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Broadband Direct Air-to-Ground Communications;
Equipment operating in the 1 900 MHz to 1 920 MHz and 5 855 MHz to 5 875 MHz frequency bands;
Fixed pattern antennas;
Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

Reference
DEN/BRAN-0060014

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN), 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 in reply to the Commission's standardisation request Commission Implementing Decision C(2015) 5376 final of 04.08.2015 to provide a means of conforming to the essential requirements of Directive 2014/053/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment.

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.

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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Executive summary

The present document addresses the Broadband Direct Air-to-Ground Communications system based on the ETSI System Reference Document ETSI TR 103 108 [i.6]. This System Requirement document was used by the ECC, in conjunction with other contributions, to develop technology neutral ECC Decisions on the allocation of European spectrum in the frequency bands 1 900 MHz to 1 920 MHz and 5 855 MHz to 5 875 MHz.

The technical requirements in the present document reflect, in part, the results of studies undertaken within the CEPT on compatibility between broadband direct air-to-ground systems and other applications operating within, or adjacent to, the frequency bands that are designated for Broadband DA2GC operations.

Introduction

The technical requirements in the present document reflect, in part, the results of studies undertaken within the CEPT on compatibility between broadband direct air-to-ground systems and other applications operating within, or adjacent to, the frequency bands which are designated for BDA2GC operations. These studies are described in ECC Report 209 [i.2] (for the 1 900 MHz to 1 920 MHz band) and ECC Report 210 [i.3] (for the 5 855 MHz to 5 875 MHz band).

The resulting technical and operational requirements to be applied to BDA2GC systems in the 1 900 MHz to 1 920 MHz bands and the 5 855 MHz to 5 875 MHz bands are contained within ECC Decision(15)02 [i.4] and ECC Decision(15)03 [i.5] respectively.

1 Scope

The present document applies to the Ground Station, Aircraft Station and antenna equipment for DA2GC (TDD).

This radio equipment type is capable of operating in all or any part of the frequency bands given in table 1.

Table 1: DA2GC TDD service frequency bands

Direction of Transmission	Frequency Band
Transmit 1	1 900 MHz to 1 920 MHz
Receive 1	1 900 MHz to 1 920 MHz
Transmit 2	5 855 MHz to 5 875 MHz
Receive 2	5 855 MHz to 5 875 MHz

The present document contains requirements to demonstrate that 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 EN 301 126-3-2 (V1.2.1) (12-2003): "Fixed Radio Systems; Conformance testing; Part 3-2: Point-to-Multipoint antennas - Definitions, general requirements and test procedures".

[2] NIMA Technical Report TR8350.2 (1984, including amendment 1 of 03 January 2000 and amendment 2 of 23 June 2004): "Department of Defense World Geodetic System 1984. Its Definition and Relationships with Local Geodetic Systems".

NOTE: Available at http://earth-info.nga.mil/GandG/publications/tr8350.2/wgs84fin.pdf.

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] 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.2] ECC Report 209: "Compatibility/sharing studies related to Broadband Direct-Air-to-Ground Communications (DA2GC) in the frequency bands 1900-1920 MHz / 2010-2025 MHz and services/applications in the adjacent bands".

[i.3] ECC Report 210: "Compatibility/sharing studies related to Broadband Direct-Air-to-Ground Communications (DA2GC) in the frequency bands 5855-5875 MHz, 2400-2483.5 MHz and 3400-3600 MHz".

[i.4] ECC Decision ECC/DEC(15)02 "The harmonised use of broadband Direct Air-to-Ground Communications (DA2GC) systems in the frequency band 1900-1920 MHz".

[i.5] ECC Decision ECC/ DEC(15)03 "The harmonised use of broadband Direct Air-to-Ground Communications (DA2GC) systems in the frequency band 5855-5875 MHz".

[i.6] ETSI TR 103 108 (V1.1.1) (2013-07) "Electromagnetic compatibility and Radio spectrum Matters (ERM); System Reference document (SRdoc); Broadband Direct-Air-to-Ground Communications System operating in the 5,855 GHz to 5,875 GHz band using 3G technology".

[i.7] 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 (Commission Implementing Decision C(2015) 5376 final of 4.8.2015).

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in Directive 2014/53/EU [i.1] and the following apply:

altitude: height above ground level

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

3.2 Symbols

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

f_o frequency offset

3.3 Abbreviations

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

ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
AS	Aircraft Station
BER	Bit Error Rate
BFWA	Broadband Fixed Wireless Access
BW	Bandwidth
CEPT	Conférence Européenne des Postes et des Télécommunications
CW	Carrier Wave
DA2GC	Direct Air to Ground Communications
e.i.r.p.	Effective Isotropic Radiated Power
ECC	Electronic Communications Committee
EEC	European Economic Community
EMC	Electromagnetic Compatibility
GNSS	Global Navigation Satellite System
GS	Ground Station
LTE	Long Term Evolution
LV	Low Voltage
OFDMA	Orthogonal Frequency Division Multiple Access
QPSK	Quadrature Phase-Shift Keying
REFSENS	Receiver Reference Sensitivity
REQPERF	Receiver Required Performance

RF	Radio Frequency
RMS	Root Mean Square
TDD	Time Division Duplex
WCDMA	Wideband Code Division Multiple Access

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 Conformance requirements

4.2.1 Introduction

This clause describes the conformance requirements for the DA2GC equipment. The requirements for the bands 1 900 MHz to 1 920 MHz and 5 855 MHz to 5 875 MHz are identical unless otherwise stated. Consequently, the maximum channel bandwidth is 20 MHz for each band.

To meet the essential requirement of Directive 2014/53/EU [i.1] for DA2GC equipment five essential parameters have been identified. Table 2 provides a cross reference between these five essential parameters and the corresponding ten technical requirements for equipment within the scope of the present document.

To fulfil an essential parameter the compliance with all the corresponding technical requirements in table 2 shall be verified.

The required performance REQPERF is defined as follows:

- For WCDMA modulation: "BER ≤ 0,1 %".
- For OFDMA modulation: "95 % of theoretical maximum throughput when using the QPSK modulation scheme."

The reference sensitivity REFSENS is the minimum signal power required to achieve REQPERF.

Table 2: Cross references

Essential parameter	Corresponding technical requirements
Spectrum emissions mask	4.2.2 Spectrum emission mask
	4.2.3 Transmitter Adjacent Channel Leakage power Ratio (ACLR)
Conducted spurious emissions from the transmitter antenna connector	4.2.4 Transmitter spurious emissions
Accuracy of maximum output power	4.2.5 Maximum output power
Receiver Parameters	4.2.8 Minimum Receiver Sensitivity
	4.2.9 Receiver Spurious Response
	4.2.10 Receiver Adjacent Band Rejection
	4.2.11 Receiver Intermodulation Rejection
	4.2.12 Receiver Blocking Immunity
Antennas	4.2.13 Dedicated Antennas

4.2.2 Spectrum Emission Mask

4.2.2.1 Definition

Spectrum emission mask defines an out-of-band emission requirement for the Ground Station and Aircraft Station transmitters. These out-of-band emissions are emissions immediately outside the channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Its measurement is at the antenna port.

4.2.2.2 Limits

The limits given in table 3 shall apply.

Table 3: Spectrum Emission Mask Limits

Sub-System	Out-of-band Frequency Offset f_{offset} (MHz)	Maximum Emission Power (dBm/MHz)
Ground Station	$0 \le f_{offset} < 0,75 \times BW$	-12
	$0,75 \times BW \le f_{offset} < 2,5 \times BW$	-32
Aircraft Station	$0 \le f_{offset} < 0,75 \times BW$	-14
	$0,75 \times BW \le f_{offset} < 2,5 \times BW$	-34

4.2.2.3 Conformance

Conformance tests described in clause 5.3.1 shall be carried out.

4.2.3 Transmitter Adjacent Channel Leakage Power (1 900 MHz to 1 920 MHz)

4.2.3.1 Definition

Transmitter Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the mean power centred on the assigned channel frequency to the mean power centred on an adjacent channel frequency. The requirements shall apply solely for the band 1 900 MHz to 1 920 MHz and for all operating modes foreseen by the manufacturer's specification.

4.2.3.2 Limits

The ACLR shall be equal to or greater than the limits given in table 4.

Table 4: Transmitter ACLR limits

	Channel Bandwidth					
	1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Aircraft Station first ACLR	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB
Aircraft Station second ACLR	42,2 dB	42,2 dB	42,2 dB	42,2 dB	42,2 dB	42,2 dB
Ground Station first ACLR	44,2 dB	44,2 dB	44,2 dB	44,2 dB	44,2 dB	44,2 dB
Ground Station second ACLR	52,2 dB	52,2 dB	52,2 dB	52,2 dB	52,2 dB	52,2 dB

4.2.3.3 Conformance

Conformance tests described in clause 5.3.2 shall be carried out.

4.2.4 Transmitter spurious emissions

4.2.4.1 Definition

Transmitter spurious emissions are emissions that are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out-of-band emissions. This is measured at the RF output port.