TEST REPORT

Date: **ESPOO 20.06.2009** Page: **1 (18)**

Appendices **-**

Number: No. 1 / 1 **119457B**

Date of handing in: **12.05.2008**

Tested by:

Timo Hietala, Test Engineer

FINAS
Finnish Accreditation Service
T017 (EN ISO/IEC 17025)

Reviewed by:

Timo Leismala, Test Manager

SORT OF EQUIPMENT:	**Receiver of the radio modem (PCB-unit)**
TYPE:	***SATEL-TA10***
MODEL:	***SATELLINE-M3-R1 / SLR2***
MANUFACTURER:	***Satel Oy, Finland***
SERIAL NUMBER:	**-**
CLIENT:	**Satel Oy**
ADDRESS:	**Meriniitynkatu 17, FIN-24100 Salo, Finland**
TELEPHONE:	**+358 2 777 7800**
TEST LABORATORY	**Nemko Oy**
FCC REG. NO.	**359859 November 26, 2008**
IC FILE NO.	**2040F-1 December 15, 2008**

REMARKS:

Tested to FCC Part 15B and RSS-210 Issue 7, RSS-Gen Issue 2.

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Contents

1. General

Type:	**SATELLINE-M3-R1** / SLR2**/ SLR2**
Alignment range:	**406.1 – 470 MHz**

	Equipment 1	Equipment	Equipment
	Serial no. **-**	Serial no.	Serial no.
Measurement Frequencies:	1) **406.100 MHz** 2) **430.00 MHz** 3) **470.000 MHz**		

	Normal	Minimum	Maximum
Voltages:	**6 VDC**		
Temperatures:	**22,5 ± 1,0 °C**		
Humidity:	**35 ± 10 %**		

Effective radiated power:

Antenna: **50 ohm, SMA connector**
Production model: **Pre-production model**

Number of channels:

Modulation:

The receiver was tested in a standalone configuration, board only, no housing.

2. Summary of performed tests and test results

(This interpretation of the test report's results does not belong to the scope of our accreditation.)

Section in CFR 47	*Section in RSS-210 Issue 7 and RSS-Gen Issue 2*		*Result*
15.111	*RSS-Gen 6*	*Spurious radiations (conducted)*	**PASS**
15.109 (a)	*RSS-Gen 6*	*Spurious radiations (radiated)*	**PASS**
15.107 (a)	*RSS-Gen 7.2.2*	*Conducted emissions at mains ports*	**PASS**

According to the standard the measurement results have been compared directly with the limits without considering measurement uncertainties.

Explanations:

PASS The EUT passed that particular test.
FAIL The EUT failed that particular test.

2.1 Receiver spurious emissions (conducted)

Parameter	Specification
Frequency range	9kHz – 4000 MHz
Site name	Nemko Oy / Perkkaa
Date of testing	12.06.2009
Test equipment	184, 566
Test uncertainty U95	±1.8 dB
Test conditions	22 °C, 40 % RH

The EUT is connected to spectrum analyzer through suitable attenuator and filters and spurious emissions are measured with peak detector. Spectrum was searched from 9kHz to 4GHz. Spectrum analyzer settings were: 9-150kHz RBW 1kHz, VBW 3kHz, 150kHz-30MHz RBW 10kHz, VBW 30kHz, 30MHz-1000MHz RBW 100kHz, VBW 1MHz, 1000-4000MHz RBW 1MHz, VBW 1MHz

Channel 406,1 MHz		**Channel 430,0 MHz**		**Channel 470 MHz**		**Remarks**
Frequency (MHz)	**Level (dBm)**	**Frequency (MHz)**	**Level (dBm)**	**Frequency (MHz)**	**Level (dBm)**	
613.580	**-76.97**	**613.580**	**-76.80**	**613.580**	**-76.80**	
3059.875	**-70.12**	**3068.125**	**-68.87**	**3068.125**	**-68.62**	
Others 9 kHz to 4 GHz	**< -70,0**	**others 9 kHz to 4 GHz**	**< -70,0**	**others 9 kHz to 4 GHz**	**< -70,0**	
Measurement uncertainty		**± 1.8 dB**				

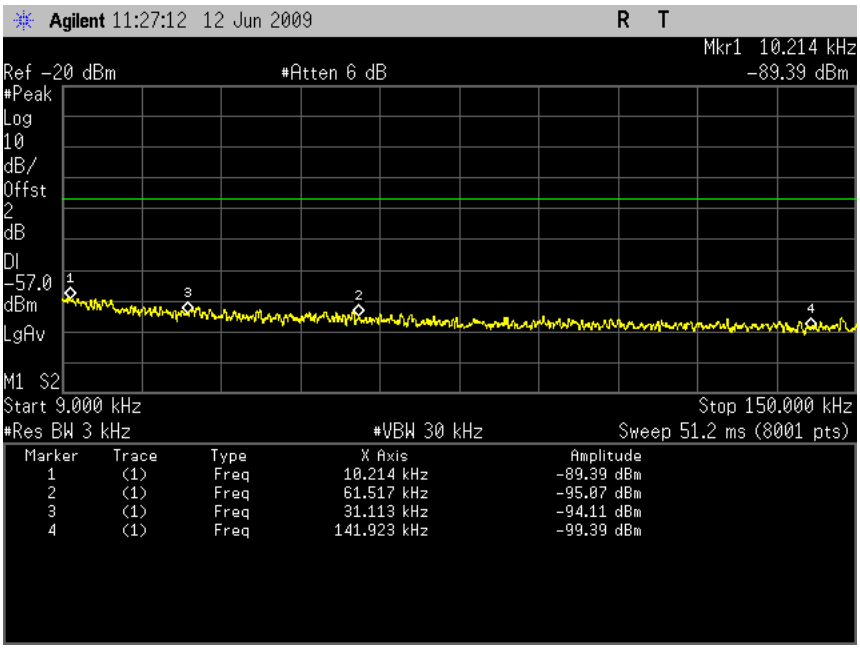
LIMITS:

Conducted components RSS Gen, clause 6

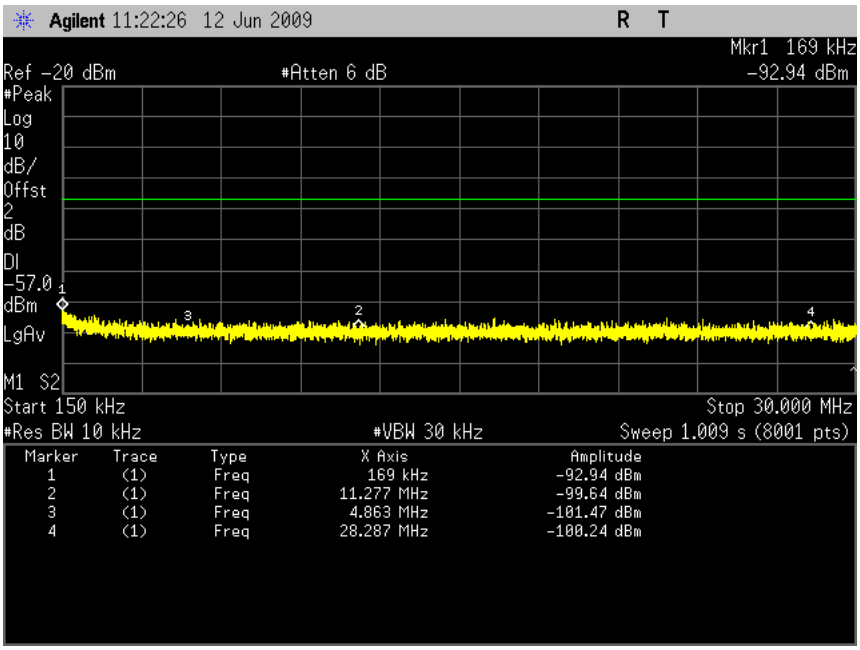
Frequency range	**Limit**
9 kHz to 1 GHz	**2,0 nW (-57 dBm)**
Above 1 GHz	**5,0 nW (-53 dBm)**

Conducted components FCC 15.111

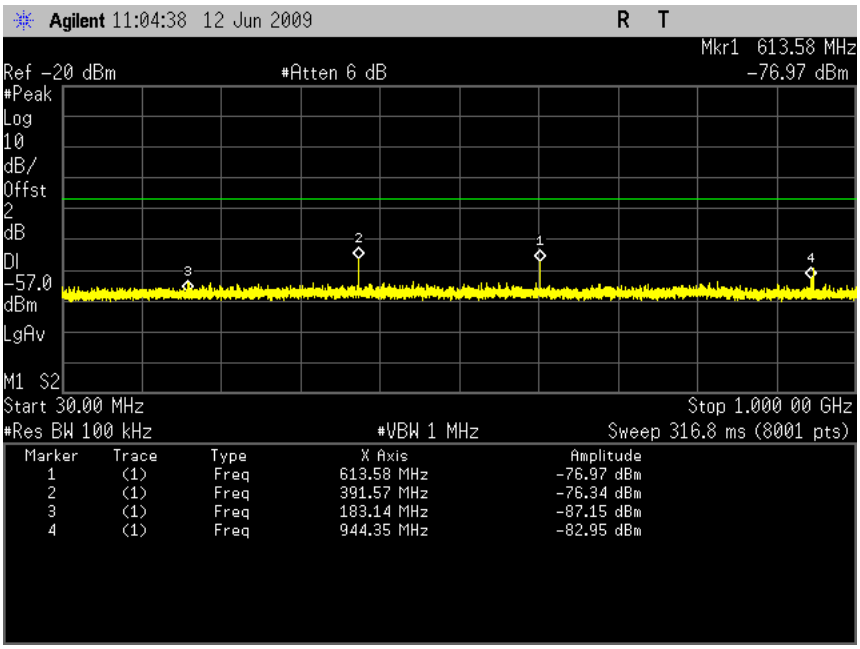
Frequency range	**Limit**
9 kHz to 2 GHz	**2,0 nW (-57 dBm)**



Note: Receiver tuned at 406.1MHz



Note: Receiver tuned at 406.1MHz



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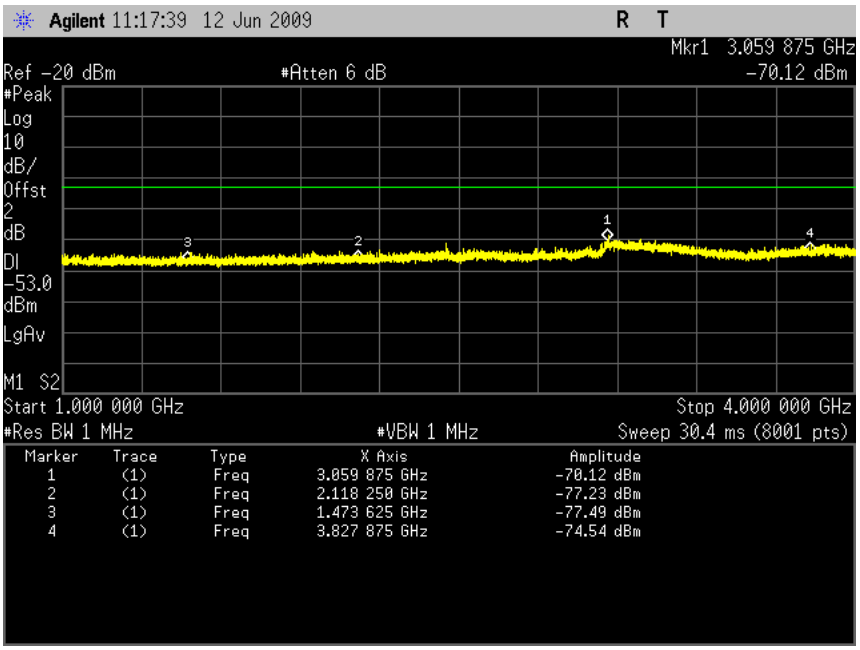
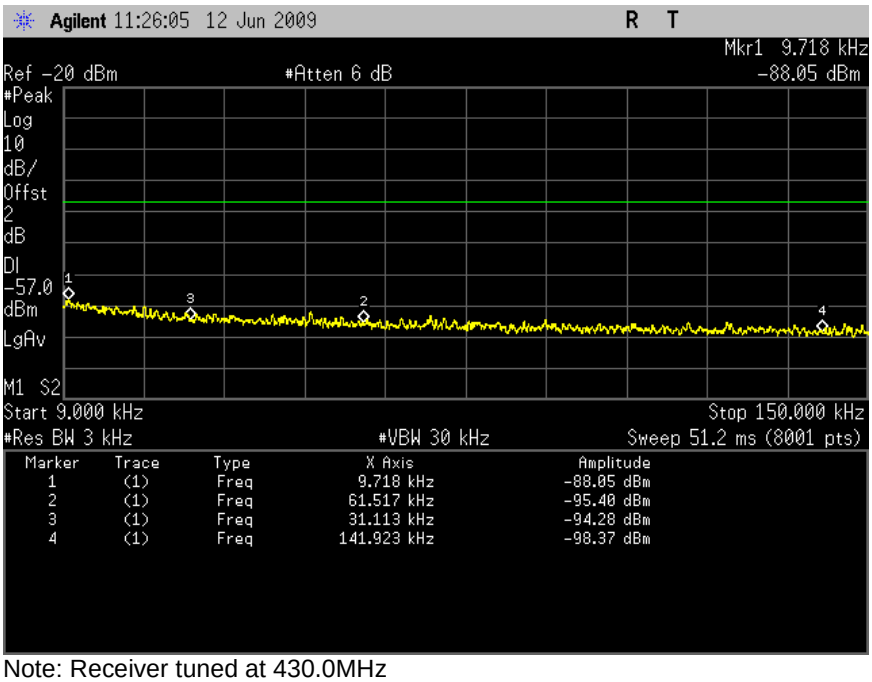
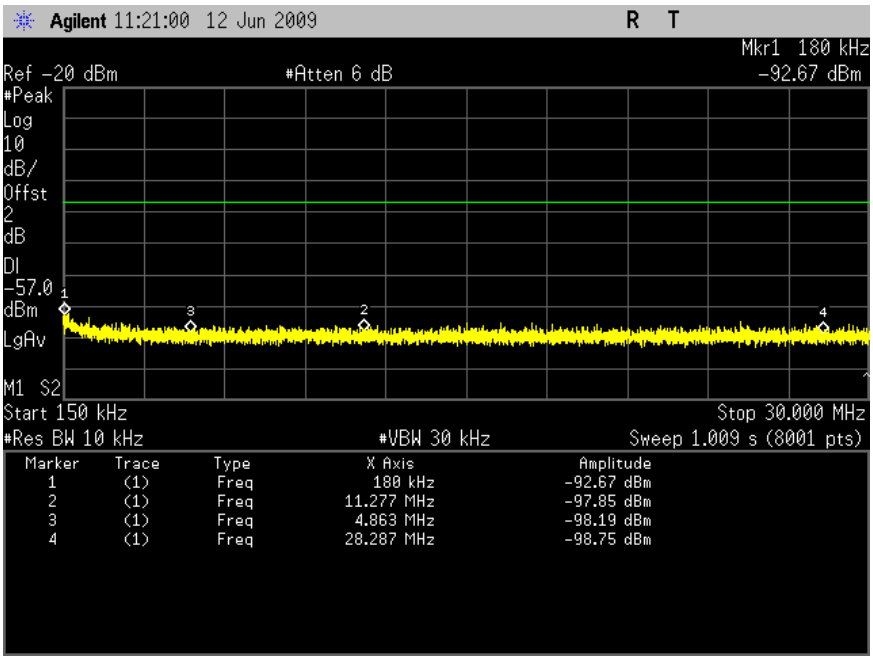


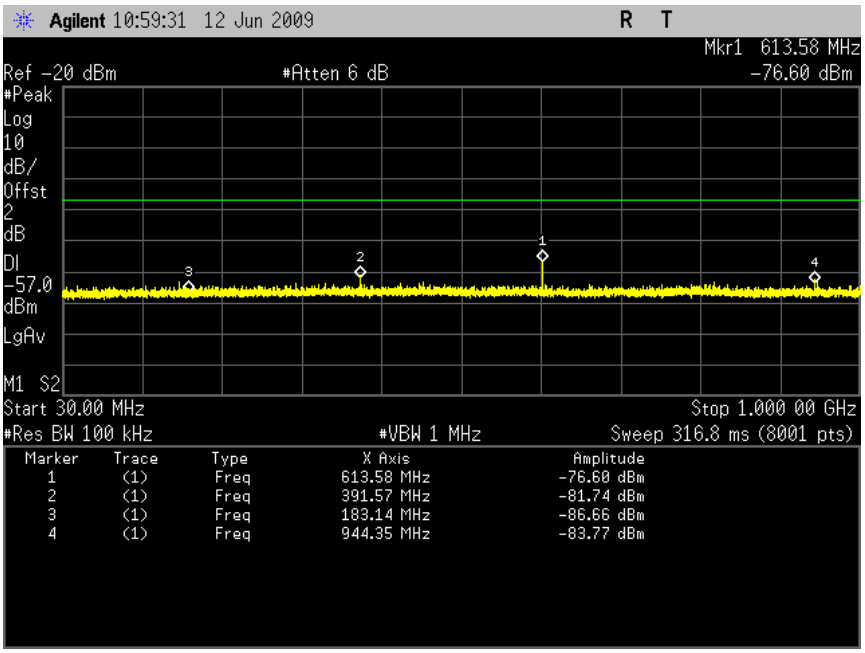
Note: Receiver tuned at 406.1MHz



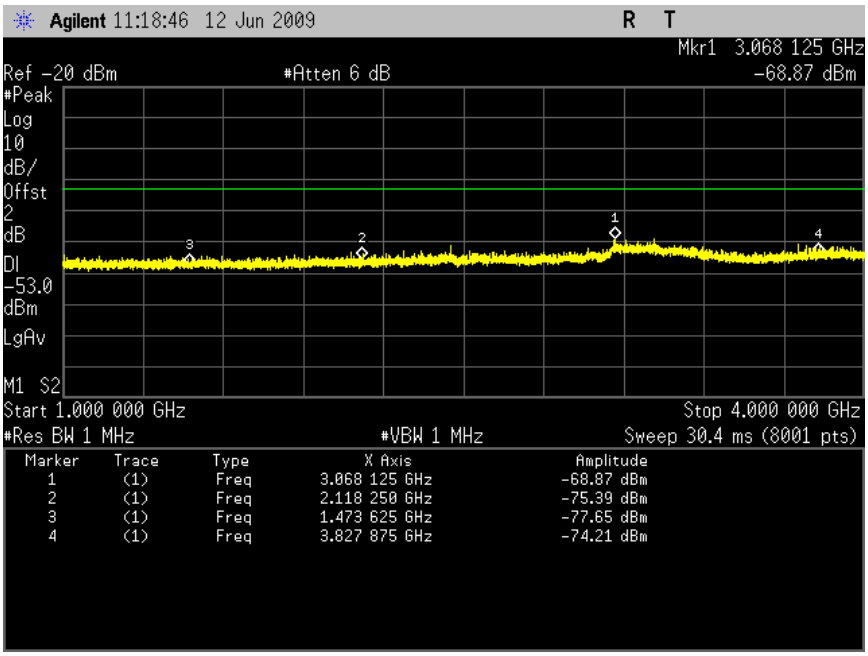
Note: Receiver tuned at 430.0MHz



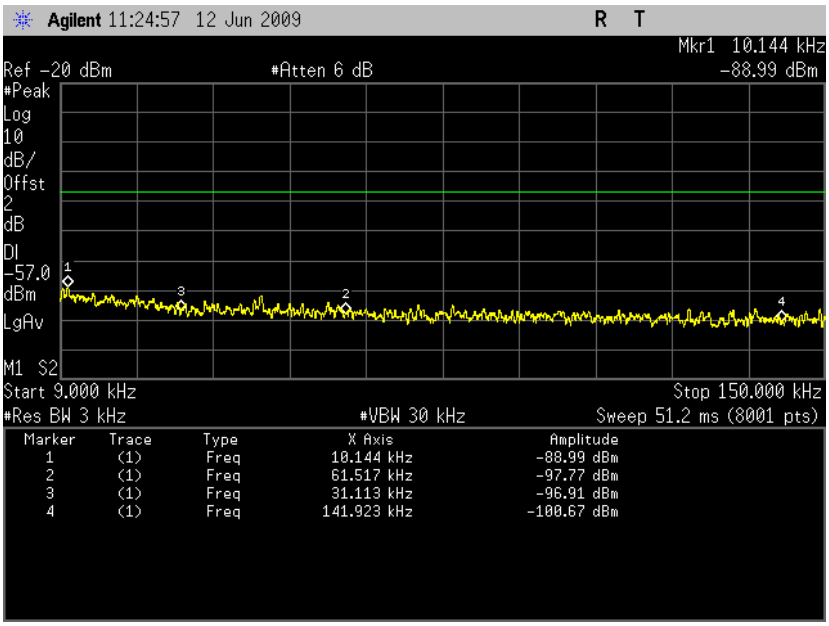
Note: Receiver tuned at 430.0MHz



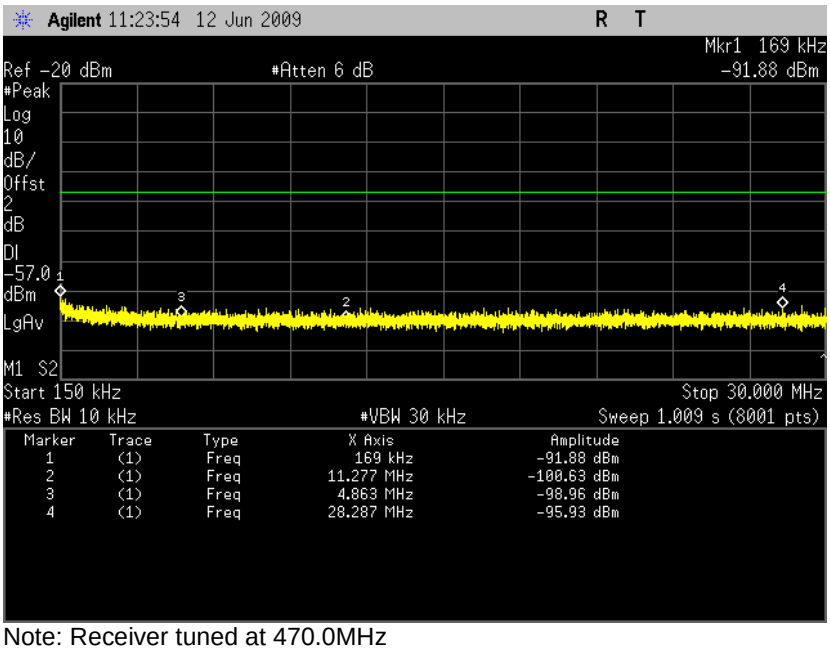
Note: Receiver tuned at 430.0MHz



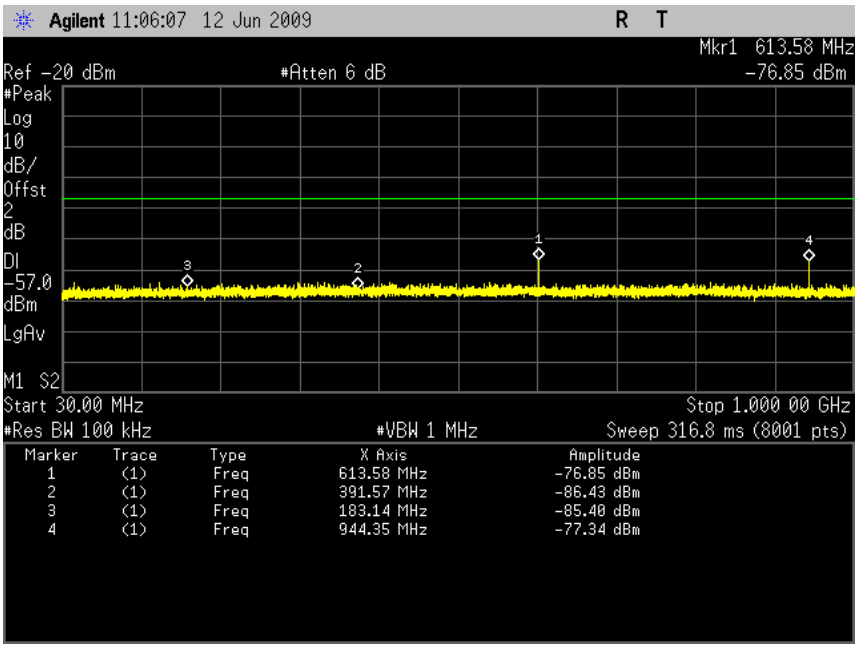
Note: Receiver tuned at 430.0MHz



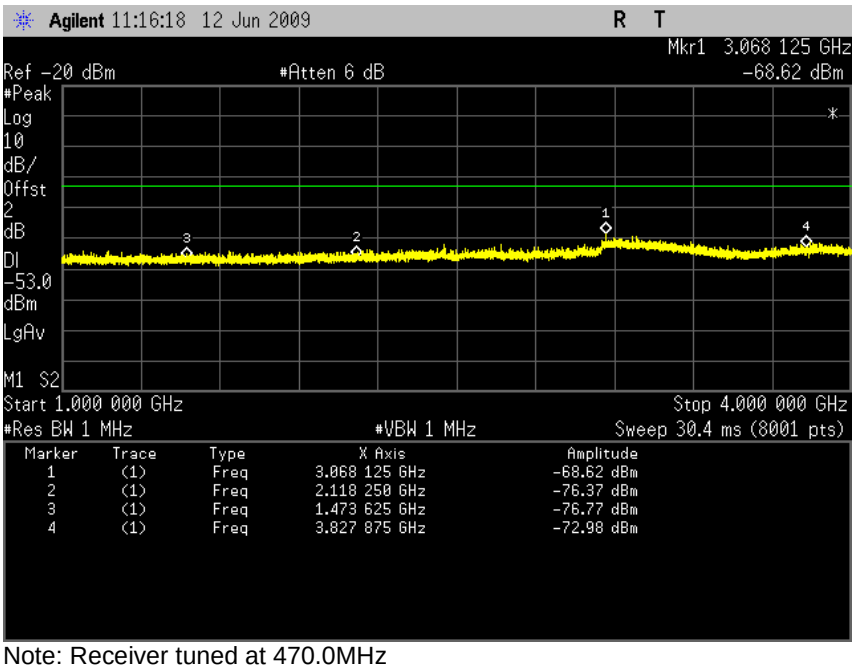
Note: Receiver tuned at 470.0MHz



Note: Receiver tuned at 470.0MHz



Note: Receiver tuned at 470.0MHz



Note: Receiver tuned at 470.0MHz

2.1.1 Radiated disturbance emission test

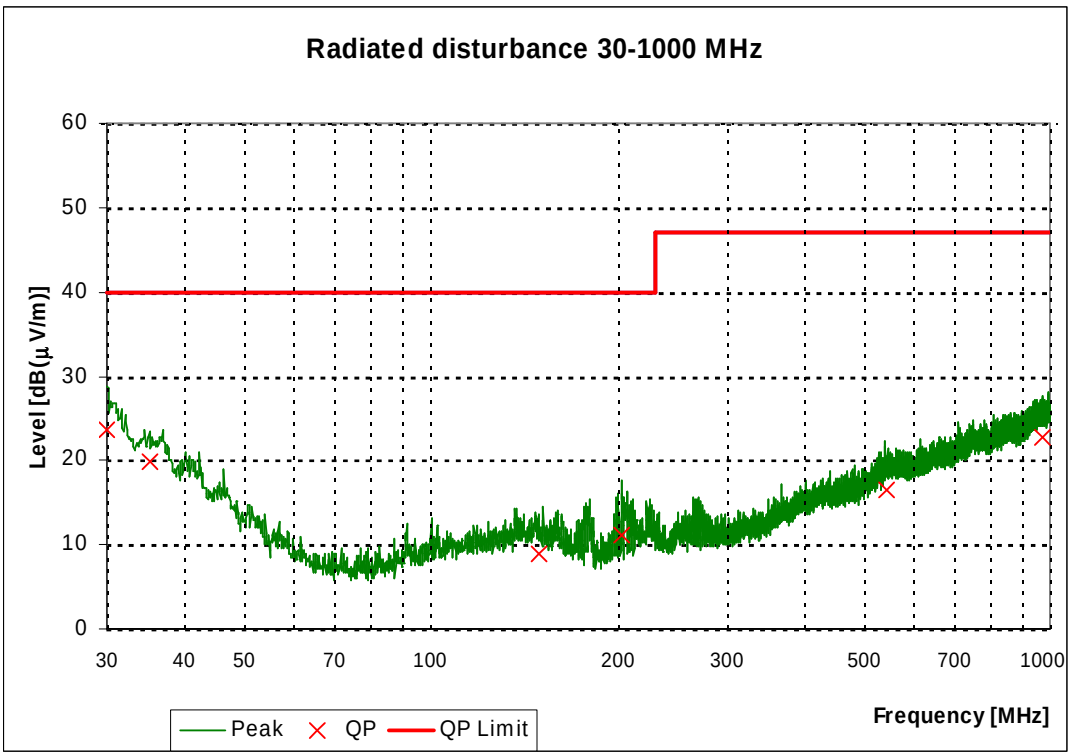
The test was performed as a compliance test. The test parameters concerned were as follows:

Parameter	Specification
Test method	CISPR 22
Frequency range	30 – 4000 MHz
Site name	Nemko Oy / Perkkaa
Date of testing	12.06.2009
Test equipment	184, 319, 350, 544, 525, 566, 564
Test uncertainty U95	±4.6 dB
Test conditions	22 °C, 40 % RH

The test was performed in a semi-anechoic shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m above the metallic ground plane (see photograph 1). During the test the distance from the EUT to the measuring antenna was 3 meters. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna and the lay-out of the EUT cables were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarizations. Spectrum was searched from 30MHz to 4GHz. Spectrum analyzer settings were: 30MHz-1000MHz RBW 100kHz, VBW 1MHz, 1000-4000MHz RBW 1MHz, VBW 1MHz.

2.1.2 Test results radiated disturbance emission test

Receiver tuned at 406.1MHz



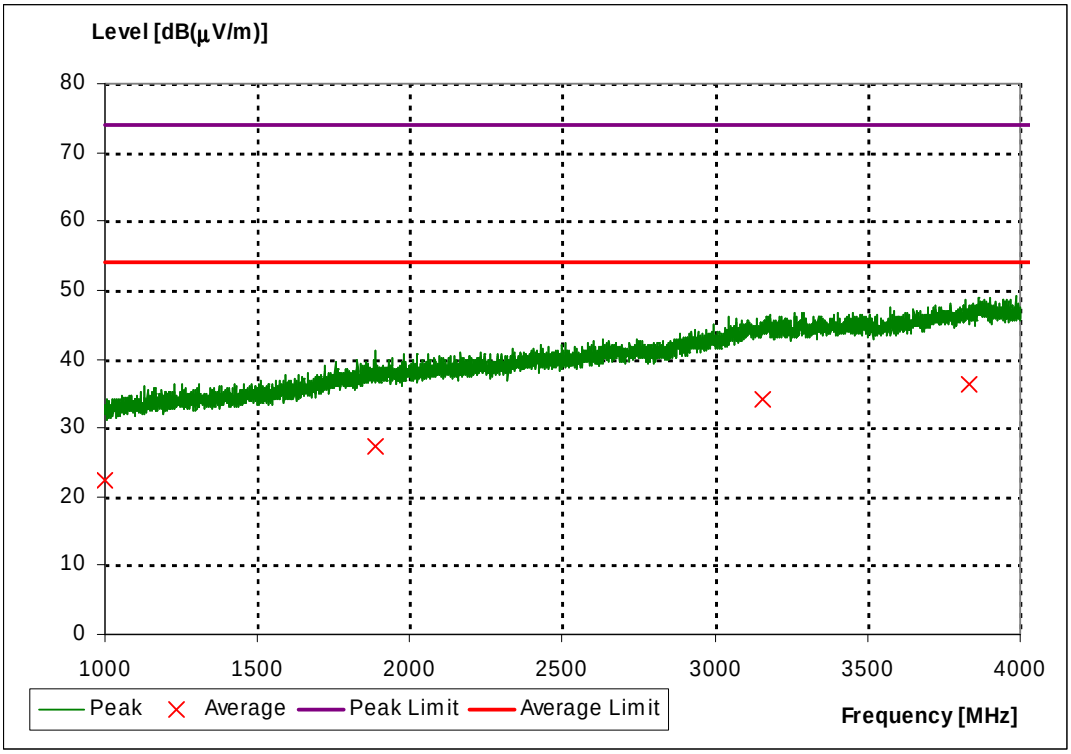
Horizontal and vertical polarisations in the frequency range 30 – 1000 MHz measured by using the peak detector. During the peak detector scan, the turntable was rotated from 0° to 360° with 30° steps with the antenna heights 1.0 m and 3.0 m. The highest levels of the radiated interference field strength measured by using the quasi-peak detector were recorded.

Measurement results (QP):

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed
30.000	23.7	40.0	16.3	–
35.210	19.9	40.0	20.1	–
149.500	9.0	40.0	31.0	–
203.630	11.2	40.0	28.8	–
545.918	16.5	40.0	23.5	–
969.081	22.8	40.0	17.2	–

The FCC 47 CFR Part 15, Subpart B, Class B limit of 500 µV/m has been calculated to correspond 54.0 dB(µV/m) as follows: [dB(µV/m)]=20log[µV/m].

Receiver tuned at 406.1MHz

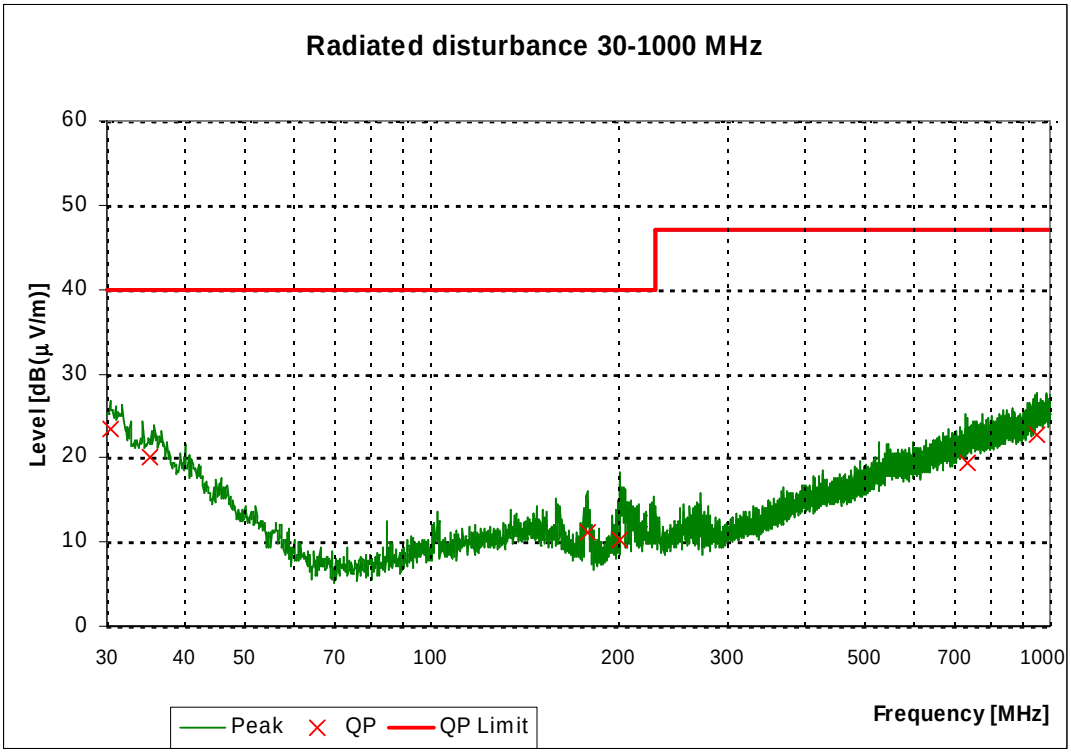


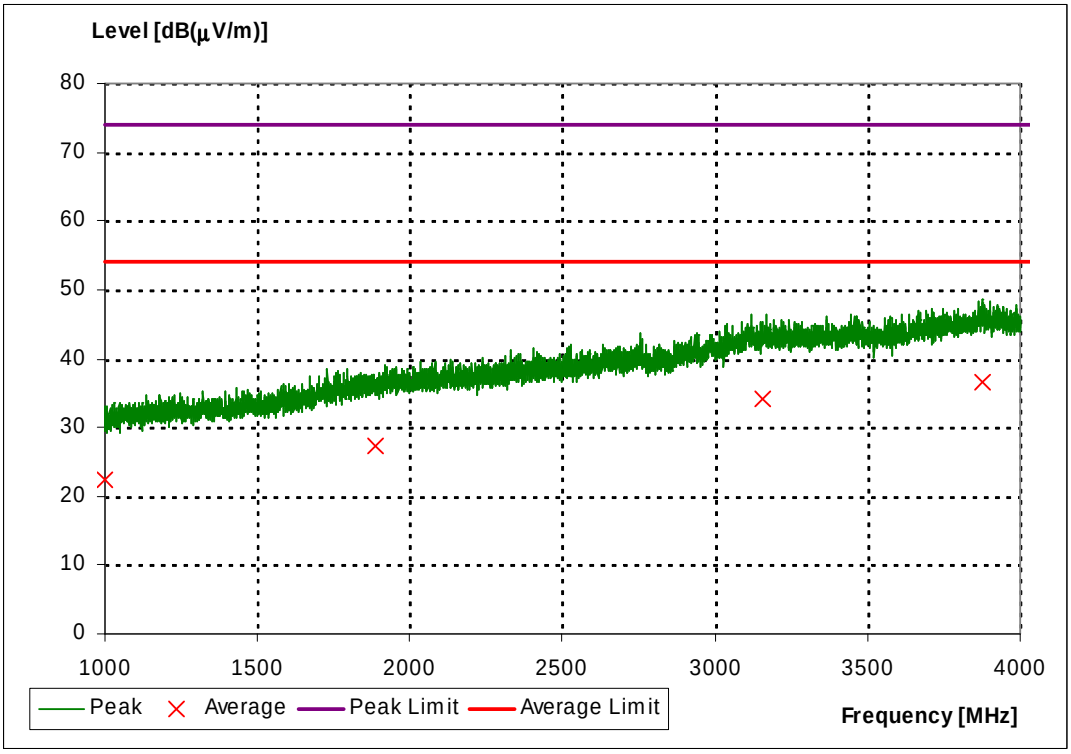
Horizontal and vertical polarizations in the frequency range 1000 – 4000 MHz measured by using the peak detector. During the peak detector scan, the turntable was rotated from 0° to 360° with 30° steps with the antenna heights 1.0m and 3.0m. The highest levels of the radiated interference field strength measured by using the average detector were recorded.

Measurement results (Average):

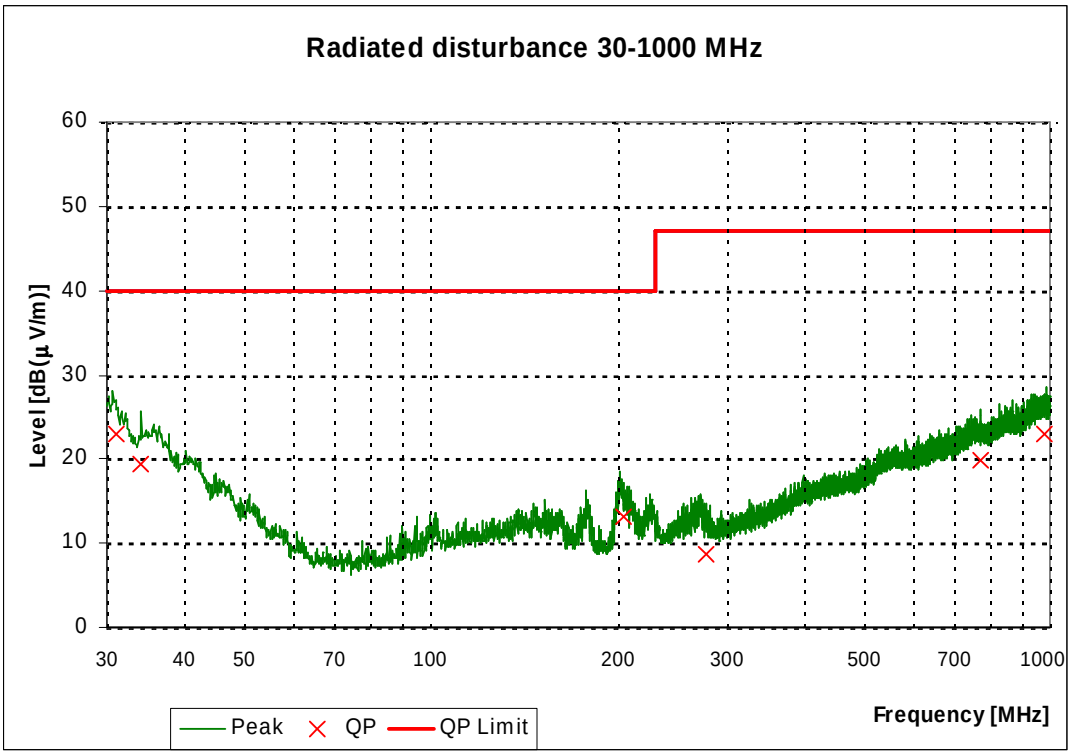
Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed
1000.000	22.4	54.0	31.6	–
1889.500	27.3	54.0	26.7	–
3158.875	34.2	54.0	19.8	–
3835.375	36.2	54.0	17.8	–

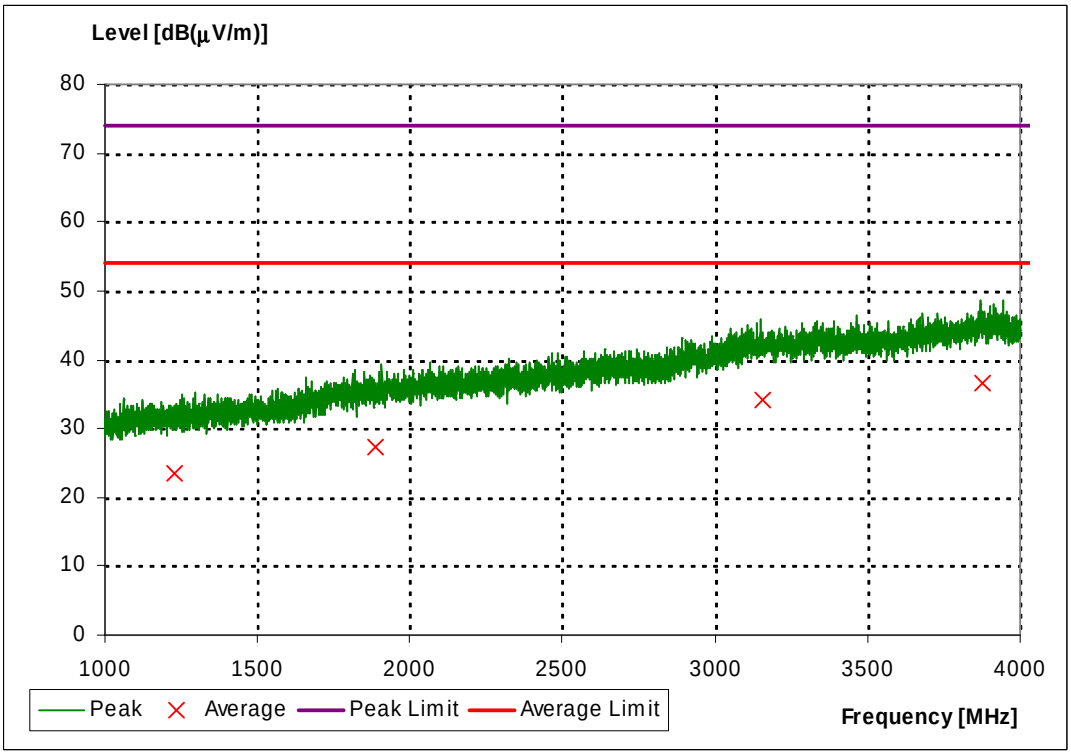
Receiver tuned at 430MHz





Receiver tuned at 470MHz





2.1.3 Conducted disturbance at mains ports emission test

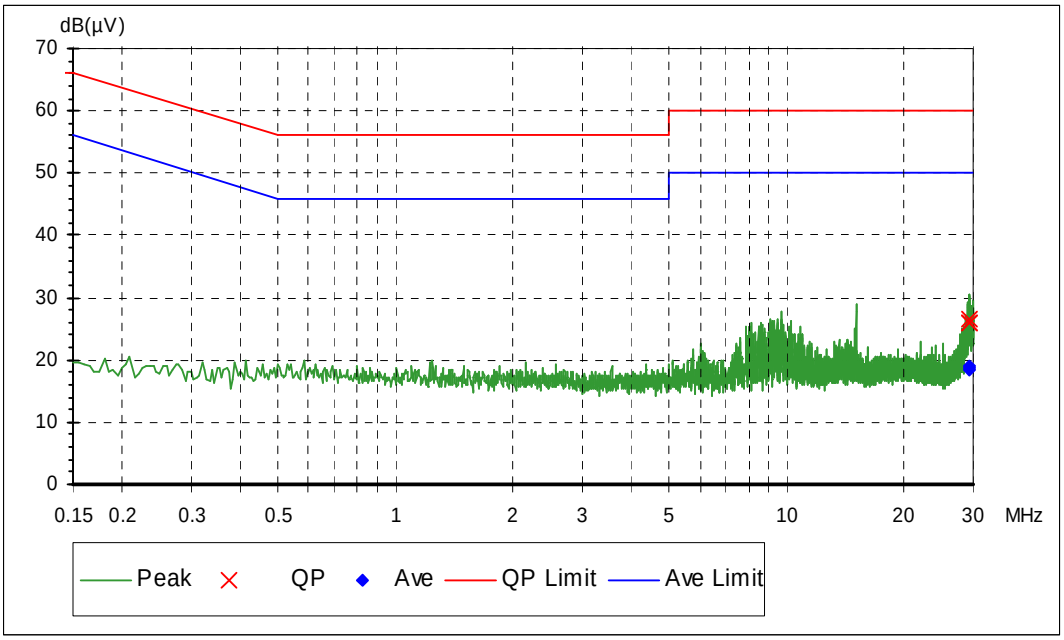
The test was performed as a compliance test. The test parameters concerned were as follows:

Parameter	Specification
Test method	CISPR 22
Frequency range	0.150 – 30 MHz
Site name	Nemko Oy / Perkkaa
Date of testing	09.06.2008
Test equipment	5, 168, 184, 348
Test uncertainty U95	+2.4 dB / -3.0 dB
Test conditions	22 °C, 45 % RH

The test was performed inside a shielded room where one of the walls and the floor comprised the reference ground plane (RGP). For the duration of the test the EUT was placed on a non-conductive table 0.8 m above the metallic ground plane (see photograph 2). The excess lengths of the cables of the EUT were made into bundles 30-40 cm in length. The DC power input cable of the EUT was connected to an artificial mains network. The test was performed separately on the live and also on the neutral wire.

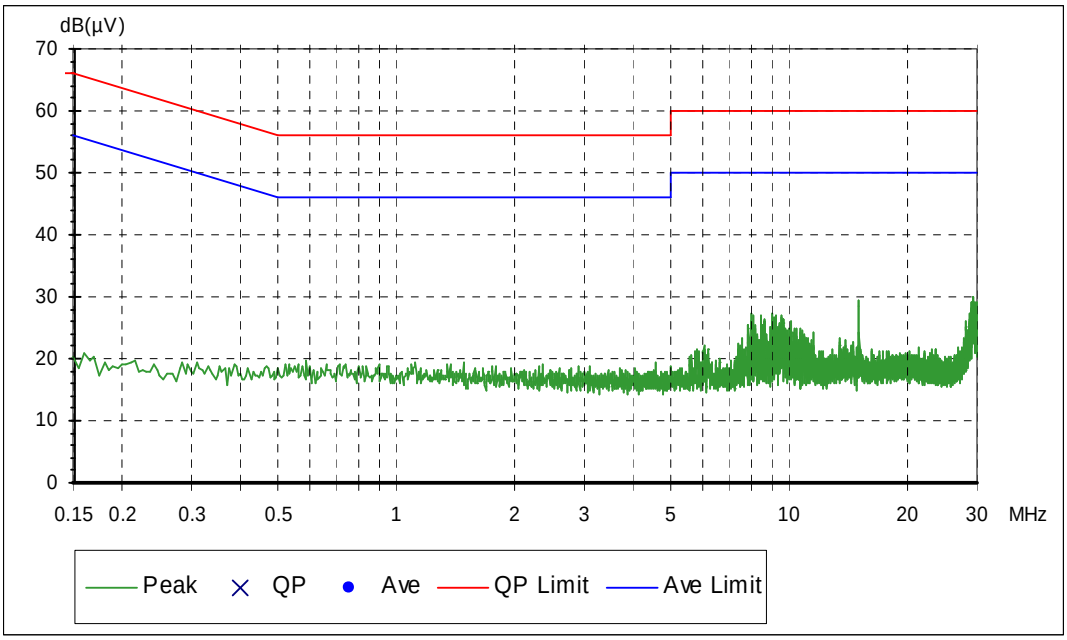
The disturbances were first examined by performing a spectrum scan by using a peak detector. The general procedure in the conducted disturbance emission test is that no further measurements are necessary if the disturbance levels measured by using the peak detector are below the limit value defined for the measurement performed by using an average detector. If not, then at the test frequencies concerned the measurement is performed also by using a quasi-peak detector. If the disturbance levels measured by using the quasi-peak detector are below the limit value defined for the measurement performed by using an average detector, then measurements by using the average detector are not necessary.

2.1.4 Test results conducted disturbance at mains ports emission test



The graphs of the disturbances measured by using a peak detector in the frequency range of 0.150 - 30 MHz, positive. The highest emissions were measured by using the quasi-peak and average detectors, refer below.

Frequency MHz	Phase	Conducted disturbance				Conclusion Pass/Fail
		Result Quasi-peak dB(µV)	Limit value Quasi-peak dB(µV)	Result Average dB(µV)	Limit value Average dB(µV)	
29.219	pos	26.7	60.0	18.6	50	Pass
29.233	pos	25.9	60.0	18.5	50	Pass
29.288	pos	25.8	60.0	19.0	50	Pass



The graphs of the disturbances measured by using a peak detector in the frequency range of 0.150 - 30 MHz, negative line. The highest emissions were measured by using the quasi-peak and average detectors.

3. List of measuring equipment:

Nr.	Equipment	Type	Manufacturer	Serial number
5	Test receiver	ESH-3	Rohde & Schwarz	894718/015
42	Spectrum analyzer	8566B	Hewlett Packard	2637A04102
89	Antenna	3147	EMCO	9202-1078
167	Artificial Mains	NSLK 8126	Schwartzbeck	8126101
168	Artificial Mains	NSLK 8127	Schwartzbeck	8127162
176	Anechoic chamber	RFD-60	Euroshield	509
184	Temp. & humidity meter	H MI 32	Vaisala	63837
196	Ferrite clamp	FGZ 40X15E	Lüthi	4057
197	Ferrite clamp	FGZ 40X15E	Lüthi	4058
198	Ferrite clamp	FGZ 40X15E	Lüthi	4069
289	Universal power analyzer	PM 3000A	Voltech	8448
290	Ref. impedance network	IEC555	Voltech	8448
316	Power supply	HP 6032A	Hewlett Packard	2517A-00654
319	Antenna	CBL6112	Chase	2018
323	T-network	EZ-10	Rohde & Schwarz	843074/005
324	T-network	ESH3-Z4	Rohde & Schwarz	842929/012
325	T-network	ESH3-Z4	Rohde & Schwarz	842929/010
338	Test receiver	ESS	Rohde & Schwarz	847151/009
343	Artificial Mains Network	NSLK8128	Schwarzbeck	8128177
344	mV-meter	URV4	Rohde & Schwarz	879747/013
348	Shielded room	RFSD-100	Euroshield Oy	1320
349	Shielded room	RFSD-100	Euroshield Oy	1319
350	Semianechoic shielded room	RFD-F-100	Euroshield Oy	1327
351	RF generator	SMT 06	Rohde & Schwarz	845715/001
367	LISN	NNB-4/200	Rolf Heine	4/200X-96009
369	Discont.Interf.analyzer	DIA 1512A	Chase	5115
370	AC Power source	15003i-400/3	California Instr.	
371	AC Power source	500i-400	California Instr.	HK 52064
372	AC Power source	500i-400	California Instr.	HK 52065
373	AC Power source	500i-400	California Instr.	HK 52063
374	Impedance network	OMNI 3-18i	California Instr.	X71344
417	Antenna, bilog	CBL 6141	Chase	4028
506	4 wire ISN	ENY41	Rohde & Schwarz	866824/029
507	2 x 2 wire ISN	ENY22	Rohde & Schwarz	833823/017
525	Double-Ridged Horn	3115	Emco	6691
534	RF-amplifier	25S1G4A	Amplifier Research	303881
542	Double-Ridged Horn	3115	Emco	00023905
543	RF-amplifier	JCA018-501	JCA Technologies	103
544	RF-amplifier	ZFL-1000VH2	Mini-Circuits	D01080
564	RF amplifier	CA018-4010	CIAO Wireless	101
566	Spectrum analyzer	E4448A	Agilent	US42510236