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DATE: 03 September 2013

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

FCC Radio Test Report

for

AeroScout Ltd.

Equipment under test:

LF Exciter with Internal Wi-Fi Receiver 2.4 GHz Transmitter

EX-5500

Written by: _____
R. Pinchuck, Documentation

Approved by: _____
A. Sharabi, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for
AeroScout Ltd.

LF Exciter with Internal Wi-Fi Receiver

EX-5500

FCC ID: Q3HEX5500

IC: 5115A-EX5500

3 September 2013

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

Equipment type: Spread Spectrum/Digital Device 2400-2483.5 MHz

LF Exciter with Internal Wi-Fi Receiver

Limits used: 47CFR15 Section 15.247

Measurement procedure used is KDB 558074 D01 April 9, 2013 and ANSI C63.4: 2003.

Application for Certification
prepared by:
Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
e-mail Sraz@itl.co.il

Applicant for this device:
(different from "prepared by")
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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 Tel: +972-8-9369393 Fax: +972-8-9365977
Manufacturer's Representative:	Dadi Matza
Equipment Under Test (E.U.T):	LF Exciter with Internal Wi-Fi Receiver
Equipment Model No.:	EX-5500
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	16.05.13
Start of Test:	16.05.13
End of Test:	16.05.13
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Subpart C RSS-210 Issue 8, 2010

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 EX5500 Exciter is a component of the AeroScout suite of enterprise visibility solutions that enables location-based applications. The EX5500 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 EX5500 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 Wi-Fi message to Internal 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 EX5500 Exciter has built in Wi-Fi receiver which enables it to receive AeroScout tag messages. The Exciter also has an embedded Wi-Fi transmitter which is utilized by the Exciter for self-health monitoring. These capabilities make the Exciter ideal for security applications.
The detection capabilities of the EX5500, 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. Radiated testing was performed at an antenna to EUT distance of 3 meters.

Radiated testing was performed according to the procedures in KDB 558074 D01 April 9, 2013 and ANSI 63-4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing November 21, 2012).
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):

± 3.6 dB

Note: See ITL Procedure No. PM 198.

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):

± 5.2 dB

Note: See ITL Procedure No. PM 198.

2. System Test Configuration

2.1 Justification

Radiated emission screening was performed in 3 orthogonal orientations. The worst case orientation was the Horizontal position as ceiling mounted.

2.2 EUT Exercise Software

Exercise Software version 400.16.

2.3 Special Accessories

No special accessories were needed to achieve compliance.

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

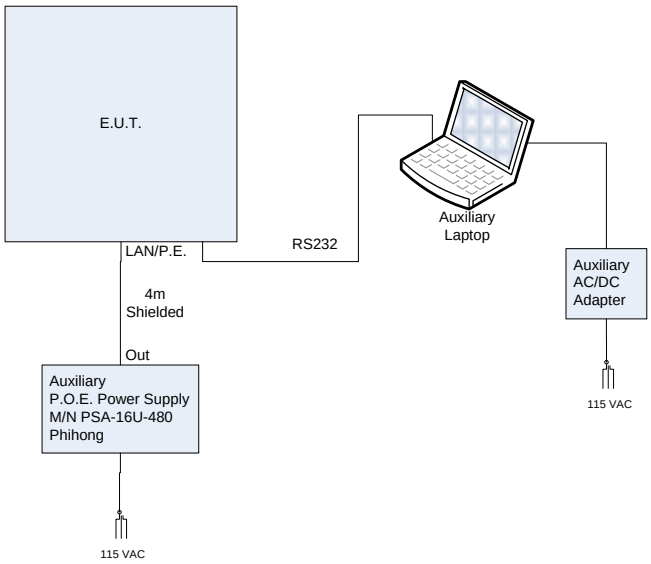

Figure 1. Configuration of Tested System

3. Conducted and Radiated Measurement Test Set-up Photo

Figure 2. Conducted Emission On AC Ports Test

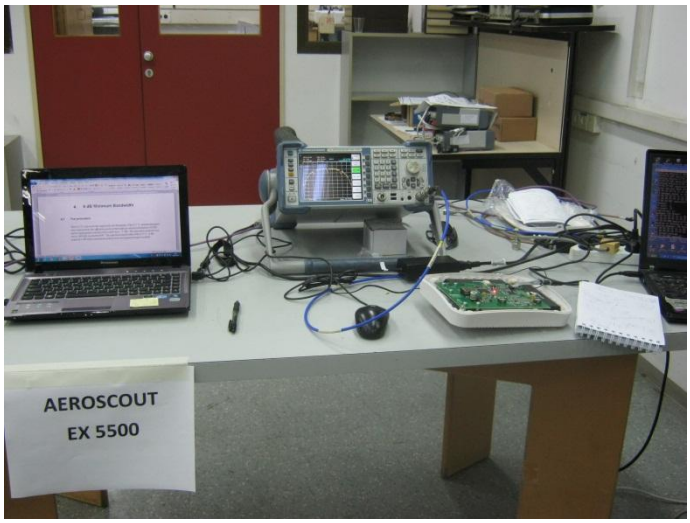

Figure 3. Conducted Emission from Antenna Ports Test

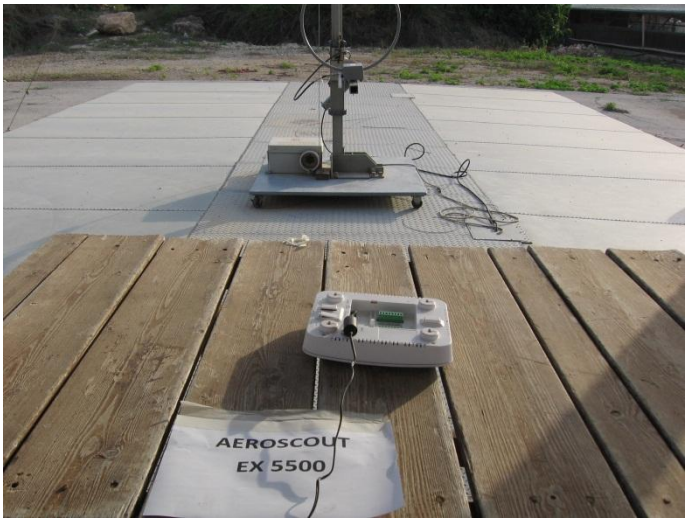

Figure 4. Radiated Emission Test

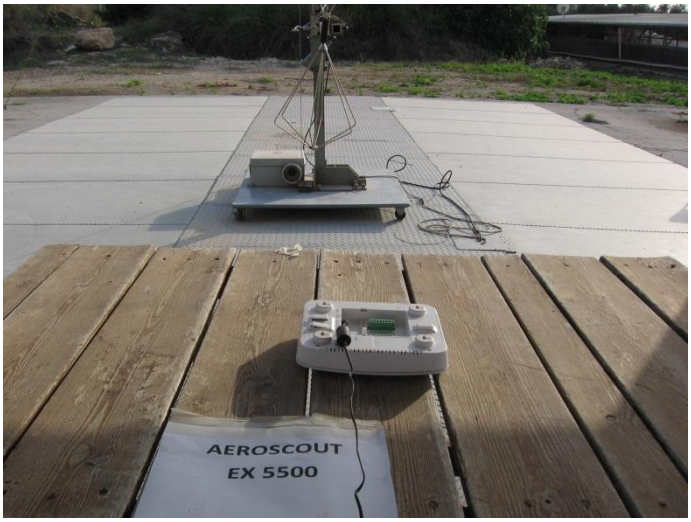

Figure 5. Radiated Emission Test

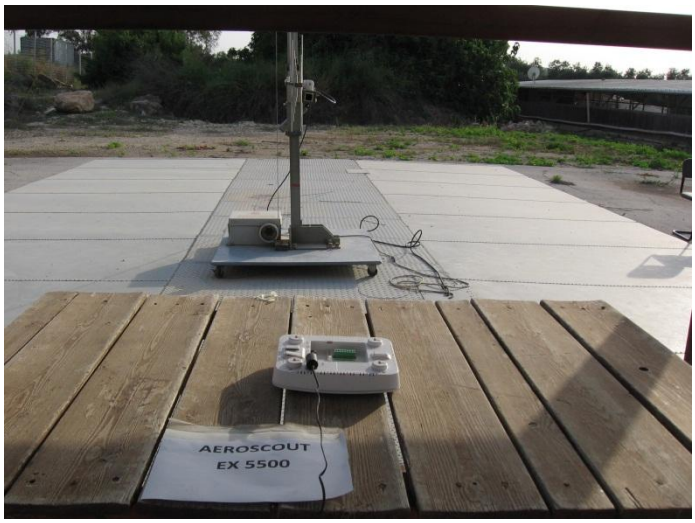

Figure 6. Radiated Emission Test

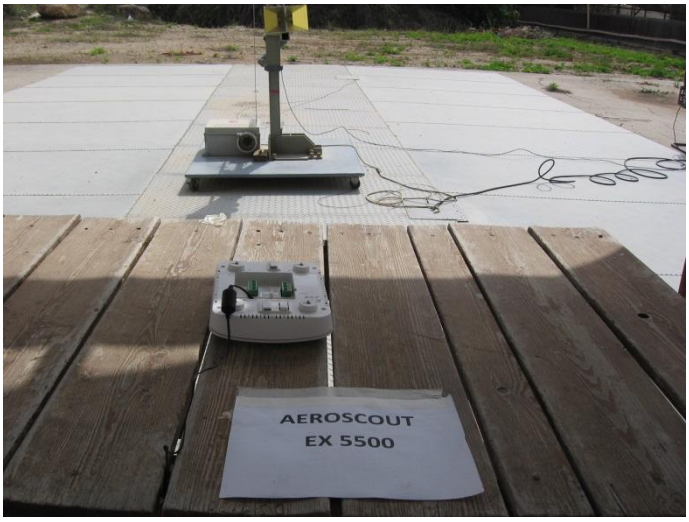

Figure 7. Radiated Emission Test

4. Conducted Emission from AC Ports

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 a 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 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

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

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

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

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

4.3 Measured Data

JUDGEMENT: Passed by 0.08 dB

The margin between the emission levels and the specification limit is, in the worst case, 0.60 dB for the phase line at 3.936 MHz and 0.08 dB at 3.934 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 8 to *Figure 11*.

TEST PERSONNEL:

Tester Signature: _____ Date: 15.08.13

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description	LF Exciter with Internal Wi-Fi Receiver
Type	EX-5500
Serial Number:	Not Designated

Specification:	FCC Part 15, Subpart C
Lead:	Phase
Detectors:	Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	3.688 MHz	45.45	-10.54
2	Average	3.688 MHz	43.49	-2.50
1	Quasi Peak	3.936 MHz	47.16	-8.83
2	Average	3.936 MHz	45.39	-0.60
1	Quasi Peak	4.668 MHz	42.54	-13.45
2	Average	4.672 MHz	43.16	-2.83

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2	Average	10.572 MHz	46.51	-3.48
1	Quasi Peak	10.816 MHz	50.03	-9.96
2	Average	10.816 MHz	46.53	-3.46
2	Average	11.064 MHz	48.35	-1.64
1	Quasi Peak	11.068 MHz	49.58	-10.41
1	Quasi Peak	11.312 MHz	49.24	-10.75
2	Average	11.312 MHz	46.34	-3.65
1	Quasi Peak	12.044 MHz	49.29	-10.70
2	Average	12.292 MHz	48.26	-1.73
1	Quasi Peak	12.296 MHz	51.71	-8.28
1	Quasi Peak	12.54 MHz	50.88	-9.11
2	Average	12.54 MHz	48.94	-1.05
1	Quasi Peak	12.784 MHz	49.03	-10.96
2	Average	13.524 MHz	47.47	-2.52
1	Quasi Peak	13.528 MHz	48.67	-11.32
1	Quasi Peak	13.772 MHz	50.18	-9.81
2	Average	14.016 MHz	46.27	-3.72
1	Quasi Peak	14.996 MHz	48.54	-11.45
2	Average	14.996 MHz	46.00	-3.99
2	Average	15.244 MHz	45.11	-4.88

Figure 8. Detectors: Quasi-Peak, AVERAGE

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	LF Exciter with Internal Wi-Fi Receiver
Type	EX-5500
Serial Number:	Not Designated

Specification:	FCC Part 15, Subpart C
Lead:	Phase
Detectors:	Quasi-peak, Average

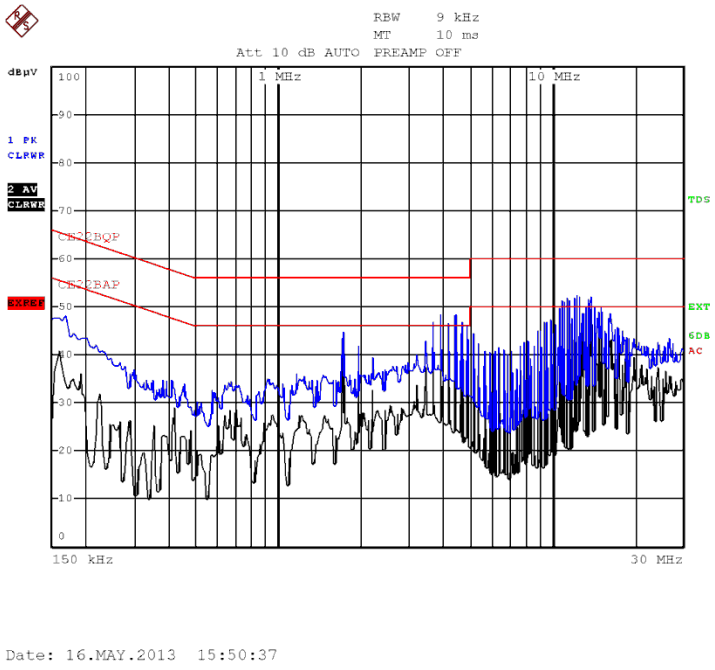

Figure 9. Detectors: Quasi-peak, Average

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	LF Exciter with Internal Wi-Fi Receiver
Type	EX-5500
Serial Number:	Not Designated

Specification:	FCC Part 15, Subpart C
Lead:	Neutral
Detectors:	Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	3.69 MHz	44.98	-11.01
2	Average	3.69 MHz	42.95	-3.04
1	Quasi Peak	3.934 MHz	47.25	-8.74
2	Average	3.934 MHz	45.91	-0.08
2	Average	4.182 MHz	42.16	-3.83
1	Quasi Peak	4.674 MHz	43.80	-12.19

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2	Average	10.578 MHz	44.56	-5.43
1	Quasi Peak	10.818 MHz	50.12	-9.87
1	Quasi Peak	11.066 MHz	50.36	-9.63
2	Average	11.066 MHz	48.54	-1.45
1	Quasi Peak	11.558 MHz	47.39	-12.60
2	Average	11.558 MHz	43.51	-6.48
1	Quasi Peak	12.05 MHz	50.48	-9.51
2	Average	12.05 MHz	48.13	-1.86
1	Quasi Peak	12.294 MHz	51.69	-8.30
2	Average	12.294 MHz	49.22	-0.77
2	Average	12.542 MHz	48.82	-1.17
1	Quasi Peak	12.546 MHz	50.07	-9.92
1	Quasi Peak	12.79 MHz	48.50	-11.49
2	Average	12.79 MHz	44.57	-5.42
1	Quasi Peak	13.278 MHz	47.18	-12.81
1	Quasi Peak	13.526 MHz	50.26	-9.73
1	Quasi Peak	13.774 MHz	49.76	-10.23
2	Average	13.774 MHz	45.74	-4.25
2	Average	14.018 MHz	46.18	-3.81
2	Average	15.002 MHz	45.20	-4.79

Figure 10. Detectors: 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	LF Exciter with Internal Wi-Fi Receiver
Type	EX-5500
Serial Number:	Not Designated

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

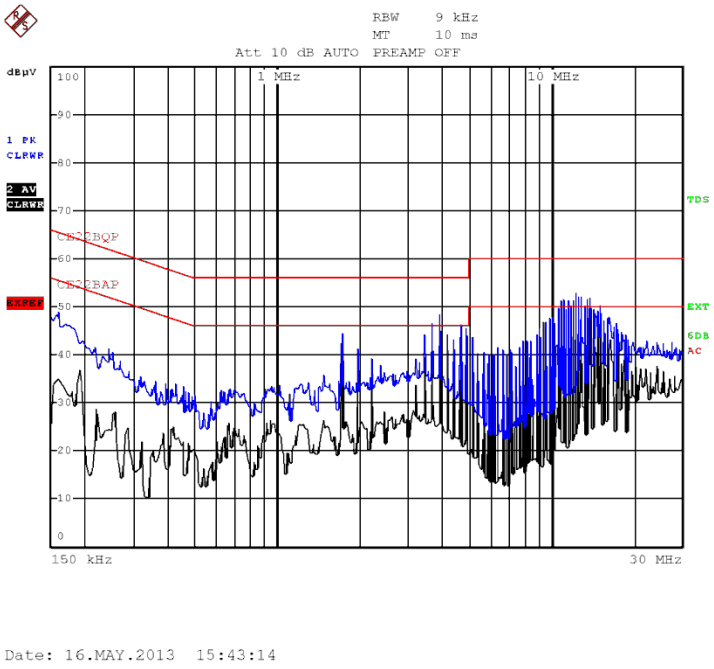

Figure 11 Detectors: Quasi-peak, Average

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 Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	EMCO	3810/2BR	1297	December 16, 2012	1 Year
Transient Limiter	HP	11947A	3107A03041	February 25, 2013	1Year
EMI Receiver	Rohde & Schwarz	ESCI7	100724	December 27, 2012	1Year

6. 6 dB Minimum Bandwidth 2.4 GHz Transmitter

6.1 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.

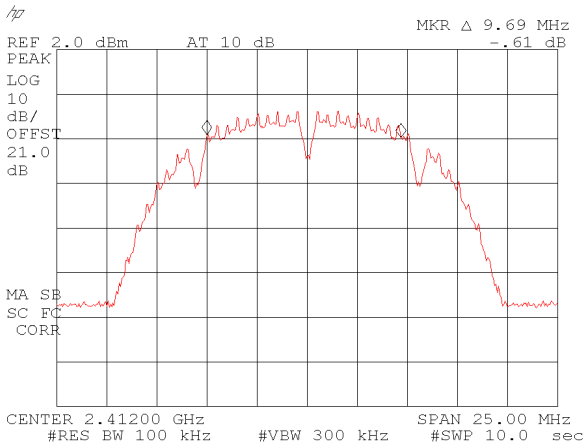

Figure 12 — Low Channel

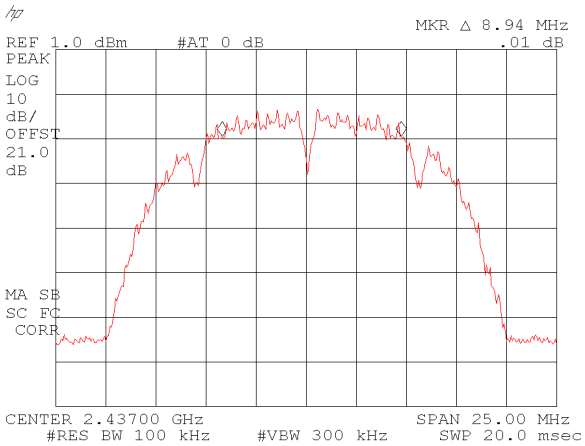

Figure 13 — Mid Channel

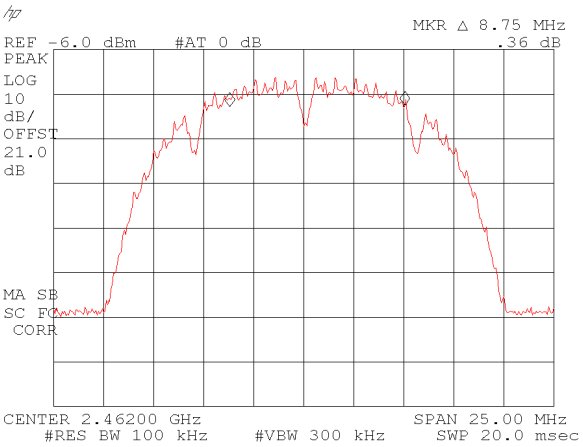

Figure 14 — High Channel

6.2 Results table

E.U.T Description: LF Exciter with Internal Wi-Fi Receiver
Model No.: EX-5500
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Modulation Mbps	Reading (MHz)	Specification (MHz)
2412.00	1	9.69	0.5
2437.00	1	8.94	0.5
2462.00	1	8.75	0.5

Figure 15 6 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 15.08.13

Typed/Printed Name: A. Sharabi

6.3 Test Equipment Used.

6 dB Minimum Bandwidth, 2.4 GHz Transmitter

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	20dB	-	May 16, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 16, 2013	1 year

Figure 16 Test Equipment Used

7. 26 dB Minimum Bandwidth 2.4 GHz Transmitter

7.1 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 26 dB below maximum peak power was measured and recorded.

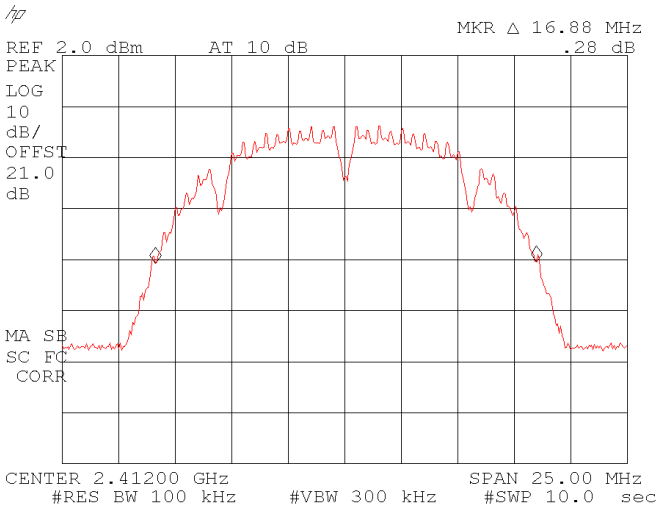

Figure 17 —Low Channel

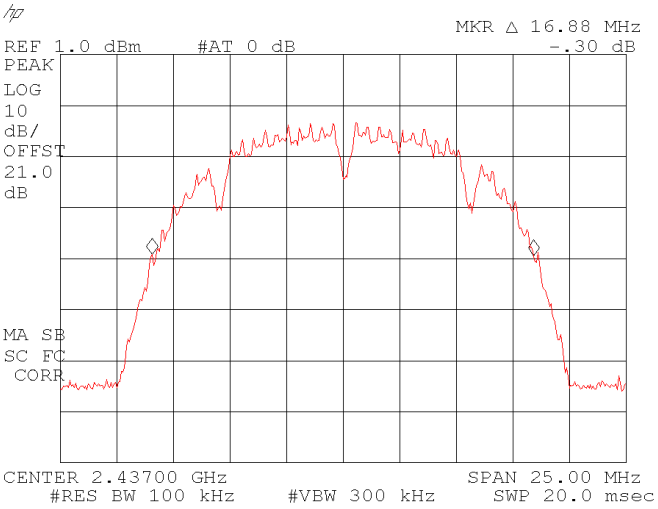

Figure 18 —Mid Channel

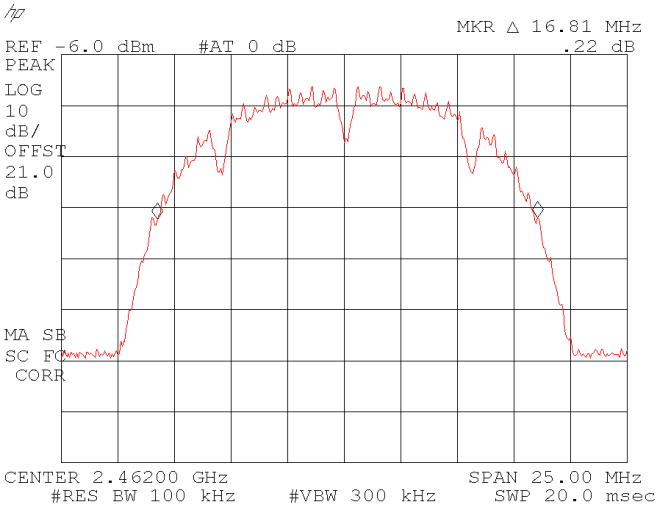

Figure 19 —High Channel

7.2 Results table

E.U.T Description: LF Exciter with Internal Wi-Fi Receiver
Model No.: EX-5500
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Modulation Mbps	Reading (MHz)
2412.00	1	16.88
2437.00	1	16.88
2462.00	1	16.81

Figure 20 26 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:
Tester Signature: _____ Date: 15.08.13
Typed/Printed Name: A. Sharabi

7.3 Test Equipment Used.

26 dB Minimum Bandwidth, 2.4 GHz Transmitter

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	20dB	-	May 16, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 16, 2013	1 year

Figure 21 Test Equipment Used

8. Maximum Transmitted Peak Power Output 2.4 GHz Transmitter

8.1 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 low, mid and high channels at 20MHz with the following modulations: QPSK (1Mbps).

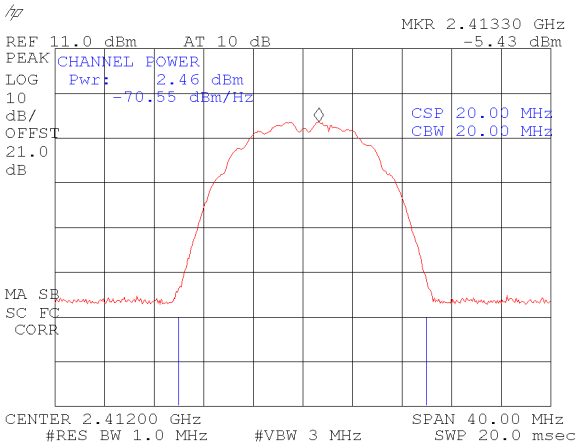

Figure 22 , Low channel

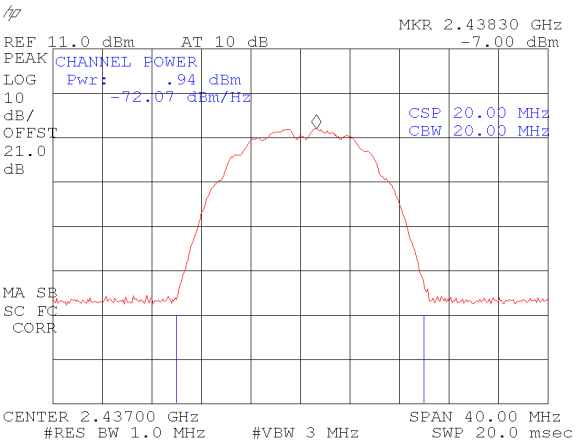

Figure 23, Mid channel

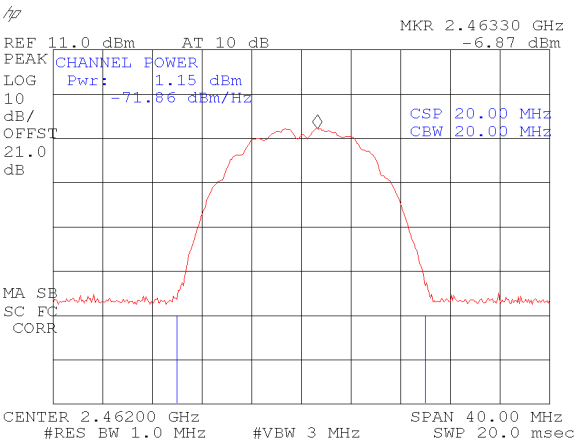

Figure 24 , High Channel

8.2 Results table

E.U.T. Description: LF Exciter with Internal Wi-Fi Receiver
Model No.: EX-5500
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C Section 15.247(b)

Operation Frequency (MHz)	Modulation Mbps	Power (dBm)	Specification (dBm)	Margin (dB)
2412	1	2.46	30.0	-27.54
2437	1	0.94	30.0	-29.06
2462	1	1.15	30.0	-28.85

Figure 25 Maximum Peak Power Output

JUDGEMENT: Passed by 27.54 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 15.08.13
Typed/Printed Name: A. Sharabi

8.3 Test Equipment Used.

Peak Power Output, 2.4 GHz Transmitter

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date.	Period
Spectrum Analyzer	HP	8562L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	20dB	-	May 16, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 16, 2013	1 year

Figure 26 Test Equipment Used

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

9.1 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 low, mid and high channels at 20 MHz with the following modulations: QPSK (1Mbps).

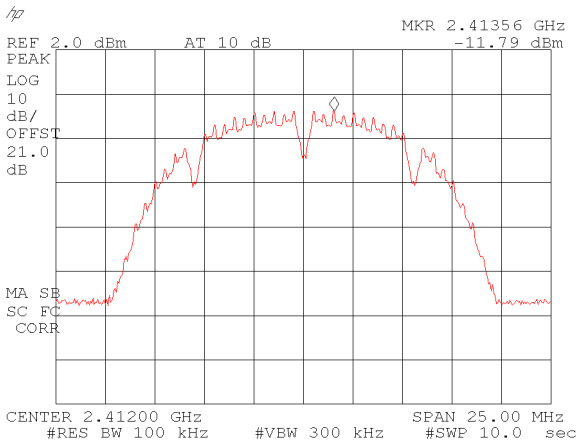

Figure 27 —2412 MHz Fundamental Peak

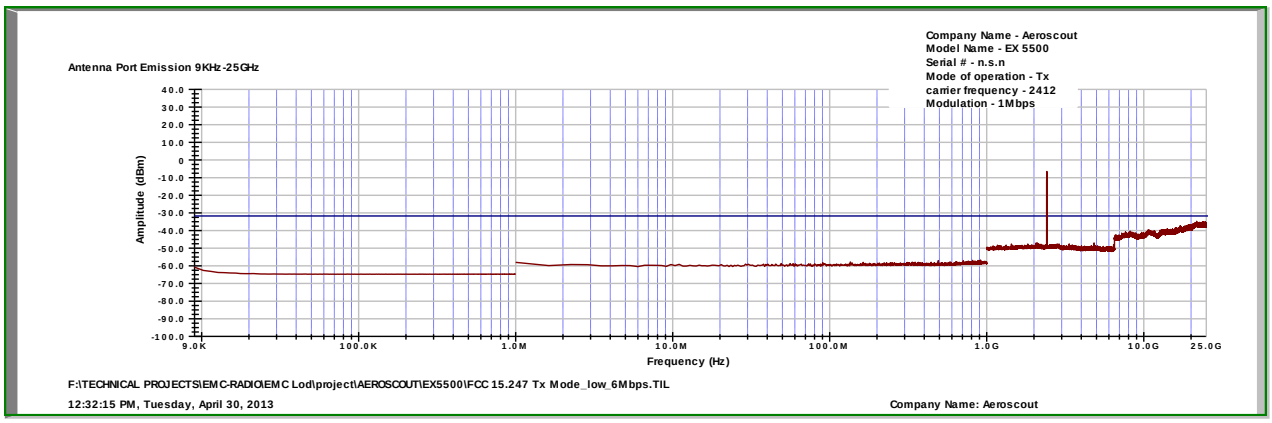

Figure 28 —2412 MHz Out of Band Conducted Spurious Emission

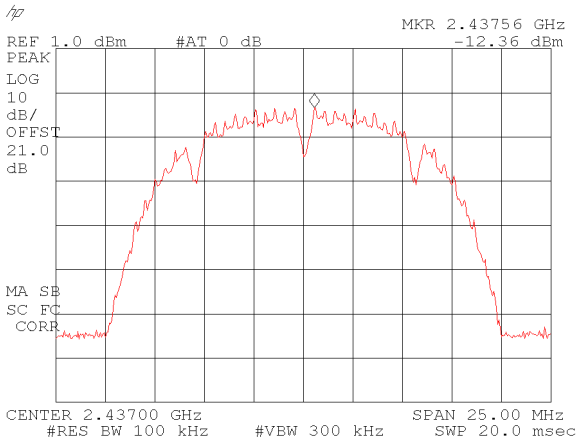

Figure 29 —2437 MHz Fundamental Peak

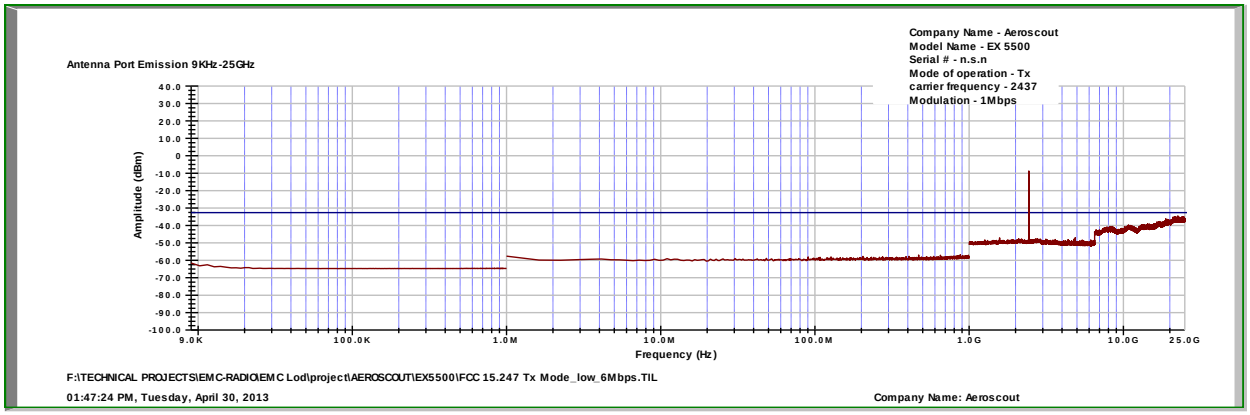

Figure 30 —2437 MHz Out of Band Conducted Spurious Emission

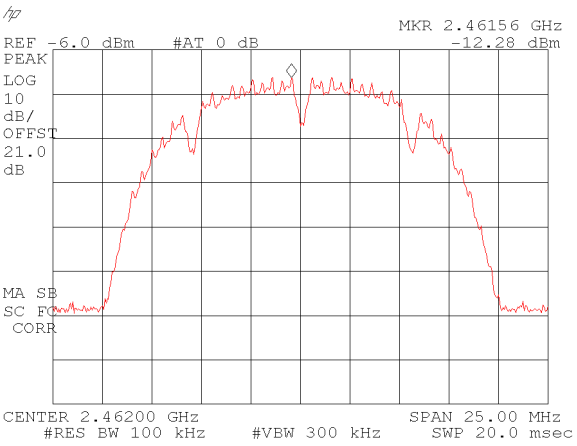

Figure 31 —2462 MHz Fundamental Peak

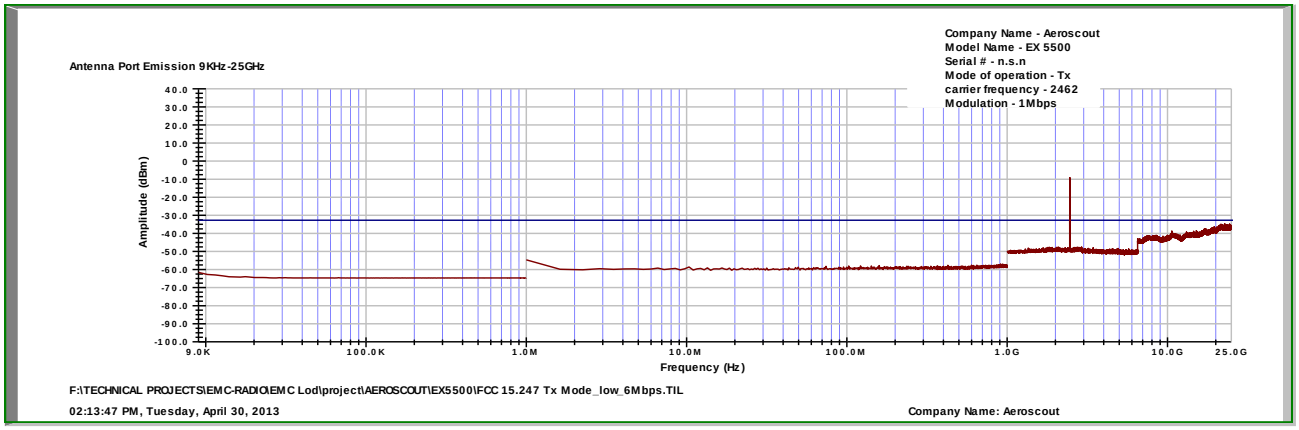

Figure 32 —2462 MHz Out of Band Conducted Spurious Emission

9.2 Results table

E.U.T Description: LF Exciter with Internal Wi-Fi Receiver
Model No.: EX-5500
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation Mbps	Reading (dBc)	Specification (dBc)	Margin (dB)
2412	1	-11.79	20.0	-8.21
2437	1	-12.36	20.0	-7.64
2462	1	-12.28	20.0	-7.72

Figure 33 Peak Power Output of 2400-2483.5 MHz Band

JUDGEMENT: Passed by 7.64 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 15.08.13
Typed/Printed Name: A. Sharabi

9.3 Test Equipment Used.

Peak Power Output of 2400-2438.5 MHz Band

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	20dB	-	May 16, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 16, 2013	1 year

Figure 34 Test Equipment Used

10. Band Edge Spectrum 2.4 GHz Transmitter

[In Accordance with section 15.247(c)]

10.1 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.

The E.U.T. was tested using the following modulations: 1Mbps

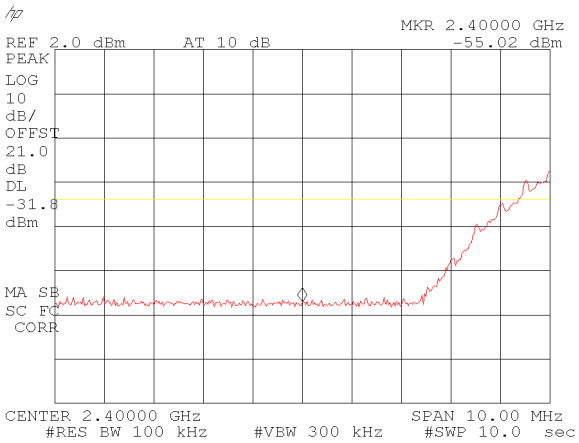

Figure 35 —Lower Band Edge

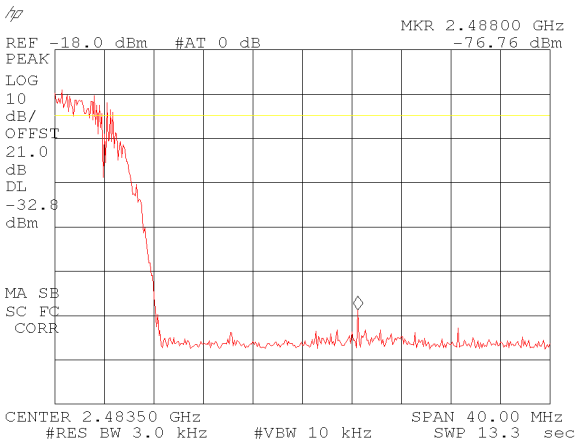

Figure 36 —Upper Band Edge

10.2 Results table

E.U.T. Description: LF Exciter with Internal Wi-Fi Receiver
Model No.: EX-5500
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation Mbps	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
2412	1	2400	-55.02	20.0	-35.02
2462	1	2483.5	-76.76	20.0	-56.76

Figure 37 Band Edge Spectrum

JUDGEMENT: Passed by 35.02 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 15.08.13
Typed/Printed Name: A. Sharabi

10.3 Test Equipment Used.

Band edge Spectrum 2.4 GHz Transmitter

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	20dB	-	May 16, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 16, 2013	1 year

Figure 38 Test Equipment Used

11. Radiated Emission, 9 kHz – 30 MHz, 2.4 GHZ Transmitter

11.1 Test Specification

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

11.2 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 with 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 low, mid and high channels using a peak detector.

11.3 Measured Data

JUDGEMENT: Passed by more than 20 dB

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

TEST PERSONNEL:

Tester Signature: _____ Date: 15.08.13

Typed/Printed Name: A. Sharabi

11.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 21, 2012	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

11.5 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 [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.

12. Spurious Radiated Emission 30 MHz– 25 GHz

12.1 Test Specification

30 MHz-2.5 GHz, F.C.C., Part 15, Subpart C

12.2 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-25 GHz 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 with 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 low, mid and high operating frequencies using a peak detector.

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 with 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.)

12.3 Test Data

JUDGEMENT: Passed by 15.2 dB.

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

In the frequency range 30-1000 MHz, the margin between the emission level and the specification limit was at least 20dB below the limit.

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is 15.2 dB in the worst case at the frequency of 4826 MHz, vertical polarization.

For the operation frequency of 2437 MHz, the margin between the emission level and the specification limit is 17.4 dB in the worst case at the frequency of 4874MHz, horizontal polarization.

For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is 17.0 dB in the worst case at the frequency of 2483.50 MHz, horizontal polarization.

The results for all modulations were the same.

The details of the highest emissions are given in *Figure 39* to *Figure 44*.

TEST PERSONNEL:

Tester Signature: _____ Date: 15.08.13

Typed/Printed Name: A. Sharabi

12.4 Field Strength Calculation

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

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

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

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

No external pre-amplifiers are used.

Radiated Emission Above 1 GHz

E.U.T Description	LF Exciter with Internal Wi-Fi Receiver
Type	EX-5500
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

Freq. (MHz)	Polarity (H/V)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2390.0	H	48.8	74.0	-25.2
2390.0	V	49.5	74.0	-24.5
4826.0	H	53.5	74.0	-20.5
4826.0	V	52.9	74.0	-21.1

Figure 39. 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 LF Exciter with Internal Wi-Fi Receiver
Type EX-5500
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters
Operation Frequency: 2412 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2390.0	H	36.3	54.0	-17.7
2390.0	V	36.1	54.0	-17.9
4826.0	H	38.7	54.0	-15.3
4826.0	V	38.8	54.0	-15.2

Figure 40. 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	LF Exciter with Internal Wi-Fi Receiver
Type	EX-5500
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: 2437 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dBµV/m)	(dB µV/m)	(dB)
4874.0	H	49.4	74.0	-24.6
4874.0	V	50.5	74.0	-23.5

Figure 41. 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 LF Exciter with Internal Wi-Fi Receiver
Type EX-5500
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters
Operation Frequency: 2437 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
4874.0	H	36.6	54.0	-17.4
4874.0	V	36.5	54.0	-17.5

Figure 42. 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	LF Exciter with Internal Wi-Fi Receiver
Type	EX-5500
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

Freq. (MHz)	Polarity (H/V)	Peak Amp (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2483.50	H	50.0	74.0	-24.0
2483.50	V	49.2	74.0	-24.8
4924.00	H	47.9	74.0	-26.1
4924.00	V	48.0	74.0	-26.0

Figure 43. 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 LF Exciter with Internal Wi-Fi Receiver
Type EX-5500
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Test Distance: 3 meters
Operation Frequency: 2462 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq. (MHz)	Polarity (H/V)	Average Amp (dBµV/m)	Average Specification (dB µV/m)	Peak. Margin (dB)
2483.50	H	37.0	54.0	-17.0
2483.50	V	36.7	54.0	-17.3
4924.00	H	34.2	54.0	-19.8
4924.00	V	36.0	54.0	-18.0

Figure 44. 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

13.1 Test Instrumentation Used, Radiated Measurements 30MHz to 25 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	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

14. Transmitted Power Density

[In accordance with section 15.247(d)]

14.1 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.

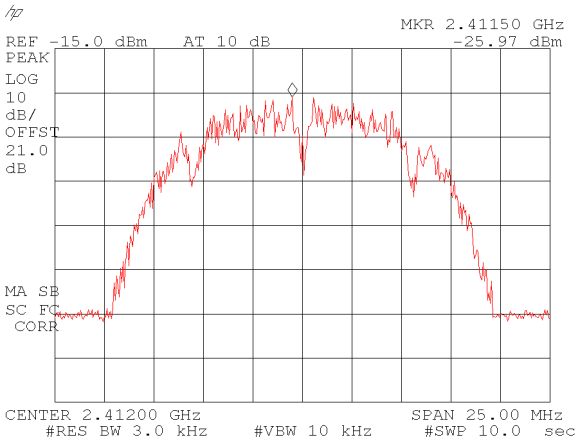

Figure 45 — Low Channel

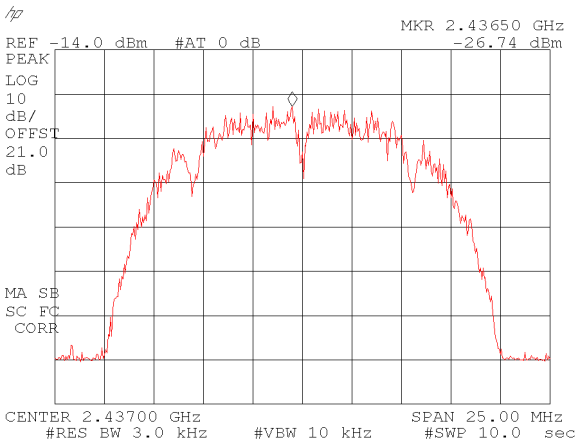

Figure 46 — Mid channel

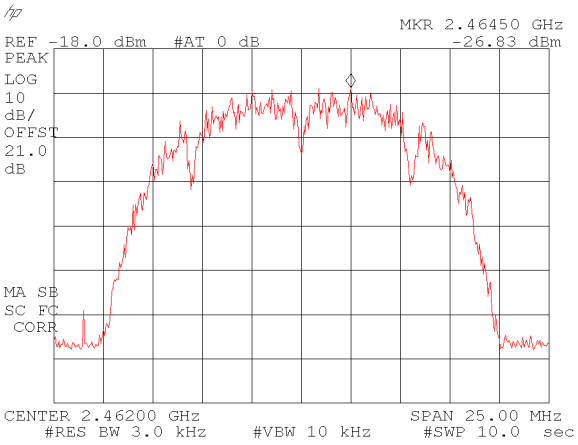

Figure 47 — High channel

14.2 Results table

E.U.T. Description: LF Exciter with Internal Wi-Fi Receiver
Model No.: EX-5500
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation Mbps	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
2412	6	-25.97	8.0	-17.97
2437	6	-26.74	8.0	-18.74
2462	6	-26.83	8.0	-18.83

Figure 48 Test Results

JUDGEMENT: Passed by 17.97 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 15.08.13
Typed/Printed Name: A. Sharabi

14.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date.	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Attenuator	Jyebao	20dB	-	May 16, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 16, 2013	1 year

Figure 49 Test Equipment Used

15. Antenna Gain/Information

The antenna gain is +3.0dBi.

16. R.F Exposure/Safety

The E.U.T. is ceiling mounted .The typical distance between the E.U.T. and the user in the worst case application, is 50 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1310 Requirements

(a) FCC limits at 2437 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 2.46 dBm (Peak) = 1.76 mw

G_T- Antenna Gain, +3.0dBi = 2 numeric

R- Distance from Transmitter using 50 cm worst case

(c) The peak power density is:

$$S_p = \frac{1.76 \times 2}{4\pi(50)^2} = 1.12 \times 10^{-4} \frac{mW}{cm^2}$$

(f) This is below the FCC limit.

17. APPENDIX A - CORRECTION FACTORS

17.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
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

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

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".

17.2 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.

17.3 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 38M3O.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".*

17.4 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".*

17.5 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".

17.6 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA 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			

17.7 Correction factors for Horn Antenna

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (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

17.8 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

18. Comparison Industry Canada Requirements With FCC

Test	FCC	IC
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