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Test Report

Report Number: F123441E1

Applicant:

Cognex Ireland Ltd.

Manufacturer:

Summit Data Communications, Inc

Equipment under Test (EUT):

Summit SDC-MSD30AG

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 (October 2012)** DTS Meas Guidance v02

[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

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:	Manuel BASTERT		18 October 2012
	Name	Signature	Date
Authorized reviewer:	Bernd Selck		18 October 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 generalizations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

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1 IDENTIFICATION

1.1 Applicant

Name:	Cognex Ireland Ltd.
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Country:	Germany
Name for contact purposes:	Mr. Guido SCHÜTZEICHEL
Phone:	+49 (0) 241-173014-26
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eMail Address:	guido.schuetzeichel@cognex.com
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	Summit Data Communications, Inc.
Address:	526 South Main Street Suite 805 Akron, Ohio 44311
Country:	USA
Name for contact purposes:	None
Phone:	None
Fax:	None
eMail Address:	None
Applicant represented during the test by the following person:	None

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: *	WLAN module (inside Handheld barcode scanner)
Type: *	SDC-MSD30AG (inside Cognex DataMan 9500)
FCC ID: *	TXH-DM9500
IC: *	6315A-DM9500
Serial number: *	1A1228XN011713 (Sample for radiated measurements) 1A1228XN011711 (Sample for conducted measurements)
Hardware version: *	PWM00207
Software version: *	4_2_0

1.5 Technical data of equipment

Channel 01	RX:	2412 MHz	TX:	2412 MHz
Channel 02	RX:	2417 MHz	TX:	2417 MHz
Channel 03	RX:	2422 MHz	TX:	2422 MHz
Channel 04	RX:	2427 MHz	TX:	2427 MHz
Channel 05	RX:	2432 MHz	TX:	2432 MHz
Channel 06	RX:	2437 MHz	TX:	2437 MHz
Channel 07	RX:	2442 MHz	TX:	2442 MHz
Channel 08	RX:	2447 MHz	TX:	2447 MHz
Channel 09	RX:	2452 MHz	TX:	2452 MHz
Channel 10	RX:	2457 MHz	TX:	2457 MHz
Channel 11	RX:	2462 MHz	TX:	2462 MHz

Fulfills WLAN specification: *	802.11b, 802.11g
Antenna type: *	Internal antenna
Antenna gain: *	1.8 dBi
Antenna connector: *	None (temporary for conducted measurements)
Power supply	Battery
Type of modulation: *	802.11b: CCK, DQPSK, DBPSK 802.11g: OFDM
Operating frequency range:*	2412 MHz to 2462 MHz
Number of channels: *	11
Temperature range: *	0 °C to +40 °C
Lowest / highest Internal clock frequency: *	Not available

* declared by the applicant.

1.6 Dates

Date of receipt of test sample:	08 August 2012
Start of test:	24 September 2012
End of test:	10 October 2012

2 OPERATIONAL STATES

The tests were carried out at a test sample with integral antenna and one with a modified sample with temporary antenna connectors.

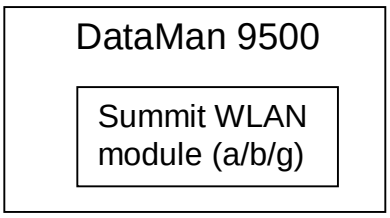
The EUT was set to its maximum available output power in each test case. The power setting was fixed to 95 %.

The operation was adjusted with the help of a test-software, which was installed on the EUT.

During the tests the test samples were powered by the internal battery with 3.7 V_{DC}.

The following operation modes were used during the tests:

Operation mode	Description of the operation mode	Modulation	Data rate / Mbps
1	Continuous transmitting on 2412 MHz	CCK (802.11b)	11
2	Continuous transmitting on 2437 MHz	CCK (802.11b)	11
3	Continuous transmitting on 2462 MHz	CCK (802.11b)	11
4	Continuous transmitting on 2412 MHz	OFDM (802.11g)	54
5	Continuous transmitting on 2437 MHz	OFDM (802.11g)	54
6	Continuous transmitting on 2462 MHz	OFDM (802.11g)	54



Preliminary tests were performed in different orthogonal directions and different EUT-settings, 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 (Position 1: EUT is standing, Display in top direction).

The following test modes were adjusted during the tests:

Test items	Operation mode
Maximum peak output power	1 - 6
Band edge compliance	1, 3, 4, 6
Radiated emissions (transmitter)	1 - 6

3 ADDITIONAL INFORMATION

The applicant has ordered a class 2 permissive change. For this reason only limited tests as listed in clause 4 were performed.

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 conducted output power	2400.0 - 2483.5	15.247 (b) (3), (4)	A8.4 (4) [4]	passed	8 et seq.
Band edge compliance	2400.0 - 2483.5	15.247 (d)	A8.5 [4]	passed	9 et seq.
Radiated emissions (transmitter)	0.009 - 25,000	15.205 (a) 15.209 (a)	7.2.2 [5], 2.5 [4]	passed	14 et seq.

5 TEST RESULTS

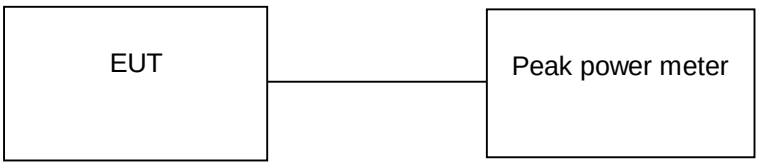
5.1 Maximum peak conducted output power

5.1.1 Method of measurement

Option 3 (peak power meter method):

The maximum peak conducted output power can be measured using a broadband peak RF power meter. The power meter must have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast, average-responding diode type sensor.

Test set-up:



5.1.2 Test results

Ambient temperature	21 °C	Relative humidity	30 %

The following test results were acquired by using Option 3 (peak power meter method).

Operation mode 1 to 6				
Channel number	Channel frequency [MHz]	Maximum peak output power [dBm]	Antenna gain [dBi]	Peak power limit [dBm]
1 (b-Mode)	2412	17.2	2	30.0
1 (g-Mode)	2412	20.5	2	30.0
6 (b-Mode)	2437	17.2	2	30.0
6 (g-Mode)	2437	20.7	2	30.0
11 (b-Mode)	2462	16.5	2	30.0
11 (g-Mode)	2462	20.4	2	30.0
Measurement uncertainty			+0.66 dB / -0.72 dB	

Test result: Passed

Test equipment used:

73, 74

5.2 Band-edge compliance

5.2.1 Method of measurement (radiated)

The same test set-up as used for the final radiated emission measurement shall be used (refer also subclause 5.3 of this test report).

The measurement of unwanted emissions at the edge of the authorized frequency bands can be complicated by the capture of RF energy from the fundamental emission within the RBW passband. The following techniques are permitted for use in performing a measurement of the unwanted emission level at the band edges.

Marker-Delta Method
The marker-delta method, as described in KDB 913591 and in C63.10, can be used to perform measurements of the unwanted emissions level at the band-edges.

Integrated Power Measurement
A narrower resolution bandwidth can be used at the band edge to improve the measurement accuracy provided that the measurement is subsequently integrated to the relevant bandwidth specification (e.g., 100 kHz within non-restricted bands and 1 MHz within restricted frequency bands).

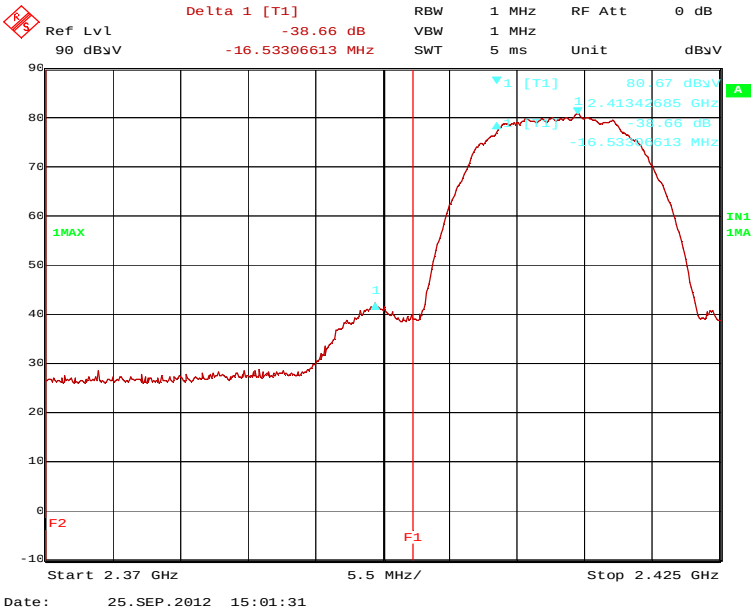
The measurement will be performed at the lower and the upper end of the assigned frequency band. For each WLAN mode the worst case configuration will be tested.

Used measurement technique: Marker-Delta Method.

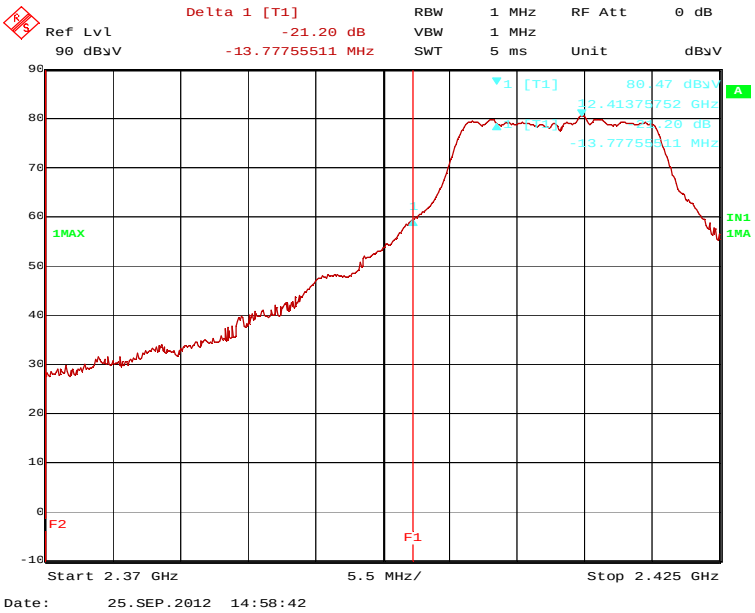
5.2.2 Test result (radiated) with internal antenna

Ambient temperature	20 °C	Relative humidity	40 %

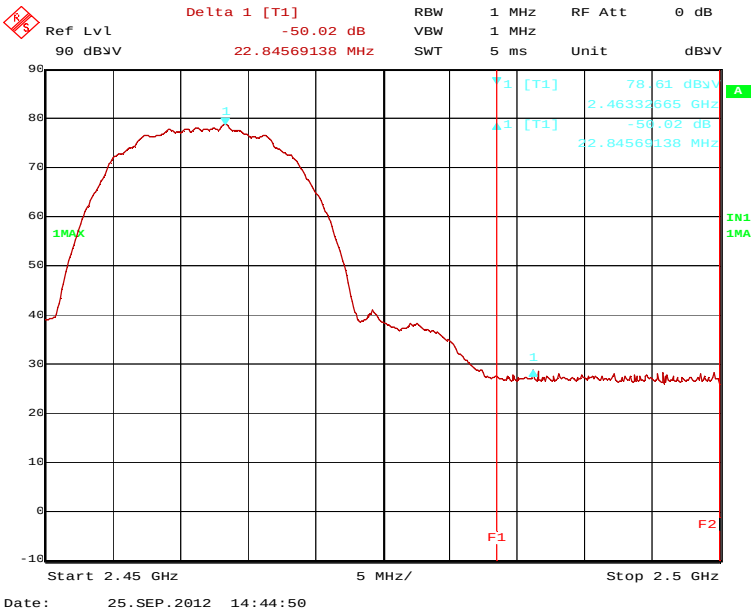
123441_9.wmf: Radiated band-edge compliance, lower band edge (operation mode 1):



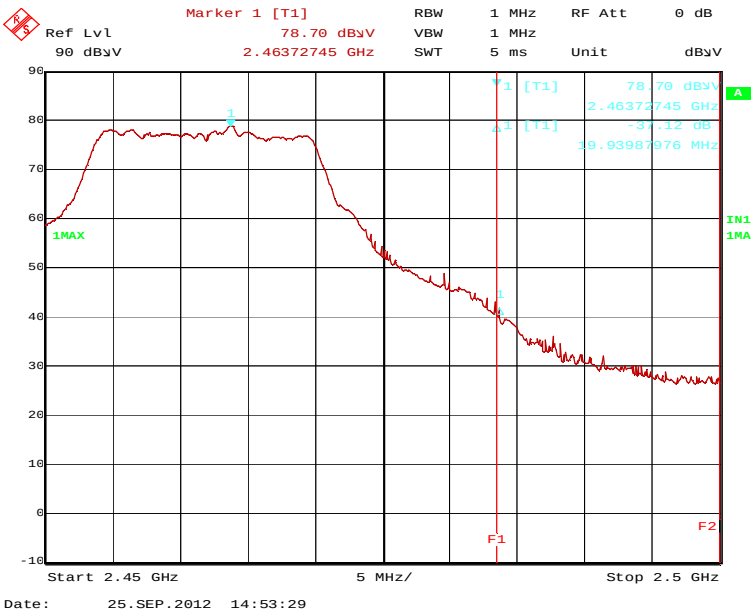
123441_8.wmf: Radiated band-edge compliance, lower band edge (operation mode 4):



123441_6.wmf: Radiated band-edge compliance, upper band edge (operation mode 3):



123441_7.wmf: Radiated band-edge compliance, upper band edge (operation mode 6):



The plots on the pages before are showing the radiated band-edge compliance for the lower and upper band-edge. The frequency line 1 (F1) shows the upper and the frequency line 2 (F2) shows the lower edge of the assigned frequency band.

Band-edge compliance (lower band edge. Mode 1)											
Result measured with the peak detector:											
Frequency MHz	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.
2412	104.7	-	-	72.6	28.4	0.0	3.7	150	Vert.	-	1
2397	39.4	84.7	45.3	33.9	28.3	26.5	3.7	150	Hor.	No	1
Result measured with the average detector:											
Frequency MHz	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.
2412	96.6	-	-	64.5	28.4	0.0	3.7	150	Vert.	-	1
2397	31.3	76.6	45.2	25.8	28.3	26.5	3.7	150	Hor.	No	1
Measurement uncertainty							+2.2 dB / -3.6 dB				

Band-edge compliance (lower band edge. Mode 4)											
Result measured with the peak detector:											
Frequency MHz	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.
2412	108.2	-	-	76.1	28.4	0.0	3.7	150	Hor.	-	1
2398	60.4	88.2	27.8	54.9	28.3	26.5	3.7	150	Hor.	No	1
Result measured with the average detector:											
Frequency MHz	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.
2412	97.2	-	-	65.1	28.4	0.0	3.7	150	Hor.	-	1
2398	49.4	77.2	27.8	43.9	28.3	26.5	3.7	150	Hor.	No	1
Measurement uncertainty							+2.2 dB / -3.6 dB				

Band-edge compliance (upper band edge. Mode 3)											
Result measured with the peak detector:											
Frequency MHz	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.
2462	108.4	-	-	76.2	28.5	0.0	3.7	150	Hor.	-	1
2485	32.0	74.0	42.0	26.2	28.5	26.5	3.8	150	Hor.	Yes	1
Result measured with the average detector:											
Frequency MHz	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.
2462	100.7	-	-	68.5	28.5	0.0	3.7	150	Hor.	-	1
2485	24.3	54.0	29.7	18.5	28.5	26.5	3.8	150	Hor.	Yes	1
Measurement uncertainty							+2.2 dB / -3.6 dB				

Band-edge compliance (upper band edge. Mode 6)											
Result measured with the peak detector:											
Frequency MHz	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.
2462	107.6	-	-	75.4	28.5	0.0	3.7	150	Hor.	-	1
2484	44.1	74.0	29.9	38.3	28.5	26.5	3.8	150	Vert.	Yes	1
Result measured with the average detector:											
Frequency MHz	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.
2462	95.8	-	-	63.6	28.5	0.0	3.7	150	Hor.	-	1
2484	32.3	54.0	21.7	26.5	28.5	26.5	3.8	150	Vert.	Yes	1
Measurement uncertainty							+2.2 dB / -3.6 dB				

Test: Passed

Test equipment used:
36, 47, 31, 29

5.3 Radiated emissions

5.3.1 Method of measurement

The radiated emission measurement is subdivided into six stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an outdoor test site without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- 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 and upper and lower edge of the assigned frequency band.

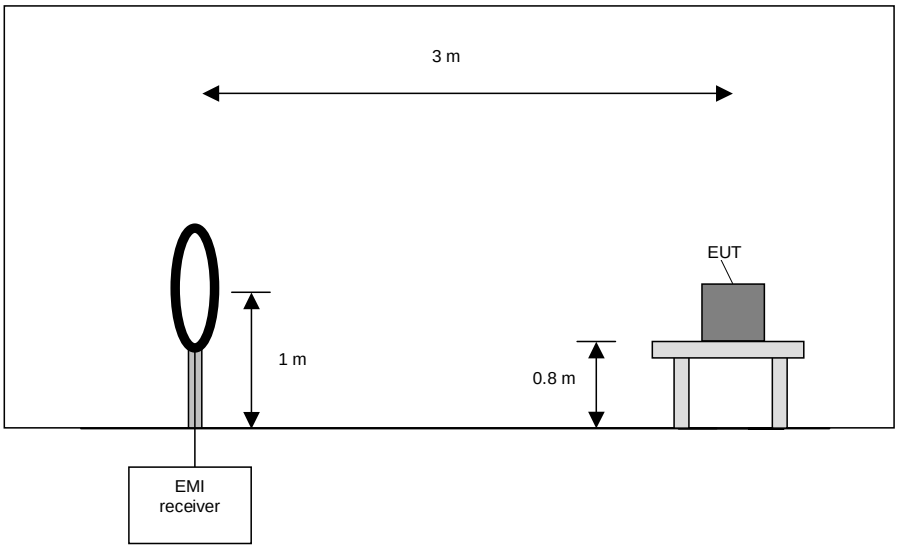
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. 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 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to find the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz



Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

1) Monitor the frequency range at “face-to-face” 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 frequencies of the highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6) Repeat steps 1) to 4) with the other orthogonal axes of the EUT.
7) Rotate the measuring antenna and repeat steps 1) to 5).

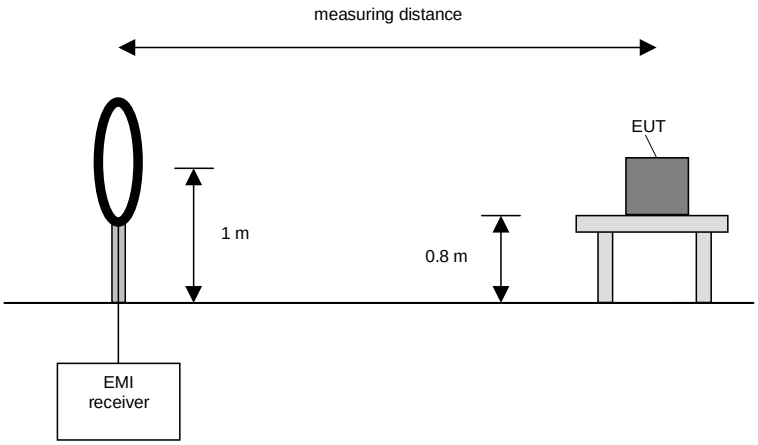
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an outdoor test site with no conducting ground plane in a measuring distance of 3 m, 10 m and 30 m. In the case where larger measuring distances is required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the during the preliminary measurement detected frequencies the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

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

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Final measurement procedure:

The following procedure will be used:

1) Monitor the frequency range with the measuring antenna at “face-to-face” orientation parallel to the EUT at an azimuth of 0 °.
2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
3) Rotate the measuring antenna to find the maximum and note the value.
4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT if applicable (handheld equipment).

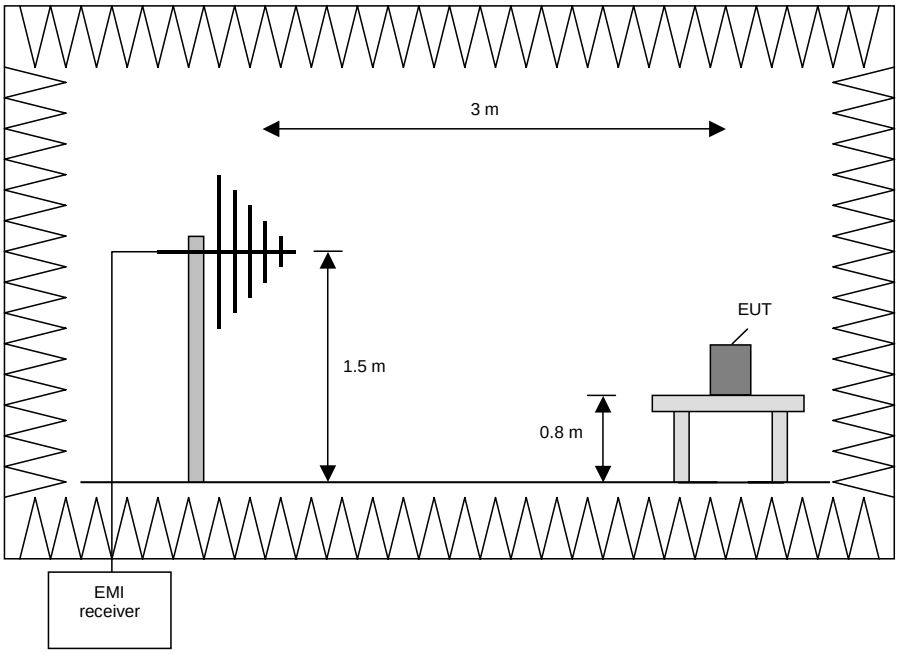
Preliminary measurement (30 MHz to 1 GHz)

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:

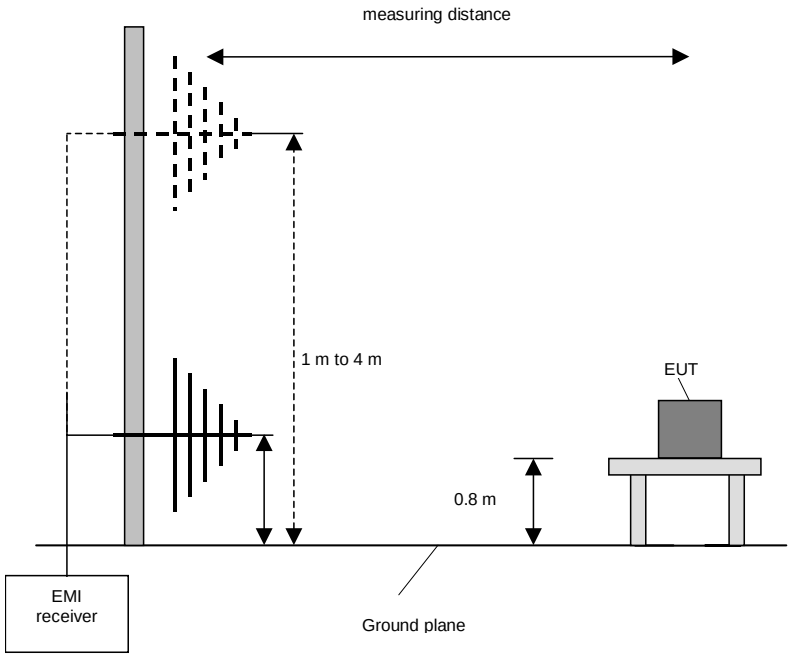
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the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

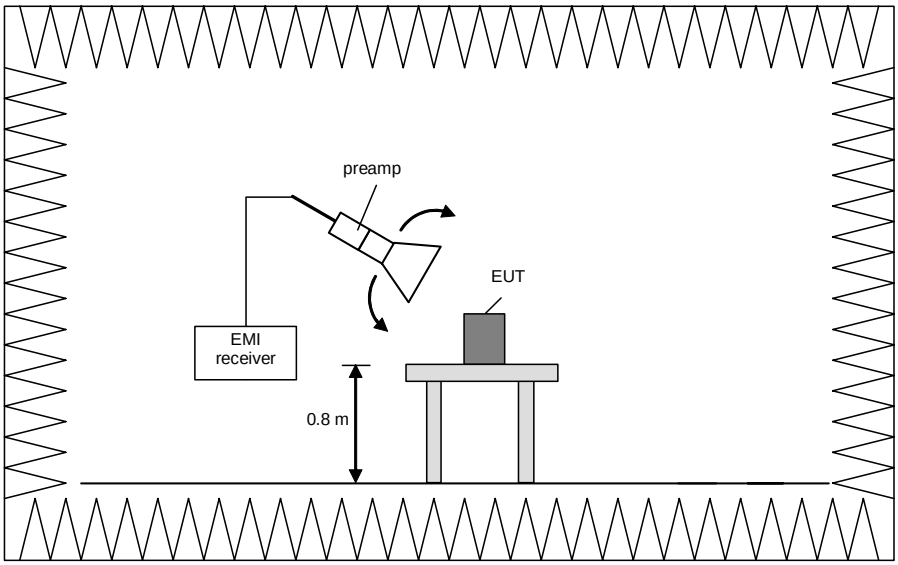
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance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

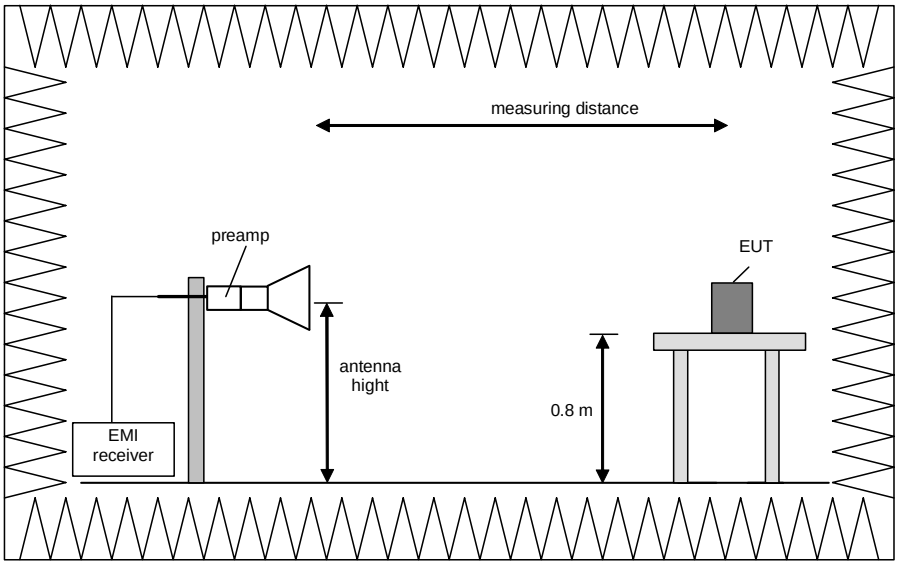


Final measurement (1 GHz to 110 GHz)

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

5.3.2.1 Preliminary radiated emission measurement (30 MHz – 1 GHz)

Ambient temperature	20 °C	Relative humidity	40 %

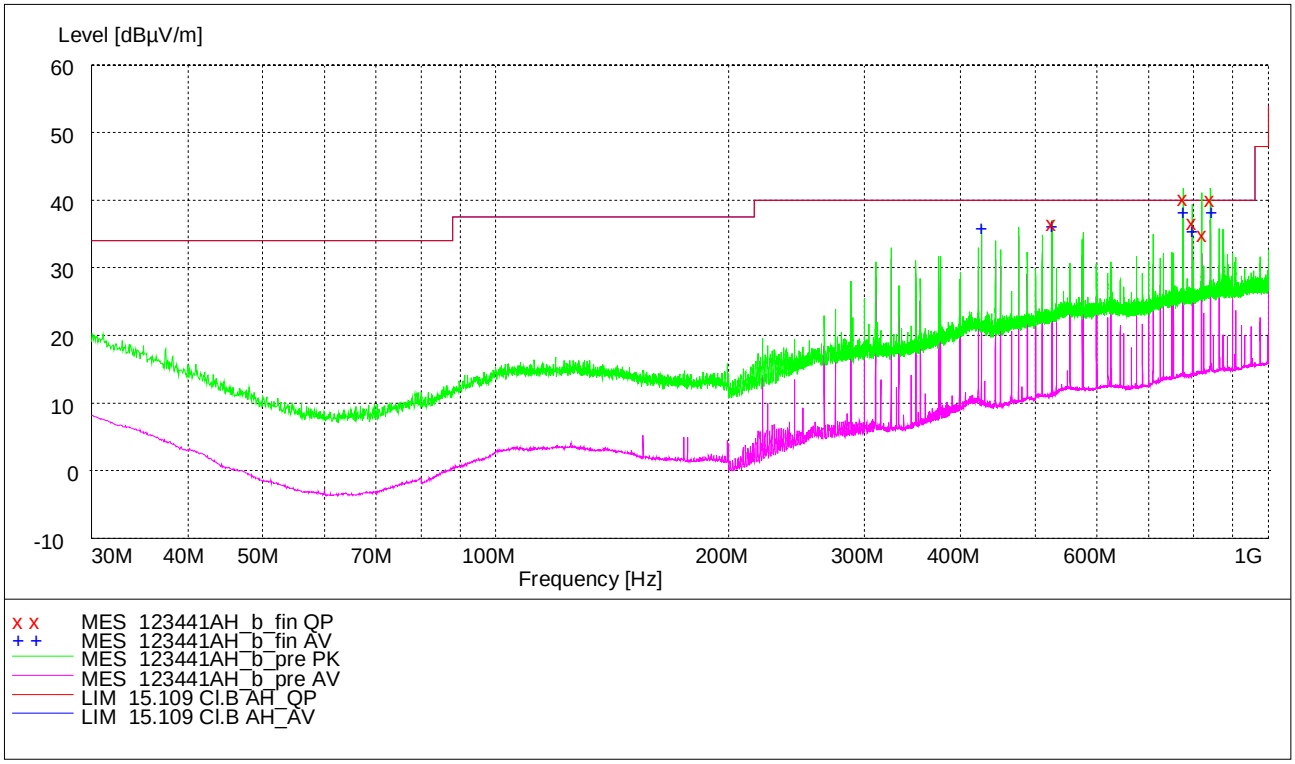
Position of EUT: The EUT was placed on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: For detail information of test set-up refer to the pictures in annex A of this test report. No cables were connected to the EUT.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with its internal battery with 3.7 V_{DC}.

Remark: As pre-tests have shown the emission in the frequency range 30 MHz to 1 GHz are independent of the operation mode. Therefore all emission measurements were performed in operation mode 3.



Result measured with the quasipeak detector (marked by an x):

Frequency MHz	Level dBµV/m	Transducer dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
525.028000	37.00	19.3	40.0	3.0	150.0	181.00	VERTICAL
775.828000	40.70	22.2	40.0	-0.7	150.0	267.00	HORIZONTAL
798.040000	37.10	22.3	40.0	2.9	150.0	270.00	HORIZONTAL
820.144000	35.40	22.8	40.0	4.6	150.0	315.00	HORIZONTAL
842.308000	40.60	22.9	40.0	-0.6	150.0	239.00	HORIZONTAL

Result measured with the average detector (marked by a +):

Frequency MHz	Level dBµV/m	Transducer dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
425.020000	36.30	18.2	40.0	3.7	150.0	180.00	VERTICAL
525.028000	36.50	19.3	40.0	3.5	150.0	180.00	VERTICAL
775.840000	38.60	22.2	40.0	1.4	150.0	269.00	HORIZONTAL
798.004000	35.70	22.3	40.0	4.3	150.0	270.00	HORIZONTAL
842.332000	38.70	22.9	40.0	1.3	150.0	236.00	HORIZONTAL

It was necessary to carry out a final measurement on the open area test site at the frequencies at the frequencies found in the preliminary measurement. The results are presented in the following.

Test equipment used:

20, 29, 31 – 35, 47,

5.3.2.2 Preliminary radiated emission measurement (1 GHz – 25 GHz)

Ambient temperature	20 °C	Relative humidity	30 %

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

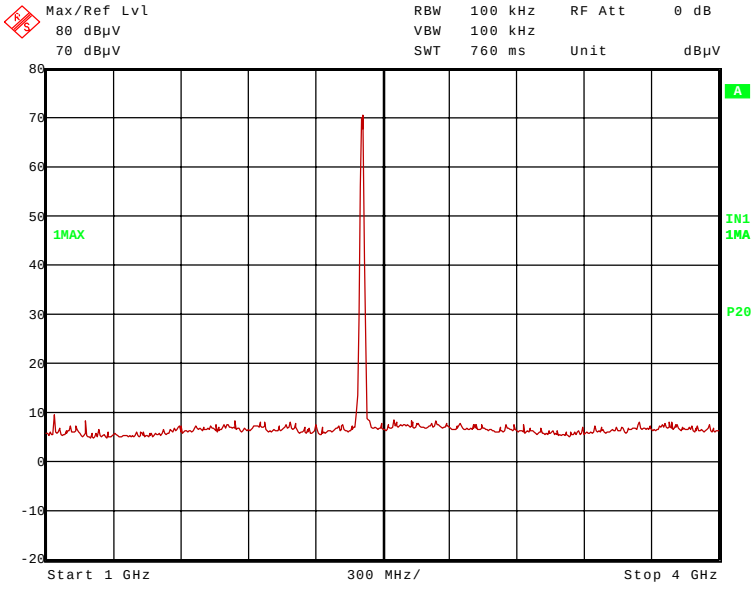
Cable guide: For detail information of test set-up refer to the pictures in annex A of this test report. No cables were connected to the EUT.

Test record: All results are shown in the following.

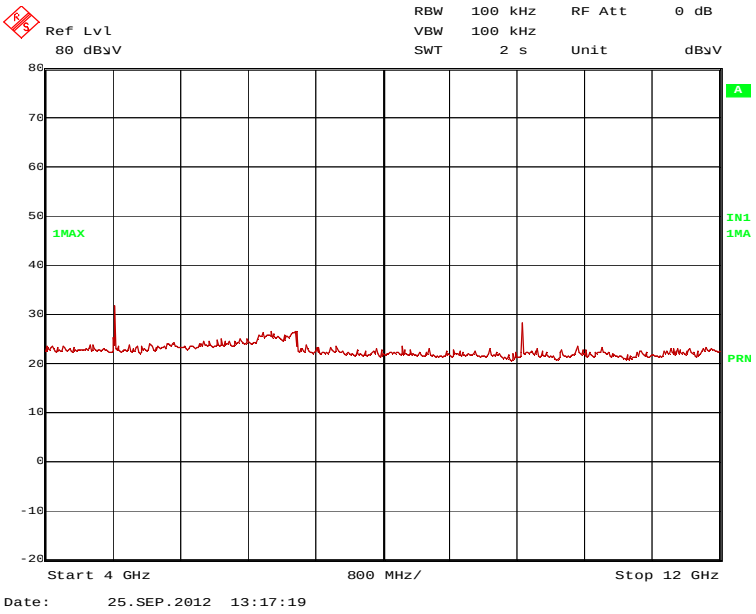
Supply voltage: During all measurements the EUT was supplied with its internal battery with 3.7 V_{DC}.

Transmitter operates at channel 1 in b-mode (operation mode 1)

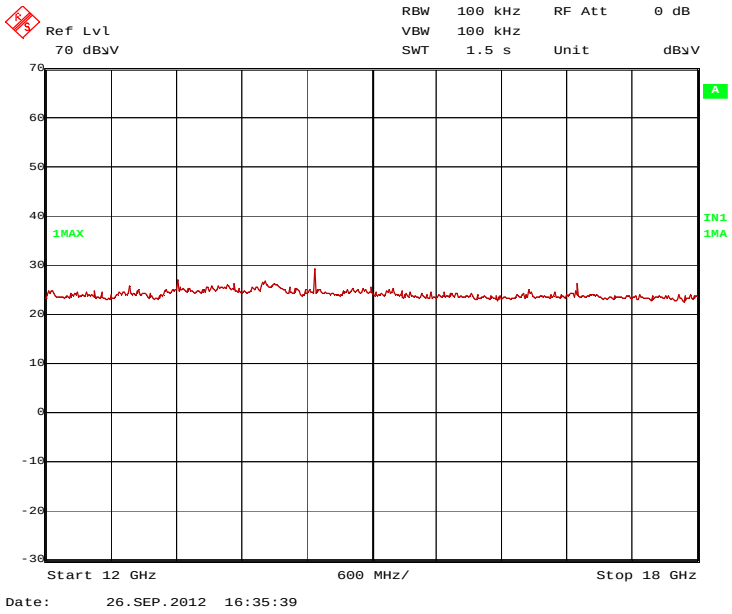
123441_1.wmf: Spurious emissions from 1 GHz to 4 GHz:



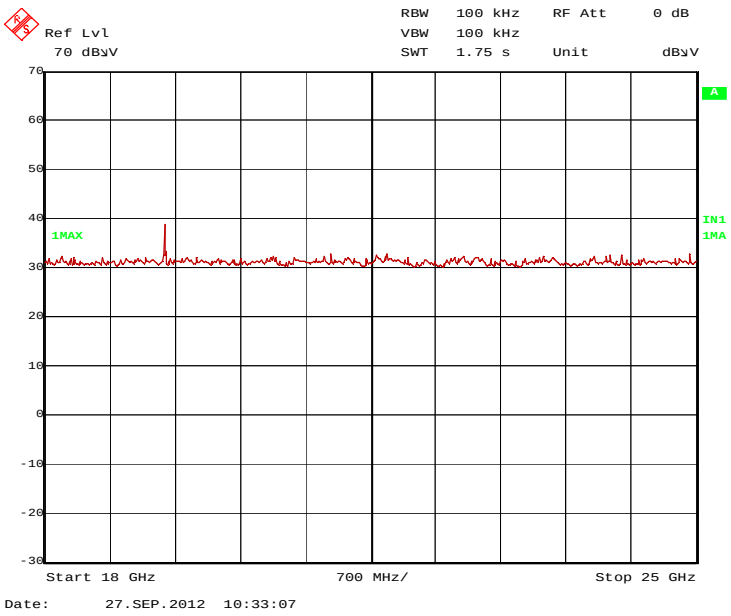
123441_2.wmf: Spurious emissions from 4 GHz to 12 GHz:



123441_17.wmf: Spurious emissions from 12 GHz to 18 GHz:



123441_23.wmf: Spurious emissions from 18 GHz to 25 GHz:



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

- 4.824 GHz, 14.472 GHz and 19.296 GHz.

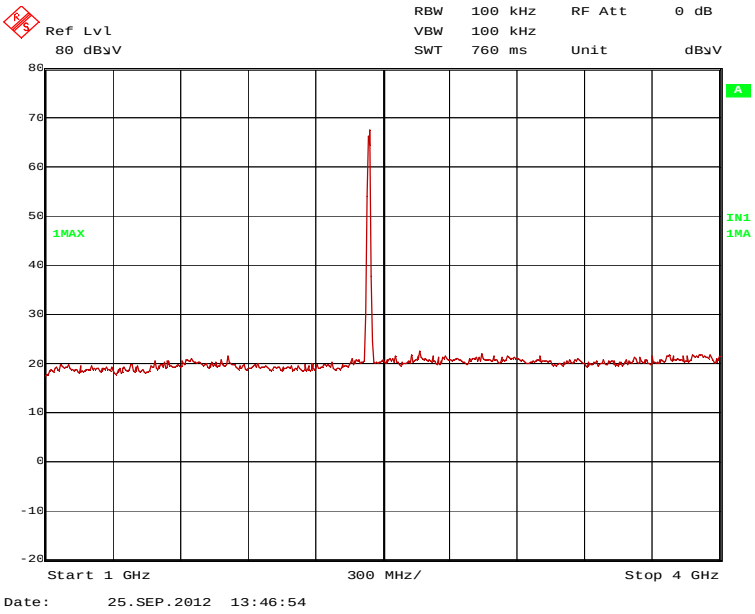
The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2.412 GHz and 7.236 GHz.

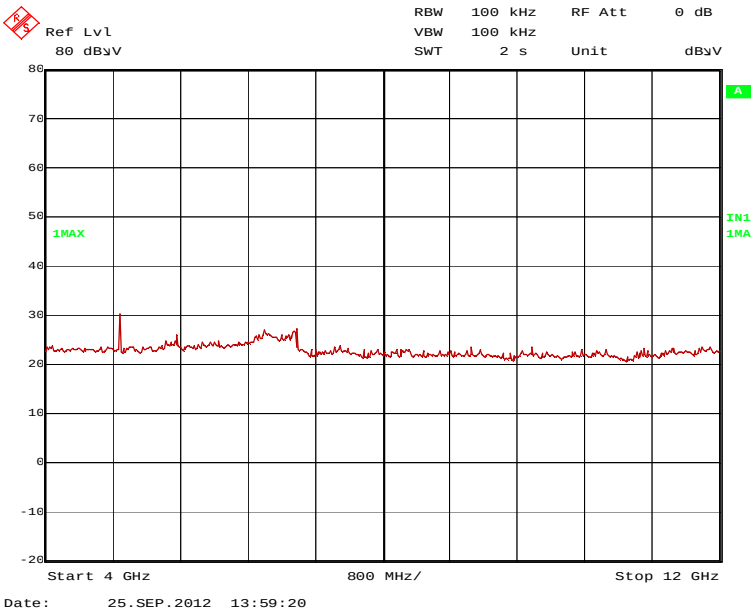
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates channel 6 in b-mode (operation mode 2)

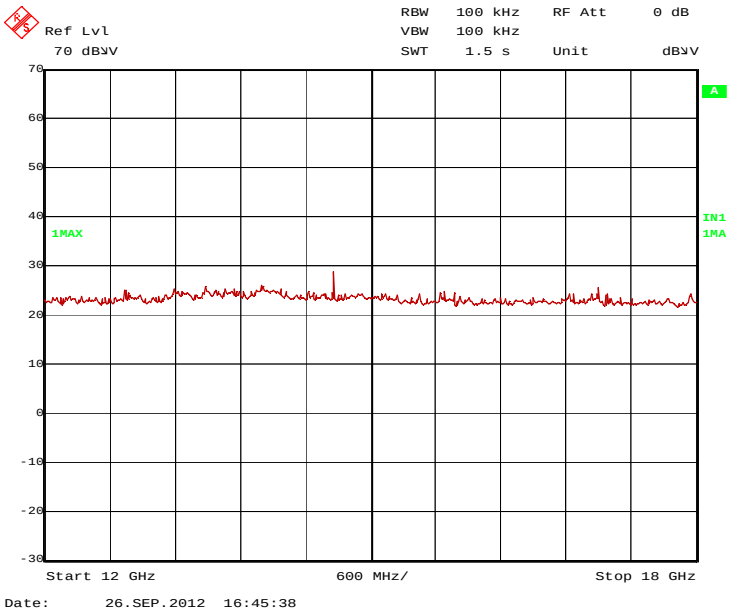
123441_3.wmf: Spurious emissions from 1 GHz to 4 GHz:



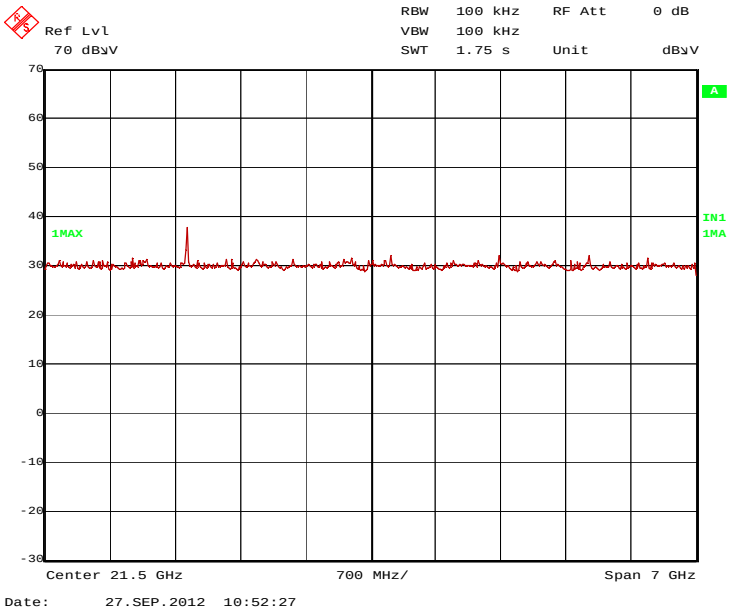
123441_4.wmf: Spurious emissions from 4 GHz to 12 GHz:



123441_18.wmf: Spurious emissions from 12 GHz to 18 GHz:



123441_24.wmf: Spurious emissions from 18 GHz to 25 GHz:



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

- 4.874 GHz and 19.496 GHz.

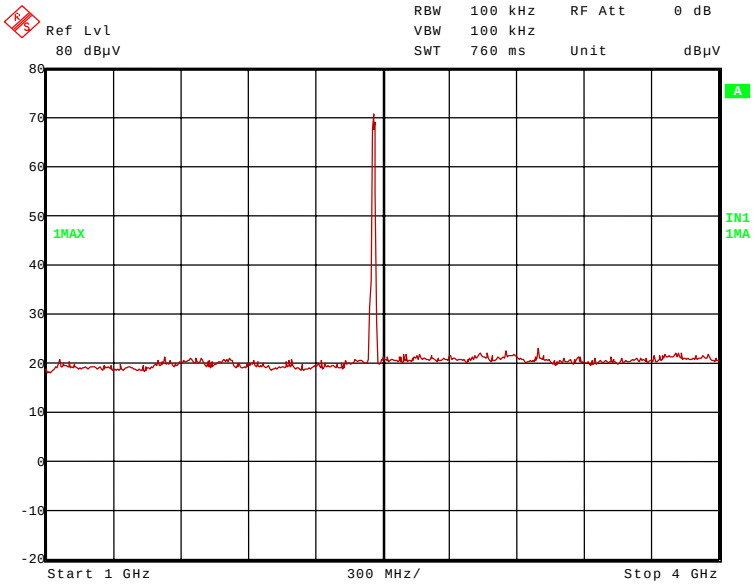
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.437 GHz and 14622 GHz.

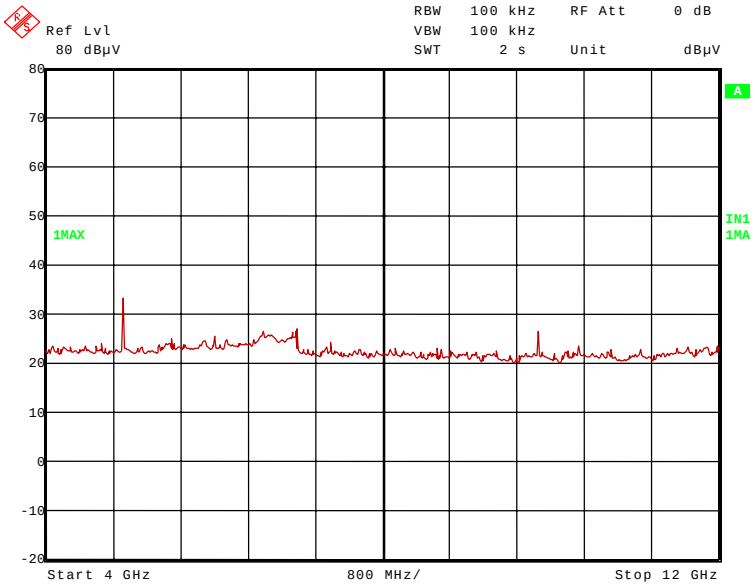
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates at channel 11 in b-mode (operation mode 3)

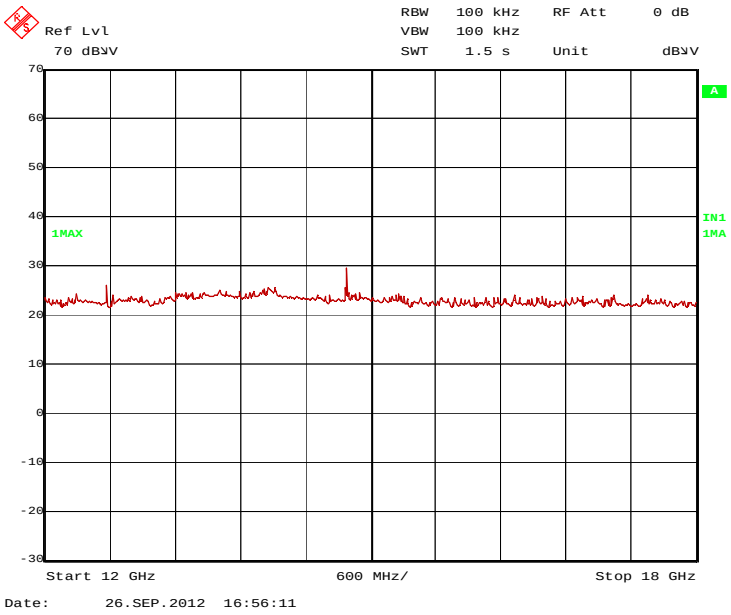
123441_10.wmf: Spurious emissions from 1 GHz to 4 GHz:



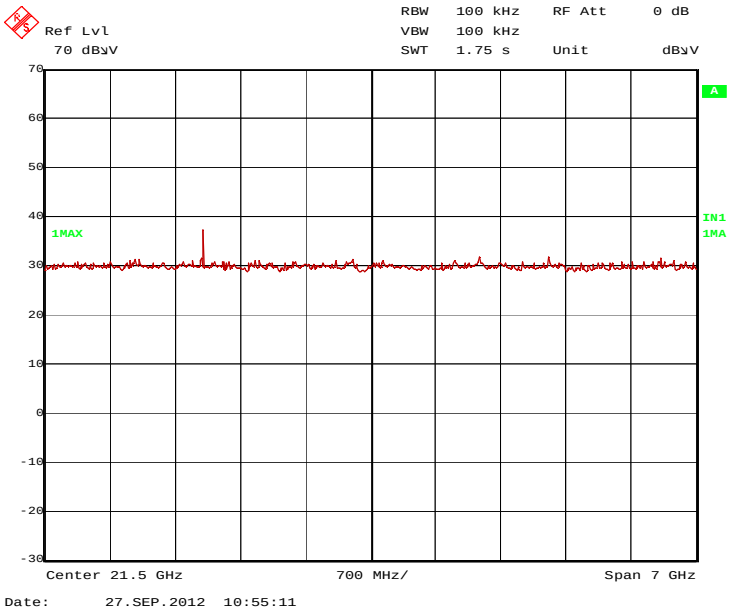
123441_5.wmf: Spurious emissions from 4 GHz to 12 GHz:



123441_19.wmf: Spurious emissions from 12 GHz to 18 GHz:



123441_25.wmf: Spurious emissions from 18 GHz to 25 GHz:



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

- 4.924 GHz, 7.386 GHz and 19.696 GHz.

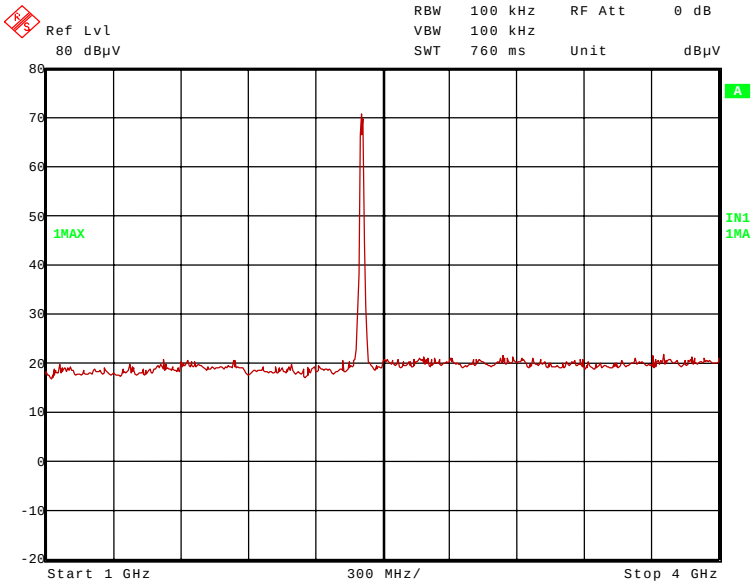
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.462 GHz and 14.772 GHz.

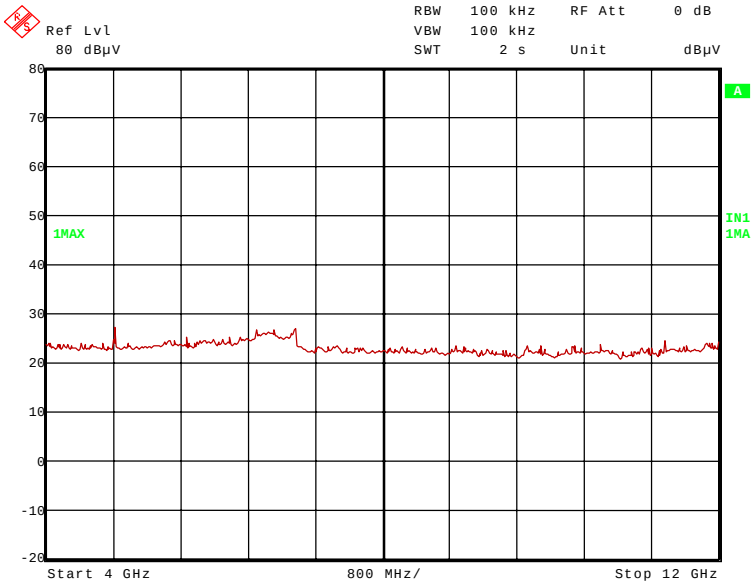
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates at channel 1 in g-mode (operation mode 4)

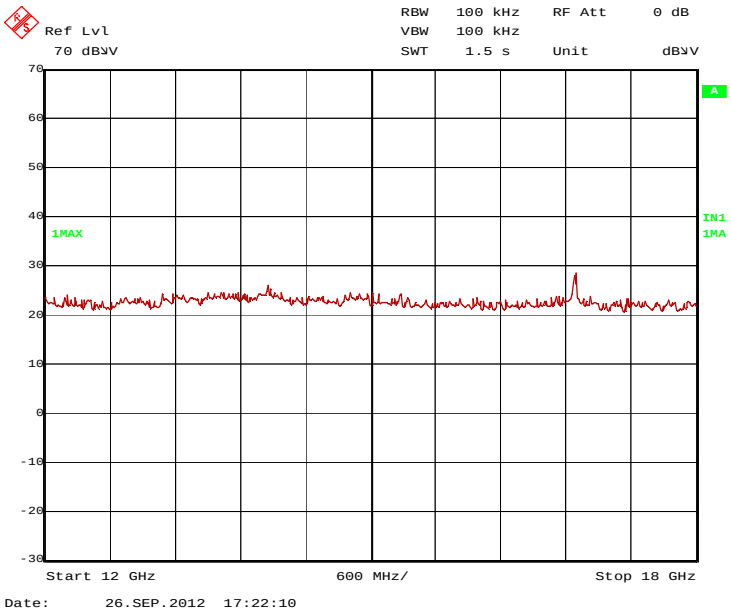
123441_13.wmf: Spurious emissions from 1 GHz to 4 GHz:



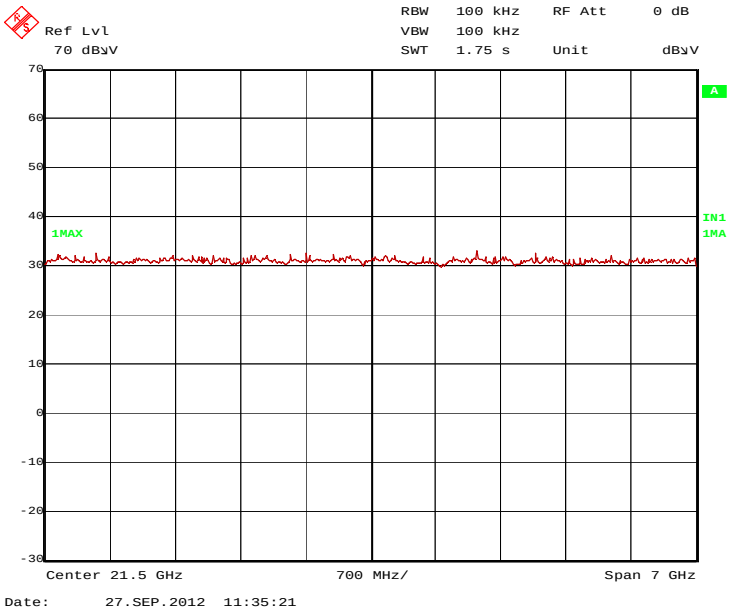
123441_14.wmf: Spurious emissions from 4 GHz to 12 GHz:



123441_22.wmf: Spurious emissions from 12 GHz to 18 GHz:



123441_28.wmf: Spurious emissions from 18 GHz to 25 GHz:



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

- none.

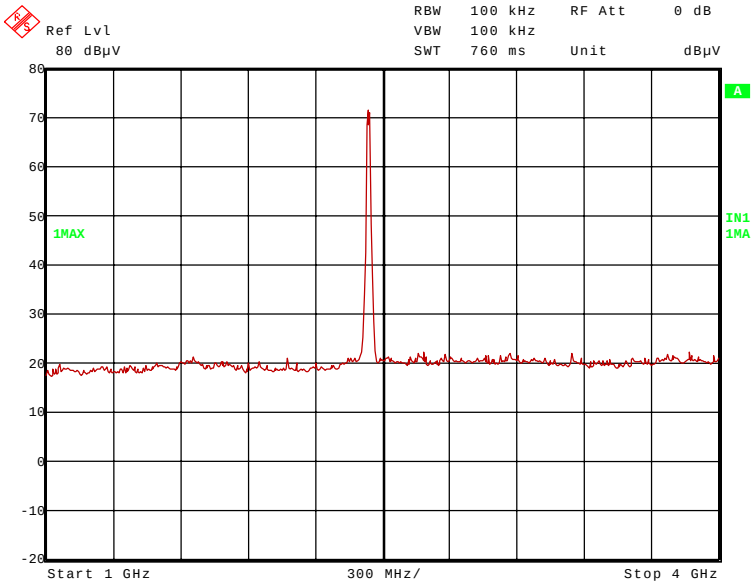
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.412 GHz and 16.884 GHz.

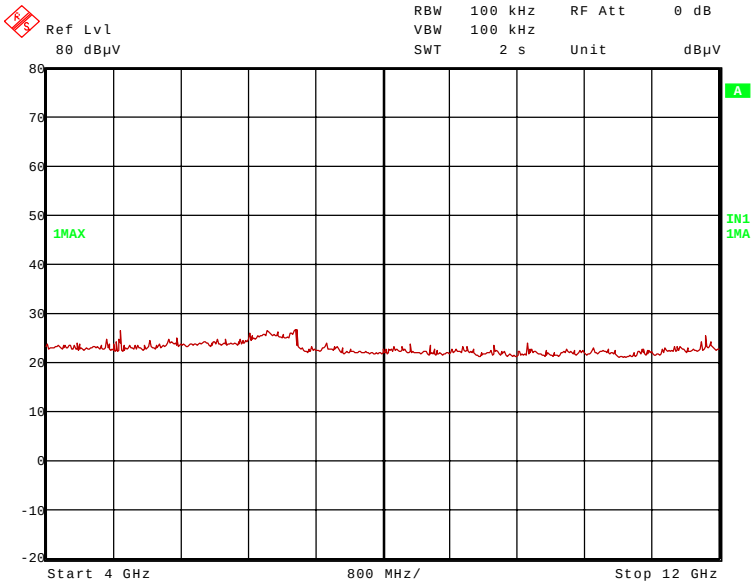
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates at channel 6 in g-mode (operation mode 5)

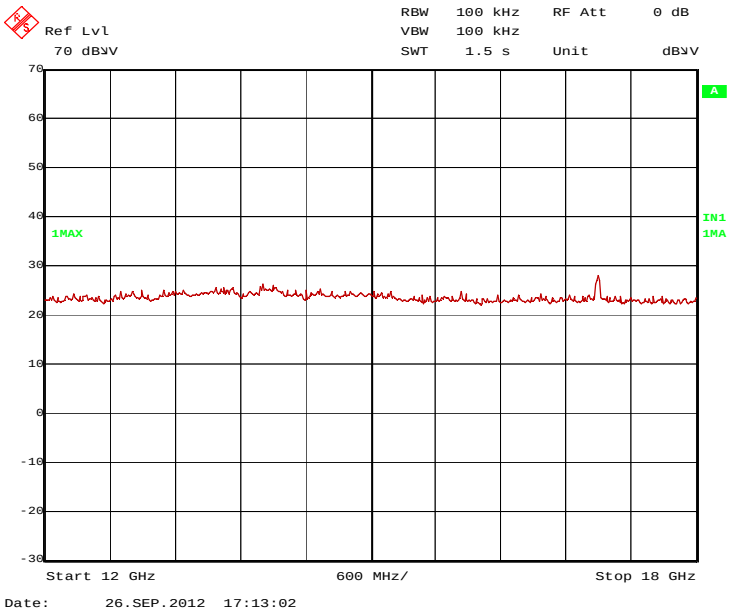
123441_12.wmf: Spurious emissions from 1 GHz to 4 GHz (operation mode 5):



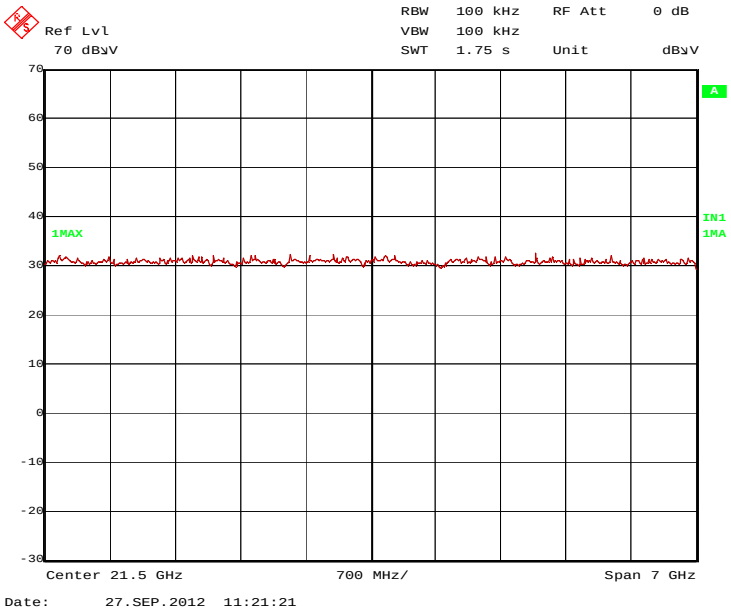
123441_15.wmf: Spurious emissions from 4 GHz to 12 GHz (operation mode 5):



123441_21.wmf: Spurious emissions from 12 GHz to 18 GHz (operation mode 5):



123441_27.wmf: Spurious emissions from 18 GHz to 25 GHz (operation mode 5):



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

- none.

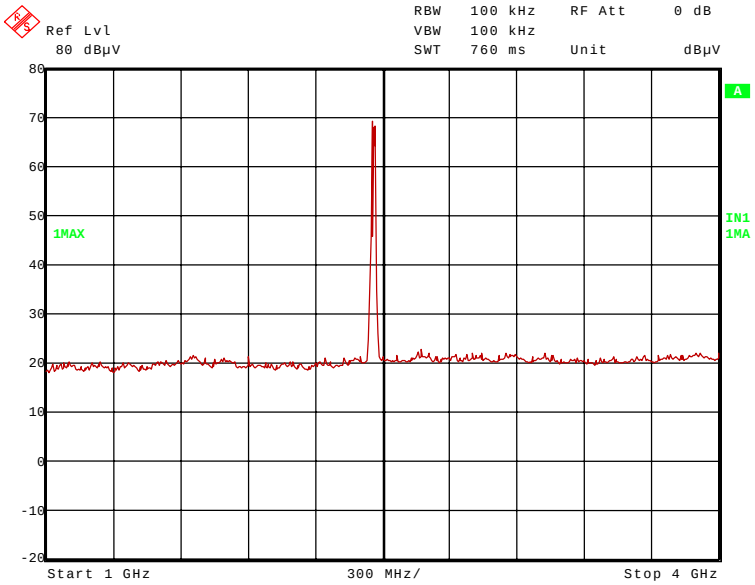
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.437 GHz and 17.059 GHz.

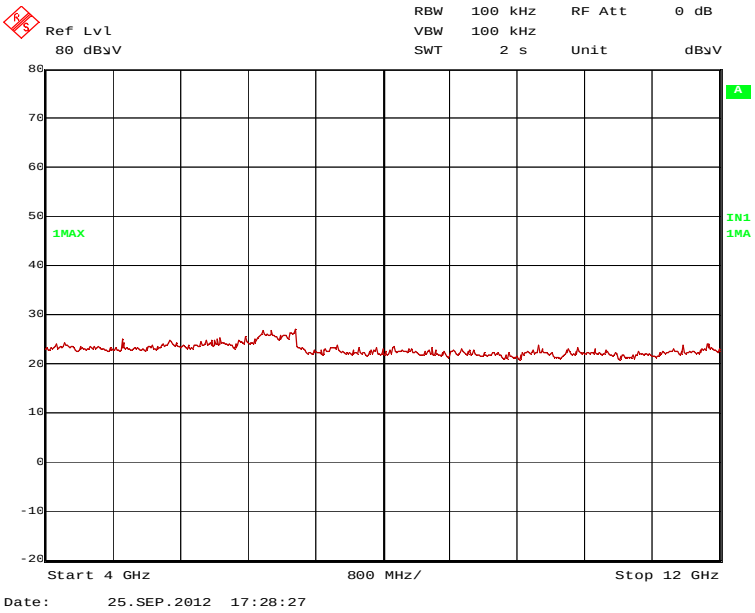
These frequencies have to be measured in a final measurement. The results were presented in the following.

Transmitter operates at channel 11 in g-mode (operation mode 6)

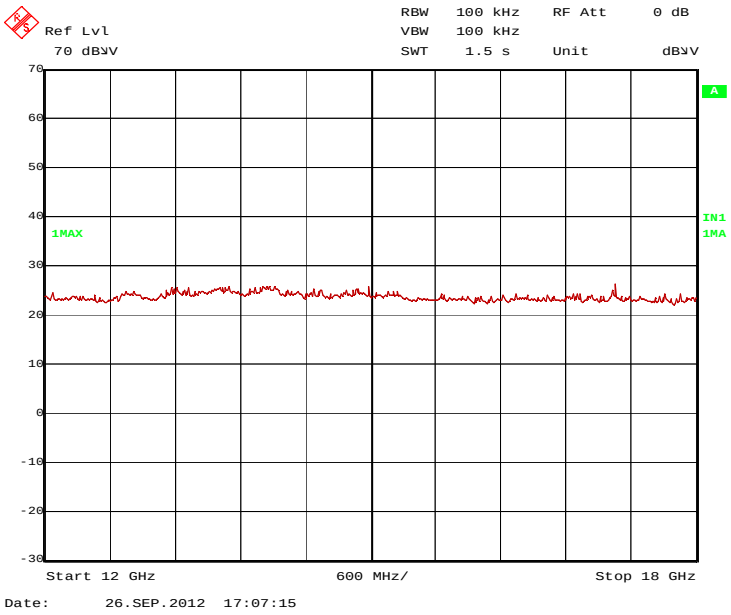
123441_11.wmf: Spurious emissions from 1 GHz to 4 GHz:



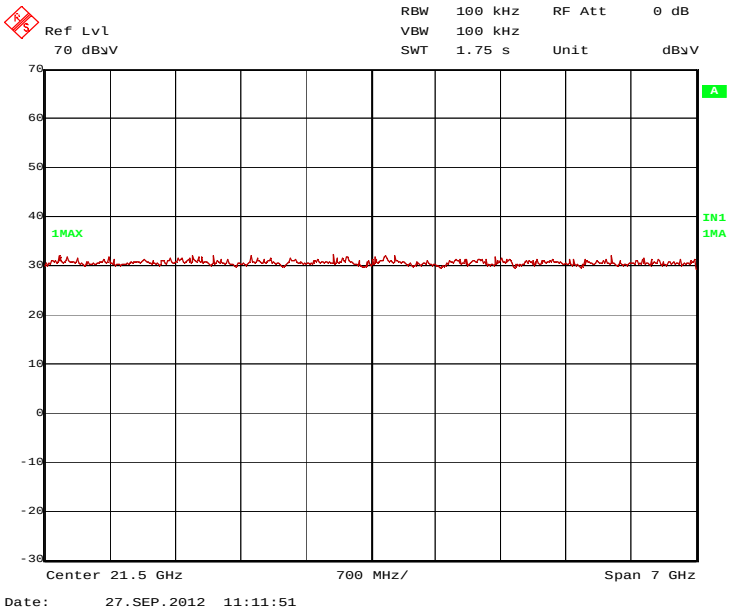
123441_16.wmf: Spurious emissions from 4 GHz to 12 GHz:



123441_20.wmf: Spurious emissions from 12 GHz to 18 GHz:



123441_26.wmf: Spurious emissions from 18 GHz to 25 GHz:



The following frequency was found inside the restricted bands during the preliminary radiated emission test: none.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test: 2.462 GHz.

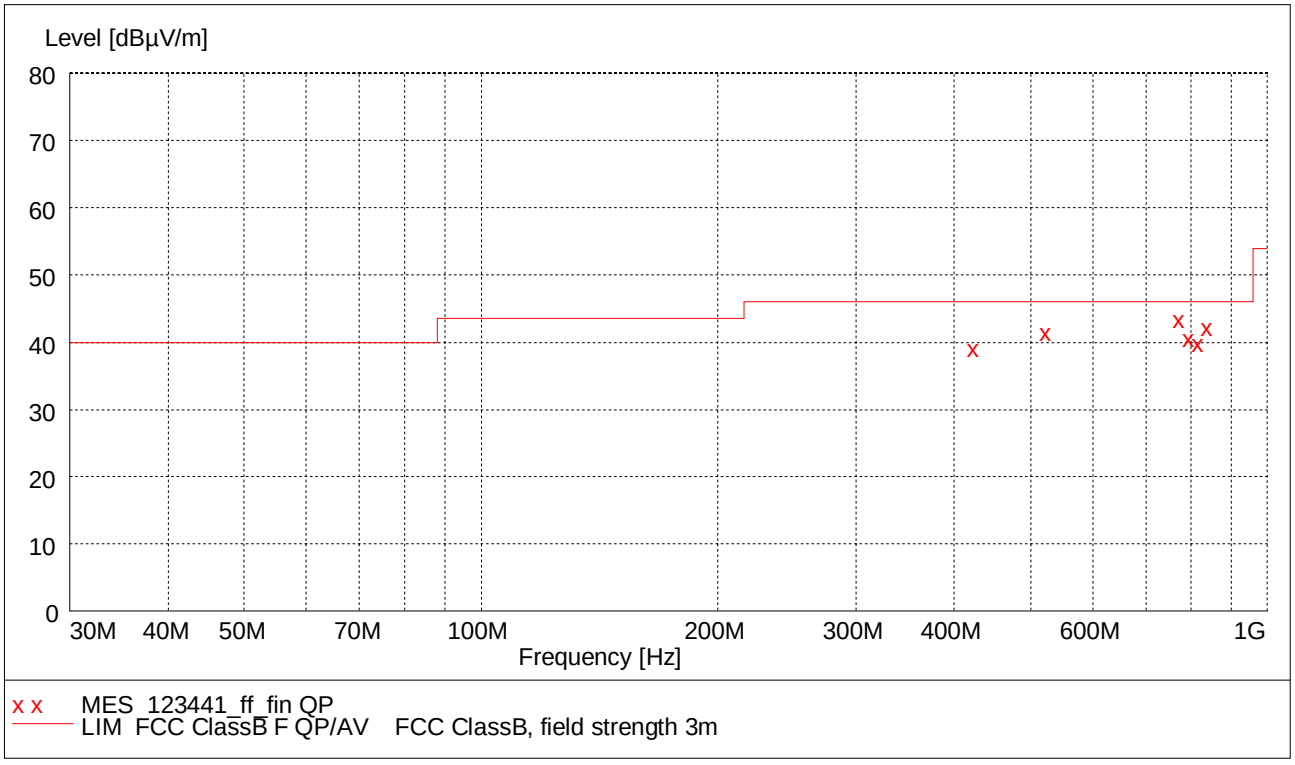
These frequencies have to be measured in a final measurement. The results were presented in the following.

Test equipment used:

29, 31 – 34, 36, 37, 39, 41, 42, 47, 49 – 51, 72

5.3.2.3 Final radiated emission measurement (30 MHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	30 %



Result measured with the quasipeak detector (marked by an x):

Frequency MHz	Level dBµV/m	Transducer dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
425.020000	39.40	19.4	46.0	6.6	108.0	39.00	VERTICAL
525.028000	41.70	21.4	46.0	4.3	100.0	27.00	VERTICAL
775.828000	43.70	25.8	46.0	2.3	243.0	105.00	HORIZONTAL
798.004000	40.90	25.8	46.0	5.1	245.0	102.00	HORIZONTAL
820.144000	40.10	26.3	46.0	5.9	250.0	265.00	HORIZONTAL
842.332000	42.50	27.1	46.0	3.5	351.0	246.00	HORIZONTAL

Test result: Passed.

Test equipment used:

14 - 20

5.3.2.4 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 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 it internal battery with 3.7 V_{DC}.

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

Transmitter operates at channel 1 in b-mode (operation mode 1)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2412	104.7	-	-	72.6	28.4	0.0	3.7	150	Vert.	-	1
4824	50.0	74.0	24.1	37.8	32.6	25.7	5.3	150	Hor.	Yes	1
7236	50.2	84.7	34.5	32.2	35.8	24.6	6.8	150	Hor.	No	1
14472	45.8	74.0	28.2	36.1	33.7	26.5	2.5	150	Hor.	Yes	1
19296	46.3	74.0	27.7	44.9	37.1	38.2	2.5	150	Vert.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2412	96.6	-	-	64.5	28.4	0.0	3.7	150	Vert.	-	1
4824	36.4	54.0	17.7	24.2	32.6	25.7	5.3	150	Hor.	Yes	1
7236	36.3	76.6	40.3	18.3	35.8	24.6	6.8	150	Hor.	No	1
14472	31.9	54.0	22.1	22.2	33.7	26.5	2.5	150	Hor.	Yes	1
19296	37.7	54.0	16.3	36.3	37.1	38.2	2.5	150	Vert.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Transmitter operates at at channel 6 in b-mode (operation mode 2)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2437	105.0	-	-	72.9	28.4	0.0	3.7	150	Vert.	-	1
4874	47.5	74.0	26.5	35.1	32.8	25.7	5.3	150	Hor.	Yes	1
14622	45.4	85.0	39.6	35.8	33.7	26.6	2.5	150	Hor.	No	1
19496	44.0	74.0	30.0	42.6	37.1	38.2	2.5	150	Hor.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2437	97.2	-	-	65.1	28.4	0.0	3.7	150	Vert.	-	1
4874	33.1	54.0	20.9	20.7	32.8	25.7	5.3	150	Hor.	Yes	1
14622	31.9	77.2	45.3	22.3	33.7	26.6	2.5	150	Vert.	No	1
19496	31.6	54.0	22.4	30.2	37.1	38.2	2.5	150	Hor.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Transmitter operates at channel 11 in b-mode (operation mode 3)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2462	108.4	-	-	76.2	28.5	0.0	3.7	150	Hor.	-	1
4924	49.6	74.0	24.4	37.0	32.9	25.6	5.3	150	Hor.	Yes	1
7386	51.2	74.0	22.8	32.6	36.3	24.5	6.8	150	Hor.	Yes	1
14772	46.4	88.4	42.0	36.9	33.7	26.7	2.5	150	Hor.	No	1
19696	44.9	74.0	29.1	43.6	37.1	38.3	2.5	150	Vert.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2462	100.7	-	-	68.5	28.5	0.0	3.7	150	Hor.	-	1
4924	36.1	54.0	17.9	23.5	32.9	25.6	5.3	150	Hor.	Yes	1
7386	37.5	54.0	16.5	18.9	36.3	24.5	6.8	150	Hor.	Yes	1
14772	32.2	80.7	48.5	22.7	33.7	26.7	2.5	150	Hor.	No	1
19696	35.6	54.0	18.4	34.3	37.1	38.3	2.5	150	Vert.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Transmitter operates at channel 1 in g-mode (operation mode 4)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2412	108.2	-	-	76.1	28.4	0.0	3.7	150	Hor.	-	1
16884	48.9	88.2	39.3	40.1	33.8	27.5	2.5	150	Vert.	No	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2412	97.2	-	-	65.1	28.4	0.0	3.7	150	Hor.	-	1
16884	33.7	77.2	43.5	24.9	33.8	27.5	2.5	150	Vert.	No	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Transmitter operates at channel 6 in g-mode (operation mode 5)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2437	108.9	-	-	76.8	28.4	0.0	3.7	150	Hor.	-	1
17059	50.4	74.0	23.6	40.8	33.9	26.8	2.5	150	Vert.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2437	97.5	-	-	65.4	28.4	0.0	3.7	150	Hor.	-	1
17059	35.5	54.0	18.6	25.9	33.9	26.8	2.5	150	Vert.	Yes	1
Measurement uncertainty						+2.2 dB / -3.6 dB					

Transmitter operates at channel 11 in g-mode (operation mode 6)

Result measured with the peak detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2462	107.6	-	-	75.4	28.5	0.0	3.7	150	Hor.	-	1
No significant spurious emissions found.											
Measurement uncertainty						+2.2 dB / -3.6 dB					

Result measured with the average detector:

Frequency MHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band	Pos.
2462	95.8	-	-	63.6	28.5	0.0	3.7	150	Hor.	-	1
No significant spurious emissions found.											
Measurement uncertainty						+2.2 dB / -3.6 dB					

Test: Passed

Test equipment used:
29, 31 – 34, 36, 37, 39, 41, 42, 47, 49 – 51, 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	02/15/2010	02/2014
16	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	MA240-0	Inn-Co GmbH	MA240-0/030/6600603	480086	-	-
19	Antenna	CBL6111 D	Chase	25761	480894	28/09/2011	09/2014
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
30	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	02/15/2012	02/2014
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/13/2012	02/2014
32	Controller	MCU	Maturo	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS620P	Deisel	620/375	480325	-	-
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.)	
41	RF-cable No. 3	Sucoflex 106B	Huber&Suhner	0563/6B	480670	Weekly verification (system cal.)	
42	RF-cable No. 40	Sucoflex 106B	Huber&Suhner	0708/6B	481330	Weekly verification (system cal.)	
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142	Weekly verification (system cal.)	
46	RF-cable 1 m	KPS-1533-400-KPS	Insulated Wire	-	480301	Six month verification (system cal.)	
47	RF-cable No. 36	Sucoflex 106B	Huber&Suhner	0587/6B	480865	Weekly 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	WHKX4.0/18G-8SS	Wainwright Instruments	1	480587	Weekly verification (system cal.)	

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
73	Power meter	NRVD	Rohde & Schwarz	833697/030	480589	02/15/2012	02/2014
74	Peak power sensor	NRV-Z32	Rohde & Schwarz	849745/016	480551	02/15/2012	02/2014
75	Attenuator	WA8/18-20-34	Weinschel	-	481451	Six month verification (system cal.)	

7 REPORT HISTORY

Report Number	Date	Comment
F123441E1	17 October 2012	Document created

8 LIST OF ANNEXES

ANNEX A TEST SET-UP PHOTOS 5 pages

123441_1.JPG: Test setup fully anechoic chamber
123441_2.JPG: Test setup fully anechoic chamber
123441_6.JPG: Test setup fully anechoic chamber
123441_7.JPG: Test setup fully anechoic chamber
123441_8.JPG: Test setup open area test site

ANNEX B INTERNAL PHOTOS 3 pages

123441_14.JPG: WLAN module, shielding removed
123441_15.JPG: WLAN module with shielding and temporary antenna connectors
123441_18.JPG: WLAN module with shielding and internal antenna

ANNEX C EXTERNAL PHOTOS 2 pages

123441_16.JPG: EUT, 3D view1
123441_17.JPG: EUT, 3D view 2