

Agenda Item: 4.3, 4.4

Source: Ericsson

Title: Use of air interface to implement the Logical Test Interface

Document for: Discussion

Physical interface aspects

The physical interface used to implement the Logical Test Interface should be based on the air interface. This is justified by:

- The conditions applied when testing the terminal equipment should be as close as possible to the operating conditions when used in a real network.
- The use of temporary wires to get access to the test interface would have impact on the RF behaviour of the terminal equipment under test.
- Introducing a physical connector for test purposes would introduce additional cost to the terminal equipment.

By using the existing air interface the test conditions will be much the same as when the terminal equipment is operating in a real network, the risk that the test set-up introduces RF interference is minimised, and it provides for a cost efficient solution as no additional hardware is required.

In GSM testing the air interface is used as the logical test interface, see example below.

Signalling & protocol aspects

The Logic Test Interface as described in documents T1R99002 and T1R99003 propose a set of parameters to be controlled via a logical test interface. These parameters are the same as those negotiated between the base station and the mobile station (MS) during MS operation in a network. Thus a MS would have to implement two protocols to provide the same function. This document propose to use the same principle as used in the GSM test specification today, i.e. to re-use the normal signalling protocol between the MS and the System Simulator (tester) to set and request MS parameters.

Specific message to control test loop back, as identified in section 5.3.2 (Test mode) of T1R99002 has to be defined, but should also be signalled using the normal signalling protocol.

To illustrate the principle the GSM 11.10-1 test case "14.1.1.1 Bad frame indication - TCH/FS - Random RF input" is enclosed to the document. Also the generic call set up procedure (specified in section 10 of GSM 11.10-1, section 10.1) referenced by the test case is enclosed.

In section "14.1.1.1.4.1 Initial conditions" it can be seen that before the test is started a call should be set up according to the generic call set up procedure using:

- a specific traffic channel (TCH/FS);
- a certain Absolute Radio Frequency Number (ARFCN); and
- a power control level set to maximum power.

The system simulator (tester) also commands the MS to complete the traffic channel loop back.

Extract from GSM 11.10-1 version 5.7.0:

14.1.1.1 Bad frame indication - TCH/FS - Random RF input

14.1.1.1.1 Definition and applicability

The performance of the Bad Frame Indication (BFI) is a measure of the effectiveness of the MS under DTX conditions. It includes the effect of the 3 bit Cyclic Redundancy Check (CRC) and all other processing associated with the DTX function. The BFI is measured on a full rate speech TCH (TCH/FS) by counting the number of undetected bad frames whilst the input signal is a randomly modulated carrier.

The requirements and this test only apply to MS supporting speech.

14.1.1.1.2 Conformance requirement

On a full rate speech TCH (TCH/FS) with a random RF input, the overall reception performance shall be such that, on average, less than one undetected bad speech frame (false bad frame indication) in 60 seconds will be measured; GSM 05.05, 6.4 b

14.1.1.1.3 Test purpose

1. To verify that the BFI performance does not exceed the conformance requirement with an allowance for the statistical significance of the test.
2. To verify that on reception of a SID frame the BFI is not set.

14.1.1.1.4 Method of test

14.1.1.1.4.1 Initial conditions

A call is set up according to the generic call set up procedure on a TCH/FS with an ARFCN in the Mid ARFCN range, power control level set to maximum power.

The SS commands the MS to complete the traffic channel loop back and signal the bad frame indication.

NOTE: DTX is used during the test to prevent the MS dropping the call.

14.1.1.1.4.2 Procedure

- a) The SS simulates a BSS in DTX mode. During the period when no transmission would occur the SS transmits a GSM carrier modulated with random data at a level 11 dB above reference sensitivity level(). The SACCH is transmitted normally at a level 20 dB above reference sensitivity(). The SID frame is transmitted in its correct time interval with valid information at a level 20 dB above reference sensitivity level(). During transmission of SACCH or SID frames the random data is discontinued.
- b) The SS transmits at least the minimum number of samples of frames of TCH/FS information and checks the BFI of the looped back signal from the MS. The SS records the number of frames where the bad frame indication is not set. During transmission by the SS of SID frames the SS checks that the BFI is not set.

NOTE 1: Further explanations on the mechanism of signalling the BFI to the SS will be found in clause 36.

NOTE 2: In some cases the MS decodes half SID frames correctly even if these are not transmitted completely. Therefore, in case that a MS detects a good SID frame, the SS has to consider the received bits in detail.

14.1.1.1.5 Test requirements

The BFI performance is accepted if the measured rate of undetected bad frames does not exceed the test limit error rate:

Test limit error rate: 0,041 %

Minimum number of samples: 492 000 (excluding SID frames).

During loop back of SID frames no BFI shall be set.

Extract from GSM 11.10-1 version 5.7.0:

10.1 Generic call set-up procedure for mobile terminating speech calls

In the test procedures described in this EN, unless otherwise stated in the test description, the Mobile Terminating Speech call set-up procedure shall be as described in this subclause.

NOTE: In test cases where a fading profile is required, a different and appropriate ARFCN may be selected, for instance if the fading simulator bandwidth does not allow use of the default ARFCN.

10.1.1 Initial conditions

System Simulator:

1 cell, default parameters.

Mobile Station:

- The MS shall be operated under normal test conditions (see annex 1 TC.2.1)
- The special Test-SIM (see annex 4) shall be inserted.
- The MS is "idle, updated", with a TMSI assigned and listening to the BCCH/CCCH of the active cell.

10.1.2 Definition of system information messages

The following parameters shall be coded into the system information messages. Parameters shall be coded according to GSM 04.08.

The RACH Control Parameters IE shall be the same in SYSTEM INFORMATION TYPE 1, TYPE 2, TYPE 3 and TYPE 4 messages.

The Location Area Identification IE, Cell Selection Parameters IE, and P1 bit shall be the same in SYSTEM INFORMATION TYPE 3 and TYPE 4 messages.

SYSTEM INFORMATION TYPE 1

Information Element	Value/remark
Cell channel description	Includes the hopping sequence ARFCNs, if hopping is used
RACH control parameters	
MAX RETRANS	Any Value
TX-INTEGER	Any Value
CELL BAR ACCESS	Not barred
CALL RE-ESTABLISHMENT	Not Allowed
EMERGENCY CALL	Allowed
ACCESS CONTROL CLASS	None Barred
(0...9, 11...15)	
SII rest octets	Spare Octets

SYSTEM INFORMATION TYPE 2

Information Element	Value/remark
BCCH Frequency list	Indicates seven surrounding cells on any ARFCN of the supported band, excluding ARFCNs in or immediately adjacent to those specified in subclause 6.2
NCC permitted NCC PERMITTED	e.g. all NCCs permitted
RACH control parameters	
MAX RETRANS	Any Value
TX-INTEGER	Any Value
CELL BAR ACCESS	Not barred
CALL RE-ESTABLISHMENT	Not Allowed
EMERGENCY CALL	Allowed
ACCESS CONTROL CLASS (0...9, 11...15)	None Barred

SYSTEM INFORMATION TYPE 3

Information Element	Value/remark
Cell identity	
CI VALUE	0001 hex (not relevant)
Location Area Identification	
MCC	001 decimal (not relevant)
MNC	01 decimal (not relevant)
LAC	0001 hex (not relevant)
Control Channel Description	
ATT (IMSI att/det)	MS shall not apply (not relevant)
BS-AG-BLKS-RES	0 blocks reserved (not relevant)
CCCH-CONF	Combined CCCH/SDCCH (not relevant)
BS-PA-MFRMS	5 multiframes (not relevant)
T3212	Infinite
Cell options	
PWRG	power control not set
DTX	MS must not use DTX
RADIO LINK TIME-OUT	8
Cell selection parameters	
CELL RESELECT HYSTERESIS	0 dB
MS-TXPWR-MAX-CCH	Max. output power of MS
RXLEV-ACCESS-MIN	-90 dBm
ACS	There are no additional cell parameters included in SI7 and SI8
NECI	New establishment cause not supported
RACH control parameters	
MAX RETRANS	Any Value
TX-INTEGER	Any Value
CELL BAR ACCESS	Not barred
CALL RE-ESTABLISHMENT	Not Allowed
EMERGENCY CALL	Allowed
ACCESS CONTROL CLASS (0...9, 11...15)	None Barred
SI3 rest octets	
P1	C2 parameters not present

SYSTEM INFORMATION TYPE 4

Information Element	Value/remark
Location Area Identification	
MCC	001 decimal (not relevant)
MNC	01 decimal (not relevant)
LAC	0001 hex (not relevant)
Cell selection parameters	
CELL RESELECT HYSTERESIS	0 dB
MS-TXPWR-MAX-CCH	Max. output power of MS
RXLEV-ACCESS-MIN	-90 dBm
RACH control parameters	
MAX RETRANS	Any Value
TX-INTEGERS	Any Value
CELL BAR ACCESS	Not barred
CALL RE-ESTABLISHMENT	Not Allowed
EMERGENCY CALL	Allowed
ACCESS CONTROL CLASS (0...9, 11...15)	None Barred
CBCH Channel Description	Omitted
CBCH Mobile Allocation	Omitted
SI4 rest octets	
P1	C2 parameters not present

SYSTEM INFORMATION TYPE 5

Information Element	Value/remark
Neighbour cell description	As Cell Channel Description in SI 1

SYSTEM INFORMATION TYPE 6

Information Element	Value/remark
Cell identity	
CI VALUE	0001 hex (not relevant)
Location Area Identification	
MCC	001 decimal (not relevant)
MNC	01 decimal (not relevant)
LAC	0001 hex (not relevant)
Cell options	
PWRC	power control not set
DTX	MS must not use DTX
RADIO LINK TIME-OUT	8
NCC permitted	
NCC PERMITTED	e.g. all NCCs permitted

10.1.3 Procedure

An MS terminating call on a TCH/FS shall be established under ideal radio conditions and with Timing advance set to 0, as follows:

Step	Direction	Message	Comments
1	SS -> MS	PAGING REQUEST TYPE 1	Sent on the correct paging subchannel
2	MS -> SS	CHANNEL REQUEST	Establishment cause indicates "answer to paging"
3	SS -> MS	IMMEDIATE ASSIGNMENT	
4	MS -> SS	PAGING RESPONSE	Message is contained in SABM
5	SS -> MS	AUTHENTICATION REQUEST	
6	MS -> SS	AUTHENTICATION RESPONSE	SRES specifies correct value
7	SS -> MS	CIPHERING MODE COMMAND	SS starts deciphering after sending the message
8	MS -> SS	CIPHERING MODE COMPLETE	Shall be sent enciphered. All following messages shall be sent enciphered
9	SS		SS starts ciphering
10	SS -> MS	SETUP	Message contains the signal IE
11	MS -> SS	CALL CONFIRMED	
A12	MS -> SS	CONNECT	
B12	MS -> SS	ALERTING	An alerting indication as defined in a PICS/PIXIT statement given by the MS
B13	MS		The MS is made to accept the call in a way described in a PICS/PIXIT statement
B14	MS		
B15	MS -> SS	CONNECT	
16	SS -> MS	ASSIGNMENT COMMAND	
17	MS -> SS	ASSIGNMENT COMPLETE	
18	MS		The TCH is through connected in both directions
19	SS -> MS	CONNECT ACKNOWLEDGE	

10.1.4 Specific message contents

PAGING REQUEST TYPE 1 (GSM 04.08, 9.1.22) to the MS

Information Element	Value/remark
Protocol Discriminator	RR
Skip Indicator	0000
Message Type	
Page Mode	Normal Paging
Channel Needed	spare, any channel
Mobile Identity 1	
Odd/even no of digits	As applicable for TMSI
Type of Identity	TMSI
Identity digits	As applicable
Mobile Identity 2	Omitted
P1 rest octets	Spare octets

IMMEDIATE ASSIGNMENT (GSM 04.08, 9.1.18) to the MS

Information Element	Value/remark
Protocol Discriminator	RR
Skip Indicator	0000
Message Type	
Page Mode	Normal
Channel Description	
Channel Type	SDCCH/SACCH 1(4)
Time slot number	zero
Training seq. code	same as BCCH
Hopping	No
ARFCN	ARFCN of the BCCH
Random Reference	
Random access info	As in CHAN REQ
N51, N32, N26	As applicable
Timing Advance	0
Mobile allocation	length 0 due to hopping
IA rest octets	Spare octets

AUTHENTICATION REQUEST (GSM 04.08, 9.2.2) to the MS

Information Element	Value/remark
Protocol Discriminator	MM
Skip Indicator	0000
Message Type	
Ciphering key seq. number	Arbitrary
Authent. parameter RAND	Arbitrary

CIPHERING MODE COMMAND (GSM 04.08, 9.1.9) to the MS

Information Element	Value/remark
Protocol Discriminator	RR
Skip Indicator	0000
Message Type	
Ciphering mode setting	Start ciphering
Algorithm Identifier	Supported by the MS
Cipher Response	IMEISV shall not be included

SETUP (GSM 04.08, 9.3.23) to the MS

Information Element	Value/remark
Protocol Discriminator	CC
Transaction Identifier	SS orig.
Message Type	
Signal	any non-reserved value
Bearer capability 1	Appropriate for the basic service selected for the test or omitted

ASSIGNMENT COMMAND (GSM 04.08, 9.1.2) to the MS

Information Element	Value/remark
Protocol Discriminator	RR
Skip Indicator	0000
Message Type	
Channel Description	
Channel type	Bm + ACCHs
Time slot number	Arbitrary
Training seq. code	Default
Hopping	No
ARFCN	Default
Power level	Power control level 7
Channel mode	Speech full rate

CONNECT ACKNOWLEDGE (GSM 04.08, 9.3.6) to the MS

Information Element	Value/remark
Protocol Discriminator	CC
Transaction Identifier	SS orig.
Message Type	

