ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC PART 15, SUBPART C, §15.245

FOR

Rokonet Ltd.

EQUIPMENT UNDER TEST

Dual technology PIR detector with microwave channel
model RK-410 DT

Hermon Laboratories Ltd.
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Electrical

ACCREDITED
839.01

Description of equipment under test

Test items	Dual technology PIR detector with microwave channel
Manufacturer	Rokonet Ltd.
Type (Model)	**RK-410 DT**

Applicant information

Applicant's representative & responsible person	Mr. Marcos Szhafir, project manager
Company	Rokonet Ltd.
Address	14 Hachoma Street
Postal code	75655
City	Rishon Le Zion
Country	Israel
Telephone number	+972 39616 555
Telefax number	+972 39616 584

Test performance

Project Number	13947
Location of the test	Hermon Laboratories, Binyamina, Israel
Test started	September 1, 1999
Test completed	September 7, 1999
Purpose of test	The EUT certification in accordance with CFR 47, part 2, §2.1033
Test specification(s)	FCC part 15, subpart C, §15.245, §15.209, subpart B, §15.107, §15.109

Table of Contents

1. Summary and signatures

The EUT, dual technology PIR detector with microwave channel, RK-410 DT, was tested according to FCC part 15 subpart C, §.15.245 and part 15 subpart B §.15.107, §.15.109 and found to comply with the standard requirements.

Test performed by:

Mr. M. Nikishin, EMC group leader _____

Test report prepared by:

Mrs. V. Mednikov, certification engineer _____

Test report approved by:

Mr. A. Usoskin, QA manager _____

The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation by A2LA.
Through this report period is used as decimal separator while thousands are separated by comma.
This report is in conformity with EN 45001 and ISO GUIDE 25.
The test results relate only to the items tested.

2. General information

2.1 Abbreviations and acronyms

The following abbreviations and acronyms are applicable to this test report:

AC	alternating current
BW	bandwidth
dB	decibel
dBm	decibel referred to one milliwatt
dB(µV)	decibel referred to one microvolt
dB(µV/m)	decibel referred to one microvolt per meter
DC	direct current
EUT	equipment under test
GHz	gigahertz
H	height
HL	Hermon Laboratories
Hz	hertz
IF	intermediate frequency
kHz	kilohertz
L	length
m	meter
mm	millimeter
MHz	megahertz
msec	millisecond
NA	not applicable
NARTE	National Association of Radio and Telecommunications Engineers, Inc.
Ω	Ohm
QP	quasi-peak (detector)
RBW	resolution bandwidth
RF	radio frequency
RE	radiated emission
RMS	root-mean-square
sec	second
V	volt

2.2 Specification references

CFR 47 part 15: October 1998	Radio Frequency Devices.
ANSI C63.2:06/1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4:1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

2.3 EUT description

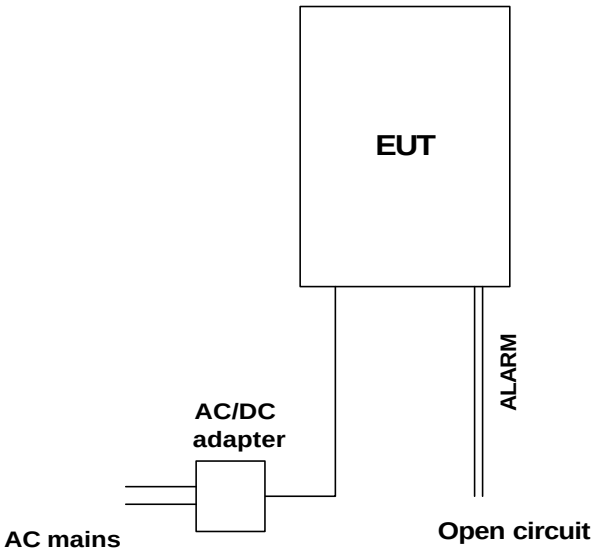
The EUT is a dual technology PIR detector with microwave channel, 2.45 GHz.

The EUT configuration is given in Figure 2.3.1, EUT ports and lines description in Table 2.3.1.

Table 2.3.1
EUT ports and lines

Port type	Port description	Connector type	Quantity	Cable type description	Cable length, m	Connected to
Power	12 V DC	non-detachable	1	unshielded	1	AC/DC adaptor
Signal	Alarm	non-detachable	1	unshielded	1	open circuit

Figure 2.3.1
EUT test configuration



3. Test facility description

3.1 General

Tests were performed at Hermon Laboratories, which is a fully independent, private EMC, Safety and Telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for radiated measurements (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-809 for anechoic chamber, C-845 for conducted emissions site), assessed by NMi Certin B.V. (Netherlands) for a number of EMC, Telecommunications, Safety standards, and assessed by AMTAC (UK) for safety of Medical Devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO GUIDE 25/EN 45001 for EMC, Telecommunications and Product Safety Information Technology Equipment (Certificate No. 839.01).
At the end of 1999 Hermon Laboratories signed an agreement with Intertek Testing Services NA Inc concerning mutual of the test results for EMC and Safety. Acording to this agreement Hermon Laboratories customers can bear ETL safety mark after successful testing in Hermon Laboratories. Also the laboratory performs various follow-up services.

Address: PO Box 23, Binyamina 30550, Israel
Telephone: +972 6628 8001
Fax: +9726 628 8277

Person for contact: Mr. Alex Usoskin, testing and QA manager.

3.2 Equipment calibration

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of MIL-STD-45662A.
The laboratory standards are calibrated by the third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

3.2.1 Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Radiated emissions in the anechoic chamber at 3 m measuring distance	Biconilog antenna: ±3.2 dB Double ridged guide antenna: ±2.36 dB

3.3 Statement of qualification

The test measurement data supplied in this test measurement report having been received by me, is hereby duly certified. The following is a statement of my qualifications:
I am an engineer, graduated from university in 1996 with an M. Sc. EE degree and certified by NARTE as an EMC Accredited Test Laboratory engineer, the certificate No. is ATL–0005–E.
I have obtained 2 years experience in EMC measurements and have been with Hermon Laboratories since 1998.

Name: Mr. Michael Nikishin Signature: _____
Position: EMC group leader Date: May 29, 2000

I hereby certify that this test measurement report was prepared by me and is hereby duly certified. The following is a statement of my qualifications.
I have a university degree and more than 10 years experience in document processing.
I have been with Hermon Laboratories since May 1999.

Name: Mrs. Valeria Mednikov Signature: _____
Position: certification engineer Date: May 29, 2000

4 Radiated emission measurements

4.1 Field strength of emissions according to § 15.245 (b)

4.1.1 General

Specified limit at 3 m distance is given in Table 4.1.1 below :

Table 4.1.1 The field strength limits

Frequency, MHz	Average detector	
	Field strength of fundamental, dB(µV/m)	Field strength of harmonics, dB(µV/m)
2450	114	–
within restricted bands below 17.7 GHz	–	54
out of restricted bands below 17.7 GHz	–	64.1
within restricted bands at and above 17.7 GHz	–	88

Emissions radiated outside of the specified frequency band, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits shown in §15.209, whichever is the lesser attenuation.

4.1.2 Test procedure

The test was performed in the anechoic chamber at 3 meters test distance, i.e. the distance between measuring antenna and EUT boundary in the frequency range from 30 MHz to 2.9 GHz and at the open field test site in the range from 2.9 GHz to 12.250 GHz including the boundaries of the specified frequency band. The EUT was placed on the wooden table, as shown in Figure 4.1.1 and operated in continuous transmitting mode. The frequency range from 30 MHz up to 5th harmonic was investigated with biconilog and double ridged guide antennas. To find maximum radiation the turntable was rotated 360^{o}, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

The peak detector with RBW = 120 kHz at frequencies below 1 GHz and RBW = 1 MHz above 1 GHz was used in course of measurements.

The EUT has met the average emission requirements.

Average factor –20.8 dB was calculated according to the formula

$$\text{Aver. factor} = 20 \log (T_{ON} / 100 \text{ ms}),$$

where

T_{ON} , transmission duration, is 182 x 50 µsec (continuous transmission $T_{x\ ON}$ = 50µsec, $T_{x\ OFF}$ = 500µsec),

$$20 \log (182 \times 50\ \mu\text{sec} / 100\ \text{ms}) = -20.8\ \text{dB}.$$

In the range 30 MHz – 1 GHz a more stringent limit for digital part was used. The EUT met the requirements of §15.109.

The worst test results are recorded in Table 4.1.2 and shown in Plots 4.1.1, 4.1.7.

All out of band emissions (except for harmonics) were found below general radiated emission limit of §15.209 (54 dB(µV/m)).

The EUT met all the requirements for field strength of emissions.

Reference numbers of test equipment used

HL 0025	HL 0038	HL 0041	HL 0275	HL 0287	HL 0465	HL 0521	HL 0547
HL 0604	HL 1116						

Full description is given in Appendix A.

Table 4.1.2

Radiated emission measurements, average limit

TEST SPECIFICATION: FCC part 15 subpart C § 15.245
DATE: March 21, 2000
RELATIVE HUMIDITY: 46%
AMBIENT TEMPERATURE: 21°C

Freq., MHz	Ant. pol.	Meas. result, dB (μV)	Ant. factor, dB(1/m)	Cable loss and ampl. gain, dB	Radiated emission, peak dB (μV/m)	Peak limit @ 3 m dB(μV/m)	Margin, dB	Radiated emission, average dB (μV/m)	Aver. limit @ 3 m dB(μV/m)	Margin, dB	Pass/ Fail
4913.16	V	49.1	39.3	18.5	69.9	74	4.1	49.1	54	4.9	Pass
4913.16	H	47.8	39.3	18.5	68.6	74	5.4	47.8	54	6.2	Pass
2456.36	H	78.1	30.9	18.9	90.1	134	43.9	69.3	114	44.7	Pass
2456.36	V	73.8	30.9	18.9	85.8	134	48.2	65.0	114	49	Pass
2464.96	H	43.1	30.9	18.9	54.7	74	19.3	33.9	54	20.1	Pass
2434.95	H	37.3	30.9	18.9	49.3	74	24.7	28.5	54	25.5	Pass
7370.48	H	51.8	41.2	31.1	61.9	74	12.1	41.1	54	12.9	Pass

Test measurement results listed in the table were obtained throughout the testing with peak detector, resolution bandwidth = 1 MHz, and double ridged guide antenna @ 1 meter height.

Radiated emission was calculated as follows:

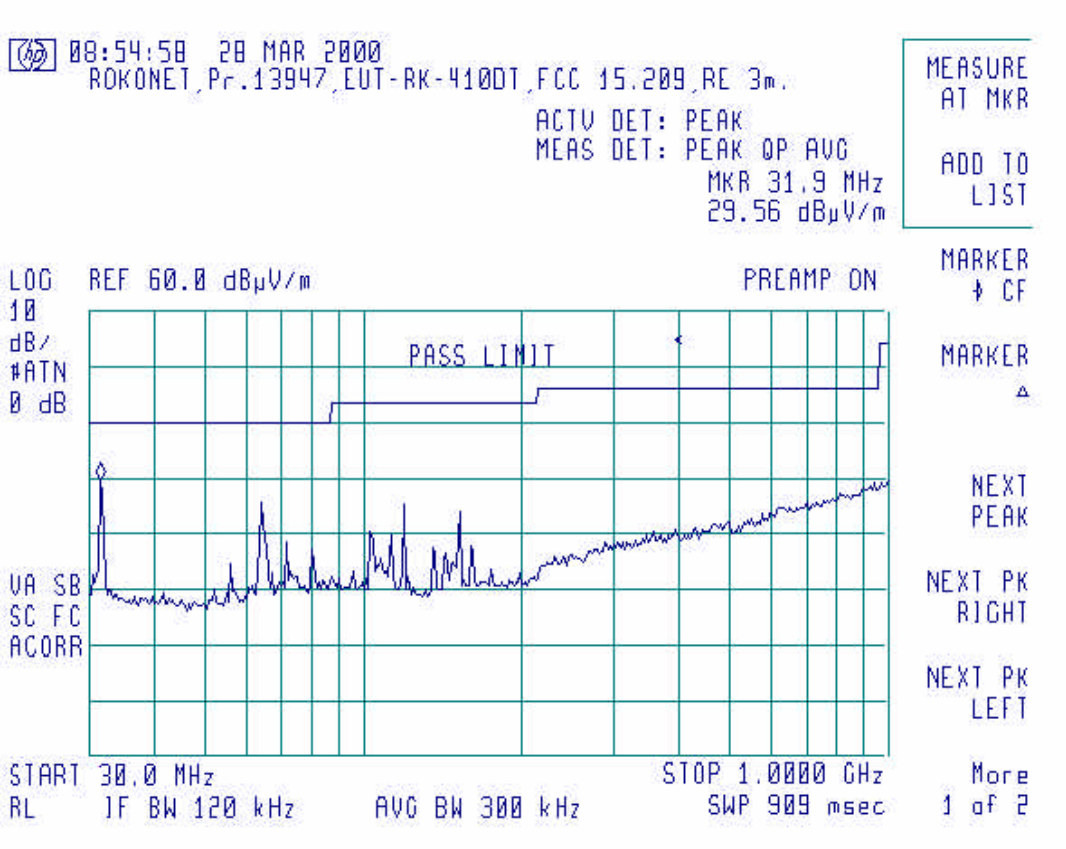
E = Meas. result (dB(μV)) + Antenna factor (dB(1/m)) – (Cable loss and ampl. gain (dB)),

Radiated emission, average, was calculated as follows:

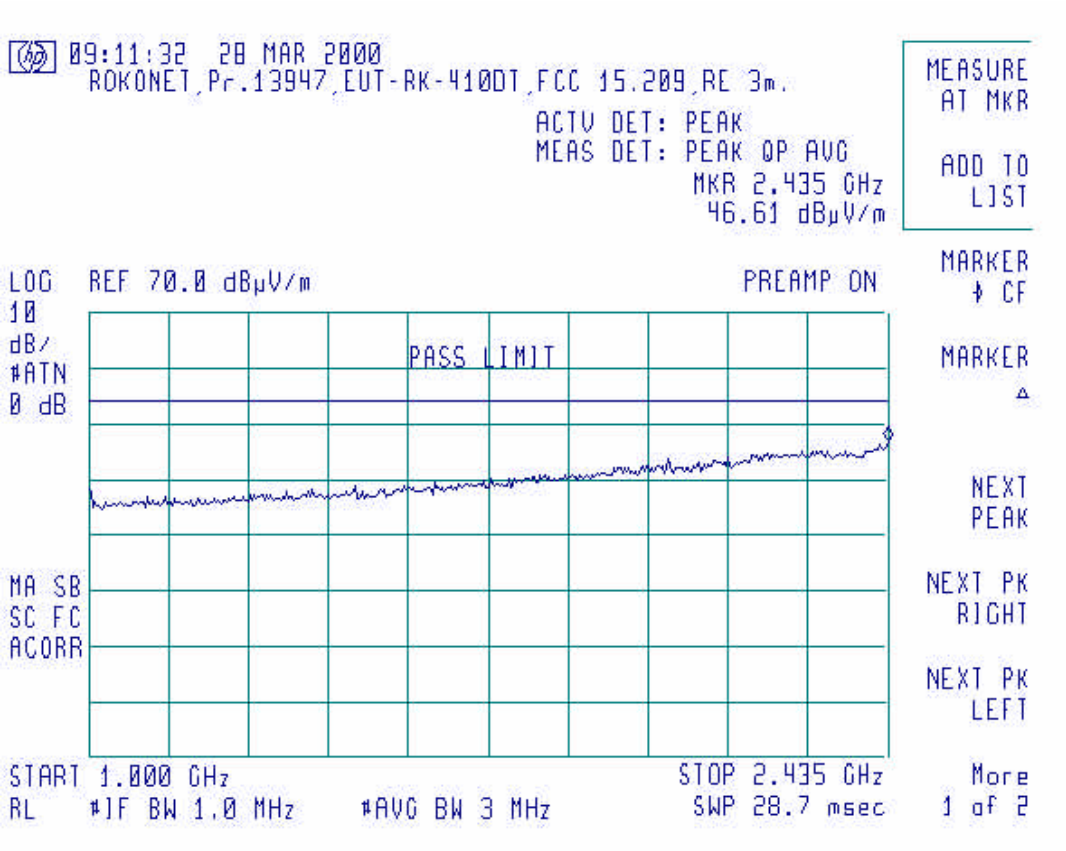
E_{aver} = E + Average factor (dB).

Notes to table:
For antenna factor refer to Appendix B.
Margin = dB below (negative if above) limit.

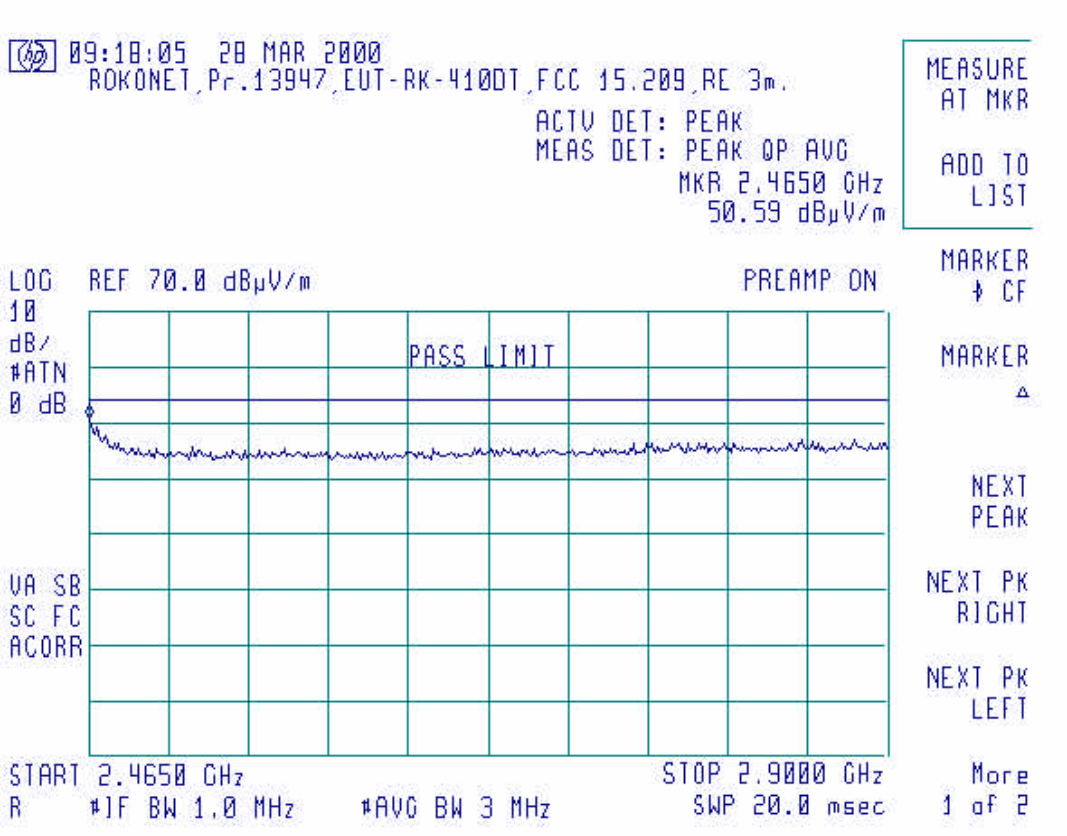
Plot 4.1.1
Radiated spurious emissions measurements,
frequency range 30 – 1000 MHz



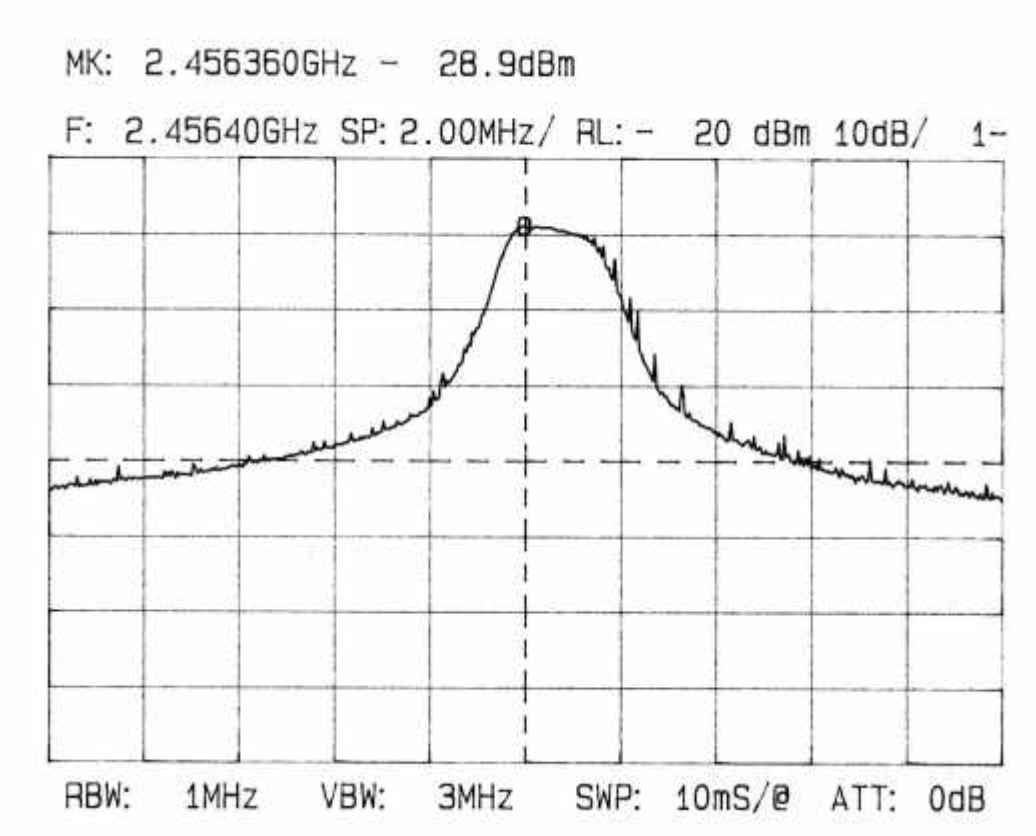
Plot 4.1.2
Radiated spurious emissions measurements,
frequency range 1000 – 2435 MHz



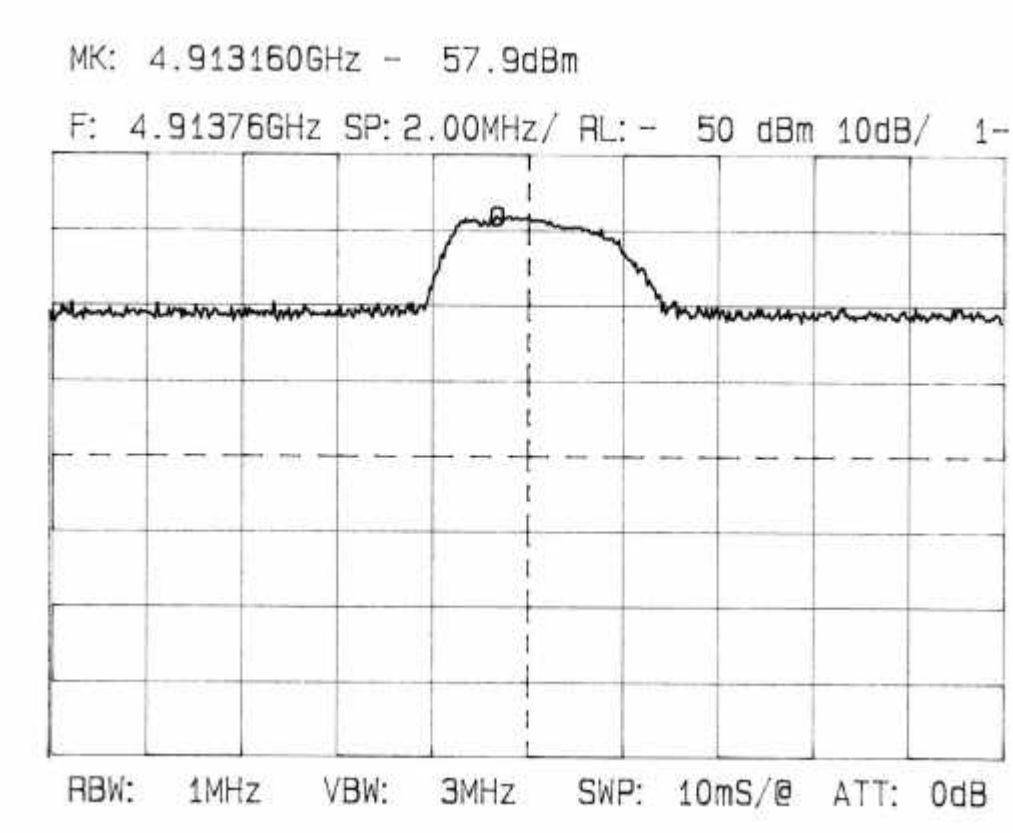
Plot 4.1.3
Radiated spurious emissions measurements,
frequency range 2465 – 2900 MHz



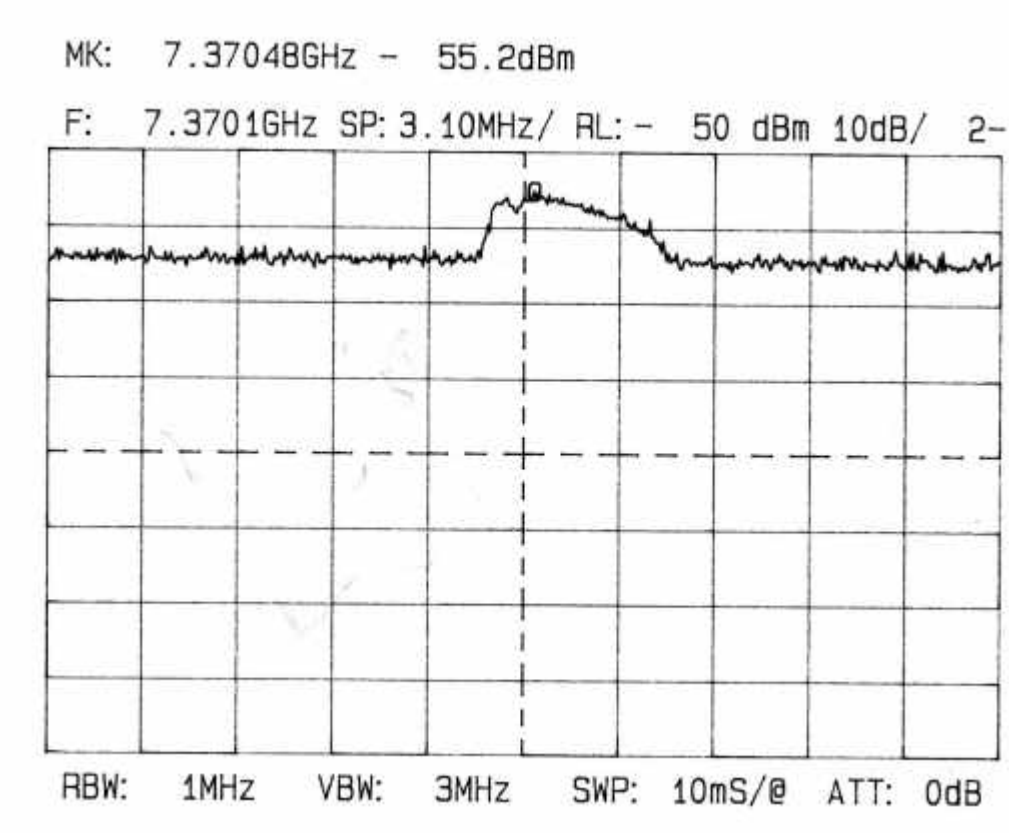
Plot 4.1.4
Carrier frequency measurements



Plot 4.1.5
2nd harmonic emission measurements



Plot 4.1.6
3d harmonic emission measurements



Plot 4.1.7
Out of band emission measurements

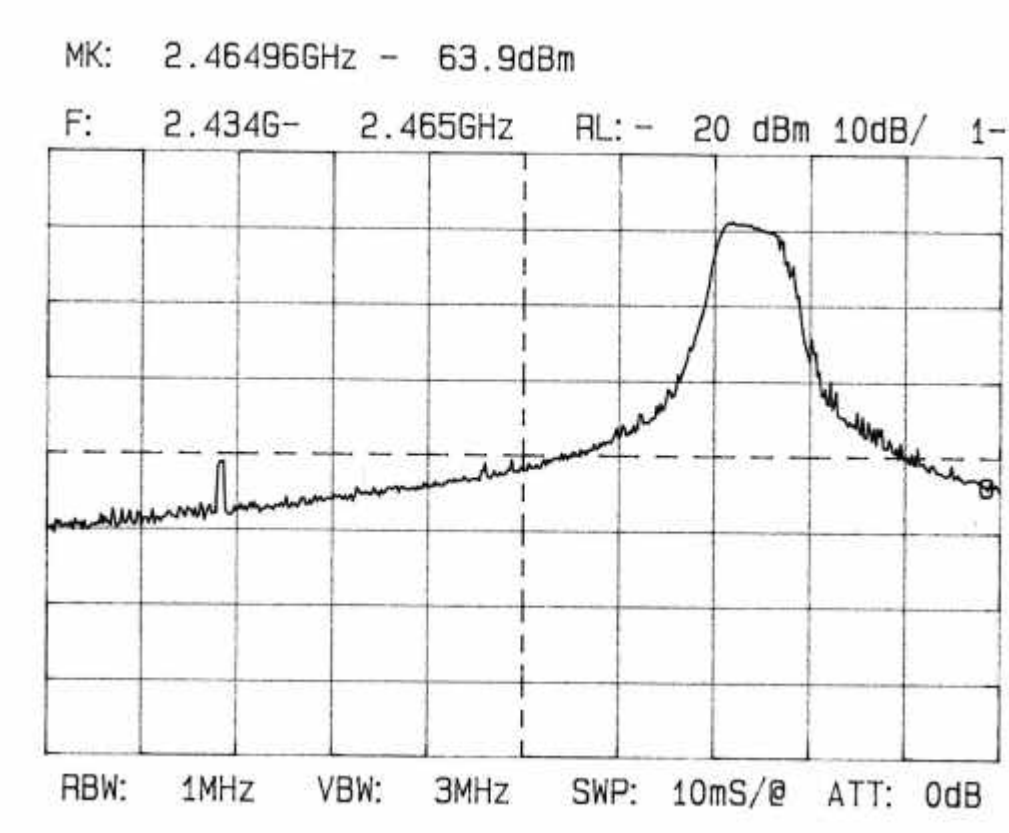
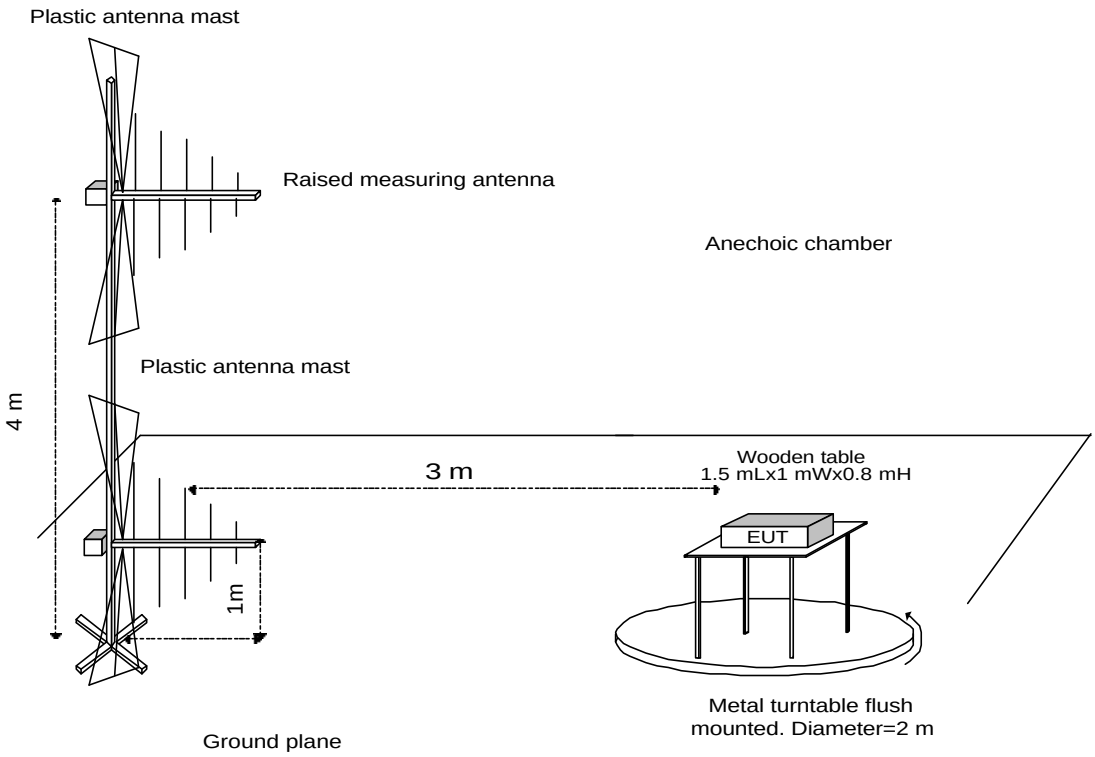


Figure 4.1.1
Radiated emission test setup



4.2 Unintentional conducted emissions test according to §15.107

4.2.1 General

Conducted emission measurements specification limits are given in Table 4.2.1 below.

Table 4.2.1
Limits for conducted emission on AC power lines

Frequency MHz	Class B equipment limit dB(mV)
0.45 - 30	48

4.2.2 Test procedure

The test was performed in the shielded room. The EUT was set up on the wooden table as shown in Figure 4.2.1, Photographs 4.2.1, 4.2.2, in configuration, given in Figure 2.3.1. Frequency range from 450 kHz to 30 MHz was investigated.
The measurements were performed on the 120 V / 60 Hz power lines (both neutral and phase) by means of the LISN, connected to the spectrum analyzer. The unused coaxial connector of the LISN was terminated in 50 Ω. The position of the EUT cables was varied to determine maximum emission level. Peak detector with 9 kHz resolution bandwidth was used.

All emissions were found at least 20 dB below the limit.

Test results are shown in Plots 4.2.1, 4.2.2.

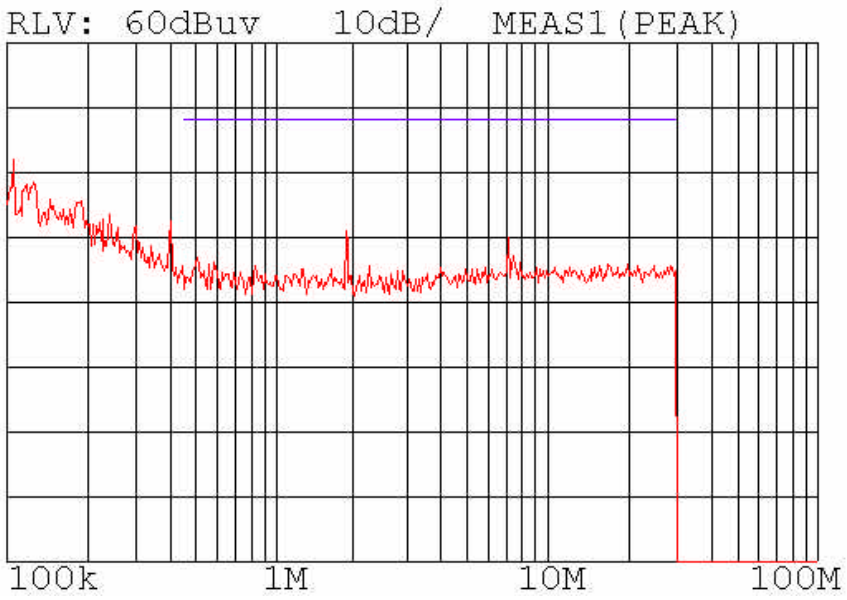
Reference numbers of test equipment used

HL 0026	HL 0163	HL 0520	HL 0580	HL 0590	HL 1206

Full description is in Appendix A.

Plot 4.2.1
Conducted emission measurements on power line

Test specification: FCC part 15 subpart B class B
Frequency range: 450 kHz-30 MHz
EUT: RK-115FC
Line: phase
Detector: peak



Plot 4.2.2
Conducted emission measurements on power line

Test specification: FCC part 15 subpart B class B
Frequency range: 450 kHz-30 MHz
EUT: RK-115FC
Line: neutral
Detector: peak

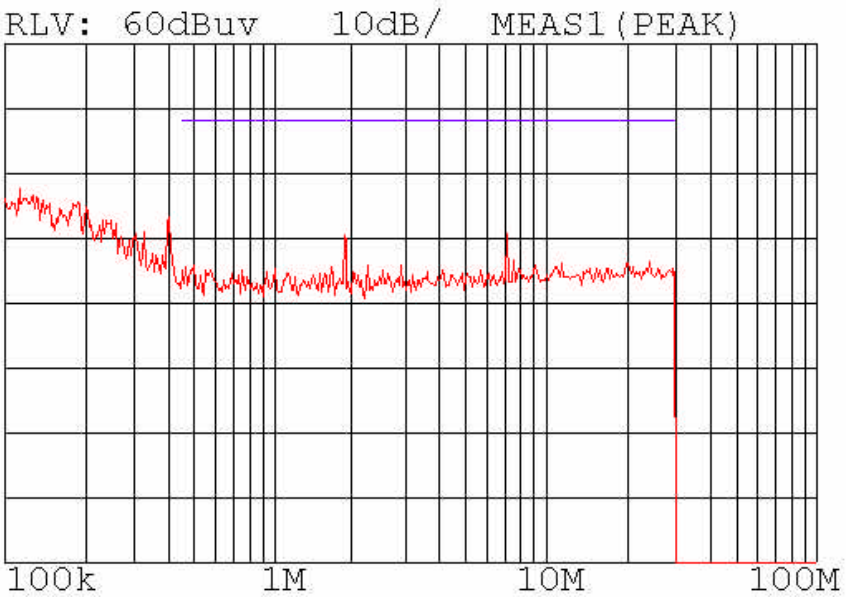
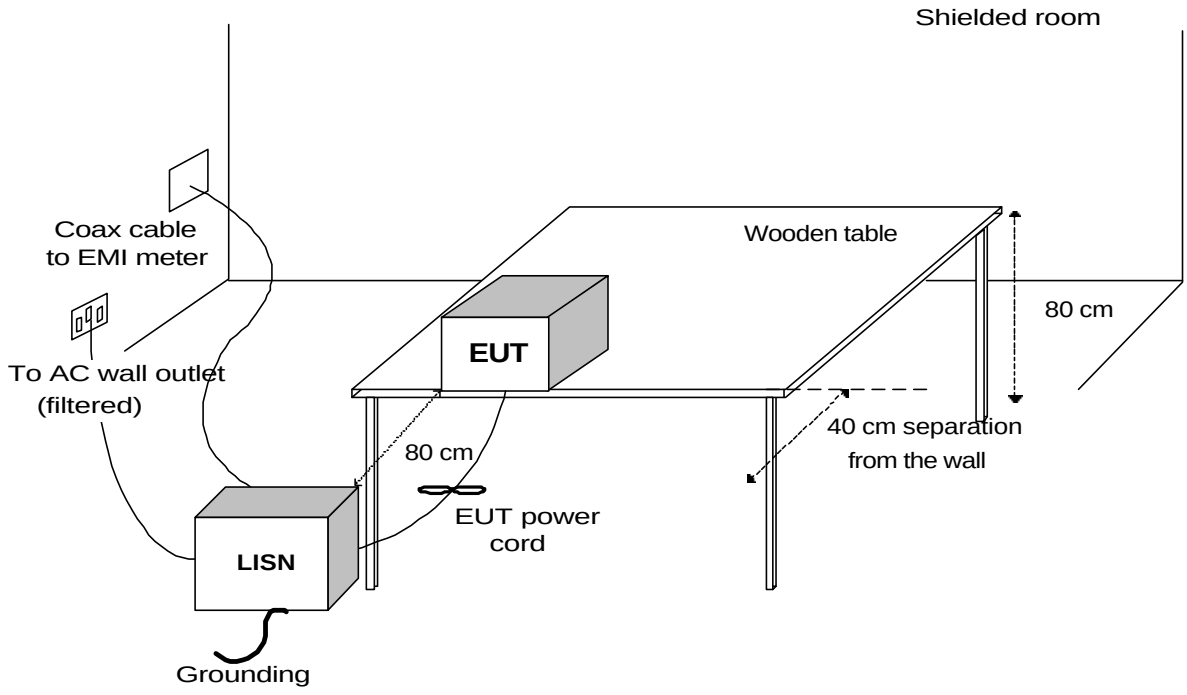


Figure 4.2.1
Conducted emissions test setup for table top equipment



Photograph 4.2.1
Conducted emissions test setup for table-top equipment

APPENDIX A – Test equipment and ancillaries used for tests

HL Serial No.	Serial No.	Description	Manufacturer	Model No.	Due Calibr.
0025	5837	Spectrum analyzer, 10 kHz-23 GHz	Anritsu	MS-710C	8/00
0026	3460	Spectrum analyzer, 100 Hz-2.2 GHz	Anritsu	MS 2601A	10/00
0038	028	Antenna mast, 1-4 m	Hermon Labs	AM-1	2/00 Check
0041	2811	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	8/00
0163	1314	LISN FCC/VDE/MIL -STD	Electro-Metrics	ANS-25/2	12/99
0275	040	Table non-metallic, adjustable height, 1.5 x 1.0 x 0.8 m	Hermon Labs	TNM	3/00 Check
0287	042	Turntable, motorized diameter, 2m	Hermon Labs	TMD-2	4/00 Check
0465	023	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	3/00
0520	520	FILTER, HIGH PASS, 56 KHz – 30 MHz	Hewlett Packard	F-CE 56	11/00
0521	0319	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	7/00
0547	400	Amplifier, GaAs FET,RF 6-18 GHz,2 W30 dB,12 V/1.2 A, N.F4.5 dB	Avantek	AMT - 12407 M	12/99
0580	580	DC block adaptor 10 kHz-2.2 GHz	Anritsu	MA8601 A	1/00
0590	10	Attenuator 10 dB, 50 Ohm, N-type, 2W	Elisra Electronic Systems	MW2100-N-Type	6/00
0604	9611-1011	Antenna Biconilog Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	12/99
1116	186	Antenna horn, 1-18 GHz	Hermon Labs	A1-18	8/00
1206	142	ONE PHASE VOLTAGE REGULATOR, 2KVA, 0-250V	Hermon Labs	TDGC-2	5/00 check

APPENDIX B-Test equipment correction factors

Antenna Factor
Double Ridged Guide Antenna
Model RGA-50/60, S/N 2811

Frequency, MHz	Antenna Factor, dB
1000	24.3
1500	25.4
2000	28.4
2500	29.2
3000	30.5
3500	31.6
4000	33.7
4500	32.2
5000	34.5
5500	34.5
6000	34.6
6500	35.3
7000	35.5
7500	35.9
8000	36.6
8500	37.3
9000	37.7
9500	37.7
10000	38.2
10500	38.5
11000	39.0
11500	40.1
12000	40.2
12500	39.3
13000	39.9
13500	40.6
14000	41.1
14500	40.5
15000	39.9
15500	37.8
16000	39.1
16500	41.1
17000	41.7
17500	45.1
18000	44.3

Antenna factor is to be added to receiver meter reading in dB(μV) to convert to field intensity in dB(μV)/meter

Antenna factor at 3m calibration
Biconilog antenna, EMCO, model 3141,Ser.No.1011

Frequency, MHz	Antenna Factor, dB(1/m)	Frequency, MHz	Antenna Factor, dB(1/m)
26	7.8	940	24.0
28	7.8	960	24.1
30	7.8	980	24.5
40	7.2	1000	24.9
60	7.1	1020	25.0
70	8.5	1040	25.2
80	9.4	1060	25.4
90	9.8	1080	25.6
100	9.7	1100	25.7
110	9.3	1120	26.0
120	8.8	1140	26.4
130	8.7	1160	27.0
140	9.2	1180	27.0
150	9.8	1200	26.7
160	10.2	1220	26.5
170	10.4	1240	26.5
180	10.4	1260	26.5
190	10.3	1280	26.6
200	10.6	1300	27.0
220	11.6	1320	27.8
240	12.4	1340	28.3
260	12.8	1360	28.2
280	13.7	1380	27.9
300	14.7	1400	27.9
320	15.2	1420	27.9
340	15.4	1440	27.8
360	16.1	1460	27.8
380	16.4	1480	28.0
400	16.6	1500	28.5
420	16.7	1520	28.9
440	17.0	1540	29.6
460	17.7	1560	29.8
480	18.1	1580	29.6
500	18.5	1600	29.5
520	19.1	1620	29.3
540	19.5	1640	29.2
560	19.8	1660	29.4
580	20.6	1680	29.6
600	21.3	1700	29.8
620	21.5	1720	30.3
640	21.2	1740	30.8
660	21.4	1760	31.1
680	21.9	1780	31.0
700	22.2	1800	30.9
720	22.2	1820	30.7
740	22.1	1840	30.6
760	22.3	1860	30.6
780	22.6	1880	30.6
800	22.7	1900	30.6
820	22.9	1920	30.7
840	23.1	1940	30.9
860	23.4	1960	31.2
880	23.8	1980	31.6
900	24.1	2000	32.0
920	24.1		

Antenna factor is to be added to receiver meter reading in dB(μV) to convert to field intensity in dB(μV/meter).

Hermon Laboratories
Antenna factor
Double ridged guide antenna, model A1-18
S/N 186 (HL 1116)

Freq, MHz	ANTENNA FACTOR, dB(1/m)
1000.0	24.6
1500.0	26.4
2000.0	29.7
2500.0	31.1
3000.0	31.5
3500.0	32.7
4000.0	36.1
4500.0	36.1
5000.0	39.9
5500.0	40.5
6000.0	40.4
6500.0	41.0
7000.0	41.2
7500.0	41.2
8000.0	44.3
8500.0	40.7
9000.0	39.3
9500.0	41.3
10000.0	42.8
10500.0	43.8
11000.0	47.0
11500.0	46.3
12000.0	43.4
12500.0	41.8
13000.0	41.9
13500.0	44.5
14000.0	44.8
14500.0	44.9
15000.0	44.4
15500.0	43.4
16000.0	42.6
16500.0	43.6
17000.0	42.3
17500.0	45.9
18000.0	45.3