

FCC DTS REPORT

Certification

Applicant Name: SAMSUNG Electronics Co., Ltd.	Date of Issue: June 15, 2021
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	Report No.: HCT-RF-2105-FC033-R2

FCC ID:	A3LSMG990U
APPLICANT:	SAMSUNG Electronics Co., Ltd.

Model:	SM-G990U
Additional Model:	SM-G990U1/DS, SM-G990U1
EUT Type:	Mobile Phone
Average Output Power:	Ant.1: 802.11b : 19.80 dBm / 802.11g : 16.91 dBm / 802.11n(HT20) : 16.83 dBm Ant.2: 802.11b : 19.59 dBm / 802.11g : 16.51 dBm / 802.11n(HT20) : 16.53 dBm Ant.1&2 : 802.11g : 19.69 dBm / 802.11n(HT20) : 19.58 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-2105-FC033-R2

REVIEWED BY



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Engineer of Telecommunication Testing Center

Report approved by : Jong Seok Lee
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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)

* The report shall not be reproduced except in full(only partly) without approval of the laboratory.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2105-FC033	May 26, 2021	- First Approval Report
HCT-RF-2105-FC033-R1	June 08, 2021	- Revised on Page 5
HCT-RF-2105-FC033-R2	June 15, 2021	- Added the Additional Model.

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1. EUT DESCRIPTION

Model	SM-G990U		
Additional Model	SM-G990U1/DS, SM-G990U1		
EUT Type	Mobile Phone		
Power Supply	DC 3.88 V		
Frequency Range	2 412 MHz ~ 2 462 MHz		
Max. RF Output Power	<u>Peak Power</u> (For information only)	Ant. 1	802.11b : 25.83 dBm (SISO) 802.11g : 24.90 dBm 802.11n(HT20) : 25.73 dBm
		Ant.2	802.11b : 25.81 dBm (SISO) 802.11g : 24.45 dBm 802.11n(HT20) : 24.60 dBm
		Ant.1&2 (MIMO)	802.11g : 27.54 dBm 802.11n(HT20) : 27.81 dBm
	<u>Average Power</u>	Ant. 1	802.11b : 19.80 dBm (SISO) 802.11g : 16.91 dBm 802.11n(HT20) : 16.83 dBm
		Ant.2	802.11b : 19.59 dBm (SISO) 802.11g : 16.51 dBm 802.11n(HT20) : 16.53 dBm
		Ant.1&2 (MIMO)	802.11g : 19.69 dBm 802.11n(HT20) : 19.58 dBm
Modulation Type	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n		
Number of Channels	11 Channels		
Date(s) of Tests	April 01, 2021 ~ May 26, 2021		
Serial number	Radiated: UDE0597M Conducted: UDJ0410M		

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

Non-DBS	5GHz	5GHz	Bluetooth
	WiFi Ant.1	WiFi Ant.2	Ant.1
2.4 GHz WiFi MIMO + 5GHz 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 _{ANT} / N _{SS}	Directional Gain (dBi)
Ant.1	-4.6		
Ant.2	-8.5		

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.

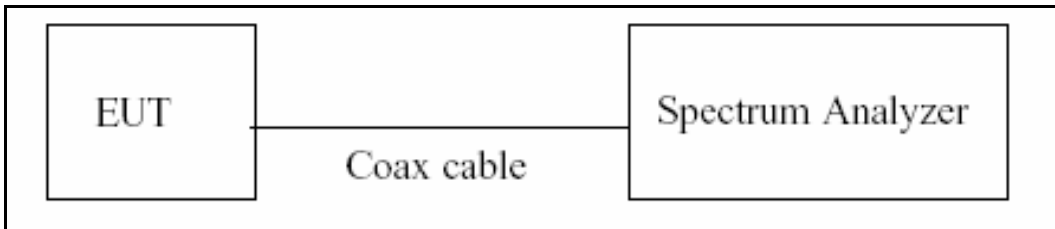
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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 $> 50/T$.

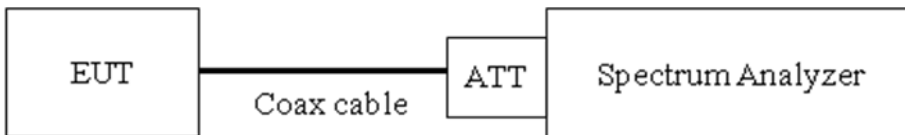
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz (\geq RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/T_{total} and Duty Cycle Factor = $10\log(1/Duty\ Cycle)$

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.

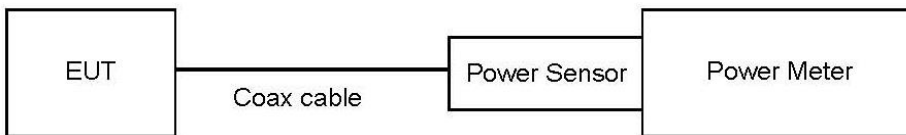
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

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

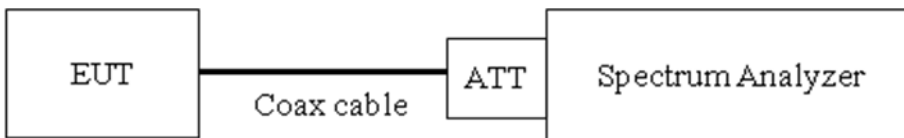
- Conducted Output Power(Peak) = Reading Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

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

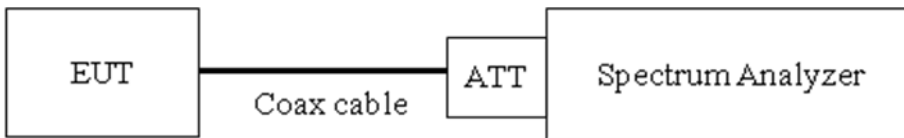
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

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	20.04
100	20.09
200	20.13
300	20.19
400	20.22
500	20.23
600	20.23
700	20.25
800	20.27
900	20.29
1000	20.31
2000	20.46
2400	20.52
2480	20.52
2500	20.52
3000	20.57
4000	20.67
5000	20.75
5150	20.77
5850	20.82
6000	20.82
7000	20.91
8000	20.98
9000	21.05
10000	21.12
11000	21.16
12000	21.24
13000	21.32
14000	21.30
15000	21.32
16000	21.37
17000	21.41
18000	21.47
19000	21.50
20000	21.56
21000	21.77
22000	21.74
23000	21.94
24000	21.77
25000	21.80
26000	21.80

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

2. Factor = Attenuator loss + Cable loss

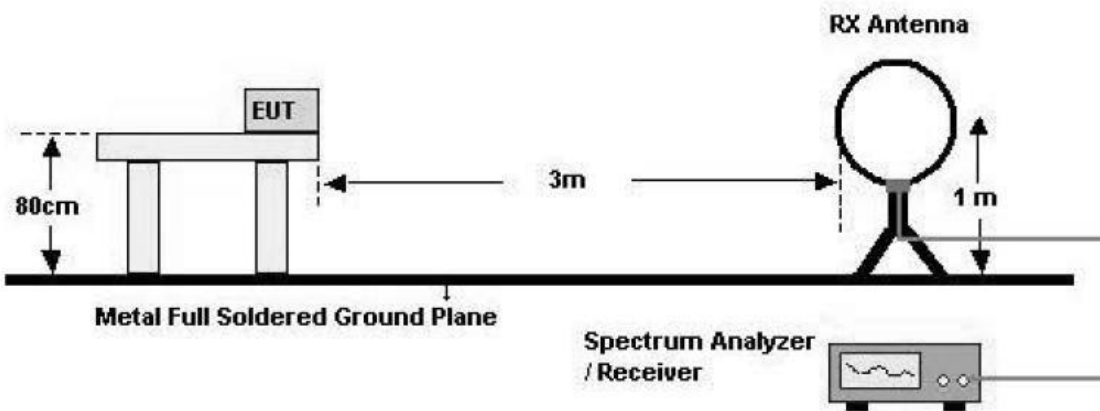
7.6. Radiated Test

Limit

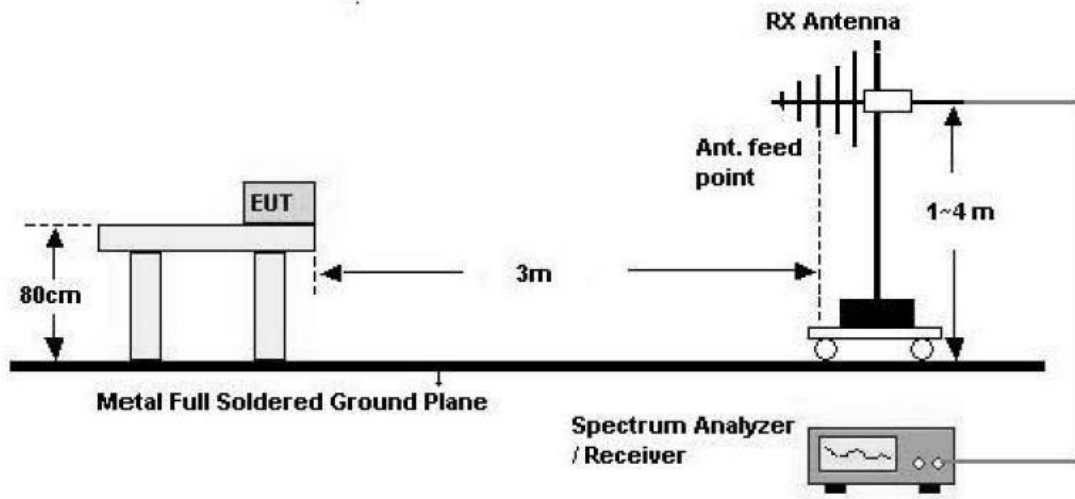
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

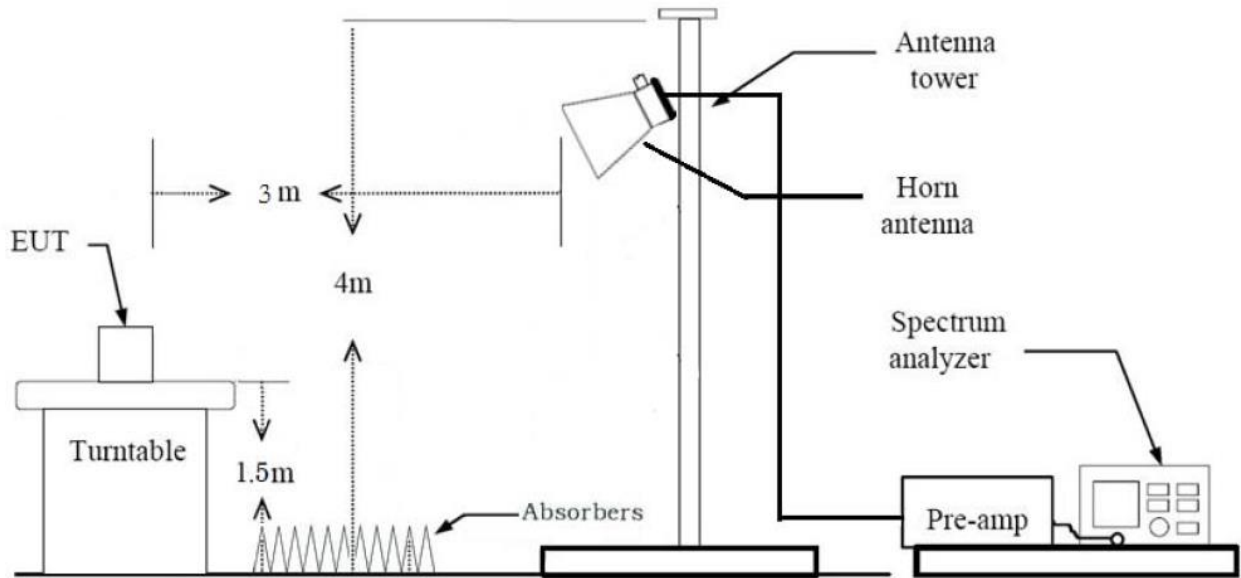
Below 30 MHz



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-G990U, SM-G990U1/DS, SM-G990U1 were tested and the worst case results are reported.
(Worst case : SM-G990U)

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	-
2.4 GHz WiFi + 5GHz WiFi MIMO		On	On	On	Case 1
2.4 GHz WiFi MIMO + 5GHz WiFi MIMO	On	On	On	On	Case 2

Non-DBS	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Bluetooth Ant.1	Test case
5GHz 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-G990U [BT] Test Report.)

Test case	Description	2.4 GHz Emission	5 GHz Emission	Bluetooth Emission
1	Antenna	Ant 2	Ant All	-
	Channel	9	116	-
	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	11	116	-
	Data Rate	6 Mbps	6 Mbps	-
	Mode	802.11g	802.11a	-

Test case	Description	5 GHz Emission	Bluetooth Emission
3	Antenna	Ant All	Ant 1
	Channel	116	78
	Data Rate	6 Mbps	1 Mbps
	Mode	802.11a	$\pi/4$ DQPSK

5. SM-G990U, SM-G990U1/DS, SM-G990U1 were tested and the worst case results are reported.

(Worst case : SM-G990U)

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-G990U, SM-G990U1/DS, SM-G990U1 were tested and the worst case results are reported.

(Worst case : SM-G990U)

Conducted test

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

2. SM-G990U, SM-G990U1/DS, SM-G990U1 were tested and the worst case results are reported.

(Worst case : SM-G990U)

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

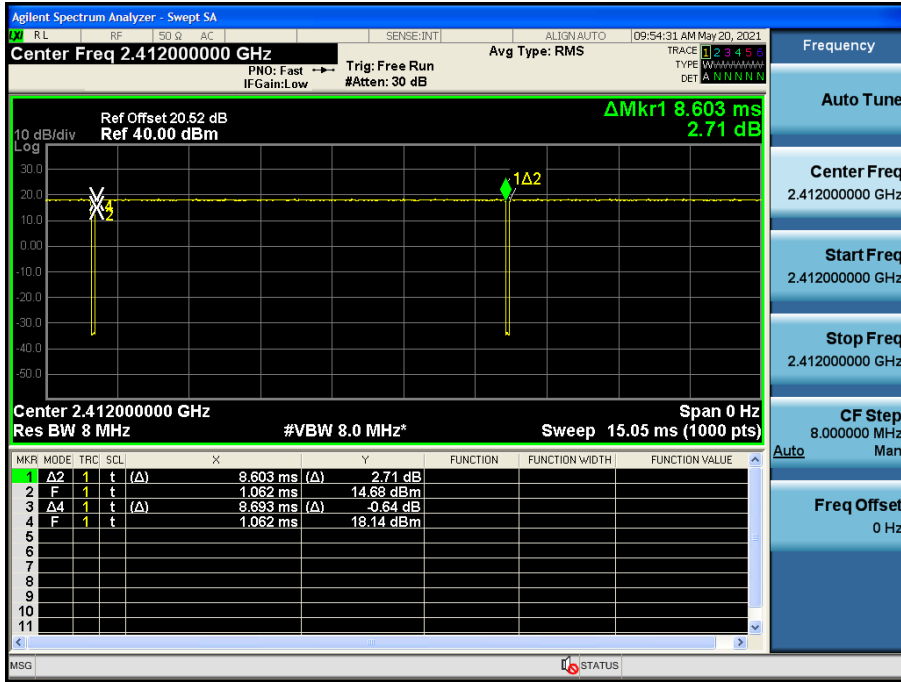
9. TEST RESULT

9.1 DUTY CYCLE

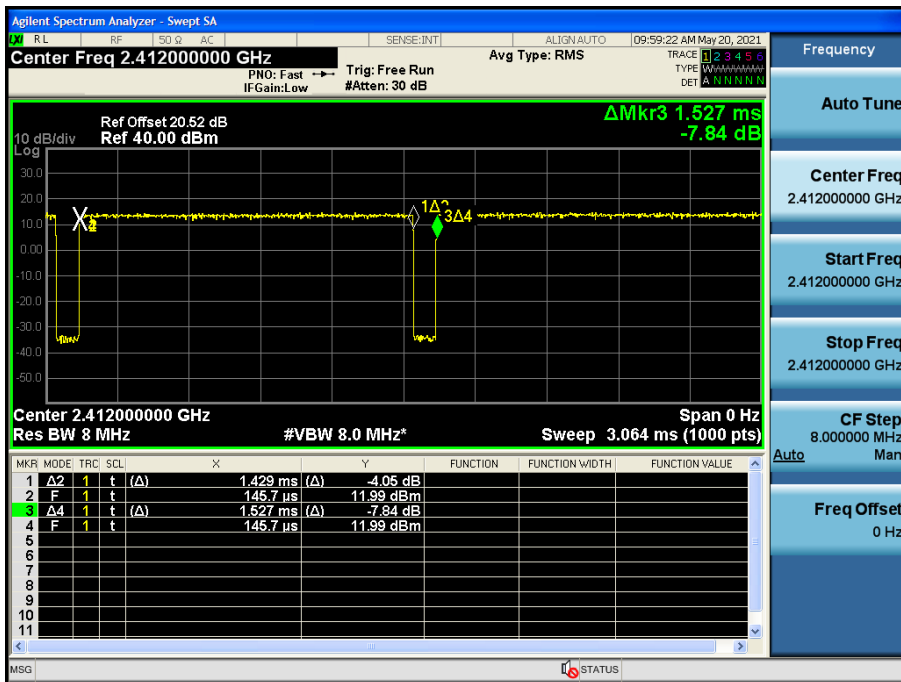
Mode	Data Rate (Mbps)	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	1	8.603	8.693	0.990	0.045
	2	4.309	4.399	0.979	0.090
	5.5	1.626	1.722	0.944	0.250
	11	0.861	0.957	0.899	0.460
802.11g	6	1.429	1.527	0.936	0.288
	9	0.961	1.060	0.906	0.427
	12	0.723	0.823	0.879	0.558
	18	0.492	0.592	0.831	0.803
	24	0.372	0.471	0.790	1.023
	36	0.256	0.355	0.721	1.420
	48	0.196	0.296	0.663	1.783
	54	0.180	0.280	0.644	1.911
802.11n (HT20)	6.5 (MCS0)	1.336	1.433	0.932	0.306
	13 (MCS1)	0.688	0.788	0.873	0.589
	19.5 (MCS2)	0.472	0.572	0.825	0.835
	26 (MCS3)	0.364	0.464	0.784	1.054
	39 (MCS4)	0.256	0.356	0.720	1.429
	52 (MCS5)	0.199	0.300	0.665	1.772
	58.5 (MCS6)	0.184	0.284	0.648	1.881
	65 (MCS7)	0.168	0.268	0.626	2.032

▣ Test Plots

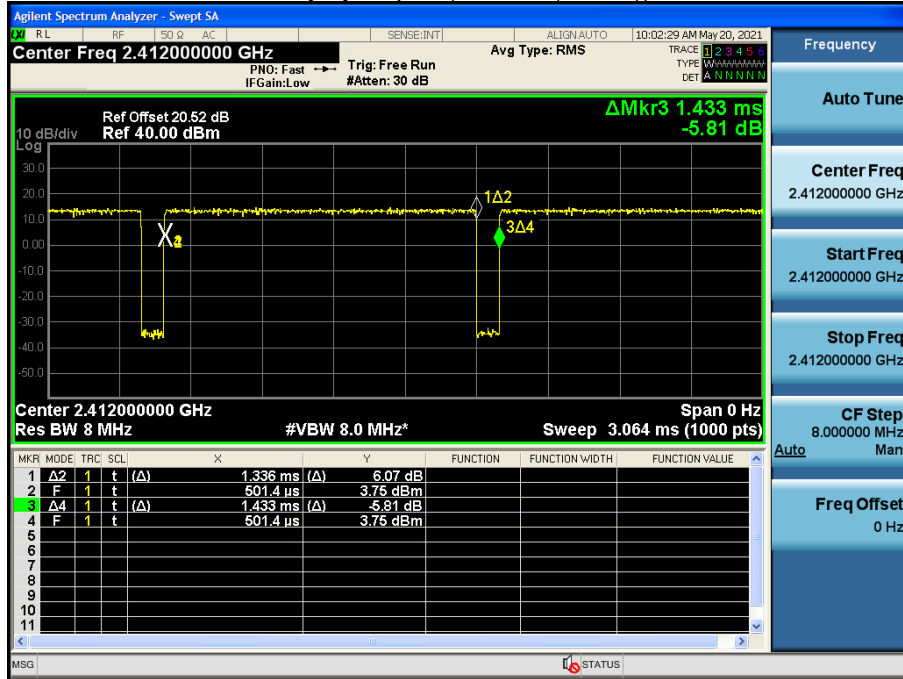
Duty cycle plot (802.11b(1Mbps))



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	7.549	0.5
2447	8	7.122	0.5
2452	9	8.006	0.5
2457	10	7.112	0.5
2462	11	7.589	0.5

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.74	0.5
2437	6	16.09	0.5
2457	10	15.67	0.5
2462	11	15.90	0.5

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.35	0.5
2437	6	16.32	0.5
2457	10	16.35	0.5
2462	11	16.59	0.5

[Ant.2]

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	7.127	0.5
2437	6	7.549	0.5
2447	8	7.588	0.5
2452	9	8.053	0.5
2457	10	7.134	0.5
2462	11	7.128	0.5

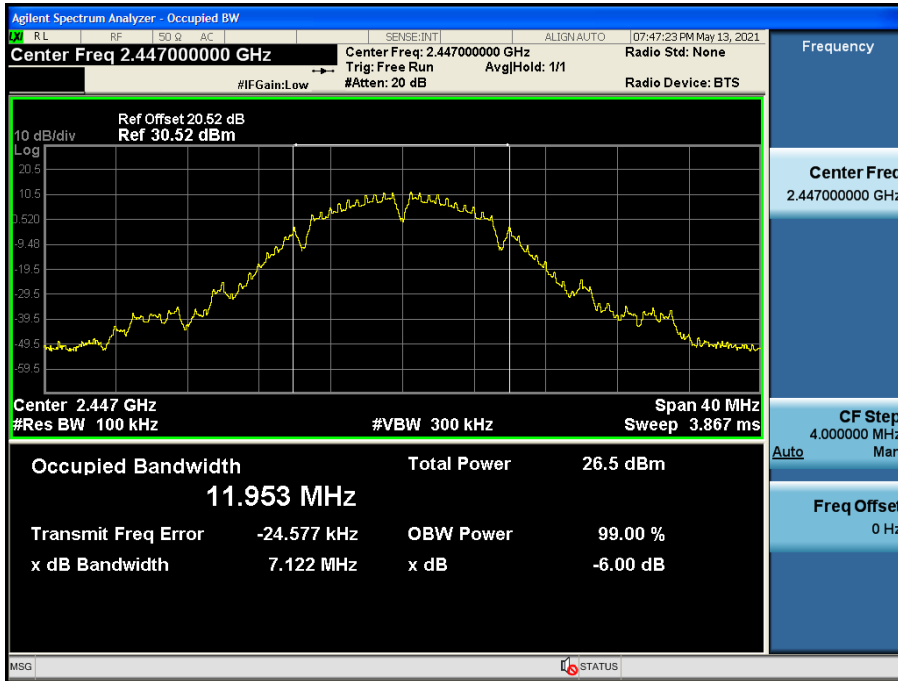
802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.00	0.5
2437	6	16.32	0.5
2457	10	15.89	0.5
2462	11	15.91	0.5

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.76	0.5
2437	6	17.19	0.5
2457	10	16.67	0.5
2462	11	16.39	0.5

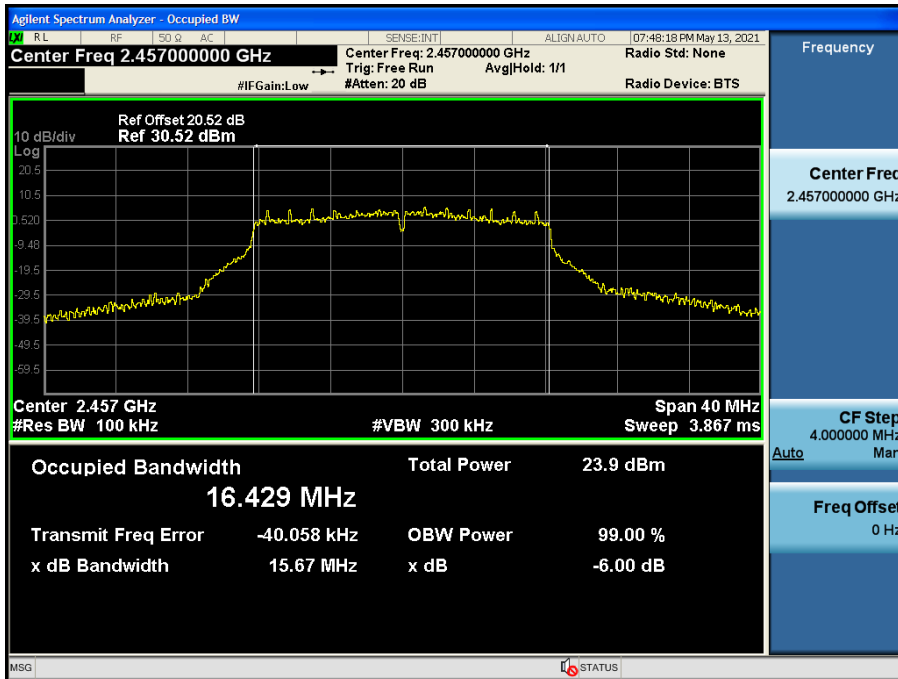
[Ant.1]

☐ Test Plots

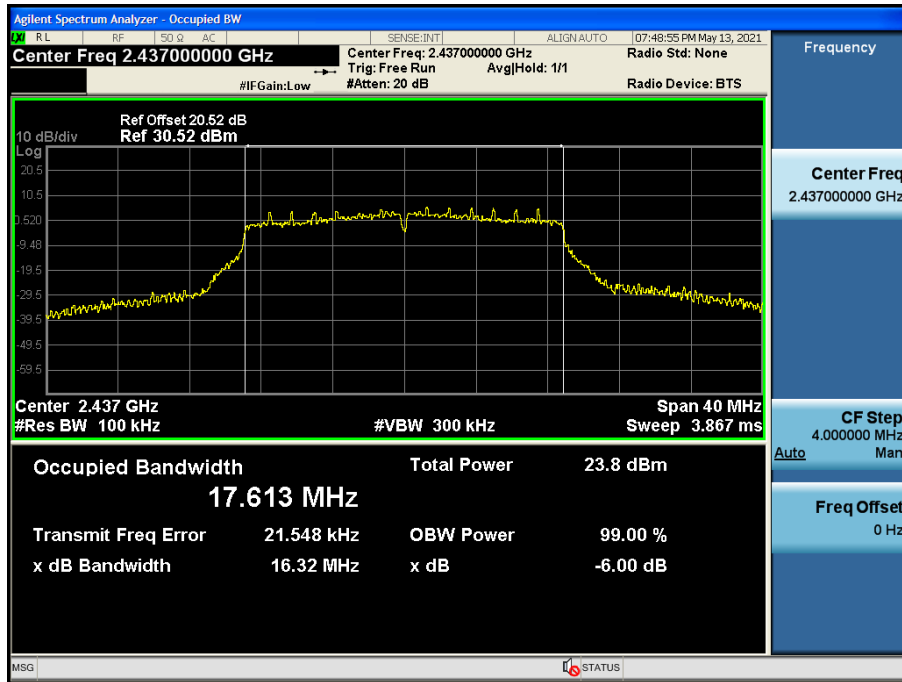
6dB Bandwidth plot (802.11b-CH 8)



6dB Bandwidth plot (802.11g-CH 10)



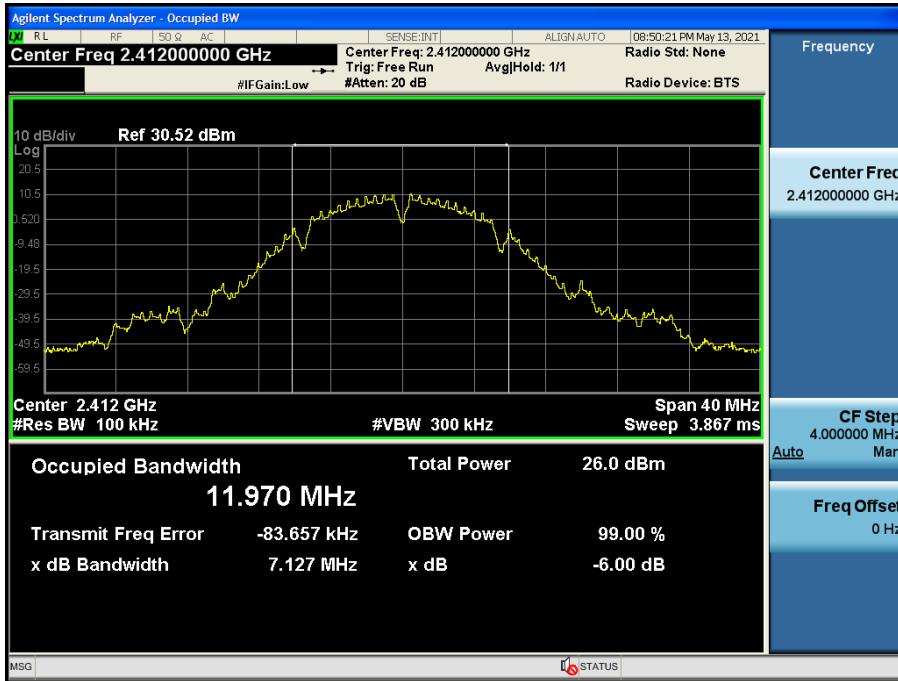
6dB Bandwidth plot (802.11n_HT20-CH 6)



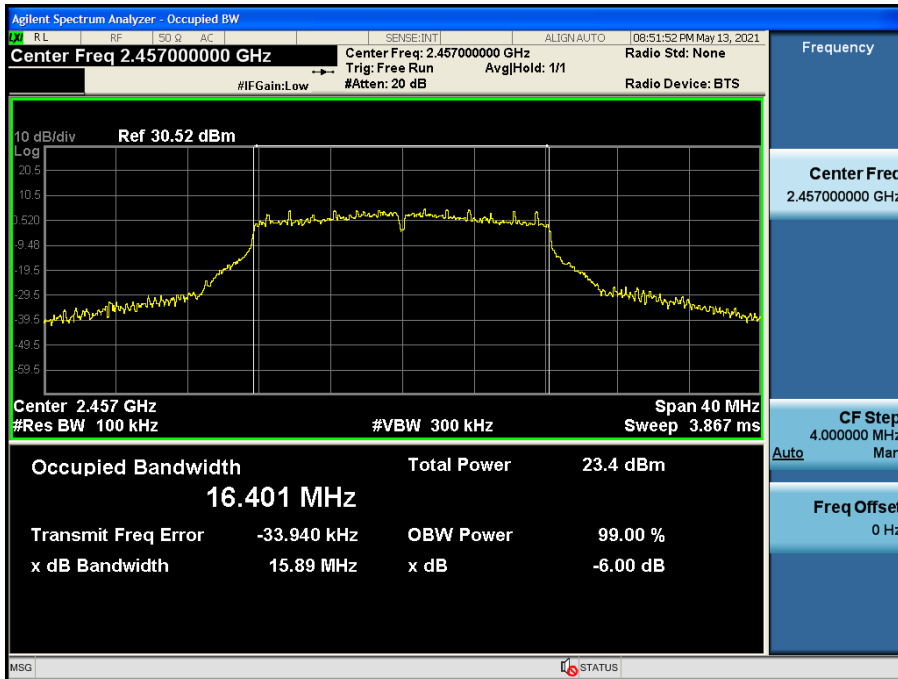
[Ant.2]

☐ Test Plots

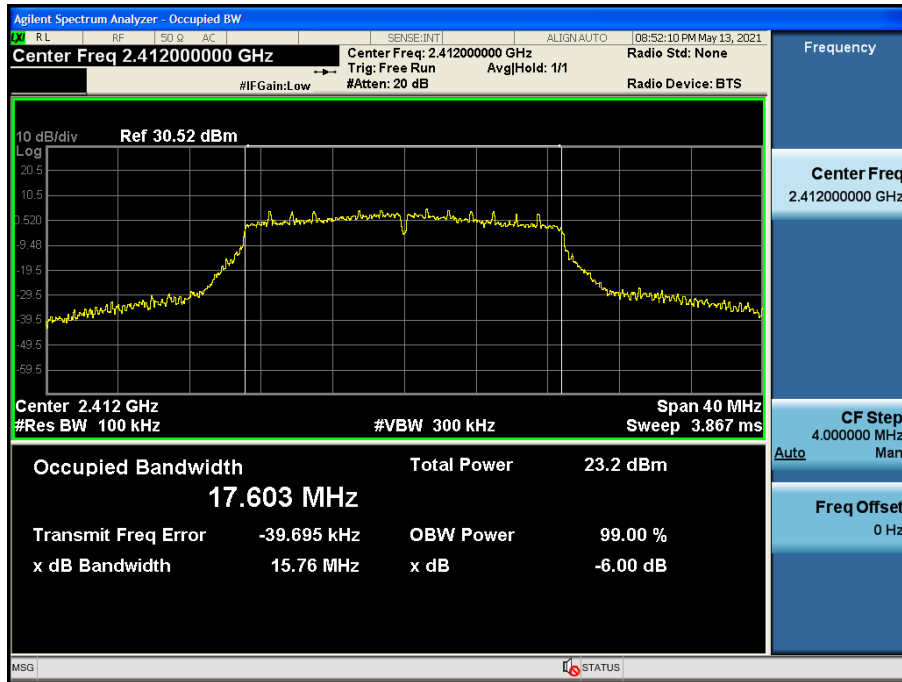
6dB Bandwidth plot (802.11b-CH 1)



6dB Bandwidth plot (802.11g-CH 10)



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, 20.52 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	21.73	30	19
		2	22.13		
		5.5	24.20		
		11	25.83		
2437	6	1	21.71		
		2	22.21		
		5.5	24.12		
		11	25.62		
2447	8	1	21.23		
		2	21.72		
		5.5	23.64		
		11	25.28		
2452	9	1	21.91		
		2	22.21		
		5.5	24.23		
		11	25.73		
2457	10	1	20.38	18	
		2	20.72		
		5.5	22.27		
		11	23.93		
2462	11	1	20.19		
		2	20.60		
		5.5	22.46		
		11	23.88		

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.				
2412	1	6	24.43	30	16
		9	24.23		
		12	24.55		
		18	23.70		
		24	24.03		
		36	24.15		
		48	24.19		
		54	24.37		
2437	6	6	24.83		
		9	24.50		
		12	24.72		
		18	24.41		
		24	24.65		
		36	24.90		
		48	24.84		
		54	24.59		
2457	10	6	24.74		
		9	24.61		
		12	24.63		
		18	24.10		
		24	24.42		
		36	24.48		
		48	24.70		
		54	24.44		
2462	11	6	22.24	14	
		9	22.10		
		12	22.39		
		18	21.95		
		24	22.26		
		36	22.52		
		48	22.73		
		54	22.45		

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.				
2412	1	0	23.97	30	16
		1	24.05		
		2	24.12		
		3	24.61		
		4	24.55		
		5	24.50		
		6	24.43		
		7	24.21		
2437	6	0	24.57		
		1	24.77		
		2	24.68		
		3	24.86		
		4	24.90		
		5	24.70		
		6	24.90		
		7	25.73		
2457	10	0	24.30		
		1	24.43		
		2	24.38		
		3	24.85		
		4	24.67		
		5	24.79		
		6	24.76		
		7	24.74		
2462	11	0	21.29		13
		1	21.35		
		2	21.41		
		3	21.72		
		4	21.60		
		5	21.72		
		6	21.67		
		7	21.37		

[Ant.2]

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.				
2412	1	1	20.90	30	19
		2	21.29		
		5.5	23.20		
		11	24.67		
2437	6	1	21.15		
		2	21.41		
		5.5	23.51		
		11	24.88		
2447	8	1	21.30		
		2	22.13		
		5.5	23.95		
		11	25.46		
2452	9	1	21.55		
		2	22.19		
		5.5	24.22		
		11	25.81		
2457	10	1	20.03	18	
		2	20.50		
		5.5	22.44		
		11	23.77		
2462	11	1	20.02		
		2	20.47		
		5.5	22.61		
		11	24.10		

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.				
2412	1	6	24.29	30	16
		9	24.20		
		12	24.44		
		18	23.76		
		24	24.02		
		36	24.17		
		48	24.45		
		54	24.42		
2437	6	6	23.49		
		9	23.51		
		12	23.59		
		18	23.09		
		24	23.41		
		36	23.51		
		48	23.37		
2457	10	6	24.32		
		9	24.19		
		12	24.40		
		18	23.74		
		24	24.11		
		36	24.34		
		48	24.31		
		54	24.07		
2462	11	6	21.86		14
		9	21.62		
		12	22.10		
		18	21.34		
		24	21.70		
		36	21.85		
		48	21.87		
		54	21.81		

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.				
2412	1	0	24.05	30	16
		1	24.05		
		2	23.99		
		3	24.54		
		4	24.17		
		5	24.38		
		6	24.47		
		7	24.25		
2437	6	0	23.29		
		1	23.44		
		2	23.29		
		3	23.67		
		4	23.68		
		5	23.76		
		6	23.69		
		7	23.60		
2457	10	0	24.18		
		1	24.20		
		2	24.09		
		3	24.53		
		4	24.43		
		5	24.34		
		6	24.60		
		7	24.38		
2462	11	0	21.20		13
		1	20.79		
		2	20.92		
		3	21.37		
		4	21.10		
		5	21.21		
		6	21.12		
		7	21.02		

[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	24.43	24.29	27.37	30	16
		9	24.23	24.20	27.22		
		12	24.55	24.44	27.51		
		18	23.70	23.76	26.74		
		24	24.03	24.02	27.04		
		36	24.15	24.17	27.17		
		48	24.19	24.45	27.33		
		54	24.37	24.42	27.41		
2437	6	6	24.83	23.49	27.22		
		9	24.50	23.51	27.04		
		12	24.72	23.59	27.20		
		18	24.41	23.09	26.81		
		24	24.65	23.41	27.08		
		36	24.90	23.51	27.27		
		48	24.84	23.37	27.18		
		54	24.59	23.44	27.06		
2457	10	6	24.74	24.32	27.54		
		9	24.61	24.19	27.41		
		12	24.63	24.40	27.52		
		18	24.10	23.74	26.93		
		24	24.42	24.11	27.28		
		36	24.48	24.34	27.42		
		48	24.70	24.31	27.52		
		54	24.44	24.07	27.27		
2462	11	6	22.24	21.86	25.06	14	
		9	22.10	21.62	24.88		
		12	22.39	22.10	25.26		
		18	21.95	21.34	24.66		
		24	22.26	21.70	25.00		
		36	22.52	21.85	25.21		
		48	22.73	21.87	25.33		
		54	22.45	21.81	25.15		

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	23.97	24.05	27.03	30	16	
		1	24.05	24.05	27.06			
		2	24.12	23.99	27.07			
		3	24.61	24.54	27.58			
		4	24.55	24.17	27.37			
		5	24.50	24.38	27.45			
		6	24.43	24.47	27.46			
		7	24.21	24.25	27.24			
2437	6	0	24.57	23.29	26.99			
		1	24.77	23.44	27.16			
		2	24.68	23.29	27.05			
		3	24.86	23.67	27.31			
		4	24.90	23.68	27.34			
		5	24.70	23.76	27.27			
		6	24.90	23.69	27.35			
		7	25.73	23.60	27.81			
2457	10	0	24.30	24.18	27.25			
		1	24.43	24.20	27.33			
		2	24.38	24.09	27.25			
		3	24.85	24.53	27.70			
		4	24.67	24.43	27.57			
		5	24.79	24.34	27.58			
		6	24.76	24.60	27.69			
		7	24.74	24.38	27.57			
2462	11	0	21.29	21.20	24.26			13
		1	21.35	20.79	24.09			
		2	21.41	20.92	24.18			
		3	21.72	21.37	24.56			
		4	21.60	21.10	24.37			
		5	21.72	21.21	24.48			
		6	21.67	21.12	24.41			
		7	21.37	21.02	24.20			

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, 20.52 dB is offset for 2.4 GHz Band.

[Ant.1]

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	1	19.08	0.045	19.12	30	19
		2	19.21	0.090	19.30		
		5.5	19.51	0.250	19.76		
		11	19.20	0.460	19.66		
2437	6	1	19.25	0.045	19.30		
		2	19.27	0.090	19.36		
		5.5	19.55	0.250	19.80		
		11	19.11	0.460	19.57		
2447	8	1	19.16	0.045	19.21		
		2	19.17	0.090	19.26		
		5.5	19.10	0.250	19.35		
		11	18.83	0.460	19.29		
2452	9	1	19.15	0.045	19.20		
		2	19.07	0.090	19.16		
		5.5	19.34	0.250	19.59		
		11	19.08	0.460	19.54		
2457	10	1	17.67	0.045	17.72	18	
		2	17.62	0.090	17.71		
		5.5	17.77	0.250	18.02		
		11	17.50	0.460	17.96		
2462	11	1	17.35	0.045	17.39		
		2	17.38	0.090	17.47		
		5.5	17.61	0.250	17.86		
		11	17.35	0.460	17.81		

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	6	16.57	0.288	16.86	30	16
		9	16.18	0.427	16.61		
		12	15.96	0.558	16.52		
		18	15.43	0.803	16.24		
		24	15.16	1.023	16.18		
		36	14.79	1.420	16.21		
		48	14.28	1.783	16.06		
		54	14.48	1.911	16.39		
2437	6	6	16.63	0.288	16.91		
		9	16.32	0.427	16.74		
		12	16.15	0.558	16.71		
		18	16.03	0.803	16.83		
		24	15.58	1.023	16.61		
		36	15.43	1.420	16.85		
		48	14.80	1.783	16.58		
		54	14.62	1.911	16.53		
2457	10	6	16.36	0.288	16.65		
		9	16.34	0.427	16.76		
		12	16.17	0.558	16.73		
		18	15.95	0.803	16.75		
		24	15.55	1.023	16.58		
		36	15.14	1.420	16.56		
		48	14.93	1.783	16.71		
		54	14.60	1.911	16.51		
2462	11	6	14.08	0.288	14.37	14	
		9	13.91	0.427	14.33		
		12	13.69	0.558	14.24		
		18	13.48	0.803	14.28		
		24	13.10	1.023	14.12		
		36	12.91	1.420	14.34		
		48	12.31	1.783	14.09		
		54	12.40	1.911	14.31		

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	0	16.31	0.306	16.62	30	16
		1	15.55	0.589	16.14		
		2	15.37	0.835	16.20		
		3	15.39	1.054	16.45		
		4	14.89	1.429	16.32		
		5	14.60	1.772	16.37		
		6	14.48	1.881	16.36		
2437	6	7	14.03	2.032	16.06		
		0	16.52	0.306	16.83		
		1	16.14	0.589	16.73		
		2	15.95	0.835	16.79		
		3	15.64	1.054	16.69		
		4	15.29	1.429	16.72		
		5	14.72	1.772	16.49		
2457	10	6	14.85	1.881	16.73		
		7	14.77	2.032	16.80		
		0	16.42	0.306	16.73		
		1	15.97	0.589	16.56		
		2	15.69	0.835	16.52		
		3	15.13	1.054	16.19		
		4	15.11	1.429	16.54		
2462	11	5	14.67	1.772	16.44		
		6	14.55	1.881	16.43		
		7	14.47	2.032	16.50		
		0	13.28	0.306	13.58		
		1	12.84	0.589	13.43		
		2	12.55	0.835	13.38		
		3	12.38	1.054	13.44		
4	11.88	1.429	13.31				
5	11.66	1.772	13.43				
6	11.52	1.881	13.40				
7	11.08	2.032	13.11				

[Ant.2]

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	1	18.28	0.045	18.33	30	19
		2	18.40	0.090	18.49		
		5.5	18.58	0.250	18.83		
		11	18.27	0.460	18.73		
2437	6	1	18.64	0.045	18.69		
		2	18.45	0.090	18.54		
		5.5	18.81	0.250	19.06		
		11	18.45	0.460	18.91		
2447	8	1	18.64	0.045	18.68		
		2	18.99	0.090	19.08		
		5.5	19.34	0.250	19.59		
		11	18.93	0.460	19.39		
2452	9	1	18.63	0.045	18.67		
		2	18.96	0.090	19.05		
		5.5	19.27	0.250	19.52		
		11	18.98	0.460	19.44		
2457	10	1	17.72	0.045	17.76	18	
		2	17.61	0.090	17.70		
		5.5	17.89	0.250	18.14		
		11	17.35	0.460	17.81		
2462	11	1	17.56	0.045	17.61		
		2	17.59	0.090	17.68		
		5.5	18.01	0.250	18.26		
		11	17.68	0.460	18.14		

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting
Frequency [MHz]	Channel No.						
2412	1	6	16.21	0.288	16.50	30	16
		9	16.01	0.427	16.44		
		12	15.80	0.558	16.36		
		18	15.39	0.803	16.19		
		24	15.13	1.023	16.16		
		36	14.77	1.420	16.19		
		48	14.49	1.783	16.27		
		54	14.46	1.911	16.37		
2437	6	6	15.33	0.288	15.62		
		9	15.02	0.427	15.45		
		12	14.92	0.558	15.47		
		18	14.64	0.803	15.44		
		24	14.49	1.023	15.51		
		36	14.01	1.420	15.43		
		48	13.53	1.783	15.31		
		54	13.42	1.911	15.33		
2457	10	6	16.22	0.288	16.51		
		9	15.98	0.427	16.41		
		12	15.57	0.558	16.13		
		18	15.42	0.803	16.22		
		24	15.24	1.023	16.26		
		36	14.84	1.420	16.26		
		48	14.43	1.783	16.21		
		54	14.19	1.911	16.10		
2462	11	6	13.63	0.288	13.92	14	
		9	13.46	0.427	13.88		
		12	13.18	0.558	13.73		
		18	13.05	0.803	13.85		
		24	12.83	1.023	13.85		
		36	12.44	1.420	13.87		
		48	12.06	1.783	13.85		
		54	11.93	1.911	13.84		

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)	Power Level Setting	
Frequency [MHz]	Channel No.							
2412	1	0	16.22	0.306	16.53	30	16	
		1	15.56	0.589	16.15			
		2	15.33	0.835	16.16			
		3	15.24	1.054	16.30			
		4	14.65	1.429	16.08			
		5	14.42	1.772	16.19			
		6	14.33	1.881	16.21			
7	14.30	2.032	16.34					
2437	6	0	15.31	0.306	15.61			
		1	14.71	0.589	15.30			
		2	14.41	0.835	15.25			
		3	14.34	1.054	15.39			
		4	13.91	1.429	15.34			
		5	13.71	1.772	15.48			
		6	13.41	1.881	15.29			
7	13.26	2.032	15.29					
2457	10	0	15.91	0.306	16.22			
		1	15.57	0.589	16.16			
		2	15.35	0.835	16.18			
		3	15.03	1.054	16.09			
		4	14.75	1.429	16.18			
		5	14.31	1.772	16.09			
		6	14.25	1.881	16.13			
7	14.13	2.032	16.16					
2462	11	0	12.84	0.306	13.15			13
		1	12.31	0.589	12.90			
		2	12.28	0.835	13.11			
		3	11.98	1.054	13.03			
		4	11.43	1.429	12.86			
		5	11.18	1.772	12.95			
		6	11.02	1.881	12.90			
7	10.83	2.032	12.86					

[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	16.86	16.50	19.69	30	16
		9	16.61	16.44	19.53		
		12	16.52	16.36	19.45		
		18	16.24	16.19	19.22		
		24	16.18	16.16	19.18		
		36	16.21	16.19	19.21		
		48	16.06	16.27	19.18		
		54	16.39	16.37	19.39		
2437	6	6	16.91	15.62	19.32		
		9	16.74	15.45	19.15		
		12	16.71	15.47	19.15		
		18	16.83	15.44	19.20		
		24	16.61	15.51	19.10		
		36	16.85	15.43	19.21		
		48	16.58	15.31	19.00		
		54	16.53	15.33	18.98		
2457	10	6	16.65	16.51	19.59		
		9	16.76	16.41	19.60		
		12	16.73	16.13	19.45		
		18	16.75	16.22	19.50		
		24	16.58	16.26	19.43		
		36	16.56	16.26	19.42		
		48	16.71	16.21	19.48		
		54	16.51	16.10	19.32		
2462	11	6	14.37	13.92	17.16		14
		9	14.33	13.88	17.12		
		12	14.24	13.73	17.01		
		18	14.28	13.85	17.08		
		24	14.12	13.85	17.00		
		36	14.34	13.87	17.12		
		48	14.09	13.85	16.98		
		54	14.31	13.84	17.09		

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	16.62	16.53	19.58	30	16
		1	16.14	16.15	19.16		
		2	16.20	16.16	19.19		
		3	16.45	16.30	19.38		
		4	16.32	16.08	19.21		
		5	16.37	16.19	19.29		
		6	16.36	16.21	19.30		
		7	16.06	16.34	19.21		
2437	6	0	16.83	15.61	19.27		
		1	16.73	15.30	19.08		
		2	16.79	15.25	19.10		
		3	16.69	15.39	19.10		
		4	16.72	15.34	19.10		
		5	16.49	15.48	19.02		
		6	16.73	15.29	19.08		
		7	16.80	15.29	19.12		
2457	10	0	16.73	16.22	19.49		
		1	16.56	16.16	19.38		
		2	16.52	16.18	19.37		
		3	16.19	16.09	19.15		
		4	16.54	16.18	19.37		
		5	16.44	16.09	19.28		
		6	16.43	16.13	19.29		
		7	16.50	16.16	19.34		
2462	11	0	13.58	13.15	16.38	13	
		1	13.43	12.90	16.18		
		2	13.38	13.11	16.26		
		3	13.44	13.03	16.25		
		4	13.31	12.86	16.10		
		5	13.43	12.95	16.21		
		6	13.40	12.90	16.17		
		7	13.11	12.86	16.00		

9.4 POWER SPECTRAL DENSITY

[Ant.1]

Mode	Frequency (MHz)	Channel No.	Test Result			
			Measured PSD (dBm)	Duty Cycle Factor	Measured PSD(dBm) + Duty Cycle Factor	Limit (dBm)
802.11b	2412	1	-2.104	0.944	-1.160	8 dBm / 3 kHz
	2437	6	-2.365	0.944	-1.421	
	2447	8	-2.559	0.944	-1.615	
	2452	9	-2.346	0.944	-1.402	
	2457	10	-3.636	0.944	-2.692	
	2462	11	-4.120	0.944	-3.176	
802.11g	2412	1	-6.484	0.936	-5.548	
	2437	6	-5.793	0.936	-4.857	
	2457	10	-6.258	0.936	-5.322	
	2462	11	-8.711	0.936	-7.775	
802.11n(HT20)	2412	1	-7.169	0.932	-6.237	
	2437	6	-7.144	0.932	-6.212	
	2457	10	-6.991	0.932	-6.059	
	2462	11	-10.158	0.932	-9.226	

[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	-2.904	0.944	-1.960	8 dBm / 3 kHz
	2437	6	-3.048	0.944	-2.104	
	2447	8	-3.177	0.944	-2.233	
	2452	9	-2.512	0.944	-1.568	
	2457	10	-4.070	0.944	-3.126	
	2462	11	-3.665	0.944	-2.721	
802.11g	2412	1	-6.634	0.936	-5.698	
	2437	6	-7.712	0.936	-6.776	
	2457	10	-6.136	0.936	-5.200	
	2462	11	-9.333	0.936	-8.397	
802.11n(HT20)	2412	1	-7.084	0.932	-6.152	
	2437	6	-8.620	0.932	-7.688	
	2457	10	-7.469	0.932	-6.537	
	2462	11	-10.672	0.932	-9.740	

[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	-5.548	-5.698	-2.612	8 dBm / 3 kHz
	2437	6	-4.857	-6.776	-2.701	
	2457	10	-5.322	-5.200	-2.251	
	2462	11	-7.775	-8.397	-5.065	
802.11n	2412	1	-6.237	-6.152	-3.184	
	2437	6	-6.212	-7.688	-3.877	
	2457	10	-6.059	-6.537	-3.281	
	2462	11	-9.226	-9.740	-6.465	

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.

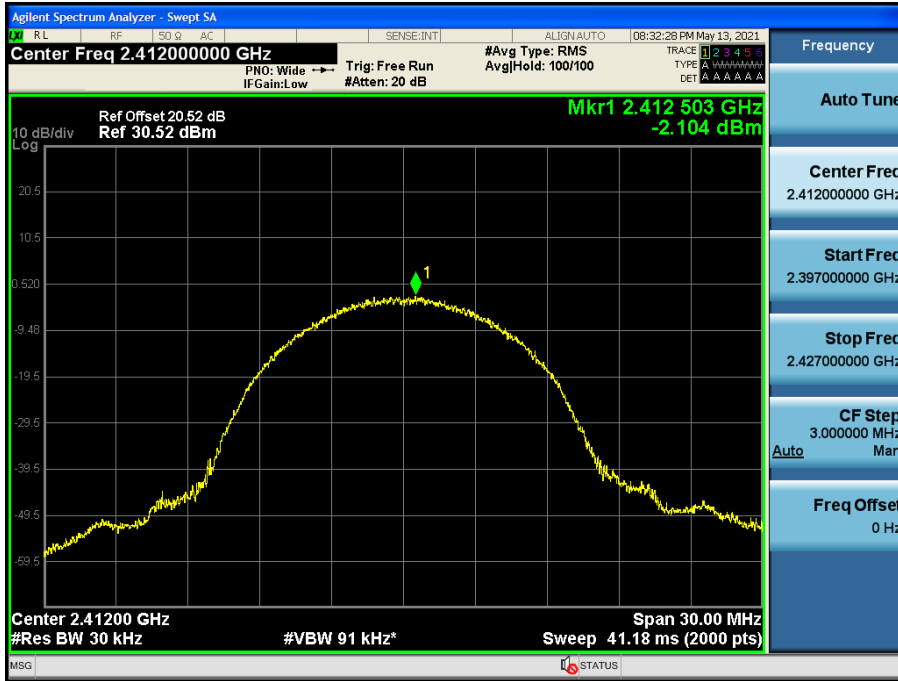
2. Spectrum offset = Attenuator loss(20 dB) + Cable loss

3. 20.52 dB is offset for 2.4 GHz Band.

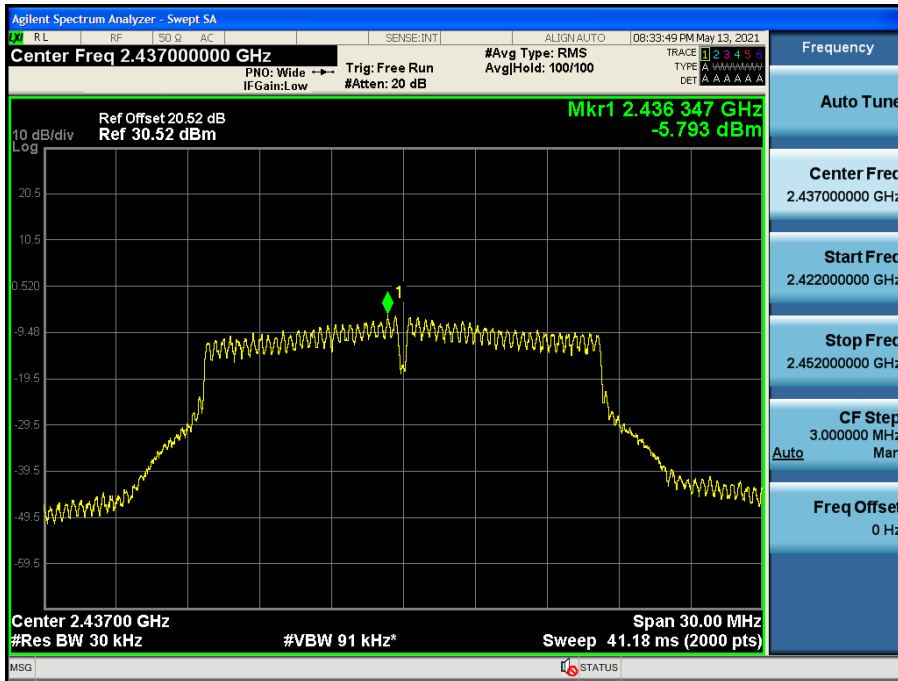
[Ant.1]

▣ Test Plots

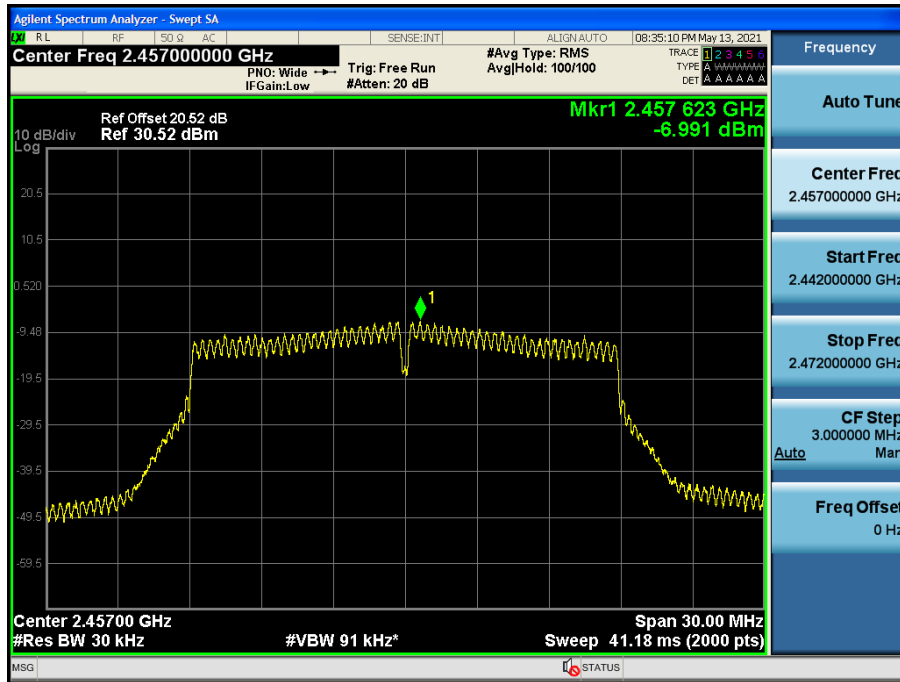
Power Spectral Density (802.11b-CH 1)



Power Spectral Density (802.11g-CH 6)



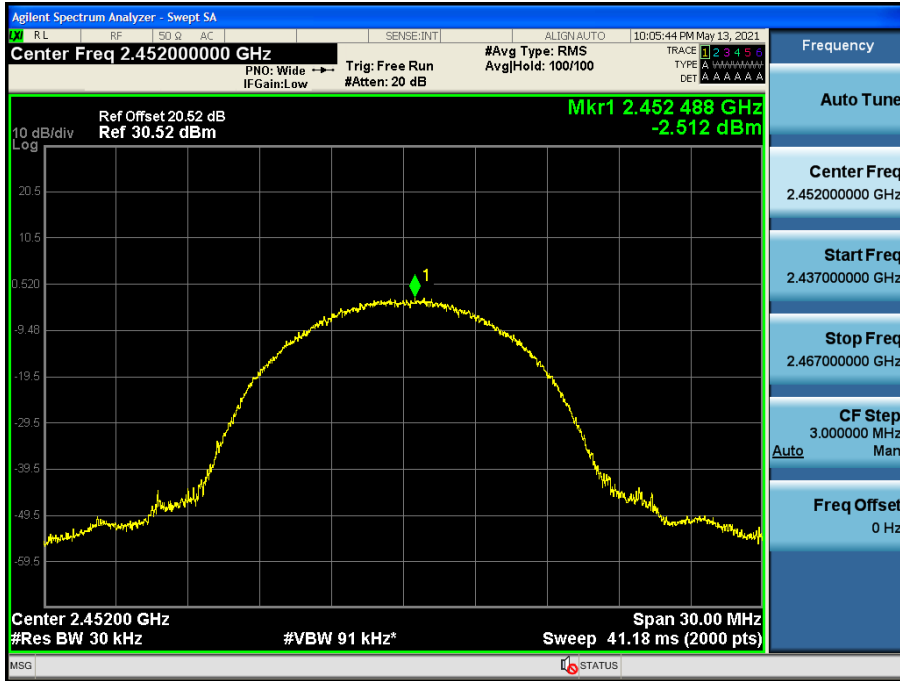
Power Spectral Density (802.11n_HT20 -CH 10)



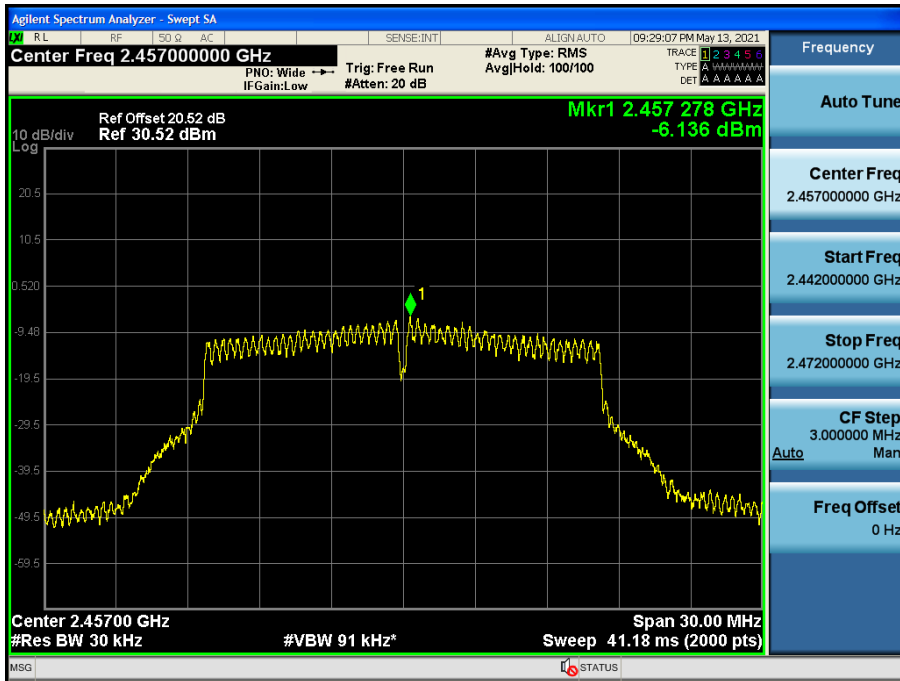
[Ant.2]

▣ Test Plots

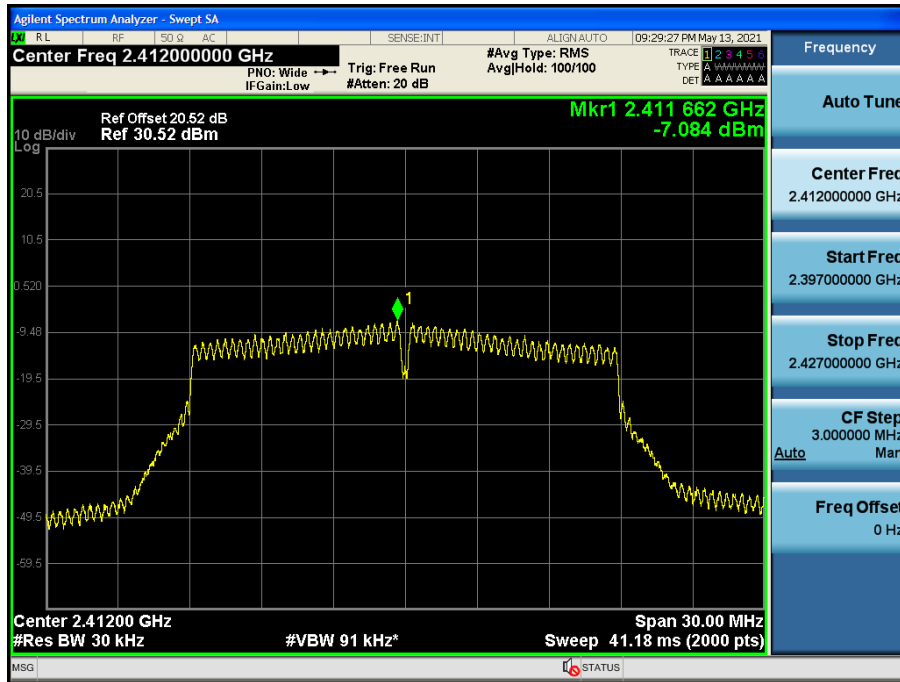
Power Spectral Density (802.11b-CH 9)



Power Spectral Density (802.11g-CH 10)



Power Spectral Density (802.11n_HT20 -CH 1)



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]

Frequency [MHz]	Channel No.	Mode	Band Edge Position	Test Result	
				Measured Level (dB)	Limit (dB)
2412	1	802.11b	Lower	43.978	30
2462	11		Upper	62.008	30
2412	1	802.11g	Lower	33.312	30
2457	10		Upper	54.160	30
2462	11		Upper	50.506	30
2412	1	802.11n (HT20)	Lower	34.870	30
2457	10		Upper	53.055	30
2462	11		Upper	48.003	30

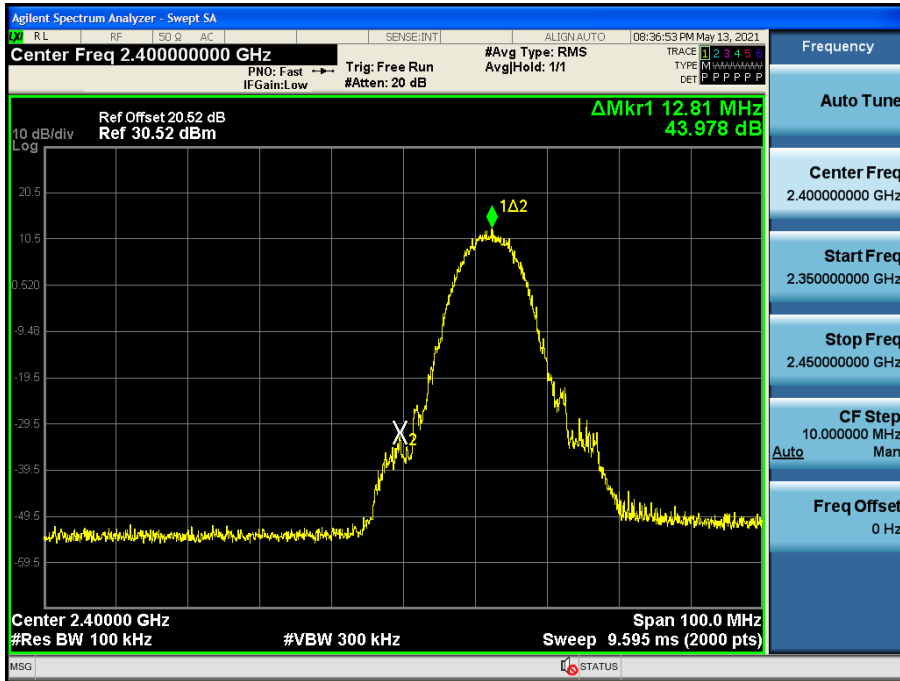
[Ant.2]

Frequency [MHz]	Channel No.	Mode	Band Edge Position	Test Result	
				Measured Level (dB)	Limit (dB)
2412	1	802.11b	Lower	47.271	30
2462	11		Upper	60.816	30
2412	1	802.11g	Lower	34.111	30
2457	10		Upper	54.193	30
2462	11		Upper	50.565	30
2412	1	802.11n (HT20)	Lower	31.347	30
2457	10		Upper	53.509	30
2462	11		Upper	47.002	30

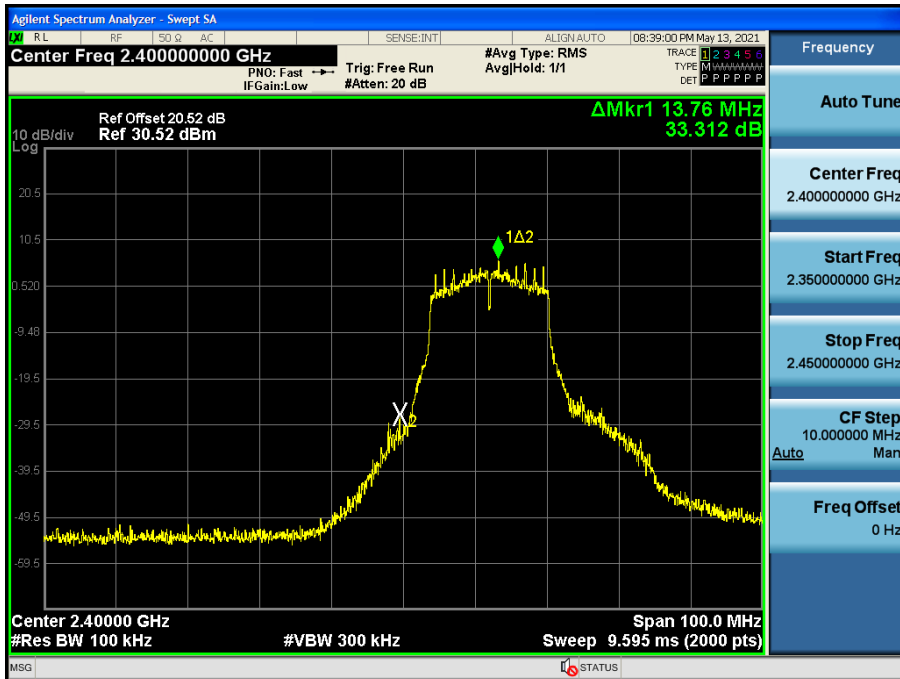
▣ Test Plots(BandEdge)

[Ant.1]

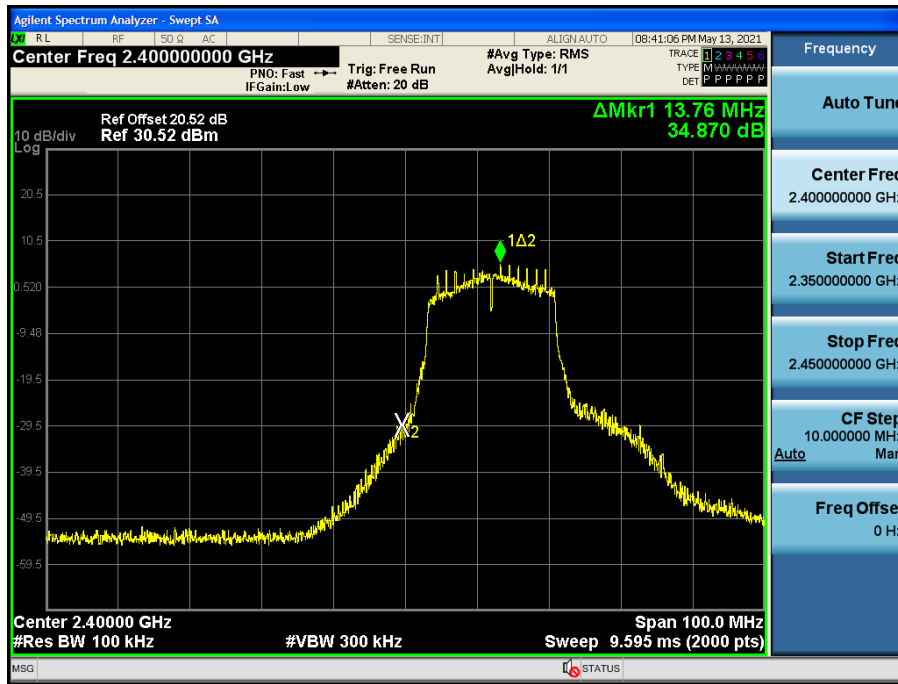
Band Edge (802.11b-CH1)



Band Edge (802.11g-CH1)



Band Edge (802.11n(HT20)-CH1)

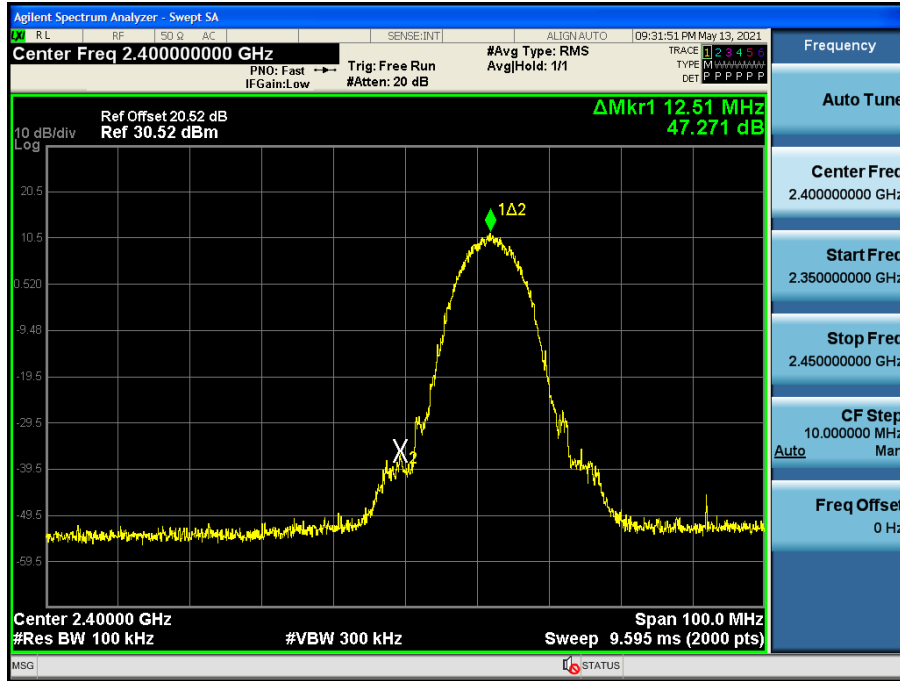


Note :

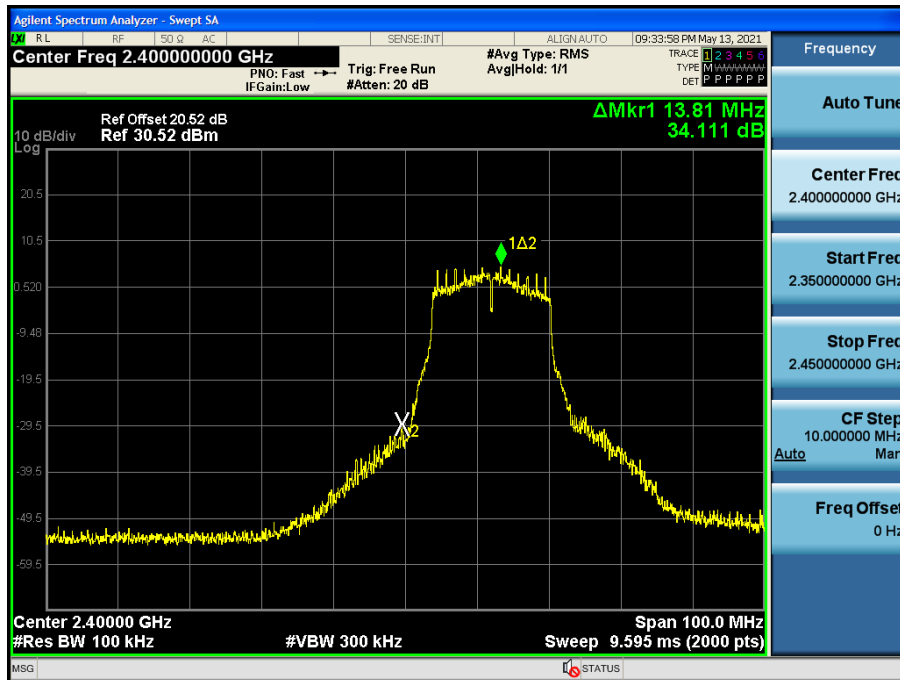
In order to simplify the report, attached plots were only the worstcase Band Edge channel.

[Ant.2]

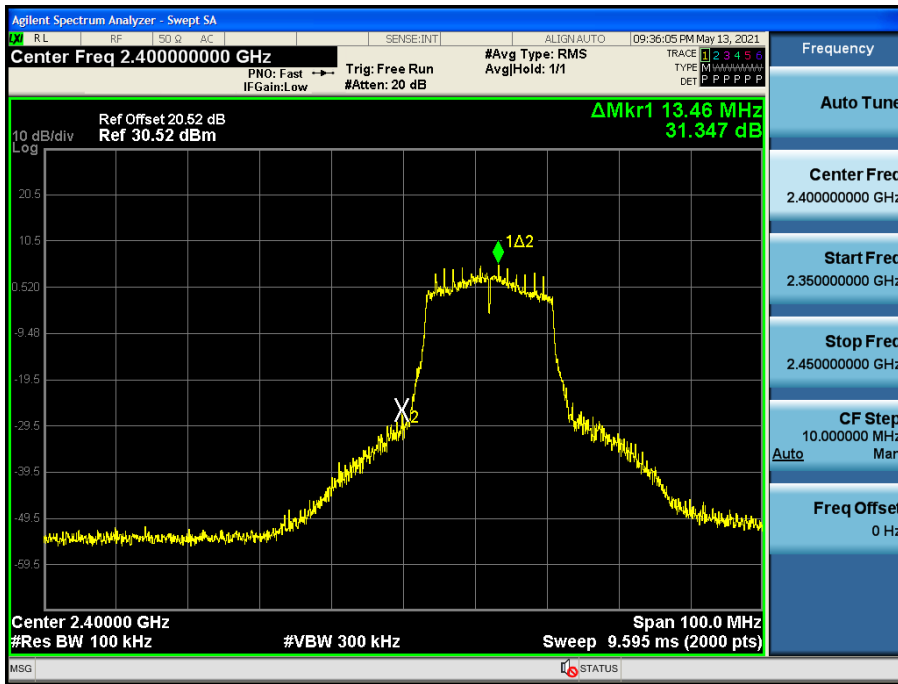
Band Edge (802.11b-CH1)



Band Edge (802.11g-CH1)



Band Edge (802.11n(HT20)-CH1)



Note :

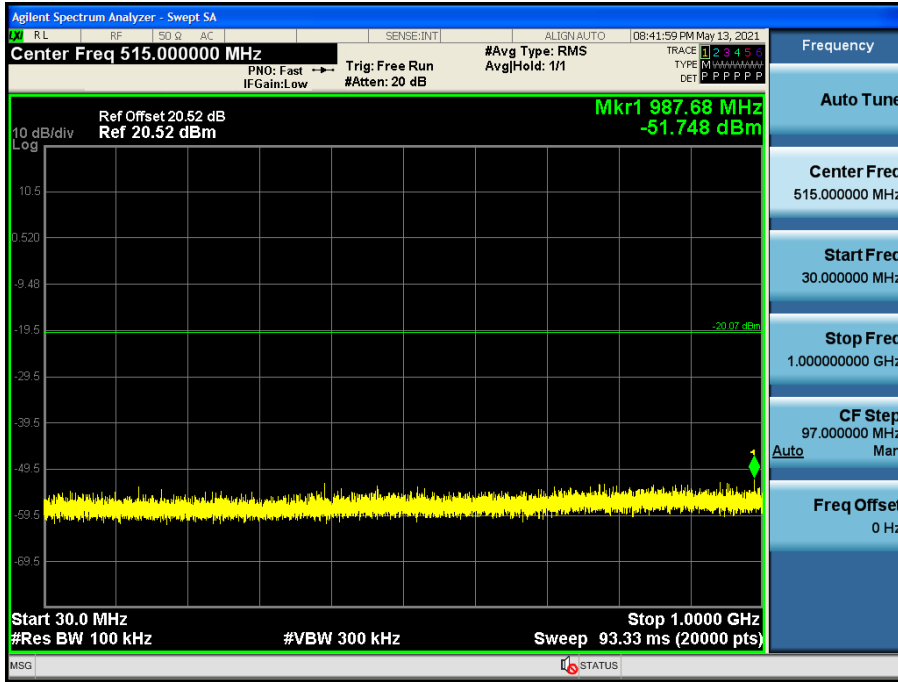
In order to simplify the report, attached plots were only the worstcase Band Edge channel.

▣ Test Plots(Conducted Spurious Emission)

In order to simplify the report, attached plots were only Ant.1 (Worst Case: Ant.1).

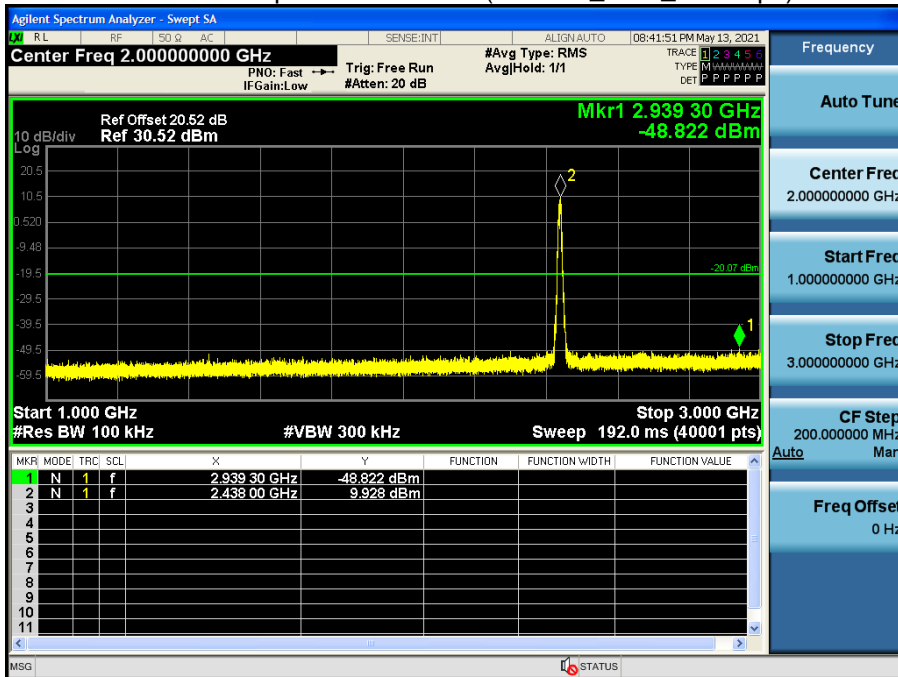
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



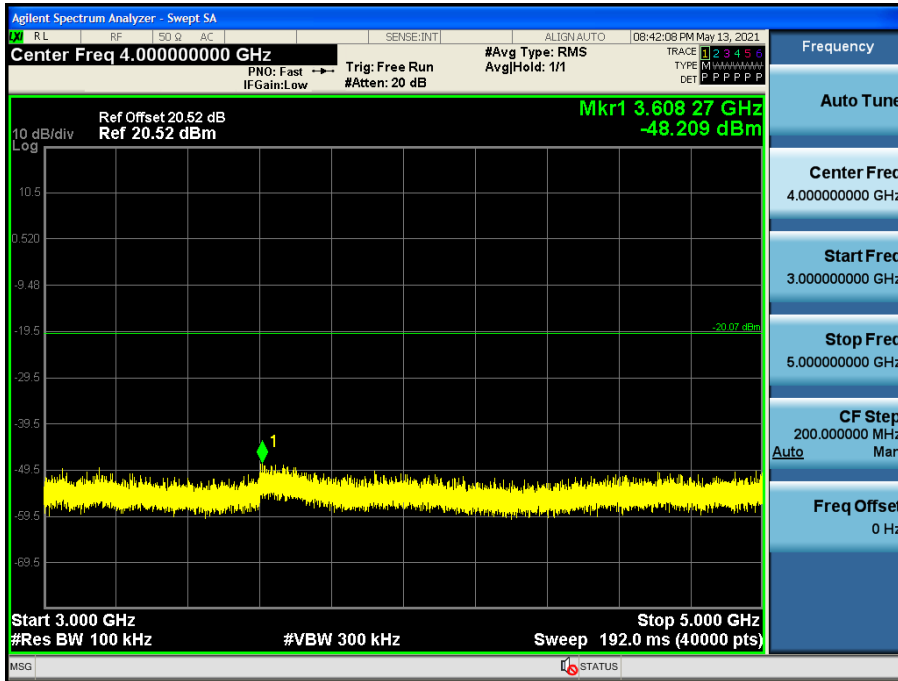
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



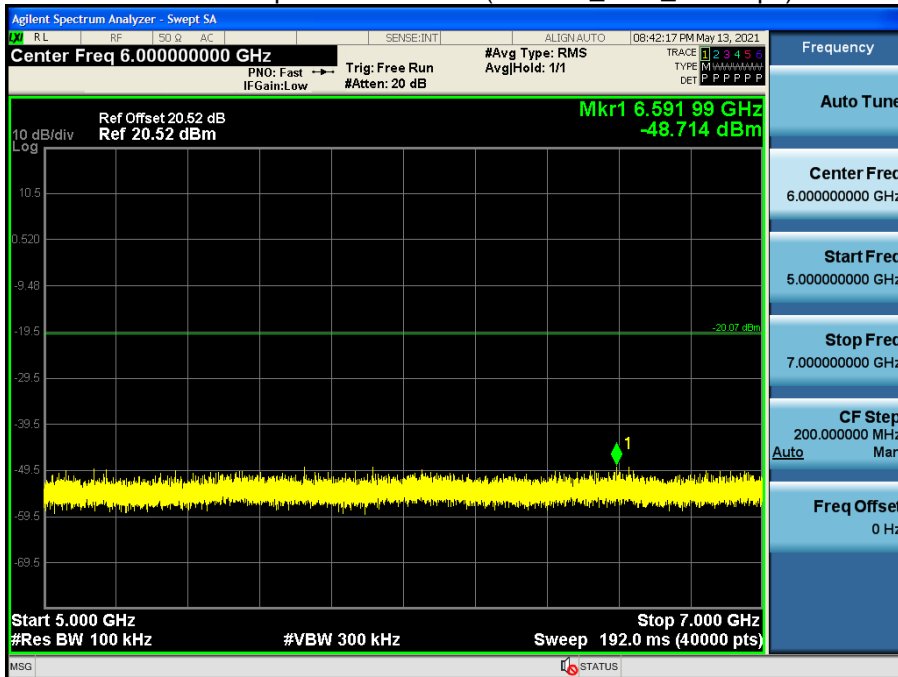
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



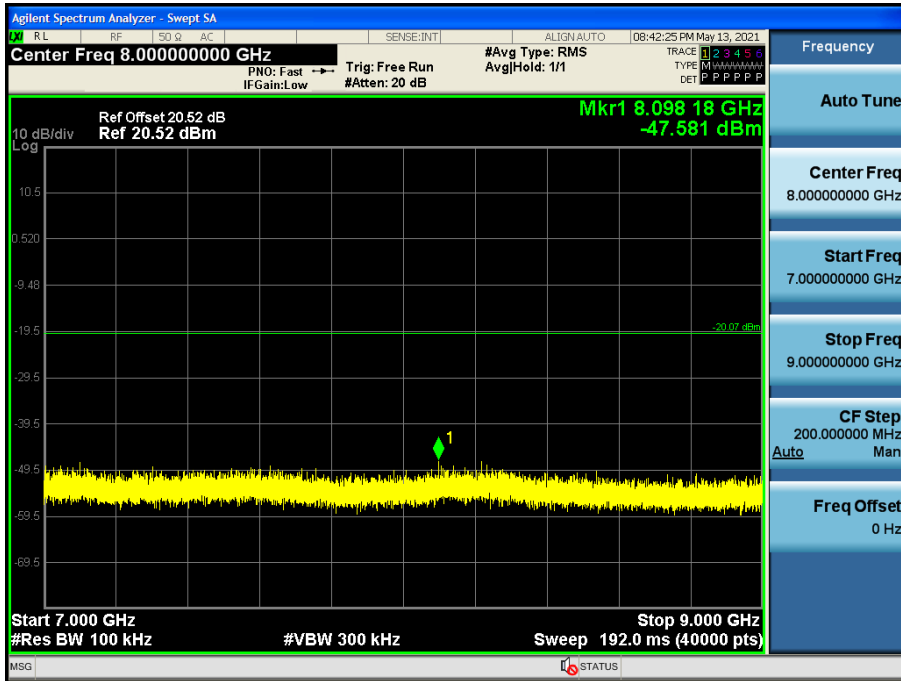
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



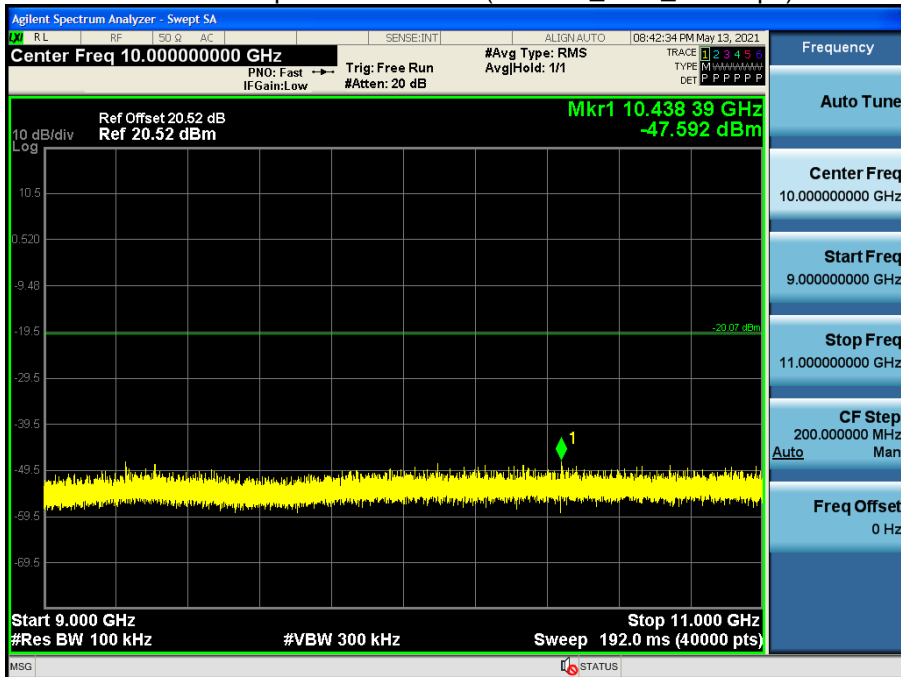
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



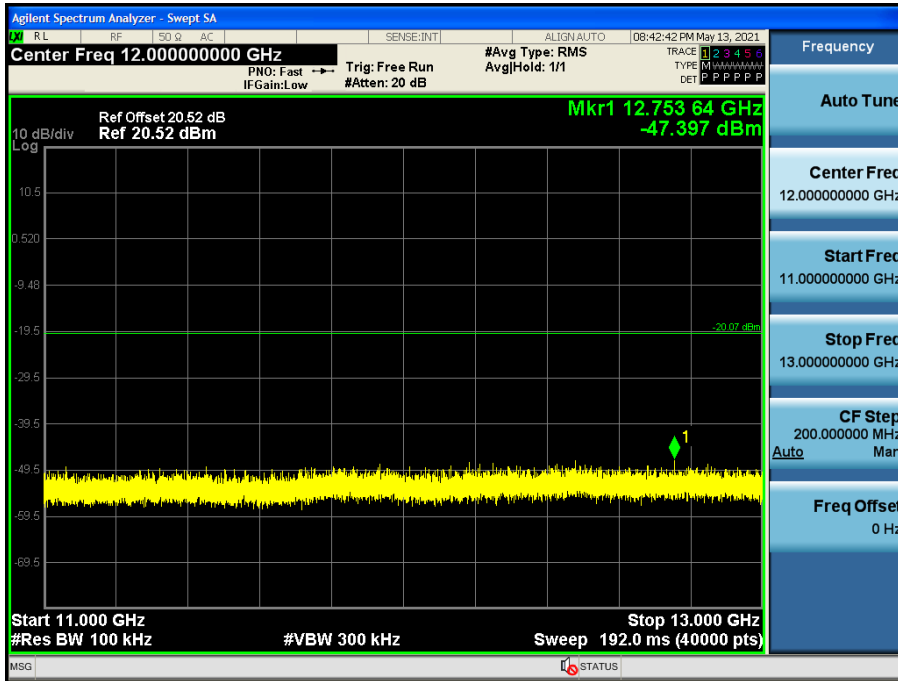
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



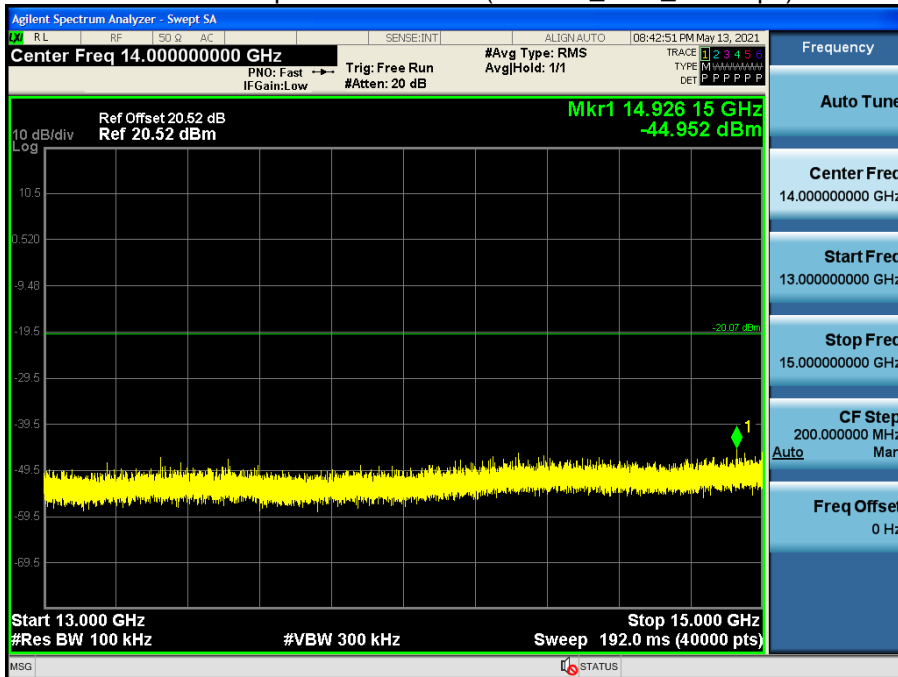
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



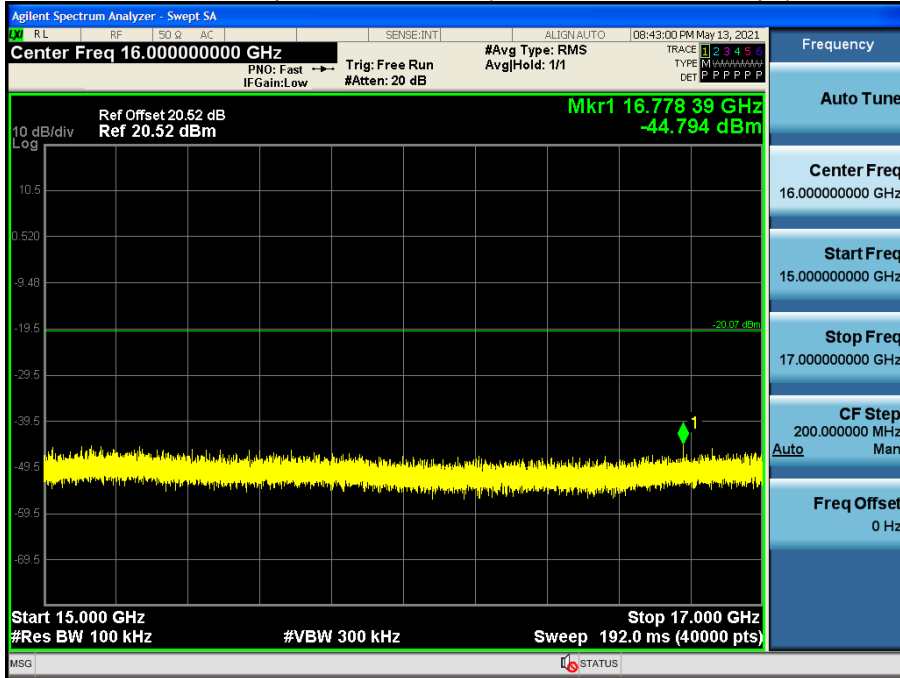
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



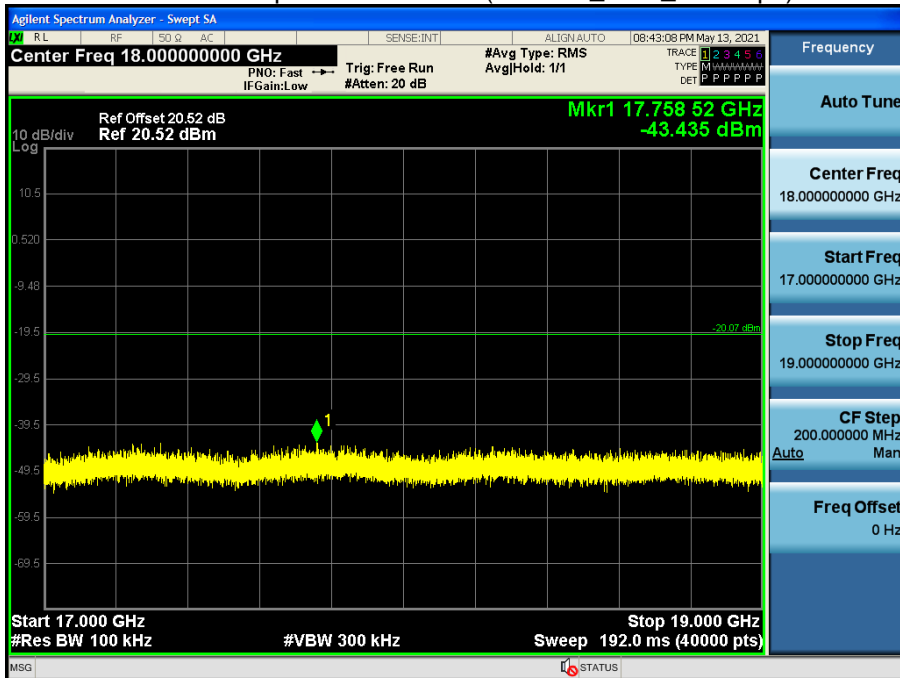
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



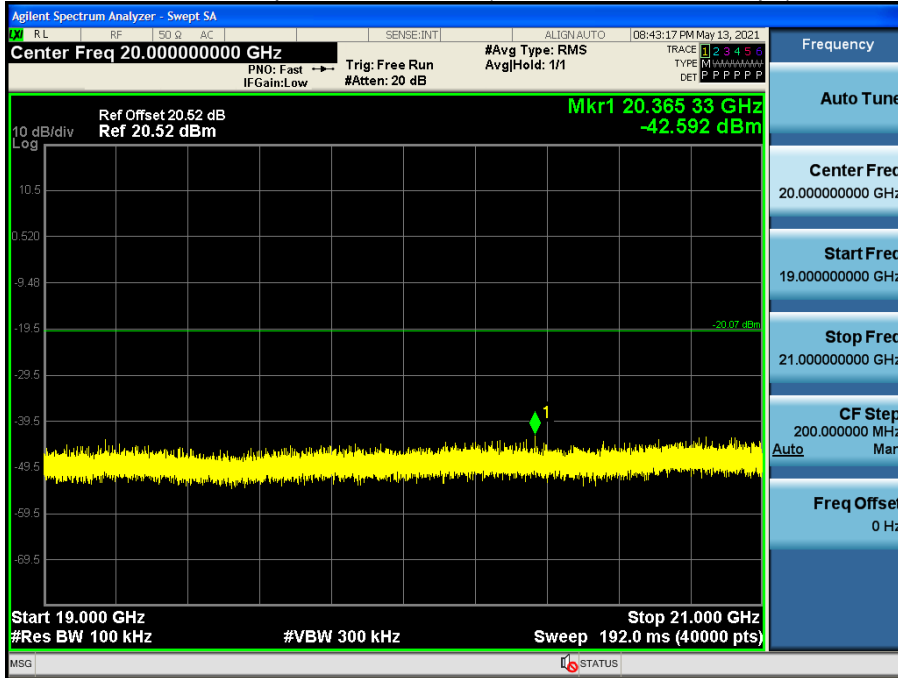
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



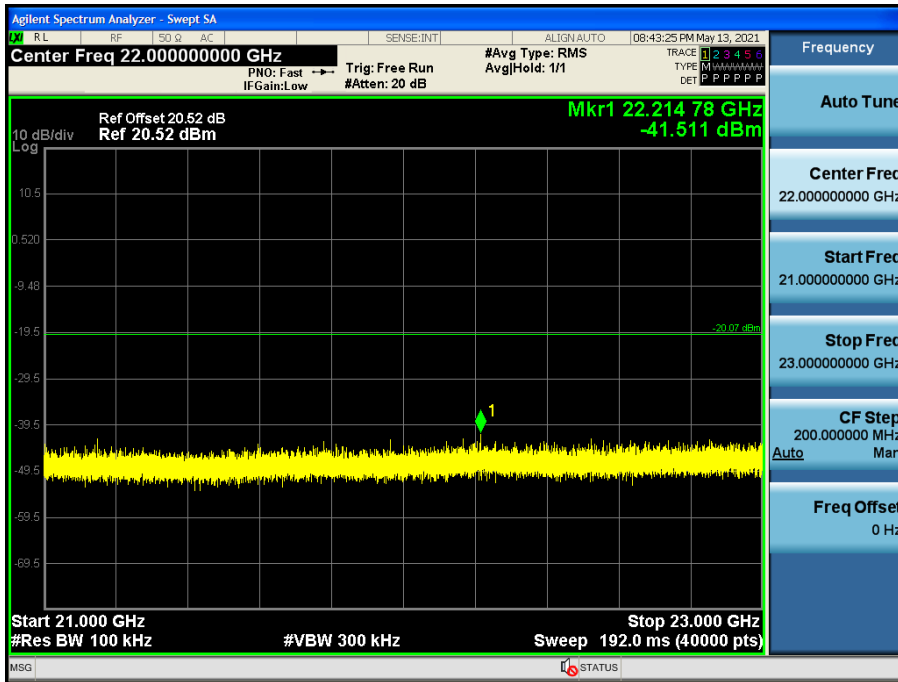
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



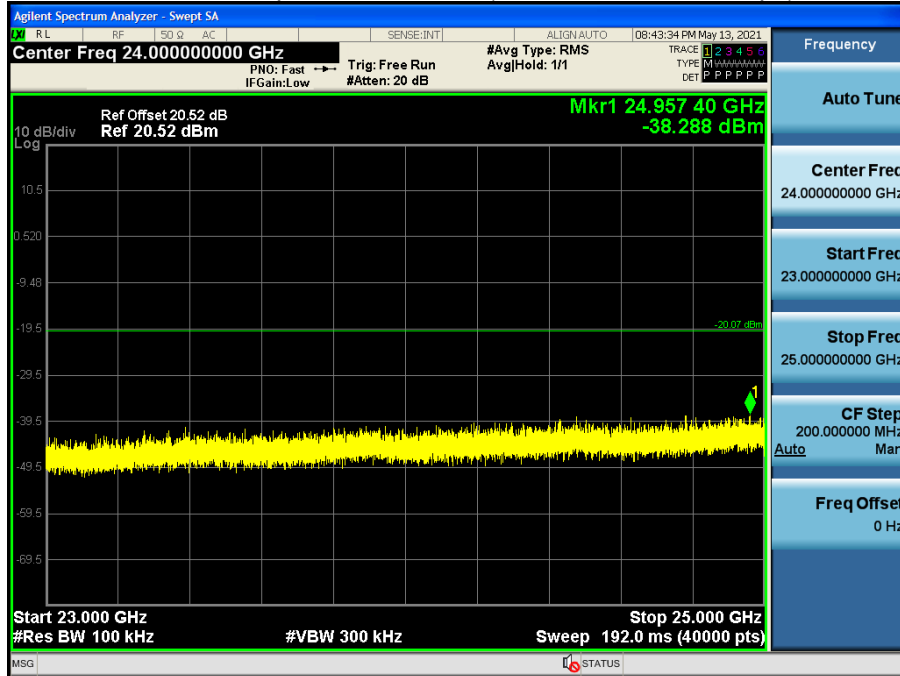
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11b_Ch.6_5.5 Mbps)



Note :

In order to simplify the report, attached plots were only the worstcase channel.

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	41.93	4.11	V	46.04	73.98	27.94	PK
4824	31.39	4.11	V	35.50	53.98	18.48	AV
7236	38.14	12.15	V	50.29	73.98	23.69	PK
7236	25.77	12.15	V	37.92	53.98	16.06	AV
4824	41.48	4.11	H	45.59	73.98	28.39	PK
4824	30.97	4.11	H	35.08	53.98	18.90	AV
7236	37.54	12.15	H	49.69	73.98	24.29	PK
7236	25.79	12.15	H	37.94	53.98	16.04	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	40.93	4.00	V	44.93	73.98	29.05	PK
4874	28.91	4.00	V	32.91	53.98	21.07	AV
7311	38.75	12.39	V	51.14	73.98	22.84	PK
7311	27.05	12.39	V	39.44	53.98	14.54	AV
4874	40.47	4.00	H	44.47	73.98	29.51	PK
4874	28.73	4.00	H	32.73	53.98	21.25	AV
7311	40.64	12.39	H	53.03	73.98	20.95	PK
7311	27.92	12.39	H	40.31	53.98	13.67	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	42.53	4.29	V	46.82	73.98	27.16	PK
4924	31.96	4.29	V	36.25	53.98	17.73	AV
7386	39.74	12.44	V	52.18	73.98	21.80	PK
7386	27.91	12.44	V	40.35	53.98	13.63	AV
4924	40.91	4.29	H	45.20	73.98	28.78	PK
4924	29.31	4.29	H	33.60	53.98	20.38	AV
7386	40.21	12.44	H	52.65	73.98	21.33	PK
7386	28.95	12.44	H	41.39	53.98	12.59	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	50.24	4.11	V	54.35	73.98	19.63	PK
4824	46.14	4.11	V	50.25	53.98	3.73	AV
7236	38.79	12.15	V	50.94	73.98	23.04	PK
7236	28.12	12.15	V	40.27	53.98	13.71	AV
4824	50.28	4.11	H	54.39	73.98	19.59	PK
4824	46.30	4.11	H	50.41	53.98	3.57	AV
7236	39.39	12.15	H	51.54	73.98	22.44	PK
7236	28.72	12.15	H	40.87	53.98	13.11	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	50.07	4.00	V	54.07	73.98	19.91	PK
4874	46.40	4.00	V	50.40	53.98	3.58	AV
7311	40.71	12.39	V	53.10	73.98	20.88	PK
7311	30.90	12.39	V	43.29	53.98	10.69	AV
4874	49.05	4.00	H	53.05	73.98	20.93	PK
4874	45.56	4.00	H	49.56	53.98	4.42	AV
7311	40.88	12.39	H	53.27	73.98	20.71	PK
7311	31.46	12.39	H	43.85	53.98	10.13	AV

Operation Mode: 802.11b
 Transfer Rate: 1 Mbps
 Operating Frequency: 2447
 Channel No. 8 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
4894	50.03	4.16	V	54.19	73.98	19.79	PK
4894	46.32	4.16	V	50.48	53.98	3.50	AV
7341	39.77	12.45	V	52.22	73.98	21.76	PK
7341	27.44	12.45	V	39.89	53.98	14.09	AV
4894	49.30	4.16	H	53.46	73.98	20.52	PK
4894	45.67	4.16	H	49.83	53.98	4.15	AV
7341	39.91	12.45	H	52.36	73.98	21.62	PK
7341	28.52	12.45	H	40.97	53.98	13.01	AV

Operation Mode: 802.11b
 Transfer Rate: 1 Mbps
 Operating Frequency: 2452
 Channel No. 9 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
4904	50.36	4.25	V	54.61	73.98	19.37	PK
4904	46.72	4.25	V	50.97	53.98	3.01	AV
7356	38.25	12.48	V	50.73	73.98	23.25	PK
7356	27.29	12.48	V	39.77	53.98	14.21	AV
4904	49.63	4.25	H	53.88	73.98	20.10	PK
4904	45.91	4.25	H	50.16	53.98	3.82	AV
7356	39.67	12.48	H	52.15	73.98	21.83	PK
7356	28.31	12.48	H	40.79	53.98	13.19	AV

Operation Mode: 802.11b
 Transfer Rate: 1 Mbps
 Operating Frequency: 2457
 Channel No.: 10 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
4914	50.58	4.26	V	54.84	73.98	19.14	PK
4914	45.71	4.26	V	49.97	53.98	4.01	AV
7371	38.96	12.48	V	51.44	73.98	22.54	PK
7371	26.95	12.48	V	39.43	53.98	14.55	AV
4914	49.65	4.26	H	53.91	73.98	20.07	PK
4914	45.18	4.26	H	49.44	53.98	4.54	AV
7371	39.34	12.48	H	51.82	73.98	22.16	PK
7371	27.23	12.48	H	39.71	53.98	14.27	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	50.27	4.29	V	54.56	73.98	19.42	PK
4924	46.49	4.29	V	50.78	53.98	3.20	AV
7386	39.41	12.44	V	51.85	73.98	22.13	PK
7386	28.00	12.44	V	40.44	53.98	13.54	AV
4924	49.51	4.29	H	53.80	73.98	20.18	PK
4924	45.32	4.29	H	49.61	53.98	4.37	AV
7386	39.23	12.44	H	51.67	73.98	22.31	PK
7386	26.77	12.44	H	39.21	53.98	14.77	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]	Measurement Type
4824	49.13	0.00	4.11	V	53.24	73.98	20.74	PK
4824	37.15	0.29	4.11	V	41.55	53.98	12.43	AV
7236	37.67	0.00	12.15	V	49.82	73.98	24.16	PK
7236	25.22	0.29	12.15	V	37.66	53.98	16.32	AV
4824	49.64	0.00	4.11	H	53.75	73.98	20.23	PK
4824	37.28	0.29	4.11	H	41.68	53.98	12.30	AV
7236	38.00	0.00	12.15	H	50.15	73.98	23.83	PK
7236	25.93	0.29	12.15	H	38.37	53.98	15.61	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]	Measurement Type
4874	50.44	0.00	4.00	V	54.44	73.98	19.54	PK
4874	38.14	0.29	4.00	V	42.43	53.98	11.55	AV
7311	38.13	0.00	12.39	V	50.52	73.98	23.46	PK
7311	26.24	0.29	12.39	V	38.92	53.98	15.06	AV
4874	50.06	0.00	4.00	H	54.06	73.98	19.92	PK
4874	37.83	0.29	4.00	H	42.12	53.98	11.86	AV
7311	38.66	0.00	12.39	H	51.05	73.98	22.93	PK
7311	26.63	0.29	12.39	H	39.31	53.98	14.67	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	51.94	0.00	4.29	V	56.23	73.98	17.75	PK
4924	39.78	0.29	4.29	V	44.36	53.98	9.62	AV
7386	37.95	0.00	12.44	V	50.39	73.98	23.59	PK
7386	26.14	0.29	12.44	V	38.87	53.98	15.11	AV
4924	51.37	0.00	4.29	H	55.66	73.98	18.32	PK
4924	39.19	0.29	4.29	H	43.77	53.98	10.21	AV
7386	38.40	0.00	12.44	H	50.84	73.98	23.14	PK
7386	26.38	0.29	12.44	H	39.11	53.98	14.87	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	50.01	0.00	4.11	V	54.12	73.98	19.86	PK
4824	36.93	0.31	4.11	V	41.35	53.98	12.63	AV
7236	38.05	0.00	12.15	V	50.20	73.98	23.78	PK
7236	25.41	0.31	12.15	V	37.87	53.98	16.11	AV
4824	50.14	0.00	4.11	H	54.25	73.98	19.73	PK
4824	37.33	0.31	4.11	H	41.75	53.98	12.23	AV
7236	38.30	0.00	12.15	H	50.45	73.98	23.53	PK
7236	25.92	0.31	12.15	H	38.38	53.98	15.60	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	50.48	0.00	4.00	V	54.48	73.98	19.50	PK
4874	37.88	0.31	4.00	V	42.19	53.98	11.79	AV
7311	38.89	0.00	12.39	V	51.28	73.98	22.70	PK
7311	26.01	0.31	12.39	V	38.71	53.98	15.27	AV
4874	50.27	0.00	4.00	H	54.27	73.98	19.71	PK
4874	37.56	0.31	4.00	H	41.87	53.98	12.11	AV
7311	39.10	0.00	12.39	H	51.49	73.98	22.49	PK
7311	26.55	0.31	12.39	H	39.25	53.98	14.73	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	50.10	0.00	4.29	V	54.39	73.98	19.59	PK
4924	37.12	0.31	4.29	V	41.72	53.98	12.26	AV
7386	38.53	0.00	12.44	V	50.97	73.98	23.01	PK
7386	26.10	0.31	12.44	V	38.85	53.98	15.13	AV
4924	49.82	0.00	4.29	H	54.11	73.98	19.87	PK
4924	36.99	0.31	4.29	H	41.59	53.98	12.39	AV
7386	38.81	0.00	12.44	H	51.25	73.98	22.73	PK
7386	26.26	0.31	12.44	H	39.01	53.98	14.97	AV

[DBS Mode]

Test case 1

802.11b Ch.9 2 452 GHz Ant 2 & 802.11a Ch.116 5580 GHz UNII-2C Ant ALL

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
4904	44.30	4.25	V	48.55	73.98	25.43	PK
4904	35.52	4.25	V	39.77	53.98	14.21	AV
7356	37.58	12.48	V	50.06	73.98	23.92	PK
7356	25.96	12.48	V	38.44	53.98	15.54	AV
4904	43.98	4.25	H	48.23	73.98	25.75	PK
4904	34.79	4.25	H	39.04	53.98	14.94	AV
7356	38.07	12.48	H	50.55	73.98	23.43	PK
7356	26.36	12.48	H	38.84	53.98	15.14	AV

Test case 2

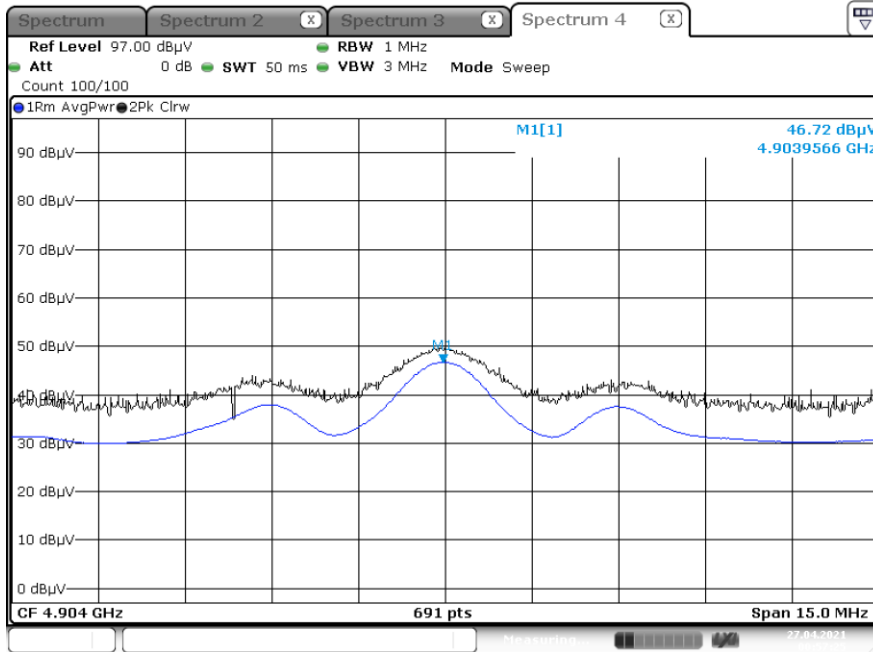
802.11g Ch.11 2 462 GHz Ant ALL & 802.11a Ch.116 5580 GHz UNII-2C Ant ALL

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	51.11	0.00	4.29	V	55.40	73.98	18.58	PK
4924	39.18	0.29	4.29	V	43.76	53.98	10.22	AV
7386	38.63	0.00	12.44	V	51.07	73.98	22.91	PK
7386	26.38	0.29	12.44	V	39.11	53.98	14.87	AV
4924	50.76	0.00	4.29	H	55.05	73.98	18.93	PK
4924	38.46	0.29	4.29	H	43.04	53.98	10.94	AV
7386	38.74	0.00	12.44	H	51.18	73.98	22.80	PK
7386	26.48	0.29	12.44	H	39.21	53.98	14.77	AV

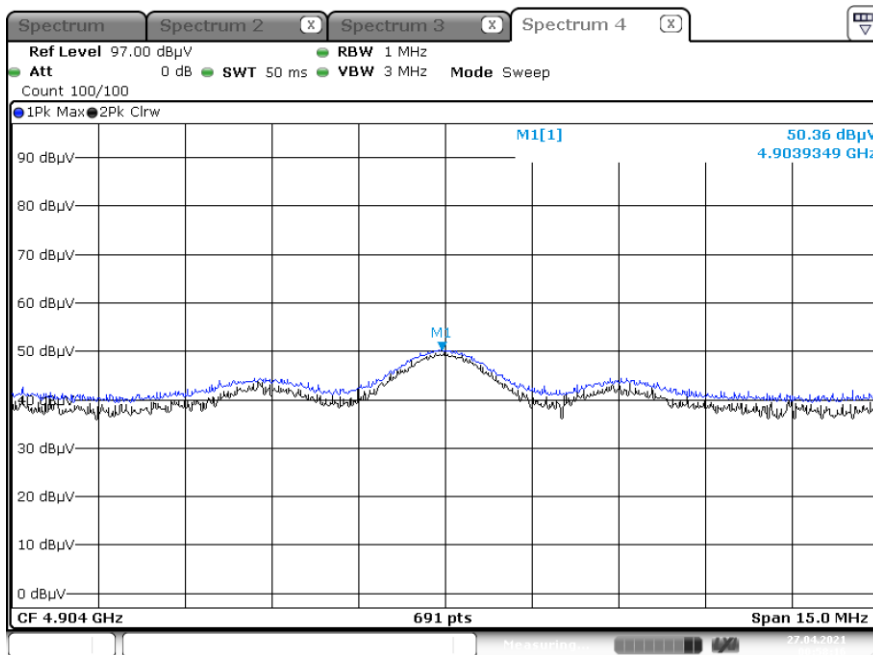
▣ Test Plots

[Ant.2_SISO] _ Worst case : Y-V

Radiated Spurious Emissions plot – Average Reading (802.11b_1 Mbps, Ch.9 2nd Harmonic)

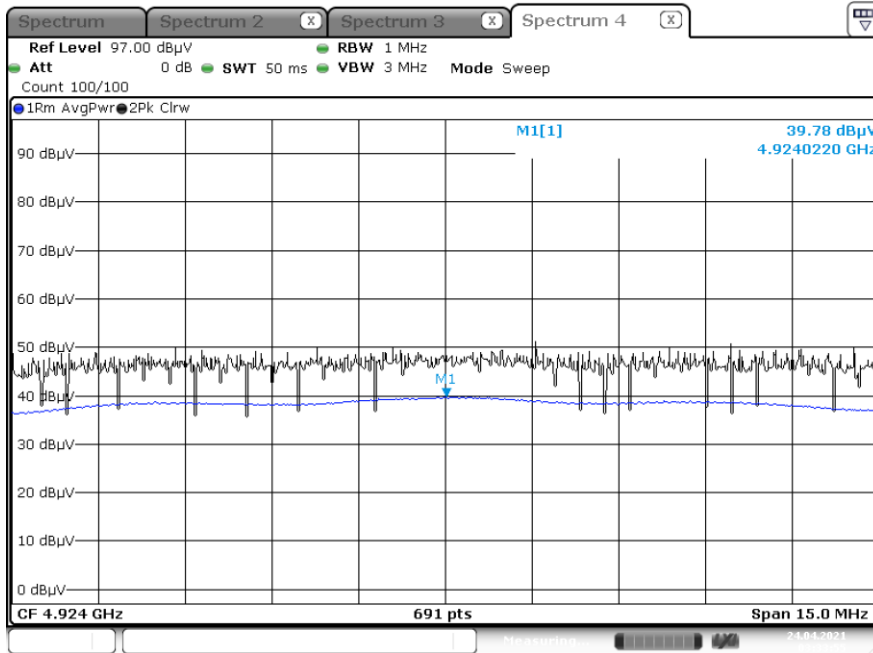


Radiated Spurious Emissions plot – Peak Reading (802.11b_1 Mbps, Ch.9 2nd Harmonic)

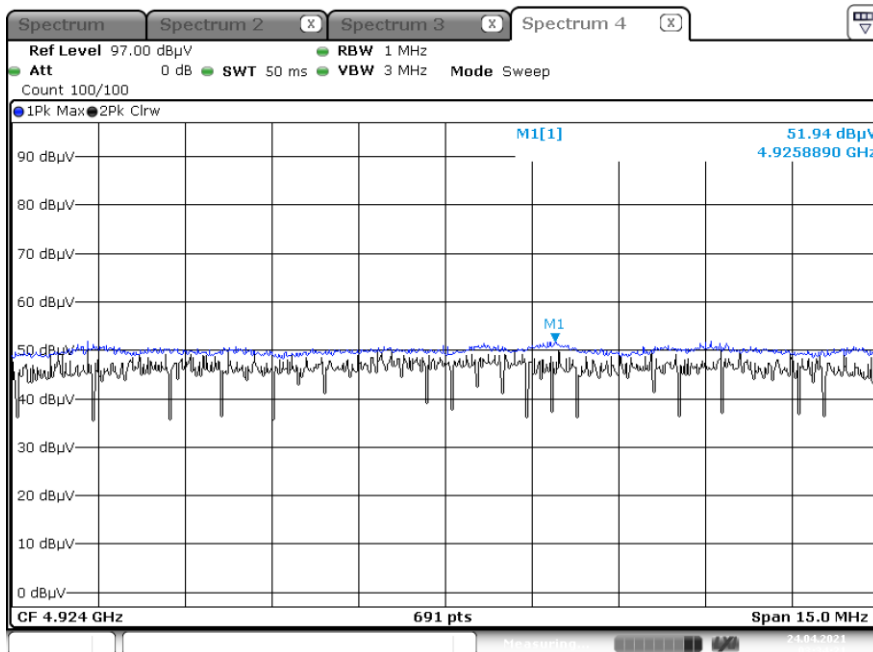


[Ant.1&Ant.2_MIMO(CDD)] _ Worst case : Y-V

Radiated Spurious Emissions plot – Average Reading (802.11g_6 Mbps, Ch.11 2nd Harmonic)

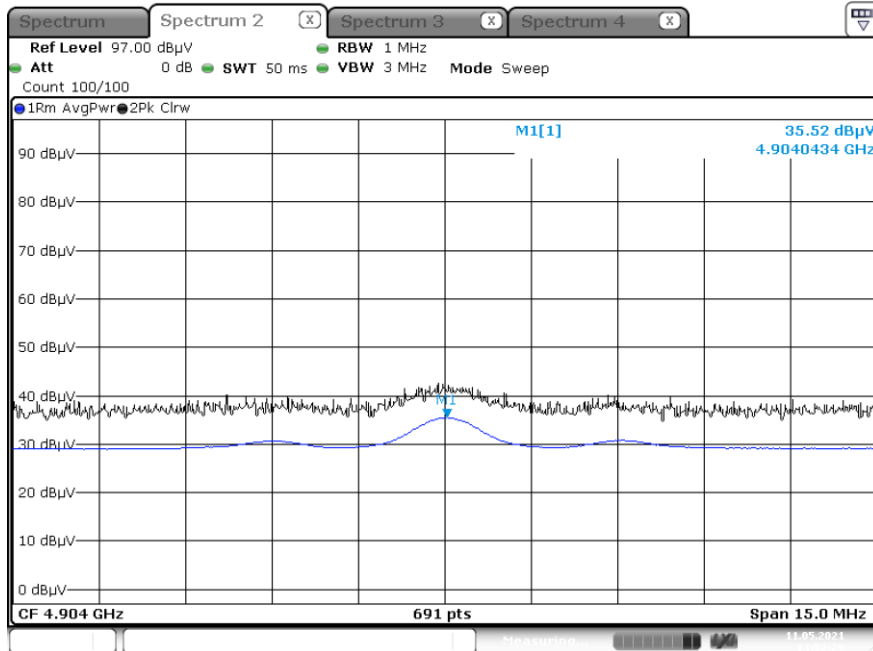


Radiated Spurious Emissions plot – Peak Reading (802.11g_6 Mbps, Ch.11 2nd Harmonic)

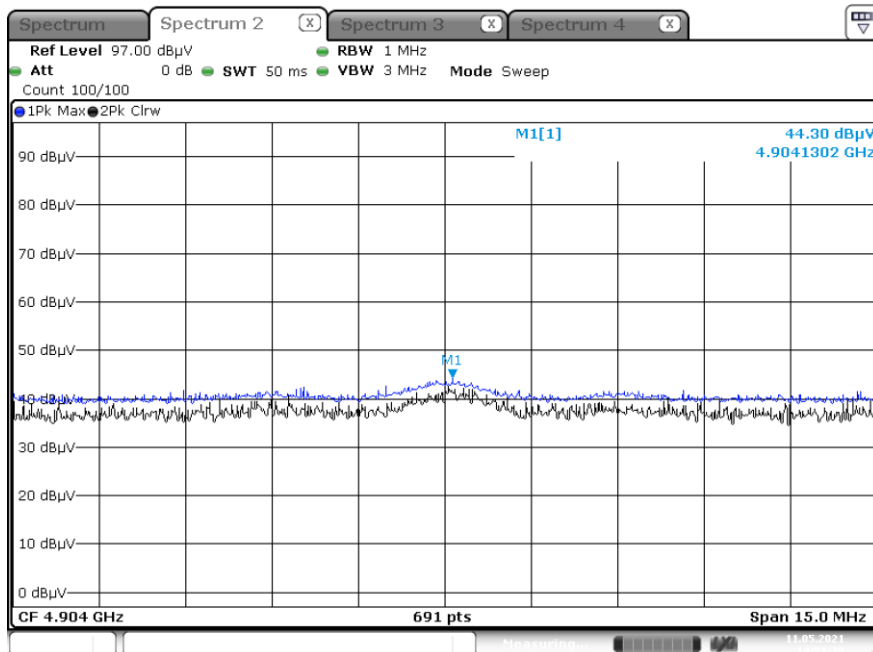


[DBS]

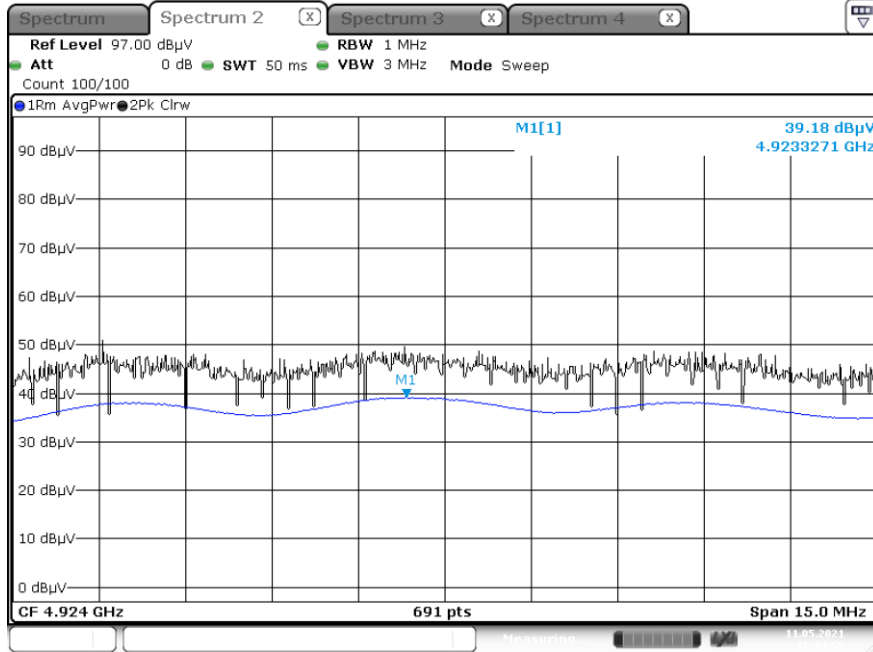
Radiated Spurious Emissions plot – Average Reading (Test case 1_Y-V_3rd Harmonic)



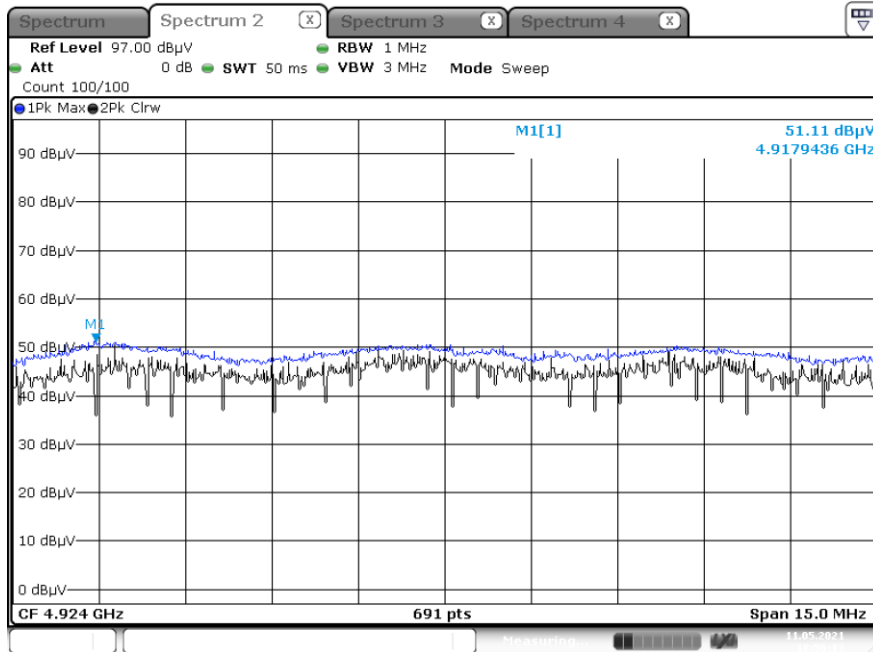
Radiated Spurious Emissions plot – Peak Reading (Test case 1_ 3rd Harmonic)



Radiated Spurious Emissions plot – Average Reading (Test case 2_ Y-V_3rd Harmonic)



Radiated Spurious Emissions plot – Peak Reading (Test case 2_Y-V_ 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	47.91	6.32	H	54.23	73.98	19.75	PK
2390.0	35.28	6.32	H	41.60	53.98	12.38	AV
2390.0	48.17	6.32	V	54.49	73.98	19.49	PK
2390.0	35.34	6.32	V	41.66	53.98	12.32	AV
2483.5	52.80	6.78	H	59.58	73.98	14.40	PK
2483.5	36.87	6.78	H	43.65	53.98	10.33	AV
2483.5	51.97	6.78	V	58.75	73.98	15.23	PK
2483.5	36.72	6.78	V	43.50	53.98	10.48	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	48.32	6.32	H	54.64	73.98	19.34	PK
2390.0	36.34	6.32	H	42.66	53.98	11.32	AV
2390.0	47.78	6.32	V	54.10	73.98	19.88	PK
2390.0	35.55	6.32	V	41.87	53.98	12.11	AV
2483.5	49.98	6.78	H	56.76	73.98	17.22	PK
2483.5	36.26	6.78	H	43.04	53.98	10.94	AV
2483.5	48.65	6.78	V	55.43	73.98	18.55	PK
2483.5	35.76	6.78	V	42.54	53.98	11.44	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	59.51	0.00	6.32	H	65.83	73.98	8.15	PK
2390.0	40.92	0.29	6.32	H	47.53	53.98	6.45	AV
2390.0	57.78	0.00	6.32	V	64.10	73.98	9.88	PK
2390.0	39.97	0.29	6.32	V	46.58	53.98	7.40	AV
2483.5#(2484)	57.82	0.00	6.78	H	64.60	73.98	9.38	PK
2483.5#(2484)	43.89	0.29	6.78	H	50.96	53.98	3.02	AV
2483.5#(2485)	56.18	0.00	6.78	H	62.96	73.98	11.02	PK
2483.5#(2485)	43.47	0.29	6.78	H	50.54	53.98	3.44	AV
2485.5~2500	60.40	0.00	6.78	H	67.18	73.98	6.80	PK
2485.5~2500	42.68	0.29	6.78	H	49.75	53.98	4.23	AV

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

Operation Mode: 802.11g
 Transfer Rate: 6 Mbps
 Operating Frequency: 2457 MHz
 Channel No. 10 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
2483.5	59.24	0.00	6.78	H	66.02	73.98	7.96	PK
2483.5	41.12	0.29	6.78	H	48.19	53.98	5.79	AV
2483.5	56.59	0.00	6.78	V	63.37	73.98	10.61	PK
2483.5	39.34	0.29	6.78	V	46.41	53.98	7.57	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	63.37	0.00	6.32	H	69.69	73.98	4.29	PK
2390.0	44.58	0.31	6.32	H	51.21	53.98	2.77	AV
2390.0	61.46	0.00	6.32	V	67.78	73.98	6.20	PK
2390.0	44.05	0.31	6.32	V	50.68	53.98	3.30	AV
2483.5#(2484)	56.41	0.00	6.78	H	63.19	73.98	10.79	PK
2483.5#(2484)	43.10	0.31	6.78	H	50.19	53.98	3.79	AV
2483.5#(2485)	55.47	0.00	6.78	H	62.25	73.98	11.73	PK
2483.5#(2485)	43.36	0.31	6.78	H	50.45	53.98	3.53	AV
2485.5~2500	58.97	0.00	6.78	H	65.75	73.98	8.23	PK
2485.5~2500	41.63	0.31	6.78	H	48.72	53.98	5.26	AV

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

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

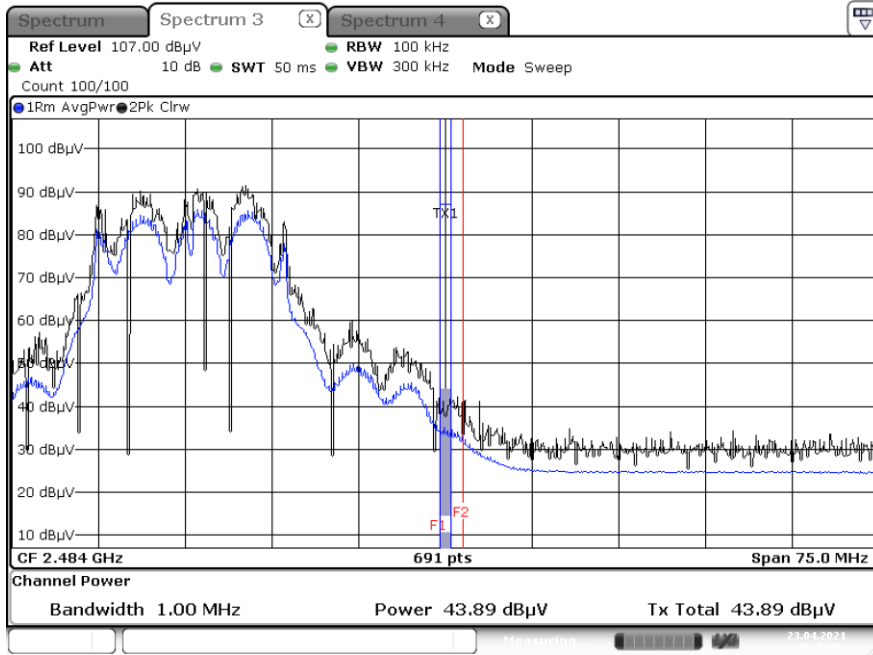
Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F.+ C.L+ ATT - A.G + D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	61.82	0.00	6.78	H	68.60	73.98	5.38	PK
2483.5	42.46	0.31	6.78	H	49.55	53.98	4.43	AV
2483.5	61.65	0.00	6.78	V	68.43	73.98	5.55	PK
2483.5	41.23	0.31	6.78	V	48.32	53.98	5.66	AV

■ Test Plots

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

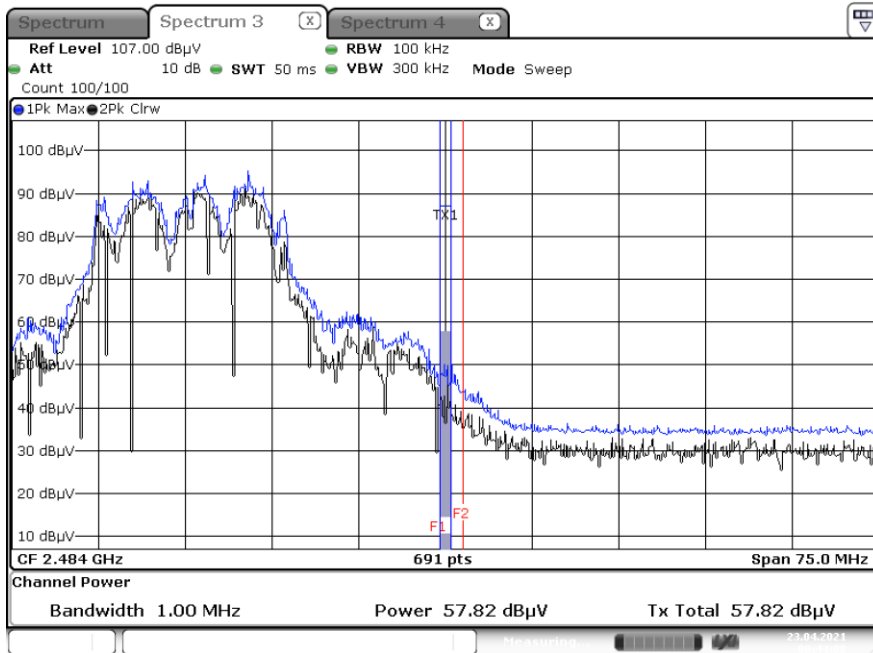
Radiated Restricted Band Edges plot – Average Reading (802.11g_6 Mbps Ch.11)

Integration method Used_2 484 MHz



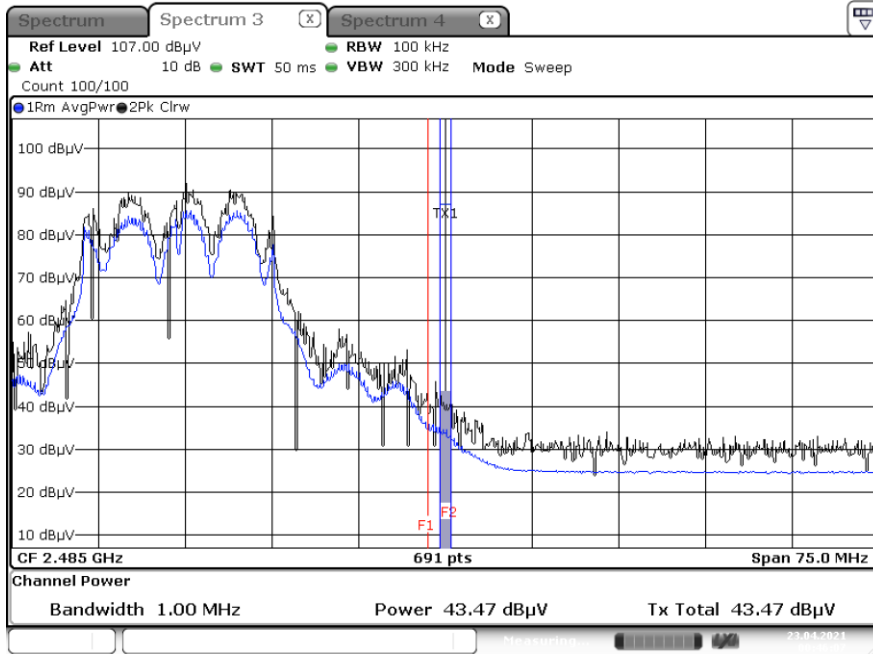
Radiated Restricted Band Edges plot – Peak Reading (802.11g_6 Mbps Ch.11)

Integration method Used_2 484 MHz



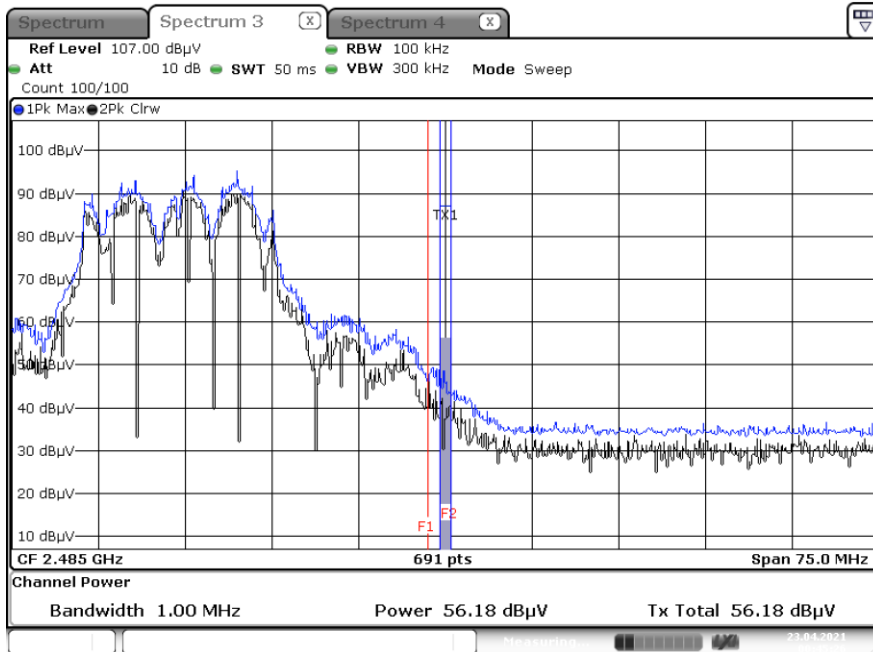
Radiated Restricted Band Edges plot – Average Reading (802.11g_6 Mbps Ch.11)

Integration method Used_2 485 MHz

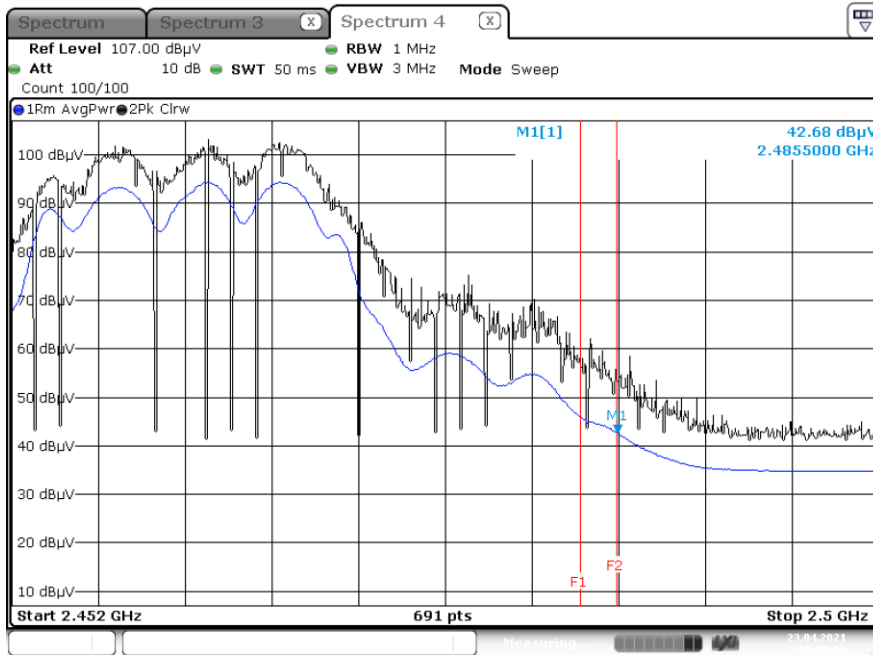


Radiated Restricted Band Edges plot – Peak Reading (802.11g_6 Mbps Ch.11)

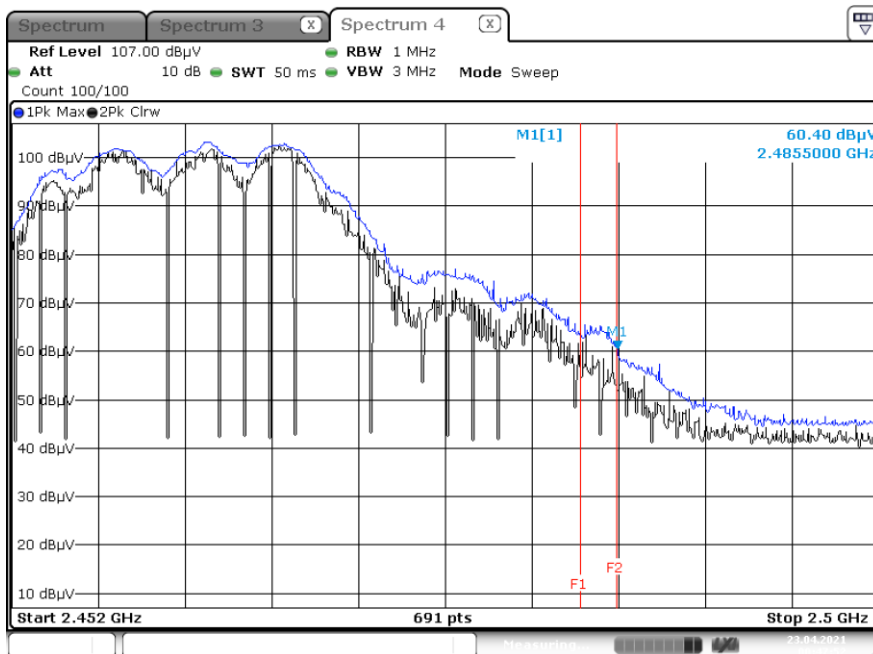
Integration method Used_2 485 MHz



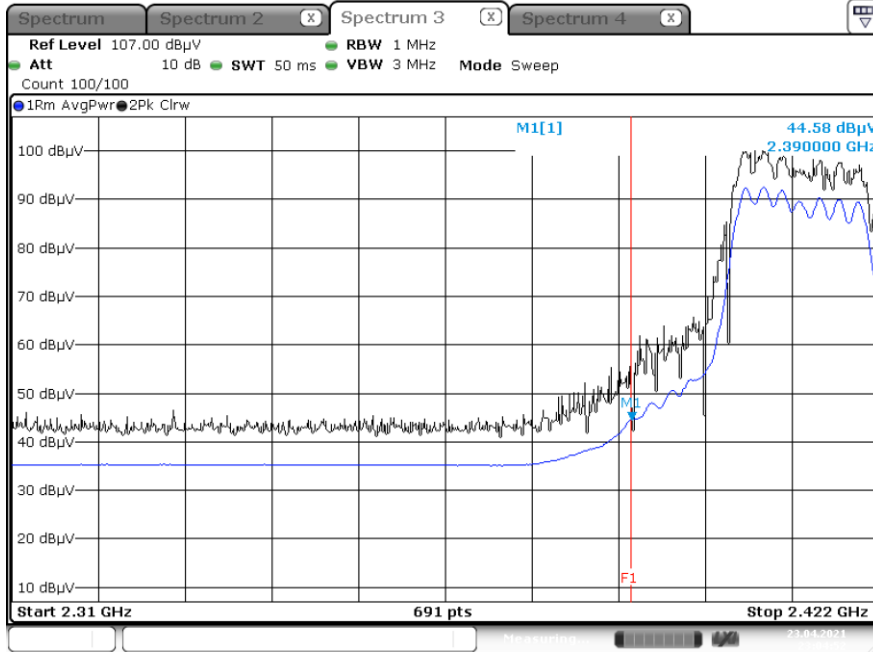
Radiated Restricted Band Edges plot – Average Reading (802.11g_6 Mbps Ch.11)



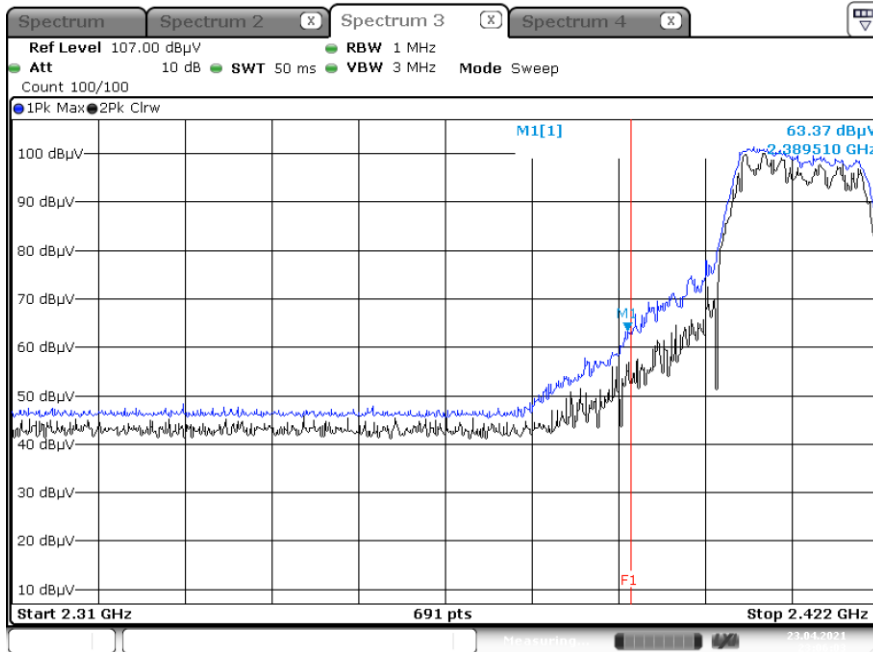
Radiated Restricted Band Edges plot – Peak Reading (802.11g_6 Mbps Ch.11)



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



Radiated Restricted Band Edges plot – Peak Reading (802.11n (HT20)_ MCS0 Ch.1)



Note:

Plot of worst case are only reported.

9.8 POWERLINE CONDUCTED EMISSIONS

Conducted Emissions (Line 1)

WLAN 2.4G MODE_L1

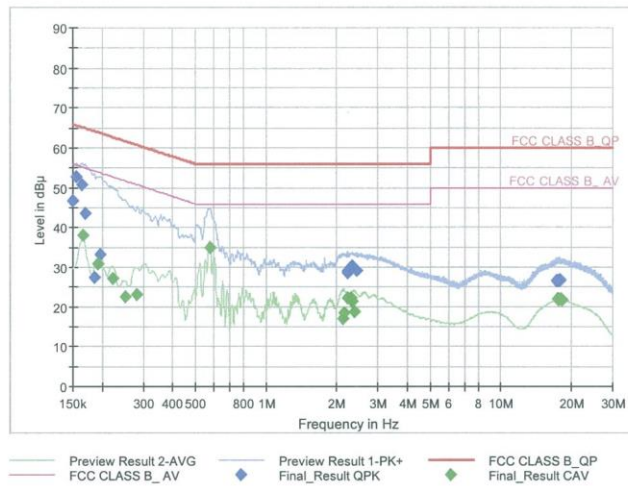
1 / 2

Test Report

Common Information

EUT : SM-G990U
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : WLAN 2.4G MODE_L1

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1500	46.78	66.00	19.22	9.000	L1	OFF	9.7
0.1545	52.67	65.75	13.08	9.000	L1	OFF	9.6
0.1635	50.66	65.28	14.63	9.000	L1	OFF	9.6
0.1703	43.64	64.95	21.31	9.000	L1	OFF	9.6
0.1860	27.41	64.21	36.80	9.000	L1	OFF	9.6
0.1973	33.26	63.73	30.46	9.000	L1	OFF	9.6
2.2190	28.91	56.00	27.09	9.000	L1	OFF	9.7
2.2258	29.00	56.00	27.00	9.000	L1	OFF	9.7
2.2303	28.64	56.00	27.36	9.000	L1	OFF	9.7
2.2843	29.63	56.00	26.37	9.000	L1	OFF	9.7
2.3225	30.17	56.00	25.83	9.000	L1	OFF	9.7
2.4508	29.11	56.00	26.89	9.000	L1	OFF	9.8
17.3840	26.45	60.00	33.55	9.000	L1	OFF	10.3
17.5123	26.59	60.00	33.41	9.000	L1	OFF	10.3
17.5573	26.42	60.00	33.58	9.000	L1	OFF	10.3
17.7733	26.47	60.00	33.53	9.000	L1	OFF	10.3
17.7823	26.72	60.00	33.28	9.000	L1	OFF	10.3
17.8453	26.55	60.00	33.45	9.000	L1	OFF	10.3

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WLAN 2.4G MODE_L1

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Final Result CAV

Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1658	38.18	55.17	16.99	9.000	L1	OFF	9.6
0.1928	30.84	53.92	23.07	9.000	L1	OFF	9.6
0.2220	27.17	52.74	25.58	9.000	L1	OFF	9.6
0.2513	22.63	51.72	29.08	9.000	L1	OFF	9.6
0.2805	23.11	50.80	27.69	9.000	L1	OFF	9.6
0.5765	34.82	46.00	11.18	9.000	L1	OFF	9.6
2.1335	16.95	46.00	29.05	9.000	L1	OFF	9.7
2.1605	18.38	46.00	27.62	9.000	L1	OFF	9.7
2.2258	22.11	46.00	23.89	9.000	L1	OFF	9.7
2.2955	22.32	46.00	23.68	9.000	L1	OFF	9.7
2.3248	21.46	46.00	24.54	9.000	L1	OFF	9.7
2.3833	18.71	46.00	27.29	9.000	L1	OFF	9.8
17.4875	21.86	50.00	28.14	9.000	L1	OFF	10.3
17.5145	21.83	50.00	28.17	9.000	L1	OFF	10.3
17.6788	21.84	50.00	28.16	9.000	L1	OFF	10.3
17.7508	21.76	50.00	28.24	9.000	L1	OFF	10.3
18.0658	21.78	50.00	28.22	9.000	L1	OFF	10.3
18.3268	21.68	50.00	28.32	9.000	L1	OFF	10.3

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Conducted Emissions (Line 2)

WLAN 2.4G MODE_N

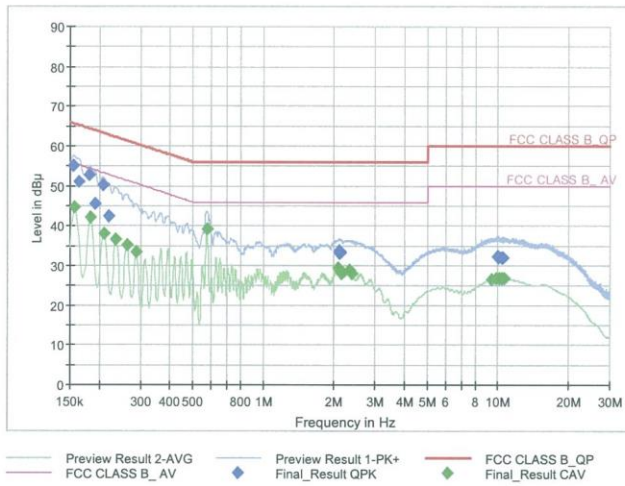
1 / 2

Test Report

Common Information

EUT : SM-G990U
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : WLAN 2.4G MODE_N

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	54.97	65.75	10.78	9.000	N	OFF	9.6
0.1635	51.06	65.28	14.23	9.000	N	OFF	9.6
0.1815	52.79	64.42	11.62	9.000	N	OFF	9.6
0.1928	45.52	63.92	18.40	9.000	N	OFF	9.6
0.2085	50.19	63.27	13.08	9.000	N	OFF	9.6
0.2198	42.27	62.83	20.56	9.000	N	OFF	9.6
2.0998	33.36	56.00	22.64	9.000	N	OFF	9.7
2.1043	33.58	56.00	22.42	9.000	N	OFF	9.7
2.1088	33.71	56.00	22.29	9.000	N	OFF	9.7
2.1178	33.28	56.00	22.72	9.000	N	OFF	9.7
2.1335	33.29	56.00	22.71	9.000	N	OFF	9.7
2.1380	33.42	56.00	22.58	9.000	N	OFF	9.7
9.9568	32.24	60.00	27.76	9.000	N	OFF	10.1
9.9995	32.30	60.00	27.70	9.000	N	OFF	10.1
10.0625	32.11	60.00	27.89	9.000	N	OFF	10.1
10.1188	32.22	60.00	27.78	9.000	N	OFF	10.1
10.4203	32.15	60.00	27.85	9.000	N	OFF	10.1
10.5283	32.03	60.00	27.97	9.000	N	OFF	10.1

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WLAN 2.4G MODE_N

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Final Result CAV

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1568	44.75	55.63	10.88	9.000	N	OFF	9.6
0.1838	42.11	54.31	12.21	9.000	N	OFF	9.6
0.2108	38.17	53.18	15.01	9.000	N	OFF	9.6
0.2355	36.64	52.25	15.62	9.000	N	OFF	9.6
0.2625	35.14	51.35	16.21	9.000	N	OFF	9.6
0.2873	33.39	50.60	17.21	9.000	N	OFF	9.6
0.5765	39.33	46.00	6.67	9.000	N	OFF	9.6
2.0818	29.41	46.00	16.59	9.000	N	OFF	9.7
2.1065	29.21	46.00	16.79	9.000	N	OFF	9.7
2.1335	28.65	46.00	17.35	9.000	N	OFF	9.7
2.1605	27.90	46.00	18.10	9.000	N	OFF	9.7
2.3428	28.88	46.00	17.12	9.000	N	OFF	9.7
2.3945	27.90	46.00	18.10	9.000	N	OFF	9.8
9.4258	26.62	50.00	23.38	9.000	N	OFF	10.1
9.8645	26.77	50.00	23.23	9.000	N	OFF	10.1
10.1368	26.86	50.00	23.14	9.000	N	OFF	10.1
10.4203	26.90	50.00	23.10	9.000	N	OFF	10.1
10.6565	26.78	50.00	23.22	9.000	N	OFF	10.1

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9.9 CONFIRMATION OF GEO-LOCATION MECHANISM

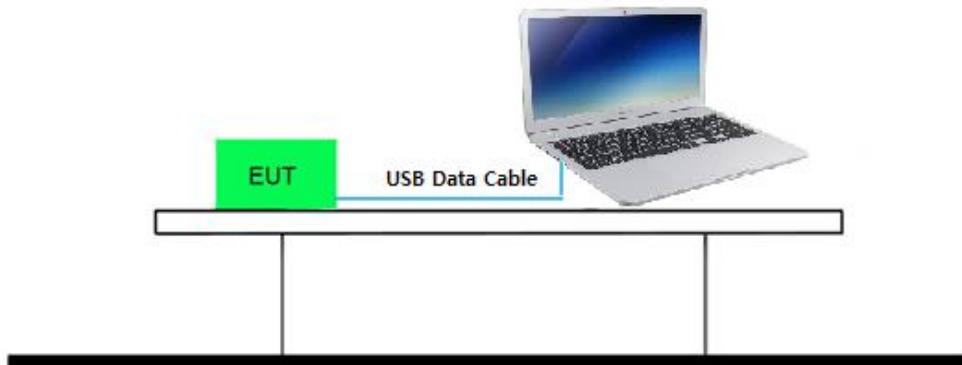
The device uses MCC information obtained from the public cellular carrier to determine that it is operating outside the U.S. and then enable channels 12 and 13 only if a non-US MCC that supports channel 12 and 13 is confirmed.

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	In case of airplane mode
1. Open Command Prompt. 2. At the Command Prompt, enter the command. - C:\adb>adb remount - C:\adb>adb shell - gts4lv:/ # wpa_cli driver country US // Setting the country. - gts4lv:/ # iw list // Channel list is obtain.	1. airplane mode on 2. Wifi on 3. Open Command Prompt. 4. At the Command Prompt, enter the command. - C:\adb>adb remount - C:\adb>adb shell - gts4lv:/ # iw list // support band in case of airplane mode

Setting the country for product

Country code = US	Country code = KR(Korea)
<pre>Microsoft Windows [Version 10.0.19041.928] (c) Microsoft Corporation. All rights reserved. C:\Users\#USER>cd/ C:\#>cd adb C:\#adb>adb remount remount succeeded C:\#adb>adb shell r9q:/ # wpa_cli DRIVER COUNTRY US Using interface 'wlan0' OK r9q:/ # iw list Wiphy phy0</pre>	<pre>Microsoft Windows [Version 10.0.19041.928] (c) Microsoft Corporation. All rights reserved. C:\Users\#USER>cd/ C:\#>cd adb C:\#adb>adb remount remount succeeded C:\#adb>adb shell r9q:/ # wpa_cli DRIVER COUNTRY KR Using interface 'wlan0' OK r9q:/ # iw list Wiphy phy0</pre>

Did not connect Airplane mode	
Airplane on	
<pre>Microsoft Windows [Version 10.0.19041.928] (c) Microsoft Corporation. All rights reserved. C:\Users\USER>cd/ C:\>cd adb C:\adb>adb remount remount succeeded C:\adb>adb shell r9q:/ # iw list Wiphy phy0</pre>	<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] (disabled) * 2472 MHz [13] (disabled)</pre>
Airplane off	
<pre>Microsoft Windows [Version 10.0.19041.928] (c) Microsoft Corporation. All rights reserved. C:\Users\USER>cd/ C:\>cd adb C:\adb>adb remount remount succeeded C:\adb>adb shell r9q:/ # iw list Wiphy phy0</pre>	<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

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216 / LISN	09/04/2020	Annual	102245
Rohde & Schwarz	ESR / EMI Test Receiver	09/16/2020	Annual	101910
ESPEC	SU-642 / Temperature Chamber	07/30/2020	Annual	0093000718
Agilent	N9020A / Signal Analyzer	05/03/2021	Annual	MY51110085
Agilent	N9030A / Signal Analyzer	03/09/2021	Annual	MY49432108
Agilent	N1911A / Power Meter	04/08/2021	Annual	MY45100523
Agilent	N1921A / Power Sensor	04/08/2021	Annual	MY57820067
Agilent	87300B / Directional Coupler	11/10/2020	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	02/09/2021	Annual	10545
HP	E3632A / DC Power Supply	09/16/2020	Annual	MY40004427
HP	8493C / Attenuator(10 dB)(DC-26.5 GHz)	06/26/2020	Annual	07560
HP	8493C / Attenuator(10 dB)(DC-26.5 GHz)	07/03/2020	Annual	08285
Rohde & Schwarz	18N-20dB / Attenuator(20 dB)	03/08/2021	Annual	8
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
TNM system	FBSM-01B / Amp & Filter Bank Switch Controller	N/A	N/A	N/A
Schwarzbeck	Loop Antenna	03/19/2020	Biennial	1513-333
Schwarzbeck	VULB 9168 / Hybrid Antenna	08/02/2019	Biennial	01039
Schwarzbeck	BBHA 9120D / Horn Antenna	08/01/2019	Biennial	9120D-1151
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	02/11/2020	Biennial	BBHA9170124
Rohde & Schwarz	FSV(10 Hz ~ 40 GHz) / Spectrum Analyzer	05/14/2021	Annual	101055
Wainwright Instruments	WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter	01/06/2021	Annual	2
Wainwright Instruments	WRCJV12-4900-5100-5900-6100-50SS	06/24/2021	Annual	5
Wainwright Instruments	WRCJV12-4900-5100-5900-6100-50SS	06/24/2021	Annual	6
CERNEX	CBL18265035 / Power Amplifier	12/04/2020	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	03/23/2021	Annual	25956
TNM system	FBSM-05B / HPF(3~18GHz) + LNA1(1~18GHz)	01/20/2021	Annual	F6
TNM system	FBSM-05B / ATT(10dB) + LNA1(1~18GHz)	01/20/2021	Annual	None
TNM system	FBSM-05B / ATT(3dB) + LNA1(1~18GHz)	01/20/2021	Annual	None
TNM system	FBSM-05B / LNA1(1~18GHz)	01/20/2021	Annual	25540
TNM system	FBSM-05B / HPF(7~18GHz) + LNA2(6~18GHz)	01/20/2021	Annual	28550
TNM system	FBSM-05B / Thru(30MHz ~ 18GHz)	01/20/2021	Annual	None
Wainwright Instruments	WRCJV5100/5850-40/50-8EEK / Band Reject Filter	02/08/2021	Annual	1
Weinschel	2-3 / Attenuator (3 dB)	10/07/2020	Annual	BR0617
H+S	5910-N-50-010 / Attenuator(10 dB)	10/28/2020	Annual	None
Rohde & Schwarz	ESCI / Test Receiver	06/10/2020	Annual	100584

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-2105-FC033-P