Cert. No. 1152.01
Electrical (EMC)

DATE: 25 September 2006

I.T.L. (PRODUCT TESTING) LTD.

FCC EMC/Radio Test Report

for

Hi-G-Tek Ltd.

Equipment under test:

AVL Reader

IG-AV1-43-916

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
E. Pitt, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

Cert. No. 1152.01
Electrical (EMC)

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

Equipment under test:

AVL Reader

FCC ID: OB6-IGAV143916

DATE: 25 September 2006

This report concerns: Original Grant _x_ Class II change ___

Class B verification ___ Class A verification__ Class I change ____

Equipment type: Radio Transmitter
Request Issue of Grant:
__**x**__Immediately upon completion of review

Limits used:
CISPR 22 _____ Part 15 _x_

Measurement procedure used is ANSI C63.4-2003.

Application for Certification
prepared by:
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ITL (Product Testing) Ltd.
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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):	AVL Reader
Equipment Model No.:	IG-AV1-43-916 *
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	23.07.06
Start of Test:	23.07.06
End of Test:	30.07.06
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Subpart C

* This test report is based on the tests on the full configuration model IG-AV2-43-916. See customer's declaration on the following page.

Hi-G-Tek Ltd.
16 Hacharoshet Street
Or-Yehuda, 60375, Israel
Tel: 03-5339359 Fax: 03-5339225
www.higtek.com

Wireless Monitoring Solutions
for Security and Management

14-AUG-06

DECLARATION

I HEREBY DECLARE THAT MODEL

IG-AV2-43-916

IS A FULL CONFIGURATION MODEL (125kHz transmitter and 916.5 MHz transmitter).

And MODEL

IG-AV1-43-916

DIFFERS FROM THE **IG-AV2-43-916** ONLY BY THE EXTRACTION OF THE 125KHz TRANSMITTER.

Thank you,

Roni Cohen
Manager, Hardware Development

Hi-G-Tek Ltd.
Wireless Monitoring
Platform

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

Hi-G-Tek's Tanker Truck Monitoring System (TTMS) secures the tanker fueling hatches and decanting valves and enables continuous real time remote monitoring of the vehicle at all points on the route. The tanker access points are secured with programmed electronic seals, these are monitored by the AVL Reader installed in the truck cabin.

Any unauthorized attempts to access the secured hatches or valves are recorded on the tank sensors (electronics seals) and invoke real-time, detailed alarms at the Control Center. The AVL Reader reports, via GPS/GPRS unit ("add on", off the shelf unit manufactured by STARCOM) to the remote control center of any unusual events along with clock and location information acquired through GPS. The control center can also transmit commands or information to the seals via the Reader.

The **AVL Reader** uses active wireless technology to provide automatic processing and real-time monitoring of cargos during transit. As aforementioned, the AVL Reader powered from the vehicle's battery (24VDC) is installed inside the truck's cabin, it has read/write capabilities for communicating with the cargo/tank sensors simultaneously in order to verify their presence and status. The AVL Reader equipped with back-up battery and supports two RS232 channels in addition to one RS485 channel for communicating with other devices of the Tanker Truck Monitoring System (TTMS).

The AVL Reader uses HF RF channel for communication with the tanker sensors.

The HF module consists of Transmitter /Receiver at 916.5MHz, FSK modulated with 40 KHz deviation and 16 KHz data rate.

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 Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing December 12, 2003).
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 ±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

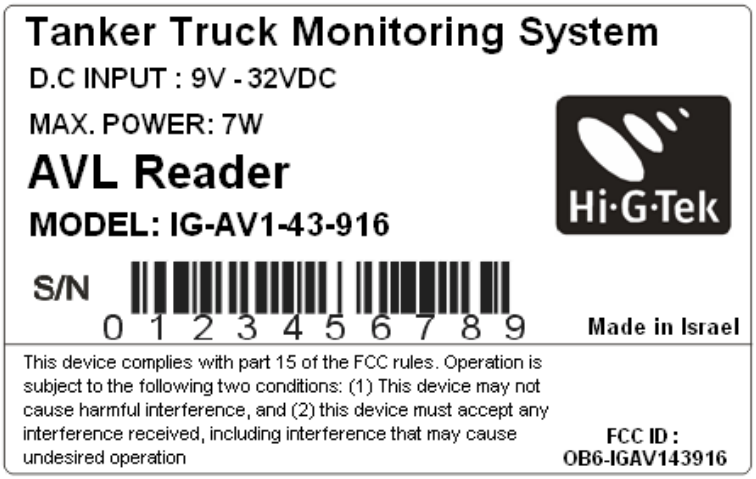

Figure 1. FCC Label

Figure 2. Label Location on EUT

3. System Test Configuration

3.1 Justification

The typical installation of the E.U.T. is either in the vertical or horizontal position.

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. antenna in various directions/positions. The vertical position of the E.U.T. antenna 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.

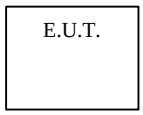

Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram

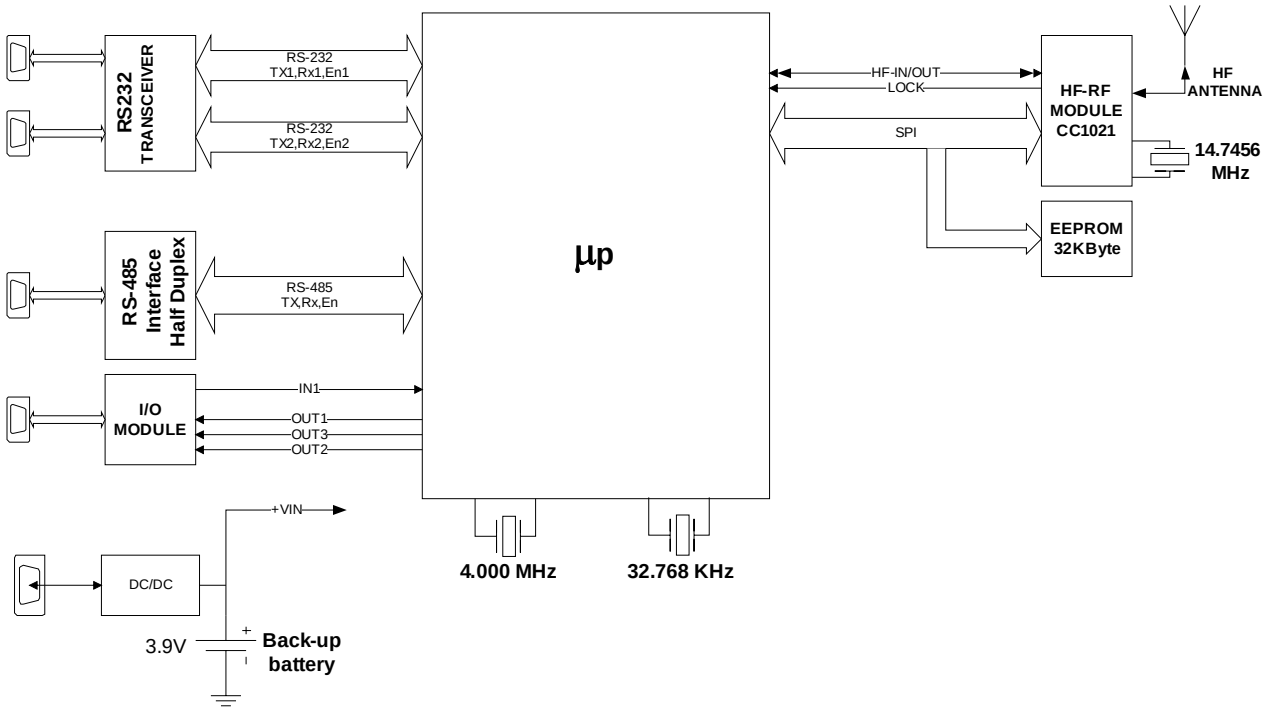

Figure 4. Block Diagram

4.2 Theory of Operation

The AVL Reader consists of two RF modules for communication, the first is the High Frequency module interconnected to the µP via SPI channel, the HF module provides operational frequency (transmit/receive) at 916.5MHz, it is FSK modulated with 40KHz deviation and 16KHz data, the HF used for continuous communication with the tanker sensors (programmed electronic seals with active RF) in order to secure real time remote monitoring of the tanker truck access points.

Typically, the HF receiver is always opened for burst messages coming from the sensors in order to obtain continuously "listening". In Tx mode-the AVL Reader interrogates the sensors for their ID, status and user data every 15min. It writes information into the sensors and retrieves logged information (events) into its EEPROM. The µP is interconnected with two serial communication interfaces, it uses dual RS232 port in addition to one RS485 port for communicating with other devices of the Tanker Truck Monitoring System (TTMS).

The I/O module provides one external interrupt input (active low, isolated) as well as three isolated outputs for general purpose. Equipped with back-up battery the AVL Reader ensures continuous operation and support of the essential features in case the power supply from the vehicle is interrupted.

5. Field Strength of Fundamental

5.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.249(a)

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 (916.500MHz) and Peak Detection.
The turntable and antenna mast were adjusted for maximum level reading on the EMI receiver.
The measurement was performed for vertical and horizontal polarizations of the test antenna.

5.3 Measured Data

JUDGEMENT: Passed by 3.54 dB

The EUT met the FCC Part 15, Subpart C, Section 15.249(a) specification requirements.

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

TEST PERSONNEL:

Tester Signature: _____ Date: 27.09.06

Typed/Printed Name: E. Pitt

Field Strength of Fundamental

E.U.T Description	AVL Reader
Model Number	IG-AV1-43-916
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal/Vertical

Test Distance: 3 meters Detector: Peak

Freq. (MHz)	Pol. V/H	Peak Reading (*) (dBµV/m)	Specification (dBµV/m)	Margin (dB)
916.50	H	76.24	94.0	-17.76
916.50	V	90.46	94.0	-3.54

Figure 5. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL/VERTICAL. Detector: Peak

Note: Margin 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.

* "Peak Amp." includes "Correction Factors.

"Correction Factors" = Antenna Correction Factor + Cable Loss.

5.4 Test Instrumentation Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	March 22, 2006	1 year
RF Section	HP	85420E	3427A00103	March 22, 2006	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 17, 2005	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	ThinkJet 2225	2738508357.0	N/A	N/A

6. Radiated Measurement Photos

Figure 6. Radiated Emission Test 9kHz-30MHz

Figure 7. Radiated Emission Test 30MHz-9.2GHz

7. Spurious Radiated Emission 9kHz-1000 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-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.
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.
In the frequency range 30-1000 MHz, 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.

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 – 1000 MHz were 20dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 15.249 specification.

TEST PERSONNEL:

Tester Signature: _____ Date: 27.09.06

Typed/Printed Name: E. Pitt

7.2 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	March 22, 2006	1 year
RF Section	HP	85420E	3427A00103	March 22, 2006	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	March 19, 2006	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 17, 2005	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2005	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	ThinkJet 2225	2738508357.0	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:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

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

8. Spurious Radiated Emission Above 1 GHz

8.1 Spurious Radiated Emission Above 1 GHz

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, 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 emission levels were compared to the requirement of Section 15.249.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used. The test distance was 3 meters.

In the frequency range 2.9-9.2 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.

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.).

8.2 Test Data

JUDGEMENT: Passed by 7.7 dB

The margin between the emission level and the specification limit is 7.7 dB in the worst case at the frequency of 2749.00 MHz, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Section 15.249, specification.

The details of the highest emissions are given in *Figure 8* to *Figure 9.*

TEST PERSONNEL:

Tester Signature: _____ Date: 27.09.06

Typed/Printed Name: E. Pitt

Spurious Radiated Emission Above 1 GHz

E.U.T Description	AVL Reader
Model Number	IG-AV1-43-916
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.249

Antenna Polarization: Horizontal/Vertical

Frequency range: 1.0 GHz to 9.2 GHz

Test Distance: 3 meters

Detector: Peak

Freq. (MHz)	**Peak Result*** (dBµV/m)	**Polarization** (H/L)	**Peak. Specification** (dB µV/m)	**Peak. Margin** (dB)
1833.20	50.2	H	74.0	-23.8
2749.00	57.8	H	74.0	-16.2
1833.20	50.8	V	74.0	-23.2
2749.00	57.3	V	74.0	-16.7

Figure 8. Spurious Radiated Emission. Antenna Polarization: HORIZONTAL/Vertical. Detector: Peak

Margin 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.

*"Peak Result" includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

Spurious Radiated Emission Above 1 GHz

E.U.T Description	AVL Reader
Model Number	IG-AV1-43-916
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.249

Antenna Polarization: Horizontal/Vertical

Frequency range: 1.0 GHz to 9.2 GHz

Test Distance: 3 meters

Detector: Average

Freq. (MHz)	Average Result* (dBµV/m)	Polarization (H/L)	Average Specification (dB µV/m)	Average Margin (dB)
1833.20	39.8	H	54.0	-14.2
2749.00	46.1	H	54.0	-7.9
1833.20	42.9	V	54.0	-11.1
2749.00	46.3	V	54.0	-7.7

Figure 9. Spurious Radiated Emission. Antenna Polarization: HORIZONTAL/VERTICAL. Detector: Average

Margin 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.

*"Average Result" includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

8.3 Test Instrumentation Used, Spurious Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	March 22, 2006	1 year
RF Section	HP	85420E	3427A00103	March 22, 2006	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	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 24,2005	2 year
Spectrum Analyzer	HP	8592L	3926A01204	February 6, 2006	1 year

9. Photographs of Tested E.U.T.

Figure 10 Front View

Figure 11 Rear View

Figure 12 Connector Side

Figure 13 Antenna Connector Side

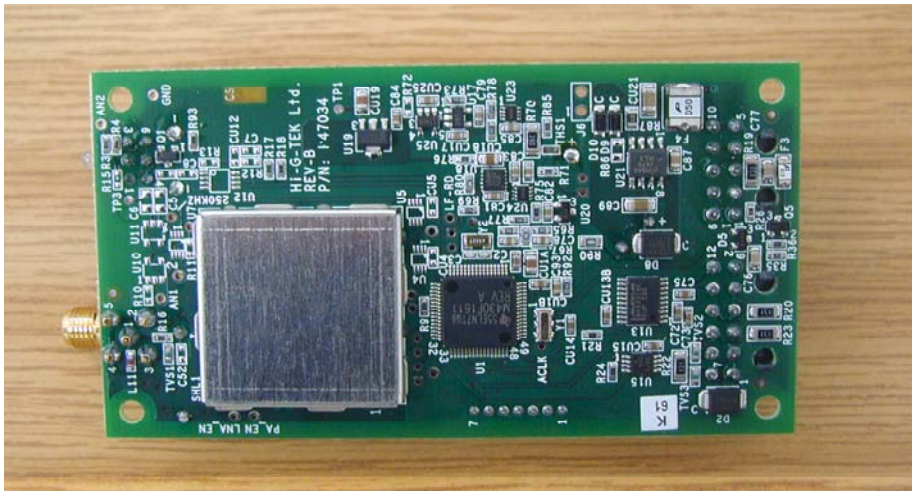

Figure 14 PCB Side 1

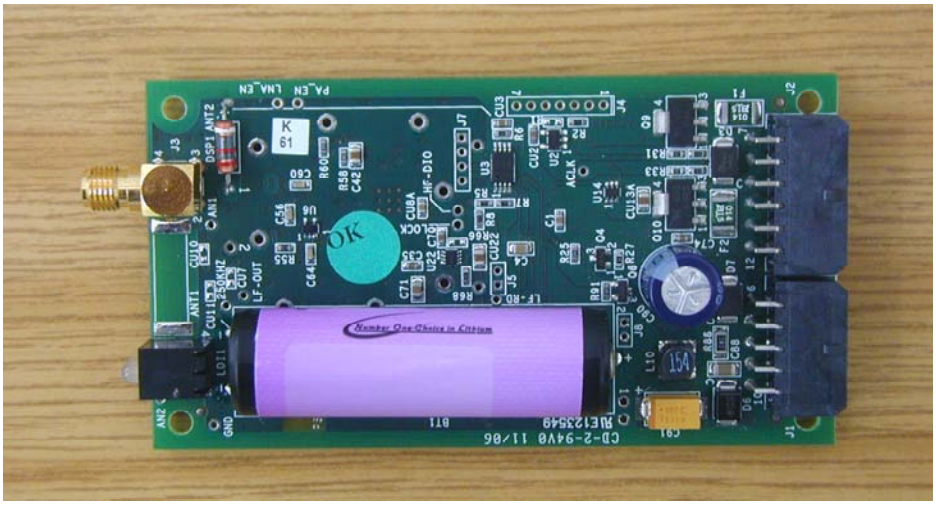

Figure 15 PCB Side 2

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)
10.0	0.5
20.0	0.7
30.0	1.0
40.0	1.2
50.0	1.3
60.0	1.5
70.0	1.6
80.0	1.7
90.0	1.8
100.0	1.9
150.0	2.4
200.0	2.7
250.0	3.0
300.0	3.3
350.0	3.7
400.0	4.0
450.0	4.3
500.0	4.7
600.0	4.9
700.0	5.4
800.0	5.8
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.5
1400.0	8.2
1600.0	9.0
1800.0	9.6
2000.0	10.7
2300.0	11.1
2600.0	11.8
2900.0	12.8

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".

10.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

10.3 Correction factors for CABLE

from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

10.4 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	11.4
400.0	14.5
500.0	15.2
600.0	17.3
700.0	19.0
850.0	20.1
1000.0	22.2

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.2
400.0	14.4
500.0	15.2
600.0	17.2
700.0	19.0
850.0	20.1
1000.0	22.1

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.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".*

10.5 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. Antenna serial number is 253.

2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.

3. The files mentioned above are located on the disk marked "Antenna Factors".

10.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B, at 3 meter range

FREQUENCY (MHz)	AFE (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".

10.7 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