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Test Report

Report Number: F122631E1

Applicant:

connectBlue AB

Manufacturer:

connectBlue AB

Equipment under Test (EUT):

cB-0925-01-1-0x

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 (August 2012)** Radio Frequency Devices

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

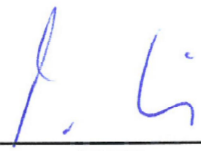
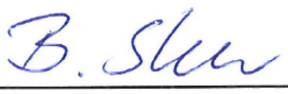
[4] **RSS-210 Issue 8 (December 2010)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

[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:	Thomas KÜHN		04 September 2012
	Name	Signature	Date
Authorized reviewer:	Bernd STEINER		04 September 2012
	Name	Signature	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.

Contents: Page

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)

Equipment under test: *	cB-0925-01-1-0x
Model name: *	cB-0925-01
Type of equipment: *	Bluetooth module
FCC ID:	PVH0925
IC:	5325A-0925
Serial number:	None
PCB identifier:	cB-0925-01
Hardware version:	1.0
Software version:	1.0

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: *	2.0 with EDR					
Antenna type: *	External (BBL-2450)					
Antenna gain: *	1 dBi (antenna peak gain)					
Rated output power: *	Max. 4 dBm					
Antenna connector: *	Hirose U.FL connector					
Power supply: *	U_{nom}=	5.0 V DC	U_{min}=	3.0 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					

*: declared by the applicant

The following external I/O cables were used:

Identification	Connector		Length
	EUT	Ancillary	
DC in (carrier board)	5.5 mm jack plug	-	2 m *
-	-	-	-

*: Length during the test if no other specified.

1.6 Dates

Date of receipt of test sample:	16 July 2012
Start of test:	28 August 2012
End of test:	29 August 2012

2 OPERATIONAL STATES

The EUT is intended to be used in several Bluetooth applications. Because the cB-0925-01-1-0x 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.

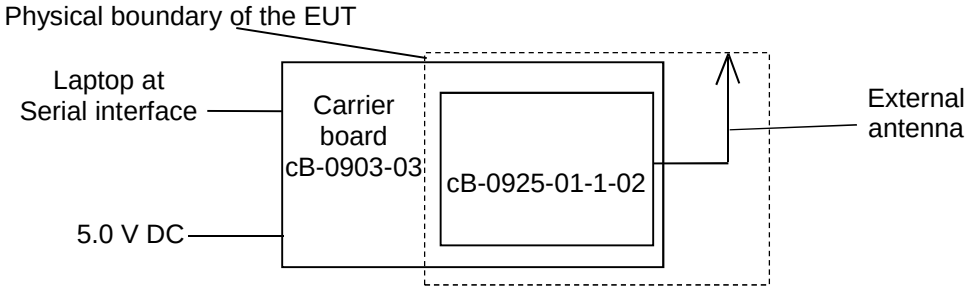
The tests were carried out with a unmodified sample with an antenna connector (cB-0925-01-1-02, sample marked with “17”) for the tests.

During the tests the test sample was powered with 5.0 V DC via either the carrier board cB-0903-03.

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 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)

3 ADDITIONAL INFORMATION

The cB-0925-01-1-0x is already tested and certified under FCC ID PVH0925 /IC 5325A-0925. The reason for this test report is a new antenna (BBL-2450) used with this the module. Due to this fact all radiated measurements were carried out with the module and the new antenna. Additionally the peak output power measurement was repeated.

The new antenna is intended to be mounted on a chrome-plated plastic enclosure. As pre-tests have shown the antenna caused higher emissions if it is mounted on this housing. For this reason all measurements were performed with the antenna in the housing.

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	11 et seq.
Radiated emissions (transmitter)	0.009 - 25,000	15.205 (a) 15.209 (a)	7.2.2 [5] 2.5 [4]	Passed	16 et seq.

5 TEST RESULTS

5.1 Maximum peak output power

5.1.1 Method of measurement (maximum peak output power)

The calibration of the spectrum analyser has to be checked with the help of a known signal from a signal generator. The EUT has to be connected to the spectrum analyser via a low loss cable. If the EUT is not equipped with an antenna connector, a temporary antenna connector has to be installed. The EUT has to be switched on and the hopping function has to be disenabled.

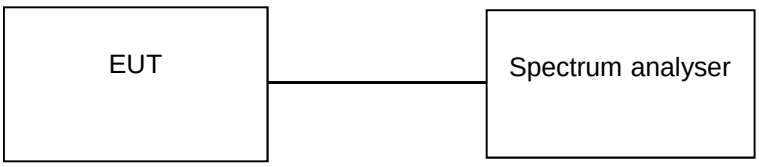
The following spectrum analyser settings shall be used:

- Span: Approx. 5 times the 20 dB bandwidth, centred on a hopping channel.
- Resolution bandwidth: > the 20 dB bandwidth of the emission being measured.
- 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 indicated level is the peak output power, which has to be corrected with the value of the cable loss and an external attenuation (if necessary).

The measurement will be performed at the upper and lower end and the middle of the assigned frequency band.

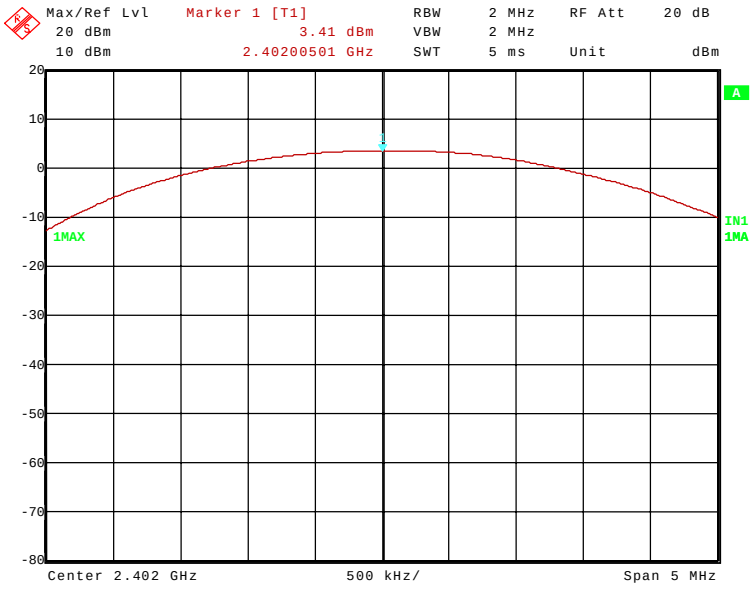
Test set-up:



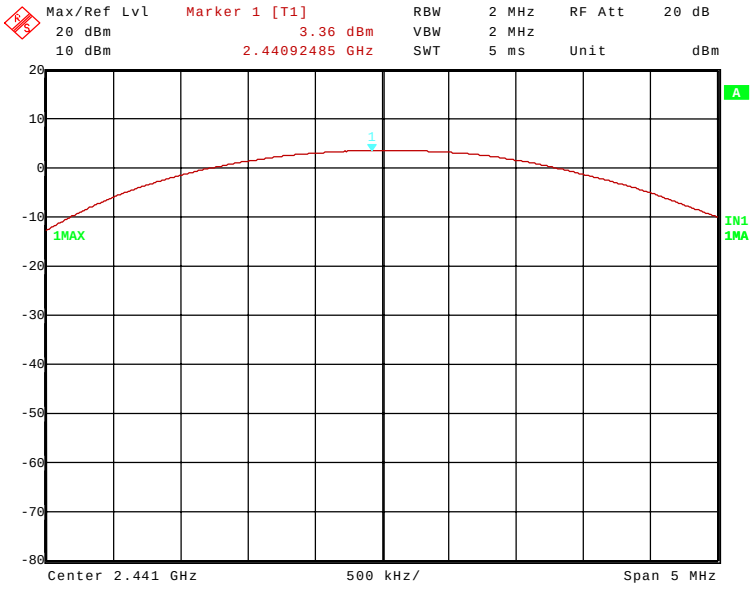
5.1.2 Test results (maximum peak output power)

Ambient temperature	21 °C	Relative humidity	60 %

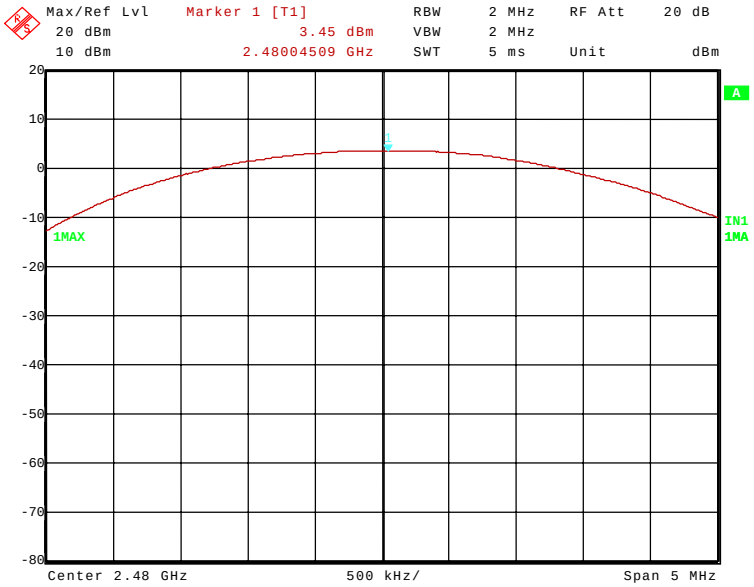
122631_1.wmf: Maximum peak output power at the lower end of the assigned frequency band (operation mode 1):



122631_2.wmf: Maximum peak output power at the middle of the assigned frequency band (operation mode 2):



122631_3.wmf: Maximum peak output power at the upper end of the assigned frequency band (operation mode 3):



Operation mode	Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Peak power limit [dBm]
1 1a 1b	0	2402	3.4 3.2 3.4	8.0 *	28.0 *
2 2a 2b	39	2441	3.4 3.2 3.4	8.0 *	28.0 *
3 3a 3b	78	2480	3.5 3.3 3.5	8.0 *	28.0 *
Measurement uncertainty				+0.66 dB / -0.72 dB	

*: Because the maximum gain of the antennas used in combination with the EUT (original filing) exceeds 6 dBi, the limit of the peak power was decreased by the amount of the exceedance.

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
31

5.2 Band-edge compliance

5.2.1 Method of measurement (band-edge compliance (radiated))

The same test set-up as used for the final radiated emission measurement shall be used (refer also subclause 5.2.1 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.

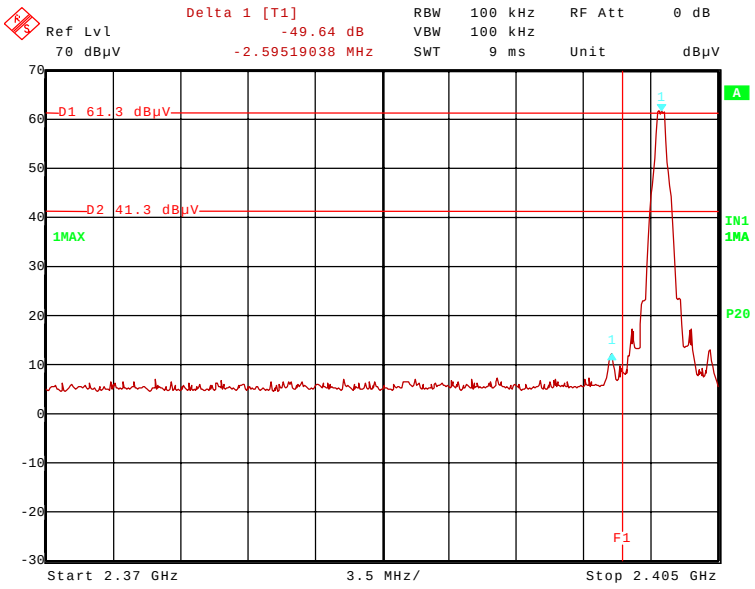
After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency line shall be set on the edge of the assigned frequency band. Set the second marker 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.

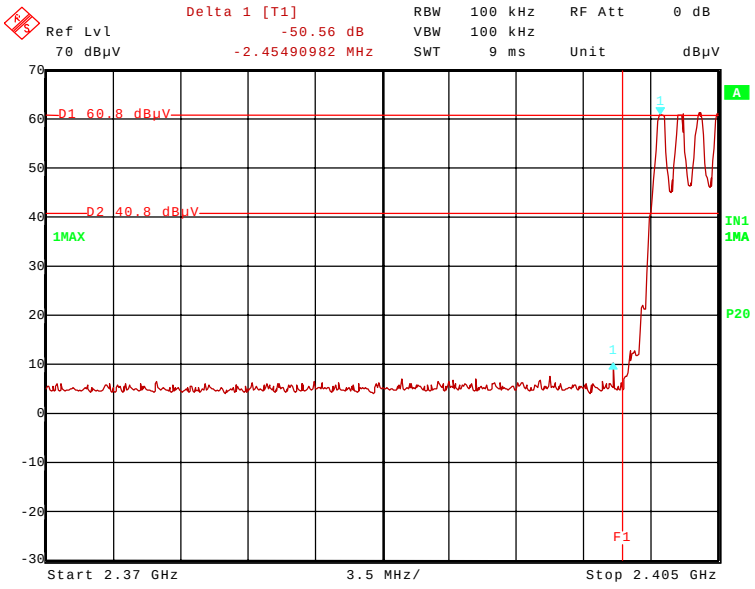
5.2.2 Test result (band-edge compliance (radiated))

Ambient temperature	21 °C		Relative humidity	60 %

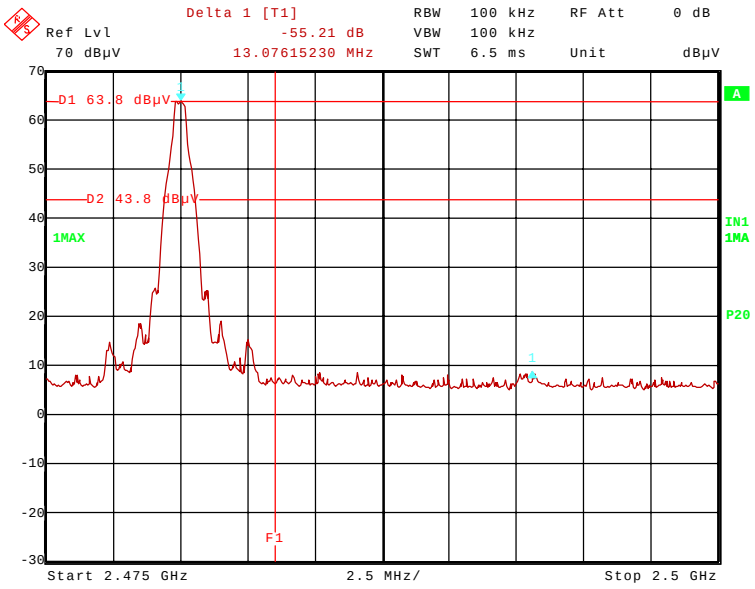
122631_5.wmf: Radiated band-edge compliance, lower band edge, hopping off (operation mode 1):



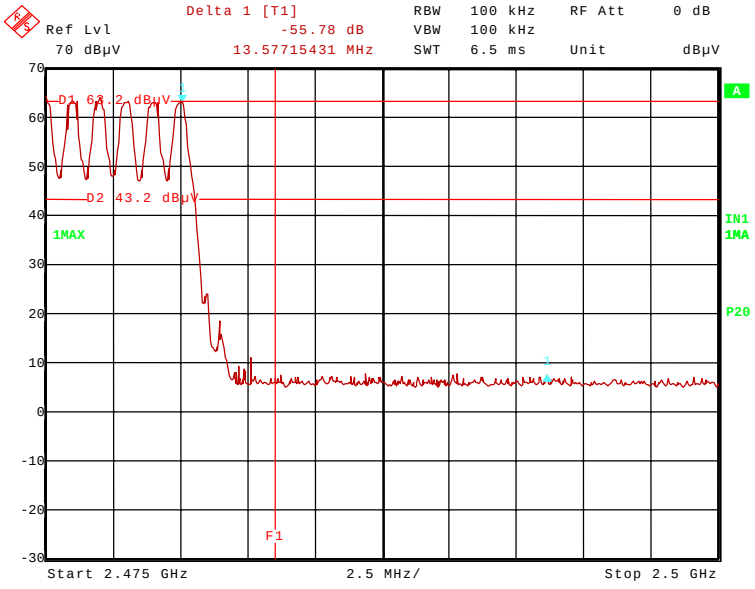
122631_6.wmf: Radiated band-edge compliance, lower band edge, hopping on (operation mode 4):



122631_9.wmf: Radiated band-edge compliance, upper band edge, hopping off (operation mode 3):



122631_10.wmf: Radiated band-edge compliance, upper band edge, hopping on (operation mode 4):



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.

Band-edge compliance (lower band edge. hopping disenabled)										
Result measured with the peak detector:										
Frequency GHz	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
2.402	93.8	-	-	61.8	28.3	0.0	3.7	150	Vert.	-
2.3995	44.2	74.0	29.8	12.2	28.3	0.0	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency GHz	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
2.402	90.8	-	-	58.8	28.3	0.0	3.7	150	Vert.	-
2.3995	41.2	70.8	29.6	9.2	28.3	0.0	3.7	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (lower band edge. hopping enabled)										
Result measured with the peak detector:										
Frequency GHz	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
2.402	93.8	-	-	61.8	28.3	0.0	3.7	150	Vert.	-
2.3997	43.2	74.0	30.8	11.2	28.3	0.0	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency GHz	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
2.402	90.8	-	-	58.8	28.3	0.0	3.7	150	Vert.	-
2.3997	40.2	70.8	30.6	8.2	28.3	0.0	3.7	150	Hor.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (upper band edge. hopping disenabled)										
Result measured with the peak detector:										
Frequency GHz	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
2.480	109.9	-	-	77.6	28.5	0.0	3.8	150	Vert.	-
2.4843	55.3	74.0	18.7	23.0	28.5	0.0	3.8	150	Hor.	Yes
Result measured with the average detector:										
Frequency GHz	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
2.480	106.8	-	-	74.5	28.5	0.0	3.8	150	Vert.	-
2.4843	35.3	54.0	18.7	3.0	28.5	0.0	3.8	150	Hor.	Yes
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (upper band edge. hopping enabled)										
Result measured with the peak detector:										
Frequency GHz	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
2.480	109.9	-	-	77.6	28.5	0.0	3.8	150	Vert.	-
2.4843	54.8	74.0	19.2	22.5	28.5	0.0	3.8	150	Hor.	Yes
Result measured with the average detector:										
Frequency GHz	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
2.480	106.8	-	-	74.5	28.5	0.0	3.8	150	Vert.	-
2.4843	30.3	54.0	23.7	-2.0	28.5	0.0	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, 44

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.

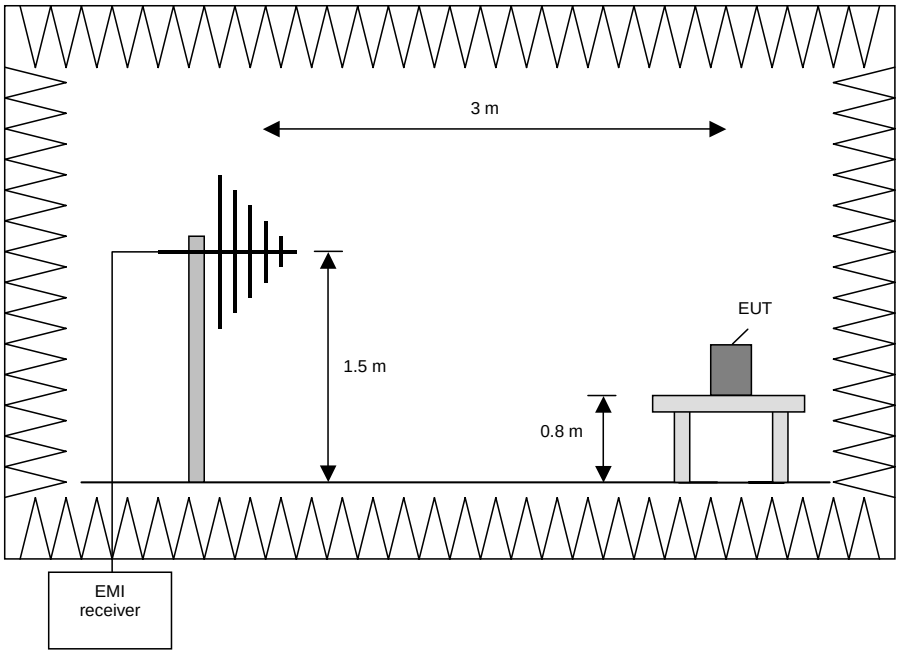
Preliminary measurement (30 MHz to 1 GHz)

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:

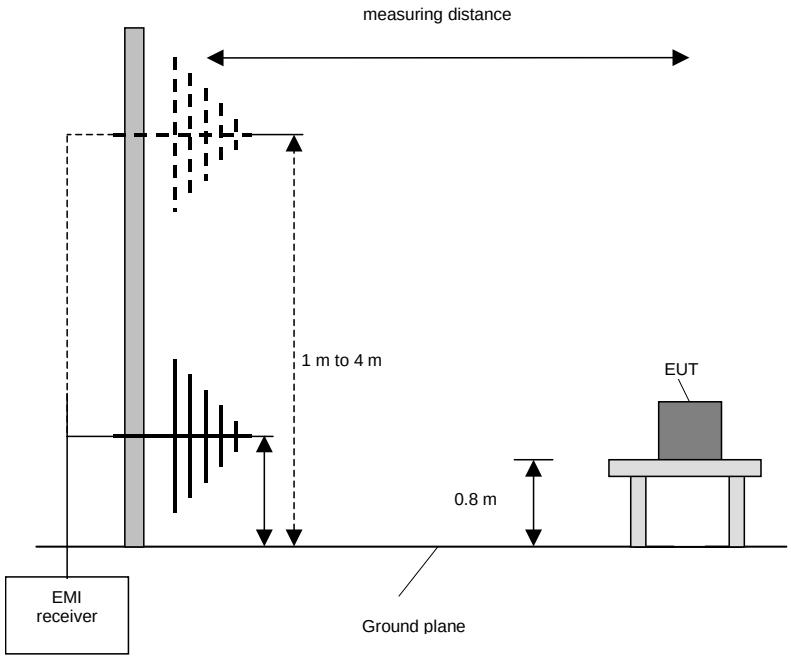
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the 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)

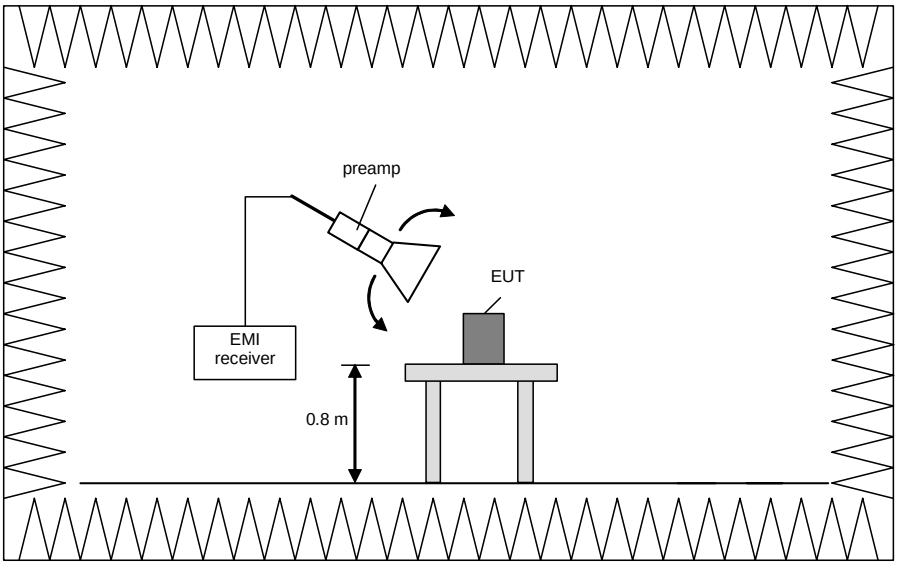
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance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

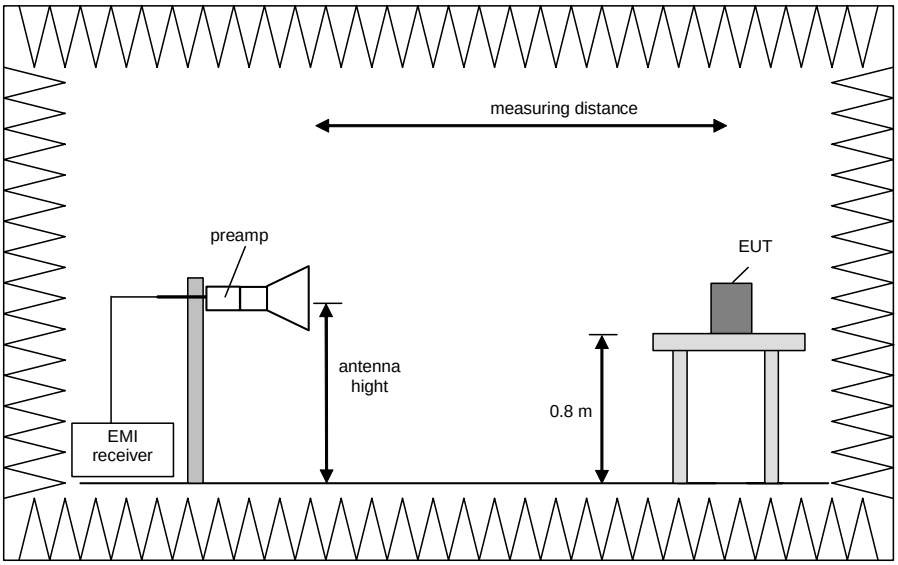


Final measurement (1 GHz to 110 GHz)

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 measurement (9 kHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	60 %

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.

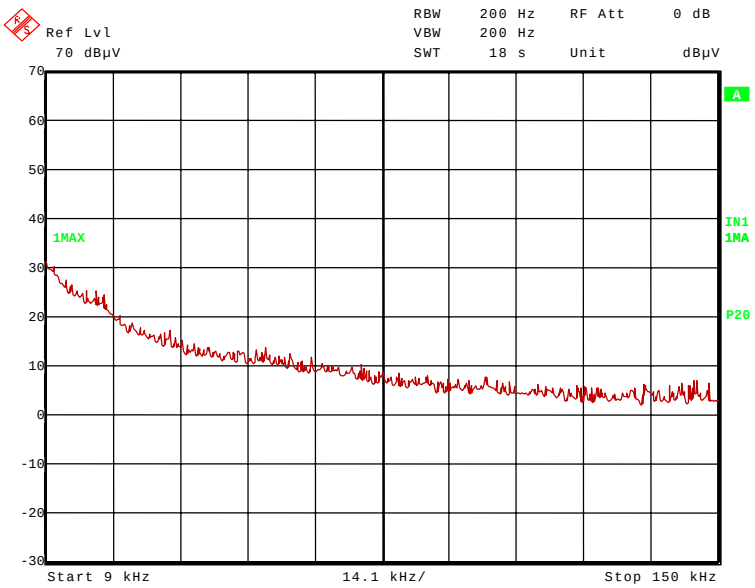
Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Remark: As pre-tests have shown, the emissions in the frequency range 9 kHz to 1 GHz are not depending on the transmitter operation mode. Therefore the emissions in this frequency range were measured only with the transmitter operates in operation mode 2.

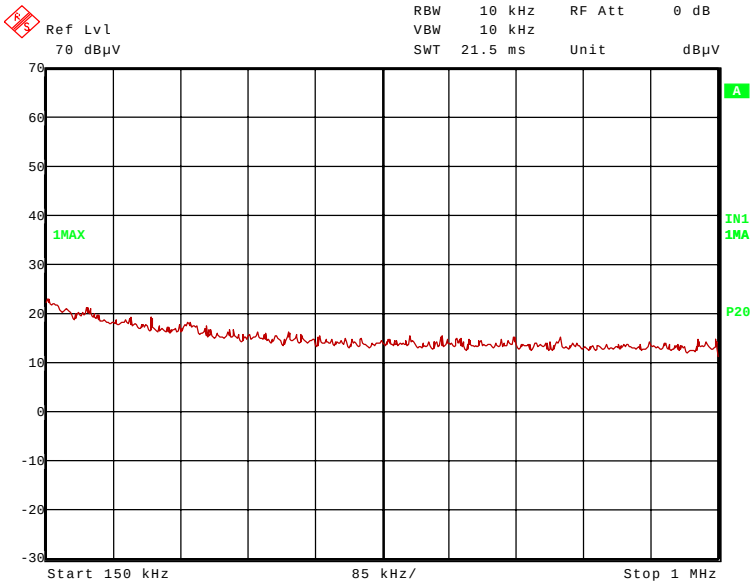
122631_24.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 2):



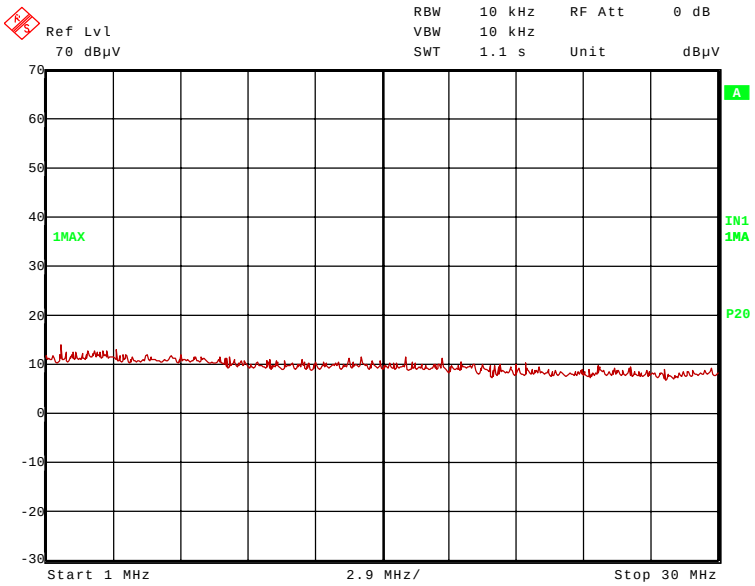
TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 35, 43, 55

122631_23.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 2):

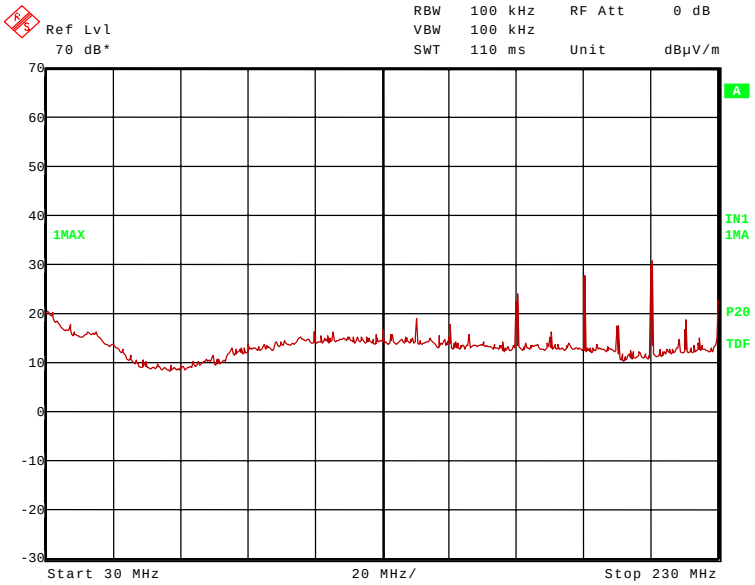


122631_22.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 2):

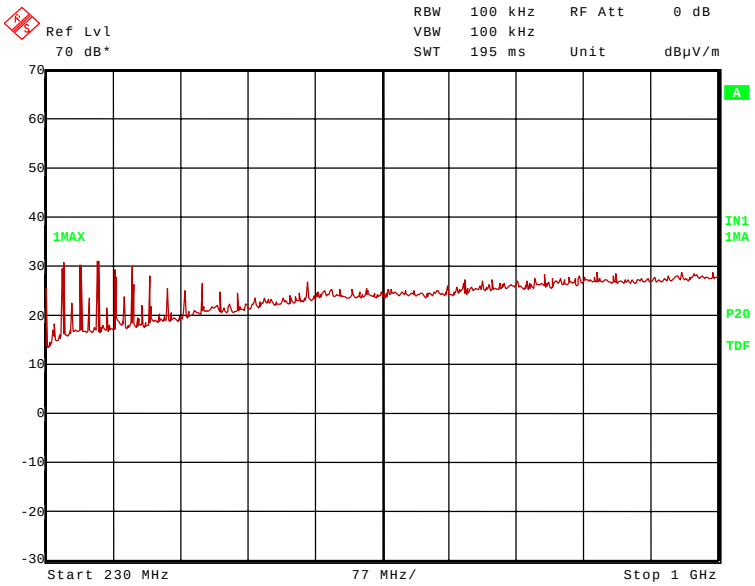


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

122631_20.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 2):



122631_21.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 2):



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

190.000 MHz, 210.000 MHz, 230.000 MHz, 290.000 MHz, 310.000 MHz and 550.000 MHz.

The following frequencies were found inside the restricted bands during the radiated emission test:

170.000 MHz, 270.000 MHz and 410.000 MHz.

These frequencies have to be measured on the open area test site. The result is presented in the following.

5.3.2.2 Final radiated emission test (30 MHz to 1 GHz)

Ambient temperature	20 °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.

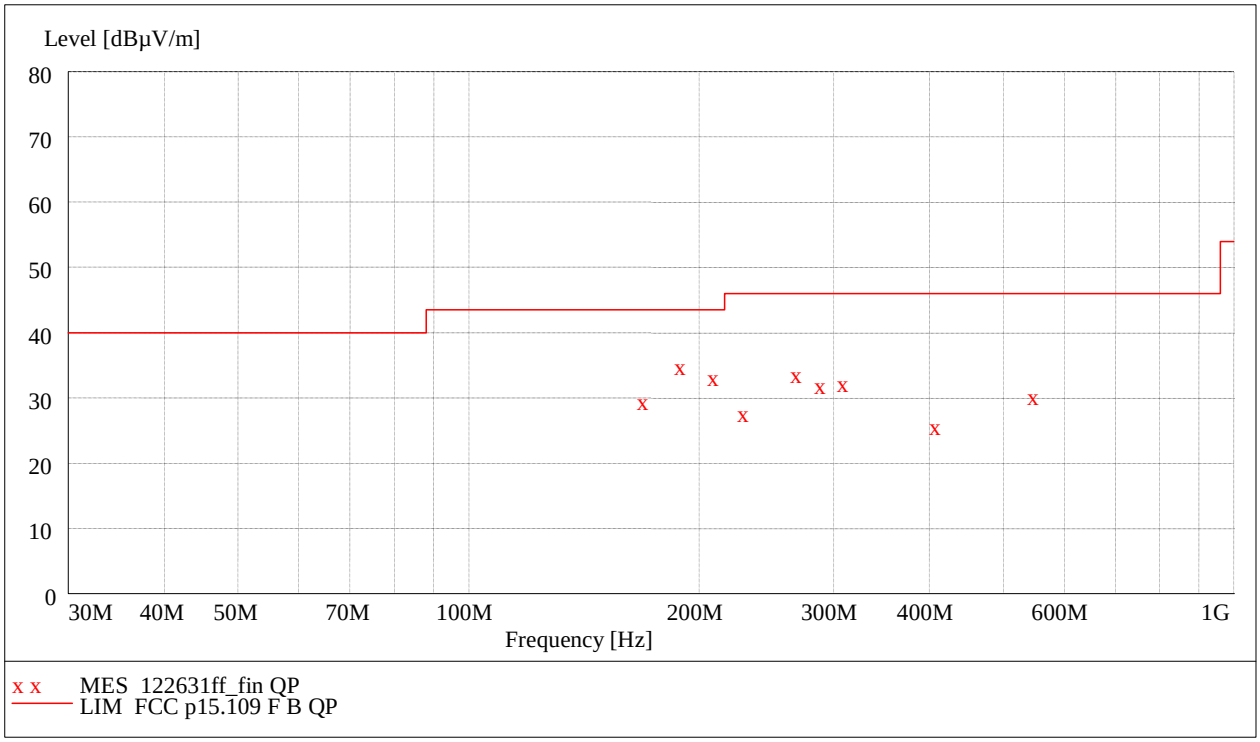
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Test results: The test results were calculated with the following formula:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m]

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with an x are the measured results of the standard final measurement on the open area test site.



Data record name: 122631ff

The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

The measurement time with the quasi-peak measuring detector is 1 second.

Result measured with the quasipeak detector:
(This value is marked in the diagram by an x)

Spurious emissions outside restricted bands									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
190.000	35.3	43.5	8.2	24.8	9.0	1.5	170.0	45.0	Hor.
210.000	33.5	43.5	10.0	22.6	9.3	1.6	148.0	51.0	Hor.
230.000	28.0	46.0	18.0	16.1	10.3	1.6	125.0	359.0	Hor.
290.000	32.2	46.0	13.8	17.3	13.0	1.9	111.0	51.0	Hor.
310.000	32.5	46.0	13.5	17.7	12.9	1.9	100.0	351.0	Hor.
550.000	30.6	46.0	15.4	8.3	19.6	2.7	100.0	294.0	Vert.
Spurious emissions in restricted bands									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
170.000	29.8	43.5	13.7	18.3	10.1	1.4	100.0	315.0	Vert.
270.000	34.0	46.0	12.0	19.8	12.3	1.9	100.0	45.0	Hor.
410.000	26.0	46.0	20.0	7.9	15.9	2.2	100.0	216.0	Hor.
Measurement uncertainty				+2.2 dB / -3.6 dB					

The test results were calculated with the following formula:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m]

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20

5.3.2.3 Preliminary measurement (1 GHz to 25 GHz)

Ambient temperature	21 °C	Relative humidity	57 %

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.

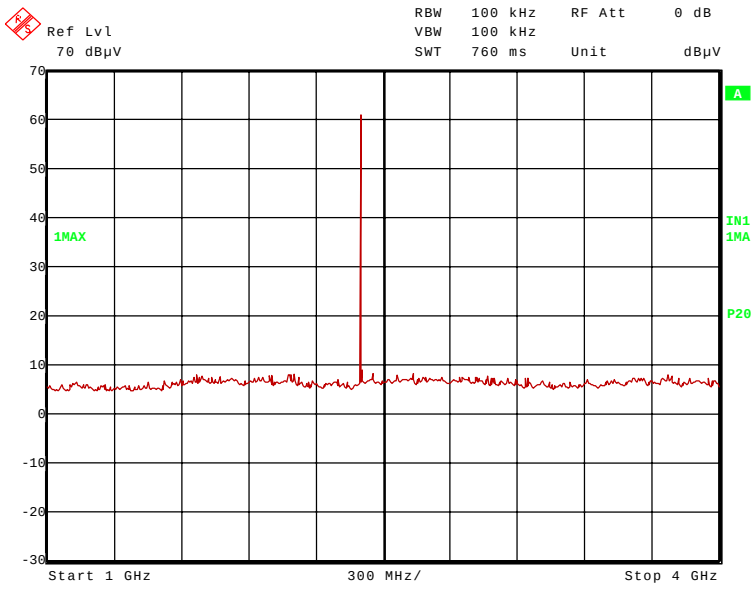
Cable guide: The cable of the EUT is running vertically to the false floor. For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

Test record: All results are shown in the following.

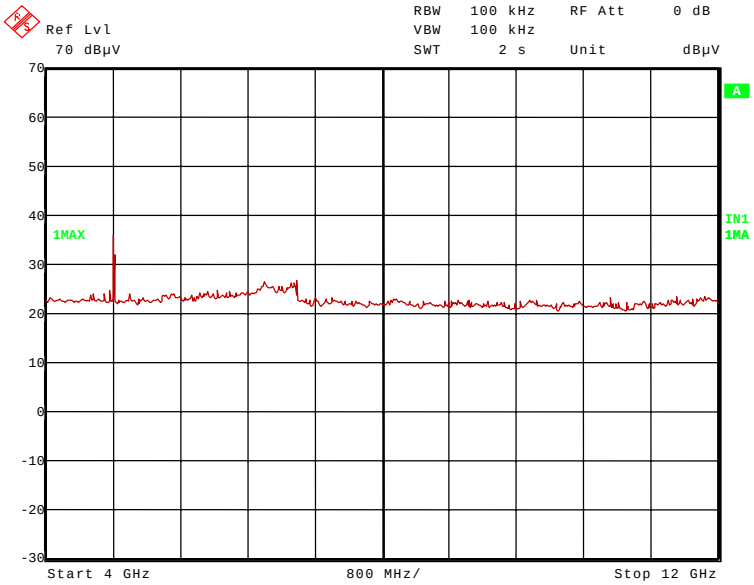
Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Transmitter operates at the lower end of the assigned frequency band

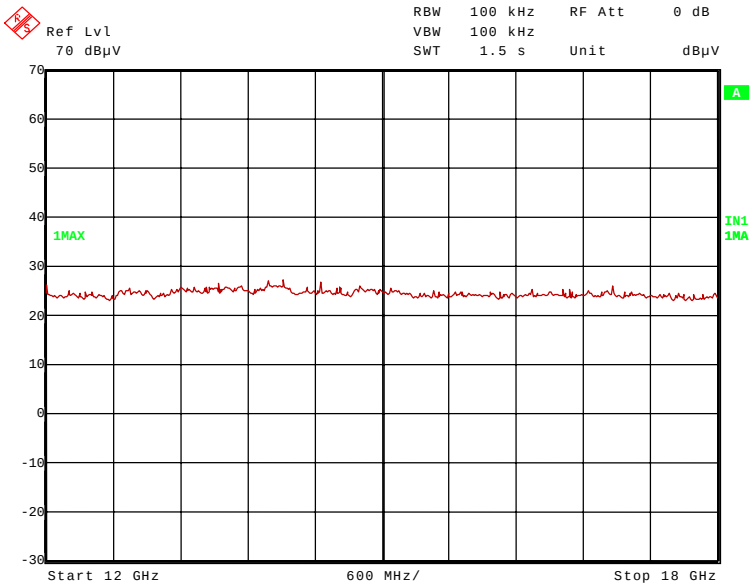
122631_4.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):



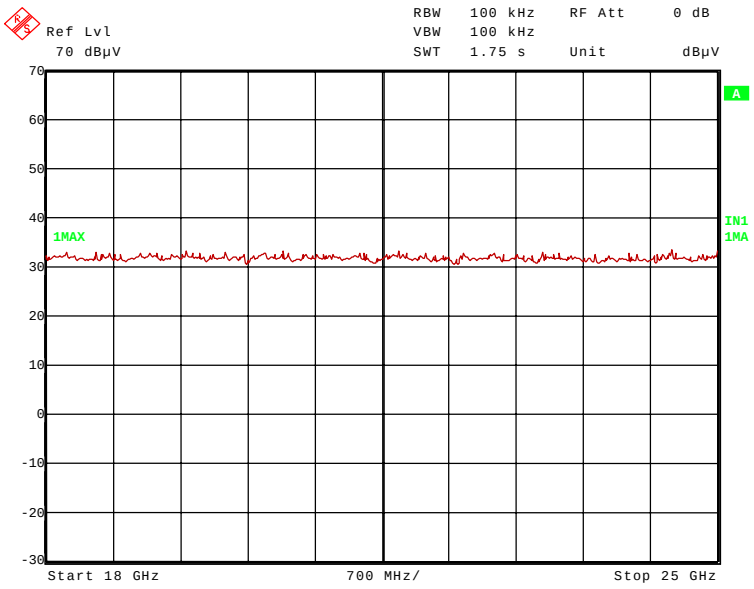
122631_13.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 1):



122631_14.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



122631_15.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 1):



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

- 4.804 GHz and 4.822 GHz.

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

- 2.402 GHz.

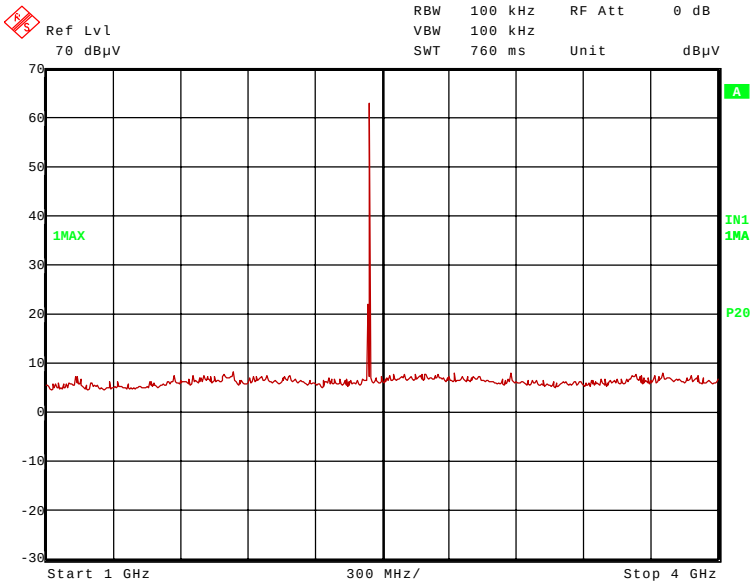
These frequencies have to be measured in a final measurement. The results were presented in the following.

TEST EQUIPMENT USED FOR THE TEST:

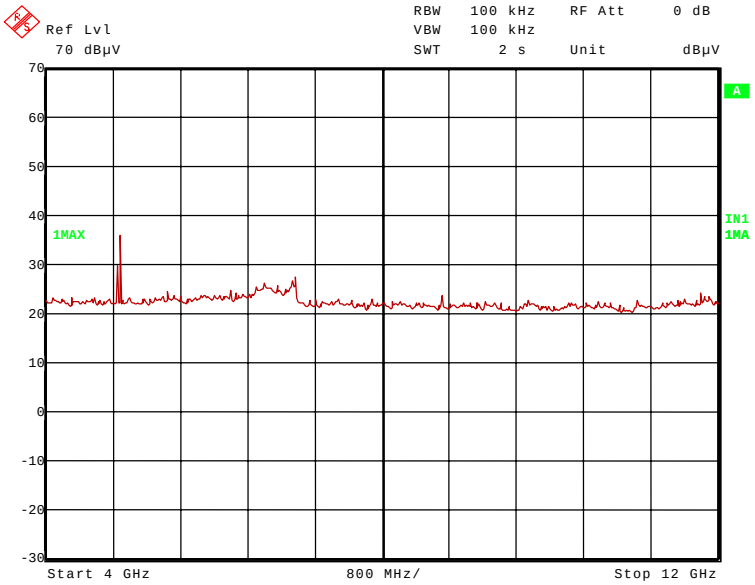
29, 31 –34, 36, 37, 39, 44, 46, 49 - 51, 72

Transmitter operates on the middle of the assigned frequency band

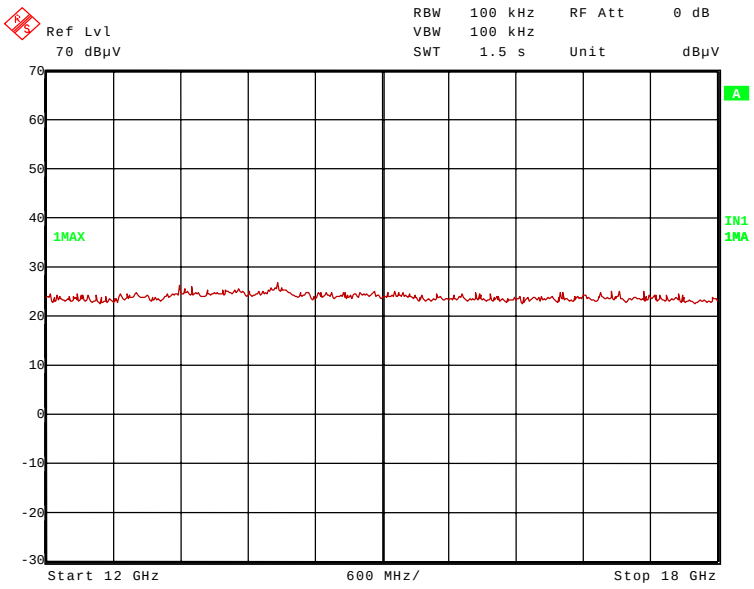
122631_7.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):



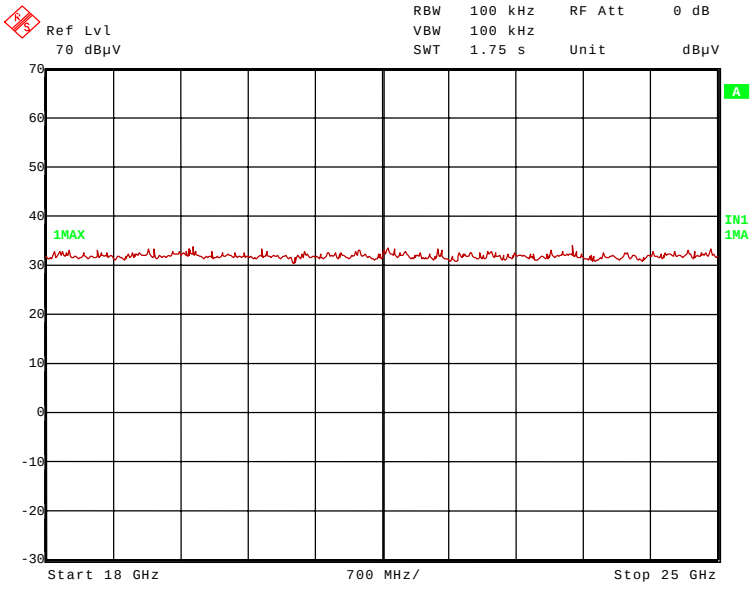
122631_12.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 2):



122631_16.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 2):



122631_17.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 2):



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

- 4.860 GHz and 4.882 GHz.

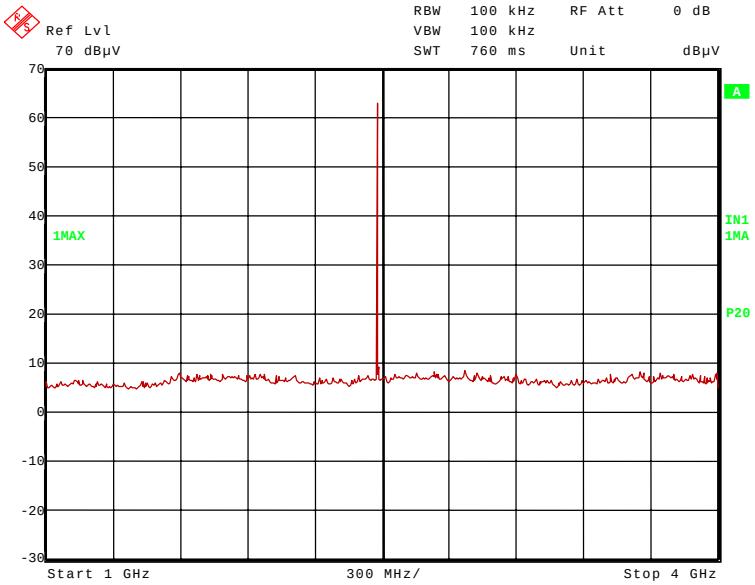
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.441 GHz.

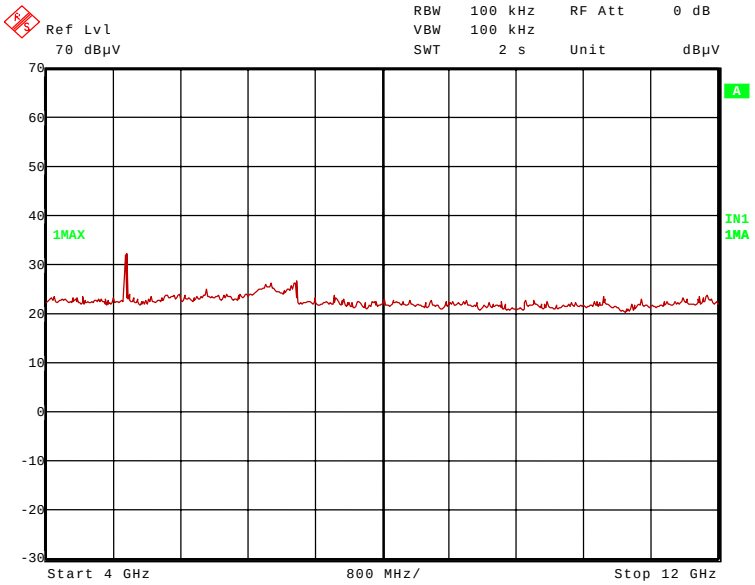
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the upper end of the assigned frequency

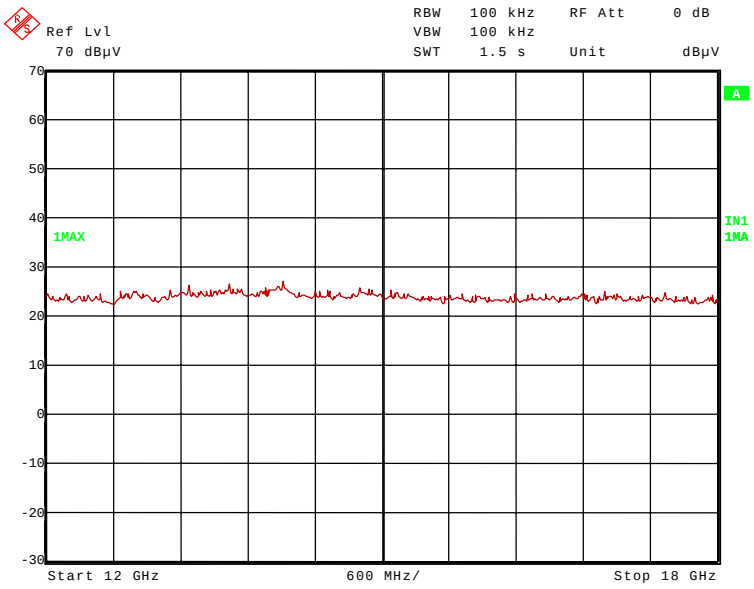
122631_8.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):



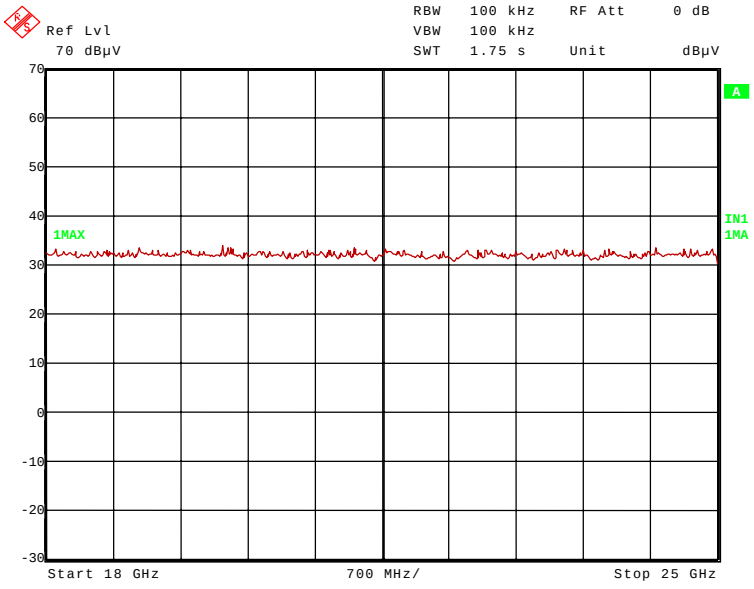
122631_11.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 3):



122631_18.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 3):



122631_19.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 3):



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

- 4.938 GHz and 4.960 GHz.

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

- 2.480 GHz.

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

5.3.2.4 Final measurement (1 GHz to 25 GHz)

Ambient temperature	21 °C	Relative humidity	57 %

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 5.0 V DC by the carrier board.

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

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

Result measured with the peak detector:

Frequency GHz	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
2.402	93.8	-	-	61.8	28.3	0.0	3.7	150	Vert.	-
4.804	52.2	74.0	21.8	40.0	32.6	25.7	5.3	150	Vert.	Yes
4.822	48.2	74.0	25.8	36.0	32.6	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	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
2.402	90.8	-	-	58.8	28.3	0.0	3.7	150	Vert.	-
4.804	45.2	54.0	8.8	33.0	32.6	25.7	5.3	150	Vert.	Yes
4.822	30.0	54.0	24.0	17.8	32.6	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

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

Result measured with the peak detector:

Frequency GHz	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
2.441	96.5	-	-	64.4	28.4	0.0	3.7	150	Vert.	-
4.860	48.9	74.0	25.1	36.7	32.7	25.7	5.2	150	Vert.	Yes
4.882	54.4	74.0	19.6	42.0	32.8	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	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
2.441	93.6	-	-	61.5	28.4	0.0	3.7	150	Vert.	-
4.860	30.4	54.0	23.6	18.2	32.7	25.7	5.2	150	Vert.	Yes
4.882	46.7	54.0	7.3	34.3	32.8	25.7	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

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

Result measured with the peak detector:

Frequency GHz	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
2.480	96.4	-	-	64.1	28.5	0.0	3.8	150	Vert.	-
4.938	48.6	74.0	25.4	36.0	32.9	25.6	5.3	150	Hor.	Yes
4.960	52.6	74.0	21.4	40.0	32.9	25.6	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Result measured with the average detector:

Frequency GHz	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
2.480	93.5	-	-	61.2	28.5	0.0	3.8	150	Vert.	-
4.938	30.5	54.0	23.5	17.9	32.9	25.6	5.3	150	Hor.	Yes
4.960	44.1	54.0	9.9	31.5	32.9	25.6	5.3	150	Hor.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 –34, 36, 44, 49, 72

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
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	AS615P	Deisel	615/310	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.)	
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	CBL6112 B	Chase	2688	480328	04/21/2011	04/2014
36	Antenna	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.)	
43	RF-cable No. 38	Sucoflex 106B	Suhner	0709/6B	481328	Weekly verification (system cal.)	
44	RF-cable No. 36	Sucoflex 106B	Suhner	0587/6B	480865	Weekly verification (system cal.)	
46	RF-cable 1m	KPS-1533-400-KPS	Insulated Wire	-	480301	Six month verification (system cal.)	
49	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	
50	Preamplifier	JS3-12001800-16-5A	Miteq	571667	480343	Six month verification (system cal.)	
51	Preamplifier	JS3-18002600-20-5A	Miteq	658697	480342	Six month verification (system cal.)	
55	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	02/16/2012	02/2014
72	4 GHz High Pass Filter	WHKX4.0/18 G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	

7 REPORT HISTORY

Report Number	Date	Comment
F122631E1	04 September 2012	Document created

8 LIST OF ANNEXES

ANNEX A TEST SETUP PHOTOGRAPHS 6 pages

122631_b.jpg cB-0925-01-1-02, test set-up fully anechoic chamber
122631_d.jpg cB-0925-01-1-02, test set-up fully anechoic chamber
122631_f.jpg cB-0925-01-1-02, test set-up fully anechoic chamber
122631_e.jpg cB-0925-01-1-02, test set-up fully anechoic chamber
122631_a.jpg cB-0925-01-1-02, test set-up fully anechoic chamber
122631_h.jpg cB-0925-01-1-02, test set-up open area test site

ANNEX B INTERNAL PHOTOGRAPHS 9 pages

122631_8.jpg cb-0925-01-1-02, top view
122631_9.jpg cB-0925-01-1-0x, bottom view
122631_5.jpg cB-0925-01-1-02 mounted on carrier board
122631_7.jpg cB-0903-03, carrier board, top view
122631_6.jpg cB-0903-03, carrier board, bottom view
122631_1.jpg Antenna BBL-2450, top view
122631_2.jpg Antenna BBL-2450, bottom view
122631_3.jpg Antenna BBL-2450, mounted on chrome plated enclosure, bottom view
122631_4.jpg Antenna BBL-2450, mounted on chrome plated enclosure, top view