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Test Report

Report Number: F130857E1

Applicant:

connectBlue AB

Manufacturer:

connectBlue AB

Equipment under Test (EUT):

cB-0939

Laboratory (CAB) accredited by
Deutsche Gesellschaft für Akkreditierung mbH
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. DGA-PL-105/99-22,
FCC Test site registration number 90877 and
Industry Canada Test site registration IC3469A-1

REFERENCES

[1] **ANSI C63.4-2009** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

[2] **FCC CFR 47 Part 15 (April 2013)** Radio Frequency Devices

[3] **FCC Public Notice DA 00-705 (March 2000)**

[4] **RSS-210 Issue 8 (December 2010)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

[5] **RSS-Gen Issue 3 (December 2010)** General Requirements and Information for the Certification of Radiocommunication Equipment

[6] **Publication Number 913591 (March 2007)** Measurement of radiated emissions at the edge of the band for a Part 15 RF Device

TEST RESULT

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test.
The complete test results are presented in the following.

Test engineer:	Paul NEUFELD Name	 Signature	9 April 2013 Date
Authorized reviewer:	Bernd STEINER Name	 Signature	9 April 2013 Date

RESERVATION

This test report is only valid in its original form.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

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1 IDENTIFICATION

1.1 Applicant

Name:	connectBlue AB
Address:	Norra Vallgatan 64 3V Malmö SE-211 19
Country:	Sweden
Name for contact purposes:	Mr. Martin Engdahl
Phone:	+ 46 40 63 07 100
Fax:	+ 46 40 23 71 37
eMail Address:	martin.engdahl@connectblue.se
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	connectBlue AB
Address:	Norra Vallgatan 64 3V Malmö SE-211 19
Country:	Sweden
Name for contact purposes:	Mr. Martin Engdahl
Phone:	+ 46 40 63 07 100
Fax:	+ 46 40 23 71 37
eMail Address:	martin.engdahl@connectblue.se
Applicant represented during the test by the following person:	-

1.3 Test laboratory

The tests were carried out at: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

accredited by DGA Deutsche Gesellschaft für Akkreditierung mbH in compliance with DIN EN ISO/IEC 17025 under Reg. No. DGA-PL-105/99-22, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469A-1.

1.4 EUT (Equipment Under Test)

Test object: *	**Bluetooth module**
Type: *	**cB-0939**
FCC ID: *	**PVH0939**
IC: *	**5325A-0939**
Serial number: *	None
PCB identifier: *	cB-0939-B1
Hardware version: *	1.0
Software version: *	3.7.0

1.5 Technical data of equipment

Channel 1	RX:	2402 MHz	TX:	2402 MHz
Channel 39	RX:	2441 MHz	TX:	2441 MHz
Channel 79	RX:	2480 MHz	TX:	2480 MHz

Fulfills Bluetooth specification: *	3.0 with EDR (class 1)					
Adaptive frequency hopping: *	Yes					
Antenna type: *	External (BTAB-2450)					
Antenna gain: *	2 dBi					
Antenna connector: *	Internal, Hirose U.FL					
Power supply: *	U_{nom}=	5.0 V DC	U_{min}=	3.3 V DC	U_{max}=	6.0 V DC
Type of modulation: *	FHSS: GFSK (1 Mbps), π/4-DPQSK (2 Mbps) or 8DPSK (3 Mbps)					
Operating frequency range:*	2402 MHz to 2480 MHz					
Number of channels: *	79					
Temperature range: *	-40 °C to +85 °C					
Internal clock frequencies	32.768 kHz, 16 MHz and 72 MHz					

* declared by the applicant.

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
DC in (carrier board)	6.3 mm jack plug	-	2 m *
-	-	-	-

*: Length during the test if no other specified.

1.6 Dates

Date of receipt of test sample:	13 March 2012
Start of test:	15 March 2012
End of test:	22 March 2012

2 OPERATIONAL STATES

The EUT is intended to be used in several Bluetooth applications. Because the cB-0939 is a module, which will be implemented in a final application, it was mounted on a carrier board to connect to power supply and change the operation modes of the EUT from a Laptop with test software.

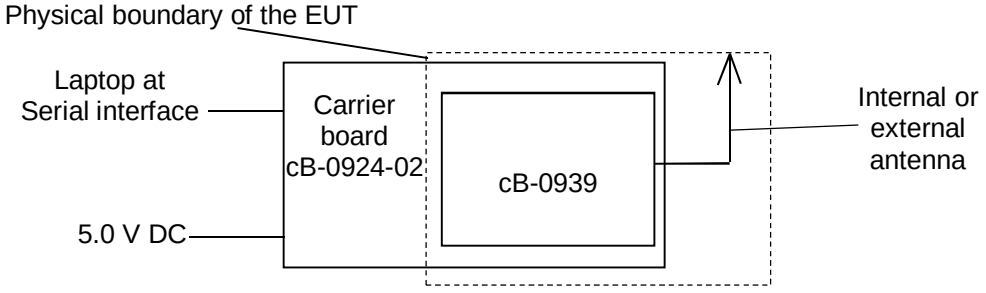
The tests were carried out with unmodified samples with an antenna connector (cB-0939-B1-02, sample marked with “49”) for TX and RX tests.

During the tests the test sample was powered with 5.0 V DC via the carrier board cB-0903-02.

For selecting an operation mode, a personal computer with a software delivered by the applicant was connected to the carrier board. After adjusting the operating mode, the personal computer was removed. To do this the test-engineer was instructed by the applicant.

The following operation modes were used during the tests:

Operation mode	Description of the operation mode	Modulation	Data rate / Mbps
1 1a 1b	Continuous transmitting on 2402 MHz	GFSK π/4-DQPSK 8DPSK	1 2 3
2 2a 2b	Continuous transmitting on 2441 MHz	GFSK π/4-DQPSK 8DPSK	1 2 3
3 3a 3b	Continuous transmitting on 2480 MHz	GFSK π/4-DQPSK 8DPSK	1 2 3
4 4a 4b	Transmitter hopping on all channels	GFSK π/4-DQPSK 8DPSK	1 2 3
5	Continuous receiving on 2441 MHz		



Preliminary tests were performed in different data rates and different orthogonal directions, to find worst-case configuration and position. The data rate shown in the table below shows the found worst-case rate with respect to specific test item. The following table shows a list of the test modes used for the results, documented in this report.

The radiated emission measurement was carried out in the orthogonal direction that emits the highest spurious emission levels. The manufacturer delivered as sample of the antenna and a sample with the antenna enclosed in the final housing. The preliminary tests show that the emissions are highest, when the antenna is implemented in the housing and the antenna housing is mounted vertically on the test table. See annex A for a picture of the worst case test setup.

The following test modes were adjusted during the tests:

Test items	Operation mode
Band edge compliance (radiated)	1, 3, 4 (1 Mbps)
Radiated emissions (transmitter)	1, 2, 3 (1 Mbps)
Radiated emissions (receiver)	5

3 ADDITIONAL INFORMATION

The cB-0939 is already tested and certified under FCC ID PVH0939 /IC 5325A-0939. The reason for this test report is a new antenna used with this the module. Due to this fact all measurements were carried out with the module and the new antenna. The new antenna BTAB-2450 antenna and has a maximum antenna gain of 2 dBi.

4 OVERVIEW

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 8 [4] or RSS-Gen, Issue 3 [5]	Status	Refer page
Maximum peak output power	2400.0 - 2483.5	15.247 (b) (1)	A8.4 (2) [4]	Passed	9 et seq.
Band edge compliance	2400.0 - 2483.5	15.247 (d)	A8.5 [4]	Passed	9 et seq.
Radiated emissions (transmitter)	0.009 - 25,000	15.205 (a) 15.209 (a)	7.2.2 [5] 2.5 [4]	Passed	13 et seq.
Radiated emissions (receiver)	0.009 – 12,500	15.109 (a)	6.1 [5]	Passed	Annex D

5 TEST RESULTS

5.1 Maximum peak output power

The maximum peak output power was measured and compared to the original test report. Including component tolerances and measurement uncertainties, the maximum peak output power is equal to the power documented in the original test report.

5.2 Band-edge compliance

5.2.1 Method of measurement (band-edge compliance – unrestricted bands (radiated))

The same test set-up as used for the final radiated emission measurement shall be used (refer also subclause 5.3.1 of this test report). The measurements shall be carried out with using a resolution bandwidth of 100 kHz.

The following spectrum analyser settings shall be used:

- Span: Wide enough to capture the peak level of the emission on the channel closest to the band-edge, as well as any modulation products, which fall outside the assigned frequency band.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: ≥ the resolution bandwidth.
- Sweep: Auto.
- Detector function: Peak.
- Trace mode: Max hold.

After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency line shall be set on the edge of the assigned frequency band. Set the second marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is higher than that at the band-edge. This frequency shall be measured with the EMI receiver as described in subclause 5.3.1 of this test report, but 100 kHz resolution bandwidth shall be used.

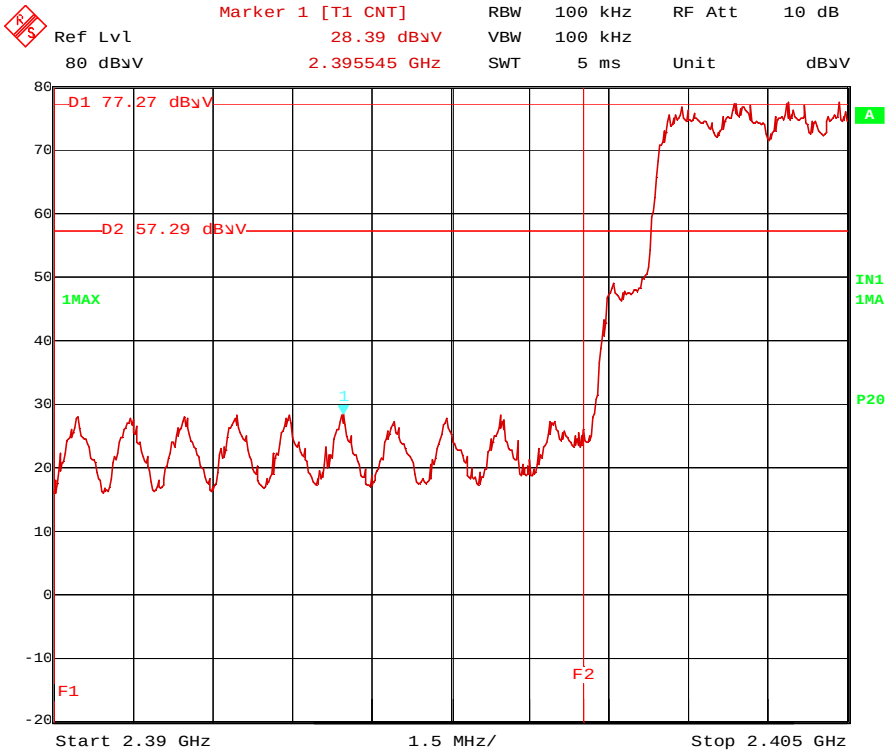
The measurement will be performed at the upper end of the assigned frequency band and with hopping on and off.

5.2.2 Test result (band-edge compliance – unrestricted bands (radiated))

Ambient temperature	20.5 °C	Relative humidity	26 %

The plots on the page before are showing the radiated band-edge compliance for the upper band-edge, with and without hopping. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance with FCC 47 CFR Part 15.247 (d). The frequency line 1 (F1) shows the edge of the assigned frequency.

Only the plot of the worst case emission is submitted below:



Operation mode	BT Channel	Band-Edge	Unwanted Emission Frequency [MHz]	Reference Level [dµV]	Limit [dµV]	Unwanted Emission Value [dµV]	Margin [dB]
1b	1	low	2399.649	77.03	57.03	26.87	30.16
4b	all	low	2395.545	77.27	57.29	28.39	28.9

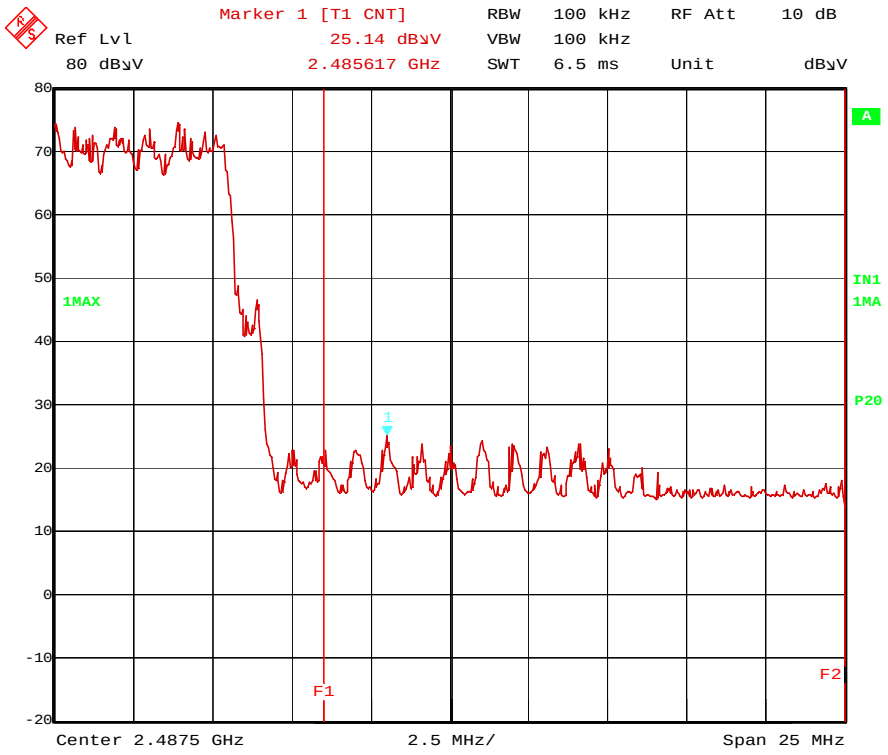
5.2.3 Method of measurement (band-edge compliance – restricted bands (radiated))

The same test set-up and measurement procedures as used for the final radiated emission measurement shall be used (refer also subclause 5.3.1 of this test report).

The measurement will be performed at the lower and upper end of the assigned frequency band and with hopping on and off.

5.2.4 Test result (band-edge compliance – restricted bands (radiated))

Only the plot of the worst case emission is submitted below:



Band-edge compliance (mode 1b, lower band edge, hopping disabled)										
Result measured with the peak detector:										
Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2389.5	64.35	74	9.65	32.31	28.34	0	3.7	150	Vert.	Yes
2388.5	61.97	74	13.03	29.93	28.34	0	3.7	150	Vert.	Yes
Result measured with the average detector:										
Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2389.5	53.17	54	0.83	21.13	28.34	0	3.7	150	Vert.	Yes
2388.5	50.85	54	3.15	18.81	28.34	0	3.7	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (mode 4b, lower band edge, hopping enabled)										
Result measured with the peak detector:										
Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2389.5	64.19	74	9.81	32.15	28.34	0	3.7	150	Vert.	Yes
Result measured with the average detector:										
Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2389.5	45.51	54	8.49	13.47	28.34	0	3.7	150	Vert.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (mode 3b, upper band edge, hopping disabled)										
Result measured with the peak detector:										
Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2492.6	65.02	74	8.98	32.67	28.55	0	3.8	150	Hor.	Yes
Result measured with the average detector:										
Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2492.6	53.98	54	0.02	21.63	28.55	0	3.8	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (mode 4b, upper band edge, hopping enabled)										
Result measured with the peak detector:										
Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2485.5	63.54	74	10.46	31.19	28.55	0	3.8	150	Hor.	Yes
Result measured with the average detector:										
Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2485.5	46.37	54	7.63	14.02	28.55	0	3.8	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 - 34, 36, 41, 42

5.3 Radiated emissions

5.3.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into four stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 110 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

All measurements will be carried out with the EUT working on the middle of the assigned frequency band.

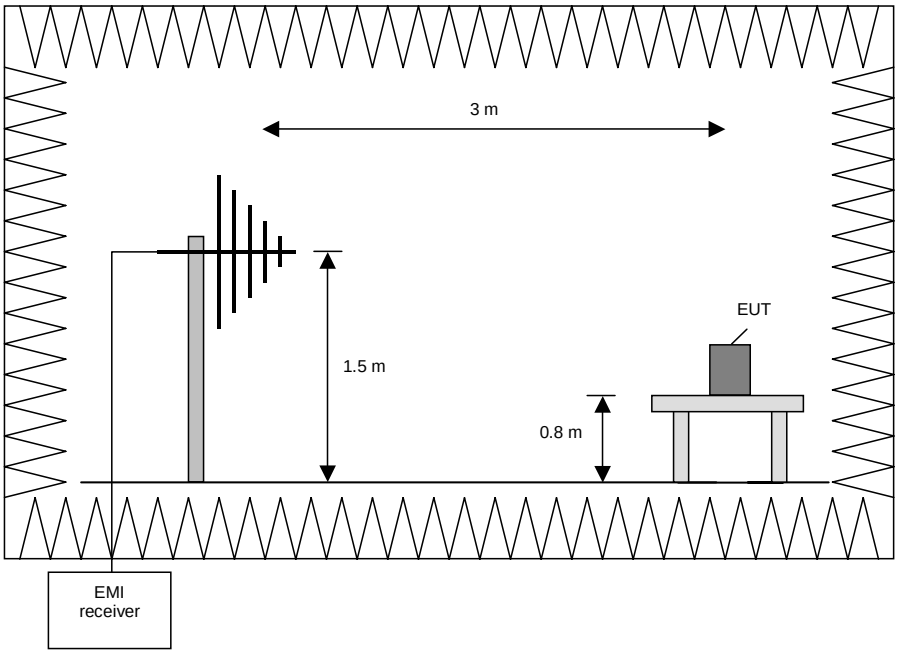
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.
The following procedure will be used:

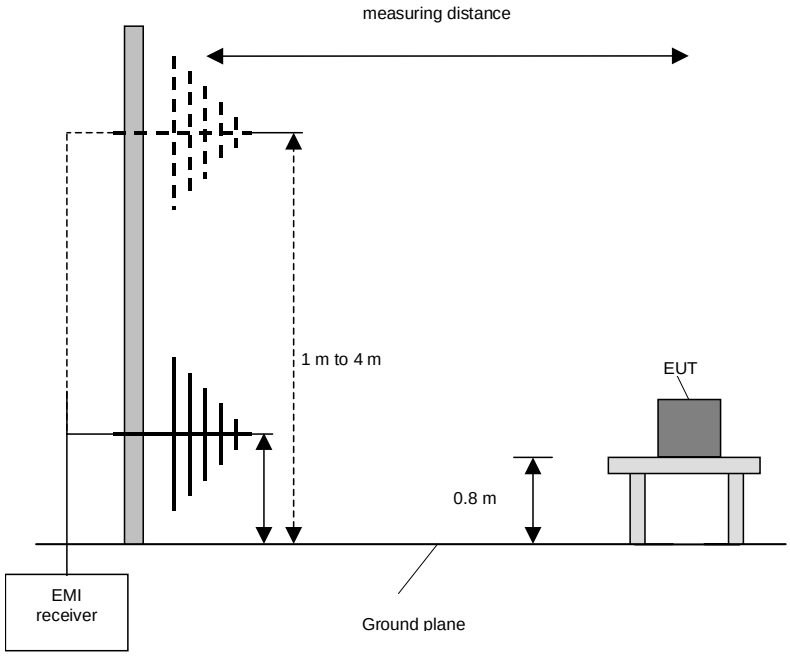
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
4) Repeat 1) to 3) for the other orthogonal antenna polarization.
5) Move the antenna and the turntable to the position where the maximum value is detected.
6) Measure while moving the antenna slowly +/- 1 m.
7) Set the antenna to the position where the maximum value is found.
8) Measure while moving the turntable +/- 45 °.
9) Set the turntable to the azimuth where the maximum value is found.
10) Measure with Final detector (QP and AV) and note the value.
11) Repeat 5) to 10) for each frequency.
12) Repeat 1) to 11) for each orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

Preliminary and final measurement (1 GHz to 110 GHz)

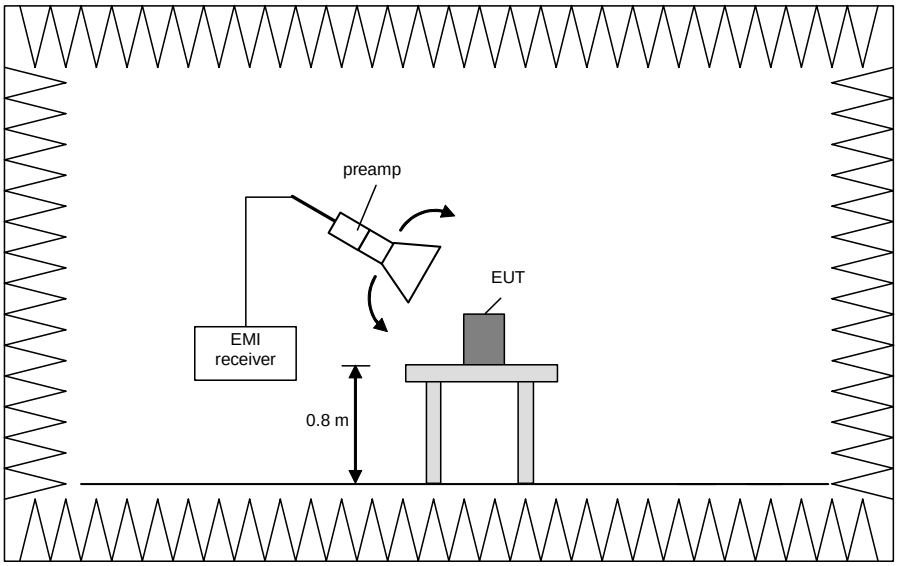
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

Preliminary measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found and than the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz
40 GHz to 60 GHz	100 kHz
50 GHz to 75 GHz	100 kHz
75 GHz to 110 GHz	100 kHz

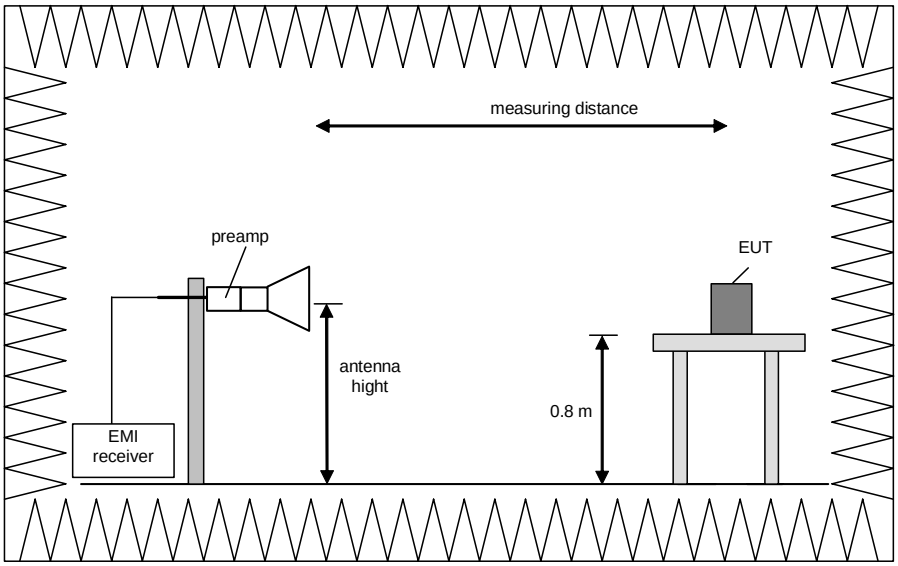


Final measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 ° in order to have the antenna inside the cone of radiation.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 26.5 GHz, 26.5 GHz to 40 GHz, 40 GHz to 60 GHz, 60 GHz to 75 GHz and 75 GHz to 110 GHz.
The following procedure will be used:

1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
2) Change the antenna polarisation and repeat 1) with vertical polarisation.
3) Make a hardcopy of the spectrum.
4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
5) Change the analyser mode to Clear / Write and found the cone of emission.
6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

Step 1) to 6) are defined as preliminary measurement.

5.3.2 Test results (radiated emissions)

5.3.2.1 Preliminary radiated emission measurement

Ambient temperature	20.5 °C	Relative humidity	26 %

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

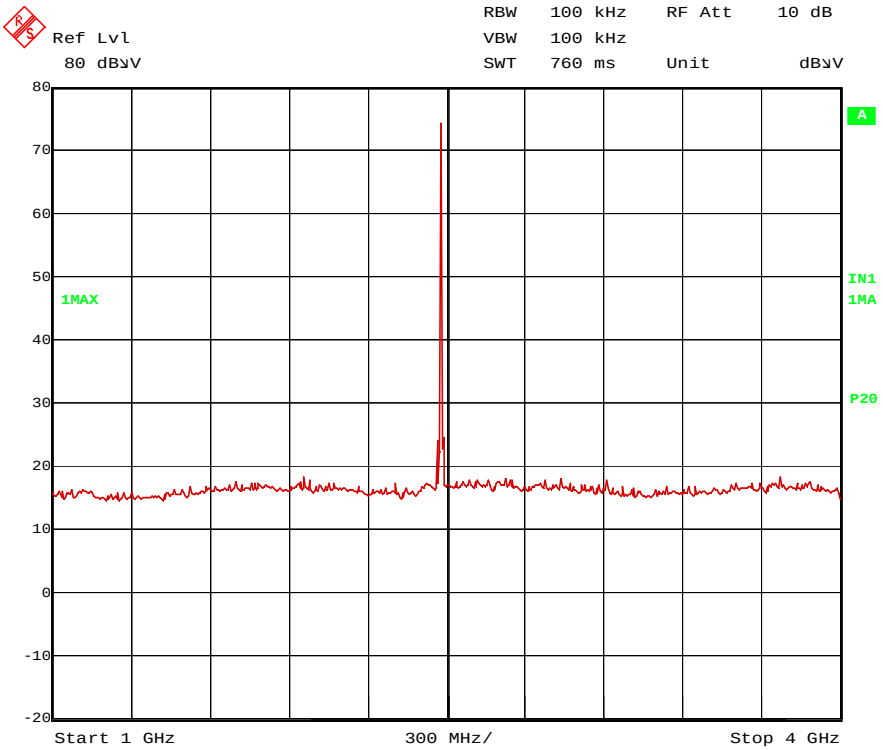
Supply voltage: During all measurements the EUT was supplied with 3.3 V DC via the carrier board cB-0903-03.

Remark: As pre-tests in the original report have shown, the emissions in the frequency range 9 kHz to 1 GHz are not depending on the transmitter operation mode. The frequency bands below 1 GHz were compared to the original report and no changes in the spurious emissions were found. Therefore the plots and measurements results are not submitted in this test report.

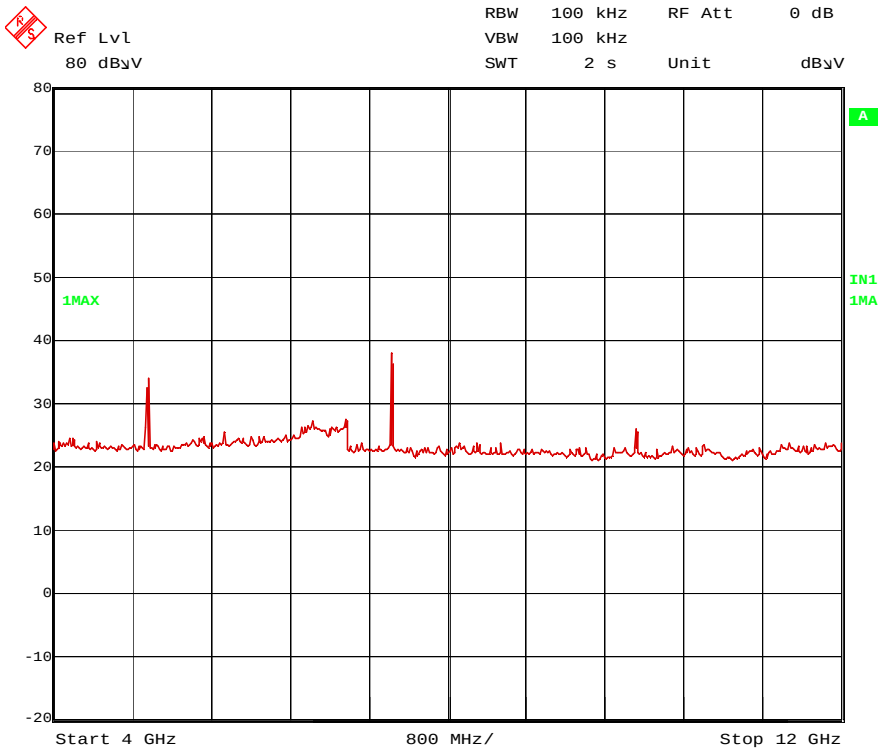
Only the plots of the worst case of the spurious emissions measurement was submitted below.

Transmitter operates on the upper end of the assigned frequency band

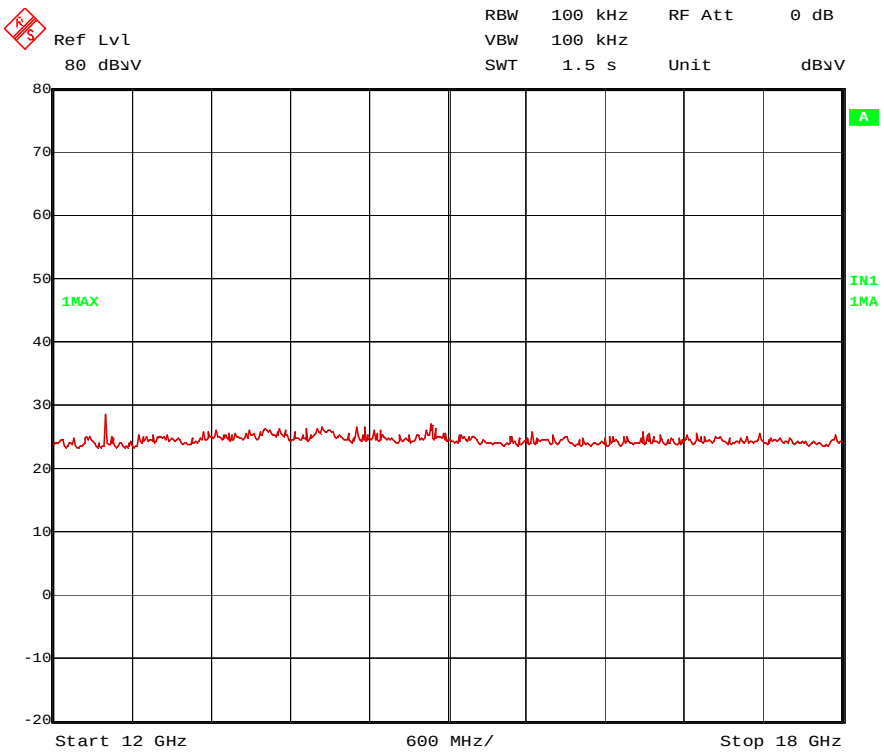
130857_ch79_1-4G_SpurEmiss.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3b):



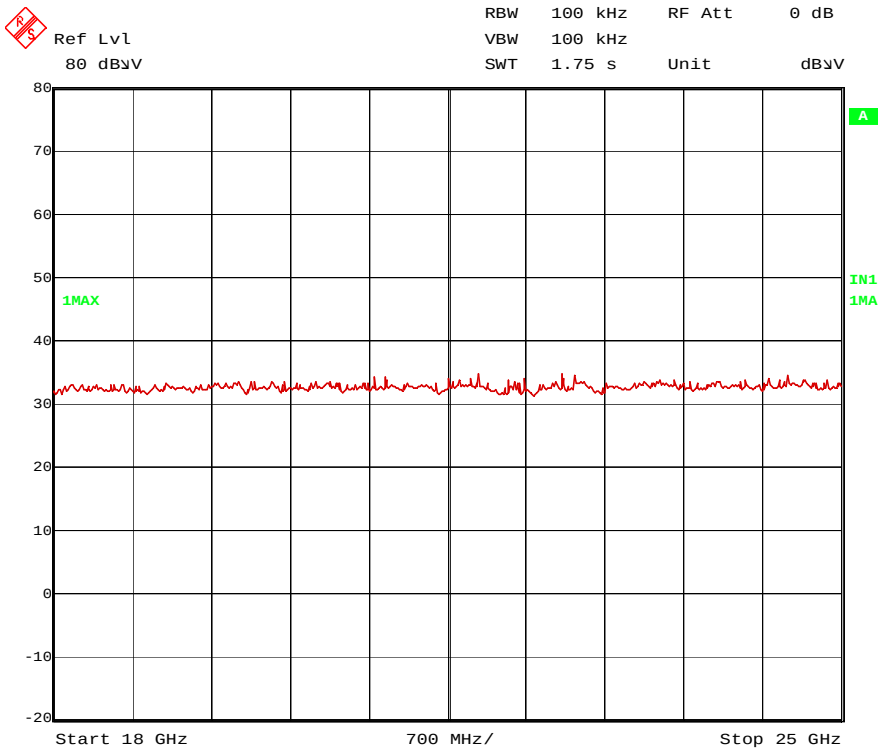
130857_ch79_4-12G_SpurEmiss.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 3b):



857_004.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 3b):



857_005.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 3b):



The following frequencies were found during the preliminary radiated emission test:

- 2480 MHz, 4960 MHz, 7440 MHz, 9920 MHz, 12400 MHz

These frequencies have to be measured in a final measurement. The results were presented in the following.

5.3.2.2 Final radiated emission measurement

Ambient temperature	21 °C	Relative humidity	55 %

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.3 V DC by the carrier board cB-0924-02.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Note: All measurement results were compared to the 15.209 limits. While being the stricter limits, conformity to these limits is sufficient pass the requirements.

Transmitter operates at the lower end of the assigned frequency band (operation mode 1b)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
2402	113.26	-	-	81.22	28.34	0	3.7	150	Vert.
4804	55.85	74.0	18.15	43.58	32.57	25.6	5.3	150	Vert.
7206	59.41	74.0	14.59	41.67	35.64	24.7	6.8	150	Vert.
12011	40.40	74.0	33.60	30.20	33.60	25.9	2.5	150	Vert.
Measurement uncertainty						+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
2402	105.90	-	-	73.86	28.34	0	3.7	150	Vert.
4804	45.75	54.0	8.25	33.48	32.57	25.6	5.3	150	Vert.
7206	47.90	54.0	6.10	30.16	35.64	24.7	6.8	150	Vert.
12011	28.00	54.0	26.00	17.80	33.60	25.9	2.5	150	Vert.
Measurement uncertainty						+2.2 dB / -3.6 dB			

Transmitter operates at the middle of the assigned frequency band (operation mode 2b)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
2441	110.69	-	-	78.56	28.43	0	3.7	150	Vert.
4882	55.71	74.0	18.29	43.19	32.82	25.6	5.3	150	Vert.
7323	57.72	74.0	16.28	39.49	36.13	24.7	6.8	150	Vert.
9764	59.10	74.0	14.90	37.78	37.32	23.9	7.9	150	Vert.
12204	49.80	74.0	24.20	39.60	33.60	25.9	2.5	150	Vert.
14646	51.40	74.0	22.60	41.80	33.70	26.6	2.5	150	Hor.
Measurement uncertainty						+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
2441	104.3	-	-	72.17	28.43	0	3.7	150	Vert.
4882	45.96	54.0	8.04	33.44	32.82	25.6	5.3	150	Vert.
7323	47.81	54.0	6.19	29.58	36.13	24.7	6.8	150	Vert.
9764	45.90	54.0	8.10	24.58	37.32	23.9	7.9	150	Vert.
12204	35.70	54.0	18.30	25.50	33.60	25.9	2.5	150	Vert.
14646	37.30	54.0	16.70	27.70	33.70	26.6	2.5	150	Hor.
Measurement uncertainty						+2.2 dB / -3.6 dB			

Transmitter operates at the upper end of the assigned frequency band (operation mode 3b)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
2480	111.76	-	-	79.41	28.55	0	3.8	150	Vert.
4960	55.52	74.0	18.48	42.93	32.89	25.6	5.3	150	Vert.
7440	62.40	74.0	11.60	43.97	36.33	24.7	6.8	150	Vert.
9920	59.28	74.0	14.72	37.91	37.37	23.9	7.9	150	Vert.
12400	50.70	74.0	23.30	40.40	33.70	25.9	2.5	150	Vert.
Measurement uncertainty						+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
2480	104.46	-	-	72.11	28.55	0	3.8	150	Vert.
4960	45.34	54.0	8.66	32.75	32.89	25.6	5.3	150	Vert.
7440	52.24	54.0	1.76	33.81	36.33	24.7	6.8	150	Vert.
9920	45.96	54.0	8.04	24.59	37.37	23.9	7.9	150	Vert.
12400	37.20	54.0	16.80	26.90	33.70	25.9	2.5	150	Vert.
Measurement uncertainty						+2.2 dB / -3.6 dB			

Transmitter operates at the upper end of the assigned frequency band (operation mode 4b)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
2457	111.08	-	-	78.95	28.43	0	3.7	150	Vert.
4920	53.04	74.0	20.96	40.52	32.82	25.6	5.3	150	Vert.
7413	61.36	74.0	12.64	42.93	36.33	24.7	6.8	150	Vert.
14760	44.70	74.0	29.30	35.20	33.70	26.7	2.5	150	Vert.
12225	46.40	74.0	27.60	36.20	33.60	25.9	2.5	150	Hor.
Measurement uncertainty						+2.2 dB / -3.6 dB			

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.
2457	80.78	-	-	48.65	28.43	0	3.7	150	Vert.
4920	32.34	54.0	21.66	19.82	32.82	25.6	5.3	150	Vert.
7413	39.57	54.0	14.43	21.14	36.33	24.7	6.8	150	Vert.
14760	29.60	54.0	24.40	20.10	33.70	26.7	2.5	150	Vert.
12225	30.60	54.0	23.40	20.40	33.60	25.9	2.5	150	Hor.
Measurement uncertainty						+2.2 dB / -3.6 dB			

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 35, 36, 37, 39, 41, 42, 46, 49 – 51, 72

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. Due
1	Shielded chamber M47	-	Albatross Projects	B83117-C6439-T262 -	480662	Weekly verification (system cal.)	
2	EMI Receiver	ESIB 26	Rohde & Schwarz	1088.7490	481182	03/09/2012	03/2014
4	High pass filter	HR 0.13-5ENN	FSY Microwave Inc.	DC 0109 SN 002	480340	Weekly verification (system cal.)	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	02/15/2012	02/2014
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	MA240-0	Inn-Co GmbH	MA240-0/030/6600603	480086	-	-
19	Antenna	CBL6111 D	Chase	25761	480894	09/28/2011	09/2014
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	02/15/2012	02/2014
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/13/2012	02/2014
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna 30 MHz – 2 GHz	CBL6112 B	Chase	2688	480328	04/21/2011	04/2014
36	Antenna 1 GHz – 18 GHz	3115 A	EMCO	9609-4918	480183	11/09/2011	11/2014
37	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294	Six month verification (system cal.)	
39	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297	Six month verification (system cal.)	
40	Standard Gain Horn Antenna 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	469	480229	Six month verification (system cal.)	
41	RF-cable No. 3	Sucoflex 106B	Huber&Suhner	0563/6B / Kabel 3	480670	Weekly verification (system cal.)	
42	RF-cable No. 40	Sucoflex 106B	Huber&Suhner	0708/6B / Kabel 40	481330	Weekly verification (system cal.)	
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142	Weekly verification (system cal.)	
46	RF-cable 1 m	KPS-1533-400-KPS	Insulated Wire	-	480301	Six month verification (system cal.)	
49	Preamplifier 1 GHz -12 GHz	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	

50	Preamplifier 12 GHz – 18 GHz	JS3- 12001800- 16-5A	Miteq	571667	480343	Six month verification (system cal.)	
51	Preamplifier 18 GHz – 26 GHz	JS3- 18002600- 20-5A	Miteq	658697	480342	Six month verification (system cal.)	
55	Loop antenna 9 kHz – 30 MHz	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/16/2012	02/2014
60	Power Meter	NRVD	Rohde & Schwarz	833697/030	480589	02/15/2012	02/2014
61	Power probe	NRV-Z32	Rohde & Schwarz	849745/016	480551	02/15/2012	02/2014
72	4 GHz High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	
73	Single Control Unit	SCU	Maturo GmbH	SCU/006/971107	480831	Calibration not necessary	
81	RF-Attenuator	WA2-10	Weinschel	8260	410122	09/2012	09/2013

7 REPORT HISTORY

Report Number	Date	Comment
F130857E1	9 April 2013	Document created

8 LIST OF ANNEXES

ANNEX A TEST SET-UP PHOTOS 6 pages

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130857_07.JPG: cB-0939 Antenna in housing, test setup fully anechoic chamber, 12 – 18 GHz
130857_08.JPG: cB-0939 Antenna in housing, test setup fully anechoic chamber, 18 – 25 GHz

ANNEX B INTERNAL PHOTOGRAPHS 7 pages

130857_26.JPG: BTAB-2450 Antenna housing – internal view
130857_18.JPG: BTAB-2450 Antenna bottom view
130857_18.JPG: BTAB-2450 Antenna top view
130857_21.JPG: cB-0939, PCB, top view
130857_27.JPG: cB-0939, PCB, top view, shielding removed
130857_22.JPG: cB-0939, PCB, bottom view
130857_15.JPG: cB-0903-03, top view, with cB-0939
130857_20.JPG: cB-0903-03, top view, cB-0939 removed
130857_17.JPG: cB-0903-03, bottom view

Annex C EXTERNAL PHOTOGRAPHS 2 pages

130857_12.JPG: EUT/antenna housing, bottom view
130857_13.JPG: EUT/antenna housing, top view 1
130857_14.JPG: EUT/antenna housing, bottom view 2
130857_25.JPG: EUT/antenna housing, top view 1, battery removed
130857_23.JPG: Battery, 3D view 1
130857_23.JPG: Battery, 3D view 2