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TEST REPORT

FCC/ISED DTS Test for ETWFAFML01
Certification

APPLICANT
LG Innotek Co., Ltd.

REPORT NO.
HCT-RF-2210-FI001-R1

DATE OF ISSUE
October 28, 2022

Tested by
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Technical Manager
Se Wook Park

Accredited by KOLAS, Republic of KOREA

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Additional Model
-

Applicant	**LG Innotek Co., Ltd.** 26, Hanamsandan 5 beon-ro, Gwangsan-gu, Gwangju, 506-731, South Korea
Eut Type Model Name	RF Module ETWFAFML01
FCC ID IC	YZP-ETWFAFML01 7414C-ETWFAFML01
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	October 14, 2022	Initial Release
1	October 28, 2022	- Revised the ANTENNA REQUIREMENTS (Page. 8) - Revised the Ant. Pol (Page. 69)

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	ETWFAFML01	
Additional Model	-	
EUT Type	RF Module	
Power Supply	DC 3.30 V	
Frequency Range	2 412 MHz – 2 462 MHz	
Max. RF Output Power	Peak Power	802.11b: 23.29 dBm 802.11g: 23.69 dBm 802.11n(HT20): 23.63 dBm 802.11n(HT40): 23.41 dBm
	Average Power	802.11b: 17.02 dBm 802.11g: 15.91 dBm 802.11n(HT20): 15.73 dBm 802.11n(HT40): 15.21 dBm
Modulation Type	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n	
Number of Channels	11 Channels	
Antenna Specification	PCB Antenna Peak Gain : 1.50 dBi	
Date(s) of Tests	September 28, 2022 ~ October 14, 2022	
PMN (Product Marketing Number)	RF Module	
HVIN (Hardware Version Identification Number)	ETWFAFML01	
FVIN (Firmware Version Identification Number)	2.0.6	
HMN (Host Marketing Name)	N/A	
EUT serial numbers	Radiated : ETWFAFML01-02 Conducted : ETWFAFML01-01	
Manufacturer	LG Innotek Co., Ltd. 26, Hanamsandan 5 beon-ro, Gwangsan-gu, Gwangju, 506-731, South 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 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

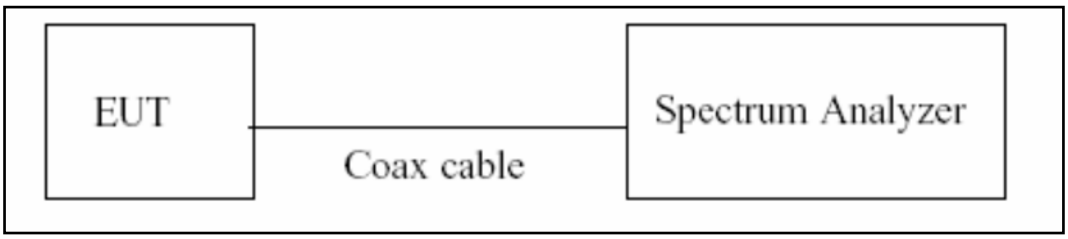
The measurement uncertainties shown below were calculated in accordance with the requirements of
ANSI C63.10-2013.
All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.
The measurement data shown herein meets or exceeds the U_{CISPR} measurement 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)	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*.

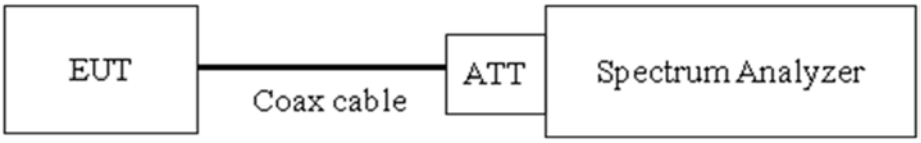
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

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

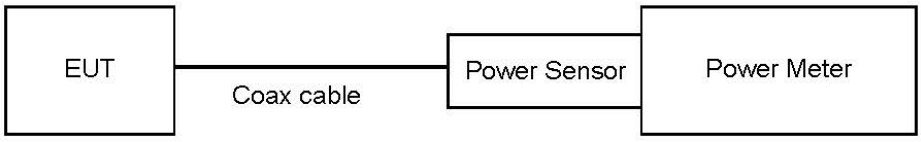
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

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

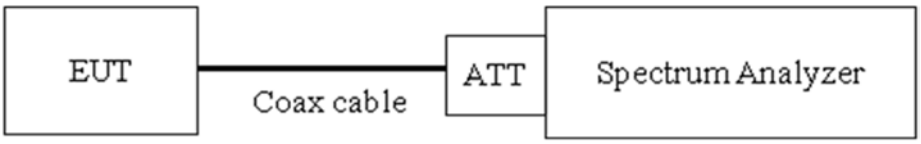
- Conducted Output Power(Peak) = Measured Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Measured Value + ATT loss + Cable loss + Duty Cycle Factor

7.4. Power Spectral Density

Limit

The transmitter power density average over 1-second interval shall not be greater than 8dBm in any 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 = Measured Value + ATT loss + Cable loss

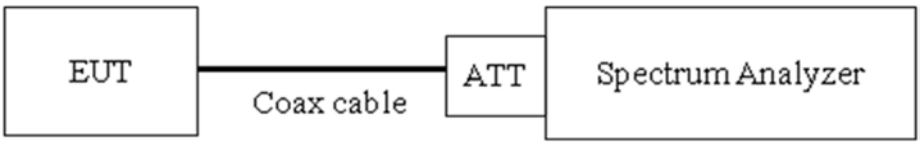
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

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 ≥ 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	20.04
100	20.09
200	20.13
300	20.19
400	20.22
500	20.23
600	20.23
700	20.25
800	20.27
900	20.29
1 000	20.31
2 000	20.46
2 400	20.52
2 480	20.52
2 500	20.52
3 000	20.57
4 000	20.67
5 000	20.75
5 150	20.77
5 850	20.82
6 000	20.82
7 000	20.91
8 000	20.98
9 000	21.05
10 000	21.12
11 000	21.16
12 000	21.24
13 000	21.32
14 000	21.30
15 000	21.32
16 000	21.37
17 000	21.41
18 000	21.47
19 000	21.50
20 000	21.56
21 000	21.77
22 000	21.74
23 000	21.94
24 000	21.77
25 000	21.80
26 000	21.80

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

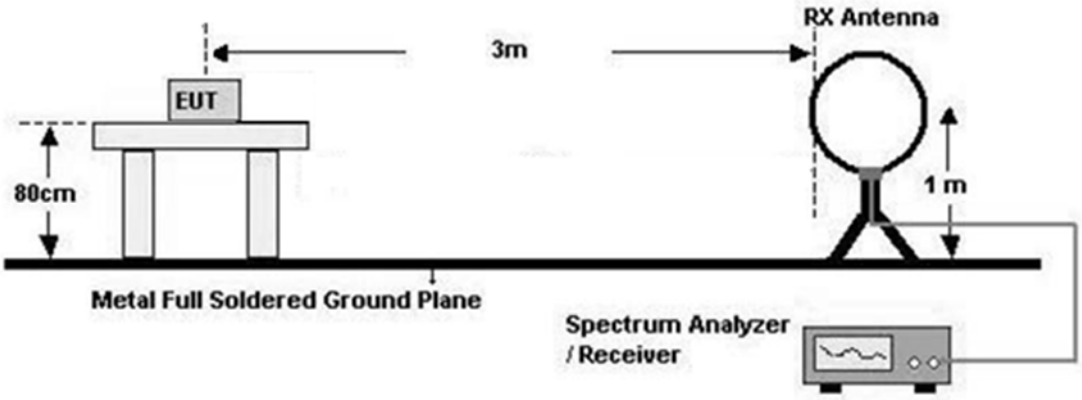
Frequency (MHz)	Field Strength (μA/m)	Measurement Distance (m)
0.009 – 0.490	6.37/F(kHz)	300
0.490 – 1.705	63.7/F(kHz)	30
1.705 – 30	0.08	30

FCC&ISED

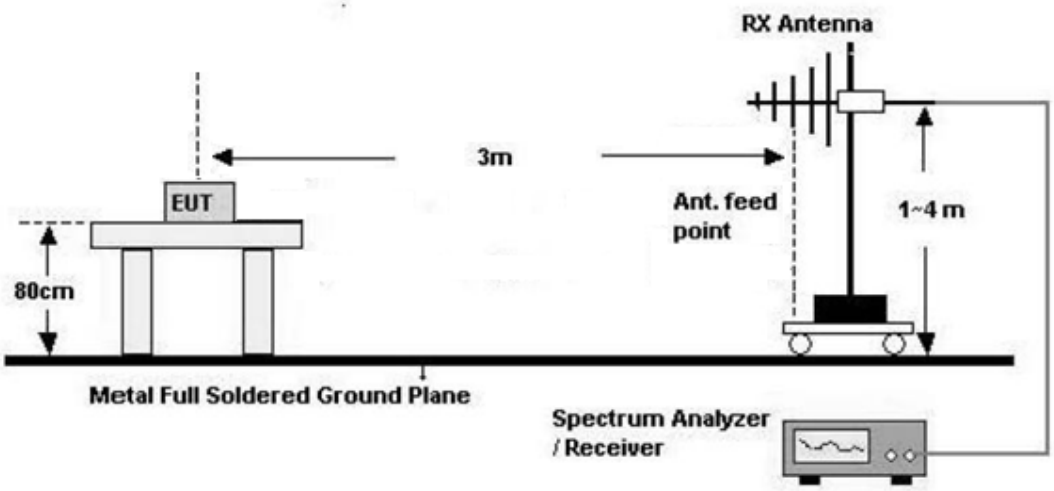
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

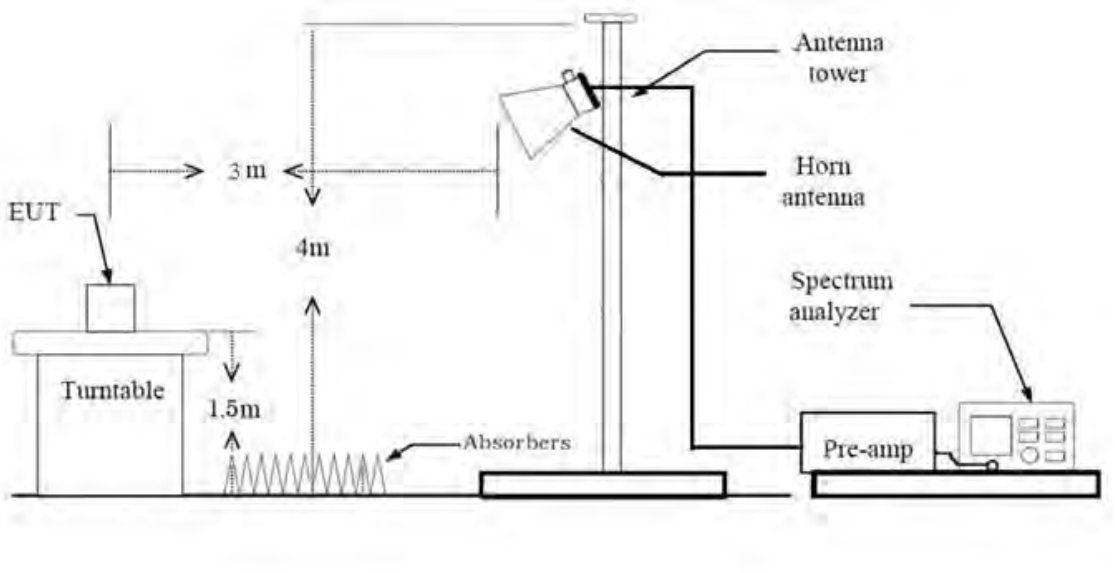
Below 30 MHz



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

KDB 414788 OFS and Chamber Correlation Justification

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

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

Test Procedure of Radiated spurious emissions(Below 1 GHz)

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

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

Test Procedure of Radiated spurious emissions (Above 1 GHz)

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. 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)
= Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(A.G) + Distance Factor(D.F)

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

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

Test Procedure of Radiated Restricted Band Edge

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

(1) Measurement Type(Peak):

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

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

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

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

- Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW ≥ 3 x RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).
- Correction factor shall be added to the measurement results prior to comparing to the

emission limit in order to compute the emission level that would have been measured had the test been performed at 100 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)
= 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)

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

7.7. AC Power line Conducted Emissions

Limit

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

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

[a]Decreases with the logarithm of the frequency.

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

Test Configuration

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

Test Procedure

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

Sample Calculation

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

7.8. Receiver Spurious Emissions

Limit

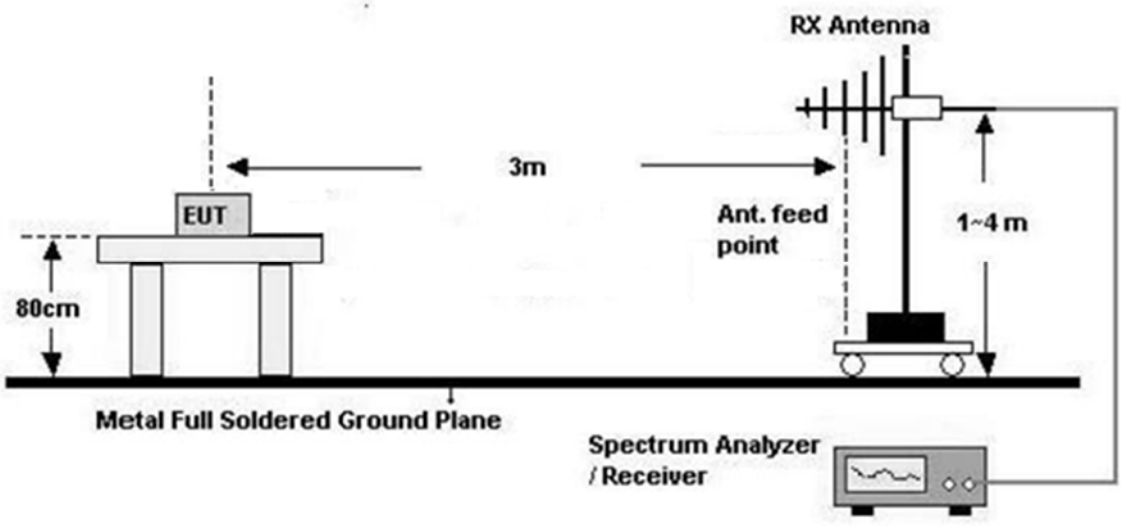
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

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

Test Configuration

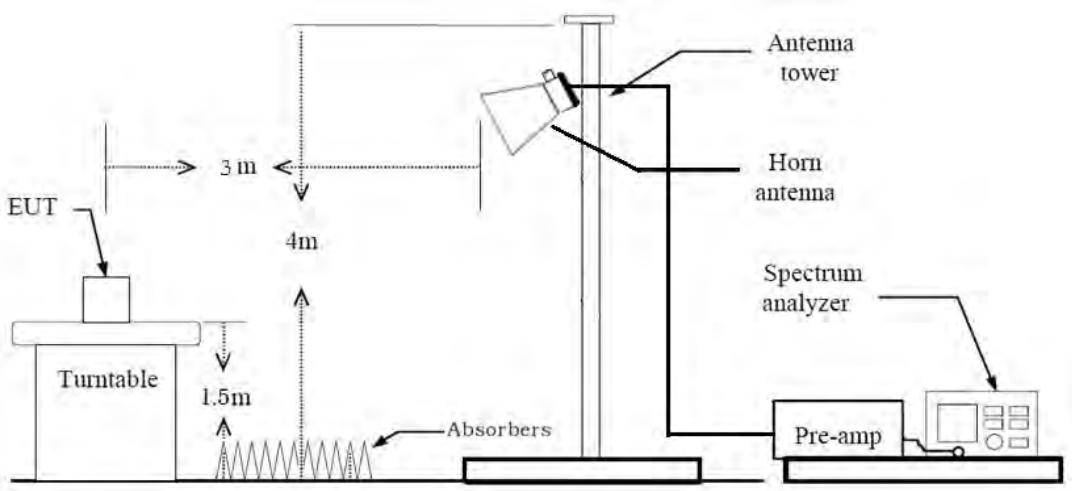
30 MHz - 1 GHz



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 = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L)

Above 1 GHz



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

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 : X, Y
   - Radiated Restricted Band Edge : X
4. Test was performed with continuous Tx.
5. All datarates 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

AC Power line Conducted Emissions

1. We don’t perform powerline conducted emission test. Because this EUT is used DC.

Conducted test

1. The EUT was configured with data rate of highest power.
2. 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

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		N/A (#Note1)
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

#Note1 : Not Tested

ISED Part

Test Description	ISED Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	RSS-247, 5.2.(a)	> 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.(d)	< 1 Watt <4 Watt(e.i.r.p.)		PASS
Power Spectral Density	RSS-247, 5.2(b)	< 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		N/A (#Note1)
Radiated Spurious Emissions	RSS-GEN, 8.9	cf. Section 7.6	Radiated	PASS
Receiver Spurious Emissions	RSS-GEN, 5 RSS-GEN, 7.3	cf. Section 7.8		PASS
Radiated Restricted Band Edge	RSS-GEN, 8.9 RSS-GEN, 8.10	cf. Section 7.6		PASS

#Note1 : Not Tested

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)	-	-	-	-
802.11n (HT40)	-	-	-	-

Note:

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

9.2 6 dB BANDWIDTH & 99 % BANDWIDTH

6 dB Bandwidth Measurements (FCC)

802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	9.590	> 0.5
2437	6	9.592	> 0.5
2462	11	9.588	> 0.5

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.42	> 0.5
2437	6	16.42	> 0.5
2462	11	16.43	> 0.5

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.05	> 0.5
2437	6	17.08	> 0.5
2462	11	17.32	> 0.5

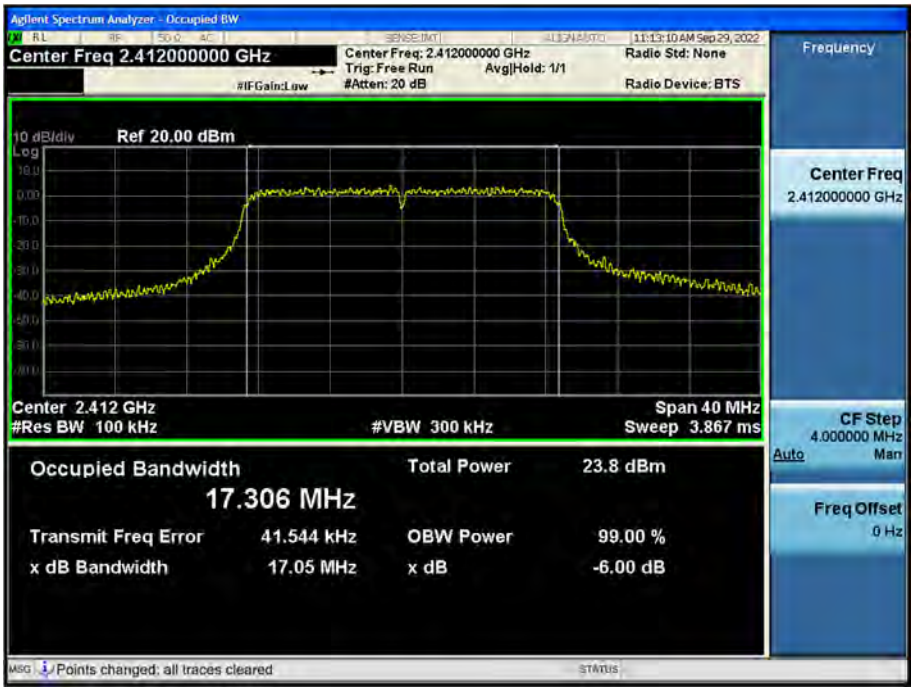
802.11n(HT40) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2422	3	33.29	> 0.5
2437	6	33.17	> 0.5
2452	9	33.31	> 0.5

▣ Test Plots

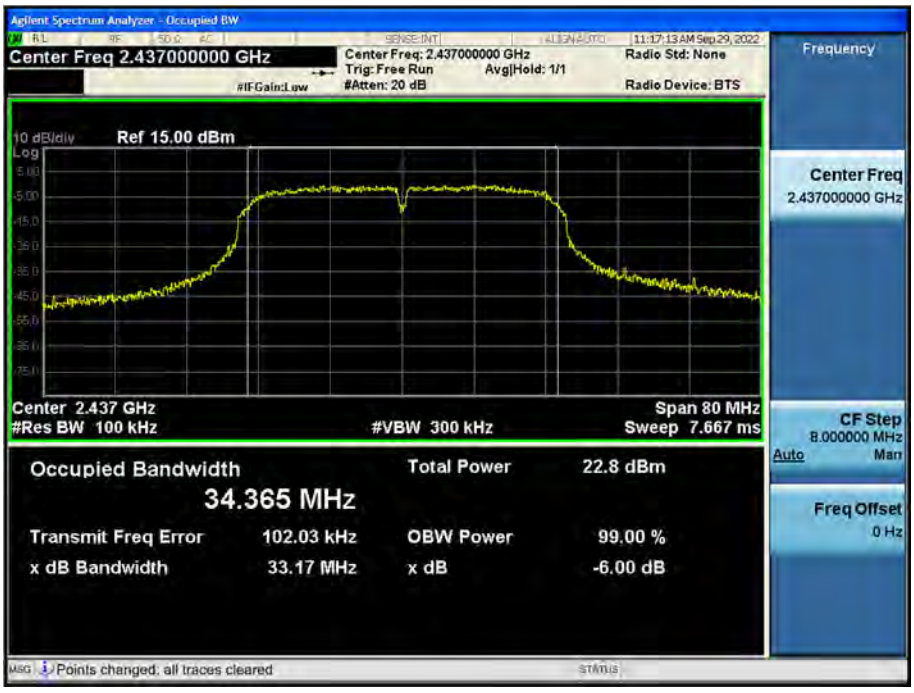
6 dB Bandwidth plot (802.11b-CH 11)

6 dB Bandwidth plot (802.11g-CH 6)

6 dB Bandwidth plot (802.11n_HT20-CH 1)



6 dB Bandwidth plot (802.11n_HT40-CH 6)



Note:

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

99 % Bandwidth Measurements (ISED)

802.11b Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	13.194	N/A
2437	6	13.188	N/A
2462	11	13.183	N/A

802.11g Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.577	N/A
2437	6	16.574	N/A
2462	11	16.577	N/A

802.11n(HT20) Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.314	N/A
2437	6	17.307	N/A
2462	11	17.309	N/A

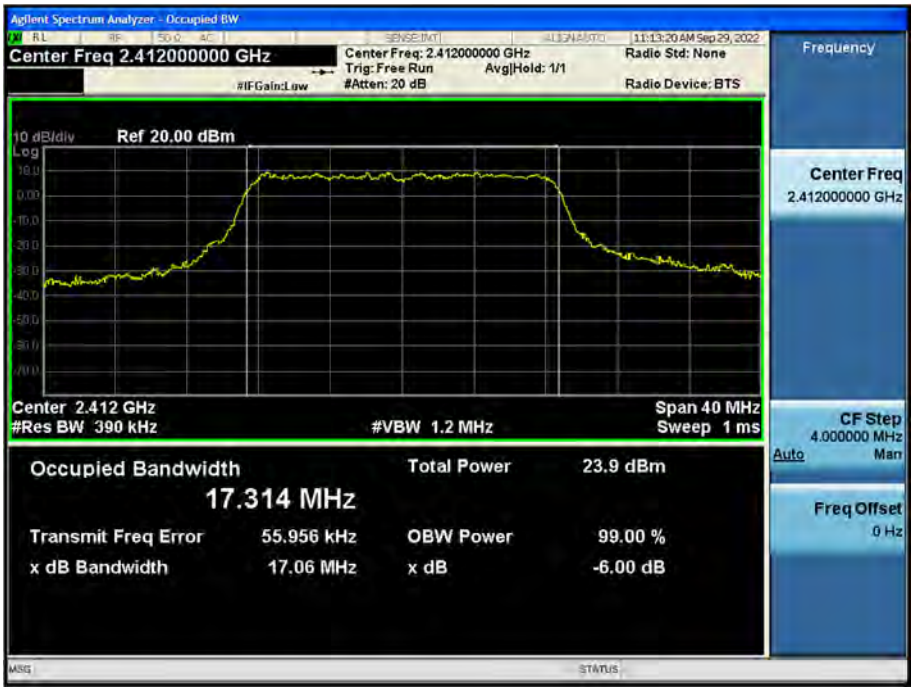
802.11n(HT40) Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2422	3	34.583	N/A
2437	6	34.558	N/A
2452	9	34.536	N/A

▣ Test Plots

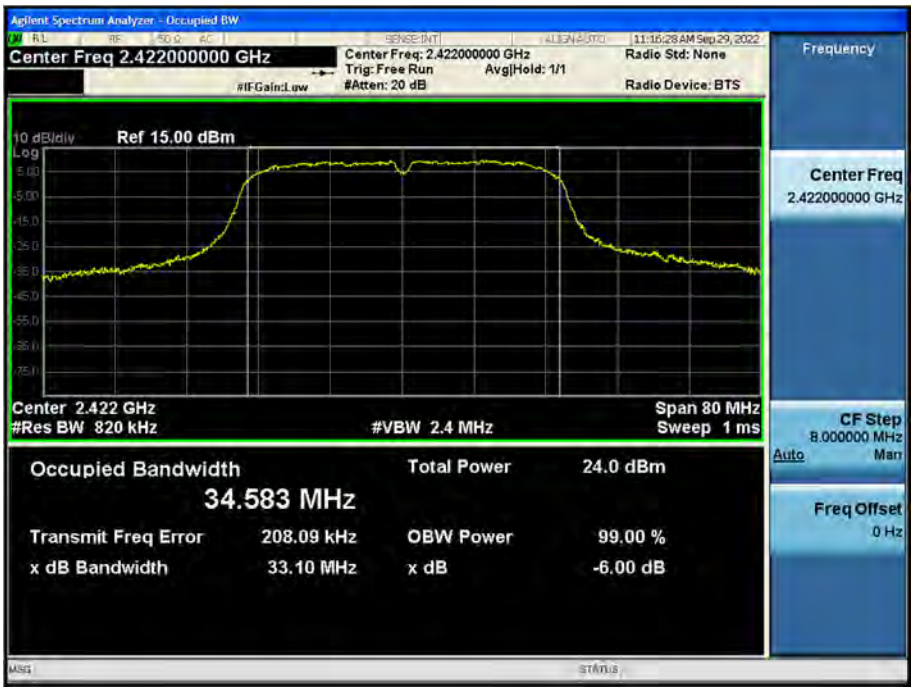
99 % Bandwidth plot (802.11b-CH 1)

99 % Bandwidth plot (802.11g-CH 11)

99 % Bandwidth plot (802.11n_HT20-CH 1)



99 % Bandwidth plot (802.11n_HT40-CH 3)



Note:

In order to simplify the report, attached plots were only the widest 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, 20.52 dB is offset for 2.4 GHz Band

802.11b Mode		Rate (Mbps)	Measured	Limit
Frequency[MHz]	Channel No.		Power(dBm)	(dBm)
2412	1	1	23.29	30
2437	6	1	23.21	30
2462	11	1	23.24	30

802.11g Mode		Rate (Mbps)	Measured	Limit
Frequency[MHz]	Channel No.		Power(dBm)	(dBm)
2412	1	6	22.52	30
2437	6	6	23.69	30
2457	10	6	22.76	30
2462	11	6	21.41	30

802.11n(HT20) Mode		MCS Index	Measured	Limit
Frequency[MHz]	Channel No.		Power(dBm)	(dBm)
2412	1	0	21.81	30
2437	6	0	23.63	30
2457	10	0	22.72	30
2462	11	0	21.57	30

802.11n(HT40) Mode		MCS Index	Measured	Limit
Frequency[MHz]	Channel No.		Power(dBm)	(dBm)
2422	3	0	19.94	30
2427	4	0	21.47	30
2432	5	0	22.91	30
2437	6	0	23.41	30
2442	7	0	23.33	30
2447	8	0	21.96	30
2452	9	0	21.25	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, 20.52 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	17.02	30
2437	6	1	16.91	30
2462	11	1	17.01	30

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6	14.65	30
2437	6	6	15.91	30
2457	10	6	14.85	30
2462	11	6	13.65	30

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	13.52	30
2437	6	0	15.73	30
2457	10	0	14.65	30
2462	11	0	13.59	30

802.11n(HT40) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2422	3	0	11.69	30
2427	4	0	12.90	30
2432	5	0	14.32	30
2437	6	0	15.21	30
2442	7	0	14.75	30
2447	8	0	13.69	30
2452	9	0	13.02	30

9.4 POWER SPECTRAL DENSITY

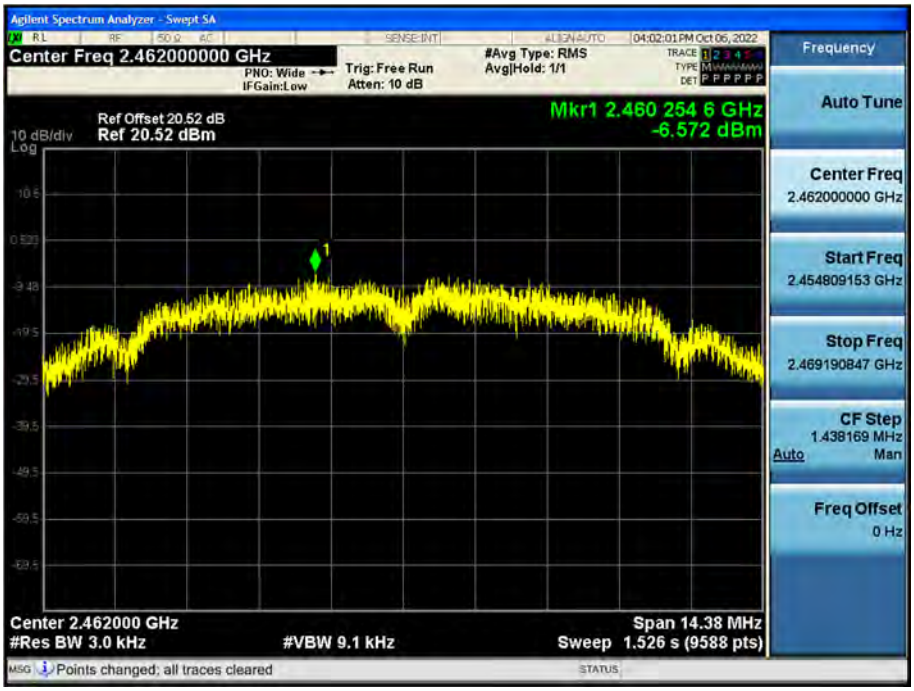
Mode	Frequency (MHz)	Channel No.	Test Result	
			Power Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)
802.11b	2412	1	-6.748	8
	2437	6	-6.674	
	2462	11	-6.572	
802.11g	2412	1	-13.359	
	2437	6	-11.886	
	2462	11	-14.250	
802.11n(HT20)	2412	1	-14.164	
	2437	6	-11.632	
	2462	11	-14.148	
802.11n(HT40)	2422	3	-16.358	
	2437	6	-12.820	
	2452	9	-15.188	

Note :

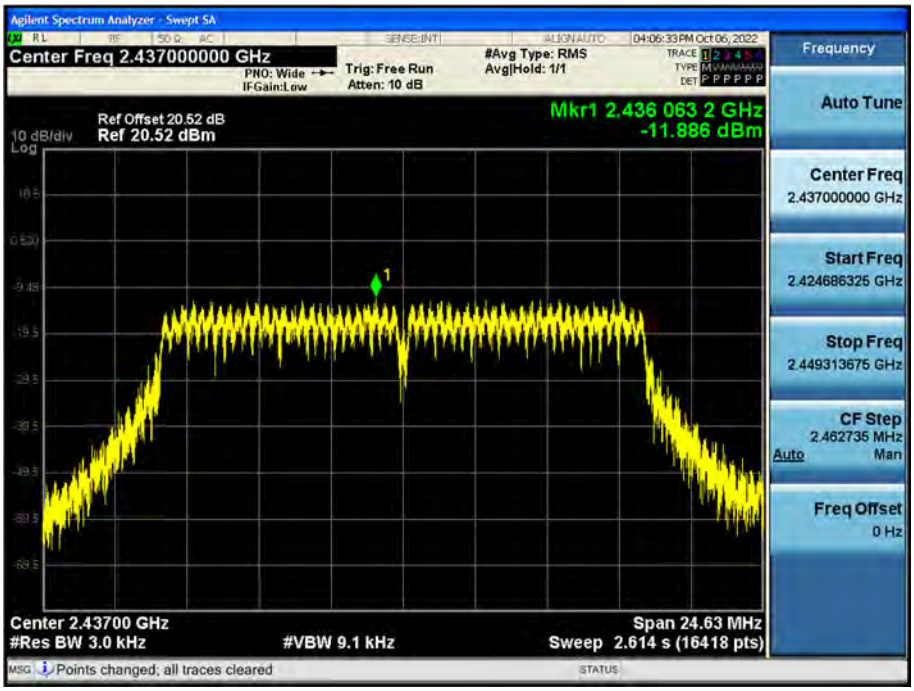
1. The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 20.52 dB is offset for 2.4 GHz Band.

▣ Test Plots

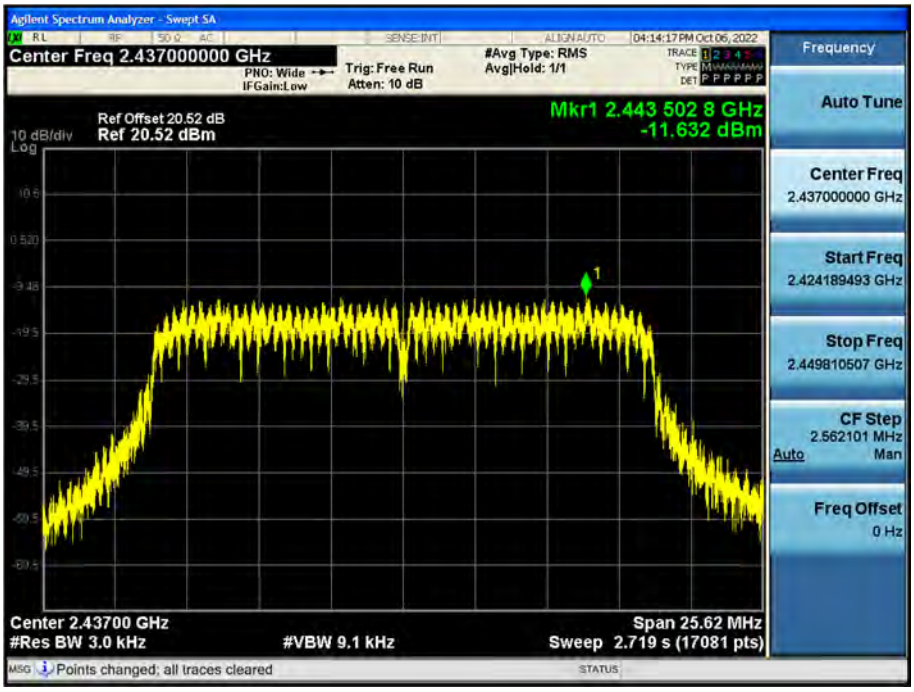
Power Spectral Density (802.11b - Ch. 11)



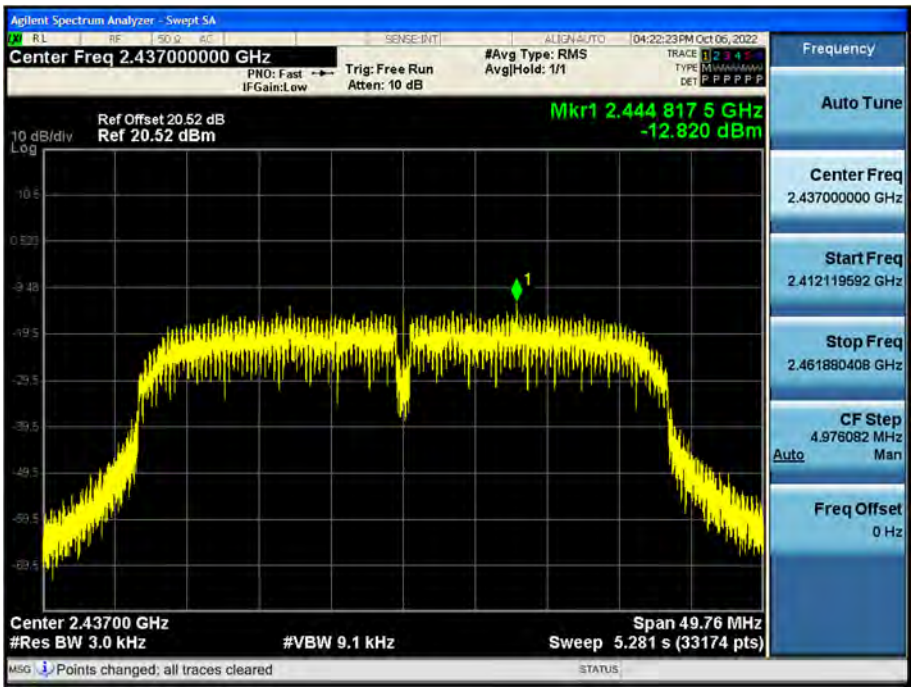
Power Spectral Density (802.11g – Ch. 6)



Power Spectral Density (802.11n_HT20 – Ch. 6)



Power Spectral Density (802.11n_HT40 – 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)

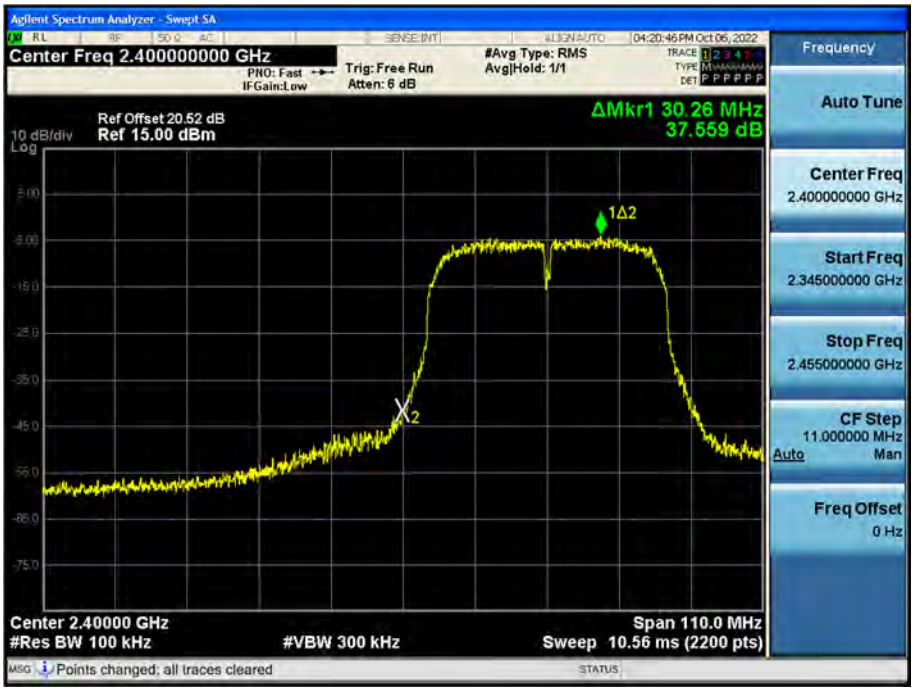
Band Edge (802.11g – Ch. 1)

Band Edge (802.11g - Ch. 11)

Band Edge (802.11n_HT20 – Ch. 1)

Band Edge (802.11n_HT20 – Ch. 11)

Band Edge (802.11n_HT40 – Ch. 3)



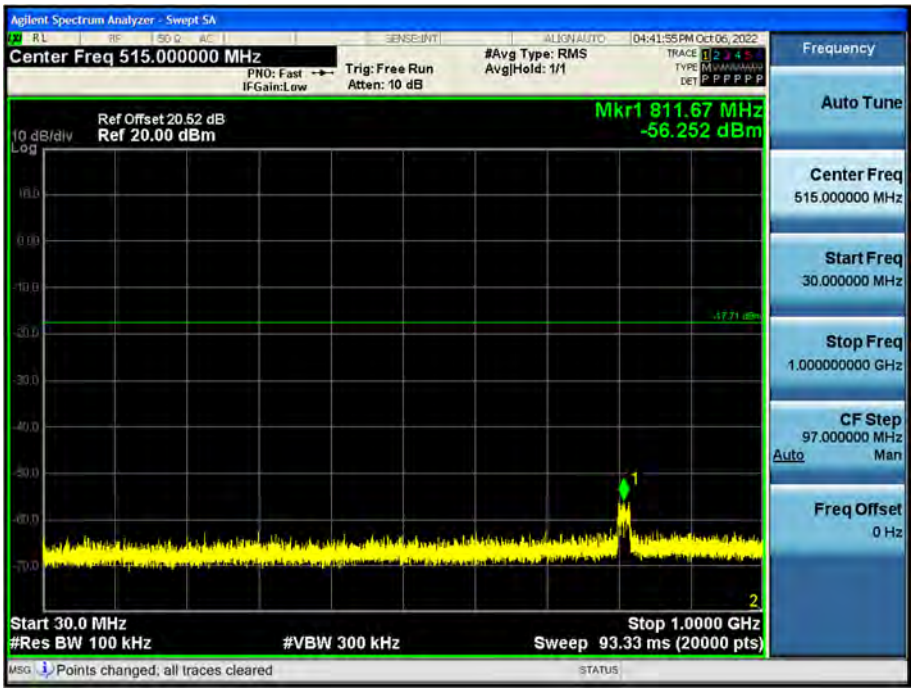
Band Edge (802.11n_HT40 – Ch. 9)

▣ Test Plots(Conducted Spurious Emission)

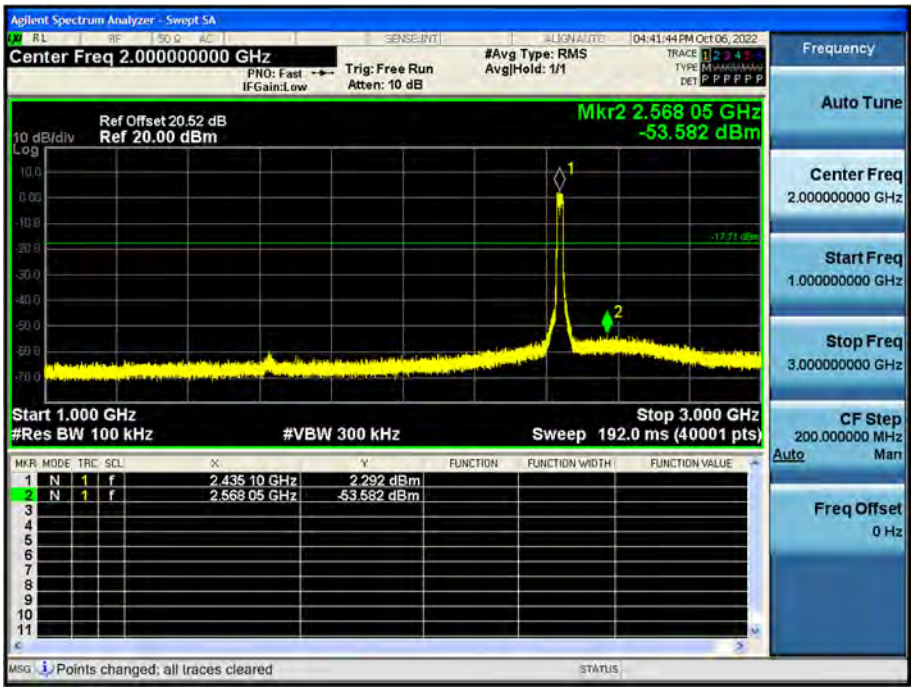
Mode : 802.11g_Ch. 6_6 Mbps

Limit : -17.71 dBm

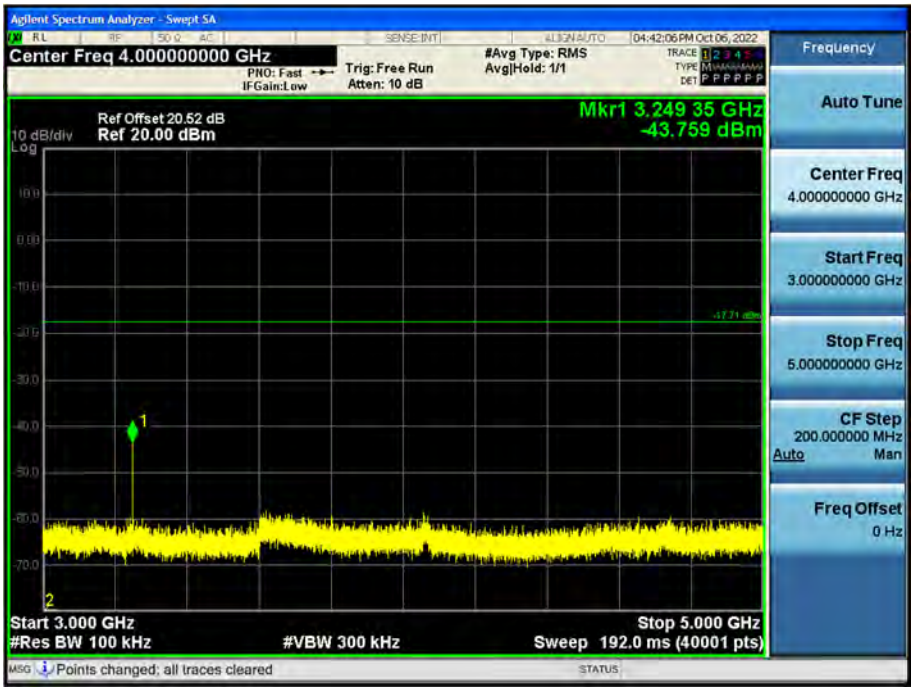
30 MHz ~ 1 GHz



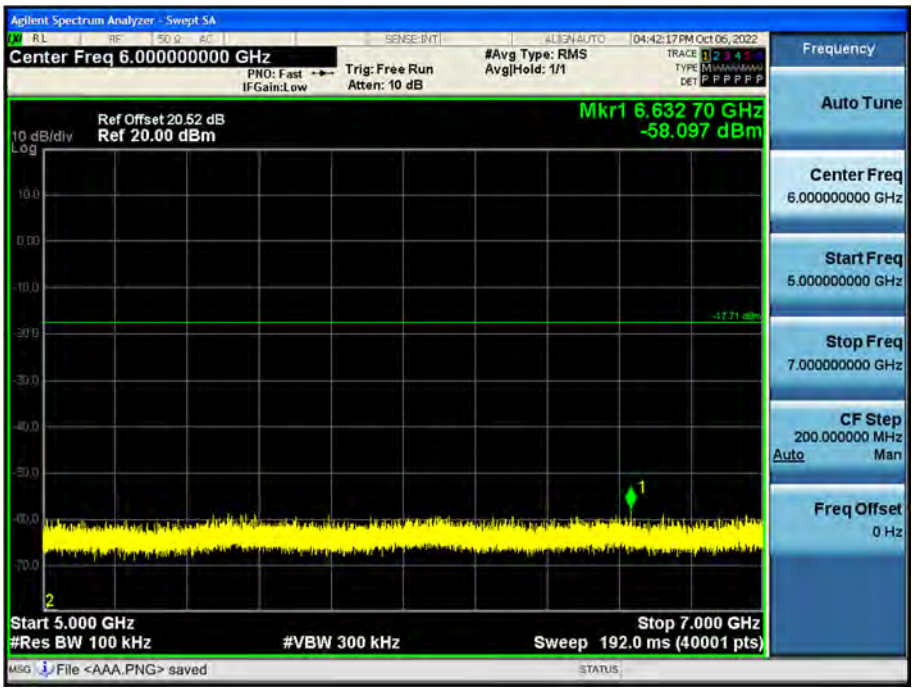
1 GHz ~ 3 GHz



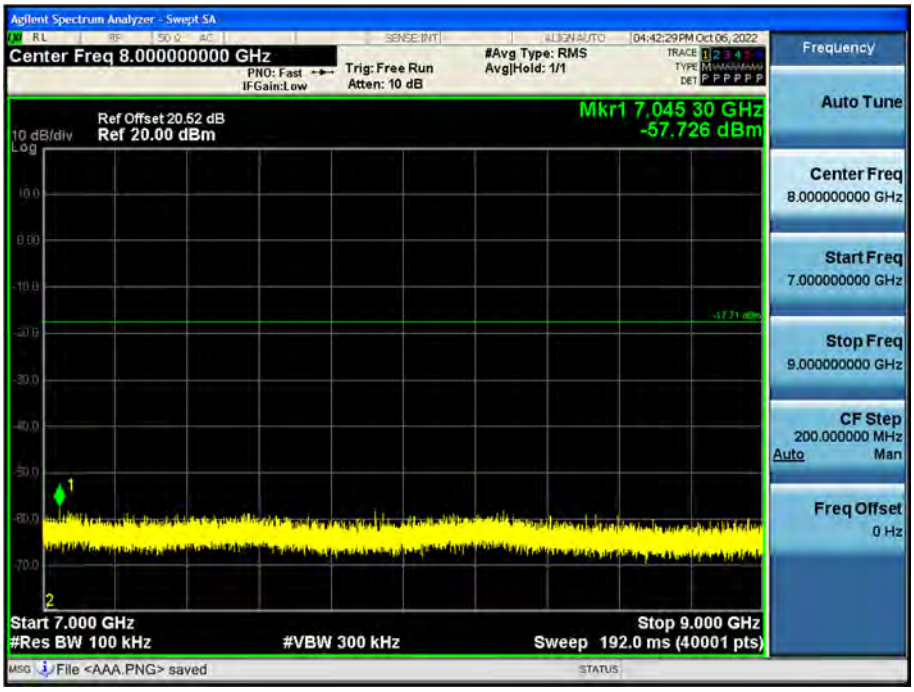
3 GHz ~ 5 GHz



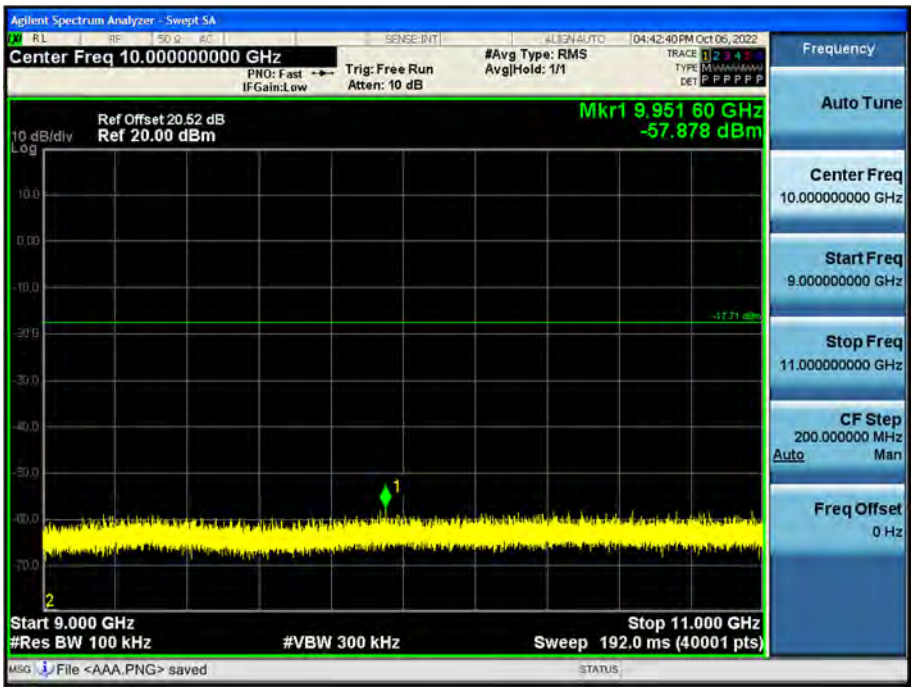
5 GHz ~ 7 GHz



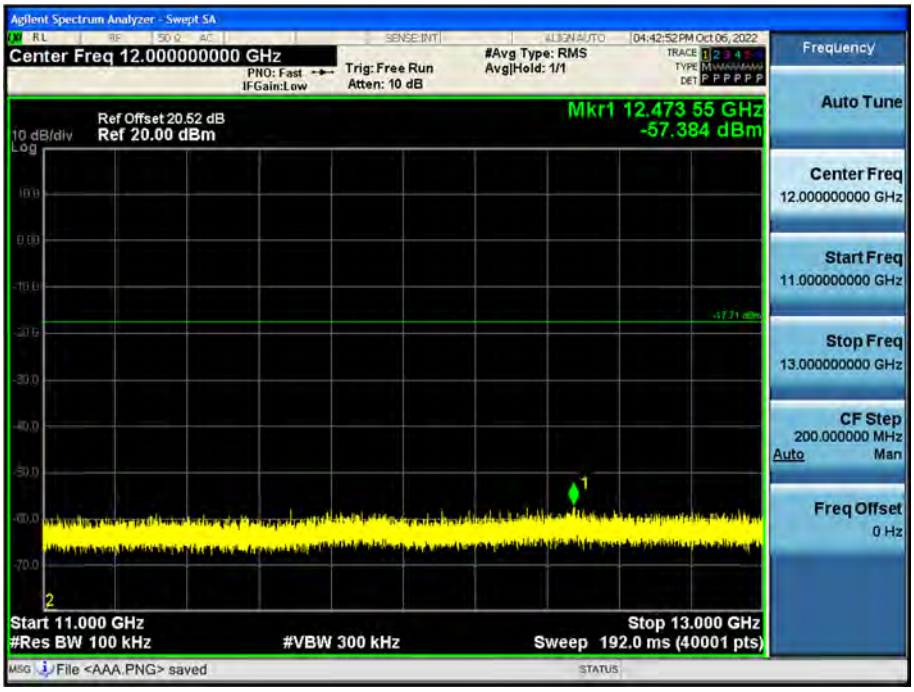
7 GHz ~ 9 GHz



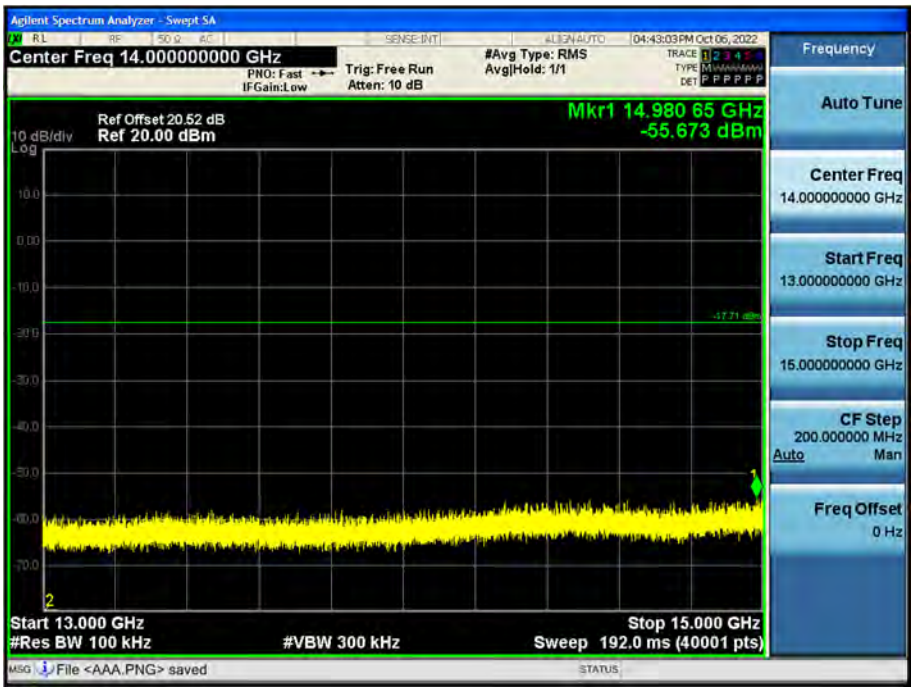
9 GHz ~ 11 GHz



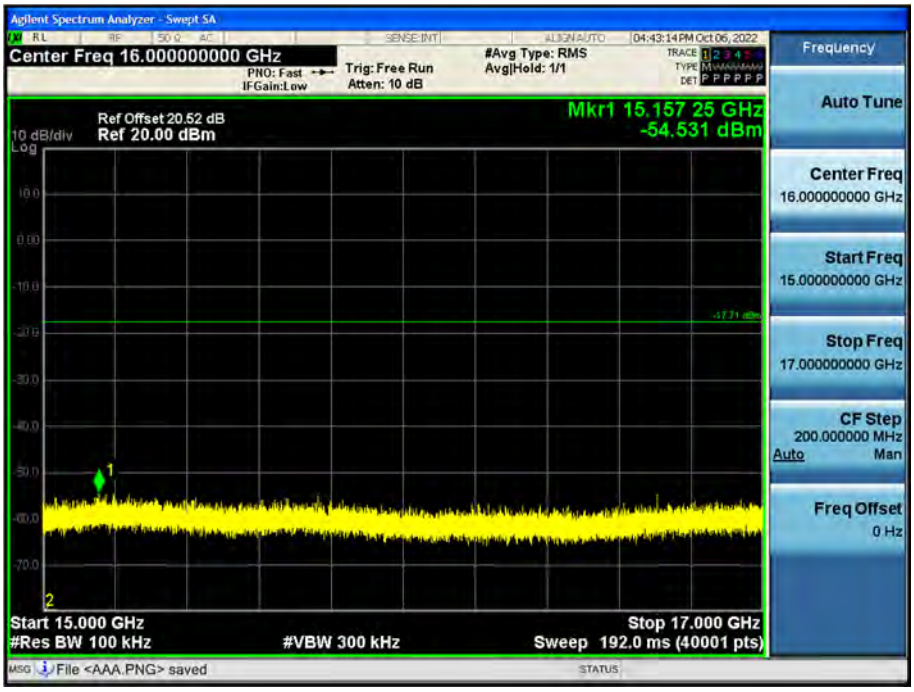
11 GHz ~ 13 GHz



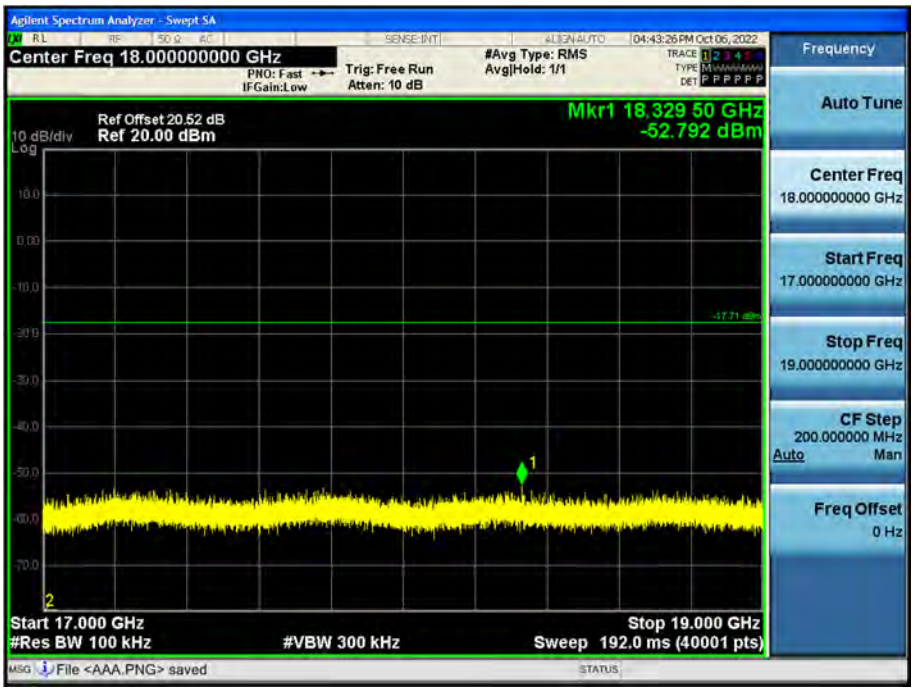
13 GHz ~ 15 GHz



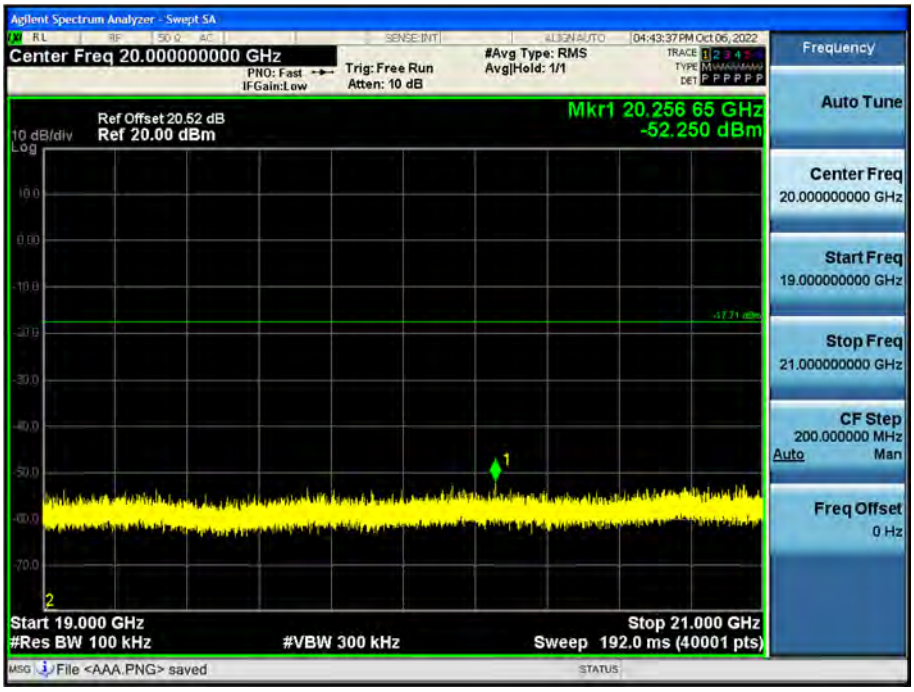
15 GHz ~ 17 GHz



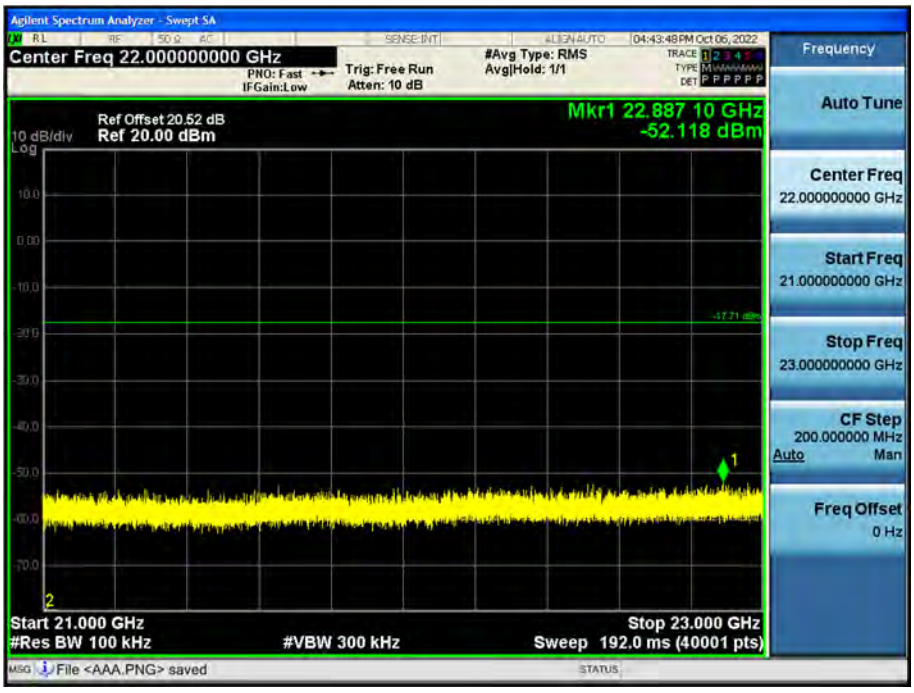
17 GHz ~ 19 GHz



19 GHz ~ 21 GHz



21 GHz ~ 23 GHz



23 GHz ~ 25 GHz


Agilent Spectrum Analyzer - Swept SA
Center Freq 24.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
#Avg Type: RMS
Avg|Hold: 1/1
04:44:00 PM Oct 06, 2022
Ref Offset 20.52 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 24.911 55 GHz
-47.674 dBm
Start 23.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 192.0 ms (40001 pts)
File <AAA.PNG> saved
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

9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

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

Note:

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

Frequency Range : Below 1 GHz

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

Note:

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

Frequency Range : Above 1 GHz

Operation Mode:	802.11b
Transfer Rate:	1 Mbps
Operating Frequency	2 412 MHz
Channel No.	01 Ch

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 824	46.57	4.02	V	50.59	73.98	23.39	PK
4 824	39.46	4.02	V	43.48	53.98	10.50	AV
7 236	37.89	11.57	V	49.46	73.98	24.52	PK
7 236	26.61	11.57	V	38.18	53.98	15.80	AV
4 824	47.01	4.02	H	51.03	73.98	22.95	PK
4 824	40.75	4.02	H	44.77	53.98	9.21	AV
7 236	38.20	11.57	H	49.77	73.98	24.21	PK
7 236	26.82	11.57	H	38.39	53.98	15.59	AV

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

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 874	47.09	4.25	V	51.34	73.98	22.64	PK
4 874	41.12	4.25	V	45.37	53.98	8.61	AV
7 311	38.96	12.01	V	50.97	73.98	23.01	PK
7 311	27.08	12.01	V	39.09	53.98	14.89	AV
4 874	47.78	4.25	H	52.03	73.98	21.95	PK
4 874	42.05	4.25	H	46.30	53.98	7.68	AV
7 311	39.42	12.01	H	51.43	73.98	22.55	PK
7 311	27.48	12.01	H	39.49	53.98	14.49	AV

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

Frequency	Measured Value	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 924	48.29	4.41	V	52.70	73.98	21.28	PK
4 924	43.43	4.41	V	47.84	53.98	6.14	AV
7 386	38.95	11.96	V	50.91	73.98	23.07	PK
7 386	27.68	11.96	V	39.64	53.98	14.34	AV
4 924	49.74	4.41	H	54.15	73.98	19.83	PK
4 924	44.22	4.41	H	48.63	53.98	5.35	AV
7 386	38.67	11.96	H	50.63	73.98	23.35	PK
7 386	27.41	11.96	H	39.37	53.98	14.61	AV

Operation Mode:	802.11g
Transfer Rate:	1 Mbps
Operating Frequency	2 412 MHz
Channel No.	01 Ch

Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 824	43.67	0.00	4.02	V	47.69	73.98	26.29	PK
4 824	32.21	0.00	4.02	V	36.23	53.98	17.75	AV
7 236	37.96	0.00	11.57	V	49.53	73.98	24.45	PK
7 236	25.78	0.00	11.57	V	37.35	53.98	16.63	AV
4 824	44.23	0.00	4.02	H	48.25	73.98	25.73	PK
4 824	32.85	0.00	4.02	H	36.87	53.98	17.11	AV
7 236	38.22	0.00	11.57	H	49.79	73.98	24.19	PK
7 236	26.12	0.00	11.57	H	37.69	53.98	16.29	AV

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

Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 874	45.22	0.00	4.25	V	49.47	73.98	24.51	PK
4 874	33.45	0.00	4.25	V	37.70	53.98	16.28	AV
7 311	38.24	0.00	12.01	V	50.25	73.98	23.73	PK
7 311	26.23	0.00	12.01	V	38.24	53.98	15.74	AV
4 874	45.71	0.00	4.25	H	49.96	73.98	24.02	PK
4 874	34.02	0.00	4.25	H	38.27	53.98	15.71	AV
7 311	38.66	0.00	12.01	H	50.67	73.98	23.31	PK
7 311	26.51	0.00	12.01	H	38.52	53.98	15.46	AV

Operation Mode:	802.11g
Transfer Rate:	1 Mbps
Operating Frequency	2 462 MHz
Channel No.	11 Ch

Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 924	47.45	0.00	4.41	V	51.86	73.98	22.12	PK
4 924	35.03	0.00	4.41	V	39.44	53.98	14.54	AV
7 386	38.55	0.00	11.96	V	50.51	73.98	23.47	PK
7 386	26.55	0.00	11.96	V	38.51	53.98	15.47	AV
4 924	47.96	0.00	4.41	H	52.37	73.98	21.61	PK
4 924	35.64	0.00	4.41	H	40.05	53.98	13.93	AV
7 386	38.07	0.00	11.96	H	50.03	73.98	23.95	PK
7 386	26.23	0.00	11.96	H	38.19	53.98	15.79	AV

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

Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 824	43.82	0.00	4.02	V	47.84	73.98	26.14	PK
4 824	32.06	0.00	4.02	V	36.08	53.98	17.90	AV
7 236	37.34	0.00	11.57	V	48.91	73.98	25.07	PK
7 236	25.78	0.00	11.57	V	37.35	53.98	16.63	AV
4 824	44.33	0.00	4.02	H	48.35	73.98	25.63	PK
4 824	32.52	0.00	4.02	H	36.54	53.98	17.44	AV
7 236	37.85	0.00	11.57	H	49.42	73.98	24.56	PK
7 236	26.08	0.00	11.57	H	37.65	53.98	16.33	AV

Operation Mode:	802.11n(HT20)
Transfer MCS Index:	0
Operating Frequency	2 437 MHz
Channel No.	06 Ch

Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 874	44.82	0.00	4.25	V	49.07	73.98	24.91	PK
4 874	32.99	0.00	4.25	V	37.24	53.98	16.74	AV
7 311	38.23	0.00	12.01	V	50.24	73.98	23.74	PK
7 311	26.08	0.00	12.01	V	38.09	53.98	15.89	AV
4 874	45.39	0.00	4.25	H	49.64	73.98	24.34	PK
4 874	33.55	0.00	4.25	H	37.80	53.98	16.18	AV
7 311	38.51	0.00	12.01	H	50.52	73.98	23.46	PK
7 311	26.45	0.00	12.01	H	38.46	53.98	15.52	AV

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

Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 924	47.11	0.00	4.41	V	51.52	73.98	22.46	PK
4 924	34.27	0.00	4.41	V	38.68	53.98	15.30	AV
7 386	38.69	0.00	11.96	V	50.65	73.98	23.33	PK
7 386	26.44	0.00	11.96	V	38.40	53.98	15.58	AV
4 924	47.56	0.00	4.41	H	51.97	73.98	22.01	PK
4 924	34.94	0.00	4.41	H	39.35	53.98	14.63	AV
7 386	38.24	0.00	11.96	H	50.20	73.98	23.78	PK
7 386	26.12	0.00	11.96	H	38.08	53.98	15.90	AV

Operation Mode:	802.11n(HT40)
Transfer MCS Index:	0
Operating Frequency	2 422 MHz
Channel No.	03 Ch

Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 844	42.25	0.00	3.94	V	46.19	73.98	27.79	PK
4 844	30.89	0.00	3.94	V	34.83	53.98	19.15	AV
7 266	38.03	0.00	11.70	V	49.73	73.98	24.25	PK
7 266	25.65	0.00	11.70	V	37.35	53.98	16.63	AV
4 844	43.08	0.00	3.94	H	47.02	73.98	26.96	PK
4 844	31.63	0.00	3.94	H	35.57	53.98	18.41	AV
7 266	38.39	0.00	11.70	H	50.09	73.98	23.89	PK
7 266	25.98	0.00	11.70	H	37.68	53.98	16.30	AV

Operation Mode:	802.11n(HT40)
Transfer MCS Index:	0
Operating Frequency	2 437 MHz
Channel No.	06 Ch

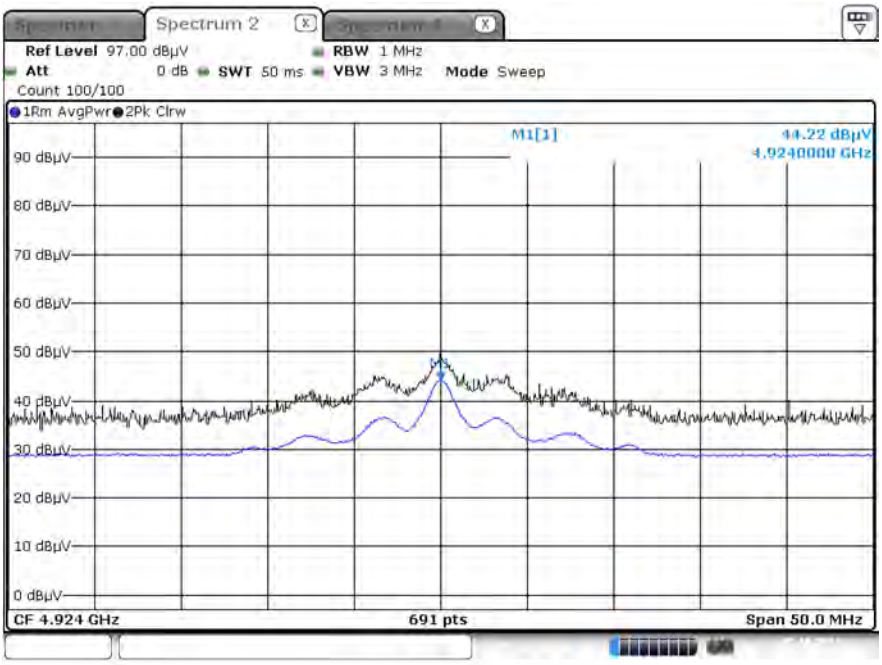
Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 874	43.67	0.00	4.25	V	47.92	73.98	26.06	PK
4 874	31.87	0.00	4.25	V	36.12	53.98	17.86	AV
7 311	38.15	0.00	12.01	V	50.16	73.98	23.82	PK
7 311	25.77	0.00	12.01	V	37.78	53.98	16.20	AV
4 874	44.18	0.00	4.25	H	48.43	73.98	25.55	PK
4 874	32.39	0.00	4.25	H	36.64	53.98	17.34	AV
7 311	38.62	0.00	12.01	H	50.63	73.98	23.35	PK
7 311	26.12	0.00	12.01	H	38.13	53.98	15.85	AV

Operation Mode:	802.11n(HT40)
Transfer MCS Index:	0
Operating Frequency	2 452 MHz
Channel No.	9 Ch

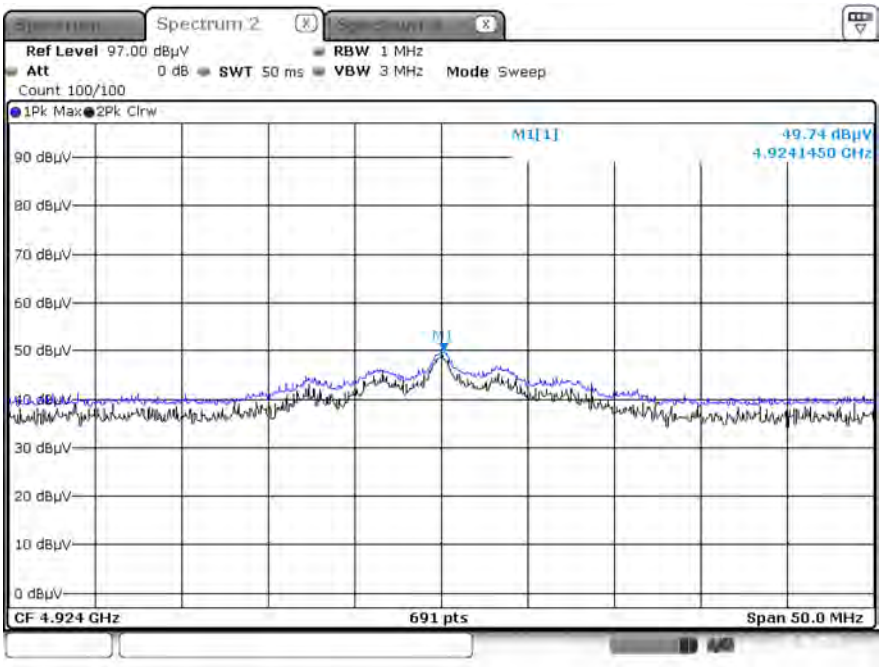
Frequency	Measured Value	Duty Cycle Factor	A.F+C.L-A.G+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
4 904	44.25	0.00	4.19	V	48.44	73.98	25.54	PK
4 904	33.10	0.00	4.19	V	37.29	53.98	16.69	AV
7 356	38.12	0.00	11.85	V	49.97	73.98	24.01	PK
7 356	26.05	0.00	11.85	V	37.90	53.98	16.08	AV
4 904	44.79	0.00	4.19	H	48.98	73.98	25.00	PK
4 904	33.51	0.00	4.19	H	37.70	53.98	16.28	AV
7 356	37.83	0.00	11.85	H	49.68	73.98	24.30	PK
7 356	25.36	0.00	11.85	H	37.21	53.98	16.77	AV

▣ **Test Plots (Worst case : X-H)**

Radiated Spurious Emissions plot – Average Result (802.11b, Ch.11 2nd Harmonic)



Radiated Spurious Emissions plot – Peak Result (802.11b, Ch.11 2nd 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	2 412 MHz, 2 462 MHz
Channel No.	01 Ch, 11 Ch

Frequency	Measured Value	※ A.F+C.L-A.G+ATT+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
2 390.0	23.21	37.05	H	60.26	73.98	13.72	PK
2 390.0	13.05	37.05	H	50.10	53.98	3.88	AV
2 390.0	22.64	37.05	V	59.69	73.98	14.29	PK
2 390.0	12.45	37.05	V	49.50	53.98	4.48	AV
2 483.5	22.14	37.03	H	59.17	73.98	14.81	PK
2 483.5	10.68	37.03	H	47.71	53.98	6.27	AV
2 483.5	21.27	37.03	V	58.30	73.98	15.68	PK
2 483.5	9.58	37.03	V	46.61	53.98	7.37	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+C.L-A.G+ATT+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
2 390.0	27.627	0.00	37.05	H	64.68	73.98	9.30	PK
# 2 389.5	13.410	0.00	37.05	H	50.46	53.98	3.52	AV
# 2 388.5	11.210	0.00	37.05	H	48.26	53.98	5.72	AV
2 388.0	11.521	0.00	37.05	H	48.57	53.98	5.41	AV
2 390.0	27.159	0.00	37.03	V	64.19	73.98	9.79	PK
# 2 389.5	12.967	0.00	37.03	V	50.00	53.98	3.98	AV
# 2 388.5	10.844	0.00	37.03	V	47.87	53.98	6.11	AV
2 388.0	10.365	0.00	37.03	V	47.40	53.98	6.58	AV

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

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+C.L-A.G+ATT+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBµV]	[dB]	[dB/m]	[H/V]	[dBµV/m]	[dBµV/m]	[dB]	
2 483.5	24.966	0.00	37.03	H	62.00	73.98	11.98	PK
# 2 484.0	12.530	0.00	37.03	H	49.56	53.98	4.42	AV
# 2 485.0	12.720	0.00	37.03	H	49.75	53.98	4.23	AV
2 485.5	13.580	0.00	37.03	H	50.61	53.98	3.37	AV
2 483.5	24.337	0.00	37.03	V	61.37	73.98	12.61	PK
# 2 484.0	12.165	0.00	37.03	V	49.20	53.98	4.79	AV
# 2 485.0	12.246	0.00	37.03	V	49.28	53.98	4.70	AV
2 485.5	13.168	0.00	37.03	V	50.20	53.98	3.78	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
Channel No.	01 Ch

Frequency	Measured Value	Duty Cycle Factor	※ A.F+C.L-A.G+ATT+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2 390.0	26.694	0.00	37.05	H	63.74	73.98	10.24	PK
# 2 389.5	13.220	0.00	37.05	H	50.27	53.98	3.71	AV
# 2 388.5	11.450	0.00	37.05	H	48.50	53.98	5.48	AV
2 388.0	12.078	0.00	37.05	H	49.13	53.98	4.85	AV
2 390.0	26.347	0.00	37.03	V	63.38	73.98	10.60	PK
# 2 389.5	12.766	0.00	37.03	V	49.80	53.98	4.18	AV
# 2 388.5	11.083	0.00	37.03	V	48.11	53.98	5.87	AV
2 388.0	11.641	0.00	37.03	V	48.67	53.98	5.31	AV

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

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

Frequency	Measured Value	Duty Cycle Factor	※ A.F+C.L-A.G+ATT+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2 483.5	25.229	0.00	37.03	H	62.26	73.98	11.72	PK
# 2 484.0	13.020	0.00	37.03	H	50.05	53.98	3.93	AV
# 2 485.0	12.600	0.00	37.03	H	49.63	53.98	4.35	AV
2 485.5	13.227	0.00	37.03	H	50.26	53.98	3.72	AV
2 483.5	24.880	0.00	37.03	V	61.91	73.98	12.07	PK
# 2 484.0	12.645	0.00	37.03	V	49.68	53.98	4.31	AV
# 2 485.0	12.234	0.00	37.03	V	49.26	53.98	4.72	AV
2 485.5	12.893	0.00	37.03	V	49.92	53.98	4.06	AV

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

Operation Mode:	802.11n (HT40)
Transfer Rate:	MCS 0
Operating Frequency	2 422 MHz
Channel No.	03 Ch

Frequency	Measured Value	Duty Cycle Factor	※ A.F+C.L-A.G+ATT+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2 390.0	24.607	0.00	37.05	H	61.66	73.98	12.32	PK
# 2 389.5	13.000	0.00	37.05	H	50.05	53.98	3.93	AV
# 2 388.5	12.710	0.00	37.05	H	49.76	53.98	4.22	AV
2 388.0	13.193	0.00	37.05	H	50.24	53.98	3.74	AV
2 390.0	24.213	0.00	37.05	V	61.26	73.98	12.72	PK
# 2 389.5	12.676	0.00	37.05	V	49.73	53.98	4.25	AV
# 2 388.5	12.325	0.00	37.05	V	49.38	53.98	4.61	AV
2 388.0	12.879	0.00	37.05	V	49.93	53.98	4.05	AV

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

Operation Mode:	802.11n (HT40)
Transfer Rate:	MCS 0
Operating Frequency	2 452 MHz
Channel No.	09 Ch

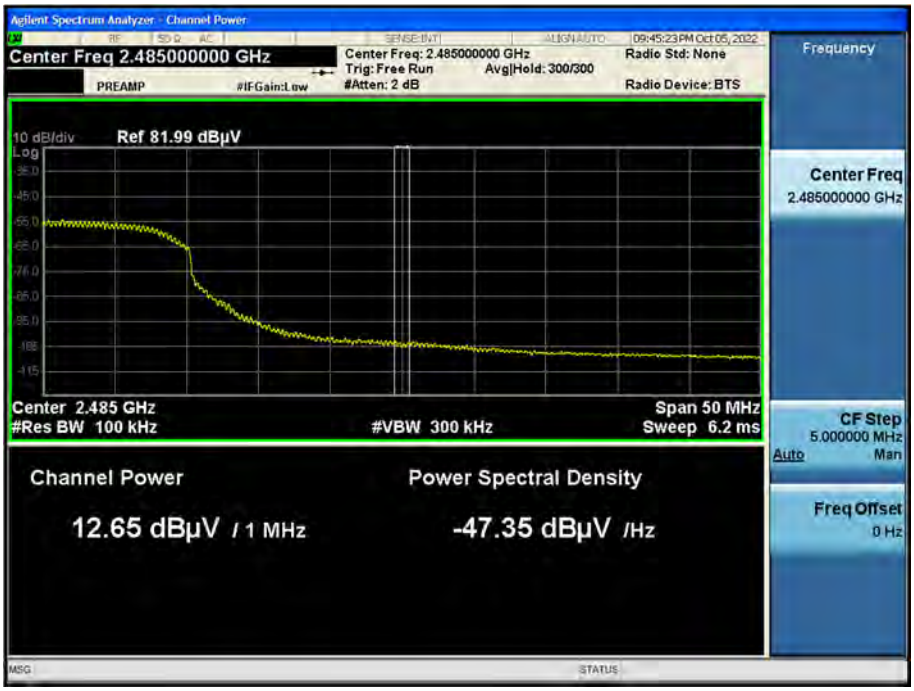
Frequency	Measured Value	Duty Cycle Factor	※ A.F+C.L-A.G+ATT+D.F	ANT. POL	Total	Limit	Margin	Measurement Type
[MHz]	[dBμV]	[dB]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	
2 483.5	25.765	0.00	37.03	H	62.80	73.98	11.19	PK
# 2 484.0	13.220	0.00	37.03	H	50.25	53.98	3.73	AV
# 2 485.0	12.650	0.00	37.03	H	49.68	53.98	4.30	AV
2 485.5	13.716	0.00	37.03	H	50.75	53.98	3.23	AV
2 483.5	25.436	0.00	37.03	V	62.47	73.98	11.51	PK
# 2 484.0	12.878	0.00	37.03	V	49.91	53.98	4.07	AV
# 2 485.0	12.224	0.00	37.03	V	49.25	53.98	4.73	AV
2 485.5	13.340	0.00	37.03	V	50.37	53.98	3.61	AV

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

▣ **Test Plots (Worst case : X-H)**

Radiated Restricted Band Edges plot – Average Result (802.11n (HT40), Ch.9(2 484 MHz))

Radiated Restricted Band Edges plot – Average Result (802.11n (HT40), Ch.9(2 485 MHz))



Radiated Restricted Band Edges plot – Average Result (802.11n (HT40), Ch.9(2 485.5 MHz))

Radiated Restricted Band Edges plot – Peak Result (802.11n (HT40), Ch.9(2 483.5 MHz))

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]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]
No Critical peaks found						

Note:

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

Frequency Range : Above 1 GHz

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

10. LIST OF TEST EQUIPMENT

Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Temperature Chamber	SU-642	ESPEC	0093014750	07/01/2023	Annual
Signal Analyzer	N9030A	Agilent	MY49432108	03/08/2023	Annual
Power Measurement Set	OSP 120	Rohde & Schwarz	101231	06/14/2023	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	E3632A	Agilent	KR75303243	04/25/2023	Annual
Attenuator(10 dB)(DC-26.5 GHz)	8493C	HP	07560	06/14/2023	Annual
Attenuator(10 dB)(DC-26.5 GHz)	8493C	HP	08285	06/21/2023	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

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
EM1000 / Controller	EM1000	Audix	060520	N/A	N/A
Turn Table	N/A	Audix	N/A	N/A	N/A
Amp & Filter Bank Switch Controller	FBSM-01B	TNM system	TM19050002	N/A	N/A
Loop Antenna	1513	Schwarzbeck	1513-333	03/17/2024	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	08/16/2024	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1300	01/18/2024	Biennial
Horn Antenna(15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170124	04/12/2023	Biennial
Spectrum Analyzer	FSV(10 Hz ~ 40 GHz)	Rohde & Schwarz	101055	05/16/2023	Annual
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
High Pass Filter(7 GHz ~ 18 GHz)	WHKX10-7150-8000-18000-50SS	Wainwright Instruments	1	03/11/2023	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/02/2022	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/11/2023	Annual
HPF(3~18GHz) + LNA1(1~18GHz)	FMSR-05B	TNM system	F6	01/19/2023	Annual
ATT(10dB) + LNA1(1~18GHz)	FMSR -05B	TNM system	None	01/19/2023	Annual
ATT(3dB) + LNA1(1~18GHz)	FMSR -05B	TNM system	None	01/19/2023	Annual
LNA1(1~18GHz)	FMSR -05B	TNM system	25540	01/19/2023	Annual
HPF(7~18GHz) + LNA2(6~18GHz)	FMSR -05B	TNM system	28550	01/19/2023	Annual
Thru(30MHz ~ 18GHz)	FMSR -05B	TNM system	None	01/19/2023	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.
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-2210-FI001-P