On your side

고 객 비 밀
CUSTOMER SECRET

TEST REPORT

FCC/ISED DTS Test for LAIWB3

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2207-FI003-R1

DATE OF ISSUE
July 22, 2022

Tested by
Kyung Jun Woo

Technical Manager
Seul Ki Lee

HCT CO., LTD.
BongJai Huh / CEO

HCT CO., LTD.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si,
Gyeonggi-do, 17383 KOREA
Tel. +82 31 634 6300 Fax. +82 31 645 6401

고 객 비 밀
CUSTOMER SECRET

HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Tel. +82 31 634 6300 Fax. +82 31 645 6401

TEST REPORT

FCC/ISED DTS Test for LAIWB3

REPORT NO.
HCT-RF-2207-FI003-R1

DATE OF ISSUE
July 22, 2022

Additional Model
-

Applicant	**LG Electronics Inc.** 170, Seongsanpaechong-ro, Seongsan-gu, Changwon-si Gyeongsangnam-do 51533 Republic of Korea
Eut Type Model Name	RF Module LAIWB3
FCC ID IC	BEJ-LAIWB3 2703N-LAIWB3
Modulation type	CCK/DSSS/OFDM
FCC Classification	Digital Transmission System(DTS)
FCC Rule Part(s)	Part 15.247
IC Rule Part(s)	RSS-247 Issue 2 (February 2017) RSS-Gen Issue 5_Amendment 2 (February 2021)

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test results were applied only to the test methods required by the standard.

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	July 14, 2022	Initial Release
1	July 22, 2022	Added Powerline Conducted Emissions Data Page 2, Revised(Applicant) Page 5, Revised(Date(s) of Tests, Factory) Page 32, Revised AC Power line Conducted Emissions

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 / ISED Rules under normal use and maintenance.

If this report is required to confirmation of authenticity, please contact to www.hct.co.kr

CONTENTS

1. EUT DESCRIPTION

Model	LAIWB3	
Additional Model	-	
EUT Type	RF Module	
Power Supply	DC 12.0 V	
Frequency Range	2 412 MHz – 2 462 MHz	
Max. RF Output Power	Peak Power	802.11b: 24.41 dBm 802.11g: 24.58 dBm 802.11n(HT20): 24.59 dBm
	Average Power	802.11b: 17.94 dBm 802.11g: 16.47 dBm 802.11n(HT20): 16.46 dBm
Modulation Type	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n	
Number of Channels	11 Channels	
Antenna Specification	WIFI Pattern Antenna Peak Gain : 2.6 dBi	
Date(s) of Tests	June 24, 2022 ~ July 07, 2022 Powerline Conducted Emissions Data, July 21, 2022	
PMN (Product Marketing Number)	RF Module	
HVIN (Hardware Version Identification Number)	LAIWB3	
FVIN (Firmware Version Identification Number)	V1.0	
HMN (Host Marketing Name)	N/A	
EUT serial numbers	Radiated : 068429 Conducted : 060288	
Factory	BEACO 1&C Beacon I&C, 82-1 Anyangcheondong-ro, Dongan-gu, Anyang-si, Gyeonggi-do Republic of Korea	

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. / RSS-Gen issue 5, RSS-247 issue 2.

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

DESCRIPTION OF TEST MODES

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

3. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

4. FACILITIES AND ACCREDITATIONS

FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.
Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).
For ISED, test facility was accepted dated February 14, 2019 (CAB identifier: 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

According to RSS-GEN(Issue 5) Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

6. MEASUREMENT UNCERTAINTY

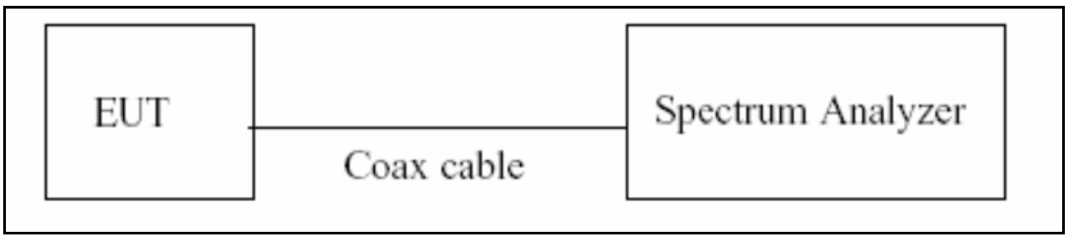
The measurement uncertainties shown below were calculated in accordance with the requirements of
ANSI C63.10-2013.
All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.
The measurement data shown herein meets or exceeds the U_{CISPR} measurement 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)	2.00 (Confidence level about 95 %, k=2)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.40 (Confidence level about 95 %, k=2)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.74 (Confidence level about 95 %, k=2)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.51 (Confidence level about 95 %, k=2)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.92 (Confidence level about 95 %, k=2)
Radiated Disturbance (Above 40 GHz)	5.48 (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*.

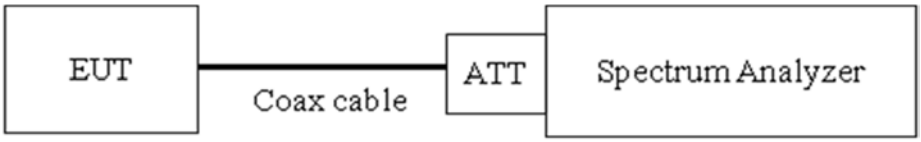
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

7.2. 6 dB Bandwidth & 99 % 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.

Test Procedure (99 % Bandwidth for ISED)

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW ≒ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

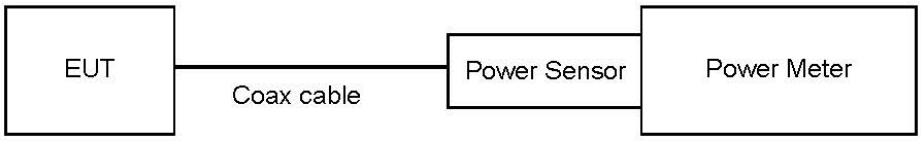
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

7.3. Output Power

Limit

The maximum permissible conducted output power is 1 Watt.

Test Configuration



Test Procedure

The transmitter output is connected to the Power Meter.

- Peak Power (Procedure 11.9.1.3 in ANSI 63.10-2013)
  : Measure the peak power of the transmitter.

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

Sample Calculation

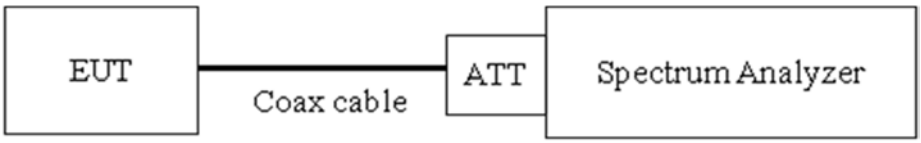
- Conducted Output Power(Peak) = Reading Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

7.4. Power Spectral Density

Limit

The transmitter power density average over 1-second interval shall not be greater than 8dBm 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 11.10.2 in ANSI 63.10-2013.

The spectrum analyzer is set to :

1) Set analyzer center frequency to DTS channel center frequency.
2) Span = 1.5 times the DTS channel bandwidth.
3) RBW = 3 kHz ≤ RBW ≤ 100 kHz.
4) VBW ≥ 3 x RBW.
5) Sweep = auto couple
6) Detector = peak
7) Trace Mode = max hold
8) Allow trace to fully stabilize.
9) 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.

Sample Calculation

- Power Spectral Density = Reading Value + ATT loss + Cable loss

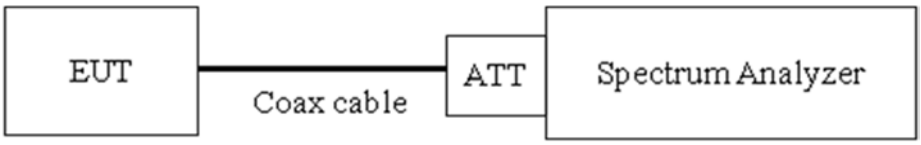
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

Limit

The maximum conducted (Average) output power was used to demonstrate compliance, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz.

[Conducted > 20 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	10.27
100	10.33
200	10.34
300	10.36
400	10.40
500	10.59
600	10.60
700	10.62
800	10.65
900	10.66
1 000	10.67
2 000	10.76
2 400	**10.82**
2 480	**10.82**
2 500	10.83
3 000	11.05
4 000	11.11
5 000	11.55
5 150	11.74
5 850	11.74
6 000	11.80
7 000	11.82
8 000	11.85
9 000	11.90
10 000	12.03
11 000	12.09
12 000	12.11
13 000	12.17
14 000	12.20
15 000	12.22
16 000	12.31
17 000	12.50
18 000	12.64
19 000	12.56
20 000	12.23
21 000	12.36
22 000	12.35
23 000	12.32
24 000	12.37
25 000	12.48
26 000	12.51

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

2. Factor = Attenuator loss + Cable loss

7.6. Radiated Test

Limit

FCC

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

ISED

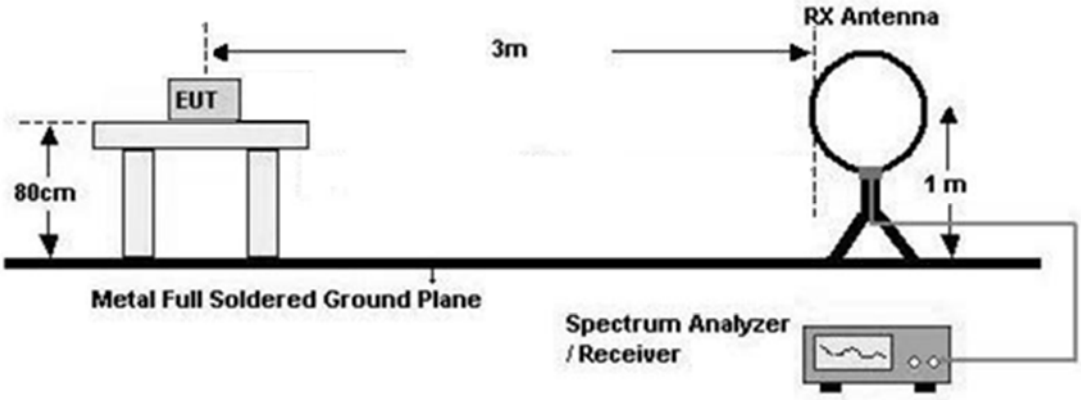
Frequency (MHz)	Field Strength (μA/m)	Measurement Distance (m)
0.009 – 0.490	6.37/F(kHz)	300
0.490 – 1.705	63.7/F(kHz)	30
1.705 – 30	0.08	30

FCC&ISED

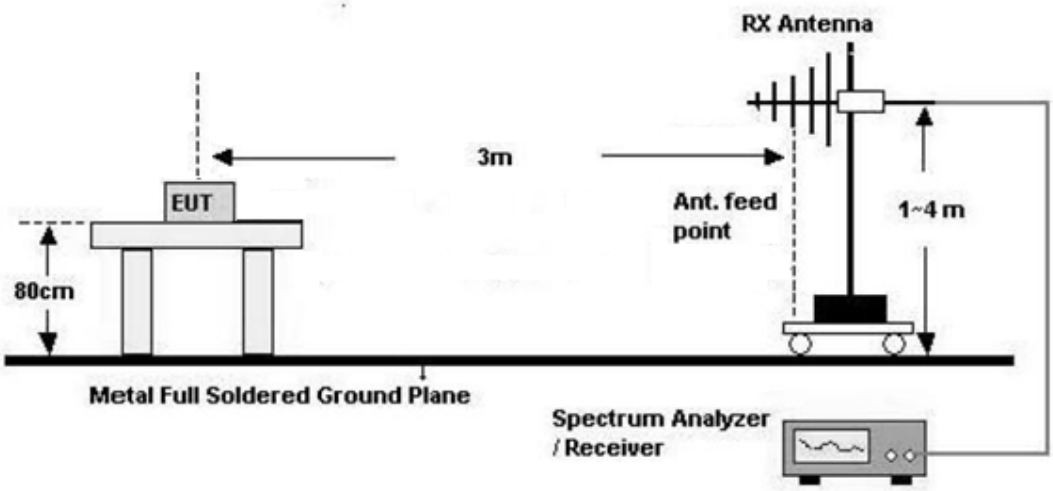
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

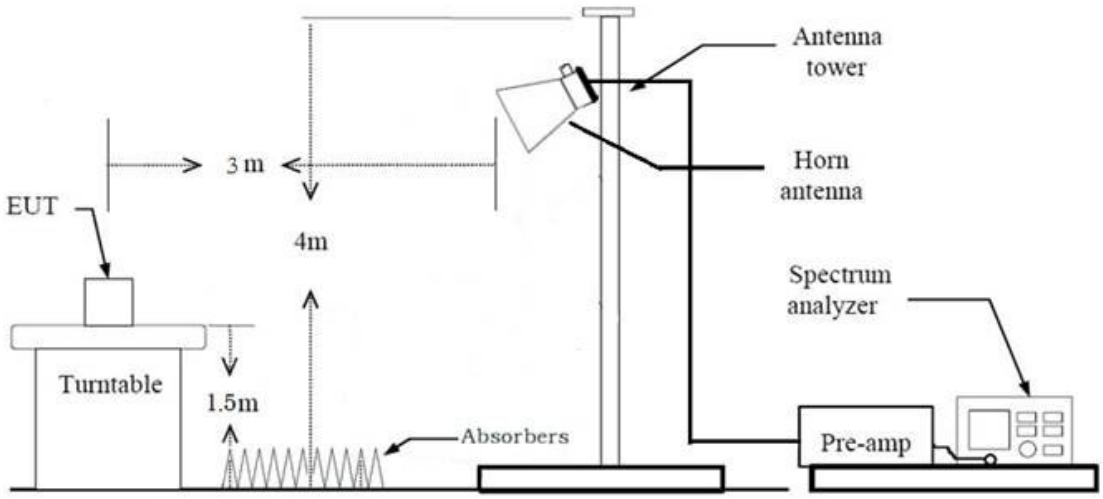
Below 30 MHz



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 = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

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

KDB 414788 OFS and Chamber Correlation Justification

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

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

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

Test Procedure of Radiated spurious emissions (Above 1 GHz)

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 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. 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 percent duty cycle.
- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

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.
9. Distance extrapolation factor = 20log (test distance / specific distance) (dB)
10. Total(Measurement Type : Peak)
    = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)

Total(Measurement Type : Average, Duty cycle ≥ 98 %)
= Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)

Total(Measurement Type : Average, Duty cycle < 98 %)
= Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(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 percent duty cycle.
- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
10. Distance extrapolation factor = 20log (test distance / specific distance) (dB)
11. Total(Measurement Type : Peak)
    = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)

    Total(Measurement Type : Average, Duty cycle ≥ 98 %)
    = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)

    Total(Measurement Type : Average, Duty cycle < 98 %)
    = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)
    + Duty Cycle Factor

7.7. AC Power line Conducted Emissions

Limit

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

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

[a]Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

7.8. Receiver Spurious Emissions

Limit

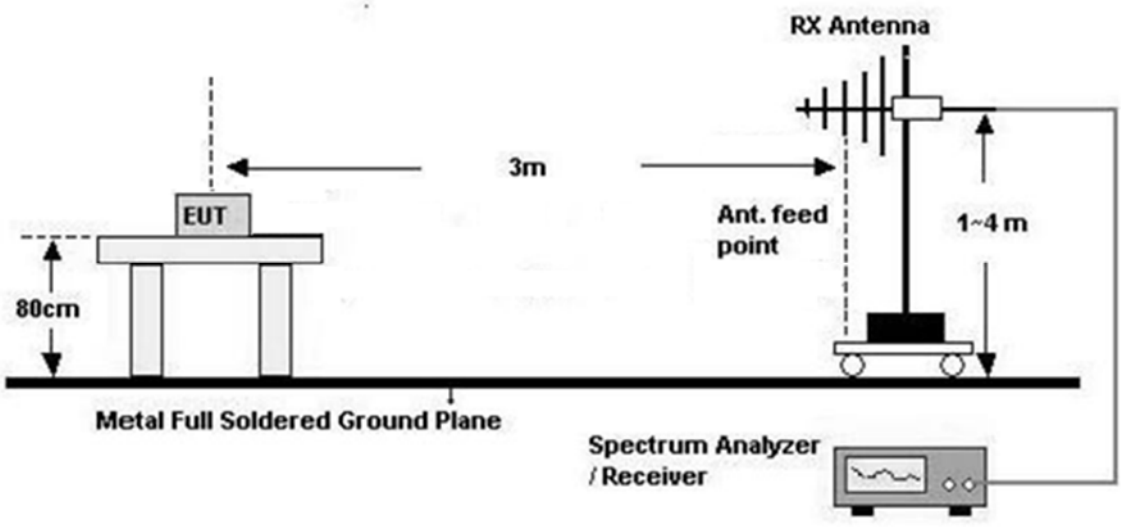
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

Measurements for compliance with the limits in table may be performed at distances other than 3 metres.

Test Configuration

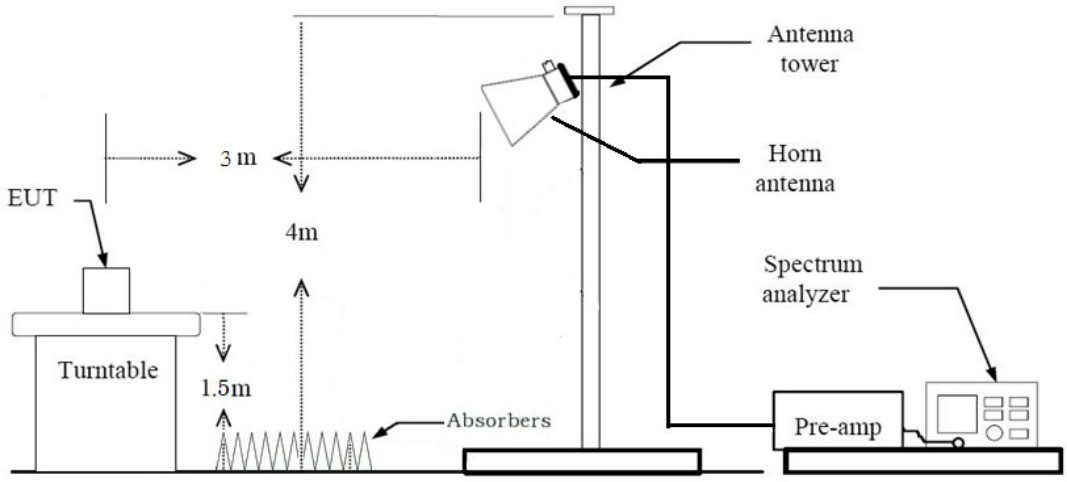
30 MHz - 1 GHz



Test Procedure of Receiver Spurious Emissions (Below 1GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 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
7. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)

Above 1 GHz



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
   (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):

- We performed using a reduced video BW method was done with the analyzer in linear mode
- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = Peak
- Trace = Maxhold
- RBW = 1 MHz
- VBW ≥ 3 x RBW

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.
11. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)

7.9. Worst case configuration and mode

Radiated test

1. All modes of operation were investigated and the worst case configuration results are reported.
2. All configurations of antenna were investigated and the worst case configuration results are reported.
   - Mode : Stand alone
   - Worstcase : Stand alone
3. EUT Axis
   - Radiated Spurious Emissions : Y
   - Radiated Restricted Band Edge : X
4. 802.11b 1 Mbps Mode 1 transmits Continuously(Duty Cycle ≥ 98%, cf 9. 1).
5. All datarate of operation were investigated and the worst case datarate results are reported
   - 802.11b : 1 Mbps
   - 802.11g : 6 Mbps
   - 802.11n : 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

Radiated test(DBS)

1. All modes of operation were investigated and the worst case configuration results are reported.
   - Mode : Stand alone
   - Worstcase : Stand alone
2. EUT Axis
   - Radiated Spurious Emissions : Y
3. The following tables show the worst case configurations determined during testing.

Description	Bluetooth Emission	2.4 GHz Emission
Antenna	WIFI/BT	WIFI/BT
Channel	78	6
Data Rate	1 Mbps	1 Mbps
Mode	GFSK : DH5	802.11b

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 (Notebook)

Conducted test

1. All datarate of operation were investigated and the worst case datarate results are reported
   - 802.11b : 11 Mbps
   - 802.11g : 9 Mbps
   - 802.11n : MCS0
2. 802.11b 1 Mbps Mode transmits Continuously(Duty Cycle ≥ 98%, cf 9. 1).

8. SUMMARY TEST OF RESULTS

FCC Part

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

ISED Part

Test Description	ISED Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	RSS-247, 5.2	> 500 kHz	Conducted	PASS
99% Bandwidth	RSS-GEN, 6.7	N/A		PASS
Conducted Maximum Peak Output Power And e.i.r.p.	RSS-247, 5.4.	< 1 Watt <4 Watt(e.i.r.p.)		PASS
Power Spectral Density	RSS-247, 5.2	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	RSS-247, 5.5	Conducted > 20 dBc		PASS
AC Power line Conducted Emissions	RSS-GEN, 8.8	cf. Section 7.7		PASS
Radiated Spurious Emissions	RSS-GEN, 8.9	cf. Section 7.6	Radiated	PASS
Receiver Spurious Emissions	RSS-GEN, 7	cf. Section 7.8		PASS
Radiated Restricted Band Edge	RSS-GEN, 8.10	cf. Section 7.6		PASS

#Note1 : Not Tested

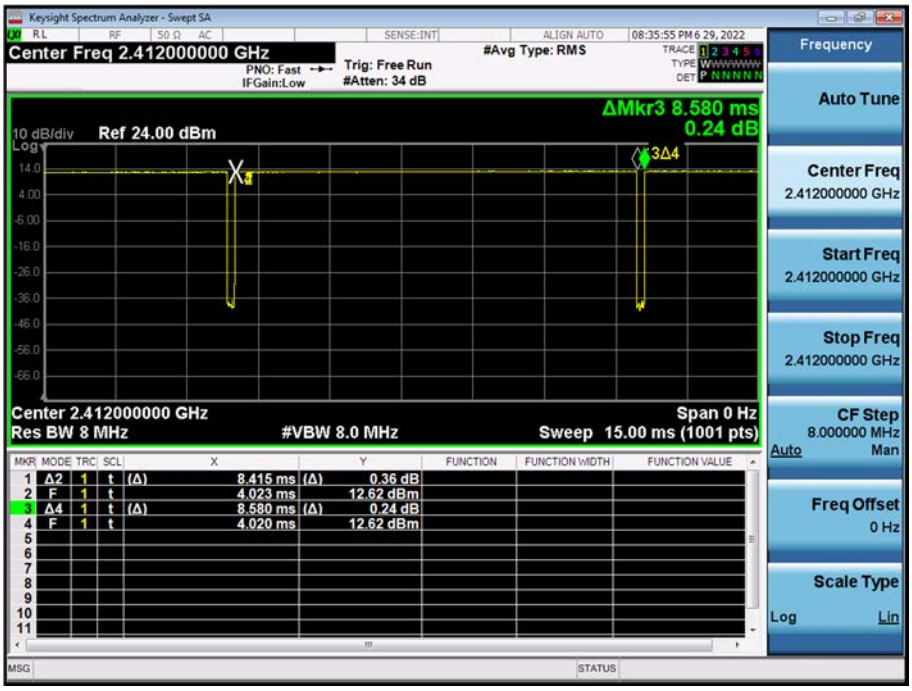
9. TEST RESULT

9.1 DUTY CYCLE

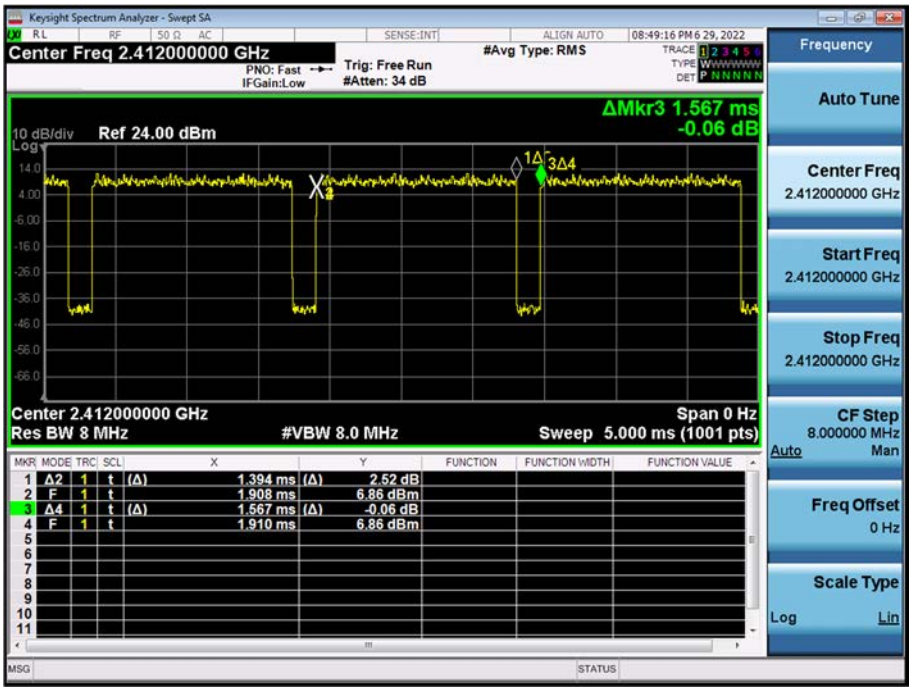
Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	1	8.415	8.580	0.981	0.084
	2	4.309	4.477	0.963	0.166
	5.5	1.687	1.826	0.924	0.343
	11	0.940	1.113	0.845	0.734
802.11g	6	1.394	1.567	0.890	0.508
	9	0.940	1.113	0.845	0.734
	12	0.705	0.885	0.797	0.988
	18	0.480	0.690	0.696	1.576
	24	0.363	0.534	0.680	1.676
	36	0.249	0.423	0.589	2.301
	48	0.192	0.363	0.529	2.766
	54	0.177	0.348	0.509	2.936
802.11n (HT20)	6.5 (MCS0)	1.308	1.519	0.861	0.649
	13 (MCS1)	0.671	0.843	0.796	0.990
	19.5 (MCS2)	0.460	0.631	0.729	1.371
	26 (MCS3)	0.356	0.527	0.676	1.700
	39 (MCS4)	0.248	0.419	0.593	2.272
	52 (MCS5)	0.196	0.367	0.533	2.732
	58.5 (MCS6)	0.180	0.352	0.513	2.902
	65 (MCS7)	0.162	0.333	0.486	3.129

▣ Test Plots

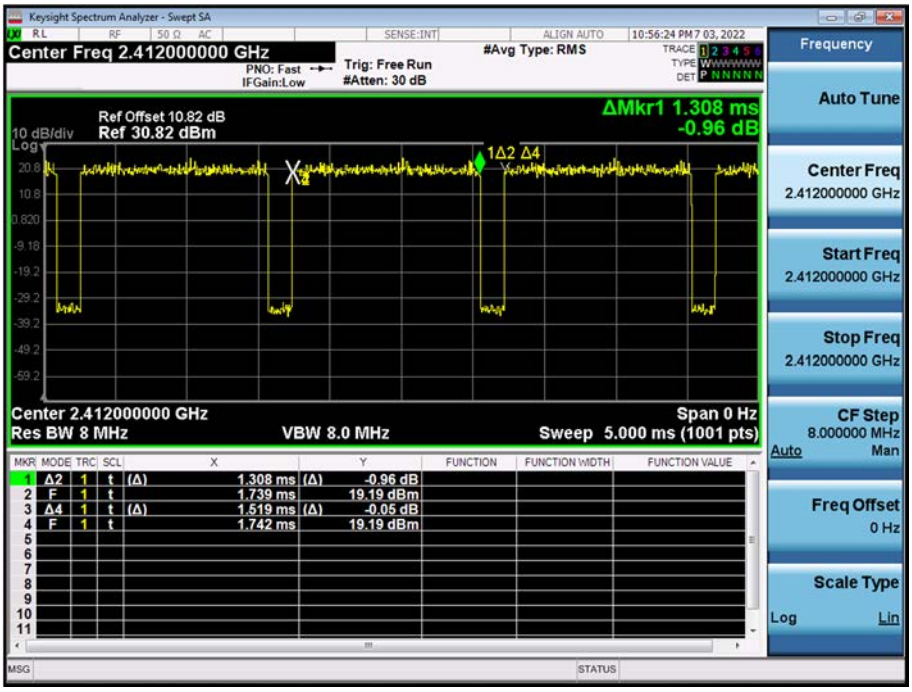
Duty cycle plot (802.11b(1 Mbps))



Duty cycle plot (802.11g(6 Mbps))



Duty cycle plot (802. 11n(MCS0))



Note:

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

9.2 6dB BANDWIDTH & 99 % BANDWIDTH

FCC

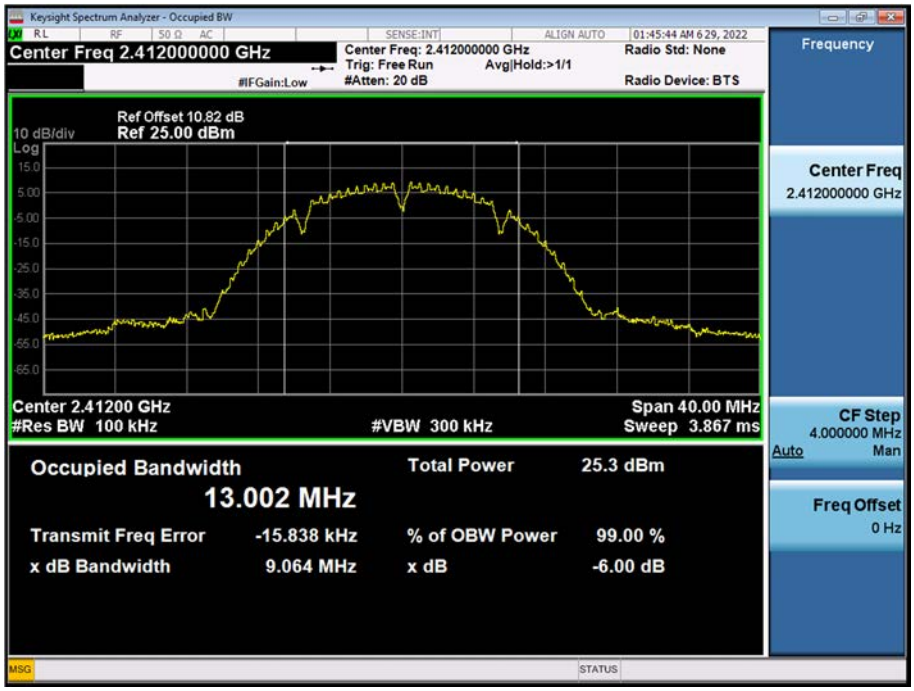
802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	9.064	> 0.5
2437	6	9.064	> 0.5
2462	11	9.085	> 0.5

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.18	> 0.5
2437	6	16.37	> 0.5
2462	11	15.47	> 0.5

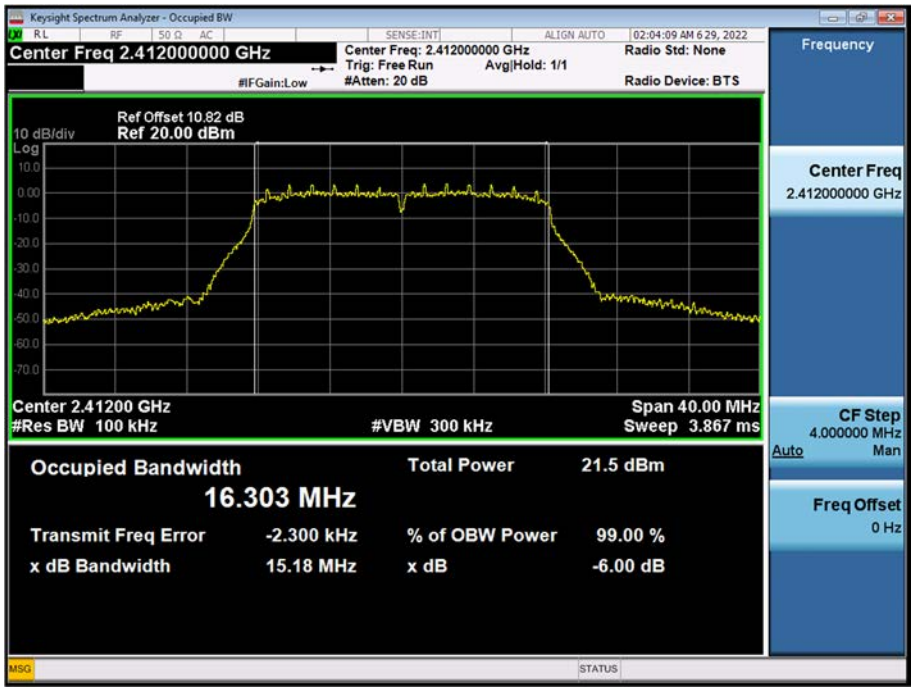
802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	15.37	> 0.5
2437	6	17.36	> 0.5
2462	11	15.38	> 0.5

▣ Test Plots

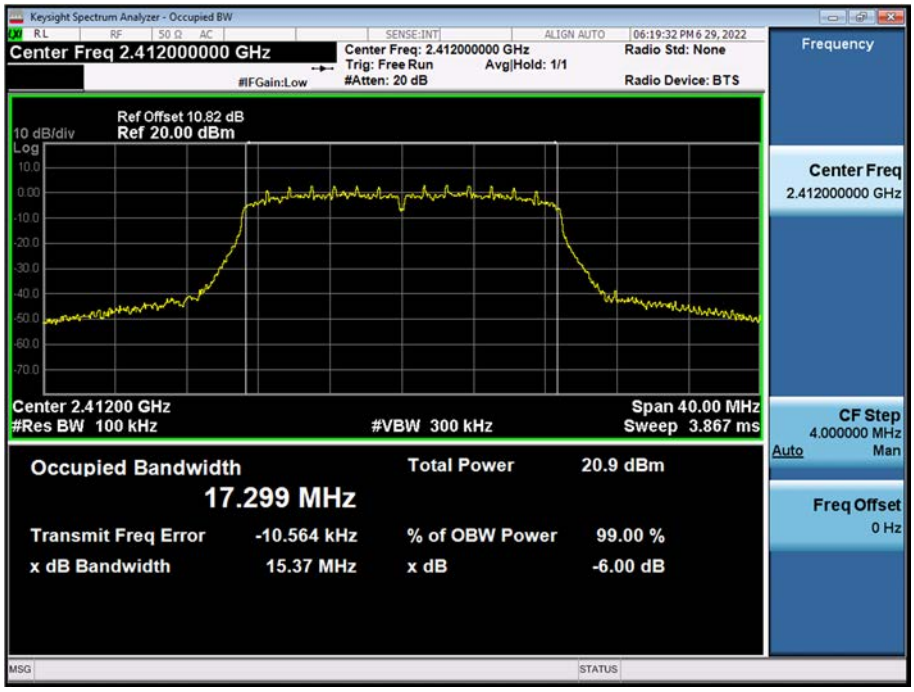
6dB Bandwidth plot (802.11b-CH 1)



6dB Bandwidth plot (802.11g-CH 1)



6dB Bandwidth plot (802.11n_HT20-CH 1)



Note:

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

99% Bandwidth Measurements(ISED)

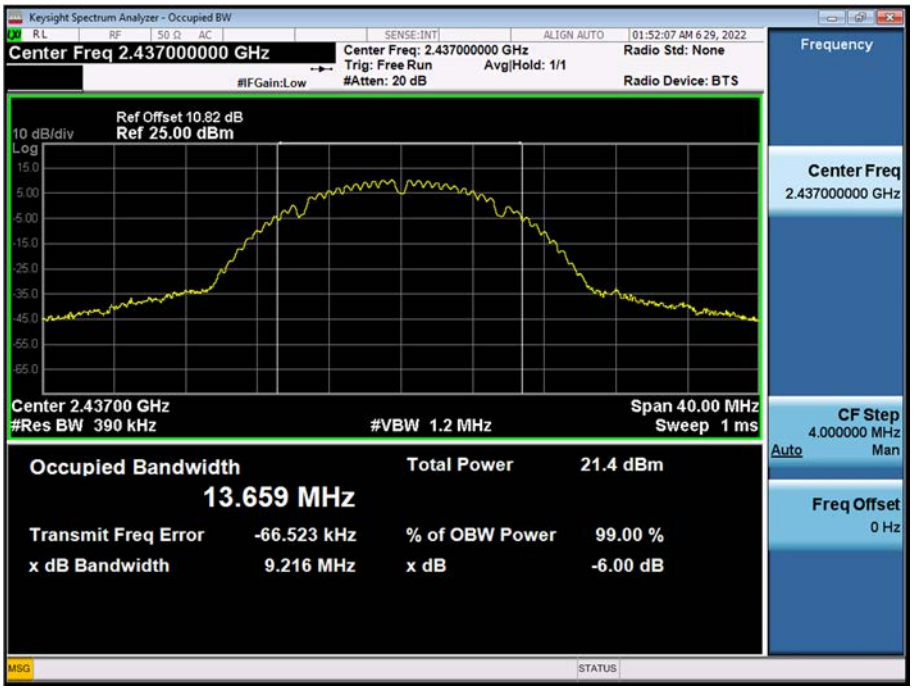
802.11b Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	13.072	N/A
2437	6	13.659	N/A
2462	11	13.146	N/A

802.11g Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.667	N/A
2437	6	17.154	N/A
2462	11	16.670	N/A

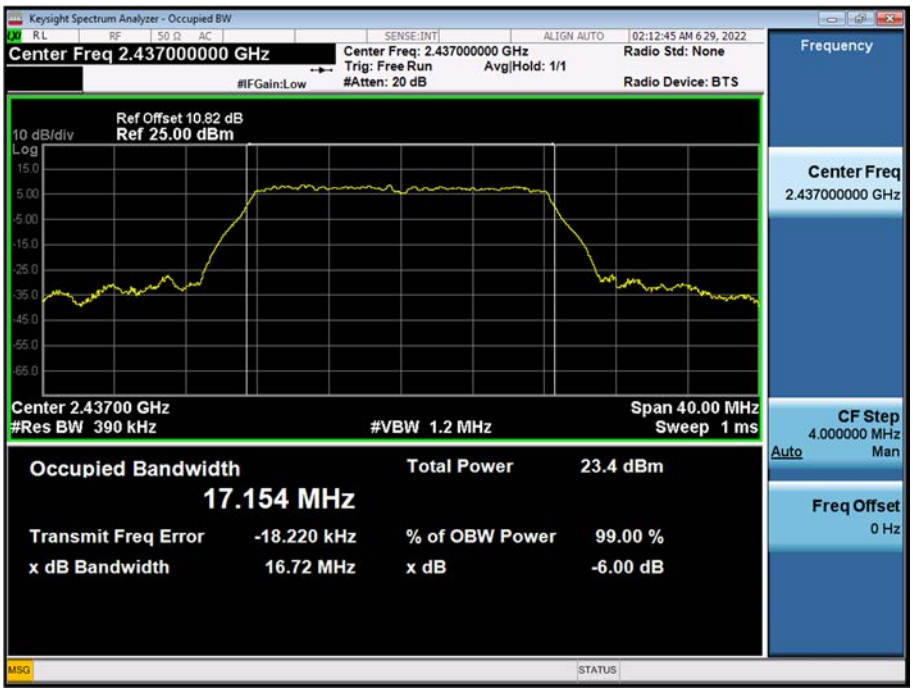
802.11n(HT20) Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.375	N/A
2437	6	17.787	N/A
2462	11	17.379	N/A

▣ Test Plots

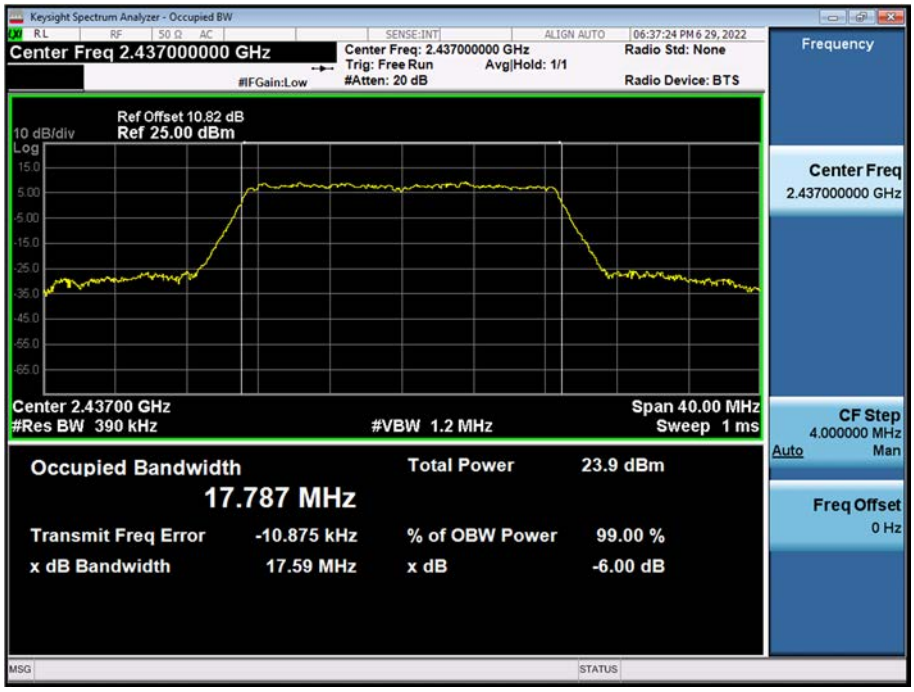
99% Bandwidth plot (802.11b-CH 6)



99% Bandwidth plot (802.11g-CH 6)



99% Bandwidth plot (802.11n_HT20-CH 6)



Note:

In order to simplify the report, attached plots were only the most wide 99% Bandwidth channel.

9.3 OUTPUT POWER

Peak Power

1. Power Meter offset = Attenuator loss+ Cable loss
2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.
So, 10.82 dB is offset for 2.4 GHz Band

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	1	20.45	30
		2	21.62	30
		5.5	22.82	30
		11	24.41	30
2437	6	1	20.71	30
		2	20.96	30
		5.5	22.34	30
		11	23.89	30
2462	11	1	20.82	30
		2	21.03	30
		5.5	22.43	30
		11	23.93	30

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6	22.41	30
		9	22.55	30
		12	22.15	30
		18	22.08	30
		24	22.41	30
		36	22.51	30
		48	22.31	30
		54	22.53	30
2437	6	6	24.48	30
		9	24.58	30
		12	24.17	30
		18	24.14	30
		24	24.48	30
		36	24.55	30
		48	24.34	30
		54	24.54	30
2462	11	6	23.61	30
		9	23.70	30
		12	23.35	30
		18	23.31	30
		24	23.61	30
		36	23.67	30
		48	23.48	30
		54	23.67	30

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	22.07	30
		1	21.81	30
		2	21.86	30
		3	21.98	30
		4	22.05	30
		5	22.04	30
		6	21.99	30
		7	22.01	30
2437	6	0	24.59	30
		1	24.14	30
		2	24.14	30
		3	24.47	30
		4	24.43	30
		5	24.39	30
		6	24.38	30
		7	24.25	30
2462	11	0	23.13	30
		1	22.70	30
		2	22.71	30
		3	22.85	30
		4	22.99	30
		5	22.94	30
		6	22.89	30
		7	22.81	30

Average Power

1. Power Meter offset = Attenuator loss + Cable loss
2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.
   So, 10.82 dB is offset for 2.4 GHz Band.

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1	17.94	0.000	17.94	30
		2	17.74	0.166	17.91	30
		5.5	17.53	0.343	17.87	30
		11	17.11	0.734	17.84	30
2437	6	1	17.90	0.000	17.90	30
		2	17.48	0.166	17.65	30
		5.5	17.14	0.343	17.48	30
		11	16.89	0.734	17.62	30
2462	11	1	17.67	0.000	17.67	30
		2	17.46	0.166	17.63	30
		5.5	17.24	0.343	17.58	30
		11	16.89	0.734	17.62	30

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6	14.07	0.508	14.58	30
		9	13.79	0.734	14.52	30
		12	13.62	0.988	14.61	30
		18	13.15	1.576	14.73	30
		24	12.84	1.676	14.52	30
		36	12.22	2.301	14.52	30
		48	11.86	2.766	14.62	30
		54	11.64	2.936	14.58	30
2437	6	6	15.95	0.508	16.46	30
		9	15.66	0.734	16.39	30
		12	15.34	0.988	16.32	30
		18	14.89	1.576	16.47	30
		24	14.72	1.676	16.40	30
		36	14.07	2.301	16.37	30
		48	13.65	2.766	16.42	30
		54	13.44	2.936	16.38	30
2462	11	6	15.12	0.508	15.63	30
		9	14.85	0.734	15.59	30
		12	14.65	0.988	15.64	30
		18	14.23	1.576	15.81	30
		24	13.90	1.676	15.57	30
		36	13.33	2.301	15.63	30
		48	12.80	2.766	15.57	30
		54	12.66	2.936	15.59	30

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	13.90	0.649	14.55	30
		1	13.67	0.990	14.66	30
		2	13.15	1.371	14.53	30
		3	12.87	1.700	14.58	30
		4	12.36	2.272	14.64	30
		5	12.05	2.732	14.78	30
		6	11.87	2.902	14.77	30
		7	11.83	3.129	14.96	30
2437	6	0	15.78	0.649	16.43	30
		1	15.22	0.990	16.21	30
		2	14.84	1.371	16.21	30
		3	14.64	1.700	16.34	30
		4	14.14	2.272	16.41	30
		5	13.73	2.732	16.46	30
		6	13.55	2.902	16.45	30
		7	13.30	3.129	16.43	30
2462	11	0	14.94	0.649	15.59	30
		1	14.48	0.990	15.47	30
		2	14.21	1.371	15.58	30
		3	13.79	1.700	15.49	30
		4	13.44	2.272	15.71	30
		5	12.97	2.732	15.70	30
		6	12.88	2.902	15.78	30
		7	12.69	3.129	15.82	30

9.4 POWER SPECTRAL DENSITY

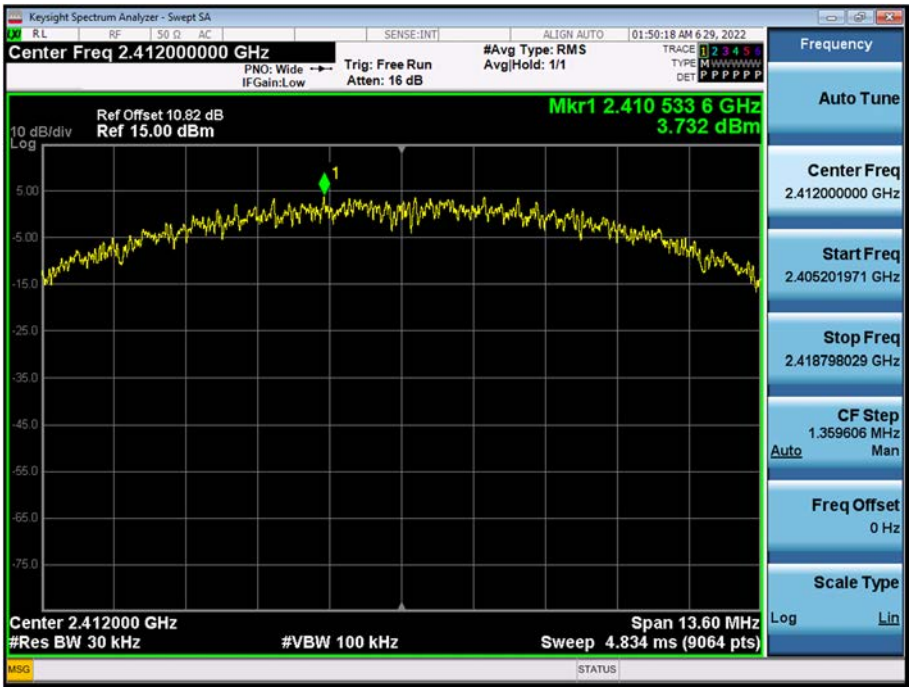
Mode	Frequency (MHz)	Channel No.	Test Result	
			Measured PSD (dBm/3 kHz)	Limit (dBm/3 kHz)
802.11b	2412	1	3.732	8
	2437	6	3.310	
	2462	11	3.268	
802.11g	2412	1	-1.258	
	2437	6	0.355	
	2462	11	-0.356	
802.11n(HT20)	2412	1	-1.619	
	2437	6	0.448	
	2462	11	-0.598	

Note :

1. The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss(10 dB) + Cable loss(1ea)
3. 10.82 dB is offset for 2.4 GHz Band.

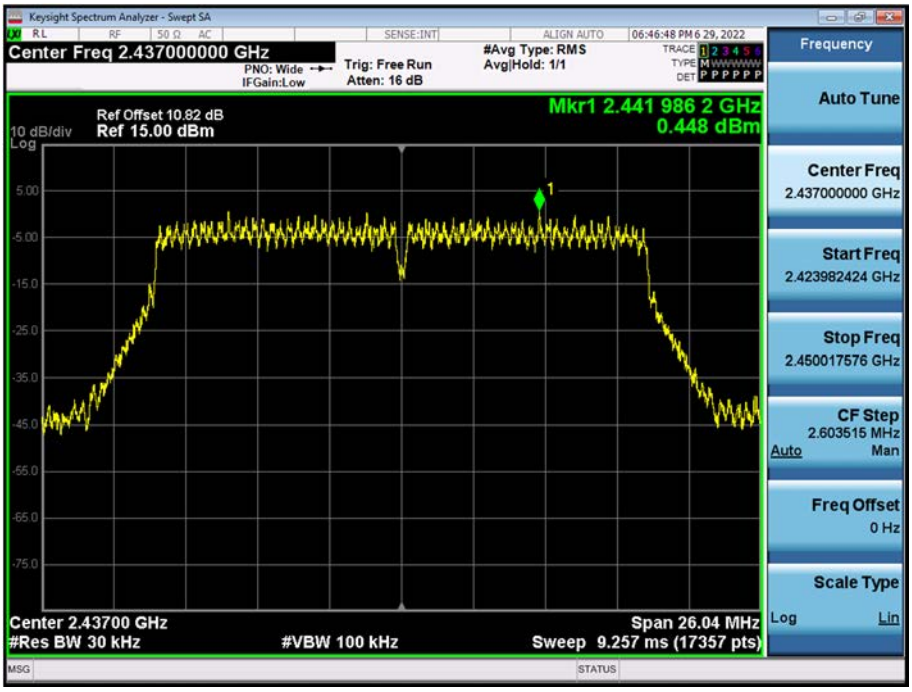
▣ Test Plots

Power Spectral Density (802.11b - Ch. 1)



Power Spectral Density (802.11g – Ch. 6)

Power Spectral Density (802.11n_HT20 – Ch. 6)



Note :

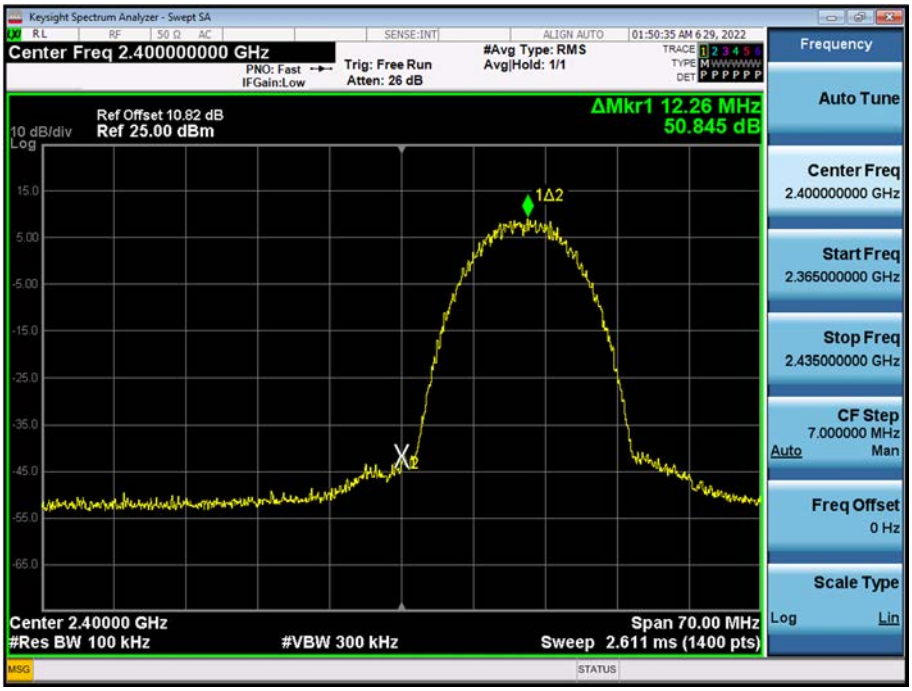
In order to simplify the report, attached plots were only the worstcase PSD channel.

9.5 BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

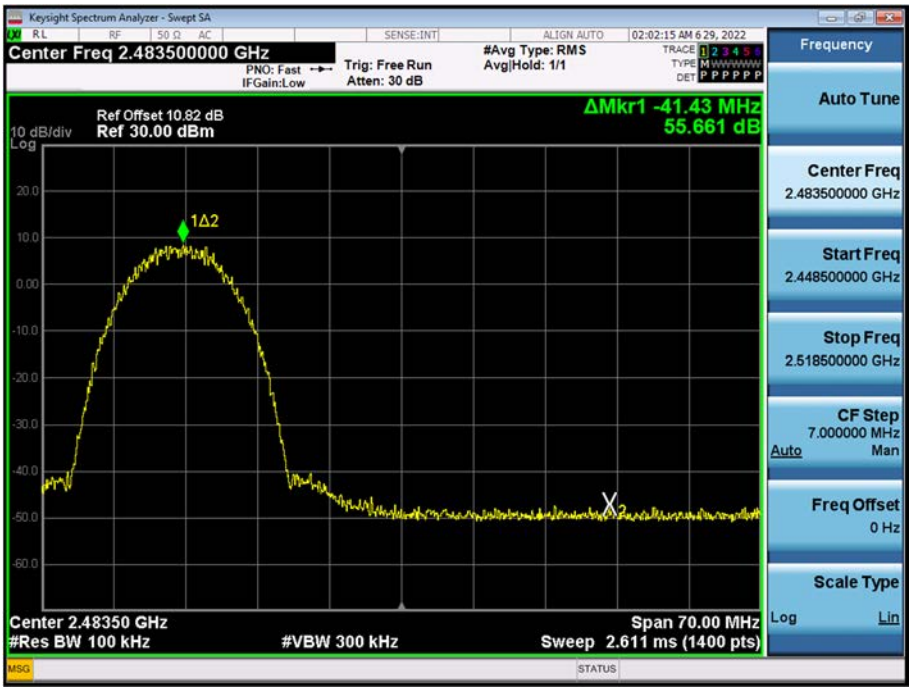
Test Result : please refer to the plot below.
In order to simplify the report, attached plots were only the worst case channel and data rate.

▣ Test Plots(BandEdge)

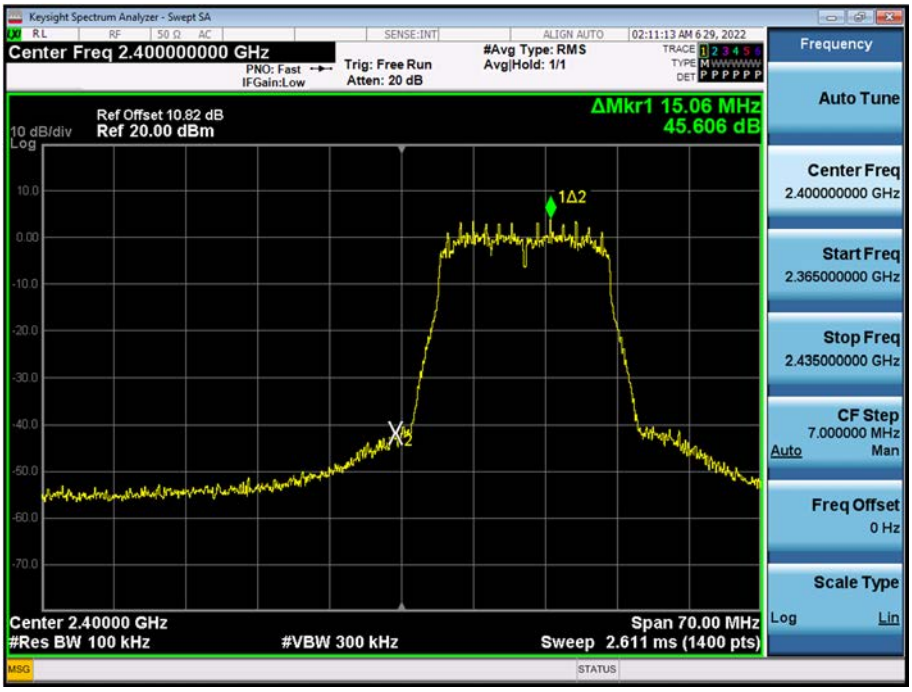
Band Edge (802.11b – Ch. 1)



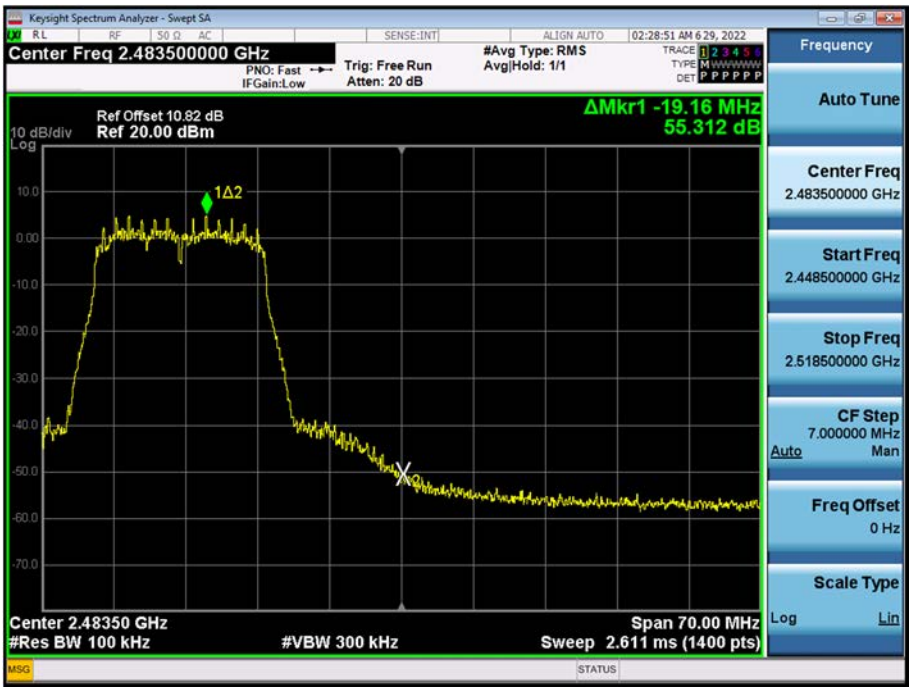
Band Edge (802.11b – Ch. 11)



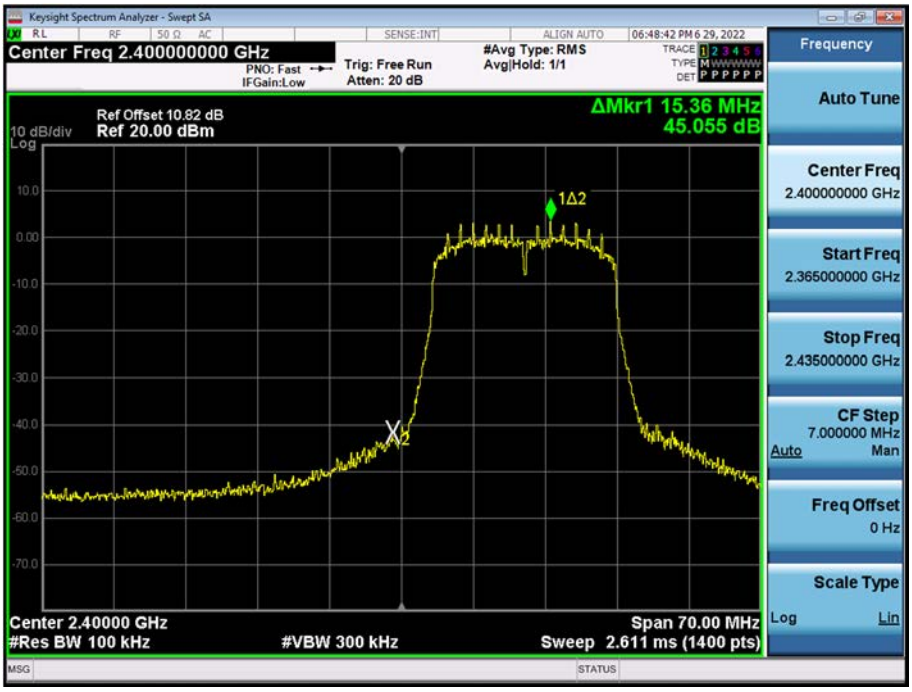
Band Edge (802.11g – Ch. 1)



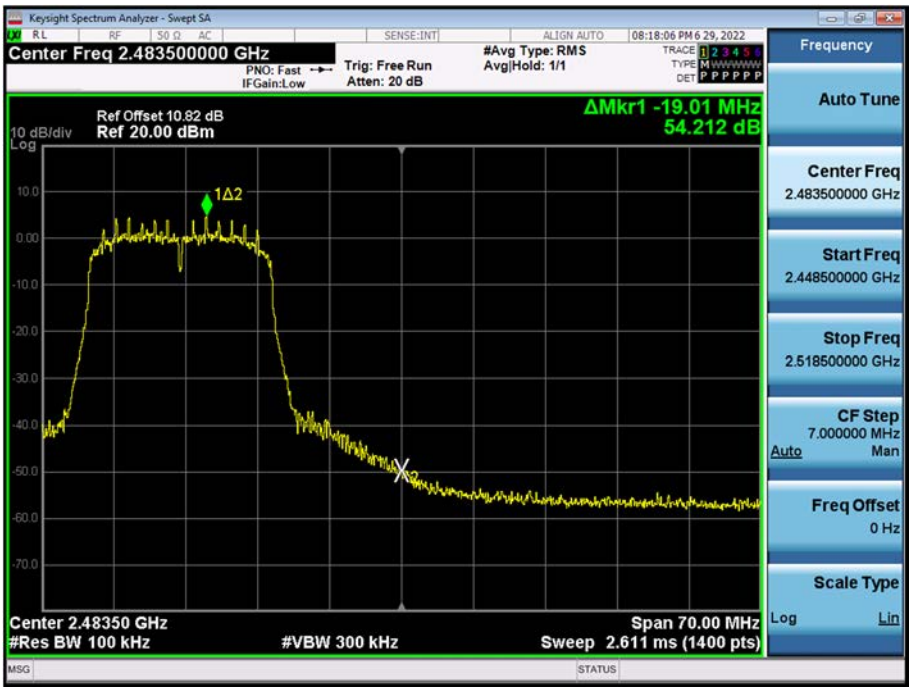
Band Edge (802.11g - Ch. 11)



Band Edge (802.11n_HT20 – Ch. 1)



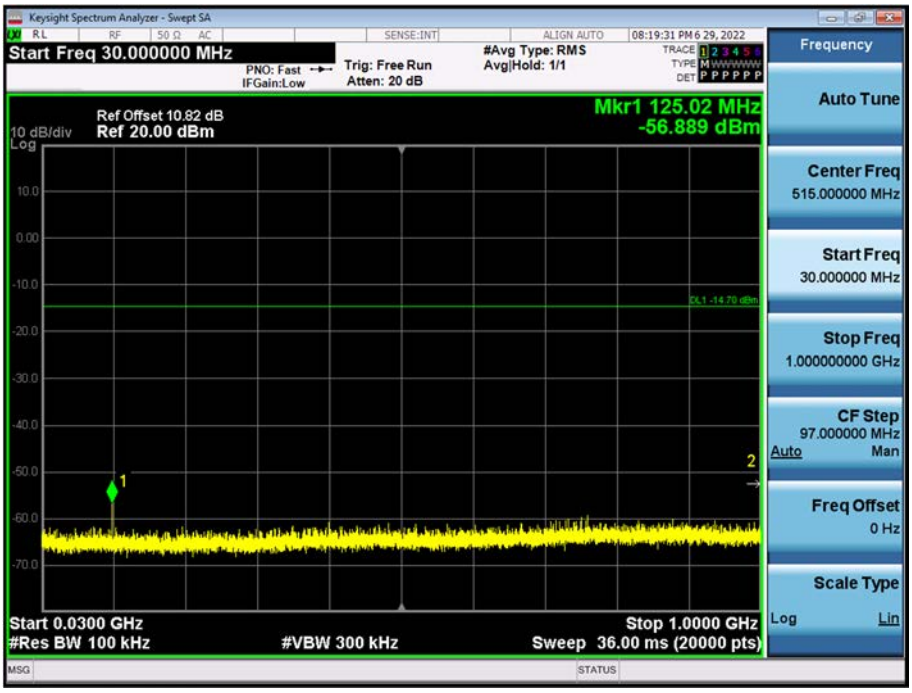
Band Edge (802.11n_HT20 – Ch. 11)



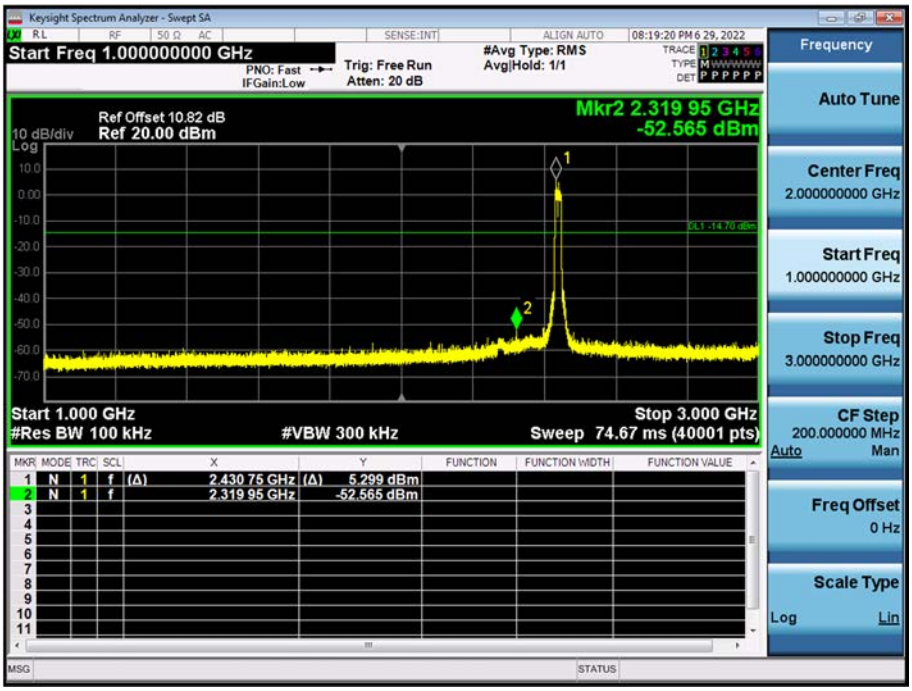
▣ Test Plots(Conducted Spurious Emission)

Mode : 802.11n HT20_Ch. 6_MCS0

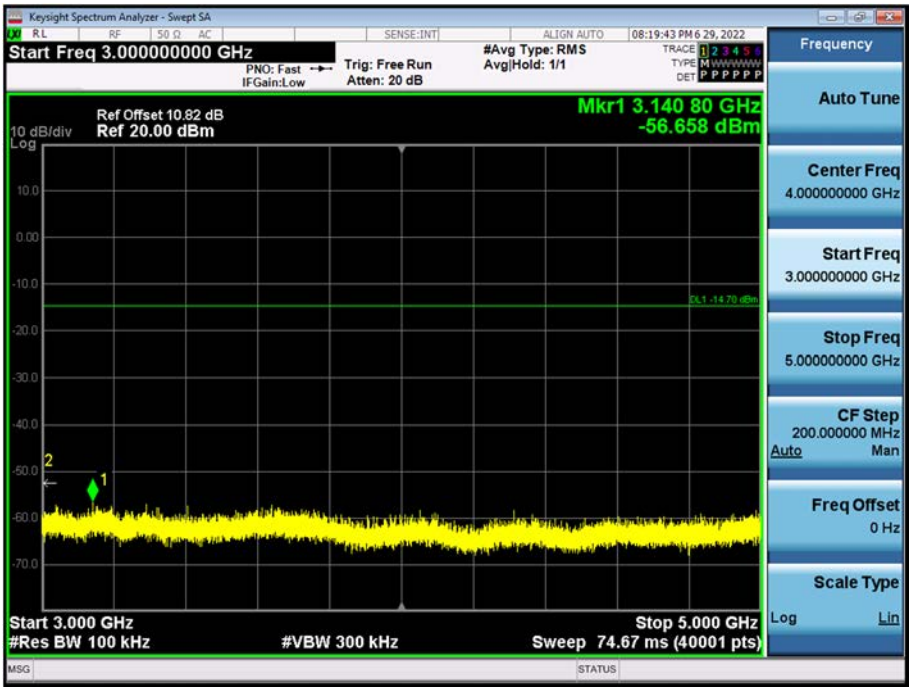
30 MHz ~ 1 GHz



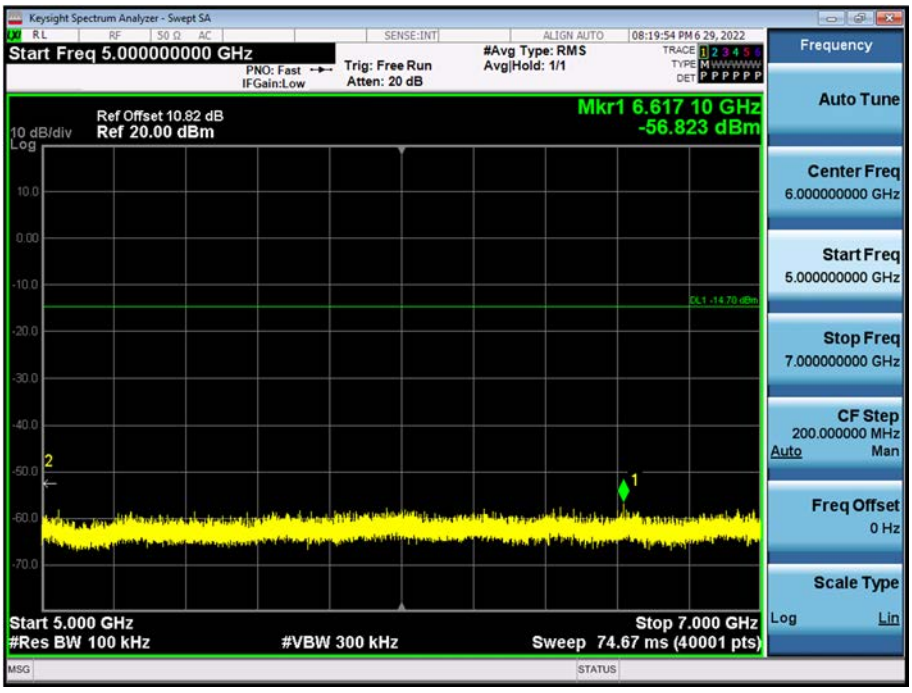
1 GHz ~ 3 GHz



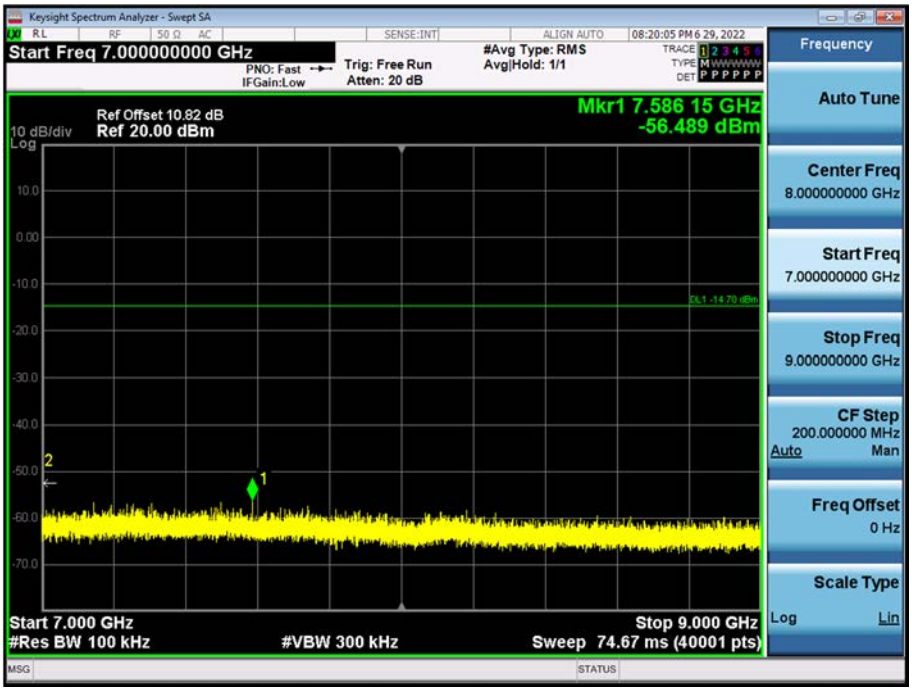
3 GHz ~ 5 GHz



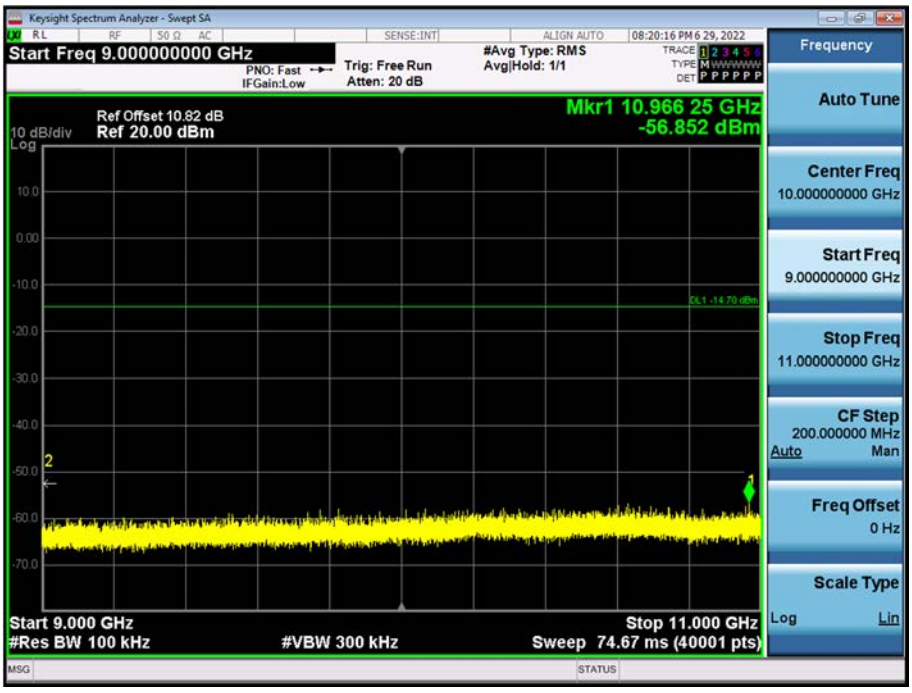
5 GHz ~ 7 GHz



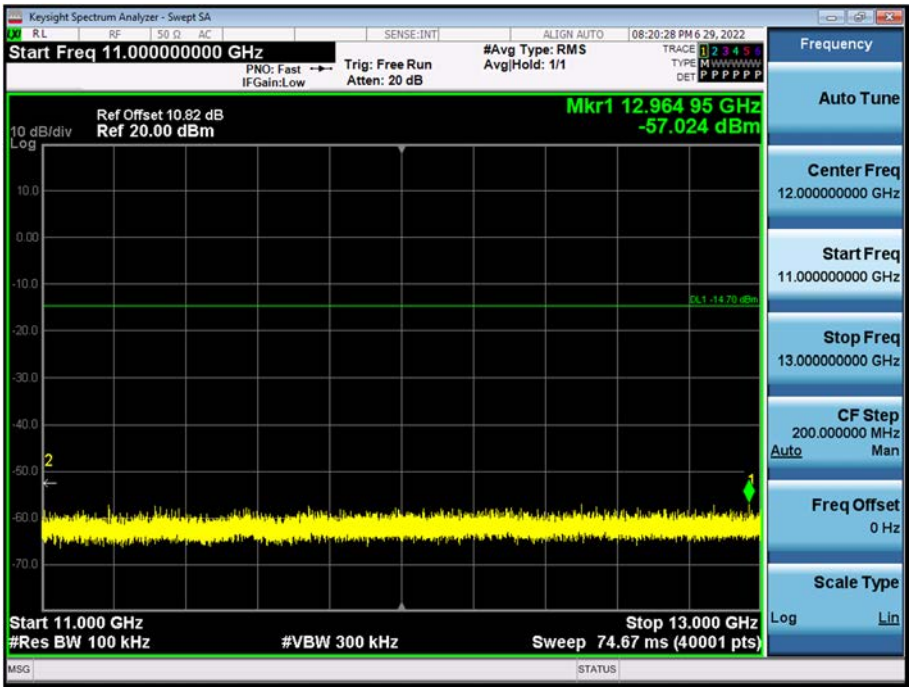
7 GHz ~ 9 GHz



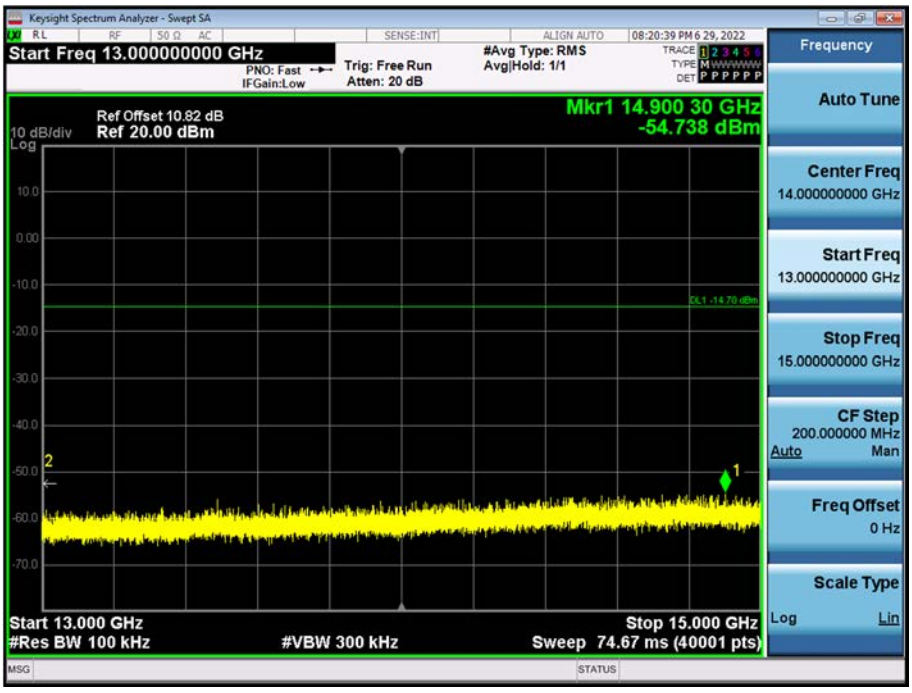
9 GHz ~ 11 GHz



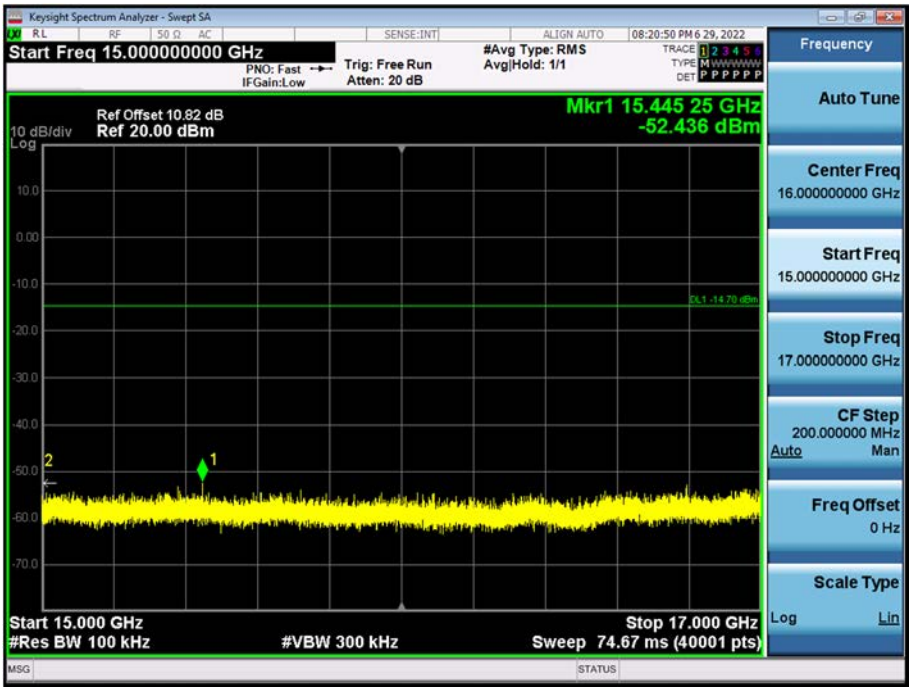
11 GHz ~ 13 GHz



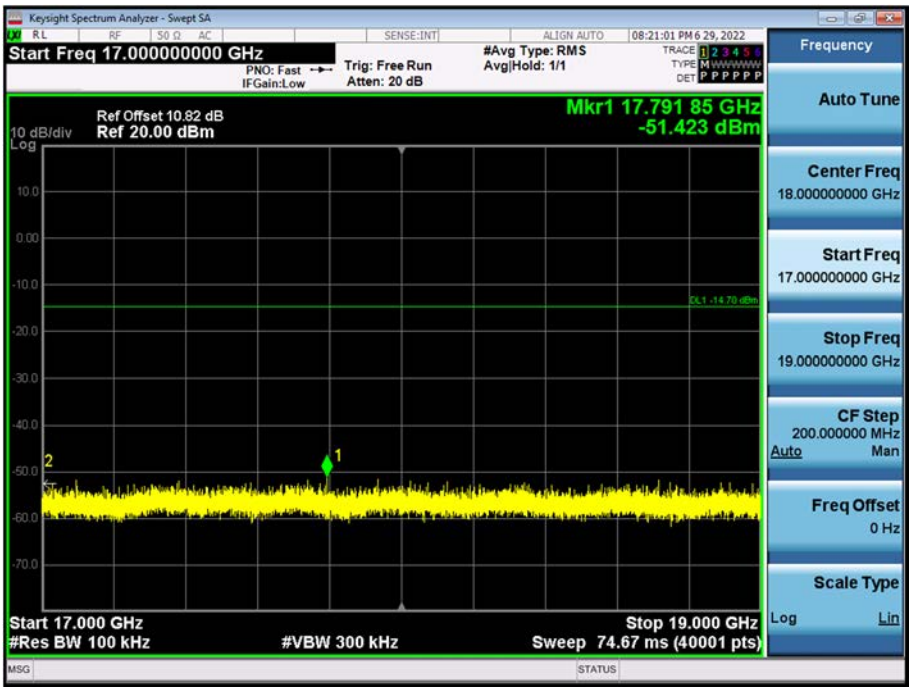
13 GHz ~ 15 GHz



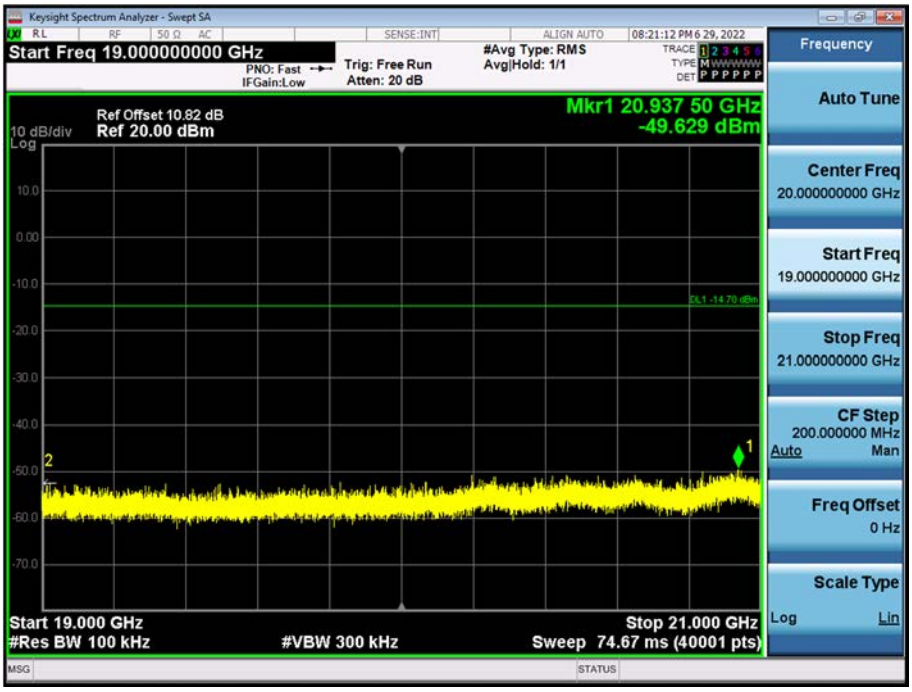
15 GHz ~ 17 GHz



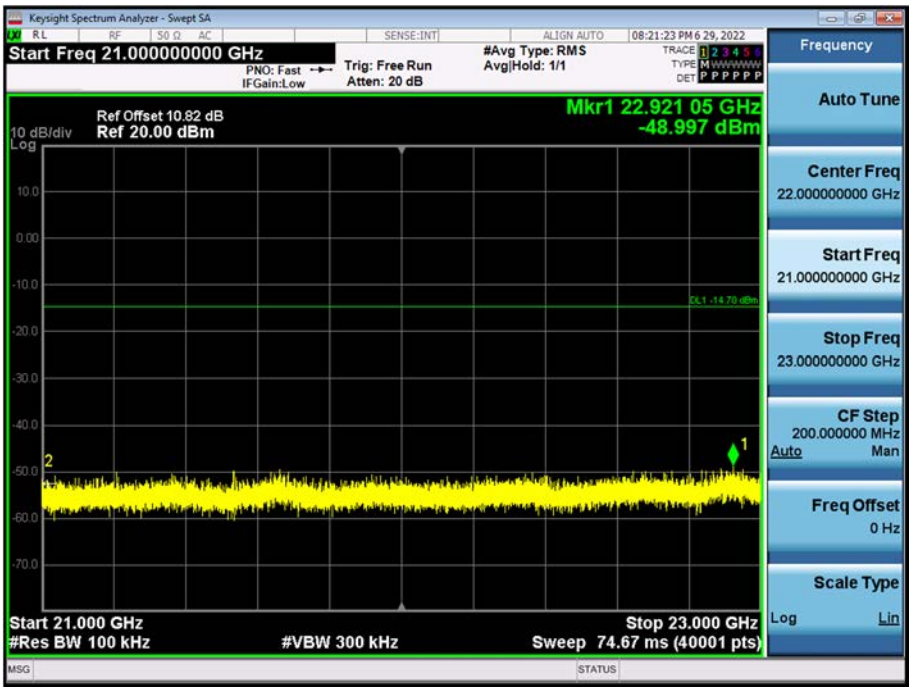
17 GHz ~ 19 GHz



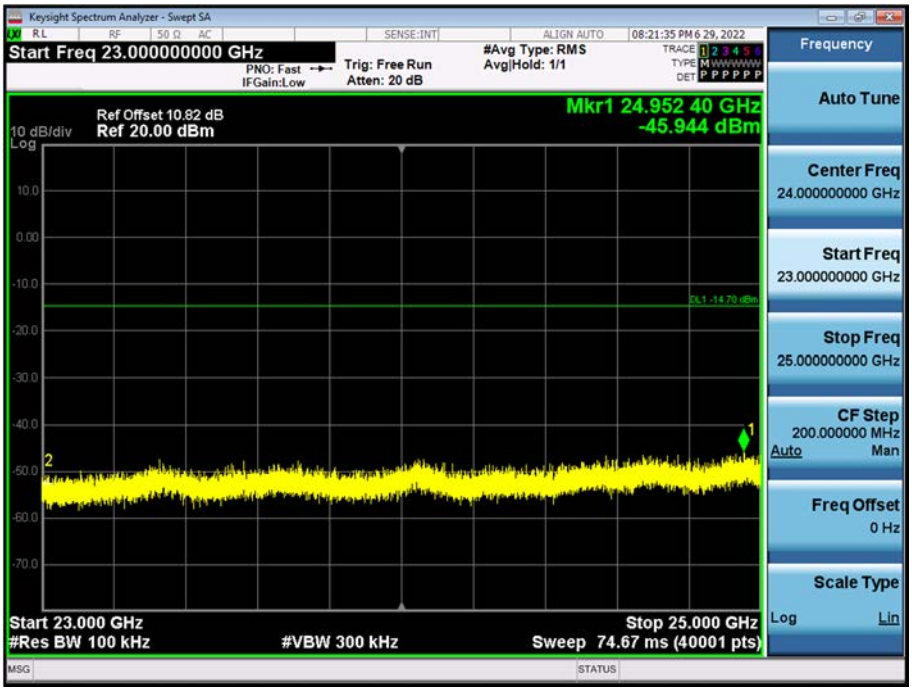
19 GHz ~ 21 GHz



21 GHz ~ 23 GHz



23 GHz ~ 25 GHz


Keysight Spectrum Analyzer - Swept SA
Start Freq 23.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 1/1
08:21:35 PM 6 29, 2022
Ref Offset 10.82 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 24.952 40 GHz
-45.944 dBm
Start 23.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 74.67 ms (40001 pts)
Frequency
Auto Tune
Center Freq
24.000000000 GHz
Start Freq
23.000000000 GHz
Stop Freq
25.000000000 GHz
CF Step
200.000000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin
MSG
STATUS

9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

Frequency	Measured Level	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV/m	dB/m	dB	(H/V)	dBμV/m	dBμV/m	dB
No Critical peaks found							

Note:

1. The Measured Level 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 Level	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV/m	dB/m	dB	(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

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

Frequency	Measured Level	AF+CL+DF-AG	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4824	47.80	3.54	V	51.34	73.98	22.64	PK
4824	41.51	3.54	V	45.05	53.98	8.93	AV
7236	40.11	8.25	V	48.36	73.98	25.62	PK
7236	28.02	8.25	V	36.27	53.98	17.71	AV
9648	42.71	13.71	V	56.42	73.98	17.56	PK
9648	35.98	13.71	V	49.69	53.98	4.29	AV
4824	48.44	3.54	H	51.98	73.98	22.00	PK
4824	42.35	3.54	H	45.89	53.98	8.09	AV
7236	41.33	8.25	H	49.58	73.98	24.40	PK
7236	29.29	8.25	H	37.54	53.98	16.44	AV
9648	41.82	13.71	H	55.53	73.98	18.45	PK
9648	34.70	13.71	H	48.41	53.98	5.57	AV

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

Frequency	Measured Level	AF+CL+DF-AG	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4874	48.60	2.70	V	51.30	73.98	22.68	PK
4874	43.39	2.70	V	46.09	53.98	7.89	AV
7311	40.88	9.28	V	50.16	73.98	23.82	PK
7311	27.55	9.28	V	36.83	53.98	17.15	AV
9748	42.32	14.67	V	56.99	73.98	16.99	PK
9748	35.74	14.67	V	50.41	53.98	3.57	AV
4874	48.75	2.70	H	51.45	73.98	22.53	PK
4874	43.17	2.70	H	45.87	53.98	8.11	AV
7311	42.06	9.28	H	51.34	73.98	22.64	PK
7311	29.49	9.28	H	38.77	53.98	15.21	AV
9748	39.95	14.67	H	54.62	73.98	19.36	PK
9748	31.64	14.67	H	46.31	53.98	7.67	AV

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

Frequency	Measured Level	AF+CL+DF-AG	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4924	49.01	2.21	V	51.22	73.98	22.76	PK
4924	43.90	2.21	V	46.11	53.98	7.87	AV
7386	40.02	9.95	V	49.97	73.98	24.01	PK
7386	27.55	9.95	V	37.50	53.98	16.48	AV
9848	41.34	14.31	V	55.65	73.98	18.33	PK
9848	33.99	14.31	V	48.30	53.98	5.68	AV
4924	47.27	2.21	H	49.48	73.98	24.50	PK
4924	41.43	2.21	H	43.64	53.98	10.34	AV
7386	41.46	9.95	H	51.41	73.98	22.57	PK
7386	29.48	9.95	H	39.43	53.98	14.55	AV
9848	40.01	14.31	H	54.32	73.98	19.66	PK
9848	31.58	14.31	H	45.89	53.98	8.09	AV

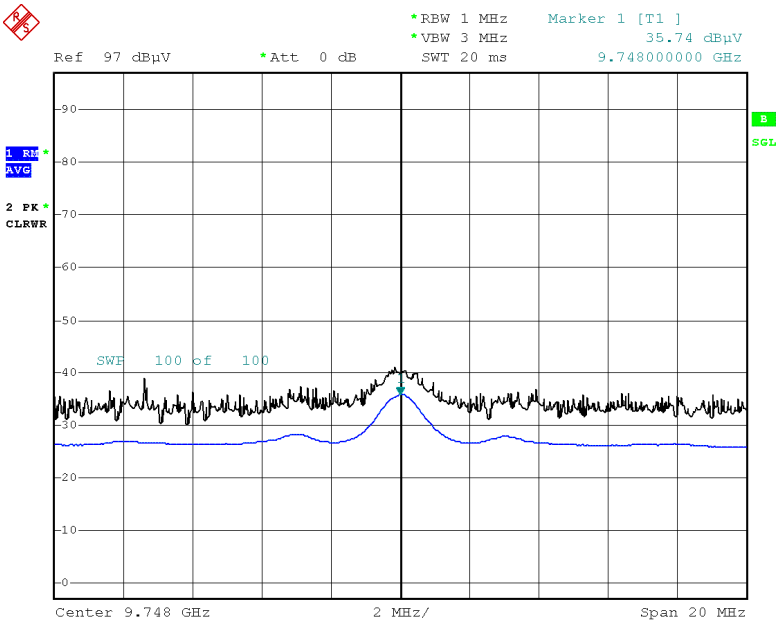
[DBS Mode]

BT GFSK Ch.0 & WLAN 2.4 GHz 802.11b 1 Mbps Ch.6

Frequency	Measured Level	AF+CL+DF-AG	ANT. POL	Total	Limit	Margin	Detect
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
9748	41.63	14.67	V	56.30	73.98	17.68	PK
9748	34.81	14.67	V	49.48	53.98	4.50	AV
9748	41.78	14.67	H	56.45	73.98	17.53	PK
9748	33.69	14.67	H	48.36	53.98	5.62	AV

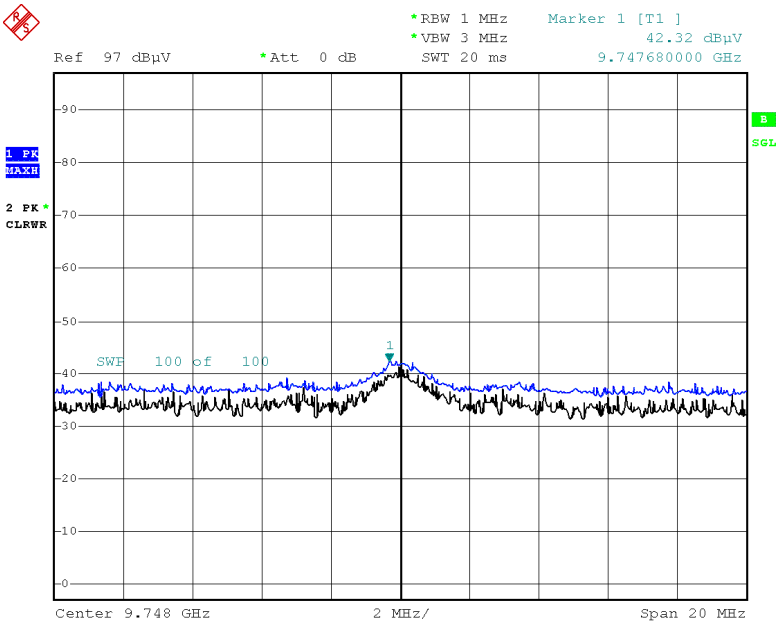
▣ Test Plots (Worst case : Y-V)

Radiated Spurious Emissions plot – Average Reading (802.11b, Ch. 6 4th Harmonic)



Date: 24.JUN.2022 17:54:06

Radiated Spurious Emissions plot – Peak Reading (802.11b, Ch.6 4th Harmonic)



Date: 24.JUN.2022 17:54:18

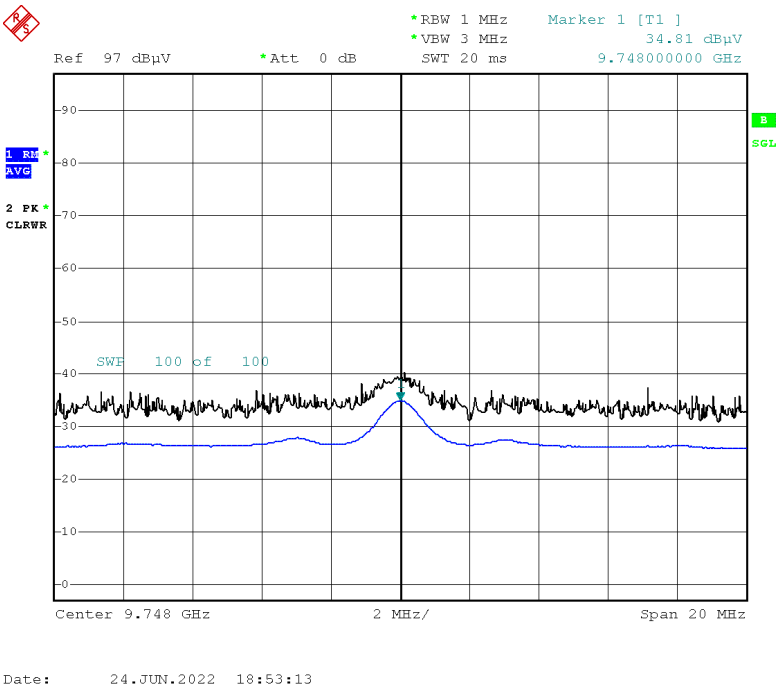
Note:

Plot of worst case are only reported.

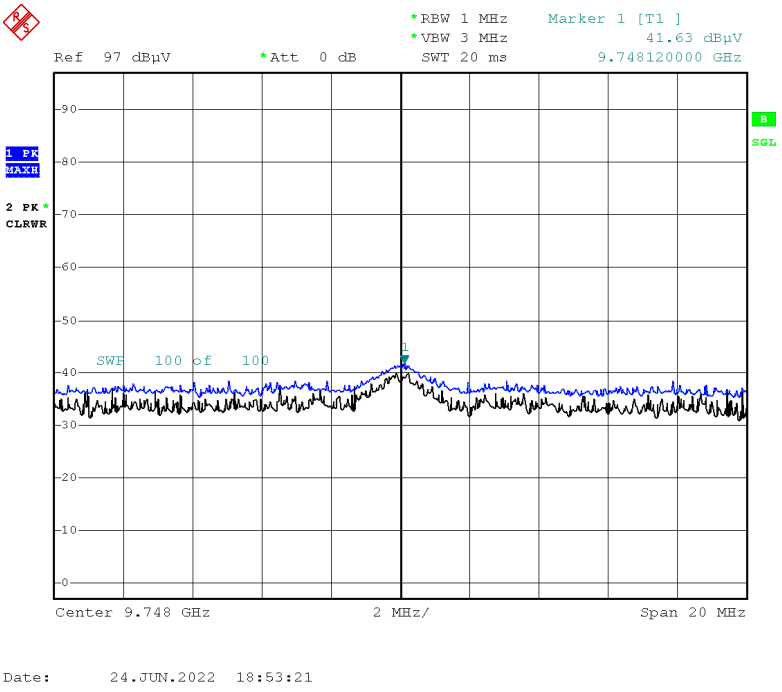
[DBS Mode]

BT GFSK Ch.0 & WLAN 2.4 GHz 802.11b 1 Mbps Ch.6 (Worst case : Y-V)

Radiated Spurious Emissions plot – Average Reading (802.11b, Ch.6 4th Harmonic)



Radiated Spurious Emissions plot – Peak Reading (802.11b, Ch.6 4th Harmonic)



Note:

Plot of worst case are only reported.

9.7 RADIATED RESTRICTED BAND EDGES

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

Frequency	Measured Level	AF+CL+DF	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
2310-2390	21.43	35.43	H	56.85	73.98	17.13	PK
2310-2390	12.25	35.43	H	47.68	53.98	6.30	AV
2310-2390	23.58	35.43	V	59.01	73.98	14.97	PK
2310-2390	14.67	35.43	V	50.09	53.98	3.89	AV
2483.5-2500	21.31	35.57	H	56.88	73.98	17.10	PK
2483.5-2500	12.05	35.57	H	47.62	53.98	6.36	AV
2483.5-2500	23.29	35.57	V	58.86	73.98	15.12	PK
2483.5-2500	13.40	35.57	V	48.96	53.98	5.02	AV

Operation Mode:	802.11g
Transfer Rate:	6 Mbps
Operating Frequency	2 412 MHz, 2 462 MHz
Channel No.	01 Ch, 11 Ch

Frequency	Measured Level	Duty Cycle Factor	AF+CL+DF	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
2 310 ~ 2 389	26.63	0.00	35.43	H	62.05	73.98	11.93	PK
2 310 ~ 2 389	13.09	0.51	35.43	H	49.02	53.98	4.96	AV
#2 389 ~ 2 390	22.71	0.00	35.43	H	58.14	73.98	15.84	PK
#2 389 ~ 2 390	14.55	0.51	35.43	H	50.48	53.98	3.50	AV
2 310 ~ 2 389	25.31	0.00	35.43	V	60.74	73.98	13.24	PK
2 310 ~ 2 389	13.10	0.51	35.43	V	49.03	53.98	4.95	AV
#2 389 ~ 2 390	23.69	0.00	35.43	V	59.12	73.98	14.86	PK
#2 389 ~ 2 390	14.06	0.51	35.43	V	49.99	53.98	3.99	AV
#2 483.5 ~ 2 484.5	25.04	0.00	35.57	H	60.61	73.98	13.37	PK
#2 483.5 ~ 2 484.5	14.40	0.51	35.57	H	50.47	53.98	3.51	AV
2 484.5 ~ 2 500	27.56	0.00	35.57	H	63.12	73.98	10.86	PK
2 484.5 ~ 2 500	13.75	0.51	35.57	H	49.82	53.98	4.16	AV
#2 483.5 ~ 2 484.5	25.17	0.00	35.57	V	60.74	73.98	13.24	PK
#2 483.5 ~ 2 484.5	14.30	0.51	35.57	V	50.37	53.98	3.61	AV
2 484.5 ~ 2 500	26.73	0.00	35.57	V	62.29	73.98	11.69	PK
2 484.5 ~ 2 500	13.63	0.51	35.57	V	49.70	53.98	4.28	AV

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

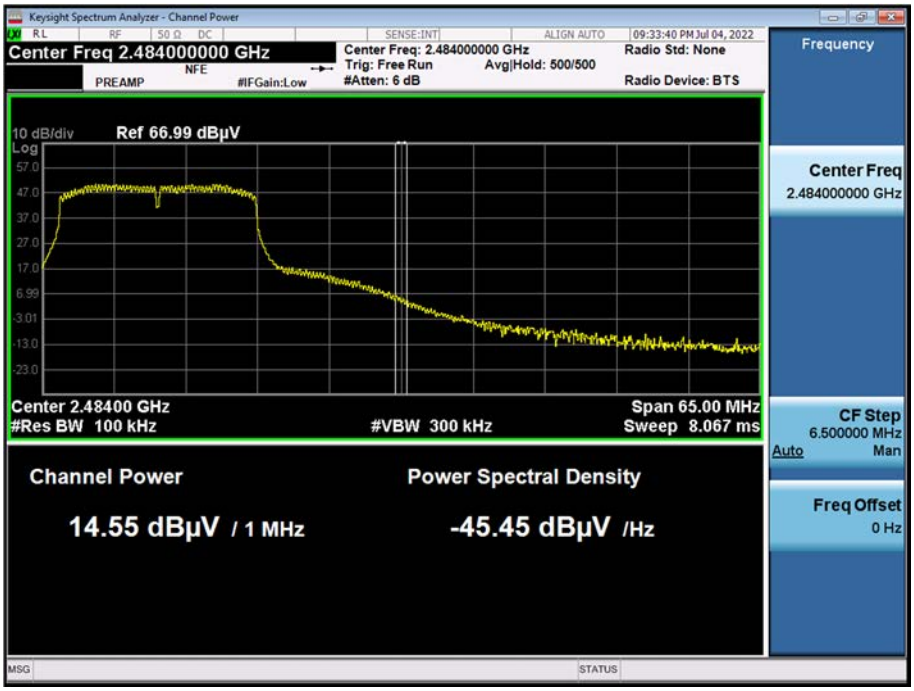
Operation Mode:	802.11n (HT20)
Transfer Rate:	MCS 0
Operating Frequency	2 412 MHz, 2 462 MHz
Channel No.	01 Ch, 11 Ch

Frequency	Measured Level	Duty Cycle Factor	AF+CL+DF	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
2 310 ~ 2 389	29.23	0.00	35.43	H	64.66	73.98	9.32	PK
2 310 ~ 2 389	14.07	0.62	35.43	H	50.12	53.98	3.86	AV
#2 389 ~ 2 390	24.60	0.00	35.43	H	60.03	73.98	13.95	PK
#2 389 ~ 2 390	14.62	0.62	35.43	H	50.67	53.98	3.31	AV
2 310 ~ 2 389	26.87	0.00	35.43	V	62.29	73.98	11.69	PK
2 310 ~ 2 389	13.37	0.62	35.43	V	49.42	53.98	4.56	AV
#2 389 ~ 2 390	24.70	0.00	35.43	V	60.13	73.98	13.85	PK
#2 389 ~ 2 390	13.93	0.62	35.43	V	49.98	53.98	4.00	AV
#2 483.5 ~ 2 484.5	24.29	0.00	35.57	H	59.86	73.98	14.12	PK
#2 483.5 ~ 2 484.5	14.55	0.62	35.57	H	50.74	53.98	3.24	AV
2 484.5 ~ 2 500	29.23	0.00	35.57	H	64.80	73.98	9.18	PK
2 484.5 ~ 2 500	13.80	0.62	35.57	H	49.99	53.98	3.99	AV
#2 483.5 ~ 2 484.5	25.01	0.00	35.57	V	60.58	73.98	13.40	PK
#2 483.5 ~ 2 484.5	14.25	0.62	35.57	V	50.44	53.98	3.54	AV
#2 484.5 ~ 2 500	28.37	0.00	35.57	V	63.93	73.98	10.05	PK
2 484.5 ~ 2 500	13.10	0.62	35.57	V	49.29	53.98	4.69	AV

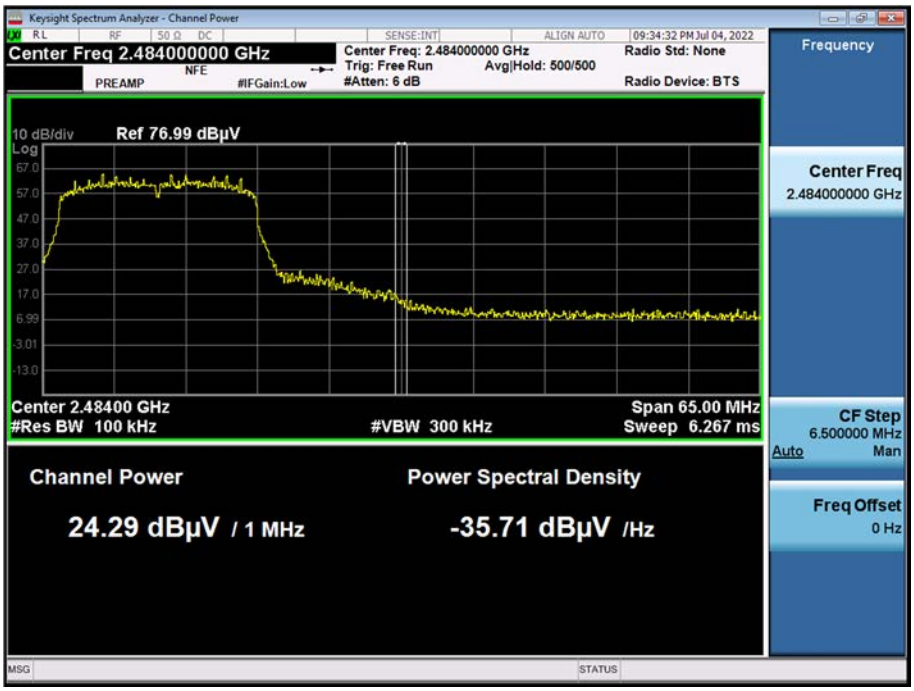
 # Note : Integration method Used (ANSI C63.10 Section11.13.3)

▣ **Test Plots (Worst case : X-H)**

Radiated Restricted Band Edges plot – Average Reading (802.11n(20M), Ch.11)



Radiated Restricted Band Edges plot – Peak Reading (802.11n(20M), Ch.11)



Note:

Plot of worst case are only reported.

9.8 RECEIVER SPURIOUS EMISSIONS

Frequency Range : Below 1 GHz

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

Note:

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

Frequency Range : Above 1 GHz

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

9.9 POWERLINE CONDUCTED EMISSIONS

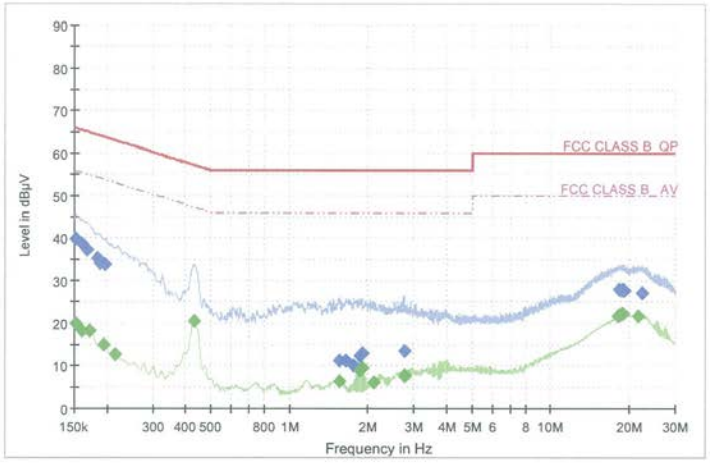
Conducted Emissions (Line 1)

Test Report

Common Information

EUT :	LAIWB3
Manufacturer :	LG Innotek
Test Site:	SHIELD ROOM
Operating Conditions :	WIFI 2.4GHz MODE_L1

Full Spectrum



Final_Result_QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	39.81	65.88	26.06	9.000	L1	OFF	9.6
0.1613	38.79	65.40	26.61	9.000	L1	OFF	9.6
0.1680	37.24	65.06	27.82	9.000	L1	OFF	9.6
0.1838	35.20	64.31	29.12	9.000	L1	OFF	9.6
0.1883	34.01	64.11	30.10	9.000	L1	OFF	9.6
0.1973	33.65	63.73	30.07	9.000	L1	OFF	9.6
1.5485	11.22	56.00	44.78	9.000	L1	OFF	9.6
1.6498	11.27	56.00	44.73	9.000	L1	OFF	9.6
1.7623	10.06	56.00	45.94	9.000	L1	OFF	9.6
1.8568	12.37	56.00	43.63	9.000	L1	OFF	9.6
1.8995	13.04	56.00	42.96	9.000	L1	OFF	9.6
2.7478	13.52	56.00	42.48	9.000	L1	OFF	9.7
18.3605	27.95	60.00	32.05	9.000	L1	OFF	9.9
18.7408	27.72	60.00	32.28	9.000	L1	OFF	9.9
18.8443	27.95	60.00	32.05	9.000	L1	OFF	9.9
19.1390	27.71	60.00	32.29	9.000	L1	OFF	9.9
19.1458	27.80	60.00	32.20	9.000	L1	OFF	9.9
22.2845	27.06	60.00	32.94	9.000	L1	OFF	9.9

Test 2 / 2

Final_Result_CAV

Frequency (MHz)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	20.03	55.88	35.84	9.000	L1	OFF	9.6
0.1613	18.20	55.40	37.20	9.000	L1	OFF	9.6
0.1725	18.07	54.84	36.77	9.000	L1	OFF	9.6
0.1950	14.89	53.82	38.93	9.000	L1	OFF	9.6
0.2153	12.55	53.00	40.45	9.000	L1	OFF	9.6
0.4313	20.36	47.23	26.87	9.000	L1	OFF	9.6
1.5620	6.25	46.00	39.75	9.000	L1	OFF	9.6
1.8545	9.02	46.00	36.98	9.000	L1	OFF	9.6
1.8995	9.45	46.00	36.55	9.000	L1	OFF	9.6
2.1088	6.13	46.00	39.87	9.000	L1	OFF	9.6
2.7500	7.44	46.00	38.56	9.000	L1	OFF	9.7
2.7613	7.72	46.00	38.28	9.000	L1	OFF	9.7
18.0523	21.64	50.00	28.36	9.000	L1	OFF	9.9
18.3898	22.01	50.00	27.99	9.000	L1	OFF	9.9
18.4145	22.02	50.00	27.98	9.000	L1	OFF	9.9
18.7633	22.25	50.00	27.75	9.000	L1	OFF	9.9
18.8465	22.18	50.00	27.82	9.000	L1	OFF	9.9
21.6095	21.70	50.00	28.30	9.000	L1	OFF	9.9

2022-07-21 오후 3:15:44

Conducted Emissions (Line 2)

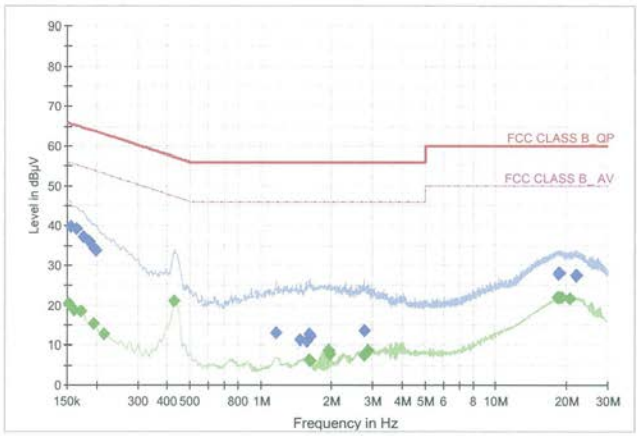
Test 1 / 2

Test Report

Common Information

EUT :	LAIWB3
Manufacturer :	LG Innotek
Test Site:	SHIELD ROOM
Operating Conditions :	WIFI 2.4GHz MODE_N

Full Spectrum



Final_Result_QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	39.67	65.75	26.08	9.000	N	OFF	9.6
0.1635	39.12	65.28	26.16	9.000	N	OFF	9.6
0.1748	37.35	64.73	27.38	9.000	N	OFF	9.6
0.1860	35.94	64.21	28.27	9.000	N	OFF	9.6
0.1950	34.32	63.82	29.50	9.000	N	OFF	9.6
0.1995	33.74	63.63	29.89	9.000	N	OFF	9.6
1.1638	12.89	56.00	43.11	9.000	N	OFF	9.6
1.4788	11.15	56.00	44.85	9.000	N	OFF	9.6
1.5688	11.09	56.00	44.91	9.000	N	OFF	9.6
1.6093	12.63	56.00	43.37	9.000	N	OFF	9.6
1.6318	11.99	56.00	44.01	9.000	N	OFF	9.6
2.7523	13.68	56.00	42.32	9.000	N	OFF	9.7
18.4078	28.01	60.00	31.99	9.000	N	OFF	9.9
18.4235	27.86	60.00	32.14	9.000	N	OFF	9.9
18.4370	27.81	60.00	32.19	9.000	N	OFF	9.9
18.6148	27.93	60.00	32.07	9.000	N	OFF	9.9
21.9470	27.37	60.00	32.63	9.000	N	OFF	9.9
22.2283	27.40	60.00	32.60	9.000	N	OFF	9.9

2022-07-21 오후 3:12:09

Test 2 / 2

Final_Result_CAV

Frequency (MHz)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	20.57	55.88	35.30	9.000	N	OFF	9.6
0.1613	18.63	55.40	36.77	9.000	N	OFF	9.6
0.1725	18.52	54.84	36.32	9.000	N	OFF	9.6
0.1950	15.33	53.82	38.49	9.000	N	OFF	9.6
0.2153	12.77	53.00	40.23	9.000	N	OFF	9.6
0.4290	21.15	47.27	26.12	9.000	N	OFF	9.6
1.6070	6.42	46.00	39.58	9.000	N	OFF	9.6
1.6295	6.14	46.00	39.86	9.000	N	OFF	9.6
1.9468	8.64	46.00	37.36	9.000	N	OFF	9.6
1.9693	7.86	46.00	38.14	9.000	N	OFF	9.6
2.7523	7.41	46.00	38.59	9.000	N	OFF	9.7
2.8738	8.79	46.00	37.21	9.000	N	OFF	9.7
18.3425	21.99	50.00	28.01	9.000	N	OFF	9.9
18.3605	21.94	50.00	28.06	9.000	N	OFF	9.9
18.4280	21.96	50.00	28.04	9.000	N	OFF	9.9
18.7273	22.04	50.00	27.96	9.000	N	OFF	9.9
19.1323	21.95	50.00	28.05	9.000	N	OFF	9.9
20.7163	21.67	50.00	28.33	9.000	N	OFF	9.9

2022-07-21 오후 3:12:09

10. LIST OF TEST EQUIPMENT

Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	08/23/2022	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	06/07/2023	Annual
Temperature Chamber	SU-642	ESPEC	0093008124	03/04/2023	Annual
Signal Analyzer	N9030A	Keysight	MY55410508	09/07/2022	Annual
Power Meter	N1911A	Agilent	MY45100523	03/24/2023	Annual
Power Sensor	N1921A	Agilent	MY57820067	03/24/2023	Annual
Directional Coupler	87300B	Agilent	3116A03621	11/02/2022	Annual
Power Splitter	11667B	Hewlett Packard	10545	02/03/2023	Annual
DC Power Supply	E3646A	Agilent	MY40002937	12/14/2022	Annual
Attenuator(10 dB) (DC-26.5 GHz)	5910-N-50-010	H+S	00801	10/29/2022	Annual
Attenuator(20 dB)	18N-20dB	Rohde & Schwarz	8	03/07/2023	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	02/22/2023	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	N/A	N/A	N/A
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	03/17/2024	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	09/04/2022	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/18/2023	Biennial
Horn Antenna (15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170124	04/12/2023	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	01/06/2023	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	5	06/13/2023	Annual
Band Reject Filter	WRCJV12-4900-5100-5900-6100-50SS	Wainwright Instruments	6	06/13/2023	Annual
Band Reject Filter	WRCJV5100/5850-40/50-8EEK	Wainwright Instruments	1	02/07/2023	Annual
ATT(3 dB) + LNA2(6~18 GHz)	18B-03, CBL06185030	WEINSCHEL CERNEX	N/A	12/22/2022	Annual
ATT(10 dB) + LNA1(0.1~18 GHz)	56-10, CBLU1183540B-01	Api tech, CERNEX	N/A	12/22/2022	Annual
High Pass Filter	WHKX10-2700-3000-18000-40SS	Wainwright Instruments	N/A	12/22/2022	Annual
High Pass Filter	WHKX8-6090-7000-18000-40SS	Wainwright Instruments	N/A	12/22/2022	Annual
Thru	COAXIAL ATTENUATOR	T&M SYSTEM	N/A	12/22/2022	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/02/2022	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/11/2023	Annual
Bluetooth Tester	TC-3000C	TESCOM	3000C000175	04/05/2023	Annual
Spectrum Analyzer	FSP(9 kHz ~ 30 GHz)	Rohde & Schwarz	836650/016	09/13/2022	Annual
Spectrum Analyzer	FSV40-N(9 kHz ~ 30 GHz)	Rohde & Schwarz	101068-SZ	09/15/2022	Annual

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

11. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-XXXX-FIXXX-P