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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 covering the essential requirements of article 3.2 of the Directive 2014/53/EU

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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	15
4.3 Transmitter conformance requirements.....	15
4.3.1 Frequency error.....	15
4.3.1.1 Applicability.....	15
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	16
4.3.2.4 Conformance.....	16
4.3.3 Effective radiated power.....	16
4.3.3.1 Applicability.....	16
4.3.3.2 Definition	16
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	17
4.3.4.4 Conformance.....	17
4.3.5 Transmitter spectrum masks	17
4.3.5.1 Applicability.....	17
4.3.5.2 Definition	17
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)	18
4.3.5.4 Conformance.....	19
4.3.6 Transmitter spurious emissions.....	19
4.3.6.1 Applicability.....	19
4.3.6.2 Definition	19

4.3.6.3	Limits	19
4.3.6.4	Conformance	20
4.3.7	Transmission times	20
4.3.7.1	Applicability	20
4.3.7.2	Definition	20
4.3.7.3	Limits	20
4.3.7.4	Conformance	20
4.3.8	Mitigation using DAA	21
4.3.8.1	Applicability	21
4.3.8.2	Definition	21
4.3.8.3	Limits	21
4.3.8.4	Conformance	21
4.4	Receiver conformance requirements	21
4.4.1	Adjacent channel selectivity	21
4.4.1.1	Applicability	21
4.4.1.2	Definition	21
4.4.1.3	Limits	21
4.4.1.4	Conformance	21
4.4.2	Blocking or desensitization	22
4.4.2.1	Applicability	22
4.4.2.2	Definition	22
4.4.2.3	Limits	22
4.4.2.4	Conformance	22
4.4.3	Spurious emissions	22
4.4.3.1	Applicability	22
4.4.3.2	Definition	22
4.4.3.3	Limits	22
4.4.3.4	Conformance	22
4.5	Tag conformance requirements	23
4.5.1	Radiated power (e.r.p.)	23
4.5.1.1	Applicability	23
4.5.1.2	Definition	23
4.5.1.3	Limits	23
4.5.1.4	Conformance	23
4.5.2	Unwanted emissions	23
4.5.2.1	Applicability	23
4.5.2.2	Definition	23
4.5.2.3	Limits	23
4.5.2.4	Conformance	24
5	Testing for compliance with technical requirements	25
5.1	Environmental conditions for testing	25
5.1.1	Normal and extreme test conditions	25
5.1.1.1	Normal test conditions	25
5.1.1.2	Extreme temperatures	25
5.1.1.2.1	Procedure for tests at extreme temperatures	25
5.1.1.2.2	Procedure for equipment designed for continuous operation	25
5.1.1.2.3	Procedure for equipment designed for intermittent operation	25
5.1.1.3	Extreme temperature ranges	26
5.1.2	Test power sources	26
5.1.2.1	General requirements	26
5.1.2.2	Normal test power source	26
5.1.2.2.1	Mains voltage	26
5.1.2.2.2	Regulated lead-acid battery power sources	26
5.1.2.2.3	Other power sources	26
5.1.2.3	Extreme test power source	27
5.1.2.3.1	Mains voltage	27
5.1.2.3.2	Regulated lead-acid battery power sources and gel-cell battery power sources	27
5.1.2.3.3	Power sources using other types of batteries	27
5.1.2.3.4	Other power sources	27
5.1.3	Testing under extreme conditions	27
5.2	Interpretation of the measurement results	27

5.3	Submission of equipment for testing	28
5.3.1	Mechanical and electrical design	28
5.3.1.1	General requirements	28
5.3.1.2	Controls	28
5.3.1.3	Transmitter shut-off facility	28
5.3.1.4	Battery saving circuit	28
5.3.1.5	Declarations by the provider	28
5.3.1.6	Auxiliary test equipment	28
5.3.2	General conditions for testing of transmitters	29
5.3.2.1	Normal test signals and test modulation	29
5.3.2.2	Normal test signals for data	29
5.3.2.3	Artificial antenna	29
5.3.2.4	Modes of operation of the transmitter	29
5.3.2.5	Test sites and general arrangements for radiated measurements	29
5.3.2.6	Measuring receiver	29
5.3.2.7	Testing of operational frequencies	29
5.4	Presentation of equipment for testing	29
5.4.1	General requirements	29
5.4.2	Choice of model for testing	30
5.4.3	Provisions of samples for testing	30
5.4.4	Equipment without an internal permanent or temporary antenna connector	30
5.4.5	Test fixture	30
5.4.6	Submission of additional equipment with a temporary antenna connector	31
5.4.7	Channel range	31
5.4.8	Adjustable carrier levels	31
5.4.9	Test mode	31
5.5	Essential transmitter test suites	32
5.5.1	Measurement of frequency error for mains operated equipment	32
5.5.2	Frequency stability under low voltage conditions	32
5.5.3	Effective Radiated power (e.r.p.)	32
5.5.3.1	General	32
5.5.3.2	Method of measurement	32
5.5.3.2.1	General	32
5.5.3.2.2	Radiated measurement	32
5.5.3.2.3	Conducted measurement	34
5.5.4	Transmitter antenna beam-width	34
5.5.4.1	General	34
5.5.4.2	Radiated measurement	34
5.5.5	Transmitter spectrum mask	35
5.5.5.1	Method of measurement	35
5.5.6	Transmitter spurious emissions	36
5.5.6.1	Method of measurement	36
5.5.6.2	Method of measuring the spurious power level in a specified load, clause 5.5.6.1, a) i)	37
5.5.6.3	Method of measuring the spurious effective radiated power, clause 5.5.6.1 a) ii)	37
5.5.6.4	Method of measuring spurious effective radiated power, clause 5.5.6.1, b)	38
5.5.7	Transmission times	39
5.5.7.1	Method of measurement	39
5.5.8	Mitigation using DAA	39
5.5.8.1	Set-up for tests	39
5.5.8.2	Tests for Mitigation Method 1	40
5.5.8.3	Tests for Mitigation Method 2	41
5.6	Essential receiver test suites	43
5.6.1	Adjacent channel selectivity	43
5.6.1.1	General	43
5.6.1.2	Method of measuring radiated signals	43
5.6.1.3	Conducted method of measurement	44
5.6.2	Blocking or desensitization	46
5.6.2.1	General	46
5.6.2.2	Method of measuring radiated signals	46
5.6.2.3	Conducted method of measurement	47
5.7	Essential tag test suites	47
5.7.1	Tag radiated power (e.r.p.)	47

5.7.1.1	Method of measurement.....	47
5.7.1.2	Method of measuring the power in an un-modulated sub-carrier, clause 5.7.1.1 a).....	48
5.7.1.3	Method of measuring the power in a modulated sub-carrier, clause 5.7.1.1 b).....	49
5.7.2	Unwanted emissions	50
5.7.2.1	Method of measurement.....	50
Annex A (normative):	Relationship between the present document and the essential requirements of Directive 2014/53/EU	52
Annex B (normative):	Radiated measurement.....	54
B.1	Test sites and general arrangements for measurements involving the use of radiated fields	54
B.1.1	General	54
B.1.2	Anechoic chamber	54
B.1.3	Anechoic chamber with a conductive ground plane	55
B.1.4	Open Area Test Site (OATS)	56
B.1.5	Test antenna.....	57
B.1.6	Substitution antenna	57
B.1.7	Measuring antenna	58
B.1.8	Stripline arrangement	58
B.1.8.1	General.....	58
B.1.8.2	Description.....	58
B.1.8.3	Calibration	58
B.1.8.4	Mode of use	58
B.2	Guidance on the use of radiation test sites	58
B.2.1	General	58
B.2.2	Verification of the test site	59
B.2.3	Preparation of the EUT.....	59
B.2.4	Power supplies to the EUT	59
B.2.5	Range length.....	59
B.2.6	Site preparation	60
B.3	Coupling of signals.....	60
B.3.1	General	60
B.3.2	Data signals	60
B.4	Standard test position	61
B.5	Test fixture	61
B.5.1	General	61
B.5.2	Description	61
B.5.3	Calibration	62
B.5.4	Mode of use.....	63
Annex C (normative):	Mitigation technique.....	64
C.1	Introduction	64
C.2	Principle of operation	64
C.3	Method 1 - Scanning band 918 MHz to 925 MHz	64
C.4	Method 2 - Scanning band 921 MHz to 925 MHz	64
C.5	Technical requirements	65
C.6	Requirements for Method 1	65
C.7	Requirements for Method 2.....	67
Annex D (informative):	Bibliography.....	68
History		69

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

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.

National transposition dates

Date of adoption of this EN:	23 May 2016
Date of latest announcement of this EN (doa):	31 August 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	28 February 2017
Date of withdrawal of any conflicting National Standard (dow):	28 February 2018

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.

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.

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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

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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] 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".

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
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 manufacturer. 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 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.

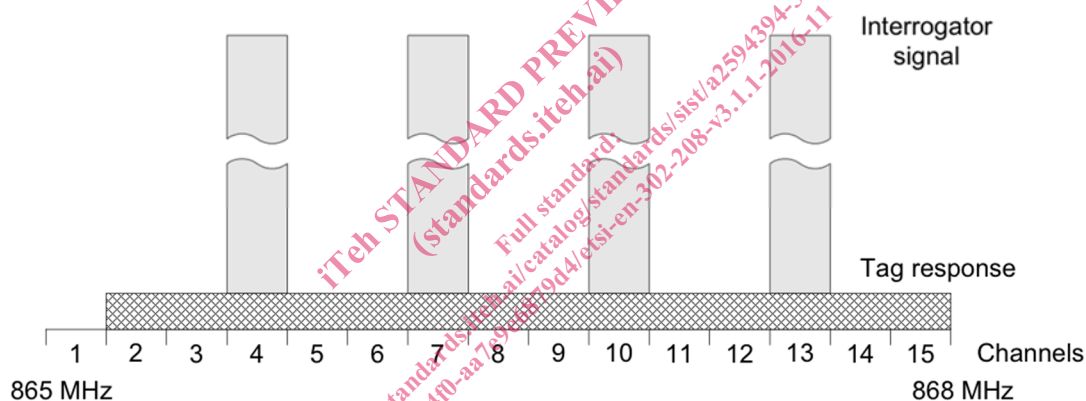


Figure 1: Channel plan for lower band

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.