

ETSI TS 102 490 V1.9.1 (2016-08)



TECHNICAL SPECIFICATION

**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
Peer-to-Peer Digital Private Mobile Radio using FDMA
with a channel spacing of 6,25 kHz with e.r.p. of up to 500 mW**

Reference

RTS/ERM-TGDMM-355

Keywords

air interface, digital, FDMA, PMR, protocol, radio

ETSI

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
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:
<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.
All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.
3GPP™ and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.
GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Contents

Intellectual Property Rights	7
Foreword.....	7
Modal verbs terminology.....	7
1 Scope	8
2 References	8
2.1 Normative references	8
2.2 Informative references.....	8
3 Definitions, symbols and abbreviations	9
3.1 Definitions.....	9
3.2 Symbols.....	10
3.3 Abbreviations	10
4 Overview	11
4.0 General	11
4.1 Protocol architecture.....	12
4.1.0 General.....	12
4.1.1 Air Interface Physical Layer (layer 1).....	13
4.1.2 Air Interface Data Link Layer (layer 2)	13
4.1.3 Air Interface Call Control Layer (layer 3)	13
4.2 FDMA Structure.....	14
4.2.1 Overview of the transmission structure	14
4.2.2 Transmission format	14
4.2.3 Transmission sequences.....	15
5 Frame coding.....	17
5.1 Superframe	17
5.2 Header frame	18
5.3 End frame	18
5.4 Packet data header.....	18
5.5 ACK frame	19
5.6 Frame numbering	20
5.7 Communication mode	20
5.8 Communication format.....	20
5.9 SLD format.....	20
5.9.0 General.....	20
5.9.1 Slow data in the voice superframe	21
5.9.2 Slow data field use with Type 1 or 2 data.....	21
5.10 Call information	22
5.10.0 General.....	22
5.10.1 Call Information for powersave	22
5.10.2 Call Information for Types 1 and 2 data	22
5.10.3 Call Information for Type 3 (packet) data	23
5.10.4 Call Information for system transactions	24
5.10.5 Call Information for acknowledgements.....	24
5.11 Header type	24
5.12 End type	25
5.13 ARQ	25
5.14 Tx Wait.....	25
5.15 Status	25
5.16 Version [V].....	26
6 Synchronization.....	26
6.1 Frame synchronization	26
6.1.1 FS1.....	26
6.1.2 FS2.....	26
6.1.3 FS3.....	26

6.1.4	FS4.....	26
6.1.5	Channel code	27
6.1.6	Preamble	29
7	Interleaving and FEC coding.....	29
7.1	Di-bit coding	29
7.2	CRC addition.....	29
7.3	Hamming code	29
7.4	Scrambling	30
7.5	Interleaving.....	30
7.6	FEC coding of CCH (superframe).....	31
7.7	FEC coding of HI (header information)	32
7.8	FEC coding of END information	32
8	Bearer services, tele-services and supplementary services	32
8.1	Initial mode	32
8.1.0	General.....	32
8.1.1	Initial addressing.....	33
8.1.1.0	General.....	33
8.1.1.1	Common ID.....	33
8.1.1.2	Fixed part of address	33
8.1.2	ISF channel codes	33
8.2	Configured mode.....	33
8.2.0	General.....	33
8.2.1	Call types	34
8.2.1.1	Individual call	34
8.2.1.2	Group call.....	34
8.2.2	Addressing	34
8.2.3	CSF channel codes.....	34
8.3	Packet data.....	35
8.3.1	Format.....	35
8.3.2	Receiving party	35
8.3.3	Packet frame coding.....	35
8.3.4	Data frame size	36
8.3.5	Valid data length.....	36
8.3.6	Data checksum.....	37
9	Channel coding process.....	39
9.0	General	39
9.1	Voice superframe	39
9.2	Type 1 data superframe	42
9.3	Type 2 Data superframe	44
9.4	Type 3 (Packet) Data frame.....	45
9.5	Headers.....	47
9.6	End frames.....	48
10	Channel access	49
10.1	Listen Before Transmit (LBT).....	49
10.2	Hang time messages and timers	50
10.2.1	Definition.....	50
10.2.2	Action by receiving stations.....	50
10.2.3	Break-in requests	50
10.3	Call duration timers	50
10.4	Transmit admit criteria	50
10.4.1	General admit criteria	50
10.4.2	ISF admit criteria	51
10.4.3	CSF admit criteria.....	51
10.5	Transmission re-tries	51
10.6	Channel access timers and constants	51
10.6.1	Timers.....	51
10.6.2	Constants	52
11	Powersave.....	52
11.1	Transmitted format.....	52

11.2	Receive format	53
12	Physical Layer	53
12.1	General parameters	53
12.1.0	General	53
12.1.1	Frequency range	53
12.1.2	RF carrier bandwidth	53
12.1.3	Transmit frequency error	53
12.1.4	Time base clock drift error	53
12.2	Modulation	54
12.2.1	Symbols	54
12.2.2	4FSK generation	54
12.2.2.0	General	54
12.2.2.1	Deviation index	54
12.2.2.2	Square root raised cosine filter	55
12.2.2.3	4FSK Modulator	56
Annex A (normative): Standard User Interface for CSF radios.....		57
A.0	General	57
A.1	Numbering and dialling plan	57
A.1.1	Introduction to the numbering and dialling plan	57
A.2	Subscriber mapping	58
A.2.1	User Interface - Air Interface	58
A.2.1.0	General	58
A.2.1.1	Mapping for MS address space	59
A.2.1.1.0	General	59
A.2.1.1.1	The concept of the wildcard character	59
A.2.1.1.2	The concept of stored parameters	60
A.2.1.1.3	The concept of ad-hoc arrangement	60
A.2.1.1.4	The rules for the sender	60
A.2.1.1.5	The rules for the recipient	60
A.2.1.1.6	Mapping of dialled strings to the AI address space	60
A.2.1.1.6.0	General	60
A.2.1.1.6.1	Mapping of numeric dialled strings to the AI address space	61
A.2.2	Addresses	62
A.2.3	Conversion rules	62
A.2.3.1	MS addresses	62
A.2.3.2	Limiting the length of the destination address	62
A.2.3.3	All talkgroup address	62
A.3	User dialling plan	63
A.3.1	User numbering	63
A.3.1.0	General	63
A.3.1.1	Dialling method	63
A.3.1.2	Call Type determination	63
A.3.1.3	Call modifier strings	63
A.3.2	Dialled digits to address mapping	63
A.3.3	Storage requirements	64
A.3.3.1	MS individual address	64
A.3.3.2	Dialled Talkgroups	64
A.3.3.3	All MSs	64
A.3.3.4	Non-dialable numbers	64
A.3.3.5	Talkgroup recognition	64
A.3.3.5.1	All numeric talkgroups	64
A.3.3.5.2	Talkgroups defined by wildcards	65
A.3.3.5.3	MS receives a talkgroup call	65
A.3.4	Dialling procedures	65
A.3.4.1	MS calls	65
A.3.4.1.1	Seven digit dialling	65
A.3.4.1.2	Abbreviated dialling	66
A.3.4.1.3	Masked dialling	66

A.3.4.1.4	Dialling with numbers and wildcards.....	67
A.3.4.2	Call modifiers	67
A.3.4.2.0	General	67
A.3.4.2.1	Broadcast call.....	67
A.3.4.2.2	Status call.....	67
A.3.4.2.3	Force talkgroup service	68
A.3.4.3	Call set-up abandon or call complete.....	68
History	69

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document covers digital private mobile radio equipment operating in peer-to-peer mode only.

The equipment is based on FDMA with channel spacing of 6,25 kHz supporting voice and data applications.

It covers only hand portable equipment complying with ETSI EN 303 405 [1] and having an integral antenna.

This equipment is for use:

- i) In accordance with ECC/DEC/(15)05 [i.1] the harmonised frequency range 446,0 MHz to 446,2 MHz, technical characteristics, exemption from individual licensing and free carriage and use of analogue and digital PMR 446 applications.

NOTE 1: The technical requirements for Digital PMR 446 included in ECC/DEC/(05)12 [i.1] are: handheld only operation in the frequency range 446,000 MHz to 446,200 MHz, maximum e.r.p. of 500 mW, and a maximum transmitter time-out-time of 180 seconds.

- ii) In the frequency band 149,01875 MHz to 149,11875 MHz under exemption from individual licensing.

NOTE 2: These requirements are: maximum e.r.p. of 500 mW, and a maximum transmitter time-out-time of 180 seconds.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI EN 303 405: "Land Mobile Service; Analogue and Digital PMR446 Equipment Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [2] Void.
- [3] ETSI ETS 300 230: "Radio Equipment and Systems (RES); Land mobile service; Binary Interchange of Information and Signalling (BIIS) at 1200 bit/s (BIIS 1 200)".
- [4] MPT 1327 (June 1997): "A Signalling Standard for Trunked Private Land Mobile Radio Systems".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.