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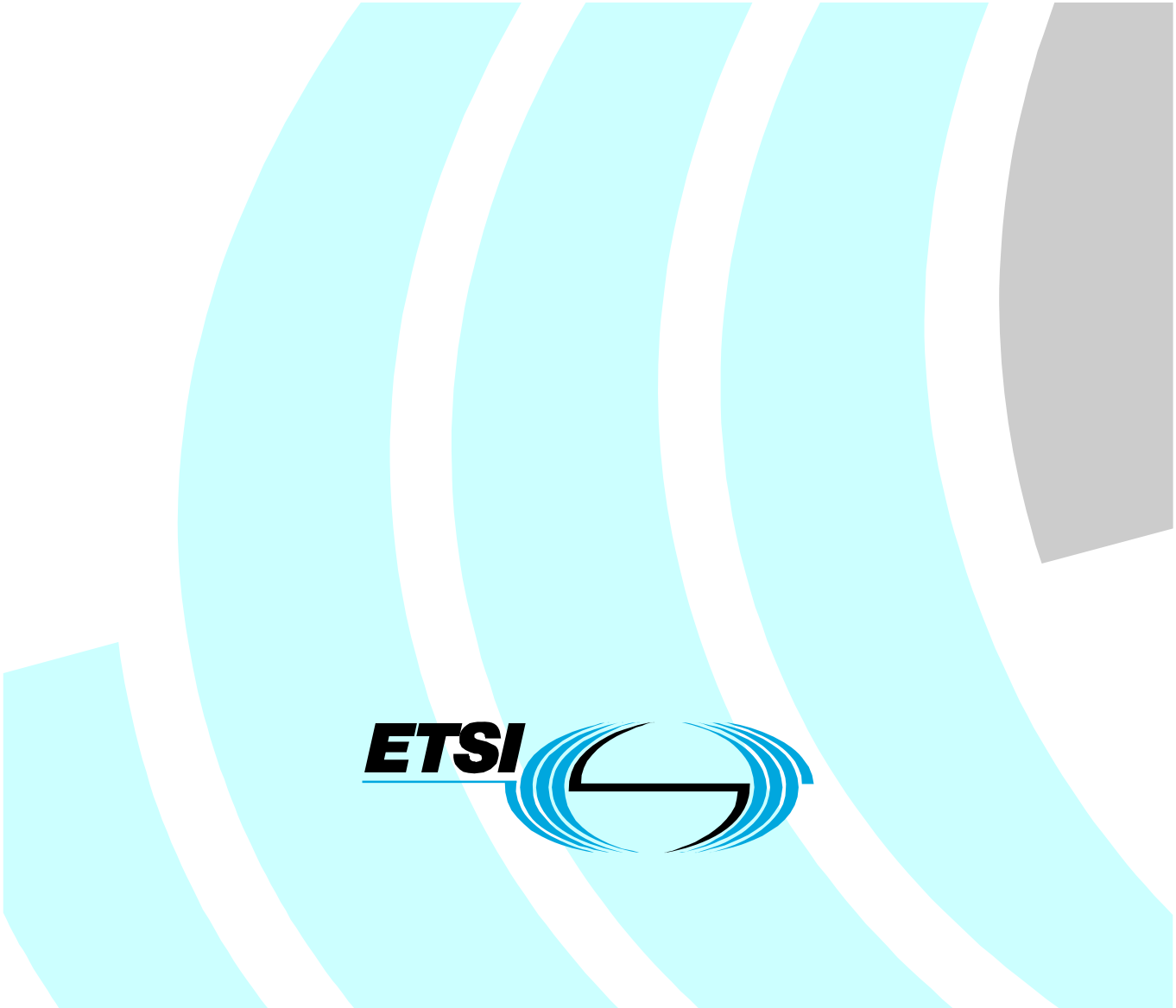
Harmonized European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Harmonized EN for the GSM onboard aircraft system covering essential requirements of Article 3.2 of the R&TTE Directive



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Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive").

Technical specifications relevant to Directive 1999/5/EC are given in annex A.

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

Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive. The modular structure is shown in EG 201 399 (see bibliography).

1 Scope

The present document applies to a system comprising the following radio equipment types:

1) an Onboard GSM Base Transceiver System (OBTS) supporting the GSM 1800 functions with specific protocols for power constraints;

2) a Network Control Unit (NCU).

These radio equipment types are capable of operating in all or any part of the frequency bands given below:

Table 1: Radiocommunications service frequency bands

	Radiocommunications service frequency bands
Transmit 1 (OBTS)	1 805 MHz to 1 880 MHz
Receive 1 (OBTS)	1 710 MHz to 1 785 MHz
Transmit 2 (NCU)	460 MHz to 470 MHz
Transmit 2 (NCU)	921 MHz to 960 MHz
Transmit 2 (NCU)	1 805 MHz to 1 880 MHz
Transmit 2 (NCU)	2 110 MHz to 2 170 MHz

It applies to equipment for continuous and discontinuous transmission of data and digital speech.

The present document applies only to radio equipment using a dedicated transmitting antenna that is designed as an indispensable part of the system for usage on board an aircraft.

The system covered by the present document operates in accordance with the operational requirements as outlined in the Decision ECC/DEC/(06)07.

The present document covers the provisions of Directive 1999/5/EC (the R&TTE Directive), Article 3.2, which states that "….. radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of Article 3 of the R&TTE Directive may apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site http://www.newapproach.org.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version 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.

[1] ETSI TS 145 005 (V6.14.0): "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (3GPP TS 45.005 version 6.14.0 Release 6)".

[2] ETSI TS 145 008 (V6.18.0): "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (3GPP TS 45.008 version 6.18.0 Release 6)".

[3] 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".

[4] ETSI TS 151 021 (V6.3.0): "Digital cellular telecommunications system (Phase 2+); Base Station System (BSS) equipment specification; Radio aspects (3GPP TS 51.021 version 6.3.0 Release 6)".

[5] CISPR 16-2-1 (2005): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements".

[6] EUROCAE ED-14E (2005) (Equivalent to RTCA DO-160E): "Environmental Conditions and Test Procedures for Airborne Equipment".

3 Definitions and abbreviations

3.1 Definitions

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

Base Station System Test Equipment (BSSTE): functional tool for the purpose of acceptance testing of GSM Base Station Systems

NOTE: The BSSTE functionally carries out all tests described in the OBTS specification.

Base Transceiver Station (BTS): network element in radio access network responsible for radio transmission and reception to or from the MS

environmental profile: range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document

Installable Equipment (IE): equipment which is intended to be fitted to an aircraft

Network Control Unit (**NCU):** component of the system preventing direct connection of the onboard mobile terminals with mobile networks on the ground by raising the noise floor in the cabin

3.2 Abbreviations

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

ACU	Antenna Coupler Unit
BSSTE	Base Station System Test Equipment
BTS	Base Transceiver Station
dB	decibel
dBm	decibel relative to 1 mW
e.i.r.p.	equivalent isotropically radiated power
ECC	Electronic Communications Committee
GGW	Ground GateWay
GSM	Global System for Mobile communications
GSMOBA	GSM OnBoard Aircraft
IE	Installable Equipment
MS	Mobile Station
MSC	Mobile Switching Centre
NCU	Network Control Unit
OBA	OnBoard Aircraft
OBTS	Onboard BTS
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency

rms	root mean square
SGSN	Serving GPRS Support Node
STE	Special Test Equipment

4 Technical requirements specifications

4.1 General

4.1.1 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 and for the environmental conditions (as specified in clause B.3).

4.1.2 GSMOBA states

Figure 1 represents the state diagram of the GSMOBA system.

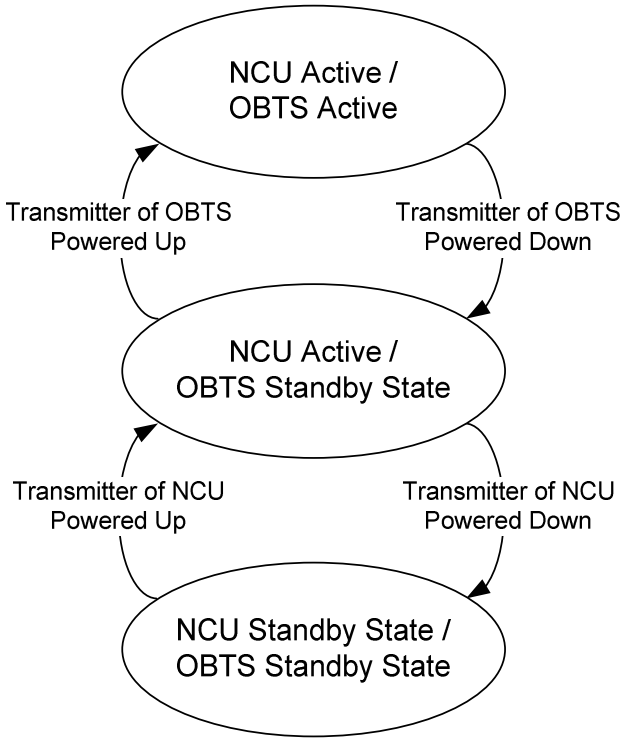


Figure 1: State diagram of GSMOBA system

When the NCU function of the GSMOBA system is in NCU Active state the Transmitter of the NCU is powered up, whereas when the NCU function of the GSMOBA system is in NCU Standby state the NCU is powered down.

When the OBTS function of the GSMOBA system is in OBTS Active state the Transmitter of the OBTS is powered up, whereas when the OBTS function of the GSMOBA system is in OBTS Standby state the OBTS is powered down.

4.2 Conformance requirements

4.2.1 OBTS Transmitter Performance

4.2.1.1 OBTS maximum output power

4.2.1.1.1 Definition

Output power refers to the measure of the power when averaged over the useful part of the burst (see TS 145 005 [1]).

4.2.1.1.2 Limits

The limit for the OBTS maximum output power shall conform to the maximum limit in clause 4.1.2 of TS 145 005 [1] for the BTS power class P1.

4.2.1.2 OBTS Output RF spectrum

4.2.1.2.1 Spectrum due to modulation and wideband noise

4.2.1.2.1.1 Definition

The spectrum due to modulation and wideband noise is the spectral spread caused by the modulation process in the transmitter.

4.2.1.2.1.2 Limits

The limit for the OBTS output RF power shall conform to the limits in clause 4.2.1 of TS 145 005 [1] for the applicable BTS power class P1.

4.2.1.2.2 Spectrum due to switching transients

4.2.1.2.2.1 Definition

The spectrum due to switching transients is the undesirable spectrum components in the transmission if the RF power is ramped too quickly.

4.2.1.2.2.2 Limits

The limit for the maximum power level shall conform to the limits in clause 4.2.2 of TS 145 005 [1].

4.2.1.3 OBTS Radio Frequency Tolerance

4.2.1.3.1 Definition

The radio frequency tolerance of the transmitter is the difference between the unmodulated carrier frequency and the nominal frequency selected for the test.

4.2.1.3.2 Limits

The limit for the radio frequency tolerance shall conform to the limits in clause 4.4 of TS 145 005 [1] for the applicable BTS power class P1.

4.2.1.4 OBTS controlled MS RF power

4.2.1.4.1 Definition

When an MS is switched on, it first scans its RF environment, then selects one GSM cell to camp on and then decodes the System Information transmitted on the BCCH channel of that cell. One of the parameters (MS_TXPWR_MAX_CCH) contained in the System Information (SI3) indicates to MS the maximum transmit power level that can be used by an MS during the initial access.

When an MS is in dedicated mode and connected to the GSMOBA system the RF output power of the MS shall be set at the nominal minimum power level of 0 dBm.

4.2.1.4.2 Limits

The following parameters shall be set to the power control level 15 i.e. 0 dBm (TS 145 005 [1], clause 4.1.1):

- MS_TXPWR_MAX_CCH;
- POWER_LEVEL; and
- GPRS_MS_TXPWR_MAX_CCH (if PBCCH is implemented).

POWER OFFSET shall be set to PARAMETER = 00 i.e. 0 dB (TS 145 008 [2], clause 6.4 only applicable for class 3 DCS1800 MS).

4.2.2 OBTS Receiver Performance

4.2.2.1 OBTS Reference Sensitivity Level

4.2.2.1.1 Definition

The static reference sensitivity level of the receiver is the level of signal at the receiver input with a standard test signal at which the receiver will produce after demodulation and channel decoding data with a Frame Erasure Ratio (FER), Residual Bit Error Ratio (RBER) Bit Error Ratio (BER) or Block Error Ratio (BLER) better than or equal to that specified for a specific logical channel type under static propagation conditions.

4.2.2.1.2 Limits

The limit for the OBTS reference sensivity level shall conform to the limits in clause 6.2 of TS 145 005 [1] for the applicable BTS power class P1.

4.2.2.2 Unwanted emissions in the spurious domain

4.2.2.2.1 Definition

Unwanted emissions in the spurious domain are emissions at frequencies, other than those of the transmitter carrier and sidebands associated with normal modulation at the adjacent frequencies.

4.2.2.2.2 Limits

The limit for the spurious emissions for the OBTS Receiver shall conform to the limits in clause 5.4 of TS 145 005 [1].

4.2.3 NCU Transmitter Performance

4.2.3.1 NCU maximum mean power spectral density

4.2.3.1.1 Definition

The maximum mean power spectral density for a given bandwidth represents the integration of power in a given bandwidth taking into account the antenna gain.

4.2.3.1.2 Limits

The maximum mean power spectral density shall not exceed the value contained in table 2.

The values for frequency bands 900 MHz (20 dBm) and 1 800 MHz (23 dBm) have been taken from the upper limit of the power class P1 (see TS 145 005 [1], clause 4.1.2).

The values for the frequency bands 450 MHz and 2 GHz have been derived using the same power class but converted to the reference bandwidth.

Table 2: power spectral density limit

Frequency band (MHz)	**460 - 470**	**921 - 960**	**1 805 - 1 880**	**2 110 - 2 170**
Reference bandwidth	1,25 MHz	200 kHz	200 kHz	3,84 MHz
Power (dBm within reference bandwidth)	28	20	23	36

It is highlighted that conformance to the power limits shown above shall not be interpreted as conformance of e.i.r.p. authorization limits as defined in the ECC/DEC/(06)07.

4.2.3.2 NCU power flatness

4.2.3.2.1 Definition

The power flatness is the variation of the power over each operating frequency band.

4.2.3.2.2 Limits

The power flatness shall be within ±3 dB over each operating frequency band.

4.2.4 GSMOBA Transmitter Performance

4.2.4.1 Unwanted emissions in the out-of-band domain

4.2.4.1.1 Definition

Unwanted emissions in the out-of-band domain are defined as the unwanted emissions outside the channel bandwidth resulting from the modulation process and non-linearity of the power amplifier in the transmitter and exclude the spurious emissions.

4.2.4.1.2 Limits

Out-of-band emission power spectral density measured in 100 kHz bandwidth shall be attenuated relative to the maximum power spectral density in each operating frequency band by the minimum attenuation values and for the frequency bands in table 3.

Table 3: Frequency parameters

		6 dB minimum attenuation		25 dB minimum attenuation		45 dB minimum attenuation	
Lower band limit f1 (MHz)	**Upper band limit f2 (MHz)**	**Lower band limit fc-Bw*58 % (MHz)**	**Upper band limit fc+Bw*58 % (MHz)**	**Lower band limit fc-Bw*75 % (MHz)**	**Upper band limit fc+Bw*75 % (MHz)**	**Lower band limit fc-Bw*250 % (MHz)**	**Upper band limit fc+Bw*250 % (MHz)**
460	470	459,2	470,8	457,5	472,5	440	490
921	960	917,88	963,12	911,25	969,75	843	1 038
1 805	1 880	1 799,0	1 886,0	1 786,25	1 898,75	1 665	2 030
2 110	2 170	2 105,2	2 174,8	2 095	2 185	1 990	2 290

4.2.4.2 Unwanted emissions in the spurious domain

4.2.4.2.1 Definition

Unwanted emissions in the spurious domain are emissions at frequencies, other than those of the transmitter carrier and sidebands associated with normal modulation at the adjacent frequencies.

4.2.4.2.2 Limits

The maximum power shall not exceed:

1) when the system is in standby state:

   -57 dBm for 30 MHz $\leq$ f $\leq$ 1GHz in 100 kHz bandwidth;

   -47 dBm for 1GHz < f $\leq$12,75 GHz in 1 MHz bandwidth;

2) when the system is in active state:

   -30 dBm for 30 MHz $\leq$ f $\leq$ 1GHz in 100 kHz bandwidth;

   -36 dBm for 1GHz < f $\leq$ 12,75 GHz in 1 MHz bandwidth.

The frequency boundary and the detailed transitions of the limits between the requirement for out band emissions and spectrum emissions are based on ERC/REC 74-01.

4.2.4.3 Cessation of emissions

4.2.4.3.1 Definition

When the GSMOBA system is in the active state and a condition requiring cessation of emissions occurs, the GSMOBA system shall automatically cease transmissions and enter into the standby state.

4.2.4.3.2 Specification

When in the active state a condition requiring cessation of emissions occurs, the GSMOBA system shall cease transmissions as described in figure 1 contained in clause 4.1.2 and enters the standby state.

5 Testing for compliance with technical requirements

5.1 Interpretation of results and measurement uncertainty

5.1.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile (see clause B.3).

Where the technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance to the associated technical requirements

5.1.2 Interpretation of the measurement results

The interpretation of the measurement results recorded in a test report for the compliance testing described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 4.

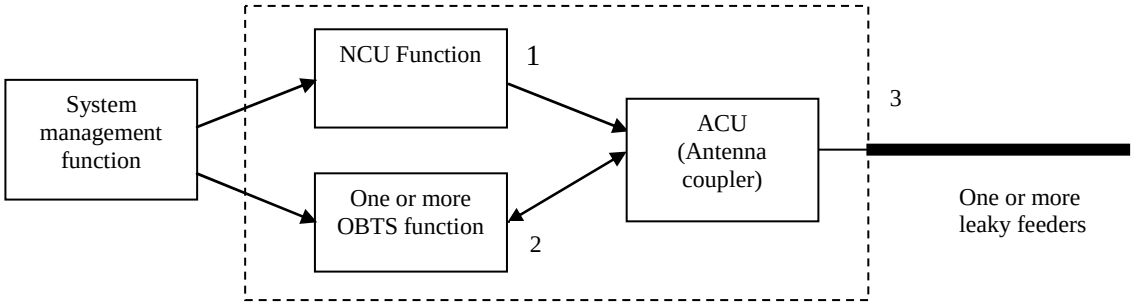
For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028-1 [3] or TR 102 215 (see bibliography) and shall correspond to an expansion factor (coverage factor)
k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Table 4 is based on such expansion factors.

Table 4: Maximum measurement uncertainty

Parameter	uncertainty
Temperature	±1 K
Humidity	±5 %
Radio Frequency tolerance	±1 x 10^{-7}
Conducted power	±0,75 dB
OBTS output power	±2 dB
OBTS spectrum due to modulation and wideband noise	±2 dB
OBTS spectrum due to switching transients	±1,5 dB
OBTS reference sensivity level	±3 dB
OBTS spurious emissions from the receiver antenna connector	±3 dB
NCU mean power spectral density	±3 dB
NCU power flatness	±3 dB
GSMOBA out-of-band emissions	±3 dB
GSMOBA transmitter spurious emissions	±3 dB

5.1.3 Measurement options

Unless explicitly stated, the tests below can be performed either at the System reference point (port 3 in figure 2) or at NCU and BTS reference points (1 and 2 in figure 2). Testing at unit reference points (1 and 2) may be applied to all tests in clause 5 except spurious emissions (clause 5.2.4.2) and out-of-band emissions (clause 5.2.4.1). If the testing is performed at reference point 1 and 2, losses in combiner, cables and other passive components, inserted between these test points and System reference point, need to be considered.



1 NCU reference point
2 OBTS reference point
3 System reference point (NCU + OBTS)

Figure 2: System reference point

5.2 Essential radio test suites

5.2.1 OBTS Transmitter Performance

5.2.1.1 OBTS Output power

5.2.1.1.1 Test purpose

To verify the accuracy of the mean transmitted RF carrier power across the frequency range.

5.2.1.1.2 Test case

The test procedure specified in clause 6.3.2 of TS 151 021 [4] shall be carried out.

5.2.1.2 OBTS RF spectrum

5.2.1.2.1 Spectrum due to modulation and wideband noise

5.2.1.2.1.1 Test purpose

To verify that the output RF spectrum due to modulation and wideband noise does not exceed the specified levels for an individual transceiver.

5.2.1.2.1.2 Test case

The test procedure specified in clause 6.5.1.2 of TS 151 021 [4] shall be carried out.

5.2.1.2.2 Spectrum due to switching transients

5.2.1.2.2.1 Test purpose

To verify that the output RF spectrum due to switching transients does not exceed the specified limits.

5.2.1.2.2.2 Test case

The test procedure specified in clause 6.5.2.2 of TS 151 021 [4] shall be carried out.

5.2.1.3 OBTS Radio Frequency Tolerance

5.2.1.3.1 Test purpose

1) To verify the correct implementation of the pulse shaping filtering.

2) To verify that the phase error during the active part of the time slot does not exceed the specified limits under normal and extreme test conditions and when subjected to vibration.

3) To verify that the frequency error during the active part of the time slot does not exceed the specified limits under normal and extreme test conditions and when subjected to vibration.

5.2.1.3.2 Test case

The test procedure specified in clause 6.2.2 of TS 151 021 [4] shall be carried out.

5.2.1.4 OBTS controlled RF power

5.2.1.4.1 Test purpose

To verify that the OBTS send the right command to the MS connected to the GSMOBA system in order to the MS to set its RF output power for initial access at the lowest nominal power and to maintain this in dedicated mode.

5.2.1.4.2 Methods of measurement

The measurement must cover the following modes:

- access burst on the RACH;
- speech burst on a TCH;
- GPRS data burst;
- DTM with combined TCH and GPRS.

Equipment required:

- base station system test equipment (BSSTE);
- Duplexer;
- Step attenuator.

Initial state:

The attenuator is set to 0 dBm.

The GSMOBA is on standby mode.

Measurement procedure:

Step 1: set the GSMOBA system into the active mode.

Step 2: Connect the equipment as shown on the figure 3.

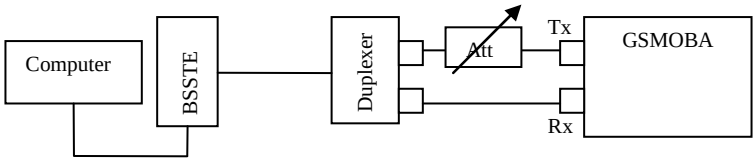


Figure 3: measurement setup

Step 3: Initiate the procedure to attach the BSSTE to the GSMOBA system; apply the appropriate procedure to assure that all received power commands can be monitored.

Step 4: Record the value of the MS_TXPWR_MAX_CCH given by the BSSTE; If PBCCH is implemented, record the value of GPRS_MS_TXPWR_MAX_CCH as well.

Step 5: Initiate a call.

Step 6: Record the POWER LEVEL used by the BSSTE at initial access.

Step 7: Increase the attenuation by one step (i.e.: 6 dB).

Step 8: Record the POWER LEVEL given by the BSSTE.

Step 9: Repeat step 8 and step 9 until the connection is lost.

Step 10: If GSMOBA supports more than one simultaneous RF channel, step 12 to 16 are performed.

Step 11: During a call set the attenuator to 10 dB.

Step 12: Activate a second carrier with 10 dB higher output power than the used channel and initiate an intra-BSC handover.

Step 13: Record the MS_TXPWR_MAX_CCH and POWER LEVEL given by the BSSTE.

Step 14: Switch-off the second carrier and increase the attenuation to the highest value in step 10 with the call maintained.

Step 15: Repeat step 13 and step 14.

Step 16: Check that the recorded parameters are set in all cases to the values as defined in clause 4.2.1.4.

5.2.2 OBTS Receiver Performance

5.2.2.1 OBTS Reference Sensitivity Level

5.2.2.1.1 Test Purpose

To verify that the OBTS receiver can receive, demodulate and decode at very low-level signal.

5.2.2.1.2 Test Case

The test procedure specified in clause 7.3.2 of TS 151 021 [4] shall be carried out.

5.2.2.2 Unwanted emissions in the spurious domain

5.2.2.2.1 Test Purpose

To verify that the spurious emissions from the OBTS receiver antenna connector do not exceed the defined limits.

5.2.2.2.2 Test Case

The test procedure specified in clause 7.9.2 of TS 151 021 [4] shall be carried out.

5.2.3 NCU Transmitter Performance

5.2.3.1 NCU maximum mean power spectral density

5.2.3.1.1 Test purpose

To verify that the power spectral density is set to a specific range according the operating frequency band while the OBTS function is in standby state.

5.2.3.1.2 Methods of measurement

Equipment required:

- Spectrum analyzer;
- 50 Ω power attenuator.

Initial state:

The NCU shall be in standby mode.

Measurement procedure:

The NCU function of the GSMOBA system shall be active in all the supported frequency bands while the OBTS function is in standby state.

Step 1: Connect the spectrum analyzer to the NCU output port via through a 50 Ω power attenuator.

Step 2: Set the NCU output power for each operating frequency band to the maximum output declared by the manufacturer.

Step 3: Select one of the operating frequency bands of the NCU function to be measured (see table 5).

Step 4: Set the "center" frequency of the spectrum analyzer to the centre frequency of the selected operating frequency band (see table 5).

Step 5: Set the frequency span of the spectrum analyzer according to the bandwidth of the selected operating frequency band (see table 5).

Step 6: Set the resolution bandwidth to 100 kHz.
Set the video bandwidth to 1 MHz or greater the value of the resolution bandwidth.

Step 7: Activate the "rms" detector.

Step 8: Measure the power spectral density.

Step 9: Repeat step 3 to 8 for all frequency bands.

Step 10: Check that the maximum mean power spectral density measurements do not exceed the limit contained in clause 4.2.3.1.2 in all cases by applying the following conversion factors:

- 10,7 dB for a reference bandwidth of 1,25 MHz;
- 3 dB for a reference bandwidth of 200 kHz; and
- 15,8 dB for a reference bandwidth of 3,84 MHz.

Table 5: Frequency Parameters

Frequency band (MHz)	Centre frequency (MHz)	Frequency span (MHz)
460- 470	465	10
921 - 960	940,50	39
1 805 - 1 880	1 842,50	75
2 110 - 2 170	2 140	60

5.2.3.2 NCU power flatness

5.2.3.2.1 Test purpose

To verify that the NCU power flatness of the GSMOBA system is maintained within a specified limit for each NCU frequency band while the OBTS function is in standby state.

5.2.3.2.2 Methods of measurement

Equipment required:

- Spectrum analyzer;
- 50 Ω power attenuator.

Initial state:

The NCU shall be in standby mode.

Measurement procedure:

The NCU functions of the GSMOBA system shall be active in all the supported frequency bands while the OBTS function is in standby state. The output power of the NCU for each operating frequency shall be set to the maximum output power.

Step 1: Connect the spectrum analyzer to the NCU output port through a 50 Ω power attenuation.

Step 2: Select one of the NCU operating frequency bands to be measured (see table 6).

Step 3: Set the "center" frequency of the spectrum analyzer to the centre frequency of the selected frequency band (see table 6).

Step 4: Set the frequency span of the spectrum analyzer according to the bandwidth of the selected frequency band (see table 6).

Step 5: Set the resolution bandwidth to 100 kHz.

Set the video bandwidth to 1 MHz or greater.

Step 6: Measure the minimum value within the selected frequency band.

Step 7: Measure the maximum value within the selected frequency band.

Step 8: Calculate the difference between the minimum and maximum value.

Step 9: Repeat step 2 to 6 for the other frequency bands.

Step 10: Check that the power flatness requirement (clause 4.2.3.2.2) is satisfied in all cases.

Table 6: Frequency Parameters

Frequency band (MHz)	Centre frequency (MHz)	Frequency span (MHz)
460 - 470	465	10
921 - 960	940,50	39
1 805 - 1 880	1 842,50	75
2 110 - 2 170	2 140	60

5.2.4 GSMOBA Transmitter Performance

5.2.4.1 Unwanted emissions in the out-of band domain

5.2.4.1.1 Test purpose

To verify that the out-of-band emissions are below a certain limit when the output power of the NCU function is set to its maximum value.

5.2.4.1.2 Methods of measurement

Equipment required:

- Spectrum analyzer;
- 50 Ω power attenuator.

Initial state:

The GSMOBA shall be in standby state.

5.2.4.1.2.1 Unwanted emissions in the out-of-band domain when OBTS is in standby state

Measurement procedure:

Step1: Connect the GSMOBA antenna output port to the spectrum analyser through a 50 Ω power attenuator.

Step 2: Select one of the operating frequency bands of the NCU (see table 7): the EUT shall be active in the selected band, while the NCU should be in standby state for all other operating frequency bands.

Step 3: Set the Resolution bandwidth (RBW) to 100 kHz.
Set the Video bandwidth (VBW) to 1 MHz or greater.

Step 4: The measurements shall be made from Fc (centre frequency) - 50 % of the frequency bandwidth to Fc (centre frequency) - 250 % of the frequency bandwidth and from Fc + 50 % of the frequency bandwidth to Fc + 250 % of the frequency bandwidth (see table 7).

Step 5: Measure the power by activating the "rms" detector.

Step 6: Repeat step 2 to 6 for all other frequency bands.

Step 7: Check that the out-of-band emissions requirement (clause 4.2.4.1.2) is satisfied in all cases.

5.2.4.1.2.2 Unwanted emissions in the out-of-band domain when OBTS is in active state

Measurement procedure:

Step1: Connect the GSMOBA antenna output port to the spectrum analyser through a 50 Ω power attenuator.

Step 2: Activate all the operating frequency bands of the NCU (see table 7).

Step 3: Activate the OBTS at lowest configurable GSM channel transmitting at maximum output power.

Step 4: Set the Resolution bandwidth (RBW) to 100 kHz.
Set the Video bandwidth (VBW) to 1 MHz or greater.

Step 5: The measurements shall be made from Fc (centre frequency) - 50 % of the frequency bandwidth to Fc (centre frequency) - 250 % of the frequency bandwidth and from Fc + 50 % of the frequency bandwidth to Fc + 250 % of the frequency bandwidth (see table 7).

Step 6: Measure the power by activating the "rms" detector.

Step 7: Check that the out of band emissions requirement (clause 4.2.4.1.2) is satisfied in all cases.

Step 8: Activate the OBTS on the highest configurable GSM channel transmitting at maximum output power.

Step 9: Repeat step 3 to 7.

Table 7: Frequency Parameters

Frequency band (MHz)	Lower frequency band (MHz)		Upper Frequency band (MHz)	
	Fc - 50 % of BW	Fc - 250 % of BW	Fc + 50 % of BW	Fc + 250 % of BW
460 - 470	460	440	470	490
921 - 960	921	843	960	1 038
1 805 - 1 880	1 805	1 655	1 880	2 030
2 110 - 2 170	2 110	1 990	2 170	2 290

5.2.4.2 Unwanted emissions in the spurious domain

5.2.4.2.1 Test purpose

To verify that the GSMOBA system does not cause spurious emissions above defined limits in both standby and active states.

5.2.4.2.2 Methods of measurement

Equipment required:

- Spectrum analyzer;
- 50 Ω power attenuator;
- Variable filter (optional).

Initial state:

The GSMOBA shall be in standby state.

5.2.4.2.2.1 Unwanted emissions in the spurious domain when system is in standby state

Measurement procedure:

Step 1: Connect the GSMOBA antenna output port to the spectrum analyzer through a 50 Ω power attenuator.

Step 2: Enable transmitting with its maximum output power.

Step 3: Set the GSMOBA system to standby state.

Step 4: Check that the GSMOBA system does not transmit in any of the operating frequency bands.

Step 5: Set the Resolution bandwidth (RBW) to 100 kHz for frequencies below 1 GHz otherwise set the Resolution bandwidth (RBW) to 1 MHz.
Set the Video bandwidth (VBW) to 1 MHz or greater.

Step 6: Measure the spurious emissions by activating the quasi peak detector for frequencies below 1 GHz, and the peak detector for frequencies above 1 GHz (as defined in CISPR 16).

Step 7: Check that the spurious emissions requirements (clause 4.2.4.2.2) are satisfied for the frequency range in question.

5.2.4.2.2.2 Unwanted emissions in the spurious domain when system is in active state

Measurement procedure:

Step1: Connect the GSMOBA antenna output port to the measuring receiver input through to a 50 Ω power attenuator and if necessary, an appropriate filter to avoid overloading of the spectrum analyzer.

Step 2: Activate all the GSMOBA operating frequency bands.

Step 3: The detecting device shall be configured as defined in the table 8. The video bandwidth shall be configured to 1MHz or greater.

Step 4: Measure the power by activating the quasi peak detector below 1 GHz and the peak detector above 1 GHz (CISPR 16-2-1 [5]).

Step 5: Check that the spurious emissions requirement (clause 4.2.4.2.2) is satisfied in all cases.

Table 8: Spurious emissions measurements outside the GSM OBA transmit bands

From frequency	To frequency	Resolution bandwidth
≥ 30 MHz	≤ 440 MHz	100 kHz
> 490 MHz	< 843 MHz	100 kHz
> 1 038 MHz	< 1 655 MHz	1 MHz
> 2 290 MHz	≤ 12,75 GHz	1 MHz

5.2.4.3 Cessation of emissions

5.2.4.3.1 Test purpose

To verify that the GSMOBA system ceases emissions as described in figure 1 contained in clause 4.1.2 and enters into the standby state when a condition requiring cessation of emissions occurs. The tests shall confirm that transmission cease:

i) when a GSMOBA system is in a geographical position where emissions are prohibited, and both OBTS and NCU enter automatically the standby state;

ii) when a GSMOBA system is at an altitude (Above Ground Level, AGL) where emissions are prohibited, and both OBTS and NCU enter automatically the standby state.

5.2.4.3.2 Methods of measurement

Equipment required:

- spectrum analyser;
- 50 Ω power attenuator;
- STE.

Initial state:

The GSMOBA system shall be on standby mode.

Measurement procedure:

Geographical position where to cease emissions:

Step 1: Connect the GSMOBA antenna output port to the spectrum analyser through the 50 Ω power attenuator.

Step 2: Connect the STE to the GSMOBA system via a suitable interface.

Step 3: Set the GSMOBA system into the transmission state.

Step 4: Initiate a condition requiring cessation of emissions by the STE, which simulates the geographical location of the aircraft.

Step 5: Check that the GSMOBA system enters into the standby state in a controlled manner as represented in the state diagram in figure 1 contained in clause 4.1.2.

Altitude (AGL) where to cease emissions:

Step 1: Connect the GSMOBA antenna output port to the spectrum analyser through the 50 Ω power attenuator.

Step 2: Connect the STE to the GSMOBA system via a suitable interface.

Step 3: Set the GSMOBA system into the transmission state.

Step 4: Initiate a condition requiring cessation of emission by the STE, which simulates the altitude of the aircraft.

Step 5: Check that the GSMOBA system enters into the standby state in a controlled manner as represented in the state diagram in figure 1 contained in clause 4.1.2.

Annex A (normative): HS Requirements and conformance Test specifications Table (HS-RTT)

The HS Requirements and conformance Test specifications Table (HS-RTT) in table A.1 serves a number of purposes, as follows:

- it provides a statement of all the essential requirements in words and by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it provides a statement of all the test procedures corresponding to those essential requirements by cross reference to (a) specific clause(s) in the present document or to (a) specific clause(s) in (a) specific referenced document(s);
- it qualifies each requirement to be either:
  - Unconditional: meaning that the requirement applies in all circumstances; or
  - Conditional: meaning that the requirement is dependent on the manufacturer having chosen to support optional functionality defined within the schedule;
- in the case of Conditional requirements, it associates the requirement with the particular optional service or functionality;
- it qualifies each test procedure to be either:
  - Essential: meaning that it is included with the Essential Radio Test Suite and therefore the requirement shall be demonstrated to be met in accordance with the referenced procedures;
  - Other: meaning that the test procedure is illustrative but other means of demonstrating compliance with the requirement are permitted.

Table A.1: HS Requirements and conformance Test specifications Table (HS-RTT)

Harmonized Standard EN 302 480 The following essential requirements and test specifications are relevant to the presumption of conformity under Article 3.2 of the R&TTE Directive						
Essential Requirement			**Requirement Conditionality**		**Test Specification**	
No	**Description**	**Reference: Clause No**	**U/C**	**Condition**	**E/O**	**Reference: Clause No**
1	OBTS maximum output power	4.2.1.1	C	Applies to OBTS	E	5.2.1.1
2	OBTS output RF spectrum - spectrum due to modulation and wideband noise	4.2.1.2.1	C	Applies to OBTS	E	5.2.1.2.1
3	OBTS RF output spectrum - switching transients spectrum	4.2.1.2.2	C	Applies to OBTS	E	5.2.1.2.2
4	BTS radio frequency tolerance	4.2.1.3	C	Applies to BTS	E	5.2.1.3
5	OBTS controlled MS power	4.2.1.4	C	Applies to OBTS	E	5.2.1.4
6	OBTS reference sensivity level	4.2.2.1	C	Applies to OBTS	E	5.2.2.1
7	OBTS Receiver Spurious emissions	4.2.2.2	C	Applies to OBTS	E	5.2.2.2
8	NCU maximum meanpower spectral density	4.2.3.1	C	Applies to NCU	E	5.2.3.1
9	NCU power flatness	4.2.3.2	C	Applies to NCU	E	5.2.3.2
10	GSMOBA out-of-band emissions	4.2.4.1	U		E	5.2.4.1
11	GSMOBA spurious emissions	4.2.4.2	U		E	5.2.4.2
12	Cessation of GSMOBA emissions	4.2.4.3	U		E	5.2.4.3

Key to columns:

Essential Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement or its test specification.

Description A textual reference to the requirement.

Clause Number Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is to be *unconditionally* applicable (U) or is *conditional* upon the manufacturers claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement shall or shall not be applicable for a technical requirement which is classified "conditional".

Test Specification:

E/O Indicates whether the test specification forms part of the Essential Radio Test Suite (E) or whether it is one of the Other Test Suite (O).

NOTE: All tests whether "E" or "O" are relevant to the requirements. Rows designated "E" collectively make up the Essential Radio Test Suite; those designated "O" make up the Other Test Suite; for those designated "X" there is no test specified corresponding to the requirement. The completion of all tests classified "E" as specified with satisfactory outcomes is a necessary condition for a presumption of conformity. Compliance with requirements associated with tests classified "O" or "X" is a necessary condition for presumption of conformity, although conformance with the requirement may be claimed by an equivalent test or by manufacturer's assertion supported by appropriate entries in the technical construction file.

Clause Number Identification of clause(s) defining the test specification in the present document unless another document is referenced explicitly Where no test is specified (that is, where the previous field is "X") this field remains blank.

Annex B (normative): Environmental conditions

B.1 General

This annex specifies the environmental conditions under which the relevant requirements of the present document shall be fulfilled.

Testing under aircraft specific environmental and EMC conditions will be undertaken by manufacturers according to the requirements of EUROCAE ED-14E/RTCA DO-160E [6], and need not be repeated as it is not a requirement of the present document.

B.2 Environmental conformance requirements

GSM OBA system and the leaky cable are typically Installable Equipments (IE).

B.3 Environmental test conditions

The GSM OBA equipment may be subject to different environmental and EMC conditions and is required to maintain its performance in accordance with the present document under all environmental circumstances for the Equipment Categories applicable to them as defined in EUROCAE ED-14E [6]. Tests specified in the present document shall be maintained within the following range of environmental conditions (or otherwise as specified by the manufacturer):

temperature: +15°C to +35°C;

relative humidity: ≤ 85 %;

pressure: 840 hPa to 1 070 hPa (equivalent to +1 525 m to -460 m altitude).

Tests made at environmental conditions other than ambient as specified above shall be conducted subject to the following tolerances:

Temperature: ± 3°C;

Pressure: ± 5 %.

The power supply shall be in accordance with EUROCAE ED-14E/RTCA DO-160E [6] Normal Operating Conditions (nominal), for the Equipment Category applicable to the GSMOBA.

Annex C (informative): System Description

C.1 High level System Description

The GSMOBA system comprises of an onboard BTS (OBTS) and an Network Control Unit (NCU). These are connected to a dedicated antenna system. The whole system is then connected to the ground network via a satellite link. Figure C.1 represents the high level system description.

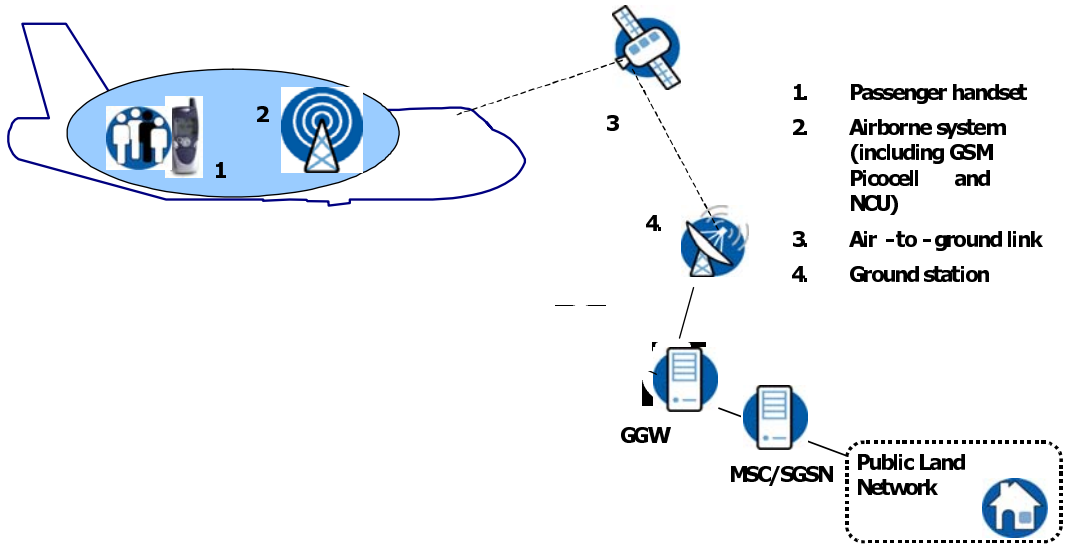
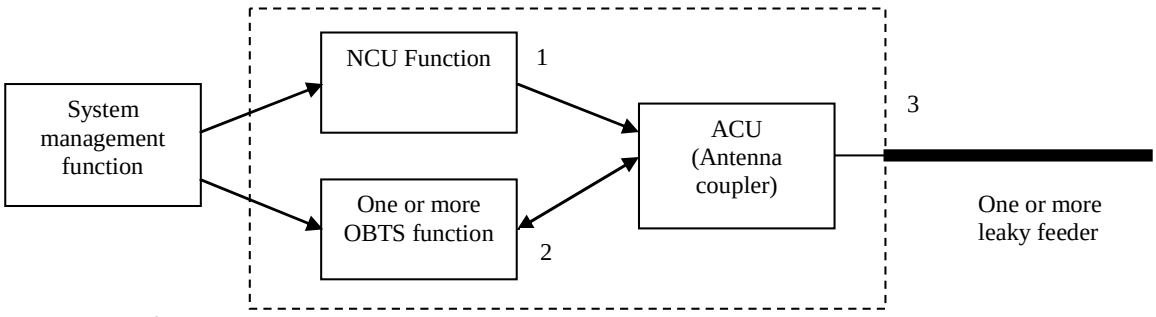


Figure C.1: Overview of the GSMOBA system and associated terrestrial components

The scope of the present document covers the onboard elements; OBTS, NCU and the transmission antenna only.

Figure C.2 represents the functional organization of the GSM OBA system, which is limited by the dotted box. This system may comprise one or more NCUs, one or more BTS functions and antenna coupling units (ACU).



1 NCU reference point
2 OBTS reference point
3 System reference point (NCU + OBTS)

Figure C.2: System description

C.2 OBTS

The OBTS establishes the communication access to the MS in the aircraft and supports all necessary system features such as radio access and radio resource management.

The OBTS has the following characteristics:

- Support of GSM services.
- Operates in the 1 800 MHz spectrum band.
- Operates at a sufficient margin (at least 9dB) over the NCU level.
- Ensures that an MS communicating with the OBTS transmits at the nominal minimum power level (0 dBm).

C.3 RF Screening

Onboard aircraft mobile terminals must be prevented from attempting to access networks on the ground. This could be done:

- By passive means e.g. through RF shielding of the aircraft fuselage to further attenuate the signal entering and leaving the fuselage.
- By the inclusion of a Network Control Unit (NCU), which raises the noise floor inside the cabin in mobile receive bands by transmitting a broadband signal within those operating frequency bands.

These methods can be combined to minimize the active NCU power level.

The RF Screening will cover the appropriate frequency ranges, the frequency bands of which are as listed in table C.1.

Table C.1: Frequency bands

Frequency bands
460 MHz to 470 MHz
921 MHz to 960 MHz
1 805 MHz to 1 880 MHz
2 110 MHz to 2 170 MHz

NOTE: Any NCU will only be operational above the minimum height above the ground at which the system is permitted to be operated.

C.4 Dedicated antenna system

Transmission of the signals is distributed in the cabin by a leaky cable antenna system. This leaky cable is specially designed for use onboard aircraft. The leaky cable RF characteristics can be defined by the following parameters:

- Method of transmission.
- Insertion loss.
- Coupling loss.

C.5 Dedicated antenna installation

Transmission of the signals distributed in the cabin may be affected by the type of installation used. The characteristics for the dedicated installation type are defined by the following parameters:

- Number of leaky cables in use.
- Length of cable(s).
- Required radial coverage.
- Placement of the installation.
- Additional characteristics of installation.

Annex D (informative): The EN title in the official languages

Language	EN title
Bulgarian	
Czech	
Danish	Elektromagnetisk kompatibilitet og Radiospektrum Anliggender (ERM); Harmoniseret EN for det på luftfartsfartøj ombordværende GSM system der dækker de væsentlige krav i R&TTE direktivets artikel 3.2
Dutch	Elektromagnetische compatibiliteit en radiospectrum zaken (ERM); Geharmoniseerde EN voor GSM aan boord van vliegtuigen welke invulling geeft aan de essentiële vereisten, neergelegd in artikel 3.2 va de R&TTE Directive
English	Electromagnetic compatibility and Radio spectrum Matters (ERM); Harmonized EN for the GSM onboard aircraft system covering essential requirements of Article 3.2 of the R&TTE Directive
Estonian	Elektromagnetilise ühilduvuse ja raadiospektri küsimused (ERM); Õhusõiduki pardal asuv GSM süsteem, harmoneeritud EN R&TTE direktiivi artikli 3.2 põhinõuete alusel
Finnish	Sähkömagneettinen yhteensopivuus ja radiospektriasiat (ERM); Lentokoneeseen asennettavat GSM-tukiasemat Yhdenmukaistettu standardi (EN), joka kattaa R&TTE direktiivin artiklan 3.2 mukaiset olennaiset vaatimukset
French	CEM et spectre radioélectrique (ERM) - Norme harmonisée pour l'equipement GSM embarqué à bord des aéronefs couvrant les exigences essentielles de l'article 3.2 de la Directive R&TTE
German	Elektromagnetische Verträglichkeit und Funkspektrumangelegenheiten (ERM); Harmonisierte Europäische Norm (EN) für GSM im Flugzeug system mit wesentlichen Anforderungen nach R&TTE-Richtlinie Artikel 3.2
Greek	
Hungarian	Elektromágneses összeférhetőségi és rádióspektrumügyek (ERM): Repülőgépfedélzeti GSM rendszerre vonatkozó, az R&TTE-irányelv 3.2. cikkelyének lényegi követelményeit tartalmazó harmonizált európai szabvány
Icelandic	
Italian	Compatibilità elettromagnetica e Questioni relative allo spettro delle radiofrequenze (ERM); Norma armonizzata per Sistema GSM a bordo di aeromobile relativa ai requisiti essenziali dell'articolo 3.2 della direttiva R&TTE
Latvian	
Lithuanian	Elektromagnetinio suderinamumo ir radijo dažnių spektro dalykai; Darnusis Europos standartas, GSM sistemai orlaiviuose, apimantis esminius reikalavimus pagal 1999/5/EC* direktyvos 3.2 straipsnį
Maltese	
Norwegian	Elektromagnetisk kompatibilitet og radiospektrumspørsmål (ERM); Harmonisert for EN GSM system for bruk ombord i fly som dekker de grunnleggende krav i R&TTE-direktivets artikkel 3.2
Polish	Kompatybilność Elektromagnetyczna i Zagadnienia Widma Radiowego (ERM) - Zharmonizowana EN dla Systemu GSM na Pokladzie Samolotu zapewniająca spełnianie zasadniczych wymagań zgodnie z artykułem 3.2 dyrektywy R&TTE
Portuguese	Assuntos de Espectro Radioeléctrico e Compatibilidade Electromagnética (ERM); EN harmonizada para o sistema GSM a bordo de aeronaves cobrindo os requisitos essenciais no âmbito do Artigo 3.2 da Directiva R&TTE
Romanian	Compatibilitate electromagnetica si probleme de spectru radio; Norme europene armonizate pentru sistemele GSM de la bordul aeronavelor, ce indeplinesc cerintele esentiale din Articolul 3.2 al directivei R&TTE
Slovak	
Slovenian	Elektromagnetna združljivost (EMC) in zadeve v zvezi z radijskim spektrom (ERM) - Harmonizirani EN za mobilne komunikacije na zrakoplovu, ki zajema bistvene zahteve člena 3.2 direktive R&TTE
Spanish	Compatibilidad electromagnética y cuestiones de espectro de radiofrecuencia (ERM); EN Harmonizada para el sistema GSM a bordo de aeronaves cubriendo los requisitos esenciales según el artículo 3.2 de la directiva de R&TTE
Swedish	Elektromagnetisk kompatibilitet och radiospektrumfrågor (ERM); Harmoniserad EN för GSM ombord flygplan omfattande väsentliga krav enligt artikel 3.2 i R&TTE-direktivet

Annex E (informative): Bibliography

Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

ETSI TR 102 215 (V1.3.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Recommended approach and possible limits for measurement uncertainty for the measurement of radiated electromagnetic field above 1 GHz".

ECC REPORT 93: "Report on the compatibility between GSM equipment onboard aircraft and terrestrial networks".

Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

ETSI EG 201 399 (V2.1.1) (2005-12): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".

CEPT/ECC/DEC/(06)07: "ECC Decision of 1 December 2006 on the harmonized use of airborne GSM systems in the frequency bands 1710-1785 and 1805-1880 MHz".

CEPT/ERC/REC 74-01 (2005) (equivalent to ITU-R Recommendation SM.329-10) "Unwanted emissions in the spurious domain".

ERC/DEC(98)11: "ERC Decision of 23 November 1998 on the harmonized frequency band to be designated for CEPT PR 27 radio equipment and on the implementation of the technical standard for this equipment".

History

Document history			
V1.1.1	July 2007	Public Enquiry	PE 20071116: 2007-07-18 to 2007-11-16