

# FCC DTS REPORT

## Certification

<b>Applicant Name:</b> SAMSUNG Electronics Co., Ltd.	<b>Date of Issue:</b> May 17, 2023
<b>Address:</b> 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea	<b>Test Site/Location:</b> 74, Seoicheon-ro 578 beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
	<b>Report No.:</b> HCT-RF-2305-FC043-R1

<b>FCC ID:</b>	<b>A3LSMX818U</b>
<b>APPLICANT:</b>	<b>SAMSUNG Electronics Co., Ltd.</b>

<b>Model:</b>	SM-X818U
<b>EUT Type:</b>	Tablet
<b>Average Output Power:</b>	802.11b : 18.45 dBm
	SISO : 802.11g : 17.27 dBm
	802.11n(HT20) : 17.15 dBm
	MIMO : 802.11b : 21.23 dBm
	802.11g : 20.13 dBm
	802.11n(HT20) : 19.97 dBm
<b>Frequency Range:</b>	2 412 MHz ~ 2 462 MHz
<b>Modulation type:</b>	CCK/DSSS/OFDM
<b>FCC Classification:</b>	Digital Transmission System(DTS)
<b>FCC Rule Part(s):</b>	Part 15.247

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

Report No.: HCT-RF-2305-FC043-R1

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REVIEWED BY



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Report prepared by : Jin Gwan Lee  
Engineer of Telecommunication Testing Center

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Report approved by : Jong Seok Lee  
Manager of Telecommunication Testing Center

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked \*.

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

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## Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2305-FC043	May 09, 2023	- First Approval Report
HCT-RF-2305-FC043-R1	May 17, 2023	- Page 26, Revised worst case & RSDB Scenario table 1-3.

# Table of Contents

REVIEWED BY .....	2
1. EUT DESCRIPTION .....	5
ANTENNA CONFIGURATIONS .....	6
2. TEST METHODOLOGY .....	8
EUT CONFIGURATION .....	8
EUT EXERCISE .....	8
GENERAL TEST PROCEDURES .....	8
DESCRIPTION OF TEST MODES .....	8
3. INSTRUMENT CALIBRATION.....	9
4. FACILITIES AND ACCREDITATIONS .....	9
FACILITIES .....	9
EQUIPMENT .....	9
5. ANTENNA REQUIREMENTS .....	10
6. MEASUREMENT UNCERTAINTY .....	10
7. DESCRIPTION OF TESTS.....	11
8. SUMMARY TEST OF RESULTS .....	28
9. TEST RESULT .....	29
9.1 DUTY CYCLE.....	29
9.2 6 dB BANDWIDTH .....	32
9.3 OUTPUT POWER .....	37
9.4 POWER SPECTRAL DENSITY .....	55
9.5 BAND EDGE / CONDUCTED SPURIOUS EMISSIONS.....	61
9.6 RADIATED SPURIOUS EMISSIONS .....	69
9.7 RADIATED RESTRICTED BAND EDGES .....	78
9.8 POWERLINE CONDUCTED EMISSIONS .....	82
9.9 CONFIRMATION OF GEO-LOCATION MECHANISM .....	84
10. LIST OF TEST EQUIPMENT .....	88
11. ANNEX A_ TEST SETUP PHOTO .....	91

**1. EUT DESCRIPTION**

<b>Model</b>	SM-X818U		
<b>Additional Model</b>	-		
<b>EUT Type</b>	Tablet		
<b>Power Supply</b>	DC 3.88 V		
<b>Frequency Range</b>	2 412 MHz ~ 2 462 MHz		
<b>Max. RF Output Power</b>	<u>Average Power</u>	SISO(Ant. 2)	802.11b : 18.45 dBm 802.11g : 17.27 dBm 802.11n(HT20) : 17.15 dBm
		MIMO	802.11b : 21.23 dBm 802.11g : 20.13 dBm 802.11n(HT20) : 19.97 dBm
	<u>Peak Power</u>	SISO(Ant. 2)	802.11b : 23.87 dBm 802.11g : 25.35 dBm 802.11n(HT20) : 24.79 dBm
		MIMO	802.11b : 26.67 dBm 802.11g : 28.14 dBm 802.11n(HT20) : 27.56 dBm
<b>Modulation Type</b>	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n		
<b>Number of Channels</b>	11 Channels		
<b>Date(s) of Tests</b>	March 13, 2023 ~ May 09, 2023		
<b>Serial number</b>	Radiated: R32W2003JZY Conducted: R32W2003J2A		

## ANTENNA CONFIGURATIONS

### 1. Antenna configuration

Configurations	SISO		MIMO	
	Ant1	Ant2	CDD	SDM
802.11b	X	O	O	X
802.11g	X	O	O	X
802.11n(HT20)	X	O	O	O
802.11ac(VHT20)	X	O	O	O

**Note:**

- (1) O = Support, X = Not Support
- (2) SISO = Single Input Single Output
- (3) SDM = Spatial Diversity Multiplexing
- (4) CDD = Cyclic Delay Diversity

2.This device supports simultaneous transmission operation, which allows for two channels to operate independent of one another in the 2.4 GHz and 5 GHz or 6GHz Bands simultaneously on each antenna.

RSDB Scenario	2.4 GHz	2.4 GHz	5 GHz	5 GHz	6 GHz	6 GHz	Bluetooth Ant.1	Bluetooth Ant.2	Test Case
	WiFi Ant.1	WiFi Ant.2	WiFi Ant.1	WiFi Ant.2	WiFi Ant.1	WiFi Ant.2			
2.4 GHz WiFi MIMO + 6 GHz WiFi MIMO	on	on			on	on			Scenario 1
2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO	on	on	on	on					Scenario 2
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi MIMO		on	on	on			on		Scenario 3
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 6 GHz WiFi MIMO		on			on	on	on		

### 3. Directional Gain Calculation

According to KDB 662911 D01 Multiple Transmitter Output v02r01 F) 2) e) (iii), f) ii)

$$\text{Directional gain(SDM)} = G_{\max} + 10 \cdot \log(N_{\text{ANT}}/ N_{\text{SS}}),$$

$$\text{Directional Gain(CDD)} = 10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{\text{SS}}} (\sum_{k=1}^{N_{\text{ANT}}} g_{j,k})^2}{N_{\text{ANT}}} \right]$$

Ant Gain (dBi)		N <sub>ANT</sub> / N <sub>SS</sub>	Directional Gain (dBi)	
			SDM	CDD
ANT1	-4.70	2 / 2	-4.70	-2.18
ANT2	-5.70			

**Note**

According to Ansi C63.10-2013 section 14.4.3, the directional gain is calculated using the formula, where G<sub>N</sub> is the gain of the nth antenna and N<sub>ANT</sub> is the total number of antennas used.

$$\text{Directional gain(SDM)} = G_{\max} + 10 \cdot \log(N_{\text{ANT}}/ N_{\text{SS}}),$$

$$\text{Directional Gain(CDD)} = 10 \cdot \log(((10^{(\text{ANT1 Gain}/20)} + 10^{(\text{ANT2 Gain}/20)})^2 / 2) \text{ dBi}$$

**Sample MIMO Calculation:**

Ex) Ant 1 : 11.58 dBm Ant 2 : 12.08 dBm

$$\text{Ant1} + \text{Ant 2} = \text{MIMO}$$

$$(11.58 \text{ dBm} + 12.08 \text{ dBm}) = (14.387 \text{ mW} + 16.143 \text{ mW}) = 30.53 \text{ mW} = 14.88 \text{ dBm}$$

## 2. TEST METHODOLOGY

FCC KDB 558074 D01 15.247 Meas Guidance v05r02 dated April 02, 2019 entitled “guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices and the measurement procedure described in ANSI C63.10(Version : 2013) ‘the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices’.

### EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

### EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

## GENERAL TEST PROCEDURES

### Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and average detector modes.

### Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1 GHz. Above 1 GHz with 1.5 m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 6.6.5 of ANSI C63.10. (Version: 2013)

## DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.



### **3. INSTRUMENT CALIBRATION**

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards.

Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

### **4. FACILITIES AND ACCREDITATIONS**

#### **FACILITIES**

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).

#### **EQUIPMENT**

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

## 5. ANTENNA REQUIREMENTS

### According to FCC 47 CFR §15.203:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”

- (1) The antennas of this E.U.T are permanently attached.
- (2) The E.U.T Complies with the requirement of §15.203

## 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95 % level of confidence.

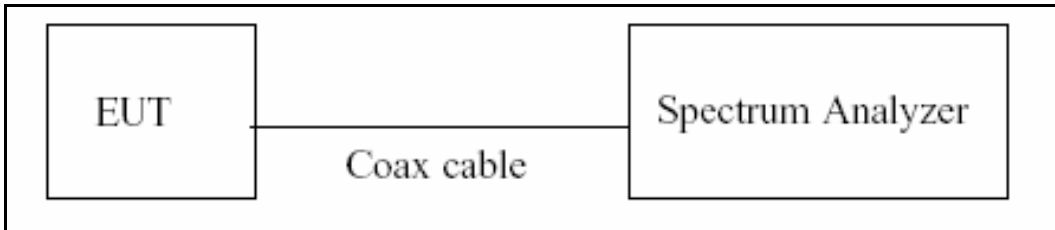
The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.90 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (9 kHz ~ 30 MHz)	4.14 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (30 MHz ~ 1 GHz)	5.82 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (1 GHz ~ 18 GHz)	5.74 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (18 GHz ~ 40 GHz)	5.76 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (Above 40 GHz)	5.52 ( Confidence level about 95 %, $k=2$ )

## 7. DESCRIPTION OF TESTS

### 7.1. Duty Cycle

#### Test Configuration



#### Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to the zero-span measurement method.

The largest available value of RBW is 8 MHz and VBW is 50 MHz.

The zero-span method of measuring duty cycle shall not be used if  $T \leq 6.25$  microseconds. ( $50/6.25 = 8$ )

The zero-span method was used because all measured  $T$  data are  $> 6.25$  microseconds and both RBW and VBW are  $> 50/T$ .

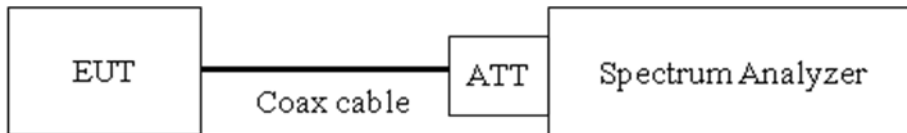
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ( $\geq$  RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep  $> 100$
6. Trace mode = Clear write
7. Measure  $T_{total}$  and  $T_{on}$
8. Calculate Duty Cycle =  $T_{on} / T_{total}$  and Duty Cycle Factor =  $10\log(1/\text{Duty Cycle})$

## 7.2. 6 dB Bandwidth

### Limit

The minimum permissible 6 dB bandwidth is 500 kHz.

### Test Configuration



### Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to (Procedure 11.8.1 in ANSI 63.10-2013)

- 1) RBW = 100 kHz
- 2) VBW  $\geq 3 \times$  RBW
- 3) Detector = Peak
- 4) Trace mode = max hold
- 5) Sweep = auto couple
- 6) Allow the trace to stabilize
- 7) We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

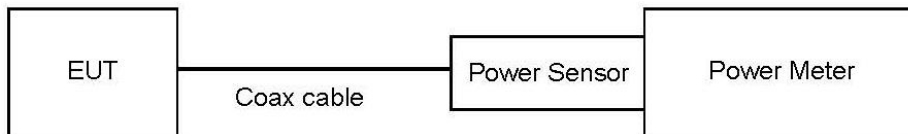
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

### 7.3. Output Power

#### Limit

The maximum permissible conducted output power is 1 Watt.

#### Test Configuration



#### Test Procedure

The transmitter output is connected to the Power Meter.

- Peak Power (Procedure 11.9.1.3 in ANSI 63.10-2013)  
: Measure the peak power of the transmitter.
  
- Average Power (Procedure 11.9.2.3 in ANSI 63.10-2013)
  - 1) Measure the duty cycle.
  - 2) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
  - 3) Add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

#### Sample Calculation

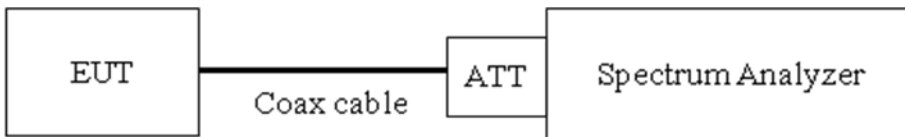
- Conducted Output Power(Peak) = Measured Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Measured Value + ATT loss + Cable loss + Duty Cycle Factor

## 7.4. Power Spectral Density

### Limit

The transmitter power density average over 1-second interval shall not be greater than 8 dBm in any 3 kHz BW.

### Test Configuration



### Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure 8.4 in KDB 558074 v05r02, Procedure 11.10 in ANSI 63.10-2013.

The spectrum analyzer is set to :

- 1) Set analyzer center frequency to DTS channel center frequency.
- 2) Set span to at least 1.5 times the OBW.
- 3)  $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$ .
- 4)  $VBW \geq 3 \times RBW$ .
- 5) Sweep = auto couple
- 6) Detector = power averaging (rms) or sample detector (when rms not available).
- 7) Ensure that the number of measurement points in the sweep  $\geq [2 \times \text{span} / RBW]$ .
- 8) Employ trace averaging (rms) mode over a minimum of 100 traces
- 9) Use the peak marker function to determine the maximum amplitude level.
- 10) Use the peak marker function to determine the maximum amplitude level within the RBW.  
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
- 11) if then duty factor shall be added to adjust the result if the duty cycle is less than 98 %

### Sample Calculation

- Power Spectral Density = Measured Value + ATT loss + Cable loss + Duty Cycle Factor

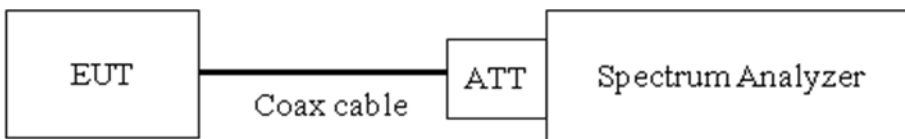
## 7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

### Limit

The maximum conducted (Average) output power was used to demonstrate compliance, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least relative to the maximum in-band peak PSD level in 100 kHz.

[ Conducted > 30 dBc ]

### Test Configuration



### Test Procedure

The transmitter output is connected to the spectrum analyzer.

(Procedure 11.11 in ANSI 63.10-2013)

- 1) RBW = 100 kHz
- 2) VBW  $\geq 3 \times$  RBW
- 3) Set span to encompass the spectrum to be examined
- 4) Detector = Peak
- 5) Trace Mode = max hold
- 6) Sweep time = auto couple
- 7) Ensure that the number of measurement points  $\geq 2 \times$  Span/RBW
- 8) Allow trace to fully stabilize.
- 9) Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the lowest, middle, and highest channels.

**Factors for frequency**

Freq(MHz)	Factor(dB)
30	10.03
100	10.05
200	10.08
300	10.10
400	10.14
500	10.16
600	10.18
700	10.20
800	10.27
900	10.35
1000	10.41
2000	10.57
2400	10.63
2412	10.82
2437	10.82
2462	10.82
2500	10.86
3000	11.04
4000	11.24
5000	11.42
5700	11.87
5800	11.87
6000	11.98
7000	12.07
8000	12.19
9000	12.24
10000	12.38
11000	12.43
12000	12.49
13000	12.66
14000	12.96
15000	13.12
16000	13.15
17000	13.05
18000	13.08
19000	12.97
20000	13.23
21000	13.67
22000	13.49
23000	13.62
24000	13.60
25000	13.92

Note : 1. 2400 ~ 2500 MHz is fundamental frequency range.

2. Factor = Attenuator loss + Cable loss(1ea)



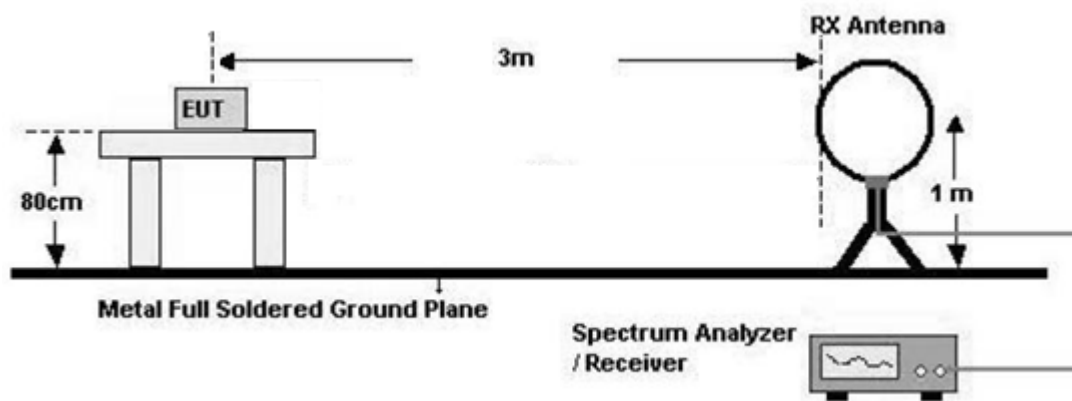
## 7.6. Radiated Test

### Limit

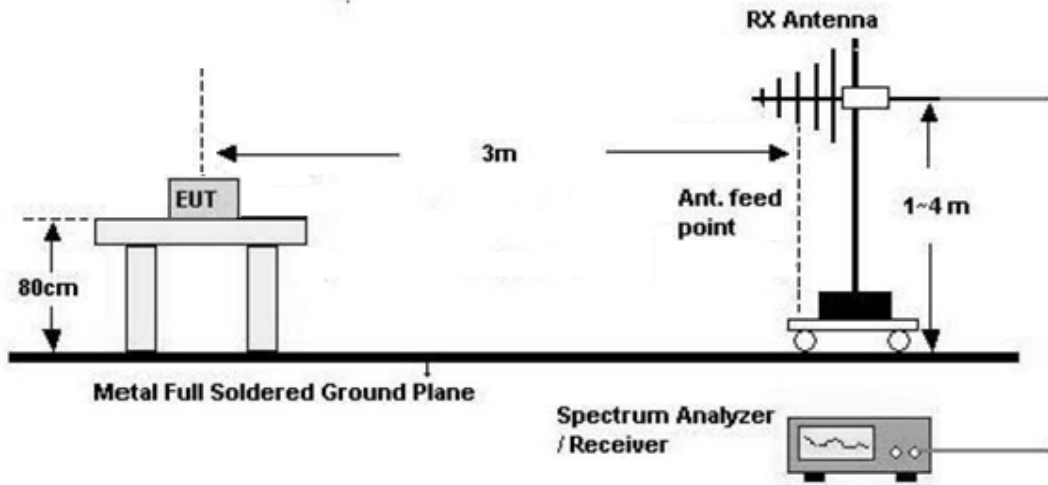
Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ )	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

### Test Configuration

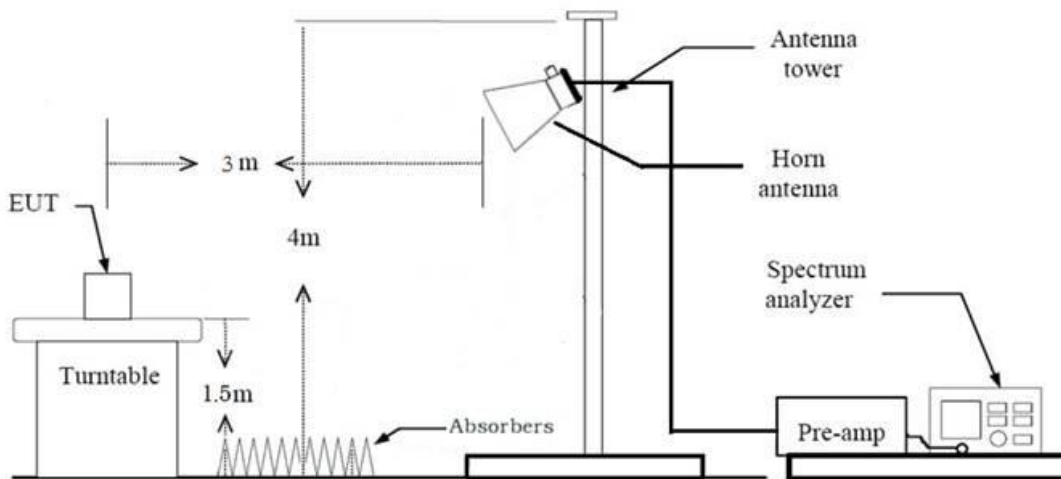
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



**Test Procedure of Radiated spurious emissions (Below 30 MHz)**

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3 m from the EUT
3. The EUT is placed on a turntable, which is 0.8 m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor(0.009 MHz – 0.490 MHz) =  $40\log(3\text{ m}/300\text{ m}) = - 80\text{ dB}$   
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) =  $40\log(3\text{ m}/30\text{ m}) = - 40\text{ dB}$   
Measurement Distance : 3 m
8. Spectrum Setting
  - Frequency Range = 9 kHz ~ 30 MHz
  - Detector = Peak
  - Trace = Maxhold
  - RBW = 9 kHz
  - VBW  $\geq 3 \times$  RBW
9. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

**KDB 414788 OFS and Chamber Correlation Justification**

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

**Test Procedure of Radiated spurious emissions (Below 1 GHz)**

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8 m above ground plane.
3. The Hybrid antenna was placed at a location 3 m from the EUT, which is varied from 1 m to 4 m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
  - (1) Measurement Type(Peak):
    - Measured Frequency Range : 30 MHz – 1 GHz
    - Detector = Peak
    - Trace = Maxhold
    - RBW = 100 kHz
    - VBW  $\geq$  3 x RBW
  - (2) Measurement Type(Quasi-peak):
    - Measured Frequency Range : 30 MHz – 1 GHz
    - Detector = Quasi-Peak
    - RBW = 120 kHz
- In general, (1) is used mainly
7. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L)
8. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

**Test Procedure of Radiated spurious emissions (Above 1 GHz)**

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting (Method 8.6 in KDB 558074 v05r02, Procedure 11.12 in ANSI 63.10-2013)
  - (1) Measurement Type(Peak):
    - Measured Frequency Range : 1 GHz – 25 GHz
    - Detector = Peak

- Trace = Maxhold
- RBW = 1 MHz
- VBW  $\geq 3 \times$  RBW

(2) Measurement Type(Average): Duty cycle  $\geq 98 \%$

- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW  $\geq 3 \times$  RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).

(3) Measurement Type(Average): Duty cycle  $< 98 \%$ , duty cycle variations are less than  $\pm 2 \%$

- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW  $\geq 3 \times$  RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).
- Correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 % duty cycle.
- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin  $> 20$  dB from the applicable limit) and considered that's already beyond the background noise floor.

10. Distance extrapolation factor =  $20\log$  (test distance / specific distance) (dB)

11. Total(Measurement Type : Peak)

$$= \text{Measured value} + \text{Antenna Factor(A.F)} + \text{Cable Loss(C.L)} - \text{Amp Gain(A.G)} + \text{Distance Factor(D.F)}$$

Total(Measurement Type : Average, Duty cycle  $\geq 98 \%$ )

$$= \text{Measured value} + \text{Antenna Factor(A.F)} + \text{Cable Loss(C.L)} - \text{Amp Gain(A.G)} + \text{Distance Factor(D.F)}$$

Total(Measurement Type : Average, Duty cycle  $< 98 \%$ )

$$= \text{Measured value} + \text{Antenna Factor(A.F)} + \text{Cable Loss(C.L)} - \text{Amp Gain(A.G)} + \text{Distance Factor(D.F)} \\ + \text{Duty Cycle Factor}$$

**Test Procedure of Radiated Restricted Band Edge**

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting

## (1) Measurement Type(Peak):

- Measured Frequency Range : 2310 MHz ~ 2390 MHz / 2483.5 MHz ~ 2500 MHz
- Detector = Peak
- Trace = Maxhold
- RBW = 1 MHz
- VBW  $\geq 3 \times$  RBW

(2) Measurement Type(Average): Duty cycle  $\geq 98$  %,

- Measured Frequency Range : 2310 MHz ~ 2390 MHz / 2483.5 MHz ~ 2500 MHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW  $\geq 3 \times$  RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).

(3) Measurement Type(Average): Duty cycle  $< 98$  %, duty cycle variations are less than  $\pm 2$  %

- Measured Frequency Range : 2310 MHz ~ 2390 MHz / 2483.5 MHz ~ 2500 MHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW  $\geq 3 \times$  RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).
- Correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 % duty cycle.
- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
10. Distance extrapolation factor =  $20\log(\text{test distance} / \text{specific distance})$  (dB)
11. Total(Measurement Type : Peak)  
= Measured value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
- Total(Measurement Type : Average, Duty cycle  $\geq 98\%$ )  
= Measured value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
- Total(Measurement Type : Average, Duty cycle < 98 %)  
= Measured value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F) + Duty Cycle Factor

## 7.7. AC Power line Conducted Emissions

### Limit

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  $\mu$ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56 <sup>(a)</sup>	56 to 46 <sup>(a)</sup>
0.50 to 5	56	46
5 to 30	60	50

<sup>(a)</sup>Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

### Test Configuration

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

### Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

### Sample Calculation

Quasi-peak(Final Result) = Measured Value + Correction Factor



**7.8. Worst case configuration and mode****Radiated test**

1. All modes of operation were investigated and the worst case configuration results are reported.
  - Mode : Stand alone, Stand alone + External accessories(Earphone, etc)
  - Worstcase : Stand alone
2. EUT Axis
  - Radiated Spurious Emissions : X, Z
  - Radiated Restricted Band Edge : Z
3. Duty cycle factor applies only 802.11g/n (Duty cycle < 98 %).
4. All data rate of operation were investigated and the test results are worst case in lowest Data Rate of each mode.
  - 802.11b : 1 Mbps
  - 802.11g : 6 Mbps
  - 802.11n(HT20): MCS0
5. All position of loop antenna were investigated and the test result is a no critical peak found at all positions.
  - Position : Horizontal, Vertical, Parallel to the ground plane

**Radiated test(RSDB)**

1. All modes of operation were investigated and the worst case configuration results are reported.
  - Mode : Stand alone, Stand alone + External accessories(Earphone, etc)
  - Worstcase : Stand alone
2. EUT Axis
  - Radiated Spurious Emissions : Z
3. All of RSDB Scenario were investigated and the worst case configuration results are reported.
  - Worst case : 2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO

RSDB Scenario	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5 GHz WiFi Ant.1	5 GHz WiFi Ant.2	6 GHz WiFi Ant.1	6 GHz WiFi Ant.2	Bluetooth Ant.1	Bluetooth Ant.2	Test Case
2.4 GHz WiFi MIMO + 6 GHz WiFi MIMO	on	on			on	on			Scenario 1
2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO	on	on	on	on					Scenario 2
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi MIMO		on	on	on			on		Scenario 3
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 6 GHz WiFi MIMO		on			on	on	on		

4. The following tables show the worst case configurations determined during testing.

(Worst case: The lowest margin condition the channels and modes were selected for test.)

RSDB Scenario 1	Description	2.4GHz Emission	6 GHz Emission
2.4 GHz WiFi MIMO + 6 GHz WiFi MIMO	Antenna	Ant All	Ant All
	Channel	1	7
	Data Rate	1 Mbps	MCS 0
	Mode	802.11b	802.11ax(HE80) SU

**Note** : UNII 6e RSDB Data refer to [UNII 6e] Test Report

RSDB Scenario 2	Description	2.4GHz Emission	5 GHz Emission
2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO	Antenna	Ant All	Ant All
	Channel	1	169
	Data Rate	1 Mbps	MCS 0
	Mode	802.11b	802.11n(HT20)

**Note** : UNII RSDB Data refer to [UNII] Test Report

RSDB Scenario 3	Description	Bluetooth Emission	2.4GHz Emission	5 GHz Emission
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi MIMO	Antenna	ANT1	ANT2	Ant All
	Channel	78	1	169
	Data Rate	1 Mbps	1 Mbps	MCS 0
	Mode	GFSK	802.11b	802.11n(HT20)

**Note** : BT, UNII RSDB Data refer to [BT] , [UNII] Test Report

**AC Power line Conducted Emissions**

1. All modes of operation were investigated and the worst case configuration results are reported.

- Mode : Stand alone + External accessories(Earphone, etc) + Travel Adapter,  
Stand alone + Travel Adapter
- Worstcase : Stand alone + Travel Adapter

**Conducted test**

1. The EUT was configured with data rate of highest power.

**8. SUMMARY TEST OF RESULTS**

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§15.247(a)(2)	> 500 kHz	Conducted	PASS
Conducted Maximum Output Power	§15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge (Out of Band Emissions)	§15.247(d)	Conducted > 30 dBc		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 7.7		PASS
Radiated Spurious Emissions	§15.247(d), 15.205, 15.209	cf. Section 7.6	Radiated	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 7.6		PASS

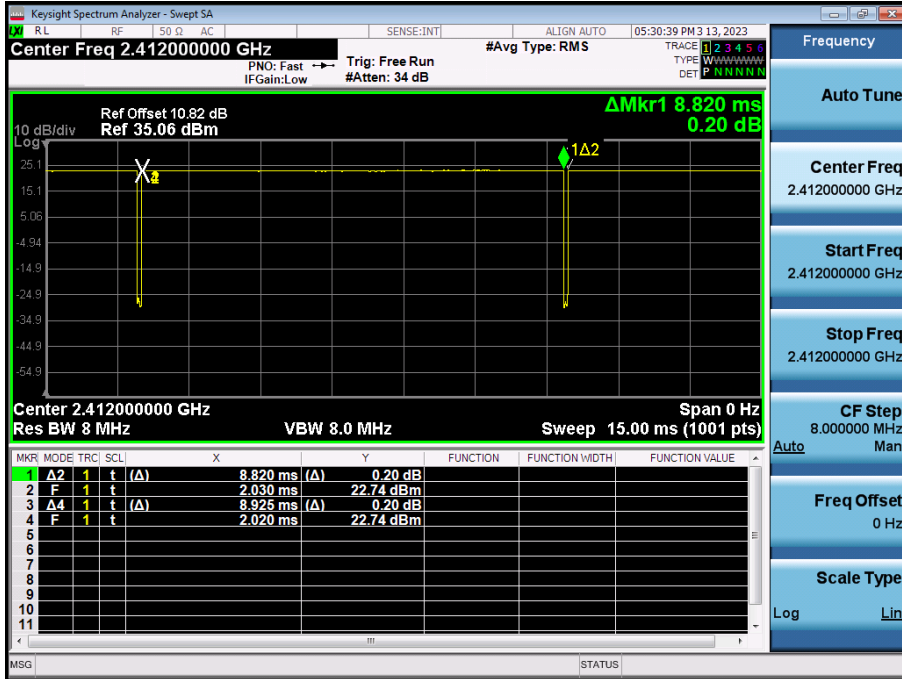
## 9. TEST RESULT

### 9.1 DUTY CYCLE

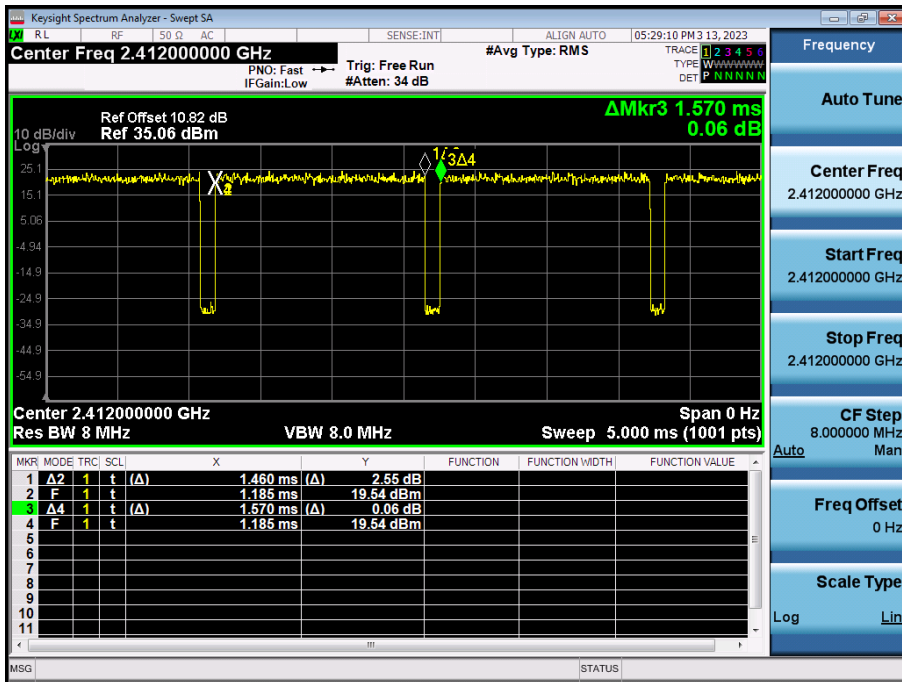
Mode	Data Rate	T <sub>on</sub> (ms)	T <sub>total</sub> (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	1 Mbps	8.820	8.925	0.988	0.051
	2 Mbps	4.399	4.512	0.975	0.110
	5.5 Mbps	1.667	1.768	0.943	0.256
	11 Mbps	0.877	0.983	0.892	0.498
802.11g	6 Mbps	1.460	1.570	0.930	0.315
	9 Mbps	0.983	1.089	0.902	0.446
	12 Mbps	0.740	0.851	0.869	0.610
	18 Mbps	0.502	0.608	0.825	0.835
	24 Mbps	0.385	0.491	0.784	1.060
	36 Mbps	0.263	0.370	0.712	1.473
	48 Mbps	0.203	0.309	0.656	1.833
	54 Mbps	0.182	0.289	0.632	1.996
802.11n (HT20)	MCS0	1.248	1.353	0.923	0.350
	MCS1	0.638	0.750	0.851	0.699
	MCS2	0.441	0.547	0.806	0.939
	MCS3	0.339	0.446	0.761	1.184
	MCS4	0.238	0.345	0.691	1.604
	MCS5	0.187	0.294	0.638	1.952
	MCS6	0.174	0.290	0.600	2.218
	MCS7	0.162	0.294	0.552	2.583

Test Plots

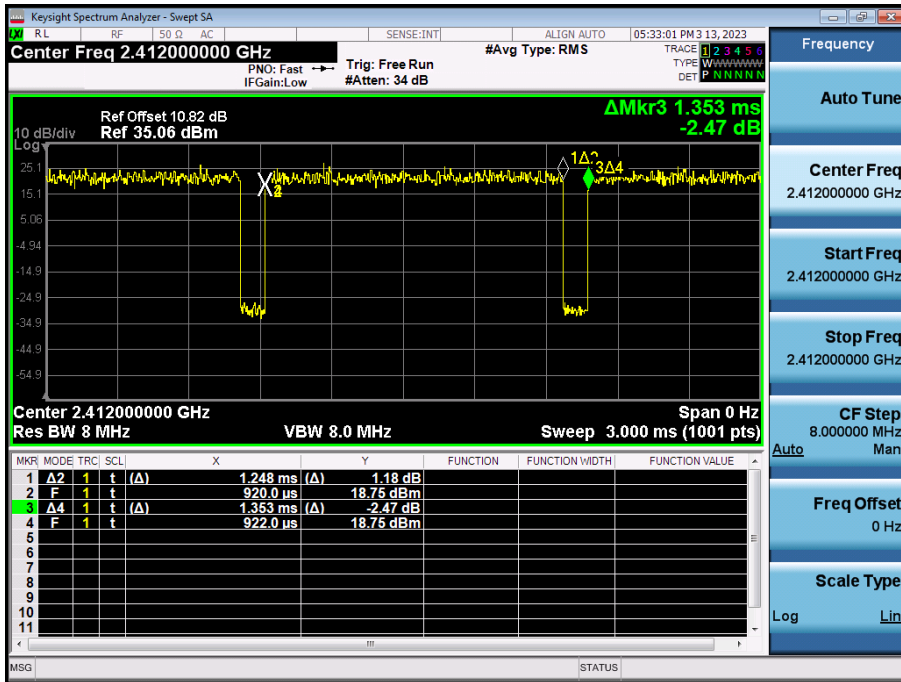
Duty cycle plot (802.11b(1 Mbps))



Duty cycle plot (802.11g(6 Mbps))



Duty cycle plot (802. 11n(MCS0))



**Note:**

In order to simplify the report, attached plots were only the lowest data rate.

**9.2 6 dB BANDWIDTH****[Ant. 1]**

<b>Mode</b>	<b>Frequency [MHz]</b>	<b>Channel No.</b>	<b>6dB Bandwidth [MHz]</b>	<b>Minimum Bandwidth [MHz]</b>
802.11b	2412	1	8.103	0.50
	2437	6	8.108	0.50
	2462	11	8.105	0.50
802.11g	2412	1	15.71	0.50
	2437	6	15.15	0.50
	2462	11	15.75	0.50
802.11n(HT20)	2412	1	16.09	0.50
	2437	6	15.15	0.50
	2462	11	16.35	0.50

**[Ant. 2]**

<b>Mode</b>	<b>Frequency [MHz]</b>	<b>Channel No.</b>	<b>6dB Bandwidth [MHz]</b>	<b>Minimum Bandwidth [MHz]</b>
802.11b	2412	1	8.112	0.50
	2437	6	8.104	0.50
	2462	11	8.098	0.50
802.11g	2412	1	15.71	0.50
	2437	6	15.13	0.50
	2462	11	15.75	0.50
802.11n(HT20)	2412	1	16.29	0.50
	2437	6	15.15	0.50
	2462	11	16.34	0.50



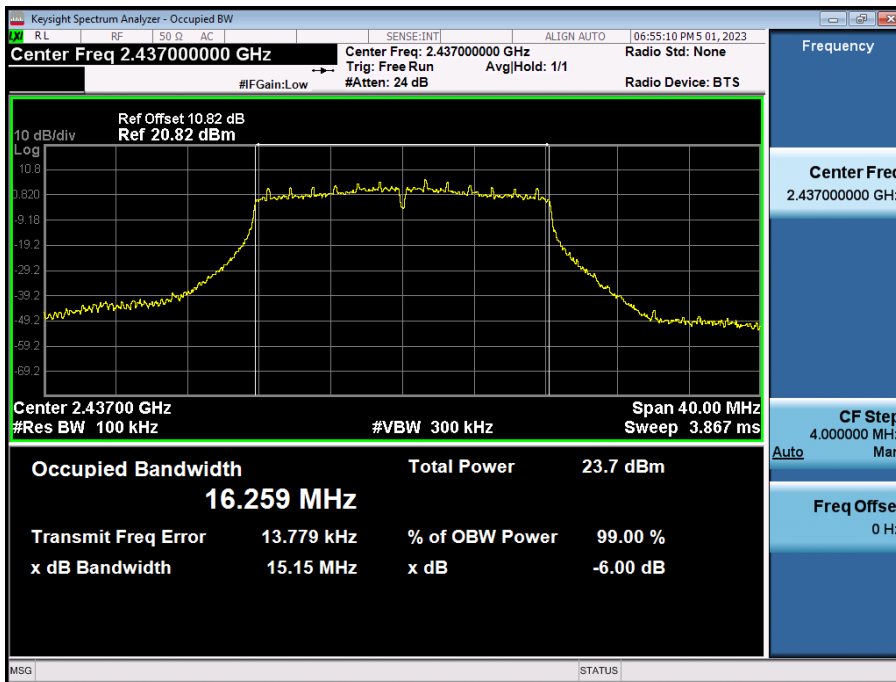
[Ant.1]

▣ Test Plots

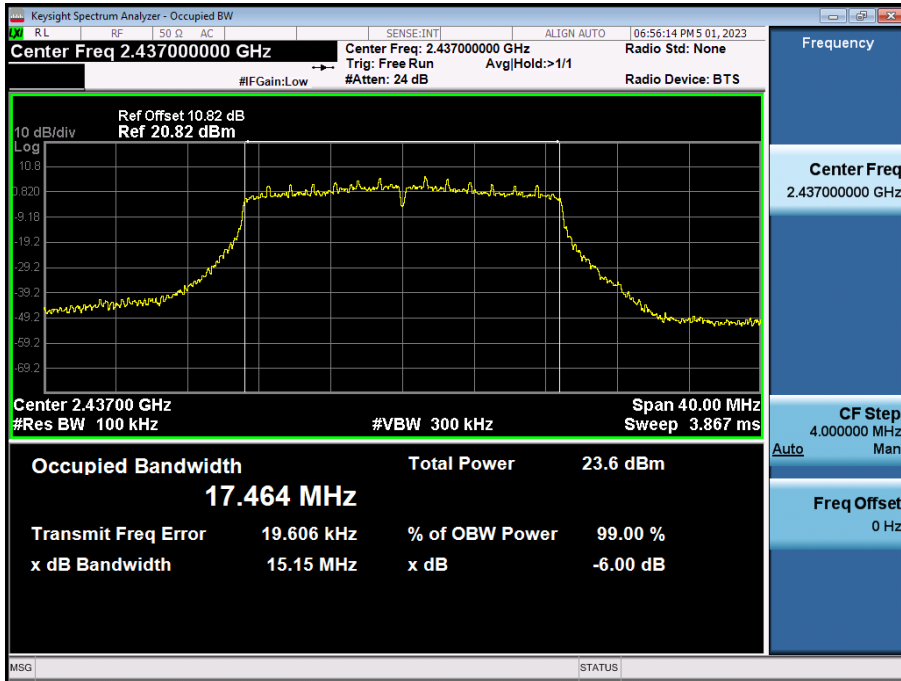
6 dB Bandwidth plot (802.11b-CH 1)



6 dB Bandwidth plot (802.11g-CH 6)



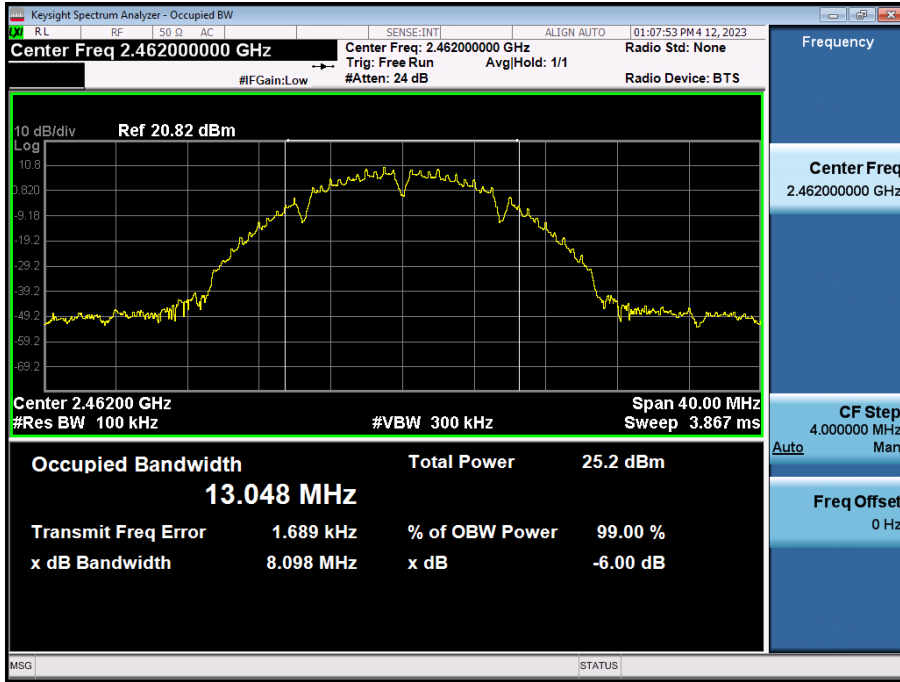
6 dB Bandwidth plot (802.11n\_HT20-CH 6)



[Ant.2]

▣ Test Plots

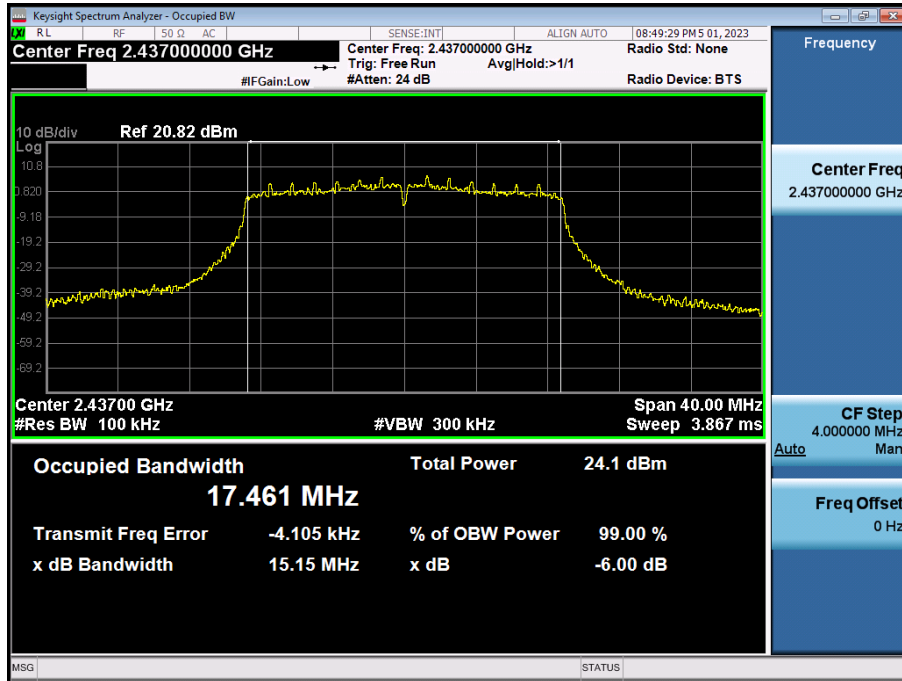
6 dB Bandwidth plot (802.11b-CH 11)



6 dB Bandwidth plot (802.11g-CH 6)



6 dB Bandwidth plot (802.11n\_HT20-CH 6)



**Note:**

In order to simplify the report, attached plots were only the narrowest 6 dB BW channel.

### 9.3 OUTPUT POWER

**Note :**

1. MIMO Power =  $10 \cdot \log((10^{\text{Ant. 1 power / 10}}) + (10^{\text{Ant. 2 power / 10}}))$

**Peak Power****[Ant.1]**

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	1	20.12	30
		2	20.48	30
		5.5	21.91	30
		11	23.36	30
2437	6	1	20.28	30
		2	20.65	30
		5.5	22.05	30
		11	23.52	30
2462	11	1	20.13	30
		2	20.49	30
		5.5	21.89	30
		11	23.31	30

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6	22.06	30
		9	22.40	30
		12	22.83	30
		18	22.57	30
		24	22.99	30
		36	22.65	30
		48	22.73	30
		54	22.88	30
2437	6	6	24.14	30
		9	24.42	30
		12	24.89	30
		18	24.41	30
		24	24.91	30
		36	24.52	30
		48	24.60	30
		54	24.80	30
2462	11	6	22.08	30
		9	22.42	30
		12	22.84	30
		18	22.27	30
		24	23.01	30
		36	22.70	30
		48	22.74	30
		54	22.89	30

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	22.04	30
		1	22.18	30
		2	22.26	30
		3	22.30	30
		4	22.24	30
		5	22.39	30
		6	22.40	30
		7	22.21	30
2437	6	0	24.01	30
		1	24.08	30
		2	24.18	30
		3	24.31	30
		4	24.12	30
		5	24.31	30
		6	24.28	30
		7	24.15	30
2462	11	0	22.09	30
		1	22.23	30
		2	22.28	30
		3	22.41	30
		4	22.43	30
		5	22.62	30
		6	22.66	30
		7	22.49	30

**[Ant.2]**

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	1	20.37	30
		2	20.72	30
		5.5	22.10	30
		11	23.47	30
2437	6	1	20.59	30
		2	20.98	30
		5.5	22.39	30
		11	23.79	30
2462	11	1	20.76	30
		2	21.16	30
		5.5	22.51	30
		11	23.87	30



802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6	22.64	30
		9	22.98	30
		12	23.44	30
		18	23.17	30
		24	23.47	30
		36	23.13	30
		48	23.18	30
		54	23.34	30
2437	6	6	24.64	30
		9	24.94	30
		12	25.35	30
		18	24.87	30
		24	25.27	30
		36	25.05	30
		48	25.18	30
		54	25.29	30
2462	11	6	22.99	30
		9	23.39	30
		12	23.80	30
		18	23.20	30
		24	23.99	30
		36	23.66	30
		48	23.66	30
		54	23.92	30

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	22.64	30
		1	22.75	30
		2	22.82	30
		3	22.90	30
		4	22.79	30
		5	22.95	30
		6	22.96	30
		7	22.80	30
2437	6	0	24.47	30
		1	24.64	30
		2	24.59	30
		3	24.71	30
		4	24.54	30
		5	24.79	30
		6	24.71	30
		7	24.52	30
2462	11	0	23.06	30
		1	23.14	30
		2	23.24	30
		3	23.28	30
		4	23.40	30
		5	23.49	30
		6	23.56	30
		7	23.42	30

**[MIMO]**

802.11b Mode		Rate (Mbps)	Ant.1 Measured Power(dBm)	Ant.2 Measured Power(dBm)	MIMO Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.					
2412	1	1	20.12	20.37	23.26	30
		2	20.48	20.72	23.61	30
		5.5	21.91	22.10	25.01	30
		11	23.36	23.47	26.43	30
2437	6	1	20.28	20.59	23.45	30
		2	20.65	20.98	23.83	30
		5.5	22.05	22.39	25.23	30
		11	23.52	23.79	26.67	30
2462	11	1	20.13	20.76	23.47	30
		2	20.49	21.16	23.85	30
		5.5	21.89	22.51	25.22	30
		11	23.31	23.87	26.61	30

802.11g Mode		Rate (Mbps)	Ant.1 Measured Power(dBm)	Ant.2 Measured Power(dBm)	MIMO Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.					
2412	1	6	22.06	22.64	25.37	30
		9	22.40	22.98	25.71	30
		12	22.83	23.44	26.16	30
		18	22.57	23.17	25.89	30
		24	22.99	23.47	26.25	30
		36	22.65	23.13	25.91	30
		48	22.73	23.18	25.97	30
		54	22.88	23.34	26.13	30
2437	6	6	24.14	24.64	27.41	30
		9	24.42	24.94	27.70	30
		12	24.89	25.35	28.14	30
		18	24.41	24.87	27.66	30
		24	24.91	25.27	28.11	30
		36	24.52	25.05	27.80	30
		48	24.60	25.18	27.91	30
		54	24.80	25.29	28.06	30
2462	11	6	22.08	22.99	25.57	30
		9	22.42	23.39	25.94	30
		12	22.84	23.80	26.35	30
		18	22.27	23.20	25.77	30
		24	23.01	23.99	26.54	30
		36	22.70	23.66	26.22	30
		48	22.74	23.66	26.24	30
		54	22.89	23.92	26.45	30

802.11n(HT20) Mode		MCS Index	Ant.1 Measured Power(dBm)	Ant.2 Measured Power(dBm)	MIMO Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.					
2412	1	0	22.04	22.64	25.37	30
		1	22.18	22.75	25.48	30
		2	22.26	22.82	25.56	30
		3	22.30	22.90	25.62	30
		4	22.24	22.79	25.53	30
		5	22.39	22.95	25.69	30
		6	22.40	22.96	25.70	30
		7	22.21	22.80	25.53	30
2437	6	0	24.01	24.47	27.26	30
		1	24.08	24.64	27.38	30
		2	24.18	24.59	27.40	30
		3	24.31	24.71	27.52	30
		4	24.12	24.54	27.35	30
		5	24.31	24.79	27.56	30
		6	24.28	24.71	27.51	30
		7	24.15	24.52	27.35	30
2462	11	0	22.09	23.06	25.61	30
		1	22.23	23.14	25.72	30
		2	22.28	23.24	25.80	30
		3	22.41	23.28	25.88	30
		4	22.43	23.40	25.96	30
		5	22.62	23.49	26.09	30
		6	22.66	23.56	26.14	30
		7	22.49	23.42	25.99	30

**Average Power**

Power Meter offset Loss = Attenuator loss(20 dB) + Cable loss

**[Ant.1]**

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1	17.94	0.000	17.94	30
		2	17.75	0.103	17.85	30
		5.5	17.53	0.356	17.89	30
		11	17.34	0.473	17.81	30
2437	6	1	17.55	0.000	17.55	30
		2	17.40	0.103	17.50	30
		5.5	17.26	0.356	17.62	30
		11	17.01	0.473	17.48	30
2462	11	1	17.97	0.000	17.97	30
		2	17.66	0.103	17.76	30
		5.5	17.53	0.356	17.89	30
		11	17.34	0.473	17.81	30

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6	14.15	0.310	14.46	30
		9	13.83	0.446	14.28	30
		12	13.70	0.580	14.28	30
		18	13.56	0.872	14.43	30
		24	13.24	1.060	14.30	30
		36	12.82	1.473	14.29	30
		48	12.46	1.833	14.29	30
		54	12.15	1.996	14.14	30
2437	6	6	16.65	0.310	16.96	30
		9	16.36	0.446	16.81	30
		12	16.21	0.580	16.79	30
		18	16.12	0.872	16.99	30
		24	15.71	1.060	16.77	30
		36	15.30	1.473	16.78	30
		48	14.89	1.833	16.72	30
		54	14.61	1.996	16.60	30
2462	11	6	14.14	0.310	14.45	30
		9	13.81	0.446	14.26	30
		12	13.62	0.580	14.20	30
		18	13.55	0.872	14.42	30
		24	13.23	1.060	14.29	30
		36	12.80	1.473	14.27	30
		48	12.51	1.833	14.34	30
		54	12.22	1.996	14.21	30

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	14.00	0.360	14.36	30
		1	13.42	0.699	14.12	30
		2	13.29	0.939	14.23	30
		3	13.03	1.184	14.22	30
		4	12.69	1.604	14.30	30
		5	12.16	1.952	14.12	30
		6	11.91	2.089	14.00	30
		7	11.51	2.721	14.24	30
2437	6	0	16.41	0.360	16.77	30
		1	15.83	0.699	16.53	30
		2	15.64	0.939	16.58	30
		3	15.42	1.184	16.60	30
		4	15.09	1.604	16.69	30
		5	14.70	1.952	16.65	30
		6	14.30	2.089	16.39	30
		7	14.03	2.721	16.75	30
2462	11	0	13.96	0.360	14.32	30
		1	13.46	0.699	14.16	30
		2	13.36	0.939	14.30	30
		3	13.09	1.184	14.28	30
		4	12.53	1.604	14.13	30
		5	12.27	1.952	14.22	30
		6	11.92	2.089	14.01	30
		7	11.48	2.721	14.20	30



**[Ant.2]**

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1	18.14	0.000	18.14	30
		2	17.81	0.103	17.91	30
		5.5	17.63	0.356	17.99	30
		11	17.43	0.473	17.91	30
2437	6	1	18.32	0.000	18.32	30
		2	17.95	0.103	18.05	30
		5.5	17.82	0.356	18.18	30
		11	17.65	0.473	18.12	30
2462	11	1	18.45	0.000	18.45	30
		2	18.08	0.103	18.18	30
		5.5	17.91	0.356	18.26	30
		11	17.73	0.473	18.20	30

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6	14.49	0.310	14.80	30
		9	14.17	0.446	14.62	30
		12	14.05	0.580	14.63	30
		18	13.91	0.872	14.79	30
		24	13.53	1.060	14.59	30
		36	13.02	1.473	14.50	30
		48	12.78	1.833	14.61	30
		54	12.43	1.996	14.43	30
2437	6	6	16.96	0.310	17.27	30
		9	16.64	0.446	17.09	30
		12	16.45	0.580	17.03	30
		18	16.29	0.872	17.17	30
		24	15.93	1.060	16.99	30
		36	15.55	1.473	17.02	30
		48	15.25	1.833	17.08	30
		54	14.99	1.996	16.98	30
2462	11	6	14.83	0.310	15.14	30
		9	14.51	0.446	14.96	30
		12	14.32	0.580	14.90	30
		18	14.23	0.872	15.10	30
		24	13.98	1.060	15.04	30
		36	13.55	1.473	15.02	30
		48	13.28	1.833	15.12	30
		54	12.98	1.996	14.97	30

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	14.40	0.360	14.76	30
		1	13.99	0.699	14.69	30
		2	13.77	0.939	14.70	30
		3	13.48	1.184	14.66	30
		4	13.08	1.604	14.68	30
		5	12.73	1.952	14.68	30
		6	12.43	2.089	14.52	30
		7	12.13	2.721	14.85	30
2437	6	0	16.79	0.360	17.15	30
		1	16.15	0.699	16.85	30
		2	15.95	0.939	16.89	30
		3	15.61	1.184	16.80	30
		4	15.33	1.604	16.94	30
		5	14.97	1.952	16.93	30
		6	14.60	2.089	16.69	30
		7	14.36	2.721	17.08	30
2462	11	0	14.77	0.360	15.13	30
		1	14.37	0.699	15.07	30
		2	14.08	0.939	15.02	30
		3	13.84	1.184	15.02	30
		4	13.34	1.604	14.95	30
		5	13.05	1.952	15.00	30
		6	12.84	2.089	14.93	30
		7	12.41	2.721	15.13	30

**[MIMO]**

802.11b Mode		Rate (Mbps)	Ant.1 Measured Power(dBm)	Ant.2 Measured Power(dBm)	MIMO Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.					
2412	1	1	17.94	18.14	21.05	30
		2	17.85	17.91	20.89	30
		5.5	17.89	17.99	20.95	30
		11	17.81	17.91	20.87	30
2437	6	1	17.55	18.32	20.96	30
		2	17.50	18.05	20.80	30
		5.5	17.62	18.18	20.92	30
		11	17.48	18.12	20.82	30
2462	11	1	17.97	18.45	21.23	30
		2	17.76	18.18	20.99	30
		5.5	17.89	18.26	21.09	30
		11	17.81	18.20	21.02	30

802.11g Mode		Rate (Mbps)	Ant.1 Measured Power(dBm)	Ant.2 Measured Power(dBm)	MIMO Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.					
2412	1	6	14.46	14.80	17.64	30
		9	14.28	14.62	17.46	30
		12	14.28	14.63	17.47	30
		18	14.43	14.79	17.62	30
		24	14.30	14.59	17.46	30
		36	14.29	14.50	17.41	30
		48	14.29	14.61	17.46	30
		54	14.14	14.43	17.30	30
2437	6	6	16.96	17.27	20.13	30
		9	16.81	17.09	19.96	30
		12	16.79	17.03	19.92	30
		18	16.99	17.17	20.09	30
		24	16.77	16.99	19.89	30
		36	16.78	17.02	19.91	30
		48	16.72	17.08	19.91	30
		54	16.60	16.98	19.81	30
2462	11	6	14.45	15.14	17.82	30
		9	14.26	14.96	17.63	30
		12	14.20	14.90	17.58	30
		18	14.42	15.10	17.78	30
		24	14.29	15.04	17.69	30
		36	14.27	15.02	17.67	30
		48	14.34	15.12	17.76	30
		54	14.21	14.97	17.62	30

802.11n(HT20) Mode		MCS Index	Ant.1 Measured Power(dBm)	Ant.2 Measured Power(dBm)	MIMO Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.					
2412	1	0	14.36	14.76	17.58	30
		1	14.12	14.69	17.43	30
		2	14.23	14.70	17.48	30
		3	14.22	14.66	17.46	30
		4	14.30	14.68	17.50	30
		5	14.12	14.68	17.42	30
		6	14.00	14.52	17.28	30
		7	14.24	14.85	17.56	30
2437	6	0	16.77	17.15	19.97	30
		1	16.53	16.85	19.70	30
		2	16.58	16.89	19.75	30
		3	16.60	16.80	19.71	30
		4	16.69	16.94	19.83	30
		5	16.65	16.93	19.80	30
		6	16.39	16.69	19.55	30
		7	16.75	17.08	19.93	30
2462	11	0	14.32	15.13	17.75	30
		1	14.16	15.07	17.65	30
		2	14.30	15.02	17.68	30
		3	14.28	15.02	17.68	30
		4	14.13	14.95	17.57	30
		5	14.22	15.00	17.64	30
		6	14.01	14.93	17.50	30
		7	14.20	15.13	17.70	30

### 9.4 POWER SPECTRAL DENSITY

**Note :**

1. MIMO PSD =  $10 \cdot \log((10^{(\text{Ant. 1 PSD} / 10)} + 10^{(\text{Ant. 2 PSD} / 10)}))$
2. Total PSD = Measured Value + Duty Cycle Factor

**[Ant.1]**

Mode	Frequency (MHz)	Channel No.	Test Result			
			Measured PSD (dBm)	Duty Cycle Factor	Total PSD (dBm)	Limit
802.11b	2412	1	-3.964	0.000	-3.964	8 dBm / 3 kHz
	2437	6	-3.873		-3.873	
	2462	11	-4.182		-4.182	
802.11g	2412	1	-8.823	0.315	-8.508	
	2437	6	-6.150		-5.835	
	2462	11	-8.446		-8.131	
802.11n(HT20)	2412	1	-9.138	0.350	-8.788	
	2437	6	-6.777		-6.427	
	2462	11	-8.818		-8.468	

**[Ant.2]**

Mode	Frequency (MHz)	Channel No.	Test Result			
			Measured PSD (dBm)	Duty Cycle Factor	Total PSD (dBm)	Limit
802.11b	2412	1	-3.963	0.000	-3.963	8 dBm / 3 kHz
	2437	6	-3.395		-3.395	
	2462	11	-3.316		-3.316	
802.11g	2412	1	-8.127	0.315	-7.812	
	2437	6	-6.084		-5.769	
	2462	11	-7.842		-7.527	
802.11n(HT20)	2412	1	-8.349	0.350	-7.999	
	2437	6	-6.639		-6.289	
	2462	11	-8.256		-7.906	

**[MIMO]**

Mode	Frequency (MHz)	Channel No.	Test Result			Limit
			Ant.1 PSD (dBm)	Ant.2 PSD (dBm)	MIMO PSD (dBm)	
802.11b	2412	1	-3.964	-3.963	-0.953	8 dBm / 3 kHz
	2437	6	-3.873	-3.395	-0.617	
	2462	11	-4.182	-3.316	-0.717	
802.11g	2412	1	-8.508	-7.812	-5.135	
	2437	6	-5.835	-5.769	-2.791	
	2462	11	-8.131	-7.527	-4.808	
802.11n(HT20)	2412	1	-8.788	-7.999	-5.365	
	2437	6	-6.427	-6.289	-3.347	
	2462	11	-8.468	-7.906	-5.167	



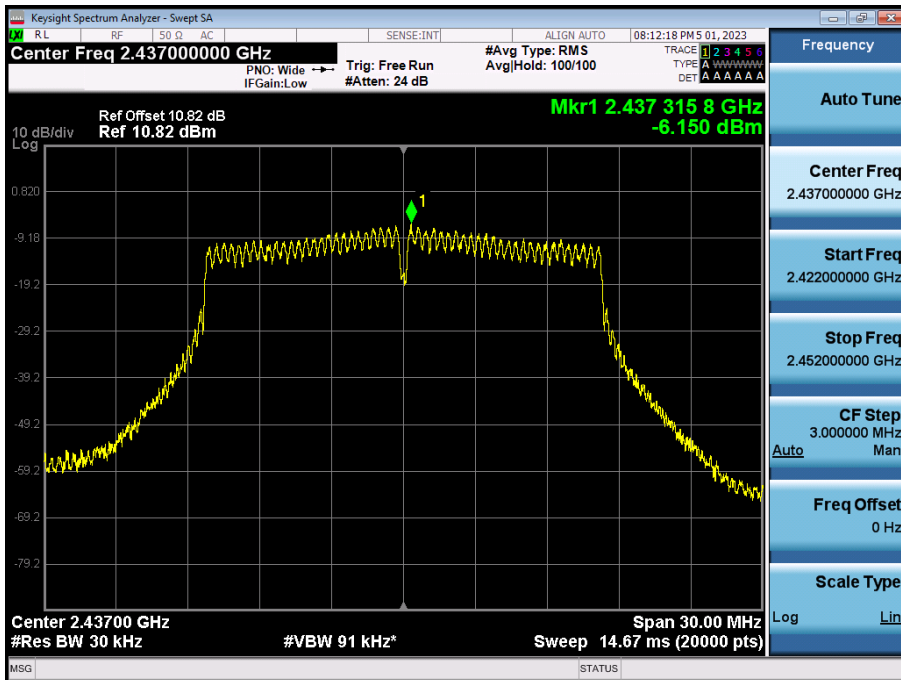
[Ant.1]

Test Plots

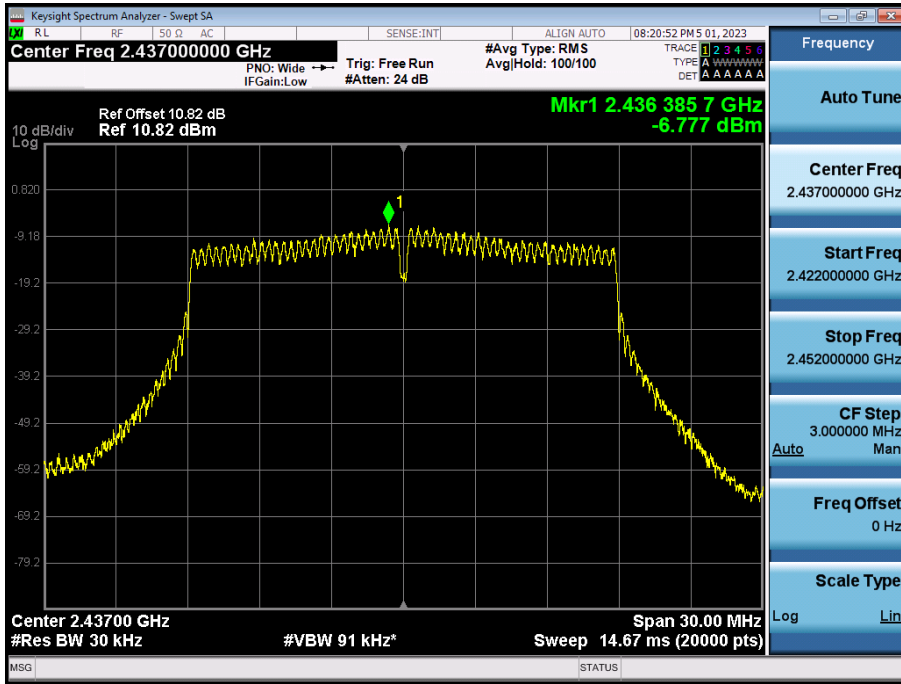
Power Spectral Density (802.11b-Ch. 6)



Power Spectral Density (802.11g-Ch. 6)



Power Spectral Density (802.11n\_HT20-Ch. 6)



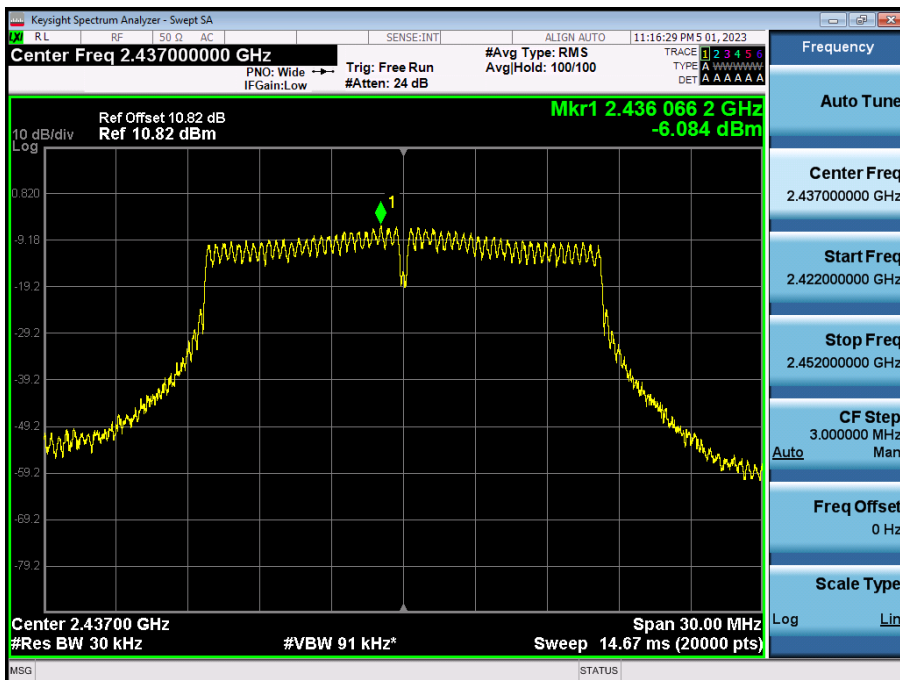
[Ant.2]

▣ Test Plots

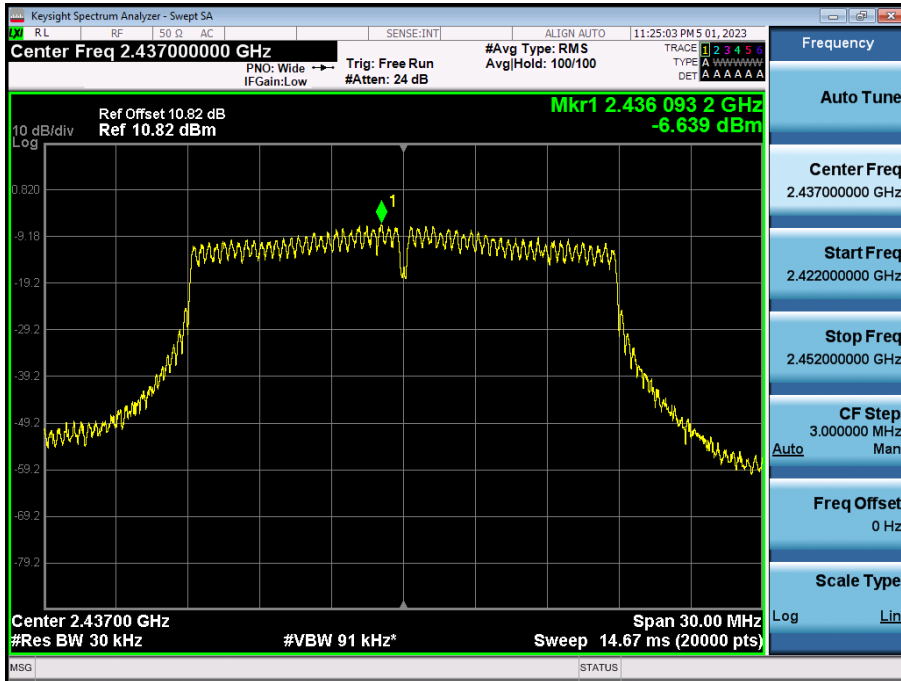
Power Spectral Density (802.11b-CH 11)



Power Spectral Density (802.11g-CH 6)



### Power Spectral Density (802.11n\_HT20-CH 6)



**Note :**

In order to simplify the report, attached plots were only the worst case PSD channel.

## 9.5 BAND EDGE / CONDUCTED SPURIOUS EMISSIONS

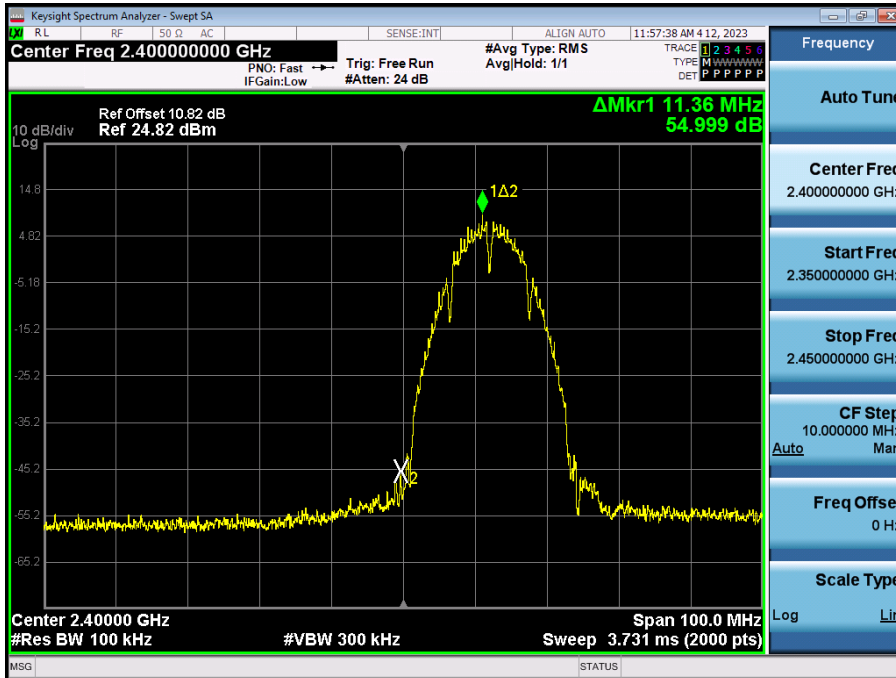
Test Result : please refer to the plot below.

In order to simplify the report, attached plots were only the worst case channel and data rate.

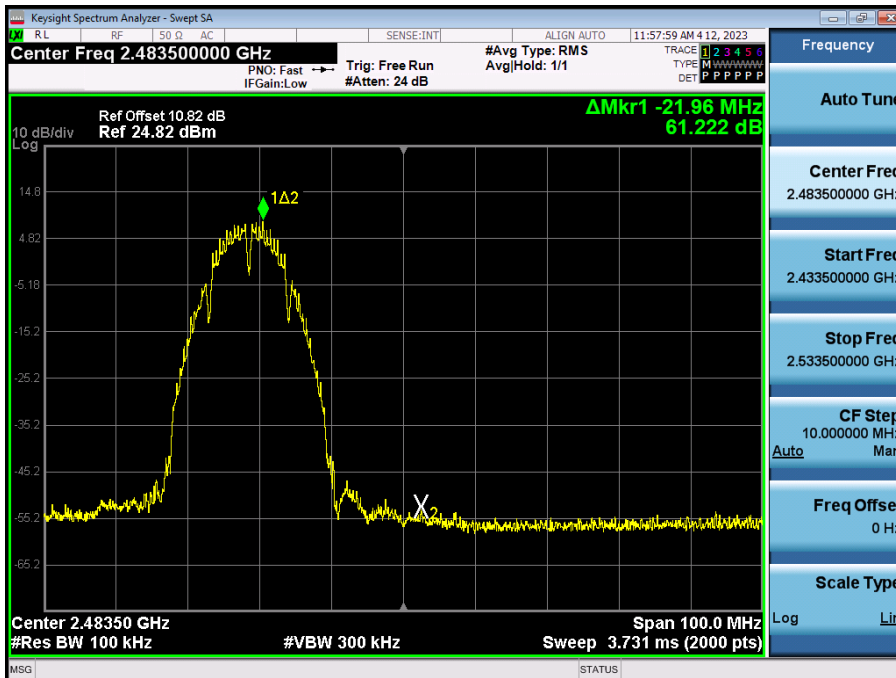
[Ant.1]

☑ Test Plots(Band Edge)

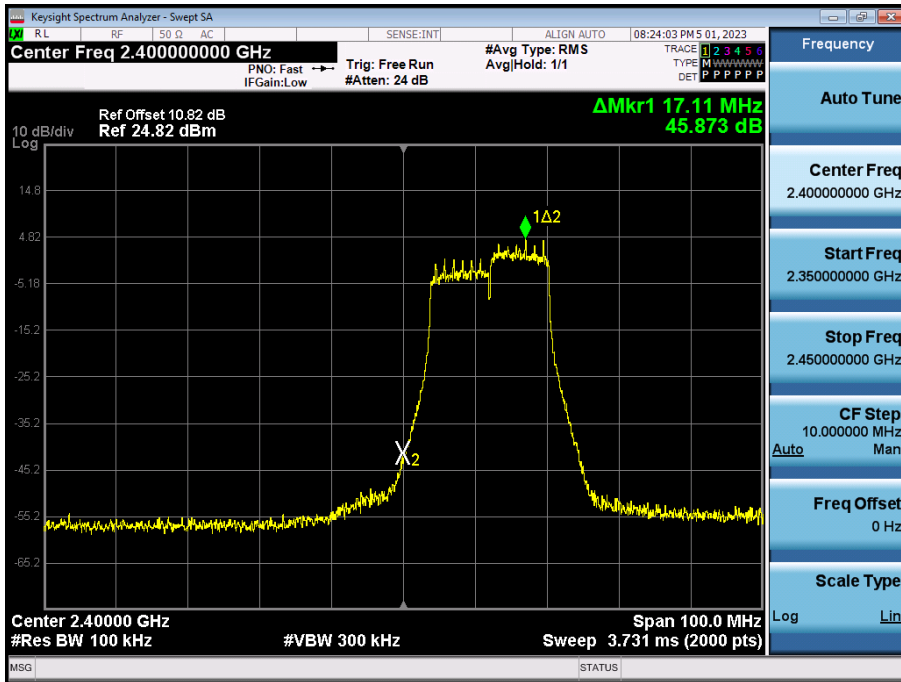
Band Edge (802.11b-CH1)



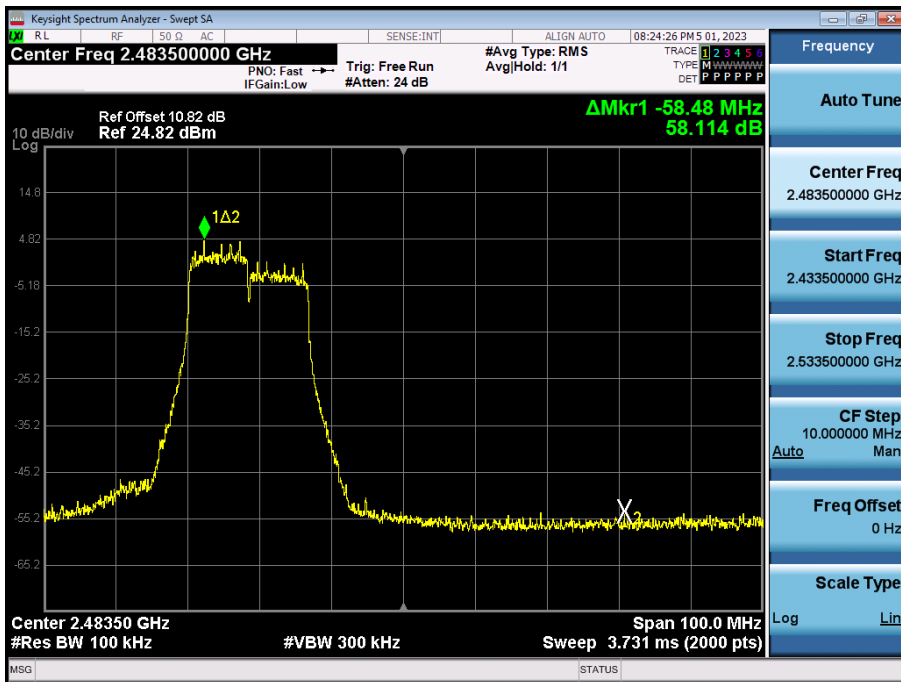
Band Edge (802.11b-CH11)



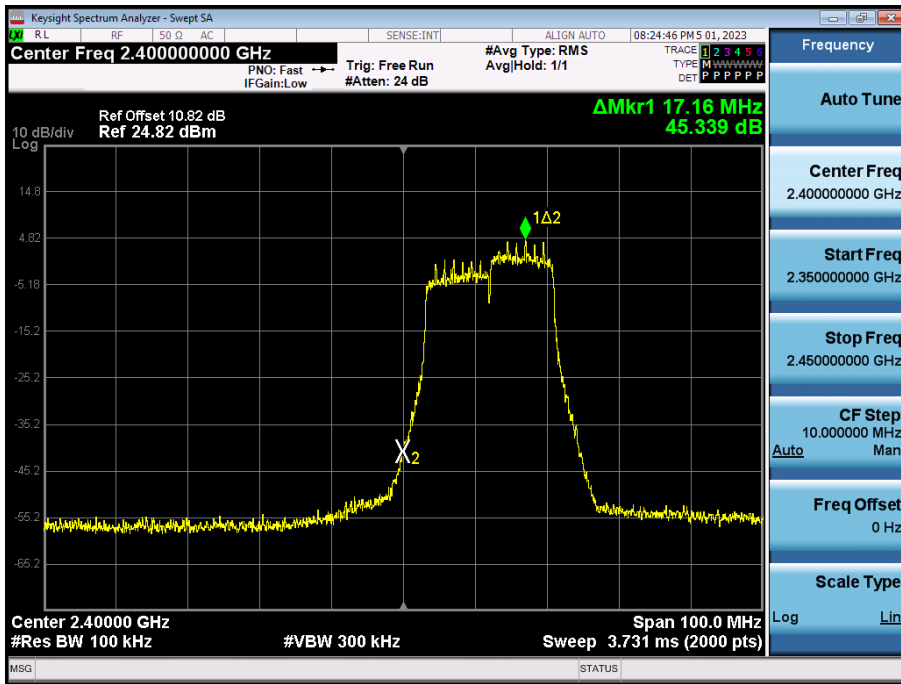
### Band Edge (802.11g-CH1)



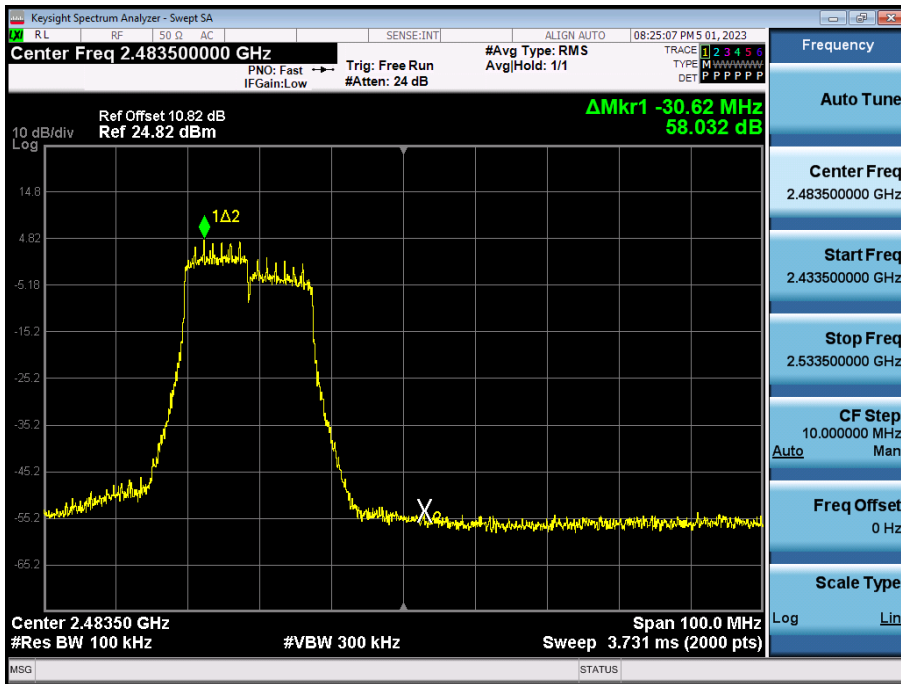
### Band Edge (802.11g-CH11)



Band Edge (802.11n\_HT20-CH1)



Band Edge (802.11n\_HT20-CH11)

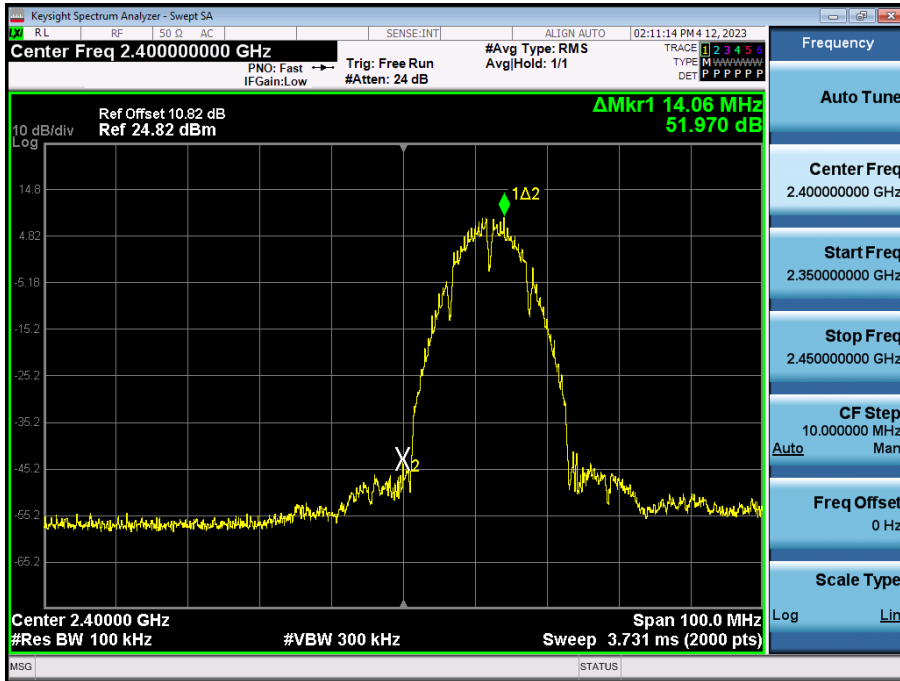




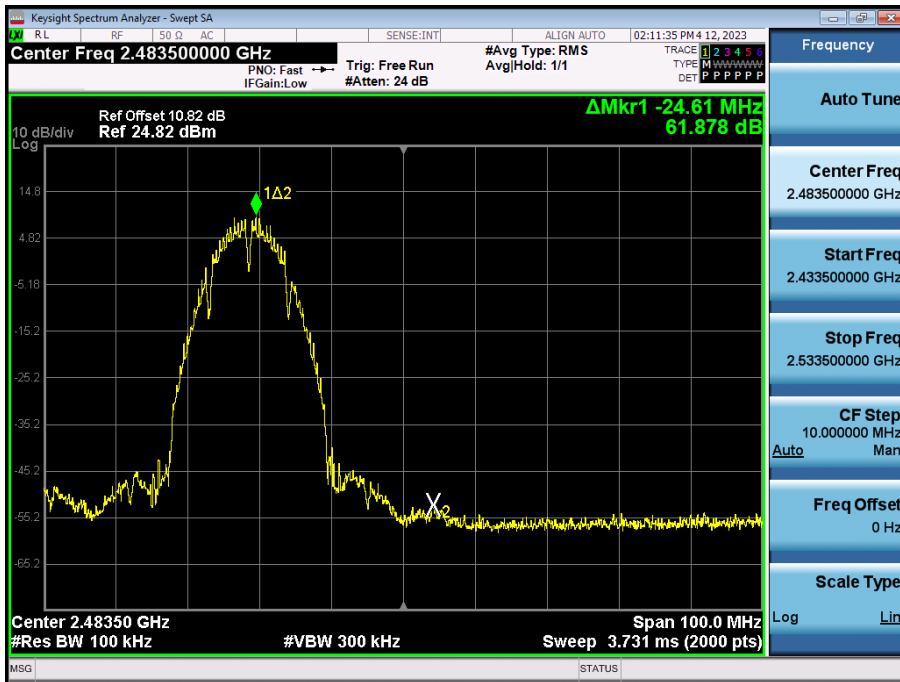
[Ant.2]

▣ Test Plots(Band Edge)

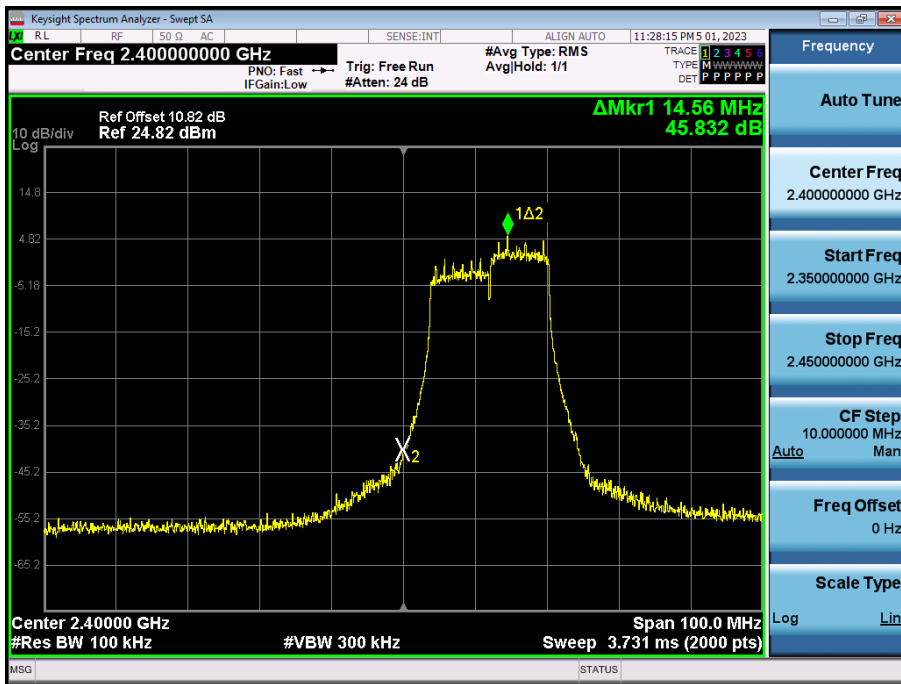
Band Edge (802.11b-CH1)



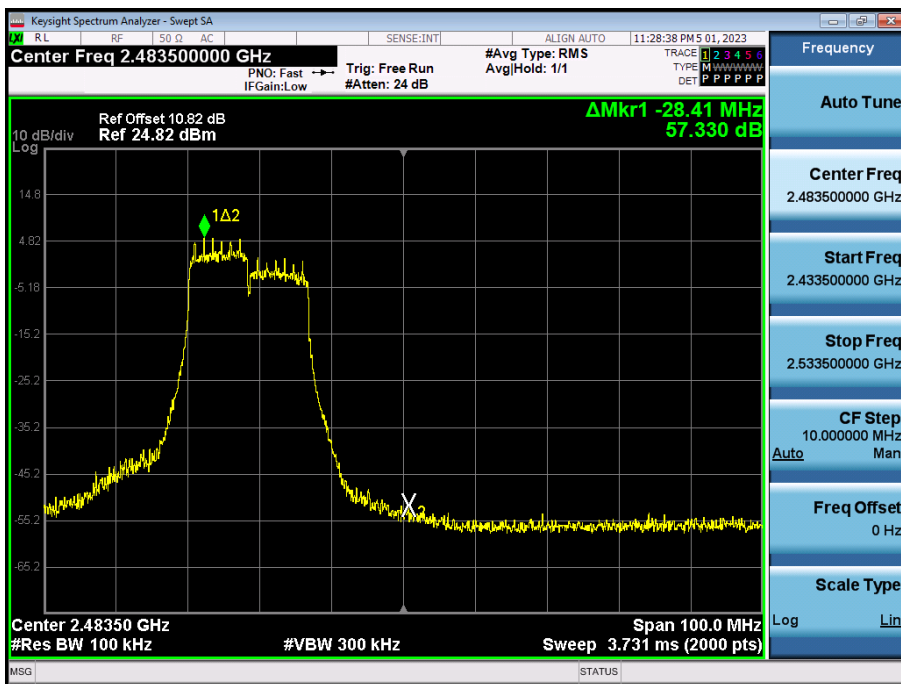
Band Edge (802.11b-CH11)



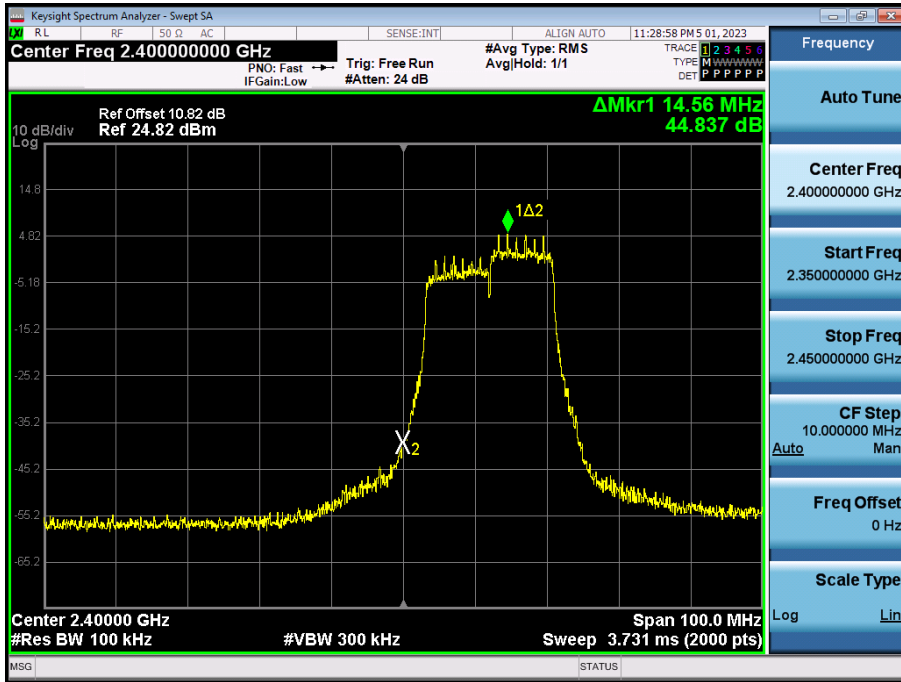
Band Edge (802.11g-CH1)



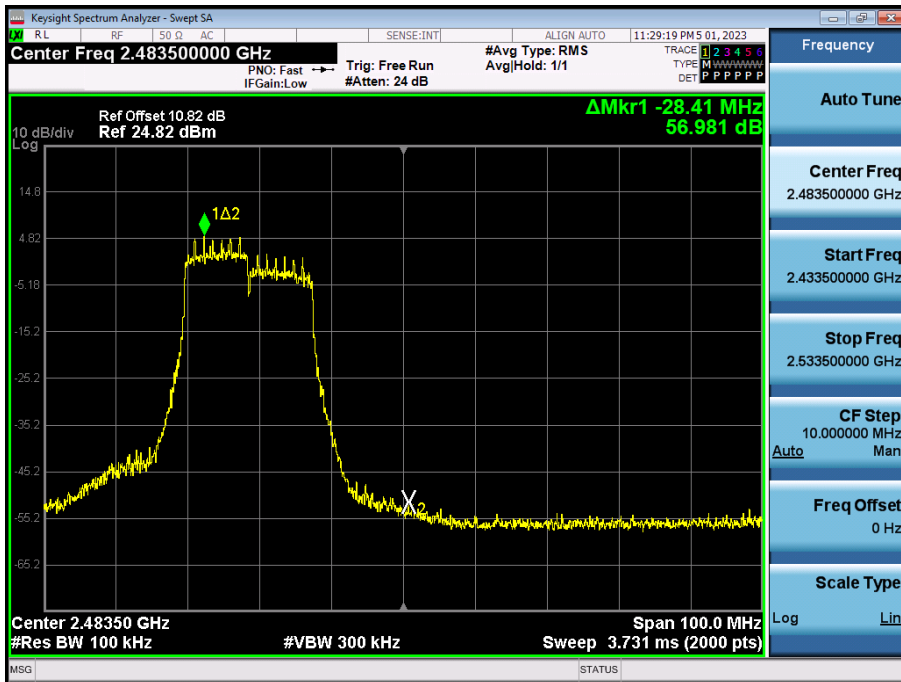
Band Edge (802.11g-CH11)



### Band Edge (802.11n\_HT20-CH1)



### Band Edge (802.11n\_HT20-CH11)

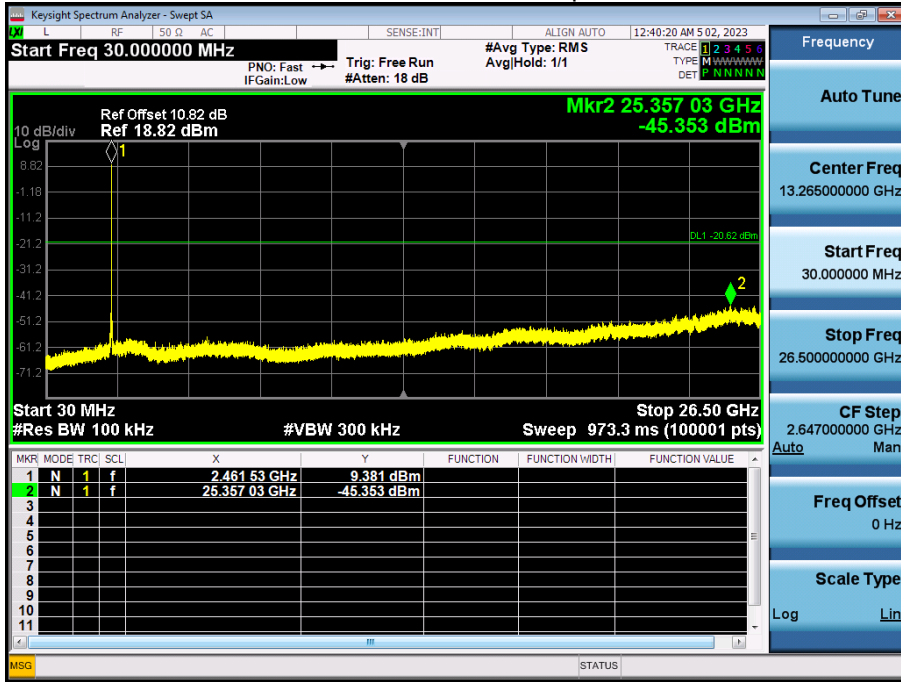


☑ Test Plots(Conducted Spurious Emission)

[Ant.1]

30 MHz ~ 26.5 GHz

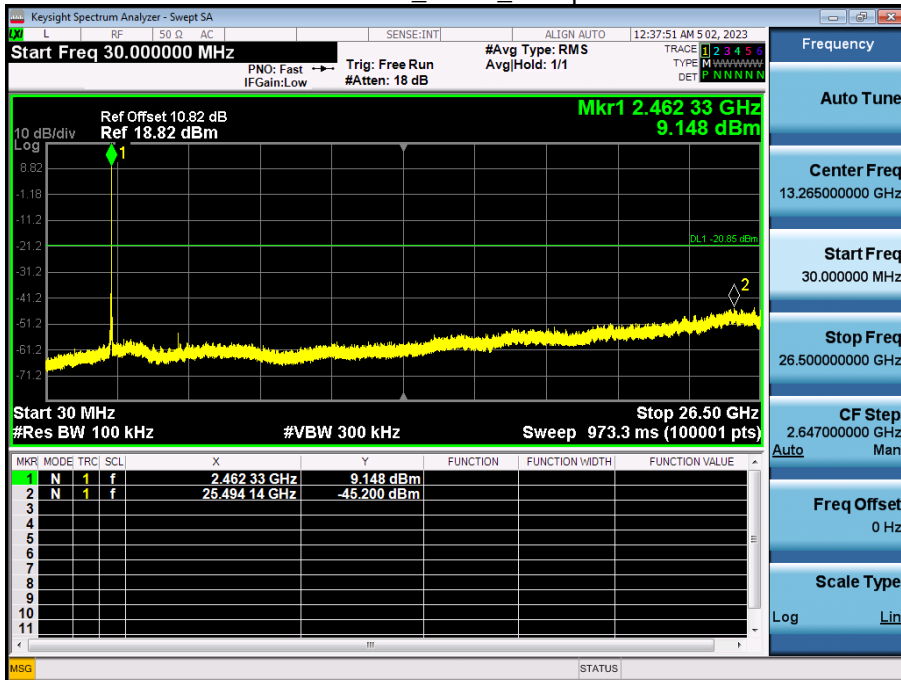
802.11b\_Ch.11\_1 Mbps



[Ant.2]

30 MHz ~ 26.5 GHz

802.11b\_Ch.11\_1 Mbps



**9.6 RADIATED SPURIOUS EMISSIONS****Frequency Range : 9 kHz – 30 MHz**

Frequency	Measured Value	A.F+C.L+D.F	Ant. POL	Total	Limit	Margin
[MHz]	[dB $\mu$ V]	[dB/m]	[H/V]	[dB $\mu$ V/m]	[dB $\mu$ V/m]	[dB]
No Critical peaks found						

**Note:**

1. The Measured value of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
2. Distance extrapolation factor =  $40\log(\text{specific distance} / \text{test distance})$  (dB)
3. Limit line = specific Limits (dB $\mu$ V) + Distance extrapolation factor

**Frequency Range : Below 1 GHz**

Frequency	Measured Value	A.F+C.L	Ant. POL	Total	Limit	Margin
[MHz]	[dB $\mu$ V]	[dB/m]	[H/V]	[dB $\mu$ V/m]	[dB $\mu$ V/m]	[dB]
No Critical peaks found						

**Note:**

1. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.

**Frequency Range : Above 1 GHz**

**[MIMO]**

Operation Mode: 802.11b  
 Transfer Rate: 1 Mbps  
 Operating Frequency: 2412 MHz  
 Channel No. 01 Ch

Frequency [MHz]	Measured Value [dBμV]	AF+CL+DF-AG [dB/m]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4824	46.34	3.42	V	49.76	73.98	24.22	PK
4824	38.26	3.42	V	41.68	53.98	12.30	AV
7236	41.06	8.48	V	49.54	73.98	24.44	PK
7236	28.98	8.48	V	37.46	53.98	16.52	AV
4824	48.15	3.42	H	51.57	73.98	22.41	PK
4824	40.18	3.42	H	43.60	53.98	10.38	AV
7236	41.20	8.48	H	49.68	73.98	24.30	PK
7236	29.15	8.48	H	37.63	53.98	16.35	AV

Operation Mode: 802.11b  
 Transfer Rate: 1 Mbps  
 Operating Frequency: 2437 MHz  
 Channel No. 06 Ch

Frequency [MHz]	Measured Value [dBμV]	AF+CL+DF-AG [dB/m]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4874	44.71	2.97	V	47.68	73.98	26.30	PK
4874	36.14	2.97	V	39.11	53.98	14.87	AV
7311	40.56	9.43	V	49.99	73.98	23.99	PK
7311	28.84	9.43	V	38.27	53.98	15.71	AV
4874	44.83	2.97	H	47.80	73.98	26.18	PK
4874	36.80	2.97	H	39.77	53.98	14.21	AV
7311	40.87	9.43	H	50.30	73.98	23.68	PK
7311	28.96	9.43	H	38.39	53.98	15.59	AV

Operation Mode: 802.11b  
Transfer Rate: 1 Mbps  
Operating Frequency: 2462 MHz  
Channel No.: 11 Ch

Frequency [MHz]	Measured Value [dB $\mu$ V]	AF+CL+DF-AG [dB/m]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measurement Type
4924	43.99	2.47	V	46.46	73.98	27.52	PK
4924	35.96	2.47	V	38.43	53.98	15.55	AV
7386	40.51	10.24	V	50.75	73.98	23.23	PK
7386	28.26	10.24	V	38.50	53.98	15.48	AV
4924	44.58	2.47	H	47.05	73.98	26.93	PK
4924	36.10	2.47	H	38.57	53.98	15.41	AV
7386	40.65	10.24	H	50.89	73.98	23.09	PK
7386	28.55	10.24	H	38.79	53.98	15.19	AV

**[RSDB]**

**Scenario 1**

WLAN 2.4 GHz MIMO(802.11b Ch.1)+ WLAN 6 GHz MIMO(802.11ax80 SU Ch.7)

Frequency [MHz]	Measured Value [dBμV]	AF+CL+DF-AG [dB/m]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4824	43.98	3.42	V	47.40	73.98	26.58	PK
4824	34.99	3.42	V	38.41	53.98	15.57	AV
7236	44.28	8.48	V	52.76	73.98	21.22	PK
7236	34.69	8.48	V	43.17	53.98	10.81	AV
4824	44.37	3.42	H	47.79	73.98	26.19	PK
4824	35.79	3.42	H	39.21	53.98	14.77	AV
7236	44.79	8.48	H	53.27	73.98	20.71	PK
7236	35.21	8.48	H	43.69	53.98	10.29	AV

**Note :**

UNII 6e Simultaneous Transmission Data refer to [UNII 6e] Test Report.

**Scenario 2**

WLAN 2.4 GHz MIMO(802.11b Ch.1)+ WLAN 5 GHz MIMO(802.11n20 Ch.169)

Frequency [MHz]	Measured Value [dBμV]	AF+CL+DF-AG [dB/m]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4824	44.18	3.42	V	47.60	73.98	26.38	PK
4824	34.69	3.42	V	38.11	53.98	15.87	AV
7236	43.50	8.48	V	51.98	73.98	22.00	PK
7236	34.47	8.48	V	42.95	53.98	11.03	AV
4824	44.46	3.42	H	47.88	73.98	26.10	PK
4824	35.16	3.42	H	38.58	53.98	15.40	AV
7236	43.97	8.48	H	52.45	73.98	21.53	PK
7236	35.76	8.48	H	44.24	53.98	9.74	AV

**Note :**

UNII Simultaneous Transmission Data refer to [UNII] Test Report.



**Scenario 3**

BT Ant.1(GFSK Ch.78) + WLAN 2.4 GHz Ant.2(802.11b, Ch.1) + WLAN 5 GHz MIMO(802.11n20, Ch.169)

Frequency [MHz]	Measured Value [dB $\mu$ V]	AF+CL+DF-AG [dB/m]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measurement Type
4824	45.67	3.42	V	49.09	73.98	24.89	PK
4824	37.29	3.42	V	40.71	53.98	13.27	AV
7236	41.24	8.48	V	49.72	73.98	24.26	PK
7236	29.15	8.48	V	37.63	53.98	16.35	AV
4824	45.91	3.42	H	49.33	73.98	24.65	PK
4824	37.31	3.42	H	40.73	53.98	13.25	AV
7236	41.32	8.48	H	49.80	73.98	24.18	PK
7236	29.11	8.48	H	37.59	53.98	16.39	AV

**Note :**

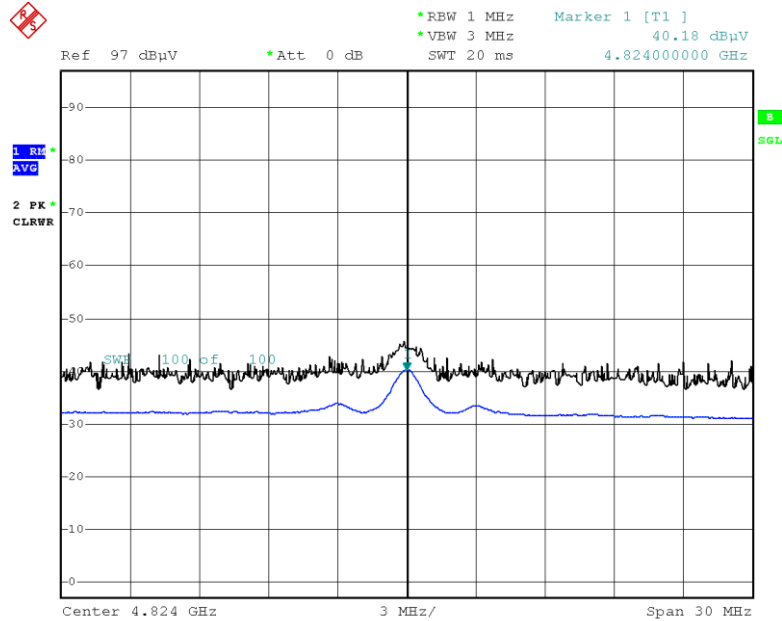
BT, UNII Simultaneous Transmission Data refer to [BT], [UNII] Test Report.

## Test Plots

### Note:

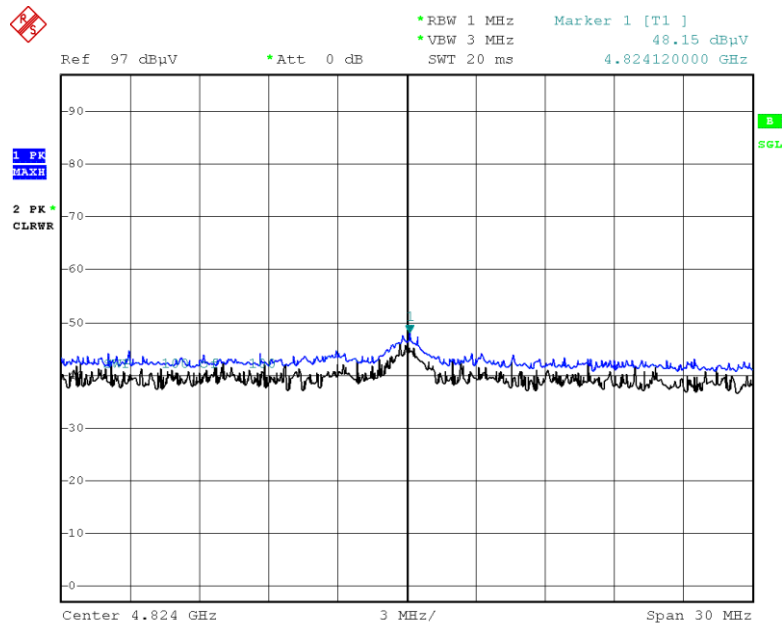
In order to simplify the report, Plot of worst case are only reported.

Radiated Spurious Emissions plot – Average Result (802.11b\_1 Mbps, Ch.1 2nd Harmonic, Z-H)



Date: 13.APR.2023 21:46:17

Radiated Spurious Emissions plot – Peak Result (802.11b\_1 Mbps, Ch.1 2nd Harmonic, Z-H)



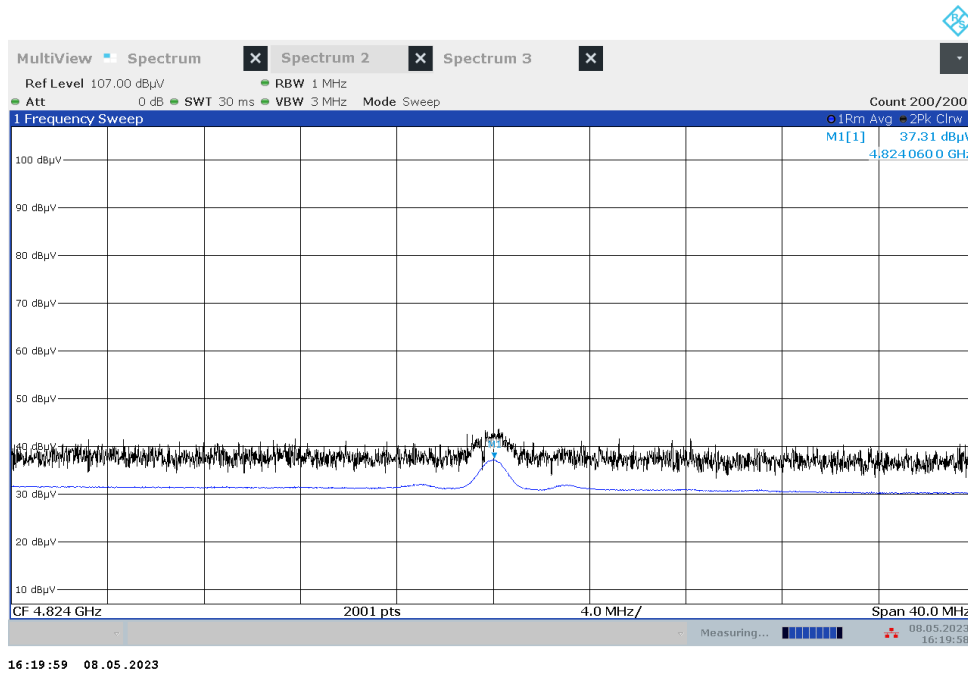
Date: 13.APR.2023 21:46:26

[RSDB]

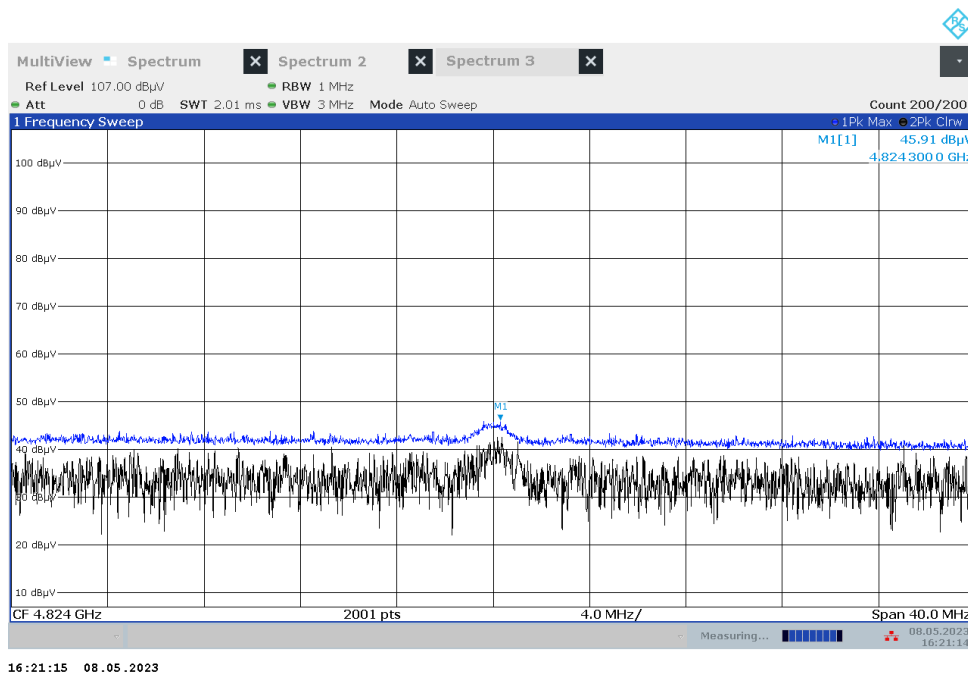
### Scenario 3

BT Ant.1(GFSK Ch.78) + WLAN 2.4 GHz Ant.2(802.11b, Ch.1) + WLAN 5 GHz MIMO(802.11n20, Ch.169)

Radiated Spurious Emissions plot – Average Result (802.11b, 1 Mbps, 2nd Harmonic, X-H)



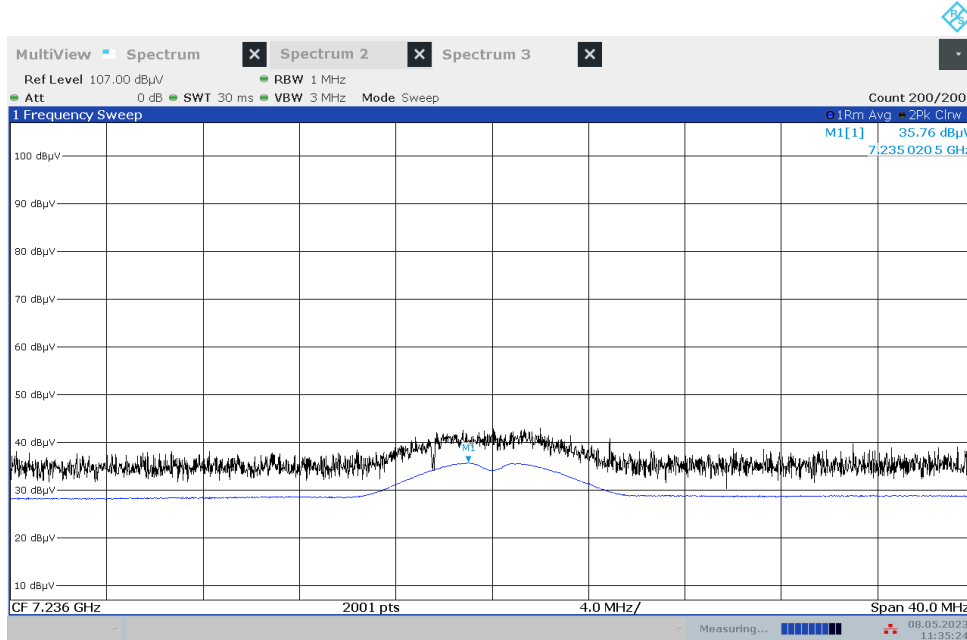
Radiated Spurious Emissions plot – Peak Result (802.11b, 1 Mbps, 2nd Harmonic, X-H)



## Scenario 2

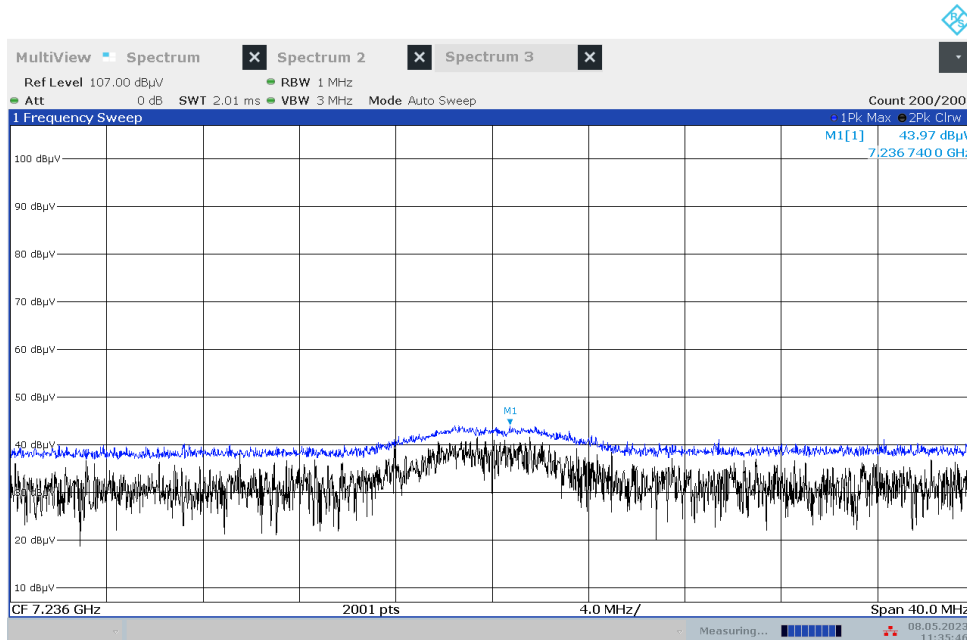
WLAN 2.4 GHz MIMO(802.11b Ch.1)+ WLAN 5 GHz MIMO(802.11n20 Ch.169)

Radiated Spurious Emissions plot – Average Result (802.11b, 1 Mbps, 3rd Harmonic, Z-H)



11:35:25 08.05.2023

Radiated Spurious Emissions plot – Peak Result (802.11b, 1 Mbps, 3rd Harmonic, Z-H)

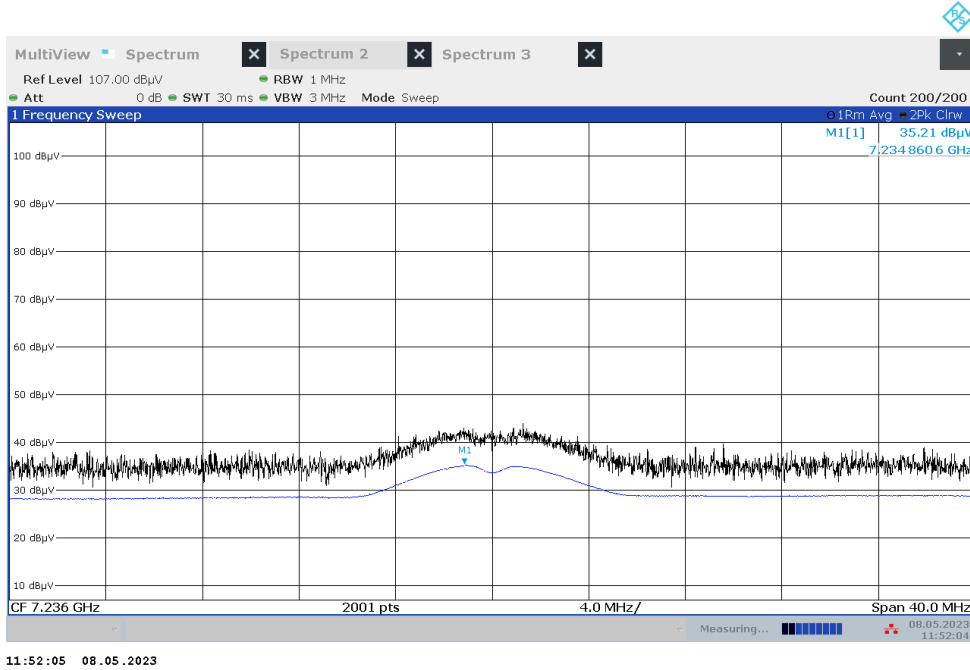


11:35:47 08.05.2023

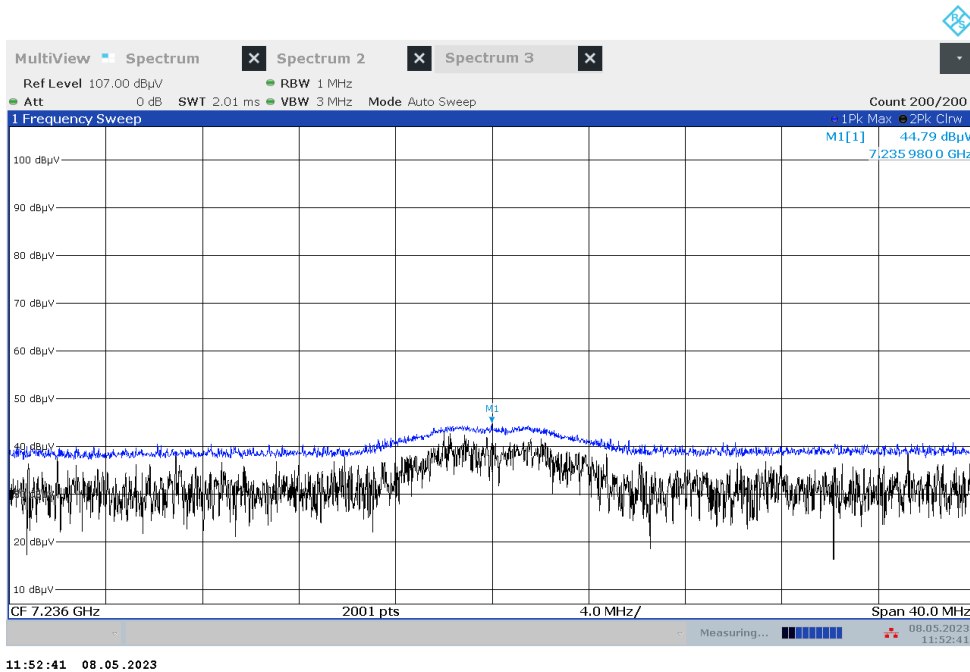
## Scenario 1

### WLAN 2.4 GHz MIMO(802.11b Ch.1)+ WLAN 6 GHz MIMO(802.11ax80 SU Ch.7)

Radiated Spurious Emissions plot – Average Result (802.11b, 1 Mbps, 3rd Harmonic, Z-H)



Radiated Spurious Emissions plot – Peak Result (802.11b, 1 Mbps, 3rd Harmonic, Z-H)



**9.7 RADIATED RESTRICTED BAND EDGES**

Operation Mode: 802.11b  
 Transfer Rate: 1 Mbps  
 Operating Frequency: 2412 MHz, 2462 MHz  
 Channel No. 01 Ch, 11 Ch

Frequency [MHz]	Measured Value [dBμV]	AF+CL+DF [dB/m]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
2390.0	19.96	34.90	H	54.86	73.98	19.12	PK
#2390.0	8.35	34.90	H	43.25	53.98	10.73	AV
2390.0	19.66	34.90	V	54.56	73.98	19.42	PK
#2390.0	8.45	34.90	V	43.35	53.98	10.63	AV
2483.5	19.53	35.10	H	54.63	73.98	19.35	PK
2483.5	7.74	35.10	H	42.84	53.98	11.14	AV
2483.5	19.25	35.10	V	54.35	73.98	19.63	PK
2483.5	7.65	35.10	V	42.75	53.98	11.23	AV

# Note : Integration method Used (ANSI C63.10 Section11.13.3)

Operation Mode: 802.11g  
 Transfer Rate: 6 Mbps  
 Operating Frequency: 2412 MHz, 2462 MHz  
 Channel No. 01 Ch, 11 Ch

Frequency [MHz]	Measured Value [dBμV]	Duty Cycle Factor [dB]	AF+CL+DF [dB/m]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
2390.0	32.71	0.00	34.90	H	67.61	73.98	6.37	PK
#2390.0	15.36	0.32	34.90	H	50.57	53.98	3.41	AV
2390.0	32.54	0.00	34.90	V	67.44	73.98	6.54	PK
#2390.0	15.28	0.32	34.90	V	50.49	53.98	3.49	AV
2483.5	31.29	0.00	35.10	H	66.39	73.98	7.59	PK
2483.5	15.05	0.32	35.10	H	50.46	53.98	3.52	AV
2483.5	31.08	0.00	35.10	V	66.18	73.98	7.80	PK
2483.5	14.63	0.32	35.10	V	50.04	53.98	3.94	AV

# Note : Integration method Used (ANSI C63.10 Section11.13.3)

Operation Mode: 802.11g  
 Transfer Rate: 6 Mbps  
 Operating Frequency: 2417 MHz, 2457 MHz  
 Channel No.: 02 Ch, 10 Ch

Frequency [MHz]	Measured Value [dBμV]	Duty Cycle Factor [dB]	AF+CL+DF [dB/m]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
2390.0	31.9	0.00	34.90	H	66.80	73.98	7.18	PK
2390.0	15.13	0.32	34.90	H	50.34	53.98	3.64	AV
2390.0	31.28	0.00	34.90	V	66.18	73.98	7.80	PK
2390.0	15.09	0.32	34.90	V	50.30	53.98	3.68	AV
2483.5	31.87	0.00	35.10	H	66.97	73.98	7.01	PK
2483.5	16.25	0.32	35.10	H	51.66	53.98	2.32	AV
2483.5	31.57	0.00	35.10	V	66.67	73.98	7.31	PK
2483.5	16.11	0.32	35.10	V	51.52	53.98	2.46	AV

Operation Mode: 802.11n (HT20)  
 Transfer Rate: 0  
 Operating Frequency: 2412 MHz, 2462 MHz  
 Channel No.: 01 Ch, 11 Ch

Frequency [MHz]	Measured Value [dBμV]	Duty Cycle Factor [dB]	AF+CL+DF [dB/m]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
2390.0	31.67	0.00	34.90	H	66.57	73.98	7.41	PK
2390.0	15.74	0.38	34.90	H	51.02	53.98	2.96	AV
2390.0	30.94	0.00	34.90	V	65.84	73.98	8.14	PK
2390.0	15.39	0.38	34.90	V	50.67	53.98	3.31	AV
2483.5	28.30	0.00	35.10	H	63.40	73.98	10.58	PK
2483.5	13.54	0.38	35.10	H	49.02	53.98	4.96	AV
2483.5	28.08	0.00	35.10	V	63.18	73.98	10.80	PK
2483.5	13.44	0.38	35.10	V	48.92	53.98	5.06	AV

Operation Mode: 802.11n (HT20)  
Transfer Rate: 0  
Operating Frequency: 2417 MHz, 2457 MHz  
Channel No.: 02 Ch, 10 Ch

Frequency [MHz]	Measured Value [dB $\mu$ V]	Duty Cycle Factor [dB]	AF+CL+DF [dB/m]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measurement Type
2390.0	30.06	0.00	34.90	H	64.96	73.98	9.02	PK
2390.0	13.74	0.38	34.90	H	49.02	53.98	4.96	AV
2390.0	29.87	0.00	34.90	V	64.77	73.98	9.21	PK
2390.0	13.58	0.38	34.90	V	48.86	53.98	5.12	AV
2483.5	30.33	0.00	35.10	H	65.43	73.98	8.55	PK
2483.5	14.48	0.38	35.10	H	49.96	53.98	4.02	AV
2483.5	29.68	0.00	35.10	V	64.78	73.98	9.20	PK
2483.5	14.36	0.38	35.10	V	49.84	53.98	4.14	AV



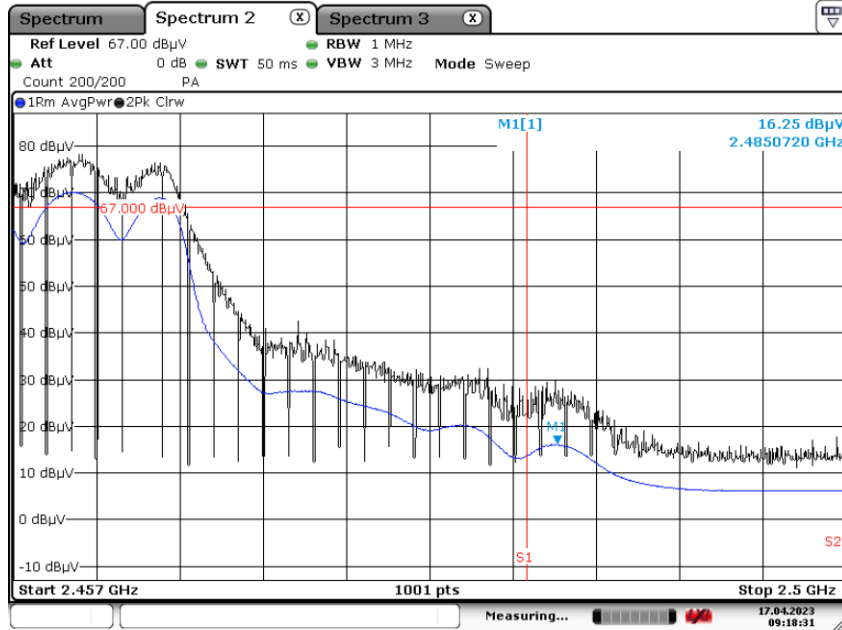
## Test Plots

### Note:

In order to simplify the report, Plots of worst case are only reported.

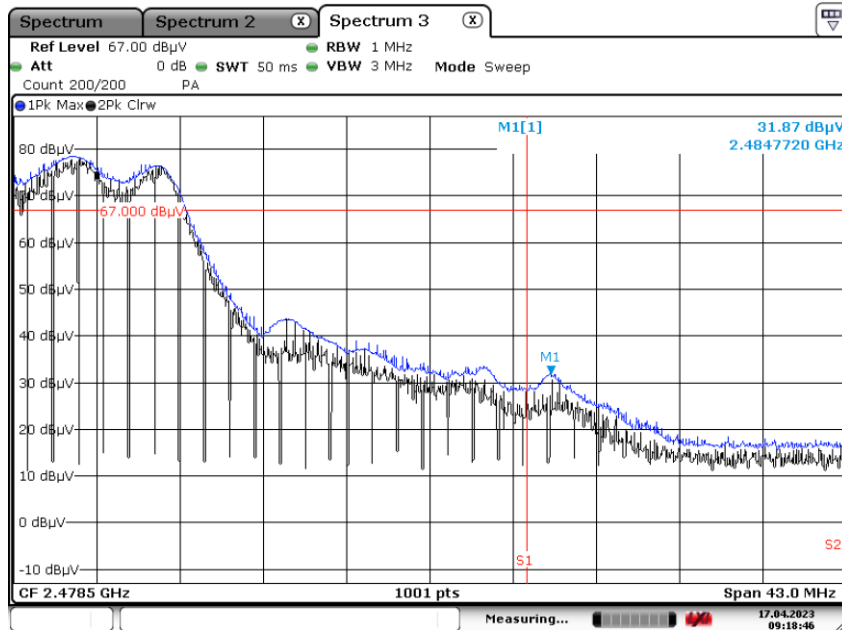
### [MIMO]

Radiated Restricted Band Edges plot – Average Result (802.11g\_ 6 Mbps, Ch.10, Z-H)



Date: 17.APR.2023 09:18:31

Radiated Restricted Band Edges plot –Peak Result (802.11g\_ 6 Mbps, Ch.10, Z-H)



Date: 17.APR.2023 09:18:46

## 9.8 POWERLINE CONDUCTED EMISSIONS

### Conducted Emissions

Test

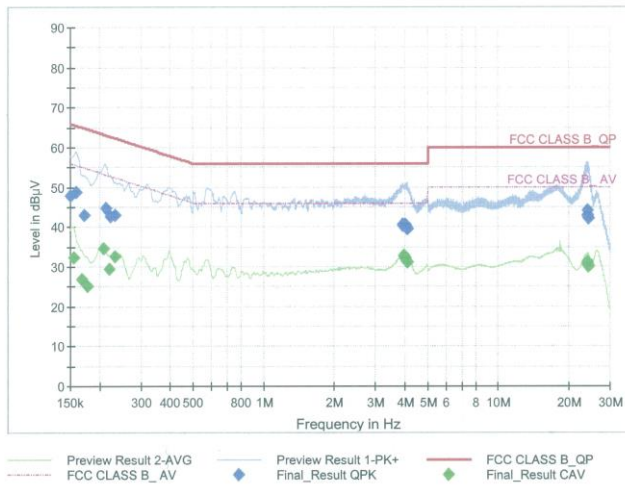
1 / 2

## Test Report

### Common Information

EUT : SM-X818U  
 Operating Conditions : 2.4G WLAN Mode  
 Comment :

Full Spectrum



### Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1500	47.85	66.00	18.15	1000.0	9.000	N	OFF	9.6
0.1590	48.83	65.52	16.69	1000.0	9.000	N	OFF	9.6
0.1725	43.04	64.84	21.80	1000.0	9.000	N	OFF	9.6
0.2130	44.85	63.09	18.24	1000.0	9.000	N	OFF	9.6
0.2220	42.76	62.74	19.98	1000.0	9.000	N	OFF	9.6
0.2333	43.02	62.33	19.32	1000.0	9.000	N	OFF	9.6
3.9245	40.50	56.00	15.51	1000.0	9.000	L1	OFF	9.8
3.9380	40.60	56.00	15.40	1000.0	9.000	L1	OFF	9.8
3.9920	40.64	56.00	15.36	1000.0	9.000	L1	OFF	9.8
4.0190	40.71	56.00	15.29	1000.0	9.000	L1	OFF	9.8
4.0438	40.14	56.00	15.86	1000.0	9.000	L1	OFF	9.8
4.0978	39.51	56.00	16.49	1000.0	9.000	L1	OFF	9.8
23.9158	44.07	60.00	15.93	1000.0	9.000	N	OFF	10.6
24.0080	43.12	60.00	16.88	1000.0	9.000	N	OFF	10.6
24.0170	42.82	60.00	17.18	1000.0	9.000	N	OFF	10.6
24.0238	42.93	60.00	17.07	1000.0	9.000	N	OFF	10.6
24.0778	42.80	60.00	17.20	1000.0	9.000	N	OFF	10.6
24.1768	42.24	60.00	17.76	1000.0	9.000	N	OFF	10.6

2023-04-18

오전 1:28:19

Test

2 / 2

**Final Result CAV**

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	32.37	55.75	23.38	1000.0	9.000	N	OFF	9.6
0.1680	26.87	55.06	28.18	1000.0	9.000	N	OFF	9.6
0.1770	25.18	54.63	29.44	1000.0	9.000	N	OFF	9.6
0.2085	34.71	53.27	18.56	1000.0	9.000	L1	OFF	9.7
0.2198	29.43	52.83	23.39	1000.0	9.000	N	OFF	9.6
0.2333	32.72	52.33	19.62	1000.0	9.000	N	OFF	9.6
3.9515	32.82	46.00	13.18	1000.0	9.000	L1	OFF	9.8
3.9718	32.64	46.00	13.36	1000.0	9.000	L1	OFF	9.8
3.9853	32.30	46.00	13.70	1000.0	9.000	L1	OFF	9.8
4.0235	32.15	46.00	13.85	1000.0	9.000	L1	OFF	9.8
4.0483	31.56	46.00	14.44	1000.0	9.000	L1	OFF	9.8
4.0798	31.29	46.00	14.71	1000.0	9.000	L1	OFF	9.8
23.8528	31.03	50.00	18.97	1000.0	9.000	N	OFF	10.6
23.9540	30.72	50.00	19.28	1000.0	9.000	N	OFF	10.6
24.0148	30.49	50.00	19.51	1000.0	9.000	N	OFF	10.6
24.1138	30.15	50.00	19.85	1000.0	9.000	N	OFF	10.6
24.1273	30.07	50.00	19.93	1000.0	9.000	N	OFF	10.6
24.1745	30.10	50.00	19.90	1000.0	9.000	N	OFF	10.6

2023-04-18

오전 1:28:19

## 9.9 CONFIRMATION OF GEO-LOCATION MECHANISM

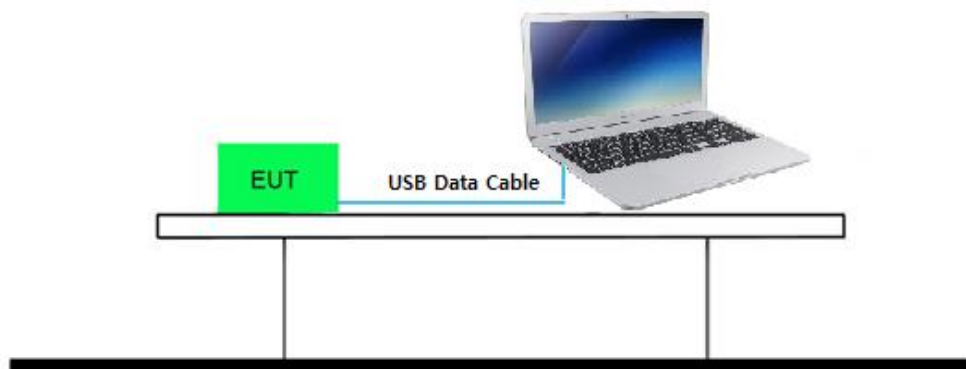
The device uses MCC information obtained from the public cellular carrier to determine that it is operating outside the U.S. and then enable channels 12 and 13 only if a non-US MCC that supports channel 12 and 13 is confirmed.

The device uses a geo-location mechanism based on the Country in order to only enable certain WLAN DTS bands when the device is not in the USA.

WLAN	Country code = US	Country code = KR(Korea)
CH 12	Did not connect	Connected
CH 13	Did not connect	Connected

The verification tests confirmed the operational of the geo-location mechanism.

### Test Setup



### Test Procedure

#### **In case of Country code**

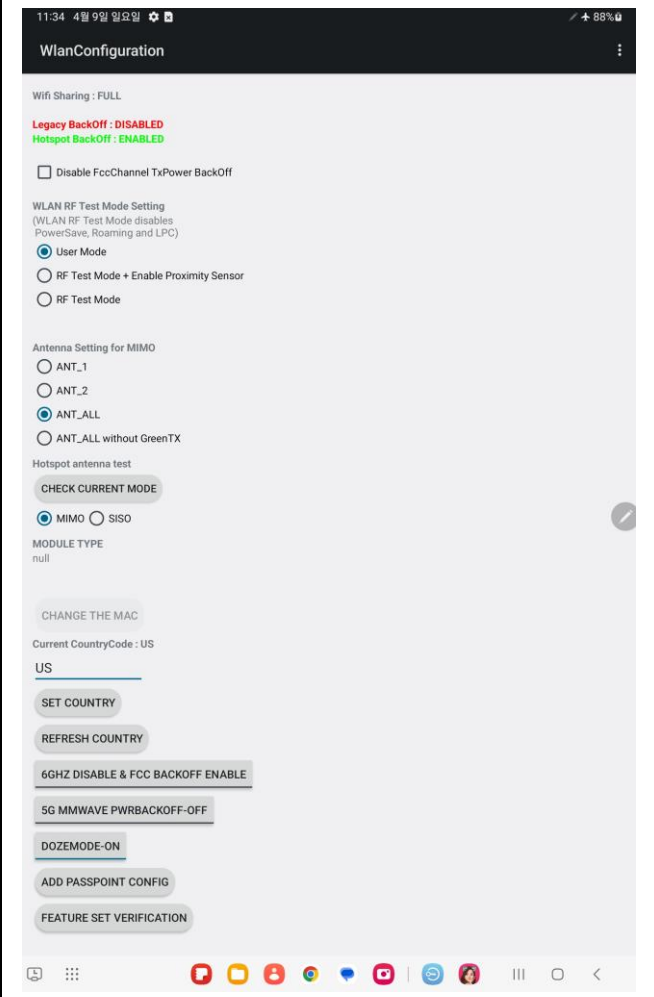
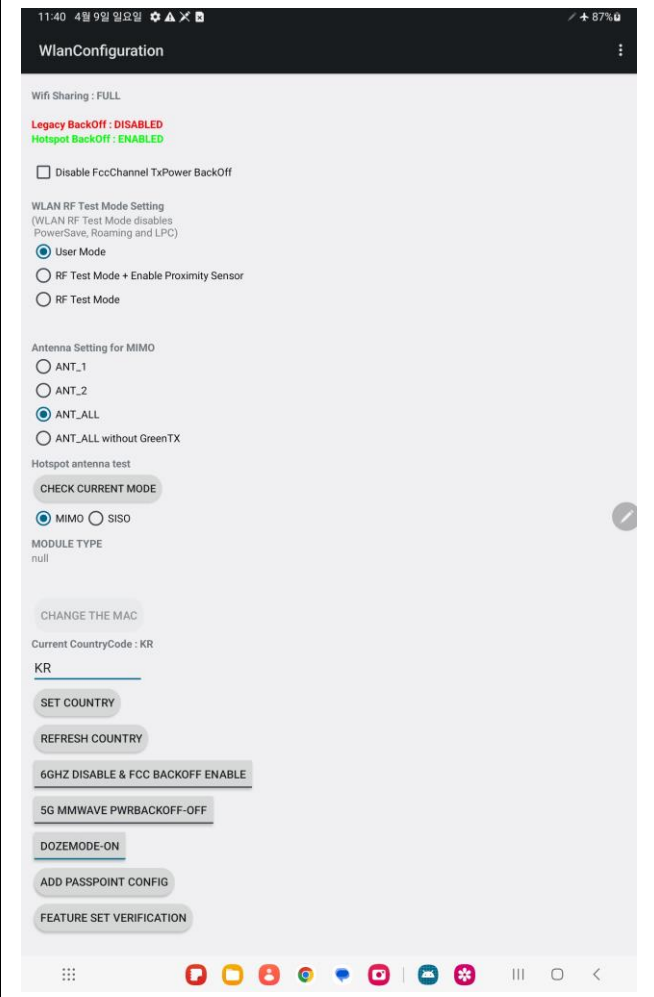
1. Open Command Prompt.
2. Setting the country for product
3. At the Command Prompt, enter the command.

```
>adb root
```

```
>adb remount
```

```
>adb shell iw list
```

## Setting the country for product

Country code = US	Country code = KR(Korea)
 <p>WlanConfiguration</p> <p>Wifi Sharing : FULL</p> <p>Legacy BackOff : DISABLED Hotspot BackOff : ENABLED</p> <p><input type="checkbox"/> Disable FccChannel TxPower BackOff</p> <p>WLAN RF Test Mode Setting (WLAN RF Test Mode disables PowerSave, Roaming and LPC)</p> <p><input checked="" type="radio"/> User Mode <input type="radio"/> RF Test Mode + Enable Proximity Sensor <input type="radio"/> RF Test Mode</p> <p>Antenna Setting for MIMO</p> <p><input type="radio"/> ANT_1 <input type="radio"/> ANT_2 <input checked="" type="radio"/> ANT_ALL <input type="radio"/> ANT_ALL without GreenTX</p> <p>Hotspot antenna test</p> <p>CHECK CURRENT MODE</p> <p><input checked="" type="radio"/> MIMO <input type="radio"/> SISO</p> <p>MODULE TYPE null</p> <p>CHANGE THE MAC</p> <p>Current CountryCode : US</p> <p><u>US</u></p> <p>SET COUNTRY</p> <p>REFRESH COUNTRY</p> <p>6GHZ DISABLE &amp; FCC BACKOFF ENABLE</p> <p>5G MMWAVE PWRBACKOFF-OFF</p> <p>DOZEMODE-ON</p> <p>ADD PASSPOINT CONFIG</p> <p>FEATURE SET VERIFICATION</p>	 <p>WlanConfiguration</p> <p>Wifi Sharing : FULL</p> <p>Legacy BackOff : DISABLED Hotspot BackOff : ENABLED</p> <p><input type="checkbox"/> Disable FccChannel TxPower BackOff</p> <p>WLAN RF Test Mode Setting (WLAN RF Test Mode disables PowerSave, Roaming and LPC)</p> <p><input checked="" type="radio"/> User Mode <input type="radio"/> RF Test Mode + Enable Proximity Sensor <input type="radio"/> RF Test Mode</p> <p>Antenna Setting for MIMO</p> <p><input type="radio"/> ANT_1 <input type="radio"/> ANT_2 <input checked="" type="radio"/> ANT_ALL <input type="radio"/> ANT_ALL without GreenTX</p> <p>Hotspot antenna test</p> <p>CHECK CURRENT MODE</p> <p><input checked="" type="radio"/> MIMO <input type="radio"/> SISO</p> <p>MODULE TYPE null</p> <p>CHANGE THE MAC</p> <p>Current CountryCode : KR</p> <p><u>KR</u></p> <p>SET COUNTRY</p> <p>REFRESH COUNTRY</p> <p>6GHZ DISABLE &amp; FCC BACKOFF ENABLE</p> <p>5G MMWAVE PWRBACKOFF-OFF</p> <p>DOZEMODE-ON</p> <p>ADD PASSPOINT CONFIG</p> <p>FEATURE SET VERIFICATION</p>

Country code = US

```
Frequencies:  
* 2412 MHz [1] (30.0 dBm)  
* 2417 MHz [2] (30.0 dBm)  
* 2422 MHz [3] (30.0 dBm)  
* 2427 MHz [4] (30.0 dBm)  
* 2432 MHz [5] (30.0 dBm)  
* 2437 MHz [6] (30.0 dBm)  
* 2442 MHz [7] (30.0 dBm)  
* 2447 MHz [8] (30.0 dBm)  
* 2452 MHz [9] (30.0 dBm)  
* 2457 MHz [10] (30.0 dBm)  
* 2462 MHz [11] (30.0 dBm)  
* 2467 MHz [12] (disabled)  
* 2472 MHz [13] (disabled)  
* 2484 MHz [14] (disabled)
```

```
gts9p:/ # iw reg get  
global  
country 00: DFS-UNSET  
 (2402 - 2472 @ 40), (6, 20), (N/A)  
 (2457 - 2482 @ 20), (6, 20), (N/A), AUTO-BW, PASSIVE-SCAN  
 (2474 - 2494 @ 20), (6, 20), (N/A), NO-OFDM, PASSIVE-SCAN  
 (5170 - 5250 @ 80), (6, 20), (N/A), AUTO-BW, PASSIVE-SCAN  
 (5250 - 5330 @ 80), (6, 20), (0 ms), DFS, AUTO-BW, PASSIVE-SCAN  
 (5490 - 5730 @ 160), (6, 20), (0 ms), DFS, PASSIVE-SCAN  
 (5735 - 5835 @ 80), (6, 20), (N/A), PASSIVE-SCAN  
 (57240 - 63720 @ 2160), (N/A, 0), (N/A)  
  
phy#0 (self-managed)  
country US: DFS-FCC  
 (2402 - 2472 @ 40), (6, 30), (N/A), AUTO-BW  
 (5170 - 5250 @ 80), (6, 30), (N/A), AUTO-BW  
 (5250 - 5330 @ 80), (6, 24), (0 ms), DFS, AUTO-BW  
 (5490 - 5730 @ 160), (6, 24), (0 ms), DFS, AUTO-BW  
 (5735 - 5835 @ 80), (6, 30), (N/A), AUTO-BW  
 (5835 - 5895 @ 40), (6, 30), (N/A), NO-OUTDOOR, AUTO-BW  
 (5925 - 7125 @ 160), (N/A, 24), (N/A), NO-OUTDOOR, AUTO-BW
```

Country code = KR (Korea)

```
Frequencies:  
* 2412 MHz [1] (23.0 dBm)  
* 2417 MHz [2] (23.0 dBm)  
* 2422 MHz [3] (23.0 dBm)  
* 2427 MHz [4] (23.0 dBm)  
* 2432 MHz [5] (23.0 dBm)  
* 2437 MHz [6] (23.0 dBm)  
* 2442 MHz [7] (23.0 dBm)  
* 2447 MHz [8] (23.0 dBm)  
* 2452 MHz [9] (23.0 dBm)  
* 2457 MHz [10] (23.0 dBm)  
* 2462 MHz [11] (23.0 dBm)  
* 2467 MHz [12] (23.0 dBm)  
* 2472 MHz [13] (23.0 dBm)  
* 2484 MHz [14] (disabled)
```

```
gts9p:/ # iw reg get  
global  
country 00: DFS-UNSET  
        (2402 - 2472 @ 40), (6, 20), (N/A)  
        (2457 - 2482 @ 20), (6, 20), (N/A), AUTO-BW, PASSIVE-SCAN  
        (2474 - 2494 @ 20), (6, 20), (N/A), NO-OFDM, PASSIVE-SCAN  
        (5170 - 5250 @ 80), (6, 20), (N/A), AUTO-BW, PASSIVE-SCAN  
        (5250 - 5330 @ 80), (6, 20), (0 ms), DFS, AUTO-BW, PASSIVE-SCAN  
        (5490 - 5730 @ 160), (6, 20), (0 ms), DFS, PASSIVE-SCAN  
        (5735 - 5835 @ 80), (6, 20), (N/A), PASSIVE-SCAN  
        (57240 - 63720 @ 2160), (N/A, 0), (N/A)  
  
phy#0 (self-managed)  
country KR: DFS-UNSET  
        (2402 - 2482 @ 40), (N/A, 23), (N/A), AUTO-BW  
        (5170 - 5250 @ 80), (6, 23), (N/A), AUTO-BW  
        (5250 - 5330 @ 80), (6, 23), (0 ms), DFS, AUTO-BW  
        (5490 - 5730 @ 160), (6, 23), (0 ms), DFS, AUTO-BW  
        (5735 - 5835 @ 80), (6, 23), (N/A), AUTO-BW  
        (5925 - 7125 @ 160), (N/A, 24), (N/A), NO-OUTDOOR, AUTO-BW
```

## 10. LIST OF TEST EQUIPMENT

### Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	08/22/2023	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	06/07/2023	Annual
Temperature Chamber	SU-642	ESPEC	0093008124	02/22/2024	Annual
Signal Analyzer	N9030A	Keysight	MY55410508	09/06/2023	Annual
Power Meter	N1911A	Agilent	MY45100523	03/06/2024	Annual
Power Sensor	N1921A	Agilent	MY57820067	03/06/2024	Annual
Directional Coupler	87300B	Agilent	3116A03621	11/02/2023	Annual
Power Splitter	11667B	Hewlett Packard	10545	02/06/2024	Annual
DC Power Supply	E3632A	Agilent	KR75305528	01/03/2024	Annual
Attenuator(10 dB)(DC-26.5 GHz)	8493C-010	Agilent	08285	06/21/2023	Annual
Attenuator(20 dB)	18N-20dB	Rohde & Schwarz	8	03/08/2024	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A
FCC WLAN&BT&BLE Conducted Test Software v3.0	N/A	HCT CO., LTD.	N/A	N/A	N/A
Bluetooth Tester	CBT	Rohde & Schwarz	100808	02/16/2024	Annual

### Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.



**Radiated Test**

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Controller(Antenna mast)	CO3000	Innco system	CO3000-4p	N/A	N/A
Antenna Position Tower	MA4640/800-XP-EP	Innco system	N/A	N/A	N/A
Controller	EM2090	Emco	060520	N/A	N/A
Turn Table	N/A	Ets	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	03/17/2024	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	08/16/2024	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/18/2023	Biennial
Horn Antenna(15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170124	03/28/2025	Biennial
Amp & Filter Bank Switch Controller	FBSM-01A	TNM system	0	N/A	N/A
Band Reject Filter	WRCJV2400/2483.5-2370/2520-60/12SS	Wainwright Instruments	2	01/05/2024	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	5	06/13/2023	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	6	06/13/2023	Annual
Band Reject Filter	WRCJV5100/5850-40/50-8EEK	Wainwright Instruments	1	02/09/2024	Annual
ATT(3 dB) + LNA2(6~18 GHz)	18B-03, CBL06185030	WEINSCHEL CERNEX	N/A	12/05/2023	Annual
ATT(10 dB) + LNA1(0.1~18 GHz)	56-10, CBLU1183540B-01	Api tech, CERNEX	N/A	12/05/2023	Annual
High Pass Filter	WHKX10-2700-3000-18000-40SS	Wainwright Instruments	N/A	12/05/2023	Annual
High Pass Filter	WHKX8-6090-7000-18000-40SS	Wainwright Instruments	N/A	12/05/2023	Annual
Thru	COAXIAL ATTENUATOR	T&M SYSTEM	N/A	12/05/2023	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/01/2023	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/02/2024	Annual
Bluetooth Tester	TC-3000C	TESCOM	3000C000175	03/28/2024	Annual
Spectrum Analyzer	FSP(9 kHz ~ 30 GHz)	Rohde & Schwarz	836650/016	09/06/2023	Annual
Spectrum Analyzer	FSVA40(10 Hz ~ 40 GHz)	Rohde & Schwarz	101502	03/17/2024	Annual
Spectrum Analyzer	FSW	Rohde & Schwarz	101736	05/17/2023	Annual
Signal Analyzer	N9030A	Keysight	MY52350879	01/02/2024	Annual

**Note:**

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
3. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5(Version : 2017).

**11. ANNEX A\_ TEST SETUP PHOTO**

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2305-FC043-P