

DATE: 14 November 2004

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

FCC EMC/Radio Test

for

AeroScout Ltd.

Equipment under test:

Exciter

(Transmitter Section)

EX-1000

Written by:



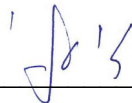
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Approved by:



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 AeroScout Ltd.

Exciter

(For Transmitter Section)

EX-1000

FCC ID:Q3H BS2035-0

14 November 2004

This report concerns: Original Grant x Class II change

Class B verification _____ Class A verification _____ Class I change

Equipment type: Radio Telemetry Transmitter

Request Issue of Grant:

x Immediately upon completion of review

Limits used:

CISPR 22 _____

Part 15 x

Measurement procedure used is ANSI C63.4-2001.

Application for Certification

prepared by:

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1. General Information

1.1 Administrative Information

Manufacturer:	AeroScout Ltd.
Manufacturer's Address:	10 Oppenheimer St. Park Tamar Rehovot 76701 Israel Tel: +972-8-9363136 Fax: +972-8-9365977
Manufacturer's Representative:	Reuven Amsalem Edward Mirodin
Equipment Under Test (E.U.T):	Exciter
Equipment Model No.:	EX-1000
Equipment Serial No.:	000CCC001278
Date of Receipt of E.U.T:	14.10.04
Start of Test:	14.10.04
End of Test:	21.10.04
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Sub-part 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 AeroScout Exciter extends the AeroScout suite to provide robust and sophisticated LF detection capabilities, using the same Wi-Fi tags that can also be accurately located in real time by the AeroScout system.

The Exciter serves as a Beacon which transmits the same message continually. The Exciter transmits the message in ASK modulation with a carrier of 125 kHz.

The Exciter triggers AeroScout's T2 tags as they pass through a choke point to transmit a message that is received by an AeroScout Location Receiver. This provides instant knowledge that a tagged asset or person passed through a gate, doorway or some other tightly defined area. The detection capabilities of the Exciter, combined with the location features of the AeroScout Location Receiver, make the AeroScout suite the most sophisticated enterprise visibility solution for a wide variety of industries.

Key features include:

- Long range LF detection of AeroScout T2 tags, triggering them to transmit as they pass through a defined area.

- Rugged IP66/67 NEMA 4X-rated enclosure for use in any hostile indoor or outdoor environment and in a wide temperature range.

- Ethernet connectivity for centralized programming, monitoring and software updates by the AeroScout system manager.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2001. 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 C63.4-2001. 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

101.6 x 28.57
White background
Black logo

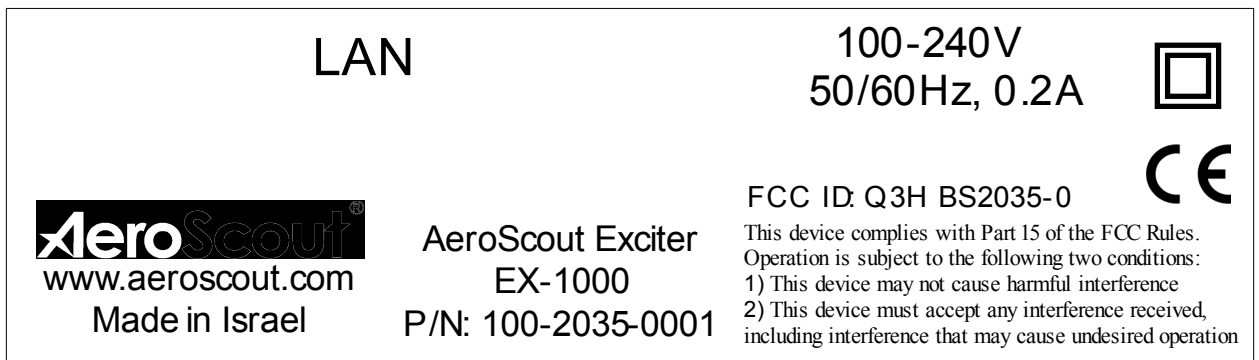


Figure 1. FCC Label

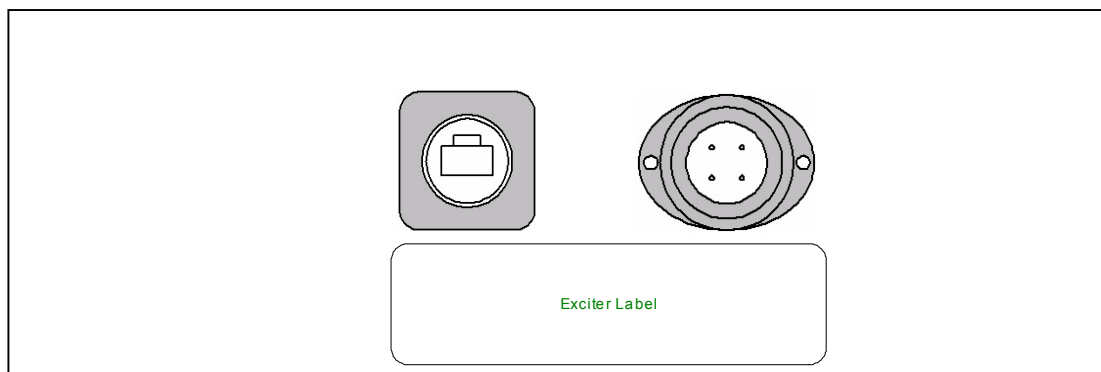


Figure 2. Location of Label on EUT

3. System Test Configuration

3.1 Justification

The E.U.T. is a fixed wall mounted unit in vertical position.

The typical operation of the Exciter (as a customer would normally use) is that the Exciter is used as a beacon which is programmed to transmit a specific message and in preprogrammed interval (10ms – 2s).

In the test configuration the Exciter was programmed to the lowest transmission interval and maximum transmission power which is the worst case operating mode of the Excite.

3.2 EUT Exercise Software

The Exciter SW supports two modes of operation:

1. Continuous 125 kHz carrier (use only in test mode).
2. ASK modulated 125 kHz signal.

The Exciter was configured to send an “Exciter ID” message with 10ms Tx interval in maximum transmission power.

3.3 Special Accessories

No special accessories were needed to achieve compliance.

3.4 Equipment Modifications

No equipment modifications are required and none have been made.

3.5 Configuration of Tested System

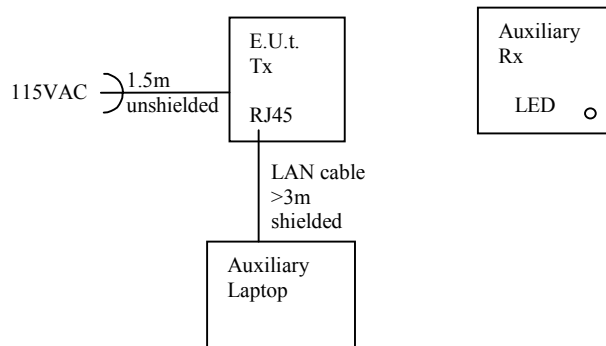


Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram

Withheld for reasons of confidentiality

4.2 Theory of Operation

The Exciter is a 125 kHz transmitter, which is powered from a 100-240VAC source. The Exciter can be connected to the AeroScout server for dynamically configuration and monitoring or can act as standalone Exciter with no connection to the server. The Exciter is a 125 kHz ASK modulated Beacon which transmits the same message in a preprogrammed interval. The messages that the Exciter transmits cause the AeroScout tag to wakeup and transmit a reply message to the AeroScout location Receivers.

5. Conducted and Radiated Measurement Photos



Figure 4. Conducted Emission Test.



Figure 5. Radiated Emission Test.

6. Conducted Emission Data

6.1 Test Specification

F.C.C., Part 15, Subpart B: Class B

6.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 3.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room (see section 3), with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50 μ Hn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, and using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

The E.U.T. was operated in the frequency of 125 kHz.

6.3 **Measured Data**

JUDGEMENT: Passed by 19.3 dB

The margin between the emission levels and the specification limit is, in the worst case, 19.3 dB for the phase line at 2.59 MHz and 20.3 dB at 5.69 MHz for the neutral line.

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

The details of the highest emissions are given in Figure 6 to Figure 11.

TEST PERSONNEL:

Tester Signature: 

Date: 14.11.04

Typed/Printed Name: E. Pitt

Conducted Emission

E.U.T Description Exciter
Type EX-1000
Serial Number: 000CCC001278

Specification: F.C.C., Part 15, Subpart B:
 Class B
Lead: Phase
Detectors: Peak, Quasi-peak, Average

Frequency (MHz)	Peak Amplitude (dB μ V)	Quasi-peak Amplitude (dB μ V)	Specification (dB μ V)	Pass/Fail	Margin (dB)
0.20	39.9	38.9	63.7	Pass	-24.8
0.40	30.3	28.7	57.9	Pass	-29.2
0.60	23.5	22.7	56.0	Pass	-33.3
2.59	29.8	29.0	56.0	Pass	-27.0
5.67	33.8	31.7	60.0	Pass	-28.3
17.41	30.9	28.9	60.0	Pass	-31.1

Figure 6. Detectors: Peak, QUASI-PEAK

Frequency (MHz)	Peak Amplitude (dB μ V)	Average Amplitude (dB μ V)	Specification (dB μ V)	Pass/Fail	Margin (dB)
0.20	39.9	30.4	53.6	Pass	-23.2
0.40	30.3	26.0	47.9	Pass	-21.9
0.60	23.5	22.2	46.0	Pass	-23.8
2.59	29.8	26.7	46.0	Pass	-19.3
5.67	33.8	29.4	50.0	Pass	-20.6
17.41	30.9	24.1	50.0	Pass	-25.9

Figure 7. Detectors: Peak, AVERAGE .

Conducted Emission

E.U.T Description Exciter
Type EX-1000
Serial Number: 000CCC001278

Specification: F.C.C., Part 15, Subpart B:
 Class B
Lead: Phase
Detectors: Peak, Quasi-peak, Average

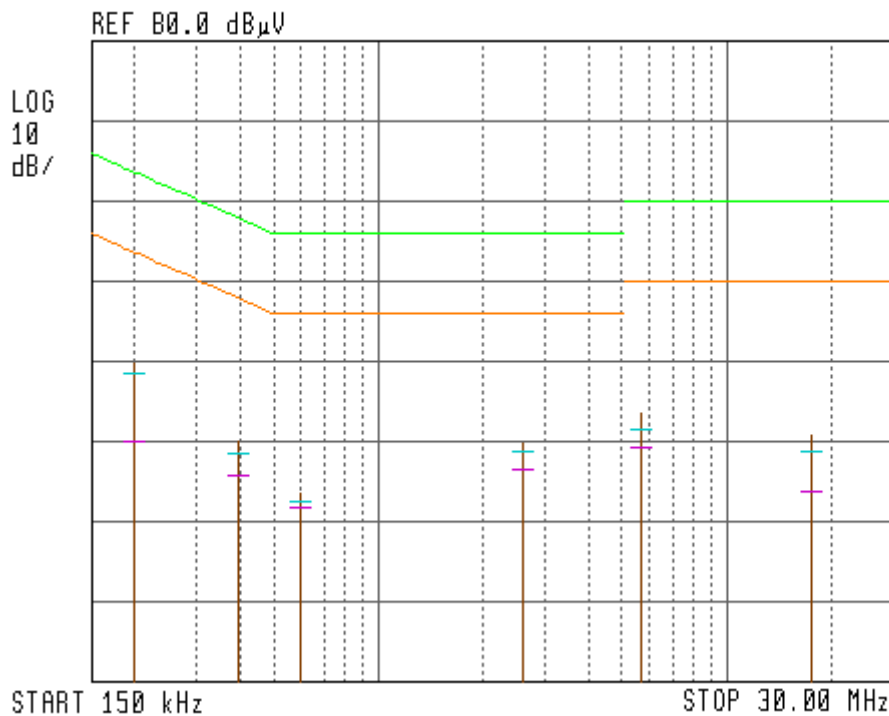


Figure 8. Detectors: Peak, Quasi-peak, Average

Notes:

1. Horizontal axis shows logarithmic frequency scale.
2. The vertical axis shows amplitude (in dB μV).
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.
5. Average detection is designated by the second dash mark (from the top) of each vertical line.

Conducted Emission

E.U.T Description Exciter
Type EX-1000
Serial Number: 000CCC001278

Specification: F.C.C., Part 15, Subpart B:
 Class B
Lead: Neutral
Detectors: Peak, Quasi-peak, Average

Frequency (MHz)	Peak Amplitude (dB μ V)	Quasi-peak Amplitude (dB μ V)	Specification (dB μ V)	Pass/Fail	Margin (dB)
0.20	40.7	39.9	63.7	Pass	-23.8
0.40	31.0	29.4	57.8	Pass	-28.4
0.60	25.8	24.6	56.0	Pass	-31.4
2.60	29.0	28.0	56.0	Pass	-28.0
5.69	33.9	32.3	60.0	Pass	-27.7
16.96	34.7	32.5	60.0	Pass	-27.5

Figure 9. Detectors: Peak, QUASI-PEAK

Frequency (MHz)	Peak Amplitude (dB μ V)	Average Amplitude (dB μ V)	Specification (dB μ V)	Pass/Fail	Margin (dB)
0.20	40.7	28.5	53.6	Pass	-25.1
0.40	31.0	26.6	47.9	Pass	-21.3
0.60	25.8	23.8	46.0	Pass	-22.2
2.60	29.0	25.2	46.0	Pass	-20.8
5.69	33.9	29.7	50.0	Pass	-20.3
16.96	34.7	28.7	50.0	Pass	-21.3

Figure 10. Detectors: Peak, AVERAGE

Conducted Emission

E.U.T Description Exciter
Type EX-1000
Serial Number: 000CCC001278

Specification: F.C.C., Part 15, Subpart B:
Class B

Lead: Neutral

Detectors: Peak, Quasi-peak, Average

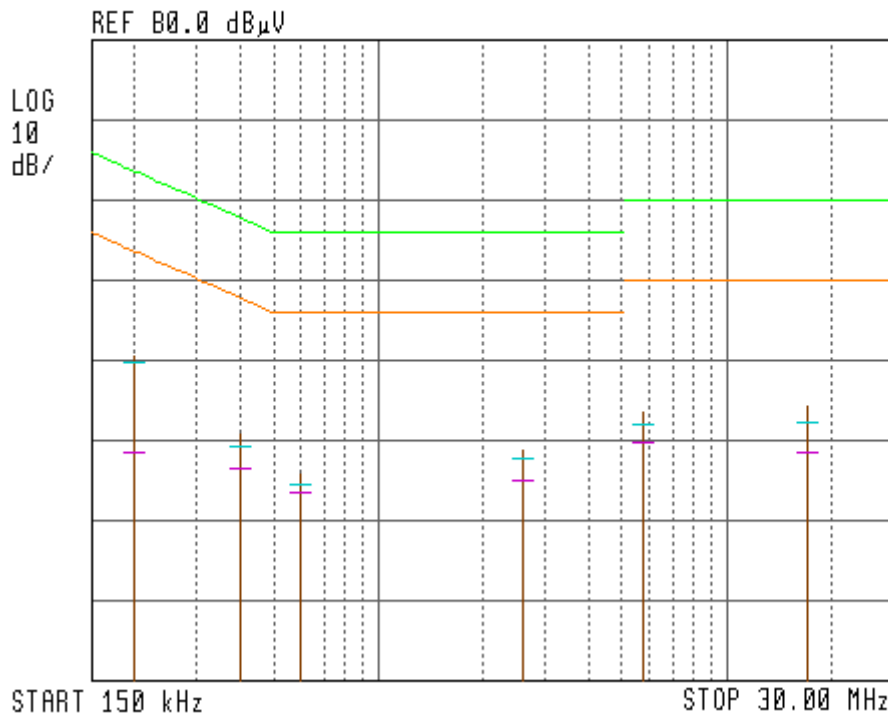


Figure 11 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

Notes:

1. Horizontal axis shows logarithmic frequency scale.
2. The vertical axis shows amplitude (in dB μV).
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.
5. Average detection is designated by the second dash mark (from the top) of each vertical line.

6.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Calibration	Period
LISN	Fischer	FCC-LISN-2A	127	April 1, 2004	1 year
LISN	Fischer	FCC-LISN-2A	128	April 1, 2004	1 year
Receiver	HP	85420E/85422E	3427A00103/34	February 28, 2004	1 year
Printer	HP	ThinkJet2225	2738508357	N/A	N/A

7. Radiated Emission, 9 kHz – 30 MHz

7.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C

7.2 Test Procedure

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 3.1.

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

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-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 10 meters.

The E.U.T. was operated at the frequency of 125 kHz

7.3 Measured Data

The only signal in the band 9 kHz – 30 MHz was the carrier frequency.

The margin between the emission levels and the specification limit is 26.3 dB.

See details in Figure 12.

TEST PERSONNEL:

Tester Signature: 

Date: 14.11.04

Typed/Printed Name: E. Pitt

Radiated Emission, Below 1 GHz

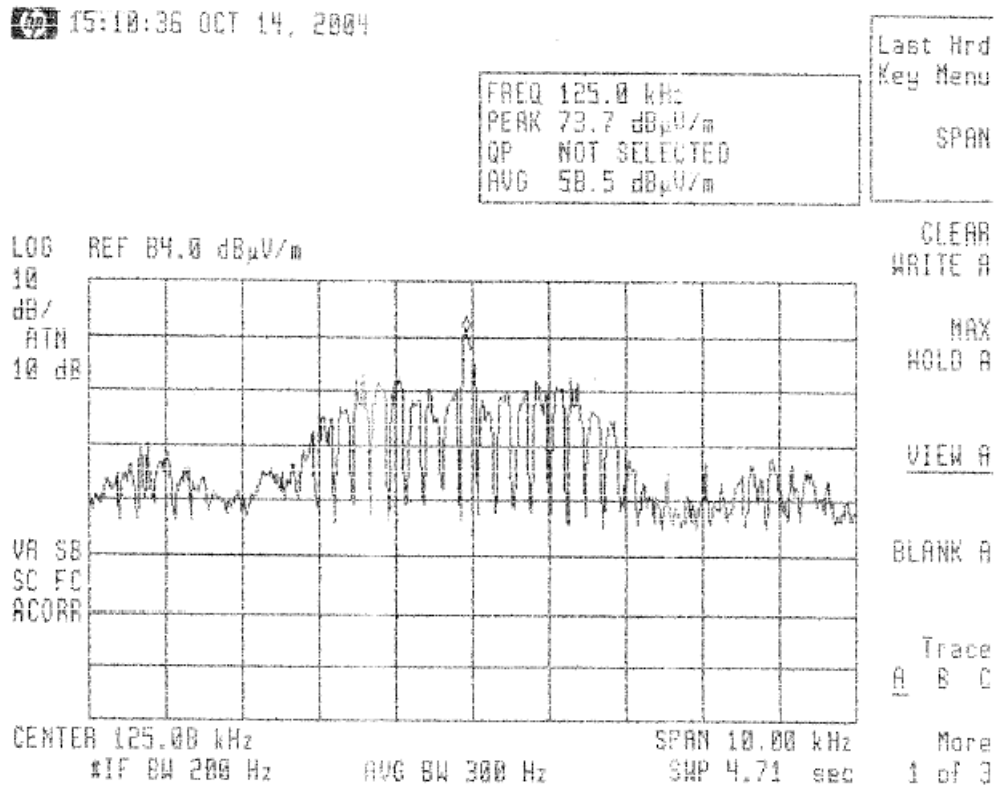


Figure 12 Spurious Radiated Emissions 9 kHz – 30 MHz

$$\text{Limit}_{300\text{m}} = 20 \log \frac{2400}{125} = 25.7 \text{ dB}\mu\text{V}/\text{m}$$

$$\text{Limit}_{10\text{m}} = 25.7 + 40 \log \frac{300}{10} = 84.8 \text{ dB}\mu\text{V}/\text{m}$$

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	February 28, 2004	1 year
RF Section	HP	85420E	3427A00103	February 28, 2004	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	April 11, 2004	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 21, 2004	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2003	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

7.5 Field Strength Calculation

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

$$FS = RA + AF + CF$$

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

No external pre-amplifiers are used.

8. Radiated Emission, 30 MHz –1 GHz

8.1 Test Specification

30 MHz-1000 MHz, FCC, Part 15, Subpart C

8.2 Test Procedure

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 3.1.

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

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

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 30-1000MHz, 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 E.U.T. was operated at the frequency of 125 kHz

8.3 **Measured Data**

The results for both operating and standby modes were the same.

JUDGEMENT: Passed by 4.2 dB

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

The margin between the emission level and the specification limit is 4.2 dB in the worst case at the frequency of 110.00 MHz, vertical polarization.

The details of the highest emissions are given in Figure 13 to Figure 20.

TEST PERSONNEL:

Tester Signature: 

Date: 14.11.04

Typed/Printed Name: E. Pitt

Radiated Emission 30 MHz– 1 GHz

E.U.T Description Exciter
 Type EX-1000
 Serial Number: 000CCC001278

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal
 Antenna: 3 meters distance

Frequency range: 30 MHz to 300 MHz
 Detectors: Peak, Quasi-peak

Frequency (MHz)	Peak Amp (dBμV/m)	QP Amp (dBμV/m)	Correction (dB)	Specification (dBμV/m)	Margin (dB)
51.03	26.2	22.0	11.4	40.0	-18.0
61.30	24.9	21.5	10.5	40.0	-18.5
110.01	32.6	31.6	13.0	43.5	-11.9
132.01	32.2	30.5	14.0	43.5	-13.0
154.01	37.5	36.6	15.1	43.5	-6.9
242.00	29.5	27.3	19.7	46.0	-18.7

**Figure 13. Radiated Emission. Antenna Polarization: HORIZONTAL.
 Detectors: Peak, Quasi-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.

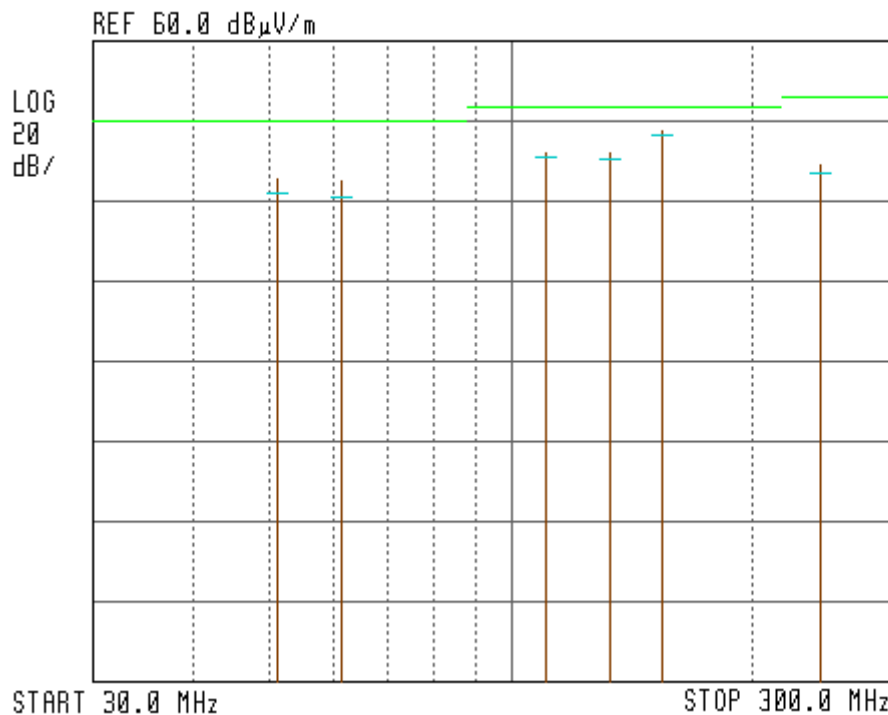
Radiated Emission 30 MHz– 1 GHz

E.U.T Description Exciter
 Type EX-1000
 Serial Number: 000CCC001278

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal
 Antenna: 3 meters distance

Frequency range: 30 MHz to 300 MHz
 Detectors: Peak, Quasi-peak



**Figure 14. 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 μ 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 30 MHz– 1 GHz

E.U.T Description Exciter
 Type EX-1000
 Serial Number: 000CCC001278

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal
 Antenna: 3 meters distance

Frequency range: 300 MHz to 1 GHz
 Detectors: Peak, Quasi-peak

Frequency (MHz)	Peak Amp (dBμV/m)	QP Amp (dBμV/m)	Correction (dB)	Specification (dBμV/m)	Margin (dB)
462.00	38.8	37.7	19.3	46.0	-8.3
506.00	37.9	36.9	20.0	46.0	-9.1
550.00	39.5	38.7	21.1	46.0	-7.3
616.00	38.1	36.6	22.6	46.0	-9.4
660.00	38.3	36.6	23.5	46.0	-9.4
792.00	33.4	30.3	25.4	46.0	-15.7

**Figure 15. Radiated Emission. Antenna Polarization: HORIZONTAL.
 Detectors: Peak, Quasi-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.

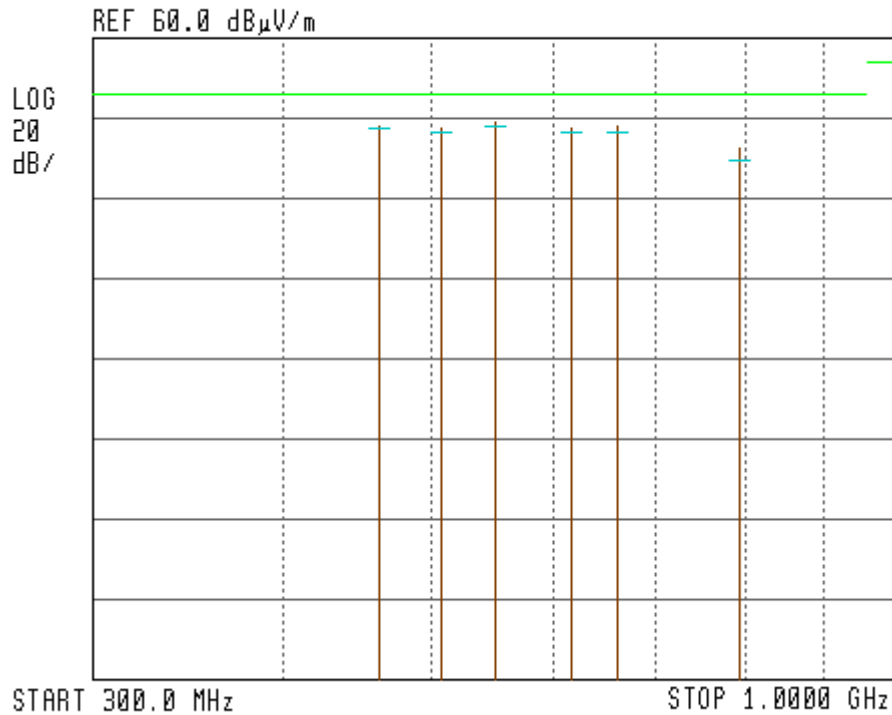
Radiated Emission 30 MHz– 1 GHz

E.U.T Description Exciter
 Type EX-1000
 Serial Number: 000CCC001278

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal
 Antenna: 3 meters distance

Frequency range: 300 MHz to 1 GHz
 Detectors: Peak, Quasi-peak



**Figure 16. 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 μ 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 30 MHz– 1 GHz

E.U.T Description Exciter
 Type EX-1000
 Serial Number: 000CCC001278

Specification: FCC Part 15, Subpart C

Antenna Polarization: Vertical
 Antenna: 3 meters distance

Frequency range: 30 MHz to 300 MHz
 Detectors: Peak, Quasi-peak

Frequency	Peak Amp	QP Amp	Correction	Specification	Margin
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB)
44.61	38.1	34.7	12.4	40.0	-5.3
50.81	36.8	33.0	11.4	40.0	-7.0
62.77	35.7	32.0	10.4	40.0	-8.0
110.00	40.0	39.3	13.0	43.5	-4.2
132.00	33.0	31.6	14.0	43.5	-11.9
154.00	35.3	34.5	15.1	43.5	-9.0

**Figure 17. Radiated Emission. Antenna Polarization: VERTICAL.
 Detectors: Peak, Quasi-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.

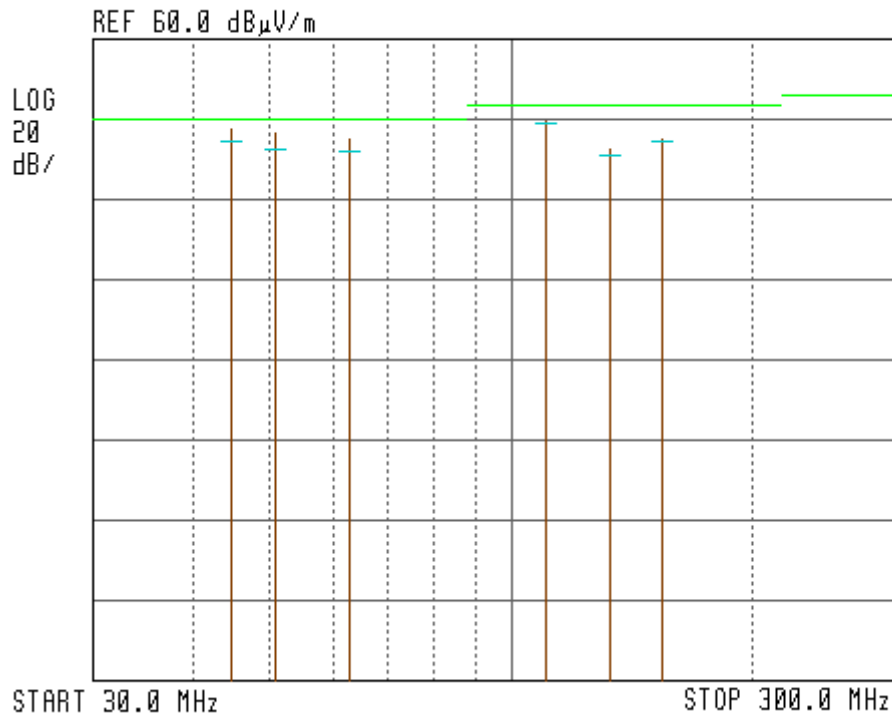
Radiated Emission 30 MHz– 1 GHz

E.U.T Description	Exciter
Type	EX-1000
Serial Number:	000CCC001278

Specification: FCC Part 15, Subpart C

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 30 MHz to 300 MHz
Detectors: Peak, Quasi-peak



**Figure 18. 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 μ 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 30 MHz– 1 GHz

E.U.T Description Exciter
 Type EX-1000
 Serial Number: 000CCC001278

Specification: FCC Part 15, Subpart C

Antenna Polarization: Vertical
 Antenna: 3 meters distance

Frequency range: 300 MHz to 1 GHz
 Detectors: Peak, Quasi-peak

Frequency	Peak Amp	QP Amp	Correction	Specification	Margin
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB)
308.00	30.9	29.0	15.0	46.0	-17.0
418.00	32.7	31.1	18.7	46.0	-14.9
462.00	35.9	34.2	19.3	46.0	-11.8
616.00	37.4	35.6	22.6	46.0	-10.4
660.00	40.7	39.6	23.5	46.0	-6.4
682.00	34.5	32.3	24.0	46.0	-13.7

**Figure 19. Radiated Emission. Antenna Polarization: VERTICAL.
 Detectors: Peak, Quasi-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.

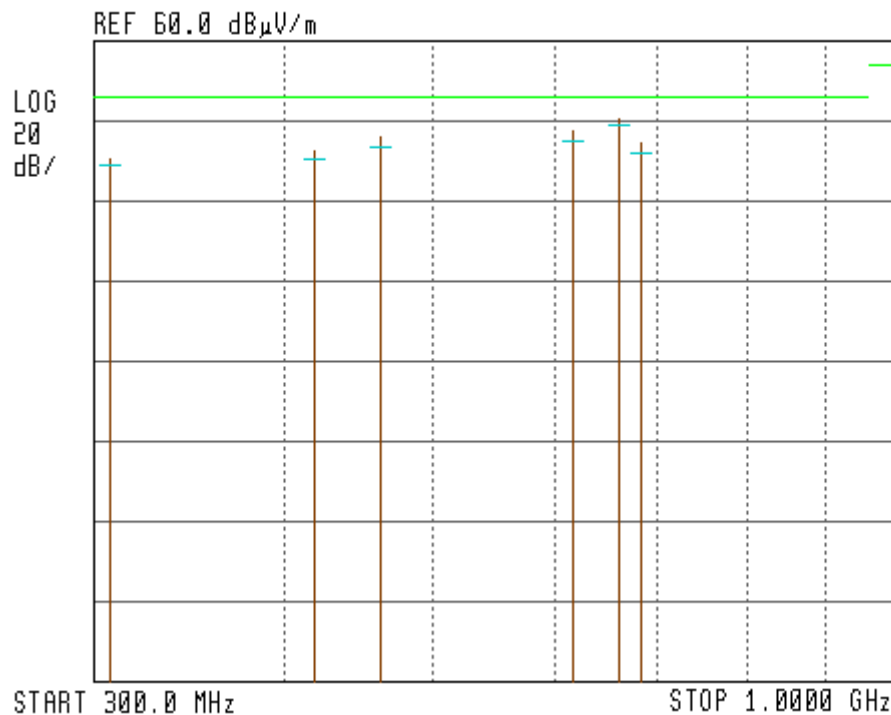
Radiated Emission 30 MHz– 1 GHz

E.U.T Description	Exciter
Type	EX-1000
Serial Number:	000CCC001278

Specification: FCC Part 15, Subpart C

Antenna Polarization: Vertical
Antenna: 3 meters distance

Frequency range: 300 MHz to 1 GHz
Detectors: Peak, Quasi-peak



**Figure 20. 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 μ 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 Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	February 28, 2004	1 year
RF Section	HP	85420E	3427A00103	February 28, 2004	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	April 11, 2004	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 21, 2004	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2003	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

8.5 Field Strength Calculation

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

$$FS = RA + AF + CF$$

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

No external pre-amplifiers are used.

9. Photographs of Tested E.U.T.



Figure 21 Front View



Figure 22 Rear View



Figure 23 Top View



Figure 24 Bottom View



Figure 25 Front Cover Internal View With Antennas



Figure 26 Rear Cover Internal View

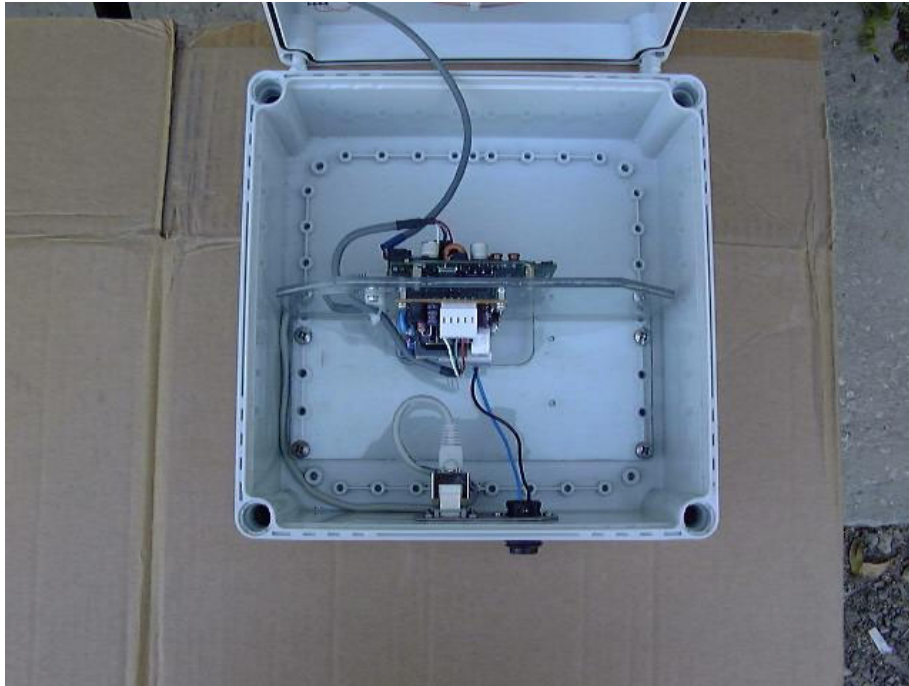


Figure 27 PCBs in Unit



Figure 28 PCBs Side 1

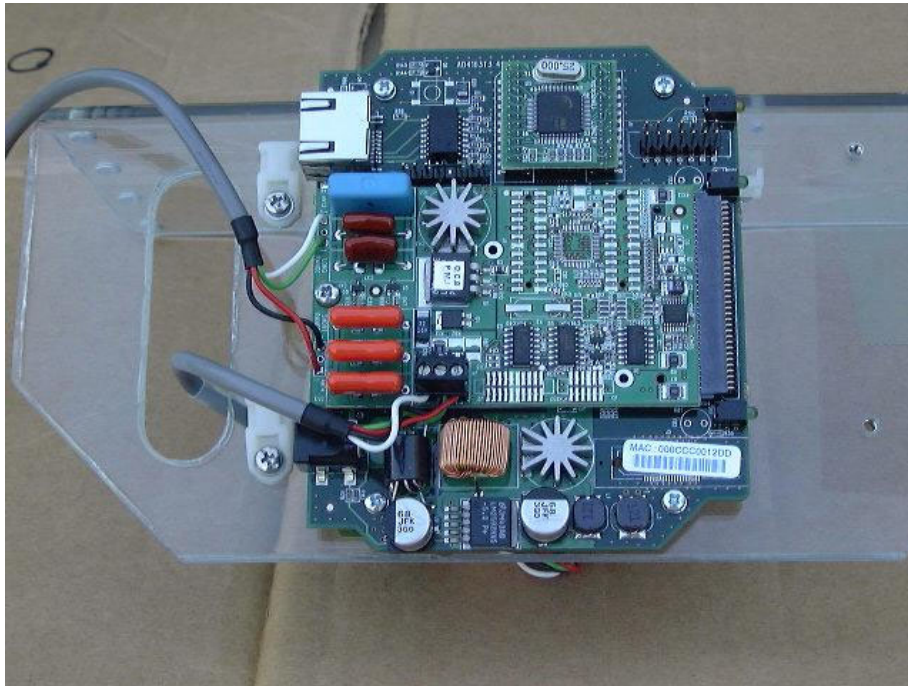


Figure 29 PCBs Side 2

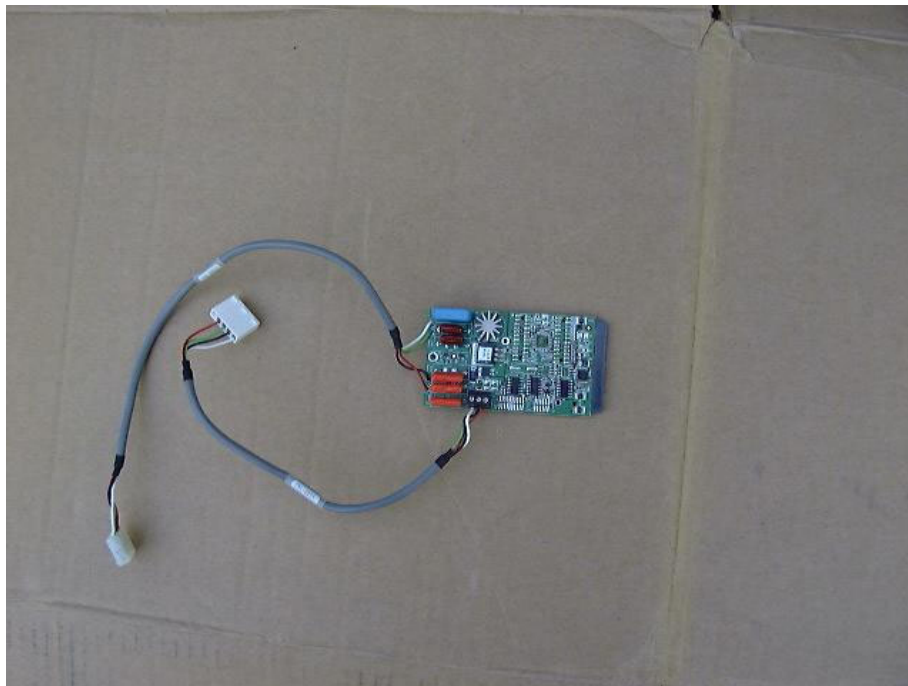


Figure 30 PCB 1 + Connecting Cables

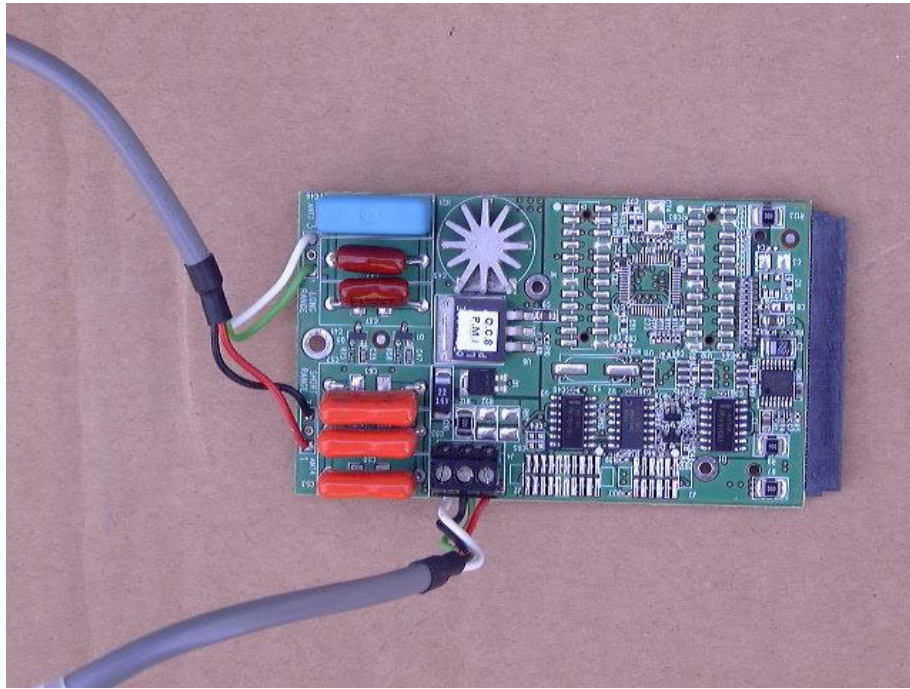


Figure 31 PCB 1 Side 1

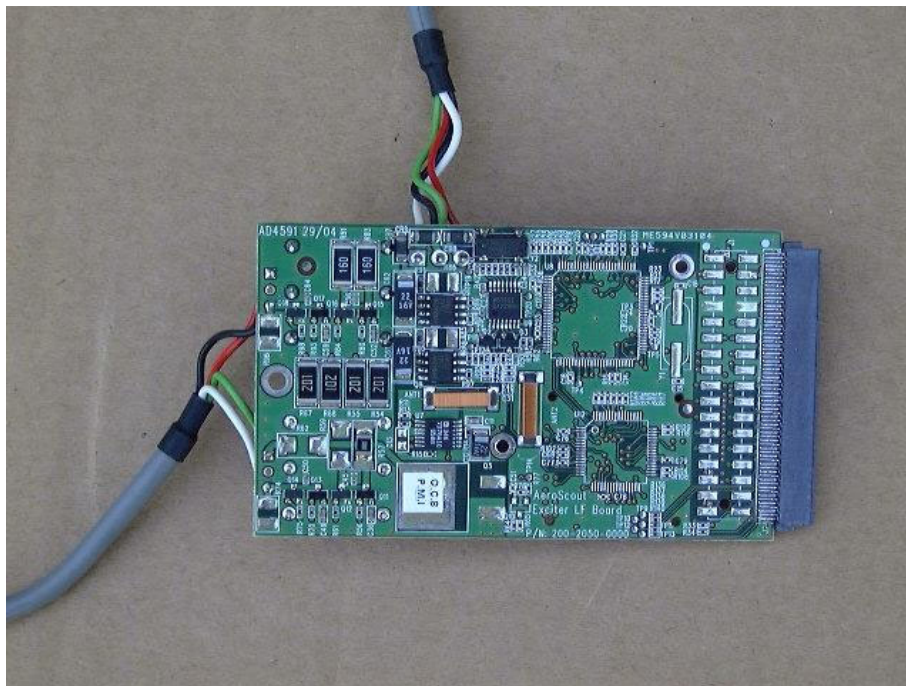


Figure 32 PCB 1 Side 2

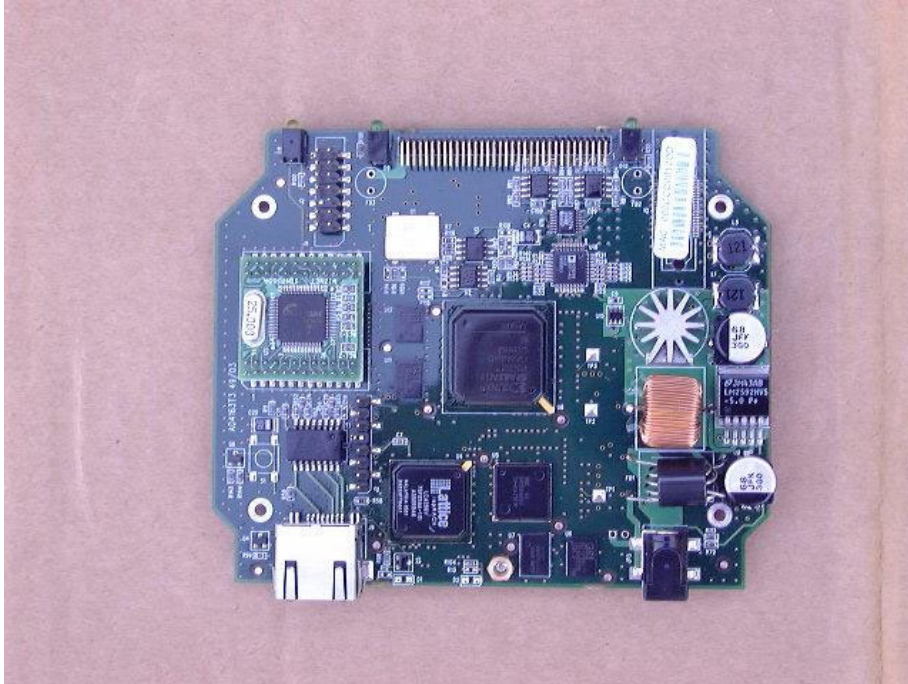


Figure 33 PCB 2 Side 1

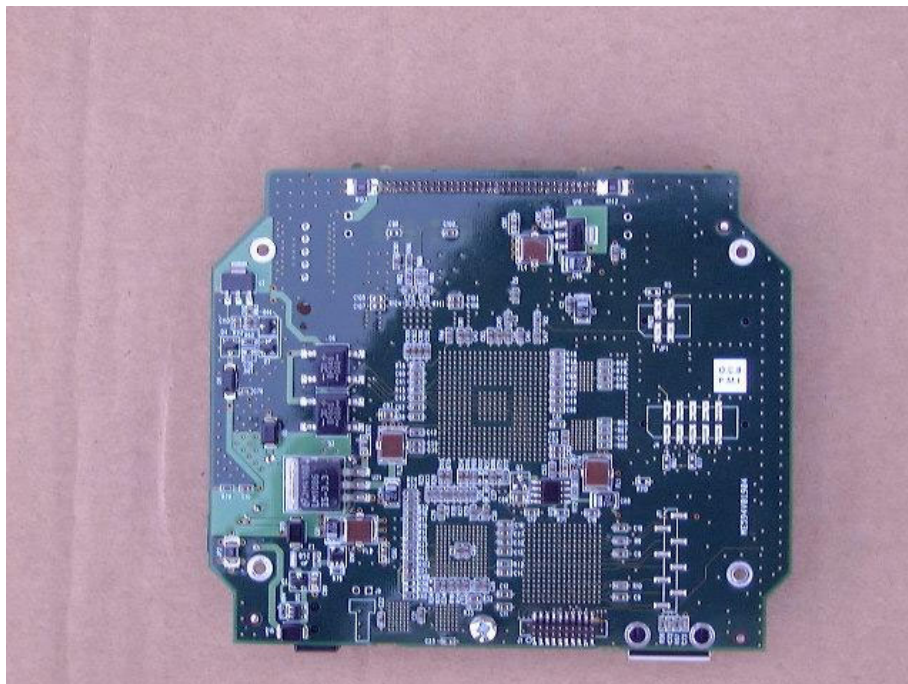


Figure 34 PCB 2 Side 2



Figure 35 PCB 3 Side 1

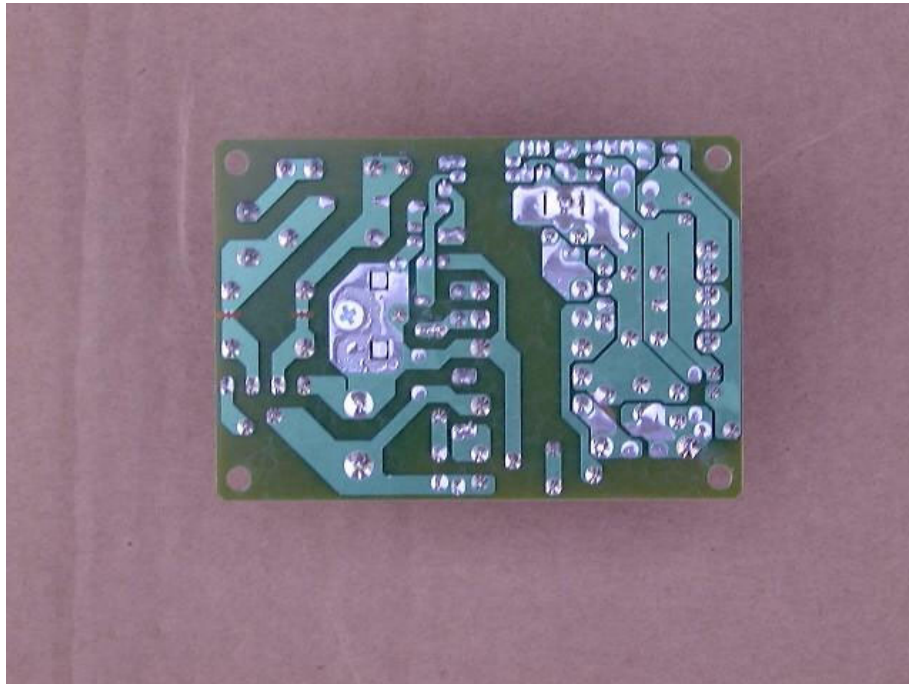


Figure 36 PCB 3 Side 2

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	0.5	1200.0	7.5
20.0	0.7	1400.0	8.2
30.0	1.0	1600.0	9.0
40.0	1.2	1800.0	9.6
50.0	1.3	2000.0	10.7
60.0	1.5	2300.0	11.1
70.0	1.6	2600.0	11.8
80.0	1.7	2900.0	12.8
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		

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 EMI receiver
to test antenna

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.1	1200.0	1.4
20.0	0.1	1400.0	1.5
30.0	0.2	1600.0	1.5
40.0	0.2	1800.0	1.7
50.0	0.2	2000.0	1.7
60.0	0.2	2300.0	2.0
70.0	0.3	2600.0	2.1
80.0	0.3	2900.0	2.2
90.0	0.3		
100.0	0.3		
150.0	0.4		
200.0	0.4		
250.0	0.4		
300.0	0.5		
350.0	0.6		
400.0	0.6		
450.0	0.6		
500.0	0.7		
600.0	0.8		
700.0	0.8		
800.0	1.0		
900.0	1.1		
1000.0	1.1		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 5.5 meters.

10.4 Correction factors for

CABLE

from EMI receiver
to test antenna
at 10 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.6	1200.0	9.7
20.0	1.1	1400.0	10.5
30.0	1.3	1600.0	11.5
40.0	1.6	1800.0	12.6
50.0	1.7	2000.0	13.5
60.0	1.9	2300.0	14.3
70.0	2.0	2600.0	15.5
80.0	2.2	2900.0	16.4
90.0	2.3		
100.0	2.4		
150.0	3.1		
200.0	3.6		
250.0	4.2		
300.0	4.5		
350.0	4.8		
400.0	5.2		
450.0	5.5		
500.0	6.2		
600.0	6.4		
700.0	7.0		
800.0	7.5		
900.0	8.1		
1000.0	8.6		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 34 meters.
3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

10.5 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 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".

10.6 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 BICONICAL ANTENNA
Type BCD-235/B,
10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

10.8 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

17.13 Correction factors for**Horn Antenna****Model: SWH-28
at 1 meter range.**

FREQUENCY (GHz)	AFE (dB /m)	Gain (dBi)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

17.14 Correction factors for BICONICAL ANTENNA
Type 3109,
1.0 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	11.1
30.0	12.0
40.0	12.0
50.0	11.4
60.0	10.3
70.0	10.7
80.0	8.3
90.0	9.0
100.0	10.0
110.0	11.6
120.0	13.6
130.0	14.2
140.0	13.5
150.0	12.7
160.0	12.7
170.0	13.6
180.0	15.3
190.0	14.6
200.0	14.7
210.0	15.3
220.0	15.8
230.0	17.0
240.0	18.0
250.0	18.1
260.0	18.0
270.0	17.5
280.0	18.2
290.0	19.7
300.0	21.8

NOTES:

1. Antenna serial number is 3244.
2. The above list is located in file 44BIC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"

17.15. Correction factors for BICONICAL ANTENNA
Type 3109,
3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	18.4
30.0	14.0
40.0	12.3
50.0	10.6
60.0	8.3
70.0	8.7
80.0	7.2
90.0	8.6
100.0	10.1
110.0	11.2
120.0	11.8
130.0	12.3
140.0	12.7
150.0	12.5
160.0	12.4
170.0	12.1
180.0	12.2
190.0	12.8
200.0	13.7
210.0	14.5
220.0	15.4
230.0	15.9
240.0	16.3
250.0	16.7
260.0	17.1
270.0	17.2
280.0	17.5
290.0	18.1
300.0	18.9

NOTES:

- 1. Antenna serial number is 3244.*
- 2. The above list is located in file 44BIC3M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"*