REPORT: **Electromagnetic Compatibility (EMC) test report**
This report replaces the old test report T08-631C-EMC

PRODUCT:

Test item description:	Bluetooth heart rate monitor
Trade Mark:	Polar iWL
Model/Type reference:	iWL
Serial number:	-
Customer:	Polar Electro Oy Professorintie 5 90440 Kempele FINLAND
Contact person:	Jouni Savolainen
Manufacturer:	Polar Electro Oy Professorintie 5 90440 Kempele FINLAND

ORIGINAL DATE: **11.9.2008**
CORRECTED DATE: **8.1.2009**

TESTED BY:
Simo Ojanen ; Test engineer

APPROVED BY:
Tuomo Hahl ; Test engineer

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1 LABORATORY INFORMATION

Test Laboratory	INTERTEK ETL SEMKO OY EMC Laboratory Koneenkatu 12 / K17 05830 Hyvinkää FINLAND Tel: +358 10 424 6200 Fax: +358 10 424 6201 e-mail: firstname.surname@intertek.com
FCC registration number: **IC file number:**	910391 (January 27, 2003) IC 2042C-1 (May 14, 2003)

2 CUSTOMER INFORMATION

Client	Polar Electro Oy Professorintie 5 90440 Kempele Finland Tel. +358 8 520 2100 Fax +358 8 520 2200
Contact person:	Jouni savolainen Polar Electro Oy Professorintie 5 90440 Kempele Finland Tel: +358 8 520 2100 Fax: +358 8520 2200
Testing date:	July 7, 2008 - September 1, 2008
Report date:	September 9, 2008

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

3 SUMMARY OF TEST RESULTS

Transmitter measurements

Section in CFR 47	Section in RSS-210	Test	Result
15.247, a 1	A8.1 (2)	Carrier frequency separation	PASS
15.247, a 1 iii	A8.1 (4)	Number of hopping frequencies	PASS
15.247, a 1 iii	A8.1 (4)	Time of occupancy	PASS
15.247, a	A8.1 (1)	20dB bandwidth	PASS
15.247, b 1	A8.4 (2)	Peak output power	PASS
15.247, d	A8.5	Band-edge compliance of RF emissions	PASS
15.247, d	A8.5	Spurious RF conducted emissions	PASS
15.247, d	A8.5	Spurious radiated emissions	PASS
	RSS-GEN 4.4.1	99% bandwidth	PASS

Receiver measurements

Section in CFR 47	Section in RSS-GEN	Section in ICES-003	Test	Result
§15.107	7.2.2	5.3	Conducted emissions to AC-power lines	N/A
§15.109	7.2.3	5.5	Radiated emissions	PASS

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

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4 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	Bluetooth heart rate monitor	Polar iWL	-	1
	Bluetooth heart rate monitor	Polar iWL	-	2 *
	Bluetooth heart rate monitor	Polar iWL	A27	3 **
	Bluetooth heart rate monitor	Polar iWL	A28	4 **
	Bluetooth heart rate monitor	Polar iWL	A29	5 **
Accessories	BT communication tester	Agilent N4010A	GB46170528	6

Notes:

* Antenna replaced with SMA-connector

** Modified for continuous transmission

4.1 EUT description

EUT is battery powered Bluetooth heart rate monitor.

The EUT was not modified during the tests.

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5 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 18.

6 APPLICABLE STANDARDS

The tests were performed in guidance of:

CFR 47 part:

§15.109
§15.209
§15.247
ANSI C63.4, 2003

IC standard:

RSS-GEN, Issue 1
RSS-210, Issue 7
CISPR 22, 2002

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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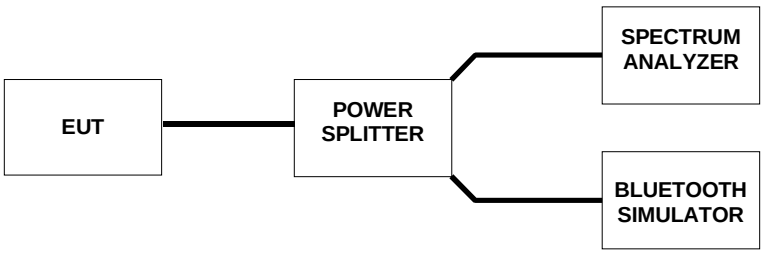
7 CARRIER FREQUENCY SEPARATION

EUT	2		
Accessories	6		
Temp, Humidity, Air Pressure	23 ºC	42 RH%	993 hPa
Date of measurement	August 22, 2008		
FCC rule part	15.247, a 1		
RSS-210 section	A8.1 (2)		
Measured by	Simo Ojanen		

7.1 Test setup and testing method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 1: Test setup for carrier frequency separation measurement

Spectrum analyzer was set to sweep the Bluetooth operating band 2,40 – 2,483 GHz.
30 kHz resolution bandwidth and maximum hold function was used to measure the EUT transmission over sufficient time. Carrier frequency separation was read from the screen.

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7.2 EUT operation mode

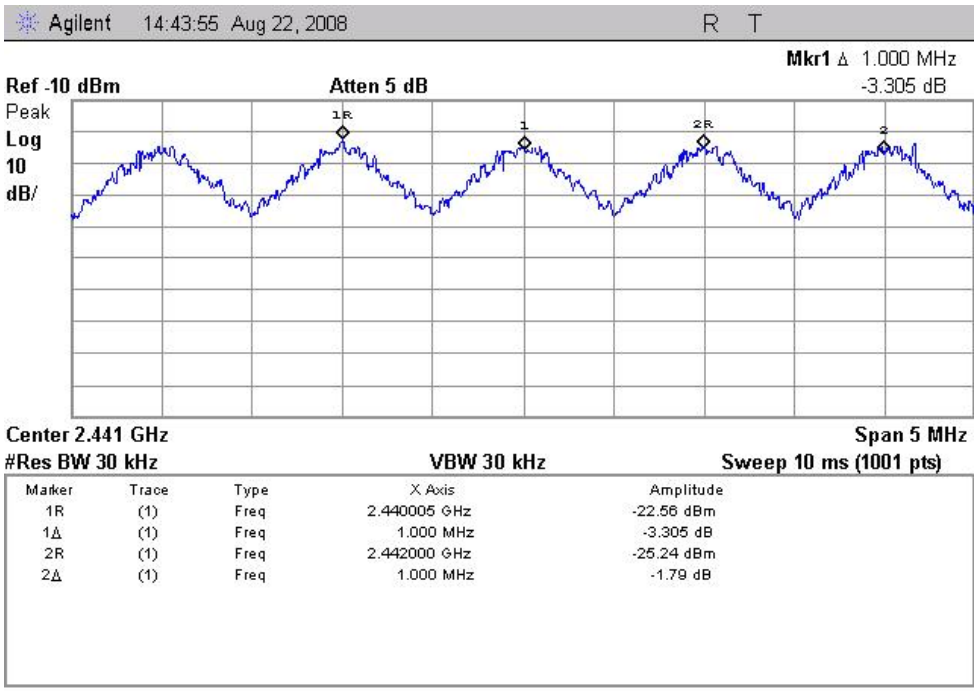
EUT operation mode	Connection, GFSK modulation, PRBS packet type
EUT channel	Hopping
EUT TX power level	max

7.3 Results

Table 1: Carrier frequency separation measurement results

Limit	Result
2/3 * 20dB bandwidth	1,00 MHz

7.4 Screen shots



Picture 2: Carrier frequency separation, Channels 38 and 39

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7.5 EUT operation mode

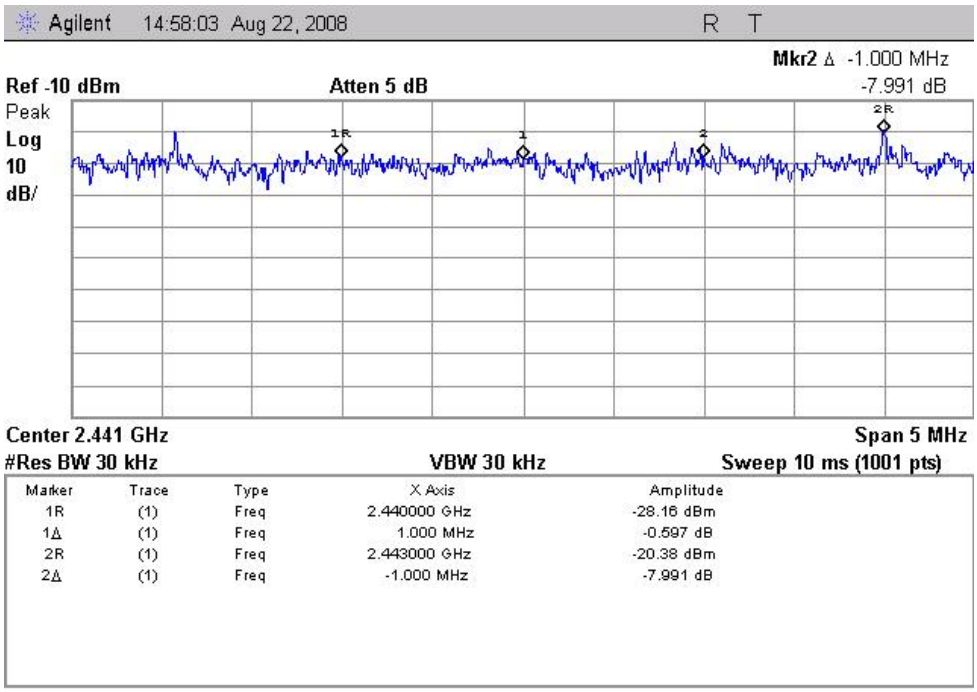
EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	Hopping
EUT TX power level	max

7.6 Results

Table 2: Carrier frequency separation measurement results

Limit	Result
2/3 * 20dB bandwidth	1,00 MHz

7.7 Screen shots



Picture 3: Carrier frequency separation, Channels 38 and 39

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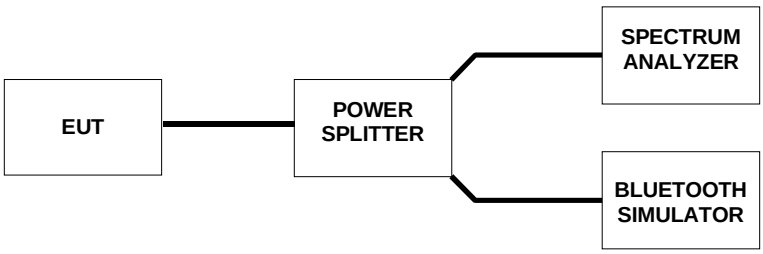
8 NUMBER OF HOPPING FREQUENCIES

EUT	2		
Accessories	6		
Temp, Humidity, Air Pressure	23 ºC	42 RH%	993 hPa
Date of measurement	August 22, 2008		
FCC rule part	15.247, a 1 iii		
RSS-210 section	A8.1 (4)		
Measured by	Simo Ojanen		

8.1 Test setup

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 4: Test setup for measurement of number of hopping frequencies

Spectrum analyzer was set to sweep the Bluetooth operating band 2,40 – 2,483 GHz.
300 kHz resolution bandwidth and maximum hold function was used to measure the EUT transmission over sufficient time. Number of hopping frequencies was calculated from the screen.

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8.2 EUT operation mode

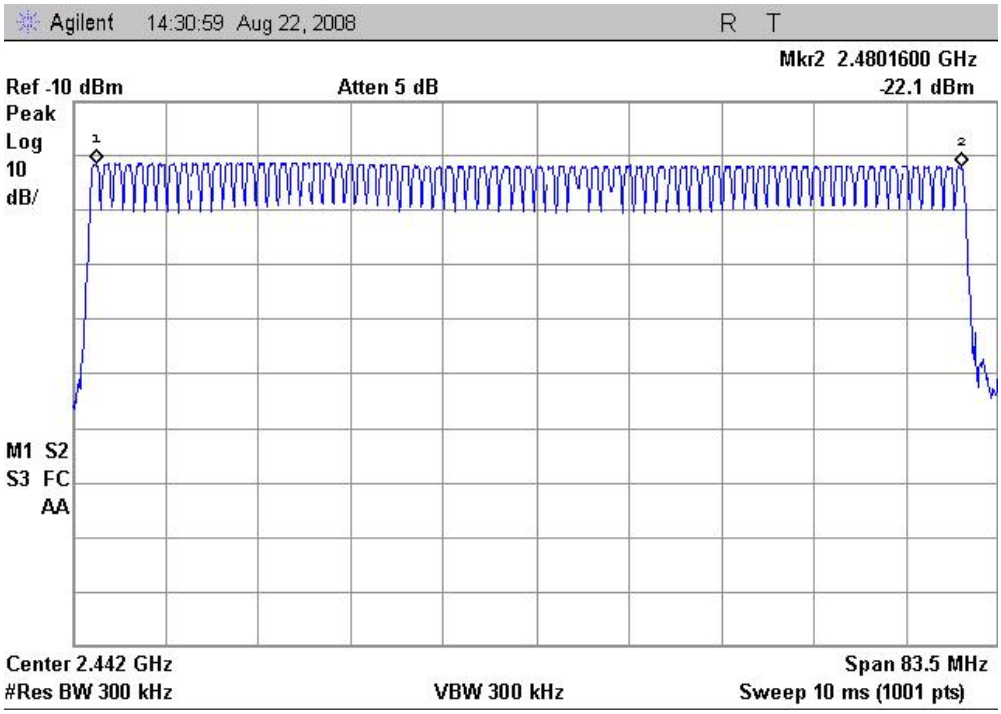
EUT operation mode	Connection, GFSK modulation, PRBS packet type
EUT channel	Hopping
EUT TX power level	max

8.3 Results

Table 3: Number of hopping frequencies measurement results

Limit	Result
≥ 75	79

8.4 Screen shots



Picture 5: Number of hopping frequencies measurement

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8.5 EUT operation mode

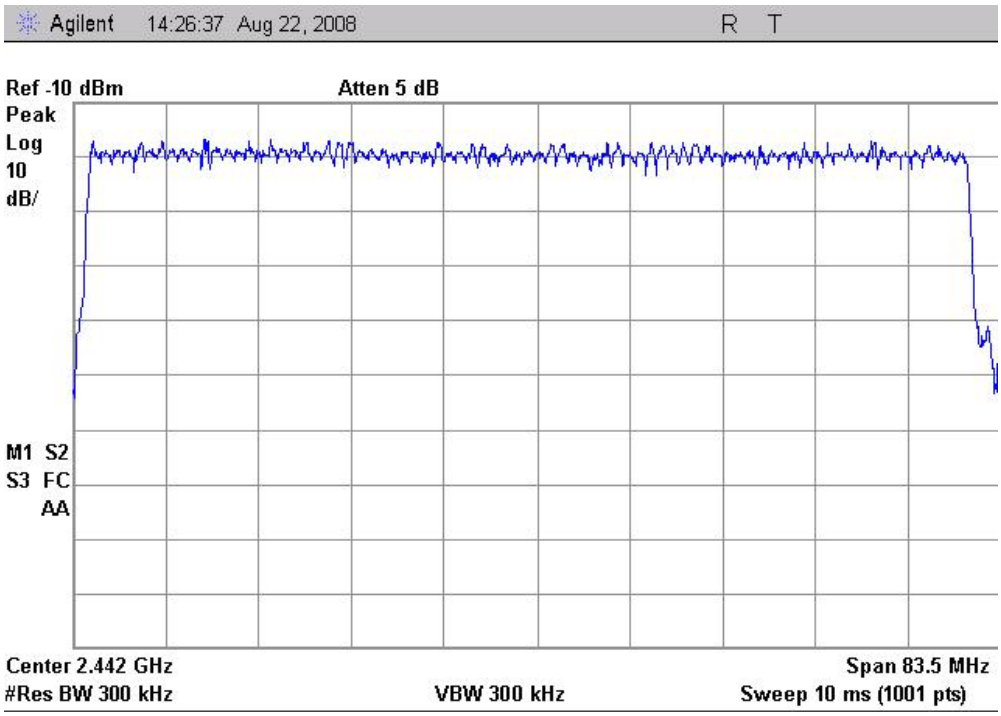
EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	Hopping
EUT TX power level	max

8.6 Results

Table 4: Number of hopping frequencies measurement results

Limit	Result
≥ 75	79

8.7 Screen shots



Picture 6: Number of hopping frequencies measurement

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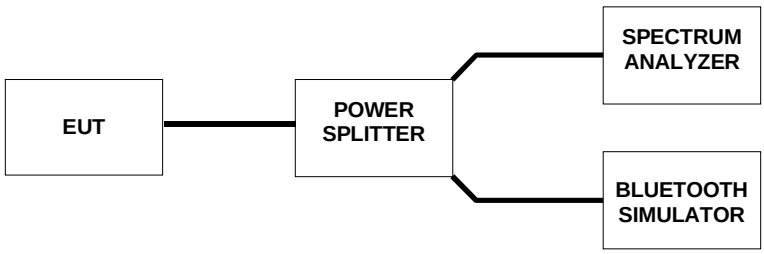
9 TIME OF OCCUPANCY

EUT	2		
Accessories	6		
Temp, Humidity, Air Pressure	23 ºC	42 RH%	993 hPa
Date of measurement	August 22, 2008		
FCC rule part	15.247, a 1 iii		
RSS-210 section	A8.1 (4)		
Measured by	Simo Ojanen		

9.1 Test setup and testing method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 7: Test setup for conducted RF output power measurement

Spectrum analyzer with single sweep and 0 Hz span was used to monitor the transmitter operation over time.

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9.2 Connection mode

9.2.1 EUT operation mode

EUT operation mode	Connection, GFSK modulation, PRBS packet type
EUT channel	Hopping
EUT TX power level	max

9.2.2 Results

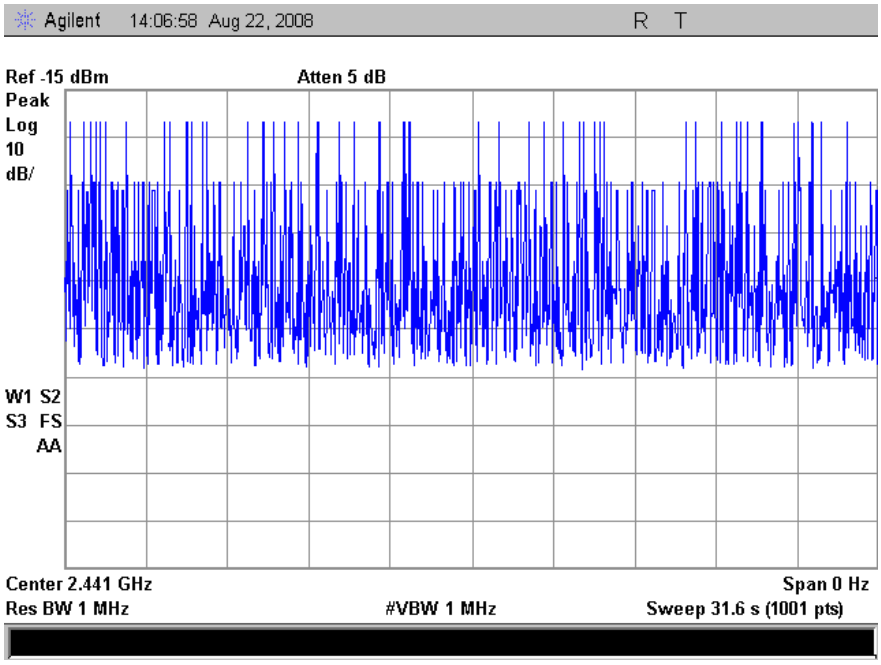
Table 5: Time of occupancy during connection mode measurement results

Limit	Result
≤ 0,4 s over 31,6 s period	0,1334 s

Limit:
In the connection mode Bluetooth uses 79 channels. As defined in 15.247, a 1 iii, the limit for time of occupancy is 0.4s over time of number of channels multiplied with 0,4s (79 * 0,4s = 31,6 s).

Results:
In measurement time of 31,6 s, total of 46 transmissions occurred. The duration of one transmission was 2,9ms. Based on these measurements the transmitter operated 46 * 2,9 ms = 0,1334 s during the 31,6 s period

9.2.3 Screen shots



Picture 8: Number of transmissions on connection state, channel 39

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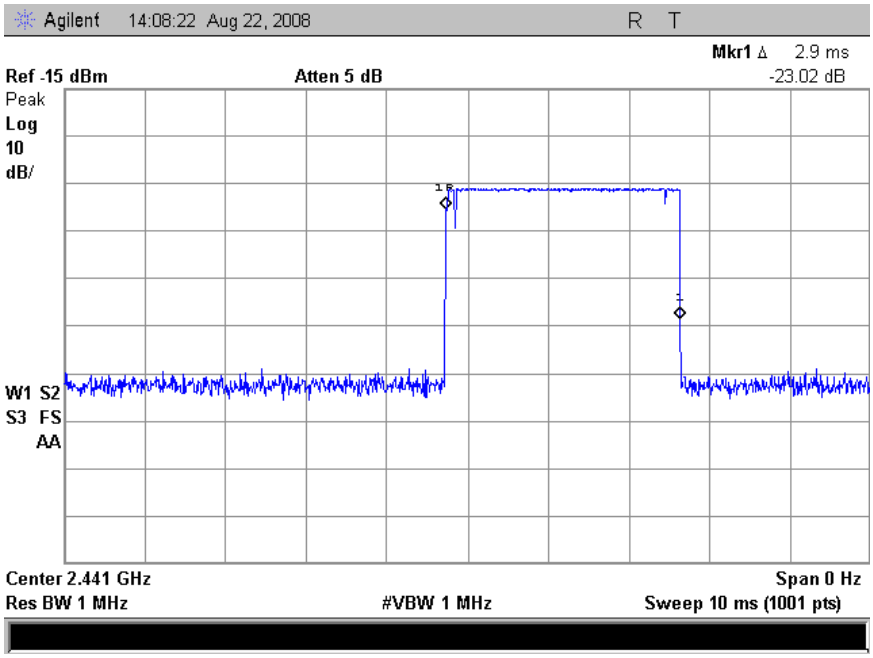

Picture 9: Duration of one transmission on connection state, channel 39

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9.2.4 EUT operation mode

EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	Hopping
EUT TX power level	max

9.2.5 Results

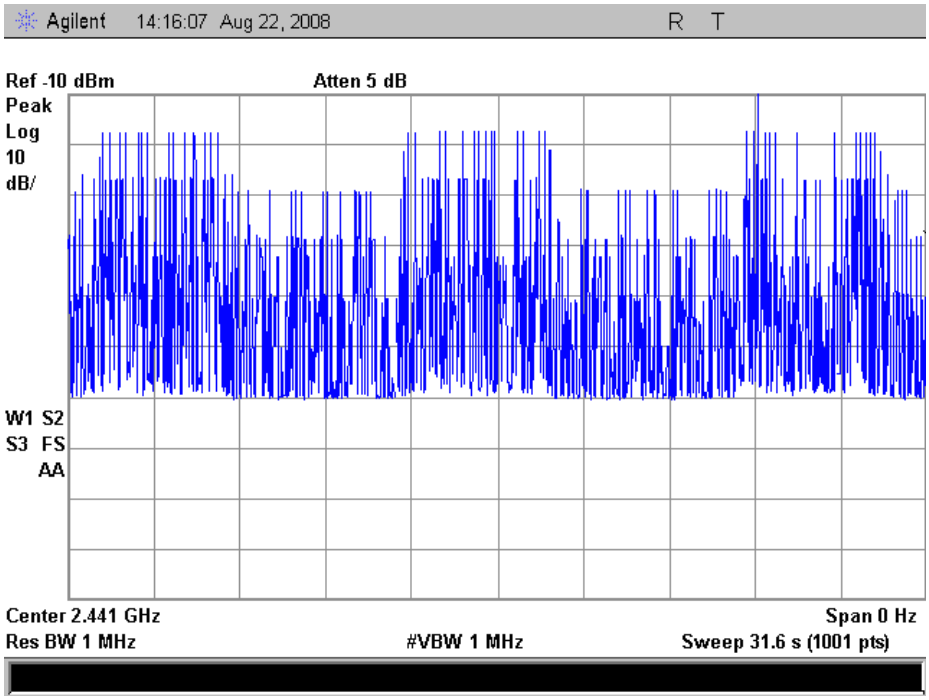
Table 6: Time of occupancy during connection mode measurement results

Limit	Result
≤ 0,4 s over 31,6 s period	0,1185 s

Limit:
In the connection mode Bluetooth uses 79 channels. As defined in 15.247, a 1 iii, the limit for time of occupancy is 0,4s over time of number of channels multiplied with 0,4s (79 * 0,4s = 31,6 s).

Results:
In measurement time of 31,6 s, total of 41 transmissions occurred. The duration of one transmission was 2,89ms. Based on these measurements the transmitter operated 41 * 2,89 ms = 0,1185s during the 31,6 s period

9.2.6 Screen shots



Picture 10: Number of transmissions on connection state, channel 39

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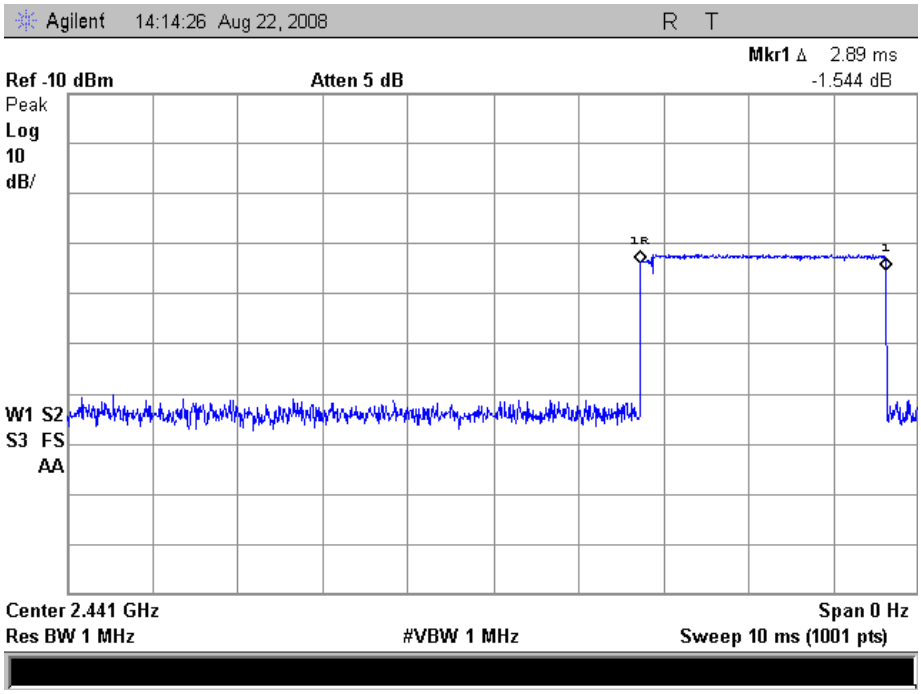

Picture 11: Duration of one transmission on connection state, channel 39

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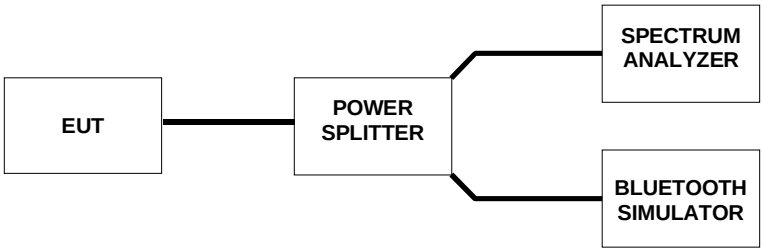
10 20 dB BANDWIDTH

EUT	2		
Accessories	6		
Temp, Humidity, Air Pressure	23 ºC	42 RH%	993 hPa
Date of measurement	August 22, 2008		
FCC rule part	15.247, a		
RSS-210 section	A8.1 (1)		
Measured by	Simo Ojanen		

10.1 Test setup and measurement method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 12: Test setup for conducted RF output power measurement

The 20dB bandwidth was measured using 10 kHz resolution bandwidth and maximum hold function of the spectrum analyzer. 20dB bandwidth was defined by measuring the maximum level on the measured channel and by placing display line 20 dB below this value and by reading the bandwidth from the intersection of the measured trace and display line.

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10.2 EUT operation mode

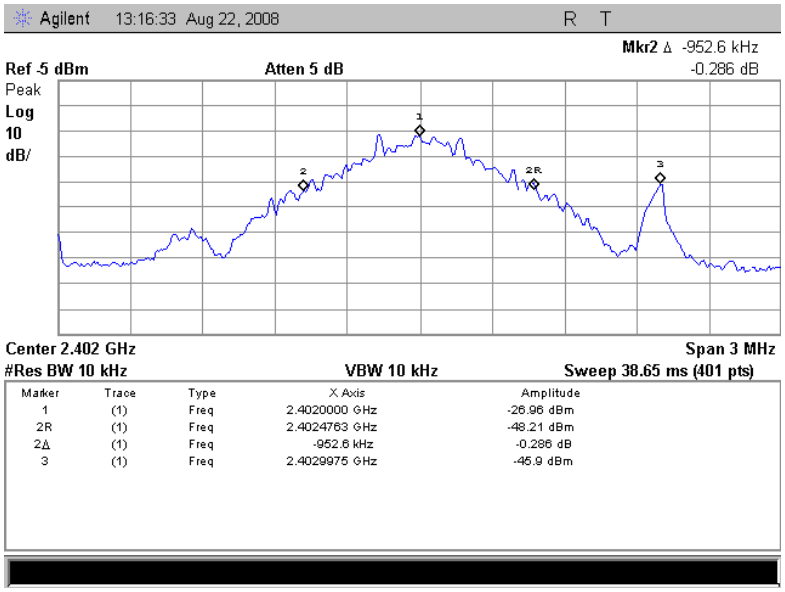
EUT operation mode	Connection, GFSK modulation, PRBS packet type
EUT channel	0, 39 and 78
EUT TX power level	max

10.3 Results

Table 7: 20dB bandwidth measurement results

EUT Channel	Limit (MHz)	Measured value (MHz)
0	N/A	1,476
39		1,478
78		1,466

10.4 Screen shots



Picture 13: 20dB Bandwidth measurement result, Channel 0

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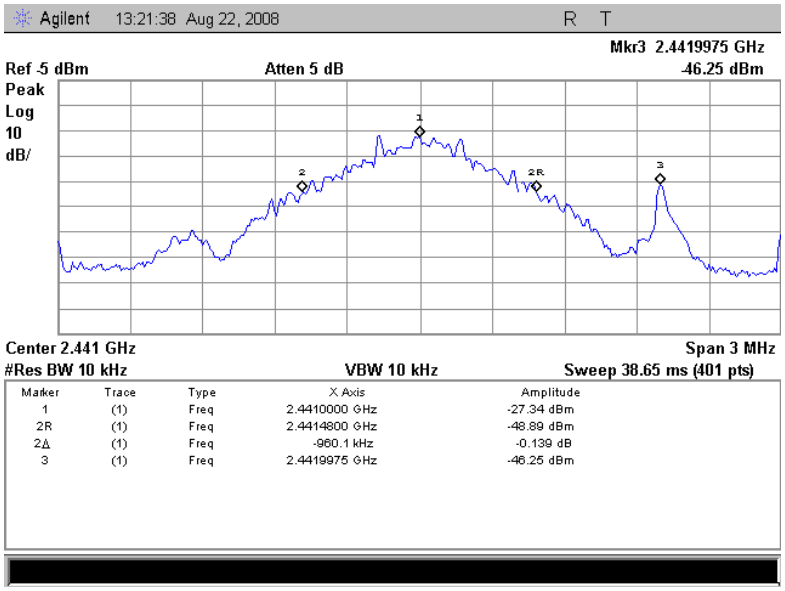
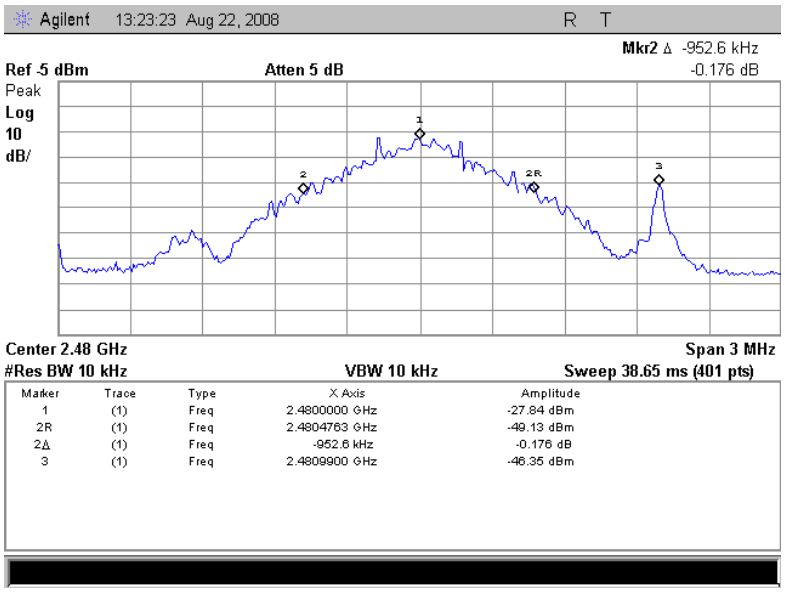


Picture 14: 20dB Bandwidth measurement result, Channel 39



Picture 15: 20dB Bandwidth measurement result, Channel 78

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10.5 EUT operation mode

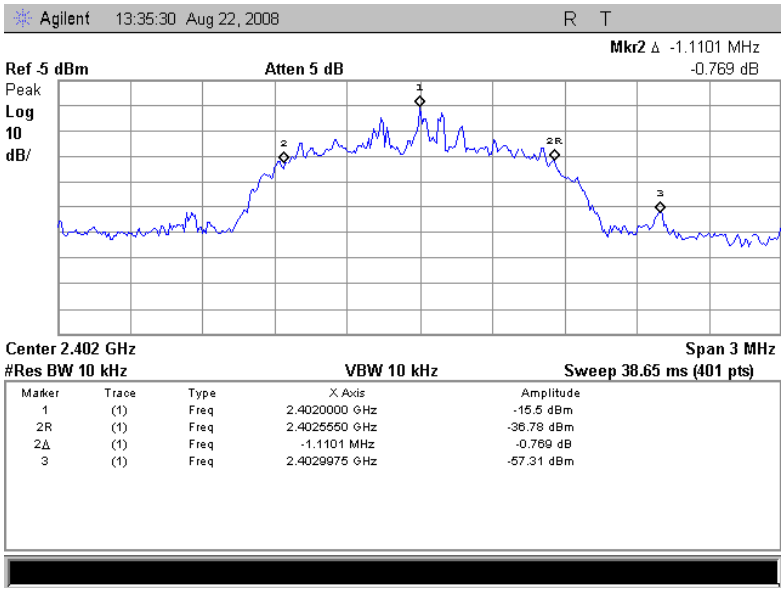
EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	0, 39 and 78
EUT TX power level	max

10.6 Results

Table 8: 20dB bandwidth measurement results

EUT Channel	Limit (MHz)	Measured value (MHz)
0	N/A	1,110
39		1,065
78		1,073

10.7 Screen shots



Picture 16: 20dB Bandwidth measurement result, Channel 0

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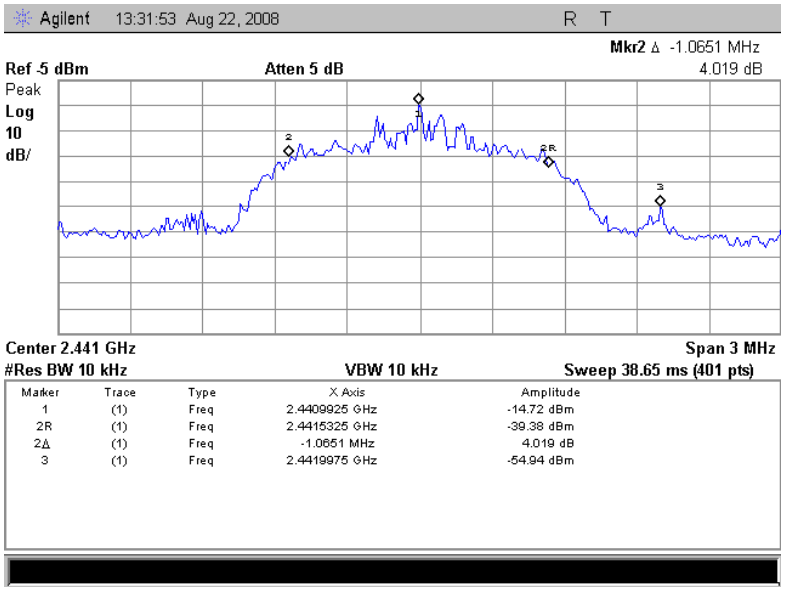
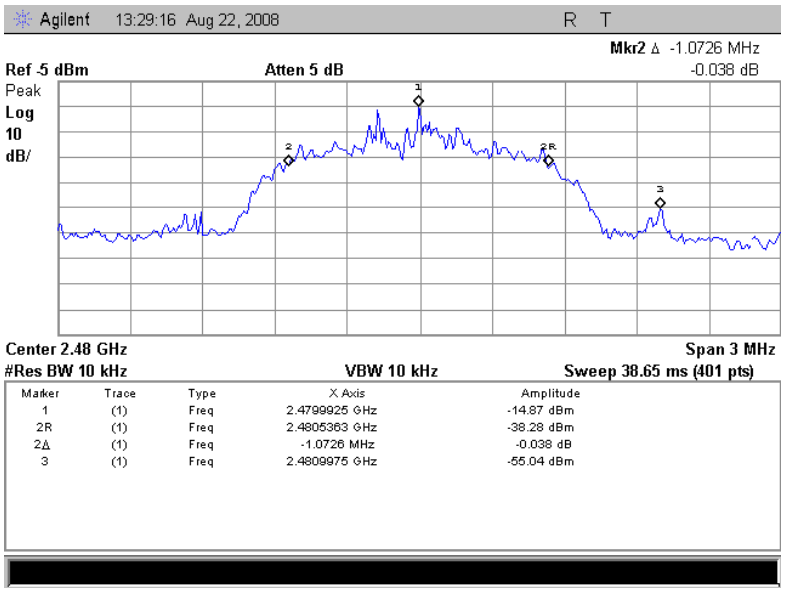


Picture 17: 20dB Bandwidth measurement result, Channel 39



Picture 18: 20dB Bandwidth measurement result, Channel 78

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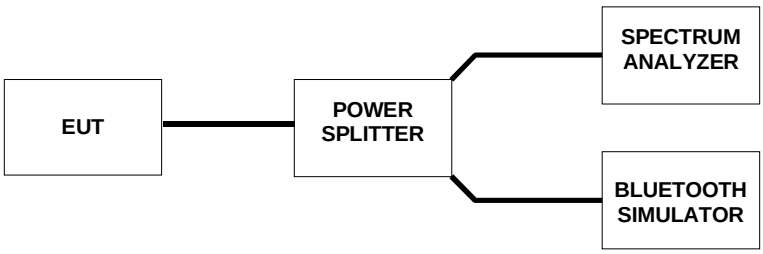
11 PEAK OUTPUT POWER

EUT	2		
Accessories	6		
Temp, Humidity, Air Pressure	23 ºC	42 RH%	993 hPa
Date of measurement	August 22, 2008		
FCC rule part	15.247, b 1		
RSS-210 section	A8.4 (2)		
Measured by	Simo Ojanen		

11.1 Test setup and measurement method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 19: Test setup for conducted RF output power measurement

In the peak output power measurement the power splitter, attenuator and cable attenuations were measured prior to the power measurement and set as parameter for cable loss in the spectrum analyzer to correct the reading of the peak output power. Spectrum analyzer subtracts the set attenuation value from the measured reading.
The measurement was made using 3 MHz resolution bandwidth and 3 MHz video bandwidth and maximum hold function to record the maximum peak output power.

11.2 EUT operation mode

EUT operation mode	Connection, GFSK modulation, PRBS packet type
EUT channel	0, 39 and 78
EUT TX power level	0 dBm

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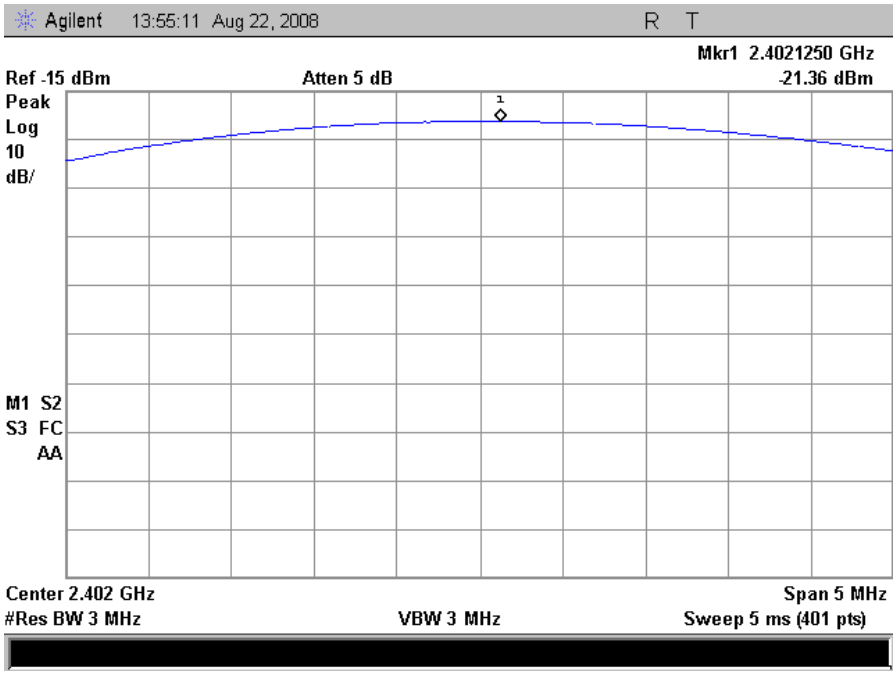
11.3 Results

Table 9: Peak output power measurement results

EUT Ch	Limit (dBm)	Cable attenuation (dB)	Measured value (dBm)	Corrected value (dBm)	Limit (W)	Test result (mW)
0	≤ 30	4,1	-21,3	-17,2	≤ 1	0,01897
39		4,1	-21,8	-17,6		0,01718
78		4,1	-21,8	-17,7		0,01683

11.4 Screen shots



Picture 20: Peak output power, channel 0

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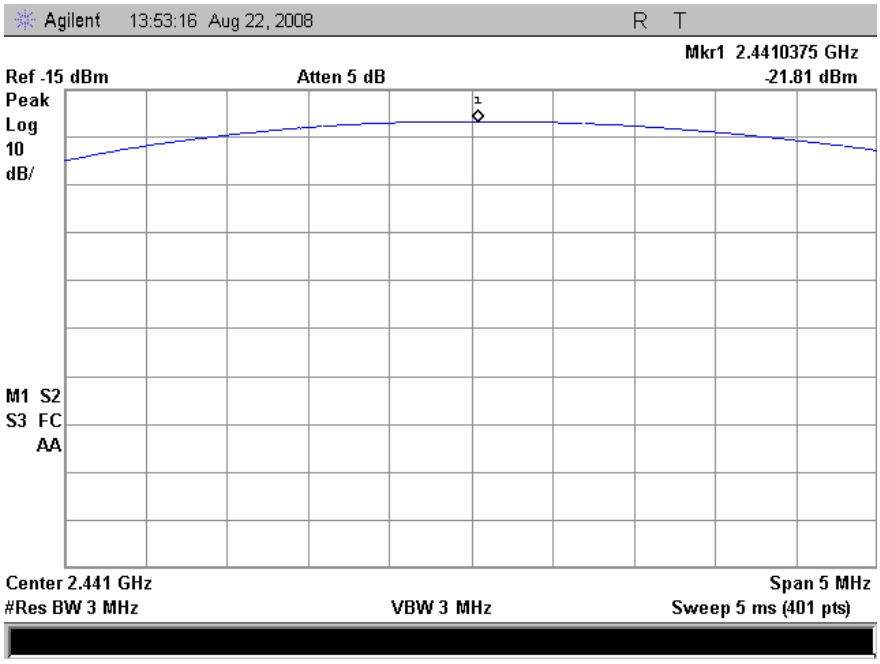
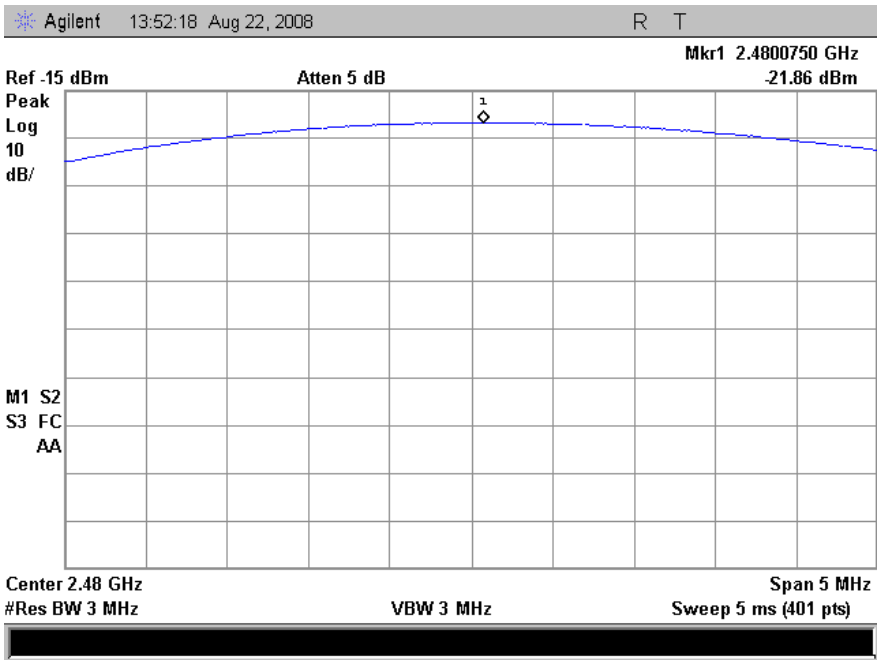


Picture 21: Peak output power, channel 39



Picture 22: Peak output power, channel 78

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11.5 EUT operation mode

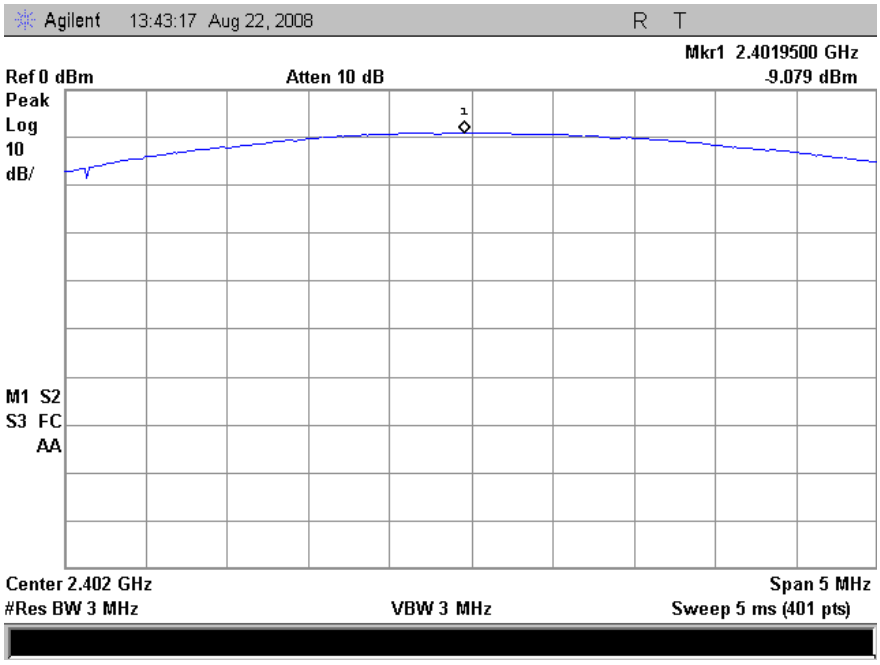
EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	0, 39 and 78
EUT TX power level	0 dBm

11.6 Results

Table 10: Peak output power measurement results

EUT Ch	Limit (dBm)	Cable attenuation (dB)	Measured value (dBm)	Corrected value (dBm)	Limit (W)	Test result (mW)
0	≤ 30	4,1	-9,1	-4,9	≤ 1	0,32070
39		4,1	-9,3	-5,2		0,30061
78		4,1	-9,7	-5,5		0,27555

11.7 Screen shots



Picture 23: Peak output power, channel 0

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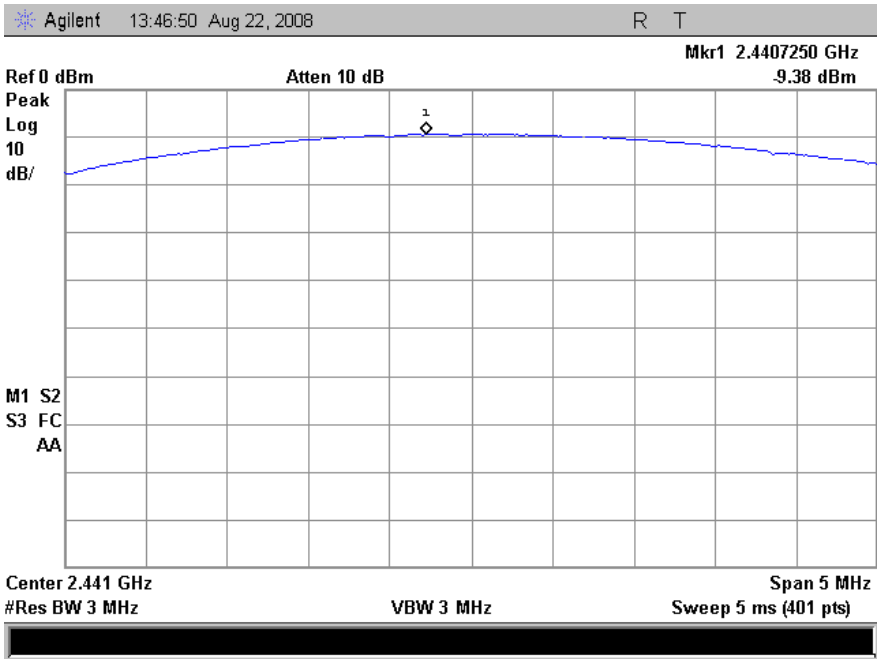
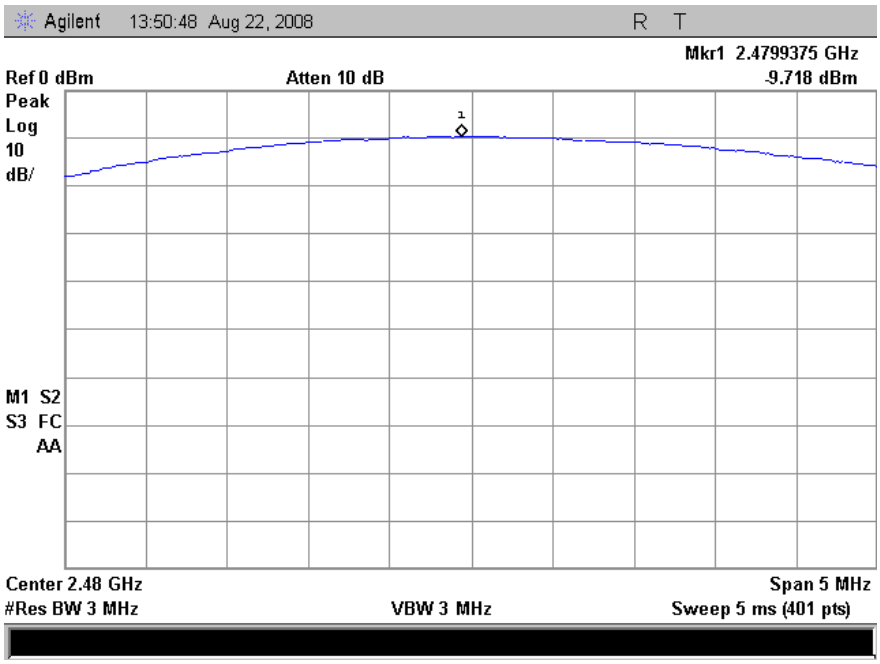


Picture 24: Peak output power, channel 39



Picture 25: Peak output power, channel 78

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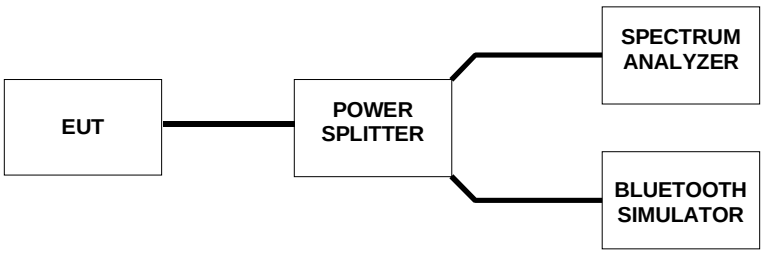
12 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

EUT	2		
Accessories	6		
Temp, Humidity, Air Pressure	23 ºC	42 RH%	993 hPa
Date of measurement	August 22, 2008		
FCC rule part	15.247, d		
RSS-210 section	A8.5		
Measured by	Simo Ojanen		

12.1 Test setup and measurement method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 26: Test setup for band edge compliance measurement

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 0 and 79. The measured power and power on the band edge was then compared.

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12.2 Hopping enabled

12.2.1 EUT operation mode

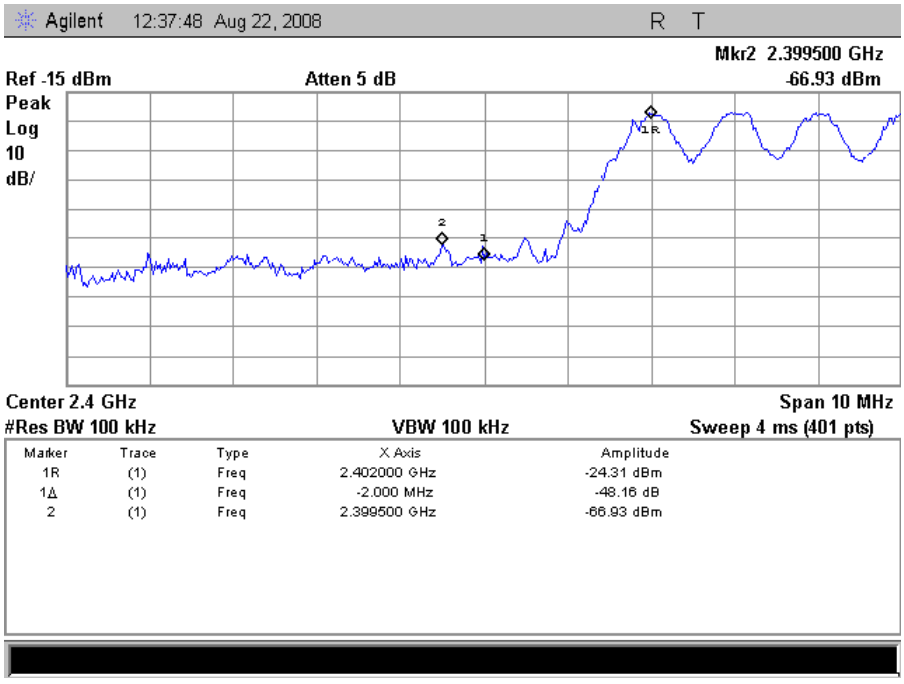
EUT operation mode	Connection, GFSK modulation, PRBS packet type
EUT channel	Hopping
EUT TX power level	max

12.2.2 Results

Table 11: Number of hopping frequencies measurement results

EUT Channel	Limit (dBc)	Test result (dBc)
0	≤ -20	-42,6
78		-40,7

12.2.3 Screen shots



Picture 27: Band edge compliance, channel 0, hopping enabled

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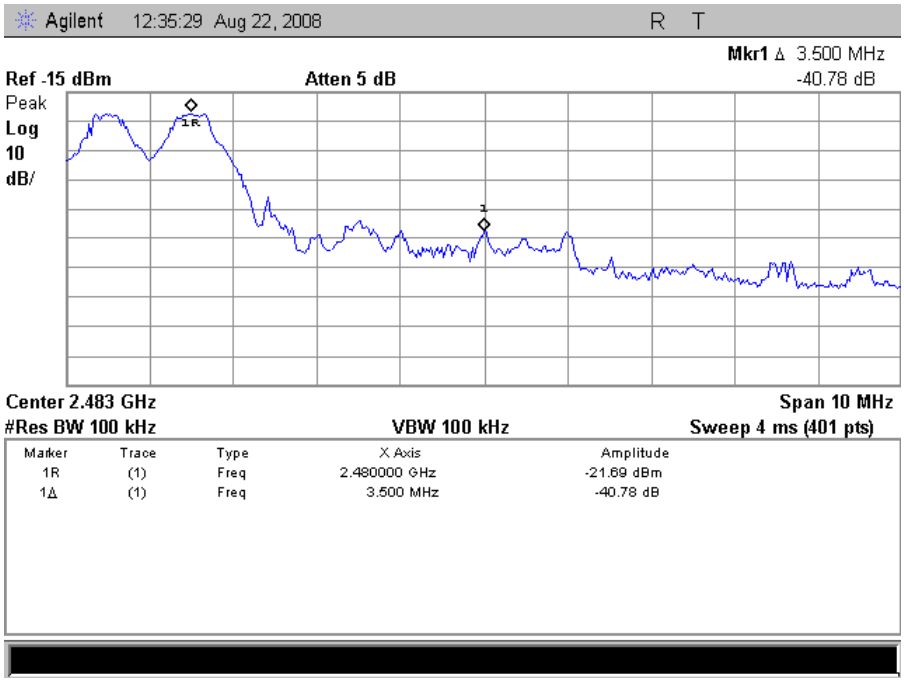

Picture 28: Band edge compliance, channel 78, hopping enabled

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12.2.4 EUT operation mode

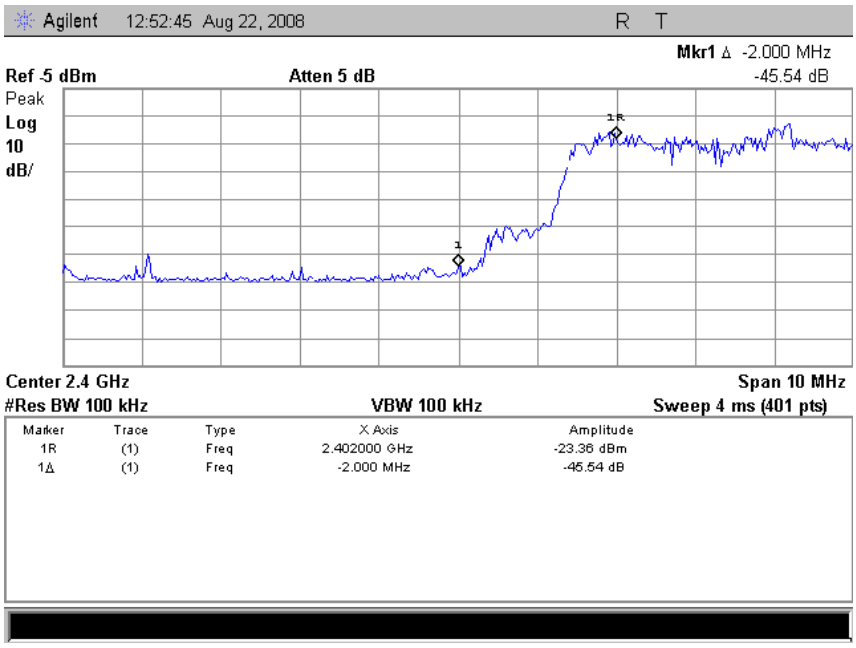
EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	Hopping
EUT TX power level	max

12.2.5 Results

Table 12: Number of hopping frequencies measurement results

EUT Channel	Limit (dBc)	Test result (dBc)
0	≤ -20	-45,5
78		-39,9

12.2.6 Screen shots



Picture 29: Band edge compliance, channel 0, hopping enabled

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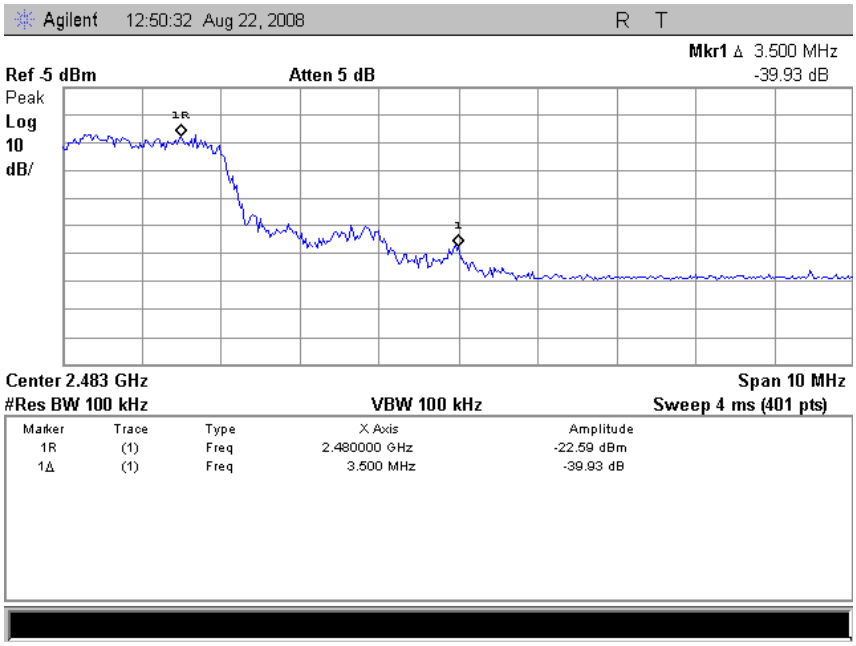

Picture 30: Band edge compliance, channel 78, hopping enabled

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12.3 Hopping disabled

12.3.1 EUT operation mode

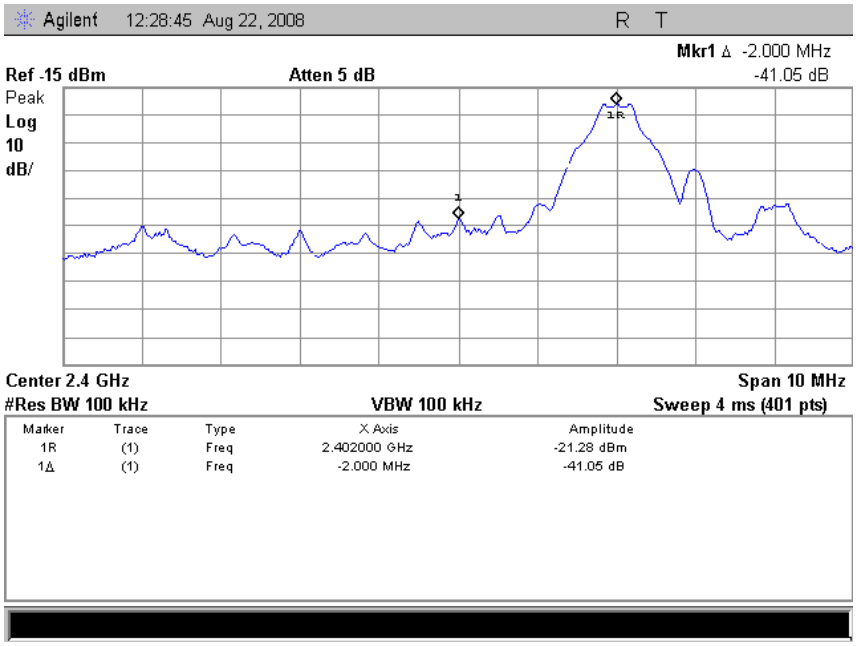
EUT operation mode	Connection, GFSK modulation, PRBS packet type
EUT channel	0 (2402 MHz), 78 (2480 MHz)
EUT TX power level	max

12.3.2 Results

Table 13: Band edge compliance measurement results

EUT Channel	Limit (dBc)	Test result (dBc)
0	≤ -20	-41,0
79		-40,4

12.3.3 Screen shots



Picture 31: Band edge compliance, channel 0, hopping disabled

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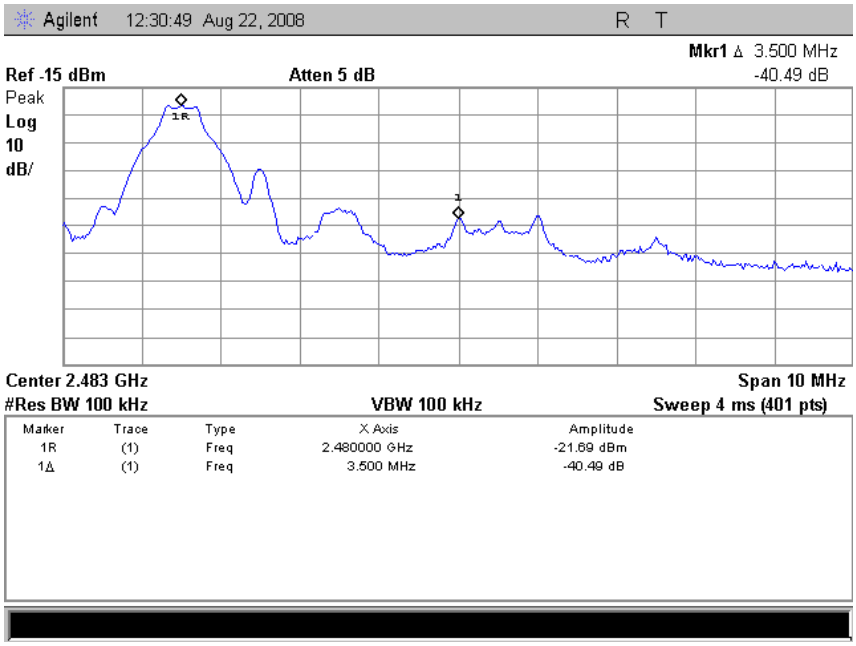

Picture 32: Band edge compliance, channel 78, hopping disabled

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12.3.4 EUT operation mode

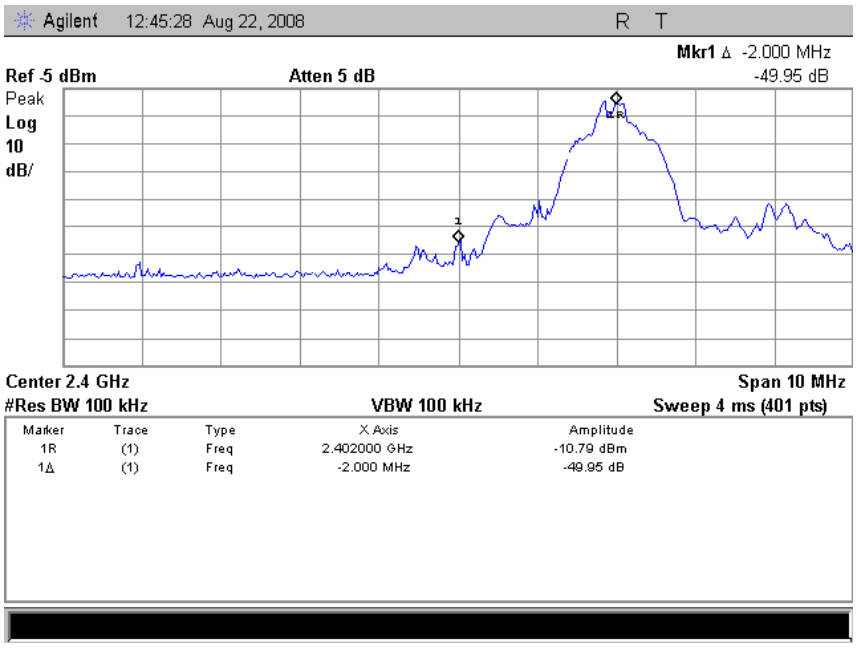
EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	0 (2402 MHz), 78 (2480 MHz)
EUT TX power level	max

12.3.5 Results

Table 14: Band edge compliance measurement results

EUT Channel	Limit (dBc)	Test result (dBc)
0	≤ -20	-49,9
79		-50,2

12.3.6 Screen shots



Picture 33: Band edge compliance, channel 0, hopping disabled

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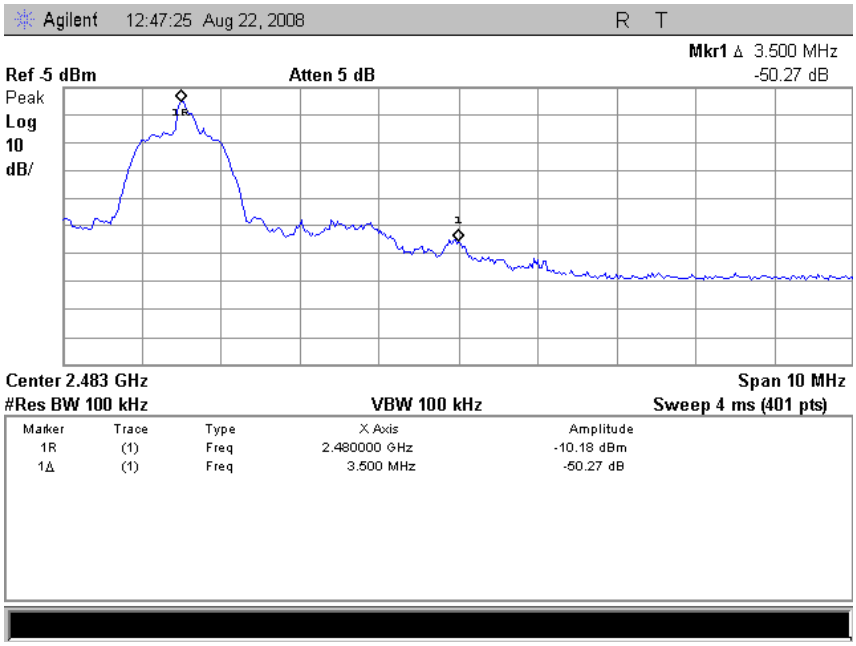

Picture 34: Band edge compliance, channel 78, hopping disabled

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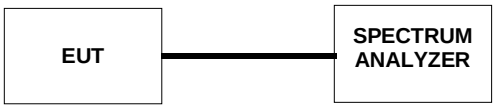
13 SPURIOUS RF CONDUCTED EMISSIONS

EUT	2		
Accessories	-		
Temp, Humidity, Air Pressure	23 ºC	50 RH%	996 hPa
Date of measurement	September 01, 2008		
FCC rule part	15.247, d		
RSS-210 section	A8.5		
Measured by	Matti Virkki		

13.1 Test setup and measurement method

The Bluetooth simulator was used to:

- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns



Picture 35: Test setup for band edge compliance measurement

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.

13.2 EUT operation mode

EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	0, 39 and 78
EUT TX power level	Max.

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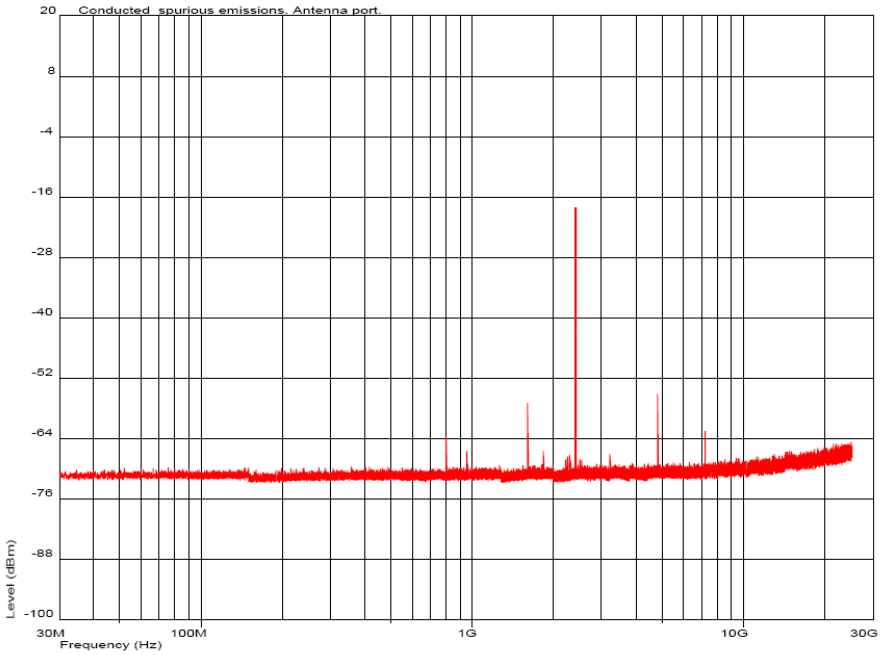
13.3 Limit

EUT Channel	Limit (dBc)
0	≤ -20
39	
78	

13.4 Results

All spurious emissions measured were at least 30 dB below the carrier level.



Picture 36: Conducted spurious emissions on antenna port, Channel 0

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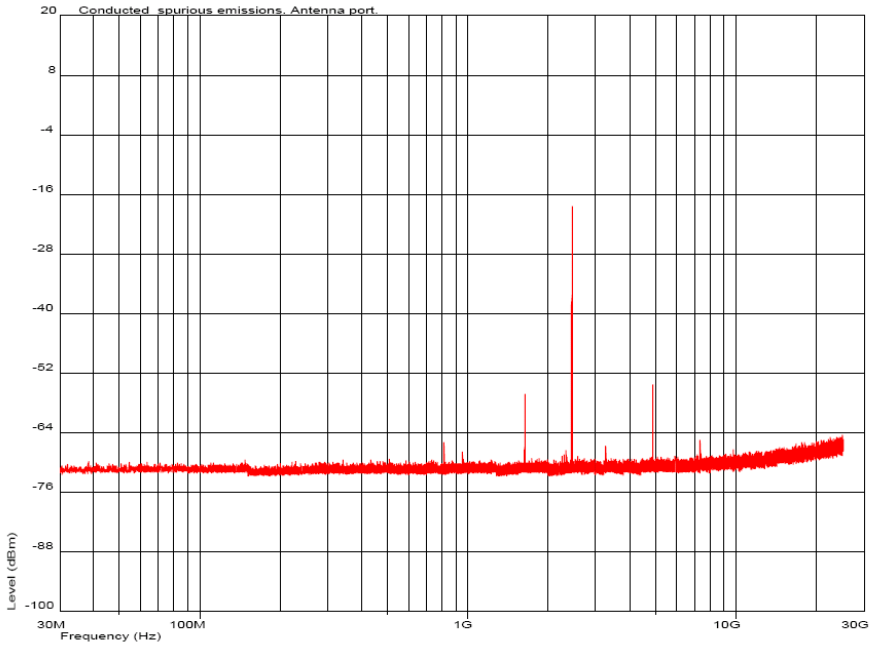
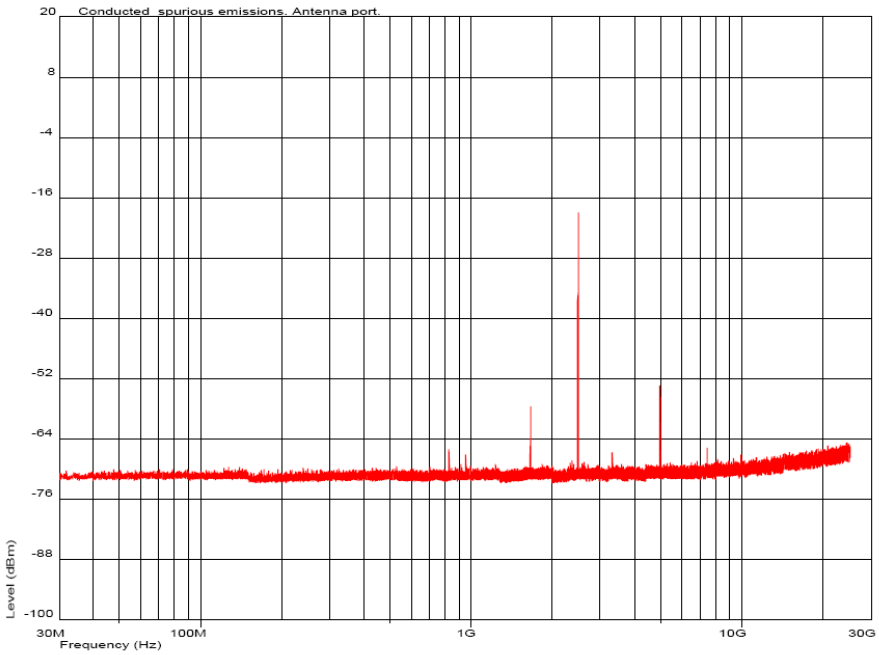


Picture 37: Conducted spurious emissions on antenna port, Channel 39



Picture 38: Conducted spurious emissions on antenna port, Channel 78

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14 RADIATED SPURIOUS EMISSIONS

EUT	3, 4, 5		
Accessories	6		
Temp, Humidity, Air Pressure	23 ºC	35 RH%	1000 hPa
Date of measurement	August 18, 2008		
FCC rule part	15.247, d		
RSS-210 section	A8.5		
Measured by	Simo Ojanen		

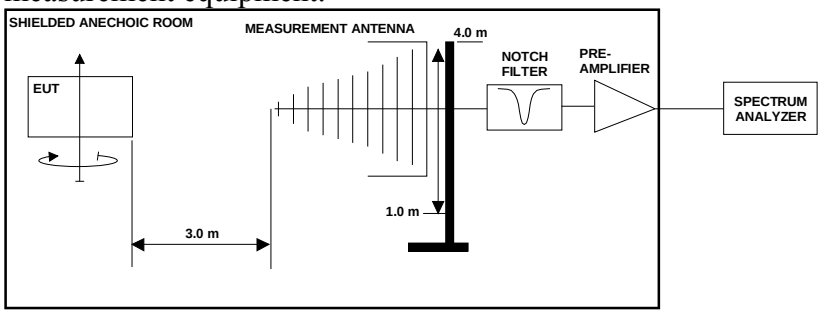
14.1 Test setup

The Bluetooth simulator was used to:

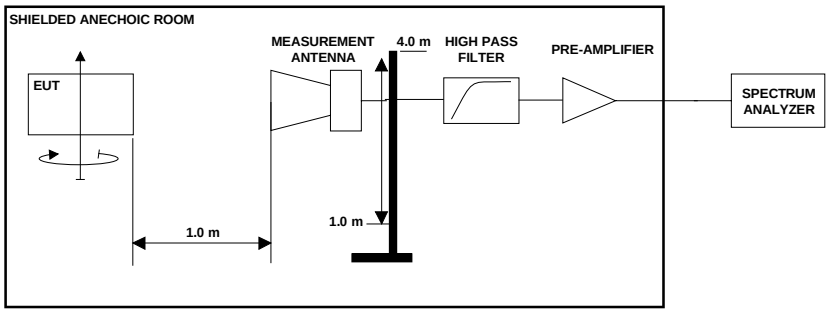
- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping

select between several different test modulation patterns

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



Picture 39: Test setup for radiated spurious emissions measurement
30 MHz - 3 GHz frequencies



Picture 40: Test setup for radiated spurious emissions measurement
3 GHz – 25 GHz frequencies

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14.2 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.

14.3 EUT operation mode

EUT operation mode	Continuous transmission
EUT channel	2400 MHZ, 2440 MHz, 2483 MHz
EUT TX power level	max

14.4 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 - 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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14.5 Results

Measurement system noise level was 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 16: Emission levels PEAK detector, 2400 MHz

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	Marginal dB	EUT Position	Ant Pol.	Ant height
4800	75,0	-14,9	60,1	13,8	Pos 1	Ver	1,0

Table 17: Emission levels PEAK detector, 2440 MHz

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	Marginal dB	EUT Position	Ant Pol.	Ant height
4880	76,8	-14,6	62,1	11,8	Pos 1	Ver	1,0

Table 18: Emission levels PEAK detector, 2483 MHz

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	Marginal dB	EUT Position	Ant Pol.	Ant height
4966	73,9	-14,4	59,5	14,4	Pos 1	Ver	1,0

Since the measurements are made with sample that is modified to continuous transmission, average results are calculated from peak results using duty cycle.

Average level ≤ Peak level – 20 log (duty cycle)

According to manufacturer the worst case duty cycle for this product is less than 11,25ms at any given 100ms period. Therefore,

Average level ≤ Peak level – 20 log (11,25/100)
Average level ≤ Peak level – **18,977 dB**

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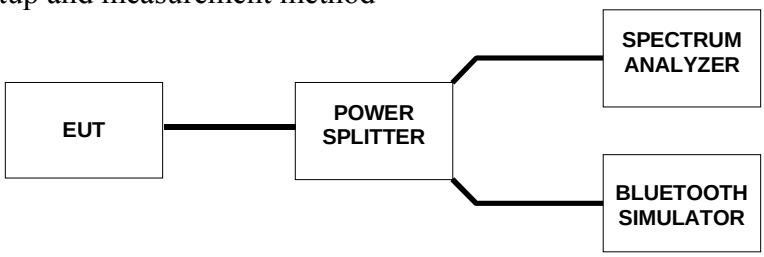
15 99 % BANDWIDTH

EUT	2		
Accessories	6		
Temp, Humidity, Air Pressure	23 ºC	42 RH%	993 hPa
Date of measurement	August 22, 2008		
FCC rule part			
RSS-GEN section	4.4.1		
Measured by	Simo Ojanen		

15.1 Test setup and measurement method



Picture 41: Test setup for 99% BW measurement

The 99% occupied bandwidth was calculated from spectrum analyzer measurements. The measurement data was read from the analyzer to computer. Software in computer calculated the total power from the measurement data and defined the frequency band containing 99% of the total power.
Markers in the spectrum analyzer were then placed between the calculated frequencies to show the calculated 99% power band in the screenshots.

15.2 EUT operation mode

EUT operation mode	Connection, GFSK modulation, PRBS packet type
EUT channel	39
EUT TX power level	max

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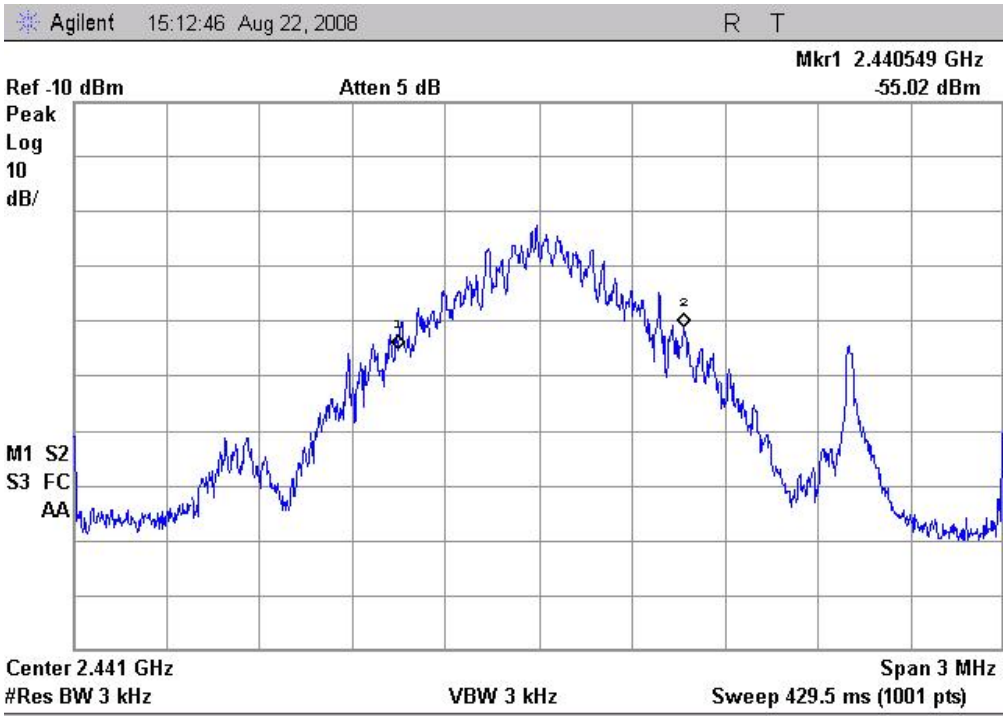
15.3 Results

Table 19: 99% bandwidth measurement results

EUT Frequency MHz	Limit MHz	Measured value MHz
2441	-	0,92

15.4 Screen shots



Picture 42: 99% Bandwidth measurement result

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15.5 EUT operation mode

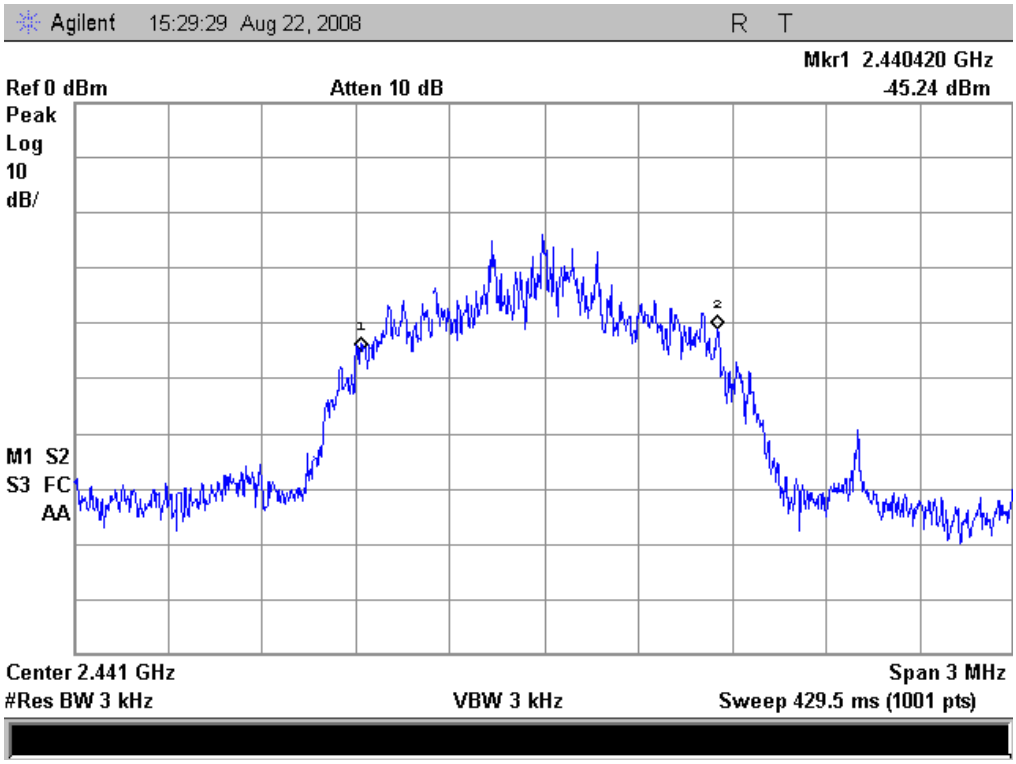
EUT operation mode	Connection, 8DPSK modulation, PRBS packet type
EUT channel	39
EUT TX power level	max

15.6 Results

Table 20: 99% bandwidth measurement results

EUT Frequency MHz	Limit MHz	Measured value MHz
2441	-	1,13

15.7 Screen shots



Picture 43: 99% Bandwidth measurement result

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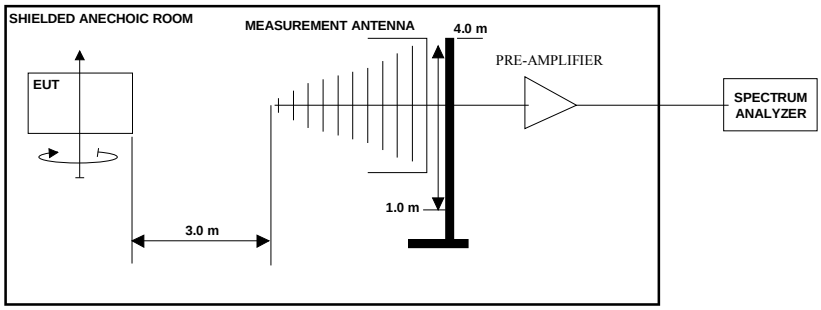
16 RECEIVER RADIATED EMISSION

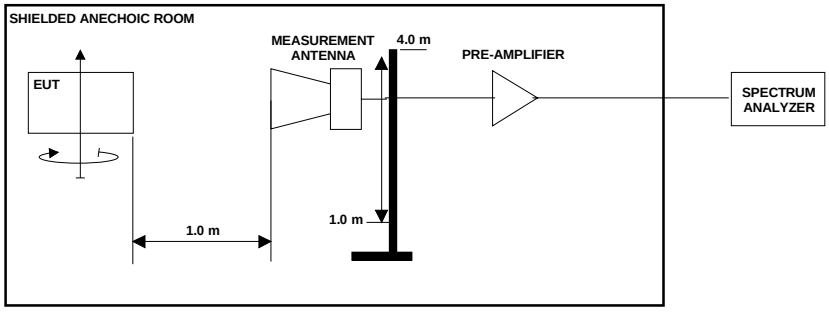
EUT	2		
Accessories	-		
Temp, Humidity, Air Pressure	25 ºC	45 RH%	995 hPa
Date of measurement	August 14, 2008		
FCC rule part	§15.109		
RSS-GEN section	7.2.3		
ICES-003 section	5.5		
Measured by	Päivi Punta		

16.1 Test setup

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



Picture 44: Test setup for radiated spurious emissions measurement 30 MHz - 1 GHz frequencies



Picture 45: Test setup for radiated spurious emissions measurement 1 GHz – 12,4 GHz frequencies

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16.2 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.

16.3 EUT operation mode

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

16.4 Limit

Table 21: 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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16.5 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 22, 23 and 24.

Table 22: Radiated emissions using Quasi peak detector

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	Marginal dB	EUT Position	Ant Pol.	Ant height	TT angle
N/A								

Table 23: Radiated emissions using Peak detector

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	Marginal dB	EUT Position	Ant Pol.	Ant height	TT angle
1627,5	58,0	-25,7	32,2	41,7	Pos 1	Hor	1,7	0
1827	60,4	-25,7	34,6	39,3	Pos 1	Ver	2,0	209

Table 24: Radiated emissions using Average detector

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	Marginal dB	EUT Position	Ant Pol.	Ant height	TT angle
1627,5	37,3	-25,7	11,5	42,4	Pos 1	Hor	1,7	0
1827	40,2	-25,7	14,4	39,5	Pos 1	Ver	2,0	209

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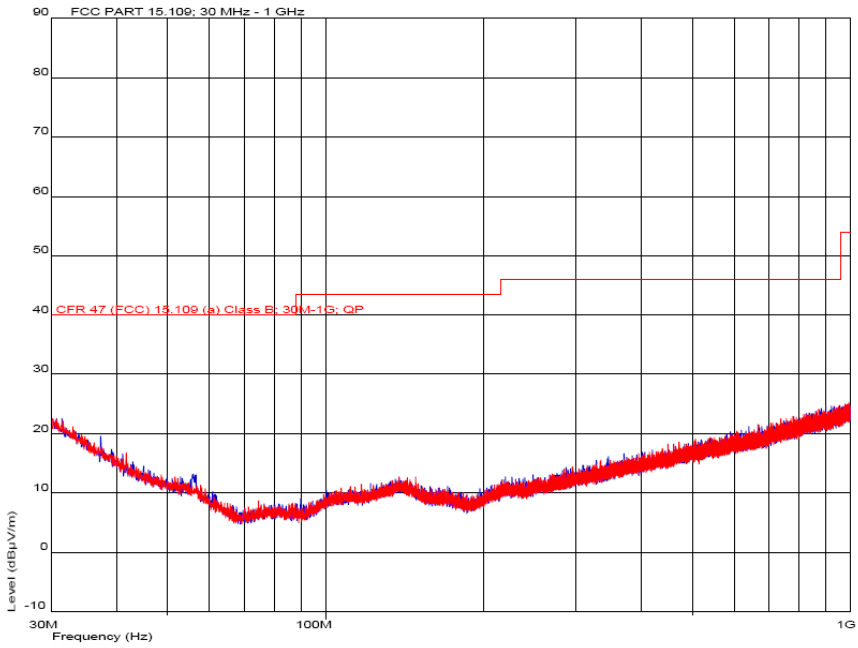
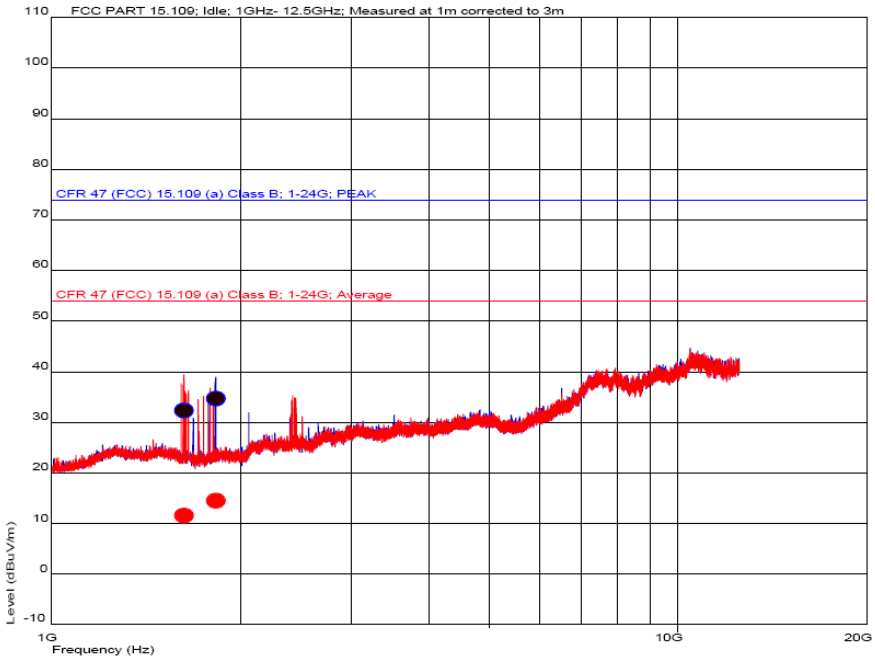


Picture 46: radiated emission results, 30 – 1000 MHz,
Red= horizontal polarization, blue = vertical polarization



Picture 47: radiated emission results, 1 – 12,4 GHz,
Red= horizontal polarization, blue = vertical polarization

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17 TEST EQUIPMENT

All testing and measurement equipment has been calibrated once a year, except the antennas which are calibrated every two years.

17.1 Conducted measurements

Equipment	Manufacturer	Model
Spectrum Analyzer	Agilent	E7405A
Bluetooth Simulator	Anritsu	MT8850A
Measurement receiver	Rohde & Schwarz	ESCS 30
Attenuator 3 dB	Narda	779-3
Power splitter	Narda	4426-2
Transient limiter / 10 dB attenuator	Chase	CFL 9206
Line Impedance Stabilization Network (LISN)	Rohde & Schwarz	ESH 3-Z5

17.2 Radiated measurements

Equipment	Manufacturer	Model
Spectrum Analyzer	Agilent	E7405A
Bluetooth simulator	Anritsu	MT8850A
Antenna	Chase	CBL 6141
Antenna	Schwarzbeck	BBHA 9120D
Antenna	Schwarzbeck	BBHA 9170
High pass filter	Wainwright Instruments	WHK3.0/18GST
Pre-amplifier	JCA	118-400
Pre-amplifier	Miteq	AMF-6F-18002650-25-10P
Turn table / antenna mast controller	EMCO	2090
Antenna mast	EMCO	2075-2

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18 TEST SETUP PHOTOGRAPHS

Test setup photograph can be found in a separate document

T08-631D-EMC_PHOTOS.doc

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