1 dB in subclause 13, 14 except;

< ±3 dB for test 14.2 radiated;

< ±1,2 dB for test 14.6;

< ±2,5 dB for all other tests.

Settling time: < 10 us.

DYNAMIC LEVEL SETTING:

The SS shall be able to switch from any power level to any other power level within the range of 30 dB on a timeslot per timeslot basis. This dynamic switching requirement only applicable for a single channel for a limited number of tests.

SPURIOUS:

in channel:

Covered by phase error.

out channel:

Noise Power, 1 Hz bandwidth:

< -100 dBc for > 100 kHz carrier offset;

< -110 dBc for > 300 kHz carrier offset;

< -121 dBc for > 1 500 kHz carrier offset.

Non harmonics:

< -55 dBc for > 100 kHz carrier offset;

< -68 dBc for > 1 500 kHz carrier offset.

FREQUENCY HOPPING:

The signal shall be capable of hopping according to the criteria of 3GPP TS 05.02. The timing of the frequency change shall be such that frequency transitions do not occur during the active timeslot of the MS.

A5.3.4.8 The first interfering signal or traffic channel of the first adjacent cell

The First interfering signal is used in measurements of co-channel rejection, adjacent channel rejection and intermodulation rejection. The Traffic channel of the first adjacent cell is used in handover tests.

FREQUENCY:

Uncertainty:

< ±5*10E-9

PHASE:

Uncertainty:

< ±1 degree RMS; and

< ±4 degrees peak(as defined in 3GPP TS 05.05).

LEVEL:

Uncertainty:

< ±1 dB relative to the wanted signal for test 13.2 and 14.5;

< ±0,3 dB relative to the wanted signal for test 14.4, 14.10, 14.11, 14.12 and 14.16.4;

< ±1 dB for test 14.6;

< ±2,5 dB for all other tests.

MODULATION:

GMSK (as specified in 3GPP TS 05.04)

The total relative single sideband power (noise + harmonics) in the frequency range 1,5 MHz to 1,7 MHz offset from the nominal carrier frequency shall be less than -72 dBc.

SPURIOUS:

In channel:

Covered by phase error.

Out channel:

Noise Power, 1 Hz bandwidth:

< -100 dBc for > 100kHz carrier offset;

< -110 dBc for > 300kHz carrier offset;

< -127 dBc for > 1 500kHz carrier offset.

non harmonics:

< -55 dBc for > 100 kHz carrier offset;

< -68 dBc for > 1 500 kHz carrier offset.

FREQUENCY HOPPING:

The signal shall be capable of hopping according to the criteria of 3GPP TS 05.02. The timing of the frequency change shall be such that frequency transitions do not occur during the active timeslot of the MS.

A5.3.4.9 The second interfering signal

The second interfering signal is used in the measurements of intermodulation rejection and blocking.

FREQUENCY:

Uncertainty:

< ±5*10E-9.

LEVEL:

Uncertainty:

< ±1 dB for test 14.6;

< ±1,5 dB relative to the wanted signal for all other tests.

MODULATION:

Unmodulated.

SPURIOUS:

In channel:

No requirements.

Out channel:

Noise Power, 1 Hz bandwidth:

< -135 dBc for > 500kHz carrier offset;

< -140 dBc for > 700kHz carrier offset;

< -150 dBc for > 1 500kHz carrier offset.

Non harmonics:

< -79 dBc for > 500 kHz carrier offset;

< -84 dBc for > 700 kHz carrier offset;

< -94 dBc for > 1 500 kHz carrier offset.

Harmonically related spurii:

< -40 dBc.

A5.3.4.10 BCCH carriers of serving and adjacent cells

The BCCH of the serving cell is used for synchronizing the MS and to send network information to the MS under test. The BCCH signals of the adjacent cells are used in the handover tests. The MS measures the RF-levels of the BCCHs of adjacent cells.

FREQUENCY:

Uncertainty:

< ±5*10E-9.

PHASE:

Uncertainty:

< ±1 degree RMS; and

< ±4 degrees peak(as defined in 3GPP TS 05.05).

LEVEL:

Uncertainty:

< 1 dB for test 13.2 and 20;

< 2,5 dB for all other tests;

< 0,6 dB relative to each other and to TCH for test 21 over the range 65 dBmicroVoltemf to 3 dBmicroVoltemf;

< 1,2 dB relative to each other and to TCH for test 26.3.

MODULATION:

GMSK (as specified in 3GPP TS 05.04).

SPURIOUS:

In channel:

Covered by phase error.

Out channel:

Noise Power, 1Hz bandwidth:

< -100 dBc for > 100 kHz carrier offset;

< -125 dBc for > 1 500 kHz carrier offset.

Non harmonics:

< -55 dBc for > 100 kHz carrier offset;

< -72 dBc for > 1 500 kHz carrier offset.

A5.3.4.11 The wide frequency range signal

The wide frequency range signal is used in the measurements of spurious response.

FREQUENCY

Uncertainty:

< ± 5*10E-9.

LEVEL

Uncertainty:

< ±1,5 dB relative to the wanted signal for test 14.7;

< ±1 dB error of substituted "wanted signal".

MODULATION:

Unmodulated.

SPURIOUS in the MS receiving range:

Non harmonics:

< -94 dBc.

Harmonically related spurii:

< -40 dBc.

Noise:

< -4 dBuVemf equivalent at the MS receiver input when measured in a 200 kHz bandwidth.

A5.3.4.12 The multipath fading function

The multipath fading function simulates the fading effects of a broadband radio channel in mobile radio communication.

The propagation conditions are specified in 3GPP TS 05.05, annex 3.

The multipath fading function shall be performed only within a 5 MHz bandwidth during one test case.

A5.3.5 MS audio interface and DAI

A5.3.5.1 General uncertainties

Unless otherwise specified, the following uncertainties apply to the audio interface:

Signal level measurement uncertainty: ± 0,2 dB;

Sound pressure measurement uncertainty: ± 0,6 dB;

Frequency Measurement uncertainty: ± 0,1 %.

Stimulus frequency setting uncertainty:

Frequency settings are taken from ISO 3, R10 series or R40 series or from table 2 of Rec. ITU-T Recommendation P.79. A departure from the nominal frequencies of ±5 % below 240 Hz and ±2 % at 240 Hz and above is accepted.

In the case of 4 kHz the departure is restricted to -2 %.

A5.3.5.2 Analogue single test tone

Total distortion:

< 0,5 %.

A5.3.5.3 Delay measurement between Um and DAI

The delay measurement between the Um interface of the MS and its DAI in both directions is described in subclause 32.5.

Uncertainty:

< ±0,1 ms.

A5.4 SIM simulator functional requirements

A5.4.1 General

The SIM simulator shall implement the functions of a SIM as described in 3GPP TS 02.17 and 3GPP TS 11.11.

The Test Algorithm for authentication incorporated in the SIM Simulator shall operate as described in annex 3.

A5.4.2 Contacts C1, C2, C6, C7

A5.4.2.1 Default measurement / setting uncertainties

Unless stated otherwise below, the following uncertainties apply:

Voltage measurement uncertainty: < ±50 mV;

Voltage setting uncertainty: < ±20 mV;

Time measurement uncertainty: < ±100 ns.

A5.4.2.2 Contact C1

Continuous Spikes:

Voltage measurement uncertainty:

< ± 100 mV.

Current Load Amplitude:

0 mA - 20 mA

Adjustable Step Size:

1 mA.

Uncertainty

< ±1 mA.

Additional Current Offset:

0 mA - 5 mA.

Adjustable Step Size:

1 mA.

Uncertainty:

< ±1 mA.

Pulse Width:

100 ns - 500 ns.

Adjustable Step Size:

50 ns.

Uncertainty:

< ±25 ns.

Rise and Fall Time:

≤ 50 ns.

Pause Width:

100 ns - 500 ns.

Adjustable Step Size:

50 ns.

Uncertainty:

< ±25 ns.

Random Spikes:

Voltage measurement uncertainty:

< ±100 mV.

Current Load Amplitude:

50 mA - 200 mA.

Adjustable Step Size:

1 mA.

Uncertainty:

< ±1 mA.

Additional Current Offset:

0 mA - 5 mA.

Adjustable Step Size:

1 mA.

Uncertainty:

< ±0,1 mA.

Pulse Width:

100 ns - 500 ns.

Adjustable Step Size:

50 ns.

Uncertainty:

< ±25 ns.

Rise and Fall Time:

≤ 50 ns.

Pause Width:

0,1 ms - 500 ms, randomly varied.

Adjustable Step Size:

0,1 ms.

Uncertainty:

< ±0,1 ms.

A5.4.2.3 Contact C7

The Elementary Time Unit (etu) used in the subclauses below refer to the nominal bit duration on the I/O line, as defined in ISO 7816-3.

Rise & fall Time setting uncertainty: < ±100 ns.

Jitter measurement uncertainty: < ±5*10E-3 etu.

Jitter setting uncertainty: < ±5*10E-3 etu.

A5.4.3 Contact C3

Frequency measurement uncertainty: < ±0,5 %.

Voltage Measurement uncertainty: < ±50 mV.

Rise & fall time measurement uncertainty: < ±5 ns.

Duty cycle measurement uncertainty: < ±2,5 %.

A5.4.4 Definition of timing

It shall be possible to define all timings relative to the clock. The SIM simulator shall be able to calculate and to use the absolute values automatically, even if the ME changes the frequency during the communication.

A5.5 A-GPS and A-GNSS Minimum Performance Test System requirements

A5.5.1 Test System Uncertainty for A-GPS and A-GNSS Minimum Performance tests

The maximum acceptable uncertainty of the Test System is specified below for each test, where appropriate.

The Test System shall enable the stimulus signals in the test case to be adjusted to within the specified range, and the equipment under test to be measured with an uncertainty not exceeding the specified values. All ranges and uncertainties are absolute values, and are valid for a confidence level of 95 %, unless otherwise stated.

A confidence level of 95 % is the measurement uncertainty tolerance interval for a specific measurement that contains 95 % of the performance of a population of test equipment.

It should be noted that the uncertainties in this clause apply to the Test System operating into a nominal 50 ohm load and do not include system effects due to mismatch between the DUT and the Test System.

Table A5.5.1: Maximum Test System Uncertainty for A-GPS Minimum Performance tests

Clause	Maximum Test System Uncertainty		Derivation of Test System Uncertainty
70.11.5.1 Sensitivity Coarse Time Assistance	Coarse Time Assistance	±200 ms	
	Absolute GPS signal level	±1 dB	
	Position error	±0.05 m	Position error consists of ±0.05 m system uncertainty. The effect of position reporting resolution of approximately ±1.2 m (see note) is not included in the allowable test system uncertainty but is included in the Test Parameter Relaxations since this resolution limitation limits the reporting capability of the MS. . For simplicity the combined Test Parameter Relaxation is given as ±1.3 m
	Response time	± 300 ms	
70.11.5.2 Sensitivity Fine Time Assistance	Coarse Time Assistance	±200 ms	
	Fine Time Assistance	±1 us	
	Absolute GPS signal level	±1 dB	
	Position error	±0.05 m	Position error as above
	Response time	± 300 ms	
70.11.6 Nominal Accuracy	Coarse Time Assistance	±200 ms	
	Absolute GPS signal level	±1 dB	
	Position error	±0.05 m	Position error as above
	Response time	± 300 ms	
70.11.7 Dynamic Range	Coarse Time Assistance	±200 ms	
	Absolute GPS signal level	±1 dB	
	Relative GPS signal level	±0.2 dB	
	Position error	±0.05 m	Position error as above
	Response time	± 300 ms	
70.11.8 Multi-Path scenario	Coarse Time Assistance	±200 ms	
	Absolute GPS signal level	±1 dB	
	Relative GPS signal level	±0.2 dB	
	Position error	±0.05 m	Position error as above
	Response time	± 300 ms	

NOTE: For MS based mode the effect of position reporting resolution is given by:

$$\sqrt{\left(\frac{90\times 2\times \pi \times R}{2E23\times 360}\right)^2+\left(\frac{360\times 2\times \pi \times R\times \cos\phi}{2E24\times 360}\right)^2}$$

meters, where R is the radius of the earth and φ is the latitude of the location. For the two GPS scenarios defined in TS 51.010-7 subclause 5.2 this equates to approximately 2.32 m and 2.24 m. For simplicity this is given as ±1.2 m.

For MS assisted mode it is assumed that the output from the WLS position solution calculation in clause 70.11.4.3 is coded using the same position coding method as for MS based mode before being used to calculate position error. Therefore the effect of reporting resolution will be the same as for MS based mode.

Table A5.5.2: Maximum Test System Uncertainty for A-GNSS Minimum Performance tests

Clause	Maximum Test System Uncertainty		Derivation of Test System Uncertainty
70.16.5.1 Sensitivity Coarse Time Assistance	Coarse Time Assistance	±200 ms	
	Absolute GNSS signal level	±1 dB	
	Position error	±0.05 m	Position error consists of ±0.05 m system uncertainty. The effect of position reporting resolution of approximately ±1.2 m (see note) is not included in the allowable test system uncertainty but is included in the Test Parameter Relaxations since this resolution limitation limits the reporting capability of the MS. For simplicity the combined Test Parameter Relaxation is given as ±1.3 m
	Response time	± 300 ms	
70.16.5.2 Sensitivity Fine Time Assistance	Coarse Time Assistance	±200 ms	
	Fine Time Assistance	±1 us	
	Absolute GNSS signal level	±1 dB	
	Position error	±0.05 m	Position error as above
	Response time	± 300 ms	
70.16.6 Nominal Accuracy	Coarse Time Assistance	±200 ms	
	Absolute GNSS signal level	±1 dB	
	Position error	±0.05 m	Position error as above
	Response time	± 300 ms	
70.16.7 Dynamic Range	Coarse Time Assistance	±200 ms	
	Absolute GNSS signal level	±1 dB	
	Relative GNSS signal level	±0.2 dB	
	Position error	±0.05 m	Position error as above
	Response time	± 300 ms	
70.16.8 Multi-Path scenario	Coarse Time Assistance	±200 ms	
	Absolute GNSS signal level	±1 dB	
	Relative GNSS signal level	±0.2 dB	
	Position error	±0.05 m	Position error as above
	Response time	± 300 ms	

NOTE: For MS based mode the effect of position reporting resolution is given by:

$\sqrt{\left(\frac{90\times 2\times \pi \times R}{2E23\times 360}\right)^2+\left(\frac{360\times 2\times \pi \times R\times \cos\phi}{2E24\times 360}\right)^2}$ meters, where R is the radius of the earth and φ is the latitude of the location. For the GNSS scenarios defined in TS 51.010-7 subclause 6.2 this equates to approximately [TBD] m. For simplicity this is given as ±1.2 m.

For MS assisted mode it is assumed that the output from the WLS position solution calculation in clause 70.16.4.3 is coded using the same position coding method as for MS based mode before being used to calculate position error. Therefore the effect of reporting resolution will be the same as for MS based mode.

A5.5.2 Test Parameter Relaxations (This clause is informative)

The Test Parameter Relaxations defined in this clause have been used to relax the Conformance requirement to derive the Test Requirements.

The Test Parameter Relaxations are derived from Test System uncertainties, regulatory requirements and criticality to system performance. As a result, the Test Parameter Relaxations may sometimes be set to zero.

The Test Parameter Relaxations should not be modified for any reason e.g. to take account of commonly known test system errors (such as mismatch, cable loss, etc.).

Table A5.5.2.1: Test Parameter Relaxations for A-GPS Minimum Performance tests

Clause	Test Parameter Relaxation	
70.11.5.1 Sensitivity Coarse Time Assistance	Coarse Time Assistance	200 ms
	Absolute GPS signal level	1 dB
	Position error	1.3 m
	Response time	300 ms
70.11.5.2 Sensitivity Fine Time Assistance	Coarse Time Assistance	200 ms
	Fine Time Assistance	1 us
	Absolute GPS signal level	1 dB
	Position error	1.3 m
	Response time	300 ms
70.11.6 Nominal Accuracy	Coarse Time Assistance	200 ms
	Absolute GPS signal level	0 dB
	Position error	1.3 m
	Response time	300 ms
70.11.7 Dynamic Range	Coarse Time Assistance	200 ms
	Absolute GPS signal level	0 dB
	Relative GPS signal level	0.2 dB
	Position error	1.3 m
	Response time	300 ms
70.11.8 Multi-Path scenario	Coarse Time Assistance	200 ms
	Absolute GPS signal level	0 dB
	Relative GPS signal level	0.2 dB
	Position error	1.3 m
	Response time	300 ms

Table A5.5.2.2: Test Parameter Relaxations for A-GNSS Minimum Performance tests

Clause	Test Parameter Relaxation	
70.16.5.1 Sensitivity Coarse Time Assistance	Coarse Time Assistance	200 ms
	Absolute GNSS signal level	1 dB
	Position error	1.3 m
	Response time	300 ms
70.16.5.2 Sensitivity Fine Time Assistance	Coarse Time Assistance	200 ms
	Fine Time Assistance	1 us
	Absolute GNSS signal level	1 dB
	Position error	1.3 m
	Response time	300 ms
70.16.6 Nominal Accuracy	Coarse Time Assistance	200 ms
	Absolute GNSS signal level	0 dB
	Position error	1.3 m
	Response time	300 ms
70.16.7 Dynamic Range	Coarse Time Assistance	200 ms
	Absolute GNSS signal level	0 dB
	Relative GNSS signal level	0.2 dB
	Position error	1.3 m
	Response time	300 ms
70.16.8 Multi-Path scenario	Coarse Time Assistance	200 ms
	Absolute GNSS signal level	0 dB
	Relative GNSS signal level	0.2 dB
	Position error	1.3 m
	Response time	300 ms

A5.5.3 Interpretation of measurement results

The measurement results returned by the Test System are compared - without any modification - against the Test Requirements as defined by the shared risk principle.

The Shared Risk principle is defined in TR 102 273-1-2, clause 6.5.

The actual measurement uncertainty of the Test System for the measurement of each parameter shall be included in the test report.

The recorded value for the Test System uncertainty shall be, for each measurement, equal to or lower than the appropriate figure in clause A5.5.1.

If the Test System for a test is known to have a measurement uncertainty greater than that specified in clause A5.5.1, it is still permitted to use this apparatus provided that an adjustment is made value as follows:

Any additional uncertainty in the Test System over and above that specified in clause A5.5.1 shall be used to tighten the Test Requirement - making the test harder to pass. (This may require modification of stimulus signals). This procedure will ensure that a Test System not compliant with clause A5.5.1does not increase the chance of passing a device under test where that device would otherwise have failed the test if a Test System compliant with clause A5.5.1 had been used.

A5.5.4 Derivation of Test Requirements (This clause is informative)

The Test Requirements have been calculated by relaxing the Conformance requirement of the core specification using the Test Parameter Relaxations defined in clause A5.5.2. When the Test Parameter Relaxation is zero, the Test Requirement will be the same as the Conformance requirement. When the Test Parameter Relaxation is non-zero, the Test Requirements will differ from the Conformance requirement, and the formula used for this relaxation is given in table A5.5.4.1 and A5.5.4.2.

Table A5.5.4.1: Derivation of Test Requirements for A-GPS Minimum Performance tests

Test	Conformance requirement in 3GPP TS 45.005		Test Parameter Relaxation (TPR)	Test Requirement
70.11.5.1 Sensitivity Coarse Time Assistance	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Absolute GPS signal level	-142, -147 dBm	1 dB	Level + TPR: -141, -146 dBm
	Position error	100 m	1.3 m	Error +TPR: 101.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s
70.11.5.2 Sensitivity Fine Time Assistance	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Fine Time Assistance	±10 us	1 us	UL-TPR, LL+TPR: ±9 us
	Absolute GPS signal level	-147 dBm	1 dB	Level + TPR: -146 dBm
	Position error	100 m	1.3 m	Error +TPR: 101.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s
70.11.6 Nominal Accuracy	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Absolute GPS signal level	-130 dBm	0 dB	Level + TPR: -130 dBm
	Position error	30 m	1.3 m	Error +TPR: 31.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s
70.11.7 Dynamic Range	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Absolute GPS signal level	-129 to -147 dBm	1 dB	Level + TPR: each level +1 dBm
	Relative GPS signal level	18 dB	0.2 dB	Level - TPR: highest level -0.2 dB: -128.2dBm
	Position error	100 m	1.3 m	Error +TPR: 101.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s
70.11.8 Multi-Path scenario	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Absolute GPS signal level	-130 dBm	0 dB	Level + TPR: -130 dBm
	Relative GPS signal level	6 dB	0.2 dB	Level + TPR: lower level -0.2dB: -136.2 dBm
	Position error	100 m	1.3 m	Error +TPR: 101.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s

Table A5.5.4.2: Derivation of Test Requirements for A-GNSS Minimum Performance tests

Test	Conformance requirement in 3GPP TS 45.005		Test Parameter Relaxation (TPR)	Test Requirement
70.16.5.1 Sensitivity Coarse Time Assistance	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Absolute GNSS signal level (Galileo)	-142, -147 dBm	1 dB	Level + TPR: -141, -146 dBm
	Absolute GNSS signal level (GPS)	-142, -147 dBm	1 dB	Level + TPR: -141, -146 dBm
	Absolute GNSS signal level (GLONASS)	-142, -147 dBm	1 dB	Level + TPR: -141, -146 dBm
	Position error	100 m	1.3 m	Error +TPR: 101.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s
70.16.5.2 Sensitivity Fine Time Assistance	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Fine Time Assistance	±10 us	1 us	UL-TPR, LL+TPR: ±9 us
	Absolute GNSS signal level (Galileo)	-147 dBm	1 dB	Level + TPR: -146 dBm
	Absolute GNSS signal level (GPS)	-147 dBm	1 dB	Level + TPR: -146 dBm
	Absolute GNSS signal level (GLONASS)	-147 dBm	1 dB	Level + TPR: -146 dBm
	Position error	100 m	1.3 m	Error +TPR: 101.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s
70.16.6 Nominal Accuracy	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Absolute GNSS signal level (Galileo)	-127 dBm	0 dB	Level + TPR: -127 dBm
	Absolute GNSS signal level (GPS)	-128.5 dBm	0 dB	Level + TPR: -128.5 dBm
	Absolute GNSS signal level (GLONASS)	-131 dBm	0 dB	Level + TPR: -131 dBm
	Absolute GNSS signal level (QZSS)	-128.5 dBm	0 dB	Level + TPR: -128.5 dBm
	Absolute GNSS signal level (SBAS)	-131 dBm	0 dB	Level + TPR: -131 dBm
	Position error	15 m	1.3 m	Error +TPR: 16.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s
70.16.7 Dynamic Range	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Absolute GNSS signal level (Galileo)	-127.5 to -147 dBm	1 dB	Level + TPR: each level +1 dBm
	Absolute GNSS signal level (GPS)	-129 to -147 dBm	1 dB	Level + TPR: each level +1 dBm
	Absolute GNSS signal level (GLONASS)	-131.5 to -147 dBm	1 dB	Level + TPR: each level +1 dBm
	Relative GNSS signal level (Galileo)	19.5 dB	0.2 dB	Level - TPR: highest level -0.2 dB: -126.7 dBm
	Relative GNSS signal level (GPS)	18 dB	0.2 dB	Level - TPR: highest level -0.2 dB: -128.2 dBm
	Relative GNSS signal level (GLONASS)	15.5 dB	0.2 dB	Level - TPR: highest level -0.2 dB: -130.7 dBm
	Position error	100 m	1.3 m	Error +TPR: 101.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s
70.16.8 Multi-Path scenario	Coarse Time Assistance	±2 s	200 ms	Formulas: UL-TPR, LL+TPR: ±1.8 s
	Absolute GNSS signal level (Galileo)	-127 dBm	0 dB	Level + TPR: -127 dBm
	Absolute GNSS signal level (GPS)	-128.5 dBm	0 dB	Level + TPR: -128.5 dBm
	Absolute GNSS signal level (GLONASS)	-131 dBm	0 dB	Level + TPR: -131 dBm

Test	Conformance requirement in 3GPP TS 45.005		Test Parameter Relaxation (TPR)	Test Requirement
	Relative GNSS signal level (all GNSSs)	Y dB where "Y" is given in Table 70.16.2.1	0.2 dB	Relative level + TPR: relative level + 0.2dB: Y + 0.2 dB
	Position error	100 m	1.3 m	Error +TPR: 101.3 m
	Response time	20 s	300 ms	Time + TPR: 20.3 s

Annex 6 (informative): E-OTD Accuracy Measurement Test Environment

A6.1 Recommended Timing Accuracy Test Environment (Unassisted)

3GPP TS 05.05, annex I calls for a best-case MS measurement observed timing difference (OTD) accuracy of 100 nanoseconds. This level of measurement accuracy implies that:

1. The time delay and phase shift of all components in the test environment must be taken into account.
2. The laboratory equipment utilized to measure the burst alignment of the two base station simulators must support a time resolution of at least 10 nanoseconds.
3. All base station simulators, active RF channel simulators, and time measurement equipment must be phase-locked to a common reference clock.
4. All base station simulators used for this test must be frame synchronized.

Figure A6-1 represents a recommended configuration for the unassisted measurement of E-OTD accuracy. If this test environment is utilized, the effects of differing cable lengths, channel simulator processing delays, etc., must be compensated for in order to establish the RTD between bursts from the base station simulators.

The "unassisted" test environment should require a relatively short time (< 3 000 s) for the test environment to obtain N measurements for the purpose of calculating the RMS_{90} timing error of the MS. In many cases, the predominant component leading to uncertainty in RTD between the two base station simulators during the measurement period will be phase jitter, which should follow a Gaussian distribution. The standard deviation of this distribution must be kept within a range that allows the test laboratory to confirm that this uncertainty component does not significantly affect the results of the OTD measurements made and reported by the MS. Test labs and base station simulator manufacturers are expected to quantify and document the test environment's RTD. Test labs and base station simulator manufacturers are also expected to have some means of verifying the standard deviation of the test environment's RTD (including phase jitter introduced by the RF channel simulators), declaring that this uncertainty will be negligible relative to the 100 nanosecond RMS_{90} best-case requirements of 3GPP TS 05.05 (V8.7.1), Release 99, annex I.

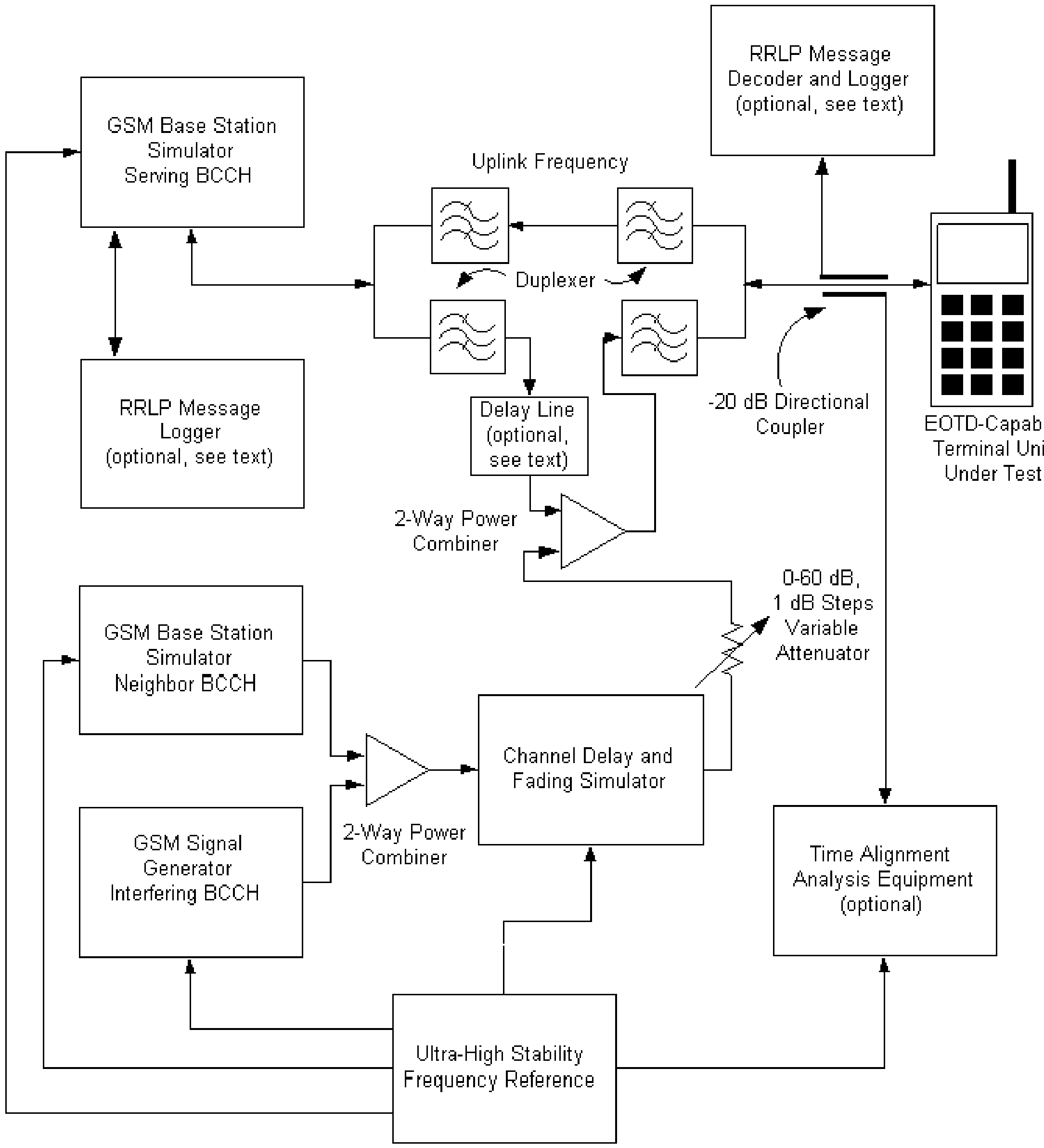


Figure A6-1: "Unassisted" E-OTD Test Environment

A6.2 Recommended Timing Accuracy Test Environment (Assisted)

In some laboratory environments, test equipment may not be available to measure and/or maintain the base station simulator burst time alignment to the accuracy required by the "unassisted" test environment described earlier. In such cases, a test configuration of the type shown in figure A6-2 may be employed for E-OTD performance validation. In this configuration, an LMU of known accuracy is used to measure the real timing difference (RTD) between the serving and neighbour base station simulators.

The "assisted" test environment should require a relatively short time (< 3 000 s) for the test environment to obtain *N* measurements for the purpose of calculating the RMS_{90} timing error of the MS. In many cases, the predominant component leading to uncertainty in RTD between the two base station simulators during the measurement period will be phase jitter, which should follow a Gaussian distribution. The timing offset or RTD between the two base station simulators is reported by the LMU. Even if an RTD measurement from the LMU is made in synchronism with an OTD measurement from the MS, some means of verification must be available to assure that the standard deviation of the RTD is kept within a range that allows the laboratory to confirm that this uncertainty does not significantly affect the results of the OTD reported by the MS. Test labs and LMU manufacturers are expected to have some means of verifying the standard deviation of the RTD reported for the test environment (including phase jitter introduced by the RF channel simulator), and declaring that this uncertainty component will be negligible relative to the 100 nanosecond RMS_{90} best-case requirements of 3GPP TS 05.05 (V8.7.1), Release 99, annex I.

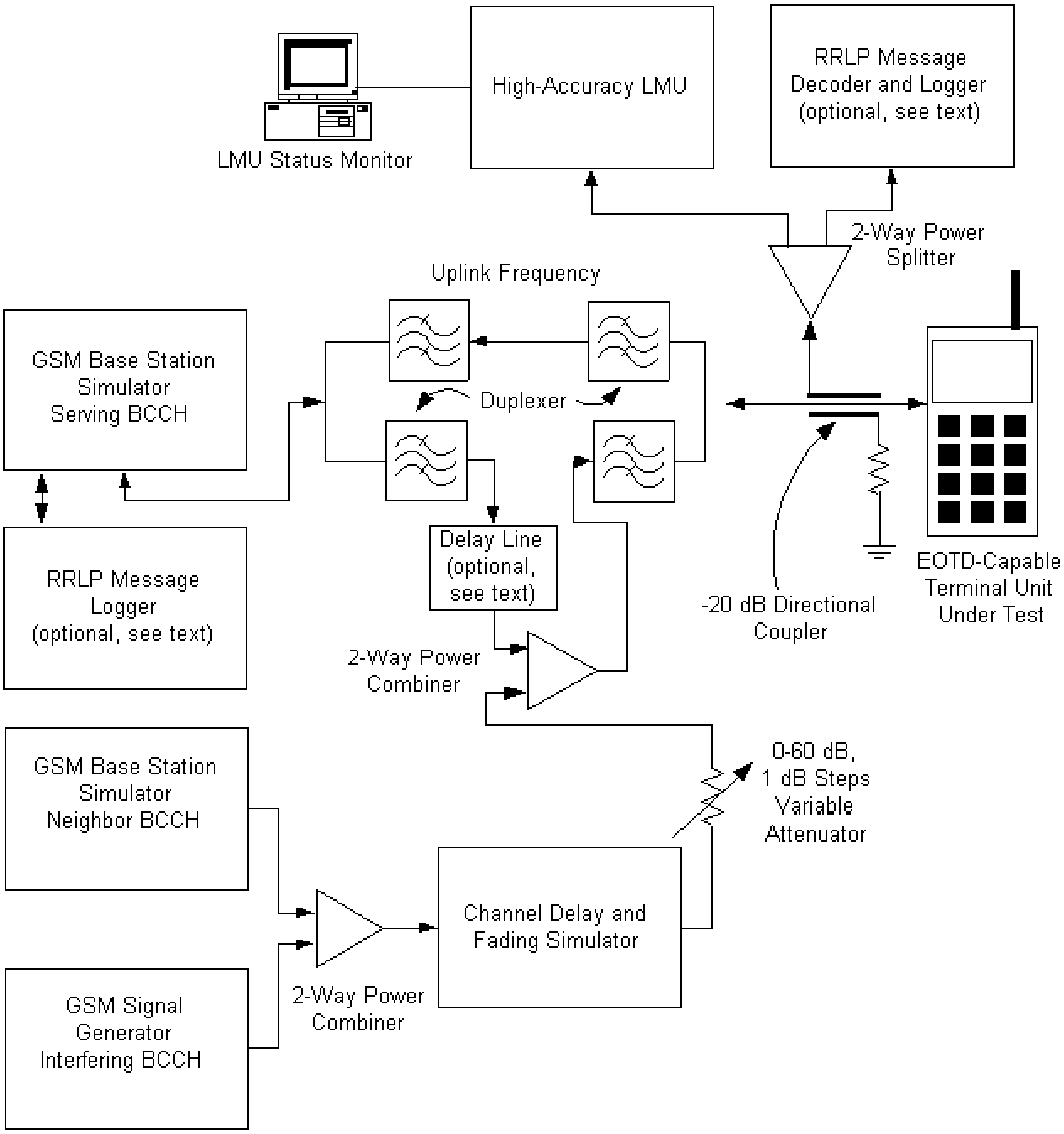


Figure A6-2: "Assisted" E-OTD Test Environment

Delay Line

Almost all active RF channel fading simulators introduce some intrinsic propagation delay, even when set to an RF channel delay of zero. In some cases, this delay may be to great to compensate for using a passive delay as shown in figure A6-1 and figure A6-2. In such cases, the intrinsic delay of the channel simulator shall be included in the calculation of RTD for the test environment. Any phase jitter contribution from the RF channel fading simulator must be taken into account when evaluating the standard deviation of the test environment's RTD.

Simulated Geometric Time Difference

Once the RTD of the test environment is known, any additional time delay added to the fading simulator RF path will simulate the effect of distance between the MS and its neighbour cell. 3GPP TS 05.05 (V8.7.1), Release 99, annex I does not specify a value for geometric time delay, in part because the MS could be equidistant from the three base stations required for E-OTD calculation in a real network. Also, in an actual network, the geometric delay an MS must contend with can vary from 0 µsec to over 50 µsec, however, the 3GPP TS 05.05, annex I specification is only concerned with measurement error. Consequently, the test procedures described in this subclause require that no additional time delay will be added to simulate a geometric time difference.

Neighbour Lists

The serving base station simulator must be configured to include the neighbour base station simulator in its BA list. During interference tests, the interfering signal generator shall not be included in the serving base station simulator's BA list.

Interfering BCCH Signal Generator

The interfering BCCH signal generator shall provide a continuous GMSK signal, modulated with a pseudo-random bit sequence. This signal generator shall not be frame-synchronized with the serving or neighbour base station simulators.

RRLP Measure Position Request

The RRLP Measure Position Request sent from the serving base station simulator shall include the field values listed in table A6-1.

Table A6-1: RRLP Measure Position Request Field Values, Positioning Instructions Data Element

Field Name	Value	Comments
Method Type	0	Value="MS assisted"
Positioning Methods	0	Value="E-OTD"
Response Time	1	Value=2 seconds
Accuracy	NA	This field is optional
Multiple Sets	0	Value=Multiple sets allowed
Environmental Characterisation	NA	This field is optional

The following Measure Position Request components will be used when relevant to the test:

- E-OTD Reference BTS of Assistance Data;
- E-OTD Measurement Assistance Data for System Information List Element;

These two assistance data elements are necessary in the Measure Position Request to facilitate the execution of certain physical-layer E-OTD tests. For example, 3GPP TS 05.05, Annex I requires that in some instances, an E-OTD capable MS must support a specified timing measurement accuracy when the neighbour BCCH is below the device's reference sensitivity. Without assistance data, it may be impossible to execute the necessary physical layer validation tests because the MS upper protocol layers would be incapable of decoding the BSIC of the neighbour BCCH.

MS Mode During Measurement

The MS under test shall make the requested measurements while in the dedicated mode on a TCH.

Automation of E-OTD Measurements

If at all possible, the laboratory environment used to verify E-OTD accuracy should be capable of supporting automated measurements. A minimum of 250 trials shall be utilized.

Terminal Unit RRLP Message Monitoring

The test lab shall have some means of logging the Measure Position Response message transmitted by the MS. This can be accomplished utilizing a suitable U_m interface analyzer monitoring the MS RRLP messages on the uplink, or through a base station simulator capable of reading and logging RRLP messaging. The device used to capture the received

RRLP messages should be capable of logging the MS observed time difference measurement to a flat ASCII file, with each of the reported OTD values in decimal.

E-OTD Measurement With 8PSK Modulated Bursts

3GPP TS 05.05 (V8.7.1) Release 99, annex I requires that an E-OTD-capable MS must support E-OTD measurements when the serving and the neighbour base stations are transmitting 8PSK modulated bursts. This test plan verifies that the timing error of an E-OTD-capable MS is maintained regardless of whether the serving and neighbour base station simulators are transmitting either GMSK or 8PSK in time slots 1 through 7.

Accuracy Calculation

In order to minimize the effects of "outlying" data points, the timing difference measurement accuracy of an E-OTD MS shall be calculated as an RMS value of 90% of the measurement trials with the least error. For example, if N=250 measurement trials, the trial error results x_1 through x_{250} shall be sorted in ascending order of error. A subset M that includes 90 % of the trials in set N (M=225 trials in this example) shall be established. In this example, the subset M will include the 225 trial results with the least error from set N. The RMS error is then calculated from the data points in subset M according to Equation A6-1 below:

(Equation A6-1) RMS_{90} Calculation

$$\mathbf{Error_{RMS}} = \sqrt{\left(\left(\sum_{1}^{M} x^2\right) \div M\right)}$$

Annex 7 (informative): General rules for statistical testing

A7.1 Statistical testing of receiver performance

Testing the receiver performance can be done either in the classical way with a fixed minimum number of samples or using statistical methods that lead to an early pass/fail decision with test time significantly reduced for MS with an error rate not on the limit.

Statistical testing of the receiver performance is based on the evaluation of error rates, such as bit error rates, block error rates or also the rate of missing bad frame indications.

A7.1.1 Basics

A7.1.1.1 Definition of (error) events

1) Bit Error Ratio (BER)

   The Bit Error Ratio is defined as the ratio of the bits wrongly received to all data bits sent.

2) Block Error Ratio (BLER)

   A Block Error Ratio is defined as the ratio of the number of erroneous blocks received to the total number of blocks sent. An erroneous block is defined as a Transport Block, the cyclic redundancy check (CRC) of which is wrong.

3) Rate of missing Bad Frame Indications (BFI)

   The rate of missing Bad Frame Indications is the ratio of frames not marked incorrect to all frames sent, although all frames sent are incorrectly. This mechanism is used to test Bad Frame Indication of the MS.

A7.1.1.2 Test Method

Each test is performed in the following manner:

a) Set up the required test conditions.

b) Continuously record the number of samples tested and the number of (error) events (bit error, block error or missing BFI).

c) While recording samples and errors continuously check, if it is about time to make a decision. The possible outcomes of a decision are: Early pass, early fail, continue with measuring the error rates, pass or fail.

A7.1.1.3 Test Criteria

The test shall fulfil the following requirements:

a) good pass fail decision with high confidence level

   1) to keep reasonably low the probability (risk) of passing a bad unit for each individual test;

   2) to have high probability of passing a good unit for each individual test;

b) good balance between test time and statistical significance

   3) to perform measurements with a high degree of statistical significance;

   4) to keep the test time as low as possible.

A7.1.1.4 Calculation assumptions

A7.1.1.4.1 Statistical independence

(a) It is assumed, that error events are rare (error rate close to zero) and independent statistical events.

The assumption of rare events is justified by the error rates that need to be met by the DUT. Statistical independence is given as data bits of completely transmitted bursts are evaluated without further memory of the receiver active. Samples and errors are summed up after every time slot interval. So the assumption of independent error events is justified.

(b) In error rate tests with fading there is the memory of the multipath fading channel which interferes the statistical independence. A minimum test time is introduced to average fluctuations of the multipath fading channel. So the assumption of independent error events is justified approximately.

A7.1.1.4.2 Applied formulas

The formulas, applied to describe the error rate test, are based on the following experiments:

(1) After having observed a certain number of (error) events (**ne**) the number of samples are counted to calculate the error rate. Provisions are made such that the complementary experiment is valid as well:

(2) After a certain number of samples (**ns**) the number of errors, occurred, are counted to calculate the error rate.

Experiment (1) stipulates to use the following Chi Square Distribution with degree of freedom **ne**:

$$2 \times X^2(2 \times \nu, 2 \times \mathbf{ne})$$

Where X^2 is the Chi-square distribution.

Experiment (2) stipulates to use the Poisson Distribution:

$$P_\nu(\mathbf{ne})$$

Where $P_\nu(\mathbf{ne})$ is the Poisson distribution for **ne** with mean ν.

with ν as the mean of the distribution.

To determine the early stop conditions, the following inverse cumulative operation is applied:

$\frac{1}{2} C^{-1}\left(D, 2 \times \mathbf{ne}\right)$. This is applicable for experiment (1) and (2).

D Wrong decision risk per test step.

NOTE: Where C^{-1} is the inverse cumulative distribution function for the X^2 distribution (the D-quantile function)
Other inverse cumulative operations are available, however only this is suited for experiment (1) and (2).

A7.1.2 Definition of good pass fail decision

A correct pass/fail decision requires the knowledge of the exact (true) error ratio of the DUT. However the true error ratio of the DUT is generally unknown. Measuring the true error ratio of the DUT requires to evaluate an infinite number of samples, which of course is not possible. This means that any error rate measurement within limited time is affected by an uncertainty, leading to two kinds of wrong decisions possible. If the measured error rate is higher than the true error rate a good DUT could possibly be failed and vice versa if the measured error rate is lower a bad DUT could possibly be passed.

Error rate tests within limited time hence require the acceptance of a wrong decision risk. The measure of a good pass fail decision is given by the probability (risk) F of the wrong decision at the end of the test. The probability of a correct decision is 1-F.

Wrong decision risk F for one single error ratio test:

The probability (risk) to fail a good DUT shall be F_{fail} according to the following definition: A DUT is failed, accepting a probability F_{fail} that the DUT is still better than the test requirement

The probability (risk) to pass a bad DUT shall be F_{pass} according to the following definition: A DUT is passed, accepting a probability F_{pass} that the DUT is still worse than M times the specified error ratio. (M>1 is the bad DUT factor).

The wrong decision risk F explained above applies to one single error ratio test. In most test cases where only one or few error ratio tests are done the wrong decision risk acceptable for an erroneous pass is identical to the acceptable risk for an erroneous fail:

$F_{pass} = F_{fail} = F$ and e.g. $F = 0.2\%$

If a test is repeated under different conditions for several times, the total wrong decision risk for the DUT increases. The increasing risk for a bad fail decision is not acceptable for test cases that are composed of many single error rate tests like e.g. the blocking test, which implies approximately 3000 error rate tests (depends on design of MS). A DUT on the limit will fail approximately 6 to 7 times due to statistical reasons (wrong decision probability at the end of the test F = 0.2%). 30 fails (6 in inband range and 24 outside) are allowed in the blocking test but these fails are reserved for spurious responses. This problem shall be solved by the following rules:

- All passes (based on $F_{pass} = 0.2\%$) are accepted, including the wrong decisions due to statistical reasons.
- An early fail limit based on $F_{fail} = 0.02\%$ instead of 0.2% is established, that ensures that wrong decisions due to statistical reasons are reduced to less than one.

These asymmetric test conditions ensure that a DUT on the test limit consumes hardly more test time for a blocking test than in the symmetric case and on the other hand discriminates sufficiently between statistical fails and spurious response cases.

Wrong decision probability D per test step:

As one single error ratio test is composed of several test steps the wrong decision probability per test step needs to be sufficiently small to keep the wrong decision risk F (the wrong decision risk at the end of the test) within the requirements. The wrong decision probability D per test step is a numerically evaluated fraction of F. Considerations regarding symmetry between probability of wrong pass and wrong fail decision are identical to those given for F.

For most test cases where only one or few error rate tests are done the wrong decision probability D per test step for a pass decision is identical to the wrong decision probability for a fail decision.

$D_{pass} = D_{fail} = D$ and e.g. $D = 0.0085\%$

For test cases where $F_{pass} \neq F_{fail}$ (e.g. blocking) this applies also to D: $D_{pass} \neq D_{fail}$.

A7.1.3 Implementation

A7.1.3.1 Proceeding

a) Set up the required test conditions.

b) Continuously record the number of samples tested and the number of (error) events (bit error, block error or missing BFI). Calculate the preliminary error rates ber_0 and ber_1 from the number of samples and the number of (error) events. Regarding ber_0 and ber_1 refer to "A7.1.3.1 Limit lines".

c) Continuously check while recording samples and errors, if it is about time to make a decision. The possible outcomes of a decision are: Early pass, early fail, continue with measuring the error rates, pass or fail.

- 1st decision after minimum test time due to fading (refer to Table A7.1.4.2 : Minimum test time due to fading) has elapsed. In case the test runs without fading conditions this time is zero and in case this time exceeds the target test time (refer to A7.1.3.1 Limit lines), the test is already finished requiring a pass/fail decision .
- 2nd and possibly further (early) decisions after a certain cyclic interval or the occurrence of the next error event. As long as no early decision can be made the test is continued.
- If the target test time has elapsed the test is definitively finished and a pass/fail decision can be made. In case the minimum test time due to fading exceeds the target test time this point is reached already in the 1st step.

A7.1.3.2 Limit lines

Early decisions require that the actual error rate is checked both against a limit line for early pass and a limit line for early fail.

Limit line for early pass decision (for **ne** ≥1):

The condition for an early pass decision is: $ber_1 < berlimbad_{pass}$

$$\text{berlimbad}_{\text{pass}}(D_{\text{pass}}, \mathbf{ne}) = \frac{2 \times \mathbf{ne} \times M}{C^{-1}(1 - D_{\text{pass}}, 2 \times \mathbf{ne})}$$

ber_1 is the normalised bit error rate with counting errors started from one which means that an artificial error is introduced at the beginning to avoid that the early pass condition is met when the test starts. After the first real error event has occurred the artificial error has to be removed to calculate the error rate correctly.

Limit line for early fail decision (for **ne**≥ 7):

The condition for an early fail decision is: $ber_0 > berlim_{fail}$

$$\text{berlim}_{\text{fail}}(D_{\text{fail}}, \mathbf{ne}) = \frac{2 \times \mathbf{ne}}{C^{-1}(D_{\text{fail}}, 2 \times \mathbf{ne})}$$

ber_0 is the normalised bit error rate with counting errors started from zero, meaning that no artificial erroneous sample is introduced at the beginning of the test..

Due to the nature of the test, namely discrete error events, the early fail condition shall not be valid, when fractional errors <1 are used to calculate the early fail limit: Any early fail decision is postponed until number of errors **ne** ≥7. In the blocking test any early fail decision is postponed until number of errors **ne** ≥ 8.

Parameters for limit lines:

1.	D		wrong decision probability per test step.
2.	M	= 1.5	bad DUT factor
3.	**ne**		number of (error) events. This parameter is the x-ordinate in figure A7.1.3.1 Limit lines.
4.	ns		number of samples. This parameter is not needed for limit lines, but enumerated here because it is aligned to ne closely. The bit error rate is calculated from ne and ns.
	Parameters D and M define the limit lines for early pass and early fail. With the two curves known the intersection point of the two limit lines can be calculated. The x-ordinate of this intersection point is the target number of errors (TNE) and y-ordinate is the (normalised) test limit (TL). This intersection point is reached when the target test time has elapsed. In this case a decision against the test limit (column “derived test limit”) can be made.		
5.	TL	= 1.234	For tests with F = 0.2 the parameters given above lead to this (normalised) test limit. The BER limit given in the core specs (column “Orig. BER requirement” in the tables defining the test limits) is multiplied with the test limit factor TL to gain the limit for the pass/fail decision (column “derived test limit”).
	TL	= 1.251	Normalized test limit for tests with F = 0.02 (e.g. blocking test).
6.	TNE		The parameters given above lead to a target number of errors. For tests with F = 0.2 the target number of errors is 345. For tests with F = 0.02 (e.g. blocking test) the target number of errors results in 403.

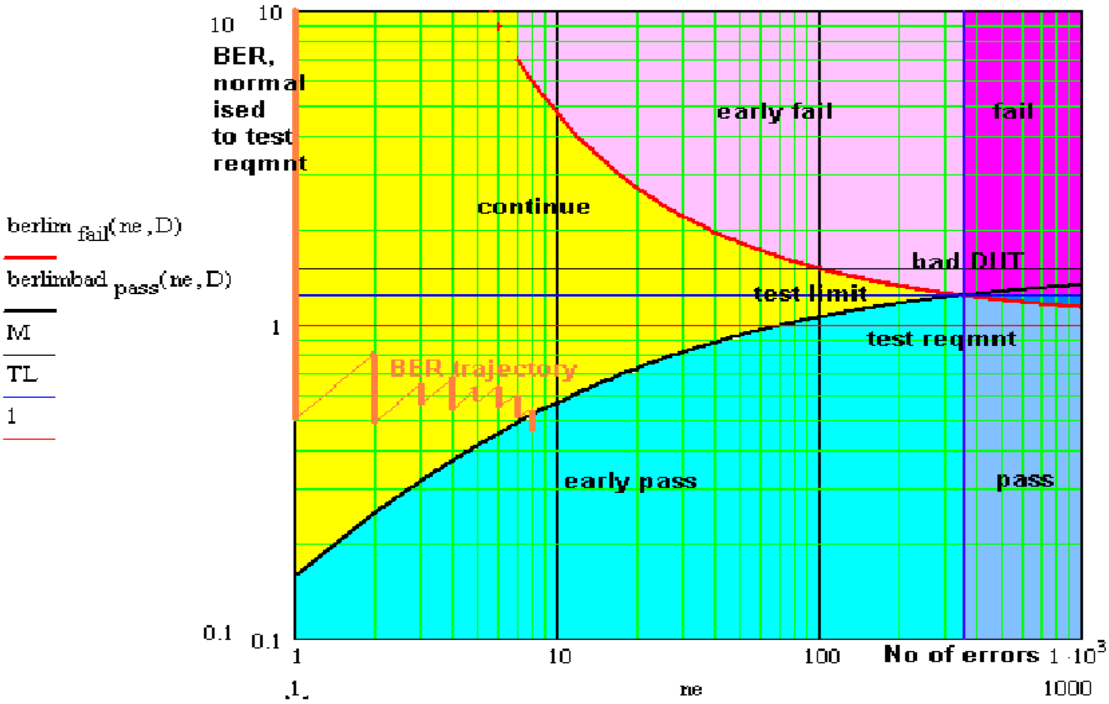


Figure A7.1.3.1 Limit lines

A typical error rate test, calculated form the number of samples and errors using experimental method (1) or (2) (see A7.1.1.4 Calculation assumptions) runs along the yellow trajectory. With an errorless sample the trajectory goes down vertically. With an erroneous sample it jumps up right. Making a pass/fail decision means to check if the error rate

("BER trajectory") intersects the limit lines for early pass or early fail. The term 'test limit' used in the figure above denotes the term 'derived test limit' used in this document.

A7.1.4 Good balance between test time and statistical significance

Three independent test parameters are introduced into the test and shown in Table A7.1.4.1. These are the obvious basis of test time and statistical significance. From the first two of them four dependent test parameters are derived. The third independent test parameter is justified separately.

Table A7.1.4.1 Independent and dependent test parameters

Independent test parameters			Dependent test parameters		
Test Parameter	**Value**	**Reference**	**Test parameter**	**Value**	**Reference**
Bad DUT factor M	1.5	Section A7.1.3.1	Early pass/fail condition	Curves	Section A7.1.3.1 Figure A7.1.3.1
Final probability of wrong pass/fail decision F	0.2% 0.02% for blocking	Section A7.1.2	Target number of error events	345 403 for blocking	Section A7.1.3.1
			Probability of wrong pass/fail decision per test step D	0.0085% 0.0008% for blocking	Section A7.1.2
			Test limit factor TL	1.234 1.251 for blocking	Section A7.1.3.1
Minimum test time		Table A7.1.4.2			

The minimum test time is derived from the following justification:

1) For no propagation conditions and static propagation condition

   No early fail calculated from fractional number of errors <1

2) For multipath fading condition

   No stop of the test until 990 wavelengths are crossed for fading profiles greater than 5km/h, and 250 wavelengths are crossed for fading profiles less than or equal to 5km/h. The minimum test time due to multipath fading conditions depends on the frequency of the DL signal, the vehicle speed and the data rate (full rate or half rate). Refer to table A7.1.6.2 : Minimum test time due to fading

Table A7.1.4.2: Minimum test time due to fading

Frequency	0,4	0,7	0,85	0,9	1,8	1,9	GHz
Full Rate 3 km/h							
min test time	1800	1029	847	800	400	379	s
	0:30:00	**0:17:09**	**0:14:07**	**0:13:20**	**0:06:40**	**0:06:19**	**hh:mm:ss**
Half Rate 3 km/h							
min test time	**3600**	**2057**	**1694**	**1600**	**800**	**758**	**s**
	1:00:00	**0:34:17**	**0:28:14**	**0:26:40**	**0:13:20**	**0:12:38**	**hh:mm:ss**
Full Rate 50 km/h							
min test time	**428**	**244**	**201**	**190**	**95**	**90**	**s**
	0:07:08	**0:04:04**	**0:03:21**	**0:03:10**	**0:01:35**	**0:01:30**	**hh:mm:ss**
Half Rate 50 km/h							
min test time	**855**	**489**	**403**	**380**	**190**	**180**	**s**
	0:14:15	**0:08:09**	**0:06:43**	**0:06:20**	**0:03:10**	**0:03:00**	**hh:mm:ss**
Full Rate 100 km/h							
min test time	**214**	**122**	**101**	**95**	**48**	**45**	**s**
	0:03:34	**0:02:02**	**0:01:41**	**0:01:35**	**0:00:48**	**0:00:45**	**hh:mm:ss**
Half Rate 100 km/h							
min test time	**428**	**244**	**201**	**190**	**95**	**90**	**s**
	0:07:08	**0:04:04**	**0:03:21**	**0:03:10**	**0:01:35**	**0:01:30**	**hh:mm:ss**
Full Rate 130 km/h							
min test time	**164**	**94**	**77**	**73**	**37**	**35**	**s**
	0:02:44	**0:01:34**	**0:01:17**	**0:01:13**	**0:00:37**	**0:00:35**	**hh:mm:ss**
Half Rate 130 km/h							
min test time	**329**	**188**	**155**	**146**	**73**	**69**	**s**
	0:05:29	**0:03:08**	**0:02:35**	**0:02:26**	**0:01:13**	**0:01:09**	**hh:mm:ss**
Full Rate 250 km/h							
min test time	**86**	**49**	**40**	**38**	**19**	**18**	**s**
	0:01:26	**0:00:49**	**0:00:40**	**0:00:38**	**0:00:19**	**0:00:18**	**hh:mm:ss**
Half Rate 250 km/h							
min test time	**171**	**98**	**81**	**76**	**38**	**36**	**s**
	0:02:51	**0:01:38**	**0:01:21**	**0:01:16**	**0:00:38**	**0:00:36**	**hh:mm:ss**

A7.1.5 Minimum and maximum expected duration of tests

Since there are a number of dependant and independent factors which determine the expected duration of a test using these statistical methods, it is recommended that in individual test cases an expected minimum and an expected maximum duration of test is specified for each configuration (e.g. times may significantly change for differing bands). Where the expected minimum and maximum duration are constrained by the same factor, and are thus the same, for clarity both values should be stated.

Where minimum and/or maximum test durations are specified, they should only be used a in an informative manner (e.g. by a test case implementer to determine whether a given implementation is correct). These specified durations should not be used as a failure determination unless this is explicitly stated in an individual clause.

A7.2 Statistical testing of 2 D position error and TTFF for A-GPS and A-GNSS Minimum Performance test cases

A7.2.1 Test Method

Each test is performed in the following manner:

a) Setup the required test conditions.

b) Measure the 2D position and Time to First Fix repeated times. Start each repetition after having applied the message ‘RESET MS POSITIONING STORED INFORMATION’. This ensures that each result is independent from the previous one. The results, measured, are simplified to:

good result, if the 2D position and TTFF are ≤ limit.

bad result, if the 2D position or TTFF or both are > limit

c) Record the number of results (ns) and the number of bad results (ne)

d) Stop the test at a pass or an fail event.

e) Once the test is stopped, decide according to the pass fail decision rules (A7.2.4.2)

A7.2.2 Error Ratio (ER)

The Error Ratio (ER) is defined as the ratio of bad results (ne) to all results (ns).
(1-ER is the success ratio)

A7.2.3 Test Design

A statistical test is characterised by:

Test-time, Selectivity and Confidence level

A7.2.3.1 Confidence level

The outcome of a statistical test is a decision. This decision may be correct or in-correct. The Confidence Level CL describes the probability that the decision is a correct one. The complement is the wrong decision probability (risk) D = 1-CL

A7.2.3.2 Introduction: Supplier Risk versus Customer Risk

There are two targets of decision:

a) A measurement on the pass-limit shows, that the DUT has the specified quality or is better with probability CL (CL e.g.95%) This shall lead to a “pass decision”

The pass-limit is on the good side of the specified DUT-quality. A more stringent CL (CL e.g.99%) shifts the pass-limit further into the good direction. Given that the quality of the DUTs is distributed, a greater CL passes less and better DUTs.

A measurement on the bad side of the pass-limit is simply “not pass” (undecided)

aa) Complementary:

A measurement on the fail-limit shows, that the DUT is worse than the specified quality with probability CL.

The fail-limit is on the bad side of the specified DUT-quality. A more stringent CL shifts the fail-limit further into the bad direction. Given that the quality of the DUTs is distributed, a greater CL fails less and worse DUTs.

A measurement on the good side of the fail-limit is simply “not fail”.

b) A DUT, known to have the specified quality, shall be measured and decided pass with probability CL. This leads to the pass limit.

For CL e.g. 95%, the pass limit is on the bad side of the specified DUT-quality. CL e.g.99% shifts the pass-limit further into the bad direction. Given that the DUT-quality is distributed, a greater CL passes more and worse DUTs.

bb) A DUT, known to be an ($\varepsilon \rightarrow 0$) beyond the specified quality, shall be measured and decided fail with probability CL.

For CL e.g.95%, the fail limit is on the good side of the specified DUT-quality.

NOTE: the different sense for CL in (a), (aa) versus (b), (bb).

NOTE: for constant CL in all 4 bullets (a) is equivalent to (bb) and (aa) is equivalent to (b).

A7.2.3.3 Supplier Risk versus Customer Risk

The table below summarizes the different targets of decision.

Table A7.2.3.3 Equivalent statements

	Equivalent statements, using different cause-to-effect-directions, and assuming CL = constant >0.5	
cause-to-effect-directions	Known measurement result → estimation of the DUT's quality	Known DUT's quality → estimation of the measurement's outcome
Supplier Risk	**A measurement on the pass-limit shows, that the DUT has the specified quality or is better (a)**	A DUT, known to have an (ε→0) beyond the specified DUT-quality, shall be measured and decided fail (bb)
Customer Risk	A measurement on the fail-limit shall shows, that the DUT is worse than the specified quality (aa)	**A DUT, known to have the specified quality, shall be measured and decided pass (b)**

NOTE: The bold text shows the obvious interpretation of Supplier Risk and Customer Risk. The same statements can be based on other DUT-quality-definitions.

A7.2.3.4 Introduction: Standard test versus early decision concept

In standard statistical tests, a certain number of results (ns) is predefined in advance of the test. After ns results the number of bad results (ne) is counted and the error ratio (ER) is calculated as ne/ns.

Applying statistical theory, a decision limit can be designed, against which the calculated ER is compared to derive the decision. Such a limit is one decision point and is characterised by:

- D: the wrong decision probability (a predefined parameter)
- ns: the number of results (a fixed predefined parameter)
- ne: the number of bad results (the limit based on just ns)

In the formula for the limit, D and ns are parameters and ne is the variable. In the standard test ns and D are constant. The property of such a test is: It discriminate between two states only, depending on the test design:

- pass (with CL) / undecided (undecided in the sense: finally undecided)
- fail (with CL) / undecided (undecided in the sense: finally undecided)
- pass(with CL) / fail (with CL) (however against two limits).

In contrast to the standard statistical tests, the early decision concept predefines a set of (ne,ns) co-ordinates, representing the limit-curve for decision. After each result a preliminary ER is calculated and compared against the limit-curve. After each result one may make the decision or not (undecided for later decision) The parameters and variables in the limit-curve for the early decision concept have a similar but not equal meaning:

- D: the wrong decision probability (a predefined parameter)
- ns: the number of results (a variable parameter)
- ne: the number of bad results (the limit. It varies together with ns)

To avoid a "final undecided" in the standard test, a second limit must be introduced and the single decision co-ordinate (ne,ns) needs a high ne, leading to a fixed (high) test time. In the early decision concept, having the same selectivity and the same confidence level an "undecided" does not need to be avoided, as it can be decided later. A perfect DUT will hit the decision coordinate (ne,ns) with ne=0. This test time is short.

A7.2.3.5 Standard test versus early decision concept

For Supplier Risk:
The wrong decision probability D in the standard test is the probability, to decide a DUT in-correctly in the single decision point. In the early decision concept there is a probability of in-correct decisions d at each point of the limit-curve. The sum of all those wrong decision probabilities accumulate to D. Hence d<D

For Customer Risk:
The correct decision probability CL in the standard test is the probability, to decide a DUT correctly in the single decision point. In the early decision concept there is a probability of correct decisions cl at each point of the limit-curve. The sum of all those correct decision probabilities accumulate to CL. Hence cl<CL or d>D

A7.2.3.6 Selectivity

There is no statistical test which can discriminate between a limit-DUT-quality and a DUT-quality which is an ($\varepsilon \rightarrow 0$) apart from the limit in finite time and confidence level CL>1/2. Either the test discriminates against one limit with the results pass (with CL)/undecided or fail (with CL)/undecided, or the test ends in a result pass (with CL)/fail (with CL) but this requires a second limit.

For CL>0.5, a (measurement-result = specified-DUT-quality), generates undecided in test "supplier risk against pass limit" (a in clause A7.2.3.2) and also in the equivalent test against the fail limit (aa in clause A7.2.3.2)

For CL>0.5, a DUT, known to be on the limit, will be decided pass for the test "customer risk against pass limit" (b in clause A7.2.3.2) and also in the equivalent test against fail limit (bb in clause A7.2.3.2).

This overlap or undecided area is not a fault or a contradiction, however it can be avoided by introducing a Bad or a Good DUT quality according to:

- Bad DUT quality: specified DUT-quality * M (M>1)
- Good DUT quality: specified DUT-quality * m (m<1)

Using e.g M>1 and CL=95% the test for different DUT qualities yield different pass probabilities:

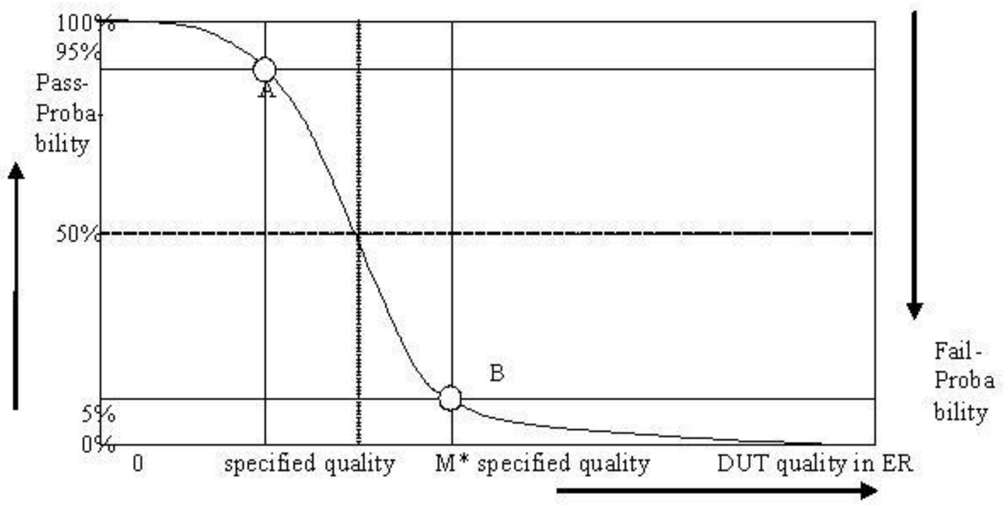


Figure A7.2.3.6: Pass probability versus DUT quality

A7.2.3.7 Design of the test

The test is defined according to the following design principles:

1. The early decision concept is applied.
2. A second limit is introduced: Bad DUT factor M>1
3. To decide the test pass:

   Supplier risk is applied based on the Bad DUT quality

   To decide the test fail

   Cusomer Risk is applied based on the specified DUT quality

The test is defined using the following parameters:

1. Specified DUT quality: ER = 0.05
2. Bad DUT quality: M=1.5 (selectivity)
3. Confidence level CL = 95% (for specified DUT and Bad DUT-quality)

This has the following consequences:

a) A measurement on the fail limit is connected with 2 equivalent statements:

A measurement on the fail-limit shows, that the DUT is worse than the specified DUT-quality	A DUT, known to have the specified quality, shall be measured and decided pass

A measurement on the pass limit is connected with the complementary statements:

A measurement on the pass limit shows, that the DUT is better than the Bad DUT-quality.	A DUT, known to have the Bad DUT quality, shall be measured and decided fail

The left column is used to decide the measurement.

The right column is used to verify the design of the test by simulation.

The simulation is based on the two fulcrums A and B only in Figure A7.2.3.6. There is freedom to shape the remainder of the function.

b) Test time

   1. The minimum and maximum test time is fixed.
   2. The average test time is a function of the DUT's quality.
   3. The individual test time is not predictable (except ideal DUT).

c) The number of decision co-ordinates (ne,ns) in the early decision concept is responsible for the selectivity of the test and the maximum test time. Having fixed the number of decision co-ordinates there is still freedom to select the individual decision co-ordinates in many combinations, all leading to the same confidence level.

A7.2.4 Pass fail decision

A7.2.4.1 Numerical definition of the pass fail limits

ne	nsp	nsf	ne	nsp	nsf	ne	nsp	nsf	ne	nsp	nsf
0	77	NA	43	855	576	86	1525	1297	129	2173	2050
1	106	NA	44	871	592	87	1540	1314	130	2188	2067
2	131	NA	45	887	608	88	1556	1331	131	2203	2085
3	154	NA	46	903	625	89	1571	1349	132	2218	2103
4	176	NA	47	919	641	90	1586	1366	133	2233	2121
5	197	NA	48	935	657	91	1601	1383	134	2248	2139
6	218	42	49	951	674	92	1617	1401	135	2263	2156
7	238	52	50	967	690	93	1632	1418	136	2277	2174
8	257	64	51	982	706	94	1647	1435	137	2292	2192
9	277	75	52	998	723	95	1662	1453	138	2307	2210
10	295	87	53	1014	739	96	1677	1470	139	2322	2227
11	314	100	54	1030	756	97	1692	1487	140	2337	2245
12	333	112	55	1046	772	98	1708	1505	141	2352	2263
13	351	125	56	1061	789	99	1723	1522	142	2367	2281
14	369	139	57	1077	805	100	1738	1540	143	2381	2299
15	387	152	58	1093	822	101	1753	1557	144	2396	2317
16	405	166	59	1108	839	102	1768	1574	145	2411	2335
17	422	180	60	1124	855	103	1783	1592	146	2426	2352
18	440	194	61	1140	872	104	1798	1609	147	2441	2370
19	457	208	62	1155	889	105	1813	1627	148	2456	2388
20	474	222	63	1171	906	106	1828	1644	149	2470	2406
21	492	237	64	1186	922	107	1844	1662	150	2485	2424
22	509	251	65	1202	939	108	1859	1679	151	2500	2442
23	526	266	66	1217	956	109	1874	1697	152	2515	2460
24	543	281	67	1233	973	110	1889	1714	153	2530	2478
25	560	295	68	1248	990	111	1904	1732	154	2544	2496
26	577	310	69	1264	1007	112	1919	1750	155	2559	2513
27	593	325	70	1279	1024	113	1934	1767	156	2574	2531
28	610	341	71	1295	1040	114	1949	1785	157	2589	2549
29	627	356	72	1310	1057	115	1964	1802	158	2603	2567
30	643	371	73	1326	1074	116	1979	1820	159	2618	2585
31	660	387	74	1341	1091	117	1994	1838	160	2633	2603
32	676	402	75	1357	1108	118	2009	1855	161	2648	2621
33	693	418	76	1372	1126	119	2024	1873	162	2662	2639
34	709	433	77	1387	1143	120	2039	1890	163	2677	2657
35	725	449	78	1403	1160	121	2054	1908	164	2692	2675
36	742	465	79	1418	1177	122	2069	1926	165	2707	2693
37	758	480	80	1433	1194	123	2084	1943	166	2721	2711
38	774	496	81	1449	1211	124	2099	1961	167	2736	2729
39	790	512	82	1464	1228	125	2114	1979	168	2751	2747
40	807	528	83	1479	1245	126	2128	1997	169	2765	NA
41	823	544	84	1495	1263	127	2143	2014			
42	839	560	85	1510	1280	128	2158	2032			

NOTE: The first column is the number of bad results (ne)
The second column is the number of results for the pass limit (ns_p)
The third column is the number of results for the fail limit (ns_f)

A7.2.4.2 Pass fail decision rules

Having observed 0 bad results, pass the test at ≥77 results, otherwise continue

Having observed 1 bad result, pass the test at ≥106 results, otherwise continue

Having observed 2 bad results, pass the test at ≥131 results, otherwise continue

etc. until

Having observed 6 bad results, pass the test at ≥218 results, fail the test at ≤ 42 results, otherwise continue

Having observed 7 bad results, pass the test at ≥238 results, fail the test at ≤ 52 results, otherwise continue

etc. until

Having observed 168 bad results, pass the test at ≥2751 results, fail the test at ≤2747 results, otherwise continue

Having observed 169 bad results, pass the test at ≥2765 results, otherwise fail

NOTE: an ideal DUT passes after 77 results. The maximum test time is 2765 results.

A7.2.4.3 Background information to the pass fail limits

There is freedom to design the decision co-ordinates (ne,ns).

The binomial distribution and its inverse is used to design the pass and fail limits. Note that this method is not unique and that other methods exist.

$$\mathrm{fail}(ne, d_f) := \frac{ne}{(ne + \mathrm{qnbinom}(d_f, ne, ER))}$$

$$\mathrm{pass}(ne, cl_p, M) := \frac{ne}{(ne + \mathrm{qnbinom}(cl_p, ne, ER \cdot M))}$$

Where

fail(..) is the error ratio for the fail limit

pass(..) is the error ratio for the pass limit

ER is the specified error ratio 0.05

ne is the number of bad results. This is the variable in both equations

M is the Bad DUT factor M=1.5

d_f is the wrong decision probability of a single (ne,ns) co-ordinate for the fail limit.
It is found by simulation to be $d_f = 0.004$

cl_p is the confidence level of a single (ne,ns) co-ordinate for the pass limit.
It is found by simulation to be $cl_p = 0.9975$

qnbinom(..): The inverse cumulative function of the negative binomial distribution

The simulation works as follows:

A large population of limit DUTs with true ER = 0.05 is decided against the pass and fail limits.

cl_p and d_f are tuned such that CL (95%) of the population passes and D (5%) of the population fails.

A population of Bad DUTs with true ER = M*0.05 is decided against the same pass and fail limits.

cl_p and d_f are tuned such that CL (95%) of the population fails and D (5%) of the population passes.

This procedure and the relationship to the measurement is justified in clause A7.2.3.7. The number of DUTs decrease during the simulation, as the decided DUTs leave the population. That number decreases with an approximately exponential characteristics. After 169 bad results all DUTs of the population are decided.

NOTE: The exponential decrease of the population is an optimal design goal for the decision co-ordinates (ne,ns), which can be achieved with other formulas or methods as well.

Annex 8:
Void

Annex 9 (normative): GAN certificate

A9.1 Files relating to GAN certificate for testing

All files associated with the certificates to be used for authentication in IPSec are contained in archive GAN_certificate_V1.zip.

Files to be used both by MS and SS are contained in this archive.

The archive file set consists of the following:

-	Ca.key	
-	Ca.crt	
-	Segw.key	
-	Segw.csr	
-	Segw.crt	
-	_Command.txt	The commands performed to generate the above files
-	_Openssl.txt	Input file containing information required to generate above certificates (renamed from openssl.cnf)
-	_Exectution.txt	Activity log generated whilst above files are generated (also contains details of information prompted for during command execution)

A9.1.1 Overview and usage of certificate files

In a regular network (non-test) environment, a public certification authority (CA) would be used to generate a SEGW certificate (ca.crt) using the CA's private key and the network operator's information. For testing we are using our own test CA and have made available the test CA self-signed root certificate (self signing ca.crt).

Of the above files, the MS will need to store the test CA root certificate (ca.crt).

The SS will use the private key (segw.key) and certificate (segw.crt) for mutual authentication relating to the provisioning SEGW.

The SS vendor will use the test CA private key (ca.key) and test CA root certificate (ca.crt) to generate further certificates relating to the default and serving SEGWs.

A9.1.2 Privacy of private keys and usage of certificate

Since the private key relating to the root certificate is published here, there is no privacy, and thus no relationship of trust associated with this root certificate (ca.crt). It is of the utmost importance that the MS will only utilise this certificate for test purposes. For further details refer to TS 44.014.

Annex 10 (informative): Repeated SACCH Layer 1 Test Method:

A10.1 Details on Repeated SACCH Testing

Table A10.1.1 shows the PCL values exchanged in the L1 headers between a MS and SS during a typical session with zero block errors on time slot 0. On the DL the SS updates the commanded PCL every second SACCH interval as each SACCH block is repeated. The SS must complete the following actions during the period between the last burst of the UL SACCH and the first burst of the DL SACCH (26 frames):

- Decode the reported PCL in the UL SACCH L1 header.
- Determine the new PCL based on the reported PCL in the UL L1 header and the PCL commanded in the previous SACCH interval on the DL. The procedure used is specified in section 14.2.26 or 14.4.32.
- Format the data for the first burst in the DL SACCH L1 header.

Using the information in Table A10.1.1 as an example, the SS must complete the above steps between the end of FN 42106 and the start of FN 42132. The "Next Commanded PCL by SS" to use in FN 42132 is determined according to table 14.2.26-1 or 14.4.32-1, referring to the following parameters:

- The "Last Commanded PCL" is that used in the DL SACCH block that started at FN 42028,
- The "Corresponding Reported MS PCL" is that reported for the UL SACCH block that started at FN 42028.

The entries in table 14.2.26-1 or 14.4.32-1 are derived such that the "Next commanded PCL by SS" is chosen so that it is not equal to either the "Last commanded PCL by SS" or the "Corresponding Reported MS PCL". This ensures that the SS can detect all block error events. Only three PCL values are needed to ensure that all block error events are captured. The choice of PCL values 7, 8 and 9 are specified to ensure that all PCL values are within 2 steps of each other. This is to avoid rate limiting between changes in PCL values [see TS 45.008 subclause 4.7.1]. Note that PCL values 7, 8,and 9 were chosen to ensure all MSs, even those that do not support PCL values of 0, would work with these test cases.

Table A10.1.2 illustrates the specific case where an error only occurs in the first SACCH block of a repeated SACCH interval. Although this affects the SACCH block sequence that the SS receives from the MS, it does not alter its decisions as no block error occurs. In the case where only the second SACCH block of a repeated SACCH interval is in error, this is not detectable by the SS, however this is not a block error condition as the first SACCH block of the repeated SACCH interval was received without error.

Table A10.1.3 illustrates the specific case where an error occurs in the both the first and second SACCH blocks of a repeated SACCH interval. In this event, the SS detects the block error and the PCL sequence used by the SS is altered from the normal case in response to the sequence received from the MS.

Table A10.1.4 illustrates the specific case where multiple (in this case 4) sequential errors occur. In this event the SS detects two block errors and the PCL sequence used by the SS is altered from the normal case in response to the sequence received from the MS.

Table A10.1.1: Repeated SACCH Typical PCL Sequence (No Errors)

FN OF FIRST BURST OF SACCH	FN OF LAST BURST OF SACCH	SS DL COMMANDED PCL IN L1 HEADER	MS UL REPORTED PCL IN L1 HEADER	COMMENTS
…	…	…	…	
41508	41586	8	7	
41612	41690	8	7	
41716	41794	9	8	
41820	41898	9	8	
41924	42002	7	9	
42028	42106	7	9	
42132	42210	8	7	New SS commanded DL PCL of 8 chosen based on table 14.2.26-1 or 14.4.32-1.
42236	42314	8	7	SS does not update PCL for second SACCH in repeated SACCH interval.
42340	42418	9	8	
42444	42522	9	8	
…	…	…	…	

Table A10.1.2: Repeated SACCH Typical PCL Sequence (Single SACCH Block PCL Error)

FN OF FIRST BURST OF SACCH	FN OF LAST BURST OF SACCH	SS DL COMMANDED PCL IN L1 HEADER	MS UL REPORTED PCL IN L1 HEADER	COMMENTS
…	…	…	…	
41508	41586	8	7	
41612	41690	8	7	
41716	41794	9	8	
41820	41898	9	8	
41924	42002	7	8	First SACCH block of repeated SACCH interval received in error. Correct reported PCL from MS should be 9.
42028	42106	7	9	Second SACCH block of repeated SACCH interval received correctly
42132	42210	8	7	
42236	42314	8	7	
42340	42418	9	8	
42444	42522	9	8	
…	…	…	…	

Table A10.1.3: Repeated SACCH Typical PCL Sequence (Dual SACCH Block PCL Error)

FN OF FIRST BURST OF SACCH	FN OF LAST BURST OF SACCH	SS DL COMMANDED PCL IN L1 HEADER	MS UL REPORTED PCL IN L1 HEADER	COMMENTS
…	…	…	…	
41508	41586	8	7	
41612	41690	8	7	
41716	41794	9	8	
41820	41898	9	8	
41924	42002	7	8	First SACCH block of repeated SACCH interval received in error. Correct reported PCL from MS should be 9.
42028	42106	7	8	Second SACCH block of repeated SACCH interval received in error. Correct reported PCL from MS should be 9.
42132	42210	9	7	
42236	42314	9	7	
42340	42418	8	9	
42444	42522	8	9	
…	…	…	…	

Table A10.1.4: Repeated SACCH Typical PCL Sequence (Multiple SACCH Block PCL Error)

FN OF FIRST BURST OF SACCH	FN OF LAST BURST OF SACCH	SS DL COMMANDED PCL IN L1 HEADER	MS UL REPORTED PCL IN L1 HEADER	COMMENTS
…	…	…	…	
41508	41586	8	7	
41612	41690	8	7	
41716	41794	9	8	
41820	41898	9	8	
41924	42002	7	8	First SACCH block of repeated SACCH interval received in error. Correct reported PCL from MS should be 9.
42028	42106	7	8	Second SACCH block of repeated SACCH interval received in error. Correct reported PCL from MS should be 9.
42132	42210	9	8	First SACCH block of repeated SACCH interval received in error. Correct reported PCL from MS should be 7.
42236	42314	9	8	Second SACCH block of repeated SACCH interval received in error Correct reported PCL from MS should be 7.
42340	42418	7	9	
42444	42522	7	9	
42548	42626	8	7	
42652	42730	8	7	
…	…	…	…	