



DATE: 16 June 2013

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

Equipment under test:

TAG1200 Bi-Directional WiFi Module

TAG1200

Written by: R. Pinchuck

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A. Sharabi, Test Engineer

Approved by: I. Raz

I. Raz, EMC Laboratory Manager

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This report relates only to items tested.



Measurement/Technical Report for AeroScout Ltd.

TAG1200 Bi-Directional WiFi Module

TAG1200

FCC ID: Q3HTAG1200

IC: 5115A-TAG1200

16 June 2013

This report concerns: Original Grant:

Class I Change:

Class II Change:

Equipment type:

Bi-directional WiFi module transmitter

Limits used:

47CFR15 Section 15.247

Measurement procedure used is ANSI C63.4-2003.

Application for Certification
prepared by:

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TABLE OF CONTENTS

1. GENERAL INFORMATION -----	5
1.1 Administrative Information.....	5
1.2 List of Accreditations	6
1.3 Product Description	7
1.4 Test Methodology	7
1.5 Test Facility	7
1.6 Measurement Uncertainty	7
2. SYSTEM TEST CONFIGURATION-----	8
2.1 Justification.....	8
2.2 EUT Exercise Software	8
2.3 Special Accessories	8
2.4 Equipment Modifications	8
2.5 Configuration of Tested System.....	9
3. CONDUCTED AND RADIATED MEASUREMENT TEST SET-UP PHOTO -----	10
4. 6 DB MINIMUM BANDWIDTH -----	12
4.1 Test procedure	12
4.2 Results table.....	14
4.3 Test Equipment Used.....	15
5. 26 DB MINIMUM BANDWIDTH-----	16
5.1 Test procedure	16
5.2 Results table.....	18
5.3 Test Equipment Used.....	19
6. MAXIMUM TRANSMITTED PEAK POWER OUTPUT -----	20
6.1 Test procedure	20
6.2 Results.....	22
6.3 Test Equipment Used.....	23
7. PEAK POWER OUTPUT OUT OF 2400-2483.5 MHZ BAND-----	24
7.1 Test procedure	24
7.2 Results.....	27
7.3 Test Equipment Used.....	28
8. BAND EDGE SPECTRUM -----	29
8.1 Test procedure	29
8.2 Results.....	30
8.3 Test Equipment Used.....	31
9. RADIATED EMISSION, 9 KHZ – 30 MHZ -----	32
9.1 Test Specification	32
9.2 Test Procedure	32
9.3 Measured Data	32
9.4 Test Instrumentation Used, Radiated Measurements.....	33
9.5 Field Strength Calculation	34
10. SPURIOUS RADIATED EMISSION 30 – 25000 MHZ -----	35
10.1 Radiated Emission 30-25000 MHz.....	35
10.2 Test Data.....	36
10.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz	43
11. TRANSMITTED POWER DENSITY -----	44
11.1 Test procedure	44
11.2 Results table.....	46
11.3 Test Equipment Used.....	47
12. ANTENNA GAIN/INFORMATION -----	48
13. R.F EXPOSURE/SAFETY-----	49



14. AVERAGE FACTOR CALCULATION -----	50
14.1 Test Instrumentation Used	52
15. APPENDIX A - CORRECTION FACTORS -----	53
15.1 Correction factors for CABLE	53
15.2 Correction factors for CABLE	54
15.3 Correction factors for CABLE	55
15.4 Correction factors for CABLE	56
12.6 Correction factors for LOG PERIODIC ANTENNA	57
15.5 Correction factors for LOG PERIODIC ANTENNA	58
15.6 Correction factors for BICONICAL ANTENNA	59
15.7 Correction factors for BICONICAL ANTENNA	60
15.8 Correction factors for Double-Ridged Waveguide Horn.....	60
15.9 Correction factors for Horn Antenna	62
15.10 Correction factors for Horn Antenna	63
15.11 Correction factors for ACTIVE LOOP ANTENNA	64
16. COMPARISON INDUSTRY CANADA REQUIREMENTS WITH FCC -----	65



1. General Information

1.1 Administrative Information

Manufacturer:	AeroScout Ltd.
Manufacturer's Address:	3 Pekeris St. Einstein Entrance 4 th Floor Rechovot 76702 Tel: +972-8-9369393 Fax: +972-8-9365977
Manufacturer's Representative:	Dadi Matza
Equipment Under Test (E.U.T):	TAG1200 Bi-Directional WiFi Module
Equipment Model No.:	TAG1200
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	17.04.2013
Start of Test:	17.04.2013
End of Test:	22.04.2013
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 TAG1200 is a Wi-Fi module which designed to use for real time location systems.

The module can be installed inside variety of equipment, such as medical devices, containers, manufacturing equipment and vehicles. The module reports its location to AeroScout Visibility system via Wi-Fi infrastructure. This enables tagged items to be accurately located in real-time and in any environment – from crowded indoor locations such as hospital floors to open outdoor spaces such as parking lots.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing September 3, 2009).

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

1.6 Measurement Uncertainty

Conducted Emission

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 vertical position.

The product was tested as a module without any enclosure.

2.2 ***EUT Exercise Software***

Intensive script for transmission using Terra Term software.

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

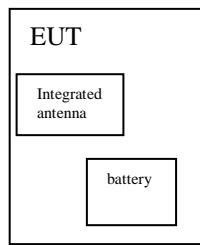


Figure 1. Configuration of Tested System

3. Conducted and Radiated Measurement Test Set-up Photo



Figure 2. Conducted Emission Test



Figure 3. Radiated Emission Test



Figure 4. Radiated Emission Test



Figure 5. Radiated Emission Test



Figure 6. Radiated Emission Test

4. 6 dB Minimum Bandwidth

4.1 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 (30 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.

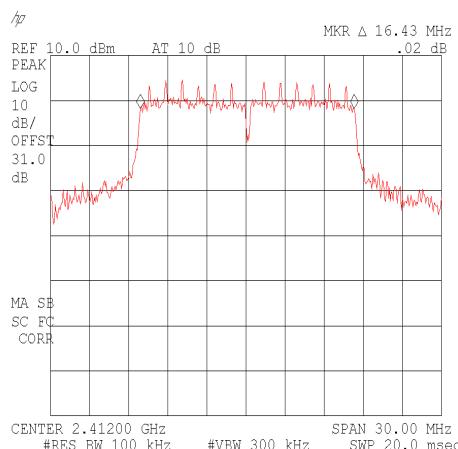


Figure 7 — Low Channel

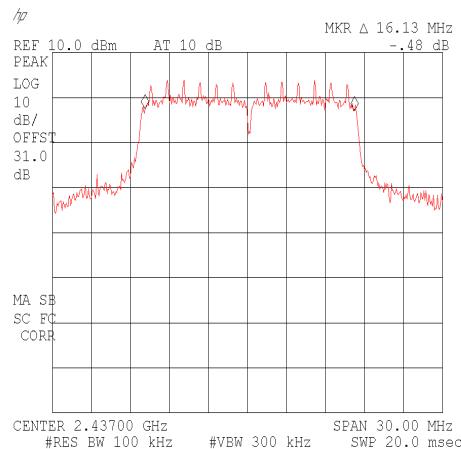


Figure 8 — Mid Channel

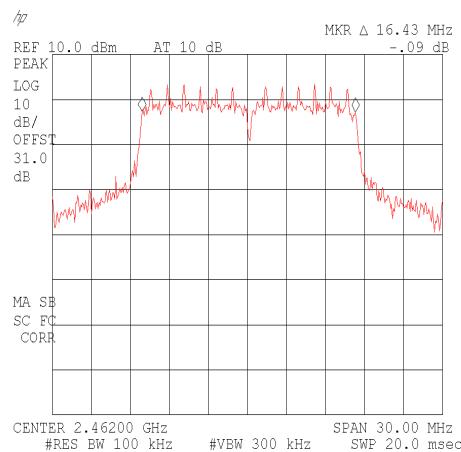


Figure 9 — High Channel



4.2 Results table

E.U.T Description: TAG1200 Bi-Directional WiFi Module

Model No.: TAG1200

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	6	16.43	0.5
2437.00	6	16.13	0.5
2462.00	6	16.43	0.5

Figure 10 6 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 16.06.13

Typed/Printed Name: A. Sharabi



4.3 **Test Equipment Used.**

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 17, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 17, 2013	1 year

Figure 11 Test Equipment Used

5. 26 dB Minimum Bandwidth

5.1 *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 (30 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.

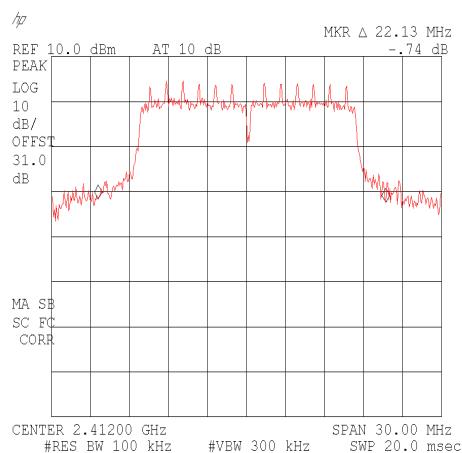


Figure 12 — Low Channel

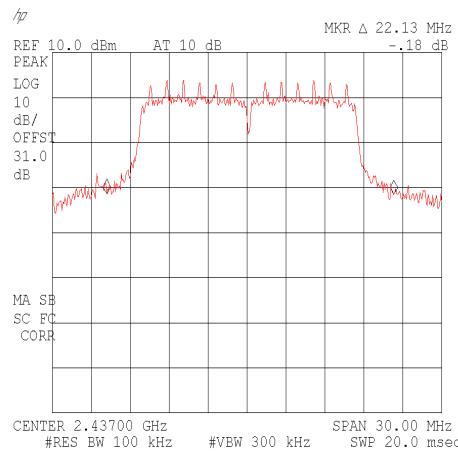


Figure 13 — Mid Channel

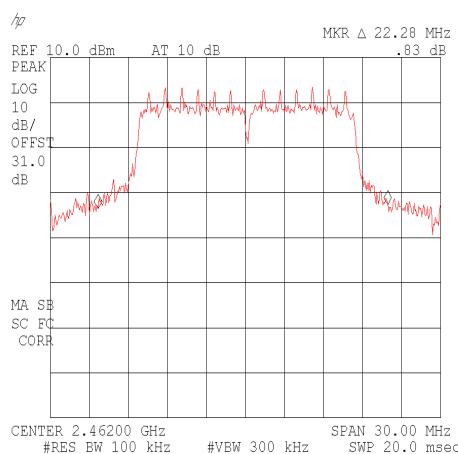


Figure 14 — High Channel



5.2 Results table

E.U.T Description: TAG1200 Bi-Directional WiFi Module

Model No.: TAG1200

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	6	22.13	0.5
2437.00	6	22.13	0.5
2462.00	6	22.28	0.5

Figure 15 26 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature:  Date: 16.06.13

Typed/Printed Name: A. Sharabi



5.3 **Test Equipment Used.**

26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 17, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 17, 2013	1 year

Figure 16 Test Equipment Used

6. Maximum Transmitted Peak Power Output

6.1 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (30 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: BPSK (6Mbps).

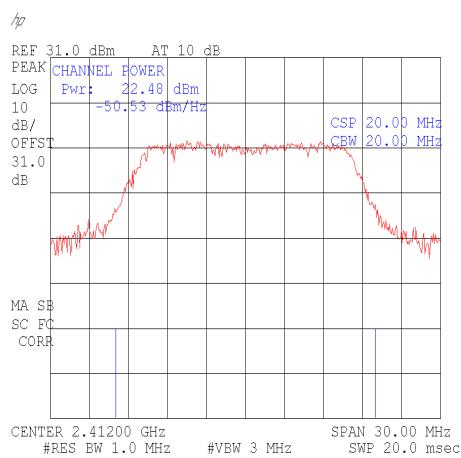


Figure 17. Low channel

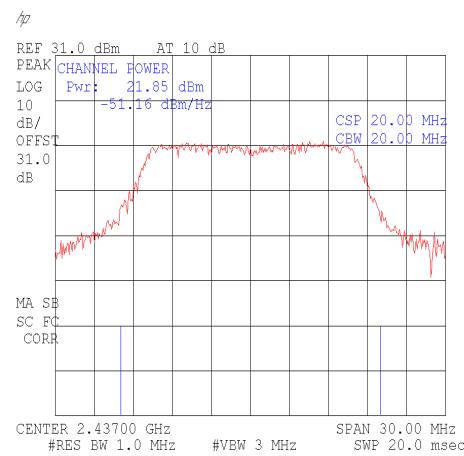


Figure 18. Mid channel

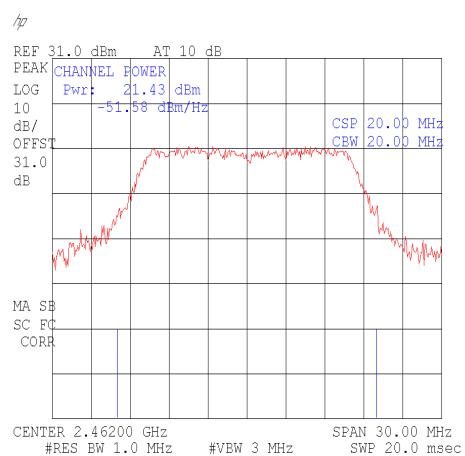


Figure 19. High Channel



6.2 Results table

E.U.T. Description: TAG1200 Bi-Directional WiFi Module
Model No.: TAG1200
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)
2412.00	6	22.48	30.0	-7.52
2437.00	6	21.85	30.0	-8.15
2462.00	6	21.43	30.0	-8.57

Figure 20 Maximum Peak Power Output

JUDGEMENT: Passed by 7.52 dB

TEST PERSONNEL:

Tester Signature:  Date: 16.06.13

Typed/Printed Name: A. Sharabi



6.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 17, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 17, 2013	1 year

Figure 21 Test Equipment Used



7. Peak Power Output Out of 2400-2483.5 MHz Band

7.1 *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 20MHz with the following modulations: BPSK (6Mbps).

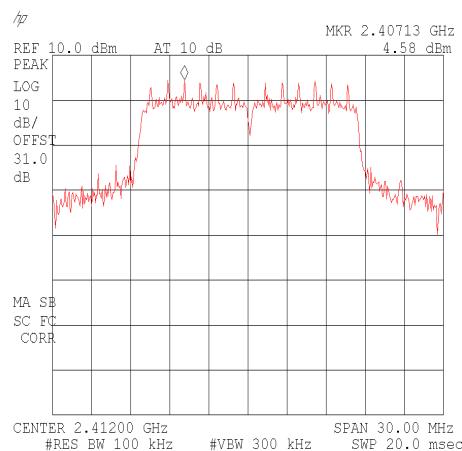


Figure 22 —2412 MHz Fundamental Peak

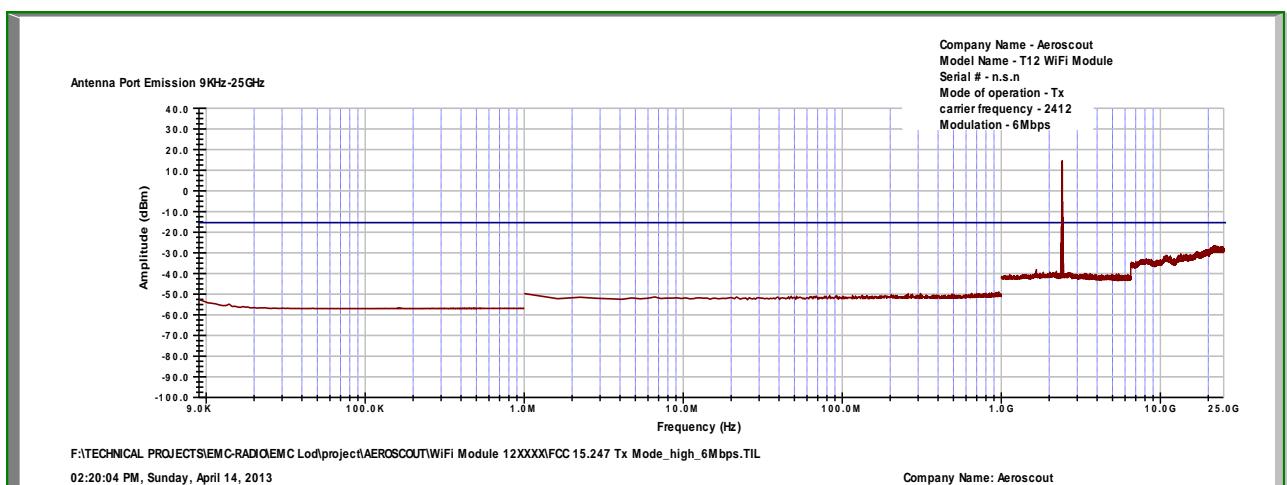


Figure 23 —2412 MHz Out of Band Conducted Spurious Emission

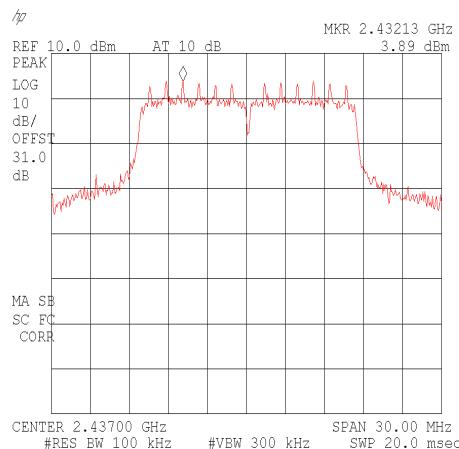


Figure 24 —2437 MHz Fundamental Peak

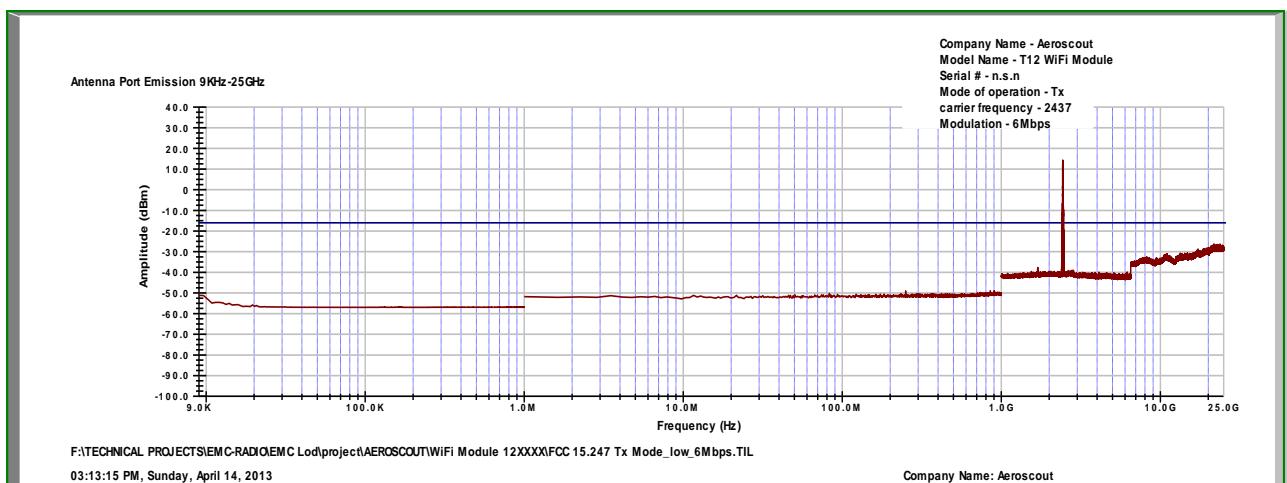


Figure 25 —2437 MHz Out of Band Conducted Spurious Emission

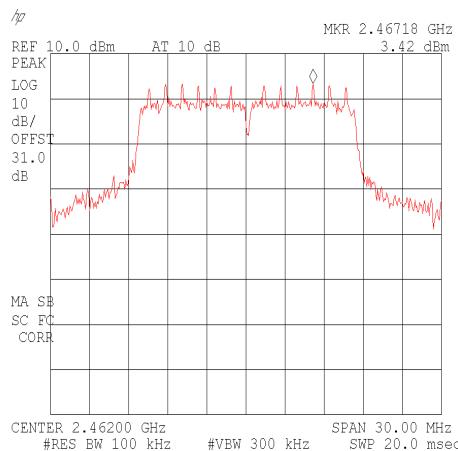


Figure 26 —2462 MHz Fundamental Peak

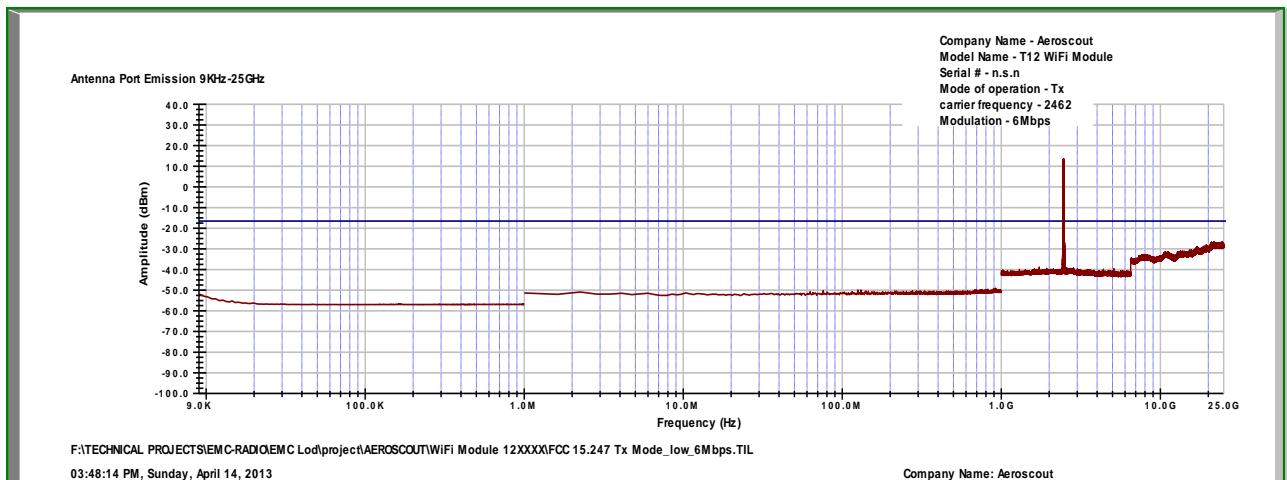


Figure 27 —2462 MHz Out of Band Conducted Spurious Emission

7.2 Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 16.06.13

Typed/Printed Name: A. Sharabi



7.3 **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	-	FAT-AM5AF5G6G2W20	April 17, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 17, 2013	1 year

Figure 28 Test Equipment Used

8. Band Edge Spectrum

[In Accordance with section 15.247(c)]

8.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (30 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: 6Mbps

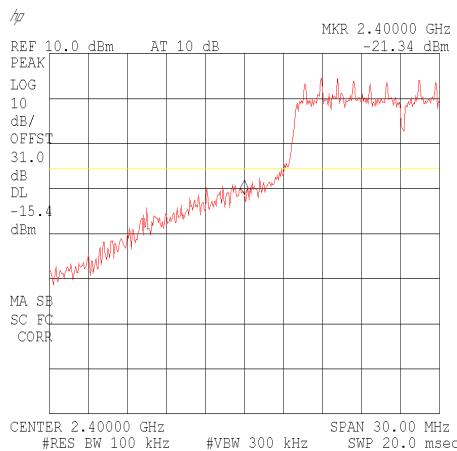


Figure 29 —Lower Band Edge

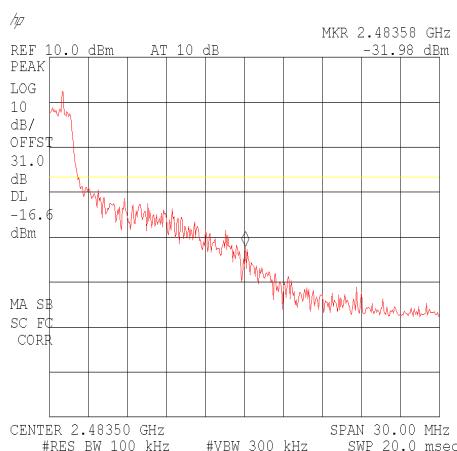


Figure 30 —Upper Band Edge



8.2 Results table

E.U.T. Description: TAG1200 Bi-Directional WiFi Module

Model No.: TAG1200

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	6	2400	-21.34	20.0	-1.34
2462	6	2483.5	-31.98	20.0	-11.98

Figure 31 Band Edge Spectrum

JUDGEMENT: Passed by 1.34 dB

TEST PERSONNEL:

Tester Signature: 

Date: 16.06.13

Typed/Printed Name: A. Sharabi



8.3 **Test Equipment Used.**

Band edge Spectrum

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 17, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 17, 2013	1 year

Figure 32 Test Equipment Used



9. Radiated Emission, 9 kHz – 30 MHz

9.1 Test Specification

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

9.2 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 the low, mid and high channels using a peak detector.

9.3 Measured Data

JUDGEMENT: Passed by more than 20dB.

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

TEST PERSONNEL:

Tester Signature: 

Date: 16.06.13

Typed/Printed Name: A. Sharabi



9.4 **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
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A



9.5 **Field Strength Calculation**

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

$$FS = RA + AF + CF$$

FS: Field Strength [dB μ V/m]

RA: Receiver Amplitude [dB μ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

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

No external pre-amplifiers are used.



10. Spurious Radiated Emission 30 – 25000 MHz

10.1 Radiated Emission 30-25000 MHz

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 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 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.)

The E.U.T. was operated at the low, mid and high channels using a peak detector.



10.2 Test Data

JUDGEMENT: Passed by 6.4 dB

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is in the worst case 7.7dB at the frequency of 4826 MHz, horizontal polarization.

For the operation frequency of 2437 MHz, the margin between the emission level and the specification limit is in the worst case 15.3dB at the frequency of 4874 MHz, vertical polarization.

For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is 6.4dB in the worst case at the frequency of 2483.50MHz, 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 33* to *Figure 38*.

TEST PERSONNEL:

Tester Signature:  Date: 16.06.13

Typed/Printed Name: A. Sharabi



Radiated Emission Above 1 GHz

E.U.T Description TAG1200 Bi-Directional WiFi Module
Type TAG1200
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 (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2390.0	H	54.0*	74.0	-20.0
2390.0	V	55.5*	74.0	-18.5
4826.0	H	66.3*	74.0	-7.7
4826.0	V	65.3*	74.0	-8.7

**Figure 33. 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 TAG1200 Bi-Directional WiFi Module
Type TAG1200
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

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
2390.0	H	37.5*	54.0	-16.5
2390.0	V	38.9*	54.0	-15.1
4826.0	H	35.7*	54.0	-18.3
4826.0	V	35.8*	54.0	-18.2

**Figure 34. 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: TAG1200 Bi-Directional WiFi Module
Type: TAG1200
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. (MHz)	Polarity (H/V)	Peak Amp (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
4874.0	H	57.7*	74.0	-16.3
4874.0	V	58.4*	74.0	-15.6

**Figure 35. 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: TAG1200 Bi-Directional WiFi Module
Type: TAG1200
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: 2437 MHz

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
4874.0	H	35.9*	54.0	-18.1
4874.0	V	38.7*	54.0	-15.3

**Figure 36. 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: TAG1200 Bi-Directional WiFi Module
Type: TAG1200
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 (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
2483.50	H	55.6**	74.0	-18.4
2483.50	V	54.8**	74.0	-19.2
4924.00	H	50.6	74.0	-23.4
4924.00	V	51.8	74.0	-22.2

**Figure 37. 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 TAG1200 Bi-Directional WiFi Module
Type TAG1200
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

Freq. (MHz)	Polarity (H/V)	Average Amp (dB μ V/m)	Average Specification (dB μ V/m)	Peak. Margin (dB)
2483.50	H	47.6**	54.0	-6.4
2483.50	V	46.6**	54.0	-7.4
4924.00	H	35.4*	54.0	-18.6
4924.00	V	34.7*	54.0	-19.3

**Figure 38. 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



10.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
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	JPKG C19982	N/A	N/A

11. Transmitted Power Density

[In accordance with section 15.247(d)]

11.1 *Test procedure*

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (30dB) 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.

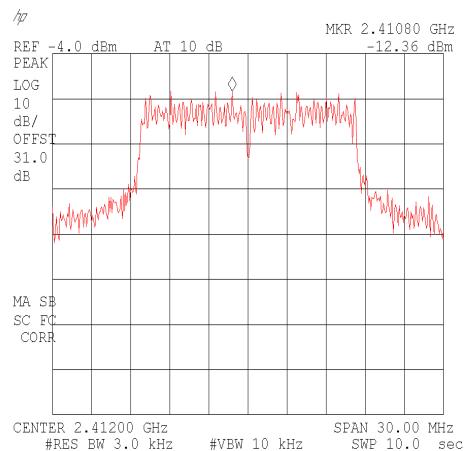


Figure 39 — Low Channel

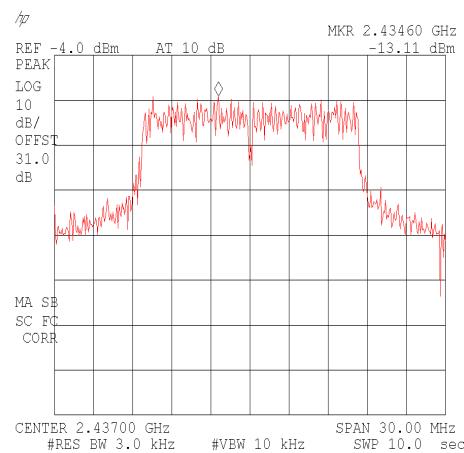


Figure 40 — Mid channel

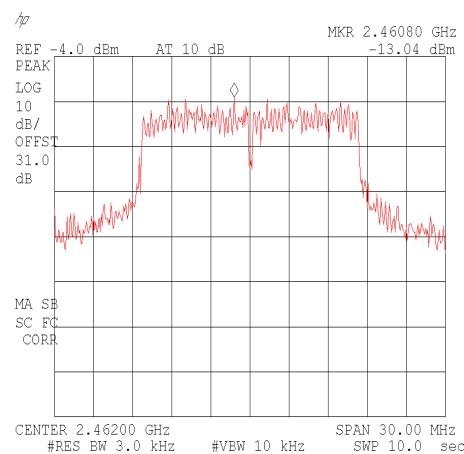


Figure 41 — High channel



11.2 Results table

E.U.T. Description: TAG1200 Bi-Directional WiFi Module

Model No.: TAG1200

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	-12.36	8.0	-4.36
2437	6	-13.11	8.0	-5.11
2462	6	-13.04	8.0	-5.04

Figure 42 Test Results

JUDGEMENT: Passed by 4.36 dB

TEST PERSONNEL:

Tester Signature: 

Date: 16.06.13

Typed/Printed Name: A. Sharabi



11.3 **Test Equipment Used.**

Transmitted Power Density

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 17, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 17, 2013	1 year

Figure 43 Test Equipment Used



12. Antenna Gain/Information

The antenna gain is -2.0dBi.



13. R.F Exposure/Safety

Typical use of the E.U.T. is in a Tag designed to be used for real time location systems. The typical placement of the E.U.T. is inside a variety of equipment, such as medical devices, containers, manufacturing equipment and vehicles. The typical distance between the E.U.T. and the user in the worst case application, is 30 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2412 MHz is: $1 \frac{mW}{cm^2}$

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

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

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

P_t- Transmitted Power 177.01 mW (Peak) = 22.48 dBm

P_{avg}- Peak – Avg. Factor = -36.5dBm = 2.23×10^{-4} mW

G_T- Antenna Gain, -2.0dBi = 0.63

R- Distance from Transmitter using 30cm worst case

(c) The peak power density is :

$$S_p = \frac{0.0002 \times 0.63}{4\pi(30)^2} = 1.11 \times 10^{-8} \frac{mW}{cm^2}$$

(d) This is below the FCC limit.

14. Average Factor Calculation

1. Pulse period = 1 (worst scenario)
2. Pulse duration = 1 (worst scenario)
3. Burst duration = 0.112msec
4. Time between bursts > 100msec

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

$$\text{Average Factor} = 20 \log \left[\frac{0.112}{100} \times 1 \right] = -59 \text{dB}$$

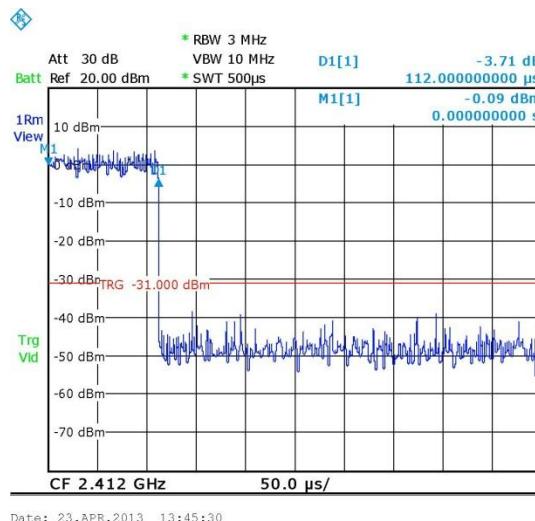


Figure 44. Transmission Burst Duration = 0.112 msec

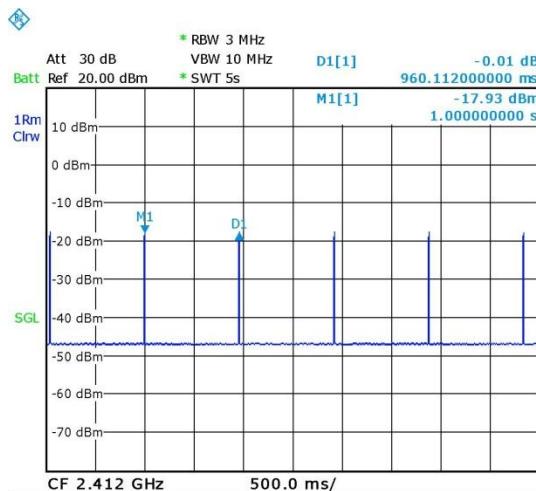


Figure 45. Time between Transmissions 1 sec



14.1 **Test Instrumentation Used**

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibration Date	Period
Spectrum Analyzer	R&S	FSL6	100194	November 1, 2012	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 17, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 17, 2013	1 year

15. APPENDIX A - CORRECTION FACTORS

**15.1 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".



**15.2 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.*



15.3 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.



15.4 Correction factors for

CABLE

**from EMI receiver
to test antenna
at 10 meter range.**

FREQUENCY	CORRECTION	FREQUENCY	CORRECTION
(MHz)	FACTOR	(MHz)	FACTOR
	(dB)		(dB)
10.0	0.3	1200.0	9.8
20.0	0.8	1400.0	10.0
30.0	0.9	1600.0	11.3
40.0	1.2	1800.0	12.2
50.0	1.4	2000.0	13.1
60.0	1.6	2300.0	14.5
70.0	1.8	2600.0	15.9
80.0	1.9	2900.0	16.4
90.0	2.0		
100.0	2.1		
150.0	2.6		
200.0	3.2		
250.0	3.8		
300.0	4.2		
350.0	4.6		
400.0	5.1		
450.0	5.3		
500.0	5.6		
600.0	6.3		
700.0	7.0		
800.0	7.6		
900.0	8.0		
1000.0	8.7		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 34 meters.
3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".



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".



15.5 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".



**15.6 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".



**15.7 Correction factors for BICONICAL ANTENNA
Type BCD-235/B,
10 meter range**

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

**15.8 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			



15.9 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



15.10 Correction factors for

**Horn Antenna
Model: V637**

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0



15.11 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



16. Comparison Industry Canada Requirements With FCC

AeroScout TAG-1200 Bi-Directional WiFi Module

M/N: TAG-12000

IC: 5115A-TAG1200 FCC ID: Q3HTAG1200

Test	FCC	IC
<input type="checkbox"/> Radiated Emission	15.209	RSS 210 Issue 8 Clause 2.5
<input type="checkbox"/> Max power / Peak power	15.247(b)(3)	RSS 210 Issue 8 A8.4(4)
<input type="checkbox"/> 6dB BW	15.247(a)2	RSS 210 Issue 8 A8.2a
<input type="checkbox"/> Power density	15.247(e)	RSS 210 Issue 8 A8.2b
<input type="checkbox"/> Spurious radiated emission in the restricted band	15.205(c)	RSS 210 Issue 8 2.5 RSS Gen 7.2.2 (Table 1)
<input type="checkbox"/> Band edge spectrum	15.247(d)	RSS 210 Issue 8 A8.5
<input type="checkbox"/> RF Exposure Limits	1.1307(b)(1)	RSS 102 4.4