



**DATE: 9 July 2018**

**I.T.L. (PRODUCT TESTING) LTD.  
FCC\IC Radio Test Report  
For**

**AeroScout**

**Equipment under test:  
Personal Tag**

**TAG-1410-CUB**

Tested by:

M. Zohar

Approved by:

D. Shidlowky

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This report relates only to items tested.



# Measurement/Technical Report for AeroScout

Personal Tag

## TAG-1410-CUB

### FCC ID: Q3HTAG1410

### IC: 5115A-TAG1410

This report concerns:	Original Grant: X
	Class I Change:
	Class II Change:
Equipment type:	FCC: DTS - Digital Transmission System IC: Spread Spectrum/Digital Device (2400–2483.5 MHz)
Limits used:	47CFR15 Section 15.247 RSS 247, Issue 2, February 2017, Section 5 RSS-Gen, Issue 4, November 2014

Measurement procedure used is KDB 558074 D01 v03r03, ANSI C63.4-2014 and RSS Gen, Issue 4: 2014

Application for Certification  
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# 1. General Information

## 1.1 Administrative Information

Manufacturer:	AeroScout
Manufacturer's Address:	2 Ilan Ramon St., Science Park Ness-Ziona, 7403635, Israel Tel: +972-8-936-9393 Fax: +972-8-936-5977
Manufacturer's Representative:	Eli Aharon
Equipment Under Test (E.U.T):	Personal Tag
PMN:	TAG1410
Equipment Serial No.:	Not designated
HVIN:	Rev 5.03
Date of Receipt of E.U.T:	February 5, 2018
Start of Test:	February 5, 2018
End of Test:	February 12, 2018
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C, Section 15.247 RSS 247, Issue 2, February 2017, Section 5 RSS-Gen, Issue 5, May 2018



## 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.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, IC 4025A-2.

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 STANLEY Healthcare T14E Bi-directional Tag is a component of the enterprise-level visibility solution based on standard Wi-Fi communication for location-based applications. The T14E Tag adds further flexibility and scalability to locate patients across a wide variety of applications.

Once deployed, the tag uses its bi-directional functionality to receive firmware and configuration updates from MobileView. This removes the need to manually collect, update and re-deploy tags in the field.

T14E Tags optionally come with a Call Button and an embedded Ultrasound Receiver.

PMN	TAG1410
Working voltage	3.7VDC Rechargeable battery
Mode of operation	Transceiver
Modulations	For Wi-Fi/b: DSSS,CCK For Wi-Fi/g: OFDM(BPSK,QPSK,16QAM ,64QAM)
Assigned Frequency Range	2400.0-2483.5MHz
Operating Frequency Range	2412.0-2462.0MHz
Transmit power(conducted)	~16.0dBm
Antenna Gain	-2 dBi printed antenna
Modulation BW	20MHz
Bit rate (Mbit/s)	For Wi-Fi/b: 1, 2, 5.5, 11 For Wi-Fi/g: 6, 9, 12, 18, 24, 36, 48, 54

### 1.4 **Test Methodology**

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r03 and ANSI C63.4: 2014. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### 1.5 **Test Facility**

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.



## 1.6 **Measurement Uncertainty**

### **Radiated Emission**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

for open site:

30-1000MHz:

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

$\pm 4.96$  dB

1 GHz to 6 GHz

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

$\pm 5.19$  dB

>6 GHz

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

$\pm 5.51$  dB



## 2. System Test Configuration

### 2.1 Justification

1. The E.U.T was operating at IEEE 802.11b/g standard (Wi-Fi/b/g) with only 20MHz CBW.
2. The unit was evaluated while transmitting at the low channel (2412MHz), the mid channel (2437MHz) and the high channel (2462MHz).
3. AC line conducted emission test done with E.U.T transmitting and in charge mode.
4. Final radiated emission for Wi-Fi b/g modes test were performed after finding 2 of the “worst case” for each different protocol type. The results are shown in the below table:

Protocol type	“worst case” bit rate
Wi-Fi/b	1,11 Mbit/s
Wi-Fi/g	6,54 Mbit/s

5. Final Radiated emission test for spurious emission in restricted bands was performed after exploratory emission testing that was performed in 3 orthogonal polarities to determine the “worst case” radiation.
6. According to results in the below table, the worst case for Wi-Fi mode was the X axis for fundamental & band edge tests and Y axis for spurious emission tests.

Orientation	Frequency	Fundamental	2 <sup>rd</sup> Harmonic	3 <sup>th</sup> Harmonic	Band Edge
	(MHz)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)
X axis	2412.0	<b>106.3</b>	36.6	30.0	<b>64.0</b>
	2437.0	<b>105.0</b>	32.6	29.8	-
	2462.0	<b>107.8</b>	29.3	30.2	<b>63.4</b>
Y axis	2412.0	105.8	<b>37.0</b>	<b>30.3</b>	63.0
	2437.0	103.5	<b>37.5</b>	<b>29.9</b>	-
	2462.0	105.6	<b>37.7</b>	<b>30.1</b>	63.3
Z axis	2412.0	100.6	31.7	29.7	64.0
	2437.0	99.5	37.0	29.7	-
	2462.0	102.1	37.5	30.0	63.3

Figure 1. Screening Results Wi-Fi mode

**2.2 EUT Exercise Software**

No special exercise software was used.

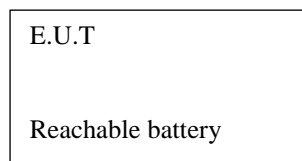
**2.3 Special Accessories**

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 2. Configuration of Tested System**

### 3. Conducted & Radiated Measurement Test Set-Up Photos

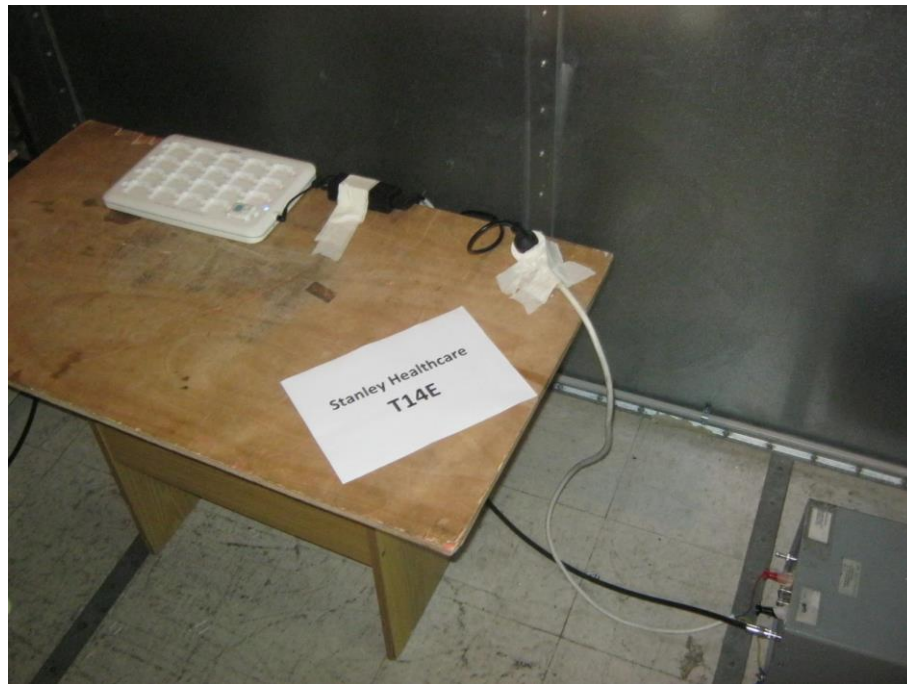
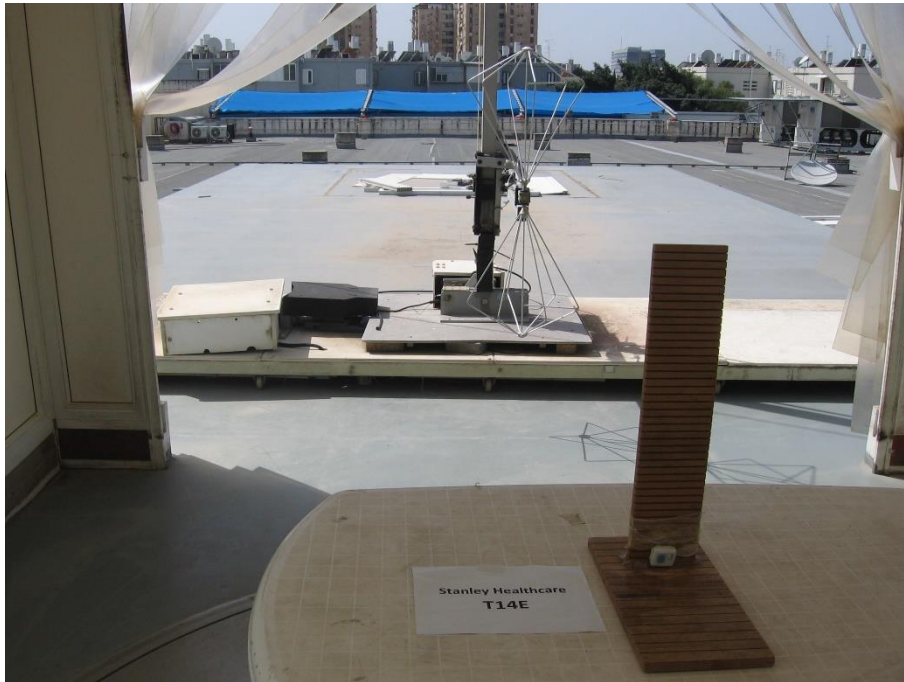


Figure 3. Conducted Emission Test



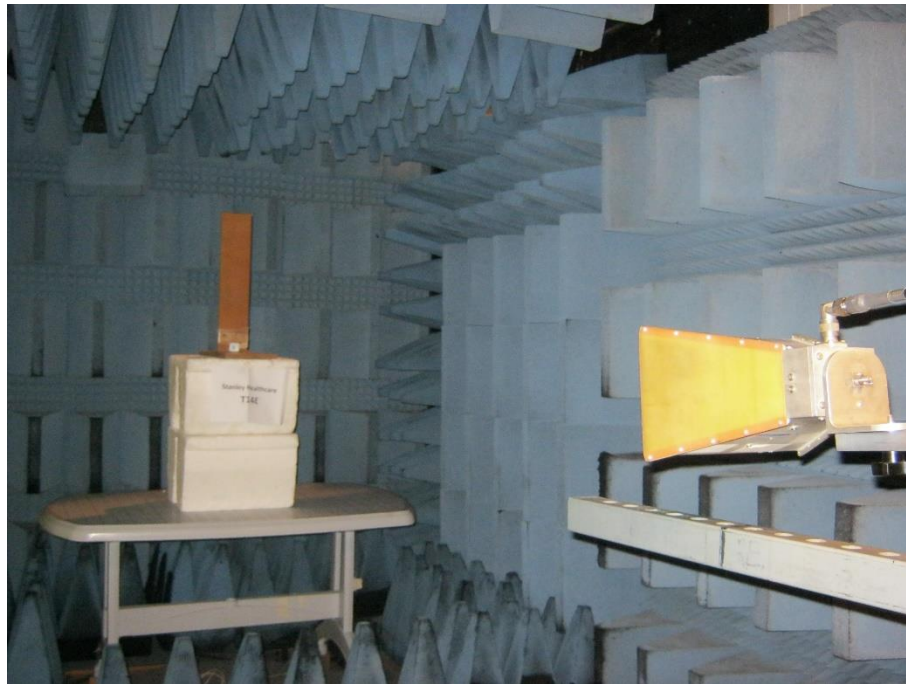
Figure 4. Radiated Emission Test, 0.009 – 30MHz



**Figure 5. Radiated Emission Test, 30-200MHz**



**Figure 6. Radiated Emission Test, 200-1000MHz**



**Figure 7. Radiated Emission Test, 1000-18,000MHz**

## 4. Conducted Emission From AC Mains

### 4.1 Test Specification

FCC Part 15, Subpart C, Section 15.207  
RSS Gen, Issue 5, Clause 8.8

### 4.2 Test Procedure

(Temperature (22°C)/ Humidity (52%RH))

The E.U.T operation mode and test setup are as described in Section 2 of this report. 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. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 115 V AC / 60 Hz via 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.'s 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 effect of varying the position of the cables was investigated to find the configuration that produces maximum emission.

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 and are displayed on the receiver's spectrum display.

The E.U.T was evaluated in TX operation mode.

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

Frequency of emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.



#### 4.4 **Test Results**

JUDGEMENT:                      Passed by 20.53 dB

The margin between the emission levels and the specification limit is, in the worst case, 23.29 dB for the phase line at 18.398 MHz and 20.53 dB at 18.398 MHz for the neutral line.

The EUT met the F.C.C. Part 15, Subpart C and RSS-Gen, Issue 5, clause 8.8 specification requirements.

The details of the highest emissions are given in *Figure 8* to *Figure 11*.



## Conducted Emission

E.U.T Description      Personal Tag  
Type                      TAG-1410-CUB  
Serial Number:        Not designated

Specification:        FCC Part 15, Subpart C;  
                              RSS-Gen, Issue 5, clause 8.8

Lead:                    Phase

Detectors: :         Peak, Quasi-peak, Average

Power Operation      AC/DC adapter

EDIT PEAK LIST (Final Measurement Results)			
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
Trace1:	CE22BQP		
Trace2:	CE22BAP		
Trace3:	---		
1 Quasi Peak	154 kHz	38.52	-27.25
2 Average	154 kHz	16.21	-39.57
1 Quasi Peak	390 kHz	18.40	-39.65
2 Average	422 kHz	9.75	-37.65
1 Quasi Peak	486 kHz	22.48	-33.75
2 Average	502 kHz	16.10	-29.89
2 Average	890 kHz	14.71	-31.28
1 Quasi Peak	1.042 MHz	20.05	-35.94
2 Average	1.534 MHz	10.69	-35.30
1 Quasi Peak	1.718 MHz	11.55	-44.44
1 Quasi Peak	3.066 MHz	16.29	-39.70
2 Average	3.066 MHz	12.22	-33.78
1 Quasi Peak	4.082 MHz	13.07	-42.92
2 Average	4.086 MHz	11.29	-34.70
1 Quasi Peak	10.222 MHz	17.59	-42.40
2 Average	10.222 MHz	14.56	-35.44
1 Quasi Peak	17.374 MHz	29.70	-30.29
2 Average	17.378 MHz	26.49	-23.50
1 Quasi Peak	18.398 MHz	30.41	-29.58
2 Average	18.398 MHz	26.70	-23.29

Date: 12.FEB.2018 08:11:43

**Figure 8. Detectors: Peak, 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

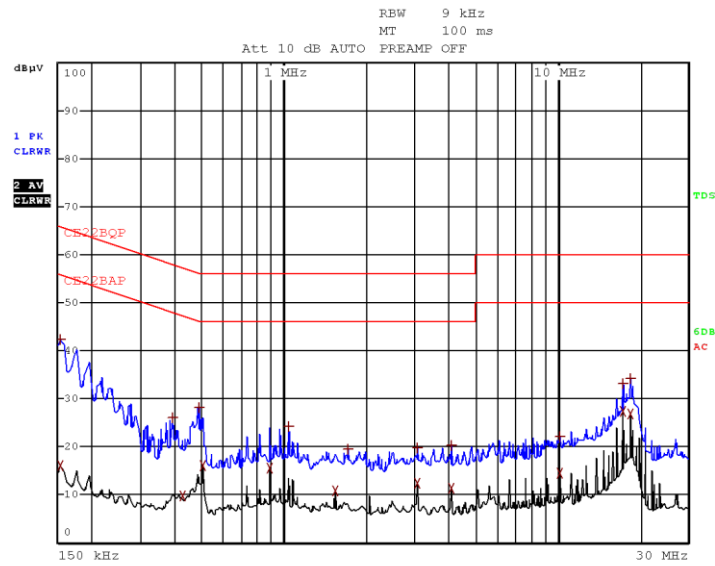
E.U.T Description    Personal Tag  
Type                    TAG-1410-CUB  
Serial Number:        Not designated

Specification:        FCC Part 15, Subpart C;  
                              RSS-Gen, Issue 5, clause 8.8

Lead:                    Phase

Detectors:             Peak, Quasi-peak, Average

Power Operation      AC/DC adapter



Date: 12.FEB.2018 08:09:54

Figure 9. Detectors: Peak, Quasi-peak, Average



## Conducted Emission

E.U.T Description    Personal Tag  
Type                    TAG-1410-CUB  
Serial Number:        Not designated

Specification:        FCC Part 15, Subpart C;  
                              RSS-Gen, Issue 5, clause 8.8

Lead:                    Neutral

Detectors:             Peak, Quasi-peak, Average

Power Operation      AC/DC adapter

EDIT PEAK LIST (Final Measurement Results)				
TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
1	Quasi Peak	154 kHz	37.65	-28.12
2	Average	158 kHz	14.15	-41.41
1	Quasi Peak	270 kHz	21.14	-39.97
2	Average	410 kHz	11.63	-36.01
1	Quasi Peak	498 kHz	24.46	-31.57
2	Average	502 kHz	18.74	-27.25
2	Average	910 kHz	10.43	-35.56
1	Quasi Peak	926 kHz	17.21	-38.79
2	Average	1.534 MHz	14.88	-31.11
1	Quasi Peak	1.662 MHz	14.19	-41.80
1	Quasi Peak	3.066 MHz	19.89	-36.10
2	Average	3.066 MHz	17.05	-28.94
1	Quasi Peak	4.086 MHz	19.10	-36.89
2	Average	4.09 MHz	17.03	-28.96
1	Quasi Peak	6.646 MHz	21.49	-38.50
2	Average	6.646 MHz	17.92	-32.07
1	Quasi Peak	17.378 MHz	29.84	-30.15
2	Average	17.378 MHz	27.05	-22.94
1	Quasi Peak	18.394 MHz	32.10	-27.89
2	Average	18.398 MHz	29.46	-20.53

Date: 12.FEB.2018 08:22:31

**Figure 10. Detectors: Peak, 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

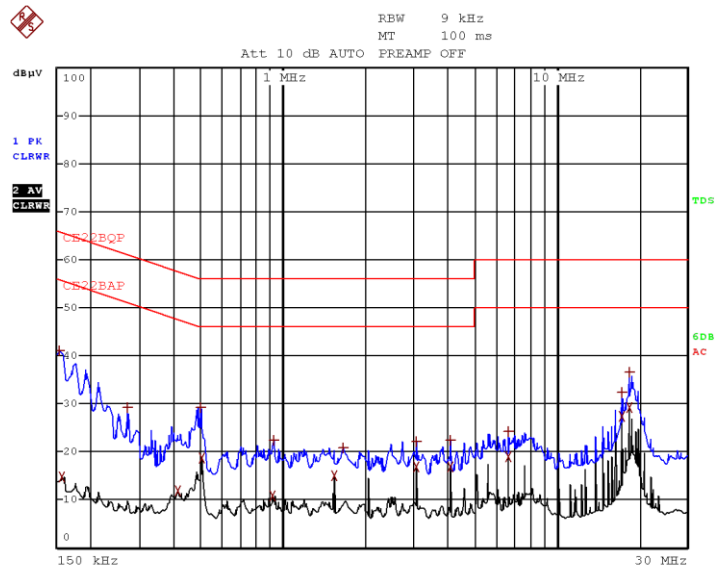
E.U.T Description    Personal Tag  
Type                    TAG-1410-CUB  
Serial Number:        Not designated

Specification:        FCC Part 15, Subpart C;  
                              RSS-Gen, Issue 5, clause 8.8

Lead:                    Neutral

Detectors:             Peak, Quasi-peak, Average

Power Operation      AC/DC adapter



Date: 12.FEB.2018 08:18:04

Figure 11 Detectors: Peak, Quasi-peak, Average



#### 4.5 *Test Equipment Used; Conducted Emission*

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Next Calibration Due</b>
LISN	Fischer	FCC-LISN-25A	127	July 20, 2017	July 20, 2018
Transient Limiter	HP	11947A	3107A03041	June 29, 2017	June 29, 2018
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 28, 2017	February 28, 2018
Cable CE Chamber 3M + 3M	Testline 18 + RJ214	11556	-	March 21, 2017	March 21, 2018

**Figure 12 Test Equipment Used**



## 5. 6 dB Minimum Bandwidth

### 5.1 *Test Specification*

FCC Part 15, Subpart C, Section 247(a)(2)

RSS 247, Issue 2, Section 5.2(a)

### 5.2 *Test Procedure*

(Temperature (22°C)/ Humidity (51%RH))

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

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of 3 meters.

The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

### 5.3 *Test Limit*

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

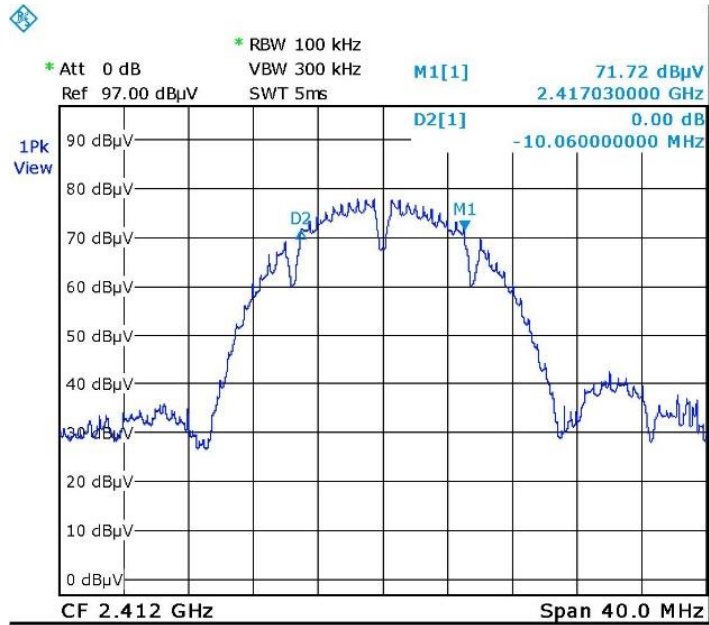
## 5.4 Test Results

Technique	Operation Frequency	Reading	Limit
	(MHz)	(kHz)	(kHz)
Wi-Fi/b 1Mbps	2412.0	10,060.0	$\geq 500.0$
	2437.0	9,741.0	$\geq 500.0$
	2462.0	9,581.0	$\geq 500.0$
Wi-Fi/b 11Mbps	2412.0	8,383.0	$\geq 500.0$
	2437.0	8,463.0	$\geq 500.0$
	2462.0	8,303.0	$\geq 500.0$
Wi-Fi/g 6Mbps	2412.0	15,010.0	$\geq 500.0$
	2437.0	13,733.0	$\geq 500.0$
	2462.0	15,729.0	$\geq 500.0$
Wi-Fi/g 54Mbps	2412.0	16,367.0	$\geq 500.0$
	2437.0	16,128.0	$\geq 500.0$
	2462.0	16,287.0	$\geq 500.0$

**Figure 13 6 dB Minimum Bandwidth**

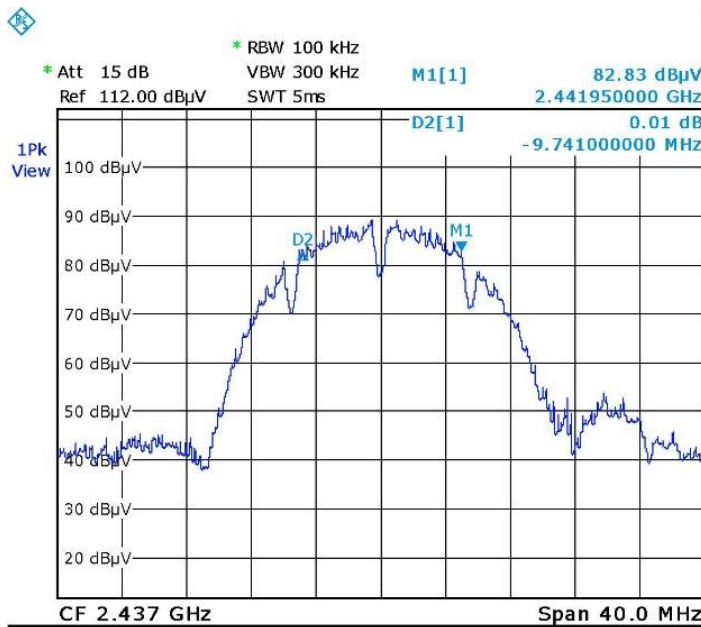
JUDGEMENT: Passed

For additional information see *Figure 14 to Figure 25*.



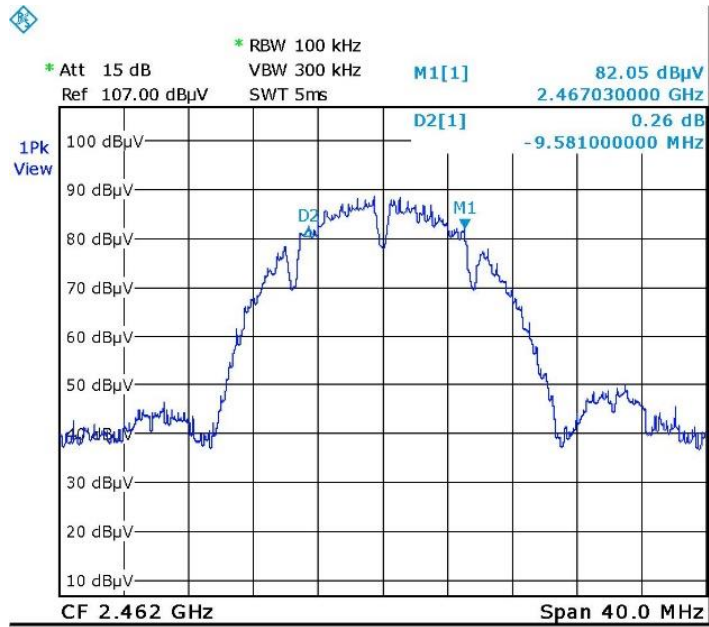
Date: 6.FEB.2018 14:16:04

Figure 14 2412.0 MHz, Wi-Fi/b 1Mbps



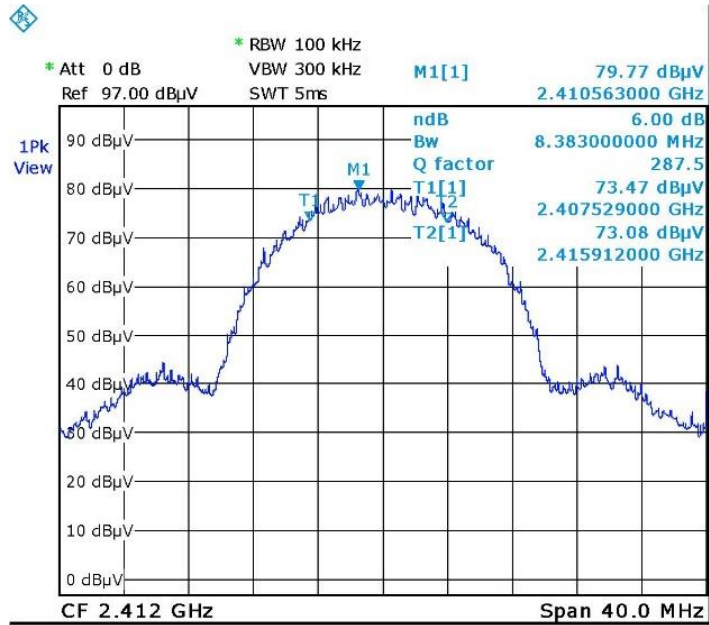
Date: 6.FEB.2018 14:41:32

Figure 15 2437.0 MHz, Wi-Fi/b 1Mbps



Date: 6.FEB.2018 15:14:44

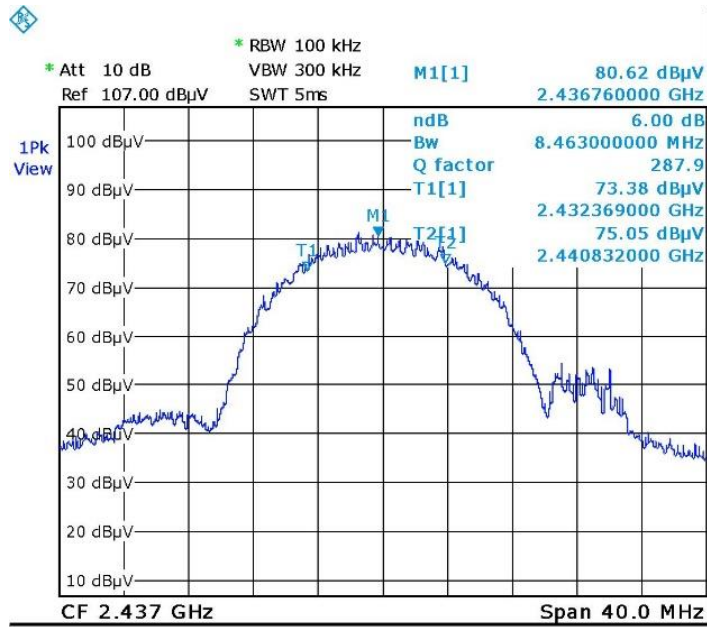
Figure 16 2462.0 MHz, Wi-Fi/b 1Mbps



Date: 6.FEB.2018 14:19:53

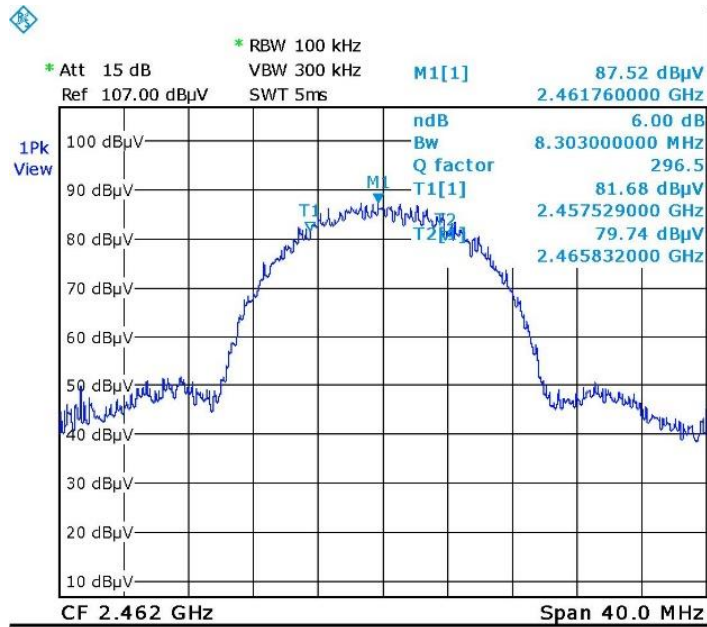
Figure 17 2412.0 MHz, Wi-Fi/b 11Mbps





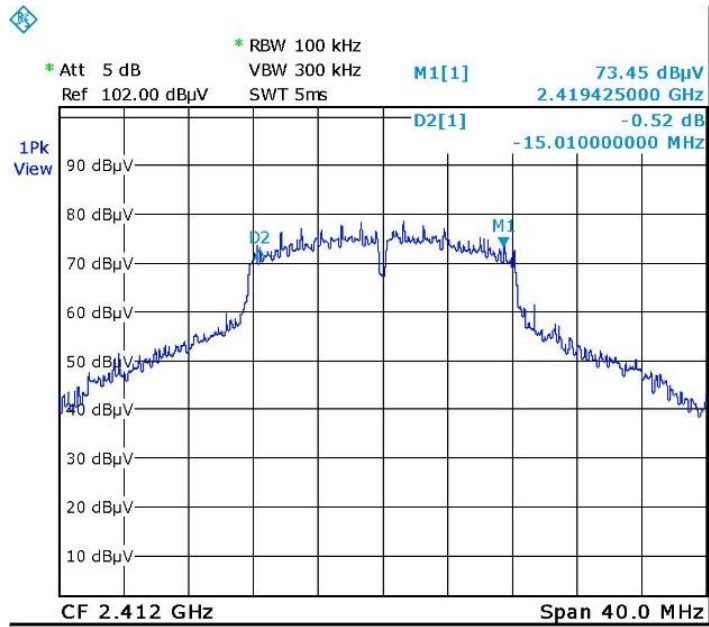
Date: 6.FEB.2018 14:58:28

Figure 18 2437.0 MHz, Wi-Fi/b 11Mbps



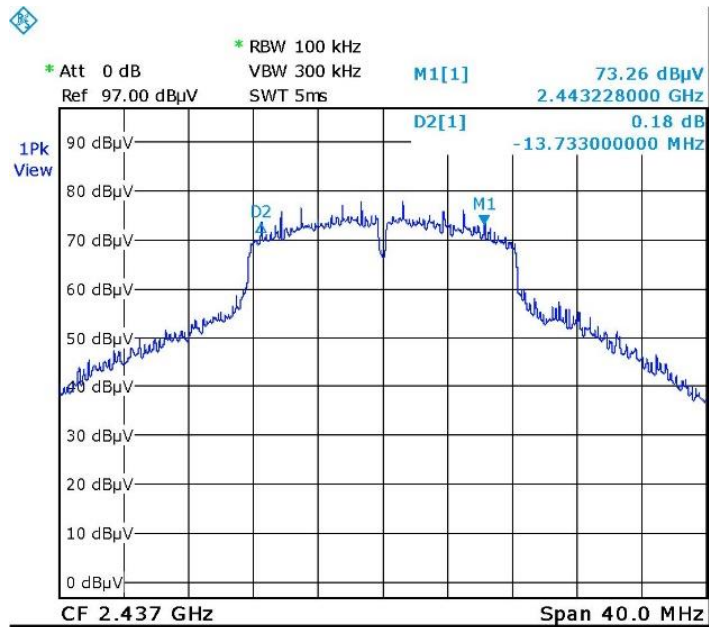
Date: 6.FEB.2018 15:18:47

Figure 19 2462.0 MHz, Wi-Fi/b 11Mbps



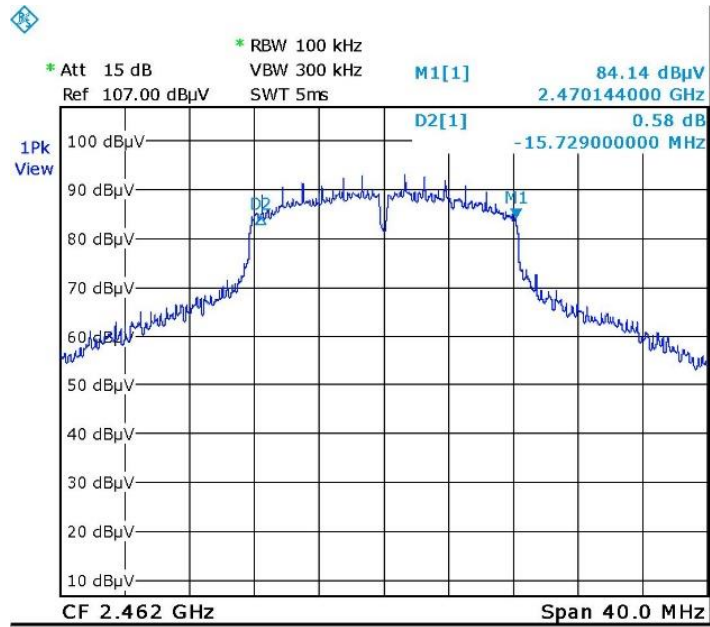
Date: 6.FEB.2018 14:25:30

Figure 20 2412.0 MHz, Wi-Fi/g 6Mbps



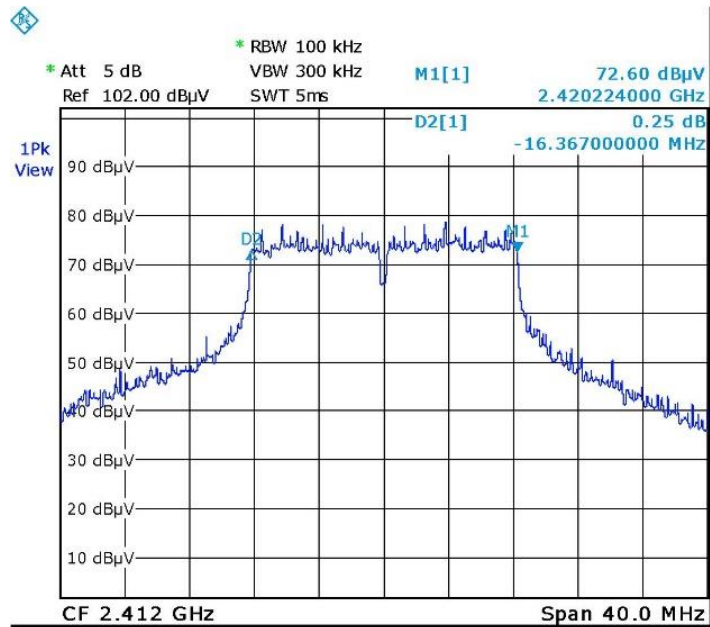
Date: 6.FEB.2018 15:04:23

Figure 21 2437.0 MHz, Wi-Fi/g 6Mbps



Date: 6.FEB.2018 15:30:08

Figure 22 2462.0 MHz, Wi-Fi/g 6Mbps



Date: 6.FEB.2018 14:30:09

Figure 23 2412.0 MHz, Wi-Fi/g 54Mbps





### 5.5 Test Equipment Used; 6dB Bandwidth

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Next Calibration Due</b>
Spectrum Analyzer	R&S	FSL6	100194	March 2, 2017	March 2, 2018
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
RF Cable	Commscope ORS	0623 WBC-400	G020132	October 1, 2017	October 1, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 26 Test Equipment Used



## 6. Maximum Transmitted Peak Power Output

### 6.1 Test Specification

FCC, Part 15, Subpart C, Section 247(b)(3)

RSS-247, Issue 2, Section 5.4(d)

### 6.2 Test Procedure

(Temperature (22°C)/ Humidity (51%RH))

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

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

The E.U.T was evaluated in 3 channels: Low (2402.0 MHz), Mid (2440.0 MHz) and High (2480 MHz).

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

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

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

### 6.3 Test Limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt.

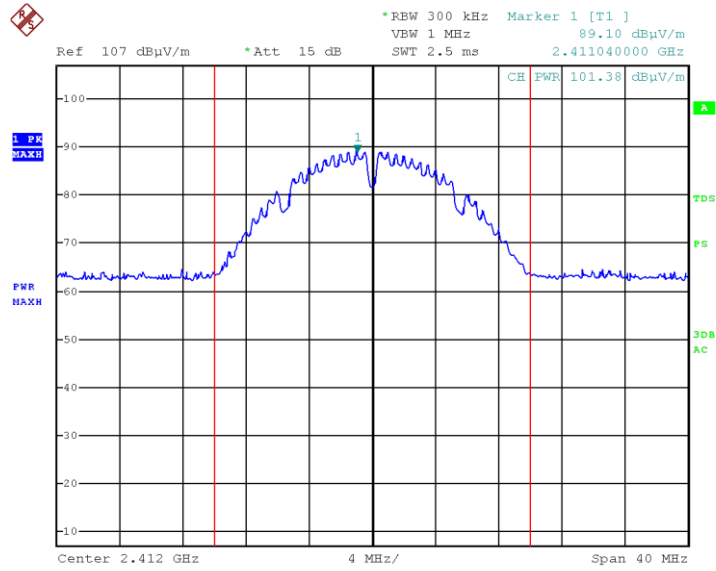
### 6.4 Test Results

Technique	Operation Frequency (MHz)	Pol (V/H)	Field Strength (dBuV/m)	EIRP (dBm)	Antenna Gain (dBi)	Conducted Power (dBm)	Conducted Power (mW)	Limit (mW)	Margin (mW)
Wi-Fi/b 1Mbps	2412.0	V	101.4	6.2	-2.0	8.2	6.6	1000.0	-993.4
		H	103.2	8.0	-2.0	10	10.0	1000.0	-990
	2437.0	V	101.5	6.3	-2.0	8.3	6.8	1000.0	-993.2
		H	104.1	8.9	-2.0	10.9	12.3	1000.0	-987.7
	2462.0	V	99.9	4.7	-2.0	6.7	4.7	1000.0	-995.3
		H	104.3	9.1	-2.0	11.1	12.9	1000.0	-987.1
Wi-Fi/b 11Mbps	2412.0	V	109.2	14.0	-2.0	16	39.8	1000.0	-960.2
		H	103.6	8.4	-2.0	10.4	11.0	1000.0	-989
	2437.0	V	105.3	10.1	-2.0	12.1	16.2	1000.0	-983.8
		H	109.5	14.3	-2.0	16.3	42.7	1000.0	-957.3
	2462.0	V	102.4	7.2	-2.0	9.2	8.3	1000.0	-991.7
		H	108.1	12.9	-2.0	14.9	30.9	1000.0	-969.1
Wi-Fi/g 6Mbps	2412.0	V	105.2	10.0	-2.0	12	15.9	1000.0	-984.1
		H	106.1	10.9	-2.0	12.9	19.5	1000.0	-980.5
	2437.0	V	103.7	8.5	-2.0	10.5	11.2	1000.0	-988.8
		H	107.4	12.2	-2.0	14.2	26.3	1000.0	-973.7
	2462.0	V	103.0	7.8	-2.0	9.8	9.6	1000.0	-990.4
		H	108.1	12.9	-2.0	14.9	30.9	1000.0	-969.1
Wi-Fi/g 54Mbps	2412.0	V	101.2	6.0	-2.0	8	6.3	1000.0	-993.7
		H	104.3	9.1	-2.0	11.1	12.9	1000.0	-987.1
	2437.0	V	103.7	8.5	-2.0	10.5	11.2	1000.0	-988.8
		H	106.0	10.8	-2.0	12.8	19.2	1000.0	-980.8
	2462.0	V	99.4	4.2	-2.0	6.2	4.2	1000.0	-995.8
		H	103.4	8.2	-2.0	10.2	10.5	1000.0	-989.5

Figure 27 Maximum Peak Power Output

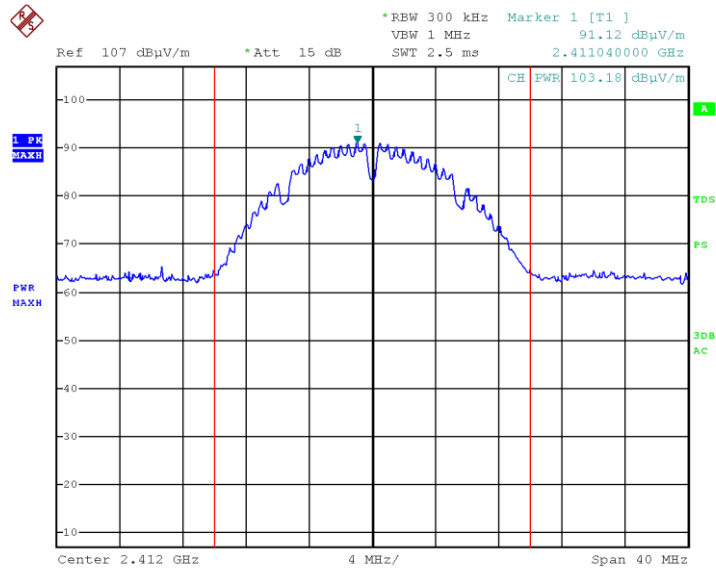
JUDGEMENT: Passed by 983.0mW

For additional information see *Figure 28 to Figure 51*.



Date: 6.FEB.2018 10:00:26

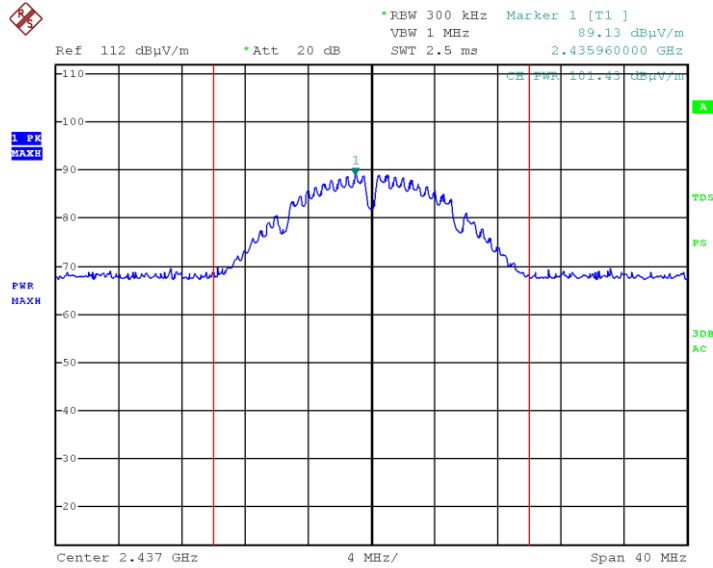
Figure 28 2412.0 MHz, Wi-Fi/b 1Mbps, Vertical



Date: 6.FEB.2018 09:56:48

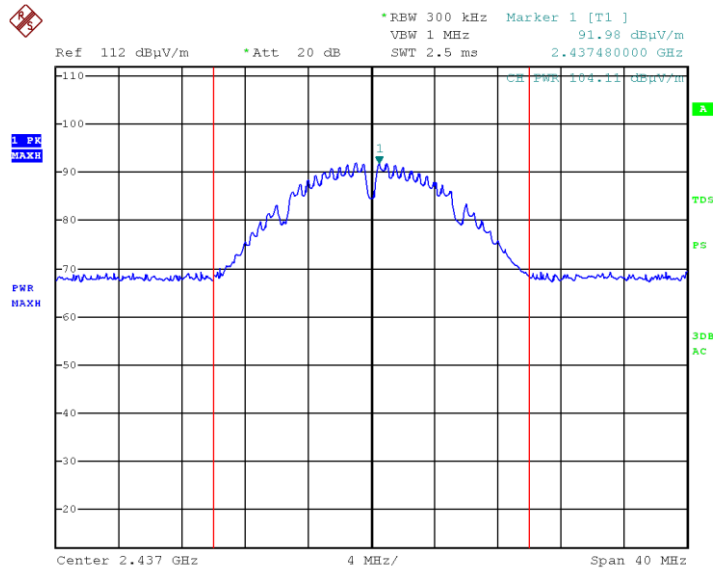
Figure 29 2412.0 MHz, Wi-Fi/b 1Mbps, Horizontal





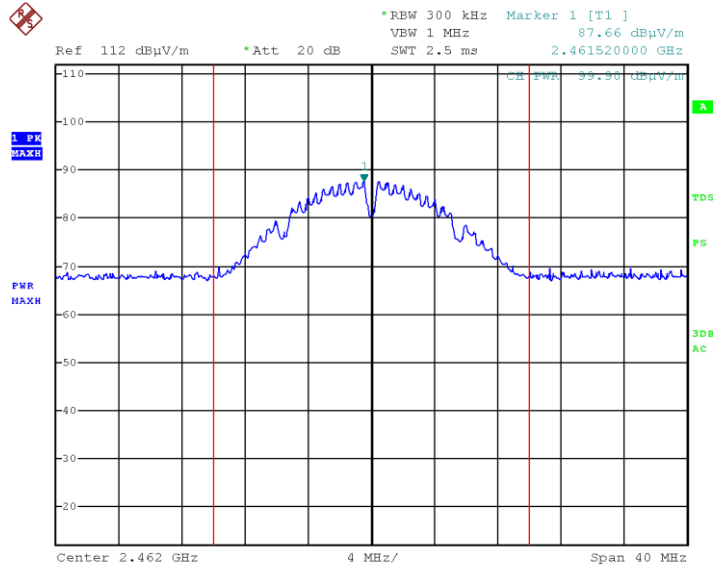
Date: 6.FEB.2018 11:34:31

Figure 30 2437.0 MHz, Wi-Fi/b 1Mbps, Vertical



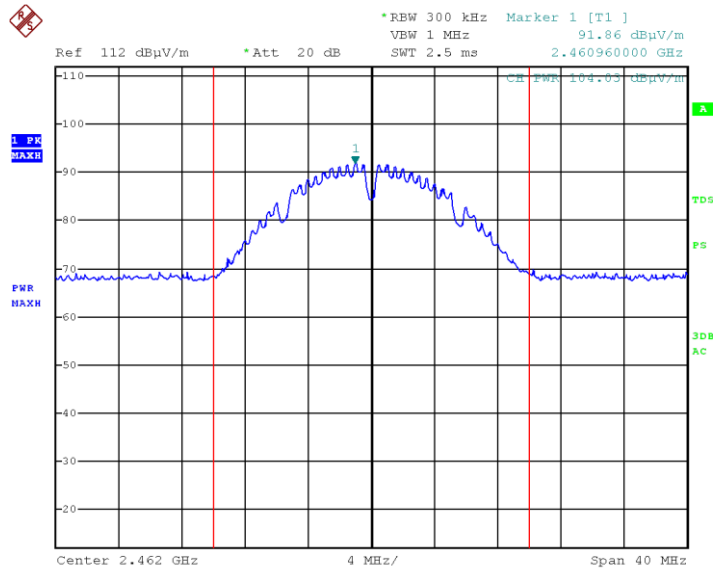
Date: 6.FEB.2018 11:31:04

Figure 31 2437.0 MHz, Wi-Fi/b 1Mbps, Horizontal



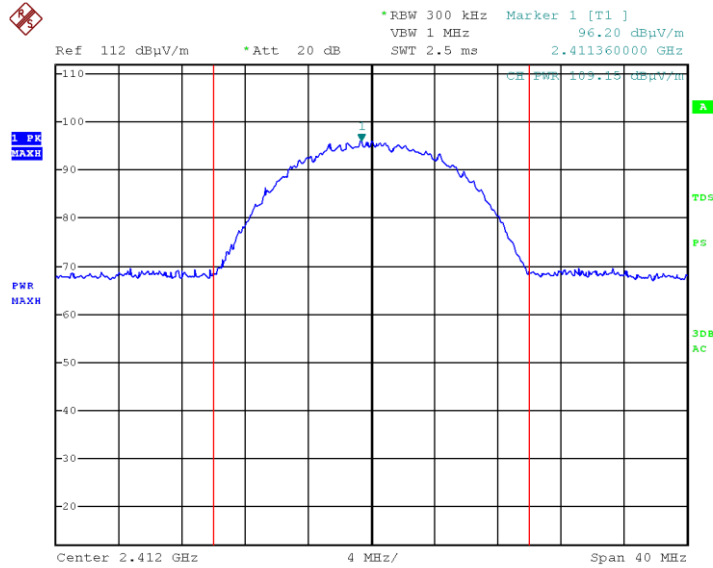
Date: 6.FEB.2018 13:04:01

Figure 32 2462.0 MHz, Wi-Fi/b 1Mbps, Vertical



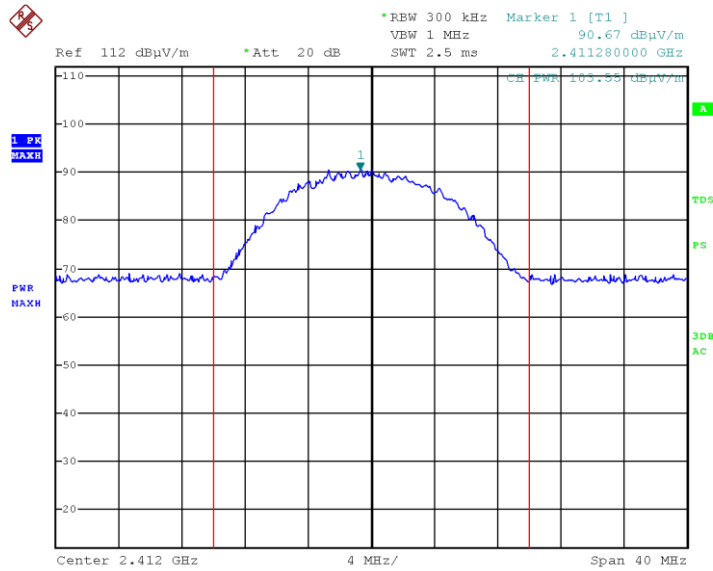
Date: 6.FEB.2018 13:00:54

Figure 33 2462.0 MHz ,Wi-Fi/b 1Mbps, Horizontal



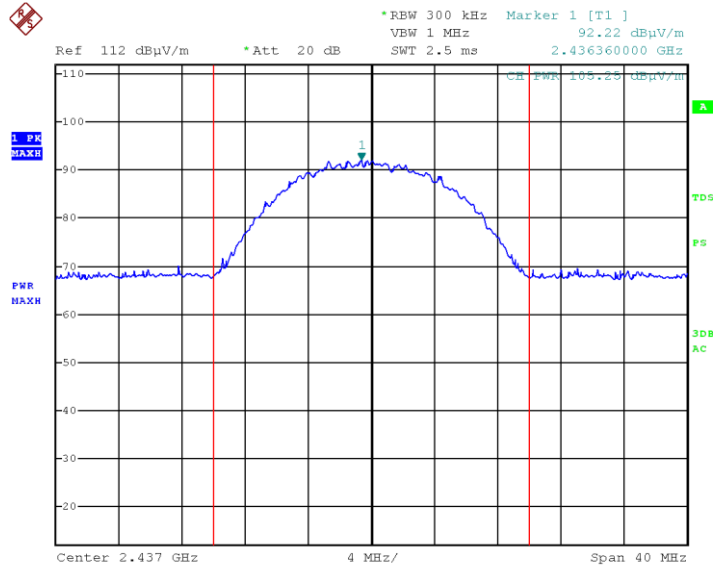
Date: 6.FEB.2018 10:05:29

Figure 34 2412.0 MHz, Wi-Fi/b 11Mbps, Vertical



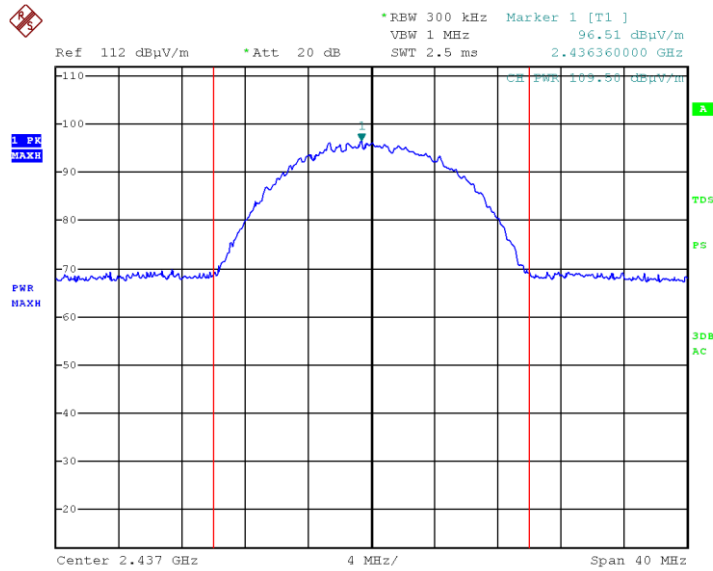
Date: 6.FEB.2018 10:08:06

Figure 35 2412.0 MHz, Wi-Fi/b 11Mbps, Horizontal



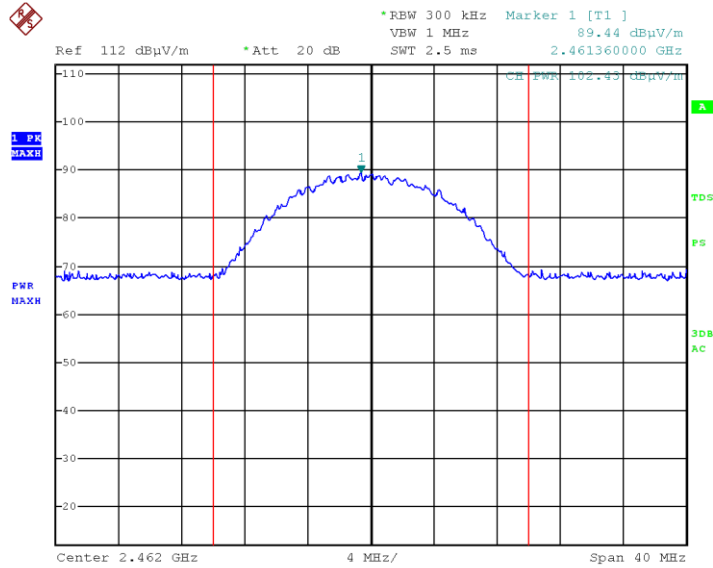
Date: 6.FEB.2018 11:40:16

Figure 36 2437.0 MHz, Wi-Fi/b 11Mbps, Vertical



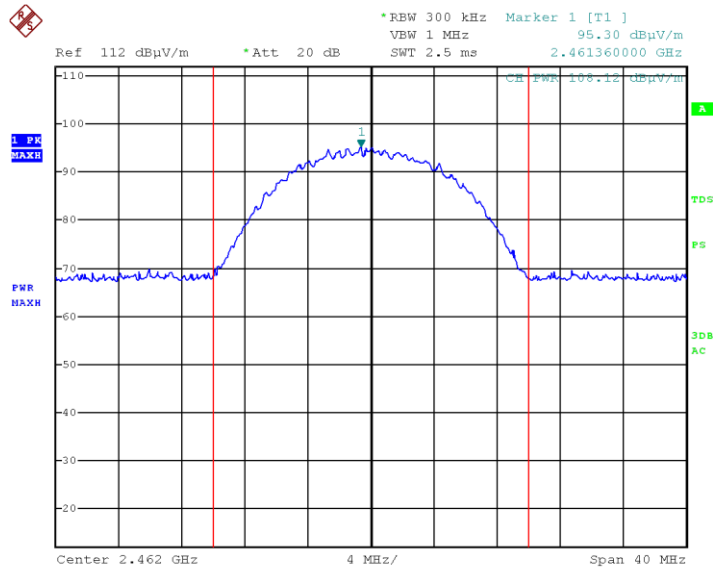
Date: 6.FEB.2018 11:43:16

Figure 37 2437.0 MHz, Wi-Fi/b 11Mbps, Horizontal



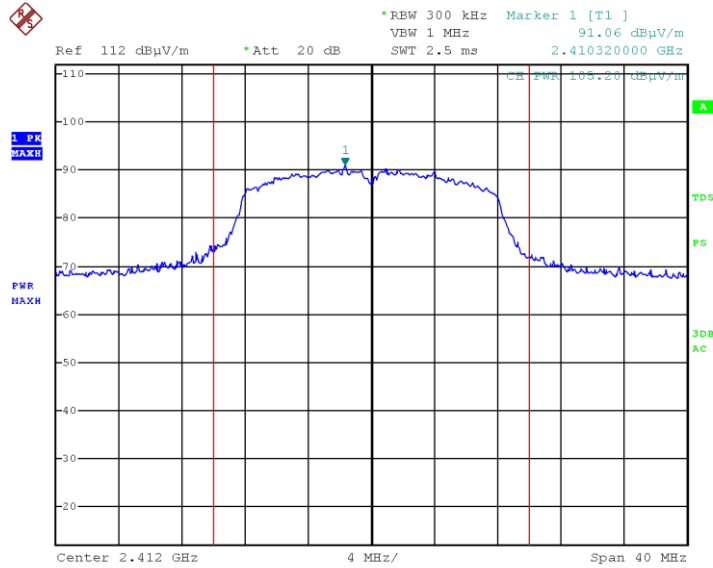
Date: 6.FEB.2018 13:09:33

**Figure 38 2462.0 MHz, Wi-Fi/b 11Mbps, Vertical**



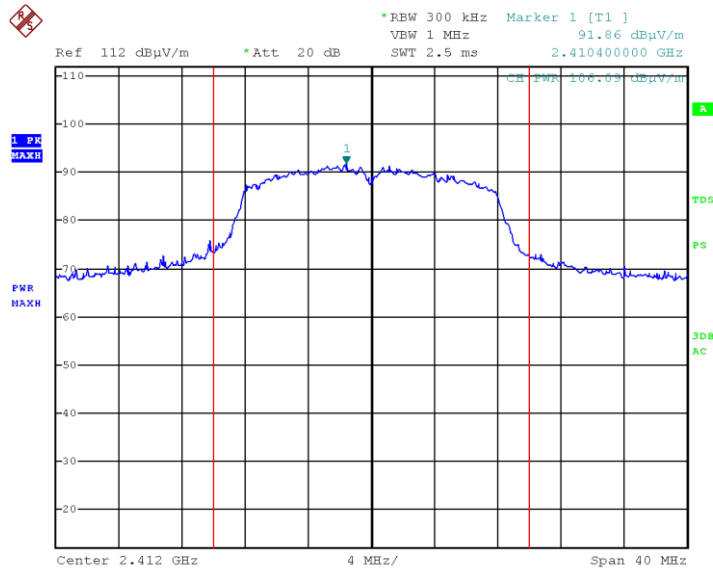
Date: 6.FEB.2018 13:12:35

**Figure 39 2462.0 MHz ,Wi-Fi/b 11Mbps, Horizontal**



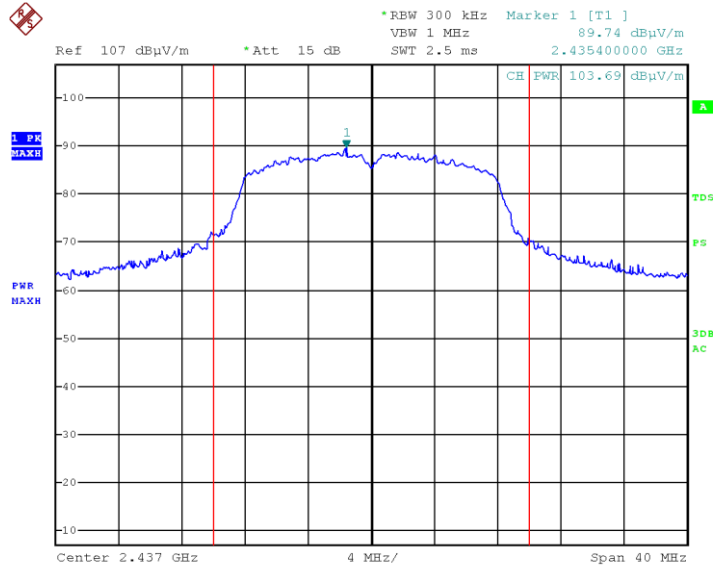
Date: 6.FEB.2018 10:19:55

Figure 40 2412.0 MHz, Wi-Fi/g 6Mbps, Vertical



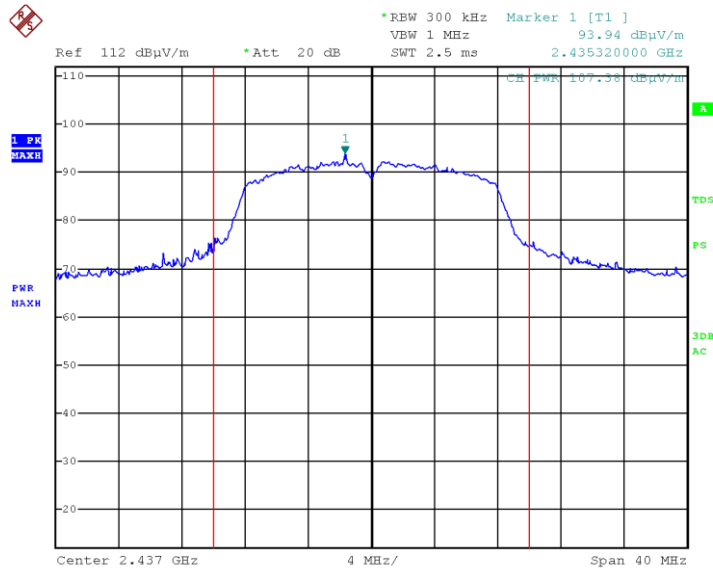
Date: 6.FEB.2018 10:14:54

Figure 41 2412.0 MHz, Wi-Fi/g 6Mbps, Horizontal



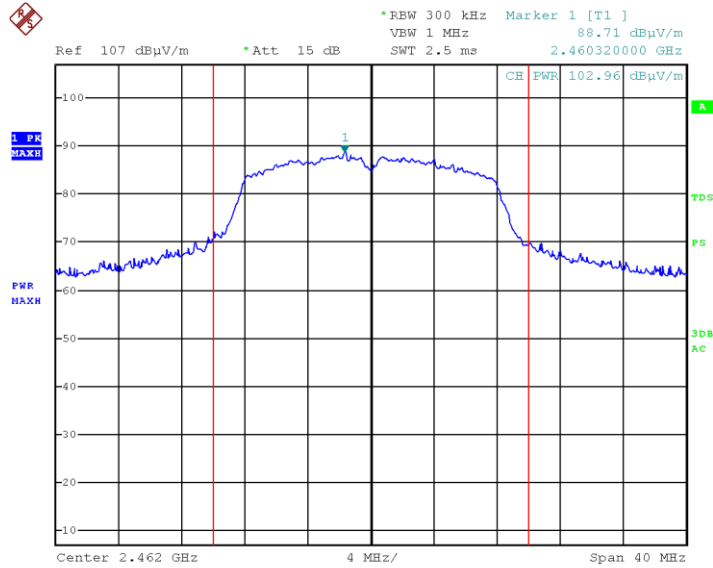
Date: 6.FEB.2018 11:57:16

Figure 42 2437.0 MHz, Wi-Fi/g 6Mbps, Vertical



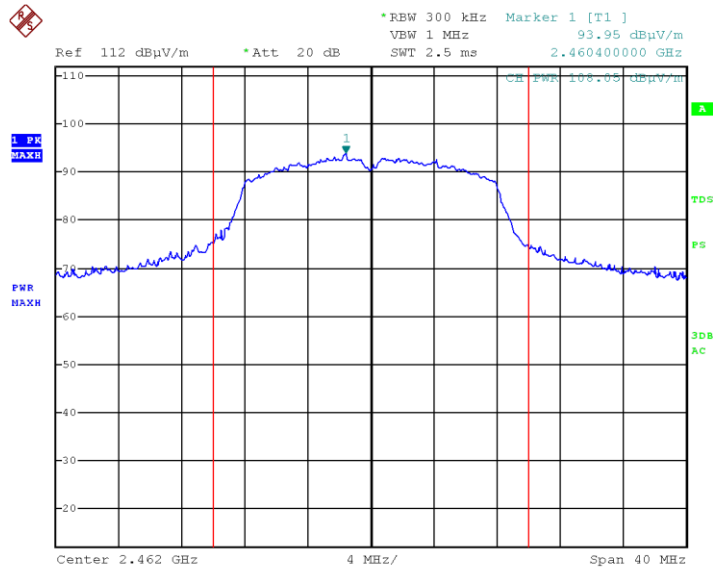
Date: 6.FEB.2018 11:52:17

Figure 43 2437.0 MHz, Wi-Fi/g 6Mbps, Horizontal



Date: 6.FEB.2018 13:21:41

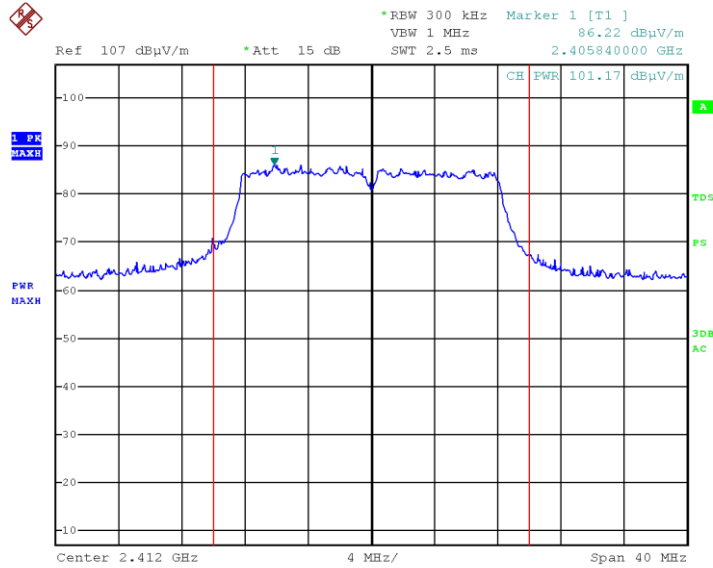
Figure 44 2462.0 MHz, Wi-Fi/g 6Mbps, Vertical



Date: 6.FEB.2018 13:18:15

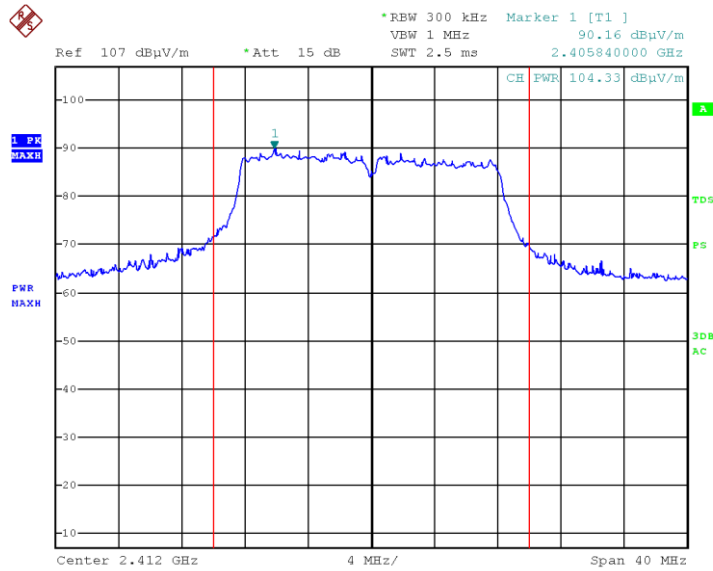
Figure 45 2462.0 MHz, Wi-Fi/g 6Mbps, Horizontal





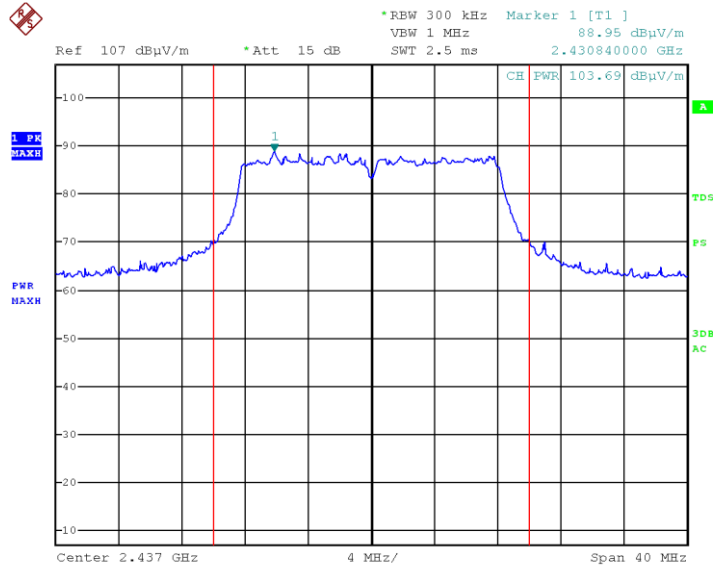
Date: 6.FEB.2018 10:33:28

Figure 46 2412.0 MHz, Wi-Fi/g 54Mbps, Vertical



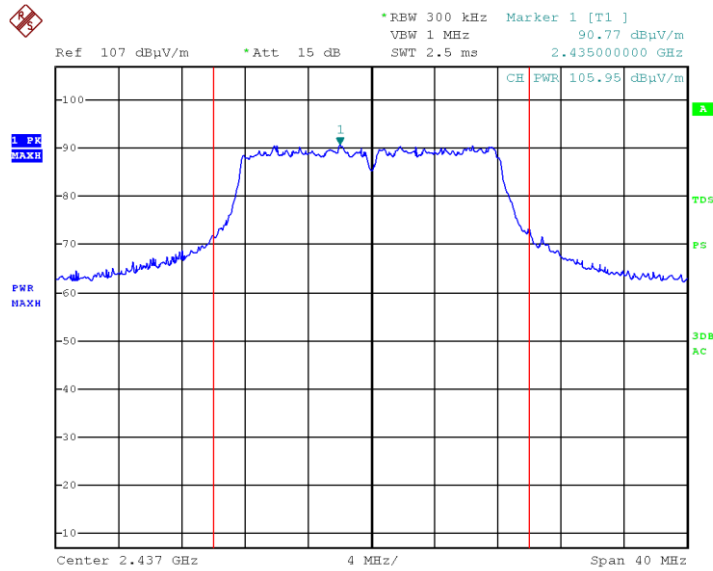
Date: 6.FEB.2018 10:37:59

Figure 47 2412.0 MHz, Wi-Fi/g 54Mbps, Horizontal



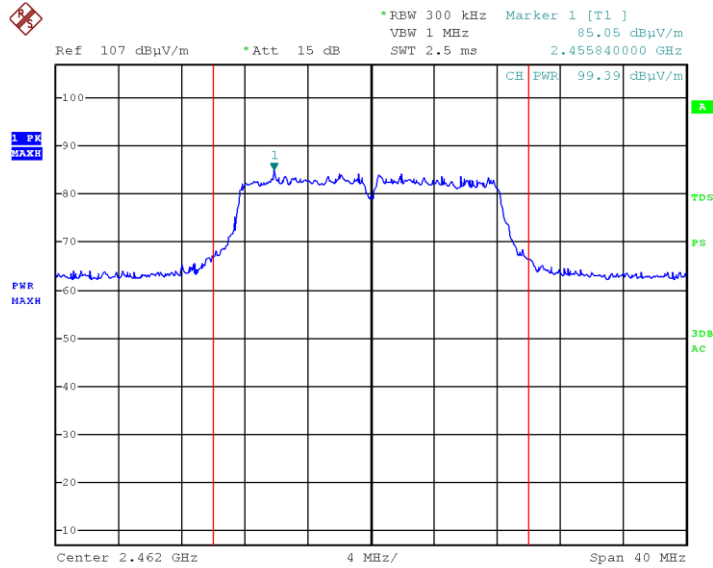
Date: 6.FEB.2018 12:41:53

Figure 48 2437.0 MHz, Wi-Fi/g 54Mbps, Vertical



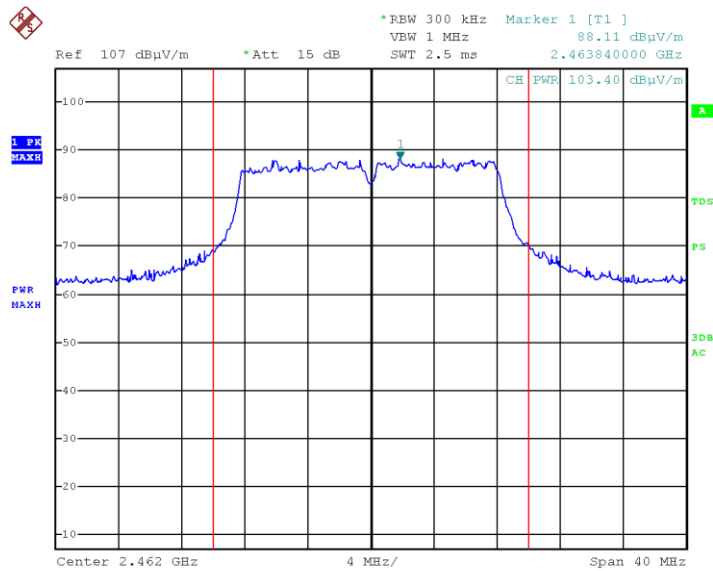
Date: 6.FEB.2018 12:45:20

Figure 49 2437.0 MHz, Wi-Fi/g 54Mbps, Horizontal



Date: 6.FEB.2018 14:02:07

Figure 50 2462.0 MHz, Wi-Fi/g 54Mbps, Vertical



Date: 6.FEB.2018 14:05:43

Figure 51 2462.0 MHz ,Wi-Fi/g 54Mbps, Horizontal



**6.5 Test Equipment Used; Maximum Peak Power Output**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Next Calibration Due</b>
EMI Receiver	R&S	ESCI7	100724	February 28, 2017	February 28, 2018
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
RF Cable	Commscope ORS	0623 WBC-400	G020132	October 1, 2017	October 1, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

**Figure 52 Test Equipment Used**



## 7. Band Edge Spectrum

### 7.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

RSS 247, Issue 2, Section 5.5

### 7.2 Test Procedure

(Temperature (21°C)/ Humidity (54%RH))

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

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization. The emissions were measured at a distance of 3 meters.

The RBW was set to 100 kHz.

### 7.3 Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

### 7.4 Test Results

Technique	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Wi-Fi/b 1Mbps	Low	2400.0	46.4	68.3	-21.9
	High	2483.5	43.9	75.5	-31.6
Wi-Fi/b 11Mbps	Low	2400.0	58.3	75.4	-17.1
	High	2483.5	43.6	76.4	-32.8
Wi-Fi/g 6Mbps	Low	2400.0	70.2	76.6	-6.4
	High	2483.5	54.6	74.8	-20.2
Wi-Fi/g 54Mbps	Low	2400.0	65.9	73.4	-7.5
	High	2483.5	51.8	72.1	-20.3

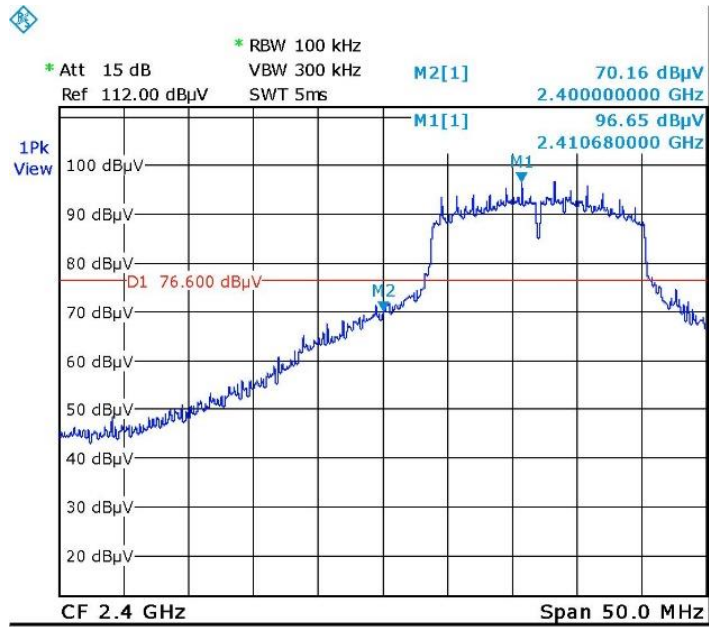
Figure 53 Band Edge Spectrum

JUDGEMENT: Passed by 6.4 dB

For additional information see *Figure 54* to *Figure 61*.

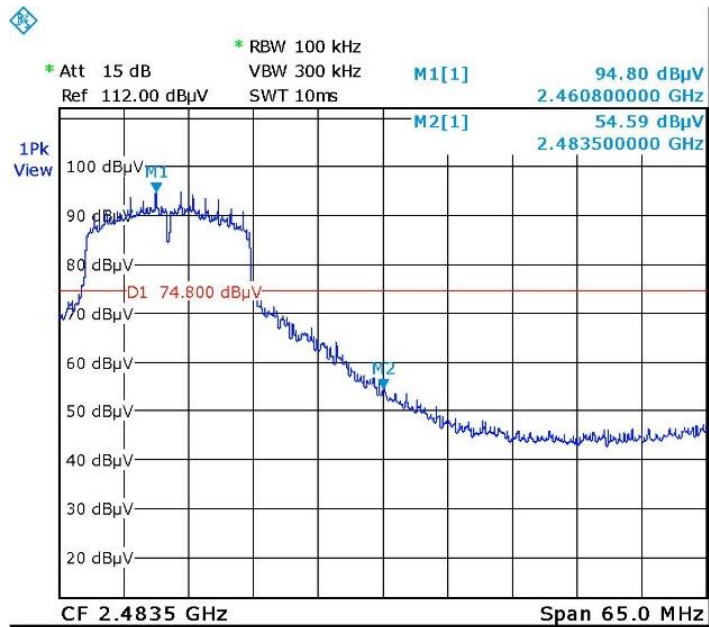






Date: 7.FEB.2018 11:52:23

Figure 58 —Lower Band Edge, Wi-Fi/g 6Mbps



Date: 7.FEB.2018 13:36:53

Figure 59 —Upper Band Edge, Wi-Fi/g 6Mbps







### 7.5 Test Equipment Used; Band Edge Spectrum

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Next Calibration Due</b>
EMI Receiver	R&S	FSL6	100194	March 2, 2017	March 2, 2018
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
RF Cable	Commscope ORS	0623 WBC-400	G020132	October 1, 2017	October 1, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

**Figure 62 Test Equipment Used**



## 8. Emissions in Non-Restricted Frequency Bands

### 8.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

RSS 247, Issue 2, Section 5.5

### 8.2 Test Procedure

(Temperature (23°C)/ Humidity (55%RH))

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

#### **For measurements between 0.009MHz-30MHz:**

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 0.009MHz-30MHz was scanned

#### **For measurements between 30.0MHz-1.0GHz:**

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 emissions were measured at a distance of 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. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

#### **For measurements between 1.0GHz-25.0GHz:**

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 1.0GHz -25.0GHz was scanned.

RBW was set to 100kHz, detector set to max peak and trace to “max hold”

The E.U.T. was operated at the low, mid and high channels (2402.0 MHz, 2440 MHz and 2480.0 MHz).

### 8.3 Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.



#### **8.4 Test Results**

JUDGEMENT: Passed

All detected emissions were greater than 20dBc below the fundamental level.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) and RSS 247, Issue 2, Section 5.5 specification.



### 8.5 Test Instrumentation Used, Emission in Non Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 28, 2017	February 28, 2018
Spectrum Analyzer	HP	8592L	3826A01204	March 1, 2017	March 1, 2018
EMI Receiver	HP	8542E	3906A00276	March 1, 2017	March 1, 2018
RF Filter Section	HP	85420E	3705A00248	March 1, 2017	March 1, 2018
Spectrum Analyzer	HP	8564E	3442A00275	March 19, 2017	March 19, 2018
Biconical Antenna	EMCO	3110B	9912-3337	May 15, 2017	May 15, 2019
Log Periodic Antenna	EMCO	3146	9505-4081	May 15, 2017	May 15, 2018
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Horn Antenna	ARA	SWH-28	1007	December 13, 2017	December 13, 2020
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2017	October 19, 2018
MicroWave System Amplifier	HP	83006A	3104A00589	October 1, 2017	October 1, 2018
Low noise amplifier 1GHz-18GHz	Miteq	AFSX4-02001800-50-8P	-	October 1, 2017	October 1, 2018
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 28, 2017	February 28, 2018
RF Cable	Commscope ORS	0623 WBC-400	G020132	October 1, 2017	October 1, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	9608-1497	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 63 Test Equipment Used



## 8.6 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors", 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.



## 9. Emissions in Restricted Frequency Bands

### 9.1 Test Specification

FCC Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)  
RSS Gen, Issue 5, Section 8.10

### 9.2 Test Procedure

(Temperature (23°C)/ Humidity (55%RH))

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

#### **For measurements between 0.009-30MHz:**

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 0.009MHz-30MHz was scanned.

#### **For measurements between 30-1000MHz:**

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 emissions were measured at a distance of 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. The frequency range 30MHz -1000MHz was scanned and the list of the highest emissions was verified and updated accordingly.

#### **For measurements between 1GHz-25GHz:**

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 1GHz -25GHz was scanned.

Tests performed for all “worst case”, each protocol type. The highest radiation described in the tables below.

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.

### 9.3 Test Limit

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBµV/m)	Field strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

\*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 64 Table of Limits

### 9.4 Test Results

JUDGEMENT: Passed by 1.1 dB

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is in the worst case 1.3 dB at the frequency of 2390.0 MHz, horizontal polarization.

For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is in the worst case 1.1 dB at the frequency of 2483.5 MHz, horizontal polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Sections 15.209, 15.205, 15.247(d) and RSS Gen, Issue 5, Section 8.10 specifications.

The details of the highest emissions are given in *Figure 65* to *Figure 68*.





## Radiated Emission

E.U.T Description    Personal Tag  
Type                    TAG-1410-CUB  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d) ;  
RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical    Frequency Range: 9KHz to 25.0 GHz  
Protocol type: WI-FI/b 1Mbps                    Detector: Peak ,Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2412.0	2390.0	V	53.2	74.0	-20.8	45.6	54.0	-8.4
	2390.0	H	54.9	74.0	-19.1	48.6	54.0	-5.4
	4824.0	V	51.3	74.0	-22.7	-	54.0	-
	4824.0	H	45.8	74.0	-28.2	-	54.0	-
2437.0	4874.0	V	49.3	74.0	-24.7	-	54.0	-
	4874.0	H	46.3	74.0	-27.7	-	54.0	-
	7311.0	V	45.5	74.0	-28.5	-	54.0	-
	7311.0	H	45.4	74.0	-28.6	-	54.0	-
2462.0	4924.0	V	51.1	74.0	-22.9	-	54.0	-
	4924.0	H	47.7	74.0	-26.3	-	54.0	-
	2483.5	V	52.8	74.0	-21.2	45.7	54.0	45.7
	2483.5	H	53.0	74.0	-21.0	45.1	54.0	45.1

**Figure 65. Radiated Emission Results**

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

E.U.T Description    Personal Tag  
Type                    TAG-1410-CUB  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d) ;  
RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical    Frequency Range: 9KHz to 25.0 GHz  
Protocol type: WI-FI/b 11Mbps                    Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2412.0	2390.0	V	54.3	74.0	-19.7	47.6	54.0	-6.4
	2390.0	H	51.6	74.0	-22.4	45.3	54.0	-8.7
	4824.0	V	50.5	74.0	-23.5	-	54.0	-
	4824.0	H	45.3	74.0	-28.7	-	54.0	-
2437.0	4874.0	V	47.2	74.0	-26.8	-	54.0	-
	4874.0	H	44.8	74.0	-29.2	-	54.0	-
	7311.0	V	45.2	74.0	-28.8	-	54.0	-
	7311.0	H	45.3	74.0	-28.7	-	54.0	-
2462.0	4924.0	V	53.5	74.0	-20.5	47.8	54.0	-6.2
	4924.0	H	43.6	74.0	-30.4	-	54.0	-
	2483.5	V	52.0	74.0	-22.0	45.2	54.0	-8.8
	2483.5	H	51.9	74.0	-22.1	45.7	54.0	-8.3

**Figure 66. Radiated Emission Results**

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

E.U.T Description    Personal Tag  
Type                    TAG-1410-CUB  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d);  
RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical    Frequency Range: 9KHz to 25.0 GHz  
Protocol type: WI-FI/g 6Mbps                    Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2412.0	2390.0	V	61.5	74.0	-12.5	50.7	54.0	-3.3
	2390.0	H	64.1	74.0	-9.9	52.6	54.0	-1.4
	4824.0	V	48.8	74.0	-25.2	-	54.0	-
	4824.0	H	47.4	74.0	-26.6	-	54.0	-
2437.0	4874.0	V	47.8	74.0	-26.2	-	54.0	-
	4874.0	H	44.0	74.0	-30	-	54.0	-
	7311.0	V	45.5	74.0	-28.5	-	54.0	-
	7311.0	H	45.0	74.0	-29	-	54.0	-
2462.0	4924.0	V	52.6	74.0	-21.4	49.8	54.0	-4.2
	4924.0	H	45.7	74.0	-28.3	-	54.0	-
	2483.5	V	63.4	74.0	-10.6	52.2	54.0	-1.8
	2483.5	H	63.6	74.0	-10.4	52.9	54.0	-1.1

**Figure 67. Radiated Emission Results**

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

E.U.T Description    Personal Tag  
Type                    TAG-1410-CUB  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d) ;  
RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical    Frequency Range: 9KHz to 25.0 GHz  
Protocol type: WI-FI/g 54Mbps                    Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
2412.0	2390.0	V	60.6	74.0	-13.4	48.7	54.0	-5.3
	2390.0	H	64.4	74.0	-9.6	52.7	54.0	-1.3
	4824.0	V	44.7	74.0	-29.3	-	54.0	-
	4824.0	H	46.8	74.0	-27.2	-	54.0	-
2437.0	4874.0	V	48.2	74.0	-25.8	-	54.0	-
	4874.0	H	45.6	74.0	-28.4	-	54.0	-
	7311.0	V	45.0	74.0	-29.0	-	54.0	-
	7311.0	H	47.1	74.0	-26.9	-	54.0	-
2462.0	4924.0	V	44.5	74.0	-29.5	-	54.0	-
	4924.0	H	45.2	74.0	-28.8	-	54.0	-
	2483.5	V	58.2	74.0	-15.8	47.3	54.0	-6.7
	2483.5	H	60.0	74.0	-14.0	49.9	54.0	-4.1

**Figure 68. Radiated Emission Results**

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



### 9.5 Test Instrumentation Used; Emissions in Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 28, 2017	February 28, 2018
Spectrum Analyzer	HP	8592L	3826A01204	March 1, 2017	March 1, 2018
EMI Receiver	HP	8542E	3906A00276	March 1, 2017	March 1, 2018
RF Filter Section	HP	85420E	3705A00248	March 1, 2017	March 1, 2018
Spectrum Analyzer	HP	8564E	3442A00275	March 19, 2017	March 19, 2018
Biconical Antenna	EMCO	3110B	9912-3337	May 15, 2017	May 15, 2019
Log Periodic Antenna	EMCO	3146	9505-4081	May 15, 2017	May 15, 2018
Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Horn Antenna	ARA	SWH-28	1007	December 13, 2017	December 13, 2020
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2017	October 19, 2018
MicroWave System Amplifier	HP	83006A	3104A00589	October 1, 2017	October 1, 2018
Low noise amplifier 1GHz-18GHz	Miteq	AFSX4-02001800-50-8P	-	October 1, 2017	October 1, 2018
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 28, 2017	February 28, 2018
RF Cable	Commscope ORS	0623 WBC-400	G020132	October 1, 2017	October 1, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	9608-1497	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 69 Test Equipment Used

## 10. Transmitted Power Density

### 10.1 Test Specification

FCC, Part 15, Subpart C, Section 247(e)

RSS 247, Issue 2, Section 5.2(b)

### 10.2 Test Procedure

(Temperature (22°C)/ Humidity (52%RH))

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

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground.

The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

The spectrum analyzer was set to 3 kHz RBW and VBW to 10 kHz.

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

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

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

### 10.3 Test Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

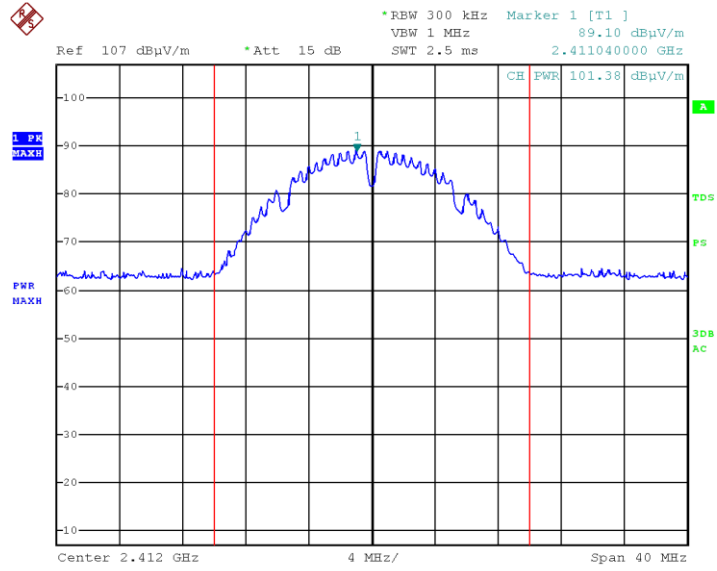
### 10.4 Test Results

Protocol	Operation Frequency	Polarization	PSD	PSD	Limit	Margin
	(MHz)	(V/H)	(dBuV/m)	(dBm)	(dBm)	(dB)
Wi-Fi/b 1Mbps	2412.0	V	89.1	-6.1	8.0	-14.1
		H	91.1	-4.1	8.0	-12.1
	2437.0	V	89.1	-6.1	8.0	-14.1
		H	92.0	-3.2	8.0	-11.2
	2462.0	V	87.7	-7.5	8.0	-15.5
		H	91.9	-3.3	8.0	-11.3
Wi-Fi/b 11Mbps	2412.0	V	96.2	1.0	8.0	-7.0
		H	90.7	-4.5	8.0	-12.5
	2437.0	V	92.2	-3.0	8.0	-11.0
		H	96.5	1.3	8.0	-6.7
	2462.0	V	89.4	-5.8	8.0	-13.8
		H	95.3	0.1	8.0	-7.9
Wi-Fi/g 6Mbps	2412.0	V	91.1	-4.1	8.0	-12.1
		H	91.9	-3.3	8.0	-11.3
	2437.0	V	89.7	-5.5	8.0	-13.5
		H	93.9	-1.3	8.0	-9.3
	2462.0	V	88.7	-6.5	8.0	-14.5
		H	94.0	-1.2	8.0	-9.2
Wi-Fi/g 54Mbps	2412.0	V	86.2	-9.0	8.0	-17.0
		H	90.2	-5.0	8.0	-13.0
	2437.0	V	89.0	-6.2	8.0	-14.2
		H	90.8	-4.4	8.0	-12.4
	2462.0	V	85.1	-10.1	8.0	-18.1
		H	88.1	-7.1	8.0	-15.1

**Figure 70 Power Spectral Density Results**

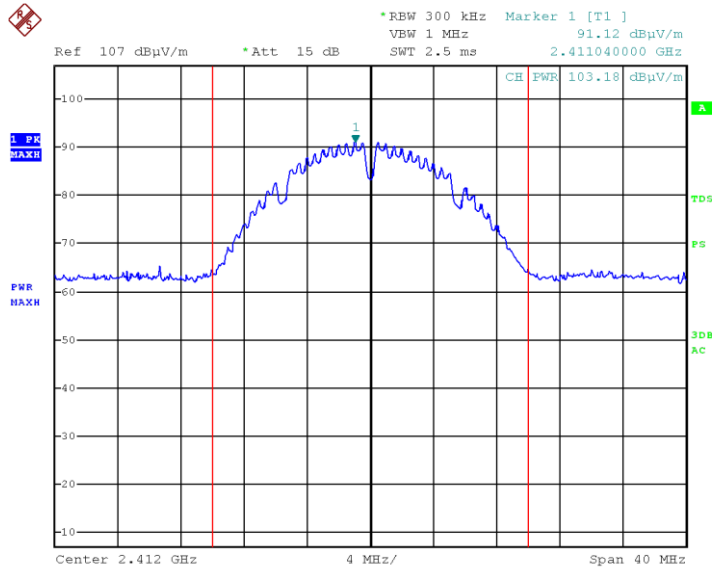
JUDGEMENT: Passed by 6.7dB

For additional information see *Figure 71* to *Figure 94*.



Date: 6.FEB.2018 10:00:26

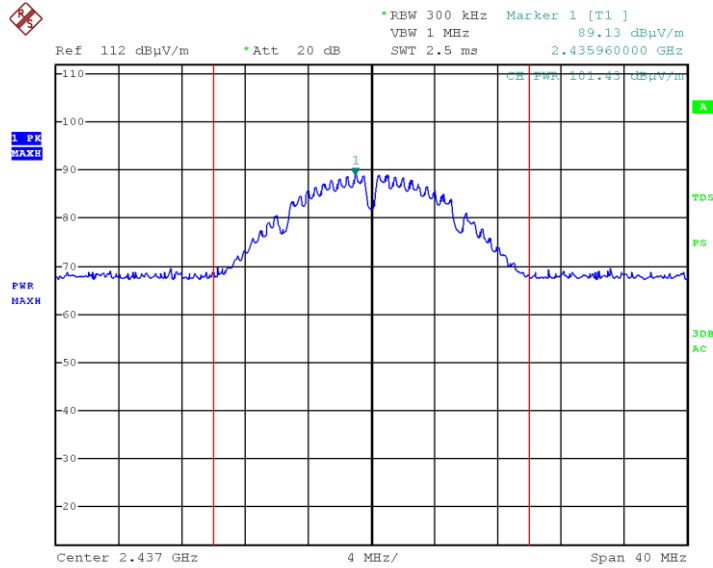
Figure 71 2412.0 MHz, Wi-Fi/b 1Mbps, Vertical



Date: 6.FEB.2018 09:56:48

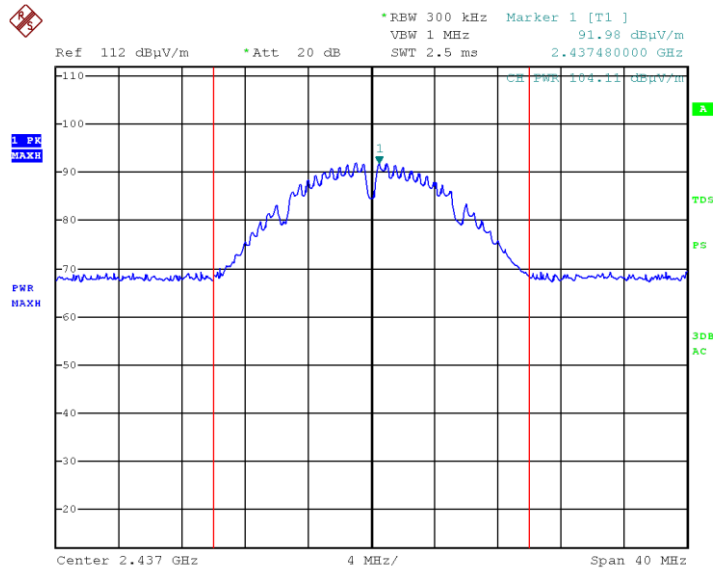
Figure 72 2412.0 MHz, Wi-Fi/b 1Mbps, Horizontal





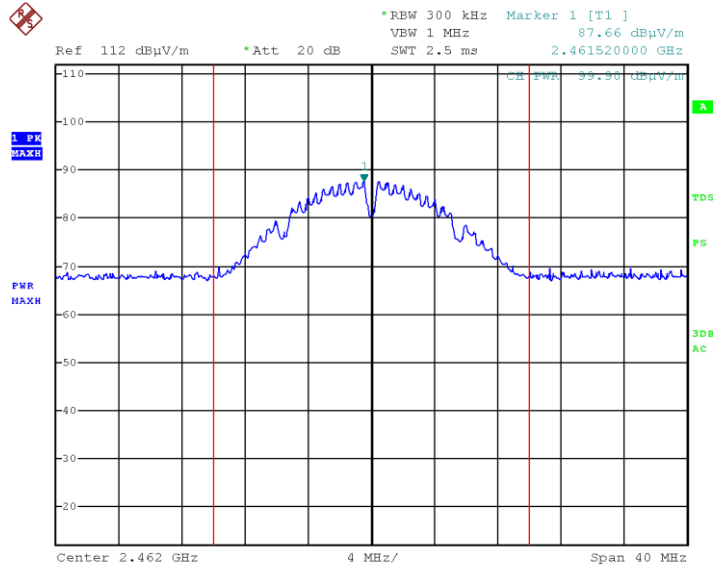
Date: 6.FEB.2018 11:34:31

Figure 73 2437.0 MHz, Wi-Fi/b 1Mbps, Vertical



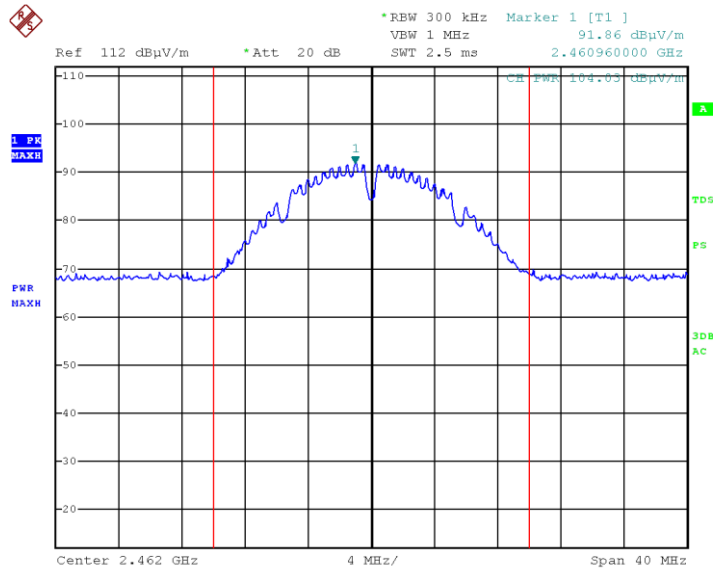
Date: 6.FEB.2018 11:31:04

Figure 74 2437.0 MHz, Wi-Fi/b 1Mbps, Horizontal



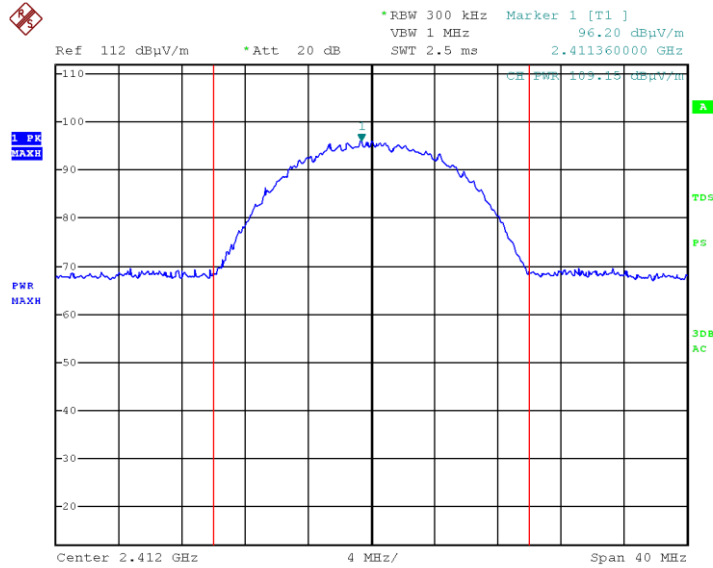
Date: 6.FEB.2018 13:04:01

Figure 75 2462.0 MHz, Wi-Fi/b 1Mbps, Vertical



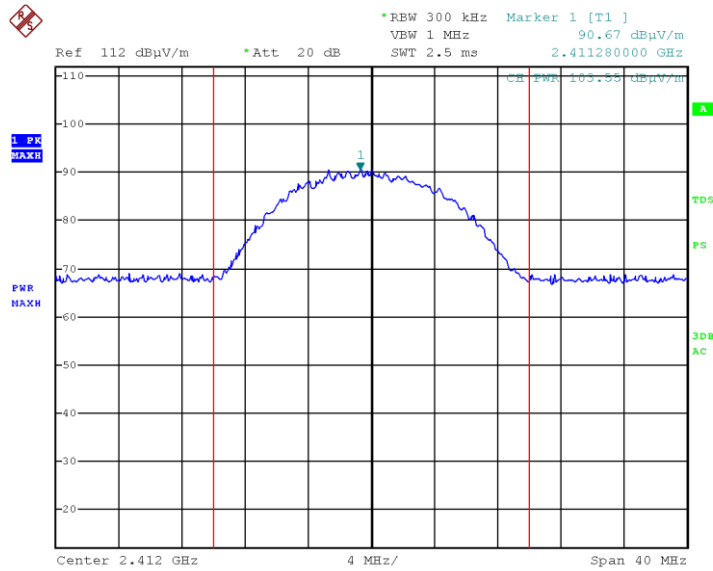
Date: 6.FEB.2018 13:00:54

Figure 76 2462.0 MHz ,Wi-Fi/b 1Mbps, Horizontal



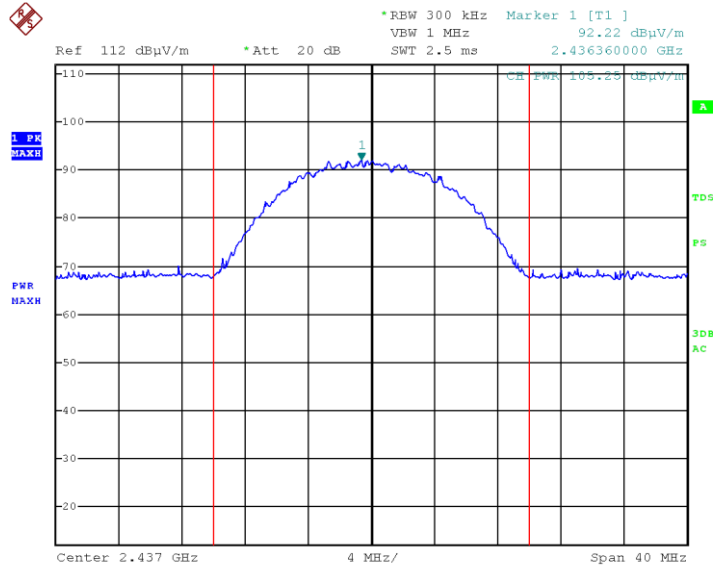
Date: 6.FEB.2018 10:05:29

Figure 77 2412.0 MHz, Wi-Fi/b 11Mbps, Vertical



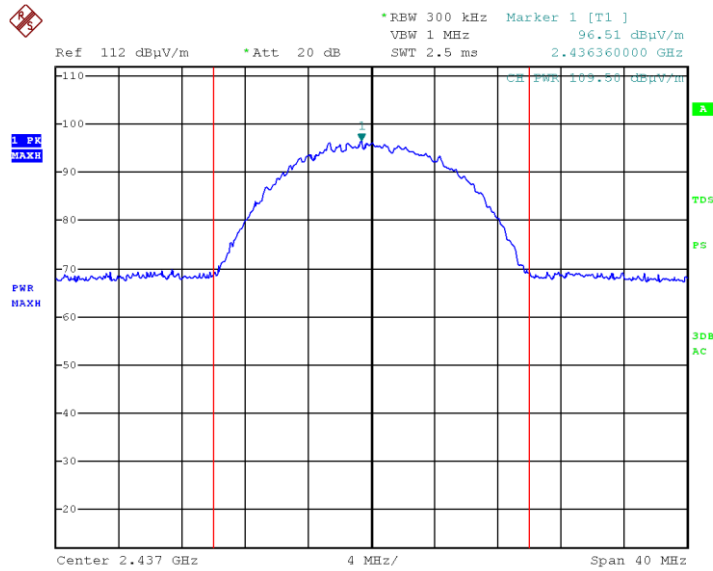
Date: 6.FEB.2018 10:08:06

Figure 78 2412.0 MHz, Wi-Fi/b 11Mbps, Horizontal



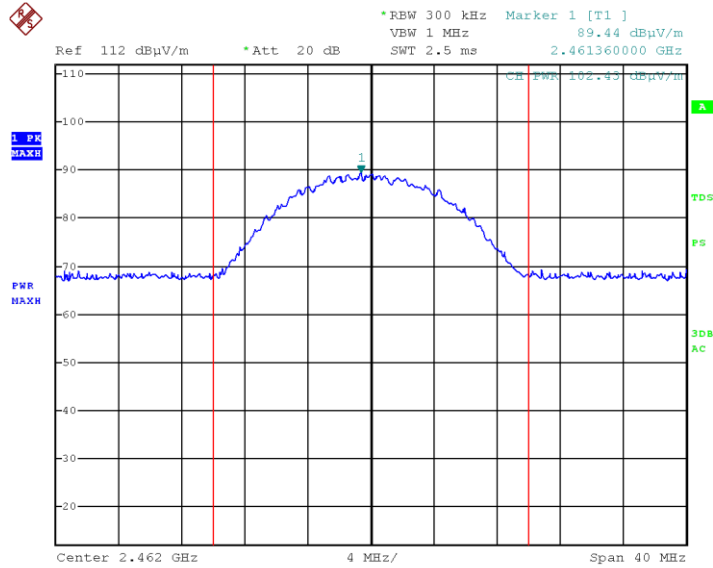
Date: 6.FEB.2018 11:40:16

**Figure 79 2437.0 MHz, Wi-Fi/b 11Mbps, Vertical**



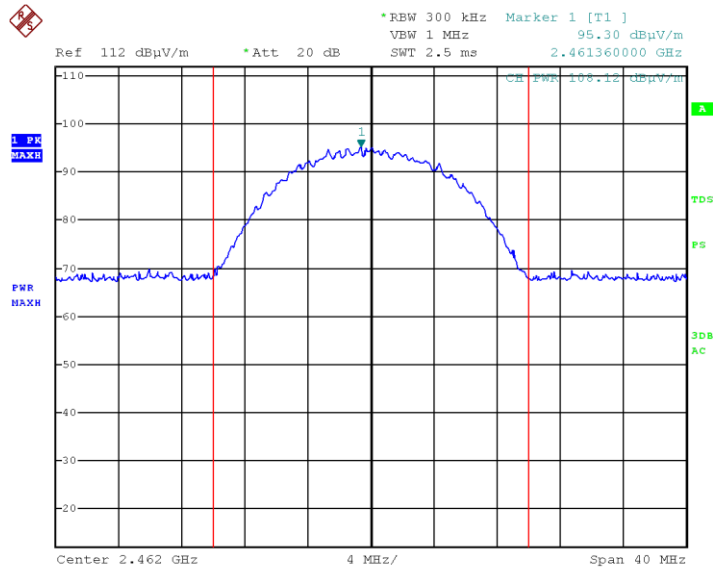
Date: 6.FEB.2018 11:43:16

**Figure 80 2437.0 MHz, Wi-Fi/b 11Mbps, Horizontal**



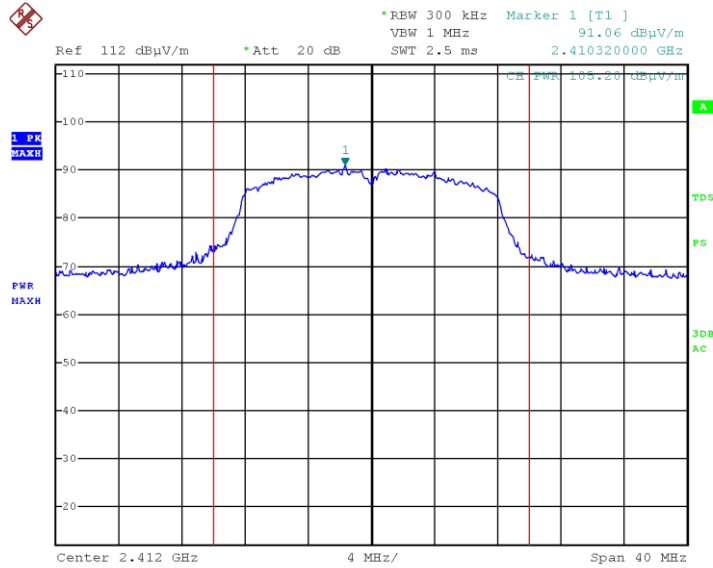
Date: 6.FEB.2018 13:09:33

Figure 81 2462.0 MHz, Wi-Fi/b 11Mbps, Vertical



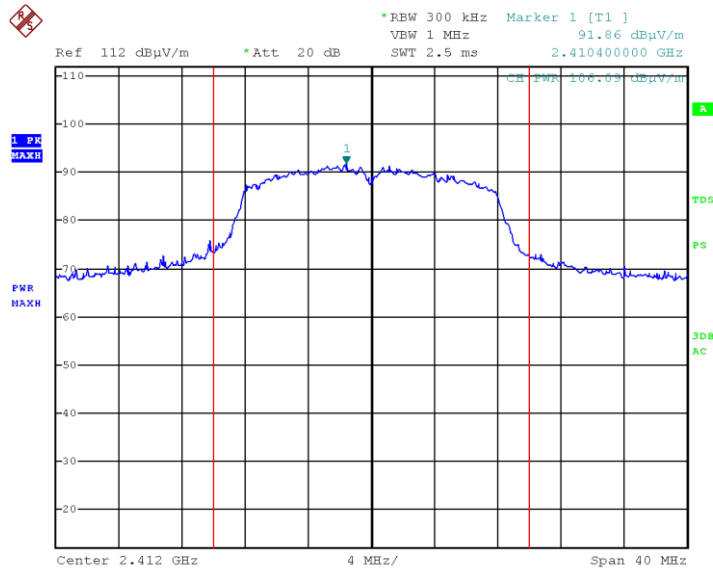
Date: 6.FEB.2018 13:12:35

Figure 82 2462.0 MHz ,Wi-Fi/b 11Mbps, Horizontal



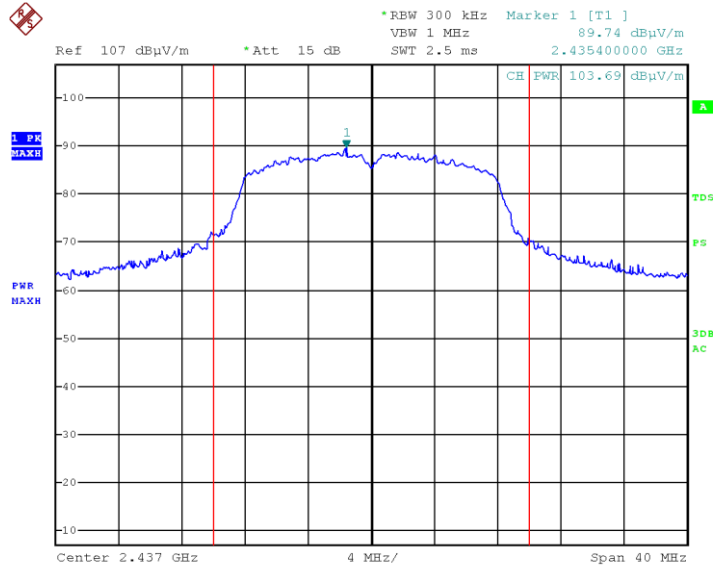
Date: 6.FEB.2018 10:19:55

Figure 83 2412.0 MHz, Wi-Fi/g 6Mbps, Vertical



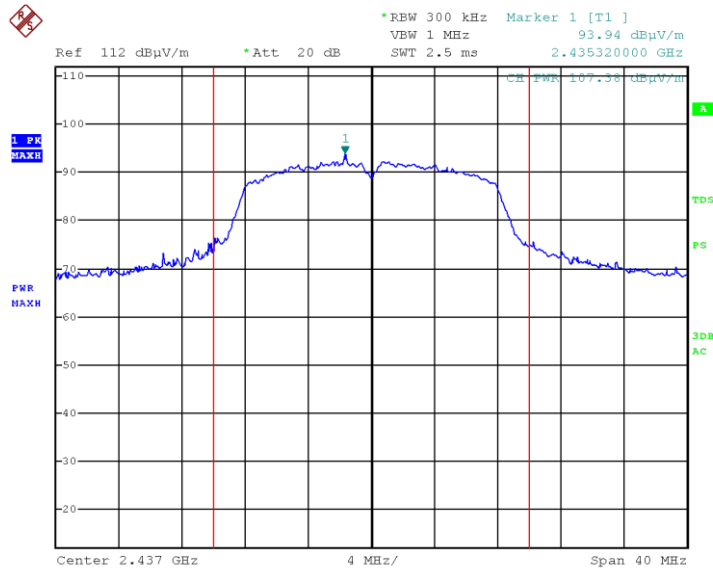
Date: 6.FEB.2018 10:14:54

Figure 84 2412.0 MHz, Wi-Fi/g 6Mbps, Horizontal



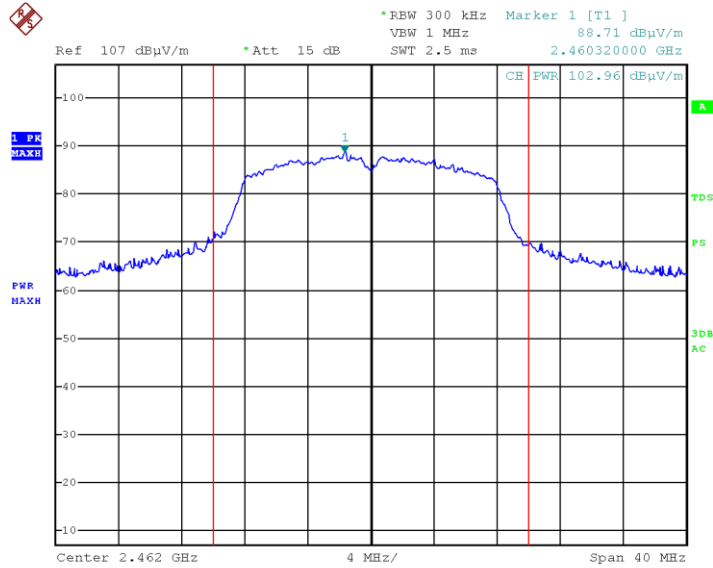
Date: 6.FEB.2018 11:57:16

Figure 85 2437.0 MHz, Wi-Fi/g 6Mbps, Vertical



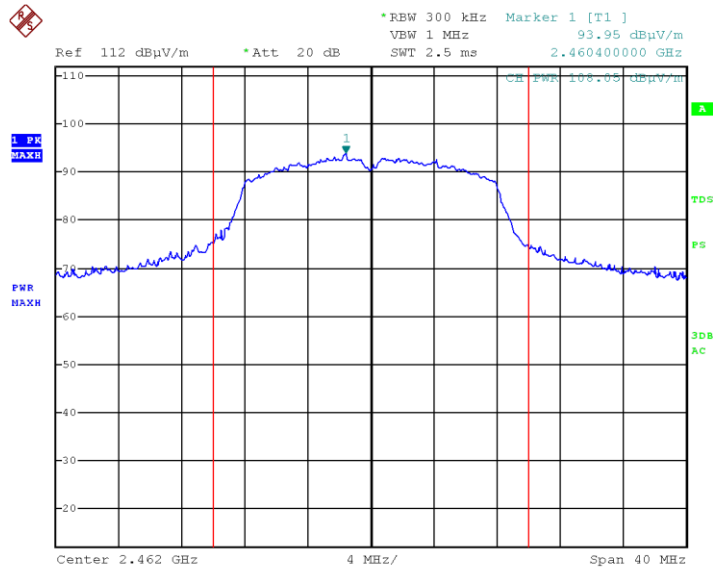
Date: 6.FEB.2018 11:52:17

Figure 86 2437.0 MHz, Wi-Fi/g 6Mbps, Horizontal



Date: 6.FEB.2018 13:21:41

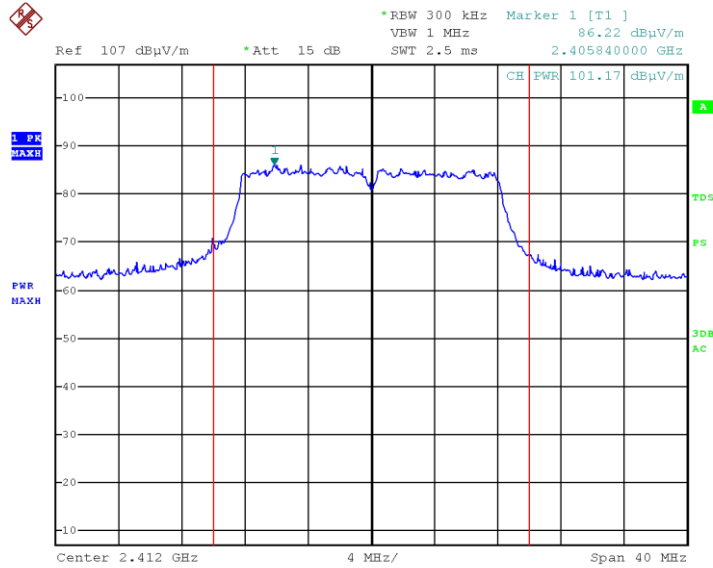
Figure 87 2462.0 MHz, Wi-Fi/g 6Mbps, Vertical



Date: 6.FEB.2018 13:18:15

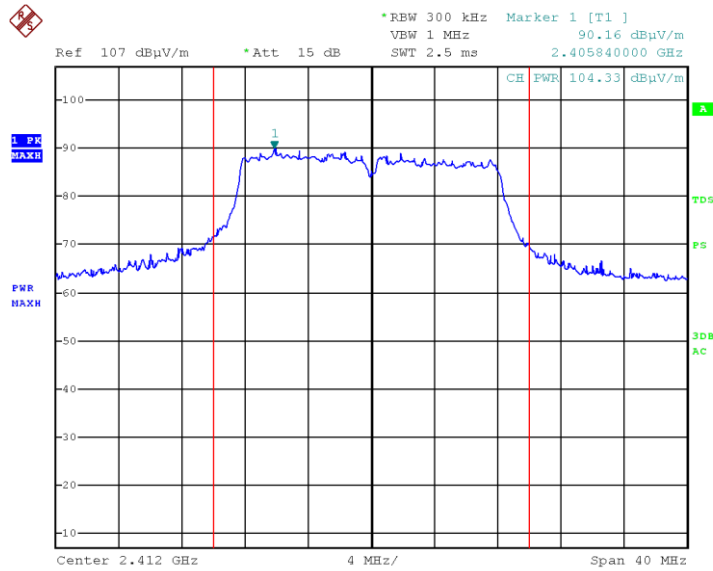
Figure 88 2462.0 MHz, Wi-Fi/g 6Mbps, Horizontal





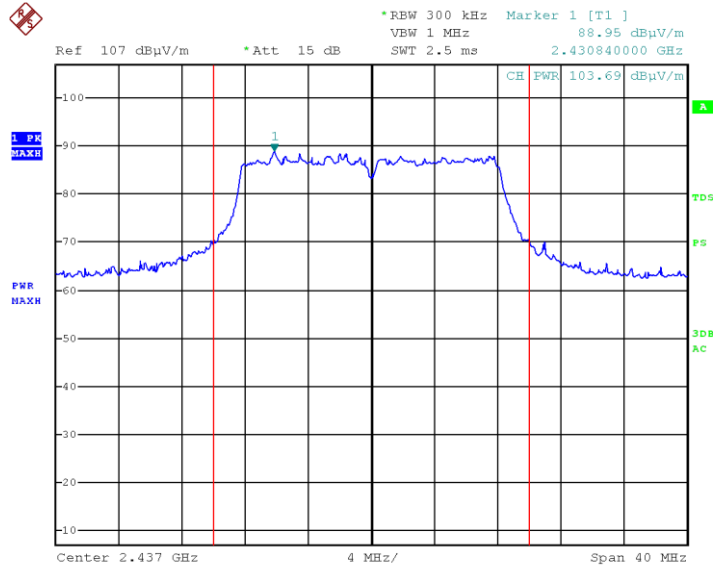
Date: 6.FEB.2018 10:33:28

Figure 89 2412.0 MHz, Wi-Fi/g 54Mbps, Vertical



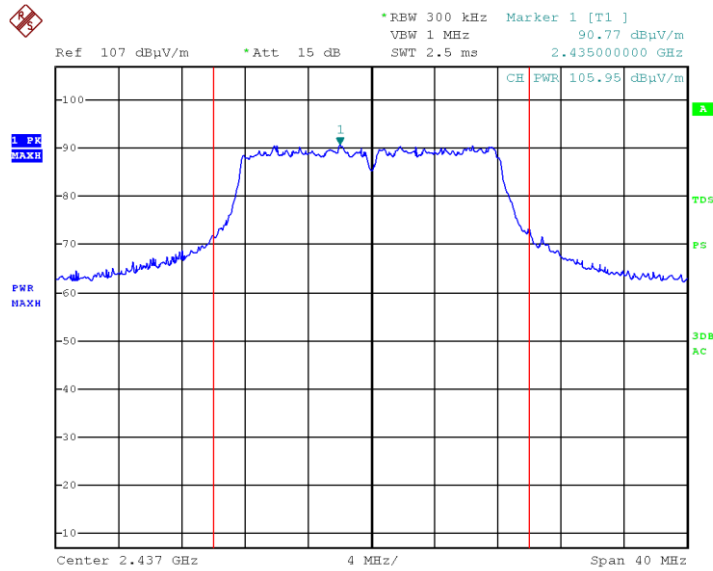
Date: 6.FEB.2018 10:37:59

Figure 90 2412.0 MHz, Wi-Fi/g 54Mbps, Horizontal



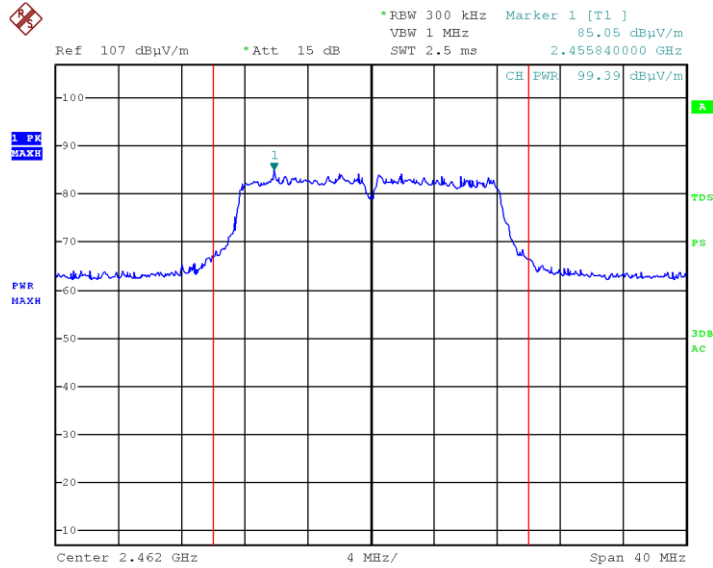
Date: 6.FEB.2018 12:41:53

Figure 91 2437.0 MHz, Wi-Fi/g 54Mbps, Vertical



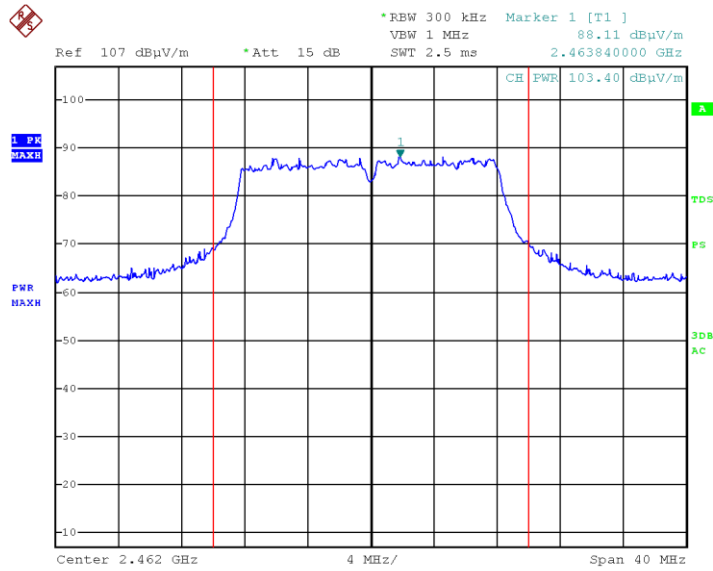
Date: 6.FEB.2018 12:45:20

Figure 92 2437.0 MHz, Wi-Fi/g 54Mbps, Horizontal



Date: 6.FEB.2018 14:02:07

Figure 93 2462.0 MHz, Wi-Fi/g 54Mbps, Vertical



Date: 6.FEB.2018 14:05:43

Figure 94 2462.0 MHz ,Wi-Fi/g 54Mbps, Horizontal



**10.5 Test Equipment Used; Power Spectral Density**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Next Calibration Due</b>
EMI Receiver	R&S	ESCI7	100724	February 28, 2017	February 28, 2018
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
RF Cable	Commscope ORS	0623 WBC-400	G020132	October 1, 2017	October 1, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

**Figure 95 Test Equipment Used**



## 11. Occupied Bandwidth

### 11.1 *Test Specification*

FCC, Part 2, Sub part J, Section 2.1049

RSS-Gen, Issue 5: 2018, Section 6.7

### 11.2 *Test Procedure*

(Temperature (22°C)/ Humidity (56%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report. The E.U.T. was placed in the chamber on a non-conductive table, 0.8 meters above the ground.

The distance between the E.U.T. and test antenna was 3 meters.

The RBW set to the range of 1% to 5% of the OBW.

The span was set to ~ 3 times the OBW.

99% occupied bandwidth function was set on.

### 11.3 *Test Limit*

N/A

**11.4 Test Results**

Protocol	Operation Frequency	Reading
	(MHz)	(MHz)
Wi-Fi/b 1Mbps	2412.0	14.2
	2437.0	14.1
	2462.0	14.1
Wi-Fi/b 11Mbps	2412.0	14.4
	2437.0	14.5
	2462.0	14.5
Wi-Fi/g 6Mbps	2412.0	18.5
	2437.0	18.0
	2462.0	18.0
Wi-Fi/g 54Mbps	2412.0	17.6
	2437.0	17.2
	2462.0	17.4

**Figure 96. Occupied Bandwidth Test Results**

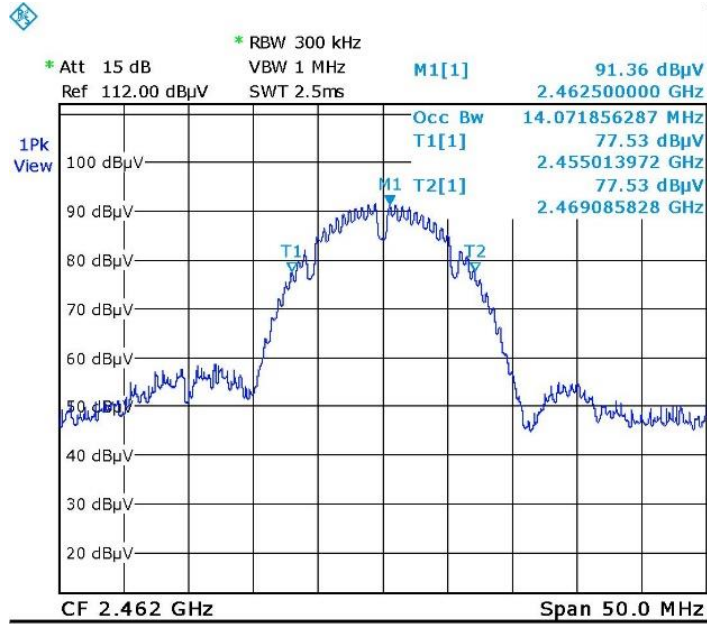
JUDGEMENT: N/A

See additional information in *Figure 97* to *Figure 108*.



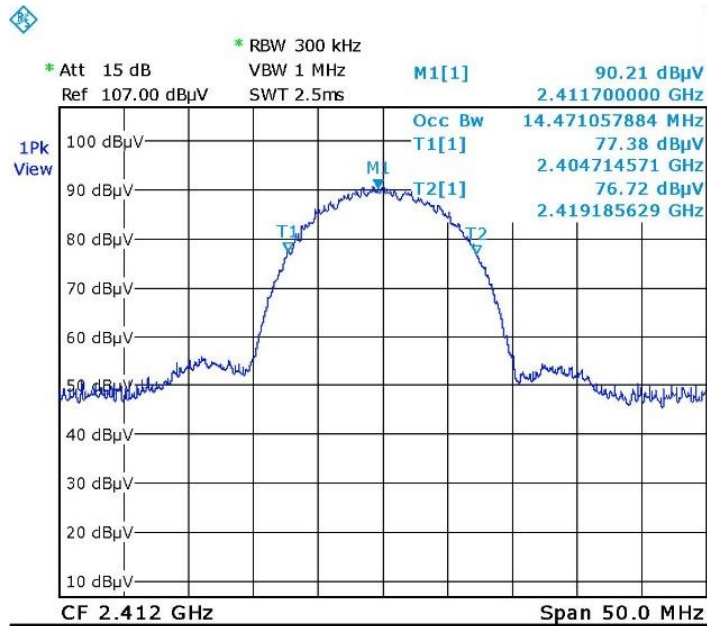
# Occupied Bandwidth

E.U.T Description    Personal Tag  
Model Number        TAG-1410-CUB  
Part Number:        Not designated



Date: 7.FEB.2018 09:18:56

Figure 99 2462.0 MHz, Wi-Fi/b 1Mbps



Date: 7.FEB.2018 08:49:06

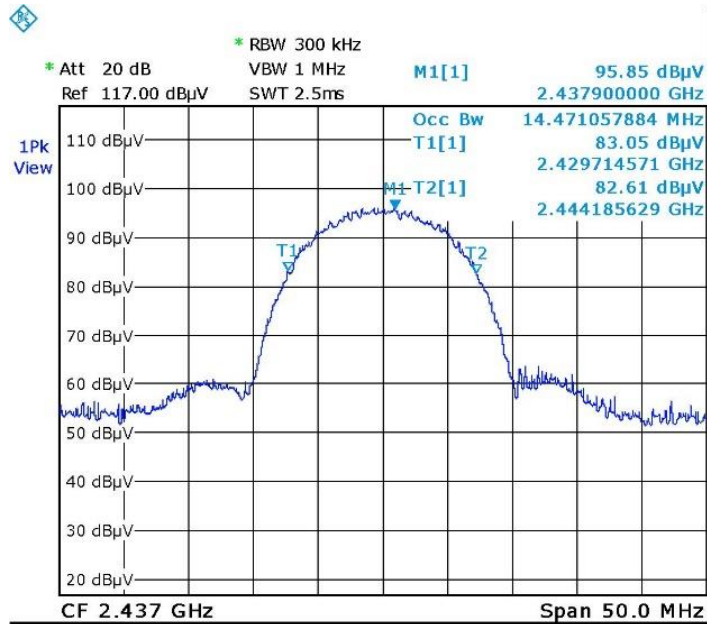
Figure 100 2412.0 MHz, Wi-Fi/b 11Mbps





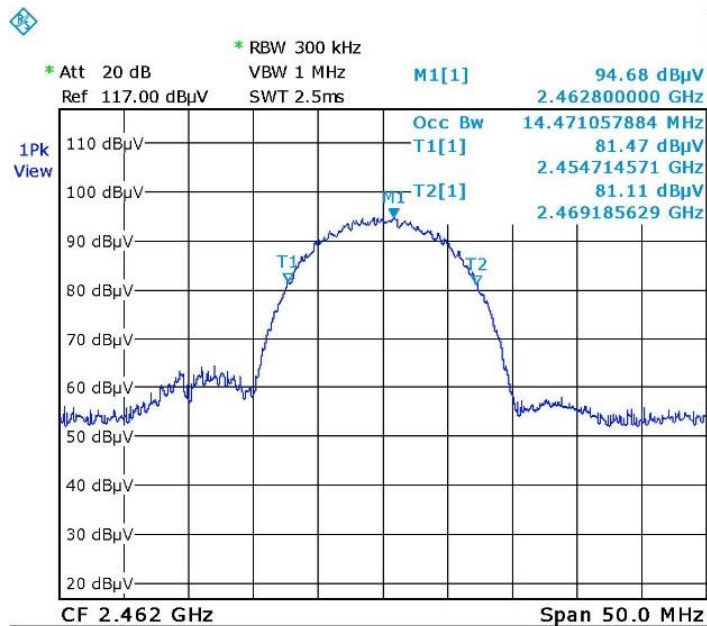
# Occupied Bandwidth

E.U.T Description    Personal Tag  
Model Number        TAG-1410-CUB  
Part Number:         Not designated



Date: 7.FEB.2018 09:09:25

Figure 101 2437.0 MHz, Wi-Fi/b 11Mbps



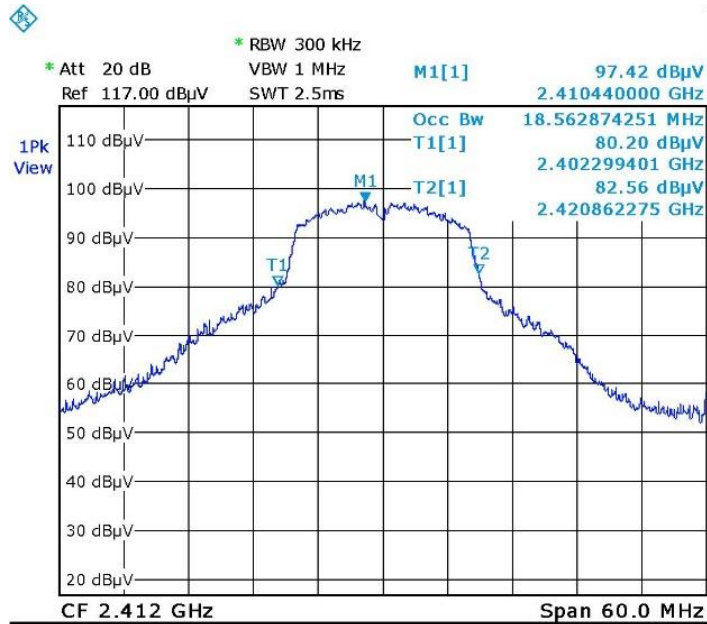
Date: 7.FEB.2018 09:22:45

Figure 102 2462.0 MHz, Wi-Fi/b 11Mbps



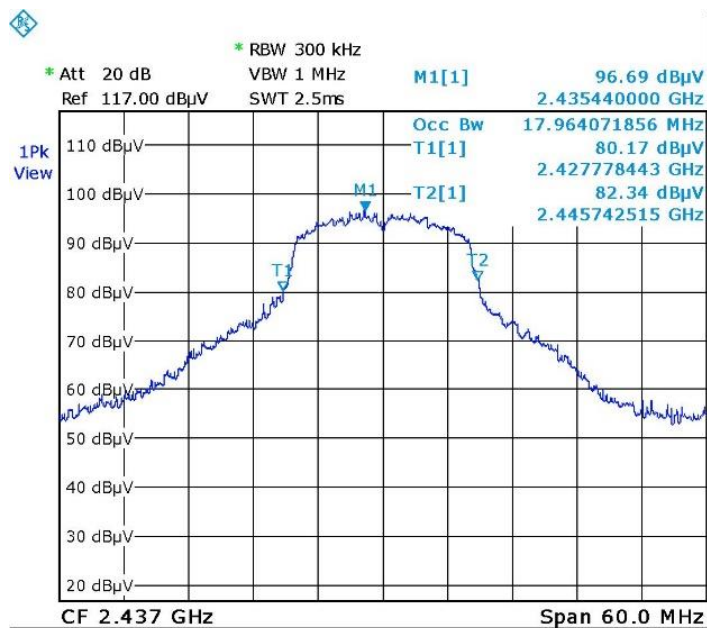
# Occupied Bandwidth

E.U.T Description    Personal Tag  
Model Number        TAG-1410-CUB  
Part Number:         Not designated



Date: 7.FEB.2018 08:53:15

Figure 103 2412.0 MHz, Wi-Fi/g 6Mbps



Date: 7.FEB.2018 09:12:29

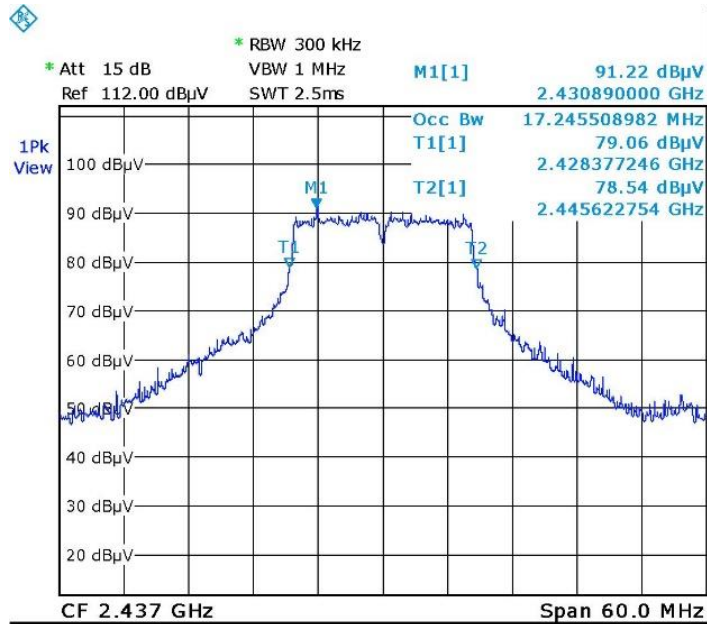
Figure 104 2437.0 MHz, Wi-Fi/g 6Mbps





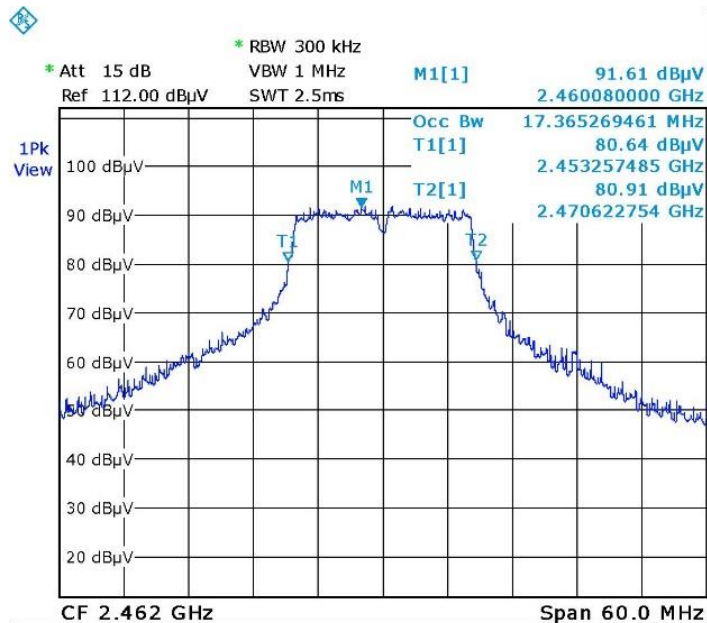
# Occupied Bandwidth

E.U.T Description    Personal Tag  
Model Number        TAG-1410-CUB  
Part Number:        Not designated



Date: 7.FEB.2018 09:15:24

Figure 107 2437.0 MHz, Wi-Fi/g 54Mbps



Date: 7.FEB.2018 09:27:54

Figure 108 2462.0 MHz, Wi-Fi/g 54Mbps

## 11.5 Test Equipment Used; Bandwidth



<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Next Calibration Due</b>
Spectrum Analyzer	R&S	FSL6	100194	March 2, 2017	March 2, 2018
Horn Antenna	ETS	3115	6142	May 19, 2015	May 19, 2018
RF Cable	Commscope ORS	0623 WBC- 400	G020132	October 1, 2017	October 1, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

**Figure 109 Test Equipment Used**

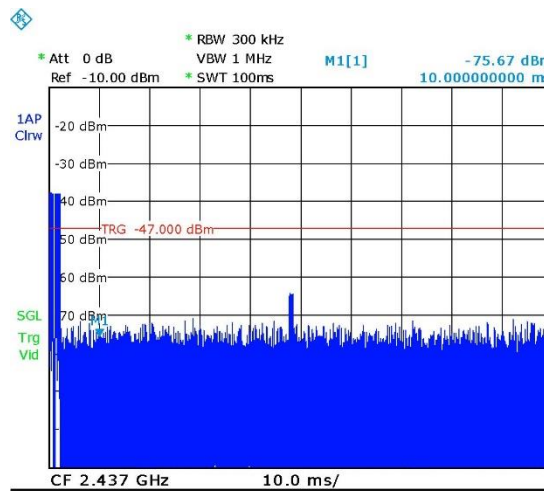
## 12. Avg. Factor Calculation

**For WIFI/b protocol:**

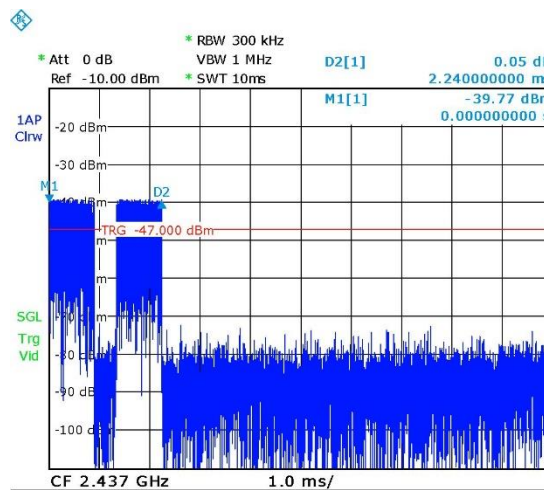
1. Pulse period = 1msec (worst scenario)
2. Pulse duration = 1 msec (worst scenario)
3. Burst duration =2.24msec

$$4. \text{ Average Factor} = 20 \log \left[ \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within 100msec} \right]$$

$$5. \text{ Average Factor} = 20\log [1*2.24/100] = -33.0$$



**Figure 110 — Number of Bursts in 100msec=1**



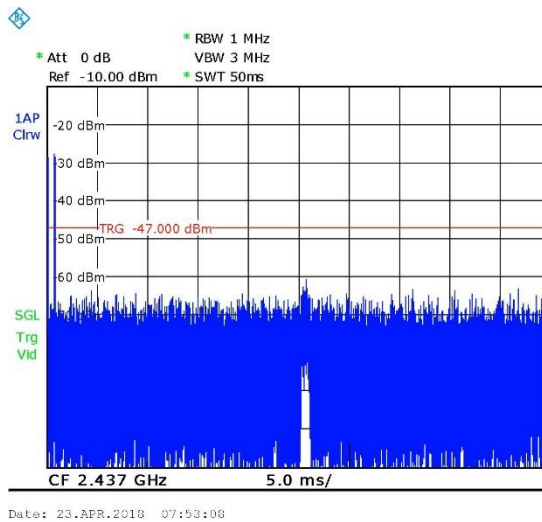
**Figure 111 — Burst Duration =2.24msec**

**For WIFI/g protocol:**

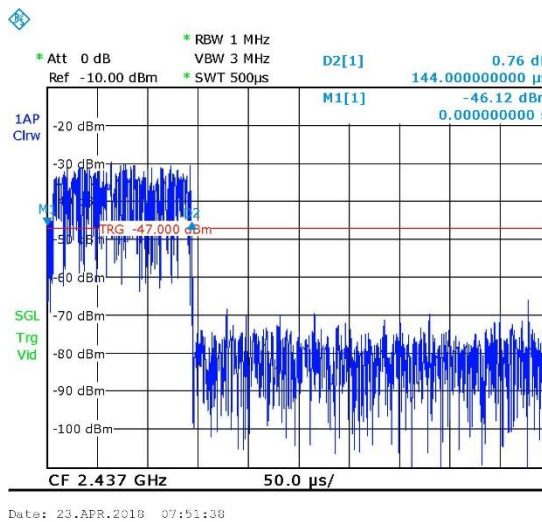
1. Pulse period = 1msec (worst scenario)
2. Pulse duration = 1 msec (worst scenario)
3. Burst duration =msec

$$4. \text{ Average Factor} = 20 \log \left[ \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within 100msec} \right]$$

$$5. \text{ Average Factor} = 20\log [4*0.144/100] = -44.8$$



**Figure 112 — Number of Bursts in 50msec=2, in 100msec=4**



**Figure 113 — Burst Duration =0.144msec**



### 12.1 Test Equipment Used, Average Factor

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Last Calibration Date</b>	<b>Next Calibration Due</b>
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	March 2, 2017	March 2, 2018
Horn antenna	ETS	3115	6142	May 19, 2015	May 19, 2018

**Figure 114 Test Equipment Used**





## 13. Antenna Gain/Information

The antenna gain is -2.0 dBi, printed.



## 14. R.F Exposure/Safety

Typical use of the E.U.T. is as a personal tag.

Separation distance 2mm.

SAR Testing Exclusion Based on Section 4.3.1 and Appendix A of KDB447498 D01 V05 and RSS 102, Issue 5, Section 2.5.2 Requirements

### **For FCC**

Section 4.3.1 and Appendix A of KDB447498 D01 V05 was used as the guidance as follows:

Conducted power = 16.3 dBm

Antenna gain = -2dBi

EIRP = 16.3 + (-2dBi) = 14.3 dBm

Taking into account the -33.0dB AVG factor (page 85)

AVG power = 14.3 - 33 = -18.7dBm = 0.013mW

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}]$

=  $0.013 / 2 * 1.55 = 0.01$  this value is less than 3.0 for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR.

The SAR measurement is not necessary

### **For IC**

For IC per Table 1 of RSS 102 Issue 5, SAR exemption based on IC limit of 4mW at a separation distance of  $\leq 5$ mm at 2450 MHz.

Conducted power = 16.3 dBm

Antenna gain = -2dBi

EIRP = 16.3 + (-2dBi) = 14.3 dBm

Taking into account the -33.0dB AVG factor (page 85)

AVG power = 14.3 - 33 = -18.7dBm = 0.013mW

This is below the 4mW SAR exemption limits.



## 15. APPENDIX A - CORRECTION FACTORS

### 15.1 Correction factors for RF OATS Cable 35m ITL #1879

Frequency (MHz)	Cable loss (dB)
30.0	1.1
50.0	1.1
100.0	1.7
150.0	2.1
200.0	2.5
250.0	2.7
300.0	2.9
350.0	3.1
400.0	3.5
450.0	3.7
500.0	3.9
550.0	4.0
600.0	4.2
650.0	4.4
700.0	4.9
750.0	5.0
800.0	5.0
850.0	4.9
900.0	5.0
950.0	5.1
1000.0	5.4



## 15.2 Correction factor for RF CABLE for Semi Anechoic Chamber

ITL # 1841

FREQ (MHz)	LOSS (dB)
1000.0	1.5
2000.0	2.1
3000.0	2.7
4000.0	3.1
5000.0	3.5
6000.0	4.1
7000.0	4.6
8000.0	4.9
9000.0	5.7
10000.0	5.7
11000.0	6.1
12000.0	6.1
13000.0	6.2
14000.0	6.7
15000.0	7.4
16000.0	7.5
17000.0	7.9
18000.0	8.1
19000.0	8.8
20000.0	9.1

### NOTES:

1. The cable is manufactured by Commscope
2. The cable type is 0623 WBC-400, serial # G020132 and 10m long



**15.3 Correction factors for Active Loop Antenna**

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

**ITL # 1075:**

f(MHz)	MAF(dBs/m)	AF(dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40	11.5
3	-40	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11
10	-40.5	11
20	-41.5	10
30	-43.5	8



**15.4 Correction factors for biconical antenna – ITL # 1356**

**Model: EMCO 3110B**

**Serial No.:9912-3337**

<b>Frequency</b>	<b>ITL 1356 AF</b>
<b>[MHz]</b>	<b>[dB/m]</b>
<b>30</b>	13.00
<b>35</b>	10.89
<b>40</b>	10.59
<b>45</b>	10.63
<b>50</b>	10.12
<b>60</b>	9.26
<b>70</b>	7.74
<b>80</b>	6.63
<b>90</b>	8.23
<b>100</b>	11.12
<b>120</b>	13.16
<b>140</b>	13.07
<b>160</b>	14.80
<b>180</b>	16.95
<b>200</b>	17.17



**15.5 Correction factors for log periodic antenna – ITL # 1349**  
**Model: EMCO 3146**  
**Serial No.:9505-4081**

Frequency [MHz]	ITL 1349 AF [dB/m]
200	11.58
250	12.04
300	14.76
400	15.55
500	17.85
600	18.66
700	20.87
800	21.15
900	22.32
1000	24.22



**15.6 Correction factors for Double –Ridged Waveguide Horn  
ANTENNA**

**Model: 3115**  
**Serial number:29845**  
**3 meter range; ITL # 1352**

<b>FREQUENCY</b>	<b>AFE</b>	<b>FREQUENCY</b>	<b>AFE</b>
<b>(GHz)</b>	<b>(dB/m)</b>	<b>(GHz)</b>	<b>(dB/m)</b>
0.75	25	9.5	38
1.0	23.5	10.0	38.5
1.5	26.0	10.5	38.5
2.0	29.0	11.0	38.5
2.5	27.5	11.5	38.5
3.0	30.0	12.0	38.0
3.5	31.5	12.5	38.5
4.0	32.5	13.0	40.0
4.5	32.5	13.5	41.0
5.0	33.0	14.0	40.0
5.5	35.0	14.5	39.0
6.0	36.5	15.0	38.0
6.5	36.5	15.5	37.5
7.0	37.5	16.0	37.5
7.5	37.5	16.5	39.0
8.0	37.5	17.0	40.0
8.5	38.0	17.5	42.0
9.0	37.5	18.0	42.5





**15.7 Correction factors for**

**Horn Antenna**

**Model: SWH-28  
at 3 meter range.  
ITL #:1353**

**CALIBRATION DATA**

**3 m distance**

Frequency, MHz	Measured antenna factor, dB/m <sup>1)</sup>
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

<sup>1)</sup> The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.