

5.5. Radiated Emissions Measurement

5.5.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

		NATT	CII
MHZ	MHZ	MHZ	GHZ
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
 \2\ Above 38.6

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz (68.2dBuV/m at 3m).

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10 th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP



5.5.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.5 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.



2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (\pm 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.



3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position $(\pm 45^\circ)$ and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.



4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.



5.5.4. Test Setup Layout

For radiated emissions below 30MHz





Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].



5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.5.6. Results of Radiated Emissions (9 KHz~30MHz)

Temperature	24.5 ℃	Humidity	56.2%
Test Engineer	Anna Hu	Configurations	IEEE 802.11a/n/ac

Freq.	Freq. Level		Over Limit	Remark
(MHz)	(MHz) (dBuV)		(dBuV)	
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

5.5.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	24.5 ℃	Humidity	50%
Test Engineer	Anna Hu	Configurations	IEEE 802.11a, 5180MHz

Test result for IEEE 802.11a, 5180MHz



Vertical



Suspected List												
NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity				
1	61.040	35.76	-15.92	40	4.24	100	192	Vertical				
2	124.575	32.86	-18.30	43.5	10.64	100	265	Vertical				
3	155.615	34.35	-18.86	43.5	9.15	100	343	Vertical				
4	316.150	32.12	-12.36	46.5	14.38	100	349	Vertical				
5	408.300	33.67	-9.88	46.5	12.83	100	245	Vertical				
6	628.490	37.39	-5.24	46.5	9.11	100	335	Vertical				



Horizontal



Susp	Suspected List												
NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity					
1	60.555	23.11	-15.79	40	16.89	100	246	Horizontal					
2	156.100	27.07	-18.84	43.5	16.43	100	265	Horizontal					
3	235.640	23.43	-14.32	46.5	23.07	100	305	Horizontal					
4	314.695	31.43	-12.41	46.5	15.07	100	249	Horizontal					
5	407.330	30.8	-9.89	46.5	15.70	100	145	Horizontal					
6	650.800	39.34	-4.96	46.5	7.16	100	313	Horizontal					

Note:

1) Pre-scan all modes and recorded the worst case results in this report (IEEE 802.11n HT40, 5190MHz). 2). Margin[dB] = Limit[dB μ V/m] – Result Level[dB μ V/m]



5.5.8. Results for Radiated Emissions (Above 1GHz)

Remark: Measured all modes and recorded worst case;

IEEE 802.11a

Channel 36/5180 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.54	56.53	33.06	35.04	3.94	58.49	68.20	-9.71	Peak	Horizontal
15.54	42.46	33.06	35.04	3.94	44.42	54.00	-9.58	Average	Horizontal
15.54	54.58	33.06	35.04	3.94	56.54	68.20	-11.66	Peak	Vertical
15.54	42.50	33.06	35.04	3.94	44.46	54.00	-9.54	Average	Vertical

Channel 40 / 5200 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.60	55.81	33.16	35.15	3.96	57.78	68.20	-10.42	Peak	Horizontal
15.60	42.52	33.16	35.15	3.96	44.49	54.00	-9.51	Average	Horizontal
15.60	54.24	33.16	35.15	3.96	56.21	68.20	-11.99	Peak	Vertical
15.60	40.35	33.16	35.15	3.96	42.32	54.00	-11.68	Average	Vertical

Channel 48 / 5240 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.72	55.18	33.26	35.14	3.98	57.28	68.20	-10.92	Peak	Horizontal
15.72	42.73	33.26	35.14	3.98	44.83	54.00	-9.17	Average	Horizontal
15.72	56.28	33.26	35.14	3.98	58.38	68.20	-9.82	Peak	Vertical
15.72	44.38	33.26	35.14	3.98	46.48	54.00	-7.52	Average	Vertical



IEEE 802.11n-HT20 Channel 36/5180 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase	
15.54	56.90	33.06	35.04	3.94	58.86	68.20	-9.34	Peak	Horizontal	
15.54	44.69	33.06	35.04	3.94	46.65	54.00	-7.35	Average	Horizontal	
15.54	54.54	33.06	35.04	3.94	56.50	68.20	-11.70	Peak	Vertical	
15.54	42.61	33.06	35.04	3.94	44.57	54.00	-9.43	Average	Vertical	

Channel 40 / 5200 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.60	56.72	33.16	35.15	3.96	58.69	68.20	-9.51	Peak	Horizontal
15.60	40.90	33.16	35.15	3.96	42.87	54.00	-11.13	Average	Horizontal
15.60	55.68	33.16	35.15	3.96	57.65	68.20	-10.55	Peak	Vertical
15.60	44.86	33.16	35.15	3.96	46.83	54.00	-7.17	Average	Vertical

Channel 48 / 5240 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.72	57.03	33.26	35.14	3.98	59.13	68.20	-9.07	Peak	Horizontal
15.72	41.88	33.26	35.14	3.98	43.98	54.00	-10.02	Average	Horizontal
15.72	55.83	33.26	35.14	3.98	57.93	68.20	-10.27	Peak	Vertical
15.72	43.59	33.26	35.14	3.98	45.69	54.00	-8.31	Average	Vertical



IEEE 802.11n HT40 Channel 38 / 5190 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.57	54.97	33.06	35.04	3.94	56.93	68.20	-11.27	Peak	Horizontal
15.57	44.22	33.06	35.04	3.94	46.18	54.00	-7.82	Average	Horizontal
15.57	57.69	33.06	35.04	3.94	59.65	68.20	-8.55	Peak	Vertical
15.57	41.06	33.06	35.04	3.94	43.02	54.00	-10.98	Average	Vertical

Channel 46 / 5230 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.69	54.61	33.16	35.15	3.96	56.58	68.20	-11.62	Peak	Horizontal
15.69	41.07	33.16	35.15	3.96	43.04	54.00	-10.96	Average	Horizontal
15.69	58.80	33.16	35.15	3.96	60.77	68.20	-7.43	Peak	Vertical
15.69	40.43	33.16	35.15	3.96	42.40	54.00	-11.60	Average	Vertical

IEEE 802.11ac VHT20

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.54	58.85	33.06	35.04	3.94	60.81	68.20	-7.39	Peak	Horizontal
15.54	40.92	33.06	35.04	3.94	42.88	54.00	-11.12	Average	Horizontal
15.54	56.65	33.06	35.04	3.94	58.61	68.20	-9.59	Peak	Vertical
15.54	44.19	33.06	35.04	3.94	46.15	54.00	-7.85	Average	Vertical

Channel 40 / 5200 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.60	58.42	33.16	35.15	3.96	60.39	68.20	-7.81	Peak	Horizontal
15.60	40.52	33.16	35.15	3.96	42.49	54.00	-11.51	Average	Horizontal
15.60	54.72	33.16	35.15	3.96	56.69	68.20	-11.51	Peak	Vertical
15.60	40.50	33.16	35.15	3.96	42.47	54.00	-11.53	Average	Vertical

Channel 48 / 5240 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.72	55.00	33.26	35.14	3.98	57.10	68.20	-11.10	Peak	Horizontal
15.72	40.48	33.26	35.14	3.98	42.58	54.00	-11.42	Average	Horizontal
15.72	57.76	33.26	35.14	3.98	59.86	68.20	-8.34	Peak	Vertical
15.72	43.86	33.26	35.14	3.98	45.96	54.00	-8.04	Average	Vertical



IEEE 802.11ac VHT40

Channel 38 / 5190 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.57	55.60	33.06	35.04	3.94	57.56	68.20	-10.64	Peak	Horizontal
15.57	43.48	33.06	35.04	3.94	45.44	54.00	-8.56	Average	Horizontal
15.57	58.91	33.06	35.04	3.94	60.87	68.20	-7.33	Peak	Vertical
15.57	42.11	33.06	35.04	3.94	44.07	54.00	-9.93	Average	Vertical

Channel 46 / 5230 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.69	56.05	33.16	35.15	3.96	58.02	68.20	-10.18	Peak	Horizontal
15.69	44.51	33.16	35.15	3.96	46.48	54.00	-7.52	Average	Horizontal
15.69	54.65	33.16	35.15	3.96	56.62	68.20	-11.58	Peak	Vertical
15.69	41.95	33.16	35.15	3.96	43.92	54.00	-10.08	Average	Vertical

IEEE 802.11ac VHT80

Channel 42 / 5210 MHz

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
15.63	54.93	33.06	35.04	3.94	56.89	68.20	-11.31	Peak	Horizontal
15.63	43.66	33.06	35.04	3.94	45.62	54.00	-8.38	Average	Horizontal
15.63	57.67	33.06	35.04	3.94	59.63	68.20	-8.57	Peak	Vertical
15.63	44.18	33.06	35.04	3.94	46.14	54.00	-7.86	Average	Vertical

Notes:

- 1. Measuring frequencies from 9 KHz ~40 GHz, No emission found between lowest internal used/generated frequencies to 30MHz.
- 2. Radiated emissions measured in frequency range from 9 KHz ~40GHz were made with an instrument using Peak detector mode.
- 3. Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40

5. Measured[dBμv/m] = Reading[dBμv/m] + Ant. Fac.[dB/m] - Pre. Fac.[dB] + Cab. Loss[dB]; Margin[dB] = Limit[dBμV/m] –Measured Level[dBμV/m]



5.6. Power line conducted emissions

5.6.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range	Limits (dBµV)				
(MHz)	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			

* Decreasing linearly with the logarithm of the frequency

5.6.2 Block Diagram of Test Setup



5.6.3 Test Results

PASS.

The test data please refer to following page.

Temperature	22.8 ℃	Humidity	50%
Test Engineer	Anna Hu	Configurations	BT

The test data please refer to following page.



The worst result for IEEE 802.11a, 5180MHz

Line







Neutral





5.7 Undesirable Emissions Measurement

5.7.1 LIMIT

According to ξ 15.407 (b) Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (a) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
- (b) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
- (c) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
- (d) For transmitters operating in the 5.725-5.85 GHz band:
- (i) 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.
- (ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.
- (e) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (f) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.
- (g) The provisions of §15.205 apply to intentional radiators operating under this section.
- (h) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

5.7.2 TEST CONFIGURATION



5.7.3 TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section G: Unwanted Emission Measurement

- 1. Unwanted Emissions in the Restricted Bands
- a) For all measurements, follow the requirements in section II.G.3. "General Requirements for Unwanted Emissions Measurements."
- b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. "Procedure for Unwanted Emissions Measurements below 1000 MHz."
- c) At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.
- d) For conducted measurements above 1000 MHz, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KDB Publication 412172):
 - i) E[dBµV/m] = EIRP[dBm] 20 log (d[meters]) + 104.77, where E = field strength and d = distance at which field strength limit is specified in the rules;
 - ii) $E[dB\mu V/m] = EIRP[dBm] + 95.2$, for d = 3 meters



- e) For conducted measurements below 1000 MHz, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.
- 2. Unwanted Emissions that fall Outside of the Restricted Bands
- a) For all measurements, follow the requirements in section II.G.3. "General Requirements for Unwanted Emissions Measurements."
- b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. "Procedure for Unwanted Emissions Measurements below 1000 MHz."
- c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., "Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 MHz."
- d) Section 15.407(b) (1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.
- i) Section 15.407(b) (4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b) (4) (i). An alternative to the band emissions mask is specified in Section 15.407(b) (4) (ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.
- e) If radiated measurements are performed, field strength is then converted to EIRP as follows:

i) EIRP = ((E×d) ^2) / 30

- Where:
- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotopically radiated power in watts;
- ii) Working in dB units, the above equation is equivalent to: EIRP [dBm] = E [dB μ V/m] + 20 log (d [meters]) - 104.77
- iii) Or, if d is 3 meters:
- $EIRP [dBm] = E [dB\mu V/m] 95.23$
- 3) Radiated versus Conducted Measurements. The unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance provided that the following steps are performed:
- (i) Cabinet emissions measurements. A radiated test shall be performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna may be replaced by a termination matching the nominal impedance of the antenna.
- (ii) Impedance matching. Conducted tests shall be performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT.
- (iii) EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater.³ However, for devices that operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20% of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 dBi be selected.
- (iv) EIRP adjustments for multiple outputs. For devices with multiple outputs occupying the same or overlapping frequency ranges in the same band (e.g., MIMO or beamforming devices), compute the total EIRP as follows:
 - Compute EIRP for each output, as described in (iii), above.
 - Follow the procedures specified in KDB Publication 662911 for summing emissions across the outputs or adjusting emission levels measured on individual outputs by 10 log (N_{ANT}), where N_{ANT} is the number of outputs.
 - Add the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.
- (v) Direction of maximum emission.
 For all radiated emissions tests, measurements shall correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).



5.7.4 TEST RESULT

TestMode	Antenna	ChName	Channel	Detector	Freq	EIRP	Limit	Verdict	
				A) ([MHZ]			D 4.00	
		Low	5180	AV	4500.000	-46.68	<=-41.20	PASS	
				AV	5150.000	-43.88	<=-41.20	PASS	
11A				Peak	4500.000	-39.94	<=-21.20	PASS	
	Ant1			Реак	5150.000	-37.68	<=-21.20	PASS	
				AV	5350.000	-44.58	<=-41.20	PASS	
		High	5240	AV	5460.000	-45.61	<=-41.20	PASS	
		5		Peak	5350.000	-37.79	<=-21.20	PASS	
				Peak	5460.000	-37.69	<=-21.20	PASS	
				AV	4500.000	-46.71	<=-41.20	PASS	
		Low	5180	AV	5150.000	-44.21	<=-41.20	PASS	
		-		Peak	4500.000	-39.47	<=-21.20	PASS	
11N20SISO	Ant1			Peak	5150.000	-35.29	<=-21.20	PASS	
	,			AV	5350.000	-44.47	<=-41.20	PASS	
		High	5240	AV	5460.000	-45.54	<=-41.20	PASS	
		g.i	0210	Peak	5350.000	-37.93	<=-21.20	PASS	
				Peak	5460.000	-37.83	<=-21.20	PASS	
				AV	4500.000	-46.5	<=-41.20	PASS	
		Low	5190	AV	5150.000	-42.44	<=-41.20	PASS	
		LOW	5190	Peak	4500.000	-37.38	<=-21.20	PASS	
1111/05150	Ant1			Peak	5150.000	-28.9	<=-21.20	PASS	
111400100	~	High	5230	AV	5350.000	-44.47	<=-41.20	PASS	
				AV	5460.000	-45.35	<=-41.20	PASS	
				Peak	5350.000	-37.59	<=-21.20	PASS	
				Peak	5460.000	-38.56	<=-21.20	PASS	
				AV	4500.000	-46.77	<=-41.20	PASS	
		Low	E190	AV	5150.000	-44.01	<=-41.20	PASS	
		LOW	5160	Peak	4500.000	-39.08	<=-21.20	PASS	
1140208180	Ant1			Peak	5150.000	-36.21	<=-21.20	PASS	
TTAC203130				AV	5350.000	-44.49	<=-41.20	PASS	
		Lligh	50.40	AV	5460.000	-45.52	<=-41.20	PASS	
		High	5240	Peak	5350.000	-38.24	<=-21.20	PASS	
				Peak	5460.000	-38.24	<=-21.20	PASS	
				AV	4500.000	-46.46	<=-41.20	PASS	
		Law	F100	AV	5150.000	-43.08	<=-41.20	PASS	
		LOW	5190	Peak	4500.000	-38.96	<=-21.20	PASS	
4440400100	A 14			Peak	5150.000	-35.06	<=-21.20	PASS	
11AC405ISO	Antí			AV	5350.000	-44.41	<=-41.20	PASS	
			5000	AV	5460.000	-45.41	<=-41.20	PASS	
		High	5230	Peak	5350.000	-37.52	<=-21.20	PASS	
				Peak	5460.000	-37.9	<=-21.20	PASS	
-				AV	4500.000	-46.03	<=-41.20	PASS	
			50/0	AV	5150.000	-41.68	<=-41.20	PASS	
		Low	5210	Peak	4500.000	-40.6	<=-21.20	PASS	
4440000000				Peak	5150.000	-35.3	<=-21.20	PASS	
11AC80SISO	Ant1			AV	5350.000	-44.38	<=-41.20	PASS	
				AV	5460.000	-45.47	<=-41.20	PASS	
		High	5210	Peak	5350.000	-38.29	<=-21.20	PASS	
					Peak	5460.000	-38.4	<=-21.20	PASS



Remark:

- 1. Measured Undesirable emission at difference data rate for each mode and recorded worst case for each mode.
- 2. Test results including cable loss;
- 3. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40
- 4. For MIMO with CCD technology device, The Directional Gain= Gain of individual transmit antennas (dBi) + Array gain;
 - Array gain = 10 log (N_{ant}), where N_{ant} is the number of transmit antennas.
- 5. Covert Radiated E Level At 3m = Conducted average power + Directional Gain + 104.77-20*log(3);
- 6. Please refer to following test plots;



11A_Ant1_L	ow_5180_AV		
Agilent Spectrum Analyzer - Swept SA R R RF 50.0 AC SENSE PULSE Center Freq 4. 850000000 CH+2	ALIGN AUTO/NORF 10:34:34 AMOCt 10, 2020 #Avg Type: RMS TRACE[] 2.3.4.5.6	Frequency	
PROFESSION OF ANT PROFESSION O	Avg[Hold: 100/100 TVPE[000000000000000000000000000000000000	Auto Tune	
10 dB/div Ref 20.00 dBm 100 100	-43.879 dBm	Center Freq	
10.0		4.850000000 GHz	
-30.0 -40.0 p2	3.0 dBA	Start Freq 4.50000000 GHz	
-50.0		Stop Freq 5.20000000 GHz	
-70.0 Start 4.5000 GHz #Res BW 1.0 MHz #VBW 820 Hz	Stop 5.2000 GHz	CF Step	
MNR MODE FRI SCI X Y 1 N I 5.179 0 GHz 5.096 dBm 2 N I f 4.500 0 GHz 46.676 dBm		Auto Man	
3 N 1 7.0505 0 GHz 40.010 dBm 4 6 6 6 6 6		Freq Offset 0 Hz	
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11A_Ant1_Lo	w_5180_Peak		
Aglent Spectrum Analyzer - Swept SA IN RL RF 50 Ω AC SPINSE:PULSE Center Freq 4,8500000000 GHz PN0: Fast →→ Trig: Free Run	ALIGN AUTO/NORF 10:33:04 AMOct 10, 2020 #Avg Type: RMS TRACE 12:3:4:5 6 Avg Hold: 100/100 TYPE MUMANNIN	Frequency	
IFGain:Low #Atten: 30 dB Ref Offset 13.55 dB	Mkr3 5.150 0 GHz -37.682 dBm	Auto Tune	
		Center Freq	
-10.0	-21.10.dBn	Start Freg	
-30.0 2 -40.0 pering have given a second state of the second state		4.50000000 GHz	
-50.0		Stop Freq 5.20000000 GHz	
Start 4.5000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz	Stop 5.2000 GHz Sweep 1.200 ms (1001 pts)	CF Step 70.000000 MHz	
WEE Model Fail Sci X Y 1 N 1 f 5.182.5 GHz 10.892 dBm 2 N 1 f 4.500.0 GHz 39.936 dBm 3 N 1 f 5.150.0 GHz 37.93.937 dBm	UNCTION FUNCTION WIDTH FUNCTION VALUE	Auto Man	
6 7		0 Hz	
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 K. Market and Ma	STATUS		
11A_Ant1_H	igh_5240_AV		
Center Freq 5.340000000 GHz Freq 5.340000000 GHz PN0: Fast →→ IFGaintow #Atten: 30 dB	ALIGN AUTOINO RF 10:42:00 AMOct 10, 2020 #Avg Type: RMS TRACE 12:34 5 6 Avg Hold: 100/100 TVPE MUMANNAN DET P P P P P	Frequency	
Ref Offset 13.94 dB 10 dB/div Ref 20.00 dBm	Mkr3 5.460 00 GHz -45.611 dBm	Auto Tune	
		Center Freq 5.34000000 GHz	
-10.0		Start Freq	
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-60.0		5.460000000 GHz	
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	.21 20 dBm 3 Start Freq	
100 and the second descendence of the second	5.220000000 GHz	
60.0	5.46000000 GHz	
Start 5.2200 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Swi IMERI MORE TREI SEL X Y Runction Function	Stop 5.4600 GHz 24.0000 ms (1001 pts) STANDARD EUROPEON VALUE ALLO Man	
1 N 1 f 5.242.80 GHz 7.639 dBm 2 N 1 f 5.350 00 GHz -37.788 dBm 3 N 1 f 5.460 00 GHz -37.889 dBm 4	Freq Offset	
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11N20SISO Ant1 Low	5180 AV	
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IFGain:Low #Atten: 30 dB Ref Offset 13.55 dB 10 dB/div Ref 20.00 dBm	Mkr3 5.150 0 GHz -35.286 dBm	
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-10.0	-2140 dBa	
300) 2 -000 #4.444,344,444,444,444,444,444,444,444,44	4.50000000 GHz	
-60.0	Stop Freq 5.20000000 GHz	
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More participation X Y Participation Participation 1 N 1 f 5.179.3 GHz 10.278 dBm Participation Participation 2 N 1 f 4.500.0 GHz -39.465 dBm	Freq Offset	
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	glent Spectrum Analyzer - Swept SA RL RF S0.Ω AC SBNSE:PULSE Center Freq 5.340000000 GHz	ALIGN AUTO/NORF 10:53:39 AMOct 10, 2020 #Avg Type: RMS TRACE 12 3 4 5 6	Frequency	
ſ	PNO: Fast Trig: Free Run IFGain:Low #Atten: 30 dB Ref Offset 13.94 dB	Avg Hold: 100/100 TYPE MUMAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	Auto Tune	
1 L	10 dB/div Ref 20.00 dBm -og 10.0 1	-45.540 dBm	Center Freq	
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	60.0 60.0		Stop Freq	
ា	70.0 Start 5.2200 GHz	Stop 5.4600 GHz	5.46000000 GHz	
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	1 N 1 F 5,236 /2 GHz 4,184 dBm 2 N 1 f 5,350 00 GHz -44,466 dBm 3 N 1 f 5,360 00 GHz -45,540 dBm 4 - - - - - -		Freq Offset	
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न द	10.0	-21.20 dBs	Start Freq	
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 	60.0		Stop Freq 5.46000000 GHz	
s #	Start 5.2200 GHz #Res BW 1.0 MHz #VBW 3.0 MHz	Stop 5.4600 GHz Sweep 1.000 ms (1001 pts)	CF Step 24.00000 MHz	
9	Mile Mile Y 1 N 1 f 5.242 56 GHz 6.626 dBm 2 N 1 f 5.350 00 GHz -37.925 dBm	FUNCTION FUNCTION WIDTH FUNCTION VALUE	Auto Man	
	3 N 1 f 5.460 00 GHz -37.828 dBm 4 -		Freq Offset 0 Hz	
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≤		The STATUS		
	11N40SISO_An	t1_Low_5190_AV		
Ac U	gilent Spectrum Analyzer - Swept SA RL RF 50.Ω AC SENSE:PULSE	ALIGN AUTO/NORF 10:58:49 AMOct 10, 2020	Frequency	
c	Center Freq 4.850000000 GHZ PN0: Fast IFGain:Low #Atten: 30 dB	Avg Hold: 100/100	Auto Tune	
1 L	Ref Offset 13.55 dB 10 dB/div Ref 20.00 dBm	-42.444 dBm		
	10.0		Center Freq 4.850000000 GHz	
े द	20.0		Start Freq 4.50000000 GHz	
-4	40.0 2 50.0 		Stop Free	
-4 -7	70.0		5.200000000 GHz	
s #	start 4.5000 GHz #Res BW 1.0 MHz #VBW 1.6 kHz	Stop 5.2000 GHz Sweep 341.2 ms (1001 pts)	CF Step 70.000000 MHz Auto Man	
	Image F State Y 1 N 1 f 5.188 8 GHz 1.280 dBm 2 N 1 f 4.500 0 GHz -46.500 dBm 3 N 1 f 5.160 0 GHz -42.444 dBm		Freq Offset	
	4 5 6 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		0 Hz	
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s Maria	sg	STATUS		
	11N40SISO_Ant1	Low_5190_Peak		



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PN0: Fast	Avg Hold: 100/100 TYPE[MUMUMU Det[P P P P P P Mkr3 5 150 0 GHz]	Auto Tune	
Ref Offset 13.55 dB 10 dB/div Ref 20.00 dBm	-28.901 dBm		
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-50.0		Stop Freq 5.20000000 GHz	
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#Res BW 1.0 MHz #VBW 3.0 MHz	Sweep 1.200 ms (1001 pts)	70.000000 MHz Auto Man	
1 N 1 f 5.1895 GHz 6.969 dBm 2 N 1 f 4.500 0 GHz 37.383 dBm 3 N 1 f 5.150 0 GHz -28.901 dBm		Freq Offset	
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40.0	4 -4120c ³		
-60.0		5.46000000 GHz	
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Ref Offset 13.94 dB 10 dB/div Ref 20.00 dBm	Mkr3 5.460 00 GHz -38.563 dBm	Auto Tune	
		Center Freq 5.33000000 GHz	
-10.0	-21,20 dBm		
-30.0	2 3	Start Freq 5.20000000 GHz	
-50.0		Stop Freq	
-70.0		5.46000000 GHz	
Start 5.2000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz	Stop 5.4600 GHz Sweep 1.000 ms (1001 pts)	CF Step 26.000000 MHz	
MKR MODE TED SCI Y FU 1 N 1 f 5.228 60 GHz 4.866 dBm 2 N 1 f 5.350 00 GHz .37.586 dBm	NCTION FUNCTION WIDTH FUNCTION VALUE	Auto Man	
3 N 1 f 5.460 00 GHz -38.563 dBm 4 5		Freq Offset 0 Hz	
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11AC20SISO_Ant	1_Low_5180_AV		



Agilent Spectrum Analyzer - Swept SA Q2 RL RF 50 Ω AC SENSE:PULSE Center Freq 4 850000000 GHz SENSE:PULSE SENSE:PULSE	ALIGN AUTO/NO RF 11:07:48 AMOct 10, 2020	Frequency	
PN0: Fast ++ Trig: Free Run IFGain:Low #Atten: 30 dB	Avg Hold: 100/100 TYPE MUCHANNI DET P P P P P Mkr3 5 150 0 GH7	Auto Tune	
Ref Umset 13.55 dB 10 dB/div Ref 20.00 dBm Log	-44.011 dBm	CenterFree	
10.0		Center Freq 4.850000000 GHz	
-20.0		Start Freq	
-40.0 2	3,20 dB	4.5000000 512	
-60.0		Stop Freq 5.20000000 GHz	
Start 4.5000 GHz #Res BW 1.0 MHz #VBW 820 Hz	Stop 5.2000 GHz Sweep 665.7 ms (1001 pts)	CF Step 70.000000 MHz	
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3 N 1 f 5.150.0 GHz -44.011 dBm 4 -		Freq Offset 0 Hz	
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Aglient Spectrum Analyzer - Swept SA			
RL RF 50 Ω AC SBNSE:PULSE Center Freq 4.850000000 GHz Trig: Free Run Trig: Free Run	ALIGN AUTO/NO RF 11:06:19 AMOct 10, 2020 #Avg Type: RMS TRACE [] 2 3 4 5 6 Avg[Hold: 100/100 TYPE [M W#XMMP DET[] P P P P P	Frequency	
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-50.0		Stop Freq	
-70.0		5.20000000 GHz	
Start 4.5000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz	Stop 5.2000 GHz Sweep 1.200 ms (1001 pts)	CF Step 70.000000 MHz <u>Auto</u> Man	
1 N 1 f 5.179 7 GHz 10.178 dBm 2 N 1 f 4.500 0 GHz -39.078 dBm 3 N 1 f 5.160 0 GHz -39.078 dBm		Freq Offset	
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11	STATUS		
11AC20SISO An	t1_High_5240_AV		
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Center Freq 5.340000000 GHz PN0: Fast IFGain:Low #Atten: 30 dB	#Avg Type: RMS Avg Hold: 100/100 Det P P P P P	Frequency	
Ref Offset 13.94 dB 10 dB/div Ref 20.00 dBm	Mkr3 5.460 00 GHz -45.517 dBm		
		Center Freq 5.34000000 GHz	
-10.0		Start Freg	
-30.0	-41.20, 3	5.22000000 GHz	
-60.0		Stop Freq 5.46000000 GHz	
-70.0 Start 5.2200 GHz	Stop 5.4600 GHz	CF Step	
#Res BW 1.0 MHz #VBW 820 Hz	Sweep 228.3 ms (1001 pts)	24.00000 MHz <u>Auto</u> Man	
1 N 1 f 5 238 72 GHz 4.262 dBm 2 N 1 f 5.350 00 GHz -44.488 dBm 3 N 1 f 5.460 00 GHz -45.517 dBm 4 -45.517 dBm		Freq Offset	
5 6 7 9		U HZ	
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11AC20SISO_Ant	I_High_5240_Peak		



Agtient Spectrum Analyzer - Swept SA D RL RF SD A AC SENSEPULSE LANJOID F 11:13:37 AMOrt10.2020
Center Freq 5.340000000 GHz PK0: Fast → Trig: Free Run Avg Hold: 100/100 Tree Run Avg Hold: 100/100
Ref Offset 13.94 dB Mkr3 5.460 000 GHz
10 dBdiv Ref 20.00 dBm -30.235 dBfm 10
0.00 5.34000000 GHz
300 Carlo and Ca
400 500 500 500 500 500 500 500 500 500
700 5.46000000 GHz
Start 5.2200 GHz Stop 5.4600 GHz CF Step #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts) 24.00000 MHz Upper total less Sweep 1.000 ms (1001 pts) Auto Man
I N f 5.239 44 GHz 7.547 dBm 2 N f 5.3500 GHz -38240 dBm N f 5.4600 GHz -38230 dBm Freq Offset
4 0Hz
9
11AC40SISO_Ant1_Low_5190_AV
Addient Spectrum Analyzer - Swept SA
Center Freq 4.850000000 GHz PROIS Fast Trig: Free Run AvgHold: 100/100 Trice [12:3:4:5 Frequency Hold: 100/100 Trice [12:3:4:5 Frequency]
Ref Offset 13.55 dB Mkr3 5.150 0 GHz Auto Tune 10 dB/div Ref 20.00 dBm -43.075 dBm
100 Center Freq 485000000 GHz
30.0 40.0 2 4.50000000 GHz 4.50000000 GHz
400 Stop Freq
-700 52000000 GHZ
Ward v3.000 miz CF Step #Res BW 1.0 MHz #VBW 1.6 KHz Sweep 34.12 ms (1001 pts) 0009 v000 miz 70.000000 Miz 0009 v000 miz Auto
1 N 1 f 518810Hz 1299 dBm 2 N 1 f 4500 0Hz -46.456 BBm 3 N 1 f 5.150 0 GHz -43.075 dBm 4 Freq Offset
5 0Hz 6 0Hz 7 0Hz
11AC40SISO_Ant1_Low_5190_Peak
Aglient Spectrum Analyzer - Swept SA
Leftrer Freq 4. 630000000 GHZ PR0: Fsat → Trig: Free Run AvgiField: 100/100 IFGainLew Alter: 30 dB
Ref Offset 13.55 dB Mkr3 5.150 0 GHz Auto take 10 dB/div Ref 20.00 dBm -35.064 dBm
10.0 Center Freq 0.00 4.85000000 GHz
100 200
300 2 400 martine alle as a strate of the st
50.0 Stop Freq 60.0 520000000 GHz
700
#Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.200 ms (1001 pts) 70.00000 MHz Model Hale Extension Function worth Function worth Auto Man
1 N T 5.1881 19HZ (.139 dBm) 2 N I f 4.5000 0HZ 38.957 dBm 8 N I f 5.1500 0HZ 38.957 dBm 4 Freq Offset 0.14
S VIII VIII VIII VIII VIII VIII VIII VI
9 -
11AC40SISO_Ant1_High_5230_AV



Agilent Spectrum Analyzer - Swept SA	A U CU U TOBIO DE 111/20-01 MIO-110 2020		
Center Freq 5.330000000 GHz PBIO: Earl Trig: Free Run	#Avg Type: RMS TRACE 1 2 3 4 5 6 Avg Hold: 100/100 Type	Frequency	
IFGain:Low #Atten: 30 dB	Mkr3 5.460 00 GHz	Auto Tune	
10 dB/div Ref 20.00 dBm	-45.410 dBm		
		Center Freq 5.33000000 GHz	
-10.0		Start Fred	
30.0	2 .41,20,c 3 ,	5.20000000 GHz	
-50.0	······	Stop Freg	
-60.0		5.46000000 GHz	
Start 5.2000 GHz #Res BW 1.0 MHz #VBW 1.6 kHz	Stop 5.4600 GHz Sweep 126.7 ms (1001 pts)	CF Step 26 00000 MHz	
XXE M003 TRE SC. X Y FUN 1 N 1 f 5,228 60 GHz 2,077 dBm	CTION FUNCTION WIDTH FUNCTION VALUE	<u>Auto</u> Man	
2 N 1 f 5.350 00 GHz -44.405 dBm 3 N 1 f 5.460 00 GHz -45.410 dBm 4		Freq Offset	
5 6 7	2 	0 Hz	
8 9 10			
MSG	STATUS		
11AC40SISO_Ant1_	_High_5230_Peak		
Agilent Spectrum Analyzer - Swept SA R L RF 50 Ω AC SENSE:PULSE	ALIGN AUTO/NO RF 11:22:46 AMOct 10, 2020	Frequency	
Center Freq 5.330000000 GHz PN0: Fast Trig: Free Run IFGain.tow #Atten: 30 dB	#Avg Type: RMS Avg Hold: 100/100 DET P P P P P	Frequency	
Ref Offset 13.94 dB	Mkr3 5.460 00 GHz -37 900 dBm	Auto Tune	
		Center Frea	
0.00		5.330000000 GHz	
-20.0	-21.20 dBn	Start Freq	
-30.0		5.20000000 GHz	
-50.0		Stop Freq	
-70.0		5.46000000 GHz	
Start 5.2000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz	Stop 5.4600 GHz Sweep 1.000 ms (1001 pts)	CF Step 26.00000 MHz	
NRR MODE TEC SCI. X FUN 1 N 1 f 5.215.60 GHz 2.188 Bm 1 N 1 f 5.215.60 GHz 2.188 Bm	CTION FUNCTION WIDTH FUNCTION VALUE	<u>Auto</u> Man	
2 N 1 f 5,350.00 GHz -37,524 dBm 3 N 1 f 5,460.00 GHz -37,900 dBm 4		Freq Offset 0 Hz	
5 6 7			
8 9 10			
	× ×		
	status		
11AC80SISO_Ant	1_Low_5210_AV		
Aglent Spectrum Analyzer - Swept SA VI RL RF 50 Q AC SENSE:PULSE Conter From A 925000000 CL-2	ALIGN AUTO/NO RF 11:27:39 AMOct 10, 2020	Frequency	
PRO: Fast ->- Trig: Free Run IFGain:Low #Atten: 30 dB	Avg Hold: 100/100	A.4	
Ref Offset 13.55 dB 10 dB/div Ref 20.00 dBm	Mkr3 5.150 00 GHz -41.675 dBm	Auto rune	
10.0		Center Freq	
-10.0		4.875000000 GHz	
-20.0		Start Freq	
-40.0 2	-41.20 dBm	4.50000000 GHz	
-50.0		Stop Freq	
-70.0		3.20000000 GHZ	
Start 4.5000 GHz #Res BW 1.0 MHz #VBW 3.3 kHz	Stop 5.2500 GHz Sweep 177.3 ms (1001 pts)	CF Step 75.000000 MHz	
N I f 5.213 25 GHz FUN 2 N I f 4.500 00 GHz 4.606 dBm	CTION FUNCTION WIDTH FUNCTION VALUE	Man	
3 N 1 f 5.150.00 GHz 40.002 dBm 4 5.150.00 GHz -41.676 dBm		Freq Offset 0 Hz	
8 9 10			
11AC80SISO_Ant1	_Low_5210_Peak		



Aglient Spectrum Analyzer - Swept SA
Lenter Freq 4, 0 / SUUUUUU GHZ PR0: Fast →→ Trig: Free Run Avg Hold: 100/100 Trig! Maxwawa If GainLaw #Atten: 30 dB
Ref Offset 13.55 dB Mkr3 5.150 00 GHz Auto Tune 10 dB/div Ref 20.00 dBm -35.297 dBm
Log 100 Center Freq
0.00 4.875000000 GHz
200
450000000 GHz
50.0 60.0 Stop Freq
Start 4.5000 GHz Stop 5.2500 GHz C F Step #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.267 ms (1001 pts) 75.000000 MHz
1 1 4.000 GHz 40.00 GHz 40.00 GHz Freq Offset 1 1 1 5.150 00 GHz 352.97 dBm 0 Hz 0 Hz
11AC80SISO_Ant1_Hign_5210_AV
Aglient Spectrum Analyzer - Swyd SN ■ RL 65 90 9 AC SNSE-PULSE ALION AUTO/NOFF 11:28:38 AMOC1 0, 2020 Center Free 5 2000 DDDD GHz FAvg Type: RMS IRVAE[1] 3 4 5 6
PHO: Fast →→ Trig: Free Run Avg Hold: \$3/100 Drie[MitWitWitWit] IFGaint.ew #Atten: 30 dB Drie[P P P P P
Ref Offset 13.55 dB Mkr3 5.460 00 GHz Auto Tune 10 dB/div Ref 20.00 dBm - 45.473 dBm
100 Center Freq
0.00 5.32000000 GHz
20.0 Start Freq
40.0 /2 /41.20.2 5.180000000 GHz
-50.0 Stop Freq
-70.0
Start 5.1800 GHz CF Step #Res BW 1.0 MHz #VBW 3.3 kHz Sweep 66.20 ms (1001 pts) 28.000000 MHz
MXE MODE TREE SCI. X Y EUNCTION FUNCTION WOTH EUNCTION WOTH E
2 N 1 f 5,350 00 GHz 44,384 dBm 3 N 1 f 5,460 00 GHz 45,473 dBm 4 0 0 Hz 0
5 0Hz 6 1 0Hz 7 1
usg 🕼 status
11AC80SISO_Ant1_High_5210_Peak
Agilant Spectrum Analyzer - Swyd SA 19 R. 66 90 9. A. SEIGE-PULSE ALIAN AUTO/NO RF 11128264MOCT 10,2020
Center Freq 5.32U000000 GHz Trig: Free Run Avg Type: RMS TROLE; 12:34.56 PNO: Fast ++ Trig: Free Run Avg[Hold: 100/100 Trig[Mumumum If Gaini.tuw #Atten: 30 dB cell P P P P P
Ref Offset 13.55 dB Mkr3 5.460 00 GHz Auto Tune 10 dB/div Ref 20.00 dBm - 38.400 dBm
0.00 5.32000000 GHz
-20.0
30.0 40.0
50.0 50.0 Stop Freq
-70.0 5.46000000 GHz
Start 5.1800 GHz Stop 5.4600 GHz CF Step
2 N 1 f 5.35000 GHz 38.266 dBm Freq Offset
0Hz
usa Dastatus



5.8. Antenna Requirements

5.8.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited

And according to FCC 47 CFR Section 15.407 (a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.8.2. Antenna Connector Construction

The directional gains of antenna refer to section 1.1, and the antenna is an internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

5.8.3. Results: Compliance.



5.9. Frequency Stability

5.9.1 Standard Applicable

According to FCC §15.407(g) "Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user manual."

According to FCC §2.1055(a) "The frequency stability shall be measured with variation of ambient temperature as follows:"

- (1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
- (2) From -20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.
- (3) From 0° to + 50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

5.9.2 Test Configuration



Variable Power Supply

5.9.3 Test Procedure

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low engouh to obtain the desired frequency resoluation and measure EUT 20 degree operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30 degree. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure wuth 10 degree increased per stage until the highest temperature of +50 degree reached.

5.9.4 Test Results

PASS

Remark:

1. Measured all conditions and recorded worst case.



IEEE 802.11a Mode / 5180 – 5240 MHz / 5180 MHz

Environment Temperature (Degree)	Voltage (VDC)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	13.2	5180.001089	5150 – 5250	PASS
20	10.8	5179.981376	5150 – 5250	PASS
50	12.0	5180.063779	5150 – 5250	PASS
40	12.0	5180.051581	5150 – 5250	PASS
30	12.0	5180.021395	5150 – 5250	PASS
20	12.0	5179.929464	5150 – 5250	PASS
10	12.0	5180.081542	5150 – 5250	PASS
0	12.0	5179.935443	5150 – 5250	PASS
-10	12.0	5179.998167	5150 – 5250	PASS
-20	12.0	5179.952662	5150 – 5250	PASS
-30	12.0	5180.007210	5150 – 5250	PASS

IEEE 802.11a Mode / 5180 – 5240 MHz / 5200 MHz

Environment Temperature (Degree)	Voltage (VDC)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	13.2	5199.946673	5150 – 5250	PASS
20	10.8	5200.007768	5150 – 5250	PASS
50	12.0	5199.933685	5150 – 5250	PASS
40	12.0	5199.953627	5150 – 5250	PASS
30	12.0	5200.011767	5150 – 5250	PASS
20	12.0	5200.035884	5150 – 5250	PASS
10	12.0	5200.032722	5150 – 5250	PASS
0	12.0	5200.039049	5150 – 5250	PASS
-10	12.0	5199.964757	5150 – 5250	PASS
-20	12.0	5199.969164	5150 – 5250	PASS
-30	12.0	5200.061473	5150 – 5250	PASS

IEEE 802.11a Mode / 5180 – 5240 MHz / 5240 MHz

Environment Temperature (Degree)	Voltage (VAC)	Measured Frequency (MHz)	Limit Range (MHz)	Test Results
20	13.2	5240.005004	5150 – 5250	PASS
20	10.8	5239.938080	5150 – 5250	Test Results PASS PASS PASS PASS PASS PASS PASS PAS
50	12.0	5239.976887	5150 – 5250	
40	12.0	5240.076149	5150 – 5250	PASS
30	12.0	5240.010554	5150 – 5250	PASS
20	12.0	5240.016845	5150 – 5250	PASS
10	12.0	5239.939885	5150 – 5250	PASS
0	12.0	5239.942771	5150 – 5250	PASS
-10	12.0	5239.967105	5150 – 5250	PASS
-20	12.0	5239.964734	5150 - 5250	PASS
-30	12.0	5239.906027	5150 – 5250	PASS

IEEE 802.11a Mode / 5180 – 5240 MHz / 5190 MHz

Environment Temperature (Degree)	Voltage (VDC)	Measured Frequency (MHz) Limit Range (MHz)		Test Results
20	13.2	5189.976062	5150 – 5250	PASS
20	10.8	5190.033949	5150 – 5250	PASS PASS
50	12.0	5189.962677	5150 – 5250	
40	12.0	5190.064091	5150 – 5250	PASS
30	12.0	5190.091521	5150 – 5250	PASS
20	12.0	5189.969159	5150 – 5250	PASS
10	12.0	5189.975751	5150 – 5250	PASS
0	12.0	5190.079371	5150 – 5250	PASS
-10	12.0	5189.981324	5150 – 5250	PASS
-20	12.0	5189.913883	5150 – 5250	PASS
-30	12.0	5189.990941	5150 - 5250	PASS

IEEE 802.11a Mode / 5180 – 5240 MHz / 5230 MHz

Environment Temperature (Degree)	Voltage (VDC)	Measured Frequency (MHz) Limit Range (MHz)		Test Results
20	13.2	5240.076655	5150 – 5250	PASS
20	10.8	5239.921013	5150 – 5250	PASS
50	12.0	5240.099996	5150 – 5250	PASS
40	12.0	5240.014995	5150 – 5250	PASS
30	12.0	5239.962217	5150 – 5250	PASS
20	12.0	5239.962407	5150 – 5250	PASS
10	12.0	5239.917897	5150 – 5250	PASS
0	12.0	5240.096154	5150 – 5250	PASS
-10	12.0	5240.059842	5150 – 5250	PASS
-20	12.0	5239.962795	5150 – 5250	PASS
-30	12.0	5240.013940	5150 – 5250	PASS

IEEE 802.11a Mode / 5180 – 5240 MHz / 5210 MHz

Environment Temperature (Degree)	Voltage (VDC)	Measured Frequency (MHz) Limit Range (MHz)		Test Results
20	13.2	5210.078957	5150 – 5250	PASS
20	10.8	5209.970649	5150 – 5250	PASS
50	12.0	5210.010703	5150 – 5250	PASS
40	12.0	5209.975574	<u>5150 - 5250</u> 5150 - 5250	PASS PASS
30	12.0	5210.023143		
20	12.0	5209.994466	5150 – 5250	PASS
10	12.0	5209.975765	5150 – 5250	PASS
0	12.0	5209.971425	5150 – 5250	PASS
-10	12.0	5209.998042	5150 – 5250	PASS
-20	12.0	5209.992584	5150 - 5250	PASS
-30 12.0		5209.968984	5150 – 5250	PASS



6. LIST OF MEASURING EQUIPMENTS

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2020/1/2	2021/1/1
2	Power Sensor	Agilent	U2021XA	MY5365004	2020/1/2	2021/1/1
3	Power Meter	Agilent	U2531A	TW53323507	2020/1/2	2021/1/1
4	Wideband Antenna	schwarzbeck	VULB 9163	958	2019/11/16	2022/11/15
5	Horn Antenna	schwarzbeck	9120D-1141	1574	2019/11/16	2022/11/15
6	EMI Test Receiver	R&S	ESCI	100849/003	2020/1/2	2021/1/1
7	Controller	MF	MF7802	N/A	N/A	N/A
8	Amplifier	schwarzbeck	BBV 9743	209	2020/1/2	2021/1/1
9	Amplifier	Tonscend	TSAMP-0518 SE		2020/1/2	2021/1/1
10	RF Cable(below 1GHz)	HUBER+SUHNE R	RG214	N/A	2020/1/2	2021/1/1
11	RF Cable(above 1GHz)	HUBER+SUHNE R	RG214	N/A	2020/1/2	2021/1/1
12	Artificial Mains	ROHDE & SCHWARZ	ENV 216	101333-IP	2020/1/2	2021/1/1
12	EMI Test Software	ROHDE & SCHWARZ	ESK1	V1.71	N/A	N/A
14	RE test software	Tonscend	JS32-RE	V2.0.2.0	N/A	N/A
15	Test Software	Tonscend	JS1120-3	V2.5.77.0418	N/A	N/A
16	Horn Antenna	A-INFO	LB-180400-K F	J211020657	2019/11/16	2022/11/15
17	Amplifier	SKET	LNPA_1840- 50	SK2018101801	2019/10/22	2020/10/21

-----THE END OF REPORT------