Advanced Compliance Laboratory

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FCC CFR47 PART 15 SUBPART C & IC RSS-247

TEST REPORT

For

Centrak, Inc.

Mini MM Patient /Asset Tag

Model Number: ITD/U-7623E/H, ITD/U-7622E/H, ITD/U-766E/H
(WiFi Mode)

FCC ID: ST2-ITD766
IC: 6012A-ITD766

Report Number: 0048-210430-02

Prepared for

CENTRAK, INC.
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USA

Prepared by
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Date: 06/24/2021

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1. TEST RESULT CERTIFICATION

COMPANY NAME: CENTRAK, INC.

EUT Name(s)/PMN: **Mini MM Patient /Asset Tag**

EUT Model(s)/HVIN: **ITD/U-7623E/H, ITD/U-7622E/H, ITD/U-766E/H**

DATE TESTED: 4/30/2021-06/24/2021

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC Part 15.247 & IC RSS-247:Issue 2 & RSS-GEN: Issue 5	NO NON-COMPLIANCE NOTED

Test Summary

Testing Items Per FCC Part 2/ Part 15.247 & IC RSS-247 /RSS-Gen Standard Requirements for DTS Modulation	Section	Limit	Result
DTS Bandwidth	15.247(a) (2) RSS-247, 5.2(1)	>=500KHz	Complies
Peak Power Limit	15.247(b) (3) RSS-247, 5.4(4)	Conducted: 1W (30dBm) e.i.r.p. 4W(36dBm)	Complies
Peak Power Spectral Density	15.247(e) RSS-247, 5.2(2)	8dBm/3KHz	Complies
Emissions (Conducted)	15.247(d) RSS-247, 5.5	-20dB/-30dB	Complies
Spurious (Radiated)	15.205(a) RSS-247, 5.5	15.209/RSS-Gen	Complies
RF Safety*	1.1310/RSS-102	1.0/5.0 mW/cm^2	Complies

NOTE: * For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

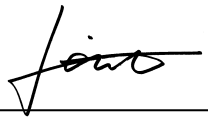
Advanced Compliance Laboratory, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note : This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Advanced Compliance Laboratory, Inc. (ACL) and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by ACL, Advanced Compliance Laboratory, Inc. will constitute fraud and shall nullify the document.

Tested By:

David Tu
EMC Engineer

Approved & Released For ACL By:



Wei Li
Manager
Advanced Compliance Laboratory, Inc.

2. EUT DESCRIPTION

The EUT for this certification is a low power transmitter, using digital modulation & operating in the 2400-2483.5 MHz band.

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Max. Rated Power	Measured Max. Conducted Output Power (dBm/W)	
2412-2462	14dBm (0.025W)	13.82dBm/ 0.025	

The EUT can use a surface mount antenna: Molex, 2,4GHz SMT MID Chip antenna, P/N 0479480001, 2.4GHz Band, 3.3 dBi Peak Gain (Monopole, Linear Polarization).

Max. e.i.r.p is 13.82+3.3=17.12dBm, i.e. 0.052W with 3.3dBi gain antenna. With this antenna, both conducted output power and e.r.i.p are under FCC & IC limit.

EUT RF Specification:

Operation Frequency & Channel Number	2412MHz~2462MHz(802.11b/g), 11 channels
Channel Separation	20MHz
Modulation (IEEE 802.11b)	Direct Sequence Spread Spectrum (DSSS)
Modulation (IEEE 802.11g)	Orthogonal Frequency Division Multiplexing (OFDM)
Data Speed (IEEE 802.11b/g)	1Mbps/54Mbps;
Antennal Type and Gain	Monopole , 3.3dBi max.
Power Supply	3.3 Vdc

There are several similar models in this product group, in which all modes are using the same RF design.

For model number details (all electronic identical):
3 General models for FCC approval: ITD/U-7623E/H, ITD/U-7622E/H, ITD/U-766E/H
12model listing for IC approval:

1. ITD-7622E
2. ITD-7622E H
3. ITDU-7622E
4. ITDU-7622E H
5. ITD-7623E
6. ITD-7623E H
7. ITDU-7623E
8. ITDU-7623E H
9. ITD-766E
10. ITD-766E H
11. ITDU-766E
12. ITDU-766E H

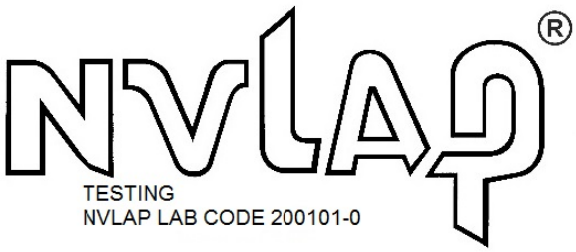
3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4(2014)/C63.10(2013), FCC CFR 47 Part 2 & 15 and IC RSS-247(Issue 2) & RSS-GEN (Issue 5). Test procedure described in FCC "KDB 558074 D01 15.247 Meas Guidance v05r02" is used in this report.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at Hillsborough, New Jersey, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods"

ACL is accredited by NVLAP, Laboratory Code 200101-0. The full accreditation can be viewed at http://www.ac-lab.com



No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. MEASUREMENT UNCERTAINTY

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty u_c	norm.	±2.36	±2.99	±1.83

5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Manufacturer	Model	Serial No.	Description	Cal Due mm/dd/ yy
Agilent	E4440A	US40420700	3Hz-26.5GHz Spec. Analyzer	6/17/22
R &S	ESPI	100018	9KHz-7GHz EMI Receiver	8/25/21
HP	HP8546A	3448A00290	9kHz to 6.5GHz EMI Receiver	9/25/21
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	11/12/21
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	11/13/21
Electro-Meterics	ALR-25M/30	289	10KHz-30MHz Active Loop Antenna	5/28/22
EMCO	3115	4945	Double Ridge Guide Horn Antenna	11/28/21
R&S	SMH	8942280/010	Signal Generator	01/15/22
RES-NET	RFA500NFF 30	0108	30dB in-line Power Attenuator	
Lorch Microwave	5NF-800/10 00-S	AC3	Notch Filter	
Lorch Microwave	5NF-1800/2 200-S	AE10	Notch Filter	
Narda	3022	80986	Directional Coupler	
Lorch Microwave	5NF-800/10 00-S	AC3	Notch Filter	

All Test Equipment Used is Calibrated, Traceable to NIST Standards.
Calibration interval: 2 years

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

None.

TEST SETUP

Testing Frequency/Channel/Port Selection:

- Conducted measurement performed at EUT's antenna connector.
- Using internal continuous testing signal source.
- Modulation: DSSS/OFDM
- L(owest), M(iddle), H(ighest) Channels of 2.4G Band were selected:
  L=2412MHz, M=2438MHz, H=2462MHz

Frequency settings:

Modulation	802.11b	
Lowest Channel (L)	2412MHz	
Middle Channel (M)	2437MHz	
Highest Channel (H)	2462MHz	

Modulation	802.11g	
Lowest Channel (L)	2412MHz	
Middle Channel (M)	2437MHz	
Highest Channel (H)	2462MHz	

Worst case Scenario:

Via pre-scan, the following modes were found representing the " worst case" data. Duty cycle was set for 100% with max. power setting for all modulations.

Mode No.	Mode Modulation & Data Rate
1	802.11b 1DSSS, 1Mbps
2	802.11g 54OFDM, 54Mbps

In real application, the tag transmits CCX/ACX packets (uno-directional) to the Aps which is used to locate the position. These transmissions can have a burst length of 5 milliseconds for each channel. The tag transmits packets on Channel 1, Channel 6 and channel 11. The signals are transmitted at about 30 sec – 1 hour intervals. The tag also transmits TCP/UDP packets (bi-directional) for once a day in order to configure profile or Wireless upgrade firmware's on the Tag. Therefore, the max. duty cycle in actual usage is 5 ms x3 / 30 ,000=0.0005.

7. APPLICABLE LIMITS AND TEST RESULTS

7.1 6dB &99% BANDWIDTH

LIMIT

§15.247 (a) (2) & RSS-247 Sec. 5.2(1): Min. 6dB DTS bandwidth should be no less than 500KHz.

TEST PROCEDURE *per FCC 558074 D01 15.247 Meas Guidance v05r02*

Measurement Procedure for Emission Bandwidth (DTS Bandwidth)	Applicable to this EUT
8.1 DTS BW Measurement Procedure: Option 1 (manual)	☐
8.2 DTS BW Measurement Procedure: Option 2 (automatic)	☒

RESULTS

No non-compliance noted.

Mode No.1: 802.11b

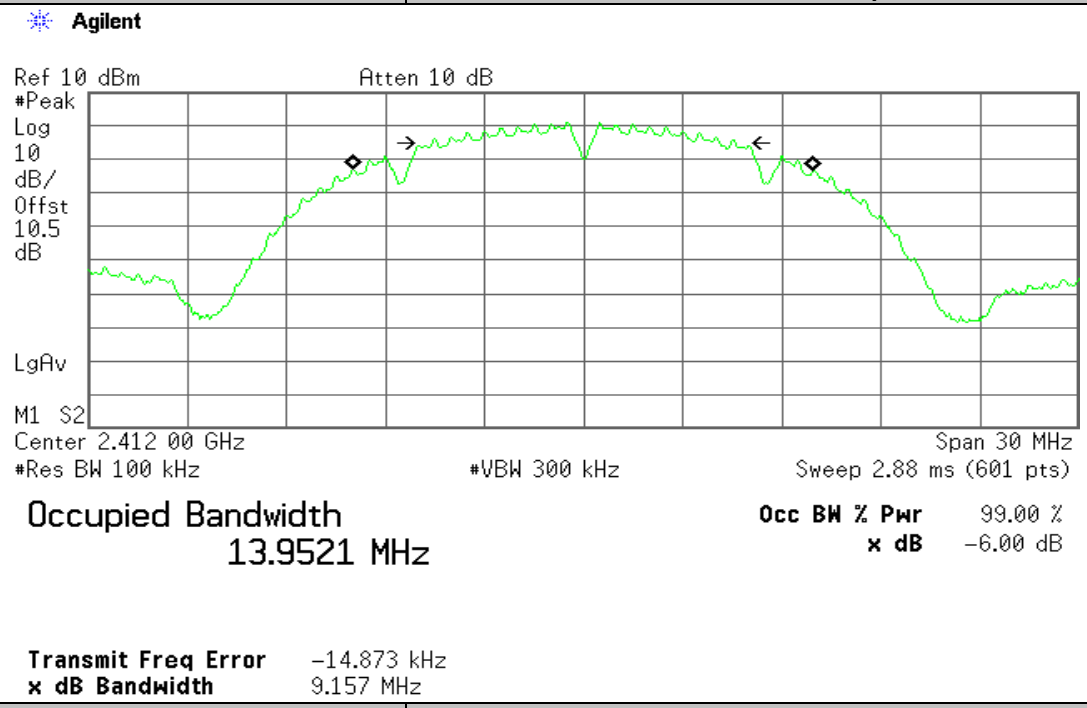
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2412	9.157	13.9521
Middle	2437	9.147	14.0432
High	2462	9.634	14.0739

Mode No.1: 802.11g

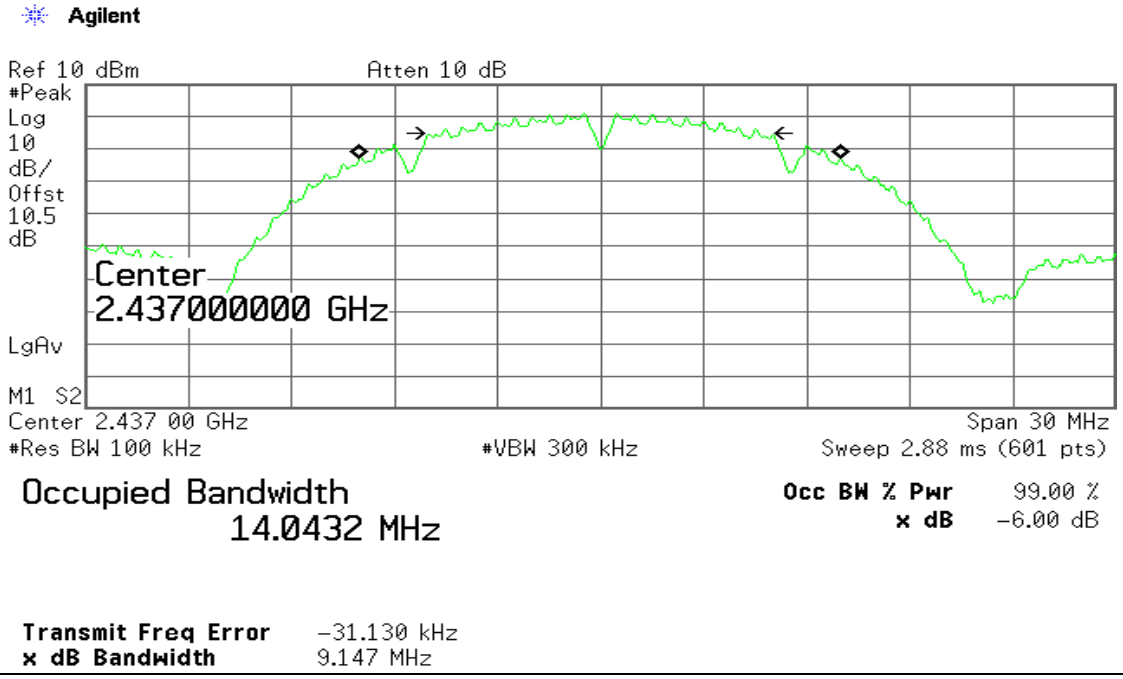
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2412	16.659	16.8492
Middle	2437	16.520	16.7852
High	2462	16.542	16.7441

6dB & 99% BANDWIDTH

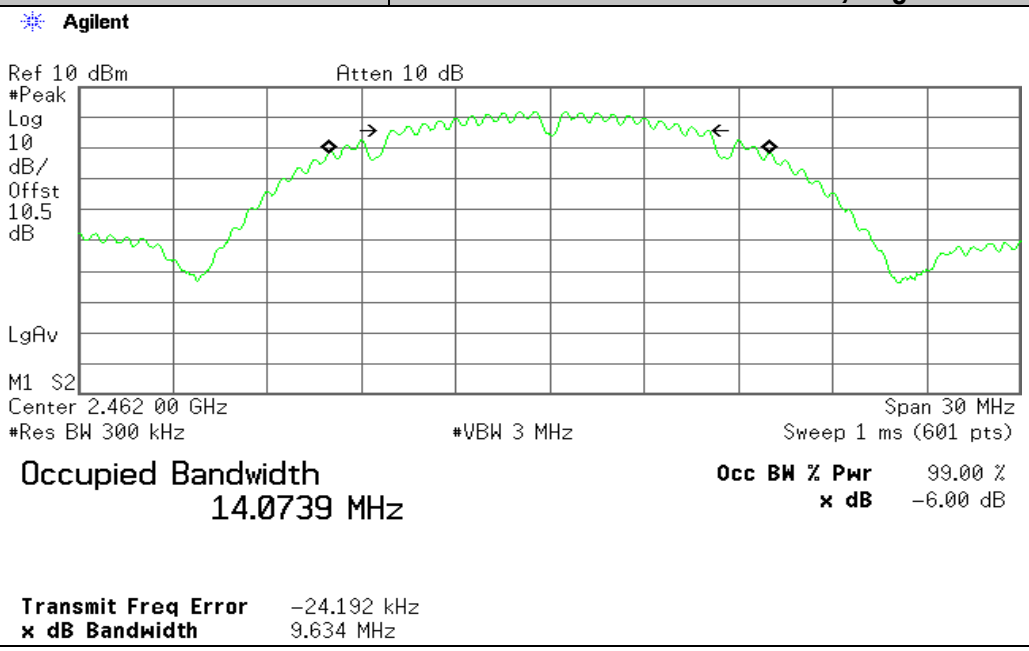
Plot Name:	6dB &99% Bandwidth, Mode No 1. 802.11b, Low CH



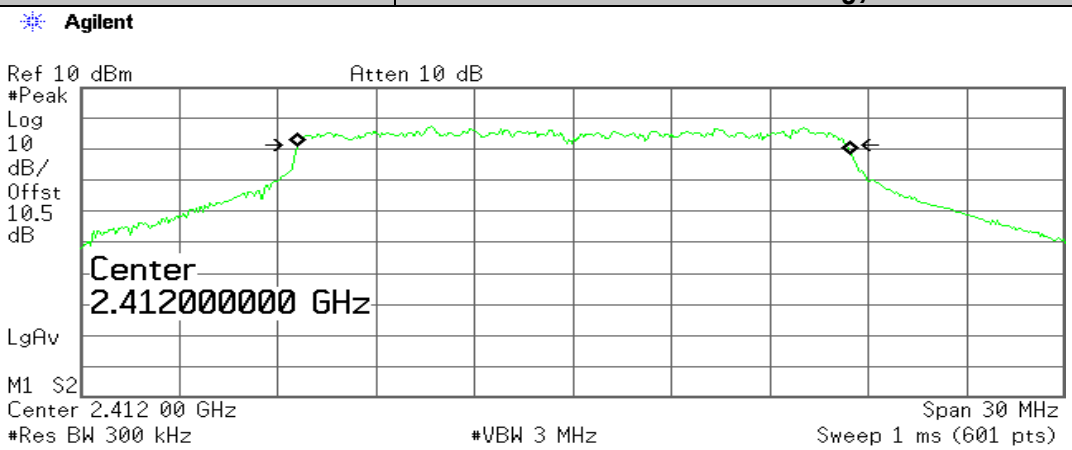
Plot Name:	6dB &99% Bandwidth, Mode No 1. 802.11b, Mid CH



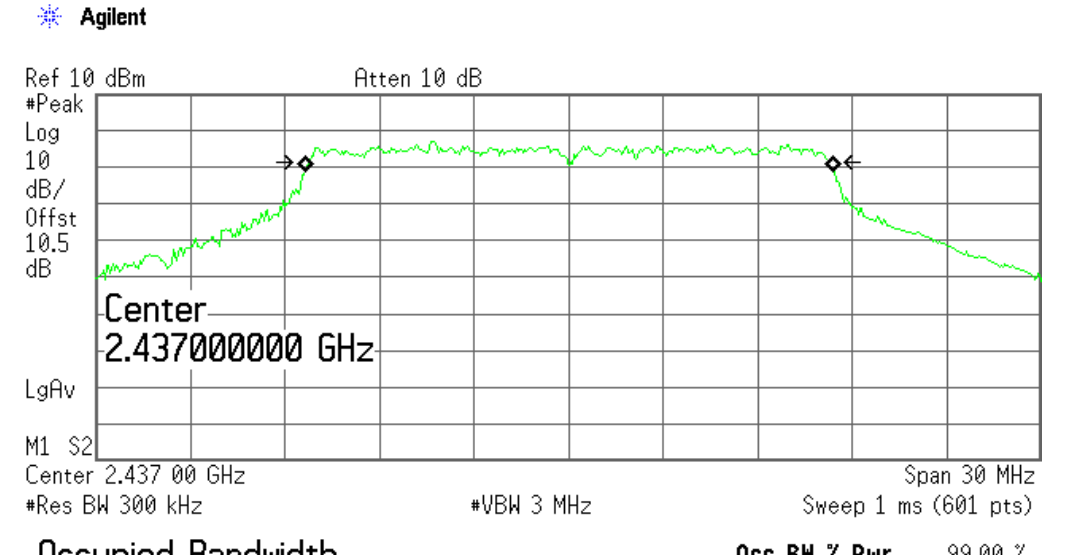
Plot Name:	6dB & 99% Bandwidth, Mode No 1. 802.11b, High CH



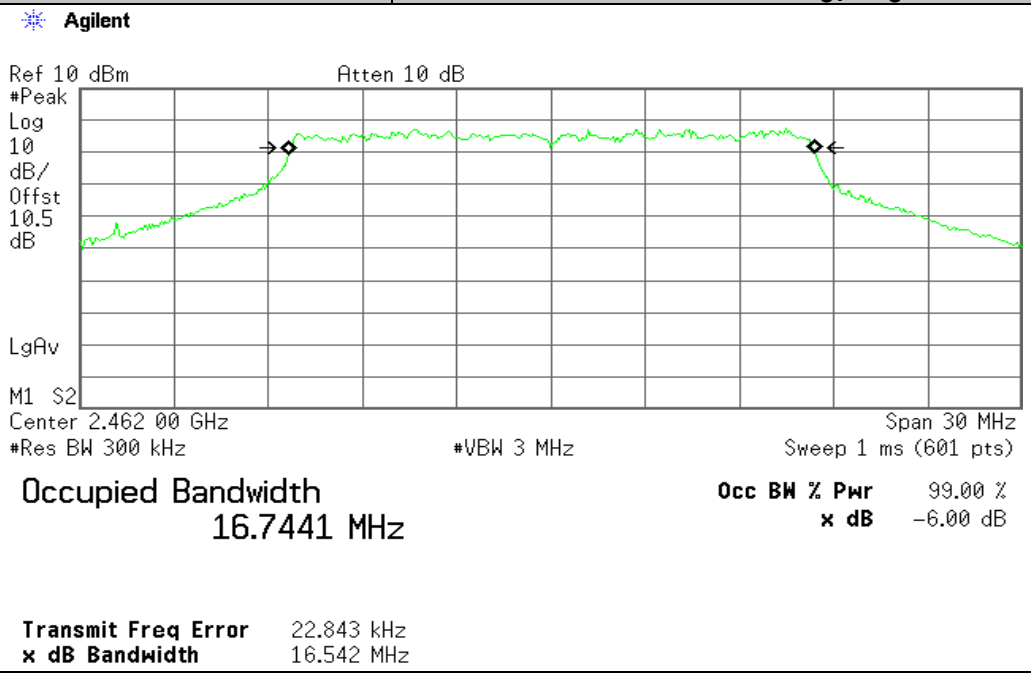
Plot Name:	6dB &99% Bandwidth, Mode No 2. 802.11g, Low CH



Plot Name:	6dB &99% Bandwidth, Mode No 2. 802.11g, Mid CH



Plot Name:	6dB & 99% Bandwidth, Mode No 2. 802.11g, High CH



7.2 MAXIMUM OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b)(3) & RSS-247 Sec. 5.4.(4)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 2400-2483.5 MHz band: 1 Watt.

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.

b(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 output 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.

Therefore, the applicable output power limit shall be calculated as follows:

Pout = 30 -(Gtx-6) for antenna gain ≤6dBi or
Pout = 30 -Floor[(Gtx-6)/3]
G_{Tx} = the maximum transmitting antenna directional gain in dBi.

TEST PROCEDURE ***per FCC KBD 558074 D01 15.247 Meas Guidance v05r02***

Measurement Procedure for Fundamental Emission Output Power*	**Applicable to this EUT**
8.3.1.1 Maximum Peak Conducted Output Power Level Measurement Procedure Option 1 (RBW≥DTS BW): Per Subclause 11.9.1.1 of ANSI C63.10	☒**preferred**
8.3.1.2 Maximum Peak Conducted Output Power Level Measurement Procedure Option 2 (RBW<DTS BW) Integrated band power method: Prefer to use integrated average power measurement, as described in 8.3.2	☐
8.3.1.3 Maximum Peak Conducted Output Power Level Measurement Procedure Option 3: PKPM1 Peak-reading power meter method per Subclause 11.9.1.3 of ANSI C63.10	☐

* For measuring output power of a device transmitting a wide-band noise-like signal (i.e., digitally-modulated) where the peak power amplitude is a statistical parameter, the preferred methodology is to use integrated average power measurements, as described in 11.9.2 and 11.13.3 of ANSI C63.10.

ALTERNATIVE METHOD
(Ref: FCC KDB 558074D01v03r05)

The measurement procedures described herein are based on the use of an antenna-port conducted test configuration. However, if antenna-port conducted tests cannot be performed on an EUT (*e.g.*, portable or handheld devices with integral antenna), then radiated tests are acceptable for demonstrating compliance to the conducted emission requirements. The guidance provided herein is applicable to either antenna-port conducted or radiated compliance measurements.

If a radiated test configuration is used, then the measured power or field strength levels shall be converted to equivalent conducted power levels for comparison to the applicable output power limit. This may be accomplished by first measuring the radiated field strength or power levels using a methodology for maximum peak conducted power or maximum conducted (average) power as applicable and peak or average power spectral density as applicable. The radiated field strength or power level can then be converted to EIRP (see ANSI C63.10 for guidance). Therefore, the applicable output power limit shall be calculated as follows:

EIRP (dBm) = E (dBuV/m) – 95.2

TEST RESULT

No non-compliance noted.

Summary of Max. Conducted (average) Output Power Testing Data:

Max. Conducted output power is 13.82dBm/ 0.025W.
Max. e.i.r.p is 17.12dBm/ 0.052W with 3.3dBi gain monopole antenna.
Both conducted output power and e.r.i.p are under FCC & IC limit.

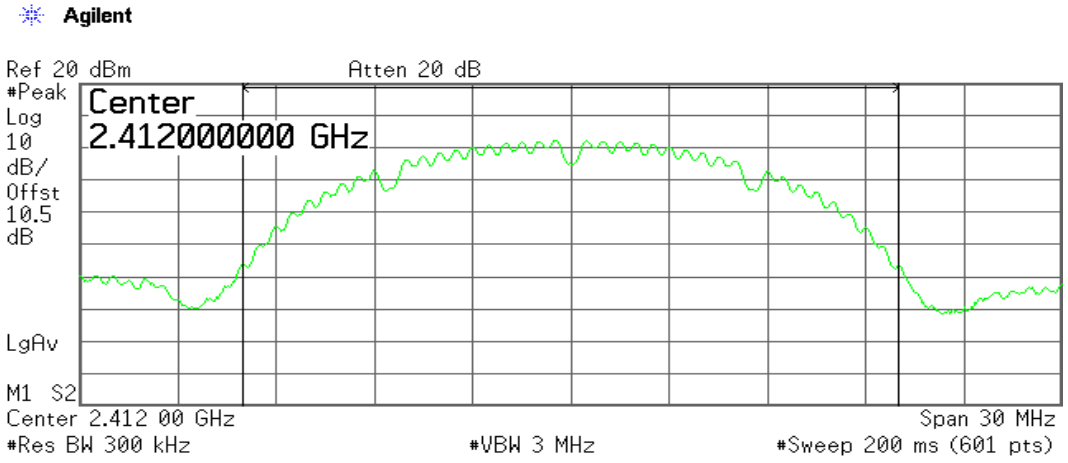
Mode No.1 802.11 b

Channel	Frequency (MHz)	Output Power* (dBm)	Limit (dBm)	Margin (dB)
Low	2412	13.65	30	-16.35
Middle	2437	13.63	30	-16.37
High	2462	13.82	30	-16.18

Mode No.2 802.11 g

Channel	Frequency (MHz)	Output Power* (dBm)	Limit (dBm)	Margin (dB)
Low	2412	7.64	30	-22.36
Middle	2437	6.89	30	-23.11
High	2462	7.28	30	-22.72

Plot Name:	Peak Power Mode No 1. 802.11b, Low CH



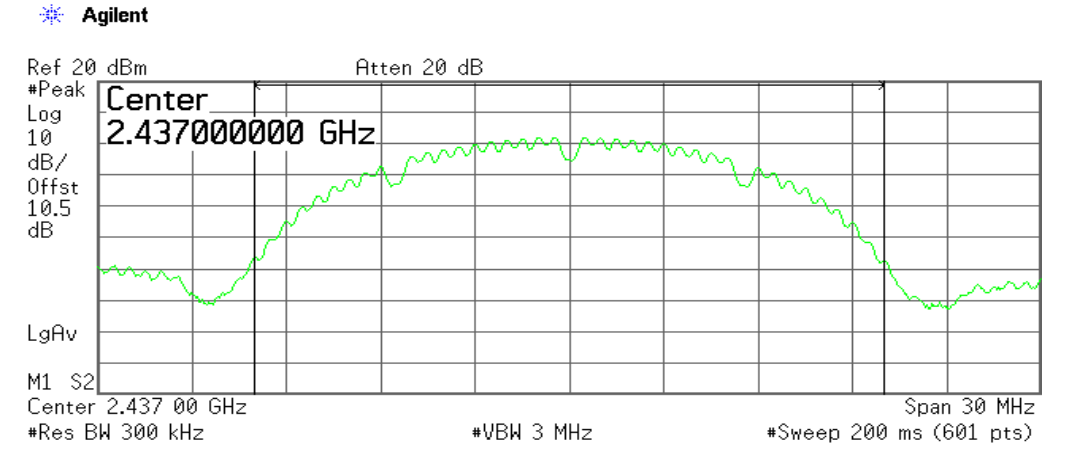
Channel Power

13.65 dBm /20.0000 MHz

Power Spectral Density

-59.36 dBm/Hz

Plot Name:	Peak Power Mode No 1. 802.11b, Mid CH



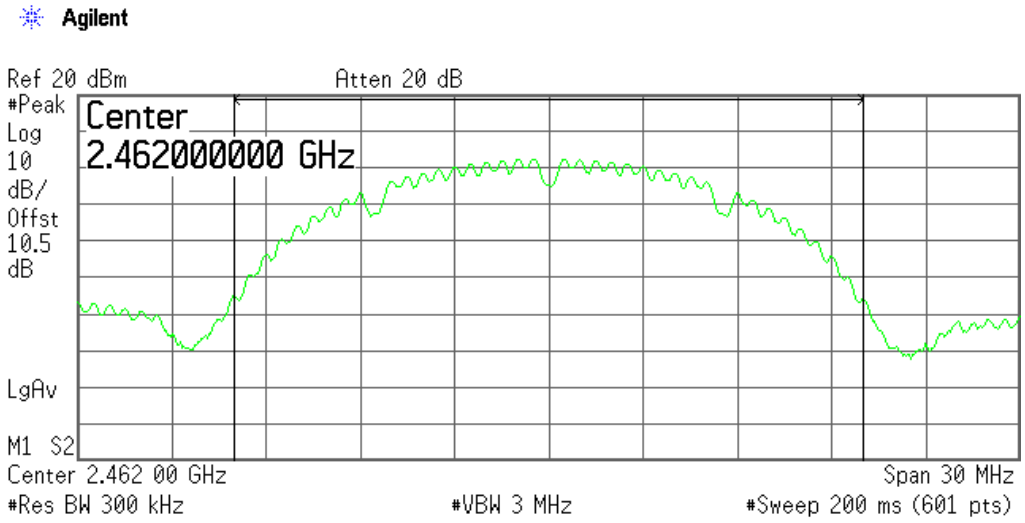
Channel Power

13.63 dBm /20.0000 MHz

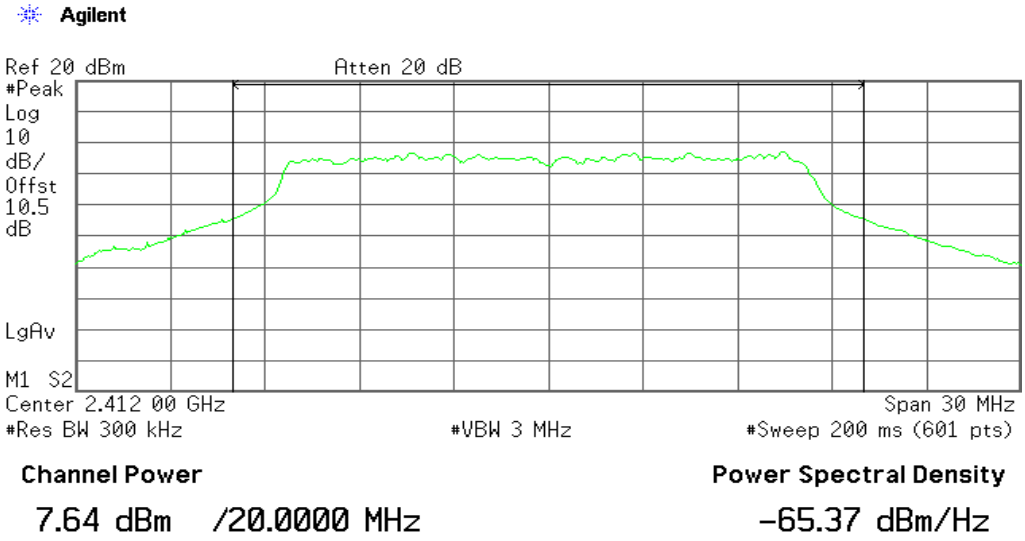
Power Spectral Density

-59.38 dBm/Hz

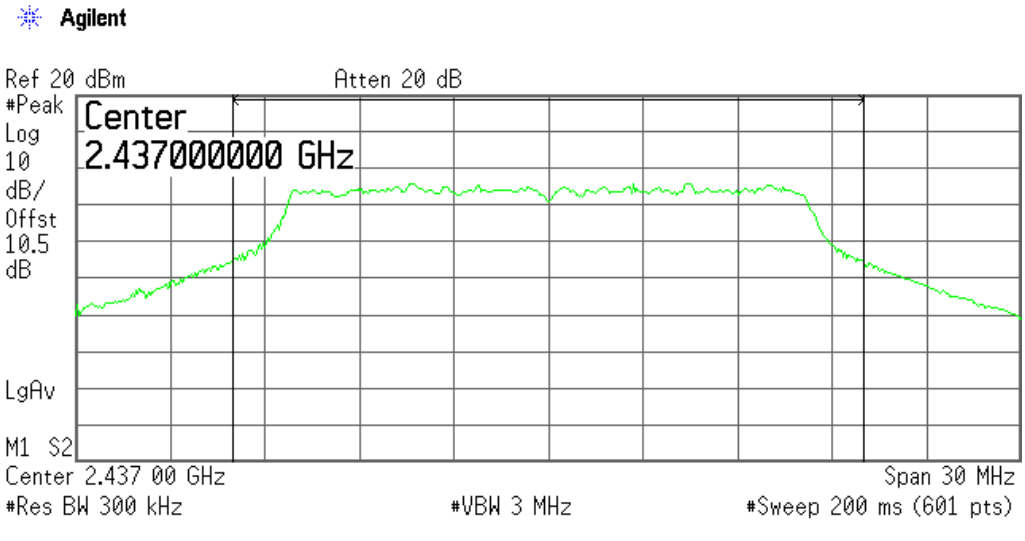
Plot Name:	Peak Power Mode No 1. 802.11b, High CH



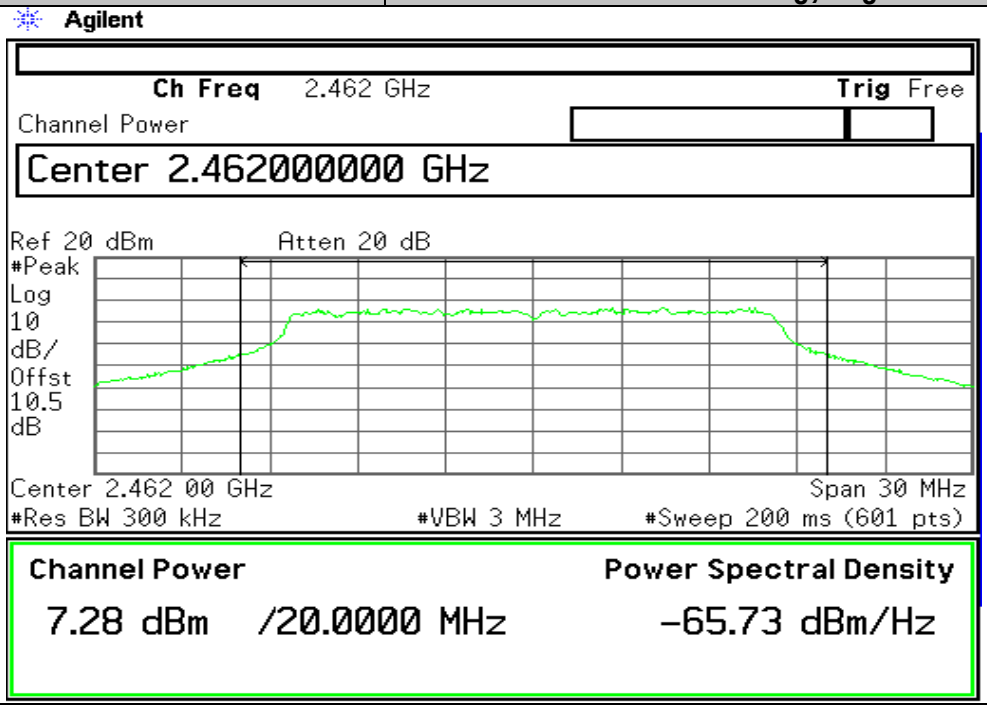
Plot Name:	Peak Power Mode No 2. 802.11g, Low CH



Plot Name:	Peak Power Mode No 2. 802.11g, Mid CH



Plot Name:	Peak Power Mode No 2. 802.11g, High CH



7.3 MAXIMUM PERMISSIBLE EXPOSURE

LIMITS for FCC RF Exposure

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,
where f(GHz) is the RF channel transmit frequency in GHz

FCC KDB 447498 D01 General RF Exposure Guidance v06, section 4.3.1 & Appendix A provides the SAR Test Exclusion Thresholds to verify that the device is exempt from 1-g extremity SAR at **separation distance of ≤5 mm**:

As example, for 900MHz Tx: 16mW (12dBm); For 2450MHz Tx: 10mW (10dBm).

Details in calculation formula for reference:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\,cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\,cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\,cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

LIMITS per RSS-102, Table 1 & Section 2.5

Per 2.5.1 Exemption Limits for Routine Evaluation — SAR Evaluation

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.

Exclusion Thresholds to verify that the device is exempt from 1-g SAR at separation distance of ≤5 mm:
For 900MHz Tx: 16mW (12dBm); For 2450MHz Tx: 4mW (6dBm), which can be calculated per 2.5.2:

Per 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:
• below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
• at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

Summary:

For FCC and IC, that max. declared power level can be modified by any duty cycle over the time averaging period. Time-averaging period is a time period not to exceed 30 minutes for fixed RF sources or a time period inherent from device transmission characteristics not to exceed 30 minutes for mobile and portable RF sources.

For rf exposure, the averaging period is 6 minutes for ISED Canada and for FCC it varies by frequency but 1~60 second for RF exposure or the period specified by product design spec. for RF exposure can be used.

So the power value for RF exposure= Declared power x Duty Cycle factor

CALCULATIONS for MPE distance and Power Density

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E \wedge 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using:

P(mW) = P (W) / 1000 and
d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$
$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using: P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

$d = 0.282 * 10 \wedge ((P + G) / 20) / \sqrt{S}$ Equation (1)
$S = 0.0795 * 10 \wedge ((P + G)/10)/ d\wedge 2$ Equation (2)

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Equation (1) and the measured Output power is used to calculate the MPE distance.
Equation (2) and the measured Output power is used to calculate the Power density.

APPLICABLE LIMITS for separation >= 20cm

FCC: From §1.1310 Table 1 (B), for Public S = 1.0 mW/cm^2 ; for Professional, S = 5.0 mW/cm^2
IC: With formula of 1.31 x 10^{-2} $f^{0.6834}$ W, more restricted EIRP limit value are 1.37W at 902MHz, 2.67W at 2400MHz.

Exclusion Thresholds to verify that the limb-worn device is exempt from 1-g SAR test at separation distance of ≤5 mm, the limit for FCC and ISED are
For 900MHz Tx: 16mW (12dBm); For 2450MHz Tx: 10mW (10dBm) for FCC Conducted; 4mW (6dBm) for ISED (conducted & EIRP).

RESULTS

No non-compliance noted:

1. For limb-worn usage:

EUT max. rated e.r.i.p =14+3.3=17.3dBm, i.e 0.054W (54mW) in 2.4GHz band.
The product duty cycle is 5ms x3 /30,000=0.0005. Then the time averaging RF power for SAR test exclusion is 54mWx 0.0005= 0.027mW, which is under the 4mW (eirp), most restricted FCC/ISED limit.

2. For >=20cm usage:

---For FCC, the worst case for this EUT, P+G=-13.82+3.30=17.12dBm, and d=20cm

Plug all three items into equation (2), yielding,

Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna] Gain (dBi)	Power Density (mW/ cm$^{2)}$	Meet min. PD Limit
1.0/5.0	13.82	3.30	0.010	Yes

---For ISED, EUT max. e.r.i.p =0.052W < limit 2.67W

Therefore, all of results are below the FCC/ISED limit.

NOTE: For mobile or fixed location transmitters, the minimum separation distance between the antenna & radiating structures of the device and nearby persons is 20 cm, even if calculations indicate that the MPE distance would be less.

7.4 AVERAGE OUTPUT POWER

AVERAGE POWER LIMIT

Section 15.247 permits the maximum conducted (average) output power to be measured as an alternative to the maximum peak conducted output power for demonstrating compliance to the limit. When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth (see ANSI C63.10 for measurement guidance).

TEST PROCEDURE *per FCC KDB 558074D01v05r02*

Measurement Procedure for Fundamental Emission Output Power	Applicable to this EUT
8.3.2.2 Maximum Conducted (average) Output Power Level * Measurement Procedure Option 1 (Measurement using a spectrum analyzer (SA): per Subclause 11.9.2.2 of ANSI C63.10	☐
8.3.2.3 Maximum Conducted (average) Output Power Level * Measurement Procedure Option 2 (using a power meter(PM): per Subclause 11.9.2.3 of ANSI C63.10	☒

* Alternative method. EUT shall be configured to transmit continuously (min. 98% duty cycle at full power). The spectrum analyzer shall be set for bin-to-bin spacing ≤RBW/2.

The transmitter output is connected to a RF broadband power meter.

RESULTS

No non-compliance noted:

Mode No.1 802.11b

Channel	Frequency (MHz)	Average Power (dBm)
Low	2412	9.06
Middle	2437	9.25
High	2462	9.18

Mode No.2 802.11g

Channel	Frequency (MHz)	Average Power (dBm)
Low	2412	-4.40
Middle	2437	-4.45
High	2462	-4.51

7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (e) & RSS-247 Sec. 5.2(2)
For direct sequence systems, the peak 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.

TEST PROCEDURE ***per FCC KDB 558074D01v05r02***

Measurement Procedure for Maximum Power Spectral Density in the Fundamental Emission	**Applicable to this EUT**
8.4 Measurement Procedure Method PKPSD (peak PSD) per Subclause 11.10.2 of ANSI C63.10	☒**preferred**
8.4 Measurement Procedure for Average PSD** (6 methods: AVGPSD-1 & Alt, AVGPSD-2 & Alt, AVGPSD-3 & Alt) per Subclause 11.10.3~11.10.8 of ANSI C63.10	☐

RESULTS

No non-compliance noted:

Summary of PPSD Testing Data:

Mode No.1 802.11b

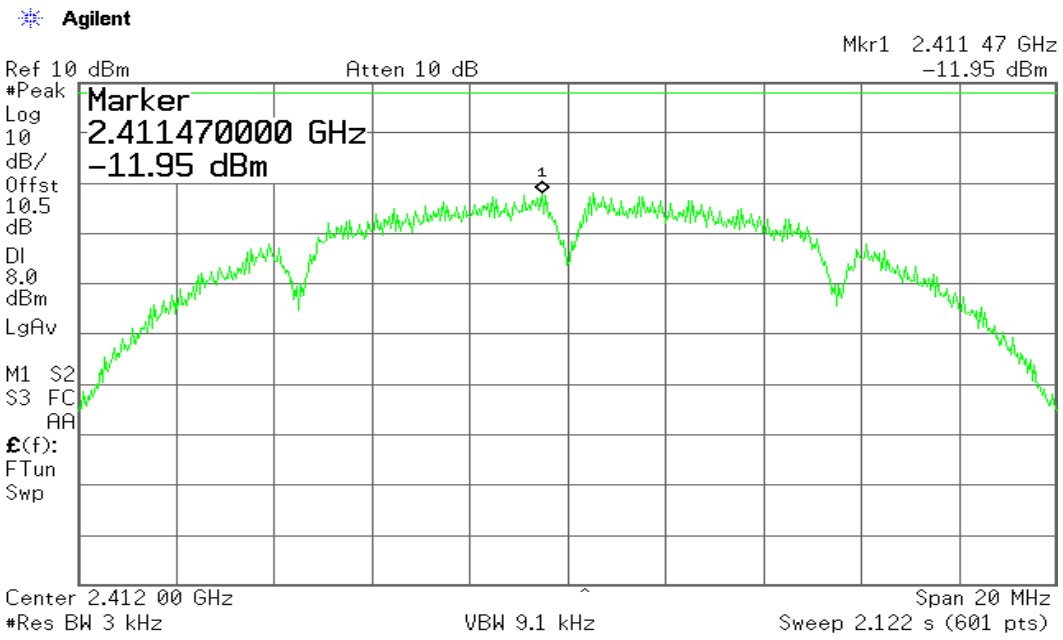
Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Limit (dBm/3KHz)	Margin (dB)
Low	2412	-11.95	8	-19.95
Middle	2437	-11.27	8	-19.27
High	2462	-10.11	8	-18.11

Mode No.2 802.11g

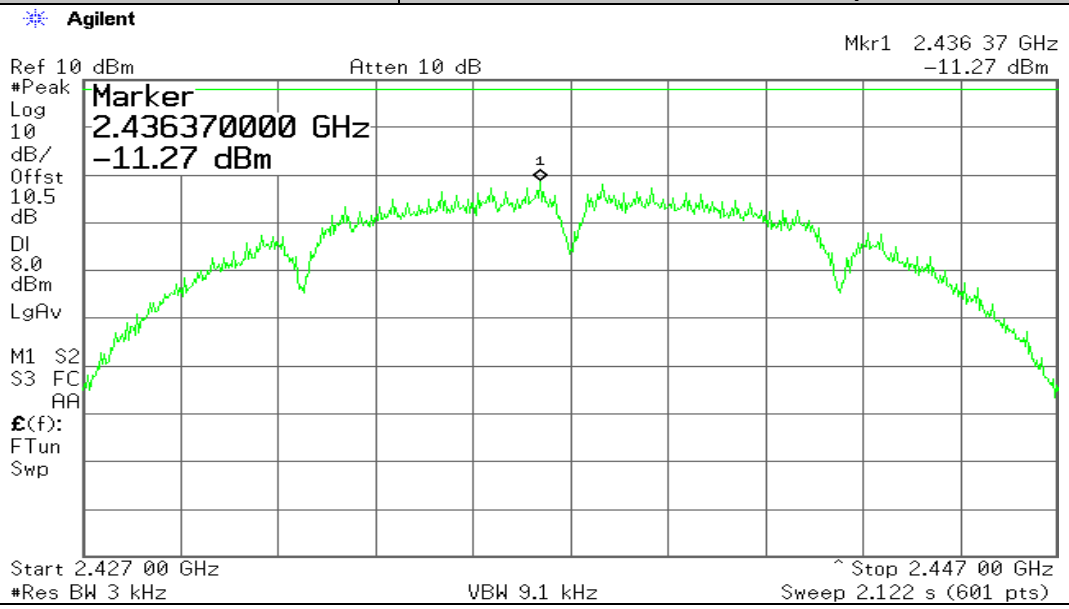
Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Limit (dBm/3KHz)	Margin (dB)
Low	2412	-24.21	8	-32.21
Middle	2437	-23.84	8	-31.84
High	2462	-24.52	8	-32.52

PEAK POWER SPECTRAL DENSITY

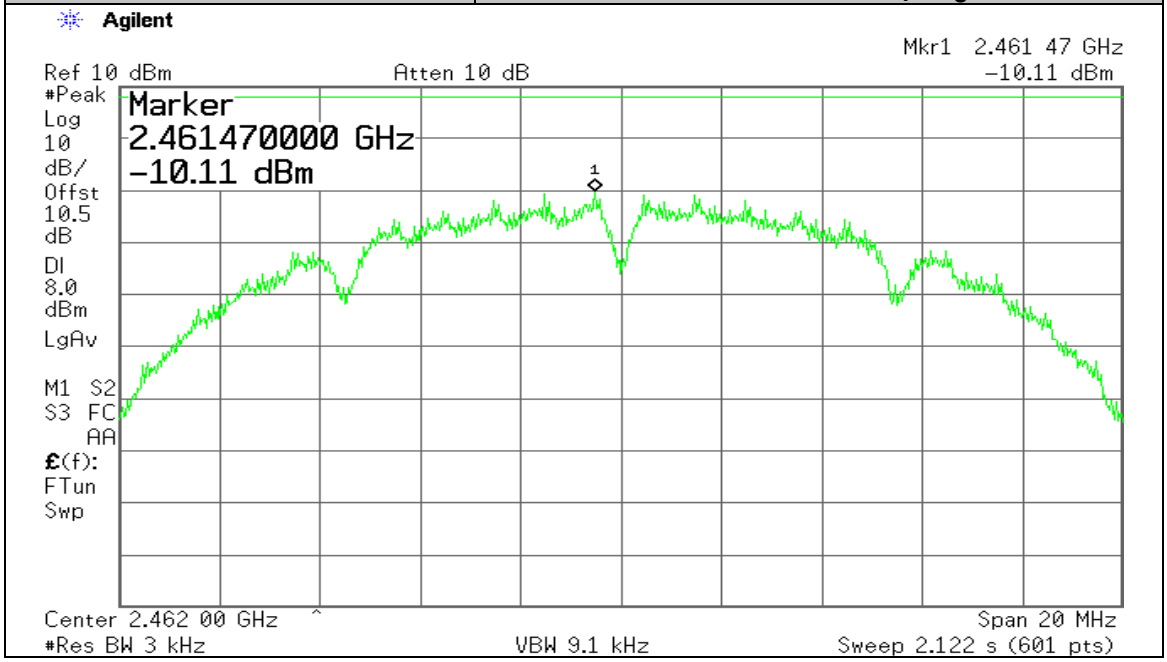
Plot Name:	POWER SPECTRAL DENSITY Mode No 1. 802.11b, Low CH



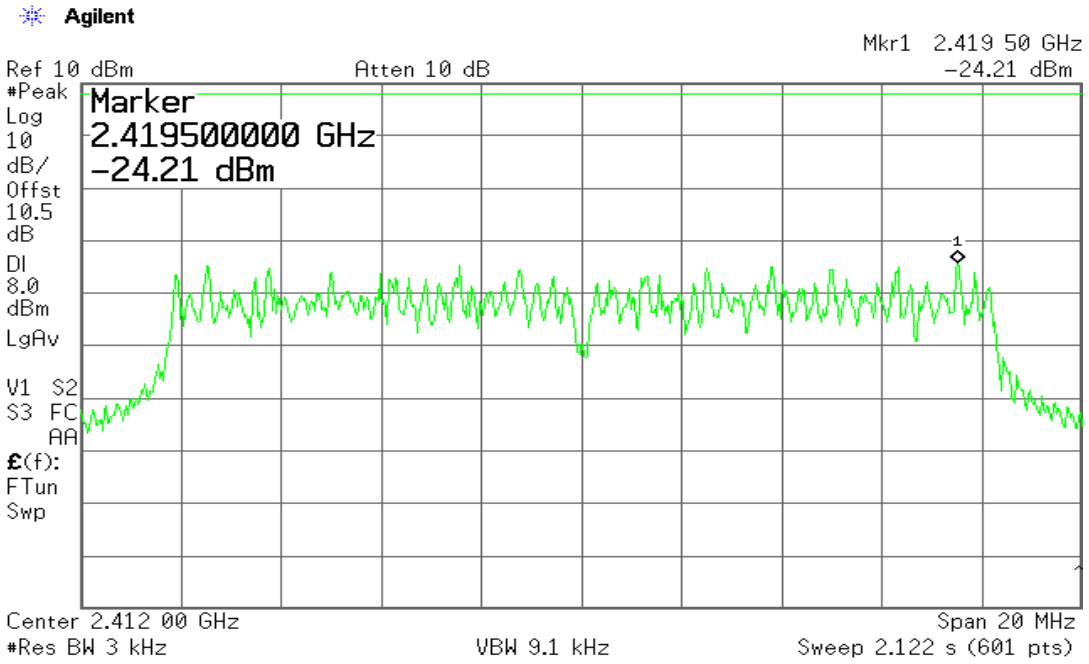
Plot Name:	POWER SPECTRAL DENSITY Mode No 1. 802.11b, Mid CH



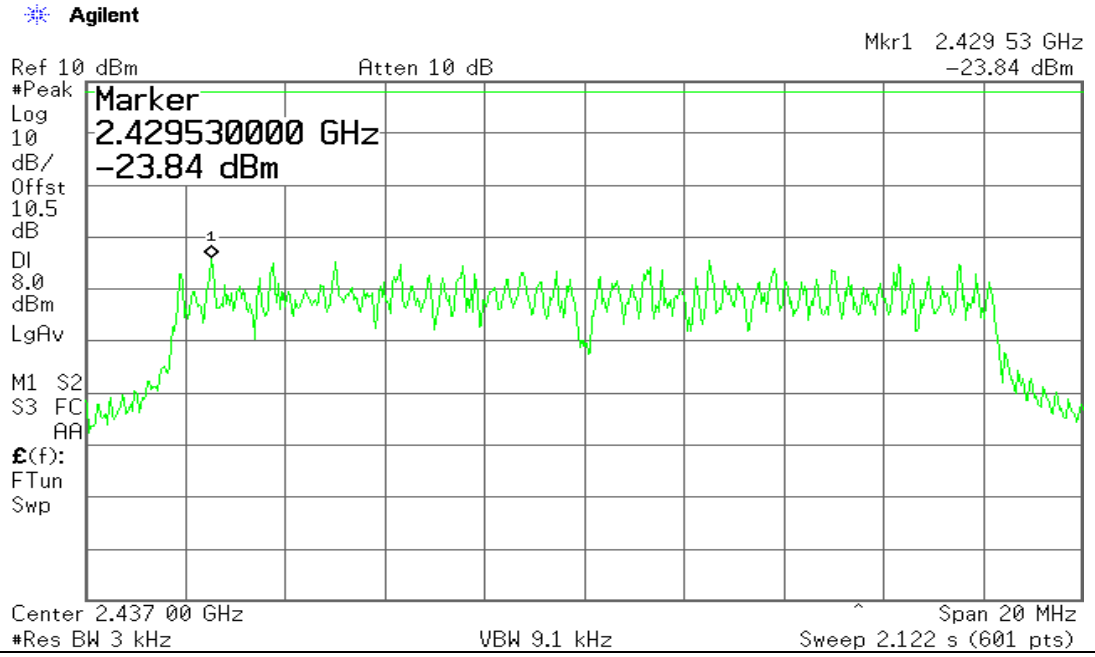
Plot Name:	POWER SPECTRAL DENSITY Mode No 1. 802.11b, High CH



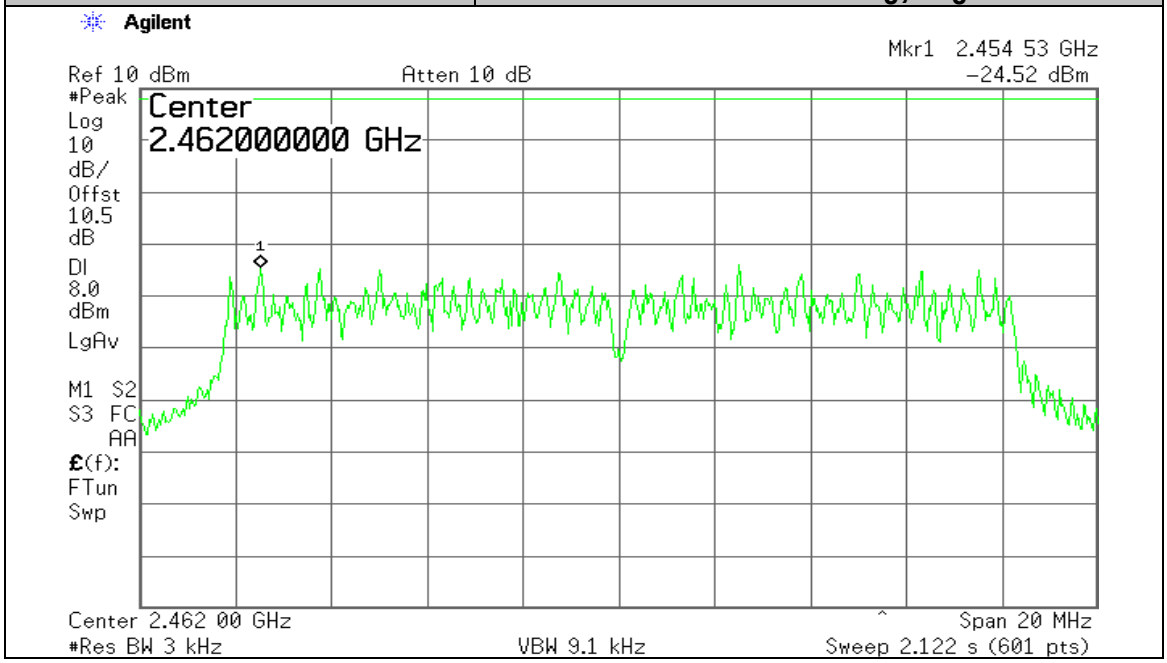
Plot Name:	POWER SPECTRAL DENSITY Mode No 2. 802.11g, Low CH



Plot Name:	POWER SPECTRAL DENSITY Mode No 2. 802.11g, Mid CH



Plot Name:	POWER SPECTRAL DENSITY Mode No 2. 802.11g, High CH



7.6 CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (d) & RSS- 247 Sec. 5.5

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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205 (a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE ***per FCC KDB 558074D01v05r02,***

A. Section 8.5 DTS emissions in non-restricted frequency bands following the methods in Subclause 11.11 of ANSI C63.10

Conducted Measurement Procedure for Maximum Unwanted Emissions into Non-Restricted Frequency Bands	**Applicable to this EUT**	
	Peak Power limit: (-20dB)	**Average Power Limit: (-30dB)**
ANSI C63.10, Sec.11.11.1-11.11.2 Measurement Procedure-Reference Level (RBW=100KHz, VBW=300KHz)	☐	☒
ANSI C63.10, Sec. 11.11.3 Measurement Procedure- Emission level*	☐ **preferred**	☒

* Different attenuation limit shall be used based on the measurement method of fundamental emission power and PSD.

B. Section 8.6 DTS emissions in restricted frequency bands following the methods in Subclause 11.12 of ANSI C63.10

Antenna-Port Conducted Measurement Procedure for Maximum Unwanted Emissions into Restricted Frequency Bands**	**Applicable to this EUT**
ANSI C63.10, Sec.11.12.2.3 CISPR Quasi-Peak Measurement (CISPR 16)	☐
ANSI C63.10, Sec.11.12.2.4 Peak Power Measurement	☐
ANSI C63.10, Sec.11.12.2.5 Average Power Measurement (three options)***	☐

** To use this conducted testing method, per 12.2.2-12.2.6, the followings shall be taken as consideration:

1. Proper RBW and detector, per 15.35 a/b, shall be chosen in different frequency ranges;
2. **Maximum transmitter antenna gain (no less than 2dBi), G, shall be added to the measured power level to determine the EIRP;**
3. **Appropriate factor, A, shall be added to model worst case ground reflections: 6.0dB (f≤30MHz) and 4.7dB (f≤30 to 1000MHz)**
4. **Electric field strength can be obtained from the equation: E= EIRP-20log(d)+104.8+G (or 2.0) +A; Then compare to applicable limit;**
5. Unwanted emissions from EUT cabinet or casing shall be measured via radiated emission test method per C63.10 (in this case, the antenna port may be terminated properly).
6. Absolute peak power limit of -21.2dBm within the unwanted emission bandwidth shall be used for meeting 15.35(b) requirement;
7. Per 15.35(c), for pulse operation, Duty Cycle factor reduction can be applied for unwanted emissions that have the same pulse characteristics as does the fundamental emissions (such as harmonics) pulse operation

*** EUT shall be configured to transmit continuously (min. 98% duty cycle at full power). The spectrum analyzer shall be set for bin-to-bin spacing ≤RBW/2.

C. ***Section 8.7 DTS band-edge emission measurements following the methods in Subclause 11.13 of ANSI C63.10***

Conducted Band-edge measurements	**Applicable to this EUT**
ANSI C63.10, Sec.11.13.2 Band-Edge Marker-Delta Method (per ANSI C63.10, Sec. 6.10.6) (within 2MHz)	☐
ANSI C63.10, Sec. 11.13.3.2~5 Band-Edge Integration Method (peak / average)	☒

RESULTS

Complied with 30dBc attenuation requirement.

Data Summary:

Mode No.1 802.11 b

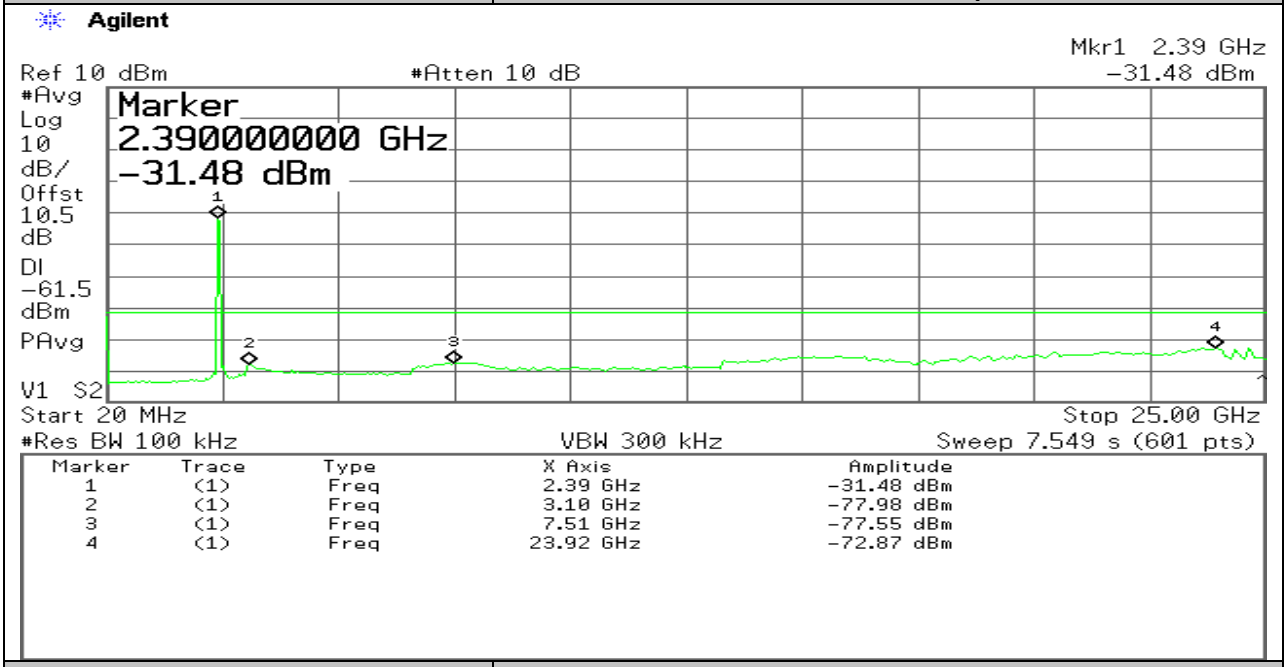
Channel	**Frequency (MHz)**	**PSD Reference Level (dBm)**	**Max. Emission Level (dBm)**	**Attenuation (dBc)**
Low	2412	-31.48	-72.87	-41.39
Middle	2437	-31.00	-72.78	-41.78
High	2462	-31.42	-72.94	-41.52

Mode No.1 802.11 g

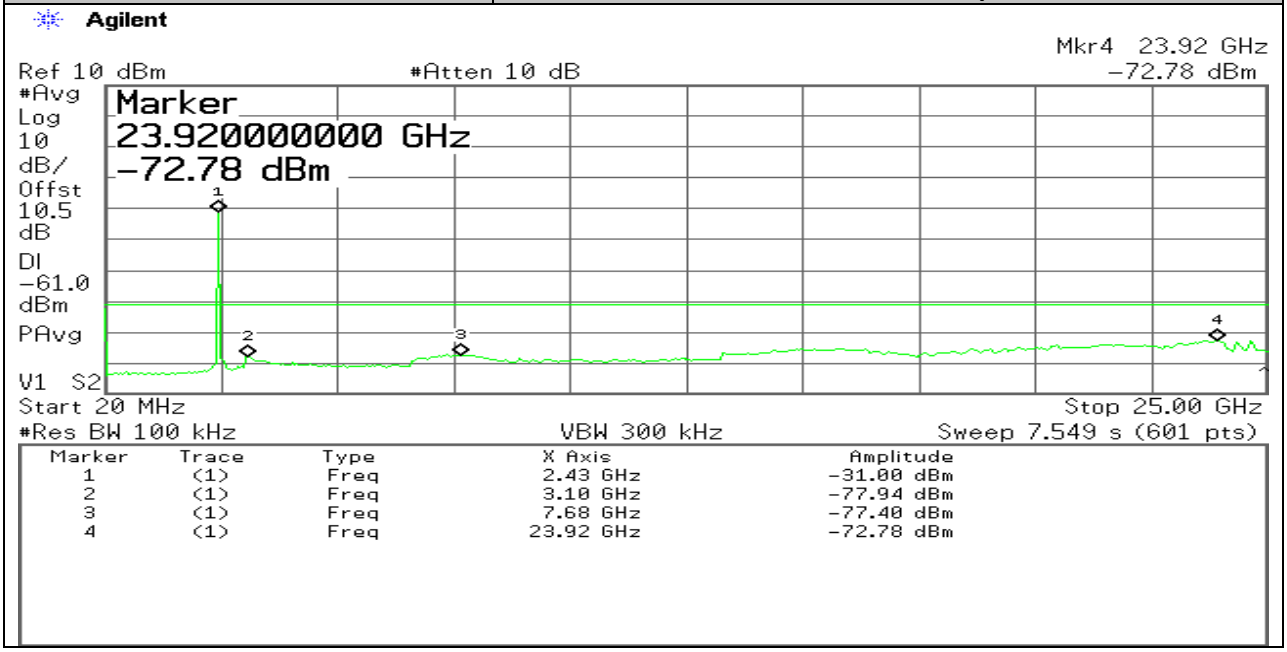
Channel	**Frequency (MHz)**	**PSD Reference Level (dBm)**	**Max. Emission Level (dBm)**	**Attenuation (dBc)**
Low	2412	-18.18	-69.35	-51.17
Middle	2437	-17.39	-71.23	-53.84
High	2462	-17.29	-71.33	-54.04

Unwanted Out-of-band Spurious via Conducted Measurement:

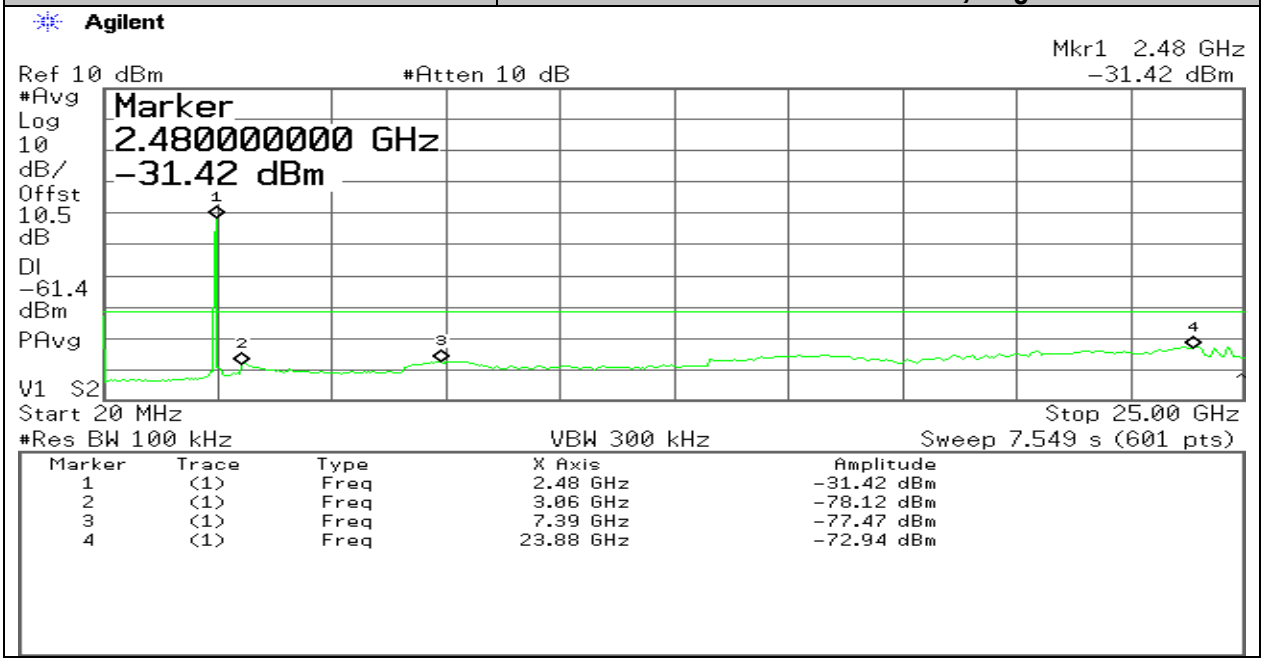
Plot Name:	CONDUCTED SPURIOUS Mode No 1. 802.11b, Low CH



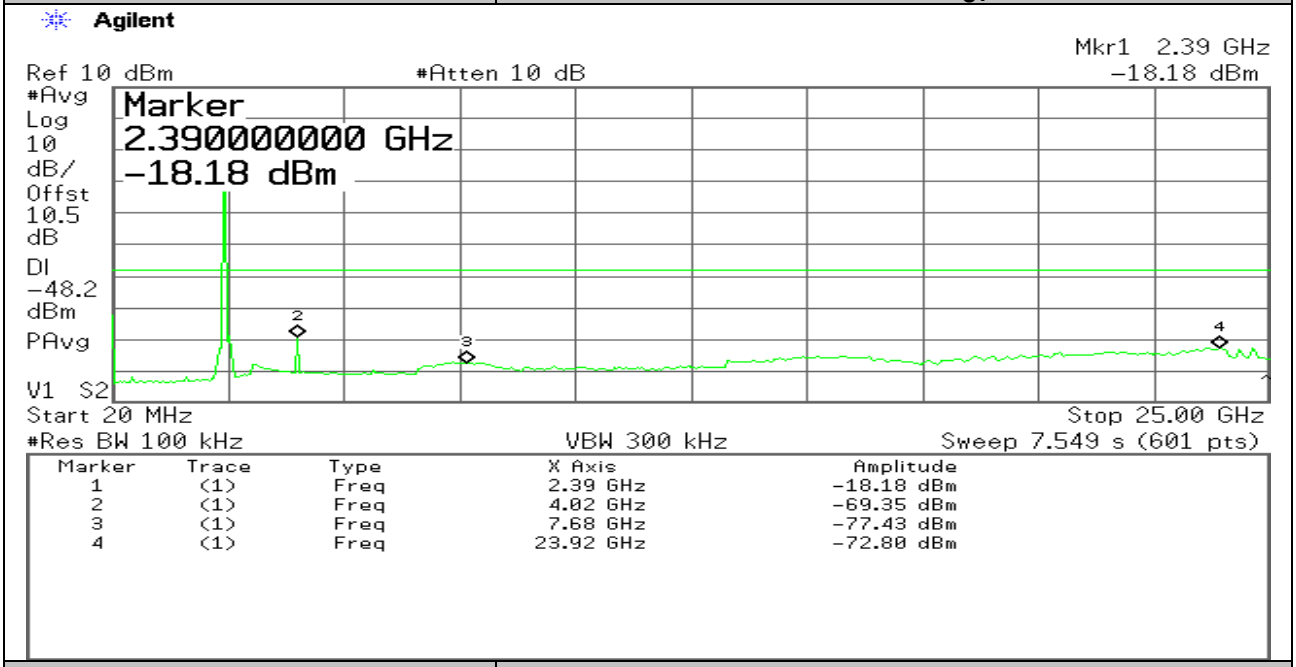
Plot Name:	CONDUCTED SPURIOUS Mode No 1. 802.11b, Mid CH



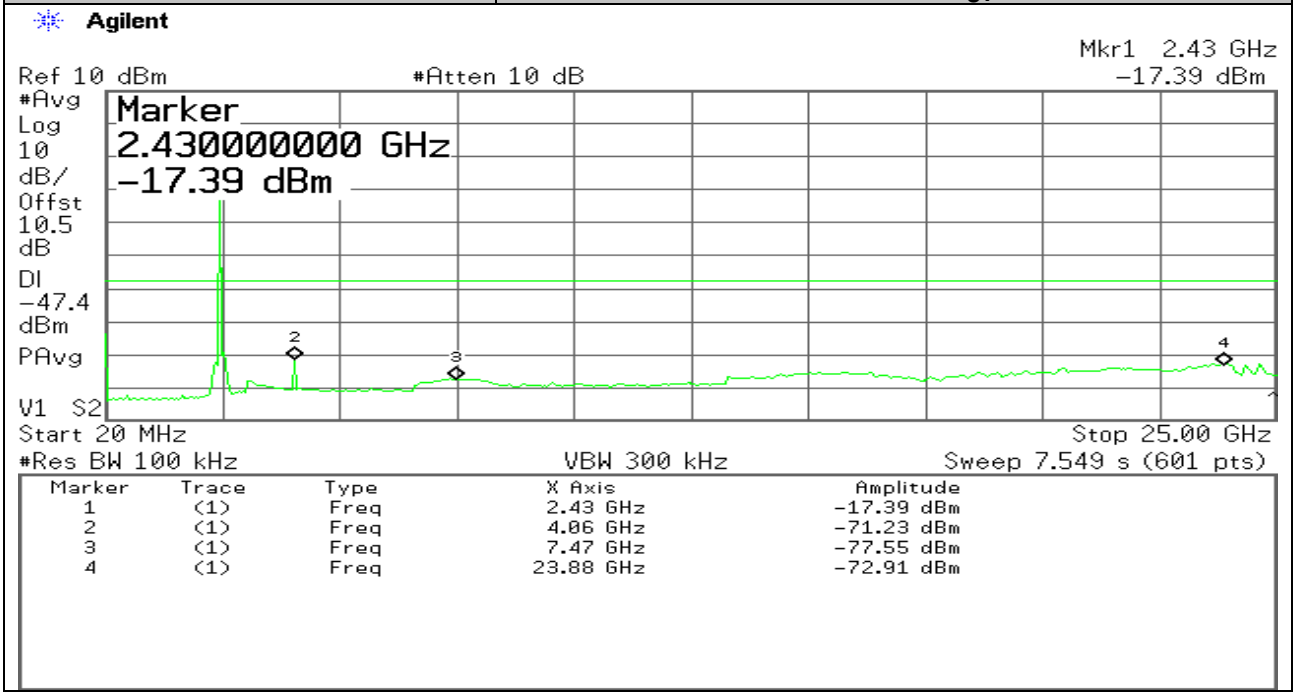
Plot Name:	CONDUCTED SPURIOUS Mode No 1. 802.11b, High CH



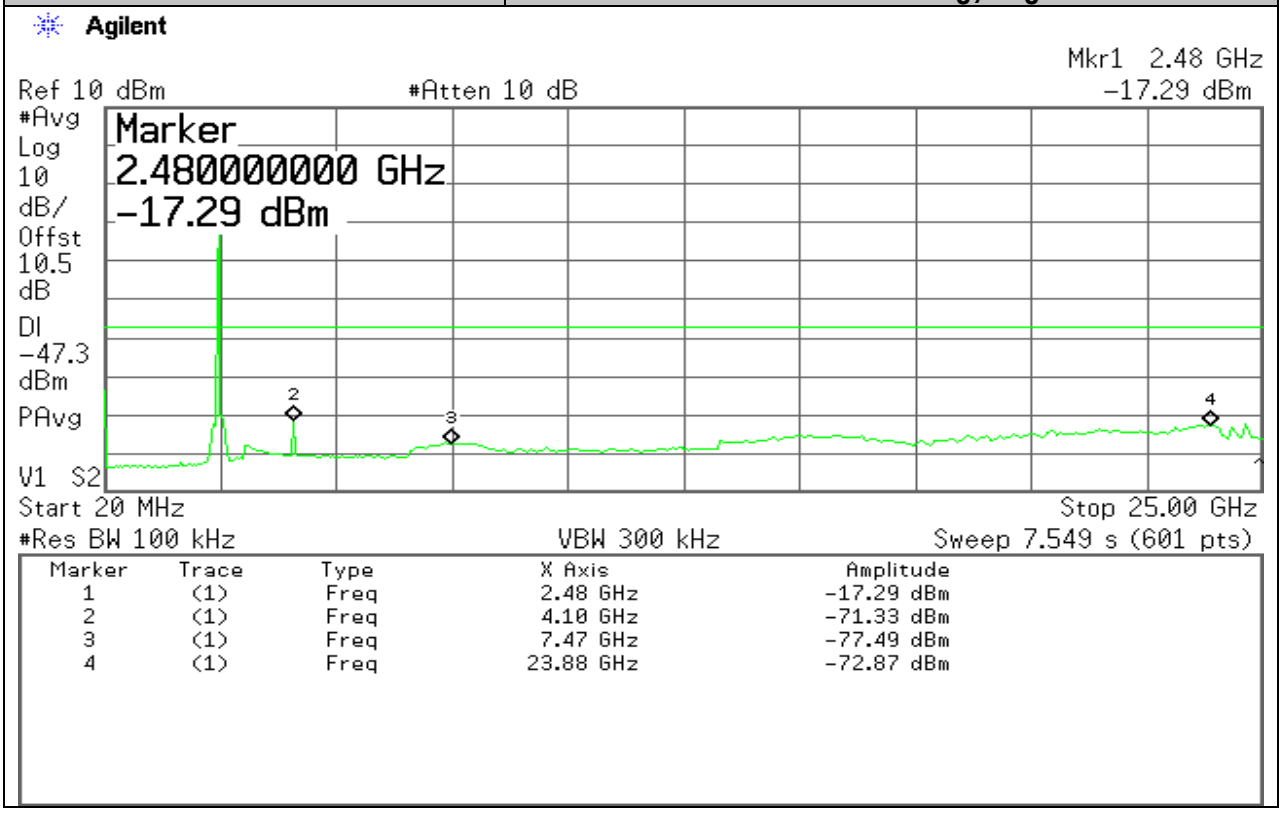
Plot Name:	CONDUCTED SPURIOUS Mode No 2. 802.11g, Low CH



Plot Name:	CONDUCTED SPURIOUS Mode No 2. 802.11g, Mid CH

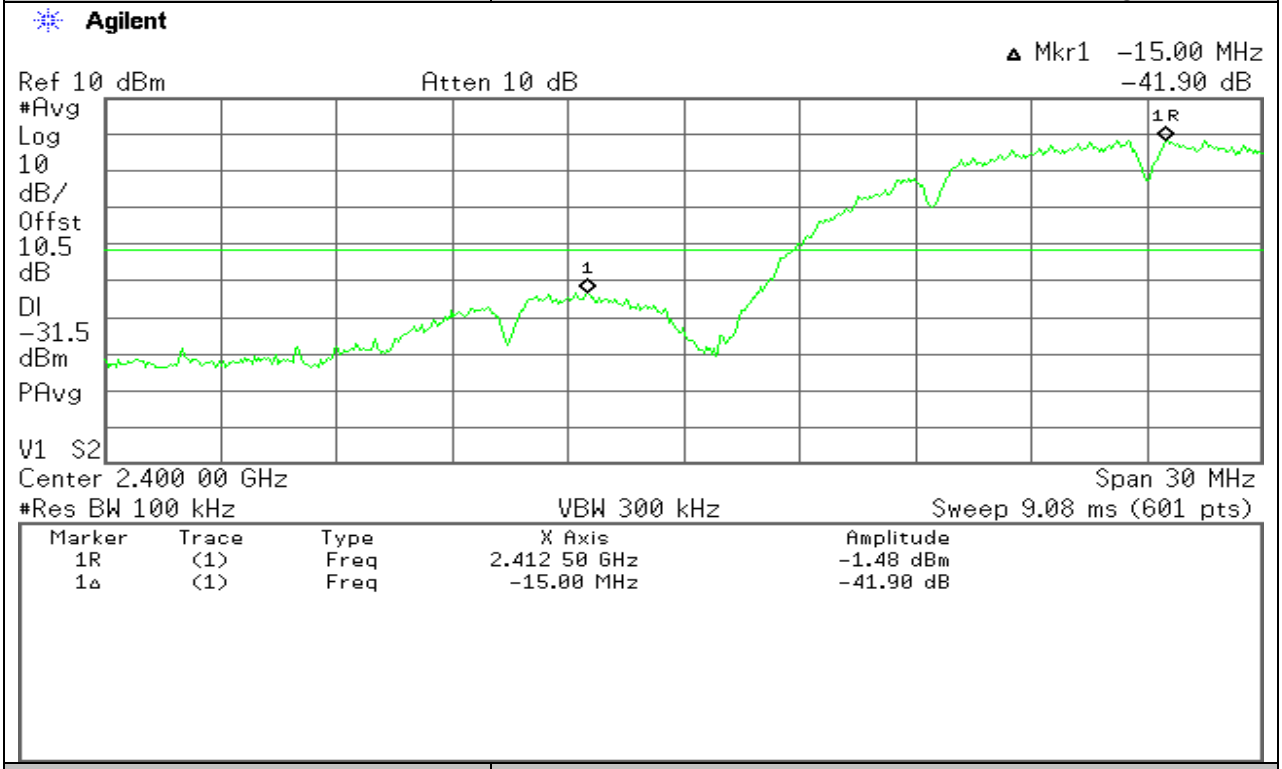


Plot Name:	CONDUCTED SPURIOUS Mode No 2. 802.11g, High CH

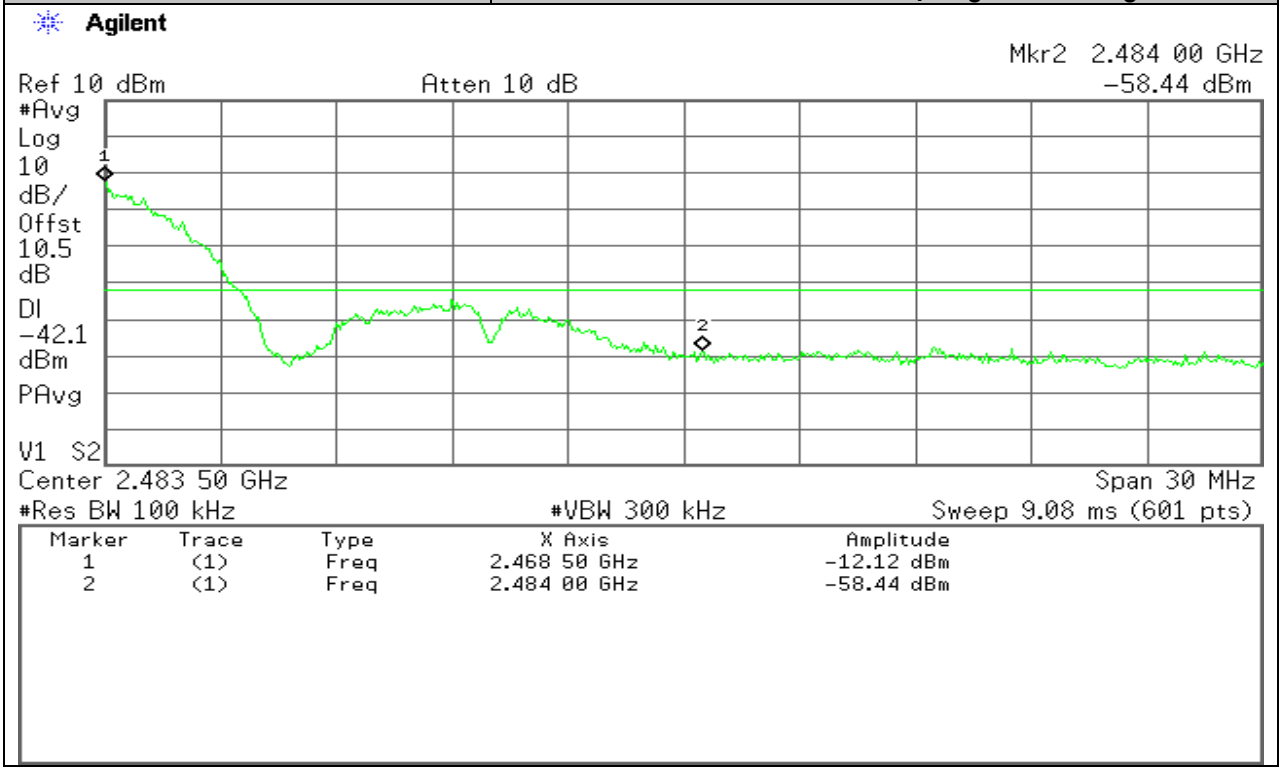


Bandedge Spurious via Conducted Measurement:

Plot Name:	CONDUCTED BANDEGE Mode No 1. 802.11b, Low Bandedge

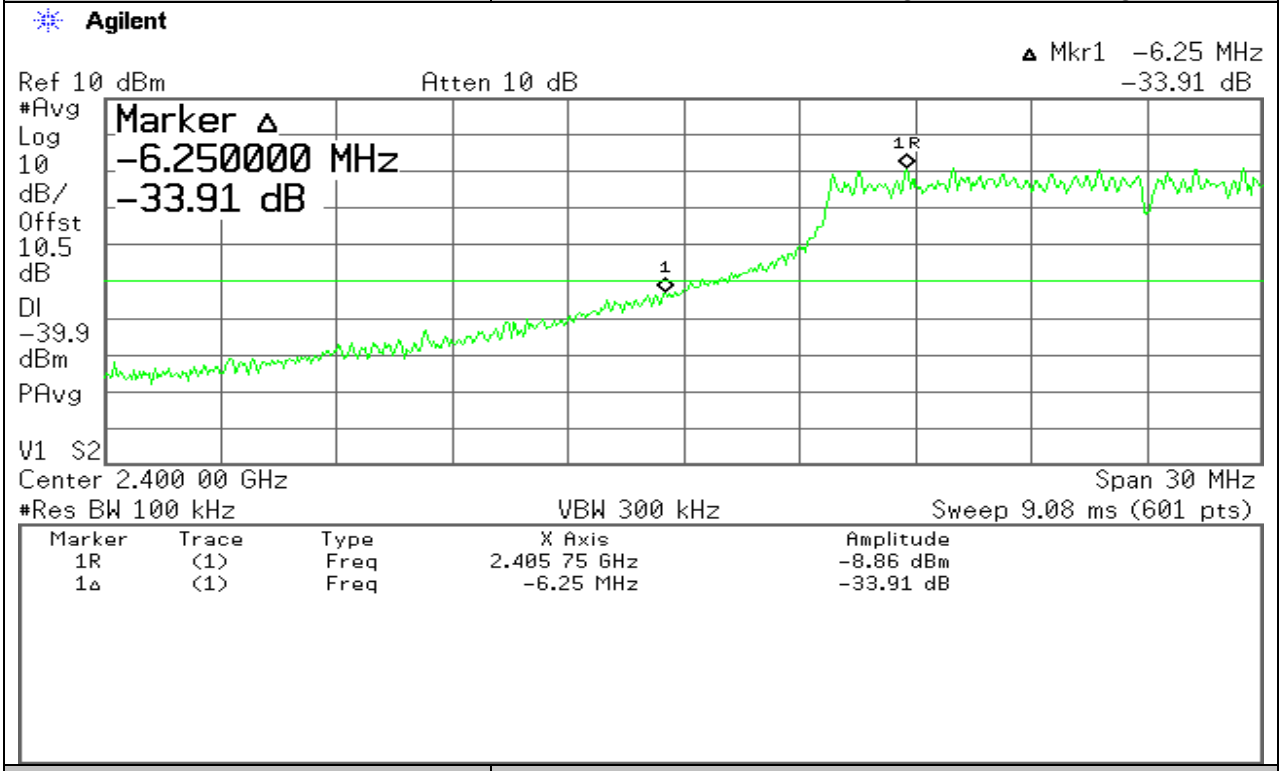


Plot Name:	CONDUCTED BANDEGE Mode No 1. 802.11b, High Bandedge

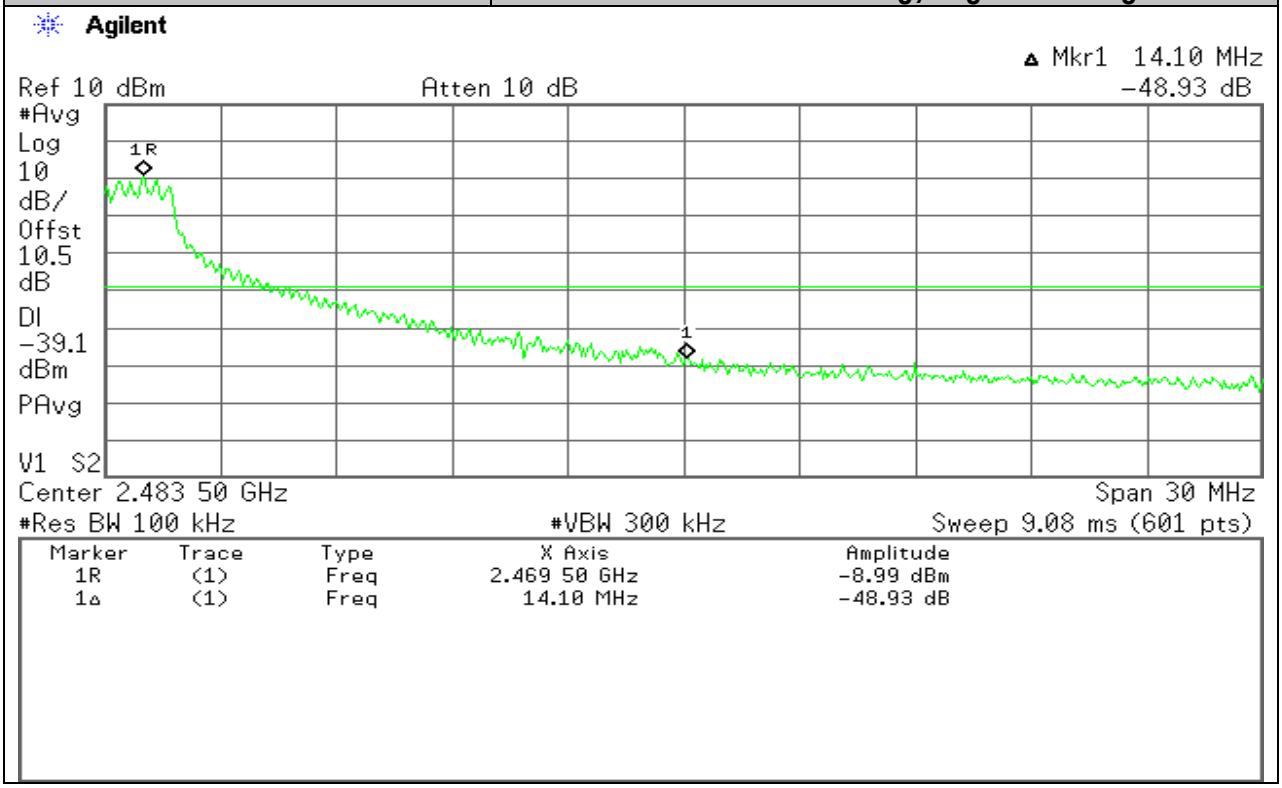


Bandedge Spurious via Conducted Measurement:

Plot Name:	CONDUCTED SPURIOUS & BANDEGE Mode No 2. 802.11g, Low Bandedge



Plot Name:	CONDUCTED BANDEGE Mode No 2. 802.11g, High Bandedge



7.7 RADIATED EMISSIONS

7.7.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) RSS-102 Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHZ	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1] 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts /meter	Measurement Distance (meters)
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode. Established procedures in C63.10 for performing radiated measurements shall be used. For cabinet emission measurements, the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. EUT was tested with applicable orientations.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The radio spectrum was investigated from the lowest frequency generated within the device (without going below 9 kHz) up to the 10^{th} harmonic of the rated transmitted emission. The emissions are investigated with the transmitter set to the lowest, middle, and highest channels.

The emissions are investigated with the transmitter set to the lowest, middle, and highest channels, if applicable. The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

RESULTS

No non-compliance noted.

7.7.2. TRANSMITTER RADIATED EMISSIONS DATA

(HARMONICS & SPURIOUS falling in restricted bands listed in Sec.15.205 and non-restricted bands *)

Operation Mode1: 802.11b

Low Channel(2412MHz) Harmonics/Spurious

Freq. (MHz)	Position (H,V) X	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4824	H,X	3		46.7	43.1	74	54	-27.3	-10.9
7236	H,X	3		-	-	74	54		
4824	V,X	3		45.5	42.8	74	54	-28.5	-11.2
7236	V,X	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Y	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4824	H,Y	3		46.5	43.0	74	54	-27.5	-11.0
7236	H,Y	3		-	-	74	54		
4824	V,Y	3		45.3	42.7	74	54	-28.7	-11.3
7236	V,Y	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Z	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4824	H,Z	3		45.3	42.8	74	54	-28.7	-11.2
7236	H,Z	3		-	-	74	54		
4824	V,Z	3		47.5	43.6	74	54	-26.5	-10.4
7236	V,Z	3		-	-	74	54		

Middle Channel(2437MHz) Harmonics/Spurious

Freq. (MHz)	Position (H,V) X	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4874	H,X	3		47.1	43.2	74	54	-26.9	-10.8
7311	H,X	3		-	-	74	54		
4874	V,X	3		47.6	43.4	74	54	-26.4	-10.6
7311	V,X	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Y	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4874	H,Y	3		47.3	43.3	74	54	-26.7	-10.7
7311	H,Y	3		-	-	74	54		
4874	V,Y	3		47.5	43.6	74	54	-26.5	-10.4
7311	V,Y	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Z	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4874	H,Z	3		47.5	44.7	74	54	-26.5	-9.3
7311	H,Z	3		-	-	74	54		
4874	V,Z	3		47.6	44.8	74	54	-26.4	-9.2
7311	V,Z	3		-	-	74	54		

High Channel(2462MHz) Harmonics/Spurious

Freq. (MHz)	Position (H,V) X	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4924	H,X	3		45.8	42.7	74	54	-28.2	-11.3
7386	H,X	3		-	-	74	54		
4924	V,X	3		46.5	43.8	74	54	-27.5	-10.2
7386	V,X	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Y	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4924	H,Y	3		45.7	42.6	74	54	-28.3	-11.4
7386	H,Y	3		-	-	74	54		
4924	V,Y	3		47.5	44.6	74	54	-26.5	-9.4
7386	V,Y	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Z	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4924	H,Z	3		47.1	45.0	74	54	-26.9	-9.0
7386	H,Z	3		-	-	74	54		
4924	V,Z	3		49.1	46.8	74	54	-24.9	-7.2
7386	V,Z	3		-	-	74	54		

* Data shown above represents the worst case in all applicable EUT orientations. No other significant emissions were found in the rest frequency range. For spurious in restricted band, the limit is per 15.209 & RSS-Gen. For the others, by measuring the field strength of fundamental (peak) with 100KHz RBW, the limit is 20dB below that level (here it is higher than the limit in 15.209 & RSS-Gen). In this case, all non-fundamental emission points are below 15.209 & RSS-Gen limit, so there is NO additional concern for non-restriction band limit compliance.

Operation Mode 2: 802.11g

Low Channel(2412MHz) Harmonics/Spurious

Freq. (MHz)	Position (H,V) X	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4824	H,X	3		43.7	37.1	74	54	-30.3	-16.9
7236	H,X	3		-	-	74	54		
4824	V,X	3		42.5	36.8	74	54	-31.5	-17.2
7236	V,X	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Y	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4824	H,Y	3		43.5	37.0	74	54	-30.5	-17.0
7236	H,Y	3		-	-	74	54		
4824	V,Y	3		42.3	36.7	74	54	-31.7	-17.3
7236	V,Y	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Z	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4824	H,Z	3		42.3	36.8	74	54	-31.7	-17.2
7236	H,Z	3		-	-	74	54		
4824	V,Z	3		44.5	37.6	74	54	-29.5	-16.4
7236	V,Z	3		-	-	74	54		

Middle Channel(2437MHz) Harmonics/Spurious

Freq. (MHz)	Position (H,V) X	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4874	H,X	3		44.1	37.2	74	54	-29.9	-16.8
7311	H,X	3				74	54		
4874	V,X	3		44.6	37.4	74	54	-29.4	-16.6
7311	V,X	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Y	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4874	H,Y	3		44.3	37.3	74	54	-29.7	-16.7
7311	H,Y	3				74	54		
4874	V,Y	3		44.5	37.6	74	54	-29.5	-16.4
7311	V,Y	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Z	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4874	H,Z	3		44.5	38.7	74	54	-29.5	-15.3
7311	H,Z	3				74	54		
4874	V,Z	3		44.6	38.8	74	54	-29.4	-15.2
7311	V,Z	3		-	-	74	54		

High Channel(2462MHz) Harmonics/Spurious

Freq. (MHz)	Position (H,V) X	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4924	H,X	3		42.8	36.7	74	54	-31.2	-17.3
7386	H,X	3				74	54		
4924	V,X	3		43.5	37.8	74	54	-30.5	-16.2
7386	V,X	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Y	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4924	H,Y	3		42.7	36.6	74	54	-31.3	-17.4
7386	H,Y	3				74	54		
4924	V,Y	3		44.5	38.6	74	54	-29.5	-15.4
7386	V,Y	3		-	-	74	54		

Freq. (MHz)	Position (H,V) Z	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	Avg@3m (dBuV/m)	PK Lim (dBuV/m)	QP/Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP/Avg.Mar. (dBuV/m)
4924	H,Z	3		44.1	39.0	74	54	-29.9	-15.0
7386	H,Z	3				74	54		
4924	V,Z	3		46.1	40.8	74	54	-27.9	-13.2
7386	V,Z	3		-	-	74	54		

* Data shown above represents the worst case in all applicable EUT orientations. No other significant emissions were found in the rest frequency range. For spurious in restricted band, the limit is per 15.209 & RSS-Gen. For the others, by measuring the field strength of fundamental (peak) with 100KHz RBW, the limit is 20dB below that level (here it is higher than the limit in 15.209 & RSS-Gen). In this case, all non-fundamental emission points are below 15.209 & RSS-Gen limit, so there is NO additional concern for non-restriction band limit compliance.

Band Edge Data for EUT

In addition, the band-edge requirements are also verified.

Testing procedure per KDB 558074D01:

The measurement of unwanted emissions at the edge of the authorized frequency bands can be complicated by the capture of RF energy from the fundamental emission within the RBW passband. The following techniques are permitted for use in performing a measurement of the unwanted emission level at the band edges.

10.2.5.1 Marker-Delta Method

The marker-delta method, as described in KDB 913591 and in C63.10, can be used to perform measurements of the unwanted emissions level at the band-edges.

10.2.5.2 Integrated Power Measurement

A narrower resolution bandwidth can be used at the band edge to improve the measurement accuracy provided that the measurement is subsequently integrated to the relevant bandwidth specification (e.g., 100 kHz within non-restricted bands and 1 MHz within restricted frequency bands).

Results:

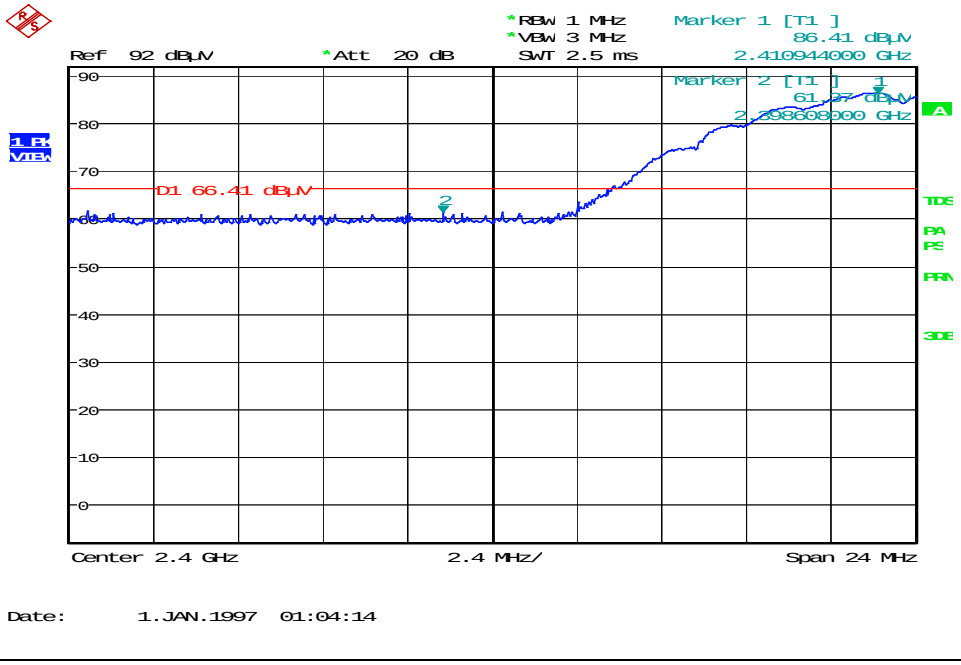
The testing results for worst case based on pretesting results are shown as following and comply with the band-edge requirements for 2400-2483.5MHz DTS per FCC Part 15.247. EUT antenna with max gain was used for this testing.

- H=Measurement antenna horizontal position
- V= Measurement antenna vertical position
- Using conventional manner for measuring the radiated emissions that are removed by more than two measurement bandwidths from band-edge, such as the emissions in the restricted band 2310-2390MHz & 2483.5-2500MHz, etc.
- Using conventional manner or if needed, using “delta” measurement technique for measuring the radiated emissions that are up to two measurement bandwidths removed from band-edge, such as the restricted band that begins at 2483.5MHz.
- The worst case for different EUT orientations was chosen for final data collection based on pre-scan testing results.

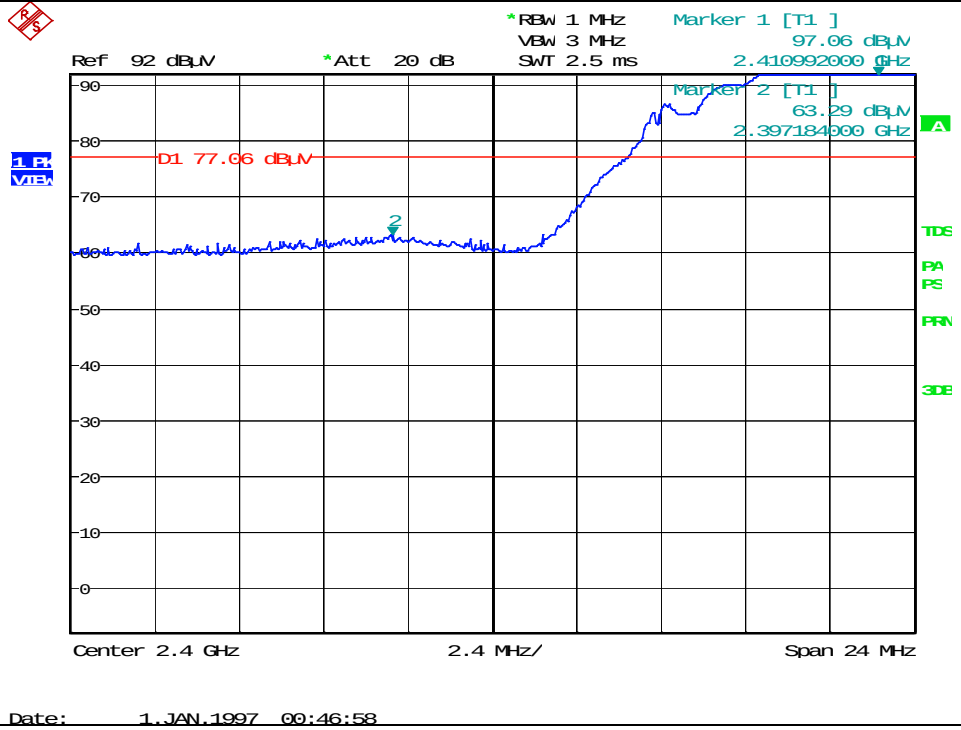
The following plots show the band edge spurious with the worst case based on pre scans. All results are below the limit in FCC 15.247, 15.209 & RSS-247, RSS-Gen.

Mode No.1 802.11b

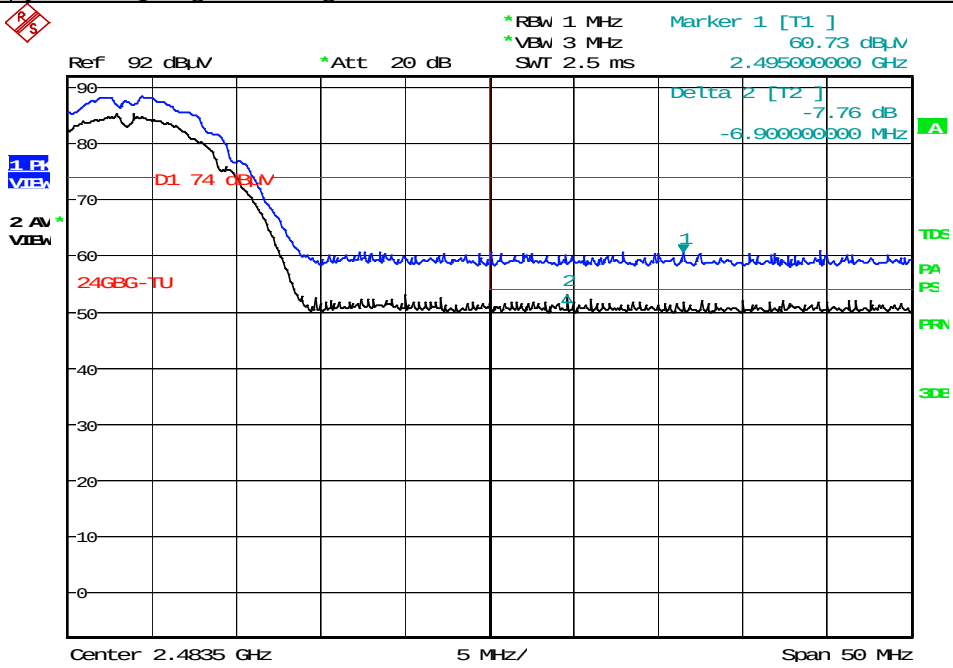
Band-Edge Radiated Emissions for Mode 1: 802.11 b @ low End, Worst (Peak)purious @ Lower Band-edge_Horizontal



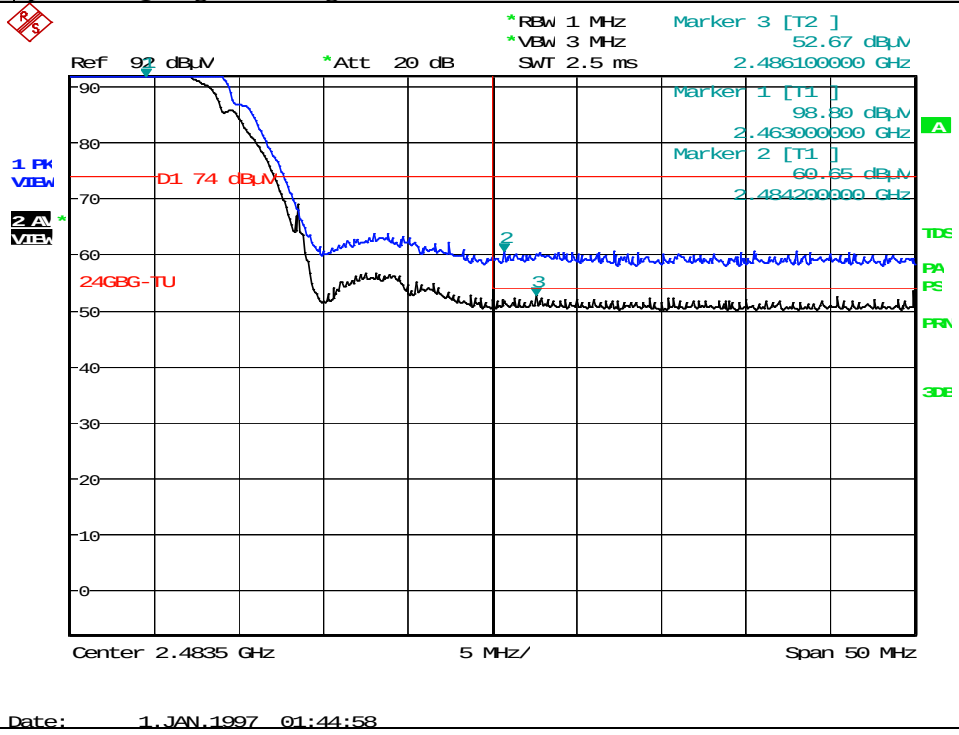
Band-Edge Radiated Emissions for Mode 1: 802.11 b @ low End, Worst (Peak) purious @ Lower Band-edge. Vertical



Band-Edge Radiated Emissions for Mode 1: 802.11 b @ High End, Worst (Peak) purious @ High Band-edge. Horizontal

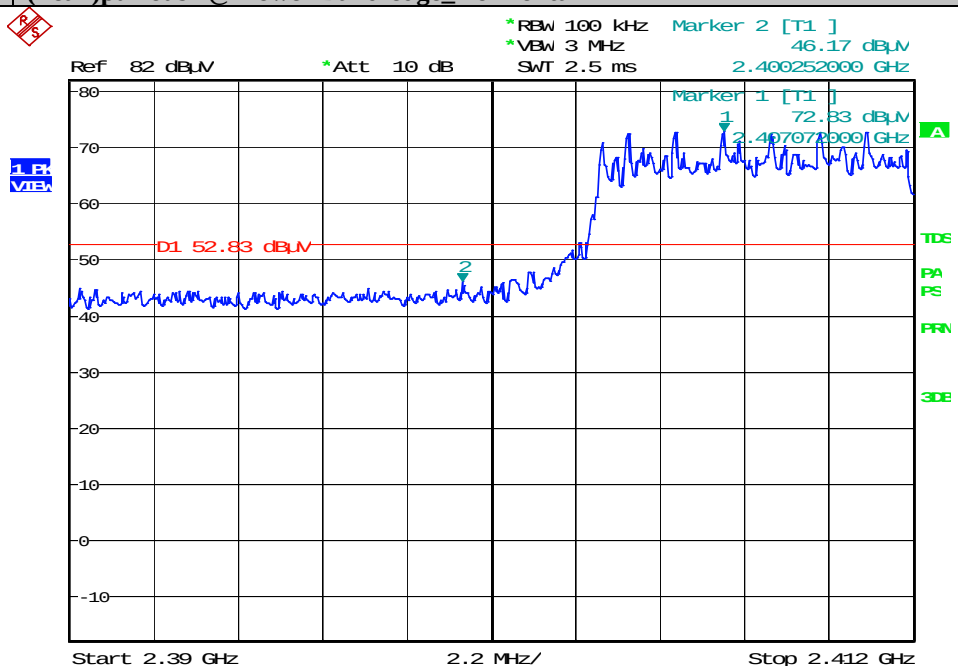


Band-Edge Radiated Emissions for Mode 1: 802.11 b @ High End, Worst (Peak) purious @ High Band-edge. Vertical

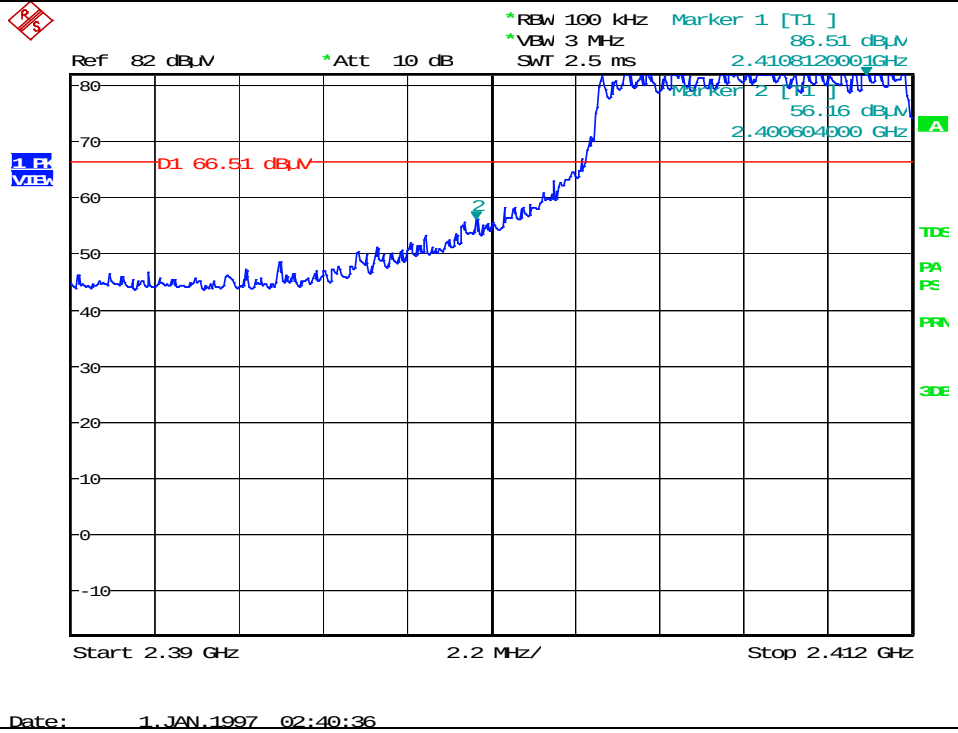


Mode No.2 802.11g

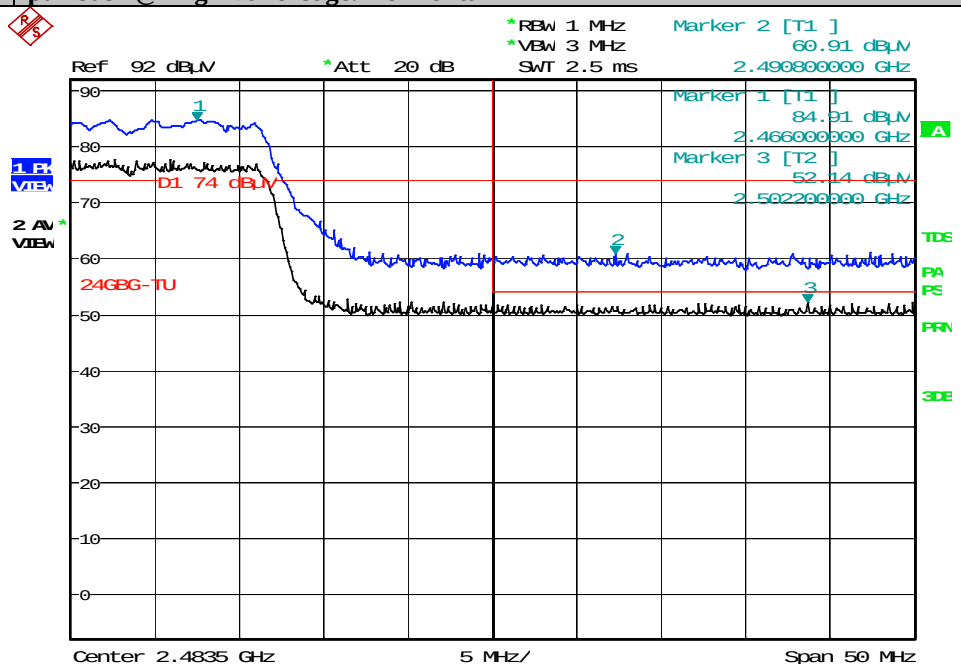
Band-Edge Radiated Emissions for Mode 2: 802.11 g @ low End, Worst (Peak)purious @ Lower Band-edge_Horizontal



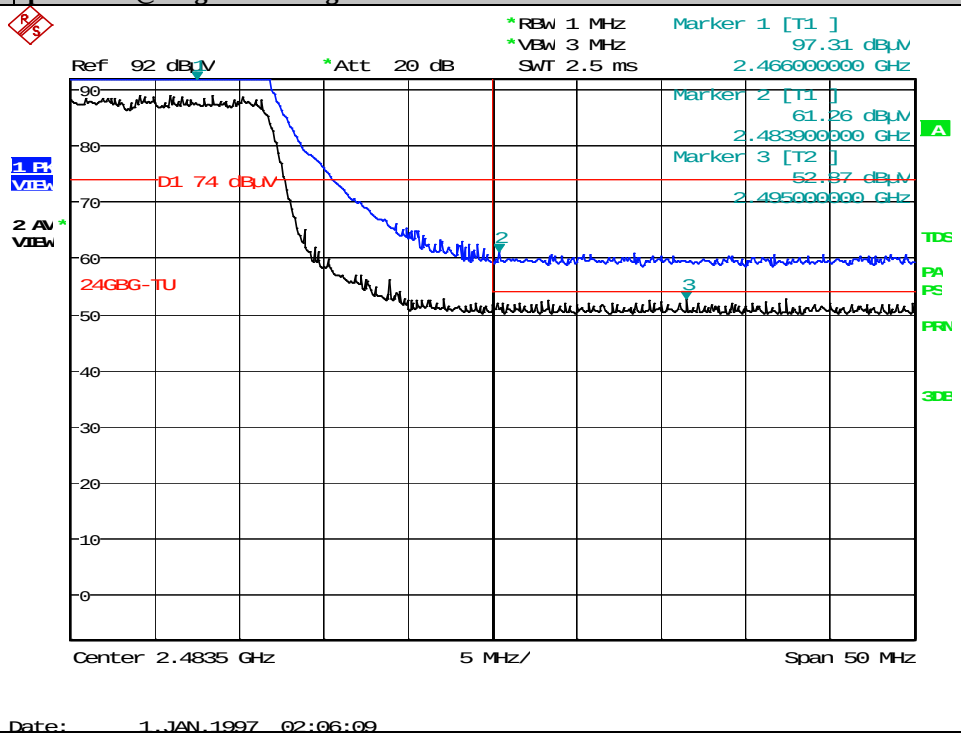
Band-Edge Radiated Emissions for Mode 2: 802.11 g @ low End, Worst (Peak) purious @ Lower Band-edge. Vertical



Band-Edge Radiated Emissions for Mode 2: 802.11 g @ High End, Worst (Peak) purious @ High Band-edge. Horizontal



Band-Edge Radiated Emissions for Mode 2: 802.11 g @ High End, Worst (Peak) purious @ High Band-edge. Vertical



7.7.3 Radiated Test Data for Receiving Mode (worst case)

Mode No.1 802.11b

Frequency (MHz)	Polarity (V,H) Position (X,Y,Z)	Antenna Height (m)	Azimuth (Degree)	Peak Reading at 3m (2) (dBuV/m)	Peak Reading After Correction (dBuV/m)	FCC/IC 3m Limit (1) (dBuV/m)	Difference (dBuV/m)
36.8	H/Z	1.8	235	33.1		40.0	-6.9
148.6	H/Z	1.8	135	36.6		43.5	-6.9
158.4	H/Z	1.8	135	37.5		43.5	-6
173.2	H/Z	1.8	240	37.8		43.5	-5.7
430	H/Z	1.1	240	34.7		46.5	-11.8
510	H/Z	1.1	180	35.4		46.5	-11.1
740	H/Z	1.0	180	39.0		46.5	-7.5
800	H/Z	1.0	180	41.4		46.5	-5.1
89.1	V/Z	1.2	045	31.9		43.5	-11.6
128.6	V/Z	1.1	045	34.1		43.5	-9.4
156.2	V/Z	1.1	045	37.1		43.5	-6.4
167.3	V/Z	1.1	090	37.2		43.5	-6.3
500	V/Z	1.1	235	35.7		46.5	-10.8
610	V/Z	1.1	135	37.3		46.5	-9.2
740	V/Z	1.1	090	38.8		46.5	-7.7
880	V/Z	1.1	090	41.2		46.5	-5.3

(1) Receiving mode spurious emissions shall be lower than the limit defined in FCC Sec. 15.209 & IC RSS-GEN.
(2) If the peak reading is less than the FCC/IC quasi-peak or average limit, it'll be not necessary to show the measured/ calculated quasi-peak or average reading.