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Prizemni snopovni radio (TETRA) – Specifikacija za preskušanje skladnosti – 1.
del: Radio

Terrestrial Trunked Radio (TETRA); Conformance testing specification; Part 1: Radio

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Contents

Intellectual Property Rights	9
Foreword.....	9
1 Scope.....	10
2 References.....	10
3 Definitions, symbols and abbreviations	11
3.1 Definitions	11
3.2 Symbols.....	11
3.3 Abbreviations.....	12
4 General.....	12
4.1 Presentation of equipment for testing purposes.....	12
4.1.1 Facilities and information required for testing.....	12
4.1.2 Choice of radio frequency channels to be tested.....	13
4.1.3 Interpretation of the measurement results.....	13
4.2 Mechanical and electrical design.....	13
4.2.1 General.....	13
4.2.2 Controls.....	14
4.2.3 Marking.....	14
5 Radio test configuration, test signals and test modes.....	14
5.1 General functional radio test configuration.....	14
5.2 Radio test modes	15
5.2.1 Test receive mode	15
5.2.1.1 MS test receive mode.....	15
5.2.1.2 BS test receive mode	15
5.2.2 Test transmit mode.....	16
5.2.2.1 MS V+D testing.....	16
5.2.2.2 MS PDO testing.....	17
5.2.2.3 BS V+D & PDO testing.....	17
5.3 Radio test signals.....	17
5.3.1 General.....	17
5.3.2 Test signal T1 (TETRA wanted signal).....	18
5.3.2.1 MS V+D testing	18
5.3.2.2 BS V+D testing	19
5.3.2.3 MS PDO testing.....	19
5.3.2.4 BS PDO testing	20
5.3.3 Test signal T2 (TETRA interferer).....	20
5.3.4 Test signal T3 (unmodulated interferer).....	20
6 Test conditions	20
6.1 General	20
6.2 Power sources and ambient conditions.....	20
6.2.1 Normal test conditions	20
6.2.2 Extreme test conditions	21
6.3 Procedure for tests at extreme temperatures.....	22
6.3.1 Equipment designed for continuous operation.....	22
6.3.2 Equipment designed for intermittent operation.....	22
7 Technical characteristics	23
7.1 Transmitter parameter definitions & limits.....	23
7.1.1 Transmitter output power	23
7.1.1.1 Definition	23
7.1.1.2 Limit values.....	23
7.1.2 Unwanted output power in non-active transmit state	23
7.1.2.1 Definition	23
7.1.2.2 Limit values.....	23

7.1.3	Adjacent channel power due to modulation.....	24
7.1.3.1	Definition.....	24
7.1.3.2	Limit values.....	24
7.1.4	Adjacent channel power due to switching transients.....	24
7.1.4.1	Definition.....	24
7.1.4.2	Limit values.....	25
7.1.5	Unwanted emissions far from the carrier.....	25
7.1.5.1	Definition.....	25
7.1.5.2	Limit values.....	25
7.1.6	Unwanted radiated emissions.....	26
7.1.6.1	Definition.....	26
7.1.6.2	Limit values.....	26
7.1.7	Unwanted emissions during the BLCH/CLCH (linearization).....	26
7.1.7.1	Definition.....	26
7.1.7.2	Limit values.....	26
7.1.8	Transmitter intermodulation attenuation.....	26
7.1.8.1	Definition.....	26
7.1.8.2	Limit values.....	27
7.1.8.2.1	MS Limit values.....	27
7.1.8.2.2	Limit values for single BS transmitter.....	27
7.1.8.2.3	Limit values for Intra BS intermodulation.....	27
7.2	Receiver parameter definitions and limits.....	27
7.2.1	General.....	27
7.2.2	Nominal error rates.....	28
7.2.2.1	Definition.....	28
7.2.2.2	Limit values.....	28
7.2.3	Reference sensitivity performance.....	28
7.2.3.1	Definition.....	28
7.2.3.2	Limit values.....	28
7.2.4	Reference interference performance.....	29
7.2.4.1	Definition.....	29
7.2.4.2	Limit values.....	29
7.2.5	Blocking characteristics.....	29
7.2.5.1	Definition.....	29
7.2.5.2	Limit values.....	30
7.2.6	Spurious response rejection.....	30
7.2.6.1	Definition.....	30
7.2.6.2	Limit values.....	30
7.2.7	Intermodulation response rejection.....	30
7.2.7.1	Definition.....	30
7.2.7.2	Limit values.....	30
7.2.8	Unwanted conducted emissions.....	31
7.2.8.1	Definition.....	31
7.2.8.2	Limit values.....	31
7.2.9	Unwanted radiated emissions.....	31
7.2.9.1	Definition.....	31
7.2.9.2	Limit values.....	31
7.3	Transmitter/receiver parameter definitions & limits.....	31
7.3.1	Modulation accuracy.....	31
7.3.1.1	Definition.....	31
7.3.1.2	Limit values.....	31
7.3.2	Carrier frequency accuracy.....	31
7.3.2.1	Definition.....	31
7.3.2.2	Limit values.....	32
7.3.3	MS receiver performance for synchronization burst acquisition.....	32
7.3.3.1	Definition.....	32
7.3.3.2	Limit values.....	32
7.3.4	MS Frame alignment performance.....	32
7.3.4.1	Definition.....	32
7.3.4.2	Limit values.....	32
7.3.5	MS link control.....	33
7.3.5.1	Definition.....	33

7.3.5.2	Limit values.....	33
8	Methods of measurement for transmitter parameters	34
8.1	Transmitter output power.....	34
8.1.1	MS transmitter output power	34
8.1.2	BS transmitter output power	35
8.2	Unwanted output power in non active transmit state.....	35
8.3	Adjacent channel power due to modulation	35
8.4	Adjacent channel power due to switching transients.....	36
8.5	Unwanted emissions far from the carrier	36
8.6	Unwanted radiated emissions.....	37
8.7	Unwanted emissions during the BLCH/CLCH (linearization).....	37
8.7.1	MS unwanted emissions during the CLCH (linearization).....	37
8.7.2	BS unwanted emissions during the BLCH (linearization).....	38
8.8	Transmitter intermodulation attenuation.....	38
8.8.1	MS Transmitter intermodulation attenuation	38
8.8.2	BS Transmitter intermodulation attenuation.....	38
8.8.3	Intra BS transmitter intermodulation attenuation	38
9	Methods of measurement for receiver parameters.....	39
9.1	General	39
9.2	Nominal error rates.....	39
9.2.1	MS nominal error rate	39
9.2.2	BS nominal error rate.....	39
9.3	Reference sensitivity performance	39
9.3.1	MS reference sensitivity performance.....	40
9.3.2	BS reference sensitivity performance.....	40
9.3.3	PUEM performance	40
9.4	Reference interference performance	41
9.4.1	MS reference interference performance.....	41
9.4.2	BS reference interference performance	41
9.5	Blocking characteristics.....	41
9.5.1	MS blocking	42
9.5.2	BS blocking	42
9.6	Spurious response rejection	42
9.7	Intermodulation response rejection	42
9.7.1	MS intermodulation response rejection	42
9.7.2	BS intermodulation response rejection.....	43
9.8	Unwanted emissions.....	43
9.9	Unwanted radiated emissions.....	43
10	Methods of measurement for transmitter/receiver parameters	44
10.1	Modulation accuracy	44
10.1.1	MS modulation accuracy.....	44
10.1.2	BS modulation accuracy.....	44
10.1.3	Vector error magnitude at symbol time.....	44
10.2	Carrier frequency accuracy	45
10.2.1	MS carrier frequency accuracy	45
10.2.2	BS carrier frequency accuracy	45
10.3	MS receiver performance for synchronization burst acquisition	46
10.4	MS Frame alignment performance.....	46
10.5	MS link control	47
11	Measurement uncertainty	48
11.1	Transmitter.....	48
11.2	Receiver.....	51
11.3	Transmitter/receiver parameter definitions & limits.....	53
11.4	Interpretation of measurement results.....	53

Annex A (normative):	TETRA receiver testing	54
A.1	Frequencies of spurious response	54
A.2	Test cases and test conditions for BS and MS receivers	55
A.3	Test signal T1, content of BSCH and BNCH/T (V+D) & MBCH/T (PDO).....	60
Annex B (normative):	Radio test system functions	62
B.1	Test transmitter and receiver	62
B.1.1	General	62
B.1.2	Sampling system	62
B.1.2.1	General	62
B.1.2.2	TETRA filter	62
B.1.2.3	Adjacent channel power measurements	63
B.1.2.4	Modulation accuracy measurements	63
B.1.2.5	Measurement of unwanted output power in the non-active transmit state.....	63
B.1.3	Spectrum analyser	63
B.1.4	Error rate tester.....	63
B.1.5	Test signal requirements	64
B.1.5.1	On channel test signal T1	64
B.1.5.2	Interfering test signal T2	64
B.1.5.3	Interfering test signal T3	64
B.1.6	Propagation simulators	65
B.1.7	Timing measurement unit	65
B.1.8	Passive test system components	65
B.1.9	Test system controller.....	65
Annex C (normative):	TETRA Test Connector Interface (TTCI)	66
C.1	General.....	66
C.2	Formal aspects.....	66
C.3	TTCI, layer 1	67
C.3.1	Mechanical and Electrical Characteristics	67
C.3.2	Transmission and Reception Characteristics.....	67
C.4	TTCI, Layer 2.....	68
C.4.1	General Structure	68
C.4.2	Frame Structure.....	68
C.4.3	Flow of I-frames on Layer 2	68
C.4.3.1	Transmission of Frames	68
C.4.3.2	Reception of frames	69
C.4.3.3	Parameters on Layer 2.....	69
C.5	TTCI, Layer 3.....	69
C.5.1	Message structure.....	69
C.5.2	Definitions of the Messages.....	70
C.5.2.1	DATO	70
C.5.2.1.1	Test equipment error handling.....	71
C.5.2.2	Bi-directional operation of the TTCI.....	71
C.5.2.3	Codec conformance testing	72
C.5.2.4	ST indicator	72
C.6	Control of MS/BS.....	72
C.6.1	Manual intervention of MS/BS	72
C.6.2	Bi-directional operation of the test interface	73
C.6.3	MS controlled by T1.....	73
C.7	Characteristics of the interface	73
C.7.1	Mechanical characteristics of the interface	73
C.7.2	Electric characteristics of the interface	73

C.8	Codec conformance testing using the TTCI.....	74
C.8.1	Codec conformance test methodology using the TTCI.....	74
Annex D (normative): RF Test Facility using RF Loop Back		75
D.1	Introduction to the TETRA Test (TT) protocol for RF loop back test.....	77
D.1.1	Outline requirements	77
D.1.2	Test Modes	77
D.1.3	Switching for loop back test mode	78
D.2	TETRA Test Entity	79
D.3	TETRA RF loop back test protocol	80
D.3.1	Setting the TETRA MS into TETRA Test mode.....	80
D.3.2	TETRA TEST protocol.....	80
D.3.2.1	Confirming that TETRA TEST MODE is set.....	80
D.3.2.2	Operating TETRA loop back.....	81
D.3.2.3	Ending TETRA Test mode	82
D.3.3	Bad frame indication	82
D.3.4	Channels required to be looped back	82
D.3.5	TETRA loop back test scenarios	83
D.4	TETRA Test (TT) PDU descriptions	83
D.4.1	TT PDU description tables downlink	83
D.4.1.1	D-LOOP COMMAND.....	83
D.4.1.2	D-OPEN LOOP COMMAND.....	84
D.4.1.3	D-TEST MODE CONFIRM COMMAND	84
D.4.1.4	D-TEST MODE END COMMAND.....	84
D.4.2	TT PDU description tables uplink.....	85
D.4.2.1	U-LOOP CONFIRM.....	85
D.4.2.2	U-OPEN LOOP CONFIRM.....	85
D.4.2.3	U-TEST MODE CONFIRM.....	85
D.4.2.4	U-TEST MODE END CONFIRM.....	86
D.4.3	Information elements coding.....	86
D.4.3.1	Loopback type	86
D.4.3.2	Confirm	87
D.4.3.3	MS power class.....	87
D.4.3.4	PDU	87
D.4.3.5	Receiver class	88
D.5	TT use of MLE, LLC and MAC.....	88
D.6	Message sequence charts and operation of TETRA loop back	88
D.7	Introduction to the T1 Test Mode for RF loop back test.....	89
D.7.1	Outline requirements	89
D.7.2	T1 Test Modes	89
D.7.3	Switching for loop back test mode	90
D.8	TETRA RF loop back T1 test mode	91
D.8.1	Setting TETRA equipment into T1 test mode.....	91
D.8.2	T1 loop back test mode operation	91
D.8.3	Logical channels to be looped back.....	92
D.8.4	Return channel for logical channel loop back	92
D.8.4.1	Type 1: TCH/7,2 + AACH	93
D.8.4.2	Type 2: SCH/F + AACH.....	93
D.8.4.3	Type 3: BSCH + SCH/HD + AACH.....	93
D.8.4.4	Type 4: TCH/2,4 N = 1 + AACH.....	94
D.8.4.5	Type 7: TCH/7,2 (uplink).....	94
D.8.4.6	Type 8: SCH/F (uplink).....	94
D.8.4.7	Type 9: STCH + STCH (uplink).....	94
D.8.4.8	Type 10: TCH/2,4 N = 1 (uplink)	95
D.8.4.9	Type 11: SCH/HU + SCH/HU.....	95
D.8.4.10	Type 15: TCH/S + TCH/S + AACH.....	95
D.8.4.11	Type 16: TCH/S + TCH/S (uplink).....	95

D.8.4.12	Type 17: TCH/4,8 N = 1 + AACH.....	96
D.8.4.13	Type 18: TCH/4,8 N = 1 (uplink)	96
D.8.4.14	Type 19: TCH/S speech codec test (downlink).....	96
D.8.4.15	Type 20: TCH/S speech codec test (uplink)	97
D.8.5	Loop back test scenarios.....	97
D.9	Direct Mode Operation (DMO).....	98
D.9.1	DO-MS	98
D.9.2	DU-MS	98
D.9.3	DW-MS	99
D.9.4	DM-REP.....	99
D.9.5	DM-GATE.....	99
D.9.6	DM-REP/GATE.....	99
D.9.7	DMO summary	99
Annex E (informative): Using RF loop back to test a TETRA MS		100
E.1	Introduction	100
E.2	Expected mode of operation for testing a MS	101
E.3	Recognition of TETRA Test mode by MS.....	104
E.4	Using loop back to test traffic channels	105
E.4.1	TCH/7,2.....	107
E.4.2	TCH/S.....	108
E.4.3	TCH/2,4, N = 8	108
E.4.4	Control messages during loop back of traffic channels	109
Annex F (normative): Direct Mode (DMO) Conformance Testing		110
F.1	Scope.....	110
F.2	Definitions, symbols and abbreviations	110
F.3	General.....	110
F.4	Radio Test Modes.....	111
F.5	Test Conditions.....	112
F.6	Additional Tests for equipment which is capable of Direct Mode Operation	113
F.6.1	DMO Test transmit mode	113
F.6.2	DMO transmitter output power profile.....	113
F.6.2.1	DMO transmitter output power profile, limit values	113
F.6.2.2	DMO transmitter output power profile, method of measurement	113
F.6.3	DMO Carrier frequency accuracy	114
F.6.3.1	DMO Carrier frequency accuracy, limit values	114
F.6.3.2	DMO Carrier frequency accuracy, method of measurement	114
F.6.4	DM-MS Slave synchronization accuracy.....	114
F.6.4.1	DM-MS Slave synchronization accuracy, definition.....	114
F.6.4.2	DM-MS Slave synchronization accuracy, limit values.....	114
F.6.4.3	DM-MS Slave synchronization accuracy, method of measurement.....	115
Annex G (normative): TETRA EMC requirements related to the antenna port and emissions from the enclosure of the radio equipment.....		116
History		117

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Project Terrestrial Trunked Radio (TETRA).

The present document contains text concerning conformance testing of the equipment to which it relates. This text should be considered only as guidance and does not make the present document mandatory.

The technical specifications relevant to the EMC Directive are listed in annex G of the present document.

The present document is part 1 of a multi-part deliverable covering the 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".

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1 Scope

The present document specifies the minimum technical characteristics of TETRA Voice plus Data (V+D) and Packet Data Optimized (PDO) Base Stations (BS) and Mobile Station (MS) equipment, and TETRA Direct Mode Operation (DMO) equipment, and the radio test methods used for type testing. Specific test methods for DMO equipment are defined in annex F of the present document. The purpose of these specifications is to provide a sufficient quality of radio transmission and reception for equipment operating in a TETRA system and to minimize harmful interference to other equipment. The document is applicable to TETRA systems operating at radio frequencies in the range of 300 MHz to 1 GHz.

These specifications do not necessarily include all the characteristics which may be required by a user of equipment, nor do they necessarily represent the optimum performance achievable.

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.

- ETSI STANDARD PREVIEW
(standards.ietf.ai)
- [1] ETSI EN 300 392-2: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".
- [2] ETSI ETS 300 393-2: "Terrestrial Trunked Radio (TETRA); Packet Data Optimized (PDO); Part 2: Air Interface (AI)".
<https://standards.ietf.ai/catalog/standards/sist/f2c9fb37-bf7b-4461-9183-29b8a3054ac8/sist-en-300-394-1-v2-3-1-2003>
- [3] ITU-T Recommendation O.153 (1992): "Basic parameters for the measurement of error performance at bit rates below the primary rate".
- [4] ETSI ETR 028: "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".
- [5] ETSI ETS 300 113: "Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector".
- [6] ITU-T Recommendation V.1 (1988): "Equivalence between binary notation symbols and the significant conditions of a two-condition code".
- [7] ISO 2110 (1989): "Information technology - Data communication - 25-pole DTE/DCE interface connector and contact number assignments".
- [8] ETSI ETS 300 395-4: "Terrestrial Trunked Radio (TETRA); Speech codec for full-rate traffic channel; Part 4: Codec conformance testing".
- [9] ETSI ETS 300 396-1: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 1: General network design".
- [10] ETSI ETS 300 396-2: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 2: Radio aspects".
- [11] ETSI ETS 300 396-3: "Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 3: Mobile Station to Mobile Station (MS-MS) Air Interface (AI) protocol".

- [12] ETSI ETS 300 392-1: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 1: General Network Design".
- [13] ETSI EN 300 392-7: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 7: Security".
- [14] ETSI ETS 300 392-11-22: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 11: Supplementary services stage 2; Sub-part 22: Dynamic Group Number Assignment (DGNA)".
- [15] ETSI ETS 300 392-12-22: "Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D); Part 12: Supplementary services stage 3; Sub-part 22: Dynamic Group Number Assignment (DGNA)".
- [16] ETSI EN 300 827: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for Terrestrial Trunked Radio (TETRA) and ancillary equipment".
- [17] ETSI ETS 300 395-2: "Terrestrial Trunked Radio (TETRA); Speech codec for full-rate traffic channel; Part 2: TETRA codec".
- [18] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.
- [19] ETSI ETS 300 607-1: "Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification; Part 1: Conformance specification (GSM 11.10-1 version 4.26.1)".

3 Definitions, symbols and abbreviations

3.1 Definitions

SIST EN 300 394-1 V2.3.1:2003

For the purposes of the present document, the following terms and definitions apply:

Refer to EN 300 392-2 [1], clause 3 for common definitions.

accreditation body: body that conducts and administers a laboratory accreditation system and grants accreditation

receive band of the equipment: maximum frequency range (declared by the manufacturer) over which the receiver can be operated without reprogramming or realignment

accredited laboratory: testing laboratory to which accreditation has been granted

testing laboratory: laboratory that performs tests

transmit band of the equipment: maximum frequency range (declared by the manufacturer) over which the transmitter can be operated without reprogramming or realignment

3.2 Symbols

For the purposes of the present document, the following symbols apply:

f _{lo}	local oscillator frequency applied to first receiver mixer
f _{l1} ...f _{ln}	receiver intermediate frequencies
P _{MS}	access power
R _{lev}	averaged signal level received by MS

3.3 Abbreviations

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

Refer to EN 300 392-2 [1], clause 3 for common abbreviations.

B	Measurement bandwidth
BER	Bit Error Ratio
C/I	Carrier to Interference ratio
dBc	Decibels relative to carrier power
dBm	Decibels relative to one mW
MER	Message Erasure Rate
PACQ	Probability of synchronization burst ACQuisition
PRBS	Pseudo Random Bit Sequence
PUEM	Probability of Undetected Erroneous Message
RF	Radio Frequency
RMS	Root Mean Square
Rx	Receiver
SB	Synchronization Burst
Tx	Transmitter

4 General

4.1 Presentation of equipment for testing purposes

Each equipment submitted for type testing shall fulfil the requirements of the present document on all channels over which it is intended to operate. The manufacturer, or other applicant, shall provide one or more production model(s) of the equipment, as appropriate, for type testing. If type approval is given on the basis of tests on pre-production models, those models shall be manufactured in accordance with the same production drawings and manufacturers specifications as the later production models. This fact shall be declared by the manufacturer in the application form. For more details refer to ETS 300 113 [5].

4.1.1 Facilities and information required for testing

The applicant shall, when submitting equipment for type testing, provide the following facilities:

- at least one antenna connector as a test point;
- for equipment supporting diversity, or for any other reason having more than one antenna connector, the applicant shall supply coupling and/or terminating devices so that the tests can be performed via a single antenna connector;
- TETRA equipment, for example PDO radio packet modem modules which may not have an antenna connector, may be submitted for type testing by the manufacturer, or other applicant, if a suitable jig or adapter is supplied which allows the conducted tests to be carried out;
- specific test modes, as defined in clause 5.2;
- a test connector which provides decoded data output for all uplink logical channels in the case of BS and downlink logical channels in the case of MS to be tested. The test connector shall also provide any test signalling data. The use of the term 'Test Connector' throughout this specification shall mean either a physical connection, as defined in annex C, or a virtual connection by means of an RF Loopback Facility as defined in annex D;
- for BS equipment a trigger signal which can be used by the test equipment for uplink synchronization. The trigger signal shall be sent once within a multiframe structure and it shall have an arbitrary but fixed relationship (frame, timeslot), defined by the base station manufacturer, to the multiframe structure. The trigger signal shall have TTL level, the timing uncertainty shall be less than $\pm 2,5 \mu\text{s}$ and the rise time and fall time shall each be less than 50 ns;
- a means to connect the equipment to the test power source according to clause 6.

Equipment submitted for type testing shall be capable of performing conformance tests using the T1 Test Signal, whether or not the optional requirements of the RF Loopback Facility are implemented. It is at the discretion of the test laboratory whether to implement a test system supporting the optional requirements of the RF Loopback Facility.

The applicant shall provide the following information to the test laboratory:

- power class of equipment;
- receiver class A, B or E (MS only);
- other capabilities and options implemented in equipment, including V+D or PDO, traffic channels supported;
- information related to radio sub-system of equipment, i.e. transmit and receive frequency bands, first local oscillator frequency (f_{l0}) and intermediate frequencies ($if_1 \dots if_n$) of receiver;
- description how to use equipment in specific test modes and test connector interface details;
- information of power source used in equipment.

4.1.2 Choice of radio frequency channels to be tested

The tests described in clauses 8, 9 and 10 shall be performed on one or more frequency channels selected from the lowest 5, the highest 5 and the middle 5 radio frequency channels of either the transmit or receive band of the equipment, whichever is appropriate. The channels required to be tested are defined in clauses 8, 9 and 10 for each individual test.

The use of the terms 'lowest radio frequency channel', 'highest radio frequency channel' and 'middle radio frequency channel' throughout this specification shall mean one of the lowest 5, one of the highest 5 and one of the middle 5 radio frequency channels respectively.

4.1.3 Interpretation of the measurement results

The interpretation of the results recorded in the test report for the measurements described in the present document shall be as follows:

- a) the measured value related to the corresponding limit will be used to decide whether an equipment meets the minimum requirements of the specification in accordance with the shared risk method;
- b) the actual measurement uncertainty of the test laboratory carrying out the measurement, for each particular measurement, shall be included in the test report;
- c) the values of the actual measurement uncertainty shall be, for each measurement, equal to or lower than the figures given in clause 11. The measurement uncertainty requirements given in this specification corresponds to a confidence level of 95 %, unless otherwise stated. The confidence level is the probability that the true value of the measured parameter lies within the range of values bounded by the uncertainty as described in ETR 028 [4].

This procedure for using maximum acceptable uncertainty values is valid until superseded by other appropriate ETSI publications covering this subject. The use of the measured value has been chosen because there is no definitive standard allowing for measurement uncertainty at the time of publication of the present document. Therefore, the measurement uncertainty shall be used to assess the quality of the actual measurement. The measurement uncertainty values can also be used by accreditation authorities during their accreditation procedures to ensure compliance of type testing to ETSI standards.

4.2 Mechanical and electrical design

4.2.1 General

The equipment submitted for type testing by the manufacturer or other applicant, shall be designed, constructed and manufactured in accordance with sound engineering practice and with the aim to minimize harmful interference to other equipment and services.