

# FCC / IC UNII REPORT

## Certification

**Applicant Name:**

LG Electronics Inc.

**Date of Issue:**

January 28, 2019

**Location:**

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**Report No.:** HCT-RF-1901-FI003

**FCC ID:****BEJI17S****IC:****2703H-I17S****APPLICANT:****LG Electronics Inc.****Model:**

I17S

**EUT Type:**

GM AVN CADILLAC

**Modulation type**

OFDM

**FCC Classification:**

Unlicensed National Information Infrastructure(UNII)

**FCC Rule Part(s):**

Part 15.407

**ISED Rule Part(s):**

RSS-247 Issue 2 (February 2017), RSS-Gen Issue 5(April 2018)

**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.



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**Engineer of Telecommunication testing center**



**Approved by : Jong Seok Lee**  
**Manager of Telecommunication testing center**

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## Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1901-FI003	January 28, 2019	- First Approval Report

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# 1. GENERAL INFORMATION

## EUT DESCRIPTION

Model	I17S	
EUT Type	GM AVN CADILLAC	
Power Supply	DC 12.00 V	
Modulation Type	OFDM : 802.11a, 802.11n, 802.11ac	
Frequency Range (MHz)	UNII 1	20MHz BW : 5180 - 5240 40MHz BW : 5190 - 5230 80MHz BW : 5210
	UNII 2A	20MHz BW : 5260 - 5320 40MHz BW : 5270 - 5310 80MHz BW : 5290
	UNII 2C	20MHz BW : 5500 - 5720 40MHz BW : 5510 - 5710 80MHz BW : 5530 - 5690
	UNII 3	20MHz BW : 5745 - 5825 40MHz BW : 5755 - 5795 80MHz BW : 5775
	Antenna Type	Ant 1: Internal Antenna Ant 2: External Antenna
Antenna Peak gain (dBi)	UNII 1 : 3.88(Ant1)/ -1.20 (Ant2) UNII 2A : 3.88(Ant1)/ -1.20(Ant2) UNII 2C : 4.54(Ant1)/ -1.50(Ant2) UNII 3 : 4.22(Ant1)/ -1.80(Ant2)	
Straddle channel	Supported	
TDWR Band	Not Supported	
Dynamic Frequency Selection	Slave without radar detection	
Date(s) of Tests	January 09, 2019 ~ January 23, 2019	
PMN (Product Marketing Number)	GM AVN CADILLAC	
HVIN (Hardware Version Identification Number)	I17S	
FVIN (Firmware Version Identification Number)	9.40.94.16	
HMN (Host Marketing Name)	N/A	

## ANTENNA CONFIGURATIONS

### 1. The device employs MIMO technology. Below are the possible configurations

Configurations	SISO		SDM	CDD
	Ant1	Ant2	Ant1 + Ant2	Ant1 + Ant2
802.11a	O	O	X	X
802.11n(HT20)	O	O	O	X
802.11n(HT40)	O	O	O	X
802.11ac(VHT20)	O	O	O	X
802.11ac(VHT40)	O	O	O	X
802.11ac(VHT80)	O	O	O	X

**Note:**

1. O = Support, X = Not Support
2. SISO = Single Input Single Output
3. SDM = Spatial Diversity Multiplexing
4. CDD = Cyclic Delay Diversity

### 2. Directional Gain Calculation

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

Directional gain =  $G_{ANT\ MAX} + 10 \log(N_{ANT}/N_{SS})$  dBi

( $N_{ANT} = 2, N_{SS} = 2, G_{ANT\ MAX}$  is the gain of the antenna having the highest gain)

Band	Ant Gain (dBi)		$N_{ANT}/ N_{SS}$	Directional Gain (= $G_{ANT\ MAX} + 10 \log(N_{ANT}/N_{SS})$ ) (dBi)
	Internal	External		
UNII 1	Internal	3.88	2 / 2	3.88
	External	-1.20		
UNII 2A	Internal	3.88	2 / 2	3.88
	External	-1.20		
UNII 2C	Internal	4.54	2 / 2	4.54
	External	-1.50		
UNII 3	Internal	4.22	2 / 2	4.22
	External	-1.80		

**3. Power Level Setting**

Mode	Channel	Ant1(=Internal)	Ant2(=External)	Ant1 + Ant2		
802.11a	36	10	14	N/A		
	40		13			
	48					
	52					
	56					
	64					
	100				12	
	116				16	16
	144					
	149					
157						
165	10	14				
36						
40						
48						
802.11n_20MHz	52	10	13	6		
	56					
	64					
	100				12	
	116				16	16
	144					
	149					
	157					
	165				10	14
	38					
46						
54						
802.11n_40MHz	62	11	14	6		
	102	12				
	110	16			16	
	142					
	151					
	159					

Mode	Channel	Ant1(=Internal)	Ant2(=External)	Ant1 + Ant2
802.11ac_20MHz	36	10	14	6
	40			
	48			
	52			
	56			
	64	12	13	12
	100			
	116			
	144			
	149			
802.11ac_40MHz	157	16	16	16
	165			
	38			
	46			
	54			
	62	10	14	6
	102			
	110			
	142			
	151			
802.11ac_80MHz	159	11	13	12
	42			
	58			
	106			
	138			
	155	16	16	16
	155			

## 2. MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted average output power as follows:

Band	Mode	Ant1 Power (dBm)	Ant2 Power (dBm)	Ant1+ Ant2 Power (dBm)
UNII1	802.11a	10.138	15.652	-
	802.11n (HT20)	10.135	15.647	10.806
	802.11n (HT40)	9.793	15.892	9.999
	802.11ac (VHT20)	10.114	15.882	10.685
	802.11ac (VHT40)	9.817	15.853	10.168
	802.11ac (VHT80)	9.558	15.905	9.757
UNII2A	802.11a	9.979	15.820	-
	802.11n (HT20)	9.952	15.844	10.808
	802.11n (HT40)	10.248	15.910	10.344
	802.11ac (VHT20)	9.894	15.880	10.762
	802.11ac (VHT40)	10.175	15.847	10.458
	802.11ac (VHT80)	10.039	14.999	10.027
UNII2C	802.11a	15.284	18.003	-
	802.11n (HT20)	15.175	17.842	19.824
	802.11n (HT40)	14.962	17.137	19.397
	802.11ac (VHT20)	15.098	17.831	19.808
	802.11ac (VHT40)	14.615	17.128	19.407
	802.11ac (VHT80)	14.256	16.789	18.972
UNII3	802.11a	14.955	17.998	-
	802.11n (HT20)	14.852	17.880	19.910
	802.11n (HT40)	14.521	17.471	19.803
	802.11ac (VHT20)	14.945	17.873	19.978
	802.11ac (VHT40)	14.381	17.498	19.709
	802.11ac (VHT80)	13.985	16.917	18.955

Band	Mode	Ant1 Power (W)	Ant2 Power (W)	Ant1+ Ant2 Power (W)
UNII1	802.11a	0.0103	0.0367	-
	802.11n (HT20)	0.0103	0.0367	0.0120
	802.11n (HT40)	0.0095	0.0388	0.0100
	802.11ac (VHT20)	0.0103	0.0387	0.0117
	802.11ac (VHT40)	0.0096	0.0385	0.0104
	802.11ac (VHT80)	0.0090	0.0389	0.0095
UNII2A	802.11a	0.0100	0.0382	-
	802.11n (HT20)	0.0099	0.0384	0.0120
	802.11n (HT40)	0.0106	0.0390	0.0108
	802.11ac (VHT20)	0.0098	0.0387	0.0119
	802.11ac (VHT40)	0.0104	0.0384	0.0111
	802.11ac (VHT80)	0.0101	0.0316	0.0101
UNII2C	802.11a	0.0338	0.0631	-
	802.11n (HT20)	0.0329	0.0608	0.0960
	802.11n (HT40)	0.0313	0.0517	0.0870
	802.11ac (VHT20)	0.0323	0.0607	0.0957
	802.11ac (VHT40)	0.0289	0.0516	0.0872
	802.11ac (VHT80)	0.0266	0.0477	0.0789
UNII3	802.11a	0.0313	0.0631	-
	802.11n (HT20)	0.0306	0.0614	0.0979
	802.11n (HT40)	0.0283	0.0559	0.0956
	802.11ac (VHT20)	0.0312	0.0613	0.0995
	802.11ac (VHT40)	0.0274	0.0562	0.0935
	802.11ac (VHT80)	0.0250	0.0492	0.0786

### **3. TEST METHODOLOGY**

The measurement procedure described in FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04 dated May 2, 2017 entitled "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part15, Subpart E" and ANSI C63.10(Version : 2013) 'the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices' were used in the measurement. For 802.11ac, KDB644545 D03 v01 dated August 14, 2014

#### **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 15.407 under the FCC Rules Part 15 Subpart E / 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 3.75 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 8 of ANSI C63.10. (Version: 2013)

##### **Conducted Antenna Terminal**

See Section from 8.1 to 8.4.( KDB 789033 D02 v02r01)

#### **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.

## 4. 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).

## 5. FACILITIES AND ACCREDITATIONS

### 5.1 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 December 20, 2016(Registration Number: 5944A-3)

### 5.2 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."

## 6. ANTENNA REQUIREMENTS

### According to FCC 47 CFR §15.203, §15.407

"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."

\* The antennas of this E.U.T are permanently attached.

\* The E.U.T Complies with the requirement of §15.203, §15.407 / RSS-Gen

## 7. 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.

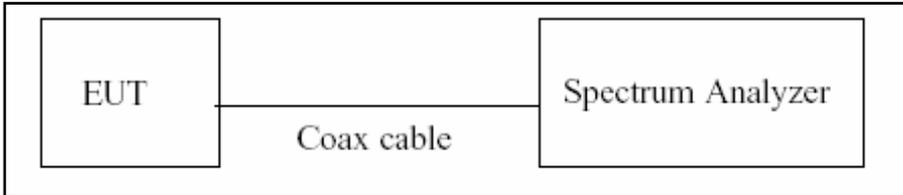
The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty ( $\pm$ 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)	5.71

## 8. DESCRIPTION OF TESTS

### 8.1. Duty Cycle

#### Test Configuration



#### Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure B.2 in KDB 789033 D02 v02r01.

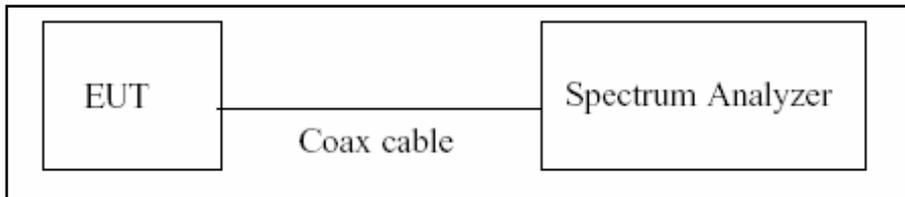
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ( $\geq$  RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure  $T_{total}$  and  $T_{on}$
8. Calculate Duty Cycle =  $T_{on} / T_{total}$  and Duty Cycle Factor =  $10 \cdot \log(1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

## 8.2. Bandwidth Measurement

### Limit

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

### Test Configuration



### Test Procedure(26dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure C.1 in KDB 789033 D02 v02r01.

1. RBW = approximately 1 % of the emission bandwidth
2. VBW > RBW
3. Detector = Peak
4. Trace mode = max hold
5. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission.  
Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

### Test Procedure(6dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure C.2 in KDB 789033 D02 v02r01.

1. RBW = 100 kHz
2. VBW  $\geq 3 \times$  RBW
3. Detector = Peak
4. Trace mode = max hold
5. Allow the trace to stabilize
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points(upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### Note:

1. We tested X dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer.
2. DFS test channels should be defined. So, We performed the OBW test to prove that no part of the fundamental emissions of any channels belong to UNII1 and UNII3 band for DFS.
3. The 26 dB bandwidth is used to determine the conducted power limits.

**8.3. Output Power Measurement**

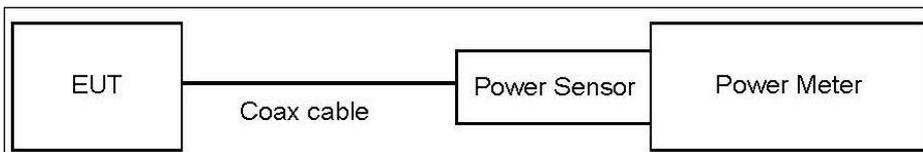
**Limit**

Band	FCC Limit
UNII 1	- Master : Not exceed 1 W(=30dBm) - Slave : Not exceed 250 mW(=23.98 dBm)
UNII 2A, 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30dBm)

Band	IC Limit
UNII 1, 2A	Maximum e.i.r.p. shall not exceed 30 mW(=14.77dBm) Or $1.76 + 10 \log_{10}(BW)$ dBm (where B is the 26 dB emission bandwidth in megahertz.)
UNII 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30dBm)

**Test Configuration**

Power Meter



**Test Procedure(Power Meter)**

We tested according to Procedure E.3.a in KDB 789033 D02 v02r01.

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**

Total Power(dBm) = Reading Value(dBm) + ATT loss(dB) + Cable loss(dB) + Duty Cycle Factor(dB)

**Note**

1. Spectrum reading values are not plot data.

The power 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. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	21.10(Ant1)/ 26.86(Ant2)
UNII 2A	21.10(Ant1)/ 26.86(Ant2)
UNII 2C	21.10(Ant1)/ 27.31(Ant2)
UNII 3	21.10(Ant1)/ 26.47(Ant2)

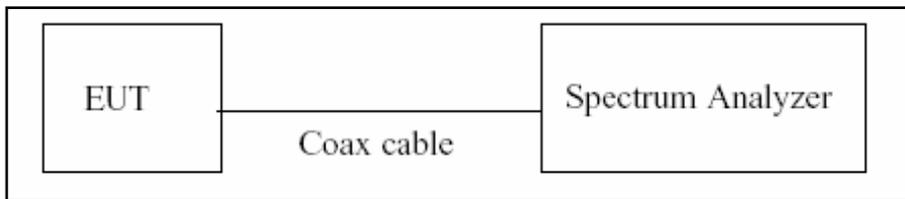
(Actual value of loss for the attenuator and cable combination)

**8.4. Power Spectral Density**

**Limit**

Band	Limit
UNII 1	11 dBm/MHz
UNII 2A, 2C	11 dBm/MHz
UNII 3	30 dBm/500 kHz

**Test Configuration**



**Test Procedure**

We tested according to Procedure F in KDB 789033 D02 v02r01.

1. Set span to encompass the entire emission bandwidth(EBW) of the signal.
2. RBW = 1 MHz(510 kHz for UNII 3)
3. VBW ≥ 3 MHz
4. Number of points in sweep ≥ 2\*span/RBW.
5. Sweep time = auto.
6. Detector = RMS(i.e., power averaging), if available. Otherwise, use sample detector mode.
7. Do not use sweep triggering. Allow the sweep to “free run”.
8. Trace average at least 100 traces in power averaging(RMS) mode
9. Use the peak search function on the spectrum analyzer to find the peak of the spectrum.
10. If Method SA-2 was used, add  $10 \log(1/x)$ , where x is the duty cycle, to the peak of the spectrum.

**Sample Calculation**

Total PSD(dBm) = Reading Value(dBm) + ATT loss(dB) + Cable loss(dB) + Duty Cycle Factor(dB)

**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 + Cable loss

3. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	21.10(Ant1)/ 26.86(Ant2)
UNII 2A	21.10(Ant1)/ 26.86(Ant2)
UNII 2C	21.10(Ant1)/ 27.31(Ant2)
UNII 3	21.10(Ant1)/ 26.47(Ant2)

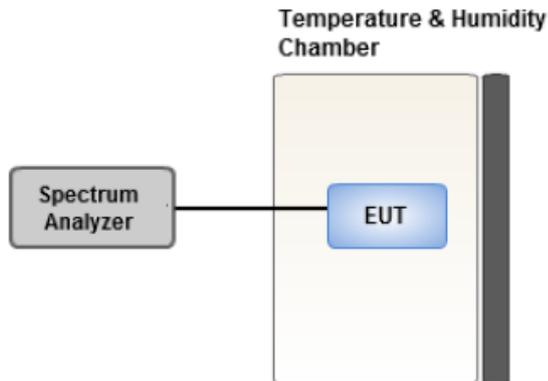
(Actual value of loss for the attenuator and cable combination)

## 8.5. Frequency Stability

### Limit

Maintained within the band

### Test Configuration



### Test Procedure

1. The EUT was placed inside an environmental chamber as the temperature in the chamber was varied between -30 °C and 50 °C.
2. The temperature was incremented by 10 °C intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.
3. The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

## 8.6. 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  $\mu$ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

\*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

**8.7. Radiated Test**

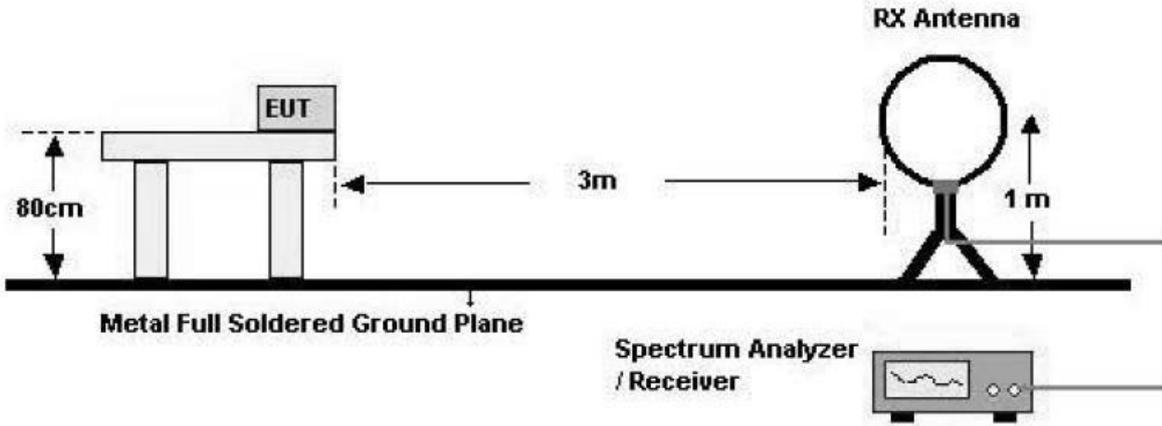
**Limit**

1. UNII 1: All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.
2. UNII 2A, 2C: All emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.
3. UNII 3: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
4. All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Section 15.209.

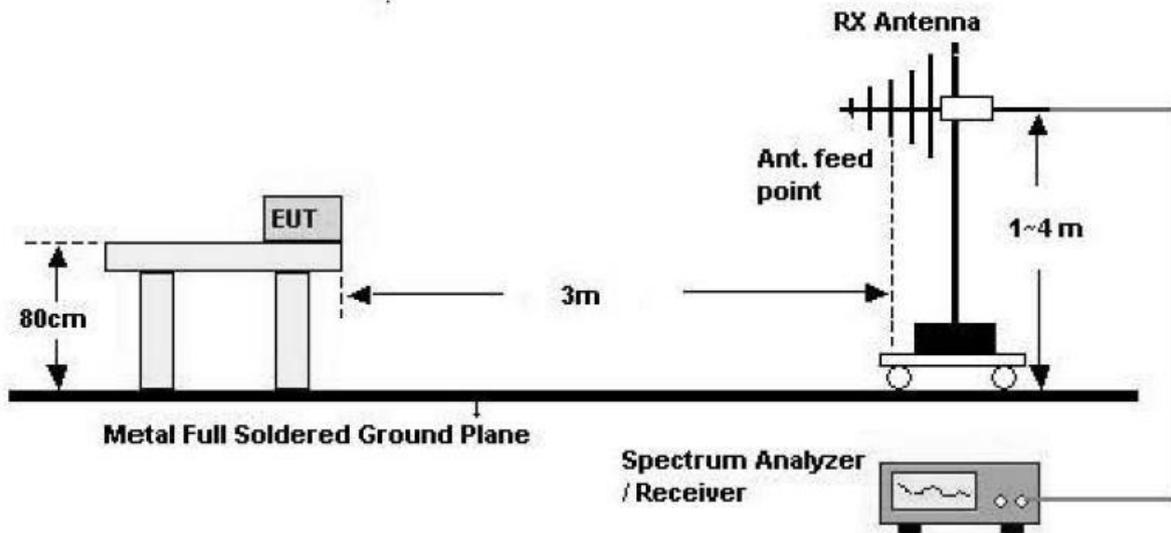
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

**Test Configuration**

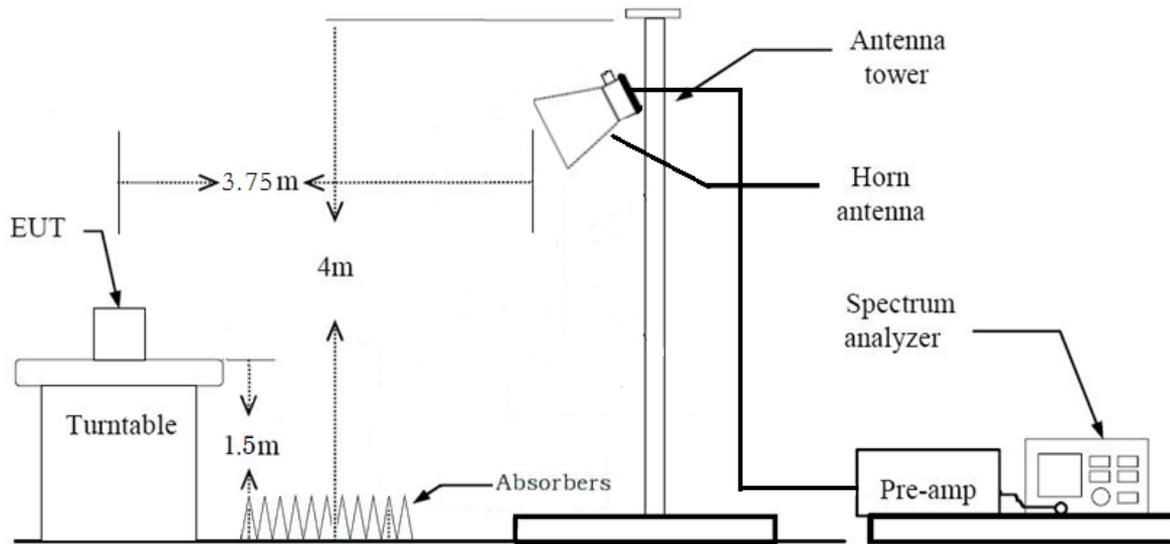
Below 30 MHz



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 in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor(0.009 MHz – 0.490 MHz) =  $40 \cdot \log(3 \text{ m}/300 \text{ m}) = -80 \text{ dB}$   
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) =  $40 \cdot \log(3 \text{ m}/30 \text{ m}) = -40 \text{ dB}$   
Measurement Distance : 3 m
8. Spectrum Setting
  - Frequency Range = 9 kHz ~ 30 MHz
  - Detector = Peak
  - Trace = Maxhold
  - RBW = 9 kHz
  - VBW  $\geq 3 \cdot \text{RBW}$
9. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
10. The test results for below 30 MHz is correlated to an open site.  
The result on OATS is about 2 dB higher than semi-anechoic chamber(10 m chamber)

**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. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Spectrum Setting

## (1) Measurement Type(Peak):

- Measured Frequency Range : 30 MHz – 1 GHz
- Detector = Peak
- Trace = Maxhold
- RBW = 100 kHz
- VBW  $\geq$  3\*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

6. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)

**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 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor( reference distance : 3 m).  
\*Distance extrapolation factor =  $20 \cdot \log(\text{test distance} / \text{specific distance})$  (dB)
6. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
7. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
8. The unit was tested with its standard battery.

## 9. Spectrum Setting

### (1) Measurement Type(Peak, G.5 in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW  $\geq$  3 MHz
- Detector = Peak
- Sweep Time = auto
- Trace mode = max hold
- Allow sweeps to continue until the trace stabilizes.

Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately  $1/x$ , where  $x$  is the duty cycle.

### (2) Measurement Type(Average, G.6.d in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW(Duty cycle  $\geq$  98 percent) =  $VBW \leq RBW/100$ (i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is  $<$  98 percent) =  $VBW \geq 1/T$ , where  $T$  is the minimum transmission duration.
- The analyzer is set to linear detector mode.
- Detector = Peak.
- Sweep time = auto.
- Trace mode = max hold.
- Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of  $1/x$ , where  $x$  is the duty cycle.

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. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency

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

**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 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor( reference distance : 3 m).  
\*Distance extrapolation factor =  $20 \cdot \log(\text{test distance} / \text{specific distance})$  (dB)
6. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
7. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
8. The unit was tested with its standard battery.
9. Spectrum Setting

## (1) Measurement Type(Peak, G.5 in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW  $\geq$  3 MHz
- Detector = Peak
- Sweep Time = auto
- Trace mode = max hold
- Allow sweeps to continue until the trace stabilizes.

Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately  $1/x$ , where  $x$  is the duty cycle.

## (2) Measurement Type(Average, G.6.d in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW(Duty cycle  $\geq$  98 percent) =  $\text{VBW} \leq \text{RBW}/100$ (i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is  $<$  98 percent) =  $\text{VBW} \geq 1/T$ , where T is the minimum transmission duration.
- The analyzer is set to linear detector mode.
- Detector = Peak.
- Sweep time = auto.
- Trace mode = max hold.
- Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of  $1/x$ , where  $x$  is the duty cycle.

10. Measured Frequency Range :

- 4500MHz ~ 5150MHz
- 5350MHz ~ 5460MHz
- 5460MHz ~ 5470MHz
- (75 MHz or more below the 5725MHz) ~ 5725MHz
- 5850MHz ~ (75 MHz or more above the 5850MHz)

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

**The actual setting value of VBW**

Mode	Worst Data rate (Mbps)	Duty Cycle	Duty Cycle Factor (dB)	The actual setting value of VBW (Hz)
a	6	0.932	0.304	1000
802.11n(HT20)	MCS0	0.931	0.310	1000
802.11n(HT40)	MCS0	0.868	0.613	3000
802.11ac(VHT20)	MCS0	0.932	0.308	1000
802.11ac(VHT40)	MCS0	0.868	0.617	3000
802.11ac(VHT80)	MCS0	0.773	1.116	10000

**8.8. Receiver Spurious Emissions****Limit**

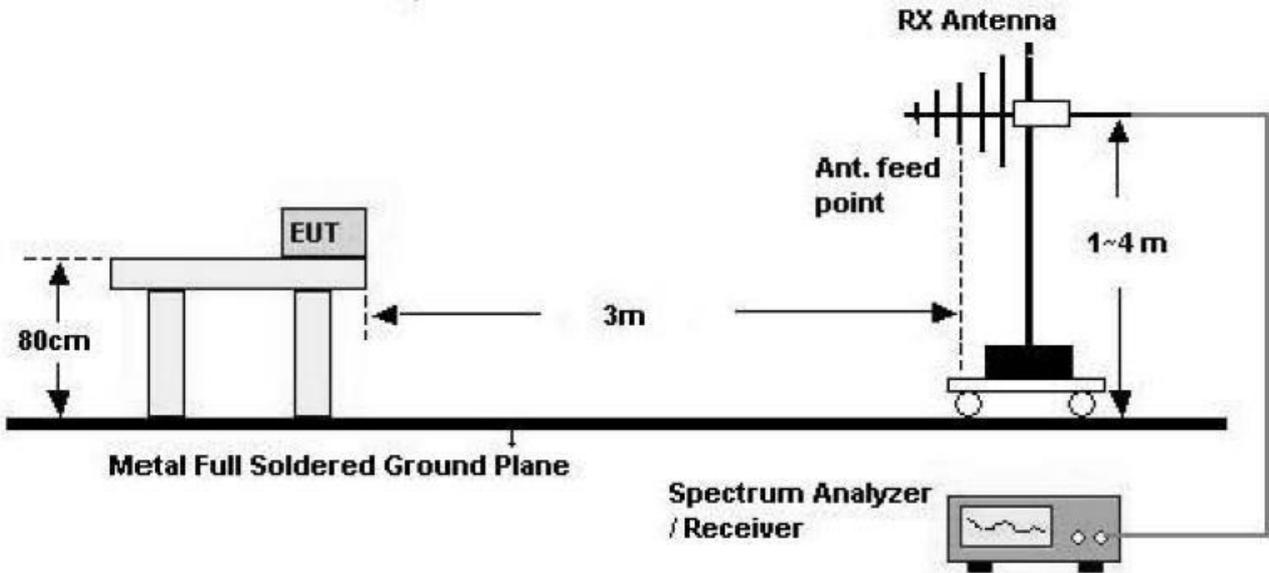
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

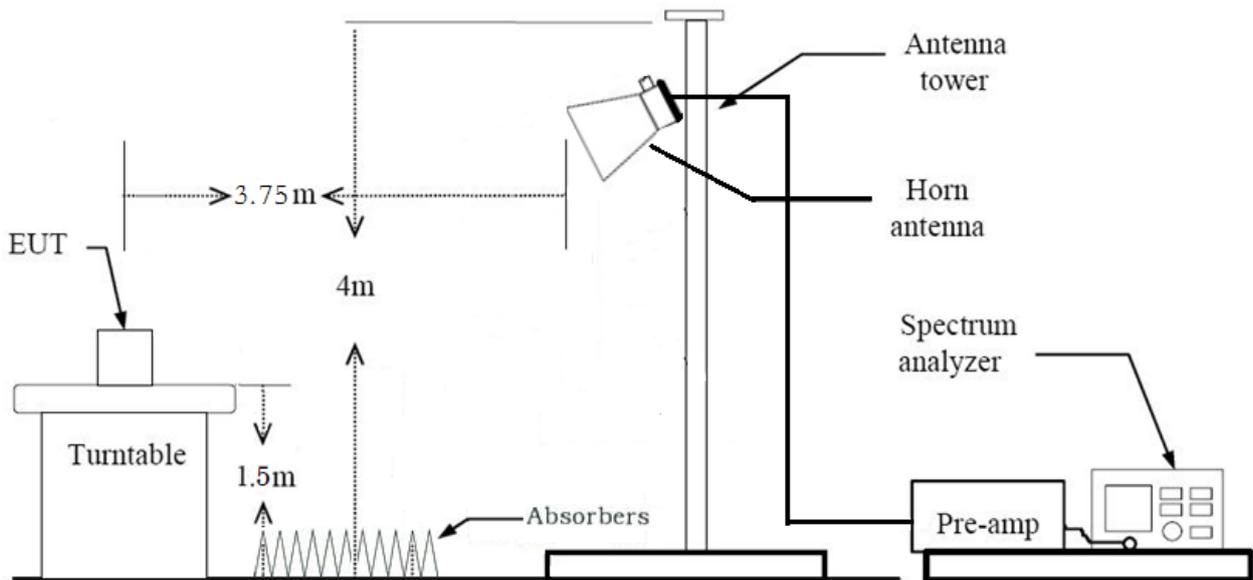
Measurements for compliance with the limits in table may be performed at distances other than 3 metres.

**Test Configuration**

30 MHz - 1 GHz



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 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor( reference distance : 3 m).  
\*Distance extrapolation factor =  $20 \cdot \log(\text{test distance} / \text{specific distance})$  (dB)
6. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
7. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
8. The unit was tested with its standard battery.
9. Spectrum Setting
  - (1) Measurement Type(Peak):
    - Measured Frequency Range : 1 GHz – 25 GHz
    - Detector = Peak
    - Trace = Maxhold
    - RBW = 1 MHz
    - VBW  $\geq 3 \cdot \text{RBW}$
  - (2) Measurement Type(Average):
    - We performed using a reduced video BW method was done with the analyzer in linear mode
    - Measured Frequency Range : 1 GHz – 25 GHz
    - Detector = Peak
    - Trace = Maxhold
    - RBW = 1 MHz
    - VBW  $\geq 1/\tau$  Hz, where  $\tau$  = pulse width in secondsThe actual setting value of VBW = 1 kHz
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) + Distance Factor(D.F)

## 8.9. 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 : Ant1(SISO), Ant2(SISO), Ant1+Ant2(SDM)
  - Worstcase : Ant1(SISO), Ant2(SISO)
3. EUT Axis
  - Radiated Spurious Emissions : Y
  - Radiated Restricted Band Edge : Y
4. All datarate of operation were investigated and the worst case datarate results are reported
  - 802.11a : 6Mbps
  - 802.11n : MCS0
  - 802.11ac : MCS0

### AC Power line Conducted Emissions

We don't perform powerline conducted emission test. Because this EUT is used with vehicle.

### Conducted test

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

[Ant1]

- 802.11a : 12Mbps
- 802.11n(HT20) : MCS2
- 802.11n(HT40) : MCS1
- 802.11ac(VHT20) : MCS2
- 802.11ac(VHT40) : MCS5
- 802.11ac(VHT80) : MCS0

[Ant2]

- 802.11a : 12Mbps
- 802.11n(HT20) : MCS2
- 802.11n(HT40) : MCS2
- 802.11ac(VHT20) : MCS2
- 802.11ac(VHT40) : MCS5
- 802.11ac(VHT80) : MCS0

[Ant1+2]

- 802.11n(HT20) : MCS10
- 802.11n(HT40) : MCS8
- 802.11ac(VHT20) : MCS9 (=MCS0NSS2)
- 802.11ac(VHT40) : MCS10 (=MCS0NSS2)
- 802.11ac(VHT80) : MCS10 (=MCS0NSS2)

2. SISO & MIMO(Multiple spatial streams) were tested and the worst case results are reported.

- Mode : Ant1(SISO), Ant2(SISO), Ant1+Ant2(SDM)
- Worstcase : Ant1(SISO), Ant2(SISO),

## 9. SUMMARY OF TEST RESULTS

### 9.1 FCC Part

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
26dB Bandwidth	§15.407 (for Power Measurement)	N/A	Conducted	PASS
6 dB Bandwidth	§15.407(e)	>500 kHz (5725-5850 MHz)		PASS
Maximum Conducted Output Power	§15.407(a)(1)	< 250 mW(5150-5250 MHz) < 250 mW or 11+10 log log <sub>10</sub> (BW) dBm (5250-5350 MHz) < 250 mW or 11+10 log log <sub>10</sub> (BW) dBm (5470-5725 MHz) <1 W(5725-5850 MHz)		PASS
Peak Power Spectral Density	§15.407(a)(1),(5)	<11 dBm/ MHz (5150-5250 MHz) <11 dBm/ MHz (5250-5350 MHz) <11 dBm/ MHz (5470-5725 MHz) <30 dBm/500 kHz(5725-5850 MHz)		PASS
Frequency Stability	§15.407(g) §2.1055	Maintained within the band		PASS
Transmit Power Control (TPC)	§15.407(h)(1)	The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.		N/A (See Note1)
AC Conducted Emissions 150 kHz-30 MHz	15.207	<FCC 15.207 limits		N/A (See Note2)
Undesirable Emissions	§15.407(b)	<-27 dBm/MHz EIRP (UNII1, 2A, 2C) cf. Section 8.7 (UNII 3)	Radiated	PASS
General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	15.205, 15.407(b)(5), (6)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS

**Note:**

1. TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW
2. We don't perform powerline conducted emission test. Because this EUT is used with vehicle.

## 9.2 IC Part

Test Description	IC Part Section(s)	Test Limit	Test Condition	Test Result
99% Bandwidth	RSS-GEN, 6.7	N/A	CONDUCTED	PASS
6 dB Bandwidth	RSS-247, 6.2.4.1	> 500 kHz (5725~5850 MHz)		PASS
Maximum Conducted Output Power, & Maximum e.i.r.p	RSS-247, 6.2	<ul style="list-style-type: none"> <li>■ Maximum e.i.r.p. shall not exceed 30 mW(=14.77dBm) or <math>1.76 + 10 \log_{10}(BW)</math>,dBm (5150-5350 MHz)</li> <li>■ &lt; 250 mW or <math>11+10 \log \log_{10} (BW)</math> dBm (5470-5725 MHz)</li> <li>■ &lt;1 W(5725-5850 MHz)</li> </ul>		PASS
Transmit Power Control (TPC)	RSS-247, 6.2.2.1	<ul style="list-style-type: none"> <li>■ at least 3 dB below the maximum permitted e.i.r.p. of 30 mW. (5150-5350 MHz)</li> <li>■ The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. (5470-5725 MHz)</li> </ul>		N/A (See Note1)
Power Spectral Density	RSS-247 6.2	<ul style="list-style-type: none"> <li>&lt;11 dBm/ MHz (5150-5250 MHz)</li> <li>&lt;11 dBm/ MHz (5250-5350 MHz)</li> <li>&lt;11 dBm/ MHz (5470-5725 MHz)</li> <li>&lt;30 dBm/500 kHz(5725-5850 MHz)</li> </ul>		PASS
AC Conducted Emissions 150 kHz-30 MHz	RSS-GEN, 8.8	cf. Section 8.6		N/A (See Note2)
Undesirable Emissions	RSS-247 6.2	<ul style="list-style-type: none"> <li>■ &lt;-27 dBm/MHz EIRP (UNII1, 2A, 2C)</li> <li>■ cf. Section 8.7 (UNII 3)</li> </ul>	RADIATED	PASS
				PASS
General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	RSS-GEN, 8.9	cf. Section 8.7		PASS
Receiver Spurious Emissions	RSS-GEN, 7	cf. Section 8.8		PASS

**Note:**

1. TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW
2. We don't perform powerline conducted emission test. Because this EUT is used with vehicle.

## 10. TEST RESULT

### 10.1 DUTY CYCLE

Mode	Data Rate (Mbps)	Duty Cycle	Duty Cycle Factor (dB)
802.11a	6	0.932	0.304
	9	0.904	0.439
	12	0.880	0.553
	18	0.834	0.791
	24	0.791	1.020
	36	0.723	1.408
	48	0.667	1.757
	54	0.648	1.882

Mode	MCS Index	Duty Cycle	Duty Cycle Factor (dB)
802.11n(HT20)	0	0.931	0.310
	1	0.875	0.580
	2	0.828	0.817
	3	0.789	1.030
	4	0.723	1.408
	5	0.673	1.721
	6	0.655	1.838
	7	0.635	1.976
	8	0.876	0.573
	9	0.791	1.019
	10	0.726	1.390
	11	0.678	1.690
	12	0.611	2.142
	13	0.561	2.511
	14	0.545	2.637
15	0.527	2.778	

Mode	MCS Index	Duty Cycle	Duty Cycle Factor (dB)
802.11n(HT40)	0	0.868	0.613
	1	0.782	1.066
	2	0.718	1.440
	3	0.668	1.750
	4	0.598	2.233
	5	0.546	2.627
	6	0.529	2.768
	7	0.510	2.925
	8	0.785	1.053
	9	0.673	1.721
	10	0.605	2.181
	11	0.554	2.563
	12	0.497	3.032
	13	0.456	3.412
	14	0.442	3.543
	15	0.429	3.671

Mode	MCS Index	Duty Cycle	Duty Cycle Factor (dB)
802.11ac(VHT20)	0	0.932	0.308
	1	0.875	0.580
	2	0.828	0.818
	3	0.789	1.027
	4	0.727	1.384
	5	0.676	1.701
	6	0.659	1.810
	7	0.638	1.952
	8	0.609	2.151
	9 (=MCS0NSS2)	0.875	0.579
	10 (=MCS1NSS2)	0.791	1.019
	11 (=MCS2NSS2)	0.729	1.372
	12 (=MCS3NSS2)	0.682	1.664
	13 (=MCS4NSS2)	0.616	2.107
	14 (=MCS5NSS2)	0.569	2.452
	15 (=MCS6NSS2)	0.553	2.572
	16 (=MCS7NSS2)	0.538	2.696
	17 (=MCS8NSS2)	0.509	2.936
18 (=MCS9NSS2)	0.875	0.579	

Mode	MCS Index	Duty Cycle	Duty Cycle Factor (dB)
802.11ac(VHT40)	0	0.868	0.617
	1	0.785	1.053
	2	0.720	1.427
	3	0.672	1.729
	4	0.603	2.195
	5	0.542	2.662
	6	0.536	2.706
	7	0.520	2.844
	8	0.499	3.021
	9	0.479	3.198
	10 (=MCS0NSS2)	0.786	1.047
	11 (=MCS1NSS2)	0.677	1.694
	12 (=MCS2NSS2)	0.609	2.151
	13 (=MCS3NSS2)	0.562	2.501
	14 (=MCS4NSS2)	0.507	2.946
	15 (=MCS5NSS2)	0.464	3.339
	16 (=MCS6NSS2)	0.456	3.412
	17 (=MCS7NSS2)	0.444	3.531
	18 (=MCS8NSS2)	0.432	3.642
19 (=MCS9NSS2)	0.419	3.779	

Mode	MCS Index	Duty Cycle	Duty Cycle Factor (dB)
802.11ac(VHT80)	0	0.773	1.116
	1	0.659	1.810
	2	0.591	2.282
	3	0.546	2.627
	4	0.490	3.101
	5	0.455	3.424
	6	0.444	3.531
	7	0.432	3.642
	8	0.417	3.797
	9	0.402	3.960
	10 (=MCS0NSS2)	0.664	1.779
	11 (=MCS1NSS2)	0.554	2.563
	12 (=MCS2NSS2)	0.500	3.010
	13 (=MCS3NSS2)	0.468	3.302
	14 (=MCS4NSS2)	0.429	3.671
	15 (=MCS5NSS2)	0.403	3.947
	16 (=MCS6NSS2)	0.403	3.947
	17 (=MCS7NSS2)	0.388	4.109
	18 (=MCS8NSS2)	0.387	4.124
19 (=MCS9NSS2)	0.371	4.301	

## 10.2 26DB BANDWIDTH

### [Ant1]

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.15	16.620
5200	40	20.99	16.625
5240	48	20.95	16.631
5260	52	20.92	16.639
5300	60	20.87	16.645
5320	64	21.14	16.631
5500	100	21.14	16.642
5600	120	22.06	16.807
5720	144	25.81	16.834
5745	149	22.04	16.815
5785	157	22.77	16.855
5825	165	22.77	16.805

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.16	17.739
5200	40	21.56	17.769
5240	48	21.35	17.761
5260	52	21.33	17.741
5300	60	21.39	17.730
5320	64	21.38	17.847
5500	100	21.27	17.781
5600	120	24.33	17.929
5720	144	25.95	17.986
5745	149	25.31	17.960
5785	157	25.23	17.945
5825	165	24.78	17.887

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.49	36.132
5230	46	39.49	36.138
5270	54	39.79	36.173
5310	62	39.63	36.119
5510	102	39.70	36.123
5590	118	48.75	36.341
5710	142	48.98	36.342
5755	151	54.92	36.306
5795	159	65.47	36.318

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.51	17.763
5200	40	21.27	17.731
5240	48	21.43	17.773
5260	52	21.37	17.783
5300	60	21.34	17.753
5320	64	21.27	17.810
5500	100	21.33	17.777
5600	120	27.97	17.903
5720	144	27.46	18.006
5745	149	21.32	17.780
5785	157	22.60	17.902
5825	165	25.42	17.905

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.37	36.098
5230	46	39.42	36.143
5270	54	39.78	36.173
5310	62	39.55	36.128
5510	102	39.67	36.146
5590	118	44.10	36.246
5710	142	51.39	36.288
5755	151	51.44	36.301
5795	159	54.38	36.303

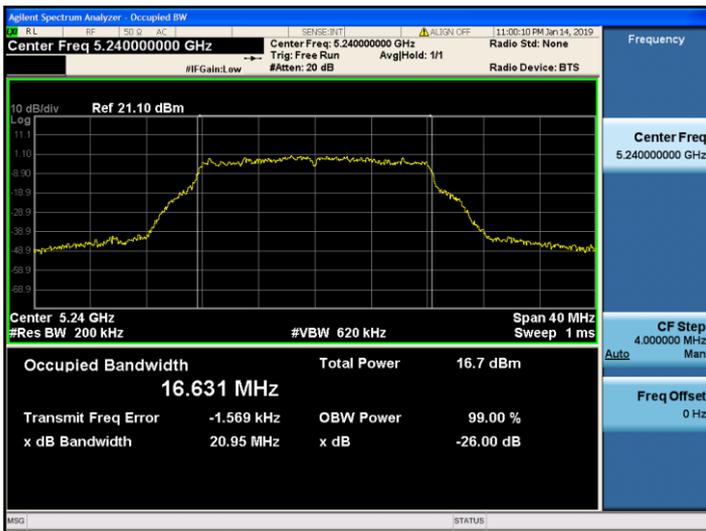
802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	81.84	75.509
5290	58	80.98	75.548
5530	106	81.44	75.546
5690	138	99.78	75.882
5775	155	106.26	75.771

**Test Plots(802.11a)**

**Note:**

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

**802.11a UNII 1 BAND 26dB Bandwidth (CH 48)**



**802.11a UNII 2A BAND 26dB Bandwidth (CH 56)**



**802.11a UNII 2C BAND 26dB Bandwidth (CH144)**



**802.11a UNII 3 BAND 26dB Bandwidth (CH 157)**







**Test Plots(802.11ac(VHT20))**

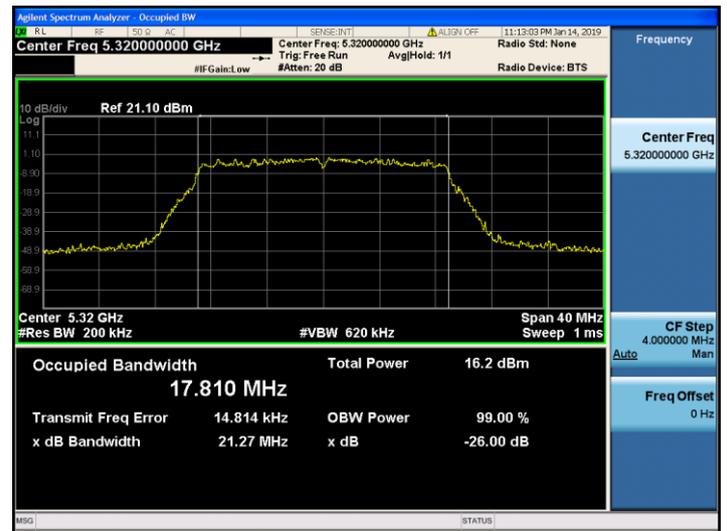
**Note:**

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

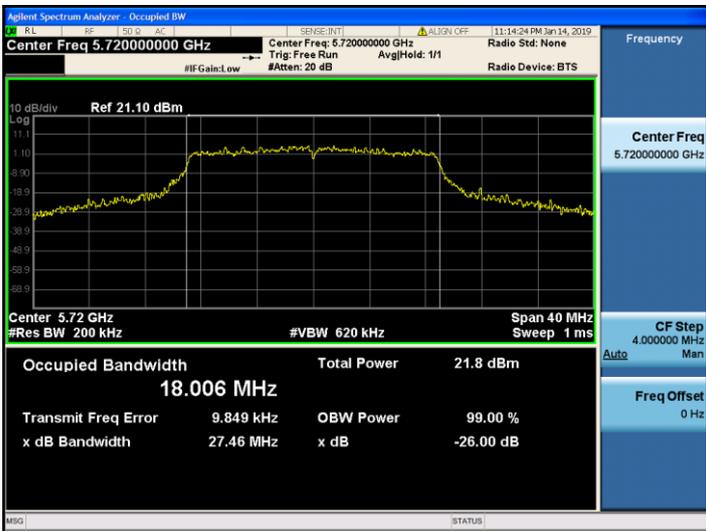
**802.11ac\_VHT20 UNII 1 BAND 26dB Bandwidth(CH 48)**



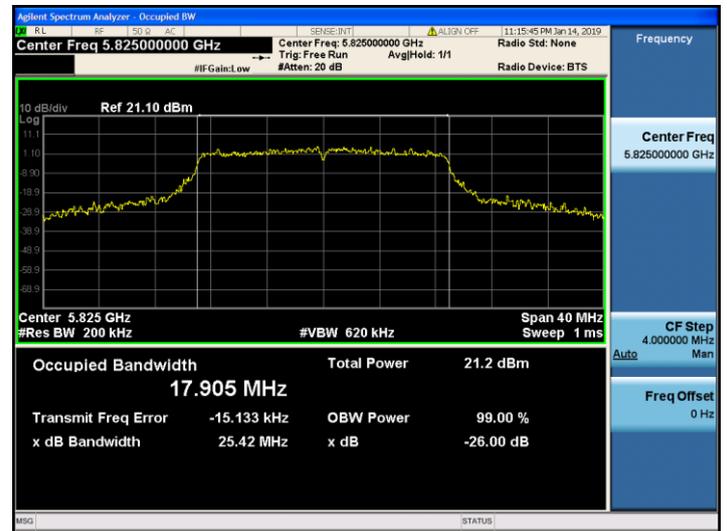
**802.11ac\_VHT20 UNII 2A BAND 26dB Bandwidth(CH 64)**



**802.11ac\_VHT20 UNII 2C BAND 26dB Bandwidth(CH 144)**



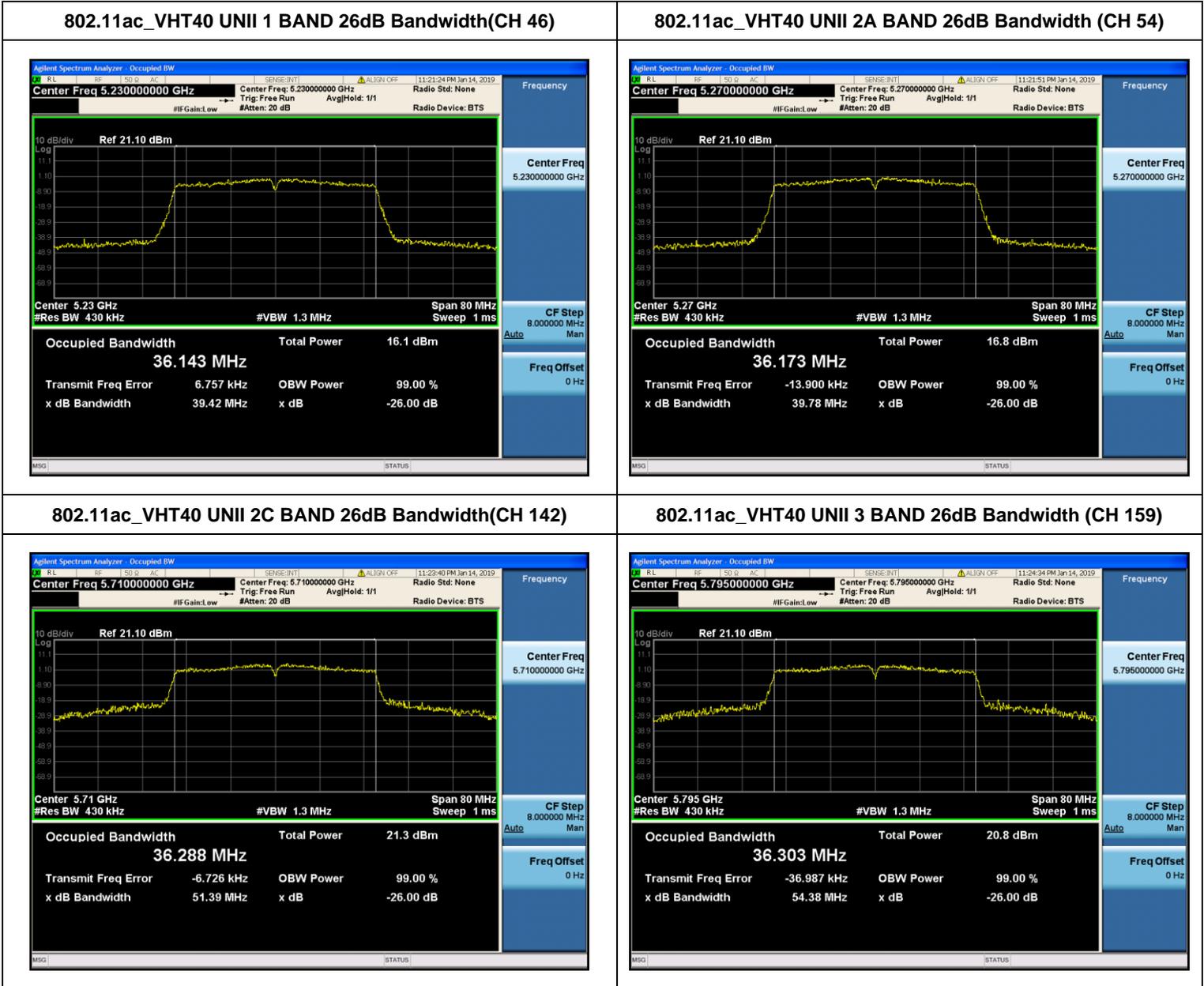
**802.11ac\_VHT20 UNII 3 BAND 26dB Bandwidth(CH 165)**



**Test Plots(802.11ac(VHT40))**

**Note:**

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





**[Ant2]**

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.18	16.689
5200	40	20.90	16.664
5240	48	21.00	16.653
5260	52	21.45	16.654
5300	60	21.11	16.661
5320	64	20.92	16.703
5500	100	21.16	16.686
5600	120	21.32	16.640
5720	144	21.21	16.658
5745	149	21.17	16.707
5785	157	21.15	16.762
5825	165	24.72	16.799

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.38	17.766
5200	40	21.30	17.787
5240	48	21.29	17.805
5260	52	21.67	17.794
5300	60	21.52	17.794
5320	64	21.56	17.846
5500	100	21.42	17.793
5600	120	21.55	17.805
5720	144	21.17	17.823
5745	149	22.74	17.808
5785	157	24.76	17.910
5825	165	26.25	17.912

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.67	36.125
5230	46	39.47	36.211
5270	54	39.46	36.148
5310	62	39.53	36.150
5510	102	39.78	36.140
5590	118	39.64	36.174
5710	142	39.56	36.123
5755	151	39.64	36.240
5795	159	43.70	36.345

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.52	17.806
5200	40	21.46	17.825
5240	48	21.38	17.790
5260	52	21.79	17.790
5300	60	21.58	17.794
5320	64	21.21	17.787
5500	100	21.44	17.819
5600	120	21.43	17.813
5720	144	21.38	17.811
5745	149	21.49	17.863
5785	157	23.88	17.871
5825	165	28.63	17.903

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.64	36.105
5230	46	39.44	36.210
5270	54	39.47	36.120
5310	62	39.51	36.090
5510	102	39.72	36.141
5590	118	39.68	36.188
5710	142	39.48	36.142
5755	151	39.98	36.222
5795	159	40.38	36.302

802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	81.53	75.492
5290	58	80.89	75.408
5530	106	81.06	75.583
5690	138	80.57	75.469
5775	155	86.99	75.669

**Test Plots(802.11a)**

**Note:**

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

**802.11a UNII 1 BAND 26dB Bandwidth (CH 36)**



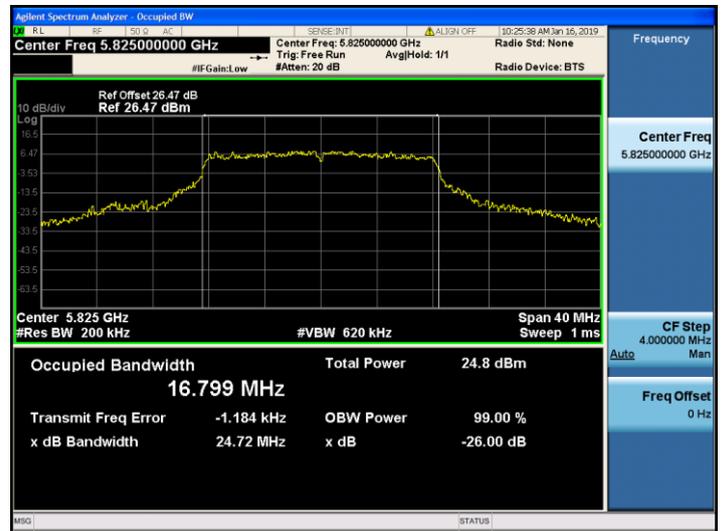
**802.11a UNII 2A BAND 26dB Bandwidth (CH 64)**



**802.11a UNII 2C BAND 26dB Bandwidth (CH100)**



**802.11a UNII 3 BAND 26dB Bandwidth (CH 165)**

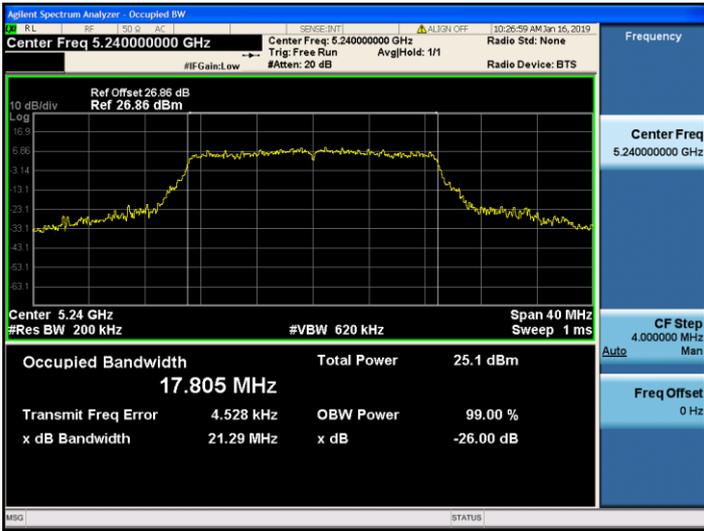


**Test Plots(802.11n(HT20))**

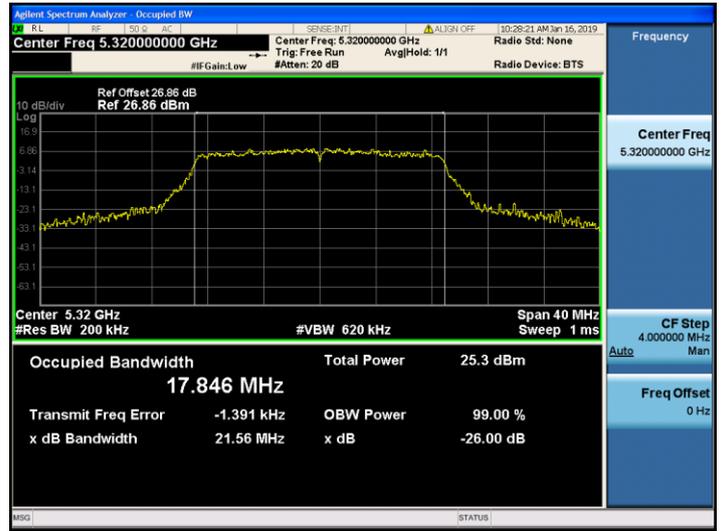
**Note:**

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

**802.11n\_HT20 UNII 1 BAND 26dB Bandwidth(CH 48)**



**802.11n\_HT20 UNII 2A BAND 26dB Bandwidth(CH 64)**



**802.11n\_HT20 UNII 2C BAND 26dB Bandwidth(CH 144)**



**802.11n\_HT20 UNII 3 BAND 26dB Bandwidth(CH 165)**

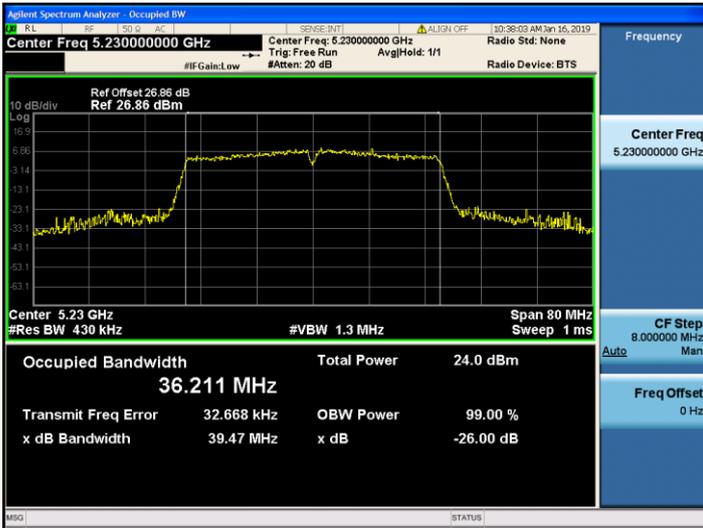


**Test Plots(802.11n(HT40))**

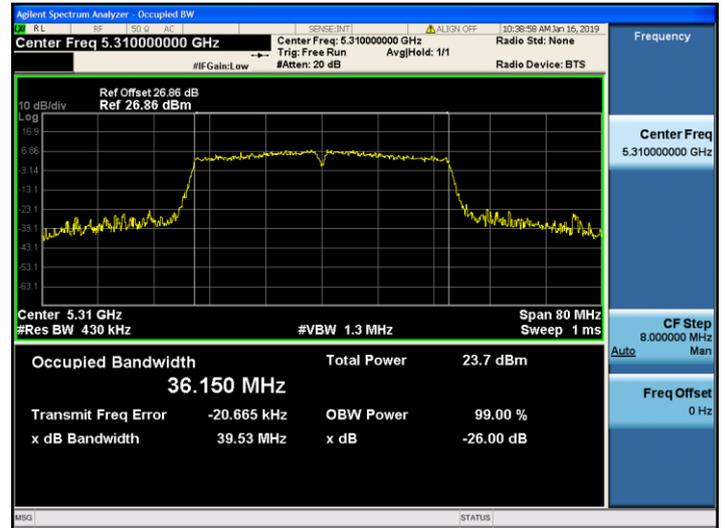
**Note:**

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

**802.11n\_HT40 UNII 1 BAND 26dB Bandwidth(CH 46)**



**802.11n\_HT40 UNII 2A BAND 26dB Bandwidth (CH 62)**



**802.11n\_HT40 UNII 2C BAND 26dB Bandwidth(CH 110)**



**802.11n\_HT40 UNII 3 BAND 26dB Bandwidth (CH 159)**

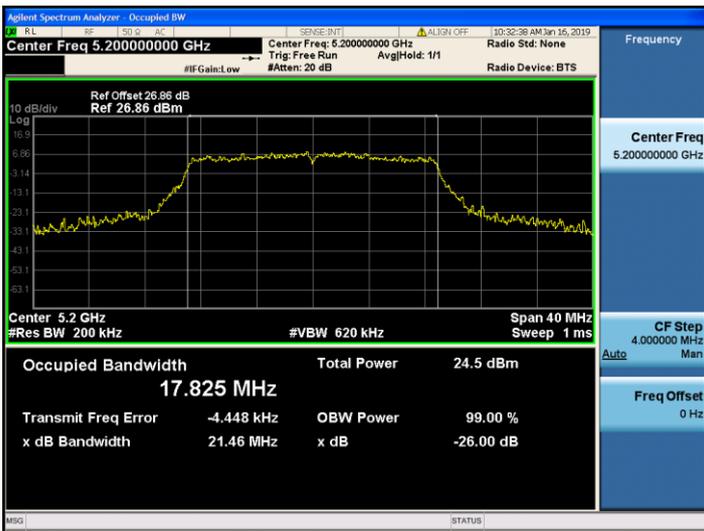


**Test Plots(802.11ac(VHT20))**

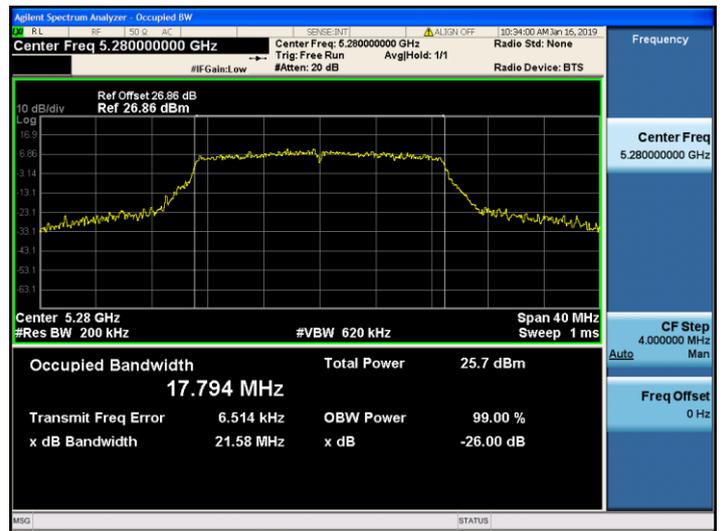
**Note:**

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

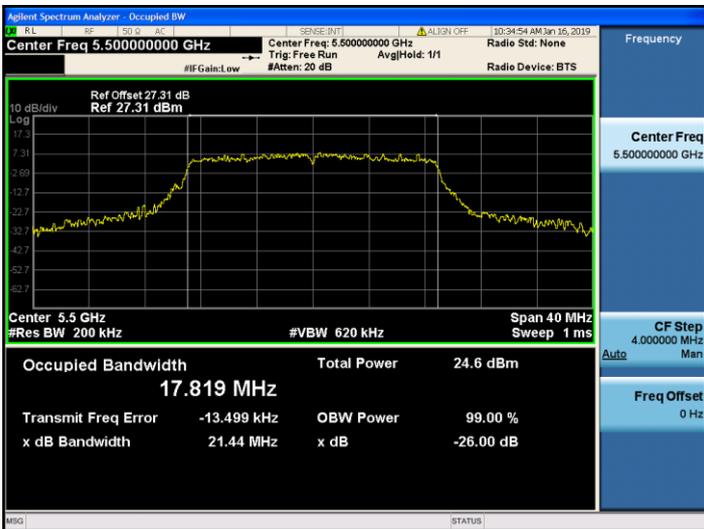
**802.11ac\_VHT20 UNII 1 BAND 26dB Bandwidth(CH 40)**



**802.11ac\_VHT20 UNII 2A BAND 26dB Bandwidth(CH 56)**



**802.11ac\_VHT20 UNII 2C BAND 26dB Bandwidth(CH 100)**



**802.11ac\_VHT20 UNII 3 BAND 26dB Bandwidth(CH 165)**

