



DATE: 25 February 2019

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

FCC Radio Test Report

for

Orcam Technologies Ltd.

Equipment under test:

Wearable Camera, Vision System

MyEye2, Revision B

Tested by:

M. Zohar

Approved by:

D. Shidlowsky

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This report relates only to items tested.



Measurement/Technical Report for Orcam Technologies Ltd.

Wearable Camera, Vision System

MyEye2, Revision B

FCC ID: 2AAWI-MYEEYE2REVB

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

Equipment type: Digital Transmission System

Limits used: 47CFR15 Section 15.247

Measurement procedure used is KDB 558074 D01 v05 and ANSI C63.10:2013

Application for Certification
prepared by:

R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva St.
Lod 7116002
e-mail Rpinchuck@itlglobal.org

Applicant for this device:
(different from "prepared by")

Ram Ben Yehuda
3 Kiryat Mada St.
PO Box 45157
Jerusalem, 9777603, Israel
Tel: +972-2-591-7805
Fax: +972-2-586-0121
e-mail: : Rami.Ben-Yehuda@orcaml.com



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1. General Information

1.1 Administrative Information

Manufacturer:	Orcam Technologies Ltd.
Manufacturer's Address:	3 Kiryat Mada St. P.O. Box 45157 Jerusalem, 9777603, Israel Tel: +972-2-591-7805 Fax: +972-2-586-0121
Manufacturer's Representative:	Ram Ben-Yehuda
Equipment Under Test (E.U.T):	Wearable Camera, Vision System
Equipment Model No.:	MyEye2, Revision B
Equipment Serial No.:	181600023
Date of Receipt of E.U.T:	June 11, 2018
Start of Test:	June 11, 2018
End of Test:	October 17, 2018
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
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.), 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 MyEye2 Revision B is a vision system that intended to help Visually Impaired. The device can read, recognizes faces, identify objects and products. The system consists wearable camera which can add on glasses and external certified AC/DC adaptor (charger).

Working voltage	3.7VDC Rechargeable battery operated via AC/DC adapter
Mode of operation	Transceiver
Modulations	For Wi-Fi/g: OFDM (BPSK, QPSK, 16QAM, 64QAM) For Wi-Fi/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) For BLE: GFSK
Assigned Frequency Range	2400.0-2483.5MHz
Operating Frequency Range	For Wi-Fi g/n: 2412.0-2462.0MHz For BLE: 2402.0-2480.0MHz
Antenna Gain	-2.0dBi
Modulation BW	For Wi-Fi g/n: 20MHz For BLE: 2MHz
Bit rate (Mbit/s)	For Wi-Fi/g: 6, 9, 12, 18, 24, 36, 48, 54 For Wi-Fi/n: 6.5, 13, 19.5, 26, 39, 52, 58.5 ,65 For BLE: 1, 2, 3

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v05 and ANSI C63.10: 2013. 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

Conducted Emission

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

0.15 – 30 MHz:

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

± 3.44 dB

Radiated Emission

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

for open site:

30-1000MHz:

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

± 4.96 dB



1 GHz to 6 GHz

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

± 5.19 dB

>6 GHz

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

± 5.51 dB

2. System Test Configuration

2.1 Justification

1. The E.U.T contains 2 optional transceivers: IEEE 802.15.1 standard (BLE) or IEEE 802.11g/n standard (Wi-Fi/g/n) with only 20MHz CBW.
2. For BLE - The unit was evaluated while transmitting at the low channel (2402MHz), the mid channel (2440MHz) and the high channel (2480MHz).
For Wi-Fi g/n - The unit was evaluated while transmitting at the low channel (2412MHz), the mid channel (2437MHz) and the high channel (2462MHz).
3. The evaluation was performed while the E.U.T was connected to typical AC/DC adapter via laptop for charge mode as the “worst case”.
4. Conducted emission on AC line evaluation was performed with 2 optional charge modes: AC/DC adapter via laptop & AC/DC adapter wall charger.
5. Final radiated emission for Wi-Fi g/n modes tests were performed using the lowest and highest bit rates for each different protocol type. The bit rates for each protocol are shown in the table below:

Protocol type	“worst case” bit rate
Wi-Fi/g	6, 54 Mbit/s
Wi-Fi/n	6.5, 65 Mbit/s (MCS0, MCS7)

6. Final radiated emission tests was performed after exploratory emission testing that was performed in 3 orthogonal polarities to determine the “worst case” radiation.
7. The results are shown on the following tables.

Orientation	Frequency	Field Strength	2 nd Harmonic	3 rd Harmonic	Band Edge
	(MHz)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)
X axis	2402.0	91.1	47.0	58.0	61.0
	2440.0	91.8	47.1	57.5	-
	2480.0	91.7	47.0	57.5	62.2
Y axis	2402.0	90.6	46.9	57.5	60.9
	2440.0	90.4	46.9	57.4	-
	2480.0	90.8	48.5	59.0	61.5
Z axis	2402.0	90.2	38.0	54.0	60.0
	2440.0	89.3	47.3	52.4	-
	2480.0	90.0	54.4	56.3	61.1

Figure 1. Screening Results BLE Mode

According to above results, for BLE the “worst case” for fundamental & spurious emission was the X axis for all channels except for spurious emission for high channel which was the Y axis.

Orientation	Frequency	Field Strength	2 nd Harmonic	3 rd Harmonic	Band Edge
	(MHz)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)
X axis	2412.0	98.8	49.2	60.0	60.5
	2437.0	97.7	50.3	59.1	-
	2462.0	99.2	49.9	59.5	60.8
Y axis	2412.0	98.4	48.9	59.6	60.1
	2437.0	95.7	48.9	59.0	-
	2462.0	96.6	51.5	60.7	60.2
Z axis	2412.0	98.5	39.2	56.4	59.9
	2437.0	97.2	48.8	53.3	-
	2462.0	99.2	56.5	56.9	60.6

Figure 2. Screening Results Wi-Fi mode

According to above results, for WiFi, the “worst case” for fundamental & spurious emission was the X axis for all channels except for spurious emission for high channel which was the Y axis.

2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

Equipment	Manufacturer	Part #	Serial #
laptop	DELL	N/A	N/A
AC/DC adapter	DELL	NSW26272	N/A
AC/DC wall charger	EDACPOWER ELEC.	EM1005AVEU	171531626

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

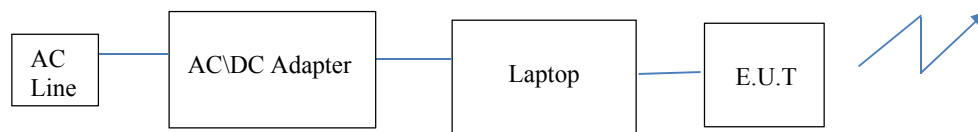


Figure 3. Configuration of Tested System

3. Conducted & Radiated Measurement Test Set-Up Photos



Figure 4. Conducted Emission from AC Line Test, AC/DC adapter via laptop charge mode



Figure 5. Conducted Emission from AC Line Test, AC/DC wall charger mode



Figure 6. Radiated Emission Test, 0.009-30MHz



Figure 7. Radiated Emission Test, 30-200MHz



Figure 8. Radiated Emission Test, 200-1000MHz



Figure 9. Radiated Emission Test, 1-18GHz



Figure 10. Radiated Emission Test, 18-25GHz

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 (61%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 μ 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 μ 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 4.9 dB

The margin between the emission levels and the specification limit is, in the worst case, 10.49 dB for the phase line at 0.410 MHz and 4.9 dB at 0.410 MHz for the neutral line.

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

The details of the highest emissions are given in *Figure 11* to *Figure 18*.

Conducted Emission

E.U.T Description: Wearable Camera, Vision System
Type: MyEye2, Revision B
Serial Number: 181600023

Specification: FCC Part 15, Subpart C
Lead: Phase
Detectors: : Peak, Quasi-peak, Average
Power Operation: AC/DC adapter via laptop

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB	
1 Quasi Peak	162 kHz	34.24	-31.12	
2 Average	170 kHz	21.21	-33.74	
2 Average	406 kHz	27.03	-20.69	
1 Quasi Peak	410 kHz	33.95	-23.69	
2 Average	438 kHz	31.30	-15.79	
1 Quasi Peak	442 kHz	37.01	-20.01	
1 Quasi Peak	750 kHz	19.82	-36.17	
2 Average	1.118 MHz	19.85	-26.14	
2 Average	1.694 MHz	18.21	-27.78	
1 Quasi Peak	1.802 MHz	29.87	-26.12	
1 Quasi Peak	2.162 MHz	30.93	-25.06	
2 Average	2.162 MHz	19.98	-26.01	
1 Quasi Peak	4.782 MHz	17.01	-38.98	
2 Average	5.038 MHz	14.68	-35.31	
1 Quasi Peak	10.066 MHz	23.13	-36.87	
2 Average	10.066 MHz	16.24	-33.75	
1 Quasi Peak	10.526 MHz	20.60	-39.39	
2 Average	15.102 MHz	16.65	-33.34	
2 Average	25.174 MHz	20.66	-29.33	
1 Quasi Peak	25.182 MHz	25.27	-34.72	

Date: 17.OCT.2018 10:09:14

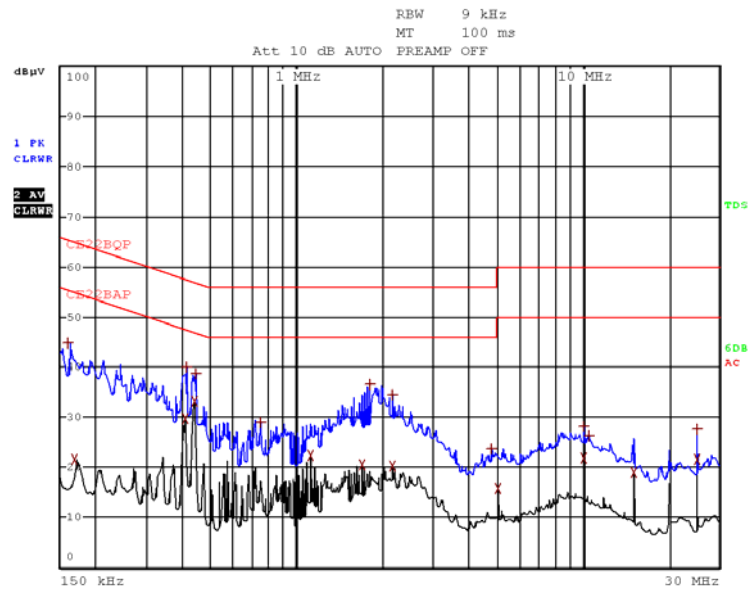
Figure 11. Detectors: Peak, Quasi-peak, Average

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 Wearable Camera,
Vision System
Type MyEye2, Revision B
Serial Number: 181600023

Specification: FCC Part 15, Subpart C
Lead: Phase
Detectors: Peak, Quasi-peak, Average
Power Operation AC/DC adapter via laptop



Date: 17.OCT.2018 10:07:49

Figure 12. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description Wearable Camera,
Vision System
Type MyEye2, Revision B
Serial Number: 181600023

Specification: FCC Part 15, Subpart C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average
Power Operation AC/DC adapter via laptop

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV	DELTA	LIMIT dB
1 Quasi Peak	154 kHz	36.67	-29.11	
2 Average	238 kHz	20.21	-31.95	
1 Quasi Peak	406 kHz	36.45	-21.27	
2 Average	406 kHz	28.89	-18.83	
2 Average	438 kHz	31.39	-15.70	
1 Quasi Peak	442 kHz	37.89	-19.13	
2 Average	1.118 MHz	14.52	-31.47	
1 Quasi Peak	1.202 MHz	17.12	-38.87	
2 Average	1.726 MHz	15.01	-30.99	
1 Quasi Peak	1.882 MHz	28.71	-27.28	
1 Quasi Peak	2.202 MHz	27.85	-28.14	
2 Average	2.374 MHz	16.72	-29.27	
1 Quasi Peak	4.742 MHz	18.02	-37.98	
2 Average	5.034 MHz	15.61	-34.38	
1 Quasi Peak	10.07 MHz	23.85	-36.14	
2 Average	10.07 MHz	20.01	-29.99	
2 Average	15.102 MHz	18.41	-31.58	
1 Quasi Peak	15.106 MHz	21.37	-38.62	
1 Quasi Peak	25.166 MHz	24.11	-35.88	
2 Average	25.174 MHz	18.40	-31.59	

Date: 17.OCT.2018 10:19:38

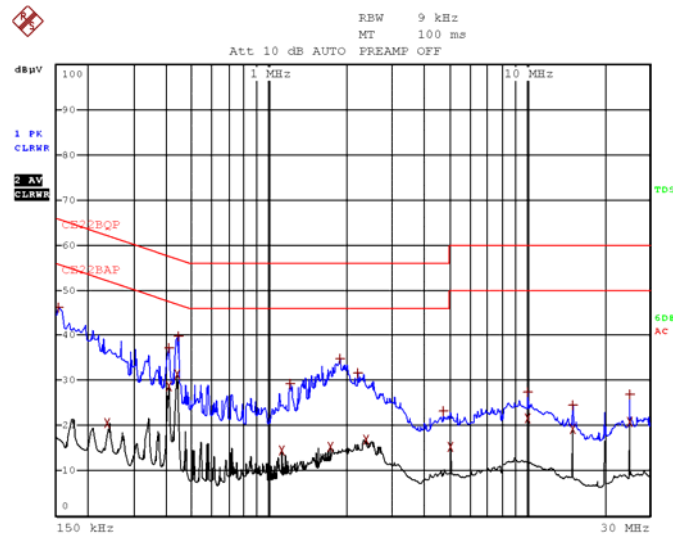
Figure 13. Detectors: Peak, Quasi-peak, Average

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 Wearable Camera,
Vision System
Type MyEye2, Revision B
Serial Number: 181600023

Specification: FCC Part 15, Subpart C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average
Power Operation AC/DC adapter via laptop



Date: 17.OCT.2018 10:18:07

Figure 14 Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description: Wearable Camera,
Vision System
Type: MyEye2, Revision B
Serial Number: 181600023

Specification: FCC Part 15, Subpart C
Lead: Phase
Detectors: : Peak, Quasi-peak, Average
Power Operation AC/DC wall charger

EDIT PEAK LIST (Final Measurement Results)			
Trace1:	CE22BQP		
Trace2:	CE22BAP		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
1 Quasi Peak	234 kHz	43.01	-19.29
2 Average	234 kHz	29.23	-23.07
2 Average	406 kHz	36.72	-11.00
1 Quasi Peak	410 kHz	47.15	-10.49
1 Quasi Peak	642 kHz	37.19	-18.80
2 Average	642 kHz	25.41	-20.58
1 Quasi Peak	814 kHz	39.66	-16.33
2 Average	1.166 MHz	25.84	-20.15
2 Average	1.282 MHz	25.10	-20.89
1 Quasi Peak	1.506 MHz	32.58	-23.41
1 Quasi Peak	2.162 MHz	34.40	-21.59
2 Average	2.162 MHz	21.21	-24.78
1 Quasi Peak	3.926 MHz	26.63	-29.36
2 Average	5.034 MHz	29.73	-20.26
1 Quasi Peak	6.87 MHz	33.89	-26.10
2 Average	10.07 MHz	32.07	-17.92
1 Quasi Peak	15.11 MHz	34.90	-25.09
2 Average	15.11 MHz	27.93	-22.07
1 Quasi Peak	18.894 MHz	28.29	-31.70
2 Average	20.146 MHz	21.27	-28.73

Date: 17.OCT.2018 10:53:14

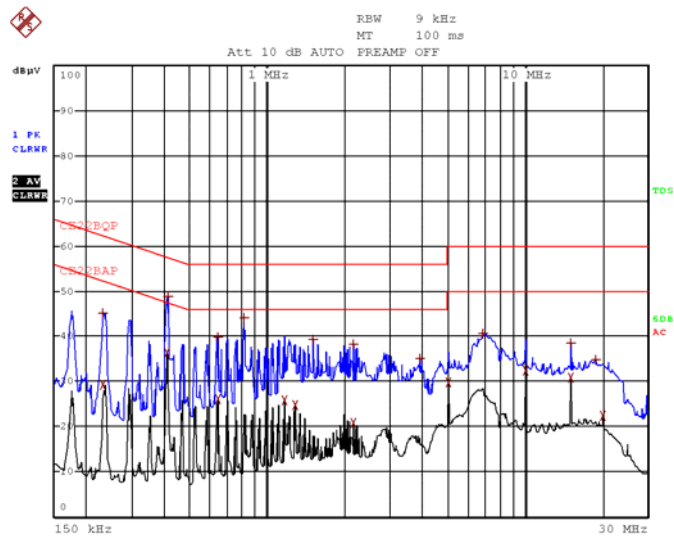
Figure 15. Detectors: Peak, Quasi-peak, Average

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 Wearable Camera,
Vision System
Type MyEye2, Revision B
Serial Number: 181600023

Specification: FCC Part 15, Subpart C
Lead: Phase
Detectors: Peak, Quasi-peak, Average
Power Operation AC/DC wall charger



Date: 17.OCT.2018 10:50:44

Figure 16. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description: Wearable Camera,
Vision System
Type: MyEye2, Revision B
Serial Number: 181600023

Specification: FCC Part 15, Subpart C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average
Power Operation: AC/DC wall charger

EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CE22BQP			
Trace2:	CE22BAP			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV	DELTA	LIMIT dB
1 Quasi Peak	234 kHz	43.54	-18.76	
2 Average	234 kHz	35.14	-17.15	
1 Quasi Peak	410 kHz	49.93	-7.71	
2 Average	410 kHz	42.74	-4.90	
1 Quasi Peak	638 kHz	39.42	-16.57	
2 Average	702 kHz	31.66	-14.33	
1 Quasi Peak	818 kHz	44.13	-11.86	
2 Average	1.11 MHz	30.33	-15.67	
1 Quasi Peak	1.274 MHz	36.37	-19.62	
2 Average	1.286 MHz	30.91	-15.08	
1 Quasi Peak	2.154 MHz	33.36	-22.63	
2 Average	2.166 MHz	23.68	-22.31	
1 Quasi Peak	3.666 MHz	27.79	-28.20	
2 Average	5.034 MHz	28.29	-21.70	
1 Quasi Peak	10.066 MHz	34.57	-25.42	
2 Average	10.074 MHz	30.01	-19.98	
1 Quasi Peak	15.106 MHz	35.64	-24.35	
2 Average	15.106 MHz	28.64	-21.35	
2 Average	20.138 MHz	20.23	-29.76	
1 Quasi Peak	22.958 MHz	26.41	-33.58	

Date: 17.OCT.2018 10:44:01

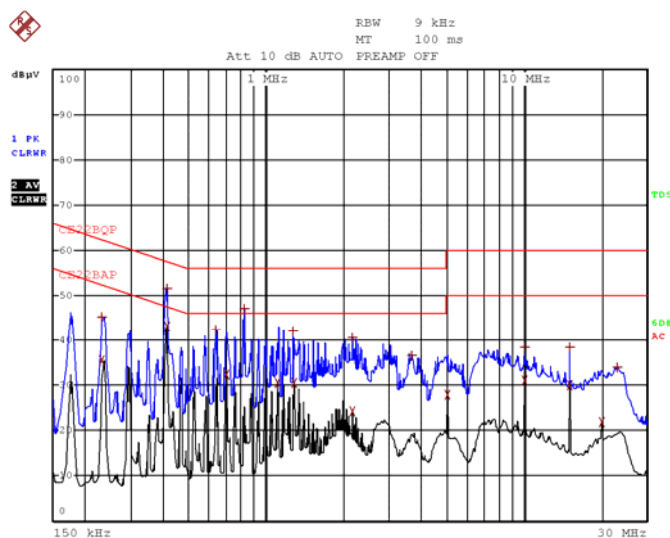
Figure 17. Detectors: Peak, Quasi-peak, Average

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 Wearable Camera,
Vision System
Type MyEye2, Revision B
Serial Number: 181600023

Specification: FCC Part 15, Subpart C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average
Power Operation AC/DC wall charger



Date: 17.OCT.2018 10:39:55

Figure 18 Detectors: Peak, Quasi-peak, Average

4.5 Test Equipment Used; Conducted Emission

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
LISN	Fischer	FCC-LISN-25A	127	July 20, 2018	July 31, 2019
Transient Limiter	HP	11947A	3107A03041	June 25, 2018	June 25, 2019
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 19, 2018	February 28, 2019
Low Loss Cable	Huber Suner	-	705A009301 EIM	October 1, 2017	October 21, 2018

Figure 19 Test Equipment Used

5. 6 dB Minimum Bandwidth

5.1 Test Specification

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

5.2 Test Procedure

(Temperature (22°C)/ Humidity (61%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

Protocol Type	Operation Frequency	Reading	Limit
	(MHz)	(kHz)	(kHz)
BLE	2402.0	706.6	>500.0
	2440.0	708.6	>500.0
	2480.0	712.6	>500.0
Wi-fi/g(6Mbit/s)	2412.0	15,090.0	>500.0
	2437.0	16,128.0	>500.0
	2462.0	15,509.0	>500.0
Wi-fi/g(54Mbit/s)	2412.0	15,888.0	>500.0
	2437.0	16,048.0	>500.0
	2462.0	16,407.0	>500.0
Wi-fi/n(6.5Mbit/s)	2412.0	15,888.0	>500.0
	2437.0	17,246.0	>500.0
	2462.0	17,246.0	>500.0
Wi-fi/n(65Mbit/s)	2412.0	15,729.0	>500.0
	2437.0	16,367.0	>500.0
	2462.0	15,729.0	>500.0

Figure 20 6 dB Minimum Bandwidth



JUDGEMENT: Passed

For additional information see *Figure 21* to *Figure 35*.

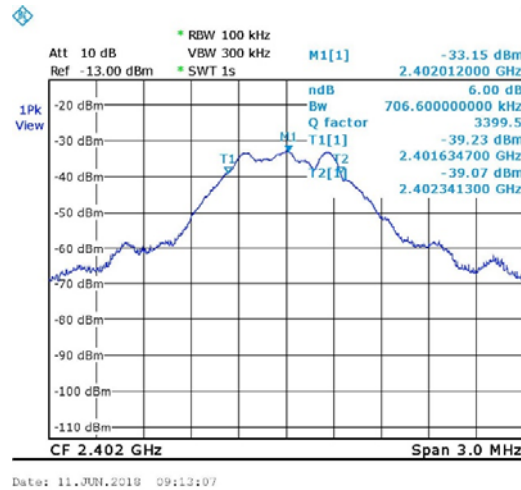


Figure 21. 2402.0 MHz, BLE

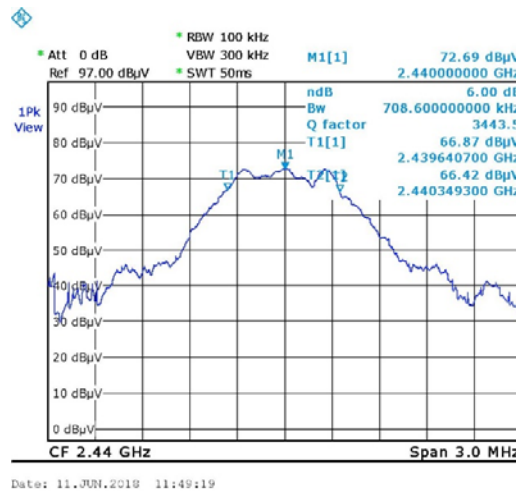


Figure 22. 2440.0 MHz, BLE

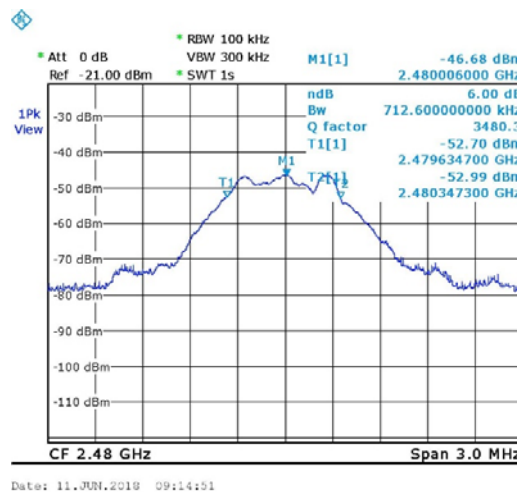


Figure 23. 2480.0 MHz, BLE

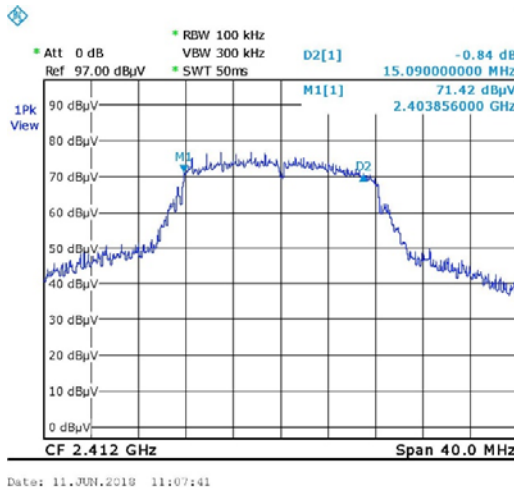


Figure 24. 2412.0 MHz, Wi-fi/g(6Mbit/s)

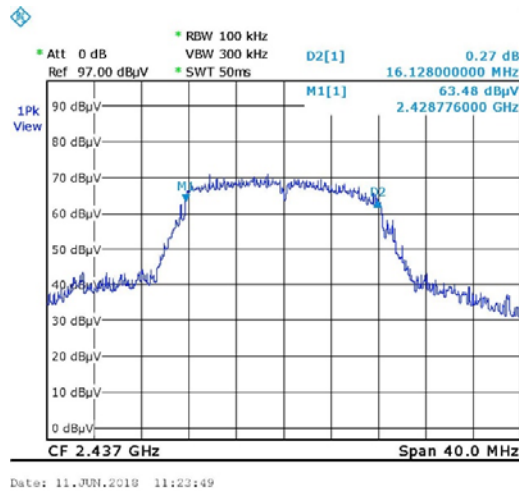


Figure 25. 2437.0 MHz, Wi-fi/g(6Mbit/s)

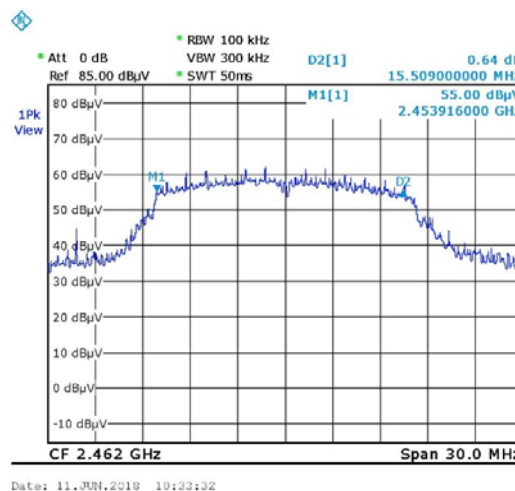


Figure 26. 2462.0 MHz, Wi-fi/g(6Mbit/s)

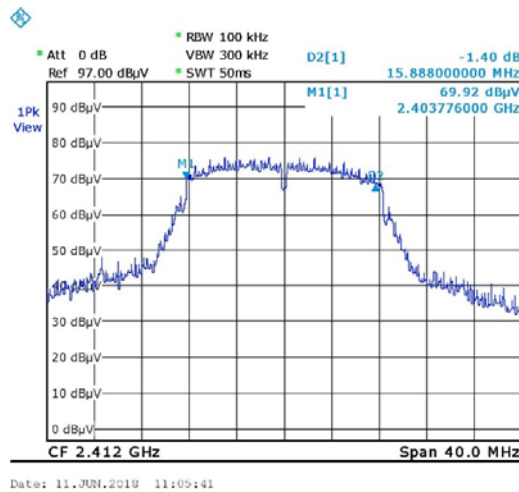


Figure 27. 2412.0 MHz, Wi-fi/g(54Mbit/s)

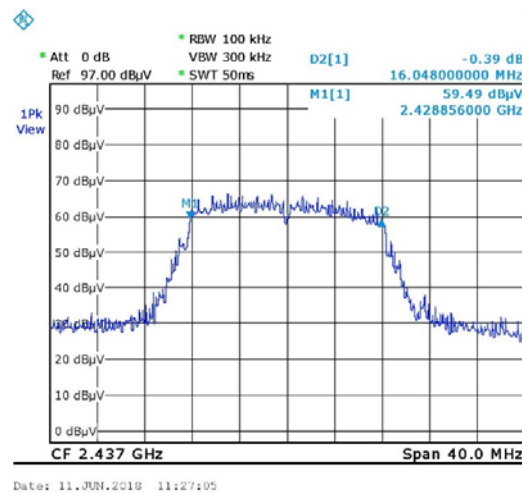


Figure 28. 2437.0 MHz, Wi-fi/g(54Mbit/s)

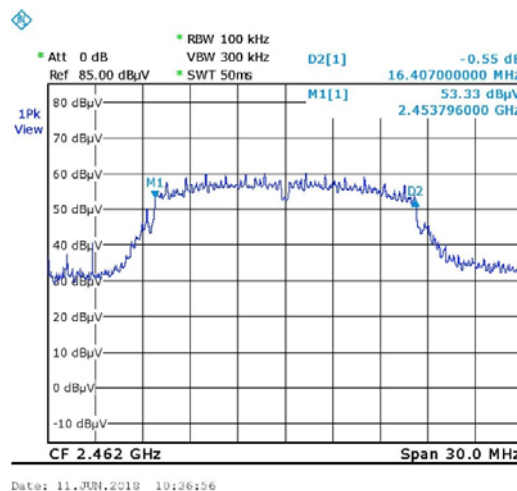
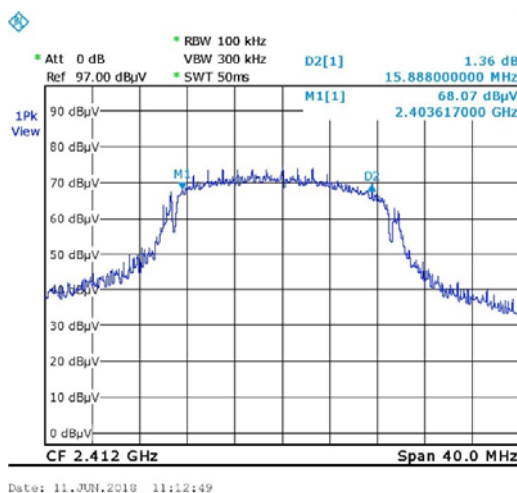
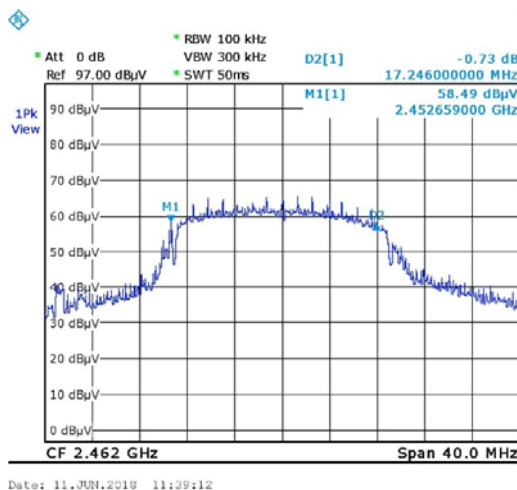


Figure 29. 2462.0 MHz, Wi-fi/g(54Mbit/s)



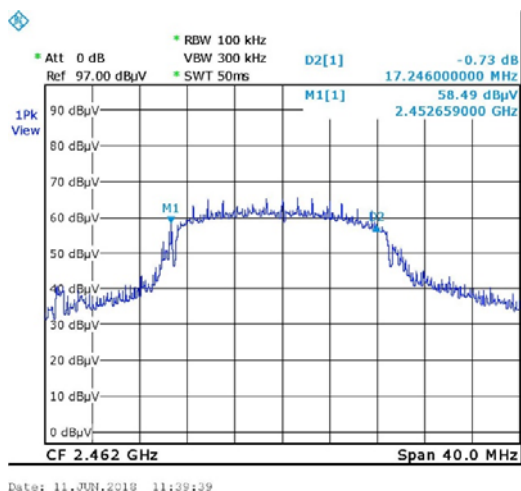
Date: 11.JUN.2019 11:12:49

Figure 30. 2412.0 MHz, Wi-fi/n(6.5Mbit/s)



Date: 11.JUN.2019 11:39:12

Figure 31. 2437.0 MHz, Wi-fi/n(6.5Mbit/s)



Date: 11.JUN.2019 11:39:39

Figure 32. 2462.0 MHz, Wi-fi/n(6.5Mbit/s)

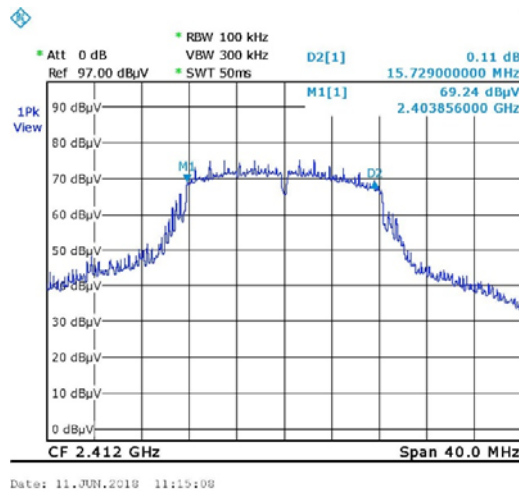


Figure 33. 2412.0 MHz, Wi-fi/n(65Mbit/s)

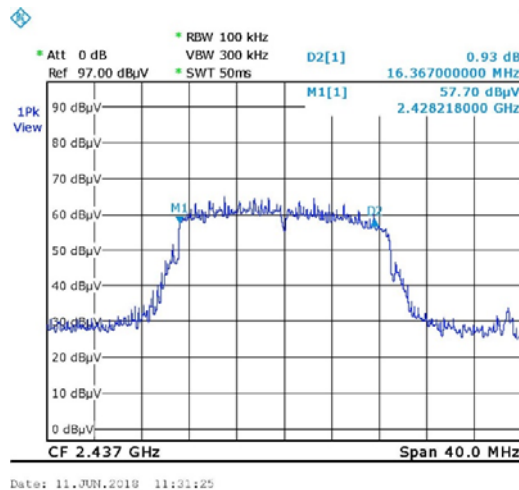


Figure 34. 2437.0 MHz, Wi-fi/n(65Mbit/s)

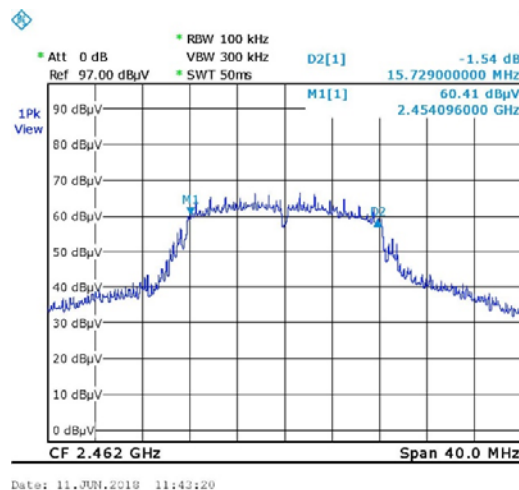


Figure 35. 2462.0 MHz, Wi-fi/n(65Mbit/s)



5.5 Test Equipment Used; 6dB Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 19, 2019
Horn Antenna	ETS	3115	6142	May 31, 2018	May 31, 2021
RF Cable	Commscope ORS	0623 WBC- 400	G020132	October 1, 2017	October 31, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 36 Test Equipment Used

6. Maximum Conducted Output Power

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 (21°C)/ Humidity (60%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.

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

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

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 5725-5850 MHz bands: 1 Watt.

6.4 Test Results

Protocol Type	Operation Frequency (MHz)	Pol. (V/H)	Field Strength (dBuV/m)	EIRP (dBm)	Ant. Gain (dBi)	Conducted Power (dBm)	Conducted Power (mW)	Limit (mW)	Margin (mW)
BLE	2402.0	V	91.8	-3.4	-2.0	-1.4	0.7	1000.0	-999.3
		H	83.4	-11.8	-2.0	-9.8	0.1	1000.0	-999.9
	2440.0	V	91.3	-3.9	-2.0	-1.9	0.6	1000.0	-999.4
		H	86.1	-9.1	-2.0	-7.1	0.2	1000.0	-999.8
	2480.0	V	91.7	-3.5	-2.0	-1.5	0.7	1000.0	-999.3
		H	85.8	-9.4	-2.0	-7.4	0.2	1000.0	-999.8
Wi-fi/g(6Mbit/s)	2412.0	V	97.5	2.3	-2.0	4.3	2.7	1000.0	-997.3
		H	99.6	4.4	-2.0	6.4	4.4	1000.0	-995.6
	2437.0	V	97.1	1.9	-2.0	3.9	2.4	1000.0	-997.6
		H	98.3	3.1	-2.0	5.1	3.2	1000.0	-996.8
	2462.0	V	98.8	3.6	-2.0	5.6	3.6	1000.0	-996.4
		H	100.2	5.0	-2.0	7.0	5.0	1000.0	-995.0
Wi-fi/g(54Mbit/s)	2412.0	V	96.0	0.8	-2.0	2.8	2.0	1000.0	-998.0
		H	98.9	3.7	-2.0	5.7	3.7	1000.0	-996.3
	2437.0	V	96.0	0.8	-2.0	2.8	2.0	1000.0	-998.0
		H	97.5	2.3	-2.0	4.3	2.7	1000.0	-997.3
	2462.0	V	97.4	2.2	-2.0	4.2	2.6	1000.0	-997.4
		H	99.2	4.0	-2.0	6.0	4.0	1000.0	-996.0
Wi-fi/n(6.5Mbit/s)	2412.0	V	95.1	-0.1	-2.0	1.9	1.5	1000.0	-998.5
		H	98.6	3.4	-2.0	5.4	3.4	1000.0	-996.6
	2437.0	V	95.4	0.2	-2.0	2.2	1.6	1000.0	-998.4
		H	98.2	3.0	-2.0	5.0	3.1	1000.0	-996.9
	2462.0	V	97.3	2.1	-2.0	4.1	2.6	1000.0	-997.4
		H	101.7	6.5	-2.0	8.5	7.1	1000.0	-992.9
Wi-fi/n(65Mbit/s)	2412.0	V	94.3	-0.9	-2.0	1.1	1.2	1000.0	-998.8
		H	96.7	1.5	-2.0	3.5	2.2	1000.0	-997.8
	2437.0	V	93.8	-1.4	-2.0	0.6	1.1	1000.0	-998.9
		H	96.7	1.5	-2.0	3.5	2.2	1000.0	-997.8
	2462.0	V	96.6	1.4	-2.0	3.4	2.2	1000.0	-997.8
		H	99.7	4.5	-2.0	6.5	4.4	1000.0	-995.6

Figure 37 Maximum Peak Power Output



JUDGEMENT: Passed by -992.9 mW
For additional information see *Figure 38* to *Figure 67*.

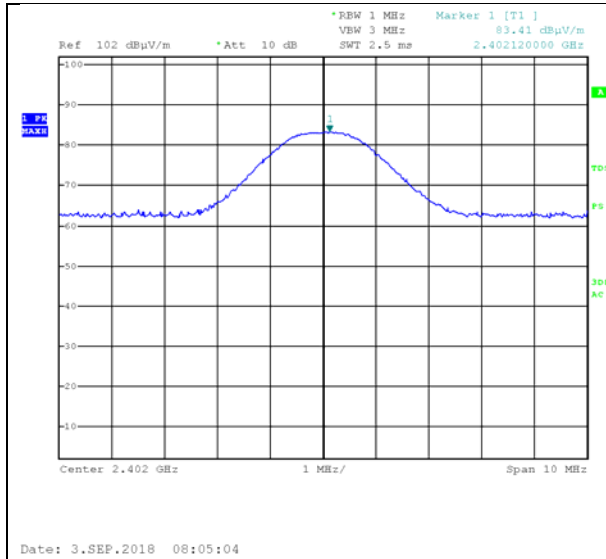


Figure 38. 2402.0 MHz, BLE, Vertical

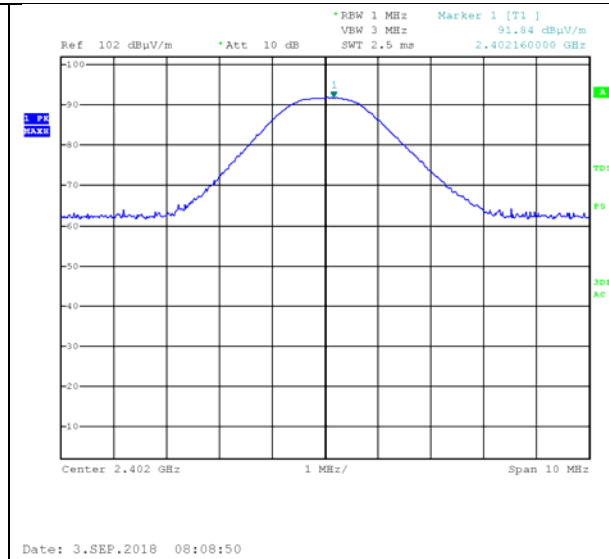


Figure 39. 2402.0 MHz, BLE, Horizontal

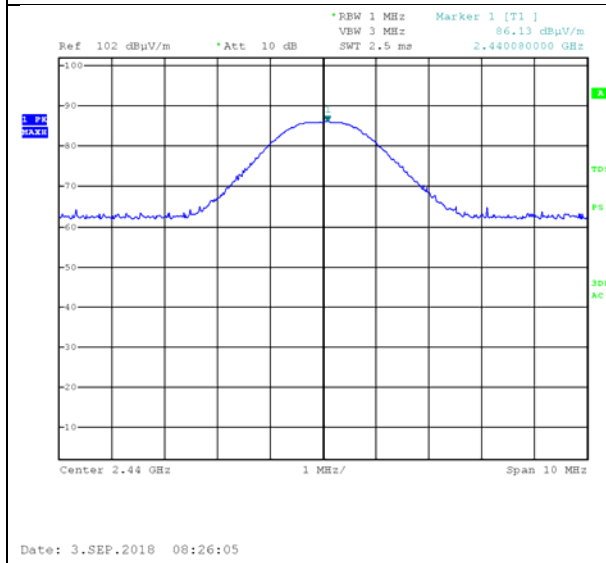


Figure 40. 2440.0 MHz, BLE, Vertical

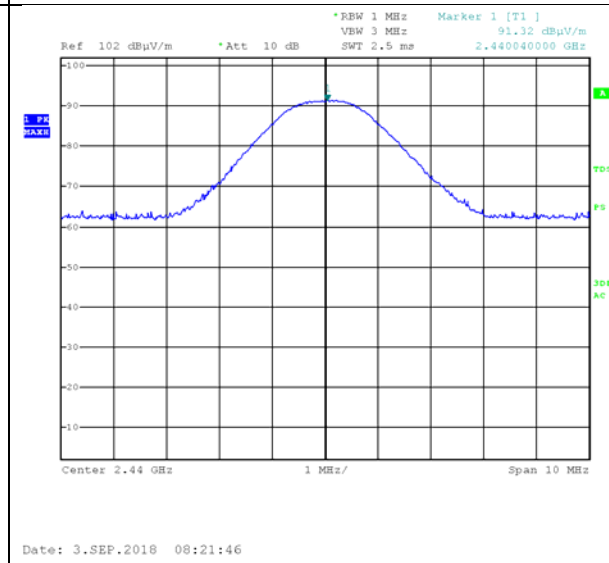


Figure 41. 2440.0 MHz, BLE, Horizontal

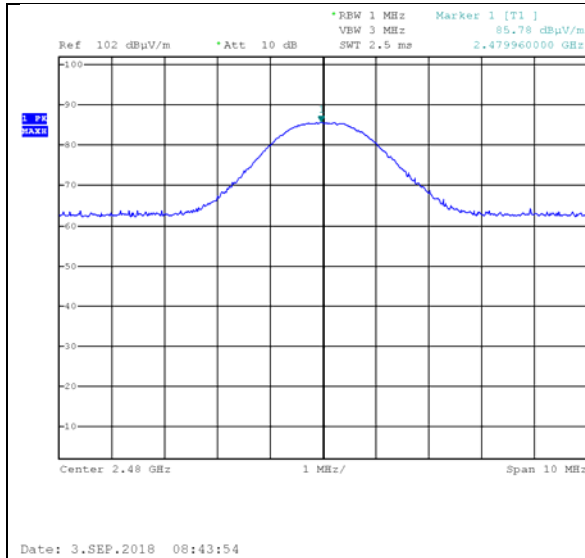


Figure 42. 2480.0 MHz, BLE, Vertical

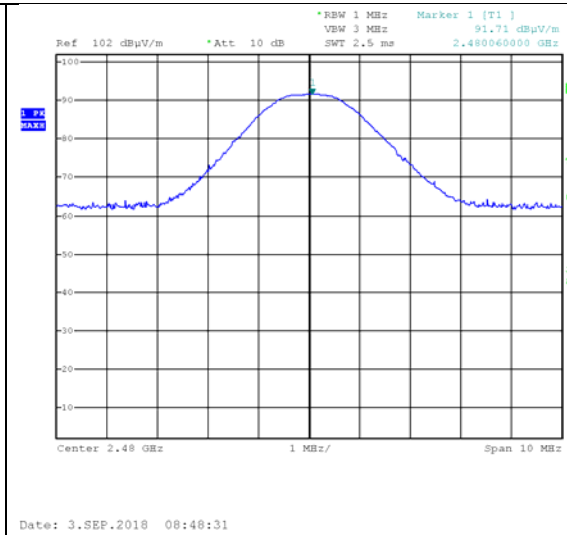


Figure 43. 2480.0 MHz, BLE, Horizontal

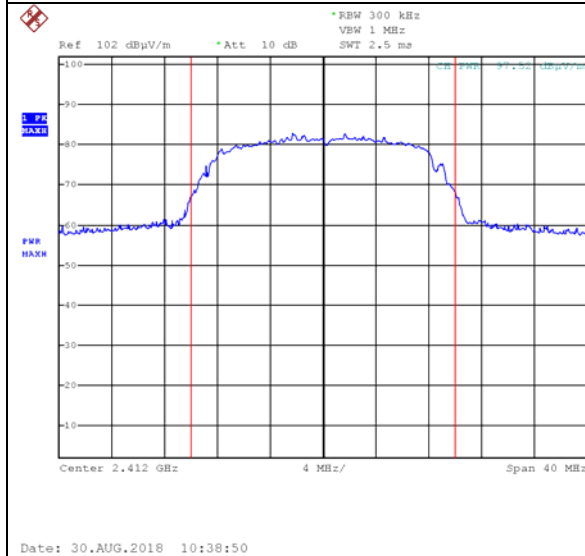


Figure 44. 2412.0 MHz, Wi-fi/g(6Mbit/s), Vertical

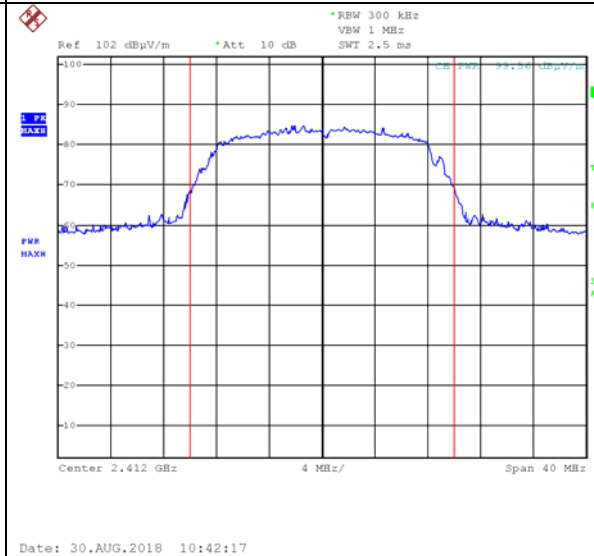


Figure 45. 2412.0 MHz, Wi-fi/g(6Mbit/s), Horizontal

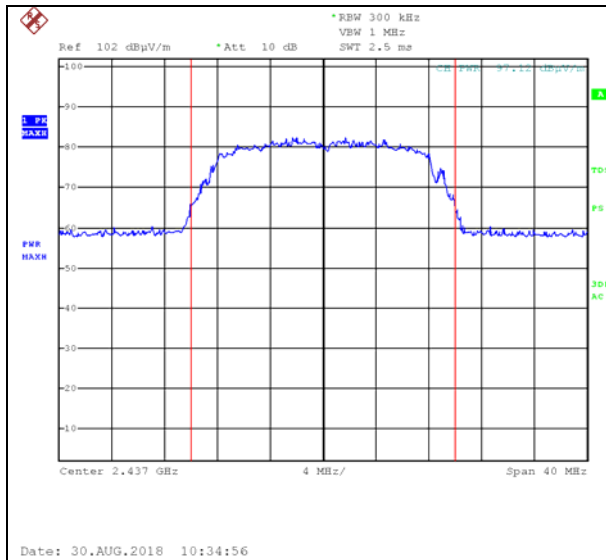


Figure 46. 2437.0 MHz, Wi-fi/g(6Mbit/s), Vertical

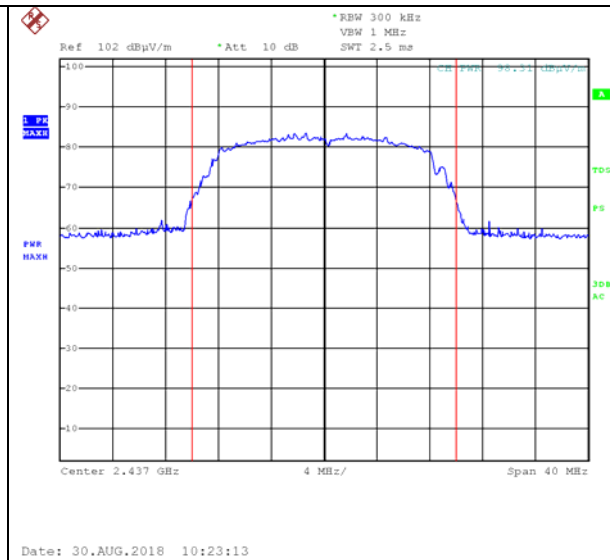


Figure 47. 2437.0 MHz, Wi-fi/g(6Mbit/s), Horizontal

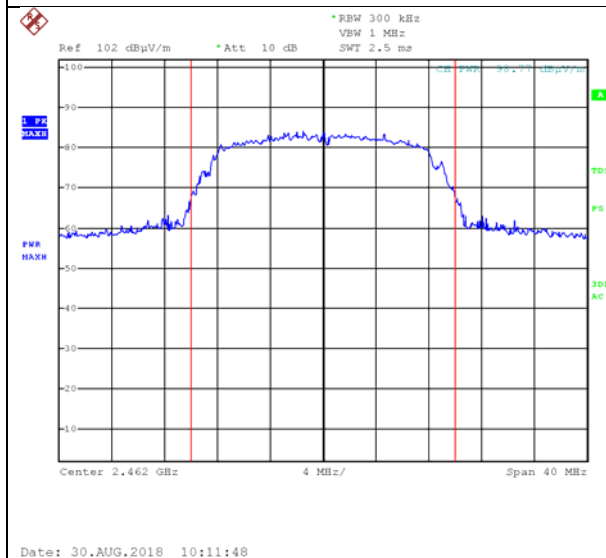


Figure 48. 2462.0 MHz, Wi-fi/g(6Mbit/s), Vertical

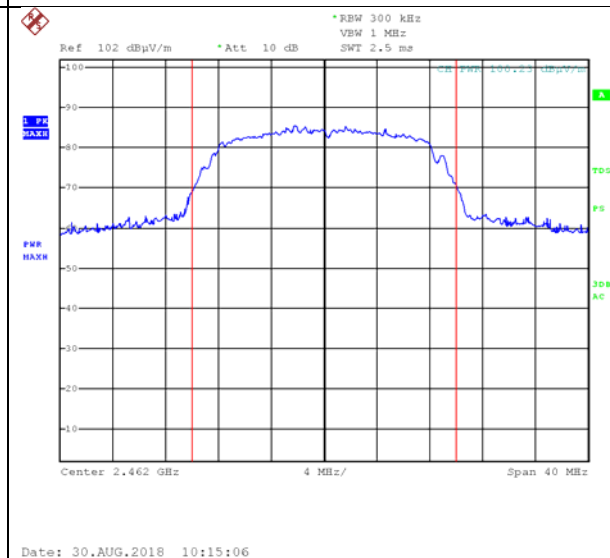


Figure 49. 2462.0 MHz, Wi-fi/g(6Mbit/s), Horizontal

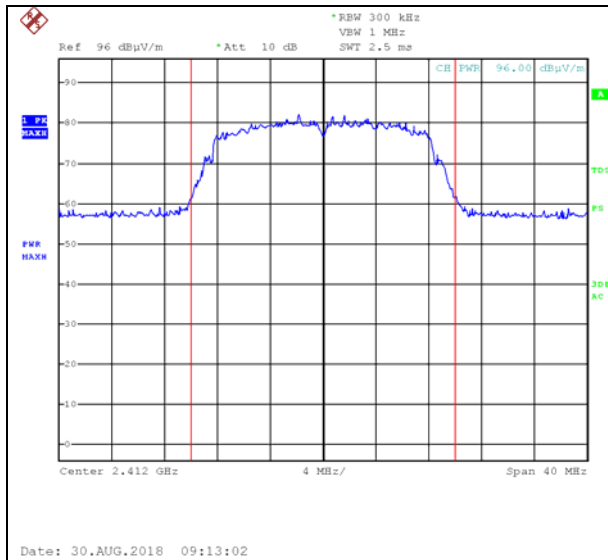


Figure 50. 2412.0 MHz, Wi-fi/g(54Mbit/s), Vertical

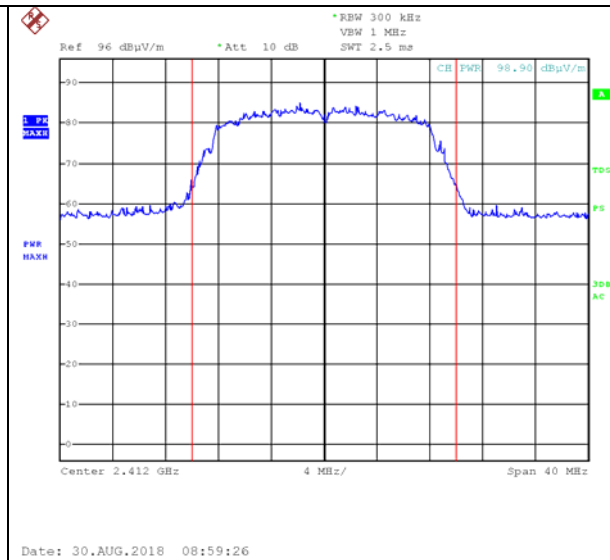


Figure 51. 2412.0 MHz, Wi-fi/g(54Mbit/s), Horizontal

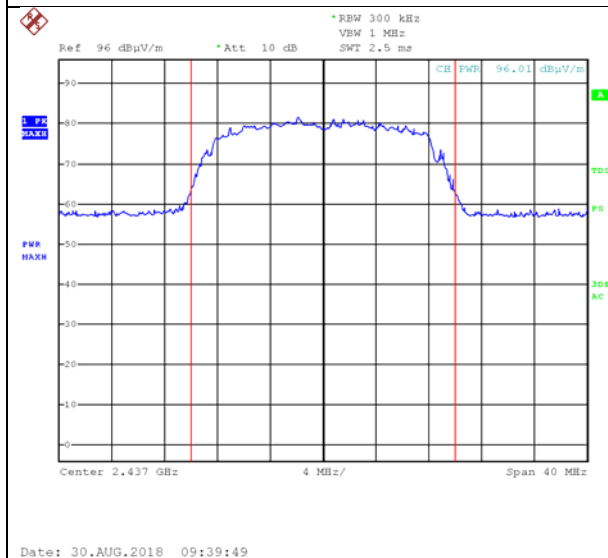


Figure 52. 2437.0 MHz, Wi-fi/g(54Mbit/s), Vertical

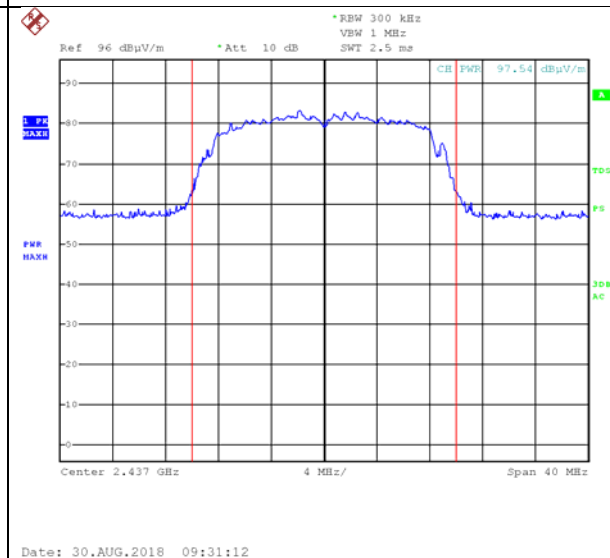


Figure 53. 2437.0 MHz, Wi-fi/g(54Mbit/s), Horizontal

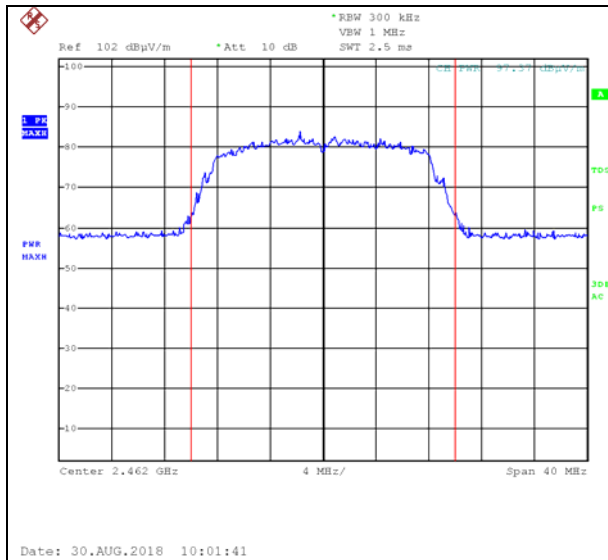


Figure 54. 2462.0 MHz, Wi-fi/g(54Mbit/s), Vertical

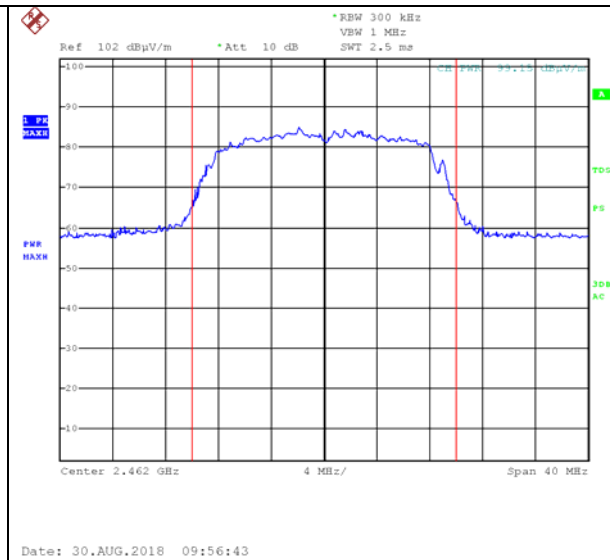


Figure 55. 2462.0 MHz, Wi-fi/g(54Mbit/s), Horizontal

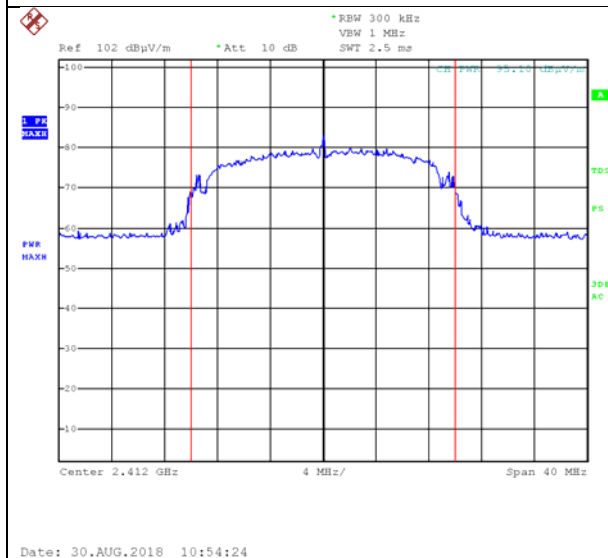


Figure 56. 2412.0 MHz, Wi-fi/n(6.5Mbit/s), Vertical

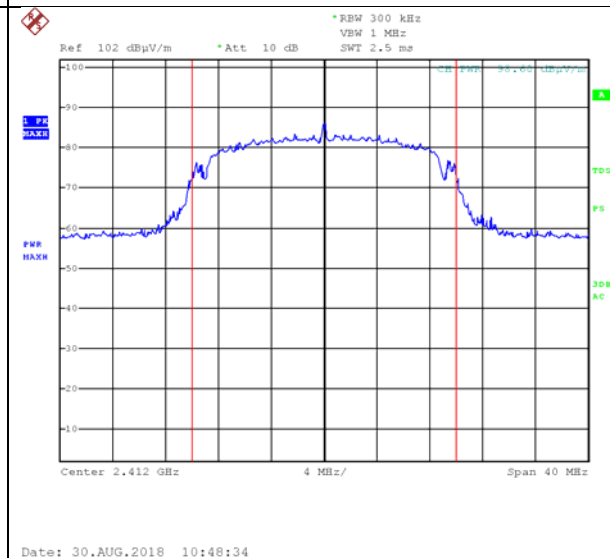


Figure 57. 2412.0 MHz, Wi-fi/n(6.5Mbit/s), Horizontal

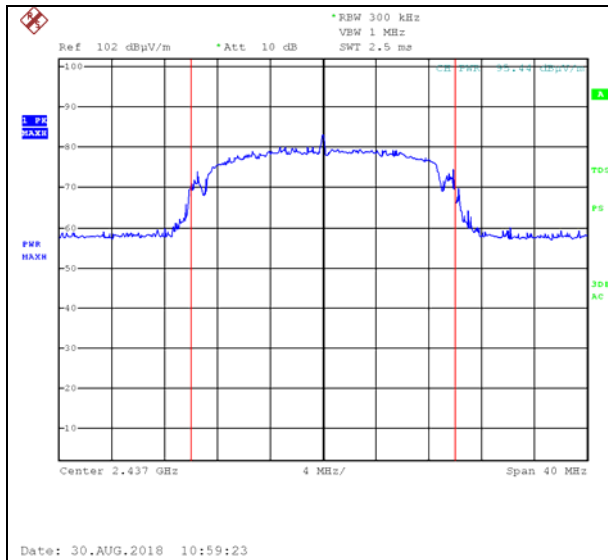


Figure 58. 2437.0 MHz, Wi-fi/n(6.5Mbit/s), Vertical

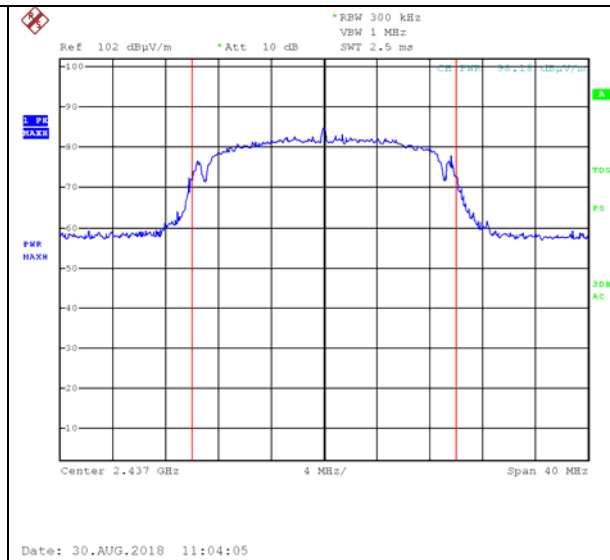


Figure 59. 2437.0 MHz, Wi-fi/n(6.5Mbit/s), Horizontal

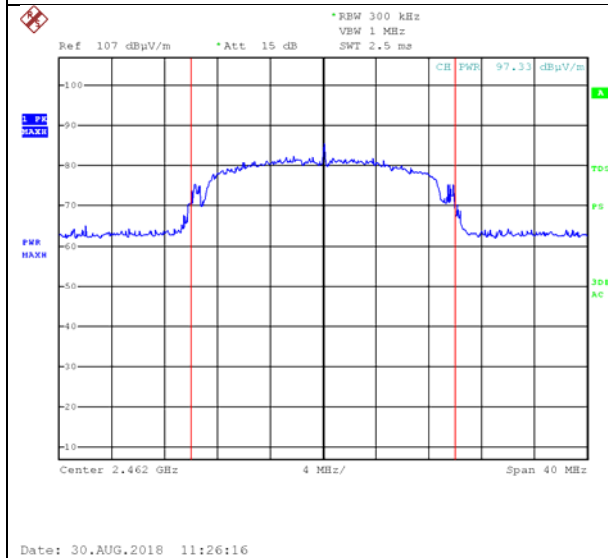


Figure 60. 2462.0 MHz, Wi-fi/n(6.5Mbit/s), Vertical

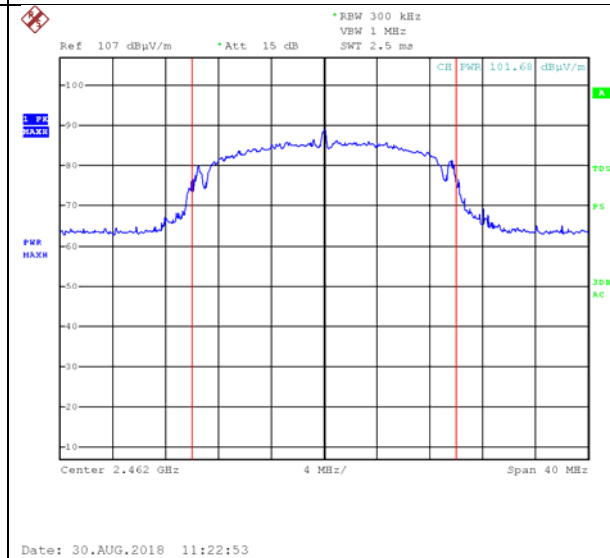


Figure 61. 2462.0 MHz, Wi-fi/n(6.5Mbit/s), Horizontal

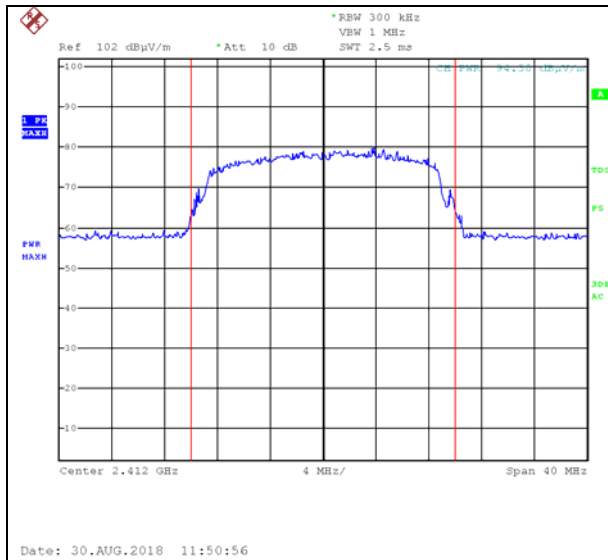


Figure 62. 2412.0 MHz, Wi-fi/n(65Mbit/s), Vertical

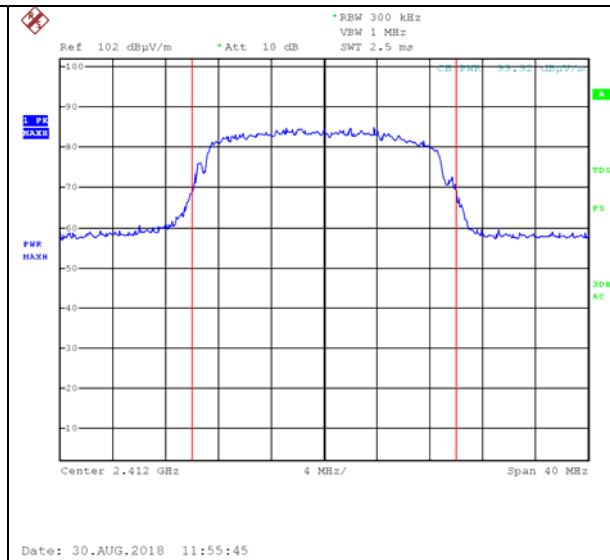


Figure 63. 2412.0 MHz, Wi-fi/n(65Mbit/s), Horizontal

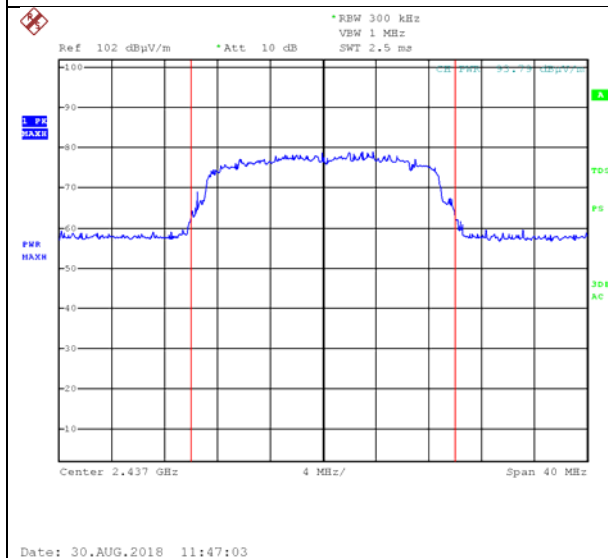


Figure 64. 2437.0 MHz, Wi-fi/n(65Mbit/s), Vertical

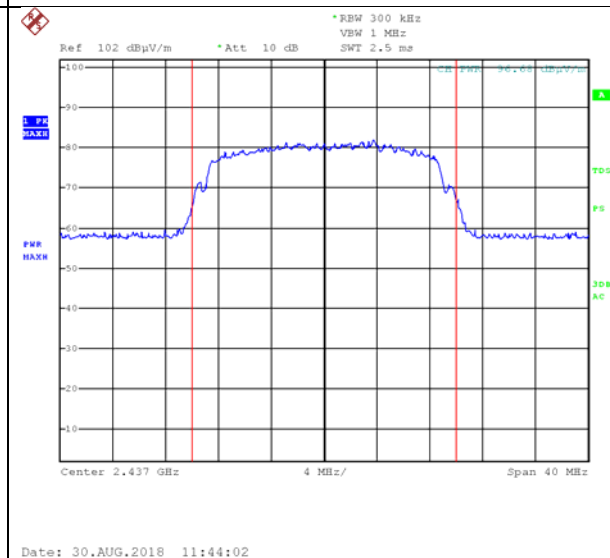


Figure 65. 2437.0 MHz, Wi-fi/n(65Mbit/s), Horizontal

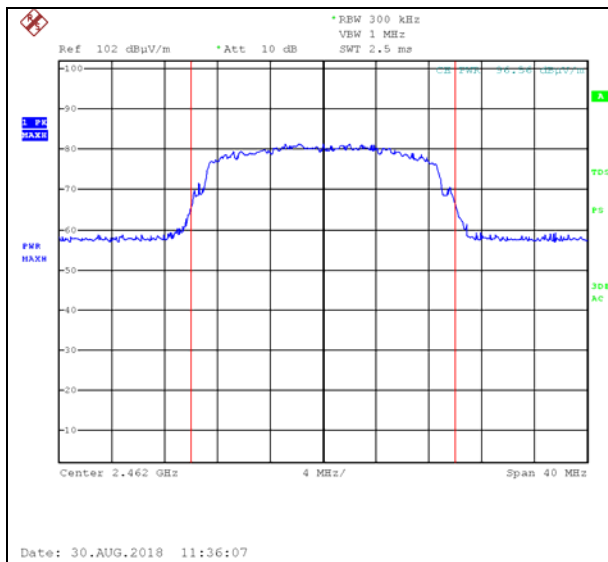


Figure 66. 2462.0 MHz, Wi-fi/n(65Mbit/s), Vertical

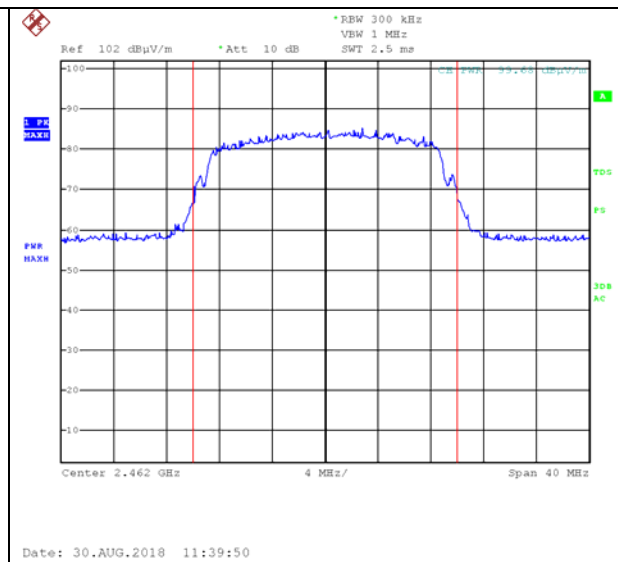


Figure 67. 2462.0 MHz, Wi-fi/n(65Mbit/s), Horizontal



6.5 Test Equipment Used; Maximum Conducted Output Power

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 19, 2018	February 28, 2019
Horn Antenna	ETS	3115	6142	May 31, 2018	May 31, 2021
RF Cable	Commscope ORS	0623 WBC-400	G020132	October 1, 2017	October 31, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 68 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 (20°C)/ Humidity (59%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

Protocol Type	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
BLE	2402.0	2400.0	27.4	52.3	-24.9
	2480.0	2483.5	30.1	63.5	-33.4
Wi-fi/g(6Mbit/s)	2412.0	2400.0	49.8	56.1	-6.3
	2462.0	2483.5	27.6	39.2	-11.6
Wi-Fi/g(54Mbit/s)	2412.0	2400.0	47.8	56.1	-8.3
	2462.0	2483.5	27.7	37.3	-9.6
Wi-Fi/n(6.5Mbit/s)	2412.0	2400.0	50.5	55.9	-5.4
	2462.0	2483.5	28.6	42.6	-14.0
Wi-fi/n(65Mbit/s)	2412.0	2400.0	55.1	44.9	10.2
	2462.0	2483.5	28.4	46.1	-17.7

Figure 69 Band Edge Spectrum

JUDGEMENT: Passed by 5.4 dB

For additional information see *Figure 70* and *Figure 79*.

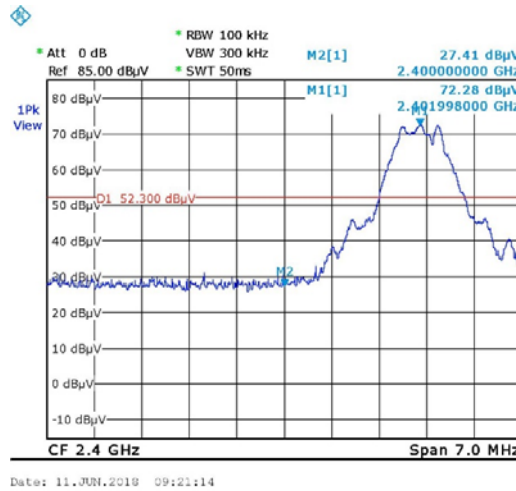


Figure 70 Band Edge Low, BLE

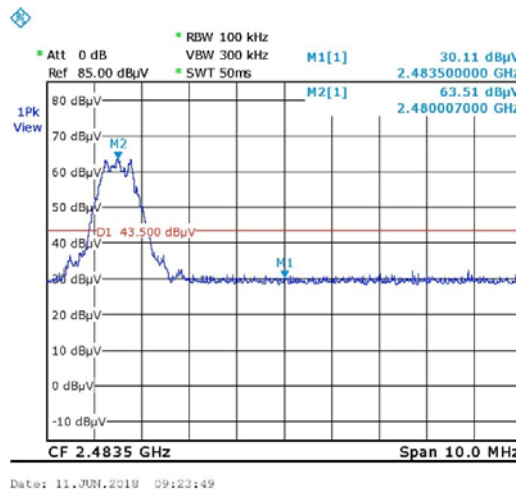
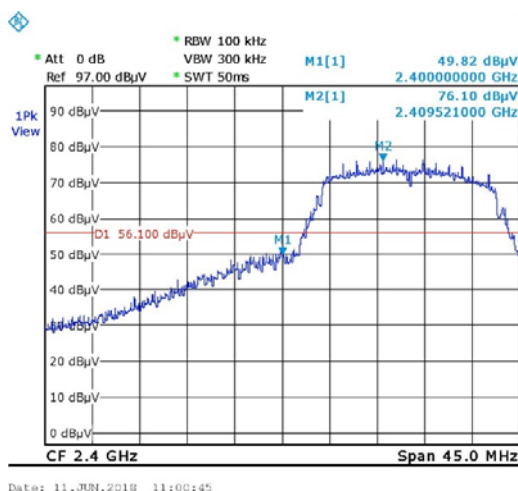
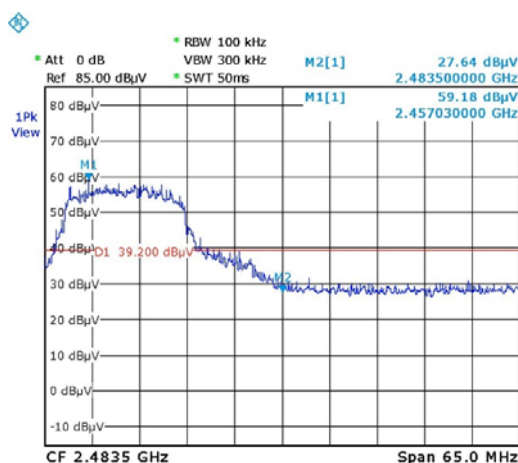


Figure 71 Band Edge High, BLE



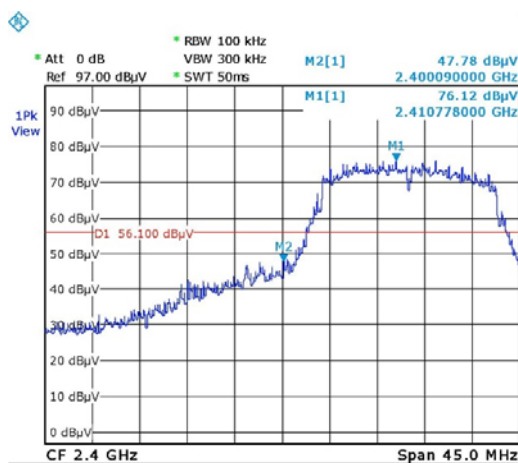
Date: 11.JUN.2018 11:00:45

Figure 72 Band Edge Low, Wi-fi/g(6Mbit/s)



Date: 11.JUN.2018 10:30:35

Figure 73 Band Edge High, Wi-fi/g(6Mbit/s)



Date: 11.JUN.2018 11:03:07

Figure 74 Band Edge Low, Wi-fi/g(54Mbit/s)

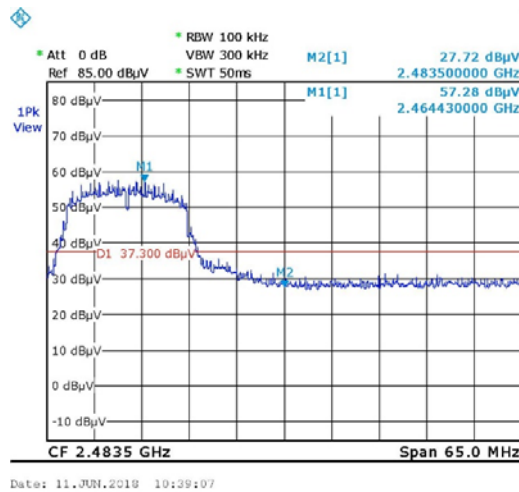


Figure 75 Band Edge High, Wi-fi/g(54Mbit/s)

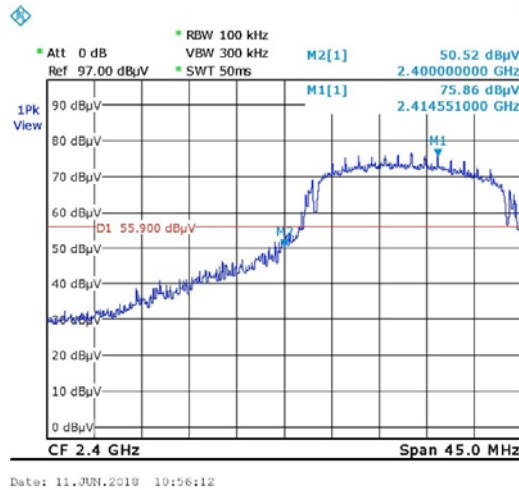


Figure 76 Band Edge Low, Wi-fi/n(6.5Mbit/s)

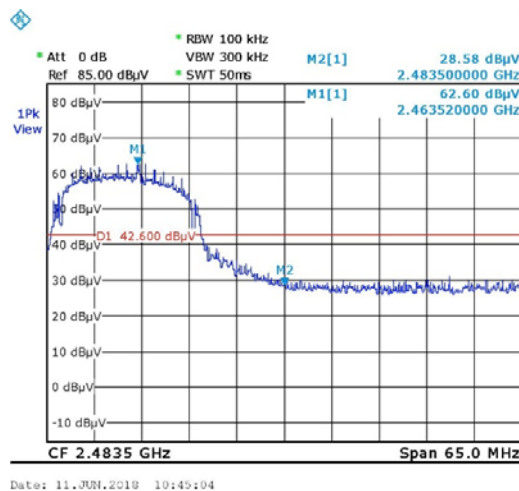


Figure 77 Band Edge High, Wi-fi/n(6.5Mbit/s)

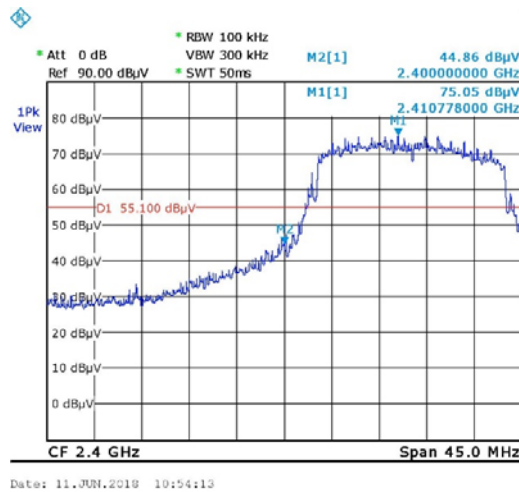


Figure 78 Band Edge Low, Wi-fi/n(65Mbit/s)

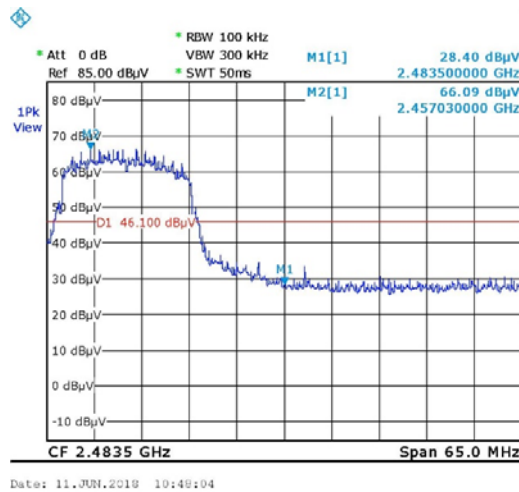


Figure 79 Band Edge High, Wi-fi/n(65Mbit/s)



7.5 Test Equipment Used; Band Edge

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 19, 2018	February 28, 2019
Horn Antenna	ETS	3115	6142	May 31, 2018	May 31, 2021
RF Cable	Commscope ORS	0623 WBC-400	G020132	October 1, 2017	October 31, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 80 Test Equipment Used

8. Transmitted Power Density

8.1 Test Specification

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

RSS 247, Issue 2, Section 5.2(b)

8.2 Test Procedure

(Temperature (22°C)/ Humidity (62%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:

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

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

8.3 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.

8.4 Test Results

Protocol Type	Operation Frequency (MHz)	Reading (dBuV/m)	PSD (dBm)	Ant. Gain (dBi)	Conducted PSD (dBm)	Limit (dBm)	Margin (mW)
BLE	2402.0	71.1	-24.1	-2.0	-22.1	8.0	-30.1
	2440.0	71.8	-23.4	-2.0	-21.4	8.0	-29.4
	2480.0	73.0	-22.2	-2.0	-20.2	8.0	-28.2
Wi-fi/g(6Mbit/s)	2412.0	67.3	-27.9	-2.0	-25.9	8.0	-33.9
	2437.0	63.5	-31.7	-2.0	-29.7	8.0	-37.7
	2462.0	67.7	-27.5	-2.0	-25.5	8.0	-33.5
Wi-fi/g(54Mbit/s)	2412.0	64.1	-31.1	-2.0	-29.1	8.0	-37.1
	2437.0	63.4	-31.8	-2.0	-29.8	8.0	-37.8
	2462.0	65.7	-29.5	-2.0	-27.5	8.0	-35.5
Wi-fi/n(6.5Mbit/s)	2412.0	66.3	-28.9	-2.0	-26.9	8.0	-34.9
	2437.0	63.0	-32.2	-2.0	-30.2	8.0	-38.2
	2462.0	69.2	-26.0	-2.0	-24.0	8.0	-32.0
Wi-fi/n(65Mbit/s)	2412.0	65.5	-29.7	-2.0	-27.7	8.0	-35.7
	2437.0	60.1	-35.1	-2.0	-33.1	8.0	-41.1
	2462.0	65.5	-29.7	-2.0	-27.7	8.0	-35.7

Figure 81 Test Results

JUDGEMENT: Passed by 28.2dB

For additional information see Figure 82 to Figure 96.

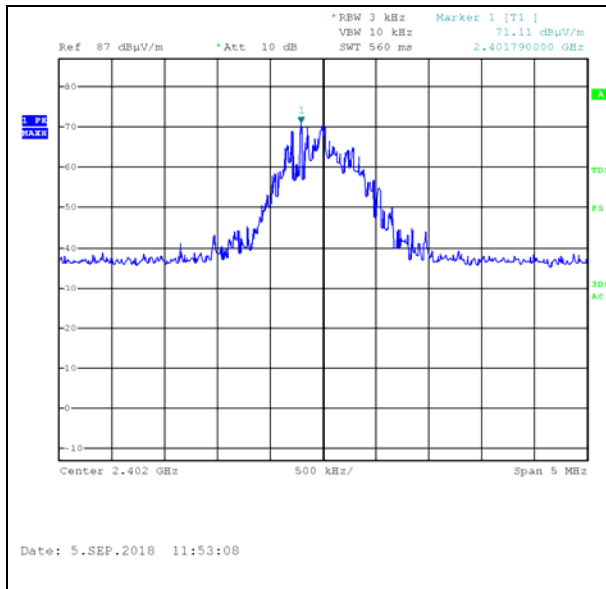


Figure 82. 2402.0 MHz, BLE

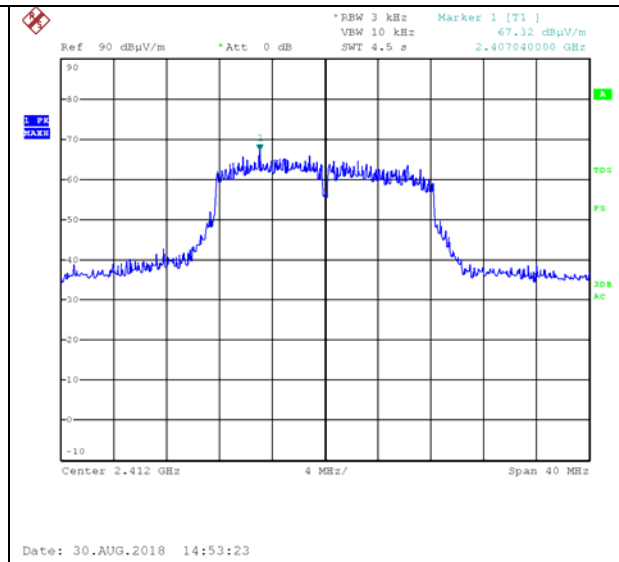


Figure 83 2412.0 MHz, Wi-fi/g(6Mbit/s)

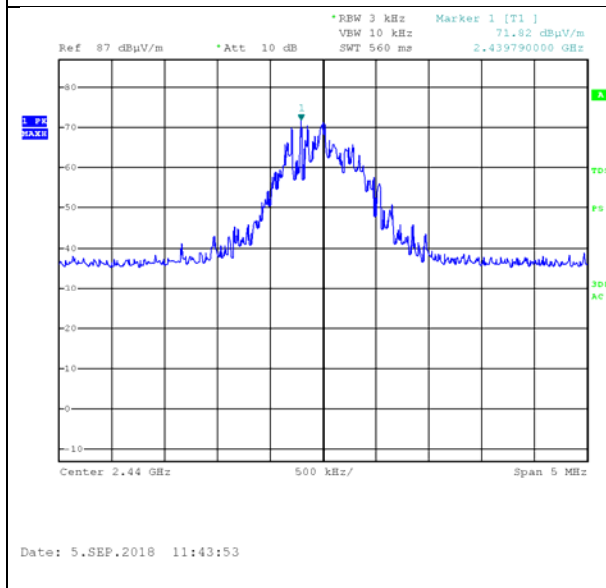


Figure 84. 2440.0 MHz, BLE

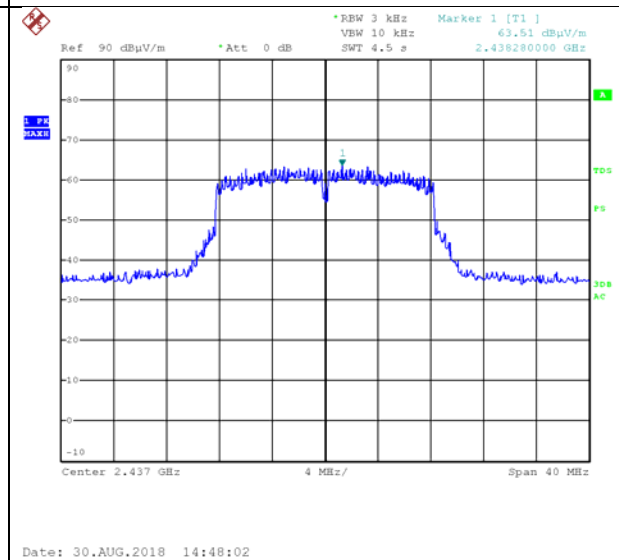


Figure 85. 2437.0 MHz, Wi-fi/g(6Mbit/s)

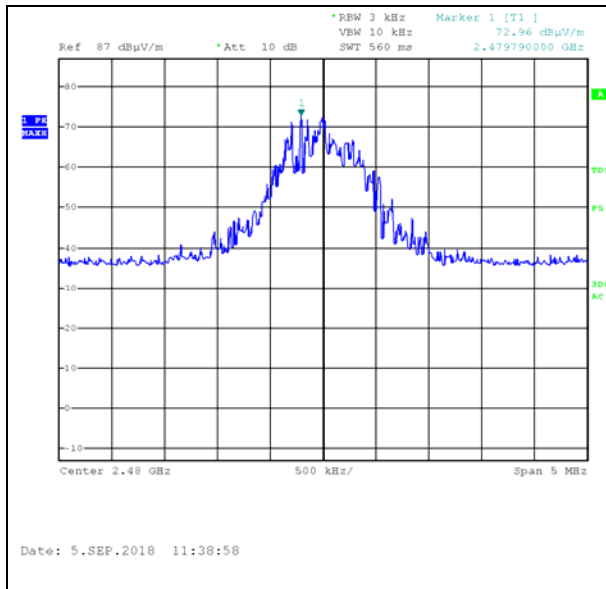


Figure 86. 2480.0 MHz, BLE

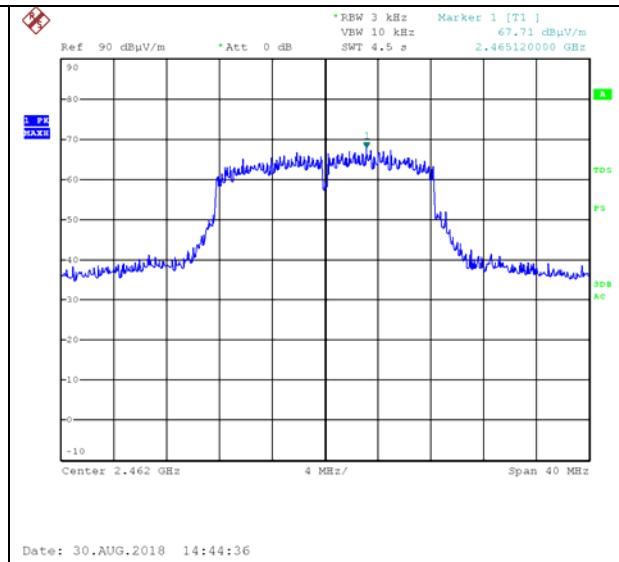


Figure 87. 2462.0 MHz, Wi-fi/g(6Mbit/s)

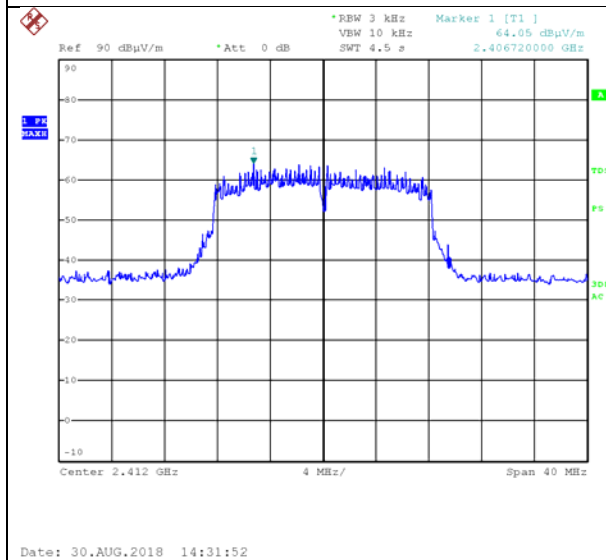


Figure 88. 2412.0 MHz, Wi-fi/g(54Mbit/s)

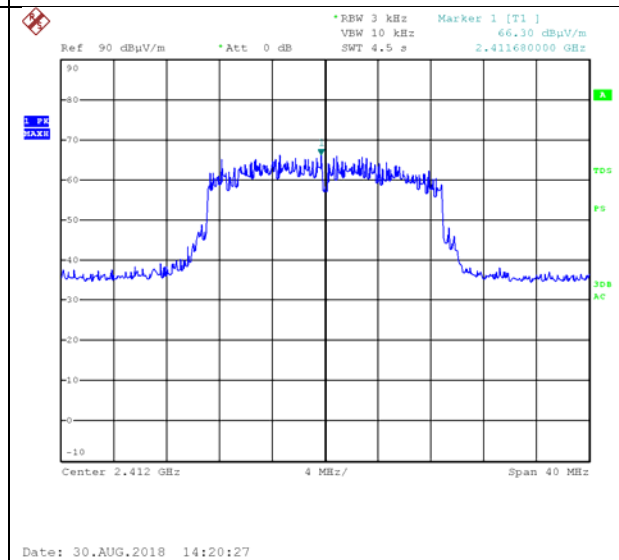


Figure 89 2412.0 MHz, Wi-fi/n(6.5Mbit/s)

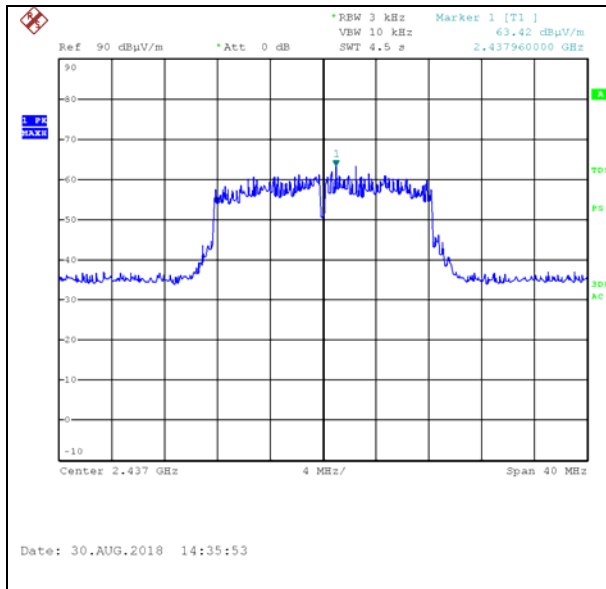


Figure 90. 2437.0 MHz, Wi-fi/g(54Mbit/s)

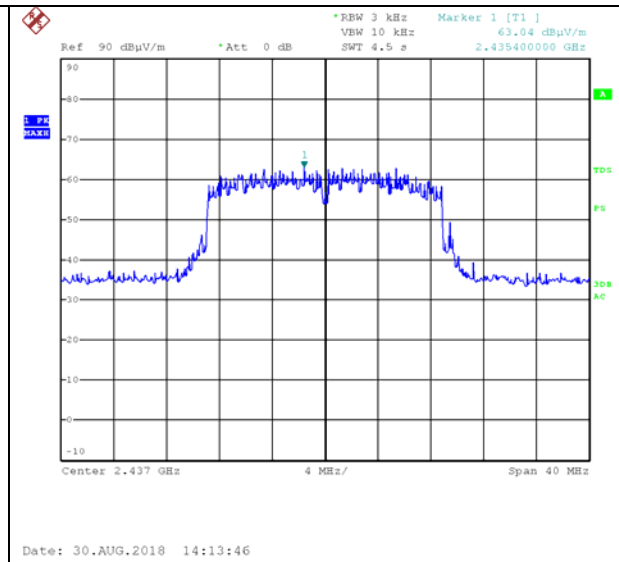


Figure 91. 2437.0 MHz, Wi-fi/n(6.5Mbit/s)

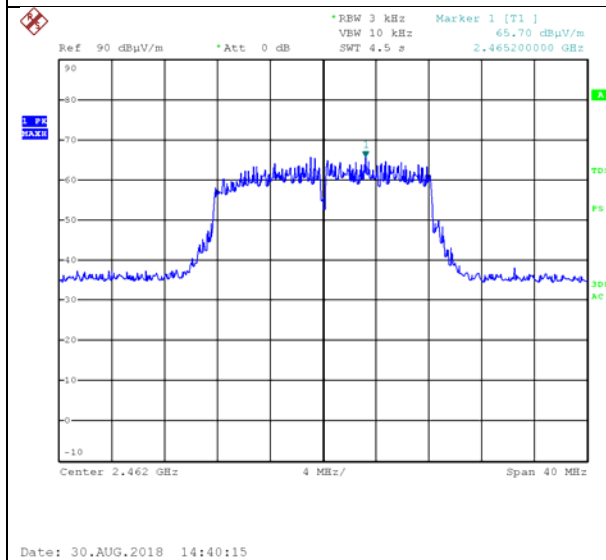


Figure 92. 2462.0 MHz, Wi-fi/g(54Mbit/s)

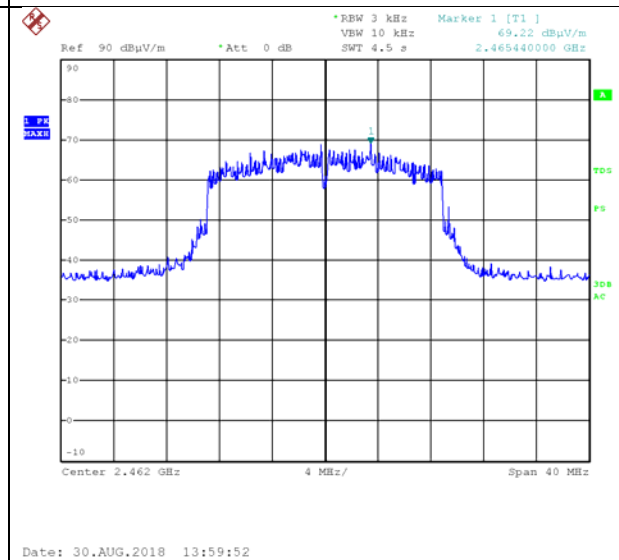


Figure 93. 2462.0 MHz, Wi-fi/n(6.5Mbit/s)

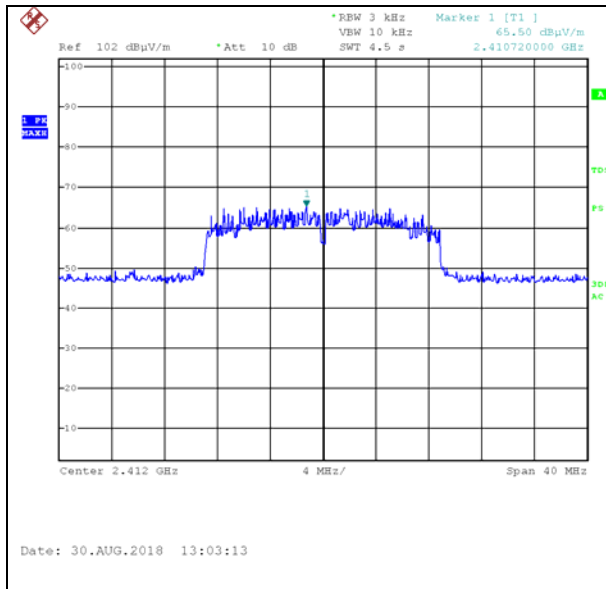


Figure 94. 2412.0 MHz, Wi-fi/n(65Mbit/s)

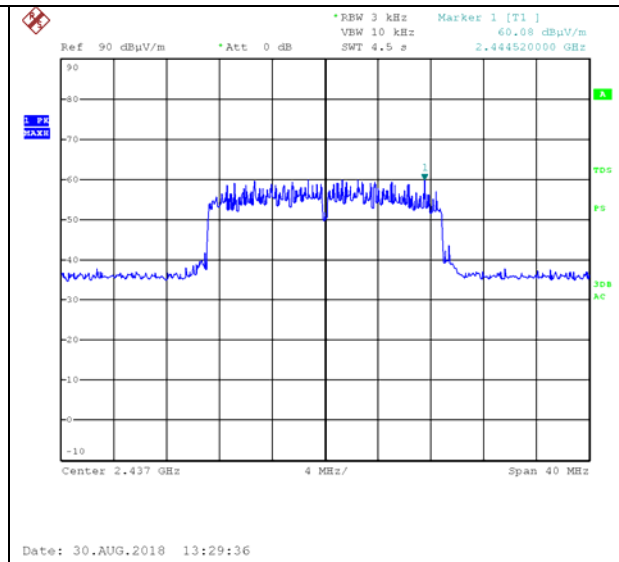


Figure 95. 2437.0 MHz, Wi-fi/n(65Mbit/s)

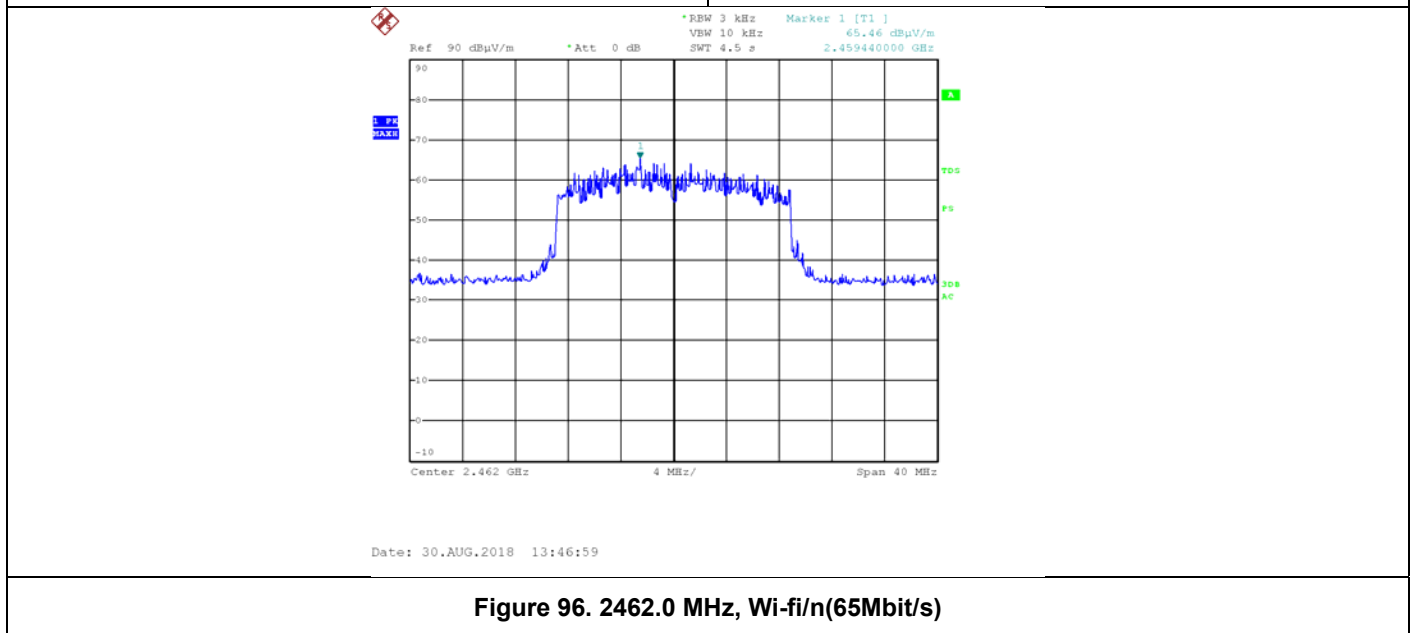


Figure 96. 2462.0 MHz, Wi-fi/n(65Mbit/s)



8.5 Test Equipment Used; Transmitted Power Density

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 19, 2018	February 19, 2019
Horn Antenna	ETS	3115	29845	May 31, 2018	May 31 2021
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132-	October 1, 2017	October 31, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR

Figure 97 Test Equipment Used

9. Emissions in Non-Restricted Frequency Bands

9.1 Test Specification

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

RSS 247, Issue 2, Section 5.5

9.2 Test Procedure

(Temperature (21°C)/ Humidity (59%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”.

9.3 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.

9.4 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) specification.

9.5 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 19, 2018	February 19, 2019
EMI Receiver	HP	8542E	3906A00276	February 19, 2018	February 19, 2019
RF Filter Section	HP	85420E	3705A00248	February 19, 2018	February 19, 2019
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 20, 2018	February 20, 2019
Biconical Antenna	EMCO	3110B	9912-3337	May 15, 2017	May 15, 2019
Log Periodic Antenna	EMCO	3146	9505-4081	May 31, 2018	May 31, 2019
Horn Antenna	ETS	3115	29845	May 31, 2018	May 31 2021
Horn Antenna	ARA	SWH-28	1007	December 13, 2017	December 13, 2020
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2018	October 31, 2019
MicroWave System Amplifier	HP	83006A	3104A00589	October 1, 2018	October 31, 2019
Low Noise Amplifier 1GHz-18GHz	Miteq	AFSX4- 02001800-50-8P	-	October 1, 2018	October 31, 2019
RF Cable Chamber	Commscope ORS	0623 WBC- 400	G020132-	October 1, 2017	October 31, 2018
RF Cable Oats	EIM	RG214- 11N(X2)	-	August 13, 2018	August 31, 2019
High Pass Band Filter	Meuro	MFL040120H5 0	902252	October 1, 2018	October 31, 2019
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 98 Test Equipment Used



9.6 **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 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. Emissions in Restricted Frequency Bands

10.1 Test Specification

FCC Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

RSS 247, Issue 2, Section 3.3

RSS Gen, Issue 5, Section 6.13

10.2 Test Procedure

(Temperature (21°C)/ Humidity (59%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 is 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.

10.3 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 99 Table of Limits

10.4 Test Results for BLE

JUDGEMENT: Passed by 4.7 dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is in the worst case 4.7 dB at the frequency of 2390.0 MHz, vertical polarization.

For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is in the worst case 4.9 dB at the frequency of 2483.5 MHz, horizontal polarization and 4.9dB at the frequency of 7440.0, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Sections 15.209, 15.205, 15.247(d) specifications.

The details of the highest emissions are given in *Figure 100*.



10.5 Test Results for WiFi

JUDGEMENT: Passed by 2.2 dB

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is in the worst case 2.9 dB at the frequency of 7236 MHz, vertical polarization.

For the operation frequency of 2437 MHz, the margin between the emission level and the specification limit is in the worst case 7.0 dB at the frequency of 7311.0 MHz, vertical polarization.

For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is in the worst case 2.2 dB at the frequency of 7386.0 MHz, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Sections 15.209, 15.205, 15.247(d) specifications.

The details of the highest emissions are given in *Figure 101* to *Figure 104*.

Radiated Emission

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 25.0 GHz
Protocol Type: BLE 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)
2402.0	2390.0	V	59.8	74.0	-14.2	49.3	54.0	-4.7
	2390.0	H	59.6	74.0	-14.4	49.2	54.0	-4.8
	7206.0	V	56.8	74.0	-17.2	40.3	54.0	-13.7
	7206.0	H	58.0	74.0	-16.0	43.3	54.0	-10.7
2440.0	4880.0	V	38.0	74.0	-36.0	-	54.0	-
	7320.0	H	47.1	74.0	-26.9	-	54.0	-
	7320.0	V	50.3	74.0	-23.7	-	54.0	-
	4880.0	H	57.5	74.0	-16.5	47.2	54.0	-6.8
2480.0	7440.0	V	59.0	74.0	-15.0	49.1	54.0	-4.9
	7440.0	H	53.0	74.0	-21.0	42.8	54.0	-11.2
	2483.5	V	60.3	74.0	-13.7	48.5	54.0	-5.5
	2483.5	H	59.8	74.0	-14.2	49.1	54.0	-4.9

Figure 100. 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

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

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	55.6	74.0	-18.4	44.4	54.0	-9.6
	2390.0	H	54.8	74.0	-19.2	44.4	54.0	-9.6
	7236.0	V	59.5	74.0	-14.5	50.1	54.0	-3.9
	7236.0	H	54.8	74.0	-19.2	44.0	54.0	-10.0
2437.0	4874.0	V	48.6	74.0	-25.4	-	54.0	-
	4874.0	H	49.7	74.0	-24.3	-	54.0	-
	7311.0	V	52.3	74.0	-21.7	43.5	54.0	-10.5
	7311.0	H	53.4	74.0	-20.6	44.1	54.0	-9.9
2462.0	7386.0	V	55.8	74.0	-18.2	46.2	54.0	-7.8
	7386.0	H	55.5	74.0	-18.5	46.0	54.0	-8.0
	2483.5	V	54.3	74.0	-19.7	45.3	54.0	-8.7
	2483.5	H	54.5	74.0	-19.5	45.5	54.0	-8.5

Figure 101. 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

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

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)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2412.0	2390.0	V	55.4	74.0	-18.6	44.3	54.0	-9.7
	2390.0	H	54.6	74.0	-19.4	43.7	54.0	-10.3
	7236.0	V	55.5	74.0	-18.5	47.1	54.0	-6.9
	7236.0	H	51.9	74.0	-22.1	42.5	54.0	-11.5
2437.0	4874.0	V	48.7	74.0	-25.3	-	54.0	-
	4874.0	H	47.0	74.0	-27.0	-	54.0	-
	7311.0	V	44.6	74.0	-29.4	-	54.0	-
	7311.0	H	43.5	74.0	-30.5	-	54.0	-
2462.0	7386.0	V	52.3	74.0	-21.7	-	54.0	-
	7386.0	H	52.1	74.0	-21.9	-	54.0	-
	2483.5	V	54.4	74.0	-19.6	45.4	54.0	-8.6
	2483.5	H	54.3	74.0	-19.7	45.5	54.0	-8.5

Figure 102. 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

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 25.0 GHz
Protocol Type: WI-FI/n 6.5Mbps 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	55.1	74.0	-18.9	44.5	54.0	-9.5
	2390.0	H	55.4	74.0	-18.6	44.3	54.0	-9.7
	7236.0	V	54.9	74.0	-19.1	45.3	54.0	-8.7
	7236.0	H	56.4	74.0	-17.6	47.5	54.0	-6.5
2437.0	4874.0	V	51.0	74.0	-23.0	-	54.0	-
	4874.0	H	47.7	74.0	-26.3	-	54.0	-
	7311.0	V	56.6	74.0	-17.4	47.0	54.0	-7.0
	7311.0	H	51.0	74.0	-23.0	-	54.0	-
2462.0	7386.0	V	55.2	74.0	-18.8	46.7	54.0	-7.3
	7386.0	H	58.3	74.0	-15.7	49.3	54.0	-4.7
	2483.5	V	54.2	74.0	-19.8	47.1	54.0	-6.9
	2483.5	H	54.5	74.0	-19.5	46.3	54.0	-7.7

Figure 103. 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

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 25.0 GHz
Protocol Type: WI-FI/n 65Mbps 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	55.2	74.0	-18.8	44.2	54.0	-9.8
	2390.0	H	54.7	74.0	-19.3	44.0	54.0	-10.0
	7236.0	V	60.2	74.0	-13.8	51.1	54.0	-2.9
	7236.0	H	52.7	74.0	-21.3	-	54.0	-
2437.0	4874.0	V	41.9	74.0	-32.1	-	54.0	-
	4874.0	H	41.4	74.0	-32.6	-	54.0	-
	7311.0	V	46.0	74.0	-28.0	-	54.0	-
	7311.0	H	45.6	74.0	-28.4	-	54.0	-
2462.0	7386.0	V	61.0	74.0	-13.0	51.8	54.0	-2.2
	7386.0	H	53.8	74.0	-20.2	45.2	54.0	-8.8
	2483.5	V	54.9	74.0	-19.1	47.4	54.0	-6.6
	2483.5	H	54.4	74.0	-19.6	46.0	54.0	-8.0

Figure 104. 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

10.6 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 19, 2018	February 19, 2019
EMI Receiver	HP	8542E	3906A00276	February 19, 2018	February 19, 2019
RF Filter Section	HP	85420E	3705A00248	February 19, 2018	February 19, 2019
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 20, 2018	February 20, 2019
Biconical Antenna	EMCO	3110B	9912-3337	May 15, 2017	May 15, 2019
Log Periodic Antenna	EMCO	3146	9505-4081	May 31, 2018	May 31, 2019
Horn Antenna	ETS	3115	29845	May 31, 2018	May 31 2021
Horn Antenna	ARA	SWH-28	1007	December 13, 2017	December 13, 2020
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2018	October 31, 2019
MicroWave System Amplifier	HP	83006A	3104A00589	October 1, 2018	October 31, 2019
Low Noise Amplifier 1GHz-18GHz	Miteq	AFSX4- 02001800-50-8P	-	October 1, 2018	October 31, 2019
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132-	October 1, 2018	October 31, 2019
RF Cable Oats	EIM	RG214- 11N(X2)	-	August 13, 2018	August 31, 2019
High Pass Band Filter	Meuro	MFL040120H5 0	902252	October 1, 2018	October 31, 2019
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 105 Test Equipment Used



12. Antenna Gain/Information

The antenna gain is -2.0dBi, integral.

13. R.F Exposure/Safety

Typical use of the E.U.T. is as a wearable camera.

The typical distance between the E.U.T. and the user is 0.5 cm.

SAR Testing Exclusion Based on Section 4.3.1 and Appendix A of KDB 447498 D01 V06 Requirements

For FCC

Section 4.3.1 and Appendix A of KDB447498 D01 V06 was used as the guidance as follows:

Conducted power output = 8.5dBm + (-2dBi) (antenna gain) = 6.5dBm = 4.47mW

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

= $4.47/5 \cdot 1.55 = 1.385$ this value is less than 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR.

The SAR measurement is not necessary.

14. APPENDIX A - CORRECTION FACTORS

14.1 Correction factors for #1911

RF OATS Cable 35m ITL

Frequency (MHz)	Ref&cable loss (dBm)	Ref loss (dBm)	Cable loss (dB)
1.00	0.7	0.2	0.5
10.00	1.3	0.3	1
20.00	1.7	0.3	1.34
30.00	2.0	0.5	1.5
50.00	2.3	0.5	1.83
100.00	3.0	0.3	2.67
150.00	3.7	0.5	3.17
200.00	4.3	0.5	3.83
250.00	4.5	0.3	4.17
300.00	5.0	0.5	4.5
350.00	5.7	0.5	5.17
400.00	6.0	0.5	5.5
450.00	6.5	0.7	5.83
500.00	6.8	0.5	6.33
550.00	7.2	0.5	6.67
600.00	7.5	0.7	6.83
650.00	7.7	0.5	7.17
700.00	8.3	0.7	7.66
750.00	8.5	0.7	7.83
800.00	8.8	0.7	8.16
850.00	9.0	0.5	8.5
900.00	9.5	0.7	8.83
950.00	9.7	0.8	8.84
1000.00	9.7	0.7	9

14.2 Correction factor for RF CABLE for Semi Anechoic Chamber

ITL # 1840

Frequency (GHz)	loss Result (dB)
0.5	-1.0
1.0	-1.4
1.5	-1.7
2.0	-2.0
2.5	-2.3
3.0	-2.6
3.5	-2.8
4.0	-3.1
4.5	-3.3
5.0	-3.6
5.5	-3.7
6.0	-4.0
6.5	-4.4
7.0	-4.7
7.5	-4.8
8.0	-5.0
8.5	-5.1
9.0	-5.6
9.5	-5.8
10.0	-6.0
10.5	-6.2
11.0	-6.2
11.5	-6.0
12.0	-6.0
12.5	-6.1
13.0	-6.3
13.5	-6.5
14.0	-6.7
14.5	-7.0
15.0	-7.3
15.5	-7.5
16.0	-7.6
16.5	-8.0
17.0	-8.0
17.5	-8.1
18.0	-8.2
18.5	-8.2
19.0	-8.3
19.5	-8.6
20.0	-8.5

NOTES:

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



14.3 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



7.4 Correction factors for biconical antenna – ITL # 1356

Model: EMCO 3110B

Serial No.:9912-3337

Frequency	ITL 1356 AF
[MHz]	[dB/m]
30	14.77
35	13.46
40	12.57
45	11.62
50	10.87
60	9.19
70	9.52
80	9.55
90	9.27
100	10.20
120	11.18
140	12.02
160	12.62
180	13.44
200	14.82



14.5 Correction factors for log periodic antenna – ITL # 1349

Model: EMCO 3146

Serial No.:9505-4081

Frequency	ITL 1349 AF
[MHz]	[dB/m]
200	11.31
250	11.85
300	14.47
400	15.12
500	17.69
600	18.45
700	20.52
800	20.77
900	21.97
1000	23.21



14.6 Correction factors for Horn Antenna

Model: 3115

Serial number: 6142

3 meter range; ITL # 1354

Frequency	Antenna #1: ITL 1354 AF1
[MHz]	[dB/m]
1000	23.64
1500	26.14
2000	27.20
2500	28.20
3000	29.63
3500	31.28
4000	31.97
4500	32.25
5000	33.34
5500	33.67
6000	34.63
6500	35.71
7000	35.92
7500	36.34
8000	37.21
8500	37.28
9000	37.24
9500	37.28
10000	37.37
10500	37.77
11000	37.96
11500	38.55
12000	38.52
13000	39.30
14000	40.75
15000	40.32
16000	42.51
17000	42.35
18000	41.58



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

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

FREQUENCY	AFE	FREQUENCY	AFE
(GHz)	(dB/m)	(GHz)	(dB/m)
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



14.8 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 ¹⁾
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

¹⁾ The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.