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DATE: 28 May 2012

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

FCC Radio Test Report

for

Precyse Technologies Inc.

Equipment under test:

SA Tag

SA24/103000

Written by:

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Approved by:

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Approved by:

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This report relates only to items tested.



Measurement/Technical Report for Precyse Technologies Inc.

SA Tag

SA24/103000

FCC ID: WONSA24103000

This report concerns: Original Grant: X
Class I Change:
Class II Change:

Equipment type: Digital Transmission System

Limits used:
47CFR15 Section 15.247

Measurement procedure used is KDB 558074 D01 18 January 2012.

Application for Certification
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1. General Information

1.1 Administrative Information

Manufacturer:	Precyse Technologies Inc.
Manufacturer's Address:	94 Em Hamoshavot St. Petach Tikva 49527 Israel Tel: +972-3-922-7093 Fax: +972-3-922-7515
Manufacturer's Representative:	Lior Bilia
Equipment Under Test (E.U.T):	SA Tag
Equipment Part No.:	SA24/103000
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	22.11.11
Start of Test:	22.11.11
End of Test:	22.01.12*
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Subpart C

* Spurious radiated emission in the frequency range of 30 MHz – 25 GHz was re-tested between 19 – 21 January 2012.



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.

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 SAT is used to track assets in real time. It is based on an RF transceiver and a microcontroller.

It uses the iLocate proprietary protocol which provides a 2 way, half duplex communication with the base station.

The unit is powered by a 2/3 AA lithium thionyl chloride (Li-SOCl₂) battery and is hermetically sealed with no connectors available to the end user.

1.4 Test Methodology

Radiated testing was performed according to the procedures in KDB 558074 D01 18 January 2012. 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

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.96 dB

2. System Test Configuration

2.1 *Justification*

Radiated emission screening was performed in 3 orthogonal orientations. The worst case orientation was the vertical position.

The unit tested was configured with all hardware options present (Motion sensor M1 and keypad connectors J2 and J3).

2.2 *EUT Exercise Software*

Since the unit, under its normal operation, does not transmit data periodically, for emissions measurements, the SAT was programmed with a special test software to transmit packets continuously at maximum output power, maximum duty cycle (20%) with power amplifier enabled.

Normal duty cycle, assuming worst case, one event per second is 0.5% (5msec transmit time per 1 second).

2.3 *Special Accessories*

No special accessories were required.

2.4 *Equipment Modifications*

Changes were made according to ECO No. 131.

2.5 *Configuration of Tested System*

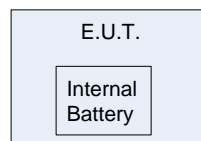


Figure 1. Configuration of Tested System

3. Test Setup Photograph



Figure 2. Radiated Emission Test

4. 6dB Minimum Bandwidth

4.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

4.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested at the operation frequencies of 2410, 2445, and 2475 MHz.

4.3 Test Results

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2410	1.59	>0.5
2445	1.66	>0.5
2475	1.56	>0.5

Figure 3 6dB Minimum Bandwidth Test Results Table

See additional information in Figure 4 to Figure 6.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 17.05.12

Typed/Printed Name: I. Siboni

6dB Minimum Bandwidth



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 1.588 MHz
-34 dB

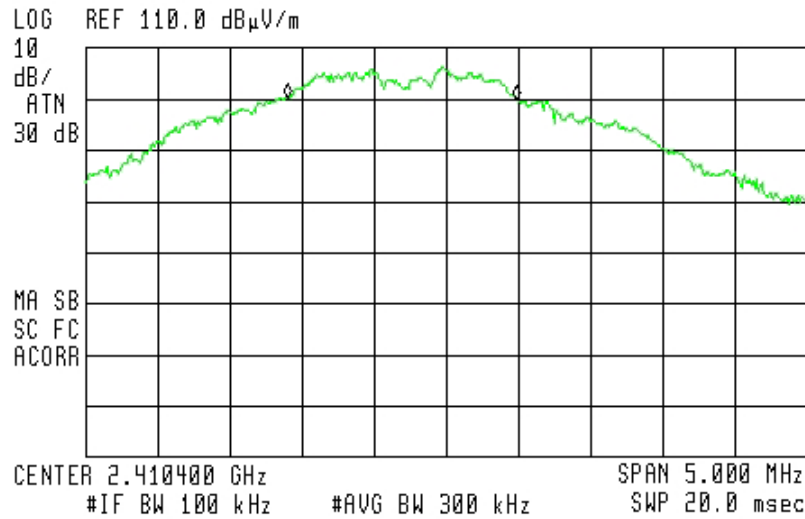


Figure 4. — 2410 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 1.663 MHz
.13 dB

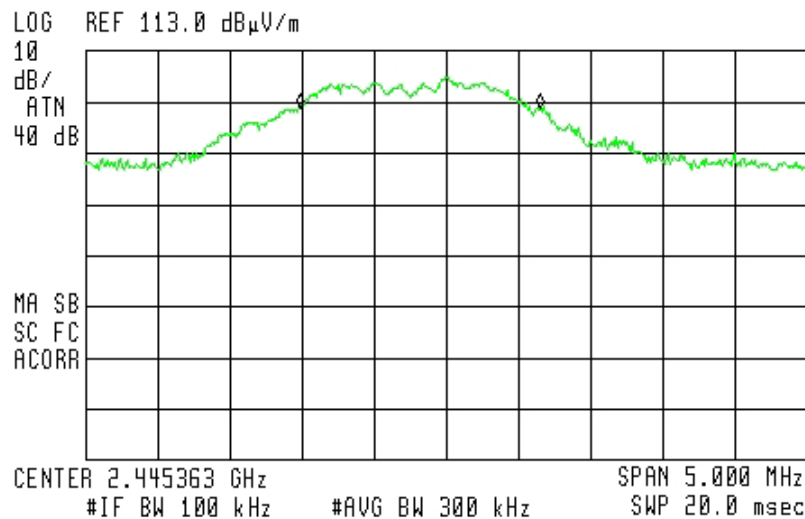


Figure 5. — 2445 MHz

6dB Minimum Bandwidth



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.563 MHz
-.04 dB

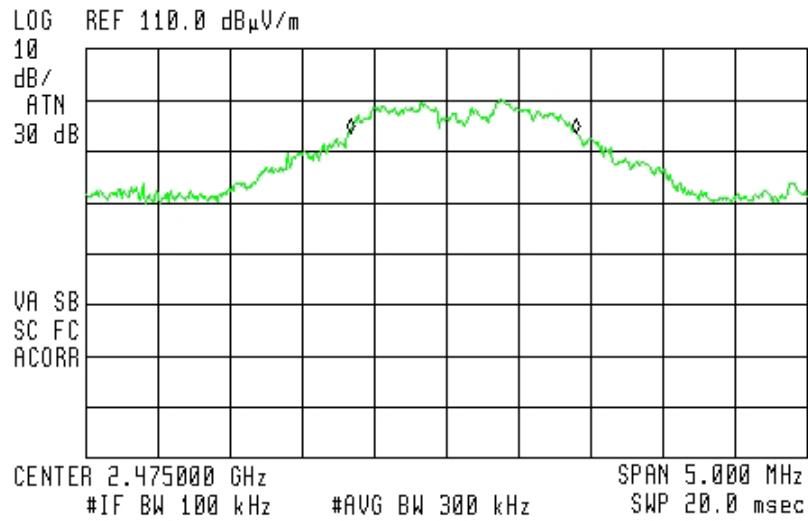


Figure 6. — 2475 MHz



6dB Minimum Bandwidth

4.4 6dB Minimum Bandwidth Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010*	1 year
RF Section	HP	85420E	3705A00248	November 24, 2010*	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	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	JPKG19982	N/A	N/A

Figure 7 Test Equipment Used

* Calibration valid until November 30 2011.

5. Radiated Maximum Power Output

5.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(b)

5.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The E.U.T. was tested at the three operating frequencies of 2410, 2445, and 2475 MHz.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [\text{W}]$$

Radiated Maximum Power Output

5.3 Test Results

Frequency	E	E	Antenna Gain	Antenna Distance	Calculated Results	Limit
(MHz)	(dB μ V/m)	(V/m)	(dBi)	(m)	(W)	(W)
2410	113.04	0.449	5.3	3	0.17788	1
2445	112.76	0.435	5.3	3	0.16696	1
2475	111.85	0.391	5.3	3	0.13489	1

Figure 8 Radiated Maximum Power Output Test Results Table

See additional information in Figure 9 to Figure 11.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 17.05.12

Typed/Printed Name: I. Siboni



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.40340 GHz
113.04 dB μ V/m

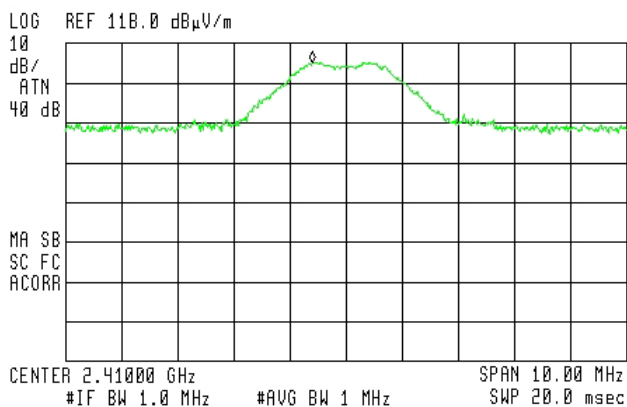


Figure 9 — 2410 MHz

Radiated Maximum Power Output



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.44448 GHz
112.76 dB μ V/m

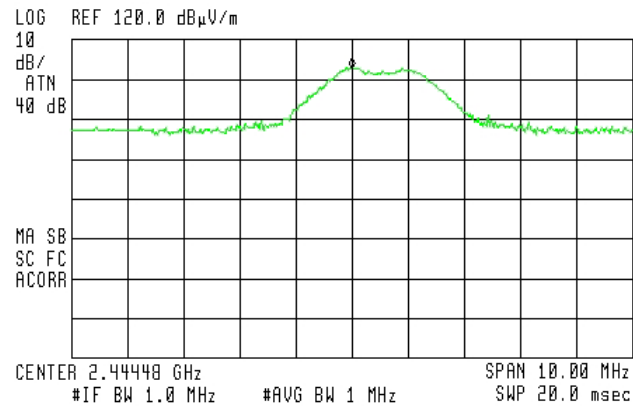


Figure 10 — 2445 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.47448 GHz
111.85 dB μ V/m

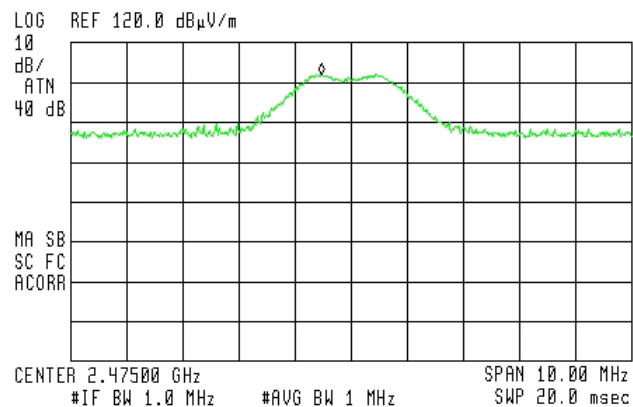


Figure 11 — 2475 MHz



Radiated Maximum Power Output

5.4 Radiated Maximum Power Output Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	November 24, 2010*	1 year
RF Section	HP	85420E	3705A00248	November 24, 2010*	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
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 27, 2011	2 years

Figure 12 Test Equipment Used

* Calibration valid until November 30 2011.

6. Band Edge

6.1 Test Specification

FCC Part 15, Subpart C, Section 15.247(d)

6.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.

Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2405 MHz, and 2480 MHz correspondingly.

The E.U.T. was tested at the operating frequencies of 2410 and 2.475 MHz.

6.3 Test Results

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
2410	2400	66.15	90.0	-23.85
2475	2483.5	76.85	91.9	-15.05

Figure 13 Band Edge Test Results Table

See additional information in Figure 14 to Figure 15.

JUDGEMENT: Passed by 15.05 dB

TEST PERSONNEL:

Tester Signature: 

Date: 17.05.12

Typed/Printed Name: I. Siboni

Band Edge



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.40000 GHz
66.15 dB μ V/m

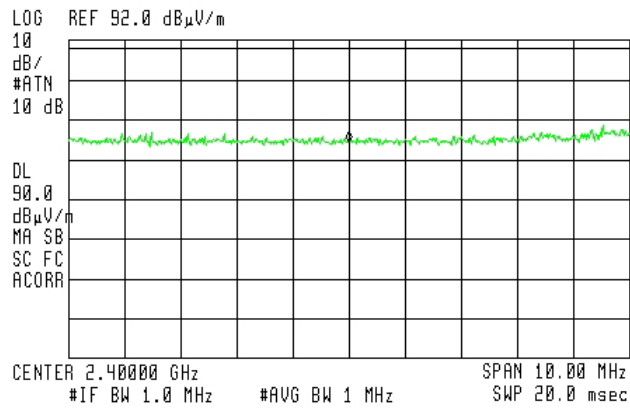


Figure 14 — 2410 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.40350 GHz
76.85 dB μ V/m

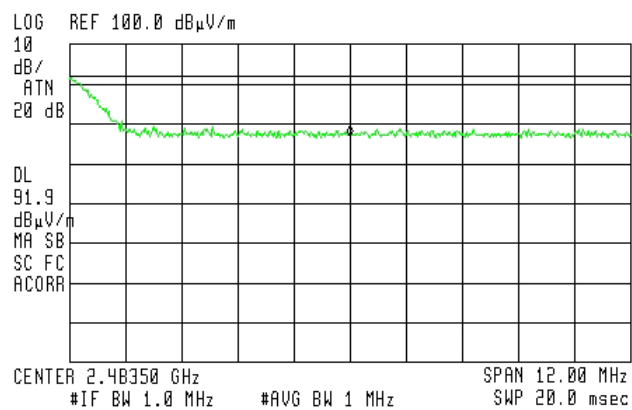


Figure 15 — 2475 MHz



Band Edge

6.4 Band Edge Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	November 24, 2010*	1 year
RF Section	HP	85420E	3705A00248	November 24, 2010*	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
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 27, 2011	2 years

Figure 16 Test Equipment Used

* Calibration valid until November 30 2011.



7. Spurious Radiated Emission, 9 kHz – 30 MHz

7.1 Test Specification

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

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.

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 tested at the three operating frequencies of 2410, 2445, and 2475 MHz.

7.3 Test Results

JUDGEMENT: Passed

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

The results for all three operating frequencies were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: 

Date: 17.05.12

Typed/Printed Name: I. Siboni



Spurious Radiated Emission, 9 kHz – 30 MHz

7.4 Spurious Radiated Emission, 9 kHz – 30 MHz Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010*	1 year
RF Section	HP	85420E	3705A00248	November 24, 2010*	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2011	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

* Calibration valid until November 30 2011.

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]

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.

8. Spurious Radiated Emission 30 – 25000 MHz

8.1 Test Specification

30 MHz-25000 MHz, F.C.C., Part 15, Subpart C

8.2 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 frequency range 30 MHz-25000 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.

In the frequency range 30 MHz -2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

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 tested at the three operating frequencies of 2410, 2445, and 2475 MHz.



8.3 Test Data

JUDGEMENT: Passed by 5.2 dB

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

For the operation frequency of 2410 MHz, the margin between the emission level and the specification limit is 5.3 in the worst case at the frequency of 2390.00 MHz, horizontal polarization.

For the operation frequency of 2445 MHz, the margin between the emission level and the specification limit is 9.5 in the worst case at the frequency of 2390.00 MHz, horizontal polarization.

For the operation frequency of 2475 MHz, the margin between the emission level and the specification limit is 5.2 in the worst case at the frequency of 2483.50 MHz, horizontal polarization.

TEST PERSONNEL:

Tester Signature: 

Date: 17.05.12

Typed/Printed Name: I. Siboni

Spurious Radiated Emission 30 MHz – 25 GHz

E.U.T Description SA Tag
Part Number SA24/103000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dB μ V/m)	Specification (dB μ V/m)	Margin (dB)
2410.00	2390.00	H	68.7	74.0	-5.3
2410.00	2390.00	V	65.7	74.0	-8.3
2410.00	4820.00	H	56.9	74.0	-17.1
2410.00	4820.00	V	51.8	74.0	-22.2
2410.00	7230.00	H	57.3	74.0	-16.7
2410.00	7230.00	V	56.7	74.0	-17.3

**Figure 17. 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 Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



Spurious Radiated Emission 30 MHz – 25 GHz

E.U.T Description SA Tag
Part Number SA24/103000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Average
Operation Frequency: MHz

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dB μ V/m)	Specification (dB μ V/m)	Margin (dB)
2410.00	2390.00	H	44.5	54.0	-9.5
2410.00	2390.00	V	44.7	54.0	-9.3
2410.00	4820.00	H	32.7	54.0	-21.3
2410.00	4820.00	V	36.1	54.0	-17.9
2410.00	7230.00	H	42.7	54.0	-11.3
2410.00	7230.00	V	42.6	54.0	-11.4

**Figure 18. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Average**

Notes:

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 Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



Spurious Radiated Emission 30 MHz – 25 GHz

E.U.T Description SA Tag
Part Number SA24/103000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dB μ V/m)	Specification (dB μ V/m)	Margin (dB)
2445.00	4890.00	H	53.1	74.0	-20.9
2445.00	4890.00	V	54.3	74.0	-19.7
2445.00	7335.00	H	56.7	74.0	-17.3
2445.00	7335.00	V	55.6	74.0	-18.4

**Figure 19. 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 Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



Spurious Radiated Emission 30 MHz – 25 GHz

E.U.T Description SA Tag
Part Number SA24/103000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Average
Operation Frequency: MHz

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dB μ V/m)	Specification (dB μ V/m)	Margin (dB)
2410.00	2390.00	H	44.5	54.0	-9.5
2445.00	4890.00	H	37.3	54.0	-16.7
2445.00	4890.00	V	36.6	54.0	-17.4
2445.00	7335.00	H	43.2	54.0	-10.8
2445.00	7335.00	V	43.1	54.0	-10.9

**Figure 20. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Average**

Notes:

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 Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Spurious Radiated Emission 30 MHz – 25 GHz

E.U.T Description SA Tag
Part Number SA24/103000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Peak

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dB μ V/m)	Specification (dB μ V/m)	Margin (dB)
2475.00	2483.50	H	68.8	74.0	-5.2
2475.00	2483.50	V	66.3	74.0	-7.7
2475.00	4950.00	H	59.8	74.0	-14.2
2475.00	4950.00	V	56.9	74.0	-17.1
2475.00	7425.00	H	57.2	74.0	-16.8
2475.00	7425.00	V	53.9	74.0	-20.1

**Figure 21. 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 Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



Spurious Radiated Emission 30 MHz – 25 GHz

E.U.T Description SA Tag
Part Number SA24/103000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters Detector: Average
Operation Frequency: MHz

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dB μ V/m)	Specification (dB μ V/m)	Margin (dB)
2475.00	2483.50	H	45.1	54.0	-8.9
2475.00	2483.50	V	45.3	54.0	-8.7
2475.00	4950.00	H	40.0	54.0	-14.0
2475.00	4950.00	V	38.4	54.0	-15.6
2475.00	7425.00	H	43.6	54.0	-10.4
2475.00	7425.00	V	41.7	54.0	-12.3

**Figure 22. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.
Detector: Average**

Notes:

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 Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



8.4 Spurious Radiated Emission 30 MHz – 25 GHz, Test Equipment Used

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 Year
RF Filter Section	HP	85420E	3705A00248	December 12, 2011	1 Year
Antenna Biconical	ARA	BCD 235/B	1041	November 12, 2011	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2011	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 Years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2010	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2011	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 04, 2011	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	January 11, 2011	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



Spurious Radiated Emission 30 MHz – 25 GHz

8.5 *Field Strength Calculation 30 – 1000 MHz*

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

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

FS:	Field Strength [dB $\mu\text{V/m}$]
RA:	Receiver Amplitude [dB μV]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.

9. Radiated Power Spectral Density

9.1 Test Specification

FCC Part 15, Subpart C, Section 15.247(d)

9.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The E.U.T. was tested at the three operating frequencies of 2410, 2445, and 2475 MHz.

Then the EMI receiver was set to 3 kHz resolution BW, span of 300.0 kHz, and sweep time of 100 seconds. The spectrum peaks were located at each of the 3 operating frequencies.

Radiated peak output power levels were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [\text{W}]$$



Radiated Power Spectral Density

9.3 Test Results

Frequency	E	Spectral Density Result	Antenna Gain	Antenna Distance	Calculated Results	Spec.	Margin
(MHz)	(dB μ V/m)	(V/m)	(dBi)	(m)	(mW)	(mW)	(mW)
2410	99.23	0.092	5.3	3	0.747	6.3	-5.553
2445	97.17	0.072	5.3	3	0.457	6.3	-5.843
2475	96.39	0.066	5.3	3	0.384	6.3	-5.916

Figure 23 Radiated Power Spectral Density Test Results

See additional information in Figure 24 to Figure 26.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 17.05.12

Typed/Printed Name: I. Siboni

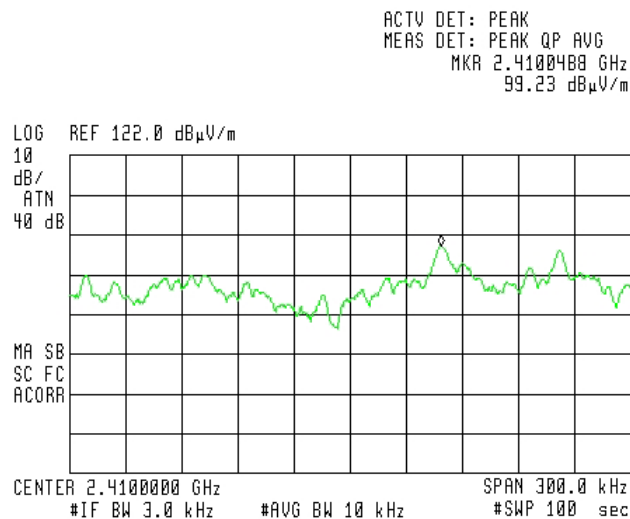


Figure 24 — 2410 MHz

Radiated Power Spectral Density



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4445440 GHz
97.17 dBμV/m

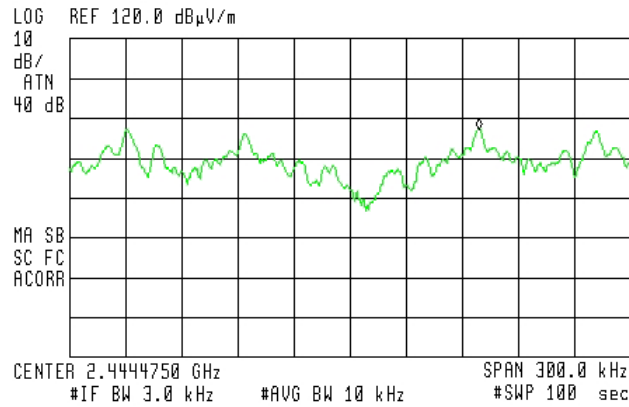


Figure 25 — 2445 MHz



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4745395 GHz
96.39 dBμV/m

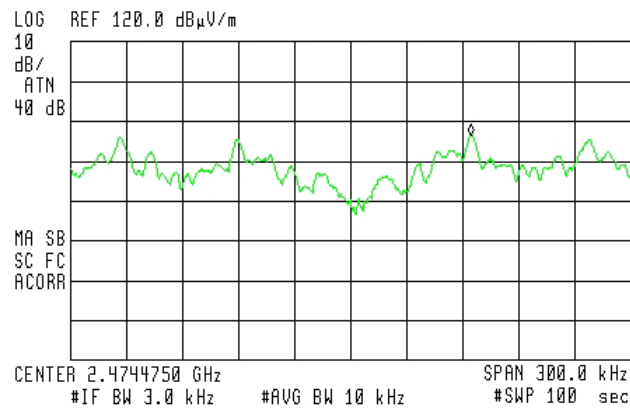


Figure 26 — 2475 MHz

Radiated Power Spectral Density

9.4 Radiated Power Spectral Density, Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010*	1 year
RF Section	HP	85420E	3705A00248	November 25, 2010*	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 years
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 27 Test Equipment Used

* Calibration valid until November 30 2011.



9.5 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 25, 2010	1 year
RF Section	HP	85420E	3705A00248	November 25, 2010	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	August 1, 2010	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 24, 2010	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



10. Antenna Gain/Information

The antenna gain is 5.3 dBi.

11. R.F Exposure/Safety Calculation

Typical use of the E.U.T. is to track assets in real time. The typical distance between the E.U.T. and the user is <1 m.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2445 MHz is: $1 \frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power 177.88 mw Peak (calculated)

G_T- Antenna Gain, 5.3 dBi = 3.4 (Numeric)

R- Distance from Transmitter using 20 cm worst case

(c) Transmitter peak power using source based time averaging of 0.5% maximum, 5 msec “ON” time, “OFF” + “ON” time 100 msec:

$$P_t = \frac{177.88 \times 5}{100} = 8.89mW$$

(d) The peak power density (time averaging) is :

$$S_p = \frac{8.89 \times 3.4}{4\pi(20)^2} = 0.006 \frac{mW}{cm^2}$$

€This is below the FCC limit.

12. APPENDIX B - CORRECTION FACTORS

12.1 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".

12.2 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.

12.3 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".



12.4 Correction factors for LOG PERIODIC ANTENNA
Type SAS-200/511
at 3 meter range.

FREQUENCY	ANTENNA
(GHz)	FACTOR
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	ANTENNA
(GHz)	FACTOR
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".

12.5 Correction factors for **BICONICAL ANTENNA**

**Type BCD-235/B,
at 3 meter range**

FREQUENCY (MHz)	APE (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".



12.6 Correction factors for Double-Ridged Waveguide Horn

**Model: 3115, S/N 29845
at 3 meter range.**

FREQUENCY	ANTENNA	ANTENN	FREQUENCY	ANTENNA	ANTENNA
(GHz)	FACTOR	A Gain	(GHz)	FACTOR	Gain
	(dB 1/m)	(dBi)		(dB 1/m)	(dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			



12.7 Correction factors for

**Horn Antenna
Model: SWH-28
at 1 meter range.**

FREQUENCY (GHz)	APE (dB /m)	Gain (dB1)
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



12.8 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