

FCC DTS REPORT

Certification

Applicant Name: SAMSUNG Electronics Co., Ltd.	Date of Issue: October 29, 2020
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	Report No.: HCT-RF-2010-FC007

FCC ID:	A3LSMG991U
APPLICANT:	SAMSUNG Electronics Co., Ltd.

Model:	SM-G991U
Additional Model:	SM-G991U1
EUT Type:	Mobile Phone
Average Output Power:	Ant.1: 802.11b : 20.76 dBm / 802.11g : 17.31 dBm / 802.11n(HT20) : 17.18 dBm Ant.2: 802.11b : 20.97 dBm / 802.11g : 17.58 dBm / 802.11n(HT20) : 17.48 dBm Ant.1&2 : 802.11g : 20.33 dBm / 802.11n(HT20) : 20.30 dBm
Frequency Range:	2 412 MHz ~ 2 462 MHz
Modulation type:	CCK/DSSS/OFDM
FCC Classification:	Digital Transmission System(DTS)
FCC Rule Part(s):	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-2010-FC007

REVIEWED BY



Report prepared by : Jung Ki Lim
Engineer of Telecommunication Testing Center

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-2010-FC007	October 29, 2020	- First Approval Report

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1. EUT DESCRIPTION

Model	SM-G991U		
Additional Model	SM-G991U1		
EUT Type	Mobile Phone		
Power Supply	DC 3.88 V		
Battery Information	Model: EB-BG991ABY Type: Li-ion Battery		
Travel Adapter Information	Model : EP-TA800 Manufacture: DONGYANG E&P		
Data Cable Information	Model : EP-DN980BBZ Manufacture: RF-Tech		
Ear-jack Information	Model : YBD-19HS-026 Manufacture: ALMUS		
Frequency Range	2 412 MHz ~ 2 462 MHz		
Max. RF Output Power	<u>Peak Power</u> (For information only)	Ant. 1 (SISO)	802.11b : 26.79 dBm 802.11g : 25.28 dBm 802.11n(HT20) : 25.68 dBm
		Ant.2 (SISO)	802.11b : 27.10 dBm 802.11g : 25.71 dBm 802.11n(HT20) : 26.12 dBm
		Ant.1&2 (MIMO)	802.11g : 28.31 dBm 802.11n(HT20) : 28.66 dBm
	<u>Average Power</u>	Ant. 1 (SISO)	802.11b : 20.76 dBm 802.11g : 17.31 dBm 802.11n(HT20) : 17.18 dBm
		Ant.2 (SISO)	802.11b : 20.97 dBm 802.11g : 17.58 dBm 802.11n(HT20) : 17.48 dBm
		Ant.1&2 (MIMO)	802.11g : 20.33 dBm 802.11n(HT20) : 20.30 dBm
Modulation Type	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n		
Number of Channels	11 Channels		
Antenna Specification	Antenna type Ant.1: Metal, Ant.2: LDS		
	Peak Gain		
	Ant.1 Peak Gain: -6.83 dBi	Ant.2 Peak Gain: -6.50 dBi	
Date(s) of Tests	September 15, 2020 ~ October 28, 2020		

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 2.4GHz and 5GHz bands simultaneously on each antenna.

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

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

3. Directional Gain Calculation

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

Directional gain =

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

Ant Gain (dBi)		N _{ANT} / N _{SS}	Directional Gain (dBi)
Ant.1	-6.83		
Ant.2	-6.50		

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 30MHz 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 1GHz. Above 1GHz with 1.5m 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.

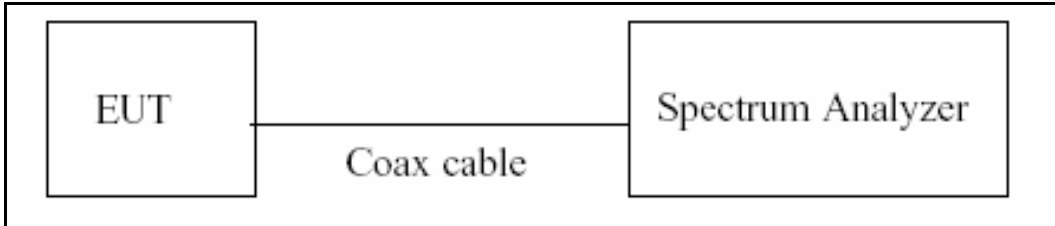
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

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 $> 50/T$.

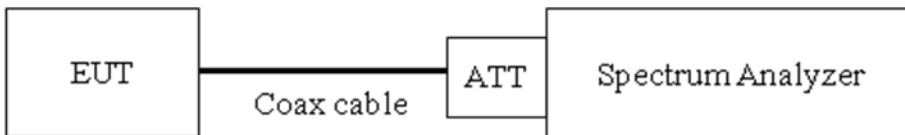
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz (\geq RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/T_{total} and Duty Cycle Factor = $10\log(1/Duty\ Cycle)$

7.2. 6dB 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.

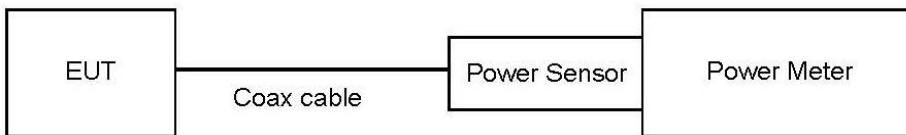
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

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

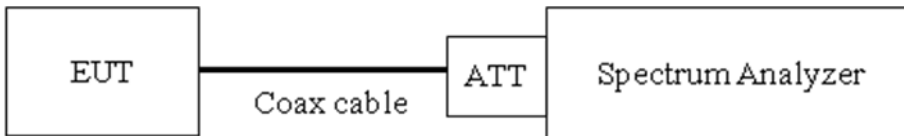
- Conducted Output Power(Peak) = Reading Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

7.4. Power Spectral Density

Limit

The transmitter power density average over 1-second interval shall not be greater than 8 dBm in any 3kHz 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 = Reading Value + ATT loss + Cable loss

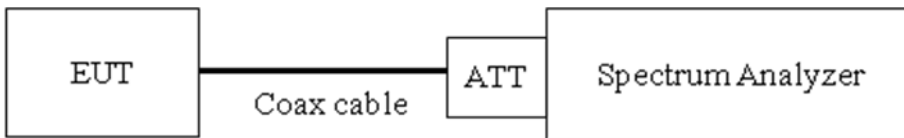
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

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	10.04
100	10.07
200	10.12
300	10.17
400	10.20
500	10.21
600	10.21
700	10.23
800	10.24
900	10.26
1000	10.27
2000	10.41
2400	10.45
2500	10.47
3000	10.52
4000	10.60
5000	10.71
6000	10.73
7000	10.80
8000	10.85
9000	10.91
10000	10.97
11000	11.02
12000	11.10
13000	11.19
14000	11.16
15000	11.21
16000	11.22
17000	11.25
18000	11.30
19000	11.32
20000	11.36
21000	11.48
22000	11.55
23000	11.55
24000	11.59
25000	11.68
26000	11.69

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

2. Factor = Attenuator loss + Cable loss

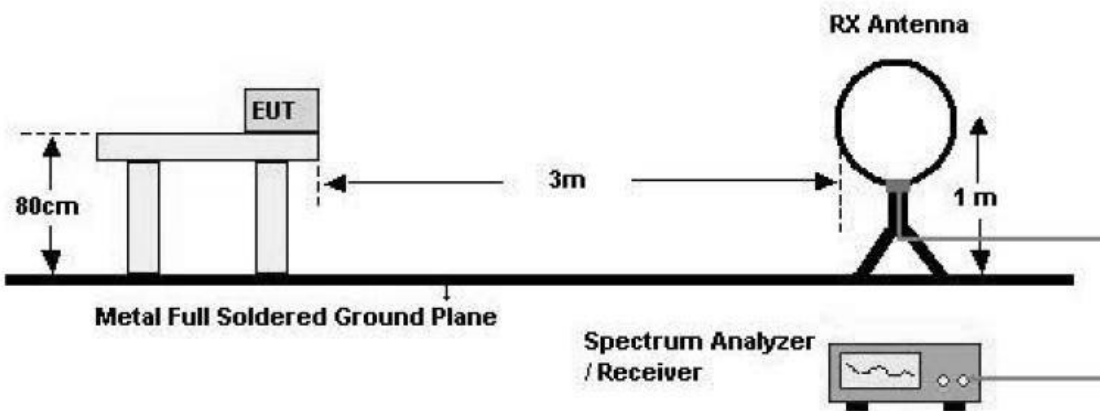
7.6. Radiated Test

Limit

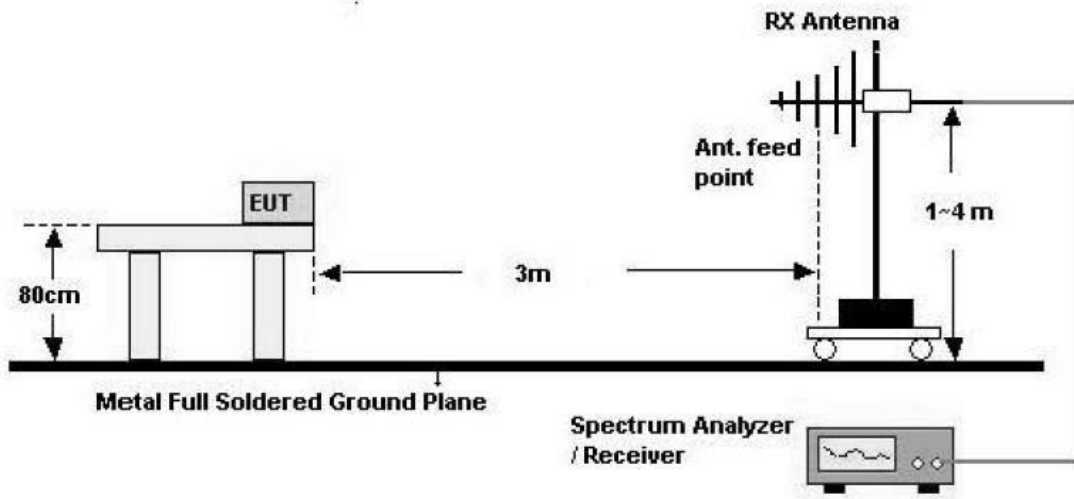
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

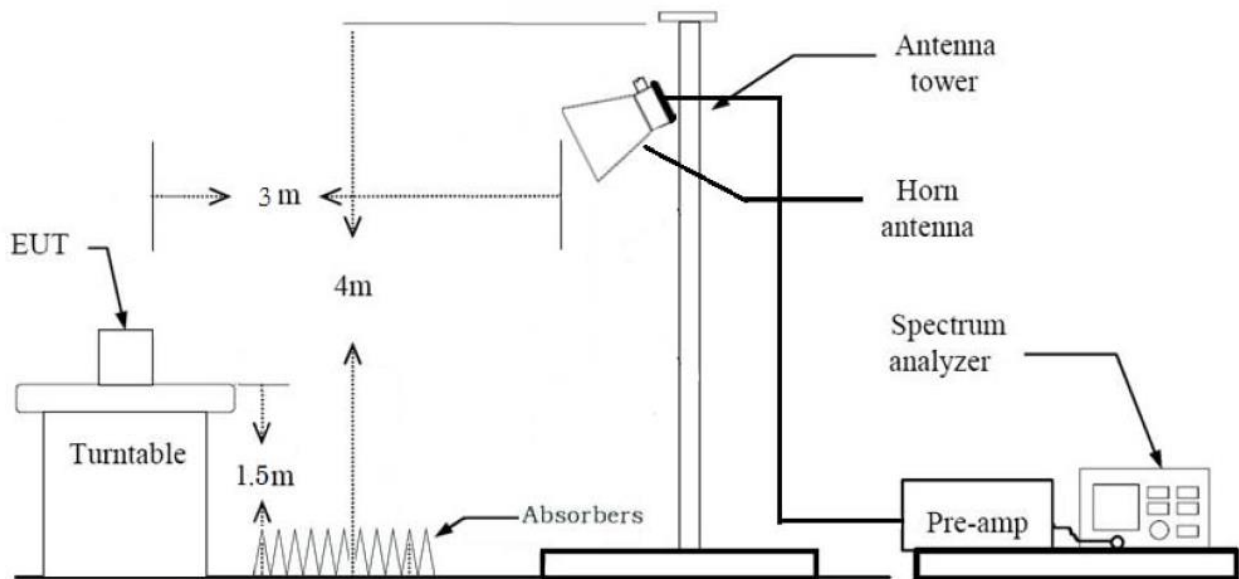
Below 30 MHz



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 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m 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 = Reading 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 1GHz)

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 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 1m to 4m 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 = Reading 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 1m to 4m 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 percent 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)

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

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

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

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

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

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 1m to 4m 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 percent 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)

= Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Attenuator
+ Distance Factor(D.F)

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

= Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Attenuator
+ Distance Factor(D.F)

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

= Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Attenuator
+ 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 μH/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56 ^(a)	56 to 46 ^(a)
0.50 to 5	56	46
5 to 30	60	50

^(a)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) = Reading 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,Y
 - Radiated Restricted Band Edge : X
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 datarate 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-G991U, SM-G991U1 were tested and the worst case results are reported.
(Worst case : SM-G991U)

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,Y

3. Test case

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

Non-DBS	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Bluetooth	Test Case
5GHz WiFi MIMO + Bluetooth	On	On	On	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-G991U [BT], [UNII] Test Report.)

Test case	Description	2.4 GHz Emission	5 GHz Emission
1	Antenna	Ant.2	Ant All
	Channel	6	165
	Data Rate	1 Mbps	6 Mbps
	Mode	802.11b	802.11a

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

5. SM-G991U, SM-G991U1 were tested and the worst case results are reported.

(Worst case : SM-G991U)

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-G991U, SM-G991U1 were tested and the worst case results are reported.

(Worst case : SM-G991U)

Conducted test

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

2. SM-G991U, SM-G991U1 were tested and the worst case results are reported.

(Worst case : SM-G991U)

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

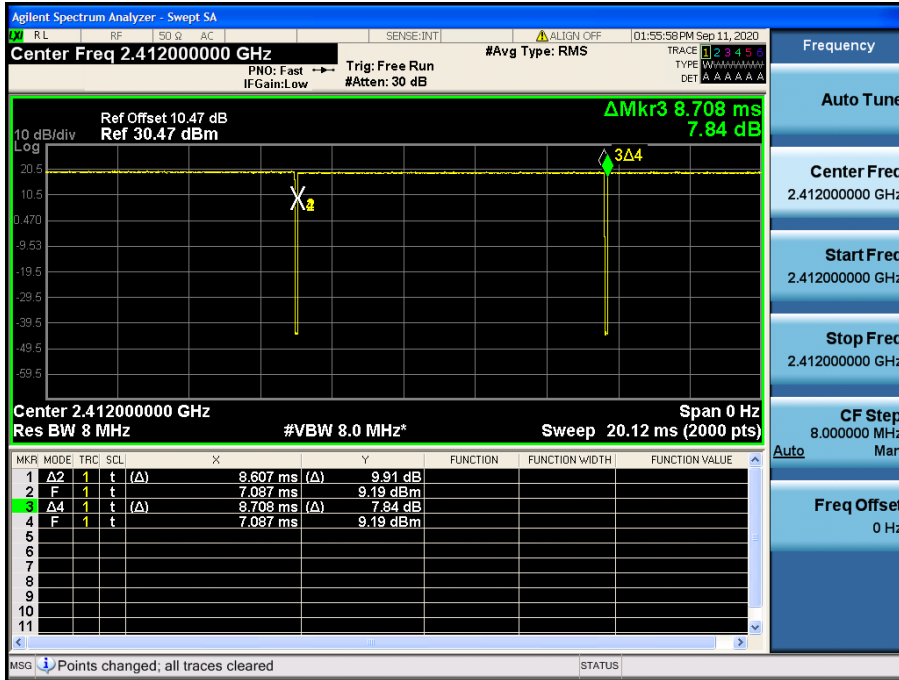
9. TEST RESULT

9.1 DUTY CYCLE

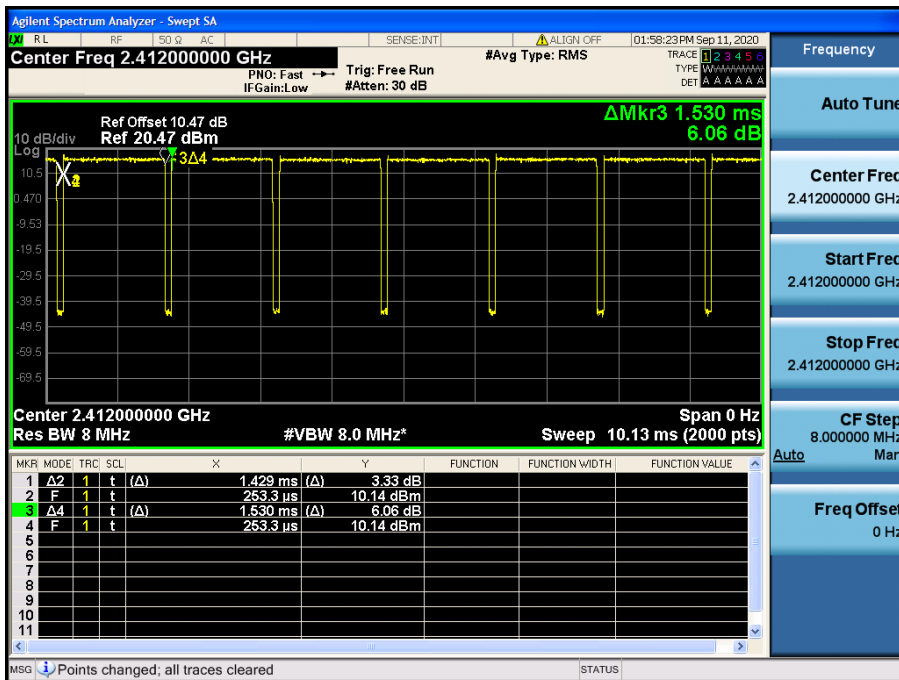
Mode	Data Rate (Mbps)	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	1	8.607	8.708	0.988	0.051
	2	4.295	4.404	0.975	0.109
	5.5	1.621	1.723	0.941	0.263
	11	0.856	0.958	0.894	0.486
802.11g	6	1.429	1.530	0.934	0.298
	9	0.963	1.064	0.905	0.435
	12	0.719	0.826	0.871	0.599
	18	0.491	0.593	0.829	0.814
	24	0.370	0.471	0.785	1.052
	36	0.253	0.355	0.714	1.461
	48	0.198	0.299	0.661	1.798
	54	0.182	0.284	0.643	1.919
802.11n (HT20)	6.5 (MCS0)	1.333	1.439	0.926	0.334
	13 (MCS1)	0.684	0.790	0.865	0.628
	19.5 (MCS2)	0.471	0.573	0.823	0.846
	26 (MCS3)	0.360	0.466	0.772	1.125
	39 (MCS4)	0.258	0.360	0.718	1.437
	52 (MCS5)	0.198	0.299	0.661	1.798
	58.5 (MCS6)	0.182	0.284	0.643	1.919
	65 (MCS7)	0.167	0.269	0.623	2.058

▣ Test Plots

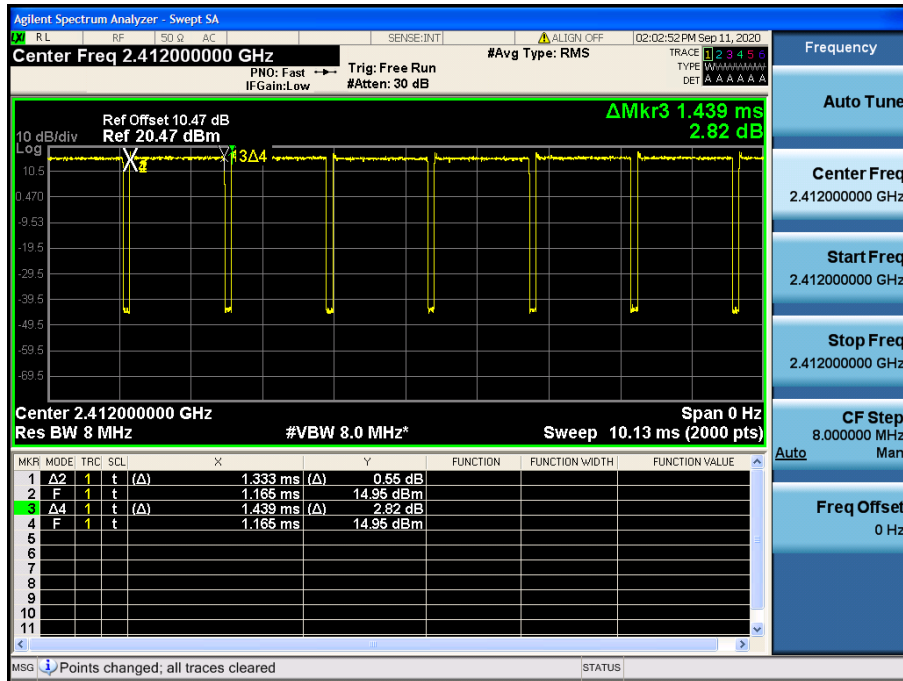
Duty cycle plot (802.11b(1Mbps))



Duty cycle plot (802.11g(6Mbps))



Duty cycle plot (802.11n(MCS0))



Note:

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

9.2 6dB BANDWIDTH

[Ant.1]

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	7.583	0.5
2437	6	7.615	0.5
2462	11	7.599	0.5

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.21	0.5
2437	6	16.06	0.5
2462	11	15.22	0.5

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.20	0.5
2437	6	16.70	0.5
2462	11	15.20	0.5

[Ant.2]

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	7.585	0.5
2437	6	8.077	0.5
2462	11	8.088	0.5

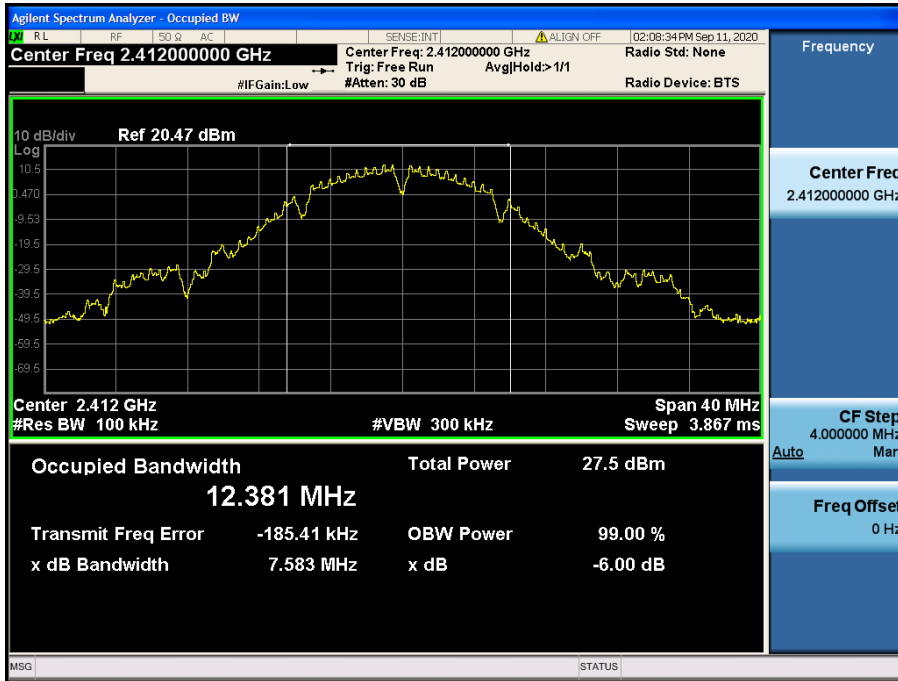
802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.17	0.5
2437	6	15.68	0.5
2462	11	15.19	0.5

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.23	0.5
2437	6	16.56	0.5
2462	11	15.24	0.5

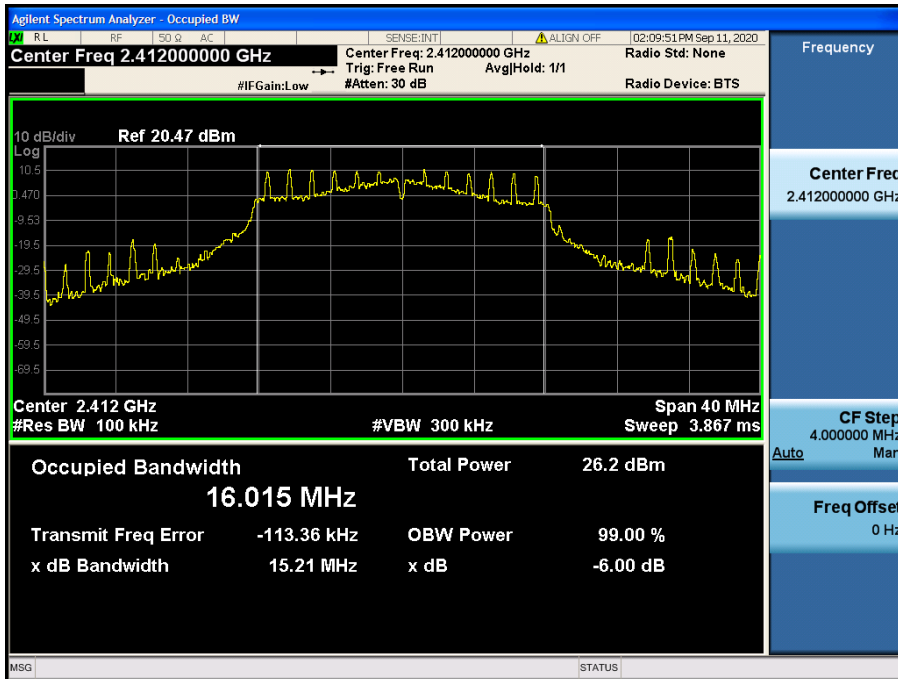
[Ant.1]

☐ Test Plots

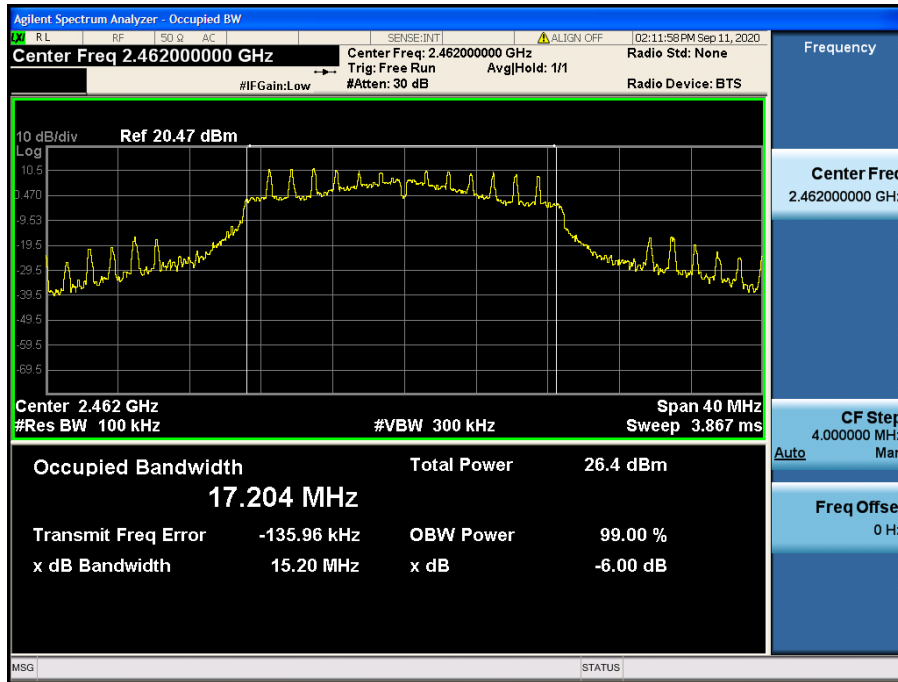
6dB Bandwidth plot (802.11b-CH 1)



6dB Bandwidth plot (802.11g-CH 1)



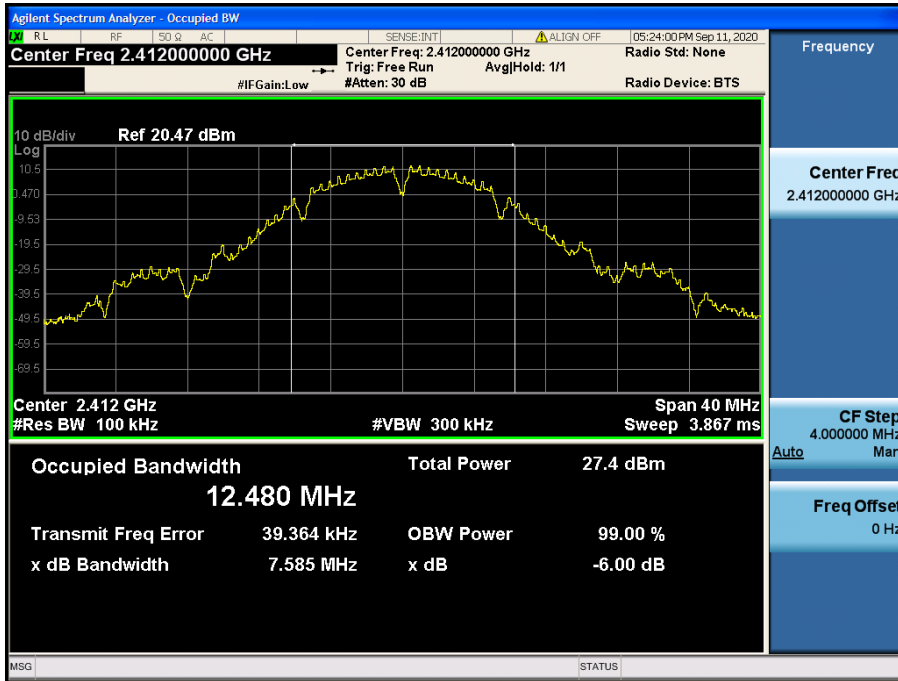
6dB Bandwidth plot (802.11n_HT20-CH 11)



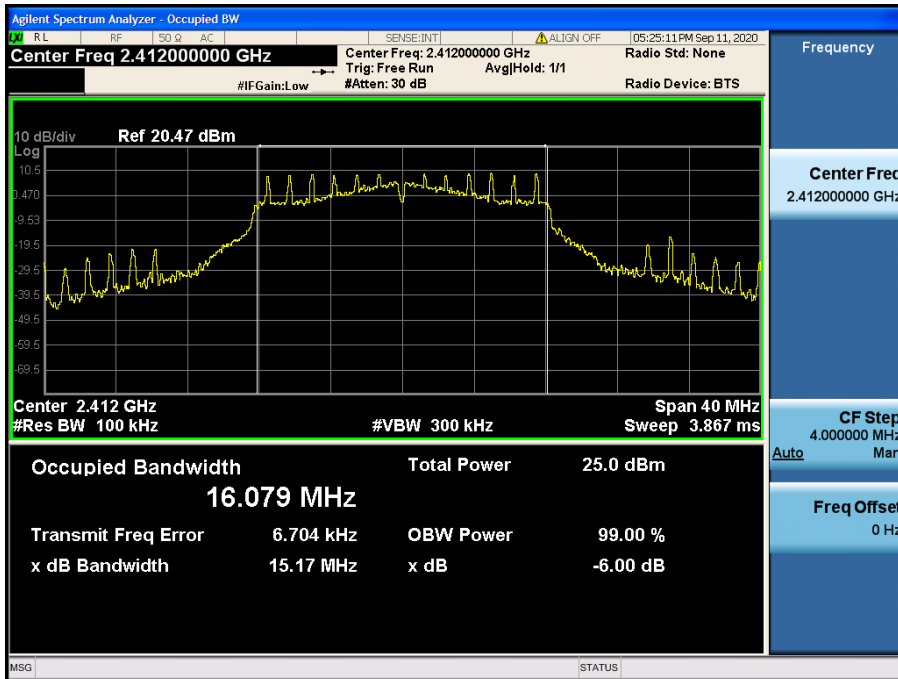
[Ant.2]

☐ Test Plots

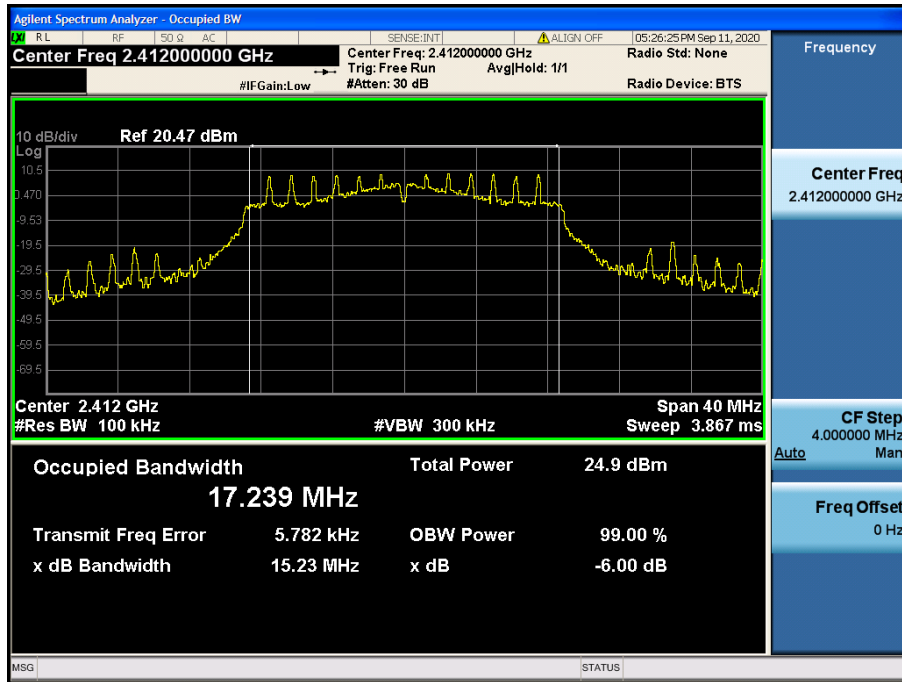
6dB Bandwidth plot (802.11b-CH 1)



6dB Bandwidth plot (802.11g-CH 1)



6dB 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 + Cable loss
2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.
So, 10.47 dB is offset for 2.4 GHz Band

[Ant.1]

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	1	22.79	30	19
		2	22.98	30	
		5.5	25.09	30	
		11	26.71	30	
2437	6	1	22.50	30	
		2	22.93	30	
		5.5	25.16	30	
		11	26.79	30	
2462	11	1	21.86	30	
		2	22.20	30	
		5.5	24.36	30	
		11	26.01	30	

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	6	24.87	30	16
		9	24.81	30	
		12	25.04	30	
		18	24.79	30	
		24	25.25	30	
		36	25.28	30	
		48	25.24	30	
		54	25.17	30	
2437	6	6	24.37	30	
		9	24.28	30	
		12	24.53	30	
		18	24.00	30	
		24	24.27	30	
		36	24.37	30	
		48	24.46	30	
		54	24.52	30	
2462	11	6	25.10	30	
		9	25.07	30	
		12	24.86	30	
		18	24.77	30	
		24	24.97	30	
		36	25.18	30	
		48	25.17	30	
		54	25.14	30	

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	0	24.75	30	16
		1	24.97	30	
		2	24.86	30	
		3	25.62	30	
		4	25.68	30	
		5	25.39	30	
		6	25.61	30	
		7	25.49	30	
2437	6	0	24.37	30	
		1	24.76	30	
		2	24.46	30	
		3	25.01	30	
		4	24.67	30	
		5	24.84	30	
		6	24.85	30	
		7	24.63	30	
2462	11	0	25.00	30	
		1	25.14	30	
		2	25.20	30	
		3	25.54	30	
		4	25.38	30	
		5	25.26	30	
		6	25.40	30	
		7	25.21	30	

[Ant.2]

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	1	22.60	30	19
		2	22.94	30	
		5.5	25.15	30	
		11	26.61	30	
2437	6	1	22.34	30	
		2	22.88	30	
		5.5	25.09	30	
		11	26.68	30	
2462	11	1	22.80	30	
		2	23.29	30	
		5.5	25.47	30	
		11	27.10	30	

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	6	25.01	30	16
		9	24.97	30	
		12	25.10	30	
		18	24.61	30	
		24	25.03	30	
		36	24.98	30	
		48	25.21	30	
		54	25.20	30	
2437	6	6	25.52	30	
		9	25.33	30	
		12	25.71	30	
		18	25.02	30	
		24	25.27	30	
		36	25.47	30	
		48	25.56	30	
		54	25.66	30	
2462	11	6	25.45	30	
		9	25.41	30	
		12	25.64	30	
		18	24.98	30	
		24	25.42	30	
		36	25.37	30	
		48	25.42	30	
		54	25.34	30	

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)	Power Level Setting
Frequency[MHz]	Channel No.				
2412	1	0	24.82	30	16
		1	24.95	30	
		2	24.98	30	
		3	25.56	30	
		4	25.49	30	
		5	25.45	30	
		6	25.49	30	
		7	25.34	30	
2437	6	0	25.49	30	
		1	26.01	30	
		2	25.83	30	
		3	26.12	30	
		4	26.06	30	
		5	25.86	30	
		6	25.93	30	
		7	25.71	30	
2462	11	0	25.52	30	
		1	25.63	30	
		2	25.65	30	
		3	25.75	30	
		4	25.76	30	
		5	25.70	30	
		6	25.73	30	
		7	25.57	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	24.87	25.01	27.95	30	16
		9	24.81	24.97	27.90	30	
		12	25.04	25.10	28.08	30	
		18	24.79	24.61	27.71	30	
		24	25.25	25.03	28.15	30	
		36	25.28	24.98	28.14	30	
		48	25.24	25.21	28.24	30	
		54	25.17	25.20	28.19	30	
2437	6	6	24.37	25.52	27.99	30	
		9	24.28	25.33	27.85	30	
		12	24.53	25.71	28.17	30	
		18	24.00	25.02	27.55	30	
		24	24.27	25.27	27.81	30	
		36	24.37	25.47	27.96	30	
		48	24.46	25.56	28.06	30	
		54	24.52	25.66	28.14	30	
2462	11	6	25.10	25.45	28.29	30	
		9	25.07	25.41	28.25	30	
		12	24.86	25.64	28.28	30	
		18	24.77	24.98	27.89	30	
		24	24.97	25.42	28.21	30	
		36	25.18	25.37	28.28	30	
		48	25.17	25.42	28.31	30	
		54	25.14	25.34	28.25	30	

802.11n(HT20) 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	0	24.75	24.82	27.80	30	16
		1	24.97	24.95	27.97	30	
		2	24.86	24.98	27.93	30	
		3	25.62	25.56	28.60	30	
		4	25.68	25.49	28.59	30	
		5	25.39	25.45	28.43	30	
		6	25.61	25.49	28.56	30	
		7	25.49	25.34	28.43	30	
2437	6	0	24.37	25.49	27.98	30	
		1	24.76	26.01	28.44	30	
		2	24.46	25.83	28.21	30	
		3	25.01	26.12	28.61	30	
		4	24.67	26.06	28.43	30	
		5	24.84	25.86	28.39	30	
		6	24.85	25.93	28.43	30	
		7	24.63	25.71	28.21	30	
2462	11	0	25.00	25.52	28.28	30	
		1	25.14	25.63	28.40	30	
		2	25.20	25.65	28.44	30	
		3	25.54	25.75	28.66	30	
		4	25.38	25.76	28.58	30	
		5	25.26	25.70	28.50	30	
		6	25.40	25.73	28.58	30	
		7	25.21	25.57	28.40	30	

Average Power

1. Power Meter offset = Attenuator loss + Cable loss
2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.
So, 10.47 dB is offset for 2.4 GHz Band.

[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	19.95	0.051	20.00	30	19
		2	20.03	0.109	20.14	30	
		5.5	20.42	0.263	20.69	30	
		11	20.02	0.486	20.50	30	
2437	6	1	19.95	0.051	20.00	30	
		2	20.07	0.109	20.18	30	
		5.5	20.50	0.263	20.76	30	
		11	20.05	0.486	20.54	30	
2462	11	1	19.18	0.051	19.23	30	
		2	19.34	0.109	19.45	30	
		5.5	19.67	0.263	19.93	30	
		11	19.23	0.486	19.72	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	15.94	0.298	16.24	30	16
		9	15.88	0.435	16.31	30	
		12	15.80	0.599	16.40	30	
		18	16.41	0.814	17.23	30	
		24	16.25	1.052	17.30	30	
		36	15.85	1.461	17.31	30	
		48	15.44	1.798	17.24	30	
		54	15.23	1.919	17.15	30	
2437	6	6	15.83	0.298	16.13	30	
		9	15.70	0.435	16.13	30	
		12	15.52	0.599	16.12	30	
		18	15.32	0.814	16.13	30	
		24	15.08	1.052	16.13	30	
		36	14.69	1.461	16.15	30	
		48	14.27	1.798	16.07	30	
		54	14.15	1.919	16.07	30	
2462	11	6	16.14	0.298	16.44	30	
		9	16.07	0.435	16.51	30	
		12	15.73	0.599	16.33	30	
		18	16.30	0.814	17.11	30	
		24	16.02	1.052	17.07	30	
		36	15.67	1.461	17.13	30	
		48	15.29	1.798	17.09	30	
		54	15.18	1.919	17.10	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	15.84	0.334	16.18	30	16
		1	15.62	0.628	16.25	30	
		2	15.35	0.846	16.20	30	
		3	16.05	1.125	17.18	30	
		4	15.73	1.437	17.17	30	
		5	15.27	1.798	17.07	30	
		6	15.25	1.919	17.17	30	
		7	15.11	2.058	17.17	30	
2437	6	0	15.90	0.334	16.24	30	
		1	15.72	0.628	16.35	30	
		2	15.22	0.846	16.07	30	
		3	15.24	1.125	16.37	30	
		4	14.68	1.437	16.12	30	
		5	14.49	1.798	16.28	30	
		6	14.28	1.919	16.19	30	
		7	14.05	2.058	16.11	30	
2462	11	0	16.09	0.334	16.43	30	
		1	15.80	0.628	16.43	30	
		2	15.69	0.846	16.54	30	
		3	15.98	1.125	17.10	30	
		4	15.57	1.437	17.00	30	
		5	15.13	1.798	16.93	30	
		6	15.08	1.919	17.00	30	
		7	14.94	2.058	17.00	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	19.98	0.051	20.03	30	19
		2	20.11	0.109	20.21	30	
		5.5	20.55	0.263	20.81	30	
		11	20.04	0.486	20.53	30	
2437	6	1	19.83	0.051	19.88	30	
		2	19.94	0.109	20.05	30	
		5.5	20.43	0.263	20.69	30	
		11	19.97	0.486	20.46	30	
2462	11	1	20.26	0.051	20.31	30	
		2	20.43	0.109	20.54	30	
		5.5	20.71	0.263	20.97	30	
		11	20.44	0.486	20.93	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	16.15	0.298	16.45	30	16
		9	16.10	0.435	16.54	30	
		12	15.88	0.599	16.48	30	
		18	16.30	0.814	17.11	30	
		24	16.06	1.052	17.11	30	
		36	15.68	1.461	17.14	30	
		48	15.32	1.798	17.12	30	
		54	15.20	1.919	17.12	30	
2437	6	6	17.25	0.298	17.55	30	
		9	17.07	0.435	17.50	30	
		12	16.85	0.599	17.45	30	
		18	16.67	0.814	17.48	30	
		24	16.35	1.052	17.40	30	
		36	16.12	1.461	17.58	30	
		48	15.60	1.798	17.40	30	
		54	15.49	1.919	17.41	30	
2462	11	6	16.71	0.298	17.01	30	
		9	16.70	0.435	17.13	30	
		12	16.59	0.599	17.19	30	
		18	16.66	0.814	17.47	30	
		24	16.39	1.052	17.44	30	
		36	16.04	1.461	17.50	30	
		48	15.57	1.798	17.37	30	
		54	15.41	1.919	17.33	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	16.05	0.334	16.38	30	16
		1	15.66	0.628	16.29	30	
		2	15.53	0.846	16.37	30	
		3	16.06	1.125	17.18	30	
		4	15.69	1.437	17.13	30	
		5	15.35	1.798	17.15	30	
		6	15.21	1.919	17.13	30	
		7	15.03	2.058	17.09	30	
2437	6	0	17.11	0.334	17.44	30	
		1	16.80	0.628	17.43	30	
		2	16.55	0.846	17.40	30	
		3	16.32	1.125	17.45	30	
		4	15.94	1.437	17.38	30	
		5	15.46	1.798	17.26	30	
		6	15.35	1.919	17.27	30	
		7	15.13	2.058	17.19	30	
2462	11	0	16.66	0.334	16.99	30	
		1	16.33	0.628	16.95	30	
		2	16.22	0.846	17.07	30	
		3	16.35	1.125	17.48	30	
		4	16.00	1.437	17.44	30	
		5	15.51	1.798	17.31	30	
		6	15.50	1.919	17.42	30	
		7	15.33	2.058	17.38	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	16.24	16.45	19.35	30	16
		9	16.31	16.54	19.44	30	
		12	16.40	16.48	19.45	30	
		18	17.23	17.11	20.18	30	
		24	17.30	17.11	20.22	30	
		36	17.31	17.14	20.24	30	
		48	17.24	17.12	20.19	30	
		54	17.15	17.12	20.15	30	
2437	6	6	16.13	17.55	19.91	30	
		9	16.13	17.50	19.88	30	
		12	16.12	17.45	19.85	30	
		18	16.13	17.48	19.87	30	
		24	16.13	17.40	19.82	30	
		36	16.15	17.58	19.94	30	
		48	16.07	17.40	19.79	30	
		54	16.07	17.41	19.80	30	
2462	11	6	16.44	17.01	19.74	30	
		9	16.51	17.13	19.84	30	
		12	16.33	17.19	19.79	30	
		18	17.11	17.47	20.31	30	
		24	17.07	17.44	20.27	30	
		36	17.13	17.50	20.33	30	
		48	17.09	17.37	20.24	30	
		54	17.10	17.33	20.22	30	

802.11n(HT20) 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	0	16.18	16.38	19.29	30	16
		1	16.25	16.29	19.28	30	
		2	16.20	16.37	19.30	30	
		3	17.18	17.18	20.19	30	
		4	17.17	17.13	20.16	30	
		5	17.07	17.15	20.12	30	
		6	17.17	17.13	20.16	30	
		7	17.17	17.09	20.14	30	
2437	6	0	16.24	17.44	19.89	30	
		1	16.35	17.43	19.93	30	
		2	16.07	17.40	19.80	30	
		3	16.37	17.45	19.95	30	
		4	16.12	17.38	19.80	30	
		5	16.28	17.26	19.81	30	
		6	16.19	17.27	19.78	30	
		7	16.11	17.19	19.69	30	
2462	11	0	16.43	16.99	19.73	30	
		1	16.43	16.95	19.71	30	
		2	16.54	17.07	19.82	30	
		3	17.10	17.48	20.30	30	
		4	17.00	17.44	20.24	30	
		5	16.93	17.31	20.13	30	
		6	17.00	17.42	20.22	30	
		7	17.00	17.38	20.21	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	-1.571	0.263	-1.308	8
	2437	6	-1.485	0.263	-1.222	
	2462	11	-2.104	0.263	-1.841	
802.11g	2412	1	-7.165	1.461	-5.704	
	2437	6	-8.299	1.461	-6.838	
	2462	11	-7.633	1.461	-6.172	
802.11n	2412	1	-7.438	1.125	-6.313	
	2437	6	-8.485	1.125	-7.360	
	2462	11	-7.784	1.125	-6.659	

[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	-1.161	0.263	-0.898	8
	2437	6	-1.165	0.263	-0.902	
	2462	11	-0.939	0.263	-0.676	
802.11g	2412	1	-7.536	1.461	-6.075	
	2437	6	-7.043	1.461	-5.582	
	2462	11	-7.051	1.461	-5.590	
802.11n	2412	1	-7.405	1.125	-6.280	
	2437	6	-7.058	1.125	-5.933	
	2462	11	-7.095	1.125	-5.970	

[MIMO]

Mode	Frequency (MHz)	Channel No.	Test Result			
			ANT 1 Measured PSD(dBm) + Duty Cycle Factor	ANT 2 Measured PSD(dBm) + Duty Cycle Factor	MIMO Result (dBm)	Limit (dBm)
802.11g	2412	1	-5.704	-6.075	-2.875	8
	2437	6	-6.838	-5.582	-3.154	
	2462	11	-6.172	-5.590	-2.861	
802.11n	2412	1	-6.313	-6.280	-3.286	
	2437	6	-7.360	-5.933	-3.578	
	2462	11	-6.659	-5.970	-3.290	

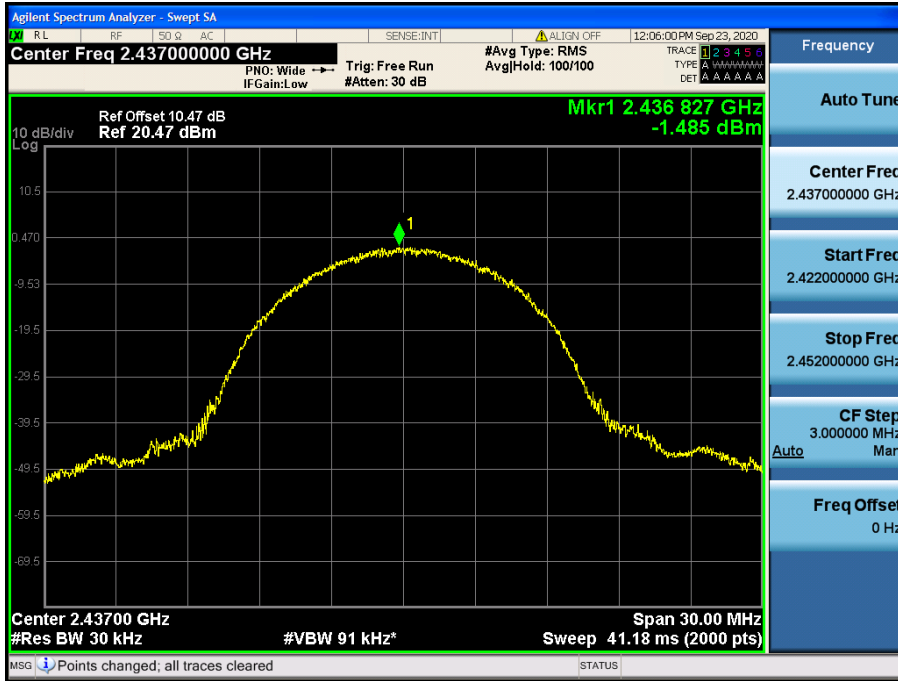
Note :

1. Spectrum reading values 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 = Attenuator loss(10 dB) + Cable loss
3. 10.47 dB is offset for 2.4 GHz Band.

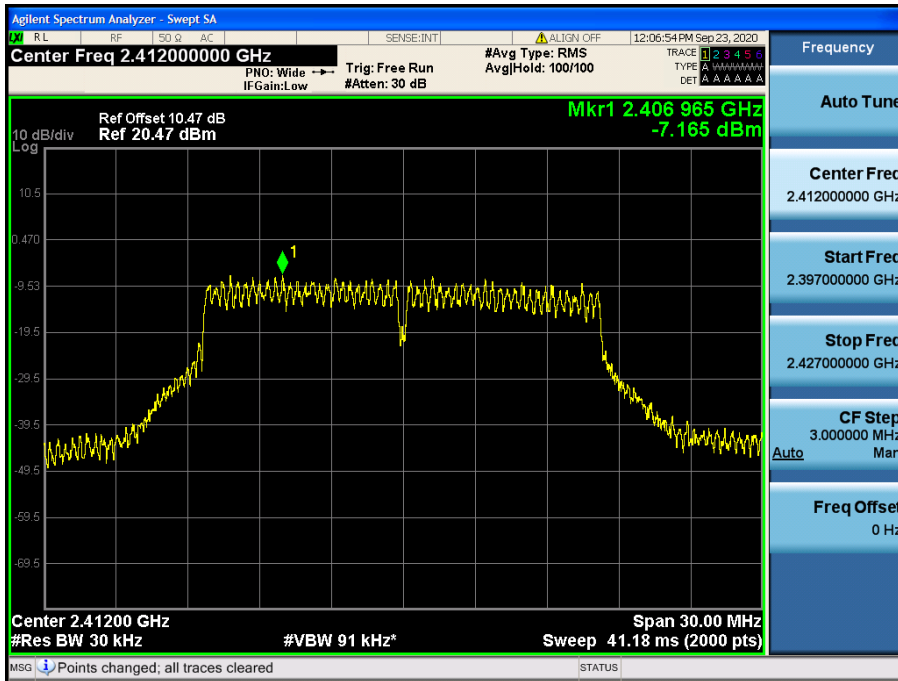
[Ant.1]

▣ Test Plots

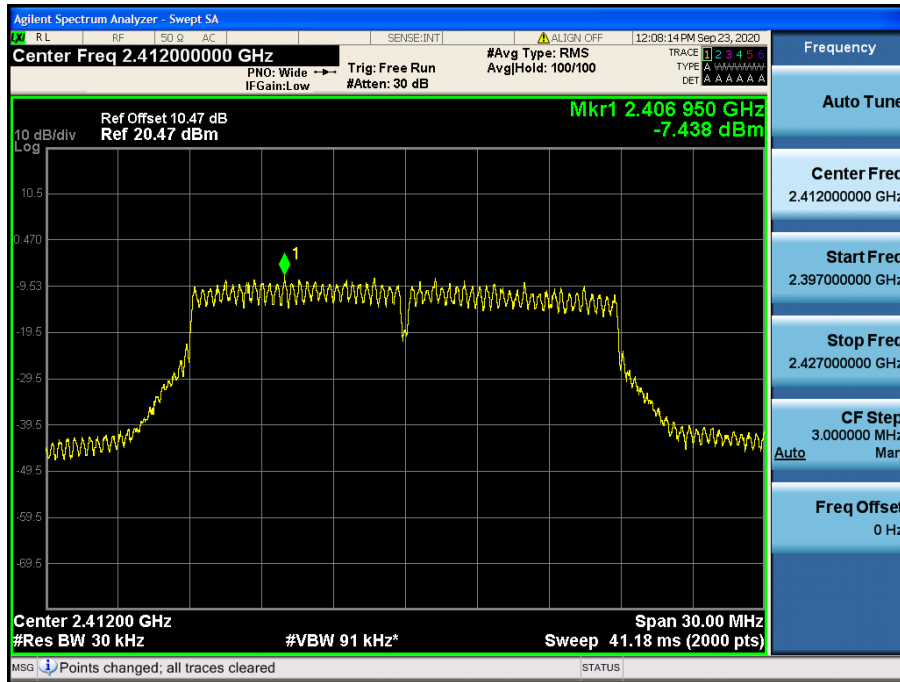
Power Spectral Density (802.11b-CH 6)



Power Spectral Density (802.11g-CH 1)



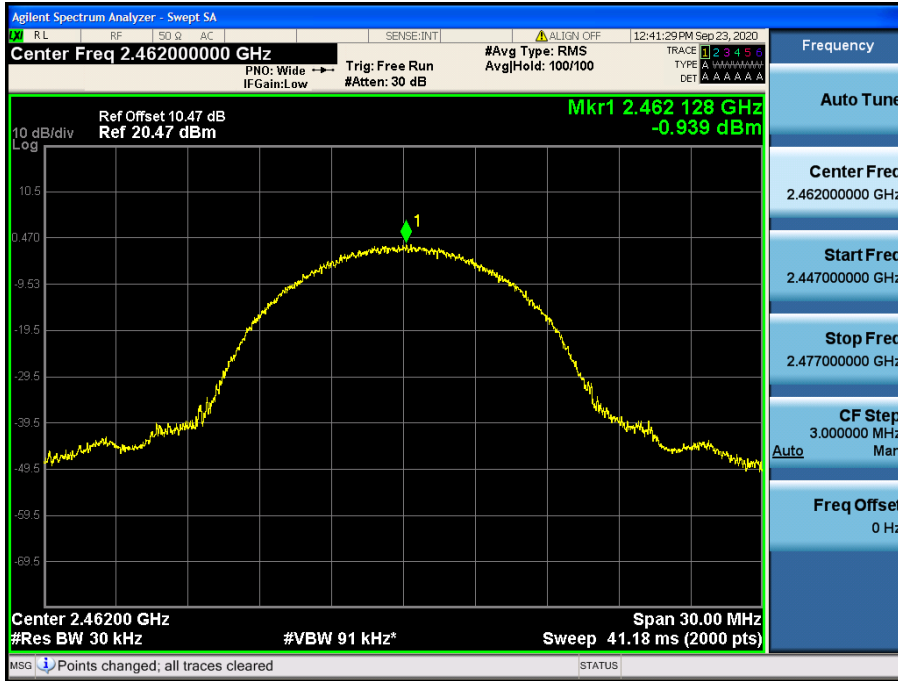
Power Spectral Density (802.11n_HT20 -CH 1)



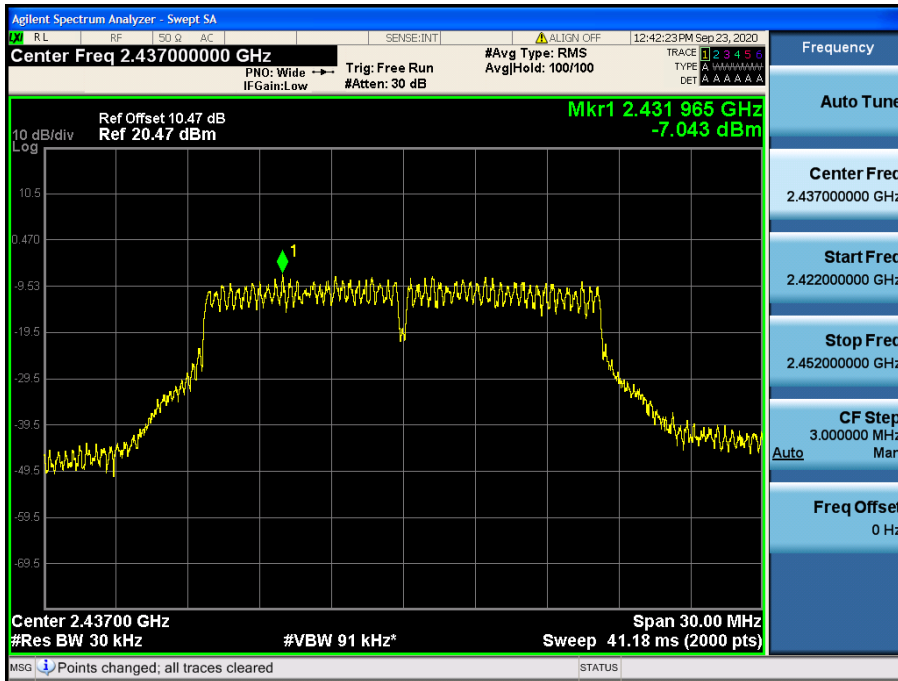
[Ant.2]

▣ Test Plots

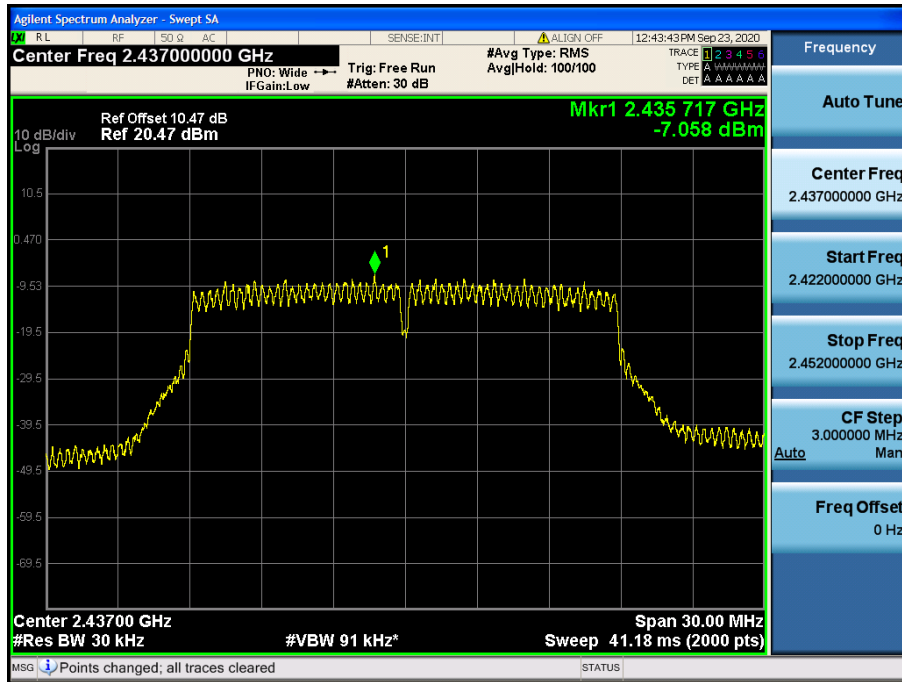
Power Spectral Density (802.11b-CH 11)



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 worstcase PSD channel.

9.5 BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

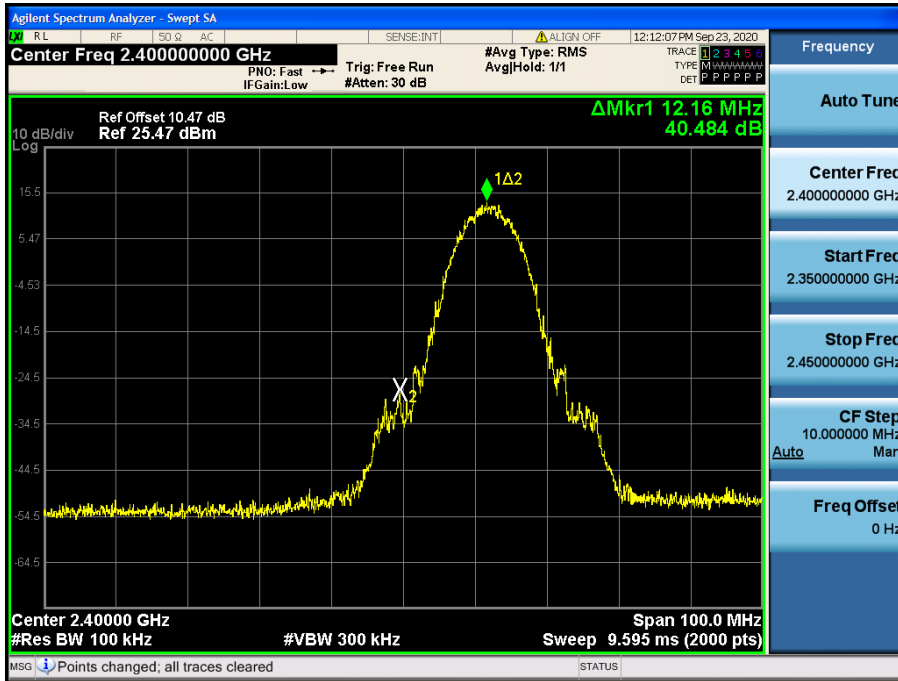
Test Result : please refer to the plot below.

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

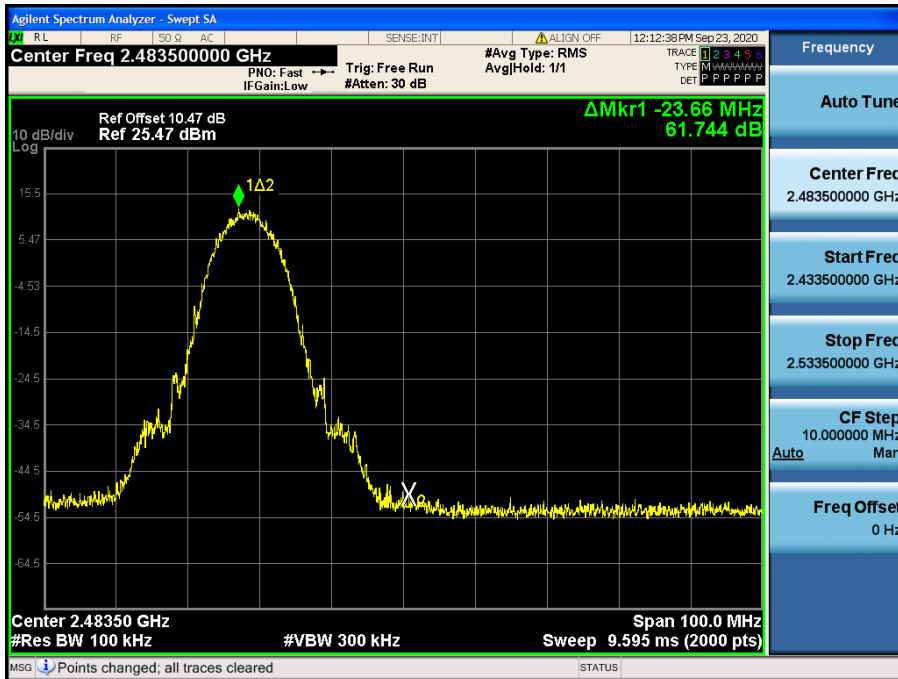
[Ant.1]

▣ Test Plots(BandEdge)

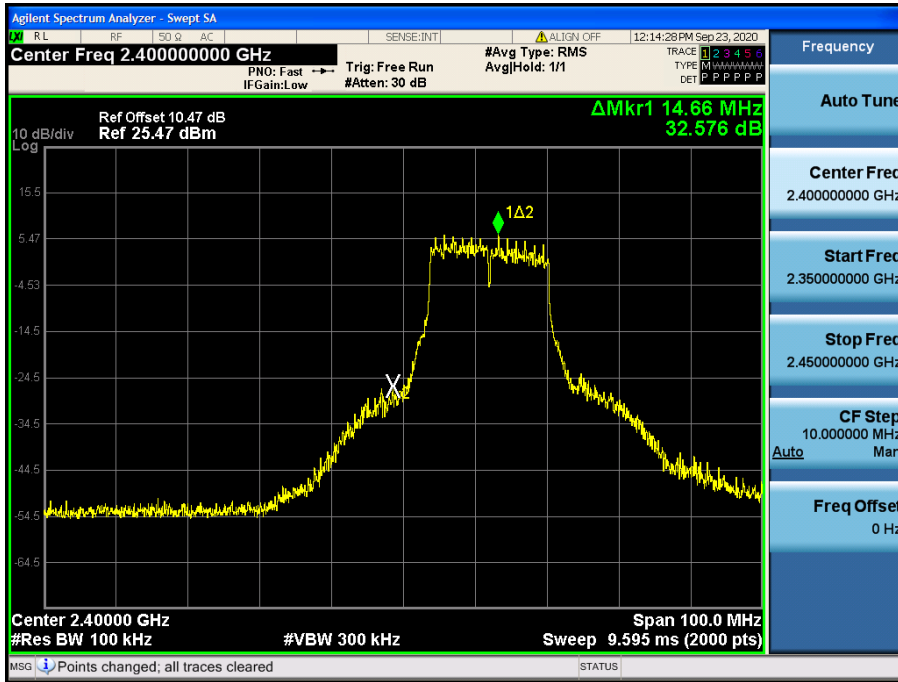
Band Edge (802.11b-CH1)



Band Edge (802.11b-CH11)



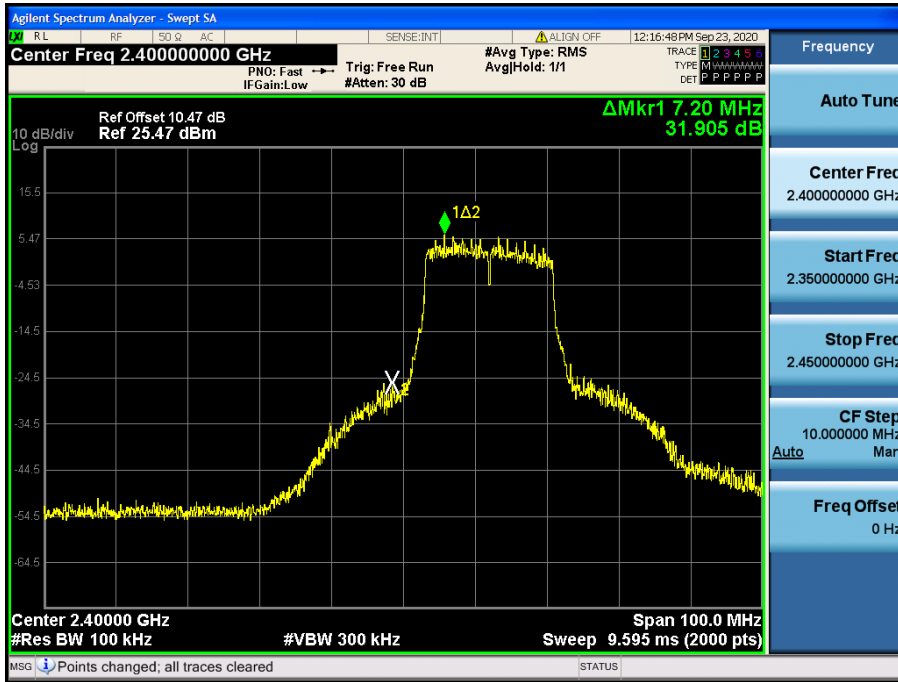
Band Edge (802.11g-CH1)



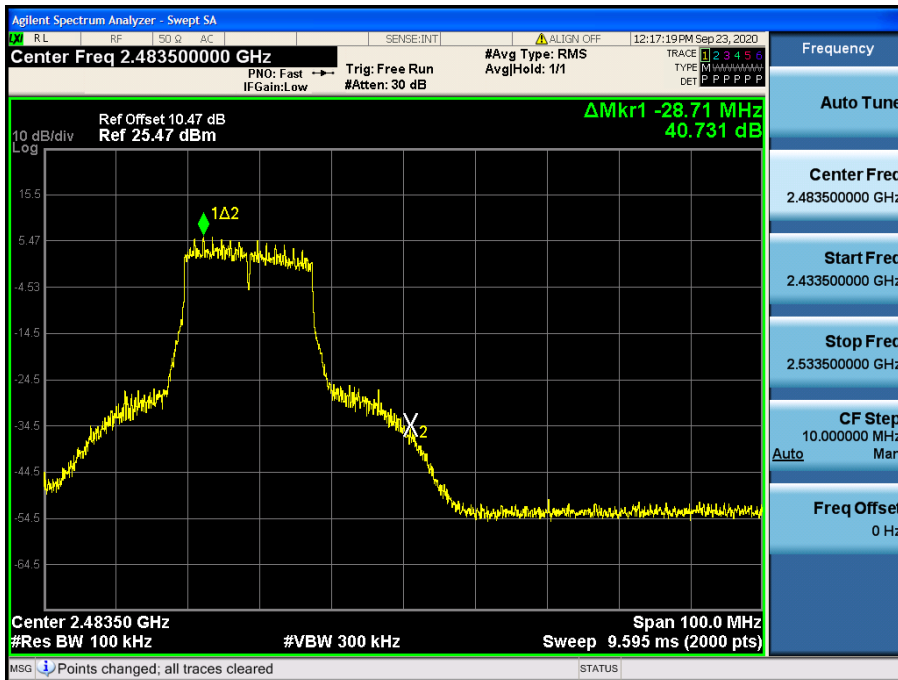
Band Edge (802.11g-CH11)



Band Edge (802.11n_HT20 -CH1)



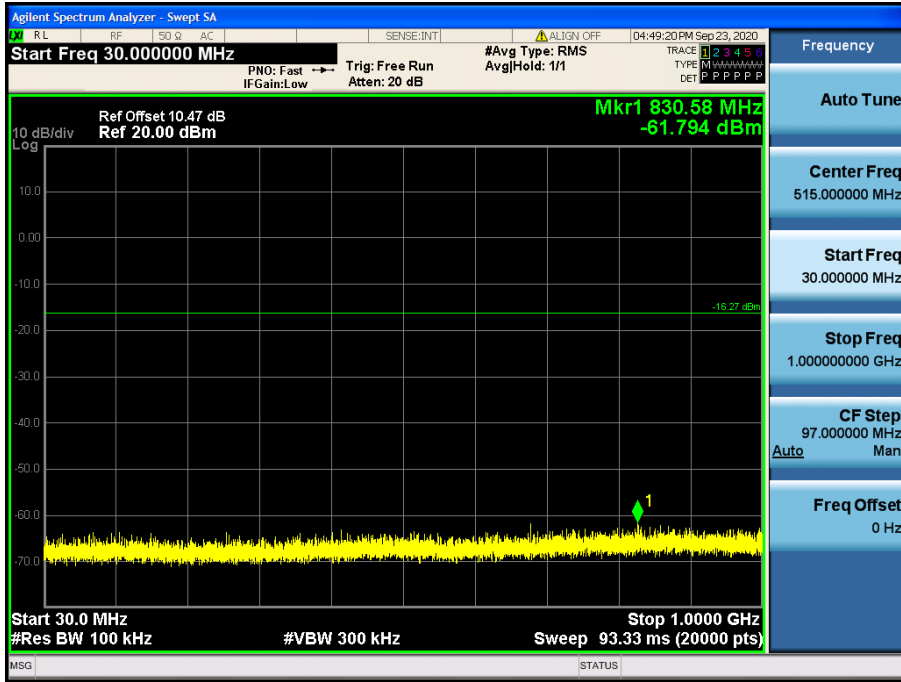
Band Edge (802.11n_HT20 -CH11)



Test Plots(Conducted Spurious Emission)

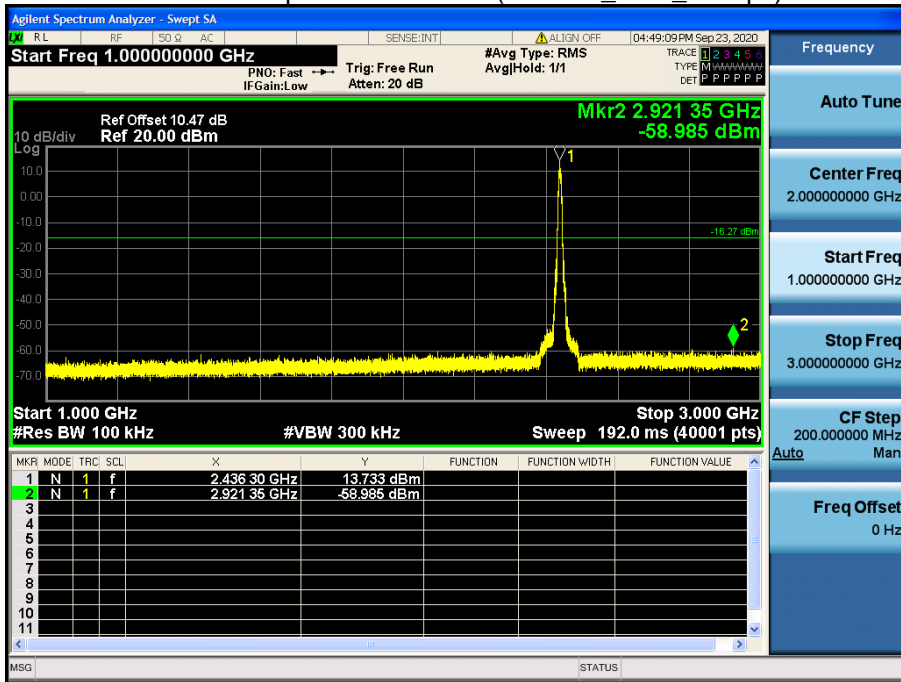
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



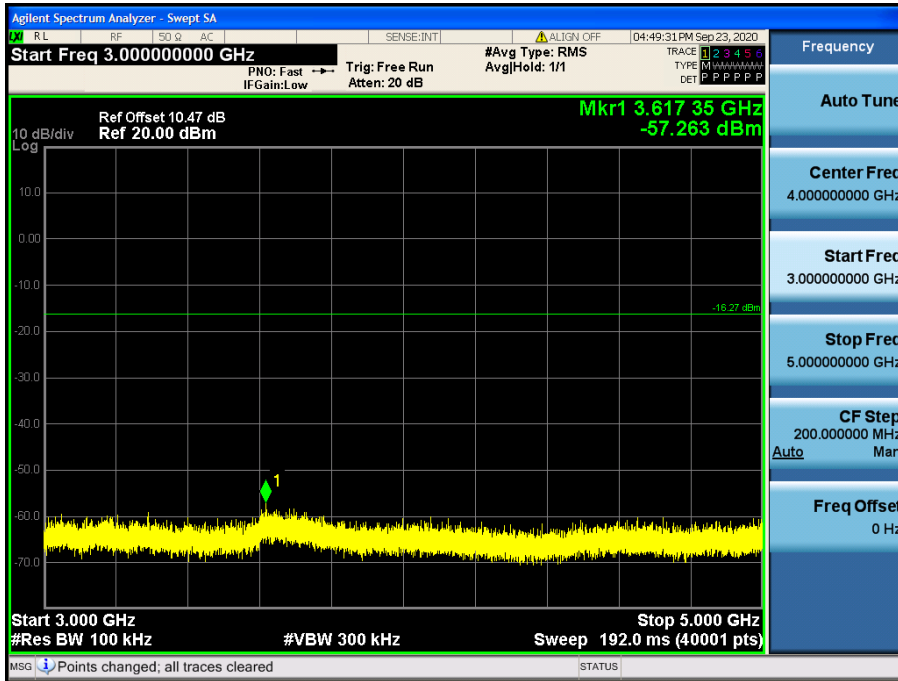
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



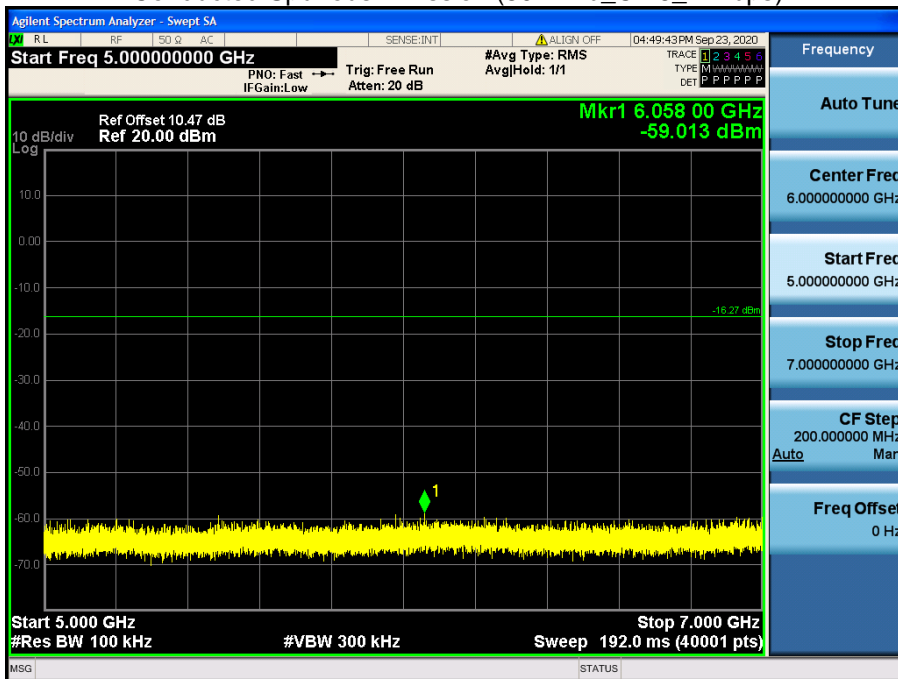
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



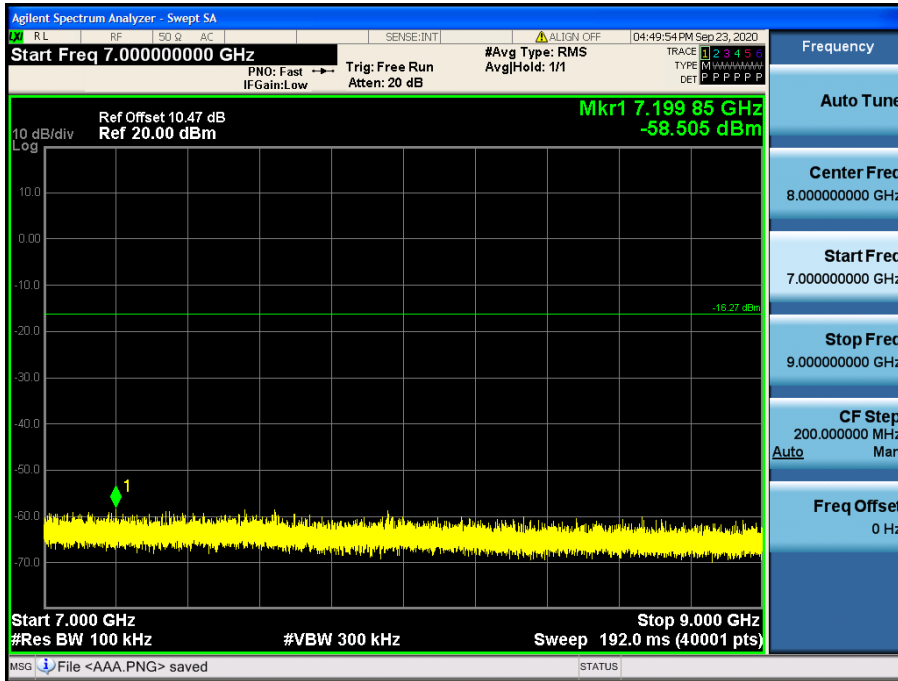
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



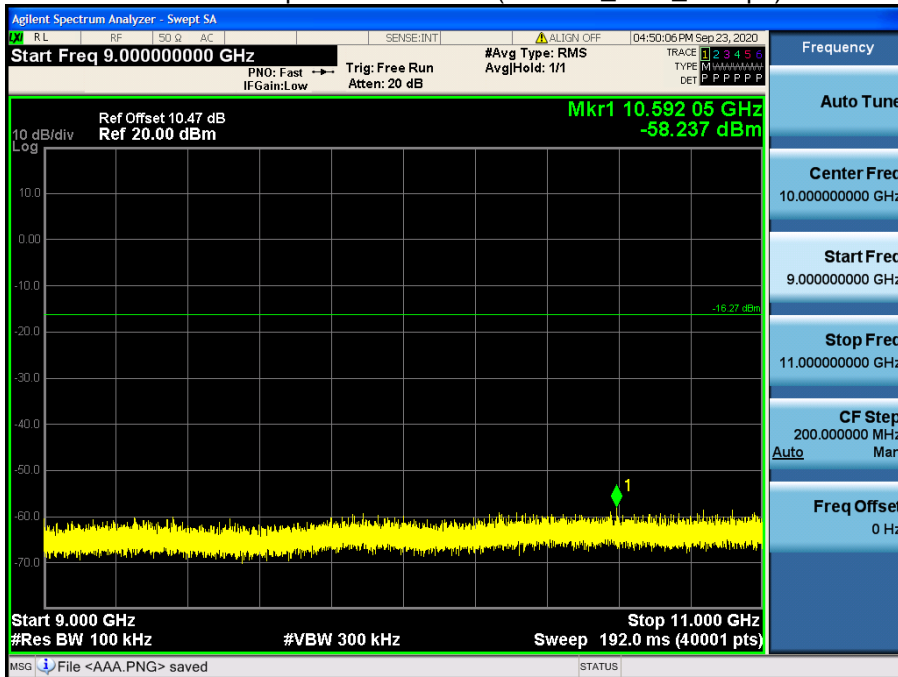
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



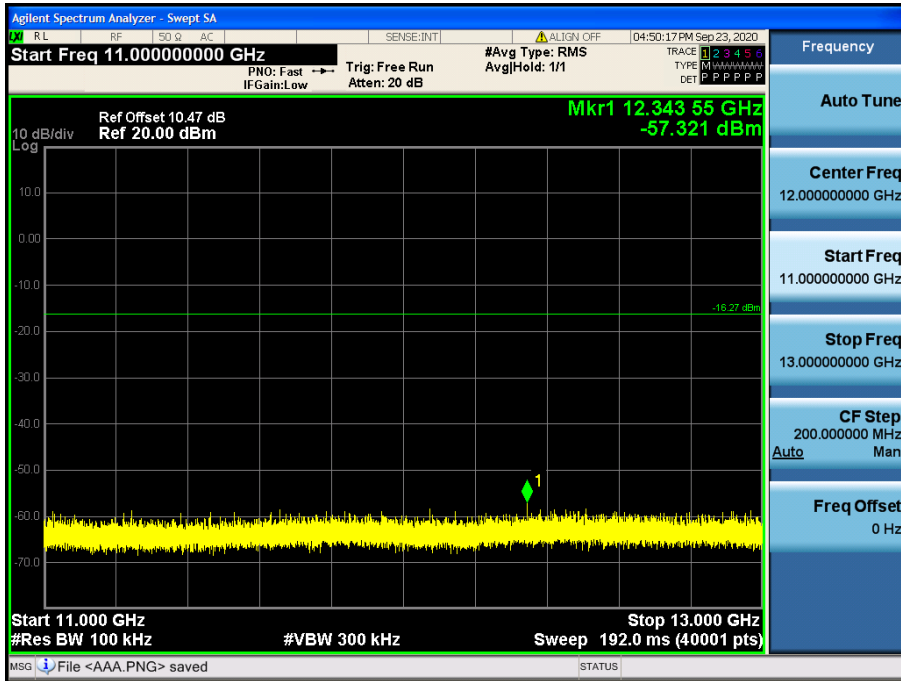
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



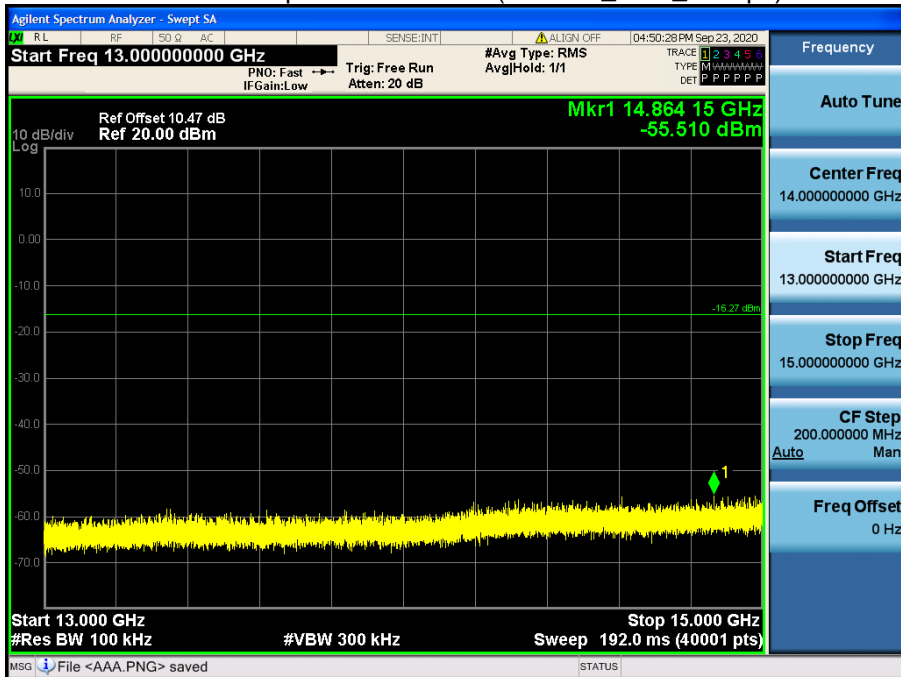
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



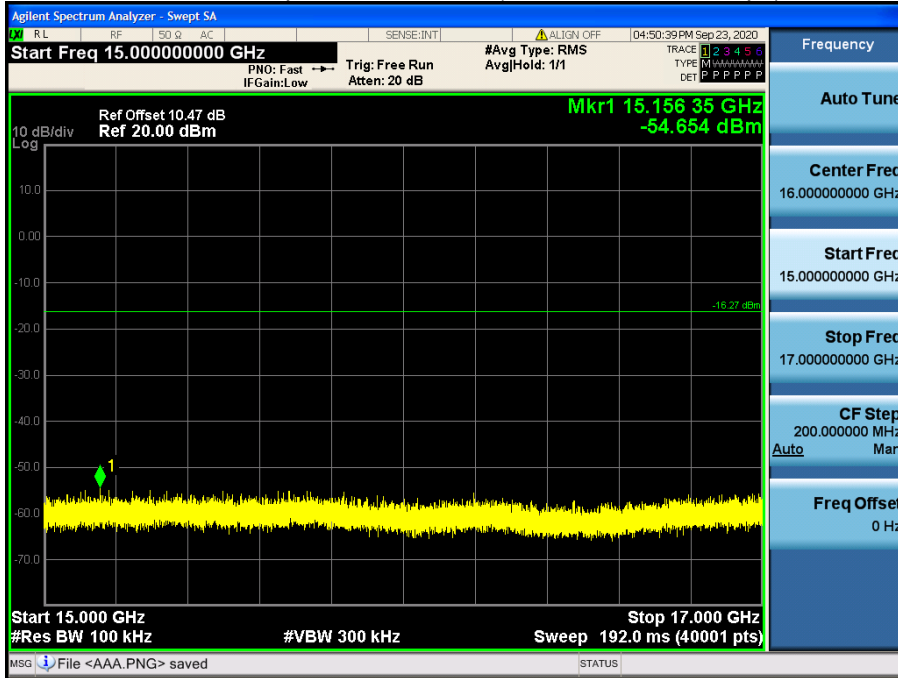
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



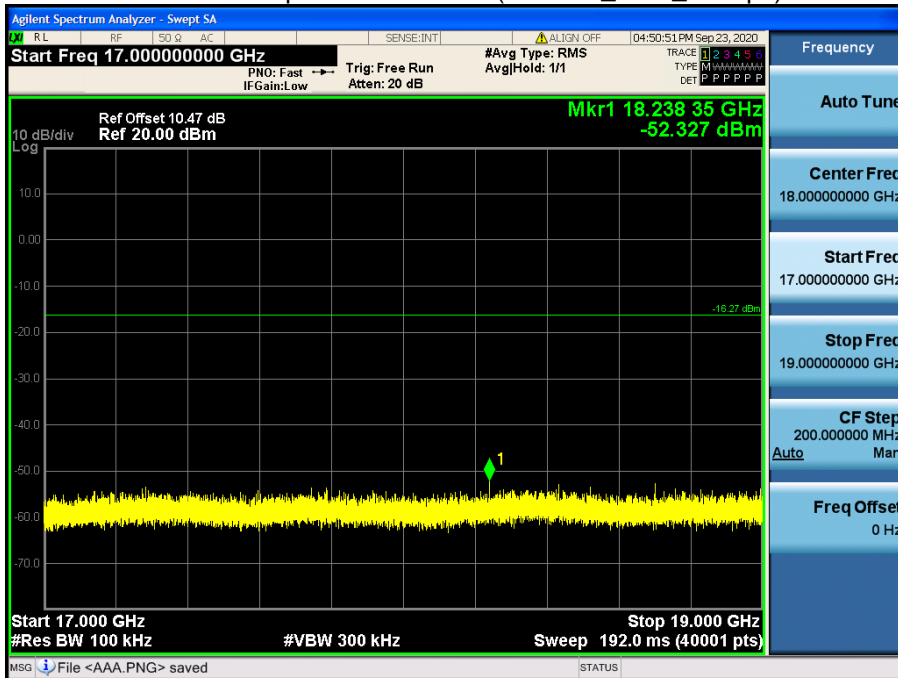
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



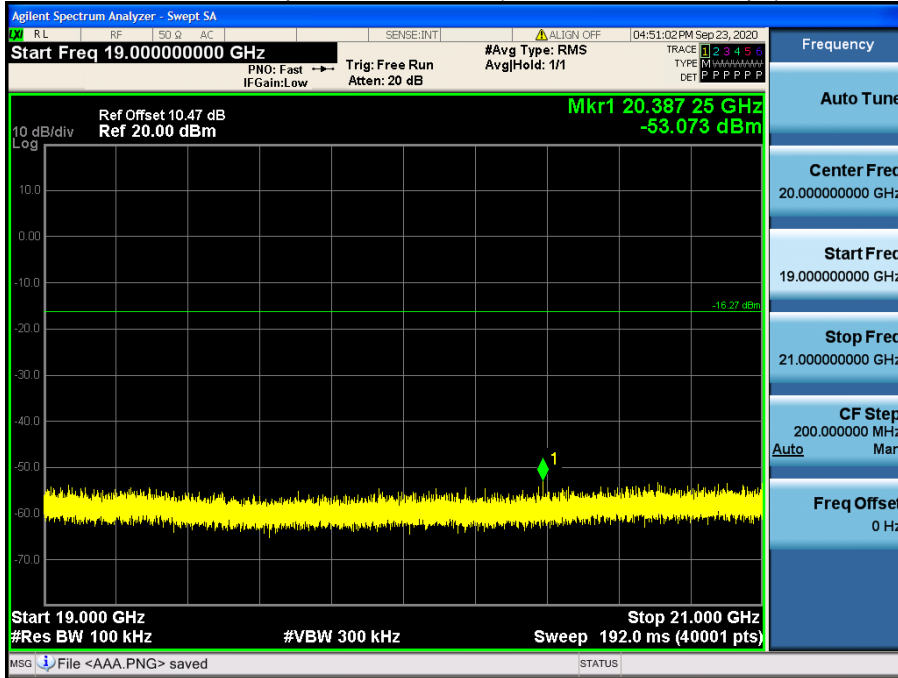
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



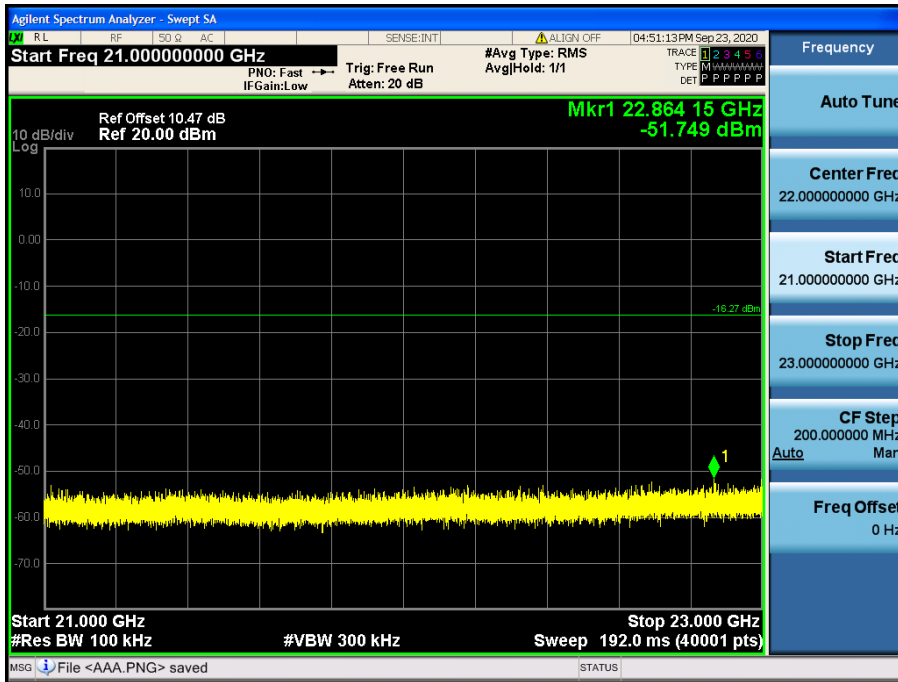
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



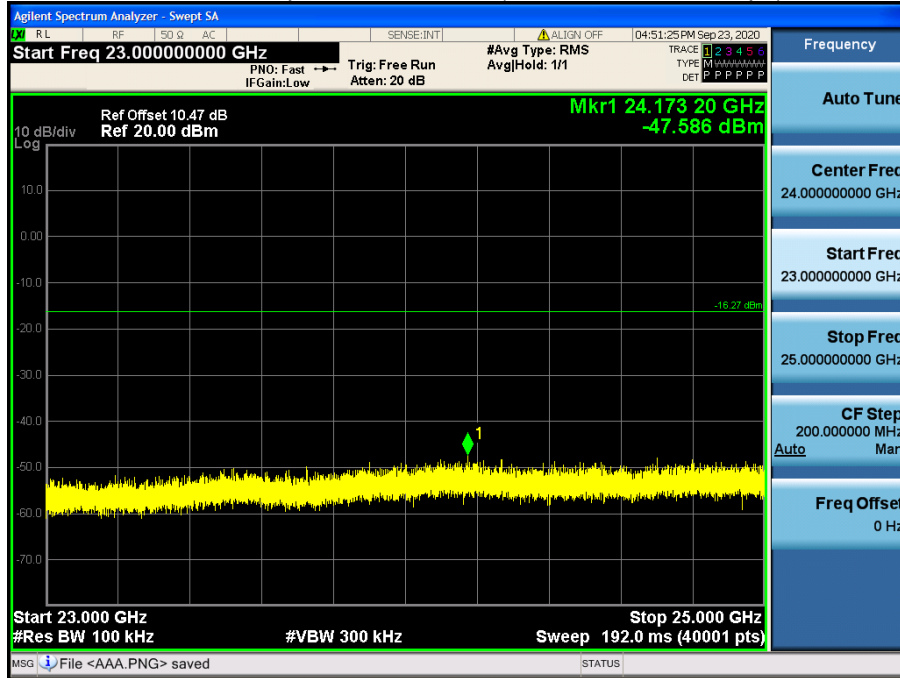
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



23 GHz ~ 25 GHz

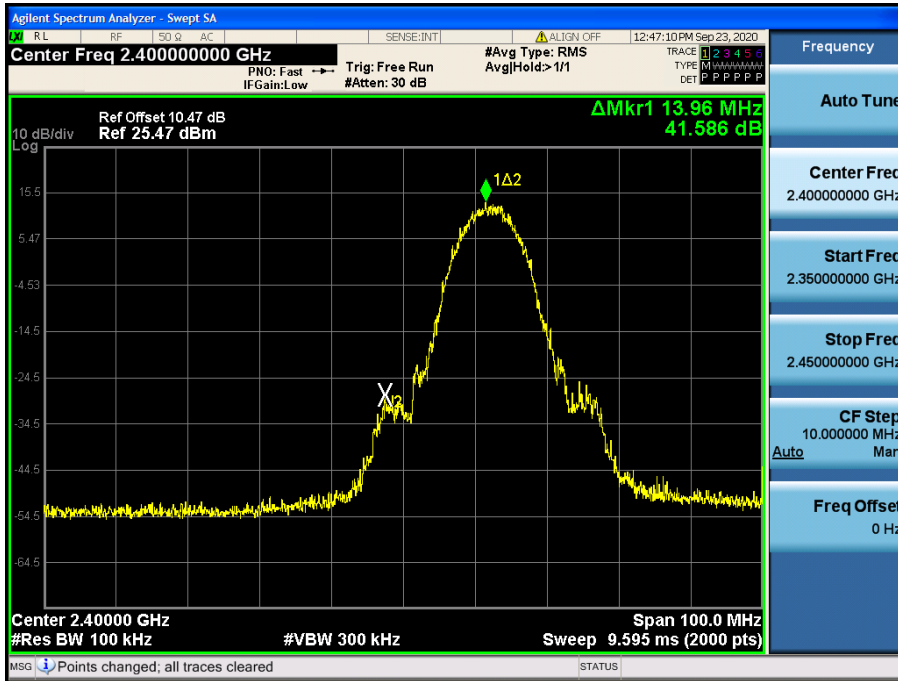
Conducted Spurious Emission (802.11b_Ch.6_1 Mbps)



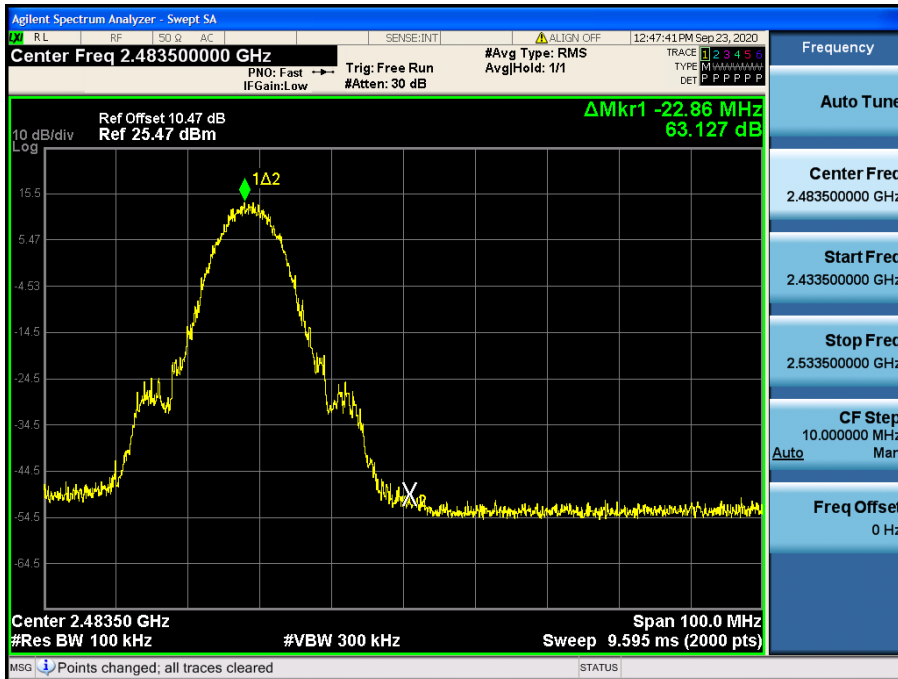
[Ant.2]

▣ Test Plots(BandEdge)

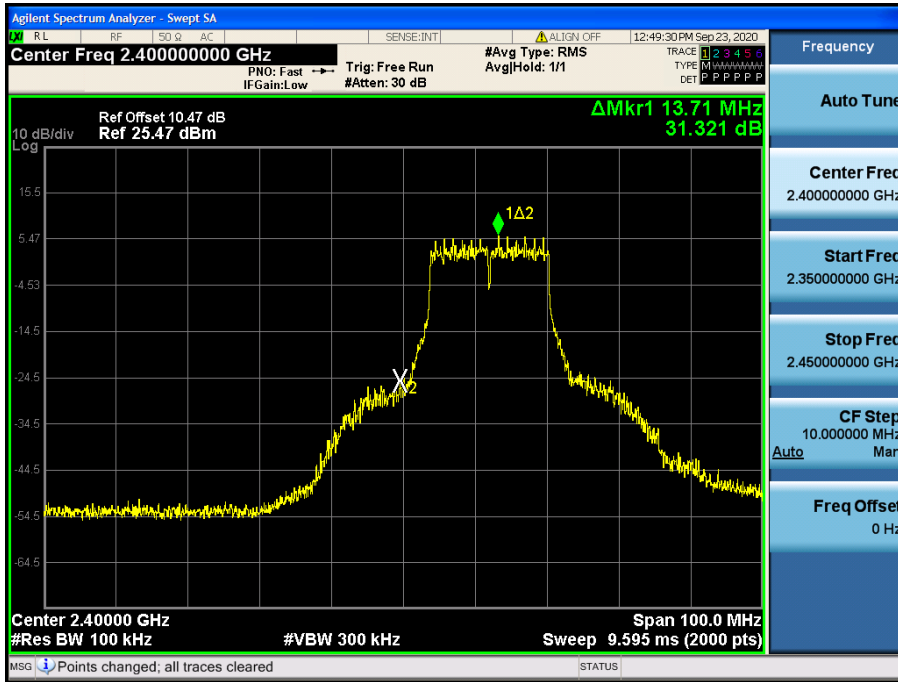
Band Edge (802.11b-CH1)



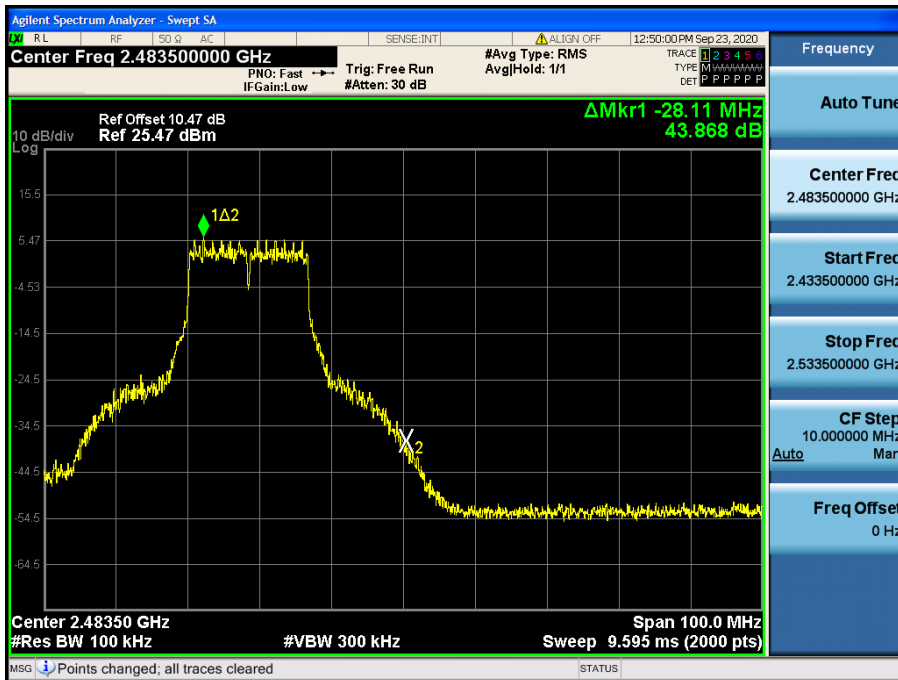
Band Edge (802.11b-CH11)



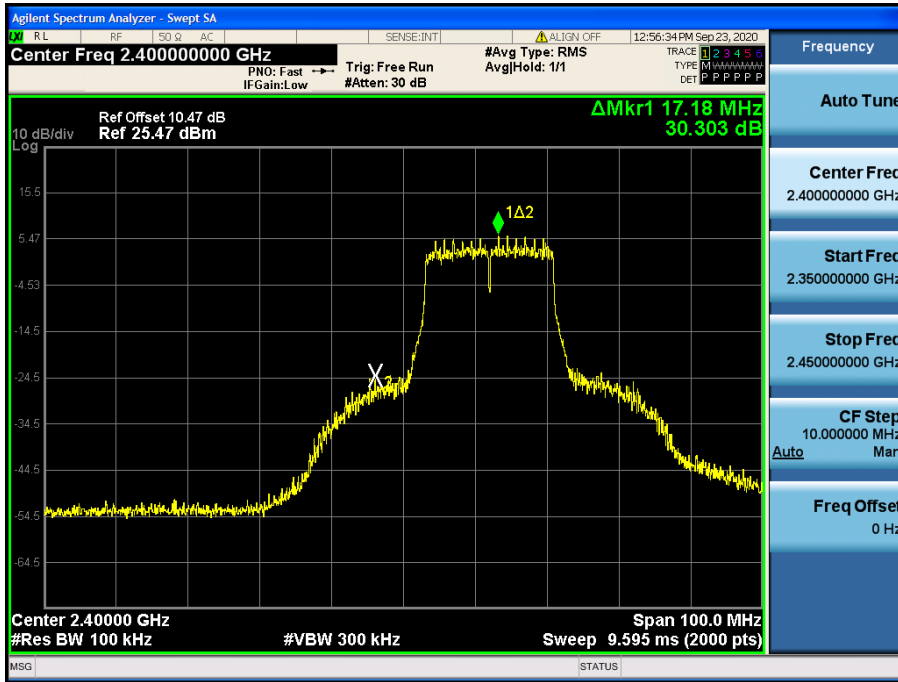
Band Edge (802.11g-CH1)



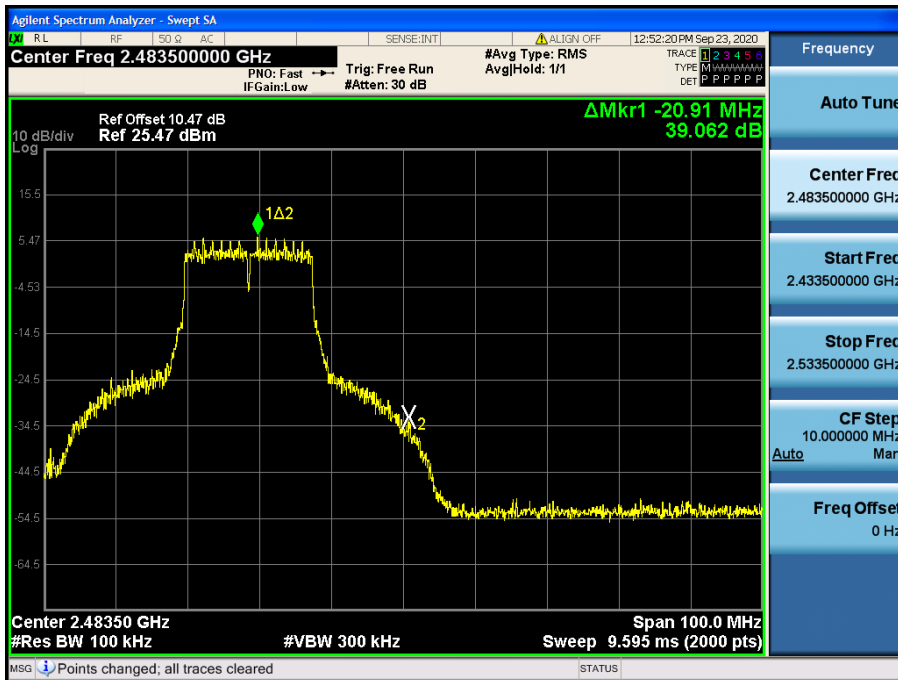
Band Edge (802.11g-CH11)



Band Edge (802.11n_HT20 -CH1)



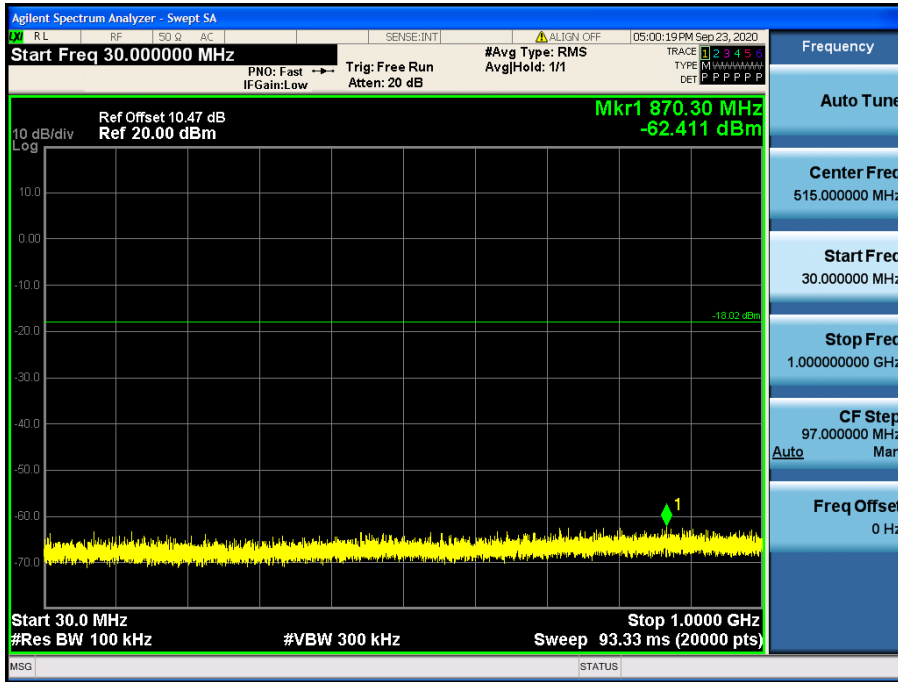
Band Edge (802.11n_HT20 -CH11)



Test Plots(Conducted Spurious Emission)

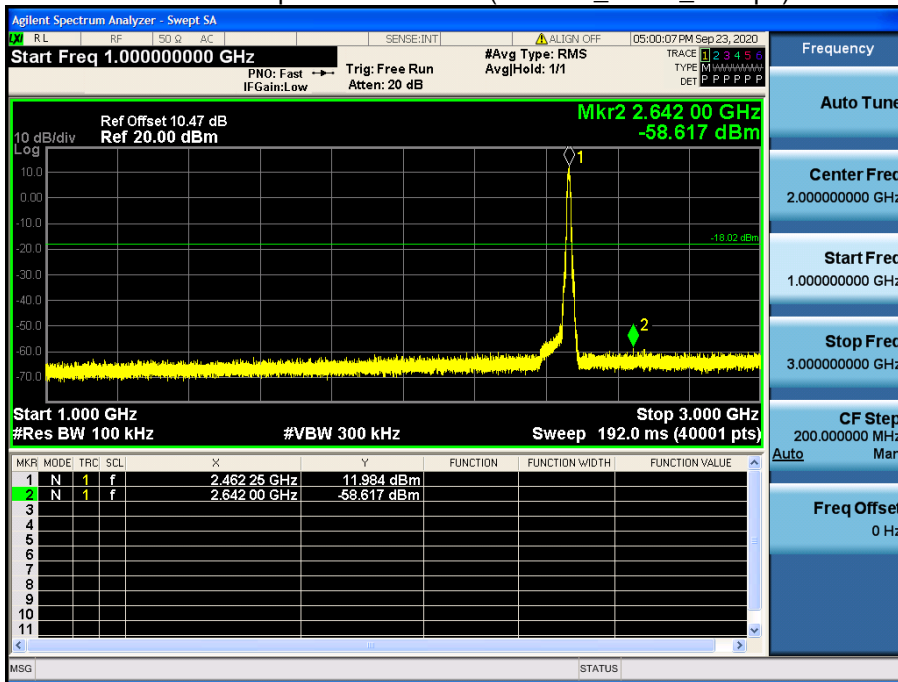
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



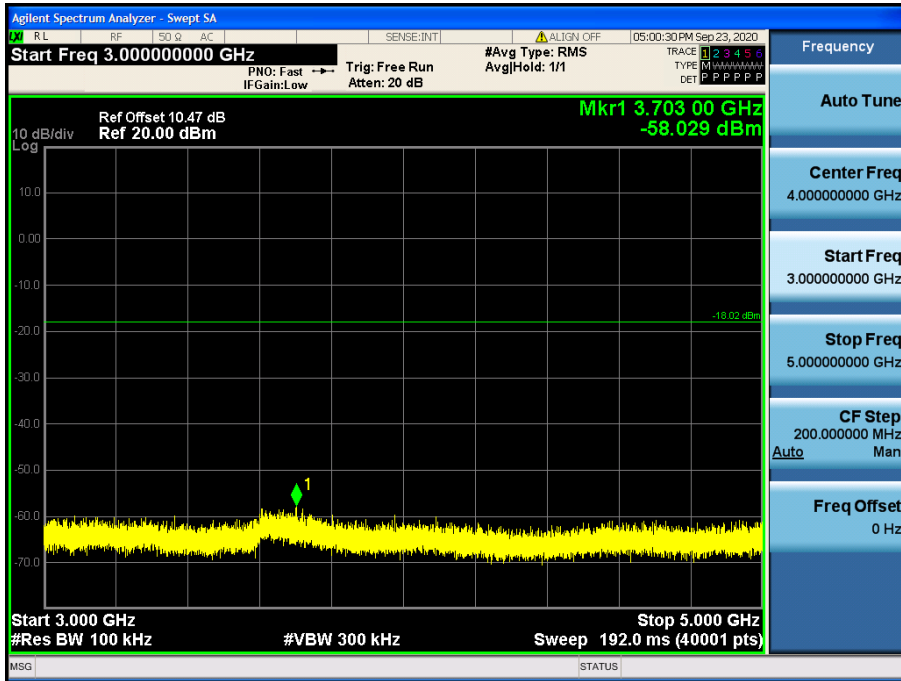
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



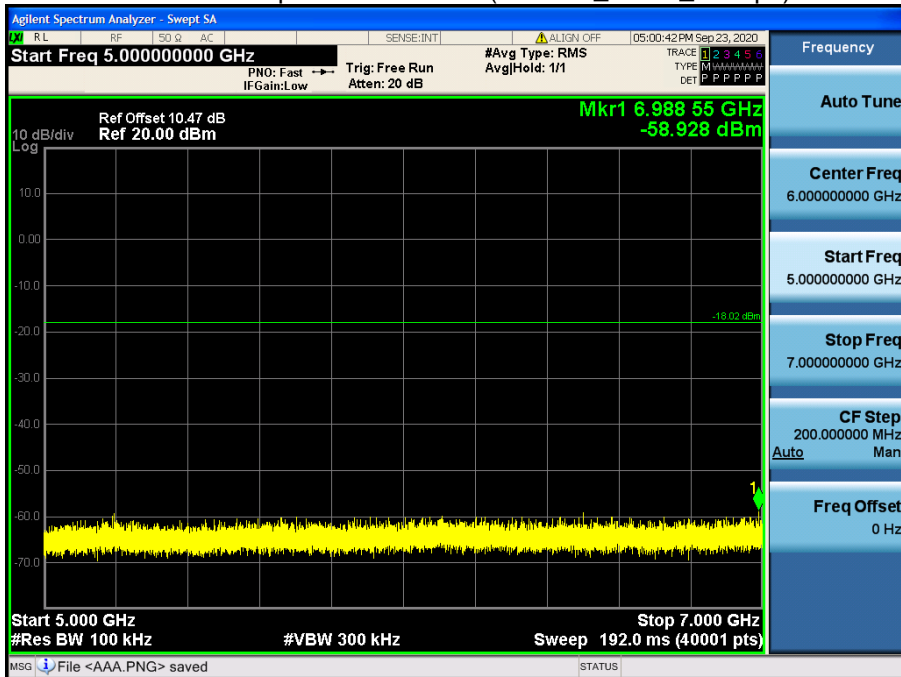
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



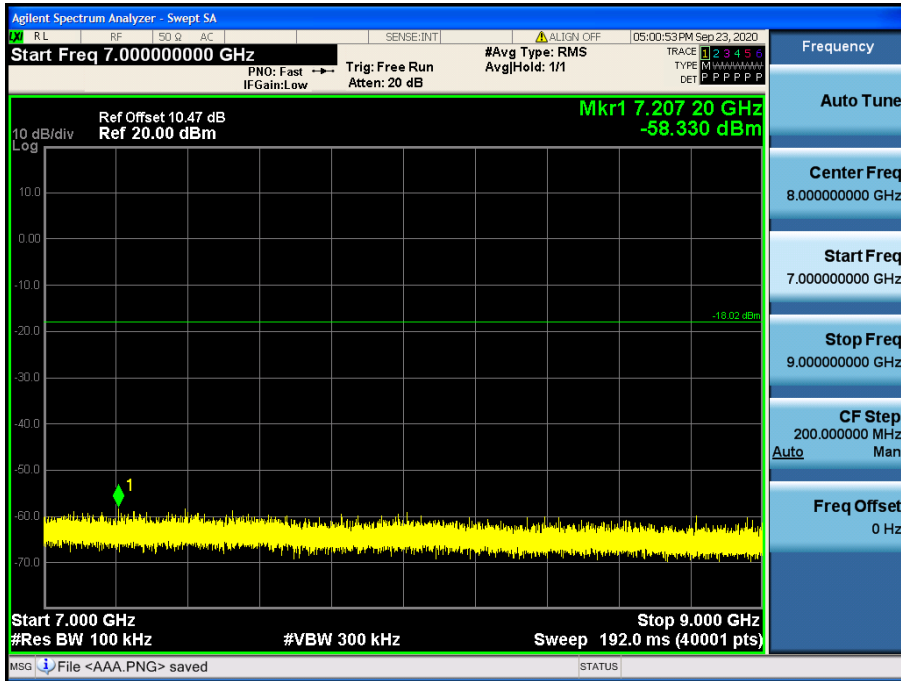
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



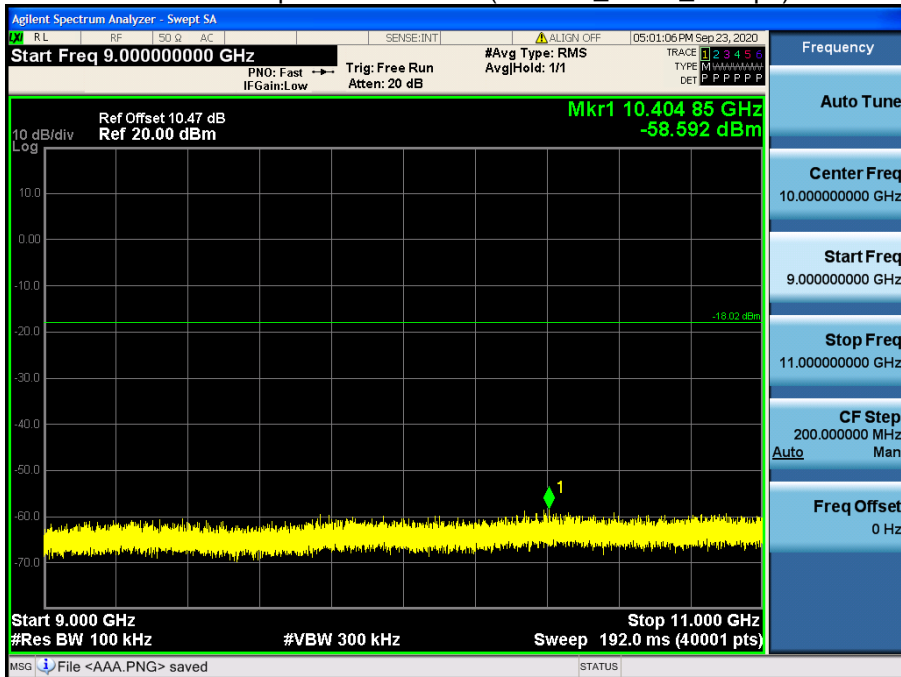
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



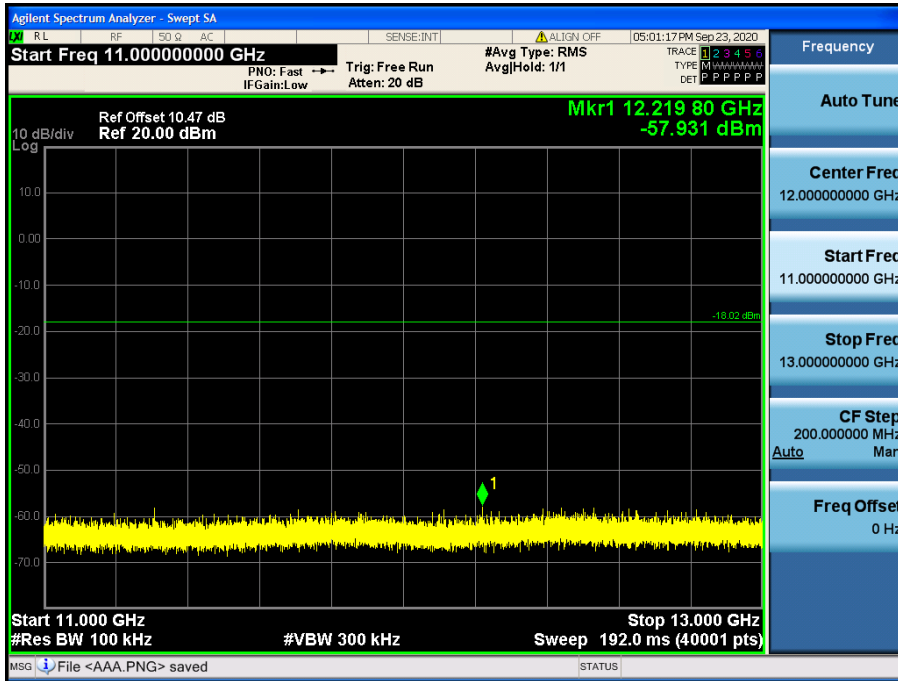
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



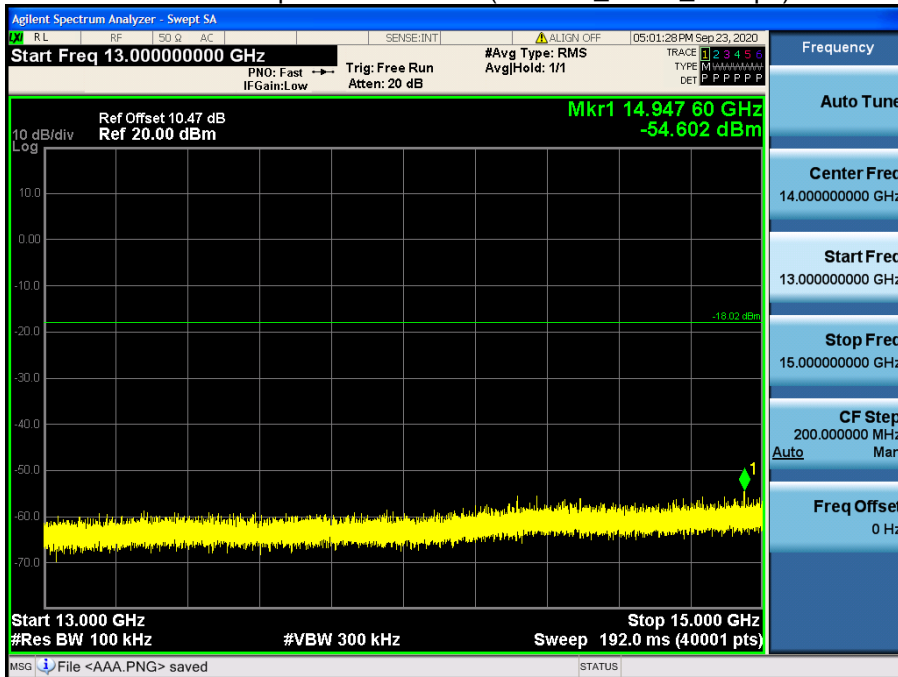
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



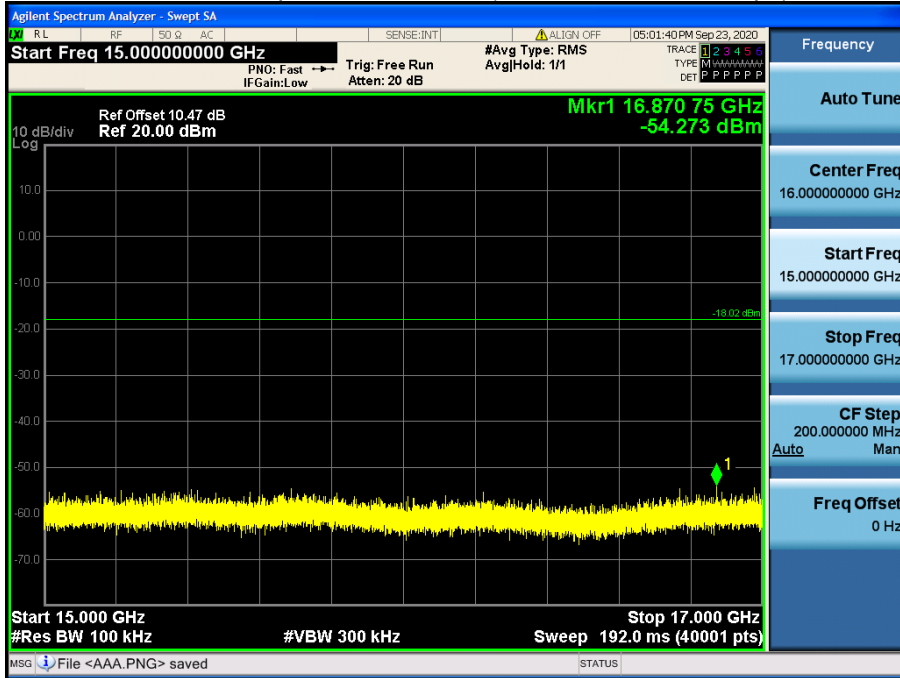
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



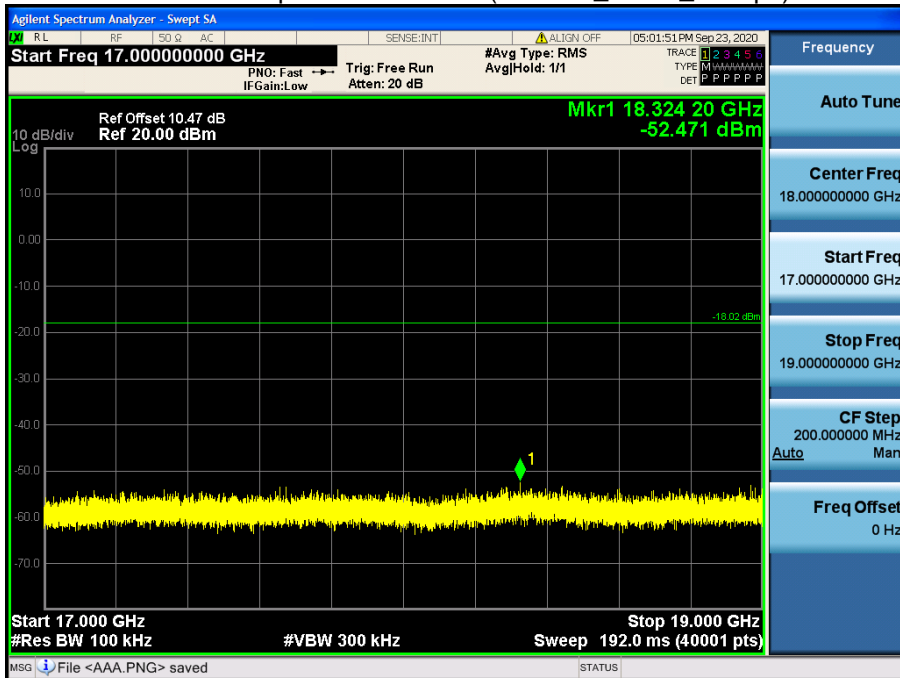
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



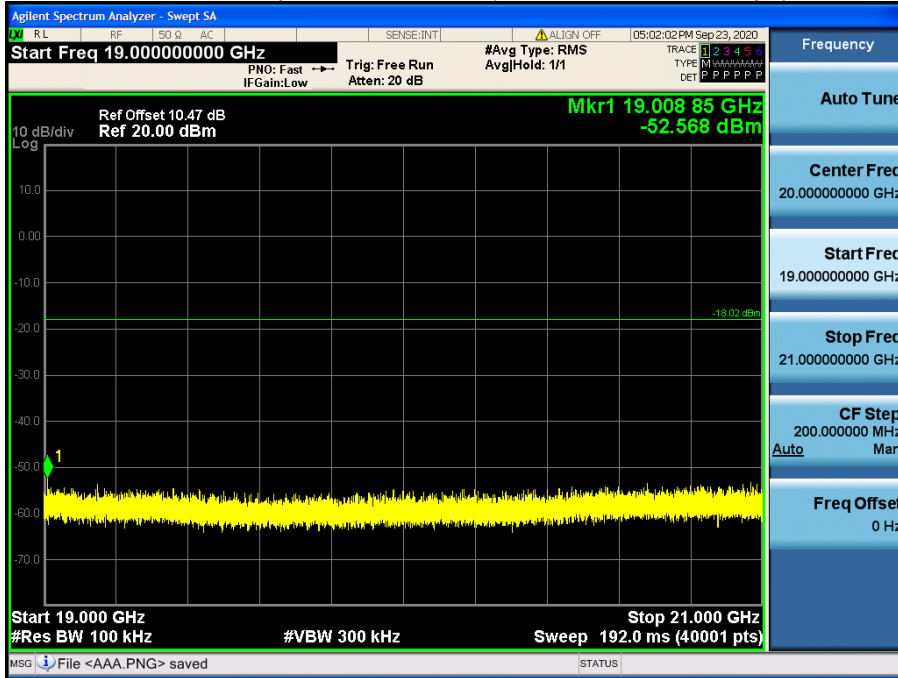
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



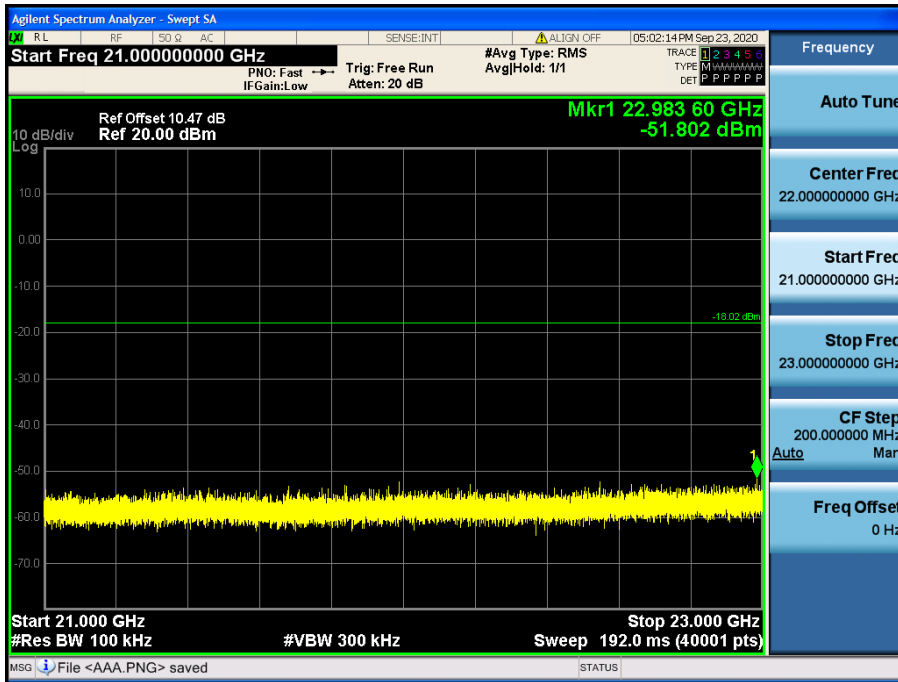
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



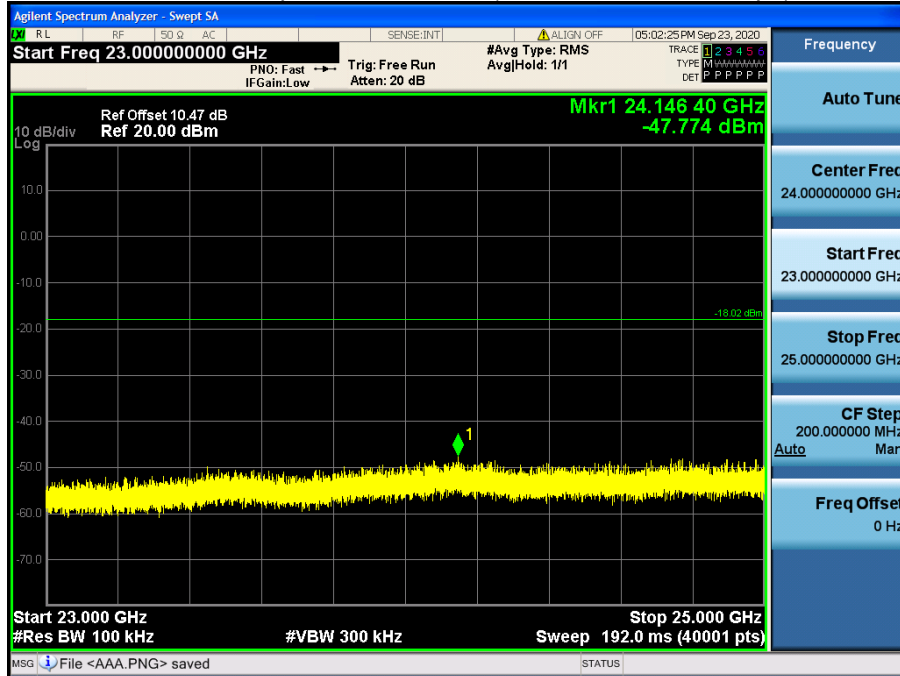
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11b_Ch.11_1 Mbps)



9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30MHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Note:

1. The reading 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 (dBuV) + Distance extrapolation factor

Frequency Range : Below 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/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

[Ant.1_SISO]

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

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	42.75	1.76	V	44.51	73.98	29.47	PK
4824	32.15	1.76	V	33.91	53.98	20.07	AV
7236	39.13	12.28	V	51.41	73.98	22.57	PK
7236	27.56	12.28	V	39.84	53.98	14.14	AV
4824	44.34	1.76	H	46.10	73.98	27.88	PK
4824	34.00	1.76	H	35.76	53.98	18.22	AV
7236	40.50	12.28	H	52.78	73.98	21.20	PK
7236	27.59	12.28	H	39.87	53.98	14.11	AV

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

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	43.13	1.96	V	45.09	73.98	28.89	PK
4874	32.79	1.96	V	34.75	53.98	19.23	AV
7311	39.79	11.45	V	51.24	73.98	22.74	PK
7311	28.22	11.45	V	39.67	53.98	14.31	AV
4874	43.88	1.96	H	45.84	73.98	28.14	PK
4874	33.13	1.96	H	35.09	53.98	18.89	AV
7311	39.68	11.45	H	51.13	73.98	22.85	PK
7311	28.15	11.45	H	39.60	53.98	14.38	AV

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

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	42.47	2.83	V	45.30	73.98	28.68	PK
4924	31.52	2.83	V	34.35	53.98	19.63	AV
7386	39.28	11.87	V	51.15	73.98	22.83	PK
7386	27.45	11.87	V	39.32	53.98	14.66	AV
4924	43.66	2.83	H	46.49	73.98	27.49	PK
4924	33.75	2.83	H	36.58	53.98	17.40	AV
7386	39.40	11.87	H	51.27	73.98	22.71	PK
7386	27.50	11.87	H	39.37	53.98	14.61	AV

[Ant.2_SISO]

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

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	42.28	1.76	V	44.04	73.98	29.94	PK
4824	31.55	1.76	V	33.31	53.98	20.67	AV
7236	39.31	12.28	V	51.59	73.98	22.39	PK
7236	27.68	12.28	V	39.96	53.98	14.02	AV
4824	42.52	1.76	H	44.28	73.98	29.70	PK
4824	31.72	1.76	H	33.48	53.98	20.50	AV
7236	39.54	12.28	H	51.82	73.98	22.16	PK
7236	27.91	12.28	H	40.19	53.98	13.79	AV

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

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	42.80	1.96	V	44.76	73.98	29.22	PK
4874	31.70	1.96	V	33.66	53.98	20.32	AV
7311	40.04	11.45	V	51.49	73.98	22.49	PK
7311	28.88	11.45	V	40.33	53.98	13.65	AV
4874	43.40	1.96	H	45.36	73.98	28.62	PK
4874	31.99	1.96	H	33.95	53.98	20.03	AV
7311	41.02	11.45	H	52.47	73.98	21.51	PK
7311	29.34	11.45	H	40.79	53.98	13.19	AV

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

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	42.13	2.83	V	44.96	73.98	29.02	PK
4924	30.36	2.83	V	33.19	53.98	20.79	AV
7386	38.69	11.87	V	50.56	73.98	23.42	PK
7386	27.49	11.87	V	39.36	53.98	14.62	AV
4924	42.78	2.83	H	45.61	73.98	28.37	PK
4924	30.60	2.83	H	33.43	53.98	20.55	AV
7386	39.60	11.87	H	51.47	73.98	22.51	PK
7386	27.57	11.87	H	39.44	53.98	14.54	AV

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

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measure ment Type
4824	43.57	0.000	1.76	V	45.33	73.98	28.65	PK
4824	31.25	0.298	1.76	V	33.31	53.98	20.67	AV
7236	39.61	0.000	12.28	V	51.89	73.98	22.09	PK
7236	27.54	0.298	12.28	V	40.12	53.98	13.86	AV
4824	43.50	0.000	1.76	H	45.26	73.98	28.72	PK
4824	31.35	0.298	1.76	H	33.41	53.98	20.57	AV
7236	40.67	0.000	12.28	H	52.95	73.98	21.03	PK
7236	27.69	0.298	12.28	H	40.27	53.98	13.71	AV

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+C.L.- A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measure ment Type
4874	41.56	0.000	1.96	V	43.52	73.98	30.46	PK
4874	31.12	0.298	1.96	V	33.38	53.98	20.60	AV
7311	40.09	0.000	11.45	V	51.54	73.98	22.44	PK
7311	28.40	0.298	11.45	V	40.15	53.98	13.83	AV
4874	42.88	0.000	1.96	H	44.84	73.98	29.14	PK
4874	31.30	0.298	1.96	H	33.56	53.98	20.42	AV
7311	41.18	0.000	11.45	H	52.63	73.98	21.35	PK
7311	28.46	0.298	11.45	H	40.21	53.98	13.77	AV

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measure ment Type
4924	42.04	0.000	2.83	V	44.87	73.98	29.11	PK
4924	30.65	0.298	2.83	V	33.78	53.98	20.20	AV
7386	38.75	0.000	11.87	V	50.62	73.98	23.36	PK
7386	27.49	0.298	11.87	V	39.66	53.98	14.32	AV
4924	42.60	0.000	2.83	H	45.43	73.98	28.55	PK
4924	30.73	0.298	2.83	H	33.86	53.98	20.12	AV
7386	39.08	0.000	11.87	H	50.95	73.98	23.03	PK
7386	27.55	0.298	11.87	H	39.72	53.98	14.26	AV

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	42.99	0.000	1.76	V	44.75	73.98	29.23	PK
4824	31.30	0.334	1.76	V	33.39	53.98	20.59	AV
7236	39.64	0.000	12.28	V	51.92	73.98	22.06	PK
7236	27.48	0.334	12.28	V	40.09	53.98	13.89	AV
4824	43.18	0.000	1.76	H	44.94	73.98	29.04	PK
4824	31.29	0.334	1.76	H	33.38	53.98	20.60	AV
7236	39.94	0.000	12.28	H	52.22	73.98	21.76	PK
7236	27.51	0.334	12.28	H	40.12	53.98	13.86	AV

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	41.94	0.000	1.96	V	43.90	73.98	30.08	PK
4874	31.18	0.334	1.96	V	33.47	53.98	20.51	AV
7311	40.14	0.000	11.45	V	51.59	73.98	22.39	PK
7311	28.32	0.334	11.45	V	40.10	53.98	13.88	AV
4874	42.44	0.000	1.96	H	44.40	73.98	29.58	PK
4874	31.25	0.334	1.96	H	33.54	53.98	20.44	AV
7311	40.58	0.000	11.45	H	52.03	73.98	21.95	PK
7311	28.39	0.334	11.45	H	40.17	53.98	13.81	AV

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+C.L.- A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measure ment Type
4924	42.61	0.000	2.83	V	45.44	73.98	28.54	PK
4924	30.55	0.334	2.83	V	33.71	53.98	20.27	AV
7386	38.64	0.000	11.87	V	50.51	73.98	23.47	PK
7386	27.55	0.334	11.87	V	39.75	53.98	14.23	AV
4924	42.78	0.000	2.83	H	45.61	73.98	28.37	PK
4924	30.80	0.334	2.83	H	33.96	53.98	20.02	AV
7386	39.99	0.000	11.87	H	51.86	73.98	22.12	PK
7386	27.48	0.334	11.87	H	39.68	53.98	14.30	AV

[DBS Mode]

Test case 1

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	43.30	1.96	V	45.26	73.98	28.72	PK
4874	32.10	1.96	V	34.06	53.98	19.92	AV
7311	39.78	11.45	V	51.23	73.98	22.75	PK
7311	27.79	11.45	V	39.24	53.98	14.74	AV
4874	43.04	1.96	H	45.00	73.98	28.98	PK
4874	32.40	1.96	H	34.36	53.98	19.62	AV
7311	39.69	11.45	H	51.14	73.98	22.84	PK
7311	27.67	11.45	H	39.12	53.98	14.86	AV

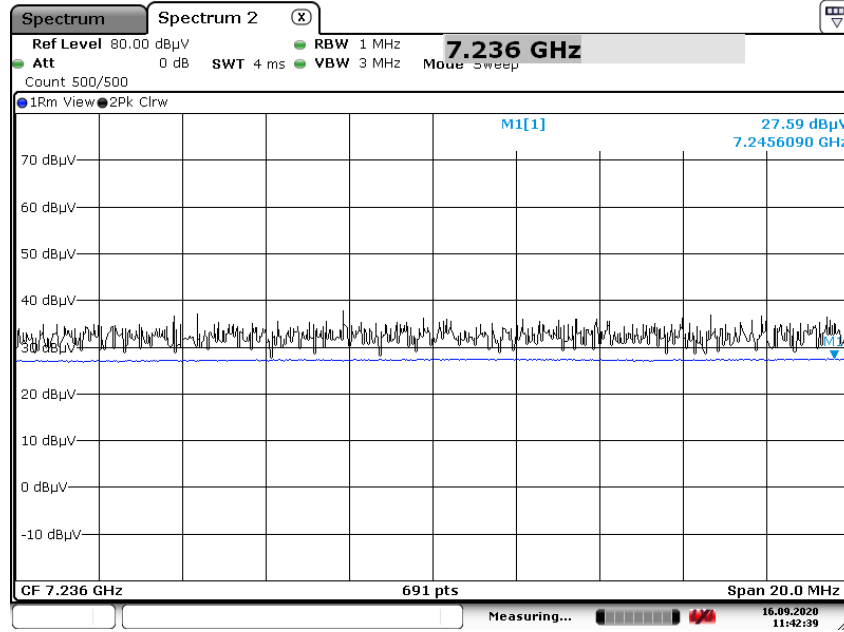
Test case 2

Frequency [MHz]	Reading [dBuV]	A.F.+C.L.-A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	45.30	1.76	V	47.06	73.98	26.92	PK
4824	33.80	1.76	V	35.56	53.98	18.42	AV
7236	38.65	12.28	V	50.93	73.98	23.05	PK
7236	27.48	12.28	V	39.76	53.98	14.22	AV
4824	45.81	1.76	H	47.57	73.98	26.41	PK
4824	34.32	1.76	H	36.08	53.98	17.90	AV
7236	39.38	12.28	H	51.66	73.98	22.32	PK
7236	27.56	12.28	H	39.84	53.98	14.14	AV

▣ Test Plots

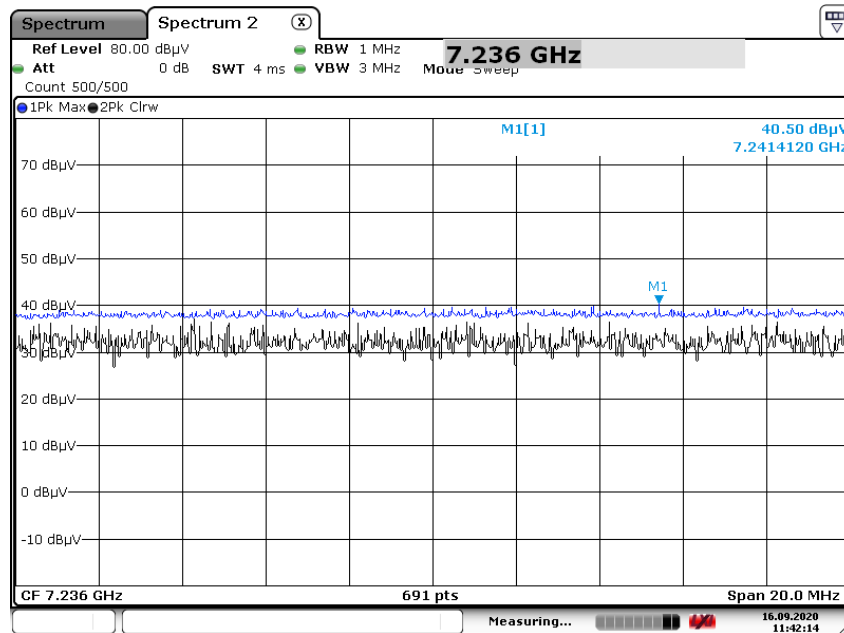
[Ant.1_SISO] _ Worst case : X-H

Radiated Spurious Emissions plot – Average Reading (802.11b_1 Mbps, Ch.1 3rd Harmonic)



Date: 16.SEP.2020 11:42:38

Radiated Spurious Emissions plot – Peak Reading (802.11b_1 Mbps, Ch.1 3rd Harmonic)

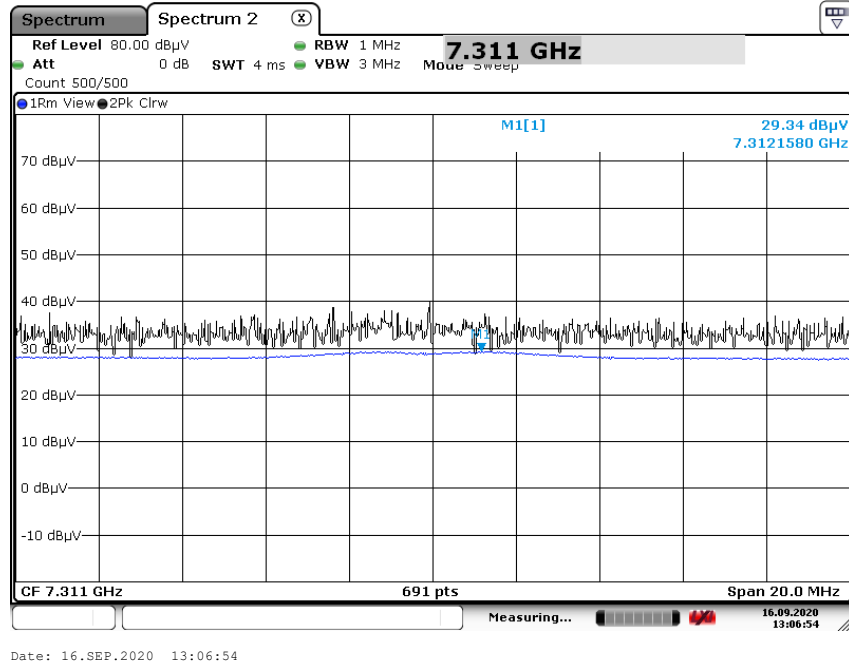


Date: 16.SEP.2020 11:42:14

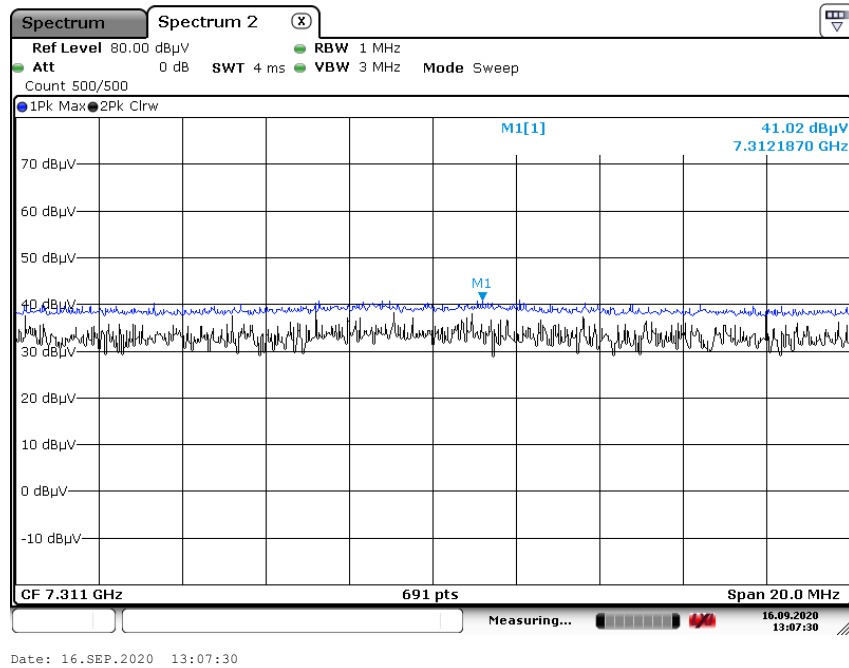
Note: Plot of worst case are only reported.

[Ant.2_SISO] _ Worst case : X-H

Radiated Spurious Emissions plot – Average Reading (802.11b_1 Mbps, Ch.6 3rd Harmonic)

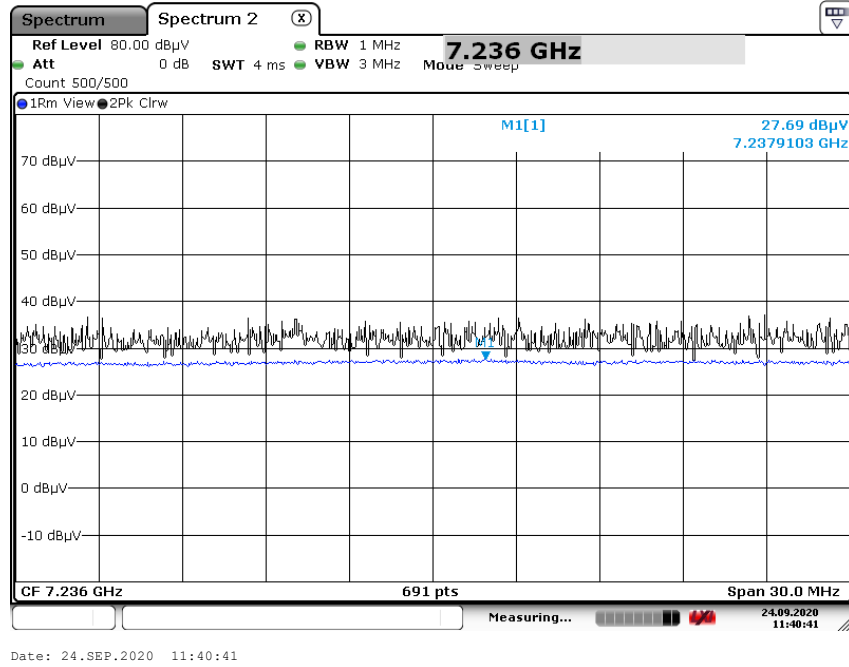


Radiated Spurious Emissions plot – Peak Reading (802.11b_1 Mbps, Ch.6 3rd Harmonic)

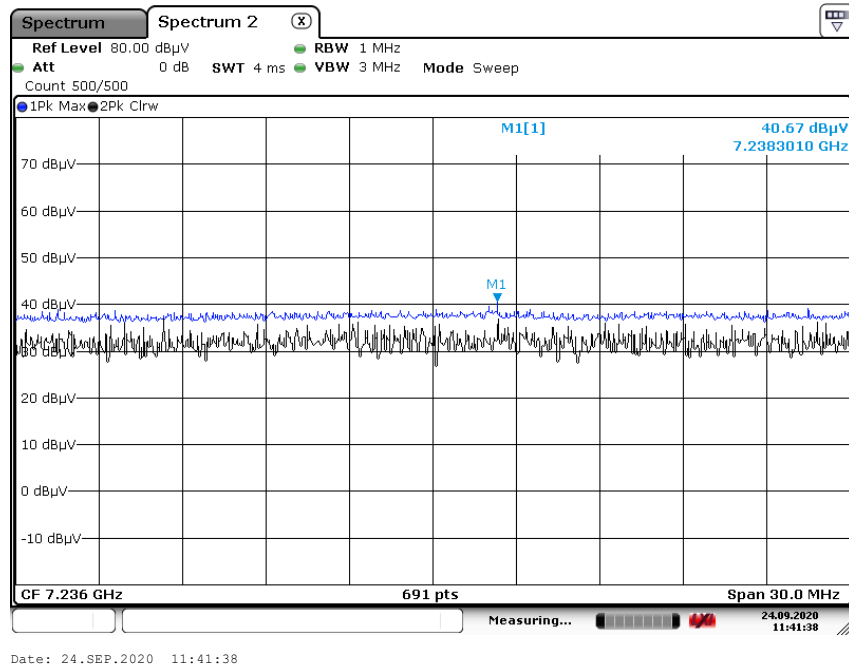


[Ant.1&Ant.2_MIMO(CDD)] _ Worst case : X-H

Radiated Spurious Emissions plot – Average Reading (802.11g_6 Mbps, Ch.1 3rd Harmonic)

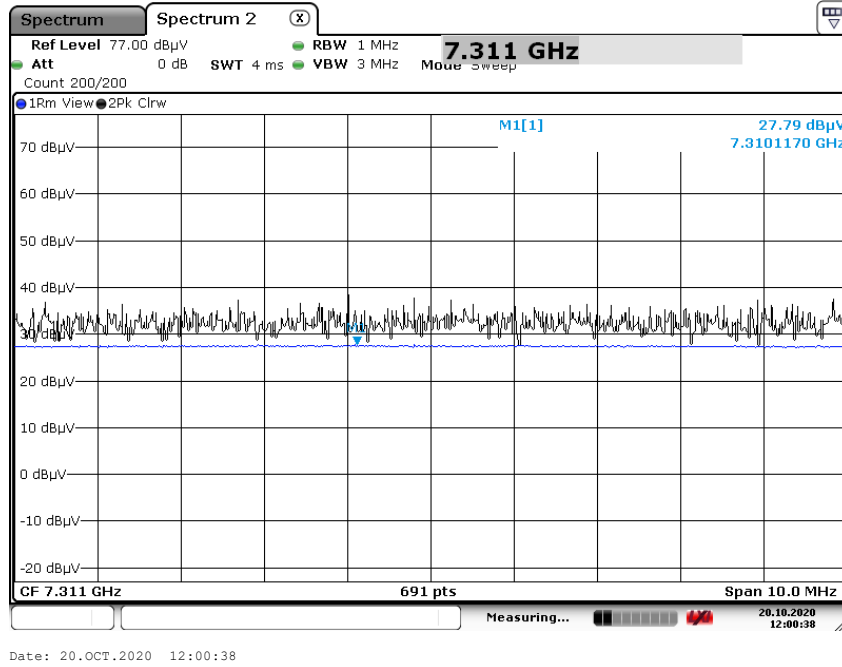


Radiated Spurious Emissions plot – Peak Reading (802.11g_6 Mbps, Ch.1 3rd Harmonic)

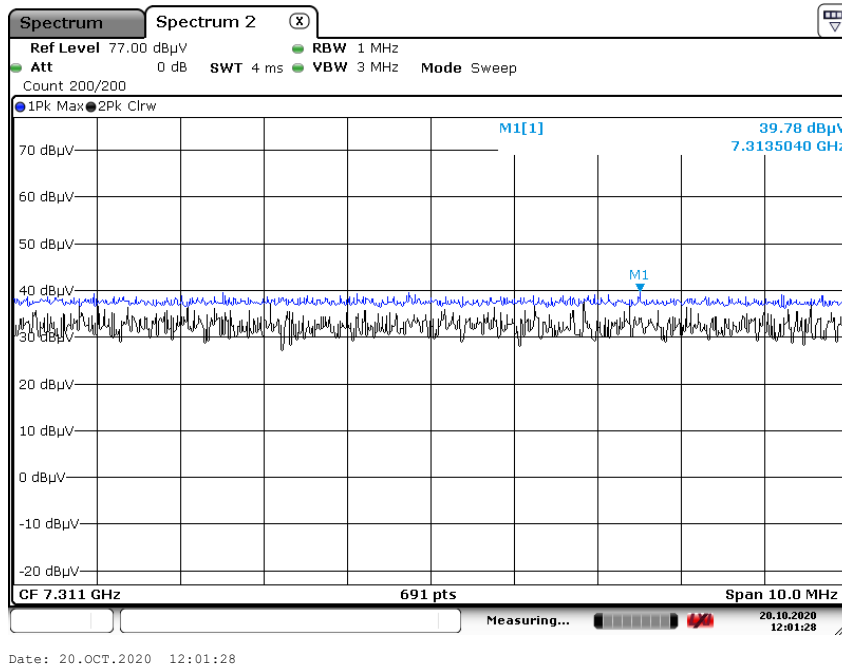


[DBS]

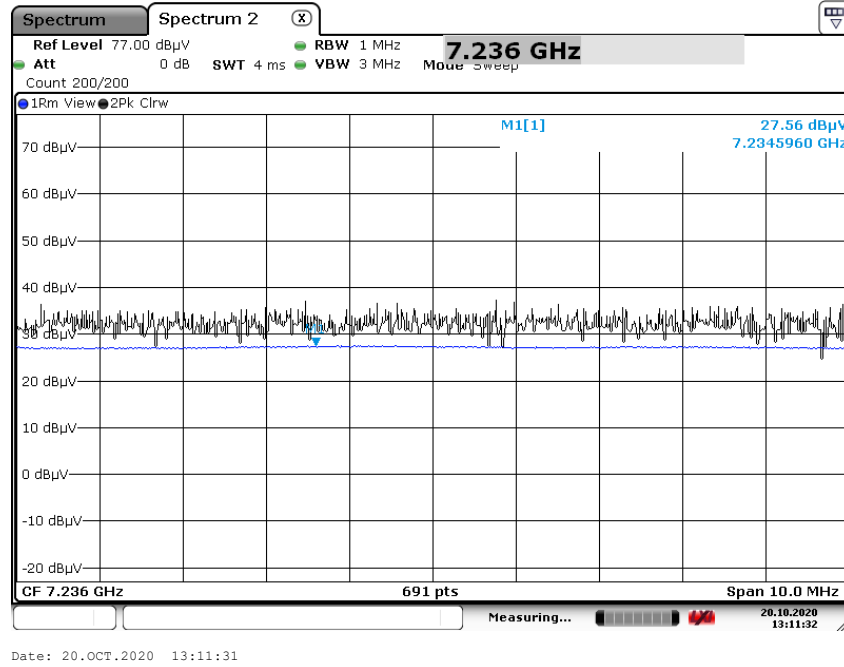
Radiated Spurious Emissions plot – Average Reading (Test case 1_Y-V_3rd Harmonic)



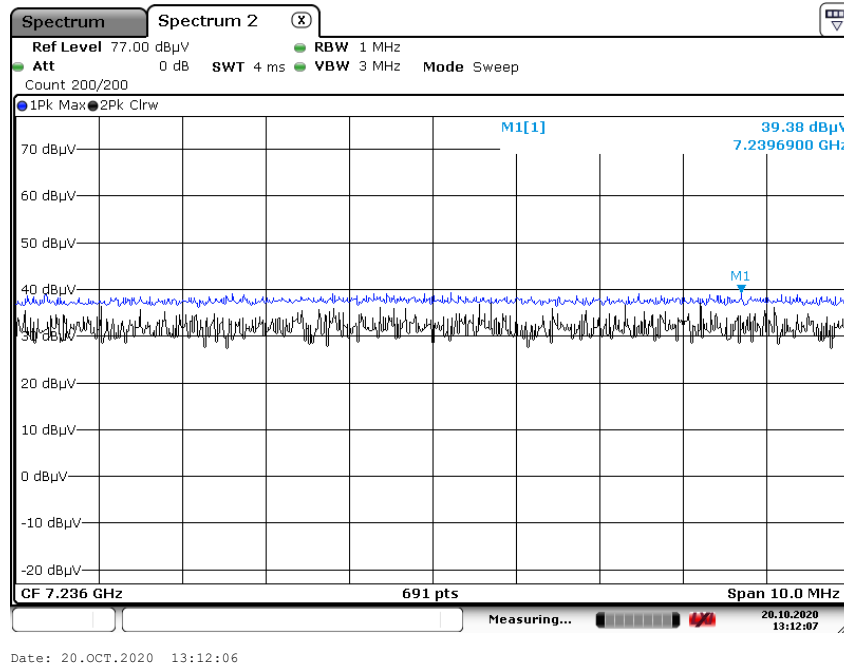
Radiated Spurious Emissions plot – Peak Reading (Test case 1_ 3rd Harmonic)



Radiated Spurious Emissions plot – Average Reading (Test case 2_ Z-H_3rd Harmonic)



Radiated Spurious Emissions plot – Peak Reading (Test case 2_ 3rd Harmonic)



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]	Reading [dBUV]	A.F.+ C.L+ ATT - A.G + D.F [dB]	ANT. POL [H/V]	Total [dBUV/m]	Limit [dBUV/m]	Margin [dB]	Measurement Type
2390.0	56.58	2.00	H	58.58	73.98	15.40	PK
2390.0	38.75	2.00	H	40.75	53.98	13.23	AV
2390.0	55.98	2.00	V	57.98	73.98	16.00	PK
2390.0	37.65	2.00	V	39.65	53.98	14.33	AV
2483.5	55.12	0.79	H	55.91	73.98	18.07	PK
2483.5	36.80	0.79	H	37.59	53.98	16.39	AV
2483.5	54.32	0.79	V	55.11	73.98	18.87	PK
2483.5	36.39	0.79	V	37.18	53.98	16.80	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]	Reading [dBUV]	A.F.+ C.L+ ATT - A.G + D.F [dB]	ANT. POL [H/V]	Total [dBUV/m]	Limit [dBUV/m]	Margin [dB]	Measurement Type
2390.0	47.22	2.00	H	49.22	73.98	24.76	PK
2390.0	36.00	2.00	H	38.00	53.98	15.98	AV
2390.0	47.31	2.00	V	49.31	73.98	24.67	PK
2390.0	35.85	2.00	V	37.85	53.98	16.13	AV
2483.5	48.53	0.79	H	49.32	73.98	24.66	PK
2483.5	36.11	0.79	H	36.90	53.98	17.08	AV
2483.5	48.65	0.79	V	49.44	73.98	24.54	PK
2483.5	36.30	0.79	V	37.09	53.98	16.89	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]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+ C.L+ ATT - A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	67.14	0.000	2.00	H	69.14	73.98	4.84	PK
2390.0	46.00	0.298	2.00	H	48.30	53.98	5.68	AV
2390.0	66.18	0.000	2.00	V	68.18	73.98	5.80	PK
2390.0	45.55	0.298	2.00	V	47.85	53.98	6.13	AV
2483.5	66.46	0.000	0.79	H	67.25	73.98	6.73	PK
2483.5	45.17	0.298	0.79	H	46.26	53.98	7.72	AV
2483.5	64.63	0.000	0.79	V	65.42	73.98	8.56	PK
2483.5	43.20	0.298	0.79	V	44.29	53.98	9.69	AV

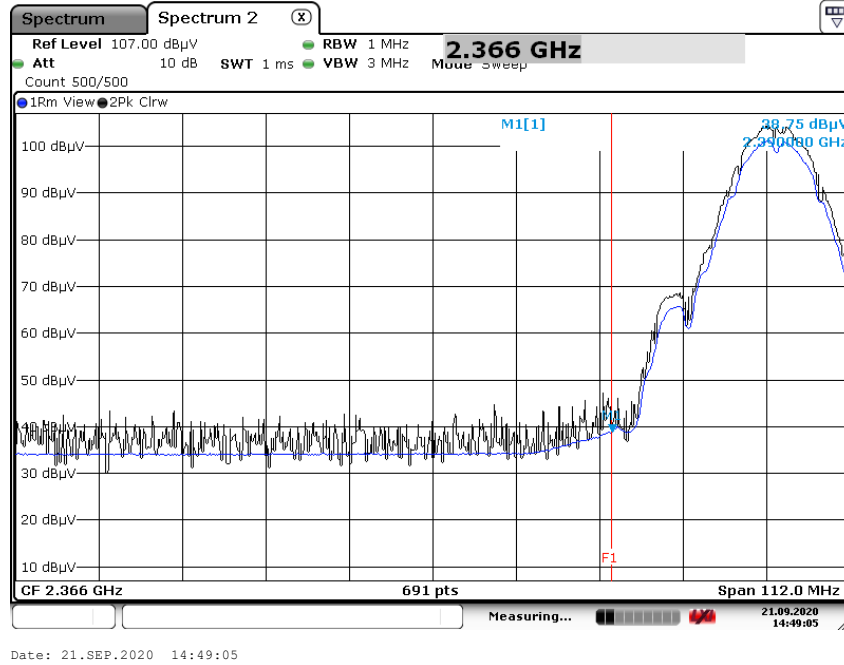
Operation Mode: 802.11n (HT20)
 Transfer Rate: 0
 Operating Frequency: 2412 MHz, 2462 MHz
 Channel No. 01 Ch, 11 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+ C.L+ ATT - A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	67.43	0.000	2.00	H	69.43	73.98	4.55	PK
2390.0	48.13	0.334	2.00	H	50.46	53.98	3.52	AV
2390.0	65.19	0.000	2.00	V	67.19	73.98	6.79	PK
2390.0	44.50	0.334	2.00	V	46.83	53.98	7.15	AV
2483.5	65.64	0.000	0.79	H	66.43	73.98	7.55	PK
2483.5	45.00	0.334	0.79	H	46.12	53.98	7.86	AV
2483.5	64.37	0.000	0.79	V	65.16	73.98	8.82	PK
2483.5	43.95	0.334	0.79	V	45.07	53.98	8.91	AV

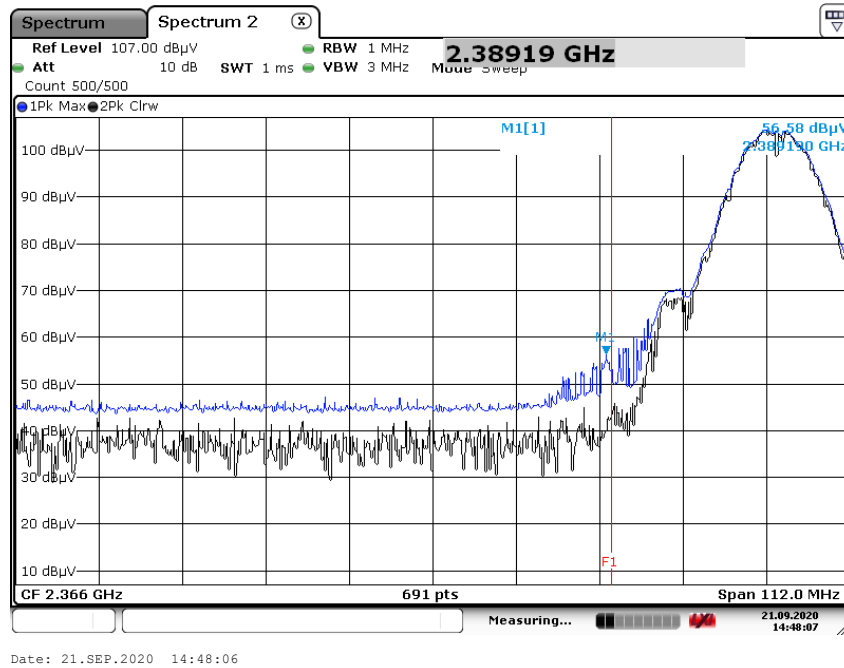
■ Test Plots

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

Radiated Restricted Band Edges plot – Average Reading (802.11b_1 Mbps Ch.1)

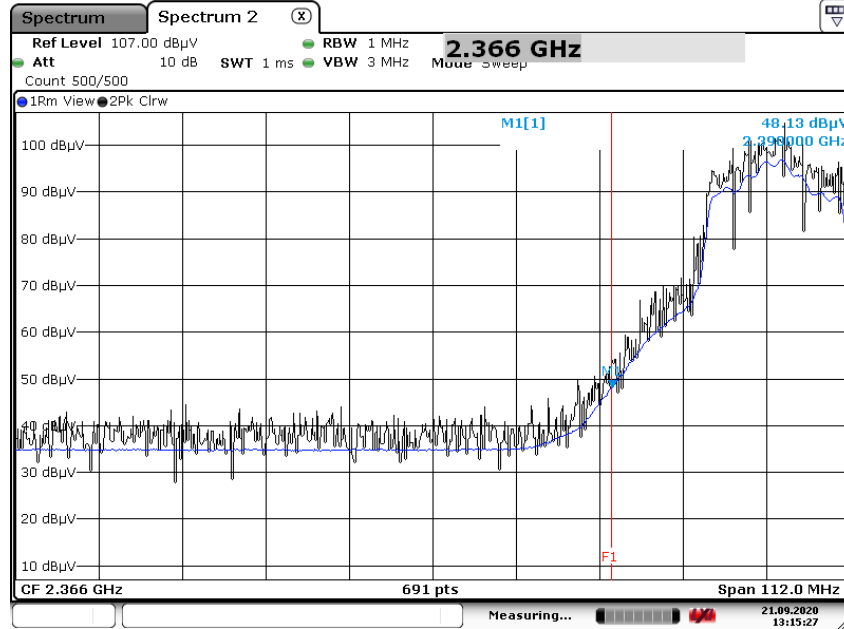


Radiated Restricted Band Edges plot – Peak Reading (802.11b_1 Mbps Ch.1)



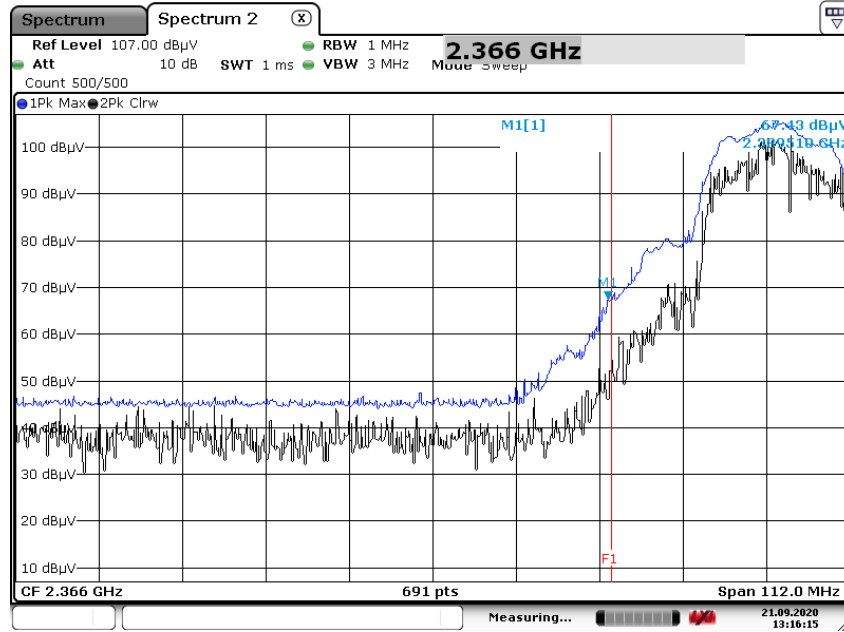
[Ant.1&Ant.2_MIMO(CDD)] (Worst case : X-H)

Radiated Restricted Band Edges plot – Average Reading (802.11n (HT20)_MCS0 Ch.1)



Date: 21.SEP.2020 13:15:27

Radiated Restricted Band Edges plot – Peak Reading (802.11n (HT20)_MCS0 Ch.1)



Date: 21.SEP.2020 13:16:15

Note:

Plot of worst case are only reported.

9.8 POWERLINE CONDUCTED EMISSIONS

Conducted Emissions (Line 1)

Test

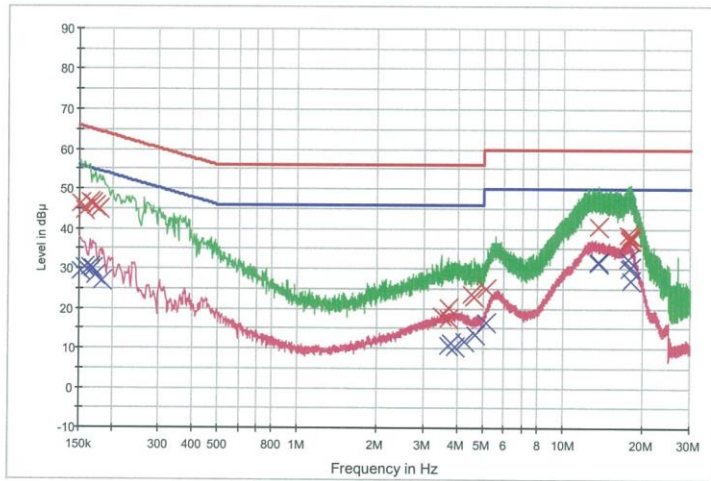
1 / 2

HCT TEST Report

Common Information

EUT: SM-G991U
 Manufacturer: SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions: 2.4GHz WLAN MODE L1

FCC CLASS B_Exten Cable



— FCC CLASS B_QP — FCC CLASS B_AV — Preview Result 1-PK+
 — Preview Result 2-AVG × Final Result 1-QPK × Final Result 2-CAV

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.152000	46.4	9.000	Off	L1	9.8	19.5	65.9
0.158000	44.6	9.000	Off	L1	9.8	21.0	65.6
0.164000	46.4	9.000	Off	L1	9.8	18.8	65.3
0.168000	46.1	9.000	Off	L1	9.8	18.9	65.1
0.172000	45.5	9.000	Off	L1	9.8	19.4	64.9
0.178000	44.9	9.000	Off	L1	9.8	19.7	64.6
3.468000	18.2	9.000	Off	L1	9.9	37.8	56.0
3.682000	17.4	9.000	Off	L1	9.9	38.6	56.0
3.714000	20.0	9.000	Off	L1	9.9	36.0	56.0
4.534000	23.5	9.000	Off	L1	10.0	32.5	56.0
4.630000	23.0	9.000	Off	L1	10.0	33.0	56.0
5.120000	24.8	9.000	Off	L1	10.0	35.2	60.0
13.604000	40.6	9.000	Off	L1	10.3	19.4	60.0
17.430000	38.5	9.000	Off	L1	10.4	21.5	60.0
17.752000	37.6	9.000	Off	L1	10.5	22.4	60.0
17.792000	37.0	9.000	Off	L1	10.5	23.0	60.0
17.912000	38.2	9.000	Off	L1	10.5	21.8	60.0
17.954000	37.1	9.000	Off	L1	10.5	22.9	60.0

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Test

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Final Result 2

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.152000	29.3	9.000	Off	L1	9.8	26.6	55.9
0.158000	30.3	9.000	Off	L1	9.8	25.3	55.6
0.164000	30.4	9.000	Off	L1	9.8	24.9	55.3
0.168000	29.9	9.000	Off	L1	9.8	25.2	55.1
0.172000	28.4	9.000	Off	L1	9.8	26.5	54.9
0.184000	26.9	9.000	Off	L1	9.8	27.4	54.3
3.682000	10.5	9.000	Off	L1	9.9	35.5	46.0
3.786000	11.2	9.000	Off	L1	9.9	34.8	46.0
3.914000	10.2	9.000	Off	L1	9.9	35.8	46.0
4.242000	11.8	9.000	Off	L1	10.0	34.2	46.0
4.684000	13.3	9.000	Off	L1	10.0	32.7	46.0
5.120000	16.5	9.000	Off	L1	10.0	33.5	50.0
13.512000	31.6	9.000	Off	L1	10.3	18.4	50.0
13.604000	31.5	9.000	Off	L1	10.3	18.5	50.0
17.430000	32.5	9.000	Off	L1	10.4	17.5	50.0
17.820000	29.9	9.000	Off	L1	10.5	20.1	50.0
17.912000	30.4	9.000	Off	L1	10.5	19.6	50.0
17.954000	26.9	9.000	Off	L1	10.5	23.1	50.0

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Conducted Emissions (Line 2)

Test

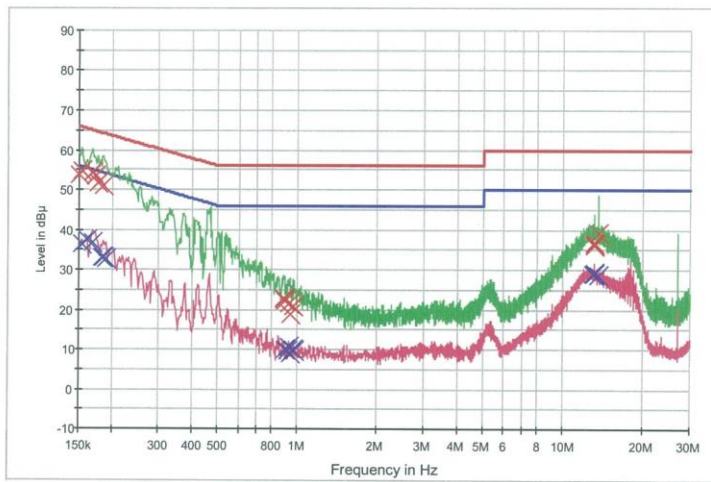
1 / 2

HCT TEST Report

Common Information

EUT: SM-G991U
 Manufacturer: SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions: 2.4GHz WLAN MODE N

FCC CLASS B_Exten Cable



— FCC CLASS B_QP — FCC CLASS B_AV — Preview Result 1-PK+
 — Preview Result 2-AVG × Final Result 1-QPK × Final Result 2-CAV

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	53.7	9.000	Off	N	9.8	12.3	66.0
0.154000	54.8	9.000	Off	N	9.8	10.9	65.8
0.168000	54.3	9.000	Off	N	9.8	10.8	65.1
0.172000	53.3	9.000	Off	N	9.8	11.6	64.9
0.176000	51.5	9.000	Off	N	9.8	13.1	64.7
0.186000	51.1	9.000	Off	N	9.8	13.1	64.2
0.884000	22.7	9.000	Off	N	9.8	33.3	56.0
0.890000	22.9	9.000	Off	N	9.8	33.1	56.0
0.894000	22.3	9.000	Off	N	9.8	33.7	56.0
0.928000	21.4	9.000	Off	N	9.8	34.6	56.0
0.944000	18.9	9.000	Off	N	9.8	37.1	56.0
0.962000	20.8	9.000	Off	N	9.8	35.2	56.0
13.086000	36.1	9.000	Off	N	10.4	23.9	60.0
13.098000	36.5	9.000	Off	N	10.4	23.5	60.0
13.102000	36.0	9.000	Off	N	10.4	24.0	60.0
13.110000	36.8	9.000	Off	N	10.4	23.2	60.0
13.122000	36.1	9.000	Off	N	10.4	23.9	60.0
13.554000	39.1	9.000	Off	N	10.4	20.9	60.0

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Test

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Final Result 2

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.154000	36.6	9.000	Off	N	9.8	19.2	55.8
0.160000	37.3	9.000	Off	N	9.8	18.1	55.5
0.168000	36.9	9.000	Off	N	9.8	18.1	55.1
0.182000	33.2	9.000	Off	N	9.8	21.2	54.4
0.186000	33.2	9.000	Off	N	9.8	21.0	54.2
0.190000	32.7	9.000	Off	N	9.8	21.4	54.0
0.896000	9.9	9.000	Off	N	9.8	36.1	46.0
0.920000	9.8	9.000	Off	N	9.8	36.2	46.0
0.928000	10.8	9.000	Off	N	9.8	35.2	46.0
0.944000	9.0	9.000	Off	N	9.8	37.0	46.0
0.962000	10.0	9.000	Off	N	9.8	36.0	46.0
0.972000	9.7	9.000	Off	N	9.8	36.3	46.0
12.952000	29.0	9.000	Off	N	10.4	21.0	50.0
13.098000	29.4	9.000	Off	N	10.4	20.6	50.0
13.102000	29.2	9.000	Off	N	10.4	20.8	50.0
13.122000	29.1	9.000	Off	N	10.4	20.9	50.0
13.126000	29.0	9.000	Off	N	10.4	21.0	50.0
13.554000	28.5	9.000	Off	N	10.4	21.5	50.0

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9.9 CONFIRMATION OF GEO-LOCATION MECHANISM

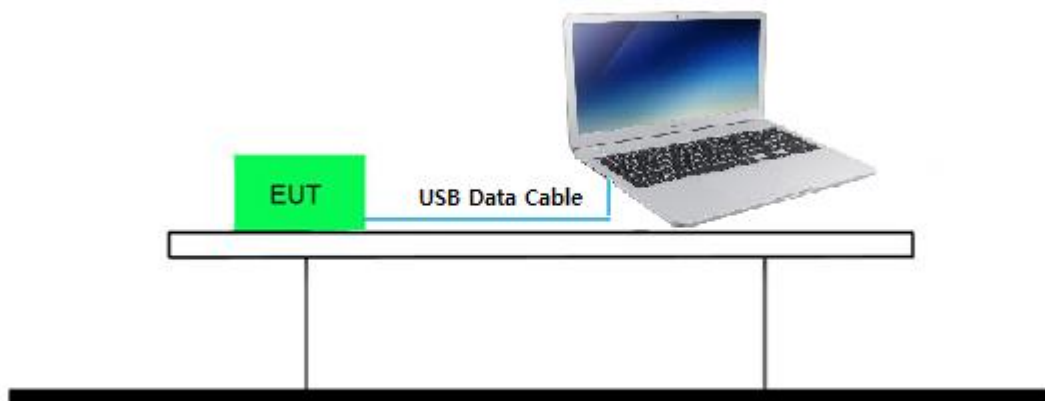
The device uses MCC information obtained from the public cellular carrier to determine that it is operating outside the U.S. and then enable channels 12 and 13 only if a non-US MCC that supports channel 12 and 13 is confirmed.

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. At the Command Prompt, enter the command.
- ```
>adb remount
>adb shell
>wl country US // Setting the country.
>wl channels // Channel list is obtain.
```



**Setting the country for product**

| Country code = US                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>C:#ADB&gt;adb shell mlq:/ # wl country US wl country US mlq:/ # wl channels wl channels 1 2 3 4 5 6 7 8 9 10 11 36 40 44 48 52 56 60 64 100 104 108 112 116 120 124 128 132 136 140 144 149 153 157 161 165</pre>       |
| Country code = KR(Korea)                                                                                                                                                                                                     |
| <pre>C:#ADB&gt;adb shell mlq:/ # wl country KR wl country KR mlq:/ # wl channels wl channels 1 2 3 4 5 6 7 8 9 10 11 12 13 36 40 44 48 52 56 60 64 100 104 108 112 116 120 124 128 132 136 140 144 149 153 157 161 165</pre> |

| Did not connect Airplane mode                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Airplane on                                                                                                                                                                                            |
| <pre>C:#&gt;cd adb C:#ADB&gt;adb shell mlq:/ # wl channels wl channels 1 2 3 4 5 6 7 8 9 10 11 36 40 44 48 52 56 60 64 100 104 108 112 116 120 124 128 132 136 140 144 149 153 157 161 165</pre>       |
| Airplane off                                                                                                                                                                                           |
| <pre>C:#&gt;cd adb C:#ADB&gt;adb shell mlq:/ # wl channels wl channels 1 2 3 4 5 6 7 8 9 10 11 12 13 36 40 44 48 52 56 60 64 100 104 108 112 116 120 124 128 132 136 140 144 149 153 157 161 165</pre> |

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

## 10. LIST OF TEST EQUIPMENT

### Conducted Test

| Manufacturer    | Model / Equipment                            | Calibration Date | Calibration Interval | Serial No. |
|-----------------|----------------------------------------------|------------------|----------------------|------------|
| Rohde & Schwarz | ENV216 / LISN                                | 09/04/2020       | Annual               | 102245     |
| Rohde & Schwarz | ESCI / Test Receiver                         | 06/10/2020       | Annual               | 100584     |
| ESPAC           | SU-642 / Temperature Chamber                 | 03/18/2020       | Annual               | 0093008124 |
| Agilent         | N9020A / Signal Analyzer                     | 05/11/2020       | Annual               | MY51110085 |
| Agilent         | N9030A / Signal Analyzer                     | 01/13/2020       | Annual               | MY49431210 |
| Rohde & Schwarz | OSP 120 / Power Measurement Set              | 07/02/2020       | Annual               | 101231     |
| Agilent         | N1911A / Power Meter                         | 04/07/2020       | Annual               | MY45100523 |
| Keysight        | N1921A / Power Sensor                        | 06/08/2020       | Annual               | MY57820067 |
| Agilent         | 87300B / Directional Coupler                 | 11/11/2019       | Annual               | 3116A03621 |
| Hewlett Packard | 11667B / Power Splitter                      | 05/25/2020       | Annual               | 05001      |
| Hewlett Packard | E3632A / DC Power Supply                     | 06/12/2020       | Annual               | KR75303960 |
| Agilent         | 8493C / Attenuator(10 dB)                    | 06/26/2020       | Annual               | 07560      |
| Rohde & Schwarz | EMC32 / Software                             | N/A              | N/A                  | N/A        |
| HCT CO., LTD.   | FCC WLAN&BT&BLE Conducted Test Software v3.0 | 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**

| Manufacturer           | Model / Equipment                                       | Calibration Date | Calibration Interval | Serial No.  |
|------------------------|---------------------------------------------------------|------------------|----------------------|-------------|
| Innco system           | CO3000 / Controller(Antenna mast)                       | N/A              | N/A                  | CO3000-4p   |
| Innco system           | MA4640/800-XP-EP / Antenna Position Tower               | N/A              | N/A                  | N/A         |
| Audix                  | EM1000 / Controller                                     | N/A              | N/A                  | 060520      |
| Audix                  | Turn Table                                              | N/A              | N/A                  | N/A         |
| Rohde & Schwarz        | Loop Antenna                                            | 05/18/2020       | Biennial             | 1513-175    |
| Schwarzbeck            | VULB 9168 / Hybrid Antenna                              | 03/22/2019       | Biennial             | 760         |
| Schwarzbeck            | BBHA 9120D / Horn Antenna                               | 04/29/2019       | Biennial             | 9120D-937   |
| Schwarzbeck            | BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)                | 11/29/2019       | Biennial             | BBHA9170541 |
| Rohde & Schwarz        | FSV40-N / Spectrum Analyzer                             | 07/28/2020       | Annual               | 102168      |
| Agilent                | N9030A / Signal Analyzer                                | 01/13/2020       | Annual               | MY49431210  |
| Wainwright Instruments | WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter | 01/21/2020       | Annual               | 2           |
| Wainwright Instruments | WRCJV5100/5850-40/50-8EEK / Band Reject Filter          | 02/10/2020       | Annual               | 1           |
| Wainwright Instruments | WHK3.0/18G-10EF / High Pass Filter                      | 03/02/2020       | Annual               | 8           |
| Wainwright Instruments | WHKX8-6090-7000-18000-40SS/ High Pass Filter            | 03/02/2020       | Annual               | 25          |
| Api tech.              | 18B-03 / Attenuator (3 dB)                              | 03/02/2020       | Annual               | 1           |
| Agilent                | 8493C-10 / Attenuator(10 dB)                            | 03/02/2020       | Annual               | 08285       |
| CERNEX                 | CBLU1183540 / Power Amplifier                           | 03/02/2020       | Annual               | 22964       |
| CERNEX                 | CBL06185030 / Power Amplifier                           | 03/02/2020       | Annual               | 22965       |
| CERNEX                 | CBL18265035 / Power Amplifier                           | 12/26/2019       | Annual               | 22966       |
| CERNEX                 | CBL26405040 / Power Amplifier                           | 03/23/2020       | Annual               | 25956       |

**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-2010-FC007-P |