



On your side



TEST REPORT

FCC/ISED DTS Test for LCWB-002EA
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2303-FI003

DATE OF ISSUE
March 31, 2023

Tested by
Chang Hee Hwang

Technical Manager
Jong Seok Lee

Accredited by KOLAS, Republic of KOREA

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



TEST REPORT

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LCWB-002EA

REPORT NO.
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Additional Model
-

Applicant

LG Electronics Inc.

170, Seongsanpaechong-ro, Seongsan-gu, Changwon-si Gyeongsangnam-do
51533 Republic of Korea

Eut Type	RF Module
Model Name	LCWB-002EA
FCC ID	BEJ-LCWB002EA
IC	2703N-LCWB002EA
Modulation type	CCK/DSSS/OFDM
FCC Classification	Digital Transmission System(DTS)
FCC Rule Part(s)	Part 15.247
ISED 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	March 31, 2023	Initial Release

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.

KOLAS Statement:

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (KOLAS Accreditation No. KT197)

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

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1. EUT DESCRIPTION

Model	LCWB-002EA	
Additional Model	-	
EUT Type	RF Module	
Power Supply	DC 5.0 V / 12.0V	
Frequency Range	2 412 MHz – 2 462 MHz	
Max. RF Output Power	Peak Power	802.11b: 18.83 dBm 802.11g: 22.85 dBm 802.11n(HT20): 22.12 dBm
	Average Power	802.11b: 13.25 dBm 802.11g: 14.27 dBm 802.11n(HT20): 14.01 dBm
Modulation Type	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n(HT20)	
Number of Channels	11 Channels	
Antenna Specification	Antenna type: PCB Antenna Peak Gain : 4.2 dBi	
Date(s) of Tests	February 22, 2023 ~ March 30, 2023	
EUT serial numbers	Conduction : LCWB-002EA-001 Radiation : LCWB-002EA-002	
PMN (Product Marketing Number)	RF Module	
HVIN (Hardware Version Identification Number)	LCWB-002EA	
FVIN (Firmware Version Identification Number)	V1.0	
HMN (Host Marketing Name)	N/A	

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 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

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

DESCRIPTION OF TEST MODES

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

3. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, 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 A NSI 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 January 26, 2021 (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 used a unique coupling.
- (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.

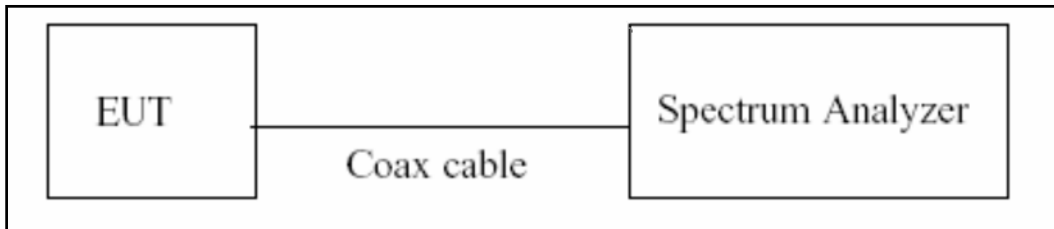
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.90 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.14 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.82 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.74 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.76 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (Above 40 GHz)	5.52 (Confidence level about 95 %, $k=2$)

7. DESCRIPTION OF TESTS

7.1. Duty Cycle

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to the zero-span measurement method.

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

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

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

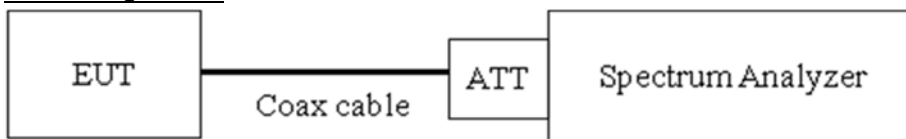
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz (\geq RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/T_{total} and Duty Cycle Factor = $10\log(1/Duty\ Cycle)$

7.2. 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 \geq 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 (for ISED)

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW \cong 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

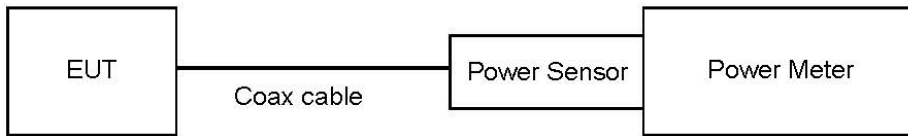
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

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

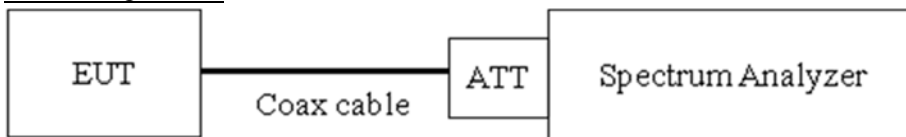
- Conducted Output Power(Peak) = Measured Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Measured Value + ATT loss + Cable loss + Duty Cycle Factor

7.4. Power Spectral Density

Limit

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

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure 8.4 in KDB 558074 v05r02, Procedure 11.10.2 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) $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$.
- 4) $VBW \geq 3 \times RBW$.
- 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 = Measured Value + ATT loss + Cable loss

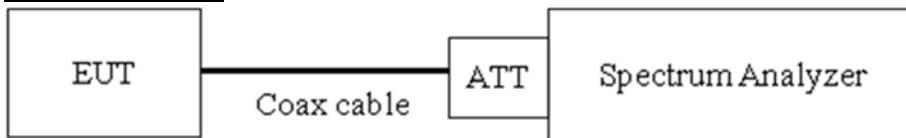
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

Limit

The maximum conducted (Peak) 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 \geq 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 \geq 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	10.04
100	10.07
200	10.12
300	10.17
400	10.20
500	10.21
600	10.21
700	10.23
800	10.24
900	10.26
1000	10.27
2000	10.41
2400	10.43
2500	10.45
3000	10.52
4000	10.60
5000	10.71
6000	10.73
7000	10.80
8000	10.85
9000	10.91
10000	10.97
11000	11.02
12000	11.10
13000	11.19
14000	11.16
15000	11.21
16000	11.22
17000	11.25
18000	11.30
19000	11.32
20000	11.36
21000	11.48
22000	11.55
23000	11.55
24000	11.59
25000	11.68

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 (V/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

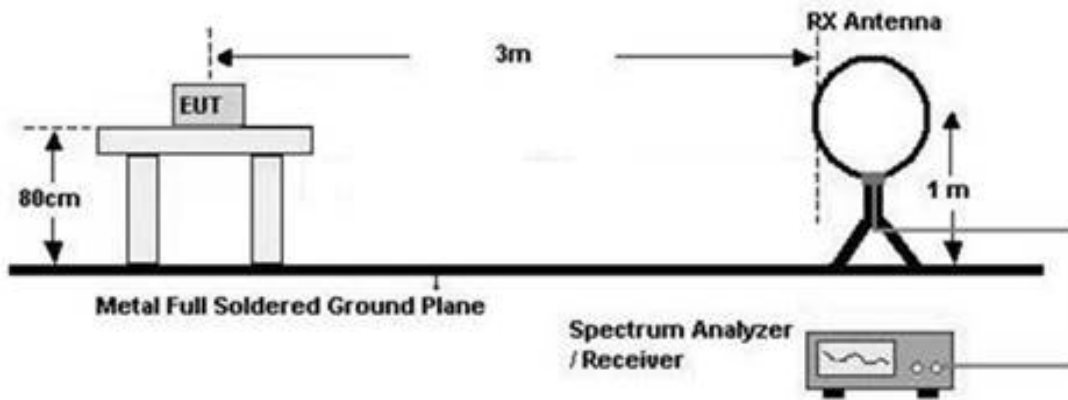
Frequency (MHz)	Field Strength (A/m)	Measurement Distance (m)
0.009 – 0.490	6.37/F(kHz)	300
0.490 – 1.705	63.7/F(kHz)	30
1.705 – 30	0.08	30

FCC&ISED

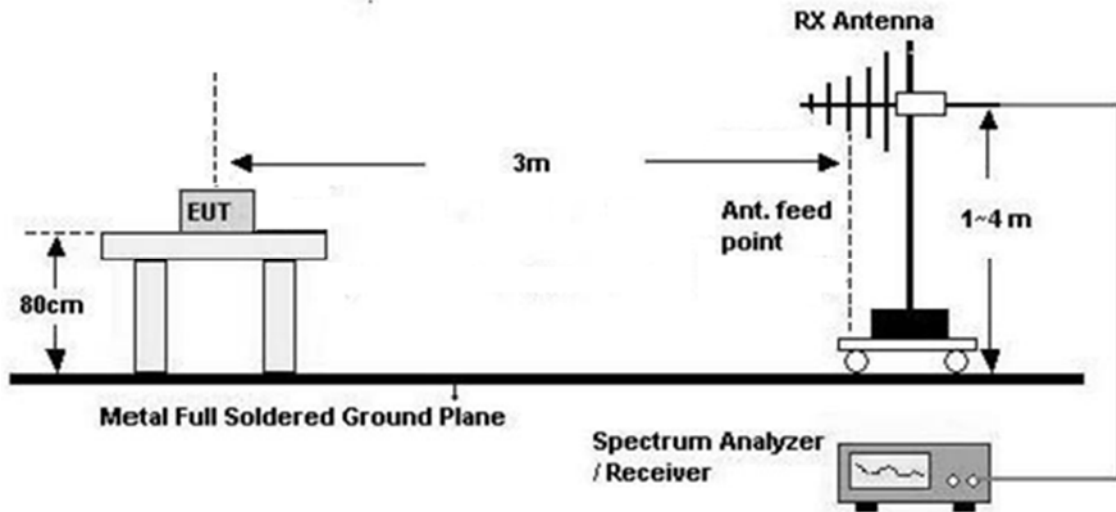
Frequency (MHz)	Field Strength (V/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

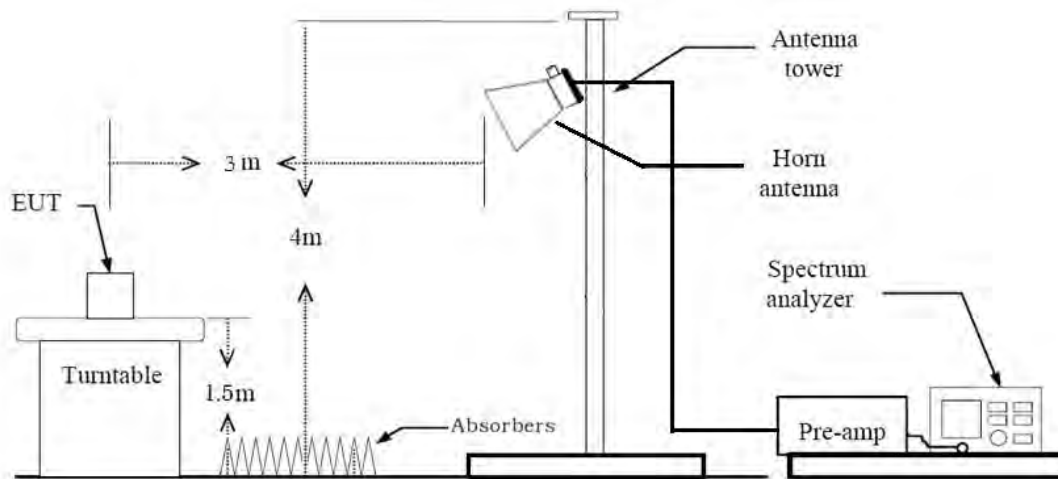
Below 30 MHz



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 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor(0.009 MHz – 0.490 MHz) = $40\log(3\text{ m}/300\text{ m}) = -80\text{ dB}$
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = $40\log(3\text{ m}/30\text{ m}) = -40\text{ dB}$
Measurement Distance : 3 m
8. Spectrum Setting
 - Frequency Range = 9 kHz ~ 30 MHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 9 kHz
 - VBW $\geq 3 \times$ RBW
9. Total = 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 1GHz)

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

※In general, (1) is used mainly
7. Total = 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 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.

8. Spectrum Setting (Method 8.6 in KDB 558074 v05r02, Procedure 11.12 in ANSI 63.10-2013)

(1) Measurement Type(Peak):

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

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

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

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

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

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

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

11. Total(Measurement Type : Peak)

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

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

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

Test Procedure of Radiated Restricted Band Edge

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

8. Spectrum Setting

(1) Measurement Type(Peak):

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

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

- Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW \geq 3 x RBW
- Sweep time = auto.

- Trace mode = average (at least 100 traces).
- (3) Measurement Type(Average): Duty cycle < 98%, duty cycle variations are less than $\pm 2\%$
 - Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
 - Detector = RMS
 - Averaging type = power (*i.e.*, RMS)
 - RBW = 1 MHz
 - VBW $\geq 3 \times$ RBW
 - Sweep time = auto.
 - Trace mode = average (at least 100 traces).
 - Correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle.
 - Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.
- 9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
- 10. Distance extrapolation factor = $20 \log(\text{test distance} / \text{specific distance})$ (dB)
- 11. Total(Measurement Type : Peak)
 - = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

- Total(Measurement Type : Average, Duty cycle $\geq 98\%$)
 - = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

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

7.7. Receiver Spurious Emissions

Limit

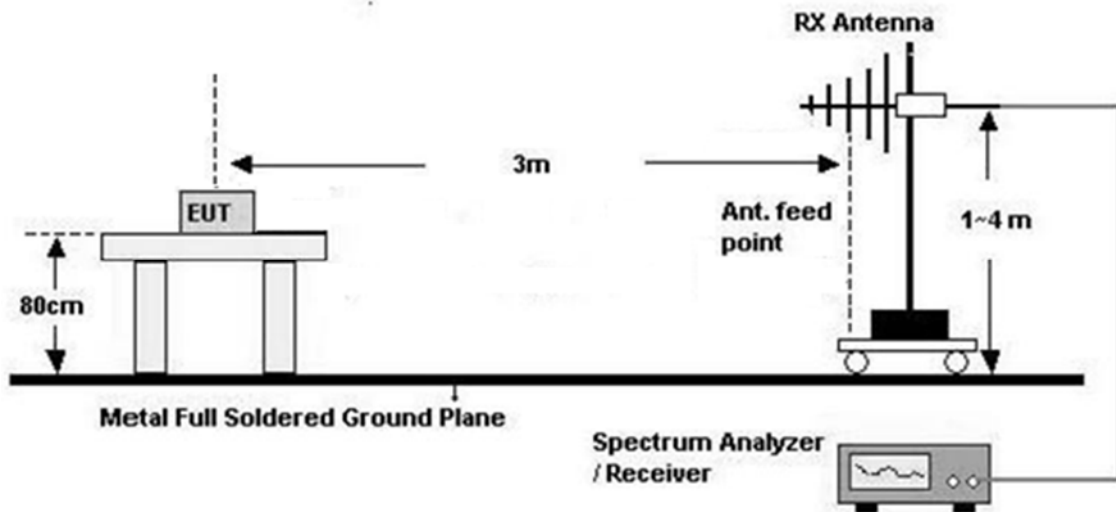
Frequency (MHz)	Field Strength (V/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

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

Test Configuration

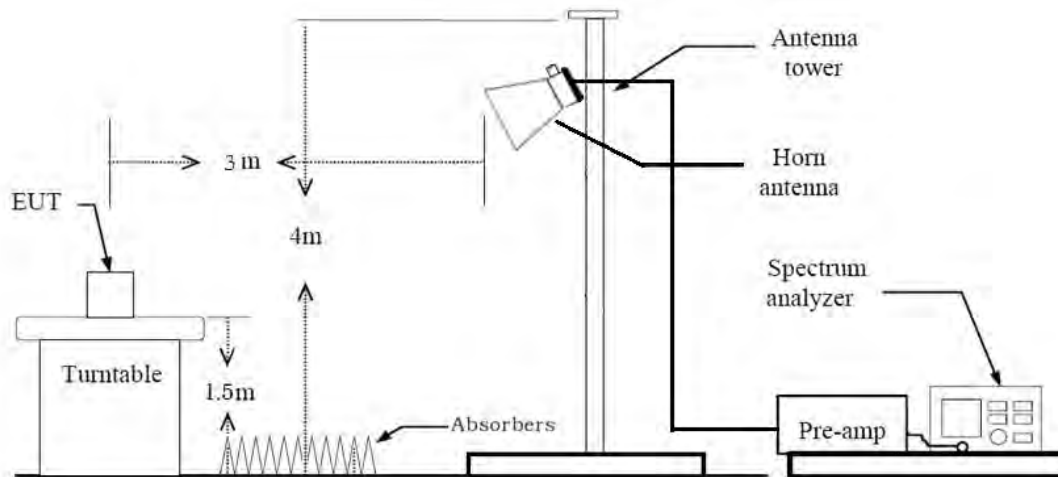
30 MHz - 1 GHz



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 1m to 4m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 100 kHz
 - VBW \geq 3 x RBW
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHz
7. Total = Measured 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 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 1 GHz – 25 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 1 MHz
 - VBW \geq 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 \geq 3 x RBW

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

7.8. 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(DC 5V), Stand alone(DC 12V)
 - Worstcase : Stand alone(DC 5V)
3. EUT Axis
 - Radiated Spurious Emissions : Y, Z
 - Radiated Restricted Band Edge : Z
4. All datarate of operation were investigated and the worst case datarate results are reported
 - 802.11b : 1Mbps
 - 802.11g : 6Mbps
 - 802.11n : MCS0
5. All position of loop antenna were investigated and the test result is a no critical peak found at all positions.
 - Position : Horizontal, Vertical, Parallel to the ground plane

AC Power line Conducted Emissions

1. All modes of operation were investigated and the worst case configuration results are reported.
 - Mode : Stand alone(DC 5V), Stand alone(DC 12V)
 - Worstcase : Stand alone(DC 5V)

Conducted test

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

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 > 20 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

#Test was performed with continuous Tx.

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

#Test was performed with continuous Tx.

9. TEST RESULT

9.1 DUTY CYCLE

Mode	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	-	-	-	-
802.11g	-	-	-	-
802.11n (HT20)	-	-	-	-

Note:

1. Duty Cycle Factor = $10 \times \log(1/\text{Duty Cycle})$. where, Duty Cycle = T_{on} / T_{total}
2. Test was performed with continuous Tx.

9.2 6 dB BANDWIDTH & 99 % BANDWIDTH

FCC

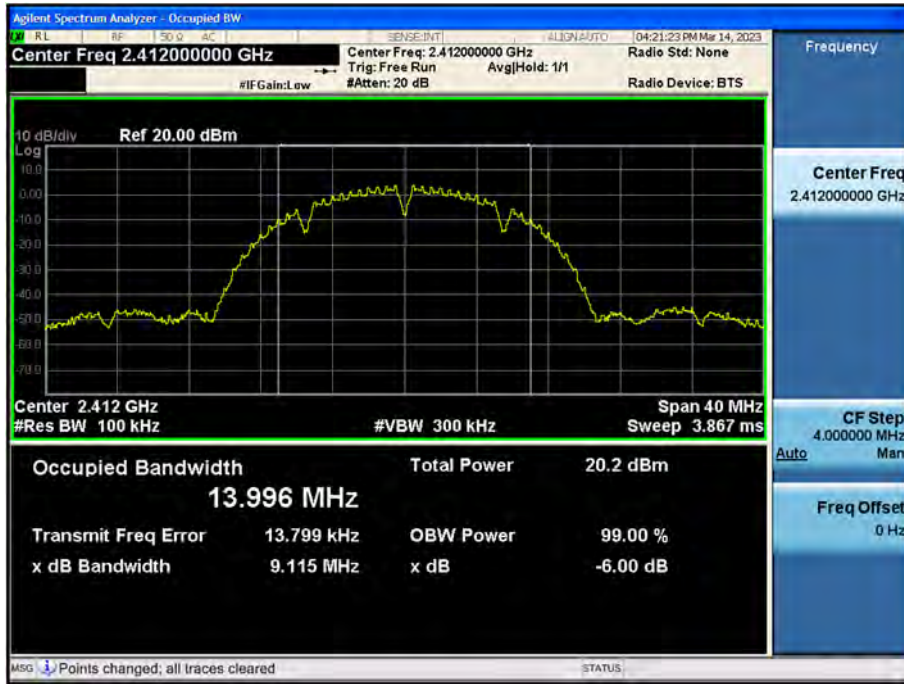
802.11b Mode		6 dB Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	9.115	> 0.5
2437	6	9.132	> 0.5
2462	11	9.118	> 0.5

802.11g Mode		6 dB Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.58	> 0.5
2437	6	16.57	> 0.5
2462	11	16.58	> 0.5

802.11n(HT20) Mode		6 dB Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.75	> 0.5
2437	6	17.76	> 0.5
2462	11	17.76	> 0.5

Test Plots

6 dB Bandwidth plot (802.11b-CH 1)



6 dB Bandwidth plot (802.11g-CH 6)



6 dB 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.

ISED

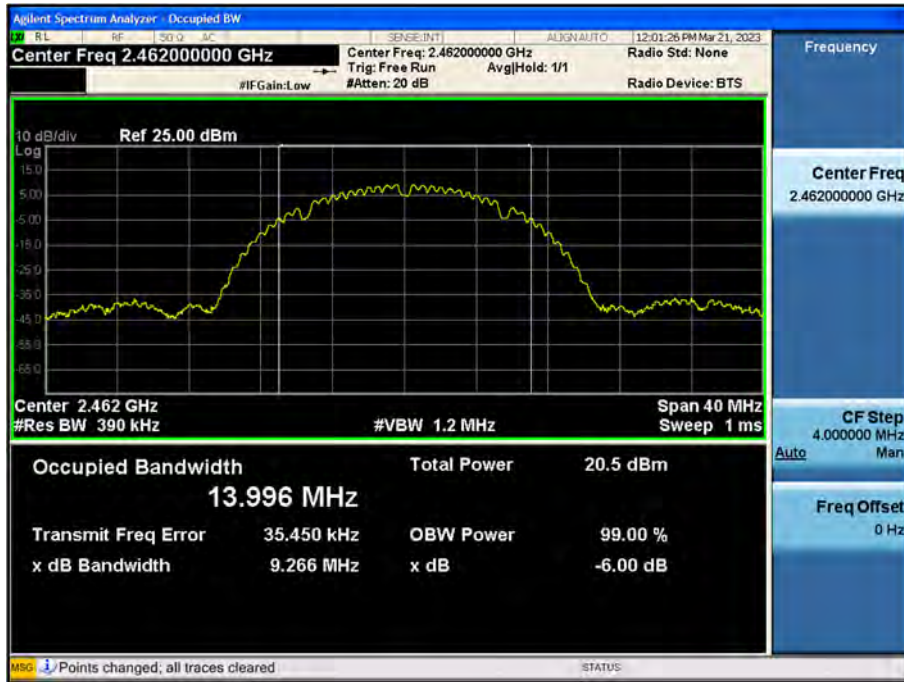
802.11b Mode		6 dB Bandwidth [MHz]	99 % Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.			
2412	1	9.274	14.016	> 0.5
2437	6	9.268	13.983	> 0.5
2462	11	9.266	13.996	> 0.5

802.11g Mode		6 dB Bandwidth [MHz]	99 % Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.			
2412	1	16.50	17.163	> 0.5
2437	6	16.49	17.152	> 0.5
2462	11	16.50	17.168	> 0.5

802.11n(HT20) Mode		6 dB Bandwidth [MHz]	99 % Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.			
2412	1	17.71	18.148	> 0.5
2437	6	17.70	18.154	> 0.5
2462	11	17.69	18.174	> 0.5

▣ Test Plots

99 % & 6 dB Bandwidth plot (802.11b-CH 11)



99 % & 6 dB Bandwidth plot (802.11g-CH 6)



99 % & 6 dB Bandwidth plot (802.11n_HT20-CH 11)



Note:

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



9.3 OUTPUT POWER

Peak Power

802.11b Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	1	15.73	30.00
		2	16.16	30.00
		5.5	18.01	30.00
		11	18.74	30.00
2437	6	1	15.69	30.00
		2	15.96	30.00
		5.5	17.39	30.00
		11	18.82	30.00
2462	11	1	15.69	30.00
		2	15.92	30.00
		5.5	17.34	30.00
		11	18.83	30.00



802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6	21.73	30.00
		9	21.90	30.00
		12	22.23	30.00
		18	20.75	30.00
		24	22.41	30.00
		36	21.95	30.00
		48	22.21	30.00
		54	22.42	30.00
2437	6	6	21.69	30.00
		9	21.87	30.00
		12	22.74	30.00
		18	21.60	30.00
		24	22.38	30.00
		36	22.85	30.00
		48	22.06	30.00
		54	22.28	30.00
2462	11	6	21.75	30.00
		9	21.86	30.00
		12	22.17	30.00
		18	21.44	30.00
		24	22.50	30.00
		36	22.20	30.00
		48	22.12	30.00
		54	22.34	30.00



802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	21.81	30.00
		1	21.61	30.00
		2	21.56	30.00
		3	21.91	30.00
		4	21.94	30.00
		5	21.99	30.00
		6	22.12	30.00
		7	22.00	30.00
2437	6	0	21.76	30.00
		1	21.64	30.00
		2	21.45	30.00
		3	21.82	30.00
		4	21.81	30.00
		5	21.81	30.00
		6	21.98	30.00
		7	22.09	30.00
2462	11	0	21.85	30.00
		1	21.61	30.00
		2	21.54	30.00
		3	21.95	30.00
		4	21.91	30.00
		5	22.04	30.00
		6	21.96	30.00
		7	21.99	30.00



Average Power

802.11b Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	1	13.04	0.000	13.04	30.00
		2	13.25	0.000	13.25	30.00
		5.5	12.94	0.000	12.94	30.00
		11	13.21	0.000	13.21	30.00
2437	6	1	12.96	0.000	12.96	30.00
		2	13.05	0.000	13.05	30.00
		5.5	13.02	0.000	13.02	30.00
		11	13.03	0.000	13.03	30.00
2462	11	1	13.02	0.000	13.02	30.00
		2	13.02	0.000	13.02	30.00
		5.5	12.99	0.000	12.99	30.00
		11	12.90	0.000	12.90	30.00



802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor (dB)	Total Power (dBm)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6	14.27	0.000	14.27	30.00
		9	14.17	0.000	14.17	30.00
		12	14.14	0.000	14.14	30.00
		18	14.18	0.000	14.18	30.00
		24	14.09	0.000	14.09	30.00
		36	14.03	0.000	14.03	30.00
		48	14.04	0.000	14.04	30.00
		54	14.02	0.000	14.02	30.00
2437	6	6	13.97	0.000	13.97	30.00
		9	13.99	0.000	13.99	30.00
		12	13.99	0.000	13.99	30.00
		18	14.03	0.000	14.03	30.00
		24	13.94	0.000	13.94	30.00
		36	13.88	0.000	13.88	30.00
		48	13.92	0.000	13.92	30.00
		54	13.88	0.000	13.88	30.00
2462	11	6	14.04	0.000	14.04	30.00
		9	14.05	0.000	14.05	30.00
		12	14.08	0.000	14.08	30.00
		18	14.13	0.000	14.13	30.00
		24	14.05	0.000	14.05	30.00
		36	13.99	0.000	13.99	30.00
		48	13.96	0.000	13.96	30.00
		54	13.93	0.000	13.93	30.00



802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor (dB)	Total Power (dBm)	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	13.95	0.000	13.95	30.00
		1	13.88	0.000	13.88	30.00
		2	13.99	0.000	13.99	30.00
		3	13.96	0.000	13.96	30.00
		4	13.98	0.000	13.98	30.00
		5	13.96	0.000	13.96	30.00
		6	13.96	0.000	13.96	30.00
		7	13.92	0.000	13.92	30.00
2437	6	0	13.87	0.000	13.87	30.00
		1	13.90	0.000	13.90	30.00
		2	13.87	0.000	13.87	30.00
		3	13.84	0.000	13.84	30.00
		4	13.83	0.000	13.83	30.00
		5	14.01	0.000	14.01	30.00
		6	13.79	0.000	13.79	30.00
		7	13.77	0.000	13.77	30.00
2462	11	0	13.99	0.000	13.99	30.00
		1	13.88	0.000	13.88	30.00
		2	13.95	0.000	13.95	30.00
		3	13.95	0.000	13.95	30.00
		4	13.92	0.000	13.92	30.00
		5	13.88	0.000	13.88	30.00
		6	13.92	0.000	13.92	30.00
		7	13.89	0.000	13.89	30.00

9.4 POWER SPECTRAL DENSITY

Mode	Frequency (MHz)	Channel No.	Test Result	
			Max. PSD	Limit (dBm/3 kHz)
802.11b	2412	1	3.766	8
	2437	6	4.102	
	2462	11	4.240	
802.11g	2412	1	1.672	
	2437	6	1.066	
	2462	11	1.485	
802.11n(HT20)	2412	1	1.564	
	2437	6	1.181	
	2462	11	1.476	

Note :

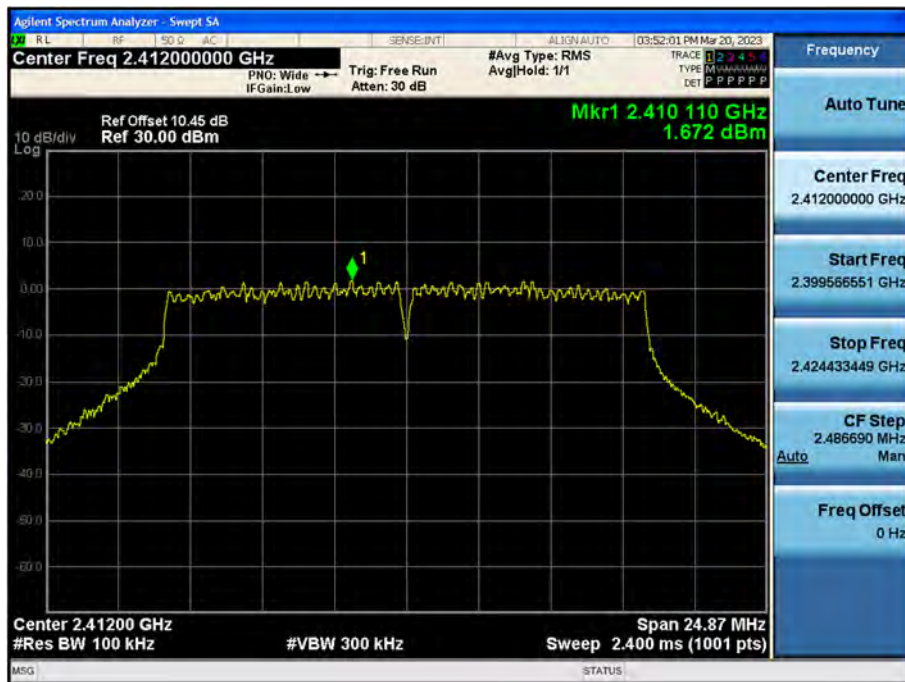
- The measured PSD results in plot is already including the actual values of loss for the attenuator and cable combination.

▣ Test Plots

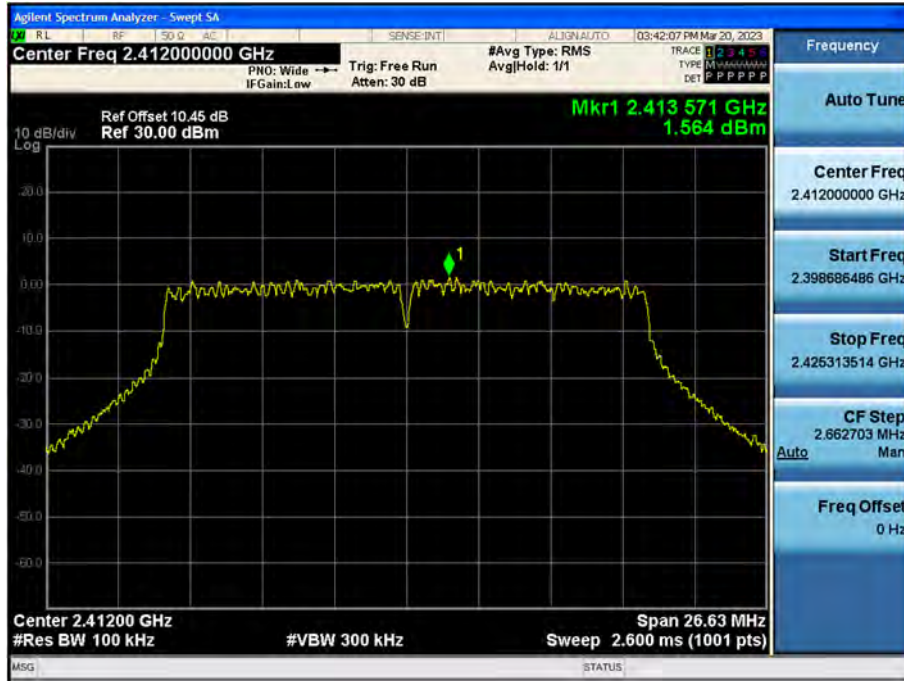
Power Spectral Density (802.11b-CH 11)



Power Spectral Density (802.11g-CH 1)



Power Spectral Density (802.11n_HT20 -CH 1)



Note :

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

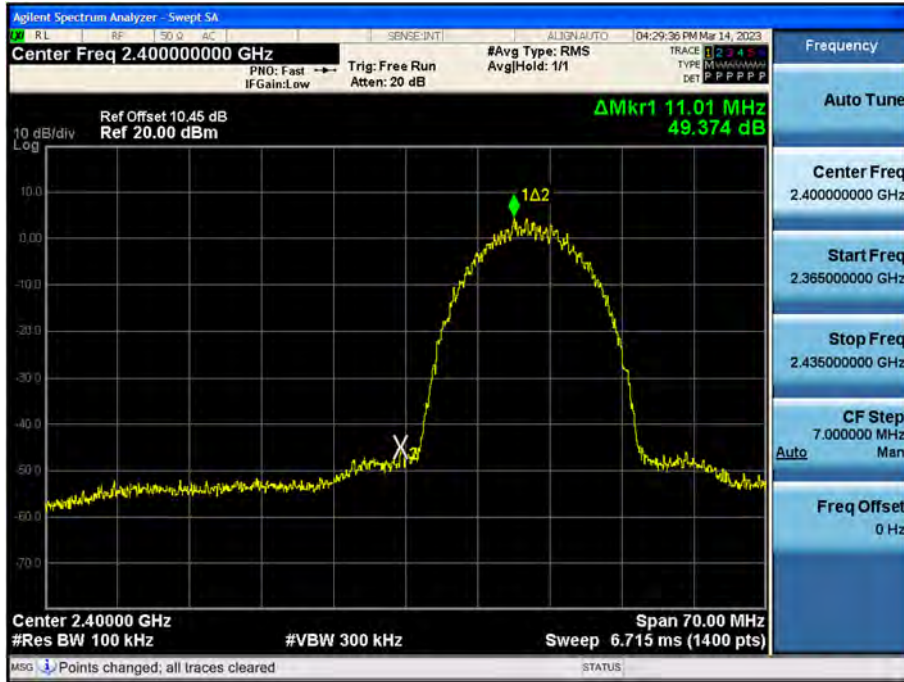
9.5 BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

Note :

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

▣ Test Plots(BandEdge)

Band Edge (802.11b-CH1)



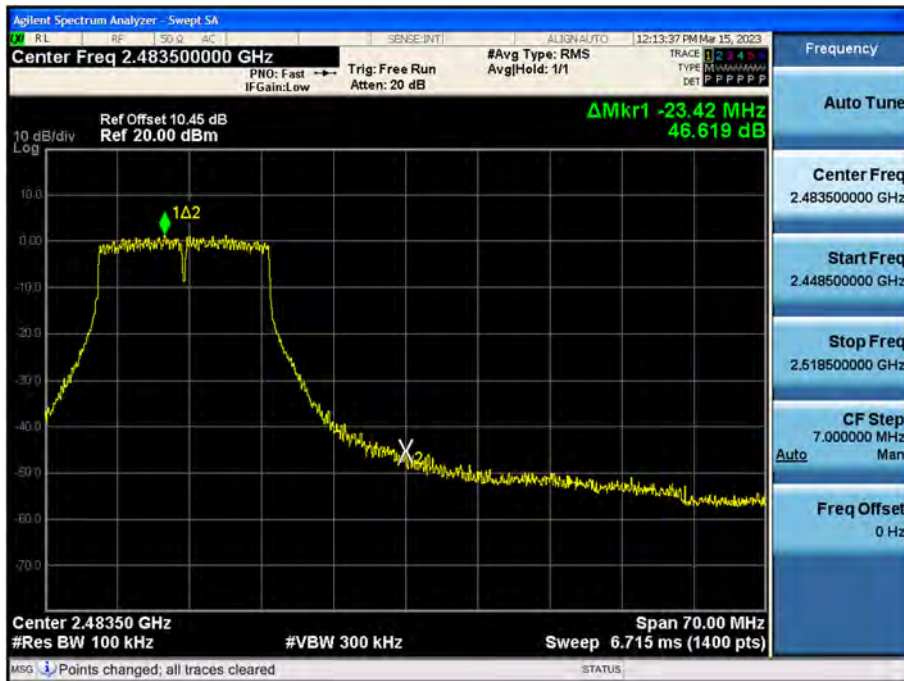
Band Edge (802.11b-CH11)



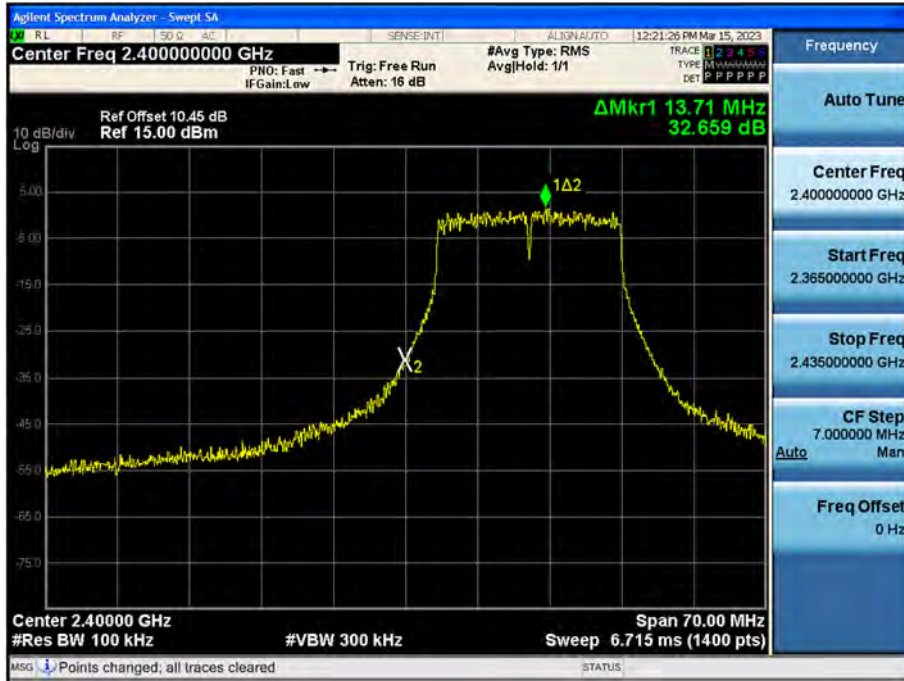
Band Edge (802.11g_Ch.1)



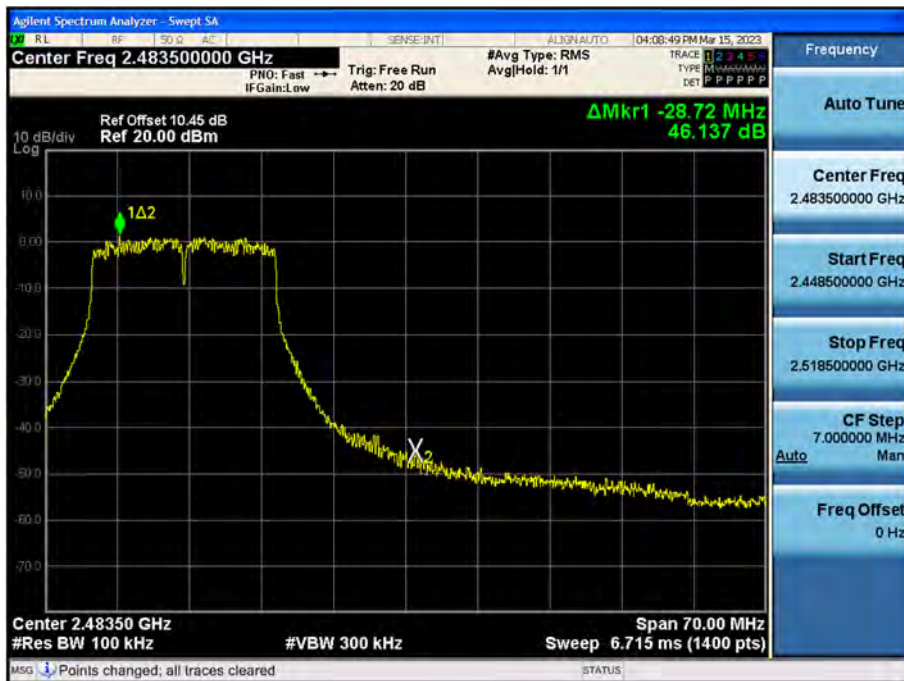
Band Edge (802.11g_Ch.11)



Band Edge (802.11n_HT20_Ch.1)



Band Edge (802.11n_HT20_Ch.11)

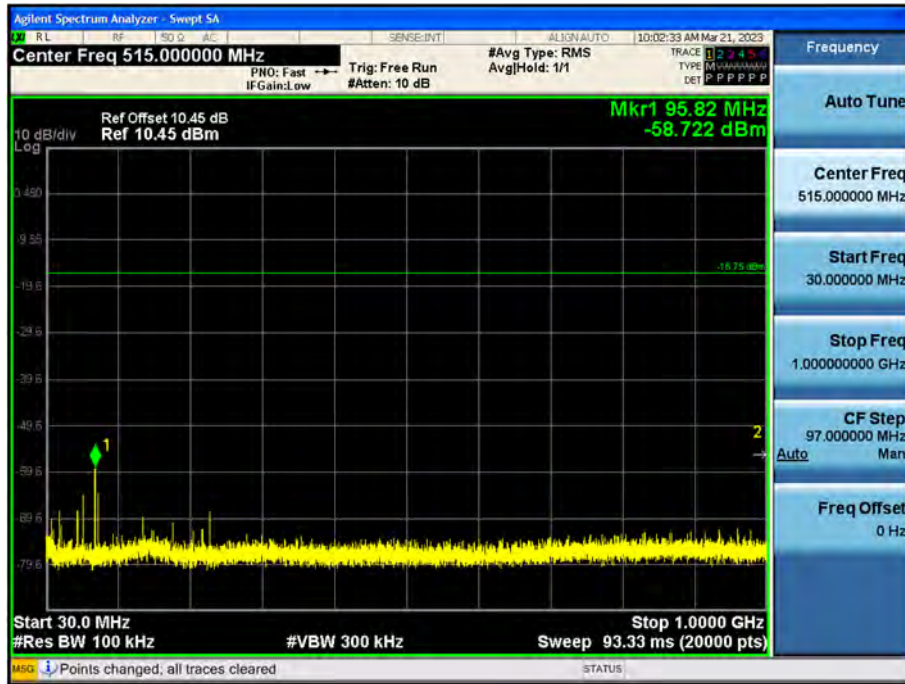


☐ Test Plots(Conducted Spurious Emission)

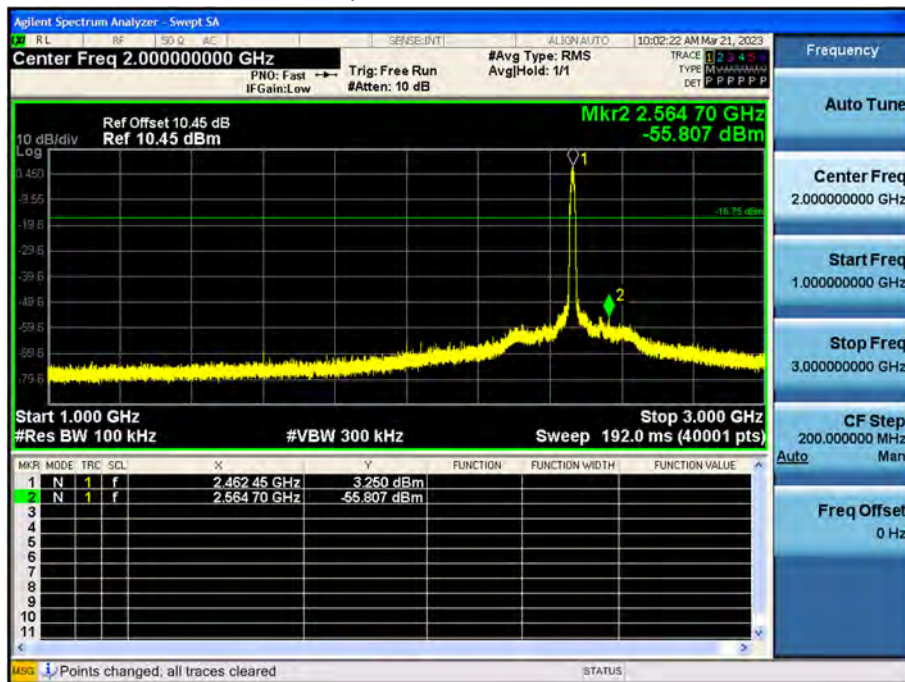
Worst case : 802.11b_Ch.11_11 Mbps

Limit : -16.75 dBm

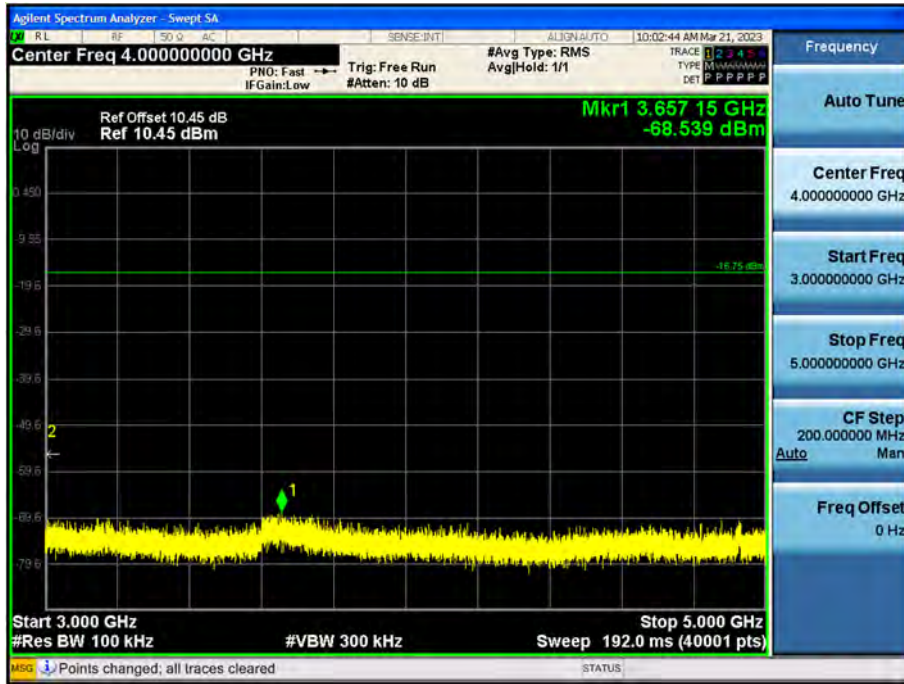
Conducted Spurious Emission (30 MHz ~ 1 GHz)



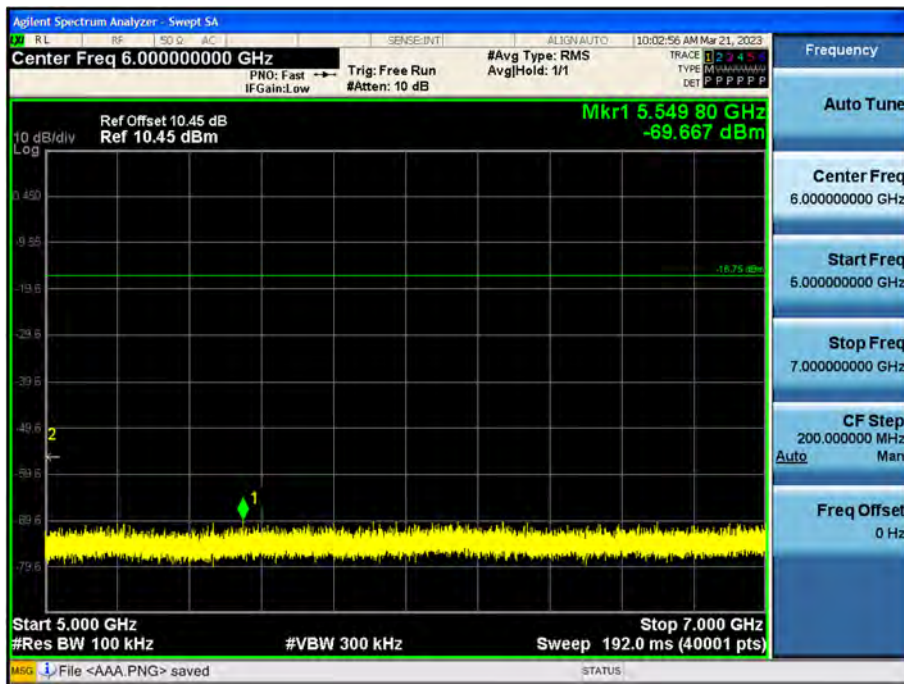
Conducted Spurious Emission (1 GHz ~ 3 GHz)



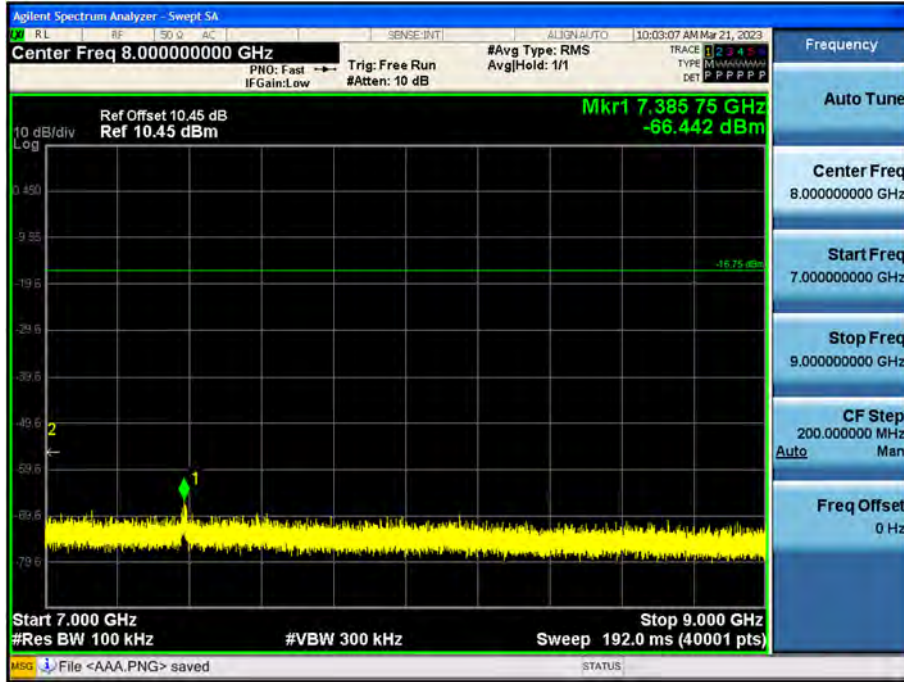
Conducted Spurious Emission (3 GHz ~ 5 GHz)



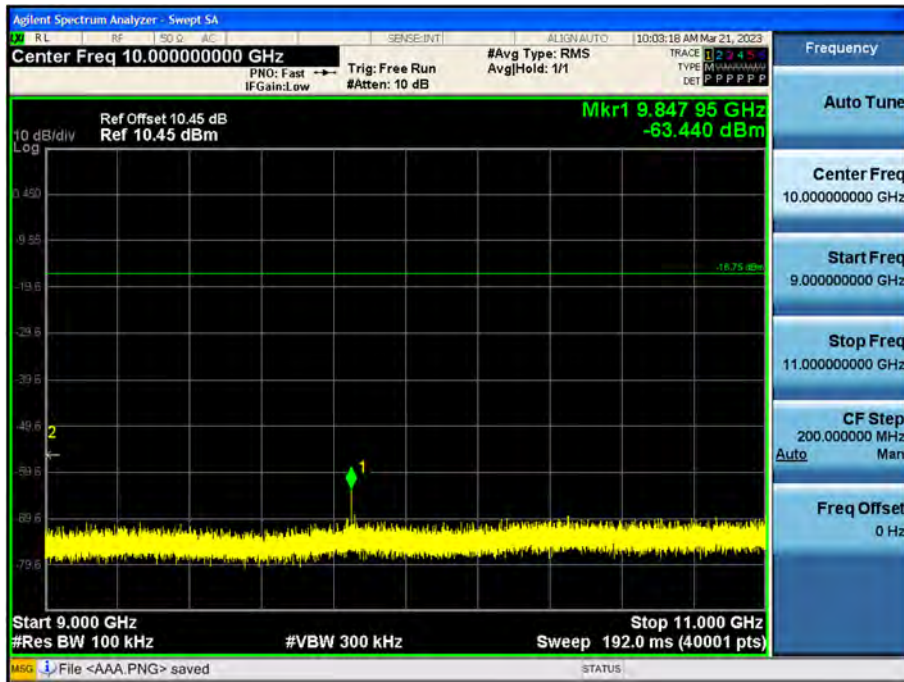
Conducted Spurious Emission (5 GHz ~ 7 GHz)



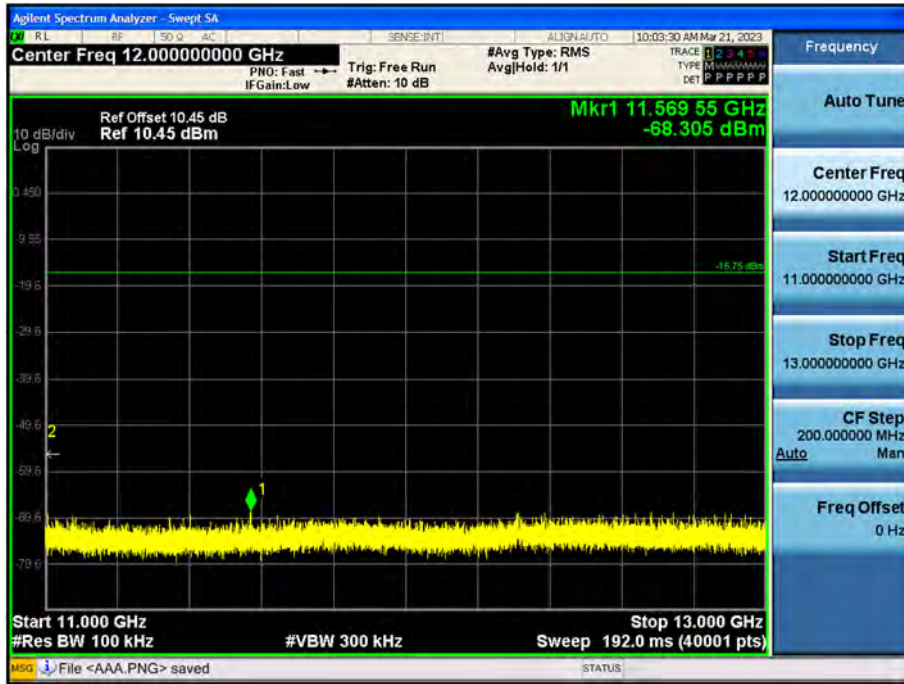
Conducted Spurious Emission (7 GHz ~ 9 GHz)



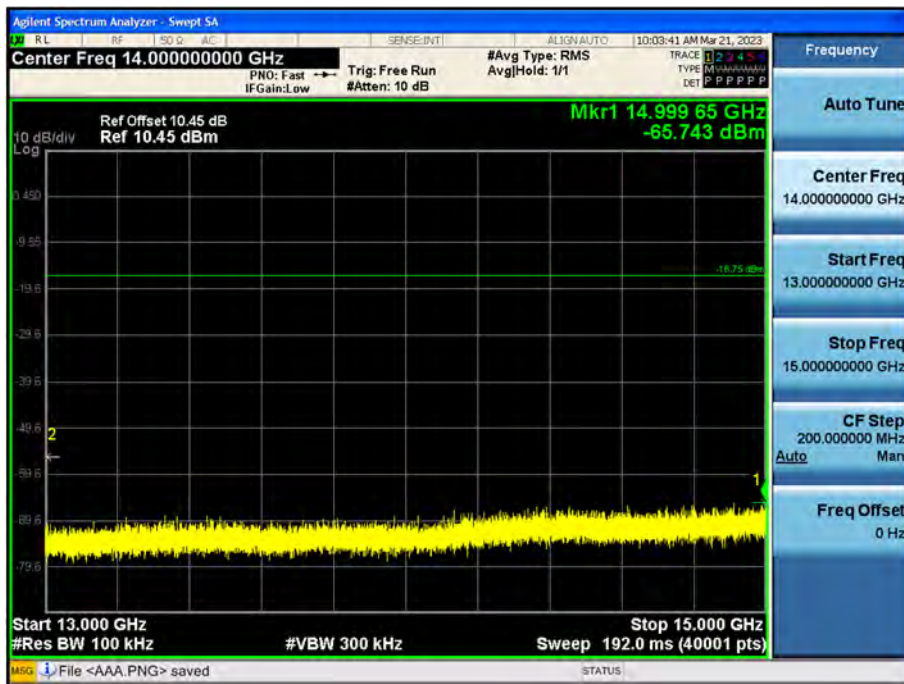
Conducted Spurious Emission (9 GHz ~ 11 GHz)



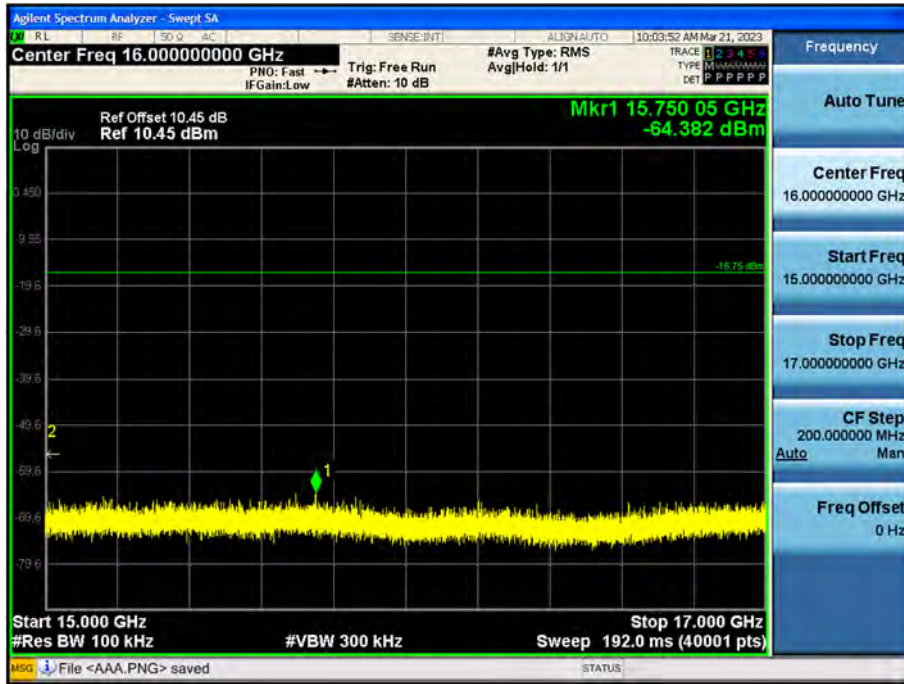
Conducted Spurious Emission (11 GHz ~ 13 GHz)



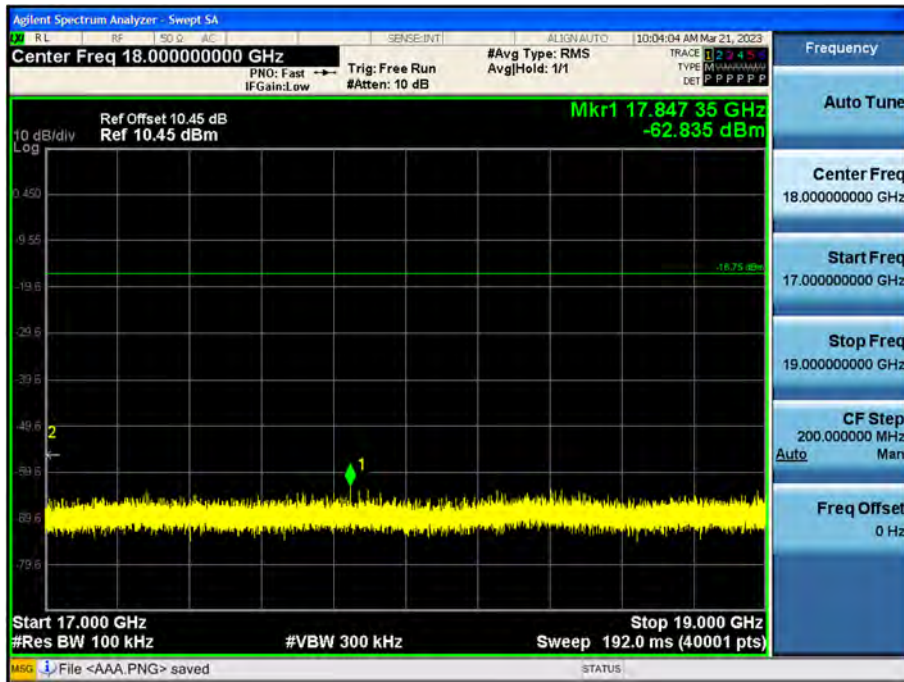
Conducted Spurious Emission (13 GHz ~ 15 GHz)



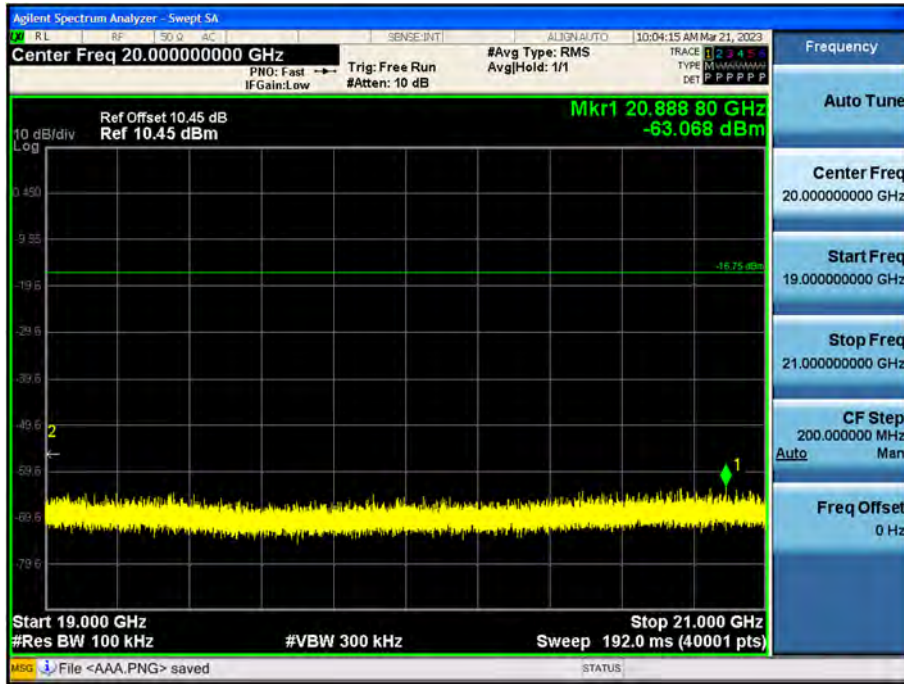
Conducted Spurious Emission (15 GHz ~ 17 GHz)



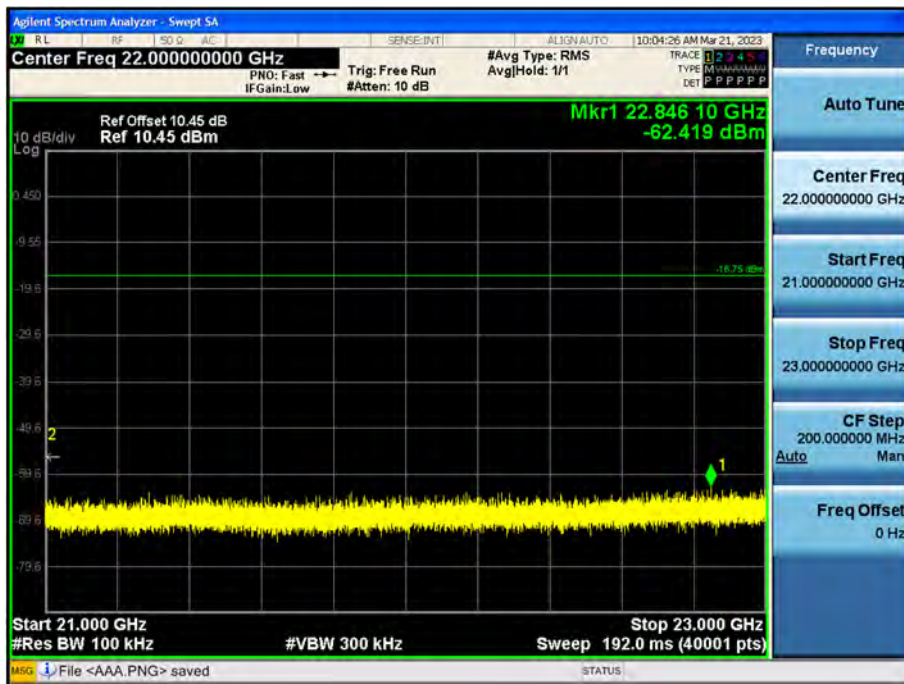
Conducted Spurious Emission (17 GHz ~ 19 GHz)



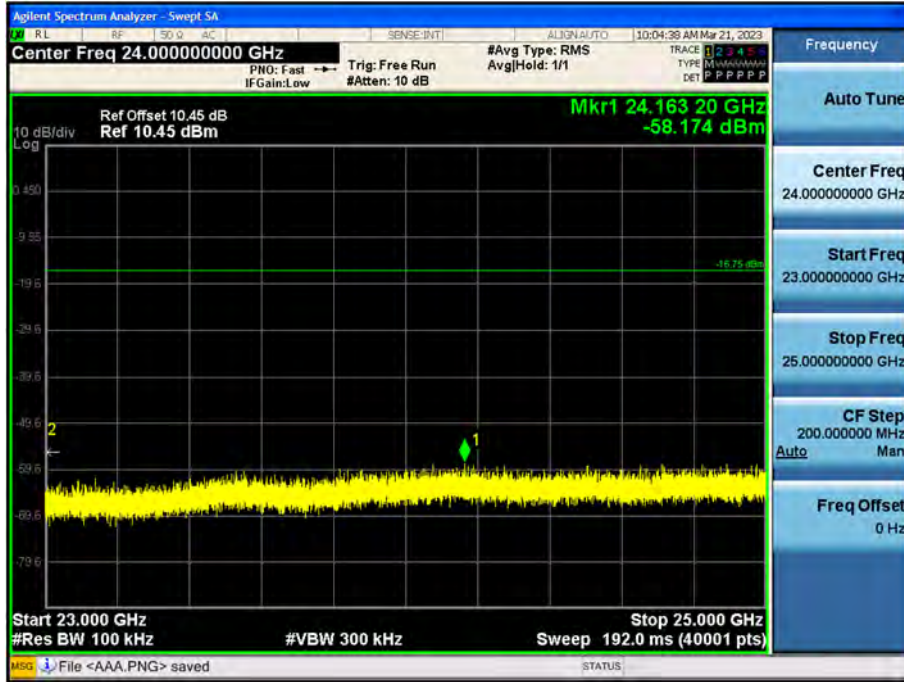
Conducted Spurious Emission (19 GHz ~ 21 GHz)



Conducted Spurious Emission (21 GHz ~ 23 GHz)



Conducted Spurious Emission (23 GHz ~ 25 GHz)



9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

Frequency	Measured Value	A.F+C.L+D.F	Ant. POL	Total	Limit	Margin
[MHz]	[dB μ V]	[dB/m]	[H/V]	[dB μ V/m]	[dB μ V/m]	[dB]

No Critical peaks found

Note:

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

Frequency Range : Below 1 GHz

Frequency	Measured Value	A.F+C.L	Ant. POL	Total	Limit	Margin
[MHz]	[dB μ V]	[dB/m]	[H/V]	[dB μ V/m]	[dB μ V/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: 2 412 MHz
 Channel No. 01 Ch

Frequency	Measured Value	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dB μ V]	[dB/m]	[H/V]	[dB μ V/m]	[dB μ V/m]	[dB]	
4824	45.62	3.58	V	49.20	73.98	24.78	PK
4824	37.83	3.58	V	41.41	53.98	12.57	AV
7236	41.58	12.72	V	54.30	73.98	19.68	PK
7236	29.88	12.72	V	42.60	53.98	11.38	AV
4824	44.44	3.58	H	48.02	73.98	25.96	PK
4824	34.17	3.58	H	37.75	53.98	16.23	AV
7236	42.07	12.72	H	54.79	73.98	19.19	PK
7236	31.93	12.72	H	44.65	53.98	9.33	AV

Operation Mode: 802.11b
 Transfer Rate: 1 Mbps
 Operating Frequency: 2 437 MHz
 Channel No. 06 Ch

Frequency	Measured Value	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dB μ V]	[dB/m]	[H/V]	[dB μ V/m]	[dB μ V/m]	[dB]	
4874	45.56	3.64	V	49.20	73.98	24.78	PK
4874	37.51	3.64	V	41.15	53.98	12.83	AV
7311	43.75	11.97	V	55.72	73.98	18.26	PK
7311	34.18	11.97	V	46.15	53.98	7.83	AV
4874	46.53	3.64	H	50.17	73.98	23.81	PK
4874	38.29	3.64	H	41.93	53.98	12.05	AV
7311	44.42	11.97	H	56.39	73.98	17.59	PK
7311	34.79	11.97	H	46.76	53.98	7.22	AV



Operation Mode:	802.11b
Transfer MCS Index:	1 Mbps
Operating Frequency	2 462 MHz
Channel No.	11 Ch

Frequency	Measured Value	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dB μ V]	[dB/m]	[H/V]	[dB μ V/m]	[dB μ V/m]	[dB]	
4924	43.09	4.84	V	47.93	73.98	26.05	PK
4924	32.03	4.84	V	36.87	53.98	17.11	AV
7386	40.12	12.44	V	52.56	73.98	21.42	PK
7386	28.22	12.44	V	40.66	53.98	13.32	AV
4924	42.72	4.84	H	47.56	73.98	26.42	PK
4924	31.97	4.84	H	36.81	53.98	17.17	AV
7386	41.56	12.44	H	54.00	73.98	19.98	PK
7386	30.02	12.44	H	42.46	53.98	11.52	AV



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

Frequency	Measured Value	Duty Cycle Factor	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4824	43.55	0.00	3.58	V	47.13	73.98	26.85	PK
4824	31.96	0.00	3.58	V	35.54	53.98	18.44	AV
7236	40.85	0.00	12.72	V	53.57	73.98	20.41	PK
7236	29.21	0.00	12.72	V	41.93	53.98	12.05	AV
4824	43.01	0.00	3.58	H	46.59	73.98	27.39	PK
4824	31.56	0.00	3.58	H	35.14	53.98	18.84	AV
7236	41.90	0.00	12.72	H	54.62	73.98	19.36	PK
7236	29.68	0.00	12.72	H	42.40	53.98	11.58	AV

Operation Mode: 802.11g
 Transfer Rate: 6 Mbps
 Operating Frequency: 2 437 MHz
 Channel No.: 06 Ch

Frequency	Measured Value	Duty Cycle Factor	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4874	43.77	0.00	3.64	V	47.41	73.98	26.57	PK
4874	32.16	0.00	3.64	V	35.80	53.98	18.18	AV
7311	42.54	0.00	11.97	V	54.51	73.98	19.47	PK
7311	29.86	0.00	11.97	V	41.83	53.98	12.15	AV
4874	45.33	0.00	3.64	H	48.97	73.98	25.01	PK
4874	32.23	0.00	3.64	H	35.87	53.98	18.11	AV
7311	41.97	0.00	11.97	H	53.94	73.98	20.04	PK
7311	29.77	0.00	11.97	H	41.74	53.98	12.24	AV

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

Frequency	Measured Value	Duty Cycle Factor	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4924	42.83	0.00	4.84	V	47.67	73.98	26.31	PK
4924	30.91	0.00	4.84	V	35.75	53.98	18.23	AV
7386	39.11	0.00	12.44	V	51.55	73.98	22.43	PK
7386	28.31	0.00	12.44	V	40.75	53.98	13.23	AV
4924	41.52	0.00	4.84	H	46.36	73.98	27.62	PK
4924	30.85	0.00	4.84	H	35.69	53.98	18.29	AV
7386	39.98	0.00	12.44	H	52.42	73.98	21.56	PK
7386	28.35	0.00	12.44	H	40.79	53.98	13.19	AV



Operation Mode: 802.11n_HT20
 MCS Index: 0
 Operating Frequency: 2 412 MHz
 Channel No.: 01 Ch

Frequency	Measured Value	Duty Cycle Factor	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4824	45.77	0.00	3.58	V	49.35	73.98	24.63	PK
4824	32.45	0.00	3.58	V	36.03	53.98	17.95	AV
7236	42.99	0.00	12.72	V	55.71	73.98	18.27	PK
7236	30.25	0.00	12.72	V	42.97	53.98	11.01	AV
4824	44.18	0.00	3.58	H	47.76	73.98	26.22	PK
4824	31.85	0.00	3.58	H	35.43	53.98	18.55	AV
7236	43.65	0.00	12.72	H	56.37	73.98	17.61	PK
7236	30.67	0.00	12.72	H	43.39	53.98	10.59	AV

Operation Mode: 802.11n_HT20
 MCS Index: 0
 Operating Frequency: 2 437 MHz
 Channel No.: 06 Ch

Frequency	Measured Value	Duty Cycle Factor	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4874	43.66	0.00	3.64	V	47.30	73.98	26.68	PK
4874	32.22	0.00	3.64	V	35.86	53.98	18.12	AV
7311	43.37	0.00	11.97	V	55.34	73.98	18.64	PK
7311	29.75	0.00	11.97	V	41.72	53.98	12.26	AV
4874	44.56	0.00	3.64	H	48.20	73.98	25.78	PK
4874	32.27	0.00	3.64	H	35.91	53.98	18.07	AV
7311	42.66	0.00	11.97	H	54.63	73.98	19.35	PK
7311	29.71	0.00	11.97	H	41.68	53.98	12.30	AV

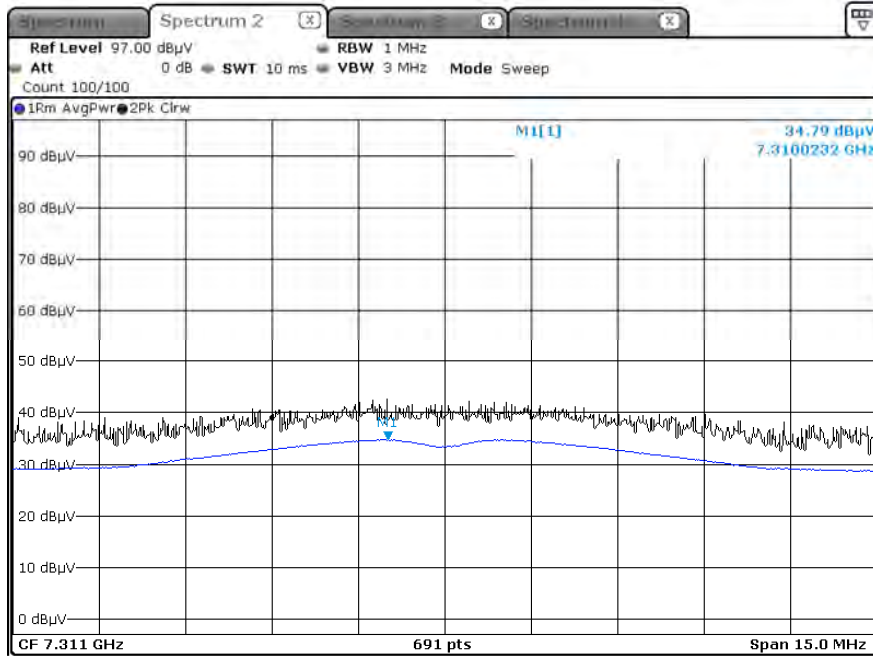


Operation Mode: 802.11n_HT20
MCS Index: 0
Operating Frequency: 2 462 MHz
Channel No.: 11 Ch

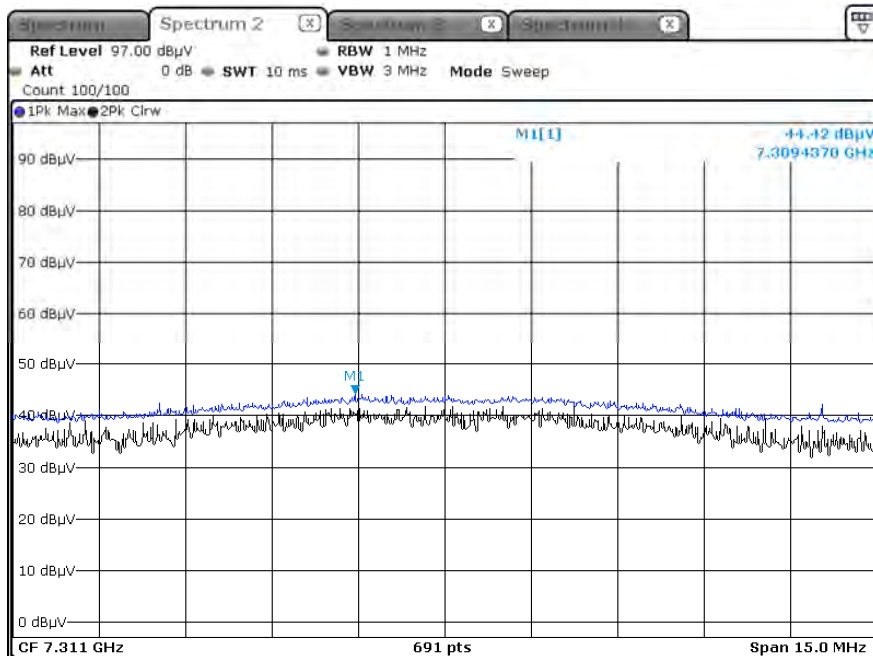
Frequency	Measured Value	Duty Cycle Factor	A.F+CL-AMP G	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
4924	42.12	0.00	4.84	V	46.96	73.98	27.02	PK
4924	30.75	0.00	4.84	V	35.59	53.98	18.39	AV
7386	40.12	0.00	12.44	V	52.56	73.98	21.42	PK
7386	28.52	0.00	12.44	V	40.96	53.98	13.02	AV
4924	42.89	0.00	4.84	H	47.73	73.98	26.25	PK
4924	30.83	0.00	4.84	H	35.67	53.98	18.31	AV
7386	40.56	0.00	12.44	H	53.00	73.98	20.98	PK
7386	28.61	0.00	12.44	H	41.05	53.98	12.93	AV

▣ Test Plots (Worst case : Y-V)

Radiated Spurious Emissions plot – Average Measured Value (802.11b, Ch.6 3rd Harmonic)



Radiated Spurious Emissions plot – Peak Measured Value (802.11b, Ch.6 3rd 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 Value	※ A.F.+CL	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dB μ V]	[dB/m]	[H/V]	[dB μ V/m]	[dB μ V/m]	[dB]	
2390.0	23.63	34.35	H	57.98	73.98	16.00	PK
2390.0	12.55	34.35	H	46.90	53.98	7.08	AV
2390.0	24.98	34.35	V	59.33	73.98	14.65	PK
2390.0	12.91	34.35	V	47.26	53.98	6.72	AV
2483.5	22.58	34.83	H	57.41	73.98	16.57	PK
2483.5	12.13	34.83	H	46.96	53.98	7.03	AV
2483.5	23.55	34.83	V	58.38	73.98	15.60	PK
2483.5	12.34	34.83	V	47.17	53.98	6.81	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	※ A.F.+CL	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dB μ V]	[dB]	[dB/m]	[H/V]	[dB μ V/m]	[dB μ V/m]	[dB]	
2390.0	23.66	0.00	34.35	H	58.01	73.98	15.97	PK
2390.0	12.82	0.00	34.35	H	47.17	53.98	6.81	AV
2390.0	24.36	0.00	34.35	V	58.71	73.98	15.27	PK
2390.0	13.20	0.00	34.35	V	47.55	53.98	6.43	AV
2483.5	24.67	0.00	34.83	H	59.50	73.98	14.48	PK
2483.5	12.55	0.00	34.83	H	47.38	53.98	6.60	AV
2483.5	25.87	0.00	34.83	V	60.70	73.98	13.28	PK
2483.5	13.00	0.00	34.83	V	47.83	53.98	6.15	AV



Operation Mode:	802.11n (HT20)
Transfer Rate:	MCS0
Operating Frequency	2412 MHz, 2462 MHz
Channel No.	01 Ch, 11 Ch

Frequency	Measured Value	Duty Cycle Factor	※ A.F.+CL	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2390.0	25.11	0.00	34.35	H	59.46	73.98	14.52	PK
2390.0	13.10	0.00	34.35	H	47.45	53.98	6.53	AV
2390.0	26.01	0.00	34.35	V	60.36	73.98	13.62	PK
2390.0	13.50	0.00	34.35	V	47.85	53.98	6.13	AV
2483.5	26.84	0.00	34.83	H	61.67	73.98	12.31	PK
2483.5	13.34	0.00	34.83	H	48.17	53.98	5.82	AV
2483.5	27.13	0.00	34.83	V	61.96	73.98	12.02	PK
2483.5	13.89	0.00	34.83	V	48.72	53.98	5.26	AV

▣ Test Plots

Radiated Restricted Band Edges plot – Average Measured Value (802.11n (HT20), Ch.11, Z-V)



Radiated Restricted Band Edges plot – Peak Measured Value (802.11n (HT20), Ch.11, Z-V)



Note:

Plot of worst case are only reported.

9.8 RECEIVER SPURIOUS EMISSIONS

Frequency Range : Below 1 GHz

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

Note:

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

9.9 POWERLINE CONDUCTED EMISSIONS

Test

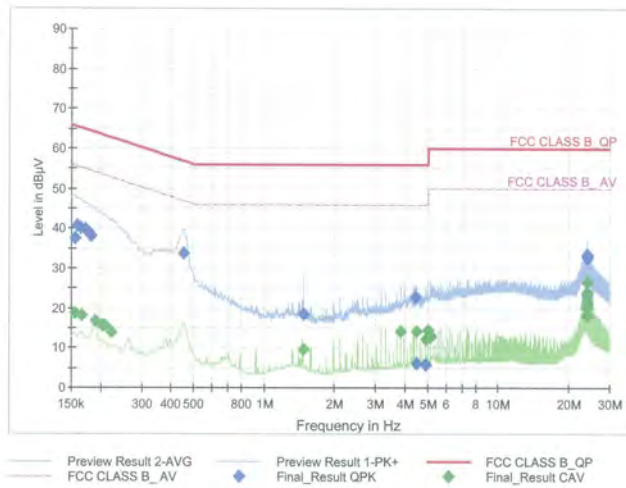
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Test Report

Common Information

EUT : LCWB-002EA
Operating Conditions : 2.4G WLAN

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	37.53	65.75	28.22	9.000	N	OFF	9.6
0.1590	40.71	65.52	24.81	9.000	N	OFF	9.6
0.1635	40.15	65.28	25.14	9.000	N	OFF	9.6
0.1725	39.73	64.84	25.11	9.000	N	OFF	9.6
0.1770	38.82	64.63	25.80	9.000	N	OFF	9.6
0.1815	37.99	64.42	26.42	9.000	N	OFF	9.6
0.4538	33.69	56.81	23.11	9.000	L1	OFF	9.7
1.4698	18.39	56.00	37.61	9.000	L1	OFF	9.7
4.4105	22.72	56.00	33.28	9.000	L1	OFF	9.8
4.4893	5.93	56.00	50.07	9.000	L1	OFF	9.8
4.8853	5.90	56.00	50.10	9.000	L1	OFF	9.8
5.1508	13.00	60.00	47.00	9.000	L1	OFF	9.8
23.8393	21.45	60.00	38.55	9.000	L1	OFF	10.5
23.8978	23.40	60.00	36.60	9.000	L1	OFF	10.5
23.9450	20.62	60.00	39.38	9.000	L1	OFF	10.5
23.9540	32.66	60.00	27.34	9.000	L1	OFF	10.5
24.0035	33.21	60.00	26.79	9.000	L1	OFF	10.5
24.0103	33.37	60.00	26.63	9.000	L1	OFF	10.5

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Test

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Final Result CAV

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	18.73	55.75	37.02	9.000	L1	OFF	9.7
0.1658	18.28	55.17	36.89	9.000	L1	OFF	9.7
0.1905	16.69	54.02	37.33	9.000	L1	OFF	9.7
0.2040	15.70	53.45	37.74	9.000	L1	OFF	9.7
0.2085	15.60	53.27	37.67	9.000	L1	OFF	9.7
0.2220	13.84	52.74	38.91	9.000	L1	OFF	9.7
1.4698	9.52	46.00	36.48	9.000	L1	OFF	9.7
3.8300	14.02	46.00	31.98	9.000	L1	OFF	9.8
4.4893	14.08	46.00	31.92	9.000	L1	OFF	9.8
4.8853	12.20	46.00	33.80	9.000	L1	OFF	9.8
5.0180	14.48	50.00	35.52	9.000	L1	OFF	9.8
5.1508	12.55	50.00	37.45	9.000	L1	OFF	9.8
23.7358	20.15	50.00	29.85	9.000	L1	OFF	10.5
23.8348	18.30	50.00	31.70	9.000	L1	OFF	10.5
23.9023	22.12	50.00	27.88	9.000	L1	OFF	10.5
23.9563	23.98	50.00	26.02	9.000	L1	OFF	10.5
23.9990	21.10	50.00	28.90	9.000	L1	OFF	10.5
24.0103	26.47	50.00	23.53	9.000	L1	OFF	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	08/22/2023	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	06/07/2023	Annual
Temperature Chamber	SU-642	ESPEC	0093008124	02/22/2024	Annual
Signal Analyzer	N9030A	Agilent	MY52350879	01/02/2024	Annual
Power Measurement Set	OSP 120	Rohde & Schwarz	101231	06/14/2023	Annual
Power Meter	N1911A	Agilent	MY45100523	03/06/2024	Annual
Power Sensor	N1921A	Keysight	MY57820067	03/06/2024	Annual
Directional Coupler	87300B	Agilent	3116A03621	11/02/2023	Annual
Power Splitter	11667B	Hewlett Packard	05001	05/18/2023	Annual
DC Power Supply	E3632A	H.P	KR75303243	04/25/2023	Annual
Attenuator(10 dB)	8493C	Hewlett Packard	07560	06/14/2023	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

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	EM1000	Audix	060520	N/A	N/A
Turn Table	N/A	Audix	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	03/17/2024	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	760	02/24/2025	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	02299	03/24/2024	Biennial
Horn Antenna (15GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170342	09/29/2024	Biennial
Spectrum Analyzer	FSV40-N	Rohde & Schwarz	102168	07/04/2023	Annual
Signal Analyzer	N9030A	Agilent	MY52350879	01/02/2024	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	WRCJV2400/2483.5-2370/2520-60/12SS	Wainwright Instruments	2	01/05/2024	Annual
High Pass Filter	WHK3.0/18G-10EF	Wainwright Instruments	8	01/16/2024	Annual
High Pass Filter	WHKX8-6090-7000-18000-40SS	Wainwright Instruments	25	01/16/2024	Annual
Attenuator (3 dB)	18B-03	Api tech.	1	05/23/2023	Annual
Attenuator(10 dB)	8493C-10	Agilent	08285	06/21/2023	Annual
Power Amplifier	CBLU1183540	CERNEX	22964	01/16/2024	Annual
Power Amplifier	CBL06185030	CERNEX	22965	01/16/2024	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/01/2023	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/02/2024	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-2303-FI003-P