

# FCC DTS REPORT

## Certification

<b>Applicant Name:</b> SAMSUNG Electronics Co., Ltd.	<b>Date of Issue:</b> September 17, 2021
<b>Address:</b> 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea	<b>Test Site/Location:</b> 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
	<b>Report No.:</b> HCT-RF-2109-FC021

<b>FCC ID:</b>	<b>A3LSMG990B</b>
<b>APPLICANT:</b>	<b>SAMSUNG Electronics Co., Ltd.</b>

<b>Model:</b>	SM-G990E/DS
<b>Additional Model:</b>	SM-G990E
<b>EUT Type:</b>	Mobile Phone
<b>Average Output Power:</b>	Ant.1 - 802.11b : 18.97 dBm, 802.11g : 15.80 dBm, 802.11n(HT20) : 14.70 dBm Ant.2 - 802.11b : 18.55 dBm, 802.11g : 16.14 dBm, 802.11n(HT20) : 15.13 dBm Ant.1&2 - 802.11g : 18.99 dBm, 802.11n(HT20) : 17.93 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-2109-FC021

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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-2109-FC021	September 17, 2021	- First Approval Report

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**1. EUT DESCRIPTION**

<b>Model</b>	SM-G990E/DS		
<b>Additional Model</b>	SM-G990E		
<b>EUT Type</b>	Mobile Phone		
<b>Power Supply</b>	DC 4.20 V		
<b>Frequency Range</b>	2 412 MHz ~ 2 462 MHz		
<b>Max. RF Output Power</b>	<u>Peak Power</u> (For information only)	Ant. 1	802.11b : 25.15 dBm (SISO) 802.11g : 23.68 dBm 802.11n(HT20) : 22.81 dBm
		Ant.2	802.11b : 24.25 dBm (SISO) 802.11g : 24.19 dBm 802.11n(HT20) : 23.47 dBm
		Ant.1&2 (MIMO)	802.11g : 26.89 dBm 802.11n(HT20) : 26.17 dBm
	<u>Average Power</u>	Ant. 1	802.11b : 18.97 dBm (SISO) 802.11g : 15.80 dBm 802.11n(HT20) : 14.70 dBm
		Ant.2	802.11b : 18.55 dBm (SISO) 802.11g : 16.14 dBm 802.11n(HT20) : 15.13 dBm
		Ant.1&2 (MIMO)	802.11g : 18.99 dBm 802.11n(HT20) : 17.93 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>	August 18, 2021 ~ September 10, 2021		
<b>Serial number</b>	Radiated: R3CR803NW1R Conducted: R3CR803N9YT		

**ANTENNA CONFIGURATIONS**

1. The device employs MIMO technology. Below are the possible configurations

Configurations	SISO		SDM	CDD
	Ant1	Ant2	Ant1 + Ant2	Ant1 + Ant2
802.11b	O	O	X	X
802.11g	X	X	X	O
802.11n(HT20)	X	X	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 bands simultaneously on each antenna.

RSDB Scenario	2.4 GHz	2.4 GHz	5 GHz	5 GHz
	WiFi Ant.1	WiFi Ant.2	WiFi Ant.1	WiFi Ant.2
2.4 GHz WiFi + 5 GHz WiFi MIMO	On		On	On
2.4 GHz WiFi + 5 GHz WiFi MIMO		On	On	On
2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO	On	On	On	On

Non-DBS	5 GHz WiFi Ant.1	5 GHz WiFi Ant.2	Bluetooth
5 GHz WiFi MIMO + Bluetooth	On	On	On

**3. Directional Gain Calculation**

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

Directional gain =

$$\bullet \quad \text{DirectionalGain} = 10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

Ant Gain (dBi)		N <sub>ANT</sub> / N <sub>SS</sub>	Directional Gain (dBi)
Ant.1	-2.0		
Ant.2	-3.9		

## 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.

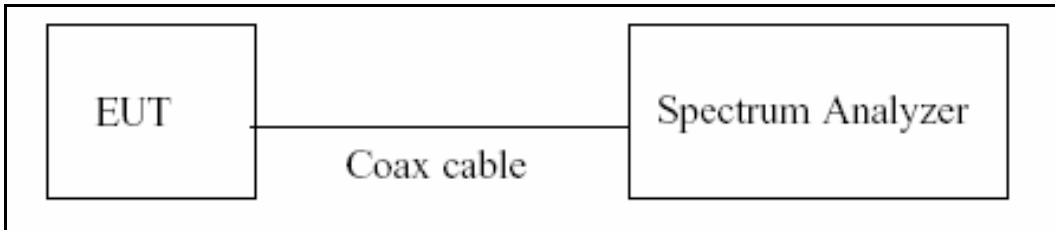
The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05 ( 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  $> 50/T$ .

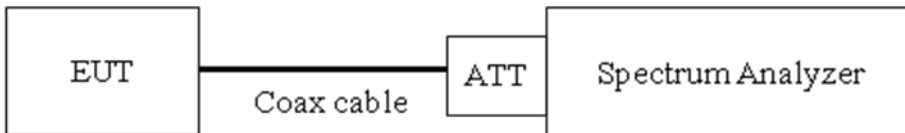
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ( $\geq$  RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep  $> 100$
6. Trace mode = Clear write
7. Measure  $T_{total}$  and  $T_{on}$
8. Calculate Duty Cycle =  $T_{on} / T_{total}$  and Duty Cycle Factor =  $10\log(1/\text{Duty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

## 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.

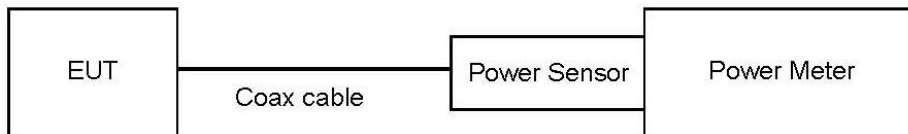
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

### 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

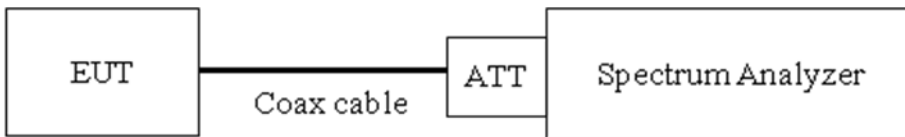
- Conducted Output Power(Peak) = Measured Level + ATT loss + Cable loss
- Conducted Output Power(Average) = Measured Level + ATT loss + Cable loss + Duty Cycle Factor

## 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 Level + ATT loss + Cable loss

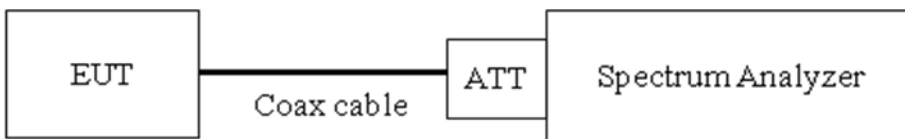
## 7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

### 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	10.05
100	10.45
200	10.49
300	10.54
400	10.60
500	10.60
600	10.61
700	10.62
800	10.63
900	10.65
1000	10.70
2000	10.85
2400	10.88
2500	10.90
3000	10.89
4000	10.99
5000	11.07
5700	11.14
5800	11.69
6000	11.69
7000	11.77
8000	11.90
9000	11.90
10 000	11.98
11 000	12.08
12 000	12.17
13 000	12.26
14 000	12.27
15 000	12.30
16 000	12.40
17 000	12.48
18 000	12.69
19 000	12.82
20 000	12.74
21 000	12.41
22 000	12.54
23 000	12.53
24 000	12.55
25 000	12.65

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

2. Factor = Attenuator loss(10 dB) + Cable loss(1ea)

3. EUT Cable loss1 = 0.35 dB

4. EUT Cable loss2 = 0.20 dB



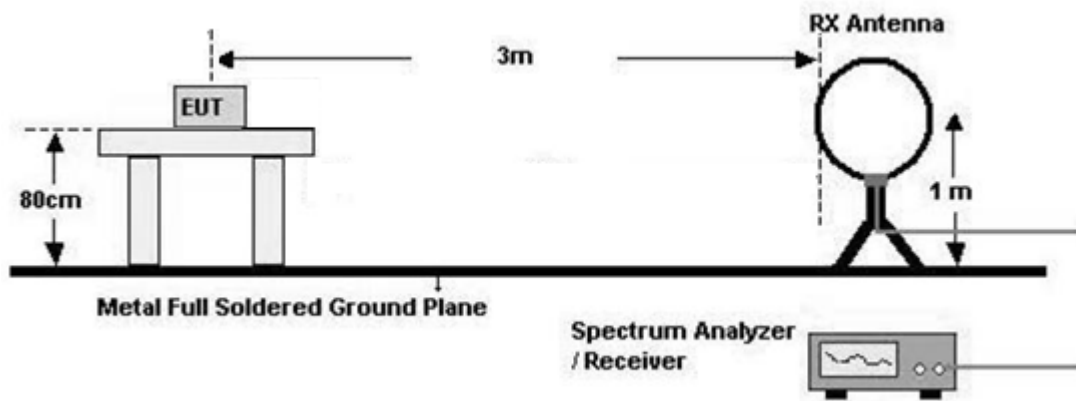
## 7.6. Radiated Test

### Limit

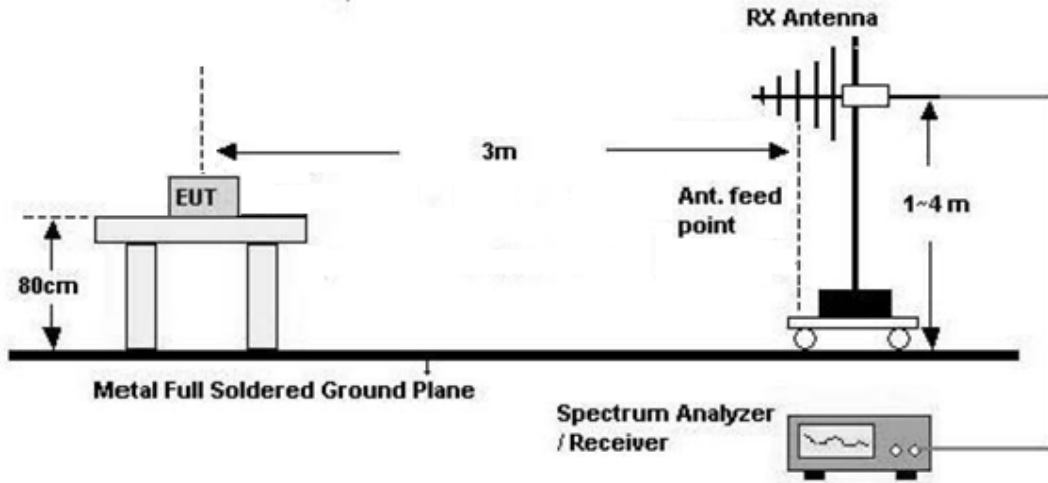
Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ )	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

### Test Configuration

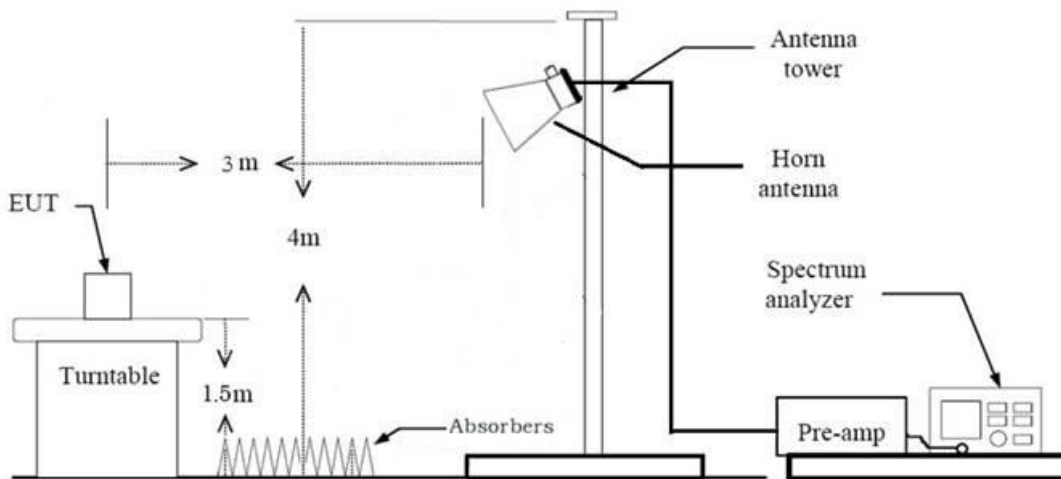
Below 30 MHz



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 Level + 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 Level + 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)

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

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

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

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

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

**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 x 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 x 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 x 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 Level + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

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

= Measured Level + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

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

= Measured Level + 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 Level + 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, Y
  - Radiated Restricted Band Edge : X, Y
3. Duty cycle factor applies only 802.11g/n/ac (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
6. SM-G990E/DS, SM-G990E were tested and the worst case results are reported.
  - (Worst case : SM-G990E/DS)

**Radiated test(DBS)**

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
3. Test case

RSDB Scenario	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5 GHz WiFi Ant.1	5 GHz WiFi Ant.2	Test case
2.4 GHz WiFi + 5 GHz WiFi MIMO	On		On	On	<u>Case 1</u>
2.4 GHz WiFi + 5 GHz WiFi MIMO		On	On	On	-
2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO	On	On	On	On	<u>Case 2</u>

Non-DBS	5 GHz WiFi Ant.1	5 GHz WiFi Ant.2	Bluetooth Ant.1	Test case
5 GHz WiFi MIMO + Bluetooth	On	On	On	Case 3

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.)

(Test case 3 Result : Please refer to the SM-G990E/DS [BT] Test Report.)

Test case	Description	2.4 GHz Emission	5 GHz Emission	Bluetooth Emission
1	Antenna	Ant 1	Ant All	-
	Channel	1	165	-
	Data Rate	1 Mbps	6 Mbps	-
	Mode	802.11b	802.11a	-

Test case	Description	2.4 GHz Emission	5 GHz Emission	Bluetooth Emission
2	Antenna	Ant All	Ant All	-
	Channel	6	165	-
	Data Rate	MCS0	6 Mbps	-
	Mode	802.11g	802.11a	-

Test case	Description	5 GHz Emission	Bluetooth Emission
3	Antenna	Ant All	Ant 1
	Channel	165	78
	Data Rate	6 Mbps	1 Mbps
	Mode	802.11a	GFSK

5. SM-G990E/DS, SM-G990E were tested and the worst case results are reported.

(Worst case : SM-G990E/DS)

**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

2. SM-G990E/DS, SM-G990E were tested and the worst case results are reported.

(Worst case : SM-G990E/DS)

**Conducted test**

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

2. SM-G990E/DS, SM-G990E were tested and the worst case results are reported.

(Worst case : SM-G990E/DS)

**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

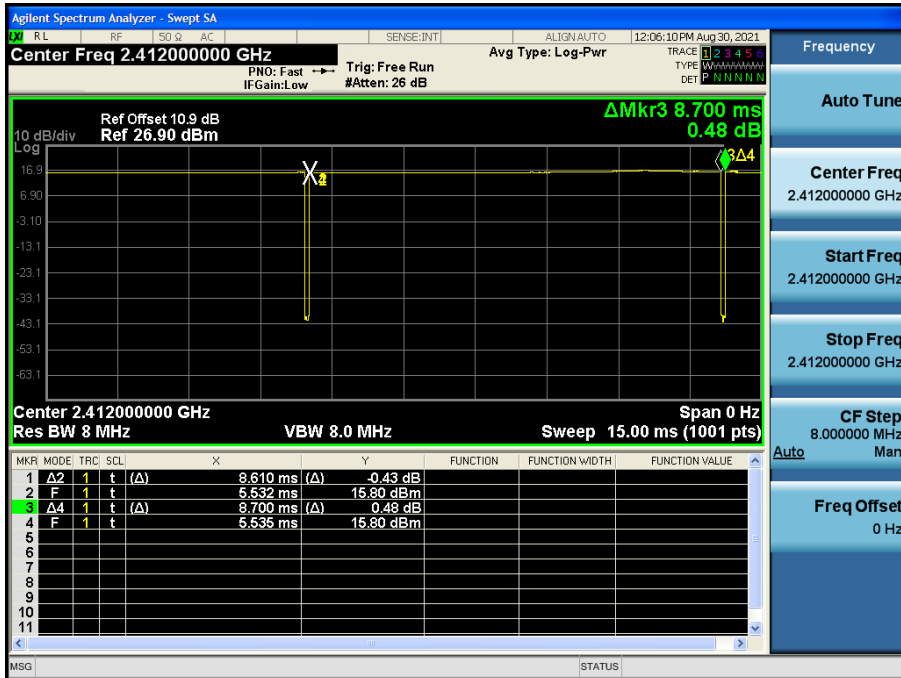
## 9. TEST RESULT

### 9.1 DUTY CYCLE

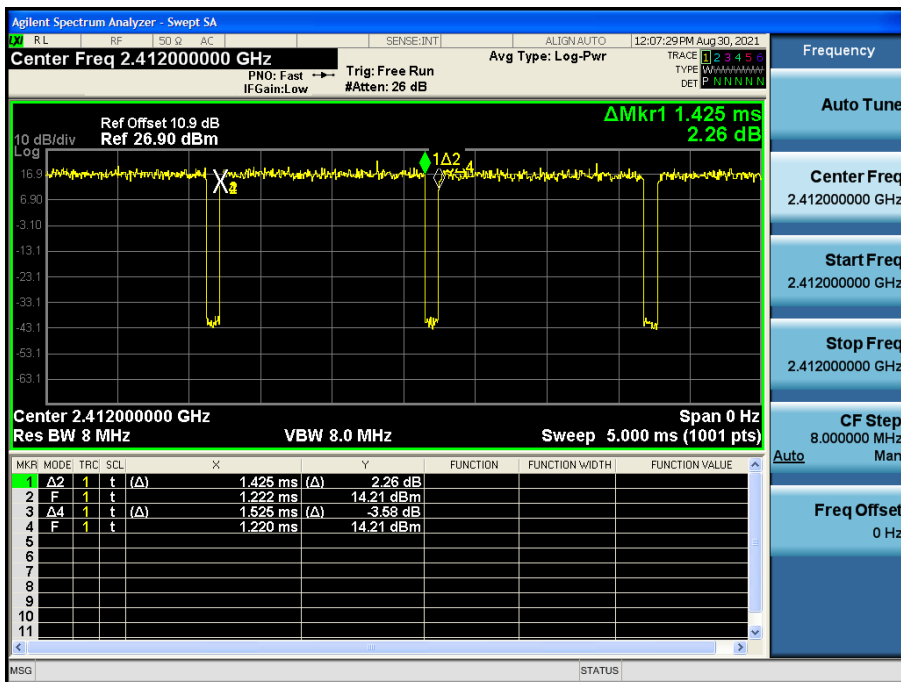
Mode	Data Rate (Mbps)	T <sub>on</sub> (ms)	T <sub>total</sub> (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	1	8.610	8.700	0.990	0.045
	2	4.309	4.399	0.979	0.090
	5.5	1.627	1.724	0.943	0.253
	11	0.862	0.957	0.901	0.454
802.11g	6	1.425	1.525	0.934	0.295
	9	0.959	1.058	0.906	0.428
	12	0.725	0.825	0.879	0.558
	18	0.491	0.591	0.832	0.800
	24	0.372	0.471	0.790	1.023
	36	0.256	0.356	0.719	1.432
	48	0.195	0.295	0.661	1.798
	54	0.180	0.280	0.644	1.914
802.11n (HT20)	6.5 (MCS0)	1.335	1.435	0.930	0.314
	13 (MCS1)	0.688	0.789	0.873	0.592
	19.5 (MCS2)	0.471	0.571	0.825	0.833
	26 (MCS3)	0.364	0.464	0.785	1.052
	39 (MCS4)	0.257	0.356	0.720	1.425
	52 (MCS5)	0.200	0.300	0.666	1.765
	58.5 (MCS6)	0.184	0.284	0.649	1.877
	65 (MCS7)	0.168	0.268	0.628	2.021

Test Plots

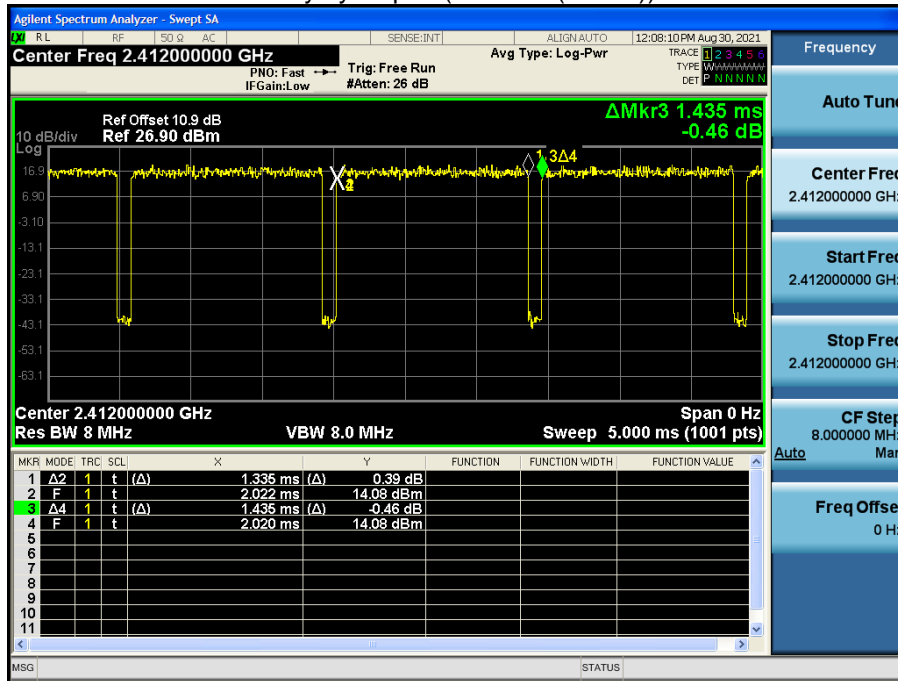
Duty cycle plot (802.11b(1 Mbps))



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 most lowest data rate.

**9.2 6 dB BANDWIDTH**

[Ant.1]

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	8.027	0.5
2437	6	8.085	0.5
2462	11	8.084	0.5

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.10	0.5
2437	6	16.40	0.5
2462	11	15.94	0.5

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.34	0.5
2437	6	17.64	0.5
2462	11	16.48	0.5

**[Ant.2]**

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	7.587	0.5
2437	6	7.607	0.5
2462	11	7.571	0.5

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.50	0.5
2437	6	16.40	0.5
2462	11	16.08	0.5

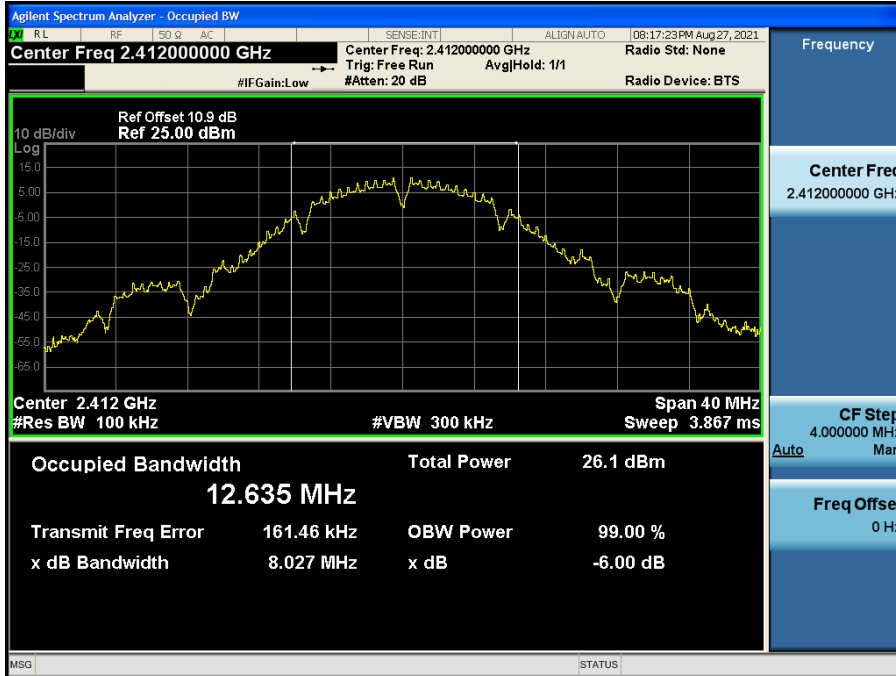
802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.45	0.5
2437	6	17.65	0.5
2462	11	16.96	0.5



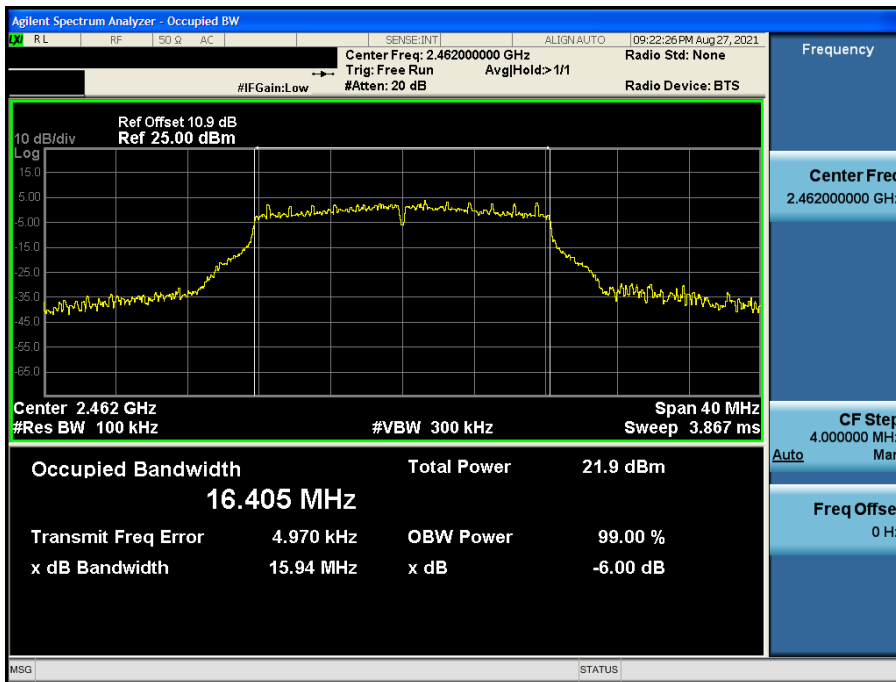
[Ant.1]

▣ Test Plots

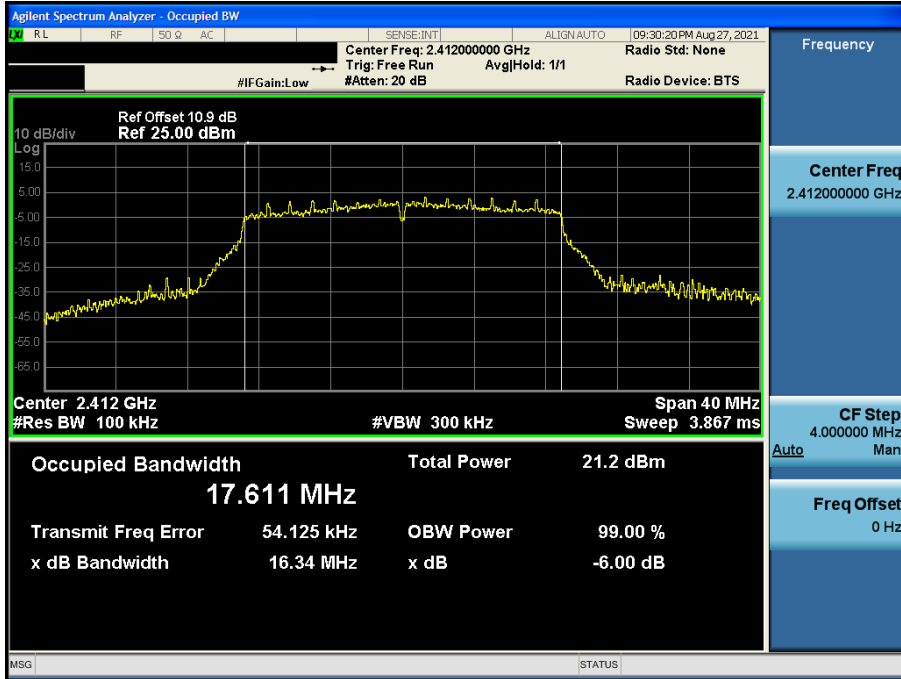
6 dB Bandwidth plot (802.11b-CH 1)



6 dB Bandwidth plot (802.11g-CH 11)



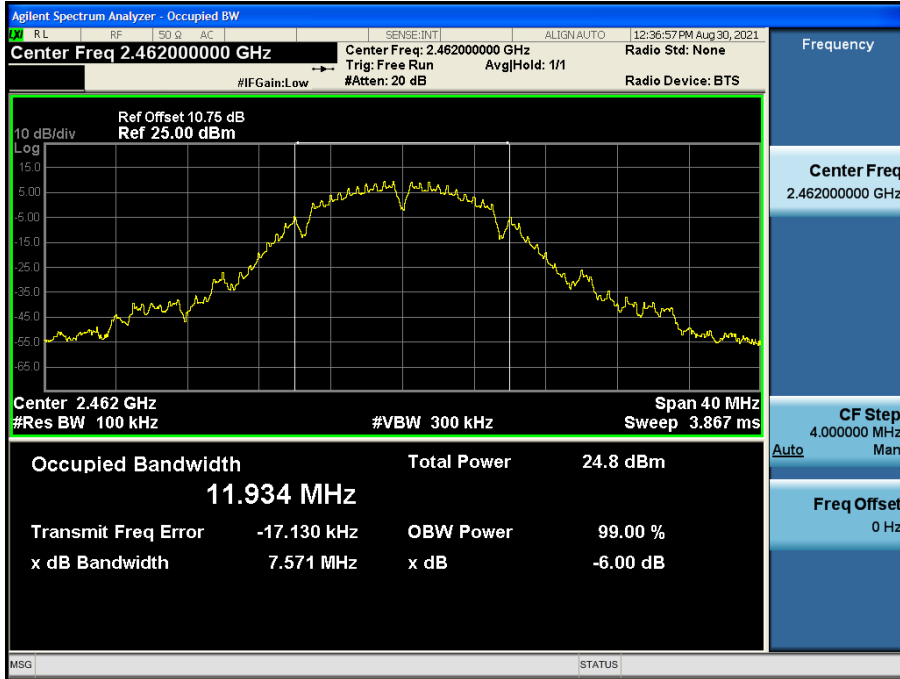
6 dB Bandwidth plot (802.11n\_HT20-CH 1)



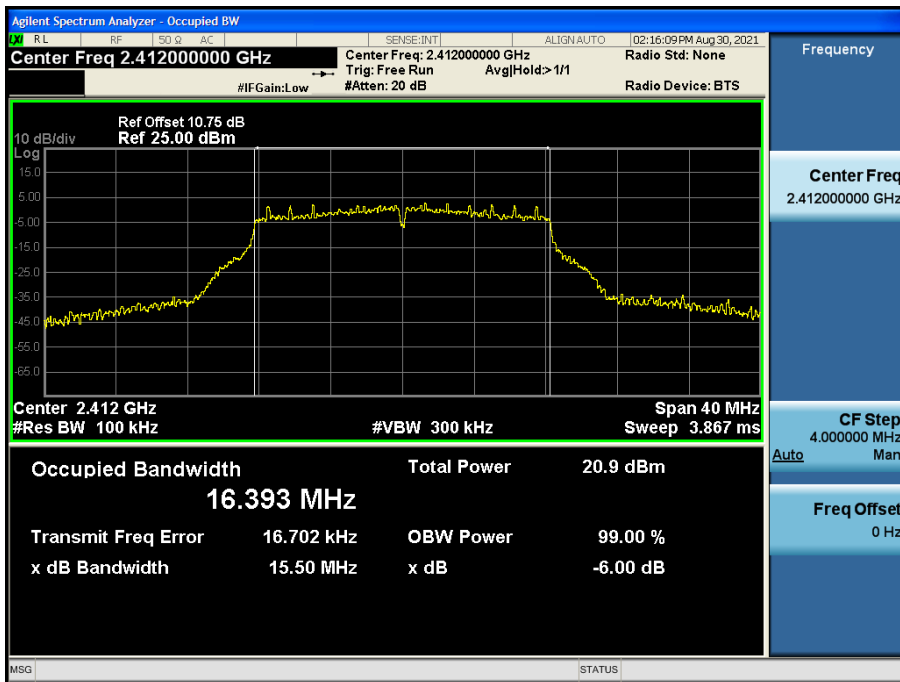
[Ant.2]

▣ Test Plots

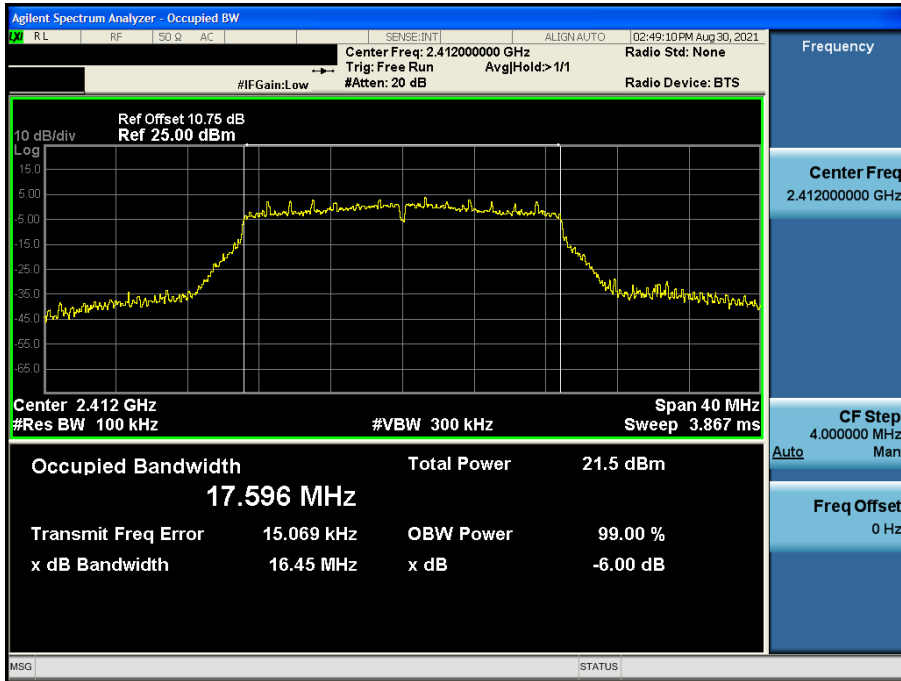
6 dB Bandwidth plot (802.11b-CH 11)



6 dB Bandwidth plot (802.11g-CH 1)



6 dB Bandwidth plot (802.11n\_HT20-CH 1)



**Note:**

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

**9.3 OUTPUT POWER**

**Peak Power**

- 1. Power Meter offset  
Attenuator loss(10 dB) + Cable loss + EUT Cable loss
- 3. EUT Cable loss1(Ant.1) = 0.35 dB
- 4. EUT Cable loss2(Ant.2) = 0.20 dB

[Ant.1]

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	1	21.26	30	18
		2	21.70	30	
		5.5	23.99	30	
		11	25.15	30	
2437	6	1	21.13	30	
		2	21.69	30	
		5.5	23.72	30	
		11	24.96	30	
2462	11	1	20.81	30	
		2	21.40	30	
		5.5	23.41	30	
		11	24.94	30	

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	6	22.07	30	14
		9	21.82	30	
		12	21.98	30	
		18	21.38	30	
		24	21.71	30	
		36	21.80	30	
		48	22.00	30	
		54	21.88	30	
2437	6	6	23.68	30	16
		9	23.42	30	
		12	23.52	30	
		18	23.10	30	
		24	23.50	30	
		36	23.41	30	
		48	23.68	30	
		54	23.43	30	
2462	11	6	20.42	30	13
		9	20.36	30	
		12	20.41	30	
		18	19.89	30	
		24	20.34	30	
		36	20.38	30	
		48	20.41	30	
		54	20.38	30	

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	0	21.77	30	14
		1	21.57	30	
		2	21.53	30	
		3	22.04	30	
		4	21.80	30	
		5	21.82	30	
		6	21.87	30	
		7	21.76	30	
2437	6	0	22.61	30	15
		1	22.27	30	
		2	22.28	30	
		3	22.81	30	
		4	22.53	30	
		5	22.67	30	
		6	22.59	30	
		7	22.55	30	
2462	11	0	19.43	30	12
		1	19.09	30	
		2	19.14	30	
		3	19.64	30	
		4	19.52	30	
		5	19.39	30	
		6	19.39	30	
		7	19.26	30	

[Ant.2]

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	1	20.30	30	18
		2	20.73	30	
		5.5	22.70	30	
		11	23.68	30	
2437	6	1	20.30	30	
		2	21.10	30	
		5.5	22.80	30	
		11	24.25	30	
2462	11	1	19.81	30	
		2	20.24	30	
		5.5	22.17	30	
		11	23.59	30	



802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	6	22.32	30	14
		9	22.17	30	
		12	22.13	30	
		18	21.65	30	
		24	21.84	30	
		36	21.86	30	
		48	21.95	30	
		54	21.97	30	
2437	6	6	23.98	30	16
		9	24.14	30	
		12	24.19	30	
		18	23.67	30	
		24	23.88	30	
		36	23.96	30	
		48	24.07	30	
		54	23.74	30	
2462	11	6	21.48	30	13
		9	21.42	30	
		12	21.39	30	
		18	20.96	30	
		24	21.28	30	
		36	21.38	30	
		48	21.55	30	
		54	21.46	30	

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	0	22.23	30	14
		1	22.00	30	
		2	21.72	30	
		3	22.13	30	
		4	22.12	30	
		5	21.94	30	
		6	22.03	30	
		7	21.98	30	
2437	6	0	23.16	30	15
		1	23.06	30	
		2	22.97	30	
		3	23.47	30	
		4	23.11	30	
		5	23.06	30	
		6	23.08	30	
		7	23.06	30	
2462	11	0	20.32	30	12
		1	20.07	30	
		2	20.18	30	
		3	20.62	30	
		4	20.58	30	
		5	20.54	30	
		6	20.52	30	
		7	20.31	30	

[MIMO]

802.11g Mode		Rate (Mbps)	Ant.1 Measured Power(dBm)	Ant.2 Measured Power(dBm)	MIMO Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.						
2412	1	6	22.07	22.32	25.21	30	14
		9	21.82	22.17	25.01	30	
		12	21.98	22.13	25.06	30	
		18	21.38	21.65	24.53	30	
		24	21.71	21.84	24.78	30	
		36	21.80	21.86	24.84	30	
		48	22.00	21.95	24.99	30	
		54	21.88	21.97	24.93	30	
2437	6	6	23.68	23.98	26.84	30	16
		9	23.42	24.14	26.81	30	
		12	23.52	24.19	26.88	30	
		18	23.10	23.67	26.40	30	
		24	23.50	23.88	26.71	30	
		36	23.41	23.96	26.70	30	
		48	23.68	24.07	26.89	30	
		54	23.43	23.74	26.60	30	
2462	11	6	20.42	21.48	24.00	30	13
		9	20.36	21.42	23.93	30	
		12	20.41	21.39	23.94	30	
		18	19.89	20.96	23.47	30	
		24	20.34	21.28	23.85	30	
		36	20.38	21.38	23.92	30	
		48	20.41	21.55	24.03	30	
		54	20.38	21.46	23.96	30	

802.11n(HT20) Mode		MCS Index	Ant.1 Measured Power(dBm)	Ant.2 Measured Power(dBm)	MIMO Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.						
2412	1	0	21.77	22.23	25.02	30	14
		1	21.57	22.00	24.80	30	
		2	21.53	21.72	24.64	30	
		3	22.04	22.13	25.10	30	
		4	21.80	22.12	24.97	30	
		5	21.82	21.94	24.89	30	
		6	21.87	22.03	24.96	30	
		7	21.76	21.98	24.88	30	
2437	6	0	22.61	23.16	25.90	30	15
		1	22.27	23.06	25.70	30	
		2	22.28	22.97	25.65	30	
		3	22.81	23.47	26.17	30	
		4	22.53	23.11	25.84	30	
		5	22.67	23.06	25.88	30	
		6	22.59	23.08	25.85	30	
		7	22.55	23.06	25.82	30	
2462	11	0	19.43	20.32	22.91	30	12
		1	19.09	20.07	22.62	30	
		2	19.14	20.18	22.70	30	
		3	19.64	20.62	23.16	30	
		4	19.52	20.58	23.09	30	
		5	19.39	20.54	23.01	30	
		6	19.39	20.52	23.00	30	
		7	19.26	20.31	22.83	30	

**Average Power**

1. Power Meter offset  
Loss = Attenuator loss(10 dB) + Cable loss + EUT Cable loss
3. EUT Cable loss1(Ant.1) = 0.35 dB
4. EUT Cable loss2(Ant.2) = 0.20 dB

**[Ant.1]**

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	1	18.45	0.045	18.50	30	18
		2	18.62	0.090	18.71	30	
		5.5	18.65	0.253	18.90	30	
		11	18.41	0.454	18.86	30	
2437	6	1	18.38	0.045	18.42	30	
		2	18.43	0.090	18.52	30	
		5.5	18.72	0.253	18.97	30	
		11	18.31	0.454	18.77	30	
2462	11	1	18.34	0.045	18.39	30	
		2	18.37	0.090	18.46	30	
		5.5	18.66	0.253	18.92	30	
		11	18.16	0.454	18.61	30	

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	6	13.85	0.295	14.14	30	14
		9	13.57	0.428	14.00	30	
		12	13.58	0.558	14.14	30	
		18	13.17	0.800	13.97	30	
		24	13.02	1.023	14.04	30	
		36	12.44	1.432	13.88	30	
		48	12.10	1.798	13.90	30	
		54	11.89	1.914	13.80	30	
2437	6	6	15.51	0.295	15.80	30	16
		9	15.27	0.428	15.70	30	
		12	15.21	0.558	15.77	30	
		18	14.98	0.800	15.78	30	
		24	14.58	1.023	15.60	30	
		36	14.20	1.432	15.63	30	
		48	13.74	1.798	15.53	30	
		54	13.47	1.914	15.38	30	
2462	11	6	12.43	0.295	12.72	30	13
		9	12.23	0.428	12.66	30	
		12	11.96	0.558	12.51	30	
		18	11.60	0.800	12.40	30	
		24	11.53	1.023	12.55	30	
		36	11.15	1.432	12.58	30	
		48	10.65	1.798	12.45	30	
		54	10.55	1.914	12.47	30	

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	0	13.69	0.314	14.00	30	14
		1	13.33	0.592	13.92	30	
		2	13.04	0.833	13.87	30	
		3	12.87	1.052	13.93	30	
		4	12.42	1.425	13.84	30	
		5	12.01	1.765	13.77	30	
		6	11.87	1.877	13.74	30	
		7	11.71	2.021	13.73	30	
2437	6	0	14.39	0.314	14.70	30	15
		1	13.83	0.592	14.42	30	
		2	13.68	0.833	14.51	30	
		3	13.38	1.052	14.43	30	
		4	13.07	1.425	14.50	30	
		5	12.62	1.765	14.39	30	
		6	12.58	1.877	14.45	30	
		7	12.43	2.021	14.45	30	
2462	11	0	11.32	0.314	11.63	30	12
		1	10.87	0.592	11.46	30	
		2	10.68	0.833	11.51	30	
		3	10.41	1.052	11.46	30	
		4	10.05	1.425	11.47	30	
		5	9.61	1.765	11.38	30	
		6	9.53	1.877	11.41	30	
		7	9.31	2.021	11.33	30	

[Ant.2]

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	1	17.51	0.045	17.56	30	18
		2	17.58	0.090	17.67	30	
		5.5	17.91	0.253	18.16	30	
		11	17.34	0.454	17.80	30	
2437	6	1	17.79	0.045	17.84	30	
		2	18.09	0.090	18.18	30	
		5.5	18.30	0.253	18.55	30	
		11	17.78	0.454	18.23	30	
2462	11	1	17.26	0.045	17.31	30	
		2	17.29	0.090	17.38	30	
		5.5	17.51	0.253	17.77	30	
		11	17.21	0.454	17.66	30	



802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	6	14.03	0.295	14.32	30	14
		9	13.78	0.428	14.21	30	
		12	13.75	0.558	14.31	30	
		18	13.38	0.800	14.18	30	
		24	13.13	1.023	14.16	30	
		36	12.66	1.432	14.10	30	
		48	12.14	1.798	13.94	30	
		54	12.11	1.914	14.02	30	
2437	6	6	15.85	0.295	16.14	30	16
		9	15.71	0.428	16.14	30	
		12	15.55	0.558	16.11	30	
		18	15.33	0.800	16.13	30	
		24	15.05	1.023	16.08	30	
		36	14.64	1.432	16.07	30	
		48	14.24	1.798	16.04	30	
		54	13.97	1.914	15.89	30	
2462	11	6	13.33	0.295	13.62	30	13
		9	13.15	0.428	13.58	30	
		12	12.94	0.558	13.50	30	
		18	12.68	0.800	13.48	30	
		24	12.44	1.023	13.47	30	
		36	12.06	1.432	13.49	30	
		48	11.69	1.798	13.49	30	
		54	11.50	1.914	13.41	30	

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	0	13.92	0.314	14.23	30	14
		1	13.55	0.592	14.15	30	
		2	13.20	0.833	14.03	30	
		3	12.98	1.052	14.03	30	
		4	12.65	1.425	14.08	30	
		5	12.11	1.765	13.87	30	
		6	12.12	1.877	13.99	30	
		7	11.93	2.021	13.95	30	
2437	6	0	14.81	0.314	15.13	30	15
		1	14.53	0.592	15.12	30	
		2	14.23	0.833	15.07	30	
		3	13.99	1.052	15.04	30	
		4	13.46	1.425	14.89	30	
		5	13.08	1.765	14.84	30	
		6	12.91	1.877	14.79	30	
		7	12.78	2.021	14.80	30	
2462	11	0	12.14	0.314	12.45	30	12
		1	11.66	0.592	12.25	30	
		2	11.51	0.833	12.34	30	
		3	11.38	1.052	12.43	30	
		4	10.94	1.425	12.36	30	
		5	10.60	1.765	12.36	30	
		6	10.46	1.877	12.34	30	
		7	10.23	2.021	12.25	30	

[MIMO]

802.11g Mode		Rate (Mbps)	Ant.1 Measured Power(dBm) + Duty Cycle Factor	Ant.2 Measured Power(dBm) + Duty Cycle Factor	MIMO Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	6	14.14	14.32	17.25	30	14
		9	14.00	14.21	17.12	30	
		12	14.14	14.31	17.23	30	
		18	13.97	14.18	17.09	30	
		24	14.04	14.16	17.11	30	
		36	13.88	14.10	17.00	30	
		48	13.90	13.94	16.93	30	
		54	13.80	14.02	16.92	30	
2437	6	6	15.80	16.14	18.99	30	16
		9	15.70	16.14	18.93	30	
		12	15.77	16.11	18.95	30	
		18	15.78	16.13	18.97	30	
		24	15.60	16.08	18.86	30	
		36	15.63	16.07	18.87	30	
		48	15.53	16.04	18.80	30	
		54	15.38	15.89	18.65	30	
2462	11	6	12.72	13.62	16.21	30	13
		9	12.66	13.58	16.15	30	
		12	12.51	13.50	16.04	30	
		18	12.40	13.48	15.98	30	
		24	12.55	13.47	16.04	30	
		36	12.58	13.49	16.07	30	
		48	12.45	13.49	16.01	30	
		54	12.47	13.41	15.98	30	

802.11n(HT20) Mode		MCS Index	Ant.1 Measured Power(dBm) + Duty Cycle Factor	Ant.2 Measured Power(dBm) + Duty Cycle Factor	MIMO Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	0	14.00	14.23	17.13	30	14
		1	13.92	14.15	17.04	30	
		2	13.87	14.03	16.96	30	
		3	13.93	14.03	16.99	30	
		4	13.84	14.08	16.97	30	
		5	13.77	13.87	16.83	30	
		6	13.74	13.99	16.88	30	
		7	13.73	13.95	16.85	30	
2437	6	0	14.70	15.13	17.93	30	15
		1	14.42	15.12	17.80	30	
		2	14.51	15.07	17.81	30	
		3	14.43	15.04	17.76	30	
		4	14.50	14.89	17.71	30	
		5	14.39	14.84	17.63	30	
		6	14.45	14.79	17.63	30	
		7	14.45	14.80	17.64	30	
2462	11	0	11.63	12.45	15.07	30	12
		1	11.46	12.25	14.88	30	
		2	11.51	12.34	14.96	30	
		3	11.46	12.43	14.98	30	
		4	11.47	12.36	14.95	30	
		5	11.38	12.36	14.91	30	
		6	11.41	12.34	14.91	30	
		7	11.33	12.25	14.82	30	

**9.4 POWER SPECTRAL DENSITY**

[Ant.1]

Mode	Frequency (MHz)	Channel No.	Test Result			Limit (dBm)
			Measured PSD (dBm)	Duty Cycle Factor	Measured PSD(dBm) + Duty Cycle Factor	
802.11b	2412	1	-2.434	0.045	-2.389	8 dBm / 3 kHz
	2437	6	-2.769	0.045	-2.724	
	2462	11	-2.801	0.045	-2.756	
802.11g	2412	1	-8.469	0.295	-8.174	
	2437	6	-8.712	0.295	-8.417	
	2462	11	-9.657	0.295	-9.362	
802.11n(HT20)	2412	1	-9.428	0.314	-9.114	
	2437	6	-9.762	0.314	-9.448	
	2462	11	-11.542	0.314	-11.228	

[Ant.2]

Mode	Frequency (MHz)	Channel No.	Test Result			Limit (dBm)
			Measured PSD (dBm)	Duty Cycle Factor	Measured PSD(dBm) + Duty Cycle Factor	
802.11b	2412	1	-3.615	0.045	-3.570	8 dBm / 3 kHz
	2437	6	-3.287	0.045	-3.242	
	2462	11	-4.072	0.045	-4.027	
802.11g	2412	1	-8.444	0.295	-8.149	
	2437	6	-7.833	0.295	-7.538	
	2462	11	-9.194	0.295	-8.899	
802.11n(HT20)	2412	1	-9.217	0.314	-8.903	
	2437	6	-9.853	0.314	-9.539	
	2462	11	-10.734	0.314	-10.420	

**[MIMO]**

Mode	Frequency (MHz)	Channel No.	Test Result			
			Ant.1 Measured Power(dBm) + Duty Cycle Factor	Ant.2 Measured Power(dBm) + Duty Cycle Factor	MIMO Measured Power(dBm)	Limit (dBm)
802.11g	2412	1	-8.469	-8.149	-5.296	8 dBm / 3 kHz
	2437	6	-8.712	-7.538	-5.075	
	2462	11	-9.657	-8.899	-6.251	
802.11n(HT20)	2412	1	-9.428	-8.903	-6.147	
	2437	6	-9.762	-9.539	-6.639	
	2462	11	-11.542	-10.420	-7.935	

**Note :**

1. Spectrum Measured Levels are not plot data.

The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.

2. Spectrum offset

Loss = Attenuator loss(10 dB) + Cable loss + EUT Cable loss

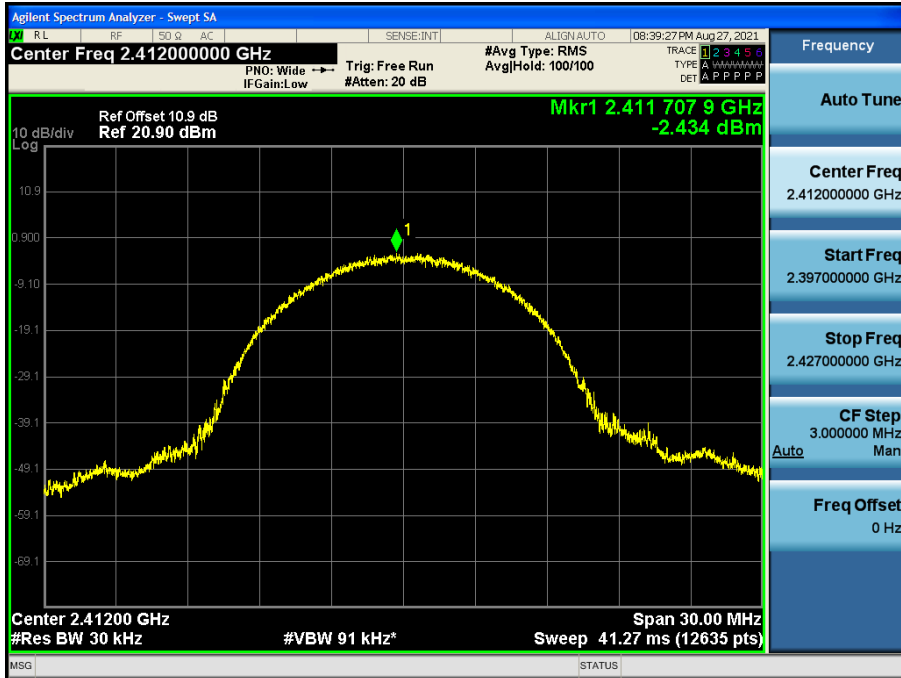
3. EUT Cable loss1(Ant.1) = 0.35 dB

4. EUT Cable loss2(Ant.2) = 0.20 dB

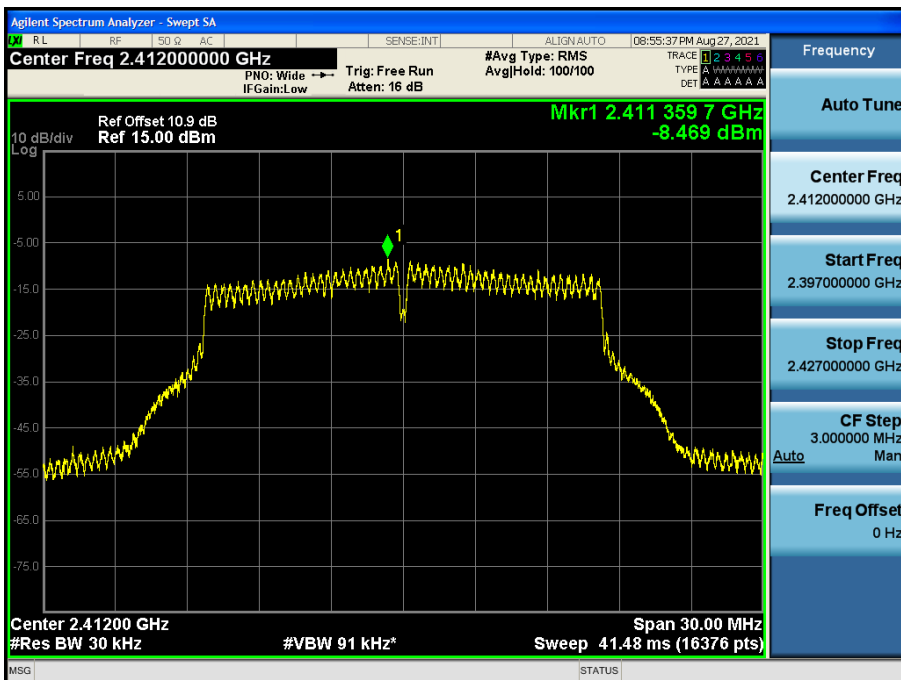
[Ant.1]

Test Plots

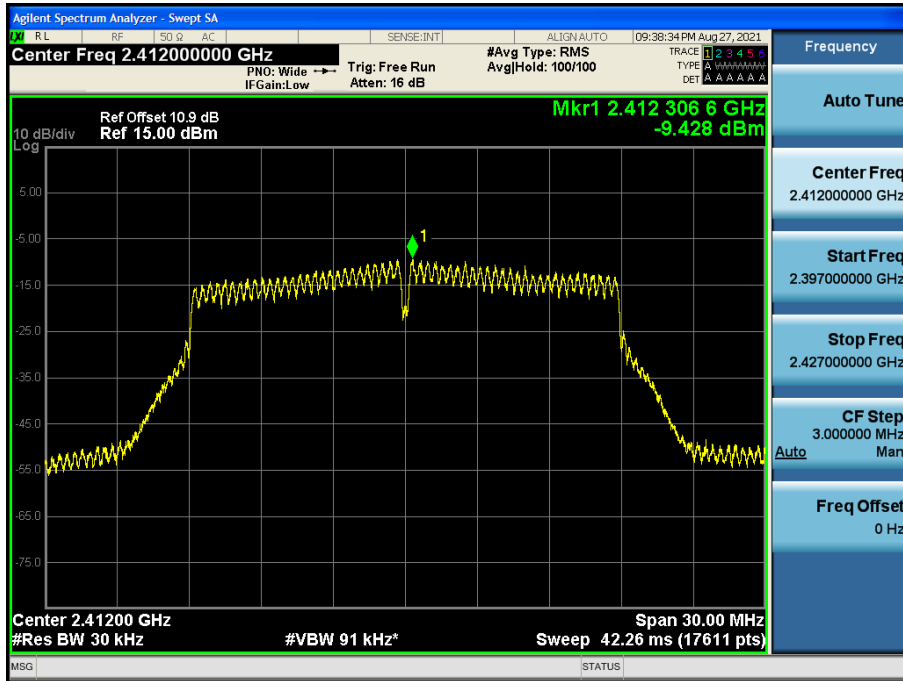
Power Spectral Density (802.11b-CH 1)



Power Spectral Density (802.11g-CH 1)



Power Spectral Density (802.11n\_HT20-CH 1)

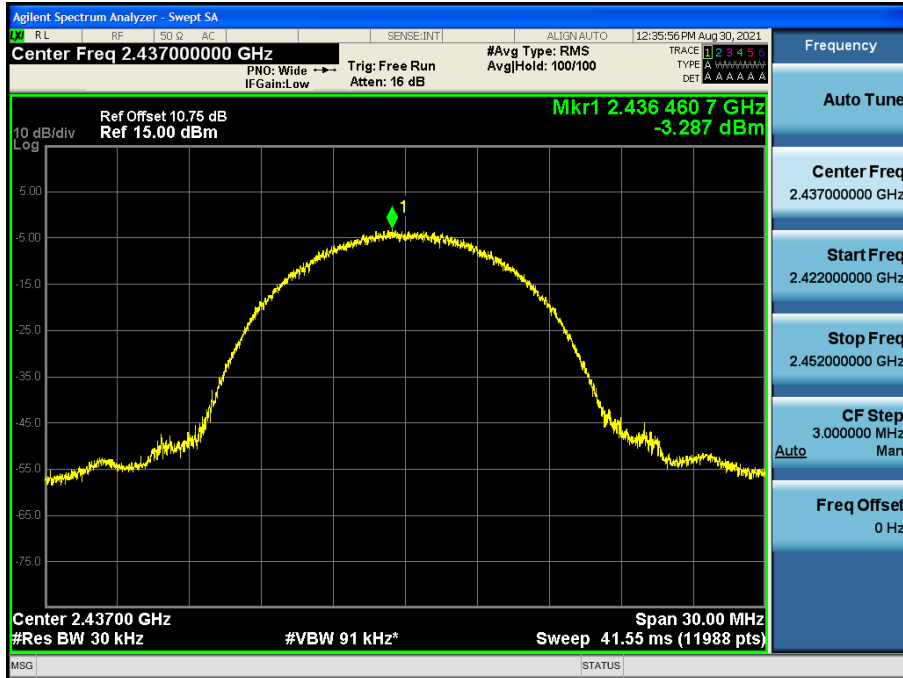




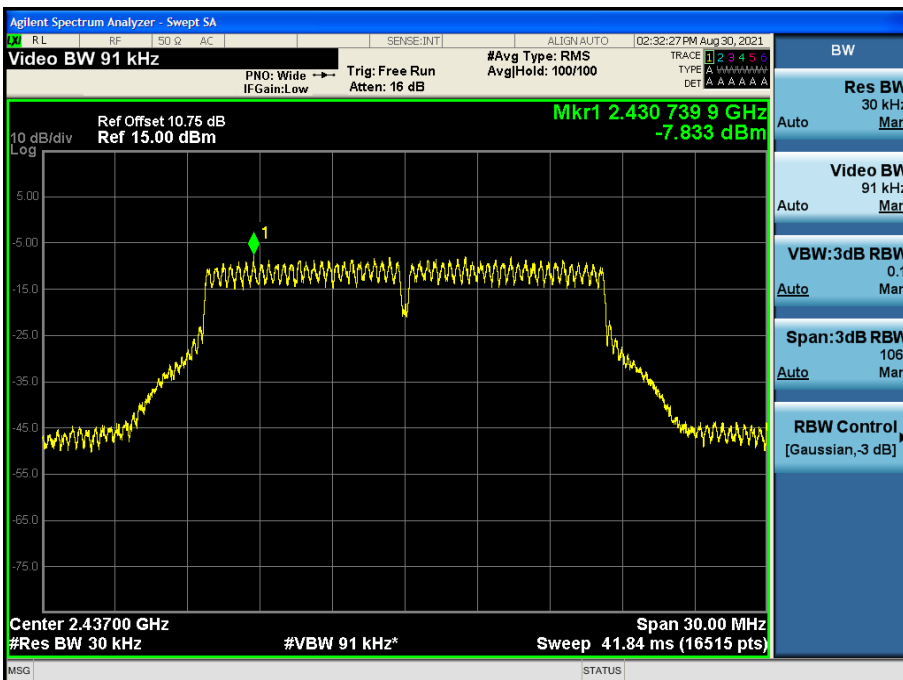
[Ant.2]

☑ Test Plots

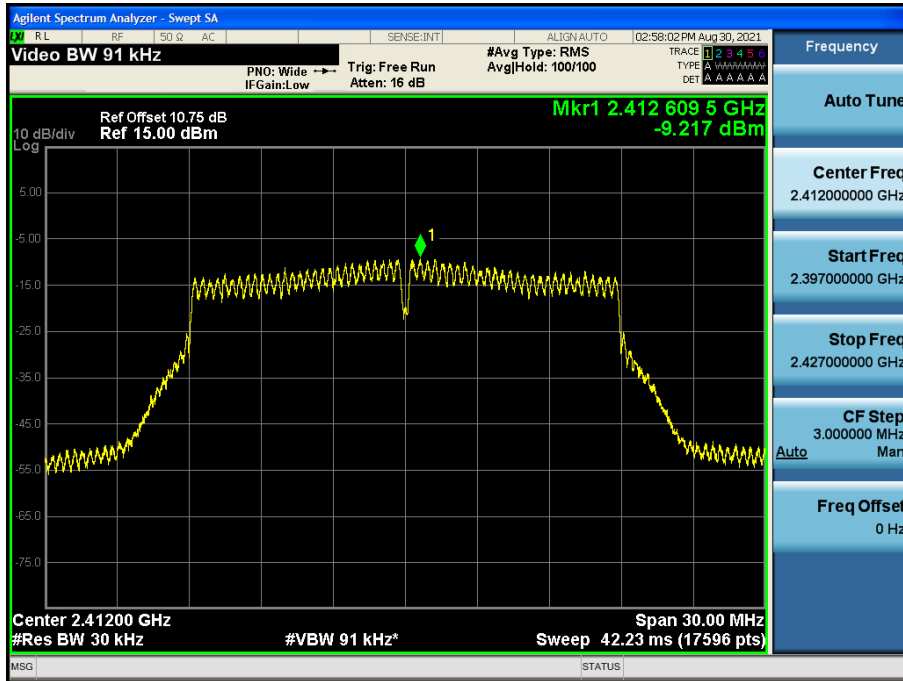
Power Spectral Density (802.11b-CH 6)



Power Spectral Density (802.11g-CH 6)



Power Spectral Density (802.11n\_HT20-CH 1)



**Note :**

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

## 9.5 BAND EDGE / CONDUCTED SPURIOUS EMISSIONS

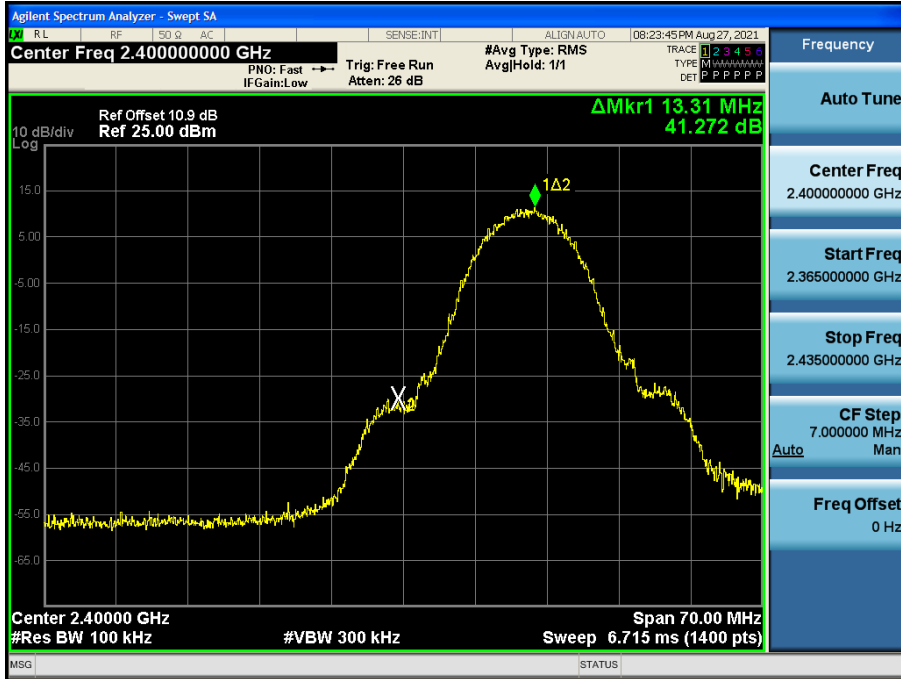
Test Result : please refer to the plot below.

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

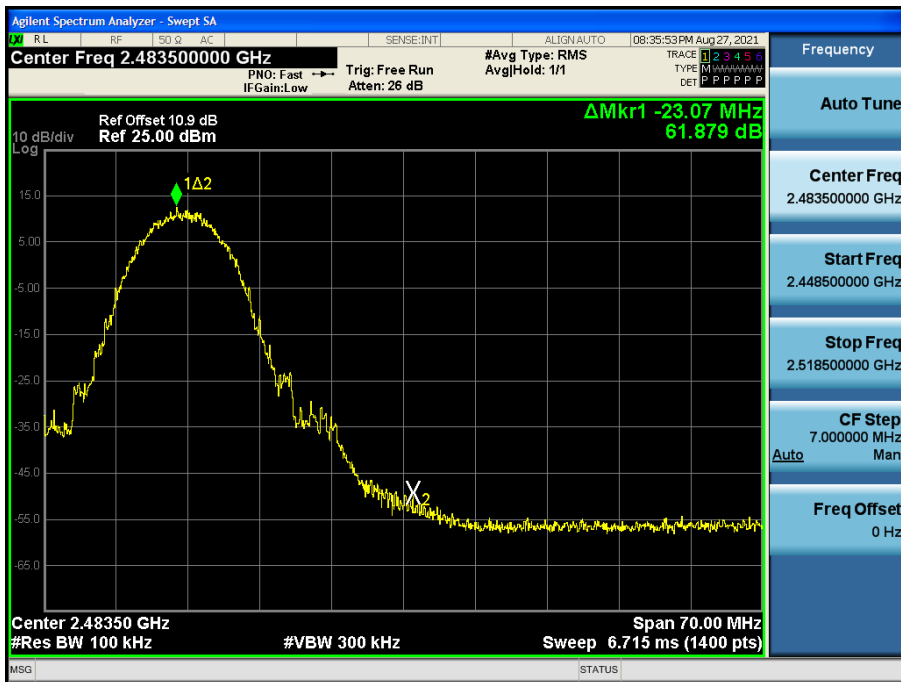
[Ant.1]

Test Plots(Band Edge)

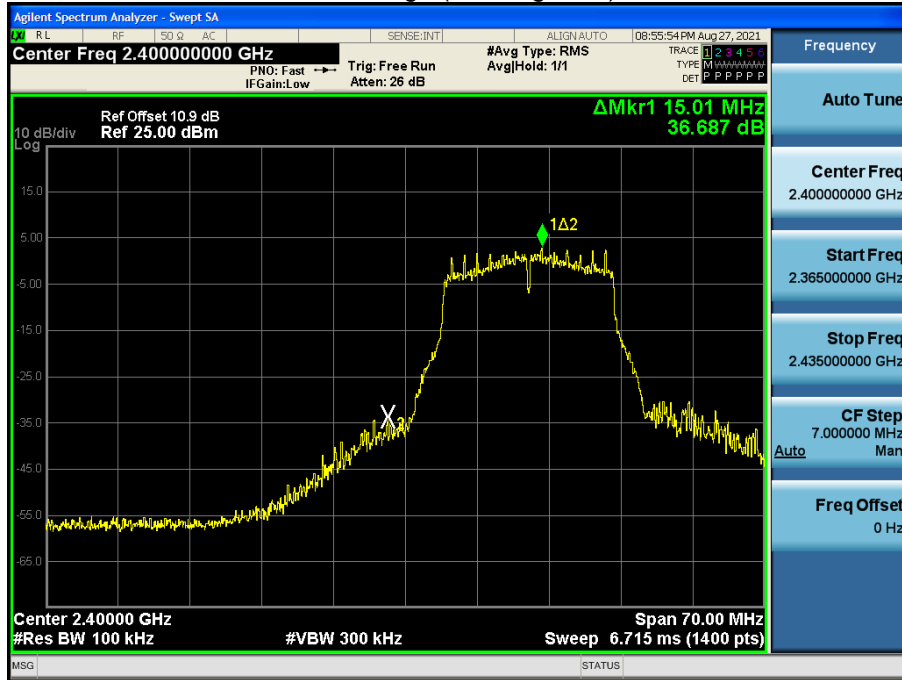
Band Edge (802.11b-CH1)



Band Edge (802.11b-CH11)



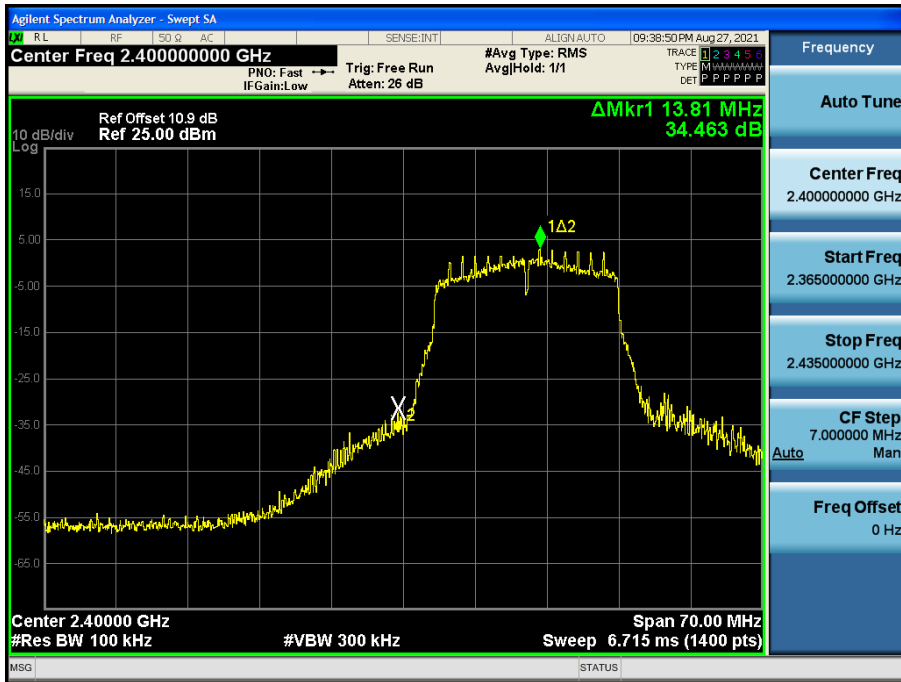
### Band Edge (802.11g-CH1)



### Band Edge (802.11g-CH11)



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



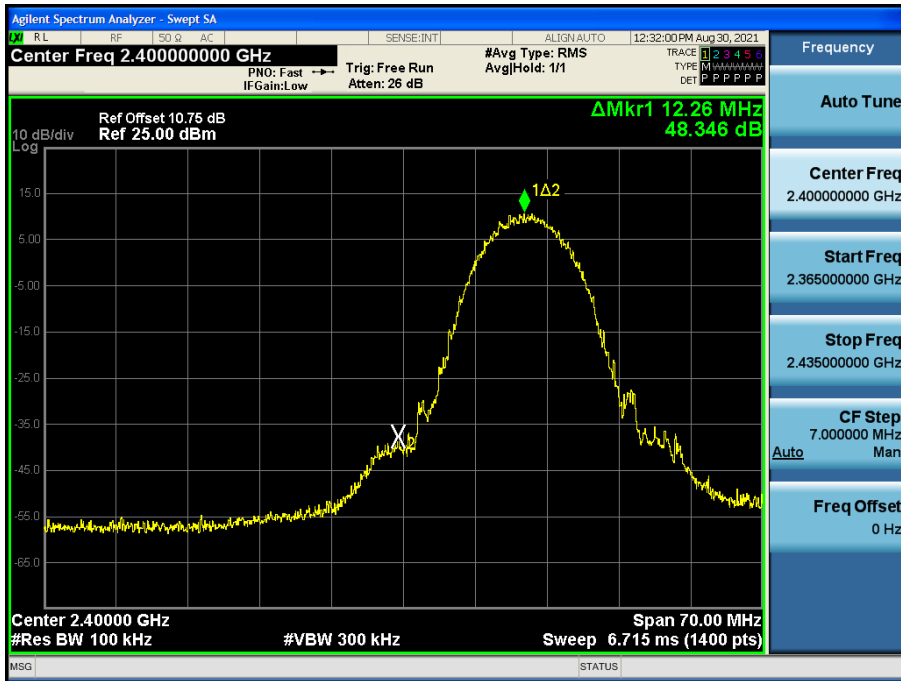
### Band Edge (802.11n\_HT20 -CH11)



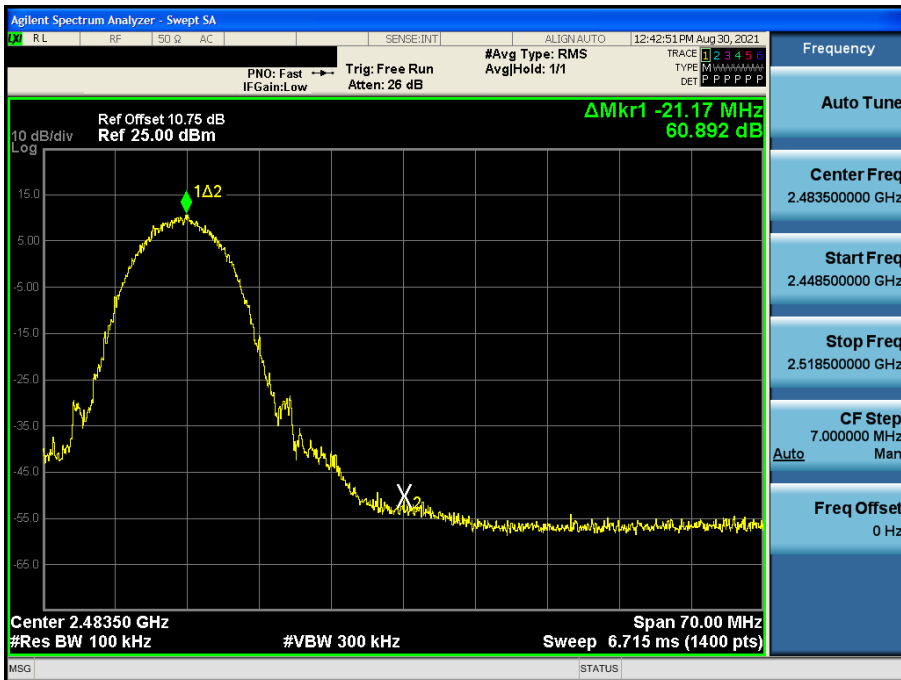
[Ant.2]

☑ Test Plots(Band Edge)

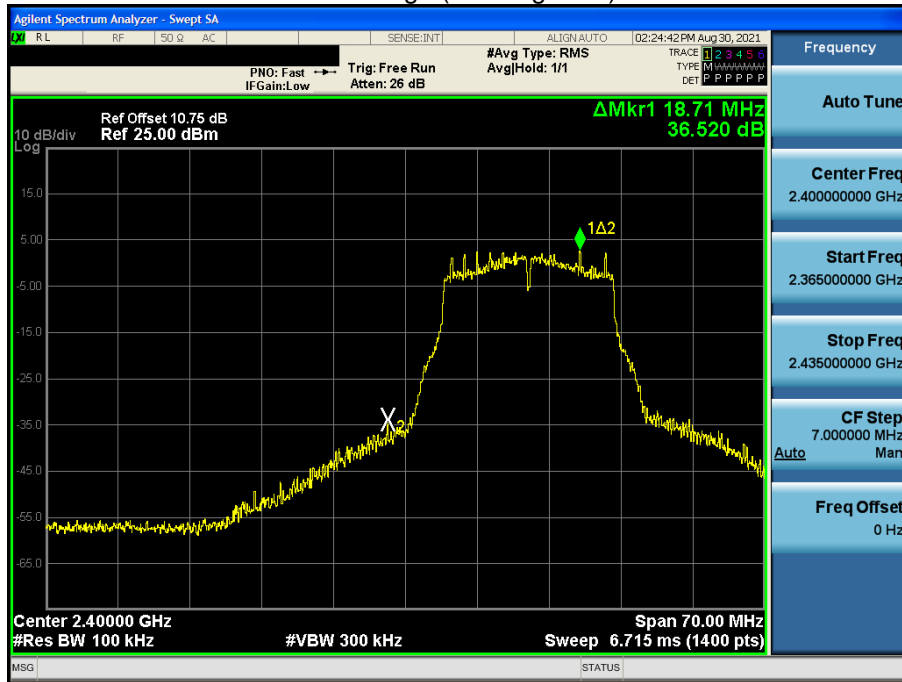
Band Edge (802.11b-CH1)



Band Edge (802.11b-CH11)



### Band Edge (802.11g-CH1)



### Band Edge (802.11g-CH11)

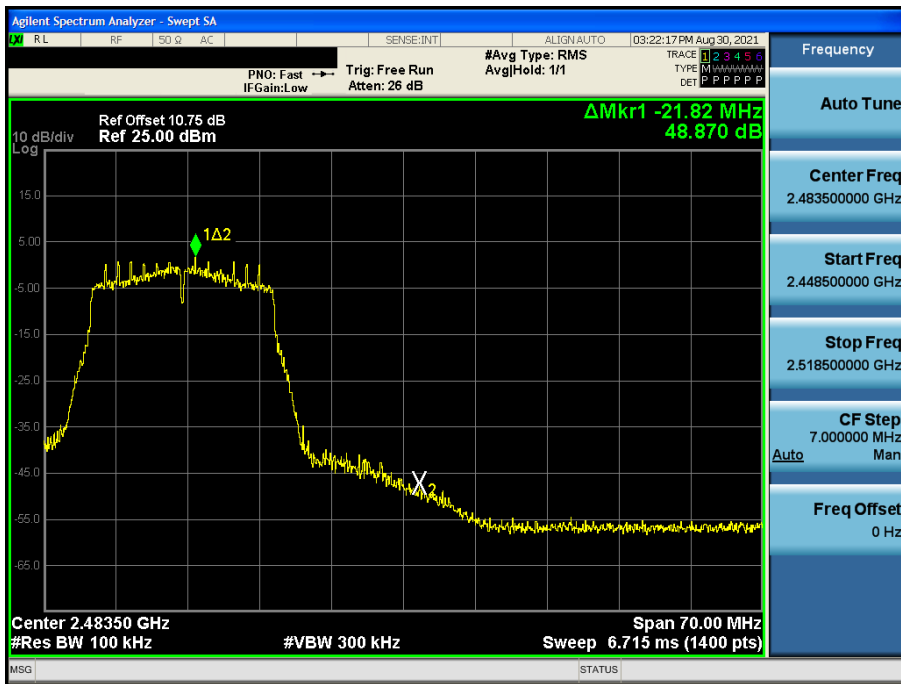




### Band Edge (802.11n\_HT20 -CH1)



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

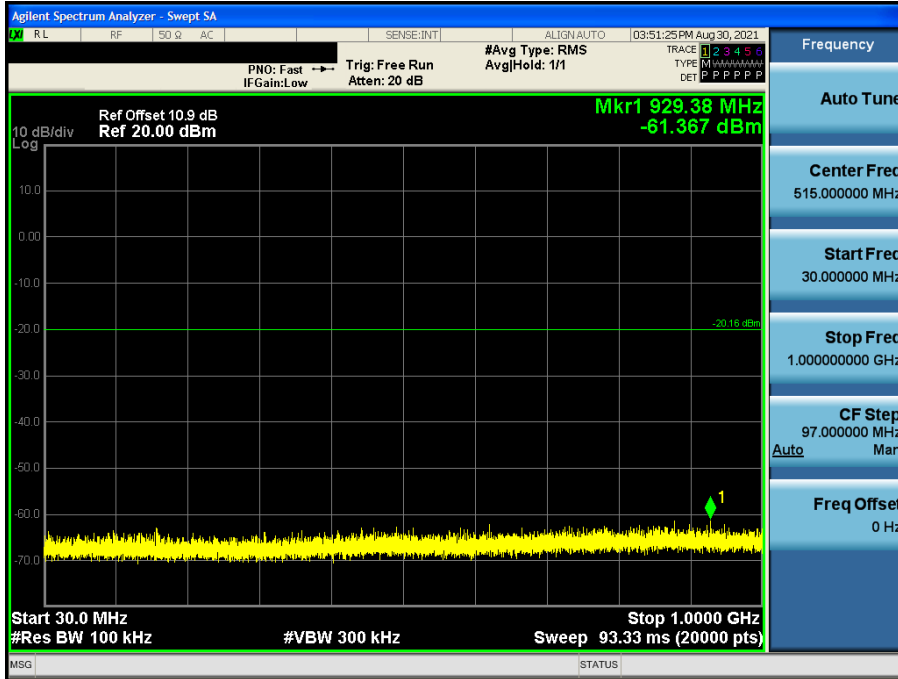


[Ant.1]

☑ Test Plots(Conducted Spurious Emission)

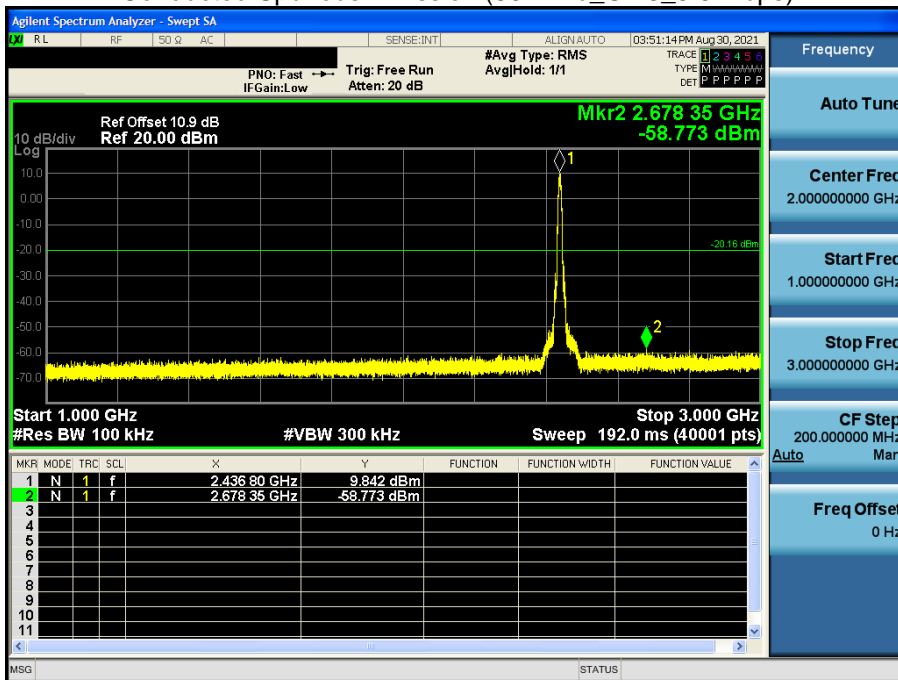
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



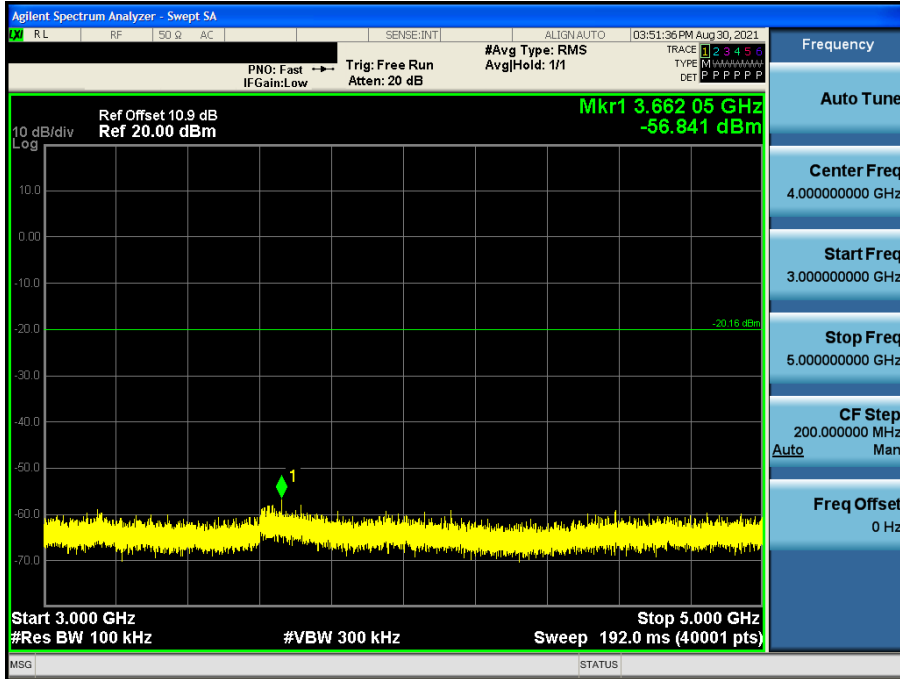
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



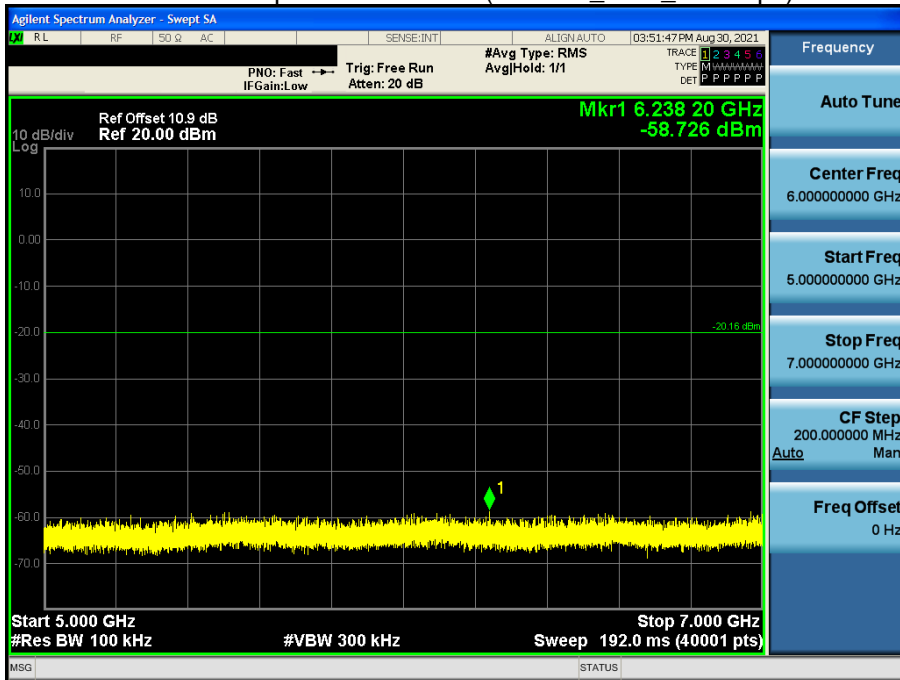
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



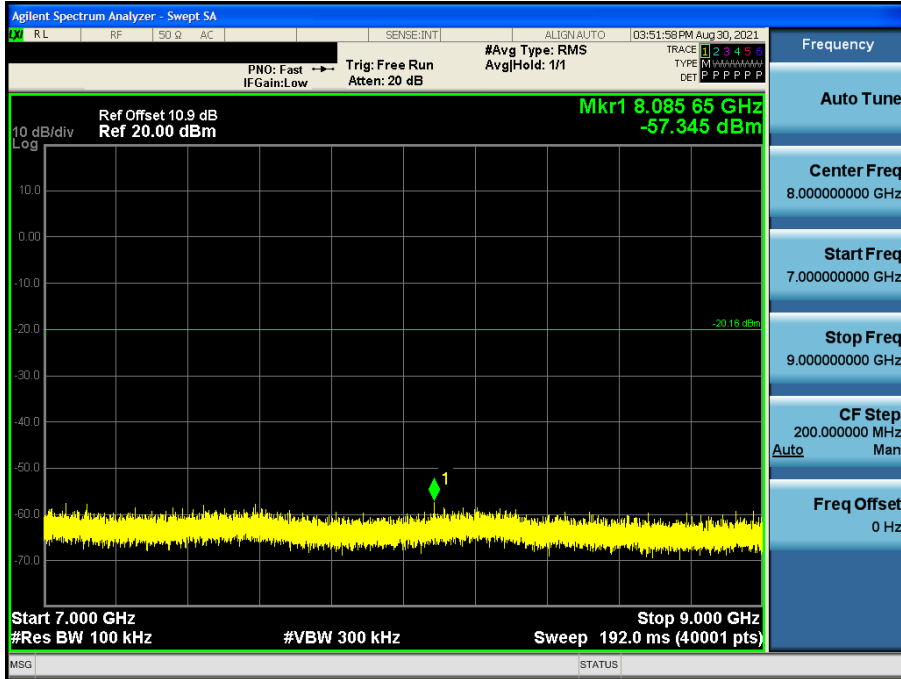
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



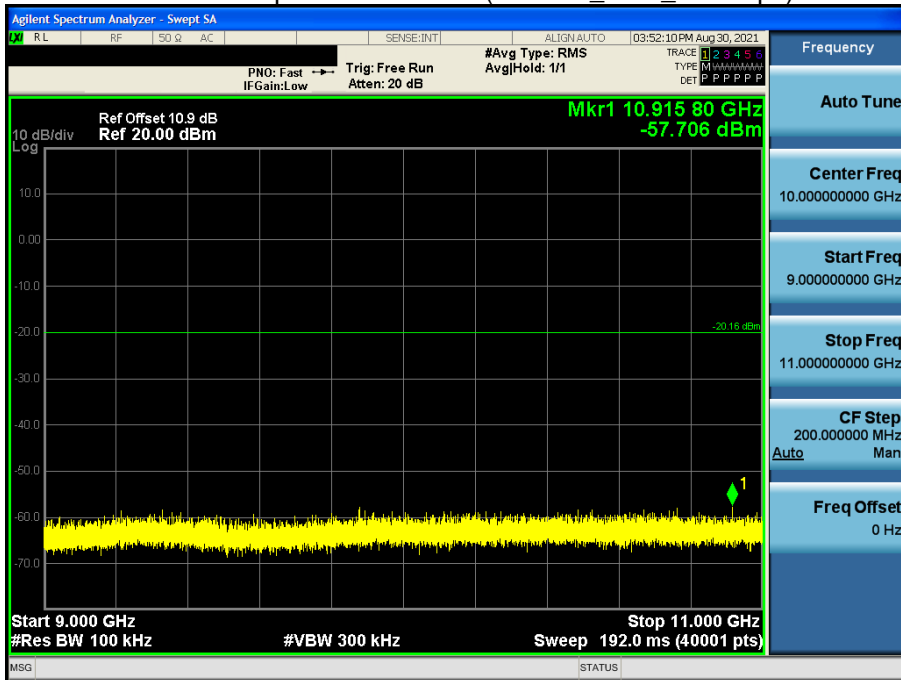
### 7 GHz ~ 9 GHz

#### Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



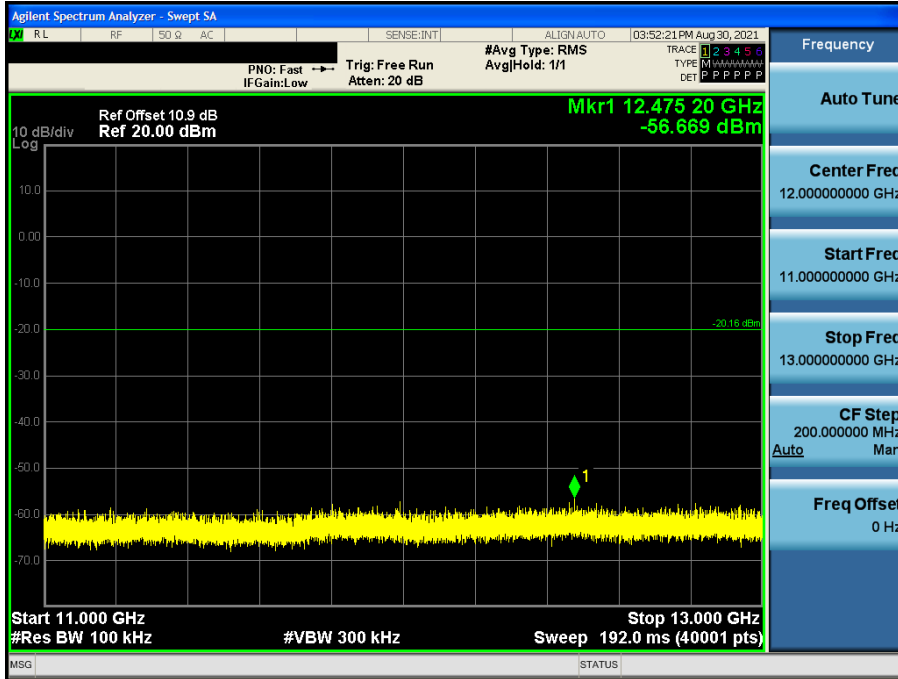
### 9 GHz ~ 11 GHz

#### Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



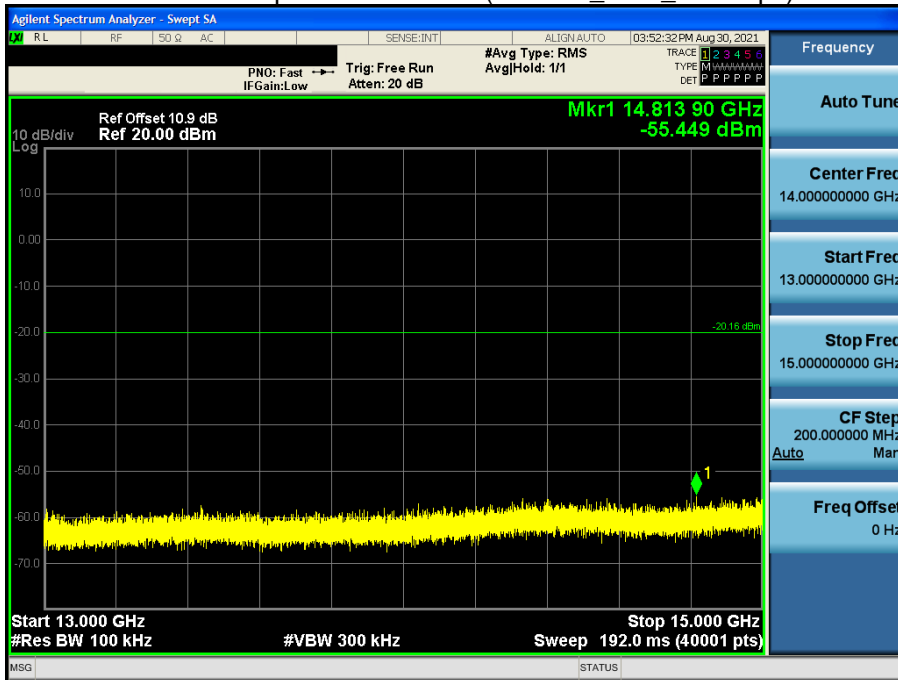
### 11 GHz ~ 13 GHz

#### Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



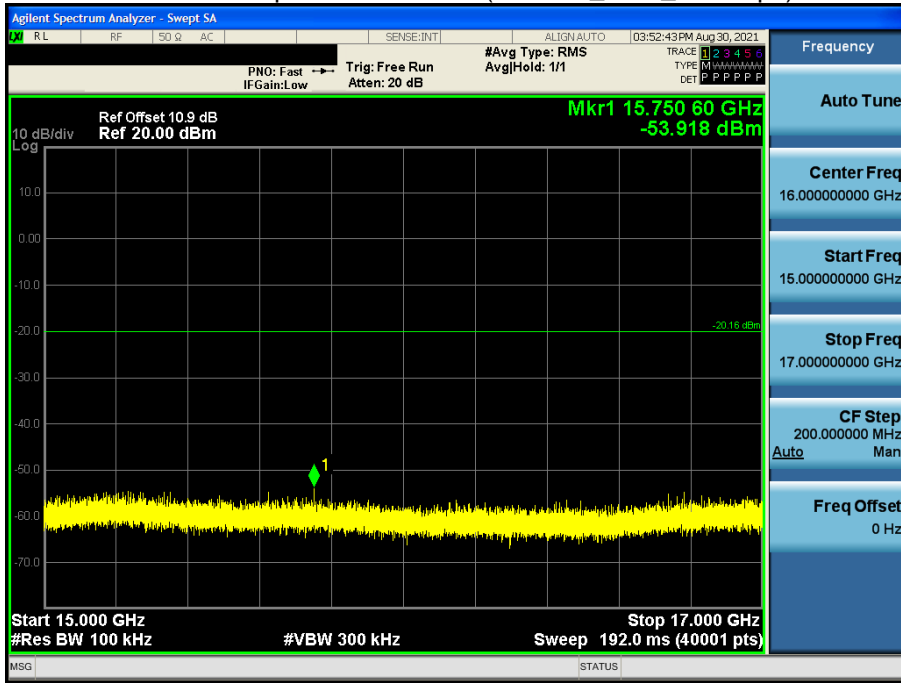
### 13 GHz ~ 15 GHz

#### Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



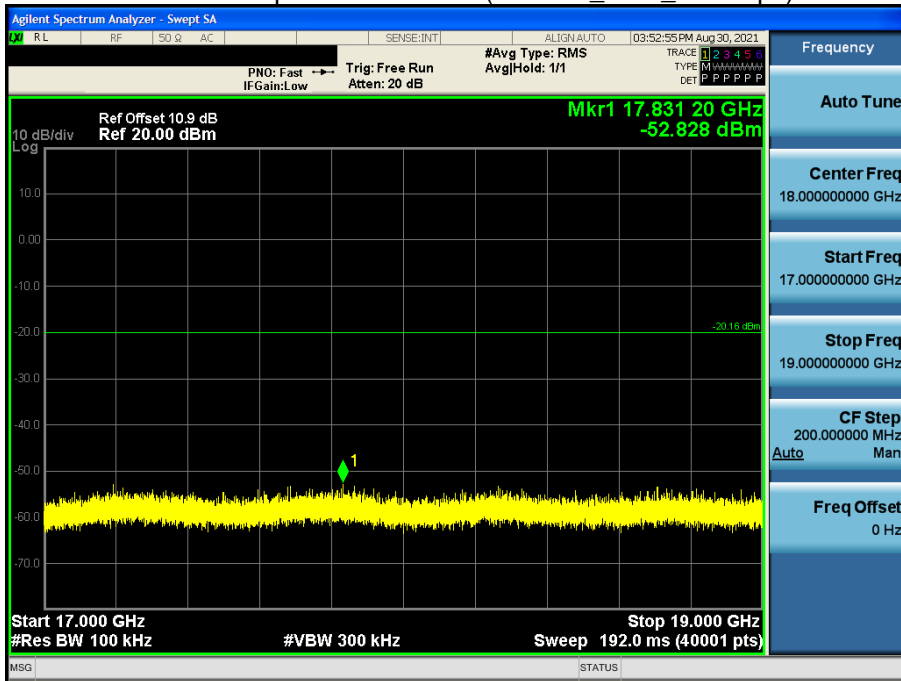
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



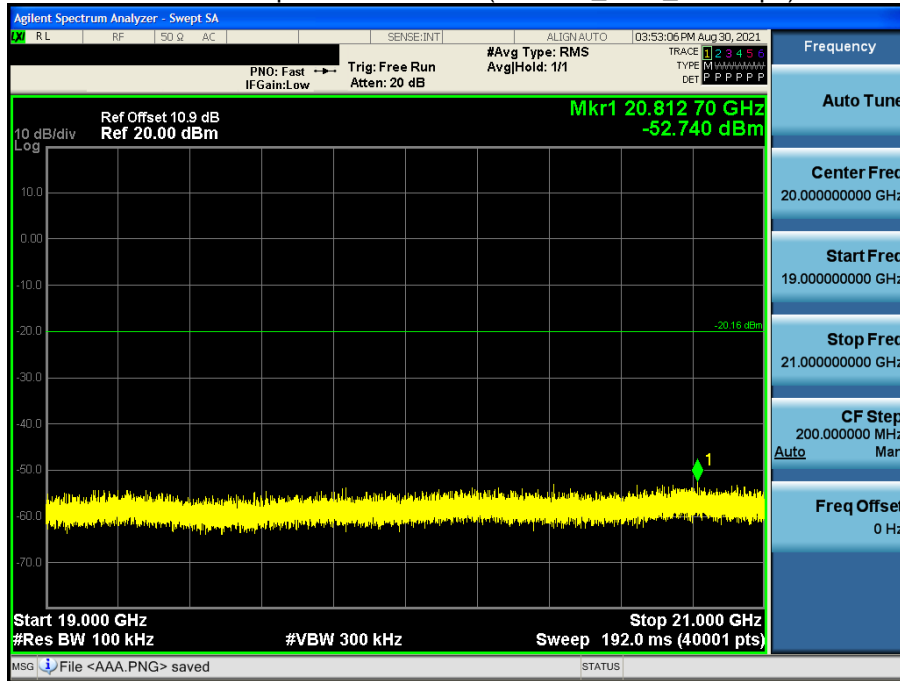
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



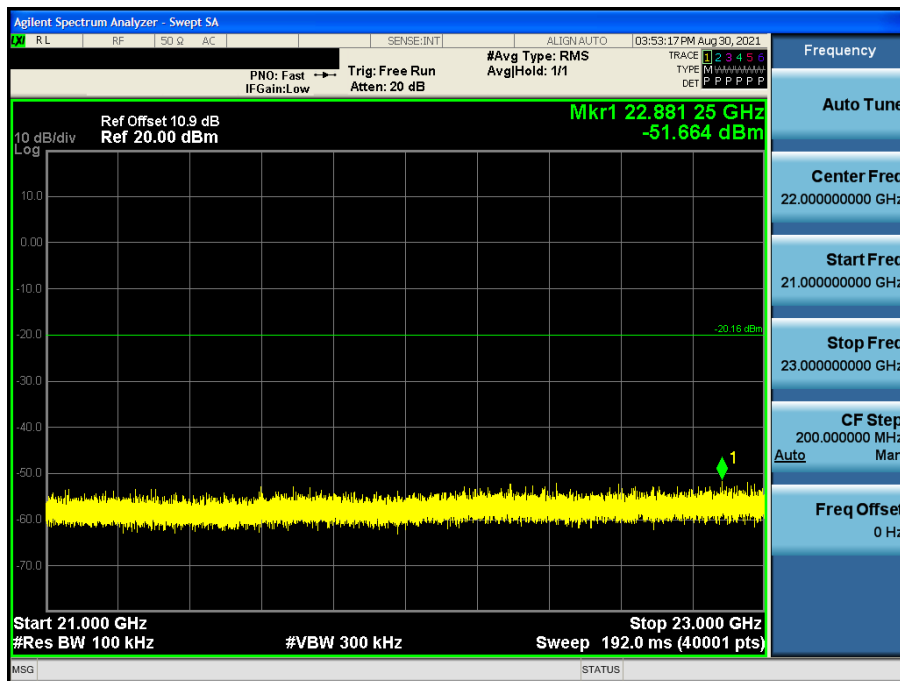
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



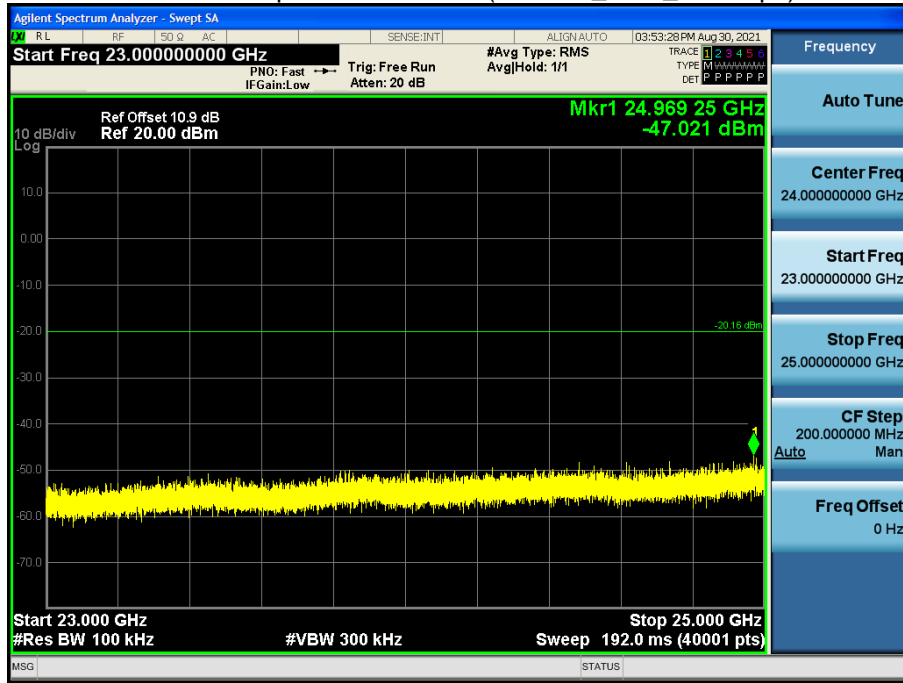
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



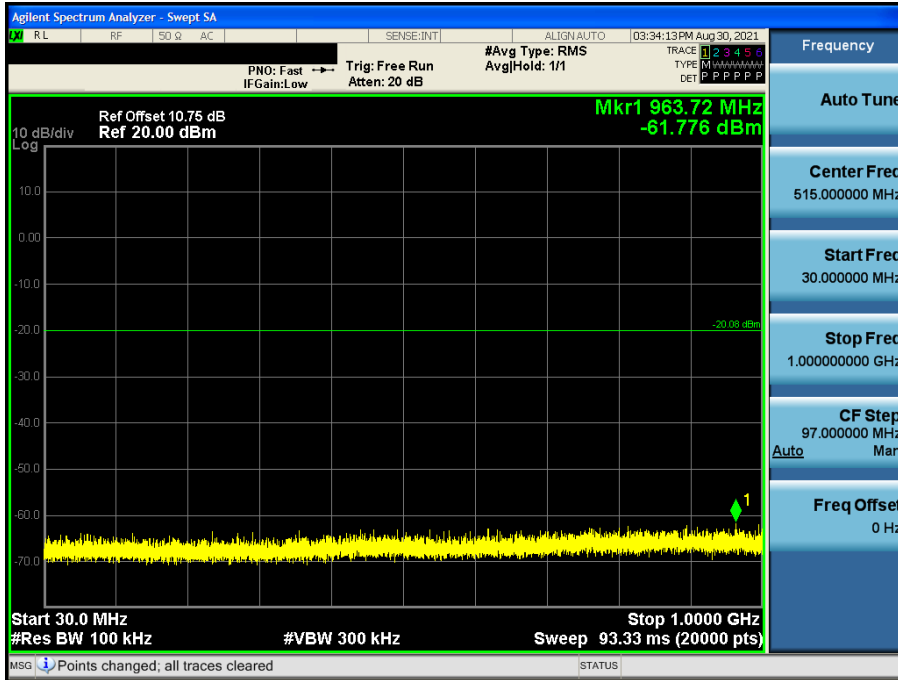


[Ant.2]

Test Plots(Conducted Spurious Emission)

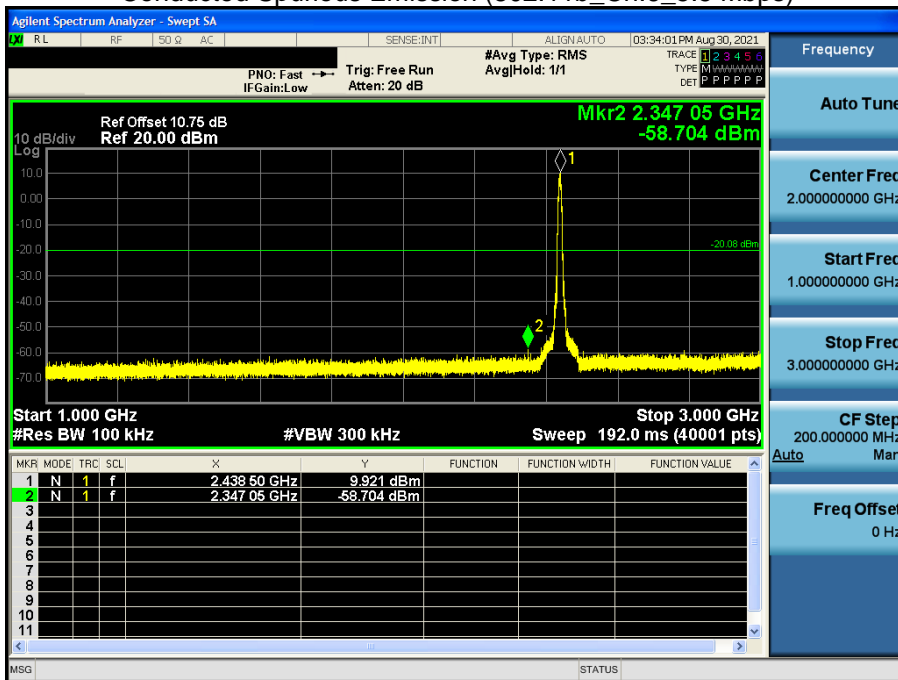
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



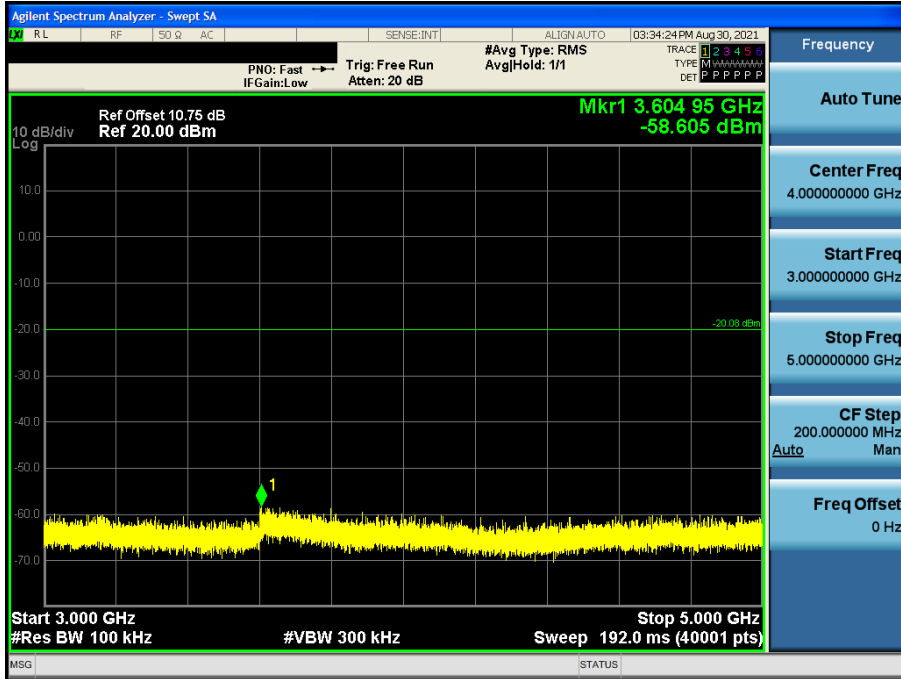
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



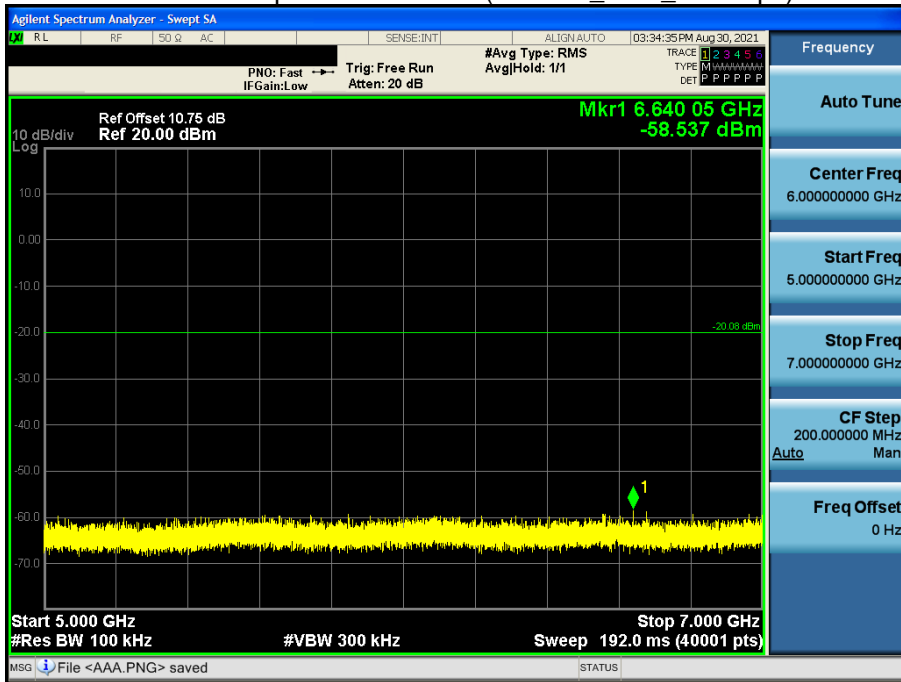
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



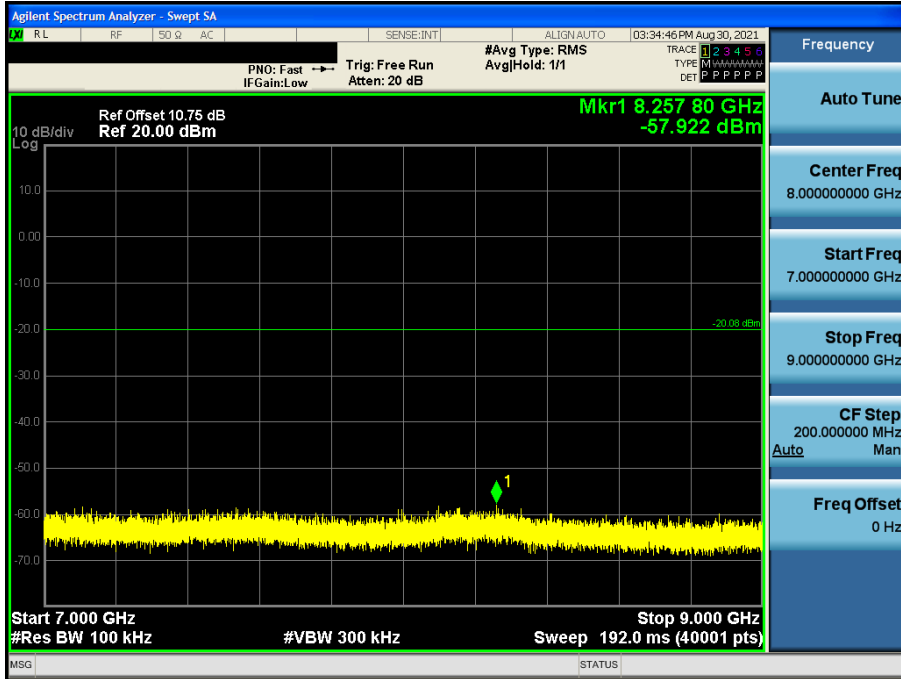
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



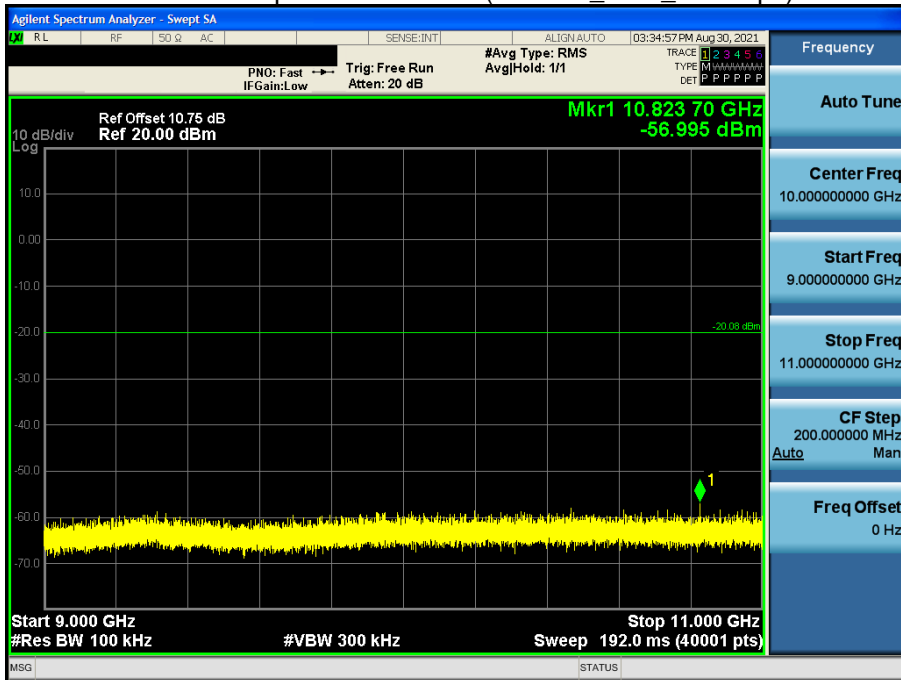
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



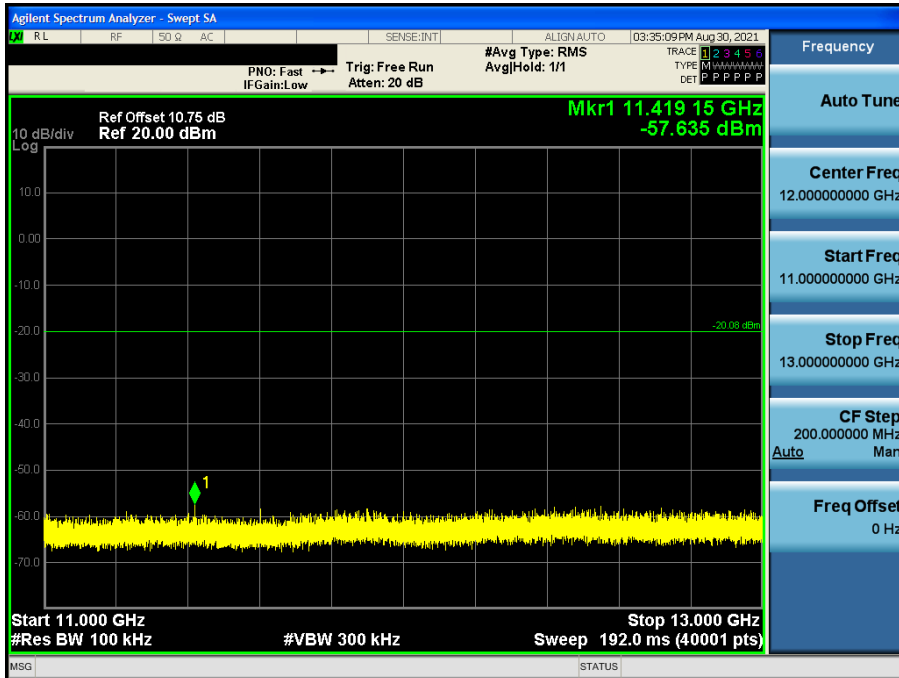
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



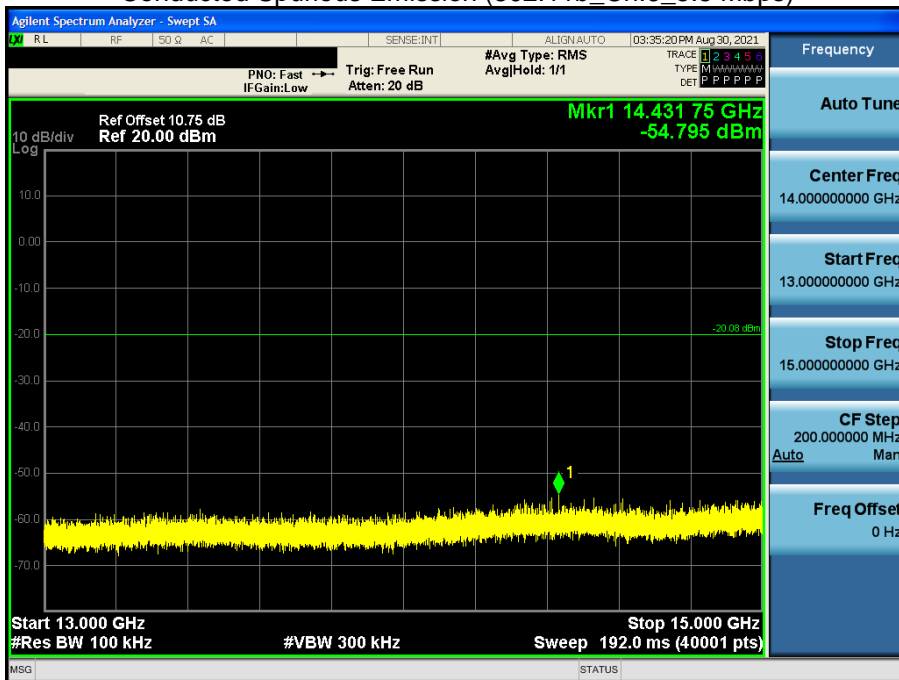
11 GHz ~ 13 GHz

### Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



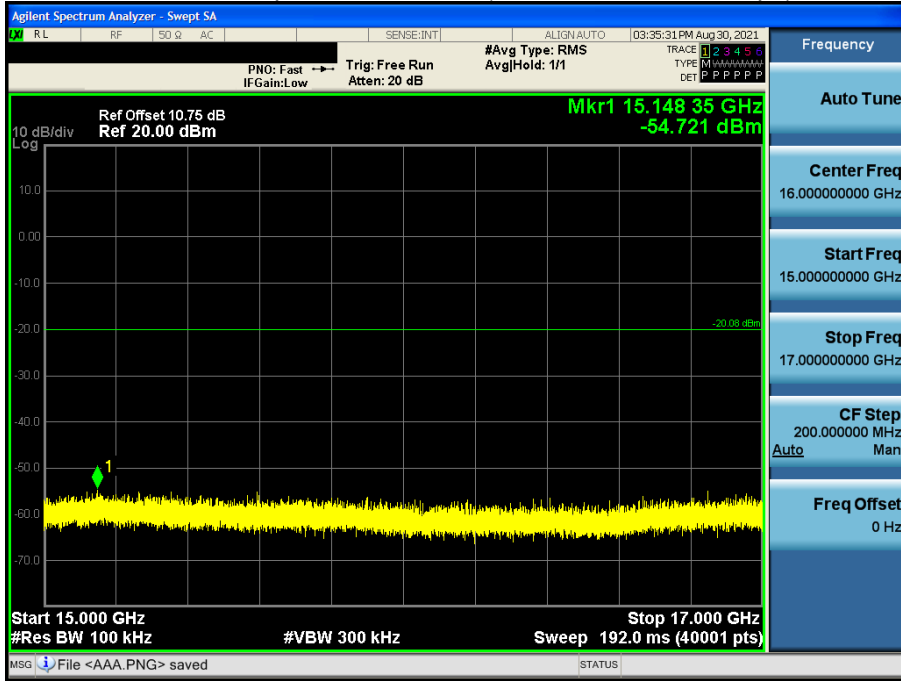
13 GHz ~ 15 GHz

### Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



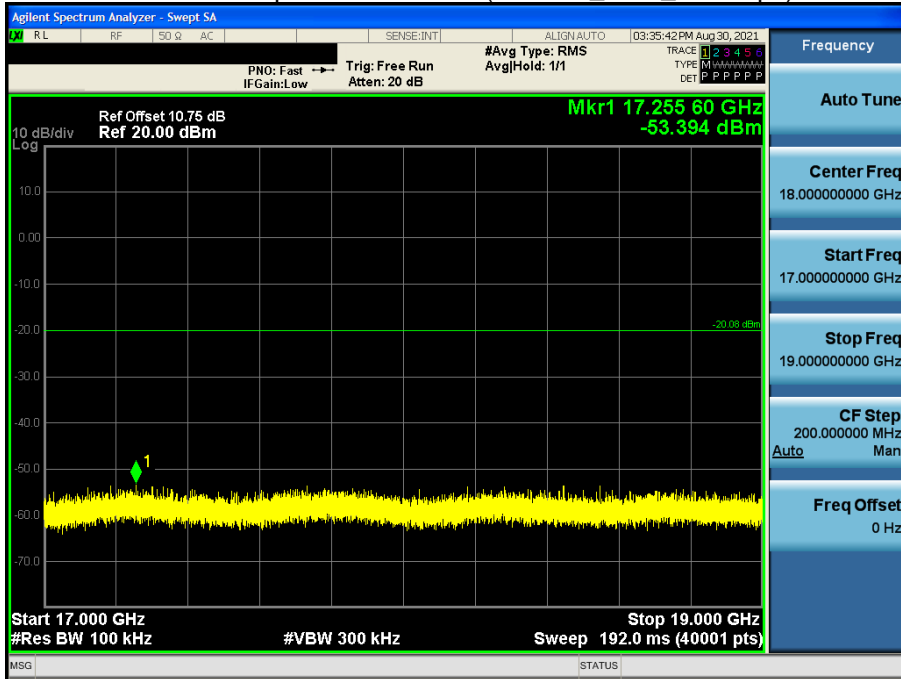
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



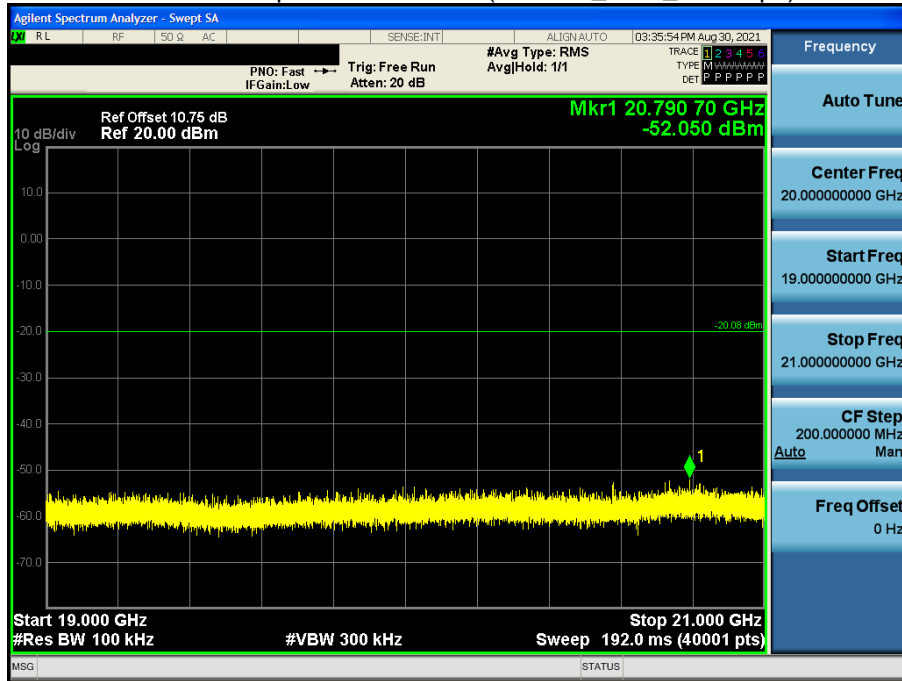
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



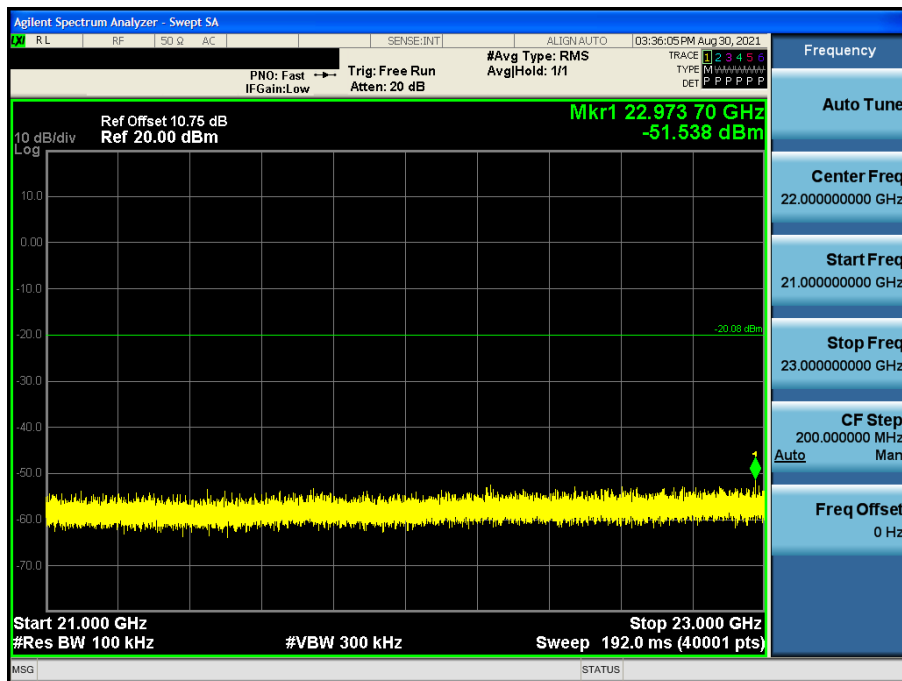
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



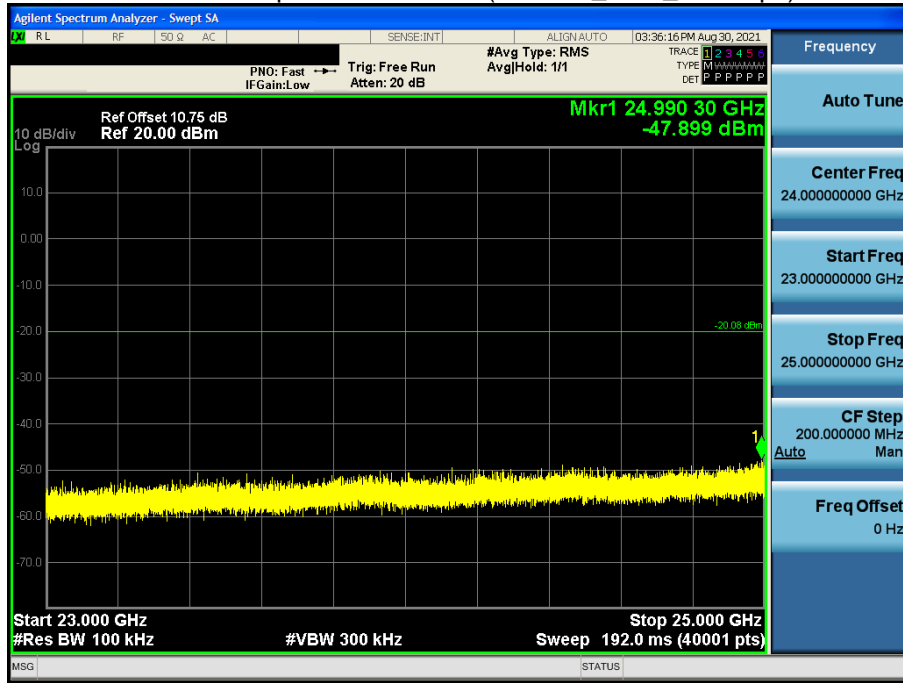
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11b\_Ch.6\_5.5 Mbps)



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

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

**Note:**

1. The Measured 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
4. Radiated test is performed with hopping off.

**Frequency Range : Below 1 GHz**

Frequency	Measured Value	A.F+C.L	POL	Total	Limit	Margin
[MHz]	[dB $\mu$ V/m]	[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.
2. Radiated test is performed with hopping off.



**Frequency Range : Above 1 GHz**

**[Ant.1(SISO)]**

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

Frequency [MHz]	Measured Level [dBμV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4824	45.82	3.48	V	49.30	73.98	24.68	PK
4824	36.19	3.48	V	39.67	53.98	14.31	AV
7236	42.93	8.67	V	51.60	73.98	22.38	PK
7236	32.84	8.67	V	41.51	53.98	12.47	AV
4824	45.53	3.48	H	49.01	73.98	24.97	PK
4824	34.21	3.48	H	37.69	53.98	16.29	AV
7236	41.75	8.67	H	50.42	73.98	23.56	PK
7236	31.22	8.67	H	39.89	53.98	14.09	AV

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

Frequency [MHz]	Measured Level [dBμV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4874	43.85	3.19	V	47.04	73.98	26.94	PK
4874	34.20	3.19	V	37.39	53.98	16.59	AV
7311	42.45	9.41	V	51.86	73.98	22.12	PK
7311	31.41	9.41	V	40.82	53.98	13.16	AV
4874	42.75	3.19	H	45.94	73.98	28.04	PK
4874	33.64	3.19	H	36.83	53.98	17.15	AV
7311	41.93	9.41	H	51.34	73.98	22.64	PK
7311	30.61	9.41	H	40.02	53.98	13.96	AV

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

Frequency [MHz]	Measured Level [dB $\mu$ V]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measurement Type
4924	44.74	2.54	V	47.28	73.98	26.70	PK
4924	35.20	2.54	V	37.74	53.98	16.24	AV
7386	44.20	10.04	V	54.24	73.98	19.74	PK
7386	33.24	10.04	V	43.28	53.98	10.70	AV
4924	44.62	2.54	H	47.16	73.98	26.82	PK
4924	35.17	2.54	H	37.71	53.98	16.27	AV
7386	43.81	10.04	H	53.85	73.98	20.13	PK
7386	32.40	10.04	H	42.44	53.98	11.54	AV

**[Ant.2(SISO)]**

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

Frequency [MHz]	Measured Level [dBμV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4824	44.53	3.48	V	48.01	73.98	25.97	PK
4824	32.48	3.48	V	35.96	53.98	18.02	AV
7236	41.69	8.67	V	50.36	73.98	23.62	PK
7236	29.50	8.67	V	38.17	53.98	15.81	AV
4824	43.68	3.48	H	47.16	73.98	26.82	PK
4824	31.54	3.48	H	35.02	53.98	18.96	AV
7236	41.16	8.67	H	49.83	73.98	24.15	PK
7236	29.01	8.67	H	37.68	53.98	16.30	AV

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

Frequency [MHz]	Measured Level [dBμV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4874	43.81	3.19	V	47.00	73.98	26.98	PK
4874	31.65	3.19	V	34.84	53.98	19.14	AV
7311	41.49	9.41	V	50.90	73.98	23.08	PK
7311	29.36	9.41	V	38.77	53.98	15.21	AV
4874	42.66	3.19	H	45.85	73.98	28.13	PK
4874	31.09	3.19	H	34.28	53.98	19.70	AV
7311	40.97	9.41	H	50.38	73.98	23.60	PK
7311	29.14	9.41	H	38.55	53.98	15.43	AV

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

Frequency [MHz]	Measured Level [dB $\mu$ V]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measurement Type
4924	43.48	2.54	V	46.02	73.98	27.96	PK
4924	31.88	2.54	V	34.42	53.98	19.56	AV
7386	41.27	10.04	V	51.31	73.98	22.67	PK
7386	28.99	10.04	V	39.03	53.98	14.95	AV
4924	42.87	2.54	H	45.41	73.98	28.57	PK
4924	31.56	2.54	H	34.10	53.98	19.88	AV
7386	40.98	10.04	H	51.02	73.98	22.96	PK
7386	28.57	10.04	H	38.61	53.98	15.37	AV

**[Ant.1&Ant.2\_MIMO(CDD)]**

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

Frequency [MHz]	Measured Level [dBμV]	Duty Cycle Factor [dB]	A.F.+C.L.- A.G+D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4824	45.15	0.00	3.48	V	48.63	73.98	25.35	PK
4824	33.36	0.30	3.48	V	37.14	53.98	16.84	AV
7236	42.79	0.00	8.67	V	51.46	73.98	22.52	PK
7236	29.75	0.30	8.67	V	38.72	53.98	15.26	AV
4824	44.51	0.00	3.48	H	47.99	73.98	25.99	PK
4824	32.62	0.30	3.48	H	36.40	53.98	17.58	AV
7236	41.35	0.00	8.67	H	50.02	73.98	23.96	PK
7236	29.63	0.30	8.67	H	38.60	53.98	15.38	AV

Operation Mode:	802.11g
Transfer Rate:	6 Mbps
Operating Frequency	2437 MHz
Channel No.	06 Ch

Frequency [MHz]	Measured Level [dBμV]	Duty Cycle Factor [dB]	A.F.+C.L.- A.G+D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4874	43.37	0.00	3.19	V	46.56	73.98	27.42	PK
4874	31.21	0.30	3.19	V	34.70	53.98	19.28	AV
7311	43.57	0.00	9.41	V	52.98	73.98	21.00	PK
7311	30.49	0.30	9.41	V	40.20	53.98	13.78	AV
4874	42.47	0.00	3.19	H	45.66	73.98	28.32	PK
4874	30.67	0.30	3.19	H	34.16	53.98	19.82	AV
7311	42.93	0.00	9.41	H	52.34	73.98	21.64	PK
7311	29.66	0.30	9.41	H	39.37	53.98	14.61	AV

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

Frequency [MHz]	Measure d Level [dB $\mu$ V]	Duty Cycle Factor [dB]	A.F.+C.L. -A.G + D.F [dB]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measure ment Type
4924	44.01	0.00	2.54	V	46.55	73.98	27.43	PK
4924	31.63	0.30	2.54	V	34.47	53.98	19.51	AV
7386	41.90	0.00	10.04	V	51.94	73.98	22.04	PK
7386	29.16	0.30	10.04	V	39.50	53.98	14.48	AV
4924	44.09	0.00	2.54	H	46.63	73.98	27.35	PK
4924	31.86	0.30	2.54	H	34.70	53.98	19.28	AV
7386	40.87	0.00	10.04	H	50.91	73.98	23.07	PK
7386	29.09	0.30	10.04	H	39.43	53.98	14.55	AV

Operation Mode: 802.11n (HT20)  
 Transfer MCS Index: 0  
 Operating Frequency: 2412 MHz  
 Channel No.: 01 Ch

Frequency [MHz]	Measure d Level [dBμV]	Duty Cycle Factor [dB]	A.F.+C.L.- A.G + D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measure ment Type
4824	45.22	0.00	3.48	V	48.70	73.98	25.28	PK
4824	33.01	0.32	3.48	V	36.81	53.98	17.17	AV
7236	41.98	0.00	8.67	V	50.65	73.98	23.33	PK
7236	29.69	0.32	8.67	V	38.68	53.98	15.30	AV
4824	44.73	0.00	3.48	H	48.21	73.98	25.77	PK
4824	32.40	0.32	3.48	H	36.20	53.98	17.78	AV
7236	40.98	0.00	8.67	H	49.65	73.98	24.33	PK
7236	29.43	0.32	8.67	H	38.42	53.98	15.56	AV

Operation Mode: 802.11n (HT20)  
 Transfer MCS Index: 0  
 Operating Frequency: 2437 MHz  
 Channel No.: 06 Ch

Frequency [MHz]	Measure d Level [dBμV]	Duty Cycle Factor [dB]	A.F.+C.L.- A.G + D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measure ment Type
4874	44.32	0.00	3.19	V	47.51	73.98	26.47	PK
4874	32.30	0.32	3.19	V	35.81	53.98	18.17	AV
7311	41.78	0.00	9.41	V	51.19	73.98	22.79	PK
7311	29.92	0.32	9.41	V	39.65	53.98	14.33	AV
4874	43.72	0.00	3.19	H	46.91	73.98	27.07	PK
4874	31.22	0.32	3.19	H	34.73	53.98	19.25	AV
7311	40.18	0.00	9.41	H	49.59	73.98	24.39	PK
7311	29.42	0.32	9.41	H	39.15	53.98	14.83	AV

Operation Mode: 802.11n (HT20)  
Transfer MCS Index: 0  
Operating Frequency: 2462 MHz  
Channel No.: 11 Ch

Frequency [MHz]	Measure d Level [dB $\mu$ V]	Duty Cycle Factor [dB]	A.F.+C.L.- A.G + D.F [dB]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measure ment Type
4924	43.29	0.00	2.54	V	45.83	73.98	28.15	PK
4924	31.33	0.32	2.54	V	34.19	53.98	19.79	AV
7386	41.25	0.00	10.04	V	51.29	73.98	22.69	PK
7386	29.07	0.32	10.04	V	39.43	53.98	14.55	AV
4924	44.29	0.00	2.54	H	46.83	73.98	27.15	PK
4924	31.47	0.32	2.54	H	34.33	53.98	19.65	AV
7386	40.47	0.00	10.04	H	50.51	73.98	23.47	PK
7386	28.99	0.32	10.04	H	39.35	53.98	14.63	AV



**[DBS Mode]**

**Test case 1**

**802.11b Ch.11 2 462 GHz Ant 1 & 802.11a Ch.165 5 825 GHz UNII-3 Ant ALL**

Frequency [MHz]	Measured Level [dBμV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
4924	50.47	2.54	V	53.01	73.98	20.97	PK
4924	41.69	2.54	V	44.23	53.98	9.75	AV
7386	41.96	10.04	V	52.00	73.98	21.98	PK
7386	30.16	10.04	V	40.20	53.98	13.78	AV
4924	51.34	2.54	H	53.88	73.98	20.10	PK
4924	45.92	2.54	H	48.46	53.98	5.52	AV
7386	41.53	10.04	H	51.57	73.98	22.41	PK
7386	29.65	10.04	H	39.69	53.98	14.29	AV

**Test case 2**

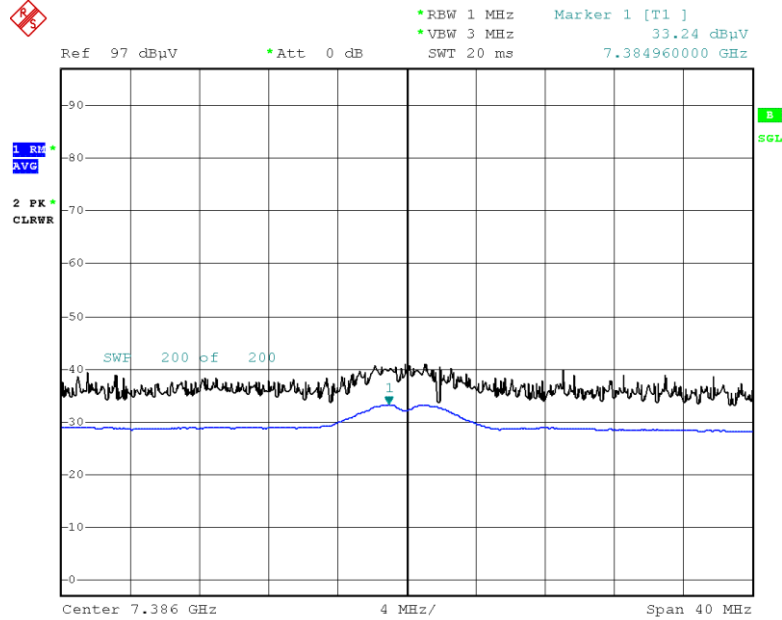
**802.11n(HT20) Ch.6 2 437 GHz Ant ALL & 802.11a Ch.165 5 825 GHz UNII-3 Ant ALL**

Frequency [MHz]	Measure d Level [dBμV]	Duty Cycle Factor [dB]	A.F.+C.L.- A.G + D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measure ment Type
4874	49.04	0.00	3.19	V	52.23	73.98	21.75	PK
4874	36.36	0.30	3.19	V	39.85	53.98	14.13	AV
7311	43.58	0.00	9.41	V	52.99	73.98	20.99	PK
7311	30.28	0.30	9.41	V	39.99	53.98	13.99	AV
4874	49.17	0.00	3.19	H	52.36	73.98	21.62	PK
4874	36.78	0.30	3.19	H	40.27	53.98	13.71	AV
7311	43.27	0.00	9.41	H	52.68	73.98	21.30	PK
7311	30.58	0.30	9.41	H	40.29	53.98	13.69	AV

## [Ant.1(SISO)]

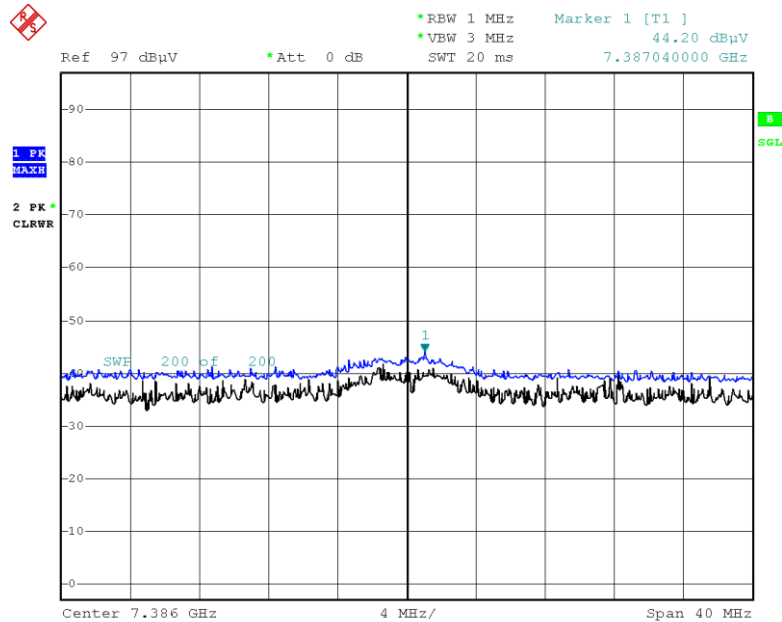
### ☑ Test Plots (Worst case : Y)

Radiated Spurious Emissions plot – Average Result (802.11b\_1 Mbps, Ch.11 3rd Harmonic)



Date: 23.AUG.2021 20:18:20

Radiated Spurious Emissions plot – Peak Result (802.11b\_1 Mbps, Ch.11 3rd Harmonic)

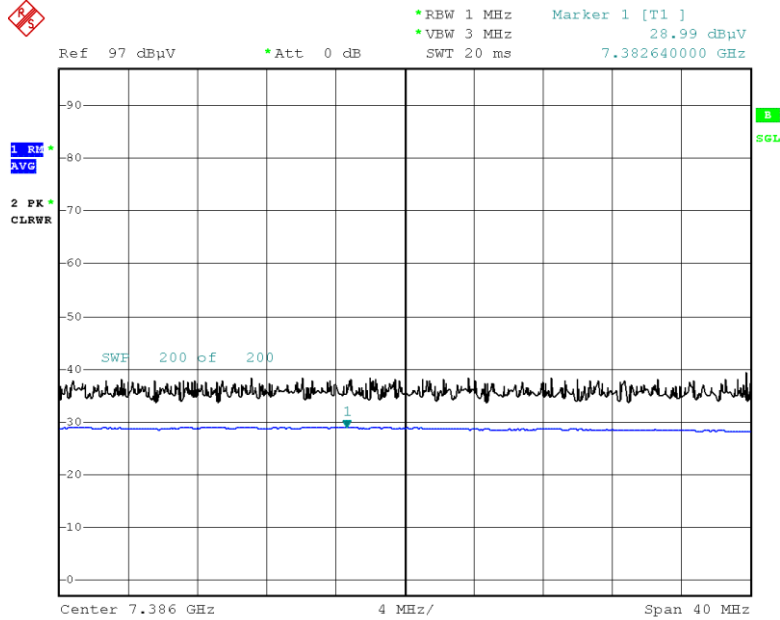


Date: 23.AUG.2021 20:18:38

## [Ant.2(SISO)]

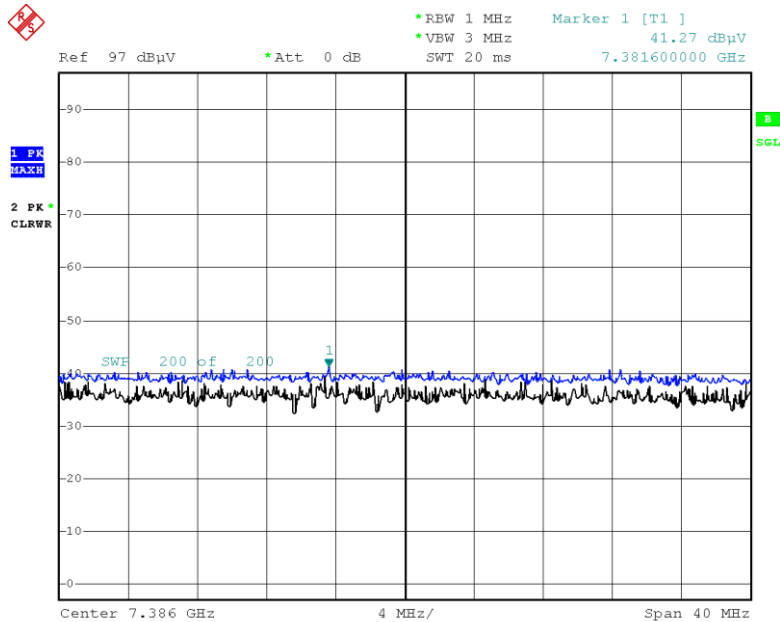
### ☑ Test Plots (Worst case : X)

Radiated Spurious Emissions plot – Average Result (802.11b\_1 Mbps, Ch.11 3rd Harmonic)



Date: 23.AUG.2021 22:48:32

Radiated Spurious Emissions plot – Peak Result (802.11b\_1 Mbps, Ch.11 3rd Harmonic)

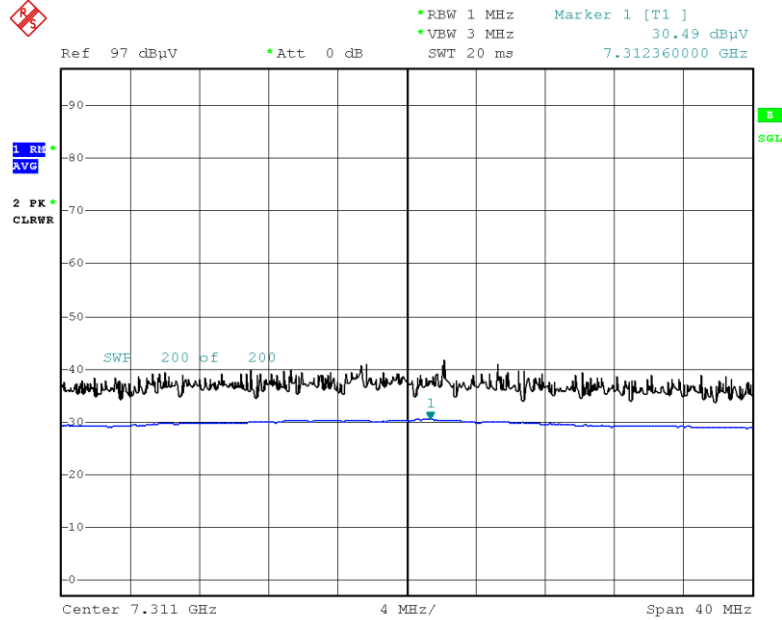


Date: 23.AUG.2021 22:48:42

## [Ant.1&Ant.2\_MIMO(CDD)]

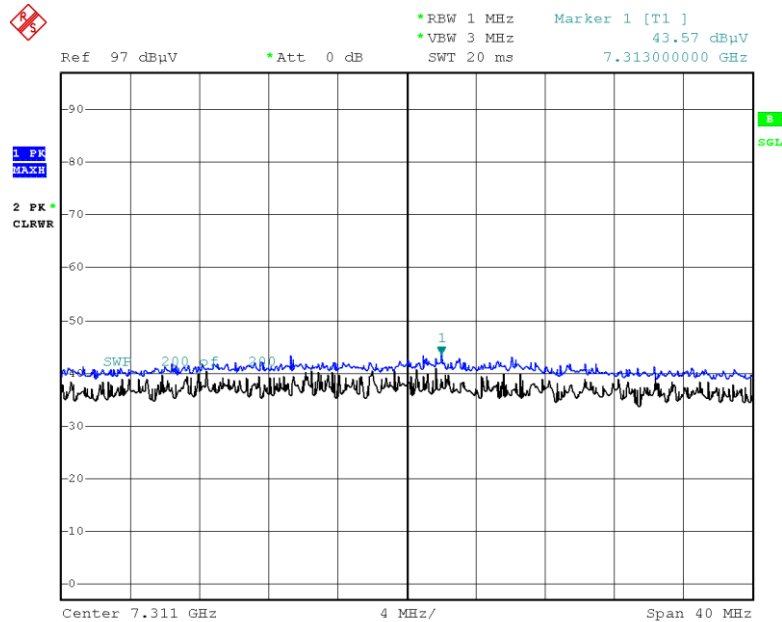
### ☑ Test Plots (Worst case : Y)

Radiated Spurious Emissions plot – Average Result (802.11g\_6 Mbps, Ch.6 3rd Harmonic)



Date: 24.AUG.2021 12:33:31

Radiated Spurious Emissions plot – Peak Result (802.11g\_6 Mbps, Ch.6 3rd Harmonic)

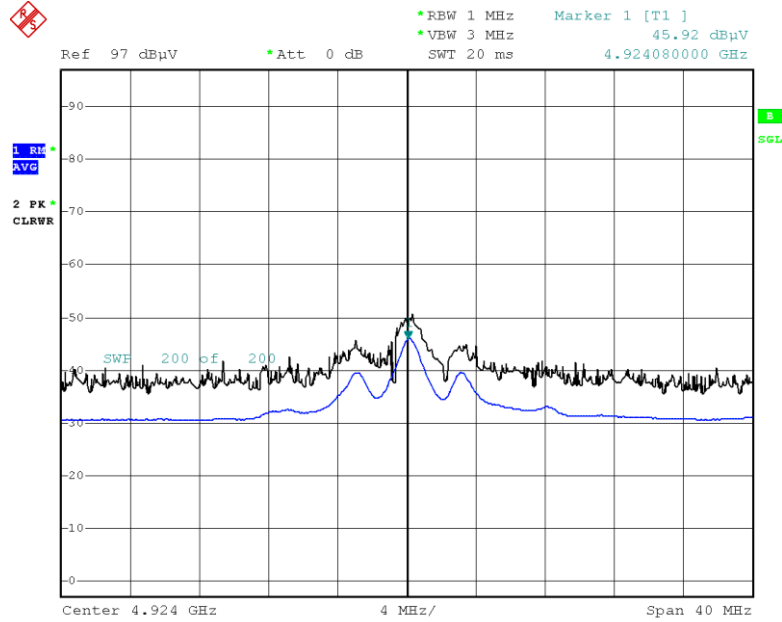


Date: 24.AUG.2021 12:33:49

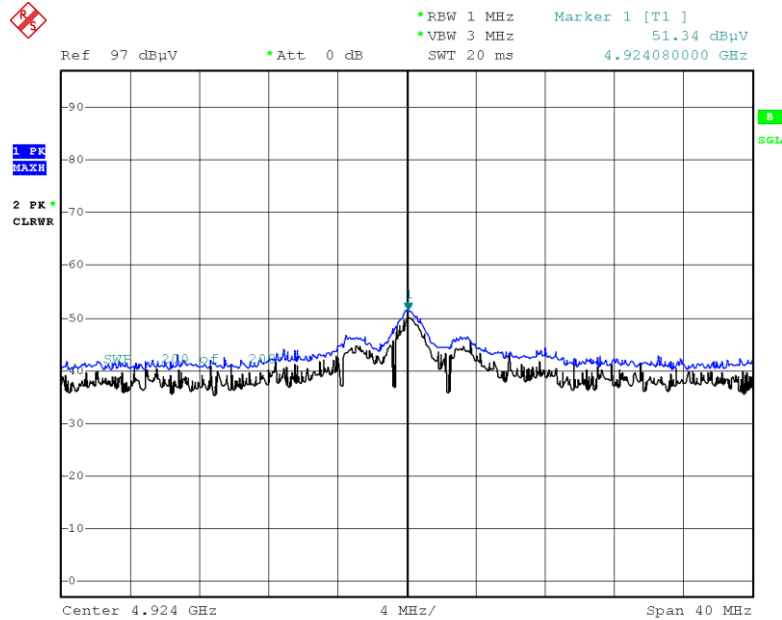
**Note:** Plot of worst case are only reported.

[DBS]

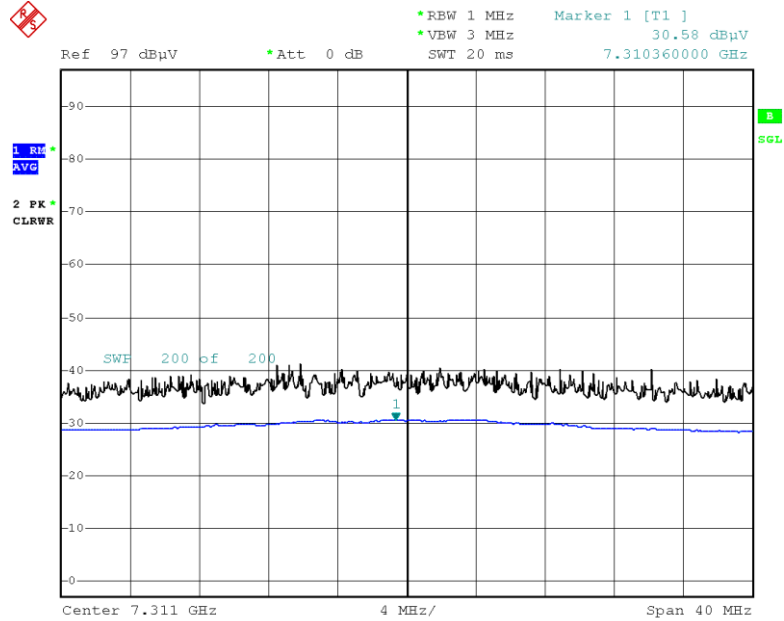
### Radiated Spurious Emissions plot – Average Result (Test case 1\_H\_2nd Harmonic)



### Radiated Spurious Emissions plot – Peak Result (Test case 1\_H\_2nd Harmonic)

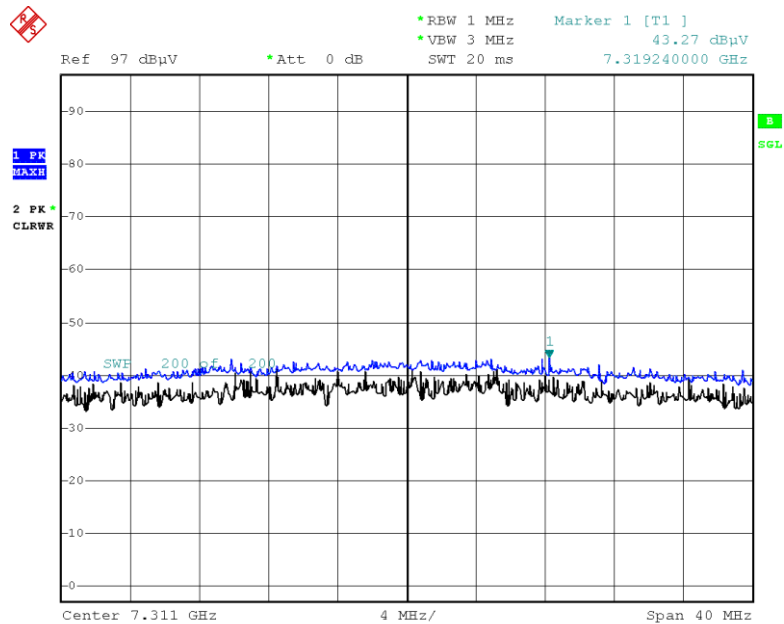


## Radiated Spurious Emissions plot – Average Result (Test case 2\_Z\_3rd Harmonic)



Date: 30.AUG.2021 17:55:56

## Radiated Spurious Emissions plot – Peak Result (Test case 2\_Z\_3rd Harmonic)



Date: 30.AUG.2021 17:56:09

**Note:** Plot of worst case are only reported.

**9.7 RADIATED RESTRICTED BAND EDGES****[Ant.1(SISO)]**

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

Frequency [MHz]	Measured Level [dB $\mu$ V]	A.F.+ C.L+ D.F [dB]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measurement Type
2390.0	24.36	33.78	H	58.14	73.98	15.84	PK
2390.0	11.98	33.78	H	45.76	53.98	8.22	AV
2390.0	23.78	33.78	V	57.56	73.98	16.42	PK
2390.0	11.35	33.78	V	45.12	53.98	8.86	AV
2483.5	28.59	34.10	H	62.69	73.98	11.29	PK
2483.5	12.87	34.10	H	46.97	53.98	7.01	AV
2483.5	28.09	34.10	V	62.19	73.98	11.79	PK
2483.5	12.04	34.10	V	46.14	53.98	7.84	AV

**[Ant.2(SISO)]**

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

Frequency [MHz]	Measured Level [dB $\mu$ V]	A.F.+ C.L+ D.F [dB]	ANT. POL [H/V]	Total [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	Measurement Type
2390.0	24.36	33.78	H	58.14	73.98	15.84	PK
2390.0	12.11	33.78	H	45.89	53.98	8.09	AV
2390.0	23.85	33.78	V	57.63	73.98	16.35	PK
2390.0	11.74	33.78	V	45.52	53.98	8.46	AV
2483.5	23.53	34.10	H	57.63	73.98	16.35	PK
2483.5	12.54	34.10	H	46.64	53.98	7.34	AV
2483.5	22.92	34.10	V	57.01	73.98	16.97	PK
2483.5	11.73	34.10	V	45.83	53.98	8.15	AV

**[Ant.1&Ant.2\_MIMO(CDD)]**

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

Frequency [MHz]	Measured Level [dBμV]	Duty Cycle Factor [dB]	A.F.+ C.L+ D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
#2389.5	29.59	0.00	33.78	H	63.37	73.98	10.61	PK
#2389.5	17.14	0.30	33.78	H	51.22	53.98	2.76	AV
2389.0	31.12	0.00	33.78	V	64.90	73.98	9.08	PK
2389.0	16.30	0.30	33.78	V	50.37	53.98	3.61	AV
2390.0	36.99	0.00	33.78	V	70.77	73.98	3.21	PK
2390.0	15.72	0.30	33.78	V	49.80	53.98	4.18	AV
#2484	31.69	0.00	34.10	H	65.79	73.98	8.19	PK
#2484	16.86	0.30	34.10	H	51.26	53.98	2.72	AV
2484.5	36.98	0.00	34.10	H	71.08	73.98	2.90	PK
2484.5	16.46	0.30	34.10	H	50.86	53.98	3.12	AV
2483.5	37.03	0.00	34.10	V	71.13	73.98	2.85	PK
2483.5	15.73	0.30	34.10	V	50.13	53.98	3.85	AV

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



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

Frequency [MHz]	Measured Level [dBμV]	Duty Cycle Factor [dB]	A.F.+ C.L+ D.F [dB]	ANT. POL [H/V]	Total [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Measurement Type
#2389.5	28.12	0.00	33.78	H	61.90	73.98	12.08	PK
#2389.5	16.27	0.32	33.78	H	50.37	53.98	3.61	AV
2389.0	33.15	0.00	33.78	V	66.93	73.98	7.05	PK
2389.0	15.75	0.32	33.78	V	49.85	53.98	4.13	AV
2390.0	37.01	0.00	33.78	V	70.79	73.98	3.19	PK
2390.0	15.16	0.32	33.78	V	49.26	53.98	4.72	AV
#2484	25.85	0.00	34.10	H	59.95	73.98	14.03	PK
#2484	14.31	0.32	34.10	H	48.73	53.98	5.25	AV
2484.5	34.46	0.00	34.10	V	68.56	73.98	5.42	PK
2484.5	14.44	0.32	34.10	V	48.86	53.98	5.12	AV
2483.5	36.60	0.00	34.10	V	70.70	73.98	3.28	PK
2483.5	14.87	0.32	34.10	V	49.29	53.98	4.69	AV

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

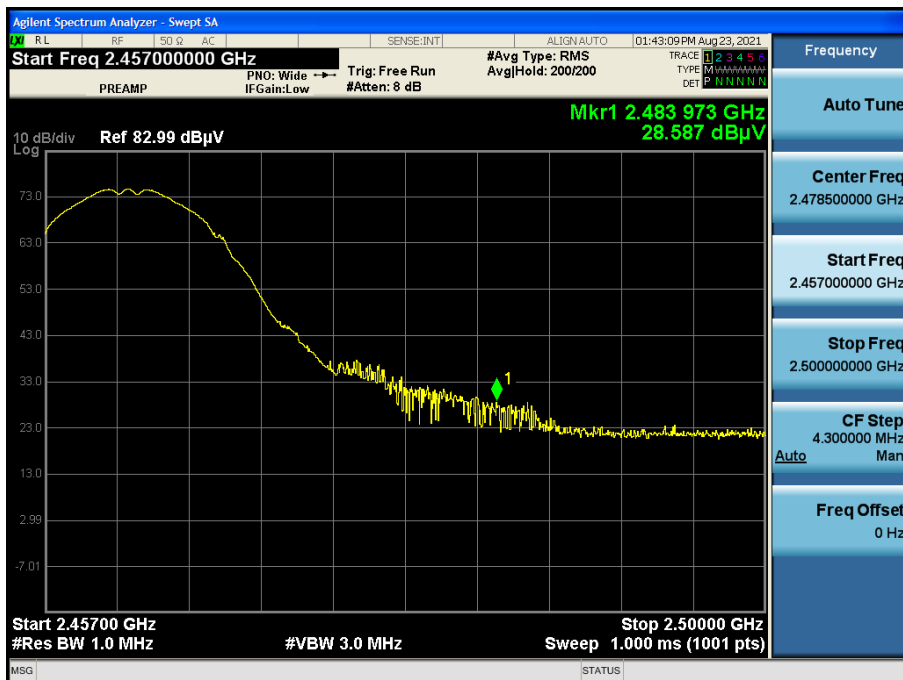
### ■ Test Plots

#### [Ant.1(SISO)] (Worst case : X-H)

Radiated Restricted Band Edges plot – Average Result (802.11b\_1 Mbps Ch.11)



Radiated Restricted Band Edges plot – Peak Result (802.11b\_1 Mbps Ch.11)

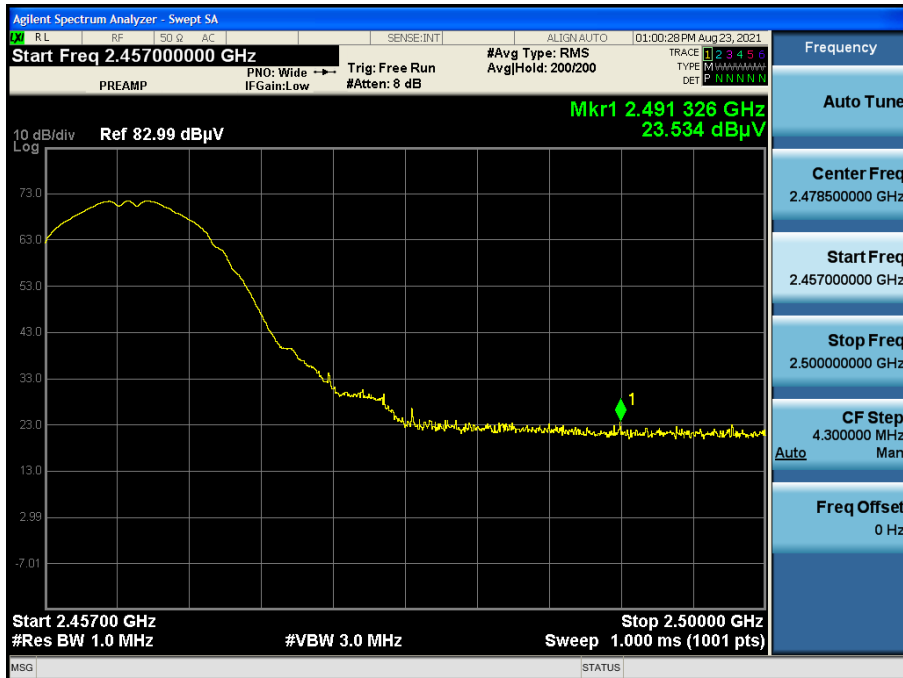


[Ant.2(SISO)] (Worst case : X-H)

Radiated Restricted Band Edges plot – Average Result (802.11b\_1 Mbps Ch.11)



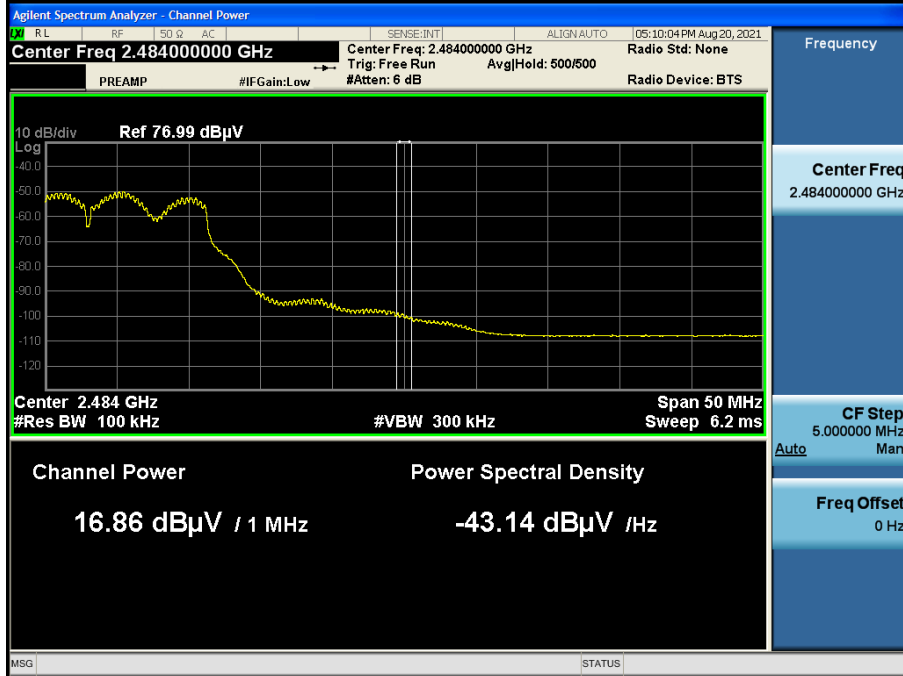
Radiated Restricted Band Edges plot – Peak Result (802.11b\_1 Mbps Ch.11)



### [Ant.1&Ant.2\_MIMO(CDD)] (Worst case : X-H)

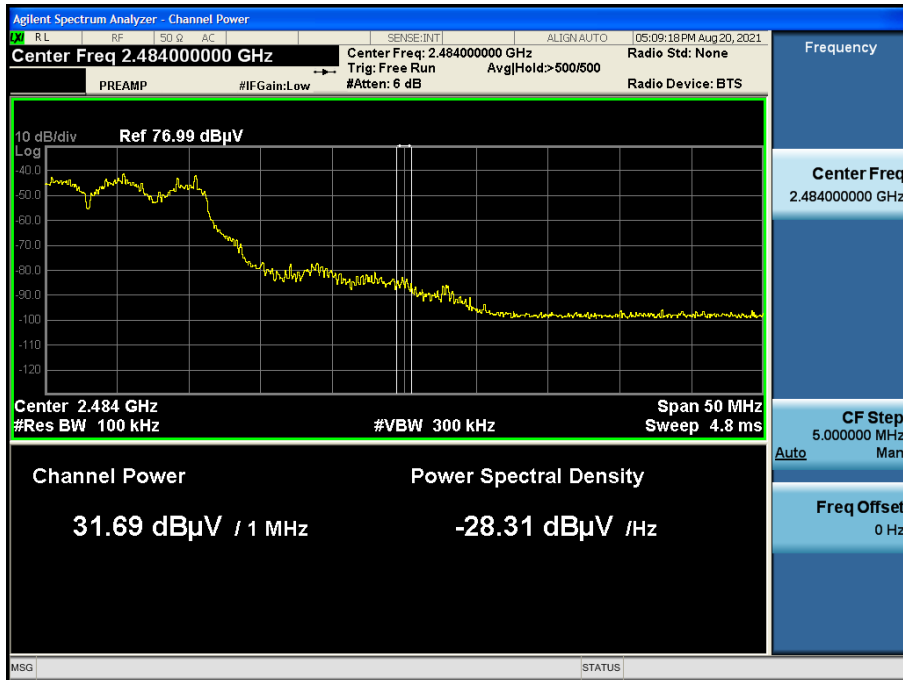
Radiated Restricted Band Edges plot – Average Result (802.11g\_6 Mbps Ch.11)

Integration method Used\_2 484 MHz

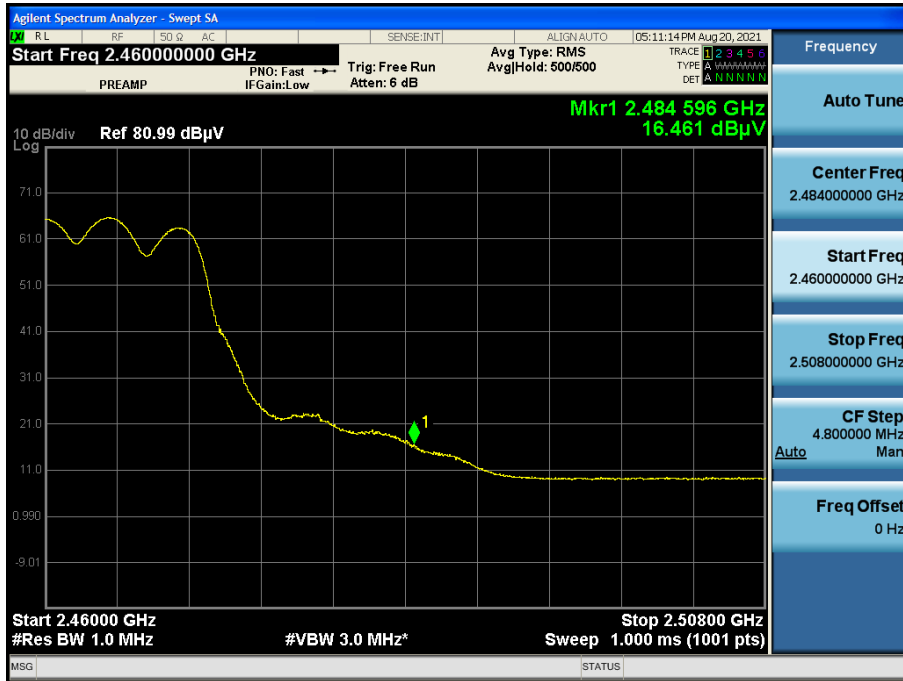


Radiated Restricted Band Edges plot – Peak Result (802.11g\_6 Mbps Ch.11)

Integration method Used\_2 484 MHz



### Radiated Restricted Band Edges plot – Average Result (802.11g\_6 Mbps Ch.11)



### Radiated Restricted Band Edges plot – Peak Result (802.11g\_6 Mbps Ch.11)



**Note:**

Plot of worst case are only reported.

## 9.8 POWERLINE CONDUCTED EMISSIONS

### Conducted Emissions (Line 1)

Test

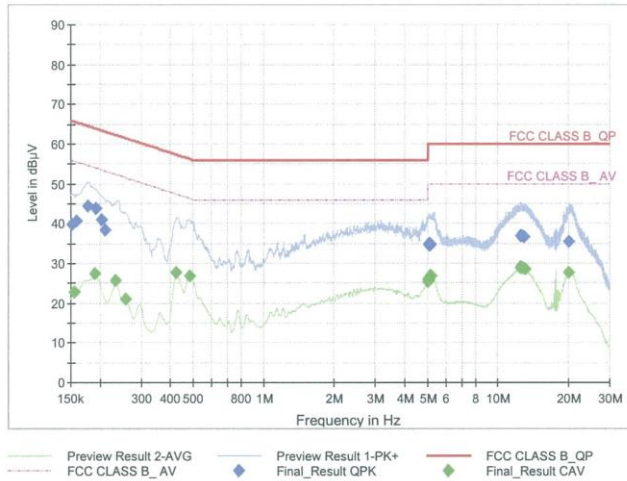
1 / 2

## Test Report

### Common Information

EUT : SM-G990E/DS  
 Manufacturer : SAMSUNG  
 Test Site: SHIELD ROOM  
 Operating Conditions : 2.4G WLAN L1  
 Operator Name:  
 Comment:

Full Spectrum



### Final Result QPK

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	39.85	65.88	26.02	9.000	L1	OFF	9.6
0.1590	40.61	65.52	24.91	9.000	L1	OFF	9.6
0.1770	44.43	64.63	20.19	9.000	L1	OFF	9.6
0.1928	43.84	63.92	20.08	9.000	L1	OFF	9.6
0.2040	40.89	63.45	22.55	9.000	L1	OFF	9.6
0.2108	38.35	63.18	24.83	9.000	L1	OFF	9.6
5.0630	34.52	60.00	25.48	9.000	L1	OFF	9.9
5.0945	34.98	60.00	25.02	9.000	L1	OFF	9.9
5.1013	34.94	60.00	25.06	9.000	L1	OFF	9.9
5.1080	35.03	60.00	24.97	9.000	L1	OFF	9.9
5.1148	34.76	60.00	25.24	9.000	L1	OFF	9.9
5.1283	34.51	60.00	25.49	9.000	L1	OFF	9.9
12.4228	36.88	60.00	23.12	9.000	L1	OFF	10.1
12.5465	36.91	60.00	23.09	9.000	L1	OFF	10.1
12.5915	36.90	60.00	23.10	9.000	L1	OFF	10.1
12.6545	36.87	60.00	23.13	9.000	L1	OFF	10.2
12.9020	36.78	60.00	23.22	9.000	L1	OFF	10.2
19.9850	35.40	60.00	24.60	9.000	L1	OFF	10.4

### Final\_Result\_CAV

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오후 7:00:00

Test

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Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	22.67	55.75	33.08	9.000	L1	OFF	9.6
0.1905	27.45	54.02	26.57	9.000	L1	OFF	9.6
0.2333	25.70	52.33	26.63	9.000	L1	OFF	9.6
0.2580	21.06	51.50	30.43	9.000	L1	OFF	9.6
0.4245	27.57	47.36	19.79	9.000	L1	OFF	9.6
0.4853	26.86	46.25	19.39	9.000	L1	OFF	9.6
5.0000	25.46	46.00	20.54	9.000	L1	OFF	9.9
5.0270	25.87	50.00	24.13	9.000	L1	OFF	9.9
5.0473	26.02	50.00	23.98	9.000	L1	OFF	9.9
5.1080	26.77	50.00	23.23	9.000	L1	OFF	9.9
5.1350	26.58	50.00	23.42	9.000	L1	OFF	9.9
5.1800	26.95	50.00	23.05	9.000	L1	OFF	9.9
12.4205	28.80	50.00	21.20	9.000	L1	OFF	10.1
12.4835	28.85	50.00	21.15	9.000	L1	OFF	10.1
12.4925	29.00	50.00	21.00	9.000	L1	OFF	10.1
12.7558	28.97	50.00	21.03	9.000	L1	OFF	10.2
13.0055	28.49	50.00	21.51	9.000	L1	OFF	10.2
19.9828	27.69	50.00	22.31	9.000	L1	OFF	10.4

2021-09-01

오후 7:00:00

## Conducted Emissions (Line 2)

Test

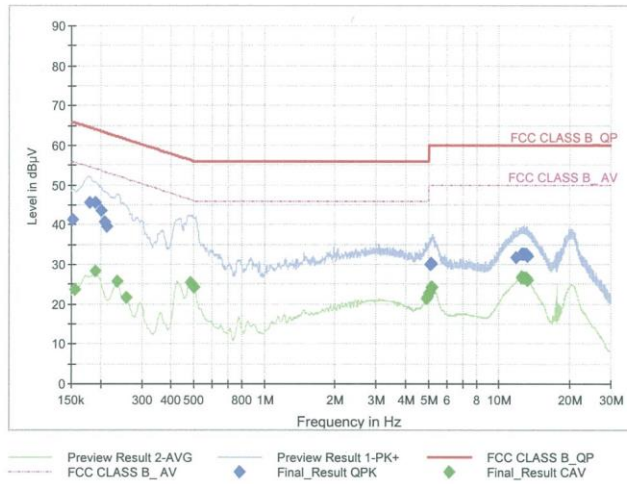
1 / 2

### Test Report

#### Common Information

EUT : SM-G990E/DS  
 Manufacturer : SAMSUNG  
 Test Site: SHIELD ROOM  
 Operating Conditions : 2.4G WLAN N  
 Operator Name:  
 Comment:

Full Spectrum



#### Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	41.23	65.88	24.65	9.000	N	OFF	9.6
0.1793	45.62	64.52	18.90	9.000	N	OFF	9.6
0.1905	45.64	64.02	18.37	9.000	N	OFF	9.6
0.2018	43.42	63.54	20.12	9.000	N	OFF	9.6
0.2085	40.73	63.27	22.53	9.000	N	OFF	9.6
0.2130	39.39	63.09	23.70	9.000	N	OFF	9.6
5.0945	30.09	60.00	29.91	9.000	N	OFF	9.9
5.0990	30.05	60.00	29.95	9.000	N	OFF	9.9
5.1148	30.26	60.00	29.74	9.000	N	OFF	9.9
5.1238	30.26	60.00	29.74	9.000	N	OFF	9.9
5.1350	30.17	60.00	29.83	9.000	N	OFF	9.9
5.1440	30.14	60.00	29.86	9.000	N	OFF	9.9
11.8445	31.84	60.00	28.16	9.000	N	OFF	10.1
12.4745	32.67	60.00	27.33	9.000	N	OFF	10.2
12.6275	32.63	60.00	27.37	9.000	N	OFF	10.2
12.7040	32.67	60.00	27.33	9.000	N	OFF	10.2
12.9943	32.60	60.00	27.40	9.000	N	OFF	10.2
13.2688	32.15	60.00	27.85	9.000	N	OFF	10.2

#### Final Result CAV

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오후 7:06:22



Test

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Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	23.63	55.75	32.13	9.000	N	OFF	9.6
0.1905	28.26	54.02	25.76	9.000	N	OFF	9.6
0.2355	25.69	52.25	26.57	9.000	N	OFF	9.6
0.2580	21.50	51.50	29.99	9.000	N	OFF	9.6
0.4830	25.44	46.29	20.84	9.000	N	OFF	9.6
0.5000	24.31	46.00	21.69	9.000	N	OFF	9.6
4.8785	21.34	46.00	24.66	9.000	N	OFF	9.9
4.9505	22.06	46.00	23.94	9.000	N	OFF	9.9
5.0000	22.68	46.00	23.32	9.000	N	OFF	9.9
5.1193	24.13	50.00	25.87	9.000	N	OFF	9.9
5.1395	24.14	50.00	25.87	9.000	N	OFF	9.9
5.1620	24.27	50.00	25.73	9.000	N	OFF	9.9
12.4745	26.48	50.00	23.52	9.000	N	OFF	10.2
12.5128	26.79	50.00	23.21	9.000	N	OFF	10.2
12.6973	26.67	50.00	23.33	9.000	N	OFF	10.2
12.8278	26.59	50.00	23.41	9.000	N	OFF	10.2
12.9943	26.47	50.00	23.53	9.000	N	OFF	10.2
13.2710	26.09	50.00	23.91	9.000	N	OFF	10.2

2021-09-01

오후 7:06:22

**9.9 CONFIRMATION OF GEO-LOCATION MECHANISM**

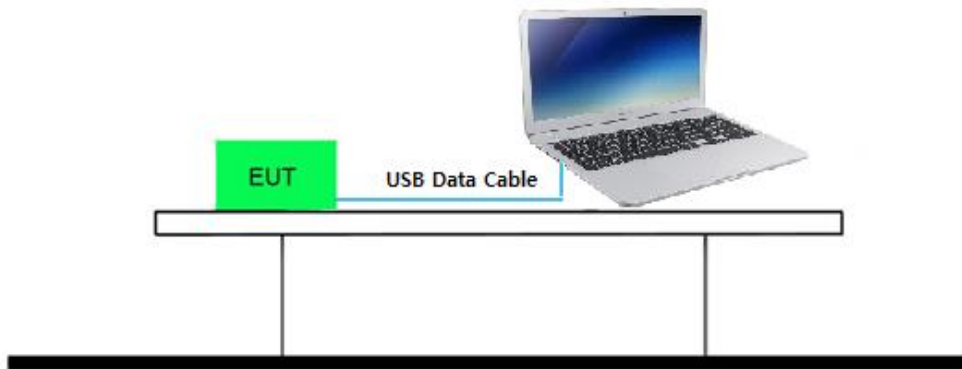
The device uses MCC information obtained from the public cellular carrier to determine that it is operating outside the U.S. and then enable channels 12 and 13 only if a non-US MCC that supports channel 12 and 13 is confirmed.

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.

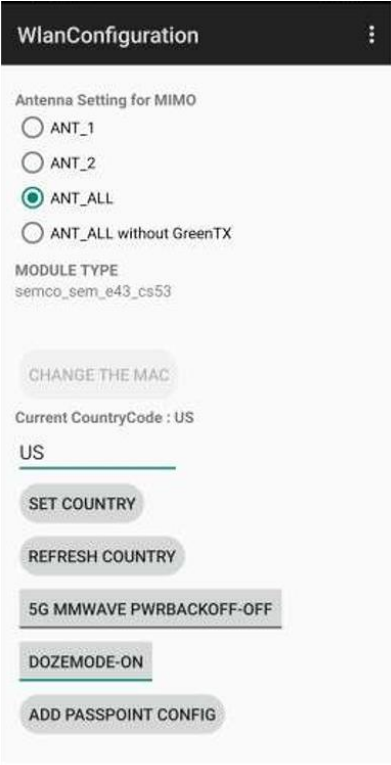
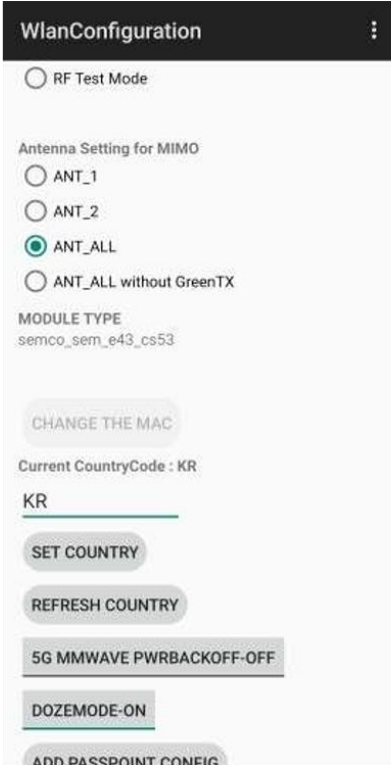
**Test Setup**



**Test Procedure**

In case of Country code	In case of airplane mode
<ol style="list-style-type: none"> <li>1. Open Command Prompt</li> <li>2. At the Command Prompt, Enter the command. <ul style="list-style-type: none"> <li>- C:\adb &gt; adb root</li> <li>- C:\adb &gt; adb remount</li> <li>- C:\adb &gt; adb push iwpriv/system/bin</li> <li>- C:\adb &gt; adb shell "chmod 777 /system/bin/iwpriv"</li> <li>- C:\adb &gt; adb shell cmd wifi force-country-code enabled US // Setting the country.</li> <li>- C:\adb &gt; adb shell iw list // Channel list is obtain.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Airplane mode on</li> <li>2. Wifi on</li> <li>3. Open Command Prompt</li> <li>4. At the Command Prompt, Enter the command. <ul style="list-style-type: none"> <li>- C:\adb &gt; adb root</li> <li>- C:\adb &gt; adb remount</li> <li>- C:\adb &gt; adb push iwpriv/system/bin</li> <li>- C:\adb &gt; adb shell "chmod 777 /system/bin/iwpriv"</li> <li>- C:\adb &gt; adb shell iw list // support band in case of airplane mode</li> </ul> </li> </ol>

### Setting the country for product

Country code = US	Country code = KR(Korea)
	
<pre>Microsoft Windows [Version 10.0.19042.1165] (c) Microsoft Corporation. All rights reserved.  C:\Users\HCT&gt;cd/adb C:\adb&gt;adb remount remount succeeded  C:\adb&gt;adb shell cmd wifi force-country-code enabled US C:\adb&gt;adb shell iw list Wiphy phy0</pre>	<pre>Microsoft Windows [Version 10.0.19042.1165] (c) Microsoft Corporation. All rights reserved.  C:\Users\HCT&gt;cd/adb C:\adb&gt;adb remount remount succeeded  C:\adb&gt;adb shell cmd wifi force-country-code enabled KR C:\adb&gt;adb shell iw list Wiphy phy0 max # scan SSIDs: 10</pre>

Did not connect Airplane mode	
Airplane on	
<pre>* 34.0 Mbps 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)</pre>	
Airplane off	
<pre>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] (30.0 dBm) * 2472 MHz [13] (30.0 dBm)</pre>	

**Note :** The frequency range is occupied band, not center frequency.

## 10. LIST OF TEST EQUIPMENT

### Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	08/23/2022	Annual
Test Receiver	ESCI	Rohde & Schwarz	100033	06/15/2022	Annual
Temperature Chamber	SU-642	ESPAC	0093008124	03/15/2022	Annual
Signal Analyzer	N9020A	Agilent	MY47380318	01/28/2022	Annual
Signal Analyzer	N9030A	Agilent	MY49431210	01/11/2022	Annual
Power Meter	N1911A	Agilent	MY45100523	04/08/2022	Annual
Power Sensor	N1921A	Agilent	MY57820067	04/08/2022	Annual
Directional Coupler	87300B	Agilent	3116A03621	11/10/2021	Annual
Power Splitter	11667B	Hewlett Packard	05001	05/20/2022	Annual
DC Power Supply	E3632A	Hewlett Packard	KR75303960	06/10/2022	Annual
Attenuator (10 dB)	5910-N-50-010	H+S	00801	10/28/2021	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A
FCC WLAN&BT&BLE Conducted Test Software v3.0	FCC WLAN&BT&BLE Conducted Test Software v3.0	HCT CO., LTD.	N/A	N/A	N/A

### 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	2090	Emco	060520	N/A	N/A
Turn Table	Turn Table	Ets	N/A	N/A	N/A
Loop Antenna	Loop Antenna	Rohde & Schwarz	1513-333	03/19/2022	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	09/04/2022	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/18/2021	Biennial
Horn Antenna (15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170541	11/29/2021	Biennial
Spectrum Analyzer	FSP (9 kHz ~ 30 GHz)	Rohde & Schwarz	836650/016	09/14/2021	Annual
Spectrum Analyzer	FSV40-N	Rohde & Schwarz	101068-SZ	09/22/2021	Annual
Band Reject Filter	WRCJV2400/2483.5-2370/2520-60/12SS	Wainwright Instruments	2	01/06/2022	Annual
Band Reject Filter	WRCJV5100/5850-40/50-8EEK	Wainwright Instruments	1	02/08/2022	Annual
Attenuator (10 dB)	CBLU1183540B-01	CERNEX	N/A	12/23/2021	Annual
56-10	56-10	WEINSCHL			
Broadband Low Noise Amplifier	CBL06185030	CERNEX	N/A	12/23/2021	Annual
Attenuator (3 dB)	18B-03	Api tech.			
High Pass Filter	WHKX10-2700-3000-18000-40SS	Wainwright Instruments	N/A	12/23/2021	Annual
High Pass Filter	WHKX8-6090-7000-18000-40SS	Wainwright Instruments	N/A	12/23/2021	Annual
Thru	COAXIAL ATTENUATOR	T&M SYSTEM	N/A	12/23/2021	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/04/2021	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/23/2022	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-2109-FC021-P