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TEST REPORT

FCC/IC DTS Test for LCWB-001
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2009-FI009

DATE OF ISSUE
15 September 2020

Tested by
Jeong Ho Kim

Technical Manager
Jong Seok Lee

Accredited by KOLAS, Republic of KOREA

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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 Model Name	RF Module LCWB-001
FCC ID IC	BEJ-LCWB001 2703N-LCWB001
Modulation type	CCK/DSSS/OFDM
FCC Classification	Digital Transmission System(DTS)
FCC Rule Part(s)	Part 15.247
IC Rule Part(s)	RSS-247 Issue 2 (February 2017) RSS-Gen Issue 5_Amendment 1 (March 2019)

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	September 15, 2020	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 / IC Rules under normal use and maintenance.

This laboratory is not accredited for the test results marked *.

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.(HCT Accreditation No.: KT197)

* The report shall not be reproduced except in full(only partly) without approval of the laboratory.

CONTENTS

1. EUT DESCRIPTION

Model	LCWB-001	
Additional Model	-	
EUT Type	RF Module	
Power Supply	DC 5V / 12V	
Frequency Range	2412 MHz - 2462 MHz	
Max. RF Output Power	Peak Power	802.11b: 22.84 dBm 802.11g: 23.36 dBm 802.11n(HT20): 22.31 dBm
	Average Power	802.11b: 16.89 dBm 802.11g: 15.54 dBm 802.11n(HT20): 14.46 dBm
Modulation Type	DSSS/CCK : 802.11b OFDM : 802.11g, 802.11n	
Number of Channels	11 Channels	
Antenna type	PCB pattern Antenna	
Antenna Peak Gain	1.5 dBi	
Date(s) of Tests	August 03, 2020 ~ September 15, 2020	
PMN (Product Marketing Number)	RF Module	
HVIN (Hardware Version Identification Number)	LCWB-001	
FVIN (Firmware Version Identification Number)	V1.0	
HMN (Host Marketing Name)	N/A	
EUT serial numbers	LCWB-001-H01, LCWB-001-H02	

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 purpse 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's, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

4. FACILITIES AND ACCREDITATIONS

FACILITIES

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

EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5. ANTENNA REQUIREMENTS

According to FCC 47 CFR § 15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

(1) The antennas of this E.U.T are permanently attached.

(2) The E.U.T Complies with the requirement of § 15.203

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.

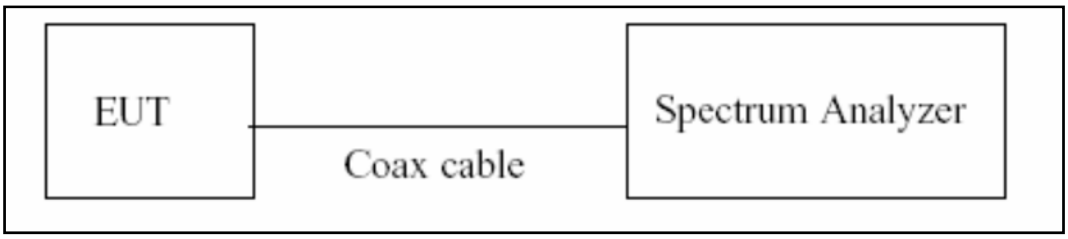
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

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 availble 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*.

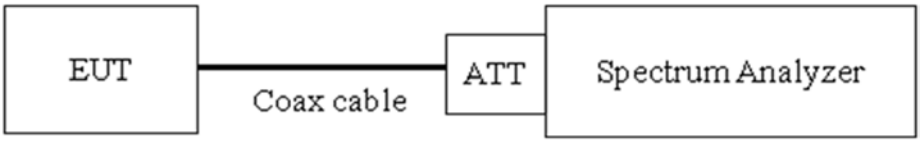
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

7.2. 6dB 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 IC)

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW ≒ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

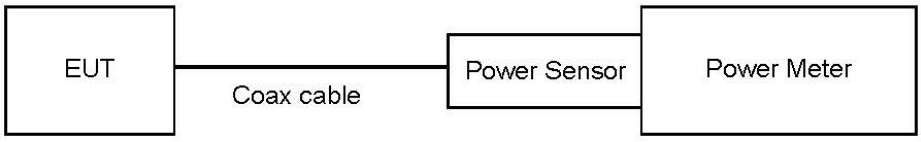
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

7.3. Output Power

Limit

The maximum permissible conducted output power is 1 Watt.

Test Configuration



Test Procedure

The transmitter output is connected to the Power Meter.

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

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

Sample Calculation

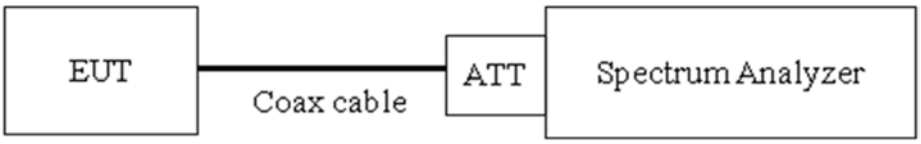
- Conducted Output Power(Peak) = Reading Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

7.4. Power Spectral Density

Limit

The transmitter power density average over 1-second interval shall not be greater than 8dBm in any 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 kHz ≤ RBW ≤ 100 kHz.
4) VBW ≥ 3 x RBW.
5) Sweep = auto couple
6) Detector = peak
7) Trace Mode = max hold
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum amplitude level within the RBW.
   If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Sample Calculation

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

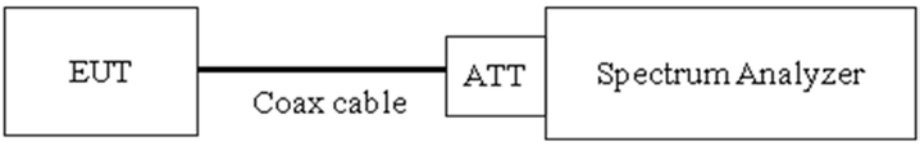
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

Limit

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

[Conducted > 20 dBc]

Test Configuration



Test Procedure

The transmitter output is connected to the spectrum analyzer.

(Procedure 11.11 in ANSI 63.10-2013)

1) RBW = 100 kHz
2) VBW ≥ 3 x RBW
3) Set span to encompass the spectrum to be examined
4) Detector = Peak
5) Trace Mode = max hold
6) Sweep time = auto couple
7) Ensure that the number of measurement points ≥ 2 x Span/RBW
8) Allow trace to fully stabilize.
9) Use peak marker function to determine the maximum amplitude level.

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

Factors for frequency

Freq(MHz)	Factor(dB)
30	10.09
100	10.12
200	10.17
300	10.22
400	10.25
500	10.26
600	10.26
700	10.28
800	10.29
900	10.31
1000	10.32
2000	10.46
2400	10.50
2480	10.52
2500	10.52
3000	10.57
4000	10.65
5000	10.76
6000	10.78
7000	10.85
8000	10.90
9000	10.96
10000	11.02
11000	11.07
12000	11.15
13000	11.24
14000	11.21
15000	11.26
16000	11.27
17000	11.30
18000	11.35
19000	11.37
20000	11.41
21000	11.53
22000	11.60
23000	11.60
24000	11.64
25000	11.73
26000	11.74

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

2. Factor = Attenuator loss(10dB) + Cable loss

7.6. Radiated Test

Limit

FCC

Frequency (MHz)	Field Strength (uV/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

IC

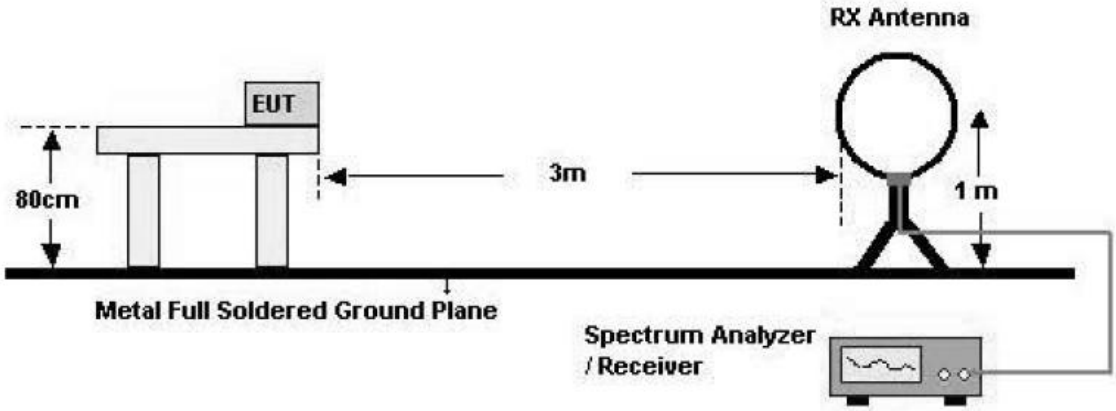
Frequency (MHz)	Field Strength (uA/m)	Measurement Distance (m)
0.009 – 0.490	6.37/F(kHz)	300
0.490 – 1.705	63.7/F(kHz)	30
1.705 – 30	0.08	30

FCC&IC

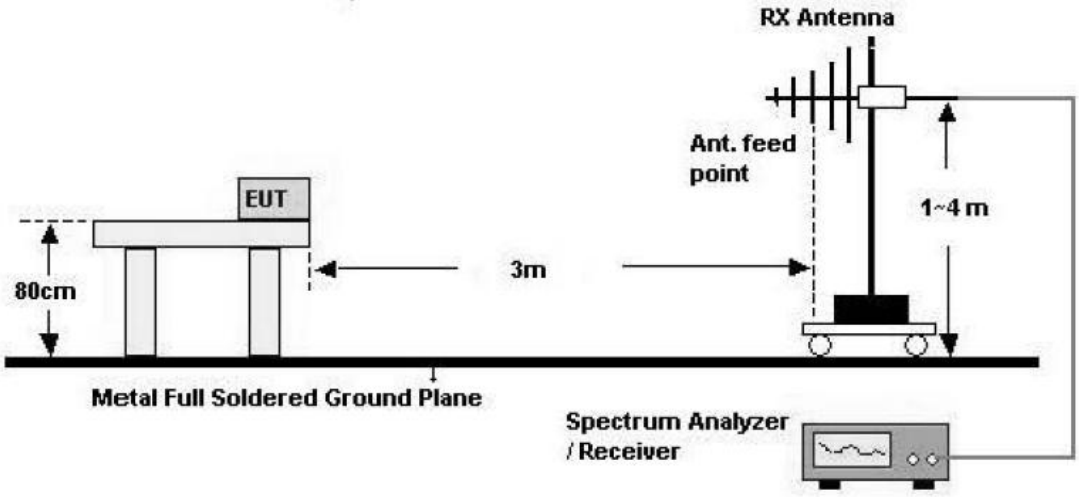
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

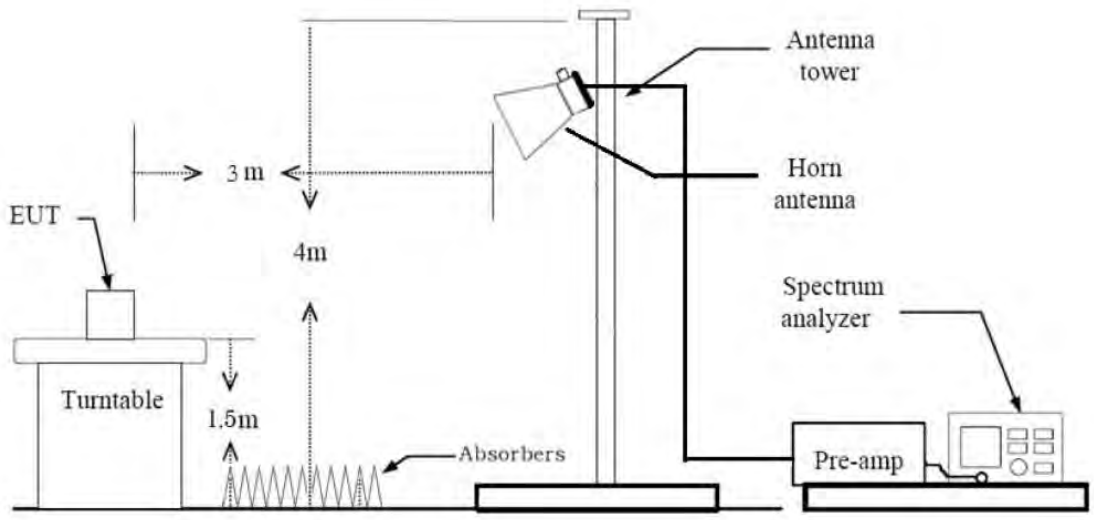
Below 30 MHz



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) = 40log(3 m/300 m) = - 80 dB
   Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = 40log(3 m/30 m) = - 40 dB
   Measurement Distance : 3 m
8. Spectrum Setting
   - Frequency Range = 9 kHz ~ 30 MHz
   - Detector = Peak
   - Trace = Maxhold
   - RBW = 9 kHz
   - VBW ≥ 3 x RBW
9. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered

that's already beyond the background noise floor.

KDB 414788 OFS and Chamber Correlation Justification

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

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

Test Procedure of Radiated spurious emissions(Below 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 ≥ 3 x RBW
   (2) Measurement Type(Quasi-peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Quasi-Peak
      - RBW = 120 kHz

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

Test Procedure of Radiated spurious emissions (Above 1 GHz)

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 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 DC Power supply.

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

(1) Measurement Type(Peak):

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

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

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

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

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

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

10. Distance extrapolation factor = 20log (test distance / specific distance) (dB)

11. Total(Measurement Type : Peak)

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

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

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

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 DC Power supply..
8. Spectrum Setting
   (1) Measurement Type(Peak):
      - Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
      - Detector = Peak
      - Trace = Maxhold
      - RBW = 1 MHz
      - VBW ≥ 3 x RBW
   (2) Measurement Type(Average): Duty cycle ≥ 98%,
      - Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
      - Detector = RMS
      - Averaging type = power (*i.e.*, RMS)
      - RBW = 1 MHz
      - VBW ≥ 3 x RBW
      - Sweep time = auto.
      - Trace mode = average (at least 100 traces).
   (3) Measurement Type(Average): Duty cycle < 98%, duty cycle variations are less than ±2%

- Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW ≥ 3 x RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).
- Correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle.
- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

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

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

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

7.7. AC Power line Conducted Emissions

Limit

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

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

[a]Decreases with the logarithm of the frequency.

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

Test Configuration

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

Test Procedure

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

Sample Calculation

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

7.8. Receiver Spurious Emissions

Limit

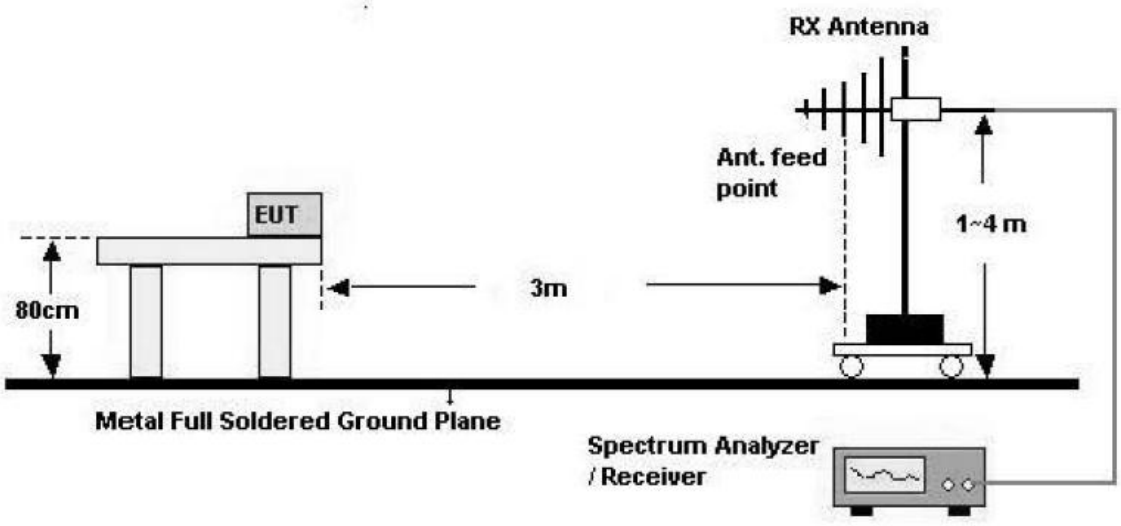
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

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

Test Configuration

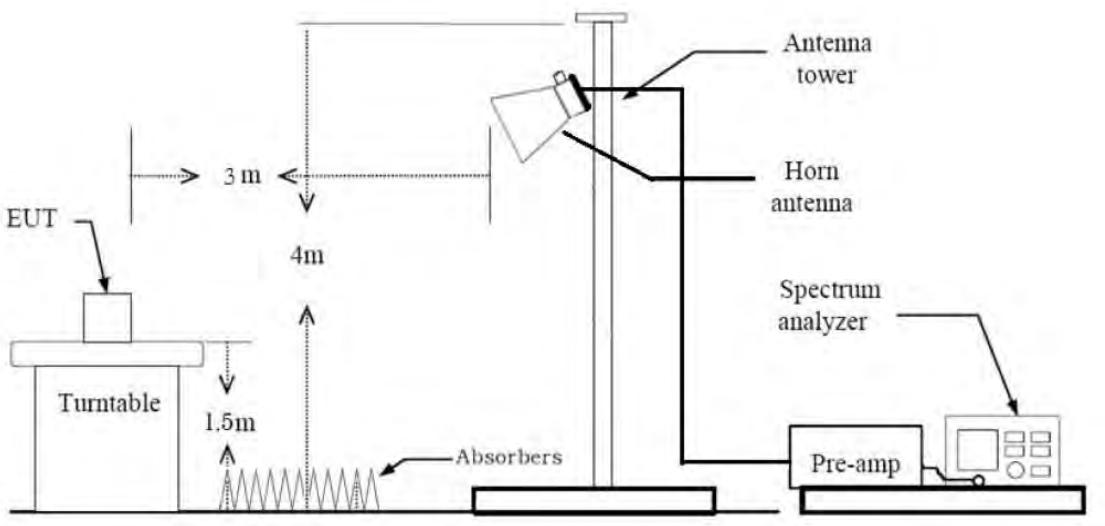
30 MHz - 1 GHz



Test Procedure of Receiver Spurious Emissions (Below 1GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 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 ≥ 3 x RBW
   (2) Measurement Type(Quasi-peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Quasi-Peak
      - RBW = 120 kHz
7. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)

Above 1 GHz



Test Procedure of Radiated spurious emissions (Above 1 GHz)

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 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 DC Power supply.
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 = Average
- Trace = RMS
- RBW = 1 MHz
- VBW ≥ 3 x RBW

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

7.9. Worst case configuration and mode

Radiated & Conducted Worst case Voltage 5[V]

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 + Shark Antenna
   - Worstcase : Stand alone + Shark Antenna
3. EUT Axis
   - Radiated Spurious Emissions : Z
   - Radiated Restricted Band Edge : X
4. Duty cycle factor applies only 802.11g/n (Duty cycle < 98%).
5. All datarate of operation were investigated and the worst case datarate results are reported
   - 802.11b : 1Mbps
   - 802.11g : 6Mbps
   - 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. All modes of operation were investigated and the worst case configuration results are reported.
   - Mode : Stand alone + Notebook
   - Worstcase : Stand alone + Notebook

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

IC Part

Test Description	IC 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		N/A (Note1)
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

9. TEST RESULT

9.1 DUTY CYCLE

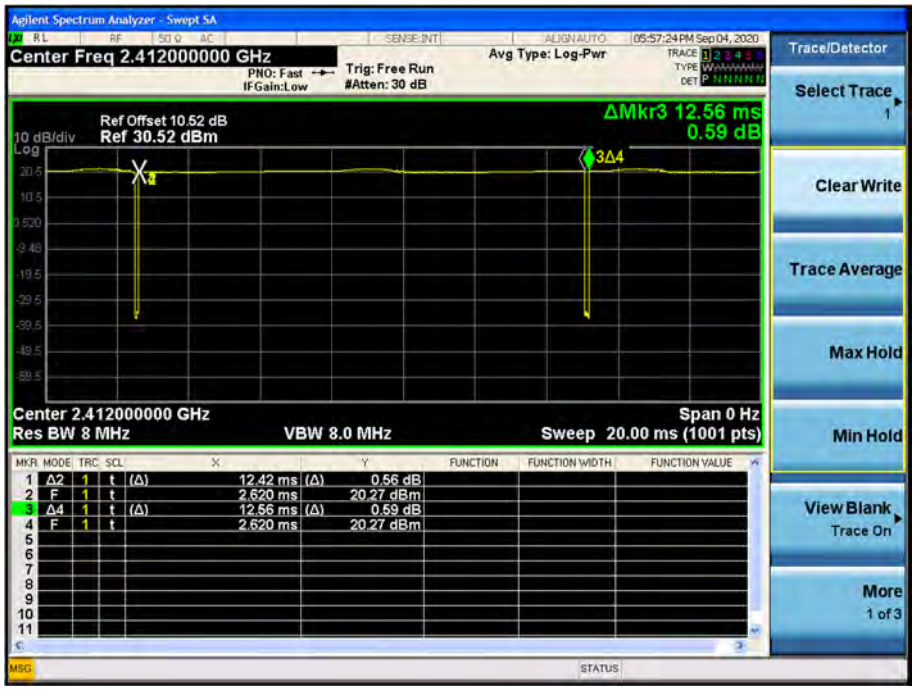
Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11b	1	12.420	12.560	0.989	0.049
	2	6.300	6.435	0.979	0.092
	5.5	2.420	2.550	0.949	0.227
	11	1.305	1.434	0.910	0.409
802.11g	6	2.065	2.195	0.941	0.265
	9	1.383	1.512	0.915	0.387
	12	1.044	1.174	0.889	0.510
	18	0.704	0.834	0.844	0.738
	24	0.532	0.662	0.803	0.951
	36	0.364	0.494	0.737	1.326
	48	0.276	0.406	0.680	1.676
	54	0.248	0.378	0.655	1.835
802.11n (HT20)	6.5 (MCS0)	1.920	2.050	0.937	0.285
	13 (MCS1)	0.980	1.110	0.883	0.541
	19.5 (MCS2)	0.664	0.794	0.836	0.779
	26 (MCS3)	0.508	0.638	0.796	0.993
	39 (MCS4)	0.352	0.482	0.730	1.365
	52 (MCS5)	0.272	0.402	0.676	1.701
	58.5 (MCS6)	0.247	0.378	0.655	1.840
	65 (MCS7)	0.228	0.358	0.636	1.964

Note:

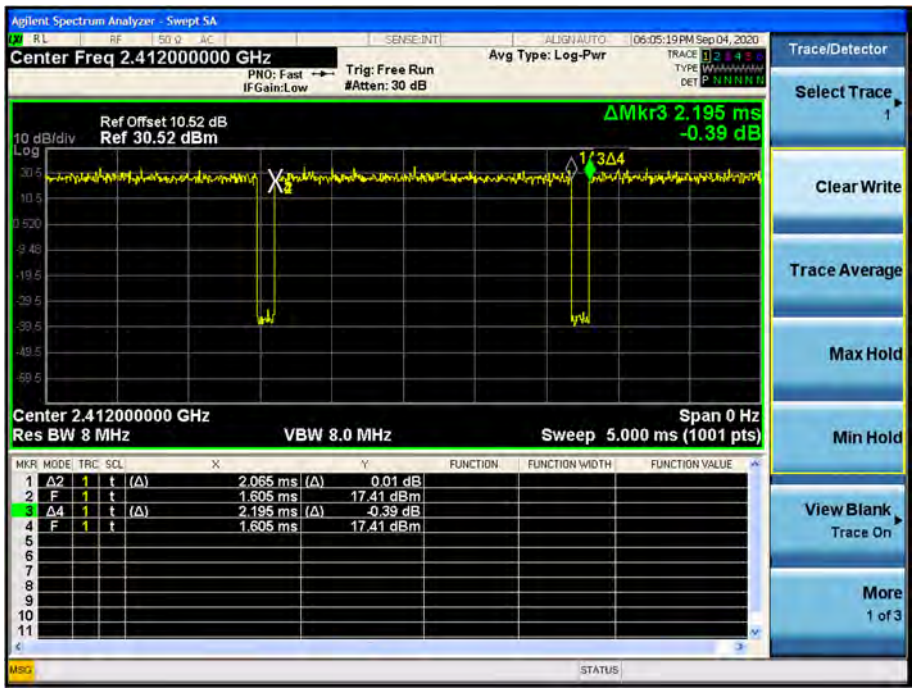
1. Duty Cycle Factor = 10Xlog(1/Duty Cycle). where, Duty Cycle = T_{on} / T_{total}
2. Test was performed with continuous Tx.

▣ Test Plots

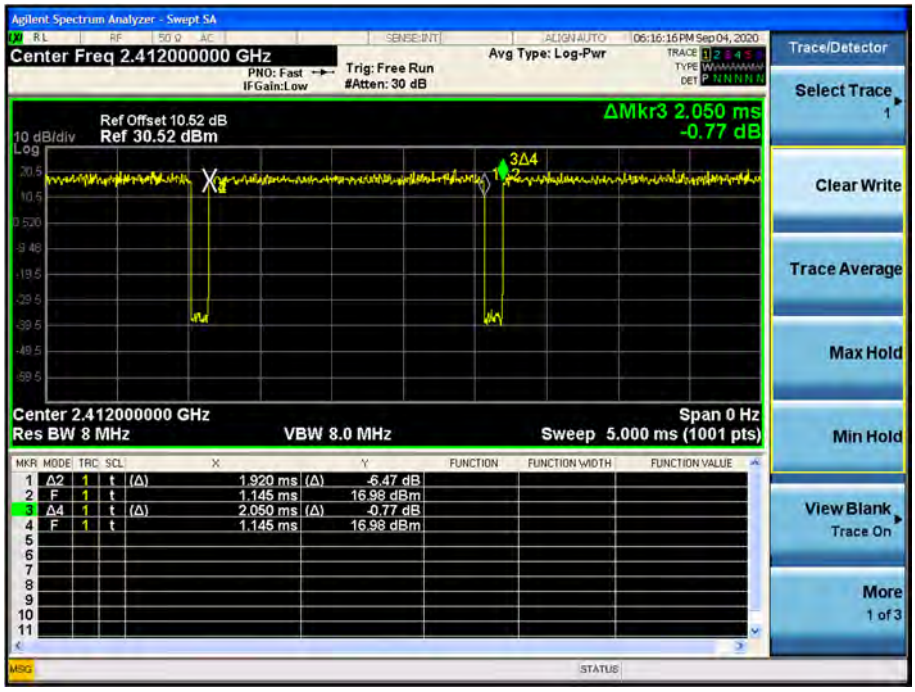
Duty cycle plot (802.11b(1Mbps))



Duty cycle plot (802.11g(6Mbps))



Duty cycle plot (802.11n(MCS0))



Note:

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

9.2 6dB BANDWIDTH & 99 % BANDWIDTH

FCC

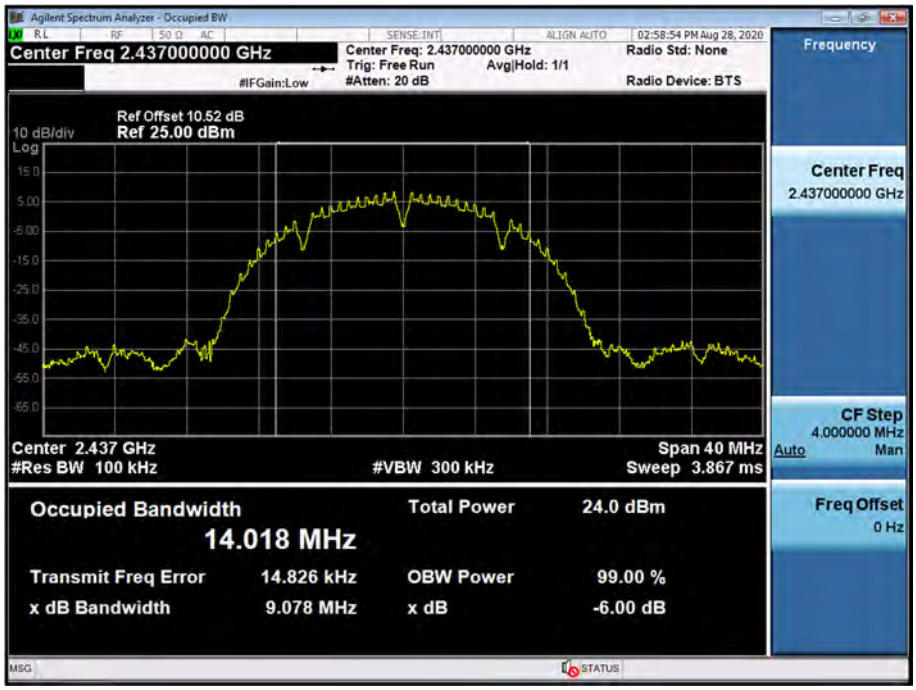
802.11b Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	9.083	> 0.5
2437	6	9.078	> 0.5
2462	11	9.099	> 0.5

802.11g Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	16.36	> 0.5
2437	6	16.35	> 0.5
2462	11	16.36	> 0.5

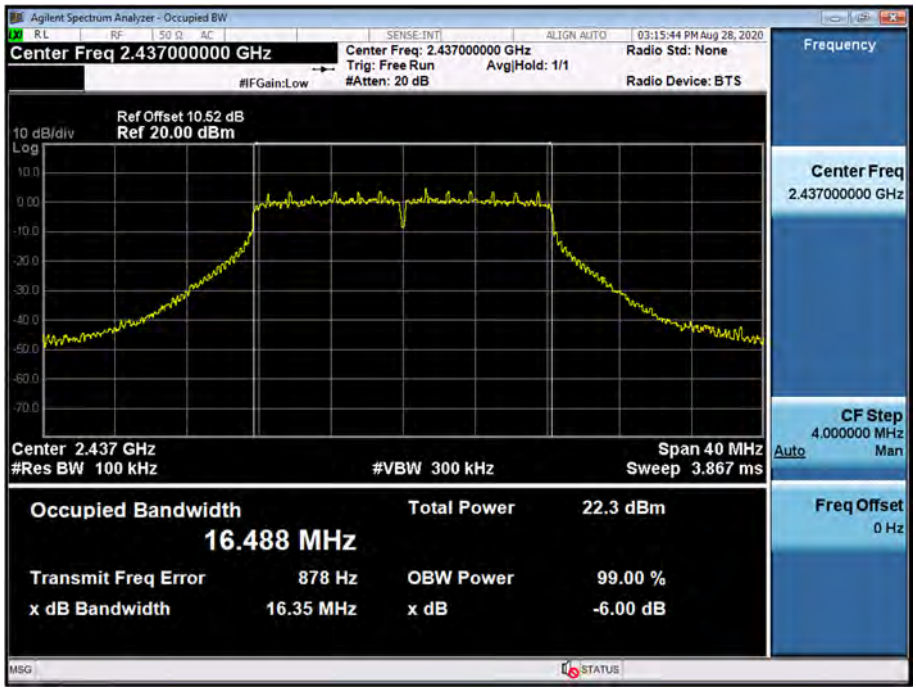
802.11n(HT20) Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.54	> 0.5
2437	6	17.59	> 0.5
2462	11	17.39	> 0.5

▣ Test Plots

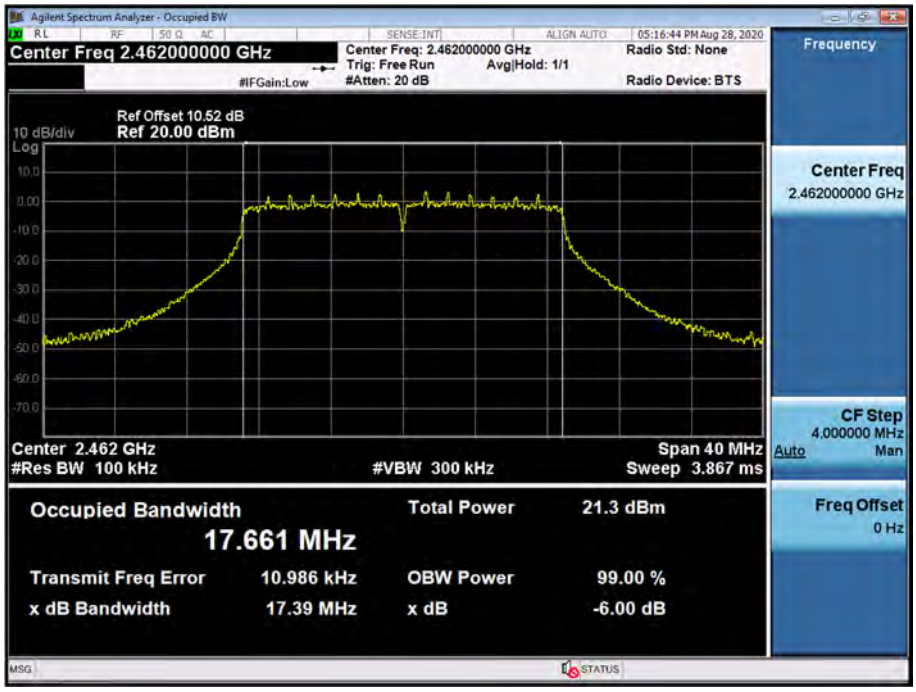
6dB Bandwidth plot (802.11b-CH 6)



6dB Bandwidth plot (802.11g-CH 6)



6dB 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.

99% Bandwidth Measurements(IC)

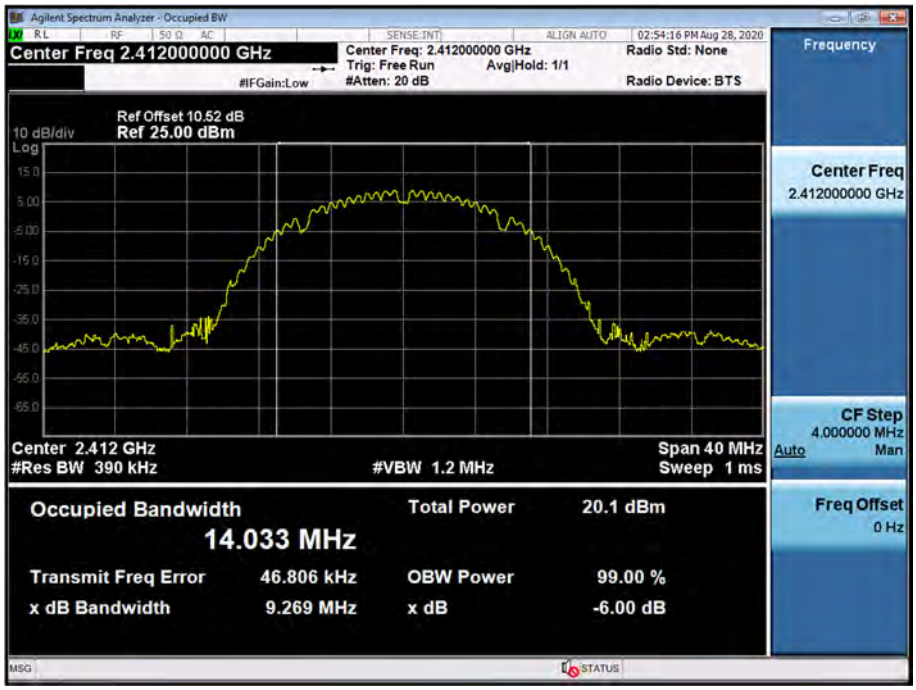
802.11b Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	14.033	N/A
2437	6	14.028	N/A
2462	11	14.026	N/A

802.11g Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	17.330	N/A
2437	6	17.168	N/A
2462	11	17.232	N/A

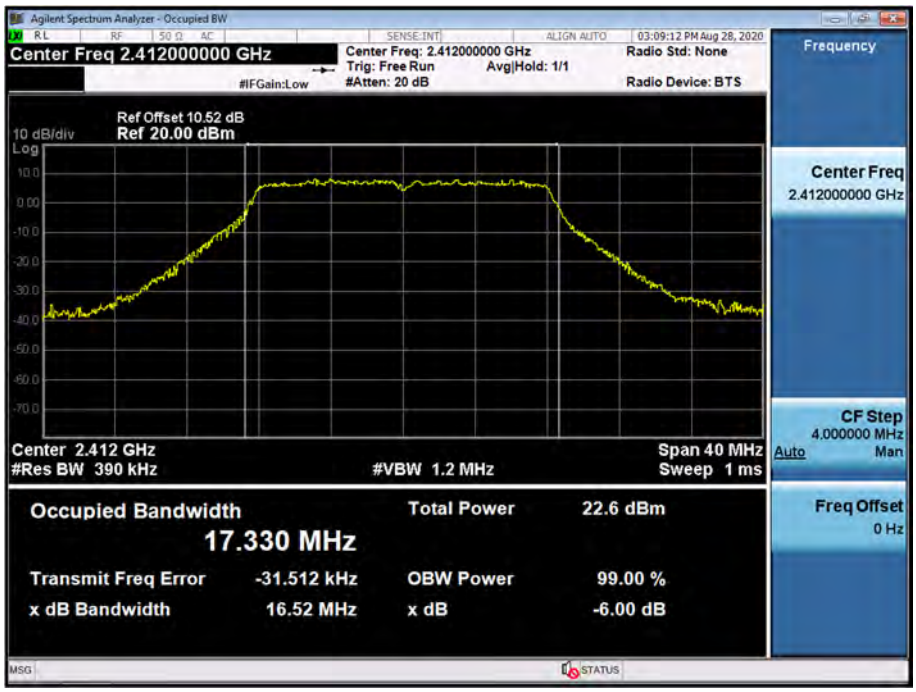
802.11n(HT20) Mode		OBW Bandwidth [MHz]	Limit [MHz]
Frequency [MHz]	Channel No.		
2412	1	18.263	N/A
2437	6	18.299	N/A
2462	11	18.359	N/A

▣ Test Plots

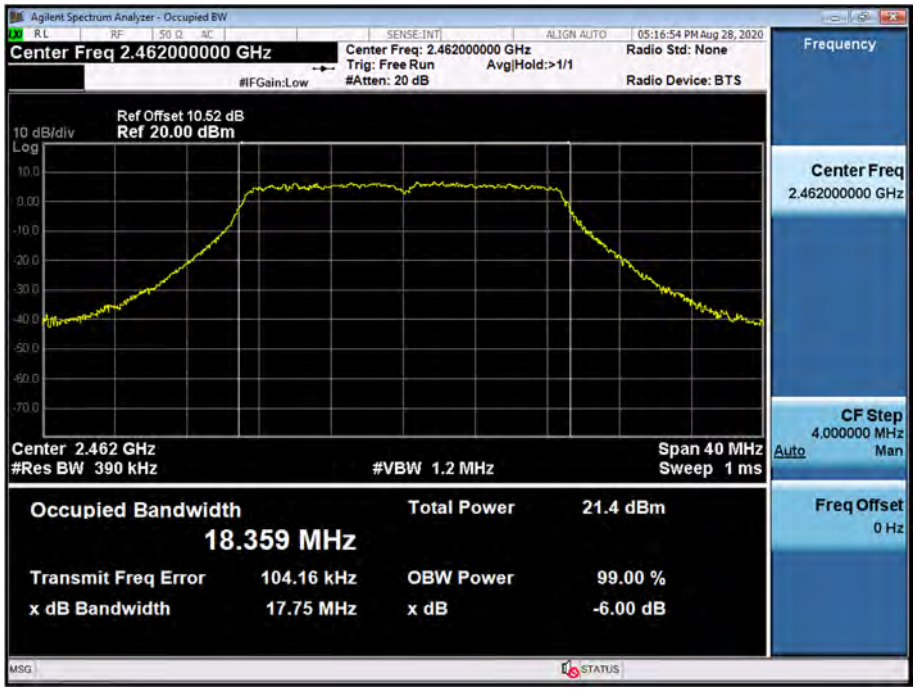
99% Bandwidth plot (802.11b-CH 1)



99% Bandwidth plot (802.11g-CH 1)



99% Bandwidth plot (802.11n_HT20-CH 11)



Note:

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

9.3 OUTPUT POWER

Peak Power

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

So, 10.52 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	19.54	30
		2	19.57	30
		5.5	21.27	30
		11	22.84	30
2437	6	1	19.23	30
		2	19.69	30
		5.5	21.02	30
		11	22.14	30
2462	11	1	19.46	30
		2	19.70	30
		5.5	21.23	30
		11	22.81	30

802.11g Mode		Rate (Mbps)	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	6	23.24	30
		9	23.30	30
		12	23.09	30
		18	22.71	30
		24	23.36	30
		36	23.36	30
		48	23.27	30
		54	23.12	30
2437	6	6	23.15	30
		9	23.10	30
		12	22.60	30
		18	22.58	30
		24	22.94	30
		36	23.07	30
		48	22.93	30
		54	22.55	30
2462	11	6	23.12	30
		9	23.13	30
		12	22.93	30
		18	22.60	30
		24	23.23	30
		36	22.96	30
		48	22.95	30
		54	22.96	30

802.11n(HT20) Mode		MCS Index	Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.			
2412	1	0	22.26	30
		1	21.80	30
		2	21.87	30
		3	22.22	30
		4	22.11	30
		5	22.13	30
		6	21.89	30
		7	22.01	30
2437	6	0	22.16	30
		1	22.05	30
		2	21.65	30
		3	22.13	30
		4	22.18	30
		5	21.89	30
		6	21.70	30
		7	21.89	30
2462	11	0	22.03	30
		1	21.95	30
		2	21.32	30
		3	22.31	30
		4	22.09	30
		5	21.54	30
		6	21.93	30
		7	21.83	30

Average Power

1. Power Meter offset = Attenuator loss + Cable loss
2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.
   So, 10.52 dB is offset for 2.4 GHz Band.

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	16.81	0.049	16.86	30
		2	16.80	0.092	16.89	30
		5.5	16.53	0.227	16.76	30
		11	16.40	0.409	16.81	30
2437	6	1	16.70	0.049	16.75	30
		2	16.65	0.092	16.74	30
		5.5	16.38	0.227	16.61	30
		11	16.28	0.409	16.69	30
2462	11	1	16.72	0.049	16.77	30
		2	16.65	0.092	16.74	30
		5.5	16.48	0.227	16.70	30
		11	16.35	0.409	16.76	30

802.11g Mode		Rate (Mbps)	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	6	15.11	0.265	15.37	30
		9	15.03	0.387	15.41	30
		12	14.95	0.510	15.46	30
		18	14.74	0.738	15.48	30
		24	14.58	0.951	15.54	30
		36	14.12	1.326	15.45	30
		48	13.71	1.676	15.39	30
		54	13.67	1.835	15.51	30
2437	6	6	14.95	0.265	15.22	30
		9	14.86	0.387	15.24	30
		12	14.78	0.510	15.29	30
		18	14.48	0.738	15.22	30
		24	14.19	0.951	15.14	30
		36	13.81	1.326	15.14	30
		48	13.26	1.676	14.93	30
		54	13.10	1.835	14.93	30
2462	11	6	14.99	0.265	15.25	30
		9	14.89	0.387	15.27	30
		12	14.56	0.510	15.07	30
		18	14.61	0.738	15.35	30
		24	14.18	0.951	15.13	30
		36	13.95	1.326	15.27	30
		48	13.42	1.676	15.10	30
		54	13.29	1.835	15.12	30

802.11n(HT20) Mode		MCS Index	Measured Power (dBm)	Duty Cycle Factor	Measured Power(dBm) + Duty Cycle Factor	Limit (dBm)
Frequency [MHz]	Channel No.					
2412	1	0	14.09	0.285	14.37	30
		1	13.85	0.541	14.39	30
		2	13.59	0.779	14.37	30
		3	13.22	0.993	14.22	30
		4	13.10	1.365	14.46	30
		5	12.51	1.701	14.21	30
		6	12.35	1.840	14.19	30
		7	12.30	1.964	14.27	30
2437	6	0	14.04	0.285	14.33	30
		1	13.84	0.541	14.39	30
		2	13.43	0.779	14.21	30
		3	13.22	0.993	14.21	30
		4	12.88	1.365	14.24	30
		5	12.41	1.701	14.11	30
		6	12.11	1.840	13.95	30
		7	12.19	1.964	14.16	30
2462	11	0	13.93	0.285	14.21	30
		1	13.69	0.541	14.23	30
		2	12.98	0.779	13.76	30
		3	13.38	0.993	14.37	30
		4	12.83	1.365	14.19	30
		5	12.53	1.701	14.23	30
		6	12.38	1.840	14.22	30
		7	12.44	1.964	14.40	30

9.4 POWER SPECTRAL DENSITY

Mode	Frequency (MHz)	Channel No.	Test Result	
			Measured PSD (dBm)	Limit (dBm)
802.11b	2412	1	-1.152	8
	2437	6	-3.479	
	2462	11	-5.790	
802.11g	2412	1	-10.104	
	2437	6	-9.915	
	2462	11	-10.737	
802.11n(HT20)	2412	1	-10.034	
	2437	6	-10.573	
	2462	11	-11.229	

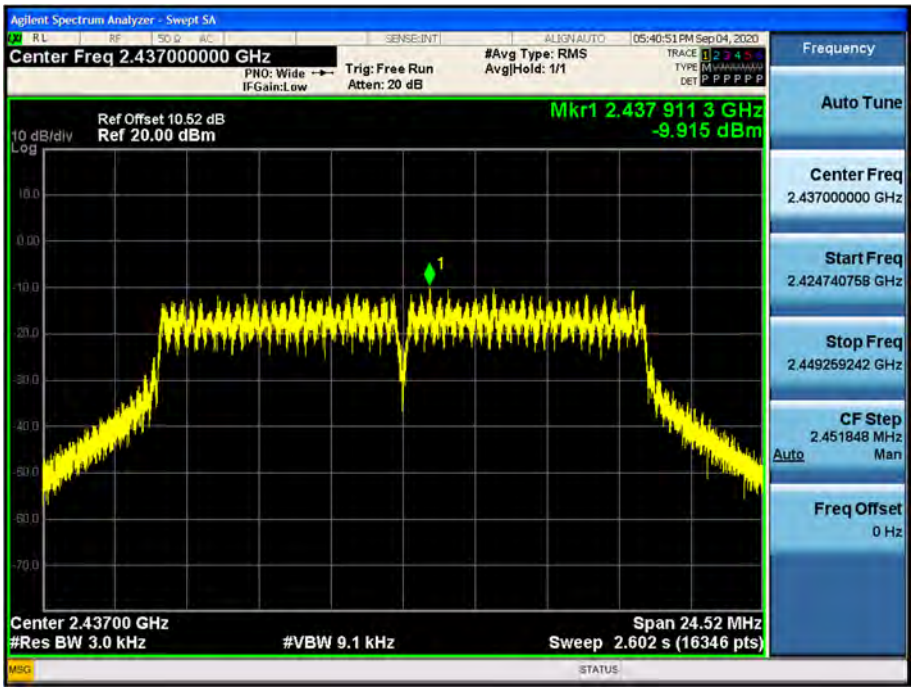
Note :

1. Spectrum reading values are not plot data.
   The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss(20 dB) + Cable loss(1ea)
3. 10.52 dB is offset for 2.4 GHz Band.

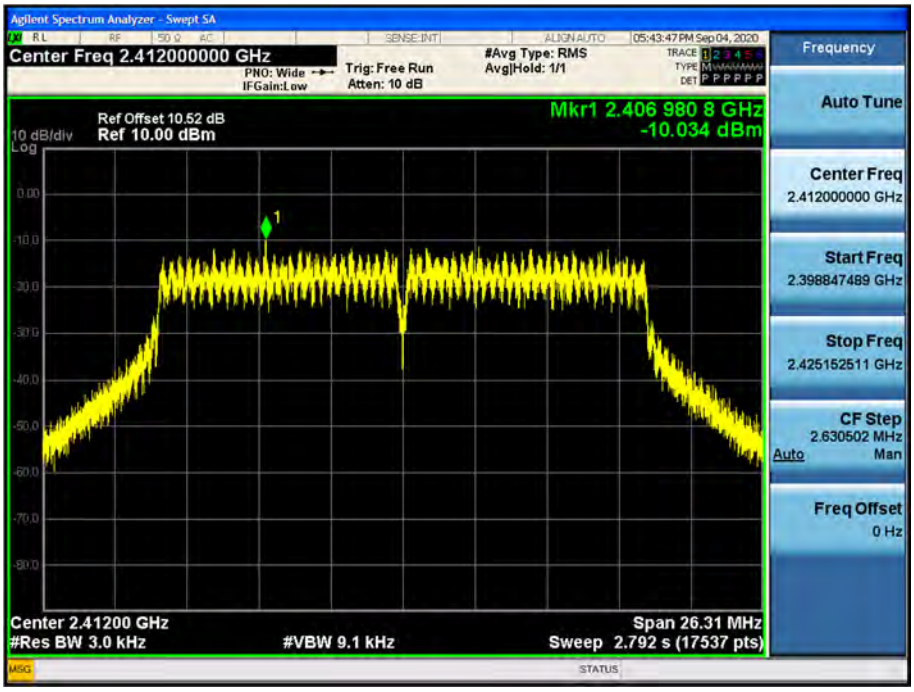
▣ Test Plots

Power Spectral Density (802.11b-CH 1)

Power Spectral Density (802.11g-CH 1)



Power Spectral Density (802.11n_HT20 -CH 6)



Note :

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

9.5 BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

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

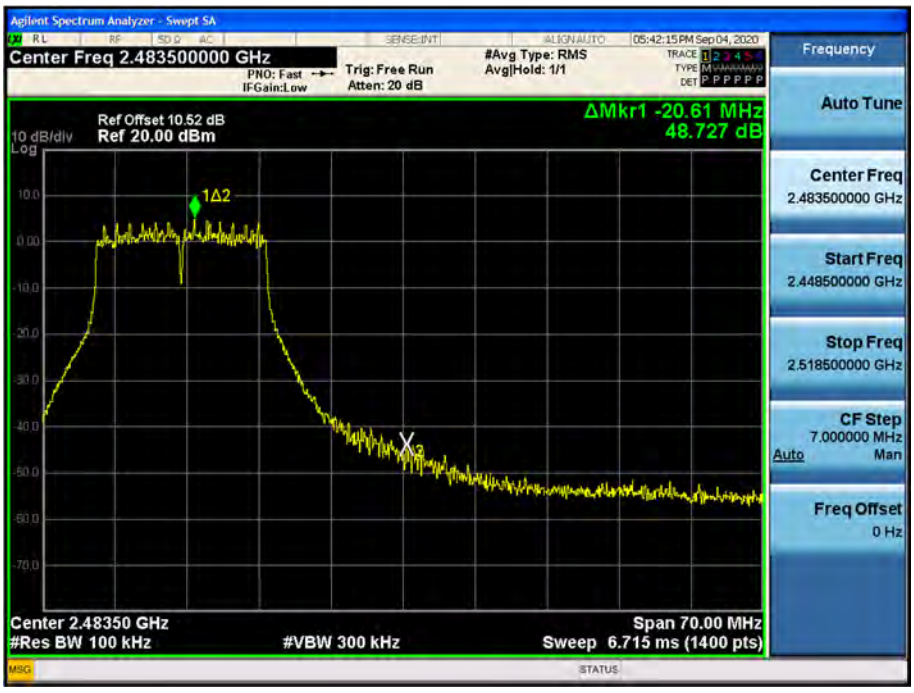
▣ Test Plots(BandEdge)

Band Edge (802.11b-CH1)

Band Edge (802.11b-CH11)

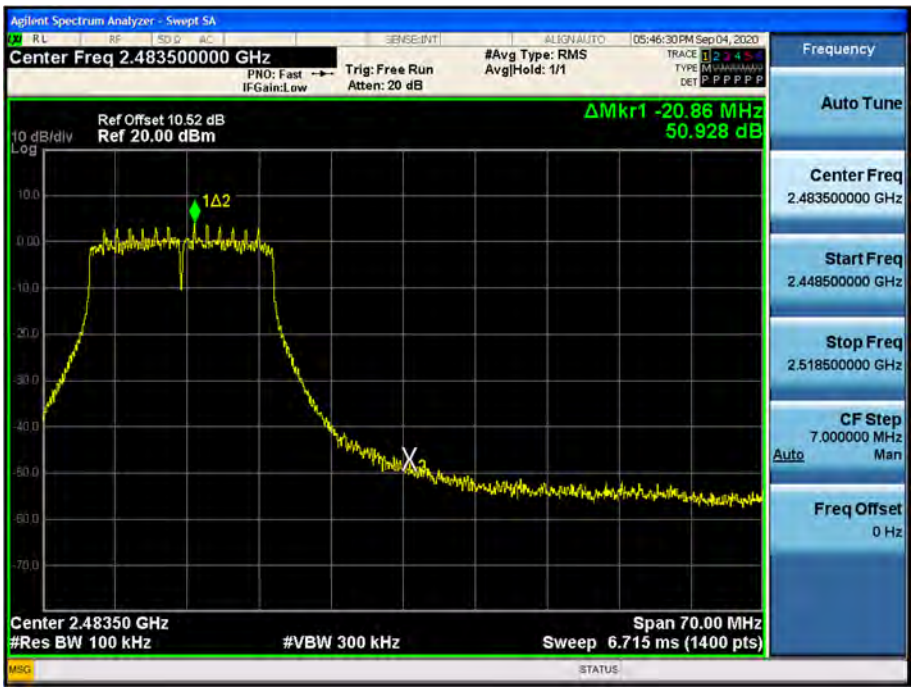
Band Edge (802.11g-CH1)

Band Edge (802.11g-CH11)



Band Edge (802.11n_HT20 -CH1)

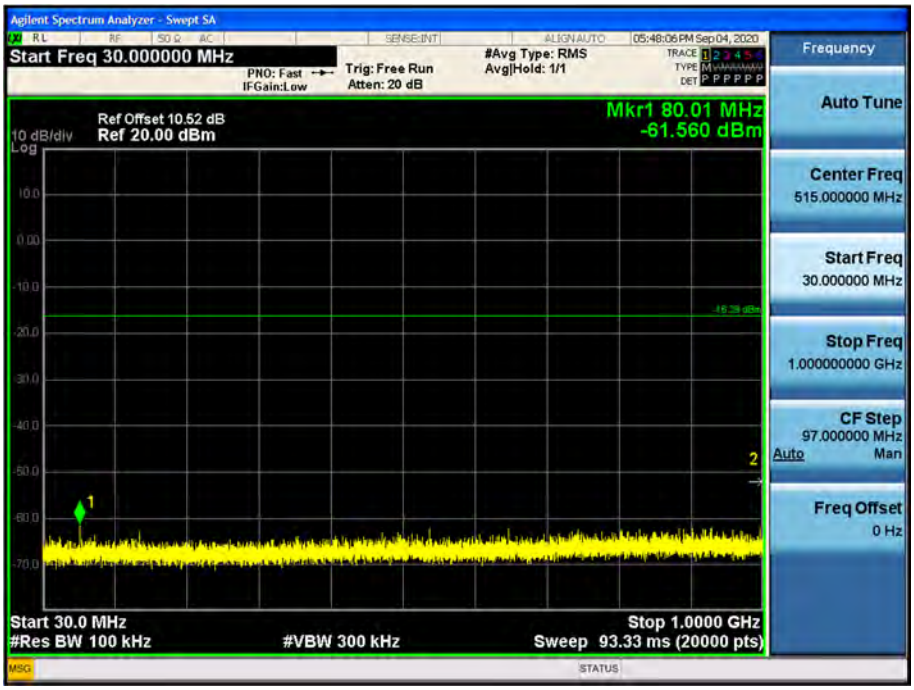
Band Edge (802.11n_HT20 -CH11)



▣ Test Plots(Conducted Spurious Emission)

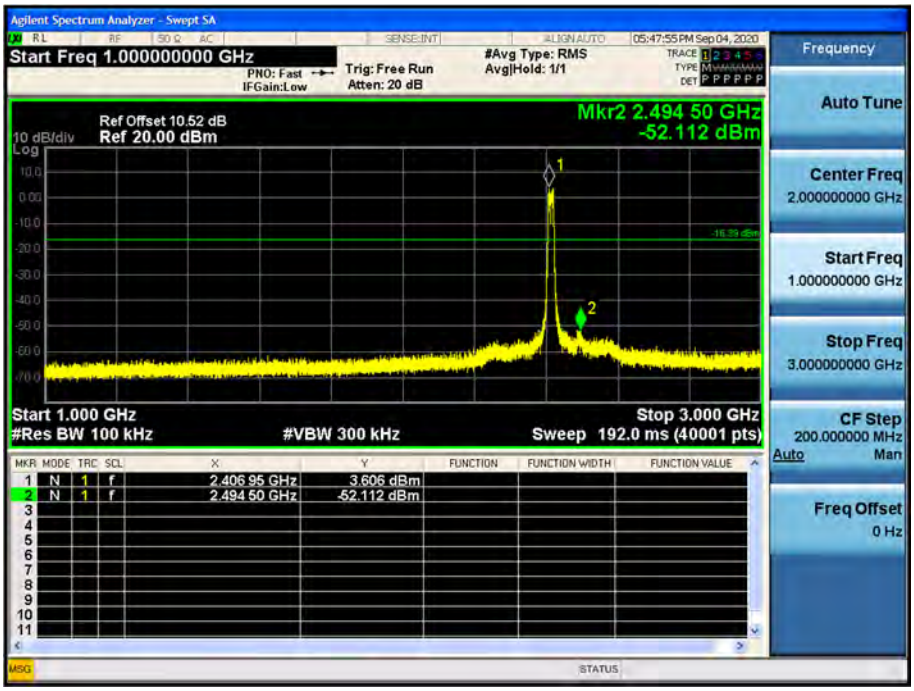
30 MHz ~ 1 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



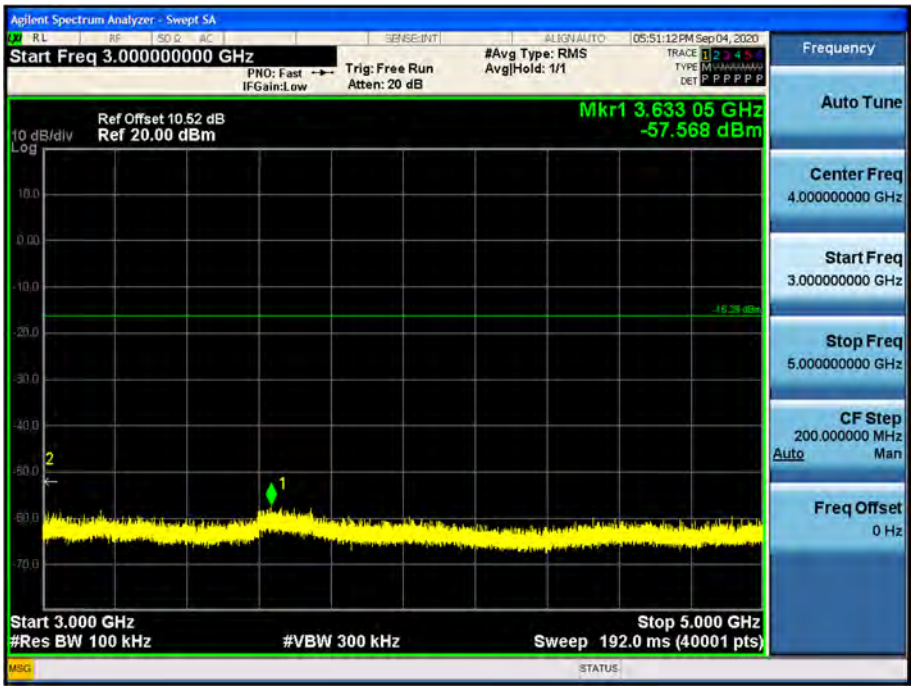
1 GHz ~ 3 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



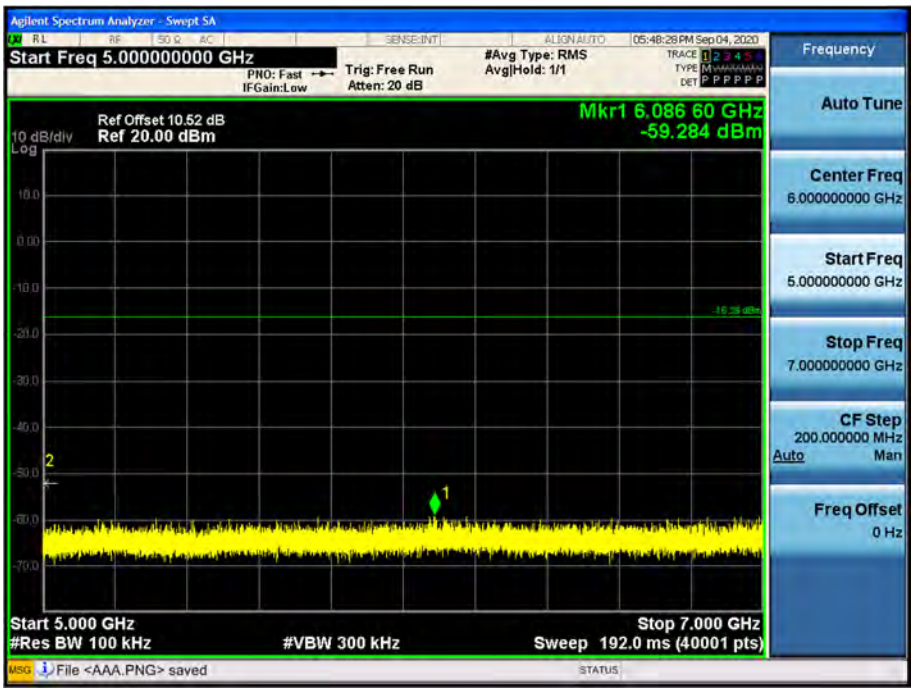
3 GHz ~ 5 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



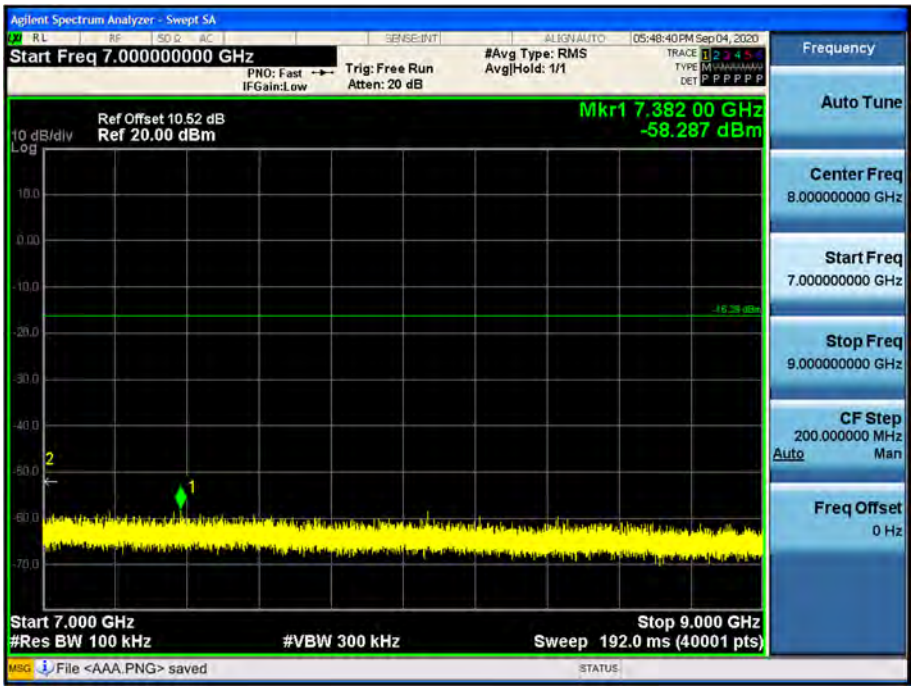
5 GHz ~ 7 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



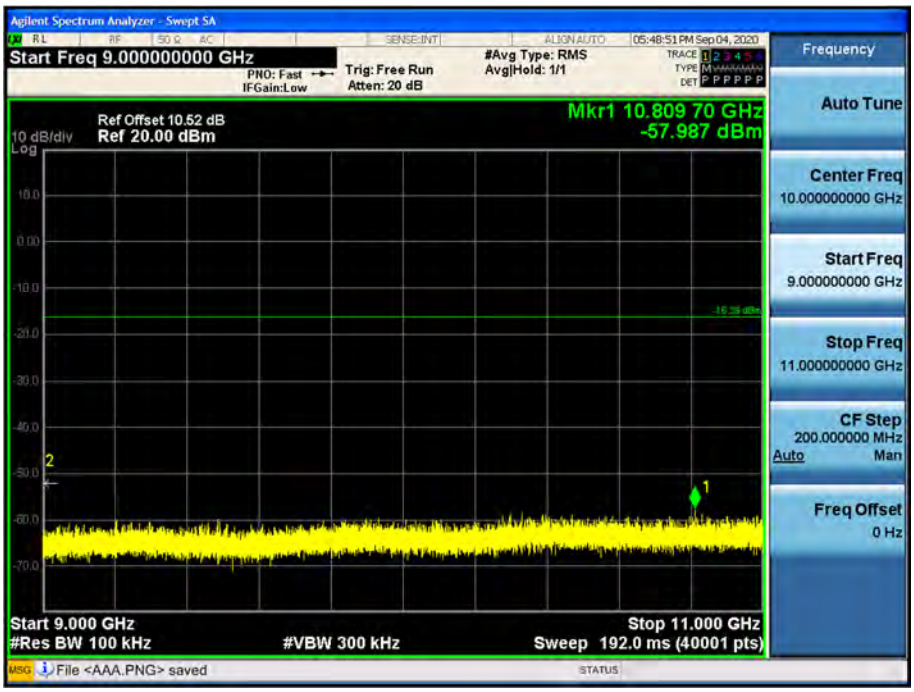
7 GHz ~ 9 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



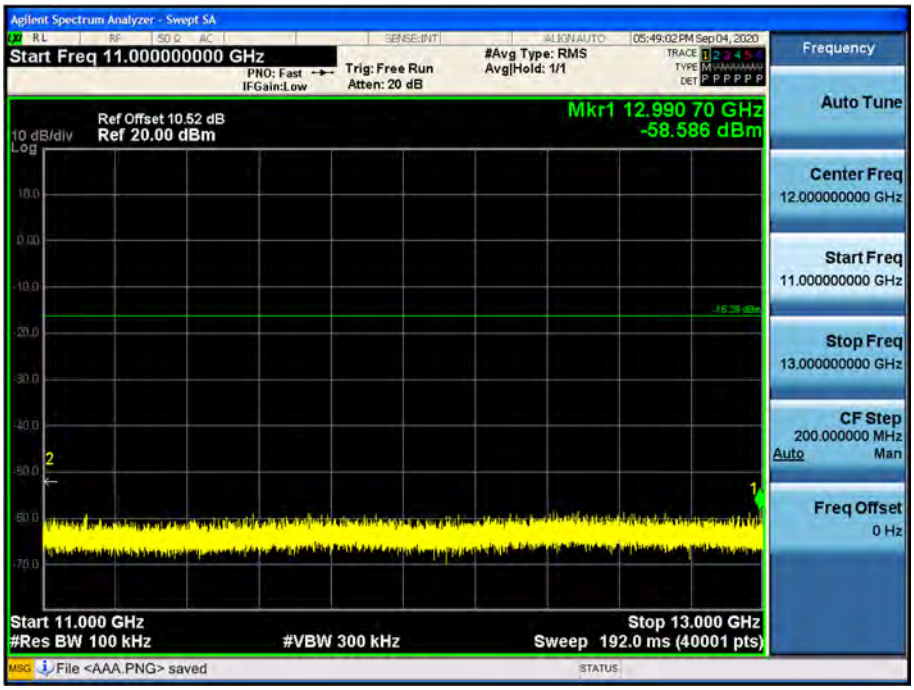
9 GHz ~ 11 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



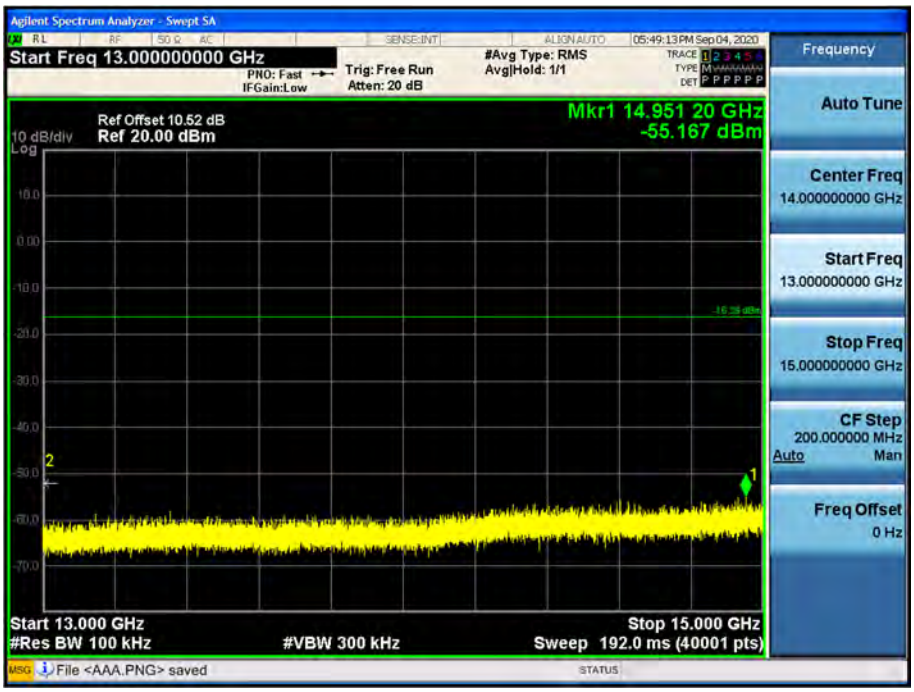
11 GHz ~ 13 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



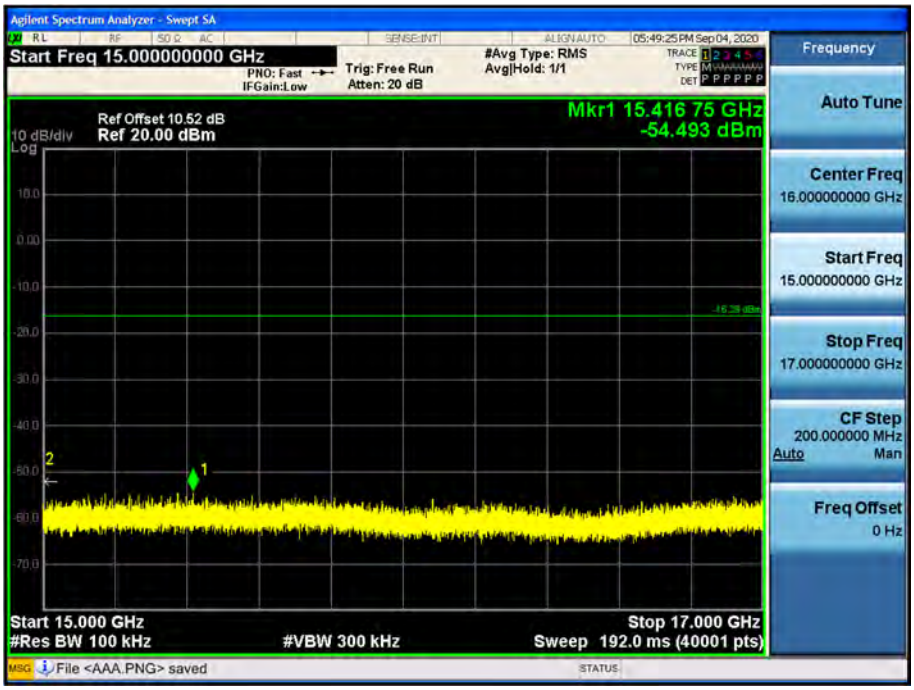
13 GHz ~ 15 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



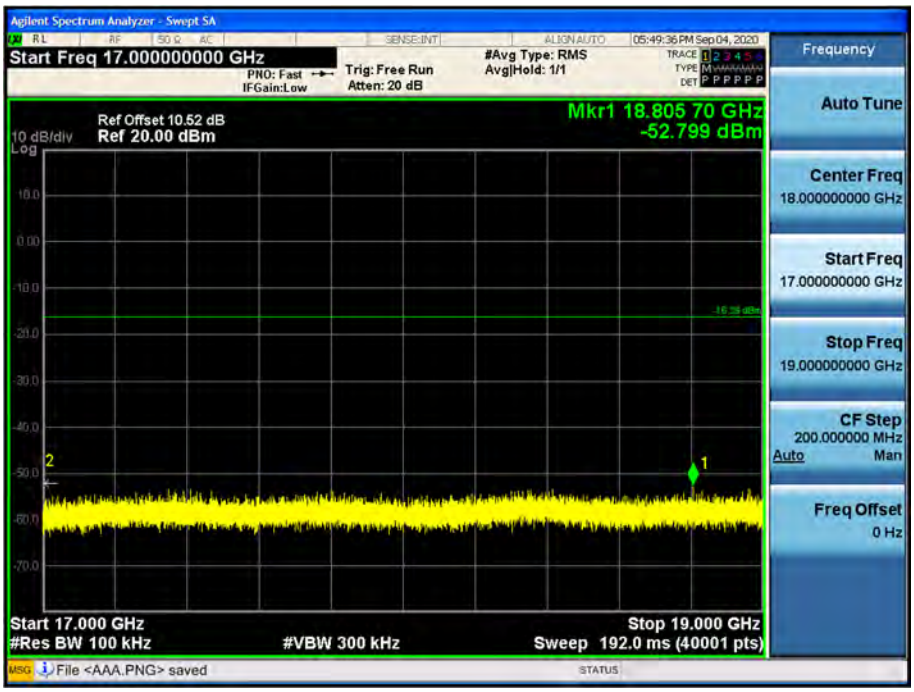
15 GHz ~ 17 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



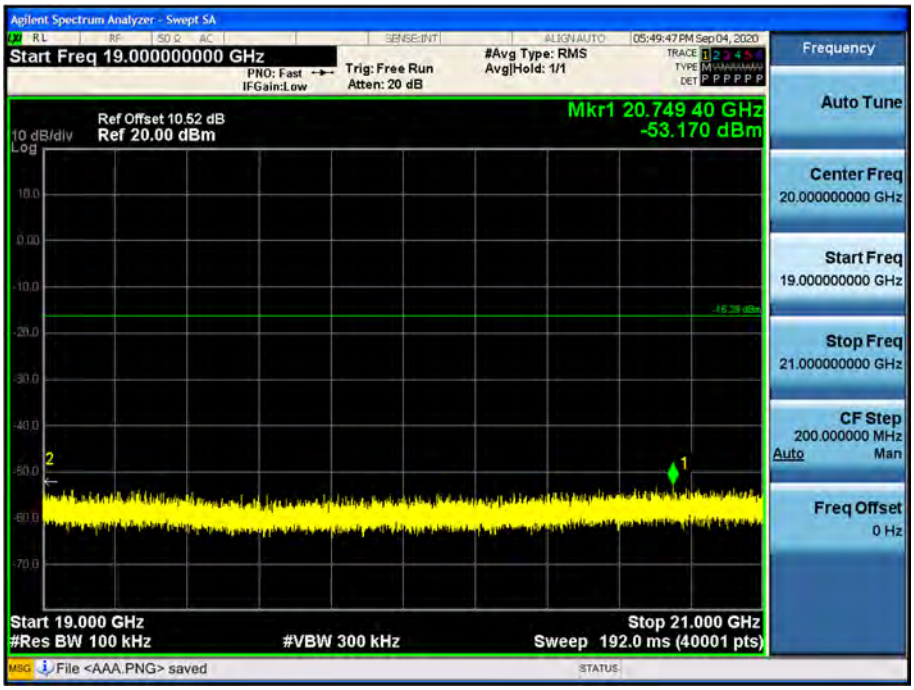
17 GHz ~ 19 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



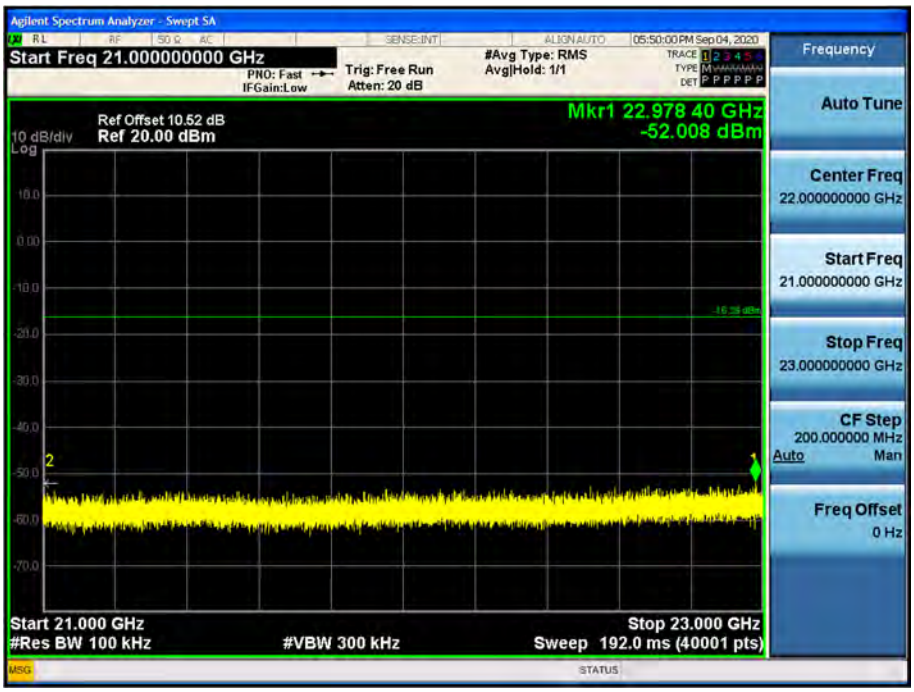
19 GHz ~ 21 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



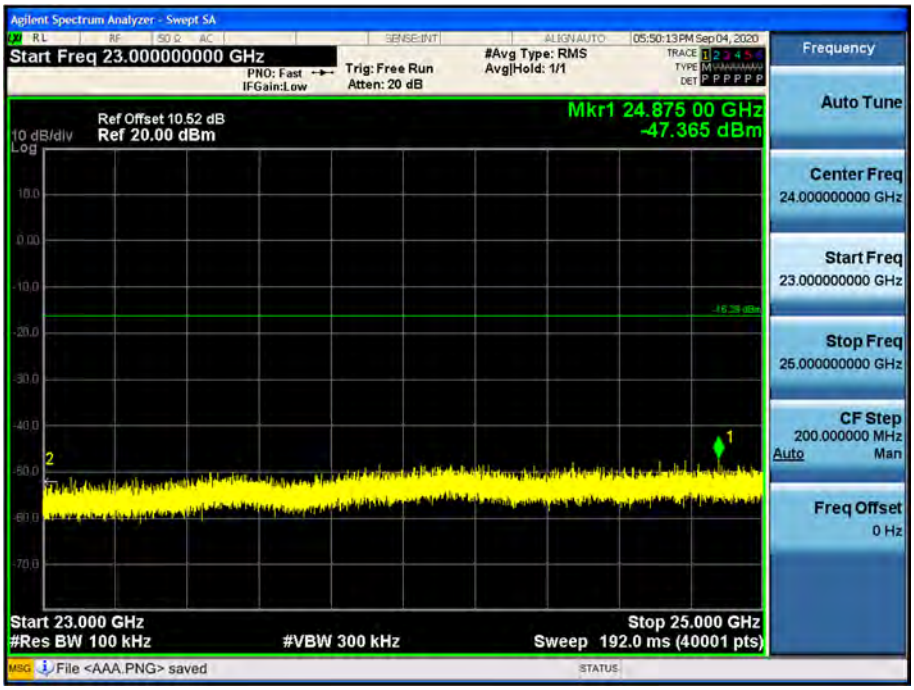
21 GHz ~ 23 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



23 GHz ~ 25 GHz

Conducted Spurious Emission (802.11g_Ch.1_36 Mbps)



9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30MHz

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

Note:

1. The reading 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 (dBuV) + Distance extrapolation factor

Frequency Range : Below 1 GHz

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

Note:

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

Frequency Range : Above 1 GHz

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

Frequency [MHz]	Reading [dBuV]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	47.62	4.31	V	51.93	73.98	22.05	PK
4824	42.34	4.31	V	46.65	53.98	7.33	AV
7236	40.13	12.35	V	52.48	73.98	21.50	PK
7236	29.62	12.35	V	41.97	53.98	12.01	AV
4824	48.53	4.31	H	52.84	73.98	21.14	PK
4824	44.19	4.31	H	48.50	53.98	5.48	AV
7236	39.92	12.35	H	52.27	73.98	21.71	PK
7236	29.59	12.35	H	41.94	53.98	12.04	AV

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

Frequency [MHz]	Reading [dBuV]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	47.83	4.40	V	52.23	73.98	21.75	PK
4874	42.59	4.40	V	46.99	53.98	6.99	AV
7311	40.64	12.37	V	53.01	73.98	20.97	PK
7311	29.56	12.37	V	41.93	53.98	12.05	AV
4874	49.05	4.40	H	53.45	73.98	20.53	PK
4874	44.71	4.40	H	49.11	53.98	4.87	AV
7311	40.27	12.37	H	52.64	73.98	21.34	PK
7311	28.15	12.37	H	40.52	53.98	13.46	AV

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

Frequency [MHz]	Reading [dBuV]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	48.77	4.51	V	53.28	73.98	20.70	PK
4924	44.21	4.51	V	48.72	53.98	5.26	AV
7386	40.29	12.31	V	52.60	73.98	21.38	PK
7386	29.29	12.31	V	41.60	53.98	12.38	AV
4924	49.31	4.51	H	53.82	73.98	20.16	PK
4924	45.40	4.51	H	49.91	53.98	4.07	AV
7386	39.81	12.31	H	52.12	73.98	21.86	PK
7386	28.67	12.31	H	40.98	53.98	13.00	AV

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	43.69	0.00	4.31	V	48.00	73.98	25.98	PK
4824	31.19	0.27	4.31	V	35.77	53.98	18.22	AV
7236	39.62	0.00	12.35	V	51.97	73.98	22.01	PK
7236	27.02	0.27	12.35	V	39.64	53.98	14.35	AV
4824	44.76	0.00	4.31	H	49.07	73.98	24.91	PK
4824	32.26	0.27	4.31	H	36.84	53.98	17.15	AV
7236	38.36	0.00	12.35	H	50.71	73.98	23.27	PK
7236	26.34	0.27	12.35	H	38.96	53.98	15.03	AV

Operation Mode:	802.11g
Transfer Rate:	6 Mbps
Operating Frequency	2437
Channel No.	06 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	44.95	0.00	4.40	V	49.35	73.98	24.63	PK
4874	31.04	0.27	4.40	V	35.71	53.98	18.28	AV
7311	40.18	0.00	12.37	V	52.55	73.98	21.43	PK
7311	27.67	0.27	12.37	V	40.31	53.98	13.68	AV
4874	45.58	0.00	4.40	H	49.98	73.98	24.00	PK
4874	32.91	0.27	4.40	H	37.58	53.98	16.41	AV
7311	39.06	0.00	12.37	H	51.43	73.98	22.55	PK
7311	26.45	0.27	12.37	H	39.09	53.98	14.90	AV

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	45.12	0.00	4.51	V	49.63	73.98	24.35	PK
4924	32.57	0.27	4.51	V	37.35	53.98	16.64	AV
7386	40.52	0.00	12.31	V	52.83	73.98	21.15	PK
7386	27.52	0.27	12.31	V	40.10	53.98	13.89	AV
4924	46.28	0.00	4.51	H	50.79	73.98	23.19	PK
4924	33.95	0.27	4.51	H	38.73	53.98	15.26	AV
7386	39.23	0.00	12.31	H	51.54	73.98	22.44	PK
7386	26.67	0.27	12.31	H	39.25	53.98	14.74	AV

Operation Mode:	802.11n (HT20)
Transfer MCS Index:	6.5 Mbps
Operating Frequency	2412
Channel No.	01 Ch

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4824	43.68	0.00	4.31	V	47.99	73.98	25.99	PK
4824	30.20	0.29	4.31	V	34.80	53.98	19.19	AV
7236	39.30	0.00	12.35	V	51.65	73.98	22.33	PK
7236	26.61	0.29	12.35	V	39.25	53.98	14.74	AV
4824	44.73	0.00	4.31	H	49.04	73.98	24.94	PK
4824	31.55	0.29	4.31	H	36.15	53.98	17.84	AV
7236	37.57	0.00	12.35	H	49.92	73.98	24.06	PK
7236	25.14	0.29	12.35	H	37.78	53.98	16.21	AV

Operation Mode:	802.11n (HT20)
Transfer MCS Index:	6.5 Mbps
Operating Frequency	2437
Channel No.	06 Ch

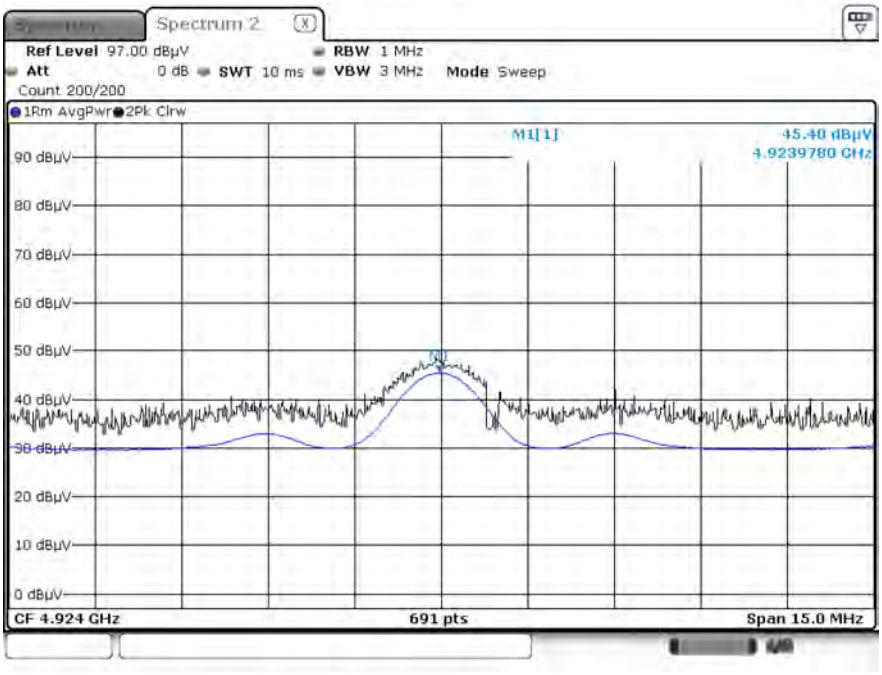
Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4874	44.75	0.00	4.40	V	49.15	73.98	24.83	PK
4874	31.36	0.29	4.40	V	36.05	53.98	17.94	AV
7311	39.79	0.00	12.37	V	52.16	73.98	21.82	PK
7311	27.25	0.29	12.37	V	39.91	53.98	14.08	AV
4874	45.40	0.00	4.40	H	49.80	73.98	24.18	PK
4874	32.21	0.29	4.40	H	36.90	53.98	17.09	AV
7311	38.48	0.00	12.37	H	50.85	73.98	23.13	PK
7311	26.69	0.29	12.37	H	39.35	53.98	14.64	AV

Operation Mode:	802.11n (HT20)
Transfer MCS Index:	6.5 Mbps
Operating Frequency	2462
Channel No.	11 Ch

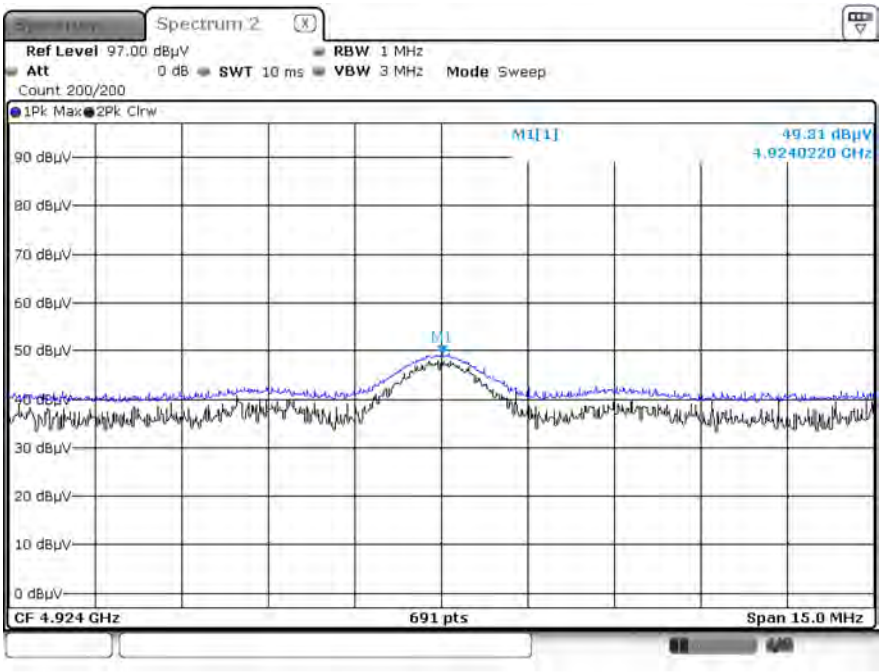
Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	A.F+C.L-AMP+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4924	44.28	0.00	4.51	V	48.79	73.98	25.19	PK
4924	31.54	0.29	4.51	V	36.34	53.98	17.65	AV
7386	39.91	0.00	12.31	V	52.22	73.98	21.76	PK
7386	27.44	0.29	12.31	V	40.04	53.98	13.95	AV
4924	45.63	0.00	4.51	H	50.14	73.98	23.84	PK
4924	32.89	0.29	4.51	H	37.69	53.98	16.30	AV
7386	38.70	0.00	12.31	H	51.01	73.98	22.97	PK
7386	26.21	0.29	12.31	H	38.81	53.98	15.18	AV

▣ Test Plots (Worst case : Z-H)

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



Radiated Spurious Emissions plot – Peak Reading (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	2412 MHz, 2462 MHz
Channel No.	01 Ch, 11 Ch

Frequency [MHz]	Reading [dBuV]	※ A.F+C.L+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	28.04	35.62	H	63.66	73.98	10.32	PK
2390.0	14.48	35.62	H	50.10	53.98	3.88	AV
2390.0	27.39	35.62	V	63.01	73.98	10.97	PK
2390.0	13.79	35.62	V	49.41	53.98	4.57	AV
2483.5	27.98	35.74	H	63.72	73.98	10.26	PK
2483.5	14.75	35.74	H	50.49	53.98	3.49	AV
2483.5	25.86	35.74	V	61.60	73.98	12.38	PK
2483.5	13.85	35.74	V	49.59	53.98	4.39	AV

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

Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	※ A.F+C.L+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	28.54	0.00	35.62	H	64.16	73.98	9.82	PK
2390.0	14.42	0.27	35.62	H	50.31	53.98	3.68	AV
2390.0	27.96	0.00	35.62	V	63.58	73.98	10.40	PK
2390.0	14.05	0.27	35.62	V	49.94	53.98	4.04	AV
2483.5※(2484)	27.89	0.00	35.74	H	63.63	73.98	10.35	PK
2483.5※(2484)	14.94	0.27	35.74	H	50.95	53.98	3.04	AV
2483.5※(2485)	26.37	0.00	35.74	H	62.11	73.98	11.87	PK
2483.5※(2485)	14.33	0.27	35.74	H	50.34	53.98	3.65	AV
2485.5~2500	32.25	0.00	35.74	H	67.99	73.98	5.99	PK
2485.5~2500	14.36	0.27	35.74	H	50.37	53.98	3.61	AV

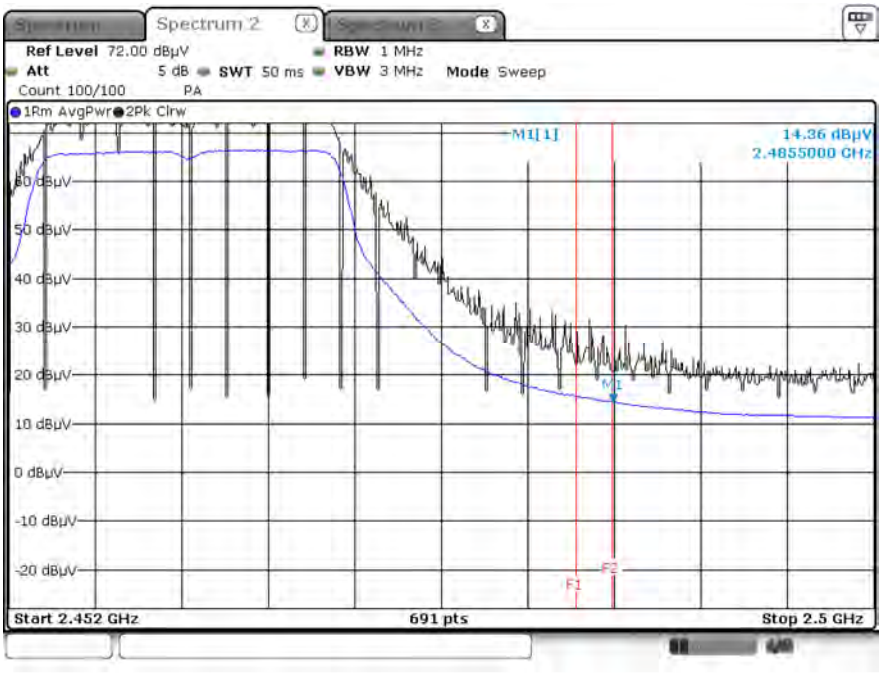
Note : integration method Used (ANSI C63.10 Section11.13.3)

Operation Mode:	802.11n (HT20)
Transfer Rate:	6.5 Mbps
Operating Frequency	2412 MHz, 2462 MHz
Channel No.	01 Ch, 11 Ch

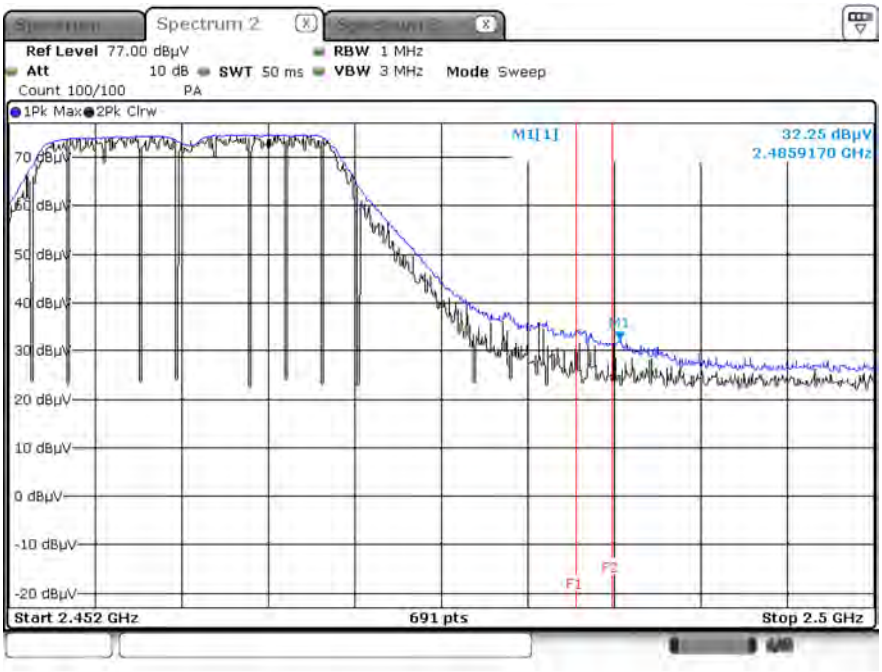
Frequency [MHz]	Reading [dBuV]	Duty Cycle Factor [dB]	※ A.F+C.L+D.F [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	28.29	0.00	35.62	H	63.91	73.98	10.07	PK
2390.0	13.36	0.29	35.62	H	49.27	53.98	4.72	AV
2390.0	27.06	0.00	35.62	V	62.68	73.98	11.30	PK
2390.0	12.69	0.29	35.62	V	48.60	53.98	5.39	AV
2483.5	27.70	0.00	35.74	H	63.44	73.98	10.54	PK
2483.5	12.53	0.29	35.74	H	48.56	53.98	5.43	AV
2483.5	26.38	0.00	35.74	V	62.12	73.98	11.86	PK
2483.5	12.09	0.29	35.74	V	48.12	53.98	5.86	AV

▣ Test Plots

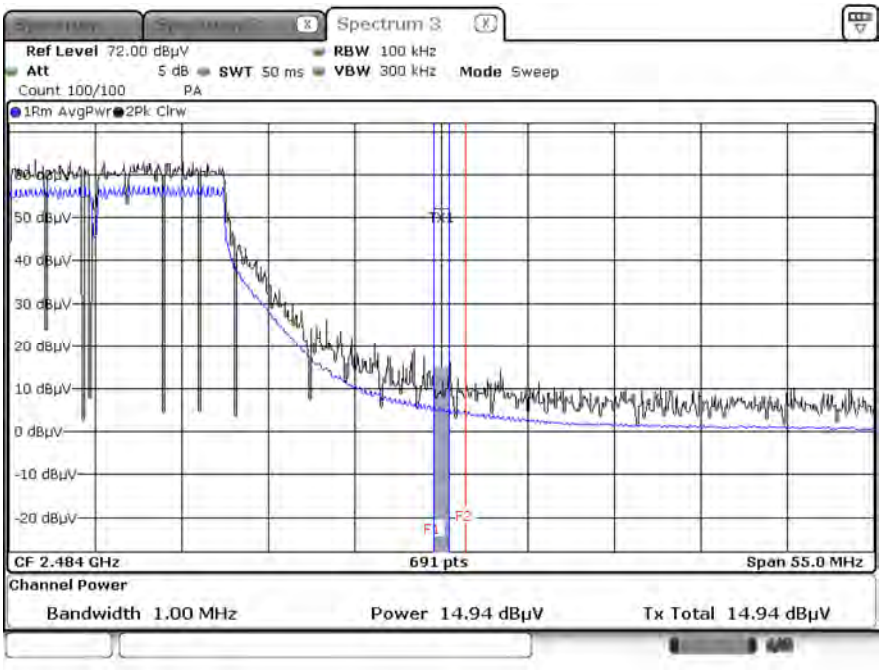
Radiated Restricted Band Edges plot – Average Reading (802.11g Ch.11)



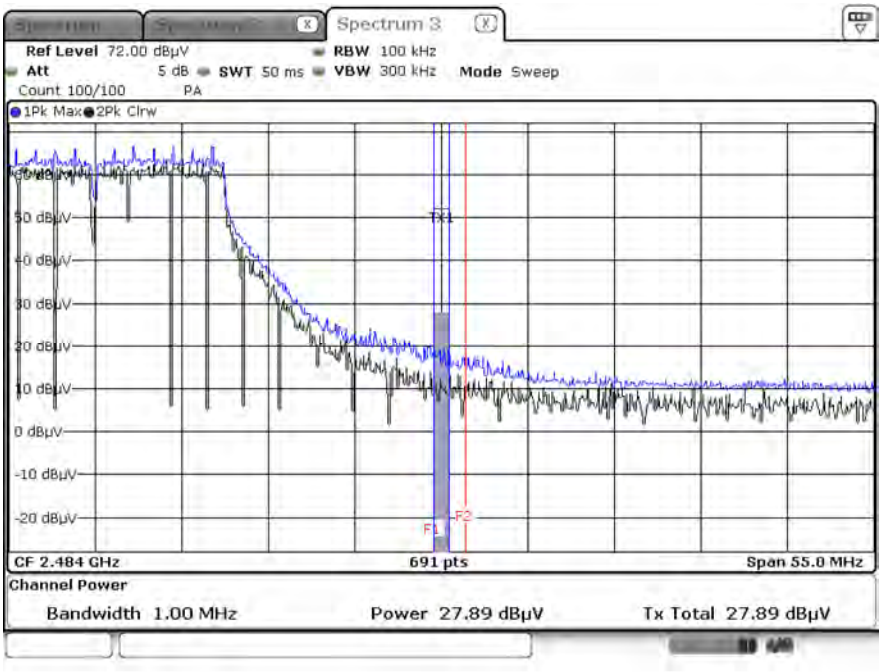
Radiated Restricted Band Edges plot – Peak Reading (802.11g Ch.11)



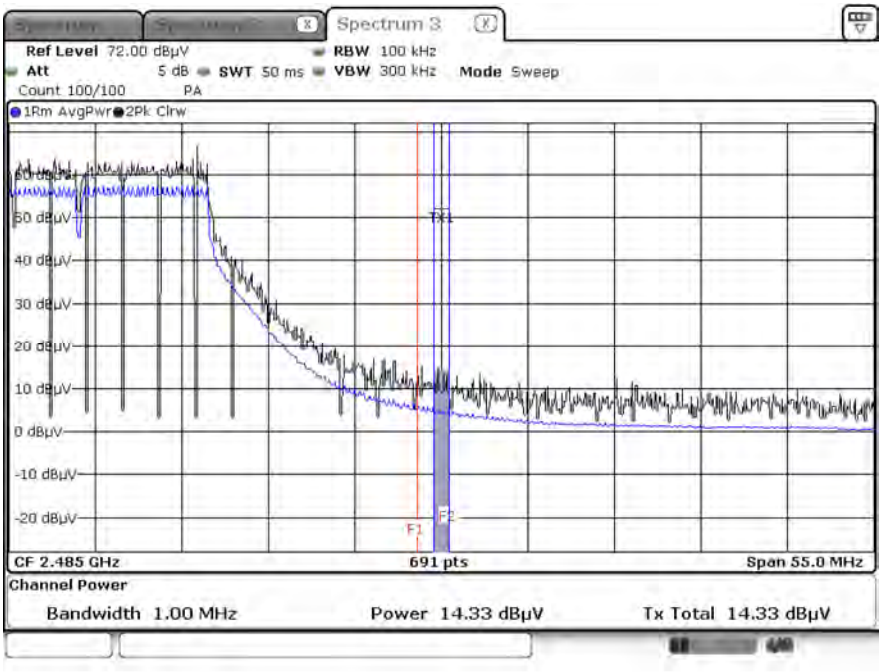
Radiated Restricted Band Edges plot – Average Reading (802.11g Ch.11)



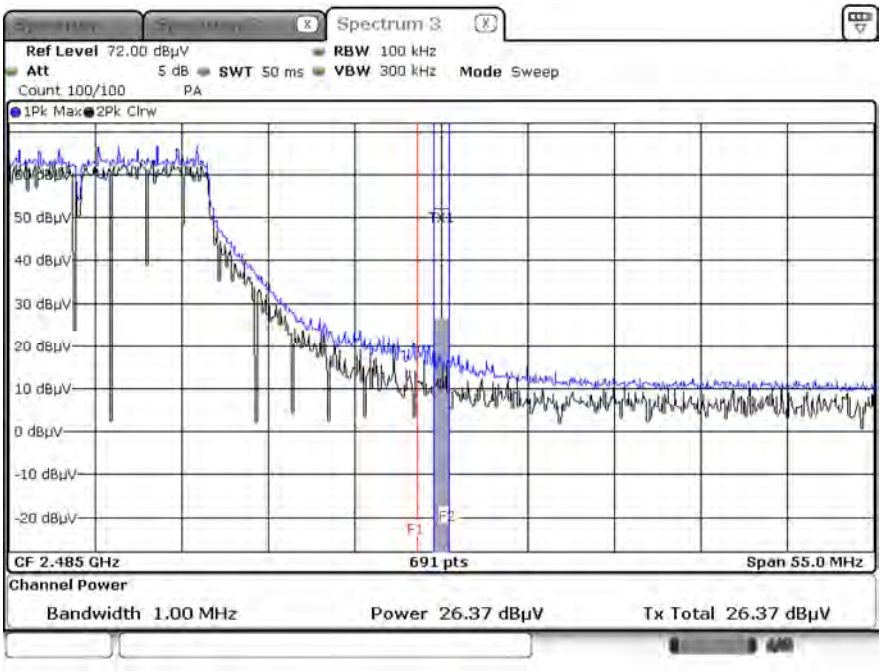
Radiated Restricted Band Edges plot – Peak Reading (802.11g Ch.11)



Radiated Restricted Band Edges plot – Average Reading (802.11g, Ch.11)



Radiated Restricted Band Edges plot – Peak Reading (802.11g, Ch.11)



Note:

Plot of worst case are only reported.

9.8 RECEIVER SPURIOUS EMISSIONS

Frequency Range : Below 1 GHz

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

Note:

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

Frequency Range : Above 1 GHz

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

9.9 POWERLINE CONDUCTED EMISSIONS

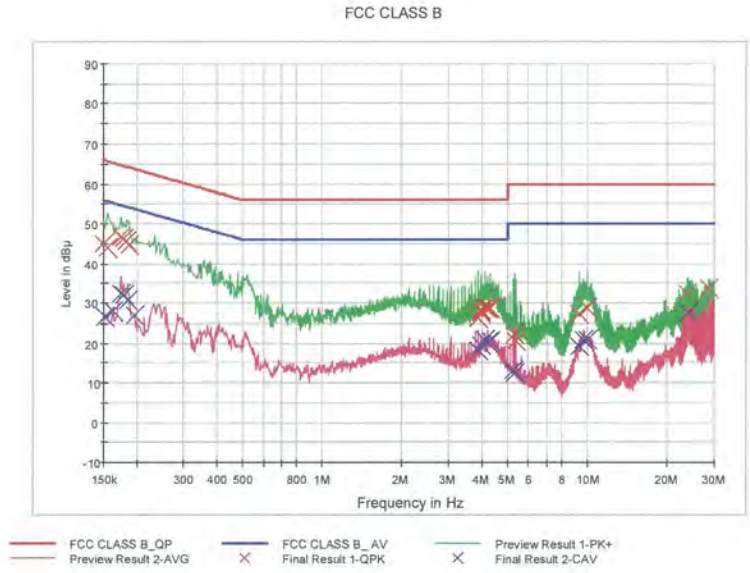
Conducted Emissions (Line 1)

Test 1 / 2

HCT TEST Report

Common Information

EUT:	LCWB-001
Manufacturer:	LG
Test Site:	SHIELD ROOM
Operating Conditions:	WLAN 2.4G MODE_N



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	44.8	9.000	On	N	9.7	21.2	66.0
0.156000	44.0	9.000	On	N	9.7	21.7	65.7
0.174000	46.5	9.000	On	N	9.7	18.3	64.8
0.178000	46.3	9.000	On	N	9.7	18.3	64.6
0.184000	45.5	9.000	On	N	9.7	18.8	64.3
0.188000	44.7	9.000	On	N	9.7	19.4	64.1
3.880000	26.3	9.000	On	N	9.8	29.7	56.0
3.984000	27.5	9.000	On	N	9.8	28.5	56.0
3.988000	28.2	9.000	On	N	9.8	27.8	56.0
4.088000	28.8	9.000	On	N	9.8	27.2	56.0
4.190000	28.6	9.000	On	N	9.8	27.4	56.0
4.294000	28.6	9.000	On	N	9.8	27.4	56.0
5.342000	22.2	9.000	On	N	9.8	37.8	60.0
5.346000	20.4	9.000	On	N	9.8	39.6	60.0
9.282000	27.1	9.000	On	N	9.9	32.9	60.0
10.010000	28.7	9.000	On	N	9.9	31.3	60.0
23.850000	32.3	9.000	On	N	10.0	27.7	60.0
28.570000	33.7	9.000	On	N	10.0	26.3	60.0

2020-08-06 오전 11:05:11

Test 2 / 2

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.152000	26.5	9.000	On	N	9.7	29.4	55.9
0.162000	27.8	9.000	On	N	9.7	27.5	55.4
0.174000	32.4	9.000	On	N	9.7	22.4	54.8
0.178000	32.0	9.000	On	N	9.7	22.6	54.6
0.186000	30.8	9.000	On	N	9.7	23.4	54.2
0.196000	26.9	9.000	On	N	9.7	26.9	53.8
3.880000	18.3	9.000	On	N	9.8	27.7	46.0
3.984000	19.6	9.000	On	N	9.8	26.4	46.0
3.988000	19.5	9.000	On	N	9.8	26.5	46.0
4.088000	20.9	9.000	On	N	9.8	25.1	46.0
4.190000	20.2	9.000	On	N	9.8	25.8	46.0
4.294000	20.4	9.000	On	N	9.8	25.6	46.0
5.240000	13.1	9.000	On	N	9.8	36.9	50.0
5.342000	12.5	9.000	On	N	9.8	37.5	50.0
9.282000	19.3	9.000	On	N	9.9	30.7	50.0
9.594000	20.7	9.000	On	N	9.9	29.3	50.0
10.010000	20.9	9.000	On	N	9.9	29.1	50.0
23.976000	27.6	9.000	On	N	10.0	22.4	50.0

2020-08-06 오전 11:05:11

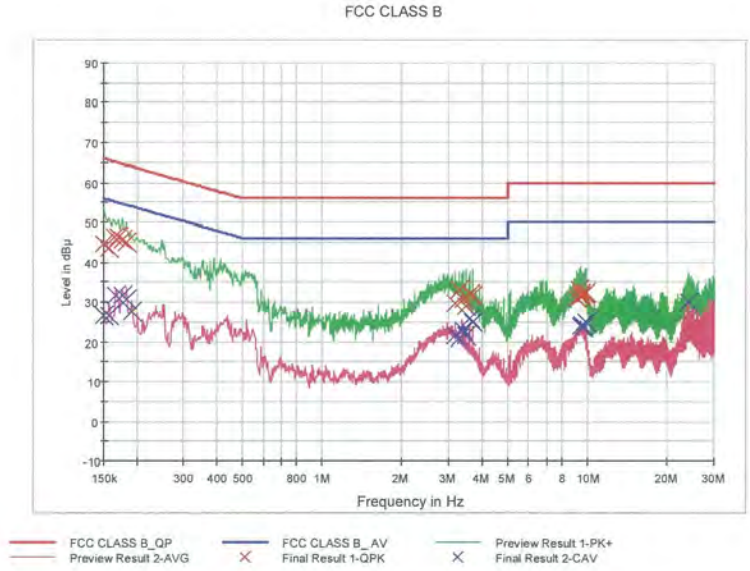
Conducted Emissions (Line 2)

Test 1 / 2

HCT TEST Report

Common Information

EUT:	LCWB-001
Manufacturer:	LG
Test Site:	SHIELD ROOM
Operating Conditions:	WLAN 2.4G MODE_L1



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	44.5	9.000	On	L1	9.7	21.5	66.0
0.158000	43.5	9.000	On	L1	9.7	22.1	65.6
0.164000	46.3	9.000	On	L1	9.7	18.9	65.3
0.170000	46.2	9.000	On	L1	9.7	18.8	65.0
0.176000	45.6	9.000	On	L1	9.7	19.1	64.7
0.182000	44.9	9.000	On	L1	9.7	19.5	64.4
3.178000	29.8	9.000	On	L1	9.8	26.2	56.0
3.282000	33.1	9.000	On	L1	9.8	22.9	56.0
3.390000	30.6	9.000	On	L1	9.8	25.4	56.0
3.490000	29.1	9.000	On	L1	9.8	26.9	56.0
3.596000	32.2	9.000	On	L1	9.8	23.8	56.0
3.694000	31.9	9.000	On	L1	9.8	24.2	56.0
9.150000	31.1	9.000	On	L1	9.9	28.9	60.0
9.350000	33.2	9.000	On	L1	9.9	26.8	60.0
9.404000	31.3	9.000	On	L1	9.9	28.7	60.0
9.446000	32.0	9.000	On	L1	9.9	28.0	60.0
9.720000	31.9	9.000	On	L1	9.9	28.1	60.0
9.822000	32.5	9.000	On	L1	9.9	27.5	60.0

2020-08-06 오전 11:15:18

Test 2 / 2

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	26.6	9.000	On	L1	9.7	29.4	56.0
0.158000	26.8	9.000	On	L1	9.7	28.8	55.6
0.166000	31.6	9.000	On	L1	9.7	23.6	55.2
0.176000	31.8	9.000	On	L1	9.7	22.9	54.7
0.184000	30.8	9.000	On	L1	9.7	23.5	54.3
0.192000	27.6	9.000	On	L1	9.7	26.4	53.9
3.178000	21.4	9.000	On	L1	9.8	24.6	46.0
3.282000	21.0	9.000	On	L1	9.8	25.0	46.0
3.390000	22.9	9.000	On	L1	9.8	23.1	46.0
3.490000	21.5	9.000	On	L1	9.8	24.5	46.0
3.596000	25.9	9.000	On	L1	9.8	20.1	46.0
3.694000	24.8	9.000	On	L1	9.8	21.2	46.0
9.404000	23.9	9.000	On	L1	9.9	26.1	50.0
9.446000	23.9	9.000	On	L1	9.9	26.1	50.0
9.508000	24.2	9.000	On	L1	9.9	25.8	50.0
9.614000	23.6	9.000	On	L1	9.9	26.4	50.0
9.822000	24.8	9.000	On	L1	9.9	25.2	50.0
23.882000	30.1	9.000	On	L1	10.0	19.9	50.0

2020-08-06 오전 11:15:18

10. LIST OF TEST EQUIPMENT

Conducted Test

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216 / LISN	04/09/2020	Annual	102245
Rohde & Schwarz	ESCI / Test Receiver	06/10/2020	Annual	100584
ESPEC	SU-642 /Temperature Chamber	07/30/2020	Annual	0093000718
Agilent	N9030A / Signal Analyzer	03/23/2020	Annual	MY49432108
Agilent	N1911A / Power Meter	04/07/2020	Annual	MY45100523
Agilent	N1921A / Power Sensor	06/08/2020	Annual	MY57820067
Agilent	87300B / Directional Coupler	11/11/2019	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	02/14/2020	Annual	10545
HP	E3632A / DC Power Supply	09/27/2019	Annual	MY40004427
HP	8493C / Attenuator(10 dB)(DC-26.5 GHz)	06/26/2020	Annual	07560
HP	8493C / Attenuator(10 dB)(DC-26.5 GHz)	07/03/2020	Annual	08285
Rohde & Schwarz	18N-20dB / Attenuator(20 dB)	03/23/2020	Annual	8
Rohde & Schwarz	EMC32 / Software	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

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Audix	EM1000 / Controller	N/A	N/A	060520
Audix	Turn Table	N/A	N/A	N/A
TNM system	FBSM-01B / Amp & Filter Bank Switch Controller	N/A	N/A	N/A
Schwarzbeck	Loop Antenna	05/18/2020	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	08/02/2019	Biennial	01039
Schwarzbeck	BBHA 9120D / Horn Antenna	06/28/2019	Biennial	1300
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	04/29/2019	Biennial	BBHA9170342
Rohde & Schwarz	FSP(10 Hz ~ 40 GHz) / Spectrum Analyzer	05/13/2020	Annual	101055
Wainwright Instruments	WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter	01/21/2020	Annual	2
Wainwright Instruments	WRCJV5100/5850-40/50-8EEK / Band Reject Filter	02/10/2020	Annual	1
CERNEX	CBL18265035 / Power Amplifier	12/26/2019	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	03/23/2020	Annual	25956
TNM system	FBSM-05B / HPF(3~18GHz) + LNA1(1~18GHz)	01/21/2020	Annual	F6
TNM system	FBSM-05B / ATT(10dB) + LNA1(1~18GHz)	01/21/2020	Annual	None
TNM system	FBSM-05B / ATT(3dB) + LNA1(1~18GHz)	01/21/2020	Annual	None
TNM system	FBSM-05B / LNA1(1~18GHz)	01/21/2020	Annual	25540
TNM system	FBSM-05B / HPF(7~18GHz) + LNA2(6~18GHz)	01/21/2020	Annual	28550
TNM system	FBSM-05B / Thru(30MHz ~ 18GHz)	01/21/2020	Annual	None

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-2009-FI009-P