Bluetooth test report
for
RA-4

FCC ID:PYARA-4
IC: 661V-RA4

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1 LABORATORY INFORMATION

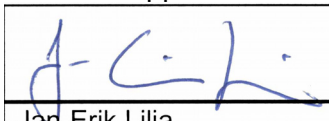
Test laboratory:	TCC Tampere Sinitaival 5 FIN-33720 TAMPERE Tel. +358 7180 46800 Fax. +358 7180 46880
FCC registration number: IC file number:	94436 (June 14, 2002) IC 3608 (March 5, 2003)

2 CUSTOMER INFORMATION

Client:	Nokia Corporation Joensuunkatu 7 FIN-24100 SALO BOX 86 FIN-24101 SALO Tel. +358-71-8008000 Fax. +358-71-8044277
Contact person:	Timo Seppälä
Receipt of EUT:	27-31.1.2005
Date of testing:	27.1-3.2.2005
Date of report:	04.02.2005

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

Contents approved:



Jan-Erik Lilja
Senior Test Engineer

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3 SUMMARY OF TEST RESULTS

Rule part in CFR 47	Section in RSS-210		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, a1ii, 15.247, f	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 powerline 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**

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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.

	Name	Type	S/N	HW	SW	EUT number
EUT	RA-4	Phone	004400571630431	5300	04.53	40168
	RA-4	Phone	004400571630423	5300	04.53	40164
Accessories	BP-6M	Battery	-	-	-	40171
	BP-6M	Battery	-	-	-	40169
	ACP-12E	Charger	-	5.0	-	40172

Notes: -

4.1 EUT description

The EUT is a triple band (GSM900/1800/1900 EGPRS) mobile phone with Bluetooth connection.

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.

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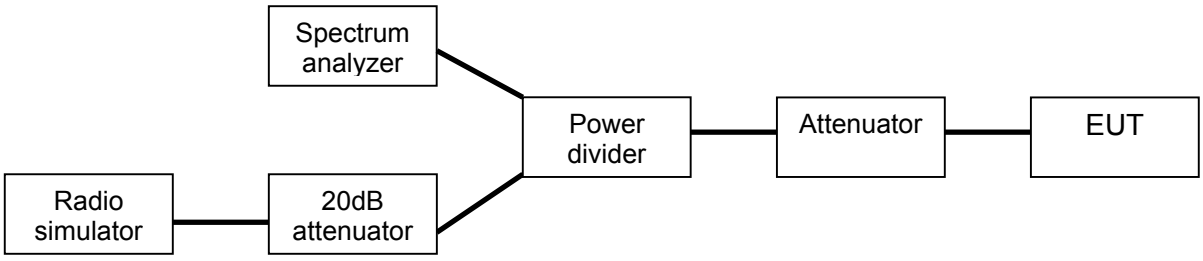
5.1 Setup A (conducted measurements)

This setup was used in conducted measurements. The Bluetooth simulator was used to control the following:

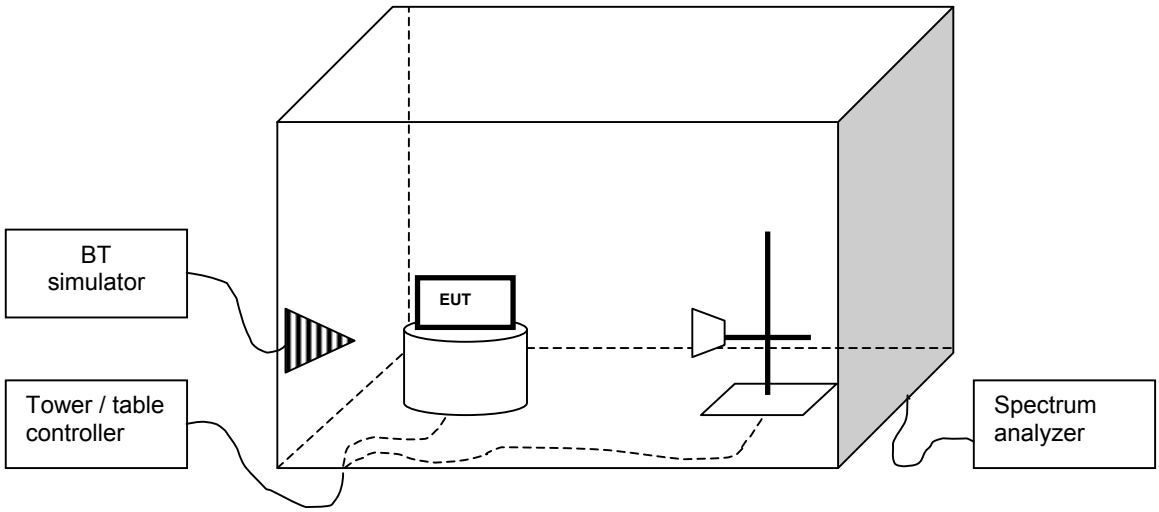
- set the EUT channel (2 – 80)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns

In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



5.2 Setup B (radiated measurements)

The EUT was set on a non-conductive turn table in a semi anechoic chamber. In the corner of the chamber there was a communication antenna, which was connected to the BT simulator located outside the chamber. The radiated power from the EUT was measured with an antenna fixed to a antenna tower. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The Bluetooth simulator was used to the same as in conducted measurements. In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



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6 STANDARDS AND MEASUREMENT METHODS

The tests were performed in guidance of CFR 47 Part 15.247, 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".

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7 CARRIER FREQUENCY SEPARATION

EUT	40168		
Accessories	40171		
Test setup	A		
Temp, Humidity, Air Pressure	24 ºC	38 %RH	1019 mbar
Date of measurement	27.01.2005		
FCC rule part	§15.247 (a) (1)		
RSS-210 section	6.2.2 (o), a1		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

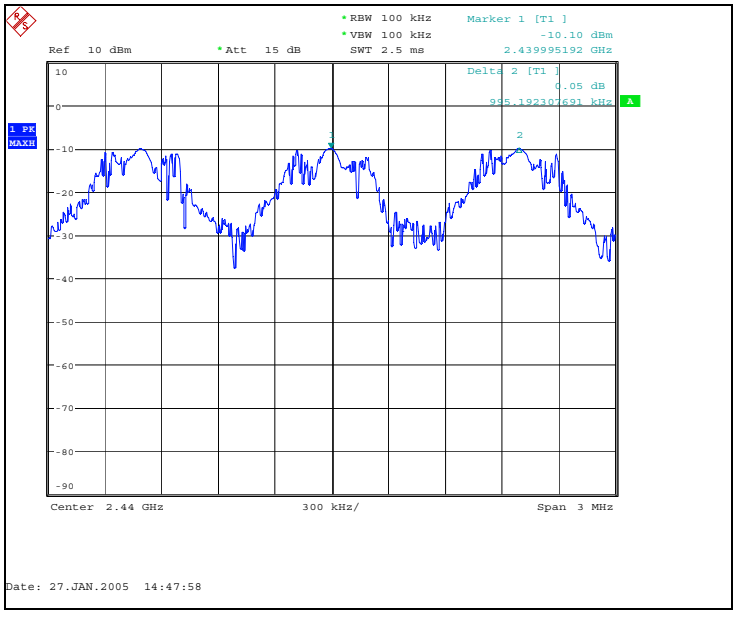
7.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	Hopping
EUT TX power level	Nominal

7.2 Limits and results

Limit (MHz)	Result (MHz)
≥ 0.025 or 20dB BW	0.995

7.3 Screen shot



Picture 1 Carrier frequency separation of channels 38 and 39

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8 NUMBER OF HOPPING FREQUENCIES

EUT	40168		
Accessories	40171		
Test setup	A		
Temp, Humidity, Air Pressure	24 ºC	38 %RH	1019 mbar
Date of measurement	27.01.2005		
FCC rule part	§15.247(a) (2)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

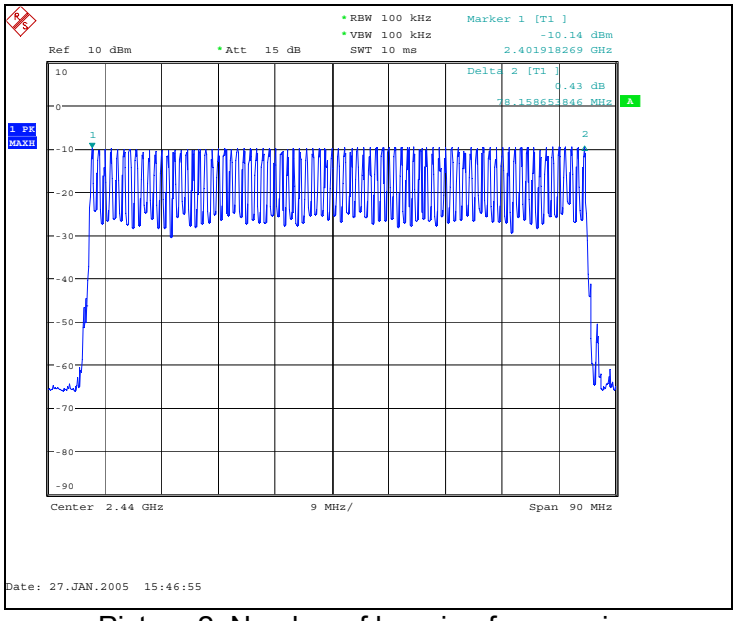
8.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	Hopping
EUT TX power level	Nominal

8.2 Limits and results

Number	Measured value
≥ 75	79

8.3 Screen shot



Picture 2 Number of hopping frequencies

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9 TIME OF OCCUPANCY

EUT	40168		
Accessories	40171		
Test setup	A		
Temp, Humidity, Air Pressure	24 ºC	38 %RH	1019 mbar
Date of measurement	27.01.2005		
FCC rule part	§15.247 (a) (3)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

9.1 Connection mode

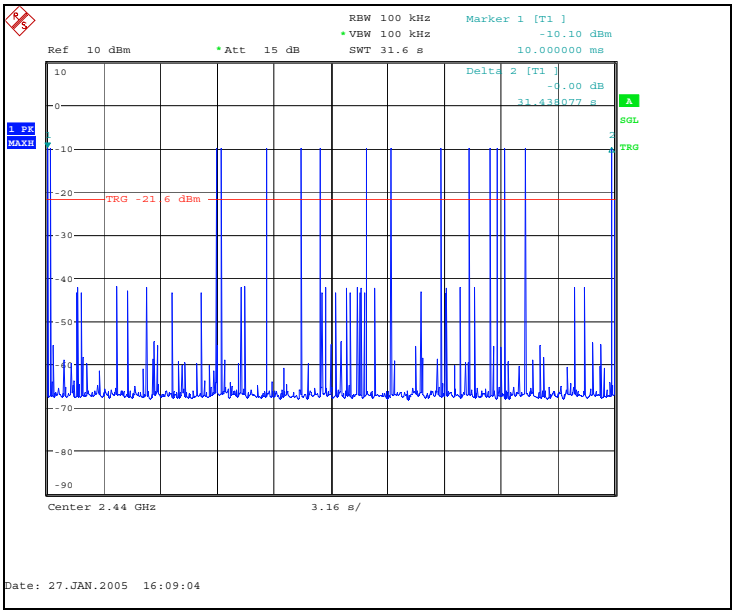
9.1.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	Hopping
EUT TX power level	Nominal

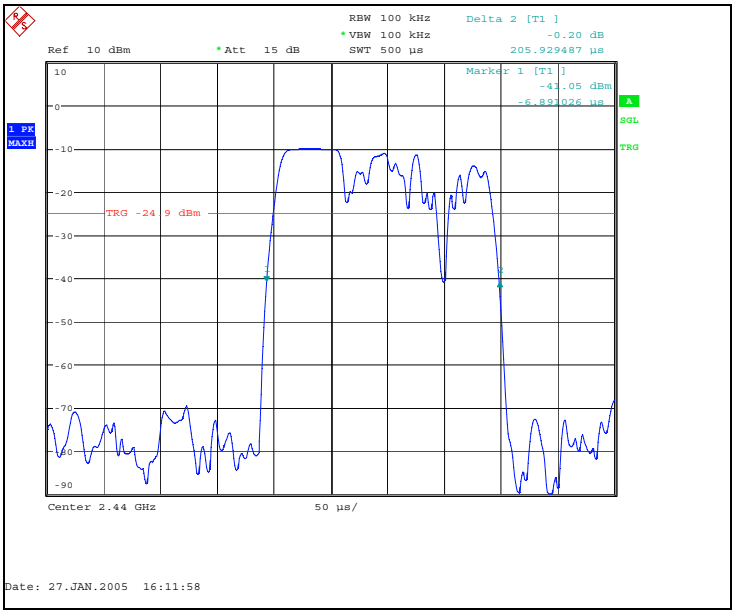
9.2 Limits and results

Limit (s)	Measured value (s)
≤ 0.4	0.003

In measurement time of 31.6 s, total of 16 transmissions occurred. The duration of one transmission was 206µs. 16 * 206µs = 3.296 ms.
Screen shots



Picture 3. Number of transmissions, channel 38



Picture 4. Duration of one transmission, channel 38

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10 20dB BANDWIDTH

EUT	40168		
Accessories	40171		
Test setup	A		
Temp, Humidity, Air Pressure	24 ºC	38 %RH	1019 mbar
Date of measurement	27.01.2005		
FCC rule part	§15.247 (a) (1)		
RSS-210 section	6.2.2 (o), a1		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

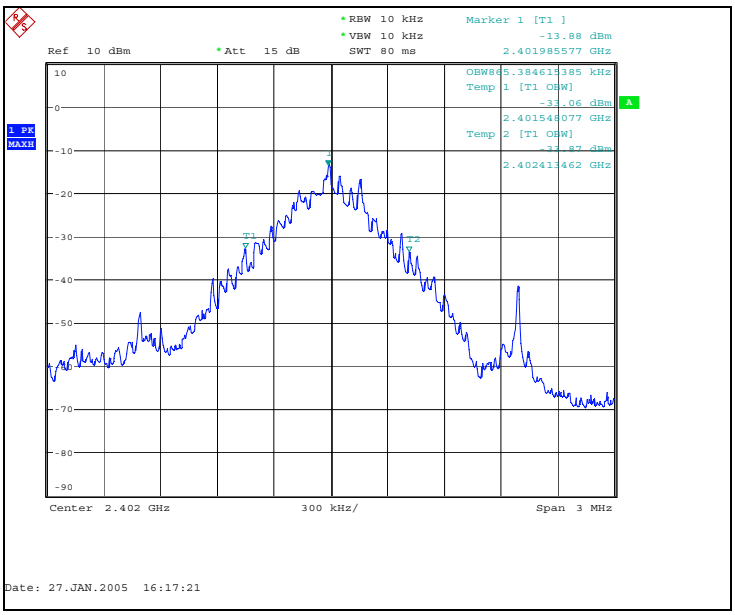
10.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	0, 38 and 78
EUT TX power level	Nominal

10.2 Limits and results

EUT Channel	Limit (MHz)	Measured value (MHz)
0	≤1.0	0.865
38		0.865
78		0.865

10.3 Screen shots



Picture 5. 20dB bandwidth, channel 0

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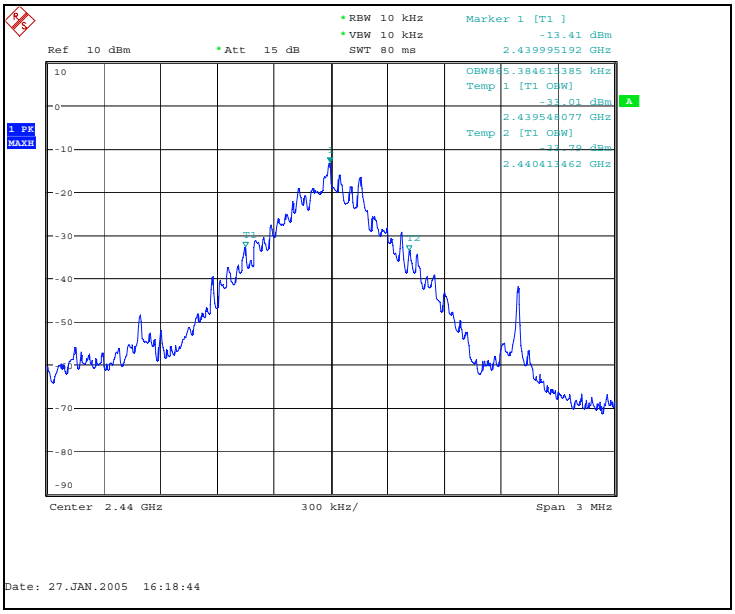
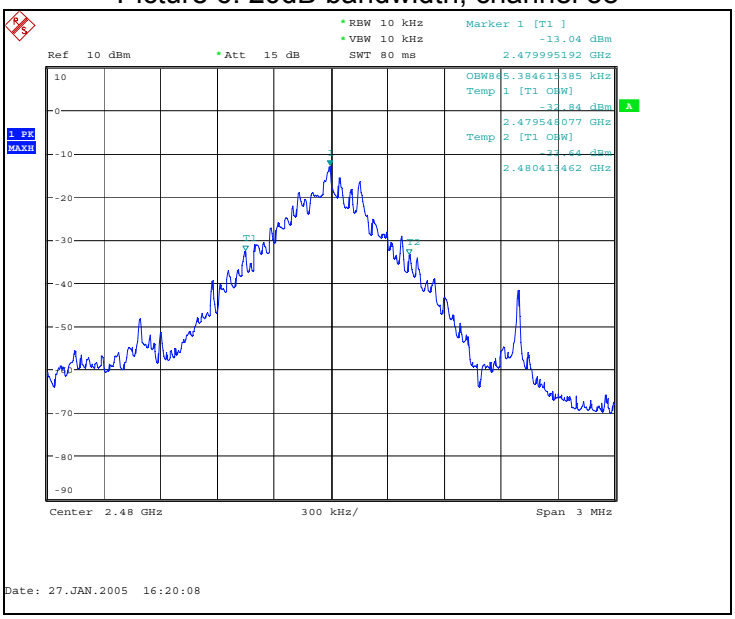


Picture 6. 20dB bandwidth, channel 38



Picture 7. 20dB bandwidth, channel 78

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11 PEAK OUTPUT POWER

EUT	40168		
Accessories	40171		
Test setup	A		
Temp, Humidity, Air Pressure	23 ºC	38 %RH	1018 mbar
Date of measurement	28.1.2005		
FCC rule part	§15.247 (b) (1)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

11.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	0, 38 and 78
EUT TX power level	Nominal

11.2 Limits and results

EUT Channel	Limit (W)	Test result [W]
0	≤ 1	0.00189
38		0.00171
78		0.00200

The measured power values were corrected with the attenuation of the cables, attenuator and power divider using the formula:

$$P[W] = \frac{10^{(P_{Meas[dBm]} + L_{Cables[dB]} + L_{Attenuator[dB]} + L_{Divider[dB]})/10}}{1000}$$

EUT Channel	Measured value [dBm]	Signal path loss [dB]	Peak output power [dBm]	Peak output power [W]
0	-9.72	12.49	2.77	0.00189
38	-10.01	12.33	2.32	0.00171
78	-9.31	12.32	3.01	0.00200

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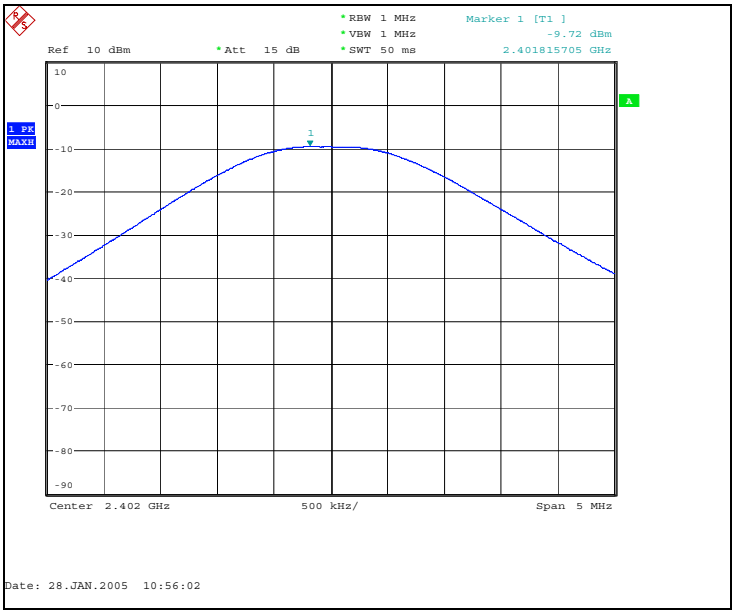
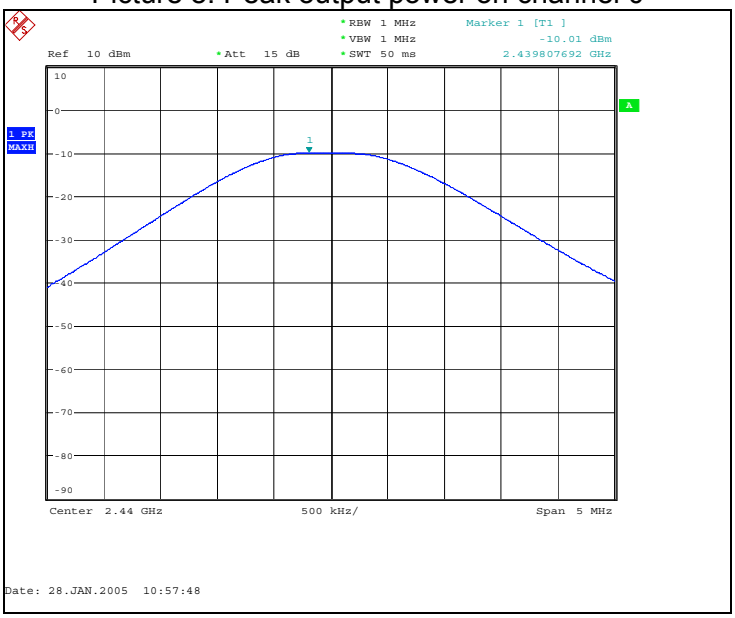
11.3 Screen shots



Picture 8. Peak output power on channel 0



Picture 9. Peak output power on channel 38

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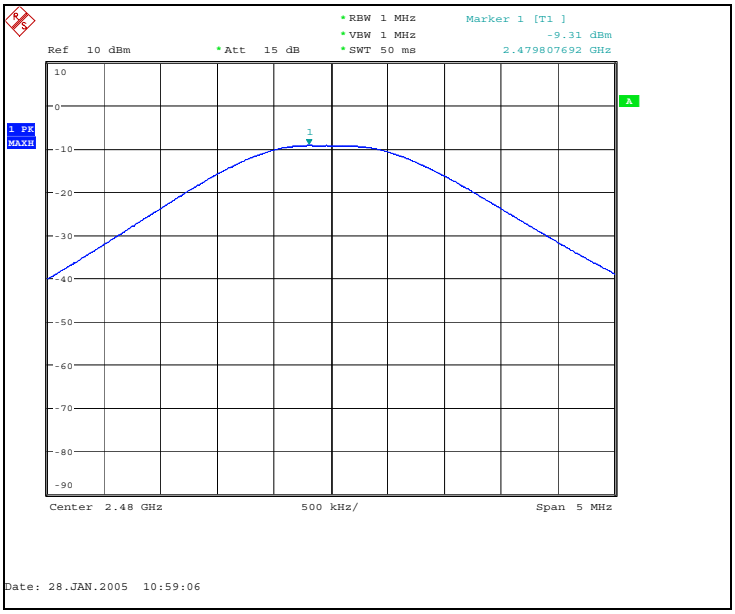

Picture 10. Peak output power on channel 78

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12 BAND-EDGE COMPLIANCE OF RF RADIATED EMISSIONS

12.1 Hopping enabled

EUT	40164		
Accessories	40169, 40172		
Test setup	B		
Temp, Humidity, Air Pressure	20ºC	49 %RH	1030 mbar
Date of measurement	3.2.2004		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jari Jantunen		
Result	**PASS**		

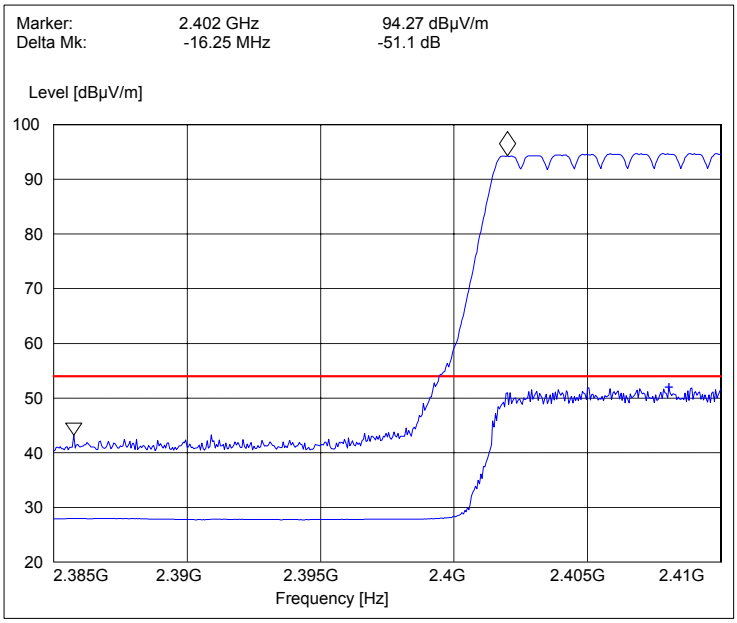
12.1.1 EUT operation mode

EUT operation mode	Connection, DH1 packet type
EUT channel	Hopping
EUT TX power level	Nominal

12.1.2 Limits and results

Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-51.10
78		-44.13

12.1.3 Screen shots



Picture 11. Bandedge compliance, low end

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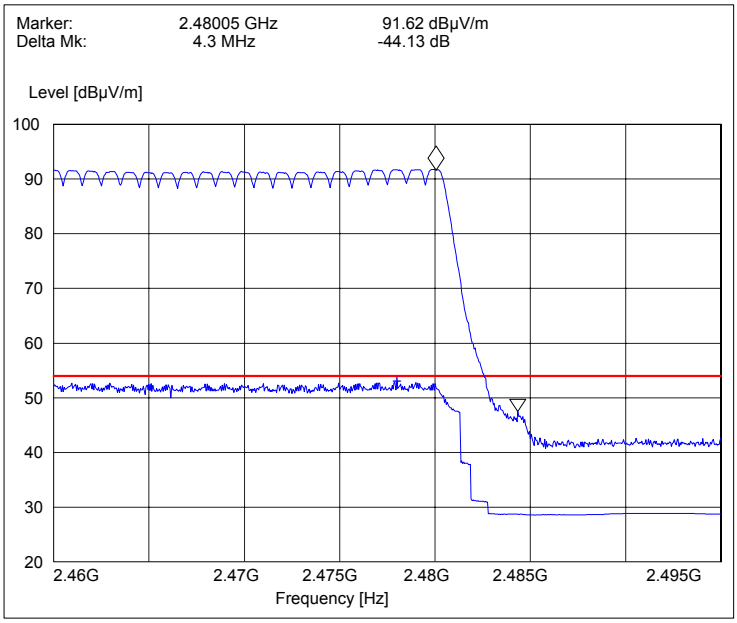

Picture 12. Bandedge compliance, high end

12.2 Hopping disabled

EUT	40164		
Accessories	40169, 40172		
Test setup	B		
Temp, Humidity, Air Pressure	20 ºC	49 %RH	1030 mbar
Date of measurement	3.2.2004		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jari Jantunen		
Result	**PASS**		

12.2.1 Test method

The test is made according to ANSI C63.4 (1992).

12.2.2 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	0 and 78
EUT TX power level	Nominal

12.2.3 Limits and results

Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-51.07
78		-43.73

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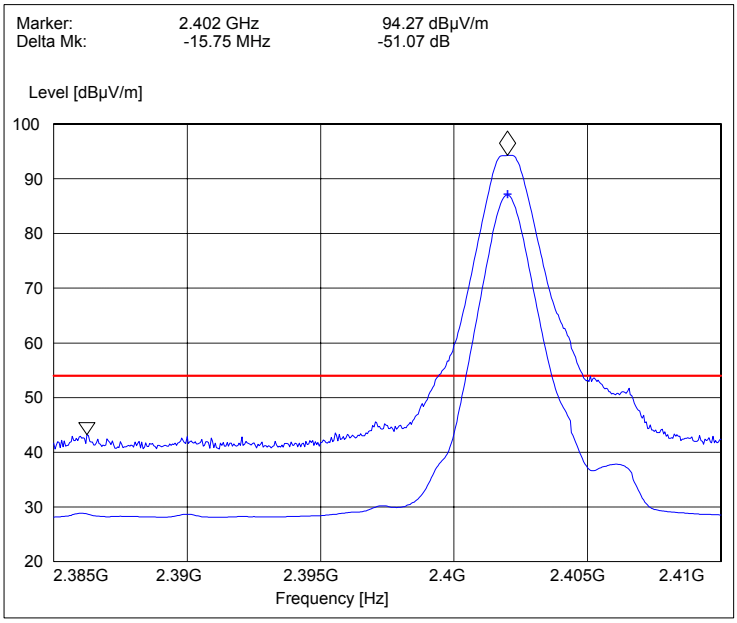
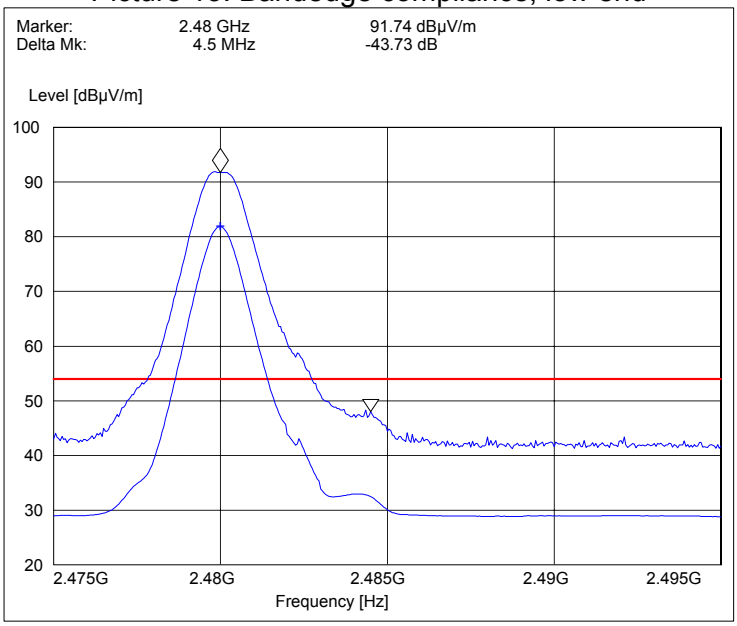
12.2.4 Screen shots



Picture 13. Bandedge compliance, low end



Picture 14. Bandedge compliance, high end

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13 AC POWERLINE CONDUCTED EMISSIONS

EUT	40164		
Accessories	40169, 40172		
Temp, Humidity, Air Pressure	19 ºC	52 %RH	1019 mbar
Date of measurement	27.1.2005		
FCC rule part	§15.207		
RSS-210 section	6.6		
Measured by	Jari Jantunen		
Result	**PASS**		

13.1 Test setup

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

13.2 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	38
EUT TX power level	Nominal
EUT operation voltage	115VAC/60Hz

13.3 Limit

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

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.

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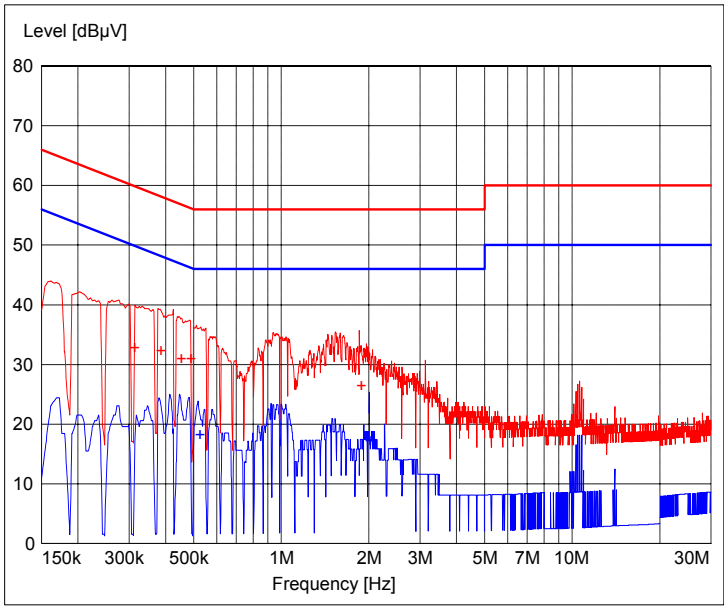

Picture 15 AC powerline emissions

Table 1 Emission measurement data, average detector

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin	Detector dB	Line	PE
0.523500	18.20	10.20	46.00	27.80	AV	N	GND
2.008500	17.20	10.40	46.00	28.80	AV	N	GND

Table 2 Emission measurement data, quasi-peak detector

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin	Detector dB	Line	PE
0.312000	32.70	10.10	59.90	27.20	QP	N	GND
0.384000	32.30	10.10	58.20	25.90	QP	N	GND
0.451500	31.00	10.10	56.80	25.80	QP	N	GND
0.487500	30.90	10.20	56.20	25.30	QP	N	GND
1.873500	26.40	10.40	56.00	29.60	QP	N	GND

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14 SPURIOUS RF CONDUCTED EMISSIONS

EUT	40168		
Accessories	40171		
Test setup	A		
Temp, Humidity, Air Pressure	23 ºC	38 %RH	1018 mbar
Date of measurement	28.1.2005		
FCC rule part	§15.247 (c) (2)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

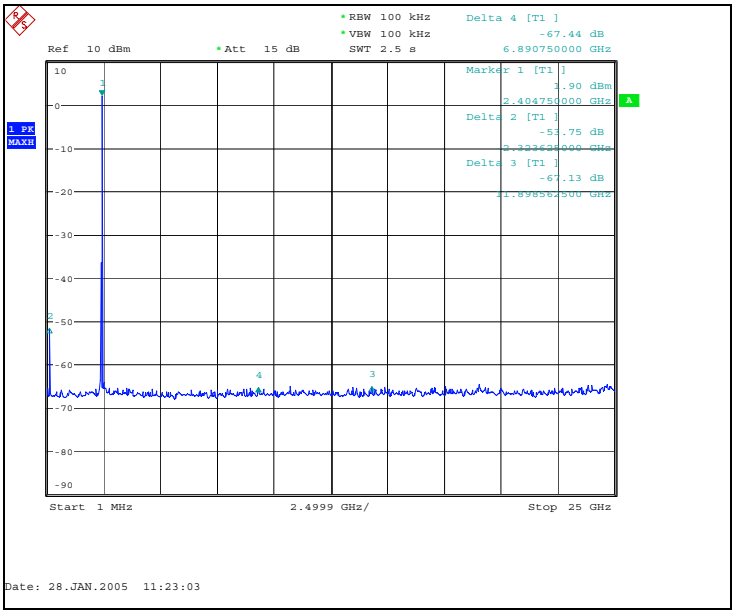
14.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	0, 38 and 78
EUT TX power level	Nominal

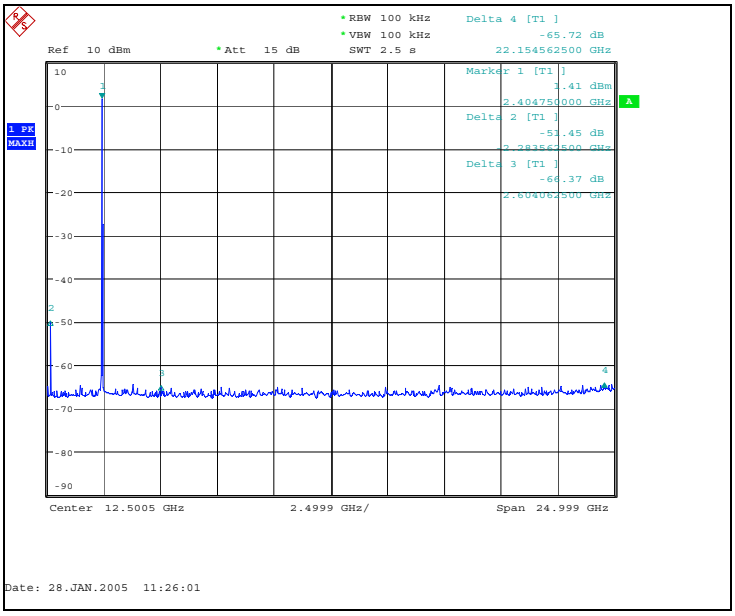
14.2 Limits and results

EUT Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-53.8
38		-51.5
78		-51.0

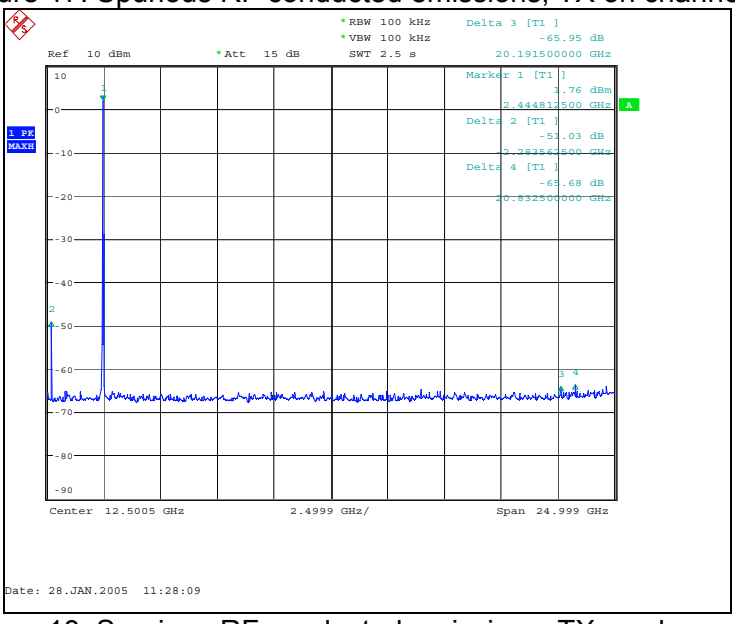
14.3 Screen shots



Picture 16. Spurious RF conducted emissions, TX on channel 0



Picture 17. Spurious RF conducted emissions, TX on channel 38



Picture 18. Spurious RF conducted emissions, TX on channel 78

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15 SPURIOUS RADIATED EMISSIONS

EUT	40164		
Accessories	40169, 40172		
Test setup	B		
Temp, Humidity, Air Pressure	20.. 21 ºC	47 %RH	1019 mbar
Date of measurement	28.1, 31.1.2005		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jari Jantunen		
Result	**PASS**		

15.1 Test method

a) The spectrum analyzer with peak detector was used to find all the emissions generated by the EUT.
b) All suspicious frequencies with emission levels were recorded.
c) The test was repeated with the EUT in three orthogonal orientations.
d) For each frequency detected in (b), the emissions were maximized by moving the turn table and measuring antenna and manipulating the EUT.
e) The maximized emissions were measured and reported.

15.2 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	0, 38 and 78
EUT TX power level	Nominal
EUT operation voltage	Nominal

15.3 Limits, 3m measuring distance

Frequency band (MHz)	Limit (µV/m)	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	Av
1000 - 25000	5000	74.0	Pk

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.

15.4 Results

The results were corrected with the cable and filter losses, preamplifier gain, antenna factor and measurement distance.

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Table 3 Emission levels, flip closed, channel 0, Average detector

Frequency MHz	Level dBµV/m
4804.00	26.70
7206.00	29.40
9608.00	32.60
12010.00	34.10
14412.00	36.80
16814.00	35.00

Table 4 Emission levels, flip closed, channel 0, Peak detector

Frequency MHz	Level dBµV/m
4804.00	39.60
7206.00	43.00
9608.00	45.10
12010.00	47.10
14412.00	49.40
16814.00	48.50

Table 5 Emission levels, flip closed, channel 38, Average detector

Frequency MHz	Level dBµV/m
4880.00	26.90
7320.00	30.30
9760.00	31.90
12200.00	33.70
14640.00	36.00
17080.00	36.00

Table 6 Emission levels, flip closed, channel 38, Peak detector

Frequency MHz	Level dBµV/m
4880.00	40.50
7320.00	42.90
9760.00	44.40
12200.00	46.80
14640.00	49.10
17080.00	48.60

Table 7 Emission levels, flip closed, channel 78, Average detector

Frequency MHz	Level dBµV/m
4960.00	27.80
7440.00	30.20
9920.00	32.90
12400.00	34.30
14880.00	35.40
17360.00	37.60

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Table 8 Emission levels, flip closed, channel 78, Peak detector

Frequency MHz	Level dBµV/m
4960.00	40.80
7440.00	42.90
9920.00	45.60
12400.00	47.50
14880.00	49.00
17360.00	50.30

Table 9 Emission levels, flip open, channel 0, Average detector

Frequency MHz	Level dBµV/m
4804.00	26.70
7206.00	29.40
9608.00	32.60
12010.00	34.10
14412.00	36.80
16814.00	35.00

Table 10 Emission levels, flip open, channel 0, Peak detector

Frequency MHz	Level dBµV/m
4804.00	39.70
7206.00	42.50
9608.00	45.40
12010.00	46.80
14412.00	49.70
16814.00	47.40

Table 11 Emission levels, flip open, channel 38, Average detector

Frequency MHz	Level dBµV/m
4880.00	26.90
7320.00	30.30
9760.00	31.90
12200.00	33.70
14640.00	35.90
17080.00	36.00

Table 12 Emission levels, flip open, channel 38, Peak detector

Frequency MHz	Level dBµV/m
4880.00	39.60
7320.00	43.50
9760.00	45.00
12200.00	47.00
14640.00	48.40
17080.00	48.90

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Table 13 Emission levels, flip open, channel 78, Average detector

Frequency MHz	Level dBµV/m
4960.000000	27.80
7440.000000	30.30
9920.000000	32.90
12400.000000	34.30
14880.000000	35.40
17360.000000	37.60

Table 14 Emission levels, flip open, channel 78, Peak detector

Frequency MHz	Level dBµV/m
4960.000000	40.90
7440.000000	43.10
9920.000000	45.80
12400.000000	46.90
14412.000000	49.40
17360.000000	50.90

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16 TEST EQUIPMENT

Each test equipment is calibrated once a year.

16.1 Conducted measurements

Equipment	Manufacturer	Model
Spectrum analyzer	Rohde & Schwarz	FSU
Radio communication tester	Rohde & Schwarz	CMU-200
Attenuator 10 dB	Huber+Suhner AG	6251.17.A
Step attenuator 110dB	Hewlett-Packard	8496A
Power splitter	Hewlett-Packard	11667A
High pass filter	Trilithic	WHK2010-10SS
Low pass filter	Trilithic	WLK1750-10SS
Tunable notch filter	Wainwright	WRCD1850/1910-0.2/40
Temperature chamber	Vötsch	VT4002
DC power supply	HP	6632A
Multimeter	Fluke	87

16.2 Radiated measurements

Equipment	Manufacturer	Model
3m semi-anechoic chamber	TDK	
EMI receiver	Rohde & Schwarz	ESI 40
Preamplifier	MITEQ	AMF-5D-020180-26-10P
Preamplifier	MITEQ	AMF-4D-10M-3G-25-20P
Dipole antenna	EMCO	3125-870
Dipole antenna	EMCO	3125-1880
Biconilog antenna	Rohde & Schwarz	HL562
Double ridged waveguide antenna	EMCO	3115
Horn antenna	EMCO	3116
Reference dipole set	Schwarzbeck	UHAP/VHAP
Communication antenna	EMC Automation	LPA-8020
Radio communication tester	Rohde & Schwarz	CMU-200
Signal generator	Hewlett-Packard	83640L
Step attenuator 110dB	Hewlett-Packard	8496A
Power splitter	Hewlett-Packard	11667A
High pass filter	Trilithic	WHK2010-10SS
Low pass filter	Trilithic	WLK1750-10SS
Tunable notch filter	Wainwright	WRCD1850/1910-0.2/40
Turntable controller	Deisel	HD-100
Turntable	Deisel	DS412
Antenna mast controller	EMCO	2090
Antenna mast	EMCO	2075
Temperature chamber	Vötsch	VT4002
DC power supply	Hewlett-Packard	6632A
Multimeter	Fluke	87

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