

TEST REPORT

FCC DTS Test for SM-S931B/DS
Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-2411-FC002

DATE OF ISSUE
November 4, 2024

Tested by
Jeong Ho Kim



Technical Manager
Jong Seok Lee



HCT CO., LTD.
Bongjai Huh
BongJai Huh / CEO

**HCT CO.,LTD.**

2-6, 73, 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea
Tel. +82 31 645 6300 Fax. +82 31 645 6401

TEST REPORT

REPORT NO.

HCT-RF-2411-FC002

DATE OF ISSUE

November 04, 2024

Additional Model

SM-S931B

Applicant

SAMSUNG Electronics Co., Ltd.

129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Product Name

Mobile Phone

Model Name

SM-S931B/DS

FCC ID

A3LSMS931B

Date of Test

September 04, 2024 ~ November 04, 2024

FCC Classification

Digital Transmission System(DTS)

Test Standard Used

FCC Rule Part(s): Part 15.247

Test Results

PASS

Location of Test

☒ Permanent Testing Lab ☐ On Site Testing Lab

(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	November 04, 2024	Initial Release

Notice

Content

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.

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

CONTENTS

1. EUT DESCRIPTION	5
ANTENNA CONFIGURATIONS	6
2. TEST METHODOLOGY	8
EUT CONFIGURATION	8
EUT EXERCISE	8
GENERAL TEST PROCEDURES	8
DESCRIPTION OF TEST MODES	9
3. INSTRUMENT CALIBRATION	9
4. FACILITIES AND ACCREDITATIONS	9
FACILITIES	9
EQUIPMENT	9
5. ANTENNA REQUIREMENTS	10
6. MEASUREMENT UNCERTAINTY	10
7. DESCRIPTION OF TESTS	11
8. SUMMARY TEST OF RESULTS	28
9. TEST RESULT	29
9.1 DUTY CYCLE	29
9.2 6 dB BANDWIDTH	30
9.3 OUTPUT POWER	34
9.4 POWER SPECTRAL DENSITY	36
9.5 BAND EDGE / CONDUCTED SPURIOUS EMISSIONS	39
9.6 RADIATED SPURIOUS EMISSIONS	43
9.7 RADIATED RESTRICTED BAND EDGES	49
9.8 POWERLINE CONDUCTED EMISSIONS	54
10. LIST OF TEST EQUIPMENT	55
11. ANNEX A_ TEST SETUP PHOTO	57

1. EUT DESCRIPTION

Model	SM-S931B/DS		
Additional Model	SM-S931B		
EUT Type	Mobile Phone		
Power Supply	DC 3.88 V		
Frequency Range	2 412 MHz ~ 2 472 MHz		
Max. RF Output Power	<u>Average Power</u>	SISO (Ant.1) :	17.61 dBm
		SISO (Ant.2) :	17.43 dBm
		MIMO_CDD (Ant.1+ Ant.2) :	20.33 dBm
	<u>Peak Power</u>	SISO (Ant.1) :	25.00 dBm
		SISO (Ant.2) :	24.69 dBm
		MIMO_CDD (Ant.1+ Ant.2) :	27.60 dBm
Modulation Type	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n, 802.11ac		
Number of Channels	13 Channels		
Antenna Specification	Type: Metal		
Serial number	Conducted : R3CX80PTALM Radiated : R3CX80PTC6A		

ANTENNA CONFIGURATIONS

1. Antenna configuration

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

Note:

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

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

RSDB Scenario	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5 GHz WiFi Ant.1	5 GHz WiFi Ant.2	6 GHz WiFi Ant.1	6 GHz WiFi Ant.2	BT Ant.1	BT Ant.2	Test Case
2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO	on	on	on	on	-	-	-	-	Scenario1
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi ANT.1	-	on	on	-	-	-	on	-	-
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi ANT.2	-	on	-	on	-	-	on	-	Scenario2
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi MIMO	-	on	on	on	-	-	on	-	Scenario3

3. Directional Gain Calculation

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

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

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

Ant Gain (dBi)		N _{ANT} / N _{ss}	Directional Gain (dBi)	
			CDD	SDM
ANT.1	-2.43	2/2	-0.50	-2.43
ANT.2	-4.74			

Note

According to ANSI C63.10-2013 section 14.4.3, the directional gain is calculated using the formula, where G_N is the gain of the nth antenna and N_{ANT} is the total number of antennas used.

$$\text{Directional gain(CDD)} = 10 \cdot \log \left(\left(\frac{10^{(\text{ANT.0 Gain}/20)} + 10^{(\text{ANT.1 Gain}/20)} \right)^2 / 2 \right) \text{ dBi}$$

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

Sample MIMO Calculation:

Ex) ANT.1 : 11.58 dBm ANT.2 : 12.08 dBm

$$\text{MIMO} = \text{ANT.1} + \text{ANT.2}$$

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

2. TEST METHODOLOGY

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

EUT CONFIGURATION

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

EUT EXERCISE

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

GENERAL TEST PROCEDURES

Conducted Emissions

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

Radiated Emissions

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

DESCRIPTION OF TEST MODES

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

3. INSTRUMENT CALIBRATION

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

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

4. FACILITIES AND ACCREDITATIONS

FACILITIES

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

Detailed description of test facility was submitted to the Commission and accepted dated March 11, 2024 (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.

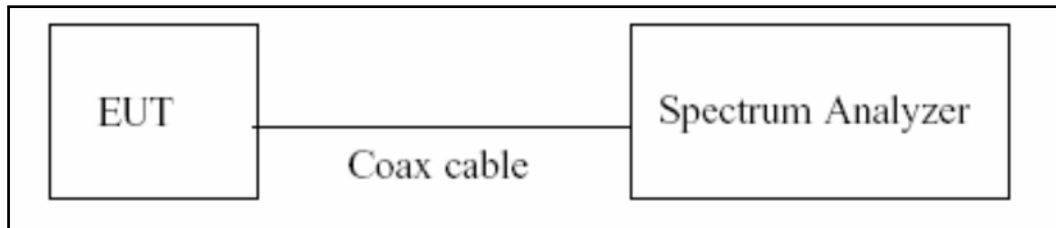
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.98 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.36 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.70 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.52 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.66 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (Above 40 GHz)	5.58 (Confidence level about 95 %, $k=2$)

7. DESCRIPTION OF TESTS

7.1. Duty Cycle

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to the zero-span measurement method.

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

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

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

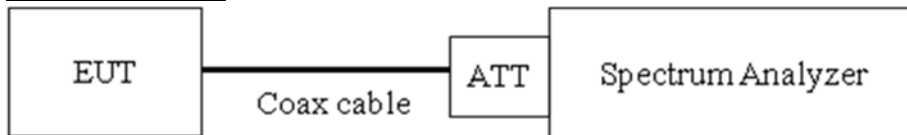
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz or 50 MHz (\geq RBW)
3. SPAN = 0 Hz
4. Detector = Average
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = $10\log(1/\text{Duty Cycle})$

7.2. 6 dB Bandwidth

Limit

The minimum permissible 6 dB bandwidth is 500 kHz.

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

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

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

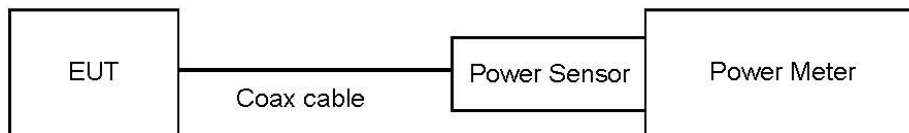
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

7.3. Output Power

Limit

The maximum permissible conducted output power is 1 Watt.

Test Configuration



Test Procedure

The transmitter output is connected to the Power Meter.

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

Sample Calculation

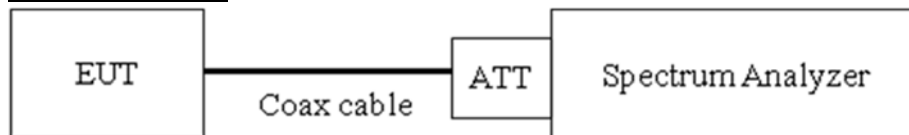
- Conducted Output Power(Peak) = Measured Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Measured Value + ATT loss + Cable loss + Duty Cycle Factor

7.4. Power Spectral Density

Limit

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

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

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

The spectrum analyzer is set to :

- 1) Set analyzer center frequency to DTS channel center frequency.
- 2) Set span to at least 1.5 times the OBW.
- 3) $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$.
- 4) $VBW \geq 3 \times RBW$.
- 5) Sweep = auto couple
- 6) Detector = power averaging (rms) or sample detector (when rms not available).
- 7) Ensure that the number of measurement points in the sweep $\geq [2 \times \text{span} / RBW]$.
- 8) Employ trace averaging (rms) mode over a minimum of 100 traces
- 9) Use the peak marker function to determine the maximum amplitude level.
- 10) Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

- 11) if then duty factor shall be added to adjust the result if the duty cycle is less than 98 %

Sample Calculation

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

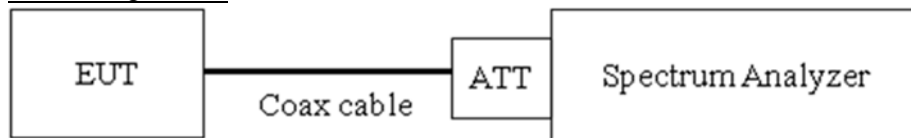
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

Limit

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

[Conducted > 30 dBc]

Test Configuration



Test Procedure

The transmitter output is connected to the spectrum analyzer.

(Procedure 11.11 in ANSI 63.10-2013)

- 1) RBW = 100 kHz
- 2) VBW $\geq 3 \times$ RBW
- 3) Set span to encompass the spectrum to be examined
- 4) Detector = Peak
- 5) Trace Mode = max hold
- 6) Sweep time = auto couple
- 7) Allow trace to fully stabilize.
- 8) 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	10.10
100	10.11
200	10.15
300	10.18
400	10.19
500	10.26
600	10.25
700	10.28
800	10.29
900	10.30
1000	10.30
2000	10.52
2400	10.60
2500	10.60
3000	10.62
4000	10.67
5000	10.80
6000	10.90
7000	10.90
8000	10.94
9000	11.04
10000	11.14
11000	11.18
12000	11.22
13000	11.28
14000	11.35
15000	11.44
16000	11.49
17000	11.53
18000	11.57
19000	11.63
20000	11.68
21000	11.71
22000	11.80
23000	11.82
24000	11.93
25000	11.95

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

2. Factor = Attenuator loss + Cable loss
3. EUT cable loss = 0.54 dB
4. Total Port offset = 11.14 dB

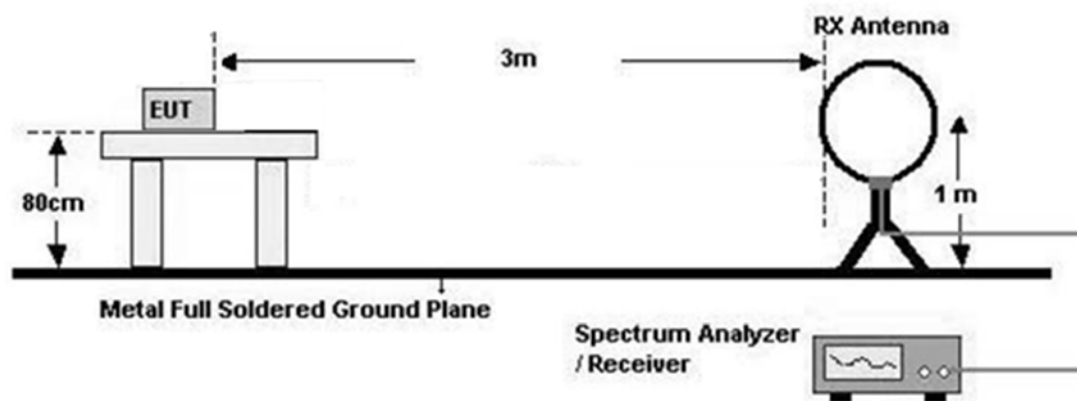
7.6. Radiated Test

Limit

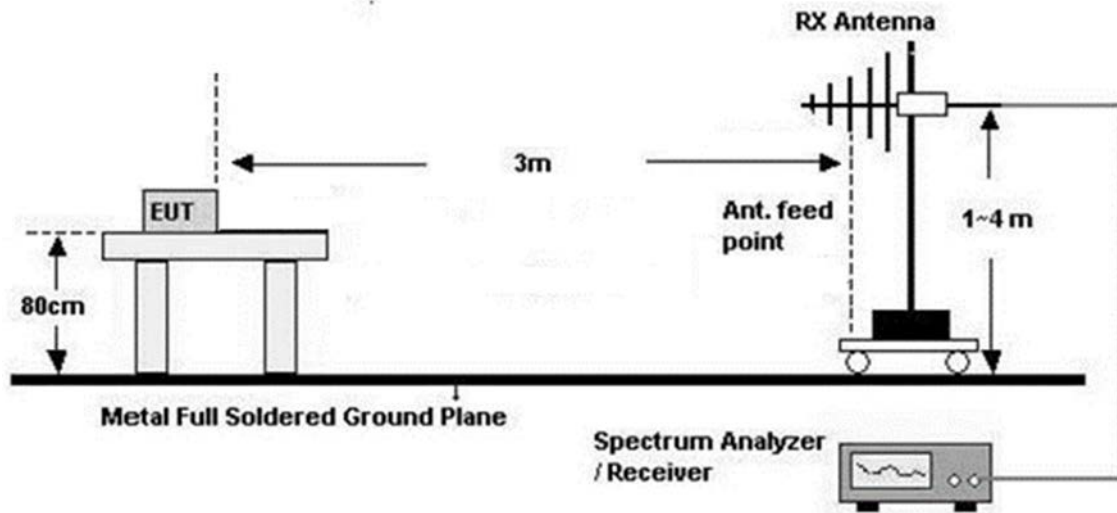
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009 – 0.490	$2400/F(\text{kHz})$	300
0.490 – 1.705	$24000/F(\text{kHz})$	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

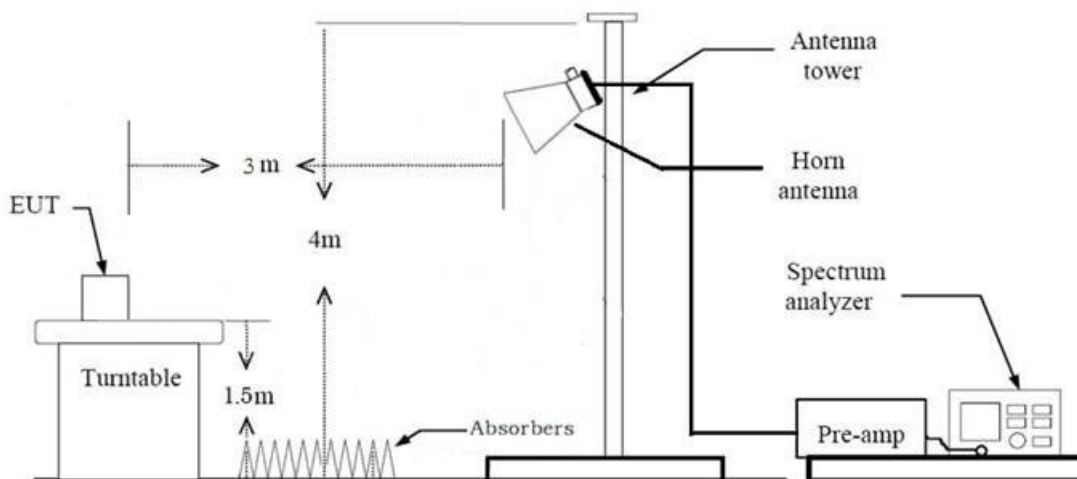
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



Test Procedure of Radiated spurious emissions (Below 30 MHz)

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

KDB 414788 OFS and Chamber Correlation Justification

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

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

Test Procedure of Radiated spurious emissions (Below 1 GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8 m above ground plane.
3. The Hybrid antenna was placed at a location 3 m from the EUT, which is varied from 1 m to 4 m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.

6. Spectrum Setting**(1) Measurement Type(Peak):**

- Measured Frequency Range : 30 MHz – 1 GHz
- Detector = Peak
- Trace = Max hold
- RBW = 100 kHz
- VBW $\geq 3 \times$ RBW

(2) Measurement Type(Quasi-peak):

- Measured Frequency Range : 30 MHz – 1 GHz
- Detector = Quasi-Peak
- RBW = 120 kHz

In general, (1) is used mainly

7. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L)
8. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

Test Procedure of Radiated spurious emissions (Above 1 GHz)

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

(1) Measurement Type(Peak):

- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = Peak
- Trace = Maxhold
- RBW = 1 MHz
- VBW $\geq 3 \times$ RBW

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

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

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

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

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

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

11. Total(Measurement Type : Peak)

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

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

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

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

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

Test Procedure of Radiated Restricted Band Edge

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

8. Spectrum Setting**(1) Measurement Type(Peak):**

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

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

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

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

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

the test been performed at 100 % duty cycle.

- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

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

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

11. Total(Measurement Type : Peak)

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

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

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

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

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

7.7. AC Power line Conducted Emissions

Limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB μ V)	
	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) = Measured Value + Correction Factor

7.8. Worst case configuration and mode

Radiated test

1. All modes of operation were investigated and the worst case configuration results are reported.
 - Mode : Stand alone, Stand alone + External accessories(Earphone, etc)
 - Worstcase : Stand alone
2. All Antenna of operation were investigated and the worst case results are reported
 - Antenna Operation Type : SISO, MIMO_CDD(Ant.1+Ant.2), MIMO_SDM(Ant.1+Ant.2)
 - Worstcase : MIMO_CDD(Ant.1+Ant.2)
3. EUT Axis
 - Radiated Spurious Emissions : X
 - Radiated Restricted Band Edge : X
4. Duty cycle factor applies only 802.11g/n/ac (Duty cycle < 98 %).
5. All data rate of operation were investigated and the test results are worst case in lowest Data Rate of each mode.
 - 802.11b : 1 Mbps
 - 802.11g : 6 Mbps
 - 802.11n(HT20): MCS0
 - 802.11ac(VHT20): MCS0
6. 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
7. Radiated Spurious Emission
 - All mode of operation were investigated and the worst case results are reported.
 - Mode: 802.11b, 802.11g, 802.11n(HT20), 802.11ac(VHT20)
 - Worst case: 802.11b
8. SM-S931B/DS, SM-S931B were tested and the worst case results are reported.
(Worst case: SM-S931B/DS)

Radiated test(RSDB)

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

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

2. EUT Axis

- Radiated Spurious Emissions : Z

3. All of RSDB Scenario were investigated and the worst case configuration results are reported.

RSDB Scenario	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5 GHz WiFi Ant.1	5 GHz WiFi Ant.2	6 GHz WiFi Ant.1	6 GHz WiFi Ant.2	BT Ant.1	BT Ant.2	Test Case
2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO	on	on	on	on	-	-	-	-	Scenario1
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi ANT.1	-	on	on	-	-	-	on	-	-
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi ANT.2	-	on	-	on	-	-	on	-	Scenario2
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi MIMO	-	on	on	on	-	-	on	-	Scenario3

4. The RSDB mode test investigated both intermodulation and radiated spurious emissions.

And the worst results were reported.

- Worst result: Radiated spurious emissions
- Intermodulation: No signals are generated.
- Radiated spurious emissions: cf. Section 10.6.2.

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

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

RSDB Scenario 1	Description	2.4GHz Emission	5 GHz Emission
2.4 GHz WiFi MIMO + 5 GHz WiFi MIMO	Antenna	Ant All	Ant All
	Channel	1	38
	Data Rate	1 Mbps	MCS 0
	Mode	802.11b	802.11be(EHT40)
	Tone, RU	N/A	26T, 9 RU

Note : UNII ax, be RSDB Data refer to [UNII ax, be] Test Report

RSDB Scenario 2	Description	Bluetooth Emission	2.4GHz Emission	5 GHz Emission
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi ANT.2	Antenna	ANT1	ANT2	ANT2
	Channel	78	1	38
	Data Rate	3 Mbps	1 Mbps	MCS 0
	Mode	8DPSK	802.11b	802.11be(EHT40)
	Tone, RU	N/A	N/A	26T, 9 RU

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

RSDB Scenario 3	Description	Bluetooth Emission	2.4GHz Emission	5 GHz Emission
Bluetooth ANT.1 + 2.4 GHz WiFi ANT.2 + 5 GHz WiFi MIMO	Antenna	ANT1	ANT2	MIMO
	Channel	78	1	38
	Data Rate	3 Mbps	1 Mbps	MCS 0
	Mode	8DPSK	802.11b	802.11be(EHT40)
	Tone, RU	N/A	N/A	26T, 9 RU

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

6. SM-S931B/DS, SM-S931B were tested and the worst case results are reported.

(Worst case: SM-S931B/DS)

AC Power line Conducted Emissions

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

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

Stand alone + Travel Adapter

- Worstcase : Stand alone + Travel Adapter

2. SM-S931B/DS, SM-S931B were tested and the worst case results are reported.

(Worst case: SM-S931B/DS)

Conducted test

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

2. SM-S931B/DS, SM-S931B were tested and the worst case results are reported.

(Worst case: SM-S931B/DS)

8. SUMMARY TEST OF RESULTS

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

9. TEST RESULT

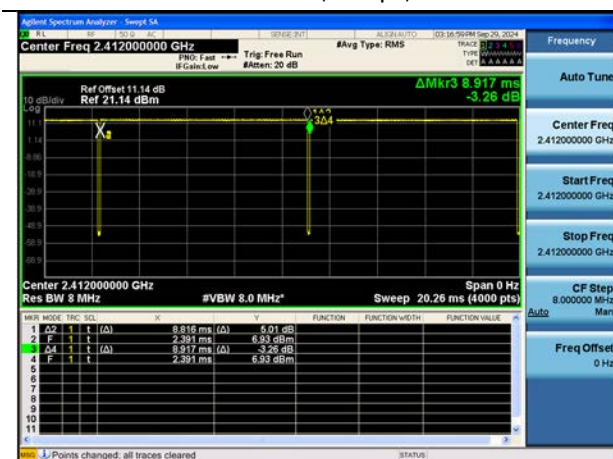
9.1 DUTY CYCLE

Mode	Data Rate	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	1 Mbps	8.816	8.917	0.989	0.050
802.11g	6 Mbps	1.465	1.572	0.932	0.304
802.11n(HT20)	MCS0	1.250	1.357	0.921	0.357
802.11ac(VHT20)	MCS0	1.255	1.361	0.922	0.351

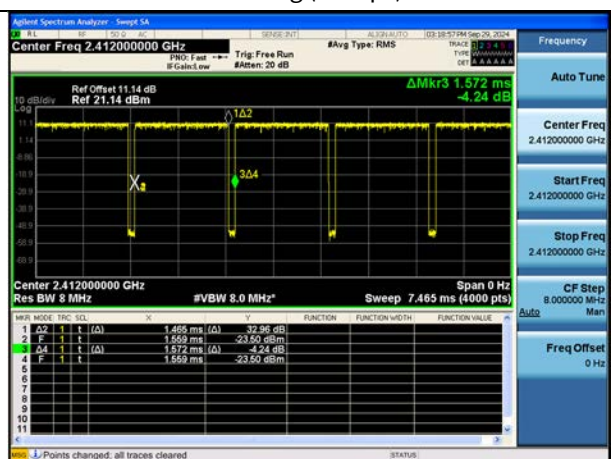
Test Plots

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

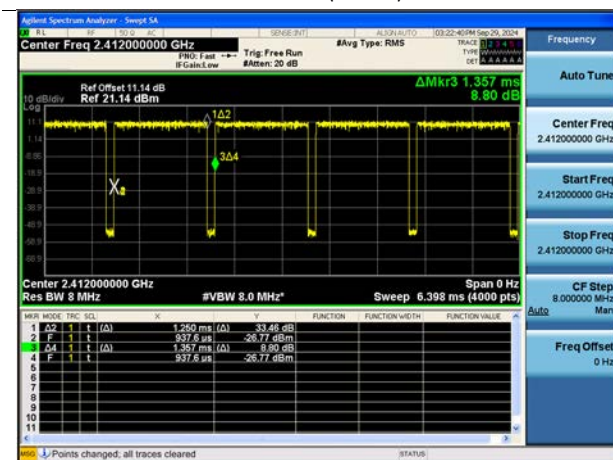
802.11b (1 Mbps)



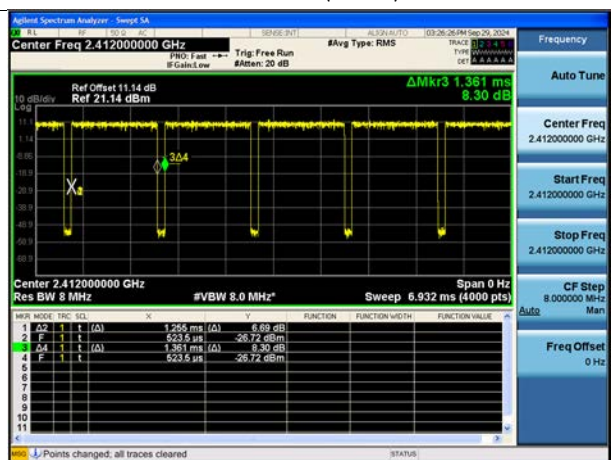
802.11g (6 Mbps)



802.11n (MCS0)



802.11ac (MCS0)



9.2 6 dB BANDWIDTH

[ANT. 1]

Mode	Frequency [MHz]	Channel No.	6dB Bandwidth [MHz]	Limit [MHz]
802.11b	2412	1	9.132	0.50
	2437	6	9.137	0.50
	2462	11	9.114	0.50
	2467	12	9.100	0.50
	2472	13	9.549	0.50
802.11g	2412	1	16.37	0.50
	2437	6	16.38	0.50
	2462	11	16.37	0.50
	2467	12	16.33	0.50
	2472	13	16.12	0.50
802.11n HT20	2412	1	17.60	0.50
	2437	6	17.64	0.50
	2462	11	17.39	0.50
	2467	12	17.25	0.50
	2472	13	17.25	0.50
802.11ac VHT20	2412	1	17.61	0.50
	2437	6	17.62	0.50
	2462	11	17.36	0.50
	2467	12	17.25	0.50
	2472	13	17.26	0.50

[ANT. 2]

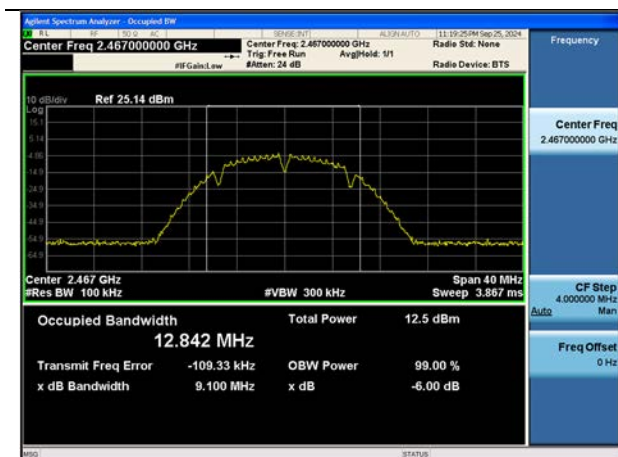
Mode	Frequency [MHz]	Channel No.	6dB Bandwidth [MHz]	Limit [MHz]
802.11b	2412	1	9.139	0.50
	2437	6	9.133	0.50
	2462	11	9.143	0.50
	2467	12	9.121	0.50
	2472	13	9.106	0.50
802.11g	2412	1	16.37	0.50
	2437	6	16.38	0.50
	2462	11	16.39	0.50
	2467	12	16.39	0.50
	2472	13	16.36	0.50
802.11n HT20	2412	1	17.60	0.50
	2437	6	17.60	0.50
	2462	11	17.62	0.50
	2467	12	17.62	0.50
	2472	13	17.34	0.50
802.11ac VHT20	2412	1	17.62	0.50
	2437	6	17.60	0.50
	2462	11	17.62	0.50
	2467	12	17.62	0.50
	2472	13	17.27	0.50

Test Plots

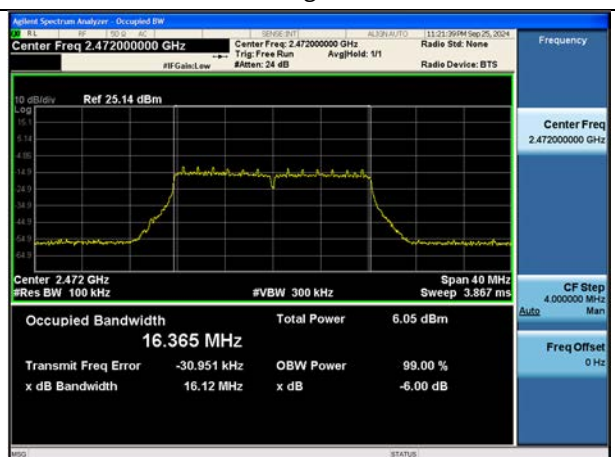
[ANT. 1]

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

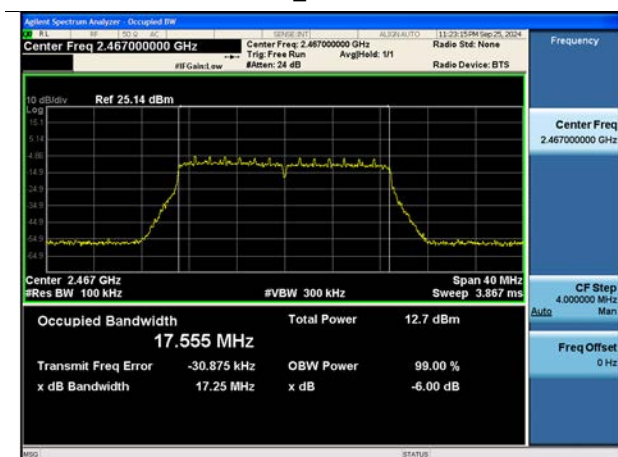
802.11b-CH 12



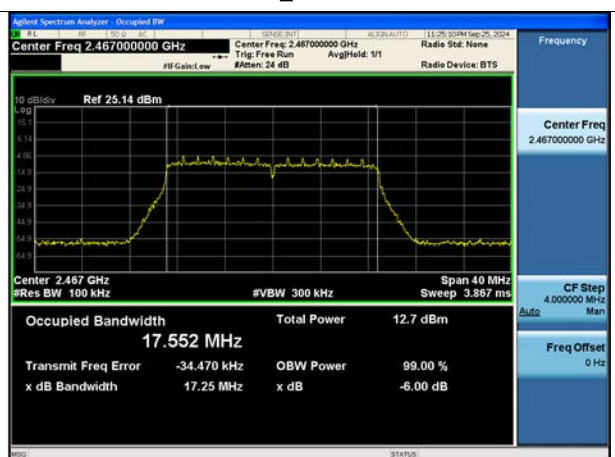
802.11g-CH 13



802.11n_HT20-CH 12



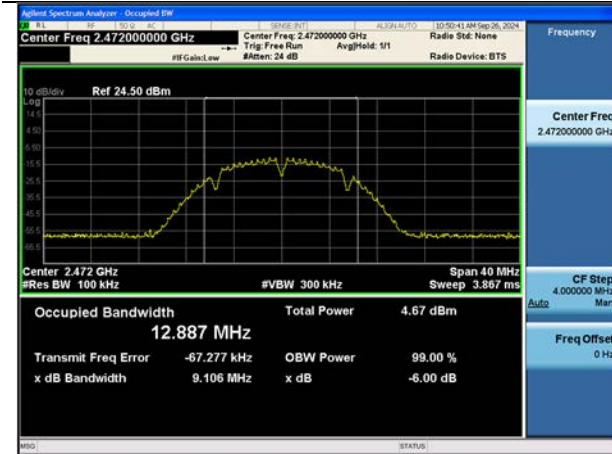
802.11ac_VHT20-CH 12



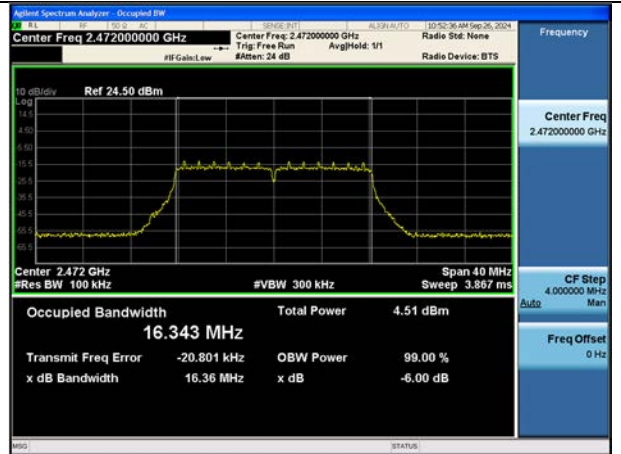
[ANT. 2]

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

802.11b-CH 13



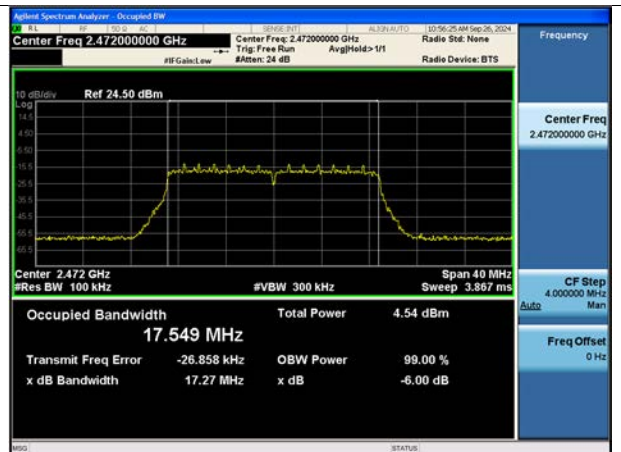
802.11g-CH 13



802.11n_HT20-CH 13



802.11ac_VHT20-CH 13



9.3 OUTPUT POWER

Note :

1. MIMO_CDD(Ant1+Ant2) Power = $10 \cdot \log((10^{(\text{Ant. 1 power}/10)}) + (10^{(\text{Ant. 2 power}/10)}))$

Peak Power

[MIMO_CDD(Ant1+Ant2)]

Mode	Frequency [MHz]	Channel No.	Data Rate	Total Peak Power [dBm]			Limit [dBm]
				ANT1	ANT2	MIMO	
802.11b	2412	1	11M	23.61	22.43	26.07	30
	2437	6	11M	23.29	23.56	26.44	30
	2462	11	11M	23.75	22.98	26.39	30
	2467	12	11M	11.93	11.91	14.93	30
	2472	13	11M	5.61	4.82	8.24	30
802.11g	2412	1	54M	24.80	23.49	27.21	30
	2437	6	54M	24.29	24.69	27.51	30
	2462	11	54M	25.00	24.13	27.60	30
	2467	12	54M	14.07	13.91	17.00	30
	2472	13	54M	8.19	7.24	10.75	30
802.11n HT20	2412	1	MCS6	24.63	23.23	27.00	30
	2437	6	MCS6	24.16	24.52	27.35	30
	2462	11	MCS6	24.74	24.01	27.40	30
	2467	12	MCS6	13.87	13.77	16.83	30
	2472	13	MCS6	8.05	7.18	10.65	30
802.11ac VHT20	2412	1	MCS8	24.59	23.22	26.97	30
	2437	6	MCS8	24.15	24.52	27.35	30
	2462	11	MCS8	24.82	23.96	27.42	30
	2467	12	MCS8	13.81	13.67	16.75	30
	2472	13	MCS8	8.07	7.15	10.64	30

Average Power

Note :

1. Total Power [dBm] = Measured Power [dBm] + Duty Cycle Factor [dB]

[MIMO_CDD(Ant1+Ant2)]

Mode	Frequency [MHz]	Channel No.	Data Rate	Total Average Power [dBm]			Limit [dBm]
				ANT1	ANT2	MIMO	
802.11b	2412	1	1M	17.55	16.38	20.01	30
	2437	6	1M	17.18	17.43	20.32	30
	2462	11	1M	17.61	17.00	20.33	30
	2467	12	1M	5.68	5.74	8.72	30
	2472	13	1M	-0.60	-1.33	2.06	30
802.11g	2412	1	6M	16.33	15.08	18.76	30
	2437	6	6M	15.85	16.30	19.09	30
	2462	11	6M	16.44	15.78	19.14	30
	2467	12	6M	5.45	5.40	8.43	30
	2472	13	6M	-1.14	-1.89	1.51	30
802.11n HT20	2412	1	MCS0	16.23	15.01	18.67	30
	2437	6	MCS0	15.79	16.20	19.01	30
	2462	11	MCS0	16.28	15.68	19.00	30
	2467	12	MCS0	5.38	5.36	8.38	30
	2472	13	MCS0	-1.19	-2.00	1.43	30
802.11ac VHT20	2412	1	MCS0	16.19	15.01	18.65	30
	2437	6	MCS0	15.80	16.19	19.01	30
	2462	11	MCS0	16.38	15.65	19.04	30
	2467	12	MCS0	5.38	5.37	8.39	30
	2472	13	MCS0	-1.15	-1.99	1.46	30

9.4 POWER SPECTRAL DENSITY

Note :

1. $\text{MIMO_CDD}(\text{Ant1}+\text{Ant2}) \text{ PSD} = 10 \cdot \log((10^{\text{Ant. 1 PSD} / 10}) + (10^{\text{Ant. 2 PSD} / 10}))$
2. Total PSD = Measured Value + Duty Cycle Factor

[MIMO_CDD(Ant1+Ant2)]

BW	Frequency [MHz]	Channel No.	Data Rate	Total Power Spectral Density [dBm/kHz]			Limit [dBm/kHz]
				ANT1	ANT2	MIMO	
802.11b	2412	1	1M	-3.671	-5.784	-1.590	8
	2437	6	1M	-4.959	-4.661	-1.798	8
	2462	11	1M	-4.062	-4.984	-1.489	8
	2467	12	1M	-16.306	-16.448	-13.366	8
	2472	13	1M	-22.578	-23.382	-19.951	8
802.11g	2412	1	6M	-8.274	-9.376	-5.779	8
	2437	6	6M	-9.068	-8.296	-5.654	8
	2462	11	6M	-8.102	-9.005	-5.519	8
	2467	12	6M	-18.933	-19.479	-16.187	8
	2472	13	6M	-25.402	-26.687	-22.986	8
802.11n HT20	2412	1	MCS0	-8.354	-9.980	-6.081	8
	2437	6	MCS0	-9.126	-8.867	-5.984	8
	2462	11	MCS0	-8.213	-9.484	-5.791	8
	2467	12	MCS0	-19.009	-19.471	-16.223	8
	2472	13	MCS0	-25.616	-26.525	-23.036	8
802.11ac VHT20	2412	1	MCS0	-7.798	-10.086	-5.782	8
	2437	6	MCS0	-9.162	-9.004	-6.072	8
	2462	11	MCS0	-8.562	-9.429	-5.963	8
	2467	12	MCS0	-19.023	-18.861	-15.931	8
	2472	13	MCS0	-25.294	-26.734	-22.944	8

Test Plots

Note :

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

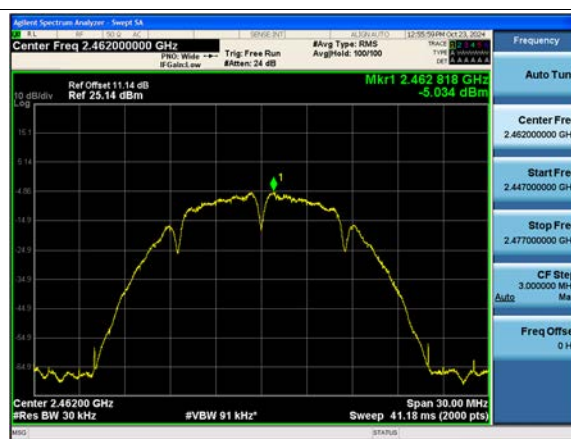
[MIMO_CDD(Ant1+Ant2)]

Power Spectral Density (802.11b-CH 11)

ANT. 1

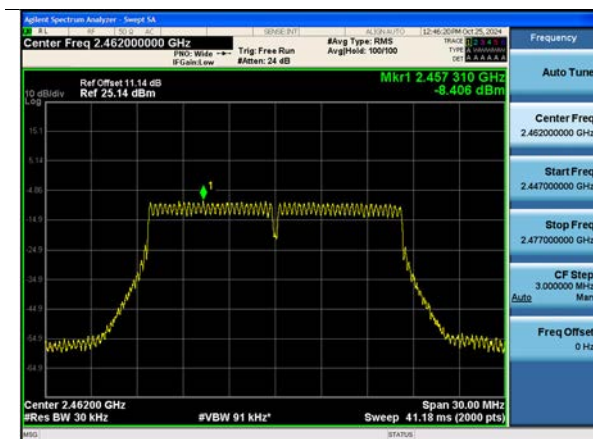


ANT. 2

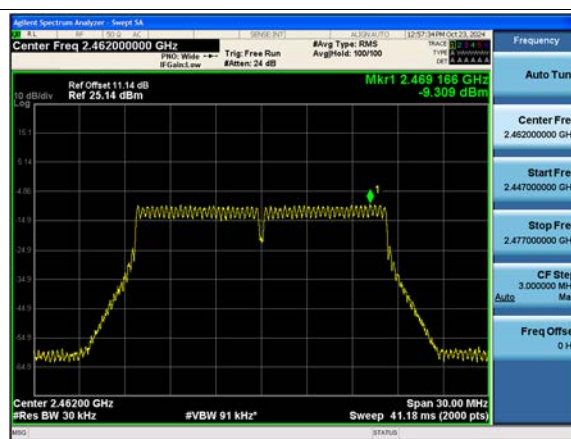


Power Spectral Density (802.11g-CH 11)

ANT. 1

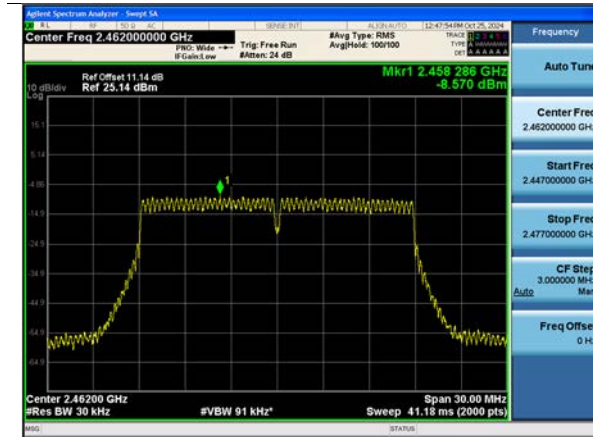


ANT. 2

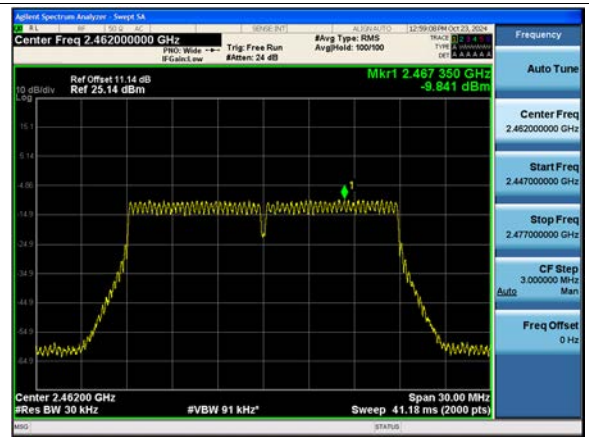


Power Spectral Density (802.11n-CH 11)

ANT. 1

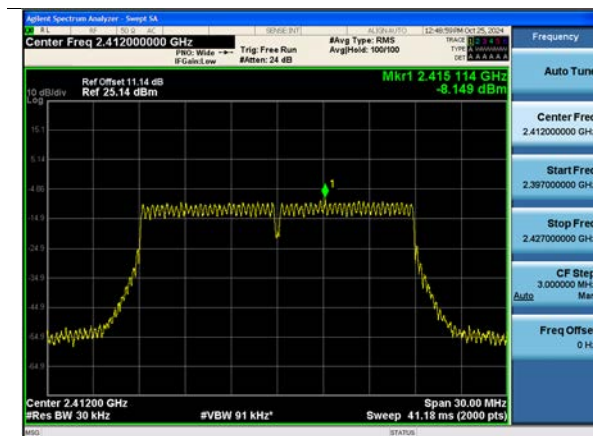


ANT. 2

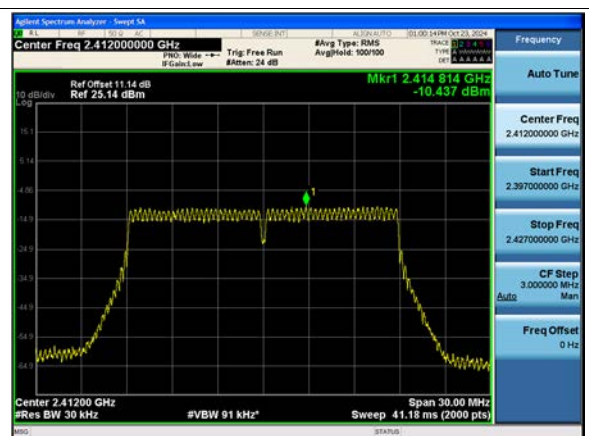


Power Spectral Density (802.11ac-CH 1)

ANT. 1



ANT. 2



9.5 BAND EDGE / CONDUCTED SPURIOUS EMISSIONS

Band Edge

Limit : 30 dBc

[ANT. 1]

Mode	Frequency [MHz]	Channel No.	Data Rate	Measured Position	Band-Edge [dB]
802.11b	2412	1	1M	Low	53.204
	2462	11	1M	High	62.752
	2467	12	1M	High	51.781
	2472	13	1M	High	45.762
802.11g	2412	1	6M	Low	41.657
	2462	11	6M	High	54.735
	2467	12	6M	High	50.097
	2472	13	6M	High	43.977
802.11n HT20	2412	1	MCS0	Low	42.527
	2462	11	MCS0	High	52.253
	2467	12	MCS0	High	50.736
	2472	13	MCS0	High	43.403
802.11ac VHT20	2412	1	MCS0	Low	42.336
	2462	11	MCS0	High	52.591
	2467	12	MCS0	High	50.237
	2472	13	MCS0	High	44.531

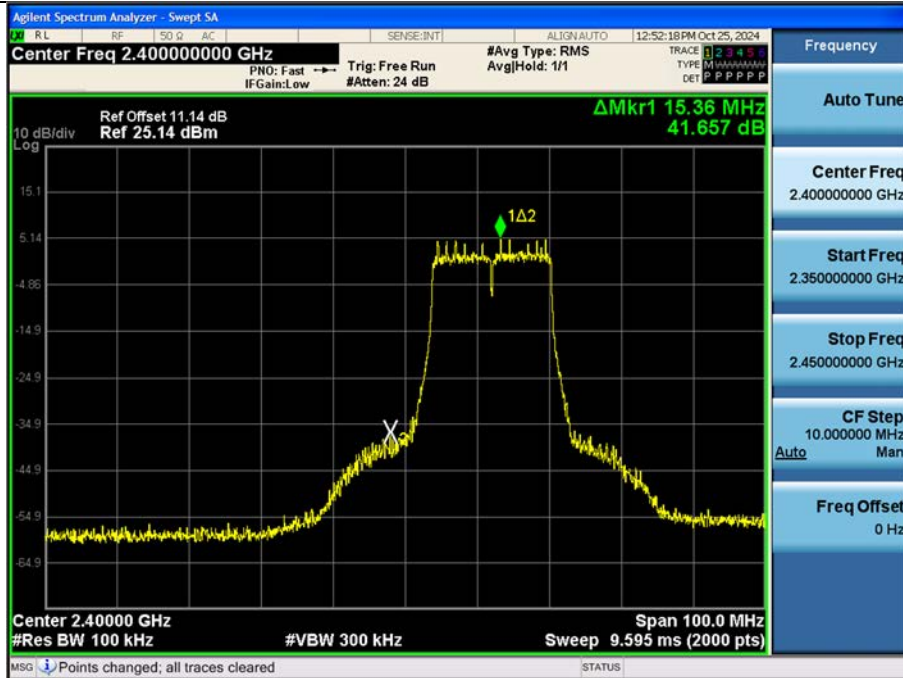
[ANT. 2]

Mode	Frequency [MHz]	Channel No.	Data Rate	Measured Position	Band-Edge [dB]
802.11b	2412	1	1M	Low	55.534
	2462	11	1M	High	62.541
	2467	12	1M	High	51.236
	2472	13	1M	High	45.134
802.11g	2412	1	6M	Low	47.773
	2462	11	6M	High	55.648
	2467	12	6M	High	49.874
	2472	13	6M	High	42.044
802.11n HT20	2412	1	MCS0	Low	48.217
	2462	11	MCS0	High	54.040
	2467	12	MCS0	High	49.983
	2472	13	MCS0	High	42.392
802.11ac VHT20	2412	1	MCS0	Low	47.759
	2462	11	MCS0	High	53.398
	2467	12	MCS0	High	49.902
	2472	13	MCS0	High	42.193

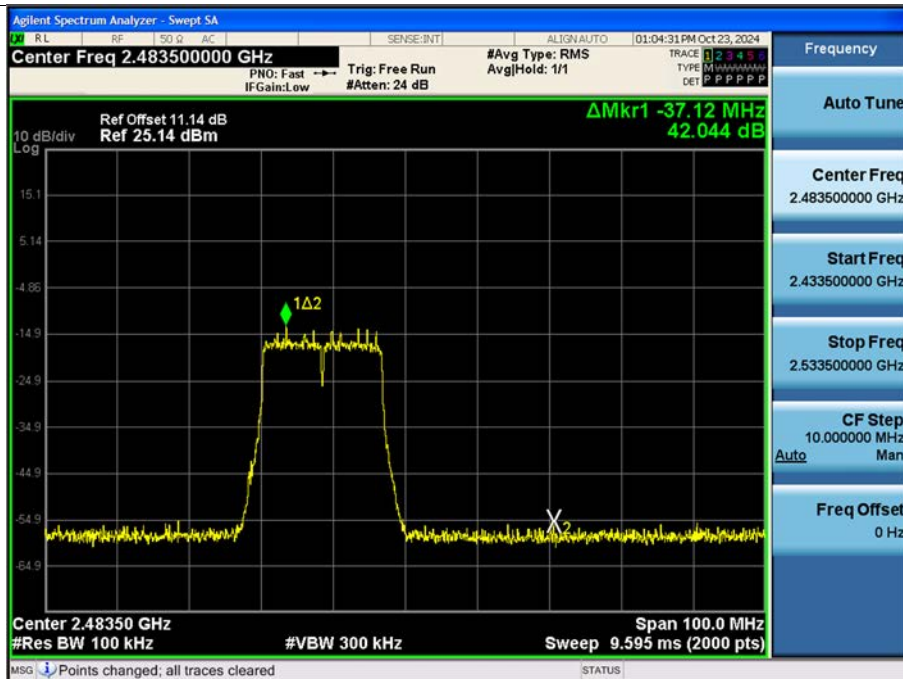
Test Plots

Note: In order to simplify the report, attached plots were only the worst case.

[ANT. 1] 802.11g - CH 1



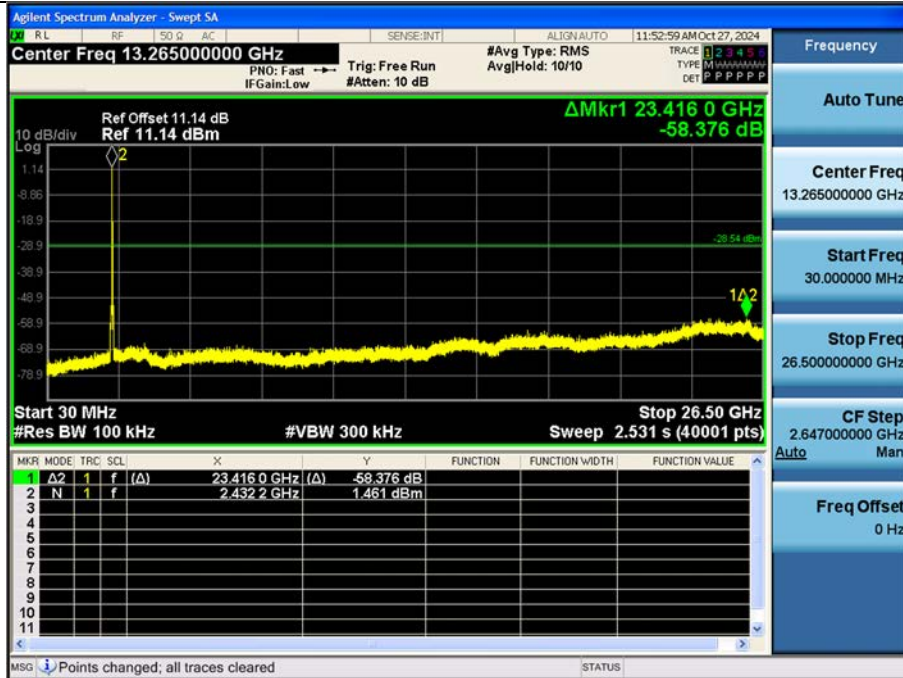
[ANT. 2] 802.11g - CH 13



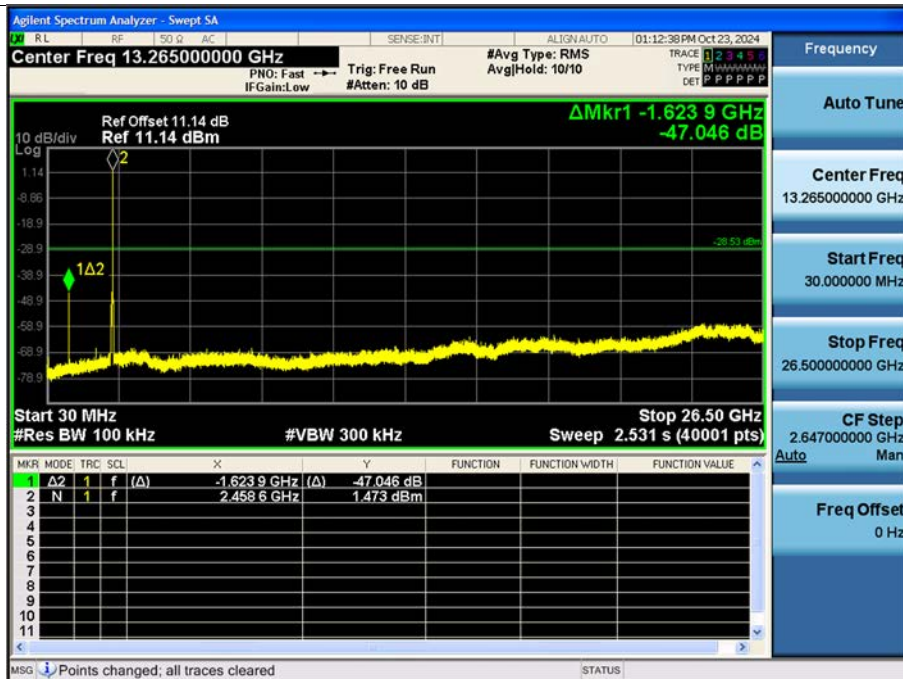
Test Plots(Conducted Spurious Emission)

Note: In order to simplify the report, attached plots were only the worst case.

[ANT. 1] 802.11n(HT20)_Ch.6_ MCS0



[ANT. 2] 802.11g_Ch.11_6 Mbps



Limit

ANT.1 : -28.539 dBm, ANT.2 : -28.527 dBm

9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

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

Note:

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

Frequency Range : Below 1 GHz

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

Note:

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

Frequency Range : Above 1 GHz

[MIMO_CDD(Ant1+Ant2)]

Band :	DTS	Operation Mode :		802.11b			
CH.1	2412	Transfer Rate :		1 Mbps			
Frequency	Measured value	CL+AF+DF-AG	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
4824	44.28	4.15	V	48.43	73.98	25.55	PK
4824	32.11	4.15	V	36.26	53.98	17.72	AV
7236	39.56	13.01	V	52.57	73.98	21.41	PK
7236	26.77	13.01	V	39.78	53.98	14.20	AV
4824	44.47	4.15	H	48.62	73.98	25.36	PK
4824	33.84	4.15	H	37.99	53.98	15.99	AV
7236	38.77	13.01	H	51.78	73.98	22.20	PK
7236	27.10	13.01	H	40.11	53.98	13.87	AV

Band :	DTS	Operation Mode :		802.11b			
CH.6	2437	Transfer Rate :		1 Mbps			
Frequency	Measured value	CL+AF+DF-AG	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
4874	44.56	4.11	V	48.67	73.98	25.31	PK
4874	32.34	4.11	V	36.45	53.98	17.53	AV
7311	40.10	12.33	V	52.43	73.98	21.55	PK
7311	27.39	12.33	V	39.72	53.98	14.26	AV
4874	44.35	4.11	H	48.46	73.98	25.52	PK
4874	33.33	4.11	H	37.44	53.98	16.54	AV
7311	39.20	12.33	H	51.53	73.98	22.45	PK
7311	27.52	12.33	H	39.85	53.98	14.13	AV

Band :	DTS	Operation Mode :		802.11b			
CH.11	2462	Transfer Rate :		1 Mbps			
Frequency	Measured value	CL+AF+DF-AG	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
4924	43.61	5.10	V	48.71	73.98	25.27	PK
4924	33.66	5.10	V	38.76	53.98	15.22	AV
7386	40.10	12.74	V	52.84	73.98	21.14	PK
7386	27.83	12.74	V	40.57	53.98	13.41	AV
4924	43.77	5.10	H	48.87	73.98	25.11	PK
4924	34.09	5.10	H	39.19	53.98	14.79	AV
7386	39.88	12.74	H	52.62	73.98	21.36	PK
7386	27.71	12.74	H	40.45	53.98	13.53	AV

[RSDB]

Scenario 1

Ant All(MIMO)_2.4 GHz 802.11b _1 Mbps Ch.1 + Ant All(MIMO) 5 GHz 802.11be(EHT40)_MCS0 Ch. 38 26T
9RU

Frequency	Measured value	CL+AF+DF-AG	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
4824	50.04	4.15	V	54.19	73.98	19.79	PK
4824	45.21	4.15	V	49.36	53.98	4.62	AV
7236	41.25	13.01	V	54.26	73.98	19.72	PK
7236	30.55	13.01	V	43.56	53.98	10.42	AV
4824	51.11	4.15	H	55.26	73.98	18.72	PK
4824	46.75	4.15	H	50.90	53.98	3.08	AV
7236	42.82	13.01	H	55.83	73.98	18.15	PK
7236	31.79	13.01	H	44.80	53.98	9.18	AV

Scenario 2

BT Ant1_ ANT1_8DPSK_ch.78 + ANT2(SISO)_2.4 GHz 802.11b _1 Mbps Ch.1 + ANT2(SISO) 5 GHz
802.11be(EHT40)_MCS0 Ch. 38 26T 9RU

Frequency	Measured value	CL+AF+DF-AG	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
4824	44.55	4.15	V	48.70	73.98	25.28	PK
4824	32.26	4.15	V	36.41	53.98	17.57	AV
7236	38.57	13.01	V	51.58	73.98	22.40	PK
7236	26.72	13.01	V	39.73	53.98	14.25	AV
4824	44.61	4.15	H	48.76	73.98	25.22	PK
4824	32.49	4.15	H	36.64	53.98	17.34	AV
7236	39.41	13.01	H	52.42	73.98	21.56	PK
7236	27.45	13.01	H	40.46	53.98	13.52	AV

Scenario 3

BT Ant1_ ANT1_8DPSK_ch.78 + ANT2(SISO)_2.4 GHz 802.11b _1 Mbps Ch.1 + Ant All(MIMO) 5 GHz
802.11be(EHT40)_MCS0 Ch. 38 26T 9RU

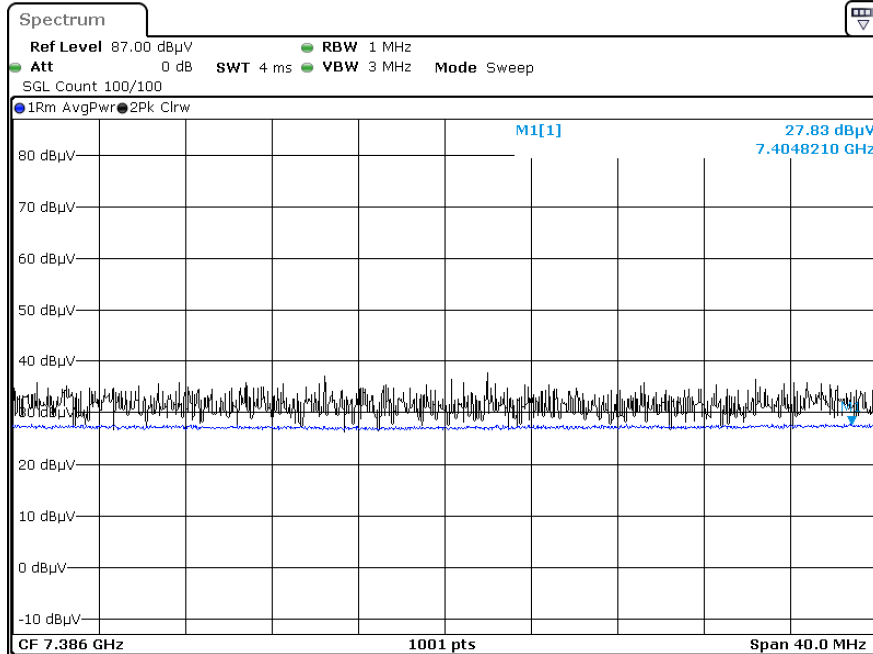
Frequency	Measured value	CL+AF+DF-AG	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
4824	43.25	4.15	V	47.40	73.98	26.58	PK
4824	31.04	4.15	V	35.19	53.98	18.79	AV
7236	38.04	13.01	V	51.05	73.98	22.93	PK
7236	26.52	13.01	V	39.53	53.98	14.45	AV
4824	44.34	4.15	H	48.49	73.98	25.49	PK
4824	32.31	4.15	H	36.46	53.98	17.52	AV
7236	38.61	13.01	H	51.62	73.98	22.36	PK
7236	26.74	13.01	H	39.75	53.98	14.23	AV

Test Plots

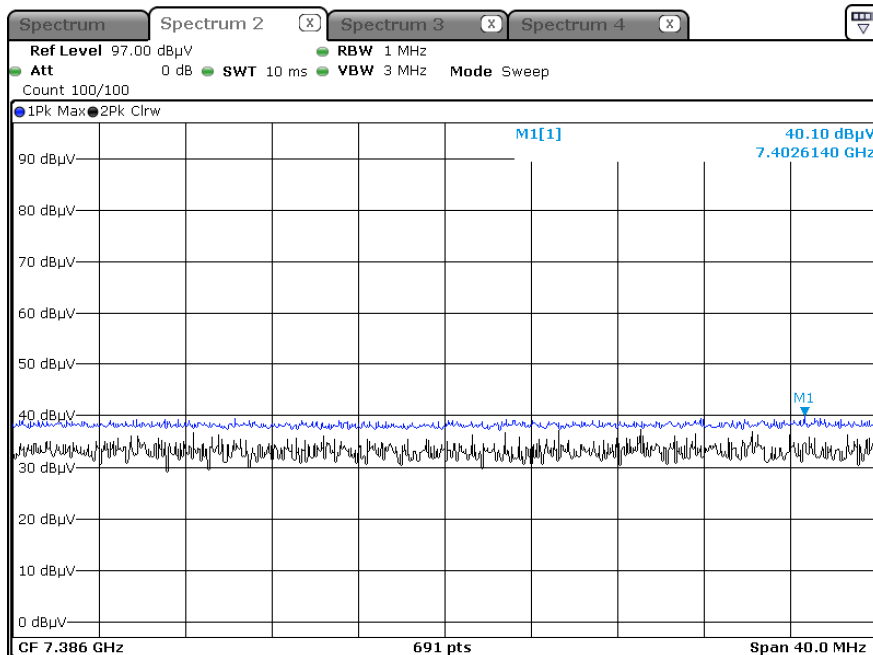
Note: In order to simplify the report, Plot of worst case are only reported.

[MIMO_CDD(Ant1+Ant2)]

Radiated Spurious Emissions plot – Average Result (802.11b_1 Mbps, Ch.11 3rd Harmonic, X-V)



Radiated Spurious Emissions plot – Peak Result (802.11b_1 Mbps, Ch.11 3rd Harmonic, X-V)

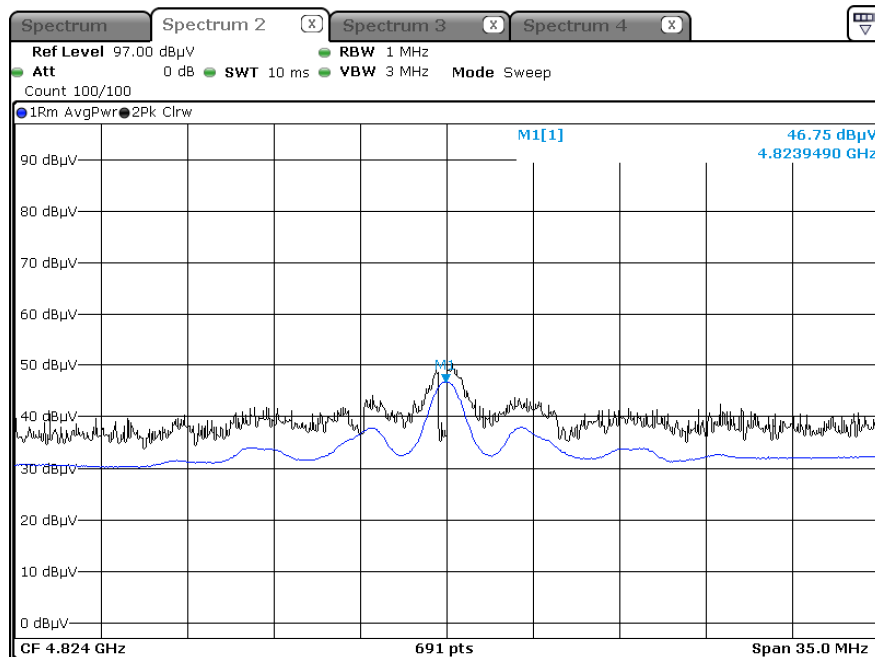


[RSDB]

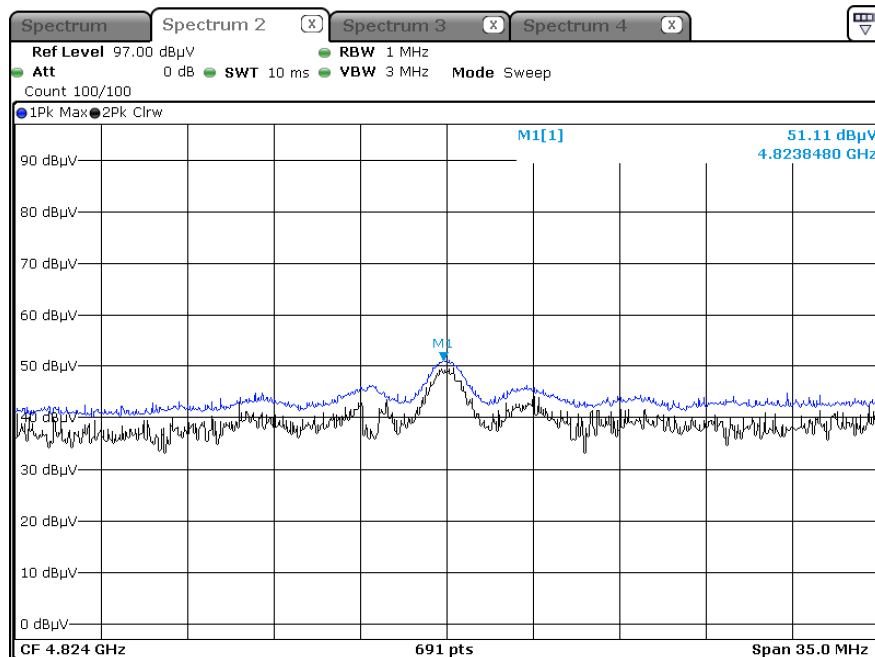
Scenario 1

Ant All(MIMO)_2.4 GHz 802.11b _1 Mbps Ch.1 + Ant All(MIMO) 5 GHz 802.11be(EHT40)_MCS0 Ch. 38 26T 9RU

Radiated Spurious Emissions plot – Average Result (2nd Harmonic, Z-H)



Radiated Spurious Emissions plot – Peak Result (2nd Harmonic, Z-H)



9.7 RADIATED RESTRICTED BAND EDGES

[MIMO_CDD(Ant1+Ant2)]

802.11b	Channel	01 Ch	Freq	2412 MHz		Transfer Rate	1 Mbps
Frequency	Measured Value	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
2390.0	23.17	34.73	H	57.90	73.98	16.08	PK
2390.0	11.13	34.73	H	45.86	53.98	8.12	AV

802.11b	Channel	11 Ch	Freq	2462 MHz		Transfer Rate	1 Mbps
Frequency	Measured Value	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
2483.5	22.16	35.59	H	57.75	73.98	16.23	PK
2483.5	10.07	35.59	H	45.66	53.98	8.32	AV

802.11b	Channel	12 Ch	Freq	2467 MHz		Transfer Rate	1 Mbps
Frequency	Measured Value	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
2483.5	21.31	35.59	H	56.90	73.98	17.08	PK
2483.5	9.34	35.59	H	44.93	53.98	9.05	AV

802.11b	Channel	13 Ch	Freq	2472 MHz		Transfer Rate	1 Mbps
Frequency	Measured Value	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement
[MHz]	[dB V]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	Type
2483.5	21.45	35.59	H	57.04	73.98	16.94	PK
2483.5	9.37	35.59	H	44.96	53.98	9.02	AV

802.11g		Channel	01 Ch	Freq	2412 MHz		Transfer Rate	6 Mbps
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dB V]	[dB]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	
2390.0	27.79	0.00	34.73	H	62.52	73.98	11.46	PK
2390.0	13.75	0.30	34.73	H	48.79	53.98	5.19	AV

802.11g		Channel	11 Ch	Freq	2462 MHz		Transfer Rate	6 Mbps
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dB V]	[dB]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	
2483.5	27.32	0.00	35.59	H	62.91	73.98	11.07	PK
2483.5	13.04	0.30	35.59	H	48.94	53.98	5.04	AV

802.11g		Channel	12 Ch	Freq	2467 MHz		Transfer Rate	6 Mbps
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dB V]	[dB]	[dB/m]	[H/V]	[dB V/m]	[dB V/m]	[dB]	
2483.5	22.03	0.00	35.59	H	57.62	73.98	16.36	PK
2483.5	9.38	0.30	35.59	H	45.28	53.98	8.70	AV

802.11g		Channel	13 Ch	Freq	2472 MHz		Transfer Rate	6 Mbps
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	22.14	0.00	35.59	H	57.73	73.98	16.25	PK
2483.5	9.55	0.30	35.59	H	45.45	53.98	8.53	AV

802.11n (HT20)		Channel	01 Ch	Freq	2412 MHz		Transfer MCS Index	MCS0
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2390.0	27.31	0.00	34.73	H	62.04	73.98	11.94	PK
2390.0	13.78	0.36	34.73	H	48.87	53.98	5.11	AV

802.11n (HT20)		Channel	11 Ch	Freq	2462 MHz		Transfer MCS Index	MCS0
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	27.10	0.00	35.59	H	62.69	73.98	11.29	PK
2483.5	13.79	0.36	35.59	H	49.74	53.98	4.24	AV

802.11n (HT20)		Channel	12 Ch	Freq	2467 MHz		Transfer MCS Index	MCS0
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	21.97	0.00	35.59	H	57.56	73.98	16.42	PK
2483.5	9.37	0.36	35.59	H	45.32	53.98	8.66	AV

802.11n (HT20)		Channel	13 Ch	Freq	2472 MHz		Transfer MCS Index	MCS0
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	21.86	0.00	35.59	H	57.45	73.98	16.53	PK
2483.5	9.81	0.36	35.59	H	45.76	53.98	8.22	AV

802.11ac (VHT20)		Channel	01 Ch	Freq	2412 MHz		Transfer MCS Index	MCS0
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2390.0	27.63	0.00	34.73	H	62.36	73.98	11.62	PK
2390.0	13.62	0.35	34.73	H	48.71	53.98	5.27	AV

802.11ac (VHT20)		Channel	11 Ch	Freq	2462 MHz		Transfer MCS Index	MCS0
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	28.80	0.00	35.59	H	64.39	73.98	9.59	PK
2483.5	14.62	0.35	35.59	H	50.57	53.98	3.41	AV

802.11ac (VHT20)		Channel	12 Ch	Freq	2467 MHz		Transfer MCS Index	MCS0
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	21.82	0.00	35.59	H	57.41	73.98	16.57	PK
2483.5	9.36	0.35	35.59	H	45.31	53.98	8.67	AV

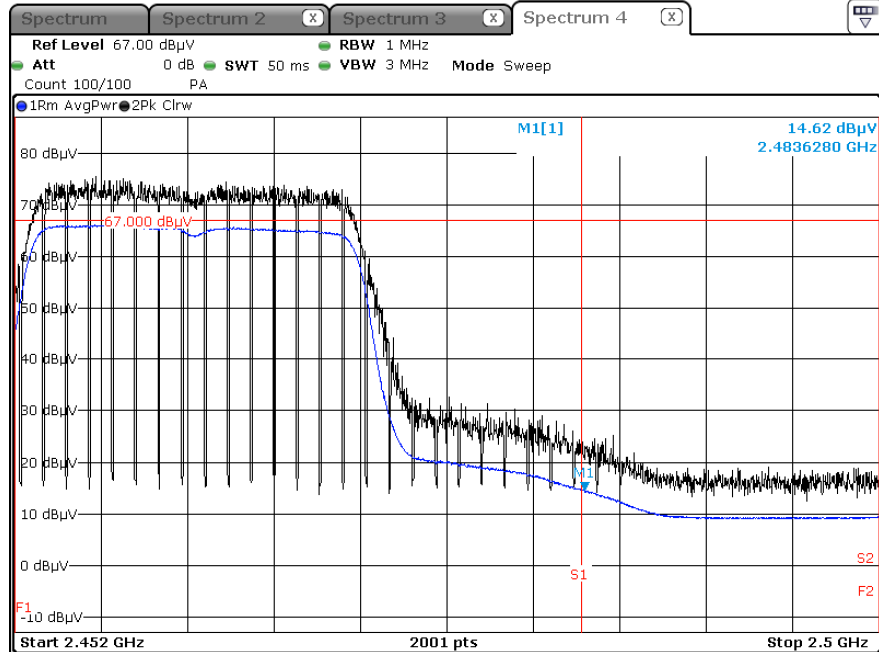
802.11ac (VHT20)		Channel	13 Ch	Freq	2472 MHz		Transfer MCS Index	MCS0
Frequency	Measured Value	Duty Cycle Factor	A.F.+C.L+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	22.57	0.00	35.59	H	58.16	73.98	15.82	PK
2483.5	9.86	0.35	35.59	H	45.81	53.98	8.17	AV

Test Plots

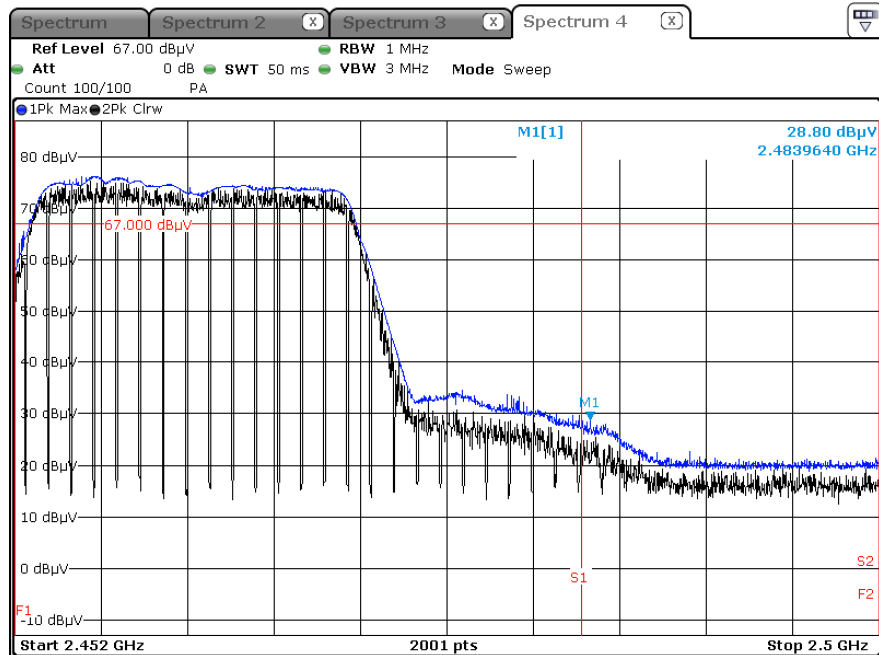
Note : In order to simplify the report, Plots of worst case are only reported.

[MIMO_CDD(Ant1+Ant2)]

Radiated Restricted Band Edges plot – Average Result (802.11ac (VHT20)_ MCS0, Ch.11, X-H)



Radiated Restricted Band Edges plot – Peak Result (802.11ac (VHT20)_ MCS0, Ch.11, X-H)



9.8 POWERLINE CONDUCTED EMISSIONS

Conducted Emissions

Test

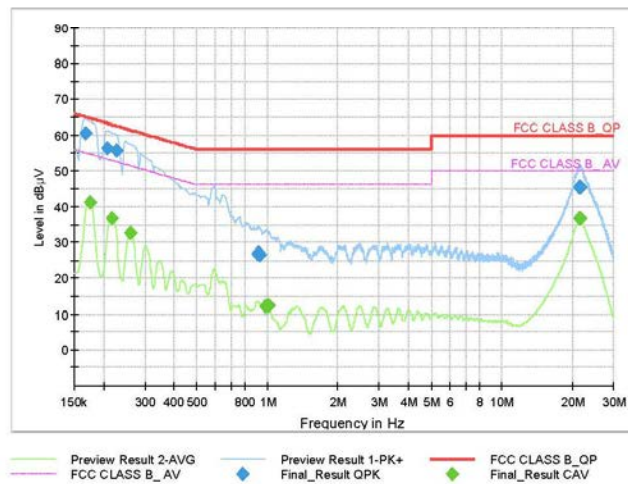
1 / 1

Test Report

Common Information

EUT : SM-S931B/DS
Operating Conditions : 2.4G WLAN Mode
Comment :

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1680	60.65	65.06	4.41	9.000	N	9.6
0.2085	56.39	63.27	6.88	9.000	N	9.6
0.2265	55.78	62.58	6.80	9.000	N	9.6
0.9118	27.01	56.00	28.99	9.000	L1	9.7
0.9163	27.15	56.00	28.85	9.000	L1	9.7
0.9275	26.50	56.00	29.50	9.000	L1	9.7
21.4610	45.55	60.00	14.45	9.000	N	10.6
21.4993	45.38	60.00	14.62	9.000	N	10.6
21.7130	45.38	60.00	14.62	9.000	N	10.6

Final Result CAV

Frequency (MHz)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1748	41.39	54.73	13.34	9.000	N	9.6
0.2175	36.94	52.91	15.97	9.000	N	9.6
0.2603	32.57	51.42	18.85	9.000	N	9.6
0.9815	12.25	46.00	33.75	9.000	N	9.7
1.0018	12.43	46.00	33.57	9.000	N	9.7
1.0108	12.43	46.00	33.57	9.000	N	9.7
21.4138	36.75	50.00	13.25	9.000	N	10.6
21.6568	36.78	50.00	13.23	9.000	N	10.6
21.7333	36.69	50.00	13.31	9.000	N	10.6

2024-10-01

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10. LIST OF TEST EQUIPMENT

Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	07/17/2025	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	07/02/2025	Annual
Temperature Chamber	SU-642	ESPEC	0093008124	02/19/2025	Annual
Signal Analyzer	N9030A	Agilent	MY52350879	04/05/2025	Annual
Power Measurement Set	OSP 120	Rohde & Schwarz	101231	10/17/2025	Annual
Power Meter	N1911A	Agilent	MY45100523	02/28/2025	Annual
Power Sensor	N1921A	Agilent	MY57820067	02/22/2025	Annual
Directional Coupler	87300B	Agilent	3116A03621	10/21/2025	Annual
Power Splitter	11667B	Hewlett Packard	05001	04/17/2025	Annual
DC Power Supply	E3632A	H.P	KR75303243	04/19/2025	Annual
Attenuator(10 dB)	8493C	Hewlett Packard	07560	06/05/2025	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A
FCC WLAN&BT&BLE Conducted Test Software v3.0	N/A	HCT CO., LTD.	N/A	N/A	N/A

Note:

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

Radiated Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Controller(Antenna mast)	CO3000	Innco system	CO3000-4p	N/A	N/A
Antenna Position Tower	MA4640/800-XP-EP	Innco system	N/A	N/A	N/A
Controller	EM1000	Audix	060520	N/A	N/A
Turn Table	N/A	Audix	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	03/07/2026	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	760	02/24/2025	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	02299	01/29/2026	Biennial
Horn Antenna (15GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170342	09/20/2026	Biennial
Spectrum Analyzer	FSV40	Rohde & Schwarz	100901	02/22/2025	Annual
Signal Analyzer	N9030A	Agilent	MY52350879	04/05/2025	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	5	06/04/2025	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	6	06/04/2025	Annual
Band Reject Filter	WRCJV2400/2483.5-2370/2520-60/12SS	Wainwright Instruments	2	01/02/2025	Annual
Band Reject Filter	WRCJV5100/5850-40/50-8EEK	Wainwright Instruments	1	02/14/2025	Annual
RF Switching System	FMSR-04B (3G HPF+LNA)	T&M SYSTEM	S2L1	12/27/2024	Annual
RF Switching System	FMSR-04B (10dB ATT+LNA)	T&M SYSTEM	S2L2	12/27/2024	Annual
RF Switching System	FMSR-04B (3dB ATT+LNA)	T&M SYSTEM	S2L3	12/27/2024	Annual
RF Switching System	FMSR-04B (LNA)	T&M SYSTEM	S2L4	12/27/2024	Annual
RF Switching System	FMSR-04B (7G HPF+LNA)	T&M SYSTEM	S2L5	12/27/2024	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/17/2024	Annual
Power Amplifier	CBL26405040	CERNEX	25956	02/26/2025	Annual

Note:

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

11. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2411-FC002-P