

ETSI EN 303 339 V1.1.1 (2016-06)



**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**

<https://standards.technical.eu/standards/etsi/en/303-339-v1.1.1-2016-06>

Reference

DEN/BRAN-0060014

Keywords

3G, 3GPP, aeronautical, broadband, cellular,
E-UTRA, IMT, IMT-2000, IMT-Advanced, LTE,
mobile, network, radio, regulation, UMTS,
WCDMA

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.

Content

Intellectual Property Rights	6
Foreword.....	6
Modal verbs terminology.....	6
Executive summary	7
Introduction	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.....	9
3.3 Abbreviations	9
4 Technical requirements specifications	10
4.1 Environmental profile.....	10
4.2 Conformance requirements	10
4.2.1 Introduction.....	10
4.2.2 Spectrum Emission Mask	11
4.2.2.1 Definition	11
4.2.2.2 Limits	11
4.2.2.3 Conformance.....	11
4.2.3 Transmitter Adjacent Channel Leakage Power (1 900 MHz to 1 920 MHz).....	11
4.2.3.1 Definition	11
4.2.3.2 Limits	12
4.2.3.3 Conformance.....	12
4.2.4 Transmitter spurious emissions and maximum unwanted emissions in the band 5,250 GHz to 5,850 GHz.....	12
4.2.4.1 Definition	12
4.2.4.2 Limits	12
4.2.4.3 Measurement bandwidths.....	12
4.2.4.4 Conformance.....	12
4.2.5 Maximum output power.....	13
4.2.5.1 Definition	13
4.2.5.2 Limits - Ground Station	13
4.2.5.3 Limits - Aircraft Station	13
4.2.5.4 Conformance.....	13
4.2.6 Altitude attenuation factor - Aircraft Station	13
4.2.6.1 Definition	13
4.2.6.2 Limits	13
4.2.6.3 Conformance.....	13
4.2.7 Compatibility with BFWA - Aircraft Station	13
4.2.7.1 Definition	13
4.2.7.2 Limits	14
4.2.7.3 Conformance.....	14
4.2.8 Receiver Minimum Sensitivity	14
4.2.8.1 Definition	14
4.2.8.2 Limit.....	14
4.2.8.3 Conformance.....	14
4.2.9 Receiver Spurious Response.....	14
4.2.9.1 Definition	14
4.2.9.2 Limit.....	14
4.2.9.3 Conformance.....	15
4.2.10 Receiver Adjacent Channel Selectivity.....	15

4.2.10.1	Definition	15
4.2.10.2	Limit.....	15
4.2.10.3	Conformance.....	15
4.2.11	Receiver Intermodulation Rejection	15
4.2.11.1	Definition	15
4.2.11.2	Limit.....	15
4.2.11.3	Conformance.....	16
4.2.12	Receiver Blocking	16
4.2.12.1	Definition	16
4.2.12.2	Limit.....	16
4.2.12.3	Conformance.....	17
4.2.13	Dedicated Antennas - Radiation Pattern Envelopes.....	17
4.2.13.1	Aircraft station	17
4.2.13.2	Ground station.....	18
4.2.13.2.1	Sectorial antenna	18
4.2.13.2.2	Directional antenna.....	19
4.2.13.2.3	Omnidirectional antenna.....	20
4.2.13.3	Conformance.....	20
4.2.14	Dedicated Antenna Gain Requirements.....	20
4.2.14.1	General	20
4.2.14.2	Antenna Maximum Gain.....	21
4.2.14.3	Conformance.....	21
5	Testing for compliance with technical requirements.....	21
5.1	Environmental conditions for testing	21
5.1.1	Ground and Aircraft Station Transceivers	21
5.1.2	Ground and Aircraft Station Antennas.....	21
5.2	Interpretation of the measurement results	21
5.3	Essential radio test suites.....	22
5.3.1	Introduction.....	22
5.3.2	Spectrum Emission Mask	23
5.3.2.1	Initial conditions	23
5.3.2.2	Procedure	23
5.3.2.3	Test requirement	23
5.3.3	Transmitter adjacent channel leakage power ratio (ACLR).....	23
5.3.3.1	Initial conditions	23
5.3.3.2	Procedure	23
5.3.3.3	Test requirement	23
5.3.4	Transmitter spurious emissions	24
5.3.4.1	Initial conditions	24
5.3.4.2	Procedure	24
5.3.4.3	Test requirement	24
5.3.5	Transmitter maximum output power.....	24
5.3.5.1	Initial conditions	24
5.3.5.2	Procedure	24
5.3.5.3	Test requirement	24
5.3.6	Altitude attenuation factor - Aircraft Station	24
5.3.6.1	Initial conditions	24
5.3.6.2	Procedure	24
5.3.6.3	Test requirement	25
5.3.7	Compatibility with BFWA - Aircraft Station	25
5.3.7.1	Initial conditions	25
5.3.7.2	Procedure	25
5.3.7.3	Test requirement	25
5.3.8	Receiver Minimum Sensitivity	25
5.3.8.1	Initial conditions	25
5.3.8.2	Procedure	25
5.3.8.3	Test requirement	25
5.3.9	Receiver Spurious Response.....	26
5.3.9.1	Initial conditions	26
5.3.9.2	Procedure	26
5.3.9.3	Test requirement	26

5.3.10	Receiver Adjacent Channel Selectivity.....	26
5.3.10.1	Initial conditions	26
5.3.10.2	Procedure	26
5.3.10.3	Test requirement	26
5.3.11	Receiver Intermodulation Rejection	27
5.3.11.1	Initial conditions	27
5.3.11.2	Procedure	27
5.3.11.3	Test requirement	27
5.3.12	Receiver Blocking	27
5.3.12.1	Initial conditions	27
5.3.12.2	Procedure	27
5.3.12.3	Test requirement	27
5.3.13	Dedicated antennas	27
Annex A (normative):	Relationship between the present document and the essential requirements of Directive 2014/53/EU	28
Annex B (normative):	Test specification.....	30
B.1	Normal test environment.....	30
B.2	RF Signals	30
B.2.1	Bandwidth	30
B.2.2	Channels.....	30
B.3	Test Configurations	30
B.3.1	Maximum output power, transmitter spurious emissions and operating band unwanted emissions	30
B.3.2	Altitude Attenuation factor.....	31
B.3.3	Receiver ACS, Blocking and Spurious.....	31
B.3.4	Receiver Intermodulation.....	32
Annex C (informative):	Environmental profile specification	33
Annex D (normative):	Geographical Data.....	34
D.1	Introduction	34
D.2	Altitude determination.....	34
D.3	BFWA mitigation.....	34
D.4	Time currency	34
Annex E (informative):	Bibliography.....	35
Annex F (informative):	Change History	36
History		37

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 Harmonised European Standard (EN) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.7] 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.1].

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.

National transposition dates	
Date of adoption of this EN:	21 June 2016
Date of latest announcement of this EN (doa):	30 September 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 March 2017
Date of withdrawal of any conflicting National Standard (dow):	31 March 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).

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

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
Full standard:
<https://standards.iteh.ai/catalog/standards/sist/7cf19bd3-c3d7-4ea5-99cc-d5db745f6ed8/etsi-en-303-339-v1.1.1-2016-06>

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.

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] 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) (07-2013): "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] 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.

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
Mcps	Megachips per second
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 fulfill 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 \leq 0,1 %".
- For OFDMA modulation: "95 % of theoretical maximum throughput when using the QPSK modulation scheme".

The reference sensitivity REFSSENS 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	$0,475 \leq f_{\text{offset}} < 0,75 \times \text{BW}$	-12
	$0,75 \times \text{BW} \leq f_{\text{offset}} < 2,5 \times \text{BW}$	-32
Aircraft Station	$0,475 \leq f_{\text{offset}} < 0,75 \times \text{BW}$	-14
	$0,75 \times \text{BW} \leq f_{\text{offset}} < 2,5 \times \text{BW}$	-34

4.2.2.3 Conformance

Conformance tests described in clause 5.3.2 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.