

**DATE: 24 February 2008**

**I.T.L. (PRODUCT TESTING) LTD.  
FCC EMC/Radio Test Report  
for**


**Hi-G-Tek Ltd.**

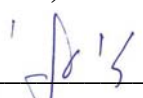
**Equipment under test:**

**IS Micro Reader**

**IG-MA-125IS**

Written by:   
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Approved by:   
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Approved by:   
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This report relates only to items tested.

## Measurement/Technical Report for Hi-G-Tek Ltd.

Equipment under test:

**IS Micro Reader**

**FCC ID: OB6-IGMA125IS**

**DATE: 24 February 2008**

This report concerns: Original Grant ☒ Class II change ☐

Class B verification ☐ Class A verification ☐ Class I change ☐

Equipment type: Low Power Transmitter Below 1705 kHz

Request Issue of Grant:

☒ Immediately upon completion of review

Limits used:

CISPR 22 ☐ Part 15 ☒

Measurement procedure used is ANSI C63.4-2003.

Application for Certification  
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Applicant for this device:  
(different from "prepared by")

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## 1. General Information

### 1.1 Administrative Information

Manufacturer:	Hi-G-Tek Ltd.
Manufacturer's Address:	16 Hacharoshet St. Or-Yehuda 60375 Israel Tel: +972-3-533-9359 Fax: +972-3-533-9225
Manufacturer's Representative:	Yossi Hershko Arkady Genin
Equipment Under Test (E.U.T):	IS Micro Reader
Equipment Model No.:	IG-MA-125IS
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	07.01.08
Start of Test:	07.01.08
End of Test:	07.01.08
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Subparts, B; C

## **1.2 List of Accreditations**

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

### **1.3 Product Description**

The Hi-G-Tek I.S Micro Reader is a component of Hi-G-Tek's wireless monitoring system designed to withstand hazardous locations such as fuel-atmosphere interactions and other harsh outdoor applications.

The Micro Reader is an ergonomic handheld sized RFID reader (Radio Frequency Identification) used for short-range wireless communication (up to 10cm)

The Micro Reader communicates over the low-frequency channel (125 KHz) with the Hi-G-Tek's RFID sensors (electronic lock/seal/ tag that provides automatic processing and real-time monitoring of secured cargoes/assets in transit and in storage)

It contains two command buttons used for two basic LF interrogation commands and two-colored LED as well as a beeper for status indication.



The Micro Reader performs two basic functions:

- 1) It verifies the lock/seal/tag status and provides the user with an indication as to whether the device has been tampered with since being set.
- 2) It can also reset the lock/seal/tag for a new use. It also leaves a “footprint” in the lock/seal/tag memory with the Micro Reader's ID, identifying the specific Micro Reader that performed a command or interrogation.

### **1.4 Test Methodology**

Radiated testing was performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5 Test Facility**

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing August 22, 2006).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

### **1.6 Measurement Uncertainty**

#### **Radiated Emission**

The Open Site complies with the  $\pm 4$  dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

## 2. Product Labeling



Figure 1. FCC Label



Figure 2. Label Location on EUT

### 3. System Test Configuration

#### 3.1 *Justification*

To determine the E.U.T. antenna orientation for the spurious radiated emissions tests, the product carrier field level was measured with the E.U.T. in 3 orthogonal positions.

The vertical position of the E.U.T. was selected as the worst case final orientation position.

#### 3.2 *EUT Exercise Software*

Normally, the EUT transmits short messages in short periods. Therefore, in order to enable measurements of the transmitted signals, the EUT exercise program used during the RF testing was designed to transmit continuously random data or carrier wave (cw) according to test procedures.

#### 3.3 *Special Accessories*

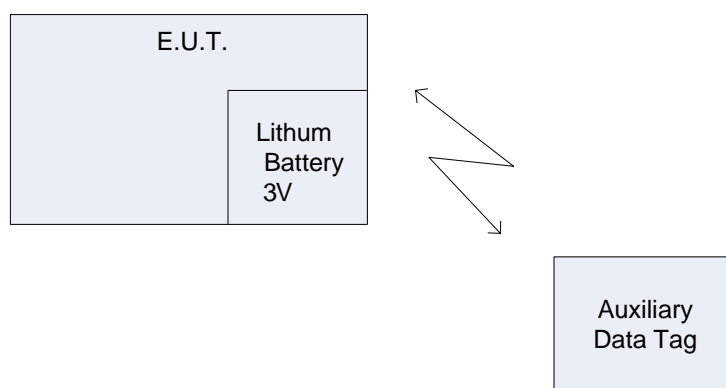
No special accessories were needed to achieve compliance.

#### 3.4 *Equipment Modifications*

No special modifications were needed to achieve compliance.

#### 3.5 *Configuration of Tested System*

The configuration of the tested system is described below.



**Figure 3. Configuration of Tested System**

## 4. Block Diagram

### 4.1 Schematic Block/Connection Diagram

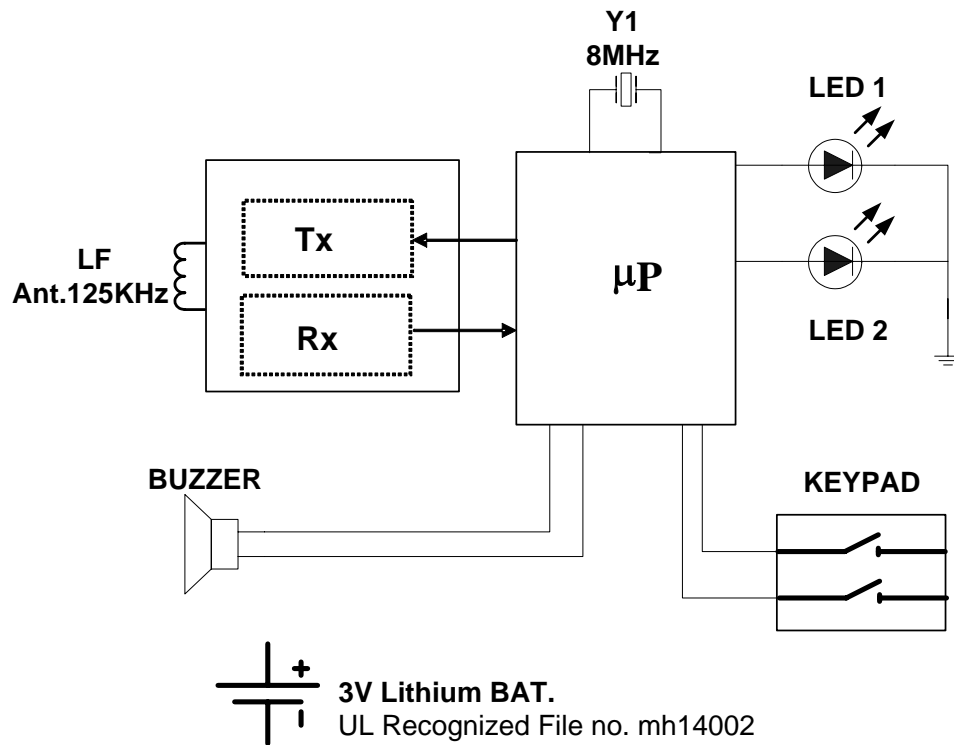


Figure 4. Block Diagram

## 4.2 Theory of Operation

**μP** : The μP(U1) is a Texas Instruments ultralow-power microcontroller (MSP430 family) with a 8MHz clock (piezoelectric ceramic resonator) is the heart of the Micro Reader, it generates the 125KHz carrier wave for the LF transceiver, synchronizes and manages the short range data communication.

**LF Transceiver**: This analog transmitter/receiver utilized for short range communication on-off keying modulation (OOK) based on 125KHz carrier wave with 4KHz data rate. The Tx interface modulates the data from the μP together with the 125Khz carrier wave, the modulated signal is transmitted through a SMT ferrite rod LF antenna .The Rx interface receive the data from the ferrite antenna, detect it and transfer it to the μP.

**Buzzer**: Standard piezo buzzer for audible notifications and alarms.

**Keypad**: Lexan keypad with two push buttons.

Antenna: Surface mount (SMD) ferrite 1.8mH inductor

**Power**: 3V replaceable Lithium battery (button cell) with rated capacity of 235mAH

**Resonator(Y1)** : 8MHz Piezoelectric ceramic resonator (manufactured by Murata) used for time base oscillator of the microcontroller.

## 5. Field Strength of Fundamental

### 5.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.209

### 5.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

The E.U.T. was placed on a non-conductive table, 0.8 meters above the O.A.T.S. ground plane.

The EMI receiver was set to the E.U.T. Fundamental Frequency (125.00 kHz).

The distance between the E.U.T. and test antenna was 3 meters.

The turntable and antenna were adjusted for maximum level reading on the EMI receiver. The loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.

### 5.3 Measured Data

JUDGEMENT: Passed by 38.66 dB

The EUT met the FCC Part 15, Subpart C, Section 15.209 specification requirements.

The details of the highest emissions are given in Figure 5.

TEST PERSONNEL:


Tester Signature: 

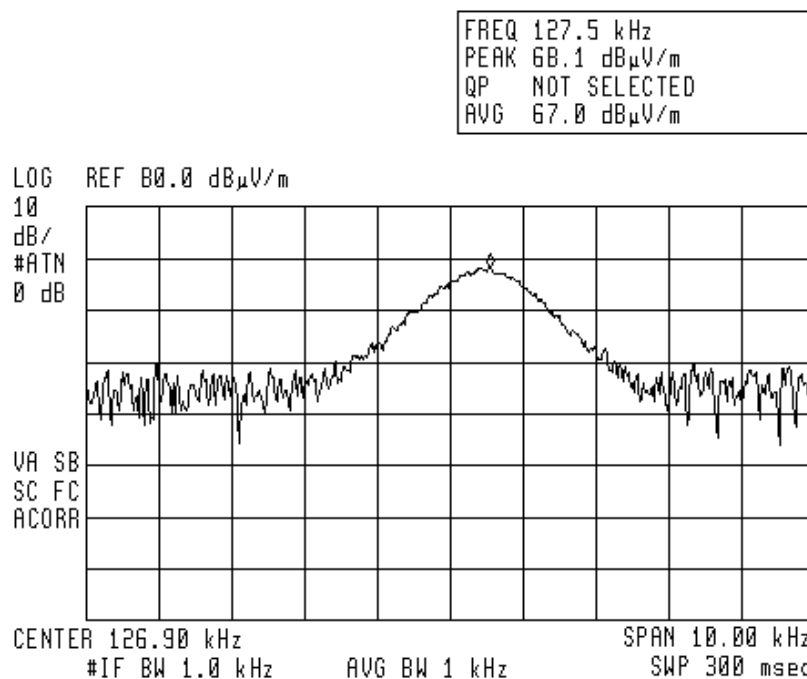
Date: 29.01.08

Typed/Printed Name: E. Pitt

## Field Strength of Fundamental

E.U.T Description IS Micro Reader  
 Model Number IG-MA-125IS  
 Serial Number: Not Designated

 12:35:40 JAN 07, 2008



**Figure 5. Field Strength of Fundamental  
 Detector: Peak**

$$L_{im300m} = 20 \log 2400/125 = 25.66 \text{ dB}\mu\text{V/m}$$

$$L_{im3m} = L_{im300m} + 40 \log 300/3 = 25.66 + 80 = 105.66 \text{ dB}\mu\text{V/m}$$

#### 5.4 Test Instrumentation Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
EMI Receiver Filter Section	HP	85420E	3427A00103	November 12, 2007	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A

## 6. Radiated Measurement Photo



Figure 6. Radiated Emission Test



Figure 7. Radiated Emission Test

## 7. Spurious Radiated Emission 9kHz-30 MHz

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in *Figure 3*.

The frequency range 9kHz-30 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30 MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.

Verification of the E.U.T emissions was based on the following methods:

- Turning the E.U.T on and off.

- Using a frequency span less than 10 MHz.

- Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

During this test the E.U.T. was operated in continuous transmission to enable better detection of signals.

### 7.1 Measured Data

JUDGEMENT: Passed

In the band 9kHz-30MHz, the only signal found was the carrier frequency.

The EUT met the requirements of the F.C.C. Part 15, Subpart C specification.

TEST PERSONNEL:

Tester Signature: 

Date: 29.01.08

Typed/Printed Name: E. Pitt

## 7.2 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 12, 2007	1 year
EMI Receiver Filter Section	HP	85420E	3427A00103	November 12, 2007	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2007	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A

### **7.3 Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{V/m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS:	Field Strength [dB $\mu$ V/m]
RA:	Receiver Amplitude [dB $\mu$ V]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

## **8. Radiated Emission Test Data Per FCC Part 15, Sub-part B**

### **8.1 Test Specification**

30-1000 MHz, FCC Part 15, Subpart B, CLASS B

### **8.2 Test Procedure**

The E.U.T operation mode and test configuration are as described in section 4.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in photograph *Figure 7*.

The E.U.T. highest frequency source or used frequency is 8 MHz.

The frequency range 30-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

- Turning the E.U.T on and off.

- Using a frequency span less than 10 MHz.

- Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The emissions were measured at a distance of 3 meters.

### 8.3 **Test Data**


JUDGEMENT: Passed by 13.6 dB

The results for both Rx and Tx modes were the same.

The E.U.T met the requirements of the FCC Part 15, Subpart B, Class B specification.

The details of the highest emissions are given in Figure 8 to Figure 11.

TEST PERSONNEL:

Tester Signature: 

Date: 29.01.08

Typed/Printed Name: E. Pitt

## Radiated Emission

E.U.T Description IS Micro Reader  
 Type IG-MA-125IS  
 Serial Number: Not Designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal  
 Antenna: 3 meters distance

Frequency range: 30 MHz to 1 GHz  
 Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak dBuV/m	QP dBuV/m	QP Delta L 1 (dB)	Avg dBuV/m	Av Delta L 2 (dB)	Corr (dB)
1	36.000000	21.8	17.0	-23.0			14.4
2	48.000000	28.0	21.9	-18.1			11.9
3	60.000000	26.1	20.4	-19.6			10.5
4	108.000000	28.7	22.8	-20.7			12.8
5	120.000000	22.1	17.6	-25.9			13.6
6	144.000000	29.8	24.5	-19.0			14.6

**Figure 8. Radiated Emission. Antenna Polarization: HORIZONTAL.  
 Detectors: Peak, Quasi-peak**

*Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*

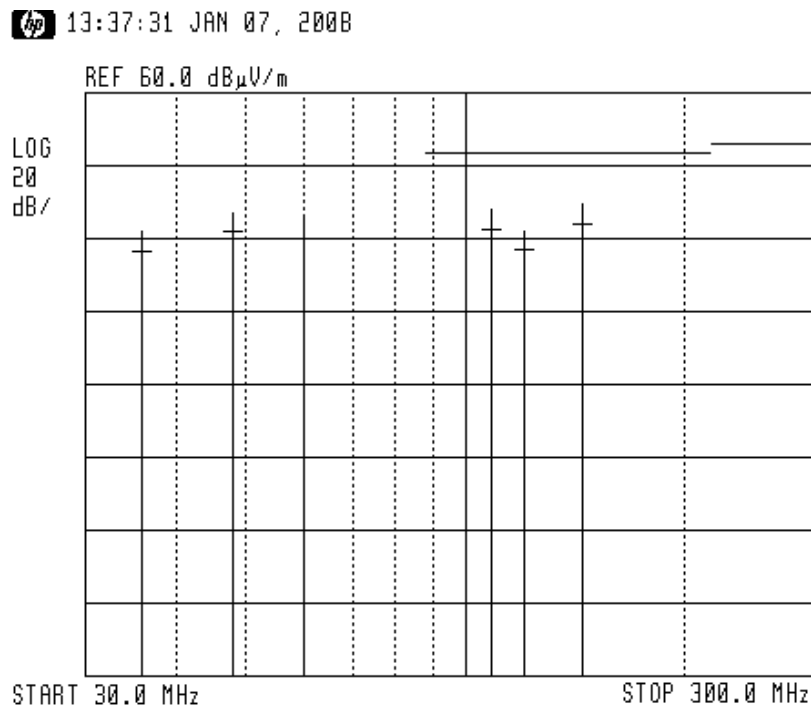
# Radiated Emission

E.U.T Description IS Micro Reader  
Type IG-MA-125IS  
Serial Number: Not Designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal  
Antenna: 3 meters distance

Frequency range: 30 MHz to 1 GHz  
Detectors: Peak, Quasi-peak



**Figure 9. Radiated Emission. Antenna Polarization: HORIZONTAL  
Detectors: Peak, Quasi-peak**

*Note:*

1. Horizontal axis shows logarithmic frequency scale.
2. The vertical axis shows amplitude (in dB  $\mu$ V/m).
3. Peak detection is designated by the top of each vertical line.
4. Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.

## Radiated Emission

E.U.T Description IS Micro Reader  
 Type IG-MA-125IS  
 Serial Number: Not Designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Vertical  
 Antenna: 3 meters distance

Frequency range: 30 MHz to 1 GHz  
 Detectors: Peak, Quasi-peak

Signal Number	Frequency (MHz)	Peak dBuV/m	QP dBuV/m	QP Delta L 1 (dB)	Avg dBuV/m	Av Delta L 2 (dB)	Corr (dB)
1	30.000000	34.2	24.9	-15.1			16.0
2	36.000000	35.2	26.4	-13.6			14.4
3	48.000000	23.3	18.0	-22.0			11.9
4	72.000000	25.9	20.0	-20.0			10.2
5	78.000000	29.2	24.1	-15.9			10.4
6	120.000000	31.2	21.8	-21.7			13.6

**Figure 10. Radiated Emission. Antenna Polarization: VERTICAL.  
 Detectors: Peak, Quasi-peak**

*Note: QP Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*

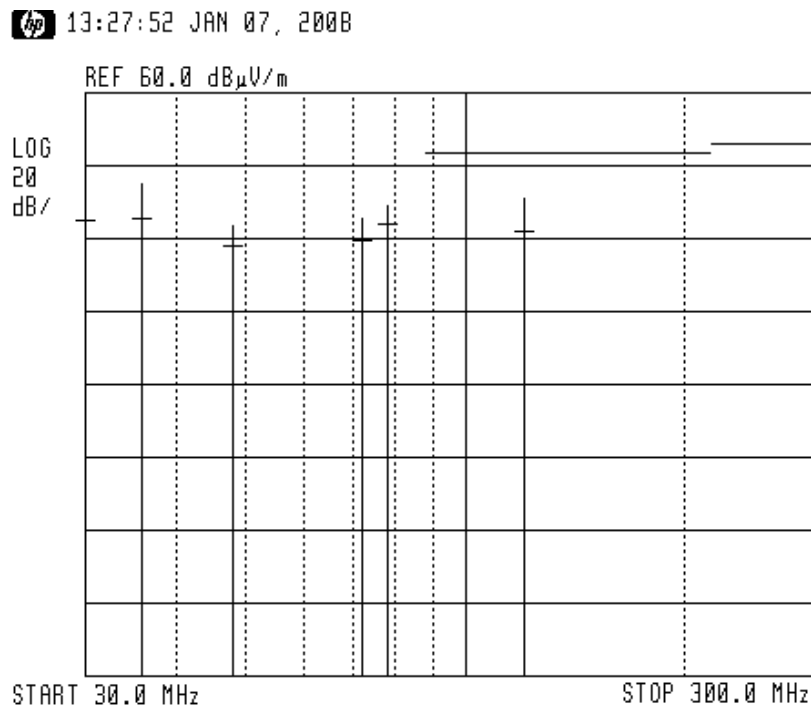
# Radiated Emission

E.U.T Description IS Micro Reader  
Type IG-MA-125IS  
Serial Number: Not Designated

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Vertical  
Antenna: 3 meters distance

Frequency range: 30 MHz to 1 GHz  
Detectors: Peak, Quasi-peak



**Figure 11. Radiated Emission. Antenna Polarization: VERTICAL.  
Detectors: Peak, Quasi-peak**

*Note:*

1. Horizontal axis shows logarithmic frequency scale.
2. The vertical axis shows amplitude (in dB  $\mu$ V/m).
3. Peak detection is designated by the top of each vertical line.
4. Quasi-peak detection is designated by the first dash mark (from the top) of each vertical line.

#### 8.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 12, 2007	1 Year
RF Filter Section	HP	85420E	3427A00103	November 12, 2007	1 Year
Antenna Biconical	ARA	BCD 235/B	1041	March 22, 2007	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 22, 2007	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

## 9. Photographs of Tested E.U.T.



**Figure 12 Front View**



**Figure 13 Rear View**



Figure 14 Rear View Cover Open

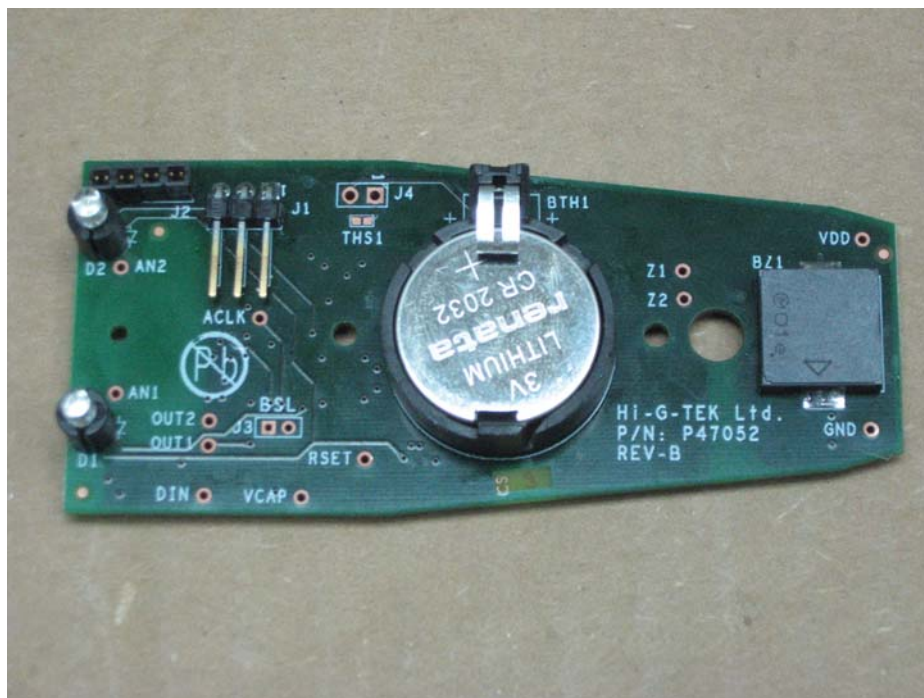
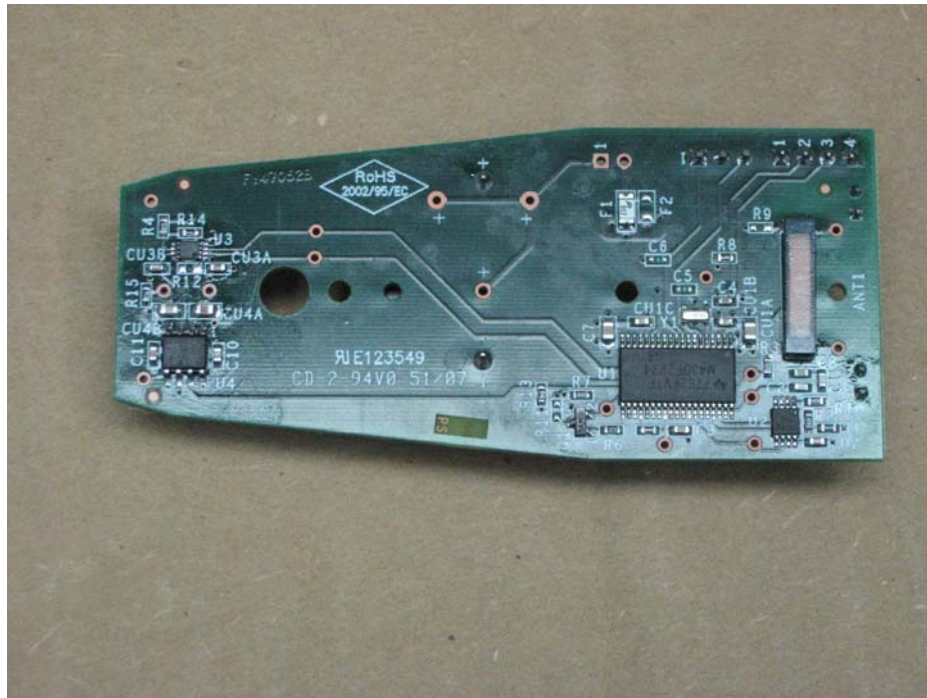


Figure 15 PCB Side 1



**Figure 16 PCB Side 2**

## 10. APPENDIX A - CORRECTION FACTORS

### 10.1 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

#### NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

## 12.6 Correction factors for LOG PERIODIC ANTENNA

**Type LPD 2010/A  
at 3 and 10 meter ranges.**

### Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

### Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

#### NOTES:

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.ANT for a 3 meter range,  
and file number 38M100.ANT for a 10 meter range.
3. The files mentioned above are located on the disk marked "Radiated Emission  
Test EMI Receiver".

**10.2 Correction factors for BICONICAL ANTENNA**  
**Type BCD-235/B,**  
**at 3 meter range**

<b>FREQUENCY</b> (MHz)	<b>AFE</b> (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

**NOTES:**

1. Antenna serial number is 1041.
2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

### 10.3 Correction factors for ACTIVE LOOP ANTENNA

**Model 6502**  
**S/N 9506-2950**

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2