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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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1 Scope

The present document specifies for Mobile Stations (MS), for the digital cellular communications system and Personal Communication Systems (PCS) operating in the 900 MHz and 1800 MHz band (GSM900 and DCS1800), standardized by 3rd Generation Partnership Project (3GPP), those ME functions which are required for conformance testing purposes only. However, except for the Electrical Man Machine Interface (EMMI) and the Multi-slot TCH Loops, they are required for every mobile station.

For conformance tests, functions are activated via the radio interface, test SIM or dedicated pins. These functions must be capable of being activated when a test SIM is present but must not function with any other (e.g. network) SIM present except where otherwise stated within the present document. In this state, the MS must be able to perform all functions specified in the present document; in addition however, the special conformance testing functions must be operational.

The special conformance testing functions of the ME are enabled by use of a dedicated Subscriber Identity Module (test SIM, see 3GPP TS 51.010-1 Annex 4). SIM, in general, is described in 3GPP TS 51.011. The ME recognizes the test SIM by the Administrative Data Field.

The present document applies to the public land mobile radio service in the GSM900 and DCS1800 systems, using constant envelope modulation and operating on radio frequencies in the 900 and 1800 MHz bands respectively with a channel separation of 200 kHz and carrying 8 full rate channels or 16 half rate channels per carrier according to the TDMA principle.

The present document is part of the 3GPP TS series of technical specifications. The present document neither replaces any of the other GSM technical specifications or GSM related TS, nor is it created to provide full understanding of (or parts of) the GSM900 and DCS1800 systems.

The present document applies to the unit which includes the hardware to establish a connection across the radio interface.

1.1 Conventions

Unless explicitly stated otherwise, the following conventions apply:

- "EGPRS" refers to "EGPRS and EGPRS2".
- "EGPRS2" refers to "EGPRS2-A and EGPRS2-B".

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[3] 3GPP TS 44.018: "Mobile radio interface layer 3 specification; Radio Resource Control Protocol".

[4] 3GPP TS 51.010: "Mobile Station (MS) conformity specification".

[5] 3GPP TS 51.011: "Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[6] (void).

[7] 3GPP TS 34.109: "Logical Test Interface (FDD) Special conformance testing functions".

[8] 3GPP TS 22.101: "UMTS Service principles".

[9] 3GPP TS 45.010: "Radio subsystem synchronization".

[11] CCITT recommendation O.153 Fascicle IV.4, (Basic parameters for the measurement of error performance at bit rates below the primary rate, Melbourne 1988)

[12] 3GPP TS 43.064: "Overall description of the GPRS radio interface; Stage 2".

3 Definitions, conventions, and applicability

For abbreviations and acronyms, see 3GPP TS 21.905.

3.1 Mobile station definition and configurations

In the present document, a MS can be:

- a vehicle mounted station;
- a portable station;
- a handheld station;
- a vehicle mounted/portable station;
- a vehicle mounted/handheld station.

For a more detailed description of MS-configurations, see 3GPP TS 22.101.

3.2 Applicability

The present document is applicable to all MSs.

4 Activation and deactivation of special test functions in the MS

The functions described in the present document can be activated and deactivated from a SS by sending appropriate layer 3 commands to the MS. The protocol discriminator to be used is defined in 3GPP TS 44.018, sub-clause 10.2.

The layer 3 commands are sent on the DCCH. On layer 2, SAPI 0 is used in acknowledged mode.

Apart from sending the appropriate deactivation command to the MS the functions can be deactivated by switching off the MS or removing the test SIM.

The following test functions can be activated (and deactivated):

- TCH Loop;
- TCH Burst-by-Burst Loop;

- Multi-slot Loop;
- Electrical MMI;
- Test via DAI.
- Reset MS Positioning Stored Information (activation only)

The TCH loops and the test via DAI are test functions which are mutually exclusive.

5 Internal test loops

A number of internal test loops are required providing access to isolated functions of the MS without introducing new physical interfaces just for the reason of type approval testing. Fig 5-1 shows a functional block diagram of a reference MS containing the different test loops.

NOTE: It should be emphasized that these test loops only describe the functional behaviour of the MS with respect to its external interfaces; physical implementation of the loops is completely left open to the manufacturer.

A particular loop is activated in an MS by transmitting the appropriate command message to the MS.

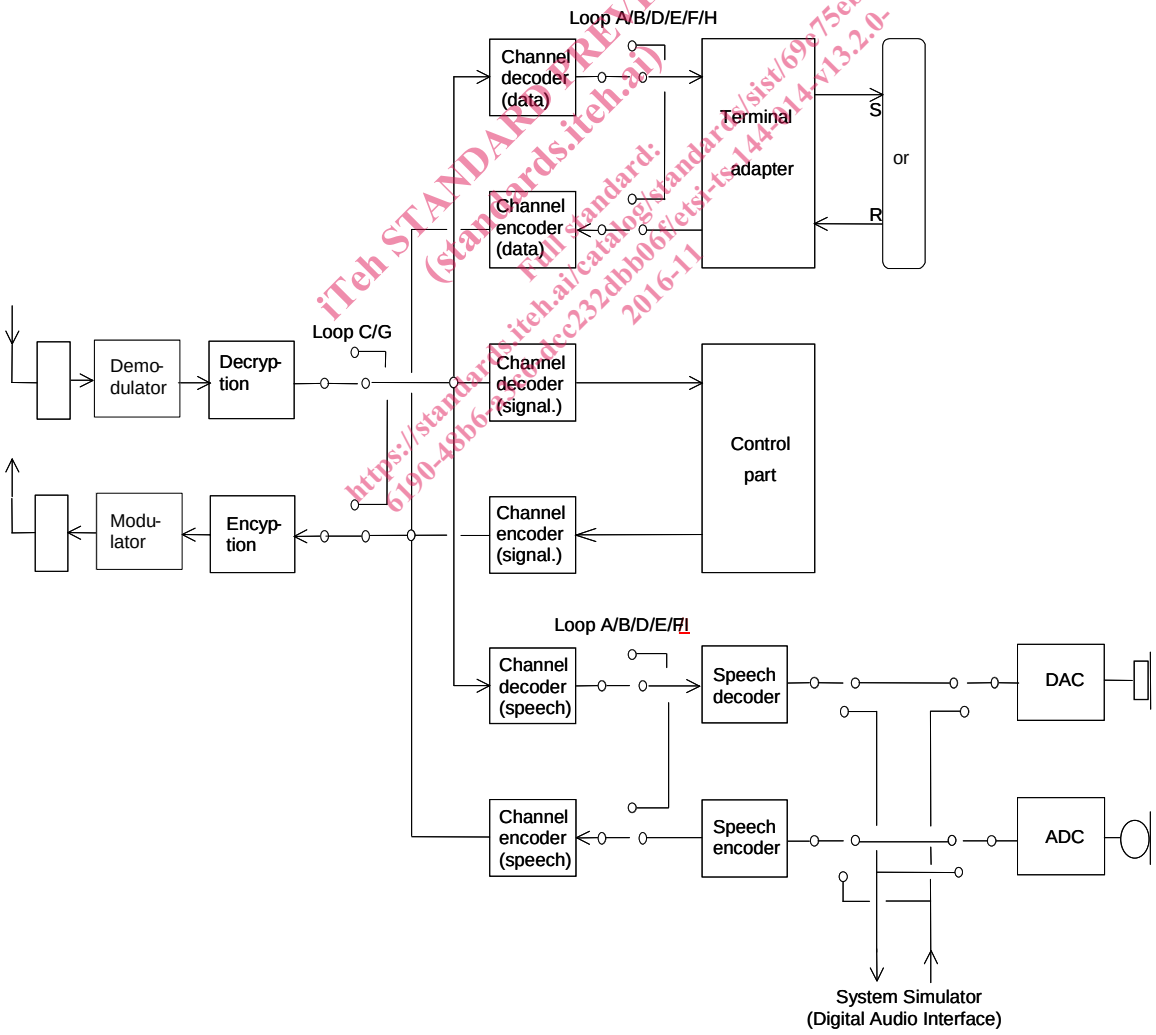

Figure 5: Test loops in the MS

5.1 Single-slot TCH loops

5.1.1 Purpose of Single-slot TCH loops

To establish a transparent loop for TCH blocks a TCH must be active between the SS and MS. The TCH may be full or half rate, speech or data of any rate specified in the GSM system.

Seven types of Single-slot TCH loop back are defined.

1: The first (A) includes the signalling of erased frames and is used to determine Frame Erasure Ratio (FER) and Residual Bit Error Ratio (RBER) for speech TCH and Bit Error Ratio (BER) for any data TCH.

In case of TCH/AFS, TCH/AHS, TCH/WFS, O-TCH/WFS and O-TCH/WHS, it also includes the signalling of erased valid SID_UPDATE and RATSCCH frames and is used to determine Erased Valid SID_UPDATE Frame Rate (EVSIDUR) and Erased Valid RATSCCH Frame Rate (EVRFR).

2: The second type (B) is required to determine Class II bit error ratio for the speech TCH.

3: With the third loop (C) the 114 information bits of each TCH burst (excluding stealing flags) prior to applying benefit of the channel decoder, but after decryption, shall be transmitted in an uplink burst. (Equivalent error rate to TCH/FS Class II). All that is received shall be re-transmitted regardless of the state of the received midamble. The midamble in the uplink bursts shall be the normal midamble used by the MS. SACCH and idle bursts are not looped back.

4: The fourth loop (D) includes the signalling of erased frames and unreliable frames and is used to determine Unreliable Frame Ratio (UFR) and Residual Bit Error Ratio (RBER) for TCH/HS.

5: The fifth loop (E) includes the signalling of erased SID frames and is used to determine Erased SID Frame Rate (ESIDR) and Residual Bit Error Ratio (RBER) for TCH/HS.

6: The sixth loop (F) includes the signalling of erased valid SID frames and is used to determine Erased Valid SID Frame Rate (EVSIDR) and Residual Bit Error Ratio (RBER) for TCH/HS.

7: The seventh loop (I) is required to determine frame error rate for the in-band channel.:

- TCH-AFS-INB FER
- TCH-AHS-INB FER
- TCH-WFS-INB FER
- O-TCH/WFS-INB FER
- O-TCH/WHS-INB FER

NOTE: Measurement of TCH/FS chip BER is approximately five times faster using loop C rather than loop B.

5.1.2 TCH loop including signalling of erased frames (A)

5.1.2.1 Procedure

The SS orders the MS to close its TCH loop by transmitting a CLOSE_TCH_LOOP_CMD message, specifying the TCH to be looped and that erased frames are to be signalled by the MS. The SS then starts timer TT01.

If no TCH is active, or any test loop is already closed, the MS shall ignore any CLOSE_TCH_LOOP_CMD message.

If a TCH is active, the MS shall close its TCH loop for the TCH specified and send back to the SS a CLOSE_TCH_LOOP_ACK message. Upon reception of that message the SS stops timer TT01.

After the MS has closed its TCH loop, every good speech frame or any user data frame received by the MS on the specified TCH (downlink) shall be taken from the output of the channel decoder, input to the channel encoder and transmitted on the same TCH (uplink).

In the case where TCH is TCH/FS, the MS shall loop back the 260 bits after normal channel decoding.

In the case where TCH is TCH/EFS, the MS shall loop back the 244 bits after normal and preliminary channel decoding.

In the case where TCH is TCH/HS, the MS shall loop back the 112 bits after normal channel decoding.

In the case where a TCH/AFS, TCH/AHS, TCH/WFS, O-TCH/WFS or O-TCH/WHS is used, the MS shall loop back the number of bits carried by the downlink speech frame, after normal channel decoding.

If the channel decoder detects a bad speech frame, then this shall be signalled to the SS by setting the input frame to the channel encoder to zero's, and transmitting on the TCH (uplink).

For all TCH, except TCH/AFS, TCH/AHS, TCH/WFS, O-TCH/WFS or O-TCH/WHS, if the MS decodes stealing flags as indicating an FACCH frame, then there is no defined response for the MS to the channel encoder for transmission on the TCH (uplink). The FACCH channel shall operate as normal.

The following requirements apply when TCH is TCH/AFS, TCH/AHS, TCH/WFS, O-TCH/WFS or O-TCH/WHS:

- The Active Codec Set (ACS) may contain between one and four codec modes.
- When the ACS contains more than one codec mode then:
  - The MS shall ignore the downlink codec mode commands received from the SS.
  - The MS shall use for the uplink the codec mode used for the decoding of the DL speech frame being looped back.
  - The MS shall not generate or send codec mode requests. All in band signalling fields (Uplink CMI and CMR) shall be used to indicate the codec mode of the looped back frame. In other words, all uplink in band signalling codewords carry a codec mode indication.
  - The MS may change codec mode indication every uplink frame when consecutive frames are not decoded with the same decoder, even if those frames were associated with the same downlink CMI.
  - When looping back any of the following frame types: NO_DATA, RATSCCH, SID_UPDATE, SID_UPDATE_INH, SID_FIRST, SID_FIRST_P1, SID_FIRST_P2 or SID_FIRST_INH, the MS shall use the codec mode of the previous uplink frame.
- The number of bits that the MS loops back depends on the codec mode used by the MS to decode the downlink frame being looped back. The MS shall loop back the bits from interface 1 (See TS 45.003 figure 1b) of the downlink channel decoder to interface 1 of the uplink channel encoder, i.e. data delivered to the encoding unit: d(k) for k = 0,1,...,K_d-1. (See TS 45.003 sub-clause 2.2).
- Frames in uplink are transmitted using TX_TYPE = SPEECH_GOOD, whatever RX_TYPE decoded in downlink.

NOTE: The definitions of TX_TYPE and RX_TYPE are as per TS 26.093.

- After the MS has closed its TCH loop, the parameters of every valid SID_UPDATE frame (RX_TYPE = SID_UPDATE and BFI = 0) received by the MS on the specified TCH (downlink), shall be taken from the output of the downlink channel decoder, input to the uplink channel encoder, using TX_TYPE = SPEECH_GOOD, and transmitted on the same TCH (uplink). The SID_UPDATE parameters shall occupy the first 35 bits of the speech frame, all other bits of the speech frame shall be set to 0.
- For TCH/AHS or O-TCH/WHS, since a SID_UPDATE occupies two speech frames, the expected uplink sequence shall be:
  - SPEECH (data as all zeros) followed by SPEECH (parameters from SID_UPDATE)
- If the channel decoder detects an erased valid SID_UPDATE frame (RX_TYPE = SID_BAD, BFI = 1), then this shall be signalled to the SS by setting the input frame to the uplink channel encoder to zero's, using TX_TYPE = SPEECH_GOOD, and transmitting on the TCH (uplink).
  - For TCH/AHS or O-TCH/WFS, each erased valid SID_UPDATE shall result in 2 SPEECH frames with all zero data sent on the uplink.

- After the MS has closed its TCH loop, a RATSCCH message shall not be interpreted by the MS. RATSCCH protocol shall be de-activated and the MS shall not send any form of RATSCCH_ACKnowledgment.

- RATSCCH data of every valid RATSCCH frame (RX_TYPE = NO_DATA (RATSCCH) and BFI = 0) received by the MS on the specified TCH (downlink), shall be taken from the output of the downlink channel decoder, input to the uplink channel encoder, using TX_TYPE = SPEECH_GOOD (for TCH/AFS, TCH/AHS, TCH/WFS, O-TCH/WFS or O-TCH/WHS), and transmitted on the same TCH (uplink). The bit content of the RATSCCH message for TCH/AFS or TCH/WFS or O-TCH/WFS, or RATSCCH_DATA for TCH/AHS or O-TCH/WHS shall occupy the first 35 bits of the speech frame, all other bits of the speech frame shall be set to 0.

- For TCH/AHS or O-TCH/WHS, since each RATSCCH_DATA must be preceded by RATSCCH_MARKER, where 2 downlink frames are fully populated by the RATSCCH_MARKER and RATSCCH_DATA, the expected uplink sequence shall be:

  - SPEECH (data as all zeros) followed by SPEECH (data from RATSCCH_DATA)

- If the channel decoder detects an erased valid RATSCCH frame (RX_TYPE = NO_DATA (RATSCCH) and BFI = 1), then this shall be signalled to the SS by setting the input frame to the uplink channel encoder to zero's, using TX_TYPE = SPEECH_GOOD (for TCH/AFS, TCH/AHS, TCH/WFS, O-TCH/WFS or O-TCH/WHS), and transmitting on the TCH (uplink).

  - For TCH/AHS, each erased valid RASTCCH shall result in 2 SPEECH frames with all zero data sent on the uplink.

- If the channel decoder detects an ONSET frame (RX_TYPE = ONSET) or SID_FIRST frame (for TCH/AFS or TCH/WFS or O-TCH/WFS only, RX_TYPE = SID_FIRST) or a SID_FIRST_P1 frame (for TCH/AHS or O-TCH/WHS only, RX_TYPE = SID_FIRST) or a NO_DATA frame (RX_TYPE = NO_DATA, not resulting from a RATSCCH) then this shall be signalled to the SS by setting the input frame to the uplink channel encoder to zero's, using TX_TYPE = SPEECH_GOOD (for TCH/AFS, TCH/AHS, TCH/WFS, O-TCH/WFS or O-TCH/WHS) and transmitting on the TCH (uplink).

- For TCH/AHS or O-TCH/WHS, if the channel decoder detects a SID_FIRST_P2 frame or a SID_FIRST_INH or SID_UPDATE_INH frame then this shall be signalled to the SS by setting the input frame to the uplink channel encoder to zero's, using TX_TYPE = SPEECH_GOOD (for TCH/AFS, TCH/AHS, TCH/WFS, O-TCH/WFS or O-TCH/WHS) and transmitting on the TCH (uplink).

5.1.3 Speech TCH loop without signalling of erased frames (B)

5.1.3.1 Procedure

The SS orders the MS to close its TCH loop by transmitting a CLOSE_TCH_LOOP_CMD message, specifying the TCH to be looped. The SS then starts timer TT01.

If no TCH is active or any test loop is already closed, the MS shall ignore any CLOSE_TCH_LOOP_CMD message.

If a TCH is active, the MS shall close its TCH loop for the TCH specified and send back to the SS a CLOSE_TCH_LOOP_ACK. Upon reception of that message the SS stops timer TT01.

After the MS has closed its TCH loop, any speech frame received by the MS on the specified TCH (downlink) shall be taken from the output of the channel decoder, input to the channel encoder, and transmitted on the same TCH (uplink).

In the case where TCH is TCH/FS, the MS shall loop back the 260 bits after normal channel decoding.

In the case where TCH is TCH/EFS, the MS shall loop back the 244 bits after normal and preliminary channel decoding.

In the case where TCH is TCH/HS, the MS shall loop back the 112 bits after normal channel decoding.

In the case where a TCH/AFS or TCH/AHS is used, the MS shall loop back the number of bits carried by the downlink speech frame, after normal channel decoding.

The SS should avoid using the FACCH downlink in this situation until the test is complete.

All requirements defined for Loop A when TCH is TCH/AFS or TCH/AHS also apply to Loop B, except that: