PHOENIX TESTLAB
Königswinkel 10
32825 Blomberg
Germany
Phone: +49 (0) 52 35 95 00-0
Fax: +49 (0) 52 35 95 00-10

Test Report

Report Number: F120262E1

Applicant:

connectBlue AB

Manufacturer:

connectBlue AB

Equipment under Test (EUT):

cB-0950

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 2011)** Radio Frequency Devices

[3] **Publication Number 558074 (January 2012)** DTS Meas Guidance v01

[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		10 February 2012
	Name	Signature	Date
Authorized reviewer:	Bernd STEINER		13 February 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)

Test object: *	**Bluetooth Low Energy transceiver**
Type: *	cB-0950
FCC ID: *	**PVH0950**
IC: *	**5325A-0950**
Serial number: *	None
PCB identifier: *	cB-09 50-02 and cB-09 50-03
Hardware version: *	2.0 and 3.0
Software version: *	1.0

1.5 Technical data of equipment

Channel 0	RX:	2402 MHz	TX:	2402 MHz
Channel 19	RX:	2440 MHz	TX:	2440 MHz
Channel 39	RX:	2480 MHz	TX:	2480 MHz

Fulfills Bluetooth specification: *	4.0 (Bluetooth Low Energy single mode)					
Antenna type: *	Refer table below					
Antenna gain: *	Refer table below					
Antenna connector: *	With internal antenna, no antenna connector is mounted. For external antennas a Hirose U.FL connector is used					
Power supply (without additional voltage regulator): *	U_{nom}=	3.0 V DC	U_{min}=	2.0 V DC	U_{max}=	3.6 V DC
Power supply (with additional voltage regulator): *	U_{nom}=	5.0 V DC	U_{min}=	3.0 V DC	U_{max}=	6.0 V DC
Type of modulation: *	GFSK (1 Mbps)					
Operating frequency range:*	2402 MHz to 2480 MHz					
Number of channels: *	40					
Temperature range: *	-40 °C to +85 °C					
Lowest / highest Internal clock frequency: *	32.768 kHz / 32.000 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.

Used antennas:

Antenna name	Manufacturer	Antenna Type	Cable length / connector	Gain [dBi] *
ANCG12G44SAA162 ***	muRata	Internal	-	-2.0
SOA 2400/360/3/20/V	Huber+Suhner	Monopole	1.5 m cable to SMA	3
SOA 2400/360/3/20/V	Huber+Suhner	Monopole	1.5 m cable to SMA + 4 m cable to MCX	0 (incl. cable)
SOA 2400/360/3/20/V	Huber+Suhner	Monopole	1.5 m cable to MCX	3
FlatWhip-2400 (RPSMA)	ProAnt	Monopole	RPSMA connector	3
Outside-2400	ProAnt	Monopole	U.FL/10 cm cable and U.FL/25 cm cable	3
Ex-IT 2400 RP-SMA 28-001	ProAnt	Monopole	RPSMA connector	3
Ex-IT 2400 RP-SMA 70-002	ProAnt	Monopole	RPSMA connector	3
Ex-IT 2400 RP-SMA 70-001	ProAnt	Monopole	RPSMA connector	3
Ex-IT 2400 MHF 70-001	ProAnt	Monopole	10 cm cable with U.FL connector	3
WCR2400-SMRP	Laird Technologies **	Monopole	RPSMA connector	2
WCR2400-IP04 WCR2400-IP10	Laird Technologies **	Monopole	RPSMA connector and cable to U.FL with cable length 10 cm and 25 cm	2
R380.500.139	Radiall	Monopole	RPSMA connector	2
IHF-242	Joymax	Monopole	Cable to MCX and IPC (U.FL) connector	2
Ex-IT 2400 MHF 28	ProAnt	Monopole	10 cm cable with U.FL connector	2
SOA 2400/360/6/0/V ***	Huber+Suhner	Monopole	4 m cable to MCX	1.1 (incl. cable)
PSTG0-2400HS (RPSMA)	Mobile Mark	Monopole	RPSMA connector	0
SPA 2400/75/8/0/V	Huber+Suhner	Patch	SMA, 4 m cable to MCX	3.4 (incl. cable)
SPA 2400/70/9/0/RCP ***	Huber+Suhner	Patch	SMA, 4 m cable to MCX	3.4 (incl. cable)
InSide-2400	ProAnt	Patch	Cable to U.FL 10 cm	3
NanoBlue-IP04	Laird Technologies **	Patch	Cable to U.FL 10 cm	2
PlanTec m70cxr (RPSMA)	REEL	Patch	Cable to RPSMA connector, cable length 20 cm, 100 cm and 300 cm	1

*: declared by the applicant
**: previous Centurion
***: worst case antennas, used for testing

1.6 Dates

Date of receipt of test sample:	24 January 2012
Start of test:	24 January 2012
End of test:	08 February 2012

2 OPERATIONAL STATES

The tests were carried out with four unmodified samples: One with an internal antenna and additional voltage regulator (sample marked with #70), one with antenna connector and additional voltage regulator (sample marked with #71), one with an internal antenna and without additional voltage regulator (sample marked with #77) and one with antenna connector and without additional voltage regulator (sample marked with #81).

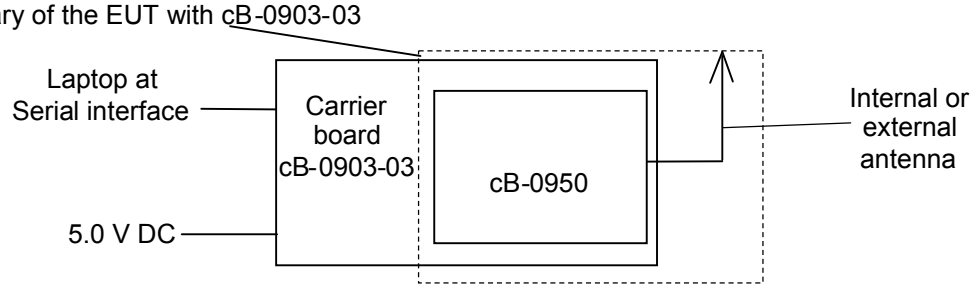
All measurements were carried out with the EUT's mounted on a carrier board. The operation was adjusted with the help of a test-software, which was installed on a laptop PC (provided by the applicant) and connected to the carrier board via a RS 232 connection. After adjusting the operation mode, the adapter board and the PC were removed.

During the tests the test samples were powered with 3.3 V DC via the carrier board cB-0903-03.

The following operation modes were used during the tests:

Operation mode	Description of the operation mode	Modulation	Data rate / Mbps
1	Continuous transmitting on 2402 MHz	GFSK	1
2	Continuous transmitting on 2440 MHz	GFSK	1
3	Continuous transmitting on 2480 MHz	GFSK	1
4	Transmitter hopping on all channels	GFSK	1
5	Continuous receiving on 2402 MHz		
6	Continuous receiving on 2440 MHz		
7	Continuous receiving on 2480 MHz		

Physical boundary of the EUT with cB-0903-03



Preliminary tests were performed in different orthogonal directions, to find worst-case configuration and position. 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 3 orthogonal axes were defined as Pos.1 EUT lying flat, Pos.2 EUT standing vertical, connector cable horizontal to the right and Pos 3 EUT standing vertical, connector cable perpendicular to the top.

The following test modes were adjusted during the tests:

Test items	Operation mode
6 dB bandwidth	1, 2, 3
Maximum peak output power	1, 2, 3
Power spectral density	1, 2, 3
Band edge compliance	1, 3, 4
Radiated emissions (transmitter)	1, 2, 3
Radiated emissions (receiver)	5

3 ADDITIONAL INFORMATION

As declared by the applicant the EUT is available in different Variants. For this variants the model name is extended as described below:

cB-0950-03-1-01-0 Module with internal antenna and with additional voltage regulator.
cB-0950-03-1-02-0 Module with antenna connector and with additional voltage regulator.
cB-0950-03-1-01-1 Module with internal antenna and without additional voltage regulator.
cB-0950-03-1-02-1 Module with antenna connector and without additional voltage regulator.
cB-0950-02-1-01-1 Module with internal antenna and without additional voltage regulator.
cB-0950-02-1-02-1 Module with antenna connector and without additional voltage regulator.

These versions were coded as follows:
cB-0950-"PCB Version-Radio"-"Antenna Option"-"Misc Options":

- PCB Version-Radio: 03-1 or 02-1;
- Antenna Option: 02 = External antenna connector, 01 = Internal ANCG12G44SAA162 antenna;
- Misc Options: 0 = Internal 3-6V voltage regulator on module, 1 = No voltage regulator

The difference between the two PCB versions is declared by the applicant as follows:

- cB-0950-02: The Red LED can only be placed below the mounting slot (close to the white connector)
- cB-0950-03: The Red LED can be placed on two different locations, same position as on cB-0950-02 or just above the green LED. The LED is never placed on both locations at the same time.

Pre-test with both PCB versions have shown no measurable difference.

The voltage regulator is called additional voltage regulator, because according the block diagram and the applicant's declaration the radio chip is equipped with an internal voltage regulator.

Bluetooth Low Energy (BLE) fulfils not the requirements for a FCC CFR 47 Part 15.247 FHSS equipment, because in some cases less than 15 hopping channels were used. Due to this fact the EUT is classified as FCC CFR 47 Part 15.247 DTS equipment.

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
6 dB bandwidth	2400.0 - 2483.5	15.247 (a) (2)	A8.2 (a) [4]	Passed	10 et seq.
Maximum peak output power	2400.0 - 2483.5	15.247 (b) (3), (4)	A8.4 (4) [4]	Passed	13 et seq.
Power spectral density	2400.0 - 2483.5	15.247 (e)	A8.2 (b) [4]	Passed	16 et seq.
Band edge compliance	2400.0 - 2483.5	15.247 (d)	A8.5 [4]	Passed	19 et seq.
Radiated emissions (transmitter)	0.009 - 25,000	15.205 (a) 15.209 (a)	7.2.2 [5], 2.5 [4]	Passed	24 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.4 [5]	Passed	66 et seq.
Radiated emissions (receiver)	30 – 12,500	15.109 (a)	6.1 [5]	Passed	Annex D

5 TEST RESULTS

5.1 6 dB bandwidth

5.1.1 Method of measurement (6 dB bandwidth)

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, the transmitter shall work with its maximum data rate.

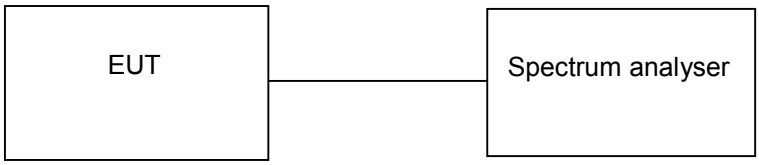
The following spectrum analyser settings shall be used:

- Span: App. 2 to 3 times the 6 dB bandwidth, centred on the actual channel.
- Resolution bandwidth: 1-5 % of the emission bandwidth.
- Video bandwidth: Three times 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 6 dB below the first line (or the peak marker). The frequency lines shall be set on the intersection points between the second display line and the measured curve.

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

Test set-up:

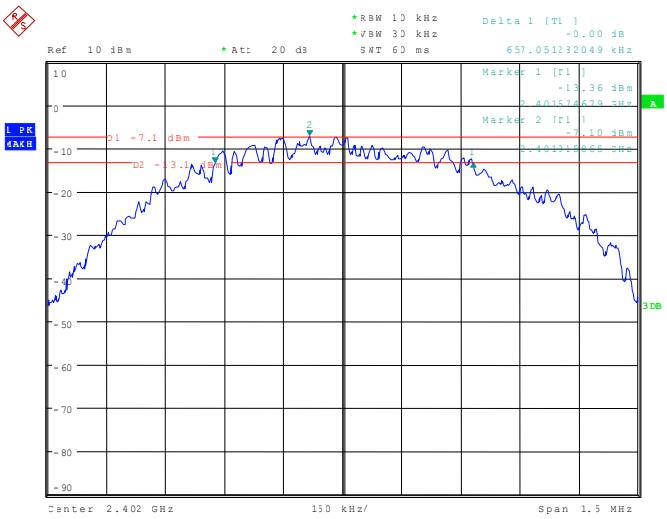


5.1.2 Test results (6 dB bandwidth)

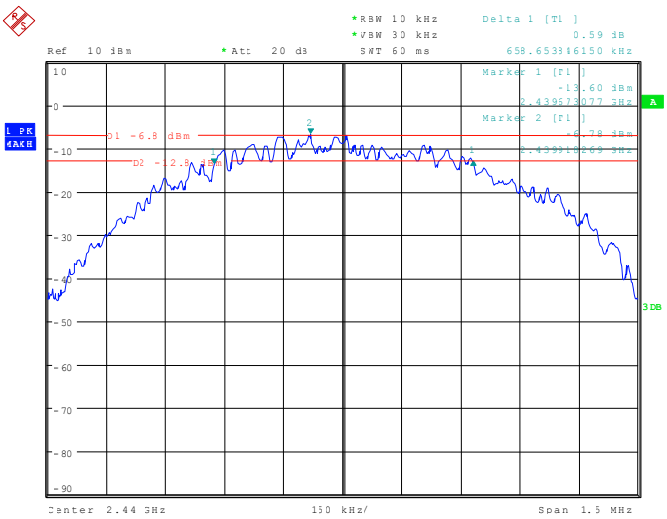
Ambient temperature	21 °C

Relative humidity	20 %

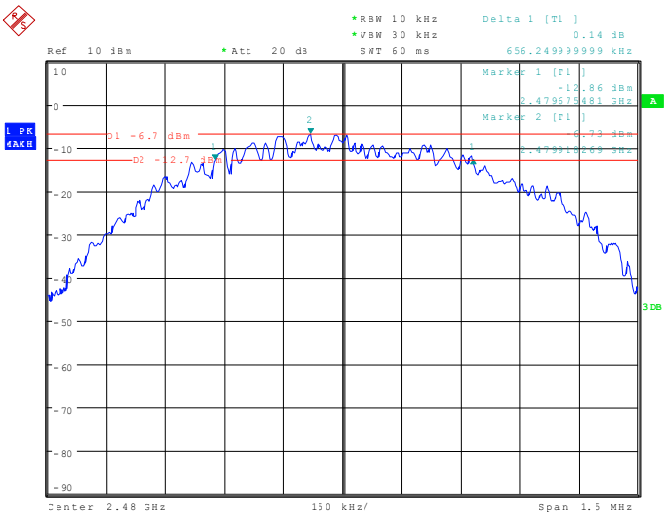
120262_119.wmf: 6 dB bandwidth (operation mode 1):



120262_120.wmf: 6 dB bandwidth (operation mode 2):



120262_121.wmf: 6 dB bandwidth (operation mode 3):



Operation mode 1 to 3			
Channel number	Channel frequency [MHz]	6 dB bandwidth [kHz]	Bandwidth limit [kHz]
0	2402	657.051	>500 kHz
19	2440	658.654	>500 kHz
39	2480	656.250	>500 kHz
Measurement uncertainty		$< \pm 1*10^{-7}$	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
30

5.2 Maximum peak output power

5.2.1 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.

Measurement procedure PK1:

The following spectrum analyser settings shall be used (available RBW is ≥ EBW):

- Span: Zero.
- Resolution bandwidth: RBW ≥ EBW.
- Video bandwidth: Three times the resolution bandwidth.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.
- Use marker function to determine the peak value

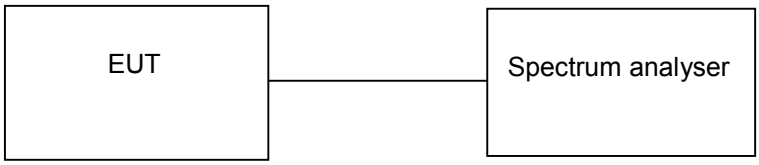
Measurement procedure PK2:

The following spectrum analyser settings shall be used (available RBW is < EBW):

- Span: 5-30 % > EBW.
- Resolution bandwidth: 1 MHz.
- Video bandwidth: 3 MHz.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.
- Use the spectrum analyser's integrated band power measurement function with band limits set equal to the EBW band edges.

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

Test set-up:

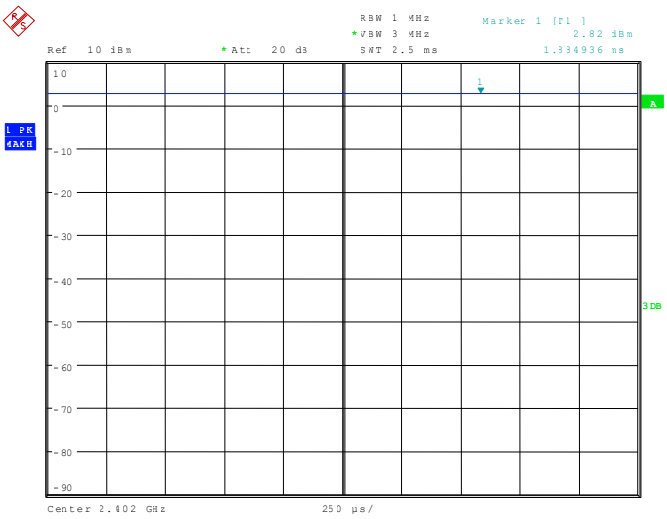


5.2.2 Test results (maximum peak output power)

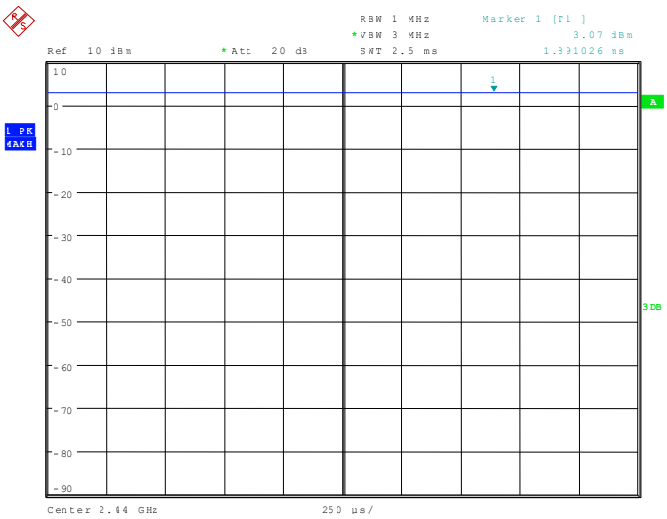
Ambient temperature	21 °C

Relative humidity	20 %

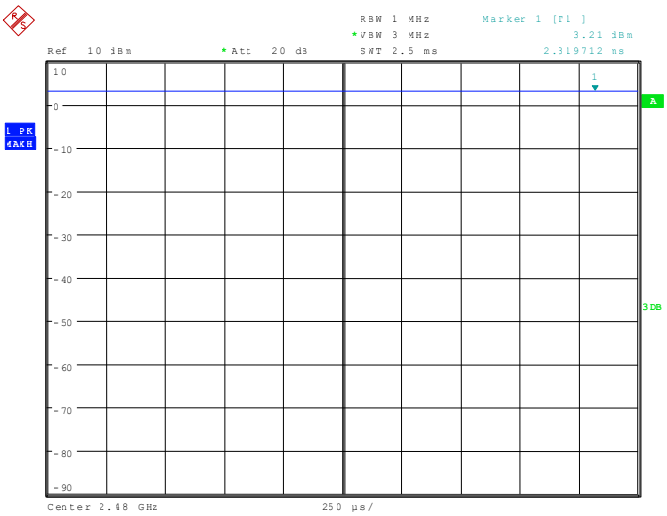
120262_123.wmf: Maximum peak conducted output power (operation mode 1):



120262_122.wmf: Maximum peak conducted output power (operation mode 2):



120262_124.wmf: Maximum peak conducted output power (operation mode 3):



Used measurement procedure: PK1				
Operation mode 1 to 3				
Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Peak power limit [dBm]
0	2402	2.8	3.4	30.0
19	2440	3.1	3.4	30.0
39	2480	3.2	3.4	30.0
Measurement uncertainty			+0.66 dB / -0.72 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
30

5.3 Power spectral density

5.3.1 Method of measurement (power spectral density)

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.

Measurement procedure PKPS (use this procedure in case of maximum peak conducted output power used to demonstrate compliance):

The following spectrum analyser settings shall be used:

- Span: 5 – 30 % greater than the EBW.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: 300 kHz.
- Sweep: Auto.
- Detector function: peak.
- Trace mode: Max hold.
- Use the peak marker to determine the maximuum power level in any 100 kHz band segment within the fundamental EBW.
- Scale the observed power level to an equivalent value in 3 kHz by adjusting the measured power by an bandwidth correction factor of -15.2 dB.

Measurement procedure AVGPSD (use this procedure in case of maximum average conducted output power used to demonstrate compliance):

The EUT must be configured to transmit continuously at full power over the measurement duration!

The following spectrum analyser settings shall be used:

- Span: 5 – 30 % greater than the EBW.
- Resolution bandwidth: 100 kHz.
- Video bandwidth: 300 kHz.
- Detector function: RMS.
- Trace mode: Single sweep.
- Ensure that the number of measurement points in the sweep ≥ 2 x span /RBW
- Sweep: ≥ 10 x number of measurement points in sweep x transmission symbol period
- Use the peak marker to determine the maximuum power level in any 100 kHz band segment within the fundamental EBW.
- Scale the observed power level to an equivalent value in 3 kHz by adjusting the measured power by an bandwidth correction factor of -15.2 dB.

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

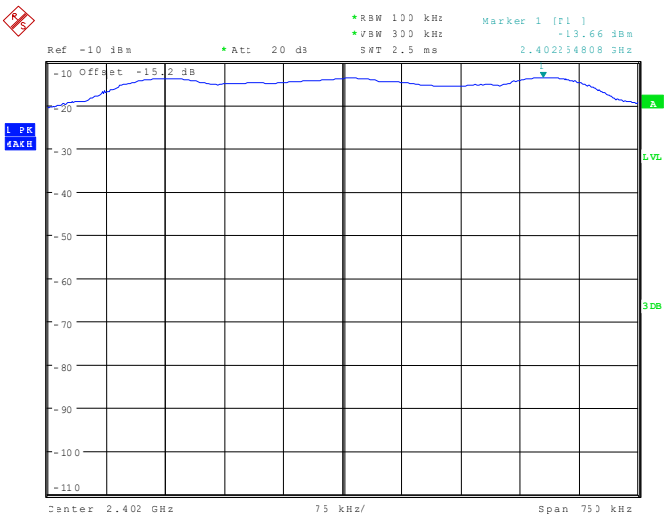
Test set-up:

5.3.2 Test results (power spectral density)

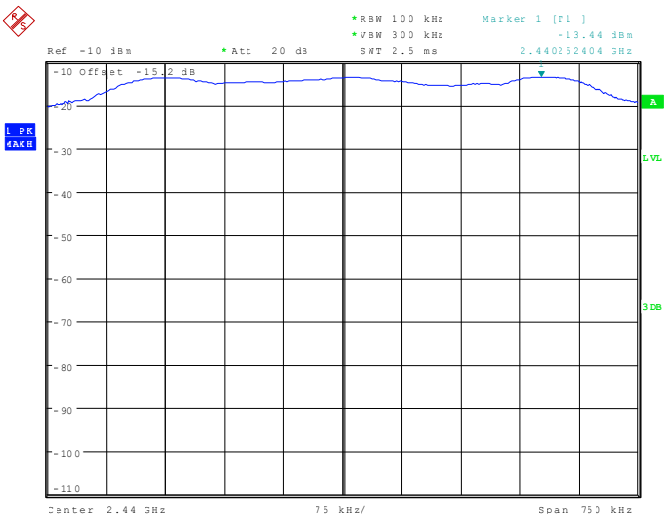
Ambient temperature	21 °C

Relative humidity	20 %

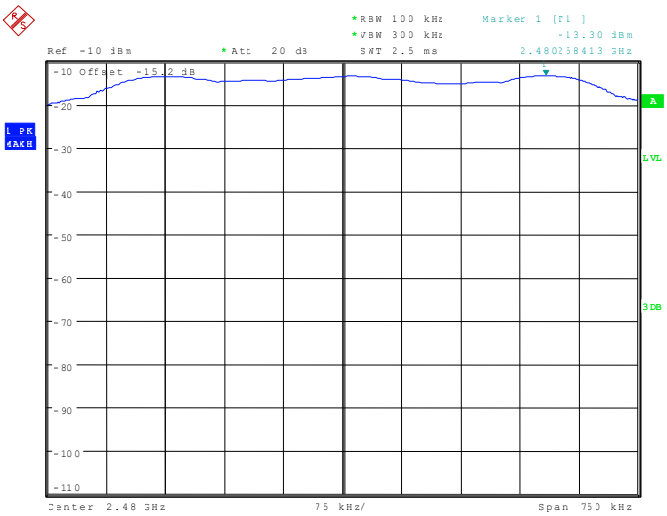
120262_126.wmf: Power spectral density (operation mode 1):



120262_127.wmf: Power spectral density (operation mode 2):



120262_125.wmf: Power spectral density (operation mode 3):



Used measurement procedure: PKPSD				
Operation mode 1 to 3				
Channel number	Channel frequency [MHz]	Power spectral density [dBm / 3 kHz]	Antenna gain [dBi]	Power spectral density limit [dBm / 3 kHz]
0	2402	-13.7	3.4	8.0
19	2440	-13.4	3.4	8.0
39	2480	-13.3	3.4	8.0
Measurement uncertainty			+1.1 dB / -1.5 dB	

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
30

5.4 Band-edge compliance

5.4.1 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 5.5.1 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.

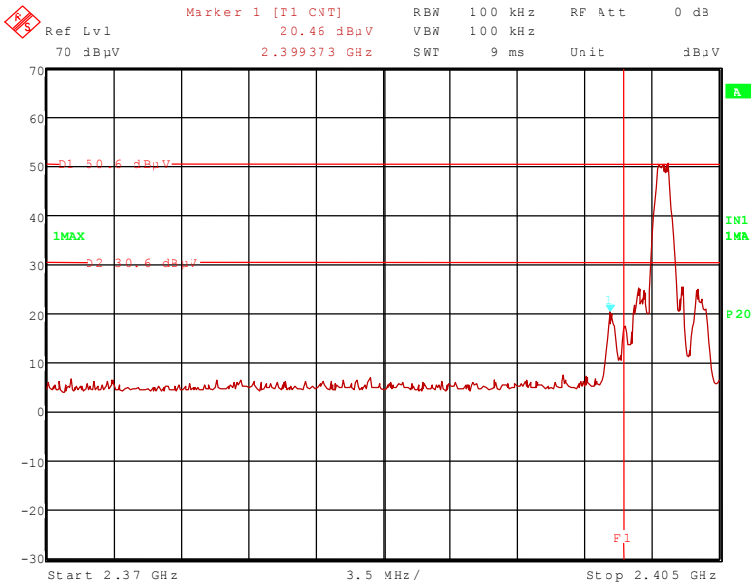
After trace stabilisation the marker shall be set on the signal peak. The first display line has to be set on this value. The second display line has to be set 20 dB below the first line (or the peak marker). The frequency line shall be set on the edge of the assigned frequency band. Now set the marker 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 (use Marker count function). This frequency shall be measured with the EMI receiver as described in subclause 5.5.1 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.

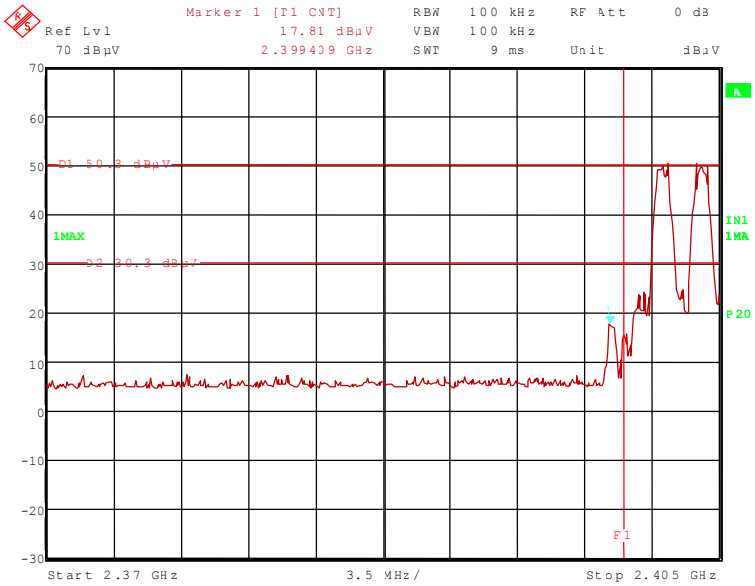
5.4.2 Test result (band-edge compliance (radiated)) with internal antenna

Ambient temperature	20 °C	Relative humidity	30 %

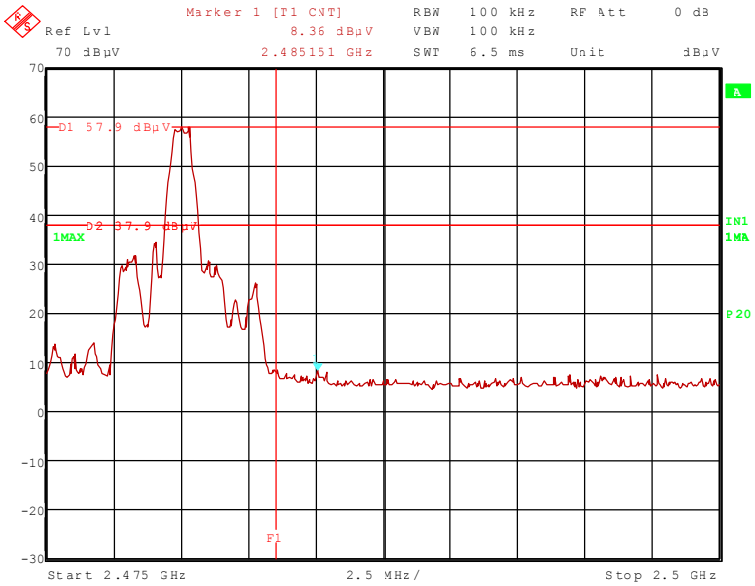
120262_3.wmf: Radiated band-edge compliance, lower band edge, hopping off (operation mode 1):



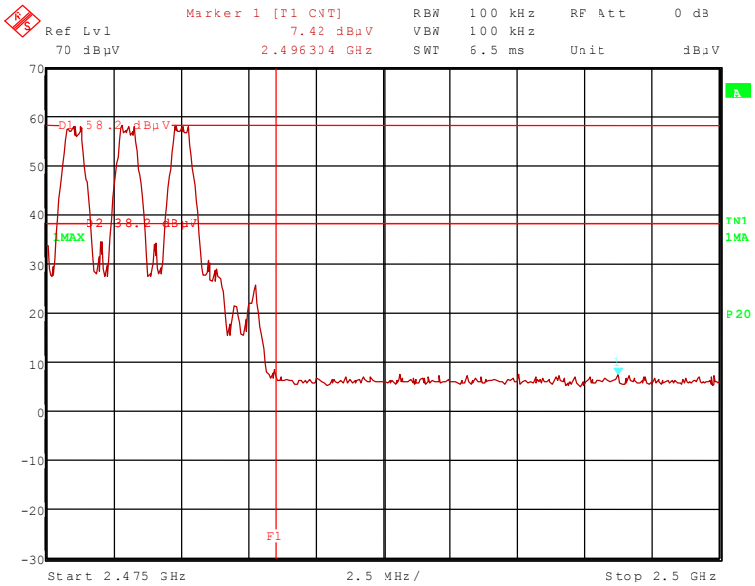
120262_7.wmf: Radiated band-edge compliance, lower band edge, hopping on (operation mode 4):



120262_5.wmf: Radiated band-edge compliance, upper band edge, hopping off (operation mode 3):



120262_6.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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	83.6	-	-	51.6	28.3	0.0	3.7	150	Hor.	-	1
2.3994	51.2	74.0	22.8	19.2	28.3	0.0	3.7	150	Hor.	No	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	78.1	-	-	46.1	28.3	0.0	3.7	150	Hor.	-	1
2.3994	38.9	58.1	19.2	6.9	28.3	0.0	3.7	150	Hor.	No	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	83.6	-	-	51.6	28.3	0.0	3.7	150	Hor.	-	1
2.3994	50.1	74.0	23.9	18.1	28.3	0.0	3.7	150	Hor.	No	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	78.1	-	-	46.1	28.3	0.0	3.7	150	Hor.	-	1
2.3994	37.0	58.1	21.1	5.0	28.3	0.0	3.7	150	Hor.	No	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	91.8	-	-	59.5	28.5	0.0	3.8	150	Hor.	-	1
2.4852	40.8	74.0	33.2	8.5	28.5	0.0	3.8	150	Hor.	Yes	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	86.1	-	-	53.8	28.5	0.0	3.8	150	Hor.	-	1
2.4852	27.9	54.0	26.1	-4.4	28.5	0.0	3.8	150	Hor.	Yes	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	91.8	-	-	59.5	28.5	0.0	3.8	150	Hor.	-	1
2.4963	40.0	74.0	34.0	7.7	28.5	0.0	3.8	150	Hor.	Yes	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	86.1	-	-	53.8	28.5	0.0	3.8	150	Hor.	-	1
2.4963	26.8	54.0	27.2	-5.5	28.5	0.0	3.8	150	Hor.	Yes	1
Measurement uncertainty							+2.2 dB / -3.6 dB				

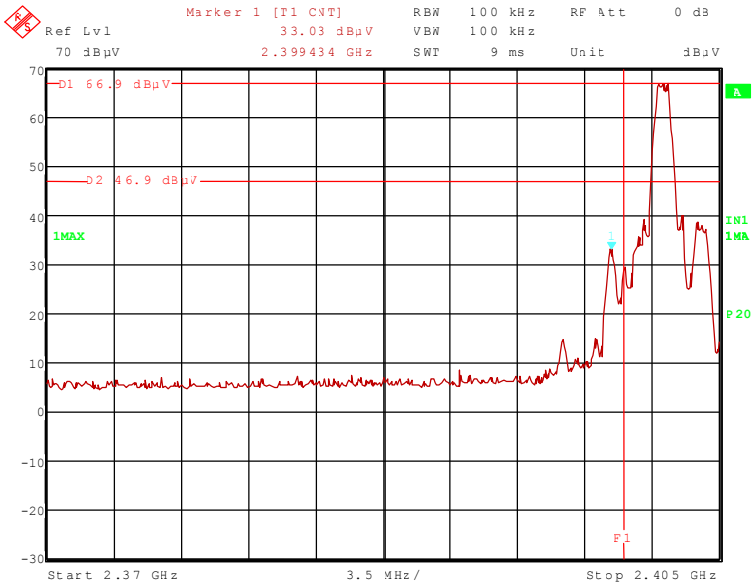
Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 44

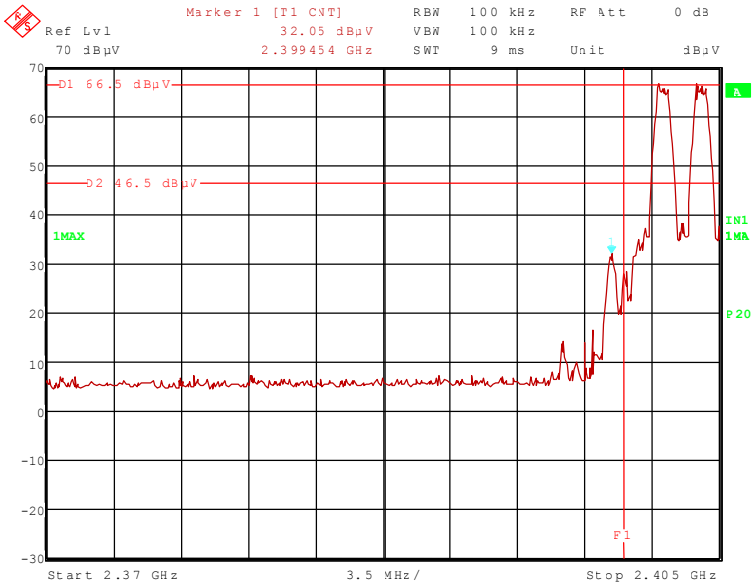
5.4.3 Test result (band-edge compliance (radiated)) with external patch antenna

Ambient temperature	20 °C		Relative humidity	30 %

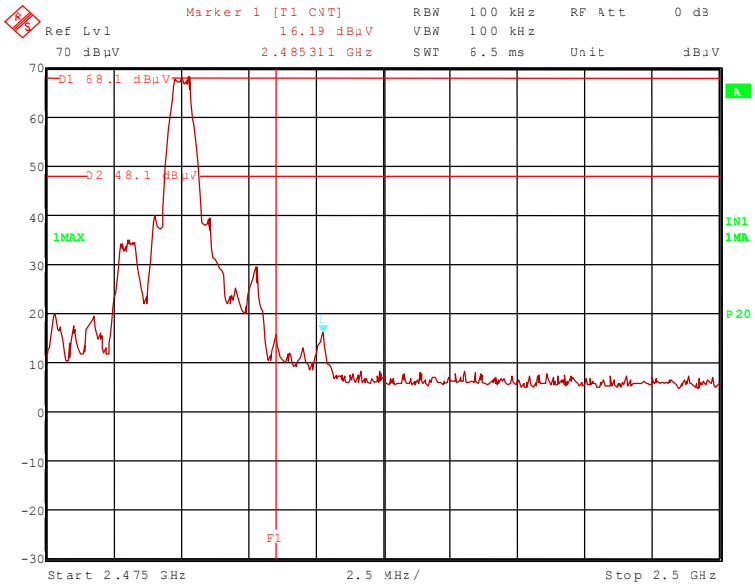
120262_12.wmf: Radiated band-edge compliance, lower band edge, hopping off (operation mode 1):



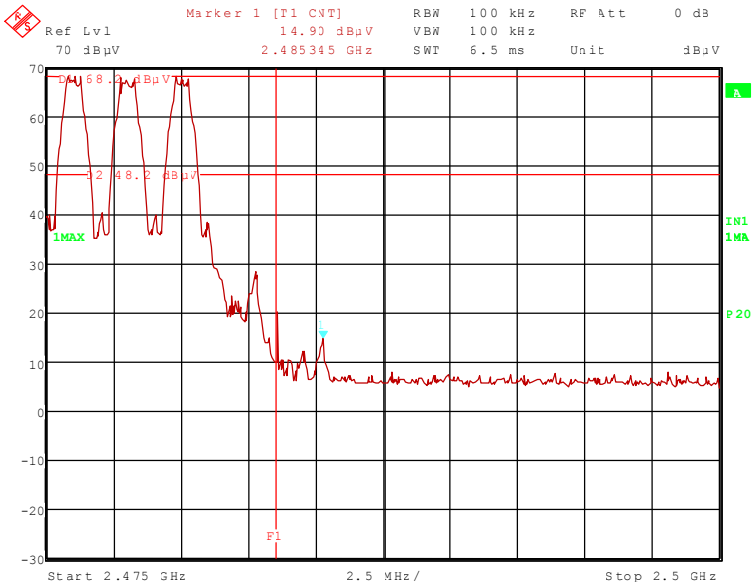
120262_20.wmf: Radiated band-edge compliance, lower band edge, hopping on (operation mode 4):



120262_18.wmf: Radiated band-edge compliance, upper band edge, hopping off (operation mode 3):



120262_19.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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	99.8	-	-	67.8	28.3	0.0	3.7	150	Hor.	-	1
2.3994	63.5	79.8	16.3	31.5	28.3	0.0	3.7	150	Hor.	No	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	94.5	-	-	62.5	28.3	0.0	3.7	150	Hor.	-	1
2.3994	51.5	74.5	23.0	19.5	28.3	0.0	3.7	150	Hor.	No	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	99.8	-	-	67.8	28.3	0.0	3.7	150	Hor.	-	1
2.3994	63.7	79.8	16.1	31.7	28.3	0.0	3.7	150	Hor.	No	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	94.5	-	-	62.5	28.3	0.0	3.7	150	Hor.	-	1
2.3994	40.6	74.5	33.9	8.6	28.3	0.0	3.7	150	Hor.	No	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	101.5	-	-	69.2	28.5	0.0	3.8	150	Hor.	-	1
2.4852	53.9	74.0	20.1	21.6	28.5	0.0	3.8	150	Hor.	Yes	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	96.2	-	-	63.9	28.5	0.0	3.8	150	Hor.	-	1
2.4852	41.0	54.0	13.0	8.7	28.5	0.0	3.8	150	Hor.	Yes	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	101.5	-	-	69.2	28.5	0.0	3.8	150	Hor.	-	1
2.4852	47.7	74.0	26.3	15.4	28.5	0.0	3.8	150	Hor.	Yes	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	96.2	-	-	63.9	28.5	0.0	3.8	150	Hor.	-	1
2.4852	27.6	54.0	26.4	-4.7	28.5	0.0	3.8	150	Hor.	Yes	1
Measurement uncertainty							+2.2 dB / -3.6 dB				

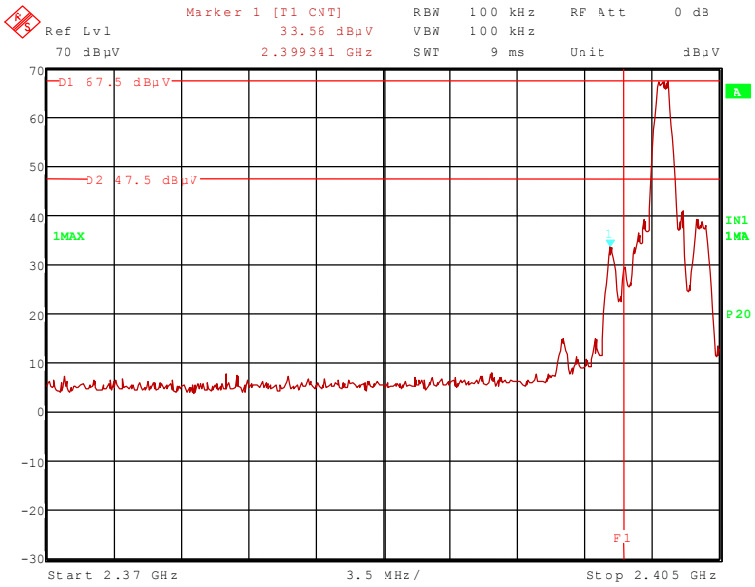
Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 44

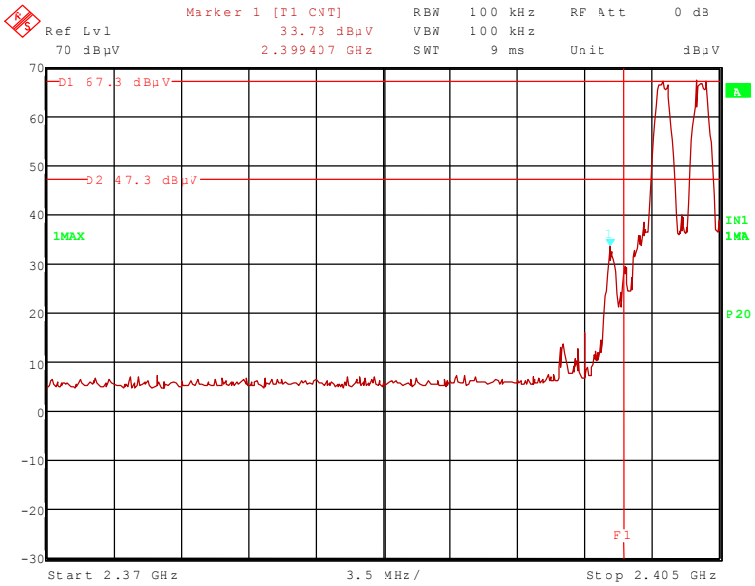
5.4.4 Test result (band-edge compliance (radiated)) with external monopole antenna

Ambient temperature	20 °C	Relative humidity	30 %

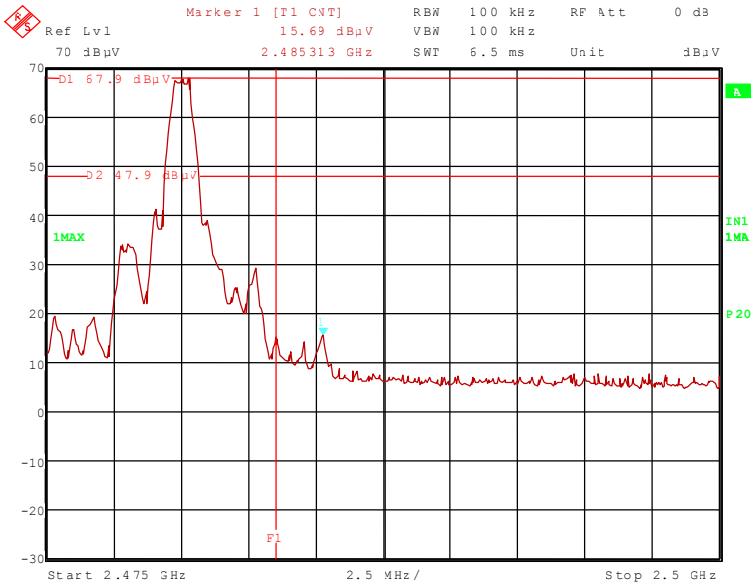
120262_23.wmf: Radiated band-edge compliance, lower band edge, hopping off (operation mode 1):



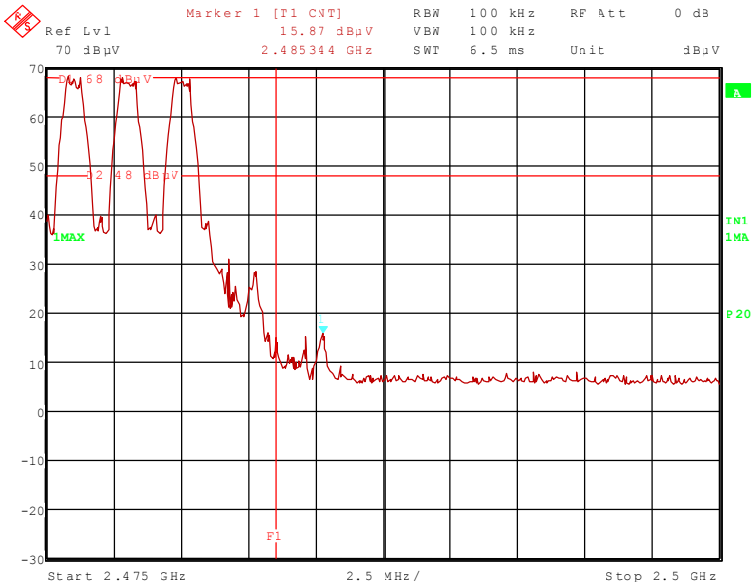
120262_27.wmf: Radiated band-edge compliance, lower band edge, hopping on (operation mode 4):



120262_25.wmf: Radiated band-edge compliance, upper band edge, hopping off (operation mode 3):



120262_26wmf: 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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	100.4	-	-	68.4	28.3	0.0	3.7	150	Vert.	-	1
2.3994	64.0	80.4	16.4	32.0	28.3	0.0	3.7	150	Vert.	No	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	95.1	-	-	63.1	28.3	0.0	3.7	150	Vert.	-	1
2.3994	52.0	75.1	23.1	20.0	28.3	0.0	3.7	150	Vert.	No	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	100.4	-	-	68.4	28.3	0.0	3.7	150	Vert.	-	1
2.3994	63.5	80.4	16.9	31.5	28.3	0.0	3.7	150	Vert.	No	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.402	95.1	-	-	63.1	28.3	0.0	3.7	150	Vert.	-	1
2.3994	30.7	75.1	44.4	-1.3	28.3	0.0	3.7	150	Vert.	No	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	101.2	-	-	68.9	28.5	0.0	3.8	150	Vert.	-	1
2.4852	47.6	74.0	26.4	15.3	28.5	0.0	3.8	150	Vert.	Yes	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	95.9	-	-	63.6	28.5	0.0	3.8	150	Vert.	-	1
2.4852	33.7	54.0	20.3	1.4	28.5	0.0	3.8	150	Vert.	Yes	1
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	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	101.2	-	-	68.9	28.5	0.0	3.8	150	Vert.	-	1
2.4852	47.6	74.0	26.4	15.3	28.5	0.0	3.8	150	Vert.	Yes	1
Result measured with the average detector:											
Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Reading dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2.480	95.9	-	-	63.6	28.5	0.0	3.8	150	Vert.	-	1
2.4852	27.3	54.0	26.7	-5.0	28.5	0.0	3.8	150	Vert.	Yes	1
Measurement uncertainty							+2.2 dB / -3.6 dB				

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 34, 36, 44

5.5 Radiated emissions

5.5.1 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.

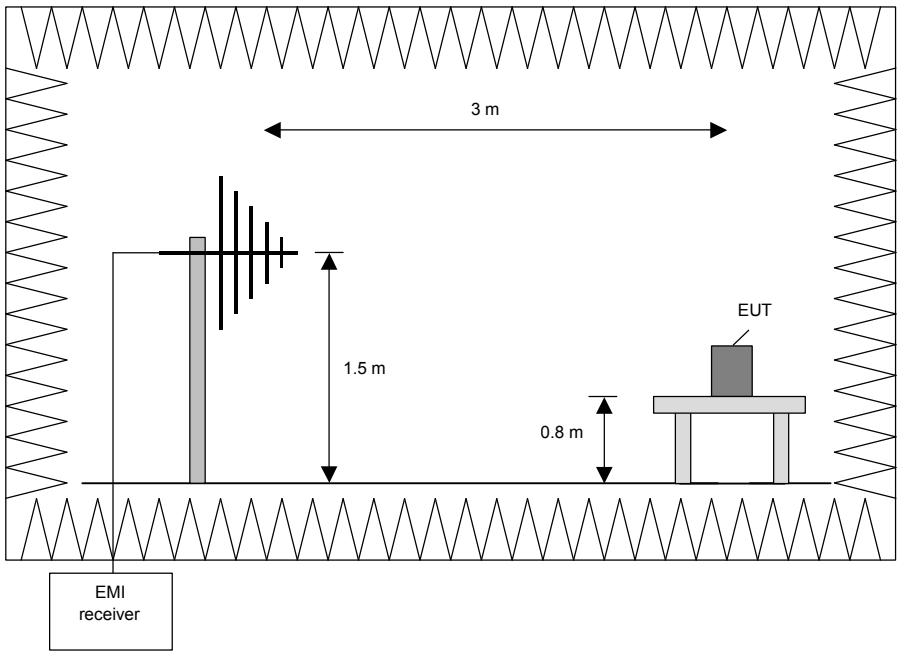
Preliminary measurement (30 MHz to 1 GHz)

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:

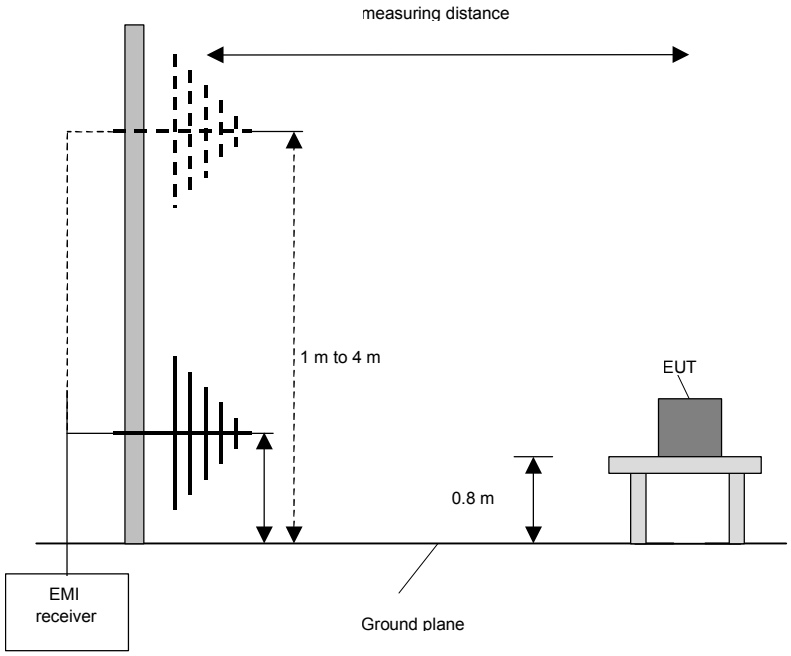
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the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

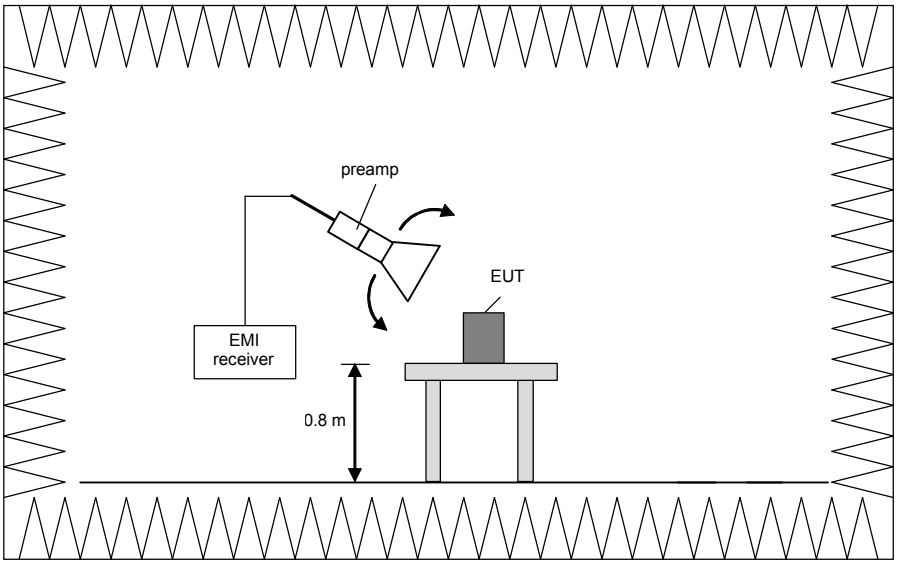
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance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

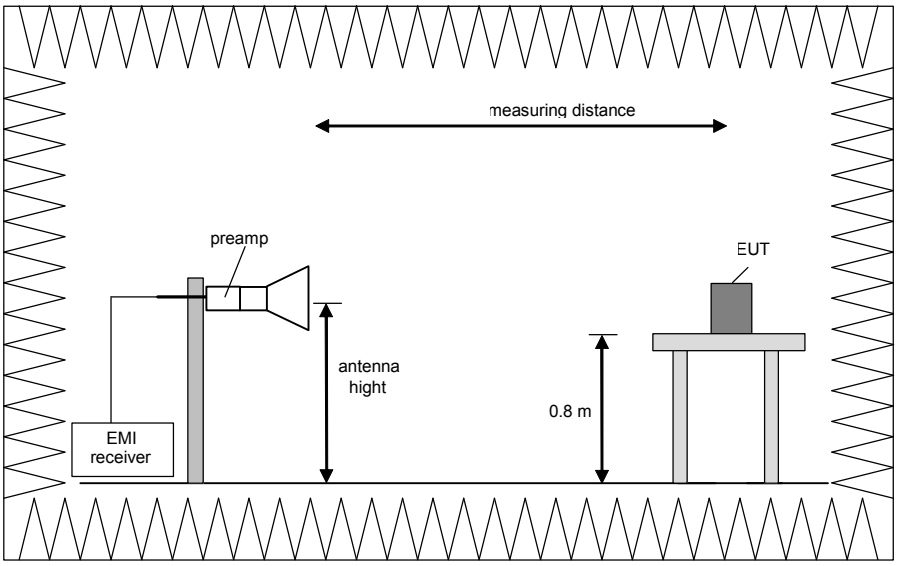


Final measurement (1 GHz to 110 GHz)

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.

5.5.2 Test results (radiated emissions) with internal antenna

5.5.2.1 Preliminary radiated emission measurement

Ambient temperature	20 °C	Relative humidity	30 %

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: For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

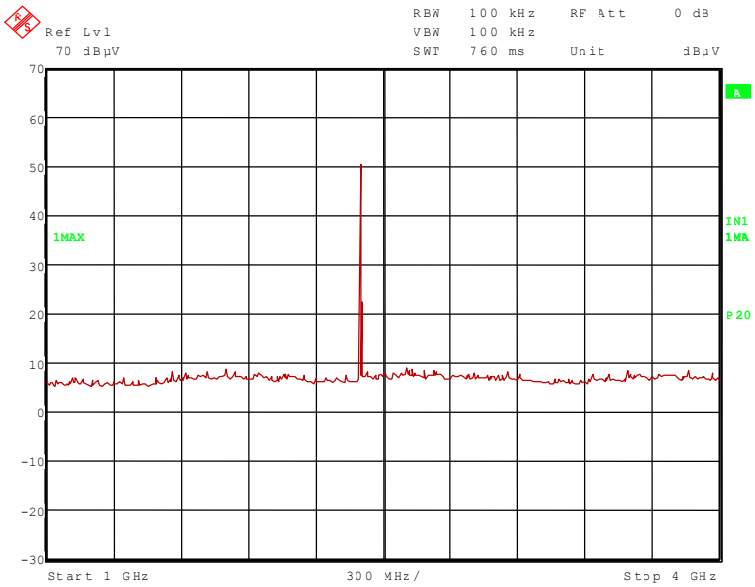
Test record: All results are shown in the following.

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

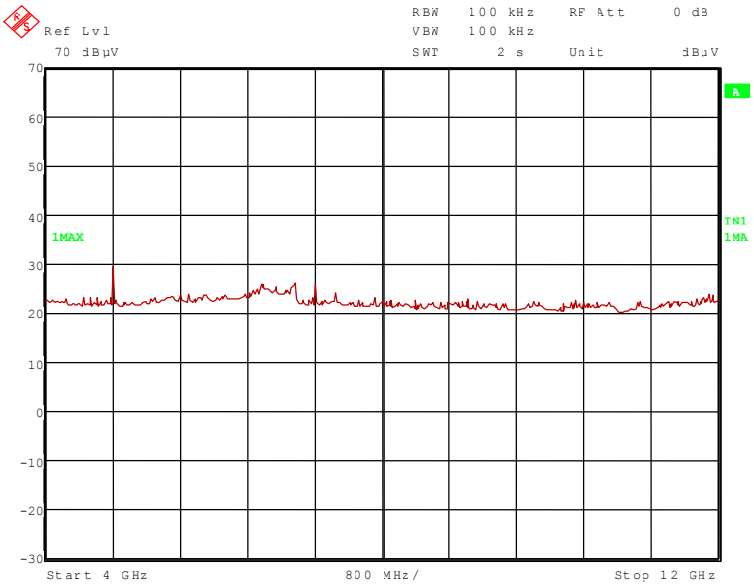
Remark: No emissions were emitted in the frequency range 9 kHz to 1 GHz independent of the transmitter operation mode. Therefore the emissions in this frequency range were documented only with the transmitter operates in operation mode 2 in combination with an external monopole antenna.

Transmitter operates at the lower end of the assigned frequency band

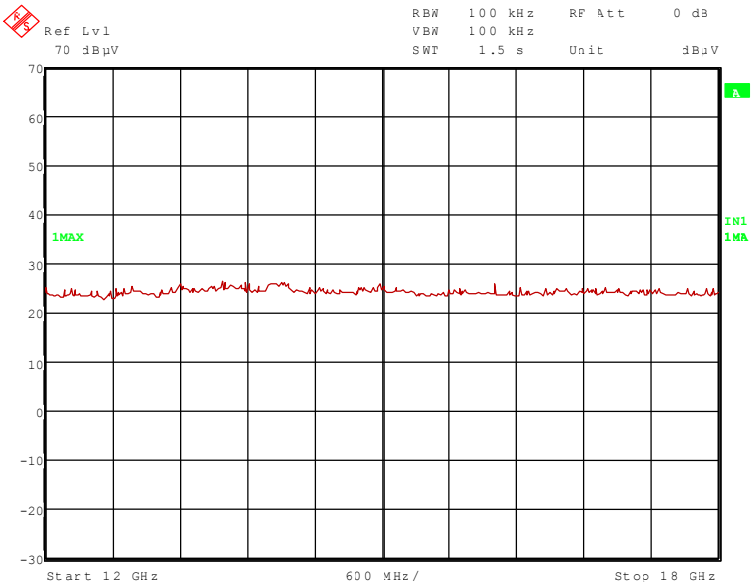
120262_2.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):



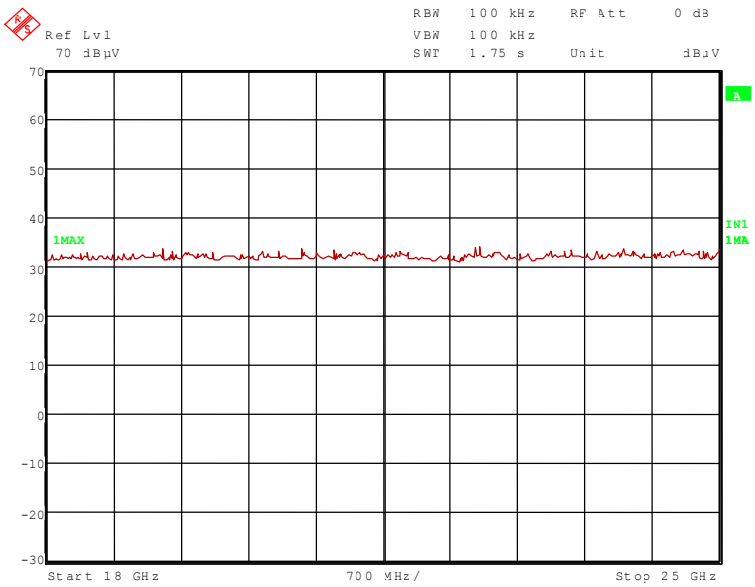
120262_8.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 1):



120262_56.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



120262_61.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 1):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.804 GHz.

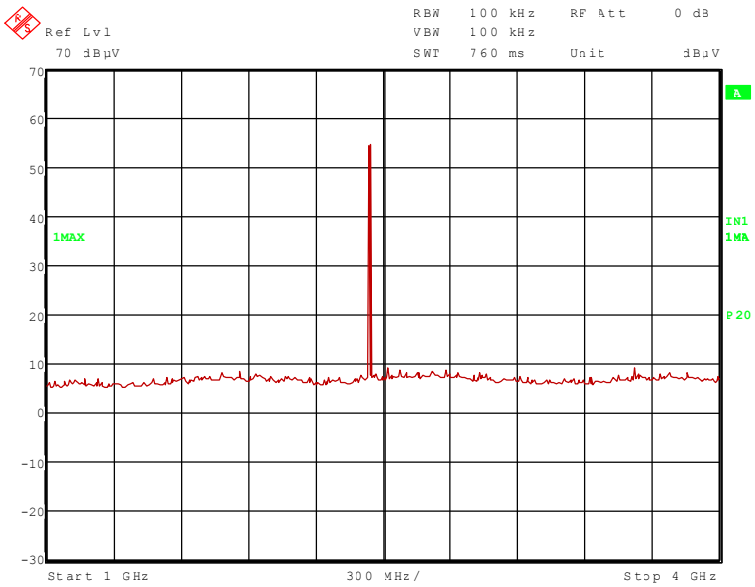
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.402 GHz and 7.206 GHz.

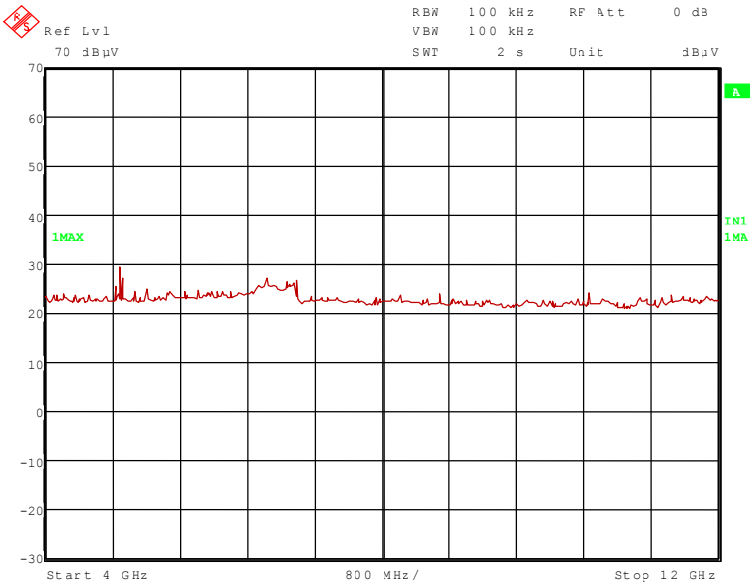
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the middle of the assigned frequency band

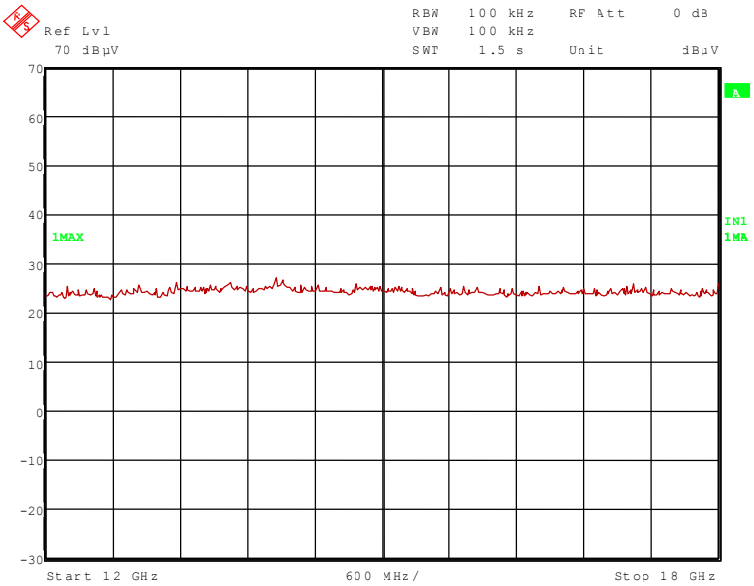
120262_1.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):



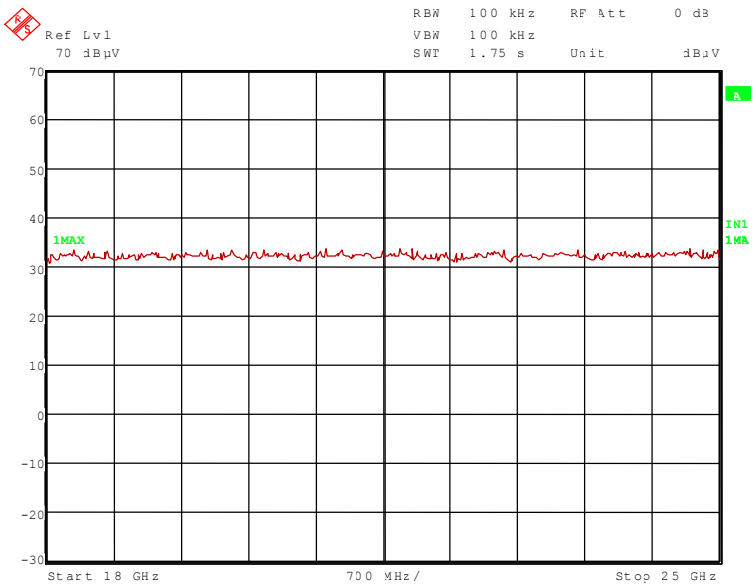
120262_9.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 2):



120262_57.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 2):



120262_60.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:

- 4.8564 GHz, 4.882 GHz and 4.9168 GHz.

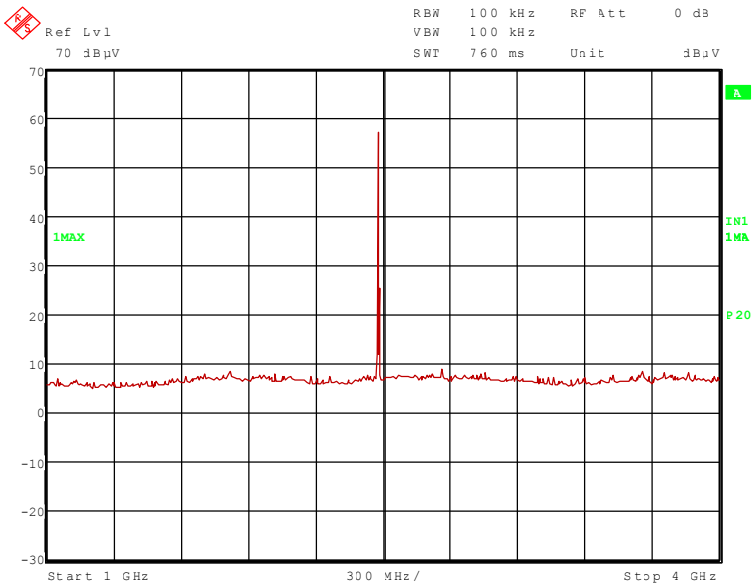
The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2.440 GHz.

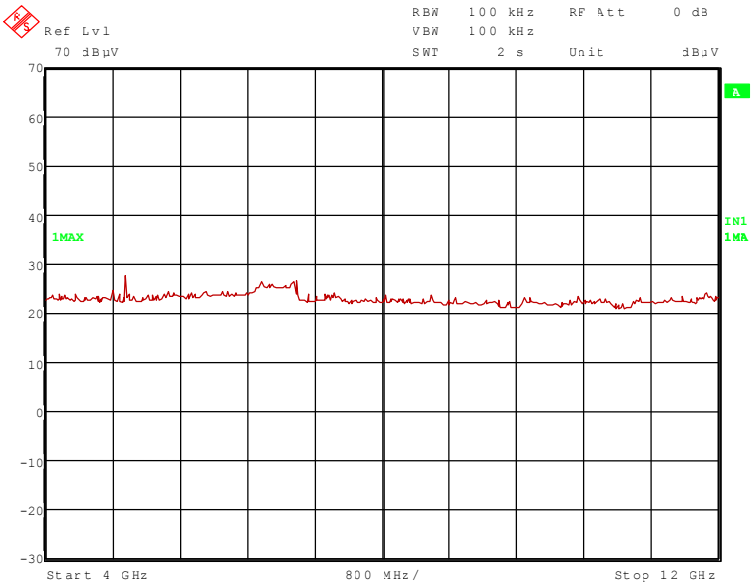
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the upper end of the assigned frequency

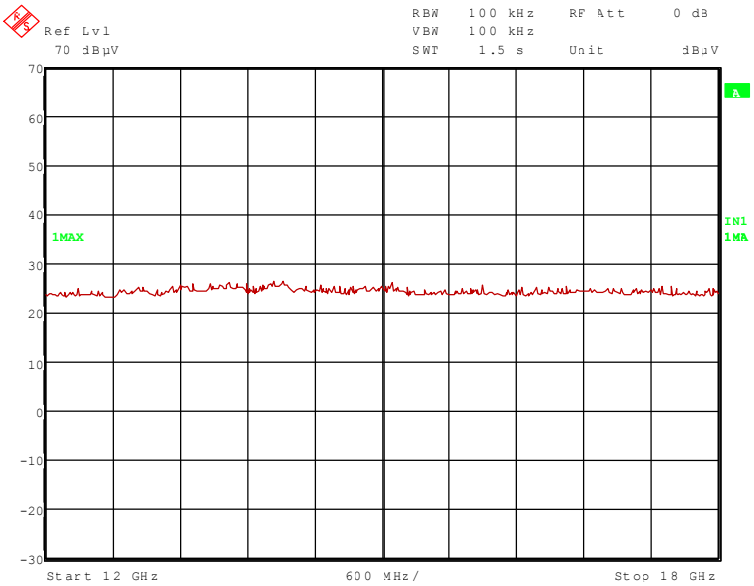
120262_4.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):



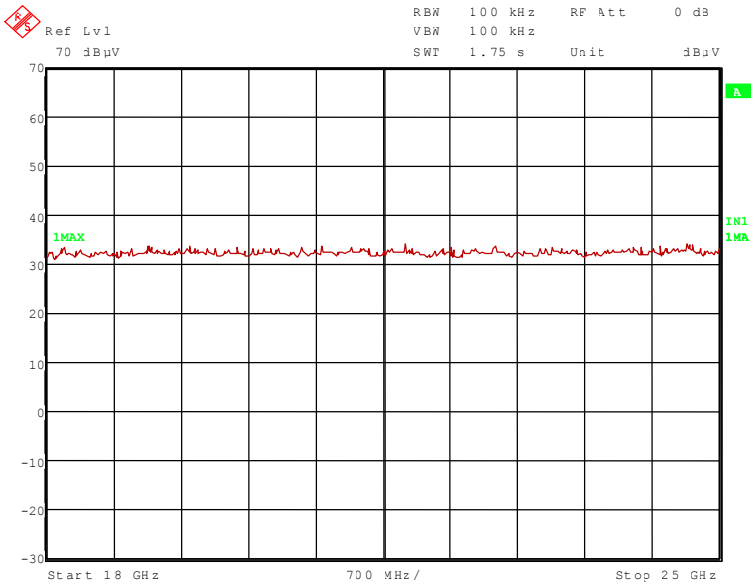
120262_10.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 3):



120262_58.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 3):



120262_59.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 3):



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.960 GHz.

The following frequency was 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.

TEST EQUIPMENT USED FOR THE TEST:
29, 31 - 37, 39, 43, 44, 46, 49 - 51, 55, 72

5.5.2.2 Final radiated emission measurement (1 GHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	30 %

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: 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.

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	Pos.
2.402	83.6	-	-	51.6	28.3	0.0	3.7	150	Hor.	-	1
4.804	42.8	74.0	31.2	30.6	32.6	25.7	5.3	150	Vert.	Yes	1
7.206	33.2	74.0	40.8	15.3	35.7	24.6	6.8	150	Hor.	No	1
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	Pos.
2.402	78.1	-	-	46.1	28.3	0.0	3.7	150	Hor.	-	1
4.804	28.4	54.0	25.6	16.2	32.6	25.7	5.3	150	Vert.	Yes	1
7.206	20.7	58.1	37.4	2.8	35.7	24.6	6.8	150	Hor.	No	1
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	Pos.
2.440	87.5	-	-	55.4	28.4	0.0	3.7	150	Hor.	-	1
4.8564	45.7	74.0	28.3	33.5	32.7	25.7	5.2	150	Hor.	Yes	2
4.882	45.4	74.0	28.6	33.0	32.8	25.7	5.3	150	Vert.	Yes	1
4.9168	41.8	74.0	32.2	29.3	32.8	25.6	5.3	150	Hor.	Yes	2
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	Pos.
2.440	82.1	-	-	50.0	28.4	0.0	3.7	150	Hor.	-	1
4.8546	27.7	54.0	26.3	15.5	32.7	25.7	5.2	150	Hor.	Yes	2
4.882	28.1	54.0	25.9	15.7	32.8	25.7	5.3	150	Vert.	Yes	1
4.9168	27.7	54.0	26.3	15.2	32.8	25.6	5.3	150	Hor.	Yes	2
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	Pos.
2.480	91.8	-	-	59.5	28.5	0.0	3.8	150	Hor.	carrier	1
4.960	42.6	74.0	31.4	30.0	32.9	25.6	5.3	150	Vert.	Yes	1
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	Pos.
2.480	86.1	-	-	53.8	28.5	0.0	3.8	150	Hor.	-	1
4.960	29.1	54.0	24.9	16.5	32.9	25.6	5.3	150	Vert.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 –34, 36, 44, 49, 72

5.5.3 Test results (radiated emissions) with external patch antenna

5.5.3.1 Preliminary radiated emission measurement

Ambient temperature	20 °C	Relative humidity	30 %

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: For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

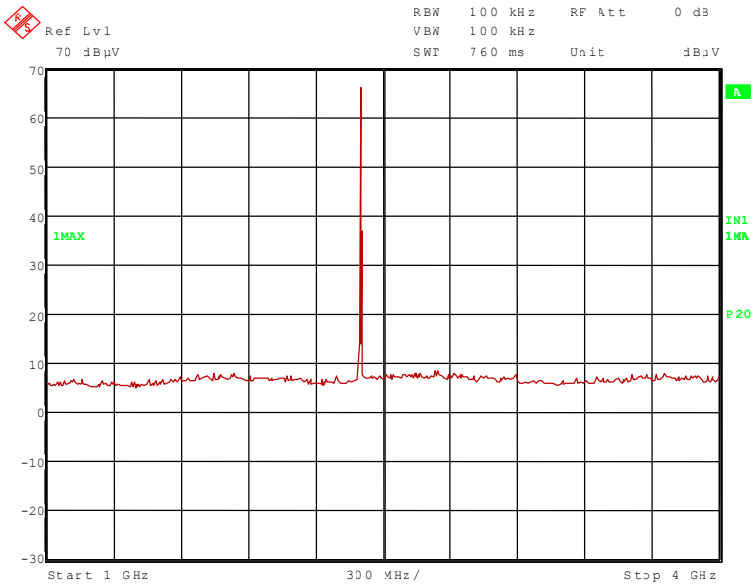
Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.3 V DC by an external battery.

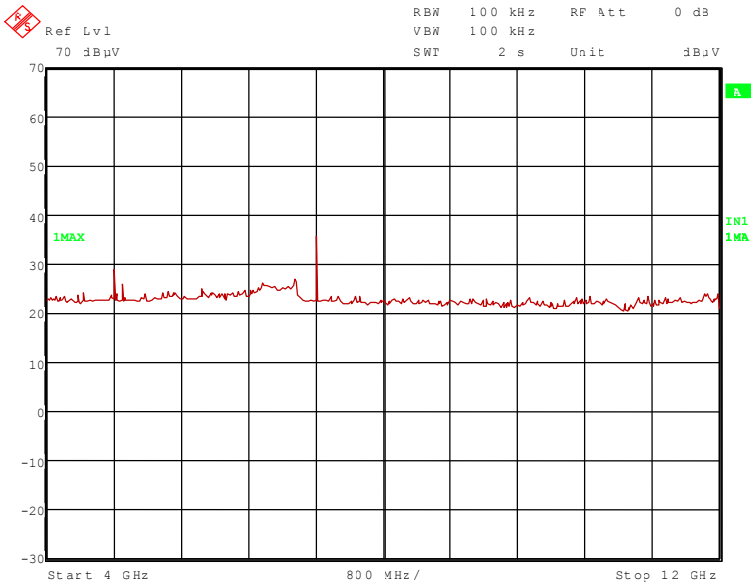
Remark: No emissions were emitted in the frequency range 9 kHz to 1 GHz independent of the transmitter operation mode. Therefore the emissions in this frequency range were documented only with the transmitter operates in operation mode 2 in combination with an external monopole antenna.
As external patch antenna the antenna type Huber+Suhner SPA 2400/70/9/0/RCP was used, because this antenna has the highest gain all antennas in question. The results were shown below. Additional pre-tests have shown that this antenna causes also in the frequency range 1 GHz to 25 GHz the highest emissions of all patch antennas in question.

Transmitter operates at the lower end of the assigned frequency band

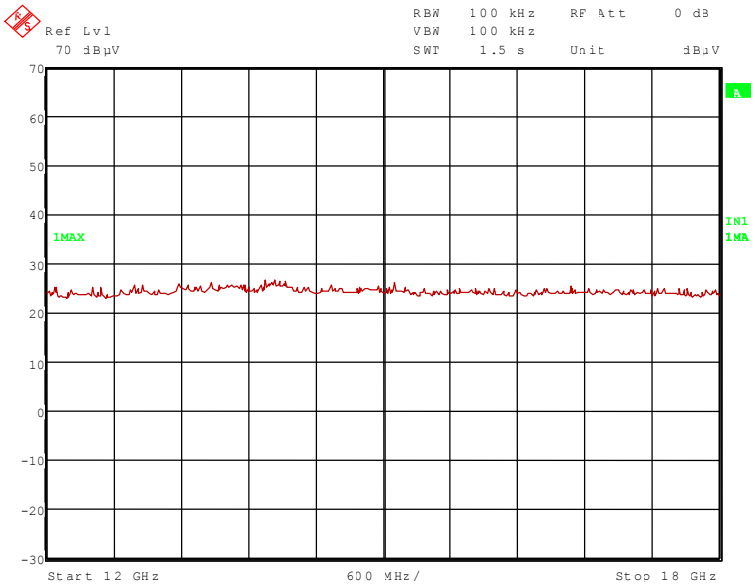
120262_11.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):



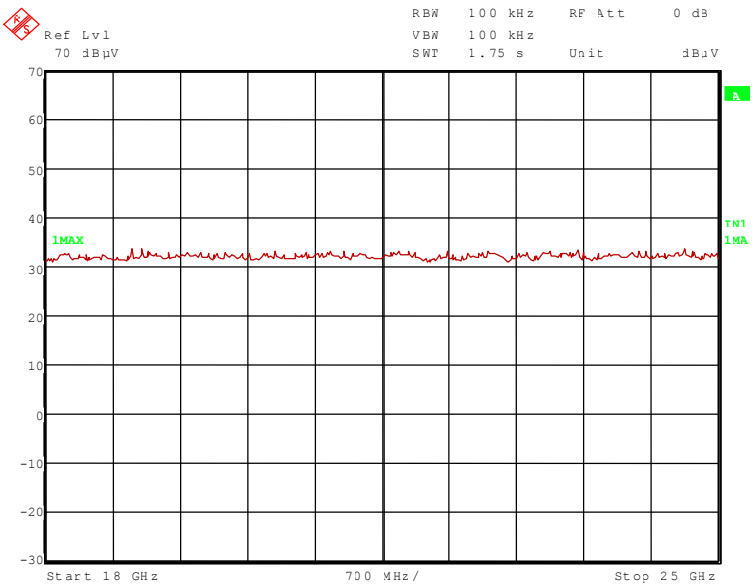
120262_17.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 1):



120262_55.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



120262_50.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:

- 4.806 GHz and 4.9003 GHz.

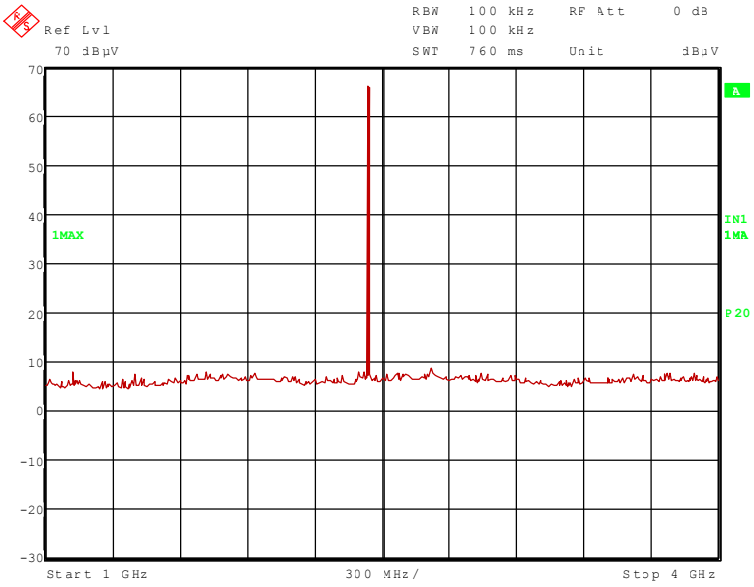
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.402 GHz and 7.206 GHz.

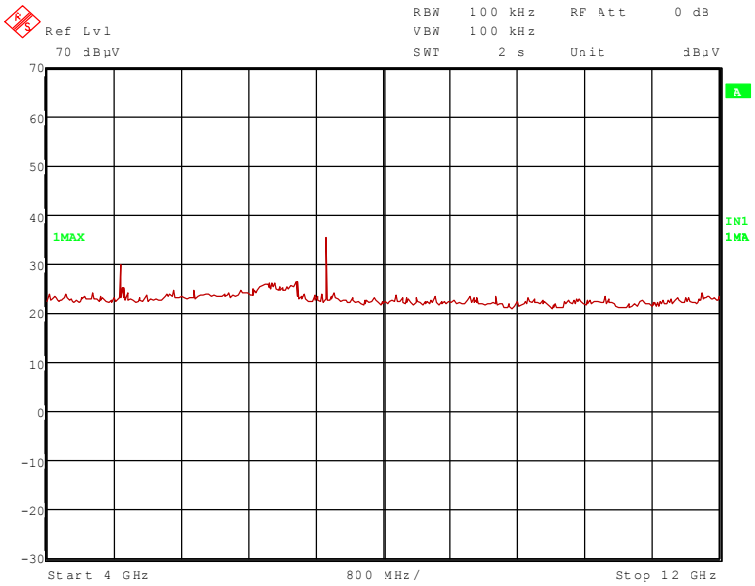
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the middle of the assigned frequency band

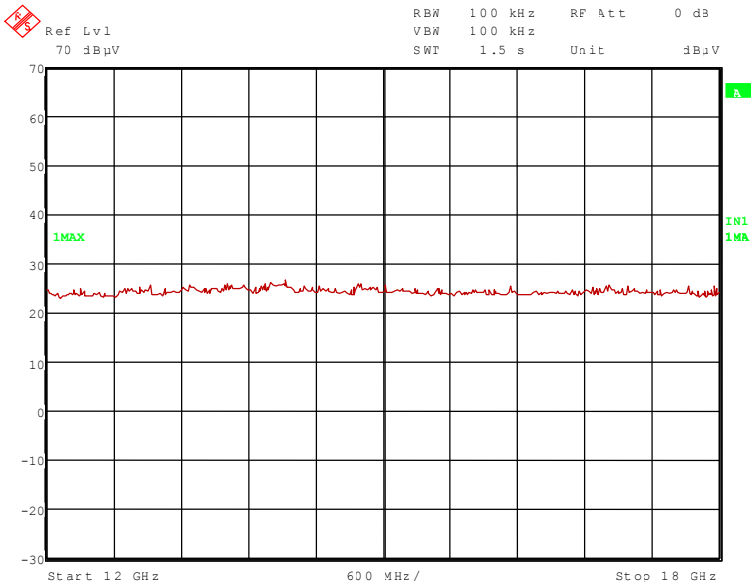
120262_13.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):



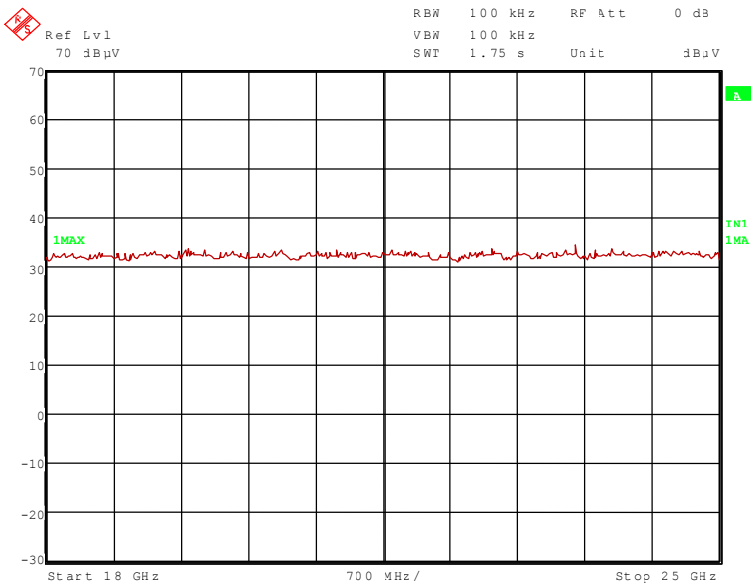
120262_16.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 2):



120262_54.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 2):



120262_51.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:

- 4.882 GHz, 4.9003 GHz and 7.320 GHz.

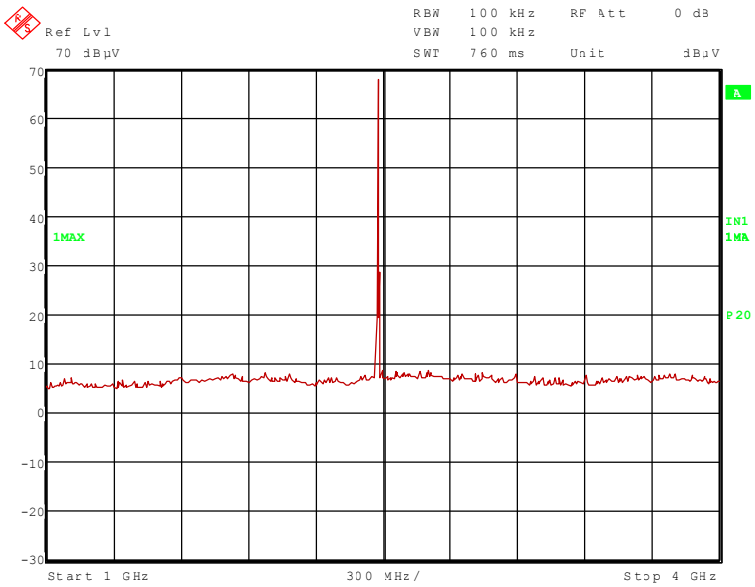
The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2.440 GHz.

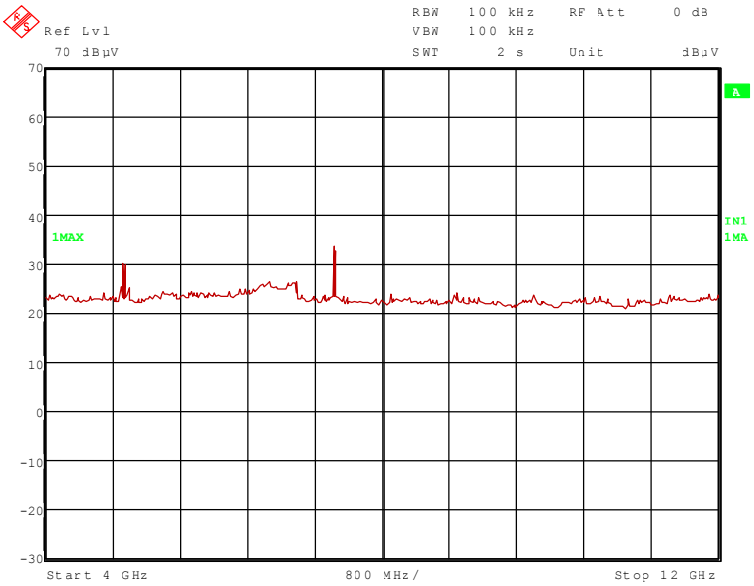
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the upper end of the assigned frequency

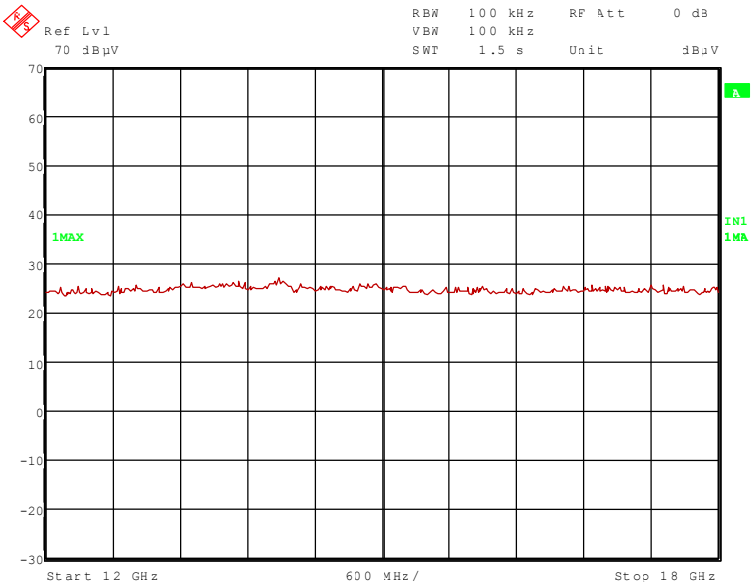
120262_14.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):



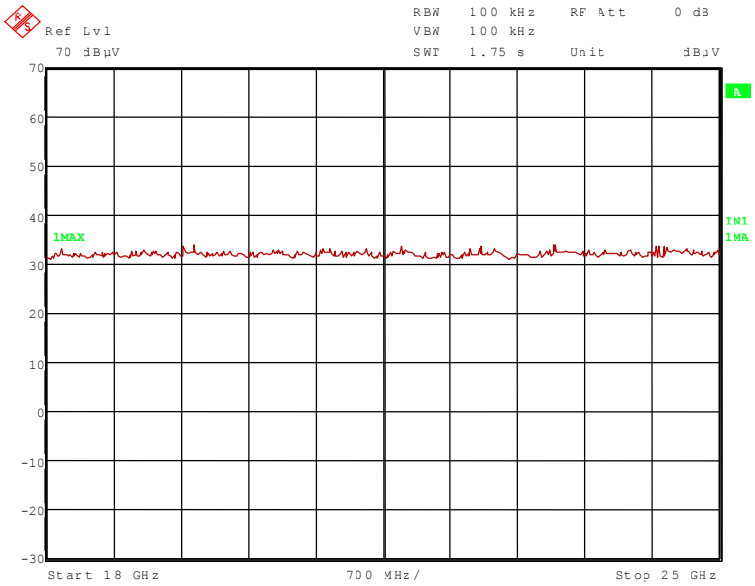
120262_15.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 3):



120262_53.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 3):



120262_52.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:

- 4.9192 GHz, 4.958 GHz and 7.440 GHz.

The following frequency was 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.

TEST EQUIPMENT USED FOR THE TEST:
29, 31 - 37, 39, 43, 44, 46, 49 - 51, 55, 72

5.5.3.2 Final radiated emission measurement (1 GHz to 25 GHz)

Ambient temperature	20 °C	Relative humidity	30 %

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: 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.

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	Pos.
2.402	99.8	-	-	67.8	28.3	0.0	3.7	150	Hor.	-	1
4.806	47.4	74.0	26.6	35.2	32.6	25.7	5.3	150	Hor.	Yes	1
4.9003	48.6	74.0	25.4	36.1	32.8	25.6	5.3	150	Vert.	Yes	2
7.206	59.3	79.8	20.5	41.4	35.7	24.6	6.8	150	Vert.	No	1
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	Pos.
2.402	94.5	-	-	62.5	28.3	0.0	3.7	150	Hor.	-	1
4.806	38.5	54.0	15.5	26.3	32.6	25.7	5.3	150	Hor.	Yes	1
4.9003	31.1	54.0	22.9	18.6	32.8	25.6	5.3	150	Vert.	Yes	2
7.206	48.2	74.5	26.3	30.3	35.7	24.6	6.8	150	Vert.	No	1
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	Pos.
2.440	99.6	-	-	67.5	28.4	0.0	3.7	150	Hor.	-	1
4.882	48.7	74.0	25.3	36.3	32.8	25.7	5.3	150	Vert.	Yes	1
4.9003	48.8	74.0	25.2	36.3	32.8	25.6	5.3	150	Vert.	Yes	2
7.320	58.6	74.0	15.4	40.2	36.2	24.6	6.8	150	Hor.	Yes	1
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	Pos.
2.440	94.2	-	-	62.1	28.4	0.0	3.7	150	Hor.	-	1
4.882	40.6	54.0	13.4	28.2	32.8	25.7	5.3	150	Vert.	Yes	1
4.9003	30.8	54.0	23.2	18.3	32.8	25.6	5.3	150	Vert.	Yes	2
7.320	47.0	54.0	7.0	28.6	36.2	24.6	6.8	150	Hor.	Yes	1
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	Pos.
2.480	101.5	-	-	69.2	28.5	0.0	3.8	150	Hor.	-	1
4.9192	46.0	74.0	28.0	33.5	32.8	25.6	5.3	150	Hor.	Yes	2
4.958	48.4	74.0	25.6	35.8	32.9	25.6	5.3	150	Vert.	Yes	1
7.440	56.8	74.0	17.2	38.2	36.3	24.5	6.8	150	Hor.	Yes	1
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	Pos.
2.480	96.2	-	-	63.9	28.5	0.0	3.8	150	Hor.	-	1
4.9192	30.9	54.0	23.1	18.4	32.8	25.6	5.3	150	Hor.	Yes	2
4.958	40.0	54.0	14.0	27.4	32.9	25.6	5.3	150	Vert.	Yes	1
7.440	44.9	54.0	9.1	26.3	36.3	24.5	6.8	150	Hor.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 –34, 36, 44, 49, 72

5.5.4 Test results (radiated emissions) with external monopole antenna

5.5.4.1 Preliminary radiated emission measurement

Ambient temperature	20 °C	Relative humidity	30 %

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.

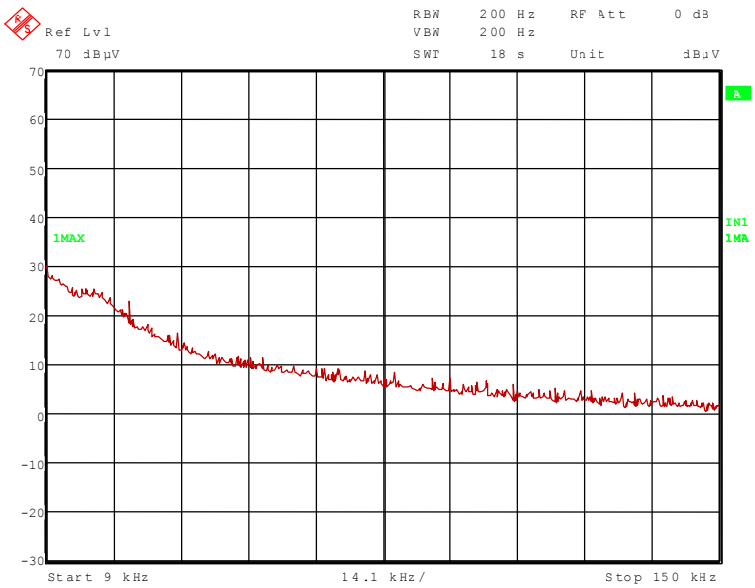
Cable guide: For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.

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.

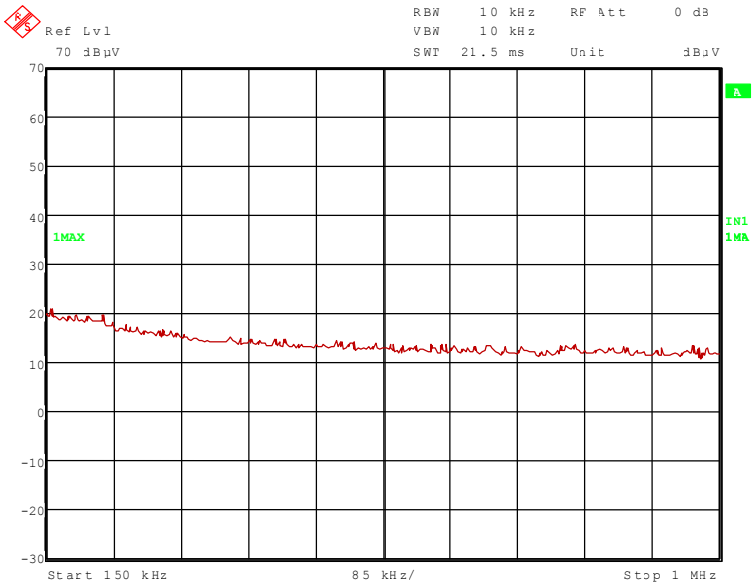
Remark: No emissions were emitted in the frequency range 9 kHz to 1 GHz independent of the transmitter operation mode. Therefore the emissions in this frequency range were documented only with the transmitter operates in operation mode 2 in combination with the external monopole antenna type Huber+Suhner SOA 2400/360/6/0/V, because additional pre-tests have shown that this antenna causes the highest emissions of all monopole antennas in question Additional pre-tests have shown that this antenna causes also in the frequency range 1 GHz to 25 GHz the highest emissions of all patch antennas in question.

120262_33.wmf: Spurious emissions from 9 kHz to 150 kHz (operation mode 2):

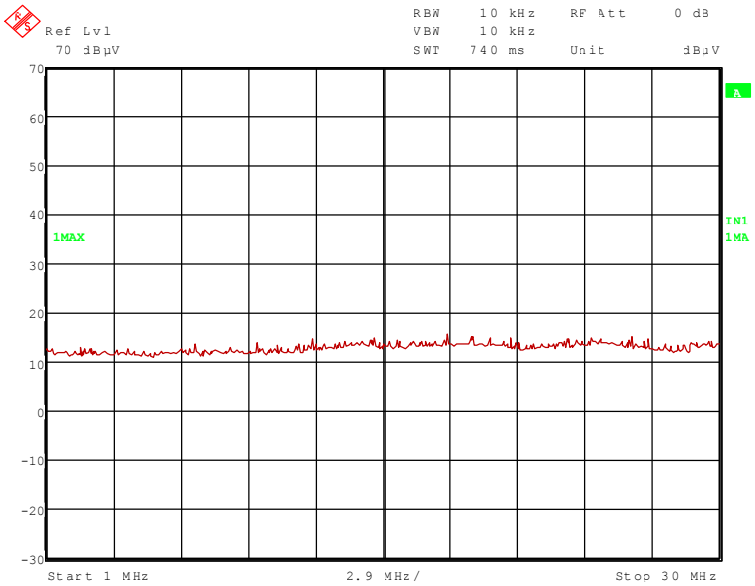


TEST EQUIPMENT USED FOR THE TEST:
29, 31 - 37, 39, 43, 44, 46, 49 - 51, 55, 72

120262_34.wmf: Spurious emissions from 150 kHz to 1 MHz (operation mode 2):

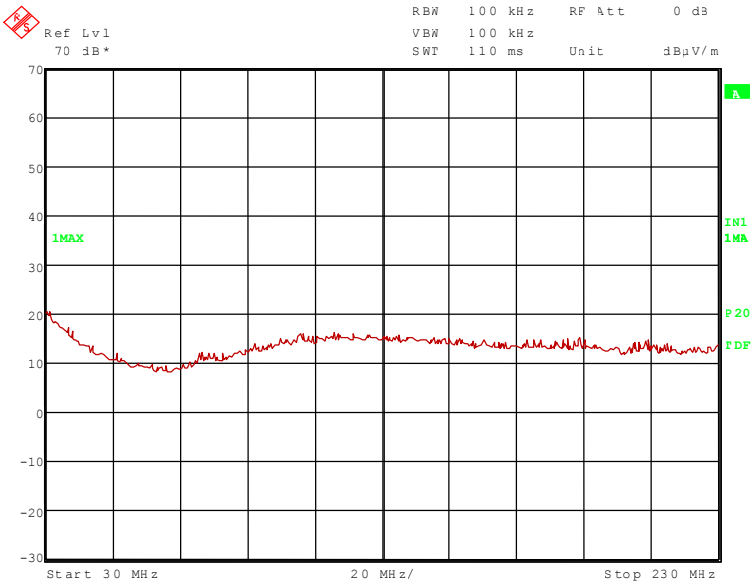


120262_35.wmf: Spurious emissions from 1 MHz to 30 MHz (operation mode 2):

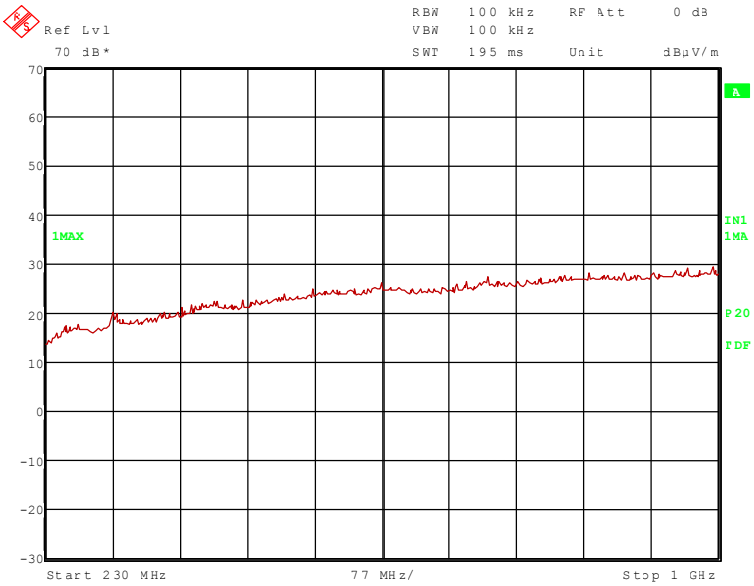


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

120262_31.wmf: Spurious emissions from 30 MHz to 230 MHz (operation mode 2):



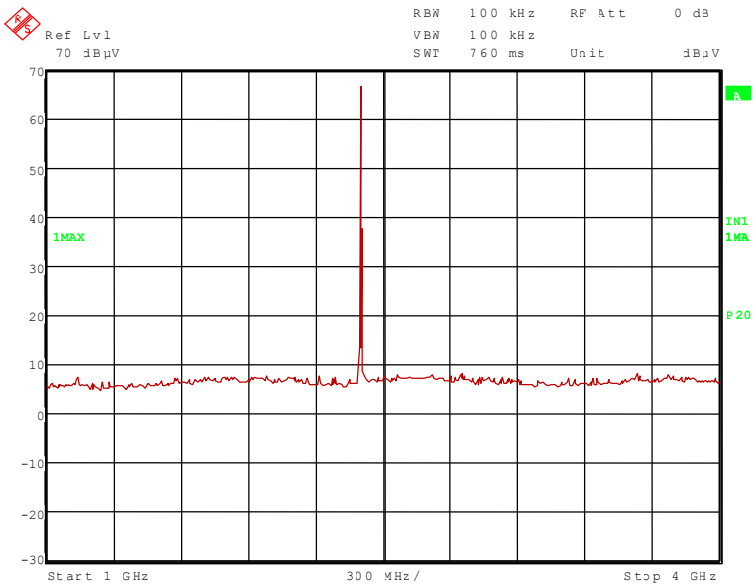
120262_32.wmf: Spurious emissions from 230 MHz to 1 GHz (operation mode 2):



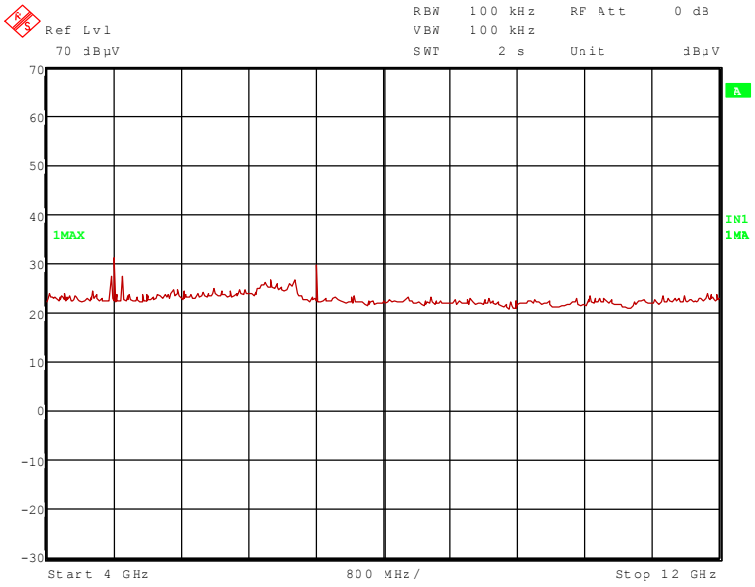
No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the open area test site.

Transmitter operates at the lower end of the assigned frequency band

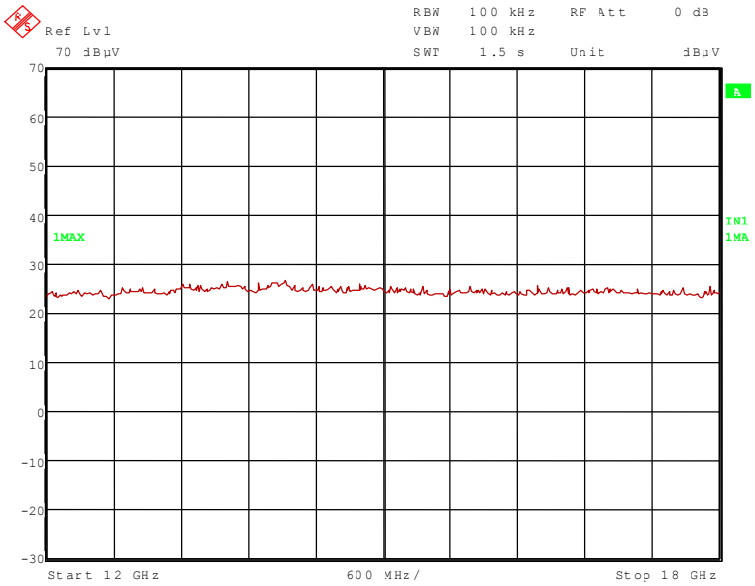
120262_22.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 1):



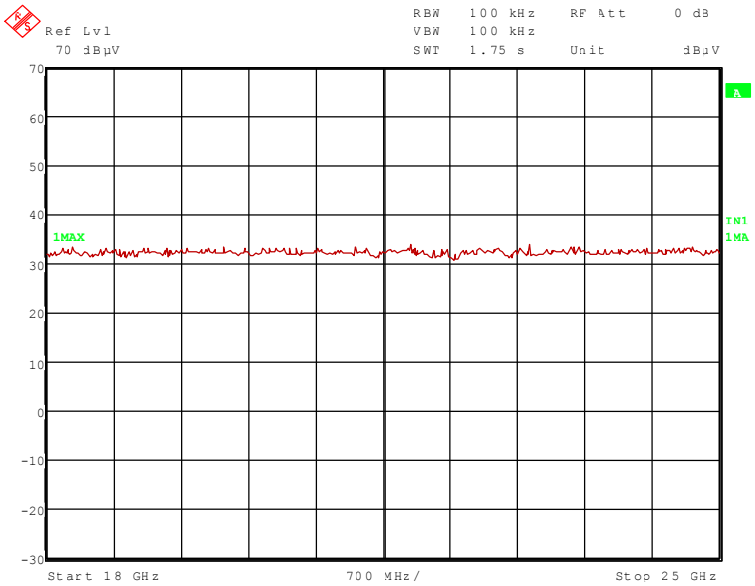
120262_28.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 1):



120262_44.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 1):



120262_49.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:

- 4.806 GHz and 4.9003 GHz.

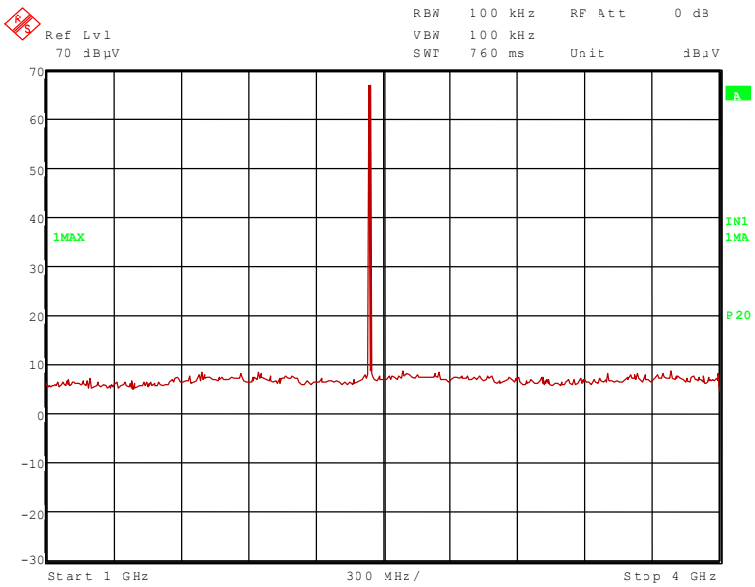
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.402 GHz and 7.206 GHz.

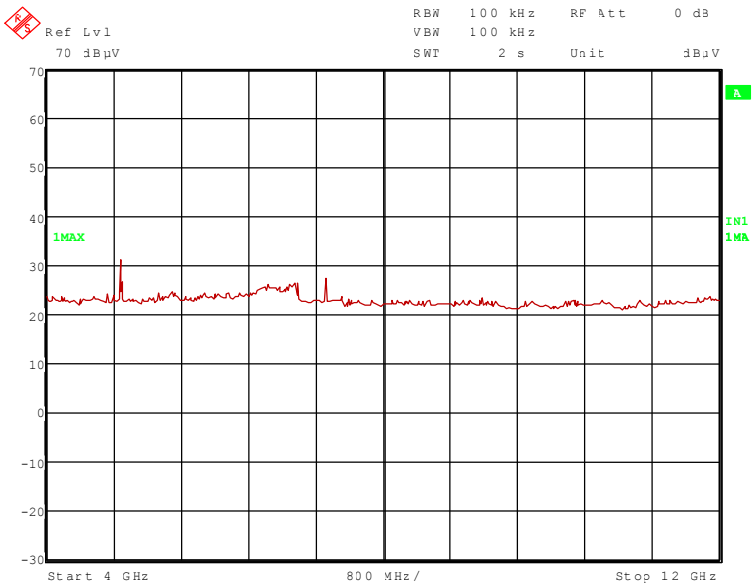
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the middle of the assigned frequency band

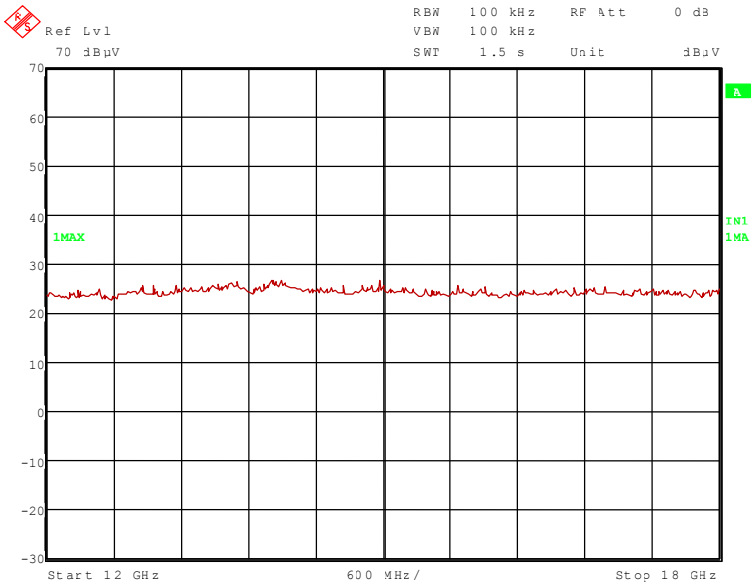
120262_21.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 2):



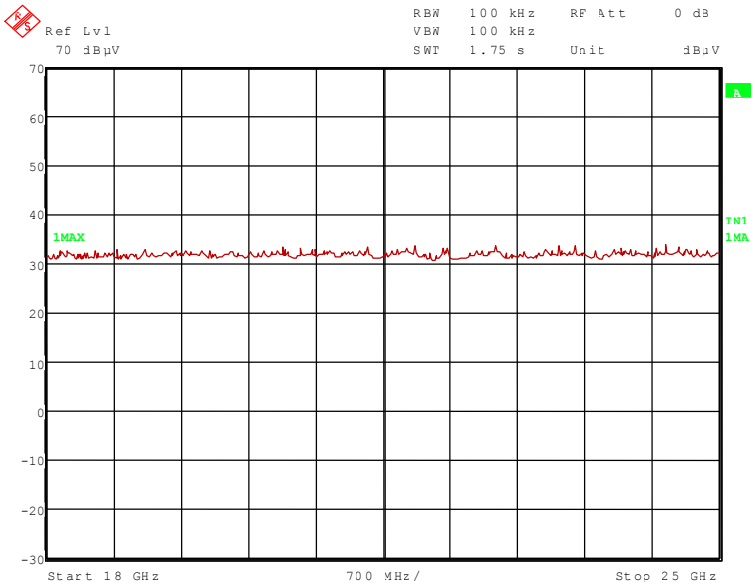
120262_29.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 2):



120262_45.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 2):



120262_48.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:

- 4.882 GHz, 4.9006 GHz and 7.320 GHz.

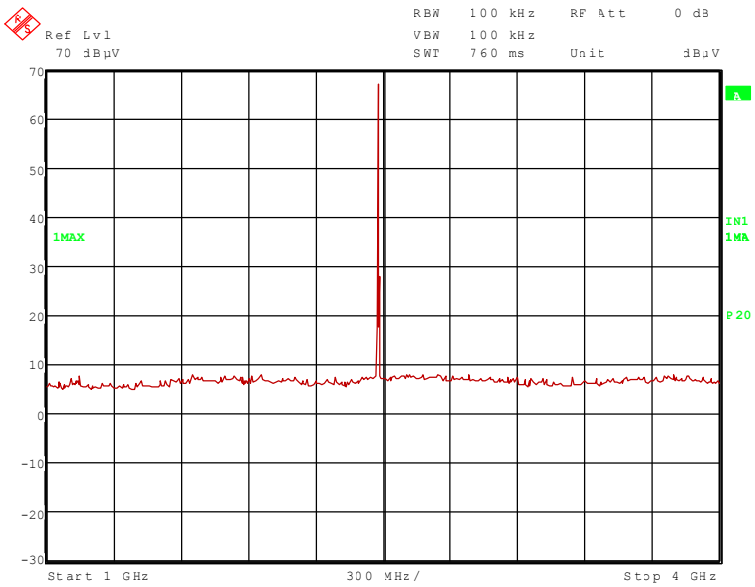
The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2.440 GHz.

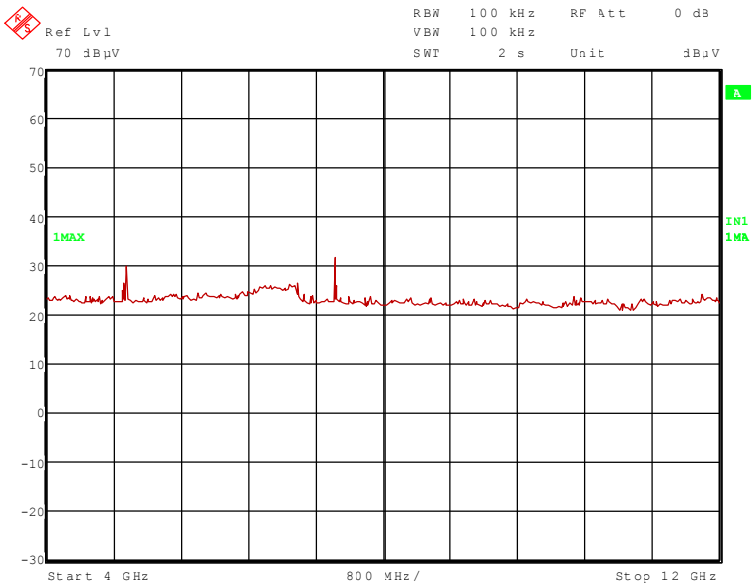
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates on the upper end of the assigned frequency

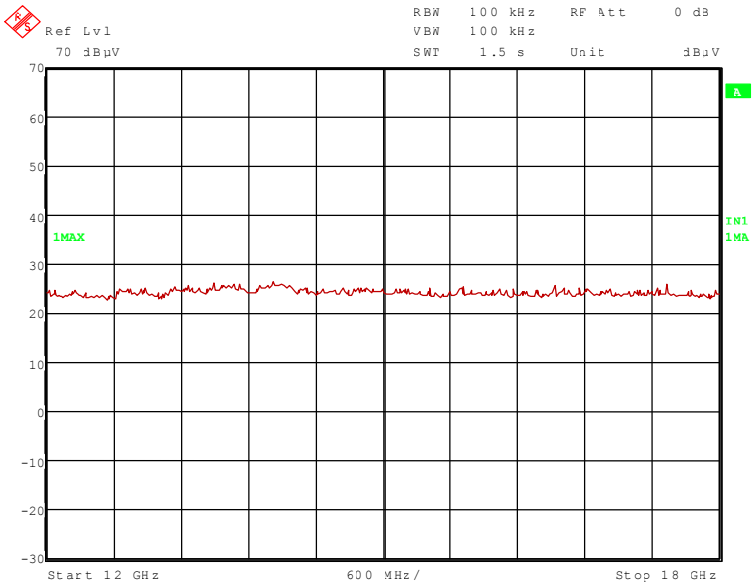
120262_24.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 3):



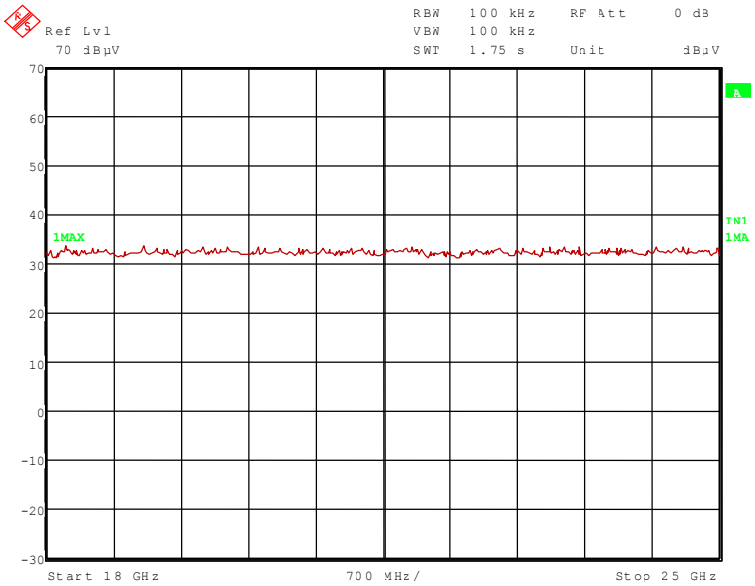
120262_30.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 3):



120262_46.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 3):



120262_47.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:

- 4.9192 GHz, 4.958 GHz and 7.440 GHz.

The following frequency was 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.

5.5.4.2 Final radiated emission measurement (1 GHz to 25 GHz)

Ambient temperature	21 °C	Relative humidity	32 %

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: 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 an external battery.

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	Pos.
2.402	100.4	-	-	68.4	28.3	0.0	3.7	150	Vert.	-	1
4.806	47.7	74.0	26.3	35.5	32.6	25.7	5.3	150	Vert.	Yes	1
4.9003	46.2	74.0	27.8	33.7	32.8	25.6	5.3	150	Vert.	Yes	2
7.206	35.2	80.4	45.2	17.3	35.7	24.6	6.8	150	Vert.	No	1
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	Pos.
2.402	95.1	-	-	63.1	28.3	0.0	3.7	150	Vert.	-	1
4.806	39.8	54.0	14.2	27.6	32.6	25.7	5.3	150	Vert.	Yes	1
4.9003	28.4	54.0	25.6	15.9	32.8	25.6	5.3	150	Vert.	Yes	2
7.206	23.1	75.1	52.0	5.2	35.7	24.6	6.8	150	Vert.	No	1
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	Pos.
2.440	100.4	-	-	68.3	28.4	0.0	3.7	150	Vert.	-	1
4.882	48.3	74.0	25.7	35.9	32.8	25.7	5.3	150	Vert.	Yes	1
4.9006	46.8	74.0	27.2	34.3	32.8	25.6	5.3	150	Hor.	Yes	2
7.320	54.6	74.0	19.4	36.2	36.2	24.6	6.8	150	Vert.	Yes	1
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	Pos.
2.440	95.1	-	-	63.0	28.4	0.0	3.7	150	Vert.	-	1
4.882	41.3	54.0	12.7	28.9	32.8	25.7	5.3	150	Vert.	Yes	1
4.9006	28.5	54.0	25.5	16.0	32.8	25.6	5.3	150	Hor.	Yes	2
7.320	42.1	54.0	11.9	23.7	36.2	24.6	6.8	150	Vert.	Yes	1
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	Pos.
2.480	101.2	-	-	68.9	28.5	0.0	3.8	150	Vert.	-	1
4.9192	46.0	74.0	28.0	33.5	32.8	25.6	5.3	150	Hor.	Yes	2
4.958	46.9	74.0	27.1	34.3	32.9	25.6	5.3	150	Vert.	Yes	1
7.440	56.3	74.0	17.7	37.7	36.3	24.5	6.8	150	Vert.	Yes	1
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	Pos.
2.480	95.9			63.6	28.5	0.0	3.8	150	Vert.	carrier	1
4.9192	28.7	54.0	25.3	16.2	32.8	25.6	5.3	150	Hor.	Yes	2
4.958	39.0	54.0	15.0	26.4	32.9	25.6	5.3	150	Vert.	Yes	1
7.440	44.7	54.0	9.3	26.1	36.3	24.5	6.8	150	Vert.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 –34, 36, 44 49, 72

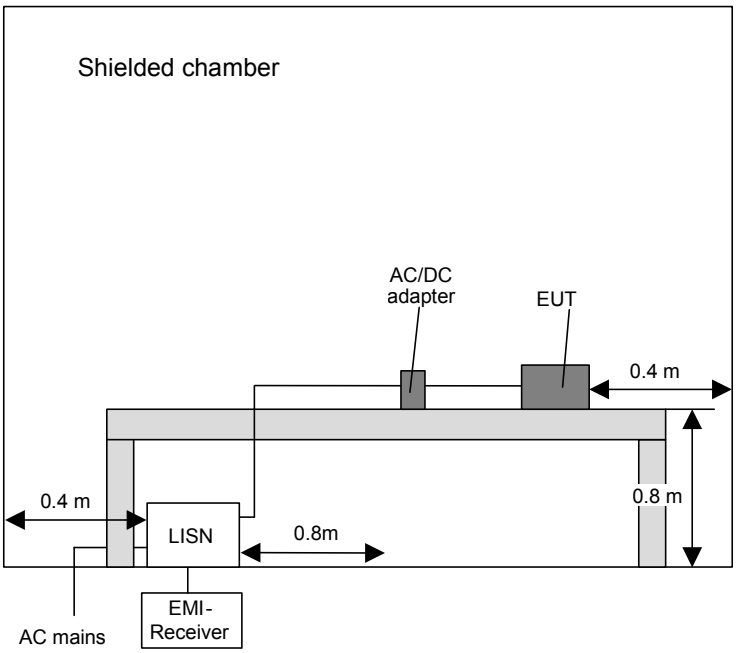
5.6 Conducted emissions on power supply lines (150 kHz to 30 MHz)

5.6.1 Method of measurement

This test will be carried out in a shielded 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 above the ground plane. Floor-standing devices will be placed directly on the ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriable limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



5.6.2 Test results (conducted emissions on power supply lines)

Ambient temperature	20 °C	Relative humidity	27 %

Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

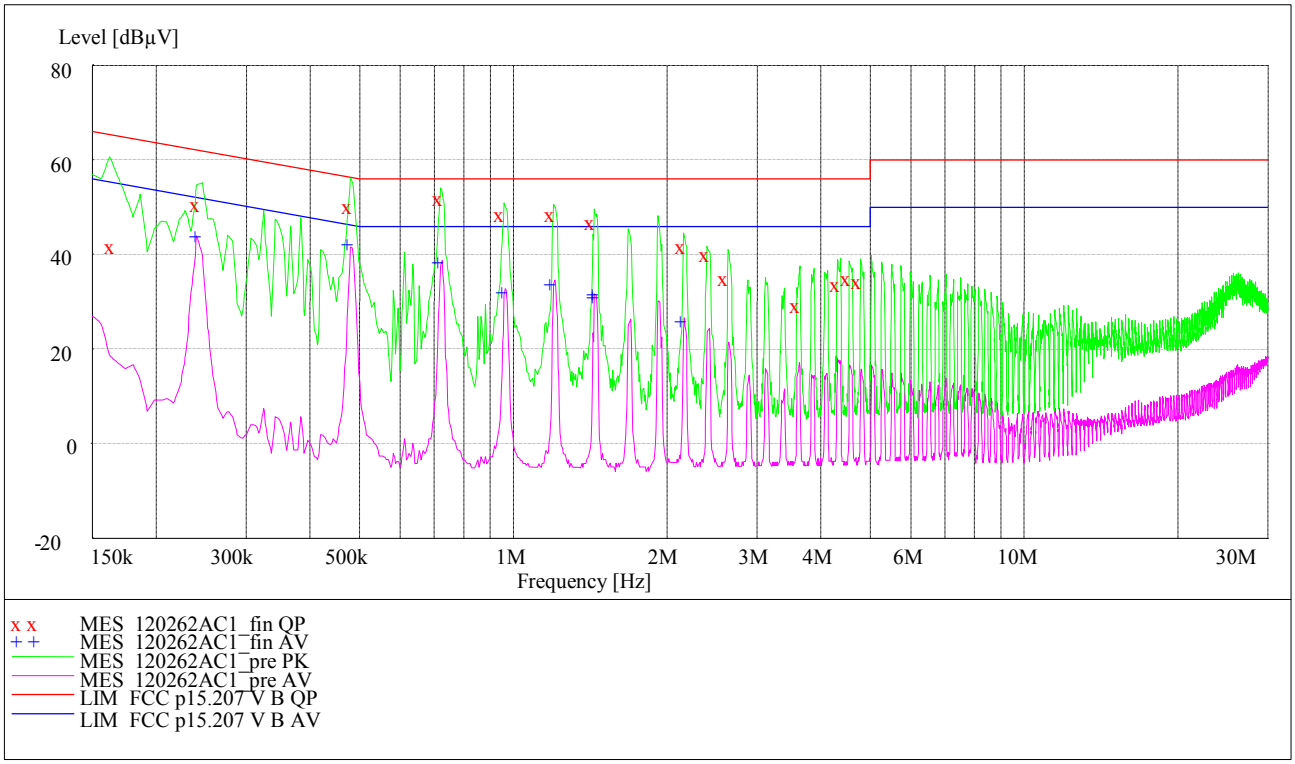
Cable guide: For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The EUT operates in operation mode 2. All results are shown in the following.

Supply voltage: During the measurement the EUT was supplied 3.3 V DC via the carrier board, which was supplied with 5 V DC by an AC / DC adaptor type Mascot 2121, which was supplied by 120 V AC / 60 Hz.

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements, which were made for each power supply line. The top-measured curve represents the peak measurement and the bottom-measured curve the average measurement. The quasi-peak measured points are marked by an x and the average measured points by an +.

Measurement results of version cB-0950-03-1-01-0x:



Data record name: 120262AC1

Result measured with the quasipeak detector:
(These values are marked in the diagram by an x)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.1644	42.7	1.2	65.2	22.5	N	FLO
0.2427	51.3	0.7	62.0	10.7	N	FLO
0.4803	51.2	0.7	56.3	5.2	N	FLO
0.7197	52.4	0.6	56.0	3.6	L1	FLO
0.9591	49.2	0.6	56.0	6.8	L1	FLO
1.1994	49.0	0.6	56.0	7.0	L1	FLO
1.4388	47.8	0.6	56.0	8.2	L1	FLO
2.1543	42.8	0.8	56.0	13.2	L1	FLO
2.3964	40.6	0.8	56.0	15.4	L1	FLO
2.6358	35.6	0.8	56.0	20.4	N	FLO
3.6375	30.0	0.9	56.0	26.0	N	FLO
4.3656	34.5	1.0	56.0	21.5	L1	FLO
4.5492	35.5	1.1	56.0	20.5	L1	FLO
4.7877	35.1	1.1	56.0	20.9	L1	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

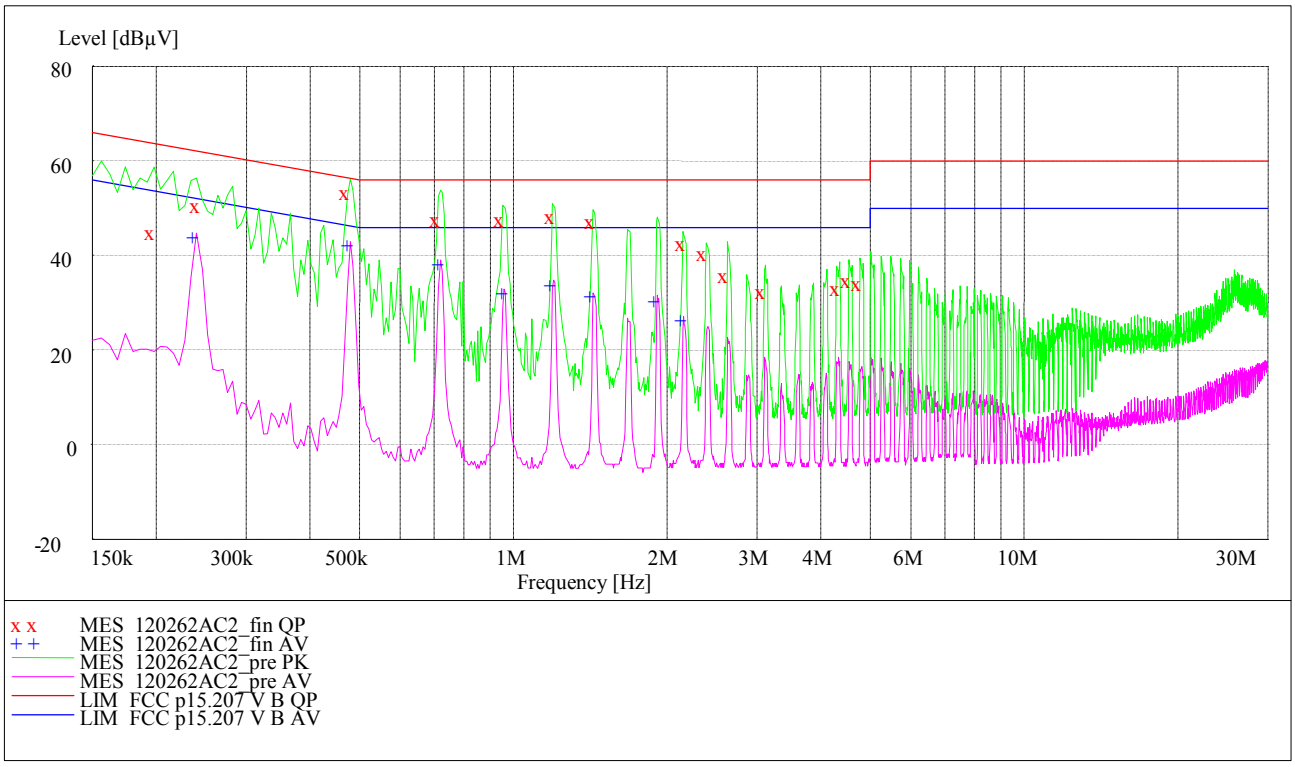
Data record name: 120262AC1_fin QP

Result measured with the average detector:
(These values are marked in the diagram by an +)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.2418	44.8	0.7	52.0	7.2	L1	FLO
0.4830	43.1	0.6	46.3	3.2	L1	FLO
0.7233	39.1	0.6	46.0	6.9	L1	FLO
0.9663	32.8	0.6	46.0	13.2	L1	FLO
1.2021	34.6	0.6	46.0	11.4	L1	FLO
1.4433	32.1	0.6	46.0	13.9	L1	FLO
1.4451	32.0	0.6	46.0	14.0	L1	FLO
2.1561	26.4	0.8	46.0	19.6	L1	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 120262AC1_fin AV

Measurement results of version cB-0950-03-1-01-1x:



Data record name: 120262AC2

Result measured with the quasipeak detector:
(These values are marked in the diagram by an x)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.1977	45.9	0.8	63.7	17.8	N	FLO
0.2418	51.6	0.7	62.0	10.5	N	FLO
0.4776	54.2	0.7	56.4	2.2	L1	FLO
0.7170	48.6	0.6	56.0	7.4	N	FLO
0.9546	48.5	0.6	56.0	7.5	L1	FLO
1.1958	49.1	0.6	56.0	6.9	L1	FLO
1.4343	48.0	0.6	56.0	8.0	L1	FLO
2.1498	43.4	0.8	56.0	12.6	L1	FLO
2.3910	41.1	0.8	56.0	14.9	L1	FLO
2.6277	36.8	0.8	56.0	19.2	N	FLO
3.1110	33.3	0.9	56.0	22.7	L1	FLO
4.3584	33.8	1.0	56.0	22.2	L1	FLO
4.5384	35.4	1.1	56.0	20.6	L1	FLO
4.7751	35.0	1.1	56.0	21.0	L1	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 120262AC2_fin QP

Result measured with the average detector:
(These values are marked in the diagram by an +)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.2400	44.8	0.7	52.1	7.3	L1	FLO
0.4812	43.1	0.7	46.3	3.2	L1	FLO
0.7206	39.1	0.6	46.0	6.9	L1	FLO
0.9618	33.0	0.6	46.0	13.0	L1	FLO
1.1967	34.7	0.6	46.0	11.3	L1	FLO
1.4370	32.5	0.6	46.0	13.5	L1	FLO
1.9122	31.2	0.7	46.0	14.8	L1	FLO
2.1534	26.9	0.8	46.0	19.1	L1	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Data record name: 120262AC2_fin AV

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
1 – 4, 20

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	02/08/2010	02/2012
3	LISN	NSLK8128	Schwarzbeck	8128161	480138	05/07/2010	05/2012
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	03/15/2010	03/2012
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	09/18/2008	09/2012
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	04/15/2010	04/2012
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	03/17/2010	03/2012
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. 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	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	03/10/2010	03/2012
72	4 GHz High Pass Filter	WHKX4.0/18G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	

7 REPORT HISTORY

Report Number	Date	Comment
F120262E1	10 February 2011	Document created

8 LIST OF ANNEXES

ANNEX A TEST SET-UP PHOTOS 8 pages

120262_4.JPG: cB-0950 with internal antenna, test set-up fully anechoic chamber (pos. 1)
120262_6.JPG: cB-0950 with external patch antenna, test set-up fully anechoic chamber (pos. 1)
120262_8.JPG: cB-0950 with external monopole antenna, test set-up fully anechoic chamber (pos. 1)
120262_15.JPG: cB-0950 with external monopole antenna (pos. 1), test set-up fully anechoic chamber
120262_13.JPG: cB-0950 with external monopole antenna (pos. 2), test set-up fully anechoic chamber
120262_3.JPG: cB-0950 with internal antenna (pos. 1), test set-up fully anechoic chamber
120262_29.JPG: cB-0950 with internal antenna, test set-up shielded chamber
120262_34.JPG: cB-0950, test set-up conducted measurements

ANNEX B INTERNAL PHOTOGRAPHS 8 pages

120262_a.JPG: cB-0950 mounted on the cB-0903-03 (carrier board)
120262_f.JPG: cB-0950 with internal antenna and additional voltage regulator, PCB, top view
120262_j.JPG: cB-0950 with antenna connector and without additional voltage regulator, PCB, top view
120262_g.JPG: cB-0950 with antenna port and additional voltage regulator, PCB, top view, shielding removed
120262_h.JPG: cB-0950 with antenna port and without additional voltage regulator, PCB, top view, shielding removed
120262_e.JPG: cB-0950, PCB, bottom view
120262_b.JPG: cB-0903, PCB, top view
120262_c.JPG: cB-0903, PCB, bottom view

ANNEX C EXTERNAL PHOTOGRAPHS - pages

Because the EUT is a module, which will be implemented into a final application, no external photographs were available

ANNEX D RESULTS OF THE RECEIVER MEASUREMENTS 10 pages