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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 for access to radio spectrum

Reference

REN/ERM-TG34-265

Keywords

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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).

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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. The frequency usage conditions for RFIDs in the band 865 MHz to 868 MHz are EU wide harmonised according to 2006/804/EC [i.12].

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.

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.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.3] is given in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

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

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

[1] Void.

[2] IEEE/ANSI C63.5-2017: "American National Standard for Electromagnetic Compatibility--Radiated Emission Measurements in Electromagnetic Interference (EMI) Control--Calibration and Qualification of Antennas (9 kHz to 40 GHz)".

[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.

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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] Void.

[i.2] Void.

[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.

[i.12] 2006/804/EC: "Commission Decision of 23 November 2006 on harmonisation of the radio spectrum for radio frequency identification (RFID) devices operating in the ultra high frequency (UHF) band".

[i.13] ETSI TR 102 273 (all parts) (V1.2.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".

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

manufacturer: As given in article 2 of Directive 2014/53/EU [i.3].

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
fc	centre frequency of carrier transmitted by interrogator
fe	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
EFTA	European Foreign Trade Association
EMC	ElectroMagnetic Compatibility
emf	electromotive force
ERC	European Radio communication Committee
ER-GSM	Extended Railways GSM
EUT	Equipment Under Test
FT	Full Tests

G_{IC}	Gain of a circular antenna in dBic
G_{MR}	Gain Measurement Receiver
GSM	Global System for Mobile
GSM-R	Global System for Mobile communication for Railways applications
IE	Information Element
LT	Limited Tests
MPT	Ministry of Posts and Telecommunications
OATS	Open Area Test Site
P_C	Power Carrier
P_{MR}	Signal strength received at the measurement receiver
ppm	part per million
RBW	Resolution Bandwidth
RF	Radio Frequency
RFID	Radio Frequency Identification
R-GSM	Railway GSM
RMS	Root Mean Square
S_{ACH}	Selectivity Adjacent Channel
SBL	Signal Blocking Level
SRD	Short Range Device
TCH	Traffic Channel
TX	Transmitter
UHF	Ultra High Frequency
VSWR	Voltage Standing Wave Ratio

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 manufacturer. The equipment shall comply with all the technical requirements of the present document which are identified as applicable in annex A 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 performed 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.

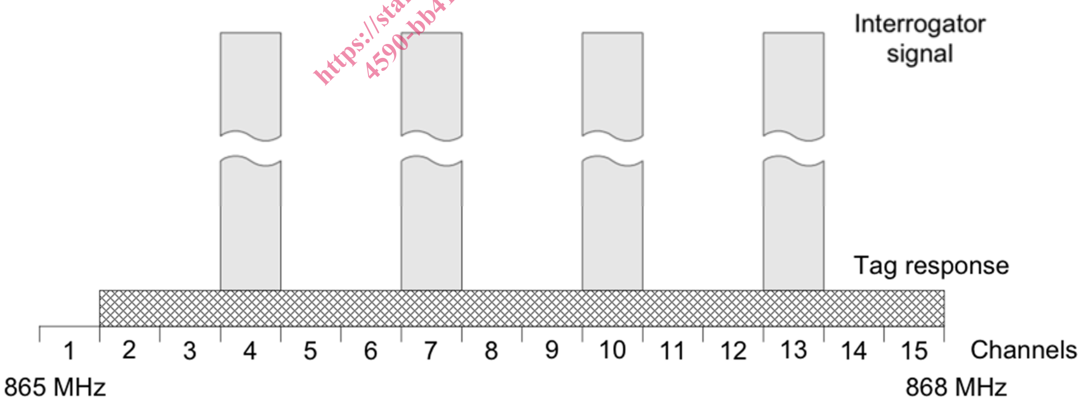

Figure 1: Channel plan for lower band

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.