

FCC requirements § 2.1033 (b)(6)

TEST MEASUREMENT REPORT

Contains 25 pages and follows this page.

ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC PART 15, SUBPART C, §15.209

FOR
Hi-G-Tek Ltd.

EQUIPMENT UNDER TEST
HI-G-SEAL Hand Held Terminal
model IG-MA-22
FCC ID:OB6-IGMA22-01

Prepared by: Cherniavsky
Mrs. M. Cherniavsky, certif. engineer
Hermon Labs

Approved by: A. Usoskin
Mr. A. Usoskin, QA manager
Hermon Labs

Approved by: Y. Haimovich
Mr. Y. Haimovich, Vice President R&D
Hi-G-Tek Ltd.

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of Hermon Laboratories Ltd.***



Description of equipment under test

Test items	Hand held terminal, FCC ID:OB6-IGMA22-01
Manufacturer	Hi-G-Tek Ltd. Microelectronics & Asset Tracking Technology
Brand Mark	Hi-G-Tek
Type (Model)	IG-MA-22, P/N TA3158
S/N	000048
Trade Mark	Hi-G-Seal

Applicant information

Applicant's representative	Mr. Rony Cohen, chief engineer
Applicant's responsible person	Mr. Yossi Haimovich, VP R&D
Company	Hi-G-Tek Ltd. Microelectronics & Asset Tracking Technology
Address	16 Hacharoshet St.
P.O. Box	NA
Postal code	60375
City	Or-Yehuda
Country	Israel
Telephone number	011-972-3533 9359
Telefax number	011-972-3533 9225

Test performance

Project Number	13067
Location of the test	Hermon Laboratories, Binyamina, Israel
Test started	November 29, 1998
Test completed	December 3, 1998
Purpose of test	The EUT certification in accordance with CFR 47, part 2, §2.1033
Test specification(s)	FCC part 15, subpart C, §15.209

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.



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1 General Information

1.1 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(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
DC	direct current
EUT	Equipment Under Test
GHz	gigahertz
H	height
HL	Hermon Laboratories
HP	Hewlett Packard
Hz	hertz
IF	intermediate frequency
kHz	kilohertz
L	length
m	meter
mm	millimeter
MHz	megahertz
msec	millisecond
mW	milliwatt
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



1.2 Specification References

CFR 47 part 15: October 1997	Radio Frequency Devices.
ANSI C63.2:06/1987	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.

1.3 EUT Description

The EUT, Hi-G-Seal active hand held terminal (reader), model IG-MA-22, is a part of Hi-G-Seal system, that enables sealing of containers and verifying of assets that need to be sealed against and monitored for any trail to tamper with them. The hand held terminal enables the user to interrogate the active Hi-G-Seals. Every opening or closing of the seal is logged and can be remotely read.

The data stored in the seal can be read by means of a hand held reader using an RF communication link at a distance of up to 1 meter from the seal. The terminal contains a transceiver with a permanently attached antenna. Transmitted frequency is $250 \pm 0.5\%$ kHz, maximum transmitted power is 335 mW. The EUT is powered by 4 x 1.5 V alkaline batteries.



1.4 Statement of Manufacturer

I, Yossi Haimovich, Vice President R&D of Hi-G-Tek Ltd. Microelectronics & Asset Tracking Technology, declare that Hi-G-Seal active hand held terminal, model IG-MA-22, was tested on November 29 and on December 3, 1998 by Hermon Laboratories and which this test report applies to, is identical of the equipment that will be marketed.

The term identical means identical within the variations that can be expected to arise as a result of quantity production technique.

Yossi Haimovich, Vice President R&D
Hi-G-Tek Ltd. Microelectronics & Asset Tracking Technology

Signature: Haimovich

Date: Jan. 6, 1999

2 Test Facility Description

2.1 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), listed by Industry Canada for radiated measurements (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), recognized by VDE (Germany) for witness test, certified by VCCI (Japan), assessed by NMI Certin B.V. (Netherlands) for a number of EMC, Telecommunications and Safety standards, recognized by TUV Sudwest (Germany) for Safety testing, 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.

2.2 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.

2.2.1 Uncertainty in Hermon Labs Measurements.

Radiated Emissions (95% Confidence)	<p>Biconical Antenna: 3m measuring distance : + 4.06 dB Expanded uncertainty : - 3.98 dB Expanded uncertainty : + 2.032 dB Combined standard uncertainty : - 1.99 dB Combined standard uncertainty</p> <p>10m measuring distance : + 3.98 dB Expanded uncertainty : - 4.08 dB Expanded uncertainty : + 1.99 dB Combined standard uncertainty : - 2.04 dB Combined standard uncertainty</p> <p>Log periodic Antenna: 3m measuring distance : + 4.74 dB Expanded uncertainty : - 3.26 dB Expanded uncertainty : + 2.37 dB Combined standard uncertainty : - 1.63 dB Combined standard uncertainty</p> <p>10m measuring distance : + 3.06 dB Expanded uncertainty : - 3.00 dB Expanded uncertainty</p>
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2.3 Laboratory Personnel

The two people of Hermon Laboratories that have participated in measurements and documentation preparation are: Mr. Michael Feldman, test technician and Mrs. Marina Cherniavsky - certification engineer.

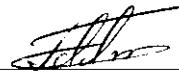
M. Cherniavsky is a telecommunication engineer certified by the National Association of Radio and Telecommunications Engineers (NARTE, USA).

The Hermon Laboratories' personnel that participated in this project have more than 50 years combined experience time in EMC measurements and electronic products design.

2.4 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 a technician, have obtained 29 years experience in electronics and measurements. I have been with Hermon Laboratories since 1995.

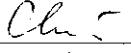
Name: Mr. Michael Feldman
Position: test technician

Signature: 
Date: December 30, 1998

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 25 years experience in electronic products design and development and 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
Position: certification engineer

Signature: 
Date: December 30, 1998



3 Radiated Emission Measurements

3.1 Field Strength of Emissions according to § 15.209 (a)

3.1.1 Specified limit

Frequency, MHz	Field strength, microvolts/meter	Measurement distance, meters
0.009 – 0.490	2400/F(kHz)	300

3.1.2 Extrapolation (distance correction) factor

The test was performed in the anechoic chamber at 3 meter test distance, i.e. the distance between measuring antenna and EUT boundary. The results were extrapolated by using the square of an inverse linear distance extrapolation factor DF:

$$DF = 40 \log (D_1/D_2) = 80 \text{ dB, where}$$

D_1 is the 300 meters specified measurement distance

D_2 is the 3 meters test measurement distance.

The DF=80 dB was applied for limit calculation at 3 m test distance measurements.

For 249 kHz frequency the calculated limit is:

$$\text{Limit}_{3\text{m}} = \text{Limit}_{300\text{ m}} + DF = 19.6 \text{ dB}(\mu\text{V/m}) + 80 \text{ dB} = 99.6 \text{ dB}(\mu\text{V/m}).$$

3.1.3 Test Procedure and Results

The EUT was placed on the wooden turntable, as shown in Figure 3.1.1, Photographs 3.1.1, 3.1.2 and was operated in continuous modulated transmitting mode. During testing the EUT was positioned in three orthogonal axes and the measurements were performed with loop antenna. The center of the loop was 1 m above the ground. The frequency range from the lowest generated signal frequency up to 10th harmonic was investigated. To find maximum radiation the turntable was rotated 360°, the antenna was rotated about its vertical axis and the antenna polarization was changed from vertical to horizontal. The average detector was used. The test measurement results were recorded into Table 3.1.1 and are shown in Plot 3.1.1.

Reference numbers of test equipment used

HL 0275	HL 0446	HL 0465	HL 0521	HL 0593	HL 0594	HL 0815
HL 0816						

Full description is given in Appendix A.

**Table 3.1.1****Radiated Emission Measurements – Test Results**

TEST SPECIFICATION: FCC part 15 subpart C § 15.209
COMPANY: Hi-G-Tek Ltd.
EUT: Hand held terminal, IG-MA-22
DATE: December 3, 1998
RELATIVE HUMIDITY: 67%
AMBIENT TEMPERATURE: 21°C

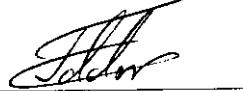
MEASUREMENTS PERFORMED AT 3 METRES DISTANCE

Frequency kHz	Resolution Bandwidth kHz	Measured Result dB (μ V)	Correction Factor dB	Calculated Limit dB (μ V/m)	Specified Margin dB	Pass/ Fail
249.75	9	82.7	80	99.6	16.9	Pass

Notes to Table:

Average detector and Loop antenna were used.
Calculated Limit is in accordance with section 3.1.2 of this test report.

Test Performed by:
Mr. Michael Feldman, test technician



Hermon Labs

Plot 3.1.1
Radiated Emission Test Results

09:12:08 DEC 03, 1998 FCC p 15
HI-TEK EUT-1G-MA-22 Pr.13067

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 250 kHz
88.63 dB μ 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

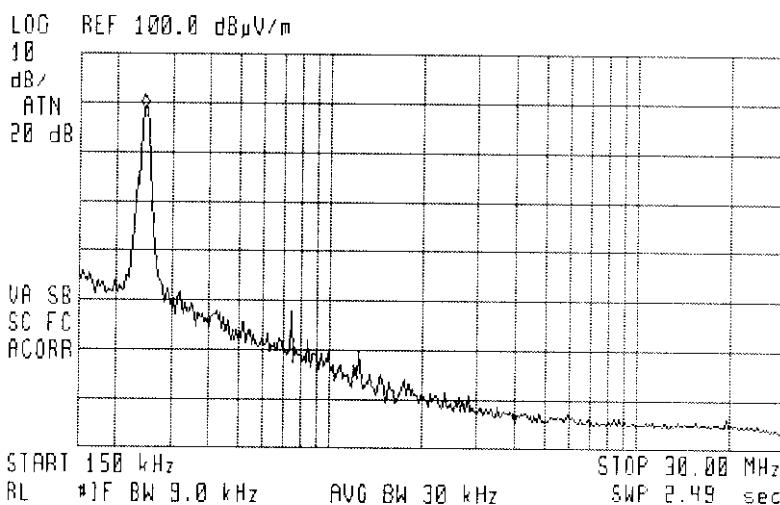
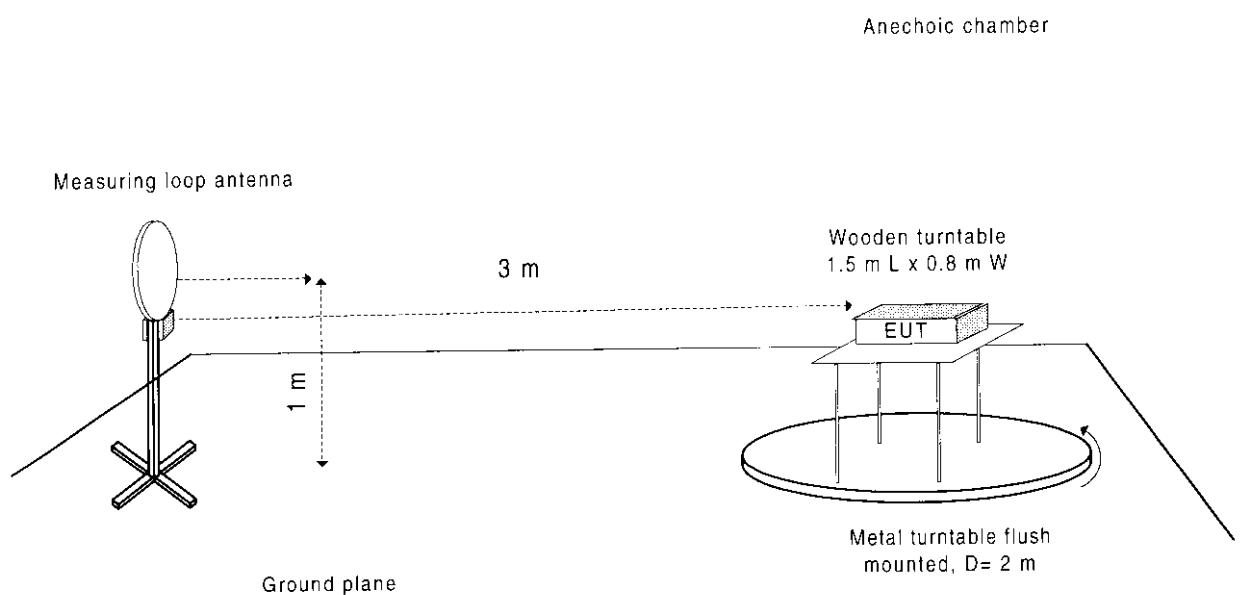


Figure 3.1.1
Radiated Emission Test Setup





3.2 Unintentional Radiated emissions test

3.2.1 Definition of the test

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

3.2.2 The test set-up configuration, Test Procedure and Results

The radiated emissions measurements of the EUT in receive mode and incorporated digital device were performed in the open field test site at 3 meter measuring distance in the frequency range from 30 MHz to 1 GHz. The EUT was placed on the wooden table as shown in Figure 3.2.1. The biconical and log periodic antennas were used. To find maximum radiation the turntable was rotated 360°, the measuring antenna height changed 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 and quasi peak detector.

The test measurement results were recorded in Table 3.2.1 and are shown in Plot 3.2.1.

Reference numbers of test equipment used

HL 0027	HL 0028	HL 0032	HL 0034	HL 0038	HL 0275	HL 0287
HL 0415	HL 0813					

Full description is given in Appendix A.



Table 3.2.1
Radiated Emission Measurements Test Results
Frequency range 30 MHz - 1 GHz

TEST SPECIFICATION: FCC part 15 subpart C § 15.109
 COMPANY: Hi-G-Tek Ltd.
 EUT: Hand held terminal, IG-MA-22
 DATE: December 3, 1998
 RELATIVE HUMIDITY: 67%
 AMBIENT TEMPERATURE: 21°C

MEASUREMENTS PERFORMED AT 3 METRES DISTANCE

Frequency (MHz)	Ant. Type	Ant. Pol.	Ant. Hgt. (m)	TT Pos. (°)	Radiated Emissions dB (μ V/m)	Correction factor dB (1/m)	Radiated Emissions dB (μ V/m)	Spec. Limit dB (μ V/m)	Spec. Margin dB	Pass/ Fail
82.6	Bic	V	1.0	-190	12	9.2	21.1	40.0	18.8	Pass
208.0	LP	H	1.5	-32	18	15.3	33.3	43.5	10.2	Pass
210.8	LP	H	1.5	-46	18	15.3	33.3	43.5	10.2	Pass
248.1	LP	H	1.0	145	21	16.6	37.6	46.0	8.4	Pass
256.1	LP	H	1.5	-47	21	16.8	37.8	46.0	8.2	Pass

Notes to Table Calculations:

Measurements were performed with quasi-peak detector

Resolution bandwidth = 120 kHz

Ant. Type = Antenna Type (Bic-biconical, LP – log periodic)

Ant. Pol. = Antenna polarization (V-vertical, H-horizontal)

Ant. Hgt. = Antenna height

TT Pos. = Turntable position in degrees, (EUT front panel = 0°)

Spec. Margin = Specification Margins = dB below (negative if above) specification limit.

Test Performed by:
 Mr. Michael Feldman, technician

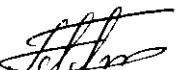
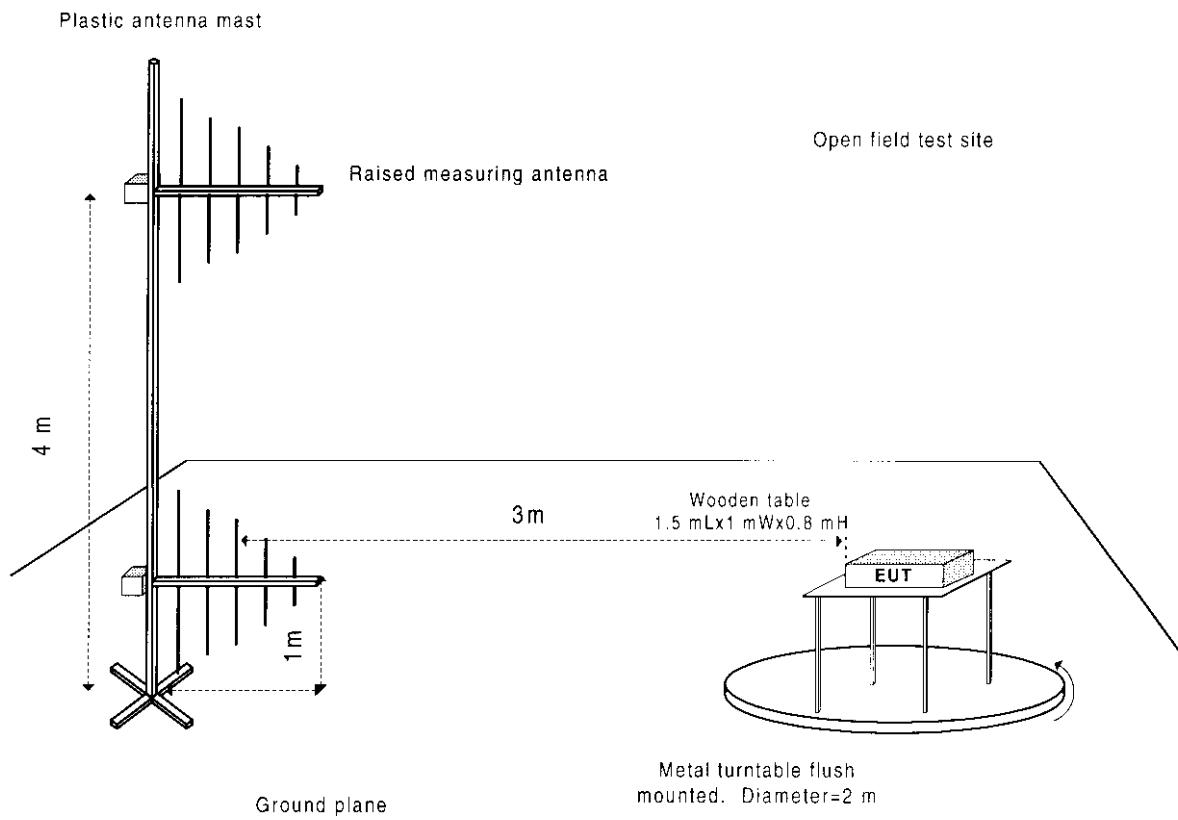

 Hermon Labs

Figure 3.2.1
Radiated Emission Test Setup





4. Summary and Signatures

The EUT, active Hand held terminal, was found to be in compliance with the FCC part 15 subpart B §15.109 class B and subpart C §15.209 limits.

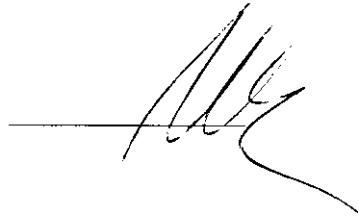
Test performed by:

Mr. Michael Feldman, test technician



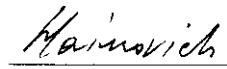
Approved by:

Dr. Edward Usoskin, C.E.O.



Responsible person from Hi-G-Tek Ltd. Microelectronics & Asset Tracking Technology

Mr. Yossi Haimovich, Vice President R&D



**APPENDIX A – Test equipment and ancillaries used for tests**

HL Serial No.	Serial No.	Description	Manufacturer	Model No.	Due Calibr.
0027	4838	Spectrum Analyzer, 50 Hz-2 GHz	Anritsu	MS-611A	10/99
0028	4147	Interference Analyzer, 9KHz-1GHz	Electro-Metrics	EMC 30MKIV	7/99
0032	3577	Biconical Antenna, 20-200 MHz	Electro-Metrics	BIA-25/30	4/99
0034	1988	Log Periodic Antenna, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	4/99
0038	38	Antenna Mast, 1-4 m	Hermon Labs	AM-1	2/99
0275	0275	Wooden Table, 1.5 x 1.0 x 0.8	Hermon Labs	WT-1	NA
0287	0287	Metal Turntable Flush Mounted	Hermon Labs	HLTT-MDC1	4/99
0415	415	Cable, coax, RG-214, 10.5 m, N-type connectors	Hermon Labs	C3M	8/99
0446	2857	Antenna, Loop active, 10 kHz – 30 MHz	Electro- Mechanics	6502	10/99
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	593	Antenna Mast, 1-4 m/ 1-6 m Pneumatic	Hermon Labs	HLAM-F1	4/99
0594	594	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
0813	813	Cable, coax, RG-214, 12 m, N-type connectors	Hermon Labs	CRA	8/99
0815	815	Cable, coax, RG-214, 7.3 m, N-type connectors	Hermon Labs	C56	8/99
0816	816	Cable, coax, RG-214, 8 m, N-type connectors	Hermon Labs	C7576	8/99

APPENDIX B-Test Equipment Correction Factors

Antenna Factor
Loop Antenna, Electro-Mechanics, Model 6502
Ser.No.2857

Frequency MHz	Antenna Factor dB(1/m)
0.009	18.7
0.010	17.7
0.020	13.2
0.050	10.4
0.075	10.2
0.100	9.9
0.150	9.8
0.250	9.9
0.500	9.8
0.750	9.7
1.000	10.1
2.000	10.0
3.000	10.2
4.000	10.1
5.000	10.1
10.000	9.6
15.000	9.6
20.000	9.3
25.000	8.7
30.000	7.5

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



Electro-Metrics
Antenna Factor at 3m test distance
Biconical Antenna Electro-Metrics Model BIA-25/30
Ser.No.3577

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
30	14.6	120	16.0
35	12.8	125	15.1
40	12.5	130	15.0
45	12.8	135	15.0
50	12.6	140	14.8
55	11.7	145	14.7
60	11.6	150	16.5
65	10.3	155	17.0
70	9.0	160	17.0
75	8.0	165	17.4
80	8.9	170	18.0
85	9.4	175	18.9
90	11.1	180	19.1
95	12.3	185	19.8
100	13.6	190	20.4
105	14.3	195	20.1
110	15.5	200	20.4
115	18.6		

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

Antenna Factor at 3m test distance
Log Periodic Antenna Electro-Metrics Model LPA-25/30
Ser.No.1988

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	15.1	625	25.3
225	15.0	650	25.9
250	16.3	675	27.2
275	17.3	700	27.5
300	18.5	725	28.1
325	19.1	750	28.0
350	19.4	775	28.3
375	20.0	800	28.5
400	20.8	825	29.1
425	21.3	850	29.5
450	22.0	875	29.9
475	22.8	900	30.3
500	23.4	925	30.3
525	23.8	950	30.6
550	24.2	975	31.2
575	24.6	1000	31.8
600	24.8		

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



HERMON LABORATORIES

APPENDIX C- A2LA Accreditation



**American Association for Laboratory Accreditation****SCOPE OF ACCREDITATION TO ISO/IEC GUIDE 25-1990 (EN 45001)**

HERMON LABORATORIES
P.O. Box 23
Binayamina 30550, Israel
Edward Usoskin Phone: 972 6 6288 001

ELECTRICAL (EMC)

Valid to: March 31, 1999

Certificate Number: 0839.01

In recognition of the successful completion of the A2LA evaluation process,
accreditation is granted to this laboratory to perform the following tests:

Electromagnetic Compatibility

Radiated Emissions Tests
Conducted Emissions Tests

Product Safety Testing

Heat Resistance	Flammability
Impulse	Overload
Clearance & Creepage Distance	Leakage Current
Temperature Rise	Hot Wire Ignition
High Current Arcing Ignition	Dielectric Withstanding
Bonding Resistance	

Telecommunications Testing

Longitudinal Balance	Return Losses
Environmental Stresses, Surges	Hazardous Voltages
DTMF & Pulse Dialing	Hearing Aids
On Hook, Off Hook DC/AC Impedances	Billing Protection
In-Band, Out of Band Signals	

On the following equipment:

Information Technology Equipment (ITE); Industrial, Scientific and Medical Equipment (ISM); Telecommunications Equipment; Electrical Appliances; Portable Tools; Motors; Transformers; and Similar Electrical Apparatus

Using the following test methods/specifications/standards:

FCC Part 15 using ANSI C63.4 - 1992
ANSI/UL 1950 - 1994
AS 3260
AS/NZS 1044, AS/NZS 2064, AS/NZS 3548
CISPR 11 - 1990, CISPR 14, CISPR 22 - 1993
EN 55011 - 1991, EN 55014 - 1987, EN 55022 - 1994, EN 60950 - 1993
IEC 950 - 1996
Israeli Ministry of Communications Specification No. 023/96
TS 001, TS 002, TS 004
US Code of Federal Regulation (CFR) 47 Parts 15, 18, and 68

Revised 06/25/97

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FCC requirements § 2.1033 (b)(7)

DEVICE PHOTOGRAPHS

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