



Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2 W and in the band 915 MHz to 921 MHz with power levels up to 4 W; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU

ETSI
https://standards.iteh.ai/standards/etsi/302208-v3.1.0-2016-02-11
4638-a4f0-aa7e9e6879d4-etsi-302208-v3.1.0-2016-02-11

Reference

REN/ERM-TG34-264

Keywords

ID, radio, RFID, SRD**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 | 9 |
| 2.1 Normative references | 9 |
| 2.2 Informative references..... | 9 |
| 3 Definitions, symbols and abbreviations | 10 |
| 3.1 Definitions..... | 10 |
| 3.2 Symbols..... | 11 |
| 3.3 Abbreviations | 11 |
| 4 Technical requirements specifications | 12 |
| 4.1 Environmental profile..... | 12 |
| 4.2 General requirements | 12 |
| 4.2.1 Conformance requirements..... | 12 |
| 4.2.2 Designated frequencies | 13 |
| 4.2.2.1 Lower band | 13 |
| 4.2.2.2 Upper band..... | 13 |
| 4.2.3 Testing of operational frequencies..... | 14 |
| 4.2.4 General considerations..... | 14 |
| 4.2.5 Choice of samples for test suite | 14 |
| 4.3 Transmitter conformance requirements | 14 |
| 4.3.1 Frequency error..... | 14 |
| 4.3.1.1 Applicability..... | 14 |
| 4.3.1.2 Definition | 15 |
| 4.3.1.3 Limits..... | 15 |
| 4.3.1.4 Conformance..... | 15 |
| 4.3.2 Frequency stability under low voltage conditions | 15 |
| 4.3.2.1 Applicability..... | 15 |
| 4.3.2.2 Definition | 15 |
| 4.3.2.3 Limits..... | 15 |
| 4.3.2.4 Conformance..... | 15 |
| 4.3.3 Effective radiated power..... | 15 |
| 4.3.3.1 Applicability..... | 15 |
| 4.3.3.2 Definition | 15 |
| 4.3.3.3 Limits..... | 16 |
| 4.3.3.3.1 Operation in the lower band (865 MHz to 868 MHz) | 16 |
| 4.3.3.3.2 Operation in the upper band (915 MHz to 928 MHz) | 16 |
| 4.3.3.4 Conformance..... | 16 |
| 4.3.4 Transmitter antenna beam-width | 16 |
| 4.3.4.1 Applicability..... | 16 |
| 4.3.4.2 Definition | 16 |
| 4.3.4.3 Limits..... | 16 |
| 4.3.4.4 Conformance..... | 16 |
| 4.3.5 Transmitter spectrum masks | 16 |
| 4.3.5.1 Applicability..... | 16 |
| 4.3.5.2 Definition | 16 |
| 4.3.5.3 Limits..... | 17 |
| 4.3.5.3.1 Limits for lower band (865 MHz to 868 MHz) | 17 |
| 4.3.5.3.2 Limits for upper band (915 MHz to 921 MHz) | 17 |
| 4.3.5.4 Conformance..... | 18 |
| 4.3.6 Transmitter spurious emissions..... | 18 |
| 4.3.6.1 Applicability..... | 18 |
| 4.3.6.2 Definition | 18 |
| 4.3.6.3 Limits..... | 18 |

| | | |
|-----------|--|----|
| 4.3.6.4 | Conformance | 19 |
| 4.3.7 | Transmission times | 19 |
| 4.3.7.1 | Applicability | 19 |
| 4.3.7.2 | Definition | 19 |
| 4.3.7.3 | Limits | 19 |
| 4.3.7.4 | Conformance | 19 |
| 4.3.8 | Mitigation using DAA | 19 |
| 4.3.8.1 | Applicability | 19 |
| 4.3.8.2 | Definition | 20 |
| 4.3.8.3 | Limits | 20 |
| 4.3.8.4 | Conformance | 20 |
| 4.4 | Receiver conformance requirements | 20 |
| 4.4.1 | Adjacent channel selectivity | 20 |
| 4.4.1.1 | Applicability | 20 |
| 4.4.1.2 | Definition | 20 |
| 4.4.1.3 | Limits | 20 |
| 4.4.1.4 | Conformance | 20 |
| 4.4.2 | Blocking or desensitization | 20 |
| 4.4.2.1 | Applicability | 20 |
| 4.4.2.2 | Definition | 20 |
| 4.4.2.3 | Limits | 21 |
| 4.4.2.4 | Conformance | 21 |
| 4.4.3 | Spurious emissions | 21 |
| 4.4.3.1 | Applicability | 21 |
| 4.4.3.2 | Definition | 21 |
| 4.4.3.3 | Limits | 21 |
| 4.4.3.4 | Conformance | 21 |
| 4.5 | Tag conformance requirements | 21 |
| 4.5.1 | Radiated power (e.r.p.) | 21 |
| 4.5.1.1 | Applicability | 21 |
| 4.5.1.2 | Definition | 21 |
| 4.5.1.3 | Limits | 21 |
| 4.5.1.4 | Conformance | 21 |
| 4.5.2 | Unwanted emissions | 22 |
| 4.5.2.1 | Applicability | 22 |
| 4.5.2.2 | Definition | 22 |
| 4.5.2.3 | Limits | 22 |
| 4.5.2.4 | Conformance | 23 |
| 5 | Testing for compliance with technical requirements | 23 |
| 5.1 | Environmental conditions for testing | 23 |
| 5.1.1 | Normal and extreme test conditions | 23 |
| 5.1.1.1 | Normal test conditions | 23 |
| 5.1.1.2 | Extreme temperatures | 23 |
| 5.1.1.2.1 | Procedure for tests at extreme temperatures | 23 |
| 5.1.1.2.2 | Procedure for equipment designed for continuous operation | 23 |
| 5.1.1.2.3 | Procedure for equipment designed for intermittent operation | 24 |
| 5.1.1.3 | Extreme temperature ranges | 24 |
| 5.1.2 | Test power sources | 24 |
| 5.1.2.1 | General requirements | 24 |
| 5.1.2.2 | Normal test power source | 24 |
| 5.1.2.2.1 | Mains voltage | 24 |
| 5.1.2.2.2 | Regulated lead-acid battery power sources | 25 |
| 5.1.2.2.3 | Other power sources | 25 |
| 5.1.2.3 | Extreme test power source | 25 |
| 5.1.2.3.1 | Mains voltage | 25 |
| 5.1.2.3.2 | Regulated lead-acid battery power sources and gel-cell battery power sources | 25 |
| 5.1.2.3.3 | Power sources using other types of batteries | 25 |
| 5.1.2.3.4 | Other power sources | 25 |
| 5.1.3 | Testing under extreme conditions | 25 |
| 5.2 | Interpretation of the measurement results | 25 |
| 5.3 | Submission of equipment for testing | 26 |

| | | |
|-----------|---|----|
| 5.3.1 | Mechanical and electrical design | 26 |
| 5.3.1.1 | General requirements | 26 |
| 5.3.1.2 | Controls | 26 |
| 5.3.1.3 | Transmitter shut-off facility | 26 |
| 5.3.1.4 | Battery saving circuit | 26 |
| 5.3.1.5 | Declarations by the provider | 26 |
| 5.3.1.6 | Auxiliary test equipment | 26 |
| 5.3.2 | General conditions for testing of transmitters | 27 |
| 5.3.2.1 | Normal test signals and test modulation | 27 |
| 5.3.2.2 | Normal test signals for data | 27 |
| 5.3.2.3 | Artificial antenna | 27 |
| 5.3.2.4 | Modes of operation of the transmitter | 27 |
| 5.3.2.5 | Test sites and general arrangements for radiated measurements | 27 |
| 5.3.2.6 | Measuring receiver | 27 |
| 5.3.2.7 | Testing of operational frequencies | 27 |
| 5.4 | Presentation of equipment for testing | 27 |
| 5.4.1 | General requirements | 27 |
| 5.4.2 | Choice of model for testing | 28 |
| 5.4.3 | Provisions of samples for testing | 28 |
| 5.4.4 | Equipment without an internal permanent or temporary antenna connector | 28 |
| 5.4.5 | Test fixture | 28 |
| 5.4.6 | Submission of additional equipment with a temporary antenna connector | 29 |
| 5.4.7 | Channel range | 29 |
| 5.4.8 | Adjustable carrier levels | 29 |
| 5.4.9 | Test mode | 29 |
| 5.5 | Essential transmitter test suites | 30 |
| 5.5.1 | Measurement of frequency error for mains operated equipment | 30 |
| 5.5.2 | Frequency stability under low voltage conditions | 30 |
| 5.5.3 | Effective Radiated power (e.r.p.) | 30 |
| 5.5.3.1 | General | 30 |
| 5.5.3.2 | Method of measurement | 30 |
| 5.5.3.2.1 | General | 30 |
| 5.5.3.2.2 | Radiated measurement | 30 |
| 5.5.3.2.3 | Conducted measurement | 32 |
| 5.5.4 | Transmitter antenna beam-width | 32 |
| 5.5.4.1 | General | 32 |
| 5.5.4.2 | Radiated measurement | 32 |
| 5.5.5 | Transmitter spectrum mask | 33 |
| 5.5.5.1 | Method of measurement | 33 |
| 5.5.6 | Transmitter spurious emissions | 34 |
| 5.5.6.1 | Method of measurement | 34 |
| 5.5.6.2 | Method of measuring the spurious power level in a specified load, clause 5.5.6.1, a) i) | 34 |
| 5.5.6.3 | Method of measuring the spurious effective radiated power, clause 5.5.6.1 a) ii) | 35 |
| 5.5.6.4 | Method of measuring spurious effective radiated power, clause 5.5.6.1, b) | 36 |
| 5.5.7 | Transmission times | 36 |
| 5.5.7.1 | Method of measurement | 36 |
| 5.5.8 | Mitigation using DAA | 37 |
| 5.5.8.1 | Set-up for tests | 37 |
| 5.5.8.2 | Tests for Mitigation Method 1 | 38 |
| 5.5.8.3 | Tests for Mitigation Method 2 | 39 |
| 5.6 | Essential receiver test suites | 41 |
| 5.6.1 | Adjacent channel selectivity | 41 |
| 5.6.1.1 | General | 41 |
| 5.6.1.2 | Method of measuring radiated signals | 41 |
| 5.6.1.3 | Conducted method of measurement | 42 |
| 5.6.2 | Blocking or desensitization | 44 |
| 5.6.2.1 | General | 44 |
| 5.6.2.2 | Method of measuring radiated signals | 44 |
| 5.6.2.3 | Conducted method of measurement | 45 |
| 5.7 | Essential tag test suites | 45 |
| 5.7.1 | Tag radiated power (e.r.p.) | 45 |
| 5.7.1.1 | Method of measurement | 45 |

| | | |
|-------------------------------|---|-----------|
| 5.7.1.2 | Method of measuring the power in an un-modulated sub-carrier, clause 5.7.1.1 a)..... | 46 |
| 5.7.1.3 | Method of measuring the power in a modulated sub-carrier, clause 5.7.1.1 b)..... | 47 |
| 5.7.2 | Unwanted emissions | 48 |
| 5.7.2.1 | Method of measurement..... | 48 |
| Annex A (normative): | Relationship between the present document and the essential requirements of Directive 2014/53/EU | 50 |
| Annex B (normative): | Radiated measurement..... | 52 |
| B.1 | Test sites and general arrangements for measurements involving the use of radiated fields | 52 |
| B.1.1 | General | 52 |
| B.1.2 | Anechoic chamber | 52 |
| B.1.3 | Anechoic chamber with a conductive ground plane | 53 |
| B.1.4 | Open Area Test Site (OATS) | 54 |
| B.1.5 | Test antenna..... | 55 |
| B.1.6 | Substitution antenna | 55 |
| B.1.7 | Measuring antenna | 55 |
| B.1.8 | Stripline arrangement | 56 |
| B.1.8.1 | General..... | 56 |
| B.1.8.2 | Description..... | 56 |
| B.1.8.3 | Calibration | 56 |
| B.1.8.4 | Mode of use | 56 |
| B.2 | Guidance on the use of radiation test sites | 56 |
| B.2.1 | General | 56 |
| B.2.2 | Verification of the test site | 56 |
| B.2.3 | Preparation of the EUT..... | 57 |
| B.2.4 | Power supplies to the EUT | 57 |
| B.2.5 | Range length..... | 57 |
| B.2.6 | Site preparation | 58 |
| B.3 | Coupling of signals..... | 58 |
| B.3.1 | General | 58 |
| B.3.2 | Data signals | 58 |
| B.4 | Standard test position | 58 |
| B.5 | Test fixture | 59 |
| B.5.1 | General | 59 |
| B.5.2 | Description | 59 |
| B.5.3 | Calibration..... | 60 |
| B.5.4 | Mode of use..... | 60 |
| Annex C (normative): | Mitigation technique..... | 61 |
| C.1 | Introduction | 61 |
| C.2 | Principle of operation | 61 |
| C.3 | Method 1 - Scanning band 918 MHz to 925 MHz..... | 61 |
| C.4 | Method 2 - Scanning band 921 MHz to 925 MHz..... | 61 |
| C.5 | Technical requirements | 62 |
| C.6 | Requirements for Method 1..... | 62 |
| C.7 | Requirements for Method 2..... | 63 |
| Annex D (informative): | Bibliography..... | 64 |
| History | | 65 |

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 draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.10] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.3].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

The present document replaces all previous versions of ETSI EN 302 208 Parts 1 and 2.

| Proposed national transposition dates | |
|--|---------------------------------|
| Date of latest announcement of this EN (doa): | 3 months after ETSI publication |
| Date of latest publication of new National Standard or endorsement of this EN (dop/e): | 6 months after doa |
| Date of withdrawal of any conflicting National Standard (dow): | 18 months after doa |

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 the minimum characteristics considered necessary in order to make the best use of the available frequencies. It does not necessarily include all the characteristics that may be required by a user, nor does it necessarily represent the optimum performance achievable.

Radio frequency identification products covered within the present document are considered by definition short-range devices. Power limits up to a maximum of 2 W e.r.p. are specified for this equipment in the frequency band 865 MHz to 868 MHz and up to a maximum of 4 W e.r.p. in the frequency band 915 MHz to 921 MHz.

It should be noted that the frequency band 915 MHz to 921 MHz has only a limited implementation status within the European Union and the CEPT countries. ERC/REC 70-03 [i.9] provides in appendix 1 an overview of countries where the band is implemented.

The present document applies to RFID interrogators and tags operating together as a system. For each specified band, four high power channels are made available for use by interrogators. The tags respond with a modulated signal preferably in the adjacent low power channels. Interrogators may be used with either integral or external antennas.

ElectroMagnetic Compatibility (EMC) requirements are covered by ETSI EN 301 489-1 [i.1] and ETSI EN 301 489-3 [i.2].

The types of equipment covered by the present document are as follows:

- fixed interrogators;
- portable interrogators;
- batteryless tags;
- battery assisted tags;
- battery powered tags.

These radio equipment are capable of operating in the frequency ranges given in table 1.

Table 1: Frequencies of operation

| Equipment | Operating frequencies |
|----------------------------------|------------------------|
| Interrogator Transmit channel 4 | 865,6 MHz to 865,8 MHz |
| Interrogator Transmit channel 7 | 866,2 MHz to 866,4 MHz |
| Interrogator Transmit channel 10 | 866,8 MHz to 867,0 MHz |
| Interrogator Transmit channel 13 | 867,4 MHz to 867,6 MHz |
| Interrogator Receive | 865,2 MHz to 868,0 MHz |
| Tag Transmit and receive | 865,2 MHz to 868,0 MHz |
| Interrogator Transmit channel 3 | 916,1 MHz to 916,5 MHz |
| Interrogator Transmit channel 6 | 917,3 MHz to 917,7 MHz |
| Interrogator Transmit channel 9 | 918,5 MHz to 918,9 MHz |
| Interrogator Transmit channel 12 | 919,7 MHz to 920,1 MHz |
| Interrogator Receive | 915,3 MHz to 925,0 MHz |
| Tag Transmit and receive | 915,3 MHz to 920,9 MHz |

The present document contains requirements to demonstrate that the specified radio equipment both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference.

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 <http://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 TR 102 273 (V1.2.1) (12-2001) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".
- [2] ANSI C63.5-2006: "American National Standard for Calibration of Antennas Used for Radiated Emission Measurements in Electro Magnetic Interference".
- [3] ETSI TS 144 018 (V11.5.0) (07-2013): "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification; Radio Resource Control (RRC) protocol (3GPP TS 44.018 version 11.5.0 Release 11)".

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.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [i.2] ETSI EN 301 489-3: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz".
- [i.3] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.4] IEC 60489-3 Appendix J Second edition (1988): "Methods of measurement for radio equipment used in the mobile services. Part 3: Receivers for A3E or F3E emissions" (pages 156 to 164).
- [i.5] ETSI TR 100 028 (all parts) (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.6] ETSI TR 100 028-2 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".

- [i.7] ETSI TS 102 902 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Methods, parameters and test procedures for cognitive interference mitigation towards ER-GSM for use by UHF RFID using Detect-And-Avoid (DAA) or other similar techniques".
- [i.8] EIRENE System Requirements Specification Version 15.1.
- [i.9] CEPT/ERC/REC 70-03: "Short Range Devices (SRD)".
- [i.10] Commission implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.
- [i.11] MPT 1314: "Performance Specification Transmitting and receiving equipment for use in the PMR Local Communication Service", Revised and reprinted December 1997.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

adaptive frequency agility: technique that allows an interrogator to change its frequency of operation automatically from one channel to another

battery assisted tag: transponder that includes a battery to enhance its receive performance and power its internal circuitry

batteryless tag: transponder that derives all of the power necessary for its operation from the field generated by an interrogator

battery powered tag: transponder that uses the power from its battery to perform all of its operational functions

conducted measurements: measurements which are made using a direct 50 Ω connection to the equipment under test

dedicated antenna: removable antenna supplied and type tested with the radio equipment, designed as an indispensable part of the equipment

dense interrogator mode: RFID operating mode in which multiple interrogators can transmit simultaneously in the same channel while tags respond in the adjacent channels

designated frequency band: frequency band within which the emission by a device is authorized

effective radiated power: product of the power supplied to the antenna and its gain relative to a half wave dipole in the direction of maximum gain

ER-GSM: extended band of 918 MHz to 960 MHz used by the railways

external antenna: antenna that may be connected to an interrogator via its external connector

Full Tests (FT): all tests specified in the present document

global scroll: test mode in which an interrogator is able to read the same tag continuously

integral antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment

interrogator: equipment that will activate an adjacent tag and read its data

NOTE: It may also enter or modify the information in a tag.

Limited Tests (LT): Tests that include:

- transmitter frequency error and frequency stability under low voltage conditions for mains operated equipment, see clause 4.3.1 of the present document;

- transmitter frequency stability under low voltage conditions, see clause 4.3.2 of the present document;
- transmitter effective radiated power, see clause 4.3.3 of the present document.

lower band: frequency range 865,0 MHz to 868,0 MHz designated for use by RFID

provider: manufacturer, or his authorized representative or person responsible for placing on the market

radiated measurements: measurements which involve the absolute measurement of a radiated field

R-GSM: interoperable band of 921 MHz to 960 MHz used by the railways

scan mode: specific test mode of an interrogator that detects a signal on a pre-selected channel and transmits automatically on another channel

NOTE: See clause C.3.

tag: transponder that holds data and responds to an interrogation signal

talk mode: transmission of intentional radiation by an interrogator

upper band: frequency range 915,0 MHz to 921,0 MHz designated for use by RFID.

3.2 Symbols

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

| | |
|----------------|---|
| dB | decibel |
| d | distance |
| f | frequency measured under normal test conditions |
| f _c | centre frequency of carrier transmitted by interrogator |
| f _e | the maximum frequency drift as measured in clause 5.5.2 |
| Ω | Ohms |
| λ | wavelength |

3.3 Abbreviations

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

| | |
|-----------------|--|
| AM | amplitude modulation |
| ANSI | American National Standards Institute |
| ARFCN | Absolute Radio Frequency Channel Number |
| BCCH | Broadcast Control Channel |
| BER | Bit Error Ratio |
| BTS | Base Transceiver Station |
| BW | Bandwidth |
| CEPT | European Conference of Postal and Telecommunications administrations |
| C _L | Total cable loss in dB |
| DAA | Detect and Avoid |
| e.r.p. | effective radiated power |
| EMC | ElectroMagnetic Compatibility |
| emf | electromotive force |
| ERC | European Radio communication Committee |
| ER-GSM | Extended Railways GSM |
| EUT | Equipment Under Test |
| FT | Full Tests |
| FTZ | Foreign Trade Zone (sometimes called Free Trade Zone) |
| G _{IC} | Gain of a circular antenna in dBic |
| GSM-R | Global System for Mobile communication for Railways applications |
| IE | Information element |
| LT | Limited Tests |
| OATS | Open Area Test Site |
| ppm | part per million |

| | |
|-------|---|
| R&TTE | Radio and Telecommunications Terminal Equipment |
| RBW | Resolution Bandwidth |
| RF | Radio Frequency |
| RFID | Radio Frequency Identification |
| R-GSM | Railway GSM |
| RMS | Root mean square |
| SRD | Short Range Device |
| TCH | Traffic Channel |
| TX | Transmitter |
| VSWR | Voltage Standing Wave Ratio |
| UHF | Ultra High Frequency |

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

4.2 General requirements

4.2.1 Conformance requirements

Interrogators shall transmit on any of the high power channels specified in clause 4.2.2 for the purpose of communicating with tags at power levels up to the limits specified in clause 4.3.3.3.

When operating in the lower band, 865 MHz to 868 MHz, an interrogator may transmit a continuous signal on any of the high power channels for a period not exceeding the limit defined in clause 4.3.7.3. At the end of the transmission the interrogator shall not transmit again on the same channel for the period defined in figure 3 of clause 4.3.7.3. Alternatively the interrogator may switch immediately to any one of the other high power channels and send a further continuous transmission in accordance with the requirements of clause 4.3.7.3. There is no limit to the number of times that this process may be repeated.

For the lower band interrogators shall support trigger techniques that indicate the presence or arrival of objects that may be tagged. Irrespective of the application, an interrogator operating in the lower band shall stop transmitting after it has ceased to read any further tags, as specified in clause 4.3.7.3.

For operation in the upper band, 915 MHz to 921 MHz, interrogators shall transmit on any of the high power channels but for no longer than is necessary to complete the intended operation.

NOTE: The frequency band 915 MHz to 921 MHz has only a limited implementation status within the European Union and the CEPT countries. ERC/REC 70-03 [i.9] provides in appendix 1 an overview of countries where the band is implemented.

In some member states the upper sub-band 918 MHz to 921 MHz is allocated to the railways for ER-GSM. For the case that a frequency allocation is available in those countries for RFID, sharing of this sub-band by RFID with ER-GSM is permitted provided RFID systems operate in accordance with agreed mitigation techniques. These are specified in clause 4.3.8.3 and annex C and require interrogators to use ER-GSM receiver(s), or equivalent, covering either the frequency range 918 MHz to 921 MHz or R-GSM receivers covering the frequency range 921 MHz to 925 MHz. Each interrogator may be fitted with its own (E)R-GSM receiver module. Alternatively it is permissible for a single (E)R-GSM receiver to monitor BCCH messages and serve all of the interrogators on a site. Where this applies the antenna of the (E)R-GSM receiver shall be positioned to ensure maximum coverage.

In some member states parts of the upper band are allocated for the exclusive use of the military and government services. This applies predominantly to the lower sub-band 915 MHz to 918 MHz. Interrogators capable of operating in this band shall provide a means to prevent operation at the restricted frequencies in the applicable member states.

Where an interrogator is only able to transmit on a single band, testing shall be preformed in the applicable band.

In a preferred method of operation tags, which are activated by an interrogator transmitting in a high power channel, respond in the adjacent low power channels. This technique is called the dense interrogator mode. It has the benefit of separating the frequencies of transmission of the interrogators and tags, allowing multiple interrogators to share the same channel thereby improving system performance. It also minimizes the generation of inter-modulation products, which may disrupt the behaviour of tags.

Interrogators may also operate in a presence-sensing mode in which they periodically transmit to determine whether tags have entered their interrogation zones. When operating in this mode, interrogators shall restrict the length of each transmission to less than 1 second and the period between successive transmissions shall be no less than 100 ms. Once an interrogator has determined the presence of tags, it will commence its reading routine.

It is permissible for interrogators to transmit simultaneously in both the lower and upper bands.

4.2.2 Designated frequencies

4.2.2.1 Lower band

Interrogators operating in the lower band shall use any of the four specified high power channels illustrated in figure 1. The centre frequency of the lowest channel shall be 865,7 MHz and the bandwidth of each high power channel shall be 200 kHz. The remaining three high power channels shall be spaced at equal intervals of 600 kHz. Tags should respond in the dense interrogator mode within the low power channels.

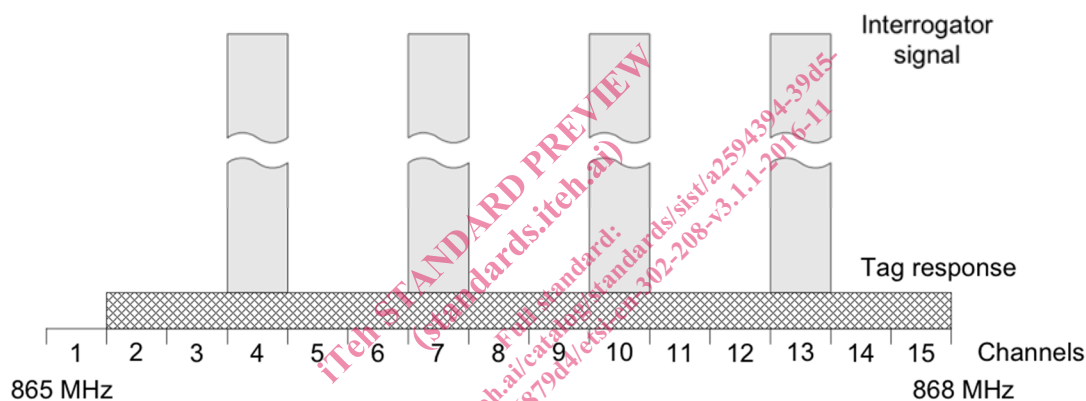


Figure 1: Channel plan for lower band

4.2.2.2 Upper band

For the upper band the centre frequency of the lowest channel shall be 916,3 MHz and the bandwidth of each high power channel shall be 400 kHz. The remaining three high power channels shall be spaced at equal intervals of 1,2 MHz. Tags shall respond in the dense interrogator mode within the low power channels.

A diagram of the channel plan for the upper band is shown in figure 2.

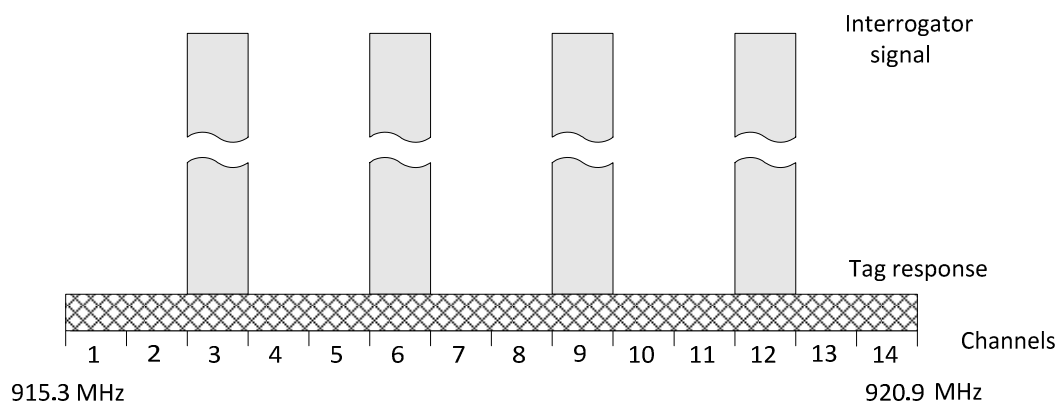


Figure 2: Channel plan for upper band