



HERMON LABORATORIES



Electrical

Hermon Laboratories Ltd.
P.O.Box 23
Binyamina 30550, Israel
Tel. +972 46288001
Fax. +972 46288277
e-mail: mail@hermonlabs.com

ELECTROMAGNETIC EMISSION TEST REPORT

ACCORDING TO 47CFR PART 15, SUBPART C § 15.209, 15.205 AND SUBPART B
for

Hi-G-Tek Ltd.

EQUIPMENT UNDER TEST:

Micro Reader

Model IG-MA-125S

This report is in conformity with and ISO/IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation.
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 Laboratories Ltd.**

Page 1 of 23

Document ID: HIGRAD_FCC.15025.doc
Date of Issue: February 2002



Contents

1	PROJECT INFORMATION.....	3
2	SUMMARY OF TESTS.....	4
3	EUT DESCRIPTION	6
3.1	GENERAL DESCRIPTION	6
3.2	EUT TEST CONFIGURATION	6
3.3	TRANSMITTER DESCRIPTION.....	7
4	TESTS RESULTS	8
4.1	FIELD STRENGTH OF EMISSION ACCORDING TO §15.209.....	8
4.2	UNINTENTIONAL RADIATED EMISSIONS TEST ACCORDING TO §15.109.....	9
	APPENDIX A PLOTS	11
	APPENDIX B TEST SET UP PHOTOGRAPHS	14
	APPENDIX C TEST EQUIPMENT USED FOR TESTS	17
	APPENDIX D GENERAL INFORMATION	18
	TEST FACILITY DESCRIPTION.....	18
	ABBREVIATIONS AND ACRONYMS.....	18
	SPECIFICATION REFERENCES	18
	FCC EQUIPMENT CODES AND DESCRIPTIONS.....	19
	APPENDIX E TEST EQUIPMENT CORRECTION FACTORS	20



1 Project information

Description of equipment under test

Test items	Micro Reader
Manufacturer	Hi-G-Tek
Type (Model)	IG-MA-125S
Hardware revision	A00
Software release	1.02
Serial number	1367343128
Equipment FCC code ¹	DSR

Applicant information

Applicant's responsible person	Mr. Sharon Azran, Project Manager
Company	Hi-G-Tek
Address	16 Haharoshet street,
Postal code	60375
City	Or-Yehuda
Country	Israel
Telephone number	+972 3 5331575
Telefax number	+972 3 5339225

Test performance

Project number:	15025
Location	Hermon Laboratories
Receipt date	March 5, 2002
Test performed	March 5, 2002
Purpose of test	Apparatus compliance verification in accordance with emission requirements
Test specifications	47CFR Part 15, §15.209, 15.205 and subpart B

¹ FCC Equipment codes – see Appendix D



2 Summary of tests

The tests listed in the table below were performed. The EUT was found complying with the limits of 47CFR Part 15, §15.209, 15.205 and subpart B.

Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Intentional radiation, §15.209								
Field strength of emission	(a)	C				Mr. Y. Neuman, test engineer	March 5, 2002	
Unintentional radiation, §15.107, §15.109								
Conducted emissions	15.107				NA			
Radiated emissions	15.109	C				Mr. Y. Neuman, test engineer	March 5, 2002	
NOTE: C: The parameter is compliant with the requirements. NC: The parameter is not compliant with the requirements. NT: The parameter is not tested. NA: The test of this parameter is not applicable.								



Parameter	Subclause	C	NC	NT	NA	Remarks
General conditions under Part 15						
The Intentional radiator operates at 125 kHz.	15.209	C				
The intentional radiator does not operate in the restricted bands of operation.	15.205	C				
The intentional radiator has permanently attached antenna or antenna that uses a unique coupling to the intentional radiator.	15.203	C				
The intentional radiator has a standard connector and must be professionally installed. To demonstrate that professional installation is required, the following three points must be addressed: (a) the application (or intended use) of the EUT; (b) the installation requirements of the EUT, and (c) the method by which the EUT will be marketed.	15.203				NA	
No antenna other than that furnished by the responsible party can be used with the device.	15.203				NA	
Antenna technical characteristics, as referred to in "Transmitter description" table in the test report	15.204	C				
NOTE: C: The parameter is compliant with the requirements. NC: The parameter is not compliant with the requirements. NT: The parameter is not tested. NA: The test of this parameter is not applicable.						

Test report prepared by: Ms. N. Averin, certification engineer

Mr. M. Nikishin, EMC group leader

Test report approved by: Mr. A. Usoskin, QA manager



3 EUT description

3.1 General description

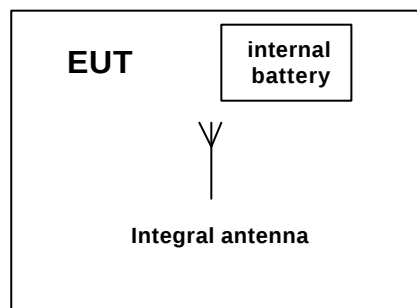
The EUT, Micro Reader, model IG-MA-125S, is a transceiver, which provides data exchange with DataSeals. The device operates at 125 kHz and is powered from 12 V alkaline battery.

Local oscillator frequency is 4 MHz.

3.2 EUT test configuration

The EUT test configuration is shown in Figure 3.2.1.

Figure 3.2.1 EUT test configuration





3.3 Transmitter description

Type of equipment					
☐	Stand-alone (Equipment with or without its own control provisions)				
☐	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
☐	Plug-in card (Equipment intended for a variety of host systems)				
☐	Other:				
Operating frequency			125 kHz		
Transmitter aggregate data rate (bits per second)				4000	
Normal test signal				Transmit carrier & transmit message	
Maximum rated output power					
At transmitter permanent external 50Ω rf output connector (dBm)					
Effective radiated power (for equipment with integral antenna) (dBm)				-25	
Is transmitter output power variable?	☐	No			
	☐	Yes			
			continuous variable		
			stepped variable		
			stepsize (dB):		
			minimum RF power (dBm):		
			maximum RF power (dBm):		
Transmitter power source					
☐	Battery		Nominal rated voltage (VDC)		12
	Nickel Cadmium				
	Lithium				
☐	Other: Alkaline A23				
	DC		Nominal rated voltage (VDC)		
	AC mains		Nominal rated voltage (VAC)		
Is there common power source for transmitter and receiver				☐	yes
				☐	no
Antenna technical characteristics					
			Type	Manufacturer	Model number
Integral	☐	with temporary RF connector			
	☐	without temporary RF connector	Ferrite	HI-G-TEK	ANT250
External					
External antenna connection					



4 Tests results

4.1 Field strength of emission according to §15.209

METHOD OF MEASUREMENTS: ANSI 63.4 §13.1.4
DATE: March 5, 2002
RELATIVE HUMIDITY: 61 %
AMBIENT TEMPERATURE: 22 °C
TEST PERFORMED IN: ANECHOIC CHAMBER
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
ANTENNA TYPE: LOOP

Average detector

Carrier frequency, kHz	Field strength, dB(μV/m)	Limit ¹ , dB(μV/m)	Margin, dB	Reference to Plots in Appendix A
126.5	59.5	105.6	46.1	A1, A2
Measurement uncertainty, dB		±4		

¹ The limit is based on measurements employing an average detector according to §15.209(d).

LIMIT

Frequency, MHz	Limit dB(μV/m)	Measurement distance, m
0.009 – 0.490	67.60-20logF*	300**
0.490 – 1.705	87.60-20logF*	30**
1.705 - 30	29.5	30**
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960*	54.0	3

* F is frequency in kHz.

**The limit for 3 m distance was calculated using the inverse square distance extrapolation factor as follows:

$\text{Lim}_{S_2} = \text{Lim}_{S_1} + 40 \log (S_1/S_2)$, where $S_1 = 300$ m or 30 m, $S_2 = 3$ m.

At 126.5 kHz frequency the limit was calculated:

$\text{Lim}_{3m} = 67.60 - 20 \log 126.5 + 40 \log (300/3) = 105.6 \text{ dB}(\mu\text{V/m})$

TEST EQUIPMENT USED:

HL 0446	HL 0465	HL 0521	HL 0589	HL 1004	HL 2009	
---------	---------	---------	---------	---------	---------	--

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table in each of three orthogonal planes in turn.

The loop antenna was positioned with its plane vertical. The loop center was 1 meter above the ground plane. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated about its vertical axis.



4.2 Unintentional radiated emissions test according to §15.109

METHOD OF MEASUREMENT: ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
TEST PERFORMED IN: ANECHOIC CHAMBER
DATE: March 5, 2002
RELATIVE HUMIDITY: 61 %
AMBIENT TEMPERATURE: 22 °C
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
THE EUT WAS TESTED AS: TABLE-TOP

	The EUT highest used frequency (not including operating frequency), MHz	Upper frequency of measurement range, MHz
	Below 1.705	30
	1.705 – 108	1000
	108 – 500	2000
	500 – 1000	5000
	Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

30 – 1000 MHz frequency range

DETECTOR TYPE: PEAK
RESOLUTION BANDWIDTH: 120 kHz
ANTENNA TYPE: BICONILOG

All the measured emissions were found more than 16 dB below specification limit, refer to Plot A3.

TEST EQUIPMENT USED:

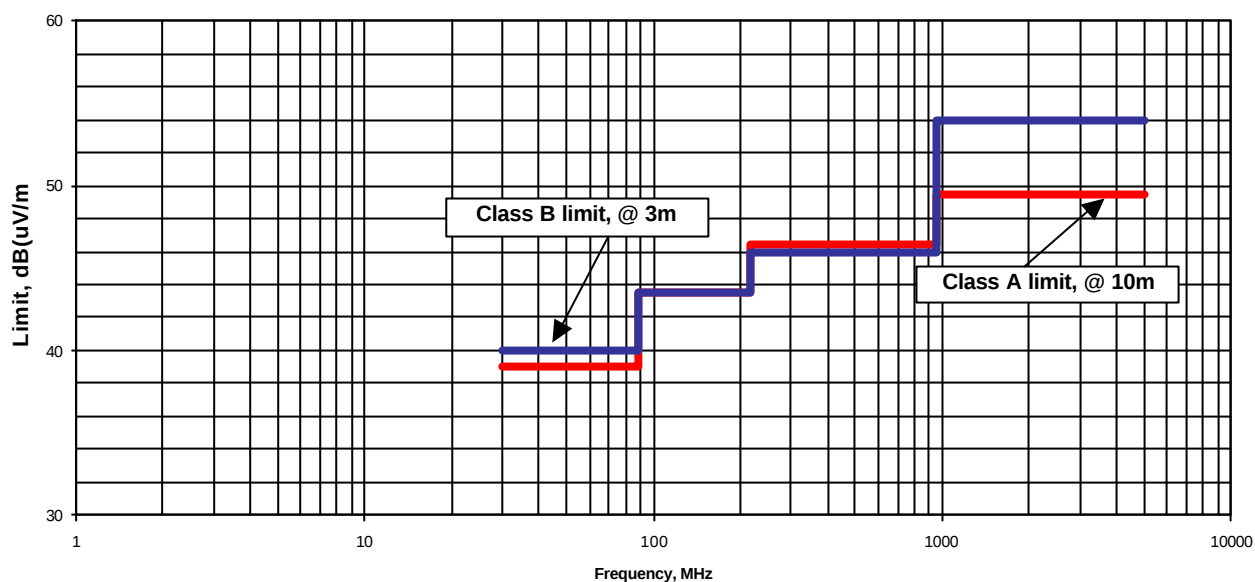
HL 0465	HL 0521	HL 0589	HL 0604	HL 1004	HL 2009	
---------	---------	---------	---------	---------	---------	--

LIMIT (§ 15.109)

Frequency, MHz	Class A equipment @ 10 m dB(μV/m)	Class B equipment @ 3 m dB(μV/m)
30 - 88	39.0	40
88 - 216	43.5	43.5
216 - 960	46.4	46
960 - 5000	49.5	54



Unintentional radiated emissions test according to § 15.109



TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table.

To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.



Appendix A Plots

Plot A1
Field strength of fundamental test result, 125 kHz carrier

10:57:13 MAR 05, 2002

FREQ 126.5 kHz
PEAK 44.6 dB μ V/m
QP 41.7 dB μ V/m
AVG 39.5 dB μ V/m

LOG REF 62.0 dB μ V/m

10
dB/
#ATT
0 dB

VA SB
SC FC
ACORR

CENTER 125.8 kHz

R #IF BW 9.0 kHz

AVG BW 30 kHz

SPAN 100.0 kHz

SWP 50.0 msec

$$E_{AVR} = 39.5 + 20 = 59.5 \text{ dB}(\mu\text{V/m})$$

Correction factor 20 dB is to be added to all results in the frequency range 9 kHz – 30 MHz.



Plot A2
Field strength of emission test results

10:45:00 MAR 05, 2002

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 120 kHz
43.57 dB μ V/m

LOG REF 62.0 dB μ V/m

10
dB/
#ATN
0 dB

VA SB
SC FC
ACORR

START 9.0 kHz

RL #IF BW 9.0 kHz

AVC BW 30 kHz

STOP 30.00 MHz

SWP 2.50 sec

Correction factor 20 dB is to be added to all results in the frequency range 9 kHz – 30 MHz.

The limit line in the range 9 kHz to 490 kHz is more than 10 dB above the reference line.



Plot A3
Unintentional radiated emissions test results

FREQUENCY RANGE:

30 – 1000 MHz

 11:32:28 MAR 05, 2002

VERTICAL & HORIZONTAL POLARIZATION

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 904.7 MHz
29.95 dB μ V/m

LOG REF 60.0 dB μ V/m

PREAMP ON

10
dB/
#ATN
0 dB

PASS LIMIT

VA SB
SC FC
ACORR

START 30.0 MHz

R #IF BW 120 kHz

AVC BW 300 kHz

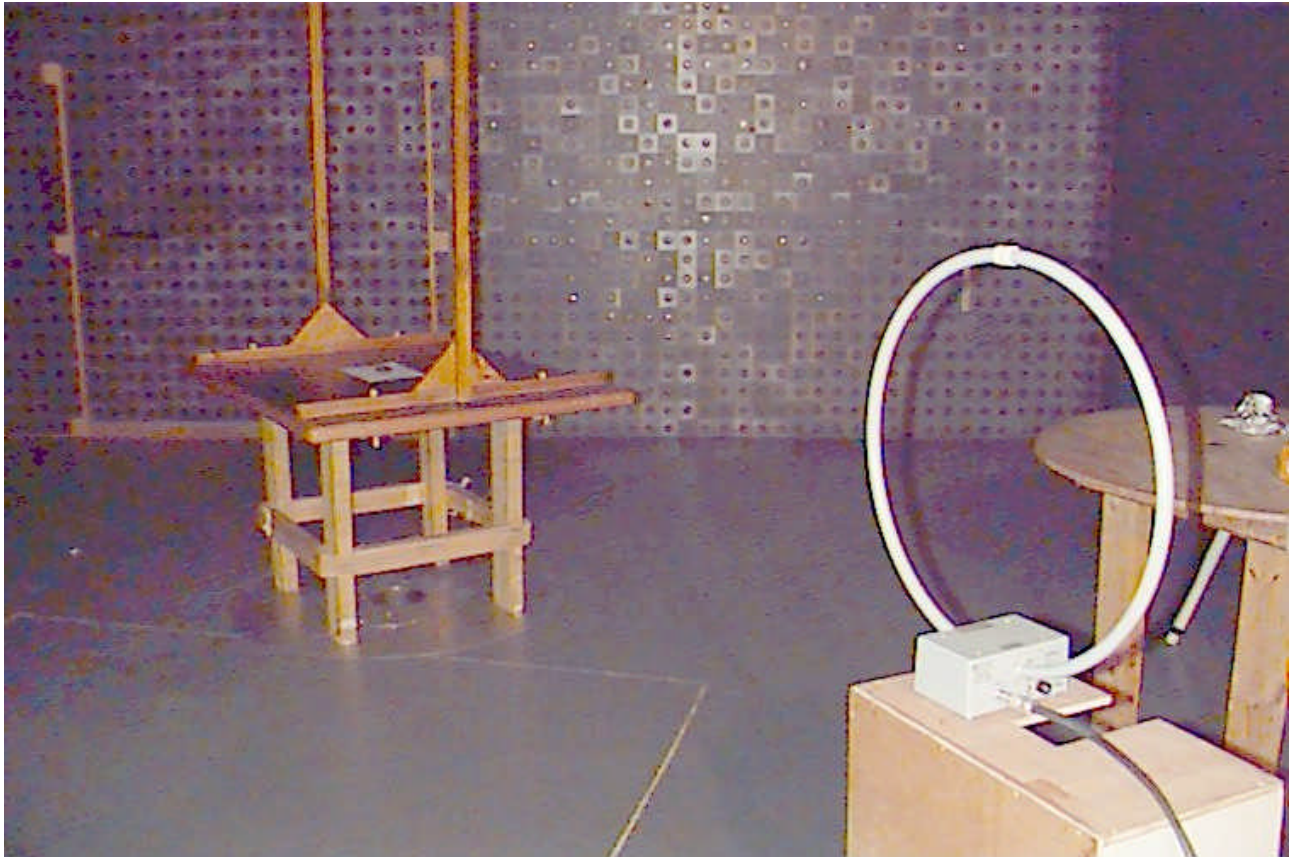
STOP 1.0000 GHz

SWP 909 msec



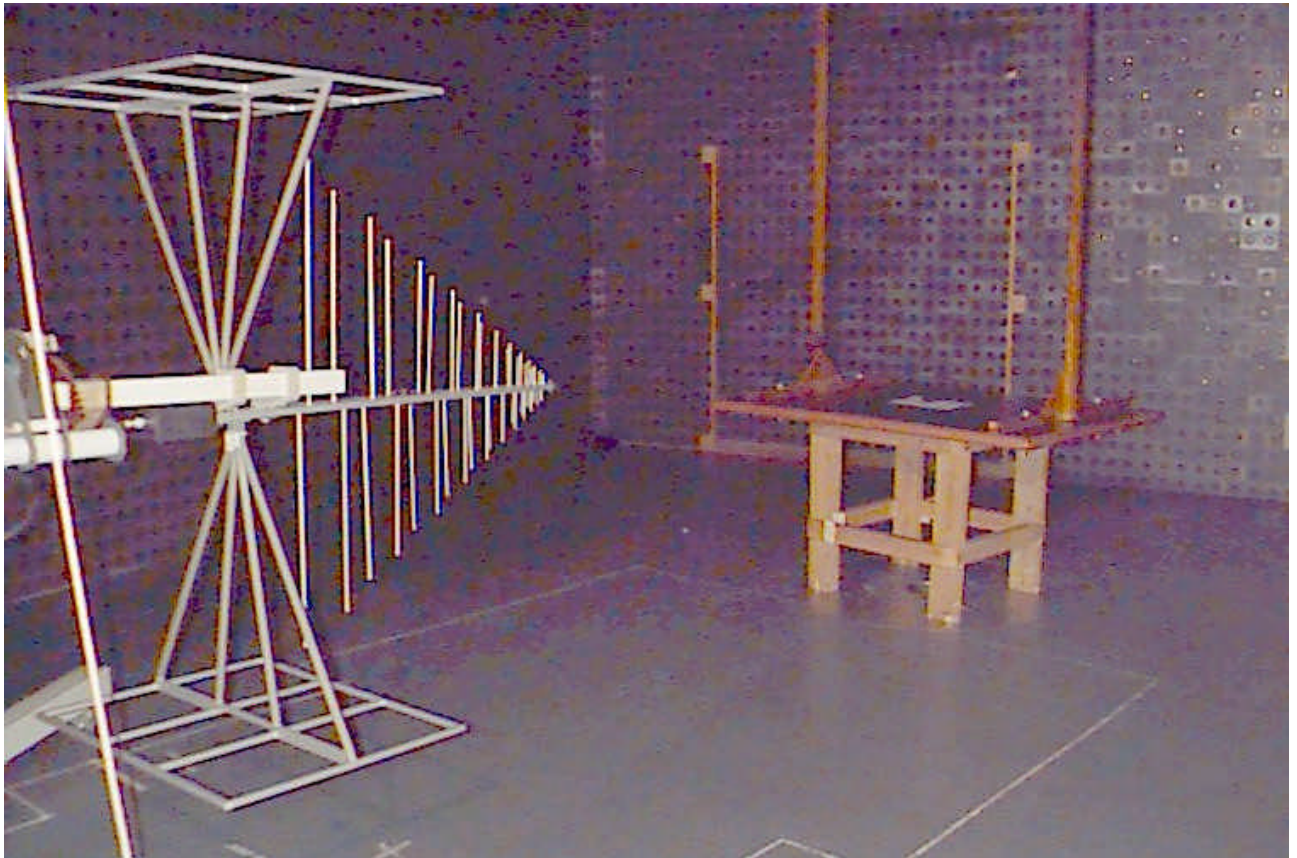
Appendix B Test setup photographs

Photograph 1 Radiated emission measurements test setup with loop antenna, 9 kHz – 30 MHz frequency range, anechoic chamber method





Photograph 2 Radiated emission measurements test setup with biconilog antenna, 30 MHz – 1000 MHz frequency range, anechoic chamber method





Photograph 3 Radiated emission measurements test setup, anechoic chamber method





Appendix C Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
0446	Active loop antenna 10 kHz-30 MHz	Electro- Mechanics	6502	2857	11/02
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	11/02
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/02
0589	Cable coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	11/02
0604	Antenna biconilog log- periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/03
1004	Cable, coaxial ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/02
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	12/02



Appendix D General information

Test facility description

Tests were performed at Hermon Laboratories Ltd., 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 electromagnetic emissions (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 TNO Certification EP&S (Netherlands) for a number of EMC, Telecommunications, Safety standards, and by AMTAC (UK) for safety of Medical Devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for Electromagnetic Compatibility, Product Safety, Telecommunications Testing and Environmental Simulation (for exact scope please refer to Certificate No. 839.01).

Address: PO Box 23, Binyamina 30550, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com

Person for contact: Mr. Alex Usoskin, QA manager.

Abbreviations and acronyms

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

cm	centimeter
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
EMC	electromagnetic compatibility
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
m	meter
MHz	megahertz
NA	not applicable
QP	quasi-peak
RF	radio frequency
RE	radiated emission
rms	root mean square
s	second
V	volt
W	width

Specification references

47CFR part 15: 2001	Radio Frequency Devices
ANSI C63.2: 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.



FCC Equipment codes and descriptions

CYY	Communications Receiver used w/ P.15 transmitter
DCD	Part 15 Low Power transmitter Below 1705 kHz
DSC	Part 15 Security/Remote Control Transmitter
DSR	Part 15 Remote Control/Security Device Transceiver
DSS	Part 15 Spread Spectrum Transmitter
DXX	Part 15 Low Power Communication Device Transmitter
EAV	Part 15 Automatic Vehicle Identification System
ETB	Part 15 Cordless Telephone Base Transceiver
ETR	Part 15 Cordless Telephone Remote Transceiver
ETS	Part 15 Cordless telephone system
FAP	Part 15 Anti-Pilferage Device
FDS	Part 15 Field Disturbance Sensor
GAT	Part 15 Auditory Assistance Device (Transmitter)
HID	Part 15 TV Interface Device
JBC	Part 15 Class B Computing Device/ Personal Computer
JBP	Part 15 Class B Computing Device Peripheral
PUB	Part 15 Unlicensed PCS base station
PUE	Part 15 Unlicensed PCS portable Tx held to ear
PUF	Part 15 Unlicensed PCS portable Tx held to face
PUT	Part 15 Unlicensed PCS portable Tx worn on body



Appendix E Test equipment correction factors

Antenna Factor
Active Loop Antenna
Model 6502
S/N 2857

Frequency, MHz	Antenna Factor, dB
0.009	-32.8
0.010	-33.8
0.020	-38.3
0.050	-41.1
0.075	-41.3
0.100	-41.6
0.150	-41.7
0.250	-41.6
0.500	-41.8
0.750	-41.9
1.000	-41.4
2.000	-41.5
3.000	-41.4
4.000	-41.4
5.000	-41.5
10.000	-41.9
15.000	-41.9
20.000	-42.2
25.000	-42.8
30.000	-44.0

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
Biconilog Antenna EMCO Model 3141
Ser.No.1011

Frequency, MHz	Antenna Factor, dB(1/m)
26	7.8
28	7.8
30	7.8
40	7.2
60	7.1
70	8.5
80	9.4
90	9.8
100	9.7
110	9.3
120	8.8
130	8.7
140	9.2
150	9.8
160	10.2
170	10.4
180	10.4
190	10.3
200	10.6
220	11.6
240	12.4
260	12.8
280	13.7
300	14.7
320	15.2
340	15.4
360	16.1
380	16.4
400	16.6
420	16.7
440	17.0
460	17.7
480	18.1
500	18.5
520	19.1
540	19.5
560	19.8
580	20.6
600	21.3
620	21.5
640	21.2
660	21.4
680	21.9
700	22.2
720	22.2
740	22.1
760	22.3
780	22.6
800	22.7
820	22.9
840	23.1
860	23.4
880	23.8
900	24.1
920	24.1

Frequency, MHz	Antenna Factor, dB(1/m)
940	24.0
960	24.1
980	24.5
1000	24.9
1020	25.0
1040	25.2
1060	25.4
1080	25.6
1100	25.7
1120	26.0
1140	26.4
1160	27.0
1180	27.0
1200	26.7
1220	26.5
1240	26.5
1260	26.5
1280	26.6
1300	27.0
1320	27.8
1340	28.3
1360	28.2
1380	27.9
1400	27.9
1420	27.9
1440	27.8
1460	27.8
1480	28.0
1500	28.5
1520	28.9
1540	29.6
1560	29.8
1580	29.6
1600	29.5
1620	29.3
1640	29.2
1660	29.4
1680	29.6
1700	29.8
1720	30.3
1740	30.8
1760	31.1
1780	31.0
1800	30.9
1820	30.7
1840	30.6
1860	30.6
1880	30.6
1900	30.6
1920	30.7
1940	30.9
1960	31.2
1980	31.6
2000	32.0

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



Cable Coaxial, GORE A2P01POL118, 2.3 m, model: GORE-3, s/n 176 (HL 0589)
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW -6, s/n 163 (HL 1004)
Calibration data

No.	Parameter	SET, MHz	Measured, dB	Deviation, dB	Tolerance (Specification), dB	Meas. Uncert., dB	Notes
1	Insertion Loss	30	0.33	-	6.5	±0.12	
2		50	0.40	-			
3		100	0.57	-			
4		300	0.97	-			
5		500	1.25	-			
6		800	1.59	-			
7		1000	1.81	-			
8		1200	1.97	-			
9		1400	2.15	-			
10		1600	2.28	-			
11		1800	2.43	-			
12		2000	2.61	-			
13		2200	2.75	-			
14		2400	2.89	-			
15		2600	2.97	-			
16	Insertion Loss	2800	3.21	-	6.5	±0.12	
17		3000	3.32	-			
18		3300	3.47	-			
19		3600	3.62	-			
20		3900	3.84	-			
21		4200	3.92	-		±0.17	
22		4500	4.07	-			
23		4800	4.36	-			
24		5100	4.62	-			
25		5400	4.78	-			
26		5700	5.16	-			
27		6000	5.67	-			
28		6500	5.99	-			



Cable RF, 8 m, model:RG-214, s/n C-56 (HL 2009)
Calibration data

No.	Parameter	SET, MHz	Measured, dB	Deviation	Tolerance (Specification)	Meas. Uncert., dB	Notes
1	Insertion Loss	1	0.10	NA	NA	±0.12	
2		10	0.14				
3		30	0.25				
4		50	0.34				
5		100	0.53				
6		300	0.99				
7		500	1.31				
8		800	1.73				
9		1000	1.98				
10		1100	2.11				
11		1200	2.21				
12		1300	2.35				
13		1400	2.46				
14		1500	2.55				
15		1600	2.68				
16		1700	2.78				
17		1800	2.88				
18		1900	2.98				
19		2000	3.09				