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Test Report

Certification

FCC ID	2AJACWIFIMOD
Equipment Under Test	040-00460
Test Report Serial No	V054100_01
Dates of Test	Radiated June 18, 22, 24, 25, 29, and 30, 2020 Conducted September 9, 2020
Report Issue Date	September 21, 2020

Test Specifications:	Applicant:
FCC Part 15, Subpart C	Wirepath Home Systems, LLC. (dba SnapAv, dba Control4) 1800 Continental Blvd, Suite 200 Charlotte, NC 28273 U.S.A.



Certification of Engineering Report

This report has been prepared by VPI Laboratories, Inc. to document compliance of the device described below with the requirements of Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

Applicant	Wirepath Home Systems, LLC. (dba SnapAv, dba Control4)
Manufacturer	Wirepath Home Systems, LLC. (dba SnapAv, dba Control4)
Brand Name	Control4
Model Number	040-00460
FCC ID	2AJACWIFIMOD

On this 21st day of September 2020, I, individually and for VPI Laboratories, Inc., certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has accredited the VPI Laboratories, Inc. EMC testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

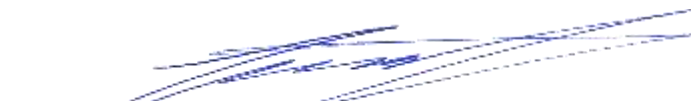
VPI Laboratories, Inc.



Radiated Emissions Testing by: Norman P. Hansen



Direct Connect Measurements by: Benjamin Antczak



Reviewed by: Jason Stewart

Revision History		
Revision	Description	Date
01	Original Report Release	September 21, 2020
02	Correcting Lab Information Page 12	October 14, 2020

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1 Client Information

1.1 Applicant

Company Name	Wirepath Home Systems, LLC. (dba SnapAV, dba Control4) 1800 Continental Blvd, Suite 200 Charlotte, NC 28273 U.S.A.
Contact Name	Roger Midgley
Title	Sr. Regulatory Compliance Engineer

1.2 Manufacturer

Company Name	Wirepath Home Systems, LLC. (dba SnapAV, dba Control4) 1800 Continental Blvd, Suite 200 Charlotte, NC 28273 U.S.A.
Contact Name	Roger Midgley
Title	Sr. Regulatory Compliance Engineer

2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	Control4
Model Number	040-00460
Serial Number	None
Dimensions (cm)	2.8 x 1.6 x 0.2

2.2 Description of EUT

The 040-00460 is a WiFi module that uses the 2.4 GHz ISM band and the UNII bands. The 2.4 GHz ISM band transceiver operates on 11 channels and at the power setting as shown in the table below. The 040-00460 has 2 antennas installed, controlled by an RF switch, and only one antenna at a time is used for transmitting data. The 040-00460 receives power from the host device the module is installed in.

Channel	Frequency	802.11b	802.11g	802.11n
1	2412	20.00	13.50	13.00
2	2417	20.00	14.75	16.00
3	2422	20.00	16.50	17.00
4	2427	20.00	18.25	18.00
5	2432	20.00	20.00	20.00
6	2437	20.00	20.00	20.00
7	2442	20.00	20.00	20.00
8	2447	20.00	20.00	19.50
9	2452	20.00	18.25	18.50
10	2457	20.00	16.00	17.00
11	2462	20.00	14.75	15.00

This report covers the circuitry of the devices subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Subpart B and the transceiver operating in the UNII bands were found compliant and are covered in separate reports.

2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: Control4 MN: 040-00460 (Note 1) SN: None	WiFi Module	See Section 2.4
BN: Control4 MN: T4 Host SN: None	Host system	Direct connection to the EUT (Note 2)

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: ASUS MN: GW5200 SN: None	Network Router	Network/Cat5e cables

Notes: (1) EUT

(2) Interface port connected to EUT (See Section 2.4).

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.4 Interface Ports on EUT

Name of Ports	No. of Ports Fitted to EUT	Cable Description/Length
Host system interface	1	Direct connection to the host system

2.5 Modification Incorporated/Special Accessories on EUT

There were no modifications or special accessories required to comply with the specification.

2.6 Deviation from Test Standard

There were no deviations from the test specification.

3 Test Specification, Methods and Procedures

3.1 Test Specification

Title	FCC PART 15, Subpart C (47 CFR 15) 15.203, 15.207, and 15.247 Limits and methods of measurement of radio interference characteristics of radio frequency devices.
Purpose of Test	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures

3.2.1 §15.203 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

3.2.2 §15.207 Conducted Limits

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	Limit (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50*	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.

Table 1: Limits for conducted emissions at mains ports of Class B ITE.

3.2.3 §15.247 Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz

- Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions.

- 1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400 – 2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
 - i. For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
 - ii. Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.
 - iii. Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels are used.
 - 2) 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.
- b) The maximum peak output power of the intentional radiator shall not exceed the following:
- 1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
 - 2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

- 3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725 – 5850 MHz bands: 1 watt. As an alternative to a peak power measurement, compliance with the Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
 - 4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- c) Operation with directional antenna gains greater than 6 dBi.
- 1) Fixed point-to-point operation:
 - i. Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.
 - ii. Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.
 - iii. Fixed, point-to-point operation, as used in paragraphs (b)(4)(i) and (b)(4)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.
 - 2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:
 - i. Different information must be transmitted to each receiver.

- ii. If the transmitter employs an antenna system that emits multiple directional beams but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna /antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:
 - A. The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or staff having the highest gain.
 - B. A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.
 - iii. If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.
 - iv. Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.
- d) 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
 - e) 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
 - f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned off, shall have an

average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

- g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.
- h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.
- i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Note: Spread spectrum systems are sharing these bands on a noninterference basis with systems supporting critical Government requirements that have been allocated the usage of these bands, secondary only to ISM equipment operated under the provisions of Part 18 of this Chapter. Many of these Government systems are airborne radiolocation systems that emit a high EIRP which can cause interference to other users. Also, investigations of the effect of spread spectrum interference to U. S. Government operations in the 902-928 MHz band may require a future decrease in the power limits allowed for spread spectrum operation.

3.3 Test Procedure

VPI Laboratories, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2021. VPI Laboratories, Inc. carries FCC Accreditation Designation Number US5263. VPI Laboratories main office is located at 313 W 12800 S, Suite 311, Draper, UT 84020. The testing was performed according to the procedures in ANSI C63.10-2013, KDB 558074, and 47 CFR Part 15.

4 Operation of EUT During Testing

4.1 Operating Environment

Power Supply	3.3 VDC from host device
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4.2 Operating Modes

The transmitter was tested on 3 orthogonal axes while in a constant transmit mode at the upper, middle, and lower channels. For radiated spurious emissions, in 802.11b mode a data rate of 1 Mbps was found worst-case, 802.11g a data rate of 6 Mbps was found to be worst-case, and 802.11n worst-case was found to be using data rate MCS4.

4.3 EUT Exercise Software

Control4 firmware was used to exercise and control the transmitter for testing.

5 Summary of Test Results

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests

Section	Environmental Phenomena	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.247(a)	Bandwidth Requirement	2400 to 2483.5	Complied
15.247(b)	Peak Output Power	2400 to 2483.5	Complied
15.247(d)	Antenna Conducted Spurious Emissions	0.009 - 25000	Complied
15.247(d)	Radiated Spurious Emissions	0.009 - 25000	Complied
15.247(e)	Peak Power Spectral Density	2400 to 2483.5	Complied

5.2 Result

In the configuration tested, the EUT complied with the requirements of the specification.

6 Measurements, Examinations and Derived Results – 802.11b

6.1 General Comments

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Section 7 of this report.

6.2 Test Results

6.2.1 §15.203 Antenna Requirements

The EUT uses 2 ACON, Advanced-Connectek Inc. ACON_ADEEE-000000 dipole antennas that have an RP-SMA connector. RG-178 coax cables with an RP-SMA and an MHF 4L connector is used to connect each antenna to the module. Note that the cable was considered part of the antenna and direct connection testing was performed with measurements taken at the MHF 4L connectors on the module PCB. The maximum gain of the antenna specified by the antenna manufacturer is 2 dBi.

Result

The EUT complied with the specification.

6.2.2 Conducted Emissions at Mains Ports Data (Hot Lead)

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.15	Hot Lead	Peak (Note 1)	51.3	56.0	-4.7
0.19	Hot Lead	Peak (Note 1)	46.2	54.1	-7.9
0.23	Hot Lead	Peak (Note 1)	41.5	52.5	-11.0
0.46	Hot Lead	Peak (Note 1)	35.3	46.7	-11.4
0.78	Hot Lead	Peak (Note 1)	36.9	46.0	-9.1
1.38	Hot Lead	Peak (Note 1)	33.3	46.0	-12.7
0.15	Neutral Lead	Peak (Note 1)	49.7	56.0	-6.3
0.20	Neutral Lead	Peak (Note 1)	47.5	53.6	-6.1
0.24	Neutral Lead	Peak (Note 1)	44.8	52.2	-7.4
0.28	Neutral Lead	Peak (Note 1)	40.1	50.9	-10.8
0.77	Neutral Lead	Peak (Note 1)	39.6	46.0	-6.4
4.56	Neutral Lead	Peak (Note 1)	34.0	46.0	-12.0

Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.

Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

Result

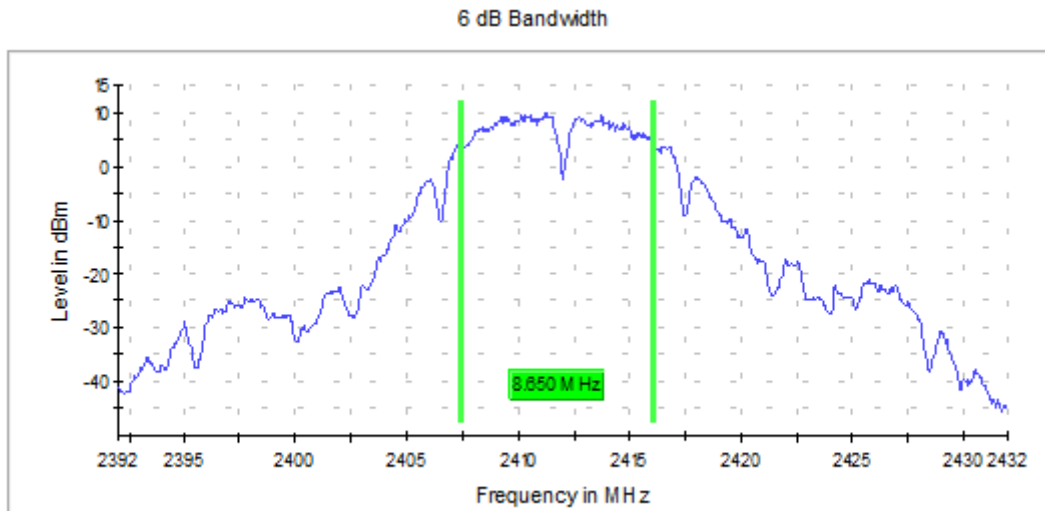
The EUT complied with the specification limit by a margin of 4.7 dB.

6.2.3 §15.247(a)(2) Emissions Bandwidth

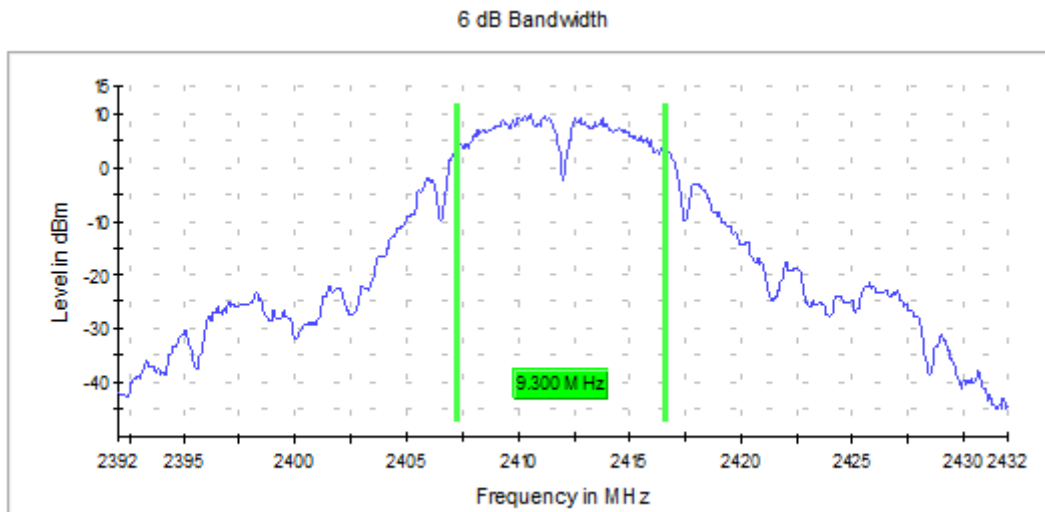
Frequency (MHz)	Emissions 6 dB bandwidth Antenna 0 (MHz)	Emissions 6 dB bandwidth Antenna 1 (MHz)
2412	8.7	9.3
2437	9.9	9.7
2462	8.9	8.9

Result

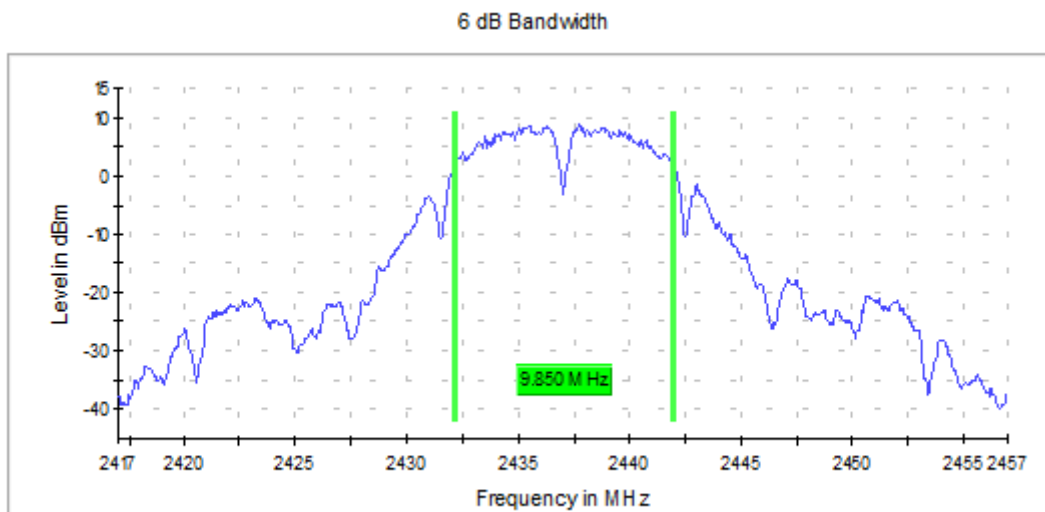
In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see plots below).



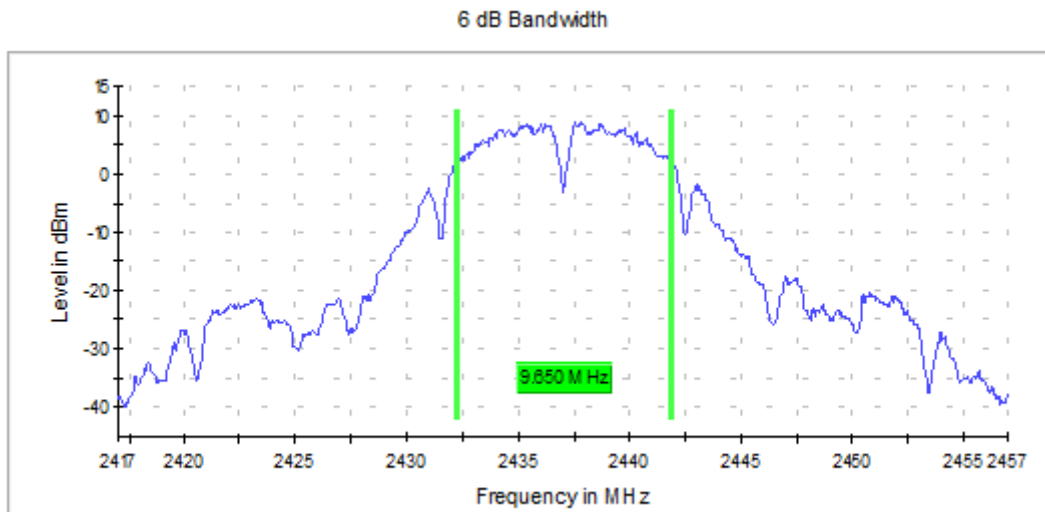
Graph 1: Antenna 0 - Lowest Channel (2412 MHz) Bandwidth - Setting 20



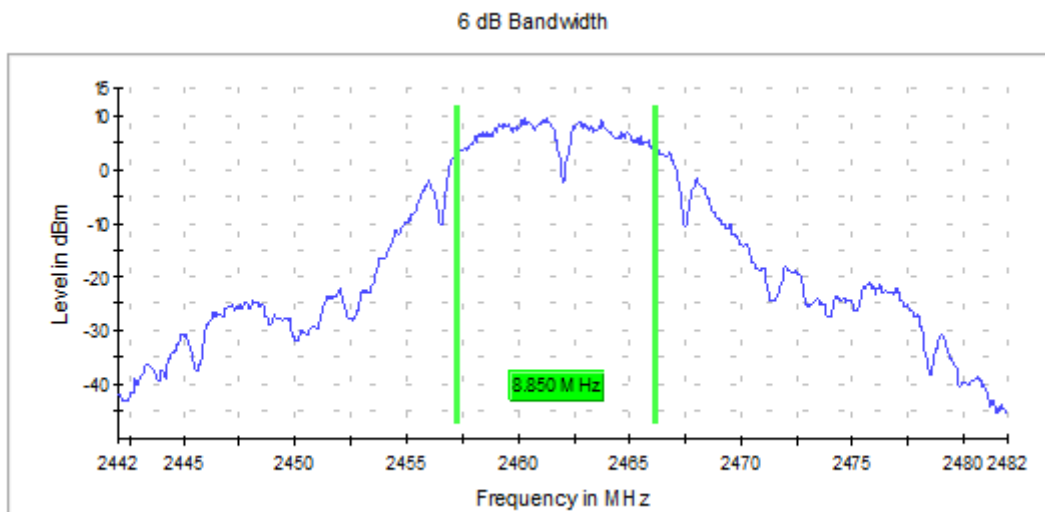
Graph 2: Antenna 1 - Lowest Channel (2412 MHz) Bandwidth - Setting 20



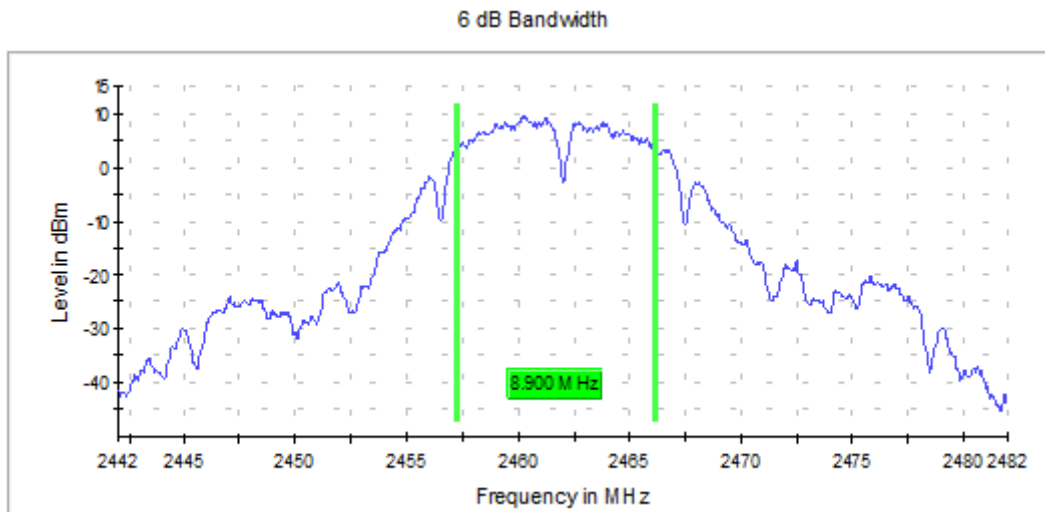
Graph 3: Antenna 0 - Middle Channel (2437 MHz) Bandwidth - Setting 20



Graph 4: Antenna 1 - Middle Channel (2437 MHz) Bandwidth - Setting 20



Graph 5: Antenna 0 - Highest Channel (2462 MHz) Bandwidth - Setting 20



Graph 6: Antenna 1 - Highest Channel (2462 MHz) Bandwidth - Setting 20

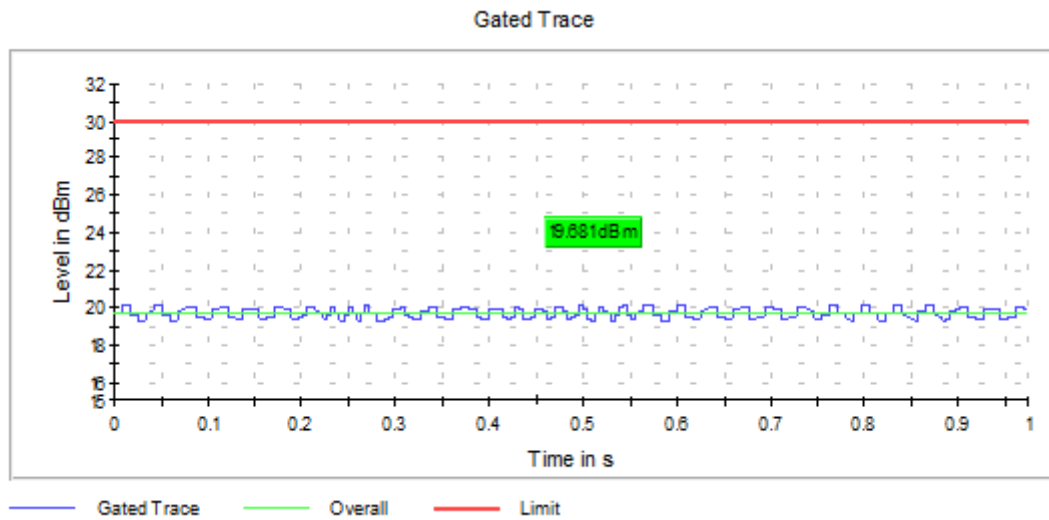
6.2.4 §15.247(b)(3) Output Power

The maximum conducted (average) output power was measured according to Method AVGPM-G (ANSI C63.10, Section 11.9.2.3.2). Measurements were taken at the maximum possible power setting (20) to demonstrate compliance with this requirement at all possible power settings. The highest measured result was 19.7 dBm for this mode. The limit is 30 dBm when using antennas with 6 dBi or less gain.

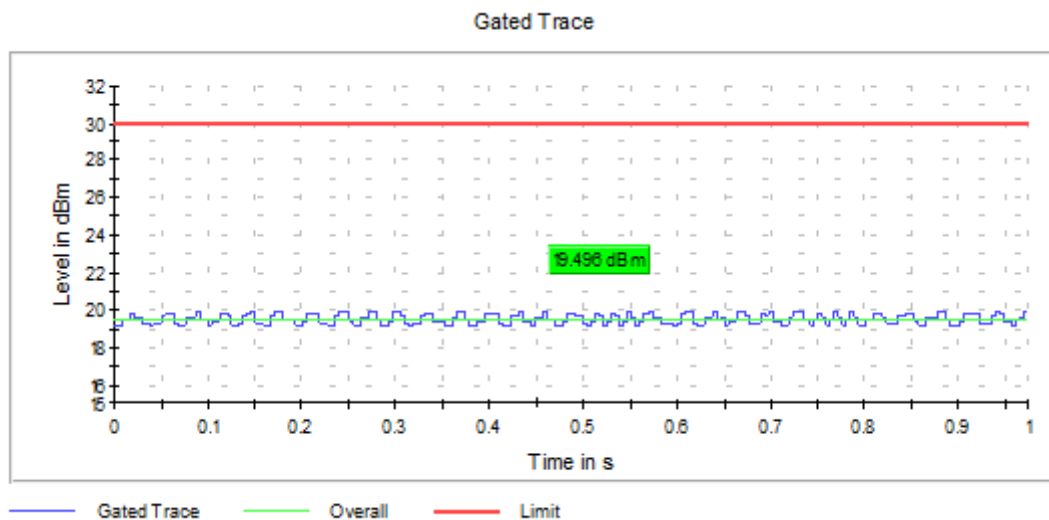
Frequency (MHz)	Measured Output Power Antenna 0 (dBm)	Measured Output Power Antenna 1 (dBm)
2412	19.7	19.5
2437	19.2	19.0
2462	19.3	19.2

Result

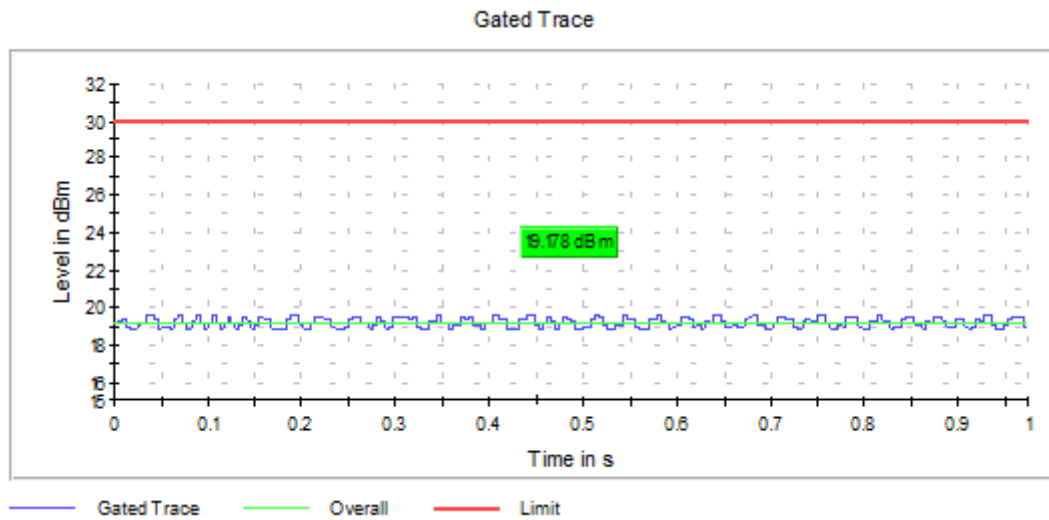
In the configuration tested, the RF output power was less than 1 Watt; therefore, the EUT complied with the requirements of the specification (see plots below).



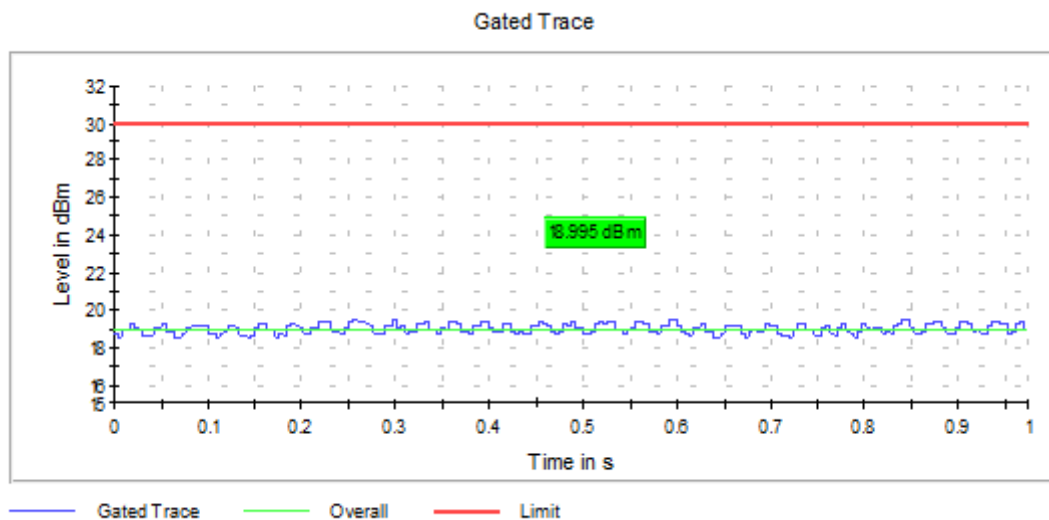
Graph 7: Antenna 0 - Lowest Channel Output Power Plot (Method AVGPM-G) - Setting 20



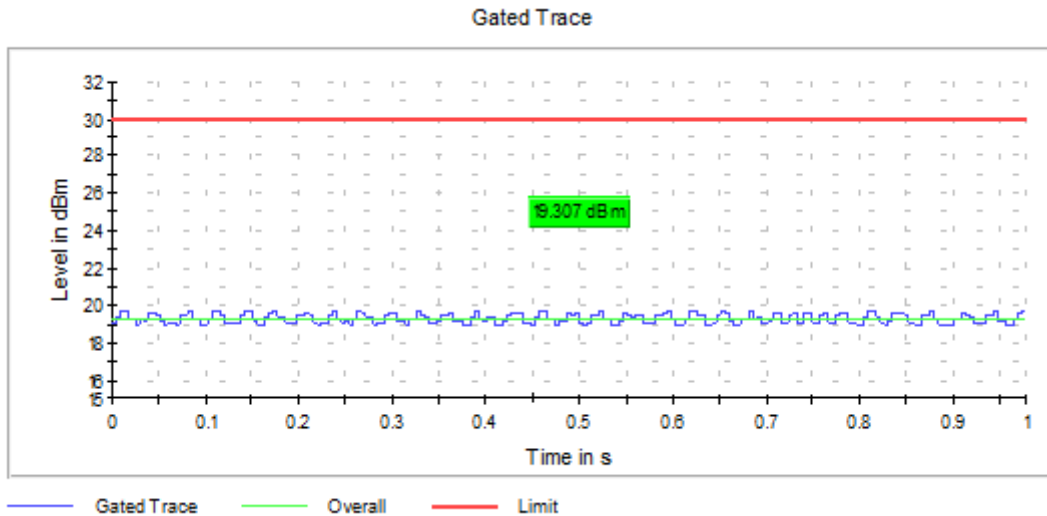
Graph 8: Antenna 1 - Lowest Channel Output Power Plot (Method AVGPM-G) - Setting 20



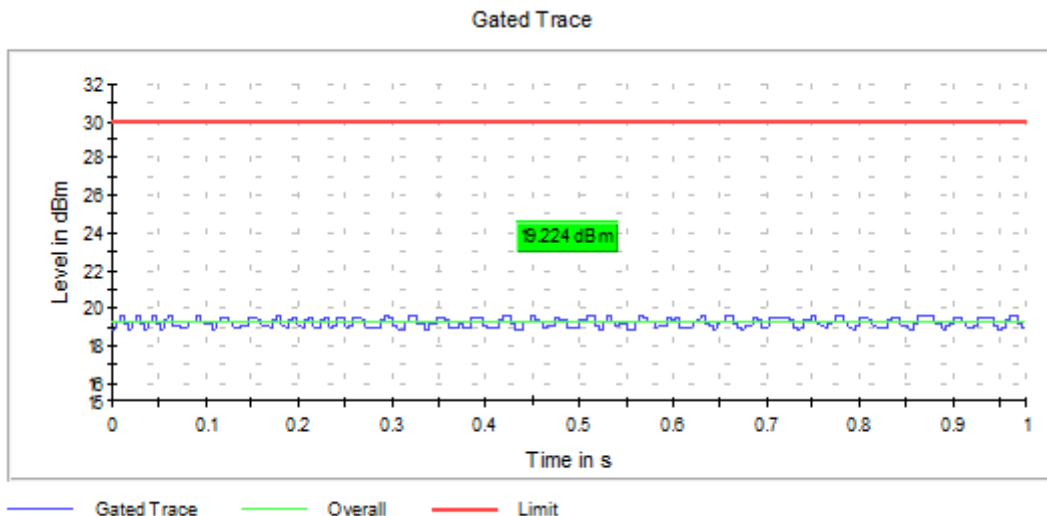
Graph 9: Antenna 0 - Middle Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 10: Antenna 1 - Middle Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 11: Antenna 0 - Highest Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 12: Antenna 1 - Highest Channel Output Power Plot (Method AVGPM-G) - Setting 20

6.2.5 §15.247(d) Spurious Emissions

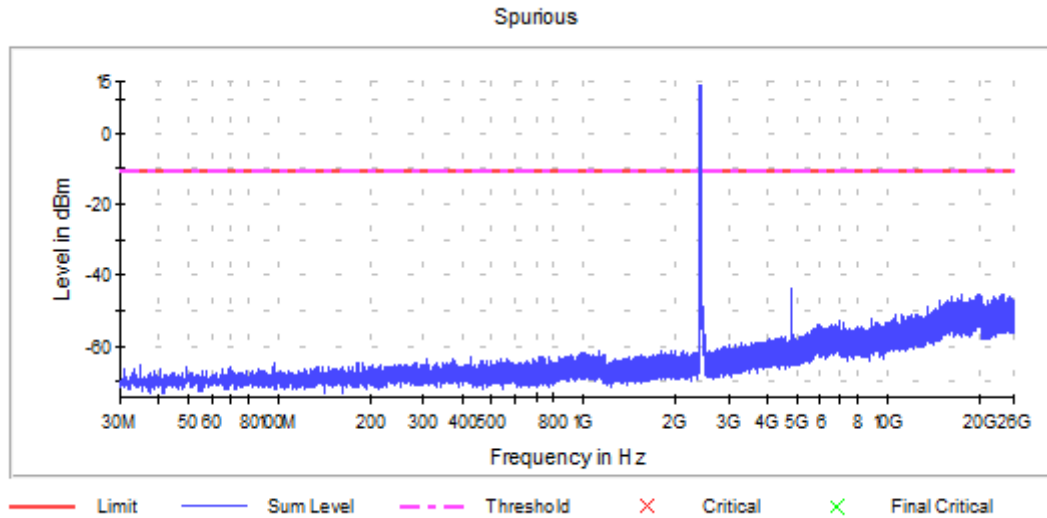
Conducted Spurious Emissions

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The tables show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency, and upper frequency. Shown below are plots with the EUT tuned to the lower, middle, and upper channels. These demonstrate compliance with the provisions of this section and at the band edges.

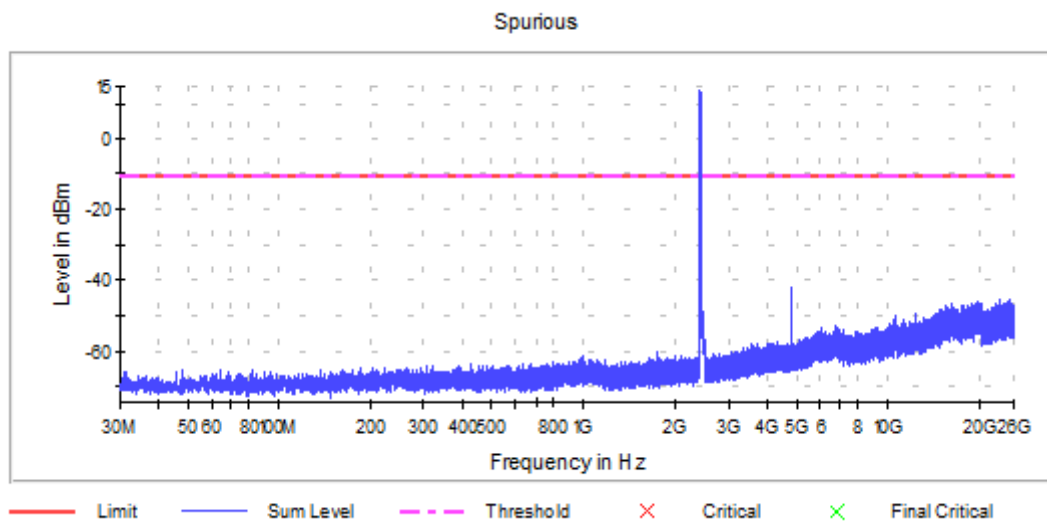
The emissions must be attenuated 30 dB below the highest power level measured within the authorized band as measured with a 100 kHz RBW.

Result

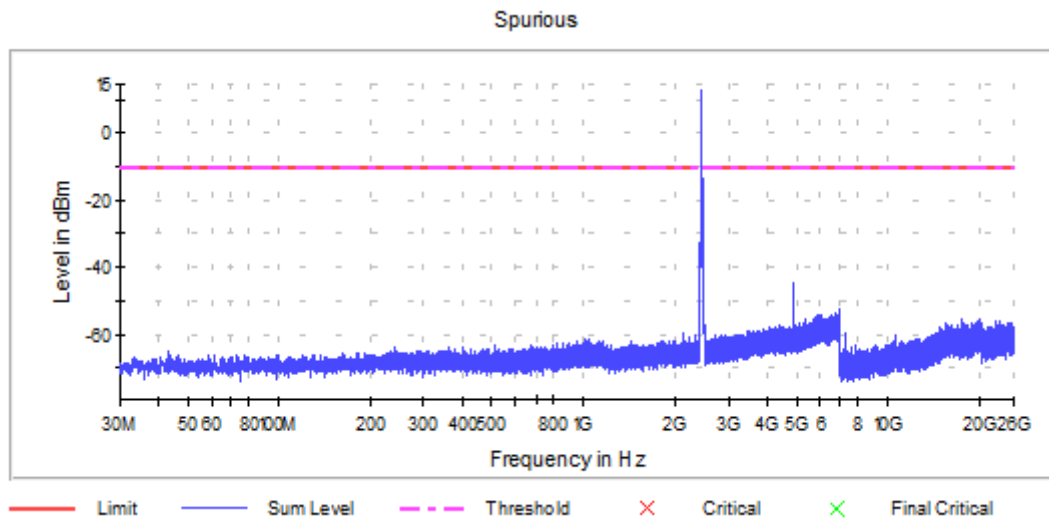
Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification. The highest power measured was 19.7 dBm in this mode; therefore, the criteria is $19.7 - 30 = -10.3$ dBm.



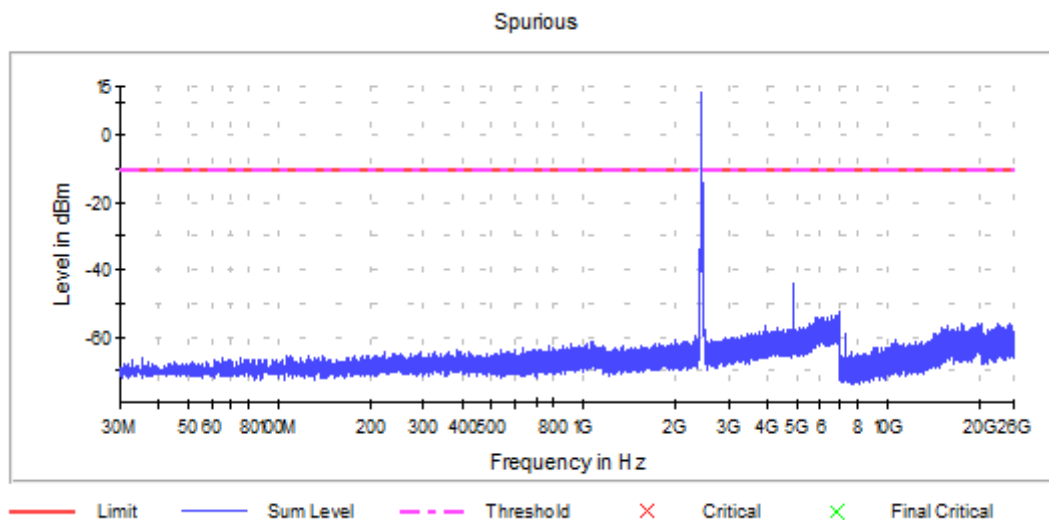
Graph 13: Antenna 0 - Transmitting on the Lowest Channel - Setting 20



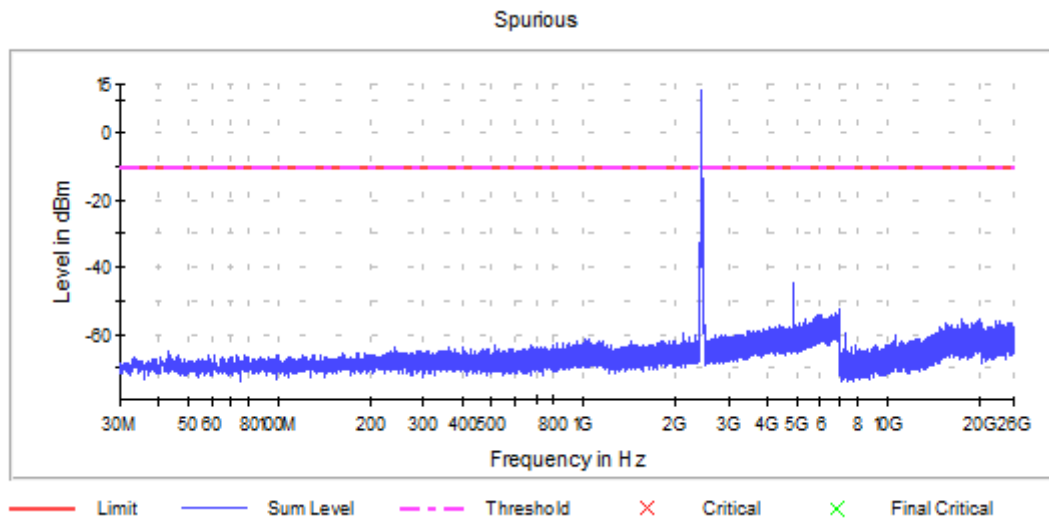
Graph 14: Antenna 1 - Transmitting on the Lowest Channel - Setting 20



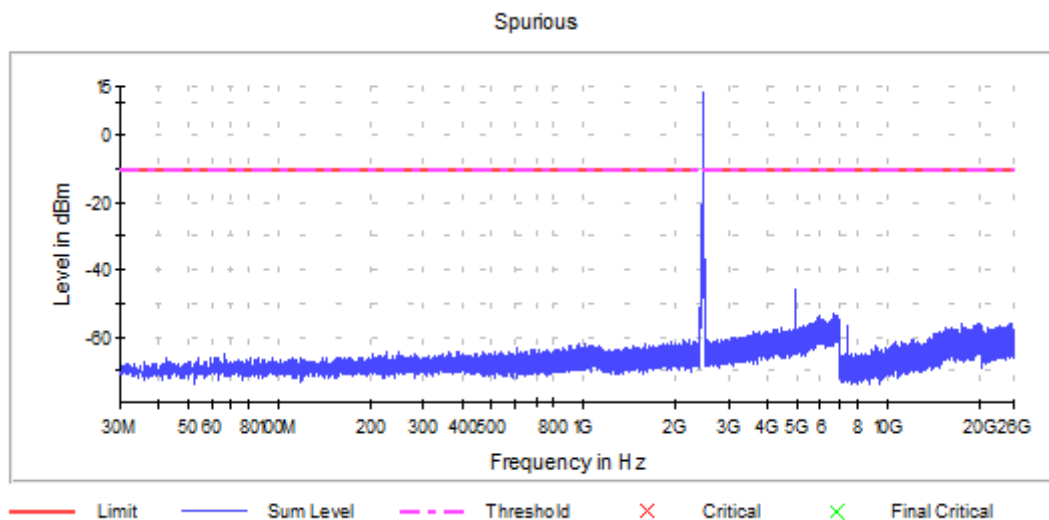
Graph 15: Antenna 0 - Transmitting on the Middle Channel - Setting 20



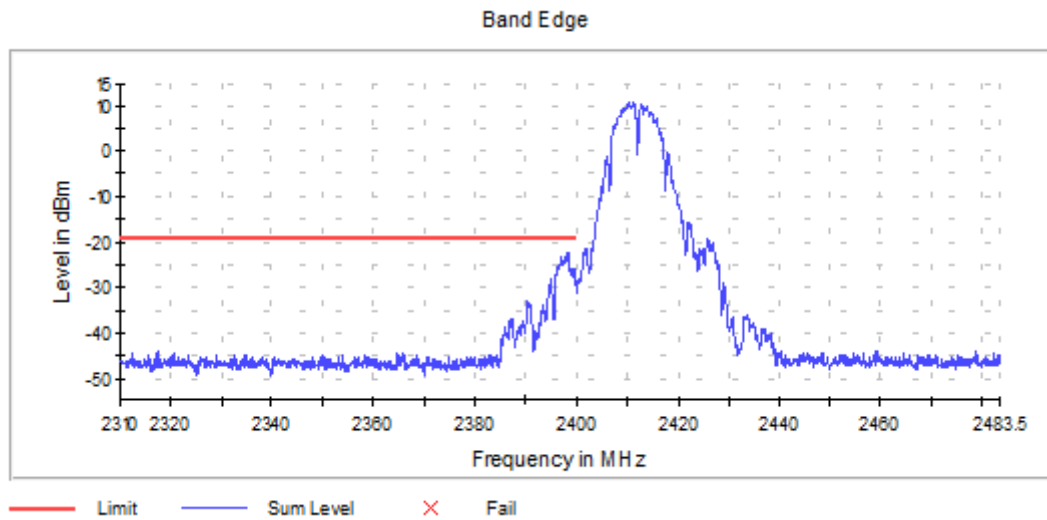
Graph 16: Antenna 1 - Transmitting on the Middle Channel - Setting 20



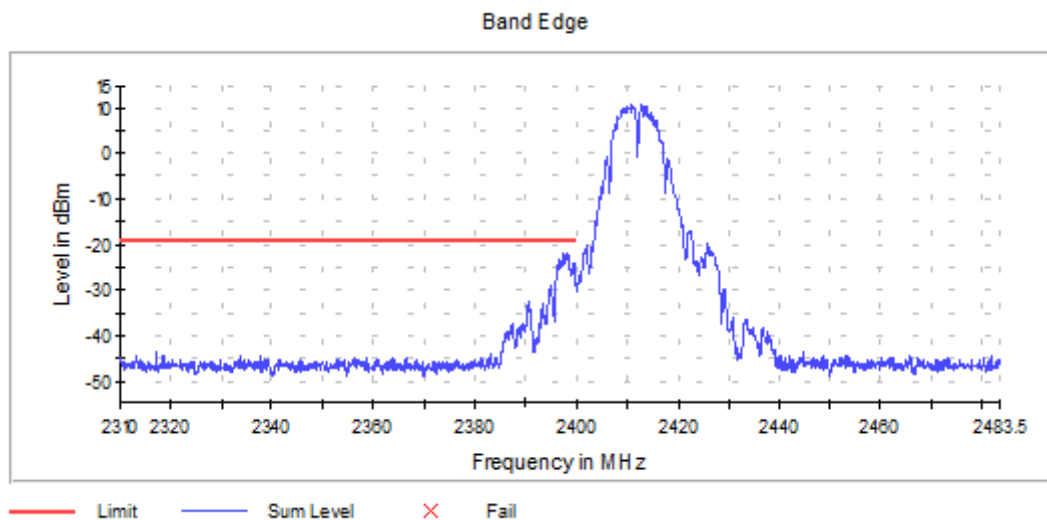
Graph 17: Antenna 0 - Transmitting on the Highest Channel - Setting 20



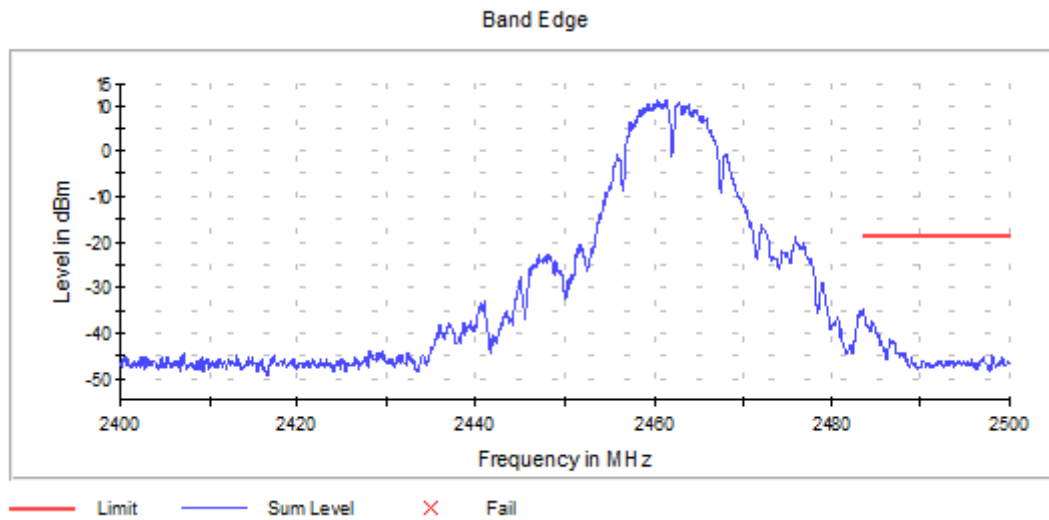
Graph 18: Antenna 1 - Transmitting on the Highest Channel - Setting 20



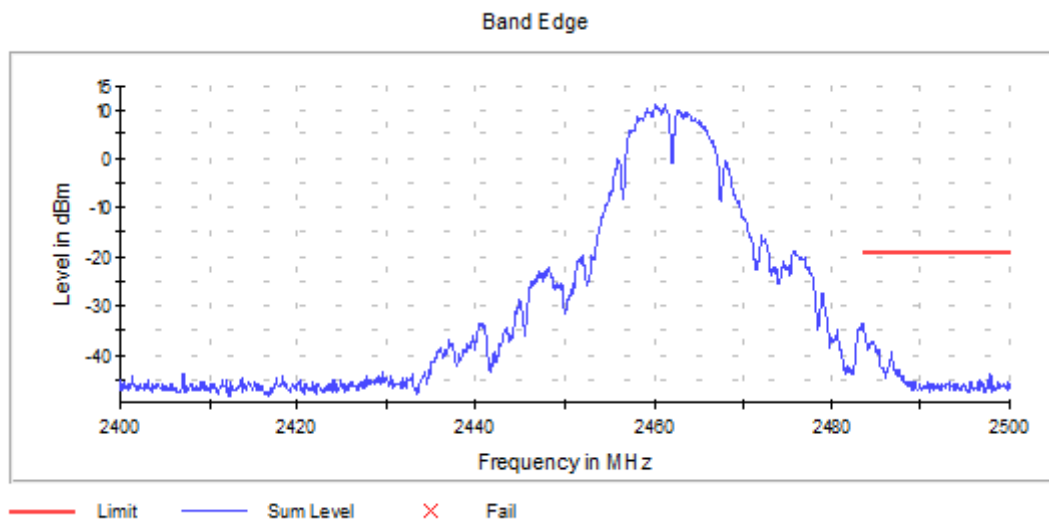
Graph 19: Antenna 0 – Channel 1 Lower Band Edge Plot - Setting 20



Graph 20: Antenna 1 – Channel 1 Lower Band Edge Plot - Setting 20



Graph 21: Antenna 0 – Channel 11 Upper Band Edge Plot - Setting 20



Graph 22: Antenna 1 – Channel 11 Upper Band Edge Plot - Setting 20

Radiated Spurious Emissions in the Restricted Bands of §15.205

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emission was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any emission that fell into the restricted bands of §15.205. The tables show the worst-case emission measured from the EUT. For frequencies above 18.0 GHz, a measurement distance of 1 meter was used. The noise floor was a minimum of 6 dB below the limit. The emissions in the restricted bands must meet the limits specified in §15.209. The spurious emissions were tested at the highest power setting used by any channel in the band (setting of 20). The band edges at the restricted bands were measured using the power settings that will be used in manufacturing. Tabular data and plots are shown below.

Result

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	8.3	38.5	46.8	74.0	-27.2
4824.0	Average	Vertical	-3.7	38.5	34.8	54.0	-19.2
4824.0	Peak	Horizontal	6.0	38.5	44.5	74.0	-29.5
4824.0	Average	Horizontal	-5.8	38.5	32.7	54.0	-21.3
7236.0	Peak	Vertical	5.7	42.7	48.4	74.0	-25.6
7236.0	Average	Vertical	-4.6	42.7	38.1	54.0	-15.9
7236.0	Peak	Horizontal	5.3	42.7	48.0	74.0	-26.0
7236.0	Average	Horizontal	-5.2	42.7	37.5	54.0	-16.5
12060.0	Peak	Vertical	4.8	47.9	52.7	74.0	-21.3
12060.0	Average	Vertical	-6.7	47.9	41.2	54.0	-12.8
12060.0	Peak	Horizontal	5.3	47.9	53.2	74.0	-20.8
12060.0	Average	Vertical	-6.7	47.9	41.2	54.0	-12.8

Table 2: Antenna 0 – Transmitting at the Lowest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	6.4	38.6	45.0	74.0	-29.0
4874.0	Average	Vertical	-3.7	38.6	34.9	54.0	-19.1
4874.0	Peak	Horizontal	6.7	38.6	45.3	74.0	-28.7
4874.0	Average	Horizontal	-6.0	38.6	32.6	54.0	-21.4
7311.0	Peak	Vertical	5.5	42.9	48.4	74.0	-25.6
7311.0	Average	Vertical	-4.7	42.9	38.2	54.0	-15.8
7311.0	Peak	Horizontal	5.2	42.9	48.1	74.0	-25.9

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
7311.0	Average	Horizontal	-5.4	42.9	37.5	54.0	-16.5
12185.0	Peak	Vertical	5.2	47.8	53.0	74.0	-21.0
12185.0	Average	Vertical	-6.6	47.8	41.2	54.0	-12.8
12185.0	Peak	Horizontal	5.1	47.8	52.9	74.0	-21.1
12185.0	Average	Vertical	-6.7	47.8	41.1	54.0	-12.9

Table 3: Antenna 0 – Transmitting at the Middle Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924.0	Peak	Vertical	8.7	38.7	47.4	74.0	-26.6
4924.0	Average	Vertical	0.8	38.7	39.5	54.0	-14.5
4924.0	Peak	Horizontal	6.5	38.7	45.2	74.0	-28.8
4924.0	Average	Horizontal	-3.4	38.7	35.3	54.0	-18.7
7386.0	Peak	Vertical	5.6	43.1	48.7	74.0	-25.3
7386.0	Average	Vertical	-5.3	43.1	37.8	54.0	-16.2
7386.0	Peak	Horizontal	5.2	43.1	48.3	74.0	-25.7
7386.0	Average	Horizontal	-6.4	43.1	36.7	54.0	-17.3
12310.0	Peak	Vertical	4.7	47.7	52.4	74.0	-21.6
12310.0	Average	Vertical	-7.0	47.7	40.7	54.0	-13.3
12310.0	Peak	Horizontal	4.8	47.7	52.5	74.0	-21.5
12310.0	Average	Vertical	-7.1	47.7	40.6	54.0	-13.4

Table 4: Antenna 0 – Transmitting at the Highest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	6.5	38.5	45.0	74.0	-29.0
4824.0	Average	Vertical	-2.3	38.5	36.2	54.0	-17.8
4824.0	Peak	Horizontal	5.9	38.5	44.4	74.0	-29.6
4824.0	Average	Horizontal	-5.1	38.5	33.4	54.0	-20.6
7236.0	Peak	Vertical	7.0	42.7	49.7	74.0	-24.3
7236.0	Average	Vertical	-2.7	42.7	40.0	54.0	-14.0
7236.0	Peak	Horizontal	5.3	42.7	48.0	74.0	-26.0
7236.0	Average	Horizontal	-5.5	42.7	37.2	54.0	-16.8

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
12060.0	Peak	Vertical	4.9	47.9	52.8	74.0	-21.2
12060.0	Average	Vertical	-6.9	47.9	41.0	54.0	-13.0
12060.0	Peak	Horizontal	5.3	47.9	53.2	74.0	-20.8
12060.0	Average	Vertical	-7.2	47.9	40.7	54.0	-13.3

Table 5: Antenna 1 – Transmitting at the Lowest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	6.9	38.6	45.5	74.0	-28.5
4874.0	Average	Vertical	-2.4	38.6	36.2	54.0	-17.8
4874.0	Peak	Horizontal	6.1	38.6	44.7	74.0	-29.3
4874.0	Average	Horizontal	-5.8	38.6	32.8	54.0	-21.2
7311.0	Peak	Vertical	6.1	42.9	49.0	74.0	-25.0
7311.0	Average	Vertical	-4.5	42.9	38.4	54.0	-15.6
7311.0	Peak	Horizontal	4.5	42.9	47.4	74.0	-26.6
7311.0	Average	Horizontal	-6.6	42.9	36.3	54.0	-17.7
12185.0	Peak	Vertical	4.3	47.8	52.1	74.0	-21.9
12185.0	Average	Vertical	-7.0	47.8	40.8	54.0	-13.2
12185.0	Peak	Horizontal	4.5	47.8	52.3	74.0	-21.7
12185.0	Average	Vertical	-6.9	47.8	40.9	54.0	-13.1

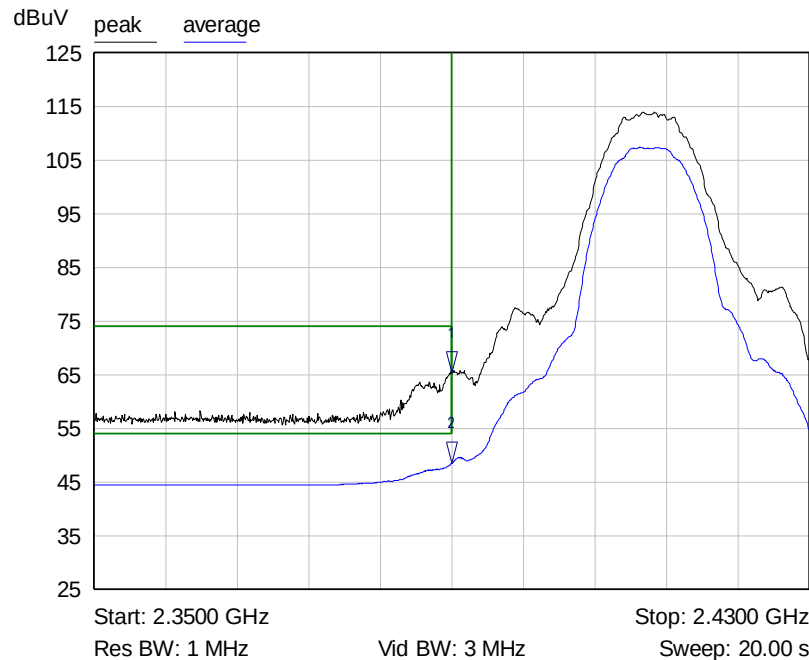
Table 6: Antenna 1 – Transmitting at the Middle Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924.0	Peak	Vertical	7.5	38.7	46.2	74.0	-27.8
4924.0	Average	Vertical	0.4	38.7	39.1	54.0	-14.9
4924.0	Peak	Horizontal	4.2	38.7	42.9	74.0	-31.1
4924.0	Average	Horizontal	-3.6	38.7	35.1	54.0	-18.9
7386.0	Peak	Vertical	5.2	43.1	48.3	74.0	-25.7
7386.0	Average	Vertical	-5.1	43.1	38.0	54.0	-16.0
7386.0	Peak	Horizontal	4.9	43.1	48.0	74.0	-26.0
7386.0	Average	Horizontal	-6.4	43.1	36.7	54.0	-17.3
12310.0	Peak	Vertical	3.7	47.7	51.4	74.0	-22.6

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dB μ V)	Correction Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
12310.0	Average	Vertical	-6.9	47.7	40.8	54.0	-13.2
12310.0	Peak	Horizontal	4.1	47.7	51.8	74.0	-22.2
12310.0	Average	Vertical	-7.7	47.7	40.0	54.0	-14.0

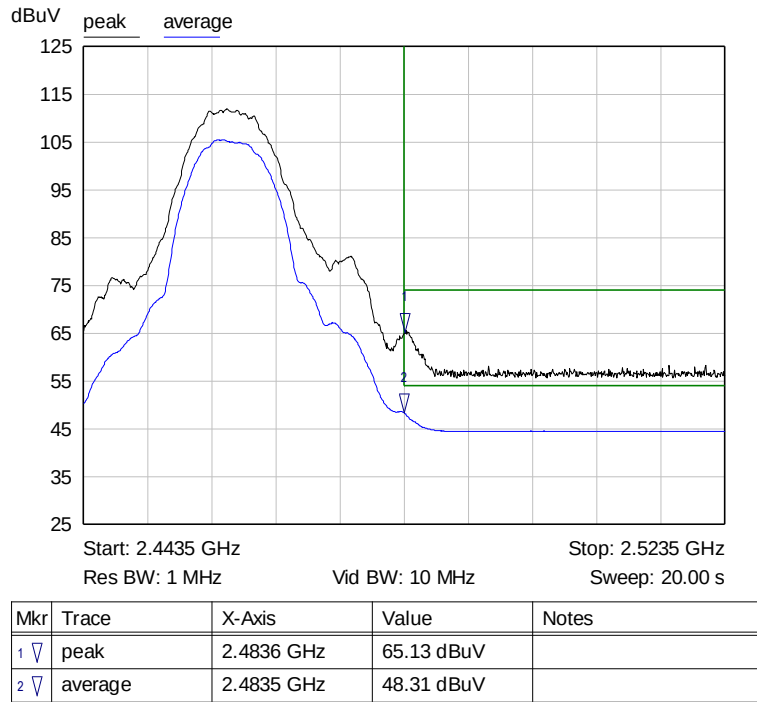
Table 7: Antenna 1 – Transmitting at the Highest Frequency – Setting 20

No other emissions were seen in the restricted bands.

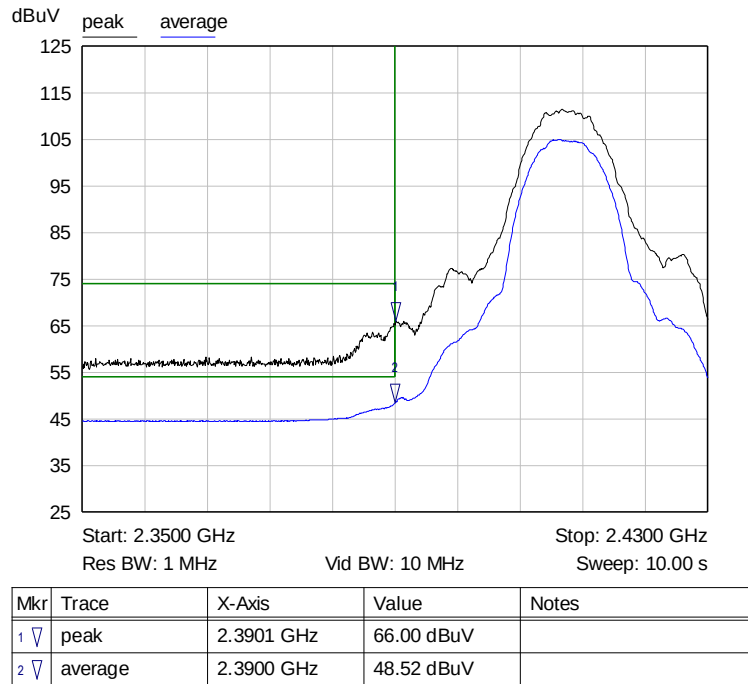


Mkr	Trace	X-Axis	Value	Notes
1 ▽	peak	2.3900 GHz	65.39 dBuV	
2 ▽	average	2.3900 GHz	48.55 dBuV	

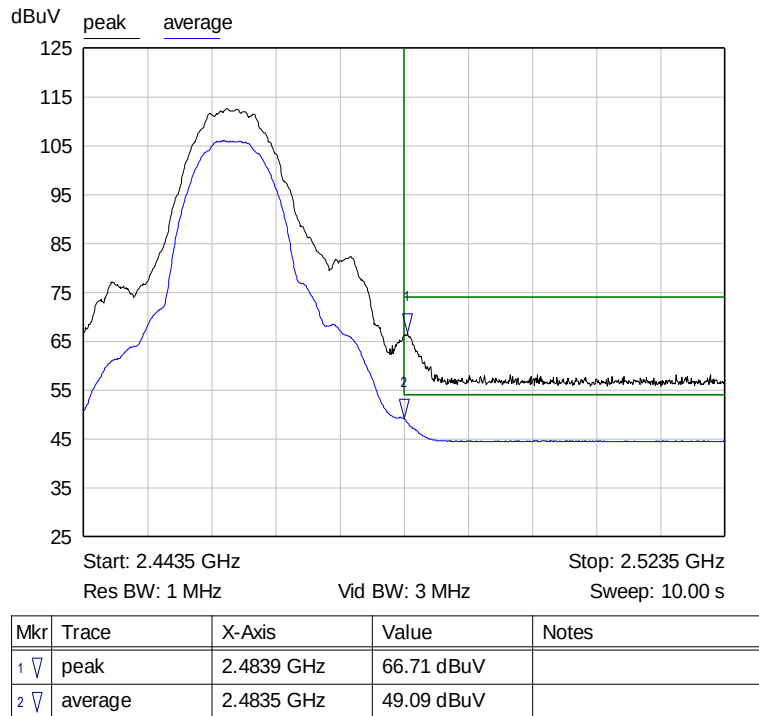
Graph 23: Antenna 0 – Channel 1 Band Edge at the Restricted Band Plot - Setting 20



Graph 24: Antenna 0 – Channel 11 Band Edge at the Restricted Band Plot - Setting 20



Graph 25: Antenna 1 – Channel 1 Band Edge at the Restricted Band Plot - Setting 20



Graph 26: Antenna 1 – Channel 11 Band Edge at the Restricted Band Plot - Setting 20

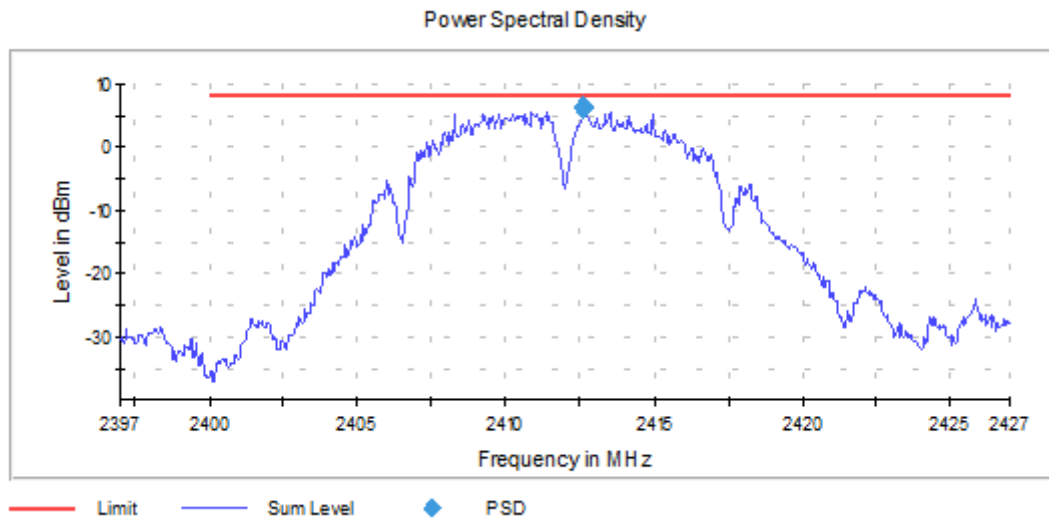
6.2.6 §15.247(e) Power Spectral Density

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. Measurements were taken according to Method AVGPS-3 was utilized (ANSI C63.10, Section 11.10.7). Results of this testing are summarized.

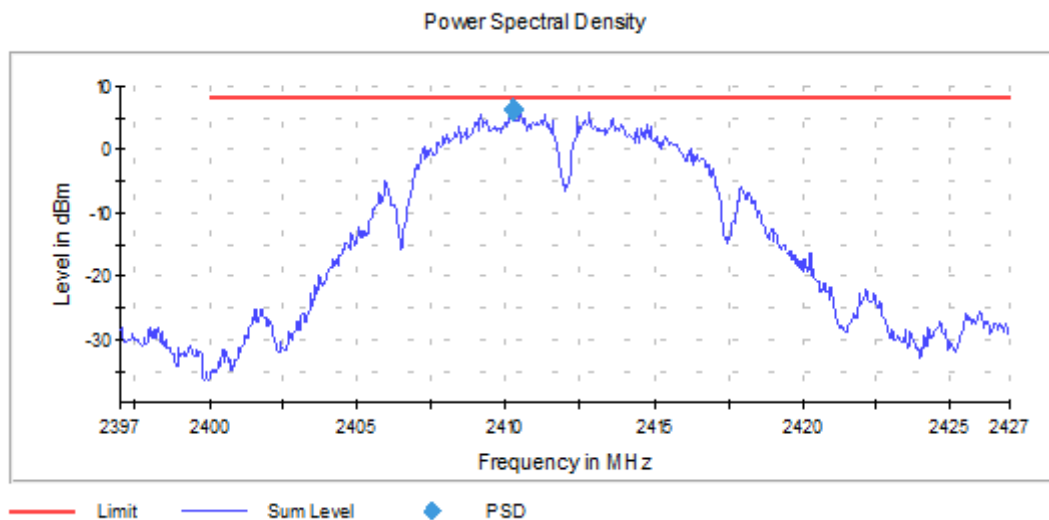
Frequency (MHz)	Measurement Antenna 0 (dBm)	Measurement Antenna 1 (dBm)	Criteria (dBm)
2412	6.1	6.1	8.0
2437	5.7	5.7	8.0
2462	6.2	5.9	8.0

Result

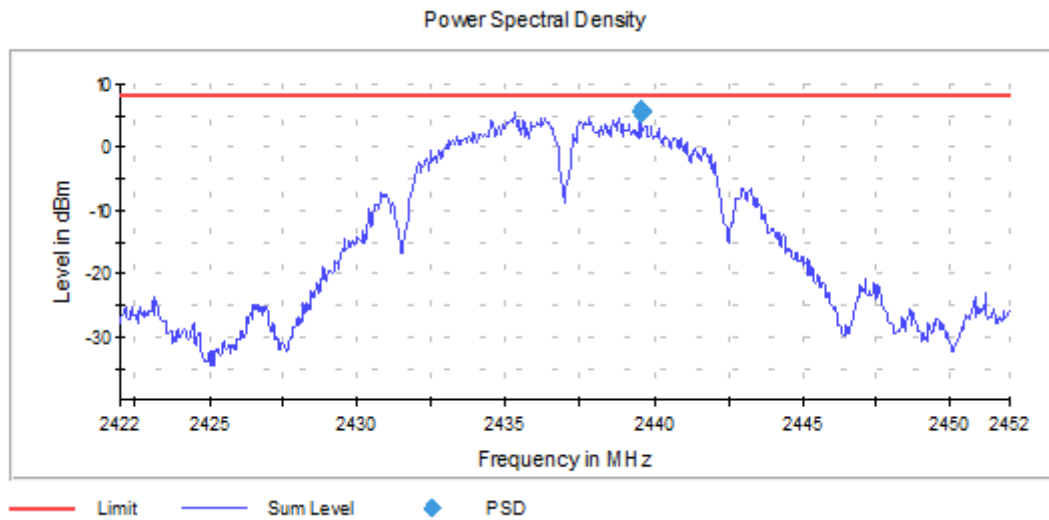
The maximum power spectral density was less than the limit of 8 dBm; therefore, the EUT complies with the specification.



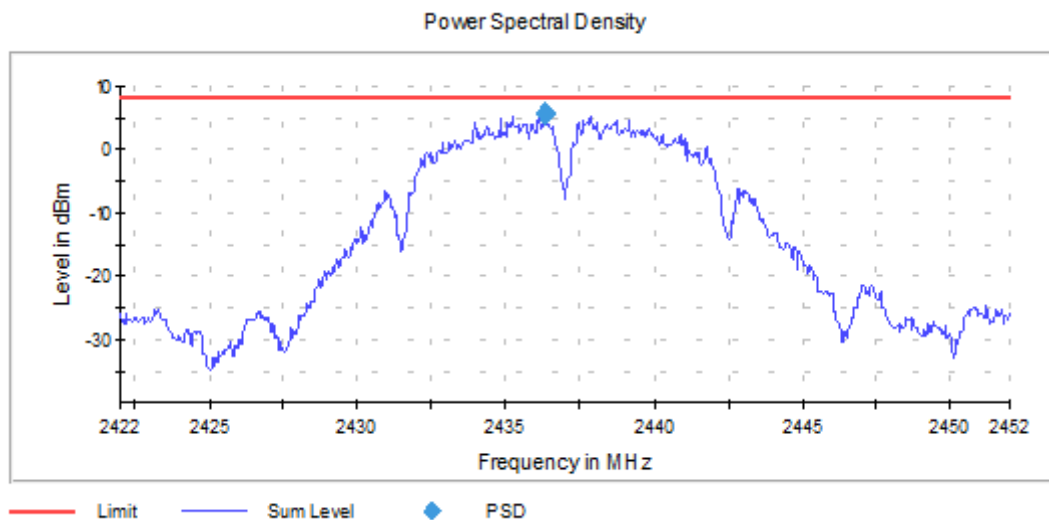
Graph 27: Antenna 0 - Lowest Channel PSD - Setting 20



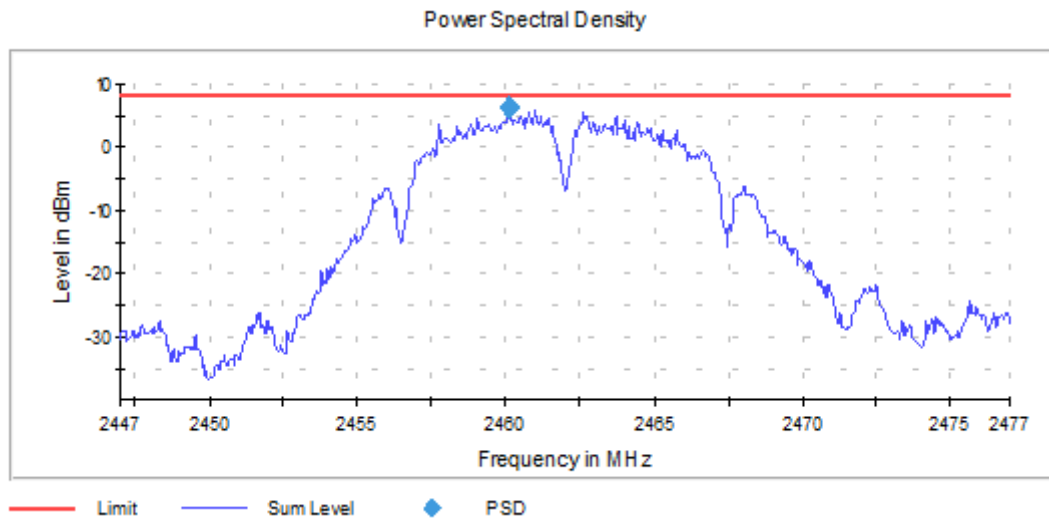
Graph 28: Antenna 1 - Lowest Channel PSD - Setting 20



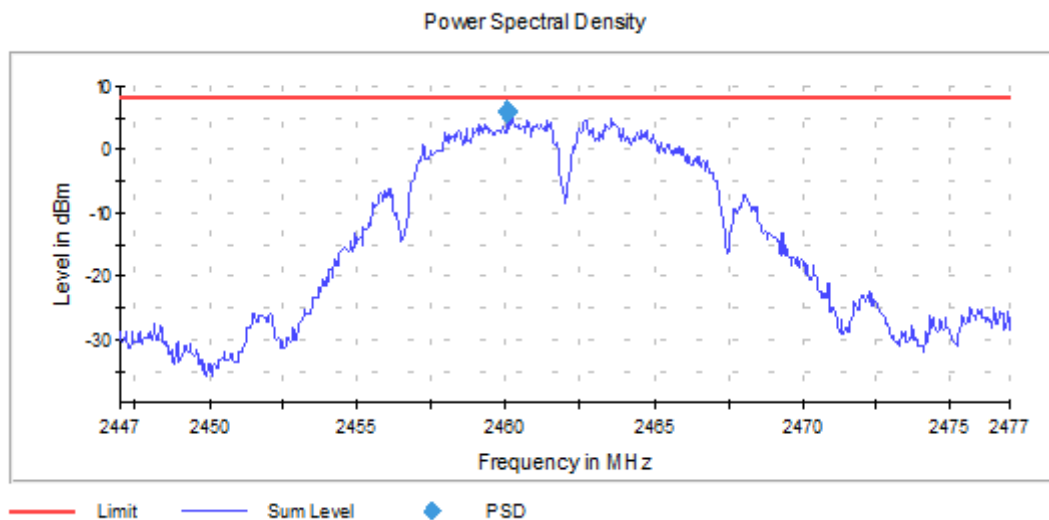
Graph 29: Antenna 0 - Middle Channel PSD - Setting 20



Graph 30: Antenna 1 - Middle Channel PSD - Setting 20



Graph 31: Antenna 0 - Highest Channel PSD - Setting 20



Graph 32: Antenna 1 - Highest Channel PSD - Setting 20

7 Measurements, Examinations and Derived Results – 802.11g

7.1 General Comments

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Section 7 of this report.

7.2 Test Results

7.2.1 §15.203 Antenna Requirements

See Section 6.2.1.

7.2.2 Conducted Emissions at Mains Ports Data (Hot Lead)

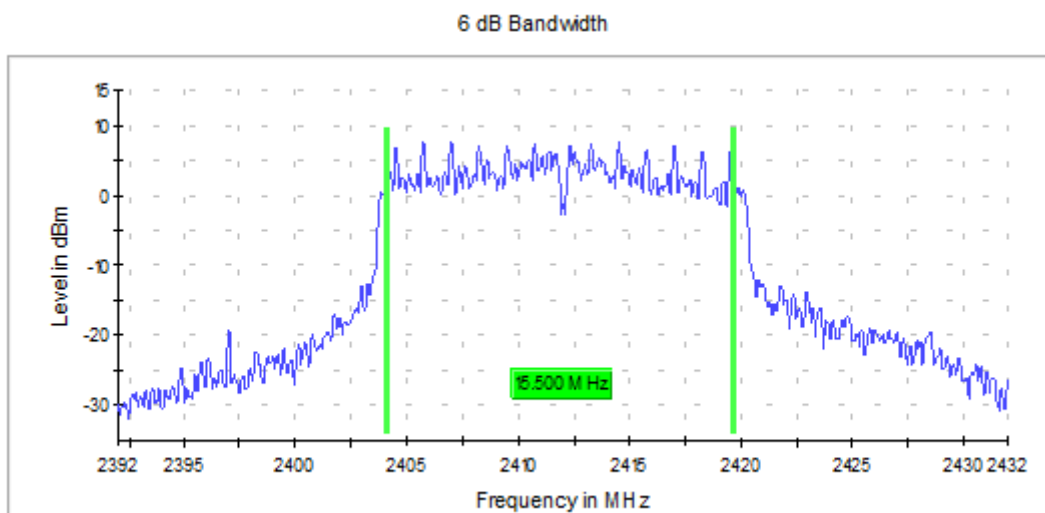
See Section 6.2.2.

7.2.3 §15.247(a)(2) Emissions Bandwidth

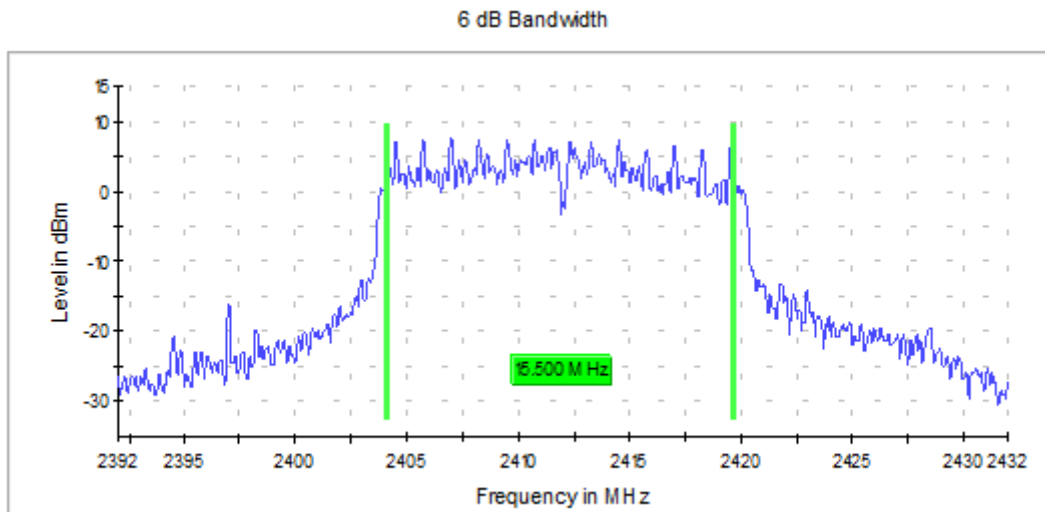
Frequency (MHz)	Emissions 6 dB bandwidth Antenna 0 (MHz)	Emissions 6 dB bandwidth Antenna 1 (MHz)
2412	15.5	15.5
2437	16.0	16.0
2462	15.5	15.5

Result

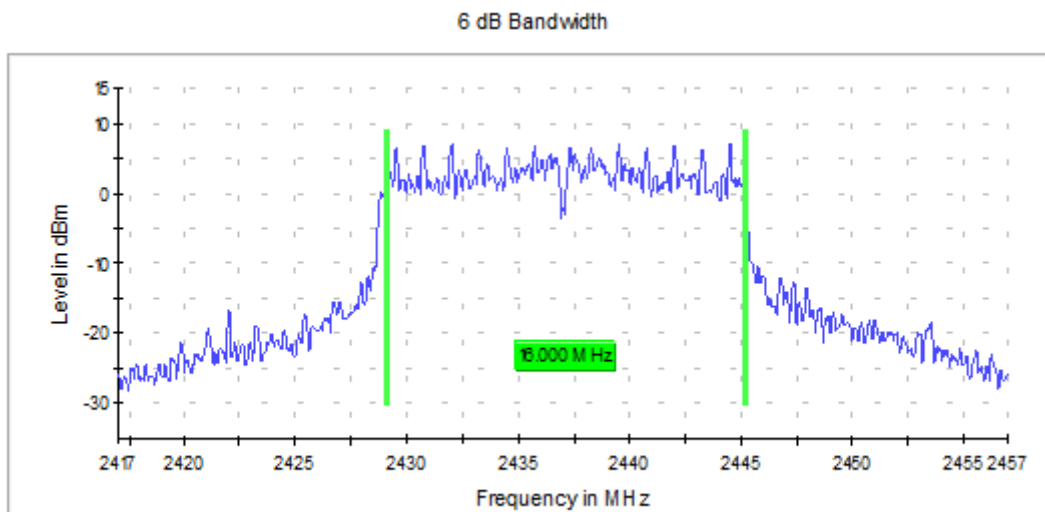
In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see plots below).



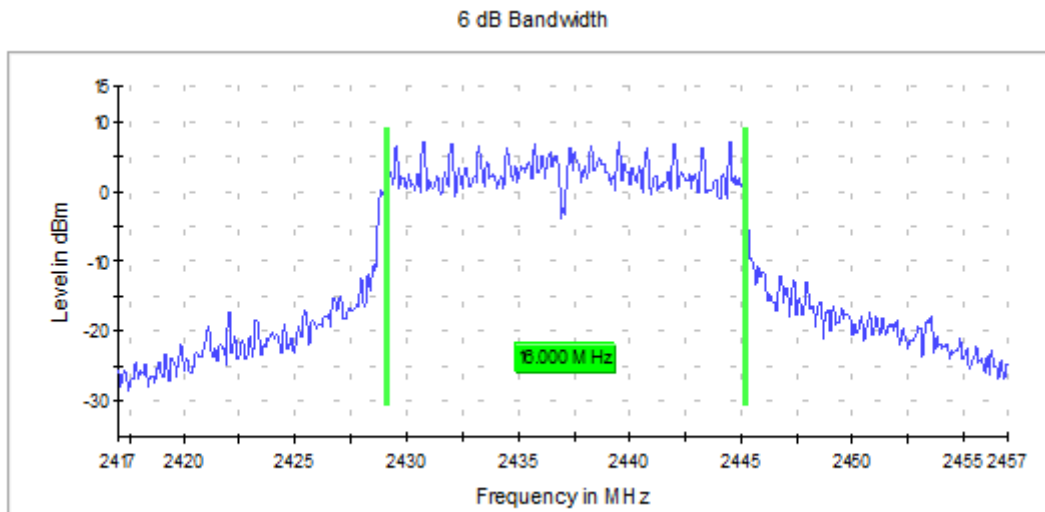
Graph 33: Antenna 0 - Lowest Channel (2412 MHz) Bandwidth - Setting 20



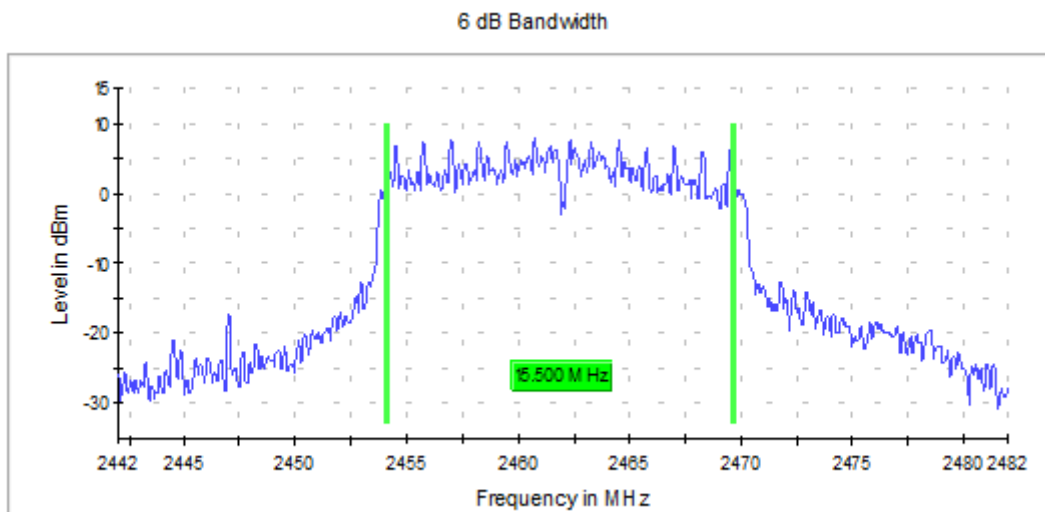
Graph 34: Antenna 1 - Lowest Channel (2412 MHz) Bandwidth - Setting 20



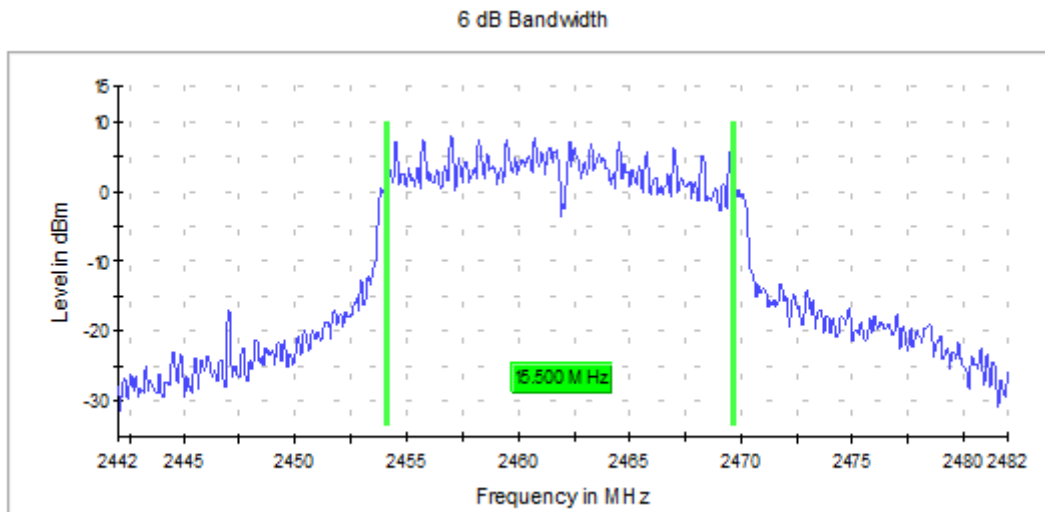
Graph 35: Antenna 0 - Middle Channel (2437 MHz) Bandwidth - Setting 20



Graph 36: Antenna 1 - Middle Channel (2437 MHz) Bandwidth - Setting 20



Graph 37: Antenna 0 - Highest Channel (2462 MHz) Bandwidth - Setting 20



Graph 38: Antenna 1 - Highest Channel (2462 MHz) Bandwidth - Setting 20

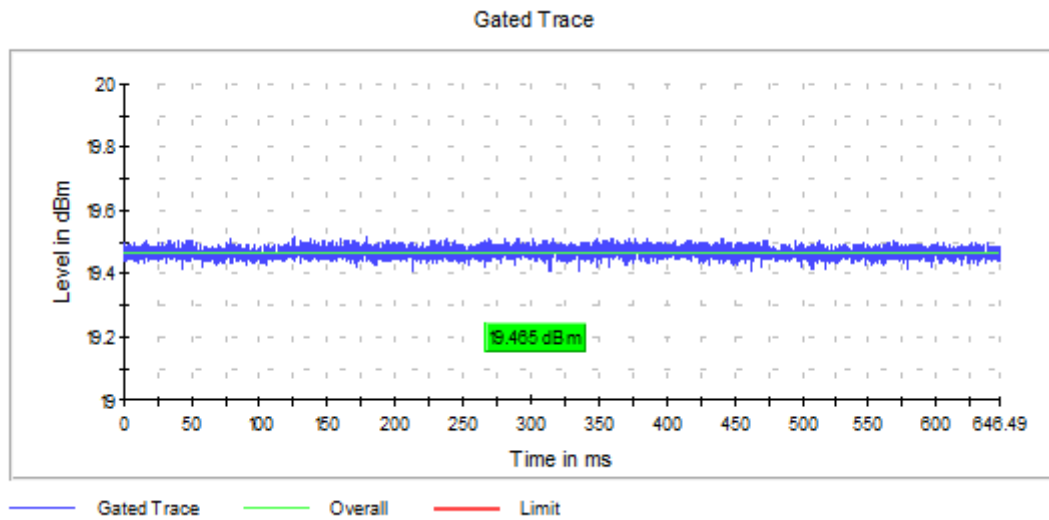
7.2.4 §15.247(b)(3) Output Power

The maximum conducted (average) output power was measured according to Method AVGPM-G (ANSI C63.10, Section 11.9.2.3.2). Measurements were taken at the maximum possible power setting (20) to demonstrate compliance with this requirement at all possible power settings. The highest measured result was 19.6 dBm for this mode. The limit is 30 dBm when using antennas with 6 dBi or less gain.

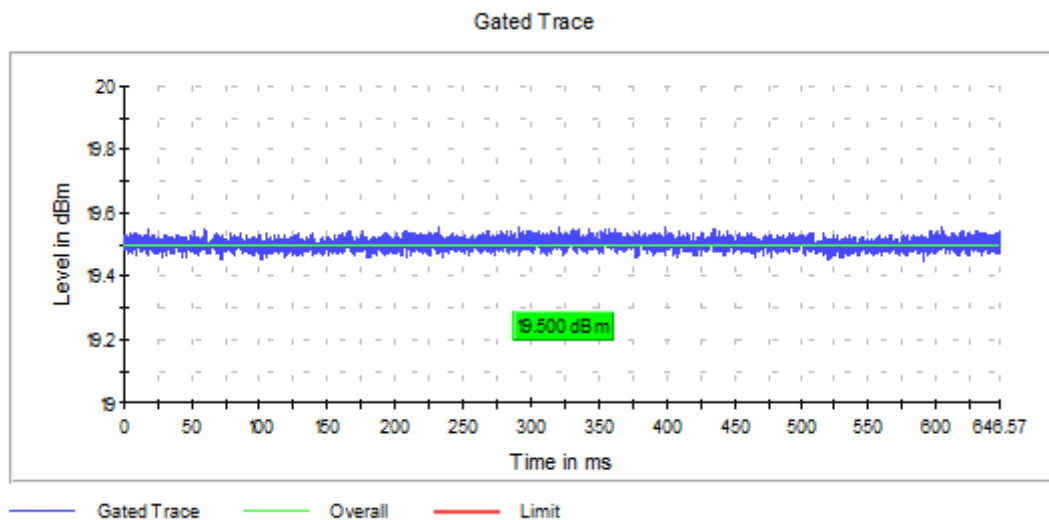
Frequency (MHz)	Measured Output Power Antenna 0 (dBm)	Measured Output Power Antenna 1 (dBm)
2412	19.5	19.5
2437	19.1	19.0
2462	19.6	19.4

Result

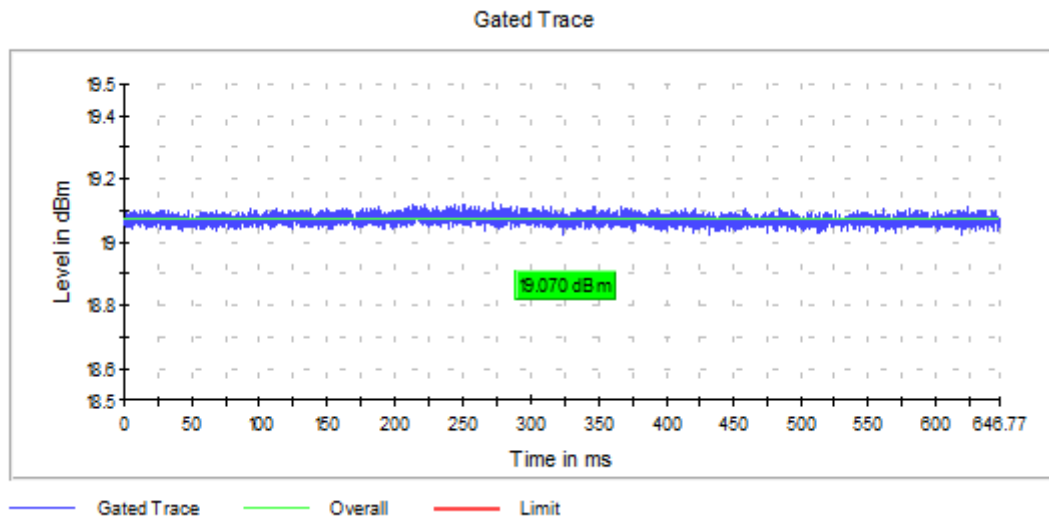
In the configuration tested, the RF output power was less than 1 Watt; therefore, the EUT complied with the requirements of the specification (see plots below).



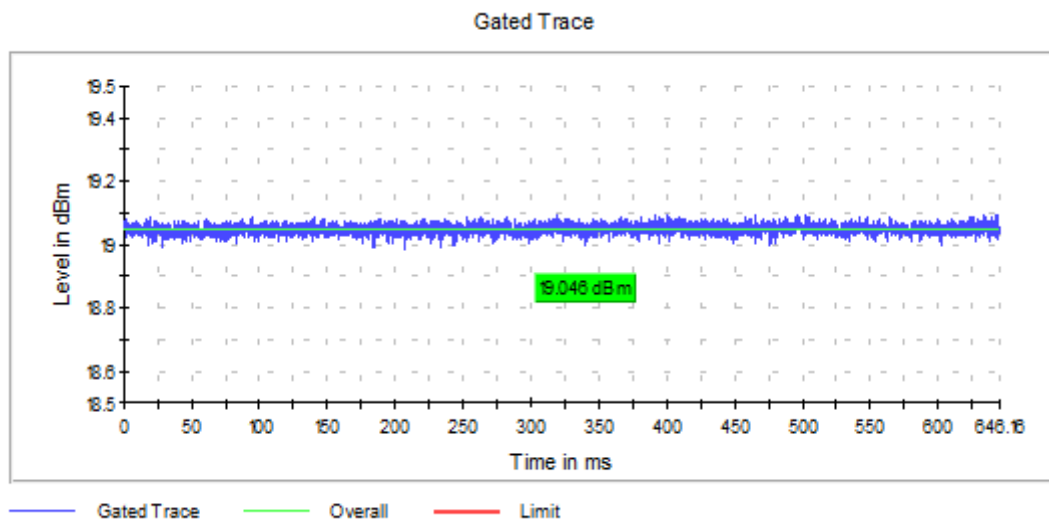
Graph 39: Antenna 0 - Lowest Channel Output Power Plot (Method AVGPM-G) - Setting 20



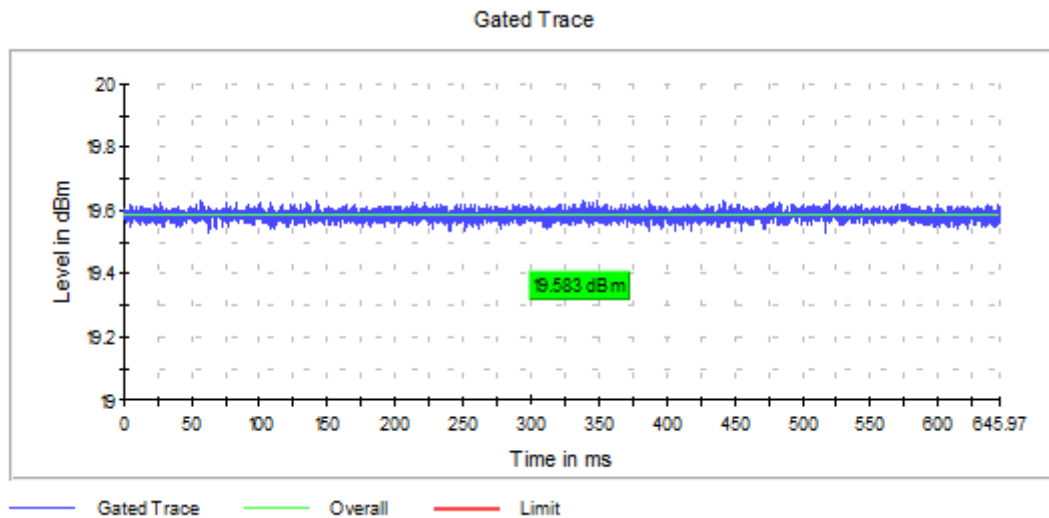
Graph 40: Antenna 1 - Lowest Channel Output Power Plot (Method AVGPM-G) - Setting 20



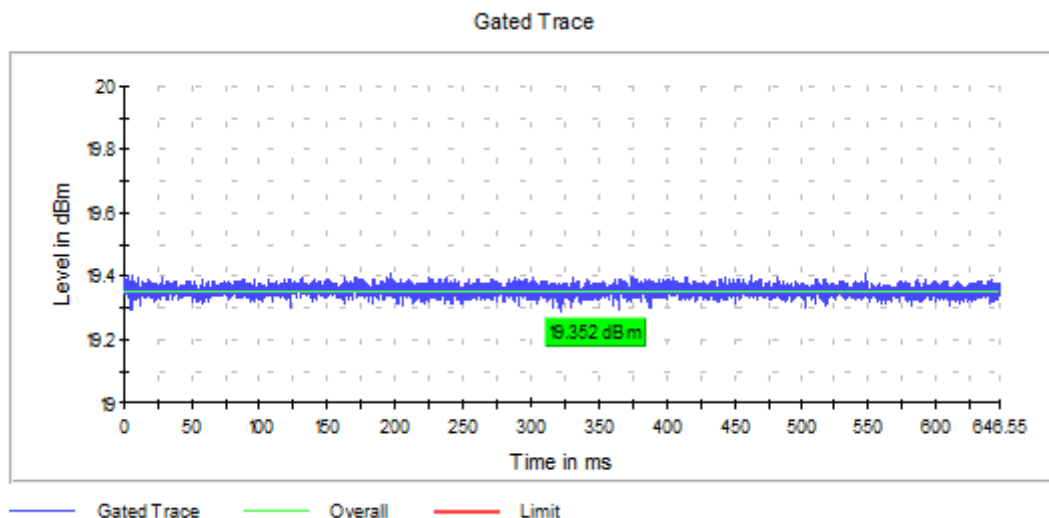
Graph 41: Antenna 0 - Middle Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 42: Antenna 1 - Middle Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 43: Antenna 0 - Highest Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 44: Antenna 1 - Highest Channel Output Power Plot (Method AVGPM-G) - Setting 20

7.2.5 §15.247(d) Spurious Emissions

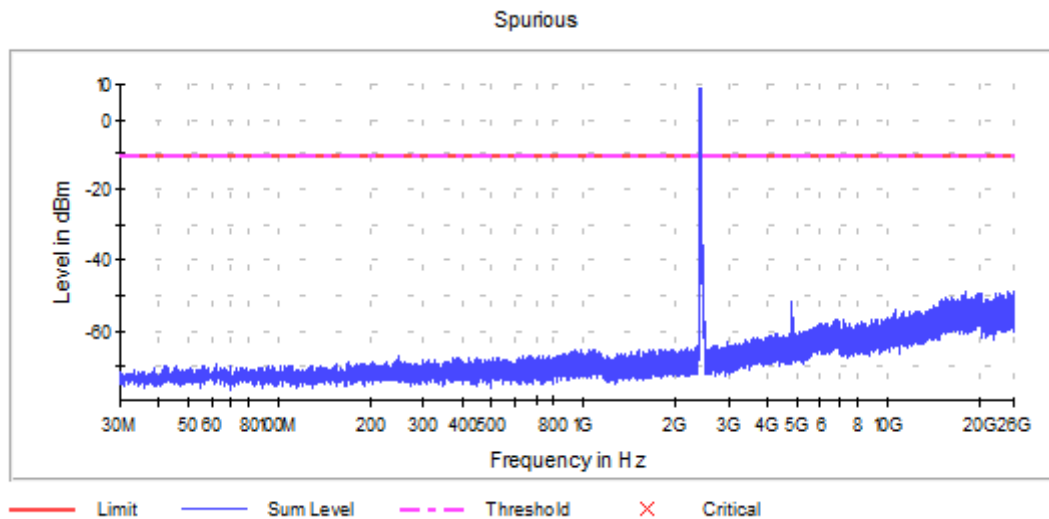
Conducted Spurious Emissions

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The plots below (Graphs 45-50) show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency, and highest frequency. Conducted spurious emissions at the antenna port were measured up to 26 GHz while transmitter was operating at maximum power setting (20) to demonstrate compliance with this requirement at all potential power settings.

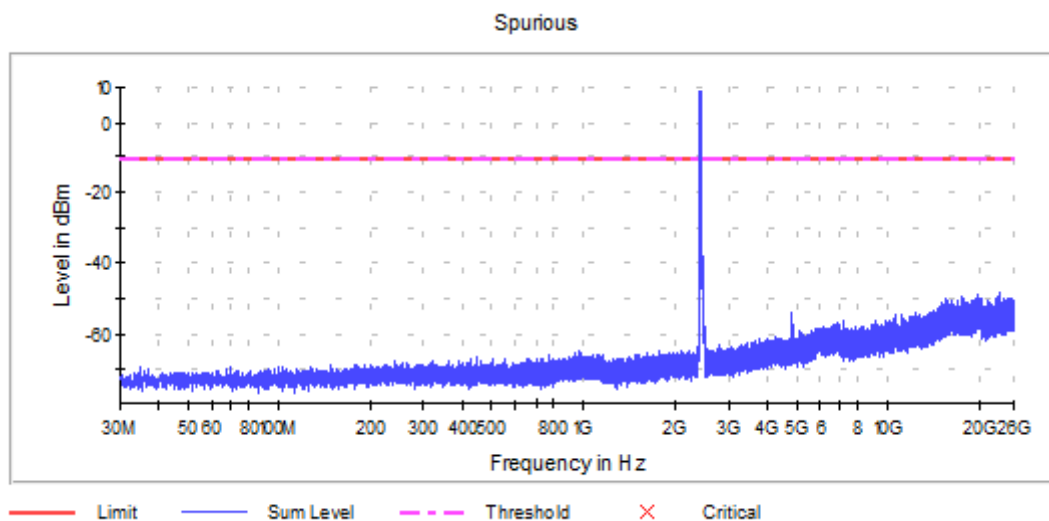
Also shown below are plots for multiple channels and power levels which demonstrate compliance with the provisions of this section and at the band edges. All band-edge plots (Graphs 51-68) were measured at the manufacturer's declared power settings (see Section 2.2 herein).

The emissions must be attenuated 30 dB below the highest power level measured within the authorized band as measured with a 100 kHz RBW.

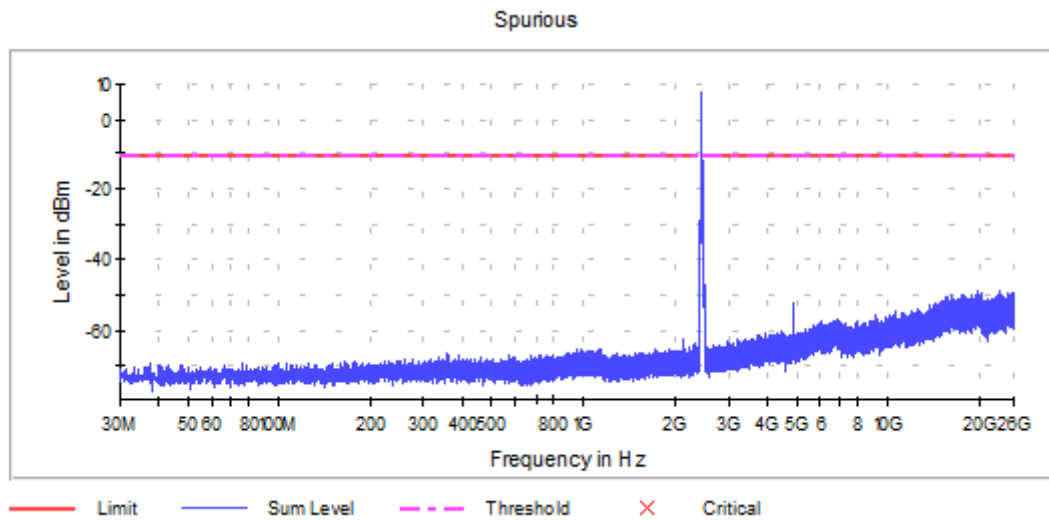
Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification. The highest power measured in this mode was 19.6 dBm; therefore, the criteria is $19.6 - 30 = -10.4$ dBm.



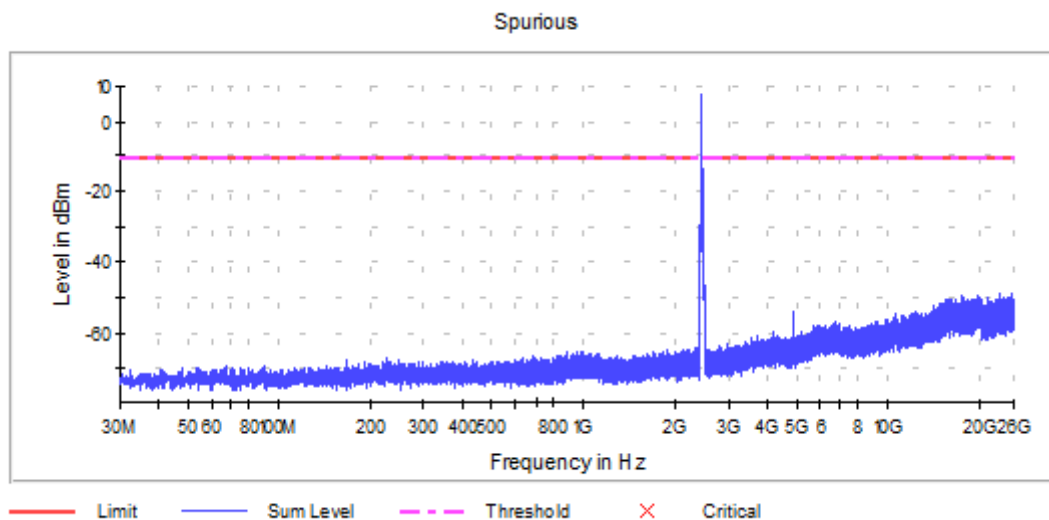
Graph 45: Antenna 0 - Transmitting on the Lowest Channel - Setting 20



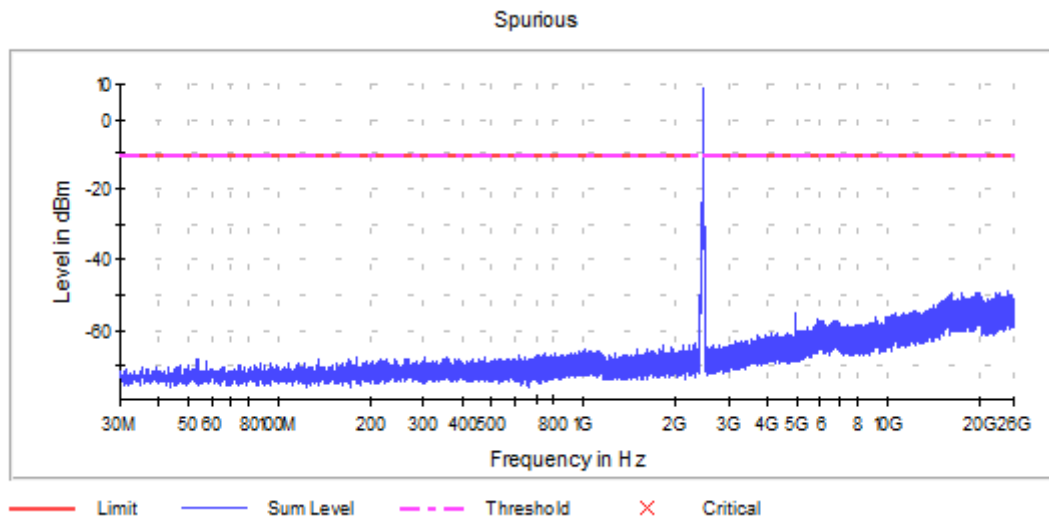
Graph 46: Antenna 1 - Transmitting on the Lowest Channel - Setting 20



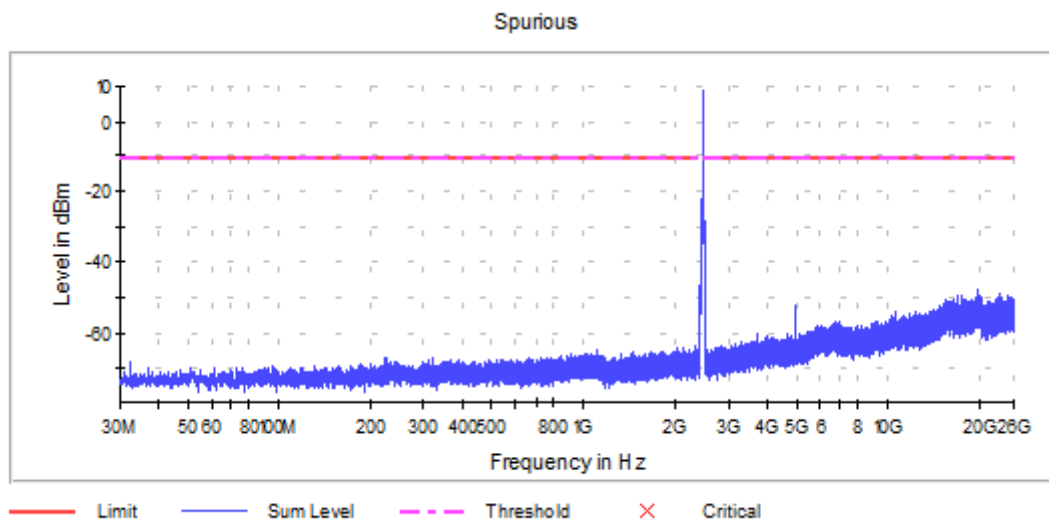
Graph 47:Antenna 0 - Transmitting on the Middle Channel - Setting 20



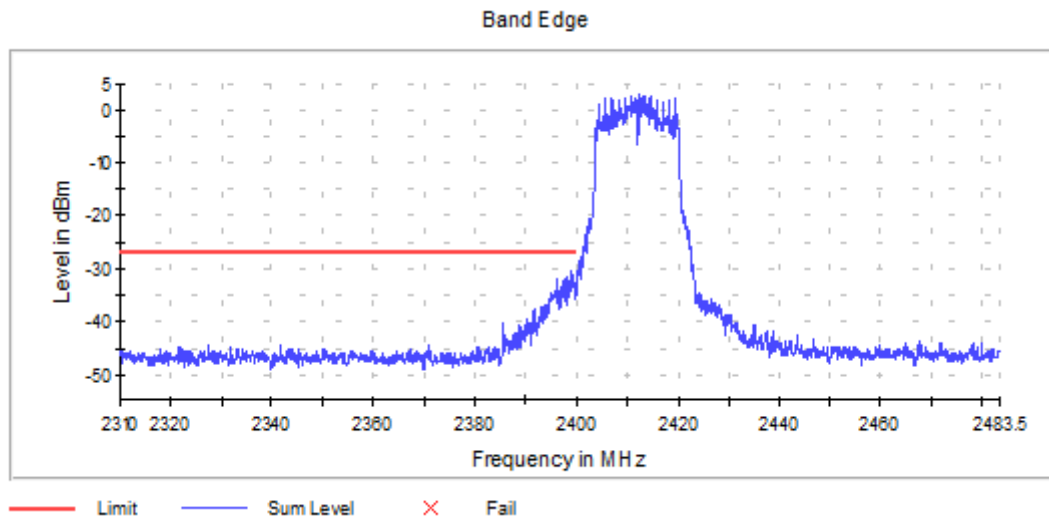
Graph 48:Antenna 1 - Transmitting on the Middle Channel - Setting 20



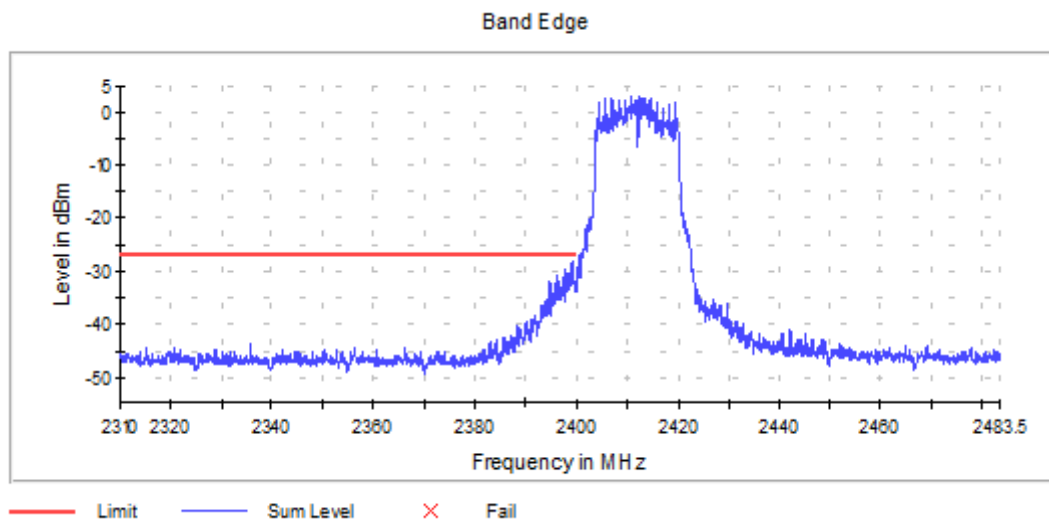
Graph 49: Antenna 0 - Transmitting on the Highest Channel - Setting 20



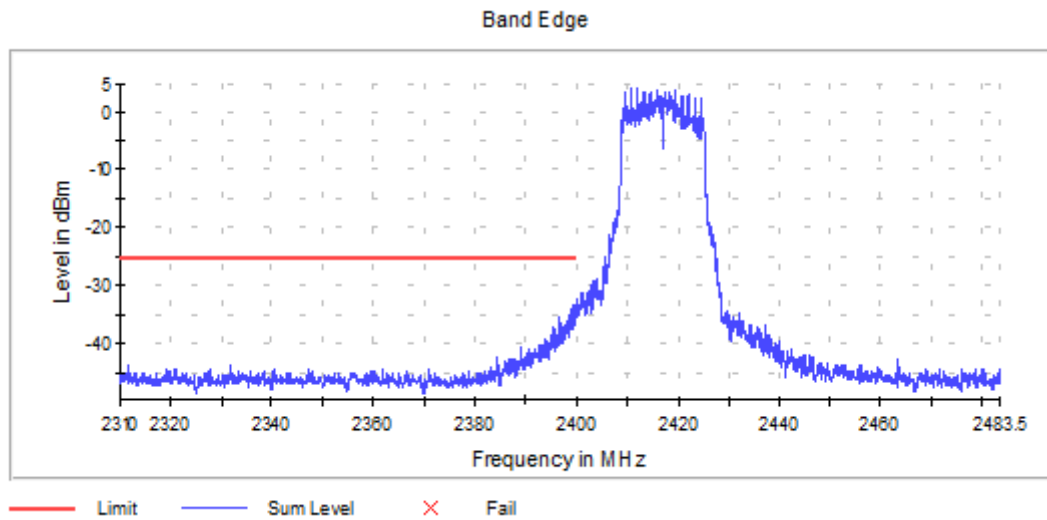
Graph 50: Antenna 1 - Transmitting on the Highest Channel - Setting 20



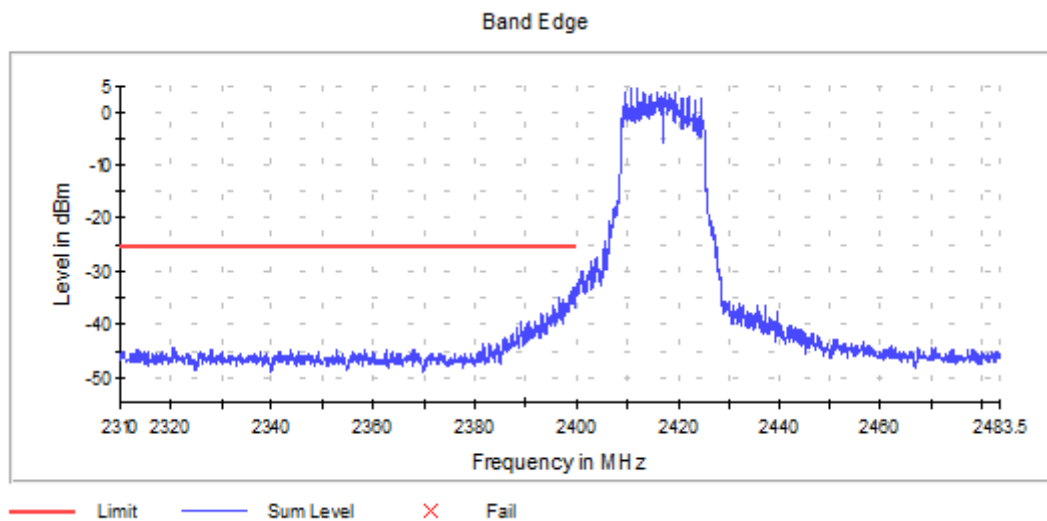
Graph 51: Antenna 0 – Channel 1 Lower Band Edge Plot - Setting 13.5



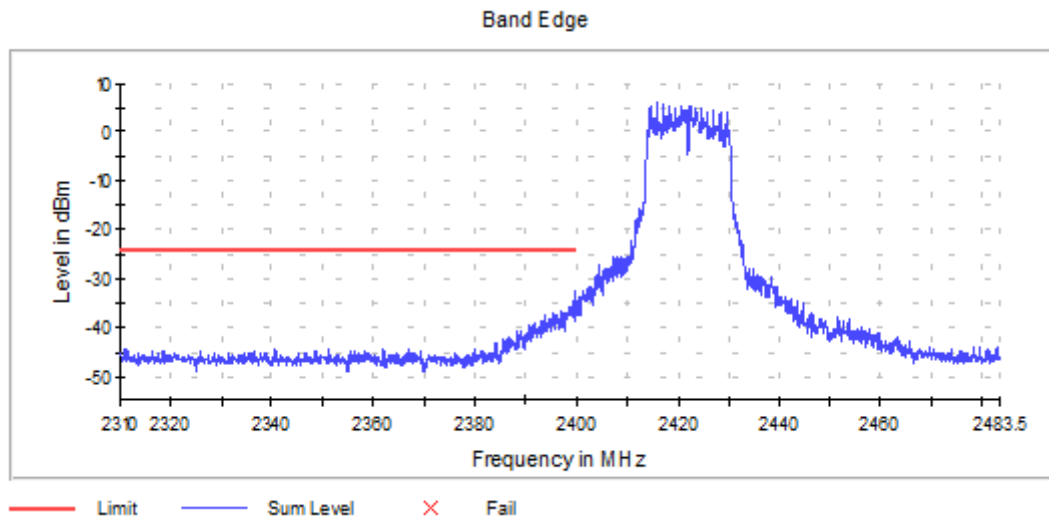
Graph 52: Antenna 1 – Channel 1 Lower Band Edge Plot - Setting 13.5



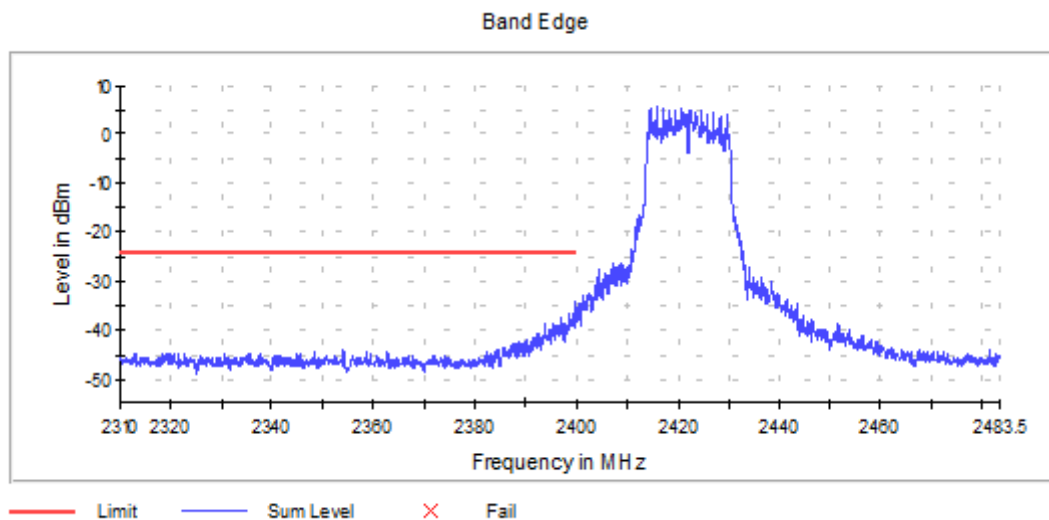
Graph 53: Antenna 0 – Channel 2 Lower Band Edge Plot - Setting 14.75



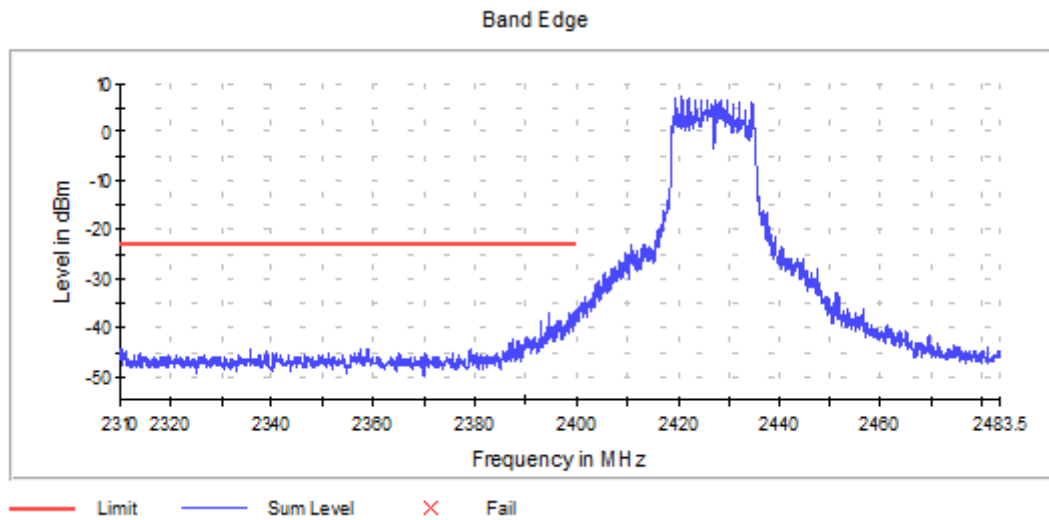
Graph 54: Antenna 1 – Channel 2 Lower Band Edge Plot - Setting 14.75



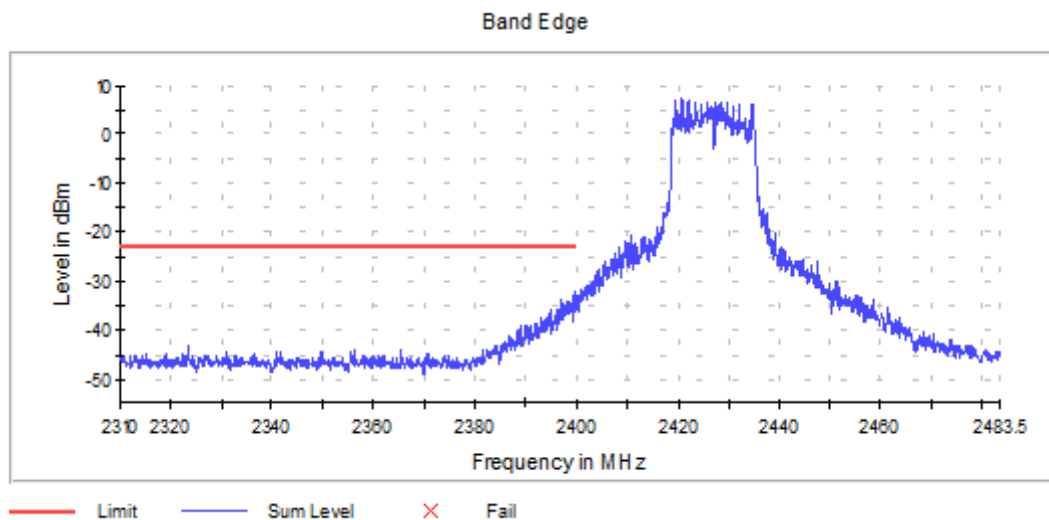
Graph 55: Antenna 0 – Channel 3 Lower Band Edge Plot - Setting 16.5



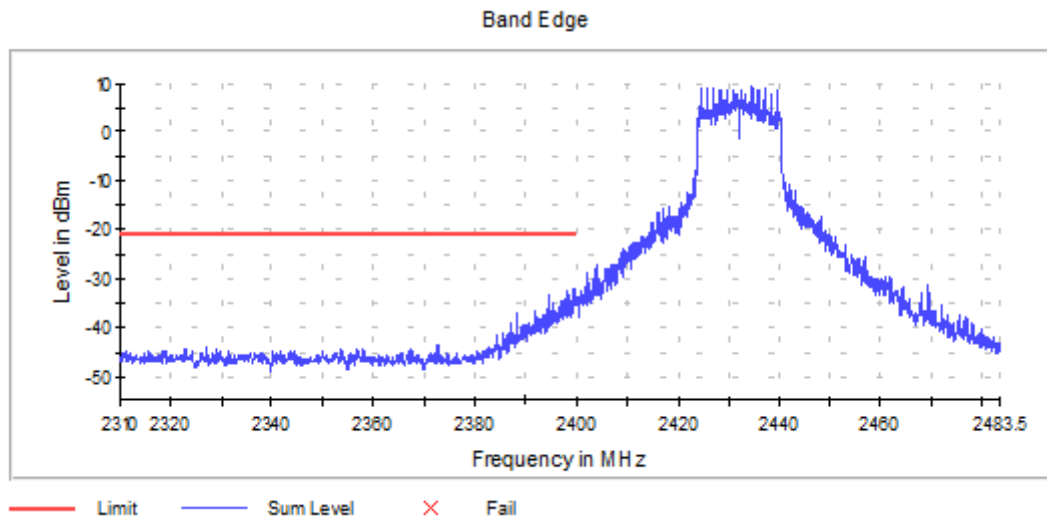
Graph 56: Antenna 1 – Channel 3 Lower Band Edge Plot - Setting 16.5



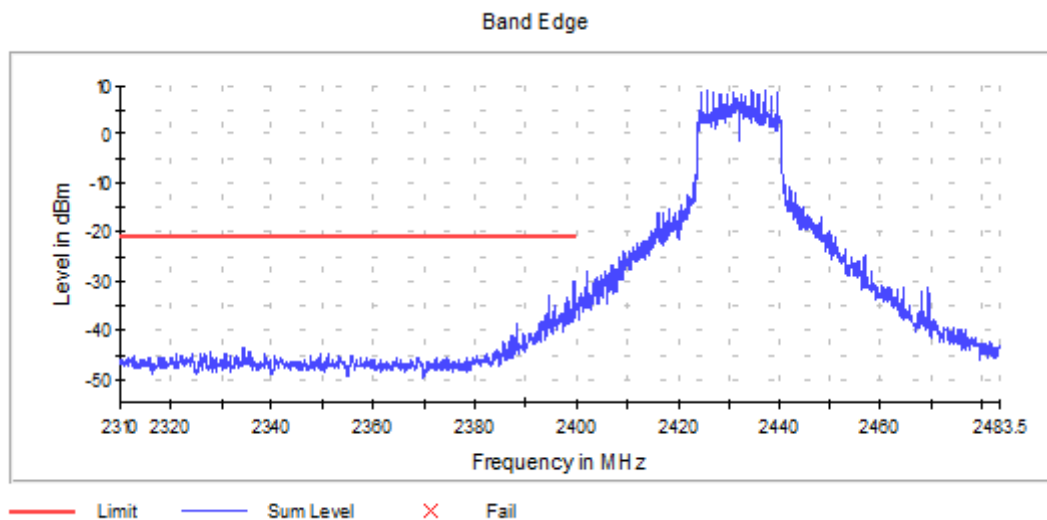
Graph 57: Antenna 0 – Channel 4 Lower Band Edge Plot - Setting 18.25



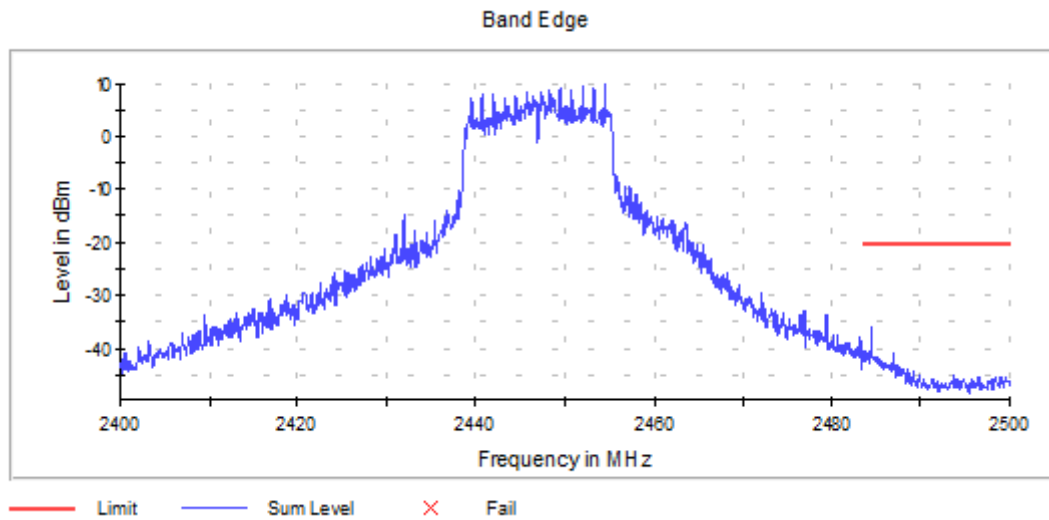
Graph 58: Antenna 1 – Channel 4 Lower Band Edge Plot - Setting 18.25



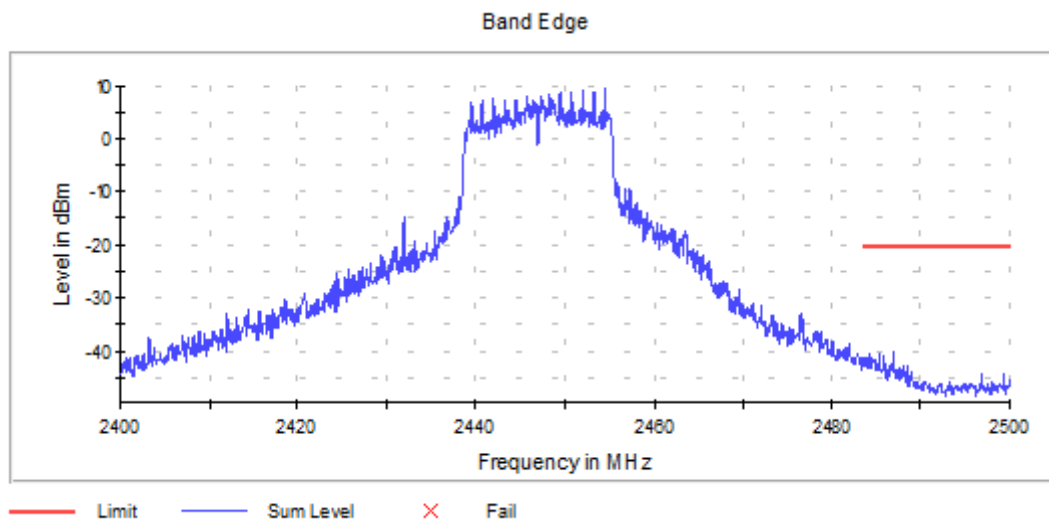
Graph 59: Antenna 0 – Channel 5 Lower Band Edge Plot - Setting 20



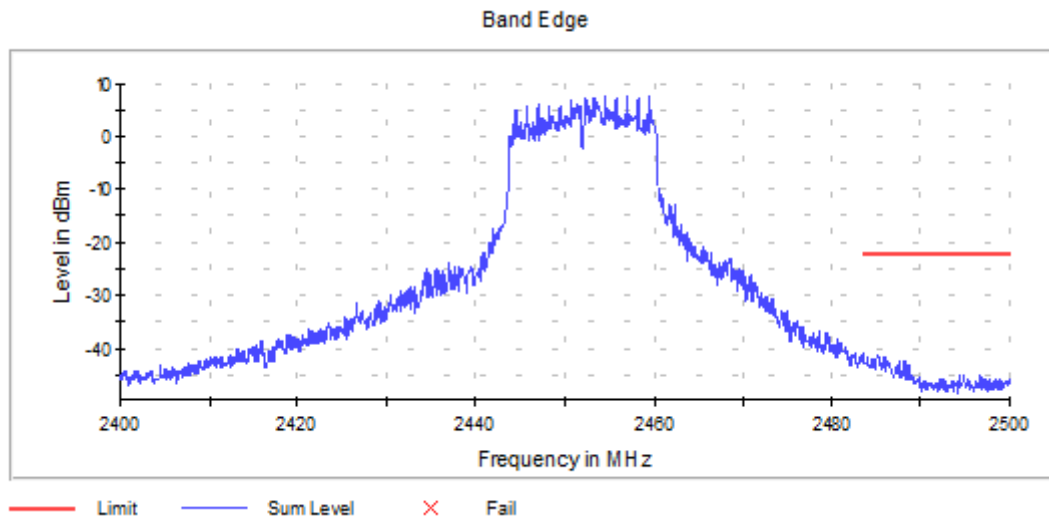
Graph 60: Antenna 1 – Channel 5 Lower Band Edge Plot - Setting 20



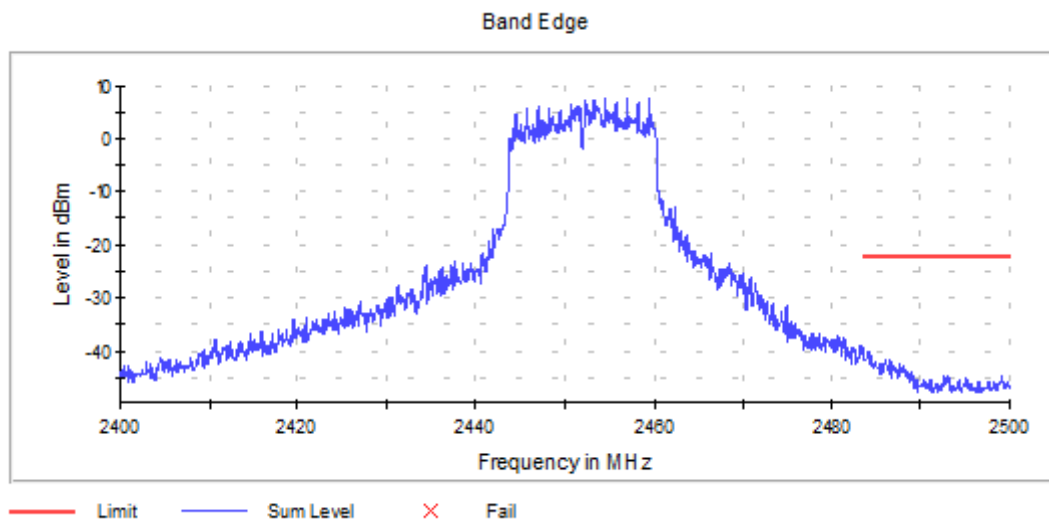
Graph 61: Antenna 0 – Channel 8 Upper Band Edge Plot - Setting 20



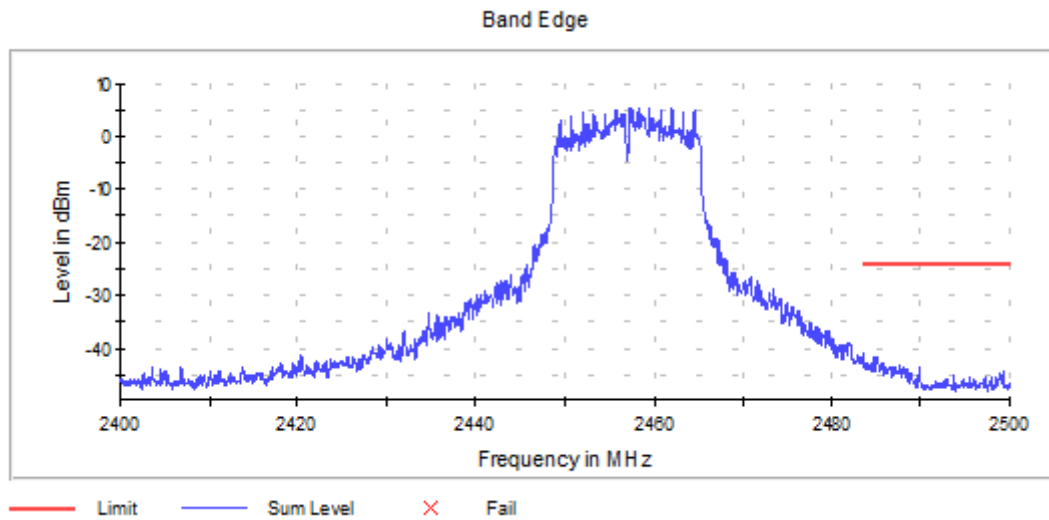
Graph 62: Antenna 1 – Channel 8 Upper Band Edge Plot - Setting 20



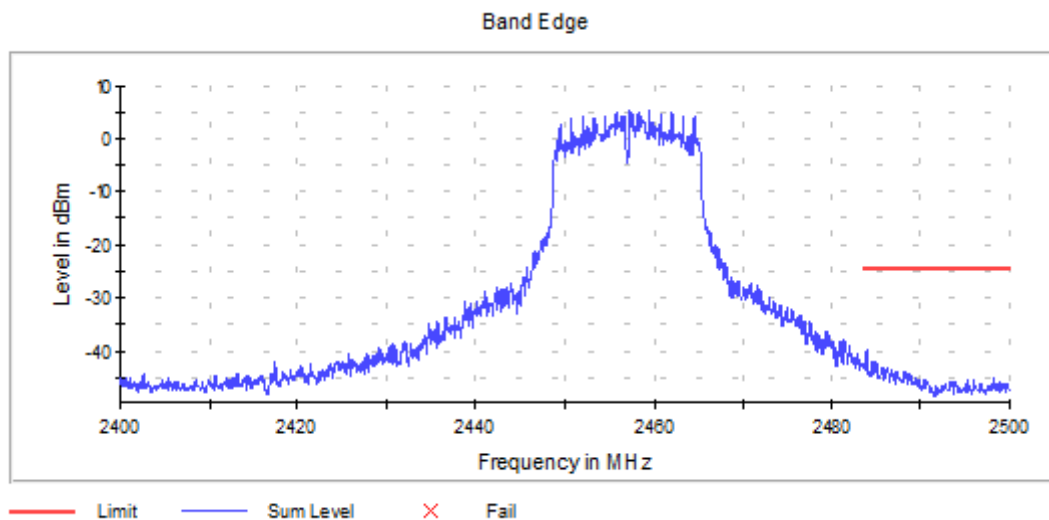
Graph 63: Antenna 0 – Channel 9 Upper Band Edge Plot - Setting 18.25



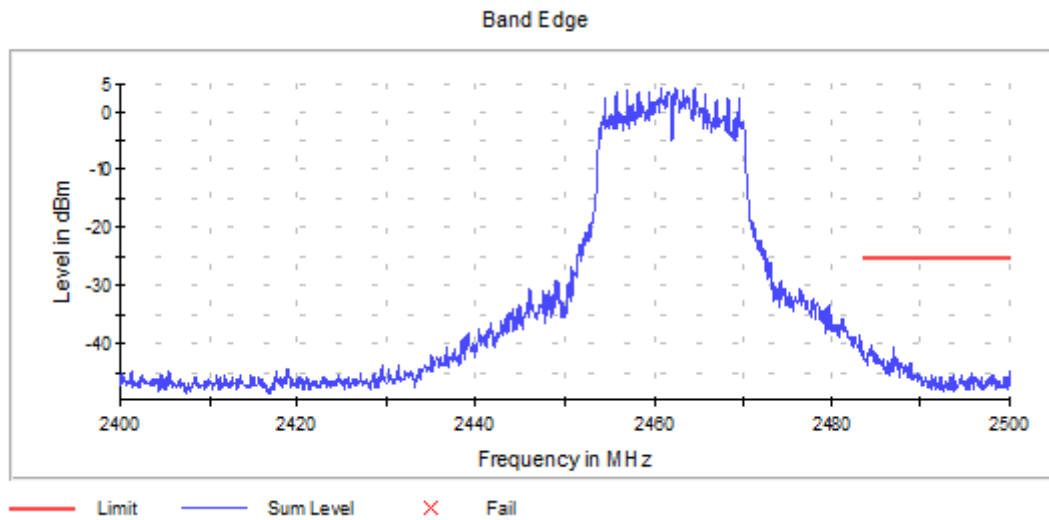
Graph 64: Antenna 1 – Channel 9 Upper Band Edge Plot - Setting 18.25



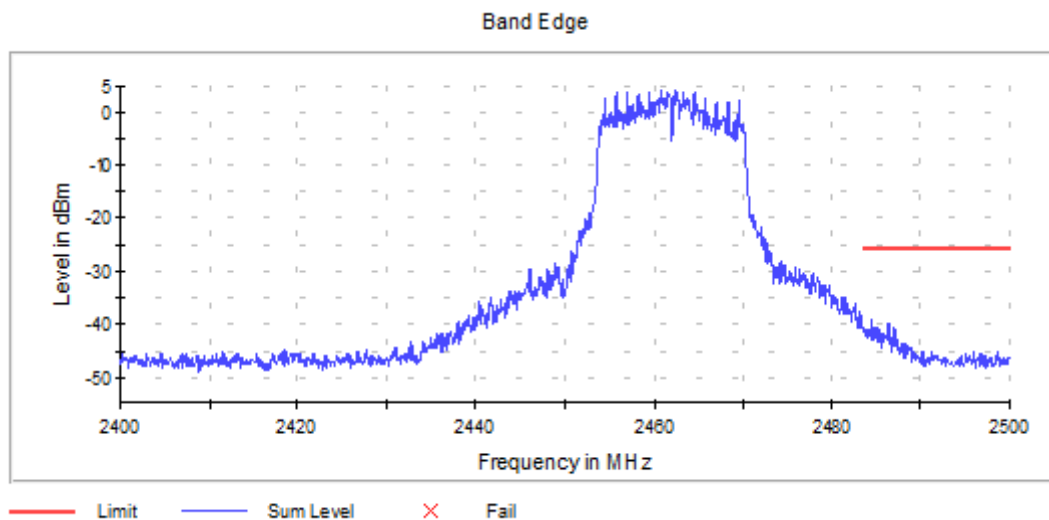
Graph 65: Antenna 0 – Channel 10 Upper Band Edge Plot - Setting 16



Graph 66: Antenna 1 – Channel 10 Upper Band Edge Plot - Setting 16



Graph 67: Antenna 0 – Channel 11 Upper Band Edge Plot - Setting 14.75



Graph 68: Antenna 1 – Channel 11 Upper Band Edge Plot - Setting 14.75

Result

Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification.

Radiated Spurious Emissions in the Restricted Bands of §15.205

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emission was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any emission that fell into the restricted bands of §15.205. The tables show the worst-case emission measured from the EUT. For frequencies above 18.0 GHz, a measurement distance of 1 meter was used. The noise floor was a minimum of 6 dB below the limit. The emissions in the restricted bands must meet the limits specified in §15.209. The spurious emissions were tested at the highest power setting used by any channel in the band (setting of 20). The band edges at the restricted bands were measured using the power settings that will be used in manufacturing. Tabular data and plots are shown below.

Result

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	6.5	38.5	45.0	74.0	-29.0
4824.0	Average	Vertical	-5.2	38.5	33.3	54.0	-20.7
4824.0	Peak	Horizontal	5.9	38.5	44.4	74.0	-29.6
4824.0	Average	Horizontal	-6.2	38.5	32.3	54.0	-21.7
7236.0	Peak	Vertical	5.0	42.7	47.7	74.0	-26.3
7236.0	Average	Vertical	-5.9	42.7	36.8	54.0	-17.2
7236.0	Peak	Horizontal	5.1	42.7	47.8	74.0	-26.2
7236.0	Average	Horizontal	-6.9	42.7	35.8	54.0	-18.2
12060.0	Peak	Vertical	4.4	47.9	52.3	74.0	-21.7
12060.0	Average	Vertical	-7.2	47.9	40.7	54.0	-13.3
12060.0	Peak	Horizontal	4.5	47.9	52.4	74.0	-21.6
12060.0	Average	Vertical	-7.2	47.9	40.7	54.0	-13.3

Table 8: Antenna 0 – Transmitting at the Lowest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	6.6	38.6	45.2	74.0	-28.8
4874.0	Average	Vertical	-5.4	38.6	33.2	54.0	-20.8
4874.0	Peak	Horizontal	5.7	38.6	44.3	74.0	-29.7
4874.0	Average	Horizontal	-6.2	38.6	32.4	54.0	-21.6
7311.0	Peak	Vertical	4.7	42.9	47.6	74.0	-26.4
7311.0	Average	Vertical	-6.4	42.9	36.5	54.0	-17.5
7311.0	Peak	Horizontal	4.7	42.9	47.6	74.0	-26.4

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
7311.0	Average	Horizontal	-7.9	42.9	35.0	54.0	-19.0
12185.0	Peak	Vertical	4.4	47.8	52.2	74.0	-21.8
12185.0	Average	Vertical	-7.2	47.8	40.6	54.0	-13.4
12185.0	Peak	Horizontal	4.0	47.8	51.8	74.0	-22.2
12185.0	Average	Vertical	-7.5	47.8	40.3	54.0	-13.7

Table 9: Antenna 0 – Transmitting at the Middle Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924.0	Peak	Vertical	9.2	38.7	47.9	74.0	-26.1
4924.0	Average	Vertical	-3.3	38.7	35.4	54.0	-18.6
4924.0	Peak	Horizontal	5.7	38.7	44.4	74.0	-29.6
4924.0	Average	Horizontal	-5.9	38.7	32.8	54.0	-21.2
7386.0	Peak	Vertical	5.0	43.1	48.1	74.0	-25.9
7386.0	Average	Vertical	-6.3	43.1	36.8	54.0	-17.2
7386.0	Peak	Horizontal	4.5	43.1	47.6	74.0	-26.4
7386.0	Average	Horizontal	-6.9	43.1	36.2	54.0	-17.8
12310.0	Peak	Vertical	3.3	47.7	51.0	74.0	-23.0
12310.0	Average	Vertical	-8.3	47.7	39.4	54.0	-14.6
12310.0	Peak	Horizontal	2.9	47.7	50.6	74.0	-23.4
12310.0	Average	Vertical	-8.1	47.7	39.6	54.0	-14.4

Table 10: Antenna 0 – Transmitting at the Highest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	6.5	38.5	45.0	74.0	-29.0
4824.0	Average	Vertical	-5.1	38.5	33.4	54.0	-20.6
4824.0	Peak	Horizontal	5.8	38.5	44.3	74.0	-29.7
4824.0	Average	Horizontal	-6.1	38.5	32.4	54.0	-21.6
7236.0	Peak	Vertical	6.3	42.7	49.0	74.0	-25.0
7236.0	Average	Vertical	-4.7	42.7	38.0	54.0	-16.0
7236.0	Peak	Horizontal	4.7	42.7	47.4	74.0	-26.6
7236.0	Average	Horizontal	-6.9	42.7	35.8	54.0	-18.2

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
12060.0	Peak	Vertical	4.0	47.9	51.9	74.0	-22.1
12060.0	Average	Vertical	-6.9	47.9	41.0	54.0	-13.0
12060.0	Peak	Horizontal	-8.0	47.9	39.9	74.0	-34.1
12060.0	Average	Vertical	-7.9	47.9	40.0	54.0	-14.0

Table 11: Antenna 1 – Transmitting at the Lowest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	6.9	38.6	45.5	74.0	-28.5
4874.0	Average	Vertical	-2.2	38.6	36.4	54.0	-17.6
4874.0	Peak	Horizontal	5.9	38.6	44.5	74.0	-29.5
4874.0	Average	Horizontal	-6.2	38.6	32.4	54.0	-21.6
7311.0	Peak	Vertical	5.2	42.9	48.1	74.0	-25.9
7311.0	Average	Vertical	-5.5	42.9	37.4	54.0	-16.6
7311.0	Peak	Horizontal	4.4	42.9	47.3	74.0	-26.7
7311.0	Average	Horizontal	-6.9	42.9	36.0	54.0	-18.0
12185.0	Peak	Vertical	5.1	47.8	52.9	74.0	-21.1
12185.0	Average	Vertical	-7.2	47.8	40.6	54.0	-13.4
12185.0	Peak	Horizontal	4.6	47.8	52.4	74.0	-21.6
12185.0	Average	Vertical	-7.5	47.8	40.3	54.0	-13.7

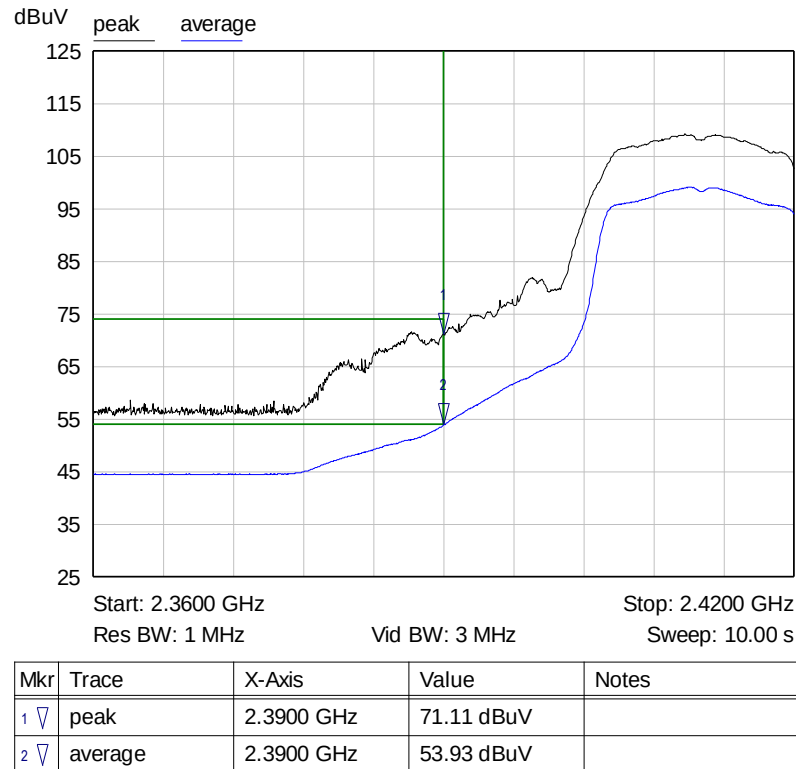
Table 12: Antenna 1 – Transmitting at the Middle Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924.0	Peak	Vertical	8.8	38.7	47.5	74.0	-26.5
4924.0	Average	Vertical	-3.6	38.7	35.1	54.0	-18.9
4924.0	Peak	Horizontal	6.0	38.7	44.7	74.0	-29.3
4924.0	Average	Horizontal	-5.6	38.7	33.1	54.0	-20.9
7386.0	Peak	Vertical	5.6	43.1	48.7	74.0	-25.3
7386.0	Average	Vertical	-5.7	43.1	37.4	54.0	-16.6
7386.0	Peak	Horizontal	4.9	43.1	48.0	74.0	-26.0
7386.0	Average	Horizontal	-7.0	43.1	36.1	54.0	-17.9
12310.0	Peak	Vertical	4.2	47.7	51.9	74.0	-22.1

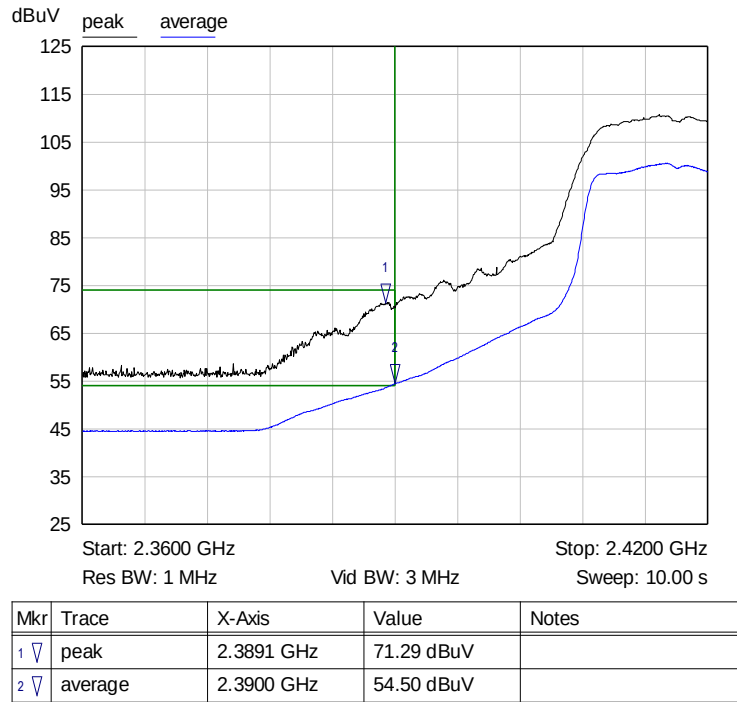
Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dB μ V)	Correction Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
12310.0	Average	Vertical	-7.7	47.7	40.0	54.0	-14.0
12310.0	Peak	Horizontal	4.0	47.7	51.7	74.0	-22.3
12310.0	Average	Vertical	-8.2	47.7	39.5	54.0	-14.5

Table 13: Antenna 1 – Transmitting at the Highest Frequency – Setting 20

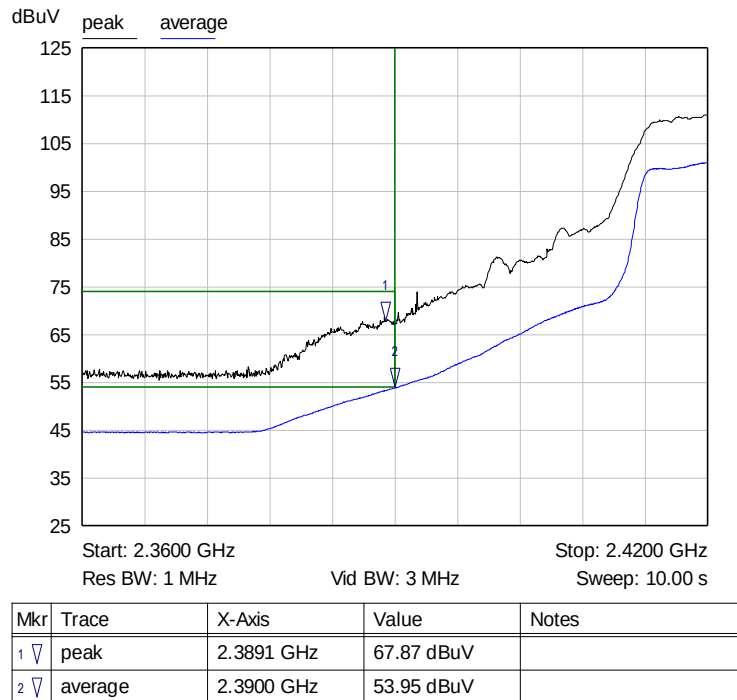
No other emissions were seen in the restricted bands.



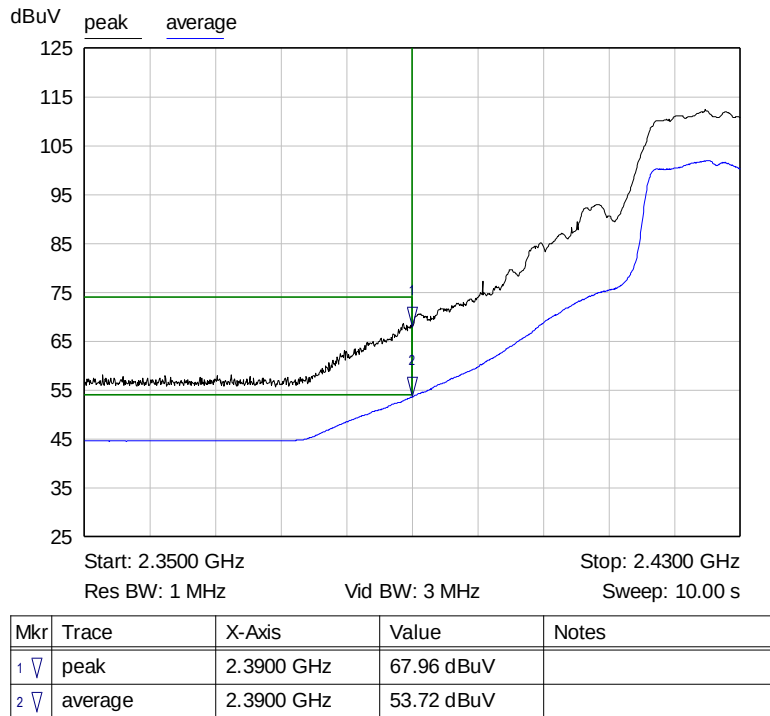
Graph 69: Antenna 0 – Channel 1 Band Edge at the Restricted Band Plot - Setting 13.5



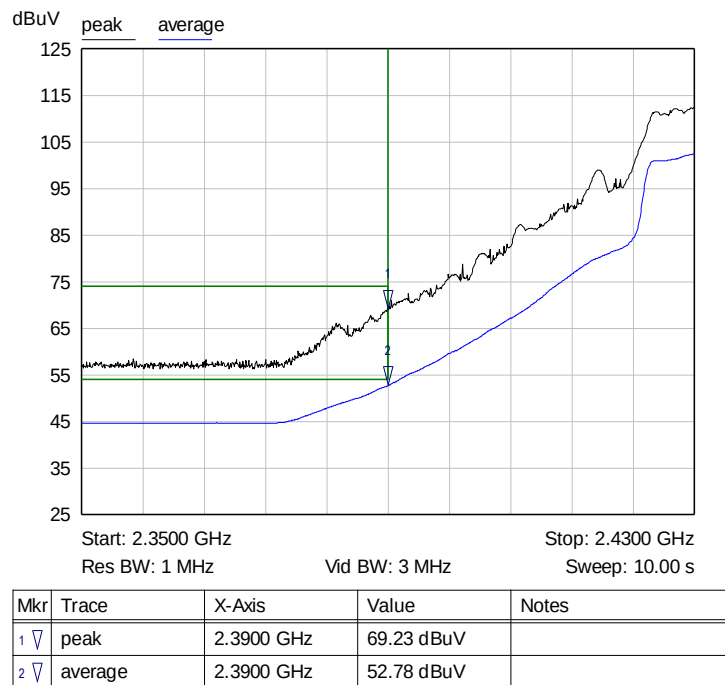
Graph 70: Antenna 0 – Channel 2 Band Edge at the Restricted Band Plot - Setting 14.75



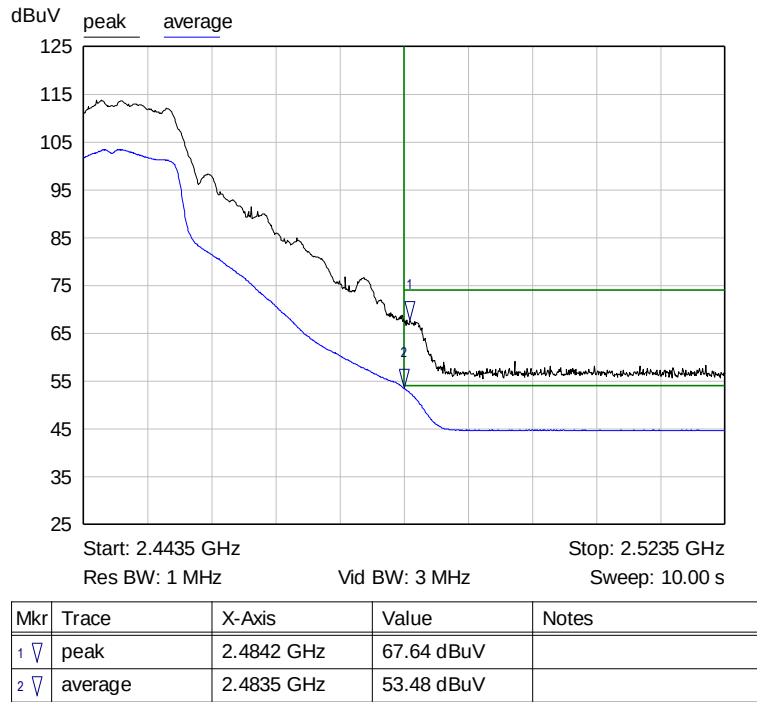
Graph 71: Antenna 0 – Channel 3 Band Edge at the Restricted Band Plot - Setting 16.5



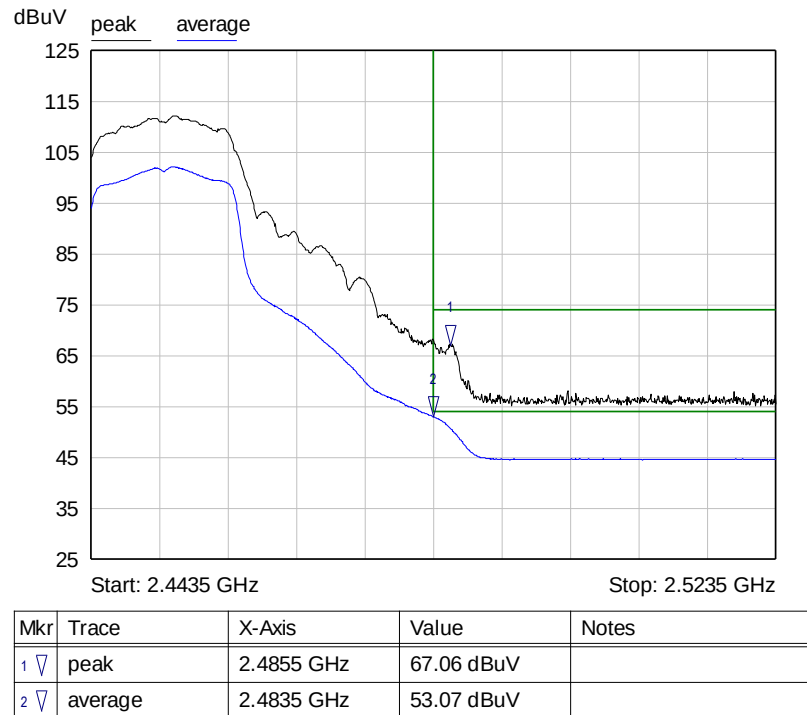
Graph 72: Antenna 0 – Channel 4 Band Edge at the Restricted Band Plot - Setting 18.25



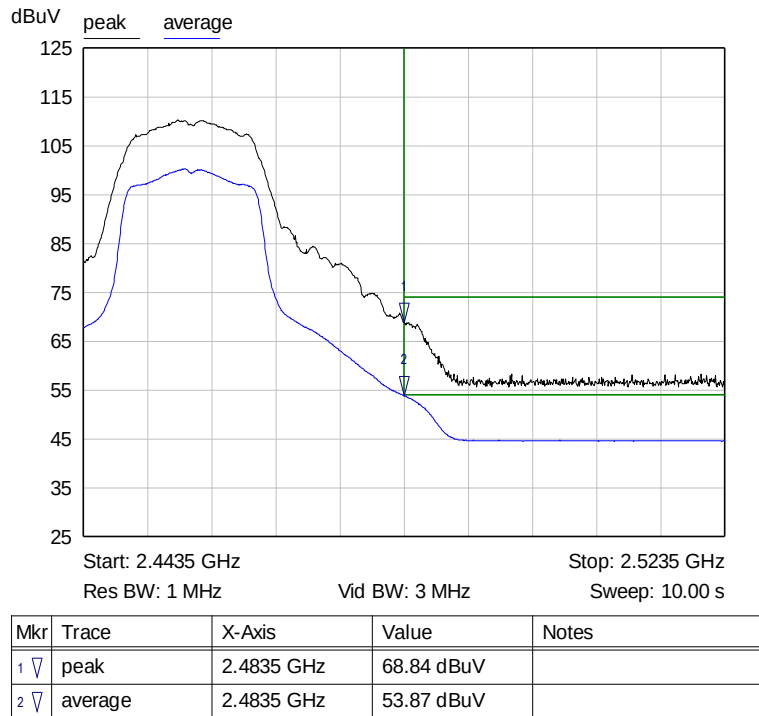
Graph 73: Antenna 0 – Channel 5 Band Edge at the Restricted Band Plot - Setting 20



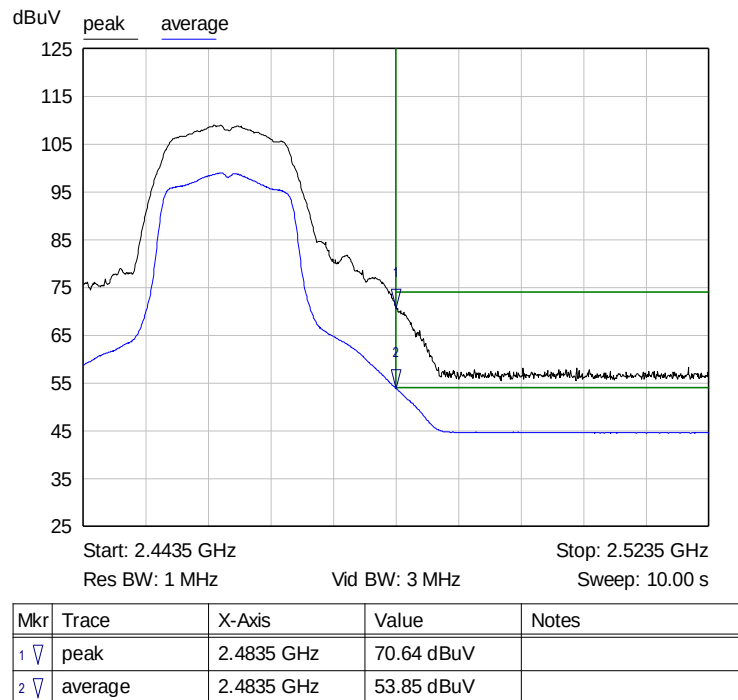
Graph 74: Antenna 0 – Channel 8 Band Edge at the Restricted Band Plot - Setting 20



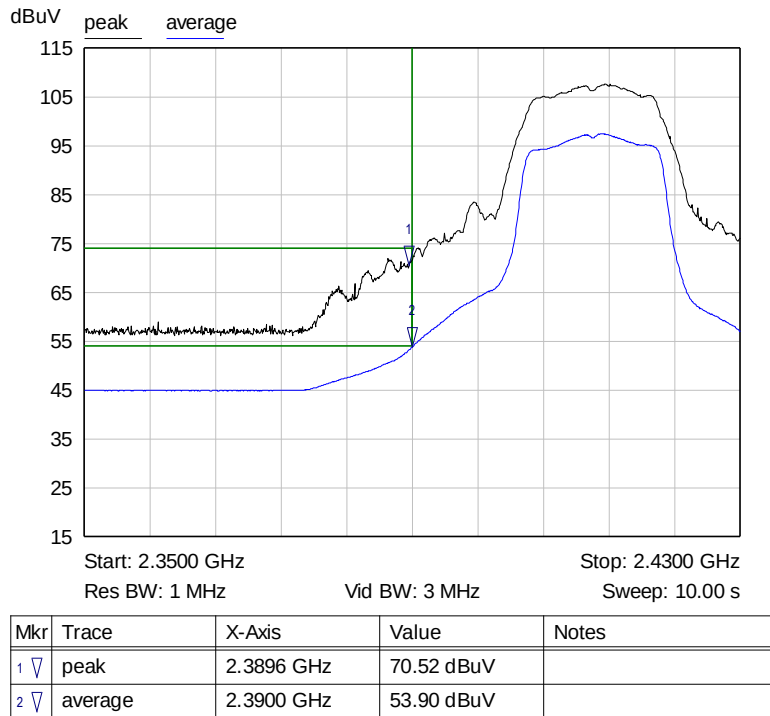
Graph 75: Antenna 0 – Channel 9 Band Edge at the Restricted Band Plot - Setting 18.25



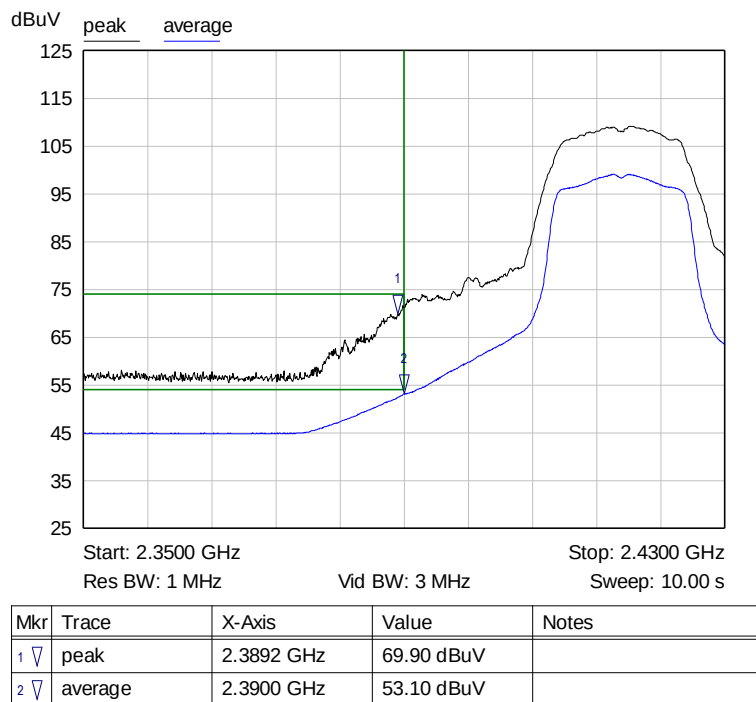
Graph 76: Antenna 0 – Channel 10 Band Edge at the Restricted Band Plot - Setting 16



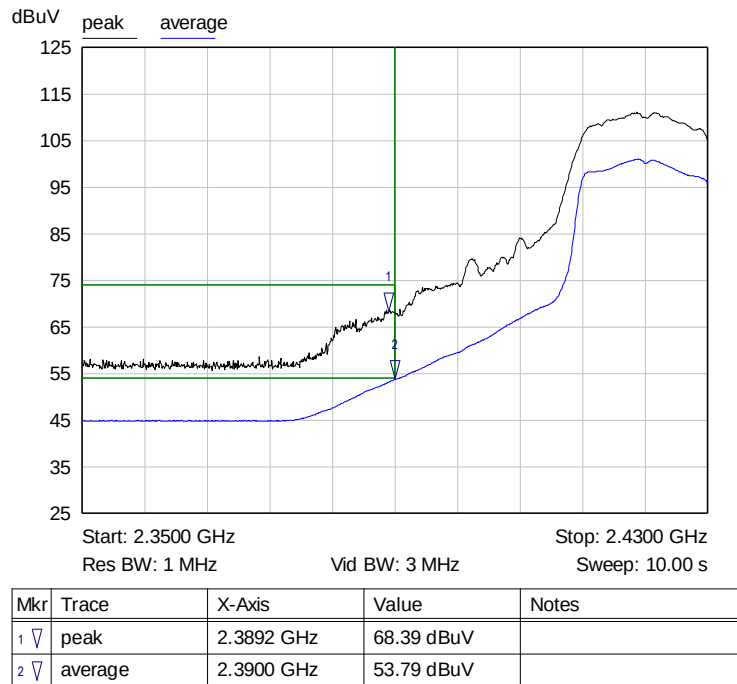
Graph 77: Antenna 0 – Channel 11 Band Edge at the Restricted Band Plot - Setting 14.75



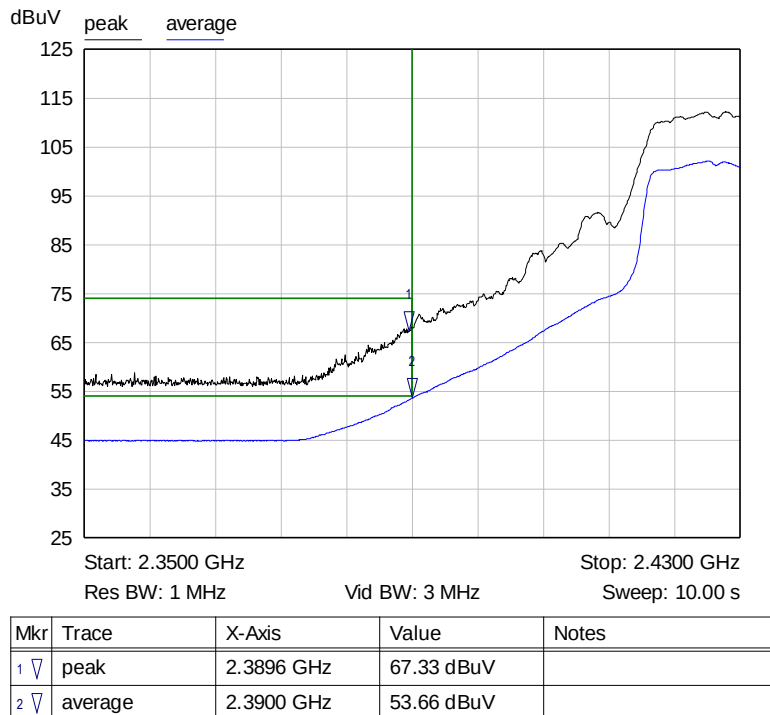
Graph 78: Antenna 1 – Channel 1 Band Edge at the Restricted Band Plot - Setting 13.5



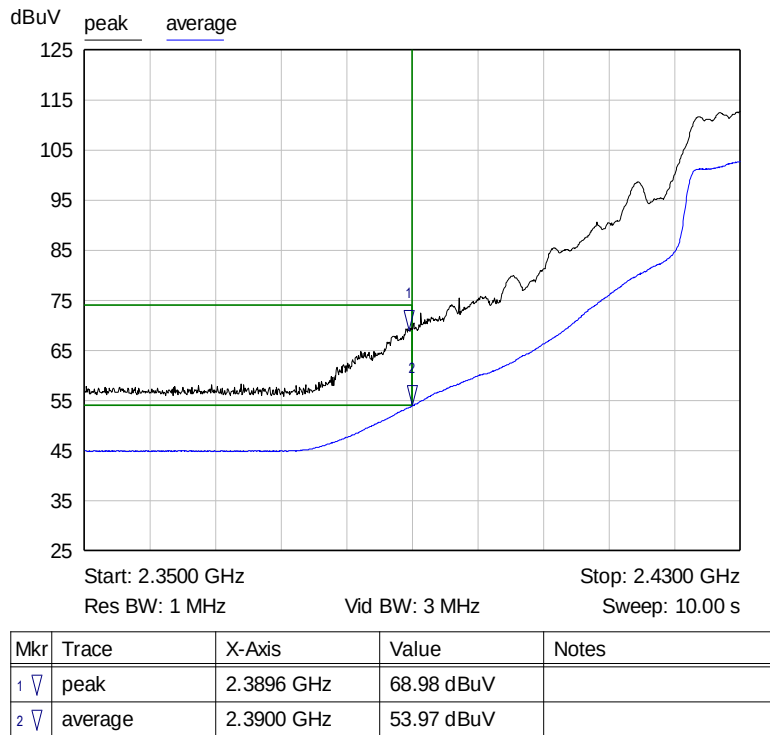
Graph 79: Antenna 1 – Channel 2 Band Edge at the Restricted Band Plot - Setting 14.75



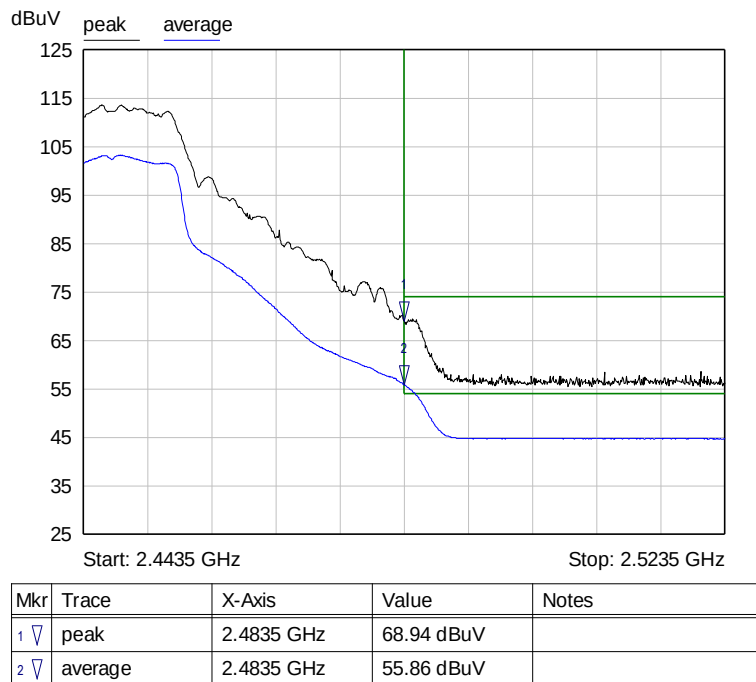
Graph 80: Antenna 1 – Channel 3 Band Edge at the Restricted Band Plot - Setting 16.5



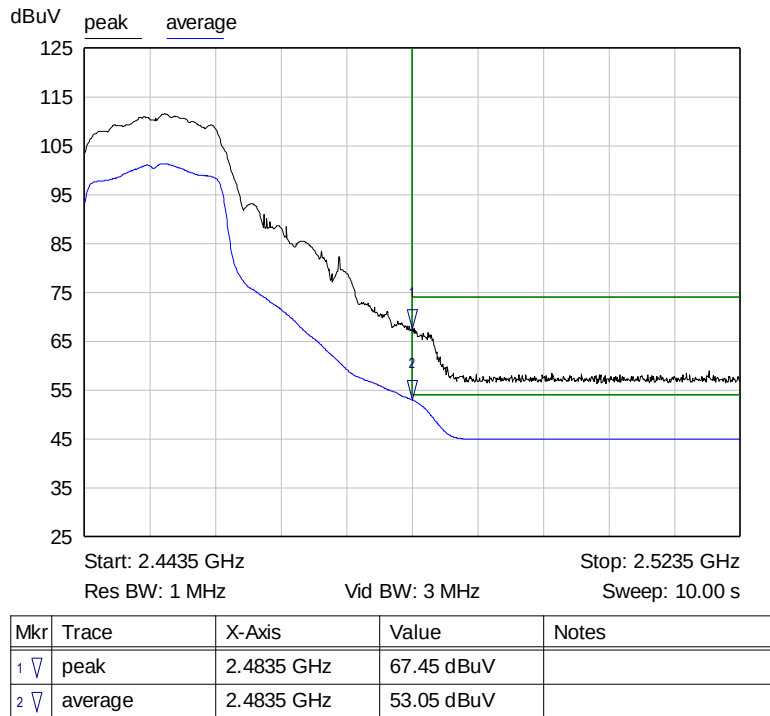
Graph 81: Antenna 1 – Channel 4 Band Edge at the Restricted Band Plot - Setting 18.25



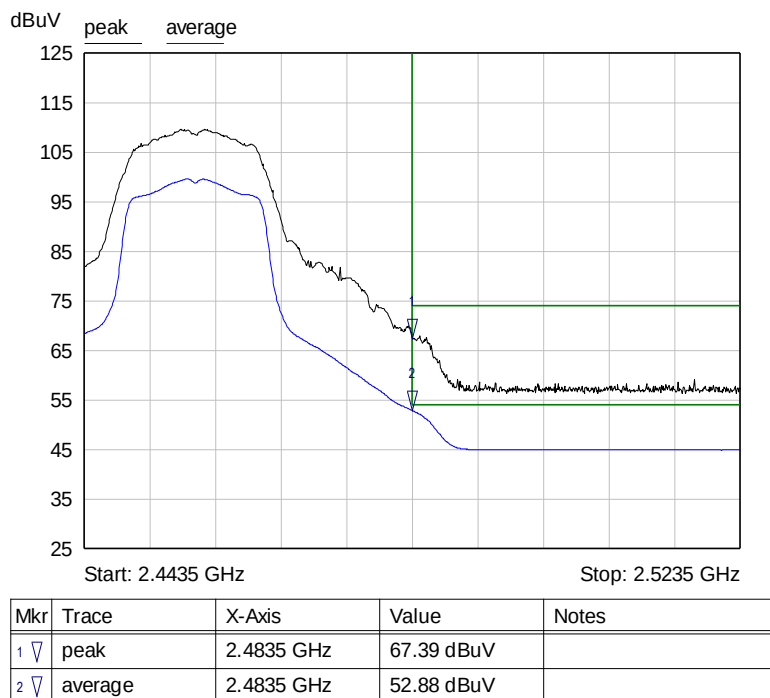
Graph 82: Antenna 1 – Channel 5 Band Edge at the Restricted Band Plot - Setting 20



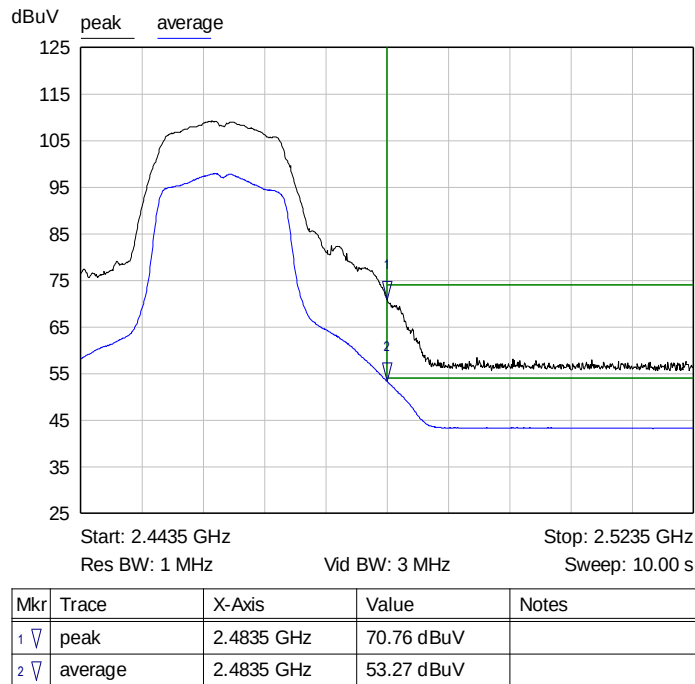
Graph 83: Antenna 1 – Channel 8 Band Edge at the Restricted Band Plot - Setting 20



Graph 84: Antenna 1 – Channel 9 Band Edge at the Restricted Band Plot - Setting 18.25



Graph 85: Antenna 1 – Channel 10 Band Edge at the Restricted Band Plot - Setting 16.0



Graph 86: Antenna 1 – Channel 11 Band Edge at the Restricted Band Plot - Setting 14.75

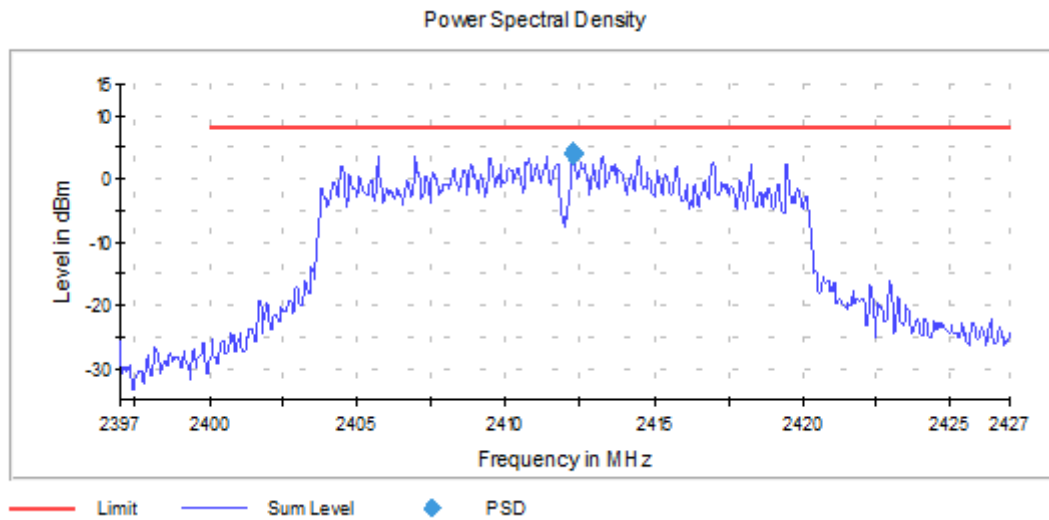
7.2.6 §15.247(e) Power Spectral Density

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. Measurements were taken according to Method AVGPS-3 (ANSI C63.10, Section 11.10.7) at the maximum possible power setting (20) to demonstrate compliance with this requirement at all possible power settings. Results of this testing are summarized.

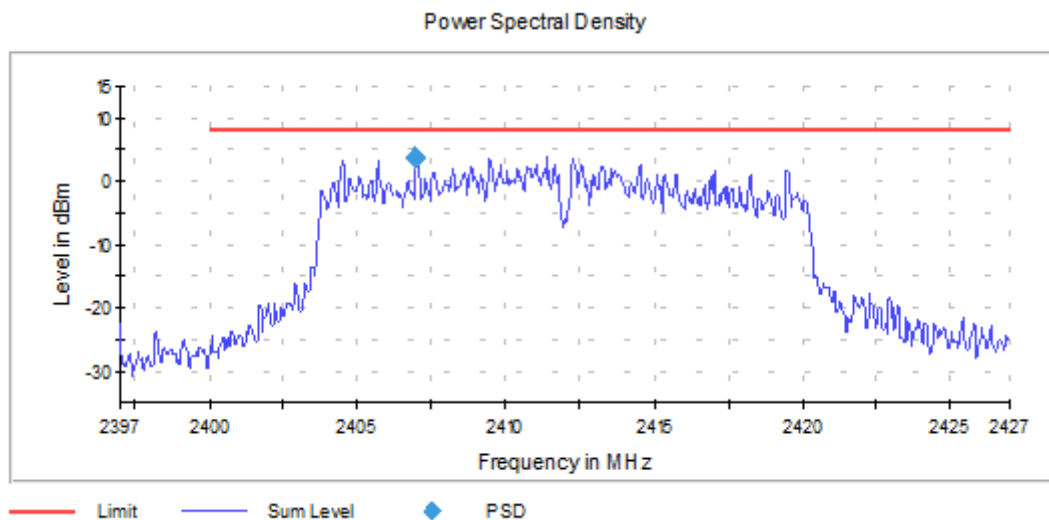
Frequency (MHz)	Measurement Antenna 0 (dBm)	Measurement Antenna 1 (dBm)	Criteria (dBm)
2412	3.9	3.7	8.0
2437	3.4	3.4	8.0
2462	4.0	3.8	8.0

Result

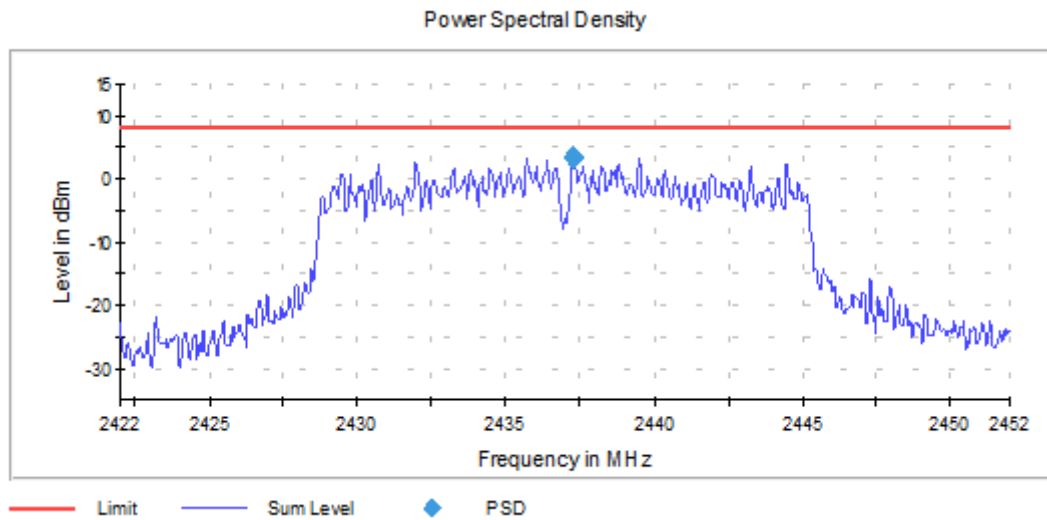
The maximum power spectral density was less than the limit of 8 dBm; therefore, the EUT complies with the specification.



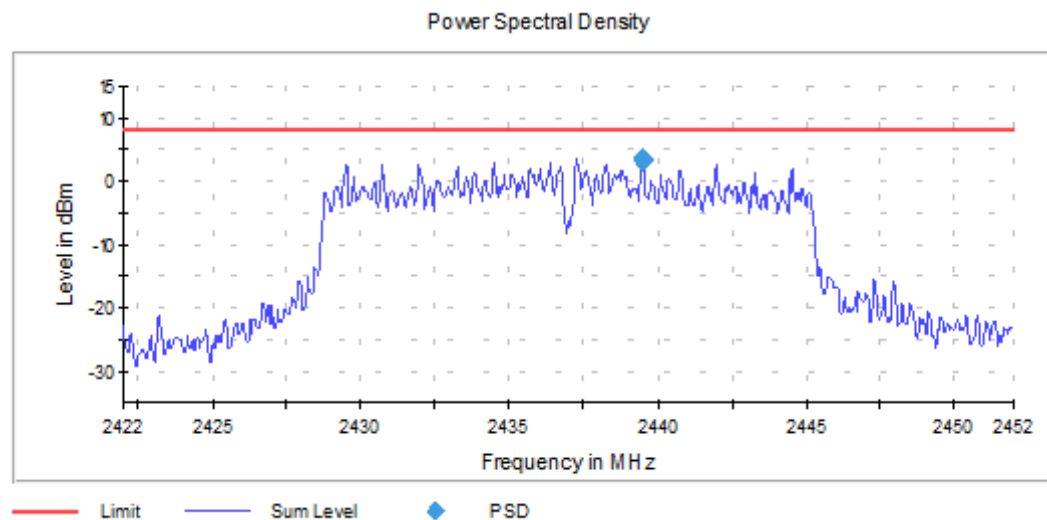
Graph 87: Antenna 0 - Lowest Channel PSD - Setting 20



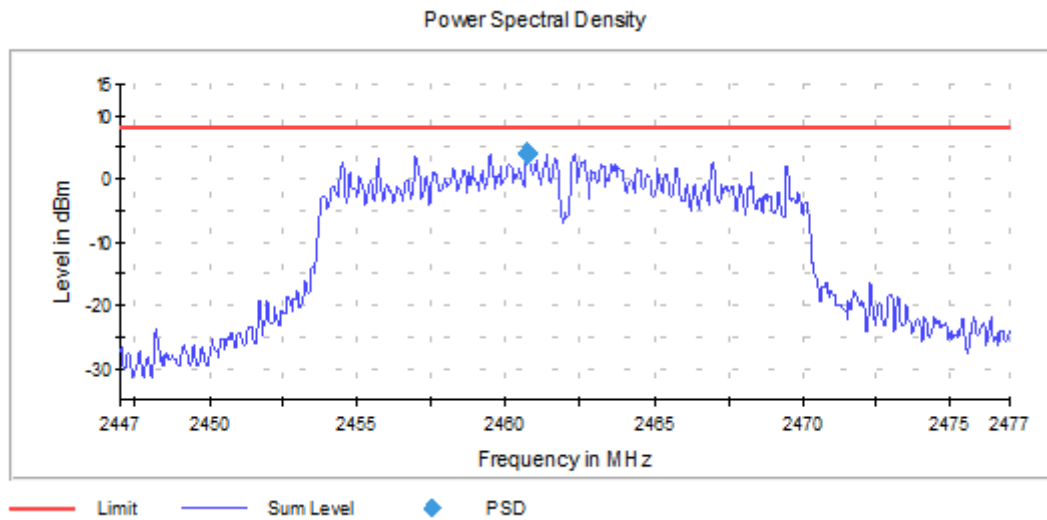
Graph 88: Antenna 1 - Lowest Channel PSD - Setting 20



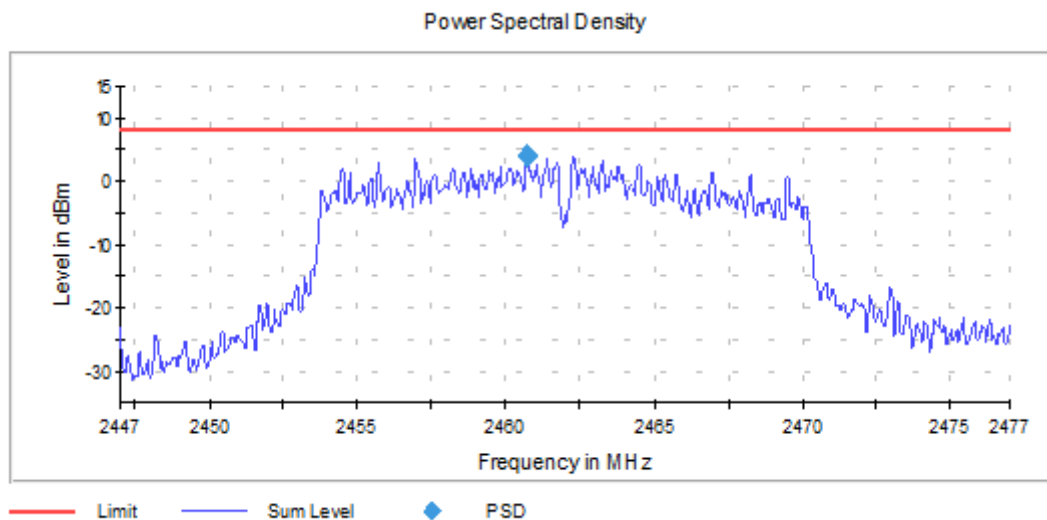
Graph 89: Antenna 0 - Middle Channel PSD - Setting 20



Graph 90: Antenna 1 - Middle Channel PSD - Setting 20



Graph 91: Antenna 0 - Highest Channel PSD - Setting 20



Graph 92: Antenna 1 - Highest Channel PSD - Setting 20

8 Measurements, Examinations and Derived Results – 802.11n

8.1 General Comments

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Section 7 of this report.

8.2 Test Results

8.2.1 §15.203 Antenna Requirements

See Section 6.2.1.

8.2.2 Conducted Emissions at Mains Ports Data (Hot Lead)

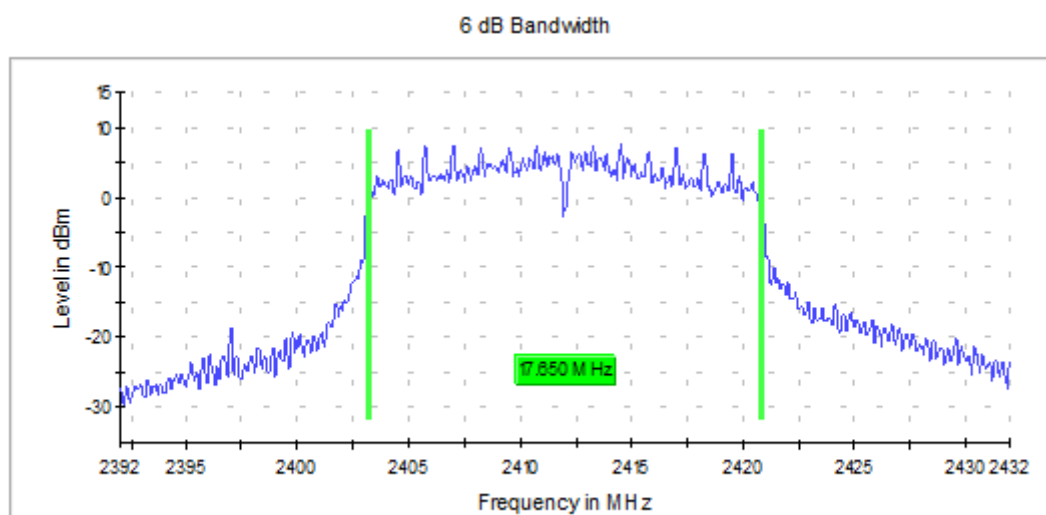
See Section 6.2.2.

8.2.3 §15.247(a)(2) Emissions Bandwidth

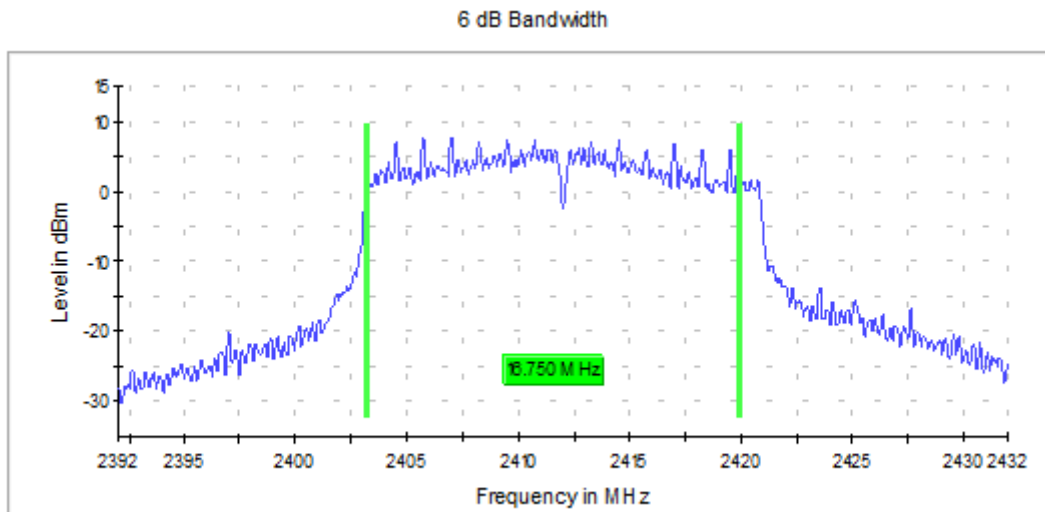
Frequency (MHz)	Emissions 6 dB bandwidth Antenna 0 (MHz)	Emissions 6 dB bandwidth Antenna 1 (MHz)
2412	17.7	16.8
2437	17.8	17.8
2462	17.7	16.3

Result

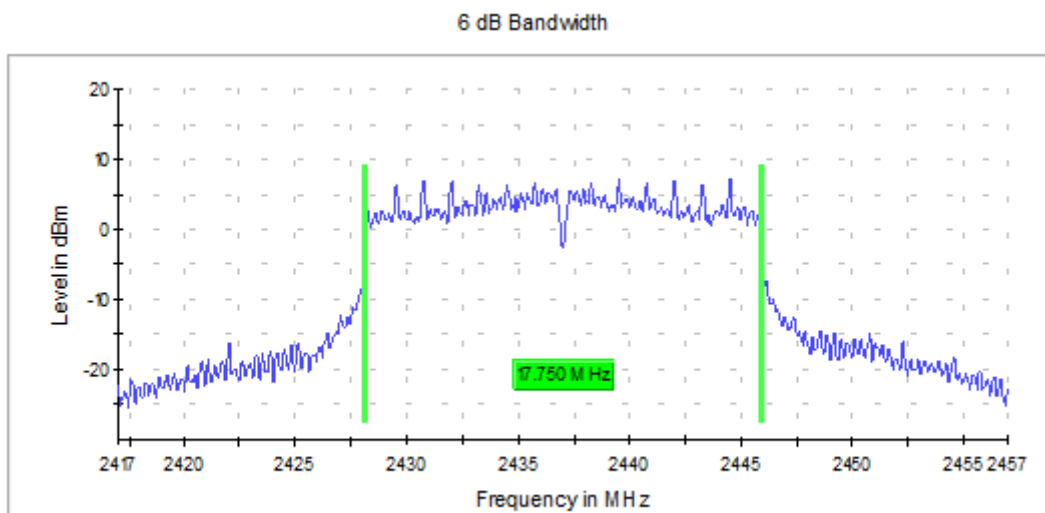
In the configuration tested, the 6 dB bandwidth was greater than 500 kHz; therefore, the EUT complied with the requirements of the specification (see plots below).



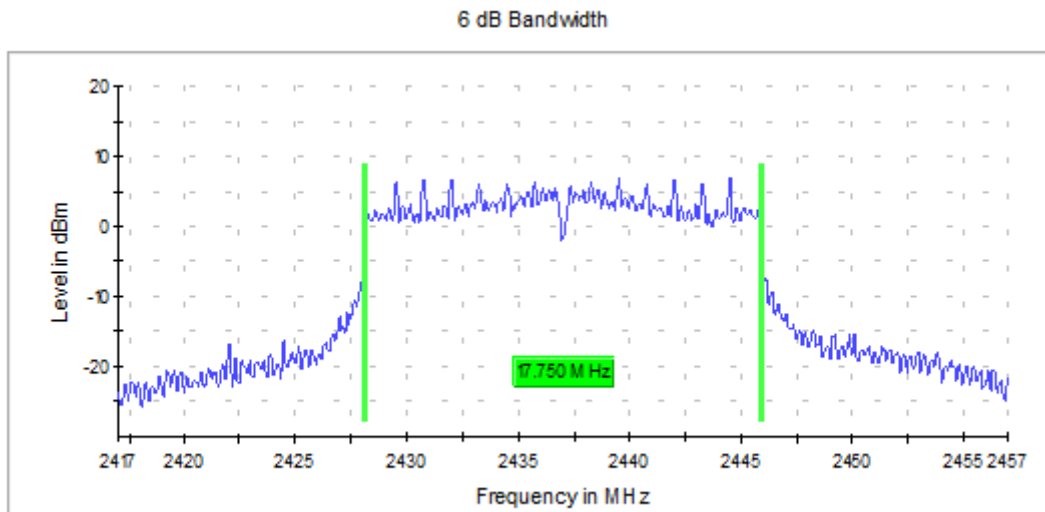
Graph 93: Antenna 0 - Lowest Channel (2412 MHz) Bandwidth - Setting 20



Graph 94: Antenna 1 - Lowest Channel (2412 MHz) Bandwidth - Setting 20



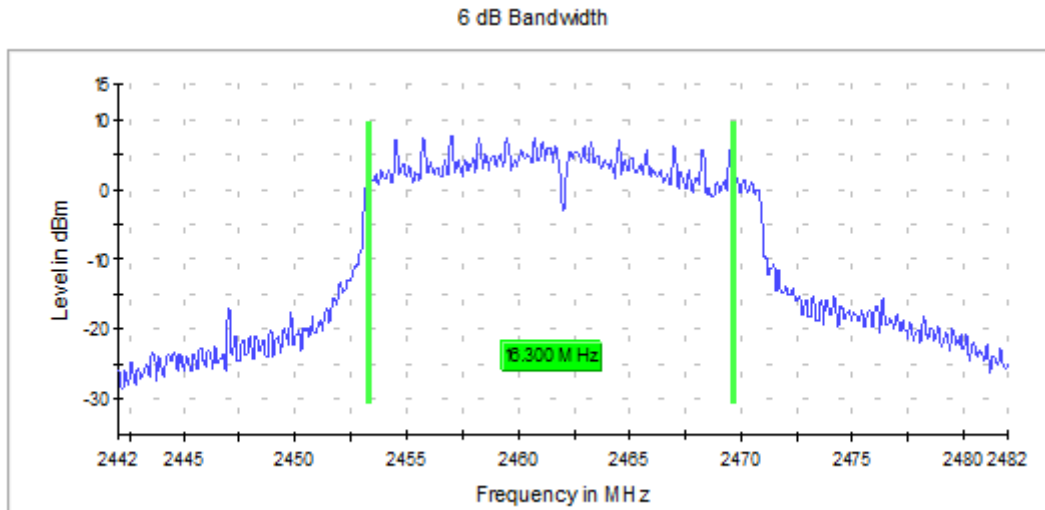
Graph 95: Antenna 0 - Middle Channel (2437 MHz) Bandwidth - Setting 20



Graph 96: Antenna 1 - Middle Channel (2437 MHz) Bandwidth - Setting 20



Graph 97: Antenna 0 - Highest Channel (2462 MHz) Bandwidth - Setting 20

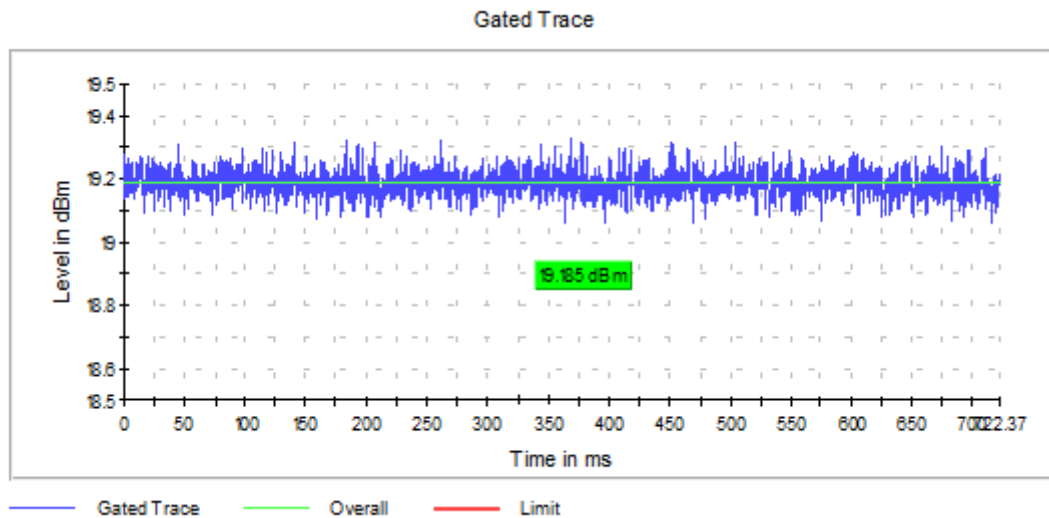


Graph 98: Antenna 1 - Highest Channel (2462 MHz) Bandwidth - Setting 20

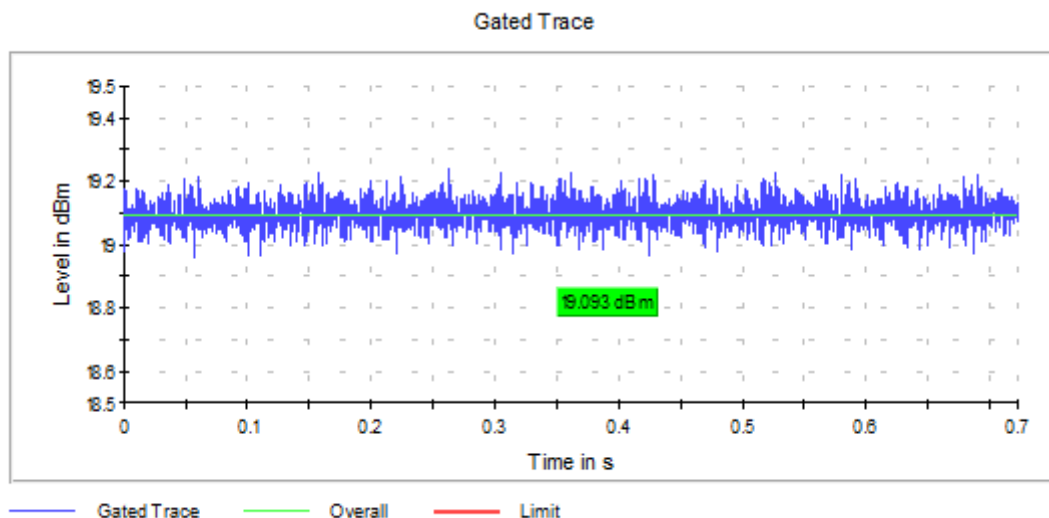
8.2.4 §15.247(b)(3) Output Power

The maximum conducted (average) output power was measured according to Method AVGPM-G (ANSI C63.10, Section 11.9.2.3.2). Measurements were taken at the maximum possible power setting (20) to demonstrate compliance with this requirement with all possible power settings. The highest measured result was 19.4 dBm for this mode. The limit is 30 dBm when using antennas with 6 dBi or less gain.

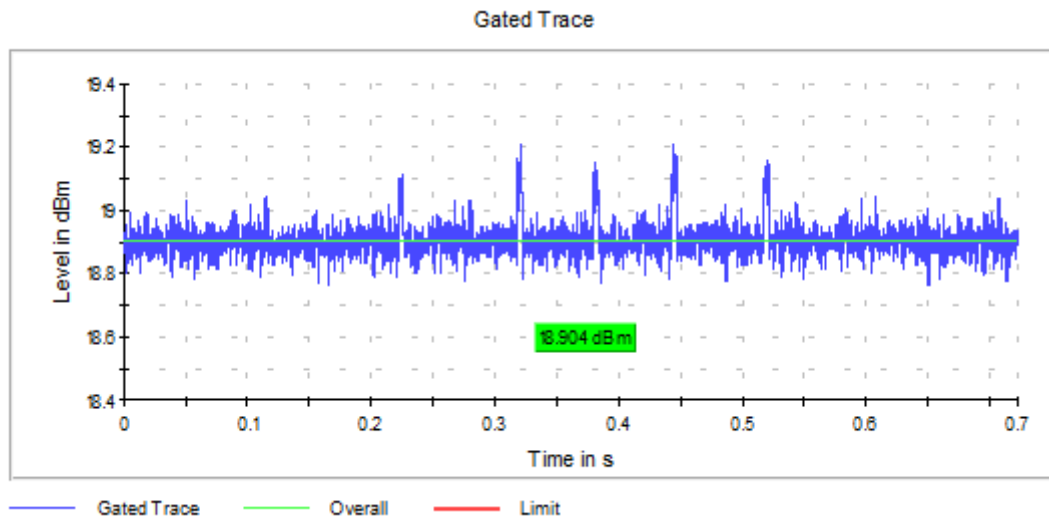
Frequency (MHz)	Measured Output Power Antenna 0 (dBm)	Measured Output Power Antenna 1 (dBm)
2412	19.2	19.1
2437	18.9	18.8
2462	19.4	19.1



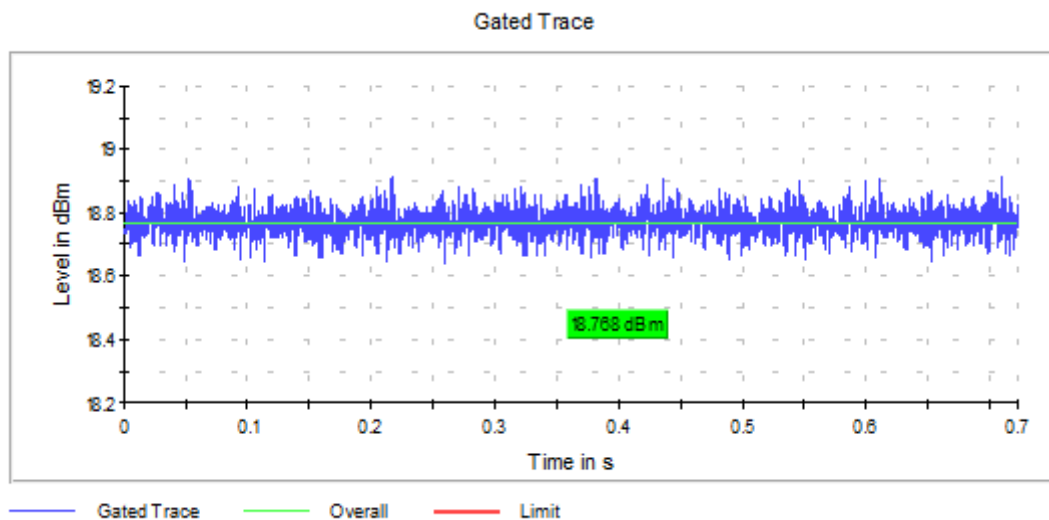
Graph 99: Antenna 0 - Lowest Channel Output Power Plot (Method AVGPM-G) - Setting 20



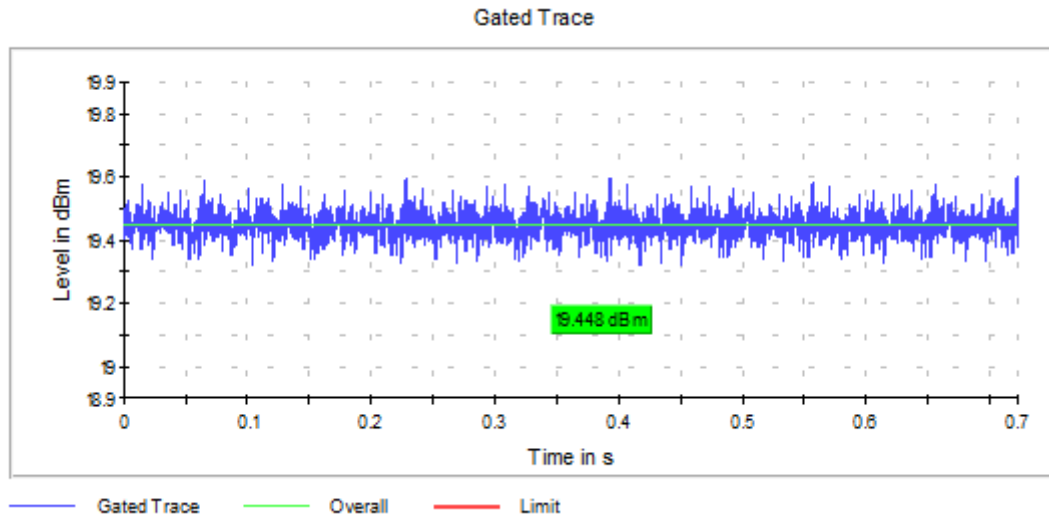
Graph 100: Antenna 1 - Lowest Channel Output Power Plot (Method AVGPM-G) - Setting 20



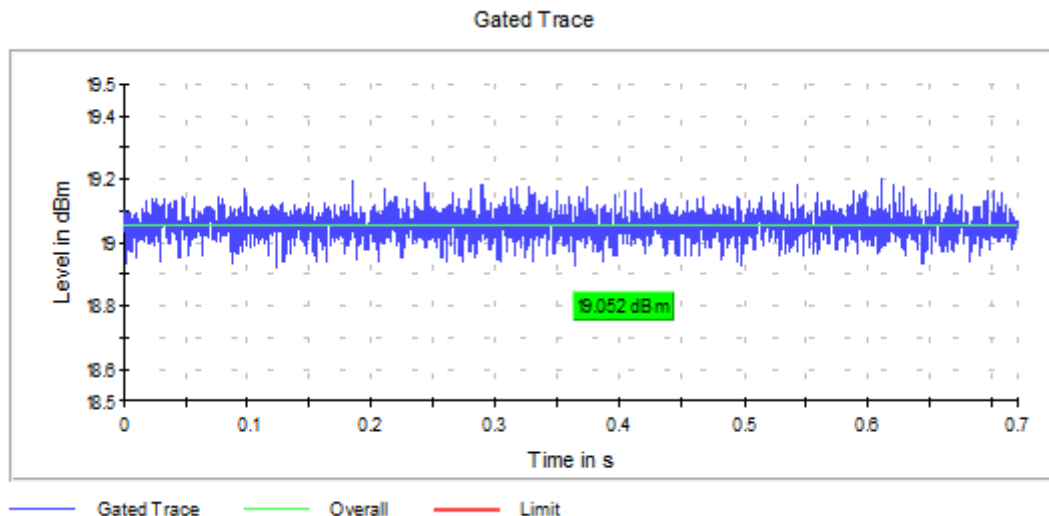
Graph 101: Antenna 0 - Middle Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 102: Antenna 1 - Middle Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 103: Antenna 0 - Highest Channel Output Power Plot (Method AVGPM-G) - Setting 20



Graph 104: Antenna 1 - Highest Channel Output Power Plot (Method AVGPM-G) - Setting 20

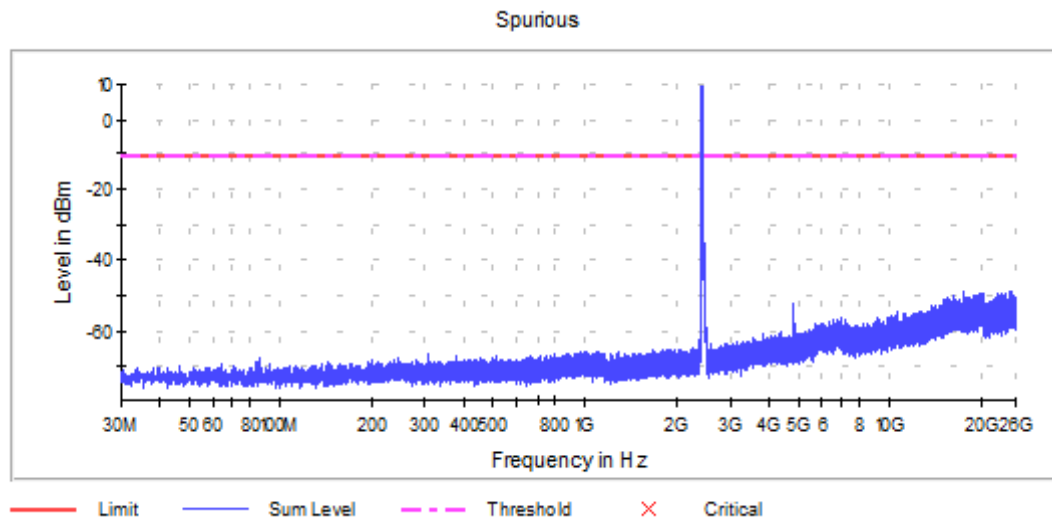
8.2.5 §15.247(d) Spurious Emissions

Conducted Spurious Emissions

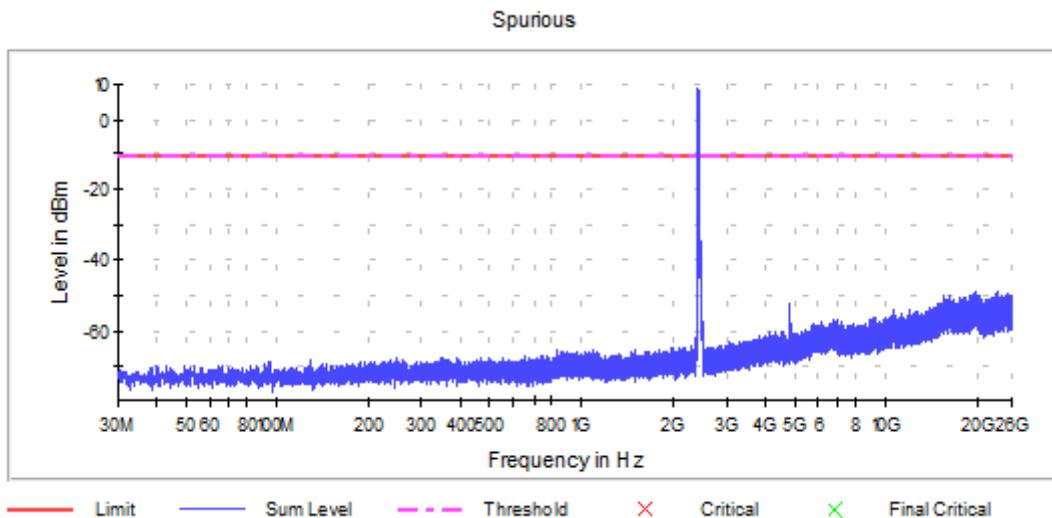
The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The plots below (Graphs 105-110) show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency, and highest frequency. Conducted spurious emissions at the antenna port were measured up to 26 GHz while transmitter was operating at maximum power setting (20) to demonstrate compliance with this requirement at all potential power settings.

Also shown below are plots for multiple channels and power levels which demonstrate compliance with the provisions of this section and at the band edges. All conducted band-edge plots (Graphs 111-130) were measured at the manufacturer's declared power settings (see Section 2.2 herein).

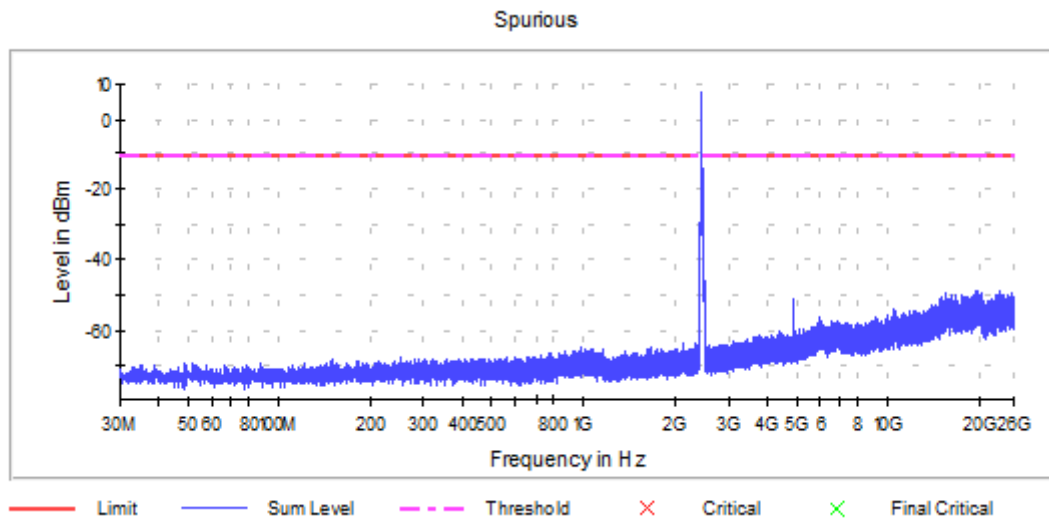
Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification. The highest power measured in this mode was 19.4 dBm; therefore, the criteria is $19.4 - 30 = -10.6$ dBm.



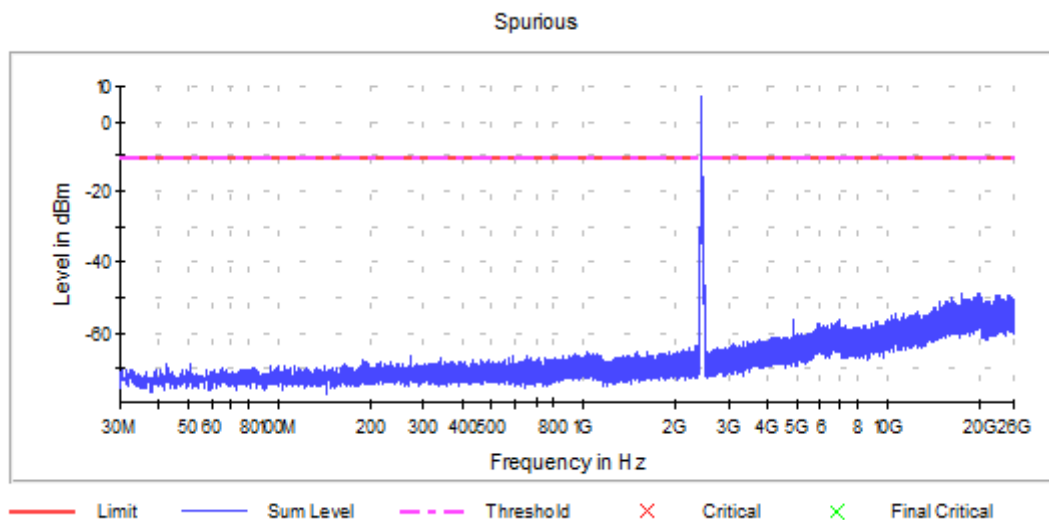
Graph 105: Antenna 0 - Transmitting on the Lowest Channel – Setting 20



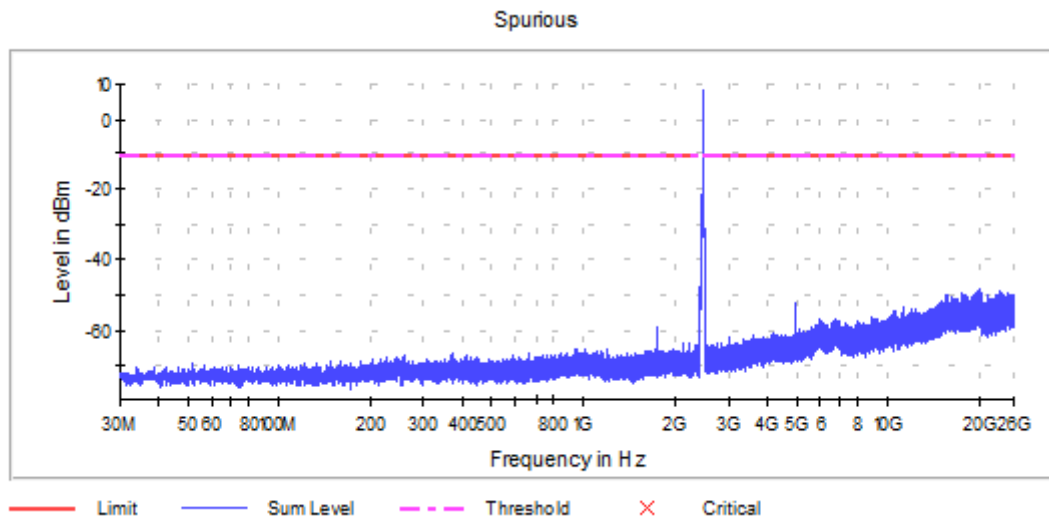
Graph 106: Antenna 1 - Transmitting on the Lowest Channel – Setting 20



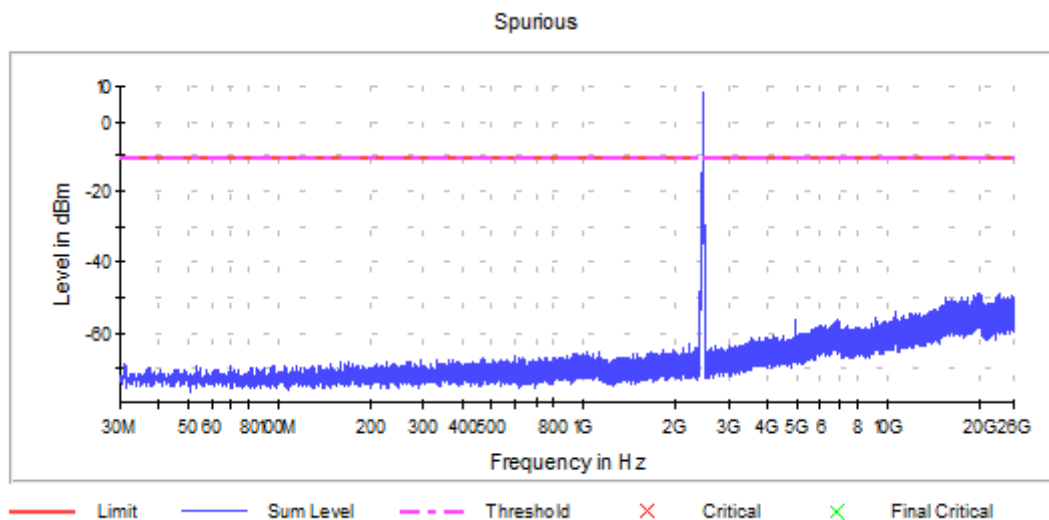
Graph 107: Antenna 0 - Transmitting on the Middle Channel – Setting 20



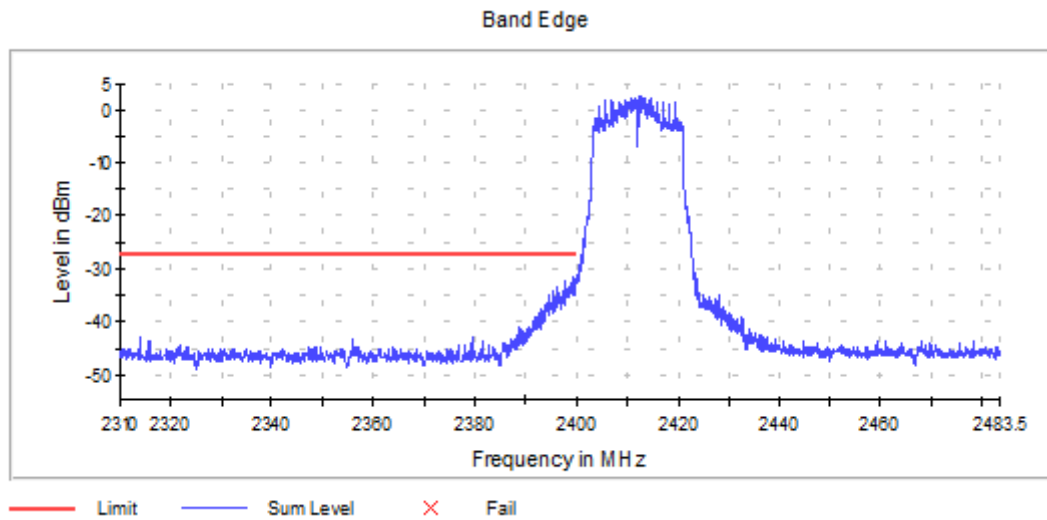
Graph 108: Antenna 1 - Transmitting on the Middle Channel – Setting 20



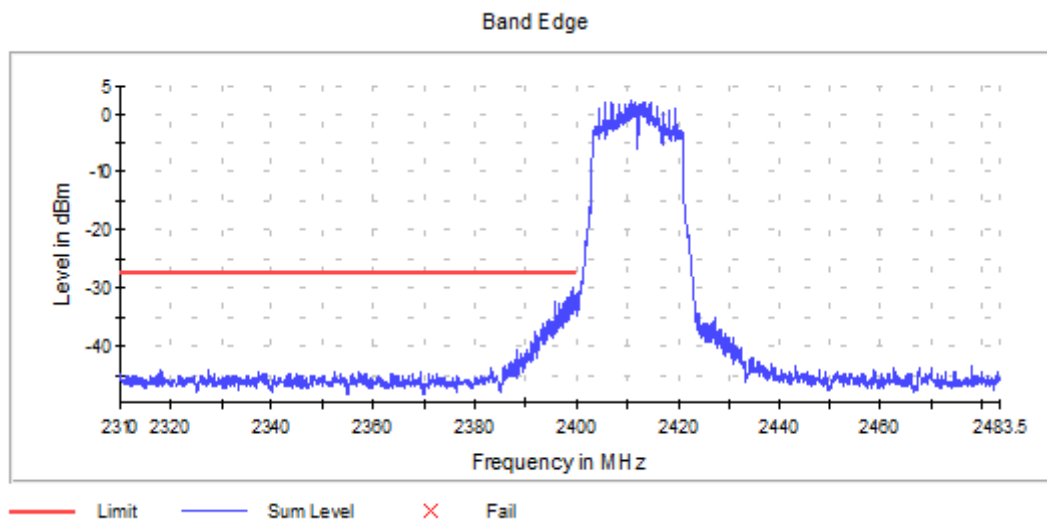
Graph 109: Antenna 0 - Transmitting on the Highest Channel – Setting 20



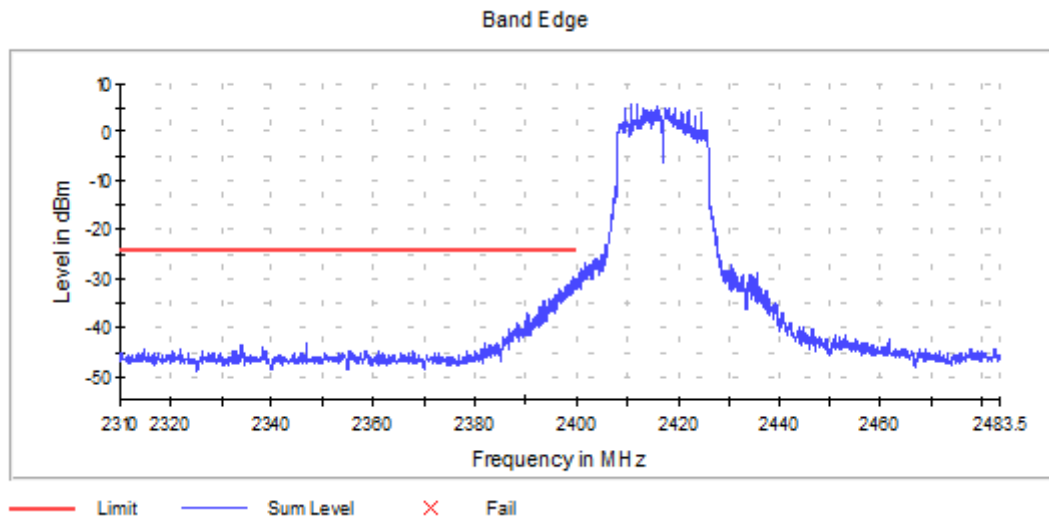
Graph 110: Antenna 1 - Transmitting on the Highest Channel – Setting 20



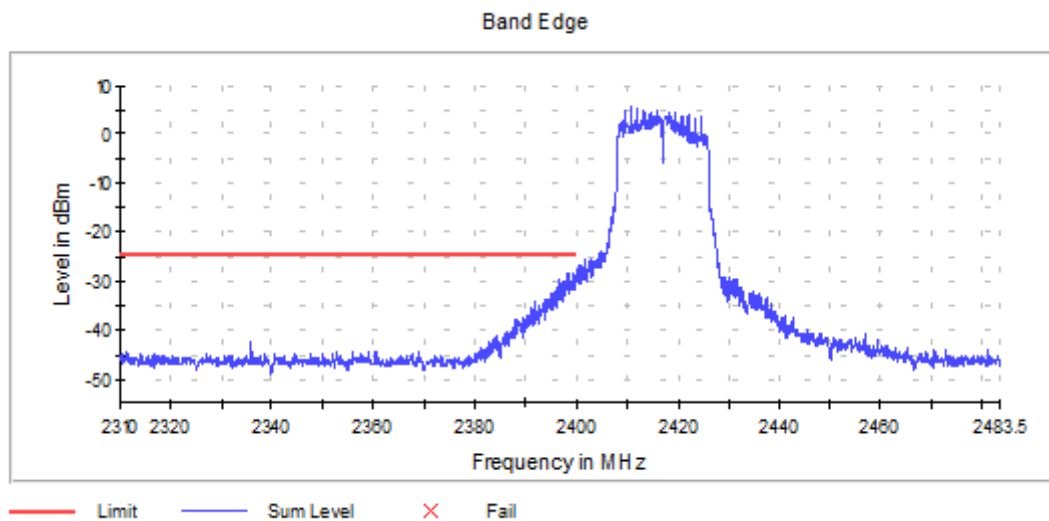
Graph 111: Antenna 0 – Channel 1 Lower Band Edge Plot - Setting 13



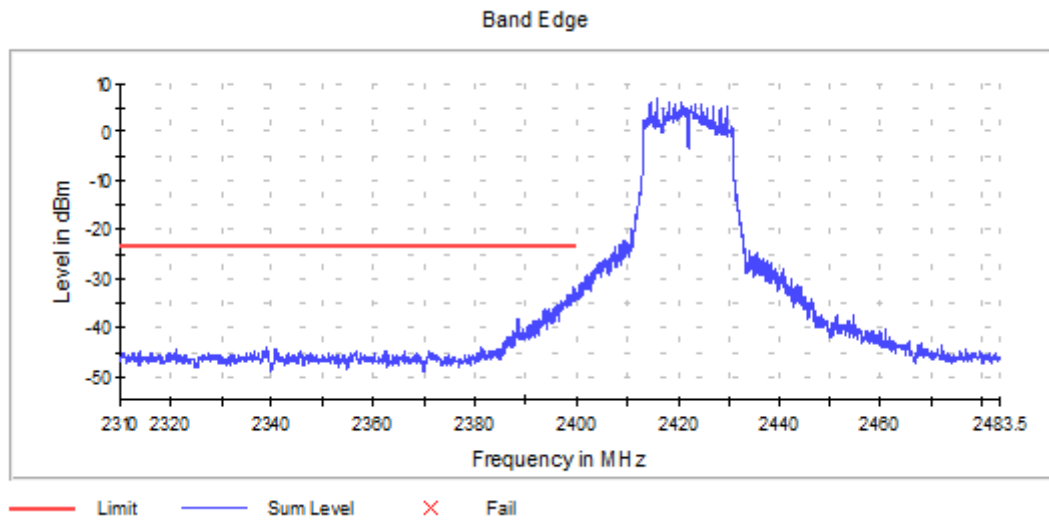
Graph 112: Antenna 1 – Channel 1 Lower Band Edge Plot - Setting 13



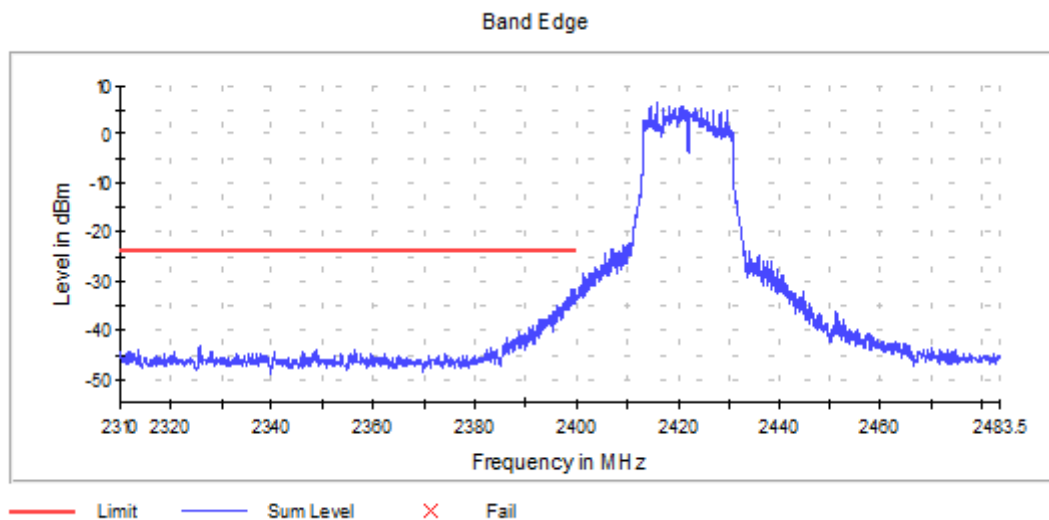
Graph 113: Antenna 0 – Channel 2 Lower Band Edge Plot - Setting 16



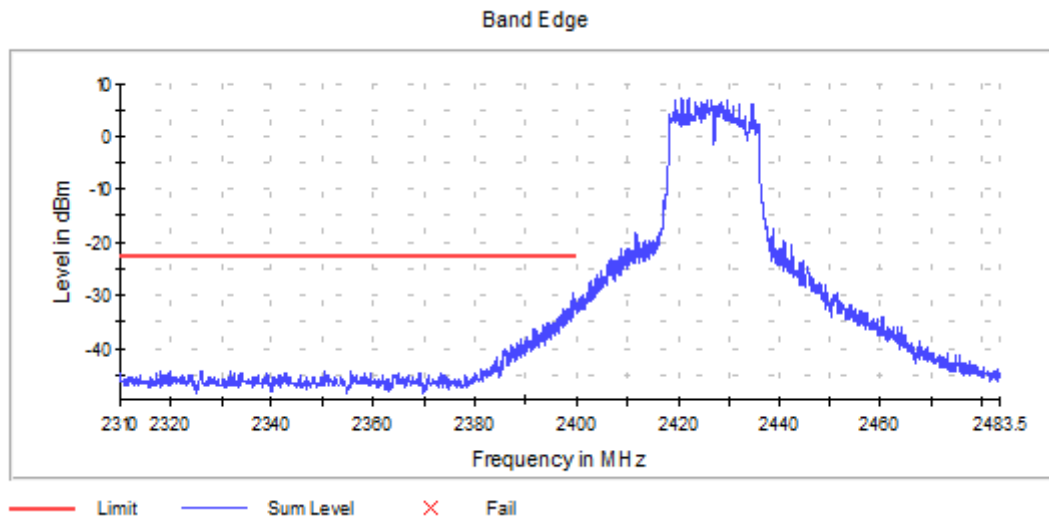
Graph 114: Antenna 1 – Channel 2 Lower Band Edge Plot - Setting 16



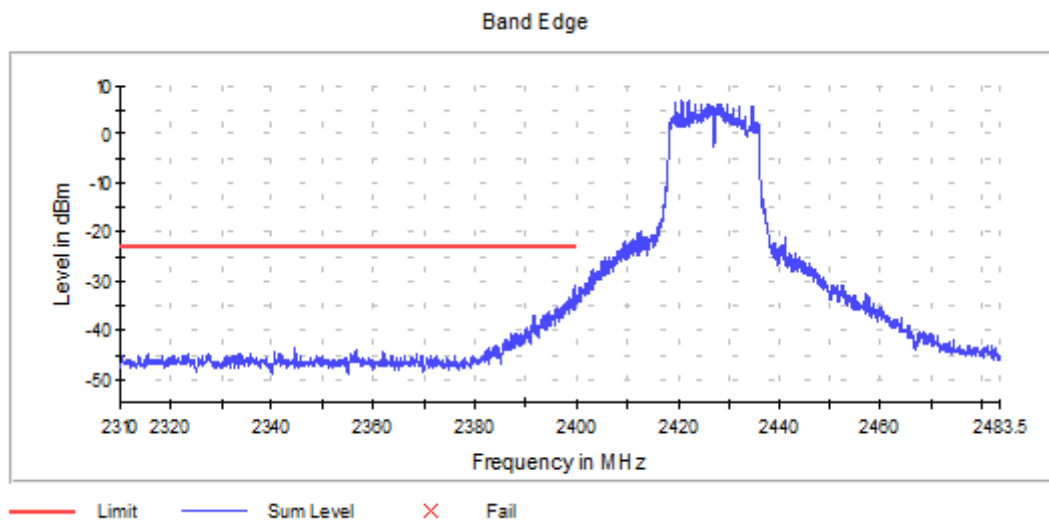
Graph 115: Antenna 0 – Channel 3 Lower Band Edge Plot - Setting 17



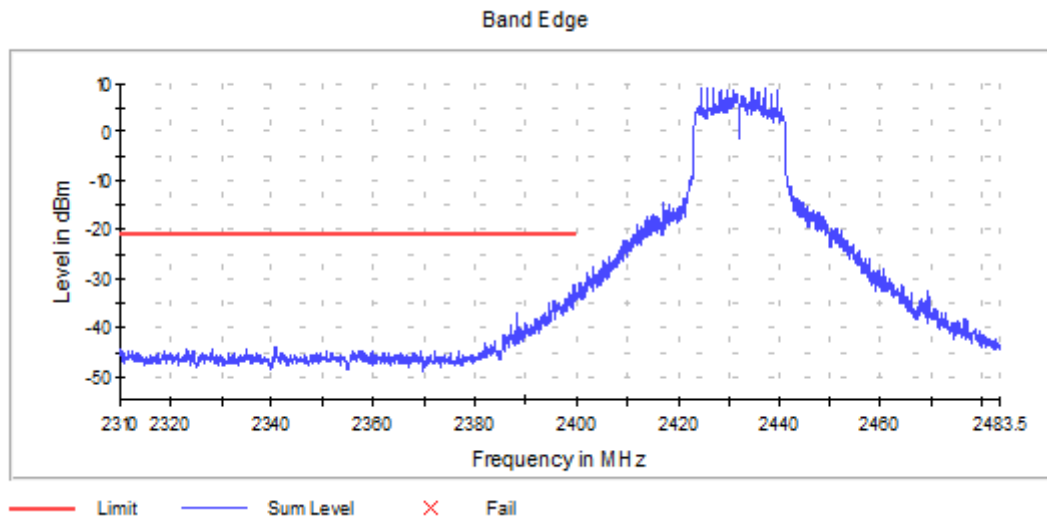
Graph 116: Antenna 1 – Channel 3 Lower Band Edge Plot - Setting 17



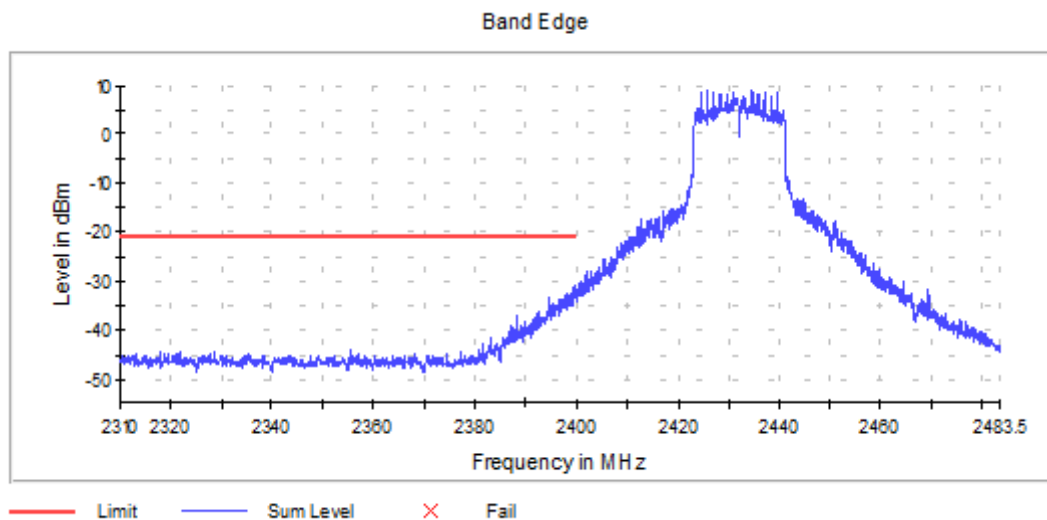
Graph 117: Antenna 0 – Channel 4 Lower Band Edge Plot - Setting 18



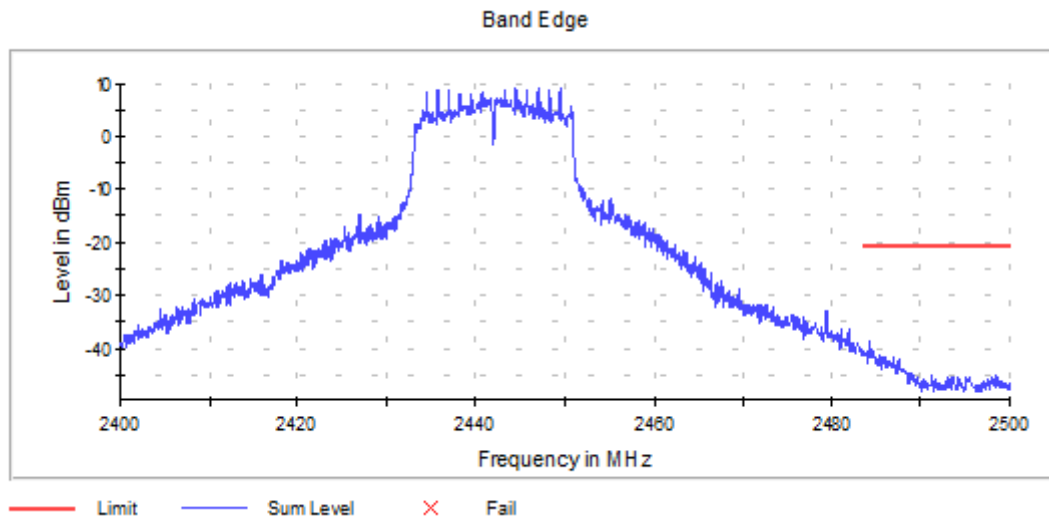
Graph 118: Antenna 1 – Channel 4 Lower Band Edge Plot - Setting 18



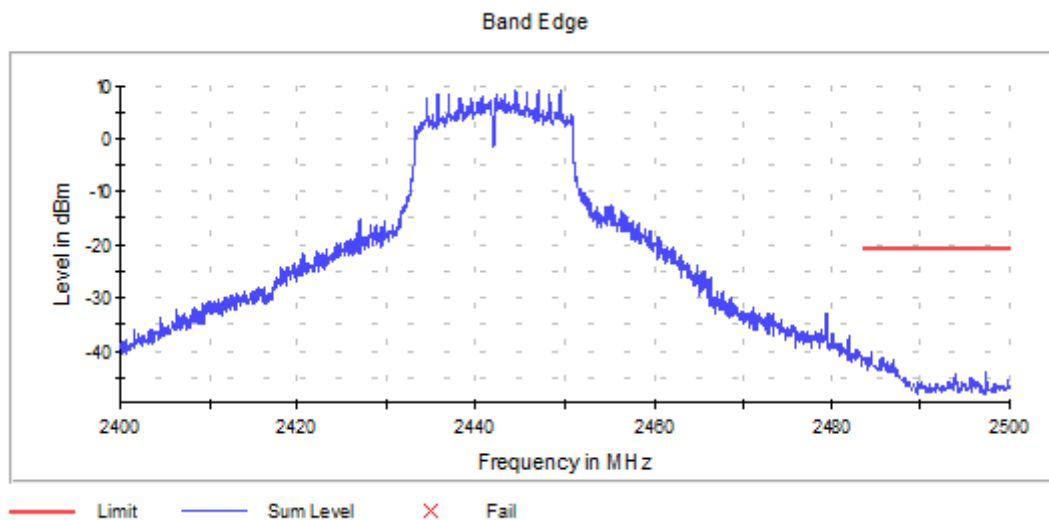
Graph 119: Antenna 0 – Channel 5 Lower Band Edge Plot - Setting 20



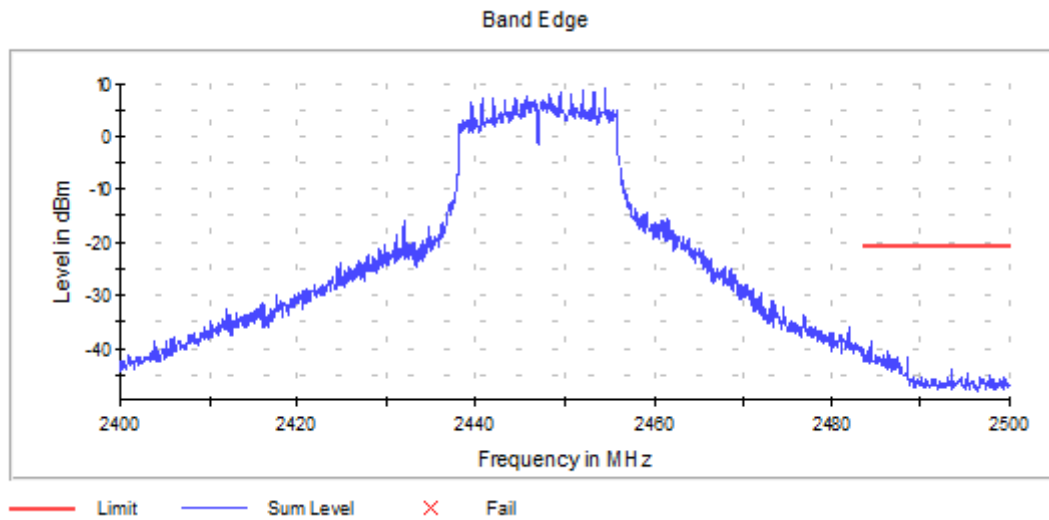
Graph 120: Antenna 1 – Channel 5 Lower Band Edge Plot - Setting 20



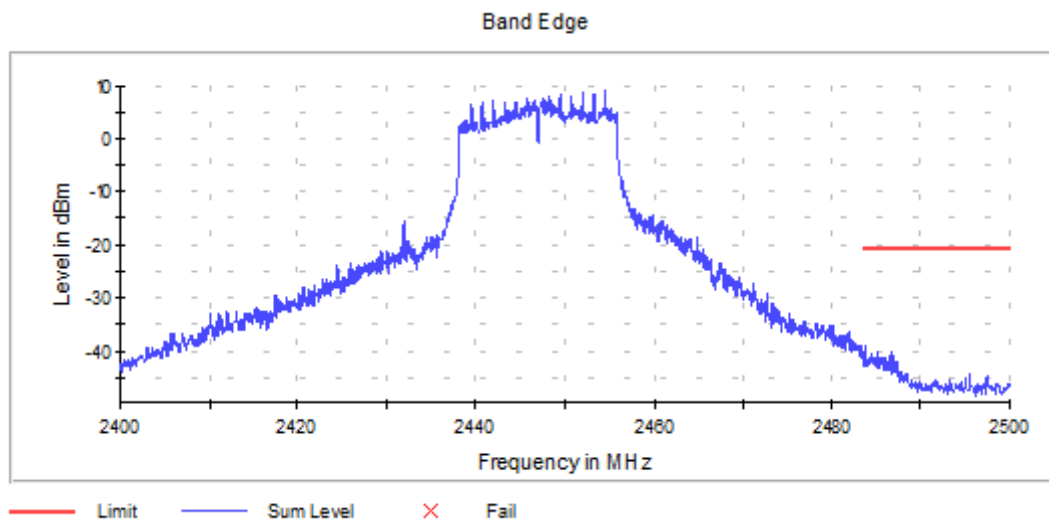
Graph 121: Antenna 0 – Channel 7 Upper Band Edge Plot - Setting 20



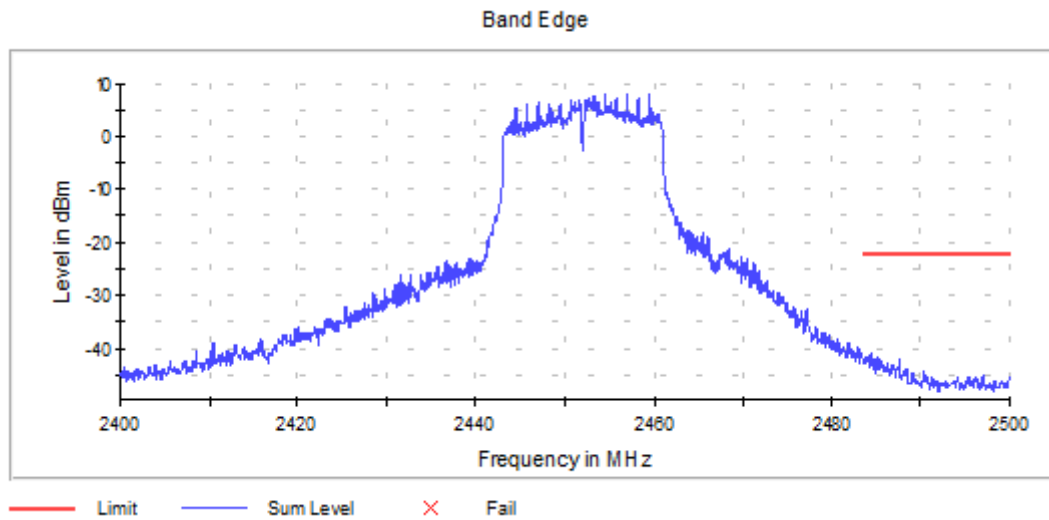
Graph 122: Antenna 1 – Channel 7 Upper Band Edge Plot - Setting 20



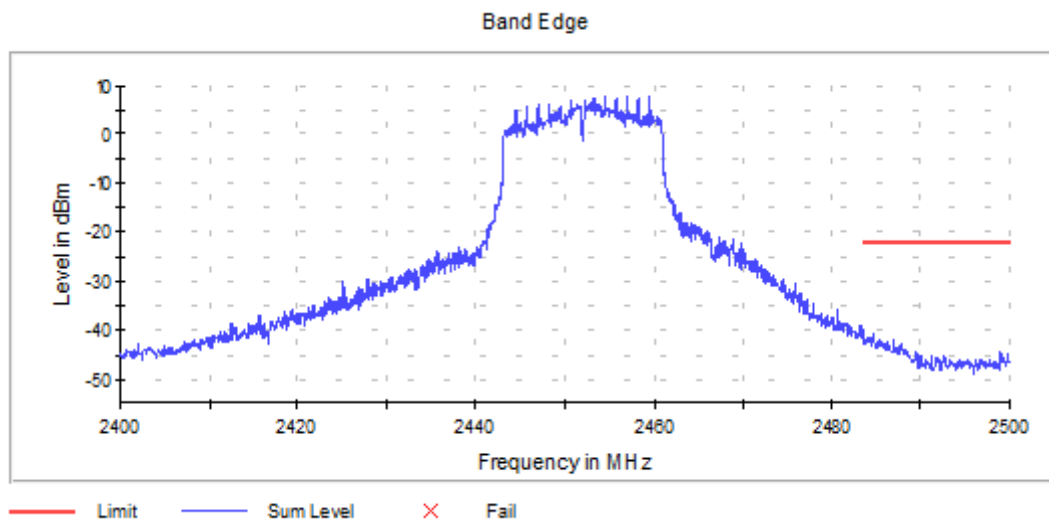
Graph 123: Antenna 0 – Channel 8 Upper Band Edge Plot - Setting 19.5



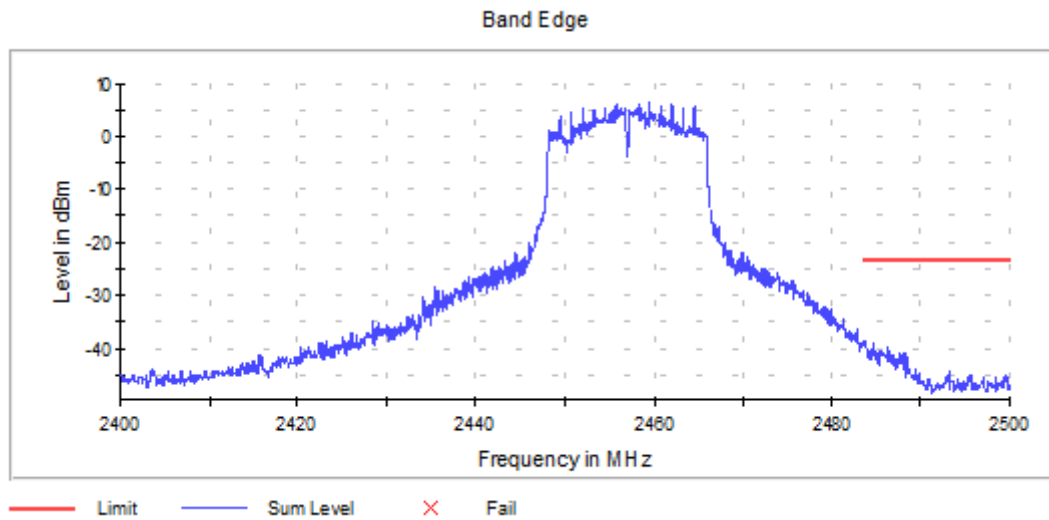
Graph 124: Antenna 1 – Channel 8 Upper Band Edge Plot - Setting 19.5



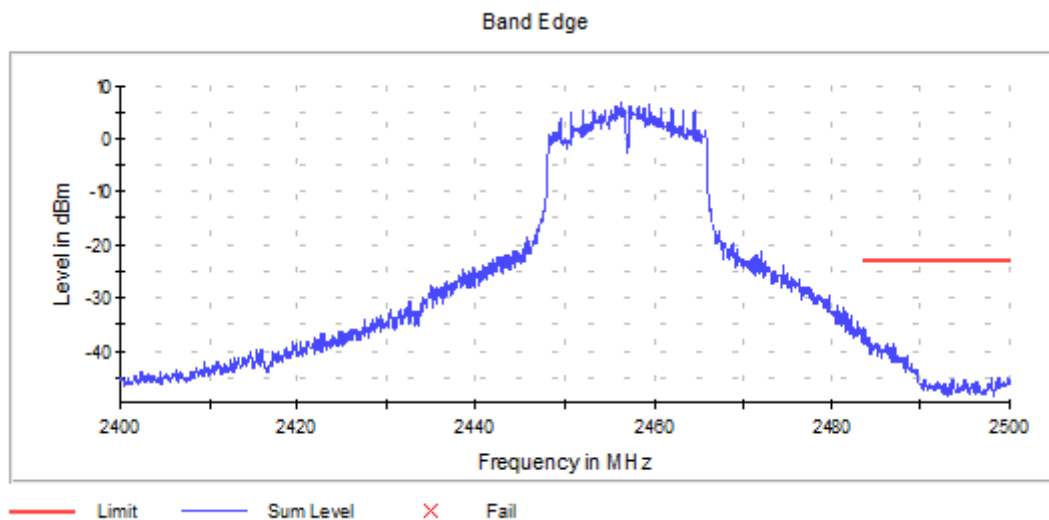
Graph 125: Antenna 0 – Channel 9 Upper Band Edge Plot - Setting 18.5



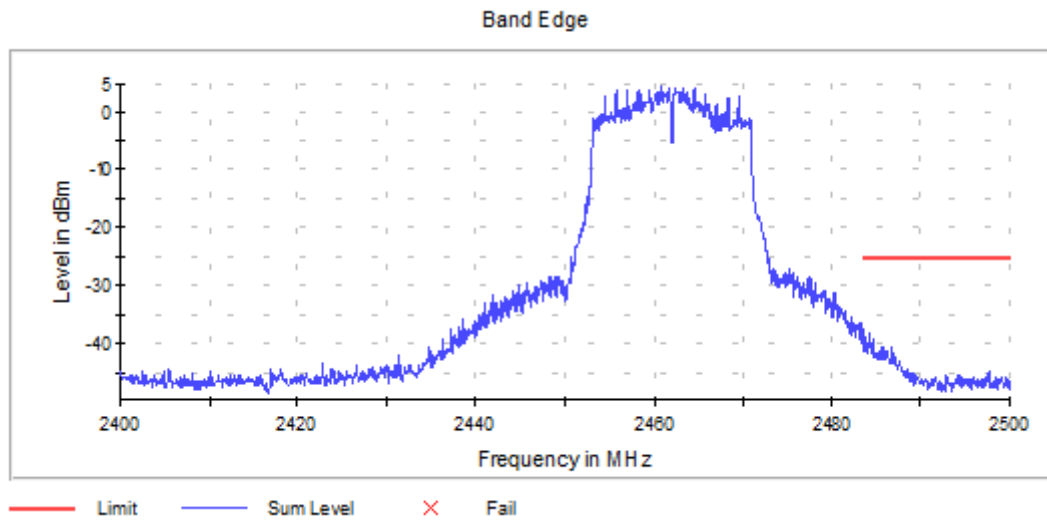
Graph 126: Antenna 1 – Channel 9 Upper Band Edge Plot - Setting 18.5



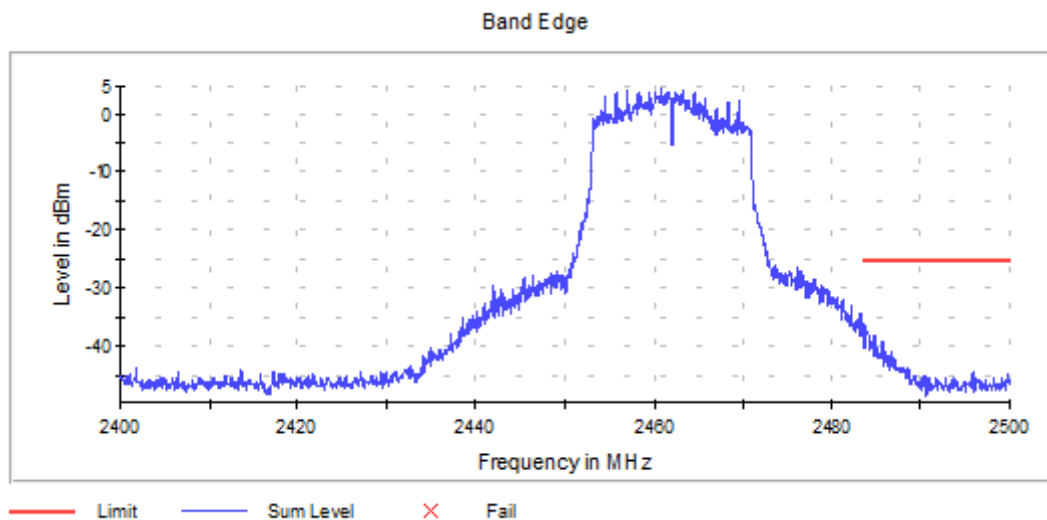
Graph 127: Antenna 0 – Channel 10 Upper Band Edge Plot - Setting 17



Graph 128: Antenna 1 – Channel 10 Upper Band Edge Plot - Setting 17



Graph 129: Antenna 0 – Channel 11 Upper Band Edge Plot - Setting 15



Graph 130: Antenna 1 – Channel 11 Upper Band Edge Plot - Setting 15

Result

Conducted spurious emissions were attenuated 30 dB or more below the fundamental; therefore, the EUT complies with the specification.

Radiated Spurious Emissions in the Restricted Bands of §15.205

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emission was investigated to measure any radiated emissions in the restricted bands. The following tables show measurements of any emission that fell into the restricted bands of §15.205. The tables show the worst-case emission measured from the EUT. For frequencies above 18.0 GHz, a measurement distance of 1 meter was used. The noise floor was a minimum of 6 dB below the limit. The emissions in the restricted bands must meet the limits specified in §15.209. The spurious emissions were tested at the highest power setting used by any channel in the band (setting of 20). The band edges at the restricted bands were measured using the power settings that will be used in manufacturing. Tabular data and plots are shown below.

Result

All emissions in the restricted bands of §15.205 met the limits specified in §15.209; therefore, the EUT complies with the specification.

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	8.8	38.5	47.3	74.0	-26.7
4824.0	Average	Vertical	-3.3	38.5	35.2	54.0	-18.8
4824.0	Peak	Horizontal	6.7	38.5	45.2	74.0	-28.8
4824.0	Average	Horizontal	-6.2	38.5	32.3	54.0	-21.7
7236.0	Peak	Vertical	5.4	42.7	48.1	74.0	-25.9
7236.0	Average	Vertical	-4.9	42.7	37.8	54.0	-16.2
7236.0	Peak	Horizontal	5.2	42.7	47.9	74.0	-26.1
7236.0	Average	Horizontal	-6.9	42.7	35.8	54.0	-18.2
12060.0	Peak	Vertical	4.8	47.9	52.7	74.0	-21.3
12060.0	Average	Vertical	-7.1	47.9	40.8	54.0	-13.2
12060.0	Peak	Horizontal	3.8	47.9	51.7	74.0	-22.3
12060.0	Average	Vertical	-7.7	47.9	40.2	54.0	-13.8

Table 14: Antenna 0 – Transmitting at the Lowest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	6.7	38.6	45.3	74.0	-28.7
4874.0	Average	Vertical	-5.5	38.6	33.1	54.0	-20.9
4874.0	Peak	Horizontal	5.5	38.6	44.1	74.0	-29.9
4874.0	Average	Horizontal	-6.3	38.6	32.3	54.0	-21.7
7311.0	Peak	Vertical	5.8	42.9	48.7	74.0	-25.3
7311.0	Average	Vertical	-6.2	42.9	36.7	54.0	-17.3
7311.0	Peak	Horizontal	4.4	42.9	47.3	74.0	-26.7

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
7311.0	Average	Horizontal	-7.3	42.9	35.6	54.0	-18.4
12185.0	Peak	Vertical	4.7	47.8	52.5	74.0	-21.5
12185.0	Average	Vertical	-7.3	47.8	40.5	54.0	-13.5
12185.0	Peak	Horizontal	4.3	47.8	52.1	74.0	-21.9
12185.0	Average	Vertical	-7.5	47.8	40.3	54.0	-13.7

Table 15: Antenna 0 – Transmitting at the Middle Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924.0	Peak	Vertical	8.2	38.7	46.9	74.0	-27.1
4924.0	Average	Vertical	-4.2	38.7	34.5	54.0	-19.5
4924.0	Peak	Horizontal	5.9	38.7	44.6	74.0	-29.4
4924.0	Average	Horizontal	-5.9	38.7	32.8	54.0	-21.2
7386.0	Peak	Vertical	4.9	43.1	48.0	74.0	-26.0
7386.0	Average	Vertical	-6.1	43.1	37.0	54.0	-17.0
7386.0	Peak	Horizontal	5.0	43.1	48.1	74.0	-25.9
7386.0	Average	Horizontal	-6.8	43.1	36.3	54.0	-17.7
12310.0	Peak	Vertical	3.7	47.7	51.4	74.0	-22.6
12310.0	Average	Vertical	-8.0	47.7	39.7	54.0	-14.3
12310.0	Peak	Horizontal	4.4	47.7	52.1	74.0	-21.9
12310.0	Average	Vertical	-8.0	47.7	39.7	54.0	-14.3

Table 16: Antenna 0 – Transmitting at the Highest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824.0	Peak	Vertical	4.6	38.5	43.1	74.0	-30.9
4824.0	Average	Vertical	-5.4	38.5	33.1	54.0	-20.9
4824.0	Peak	Horizontal	6.3	38.5	44.8	74.0	-29.2
4824.0	Average	Horizontal	-6.0	38.5	32.5	54.0	-21.5
7236.0	Peak	Vertical	5.6	42.7	48.3	74.0	-25.7
7236.0	Average	Vertical	-4.4	42.7	38.3	54.0	-15.7
7236.0	Peak	Horizontal	4.9	42.7	47.6	74.0	-26.4
7236.0	Average	Horizontal	-6.5	42.7	36.2	54.0	-17.8

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
12060.0	Peak	Vertical	4.0	47.9	51.9	74.0	-22.1
12060.0	Average	Vertical	-7.4	47.9	40.5	54.0	-13.5
12060.0	Peak	Horizontal	2.1	47.9	50.0	74.0	-24.0
12060.0	Average	Vertical	-7.8	47.9	40.1	54.0	-13.9

Table 17: Antenna 1 – Transmitting at the Lowest Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874.0	Peak	Vertical	6.4	38.6	45.0	74.0	-29.0
4874.0	Average	Vertical	-5.5	38.6	33.1	54.0	-20.9
4874.0	Peak	Horizontal	5.7	38.6	44.3	74.0	-29.7
4874.0	Average	Horizontal	-6.1	38.6	32.5	54.0	-21.5
7311.0	Peak	Vertical	5.3	42.9	48.2	74.0	-25.8
7311.0	Average	Vertical	-5.7	42.9	37.2	54.0	-16.8
7311.0	Peak	Horizontal	4.9	42.9	47.8	74.0	-26.2
7311.0	Average	Horizontal	-7.2	42.9	35.7	54.0	-18.3
12185.0	Peak	Vertical	4.4	47.8	52.2	74.0	-21.8
12185.0	Average	Vertical	-7.3	47.8	40.5	54.0	-13.5
12185.0	Peak	Horizontal	3.1	47.8	50.9	74.0	-23.1
12185.0	Average	Vertical	-7.3	47.8	40.5	54.0	-13.5

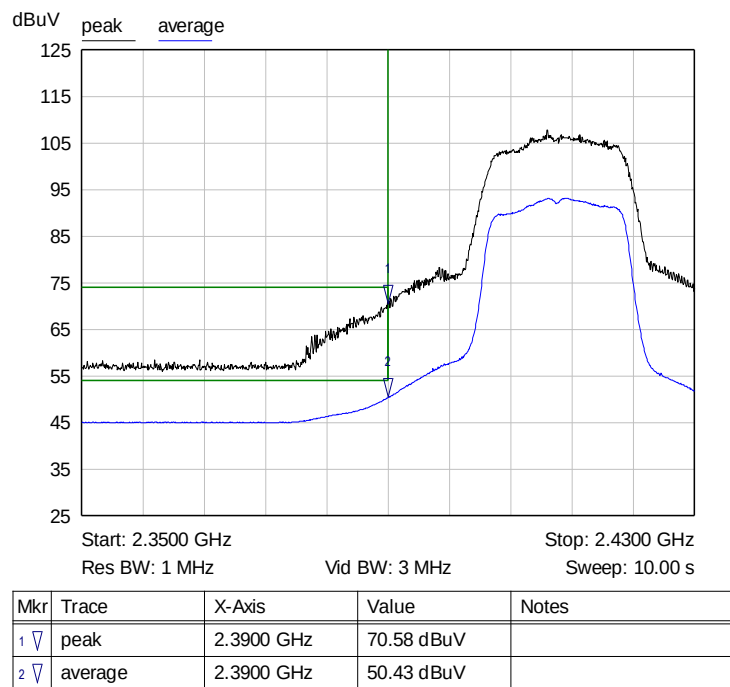
Table 18: Antenna 1 – Transmitting at the Middle Frequency – Setting 20

Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924.0	Peak	Vertical	7.9	38.7	46.6	74.0	-27.4
4924.0	Average	Vertical	-4.1	38.7	34.6	54.0	-19.4
4924.0	Peak	Horizontal	5.6	38.7	44.3	74.0	-29.7
4924.0	Average	Horizontal	-6.1	38.7	32.6	54.0	-21.4
7386.0	Peak	Vertical	4.8	43.1	47.9	74.0	-26.1
7386.0	Average	Vertical	-5.9	43.1	37.2	54.0	-16.8
7386.0	Peak	Horizontal	5.1	43.1	48.2	74.0	-25.8
7386.0	Average	Horizontal	-6.8	43.1	36.3	54.0	-17.7
12310.0	Peak	Vertical	3.1	47.7	50.8	74.0	-23.2

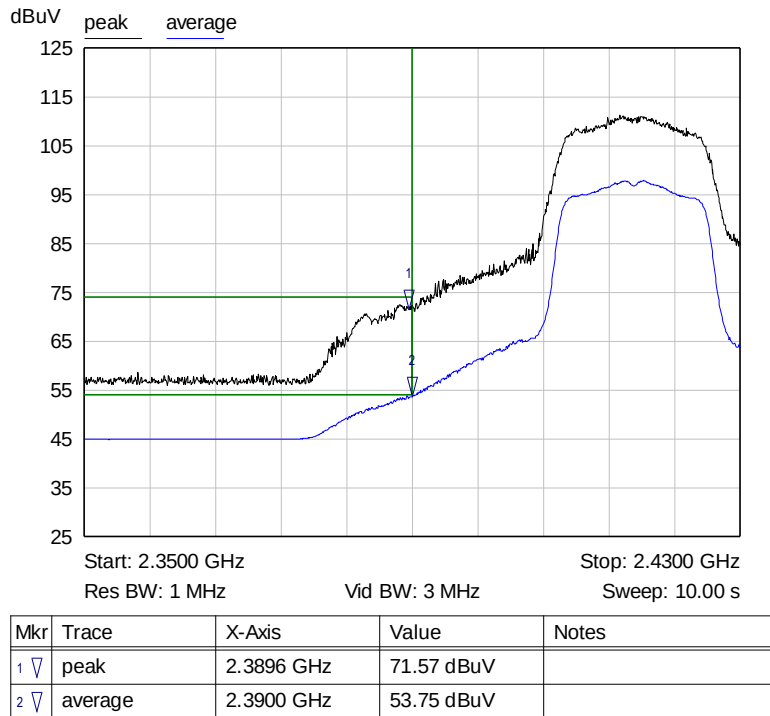
Frequency (MHz)	Detector	Antenna Polarity	Receiver Reading (dB μ V)	Correction Factor (dB)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
12310.0	Average	Vertical	-6.7	47.7	41.0	54.0	-13.0
12310.0	Peak	Horizontal	2.2	47.7	49.9	74.0	-24.1
12310.0	Average	Vertical	-7.1	47.7	40.6	54.0	-13.4

Table 19: Antenna 1 – Transmitting at the Highest Frequency – Setting 20

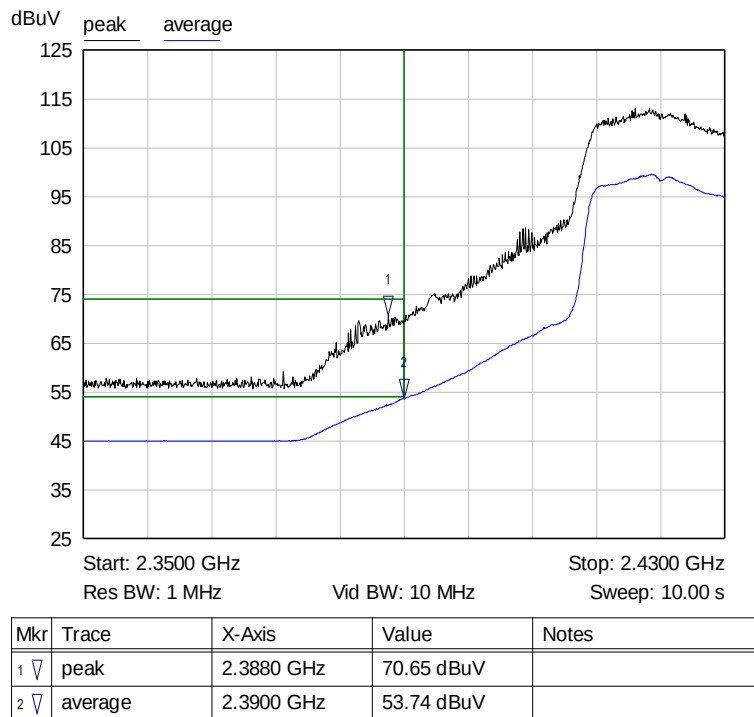
No other emissions were seen in the restricted bands.



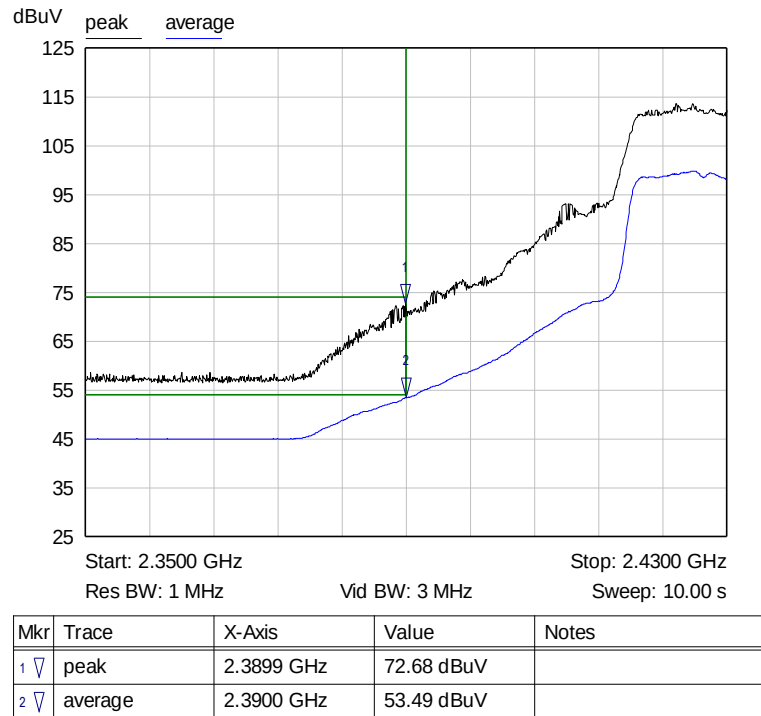
Graph 131: Antenna 0 – Channel 1 Band Edge at the Restricted Band Plot - Setting 13



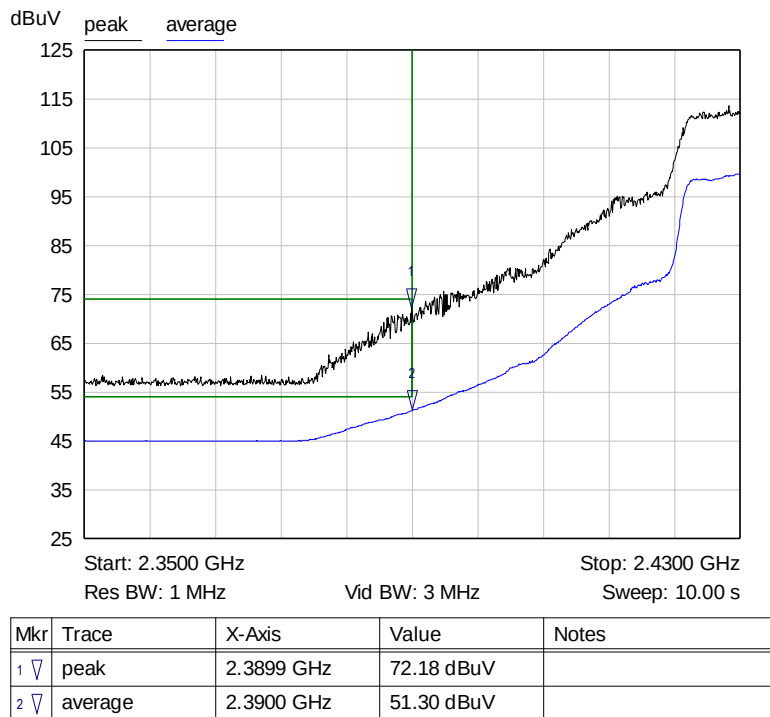
Graph 132: Antenna 0 – Channel 2 Band Edge at the Restricted Band Plot - Setting 16



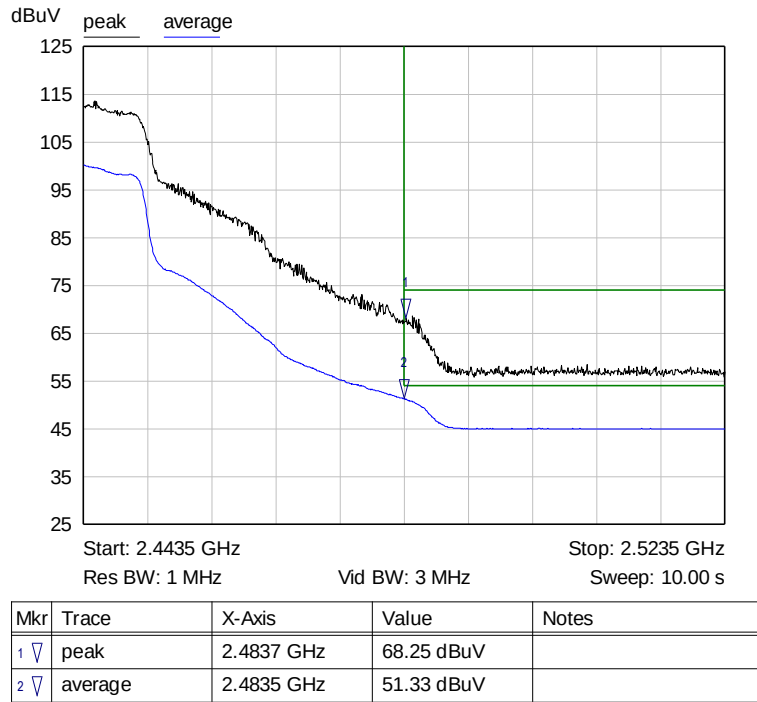
Graph 133: Antenna 0 – Channel 3 Band Edge at the Restricted Band Plot - Setting 17



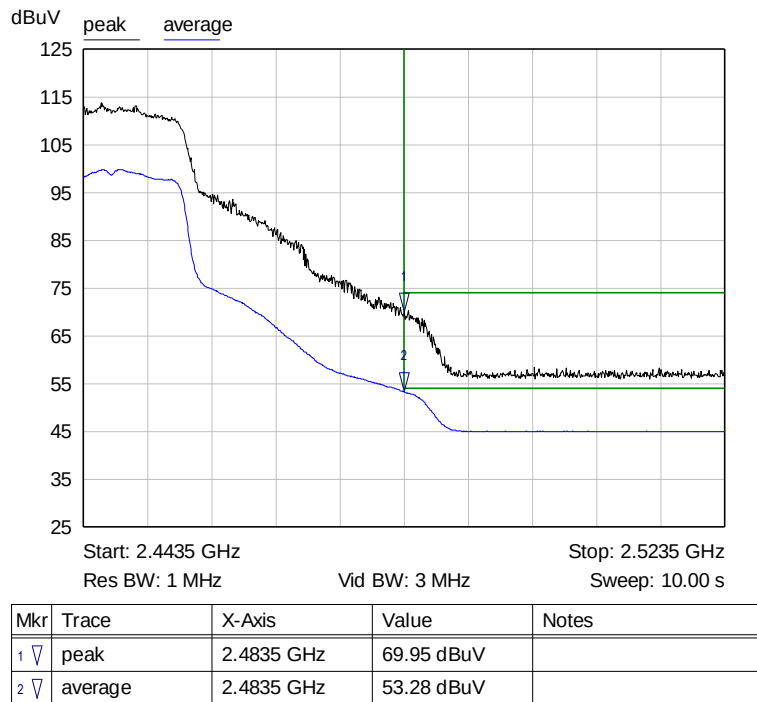
Graph 134: Antenna 0 – Channel 4 Band Edge at the Restricted Band Plot - Setting 18



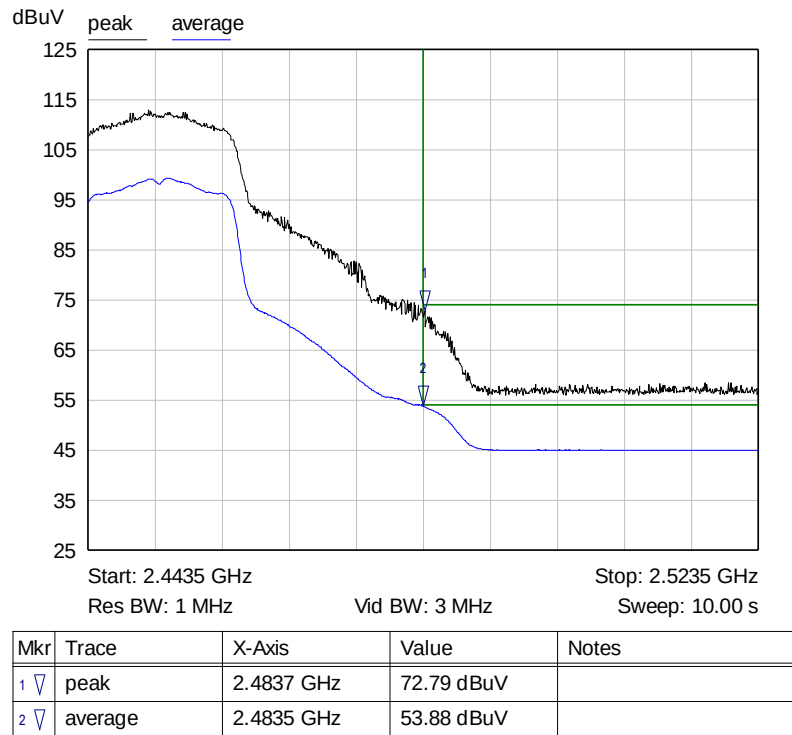
Graph 135: Antenna 0 – Channel 5 Band Edge at the Restricted Band Plot - Setting 20



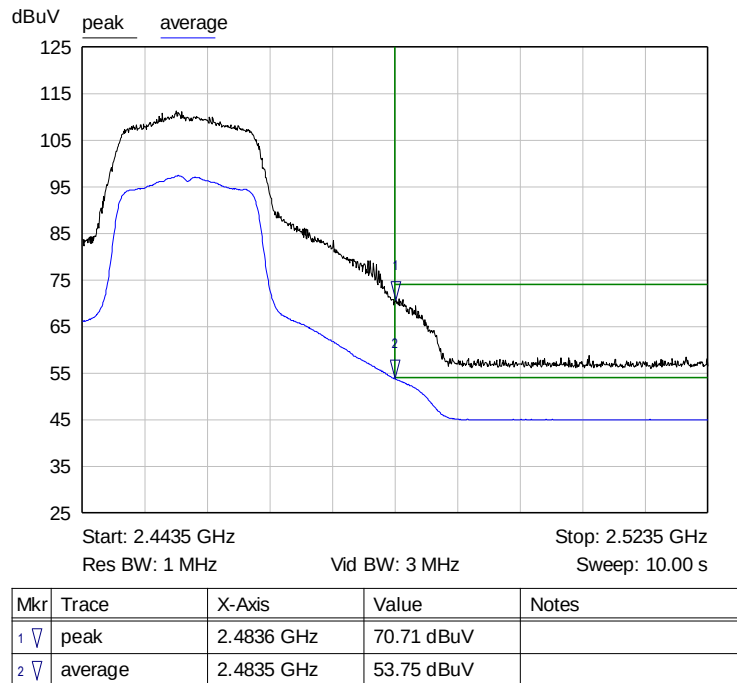
Graph 136: Antenna 0 – Channel 7 Band Edge at the Restricted Band Plot - Setting 20



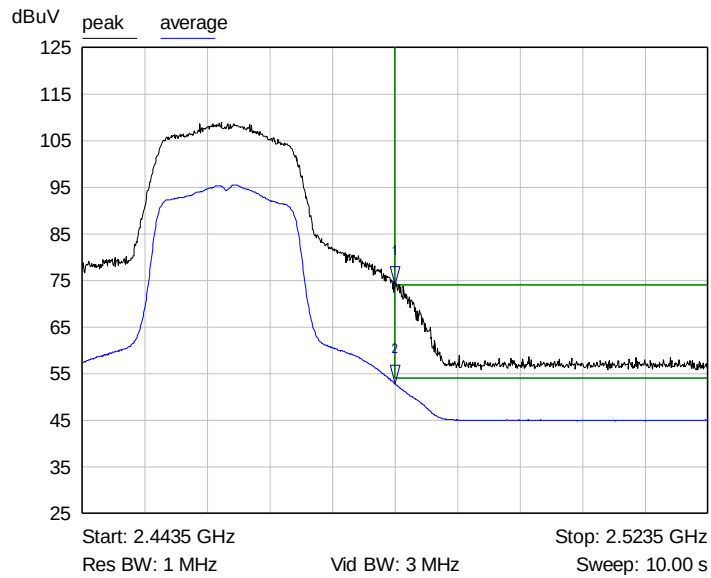
Graph 137: Antenna 0 – Channel 8 Band Edge at the Restricted Band Plot - Setting 19.5



Graph 138: Antenna 0 – Channel 9 Band Edge at the Restricted Band Plot - Setting 18.5

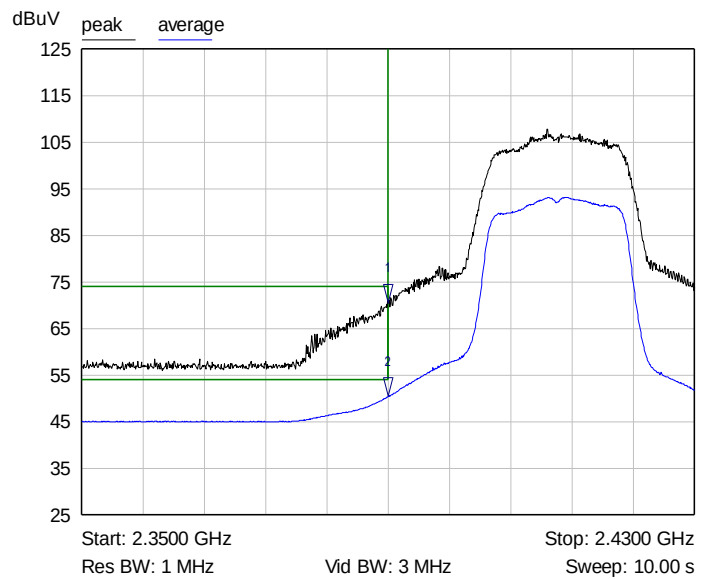


Graph 139: Antenna 0 – Channel 10 Band Edge at the Restricted Band Plot - Setting 17



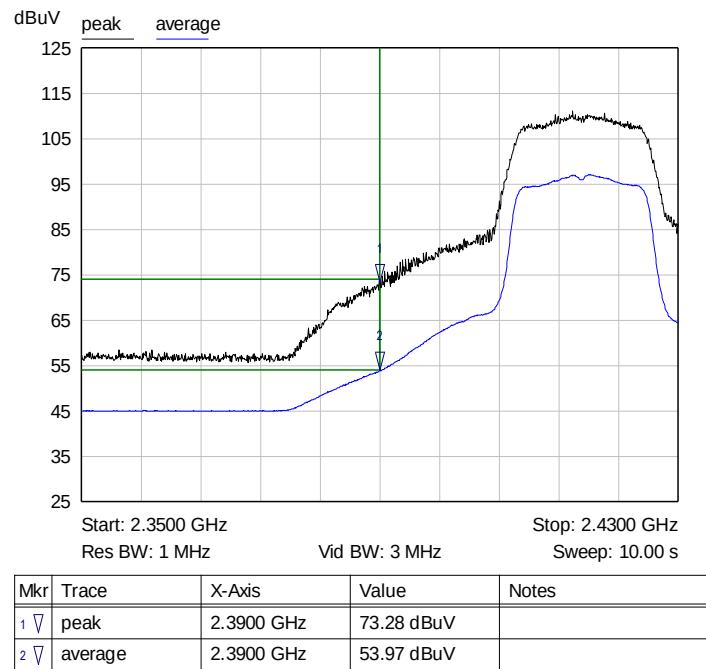
Mkr	Trace	X-Axis	Value	Notes
1 ▽	peak	2.4835 GHz	73.98 dBuV	
2 ▽	average	2.4835 GHz	52.79 dBuV	

Graph 140: Antenna 0 – Channel 11 Band Edge at the Restricted Band Plot - Setting 15

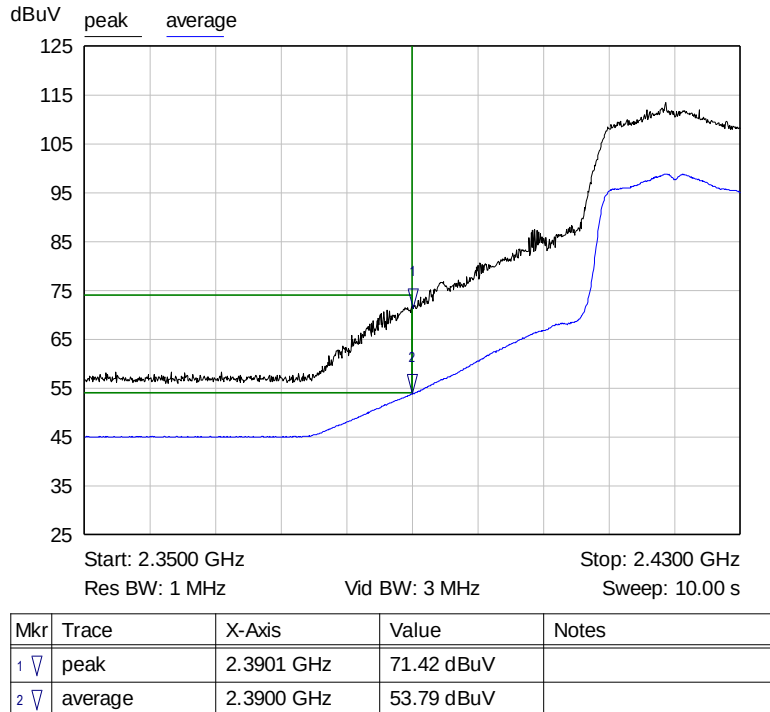


Mkr	Trace	X-Axis	Value	Notes
1 ▽	peak	2.3900 GHz	70.58 dBuV	
2 ▽	average	2.3900 GHz	50.43 dBuV	

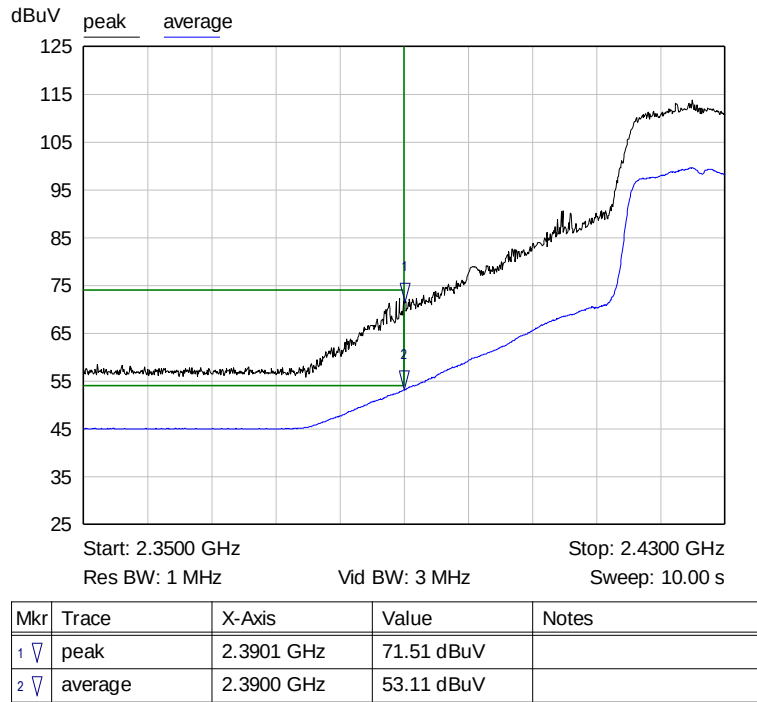
Graph 141: Antenna 1 – Channel 1 Band Edge at the Restricted Band Plot - Setting 13



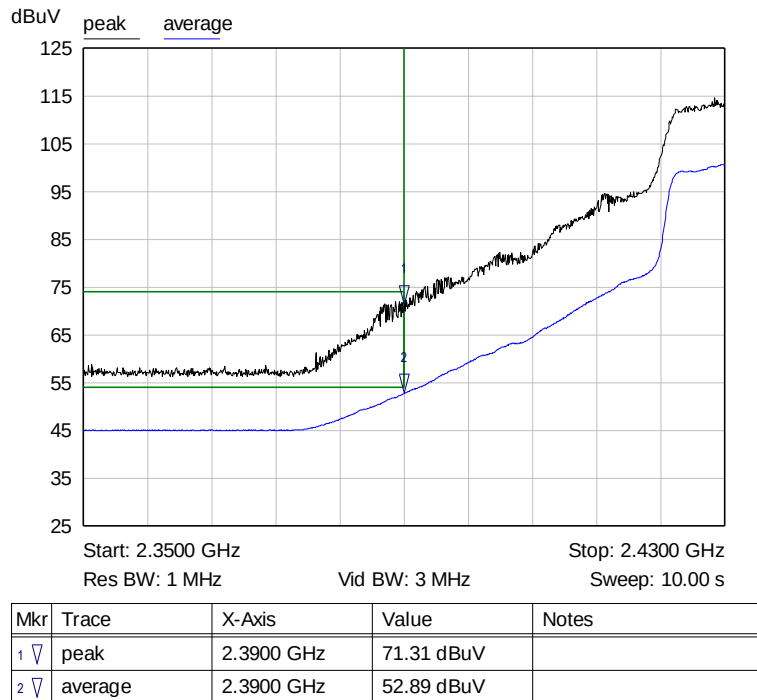
Graph 142: Antenna 1 – Channel 2 Band Edge at the Restricted Band Plot - Setting 16



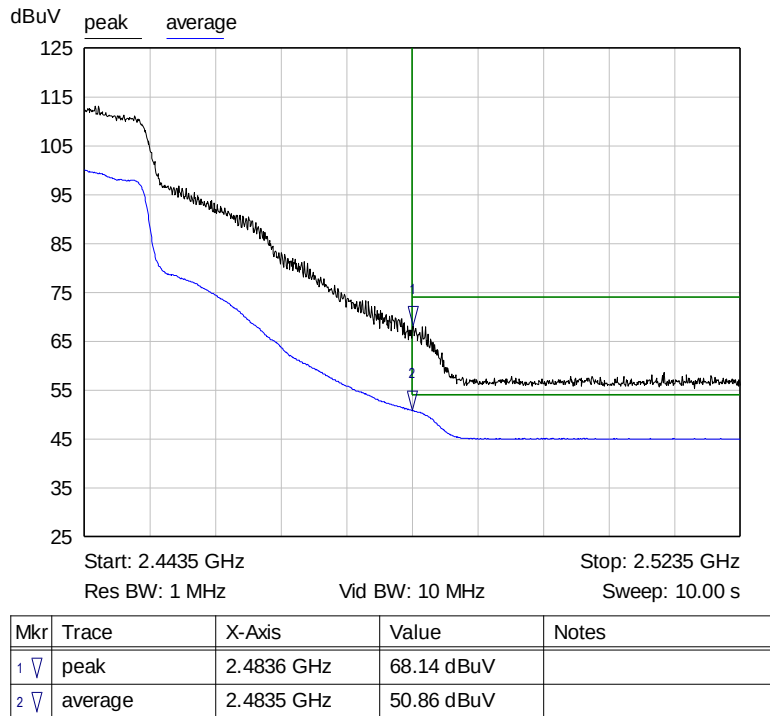
Graph 143: Antenna 1 – Channel 3 Band Edge at the Restricted Band Plot - Setting 17



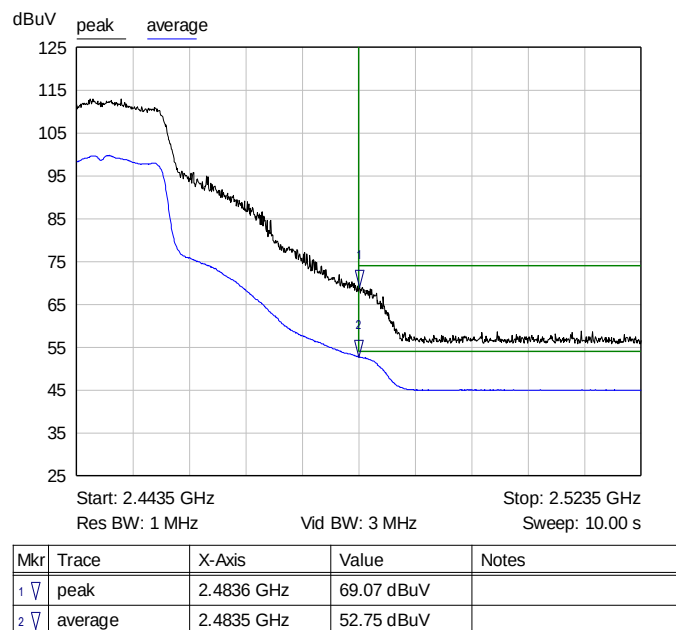
Graph 144: Antenna 1 – Channel 4 Band Edge at the Restricted Band Plot - Setting 18



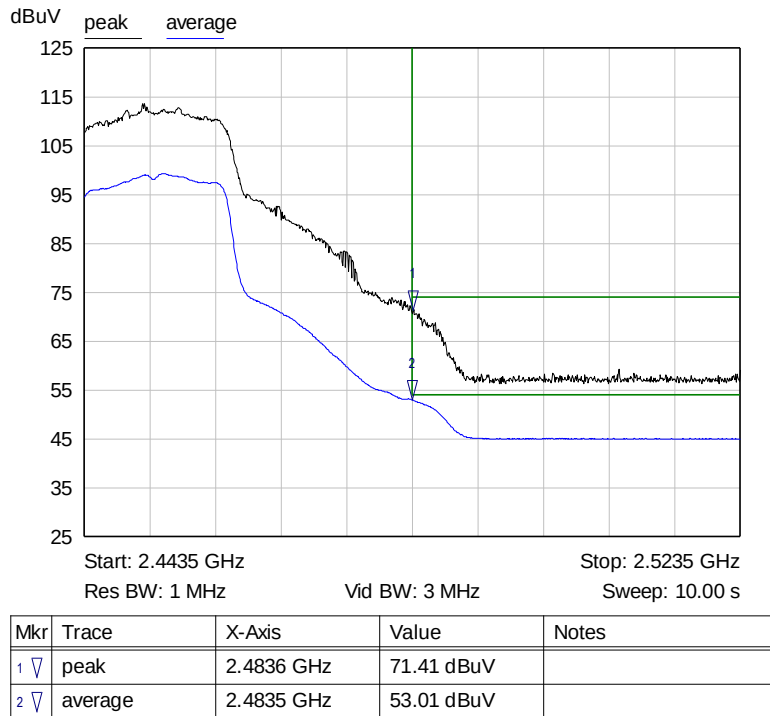
Graph 145: Antenna 1 – Channel 5 Band Edge at the Restricted Band Plot - Setting 20



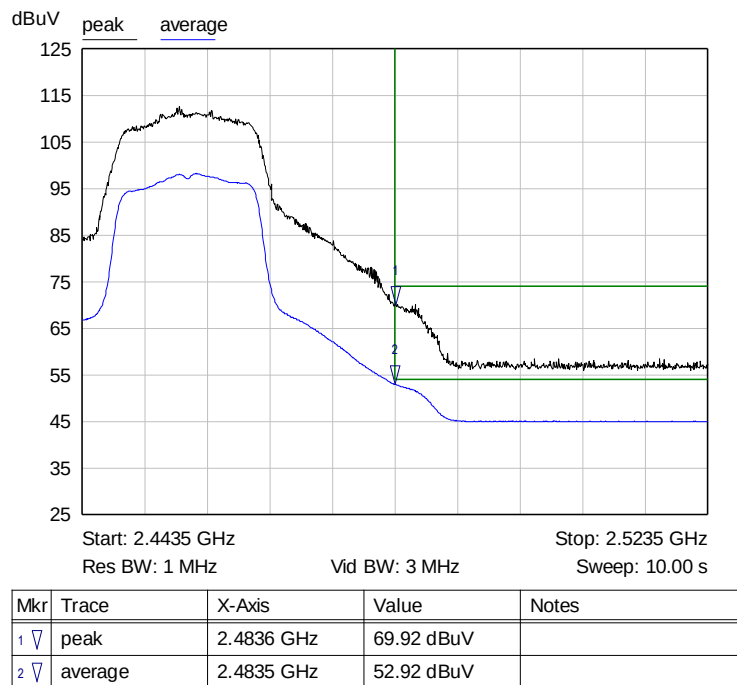
Graph 146: Antenna 1 – Channel 7 Band Edge at the Restricted Band Plot - Setting 20



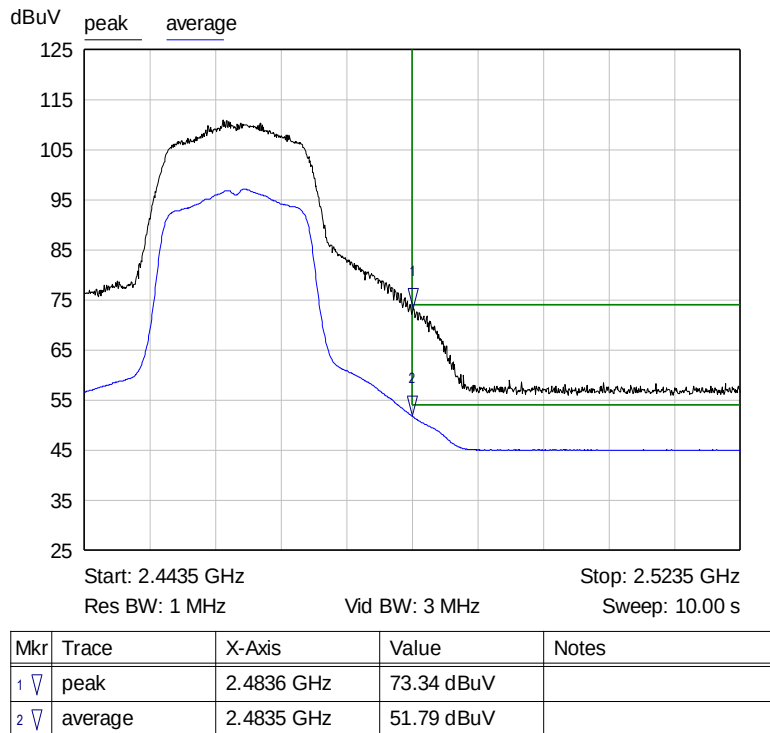
Graph 147: Antenna 1 – Channel 8 Band Edge at the Restricted Band Plot - Setting 19.5



Graph 148: Antenna 1 – Channel 9 Band Edge at the Restricted Band Plot - Setting 18.5



Graph 149: Antenna 1 – Channel 10 Band Edge at the Restricted Band Plot - Setting 17



Graph 150: Antenna 1 – Channel 11 Band Edge at the Restricted Band Plot - Setting 15

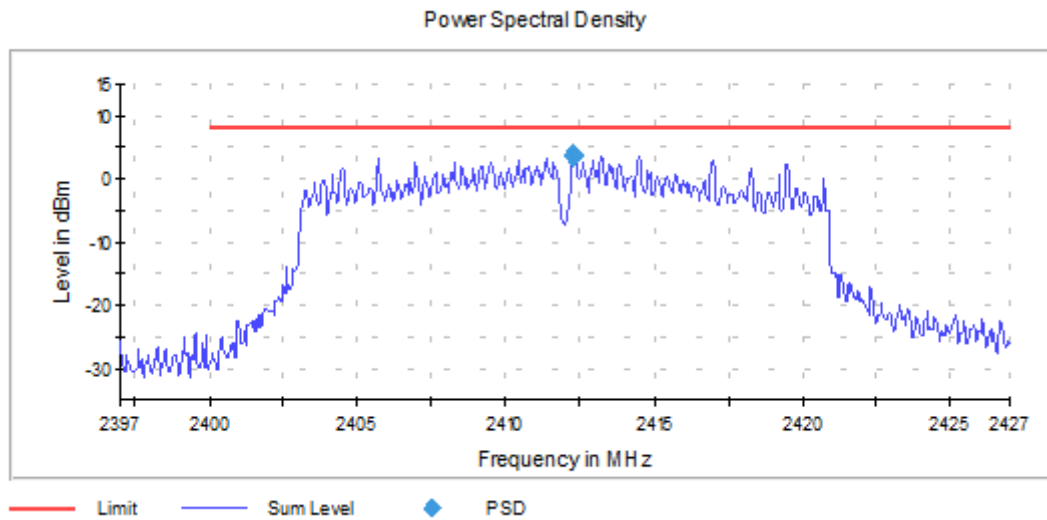
8.2.6 §15.247(e) Power Spectral Density

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. Measurements were taken according to Method AVGPS-3 (ANSI C63.10, Section 11.10.7) at the maximum possible power setting (20) to demonstrate compliance with this requirement at all possible power settings. Results of this testing are summarized.

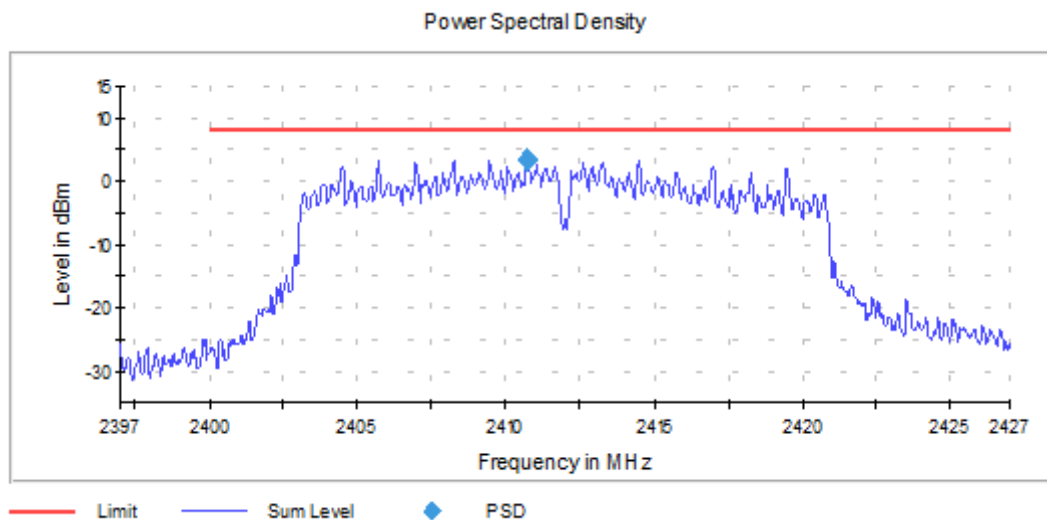
Frequency (MHz)	Measurement Antenna 0 (dBm)	Measurement Antenna 1 (dBm)	Criteria (dBm)
2412	3.7	3.5	8.0
2437	3.2	3.3	8.0
2462	4.2	3.7	8.0

Result

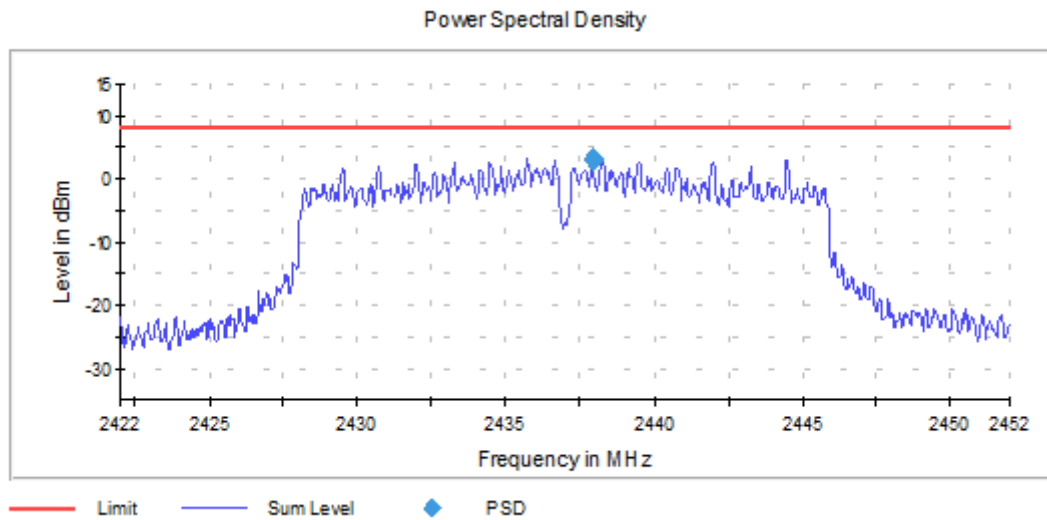
The maximum power spectral density was less than the limit of 8 dBm; therefore, the EUT complies with the specification.



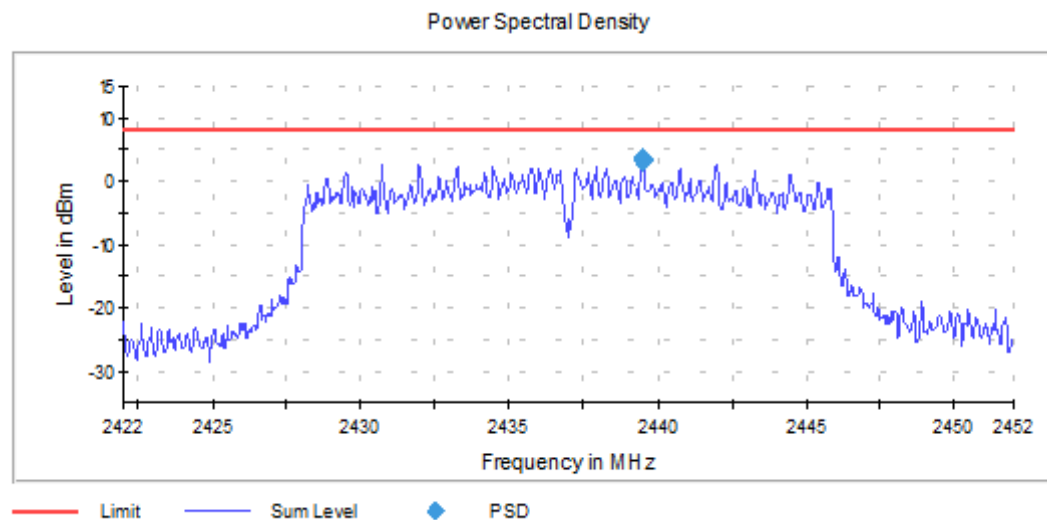
Graph 151: Antenna 0 - Lowest Channel PSD - Setting 20



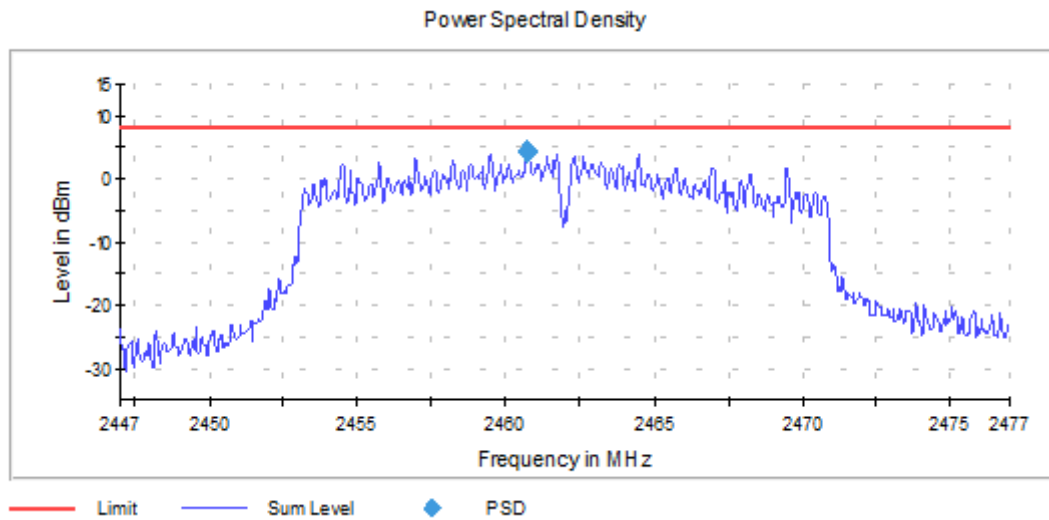
Graph 152: Antenna 1 - Lowest Channel PSD - Setting 20



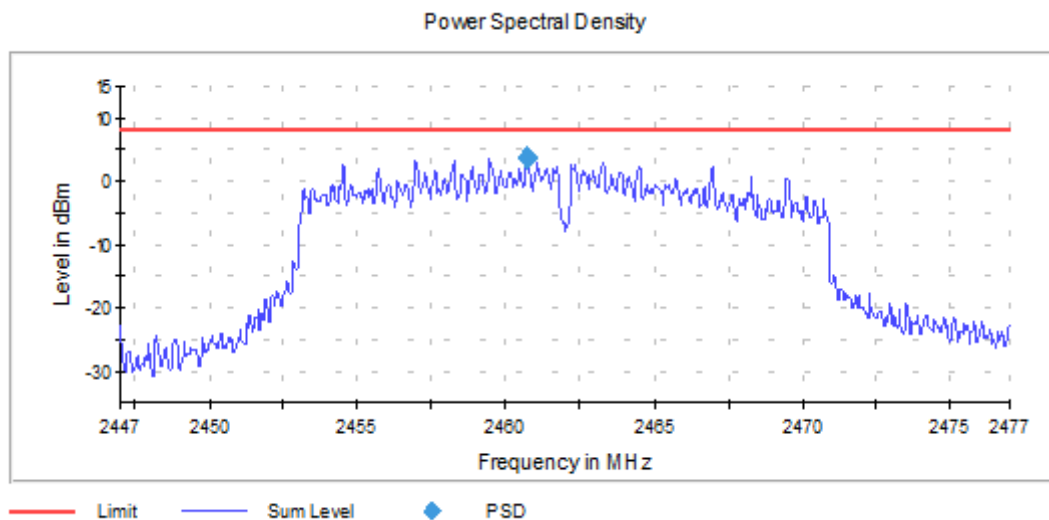
Graph 153: Antenna 0 - Middle Channel PSD - Setting 20



Graph 154: Antenna 1 - Middle Channel PSD - Setting 20



Graph 155: Antenna 0 - Highest Channel PSD - Setting 20



Graph 156: Antenna 1 - Highest Channel PSD - Setting 20

9 Test Procedures and Test Equipment

9.1 Conducted Emissions at Mains Ports

The conducted emissions at mains and telecommunications ports from the EUT were measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted emissions at mains ports measurements are performed in a screen room using a (50 Ω /50 μ H) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of devices with each device having its own power cord, the point of connection for the LISN is determined from the following rules:

- Each power cord, which is terminated in a mains supply plug, shall be tested separately.
- Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
- Power cords which are specified by the manufacturer to be connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.
- Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.
- When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

For testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	Hewlett Packard	8566B	V034141	05/12/2020	05/12/2021
Quasi-Peak Detector	Hewlett Packard	85650A	V033345	05/11/2020	05/11/2022
LISN	Teseq	NNB 51	V045406	08/20/2020	08/20/2021
Conductance Cable Wanship Upper Site	VPI Labs	Cable J	V034832	01/09/2020	01/09/2021
Filter	VPI Labs	47038	V047038	01/09/2020	01/09/2021
Test Software (AC)	VPI Labs	Revision 01	V035674	N/A	N/A

Table 20: List of equipment used for conducted emissions testing at mains ports.

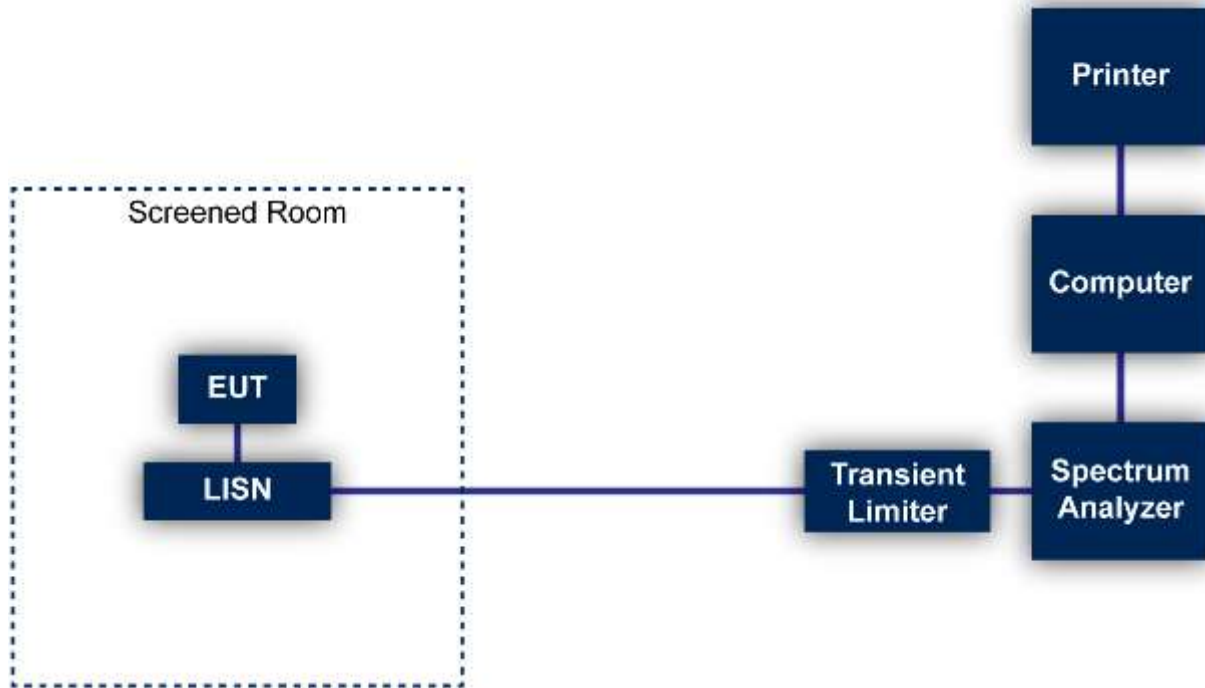


Figure 1: Conducted Emissions Test

9.2 Direct Connection at the Antenna Port Tests

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	Rohde & Schwarz	FSU40	V044352	03/13/2020	03/13/2021
Signal Generator	Rohde & Schwarz	SMB100A	V044485	03/16/2020	03/16/2021
Vector Signal Generator	Rohde & Schwarz	SMBV100A	V044217	04/01/2019	04/01/2021
40GHz Switch Extension	Rohde & Schwarz	OSP-150	V044486	03/24/2020	03/24/2022
40GHz Switch Base Unite	Rohde & Schwarz	OSP-120	V044487	04/30/2020	04/30/2022

9.2.1 Test Configuration Block Diagram

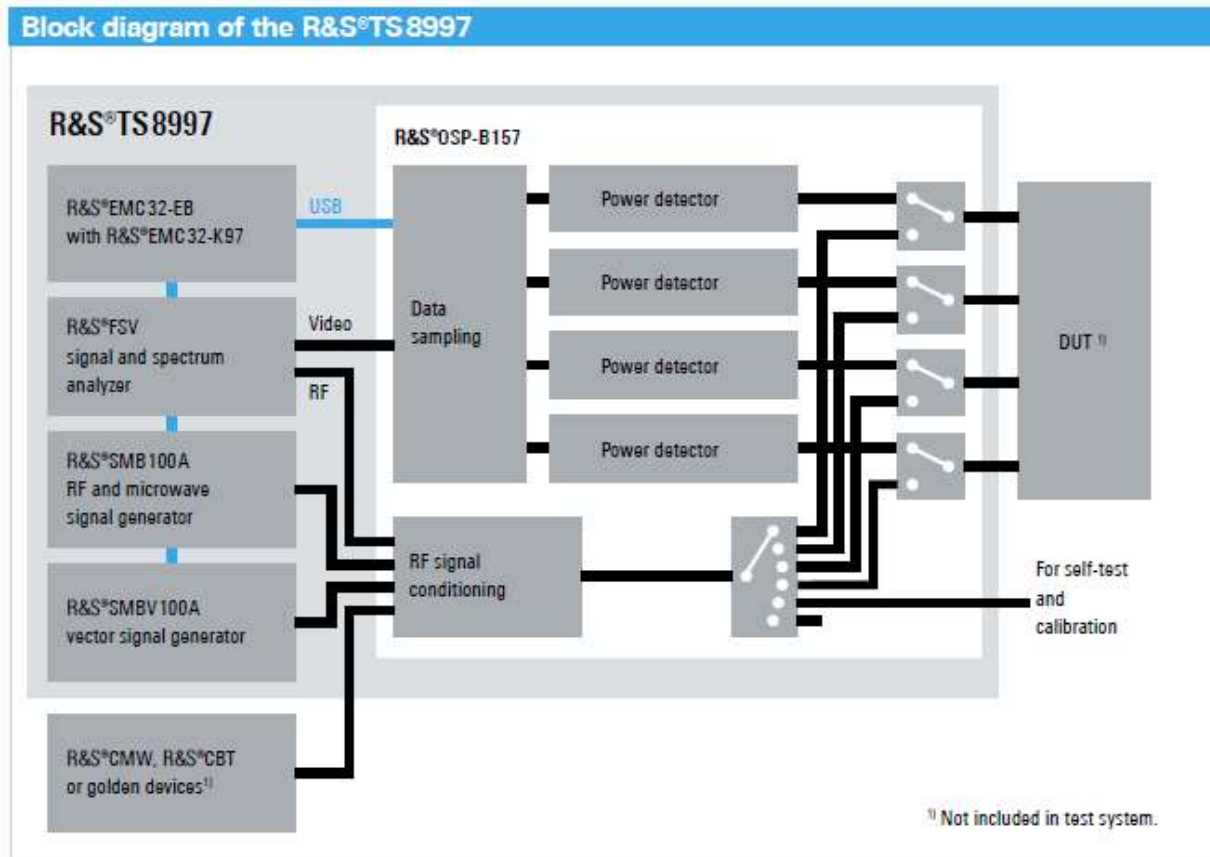


Figure 2: Direct Connection at the Antenna Port Test

9.3 Radiated Emissions

The radiated emissions from the EUT were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings.

A preamplifier with a fixed gain of 51 dB was used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges. For frequencies below 30 MHz, a 9 kHz resolution Bandwidth was used.

A loop antenna was used to measure frequencies below 30 MHz. A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 3 meters from the EUT. The readings obtained by these antennas are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors. A double-ridged guide antenna was used to measure the emissions at frequencies above 1000 MHz at a distance of 3 and/or 1 meter from the EUT.

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated emissions. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. For frequencies above 1000 MHz, the EUT is placed on a table 1.5 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

For radiated emissions testing that is performed at distances closer than the specified distance; an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer/Receiver	Rohde & Schwarz	ESU40	V033119	08/05/2020	08/05/2021
Spectrum Analyzer	Hewlett Packard	8566B	V034141	05/12/2020	05/12/2021
Quasi-Peak Detector	Hewlett Packard	85650A	V033345	05/11/2020	05/11/2022
Loop Antenna	EMCO	6502	V034216	02/11/2019	02/11/2021
Biconilog Antenna	EMCO	3142E-PA	V035736	06/24/2020	06/24/2022
Double Ridged Guide Antenna	EMCO	3115	V034194	03/09/2019	03/09/2021
Standard Gain Horn	ETS-Lindgren	3160-09	V034223	ICO	ICO
Standard Gain Horn	ETS-Lindgren	3160-10	V034224	ICO	ICO
High Frequency Amplifier	Miteq	AFS4-001018000-35-10P-4	V033997	01/09/2020	01/09/2021
High Frequency Amplifier	L3-Narda-Miteq	AMF-6F-18004000-37-8P	V042464	01/09/2020	01/09/2021
2.4 GHz Notch Filter	Micro-Tronics	BRM50702-03	V034213	01/09/2020	01/09/2021
6' High Frequency Cable	Microcoax	UFB197C-0-0720-000000	V033638	01/09/2020	01/09/2021
20' High Frequency Cable	Microcoax	UFB197C-1-3120-000000	V033979	01/09/2020	01/09/2021
3 Meter Radiated Emissions Cable Wanship Upper Site	Microcoax	UFB205A-0-4700-000000	V033639	01/09/2020	01/09/2021
Test Software (FCC)	VPI Labs	Revision 01	V035673	N/A	N/A

Table 21: List of equipment used for radiated emissions testing.

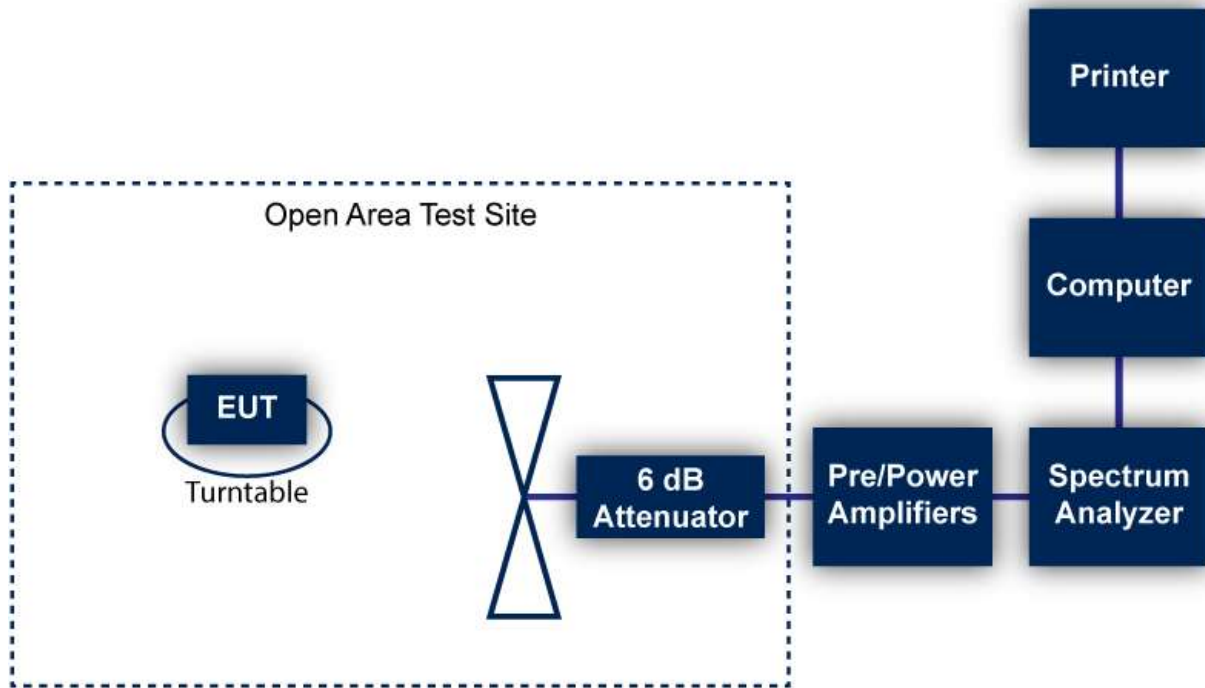


Figure 3: Radiated Emissions Test

9.4 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or VPI Laboratories, Inc. personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

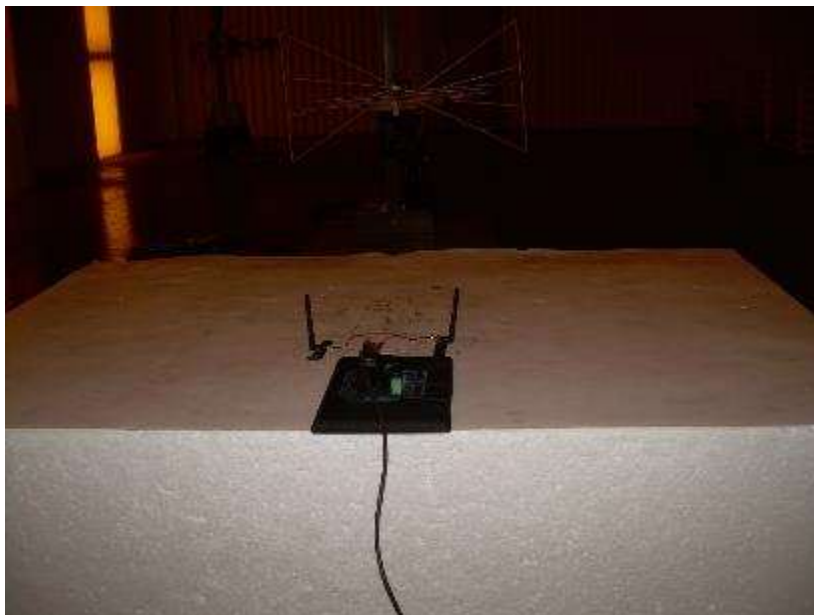
9.5 Measurement Uncertainty

Test	Uncertainty ($\pm$ dB)	Confidence (%)
Conducted Emissions	2.8	95
Radiated Emission (9 kHz to 30 MHz)	3.3	95
Radiated Emissions (30 MHz to 1 GHz)	3.4	95
Radiated Emissions (1 GHz to 18 GHz)	5.0	95
Radiated Emissions (18 GHz to 40 GHz)	4.1	95

10 Photographs



Photograph 1: Front View Radiated Emissions Worst-Case Configuration – Below 1000 MHz



Photograph 2: Back View Radiated Emissions Worst-Case Configuration



Photograph 3: Front View Radiated Emissions Worst-Case Configuration (Module Flat and Antennas Vertical) – Above 1000 MHz



Photograph 4: Back View Radiated Emissions Worst-Case Configuration (Module Flat and Antennas Vertical) – Above 1000 MHz



Photograph 5: View Radiated Emissions Module On Edge and Antennas Horizontal



Photograph 6: View Radiated Emissions Module Vertical and Antennas Vertical



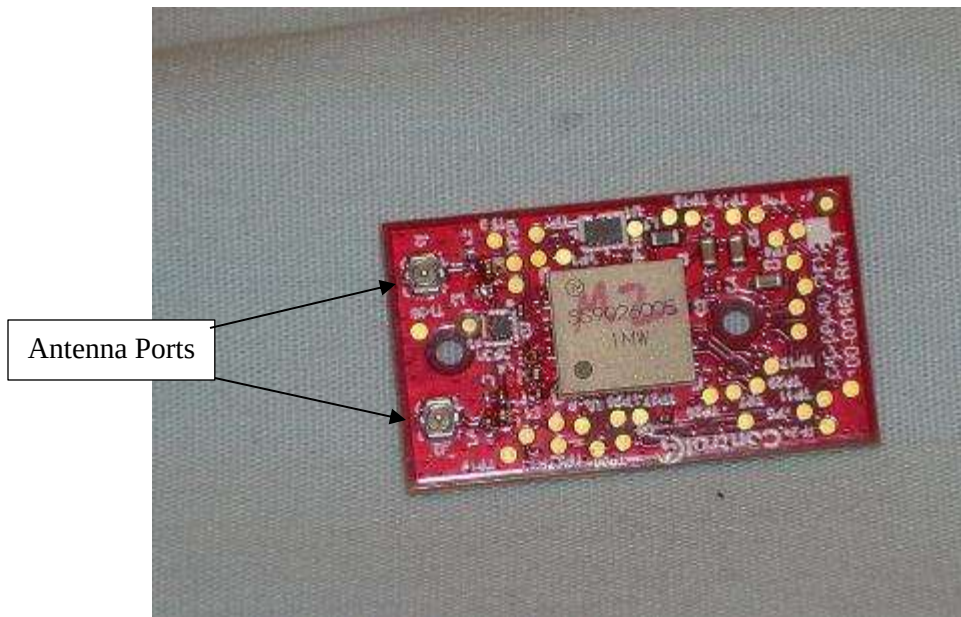
Photograph 7: View Radiated Emissions Module Flat and Antennas Flat



Photograph 8: Front View Conducted Emissions Worst-Case Configuration



Photograph 9: Back View Conducted Emissions Worst-Case Configuration



Photograph 10: Front View of the EUT



Photograph 11: Back View of the EUT



Photograph 12: View of the Antennas and Coax Cables

--- End of Report ---