



DATE: 22 April 2019

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

Equipment under test:

Wearable Device

ORCAM MYME

Tested by:
M. Zohar

Approved by:
D. Shidowsky

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This report relates only to items tested.



Measurement/Technical Report for Orcam Technologies Ltd.

Wearable Device

ORCAM MYME

FCC ID: 2AAWI-ORCAM-MYME

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

Equipment type: FCC: (DTS) 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") Rami 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@orcam.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 Device

Equipment PMN: ORCAM MYME

Equipment Serial No.: 18380173

Date of Receipt of E.U.T: December 6, 2018

Start of Test: December 6, 2018

End of Test: January 23, 2019

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

OrCam MyMe is a wearable device that uses smart artificial vision technology to recognize people.

| | |
|---------------------------|----------------------------------------------------------------------------------------------------------|
| Working voltage | 3.7VDC Rechargeable battery |
| 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 | -2dBi |
| 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 b/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 AC line emission testing was performed with 2 optional charge modes: AC/DC adapter via laptop & AC/DC adapter wall charger.
5. Conducted emission tests were performed with the E.U.T. antenna terminal connected by a RF cable to the Spectrum Analyzer through a 30dB external attenuator.
6. 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) |

7. Final radiated emission tests was performed after exploratory emission testing that was performed in 3 orthogonal polarities to determine the “worst case” radiation. According to below results the worst case was at the X 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 | 94.4 | 54.7 | 68.0 | 64.3 |
| | 2437.0 | 91.9 | 57.0 | 63.0 | - |
| | 2462.0 | 92.8 | 58.2 | 67.5 | 62.8 |
| Y axis | 2412.0 | 93.3 | 54.6 | 67.8 | 63.8 |
| | 2437.0 | 89.6 | 56.1 | 63.0 | - |
| | 2462.0 | 90.4 | 54.0 | 66.8 | |
| Z axis | 2412.0 | 94.2 | 53.9 | 64.6 | 64.5 |
| | 2437.0 | 91.8 | 55.7 | 61.8 | - |
| | 2462.0 | 91.6 | 56.2 | 63.2 | 63.1 |

Figure 1. Screening Results



2.2 ***EUT Exercise Software***

No special exercise software was used.

2.3 ***Special Accessories***

| Equipment | Manufacturer | Part Number | Serial Number |
|---------------|-----------------|----------------|---------------|
| Laptop | DELL | LATITUDE E5440 | 14290776829 |
| AC/DC adapter | DELL | LA90PM130 | N/A |
| Wall charger | EDACPOWER ELEC. | EM1005AVEU | 001626 |

2.4 ***Equipment Modifications***

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

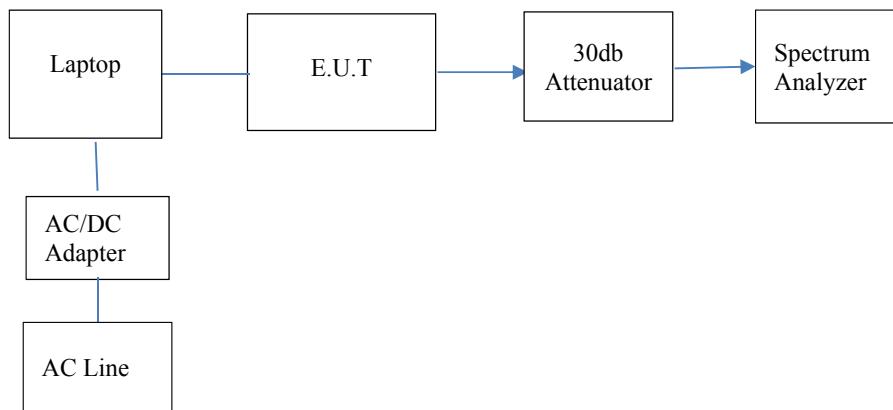


Figure 2. Configuration of Tested System Conducted

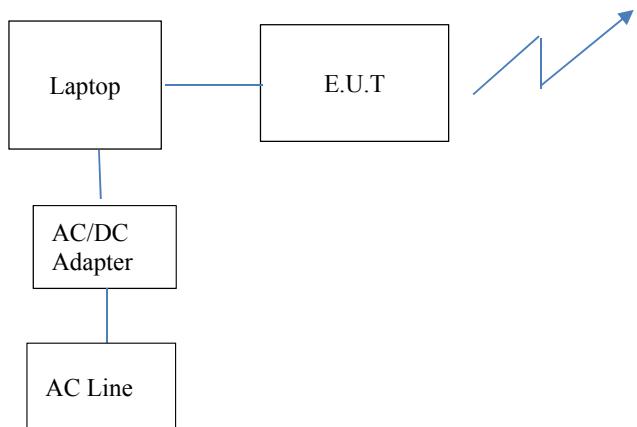


Figure 3. Configuration of Tested System Radiated



3. Conducted & Radiated Measurement Test Set-Up Photos



Figure 4. Conducted Emission from AC Line Test, AC/DC wall charger mode



Figure 5. Conducted Emission from AC Line Test, AC/DC adapter via laptop charge 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, 18-26.5GHz



4. Conducted Emission From AC Mains

4.1 Test Specification

FCC Part 15, Subpart C, Section 15.207

4.2 Test Procedure

(Temperature (20°C)/ Humidity (50%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 configurations tested are shown in the photographs, *Figure 4* and *Figure 5*.

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 6.32 dB

The margin between the emission levels and the specification limit is, in the worst case, 6.32 dB for the phase line at 0.366 MHz and 9.14 dB at 0.442 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 Device
Type ORCAM MYME
Serial Number: 18380173

Specification: FCC Part 15, Subpart C
Lead: Phase
Detectors: : Peak, Quasi-peak, Average
Power Operation Wall Charger

| EDIT PEAK LIST (Final Measurement Results) | | | | |
|--------------------------------------------|------------|------------|---------|---------|
| Trace1: | CE22BQP | Trace2: | CE22BAP | Trace3: |
| 1 | Quasi Peak | 182 kHz | 43.26 | -21.13 |
| 2 | Average | 242 kHz | 30.30 | -21.72 |
| 1 | Quasi Peak | 366 kHz | 45.79 | -12.79 |
| 2 | Average | 366 kHz | 42.27 | -6.32 |
| 1 | Quasi Peak | 606 kHz | 30.61 | -25.38 |
| 2 | Average | 730 kHz | 21.54 | -24.45 |
| 2 | Average | 758 kHz | 21.97 | -24.02 |
| 1 | Quasi Peak | 762 kHz | 35.22 | -20.78 |
| 2 | Average | 1.274 MHz | 22.42 | -23.57 |
| 1 | Quasi Peak | 1.366 MHz | 30.84 | -25.15 |
| 1 | Quasi Peak | 2.19 MHz | 26.50 | -29.49 |
| 2 | Average | 2.822 MHz | 19.45 | -26.54 |
| 2 | Average | 3.662 MHz | 17.94 | -28.05 |
| 1 | Quasi Peak | 4.522 MHz | 24.54 | -31.45 |
| 1 | Quasi Peak | 7.882 MHz | 22.72 | -37.27 |
| 2 | Average | 8.19 MHz | 16.31 | -33.69 |
| 2 | Average | 13.558 MHz | 23.14 | -26.85 |
| 1 | Quasi Peak | 16.394 MHz | 23.54 | -36.45 |
| 1 | Quasi Peak | 20.538 MHz | 27.66 | -32.33 |
| 2 | Average | 20.662 MHz | 22.57 | -27.42 |

Date: 17.JAN.2019 15:26:34

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

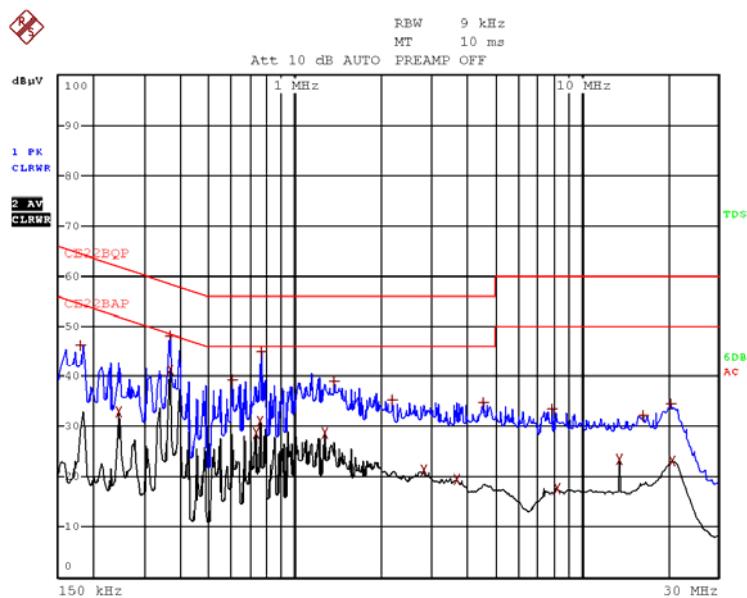
Note: *QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*



Conducted Emission

E.U.T Description Wearable Device
Type ORCAM MYME
Serial Number: 18380173

Specification: FCC Part 15, Subpart C
Lead: Phase
Detectors: Peak, Quasi-peak, Average
Power Operation Wall charger



Date: 17.JAN.2019 15:25:18

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



Conducted Emission

E.U.T Description Wearable Device
Type ORCAM MYME
Serial Number: 18380173

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

| EDIT PEAK LIST (Final Measurement Results) | | | | |
|--------------------------------------------|------------|------------------|--------|----------|
| Trace1: | CE22BQP | | | |
| Trace2: | CE22BAP | | | |
| Trace3: | --- | | | |
| TRACE | FREQUENCY | LEVEL dB μ V | DELTA | LIMIT dB |
| 1 Quasi Peak | 162 kHz | 47.02 | -18.33 | |
| 2 Average | 218 kHz | 31.26 | -21.62 | |
| 1 Quasi Peak | 378 kHz | 38.55 | -19.76 | |
| 2 Average | 378 kHz | 31.86 | -16.46 | |
| 1 Quasi Peak | 618 kHz | 25.81 | -30.18 | |
| 2 Average | 622 kHz | 19.96 | -26.03 | |
| 1 Quasi Peak | 758 kHz | 29.94 | -26.05 | |
| 2 Average | 758 kHz | 18.22 | -27.77 | |
| 1 Quasi Peak | 1.294 MHz | 22.53 | -33.46 | |
| 2 Average | 1.918 MHz | 14.22 | -31.77 | |
| 1 Quasi Peak | 2.138 MHz | 22.75 | -33.25 | |
| 2 Average | 2.758 MHz | 18.06 | -27.93 | |
| 1 Quasi Peak | 3.654 MHz | 25.52 | -30.47 | |
| 2 Average | 4.414 MHz | 16.84 | -29.15 | |
| 2 Average | 6.582 MHz | 20.59 | -29.40 | |
| 1 Quasi Peak | 7.182 MHz | 24.65 | -35.34 | |
| 2 Average | 13.562 MHz | 23.92 | -26.07 | |
| 1 Quasi Peak | 17.586 MHz | 24.97 | -35.02 | |
| 1 Quasi Peak | 20.458 MHz | 27.64 | -32.35 | |
| 2 Average | 20.814 MHz | 21.88 | -28.11 | |

Date: 17.JAN.2019 15:15:11

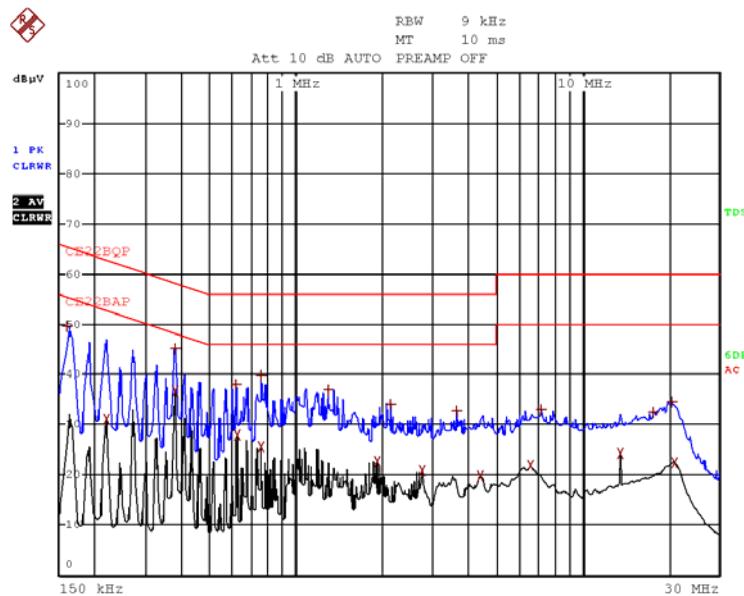
Figure 13. Detectors: Peak, Quasi-peak, Average

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 Device
Type: ORCAM MYME
Serial Number: 18380173

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



Date: 17.JAN.2019 15:12:16

Figure 14 Detectors: Peak, Quasi-peak, Average



Conducted Emission

E.U.T Description Wearable Device
Type ORCAM MYME
Serial Number: 18380173

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

| EDIT PEAK LIST (Final Measurement Results) | | | | |
|--------------------------------------------|-----------|------------------|--------|----------|
| Trace1: | CE22BQF | | | |
| Trace2: | CE22BAP | | | |
| Trace3: | --- | | | |
| TRACE | FREQUENCY | LEVEL dB μ V | DELTA | LIMIT dB |
| 1 Quasi Peak | 150 kHz | 47.58 | -18.41 | |
| 2 Average | 174 kHz | 25.72 | -29.04 | |
| 1 Quasi Peak | 206 kHz | 42.12 | -21.23 | |
| 2 Average | 214 kHz | 25.63 | -27.41 | |
| 1 Quasi Peak | 278 kHz | 36.58 | -24.28 | |
| 2 Average | 302 kHz | 20.67 | -29.51 | |
| 1 Quasi Peak | 402 kHz | 33.96 | -23.84 | |
| 2 Average | 430 kHz | 29.70 | -17.54 | |
| 2 Average | 438 kHz | 32.30 | -14.79 | |
| 1 Quasi Peak | 442 kHz | 38.46 | -18.56 | |
| 2 Average | 566 kHz | 20.72 | -25.27 | |
| 1 Quasi Peak | 586 kHz | 23.39 | -32.60 | |
| 2 Average | 738 kHz | 12.53 | -33.46 | |
| 1 Quasi Peak | 806 kHz | 21.44 | -34.55 | |
| 1 Quasi Peak | 1.118 MHz | 20.56 | -35.43 | |
| 2 Average | 1.242 MHz | 15.08 | -30.91 | |
| 1 Quasi Peak | 1.538 MHz | 27.30 | -28.69 | |
| 2 Average | 1.594 MHz | 15.13 | -30.87 | |
| 2 Average | 2.058 MHz | 21.35 | -24.64 | |
| 1 Quasi Peak | 2.102 MHz | 33.16 | -22.83 | |

Date: 17.JAN.2019 14:56:06

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

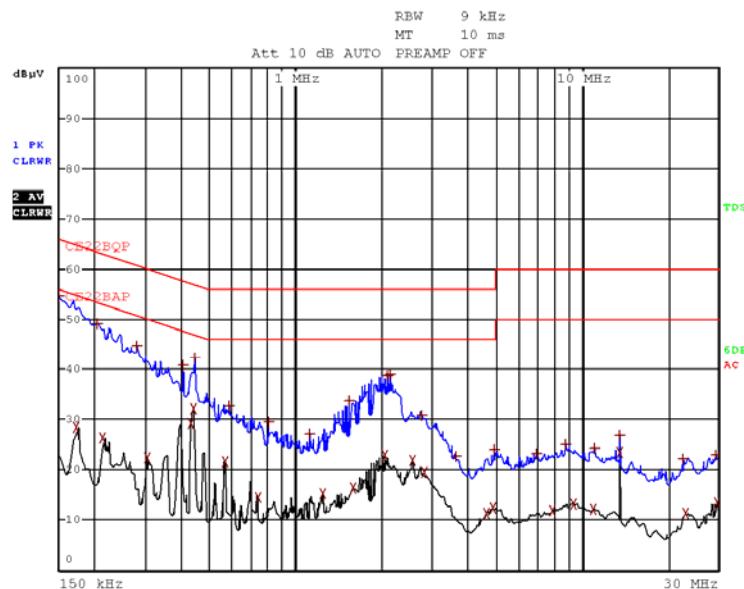
Note: *QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*



Conducted Emission

E.U.T Description Wearable Device
Type ORCAM MYME
Serial Number: 18380173

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



Date: 17.JAN.2019 14:52:45

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



Conducted Emission

E.U.T Description Wearable Device
Type ORCAM MYME
Serial Number: 18380173

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

| EDIT PEAK LIST (Final Measurement Results) | | | | |
|--------------------------------------------|------------|-------------------------|--------|----------|
| Trace1: | CE22BQP | | | |
| Trace2: | CE22BAP | | | |
| Trace3: | --- | | | |
| TRACE | FREQUENCY | LEVEL dB _μ V | DELTA | LIMIT dB |
| 1 Quasi Peak | 154 kHz | 47.51 | -18.27 | |
| 2 Average | 170 kHz | 29.03 | -25.93 | |
| 1 Quasi Peak | 258 kHz | 39.23 | -22.26 | |
| 2 Average | 402 kHz | 32.14 | -15.66 | |
| 1 Quasi Peak | 442 kHz | 38.27 | -18.74 | |
| 2 Average | 442 kHz | 37.88 | -9.14 | |
| 1 Quasi Peak | 970 kHz | 30.95 | -25.04 | |
| 2 Average | 970 kHz | 30.19 | -15.80 | |
| 2 Average | 1.37 MHz | 28.44 | -17.55 | |
| 1 Quasi Peak | 1.982 MHz | 31.83 | -24.16 | |
| 1 Quasi Peak | 2.51 MHz | 35.90 | -20.09 | |
| 2 Average | 2.51 MHz | 30.47 | -15.52 | |
| 2 Average | 4.45 MHz | 18.15 | -27.84 | |
| 1 Quasi Peak | 4.722 MHz | 20.98 | -35.01 | |
| 1 Quasi Peak | 10.214 MHz | 29.31 | -30.68 | |
| 2 Average | 10.338 MHz | 24.09 | -25.90 | |
| 2 Average | 10.466 MHz | 23.50 | -26.49 | |
| 1 Quasi Peak | 10.474 MHz | 29.98 | -30.01 | |
| 1 Quasi Peak | 29.122 MHz | 23.36 | -36.63 | |
| 2 Average | 29.122 MHz | 19.42 | -30.57 | |

Date: 23.JAN.2019 13:02:26

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

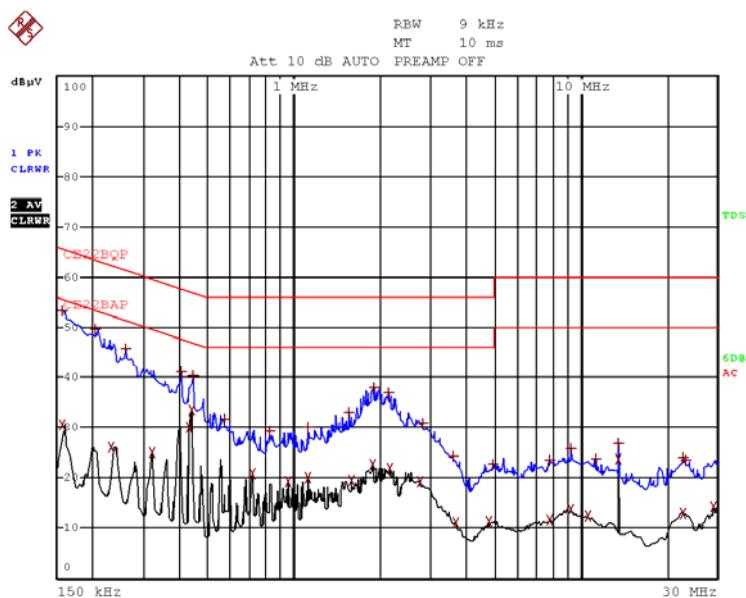
Note: *QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*



Conducted Emission

E.U.T Description: Wearable Device
Type: ORCAM MYME
Serial Number: 18380173

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



Date: 17.JAN.2019 15:01:10

Figure 18 Detectors: Peak, Quasi-peak, Average

4.5 Test Equipment Used; Conducted Emission from AC Mains

| 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 19, 2019 |
| Cable CE Chamber 3M + 3M | Testline 18 + RJ214 | 11556 | - | March 31, 2018 | March 31, 2019 |

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 (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. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=30.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

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 (MHz) | Reading (kHz) | Limit (kHz) |
|--------------------|---------------------------|---------------|-------------|
| BLE | 2402.0 | 729.0 | >500.0 |
| | 2440.0 | 719.0 | >500.0 |
| | 2480.0 | 729.0 | >500.0 |
| Wi-fi/g(6Mbit/s) | 2412.0 | 16,128.0 | >500.0 |
| | 2437.0 | 15,808.0 | >500.0 |
| | 2462.0 | 16,048.0 | >500.0 |
| Wi-fi/g(54Mbit/s) | 2412.0 | 16,437.0 | >500.0 |
| | 2437.0 | 16,128.0 | >500.0 |
| | 2462.0 | 16,447.0 | >500.0 |
| Wi-fi/n(6.5Mbit/s) | 2412.0 | 15,449.0 | >500.0 |
| | 2437.0 | 16,208.0 | >500.0 |
| | 2462.0 | 16,038.0 | >500.0 |
| Wi-fi/n(65Mbit/s) | 2412.0 | 16,208.0 | >500.0 |
| | 2437.0 | 17,485.0 | >500.0 |
| | 2462.0 | 16,607.0 | >500.0 |

Figure 20 6 dB Minimum Bandwidth



JUDGEMENT: Passed

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

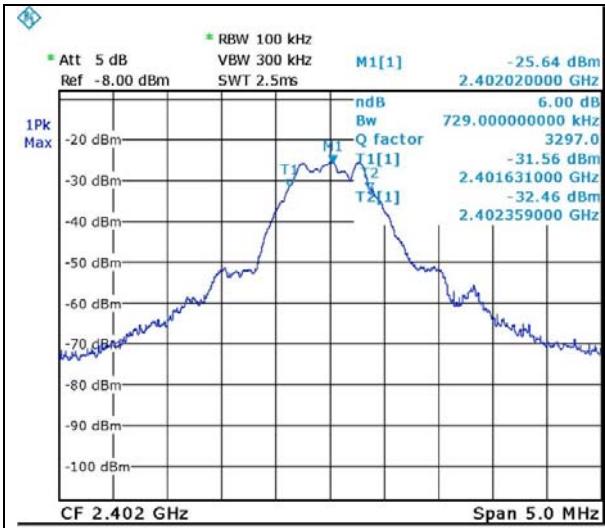


Figure 21. 2402.0 MHz, BLE

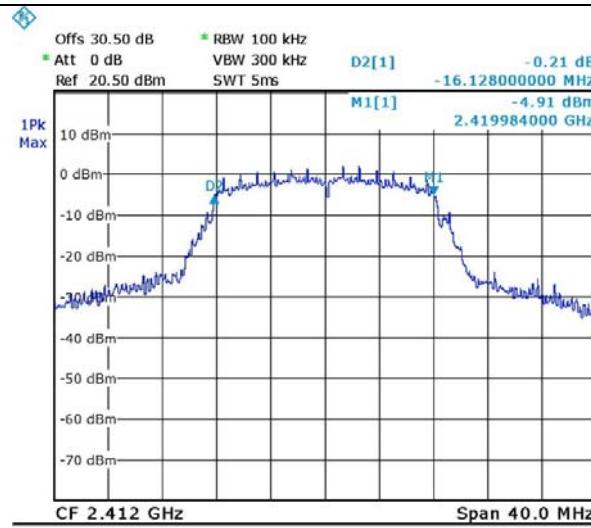


Figure 22. 2412.0 MHz, Wi-fi/g(6Mbit/s)

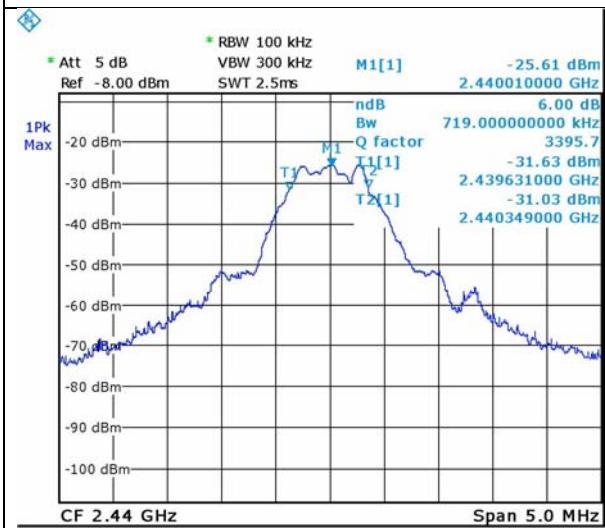


Figure 23. 2440.0 MHz, BLE

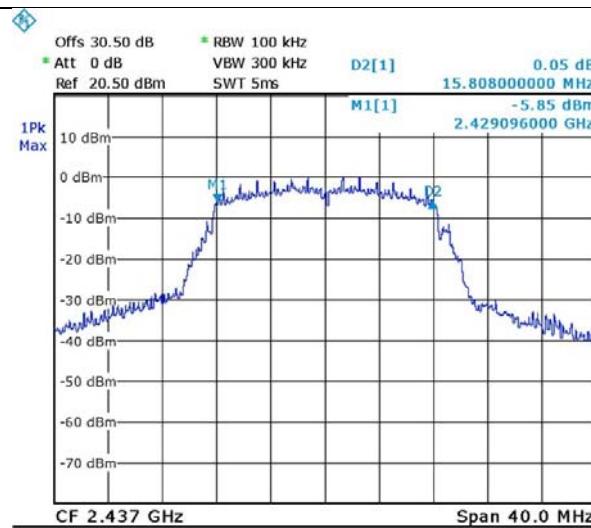
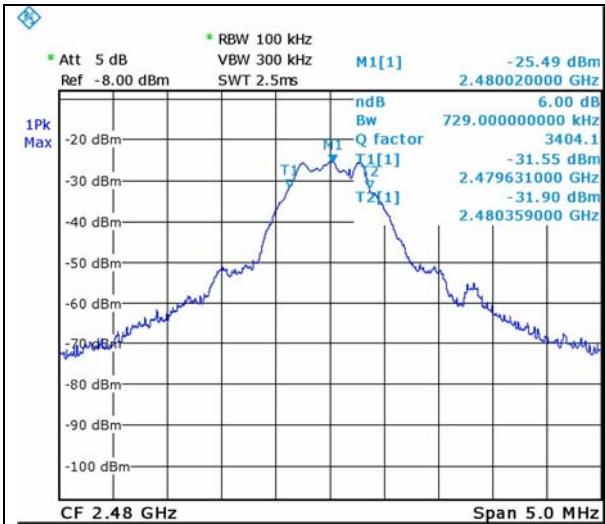
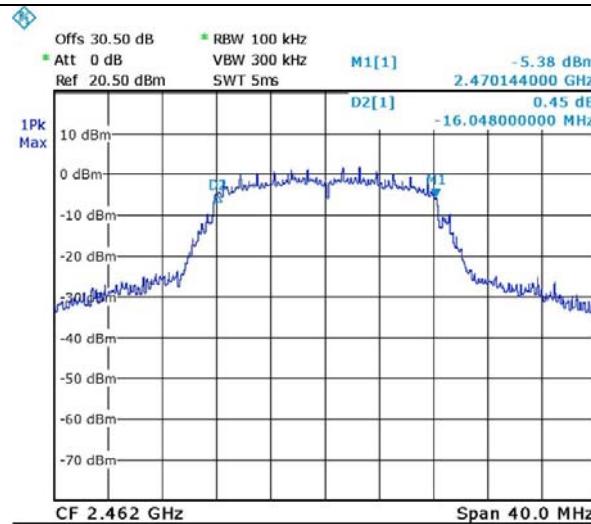


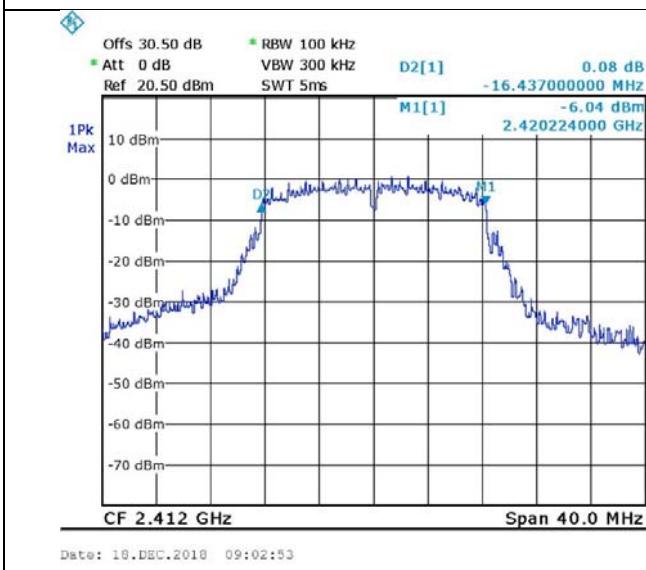
Figure 24. 2437.0 MHz, Wi-fi/g(6Mbit/s)



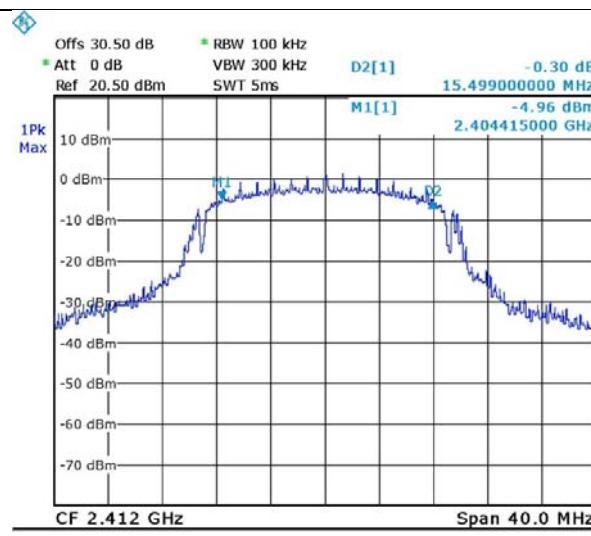
Date: 9.DEC.2018 13:40:02



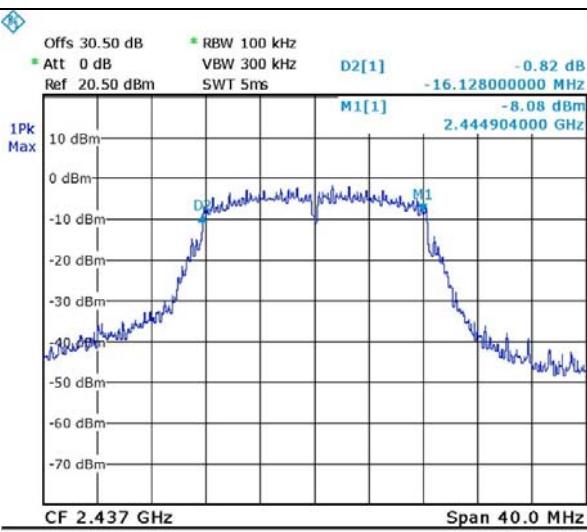
Date: 18.DEC.2018 08:48:56



Date: 18.DEC.2018 09:02:53

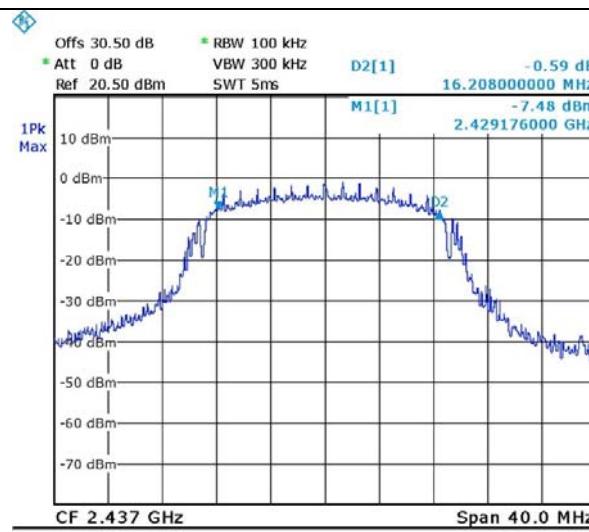


Date: 18.DEC.2018 09:06:11



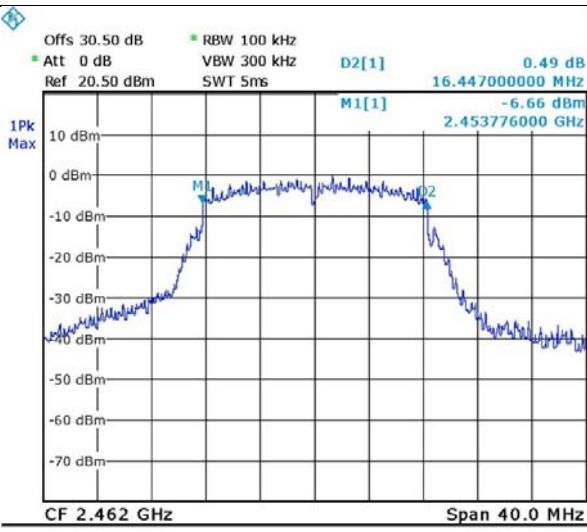
Date: 18.DEC.2018 08:58:17

Figure 29. 2437.0 MHz, Wi-fi/g(54Mbit/s)



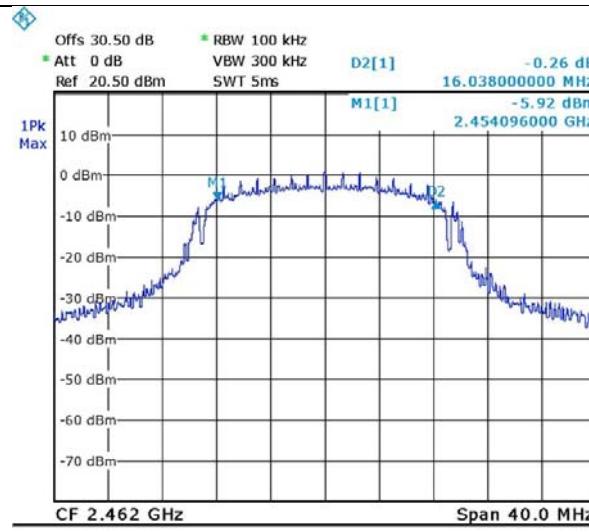
Date: 18.DEC.2018 09:11:21

Figure 30. 2437.0 MHz, Wi-fi/n(6.5Mbit/s)



Date: 18.DEC.2018 08:55:44

Figure 31. 2462.0 MHz, Wi-fi/g(54Mbit/s)



Date: 18.DEC.2018 09:14:11

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

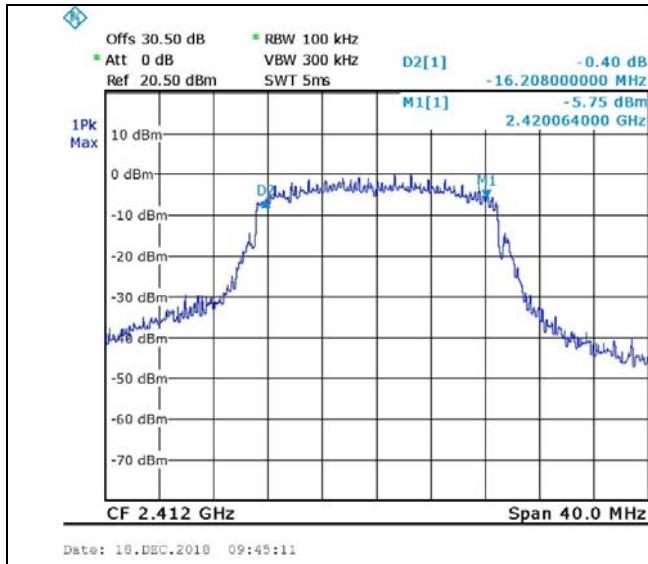


Figure 33. 2412.0 MHz, Wi-fi/n(65Mbit/s)

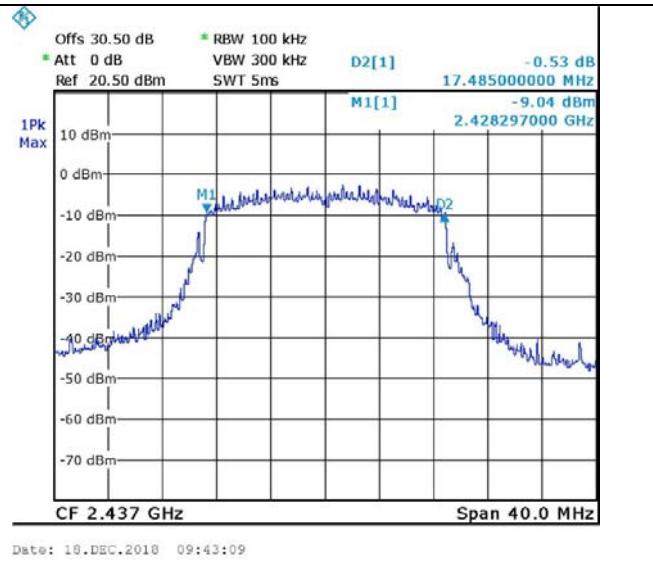


Figure 34. 2437.0 MHz, Wi-fi/n(65Mbit/s)

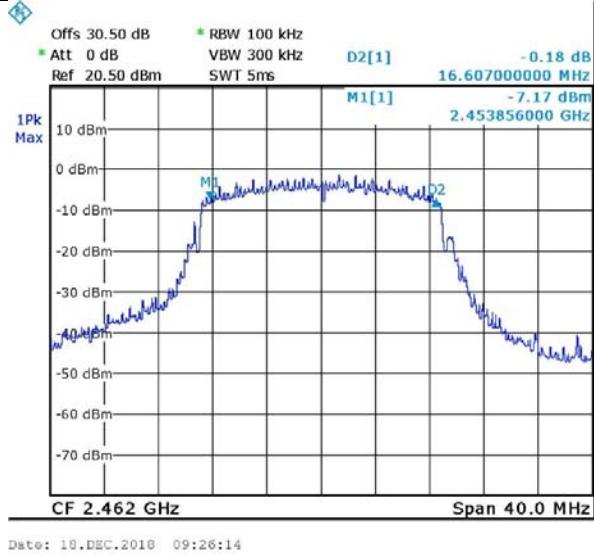


Figure 35. 2462.0 MHz, Wi-fi/n(65Mbit/s)

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 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | October 1, 2017 | December 31, 2018 See Note below |
| RF Cable | Huber Suner | Sucofelex | 27502/4PEA | October 1, 2017 | December 31, 2018 See Note below |

Note: Testing concluded December 18, 2018

Figure 36 Test Equipment Used



6. Maximum Conducted Output Power

6.1 Test Specification

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

6.2 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 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:

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

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

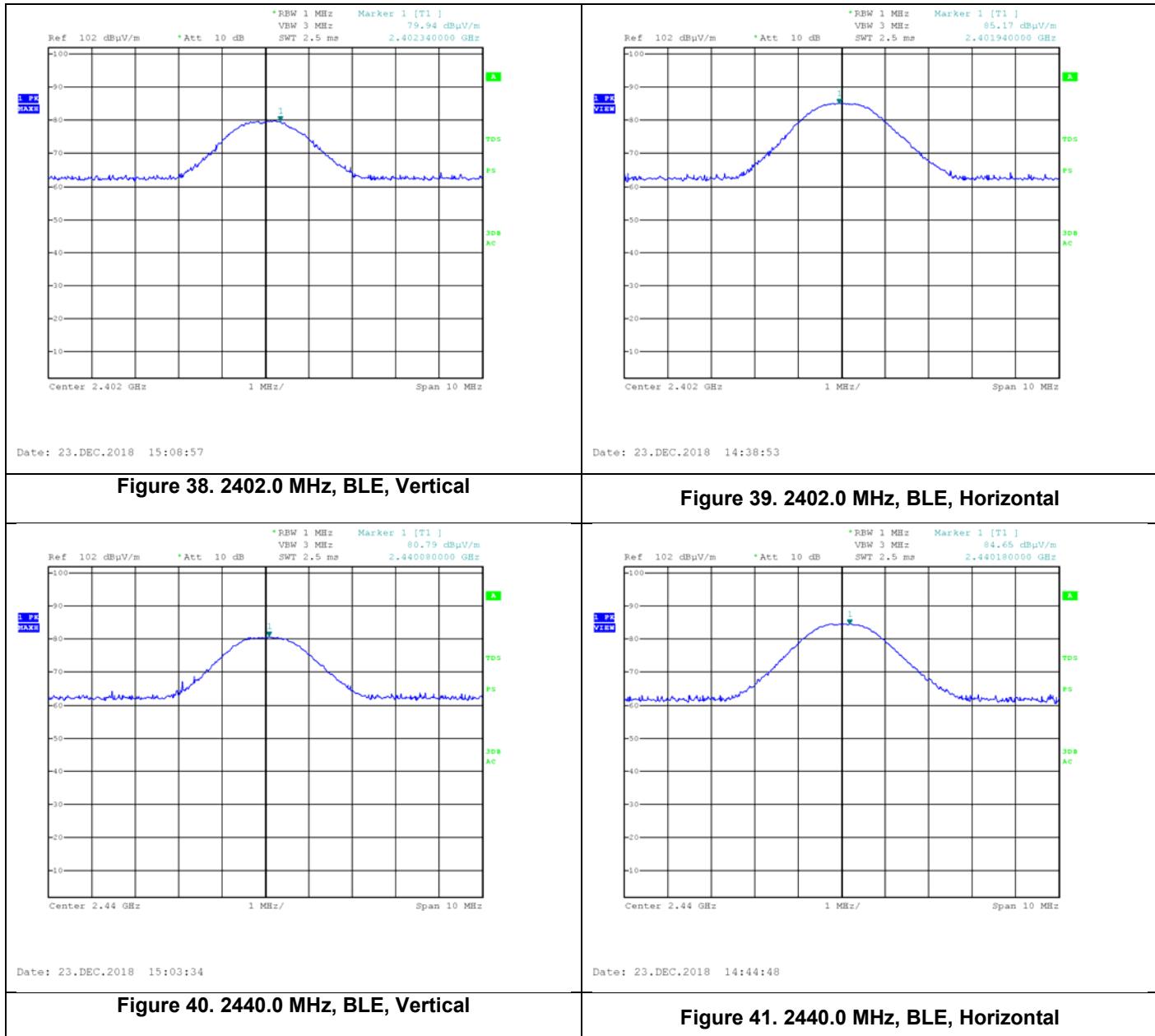
| Protocol Type | Operation Frequency | Pol. | Field Strength | EIRP | Antenna Gain | Conducted Power | Conducted Power | Limit | Margin |
|--------------------|---------------------|-------|----------------|-------|--------------|-----------------|-----------------|--------|---------|
| | (MHz) | (V/H) | (dBuV/m) | (dBm) | (dB) | (dBm) | (mW) | (mW) | (mW) |
| BLE | 2402.0 | V | 79.9 | -15.3 | -2.0 | -13.3 | 0.05 | 1000.0 | -999.95 |
| | | H | 85.2 | -10.0 | -2.0 | -8.0 | 0.16 | 1000.0 | -999.84 |
| | 2440.0 | V | 80.8 | -14.4 | -2.0 | -12.4 | 0.06 | 1000.0 | -999.94 |
| | | H | 84.7 | -10.5 | -2.0 | -8.5 | 0.14 | 1000.0 | -999.86 |
| | 2480.0 | V | 80.1 | -15.1 | -2.0 | -13.1 | 0.05 | 1000.0 | -999.95 |
| | | H | 81.7 | -13.5 | -2.0 | -11.5 | 0.07 | 1000.0 | -999.93 |
| Wi-fi/g(6Mbit/s) | 2412.0 | V | 90.0 | -5.2 | -2.0 | -3.2 | 0.48 | 1000.0 | -999.52 |
| | | H | 93.2 | -2.0 | -2.0 | 0.0 | 1.00 | 1000.0 | -999.00 |
| | 2437.0 | V | 88.0 | -7.2 | -2.0 | -5.2 | 0.30 | 1000.0 | -999.70 |
| | | H | 91.7 | -3.5 | -2.0 | -1.5 | 0.71 | 1000.0 | -999.29 |
| | 2462.0 | V | 81.5 | -13.7 | -2.0 | -11.7 | 0.07 | 1000.0 | -999.93 |
| | | H | 91.8 | -3.4 | -2.0 | -1.4 | 0.72 | 1000.0 | -999.28 |
| Wi-fi/g(54Mbit/s) | 2412.0 | V | 89.5 | -5.7 | -2.0 | -3.7 | 0.43 | 1000.0 | -999.57 |
| | | H | 93.9 | -1.3 | -2.0 | 0.7 | 1.17 | 1000.0 | -998.83 |
| | 2437.0 | V | 86.2 | -9.0 | -2.0 | -7.0 | 0.20 | 1000.0 | -999.8 |
| | | H | 91.1 | -4.1 | -2.0 | -2.1 | 0.62 | 1000.0 | -999.38 |
| | 2462.0 | V | 89.6 | -5.6 | -2.0 | -3.6 | 0.44 | 1000.0 | -999.56 |
| | | H | 90.6 | -4.6 | -2.0 | -2.6 | 0.55 | 1000.0 | -999.45 |
| Wi-fi/n(6.5Mbit/s) | 2412.0 | V | 88.1 | -7.1 | -2.0 | -5.1 | 0.31 | 1000.0 | -999.69 |
| | | H | 94.9 | -0.3 | -2.0 | 1.7 | 1.48 | 1000.0 | -998.52 |
| | 2437.0 | V | 86.3 | -8.9 | -2.0 | -6.9 | 0.20 | 1000.0 | -999.80 |
| | | H | 93.0 | -2.2 | -2.0 | -0.2 | 0.95 | 1000.0 | -999.05 |
| | 2462.0 | V | 87.2 | -8.0 | -2.0 | -6.0 | 0.25 | 1000.0 | -999.75 |
| | | H | 92.6 | -2.6 | -2.0 | -0.6 | 0.87 | 1000.0 | -999.13 |
| Wi-fi/n(65Mbit/s) | 2412.0 | V | 86.9 | -8.3 | -2.0 | -6.3 | 0.23 | 1000.0 | -999.77 |
| | | H | 94.0 | -1.2 | -2.0 | 0.8 | 1.20 | 1000.0 | -998.80 |
| | 2437.0 | V | 84.5 | -10.7 | -2.0 | -8.7 | 0.13 | 1000.0 | -999.87 |
| | | H | 91.5 | -3.7 | -2.0 | -1.7 | 0.68 | 1000.0 | -999.32 |
| | 2462.0 | V | 86.0 | -9.2 | -2.0 | -7.2 | 0.19 | 1000.0 | -999.81 |
| | | H | 91.4 | -3.8 | -2.0 | -1.8 | 0.66 | 1000.0 | -999.34 |

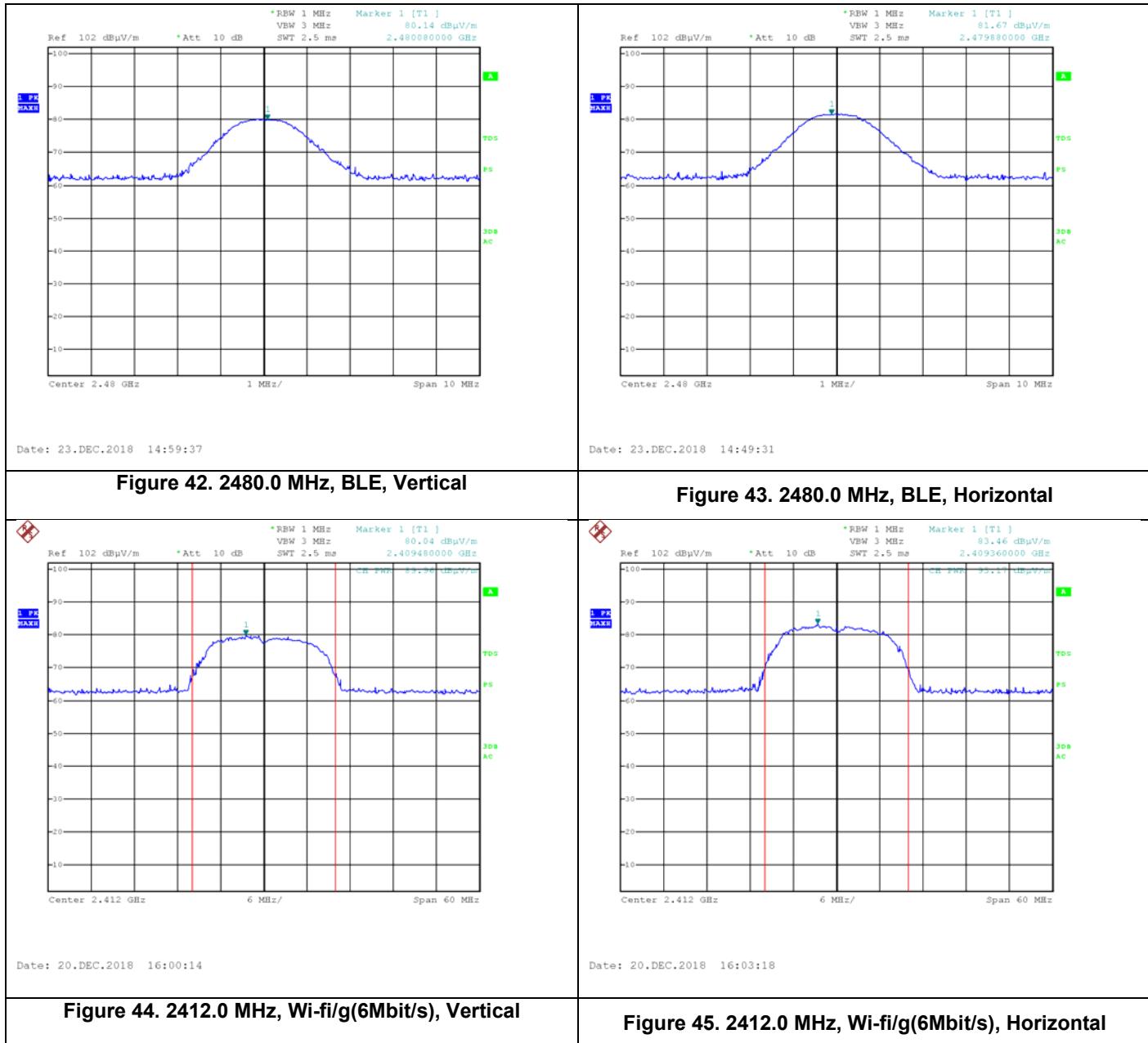
Figure 37 Maximum Peak Power Output

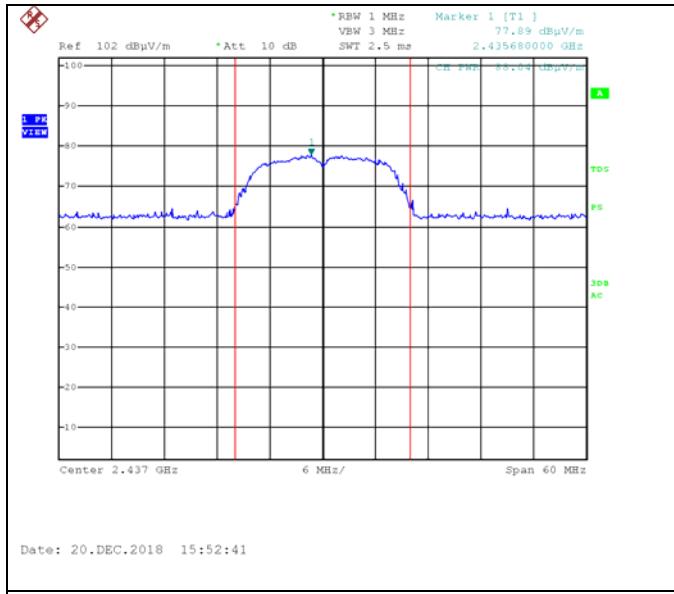


JUDGEMENT: Passed by 998.52 mW

For additional information see *Figure 38* to *Figure 67*.

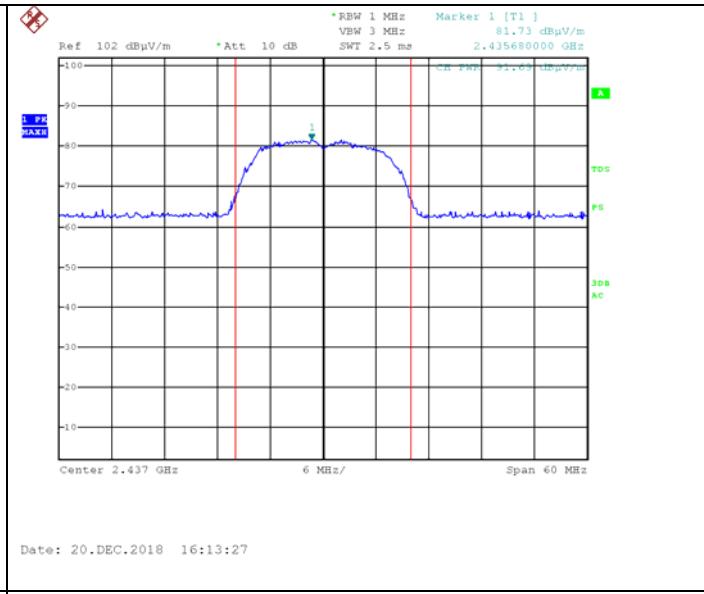






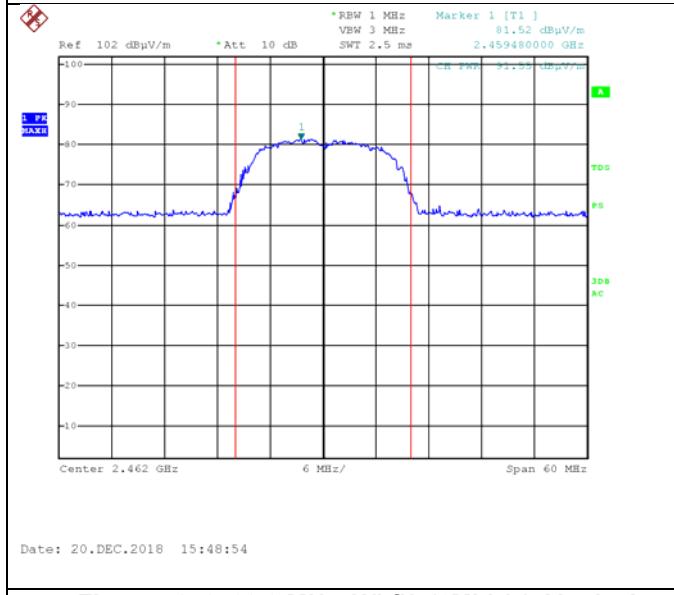
Date: 20.DEC.2018 15:52:41

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



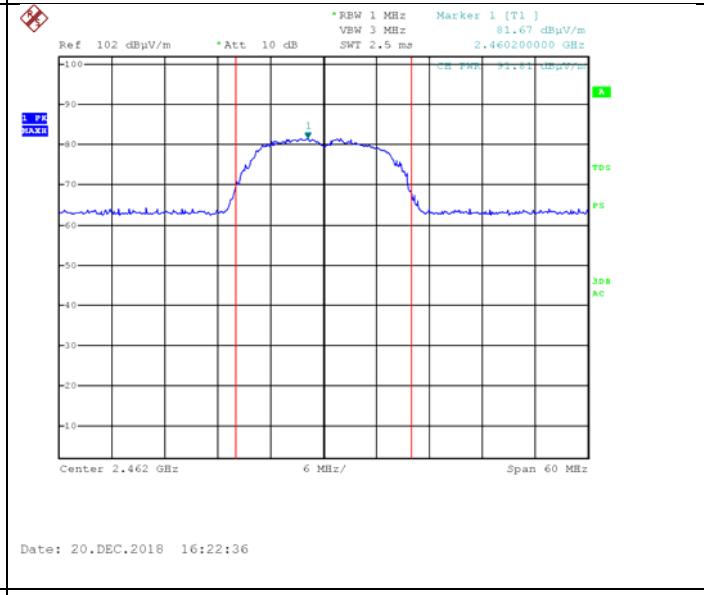
Date: 20.DEC.2018 16:13:27

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



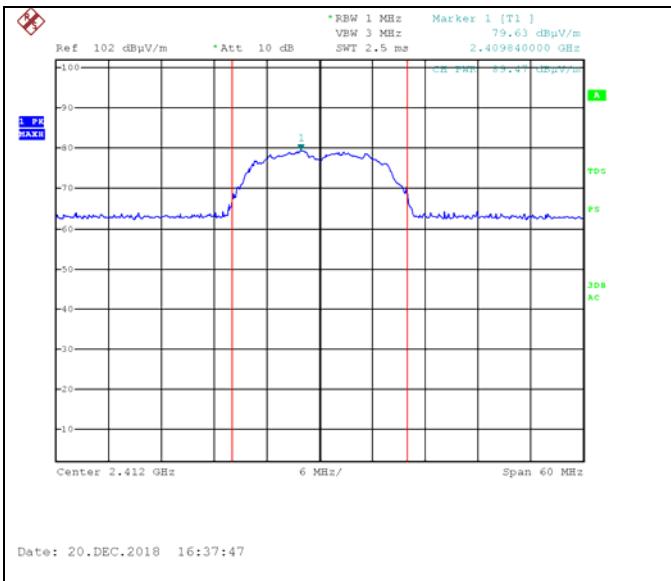
Date: 20.DEC.2018 15:48:54

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



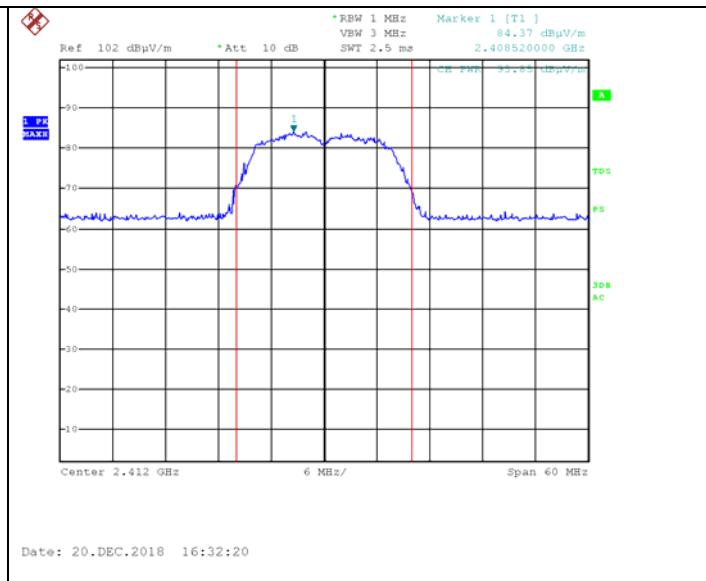
Date: 20.DEC.2018 16:22:36

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



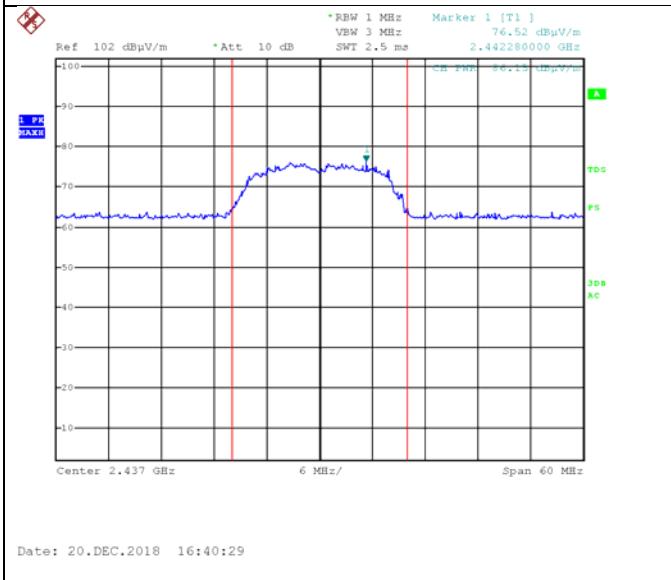
Date: 20.DEC.2018 16:37:47

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



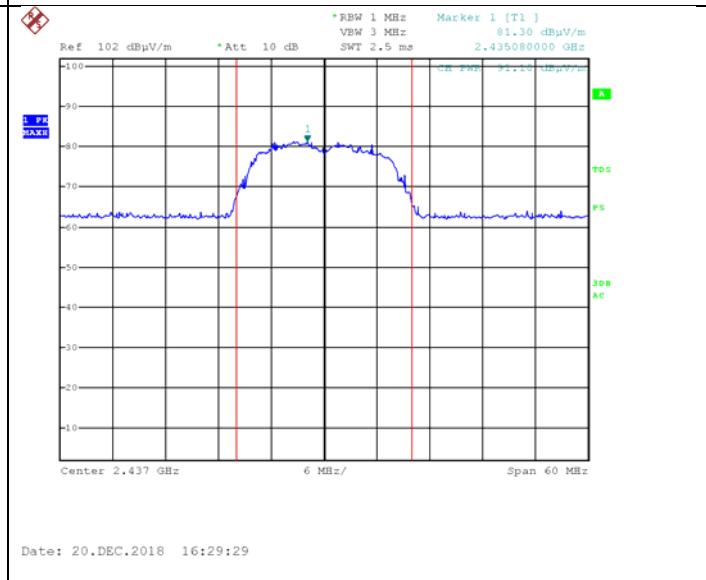
Date: 20.DEC.2018 16:32:20

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



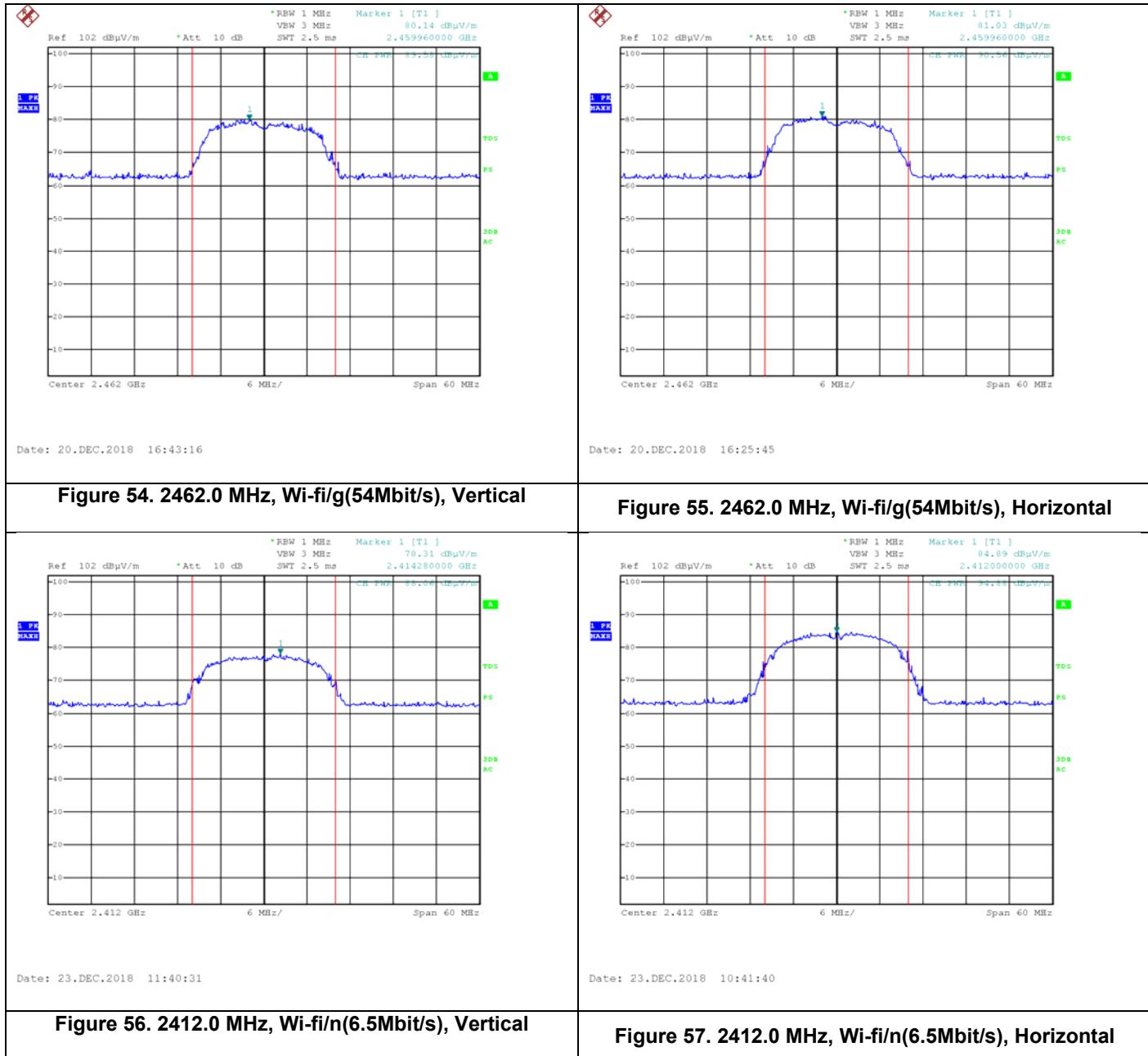
Date: 20.DEC.2018 16:40:29

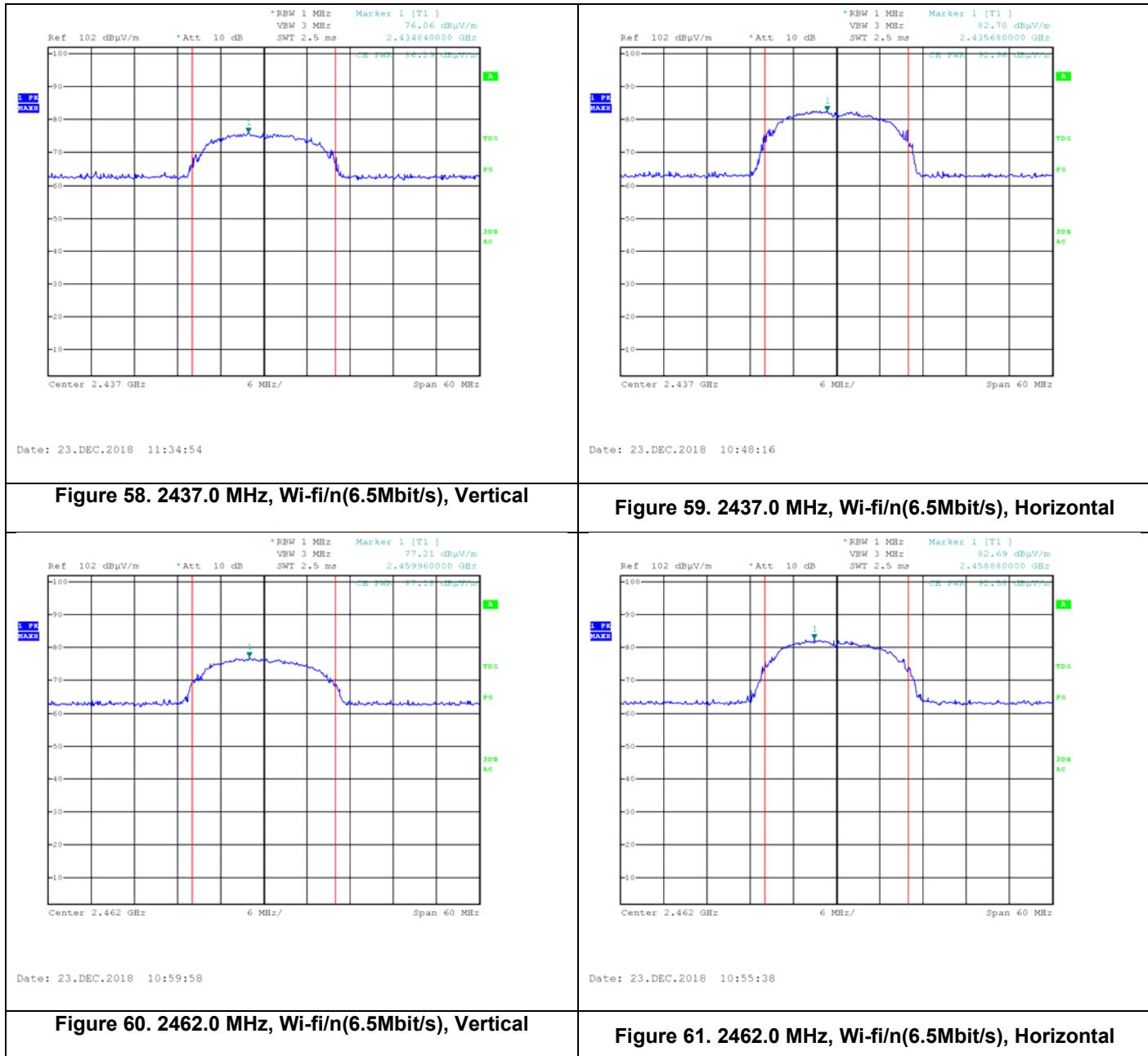
Figure 52. 2437.0 MHz, Wi-fi/g(54Mbit/s), Vertical

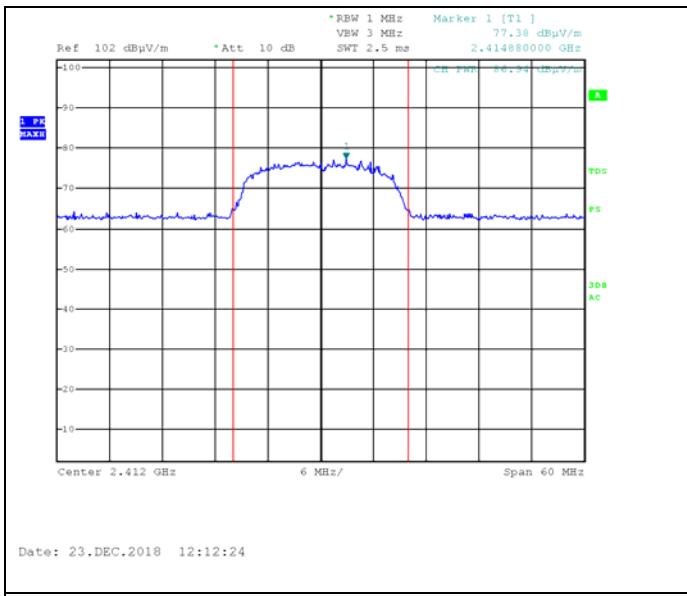


Date: 20.DEC.2018 16:29:29

Figure 53 2437.0 MHz Wi-Fi/g(54Mbit/s) Horizontal

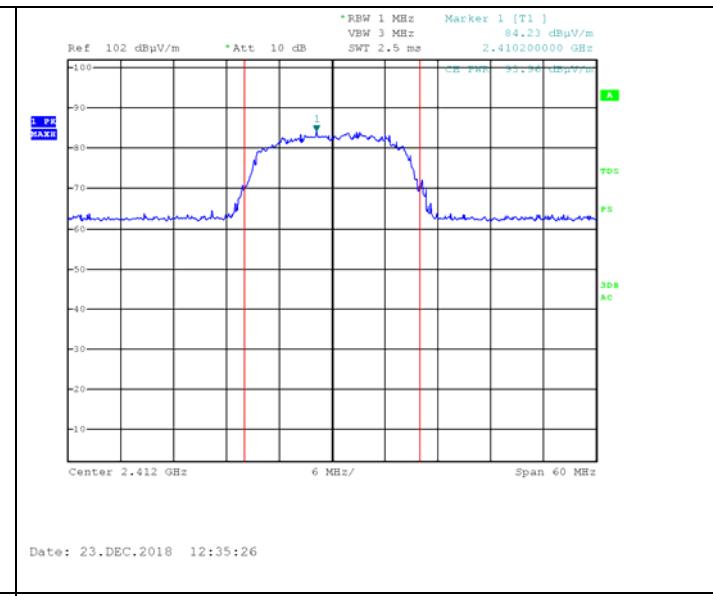






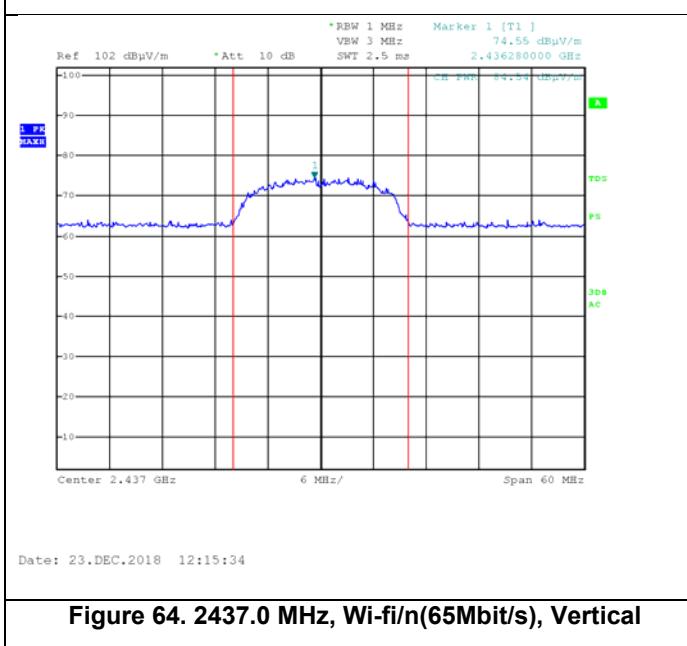
Date: 23.DEC.2018 12:12:24

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



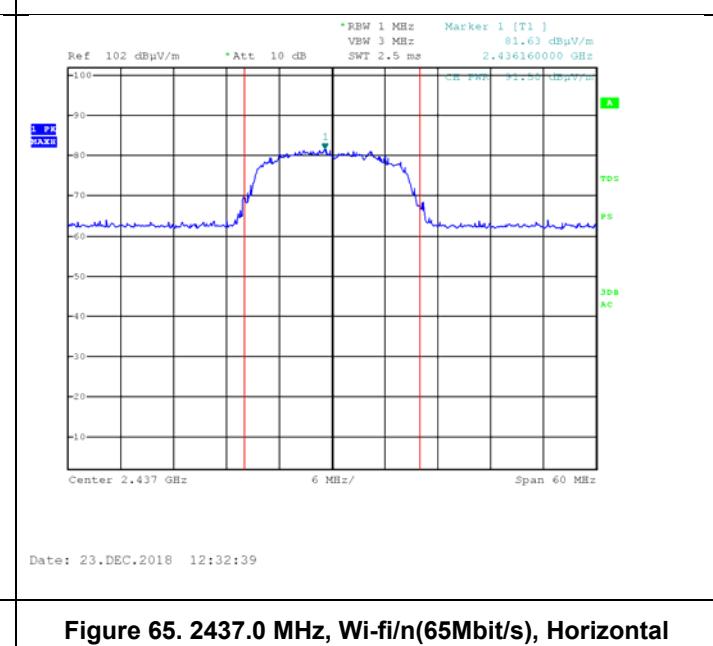
Date: 23.DEC.2018 12:35:26

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



Date: 23.DEC.2018 12:15:34

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



Date: 23.DEC.2018 12:32:39

Figure 65 2437.0 MHz Wi-Fi/n(65Mbit/s) Horizontal

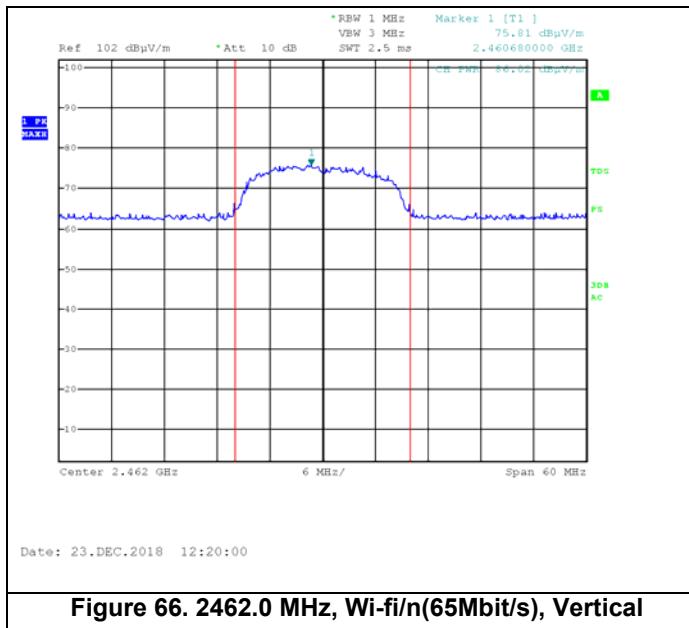


Figure 66. 2462.0 MHz, Wi-fi/n(65Mbit/s), Vertical

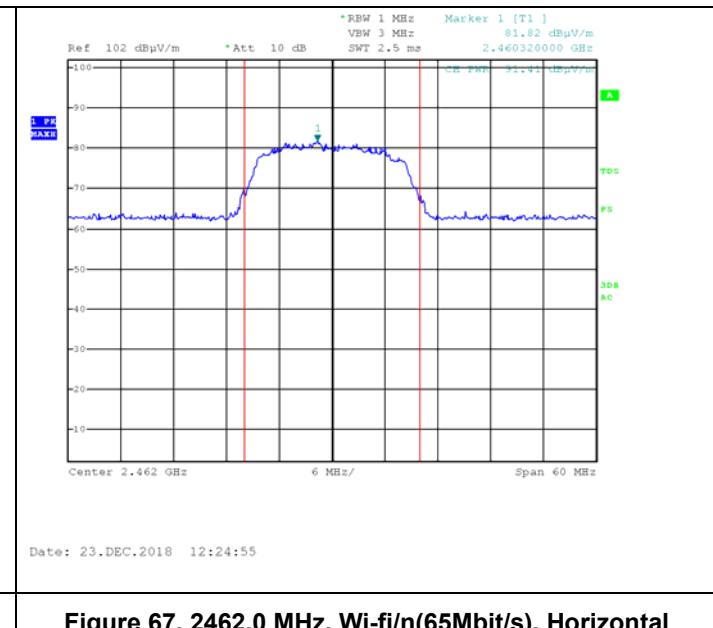


Figure 67. 2462.0 MHz, Wi-fi/n(65Mbit/s), Horizontal

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 19, 2019 |
| Horn Antenna | ETS | 3115 | 6142 | May 31, 2018 | May 31, 2021 |
| RF Cable | Commscope ORS | 0623 WBC-400 | G020132 | October 1, 2017 | December 31, 2018 See Note below |
| Semi Anechoic Civil Chamber | ETS | S81 | SL 11643 | NCR | NCR |

Note: Testing concluded December 23, 2018

Figure 68 Test Equipment Used



7. Band Edge Spectrum

7.1 Test Specification

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

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. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=30.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

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 (dBm) | Limit (dBm) | Margin (dB) |
|--------------------|---------------------------|---------------------------|----------------------|-------------|-------------|
| BLE | 2402.0 | 2400.0 | -37.4 | -15.2 | -22.2 |
| | 2480.0 | 2483.5 | -44.9 | -14.7 | -30.2 |
| Wi-fi/g(6Mbit/s) | 2412.0 | 2400.0 | -25.4 | -18.2 | -7.2 |
| | 2462.0 | 2483.5 | -35.5 | -17.7 | -17.8 |
| Wi-Fi/g(54Mbit/s) | 2412.0 | 2400.0 | -30.0 | -19.3 | -10.7 |
| | 2462.0 | 2483.5 | -40.5 | -20.3 | -20.2 |
| Wi-Fi/n(6.5Mbit/s) | 2412.0 | 2400.0 | -27.4 | -19.8 | -7.6 |
| | 2462.0 | 2483.5 | -36.9 | -19.3 | -17.6 |
| Wi-fi/n(65Mbit/s) | 2412.0 | 2400.0 | -30.7 | -20.5 | -10.2 |
| | 2462.0 | 2483.5 | -45.3 | -21.3 | -24.0 |

Figure 69 Band Edge Spectrum



JUDGEMENT: Passed by 7.2 dB

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



Band Edge Spectrum

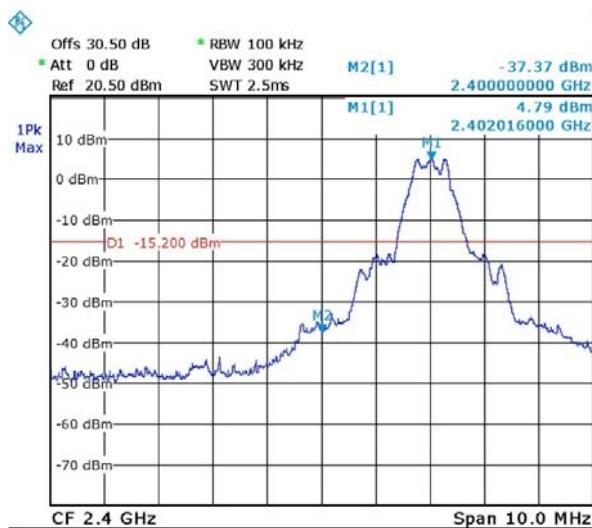


Figure 70 Band Edge Low, BLE

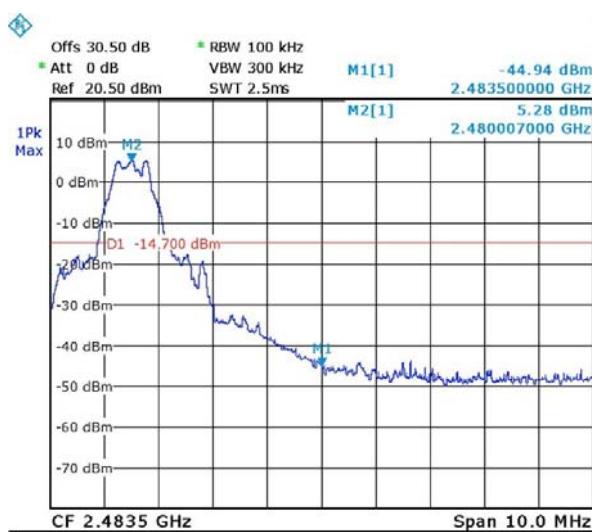
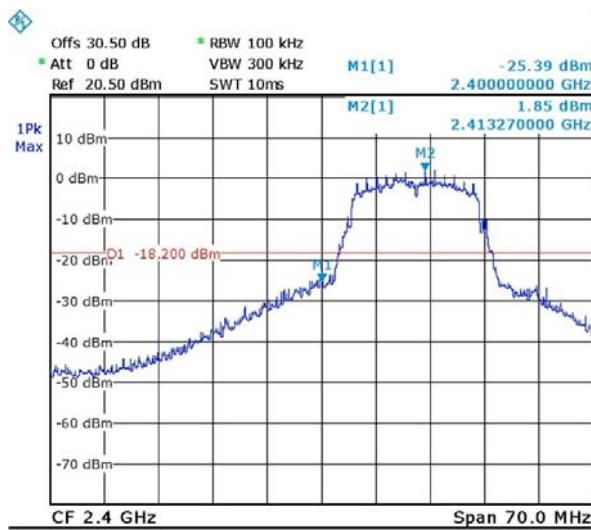


Figure 71 Band Edge High, BLE

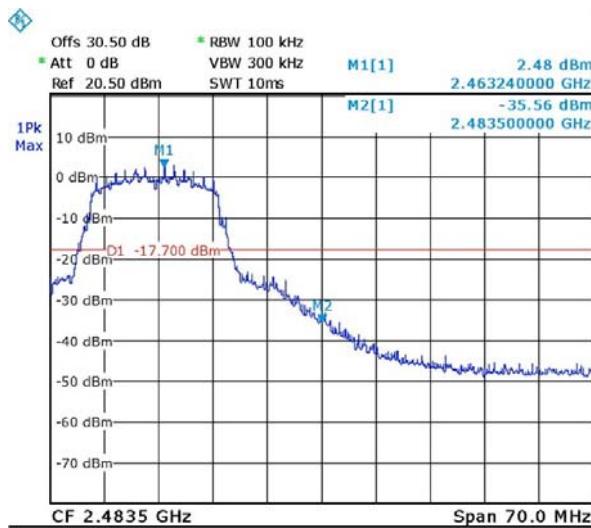


Band Edge Spectrum



Date: 18.DEC.2010 12:45:08

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

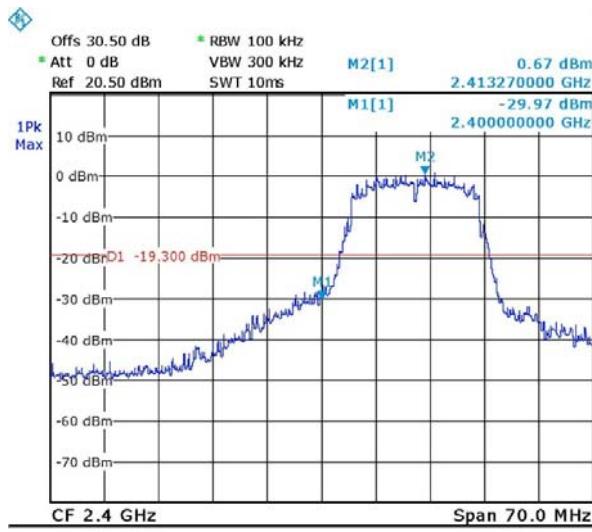


Date: 18.DEC.2010 12:54:21

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

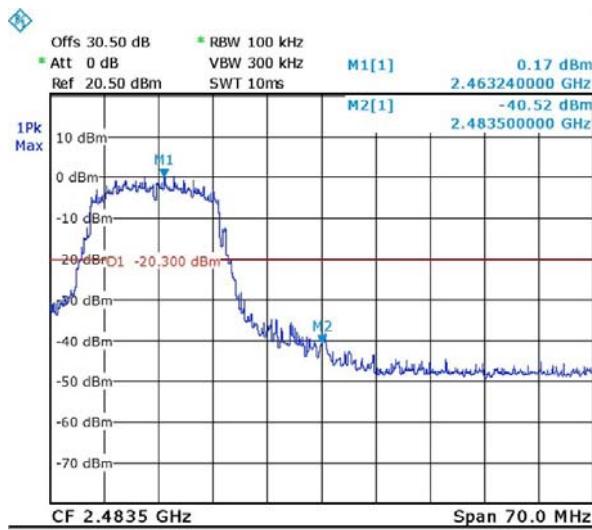


Band Edge Spectrum



Date: 18.DEC.2018 12:47:42

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

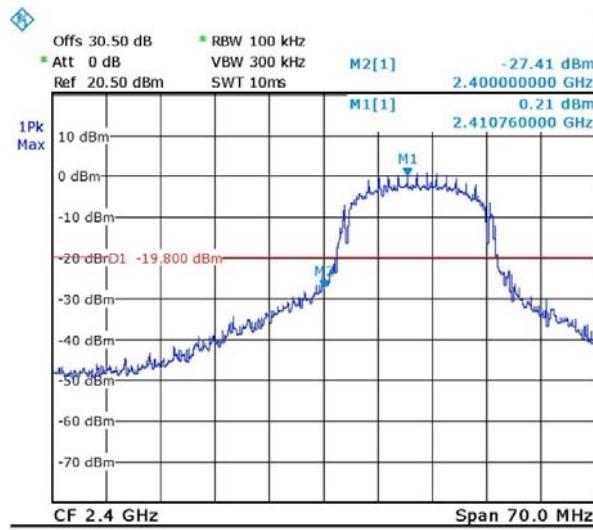


Date: 18.DEC.2018 12:50:47

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

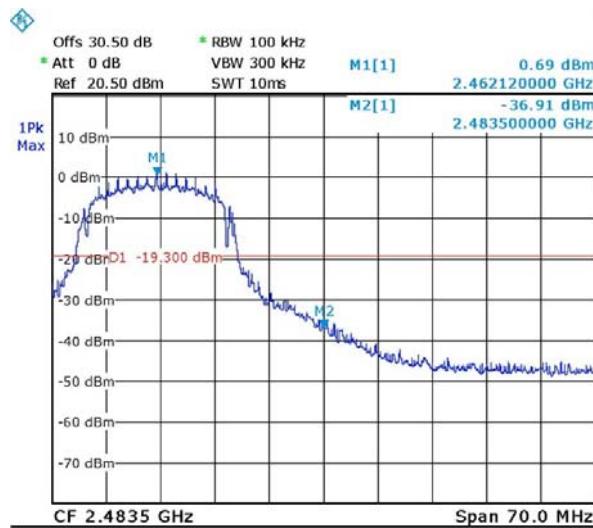


Band Edge Spectrum



Date: 18.DEC.2018 10:37:21

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



Date: 18.DEC.2018 10:35:12

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



Band Edge Spectrum

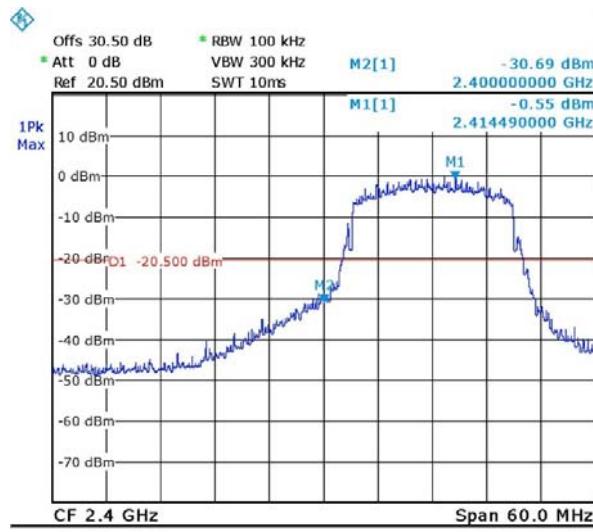


Figure 78 Band Edge Low, Wi-fi/n(65Mbit/s)

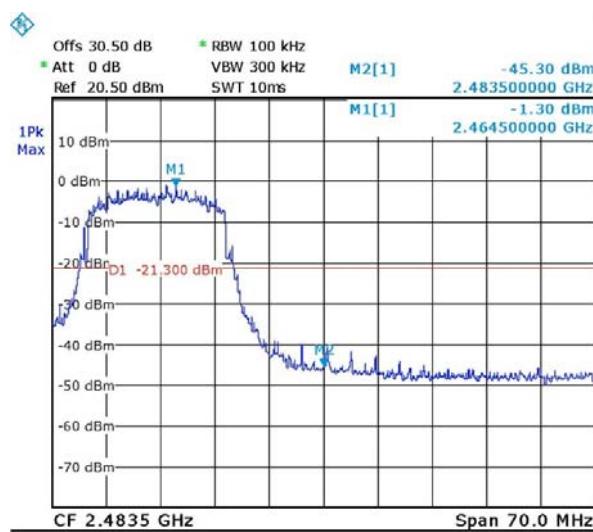


Figure 79 Band Edge High, Wi-fi/n(65Mbit/s)



7.5 **Test Equipment Used; Band Edge**

| Instrument | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Due |
|-------------------|--------------|-----------|-------------|-----------------------|-------------------------------------|
| Spectrum Analyzer | R&S | FSL6 | 100194 | February 19, 2018 | February 19, 2019 |
| 30dB Attenuator | MCL | BW-S30W5 | 533 | October 1, 2017 | December 31, 2018 See Note below |
| RF Cable | Huber Suner | Sucofelex | 27502/4PE A | October 1, 2017 | December 31, 2018 See Note below |

Note: Testing concluded December 18, 2019

Figure 80 Test Equipment Used