

**DATE: 27 May 2007**

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


**Hi-G-Tek Ltd.**

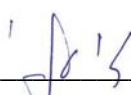
**Equipment under test:**

**Data Terminal**

**IG-MA-31**

Written by:   
D. Shidlow, Documentation

Approved by:   
E. Pitt, Test Engineer

Approved by:   
I. Raz, EMC Laboratory Manager

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This report relates only to items tested.

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

Equipment under test:

**Data Terminal**

**FCC ID: OB6-IGMA31**

**DATE: 27 May 2007**

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

prepared by:

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Applicant for this device:

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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):	Data Terminal
Equipment Model No.:	IG-MA-31
Equipment Serial No.:	0293601339
Date of Receipt of E.U.T:	18.03.07
Start of Test:	18.03.07
End of Test:	22.03.07
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod, 71100 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. 861911.
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 Handheld DataTerminal writes information into the electronic seal's memory at the departure point and retrieves the information at the destination. Events occurring in transit and logged in the electronic seal's memory are downloaded into the Handheld DataTerminal at the destination.

The Handheld DataTerminal is powered from 6VDC (standard 4 x 1.5V AA size alkaline batteries) communicates data with the electronic seal in a low frequency short-range mode (125kHz,AM). At departure, the Handheld Data Terminal writes the electronic manifest of the sealed cargo into the electronic seal's memory. Using an RS-232 communication port, the Handheld Data Terminal can download, at both departure and destination, the data to a PC for management and administration use.

Technical specifications:

#### **Physical:**

Dimensions

- Size: 210 x 100 x 45mm
- Weight: 500gr

#### **Communications:**

- Transmit/Receive at 125 KHz
- Modulation: OOK, With 4 KHz data rate.
- Read / Write Range: 40 cm
- Interface to PC: RS-232

#### **Environmental:**

- Operating Temperature: -20°C to +70°C
- Storage Temperature: -20°C to 80°C
- Humidity: 50% non-condensing
- Vibration and Shock: Hand-carried

#### **Power Source:**

- 4 x 1.5V AA size Alkaline

### **1.4 Test Methodology**

Both conducted and radiated testing were 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 1 Batsheva St., Lod, Israel. This site is a FCC listed test laboratory (FCC Registration No. 861911, date of listing September 26, 2005). 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

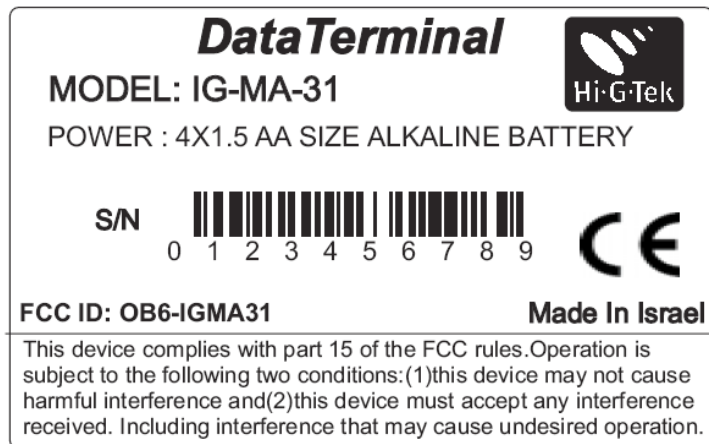


Figure 1. FCC Label



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**

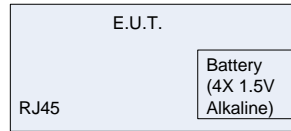
No special accessories were needed to achieve compliance.

#### **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

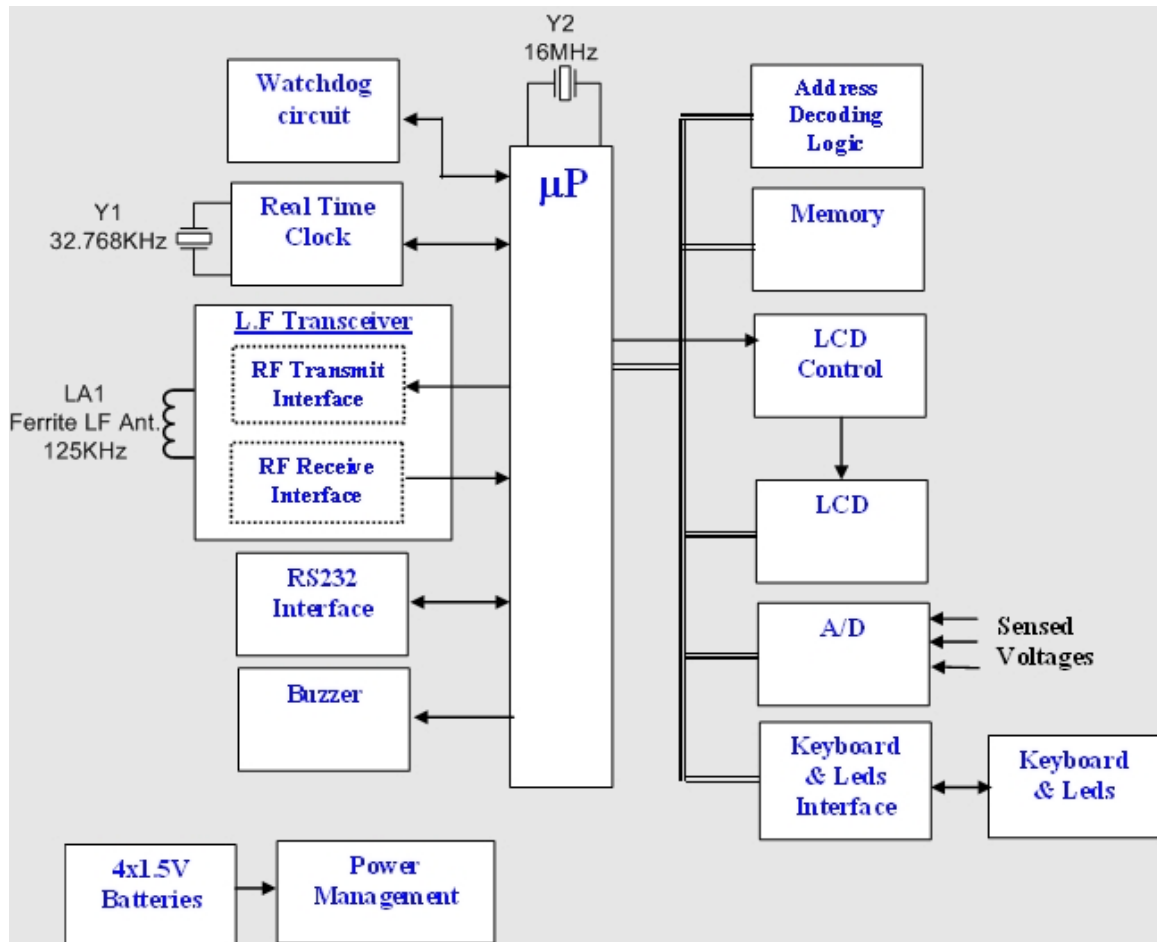


Figure 4. Block Diagram

## **4.2 Theory of Operation**

### **1. Functional Description**

The Handheld Data Terminal uses its LF transceiver (at any time when it commanded to do so) to communicate by short range link with the end devices (active RFID electronic sensors) It logged their data and transfer it via a serial RS-232 port to a PC. The Data Terminal is battery operated, it has an internal replaceable 4 AA size alkaline batteries. It consists of a graphic LCD and an alphanumerical keypad to configure data into the sensors when required.

### **2. Hardware Description**

- 2.1. There are 2 PCBs in the Data terminal. Main PCB and keypad PCB (Top PCB). The main PCB includes digital parts ( $\mu$ P, memory, RTC, A/D, RS232 driver etc.) and LF transceiver which utilizes on-off keying (OOK) modulation over a 125KHz carrier (4Kbit data rate) at short range. The Keypad PCB is located over the main PCB, it consists of keypad drivers and LEDs indicators.

## 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) and Peak Detection.

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 7.95 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: 

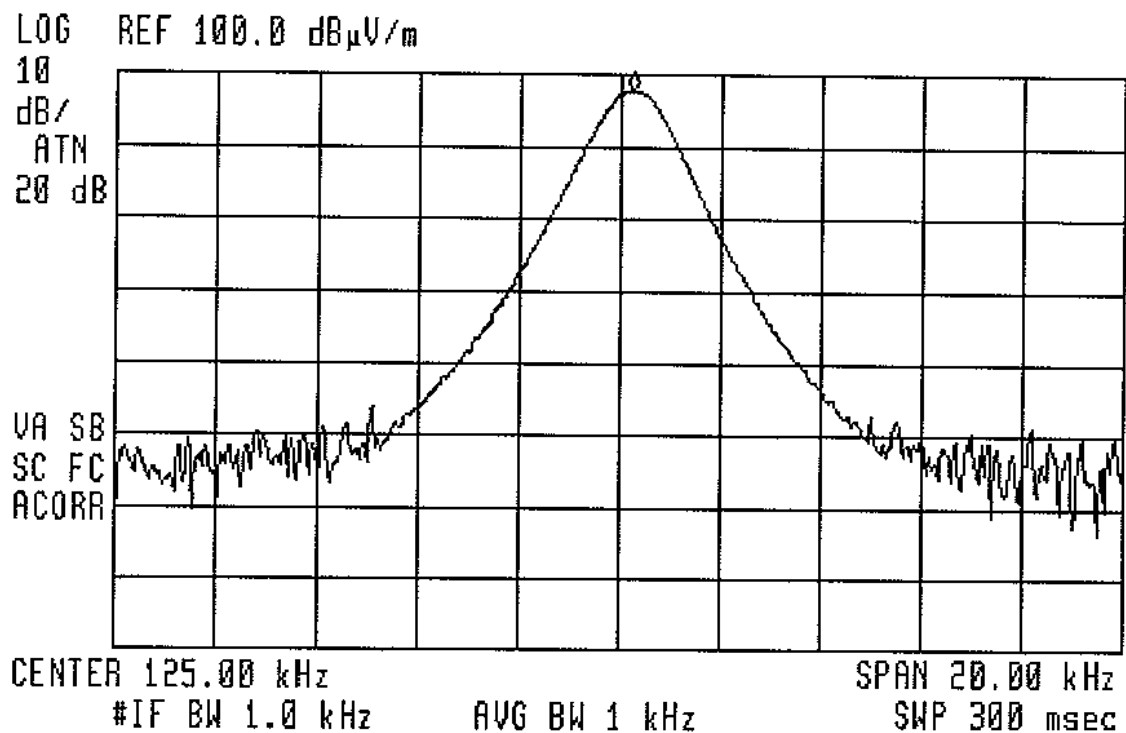
Date: 20.05.07

Typed/Printed Name: E. Pitt

## Field Strength of Fundamental

E.U.T Description    Data Terminal  
 Model Number        IG-MA-31  
 Serial Number:       0293601339

ACTV DET: PEAK  
 MEAS DET: PEAK QP AVG  
 MKR 125.25 kHz  
 97.71 dB $\mu$ V/m



**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	8546A	3650A00365	October 10, 2006	1 year
EMI Receiver Filter Section	HP	85460A	3650A00365	October 10, 2006	1 year
EMC Analyzer	HP	HP 8593	3536A00120	November 11, 2006	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 16, 2006	1 year
Antenna Mast	ETS/EMCO	2070-2	9608=1497	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

## 6. Radiated Measurement Photo



Figure 6. 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

The signals in the band 9 kHz – 30 MHz were 20dB below the specification limit.

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

TEST PERSONNEL:

Tester Signature: 

Date: 16.05.07

Typed/Printed Name: E. Pitt

## 7.2 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	8546A	3650A00365	October 10, 2006	1 year
EMI Receiver Filter Section	HP	85460A	3650A00365	October 10, 2006	1 year
EMC Analyzer	HP	HP 8593	3536A00120	November 11, 2006	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2005	Active Loop Antenna
Antenna Mast	ETS/EMCO	2070-2	9608=1497	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	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 6*.

The E.U.T. highest frequency source or used frequency is 125.00 kHz.

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 12.4 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 7* to *Figure 8*.

TEST PERSONNEL:

Tester Signature:  Date: 16.05.07

Typed/Printed Name: E. Pitt

## Radiated Emission

E.U.T Description    Data Terminal  
 Type                    IG-MA-31  
 Serial Number:        0293601339

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal/Vertical    Frequency range: 30 MHz to 1000 MHz  
 Antenna: 3 meters distance                    Detectors: Peak, Quasi-peak

Frequency	Peak Amp	QP	Antenna Polarization:		Delta-limit
(MHz)	(dBμV/m)	Limit			QPeak
		(dBμV/m)	Hor.	Ver.	(dB)
148.70	30.6	43.5	H		-12.9
151.40	30.4	43.5	H		-13.1
153.90	32.2	43.5	H		-11.3
86.40	27.1	40.0		V	-12.9
90.80	28.5	43.5		V	-15.0
93.50	32.3	43.5		V	-11.2
98.70	31.1	43.3		V	-12.4

**Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL/VERTICAL.  
 Detectors: Peak, Quasi-peak**

*Notes:*

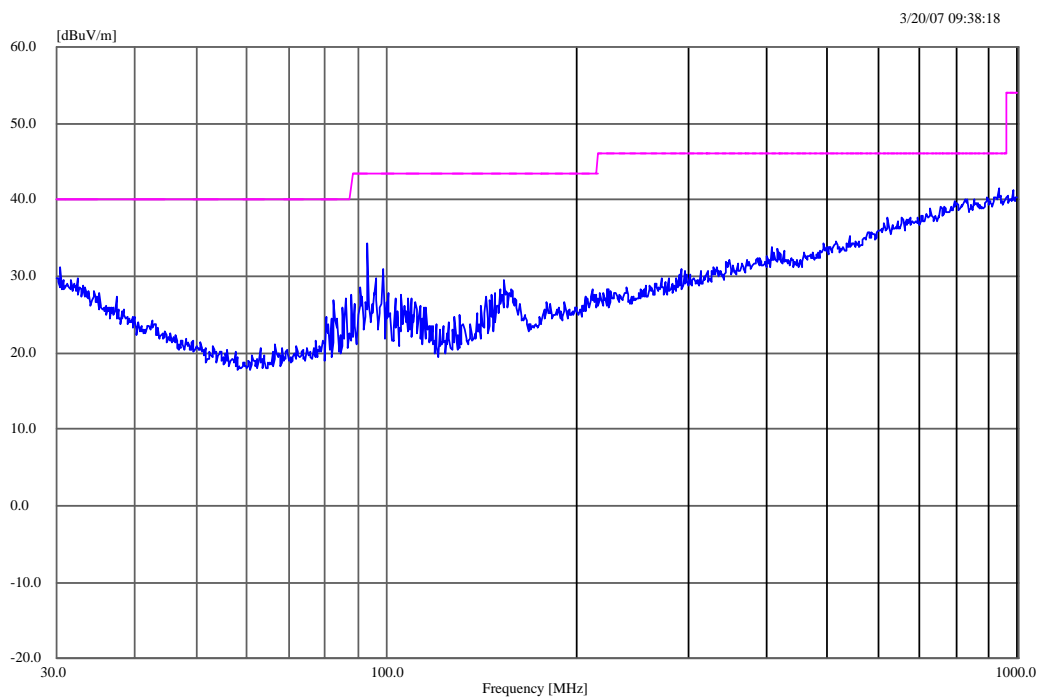
1. *Delta-limit QP refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*
2. *Peak Amp and QP Amp include correction factors (Antenna Gain + Cable Loss)*

# Radiated Emission

E.U.T Description	Data Terminal
Type	IG-MA-31
Serial Number:	0293601339

Specification: FCC Part 15, Subpart B, Class B

Antenna Polarization: Horizontal/Vertical	Frequency range: 30 MHz to 1000 MHz
Antenna: 3 meters distance	Detectors: Peak, Quasi-peak



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

#### 8.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	8546A	3650A00365	October 10, 2006	1 year
EMI Receiver Filter Section	HP	85460A	3650A00365	October 10, 2006	1 year
EMC Analyzer	HP	HP 8593	3536A00120	November 11, 2006	1 year
Antenna Biconilog	EMCO	3142B	1250	August 23, 2006	1 year
Antenna Mast	ETS/EMCO	2070-2	9608=1497	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A



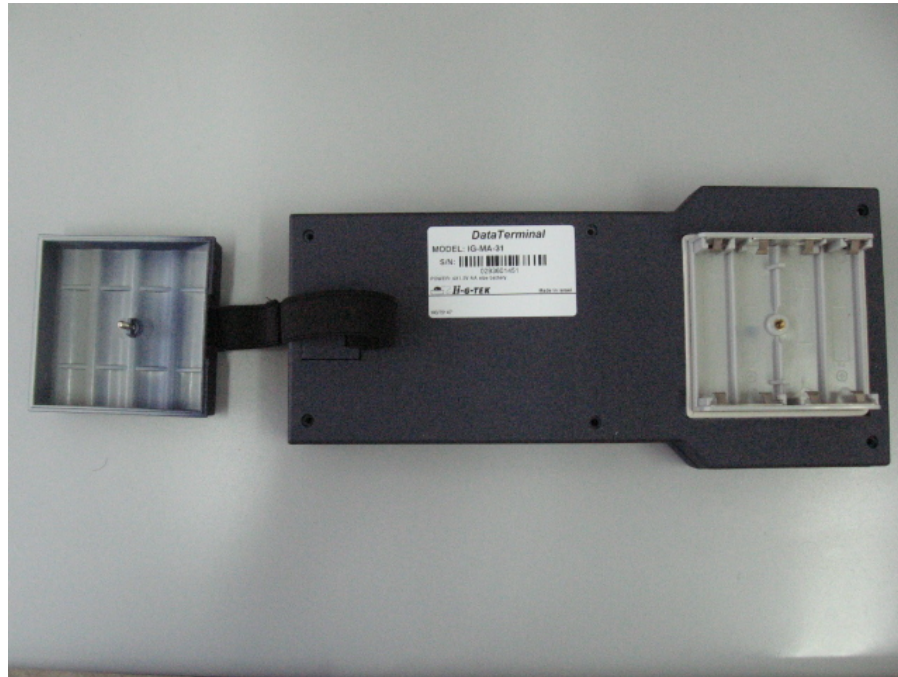
## 9. Photographs of Tested E.U.T.



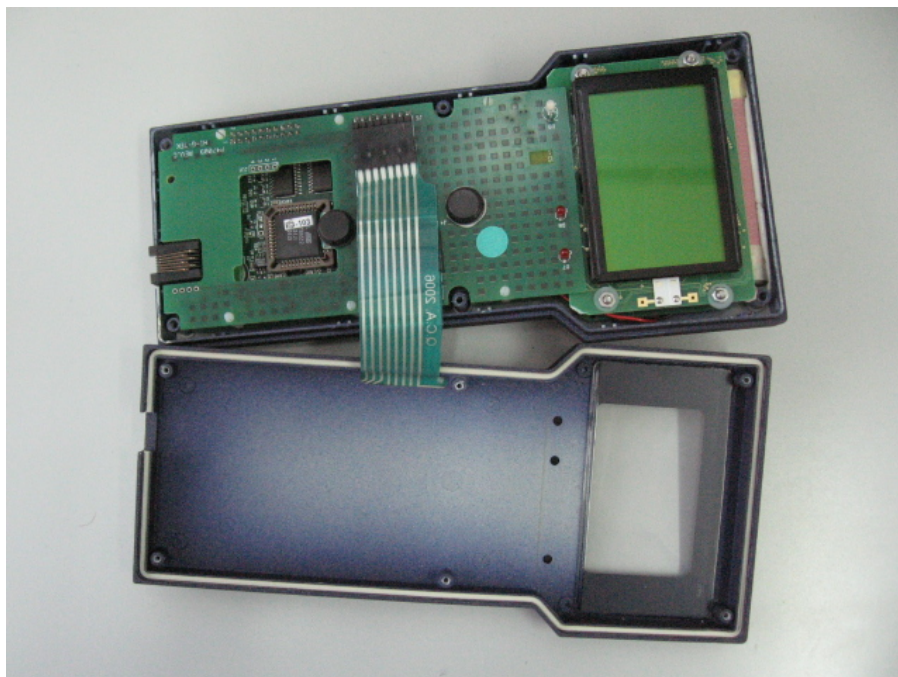
Figure 9 Front View



Figure 10 Rear View



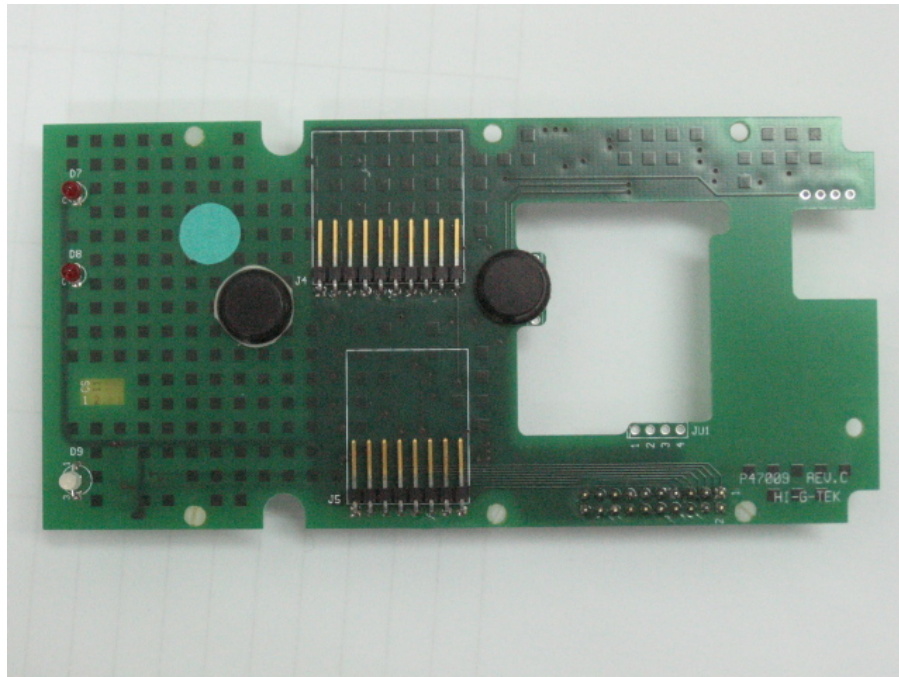
**Figure 11 Rear View Battery Cover Open**



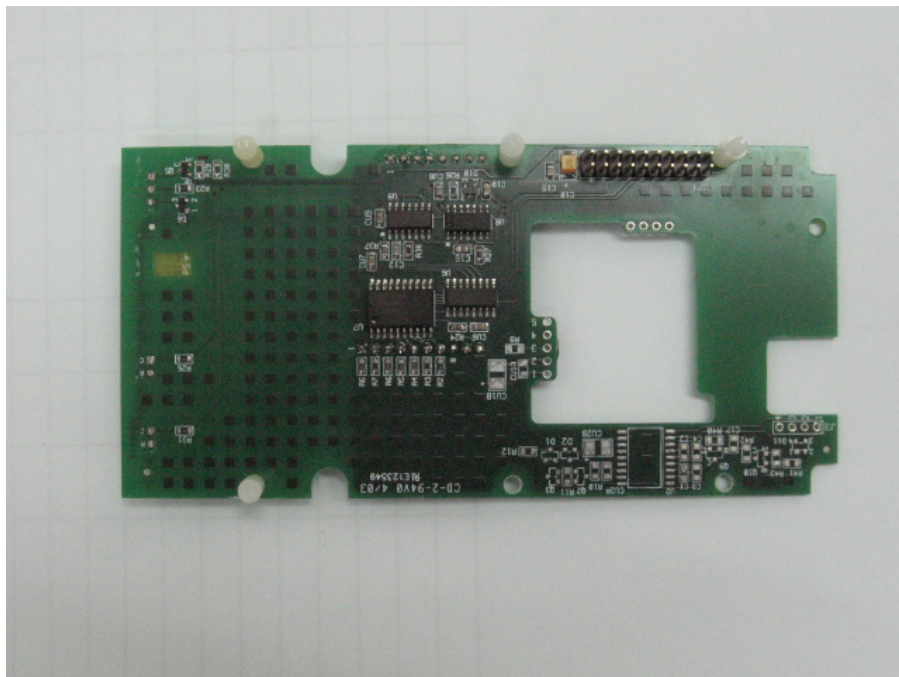
**Figure 12 Internal View**



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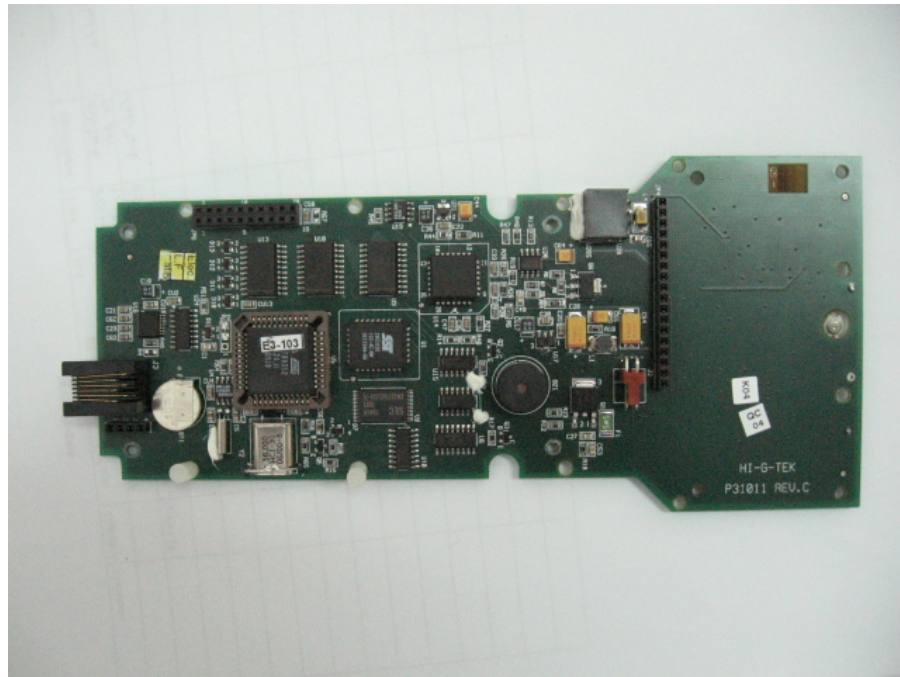


**Figure 15 PCB 1 Component Side**

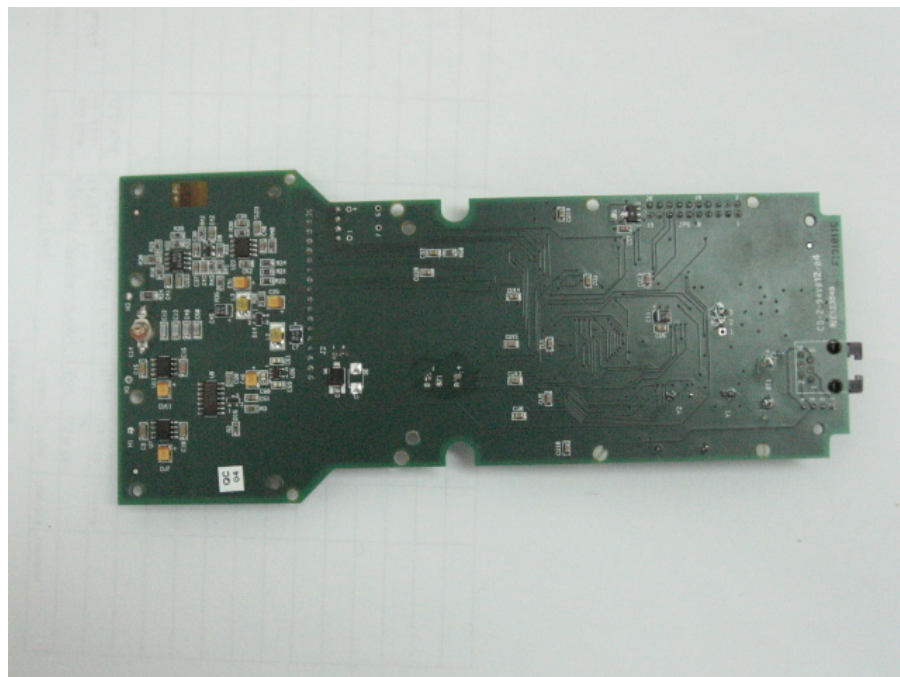


**Figure 16 PCB 1 Print Side**





**Figure 17 PCB 2 Component side**



**Figure 18 PCB 2 Print side**

## 10. APPENDIX A - CORRECTION FACTORS

### 10.1 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 and 10 meter range.

FREQUENCY	CORRECTION FACTOR	FREQUENCY	CORRECTION FACTOR
(MHz)	(dB)	(MHz)	(dB)
30	1.96	180	5.7
35	2.08	190	5.84
40	2.26	200	6.02
45	2.43	250	6.86
50	2.59	300	7.59
55	2.65	350	8.09
60	2.86	400	8.7
65	2.96	450	9.15
70	3.04	500	9.53
75	3.27	550	9.82
80	3.41	600	10.24
85	3.54	650	10.74
90	3.68	700	11.25
95	3.77	800	12.53
100	3.93	900	13.86
110	4.19	1000	14.86
120	4.41	1200	15.7
130	4.6	1400	17.05
140	4.83	1600	18.2
150	5.06	1800	19.4
160	5.35	2000	21.3
170	5.57		

#### NOTES:

1. The cable type is RG-214/U

## 10.2 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

### 10.3 Correction factors for Biconolog Antenna

at 3 and 10 meter ranges.

Model: 3142

Antenna serial number: 1250

3 meter range

FREQUENCY	AFE	FREQUENCY	AFE
(MHz)	(dB/m)	(MHz)	(dB/m)
30	18.4	500	18.6
40	13.7	600	19.6
50	9.9	700	21.1
60	8.1	800	21.4
70	7.4	900	23.5
80	7.2	1000	24.3
90	7.5	1100	25
100	8.5	1200	24.9
120	7.8	1300	26
140	8.5	1400	26.1
160	10.8	1500	27.1
180	10.4	1600	27.2
200	10.5	1700	28.3
250	12.7	1800	28.1
300	14.3	1900	28.5
400	17	2000	28.9



## 10.4 Amplifier Gain

FREQUENCY (MHz)	GAIN (dB)
0.1	29.8
0.2	29.95
0.3	29.92
0.5	29.76
0.7	29.85
1	30.48
2	30.9
5	31.2
10	31.73
20	32.59
50	32.48
100	32.55
200	32.61
500	31.53
1000	31.05
1500	30.5
2000	29.5
2500	29.66
3000	27.5