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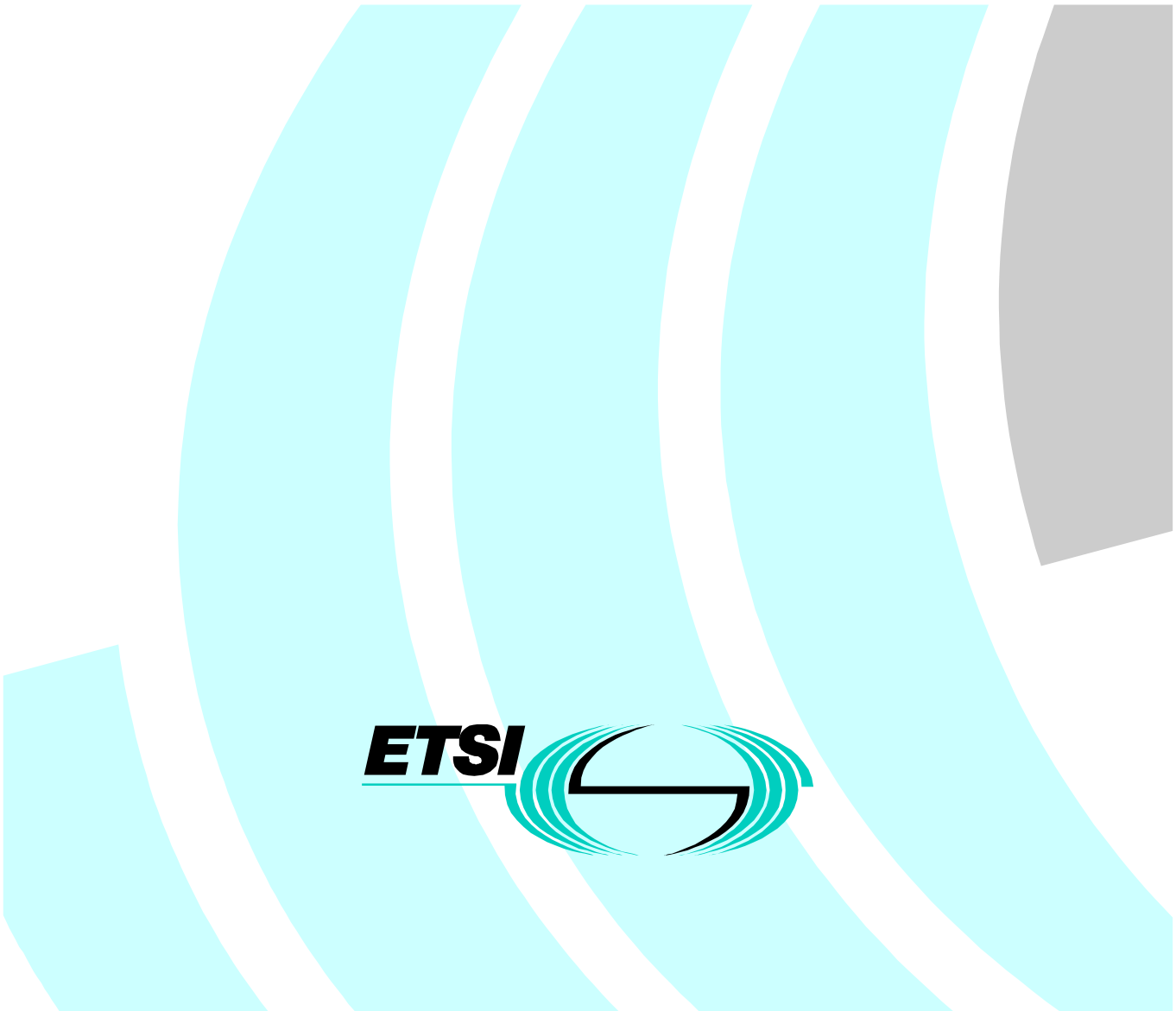
European Standard (Telecommunications series)

Terrestrial Trunked Radio (TETRA); Conformance testing specification; Part 4: Protocol testing specification for Direct Mode Operation (DMO); Sub-part 12: Test Suite Structure and Test Purposes (TSS&TP) for Repeater type 2



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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Project Terrestrial Trunked Radio (TETRA), and is now submitted for the Vote phase of the ETSI standards Two-step Approval Procedure.

The present document had been submitted to Public Enquiry as ETS 300 394-4-12. During the processing for Vote it was converted into an EN.

The present document is part 4 of a multi-part deliverable covering Terrestrial Trunked Radio (TETRA); Conformance testing specification, as identified below:

Part 1: "Radio";

Part 2: "Protocol testing specification for Voice plus Data (V+D)";

Part 3: "Protocol testing specification for Packet Data Optimized (PDO)";

Part 4: "Protocol testing specification for Direct Mode Operation (DMO)";

Part 5: "Security".

Proposed national transposition dates	
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1 Scope

The present document contains the Test Suite Structure (TSS) and Test Purposes (TPs) to test the TETRA Direct Mode Operation (DMO) protocols. The present document is divided into several parts, each one dealing with a different set of layer 3 and layer 2 DMO protocols. This present part 4, sub-part 12 deals with TSS&TP for Direct Mode Repeater type 2 (DM-REP2) Air Interface protocol, data link layer 2 only, while part 4, sub-part 1 deals with TSS&TP for DM MS to MS protocol and part 4, sub-part 11 deals with DM-MS operating through Repeater type 2 (MS-REP2) Air Interface protocol.

Testing of security features is outside the scope of the present document.

The objective of this test specification is to provide a basis for approval tests for TETRA equipment giving a high probability of air interface inter-operability between different manufacturer's TETRA equipment.

The ISO/IEC standard for the methodology of conformance testing, ISO/IEC 9646-1 [3] and ISO/IEC 9646-2 [4], as well as the ETSI methodology for conformance testing, ETS 300 406 [5], are used as the basis for the test methodology.

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.

[1] ETSI EN 300 396-7: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 7: Type 2 repeater air interface".

[2] ETSI EN 300 396-8-4: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 8: Protocol Implementation Conformance Statement (PICS) proforma specification; Sub-part 4: Type 2 repeater Air Interface (AI)".

[3] ISO/IEC 9646-1 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".
(See also ITU-T Recommendation X.290).

[4] ISO/IEC 9646-2 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification".
(See also CCITT Recommendation X.291).

[5] ETSI ETS 300 406 (1995): "Methods for Testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

[6] ETSI EN 300 396-8-2: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 8: Protocol Implementation Conformance Statement (PICS) proforma specification; Sub-part 2: Type 1 repeater Air Interface (AI)".

3 Definitions and abbreviations

3.1 TETRA definitions

For the purposes of the present document, the terms and definitions given in EN 300 396-7 [1] apply.

3.2 ISO/IEC 9646 abbreviations

For the purposes of the present document, the following ISO/IEC 9646-1 [3] abbreviations apply:

ICS	Implementation Conformance Statement
IUT	Implementation Under Test
IXIT	Implementation eXtra Information for Testing
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
TP	Test Purpose
TSS	Test Suite Structure

3.3 TETRA abbreviations

For the purposes of the present document, the following TETRA abbreviations apply:

CM	Circuit Mode
DMO	Direct Mode of Operation
MAC	Medium Access Control
MS	Mobile Station
RX	Receiver
SDS	Short Data Services
SDU	Service Data Unit

4 Test Suite Structure (TSS)

4.1 MAC layer test groups

The first level of the MAC test groups separates the MAC test suite in functional test groups: CA, BV, BI and TI.

The following list defines the MAC layer test group names and identifiers:

- DM-REP2 MAC layer (DMO_DMREP2_MAC)
  - Capability tests (CA)
  - Valid behaviour tests (BV)
  - Invalid behaviour tests (BI)
  - Timer tests (TI)

4.2 Test group description

Capability (CA) tests provide limited testing that the observable capabilities of the IUT are in accordance with the conformance requirements and the additional capabilities claimed in the PICS/PIXIT.

The Valid Behaviour (BV) group tests an IUT in response to valid behaviour of the test system. "Valid" means that a test event is syntactically and contextually correct. All test cases in the valid behaviour group are intended to verify as thoroughly as possible the various functions of the protocol.

Different timers are defined to supervise the various state transitions. The Timer (TI) test group is intended to verify that the IUT is reacting properly to an expiry of one of the timers or to a counter mismatch.

5 Introduction to Test Purposes (TPs)

The test purposes are defined in clause 6 of the present document for MAC layer.

5.1 Test purpose definition conventions

Each TP is described using text presented in a table.

Table 1 contains the following information.

Table 1

TP-Name The TP name is a unique identifier, specified according to the TP naming conventions defined in the clause below. (it is also the name of the corresponding test case)	**Requirement ref**: reference to the clause number of specification EN 300 396-7 [1] stating this conformance requirement. For example: EN 300 396-7 [1], 6.2.5.1
Purpose	purpose of the test itself, indicating for example the test performed against a requirement of the protocol, described by this test purpose. Example: test of changeover initiated from RX reservation state
Selection cond	expression based on EN 300 396-8-4 [2] PICS statements, used to select or deselect the corresponding test case according to the options of the implementation.
Test description	body of the test
Pass criteria	visible action to be observed at PCO to declare that the IUT passes the test and conforms to the specifications
Preamble	"None" or name of the preamble procedure bringing the IUT from idle state to the state required to run the test.
Postamble	"None" or name of the postamble to bring the IUT back to idle state.

5.2 Test purpose naming conventions

The identifier of a test purpose is built according to table 2.

Table 2: Test purpose naming convention

DMO/<ts>/<tt>/<nn>		
<ts> = test suite type	DMREP2	DM Repeater type 2
<tt> = Type of testing	CA	Capability Tests
	BV	Valid Behaviour Tests
	BI	Invalid Behaviour Tests
	TI	Timer expiry and counter mismatch tests
<nn> = sequential number	01-99	Test Purpose Number

5.3 Selection expressions

A test case, based on a test purpose described here, can be selected or deselected from the test suite, according to the evaluation of selection expressions which reflect the capabilities supported or not by the implementation under test.

6 DM-REP2 test purposes

In this test purpose description, the following test configuration is defined: the IUT is a DM-REP2. The main tester is a MS connected to a Repeater type 2 (MS-REP2) and it plays the role of the master of the call. A parallel tester plays the role of the slave. Most of the tests verify that the repeater re-transmits properly what is received from the main tester to the parallel tester, and from the parallel tester to the main one.

6.1 DM-REP2 MAC layer

6.1.1 DM-REP2 MAC capability tests

Test group objective: To test MAC basic capability

- fill bit mechanism.

DMO_MSREP2_MAC_CA_01	**Reference: EN 300 396-7 [1], 9.5.3.2**
Purpose	Fill bit addition and deletion mechanism
Test description	The main tester initiates a CM or SDS call according to IUT capabilities, by transmitting to the IUT a DMAC-SYNC PDU containing the appropriate PDU
Pass criteria	Check that the IUT re-transmits the DMAC-SYNC PDU containing identical PDU to the parallel tester, meaning that the IUT fill bit deletion and addition mechanism works properly
Selection **EN 300 396-8-2 [6]**	A.32/1 IUT supports circuit mode call or A.32/2 IUT supports Short Data Services
Preamble	None
Postamble	Free DM channel

Presence signal.

DMO_MSREP2_MAC_CA_02	**Reference: EN 300 396-7 [1], 9.4.5.1**
Purpose	Check sending of presence signal
Test description	The main tester is connected to the DM REP2 and the DM channel is free (both channel A and channel B are free)
Pass criteria	Check that the IUT sends at irregular intervals between DT253 and DT254 time a DPRES-SYNC PDU, in the DSB, in all four slots of DN253 consecutive frames, channel usage set to 00, channel state = 00
Selection **EN 300 396-8-2 [6]**	A.40/2 IUT sends DPRES-SYNC
Preamble	None
Postamble	None

6.1.2 DM-REP2 MAC valid behaviour tests

DMO_DMREP2_MAC_BV_01	Reference: EN 300 396-7 [1], 9.4.2.2.3, 9.5.1.1
Purpose	Check DM-REP channel surveillance when idle at DM-MS call set-up; Check retransmission of signalling message received from master DM-MS
Test description	The tester initiates a CM or SDS call, according to IUT capabilities. It translates into a DMAC_SYNC PDU with master/slave link flag set to 1, communication type element = 01, 10 bit repeater address
Pass criteria	Verify that the IUT accepts the call and re-transmits the signalling information (It retransmits the DMAC-SYNC PDU containing the DM-SETUP or DM-SETUP PRES or DM-SDS DATA or DM-SDS UDATA SDU, with master/slave link flag set to 0)
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call or A.32/2 IUT supports Short Data Services
Preamble	None
Postamble	Free DM channel

DMO_DMREP2_MAC_BV_01b	Reference: EN 300 396-7 [1], 9.4.2.2, 9.4.4
Purpose	Check retransmission of signalling message received from master DM-MS for a second call, and monitoring of the two other time slots in master channel
Test description	The tester initiates a CM call,. It translates into a DMAC_SYNC PDU with master/slave link flag set to 1, communication type element = 01, 10 bit repeater address. The IUT accepts the call and re-transmits the signalling information. The tester initiates a second CM call
Pass criteria	Verify that the IUT accepts the second call and re-transmits the signalling information (It retransmits the DMAC-SYNC PDU containing the DM-SETUP or DM-SETUP PRES, with master/slave link flag set to 0).
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	Free both DM channels

DMO_DMREP2_MAC_BV_02	Reference: EN 300 396-7 [1], 9.4.1.1, 9.5.2.1
Purpose	Check retransmission of signalling message received from a slave DM-MS
Test description	The main tester initiates a DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-CONNECT contained in a DMAC-SYNC with master/slave link flag set to 0, communication type 01, its own 10 bit repeater address
Pass criteria	Verify that the IUT re-transmits to the main tester the DMAC-SYNC containing DM-CONNECT where master/slave flag is set to 1, and using the same two time slots on this slave channel as on the master channel
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	Free DM channel

DMO_DMREP2_MAC_BV_02b	Reference: EN 300 396-7 [1], 9.4.4, 9.5.2.1
Purpose	Check retransmission of signalling message relative to a second call, received from a slave DM-MS
Test description	The main tester initiates a DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-CONNECT contained in a DMAC-SYNC with master/slave link flag set to 0, communication type 01, its own 10 bit repeater address. The IUT re-transmits to the main tester the DMAC-SYNC containing DM-CONNECT. The main tester initiates a second DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-CONNECT
Pass criteria	Verify that the IUT re-transmits to the main tester a DMAC-SYNC containing DM-CONNECT for this second call, where master/slave flag is set to 1
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	Free DM channel

DMO_DMREP2_MAC_BV_03	Reference: EN 300 396-7 [1], 9.4.4.1, 9.6.2.2
Purpose	Check DM-REP procedure: set up with presence check
Test description	The main tester initiates a DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-CONNECT
Pass criteria	Verify that the IUT re-transmits the DM-CONNECT to the main tester
Selection **EN 300 396-8-4[2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	Free DM channel

DMO_DMREP2_MAC_BV_04	Reference: EN 300 396-7 [1], 9.4.4.1, 9.6.2.2
Purpose	Check DM-REP procedure: set up with presence check
Test description	The main tester initiates a DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-DISCONNECT
Pass criteria	Verify that the IUT re-transmits the DM-DISCONNECT to the main tester
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	Free DM channel

DMO_DMREP2_MAC_BV_05	Reference: EN 300 396-7 [1], 9.4.4.1, 9.6.2.2
Purpose	Check DM-REP procedure: set up with presence check
Test description	The main tester initiates a DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-CONNECT. The IUT re-transmits the DM-CONNECT to the main tester, which issues a DM-CONNECT ACK
Pass criteria	Verify that the IUT re-transmits DM-CONNECT ACK to the parallel tester and then retransmits the traffic
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	Free DM channel

DMO_DMREP2_MAC_BV_06	Reference: EN 300 396-7 [1], 9.4.4.1, 9.6.2.2
Purpose	Check DM-REP procedure: set up with presence check
Test description	The main tester initiates a DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-CONNECT. The IUT re-transmits the DM-CONNECT to the main tester, which issues a DM-RELEASE
Pass criteria	Verify that the IUT re-transmits DM-RELEASE to the parallel tester and then returns the channel to idle
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	None

DMO_DMREP2_MAC_BV_07	Reference: EN 300 396-7 [1], 9.5.1.1.2, 9.6.2.1
Purpose	Re-transmission procedure: set up without presence check
Test description	The main tester initiates a DM-SETUP which is re-transmitted by the IUT to the parallel tester
Pass criteria	Verify that the IUT re-transmits the DM-SETUP to the parallel tester in all four slots of DN232 frames
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	Free DM channel

DMO_DMREP2_MAC_BV_08	Reference: EN 300 396-7 [1], 9.5.1.1.3
Purpose	Re-transmission procedure: DM_SDS DATA or DM_SDS UDATA
Test description	The main tester initiates a DM_SDS DATA or DM_SDS UDATA which is re-transmitted by the IUT to the parallel tester
Pass criteria	Verify that the IUT re-transmits the DM_SDS DATA or DM_SDS UDATA to the parallel tester in all four slots of DN233 frames
Selection EN 300 396-8-4 [2]	A.32/2 IUT supports Short Data Services
Preamble	None
Postamble	None

DMO_DMREP2_MAC_BV_09	Reference: EN 300 396-7 [1], 9.5.1.1.3
Purpose	Fragmentation
Test description	The main tester initiates a SDS by transmitting DM-SDS DATA or DM-SDS UDATA PDU with data type 2, 3 or 4 in order to generate a fragmented message
Pass criteria	check that the parallel tester receives from the IUT: DMAC-SYNC with Fragmentation flag set to value 1, followed by n times DMAC-FRAG then ending with DMAC-END
Selection EN 300 396-8-4 [2]	A.32/2 Short Data Service (SDS)
Preamble	None
Postamble	None

DMO_DMREP2_MAC_BV_10	Reference: EN 300 396-7 [1], 9.5.1.1.4
Purpose	Retransmission of message
Test description	The main tester initiates a command such as DM-CONNECT
Pass criteria	Check that the IUT re-transmits the DMAC_SYNC PDU containing this command without changing slot, frame numbers and frame countdown, only the master/slave link flag is changed to 0.
Selection	None
Preamble	None
Postamble	None

6.1.3 DM-REP MAC invalid behaviour tests

DMO_DMREP2_MAC_BI_01	Reference: EN 300 396-7 [1], 9.4.2.2.1, 9.4.2.2.3
Purpose	Check DM-REP channel surveillance when idle at DM-MS call set-up, wrong address
Test description	The tester initiates a CM or SDS call, according to IUT capabilities, but not containing the 10-bit repeater address
Pass criteria	Verify that the IUT ignores the call and does not re-transmit the signalling information to the parallel tester
Selection EN 300 396-8-4 [2]	A.32/1 IUT supports circuit mode call or A.32/2 IUT supports Short Data Services
Preamble	None
Postamble	Free DM channel

DMO_DMREP2_MAC_BI_02	Reference: EN 300 396-7 [1], 9.5.2.1
Purpose	Check absence of retransmission of signalling message received from a slave DM-MS, if wrong address
Test description	The main tester initiates a DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-CONNECT contained in a DMAC-SYNC with master/slave link flag set to 0, communication type 01, BUT without its own 10 bit repeater address
Pass criteria	Verify that the IUT does not re-transmit the DMAC-SYNC where master/slave flag is set to 1 to the main tester
Selection EN 300 396-8-4 [2]	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	Free DM channel

6.1.4 DM-REP MAC timer tests

DMO_DMREP2_MAC_TI_01	Reference: EN 300 396-7 [1], 9.4.2.3, 9.6.2.3
Purpose	Check DM-REP channel surveillance when active during a call
Test description	The tester initiates a CM or SDS call, according to IUT capabilities, but does not send DM-OCCUPIED within time DT256
Pass criteria	Verify that the IUT assumes the call is lost and returns to idle
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call or A.32/2 IUT supports Short Data Services
Preamble	None
Postamble	None

DMO_DMREP2_MAC_TI_02	Reference: EN 300 396-7 [1], 9.4.2.3
Purpose	Check DM-REP channel surveillance when active during a call
Test description	The tester issues channel reservation signalling not addressed to the DM-REP to make the channel appear RESERVED (see 9.4.2.1), but does not send DM-RESERVED within time DT258
Pass criteria	Verify that the IUT assumes the call is lost and returns to idle
Selection	None
Preamble	None
Postamble	None

DMO_DMREP2_MAC_TI_03	Reference: EN 300 396-7 [1], 9.6.2.2
Purpose	Check DM-REP procedure: set up with presence check, DT250 timer
Test description	The main tester initiates a DM-SETUP PRES which is re-transmitted by the IUT to the parallel tester. The parallel tester answers with DM-CONNECT. The IUT re-transmits the DM-CONNECT to the main tester, which does not issue a DM-CONNECT ACK within DT250 after transmission of DM_SETUP PRES
Pass criteria	Verify that the IUT returns to idle as it assumes that the call failed
Selection **EN 300 396-8-4 [2]**	A.32/1 IUT supports circuit mode call
Preamble	None
Postamble	None

Bibliography

ETSI ETS 300 396-1: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 1: General network design".

History

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