ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC PART 15, SUBPART C, §15.245

FOR

VISONIC Ltd.

EQUIPMENT UNDER TEST

Dual-Technology Microwave Intrusion Detectors

FCC ID: GSAK980D

Logica, Logica OEM, Logica AM, K 980 D

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ACCREDITED
839.01
Electrical

Description of equipment under test

Test items	Intrusion detector; FCC ID: GSAK980D
Manufacturer	Visonic Ltd.
Brand Mark	Visonic Ltd.
Type (Model)	Logica, Logica OEM, Logica AM, K 980 D
Trade Name	

Applicant information

Applicant's representative & responsible person	Mr. Arick Elshtein, technical support manager
Company	Visonic Ltd.
Address	30 Habarzel St.
P.O. Box	22020
Postal code	61220
City	Tel Aviv
Country	Israel
Telephone number	972 3 645 6714
Telefax number	972 3 645 6788

Test performance

Project Number	13407
Location of the test	Hermon Laboratories, Binyamina, Israel
Test started	April 28, 1999
Test completed	May 2, 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

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 a point is used as the decimal separator and the thousands are counted with a comma.
This report is in conformity with EN 45001 and ISO GUIDE 25.
The test results relate only to the items tested.

This test report must not be reproduced in any form except in full, with written approval of Hermon Laboratories Ltd.

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1 Summary and signatures

The EUT, Logica, was tested according to FCC part 15 subpart B §15.109 class B and subpart C §15.245 limits and found complying with the standard requirements. The EUT was subjected to the tests listed in the table below.

Phenomena	Test specification	Test performed by	Date	Verdict	Signature
Filed strength at fundamental frequency	FCC 15.245 (b)	Mrs. Eleonora Pitt, test engineer	28-Apr-99	Pass	
Filed strength of harmonics	FCC 15.245 (b)	Mrs. Eleonora Pitt, test engineer	29-Apr-99	Pass	
Harmonic emissions in the restricted bands	FCC 15.245 (1)	Mrs. Eleonora Pitt, test engineer	29-Apr-99	Pass	
Radiated emissions outside the specified band (except for harmonics)	FCC 15.245 (3)	Mrs. Eleonora Pitt, test engineer	02-May-99	Pass	
		Mr. Michael Nikishin, test engineer	02-May-99	Pass	
Unintentional radiated emissions (digital part)	FCC 15.109 class B	Mr. Michael Nikishin, test engineer	29-Apr-99	Pass	

Test report prepared by:

Mr. Alex Lik, certification engineer

Approved by:

Mr. Alex Usoskin, QA manager

Responsible person from Visonic Ltd.

Mr. Arick Elshtein, technical support manager

2 General information

2.1 Abbreviations and acronyms

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

AC	alternating current
AVRG	average (detector)
BW	bandwidth
CEO	chief executive officer
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
kHz	kilohertz
L	length
m	meter
mm	millimeter
MHz	megahertz
msec	millisecond
NA	not applicable
NARTE	National Association of Radio and Telecommunications Engineers, Inc.
QP	quasi-peak (detector)
RBW	resolution bandwidth
RF	radio frequency
RE	radiated emission
RMS	root-mean-square
sec	second
V	volt

2.2 Reference standards

FCC part 15	Radio Frequency Devices. Subpart C: Intentional Radiators
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, Logica, Logica OEM, Logica AM, K 980 D are intrusion detectors which contain microwave transmitter sections (10.525 GHz) and are powered by 12 V DC power supply. Logica, Logica OEM, Logica AM, K 980 D contain the same transmitting unit and integrated antenna.

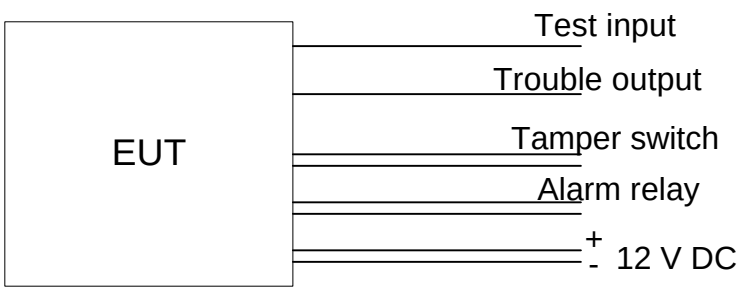
2.4 EUT test configuration

The EUT test configuration is given in figure 2.3.1.

Table 2.4.1 EUT ports and lines

Port type	Port description	Quantity	Cable description	Cable length	Connected to
Power	Power	1	Unshielded	1 m	DC power supply
Signal	Test input	1	Unshielded	2 m	Open circuit
Signal	Trouble output	1	Unshielded	2 m	Open circuit
Signal	Tamper switch	1	Unshielded	2 m	Open circuit
Signal	Alarm relay	1	Unshielded	2 m	Open circuit

Figure 2.4.1 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 and Safety standards, and Accredited 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: 972-6-628-8001
Fax: 972-6-628-8277

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 in Hermon Labs measurements.

Radiated emissions at the open field test site at 10 m measuring distance	Biconilog antenna: ±3.2 dB Log periodic antenna: ±3 dB Biconical antenna: ±4 dB
Radiated emissions at the open field test site at 3 m measuring distance	Double ridged guide antenna: ±2.36 dB
Radiated emissions in the anechoic chamber at 3 m measuring distance	Biconilog antenna: ±3.2 dB

3.3 Laboratory personnel

The three people of Hermon Laboratories who participated in test measurements and test report preparation are Mrs. Eleonora Pitt, test engineer; Mr. Michael Nikishin, test engineer and Mr. Alex Lik, certification engineer.

3.3.1 Qualification statement

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 M. Sc. EE degree and certified by NARTE as an EMC Accredited Test Laboratory engineer, the certificate No. is ATL–0006–E.
I have obtained 26 years' experience in EMC measurements and have been with Hermon Laboratories since 1991.

Name: Mrs. Eleonora Pitt Signature: _____
Position: test engineer Date: August 10, 1999

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: test engineer Date: August 10, 1999

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 graduated from college in 1993 and have obtained 6 years' experience in technical documentation processing
I have been with Hermon Laboratories since 1998.

Name: Mr. Alex Lik Signature: _____
Position: certification engineer Date: August 10, 1999

4 Radiated emission measurements

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

4.1.1 Specified limits

Fundamental frequency and harmonics 3-meter distance

Fundamental frequency MHz	Field strength of fundamental (average) dB (μV/m)	Field strength of harmonics (average) dB (μV/m)
10,500 – 10,550	128	88

4.1.2 Test procedure

The tests were performed in HL anechoic chamber (30 MHz – 6.5 GHz) and at HL open field test site (from 5 GHz to the 5th harmonic).
The following phenomena were investigated:
1. Field strength of the fundamental frequency.
2. Field strength of harmonics.
3. Field strength outside the specified band, except for harmonics.

The EUT was set up on 0.8 m high wooden table placed on metal flush mounted turntable with a ground plane as shown in Photograph 4.1.1.
Antennas selection:
1. Biconilog antenna was used in the anechoic chamber for frequency range 30 MHz – 1 GHz[1]
2. Double ridged guide antenna was used at the open field test site for frequencies from 1 GHz to 18 GHz.
3. Standard gain horn antennas were used at the open field test site for frequencies from 18 GHz to 50 GHz.

To find the maximum radiation measuring antenna height varied from 0.8 m to 2.5 m, the turntable was rotated 360°. All the measurements were performed in both vertical and horizontal polarization of measuring antenna.
The EUT was operated in a continuous transmitting mode.

The limits for 1 m and 0.5 m test distance were calculated as follows:
$20_{log}(D_1/D_2)$+ Specified limit = Calculated limit, where D_1 is the distance for which the limit is specified by the standard, D_2 is the distance for which the limit is calculated.
Several tests were carried out at closer distance because of weak signal.

The test results are recorded in Tables 4.1.1 – 4.1.4 and shown in Plots 4.1.1 to 4.1.17.
Plots 4.1.1 – 4.1.6 refer to the field strength measurements at fundamental frequency. Plots 4.1.7 – 4.1.10 refer to field strength of harmonics. Plots 4.1.11-4.1.15 refer to radiated emissions outside the specified frequency band. Plot 4.1.16 shows the attenuation on the specified band edges.

Reference numbers of test equipment used

HL 0025	HL 0038	HL 0041	HL 0275	HL 0287	HL 0465	HL 0521
HL 0593	HL 0749	HL 0750	HL 0763	HL 0769	HL 0770	HL 0771

[1] ***See Paragraph 4.2.***

HL 0812	HL 0813	HL 1175				

Full description is given in Appendix A.

Table 4.1.1 Field strength of fundamental frequency, 3 m test distance

DATE: April 28, 1999
RELATIVE HUMIDITY: 47%
AMBIENT TEMPERATURE: 25°C

Frequency GHz	Detector type	Measured result dB (µV)	Resolution bandwidth	Video bandwidth	Correction factor dB (1/m)	Radiated emissions dB (µV/m)	Specified limit dB (µV/m)	Limit margins dB	Verdict
Logica 10.520	Peak	60.0	1 MHz	1 MHz	42.6	102.6	148.0	45.4	Pass
	AVRG	35.0	1 MHz	10 kHz	42.6	77.6	128.0	50.4	Pass
Logica DF M 10.525	Peak	60.5	1 MHz	1 MHz	42.6	103.1	148.0	44.9	Pass
	AVRG	35.1	1 MHz	10 kHz	42.6	77.7	128.0	50.3	Pass
Logica FM 10.533	Peak	63.0	1 MHz	1 MHz	42.6	105.6	148.0	42.4	Pass
	AVRG	35.1	1 MHz	10 kHz	42.6	77.7	128.0	50.3	Pass

Table 4.1.2 Harmonics field strength

DATE: April 29, 1999
RELATIVE HUMIDITY: 47%
AMBIENT TEMPERATURE: 24°C

Frequency GHz	Detector type	Measured result dB (µV)	Test distance m	Video bandwidth	Correction factor dB (1/m)	Radiated emissions dB (µV/m)	Calculated limit dB (µV/m)	Limit margins dB	Verdict
21.05[1]	Peak	62.0	1	1 MHz	36.2	98.2	117.5	19.3	Pass
	AVRG	46.3	1	10 kHz	65.7	82.0	97.5	15.5	Pass
31.59	Peak	51.7	0.5	1 MHz	35.2	86.9	123.6	36.7	Pass
	AVRG	33.7	0.5	10 kHz	35.2	68.9	103.6	34.7	Pass

Instrumentation resolution bandwidth = 1 MHz

1 This harmonic was found inside a restricted band. According to CFR §15.245(b)(1)(i), 25 mV/m (88 dBì V/m) limit applies to it for it is found at frequency higher than 17.7 GHz

Table 4.1.3 Radiated emissions outside the specified frequency bands at 3 m distance

DATE: April 29, 1999
RELATIVE HUMIDITY: 47%
AMBIENT TEMPERATURE: 24°C

Frequency GHz	Detector type	Measured result dB (µV)	Resolution bandwidth	Video bandwidth	Correction factor dB (1/m)	Radiated emissions dB (µV/m)	Specified limit dB (µV/m)	Limit margins dB	Verdict
7.52	AVRG	40.0	1 MHz	10 kHz	2.2	42.2	54.0	11.8	Pass
10.08	AVRG	40.0	1 MHz	10 kHz	4.7	44.7	54.0	9.3	Pass
10.50	AVRG	40.0	1 MHz	10 kHz	4.8	44.8	54.0	9.2	Pass
10.55	AVRG	40.0	1 MHz	10 kHz	4.8	44.8	54.0	9.2	Pass

Table 4.1.4 Radiated emissions outside the specified frequency bands at 1 m distance

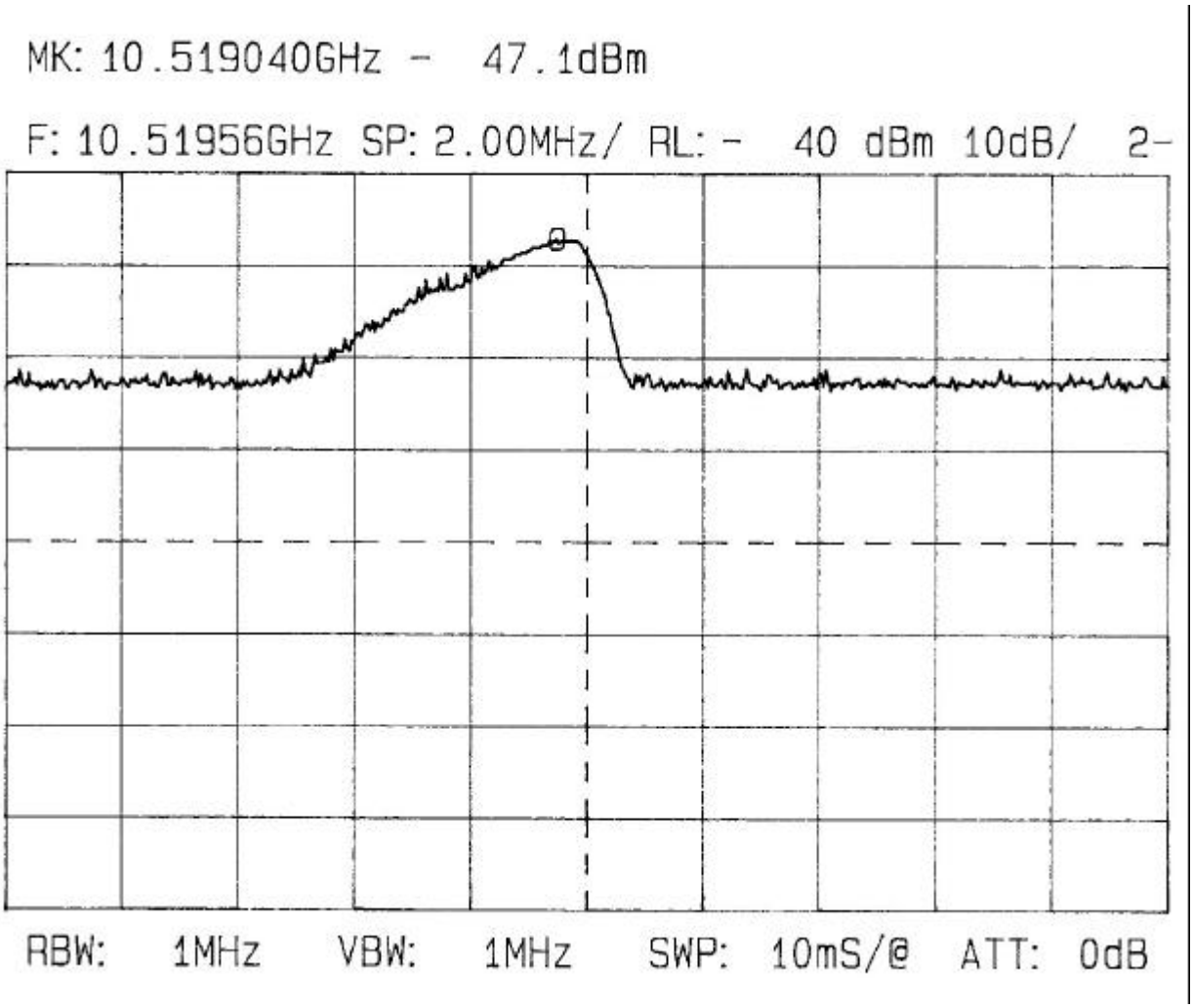
Frequency GHz	Detector type	Measured result dB (µV)	Resolution bandwidth	Video bandwidth	Correction factor dB (1/m)	Radiated emissions dB (µV/m)	Calculated limit dB (µV/m)	Limit margins dB	Verdict
9.46	Peak	44.0	1 MHz	1 MHz	4.7	48.7	63.5	14.8	Pass
17.94	Peak	52.0	1 MHz	1 MHz	10.0	62.0	63.5	1.5	Pass

Note to tables:

Radiated emission dB(µV/m) = Measured results {dB(µV)} + Correction factor (dB).
Correction factor = Antenna factor + Cable loss (refer to Appendix B) – Amplifier gain (35 dB)

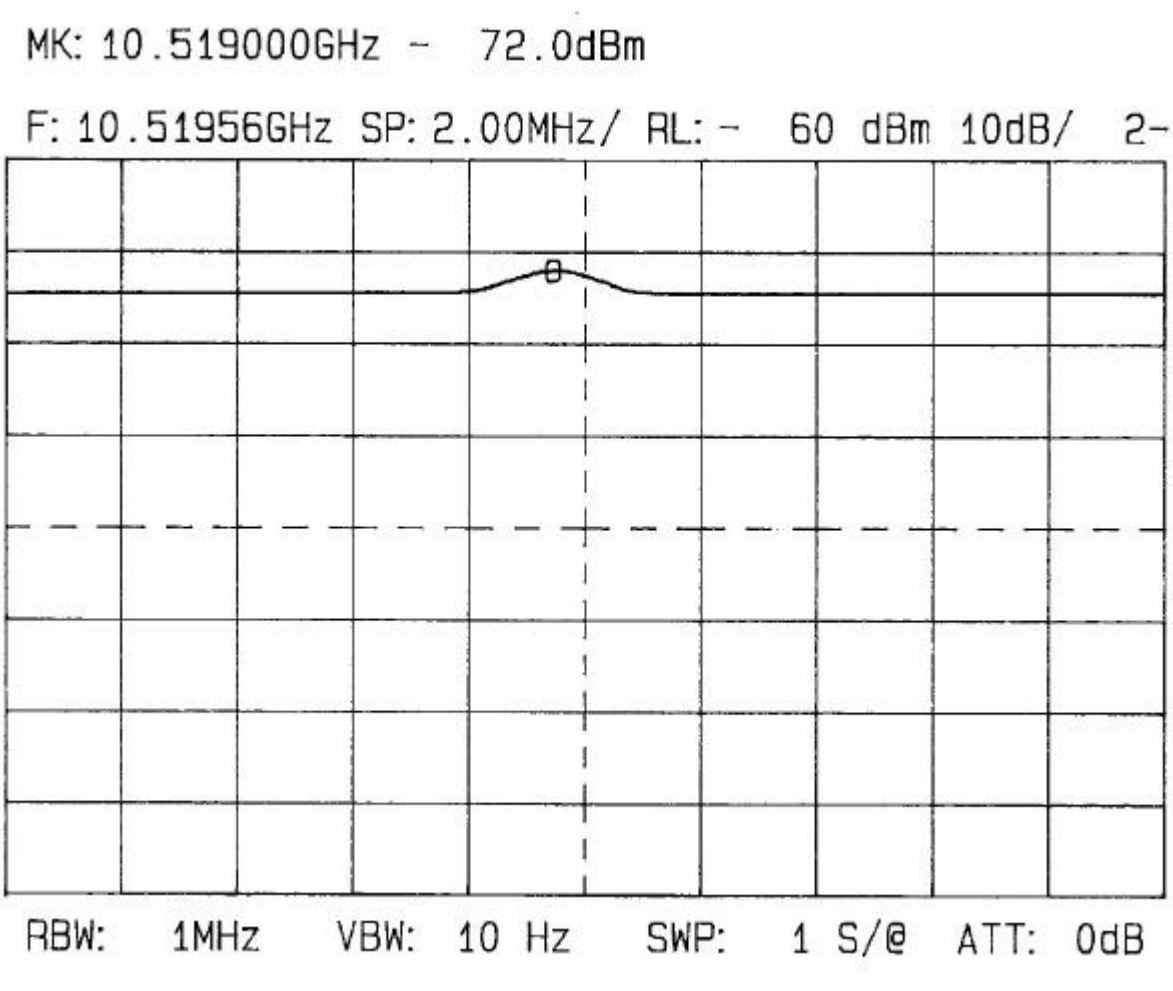
Plot 4.1.1

Field strength at fundamental frequency
EUT: Logica
Peak detector



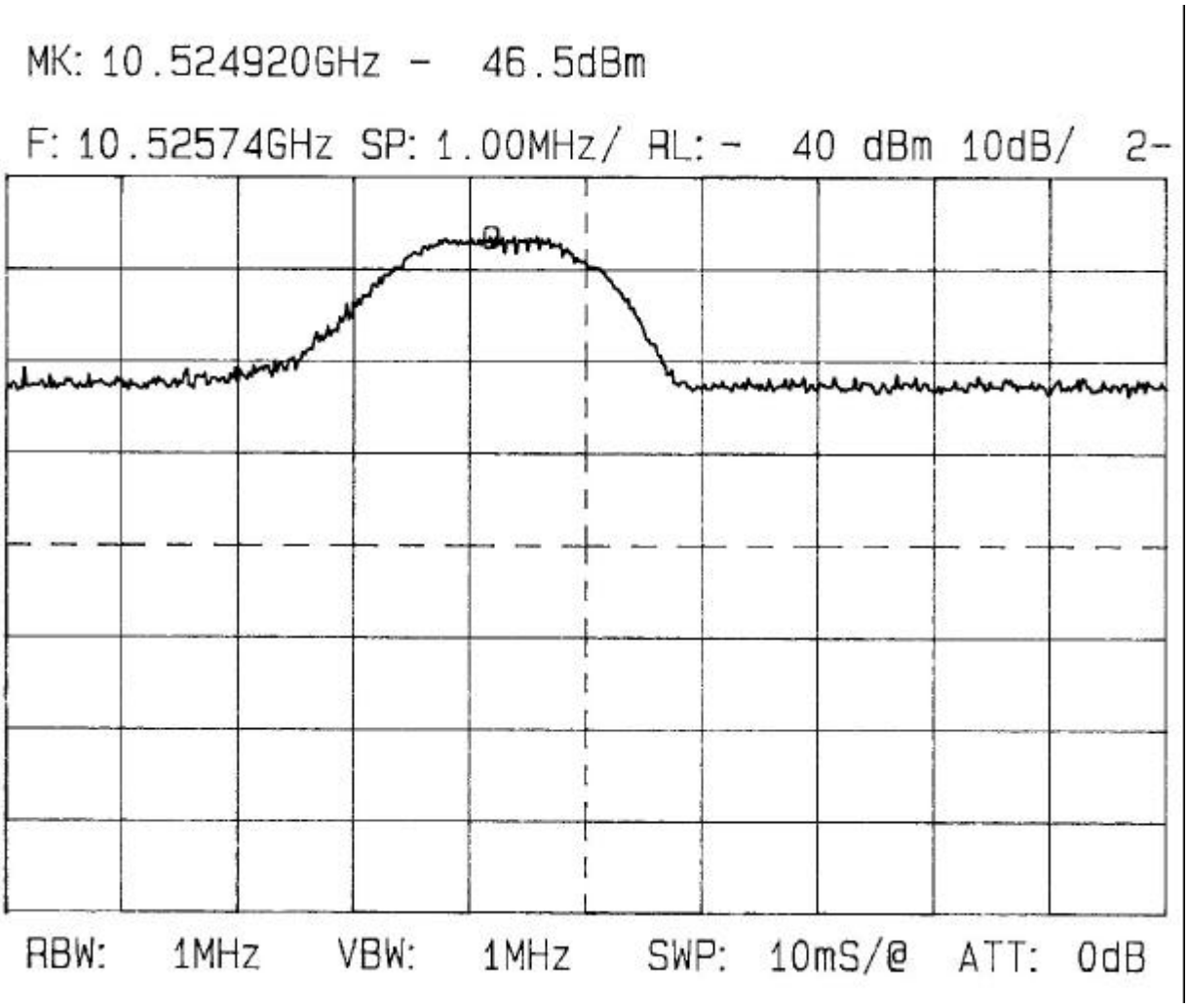
Plot 4.1.2

Field strength at fundamental frequency
EUT: Logica
Average detector



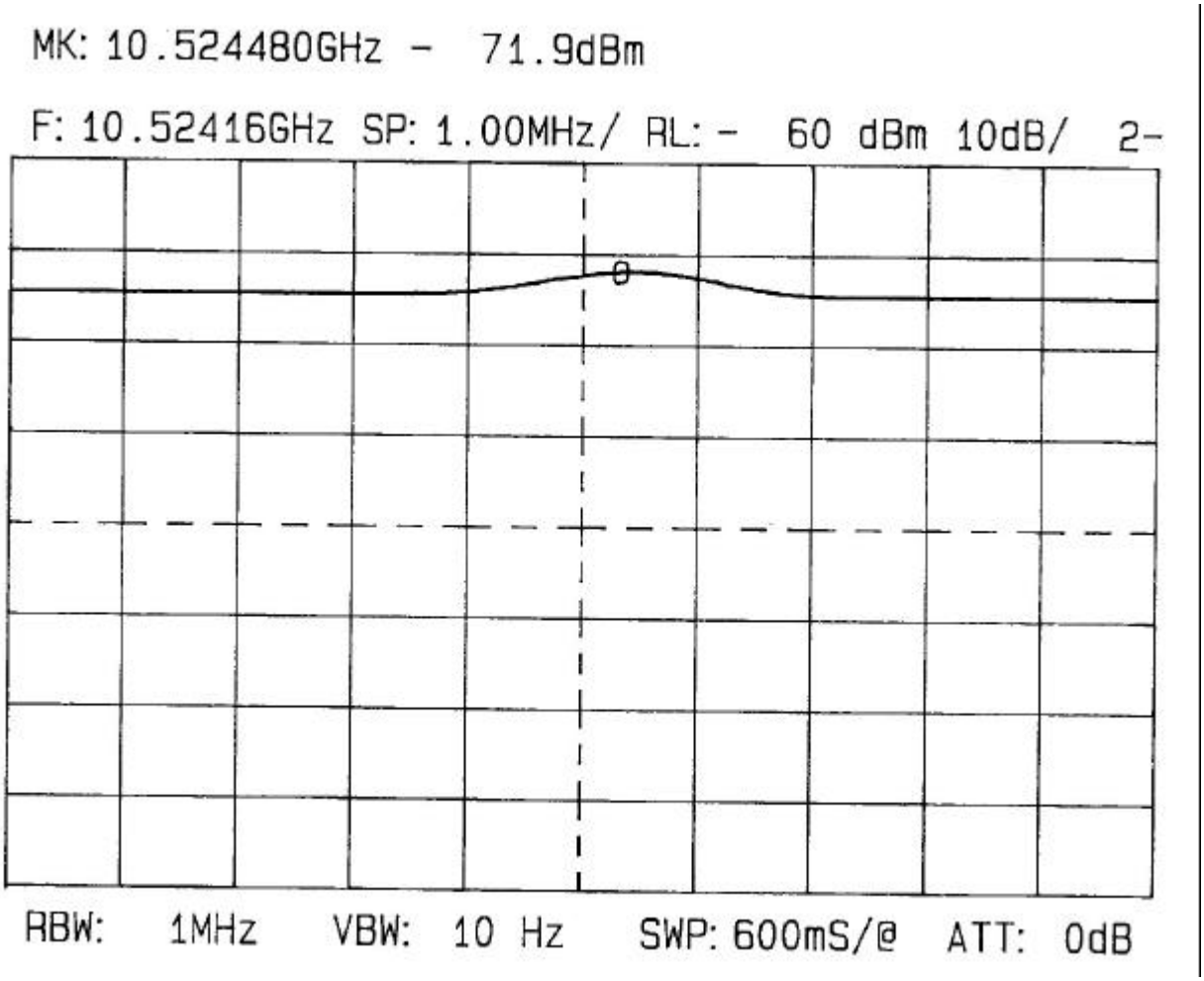
Plot 4.1.3

Field strength at fundamental frequency
EUT: Logica OEM
Peak detector



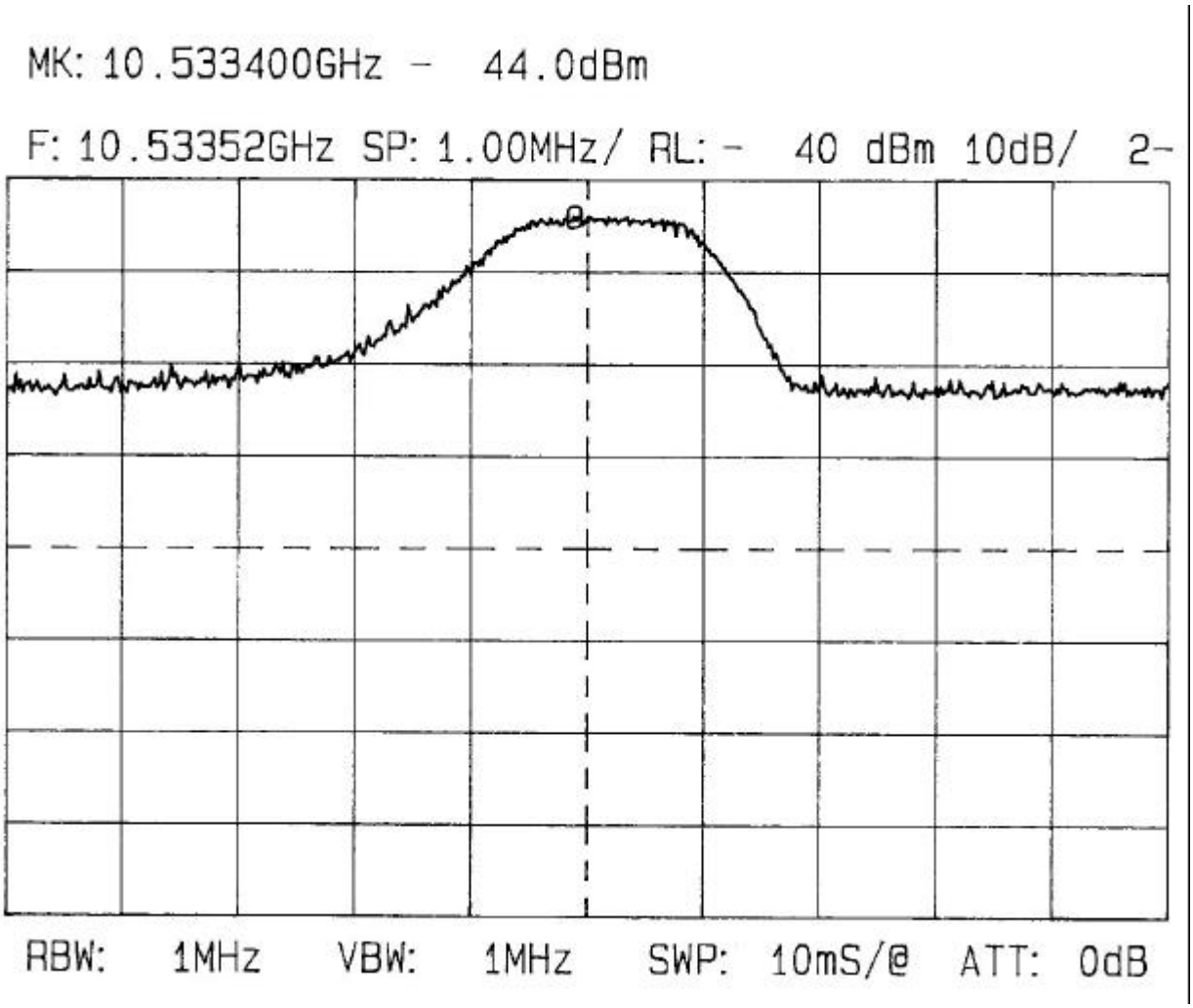
Plot 4.1.4

Field strength at fundamental frequency
EUT: Logica OEM
Average detector



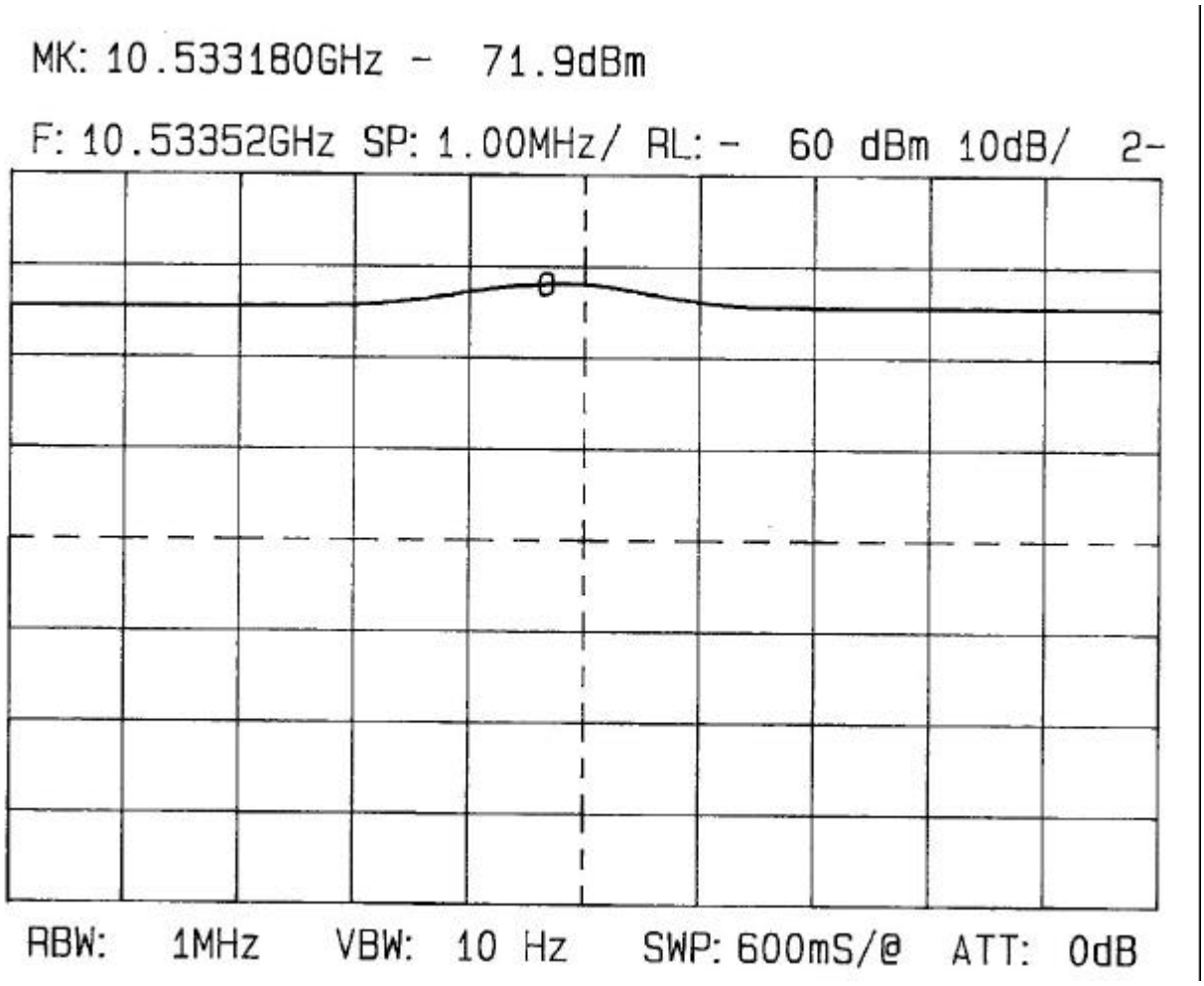
Plot 4.1.5

Field strength at fundamental frequency
EUT: Logica AM
Peak detector



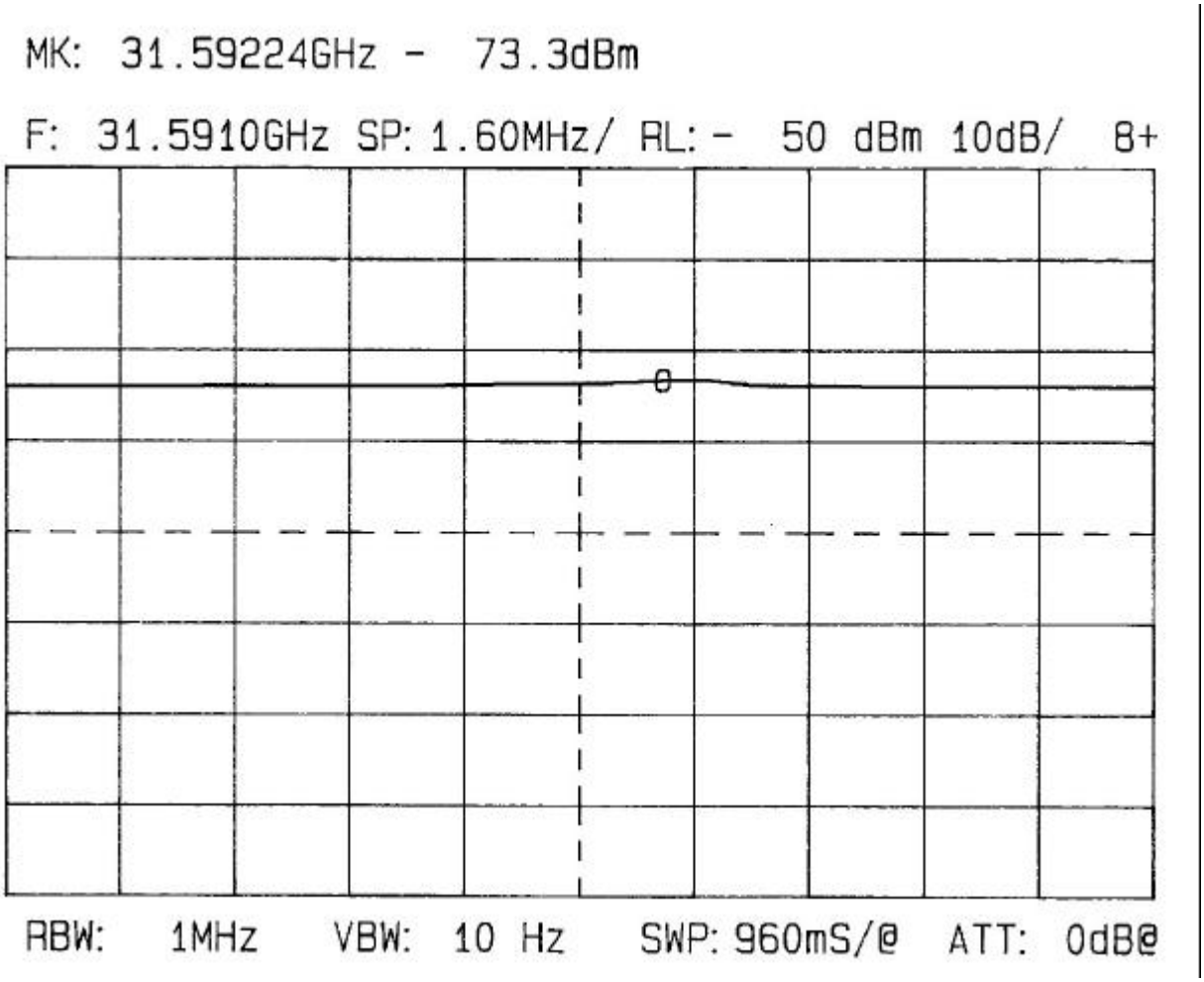
Plot 4.1.6

Field strength at fundamental frequency
EUT: Logica AM
Average detector



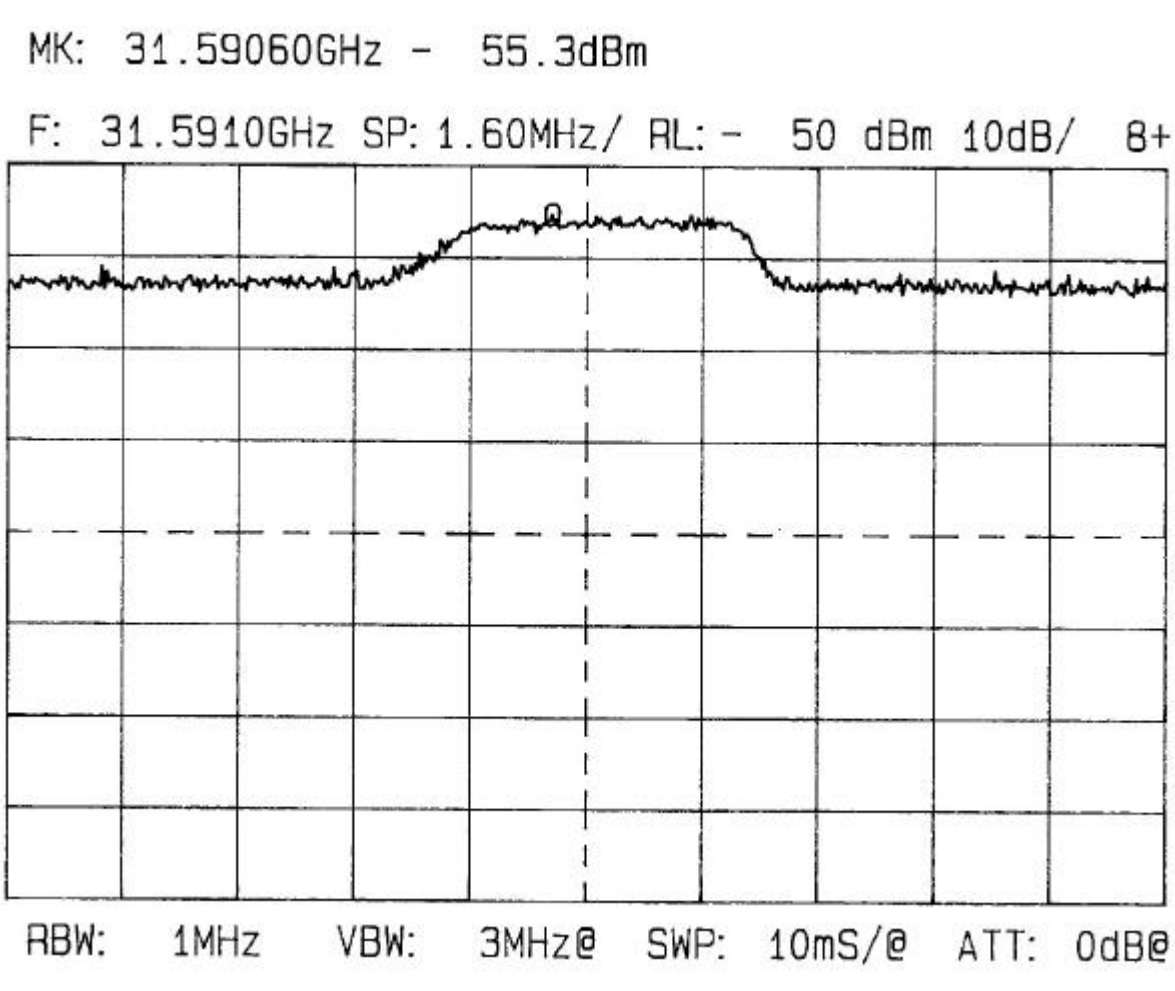
Plot 4.1.7

Field strength of harmonics, 0.5 m distance
Average detector



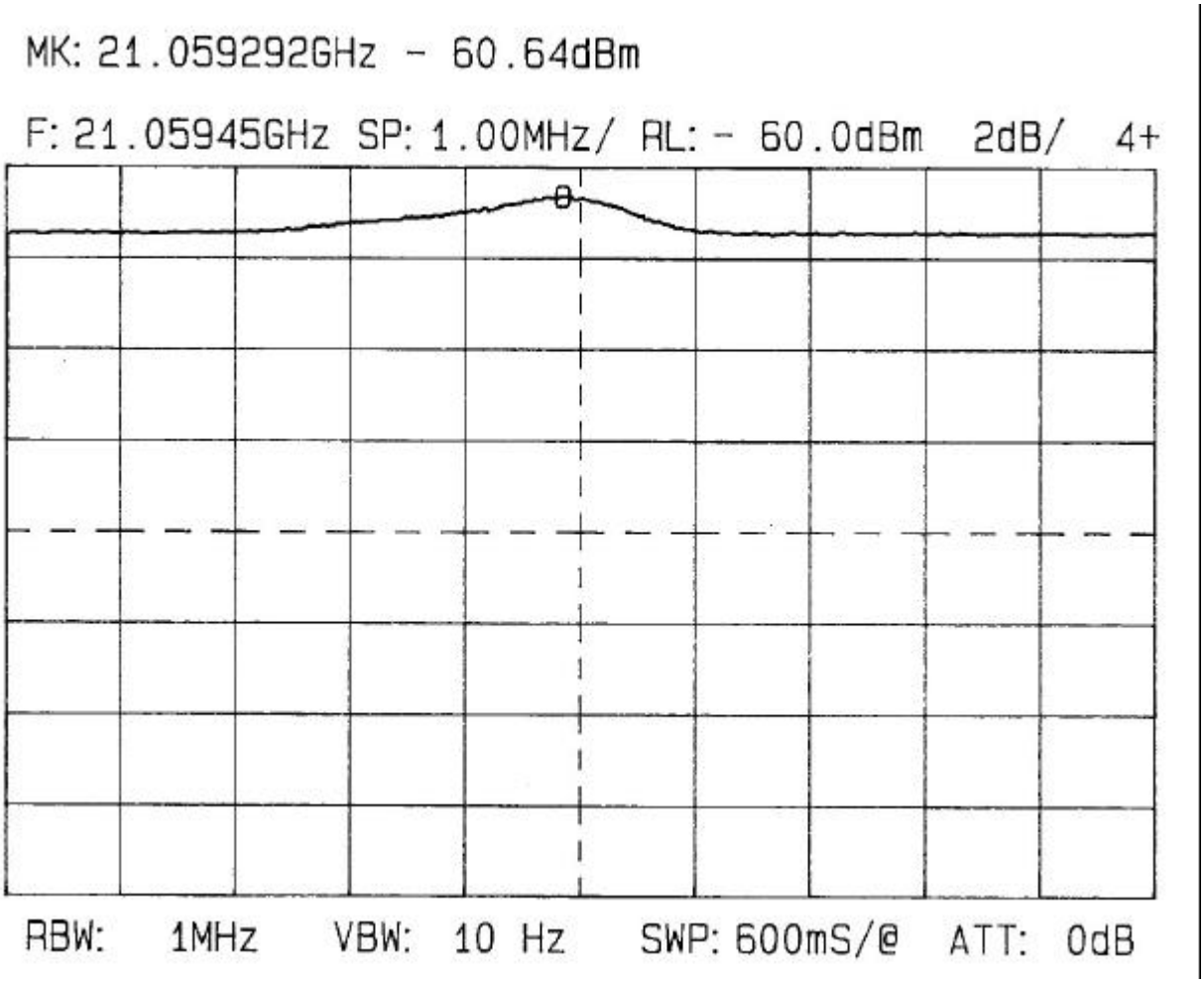
Plot 4.1.8

Field strength of harmonics, 0.5 m distance, peak detector



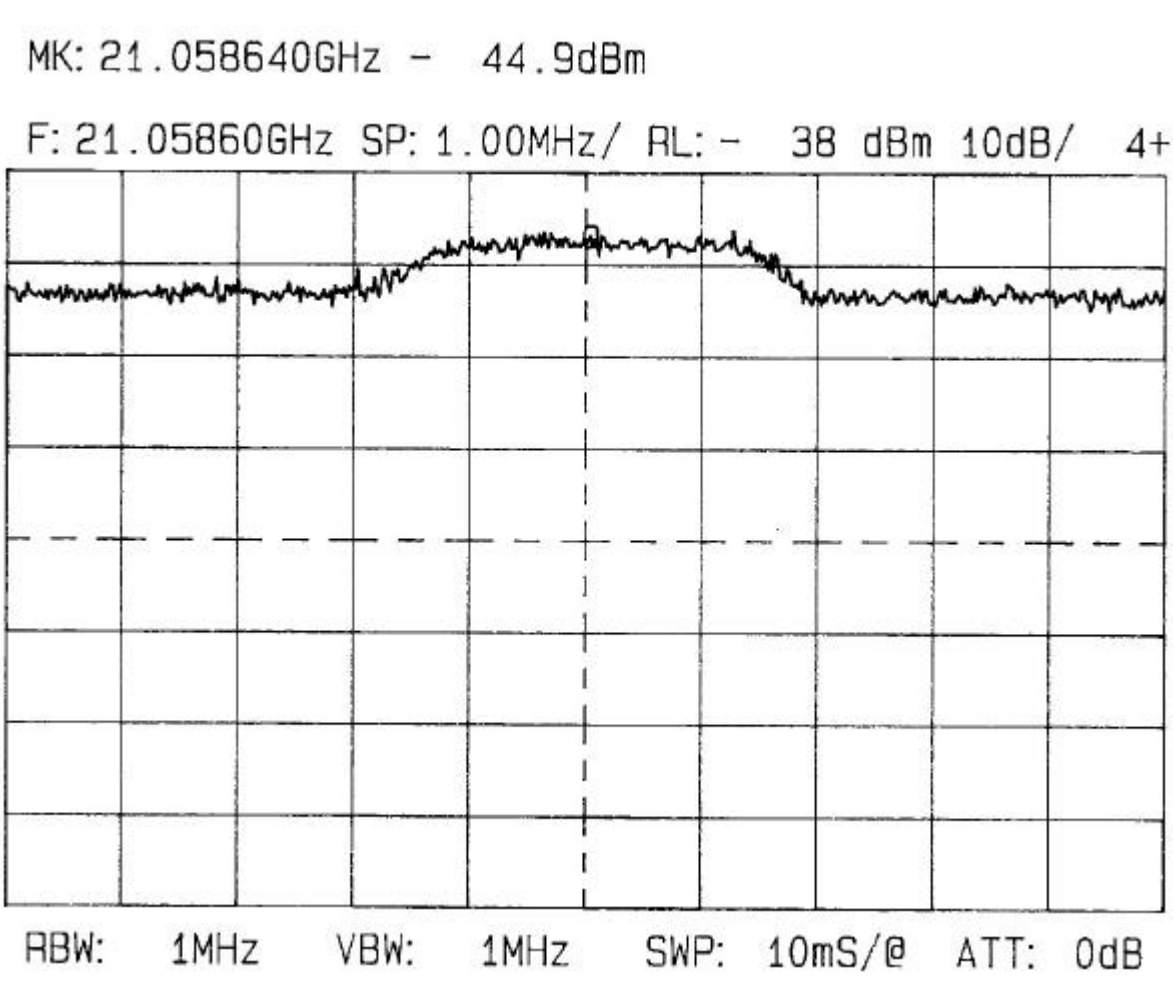
Plot 4.1.9

Field strength of harmonics, 1 m distance, average detector



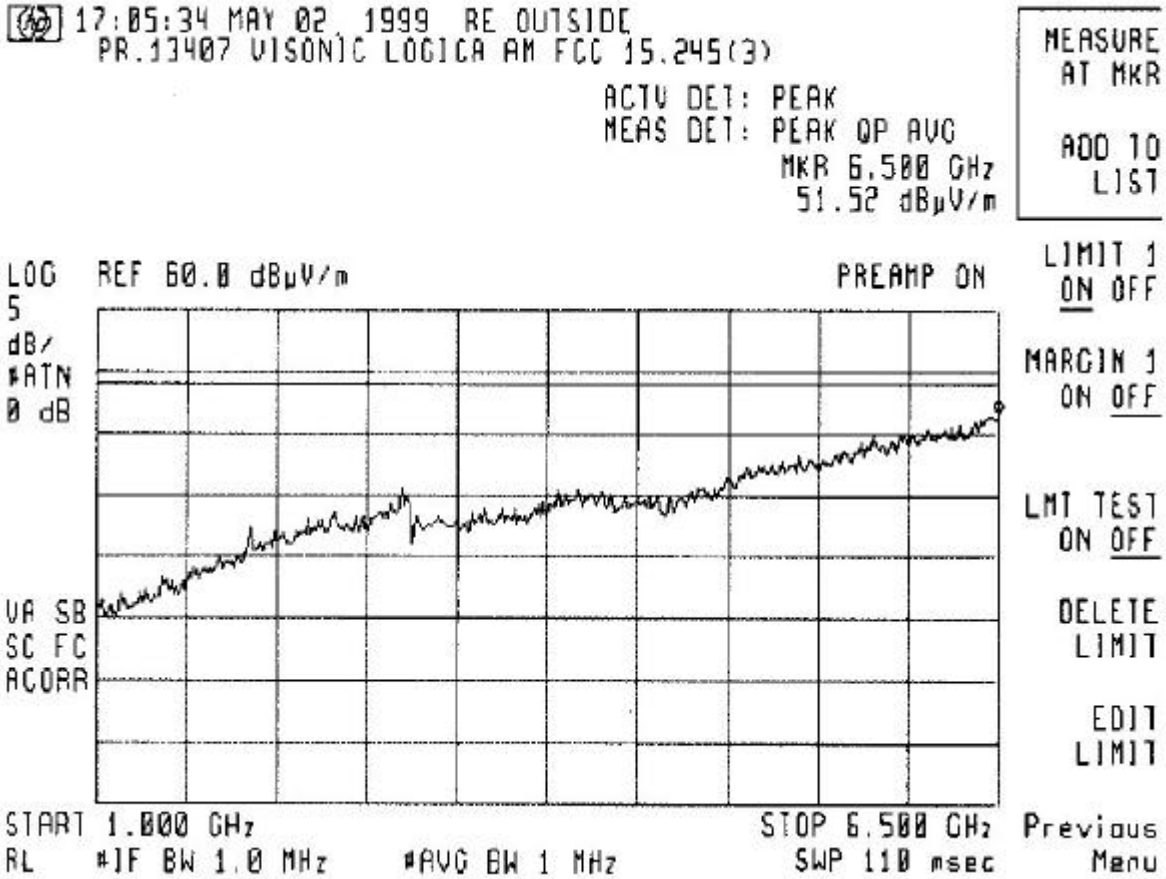
Plot 4.1.10

Field strength of harmonics, 1 m distance, peak detector



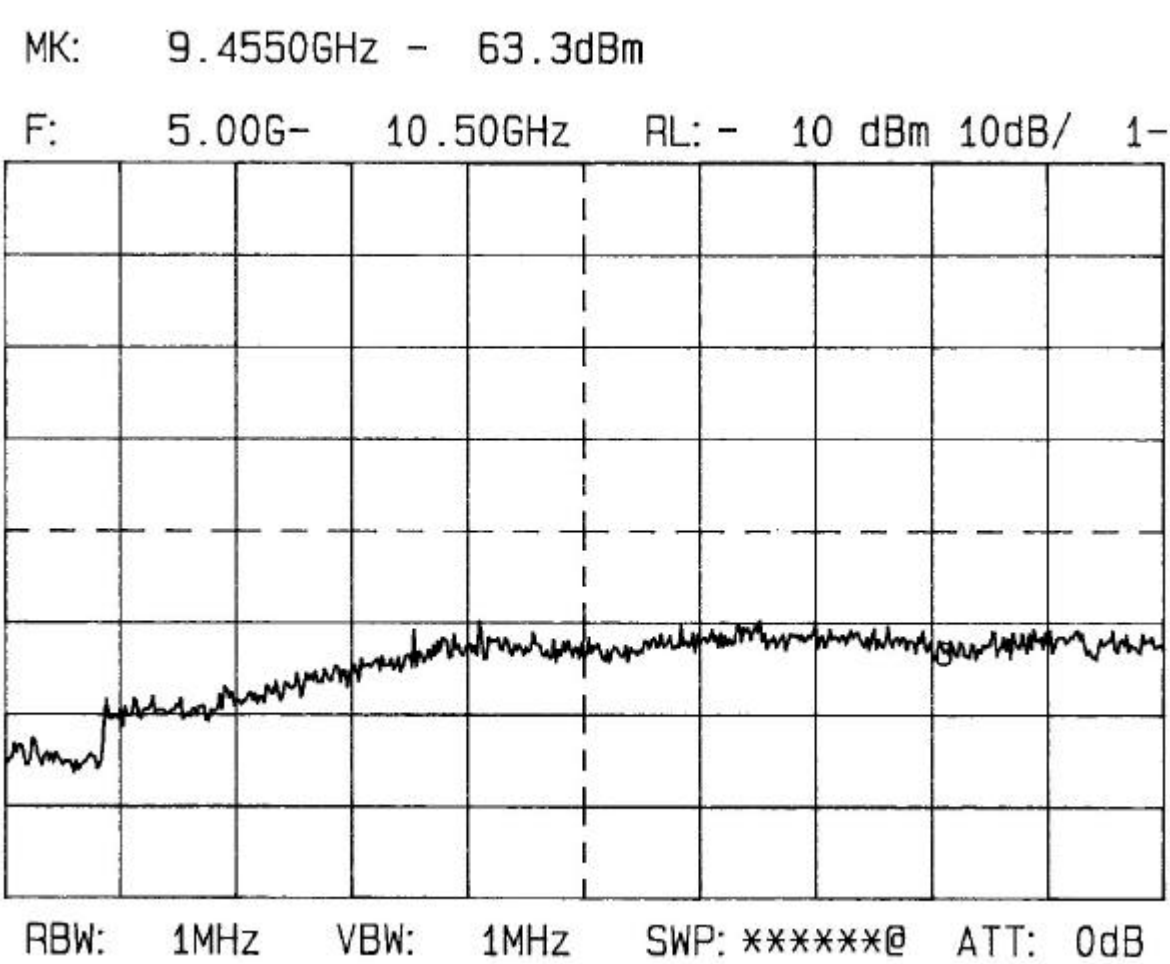
Plot 4.1.11

Radiated emissions outside the specified frequency bands



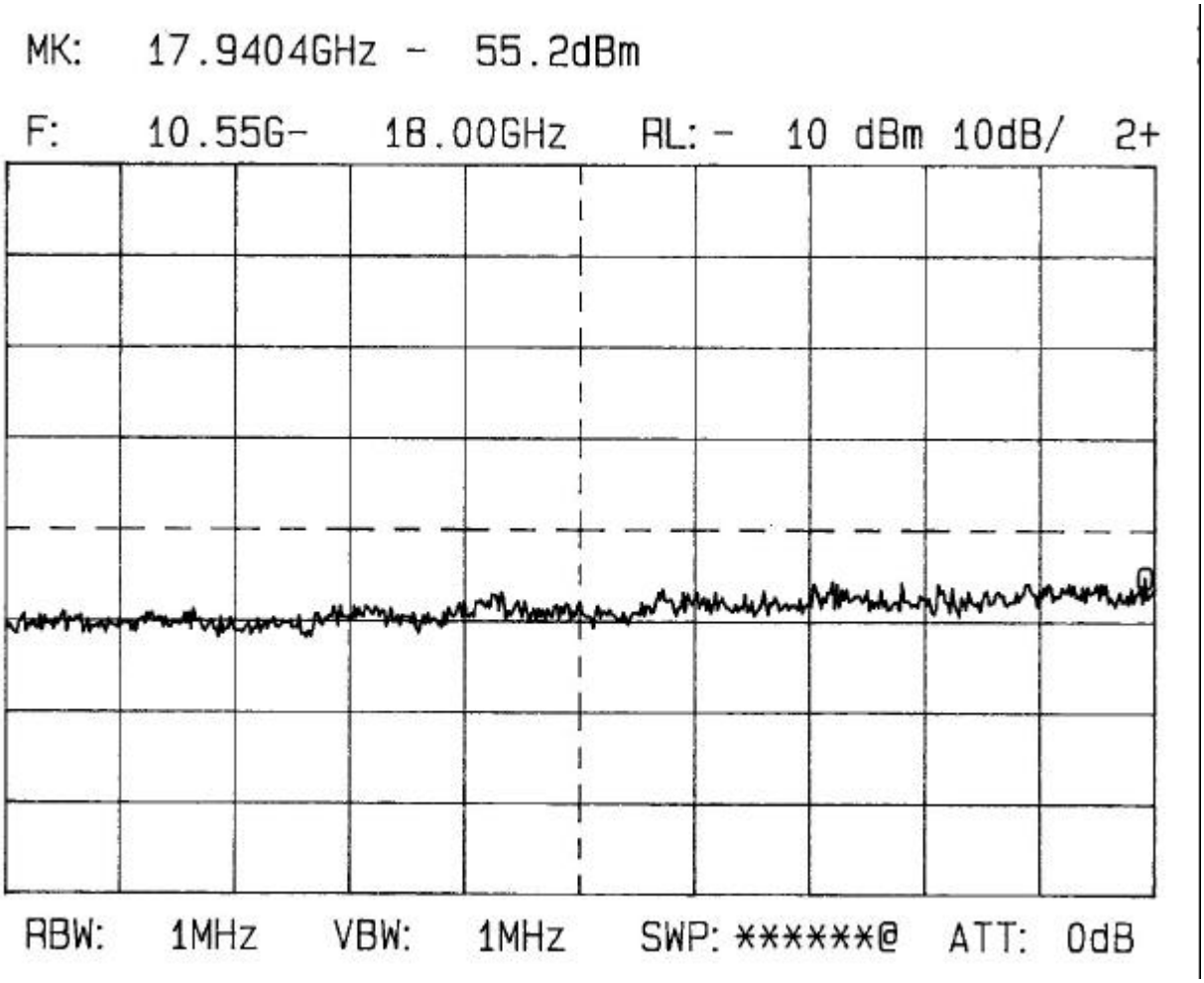
Plot 4.1.12

Radiated emissions outside the specified frequency bands



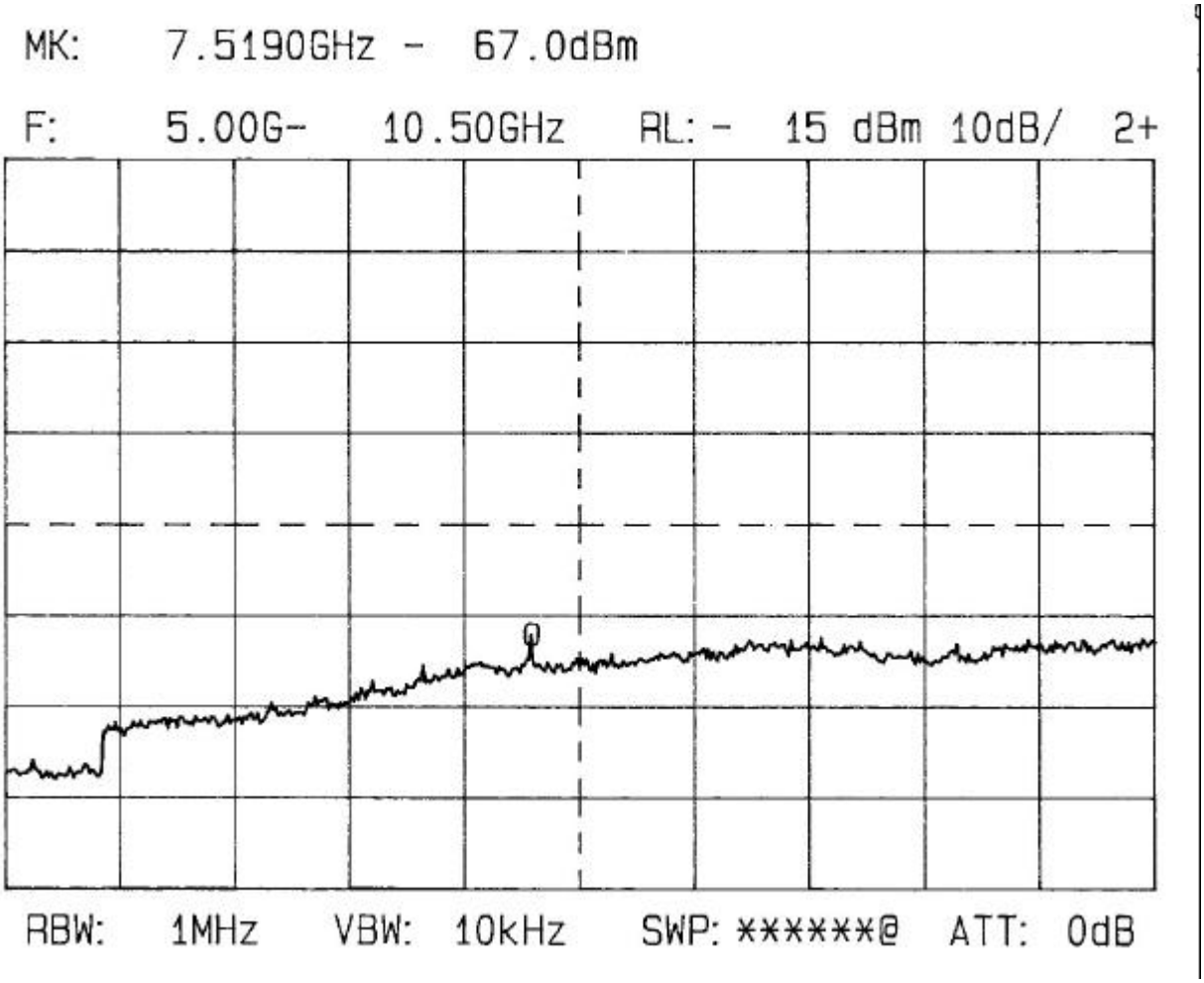
Plot 4.1.13

Radiated emissions outside the specified frequency bands



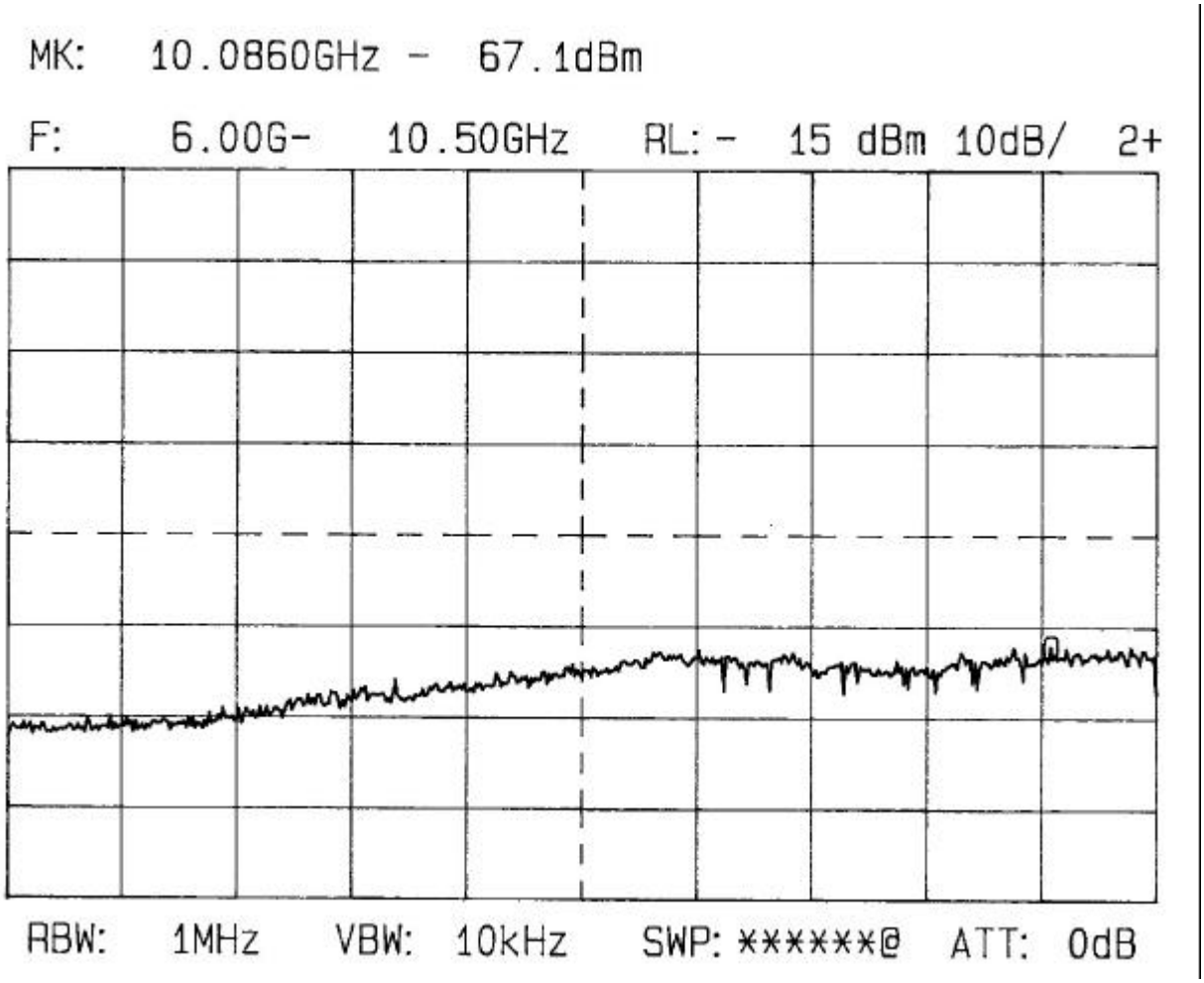
Plot 4.1.14

Radiated emissions outside the specified frequency bands



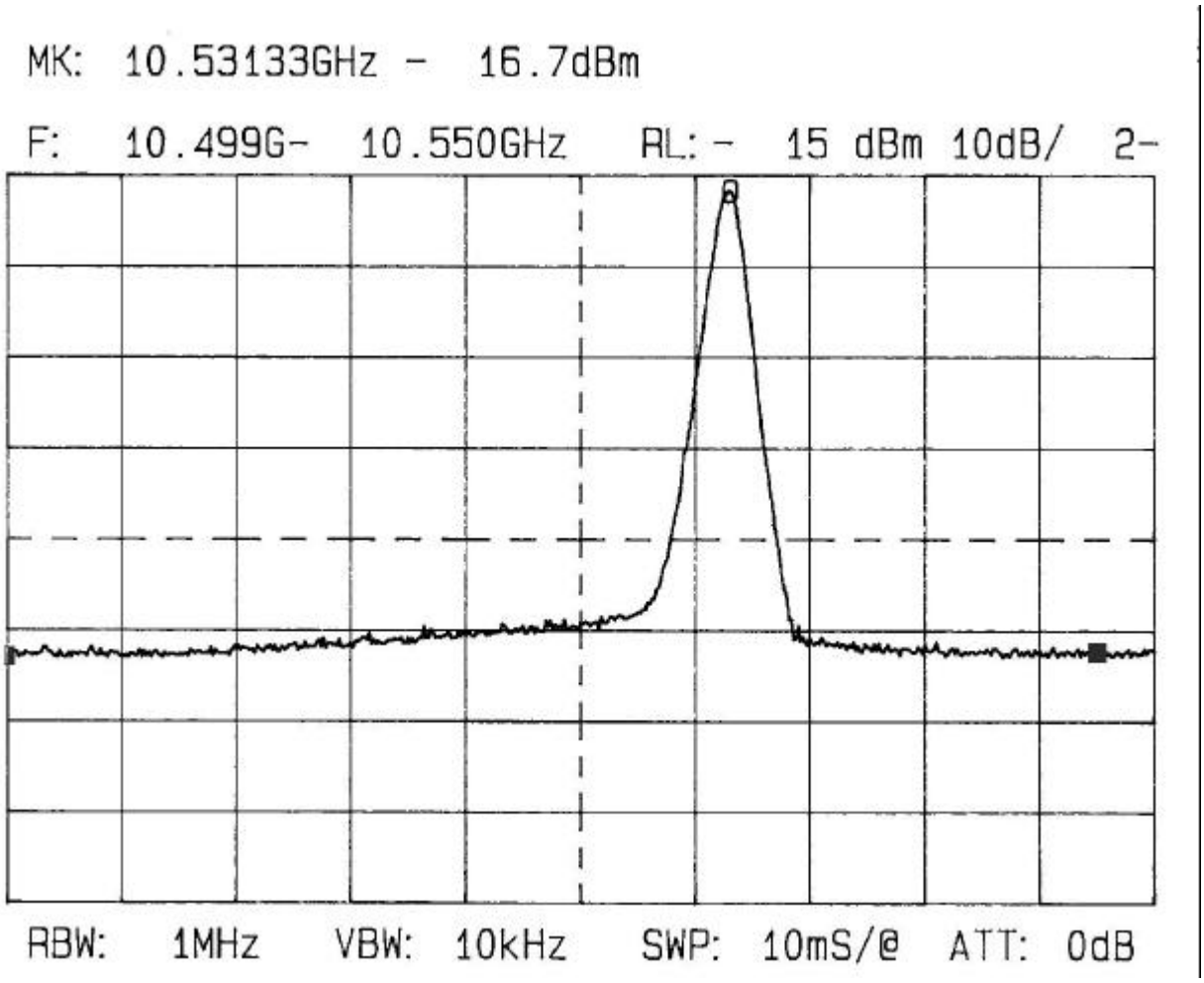
Plot 4.1.15

Radiated emissions outside the specified frequency bands



Plot 4.1.16

Radiated emissions on the specified band edges



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Photograph 4.1.1

Radiated emission measurement setup at OFTS

4.2 Unintentional Radiated emissions test

4.2.1 Purpose of the test

This test was performed to measure radiated emissions from the incorporated digital device of the EUT and also to verify the EUT full compliance with §15.109, §15.209.

4.2.2 The test set-up configuration, test procedure and results

The radiated emissions measurements of the EUT incorporated digital device were performed in HL anechoic chamber at 3 meter measuring distance at frequency range from 30 MHz to 1 GHz. The EUT was placed on wooden table as shown in Figure 4.2.1 and Photographs 4.2.1, 4.2.2. Biconilog antenna was used. To find maximum radiation the turntable was rotated 360°, the measuring antenna height varied from 1 to 4 m, and the antenna polarization was changed from vertical to horizontal.
The measurements were performed with the EMI receiver settings: RBW=120 kHz, peak and quasi peak detectors.
The test measurement results are shown in Plot 4.2.1. The radiated emissions were found at least 15 dB below the specified Class B limit.

Reference numbers of test equipment used

HL 0275	HL 0465	HL 0521	HL 0593	HL 0594	HL 0604	HL 0815
HL 0816						

Full description is given in Appendix A.

Plot 4.2.1

Unintentional radiated emission measurements – test results

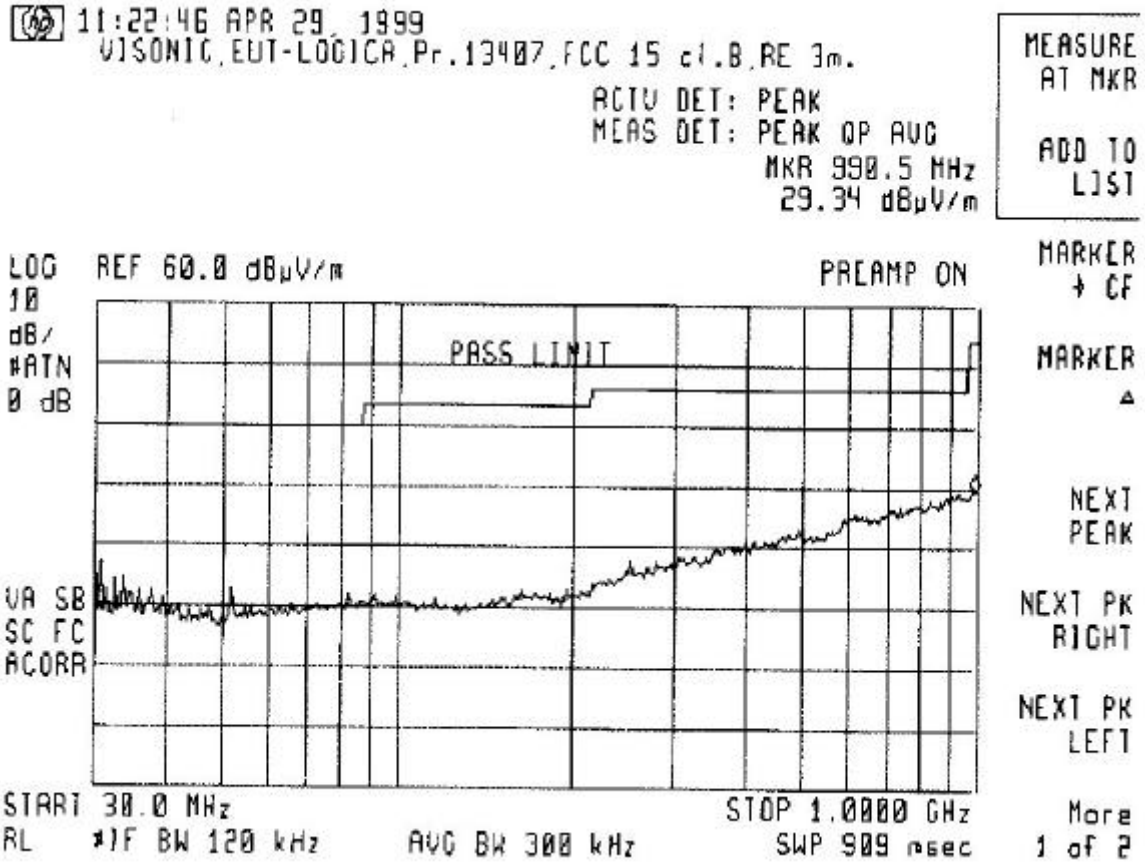
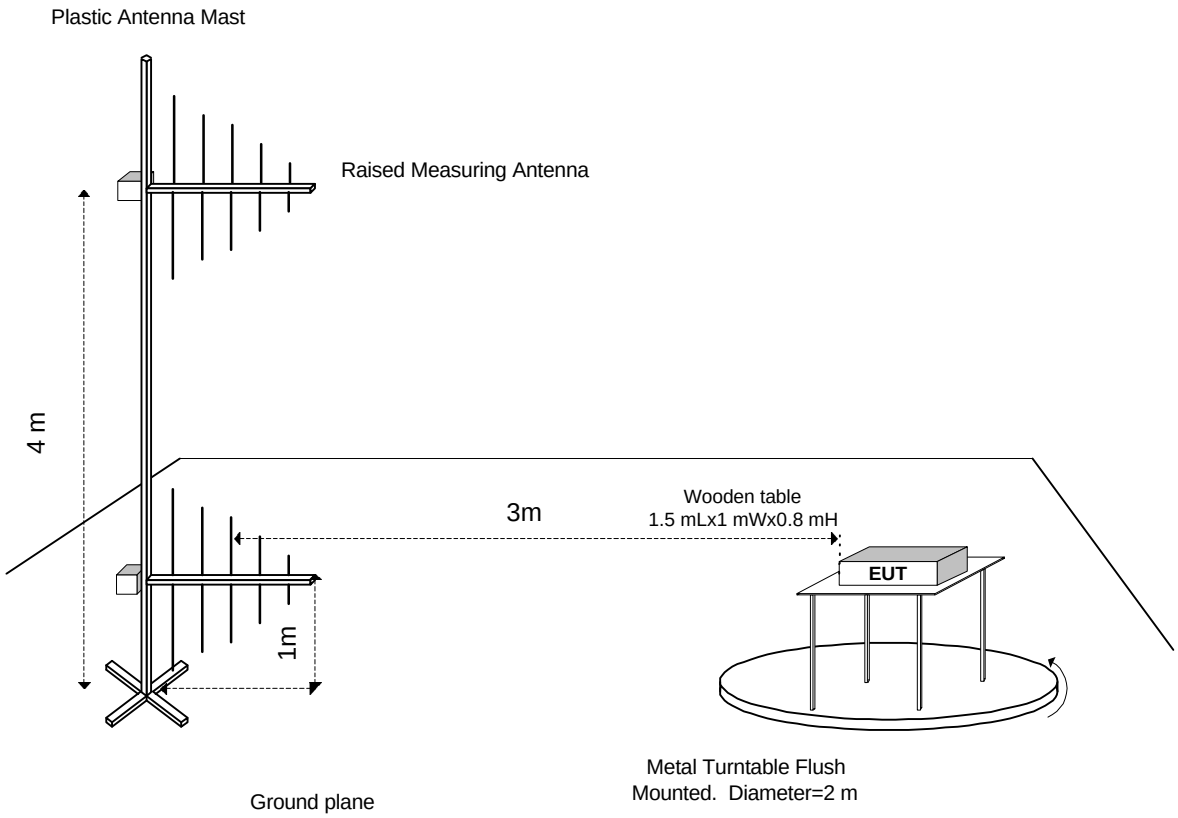


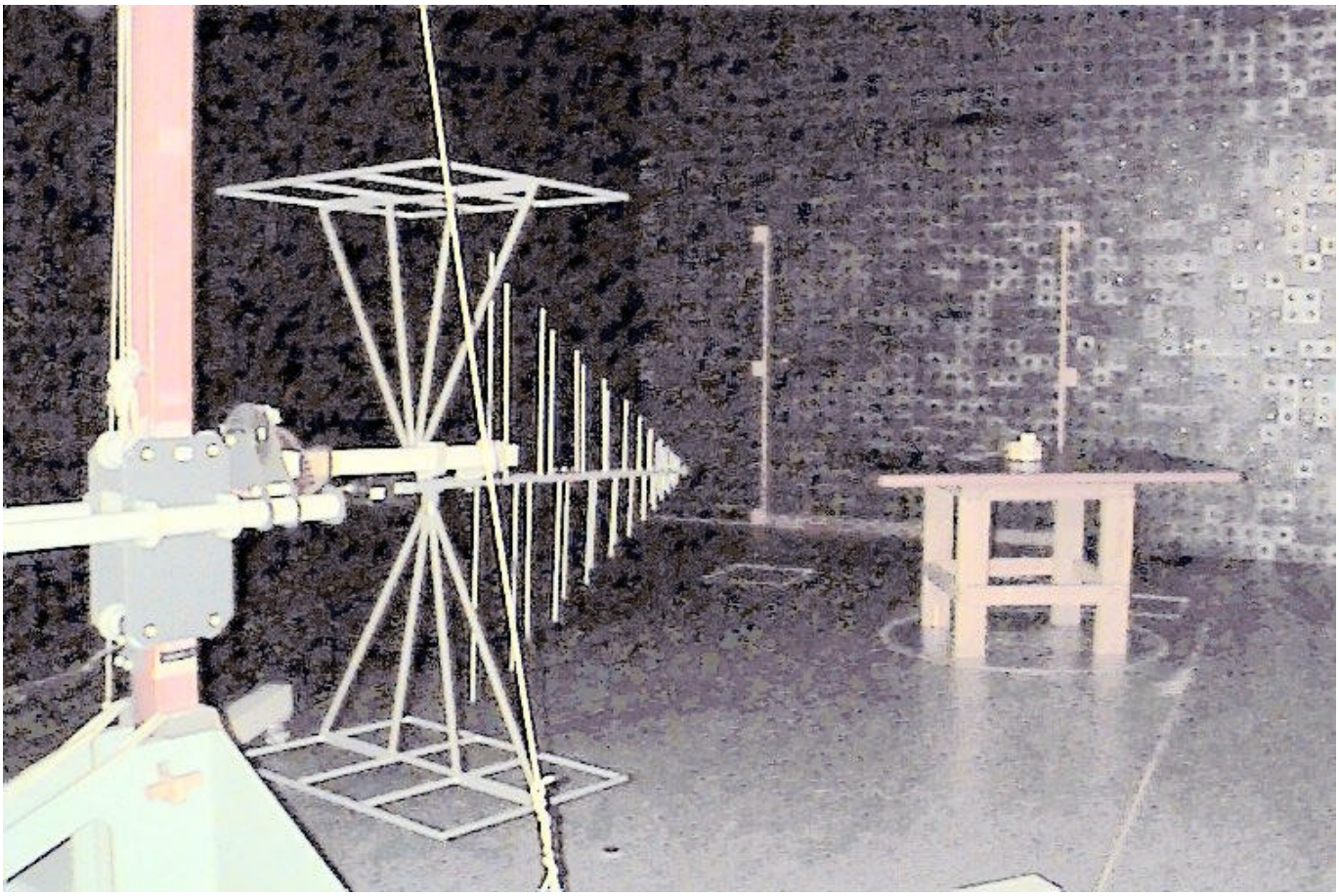
Figure 4.2.1

Radiated emission test setup



Photograph 4.2.1

Radiated emission measurements setup



Photograph 4.2.2

Radiated emission measurements setup

APPENDIX A – Test equipment and ancillaries used for tests

HL Serial No.	Serial No.	Description	Manufacturer	Model No.	Due Calibr.
0025	5837	Analyzer, Spectrum, 10 kHz - 23 GHz / 140 GHz	Anritsu	MS-710C	8/00
0038	028	Antenna Mast, 1-4 m	Hermon Labs	AM-1	2/00
0041	2811	Antenna, Double Ridged Guide (horn) , 1 - 18 GHz	Electro-Metrics	RGA 50/60	4/00
0275	040	Wooden Table, 1.5 x 1.0 x 0.8	Hermon Labs	TNM	NA
0287	0287	Metal Turntable Flush Mounted	Hermon Labs	HLTT-MDC1	4/00
0465	0465	Anechoic Chamber 9 mL x 6.5 mW x 5.5 mH	Hermon Labs	AC-1	10/99
0521	0319	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	7/99
0593	101	Antenna Mast, 1-4 m/ 1-6 m Pneumatic	Hermon Labs	HLAM-F1	4/00
0594	102	Turntable for anechoic chamber, flush mounted, D=1.2 m, pneumatic	Hermon Labs	HL TT-WDC1	11/99
0604	1011	Antenna Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141 BICONILOG	12/99
0749	NA	Mixer General Purpose waveguide 26.5-40.0 GHz	Tektronix	119-0099-01	5/00
0750	NA	Mixer General Purpose Waveguide 18.0-26.5 GHz	Tektronix	119-0098-00	5/00
0763	980976-002	Antenna Linear Horn (Optium Gain) 18 - 26.5 GHz WR-42+SMA	Continental Microwave & Tool Co.	LHA042	6/01
0769	112	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, Ka band, Gain 25 dB	Quinstar Technology	QWH-2800-BA	7/01
0770	118	Antenna Standard Gain Horn, 40-60 GHz WR-19, U-band Gain - 25 dB	Quinstar Technology	QWH-1900-AA	7/99
0771	111	Antenna Standard Gain Horn, 60-90 GHz, WR-12, Gain - 25 dB	Quinstar Technology	QWH-1200-AA	7/99
0812	148	Cable, coax, RG-214, 11.5 m, N-type connectors	Hermon Labs	C214-11	8/99
0813	149	Cable, coax, RG-214, 12 m, N-type connectors	Hermon Labs	C214-12	8/99
0815	151	Cable, coax, RG-214, 7.3 m, N-type connectors	Hermon Labs	C214-7	8/99
0816	152	Cable, coax, RG-214, 8 m, N-type connectors	Hermon Labs	C214-8	8/99
1175		Microwave 5 m cable	Gore	84C01C02245.2	2/00

APPENDIX B-Test Equipment Correction Factors

Antenna Factor
Double Ridged Guide Antenna
Electro-Metrics, Model RGA-50/60
Ser.No.2811

Frequency, MHz	Antenna Factor, dB(1/m)
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
10,000	38.2
10,500	38.5
11,000	39.0
11,500	40.1
12,000	40.2
12,500	39.3
13,000	39.9
13,500	40.6
14,000	41.1
14,500	40.5
15,000	39.9
15,500	37.8
16,000	39.1
16,500	41.1
17,000	41.7
17,500	45.1
18,000	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).

Antenna Gain
Waveguide standard gain horn antenna
Continental Microwave & Tool Co., Inc.
P/N LHA 042
Ser.No.980976-002

Frequency GHz	H-3dB BW degrees	E-3dB BW degrees	Gain dBi
18.000	10	9	23.3
18.850	10	9	23.6
19.700	10	9	23.7
20.550	9	8	24.1
21.400	9	8	24.3
22.250	9	8	24.3
23.100	8	7	24.5
23.950	8	7	24.5
24.800	8	7	24.8
25.650	7	6	24.9
26.500	7	6	24.9

Antenna Gain
Waveguide standard gain horn antenna
Continental Microwave & Tool Co., Inc.
P/N LHA 042
Ser.No.980976-001

Frequency GHz	H-3dB BW degrees	E-3dB BW degrees	Gain dBi
26.500	10	9	23.3
27.850	10	9	23.6
29.200	9	8	23.7
30.550	9	8	23.9
31.900	8	7	24.1
33.250	8	7	24.3
34.600	8	7	24.5
35.950	7	7	24.4
37.300	7	6	24.5
38.650	7	6	24.6
40.000	7	6	24.7

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