

**DATE: 28 December 2009**

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

# **FCC Radio Test Report**

**for**

**Hi-G-Tek Ltd.**

**Equipment under test:**

**ISO 18000-7 Fixed RFID Interrogator**

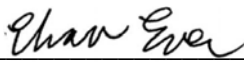
**IG-RF-97D1-433**

Written by:



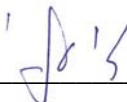
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Approved by:



E. Ever, 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.

# ISO 18000-7 Fixed RFID Interrogator

IG-RF-97D1-433

**FCC ID: OB6-IGRF97433**

28 December 2009

This report concerns:	Original Grant:	x
	Class I change:	
	Class II change:	

Equipment type: Part 15 Security/Remote Control Transceiver

47CFR15 Section 15.231 (a-d)

Measurement procedure used is ANSI C63.4-2003.

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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
Equipment Under Test (E.U.T):	ISO 18000-7 Fixed RFID Interrogator
Equipment Model No.:	IG-RF-97D1-433
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	20/10/2009
Start of Test:	21/10/2009
End of Test:	21/10/2009
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), IC File No.: 46405-4025; Site No. IC 4025B-1.
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 18.7 Series Active Fixed RFID Interrogator is designed to monitor 18.7 Secure Series Transponders.

The unit is connected to a host control computer, either directly or via Ethernet, and monitors all transponders in its vicinity. The interrogator performs periodic monitoring requests of all transponders, by broadcasting a “wake up” request sent to all the transponders and each one of them responds with its a present status.

### **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 September 3, 2009).

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

### **1.6     *Measurement Uncertainty***

Conducted Emission

The uncertainty for this test is  $\pm 2$  dB.

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. System Test Configuration

### 2.1 Justification

The E.U.T. is either pole or wall mounted.

The E.U.T. was tested in the vertical position.

### 2.2 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 (RF PILOT utility running in a laptop) used during the RF testing. The EUT was programmed by the utility to transmit continuously random data or carrier wave (CW) according to test procedures.

### 2.3 Special Accessories

No special accessories were needed.

### 2.4 Equipment Modifications

No modifications were needed in order to achieve compliance

### 2.5 Configuration of Tested System

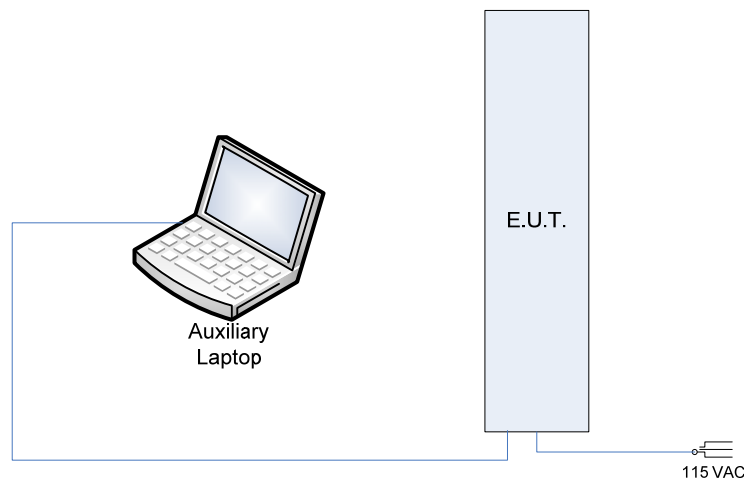


Figure 1. Configuration of Tested System



### 3. Conducted and Radiated Measurement Test Set-up Photo

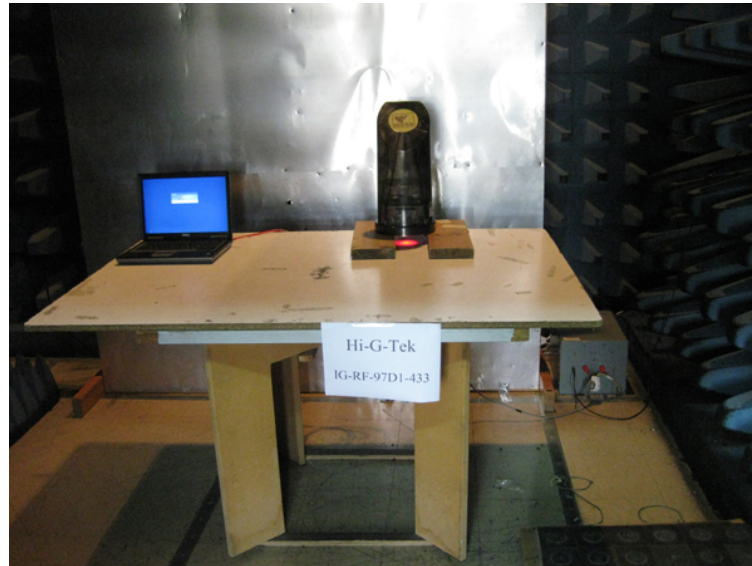


Figure 2. Conducted Emission Test



Figure 3. Radiated Emission Test

## 4. Conducted Emission Data

### 4.1 Test Specification

F.C.C., Part 15, Subpart C

### 4.2 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, 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 a 50 Ohm / 50  $\mu$ 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.

### 4.3 Measured Data

JUDGEMENT: Passed by 1.2 dB

The margin between the emission levels and the specification limit is, in the worst case, 1.2 dB for the phase line at 0.21 MHz and 1.2 dB at 16.54 MHz for the neutral line.

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

The details of the highest emissions are given in *Figure 4* to *Figure 7*.

TEST PERSONNEL:

Tester Signature: Charo Ever

Date: 28.12.09

Typed/Printed Name: E. Ever

## Conducted Emission

E.U.T Description      ISO 18000-7 Fixed RFID Interrogator  
Type                      IG-RF-97D1-433  
Serial Number:        Not Designated

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

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.206008	53.7	53.1	-10.3	52.2	-1.2	0.0
2	0.411445	34.9	34.1	-23.6	33.6	-14.1	0.0
3	0.563691	28.4	27.0	-29.0	17.8	-28.2	0.0
4	14.811338	39.2	36.1	-23.9	27.5	-22.5	0.0
5	15.955271	43.9	41.3	-18.6	37.8	-12.2	0.0
6	21.085247	39.9	38.1	-21.9	32.3	-17.7	0.0

**Figure 4. Detectors: Peak, Quasi-peak, AVERAGE .**

*Note: QP Delta/Av 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.*

## Conducted Emission

E.U.T Description      ISO 18000-7 Fixed RFID Interrogator  
Type                      IG-RF-97D1-433  
Serial Number:        Not Designated

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

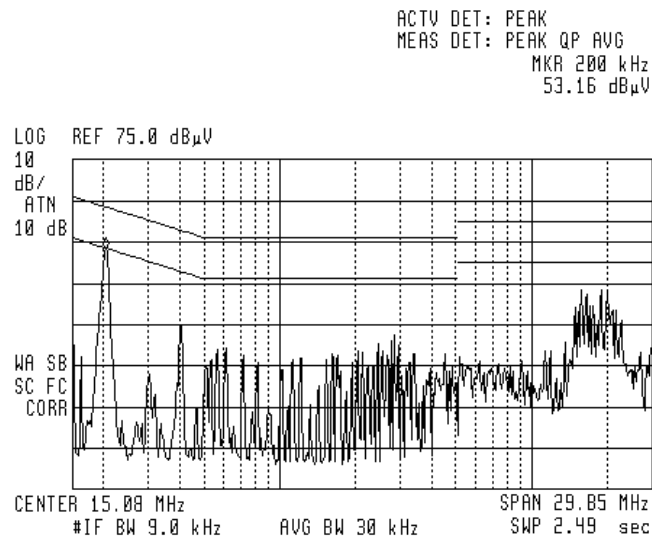


Figure 5. Detectors: Peak, Quasi-peak, Average

## Conducted Emission

E.U.T Description      ISO 18000-7 Fixed RFID Interrogator  
Type                      IG-RF-97D1-433  
Serial Number:        Not Designated

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

Signal Number	Frequency (MHz)	Peak (dBuV)	QP (dBuV)	QP Delta L 1 (dB)	Avg (dBuV)	Av Delta L 2 (dB)	Corr (dB)
1	0.204853	50.5	49.9	-13.6	48.7	-4.7	0.0
2	0.411027	33.4	31.8	-25.9	30.8	-16.8	0.0
3	19.938095	41.7	39.3	-20.7	28.1	-21.9	0.0
4	14.824595	45.7	44.4	-15.6	38.9	-11.1	0.0
5	15.960327	53.4	52.4	-7.6	45.8	-4.2	0.0
6	16.535088	53.9	53.0	-7.0	48.8	-1.2	0.0

**Figure 6. Detectors: Peak, Quasi-peak, AVERAGE**

*Note: QP Delta/Av 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.*

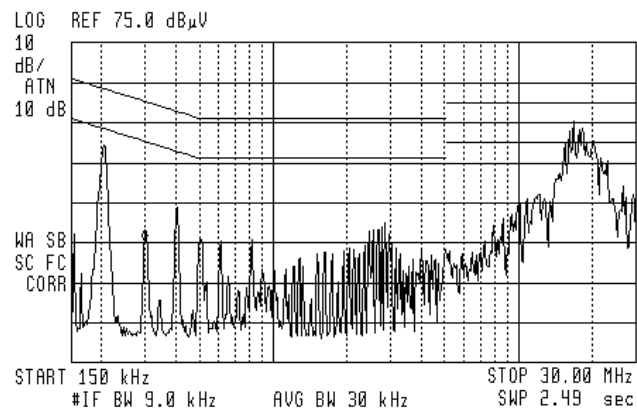
## Conducted Emission

E.U.T Description      ISO 18000-7 Fixed RFID Interrogator  
Type                      IG-RF-97D1-433  
Serial Number:        Not Designated

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



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKA 300 kHz  
25.45 dBμV



**Figure 7 Conducted Emission: NEUTRAL**  
**Detectors: Peak, Quasi-peak, Average**

#### 4.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 3, 2009	1 Year
LISN	Fischer	FCC-LISN-2A	128	March 3, 2009	1 Year
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 Year
RF Filter Section	HP	85420E	3705A00248	November 16, 2008	1 Year
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

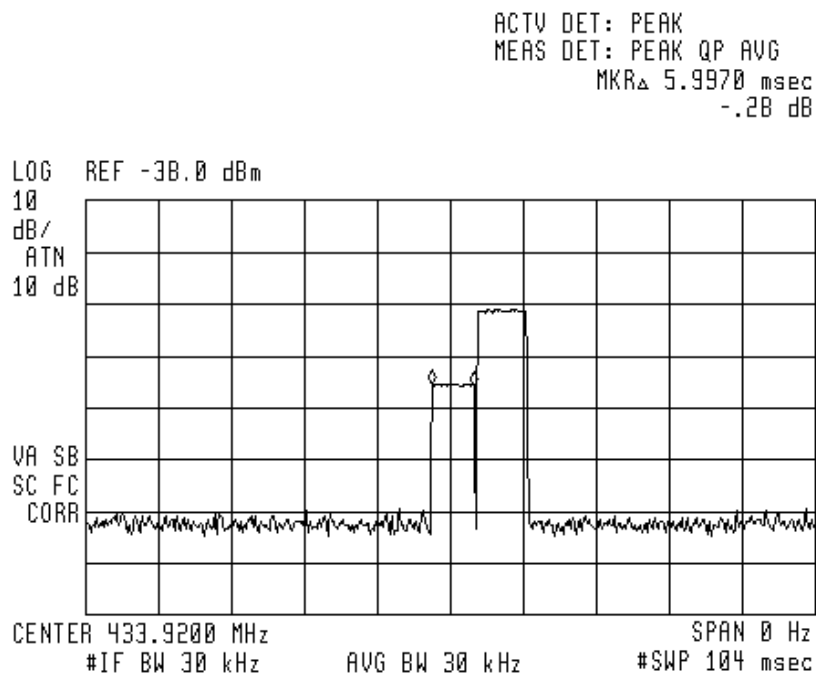
## 5. Average Factor Calculation

1. Burst duration = 5.997 msec

$$\text{Average Factor} = 20 \log \left[ \frac{\text{burst duration}}{100 \text{ msec}} \right]$$

$$\text{Average Factor} = 20 \log \left[ \frac{5.997}{100} \right]$$

Average factor is -24.4 dB with 100 msec as the worst case.



**Figure 8. Transmission pulse duration = 5.997 msec**



### 5.1 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 Year
Antenna Bioconical	ARA	BCD 235/B	1041	March 25, 2009	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	1 year
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 29, 2009	2 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. Periodic Operation

### 6.1 Specification

F.C.C., Part 15, Subpart C, Section 15.231(a)

### 6.2 Requirements

Requirement	Rationale	Verdict
Continuous transmissions are not permitted.	Customer Declaration.	Complies
A manually operated transmitter shall be deactivated within not more than 5 seconds after releasing the switch.	Not applicable	Complies
An automatically operated transmitter shall cease operation within 5 seconds after activation.	See plots in Figure 9 to Figure 11	Complies
Periodic transmissions at regular predetermined intervals are not permitted.	Customer Declaration.	Complies
Polling or supervised transmissions to determine system integrity of transmitter used in security or safety applications shall not exceed more than 2 seconds per hour.	Customer Declaration.	Complies

### 6.3 Results

JUDGEMENT: Passed

The EUT met the FCC Part 15, Subpart C, Section 15.231(a) specification requirements.

TEST PERSONNEL:

Tester Signature: E. Ever

Date: 28.12.09

Typed/Printed Name: E. Ever

## Periodic Operation

E.U.T Description ISO 18000-7 Fixed RFID Interrogator  
Type IG-RF-97D1-433  
Serial Number: Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

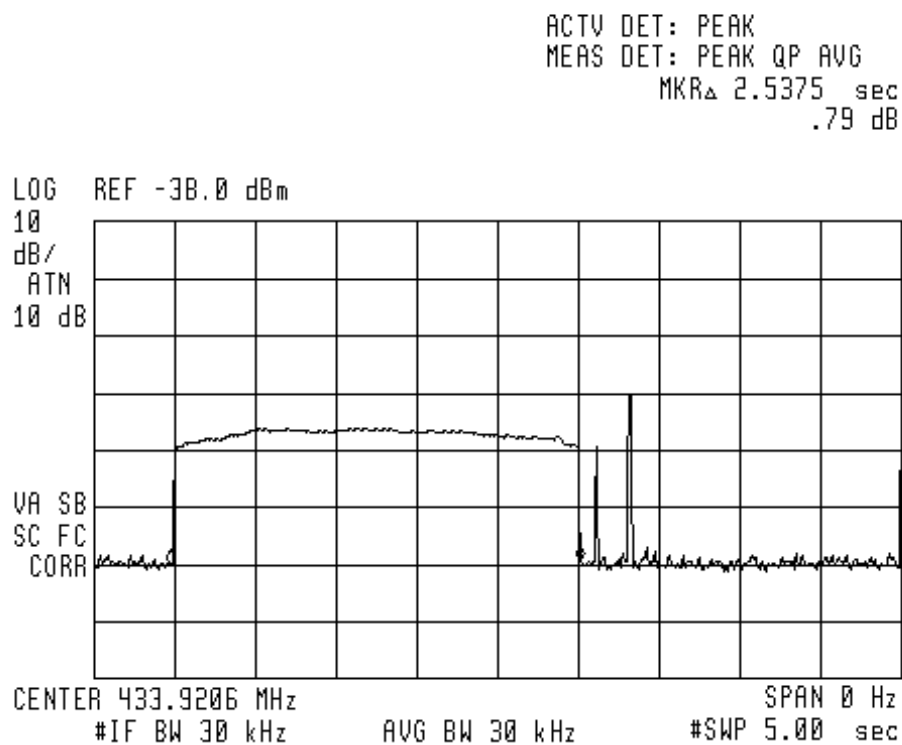


Figure 9. System Integrity Pulse Width

## Periodic Operation

E.U.T Description ISO 18000-7 Fixed RFID Interrogator  
Type IG-RF-97D1-433  
Serial Number: Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

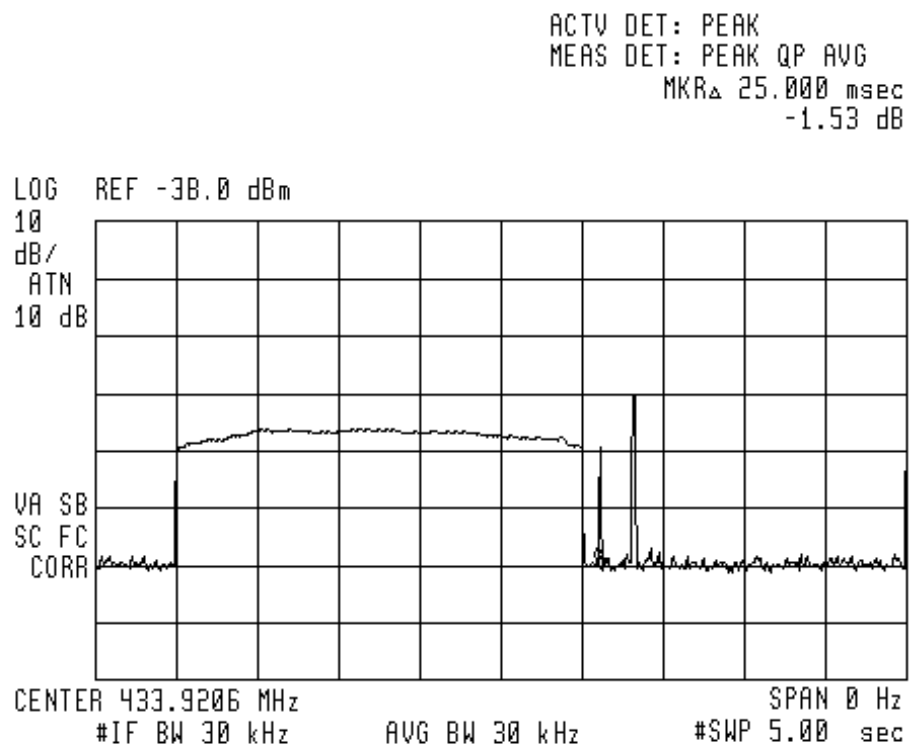


Figure 10. System Integrity Within 1 Hour

## Periodic Operation

E.U.T Description    ISO 18000-7 Fixed RFID Interrogator  
Type                    IG-RF-97D1-433  
Serial Number:        Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

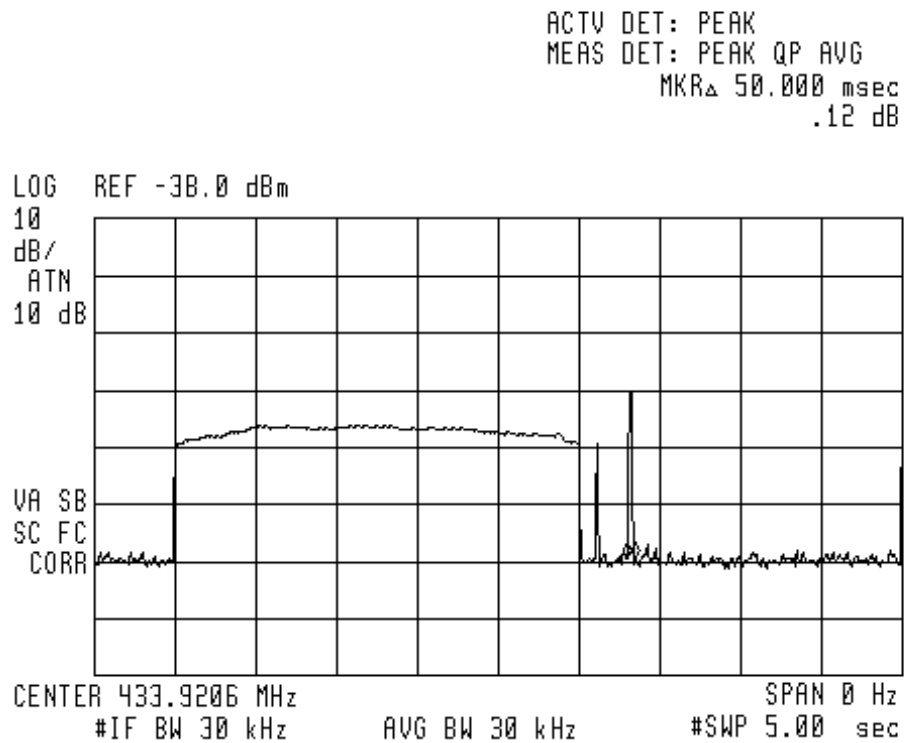


Figure 11. System Integrity Within 1 Hour

## 7. Field Strength of Fundamental

### 7.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.231(b)

### 7.2 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 (433.92MHz) 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.

The average result is:

Peak Level(dB $\mu$ V/m) + E.U.T. Duty Cycle Factor, in 100msec time window (dB)

### 7.3 Measured Data

JUDGEMENT: Passed by 34.1 dB

The EUT met the FCC Part 15, Subpart C, Section 15.231(b) specification requirements.

The details of the highest emissions are given in Figure 12 to Figure 14.

TEST PERSONNEL:

Tester Signature: E. Ever

Date: 28.12.09

Typed/Printed Name: E. Ever

## Field Strength of Fundamental

E.U.T Description ISO 18000-7 Fixed RFID Interrogator  
Type IG-RF-97D1-433  
Serial Number: Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

Antenna Polarization: Horizontal/Vertical

Test Distance: 3 meters

Detector: Peak

Freq. (MHz)	Pol. V/H	Peak Reading (dBμV/m)	Average Factor (dB)	AVG Result (dBμV/m)	AVG Specification (dBμV/m)	Margin (dB)
433.87	H	71.1	-24.4	46.7	80.8	-34.1
433.87	V	70.8	-24.4	46.4	80.8	-34.4

**Figure 12. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL/VERTICAL.  
Detector: Peak**

### Notes:

1. 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.
2. "Peak Reading." (dBμV/m) included the "Correction Factors".
3. "Correction Factors" (dB) = Test Antenna Correction Factor(dB) + Cable Loss.
4. "Average Factor = -24.4 dB
5. "Average Result" (dBμV/m)=Peak Reading (dBμV/m) + Average Factor (dB)

## Field Strength of Fundamental

E.U.T Description ISO 18000-7 Fixed RFID Interrogator  
Type IG-RF-97D1-433  
Serial Number: Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

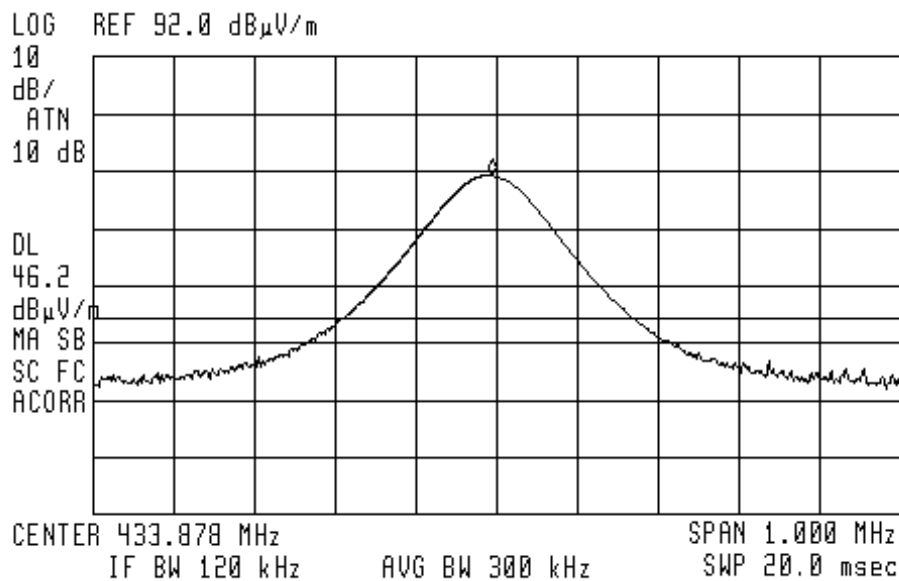
Antenna Polarization: Horizontal

Test Distance: 3 meters

Detectors: Peak, Quasi-peak, Average



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKA 433.873 MHz  
71.13 dB $\mu$ V/m



**Figure 13. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL.  
Detectors: Peak, Quasi-peak, Average**



## Field Strength of Fundamental

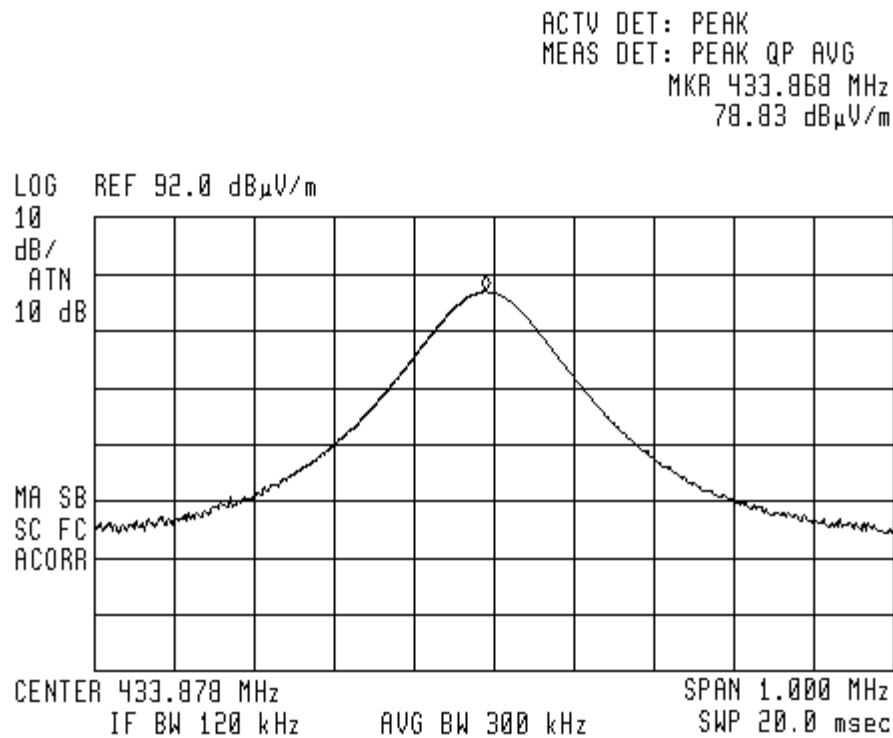
E.U.T Description ISO 18000-7 Fixed RFID Interrogator  
Type IG-RF-97D1-433  
Serial Number: Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

Antenna Polarization: Vertical

Test Distance: 3 meters

Detectors: Peak, Quasi-peak, Average



**Figure 14. Field Strength of Fundamental. Antenna Polarization: VERTICAL.  
Detectors: Peak, Quasi-peak, Average**

#### **7.4 Test Instrumentation Used, Field Strength of Fundamental**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration</b>	<b>Period</b>
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	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

## 8. Radiated Emission, 9 kHz – 30 MHz

### 8.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

### 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 9 kHz-30 MHz was scanned.

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 433.87 MHz. This frequency was measured using a peak detector.

### 8.3 Measured Data

JUDGEMENT: Passed

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

The EUT was tested and it met the requirements of the FCC Part 15, Subpart C, specification.

TEST PERSONNEL:

Tester Signature: Chan Ever

Date: 28.12.09

Typed/Printed Name: E. Ever

#### **8.4 Test Instrumentation Used, Radiated Measurements**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration</b>	<b>Period</b>
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2009	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

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

Example:  $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$

No external pre-amplifiers are used.

## 9. Spurious Radiated Emission

### 9.1 Test Specification

30 - 4400 MHz, F.C.C., Part 15, Subpart C

### 9.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3. See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

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 1. The signals from the list of the highest emissions were verified and the list was 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 2.9 – 4.4 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.)

The emissions were measured at a distance of 3 meters.

### 9.3 **Test Data**

JUDGEMENT: Passed

The signals in the band 30 – 4400 MHz were at least 20 dB below the specification limit.

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

TEST PERSONNEL:

Tester Signature: *E. Ever*

Date: 28.12.09

Typed/Printed Name: E. Ever

#### 9.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS- 0411N313	013	January 7, 2009	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 Year
Antenna Bioconical	ARA	BCD 235/B	1041	March 25, 2009	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	1 year
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 29, 2009	2 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



## 10. Bandwidth

### 10.1 Test procedure

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 30 kHz resolution BW and center frequency of the transmitter fundamental. The spectrum bandwidth of the transmitter unit was measured and recorded. The BW was measured at 20 dBc points.

The EUT was set up as shown in Figure 1, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on the modulation envelope.

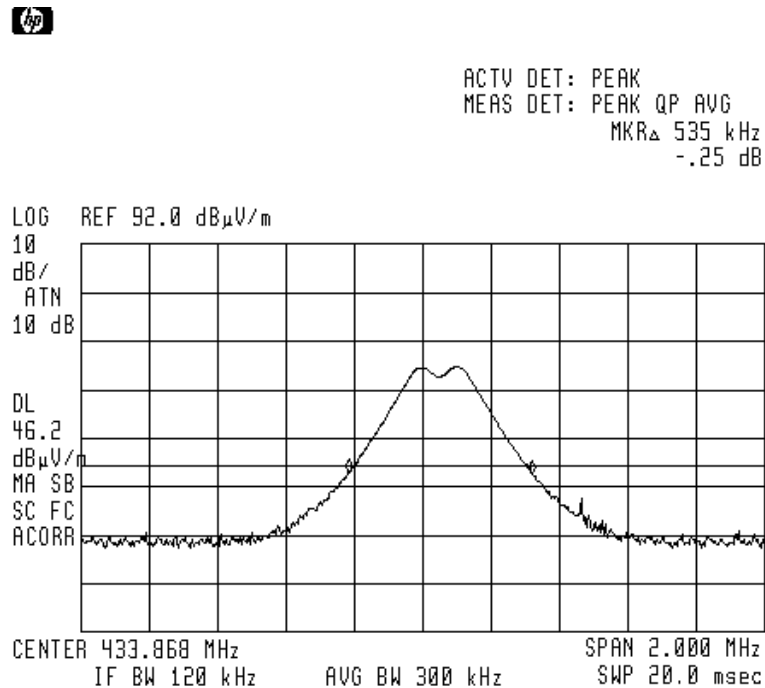


Figure 15



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 433.653 MHz  
45.14 dB $\mu$ V/m

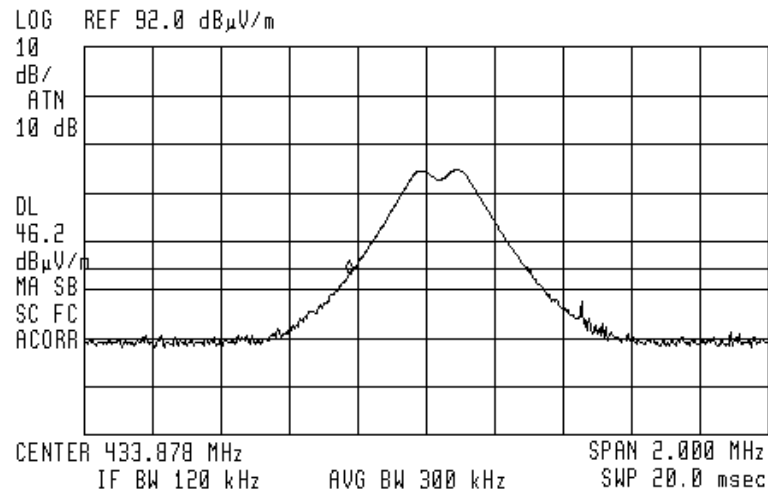


Figure 16 F<sub>Low</sub>



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 434.188 MHz  
44.49 dB $\mu$ V/m

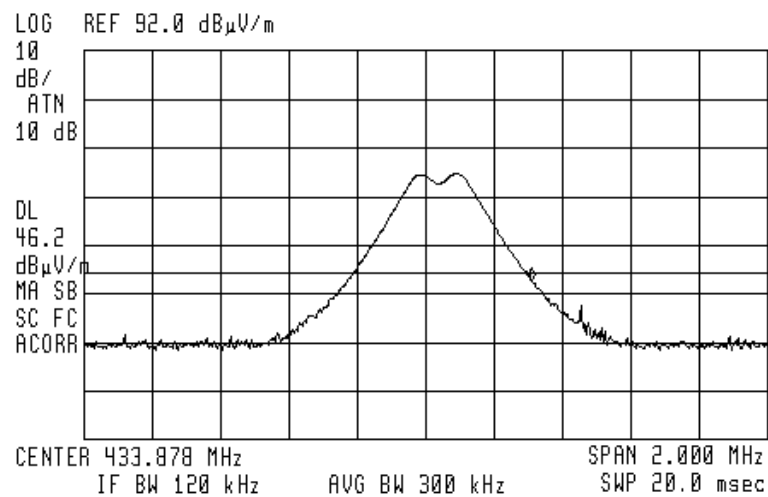


Figure 17 F<sub>High</sub>

## 10.2 Results table

E.U.T Description: ISO 18000-7 Fixed RFID Interrogator

Model: IG-RF-97D1-433

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C: (15.231(c))

Bandwidth Reading (kHz)	Specification (1) (kHz)	Margin (kHz)
535	1084	-549

**Figure 18 Bandwidth**

JUDGEMENT: Passed by 549 kHz

TEST PERSONNEL:

Tester Signature: E. Ever

Date: 28.12.09

Typed/Printed Name: E. Ever

(1) 0.25% of the E.U.T. fundamental frequency, Section 15.231(c).

### 10.3 Test Equipment Used.

Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	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	JPKG19982	N/A	N/A

**Figure 19 Test Equipment Used**

## 11. APPENDIX A - CORRECTION FACTORS

### 11.1 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".

**11.2 Correction factors for CABLE**  
**from EMI receiver**  
**to test antenna**  
**at 3 meter range.**

FREQUENCY	CORRECTION
(GHz)	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.*

### 11.3 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.

## 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".



#### 11.4 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".

**11.5 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".

## 11.6 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