



## **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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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) |



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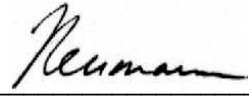


## 1. Summary and signatures

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

  
\_\_\_\_\_

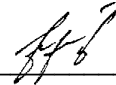
**Test report prepared by:**

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.

***This test report must not be reproduced in any form except in full, with the approval of Hermon Labs Ltd.***



## 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( $\mu$ V)   | decibel referred to one microvolt                                    |
| dB( $\mu$ V/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. |
| $\Omega$       | 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:<br>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

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: $\pm 3.2$ dB<br>Double ridged guide antenna: $\pm 2.36$ 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

Position: test engineer

Signature:

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

Position: certification engineer

Signature:

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,<br>MHz | Field strength of<br>fundamental,<br>$\mu\text{V/m}$ (dB $\mu\text{V/m}$ ) | Measurement<br>distance,<br>m |
|-------------------|----------------------------------------------------------------------------|-------------------------------|
| 432.13            | 200 (46)                                                                   | 3                             |

**Table 4.1.2 Unintentional radiator emission limits at 3 m measurement distance**

| Frequency,<br>MHz | Class B equipment ,<br>dB( $\mu\text{V/m}$ ) |
|-------------------|----------------------------------------------|
| 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°, 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,<br>MHz | Radiated<br>emissions,<br>dB ( $\mu$ V/m) | Specification<br>limit,<br>dB ( $\mu$ V/m) | Margin,<br>dB | Pass/<br>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**

15:32:57 JAN 21, 2001

PR.14168 RE FCC15.209 Given imaging CAP-157

FREQ 432.1 MHz  
PEAK 43.2 dB $\mu$ V/m  
QP 39.4 dB $\mu$ V/m  
AVG 32.7 dB $\mu$ V/m

MEASURE  
AT MKR

ADD TO  
LIST

CLEAR  
WRITE A

MAX  
HOLD A

VIEW A

BLANK A

Trace  
A B C

More  
1 of 3

LOG REF 60.0 dB $\mu$ V/m

10  
dB/  
#ATN  
0 dB

PASS LIMIT

VA SB  
SC FC  
ACORR

CENTER 432.175 MHz

RL #1F BW 120 kHz

#AVG BW 300 kHz

SPAN 5.000 MHz

SWP 20.0 msec



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



PR.14168 RE FCC15.209 Given imaging CAP-157

ACTV DET: PEAK

MEAS DET: PEAK OP AVG

MKR 431.5 MHz

42.07 dB $\mu$ V/mLOG REF 60.0 dB $\mu$ V/m

PREAMP ON

10  
dB/  
#ATN  
0 dBVA SB  
SC FC  
ACORR

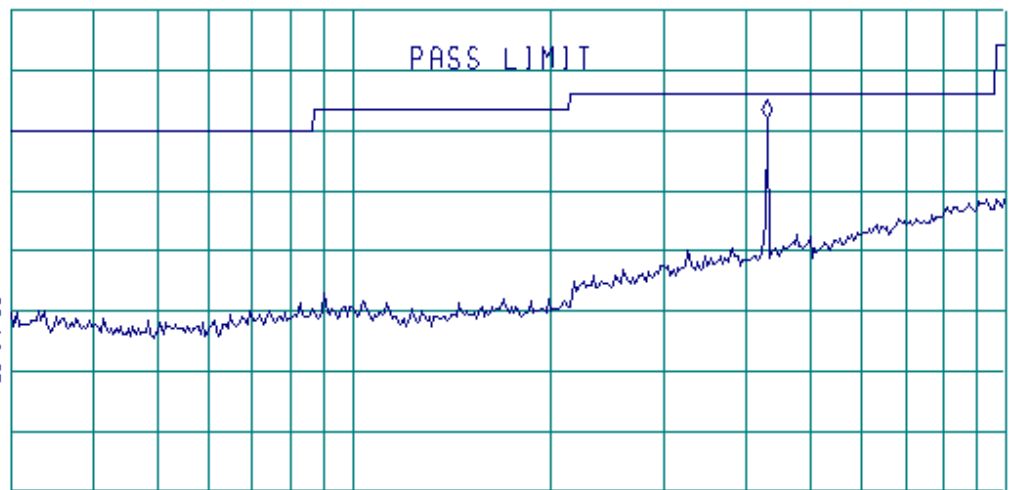
START 30.0 MHz

RL #IF BW 120 kHz

AVG BW 300 kHz

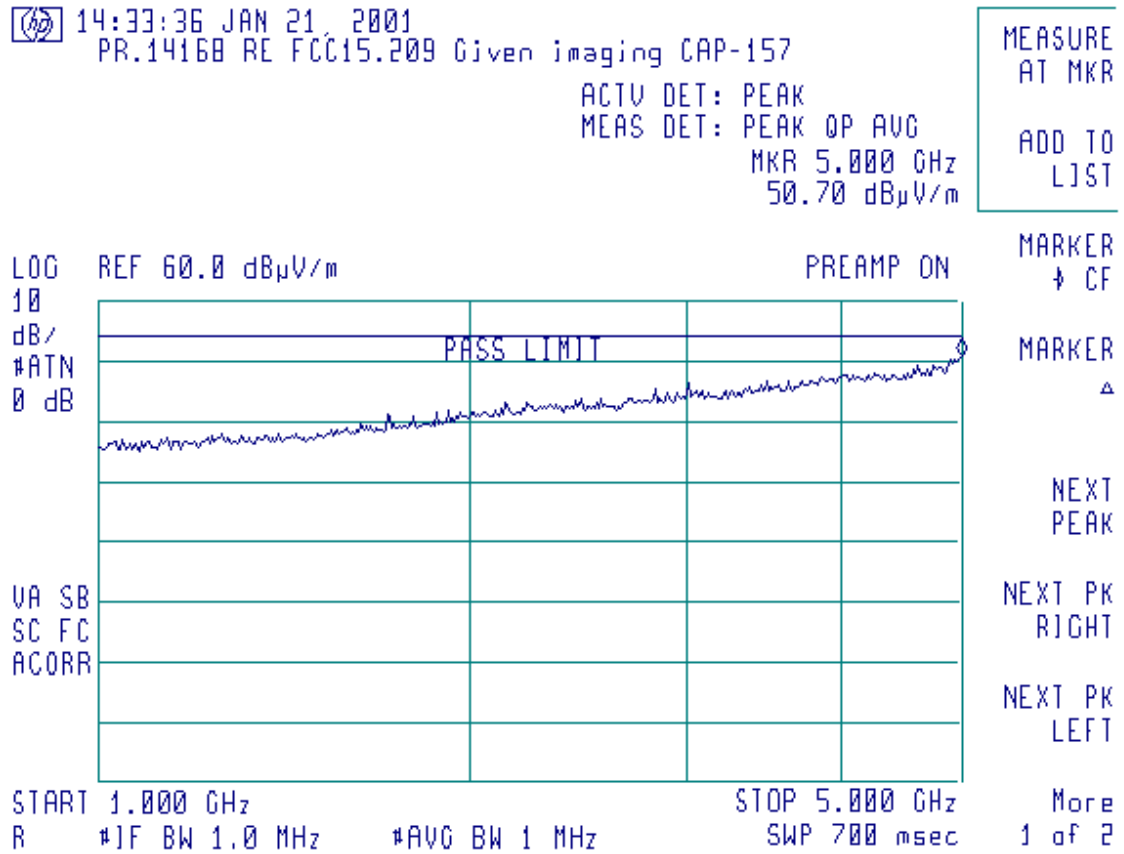
STOP 1.0000 GHz

SWP 909 msec



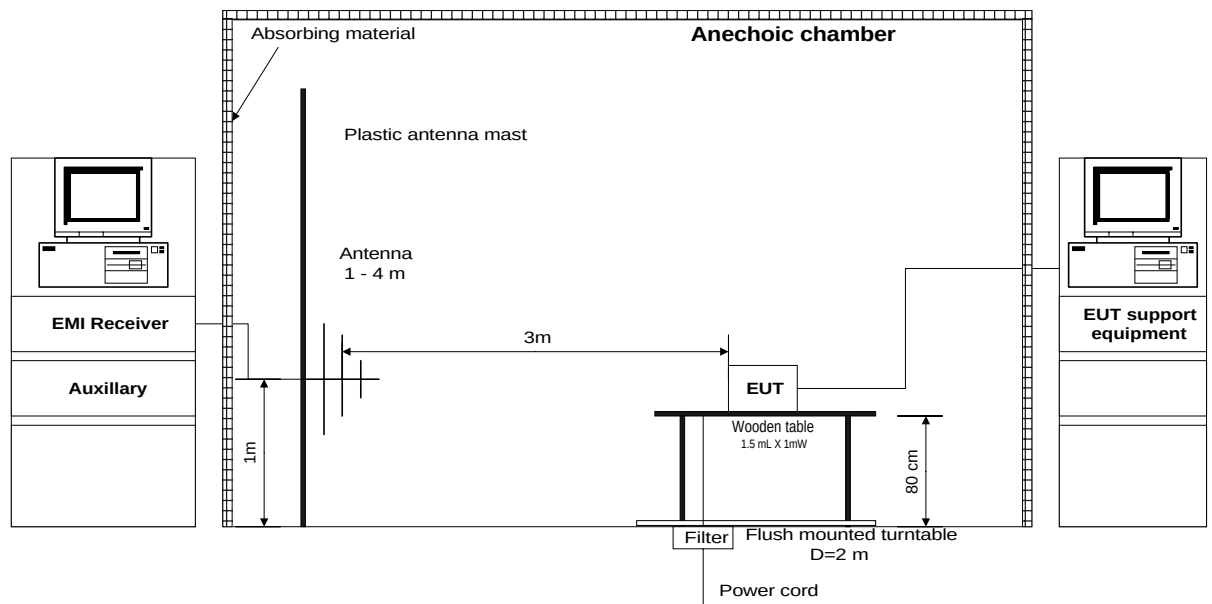


**Plot 4.1.4**  
**Spurious emission measurements**  
**Test site: anechoic chamber**  
**Frequency range 1 – 5 GHz**



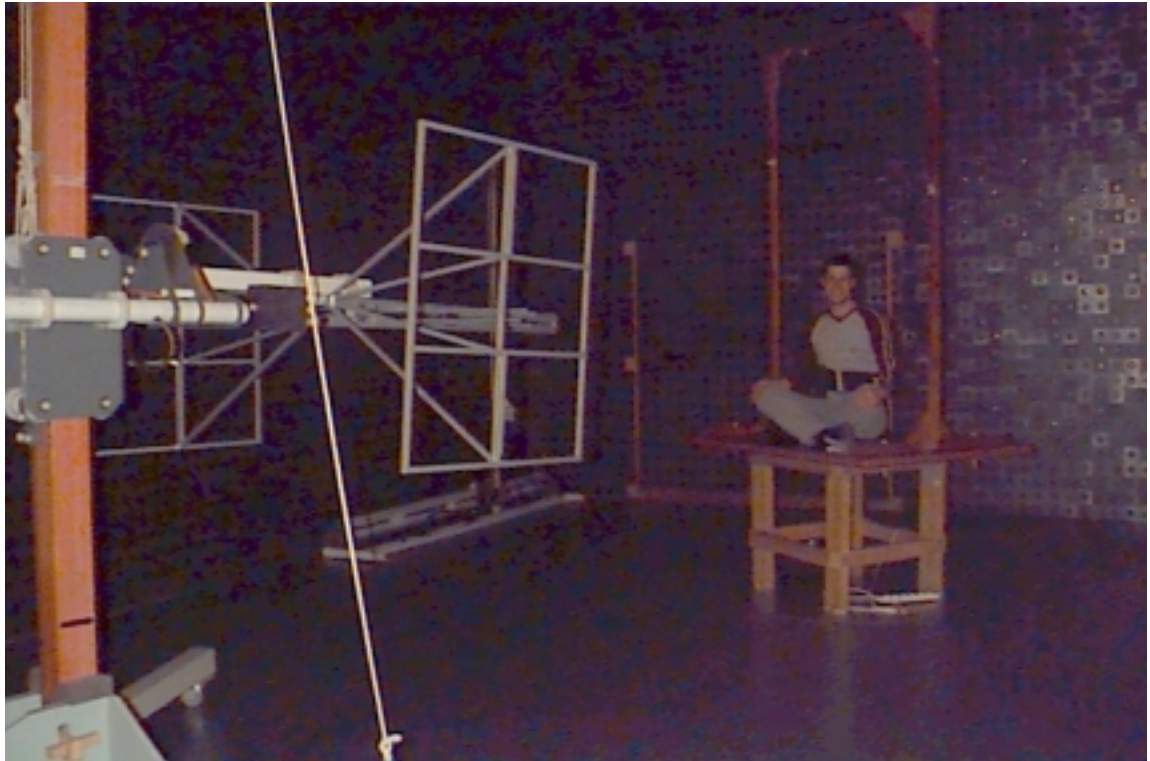


**Figure 4.1.1**  
**Radiated emission test setup**





**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<br>Serial<br>No. | Description                                                                      | Manufacturer    | Serial<br>No. | Model<br>No. | Due<br>Calibr. |
|---------------------|----------------------------------------------------------------------------------|-----------------|---------------|--------------|----------------|
| 0041                | Double ridged guide antenna, 1-18 GHz                                            | Electro-Metrics | RGA 50/60     | 2811         | 8/01           |
| 0465                | Anechoic chamber<br>9 (L) x 6.5 (W) x 5.5 (H)<br>m                               | Hermon Labs     | 023           | AC-1         | 3/03           |
| 0521                | Spectrum Analyzer with<br>RF filter section (EMI<br>Receiver 9 kHz - 6.5<br>GHz) | Hewlett Packard | 8546A         | 0319         | 7/01           |
| 0589                | Cable Coaxial, GORE<br>A2POL118.2, 3m                                            | Hermon Labs     | GORE-3        | 589          | 11/01          |
| 0594                | Turntable for Anechoic<br>Chamber, flush<br>mounted, d=1.2 m,<br>pneumatic       | Hermon Labs     | 102           | WDC1         | 11/01          |
| 0604                | Antenna Biconilog Log-<br>Periodic/T Bow-Tie, 26 -<br>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( $\mu$ V) to convert to field intensity in dB( $\mu$ V/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( $\mu$ V) to convert to field intensity in dB( $\mu$ V)/meter