

Bluetooth test report for **RH-26**

Report Date: November 25, 2003

Signatures:

Tested by:



Marko Turkkila Testing Engineer

Contents approved:



Tomi Nyberg Laboratory Manager

CONTENTS

1	LABORATORY INFORMATION	4
2	CUSTOMER INFORMATION	4
3	SUMMARY OF TEST RESULTS.....	5
4	EUT INFORMATION	6
4.1	EUT description	6
5	EUT TEST SETUPS	7
6	APPLICABLE STANDARDS	7
7	CARRIER FREQUENCY SEPARATION	8
7.1	Test setup and testing method	8
7.2	EUT operation mode	8
7.3	Results.....	9
7.4	Screen shots	9
8	NUMBER OF HOPPING FREQUENCIES.....	10
8.1	Test setup	10
8.2	EUT operation mode	10
8.3	Results.....	11
8.4	Screen shots	11
9	TIME OF OCCUPANCY	12
9.1	Test setup and testing method	12
9.2	Page mode	13
9.2.1	EUT operation mode	13
9.2.2	Results	13
9.2.3	Screen shots.....	13
9.3	Inquiry mode	15
9.3.1	EUT operation mode	15
9.3.2	Results	15
9.3.3	Screen shots.....	15
9.4	Connection mode	17
9.4.1	EUT operation mode	17
9.4.2	Results	17
9.4.3	Screen shots.....	17
10	20 dB BANDWIDTH.....	19
10.1	Test setup and measurement method	19
10.2	EUT operation mode	19
10.3	Results.....	20
10.4	Screen shots	20
11	PEAK OUTPUT POWER	22
11.1	Test setup and measurement method	22
11.2	EUT operation mode	22
11.3	Results.....	23
11.4	Screen shots	23

12	BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS	25
12.1	Test setup and measurement method	25
12.2	Hopping enabled	26
12.2.1	EUT operation mode	26
12.2.2	Results	26
12.2.3	Screen shots	26
12.3	Hopping disabled	27
12.3.1	EUT operation mode	27
12.3.2	Results	27
12.3.3	Screen shots	28
13	AC POWERLINE CONDUCTED EMISSIONS	29
13.1	Test setup and measurement method	29
13.2	EUT operation mode	29
13.3	Limits	29
13.4	Results	29
14	SPURIOUS RF CONDUCTED EMISSIONS	32
14.1	Test setup and measurement method	32
14.2	EUT operation mode	32
14.3	Limit	33
14.4	Results	33
15	RADIATED SPURIOUS EMISSIONS	35
15.1	Test setup	35
15.2	Test method	36
15.3	EUT operation mode	36
15.4	Limit	36
15.5	Results	37
15.5.1	EUT flip closed	37
15.5.2	EUT flip open	39
16	TEST EQUIPMENT	41
16.1	Conducted measurements	41
16.2	Radiated measurements	41
17	TEST SETUP PHOTOGRAPHS	42

1 LABORATORY INFORMATION

Test Laboratory	Konette Design Center Oy EMC Laboratory Koneenkatu 12 / K17 05830 Hyvinkää FINLAND Tel: +358 20 475 2800 Fax: +358 20 475 2719 e-mail: firstname.surname@ette.com
FCC registration number: IC file number:	910391 (January 27, 2003) IC 4616 (May 14, 2003)

2 CUSTOMER INFORMATION

Client	Nokia Corporation Keilalahdentie 2-4 02150 Espoo PL 226 00045 NOKIA GROUP Tel: 07180 08000
Contact person:	Jarkko Luoma Nokia Corporation / TCC Salo P.O. Box 86 (Joensuunkatu 7E / Kiila 1B) FIN -24101 SALO FINLAND Tel: +358 7180 42913 Fax: +358 7180 45220 E-mail: jarkko.luoma@nokia.com
Receipt of EUT:	October 28, 2003
Testing date:	October 30 – November 20, 2003
Report date:	November 25, 2003

The tests listed in this report have been done to demonstrate compliance to the FCC rules section §15.247, §15.207 and IC standard RSS-210.

3 SUMMARY OF TEST RESULTS

Section in CFR 47	Section in RSS-210	Test	Result
15.247, a1	6.2.2 (o), a1	Carrier frequency separation	PASS
15.247, a1ii	6.2.2 (o), a3	Number of hopping frequencies	PASS
15.247, a 1 iii	6.2.2 (o), a3	Time of occupancy	PASS
15.247, a	6.2.2 (o), a1	20dB bandwidth	PASS
15.247, b1	6.2.2 (o), a3	Peak output power	PASS
15.247, c	6.2.2 (o), e1	Band-edge compliance of RF emissions	PASS
15.207	6.6	AC power line conducted emissions	PASS
15.247, c	6.2.2 (o), e1	Spurious RF conducted emissions	PASS
15.247, c	6.2.2 (o), e1	Spurious radiated emissions	PASS

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

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	GSM 850 / 1900 Mobile phone	RH-26	004400 21 165122 7	07001
	GSM 850 / 1900 Mobile phone	RH-26	004400 21 165121 9	07002
Accessories	Battery,	BL-5C		07003
	Battery	BL-5C		07004

Notes: EUT 07002 was equipped with antenna connector for conducted measurements

4.1 EUT description

EUT is a triple band (GSM850 / GSM 1800 / GSM 1900) mobile phone with Bluetooth functionality.

The EUT was not modified during the tests.

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 17.

6 APPLICABLE STANDARDS

The tests were performed in guidance of CFR 47 Part 15.247 and 15.207, Part 2, FCC public notice DA 00-705 (March 30, 2000), ANSI C63.4 (1992), RSS-210 (Issue 5, November 2001) and CISPR-22.

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

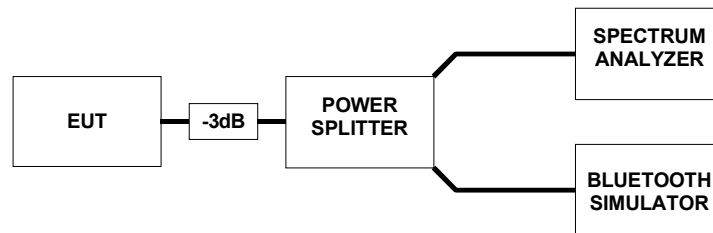
7 CARRIER FREQUENCY SEPARATION

EUT	07002		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	22 °C	48 RH%	1015 hPa
Date of measurement	November 21, 2003		
FCC rule part	§15.247 (a) (1)		
RSS-210 section	6.2.2 (o), a1		
Measured by	Marko Turkkila		

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 – 2.4835 GHz.

100 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.

7.2 EUT operation mode

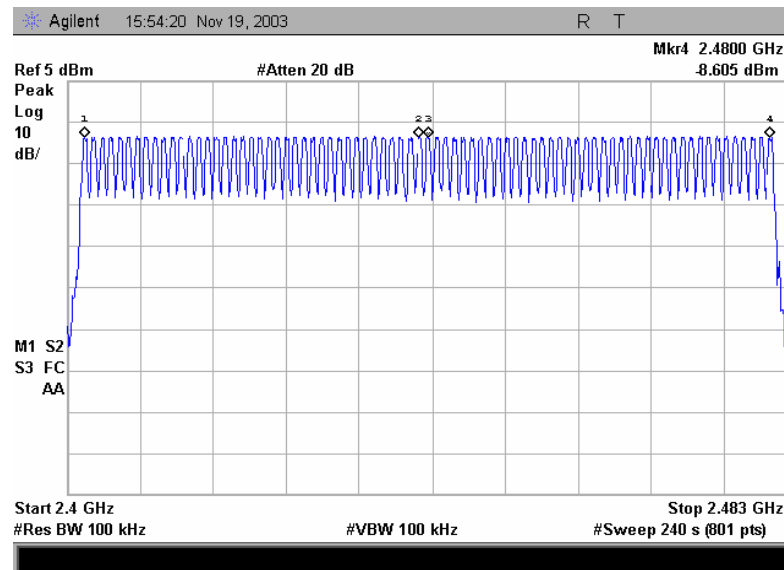
EUT operation mode	Connection, DM5, PRBS
EUT channel	Hopping
EUT TX power level	0 dBm

7.3 Results

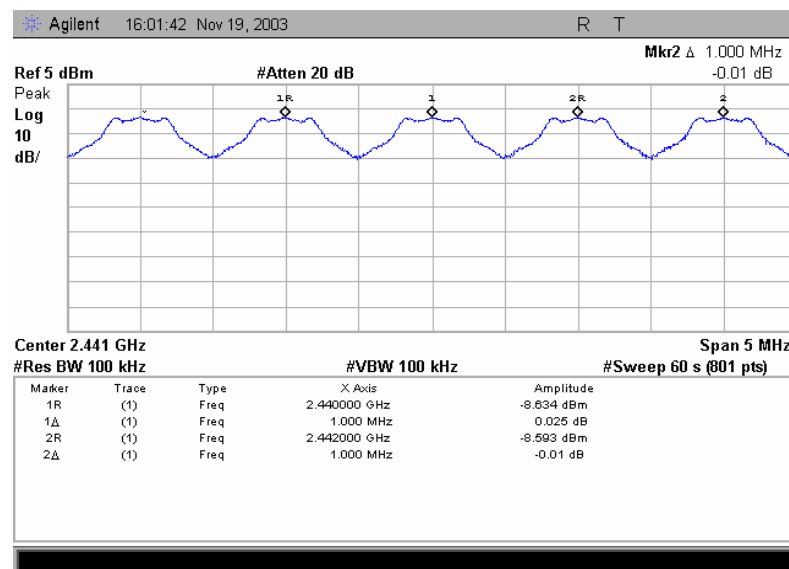
Table 1: Carrier frequency separation measurement results

Limit	Result
≥ 0.025 or 20dB BW	1.00 MHz

7.4 Screen shots



Picture 2: Carrier frequency separation, General overview of the spectrum



Picture 3: Carrier frequency separation, Channels 38 and 39

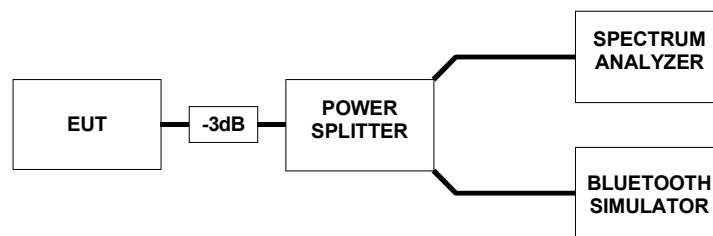
8 NUMBER OF HOPPING FREQUENCIES

EUT	07002		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	22 °C	48 RH%	1015 hPa
Date of measurement	November 21, 2003		
FCC rule part	§15.247(a) (2)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Marko Turkkila		

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 – 2.4835 GHz.

100 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.

8.2 EUT operation mode

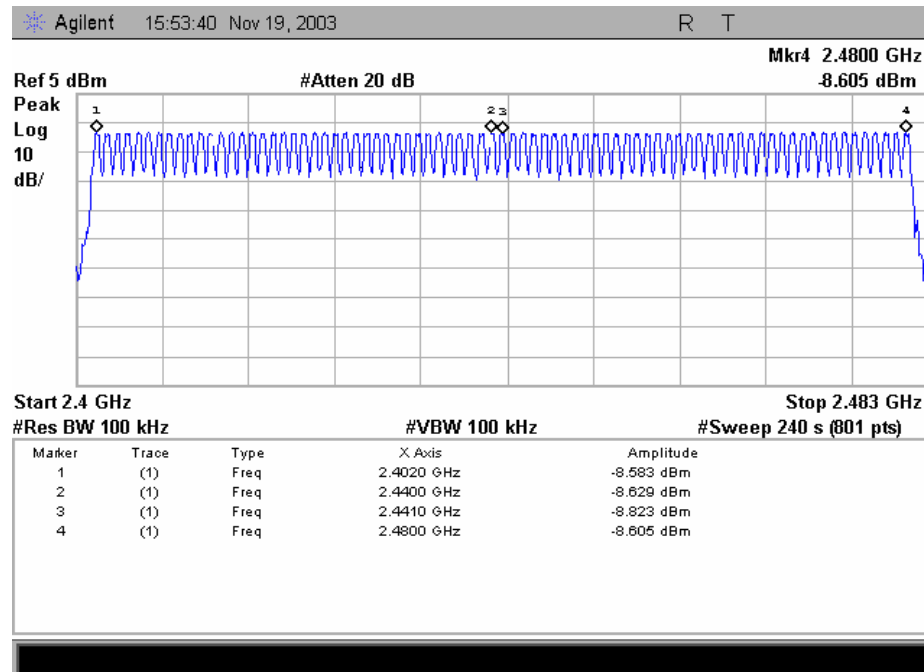
EUT operation mode	Connection, DM5, PRBS
EUT channel	Hopping
EUT TX power level	0 dBm

8.3 Results

Table 2: Number of hopping frequencies measurement results

Limit	Result
≥ 75	79

8.4 Screen shots



Picture 5: Number of hopping frequencies measurement

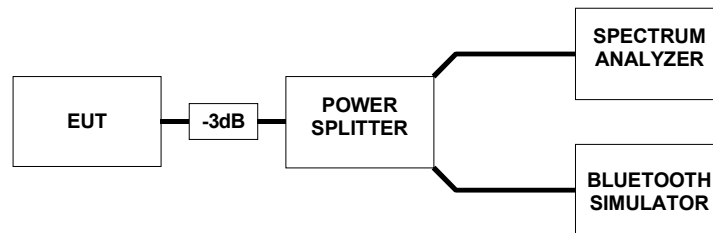
9 TIME OF OCCUPANCY

EUT	07002		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	22 °C	55 RH%	1010 hPa
Date of measurement	November 24, 2003		
FCC rule part	§15.247 (a) (1) iii		
RSS-210 section	6.2.2 (o), a3		
Measured by	Marko Turkkila		

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 6: 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.

9.2 Page mode

9.2.1 EUT operation mode

EUT operation mode	Page
EUT channel	Hopping
EUT TX power level	0 dBm

9.2.2 Results

Table 3: Time of occupancy during paging mode measurement results

Limit	Result
≤ 0.4 s over 12.8 s period	0.0457 s

Limit:

In the paging mode Bluetooth uses a reduced hopping pattern (32 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 ($32 * 0.4\text{s} = 12.8\text{ s}$).

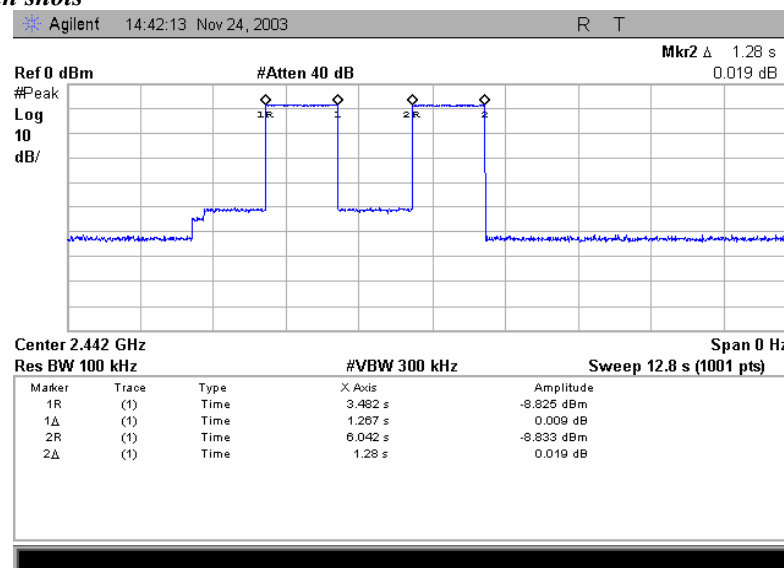
Results:

The complete paging cycle took $1.257 + 1.28 = 2.537$ s , during which the transmitter operated at every 10.00 ms.

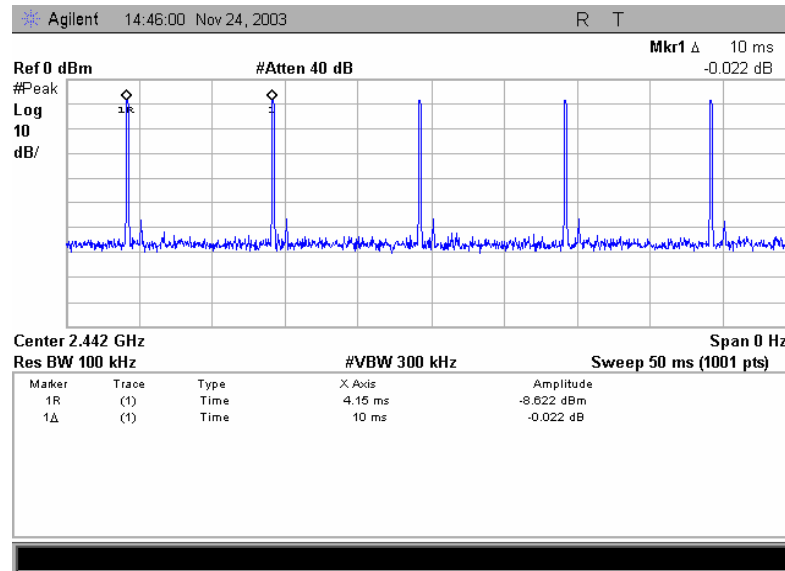
The duration of one transmission was 180 μs .

Based on these measurements, one channel was occupied
 $(2.537\text{ s} / 10.00\text{ ms}) * 180\text{ }\mu\text{s} = 0.0457\text{ s}$ during the 12.8 s period

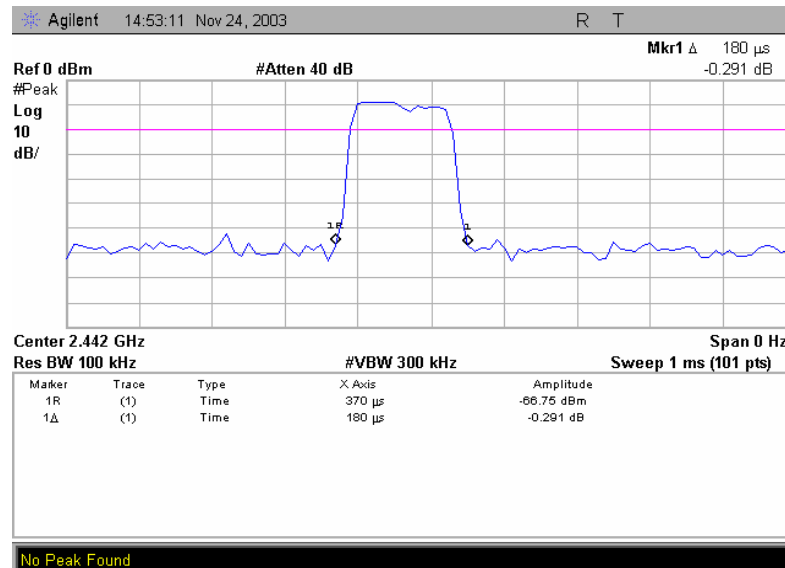
9.2.3 Screen shots



Picture 7: Complete paging cycle, channel 40



Picture 8: Transmission interval during paging cycle, channel 40



Picture 9: Duration of one transmission during paging cycle, channel 40

9.3 Inquiry mode

9.3.1 EUT operation mode

EUT operation mode	Inquiry
EUT channel	Hopping
EUT TX power level	0 dBm

9.3.2 Results

Table 4: Time of occupancy during inquiring mode measurement results

Limit	Result
≤ 0.4 s over 12.8 s period	0.0925 s

Limit:

In the inquiry mode Bluetooth uses a reduced hopping pattern (32 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 ($32 * 0.4\text{s} = 12.8$ s).

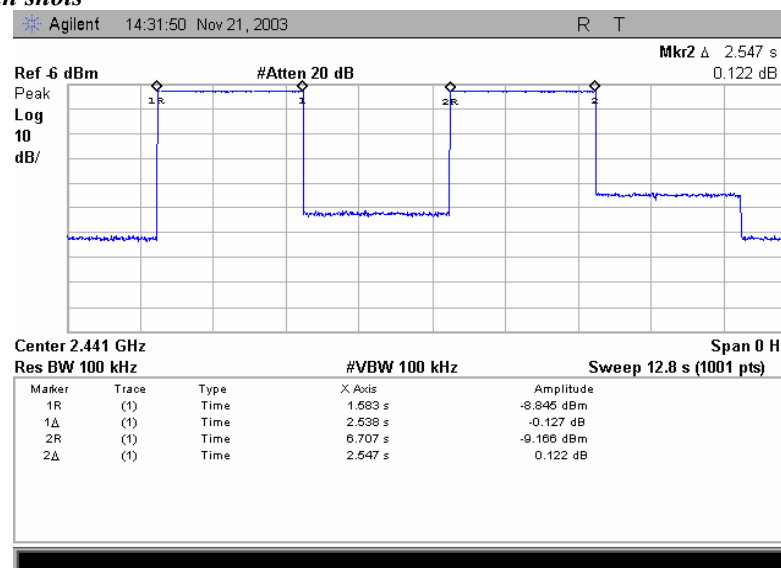
Results:

The complete inquiry cycle took $2.538 + 2.547 = 5.085$ s , during which the transmitter operated at every 10.01 ms.

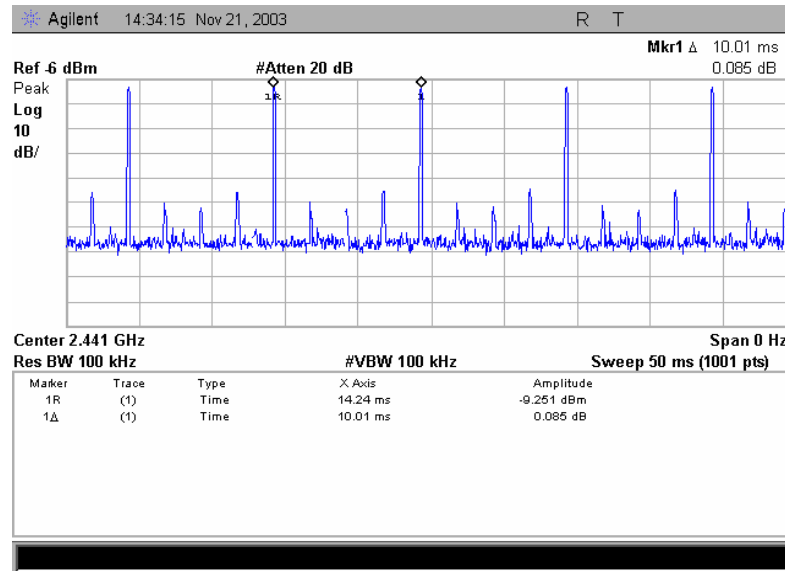
The duration of one transmission was 182.1 μs .

Based on these measurements, one channel was occupied
 $(5.085 \text{ s} / 10.01 \text{ ms}) * 182.1 \mu\text{s} = 0.0925 \text{ s}$ during the 12.8 s period.

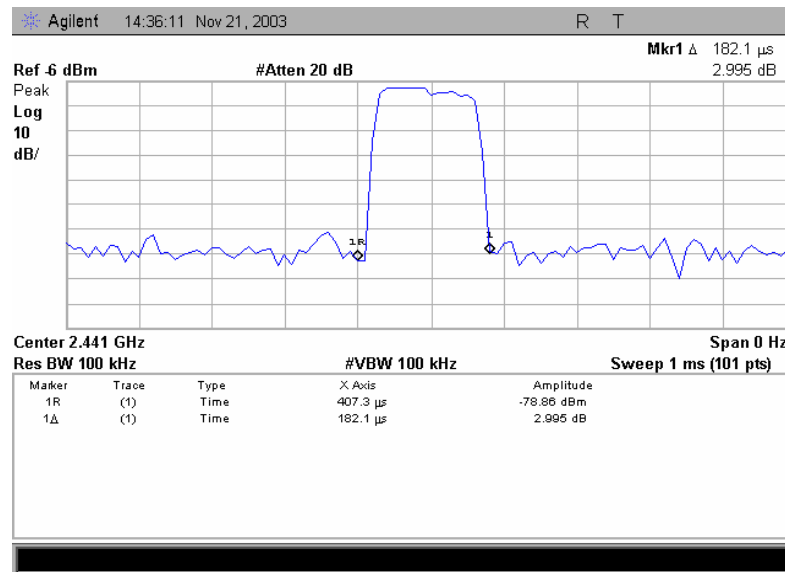
9.3.3 Screen shots



Picture 10: Complete inquiry cycle, channel 39



Picture 11: Transmission interval during inquiry cycle, channel 39



Picture 12: Duration of one transmission during inquiry, channel 39

9.4 Connection mode

9.4.1 EUT operation mode

EUT operation mode	Connection, DH5, PRBS
EUT channel	Hopping
EUT TX power level	0 dBm

9.4.2 Results

Table 5: Time of occupancy during connection mode measurement results

Limit	Result
$\leq 0.4 \text{ s over } 31.6 \text{ s period}$	0.176 s

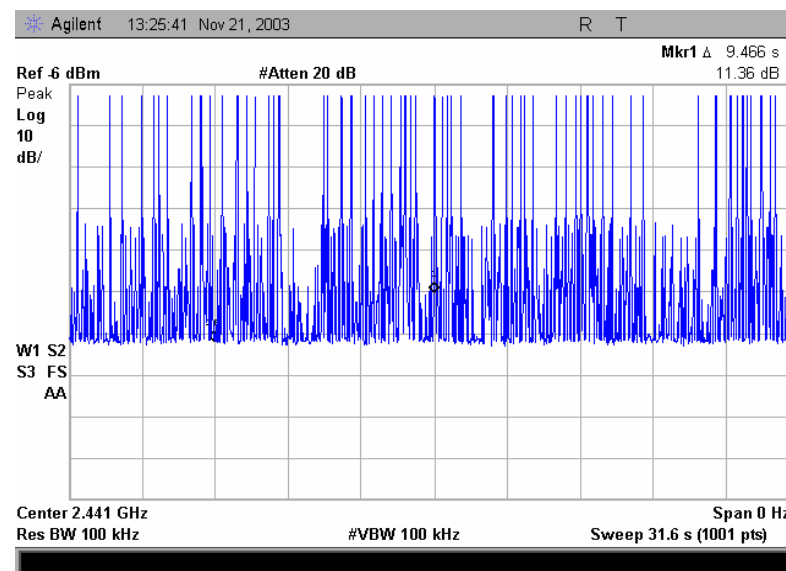
Limit:

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 ($79 * 0.4\text{s} = 31.6 \text{ s}$).

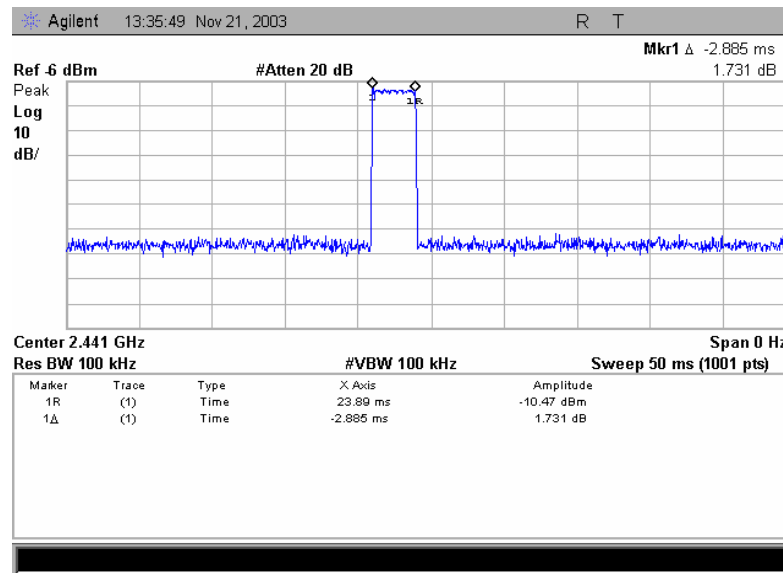
Results:

In measurement time of 31.6 s, total of 61 transmissions occurred. The duration of one transmission was 2.885ms. Based on these measurements the transmitter operated $61 * 2.885 \text{ ms} = 0.176 \text{ s}$ during the 31.6 s period

9.4.3 Screen shots



Picture 13: Number of transmissions on connection state, channel 39



Picture 14: Duration of one transmission on connection state, channel 39

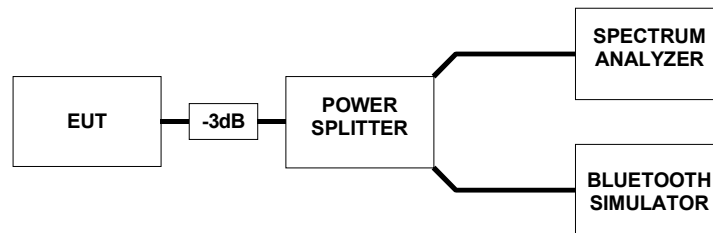
10 20 dB BANDWIDTH

EUT	07002		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	22 °C	48 RH%	1015 hPa
Date of measurement	November 21, 2003		
FCC rule part	§15.247 (a) (1)		
RSS-210 section	6.2.2 (o), a1		
Measured by	Marko Turkkila		

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 15: 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.

10.2 EUT operation mode

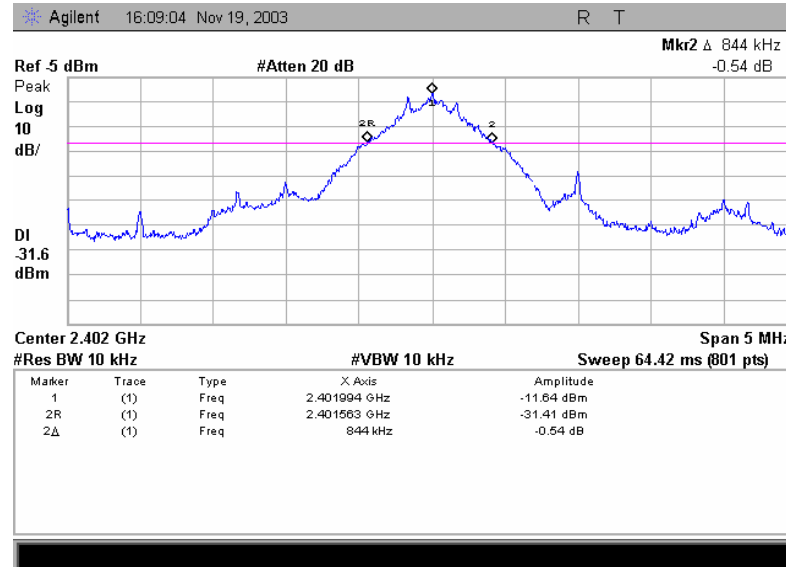
EUT operation mode	Connection, DM5, PRBS
EUT channel	0, 39 and 78
EUT TX power level	0 dBm

10.3 Results

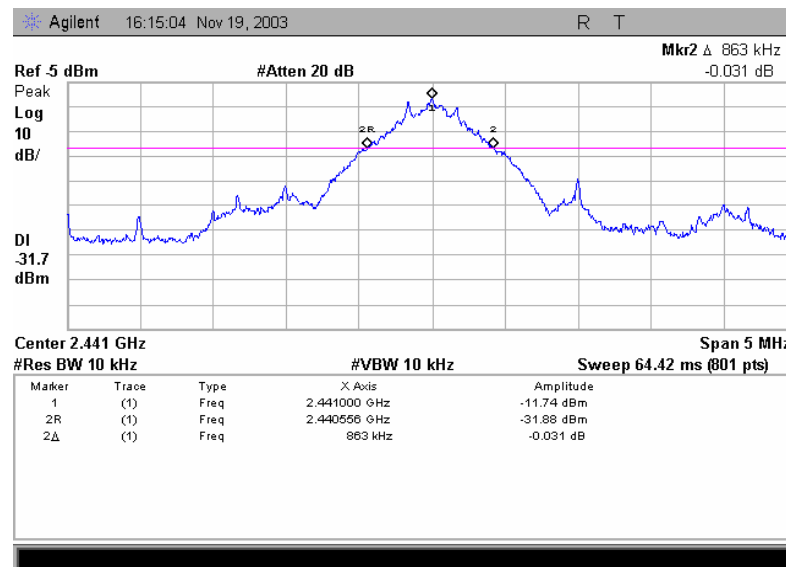
Table 6: 20dB bandwidth measurement results

EUT Channel	Limit (MHz)	Measured value (MHz)
0	≤ 1.0	0.844
39		0.863
78		0.844

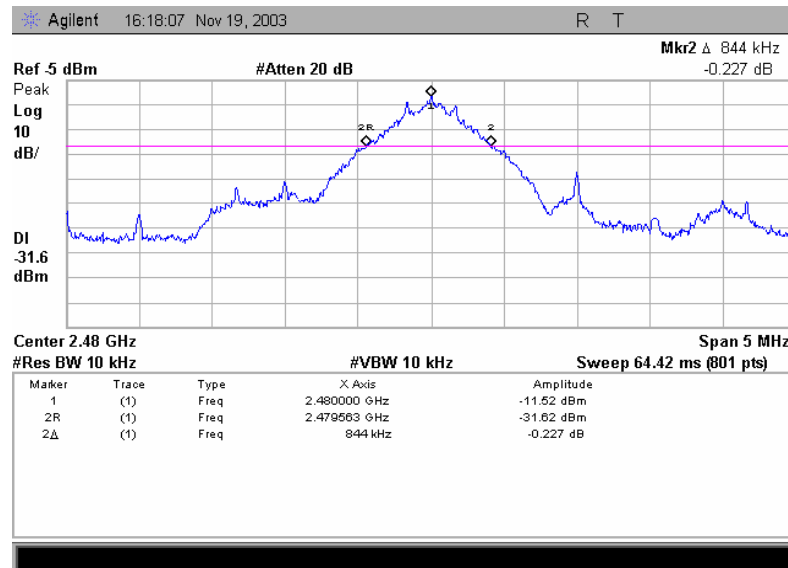
10.4 Screen shots



Picture 16: 20dB Bandwidth measurement result, Channel 0



Picture 17: 20dB Bandwidth measurement result, Channel 39



Picture 18: 20dB Bandwidth measurement result, Channel 78

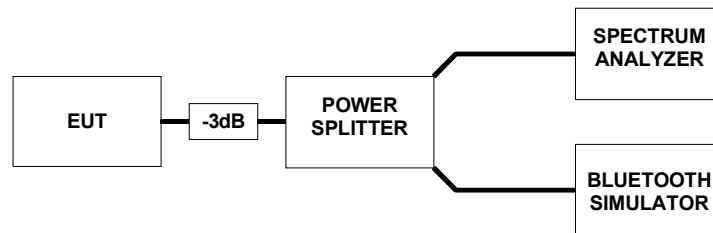
11 PEAK OUTPUT POWER

EUT	07002		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	22 °C	48 RH%	1015 hPa
Date of measurement	November 21, 2003		
FCC rule part	§15.247 (b) (1)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Marko Turkkila		

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 external preamplifier gain in the spectrum analyzer to correct the reading of the peak output power. Spectrum analyzer subtracts the set PG value shown in the screenshots from the measured reading.

The measurement was made using 1 MHz resolution bandwidth and 1 MHz video bandwidth and maximum hold function to record the maximum peak output power.

11.2 EUT operation mode

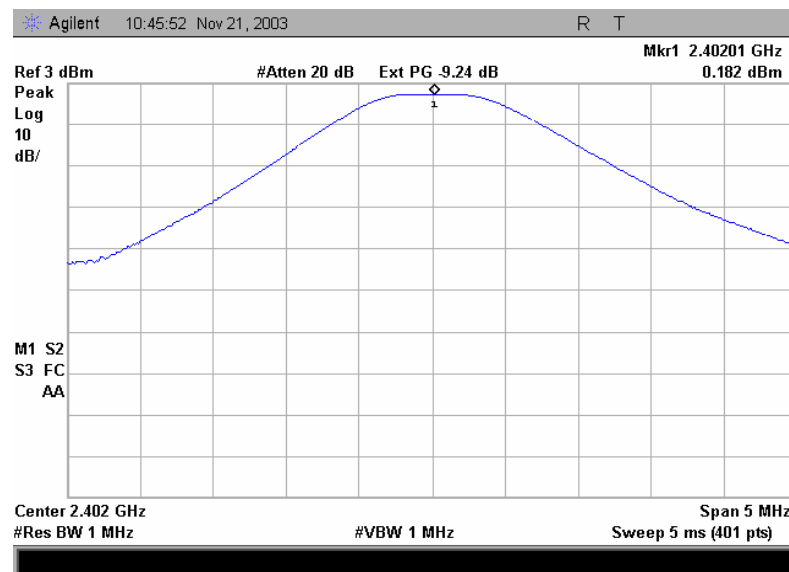
EUT operation mode	Connection, DM5, PRBS
EUT channel	0, 39 and 78
EUT TX power level	0 dBm

11.3 Results

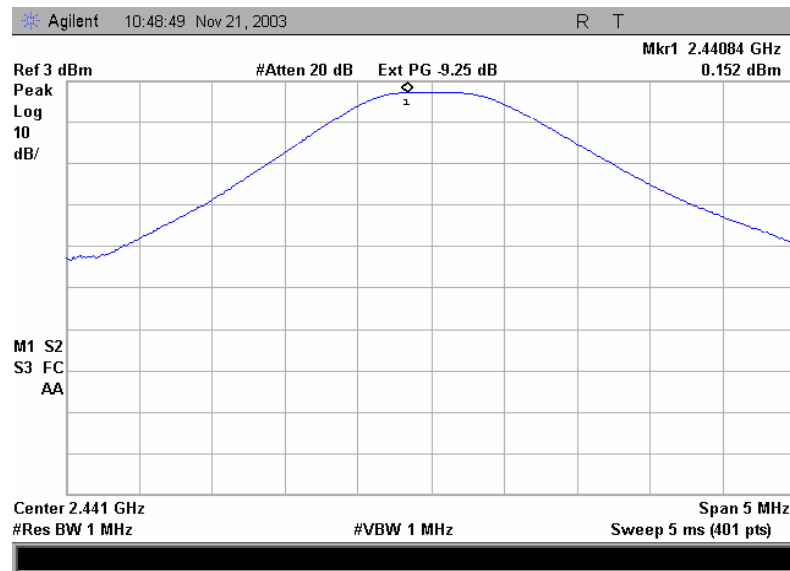
Table 7: Peak output power measurement results

EUT Channel	Limit (W)	Test result (W)	Limit (dBm)	Test result (dBm)
0	≤ 1	0.0010	≤ 30	0.182
39		0.0010		0.152
78		0.0011		0.597

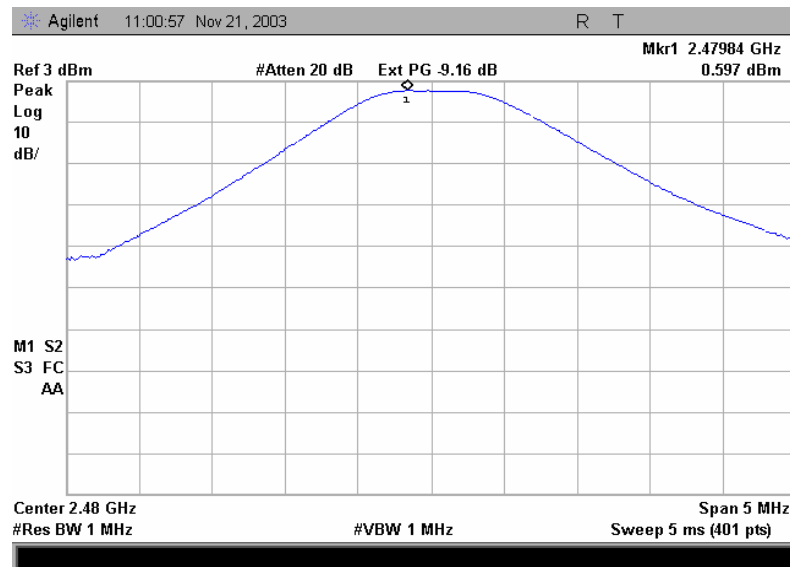
11.4 Screen shots



Picture 20: Peak output power, channel 0



Picture 21: Peak output power, channel 39



Picture 22: Peak output power, channel 78

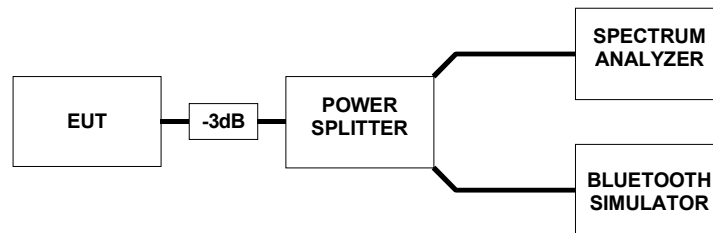
12 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

EUT	07002		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	22 °C	48 RH%	1015 hPa
Date of measurement	November 21, 2003		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Marko Turkkila		

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 23: 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.

12.2 Hopping enabled

12.2.1 EUT operation mode

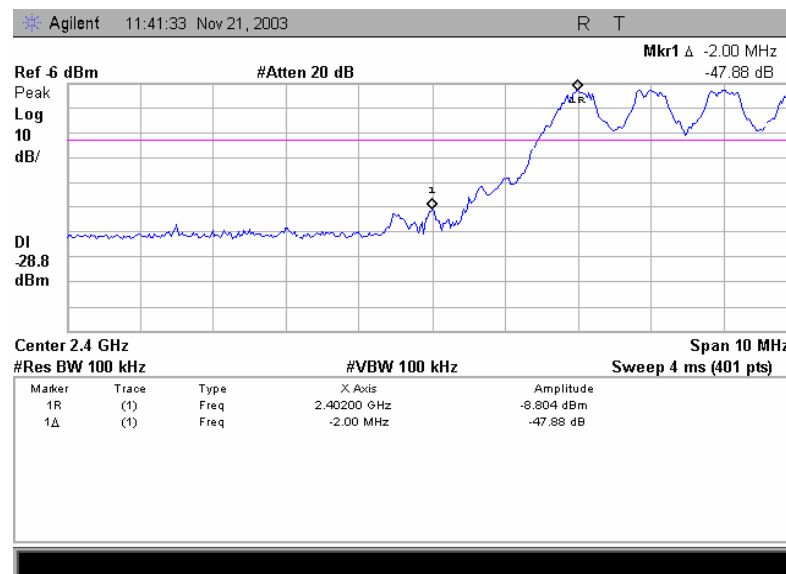
EUT operation mode	Connection, DH5, PRBS
EUT channel	Hopping
EUT TX power level	0 dBm

12.2.2 Results

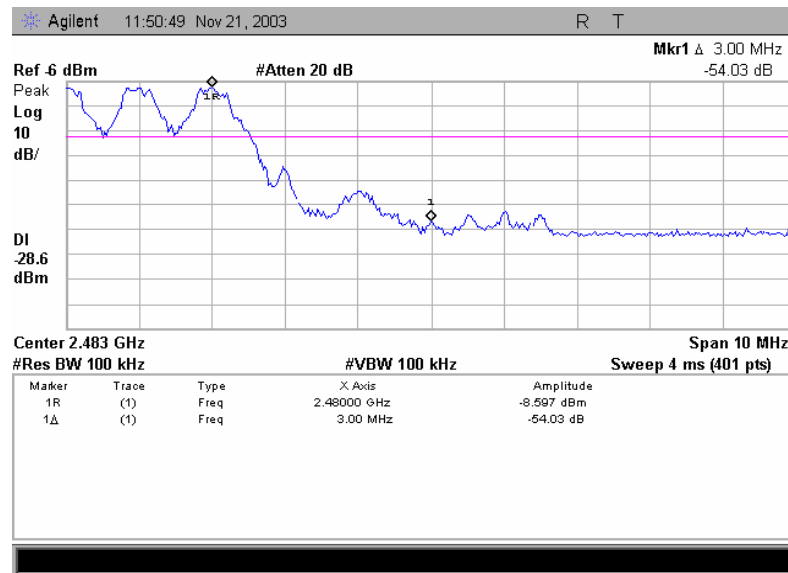
Table 8: Number of hopping frequencies measurement results

EUT Channel	Limit (dBc)	Test result (dBc)
0	≤ -20	-47.9
78		-54.0

12.2.3 Screen shots



Picture 24: Band edge compliance, channel 0, hopping enabled



Picture 25: Band edge compliance, channel 78, hopping enabled

12.3 Hopping disabled

12.3.1 EUT operation mode

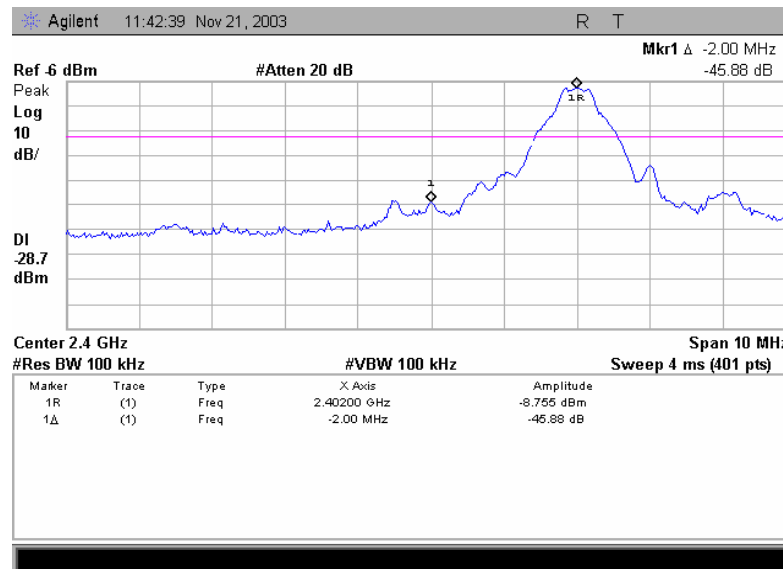
EUT operation mode	Connection, DM5, PRBS
EUT channel	0 (2402 MHz), 78 (2480 MHz)
EUT TX power level	0 dBm

12.3.2 Results

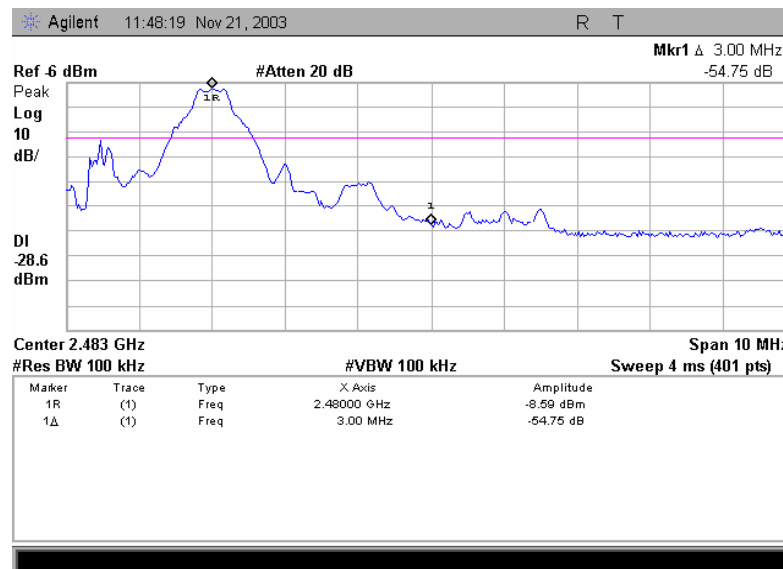
Table 9: Band edge compliance measurement results

EUT Channel	Limit (dBc)	Test result (dBc)
0	≤ -20	-45.9
79		-54.8

12.3.3 Screen shots



Picture 26: Band edge compliance, channel 0, hopping disabled



Picture 27: Band edge compliance, channel 78, hopping disabled

13 AC POWERLINE CONDUCTED EMISSIONS

EUT	07001		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	22 °C	60 RH%	998 hPa
Date of measurement	October 31, 2003		
FCC rule part	§15.207		
RSS-210 section	6.6		
Measured by	Tero Knuutila		

13.1 Test setup and measurement method

The EUT was set according to ANSI C63.4-1992, figure 9a

13.2 EUT operation mode

EUT operation mode	Connection, DH5, PRBS
EUT channel	Hopping
EUT TX power level	0 dBm
EUT operation voltage	110 VAC / 60 Hz

13.3 Limits

Table 10: AC power line conducted emission measurement results

Frequency band (MHz)	Quasi-peak limit (dBμV)	Average limit (dBμV)
0.15 – 0.5	66 – 56*	56 – 46*
0.5 – 5	56	46
5 – 30	60	50

* The limit decreases linearly with the logarithm of the frequency

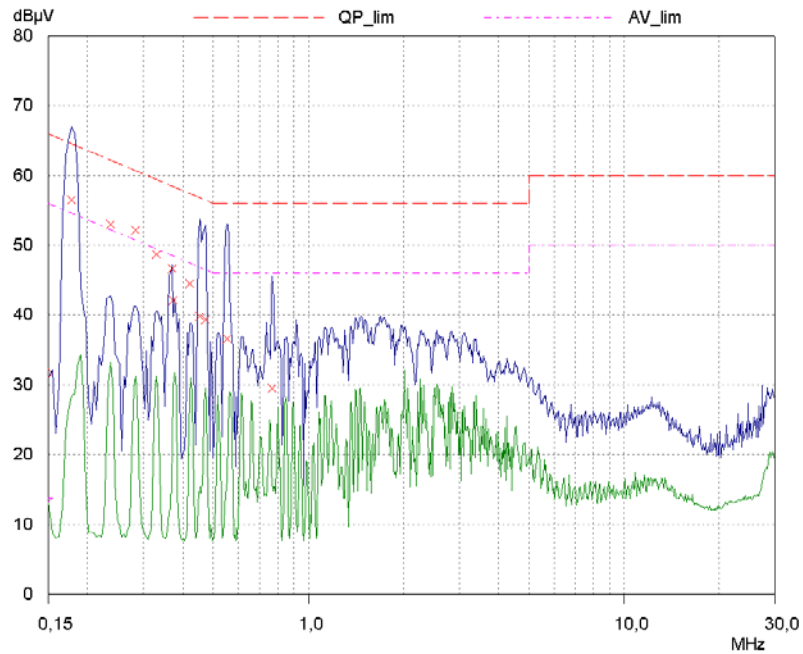
13.4 Results

The measurement results were adjusted with the attenuation of the cable between the LISN and receiver by the computer controlling the test system

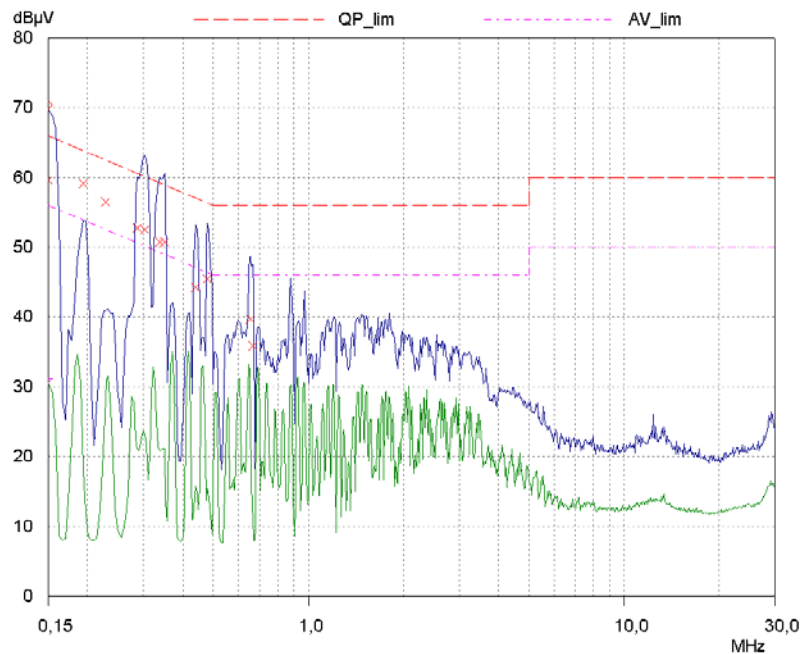
Peaks closer than 6 dB to the quasi peak limit were measured using quasi peak detector. These values have been listed in Table 11 and Table 12.

Blue curve: Peak detector.

Green curve: Average detector



Picture 28: AC power line emissions, line L.



Picture 29: AC power line emissions, line N

Table 11: Highest emissions, line L

Frequency (MHz)	QP (dB μ V)	Limit (dB μ V)	Margin (dB)
0,18	56,5	64,6	8,1
0,24	52,9	62,2	9,3
0,28	52,1	60,7	8,6
0,33	48,7	59,5	10,8
0,37	46,6	58,5	11,9
0,37	42,1	58,4	16,3
0,42	44,5	57,5	13,0
0,45	39,8	56,9	17,1
0,47	39,3	56,5	17,2
0,55	36,6	56,0	19,4
0,77	29,5	56,0	26,5

Table 12: Highest emissions, line N

Frequency (MHz)	QP (dB μ V)	Limit (dB μ V)	Margin (dB)
0,15	59,6	66,0	6,4
0,19	59,1	63,9	4,8
0,23	56,5	62,5	6,0
0,29	52,8	60,6	7,8
0,30	52,5	60,2	7,7
0,34	50,8	59,3	8,5
0,35	50,7	58,9	8,2
0,44	44,2	57,1	12,9
0,48	45,4	56,4	11,0
0,65	39,7	56,0	16,3
0,67	35,8	56,0	20,2

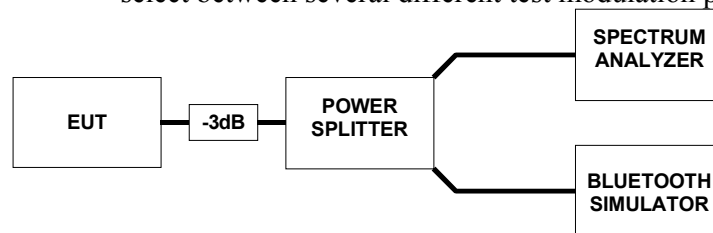
14 SPURIOUS RF CONDUCTED EMISSIONS

EUT	07002		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	22 °C	55 RH%	1010 hPa
Date of measurement	November 24, 2003		
FCC rule part	§15.247 (c) (2)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Marko Turkkila		

14.1 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 30: 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.

14.2 EUT operation mode

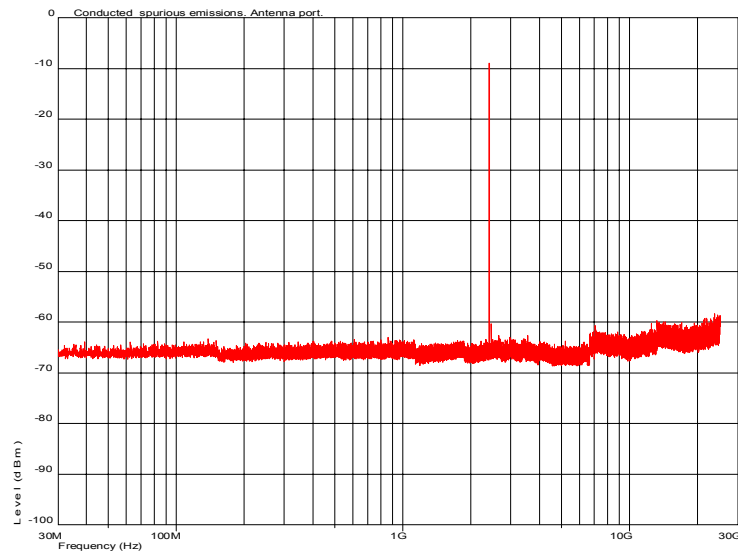
EUT operation mode	Connection, DM5, PRBS
EUT channel	0, 39 and 78
EUT TX power level	0 dBm

14.3 Limit

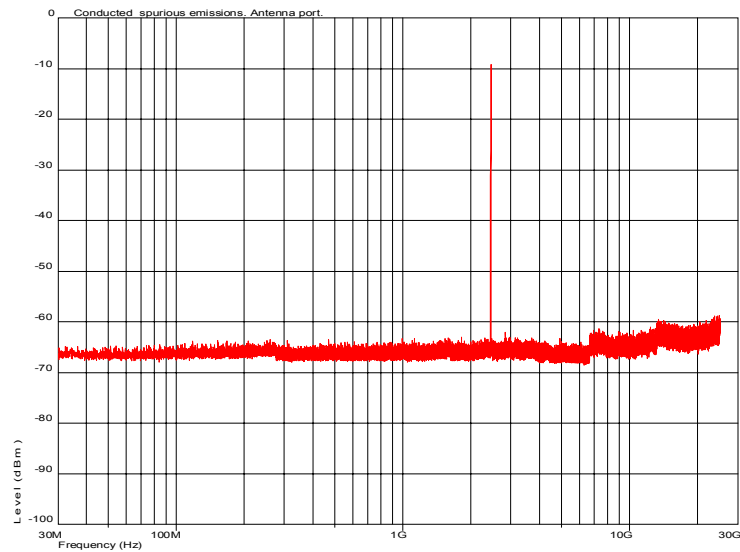
EUT Channel	Limit (dBc)
0	≤ -20
39	
78	

14.4 Results

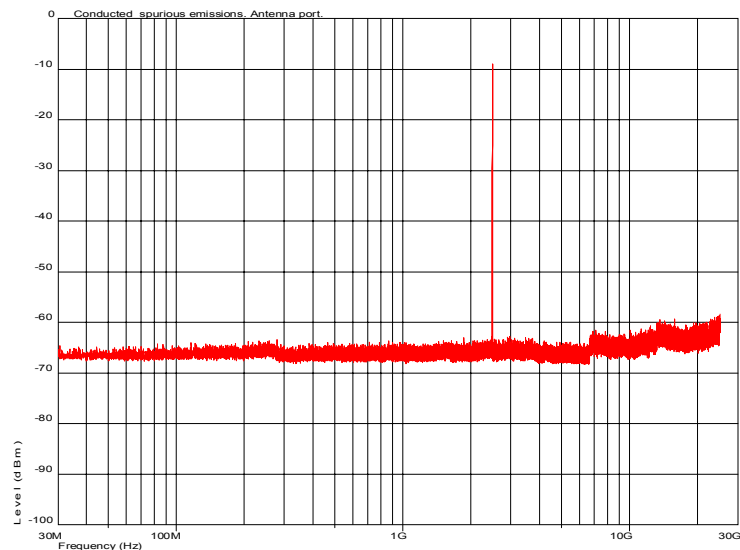
All spurious emissions measured were least 45 dB below the carrier level.



Picture 31: Conducted spurious emissions on antenna port, Channel 0



Picture 32: Conducted spurious emissions on antenna port, Channel 39



Picture 33: Conducted spurious emissions on antenna port, Channel 78

15 RADIATED SPURIOUS EMISSIONS

EUT	07001		
Accessories	07003, 07004		
Temp, Humidity, Air Pressure	20 °C	60 RH%	998 hPa
Date of measurement	November 7, 2003		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Marko Turkkila		

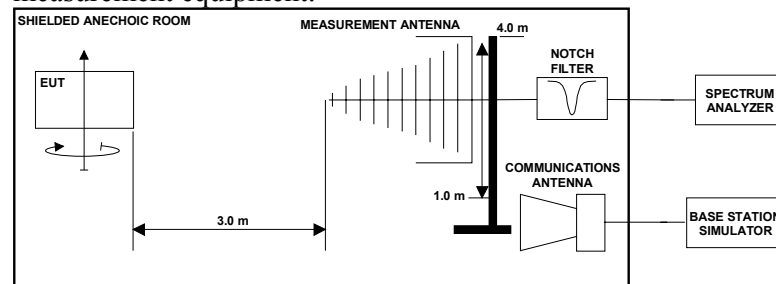
15.1 Test setup

The Bluetooth simulator was used to:

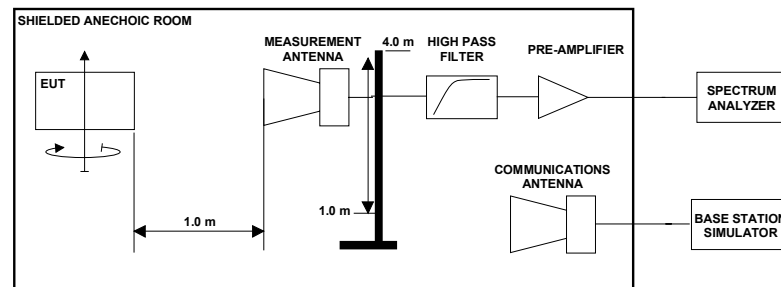
- set the EUT channel (0 – 78)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping

select between several different test modulation patterns

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



Picture 34: Test setup for radiated spurious emissions measurement on below 3 GHz frequencies



Picture 35: Test setup for radiated spurious emissions measurement on above 3 GHz frequencies

15.2 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 dB μ V/m at 3 m (1m over 3GHz) distance, are reported.
5. Test was made both with the EUT flip open and closed

15.3 EUT operation mode

EUT operation mode	Connection mode, DM5, PRBS
EUT channel	0 (2402 MHz), 39 (2441 MHz) and 78 (2480 MHz)
EUT TX power level	0 dBm

15.4 Limit

Table 13: 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

Table 14: Radiated spurious emission limits at measurement distance 1m

Frequency of emission [MHz]	1m Limit [μV / m]	1m Limit [dBμV/m]	Measurement detector type
Above 1000	500	63.5	Average
Above 1000	5000	83.5	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.

15.5 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.

15.5.1 EUT flip closed

Table 15: Emission levels PEAK detector, channel 0

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4804,0	48,7	-8,2	40,5	V	H	1,0	180,0
7206,0	44,9	1,1	46,0	H1	V	1,8	300,0
9608,0	47,2	0,4	47,7	H2	H	1,3	180,0
12010,0	42,7	6,0	48,7	V	V	1,9	240,0
14412,0	45,1	7,2	52,3	H2	H	1,0	110,0

Table 16: Emission levels PEAK detector, channel 39

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4882,0	47,9	-7,8	40,1	H2	V	2,0	0,0
7323,0	45,3	1,4	46,7	H1	V	2,0	60,0
9764,0	47,3	0,9	48,2	H2	V	1,9	180,0
12205,0	42,7	6,1	48,8	V	H	1,7	70,0
14646,0	46,1	6,6	52,8	V	H	1,0	300,0

Table 17: Emission levels PEAK detector, channel 78

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4960,0	49,5	-7,4	42,1	V	V	1,0	260,0
7440,0	44,5	1,6	46,1	H1	H	1,9	10,0
9920,0	46,6	1,4	47,9	H1	H	1,5	150,0
12400,0	42,4	6,2	48,6	H2	V	1,4	300,0

Table 18: Emission levels AVERAGE detector, channel 0

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4804,0	35,4	-8,2	27,2	V	H	1,0	180,0
7206,0	31,4	1,1	32,5	H1	V	1,8	300,0
9608,0	33,5	0,4	33,9	H1	V	1,9	240,0
12010,0	28,8	6,0	34,8	H2	H	1,1	180,0
14412,0	31,7	7,2	38,9	H2	H	1,0	110,0

Table 19: Emission levels AVERAGE detector, channel 39

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4882,0	34,2	-7,8	26,4	V	V	1,3	190,0
7323,0	31,4	1,4	32,7	V	V	1,5	300,0
9764,0	33,5	0,9	34,4	V	V	1,3	300,0
12205,0	29,0	6,1	35,0	V	H	1,7	70,0
14646,0	31,7	6,6	38,3	H2	H	1,9	0,0

Table 20: Emission levels AVERAGE detector, channel 78

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4960,0	36,8	-7,4	29,4	V	V	1,0	260,0
7440,0	31,1	1,6	32,7	V	V	1,9	300,0
9920,0	32,9	1,4	34,3	V	V	1,9	0,0
12400,0	29,0	6,2	35,2	V	H	1,7	180,0

15.5.2 EUT flip open

Table 21: Emission levels PEAK detector, channel 0

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4804,0	47,9	-8,2	39,7	V	H	1,7	60,0
7206,0	45,4	1,1	46,6	V	H	1,5	310,0
9608,0	47,1	0,4	47,5	V	H	2,0	300,0
12010,0	42,2	6,0	48,2	V	H	1,7	220,0
14412,0	45,1	7,2	52,3	H1	V	1,9	180,0

Table 22: Emission levels PEAK detector, channel 39

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4882,0	48,0	-7,8	40,2	H1	H	1,6	240,0
7323,0	45,2	1,4	46,6	V	V	1,7	240,0
9764,0	47,2	0,9	48,1	V	H	1,6	240,0
12205,0	42,8	6,1	48,9	H2	V	1,9	300,0
14646,0	42,0	6,6	48,7	V	V	1,4	0,0
17087,0	39,3	13,0	52,3	V	V	1,6	30,0

Table 23: Emission levels PEAK detector, channel 78

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4960,0	49,6	-7,4	42,2	V	V	1,2	290,0
7440,0	45,0	1,6	46,6	V	H	2,0	240,0
9920,0	46,3	1,4	47,7	V	H	2,0	40,0
12400,0	42,1	6,2	48,2	V	V	1,2	320,0
14880,0	43,1	5,4	48,5	V	H	1,7	120,0
17360,0	38,5	12,5	51,0	H2	V	1,7	180,0

Table 24: Emission levels AVERAGE detector, channel 0

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4804,0	34,5	-8,2	26,3	H2	H	1,5	270,0
7206,0	31,3	1,1	32,4	H2	H	1,5	210,0
9608,0	33,4	0,4	33,8	H2	V	1,1	80,0
12010,0	28,6	6,0	34,6	V	H	1,7	220,0
14412,0	31,6	7,2	38,8	H1	V	1,9	180,0

Table 25: Emission levels AVERAGE detector, channel 39

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4882,0	34,4	-7,8	26,6	V	V	1,4	340,0
7323,0	31,3	1,4	32,6	V	V	1,7	240,0
9764,0	33,5	0,9	34,4	H1	V	1,3	240,0
12205,0	29,1	6,1	35,1	H2	V	1,9	300,0
14646,0	28,3	6,6	34,9	V	V	1,4	0,0
17087,0	25,2	13,0	38,2	V	V	1,6	30,0

Table 26: Emission levels AVERAGE detector, channel 78

Freq MHz	Measured Value dBuV	Correction Factor dB	Result dBuV/m	EUT orientation	Antenna Pol.	Antenna height	Turntable angle
4960,0	36,6	-7,4	29,2	V	V	1,2	290,0
7440,0	31,2	1,6	32,8	V	H	2,0	240,0
9920,0	33,0	1,4	34,3	H2	V	1,9	340,0
12400,0	28,7	6,2	34,9	H2	H	1,6	240,0
14880,0	29,8	5,4	35,2	H1	H	1,2	300,0
17360,0	24,9	12,5	37,4	H1	V	1,9	240,0

16 TEST EQUIPMENT

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

16.1 Conducted measurements

Equipment	Manufacturer	Model
Spectrum Analyzer	Agilent	E7405A
Measurement receiver	Rohde & Schwarz	ESCS 30
Attenuator 3 dB	Narda	779-3
Power splitter	Mini Circuits	ZFSC-2-4
Power splitter	Narda	4426-2
Bluetooth Simulator	Anritsu	MT 8850A
Transient limiter / 10 dB attenuator	Chase	CFL 9206
Line Impedance Stabilization Network (LISN)	Rohde & Schwarz	ESH 3-Z5

16.2 Radiated measurements

Equipment	Manufacturer	Model
Spectrum Analyzer	Agilent	E7405A
Antenna	Chase	CBL 6140
Antenna	Schwarzbeck	BBHA 9120D
High pass filter	Wainwright Instruments	WHK3.0/18GST
Pre-amplifier	JCA	118-400
Turn table / antenna mast controller	EMCO	2090
Antenna mast	EMCO	2075-2
Bluetooth simulator	Anritsu	MT 8850A

17 TEST SETUP PHOTOGRAPHS

Test setup photograph can be found in a separate document

T03-070C-EMC_PHOTOS.doc