REPORT: **FCC / IC Radio Frequency (RF) test report**

PRODUCT:

Test item description:	Mobile computer for data collection
Trade Mark:	NordicID
Model/Type reference:	805-2A / HTE00072
Serial number:	-
Customer:	NordicID Oy Myllyojankatu 2A 24100 SALO FINLAND
Contact person:	Hannu Heino
Manufacturer:	NordicID Oy Myllyojankatu 2A 24100 SALO FINLAND

DATE: **20.2.2012**

TESTED BY:

Matti Virkki ; Test engineer

APPROVED BY:

Tuomo Hahl ; Test engineer

CONTENTS

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1 LABORATORY INFORMATION

Test Laboratory	Intertek ETL Semko OY Koneenkatu 12 / K17 05830 Hyvinkää FINLAND
FCC registration number: **IC file number:**	910391 (January 27, 2003) IC 2042C-1 (May 14, 2003)

2 SUMMARY OF TEST RESULTS

The tests listed in this report have been done to demonstrate compliance to the FCC rules section §15.107, §15.109, §15.247 and IC standard RSS-GEN / RSS-210.

This report contains results for following tests for Wifi transmitter.

Transmitter measurements

Section in CFR 47	Section in RSS-210	Test	Result
15.247, a 1 iii	A8.1 (4)	Number of operating frequencies	PASS
15.247, a	A8.1 (1)	6dB bandwidth	PASS
15.247, b 1	A8.4 (2)	Power output	PASS
15.247, b 1	A8.4 (2)	Power spectral density	PASS
15.247, d	A8.5	Band-edge compliance of RF emissions	PASS
15.247, d	A8.5	Spurious RF conducted emissions	PASS

Receiver measurements

Section in CFR 47	Section in RSS-GEN	Section in ICES-003	Test	Result
§15.107	7.2.4	5.3	Conducted emissions to AC-power lines	-
§15.109	7.2.5	5.5	Radiated emissions	PASS

PASS Pass
FAIL Fail
X Measured, but there is no applicable performance criteria
- Not done

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3 EUT INFORMATION

The EUT and accessories used in the tests are listed below. Later in this report only EUT numbers are used as reference.

	Device	**Type**	**S/N**	**EUT number**
EUT	NordicID Merlin	HTE0072	-	1
	NordicID Merlin	HTE0072	-	2*

Notes:

* Antenna replaced with SMA-connector

3.1 EUT description

EUT is a battery operated mobile computer for data collection purposes. Battery can be charged with charger.

The EUT has 902-928 MHz RFID radio module (FCC ID: SCCNUR05W), 2402 -2480 MHz BT 2.1 +EDR radio and 2412 – 2462 MHz 802. 11 b/g wlan radio module (FCC ID: TWG-SDCMSD30AG).

Bluetooth radio was commanded to different modes with customer's program Morphic Radio Tester.exe.
RFID module was commanded with NUR Test [dll 1.3.0]
and WLAN module with module manufacturer's program SRU_30AG_3_1_34.exe

The EUT was not modified during the tests.

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4 EUT TEST SETUPS

For each test the EUT was exercised to find out the worst case of operation modes and device configuration.

Two different test setups were used: one for conducted measurements, another for radiated measurements. One EUT was equipped with an external antenna connector for conductive measurements.

The test setup photographs are in the document referenced in section 15.

5 APPLICABLE STANDARDS

The tests were performed in guidance of:

CFR 47 Part:
§15.247
ANSI C63.4 (2009)

IC standard:
RSS-GEN, Issue 3
RSS-210, Issue 8

Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method" for each test case.

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6 6 dB BANDWIDTH

EUT	2		
Accessories	-		
Temp, Humidity, Air Pressure	19ºC	18,9RH%	1013hPa
Date of measurement	FEB. 14.2012		
FCC rule part	15.247, a		
RSS-210 section	A8.1 (1)		
Measured by	Matti Virkki		

6.1 Test setup and measurement method

The 6dB bandwidth was measured using 100 kHz resolution bandwidth and maximum hold function of the spectrum analyzer. 6dB bandwidth was defined by measuring the maximum level on the measured channel and by placing delta markers 6 dB below this value and read the value.

6.2 EUT operation mode

EUT operation mode	Connection,
EUT channel	1, 6 and 11
EUT TX power level	Max

6.3 Results

Table 1: 6dB bandwidth measurement results

EUT Channel	Limit (MHz)	Measured value (MHz)
1	>0,5	16,6
6		15,4
11		15,0

Table 2: 6dB bandwidth measurement results

EUT Channel	Limit (MHz)	Measured value (MHz)
1	>0,5	17,1
6		16,7
11		16,1

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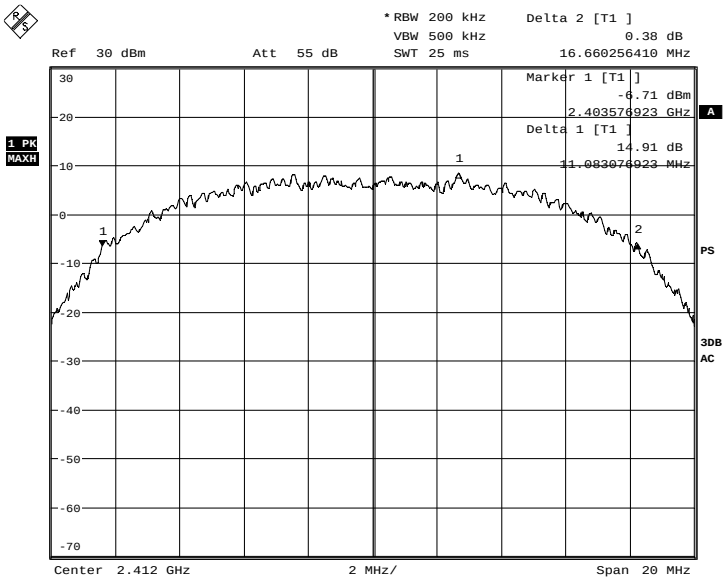
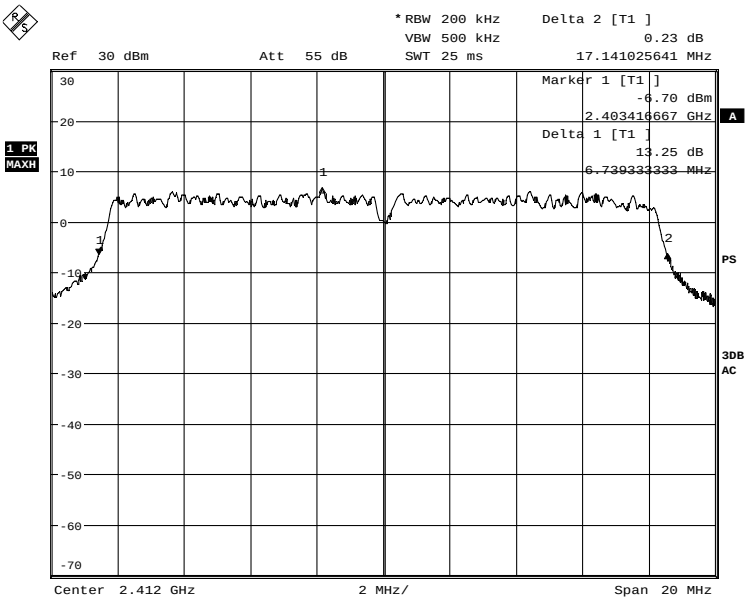
6.4 Screen shots

Picture 1: 6dB Bandwidth measurement result, 5,5 MBps Channel 1



Date: 14.FEB.2012 09:22:16

Picture 2: 6dB Bandwidth measurement result, 54 MBps Channel 1



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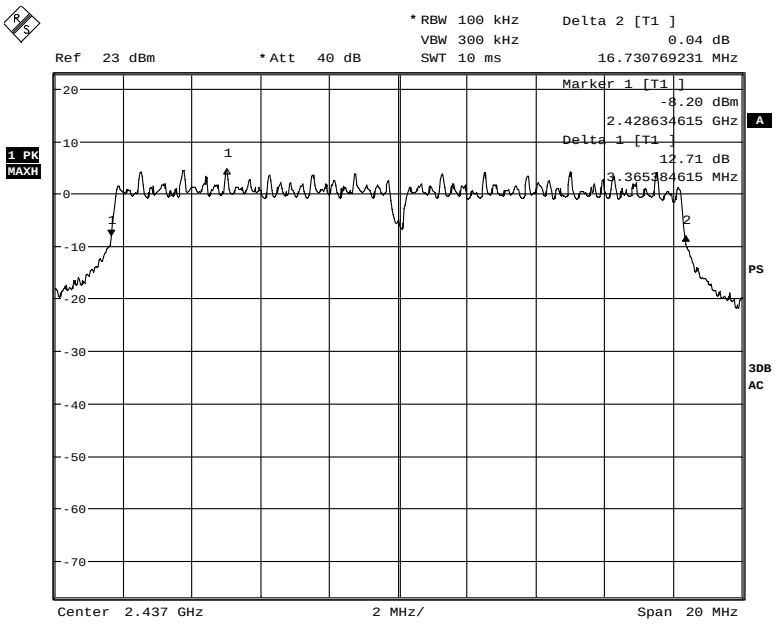
Picture 3: 6dB Bandwidth measurement result, Channel 6



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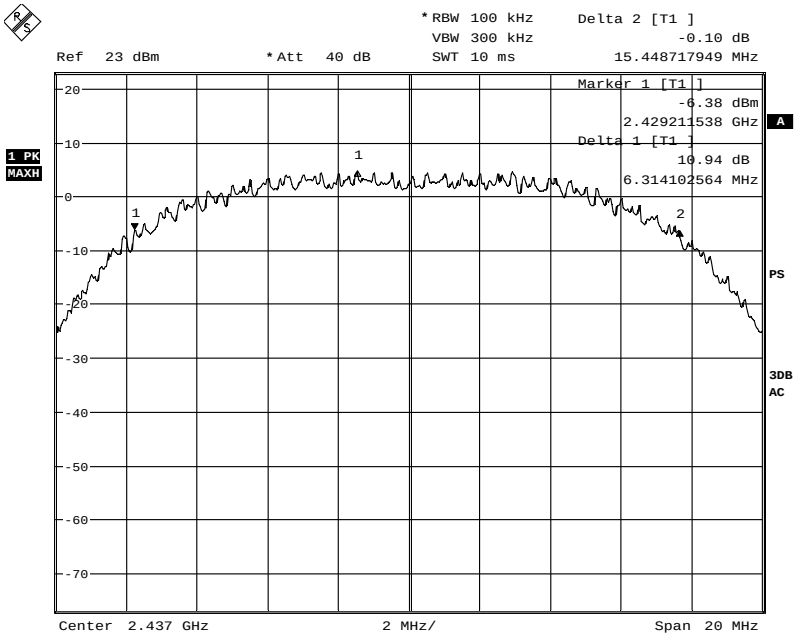

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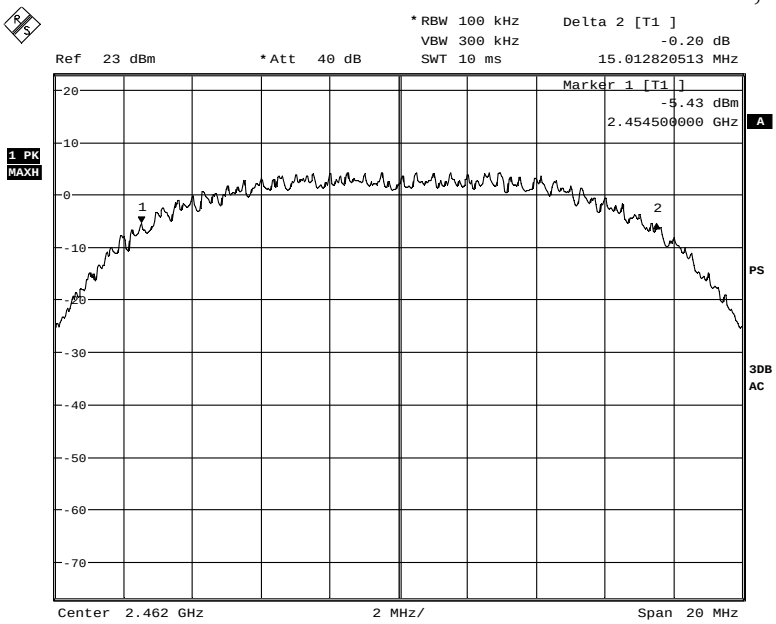
Picture 4: 6dB Bandwidth measurement result, Channel 11



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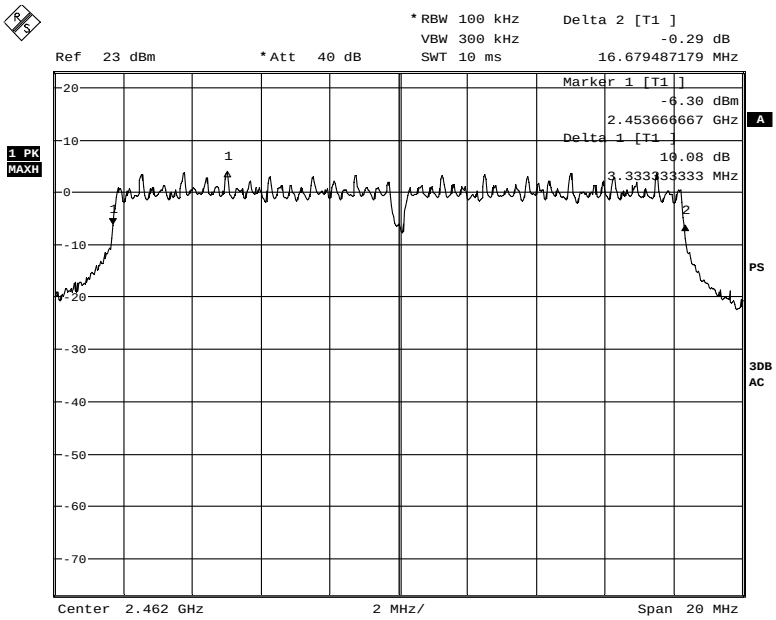

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7 99% dB BANDWIDTH

EUT	2		
Accessories	-		
Temp, Humidity, Air Pressure	19ºC	18,9RH%	1013hPa
Date of measurement	FEB. 14.2012		
FCC rule part			
RSS-GEN section	4.6.1		
Measured by	Matti Virkki		

7.1 Test setup and measurement method

The 99% occupied bandwidth was calculated with spectrum analyzers internal measurement software.

7.2 EUT operation mode

EUT operation mode	Connection,
EUT channel	1
EUT TX power level	Max

7.3 Results

Table 3: 99% bandwidth measurement results 5,5 MBps

EUT Channel	Limit (MHz)	Measured value (MHz)
1	>0,5	15,64

Table 4: 6dB bandwidth measurement results 54 MBps

EUT Channel	Limit (MHz)	Measured value (MHz)
1	>0,5	16,47

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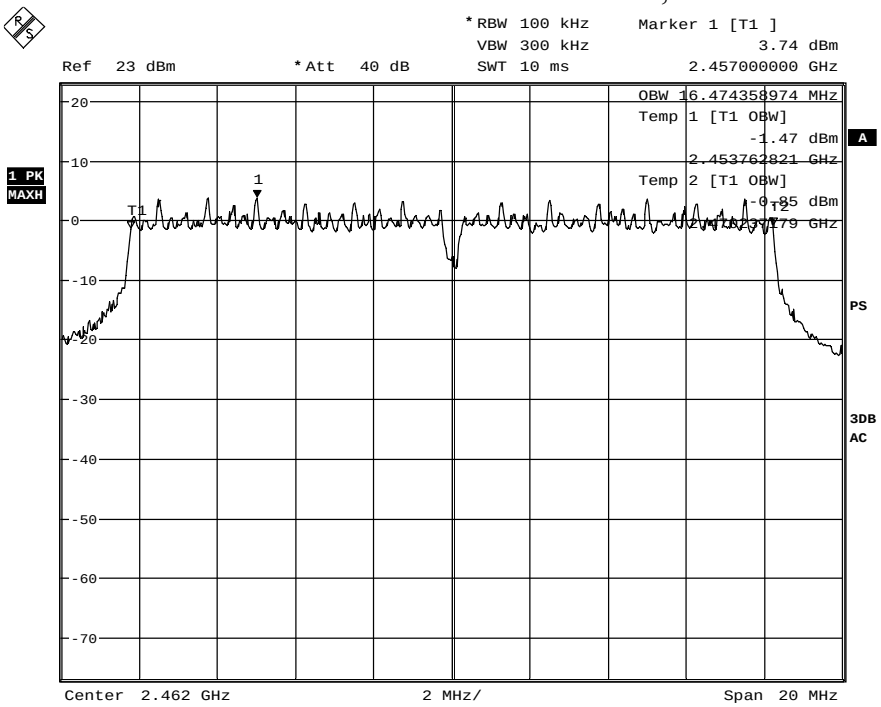
Picture 5: 99% Bandwidth measurement result, Channel 1



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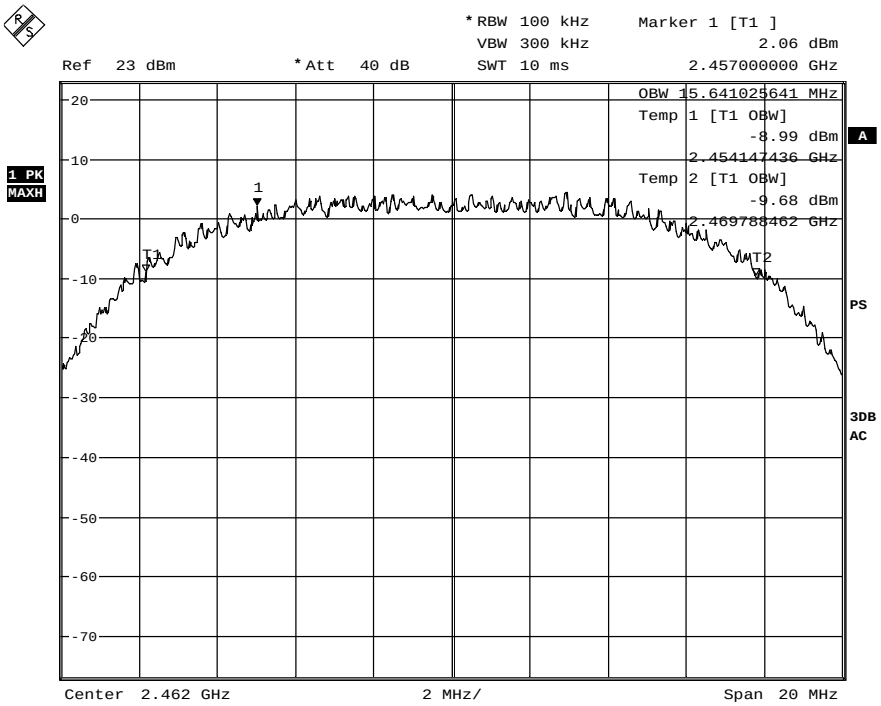

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8 POWER OUTPUT

EUT	2		
Accessories	-		
Temp, Humidity, Air Pressure	19ºC	18,9RH%	1013hPa
Date of measurement	FEB. 14.2012		
FCC rule part	15.247, b 1		
RSS-210 section	A8.4 (2)		
Measured by			

8.1 Test setup and measurement method

In the power output measurement the power splitter and cable attenuations were measured prior to the power measurement and attenuation is added to the measured result. The measurement was made using 100 trace averages with 1 MHz resolution bandwidth, 3 MHz video bandwidth sample detector and maximum hold function to record the output power. Spectrum analyzer's band power function was used to calculate power output.

8.2 EUT operation mode

EUT operation mode	Connection,
EUT channel	1, 6 and 11
EUT TX power level	max

8.3 Results

Table 5: Peak output power measurement results 54 MBps

EUT Channel	Limit (W)	Test result (mW)	Limit (dBm)	Test result (dBm)
1	≤ 1		≤ 30	12,3
6				13,1
11				11,9

Table 6: Peak output power measurement results 5,5 MBps

EUT Channel	Limit (W)	Test result (mW)	Limit (dBm)	Test result (dBm)
1	≤ 1	37,1	≤ 30	15,7
6		33,9		15,3
11		36,3		15,6

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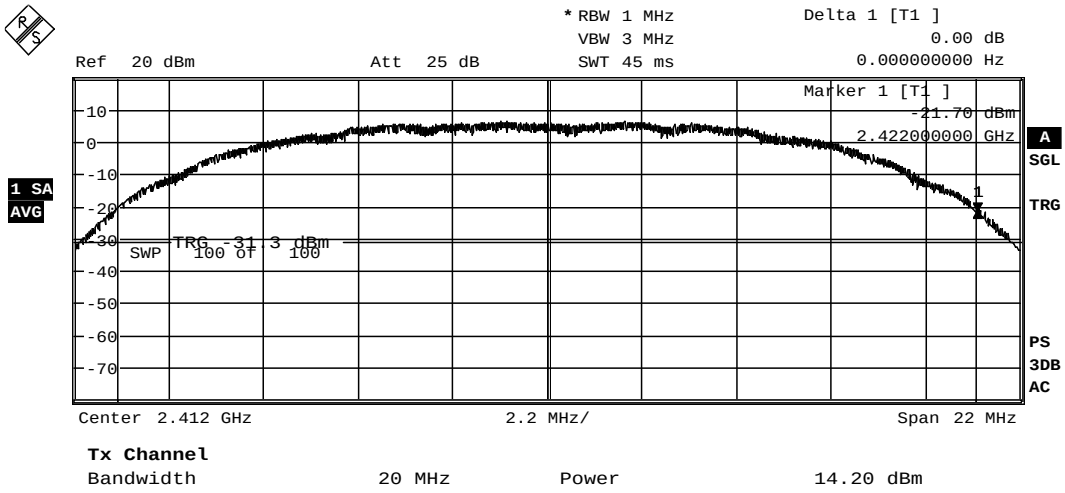
8.4 Screen shots

Picture 6: output power, channel 1



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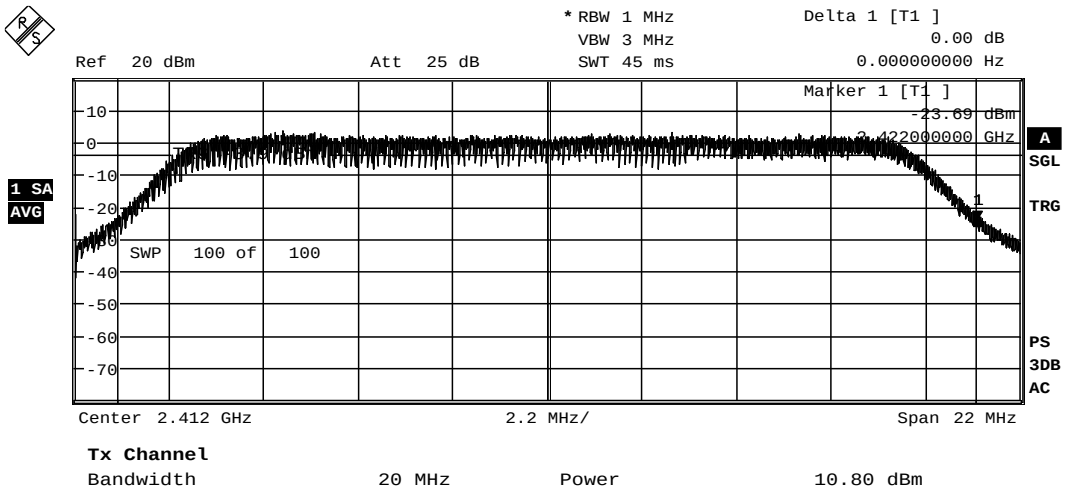

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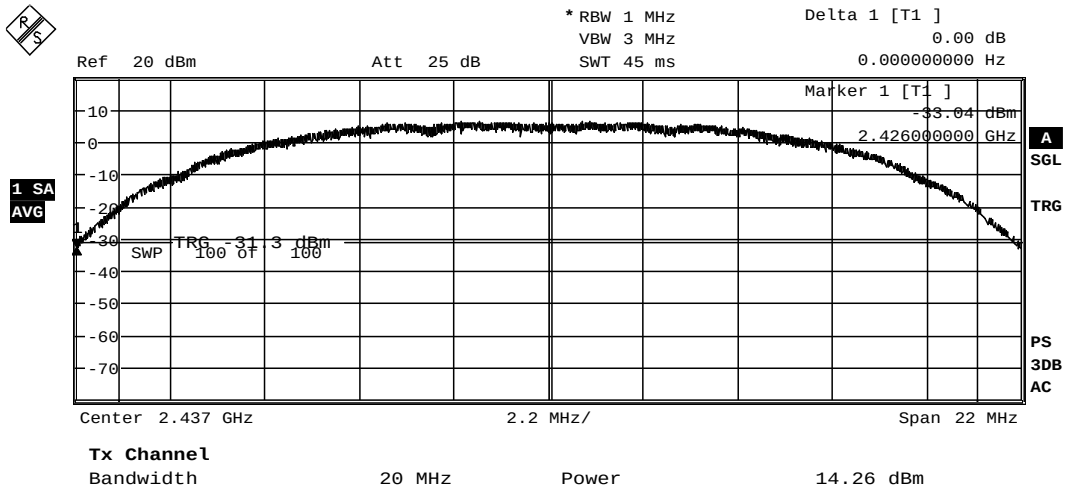
Picture 7: output power, channel 6



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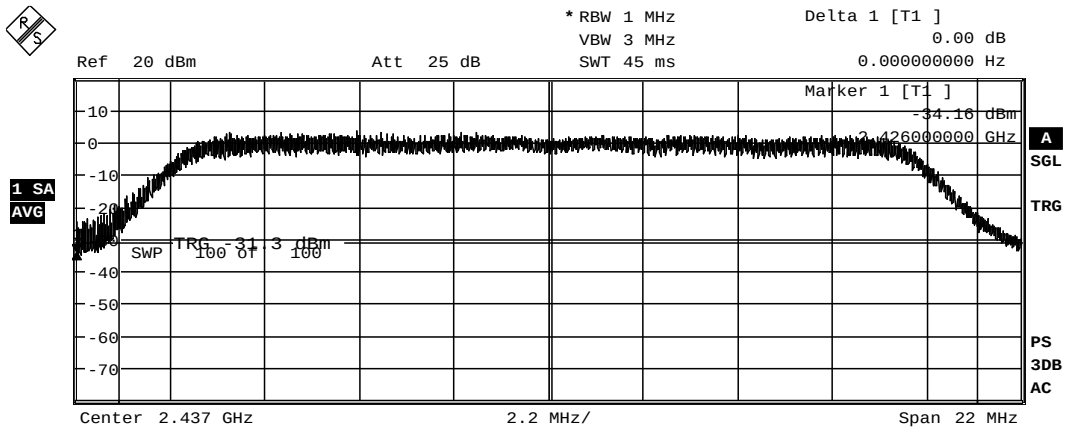

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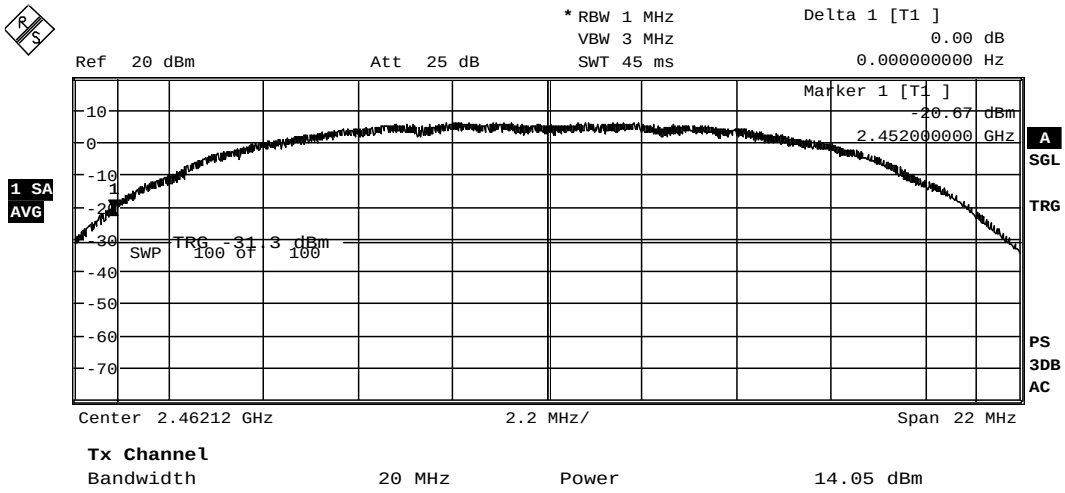
Picture 8: output power, channel 11



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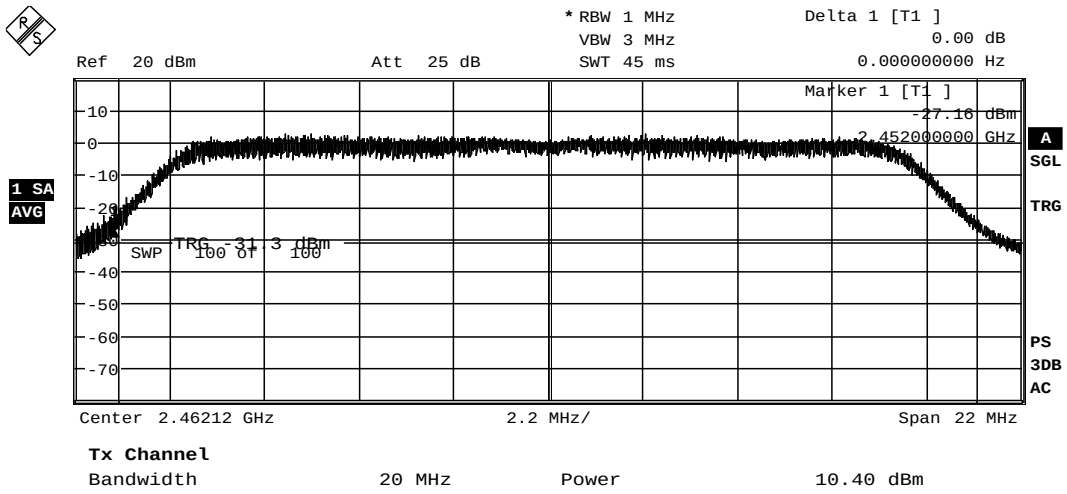

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9 POWER SPECTRAL DENSITY

EUT	2		
Accessories	-		
Temp, Humidity, Air Pressure	19ºC	18,9RH%	1013hPa
Date of measurement	FEB. 14.2012		
FCC rule part	15.247, d		
RSS-210 section	A8.4 (2)		
Measured by			

9.1 Test setup and measurement method

The measurement was made using 100 trace average with 3 kHz resolution bandwidth, 10 kHz video bandwidth peak detector and maximum hold function to record the Power spectral density.

9.2 EUT operation mode

EUT operation mode	Connection,
EUT channel	1, 6 and 11
EUT TX power level	max

9.3 Results

Table 7: Power spectral density measurement results

EUT Channel	Limit (dBm)	Test result (dBm)
1	≤ 8	-9,08
6		-9,13
11		-9,39

Table 8: Power spectral density measurement results

EUT Channel	Limit (dBm)	Test result (dBm)
1	≤ 8	-9,63
6		-9,95
11		-9,64

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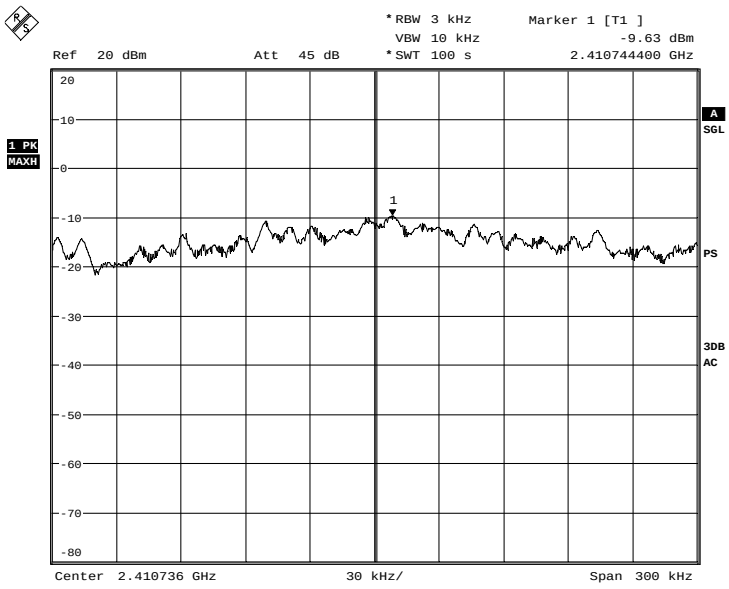
9.4 Screen shots

Picture 9:PSD, channel



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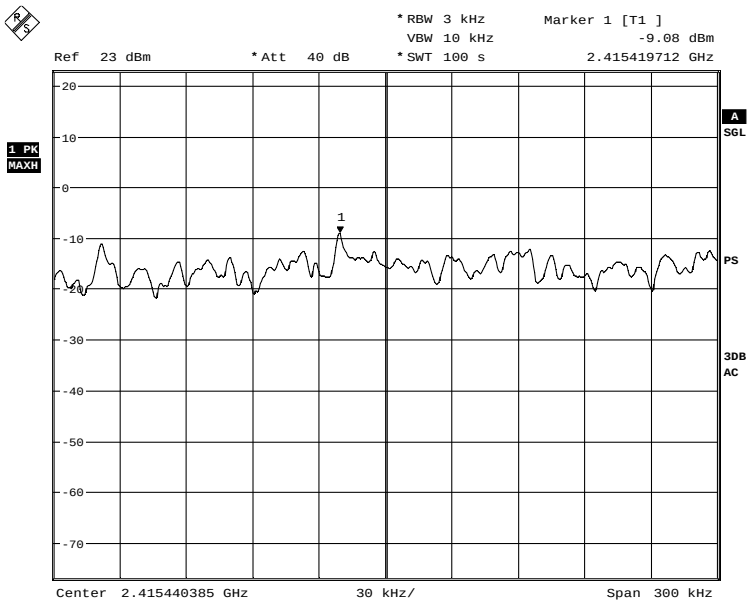

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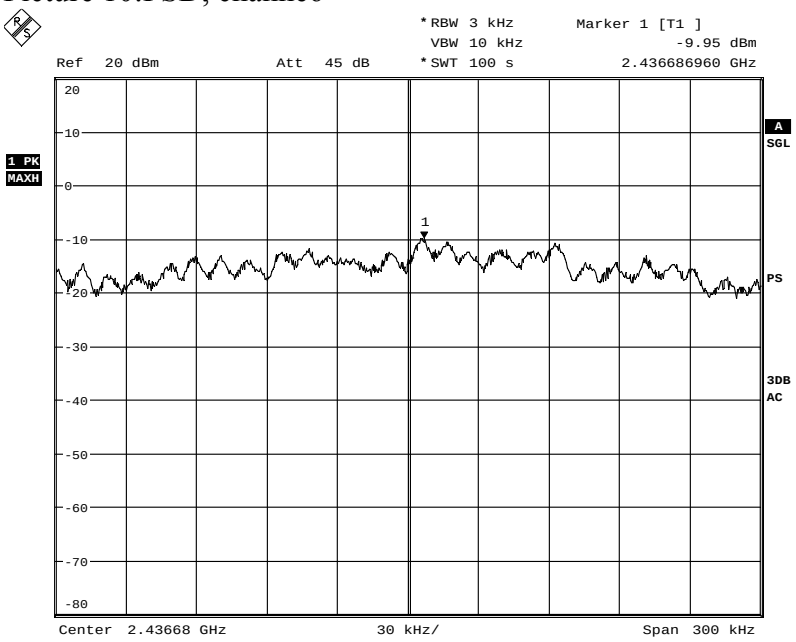
Picture 10:PSD, channe6



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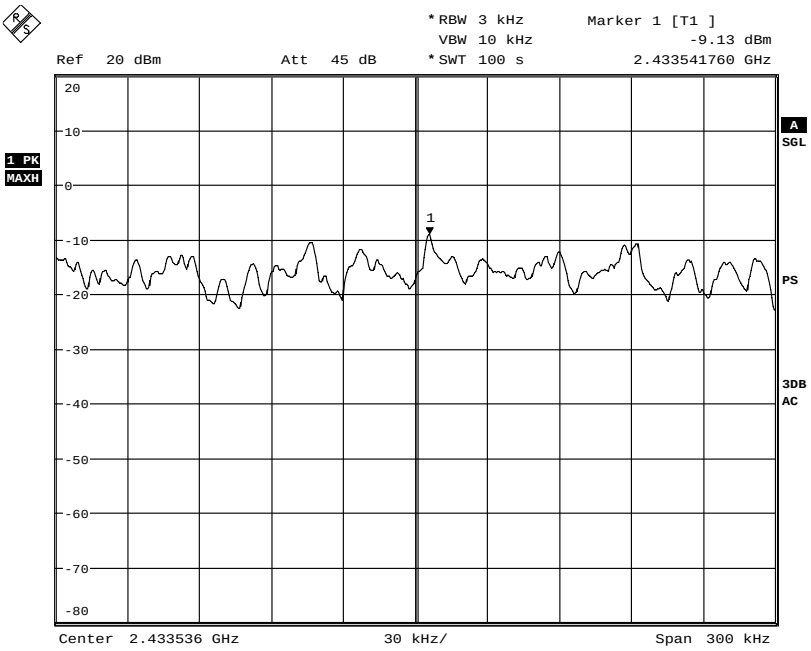

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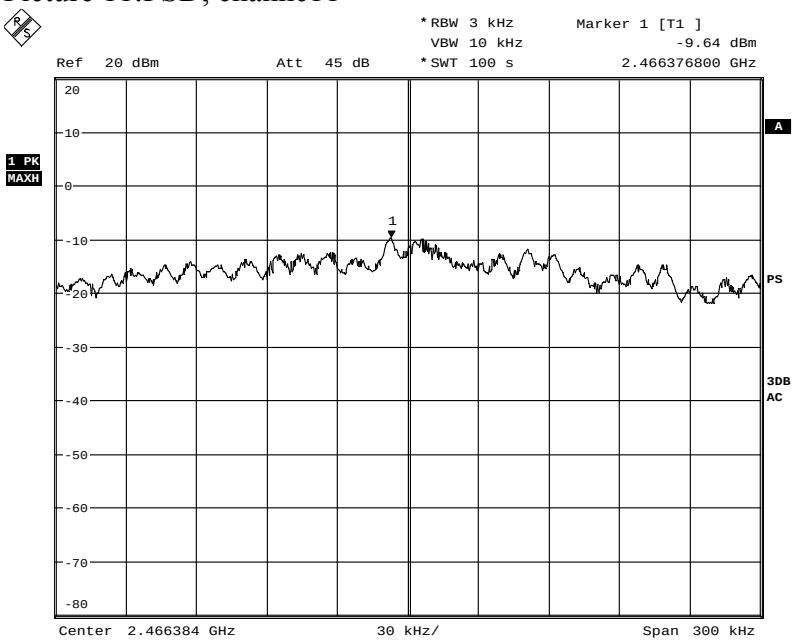
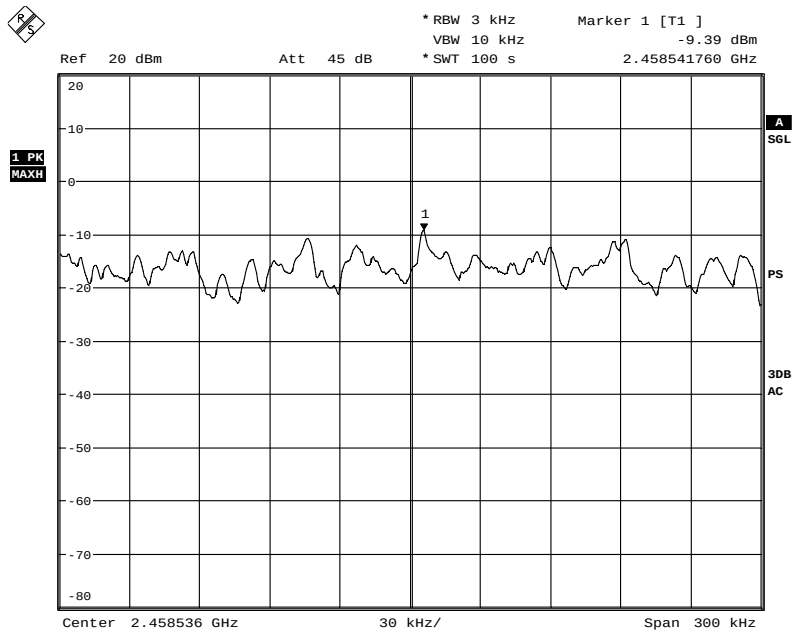
Picture 11:PSD, channe11





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10 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

EUT	2		
Accessories	-		
Temp, Humidity, Air Pressure	19ºC	18,9RH%	1013hPa
Date of measurement	FEB. 14.2012		
FCC rule part	15.247, d		
RSS-210 section	A8.5		
Measured by			

10.1 Test setup and measurement method

Band edge compliance of RF-conducted emissions was measured by setting the band edge as center frequency in the spectrum analyzer and measuring the power on the transmission on channels 1 and 11. The measured power and power on the band edge was then compared.

10.2 Results

10.2.1 EUT operation mode

EUT operation mode	Connection, 5,5 MBps and 54 MBps dataspeed
EUT channel	1 and 11
EUT TX power level	max

10.2.2 Results

Table 9: Band edge measurement results 54 MBps

EUT Channel	Limit (dBc)	Test result (dBc)
1	≤ -30	-30,55
11		-44,88

Table 10: Band edge measurement results 5,5 MBps

EUT Channel	Limit (dBc)	Test result (dBc)
1	≤ -30	-44,67
11		-60,23

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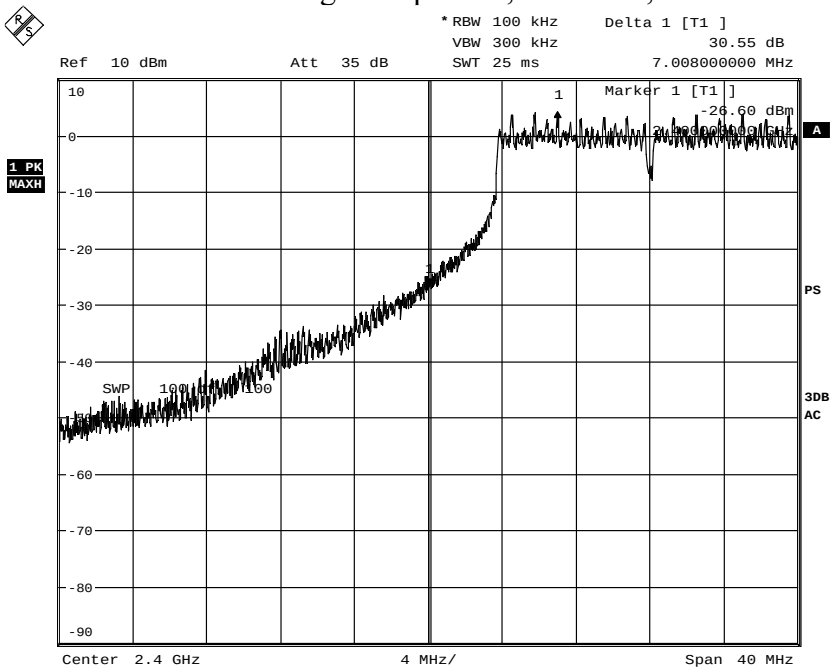
Screen shots

Picture 12: Band edge compliance, channel 1,



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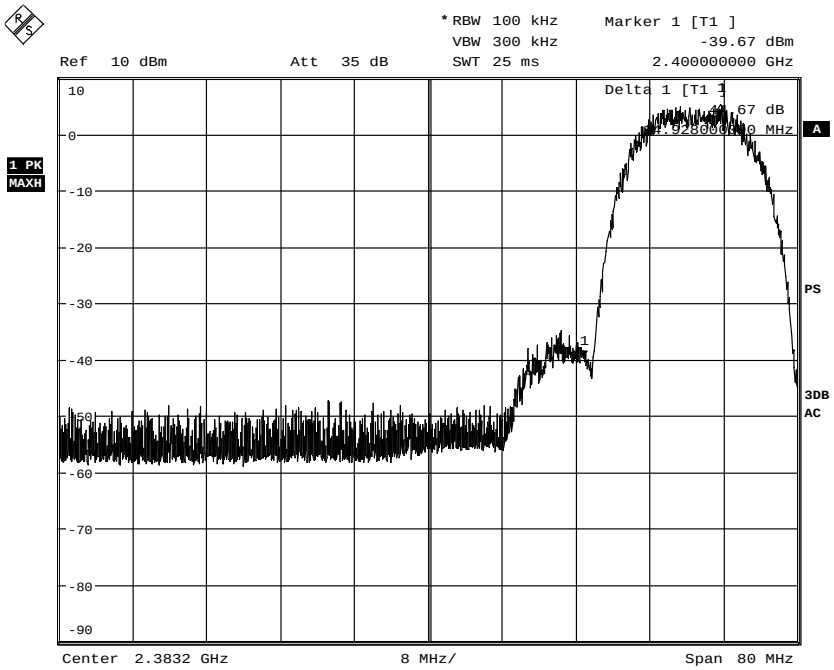

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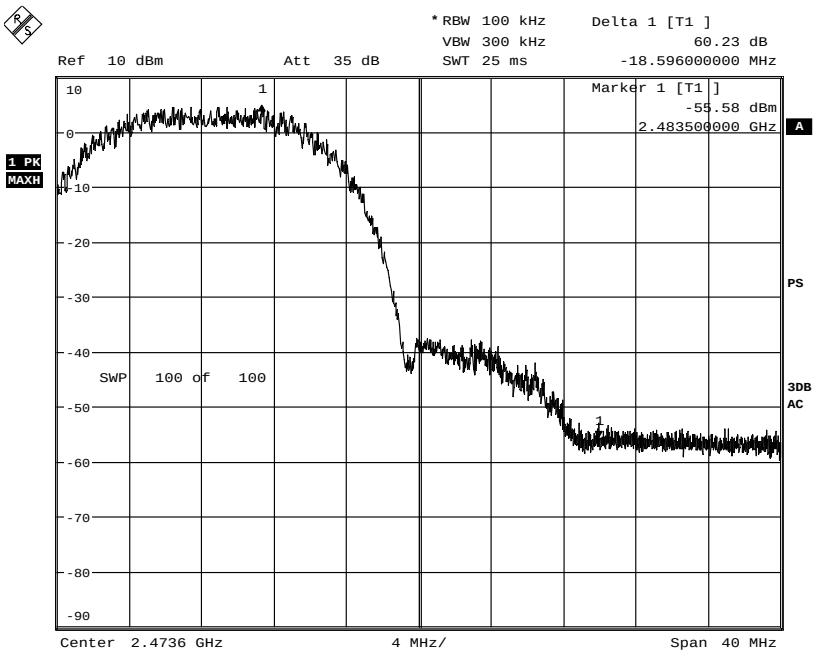
Picture 13: Band edge compliance, channel 11



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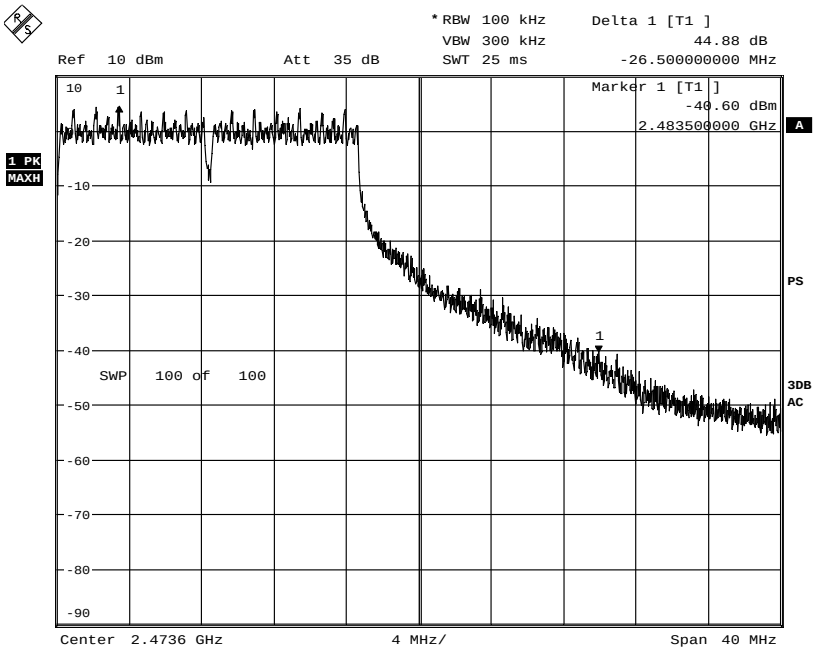

Date: 14.FEB.2012 09:29:20

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11 SPURIOUS RF CONDUCTED EMISSIONS

EUT	2		
Accessories	-		
Temp, Humidity, Air Pressure	19ºC	18,9RH%	1013hPa
Date of measurement	FEB. 14.2012		
FCC rule part	15.247, d		
RSS-210 section	A8.5		
Measured by	Matti Virkki		

11.1 Test setup and measurement method

Spectrum analyzer and automated software were used to record conducted spurious emissions on frequency range 30 MHz – 25 GHz. Frequency range was scanned using 100 kHz resolution bandwidth and 50 kHz steps.
Spurious emissions levels relative to the carrier level were read from the measured results.

11.2 EUT operation mode

EUT operation mode	Connection,
EUT channel	1, 6 and 11
EUT TX power level	max

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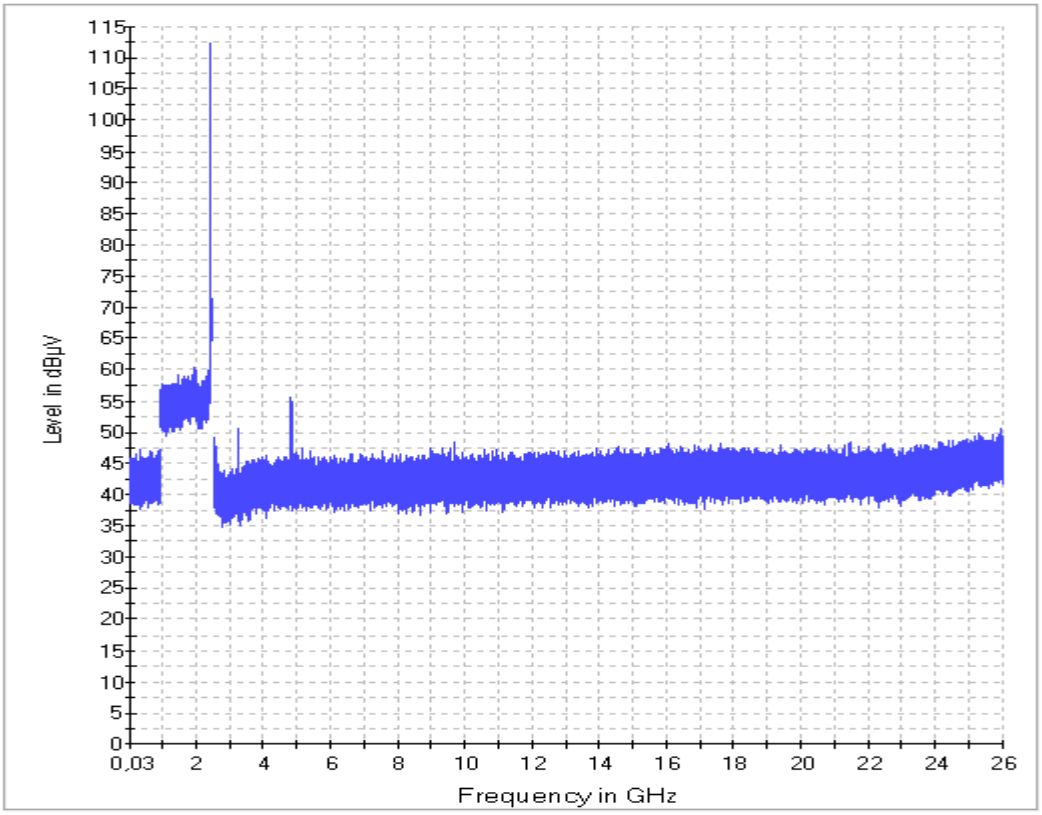
11.3 Limit

EUT Channel	Limit (dBc)
1	≤ -30
6	
11	

11.4 Results

All spurious emissions measured were least 35 dB below the carrier level.

Picture 14: Conducted spurious emissions on antenna port, Channel 1



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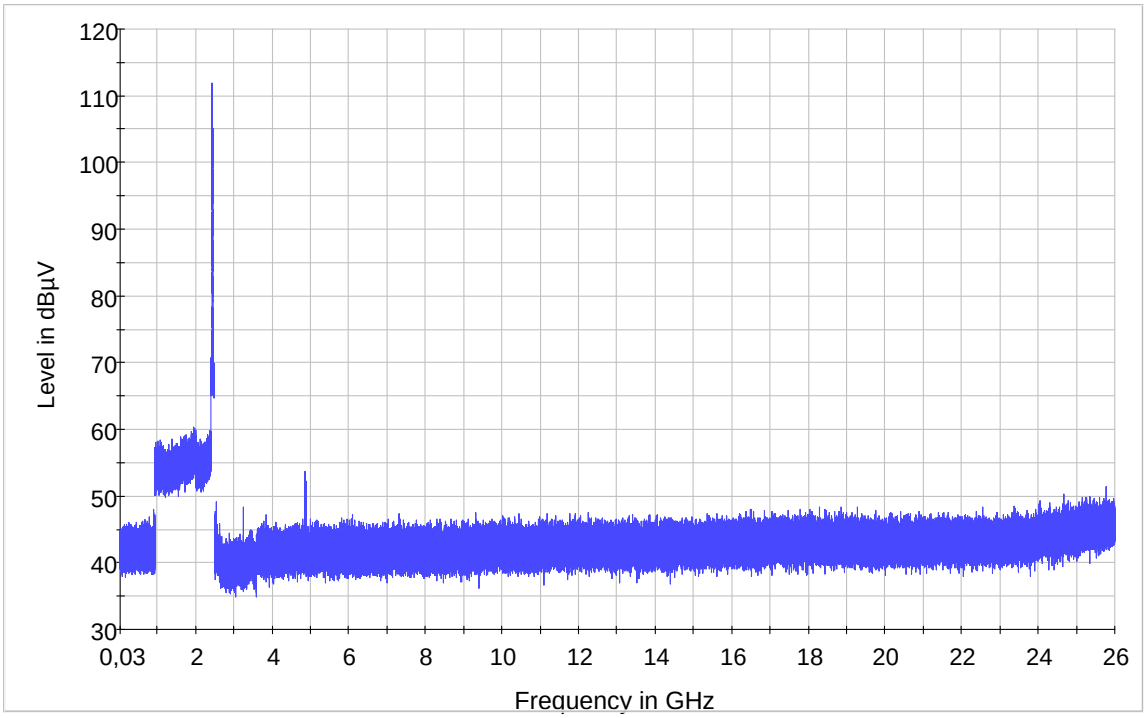
Picture 15: Conducted spurious emissions on antenna port, Channel 6



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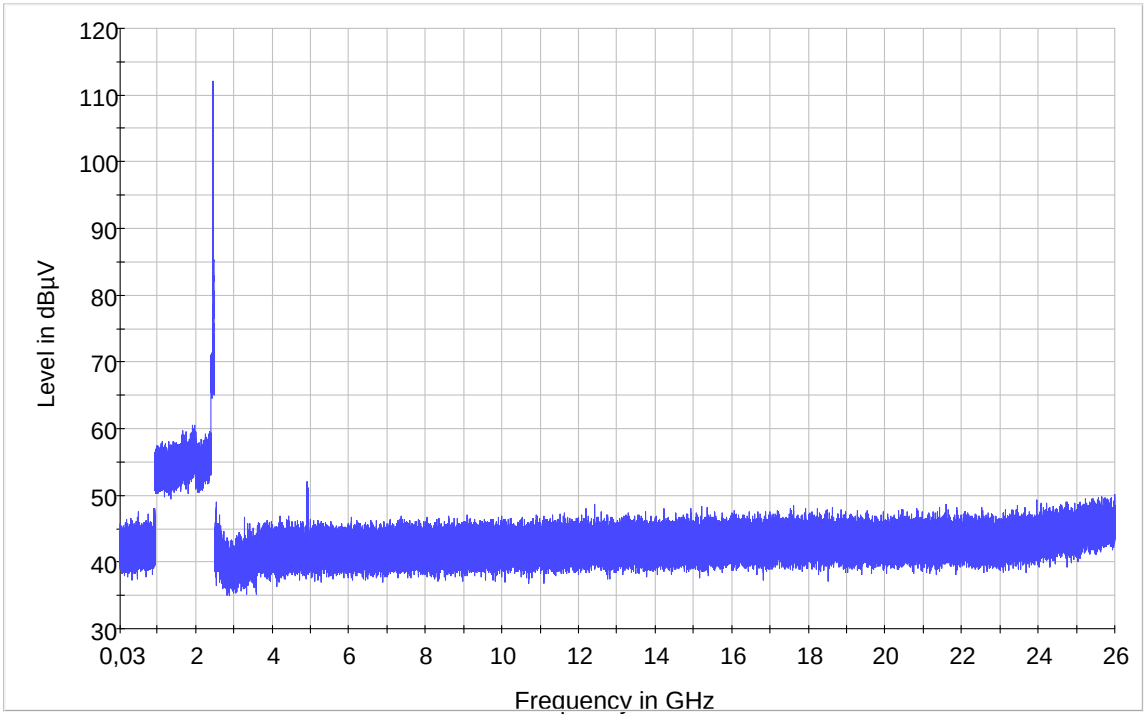
Picture 16: Conducted spurious emissions on antenna port, Channel 11



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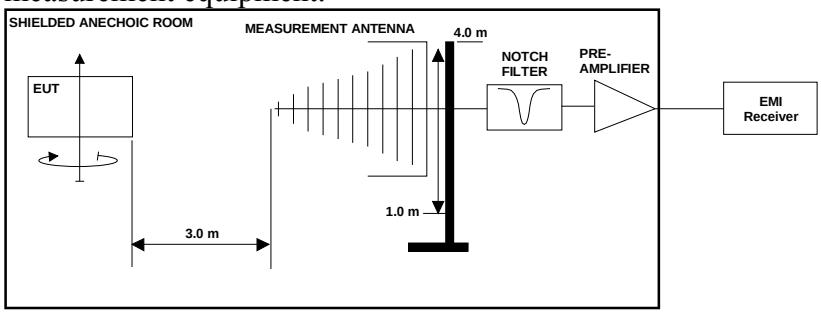
12 RADIATED SPURIOUS EMISSIONS

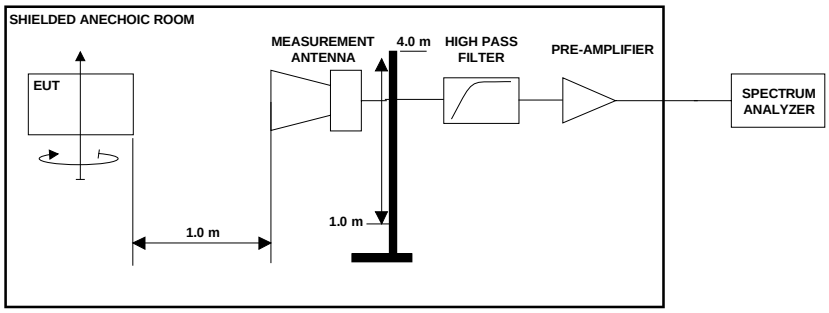
EUT	1		
Accessories	-		
Temp, Humidity, Air Pressure	19ºC	19RH%	1009hPa
Date of measurement	FEB. 13.2012		
FCC rule part	15.247, d		
RSS-210 section	A8.5		
Measured by	Matti Virkki		

12.1 Test setup

The test was done using an automated test system, where a computer controlled the measurement equipment.



Picture 17: Test setup for radiated spurious emissions measurement 30 MHz - 1 GHz frequencies



Picture 18: Test setup for radiated spurious emissions measurement 1 GHz – 25 GHz frequencies

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12.2 Test method

1. The emissions were searched and maximized by moving the turntable, changing the measuring antenna polarization and height and manipulating the EUT.
2. Levels of suspicious signals and levels of EUT transmitter harmonics were recorded.
3. The recorded levels were corrected in the automated test system with the measurement antenna factor, cable attenuations and filter attenuation.
4. The corrected values, giving the EUT radiated spurious emission levels as dBµV/m at 3 m distance, are reported.

12.3 EUT operation mode

EUT operation mode	Connection
EUT channel	1, 6 and 11
EUT TX power level	max

12.4 Limit

Table 11: Radiated spurious emission limits at measurement distance 3m

Frequency band (MHz)	3m Limit (µV/m)	3m Limit (dBµV/m)	Detector
30 – 88	100	40	QP
88 -216	150	43,5	QP
216 - 960	200	46	QP
960 - 1000	500	54,0	QP
1000 - 25000	500	54,0	AVG
1000 - 25000	5000	74,0	PEAK

As default, all emissions were compared against the general limits. If any emission exceeded that limit, it was further checked, if it was outside the restricted band thus complying with the -20dBc requirement.

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12.5 Results

Measurement system noise level was at least 15 dB below the spurious emission limit. Only levels of suspicious signals and transmitter harmonic frequencies, which were above the measurement system noise, are reported.

Table 12: Emission levels PEAK detector, channel 0

Freq MHz	Measured Value dBµV	Correction Factor dB	Result dBµV/m	Marginal dB	EUT Position	Ant Pol.	Ant height
4895,5	55,1	-8,2	46,9	7,9	Pos 1	H	1

Table 13: Emission levels PEAK detector, channel 6

Freq MHz	Measured Value dBµV	Correction Factor dB	Result dBµV/m	Marginal dB	EUT Position	Ant Pol.	Ant height
4833,8	53,7	-8,4	49,3	4,6	Pos 1	H	1

Table 14: Emission levels PEAK detector, channel 11

Freq MHz	Measured Value dBµV	Correction Factor dB	Result dBµV/m	Marginal dB	EUT Position	Ant Pol.	Ant height
4906,6	53,5	-8,2	45,3	8,7	Pos 1	H	1,2 m
7380,3	43,0	0,4	43,4	10,6	Pos 1	H	1

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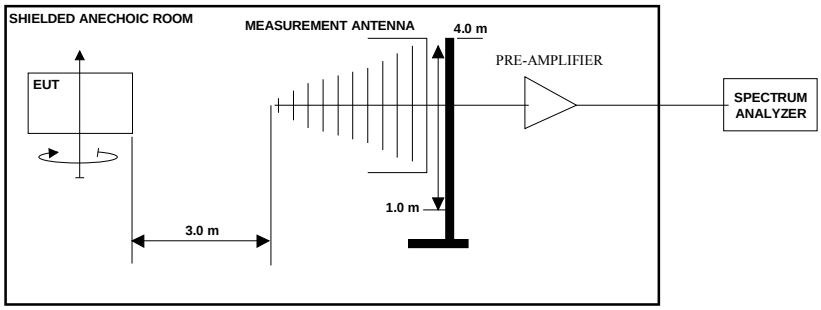
13 RECEIVER RADIATED EMISSION

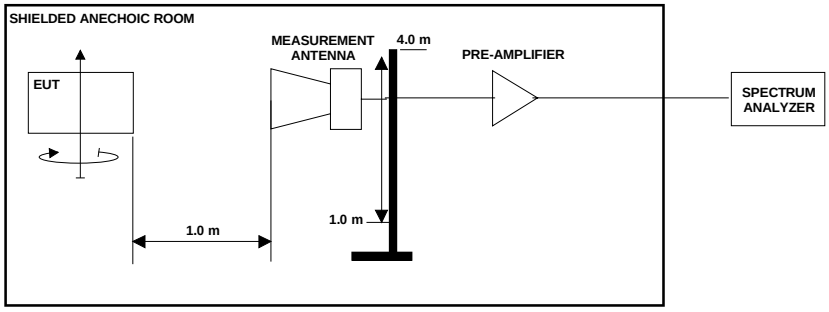
EUT	1		
Accessories	-		
Temp, Humidity, Air Pressure	19ºC	19RH%	1009hPa
Date of measurement	FEB. 13.2012		
FCC rule part	§15.109		
RSS-GEN section	7.2.3		
ICES-003 section	5.5		
Measured by	Matti Virkki		

13.1 Test setup

The test was done using an automated test system, where a computer controlled the measurement equipments.



Picture 19: Test setup for radiated spurious emissions measurement 30 MHz - 1 GHz frequencies



Picture 20: Test setup for radiated spurious emissions measurement 1 GHz – 12,4 GHz frequencies

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13.2 Test method

1. The emissions were searched and maximized by moving the turntable, changing the measuring antenna polarization and height and manipulating the EUT.
2. Levels of suspicious signals and levels of EUT transmitter harmonics were recorded.
3. The recorded levels were corrected in the automated test system with the measurement antenna factor, cable attenuations and filter attenuation.
4. The corrected values, giving the EUT radiated spurious emission levels as dBµV/m at 3 m distance, are reported.

13.3 EUT operation mode

EUT operation mode	Receiver mode
EUT frequency	Na
EUT TX power level	Na

13.4 Limit

Table 15: Radiated spurious emission limits at measurement distance 3m

Frequency band (MHz)	3m Limit (µV/m)	3m Limit (dBµV/m)	Detector
30 – 88	100	40	QP
88 -216	150	43,5	QP
216 - 960	200	46	QP
960 - 1000	500	54,0	QP
1000 - 12400	500	54,0	AVG
1000 - 12400	5000	74,0	PEAK

As default, all emissions were compared against the general limits. If any emission exceeded that limit, it was further checked, if it was outside the restricted band thus complying with the -20dBc requirement.

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13.5 Results

The measured interference values using Quasi peak and average detectors are shown in the pictures below.

All signals closer than 6 dB to the limit below 1 GHz have been measured using quasi peak or average detector and reported in the table 16, 17 .

Table 16: Radiated emissions using Quasi peak detector

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Ant. Pol	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
213,44	30,6	5000	120	125,0	H	7,0	15,7	12,9	43,5
798,00	42,3	5000	120	100,0	H	183,0	25,3	3,7	46,0

Table 17: Radiated emissions using Peak detector

Frequency (MHz)	MaxPeak-MaxHold (dBµV/m)	Average MaxHold (dBµV/m)	Height (cm)	Ant. Pol	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1063,92	40,4	37,4	125,0	H	302,0	-15,8	13,5	53,9
1330,38	39,8	35,0	100,0	H	27,0	-16,3	14,1	53,9
1462,91	38,2	33,5	100,0	H	359,0	-17,0	15,7	53,9
1596,27	42,3	36,9	125,0	H	0,0	-18,1	11,6	53,9
1728,77	38,4	33,1	100,0	H	294,0	-18,5	15,5	53,9

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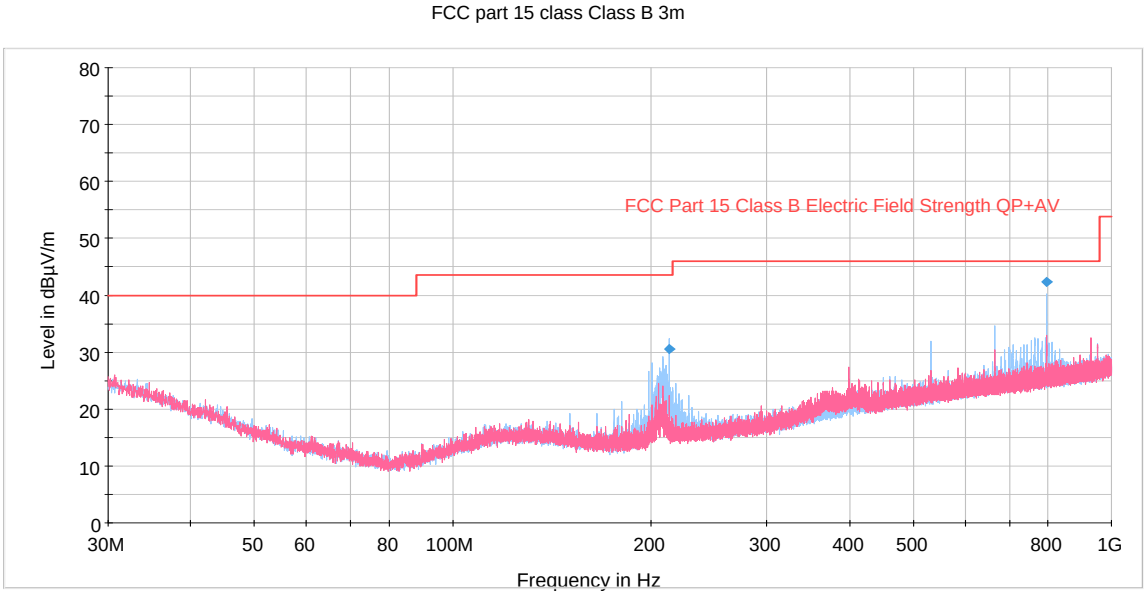
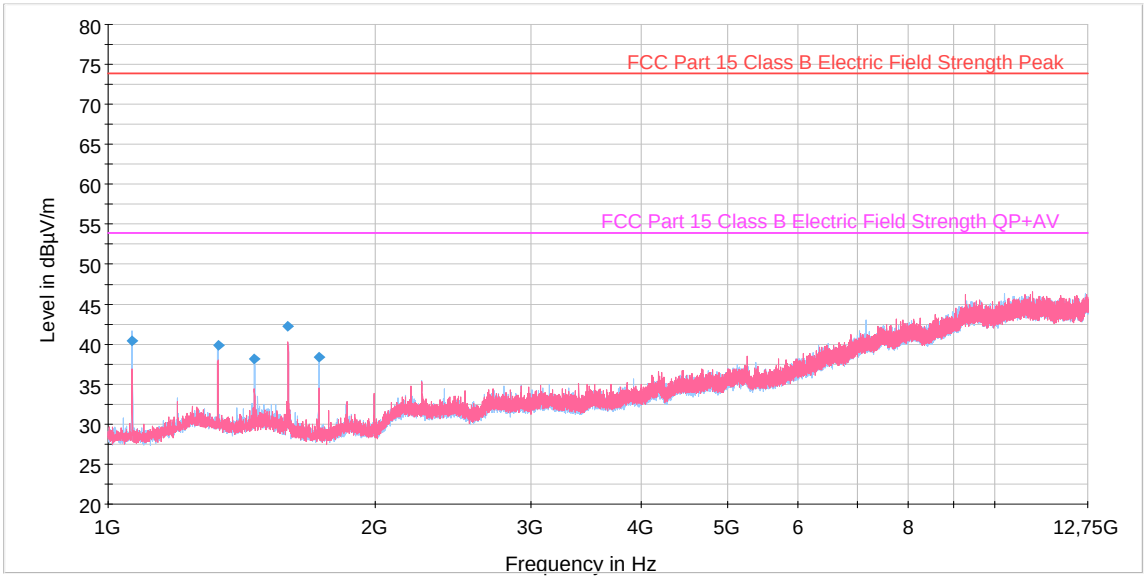
Picture 21: radiated emission results, 30 – 1000 MHz,
Red= horizontal polarization, blue = vertical polarization



Picture 22: radiated emission results, 1 – 12,4 GHz,
Red= horizontal polarization, blue = vertical polarization



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14 TEST EQUIPMENT

14.1 Conducted measurements

DEVICE	MANUFACTURER	SPKTT	SERIAL
Spectrum analyser	Rohde & Schwarz ESU 26		
EMI test receiver	Rohde & Schwarz ESCS30	020	849650/0016
LISN	Rohde & Schwarz ESH3-Z5	049	833874/029
10dB trans.limitter	Chase CFL9206	004	1105

14.2 Radiated measurements

DEVICE	MANUFACTURER	SPKTT	SERIAL
Spectrum analyser	Rohde & Schwarz ESU 26	131	MY42000072
Bilog antenna	Chase CBL6143A	221	29611
3 dB attenuator	Huber+Suhner 3dB/2W	214	-
Horn Antenna	Schwarzbeck BBHA9120D	138	365
Horn Antenna	Schwarzbeck BBHA 9170	194	0313
Pre-amplifier	JCA 118-400	142	-
Pre-amplifier	Miteq 18-26GHz	191	1128879
High pass filter	Wainwright Instruments WHK3.0/18GST	141	3
High pass filter	Wainwright Instruments		
3m Semi-anechoic chamber	ETS Euroshield	081	-
Measuring software	Teseq Compliane3	-	Ver 4.01

15 TEST SETUP PHOTOGRAPHS

Test setup photograph can be found in a separate document

100469A-RF_PHOTOS.doc

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