

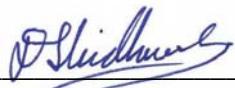
DATE: 17 August 2010

I.T.L. (PRODUCT TESTING) LTD.
FCC Radio Test Report
for
Haldor Advanced Technologies Ltd.

Equipment under test:
RFID Transponder Reader Module

OrLocate™

Written by:



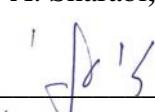
D. Shidowsky, Documentation

Approved by:



A. Sharabi, Test Engineer

Approved by:



I. Raz, EMC Laboratory Manager

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This report relates only to items tested.

Measurement/Technical Report for Haldor Advanced Technologies Ltd. RFID Transponder Reader Module

OrLocate™

FCC ID: X4V-ORLOCATE

This report concerns:	Original Grant: Class I change: Class II change: <input checked="" type="checkbox"/> X
Equipment type:	Part 15 Low Power Communication Device Transmitter
47CFR15 Section 15.225	

Measurement procedure used is ANSI C63.4-2003.

Application for Certification prepared by: Ishaishou Raz ITL (Product Testing) Ltd. Kfar Bin Nun D.N. Shimshon 99780 Israel e-mail: Sraz@itl.co.il	Applicant for this device: (different from "prepared by") Morr Avissara Haldor Advanced Technologies Ltd. 2 Habanay St. Hod Hasharon 45106 Israel Tel: +972-9-788-5867 Fax: +972-3-788-5861 e-mail: morr.avissara@haldor-tech.com
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1. General Information

1.1 Administrative Information

Manufacturer: Haldor Advanced Technologies Ltd.

Manufacturer's Address: 2 Habanay St.,
Hod Hasharon, 45319
Israel
Tel: +972-9-788-5867
Fax: +972-9-788-5861

Manufacturer's Representative: Guy Dor
Morr Avissara

Equipment Under Test (E.U.T.): RFID Transponder Reader Module

Equipment Model No.: OrLocate™

Equipment Serial No.: Not Designated

Date of Receipt of E.U.T.: 07.07.10

Start of Test: 07.07.10

End of Test: 07.07.10

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**

OrLocate™ RF system modules provide the functionality to detect RFID tagged items placed on the antenna modules or are in detection area of the antenna modules.

The system operates under the ISO 15693 standard (working frequency 13.56MHz).

The system comprise of:

1. System Cart – include the RFID reader and MUX modules as well as the other peripherals to collect and display the data and an additional Cart Antenna under the top plastic cover
2. Antenna modules - There are several antenna types that were designed to provide the required functionality
3. Tagged items – RFID tagged surgical instruments and sponges

RF MODULES

There are several modules in the system that are used to control RF transmission.

The main module is the HF (13.56MHz) ISO 15693 RF reader (FEIG - ID ISC.LRM2000) which transmits the power required for the RFID passive transponder to “wake up” and respond and also receives the transponder feedback and process it as defined in the ISO 15693 protocol.

The second module is the RF Multiplexer (FEIG - ID ISC.ANT.MUX) which switches the transmitted power each time to a specific antenna module.

The third module, which is not located inside the system cart but does included in the mobile antenna and mount antennas, is the Dynamic tuning module (FEIG - ID ISC.DAT).

The reader module is a FEIG Electronic product which is FCC compliant.

1.4 *Test Methodology*

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*

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. System Test Configuration

2.1 **Justification**

Due to the use of a re-designed sponge bucket antenna, field strength of fundamental and spurious emissions were re-tested for a C2PC application.

2.2 **EUT Exercise Software**

OrLocate application software was used. The ORLocate Application, as part of the ORLocate System, is intended for recording and counting of RFID tagged surgical items and for detecting retained surgical RFID tagged items.

2.3 **Special Accessories**

No special accessories were needed in order to achieve compliance.

2.4 **Equipment Modifications**

No modifications were needed in order to achieve compliance

2.5 **Configuration of Tested System**

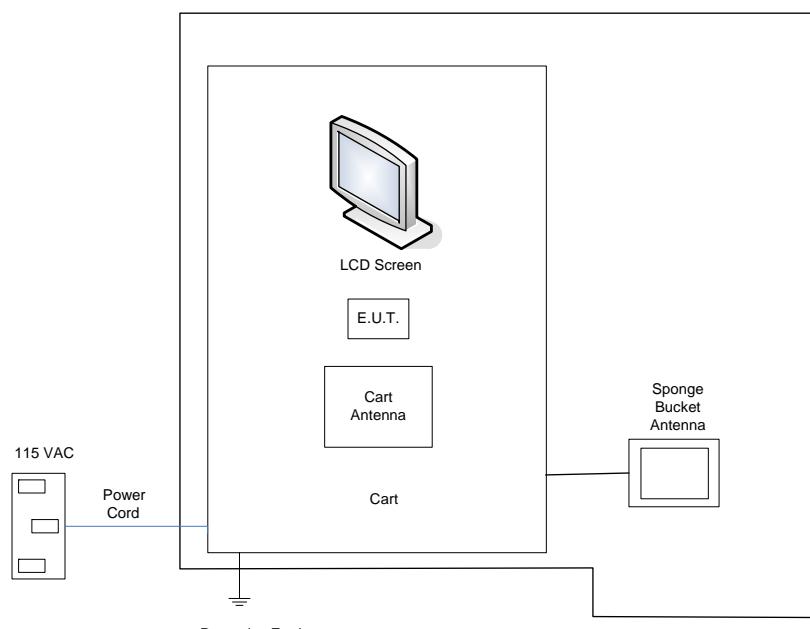


Figure 1. Configuration of Tested System

3. Test Set-up Photos



Figure 2. Radiated Emission Test 9 kHz- 30 MHz



Figure 3. Radiated Emission Test 30 MHz- 1000 MHz

4. Field Strength of Fundamental

4.1 ***Test Specification***

F.C.C., Part 15, Subpart C, Section 15.225(a)

4.2 ***Test Procedure***

The E.U.T. operation mode and test set-up are as described in Section 2.

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 (13.56 MHz) 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.

The average result is:

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

4.3 ***Measured Data***

JUDGEMENT: Passed by 32.6 dB

The EUT met the FCC Part 15, Subpart C, Section 15.225(a) specification requirements.

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

TEST PERSONNEL:

Tester Signature:  Date: 18.08.10

Typed/Printed Name: A. Sharabi

Field Strength of Fundamental

E.U.T Description: RFID Transponder Reader
 Module
 Model Number: OrLocate™
 Serial Number: Not Designated

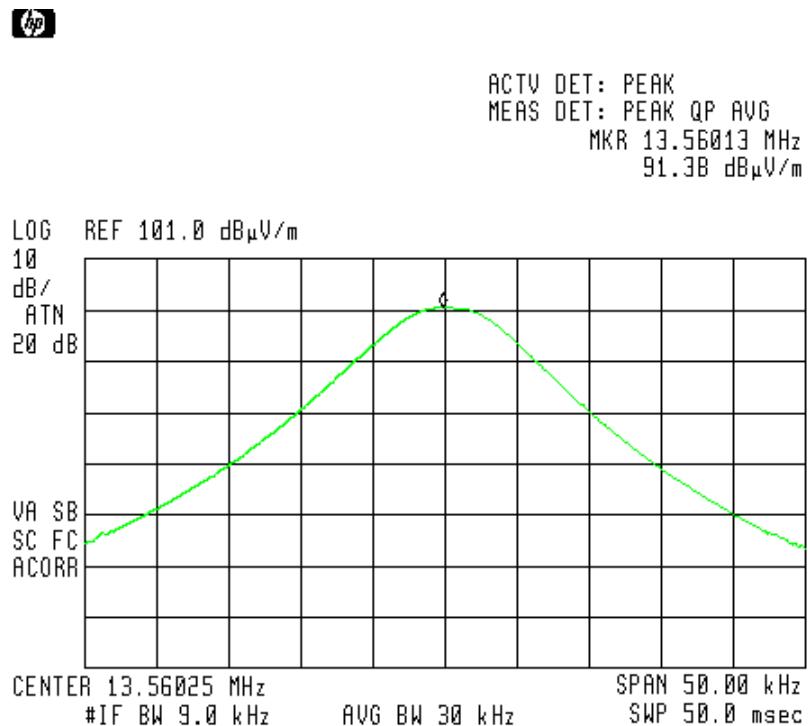


Figure 4. Field Strength of Fundamental Detector: Peak

$$\begin{aligned}
 L_{im30m} &= 15848.00 \mu\text{V/m} \\
 L_{im3m} &= 40 \text{ dB}\mu\text{V/m} + 84.0 \text{ dB}\mu\text{V/m} = 124.0 \text{ dB}\mu\text{V/m} \\
 \text{Margin} &= L_{im3m} - \text{Result} \\
 \text{Margin} &= 124.0 \text{ dB}\mu\text{V/m} - 91.38 \\
 \text{Margin} &= -32.62 \text{ dB}
 \end{aligned}$$

4.4 **Test Instrumentation Used, Field Strength of Fundamental**

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	November 10, 2009	1 year
EMI Receiver Filter Section	HP	85420E	3427A00103	November 10, 2009	1 year
Passive Loop Antenna	EMCO	6509	9702-1401	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

5. Spurious Radiated Emission, 9 kHz – 30 MHz

5.1 **Test Specification**

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

5.2 **Test Procedure**

The E.U.T. operation mode and test set-up are as described in Section 2.

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 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 3 meters.

The E.U.T. was operated at the frequency of 13.56 MHz. This frequency was measured using a peak detector.

5.3 **Measured Data**

JUDGEMENT: Passed by 45.0 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The margin between the emission level and the specification limit is 45.0 dB in the worst case at the frequency of 27.12 MHz.

See details in *Figure 5*.

TEST PERSONNEL:

Tester Signature: 

Date: 18.08.10

Typed/Printed Name: A. Sharabi

Radiated Emission, 9 kHz-30 MHz

E.U.T Description RFID Transponder Reader Module
 Type OrLocate™
 Serial Number: Not Designated

Specification: FCC Part 15, Subpart C, Section 209

Antenna: 3 meters distance Frequency range: 9 kHz to 30 MHz
 Detectors: Peak, Average

Frequency (MHz)	Peak Reading (dB μ V/m)	Peak Specification (dB μ V/m)	Margin (dB)
27.12	24.5	69.5	-45.0

Figure 5. Radiated Emission. 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.

$$L_{im30m} = 30 \mu V/m$$

$$L_{im3m} = 40 \text{ dB}\mu\text{V/m} + 29.5 \text{ dB}\mu\text{V/m} = 69.5 \text{ dB}\mu\text{V/m}$$

5.4 **Test Instrumentation Used, Radiated Measurements**

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	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
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

5.5 **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]

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.

6. Spurious Radiated Emission 30 – 1000 MHz

6.1 **Test Specification**

30 MHz-1000 MHz, F.C.C., Part 15, Subpart C

6.2 **Test Procedure**

The E.U.T. operation mode and test set-up are as described in Section 2.

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 configuration tested is shown in *Figure 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 30-1000 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.

6.3 **Test Data**

JUDGEMENT: Passed by 1.1 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 was 1.1 dB in the worst case at the frequency of 40.98 MHz, vertical polarization.

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

TEST PERSONNEL:

Tester Signature:  Date: 18.08.10

Typed/Printed Name: A. Sharabi

Radiated Emission - Spurious

E.U.T Description RFID Transponder Reader Module
 Type OrLocate™
 Serial Number: Not Designated

Specification: FCC Part 15, Subpart C

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

Frequency (MHz)	Antenna (H/V)	Peak Reading (dB μ V/m)	Peak Specification (dB μ V/m)	Margin (dB)
40.98	H	35.1	40.0	-4.9
54.24	H	21.2	40.0	-18.8
122.05	H	26.6	43.5	-16.9
135.50	H	20.7	43.5	-22.8
40.98	V	38.9	40.0	-1.1
54.24	V	36.7	40.0	-32.7
122.05	V	31.9	43.5	-42.7
135.50	V	23.6	43.5	-17.2

**Figure 6. Radiated Emission. Antenna Polarization: VERTICAL/HORIZONTAL.
Detectors: Peak, Quasi-peak**

6.4 **Test Instrumentation Used, Radiated Measurements**

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 10, 2009	1 year
RF Section	HP	85420E	3705A00248	November 10, 2009	1 year
Antenna Bi-conical	ARA	BCD 235/B	1041	March 25, 2009	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 26, 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
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

6.5 **Field Strength Calculation**

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

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

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]

Example: FS = 30.7 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.

7. APPENDIX A - CORRECTION FACTORS

7.1 *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".

7.2 *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.

7.3 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		Distance of 10 meters	
FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1	200.0	9.0
250.0	10.2	250.0	10.1
300.0	12.5	300.0	11.8
400.0	15.4	400.0	15.3
500.0	16.1	500.0	15.6
600.0	19.2	600.0	18.7
700.0	19.4	700.0	19.1
800.0	19.9	800.0	20.2
900.0	21.2	900.0	21.1
1000.0	23.5	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".

7.4 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".

7.5 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".

7.6 Correction factors for ACTIVE LOOP ANTENNA

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

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (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