HERMON LABORATORIES

ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC PART 15, SUBPART C, §15.245

FOR

Rokonet Ltd.

EQUIPMENT UNDER TEST

Dual technology motion detector
model COSMOS DT

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30550, Israel
Tel.+972 4628 8001
Fax.+972 4628 8277
Email:mail@Hermonlabs.com

ACCREDITED
839.01

Electrical

Description of equipment under test

Test items	Dual technology motion detector
Manufacturer	Rokonet Ltd.
Type (Model)	COSMOS DT

Applicant information

Applicant's representative & responsible person	Mr. Marcos Szhafir, marketing and technical support manager
Company	Rokonet Ltd.
Address	14 Hachoma Street
Postal code	75655
City	Rishon Le Zion
Country	Israel
Telephone number	+972 3961 6555
Telefax number	+972 3961 6584

Test performance

Project Number	14103
Location of the test	Hermon Laboratories, Binyamina, Israel
Test started	June 11, 2000
Test completed	June 11, 2000
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 §15.109

Table of Contents

1. Summary and signatures

The EUT, dual technology motion detector, COSMOS DT, was tested according to FCC part 15 subpart C, §.15.245 and part 15 subpart B, §.15.109 and found to comply with the standard requirements.

Test performed by:

Mrs. E. Pitt, test engineer

Test report prepared by:

Mrs. M. Cherniavsky, certification engineer

Test report approved by:

Dr. E. Usoskin, C.E.O.

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
VBW	video bandwidth

2.2 Specification references

CFR 47 part 15: October 1999	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

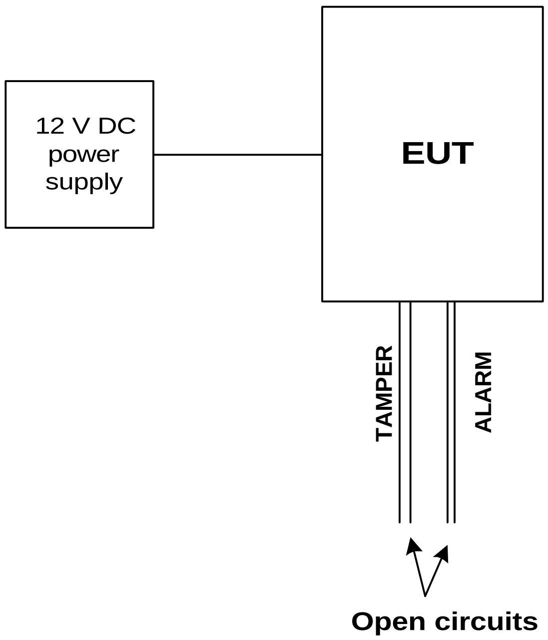
The EUT is a dual technology motion detector, combining infrared detector and microwave motion sensor (Doppler module) with 10.525 GHz frequency of operation. Throughout the testing the measurements were performed with two kinds of RF modules: manufactured by Agilis and by Microwave Solutions. The EUT is used within a building.

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	Terminal block	1	unshielded	3	DC power supply
Signal	Alarm/tamper	Terminal block	2x2	unshielded	3	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-1082 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).

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 1974 with an MScEE degree and certified by NARTE as an EMC accredited test laboratory engineer, the certificate no. is ATL–0006–E.
I have obtained 27 years experience in EMC measurements and have been with Hermon Laboratories since 1991.

Name: Mrs. Eleonora Pitt		Signature: Pitt
Position: test engineer		Date: October 4, 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 am an engineer, graduated from university in 1971, with an MScEE degree, have obtained 26years experience in electronic products design and development, have been with Hermon Laboratories since 1991. Also, I am a telecommunication class II engineer certified by the National Association of Radio and Telecommunications Engineers, Inc. (USA.), the certificate no. is E2-03410.

Name: Mrs. Marina Cherniavsky		Signature:
Position: certif. engineer		Date: October 4, 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/Peak detector	
	Field strength of fundamental, dB(μV/m)	Field strength of harmonics, dB(μV/m)
10.5 -10.55	128/148	88/108
within restricted bands below 17.7 GHz	–	54
out of restricted bands below 17.7 GHz	–	54
within restricted bands at and above 17.7 GHz	–	88/108

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 6 GHz and at the open field test site at 1 m and 0.3 m test distance in the range from 6 GHz to 5th harmonic including the boundaries of the specified frequency band. The tests were carried out at closer distance because of weak signal. The limit was calculated according to the equation:

$$20_{log}(D_1/D_2)\text{+ specified limit = calculated limit, where}$$

D_1= 3 m is the distance for which the limit is specified by the standard, D_2 is the distance for which the limit is calculated.

The EUT was placed on the wooden table, as shown in Figure 4.1.1, Photographs 4.1.1 to 4.1.4 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 EMI receiver settings are shown in the plots.

The EUT has met the average emission requirements. The carrier and harmonics measurement test results are recorded in Table 4.1.2 and shown in Plots 4.1.1 to 4.1.4 for EUT with Microwave Solutions module, in Table 4.1.3 and Plots 4.1.13 to 4.1.15 - with Agilis module. The measured results in dBm shown in the plots were converted into dBμV according to the equation:

U (dBμV) = 107 dB + Measured result (dBm), e.g. the test result –29.1 dBm @ 10.525 GHz shown in Plot 4.1.1 was converted into 77.9 dBμV, recorded in Table 4.1 2.

All out of band emissions (except for harmonics) were found below the 54 dB(μV/m) general radiated emission limit of §15.209, refer to Plots 4.1.5 – 4.1.12, 4.1.16 – 4.1.23, 4.1.25, 4.1.27. The emissions shown in Plots 4.1.7 to 4.1.12 and in Plots 4.1.18 to 4.1.23 correspond to measuring device mixer operation.

In the range 30 MHz – 1 GHz a more stringent limit for digital part was used. Emissions found in 30 - 1000 MHz range were due to the incorporated digital device. The EUT met the requirements of §15.109, refer to Plots 4.1.24 and 4.1.26.

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 0554	HL 0604	HL 0749	HL 0750	HL 0768	HL 0769	HL 0770	HL 1175

Full description is given in Appendix A.

Table 4.1.2 Radiated emission measurements of EUT with Microwave Solutions module, average limit

TEST SPECIFICATION: FCC part 15 subpart C § 15.245
DATE: June 11, 2000
RELATIVE HUMIDITY: 57%
AMBIENT TEMPERATURE: 25°C

MEASUREMENTS PERFORMED AT 3 METER DISTANCE

Frequency GHz	Measured result dB (μV)	RBW/ VBW MHz	Antenna factor dB (1/m)	Cable loss dB	Radiated emissions dB (μV/m)	Spec. limit dB (μV/m)	Margin dB	Pass/ Fail
10.525	77.9	1/3	38.5	4.38	120.8	128	7.2	Pass

MEASUREMENTS PERFORMED AT 1 METER DISTANCE

Frequency GHz	Measured result dB (μV)	RBW/ VBW MHz	Antenna factor dB (1/m)	Cable loss dB	Radiated emissions dB (μV/m)	Limit @ 1 m distance dB (μV/m)	Margin dB	Pass/ Fail
21.05	62.1	1/3	31.64	NA	93.74	97.5	3.76	Pass
31.57	53.9	1/1	35.17	NA	89.07	97.5	8.43	Pass

MEASUREMENTS PERFORMED AT 0.3 METER DISTANCE

Frequency GHz	Measured result dB (μV)	RBW/ VBW MHz	Antenna factor dB (1/m)	Cable loss dB	Radiated emissions dB (μV/m)	Limit @ 0.3 m distance dB (μV/m)	Margin dB	Pass/ Fail
42.1	58.2	1/1	37.46	NA	95.66	108	12.34	Pass

Notes to table:

Test measurement results listed in the table were obtained throughout the testing with peak detector and double ridged guide antenna in vertical polarization @ 1 meter height.
Limit is calculated for 1 m and 0.3 m test distances.
Radiated emission dB(μV/m) = measured results dB(μV) + antenna factor dB(1/m) + cable loss
For antenna factor refer to Appendix B.
Margins = dB below (negative if above) specification limit.

Table abbreviations:
RBW - resolution bandwidth
VBW - video bandwidth

Table 4.1.3 Radiated emission measurements of EUT with Agilis module, average limit

TEST SPECIFICATION:	FCC part 15 subpart C § 15.245
DATE:	June 11, 2000
RELATIVE HUMIDITY:	57%
AMBIENT TEMPERATURE:	25°C

MEASUREMENTS PERFORMED AT 3 METER DISTANCE

Frequency GHz	Measured result dB (µV)	RBW/ VBW MHz	Antenna factor dB (1/m)	Cable loss dB	Radiated emissions dB (µV/m)	Spec. limit dB (µV/m)	Margin dB	Pass/ Fail
10.525	72.5	1/3	38.5	4.38	115.4	128	12.6	Pass

MEASUREMENTS PERFORMED AT 1 METER DISTANCE

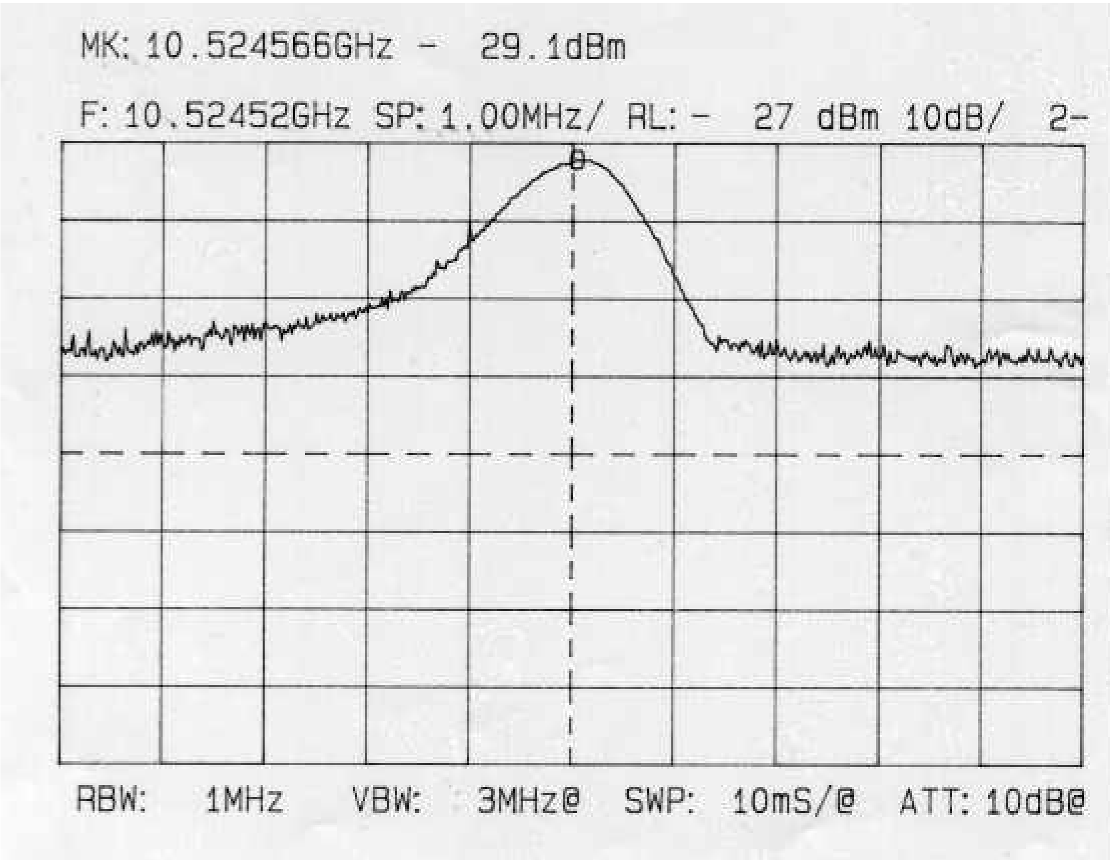
Frequency GHz	Measured result dB (µV)	RBW/ VBW MHz	Antenna factor dB (1/m)	Cable loss dB	Radiated emissions dB (µV/m)	Limit @ 1 m distance dB (µV/m)	Margin dB	Pass/ Fail
21.05	62.9	1/3	31.64	NA	94.54	97.5	2.96	Pass
31.57	55.9	1/3	35.17	NA	91.07	97.5	6.43	Pass

Notes to table:

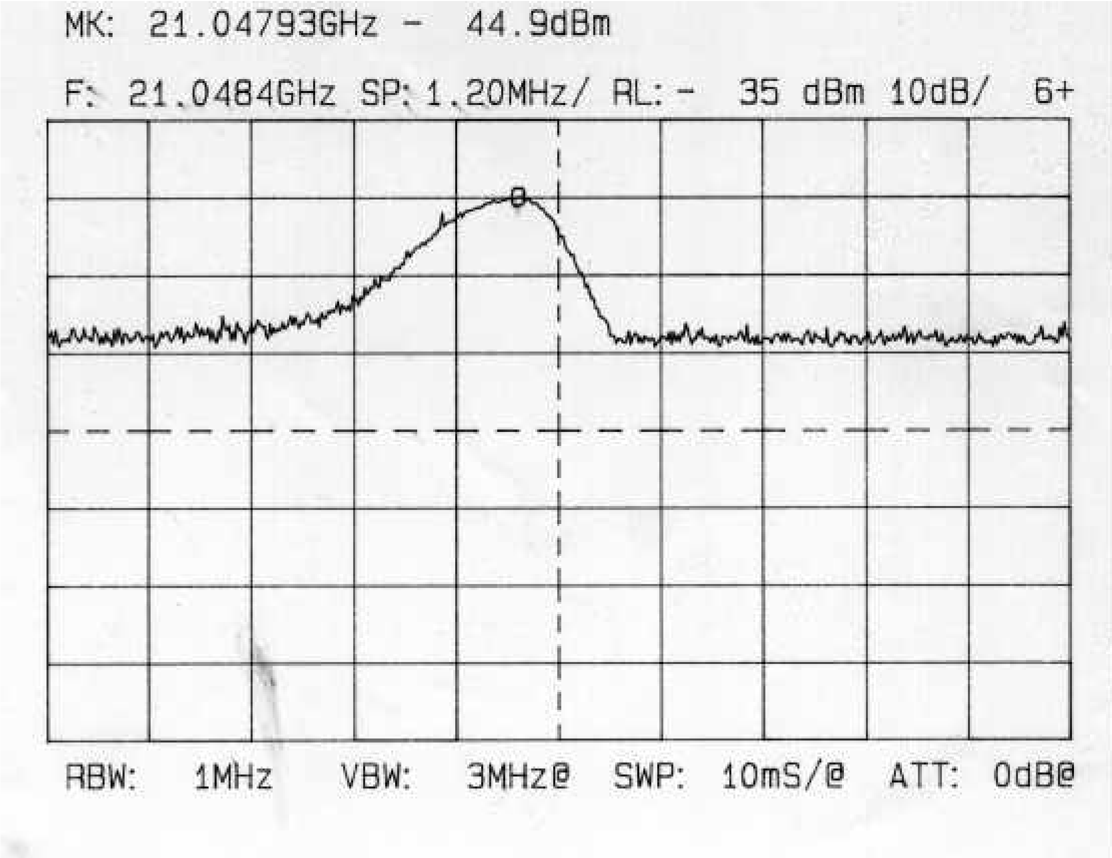
Test measurement results listed in the table were obtained throughout the testing with peak detector and double ridged guide antenna in vertical polarization @ 1 meter height.
Limit is calculated for 1 m test distances.
Radiated emission dB(µV/m) = measured results dB(µV) + antenna factor dB(1/m) + cable loss
For antenna factor refer to Appendix B.
Margins = dB below (negative if above) specification limit.

Table abbreviations:
RBW - resolution bandwidth
VBW - video bandwidth

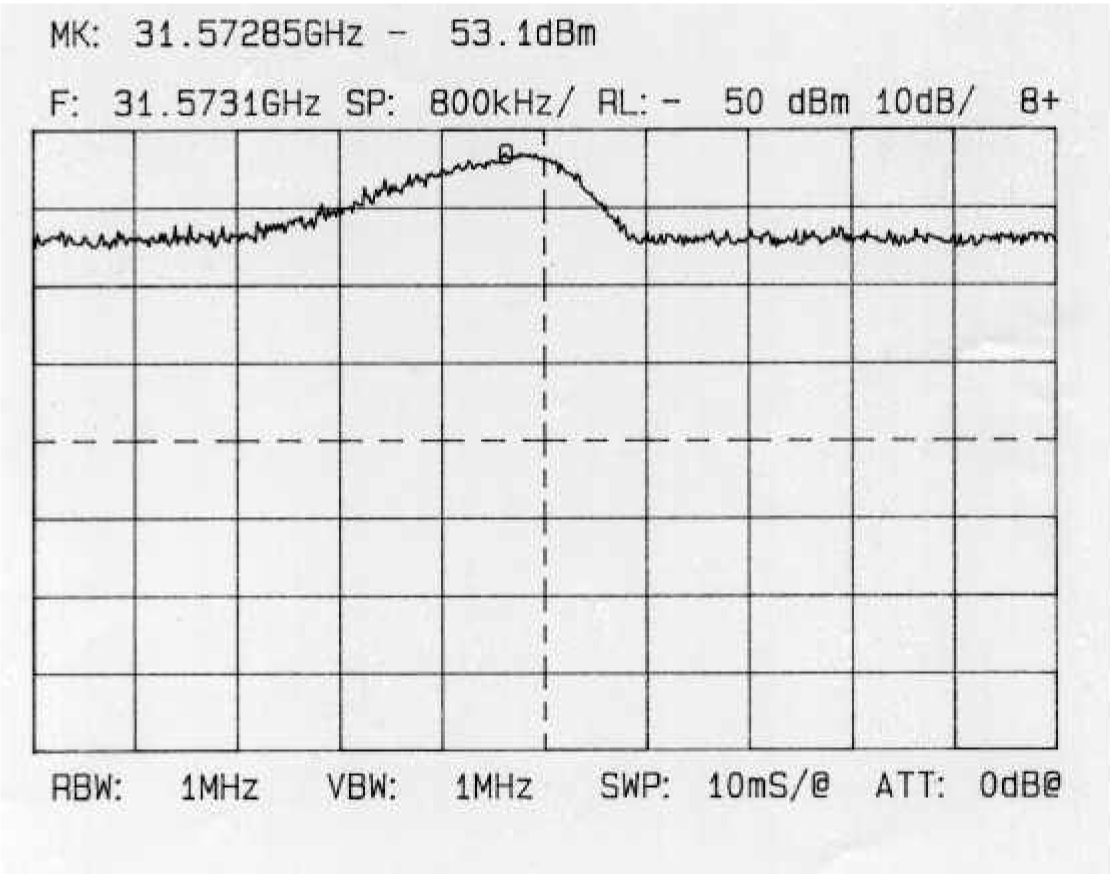
Plot 4.1.1
Carrier frequency measurements
with Microwave Solutions module



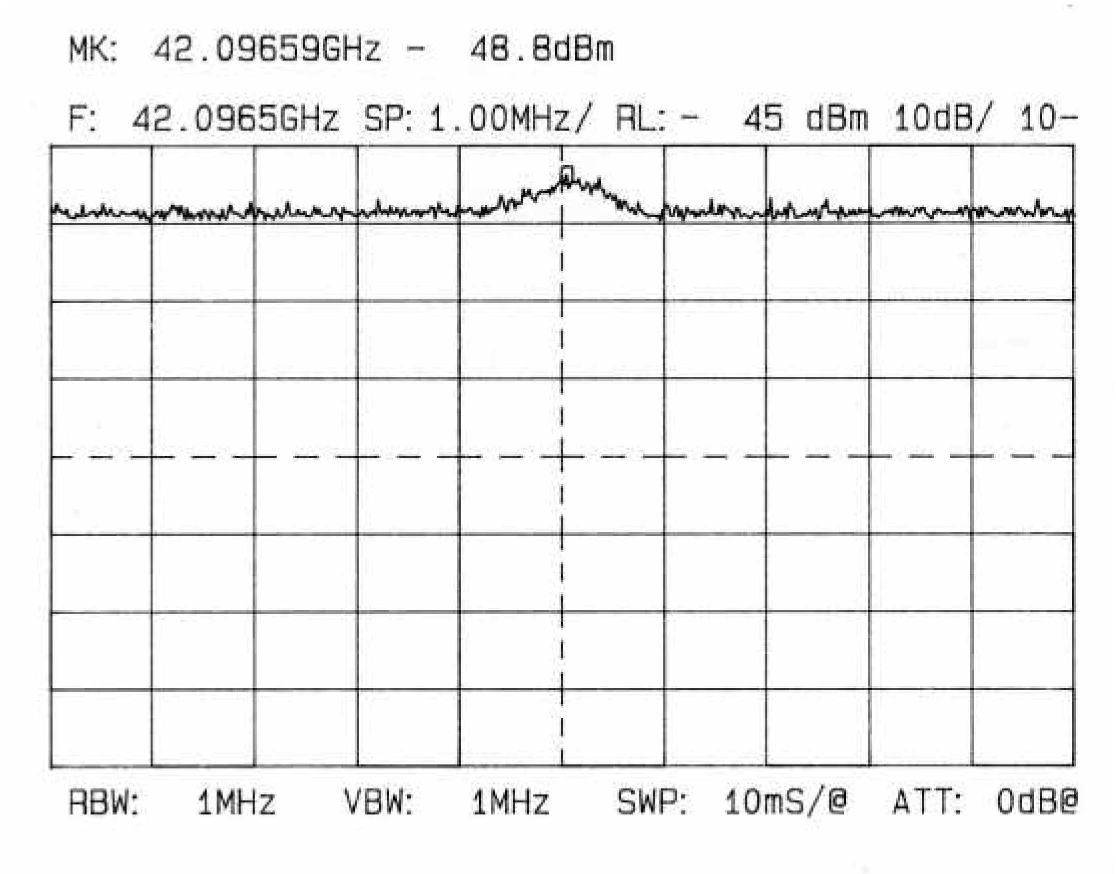
Plot 4.1.2
2nd harmonic emission measurements with Microwave Solutions module



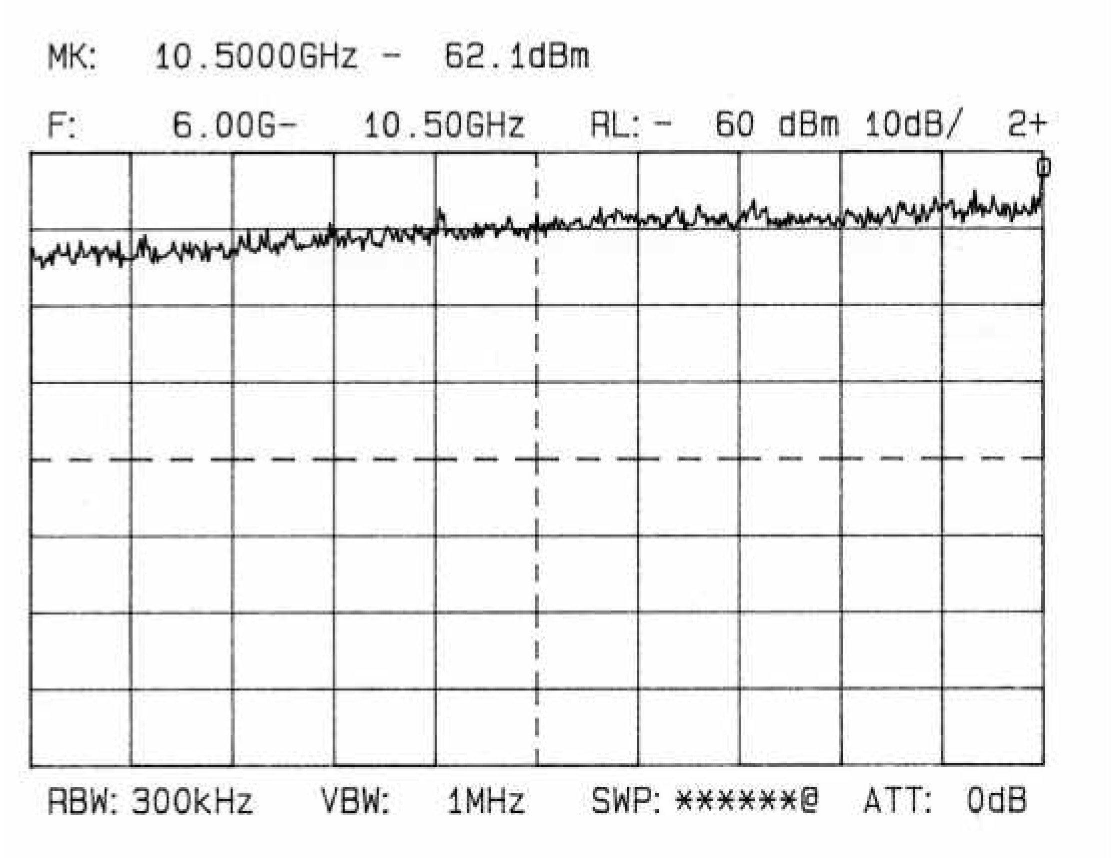
Plot 4.1.3
3d harmonic emission measurements
with Microwave Solutions module



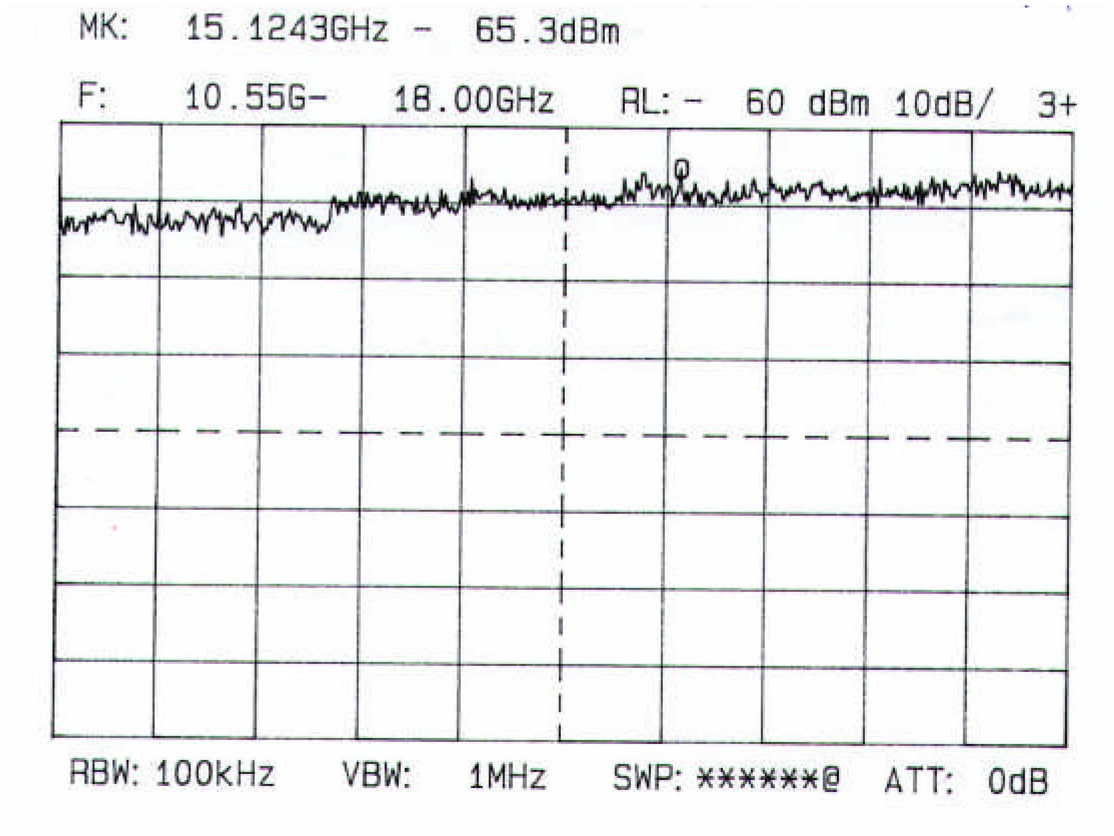
Plot 4.1.4
4th harmonic emission measurements
with Microwave Solutions module



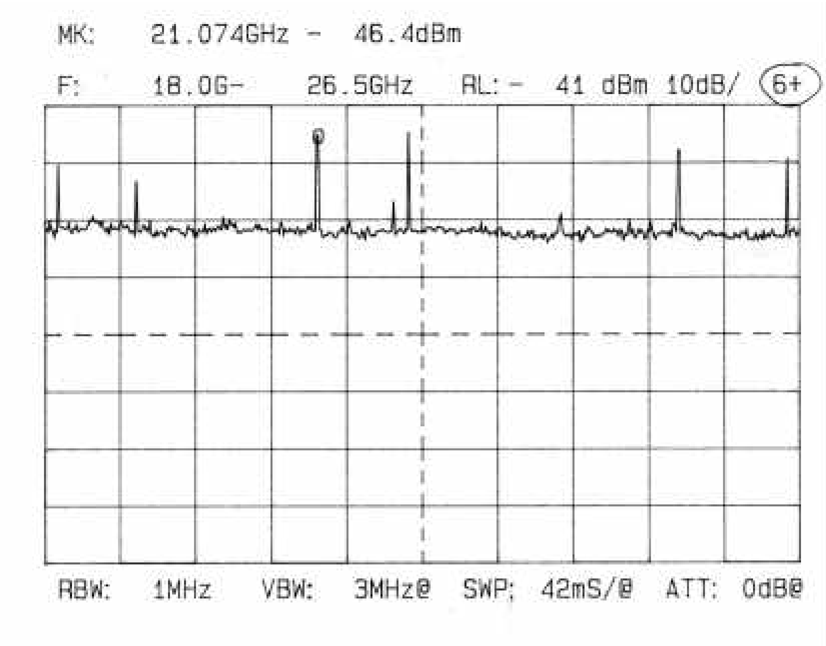
Plot 4.1.5
Out of band emission measurements with Microwave Solutions module



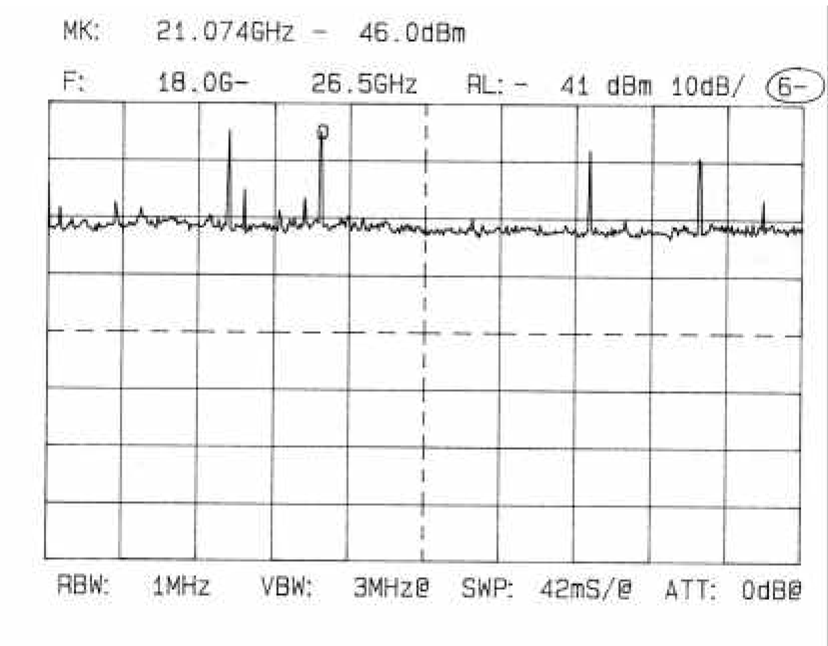
Plot 4.1.6
Out of band emission measurements with Microwave Solutions module



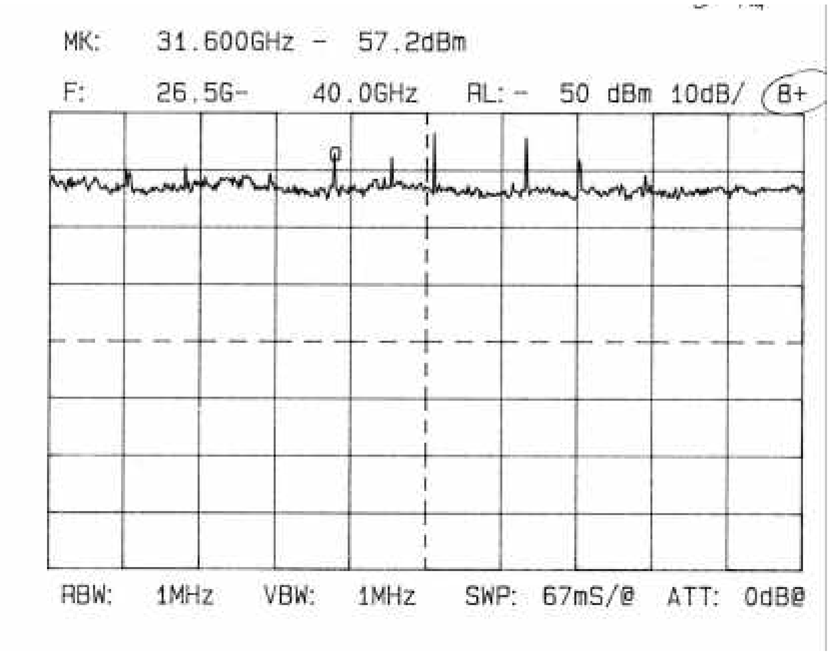
Plot 4.1.7
Out of band emission measurements with Microwave Solutions module



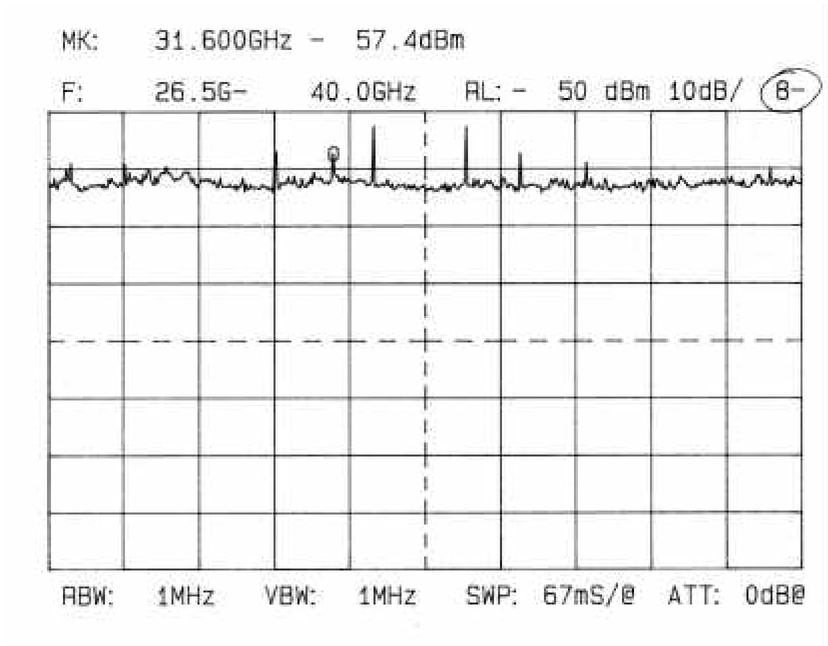
Plot 4.1.8
Out of band emission measurements with Microwave Solutions module



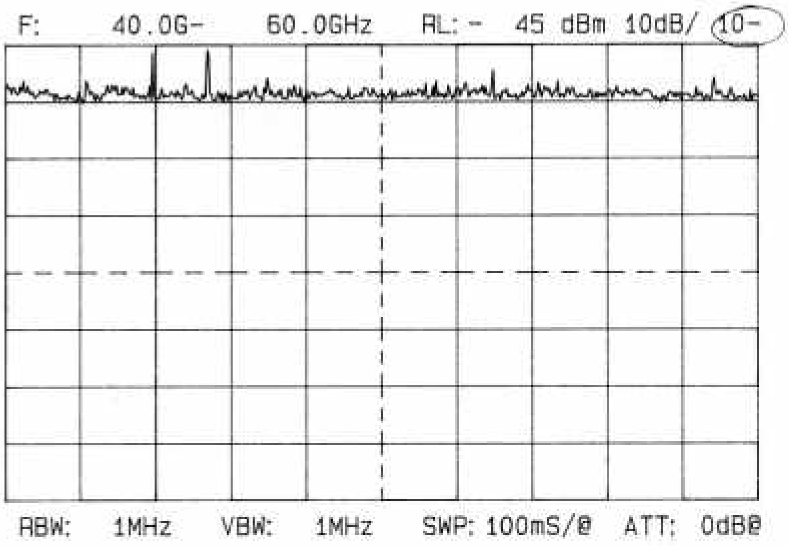
Plot 4.1.9
Out of band emission measurements with Microwave Solutions module



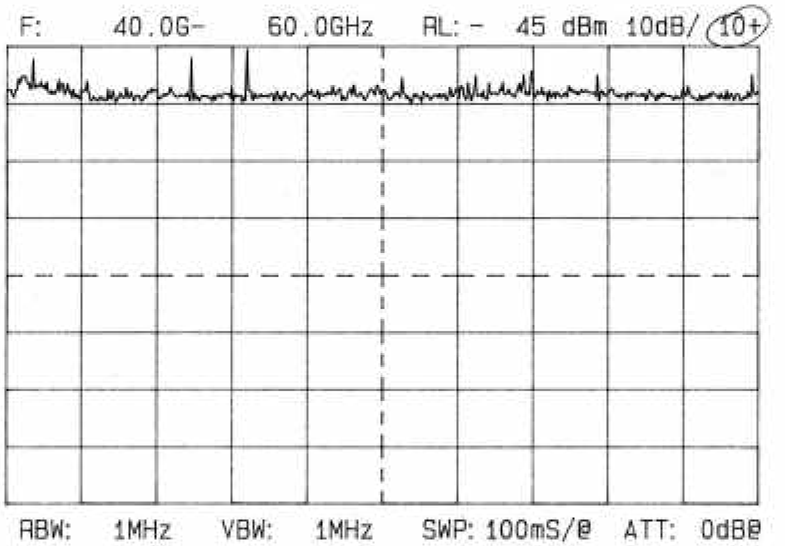
Plot 4.1.10
Out of band emission measurements with Microwave Solutions module



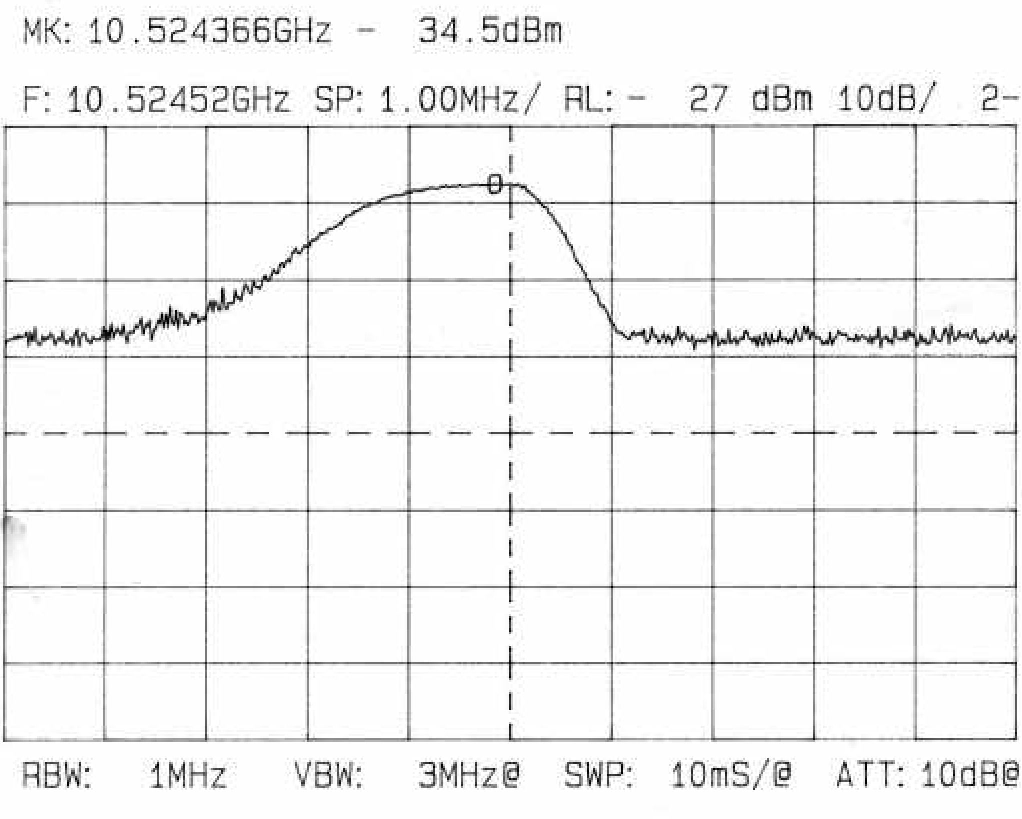
Plot 4.1.11
Out of band emission measurements with Microwave Solutions module



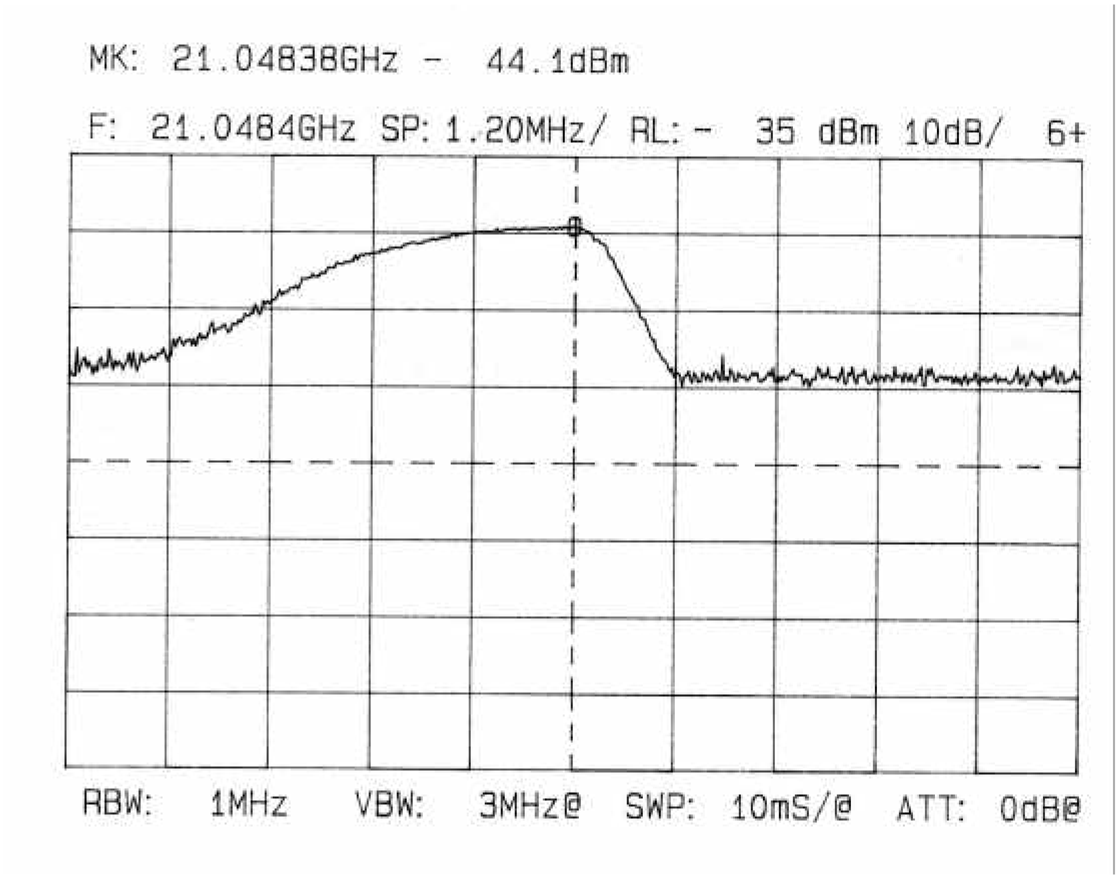
Plot 4.1.12
Out of band emission measurements with Microwave Solutions module



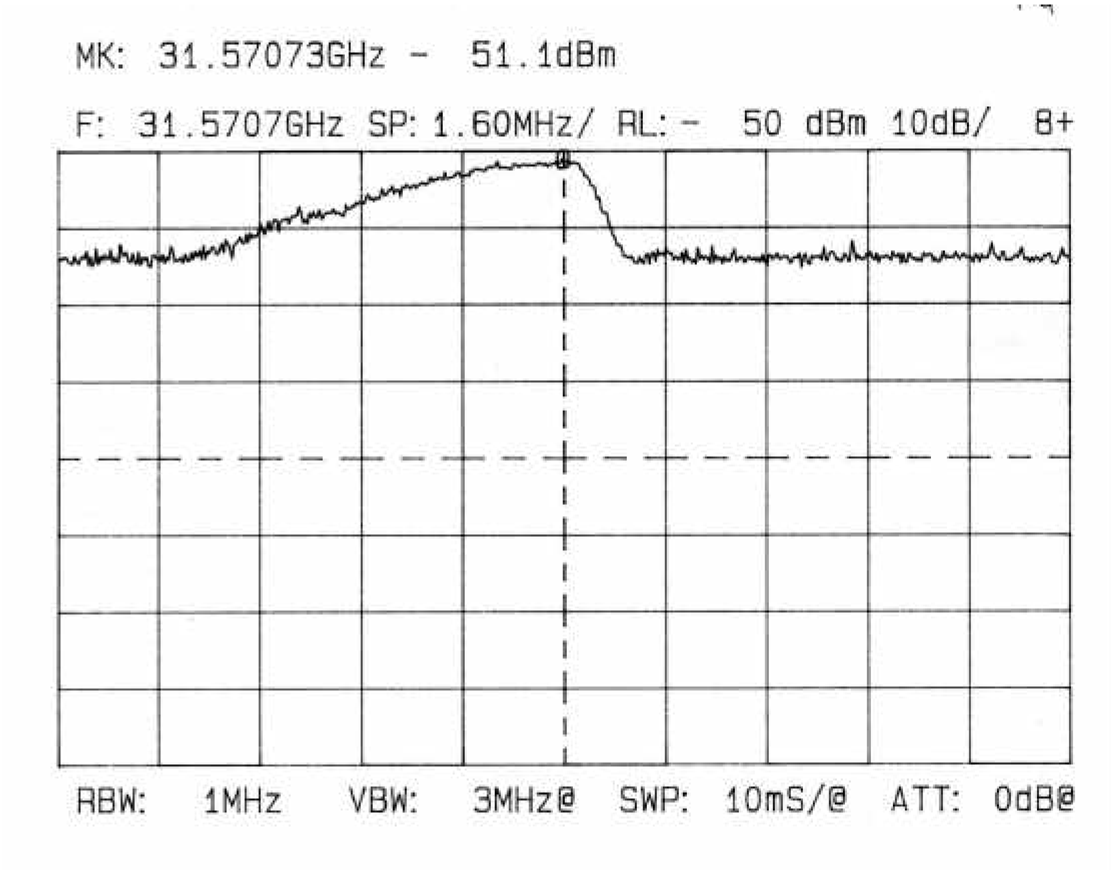
Plot 4.1.13
Carrier frequency measurements
with Agilis module



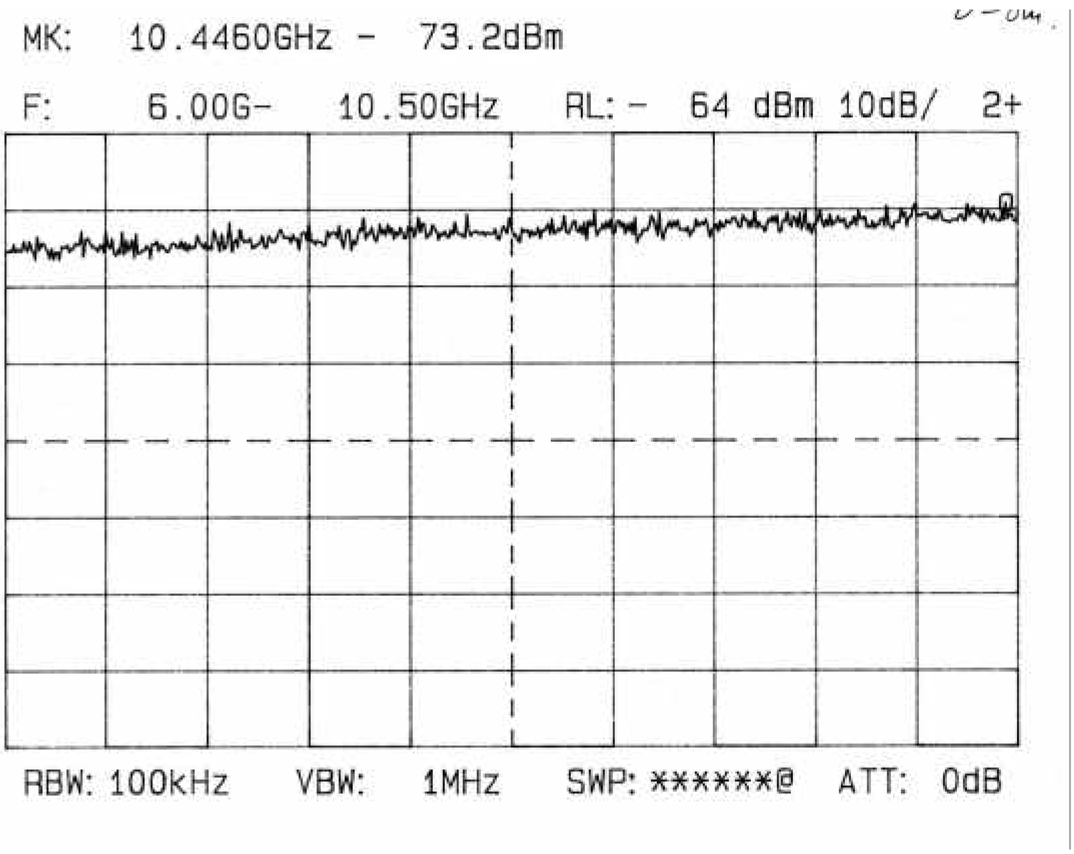
Plot 4.1.14
2nd harmonic emission measurements
with Agilis module



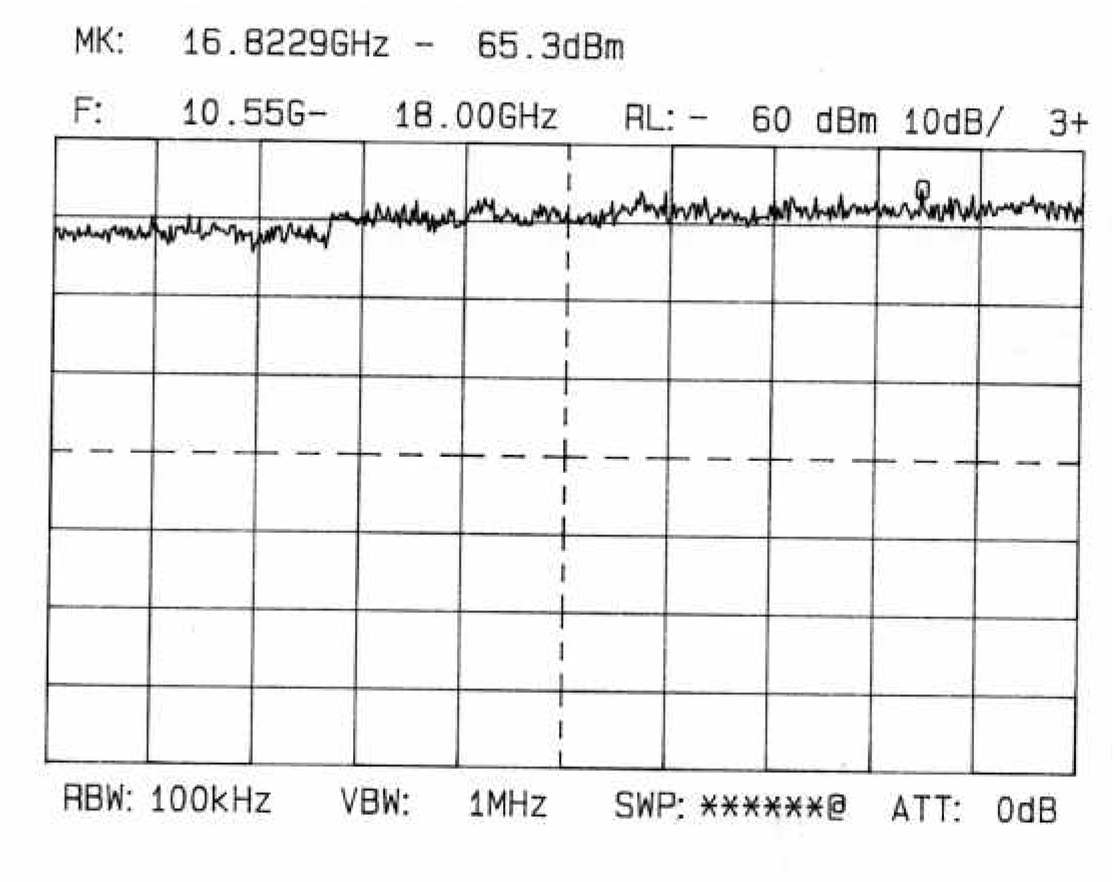
Plot 4.1.15
3d harmonic emission measurements
with Agilis module



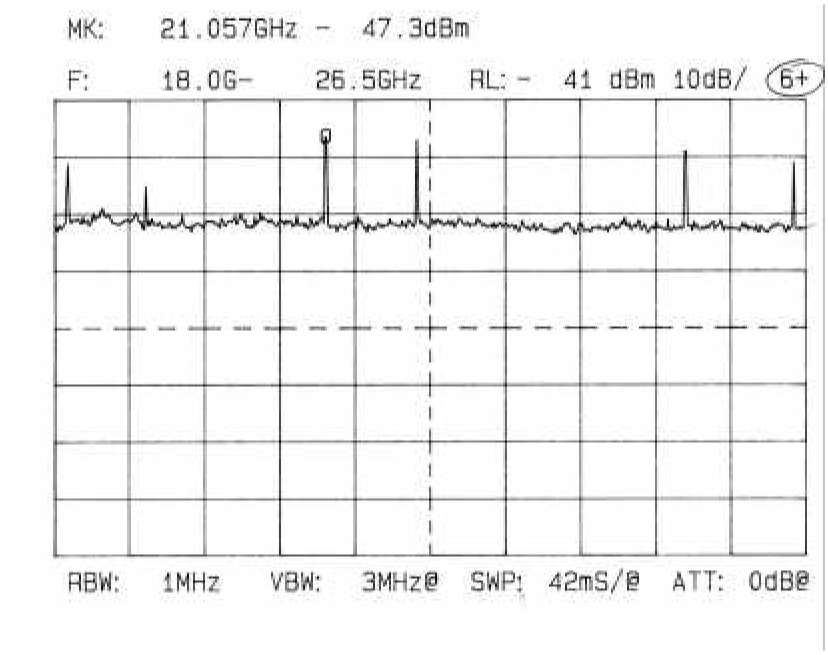
Plot 4.1.16
Out of band emission measurements with Agilis module



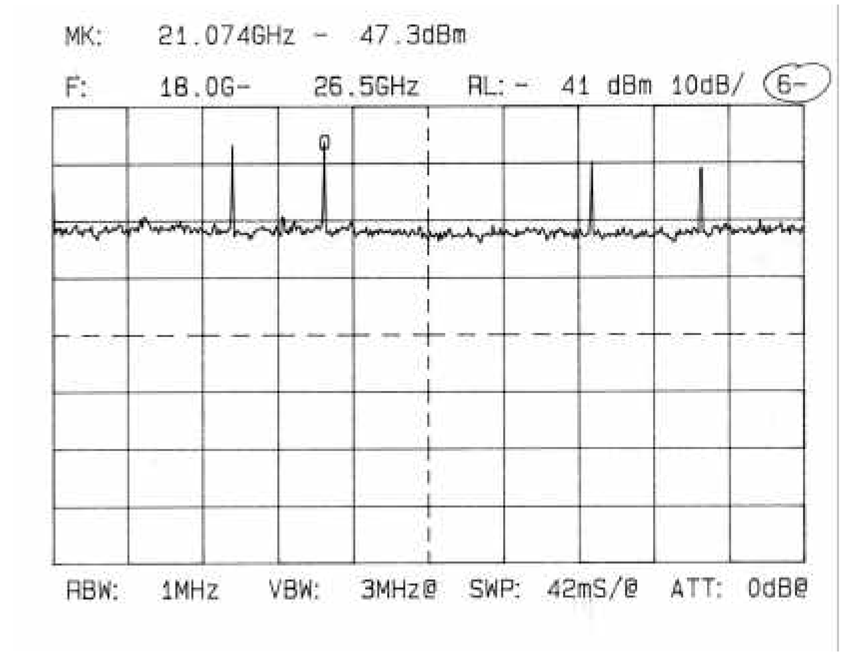
Plot 4.1.17
Out of band emission measurements with Agilis module



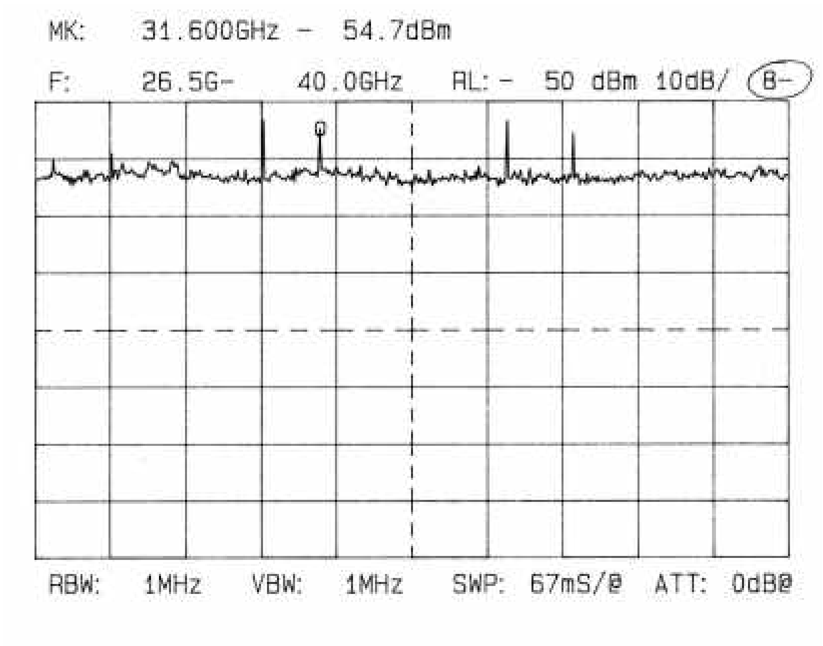
Plot 4.1.18
Out of band emission measurements with Agilis module



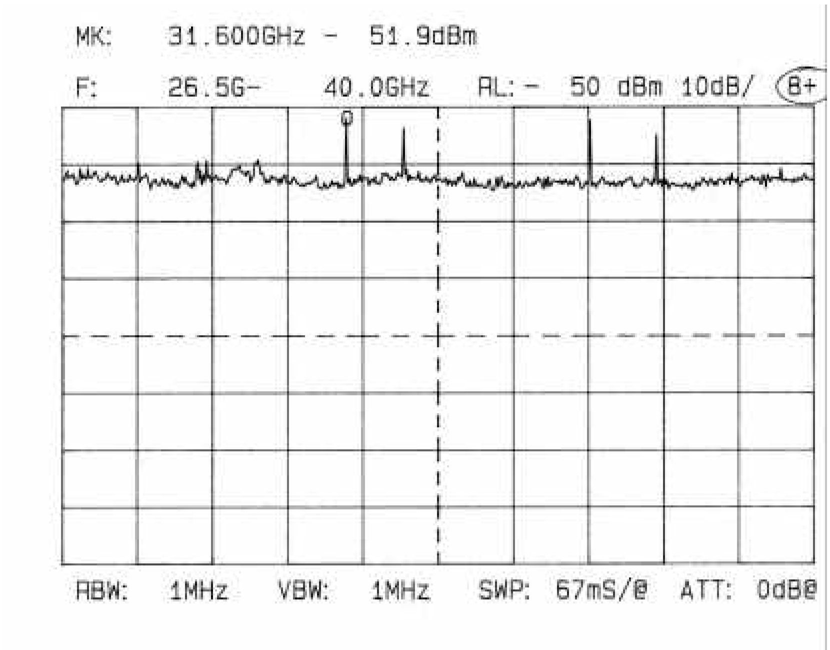
Plot 4.1.19
Out of band emission measurements with Agilis module



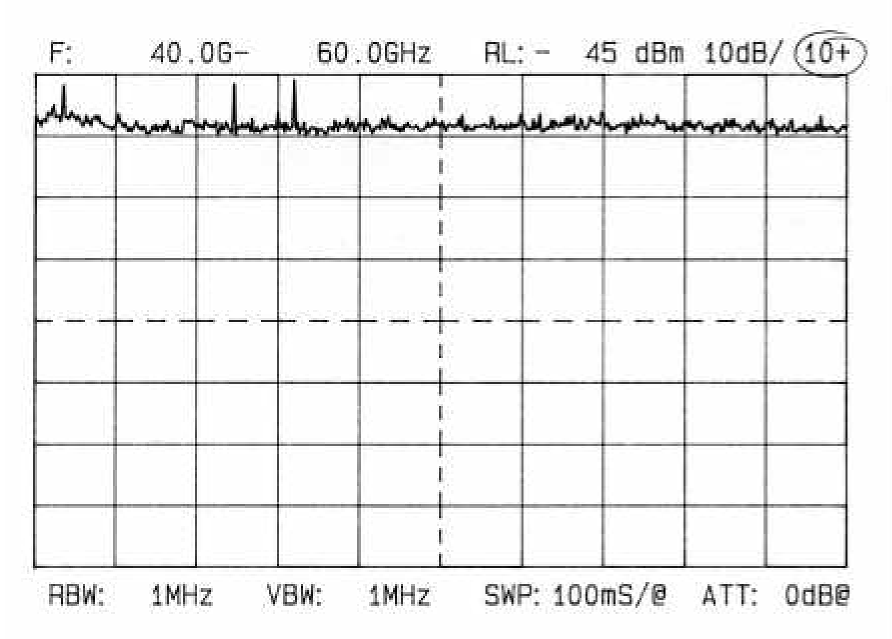
Plot 4.1.20
Out of band emission measurements with Agilis module



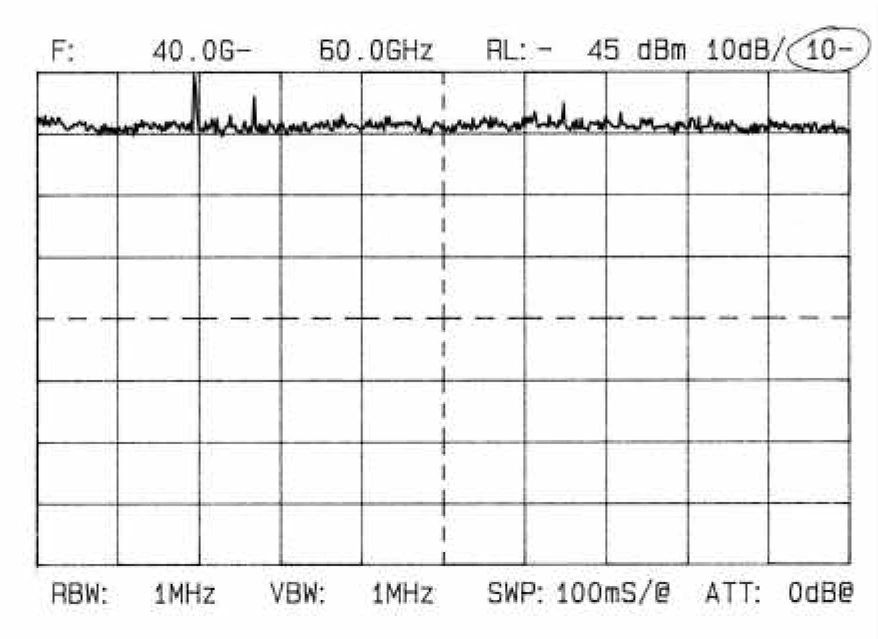
Plot 4.1.21
Out of band emission measurements with Agilis module



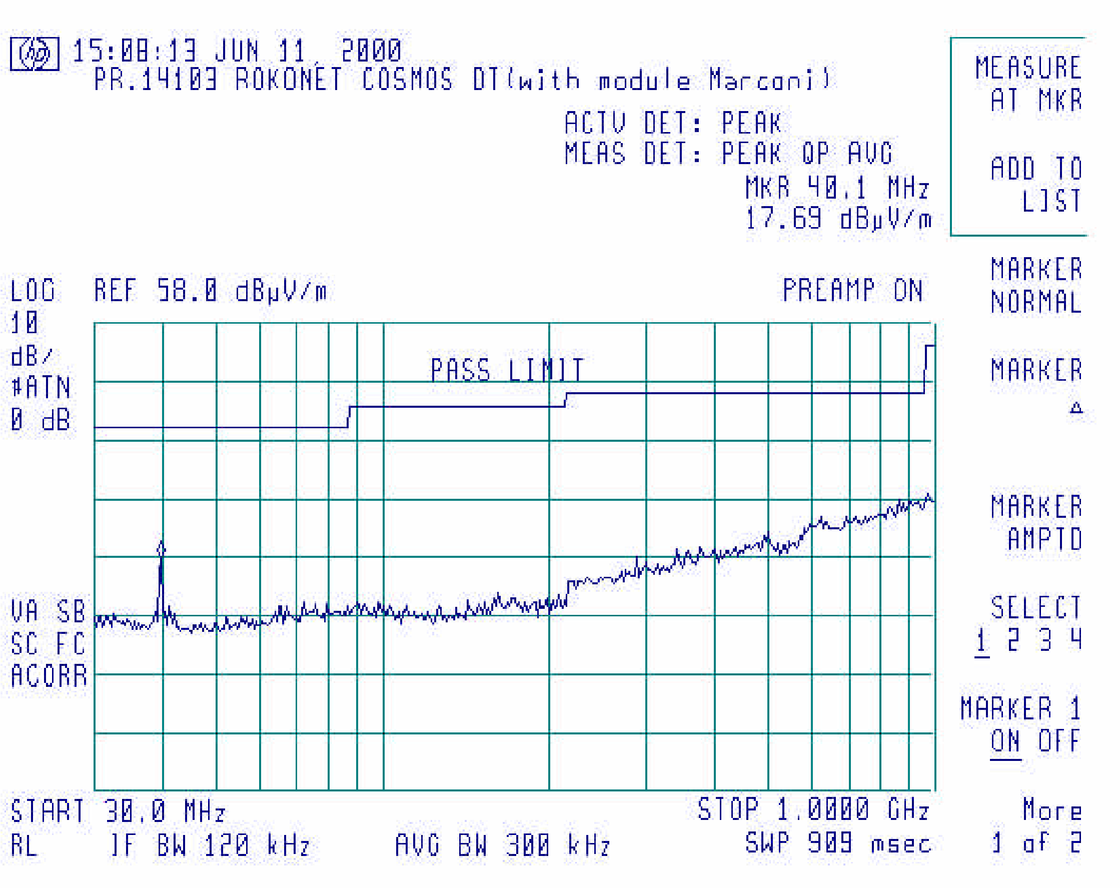
Plot 4.1.22
Out of band emission measurements with Agilis module



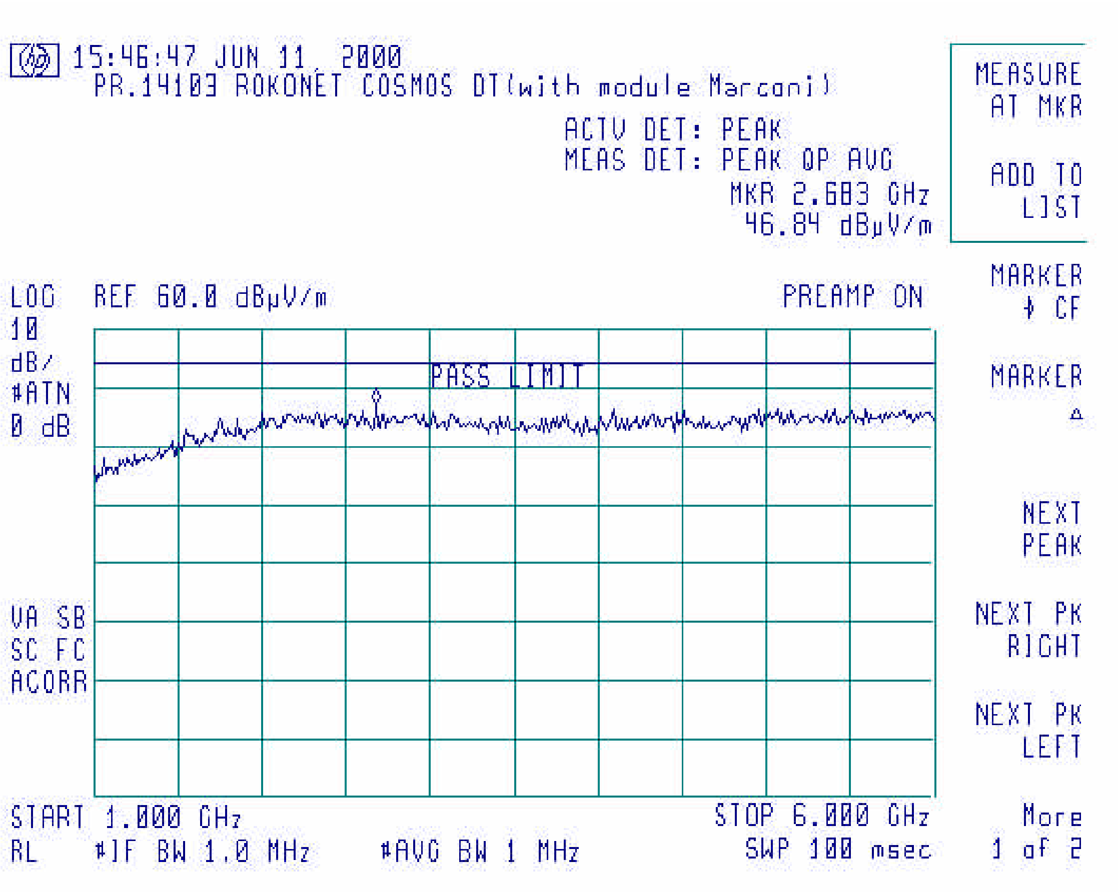
Plot 4.1.23
Out of band emission measurements with Agilis module



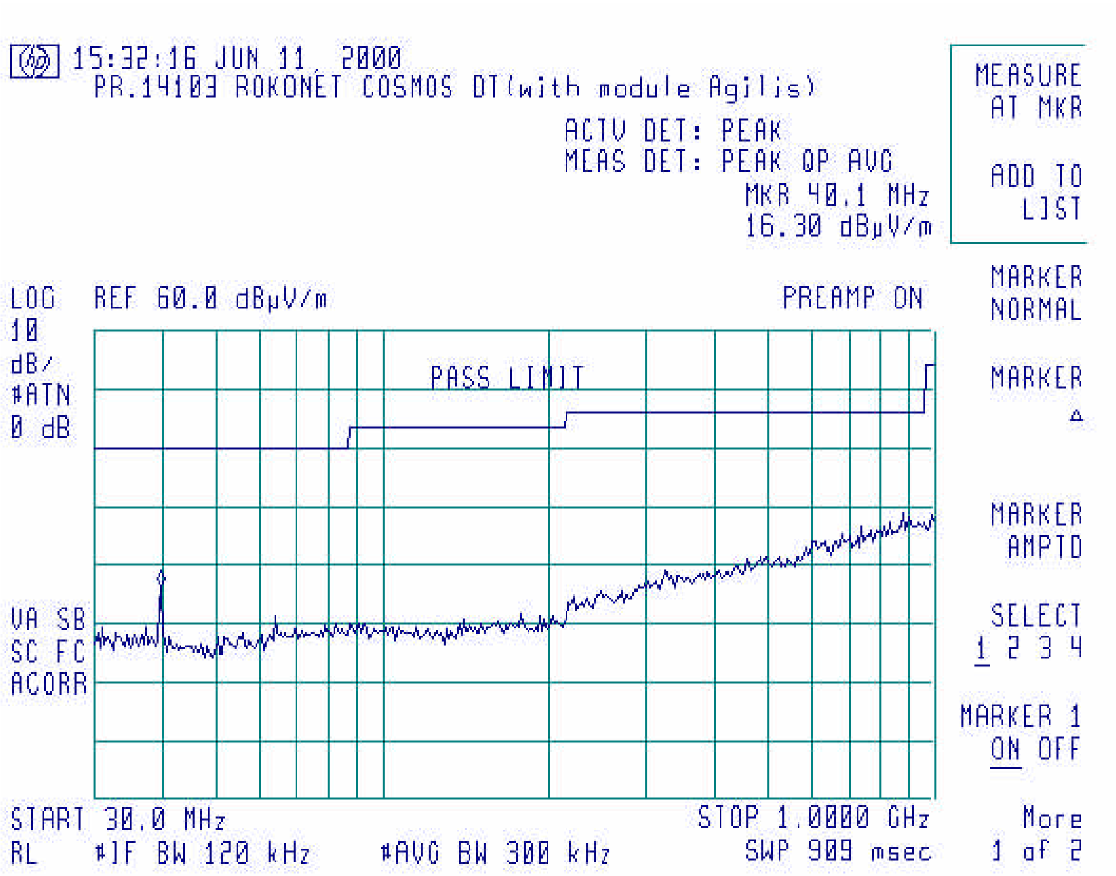
Plot 4.1.24
Radiated spurious emissions measurements with Microwave Solutions module, frequency range 30 – 1000 MHz



Plot 4.1.25
Out of band emission measurements with Microwave Solutions module



Plot 4.1.26
Radiated spurious emissions measurements with Agilis module, frequency range 30 – 1000 MHz



Plot 4.1.27
Out of band emission measurements with Agilis module

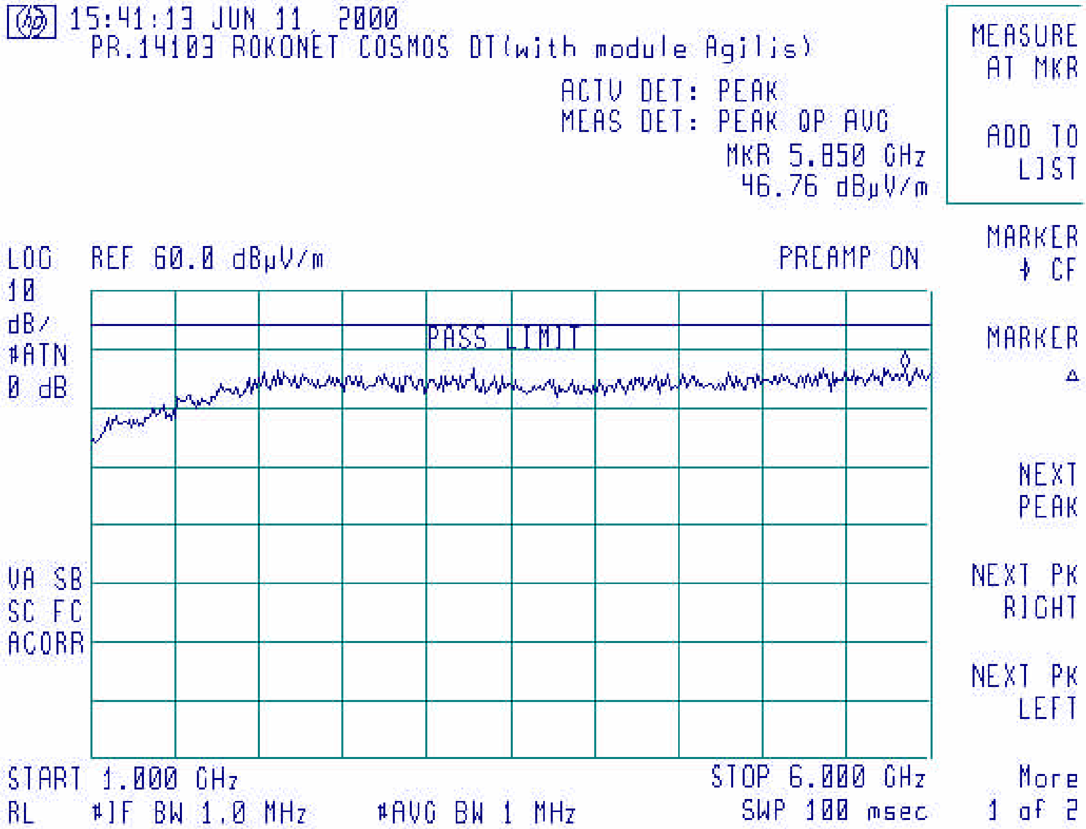
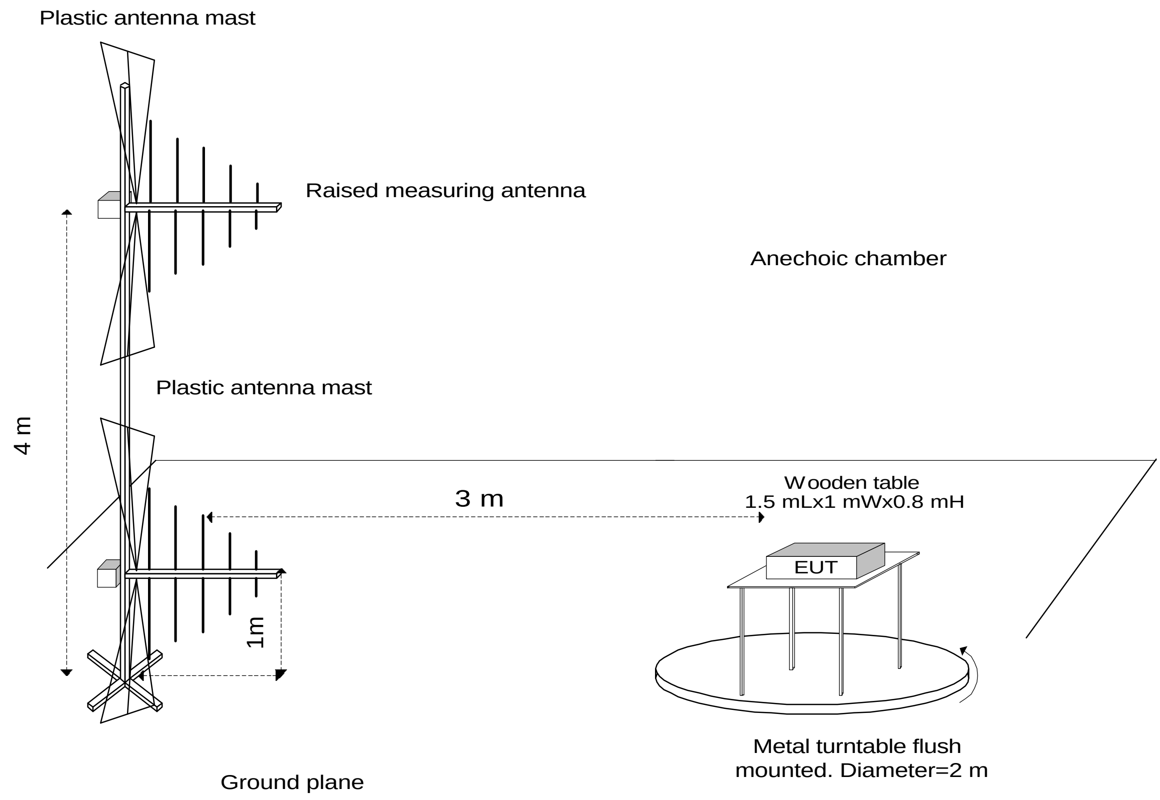


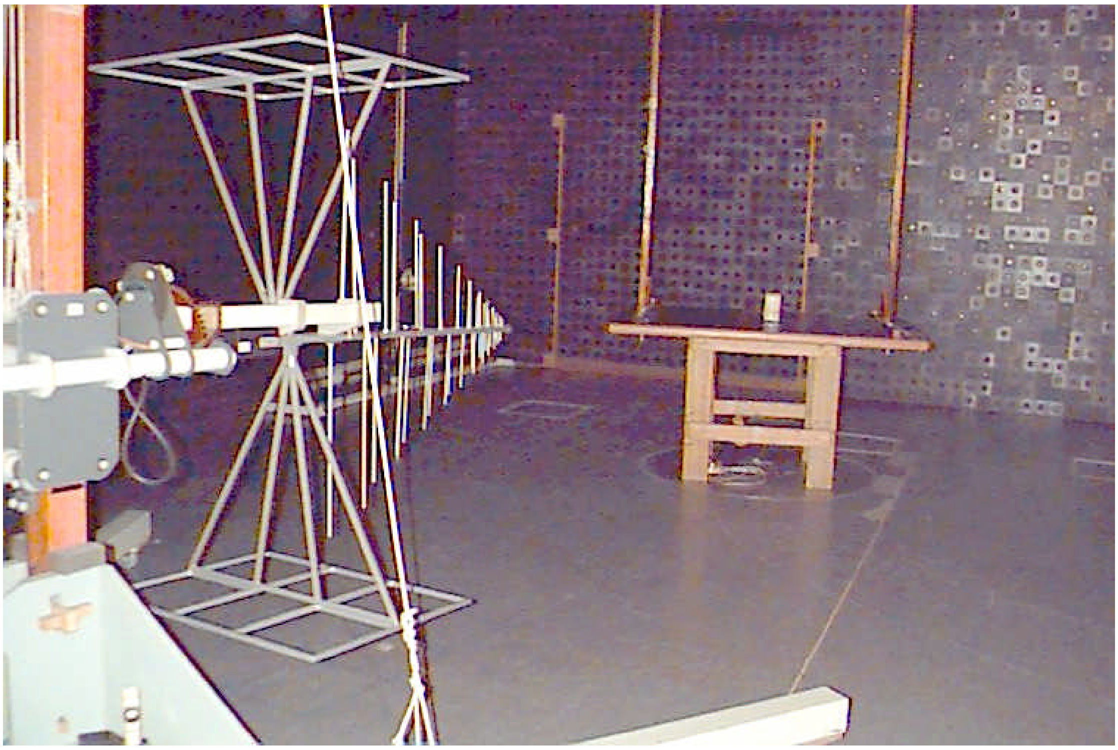
Figure 4.1.1
Radiated emission test setup



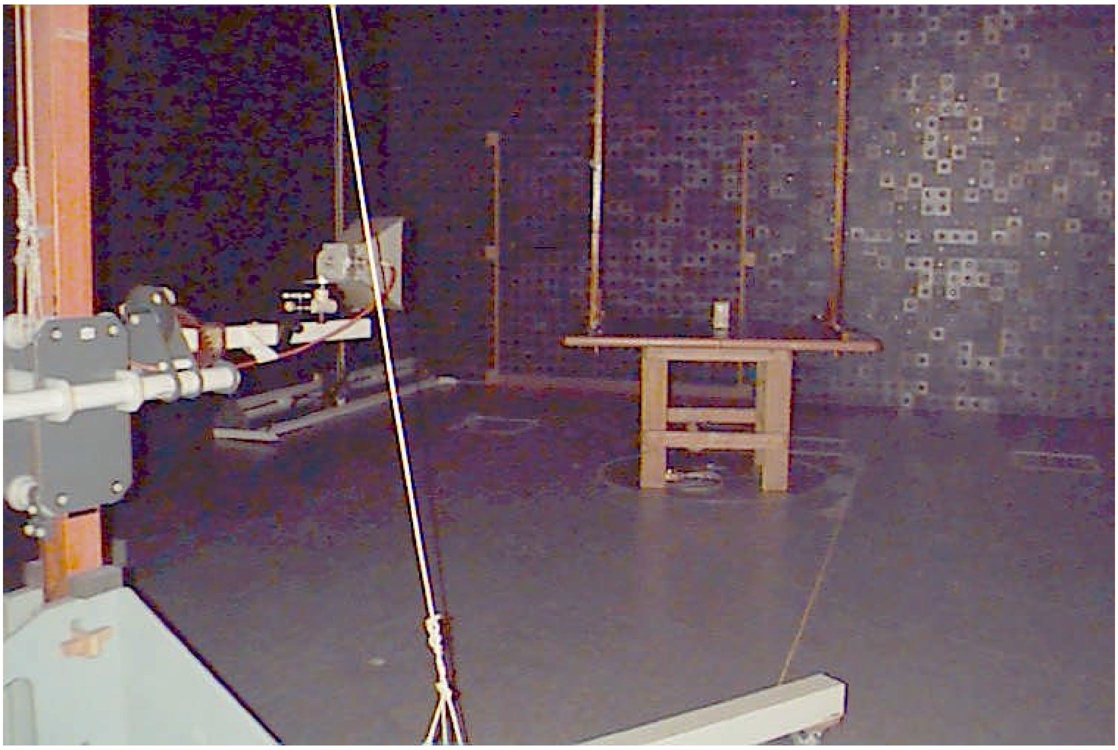
Photograph 4.1.1
Radiated emission test setup

Photograph 4.1.2
Radiated emission test setup

Photograph 4.1.3
Radiated emission test setup



Photograph 4.1.4
Radiated emission test setup



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	8/01
0038	028	Antenna mast, 1-4 m	Hermon Labs	AM-1	2/01 Check
0041	2811	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	8/01
0275	040	Table non-metallic, adjustable height, 1.5 x 1.0 x 0.8 m	Hermon Labs	TNM	3/01 Check
0287	042	Turntable, motorized diameter, 2m	Hermon Labs	TMD-2	4/01 Check
0465	023	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	3/03
0521	0319	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	7/01
0547	400	Amplifier, GaAs FET,RF 6-18 GHz,2 W30 dB,12 V/1.2 A, N.F4.5 dB	Avantek	AMT - 12407M	12/00
0554	4300	Amplifier RF, 2-18 GHz	Miteq	AFD4	12/00
0604	9611-1011	Antenna Biconilog Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	12/00
0749	749	Mixer general purpose waveguide, 26.5 – 40 GHz	Tektronix	119-0099-01	5/01
0750	750	Mixer general purpose waveguide, 18 - 26.5 GHz	Tektronix	119-0098-01	5/01
0768	110	Antenna standard gain horn, 18 – 26.5 GHz, WR-42, K-band, gain 25 dB	Quinstar Technology	QWH-4200-BA	7/01
0769	112	Antenna standard gain horn, 26.5 - 40 GHz, WR-42, K-band, gain 25 dB	Quinstar Technology	QWH-2800-BA	7/01
0770	118	Antenna standard gain horn, 40 -60 GHz, WR-42, K-band, gain 25 dB	Quinstar Technology	QWH-1900-BA	7/01
1175	1175	Microwave 5 m cable	GORE	84C01C02245	2/01

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).