

Date:	ESPOO 24.10.2006	Page: <u>1 (34)</u> Appendices
Number: No. 1 / 1	72519R2b	Date of handing in: 18.08.2006 Tested by: Timo Hietala, Test Engineer
		Reviewed by: Janne Nyman, Product Manager

SORT OF EQUIPMENT: Remote control

MARKETING NAME: RC917FH/TR02 917 MHz Transceiver with single antenna

TYPE: RC917FH/TR02

MANUFACTURER: Scanreco Industrielektronik

CLIENT: Scanreco Industrielektronik

ADDRESS: Årsta Skolgränd 22, S-100 74 Stockholm, SWEDEN

TELEPHONE: +46 8 556 32 000

TEST LABORATORY: Nemko Oy

FCC REG. NO. 91087 August 24, 2004 IC 4627-1 October 10, 2006 IC FILE NO.

SUMMARY:

In regard to the performed tests the equipment under test fulfils the requirements defined in the test specifications, see page 2 for details.

This report supersedes test report no. 72519R2 dated 06.09.2006.

The test results are valid for the tested unit only. Without a written permission of Nemko Oy it is allowed to copy this report as a whole, but not partially



Summary of performed tests and test results

Section in CFR 47	Section in RSS-210		Result
15.247, a1	A8.1	Carrier frequency separation	PASS
15.247, a1i	A8.1	Number of hopping frequencies	PASS
15.247, a1i	A8.1	Time of occupancy	PASS
15.247, a1	A8.1	20 dB bandwidth	PASS
15.247, b2	A8.4 (1)	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

Explanations:

PASS The EUT passed that particular test. FAIL

The EUT failed that particular test.
The measurement was done, but there is no applicable performance criteria. Χ





Contents

Sι	ımmar	y of performed tests and test results	2
1.	Gene	ral	4
2.	Syste	m Configuration	4
	2.1	Test set-up	4
	2.2	Operating conditions of the EUT	4
	2.3	Channels of the EUT	4
3.	Test p	procedures	5
4.	Test r	esults	6
	4.1	Carrier frequency separation	6
	4.2	Number of hopping frequencies	7
	4.3	Time of occupancy	8
	4.4	20 dB bandwidth	10
	4.5	Peak conducted output power	12
	4.6	Band-edge compliance of RF conducted emissions	14
	4.7	Spurious RF conducted emissions	18
	4.8	Spurious radiated emission	21
5.	List of	test equipment	31
6.	Photo	graphs	32



1. General

The equipment under test (EUT) was a remote control. The purpose of the performed tests was to see if in regard to these tests the EUT fulfils the requirements defined in the FCC 47 CFR PART 15, SUBPART C (2005). The tests were performed according to the test specifications CISPR 22 (1997), ANSI C63.4 – 2003, FCC 47 CFR PART 15, SUBPART C (2005) and RSS-210 (Issue 6, September 2005)

2. System Configuration

2.1 Test set-up

Equipment under test (EUT):

• Remote control: Transceiver RC917FH/TR02, S/N:---

Cables:

From	То	Туре	Length [m]
Battery pack	EUT	DC cable, unshielded	0.2

Operating voltage of the EUT during the tests:

Rechargeable battery pack 7.2 VDC.

2.2 Operating conditions of the EUT

Emission tests:

For the duration of the tests the EUT was set to a transmitting mode of operation. The device was powered off a fresh battery during the tests.

2.3 Channels of the EUT

EUT Channel	Frequency (MHz)
Lowest	915.000
Highest	919.900

Page 4 (34) Date 24.10.2006



3. Test procedures

Radiated measurements

The test was performed inside a semi anechoic shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m high standing on the turntable. The radiated power from the EUT was measured with an antenna fixed to an 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.

Conducted measurements

The test was performed inside a shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m high. The conducted power from the EUT was measured with a spectrum analyzer.

Page 5 (34) Date 24.10.2006



4. Test results

4.1 Carrier frequency separation

The test was performed as a compliance test. The test parameters concerned were as follows:

Site name	Nemko Oy / Perkkaa
FCC rule part	§ 15.247, a1
Section in RSS-210	A8.1
Date of testing	04.09.2006
Test equipment	348, 566, 525
Test conditions	23 °C, 40 % RH
Test result	PASS

4.1.1 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Hopping
EUT TX power level	Nominal

4.1.2 Limits and test results

Limit (kHz)	Result (kHz)
≥ 25 or 20 dB BW	100

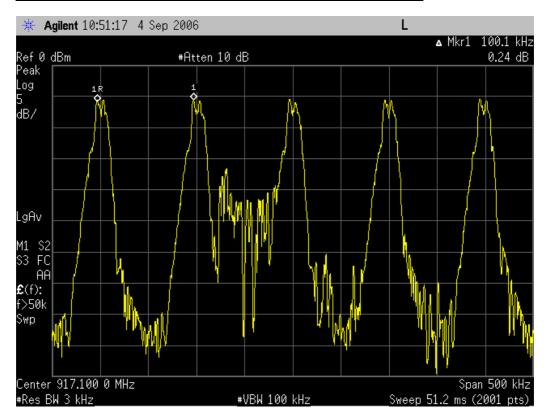


Figure 1. Carrier frequency separation



4.2 Number of hopping frequencies

The test was performed as a compliance test. The test parameters concerned were as follows:

Site name	Nemko Oy / Perkkaa
FCC rule part	§ 15.247, a1i
Section in RSS-210	A8.1
Date of testing	04.09.2006
Test equipment	348, 566, 525
Test conditions	23 °C, 40 % RH
Test result	PASS

4.2.1 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Hopping
EUT TX power level	Nominal

4.2.2 Limits and test results

Number	Measured value
≥ 50	50

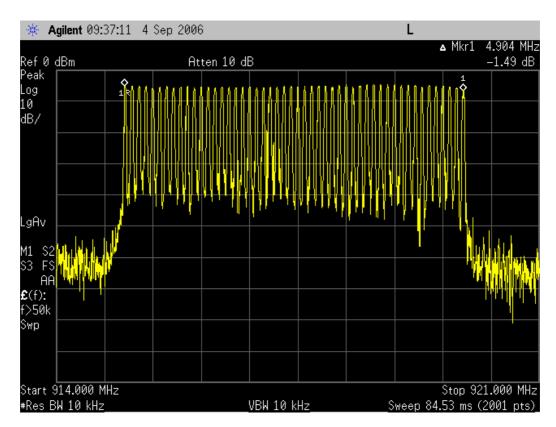


Figure 2. Number of hopping frequencies



4.3 Time of occupancy

The test was performed as a compliance test. The test parameters concerned were as follows:

Site name	Nemko Oy / Perkkaa
FCC rule part	§ 15.247, a1i
Section in RSS-210	A8.1
Date of testing	04.09.2006
Test equipment	348, 566, 525
Test conditions	23 °C, 40 % RH
Test result	PASS

4.3.1 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Hopping
EUT TX power level	Nominal

4.3.2 Limits and test results

Time of occupancy (s)	Measured value (s)
≤ 0.4	0.363

In measurement time of 20 s total of 18 transmissions occurred. The duration of one transmission was 20.16 ms, $18 \times 20.16 = 363 \text{ ms}$

Page 8 (34) Date 24.10.2006



4.3.3 Test data

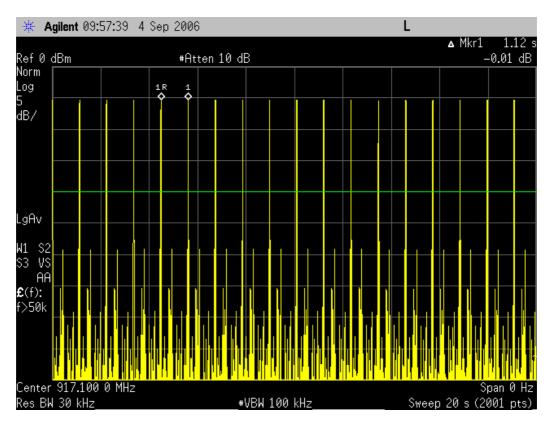


Figure 3. Number of transmissions

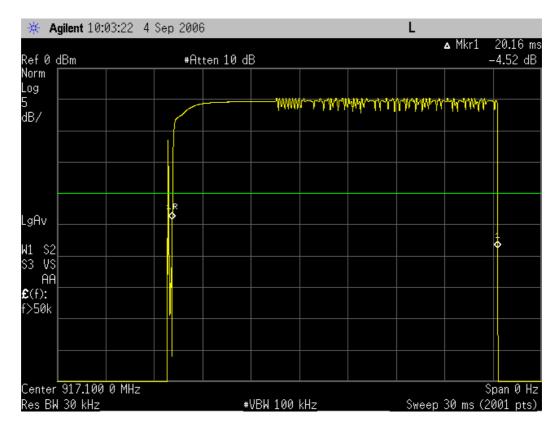


Figure 4. Duration of one transmission

9 (34)



4.4 20 dB bandwidth

The test was performed as a compliance test. The test parameters concerned were as follows:

Site name	Nemko Oy / Perkkaa		
FCC rule part	§ 15.247, a1i		
Section in RSS-210	A8.1		
Date of testing	21.10.2006		
Test equipment	348, 566		
Test conditions	22 °C, 40 % RH		
Test result	PASS		

4.4.1 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Lowest and highest
EUT TX power level	Nominal

4.4.2 Limits and test results

EUT Channel	Limit (kHz)	Measured value (kHz)	
lowest ≤ 250		13.5	
highest	≤ 250	12.7	

Page 10 (34) Date 24.10.2006



4.4.3 Test data

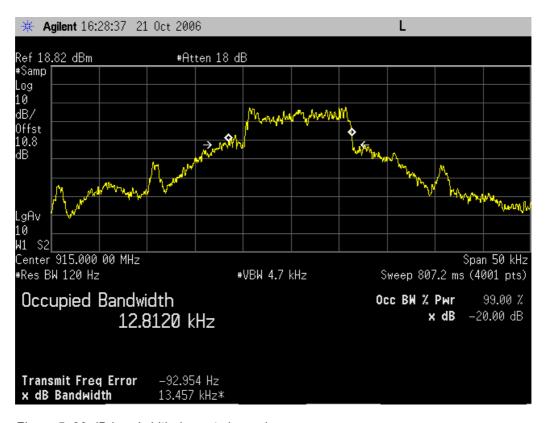


Figure 5. 20 dB bandwidth, lowest channel

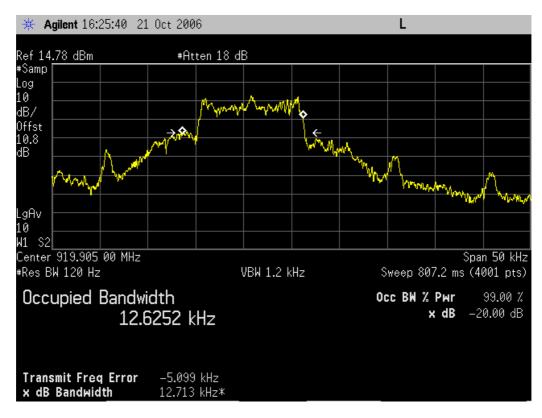


Figure 6. 20 dB bandwidth, highest channel



4.5 Peak conducted output power

The test was performed as a compliance test. The test parameters concerned were as follows:

Test result	PASS
Test conditions	23 °C, 40 % RH
Test equipment	348, 566
Date of testing	21.10.2006
Section in RSS-210	A8.4 (1)
FCC rule part	§ 15.247, b2
Site name	Nemko Oy / Perkkaa

4.5.1 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Lowest and highest
EUT TX power level	Nominal

4.5.2 Limits and test results

EUT Channel	Limit (W)	Measured value (W)	
Lowest ≤ 1.0		0.0273	
Highest ≤ 1.0		0.0254	

4.5.3 Test results

EUT Channel	P _{Measured} [dBm]	P [mW]
Lowest	14.36	27.3
Highest	14.04	25.4



4.5.4 Test data

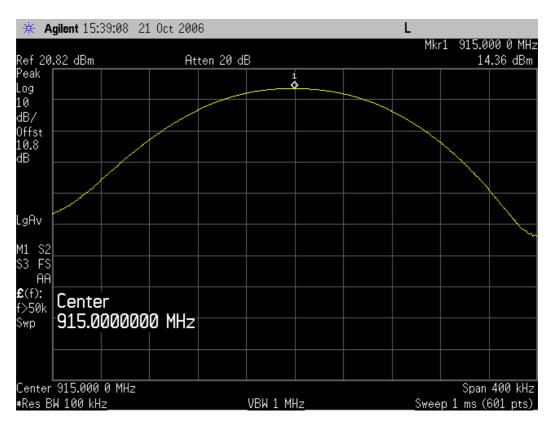


Figure 7. Peak conducted power, lowest channel

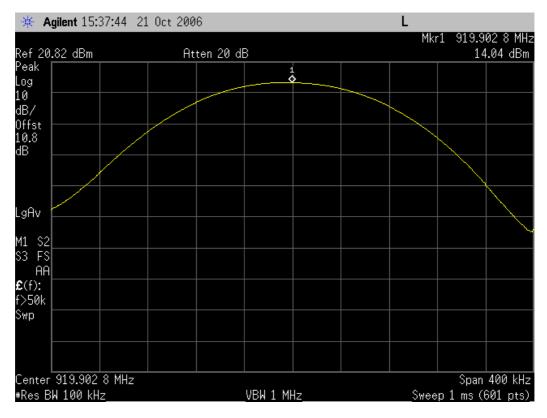


Figure 8. Peak conducted power, highest channel



4.6 Band-edge compliance of RF conducted emissions

The test was performed as a compliance test. The test parameters concerned were as follows:

Date of testing Test equipment	21.10.2006 348, 566
Test conditions	23 °C, 40 % RH
Test result	PASS

4.6.1 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Lowest and highest
EUT TX power level	Nominal

4.6.2 Limits and test results

EUT Channel	Frequency (MHz)	Result (dBm)	Result (dBc)	Limit (dBc)
lowest	893.64	-44.54	-58.90	≤ -20
highest	941.32	-39.49	-53.53	≤ -20

Page 14 (34) Date 24.10.2006



4.6.3 Test data

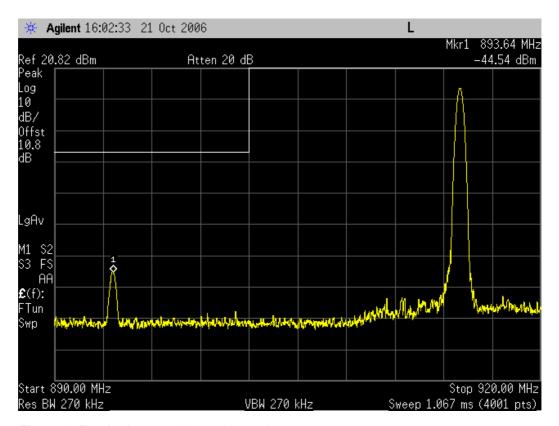


Figure 9. Band-edge compliance, low end

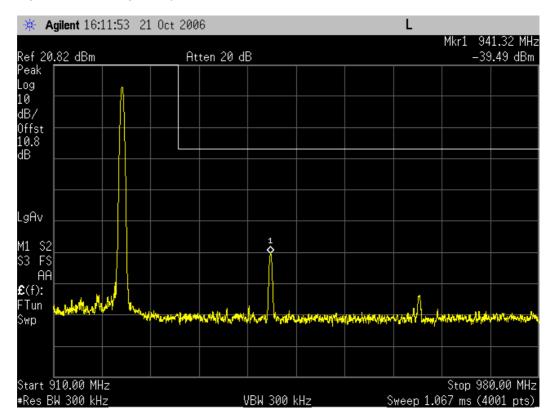


Figure 10. Band-edge compliance, high end





4.6.4 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Hopping
EUT TX power level	Nominal

4.6.5 Limits and test results

EUT Channel Frequency (MHz)		Result (dBm)	Result (dBc)	Limit (dBc)
lowest	896.97	-33.3	-47.66	≤ -20
highest	929.72	-31.1	-45.14	≤ -20



4.6.6 Test data

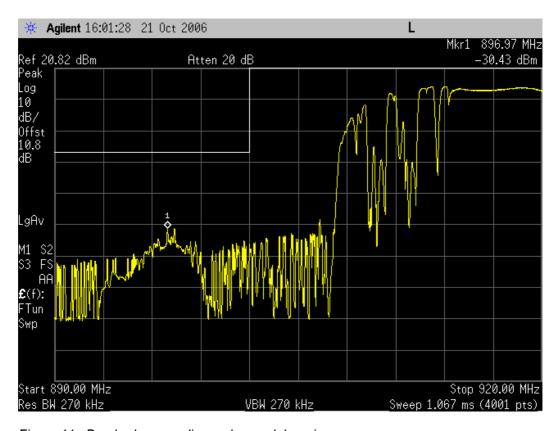


Figure 11. Band-edge compliance, low end, hopping

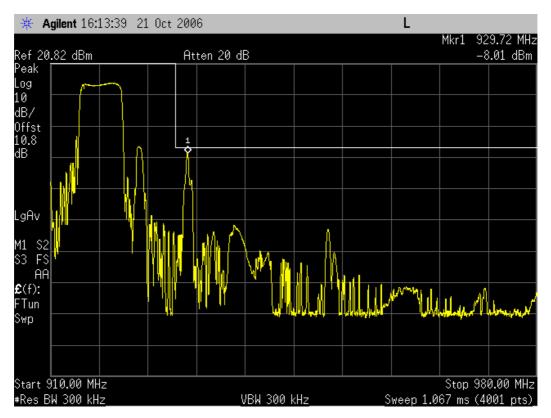


Figure 12. Band-edge compliance, high end, hopping



4.7 Spurious RF conducted emissions

The test was performed as a compliance test. The test parameters concerned were as follows:

Site name	Nemko Oy / Perkkaa
FCC rule part	§ 15.247, d
Section in RSS-210	A8.5
Date of testing	23.10.2006
Test equipment	566, 348, 572
Test conditions	23 °C, 40 % RH
Test result	PASS

4.7.1 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Lowest and highest
EUT TX power level	Nominal

4.7.2 Limits and test results

The measurement results were obtained as described below.

Result (dBm)- Peak (conducted power)= Result (dBc)

Example of the calculation of the measurement result (Lowest channel, frequency 21.4 MHz):

-54.35 dBm - 14.36 dBm = -68.71 dBc

EUT Channel	Frequency (MHz)	Result (dBm)	Result (dBc)	Limit (dBc)
lowest	21.4	-54.35	-68.71	≤ -20
lowest	85.6	-53.54	-67.90	≤ -20
lowest	107.0	-57.59	-71.95	≤ -20
lowest	893.6	-47.84	-62.20	≤ -20
lowest	1830	-32.40	-46.76	≤ -20
lowest	4573	-48.39	-62.75	≤ -20
highest	21.4	-54.19	-68.23	≤ -20
highest	85.6	-54.27	-68.31	≤ -20
highest	107.0	-57.36	-71.40	≤ -20
highest	898.5	-41.85	-55.89	≤ -20
highest	1840	-35.68	-49.72	≤ -20
highest	4599	-55.74	-69.78	≤ -20



4.7.3 Test data

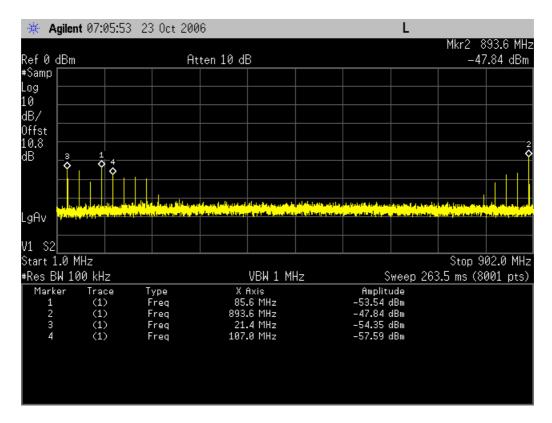


Figure 13. Spurious RF conducted emissions, lowest channel

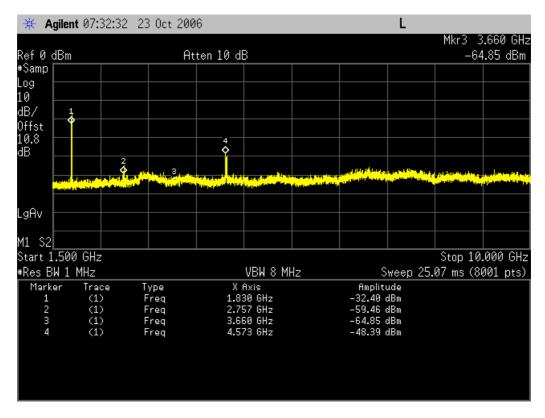


Figure 14. Spurious RF conducted emissions, lowest channel

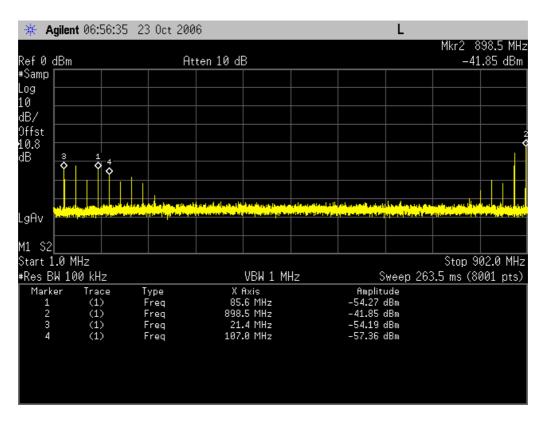


Figure 15. Spurious RF conducted emissions, highest channel

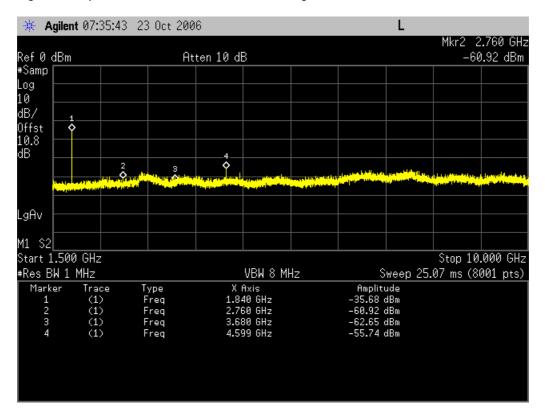


Figure 16. Spurious RF conducted emissions, highest channel

FCC 47 CFR PART 15, SUBPART C

4.8 Spurious radiated emission

The test was performed as a compliance test. The test parameters concerned were as follows:

Site name	Nemko Oy / Perkkaa
FCC rule part	§ 15.247, d
Section in RSS-210	A8.5
Date of testing	21-23.10.2006
Test equipment	566, 338, 319, 544, 564, 572, 542, 350
Test conditions	23 °C, 40 % RH
Test result	PASS

4.8.1 EUT operation mode

EUT operation mode	Transmitting
EUT channel	Lowest and highest
EUT TX power level	Nominal

4.8.2 Test method and limit

The test was performed in a semi-anechoic shielded room. The EUT was placed on a non-conductive 0.8 m high table standing on the turntable (photographs 1-6). During the test in the frequency range 30-10000 MHz the distance from the EUT to the measuring antenna was 3 m. In order to find the maximum levels of the disturbance radiation the angle of the turntable and the height of the measuring antenna were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarizations. The measurements were performed with the EUT at all three orthogonal planes to determine the worst case emissions from the device. The worst case emissions are shown in this test report.

Vertical and horizontal polarizations in the frequency range 30 – 1 000 MHz were measured by using the peak detector. During the peak detector scan the turntable was rotated from 0° to 360° with 30° step with the antenna heights 1.0 m and 3.0 m. The highest levels of the radiated interference field strength measured by using the quasi-peak detector were recorded.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak and quasi-peak detection measurements.

Vertical and horizontal polarizations in the frequency range 1000 - 10000 MHz were measured by using the peak detector. During the peak detector scan the turntable was rotated from 0° to 360° with 30° step with the antenna heights 1.0, 2.0 and 3.0 m. During the final measurement the turntable was rotated from 0° to 360° and the antenna was raised from 1.0 m and 4.0 m. The highest levels of the radiated interference field strength measured by using the peak detector were recorded.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The CFR 47 Part 15, Subpart C, limit of 500 μV/m has been calculated to correspond 54 dB(μV/m) as follows: $[dB(\mu V/m)]=20log[\mu V/m]$.

CFR 47 Part 15, Subpart C, section 15.247d limit (3m measuring distance)

Frequency band	Peak limit
MHz	dBc
30 - 10000	-20

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).



Section 15.205(a) restricted bands

MHz	MHz	GHz
37.5 - 38.25 73 - 74.6 74.8 - 75.2 108 - 121.94 123 - 138 149.9 - 150.05 156.52475 - 156.52525 156.7 - 156.9 162.0125 - 167.17 167.72 - 173.2	960 - 1240 1300 - 1427 1435 - 1626.5 1645.5 - 1646.5 1660 - 1710 1718.8 - 1722.2 2200 - 2300 2310 - 2390 2483.5 - 2500 2690 - 2900	GHz 4.5 - 5.15 5.35 - 5.46 7.25 - 7.75 8.025 - 8.5 9.0 - 9.2 9.3 - 9.5 10.6 - 12.7
240 - 285 322 - 335.4 399.9 - 410 608 - 614	3260 - 3267 3332 - 3339 3345.8 - 3358 3600 - 4400	

FCC 15.209(a) general limit (3m measuring distance)

. Go To:200(a) gonoral little (on moderning diotarios)		
Frequency band	Quasi-peak limit	
MHz	$dB(\mu V/m)$	
30 - 88	40	
88 - 216	43.5	
216 - 960	46.0	
960 - 1000	54	

FCC 15.209(a) general limit (3m measuring distance)

Frequency band	Average limit	Peak limit
MHz	dB(μV/m)	dB(μV/m)
1000 - 10000	54	74

4.8.3 Test results

The measurement results were obtained as described below.

$$E [dB(\mu V/m)] = U_{RX} + A_{CABLE} + AF - G_{PREAMP}$$

Where

U_{RX} receiver reading*A_{CABLE}* attenuation of the cable

AF antenna factor

 G_{PREAMP} gain of the preamplifier

Example of the calculation of the measurement result (Lowest channel, frequency 2745 MHz):

$$46.6 (dB\mu V/m) = 52.85 (dB\mu V) + 1.84 + 29.88 - 37.96$$

Result (dBc) = Result (dB μ V/m) - Result (fundamental dB μ V/m)

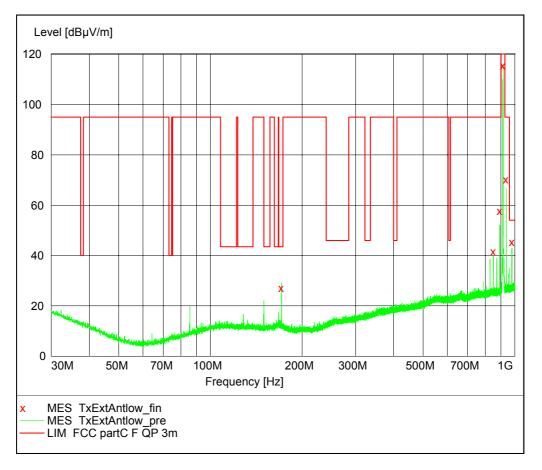
Example of the calculation of the measurement result (Lowest channel, frequency 1830 MHz):

61.3
$$dB\mu V/m - 115.0 dB\mu V/m = -53.7 dBc$$

The final average result was calculated from peak $dB\mu V/m$ result using duty cycle correction factor 20*log(dwell/100ms). For dwell time 20.16 ms correction factor -13.9 dB was used.

Page 22 (34) Date 24.10.2006



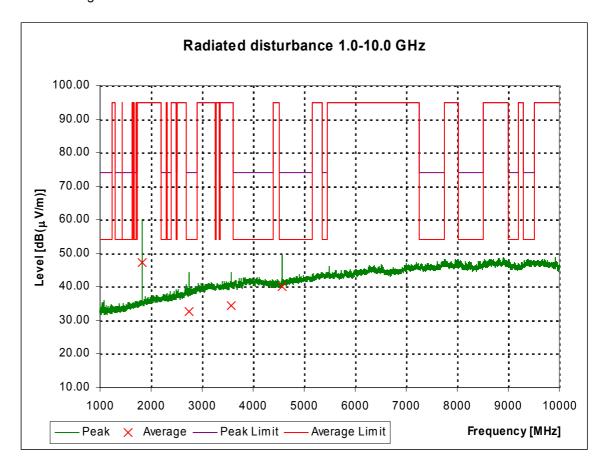


Highest emissions (Quasi-peak and peak detector):

EUT channel: lowest

Frequency	Level, QP	Limit	Margin	Level, Peak	Limit	Margin
MHz	dBµV/m	dBμV/m	dB	dBc	dBc	dB
915.00	115.0	na	na	ref.	ref.	na
171.20	27.1	43.5	16.4	-87.9	-20	67.9
850.80	41.5	na	na	-73.5	-20	53.5
893.60	57.7	na	na	-57.3	-20	37.3
936.40	70.1	na	na	-44.9	-20	24.9
979.20	45.4	54	8.6	-69.6	-20	49.6

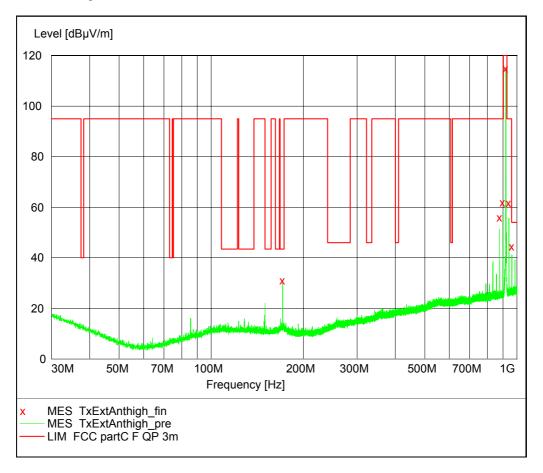




Highest emissions (peak detector and average result): *EUT channel: lowest*

Frequency MHz	Level _{pk} dB(µV/m)	Limit _{pk} dB(µV/m)	Margin dB	Level _{ave} dB(µV/m)	Limit _{ave} dB(µV/m)	Margin dB	Level _{pk} dBc	Limit _{pk} dBc	Margin dB
1830.0	61.3	na	na	47.4	na	na	-53.7	-20	33.7
2745.0	46.6	74	27.4	32.7	54	21.3	-68.4	-20	48.4
3574.4	48.2	na	na	34.3	na	na	-66.8	-20	46.8
4575.0	53.9	74	20.1	40.0	54	14.0	-61.1	-20	41.1

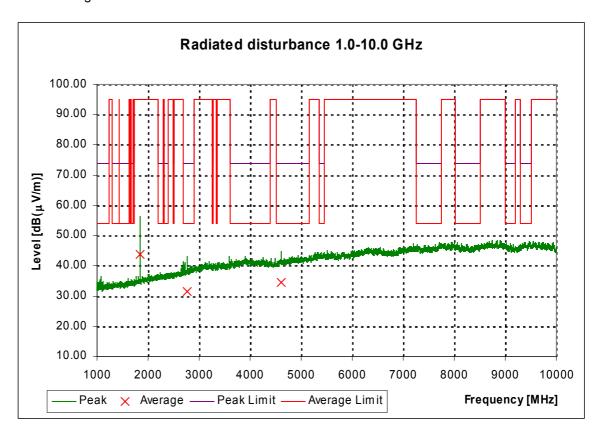




Highest emissions (Quasi-peak and peak detector): *EUT channel: highest*

Frequency	Level, QP	Limit	Margin	Level, Peak	Limit	Margin
MHz	dBμV/m	dBμV/m	dB	dBc	dBc	dB
919.90	114.8	na	na	ref.	ref.	na
171.20	31.1	43.5	12.4	-83.7	-20	63.7
877.12	55.9	na	na	-58.9	-20	38.9
898.52	61.9	na	na	-52.9	-20	32.9
941.28	61.7	na	na	-53.1	-20	33.1
962.68	44.5	54	9.5	-70.3	-20	50.3



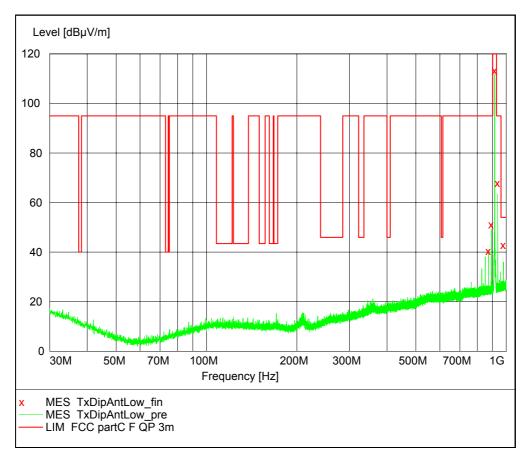


Highest emissions (peak detector and average result):

EUT channel: highest

Frequency MHz	Level _{pk} dB(µV/m)	Limit _{pk} dB(µV/m)	Margin dB	Level _{ave} dB(µV/m)	Limit _{ave} dB(µV/m)	Margin dB	Level _{pk} dBc	Limit _{pk} dBc	Margin dB
1839.8	57.7	na	na	43.8	na	na	-57.1	-20	37.1
2759.7	45.5	74	28.5	31.6	54	22.4	-69.3	-20	49.3
4599.5	48.4	74	25.6	34.5	54	19.5	-66.4	-20	46.4



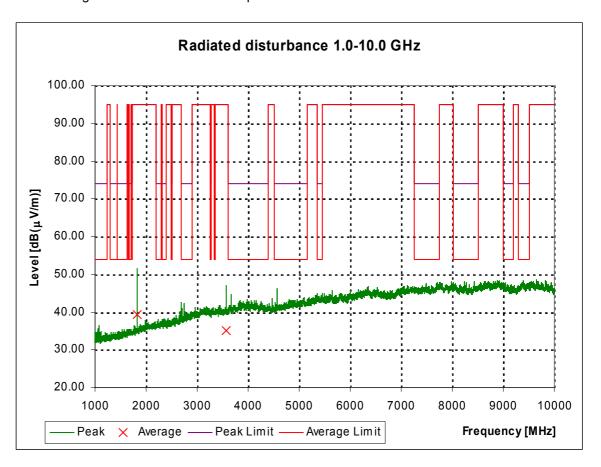


Highest emissions (Quasi-peak and peak detector):

EUT channel: lowest

Frequency	Level, QP	Limit	Margin	Level, Peak	Limit	Margin
MHz	dBμV/m	dBμV/m	dB	dBc	dBc	dB
915.00	114.8	na	na	ref.	ref.	na
872.16	40.3	na	na	-74.5	-20	54.5
893.60	51.1	na	na	-63.7	-20	43.7
936.40	67.9	na	na	-46.9	-20	26.9
979.20	42.8	54	11.2	-72.0	-20	52.0



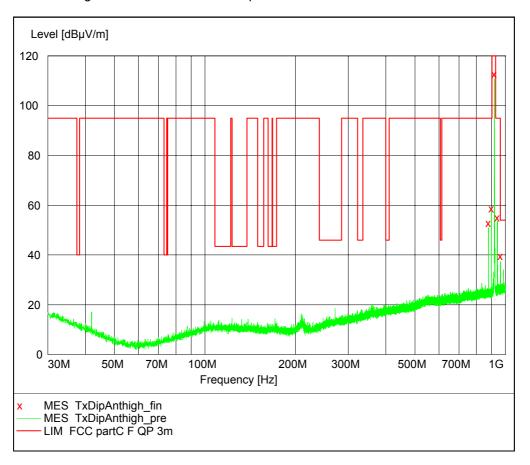


Highest emissions (peak detector and average result):

EUT channel: lowest

Frequency MHz	Level _{pk} dB(µV/m)	Limit _{pk} dB(µV/m)	Margin dB	Level _{ave} dB(µV/m)	Limit _{ave} dB(µV/m)	Margin dB	Level _{pk} dBc	Limit _{pk} dBc	Margin dB
1830.0	53.2	na	na	39.3	na	na	-61.6	-20	41.6
3574.4	49.1	na	na	35.2	na	na	-65.7	-20	45.7

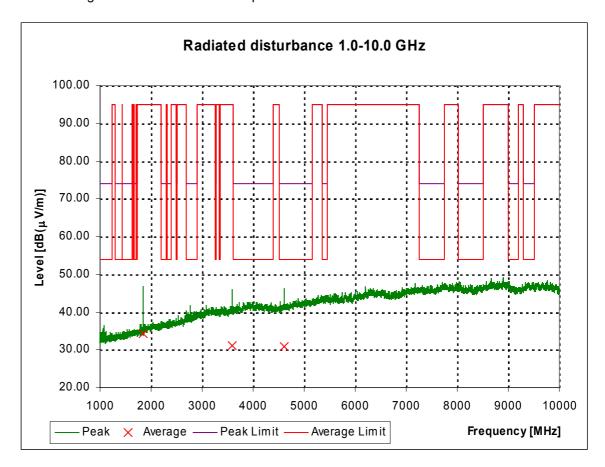




Highest emissions (Quasi-peak and peak detector): *EUT channel: highest*

Frequency	Level, QP	Limit	Margin	Level, Peak	Limit	Margin
MHz	dBμV/m	dBμV/m	dB	dBc	dBc	dB
919.90	114.5	na	na	ref.	ref.	na
877.12	52.8	na	na	-61.7	-20	41.7
898.52	58.7	na	na	-55.8	-20	35.8
941.28	55.1	na	na	-59.4	-20	39.4
962.68	39.6	54	14.4	-74.9	-20	54.9





Highest emissions (peak detector and average result): *EUT channel: highest*

Frequency MHz	Level _{pk} dB(µV/m)	Limit _{pk} dB(µV/m)	Margin dB	Level _{ave} dB(µV/m)	Limit _{ave} dB(µV/m)	Margin dB	Level _{pk} dBc	Limit _{pk} dBc	Margin dB
1839.780	48.2	na	na	34.3	na	na	-66.3	-20	46.3
3594.188	45.1	na	na	31.2	na	na	-69.4	-20	49.4
4599.752	44.7	74	29.3	30.8	54	23.2	-69.8	-20	49.8



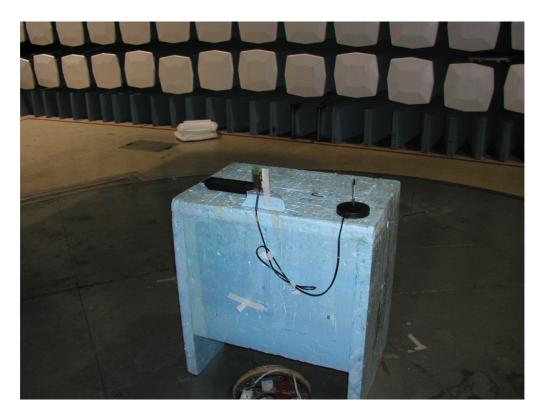
5. List of test equipment

Each active test equipment is calibrated once a year, antennas every 18 months and other passive equipment every 24 months.

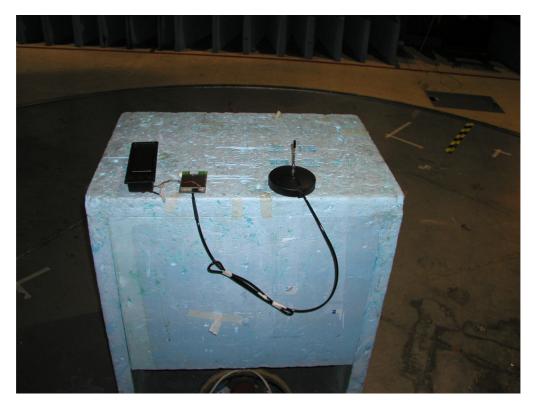
Nr.	Equipment	Туре	Manufacturer	Serial number
5	Test receiver	ESH-3	Rohde & Schwarz	894718/015
338	Test receiver	ESS	Rohde & Schwarz	847151/009
10	Oscilloscope	9400A	LeCroy	8878
42	Spectrum analyzer	8566B	Hewlett Packard	2637A04102
168	Artificial Mains	NSLK 8127	Schwartzbeck	8127162
184	Temp. & humidity meter	H MI 32	Vaisala	63837
188	Antenna	CBL6111	Chase	1028
319	Antenna	CBL6112	Chase	2018
348	Shielded room	RFSD-100	Euroshield Oy	1320
350	Semianechoic shielded room	RFD-F-100	Euroshield Oy	1327
351	RF generator	SMT 06	Rohde & Schwarz	845715/001
371	AC Power source	500i-400	California Instr.	HK 52064
519	RF High-Power Attenuator	765-20	Narda	
525	Double-Ridged Horn	3115	Emco	6691
542	Double-Ridged Horn	3115	Emco	00023905
544	RF-amplifier	ZFL-2000VH2	Mini-Circuits	D01080
559	Highpass Filter	WHKX3.0/18G-10SS	Wainwright Instruments	1
550	Notch Filter	WRCD1800/2000- 0.2/40-5SSSD	Wainwright Instruments	1
564	RF-amplifier	CA018-4010	CIAO Wireless	101
566	Spectrum analyzer	E4448A	Agilent	US42510236
572	Highpass Filter	WHKX1.5/15G-12SS	Wainwright Instruments	4



6. Photographs

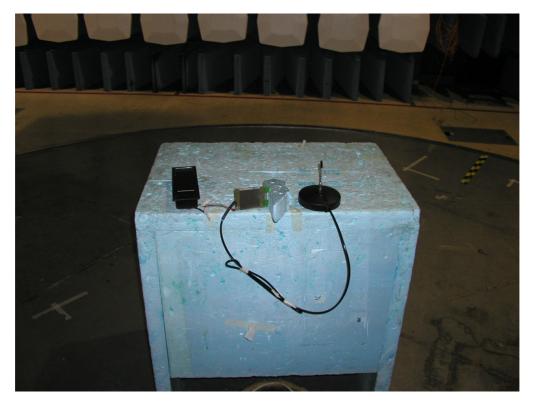


Photograph 1 Radiated emissions test setup



Photograph 2 Radiated emissions test setup



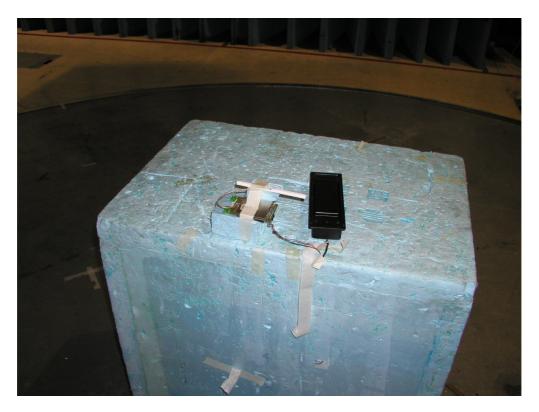


Photograph 3 Radiated emissions test setup



Photograph 4 Radiated emissions test setup





Photograph 5 Radiated emissions test setup



Photograph 6 Radiated emissions test setup