TEST REPORT

FCC DTS Test for SM-M356B/DS
Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-2403-FC017

DATE OF ISSUE
March 21, 2024

Tested by
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Applicant	**SAMSUNG Electronics Co., Ltd.** 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Product Name Model Name	Mobile Phone SM-M356B/DS
FCC ID	A3LSMM356B
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	March 21, 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 laboratory is not accredited for the test results marked *. Information provided by the applicant is marked **. Test results provided by external providers are marked ***. 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

Model	SM-M356B/DS		
Additional Model	-		
EUT Type	Mobile Phone		
Power Supply	DC 3.85 V		
Frequency Range	2 412 MHz ~ 2 472 MHz		
Max. RF Output Power	Average Power	SISO_Ant.1	802.11b : 17.42 dBm 802.11g : 15.67 dBm 802.11n(HT20) : 15.59 dBm
		MIMO_CDD(Ant.1+Ant.2)	802.11b : 20.53 dBm 802.11g : 18.67 dBm
		MIMO_SDM(Ant.1+Ant.2)	802.11n(HT20) : 18.68 dBm
	Peak Power	SISO_Ant.1	802.11b : 19.87 dBm 802.11g : 23.45 dBm 802.11n(HT20) : 23.14 dBm
		MIMO_CDD(Ant.1+Ant.2)	802.11b : 23.01 dBm 802.11g : 26.49 dBm
		MIMO_SDM(Ant.1+Ant.2)	802.11n(HT20) : 26.48 dBm
Modulation Type	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n		
Number of Channels	13 Channels		
Antenna Specification	Type: PIFA		
Date(s) of Tests	February 16, 2024 ~ March 21, 2024		
Serial number	Conducted : R3CX2042SRT Radiated : R3CX20420GF		

ANTENNA CONFIGURATIONS

1. Antenna configuration

Configurations	SISO		MIMO	
	Ant.1	Ant.2	CDD	SDM
802.11b	O	X	O	X
802.11g	O	X	O	X
802.11n(HT20)	O	X	X	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. Directional Gain Calculation

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

Directional gain(CDD) =

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

Directional gain(SDM) = Gmax + 10·log(N_{ANT}/ N_{ss}),

Ant Gain (dBi)		N_{ANT}/ N_{ss}	Directional Gain (dBi)	
			CDD	SDM
Ant.1	-3.17	CDD 2 / 1 SDM 2 / 2	-2.06	-3.17
Ant.2	-7.50			

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.

Directional gain(CDD) = 10·log(((10$^{(Ant.1\ Gain/20)}$+10$^{(Ant.2\ Gain/20)}$)^2)/2) dBi

Directional gain(SDM) = Gmax + 10·log(N_{ANT}/ N_{ss})

Sample MIMO Calculation:

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

Ant.1 + Ant.2 = MIMO

(11.58 dBm + 12.08 dBm) = (14.387 mW + 16.143 mW) = 30.53 mW = 14.88 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.

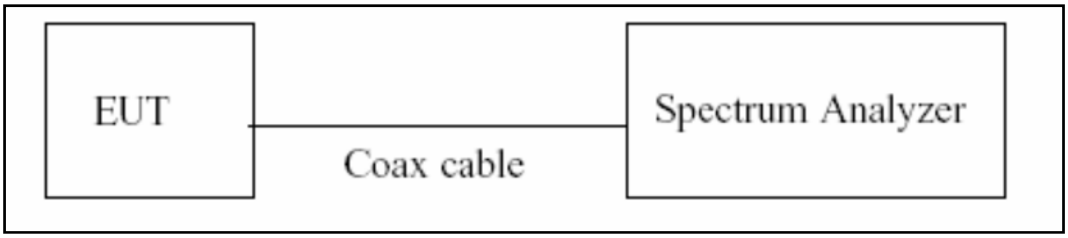
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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 ≤ 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*.

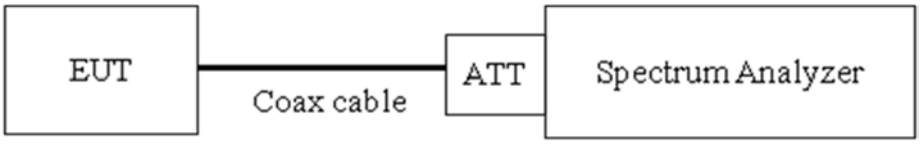
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz or 50 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Average
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

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 ≥ 3 x 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.

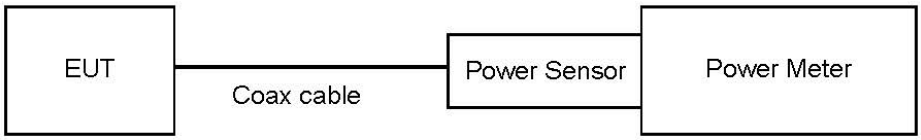
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

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

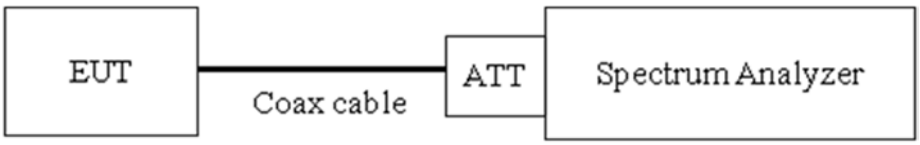
▪ Conducted Output Power(Average) = Measured Value + ATT loss + Cable loss + Duty Cycle Factor

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 kHz ≤ RBW ≤ 100 kHz.
4) VBW ≥ 3 x 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 ≥ [2 × 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

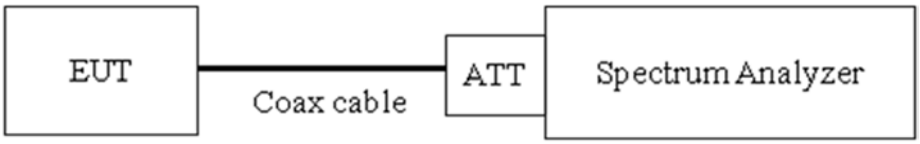
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

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 ≥ 3 x 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 ≥ 2 x Span/RBW
8) Allow trace to fully stabilize.
9) Use peak marker function to determine the maximum amplitude level.

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

Factors for frequency

Freq(MHz)	Factor(dB)
30	10.13
100	10.18
200	10.23
300	10.26
400	10.29
500	10.31
600	10.33
700	10.35
800	10.42
900	10.50
1000	10.56
2000	10.65
2400	10.74
2500	10.74
3000	11.22
4000	11.48
5000	11.79
5150	11.87
5850	11.87
6000	11.89
7000	12.01
8000	12.04
9000	12.11
10000	12.16
11000	12.30
12000	12.35
13000	12.41
14000	12.58
15000	12.88
16000	13.04
17000	13.07
18000	12.97
19000	13.00
20000	12.89
21000	13.15
22000	13.59
23000	13.41
24000	13.54

Note : 1. 2400 ~ 2500 MHz is fundamental frequency range.
2. Factor = Attenuator loss + Cable loss

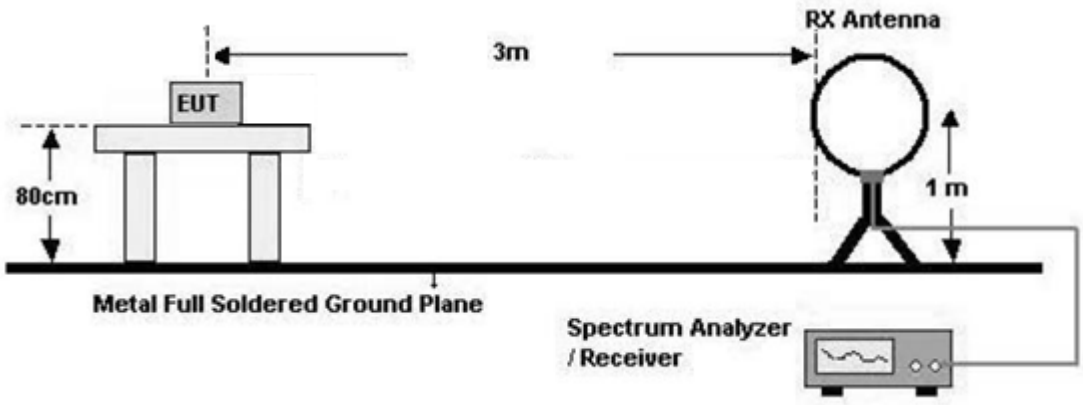
7.6. Radiated Test

Limit

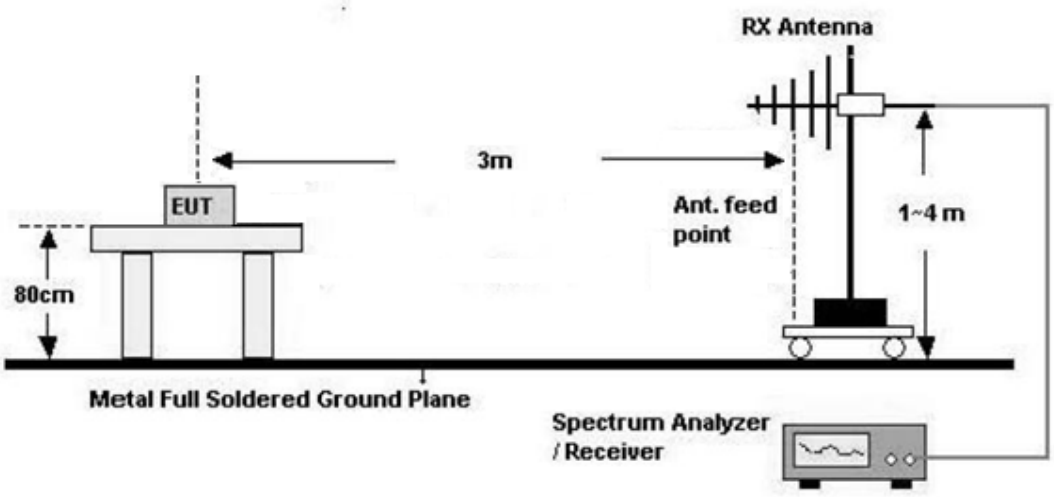
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

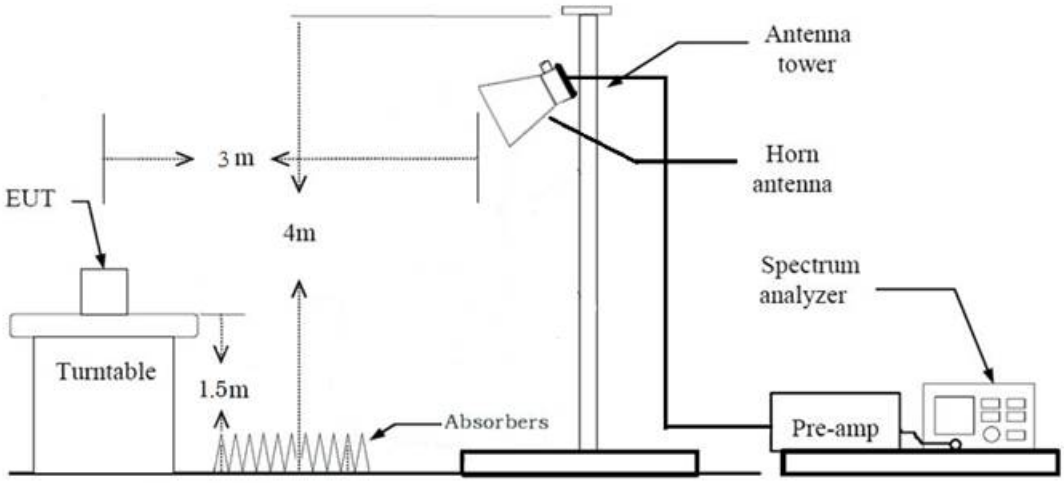
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



Test Procedure of Radiated spurious emissions (Below 30 MHz)

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

KDB 414788 OFS and Chamber Correlation Justification

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

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

Test Procedure of Radiated spurious emissions (Below 1 GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8 m above ground plane.
3. The Hybrid antenna was placed at a location 3 m from the EUT, which is varied from 1 m to 4 m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
   (1) Measurement Type(Peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Peak
      - Trace = Maxhold
      - RBW = 100 kHz
      - VBW ≥ 3 x RBW
   (2) Measurement Type(Quasi-peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Quasi-Peak
      - RBW = 120 kHz

   In general, (1) is used mainly
7. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L)
8. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

Test Procedure of Radiated spurious emissions (Above 1 GHz)

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

(1) Measurement Type(Peak):

- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = Peak
- Trace = Maxhold
- RBW = 1 MHz
- VBW ≥ 3 x RBW

(2) Measurement Type(Average): Duty cycle ≥ 98 %

- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW ≥ 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 ±2 %

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

9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
10. Distance extrapolation factor = 20log (test distance / 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 ≥ 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 ≥ 3 x RBW
   (2) Measurement Type(Average): Duty cycle ≥ 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 ≥ 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 ± 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 ≥ 3 x RBW
      - Sweep time = auto.
      - Trace mode = average (at least 100 traces).

- Correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 % duty cycle.
- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
10. Distance extrapolation factor = 20log (test distance / specific distance) (dB)
11. Total(Measurement Type : Peak)
 = Peak Measured Value
 Total(Measurement Type : Average, Duty cycle ≥ 98 %)
 = Average Measured Value
 Total(Measurement Type : Average, Duty cycle < 98 %)
 = Average Measured Value + Duty Cycle Factor
 - We apply to the offset in range 1 GHz - 18 GHz
 - The offset = Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

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) = 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
   - Mode : SISO(Ant.1), MIMO_CDD(Ant.1+Ant.2), MIMO_SDM(Ant.1+Ant.2)
   - Worst case : MIMO_CDD(Ant.1+Ant.2), MIMO_SDM(Ant.1+Ant.2)
3. EUT Axis
   - Radiated Spurious Emissions : Y
   - Radiated Restricted Band Edge : X
4. Duty cycle factor applies only 802.11g/n (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 [SISO(Ant.1), MIMO_CDD(Ant.1+Ant.2)]
   - 802.11g : 6 Mbps [SISO(Ant.1), MIMO_CDD(Ant.1+Ant.2)]
   - 802.11n(HT20): MCS 0 [SISO(Ant.1)], MCS 8 [MIMO_SDM(Ant.1+Ant.2)]
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.
   - 802.11b : 1 Mbps[MIMO_CDD(Ant.1+Ant.2)]

AC Power line Conducted Emissions

1. All modes of operation were investigated and the worst case configuration results are reported.
   - Mode : Stand alone+ External accessories(Earphone,etc) + Travel Adapter
     Stand alone + Travel Adapter
   - Worstcase : Stand alone + Travel Adapter

Conducted test

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

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

[SISO_Ant.1, MIMO_CDD(Ant.1+Ant.2)]

Mode	Data Rate	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	1 Mbps	8.608	8.725	0.987	0.058
	2 Mbps	4.306	4.416	0.975	0.110
	5.5 Mbps	1.626	1.738	0.936	0.288
	11 Mbps	0.864	0.973	0.888	0.516
802.11g	6 Mbps	1.429	1.528	0.935	0.290
	9 Mbps	0.960	1.077	0.892	0.498
	12 Mbps	0.725	0.841	0.861	0.648
	18 Mbps	0.491	0.608	0.808	0.924
	24 Mbps	0.370	0.469	0.789	1.028
	36 Mbps	0.256	0.372	0.687	1.630
	48 Mbps	0.195	0.312	0.626	2.034
	54 Mbps	0.180	0.296	0.607	2.169
802.11n (HT20)	MCS0	1.338	1.454	0.920	0.363
	MCS1	0.687	0.803	0.855	0.681
	MCS2	0.471	0.588	0.802	0.960
	MCS3	0.362	0.464	0.781	1.071
	MCS4	0.256	0.352	0.727	1.387
	MCS5	0.200	0.299	0.669	1.743
	MCS6	0.185	0.301	0.613	2.122
	MCS7	0.167	0.284	0.589	2.297

[MIMO_SDM(Ant.1+Ant.2)]

Mode	Data Rate	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11n (HT20)	MCS8	0.690	0.807	0.856	0.678
	MCS9	0.367	0.484	0.759	1.197
	MCS10	0.261	0.377	0.691	1.603
	MCS11	0.205	0.322	0.638	1.953
	MCS12	0.152	0.269	0.566	2.472
	MCS13	0.124	0.240	0.517	2.868
	MCS14	0.117	0.233	0.500	3.010
	MCS15	0.109	0.228	0.478	3.208

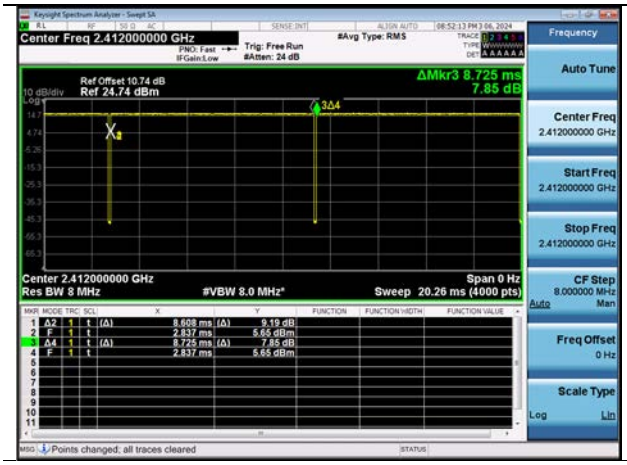
▣ Test Plots

Note:

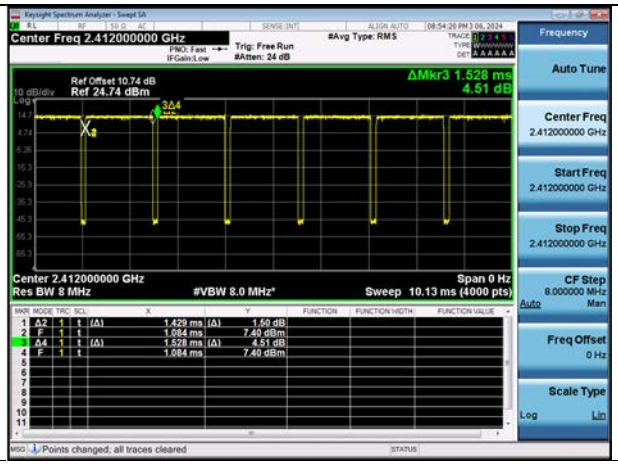
In order to simplify the report, attached plots were only the lowest data rate.

[SISO_Ant.1, MIMO_CDD(Ant.1+Ant.2)]

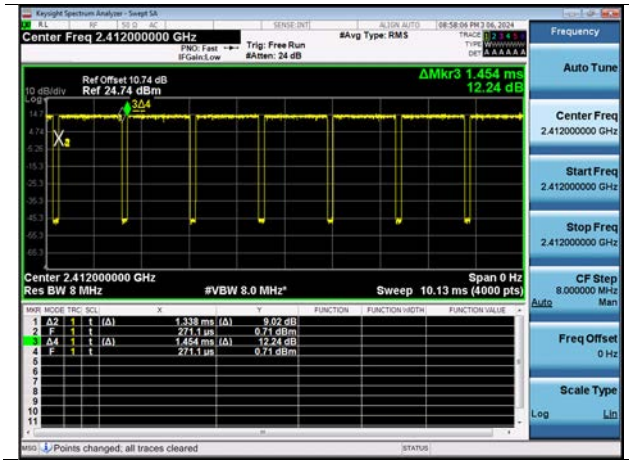
802.11b (1 Mbps)



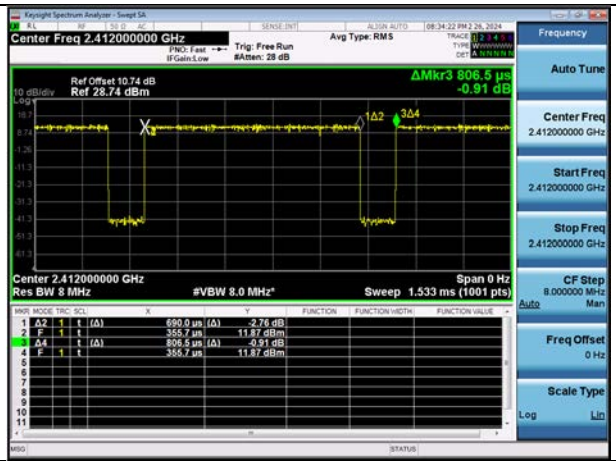
802.11g (6 Mbps)



802.11n (MCS0)



[MIMO_SDM(Ant.1+Ant.2)]

802.11n(MCS8)


Note:

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

9.2 6 dB BANDWIDTH

[SISO_Ant.1]

Mode	Frequency [MHz]	Channel No.	6dB Bandwidth [MHz]	Limit [MHz]
802.11n(HT20)	2 412	1	15.47	0.50
	2 437	6	16.10	0.50
	2 462	11	15.80	0.50
	2 467	12	16.14	0.50
	2 472	13	16.03	0.50

[MIMO_CDD(Ant.1)]

Mode	Frequency [MHz]	Channel No.	6dB Bandwidth [MHz]	Limit [MHz]
802.11b	2 412	1	8.106	0.50
	2 437	6	8.115	0.50
	2 462	11	8.101	0.50
	2 467	12	8.113	0.50
	2 472	13	8.112	0.50
802.11g	2 412	1	15.48	0.50
	2 437	6	15.71	0.50
	2 462	11	15.74	0.50
	2 467	12	15.92	0.50
	2 472	13	15.70	0.50

[MIMO_CDD(Ant.2)]

Mode	Frequency [MHz]	Channel No.	6dB Bandwidth [MHz]	Limit [MHz]
802.11b	2 412	1	8.082	0.50
	2 437	6	8.115	0.50
	2 462	11	8.102	0.50
	2 467	12	8.111	0.50
	2 472	13	8.110	0.50
802.11g	2 412	1	15.47	0.50
	2 437	6	15.35	0.50
	2 462	11	15.48	0.50
	2 467	12	15.17	0.50
	2 472	13	15.47	0.50

[MIMO_SDM(Ant.1)]

Mode	Frequency [MHz]	Channel No.	6dB Bandwidth [MHz]	Limit [MHz]
802.11n(HT20)	2 412	1	15.48	0.50
	2 437	6	16.12	0.50
	2 462	11	15.77	0.50
	2 467	12	16.27	0.50
	2 472	13	15.98	0.50

[MIMO_SDM(Ant.2)]

Mode	Frequency [MHz]	Channel No.	6dB Bandwidth [MHz]	Limit [MHz]
802.11n(HT20)	2 412	1	15.97	0.50
	2 437	6	16.36	0.50
	2 462	11	15.95	0.50
	2 467	12	15.75	0.50
	2 472	13	16.30	0.50

▣ **Test Plots**(6 dB Bandwidth)

Note:

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

[SISO_Ant.1]
802.11n_HT20-CH 1


[MIMO_CDD(Ant.1)]	[MIMO_CDD(Ant.2)]
802.11b-CH 11	802.11b-CH 1
	
802.11g-CH 1	802.11g-CH 12
	

[MIMO_SDM(Ant.1)]	[MIMO_SDM(Ant.2)]
802.11n_HT20-CH 1	802.11n_HT20-CH 12
	

9.3 OUTPUT POWER

Note :

1. MIMO Power = 10·log((10^(Ant.1 power /10))+(10^(Ant.2 power /10)))

Peak Power

[SISO_Ant.1]

Mode	Frequency [MHz]	Channel No.	Data Rate	Conducted Peak Power [dBm]	Limit [dBm]
802.11n	2 412	1	MCS0	23.14	30
	2 437	6	MCS0	22.36	30
	2 462	11	MCS0	21.77	30
	2 467	12	MCS0	15.25	30
	2 472	13	MCS0	7.72	30

[MIMO_CDD(Ant.1+Ant.2)]

Mode	Frequency [MHz]	Channel No.	Data Rate	Conducted Peak Power [dBm]			Limit [dBm]
				Ant.1	Ant.2	MIMO	
802.11b	2 412	1	1M	19.87	20.13	23.01	30
	2 437	6	1M	16.39	19.47	21.21	30
	2 462	11	1M	19.49	20.02	22.78	30
	2 467	12	1M	9.82	10.28	13.06	30
	2 472	13	1M	2.14	3.23	5.73	30
802.11g	2 412	1	6M	23.45	23.51	26.49	30
	2 437	6	6M	22.56	23.17	25.89	30
	2 462	11	6M	21.75	23.15	25.51	30
	2 467	12	6M	15.38	16.10	18.76	30
	2 472	13	6M	7.77	8.90	11.38	30

[MIMO_SDM(Ant.1+Ant.2)]

Mode	Frequency [MHz]	Channel No.	Data Rate	Conducted Peak Power [dBm]			Limit [dBm]
				Ant.1	Ant.2	MIMO	
802.11n	2 412	1	MCS8	22.91	23.97	26.48	30
	2 437	6	MCS8	22.37	23.18	25.81	30
	2 462	11	MCS8	21.46	23.46	25.59	30
	2 467	12	MCS8	14.94	16.17	18.61	30
	2 472	13	MCS8	7.50	9.12	11.39	30

Average Power

[SISO_Ant.1]

Mode	Frequency [MHz]	Channel No.	Data Rate	Conducted Average Power [dBm]			Limit [dBm]
				Measured Value	D.C.F	Summed	
802.11n	2 412	1	MCS0	15.23	0.36	15.59	30
	2 437	6	MCS0	14.18	0.36	14.54	30
	2 462	11	MCS0	14.05	0.36	14.41	30
	2 467	12	MCS0	7.16	0.36	7.52	30
	2 472	13	MCS0	-0.54	0.36	-0.18	30

[MIMO_CDD(Ant.1+Ant.2)]

Mode	Frequency [MHz]	Channel No.	Data Rate	Conducted Average Power [dBm]			Limit [dBm]
				Ant.1	Ant.2	MIMO	
802.11b	2 412	1	1M	17.42	17.61	20.53	30
	2 437	6	1M	16.51	17.01	19.78	30
	2 462	11	1M	17.10	17.57	20.35	30
	2 467	12	1M	7.31	7.72	10.53	30
	2 472	13	1M	-0.34	0.62	3.18	30
802.11g	2 412	1	6M	15.67	15.64	18.67	30
	2 437	6	6M	14.74	15.30	18.04	30
	2 462	11	6M	13.94	15.00	17.51	30
	2 467	12	6M	7.47	7.99	10.75	30
	2 472	13	6M	-0.16	0.86	3.39	30

[MIMO_SDM(Ant.1+Ant.2)]

Mode	Frequency [MHz]	Channel No.	Data Rate	Conducted Average Power [dBm]			Limit [dBm]
				Ant.1	Ant.2	MIMO	
802.11n	2 412	1	MCS8	15.83	15.50	18.68	30
	2 437	6	MCS8	15.03	15.05	18.05	30
	2 462	11	MCS8	14.01	15.07	17.58	30
	2 467	12	MCS8	7.68	7.92	10.81	30
	2 472	13	MCS8	0.10	0.76	3.45	30

9.4 POWER SPECTRAL DENSITY

Note :

1. MIMO PSD = 10·log((10^(Ant.1 PSD /10))+(10^(Ant.2 PSD /10)))

[SISO_Ant.1]

BW	Frequency [MHz]	Channel No.	Data Rate	Power Spectral Density [dBm]			Limit [dBm/kHz]
				Measured Value	D.C.F	Summed	
802.11n	2 412	1	MCS 0	-8.192	0.363	-7.829	8 dBm /3 kHz
	2 437	6	MCS 0	-9.696	0.363	-9.333	
	2 462	11	MCS 0	-10.119	0.363	-9.756	
	2 467	12	MCS 0	-16.978	0.363	-16.615	
	2 472	13	MCS 0	-24.797	0.363	-24.434	

[MIMO_CDD(Ant.1+Ant.2)]

Mode	Frequency [MHz]	Channel No.	Data Rate	Power Spectral Density [dBm]			Limit [dBm/kHz]
				Ant.1	Ant.2	Summed	
802.11b	2 412	1	1 M	-3.985	-4.177	-1.070	8 dBm/3 kHz
	2 437	6	1 M	-5.003	-4.894	-1.938	
	2 462	11	1 M	-4.554	-3.701	-1.096	
	2 467	12	1 M	-14.301	-13.998	-11.137	
	2 472	13	1 M	-22.080	-20.962	-18.475	
802.11g	2 412	1	6 M	-8.196	-8.481	-5.325	
	2 437	6	6 M	-9.283	-9.261	-6.261	
	2 462	11	6 M	-9.935	-8.978	-6.420	
	2 467	12	6 M	-16.413	-16.292	-13.341	
	2 472	13	6 M	-24.356	-23.384	-20.832	

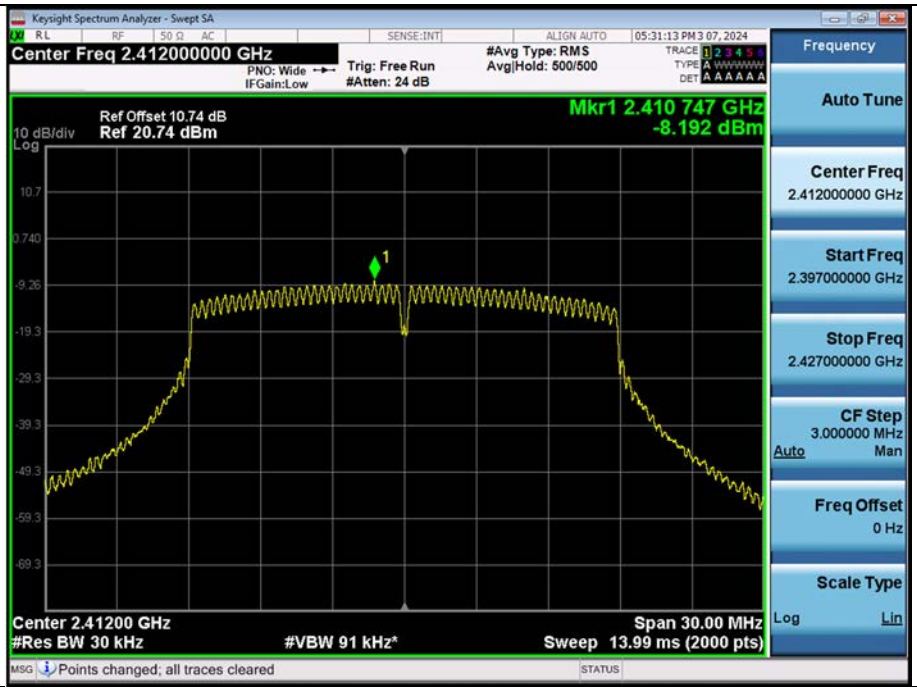
[MIMO_SDM(Ant.1+Ant.2)]

BW	Frequency [MHz]	Channel No.	Data Rate	Power Spectral Density [dBm]			Limit [dBm/kHz]
				Ant.1	Ant.2	Summed	
802.11n	2 412	1	MCS 8	-8.319	-7.821	-5.053	8 dBm/3 kHz
	2 437	6	MCS 8	-9.538	-8.400	-5.922	
	2 462	11	MCS 8	-10.013	-8.753	-6.328	
	2 467	12	MCS 8	-16.797	-15.491	-13.085	
	2 472	13	MCS 8	-24.779	-23.026	-20.805	

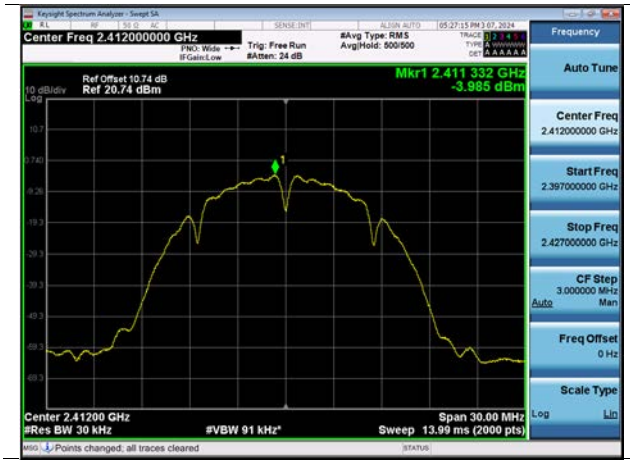
▣ Test Plots

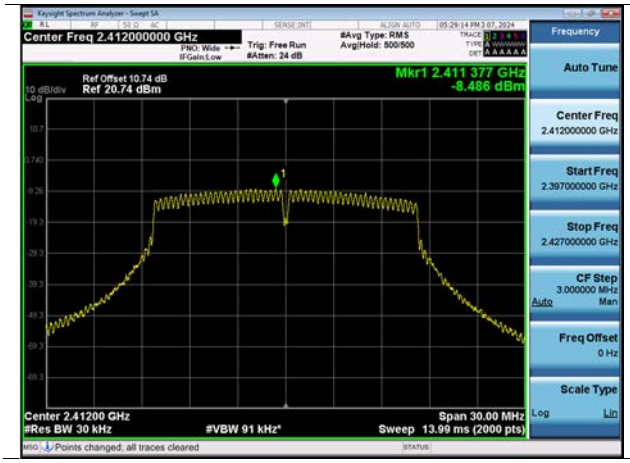
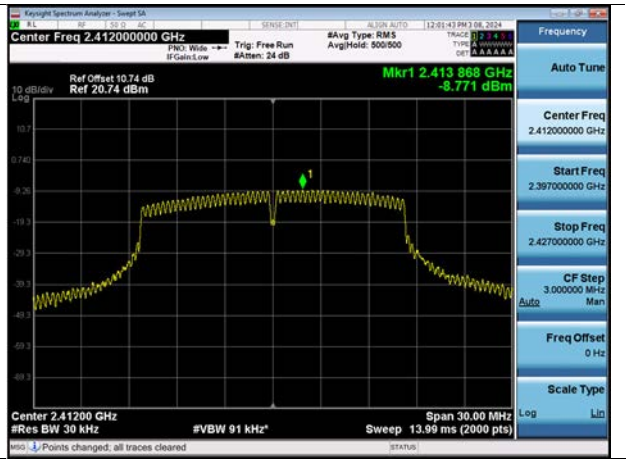
Note : In order to simplify the report, attached plots were only the worst case PSD channel.

[SISO_Ant.1]

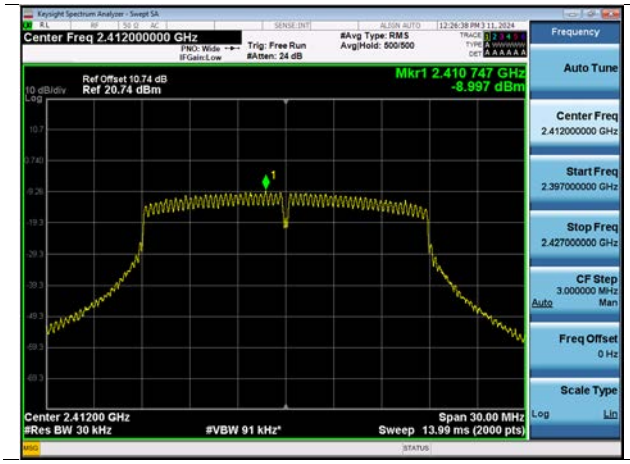
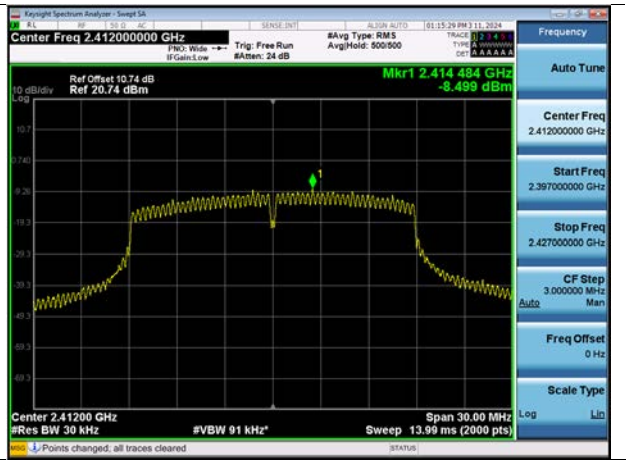
Power Spectral Density (802.11n-CH 1)


[MIMO_CDD(Ant.1+Ant.2)]

Power Spectral Density (802.11b-CH 1)	
Ant.1	Ant.2
	

Power Spectral Density (802.11g-CH 1)	
Ant.1	Ant.2
	

[MIMO_SDM(Ant.1+Ant.2)]

Power Spectral Density (802.11n-CH 1)	
Ant.1	Ant.2
	

9.5 BAND EDGE / CONDUCTED SPURIOUS EMISSIONS

Band Edge

Limit : 30 dBc

[SISO_Ant.1]

Mode	Frequency [MHz]	CH.	Measured Position	Band edge[dB]
802.11n	2 412	1	Lowest Bandedge	32.733
	2 462	11	Highest Bandedge	52.025
	2 467	12	Highest Bandedge	48.052
	2 472	13	Highest Bandedge	32.539

[MIMO_CDD(Ant.1)]

Mode	Frequency [MHz]	CH.	Measured Position	Band edge[dB]
802.11b	2 412	1	Lowest Bandedge	54.015
	2 462	11	Highest Bandedge	58.669
	2 467	12	Highest Bandedge	52.276
	2 472	13	Highest Bandedge	45.163
802.11g	2 412	1	Lowest Bandedge	34.091
	2 462	11	Highest Bandedge	51.344
	2 467	12	Highest Bandedge	47.663
	2 472	13	Highest Bandedge	35.733

[MIMO_CDD(Ant.2)]

Mode	Frequency [MHz]	CH.	Measured Position	Band edge[dB]
802.11b	2 412	1	Lowest Bandedge	47.720
	2 462	11	Highest Bandedge	55.126
	2 467	12	Highest Bandedge	52.581
	2 472	13	Highest Bandedge	45.772
802.11g	2 412	1	Lowest Bandedge	31.837
	2 462	11	Highest Bandedge	40.551
	2 467	12	Highest Bandedge	49.960
	2 472	13	Highest Bandedge	35.665

[MIMO_SDM(Ant.1)]

Mode	Frequency [MHz]	CH.	Measured Position	Band edge[dB]
802.11n	2 412	1	Lowest Bandedge	31.259
	2 462	11	Highest Bandedge	50.631
	2 467	12	Highest Bandedge	48.257
	2 472	13	Highest Bandedge	32.185

[MIMO_SDM(Ant.2)]

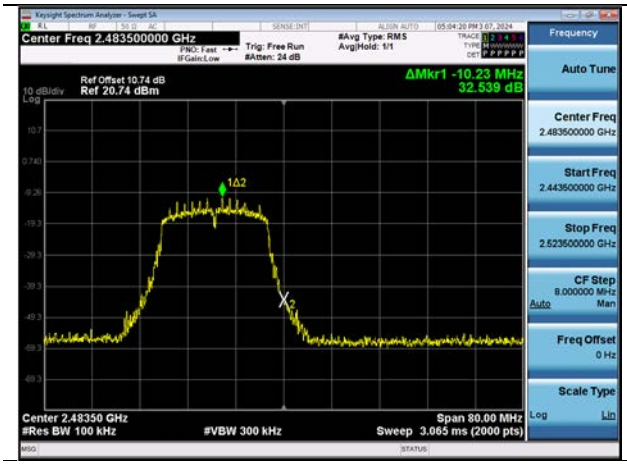
Mode	Frequency [MHz]	CH.	Measured Position	Band edge[dB]
802.11n	2 412	1	Lowest Bandedge	31.147
	2 462	11	Highest Bandedge	39.006
	2 467	12	Highest Bandedge	49.659
	2 472	13	Highest Bandedge	32.651

▣ **Test Plots**(Band Edge)

Note:

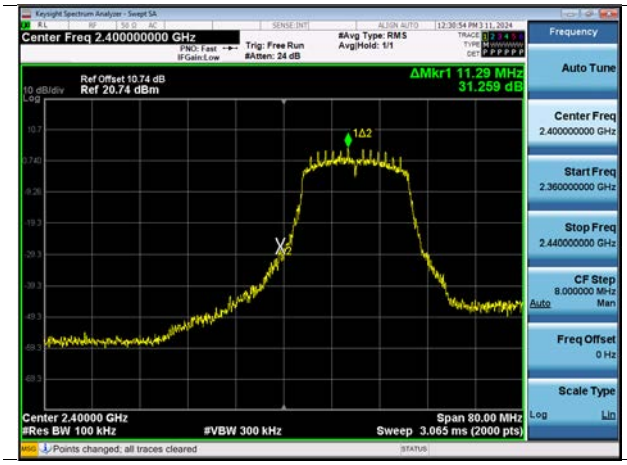
In order to simplify the report, attached plots were only the narrowest 6 dB BW channel.

[SISO_Ant.1] 802.11n_HT20-CH 13



[MIMO_CDD(Ant.1)] 802.11g-CH 1

[MIMO_SDM(Ant.1)] 802.11n_HT20-CH 1



[MIMO_CDD(Ant.2)] 802.11g-CH 1

[MIMO_SDM(Ant.2)] 802.11n_HT20-CH 1

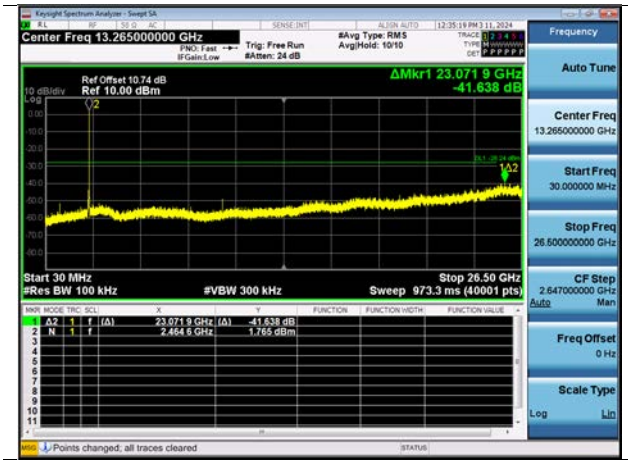
▣ Test Plots(Conducted Spurious Emission)

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

[SISO_Ant.1] 802.11n_HT20-CH 6

[MIMO_CDD(Ant.1)] 802.11g-CH 11

[MIMO_SDM(Ant.1)] 802.11n_HT20-CH 11



[MIMO_CDD(Ant.2)] 802.11g-CH 6

[MIMO_SDM(Ant.2)] 802.11n_HT20-CH 1

9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

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

Note:

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

Frequency Range : Below 1 GHz

Frequency	Measured Value	A.F+C.L	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(Ant.1+Ant.2)]

Band :	DTS		Operation Mode : 802.11b				
CH.1	2412 MHz		Transfer Rate : 1 Mbps				
Frequency [MHz]	Measured value [dBµV]	CL+AF+DF-AG [dB/m]	ANT. POL [H/V]	Total [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Measurement Type
4824	46.26	3.87	V	50.13	68.20	18.07	PK
4824	39.99	3.87	V	43.86	68.20	24.34	AV
7236	44.71	9.57	V	54.28	73.98	19.70	PK
7236	35.98	9.57	V	45.55	53.98	8.43	AV
4824	46.84	3.87	H	50.71	68.20	17.49	PK
4824	40.21	3.87	H	44.08	68.20	24.12	AV
7236	45.53	9.57	H	55.10	73.98	18.88	PK
7236	36.81	9.57	H	46.38	53.98	7.60	AV

Band :	DTS		Operation Mode : 802.11b				
CH.6	2437 MHz		Transfer Rate : 1 Mbps				
Frequency [MHz]	Measured value [dBµV]	CL+AF+DF-AG [dB/m]	ANT. POL [H/V]	Total [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Measurement Type
4874	47.23	3.84	V	51.07	73.98	22.91	PK
4874	41.42	3.84	V	45.26	53.98	8.72	AV
7311	42.23	10.11	V	52.34	73.98	21.64	PK
7311	31.08	10.11	V	41.19	53.98	12.79	AV
4874	47.59	3.84	H	51.43	73.98	22.55	PK
4874	42.44	3.84	H	46.28	53.98	7.70	AV
7311	42.07	10.11	H	52.18	73.98	21.80	PK
7311	31.81	10.11	H	41.92	53.98	12.06	AV

Band :	DTS		Operation Mode : 802.11b				
CH.11	2462 MHz		Transfer Rate : 1 Mbps				
Frequency [MHz]	Measured value [dBµV]	CL+AF+DF-AG [dB/m]	ANT. POL [H/V]	Total [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Measurement Type
4924	47.71	3.27	V	50.98	73.98	23.00	PK
4924	42.93	3.27	V	46.20	53.98	7.78	AV
7386	42.29	11.01	V	53.30	68.20	14.90	PK
7386	31.51	11.01	V	42.52	53.98	11.46	AV
4924	48.45	3.27	H	51.72	73.98	22.26	PK
4924	44.00	3.27	H	47.27	53.98	6.71	AV
7386	42.99	11.01	H	54.00	68.20	14.20	PK
7386	32.71	11.01	H	43.72	53.98	10.26	AV

Note:

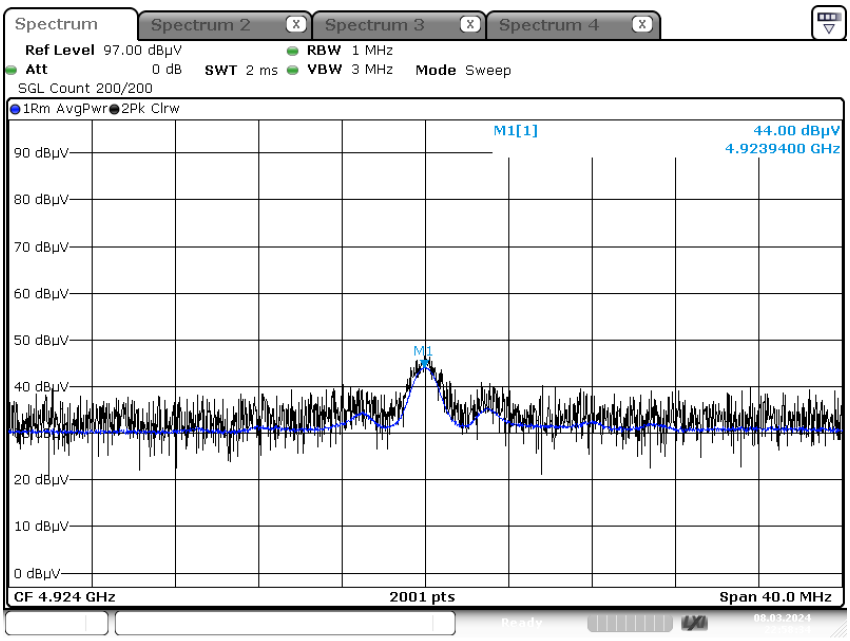
Channel 12 and 13 are less powerful than channel 11. So, The test for high channel was performed at channel 11.

▣ Test Plots

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

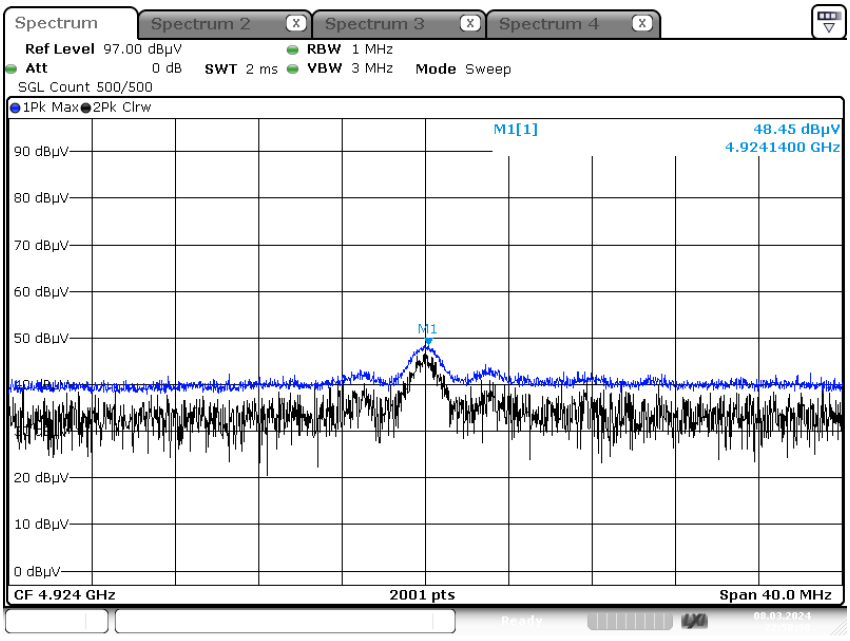
[MIMO_CDD(Ant.1+Ant.2)]

Radiated Spurious Emissions plot – Average Result (802.11b_1 Mbps, Ch.11 2nd Harmonic, Y-H)



Date: 8.MAR.2024 22:58:35

Radiated Spurious Emissions plot – Peak Result (802.11b_1 Mbps, Ch.11 2nd Harmonic, Y-H)



Date: 8.MAR.2024 22:58:39

9.7 RADIATED RESTRICTED BAND EDGES

[MIMO_CDD(Ant.1+Ant.2)]

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

Frequency	Measured Value	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2390.0	67.00	H	67.00	73.98	6.98	PK
2390.0	46.22	H	46.22	53.98	7.76	AV
2390.0	67.02	V	67.02	73.98	6.96	PK
2390.0	46.71	V	46.71	53.98	7.27	AV
2483.5	65.26	H	65.26	73.98	8.72	PK
2483.5	49.47	H	49.47	53.98	4.51	AV
2483.5	64.91	V	64.91	73.98	9.07	PK
2483.5	48.37	V	48.37	53.98	5.61	AV

Operation Mode:	802.11b
Transfer Rate:	1 Mbps
Operating Frequency	2467 MHz, 2472 MHz
Channel No.	12 Ch, 13 Ch

Frequency	Measured Value	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	59.22	H	59.22	73.98	14.76	PK
2483.5	43.17	H	43.17	53.98	10.81	AV
2483.5	58.72	V	58.72	73.98	15.26	PK
2483.5	42.69	V	42.69	53.98	11.29	AV
2483.5	55.49	H	55.49	73.98	18.49	PK
2483.5	42.97	H	42.97	53.98	11.01	AV
2483.5	54.96	V	54.96	73.98	19.02	PK
2483.5	42.65	V	42.65	53.98	11.33	AV

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

Frequency	Measured Value	Duty Cycle Factor	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2390.0	62.90	0.00	H	62.90	73.98	11.08	PK
2390.0	47.21	0.28	H	47.49	53.98	6.49	AV
2390.0	63.43	0.00	V	63.43	73.98	10.55	PK
2390.0	47.77	0.28	V	48.05	53.98	5.93	AV
2483.5	66.66	0.00	H	66.66	73.98	7.32	PK
#2483.5	49.97	0.28	H	50.25	53.98	3.73	AV
2483.5	67.13	0.00	V	67.13	73.98	6.85	PK
2483.5	49.66	0.28	V	49.94	53.98	4.04	AV

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

Operation Mode:	802.11g
Transfer Rate:	6 Mbps
Operating Frequency	2467 MHz, 2472 MHz
Channel No.	12 Ch, 13 Ch

Frequency	Measured Value	Duty Cycle Factor	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	70.81	0.00	H	70.81	73.98	3.17	PK
2483.5	49.46	0.28	H	49.74	53.98	4.24	AV
2483.5	70.33	0.00	V	70.33	73.98	3.65	PK
2483.5	47.80	0.28	V	48.08	53.98	5.90	AV
2483.5	66.80	0.00	H	66.80	73.98	7.18	PK
2483.5	49.96	0.28	H	50.24	53.98	3.74	AV
2483.5	66.47	0.00	V	66.47	73.98	7.51	PK
2483.5	49.58	0.28	V	49.86	53.98	4.12	AV

[MIMO_SDM(Ant.1+Ant.2)]

Operation Mode:	802.11n (HT20)
Transfer MCS Index:	8
Operating Frequency	2462 MHz
Channel No.	01 Ch, 11 Ch

Frequency	Measured Value	Duty Cycle Factor	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2390.0	66.28	0.00	H	66.28	73.98	7.70	PK
2390.0	47.35	0.68	H	48.03	53.98	5.95	AV
2390.0	66.36	0.00	V	66.36	73.98	7.62	PK
2390.0	47.80	0.68	V	48.48	53.98	5.50	AV
2483.5	67.37	0.00	H	67.37	73.98	6.61	PK
#2483.5	51.20	0.68	H	51.88	53.98	2.10	AV
2483.5	66.81	0.00	V	66.81	73.98	7.17	PK
2483.5	50.38	0.68	V	51.06	53.98	2.92	AV

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

Operation Mode:	802.11n (HT20)
Transfer MCS Index:	8
Operating Frequency	2467 MHz, 2472 MHz
Channel No.	12 Ch, 13 Ch

Frequency	Measured Value	Duty Cycle Factor	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2483.5	67.86	0.00	H	67.86	73.98	6.12	PK
2483.5	48.73	0.68	H	49.41	53.98	4.57	AV
2483.5	67.98	0.00	V	67.98	73.98	6.00	PK
2483.5	50.58	0.68	V	51.26	53.98	2.72	AV
2483.5	69.37	0.00	H	69.37	73.98	4.61	PK
2483.5	48.95	0.68	H	49.63	53.98	4.35	AV
2483.5	69.05	0.00	V	69.05	73.98	4.93	PK
2483.5	48.59	0.68	V	49.27	53.98	4.71	AV

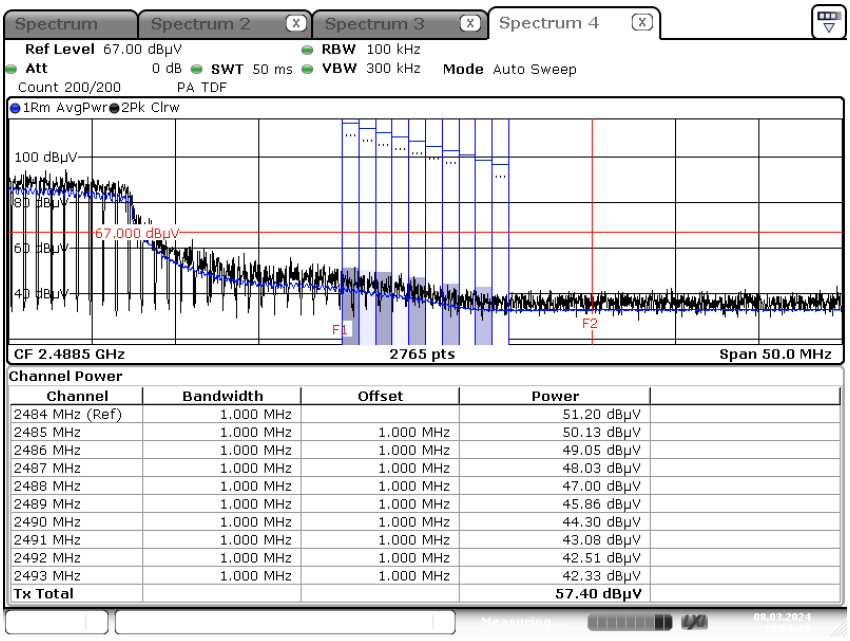
▣ Test Plots

Note:

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

[MIMO_SDM(Ant.1+Ant.2)]

Radiated Restricted Band Edges plot – Average Result (802.11n (HT20)_ MCS8, Ch.11, X-H)

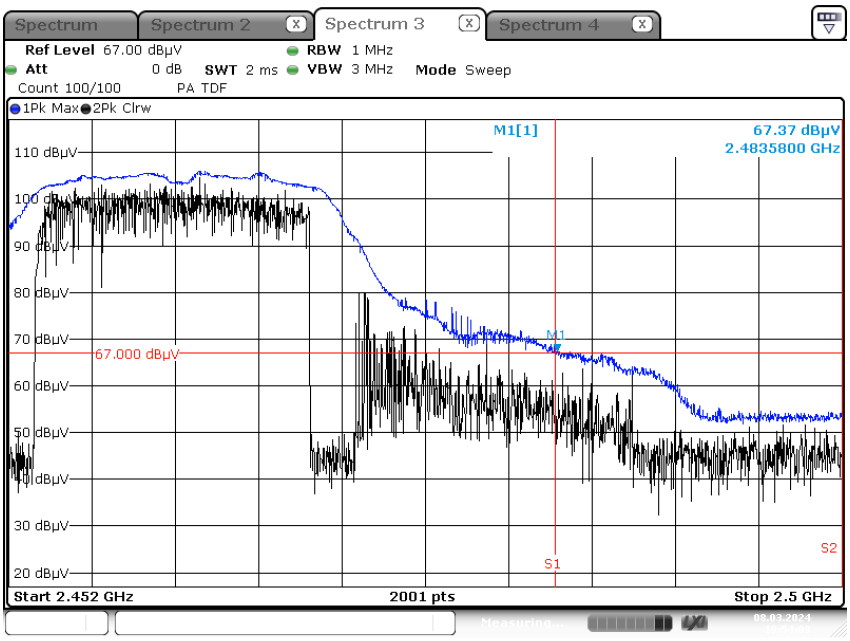


Channel Power

Channel	Bandwidth	Offset	Power
2484 MHz (Ref)	1.000 MHz		51.20 dBµV
2485 MHz	1.000 MHz	1.000 MHz	50.13 dBµV
2486 MHz	1.000 MHz	1.000 MHz	49.05 dBµV
2487 MHz	1.000 MHz	1.000 MHz	48.03 dBµV
2488 MHz	1.000 MHz	1.000 MHz	47.00 dBµV
2489 MHz	1.000 MHz	1.000 MHz	45.86 dBµV
2490 MHz	1.000 MHz	1.000 MHz	44.30 dBµV
2491 MHz	1.000 MHz	1.000 MHz	43.08 dBµV
2492 MHz	1.000 MHz	1.000 MHz	42.51 dBµV
2493 MHz	1.000 MHz	1.000 MHz	42.33 dBµV
Tx Total			57.40 dBµV

Date: 8.MAR.2024 19:51:16

Radiated Restricted Band Edges plot – Peak Result (802.11n (HT20)_ MCS8, Ch.11, X-H)



Date: 8.MAR.2024 19:54:09

9.8 POWERLINE CONDUCTED EMISSIONS

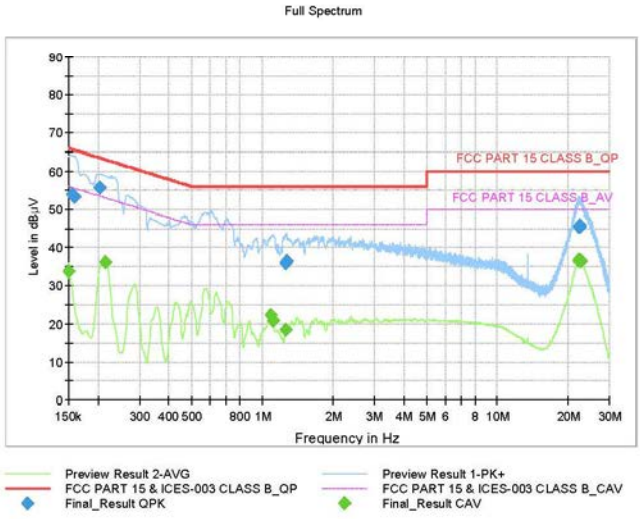
Conducted Emissions

Test 1 / 2

Test Report

Common Information

EUT : SM-M356B/DS
Operating Conditions : 2.4G WLAN Mode
Comment :



Final_Result_QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	53.93	65.75	11.82	9.000	N	9.6
0.1590	53.31	65.52	12.20	9.000	N	9.6
0.2040	55.68	63.45	7.77	9.000	N	9.6
1.2538	35.74	56.00	20.26	9.000	L1	9.7
1.2583	36.11	56.00	19.89	9.000	L1	9.7
1.2673	36.48	56.00	19.52	9.000	L1	9.7
22.2035	45.52	60.00	14.48	9.000	L1	10.5
22.3858	45.59	60.00	14.41	9.000	L1	10.5
22.4308	45.88	60.00	14.12	9.000	L1	10.5

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Test 2 / 2

Final_Result_CAV

Frequency (MHz)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1500	33.71	56.00	22.29	9.000	L1	9.6
0.2153	36.16	53.00	16.84	9.000	N	9.6
1.0895	22.38	46.00	23.62	9.000	L1	9.7
1.1075	20.68	46.00	25.32	9.000	L1	9.7
1.2628	18.42	46.00	27.58	9.000	L1	9.7
22.0978	36.55	50.00	13.45	9.000	L1	10.5
22.2035	36.75	50.00	13.25	9.000	L1	10.5
22.3768	36.85	50.00	13.15	9.000	L1	10.5
22.5680	36.55	50.00	13.45	9.000	L1	10.5

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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	08/02/2024	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	05/26/2024	Annual
Temperature Chamber	SU-642	ESPEC	93008124	02/19/2025	Annual
Signal Analyzer	N9030A	Keysight	MY55410508	09/04/2024	Annual
Power Meter	N1911A	Agilent	MY45100523	02/28/2025	Annual
Power Sensor	N1921A	Agilent	MY57820067	02/22/2025	Annual
Directional Coupler	87300B	Agilent	3116A03621	10/30/2024	Annual
Power Splitter	11667B	Hewlett Packard	10545	02/06/2025	Annual
DC Power Supply	E3632A	Agilent	KR75305528	01/02/2025	Annual
Attenuator(10 dB)(DC-26.5 GHz)	8493C-010	Agilent	08285	06/02/2024	Annual
Attenuator(20 dB)	18N-20dB	Rohde & Schwarz	8	02/20/2025	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
Bluetooth Tester	CBT	Rohde & Schwarz	100808	02/15/2025	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.

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	S3AM	08/03/2025	Biennial
Controller	EM2090	Emco	060520	N/A	N/A
Turn Table	N/A	Ets	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	03/07/2026	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	08/16/2024	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/07/2025	Biennial
Horn Antenna (15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170124	03/28/2025	Biennial
Amp & Filter Bank Switch Controller	FBSM-01A	TNM system	0	N/A	N/A
Band Reject Filter	WRCJV2400/2483.5-2370/2520-60/12SS	Wainwright Instruments	2	01/02/2025	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	5	06/12/2024	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	6	06/12/2024	Annual
Band Reject Filter	WRCJV5100/5850-40/50-8EEK	Wainwright Instruments	1	02/14/2025	Annual
RF Switching System	FBSR-03A (3G HPF+LNA)	T&M SYSTEM	S3L1	11/17/2024	Annual
RF Switching System	FBSR-03A (10dB ATT+LNA)	T&M SYSTEM	S3L2	11/17/2024	Annual
RF Switching System	FBSR-03A (7G HPF+LNA)	T&M SYSTEM	S3L3	11/17/2024	Annual
RF Switching System	FBSR-03A (3dB ATT+LNA)	T&M SYSTEM	S3L4	11/17/2024	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/17/2024	Annual
Power Amplifier	CBL26405040	CERNEX	25956	02/26/2025	Annual
Bluetooth Tester	TC-3000C	TESCOM	3000C000175	03/28/2024	Annual
Spectrum Analyzer	FSV40 (9 kHz ~ 40 GHz)	Rohde & Schwarz	100900	12/06/2024	Annual

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

11. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2403-FC017-P