



**DATE: 07 March 2013**

**I.T.L. (PRODUCT TESTING) LTD.**  
**FCC Radio Test Report**  
**for**  
**AeroScout Ltd.**

**Equipment under test:**

**Exciter**

**EX-5100**

Written by:

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Approved by: For/

A. Moses, 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

EX-5100

**FCC ID: Q3HEX5100**

**IC: 5115A-EX5100**

This report concerns:                      Original Grant:              X  
    Class I Change:  
    Class II Change:  
Equipment type:                              Part 15 Low Power Transmitter Below 1705 kHz  
    Digital Transmission System  
Limits used:  
47CFR15 Sections 15.205; 15.209; 15.247

Measurement procedure used is ANSI C63.4-2003 and KDB 558074 D01 18  
January 2012.

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") Reuven Amsalem 3 Pekeris St. Park Tamar Rechovot 76702 Israel Tel: +972-8-936-3136 Fax: +972-8-936-5977 e-mail: reuven.amsalem@aeroscout.com
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## 1. General Information

### 1.1 Administrative Information

Manufacturer:	AeroScout Ltd.
Manufacturer's Address:	3 Pekeris St. Einstein Entrance 4th Floor Rechovot 76702 Israel Tel: +972-8-9369393 Fax: +972-8-9365977
Manufacturer's Representative:	Leonid Gnušin Dadi Matza
Equipment Under Test (E.U.T.):	Exciter
Equipment Model No.:	EX-5100
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T.:	20.09.11
Start of Test:	20.09.11
End of Test:	08.02.12
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Subpart 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.

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 EX5100 Exciter is a component of the AeroScout suite of enterprise visibility solutions that enables location-based applications. The EX5100 extends the AeroScout suite to provide robust and sophisticated RFID detection capabilities, using the same AeroScout tags that can also be accurately located in real time by the AeroScout system.

The EX5100 triggers AeroScout's tags as they pass through a choke point or when they are located near the Exciter and the tags in turn transmit a message to AeroScout Location Receivers or compatible Access Points in range. The Exciter can activate/deactivate the tags, program the tags or even cause tag reaction such as blinking. This provides instant acknowledgment that a tagged asset passed through a gate, doorway or some other well-defined area. The detection capabilities of the EX5100, combined with the location features of the AeroScout Visibility System, make the AeroScout suite the most sophisticated enterprise visibility solution for a wide variety of industries.

### **1.4 *Test Methodology***

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003 and 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***

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) 0.15 – 30 MHz:

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

± 3.44 dB

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***

The E.U.T. can be either ceiling or wall mounted. Exploratory radiated emission was performed on the E.U.T. simulating both positions and the vertical/wall mounted position was selected as the “worst case” position.

The E.U.T. was operated simulating normal operation.

### 2.2 ***EUT Exercise Software***

Test software was used.

### 2.3 ***Special Accessories***

No special accessories were needed to achieve compliance.

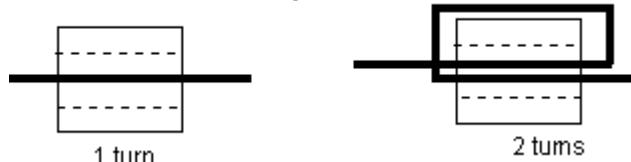
### 2.4 ***Equipment Modifications***

A ferrite core, P/N 0443164251, manufactured by Fair-Rite was added to the communication cable near the E.U.T. connector. The core has 1 turn.

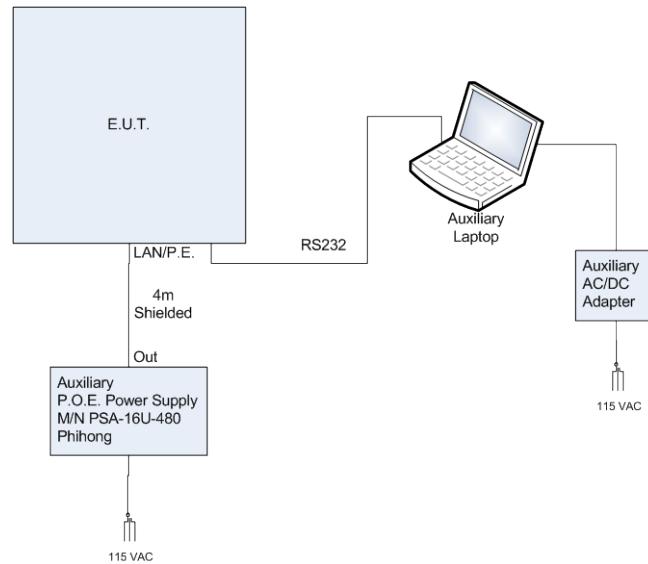
General Note:

The number of turns when using ferrite cores is determined by the times the cable/wire crosses the internal aperture of the core.

#### *Examples*



## 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 From AC Mains Test



Figure 3. Conducted Emission From Antenna Ports Tests



**Figure 4. Radiated Emission Test**



## 4. Conducted Emission From AC Mains

### 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 **Test Results**

JUDGEMENT: Passed by 4.7 dB

The margin between the emission levels and the specification limit is, in the worst case, 4.7 dB for the phase line at 1.65 MHz and 5.0 dB at 1.65 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 5* to *Figure 8*.

TEST PERSONNEL:

Tester Signature: For/ A. Moses

Date: 11.02.13

Typed/Printed Name: A. Moses



## Conducted Emission

E.U.T Description      Exciter  
Type                    EX-5100  
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	0.163231	56.3	47.3	-18.0	12.2	-43.1	0.0
2	0.945016	36.2	34.6	-21.4	34.7	-11.3	0.0
3	1.650737	41.8	41.4	-14.6	41.3	-4.7	0.0
4	5.770561	45.3	40.9	-19.1	37.0	-13.0	0.0
5	17.692861	42.8	40.1	-19.9	39.0	-11.0	0.0
6	25.237941	39.5	38.2	-21.8	37.7	-12.3	0.0

**Figure 5. Detectors: Peak, Quasi-peak, AVERAGE .**

*Note: QP Delta/Av Delta refer 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.*

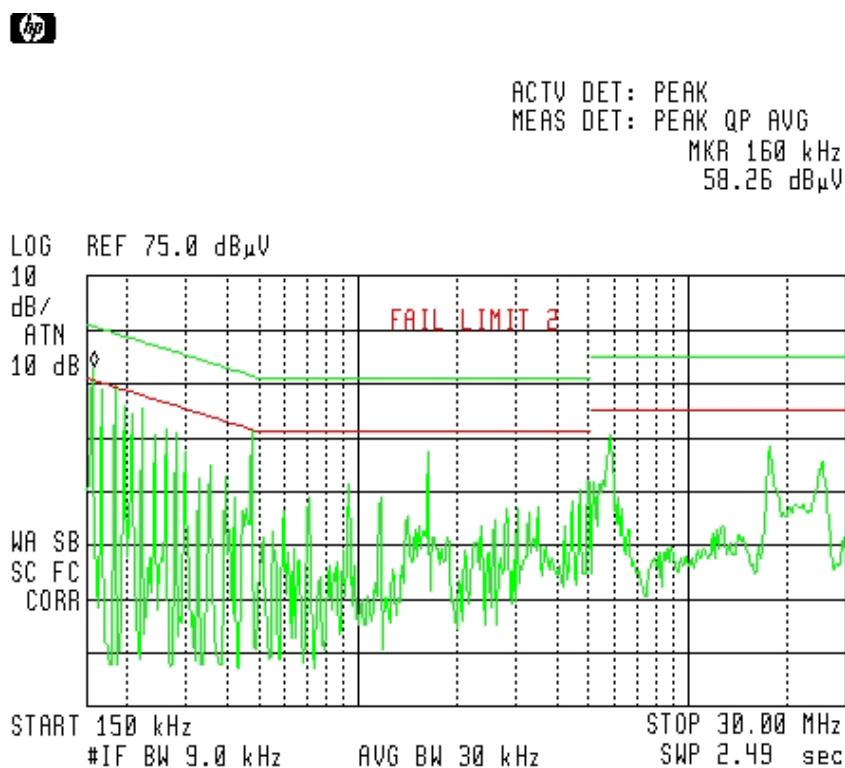
## Conducted Emission

E.U.T Description      Exciter  
Type                      EX-5100  
Serial Number:           Not Designated

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

Lead:                      Phase

Detectors:                Peak, Quasi-peak, Average



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

Note: Fail indication on the spectral plot results from peak detector level reading above the limit. This indication is for information only and it should not be interpreted as a test failure.



## Conducted Emission

E.U.T Description      Exciter  
Type                      EX-5100  
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	0.163221	57.6	48.6	-16.7	14.3	-41.1	0.0
2	0.945006	36.3	34.5	-21.5	34.5	-11.5	0.0
3	1.650731	41.7	41.1	-14.9	41.0	-5.0	0.0
4	5.770560	41.8	36.4	-23.6	30.4	-19.6	0.0
5	17.692861	41.7	40.0	-20.0	39.0	-11.0	0.0
6	25.237941	39.4	37.9	-22.1	37.5	-12.6	0.0

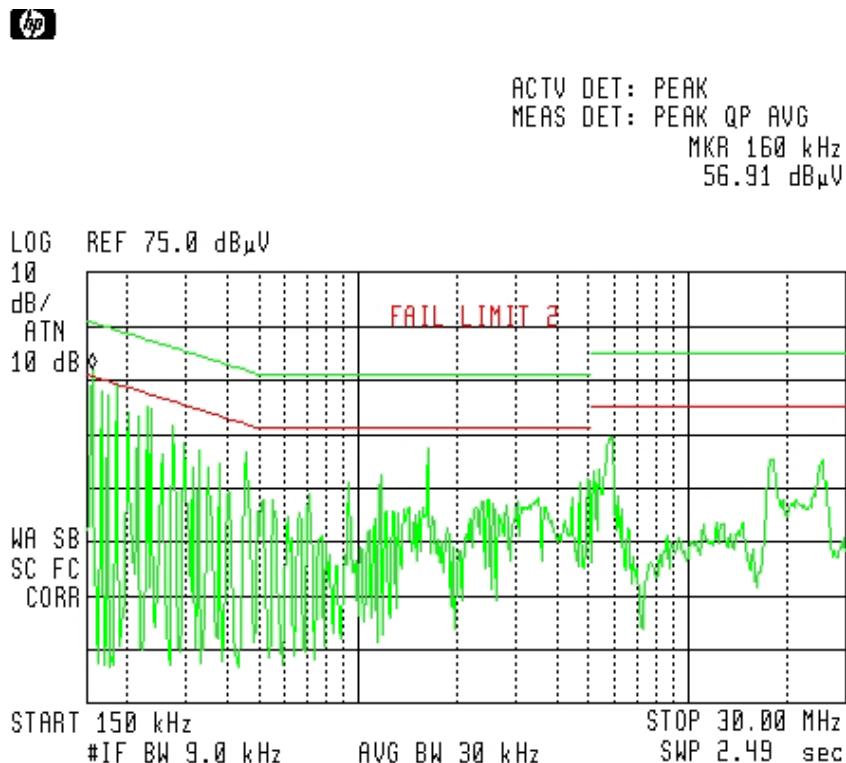
**Figure 7. Detectors: Peak, Quasi-peak, AVERAGE**

*Note: QP Delta/Av Delta refer 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      Exciter  
Type                      EX-5100  
Serial Number:           Not Designated

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



**Figure 8 Conducted Emission: NEUTRAL**  
**Detectors: Peak, Quasi-peak, Average**

Note: Fail indication on the spectral plot results from peak detector level reading above the limit. This indication is for information only and it should not be interpreted as a test failure.



#### 4.4 **Test Equipment Used, Conducted Emission from AC Mains Test**

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 3, 2011	1 Year
EMI Receiver	HP	85422E	3906A00276	November 24, 2010*	1 Year
RF Filter Section	HP	85420E	3705A00248	November 24, 2010*	1 Year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

**Figure 9 Test Equipment Used**

\* Testing performed before November 24, 2011.

## 5. Average Factor Calculation 125 kHz Transmitter

1. Pulse period = 720usec (worst scenario)\*
2. Pulse duration = 360usec (worst scenario)\*
3. Burst duration = 130msec
4. Time between bursts = 207msec

$$5. \text{ Average Factor} = 20 \log \left[ \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within 100msec} \right]$$

$$\text{Average Factor} = 20 \log \left[ \frac{360}{720} \times 1 \right] = -6.0 \text{dB}$$

\*Note: Unit applies OOK modulation with Manchester coding, worst case scenario is 50% ON signal.

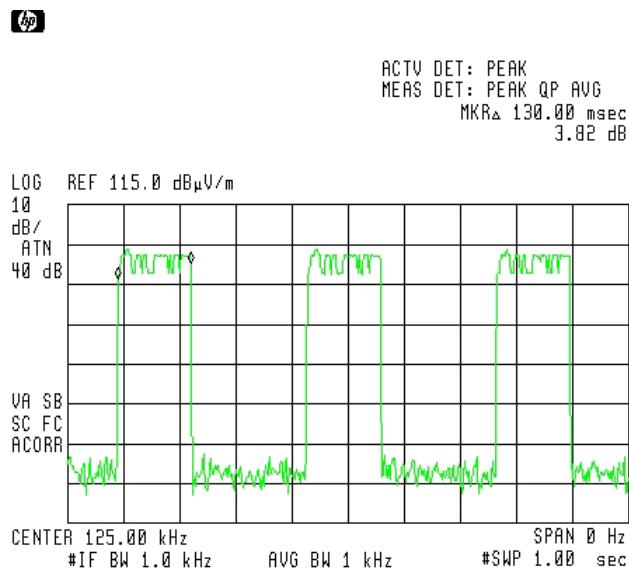


Figure 10. Transmission Burst Duration = 130 msec

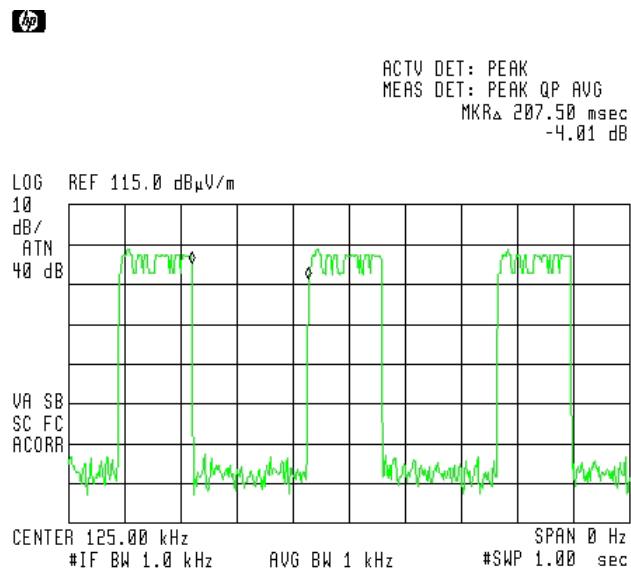


Figure 11. Time between Transmissions 207 msec



### 5.1 **Test Equipment Used, Average Factor Calculation**

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, 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

**Figure 12 Test Equipment Used**

\* Testing performed before October 19, 2011.



## 6. Field Strength of Fundamental 125 kHz Transmitter

### 6.1 ***Test Specification***

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 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 (125 kHz) 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 $\mu$ V/m) + Average Factor (dB)

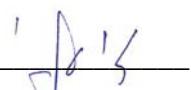
### 6.3 ***Test Results***

JUDGEMENT: Passed by 1.82 dB

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

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

TEST PERSONNEL:

Tester Signature: For/  Date: 11.02.13

Typed/Printed Name: A. Moses

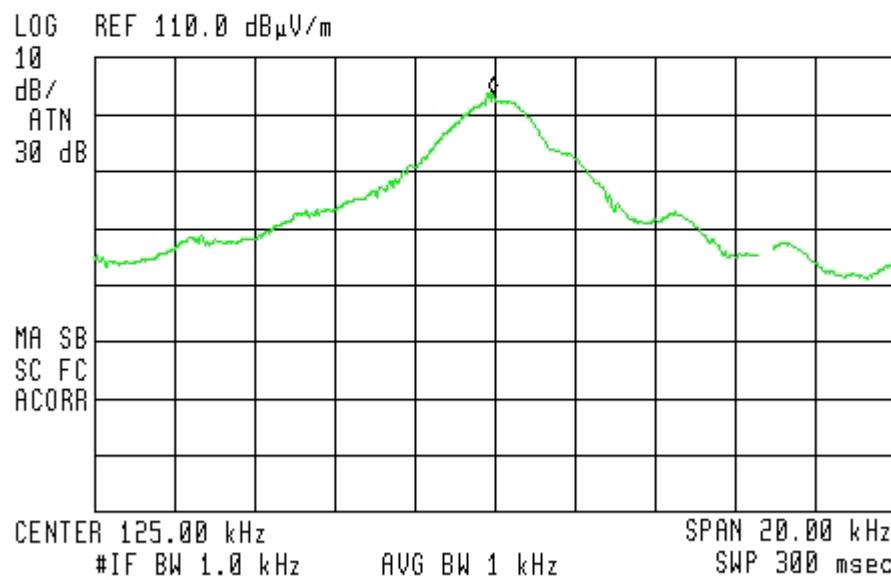


## Field Strength of Fundamental

E.U.T Description      Exciter  
Type                      EX-5100  
Serial Number:           Not Designated



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 124.95 kHz  
103.85 dB $\mu$ V/m



**Figure 13. Field Strength of Fundamental.  
Detector: Peak**

Average Limit = 105.67dB $\mu$ V/m



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

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, 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

**Figure 14 Test Equipment Used**

\* Testing performed before October 19, 2011



## 7. Spurious Radiated Emission, 9 kHz – 30 MHz, 125 kHz Transmitter

### 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 10 meters.

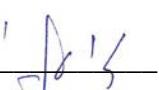
The E.U.T. was operated at the frequency of 125 kHz. This frequency was measured using a peak detector.

### 7.3 ***Test Results***

JUDGEMENT: Passed by 16.5 dB

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

TEST PERSONNEL:

Tester Signature: For/  Date: 11.02.13

Typed/Printed Name: A. Moses



## Radiated Emission

E.U.T Description      Exciter  
Type                      EX-5100  
Serial Number:           Not Designated

Specification: FCC Part 15, Subpart C

Antenna: 3 meters distance

Frequency range: 9 kHz to 30 MHz

Detectors: Peak

Frequency (kHz)	Peak Reading (dB $\mu$ V/m)	Average Factor (dB)	Average Result (dB $\mu$ V/m)	Average Specification (dB $\mu$ V/m)	Margin (dB)
250.00	74.3	-6.0	68.3	99.65	-31.35
375.00	66.5	-6.0	60.5	96.12	-35.62
500.00	63.1	-6.0	57.1	73.62	-16.52
625.00	58.0	-6.0	52.0	71.69	-19.69
750.00	50.1	-6.0	44.1	70.10	-26.00
875.00	38.0	-6.0	32.0	68.76	-36.76

**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.*



#### 7.4 **Test Equipment Used, Spurious Radiated Measurements 9 kHz -30 MHz, 125 kHz Transmitter**

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, 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

**Figure 16 Test Equipment Used**

\* Testing performed before October 19, 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 $\mu$ 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.



## 8. Spurious Radiated Emission, 30 – 1000 MHz, 125 kHz Transmitter

### 8.1 ***Test Specification***

30 - 1000 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 configuration tested is shown in Figure 4. 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.

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.)

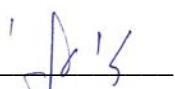
The emissions were measured at a distance of 3 meters.

### 8.3 ***Test Data***

JUDGEMENT: Passed by 6.6 dB

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

TEST PERSONNEL:

Tester Signature: For/ 

Date: 11.02.13

Typed/Printed Name: A. Moses



## Spurious Emissions

E.U.T Description      Exciter  
Type                      EX-5100  
Serial Number:           Not Designated

Specification: FCC Part 15, Subpart C

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

Frequency (MHz)	Polarization V/H	Peak Reading (dB $\mu$ V /m)	QP Reading (dB $\mu$ V /m)	Specification (dB $\mu$ V /m)	Margin (dB $\mu$ V /m)
46.84	V	34.8	30.8	40.0	-9.2
62.91	V	36.6	32.5	40.0	-7.5
71.27	V	32.2	28.7	40.0	-11.3
75.15	V	35.9	32.5	40.0	-7.5
49.77	H	37.5	33.4	40.0	-6.6
60.00	H	32.5	28.9	40.0	-11.1
65.60	H	32.8	29.0	40.0	-11.0
71.26	H	35.5	31.9	40.0	-8.1
76.01	H	36.4	32.4	40.0	-7.6

Figure 17. Spurious Emissions Horizontal Polarity

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.



#### 8.4 **Test Equipment Used, Spurious Radiated Emission, 30 -1000 MHz, 125 kHz Transmitter**

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 Bioconical	ARA	BCD 235/B	1041	November 13, 2011	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 23, 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

**Figure 18 Test Equipment Used**

\*Testing performed before November 24, 2011.

#### 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 dB $\mu$ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB $\mu$ V

No external pre-amplifiers are used.



## 9. 6 dB Minimum Bandwidth 2.4 GHz Transmitter

### 9.1 ***Test Specification***

F.C.C. Part 15, Subpart C: (15.247-a2)

### 9.2 ***Test procedure***

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded.

The E.U.T. was tested at 2412, 2438, and 2462 MHz.

### 9.3 ***Test Results***

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)	Margin (MHz)
2412	8.50	0.5	8.0
2438	9.10	0.5	8.6
2462	10.10	0.5	9.6

**Figure 19 — 6 dB Minimum Bandwidth Test Results Table**

JUDGEMENT: Passed by 8.0 MHz

See additional information in Figure 20 to Figure 22.

TEST PERSONNEL:

Tester Signature: For/ A. Moses

Date: 11.02.13

Typed/Printed Name: A. Moses

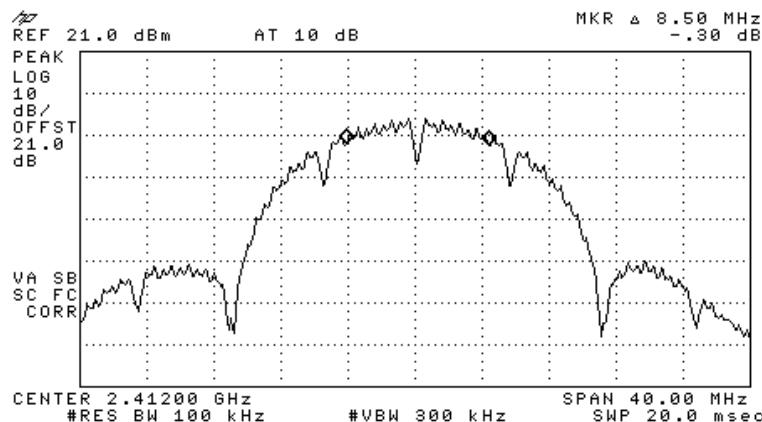


Figure 20 — 2412 MHz

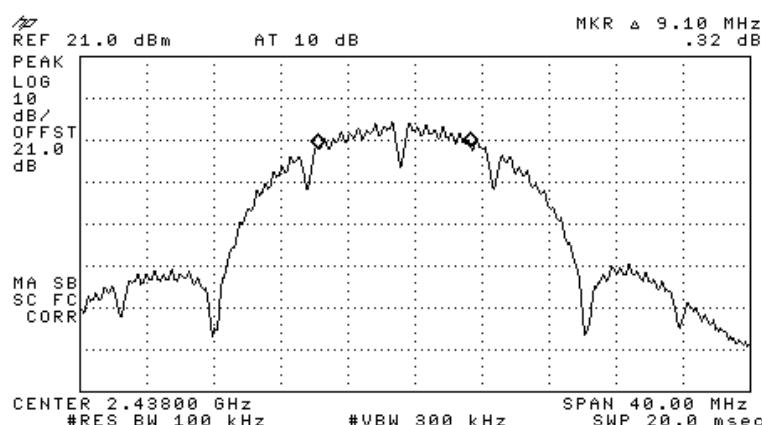


Figure 21 — 2438 MHz

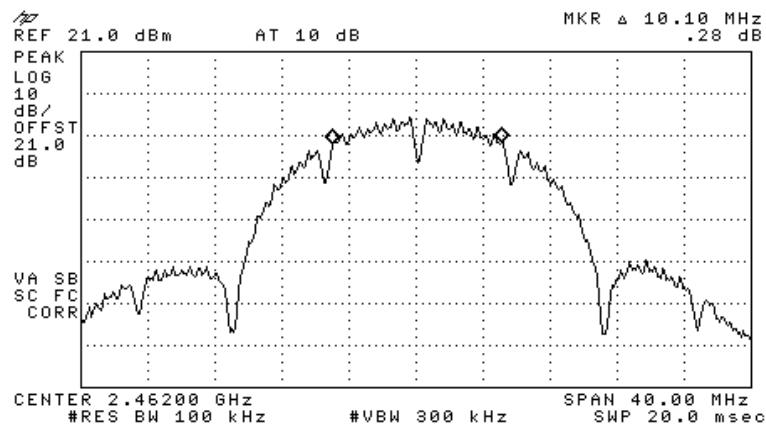


Figure 22 — 2462 MHz

#### 9.4 Test Equipment Used, 6 dB Minimum Bandwidth, 2.4 GHz Transmitter

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	September 20, 2011	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	September 20, 2011	1 year

Figure 23 Test Equipment Used



## 10. 26 dB Minimum Bandwidth 2.4 GHz Transmitter

### 10.1 ***Test Specification***

F.C.C. Part 15, Subpart C: (15.247-a2)

### 10.2 ***Test procedure***

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded.

The E.U.T. was tested at 2412, 2438, and 2462 MHz.

### 10.3 ***Test Results***

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)	Margin (MHz)
2412	19.40	0.5	18.9
2438	19.50	0.5	19.0
2462	19.40	0.5	18.9

**Figure 24 — 26 dB Minimum Bandwidth Test Results Table**

JUDGEMENT: Passed by 18.9 MHz

See additional information in Figure 25 to Figure 27.

TEST PERSONNEL:

Tester Signature: For/ A. Moses Date: 11.02.13

Typed/Printed Name: A. Moses

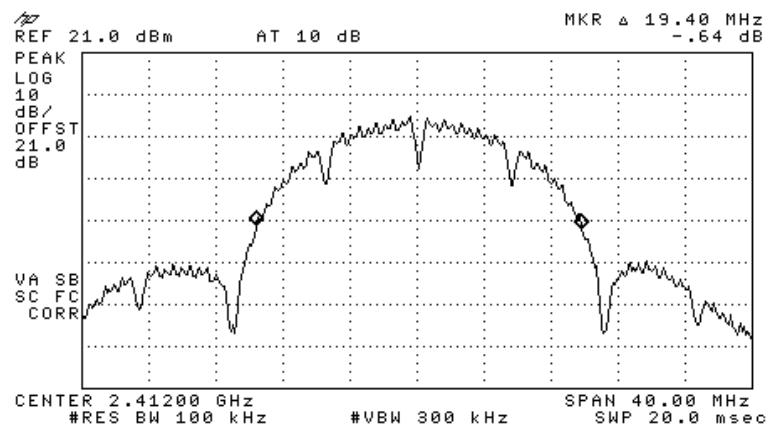


Figure 25 — 2412 MHz

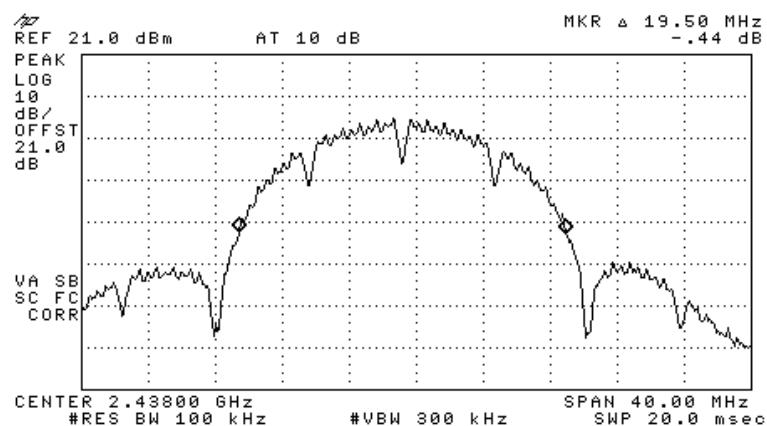


Figure 26 — 2438 MHz

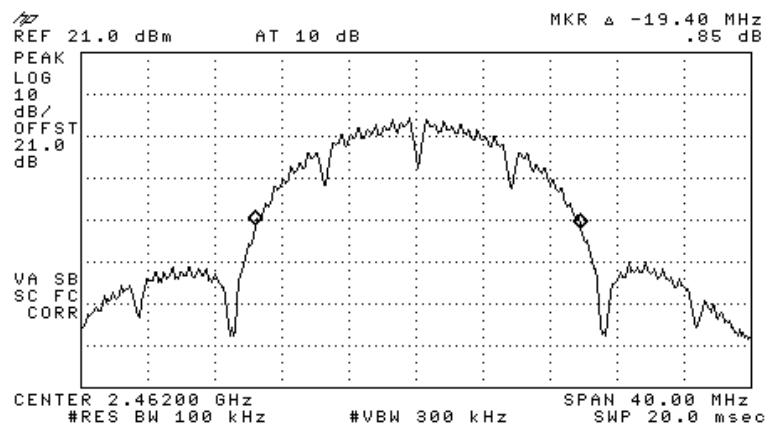


Figure 27 — 2462 MHz

#### 10.4 Test Equipment Used, 26 dB Minimum Bandwidth, 2.4 GHz Transmitter

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	September 20, 2011	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	September 20, 2011	1 year

Figure 28 Test Equipment Used



## 11. Maximum Transmitted Peak Power Output 2.4 GHz Transmitter

### 11.1 Test Specification

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

### 11.2 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The Spectrum Analyzer was set to 1.0 MHz resolution BW. Peak power level was measured at selected operation frequencies.

The E.U.T. was tested at 2412, 2438, and 2462 MHz.

### 11.3 Test Results

Operation Frequency (MHz)	Measured Power (dBm)	Specification (dBm)	Margin (dB)
2412	5.64	30.0	-24.36
2438	5.65	30.0	-24.35
2462	5.22	30.0	-24.78

**Figure 29 Maximum Transmitted Peak Power Output Test Results Table**

JUDGEMENT: Passed by 24.35 dB

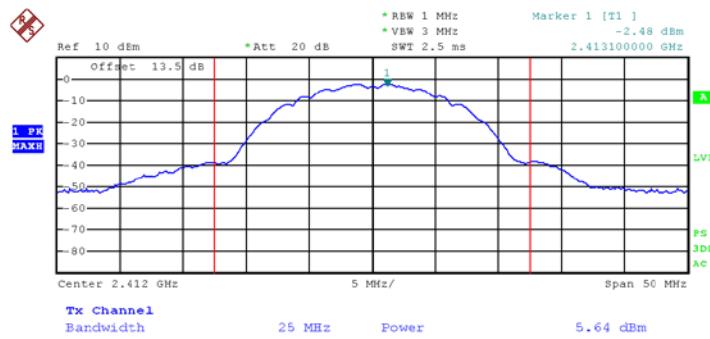
See additional information in Figure 30 to Figure 32.

TEST PERSONNEL:

Tester Signature: For/ A. Moses

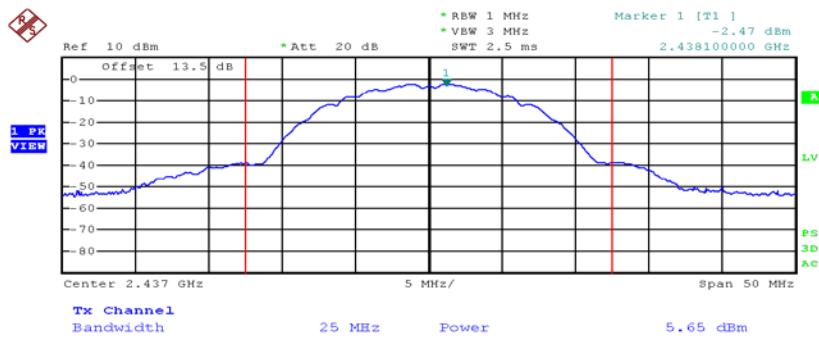
Date: 11.02.13

Typed/Printed Name: A. Moses



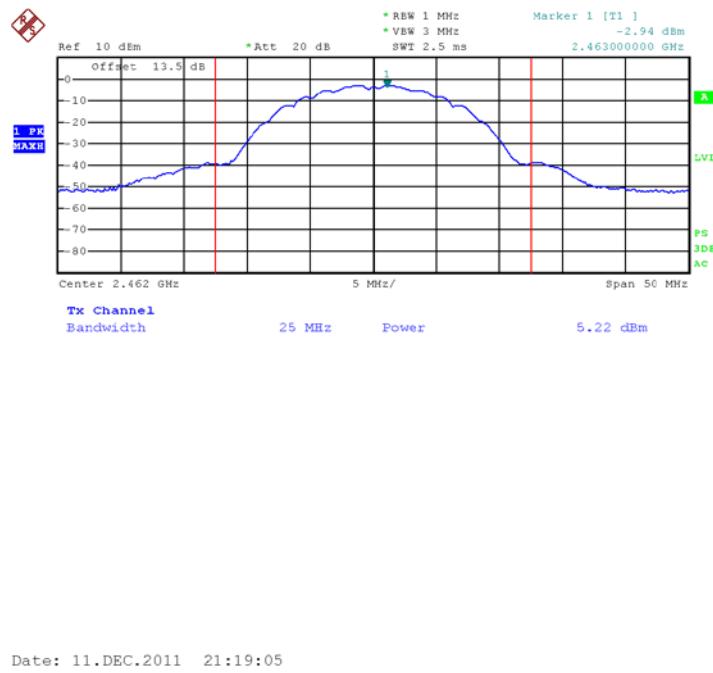
Date: 11.DEC.2011 20:50:48

**Figure 30 — 2412 MHz**



Date: 11.DEC.2011 20:48:28

**Figure 31 — 2438 MHz**



**Figure 32 — 2462 MHz**

#### 11.4 **Test Equipment Used, Maximum Transmitted Peak Power Output, 2.4 GHz Transmitter**

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Rohde & Schwarz	FSL6	10-300191865	October 30, 2011	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	September 20, 2011	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	September 20, 2011	1 year

**Figure 33 Test Equipment Used**



## 12. Peak Power Output Out of 2400-2483.5 MHz Band, 2.4 GHz Transmitter

### 12.1 ***Test Specification***

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

### 12.2 ***Test procedure***

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW except for the frequency range

9 kHz-150 kHz where the RBW was set to 1kHz and the frequency range

150 kHz-10 MHz where the RBW was set to 10kHz. The frequency range from 9 kHz to 25 GHz was scanned. Level of spectrum components out of the 2400-2483.5 MHz was measured at the selected operation frequencies.

The E.U.T. was tested at 2412, 2438, and 2462 MHz.

### 12.3 ***Test Results***

JUDGEMENT: Passed

See additional details in Figure 34 to Figure 39.

TEST PERSONNEL:

Tester Signature: For/ A. Moses Date: 11.02.13

Typed/Printed Name: A. Moses

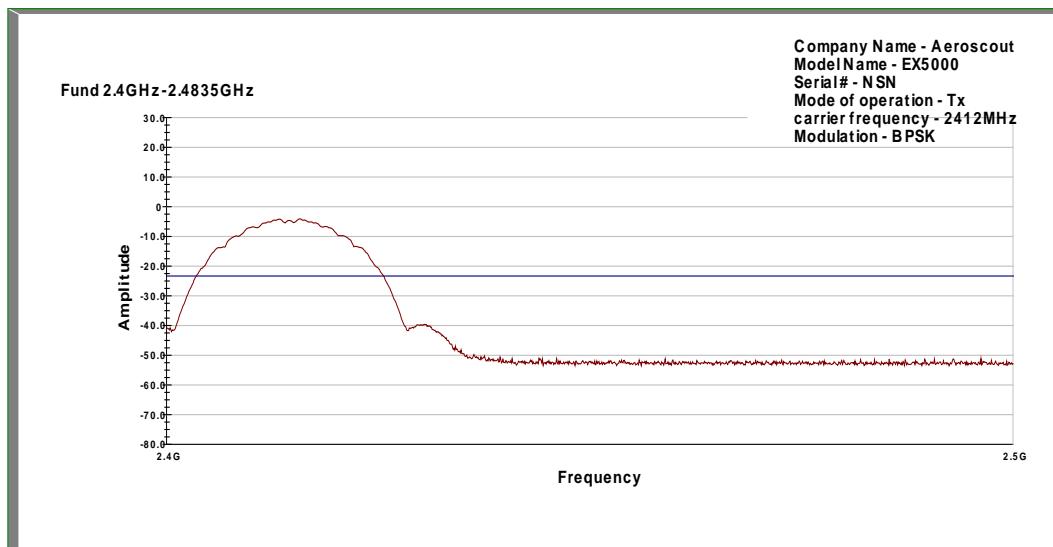


Figure 34 — 2412 MHz

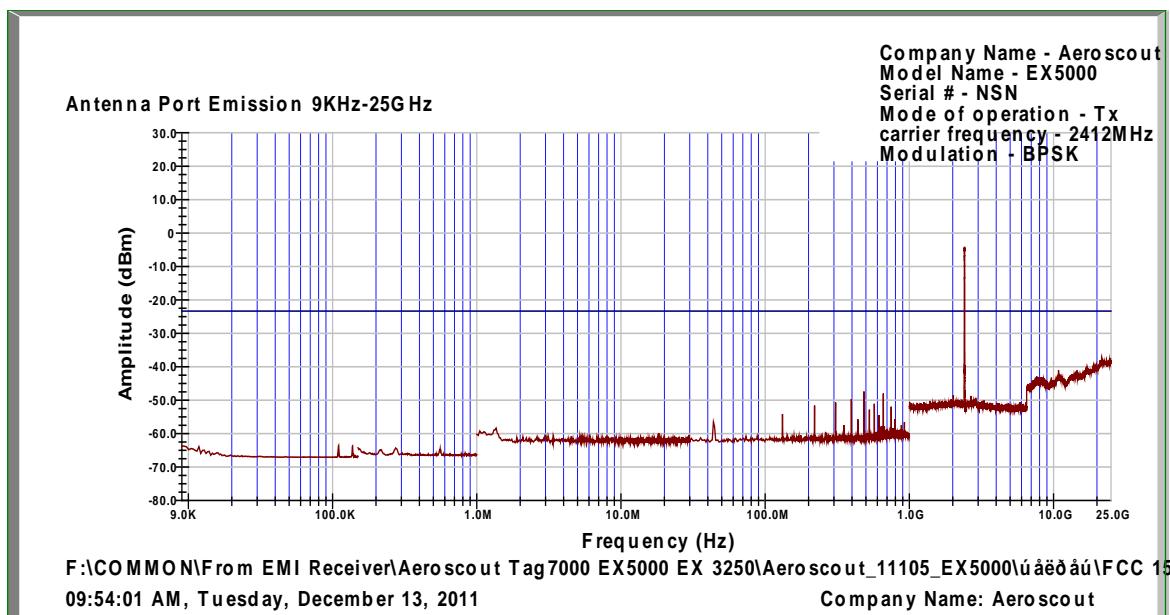


Figure 35 — 2412 MHz

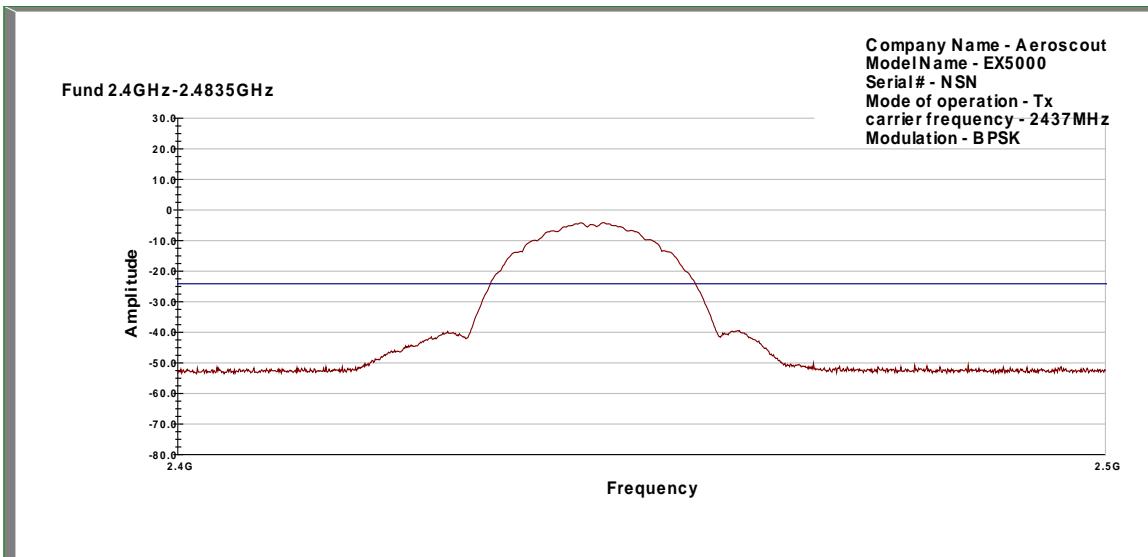


Figure 36 — 2438 MHz

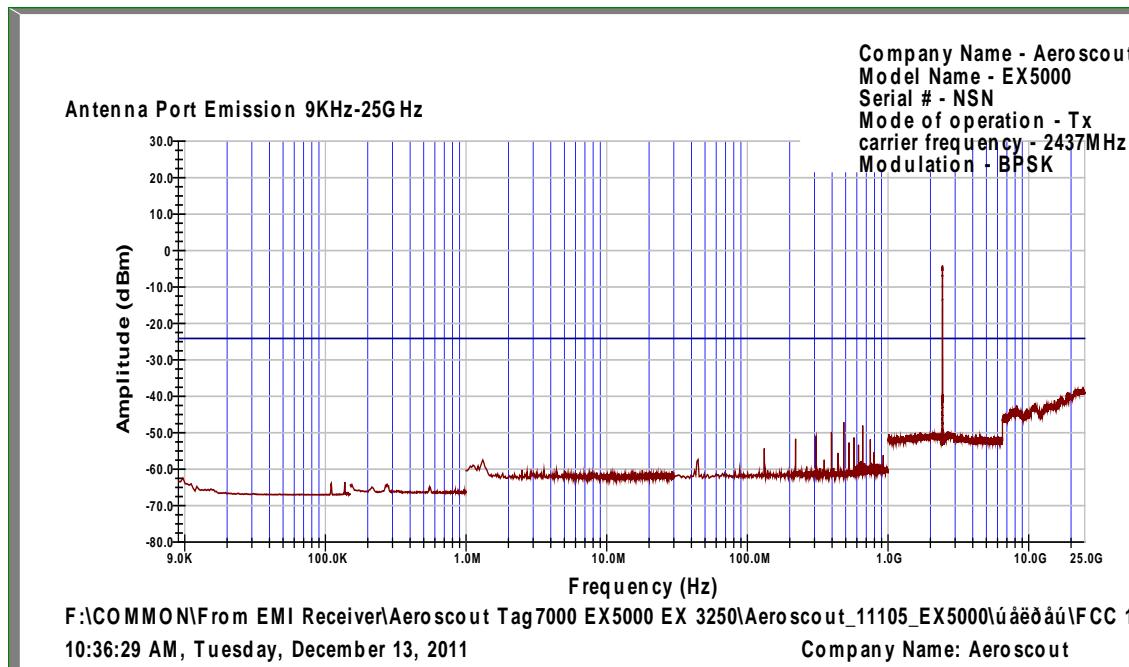


Figure 37 — 2438 MHz

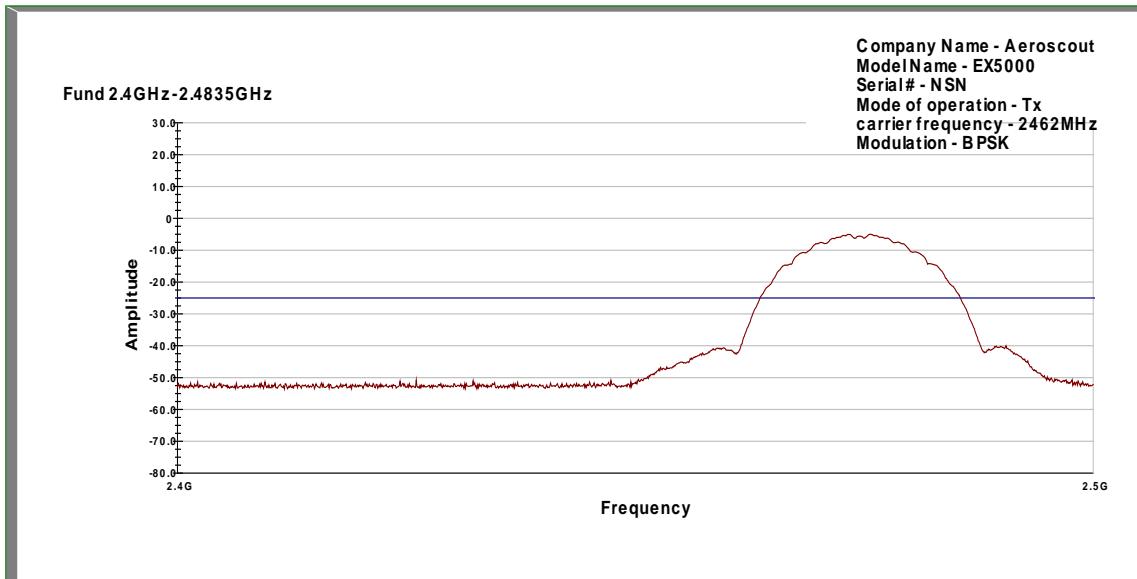


Figure 38 — 2462 MHz

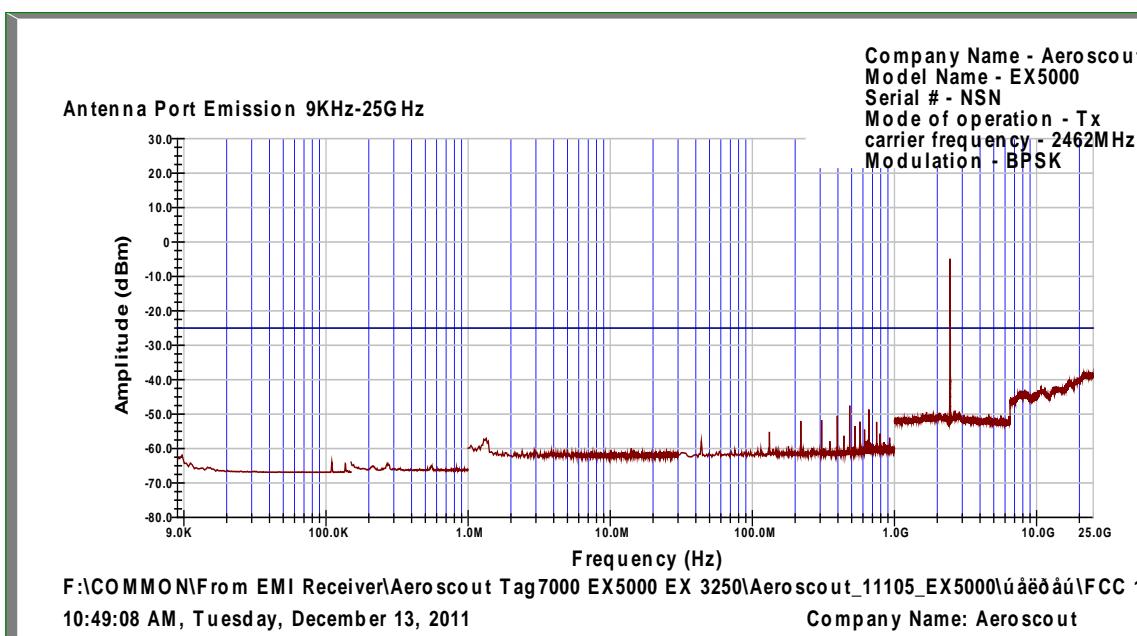


Figure 39 — 2462 MHz



#### 12.4 Test Equipment Used, Peak Power Output Out of 2400-2438.5 MHz Band, 2.4 GHz Transmitter

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	September 20, 2011	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	September 20, 2011	1 year

Figure 40 Test Equipment Used



## 13. Band Edge Spectrum 2.4 GHz Transmitter

### 13.1 ***Test procedure***

F.C.C. Part 15, Subpart C (15.247(c))

### 13.2 ***Test procedure***

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20 dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2412 MHz, and 2462 MHz correspondingly.

### 13.3 ***Test Results***

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBm)	Specification (dBm)	Margin (dB)
2412	2400.0	-45.98	-29.6	-16.38
2462	2483.5	-58.32	-29.9	-28.42

**Figure 41 Band Edge Spectrum Test Results**

See additional information in Figure 42 to Figure 43.

JUDGEMENT: Passed by 16.38 dB

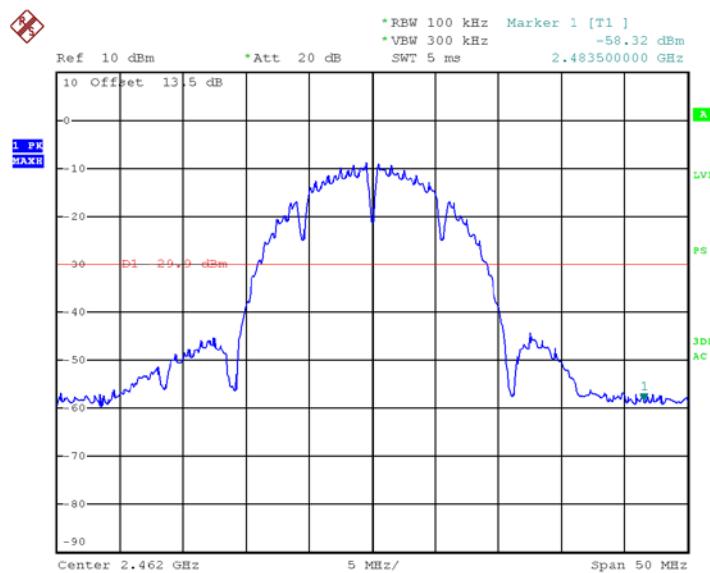
#### TEST PERSONNEL:

Tester Signature: For/ A. Moses Date: 11.02.13  
Typed/Printed Name: A. Moses



Date: 11.DEC.2011 20:55:36

**Figure 42 — 2412 MHz**



Date: 11.DEC.2011 21:21:42

**Figure 43 — 2462 MHz**



### 13.4 **Test Equipment Used, Band Edge spectrum, 2.4 GHz Transmitter**

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	R&S	FSL6	10-300191865	October 30, 2011	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	September 20, 2011	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	September 20, 2011	1 year

**Figure 44 Test Equipment Used**



## 14. Spurious Radiated Emission, 9 kHz – 30 MHz, 2.4 GHz Transmitter

### 14.1 ***Test Specification***

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

### 14.2 ***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 operated at the frequency of 2412, 2438, and 2462 MHz. These frequencies were measured using a peak detector.

### 14.3 ***Measured Data***

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: For/ A. Moses

Date: 11.02.13

Typed/Printed Name: A. Moses



#### 14.4 **Test Equipment Used, Spurious Radiated Emissions 9 kHz – 30 MHz, 2.4 GHz Transmitter**

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, 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

\* Testing performed before October 19, 2011.

#### 14.5 **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.



## 15. Spurious Radiated Emission, 30 – 1000 MHz

### 15.1 ***Test Specification***

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

### 15.2 ***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 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.

The E.U.T. was tested at the operating frequencies of 2412, 2438, and 2462 MHz.



### 15.3 **Test Data**

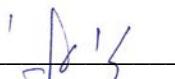
JUDGEMENT: Passed by 4.9 dB

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 4.9 dB in the worst case at the frequency of 180.0 MHz, Horizontal polarization.

The details of the highest emissions are given in Figure 45 to Figure 46.

TEST PERSONNEL:

Tester Signature: For/ 

Date: 11.02.13

Typed/Printed Name: A. Moses



## Radiated Emission

E.U.T Description      Exciter  
Type                      EX-5100  
Serial Number:           Not Designated

### Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical  
Antenna: 3 meters distance

Frequency range: 30 MHz to 1000 MHz  
Detectors: Peak, Quasi-peak

Frequency (MHz)	Peak Amp (dB $\mu$ V/m)	QP (dB $\mu$ V/m)	Polarity (H/V)	Specification (dB $\mu$ V/m)	Margin (dB)
63.07	34.0	31.1	H	40.0	-8.9
63.013	36.1	33.0	V	40.0	-7.0
171.3	31.1	26.9	V	43.5	-16.6
171.3	37.9	34.7	H	43.5	-8.8
184.3	37.0	33.6	V	43.5	-9.9
184.3	30.3	25.5	H	43.5	-18.0
180.0	36.9	31.9	V	43.5	-11.6
180.0	45.6	38.6	H	43.5	-4.9
352.0	35.3	33.4	V	46.0	-12.6
352.0	39.4	38.4	H	46.0	-7.6
396.0	37.8	36.1	H	46.0	-9.9
396.0	39.2	37.3	V	46.0	-8.7
440.0	42.0	40.7	V	46.0	-5.3
440.0	40.0	38.6	H	46.0	-7.4

**Figure 45. Radiated Emission. Antenna Polarization: HORIZONTAL/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

E.U.T Description      Exciter  
Type                      EX-5100  
Serial Number:           Not Designated

### Specification: FCC Part 15, Subpart C

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

Frequency (MHz)	Peak Amp (dB $\mu$ V/m)	QP (dB $\mu$ V/m)	Polarity (H/V)	Specification (dB $\mu$ V/m)	Margin (dB)
484.0	41.7	40.3	H	46.0	-5.7
484.0	39.1	37.2	V	46.0	-8.8
528.0	39.6	37.3	V	46.0	-8.7
528.0	37.6	35.1	H	46.0	-10.9
660.0	40.0	38.1	H	46.0	-7.9
660.0	40.6	38.7	V	46.0	-7.3
360.0	33.6	30.9	V	46.0	-15.1
360.0	33.1	30.5	H	46.0	-15.5
384.0	31.8	28.7	H	46.0	-17.3
384.0	28.8	24.0	V	46.0	-22.0

**Figure 46. Radiated Emission. Antenna Polarization: HORIZONTAL/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.*



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

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 Bioconical	ARA	BCD 235/B	1041	November 13, 2011	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 23, 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

\* Testing performed before November 24, 2011.



## 15.5 **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 $\mu$ v/m]

RA: Receiver Amplitude [dB $\mu$ v]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.



## 16. Spurious Radiated Emission Above 1 GHz

### 16.1 Radiated Emission Above 1 GHz

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, 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 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 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

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 operating frequencies of 2412, 2438, and 2462 MHz.



## 16.2 **Test Data**

JUDGEMENT: Passed by 7.3 dB

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is 7.7 dB in the worst case at the frequency of 2390 MHz, Horizontal polarization.

For the operation frequency of 2438 MHz, the margin between the emission level and the specification limit is 7.7 in the worst case at the frequency of 4872 MHz, Vertical polarization.

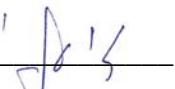
For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is 7.3 in the worst case at the frequency of 2483.5 MHz, Horizontal polarization.

The results for all modulations were the same.

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

The details of the highest emissions are given in *Figure 47* to *Figure 52*.

### TEST PERSONNEL:

Tester Signature: For/  Date: 11.02.13

Typed/Printed Name: A. Moses



## Radiated Emission Above 1 GHz

E.U.T Description      Exciter  
Type                      EX-5100  
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: 2412 MHz

<b>Freq.</b> (MHz)	<b>Polarity</b> (H/V)	<b>Peak Amp</b> (dB $\mu$ V/m)	<b>Peak. Specification</b> (dB $\mu$ V/m)	<b>Peak. Margin</b> (dB)
2390	H	64.2	74.0	-9.8
2390	V	63.6	74.0	-10.4
4824	H	48.2	74.0	-25.8
4824	V	51.2	74.0	-22.8

**Figure 47. 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 Amp” includes correction factor.

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



## Radiated Emission Above 1 GHz

E.U.T Description      Exciter  
Type                      EX-5100  
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: 2412 MHz

<b>Freq.</b> (MHz)	<b>Polarity</b> (H/V)	<b>Average Amp</b> (dB $\mu$ V/m)	<b>Average Specification</b> (dB $\mu$ V/m)	<b>Peak. Margin</b> (dB)
2390	H	46.3	54.0	-7.7
2390	V	46.3	54.0	-7.7
4824	H	38.0	54.0	-16.0
4824	V	45.6	54.0	-8.4

**Figure 48. 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 Amp” includes correction factor.

\*      Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## Radiated Emission Above 1 GHz

E.U.T Description      Exciter  
Type                      EX-5100  
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: 2438 MHz

<b>Freq.</b>	<b>Polarity</b>	<b>Peak Amp</b>	<b>Peak. Specification</b>	<b>Peak. Margin</b>
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
4872	H	47.7	74.0	-26.3
4872	V	50.8	74.0	-23.2

**Figure 49. 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 Amp” includes correction factor.

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



## Radiated Emission Above 1 GHz

E.U.T Description      Exciter  
Type                      EX-5100  
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: 2438 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB $\mu$ V/m)	Average Specification (dB $\mu$ V/m)	Peak. Margin (dB)
4872	H	40.1	54.0	-13.9
4872	V	46.3	54.0	-7.7

**Figure 50. 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 Amp” includes correction factor.

\*      Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## Radiated Emission Above 1 GHz

E.U.T Description      Exciter  
Type                      EX-5100  
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: 2462 MHz

<b>Freq.</b> (MHz)	<b>Polarity</b> (H/V)	<b>Peak Amp</b> (dB $\mu$ V/m)	<b>Peak. Specification</b> (dB $\mu$ V/m)	<b>Peak. Margin</b> (dB)
2483.50	H	65.7	74.0	-8.3
2483.50	V	64.5	74.0	-9.5
4924.0	H	48.2	74.0	-25.8
4924.0	V	48.8	74.0	-25.2

**Figure 51. 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 Amp” includes correction factor.

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

\*\*“Correction Factor” = Antenna Factor + Cable Loss



## Radiated Emission Above 1 GHz

E.U.T Description      Exciter  
Type                      EX-5100  
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: 2462 MHz

<b>Freq.</b> (MHz)	<b>Polarity</b> (H/V)	<b>Average Amp</b> (dB $\mu$ V/m)	<b>Average Specification</b> (dB $\mu$ V/m)	<b>Peak. Margin</b> (dB)
2483.50	H	46.7	54.0	-7.3
2483.50	V	46.4	54.0	-7.6
4924.0	H	39.4	54.0	-14.6
4924.0	V	39.1	54.0	-14.9

**Figure 52. 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 Amp” includes correction factor.

\*      Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

\*\*“Correction Factor” = Antenna Factor + Cable Loss



### 16.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010*	1 Year
RF Filter Section	HP	85420E	3705A00248	November 24, 2010*	1 Year
Antenna Biconical	ARA	BCD 235/B	1041	November 13, 2011	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 23, 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	1008	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 4, 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	JPKGC19982	N/A	N/A

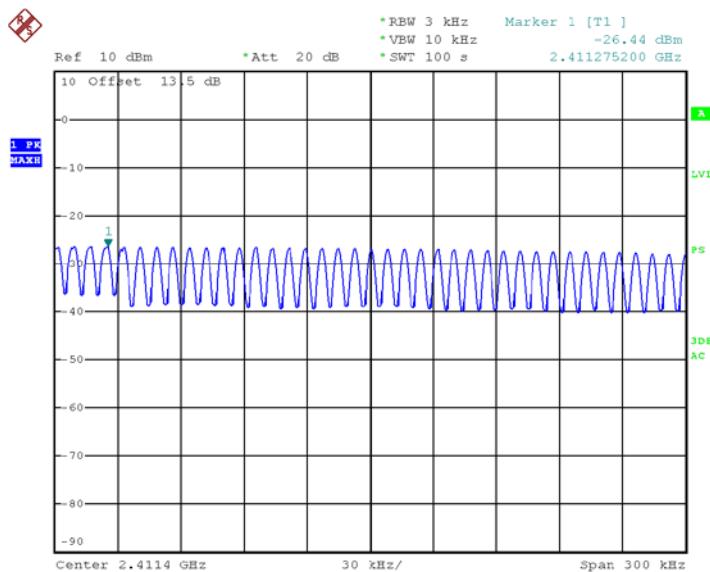
\* Testing performed before November 24, 2011.

## 17. Transmitted Power Density

[In accordance with section 15.247(d)]

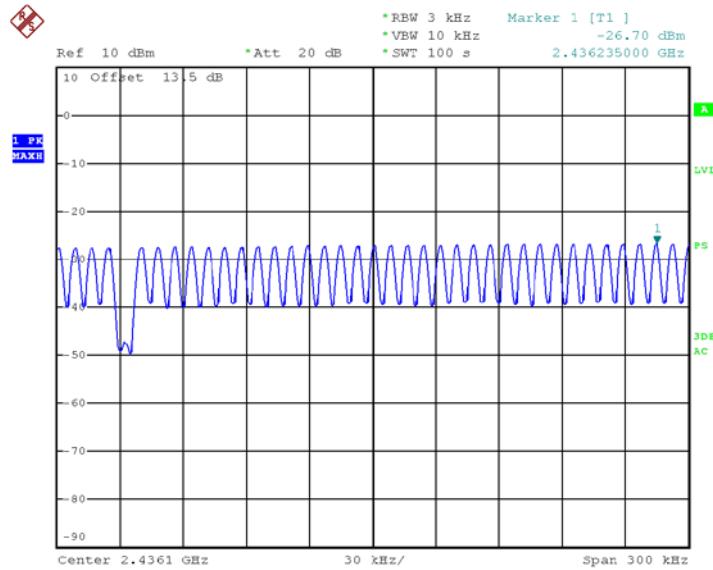
### 17.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (20dB) and an appropriate coaxial cable (cable loss = 1 dB). The spectrum analyzer was set to 3 kHz resolution BW. and sweep time of 1 second for each 3 kHz “window”. The spectrum peaks were located at each of the 3 operating frequencies.



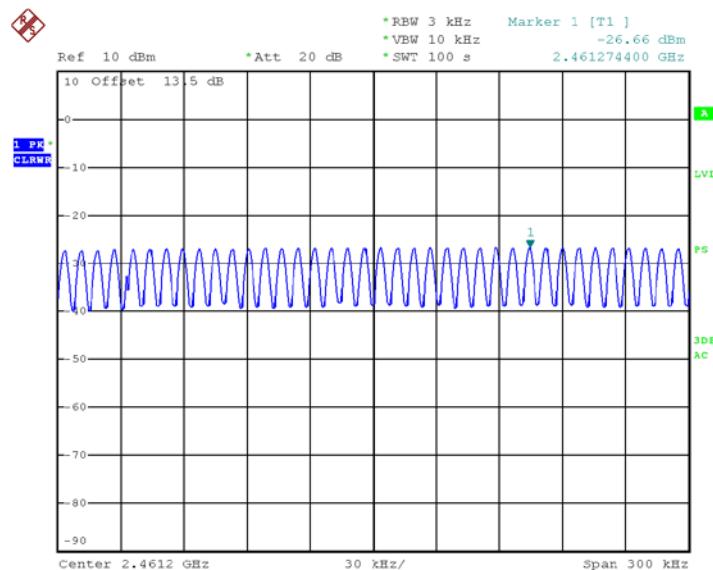
Date: 11.DEC.2011 21:12:21

Figure 53 —2412 MHz



Date: 11.DEC.2011 21:07:25

Figure 54 —2438 MHz



Date: 11.DEC.2011 21:16:17

Figure 55 —2462 MHz



## 17.2 **Results table**

E.U.T. Description: Exciter

Model No.: EX-5100

Serial Number: Not Designated

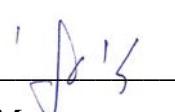
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
2412	BPSK	-26.44	8.0	-34.44
2438	BPSK	-26.70	8.0	-34.7
2462	BPSK	-26.66	8.0	-34.66

**Figure 56 Test Results**

JUDGEMENT: Passed by 34.4 dB

TEST PERSONNEL:

Tester Signature: For/  Date: 11.02.13

Typed/Printed Name: A. Moses



### 17.3 **Test Equipment Used.**

#### Transmitted Power Density

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	Rohde & Schwarz	FSL6	10-300191865	October 30, 2011	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	September 20, 2011	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	September 20, 2011	1 year

**Figure 57 Test Equipment Used**



## 18. Antenna Gain/Information

The antenna gain is -2 dBi.



## 19. R.F Exposure/Safety

The E.U.T. is wall mounted. The typical distance between the E.U.T. and the user, is 1m .

### Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2438 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<sub>t</sub>- Transmitted Power 5.65 dBm (Peak) = 3.67 mw

G<sub>T</sub>- Antenna Gain, -2 dBi = 0.6 numeric

R- Distance from Transmitter using 1 m worst case

(c) The peak power density is :

$$S_p = \frac{3.67 \times 0.6}{4\pi(100)^2} = 1.75 \times 10^{-5} \frac{mW}{cm^2}$$

(d) This is below the FCC limit.



## 20. APPENDIX A - CORRECTION FACTORS

### 20.1 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".



## 20.2 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.



### 20.3 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".



## 20.4 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".



**20.5 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".



## 20.6 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENN A Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (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			



**20.7 Correction factors for**

***Horn Antenna***

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

<b>FREQUENCY</b> (GHz)	<b>AFE</b> (dB /m)	<b>Gain</b> (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



**20.8 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



## 21. Comparison Industry Canada Requirements With FCC

Test	FCC	IC
Spurious Emission	47CFR15.209	RSS-210 Section 2.5
6dB BW	15.247(a)2	RSS 210 Issue 8 A8.2a
26 dB BW	15.247(a)2	RSS 210 Issue 8 A8.2a
Maximum Transmitted Peak Output Power	15.247(b)	RSS 210 Issue 8 A8.4(4)
Peak Power Output	15.247(b)	RSS 210 Issue 8 A8.4(4)
Band edge spectrum	15.247(d)	RSS 210 Issue 8 A8.5
Spurious radiated emission in the restricted band	15.205(c)	RSS 210 Issue 8 2.5 RSS Gen 7.2.2 (Table 1)
Transmitted Power density	15.247(e)	RSS 210 Issue 8 A8.2b
RF Exposure Limits	1.1307(b)(1)	RSS 102 4.4