ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC PART 15, SUBPART C, §15.209

FOR

Given Imaging Ltd.

EQUIPMENT UNDER TEST

Low power image transmitter
model CAP2A

Hermon Laboratories Ltd.
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ACCREDITED
839.01
Electrical

Description of equipment under test

Test items	Low power transmitter
Manufacturer	Given Imaging Ltd.
Type (Model)	CAP2A
Serial number	157

Applicant information

Applicant's representative	Mr. Semion Khait, project manager
Company	Given Imaging Ltd.
Address	Bldg. 7, New Industrial Park
P.O.Box	258
Postal code	20692
City	Yokneam
Country	Israel
Telephone number	+972 4959 9670
Telefax number	+972 4959 2466

Test performance

Project Number	14168
Location of the test	Hermon Laboratories, Binyamina, Israel
Test performed	November 26, 2000
Purpose of test	Compliance with FCC requirements
Test specification(s)	FCC part 15, subpart C, §15.209 (a); (c)

Table of Contents

1. Summary and signatures

The EUT, low power transmitter, CAP2A, was tested according to FCC part 15 subpart C, §.15.209 and **found to comply** with standard requirements.

Test performed by:

Mr. Yuri Neuman, test engineer

Test report prepared by:

Mrs. V. Mednikov, certification engineer

Test report approved by:

Mr. M. Nikishin, EMC group leader

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

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:

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 low power image transmitter enclosed in a capsule and intended for gastrointestinal imaging. The transmitter operates at 432.13 MHz frequency with MSK modulation and is powered by 3 V internal battery.

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
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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.

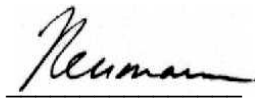
3.2.1 Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

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

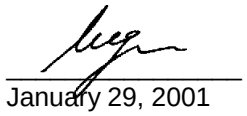
3.3 Statement of qualification

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 1992 with an MScEE degree, have obtained 8 years experience in research and development of electronic devices.
I have been with Hermon Laboratories since January 2000.

Name: Mr. Yuri Neuman Signature: 
Position: test engineer Date: January 29, 2001

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: January 29, 2001

4 Radiated emission measurements

4.1 Field strength of emissions according to § 15.209 (a), (c)

4.1.1 Specified limits

Table 4.1.1 Carrier limit

Frequency, MHz	Field strength of fundamental, µV/m (dBµV/m)	Measurement distance, m
432.13	200 (46)	3

Table 4.1.2 Unintentional radiator emission limits at 3 m measurement distance

Frequency, MHz	Class B equipment , dB(µV/m)
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 5000	54

4.1.2 Test procedure

According to customer request the measurements were performed with the EUT inside human body having the following physical parameters:
weight – 74 kg,
waste – 82 cm,
height – 182 cm.

A man with a shielded belt and the EUT in his intestine was sitting (or the EUT itself was put) on the wooden bench 80 cm height, placed on the flush mounted turntable, as shown in Figure 4.1.1 and Photographs 4.1.1, 4.1.2. The EUT was operated in continuous transmitting mode. The frequency range was investigated with biconilog and double ridged guide antennas from 30 MHz to 5 GHz.
To find maximum radiation the turntable was rotated 360^{o}, measuring antenna height was changed from 1 to 4 m, and the antenna polarization was changed from vertical to horizontal.
The peak and quasi-peak detectors were used.
The test measurement results were recorded in Table 4.1.3 and shown in Plots 4.1.1 to 4.1.3.
No emissions except the carrier were found throughout the testing.

The EUT was found to comply with the standard requirements.

Reference numbers of test equipment used

HL 0041	HL 0465	HL 0521	HL 0589	HL 0604	HL 1175

Full description is given in Appendix A.

Table 4.1.3 Radiated emission measurements test results
(EUT inside human body, with shielded belt)

TEST SPECIFICATION:	FCC part 15 subpart C § 15.209
EUT:	S/N 157
DATE:	January 21, 2001
RELATIVE HUMIDITY:	49%
AMBIENT TEMPERATURE:	23°C
DETECTOR	QUASI-PEAK

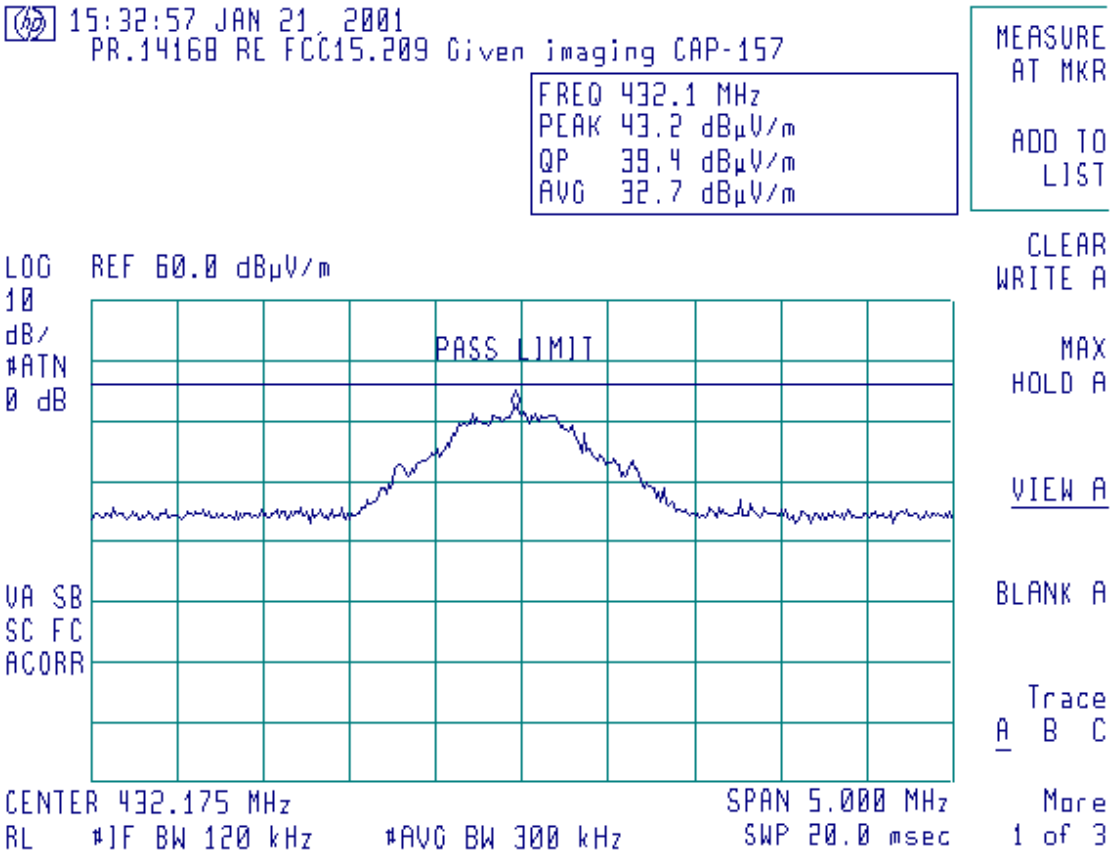
MEASUREMENTS PERFORMED AT 3 METER DISTANCE

Frequency, MHz	Radiated emissions, dB (μV/m)	Specification limit, dB (μV/m)	Margin, dB	Pass/ Fail
432.1	39.4	46	6.6	Pass

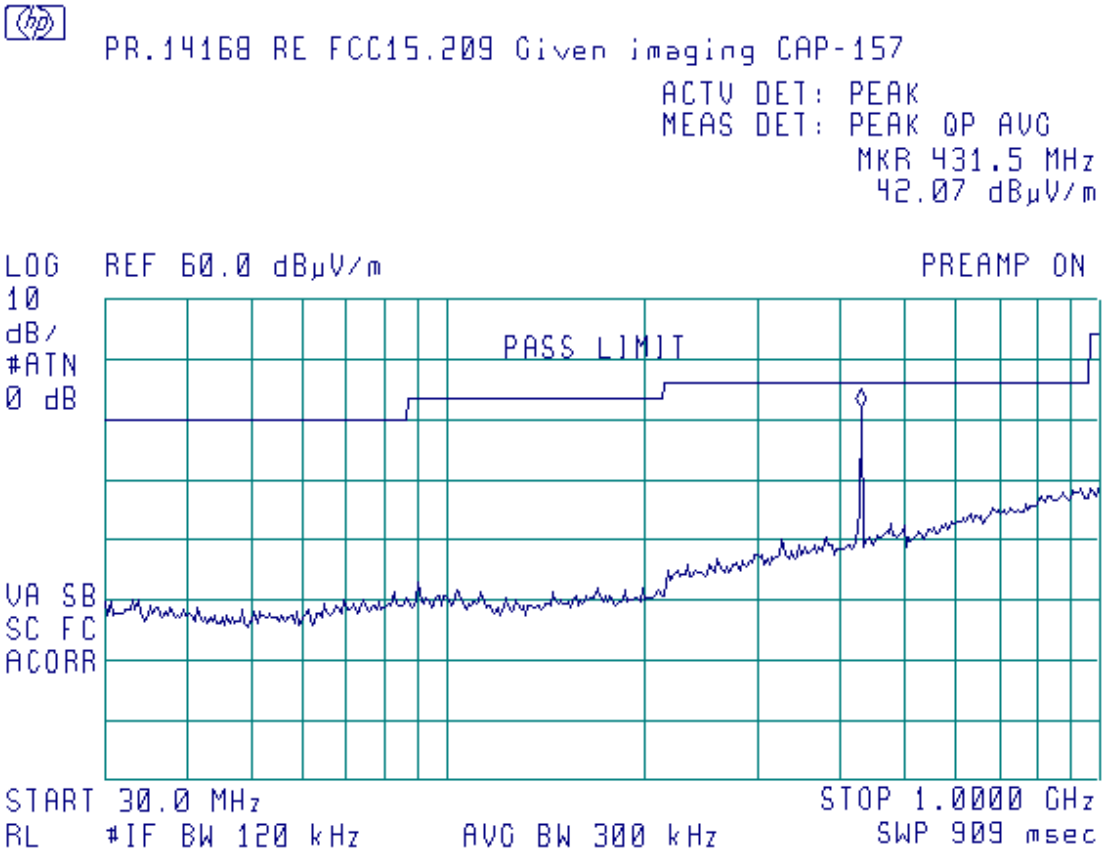
Notes to table:

Test measurement results listed in the tables were obtained throughout the testing with quasi-peak detector, resolution bandwidth = 120 kHz, and biconilog antenna in vertical polarization @ 1 meter height. Margins = dB below (negative if above) specification limit.

Plot 4.1.1
Carrier frequency measurements
Test site: anechoic chamber



Plot 4.1.2
Spurious emission measurements
Test site: anechoic chamber
Frequency range 30 MHz – 1 GHz



Plot 4.1.4
Spurious emission measurements
Test site: anechoic chamber
Frequency range 1 – 5 GHz

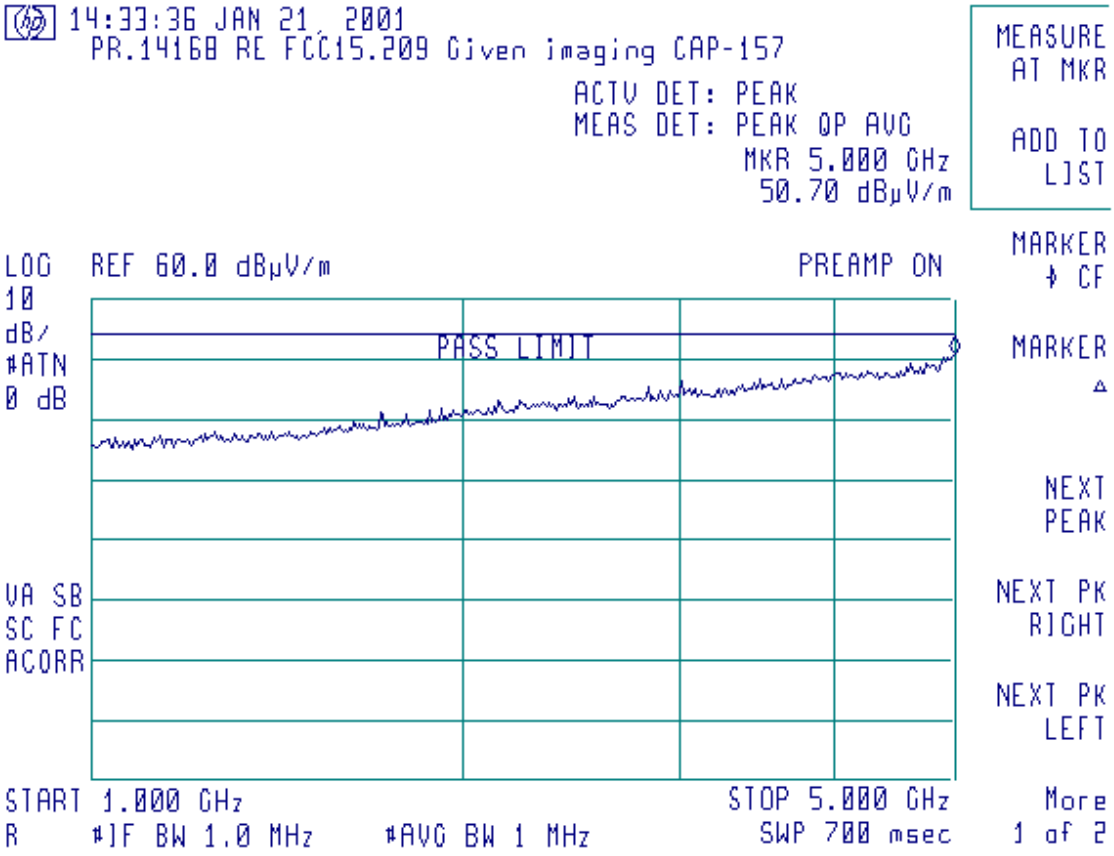
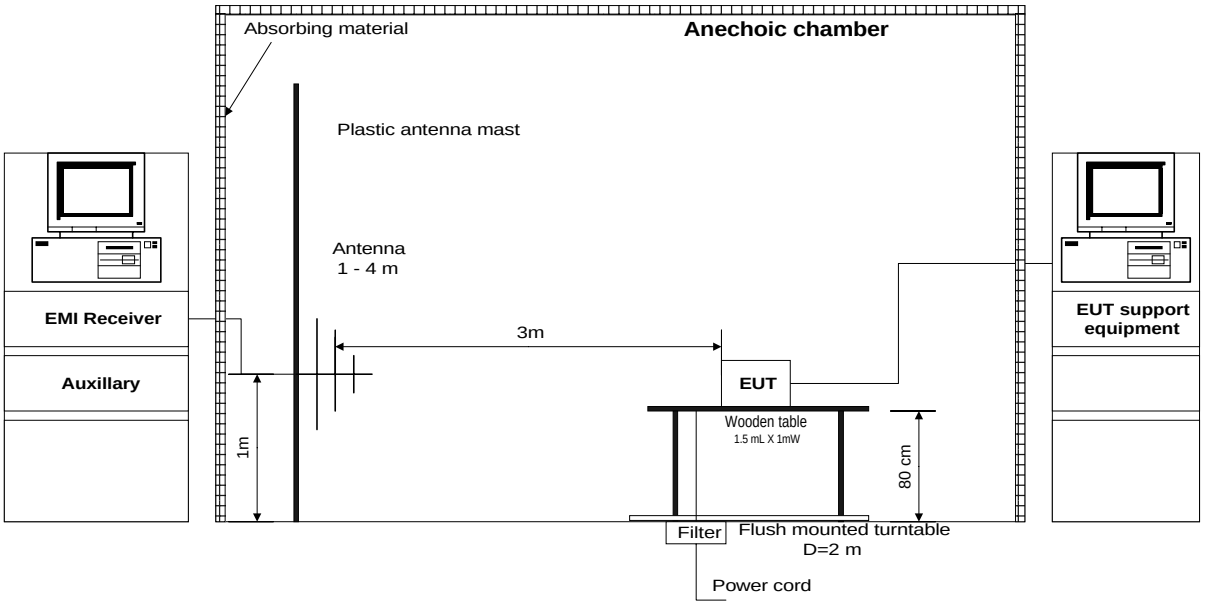
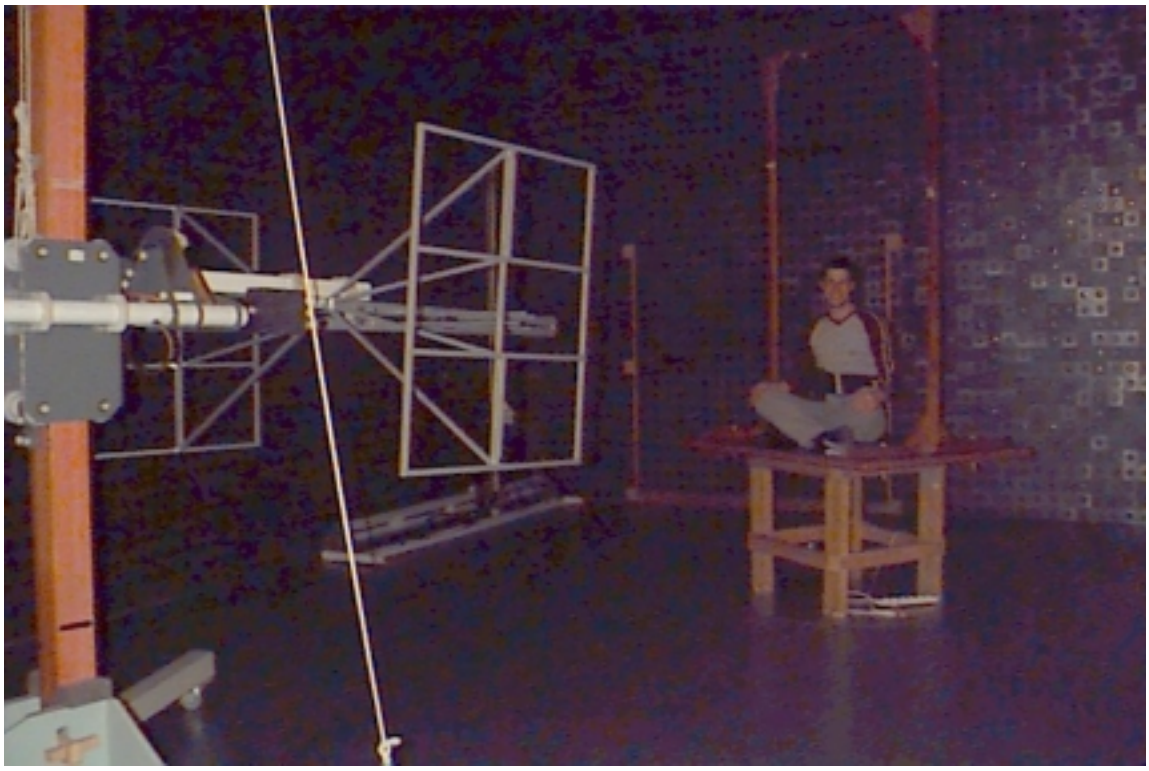


Figure 4.1.1
Radiated emission test setup



Photograph 4.1.1
Radiated emission test setup



Photograph 4.1.2
Radiated emission test setup

APPENDIX A – Test equipment and ancillaries used for tests

HL Serial No.	Description	Manufacturer	Serial No.	Model No.	Due Calibr.
0041	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	2811	8/01
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	023	AC-1	3/03
0521	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	7/01
0589	Cable Coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	11/01
0594	Turntable for Anechoic Chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	102	WDC1	11/01
0604	Antenna Biconilog Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	9611-1011	3141	12/01
1175	Microwave 5 m cable	Gore	01C02245.2	NA	2/01

APPENDIX B-Test equipment correction factors

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 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