ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC PART 15, SUBPART C, §15.231

FOR

VISONIC Ltd.

EQUIPMENT UNDER TEST

Pet-immune Powercode wireless PIR detector
model K-980 MCW

Hermon Laboratories Ltd.
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Electrical

ACCREDITED
839.01

Description of equipment under test

Test items	Pet-immune Powercode wireless PIR detector
Manufacturer	Visonic Ltd.
Type (Model)	**K-980 MCW**

Applicant information

Applicant's representative & responsible person	Mr. Arick Elshtein technical support manager
Company	Visonic Ltd.
Address	30 Habarzel street
P.O. Box	22020
Postal code	61220
City	Tel Aviv
Country	Israel
Telephone number	+972 3645 6714
Telefax number	+972 3645 6743

Test performance

Project Number	13782
Location of the test	Hermon Laboratories, Binyamina, Israel
Test performed	June 7, 2000
Purpose of test	The EUT verification in accordance with CFR 47, part 2, §2.1033
Test specification(s)	FCC part 15, subpart C, §15.231, §15.209, subpart B, §15.109

Table of Contents

1 Summary and signatures

The EUT, Pet-immune Powercode wireless PIR detector K-980 MCW was tested according to FCC part 15 subpart C, §.15.231 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. V. Mednikov, certification engineer _____

Test report approved by:

Mr. M. Nikishin, EMC group leader _____

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.

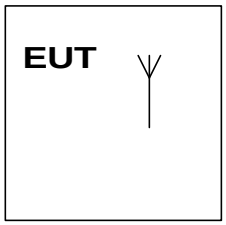
2.3 EUT description

The EUT, K-980 MCW, is a pet-immune, fully supervised ultra low-current wireless PIR detector that incorporates a Powercode transmitter. Both transmitter and detector circuits are powered by an on-board long life 3.6 V Lithium battery.

Operating frequency: 315 MHz

The EUT configuration is given in Figure 2.3.1.

Figure 2.3.1
EUT test configuration



with integral spiral antenna

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).

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

Conducted emissions with LISN	9 kHz to 30 MHz: ± 2.1 dB
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, 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 22, 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: August 22, 2000

4 Emission measurements

4.1 Field strength of emissions according to § 15.231 (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	Field strength of emission, dB(μV/m)	
	Average detector	Peak detector
315 (carrier)	75.6	95.6
frequencies outside restricted bands	55.6	75.6
1435-1625.5*	54	74
2200-2300*	54	74

* restricted bands (refer to FCC, 15.205)

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. The EUT was placed on the wooden table, as shown in Figure 4.1.1, Photographs 4.1.1 to 4.1.3 and operated in continuous transmitting mode.

Frequency range 30 MHz to 10th harmonic (3.15 GHz) 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 EUT was tested in three orthogonal planes.

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 and peak emission limitations of §15.35.

The test results are recorded into Tables 4.1.3, 4.1.4 and shown in Plots 4.1.1 to 4.1.6.

Average factor –9.82 dB was calculated according to the formula

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

where

T_{ON} , transmission duration within 100 msec , is 32.304 ms,

$$20 \log (32.304 \text{ ms}/100 \text{ ms}) = -9.82.$$

In frequency range 30 MHz – 1 GHz a more stringent limit for digital part was used, refer to Table 4.1.2 and Plot 4.1.7.

Reference numbers of test equipment used

HL 0041	HL 0465	HL 0521	HL 0604	HL 1175

Full description is given in Appendix A.

Table 4.1.2
Limits for electric field strength, quasi-peak detector

Frequency, MHz	Class B equipment @3 meter distance, dB(mV/m)
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 5000	54

Table 4.1.3

Radiated emission measurements
peak limit

TEST SPECIFICATION: FCC part 15 subpart C § 15.209
DATE: June 7, 2000
RELATIVE HUMIDITY: 57%
AMBIENT TEMPERATURE: 24°C

Frequency, MHz	Radiated emission, peak, dB (mV/m)	Peak limit @ 3 m, dB(mV/m)	Margin, dB	Pass/ Fail
315.05	76.96	95.6	18.64	Pass
630.156	45.66	75.6	29.94	Pass
945.214	45.76	75.6	29.84	Pass
1578	45.19	74	28.81	Pass
1890.423	45.74	75.6	29.86	Pass

Notes to table:

Peak detector was used.
Radiated emission dB(μV/m) = peak measured result (dB(μV)) + ant. factor (dB(1/m)) + cable loss (dB) –amplifier gain (dB).
Peak limit = average limit dB(μV/m) +20 dB.
Margin = dB below (negative if above) limit.

Table 4.1.4
Radiated emission measurements,
average limit

TEST SPECIFICATION: FCC part 15 subpart C § 15.209
DATE: June 7, 2000
RELATIVE HUMIDITY: 57%
AMBIENT TEMPERATURE: 24°C

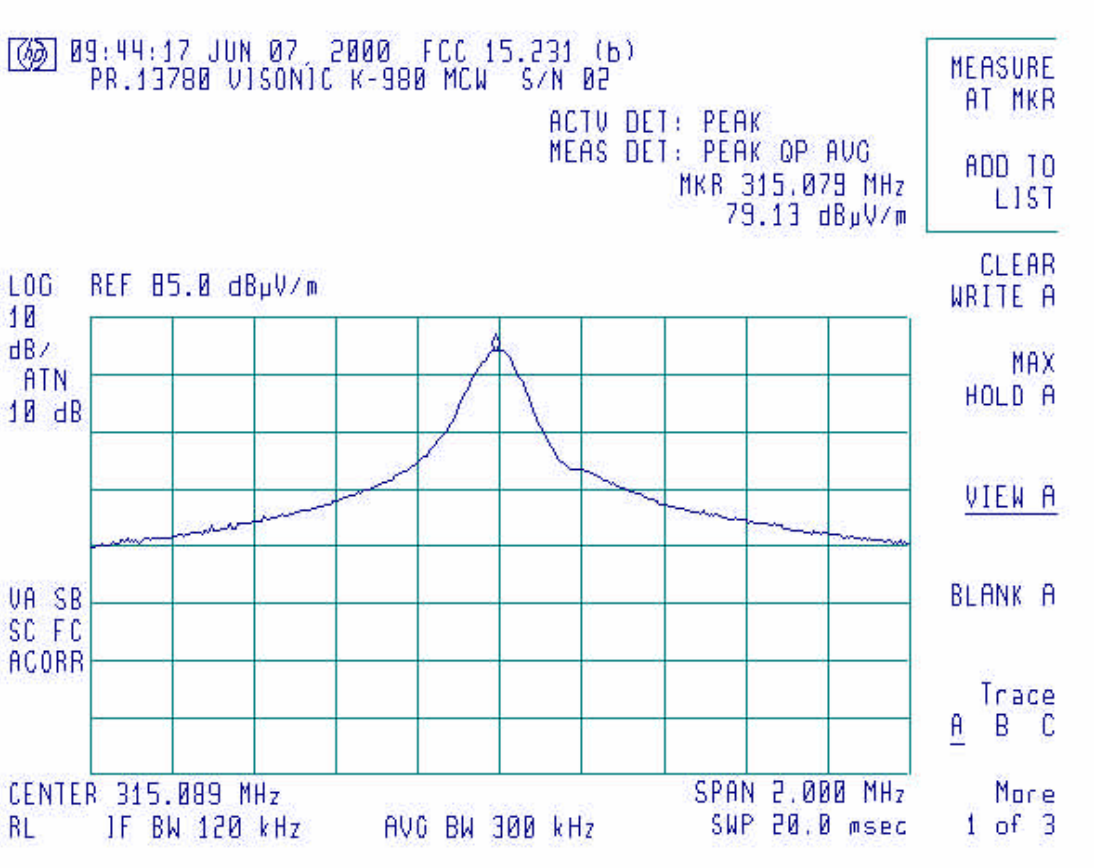
Frequency, MHz	Radiated emission, average, dB (mV/m)	Average limit @ 3 m, dB(mV/m)	Margin, dB	Pass/ Fail
315.08	67.14	75.6	8.46	Pass
630.156	35.84	55.6	19.76	Pass
945.214	35.94	55.6	19.66	Pass
1578	35.37	54	18.63	Pass
1890.423	35.92	55.6	19.68	Pass

Notes to table:

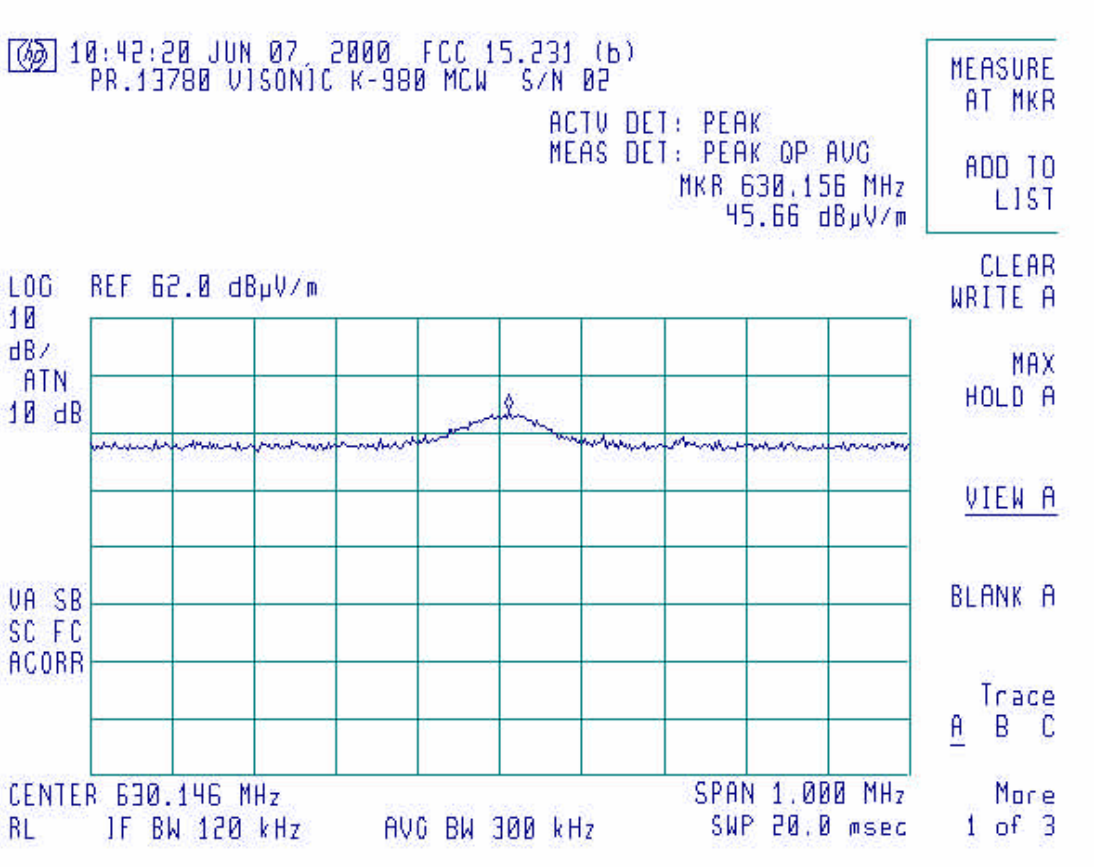
Peak detector was used.

Radiated emission dB(μV/m) = peak measured result (dB(μV)) + ant. factor (dB(1/m)) + cable loss (dB) –amplifier gain (dB) + average factor (dB).
Average factor = -9.82 dB.
Average limit is in accordance with § 15.231(b).
Margin = dB below (negative if above) limit.

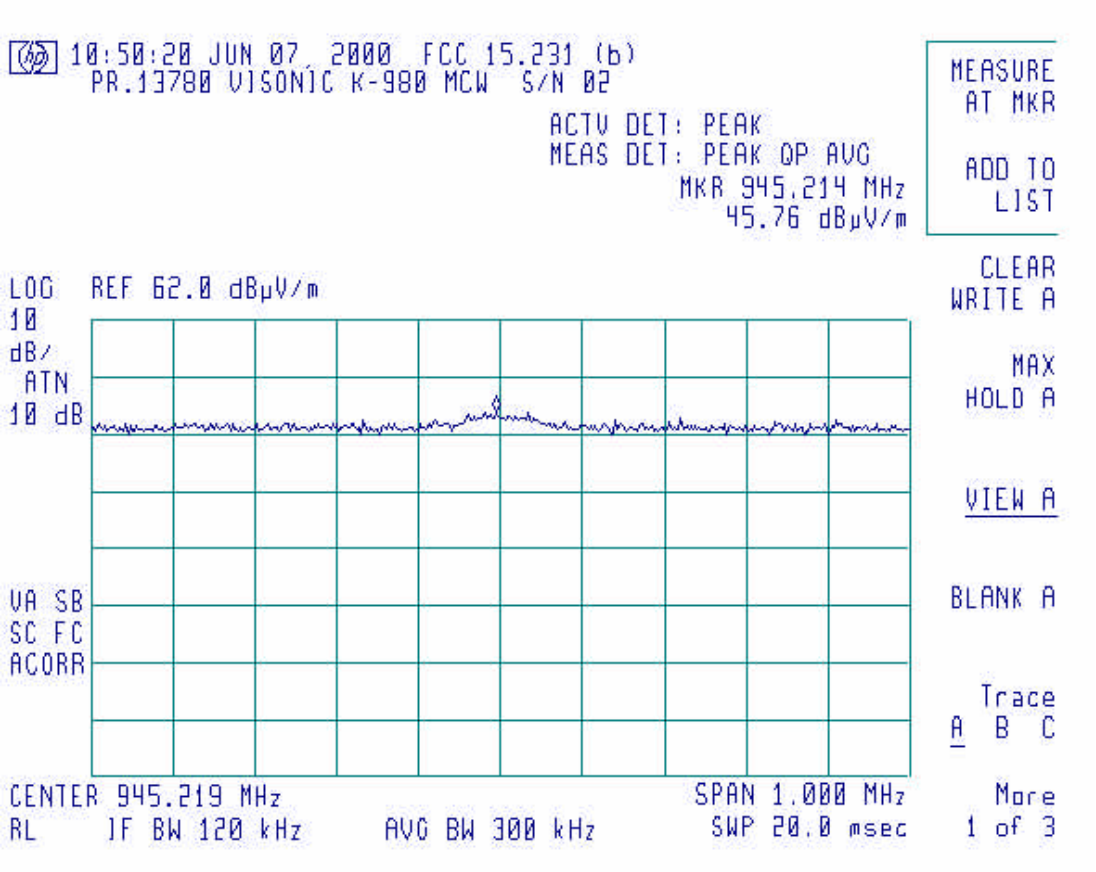
Plot 4.1.1
Carrier and spurious emissions measurements
Horizontal polarization



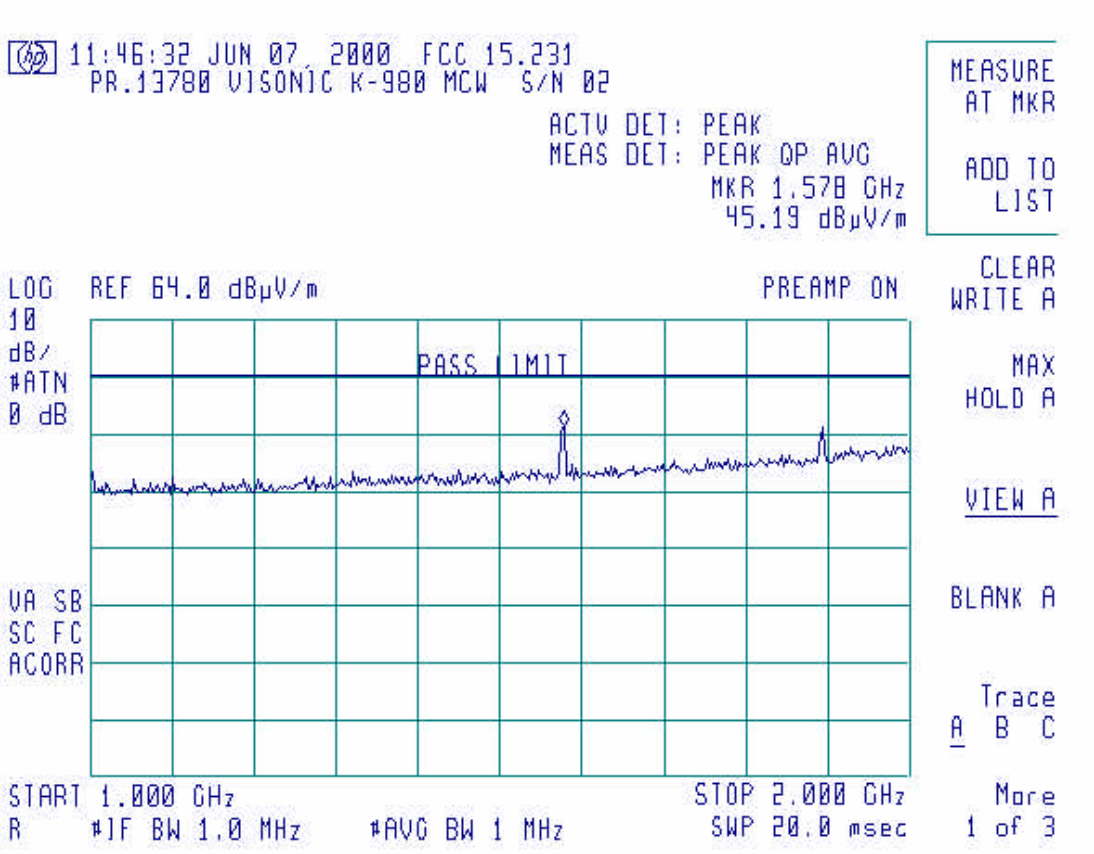
Plot 4.1.2
Radiated emission at 2nd harmonic



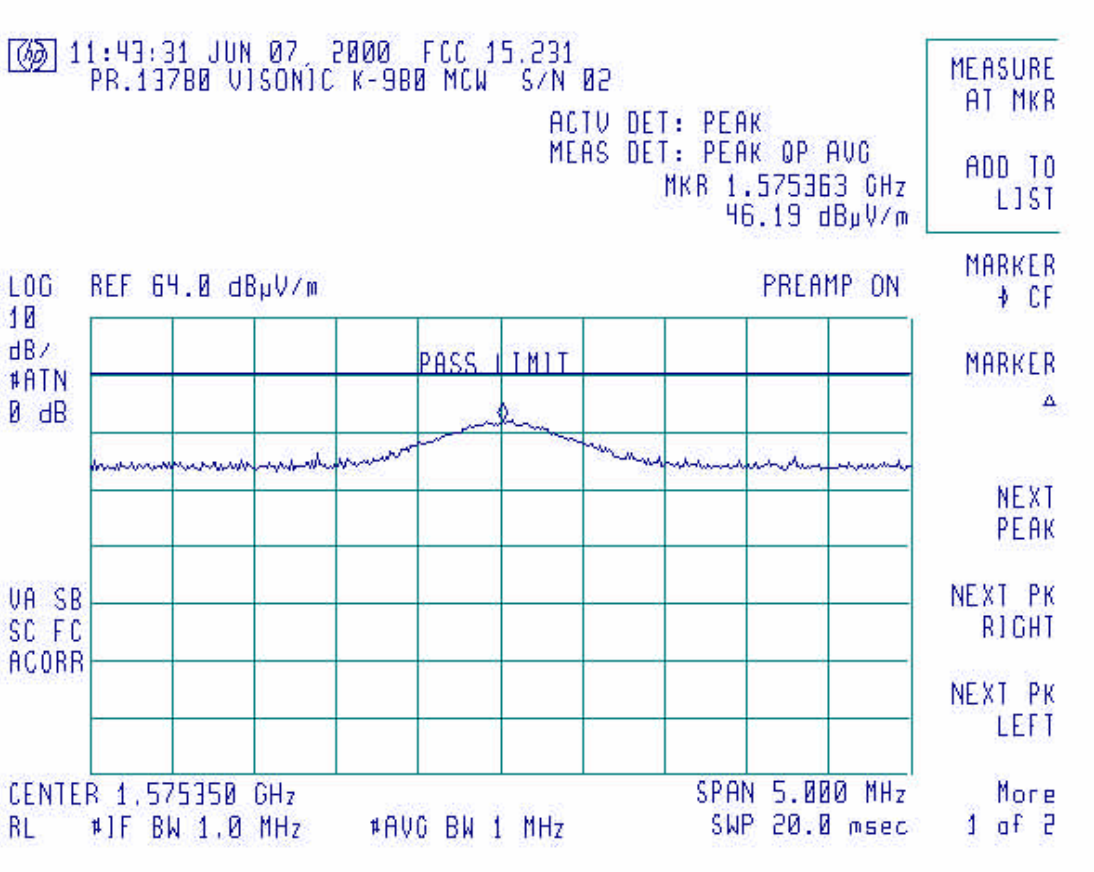
Plot 4.1.3
Radiated emission at 3rd harmonic



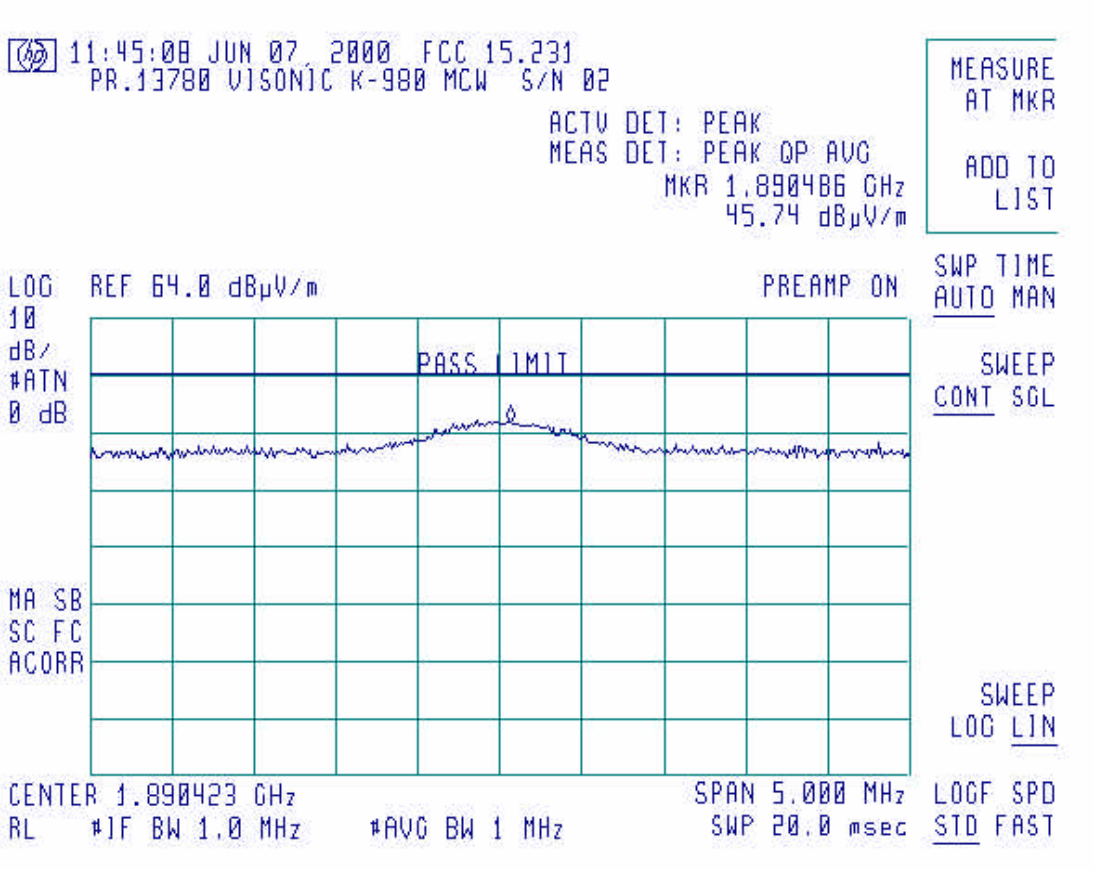
Plot 4.1.4
Radiated emission at 4th harmonic



Plot 4.1.5
Radiated emission at 5th harmonic



Plot 4.1.6
Radiated emission at 6th harmonic



Plot 4.1.7

Test specification: §15.109
Radiated emissions of digital incorporated device

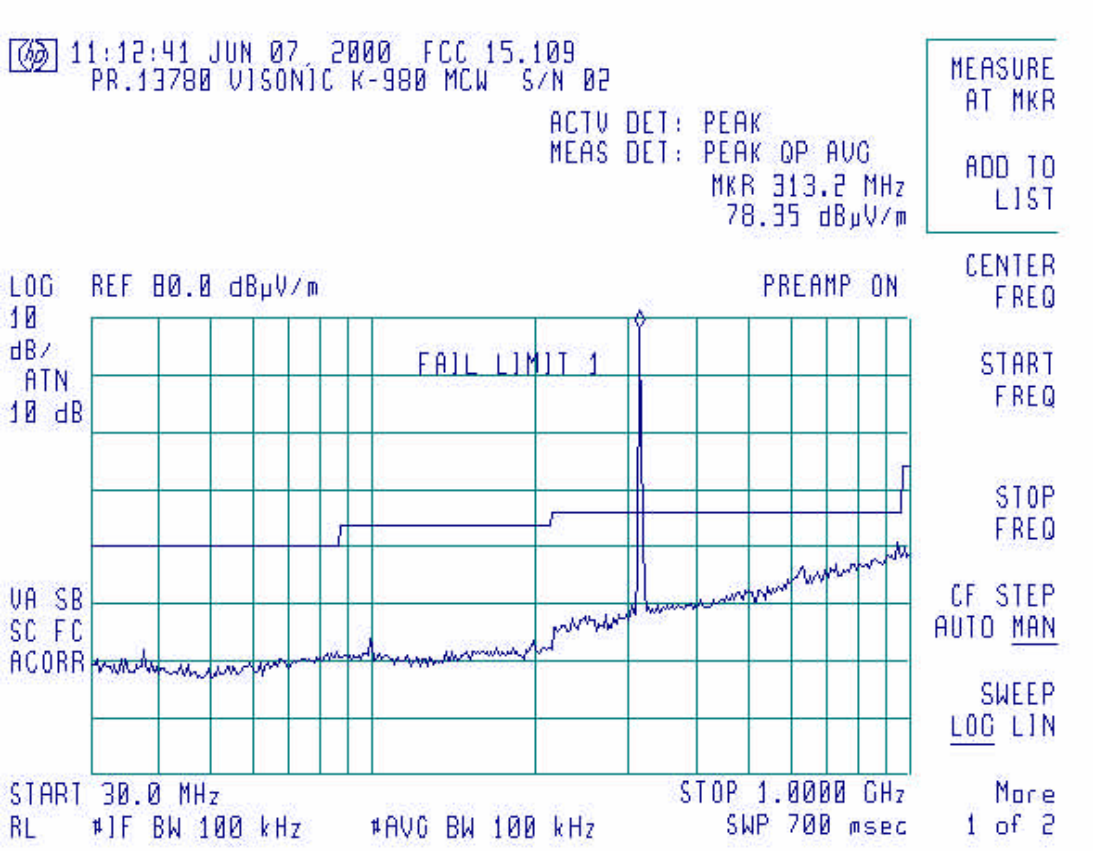
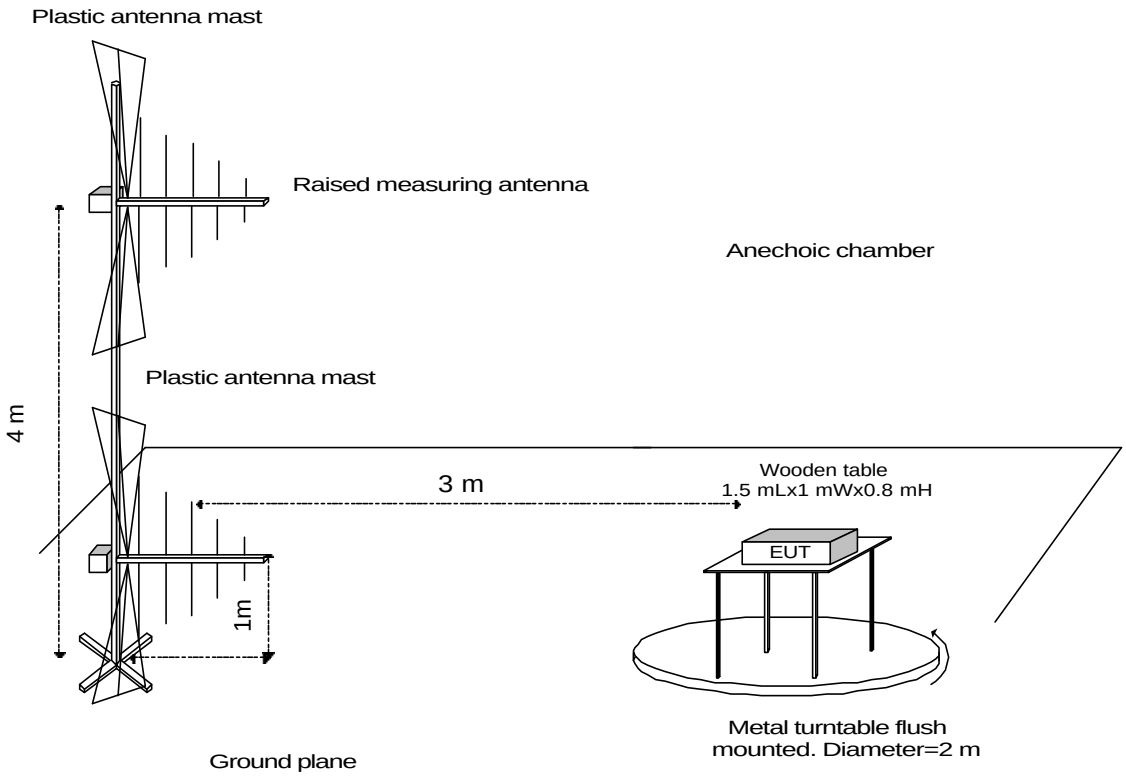
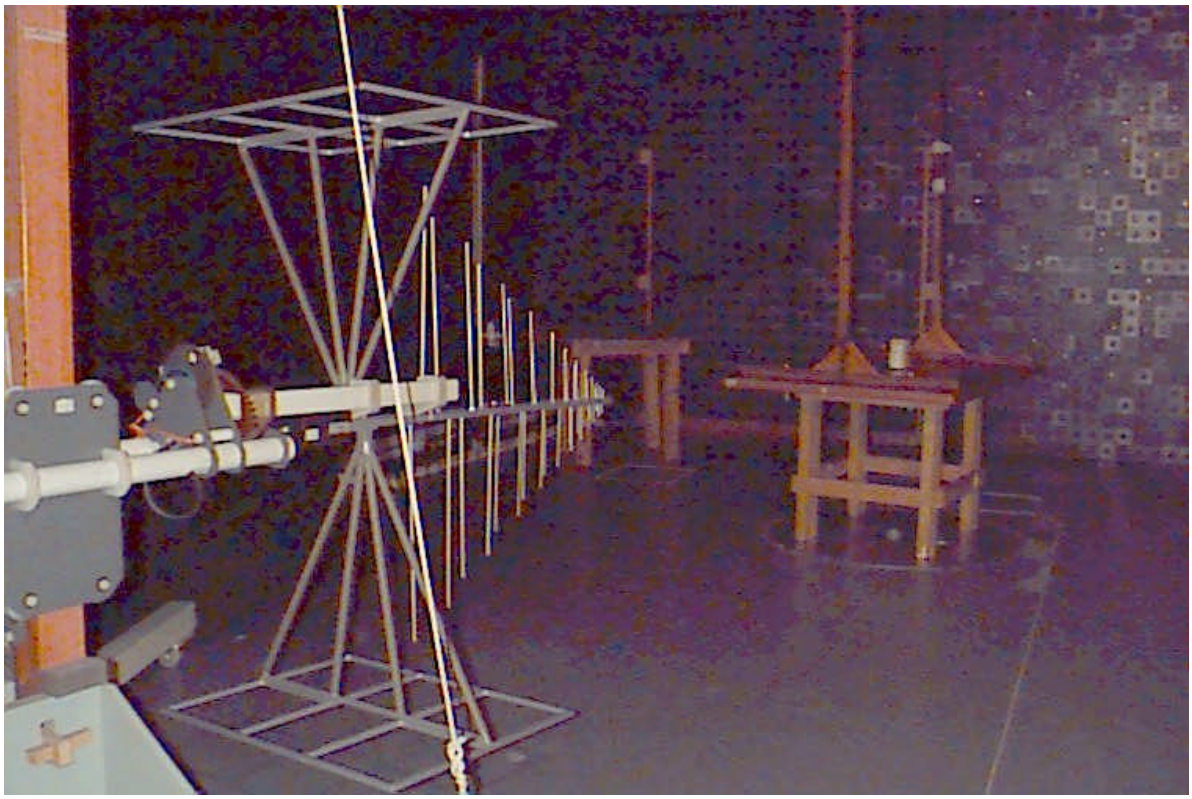


Figure 4.1.1
Radiated emission test setup

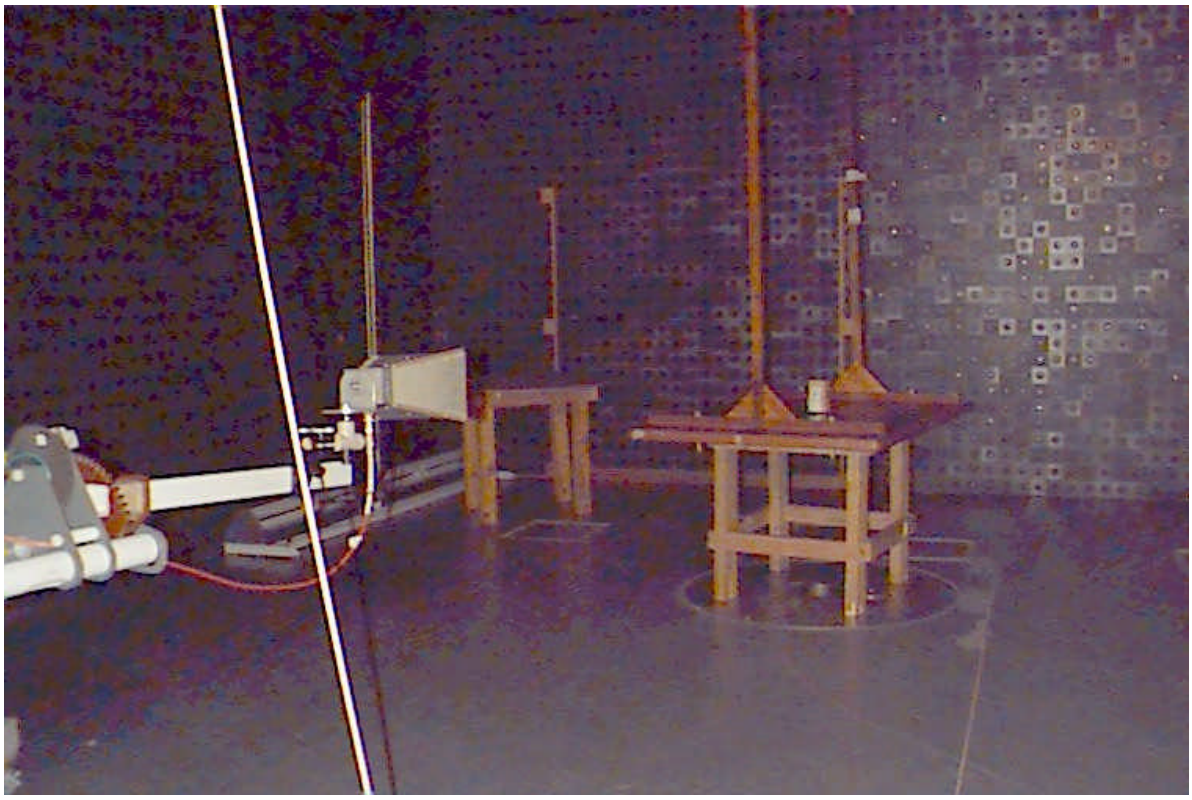


Photograph 4.1.1
Radiated emission measurements setup

Photograph 4.1.2
Radiated emission measurements setup, frequency range 30 MHz – 1 GHz



Photograph 4.1.3
Radiated emission measurements setup, frequency range 1 – 3 GHz



4.2 Bandwidth of emission according to § 15.231 (c)

4.2.1 Specified limits

The bandwidth of the emissions shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

4.2.2 Test procedure and results

The maximum allowed occupied bandwidth was calculated as 0.0025 of the center frequency:

0.0025 x 315 MHz = 785 kHz

The spectrum trace data around transmitter fundamental frequency was obtained with the spectrum analyzer in “Max Hold” mode. The bandwidth value was determined between two points 20 dB down from the modulated carrier. The occupied bandwidth of 435 kHz was measured which is narrower than admitted 785 kHz.

The test results are shown in Plot 4.2.1.

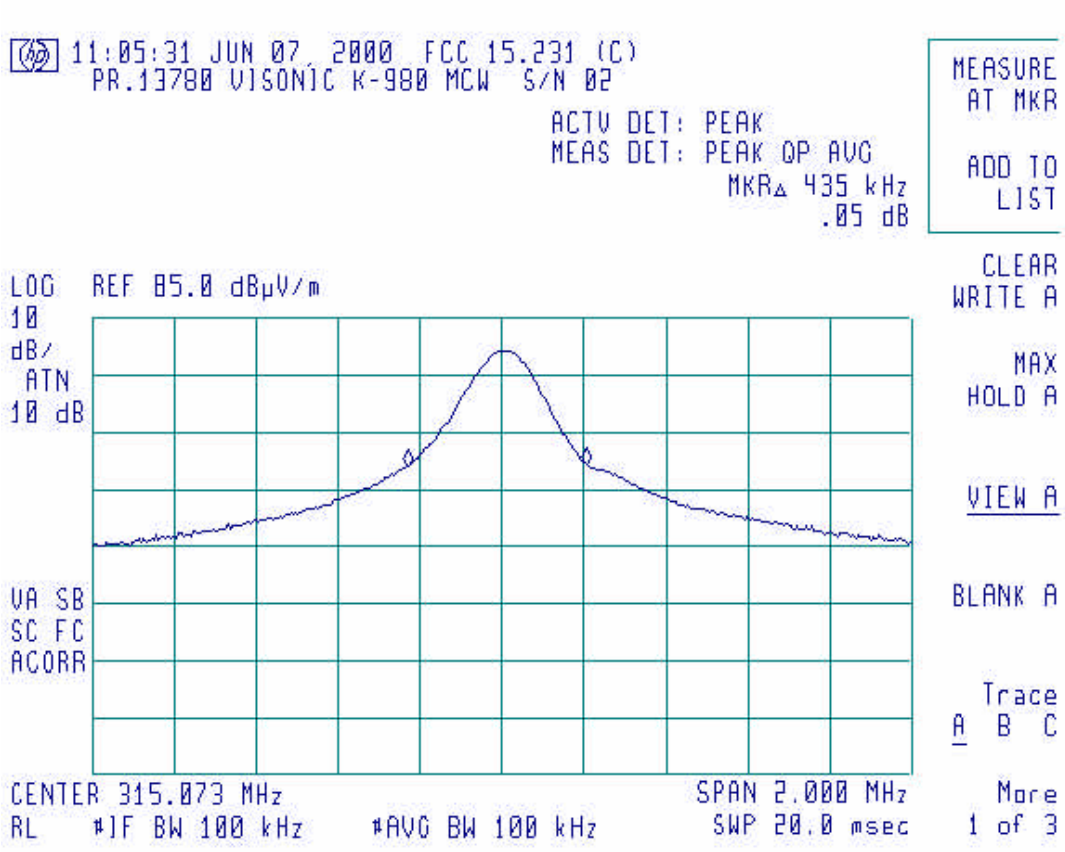
Reference numbers of test equipment used

HL 0025	HL 0026	HL 0034	HL 0041	HL 0091	HL 0287	HL 0509

Full description is given in Appendix A.

Plot 4.2.1

Emission bandwidth measurements result



4.3 Periodic operation requirement §15.231 (a) (2)

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

The K 980 MCW when activated by an alarm/intrusion detection, will activate the transmitter for 2 seconds. When the transmitter is activated, it will emit 3 bursts of 270 ms each, therefore the requirement is fully met.

APPENDIX A – Test equipment and ancillaries used for tests

HL Serial No.	Serial No.	Description	Manufacturer	Model No.	Due Calibr.
0041	2811	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	8/01
0465	023	Anechoic Chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	3/01
0521	0319	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	7/01
0589	589	Cable Coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	11/00
0604	9611-1011	Antenna biconilog log-periodic/T bow-tie, 26 - 2000 MHz	EMCO	3141	7/01
1175	NA	Microwave 5 m cable	Gore	01C02245.2	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).