FCC RADIO TEST REPORT

For

FCC ID: 2AAA9-RA340

Report Reference No..... :	19EFAS05085 31
Date of issue..... :	2019-05-24
Testing Laboratory..... :	DongGuan ShuoXin Electronic Technology Co., Ltd.
Address..... :	Zone A, 1F, No. 6, XinGang Road YuanGang Street, XinAn District, ChangAn Town, DongGuan City, GuangDong, China
Applicant's name ..... :	Relay2, Inc.
Address..... :	Suite 209, 1525 McCarthy Blvd., Milpitas, CA 95035
Manufacturer..... :	Senao Networks, Inc.
Test specification:	
Test item description..... :	Service-Ready Access Point
Trade Mark ..... :	Relay2
Model/Type reference ..... :	RA345, RA340
Ratings..... :	DC12V 3.0A

Responsible Engineer :

Lake Hu

Authorized Signatory:

Maoxing Wang

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TEST REPORT DECLARE

Applicant	:	Relay2, Inc.
Address	:	Suite 209, 1525 McCarthy Blvd., Milpitas, CA 95035
Equipment under Test	:	Service-Ready Access Point
Model No	:	RA345
Trade Mark	:	Relay2
Manufacturer	:	Senao Networks, Inc.
Address	:	No. 500, Fusing 3rd Rd., Hwa-Ya Technology Park, Kuei-Shan Dist., Taoyuan City 33383, Taiwan

Test Standard Used: FCC Part 15E 15.407

Test procedure used: ANSI C63.10-2013 and KDB 789033 D02 General UNII Test Procedures New Rules v02r01 .

We Declare:

The equipment described above is tested by DongGuan ShuoXin Electronic Technology Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and DongGuan ShuoXin Electronic Technology Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC standards.

Report No:	19EFAS05085 31		
Date of Test:	2019-04-28	**Date of Report**:	2019-05-24

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of DongGuan ShuoXin Electronic Technology Co., Ltd.

1. SUMMARY OF TEST RESULTS

The EUT have been tested according to the applicable standards as referenced below.		
FCC Part15 (15.407) , Subpart E		
Description of Test Item	**Standard**	**Results**
AC Power Line Conducted Emissions	FCC §15.207/ RSS-Gen	PASS
Spurious Radiated Emissions	FCC §15.209(a), 15.407(b)	PASS
26 dB and 99% Emission Bandwidth	FCC §15.407(a)	PASS
Maximum Conducted Output Power	FCC §407(a)(1)	PASS
Band Edges	FCC §2.1051, §15.407(b)	PASS
Power Spectral Density	FCC §15.407(a)(1)	PASS
Spurious Emissions at Antenna Terminals	FCC §2.1051, §15.407(b)	PASS
Frequency Stability	FCC §15.407(a)(6)	PASS
Antenna Requirement	FCC §15.203	PASS

2. GENERAL TEST INFORMATION

2.1. DESCRIPTION OF EUT

EUT* Name	:	Service-Ready Access Point
Model Number	:	RA345
EUT function description	:	Service-Ready Access Point with WiFi function.
Power supply	:	DC12V 3.0A
Adaptor		N/A
Operation frequency	:	WiFi: 802.11a/802.11n(HT20) /ac(VHT20): 5745MHz ~ 5825MHz 802.11n(HT40)/ac(VHT40): 5755MHz ~ 5795MHz 802.11ac(VHT80): 5775MHz,
Modulation	:	OFDM with OFDM, BPSK, QPSK, 16QAM, 64QAM, 256QAM for 802.11a/n/ac;
Data Rate	:	802.11 a: 6, 54Mbps; 802.11n(HT20):MCS0-MCS7; 802.11n(HT40): MCS0-MCS7; 802.11ac(HT20/HT40/HT80):Up to 1.3Gbps
Antenna Type	:	PIFA Antenna
Antenna Gina	:	Please see 2.7.
Date of Receipt	:	2019/05/24
Sample Type	:	N/A

UNII-4		UNII-4		UNII-4	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				

2.2. ACCESSORIES OF EUT

Description of Accessories	Shielded Type	Ferrite Core	Length
/	/	/	/

2.3. ASSISTANT EQUIPMENT USED FOR TEST

Description of Assistant equipment	Manufacturer	Model number or Type	EMC Compliance	SN
Adapter	/	Y48DE-120-3500	FCC/CE	/

2.4. BLOCK DIAGRAM OF EUT CONFIGURATION FOR TEST

2.5. TEST ENVIRONMENT CONDITIONS

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	Link Mode
Mode 2	802.11a / n 20/ac20 CH149/ CH157/ CH165
Mode 3	802.11 n40/ac40 CH151/ CH159

For Radiated Emission	
Final Test Mode	Description
Mode 1	Link Mode
Mode 2	802.11a / n 20 CH149/ CH157/ CH165
Mode 3	802.11 n40 CH151/ CH159
Mode 4	802.11ac80 CH155

Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

(2) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported

(3) The EUT was used fully-charged battery and programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

2.6. TEST ENVIRONMENT CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	21-25℃
Humidity range:	40-75%
Pressure range:	86-106kPa

2.7. MEASUREMENT UNCERTAINTY

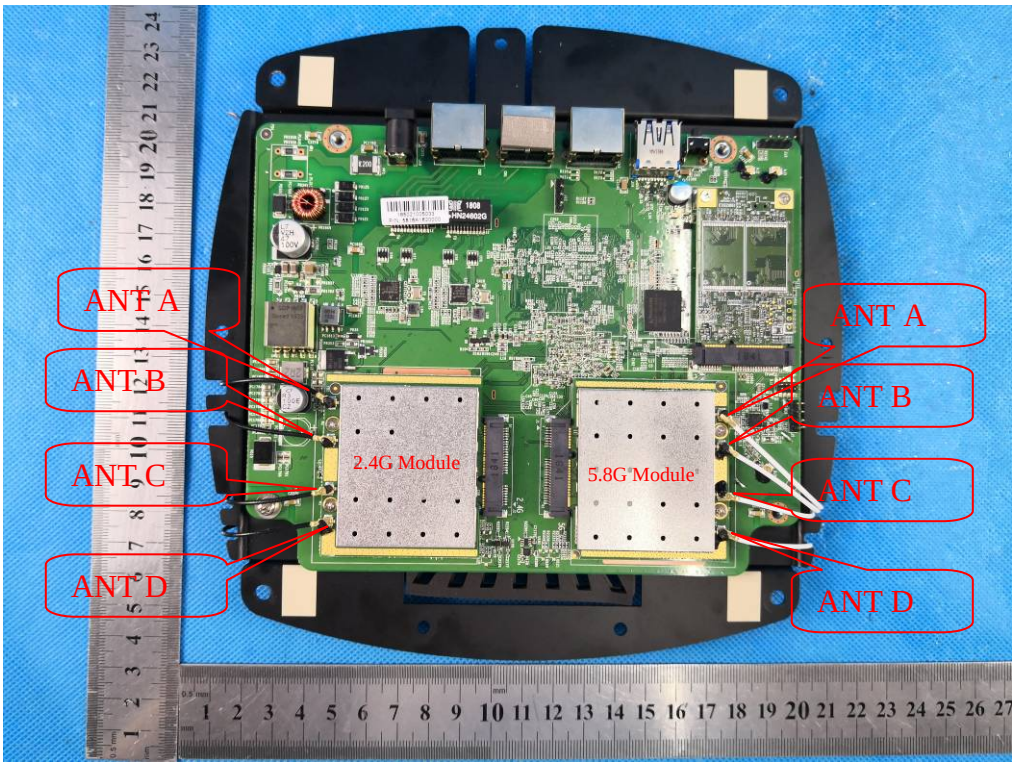
Test Item	Uncertainty
Uncertainty for Conduction emission test (9kHz-150kHz)	3.7 dB
Uncertainty for Conduction emission test (150kHz-30MHz)	3.3 dB
Uncertainty for Radiation Emission test (30MHz-200MHz)	4.6 dB (Polarize: V)
	4.6 dB (Polarize: H)
Uncertainty for Radiation Emission test (200MHz-1GHz)	6.0 dB (Polarize: V)
	5.0 dB (Polarize: H)
Uncertainty for Radiation Emission test (1GHz-6GHz)	5.1 dB (Polarize: V)
	5.1 dB (Polarize: H)
Uncertainty for Radiation Emission test (6GHz-18GHz)	5.4 dB (Polarize: V)
	5.4 dB (Polarize: H)
Uncertainty for Radiation Emission test (18GHz-40GHz)	5.06 dB (Polarize: V)
	5.06 dB (Polarize: H)
Uncertainty for radio frequency	±0.048kHz
Uncertainty for conducted RF Power	±0.32dB

Note：This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2.8. ANTENNA DESCRIPTION

Antenna	Brand	Model Name	Antenna Type	Gain (dBi)	NOTE
A/B/C/D	N/A	N/A	PIFA antenna	2.4G:3.74	Wifi Antenna
A/B/C/D	N/A	N/A	PIFA antenna	5G:5.7	Wifi Antenna

The Control software(tool_WIFI.exe) can control antenna A B,C,D ,
For 2.4GHz mode, antenna A /B are transmitting, antenna C / D are Receiving.
For 5 GHz mode, antenna A /B are transmitting, antenna C / D are Receiving.



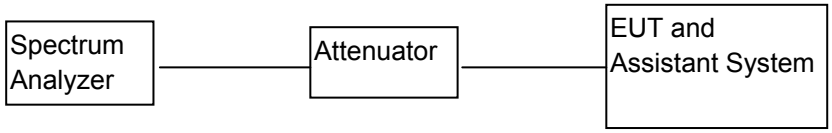
For MIMO mode: Directional gain=GANT +10log(N)dBi =6.75dbi in 2.4GHz
Directional gain=GANT +10log(N)dbi =8.71dbi in 5GHz
802.11a/b/g/n/ac 2.4GHz & 5GHz has MIMO mode.

3. POWER SPECTRAL DENSITY TEST

3.1. TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2019/05/25	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2018/12/17	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2018/12/17	1 Year
4	Spectrum analyzer	R&S	FSV40	101470	2019/06/26	1 Year

3.2. BLOCK DIAGRAM OF TEST SETUP



3.3. APPLIED PROCEDURES / LIMIT

According to FCC §15.407(a)(3)

For the band 5.15-5.25 GHz,

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi..

3.4. TEST PROCEDURE

（For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.I.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

3.5. TEST RESULT

Frequency	Power Density ANT A (dBm/MHz)	Power Density ANT B (dBm/MHz)	Total power density (dBm/MHz)	Limit (dBm/MHz)	Result
TX 802.11a Mode					
CH 149	-4.19	-4.76	-1.46	14.29	PASS
CH 157	-6.11	-6.76	-3.41	14.29	PASS
CH 165	-6.78	-6.54	-3.65	14.29	PASS
TX 802.11n20 Mode					
CH 149	-3.92	-3.98	-0.94	14.29	PASS
CH 157	-5.34	-5.78	-2.54	14.29	PASS
CH 165	-6.39	-6.99	-3.67	14.29	PASS
TX 802.11n40 Mode					
CH151	-8.60	-8.97	-5.77	14.29	PASS
CH159	-8.87	-8.96	-5.90	14.29	PASS

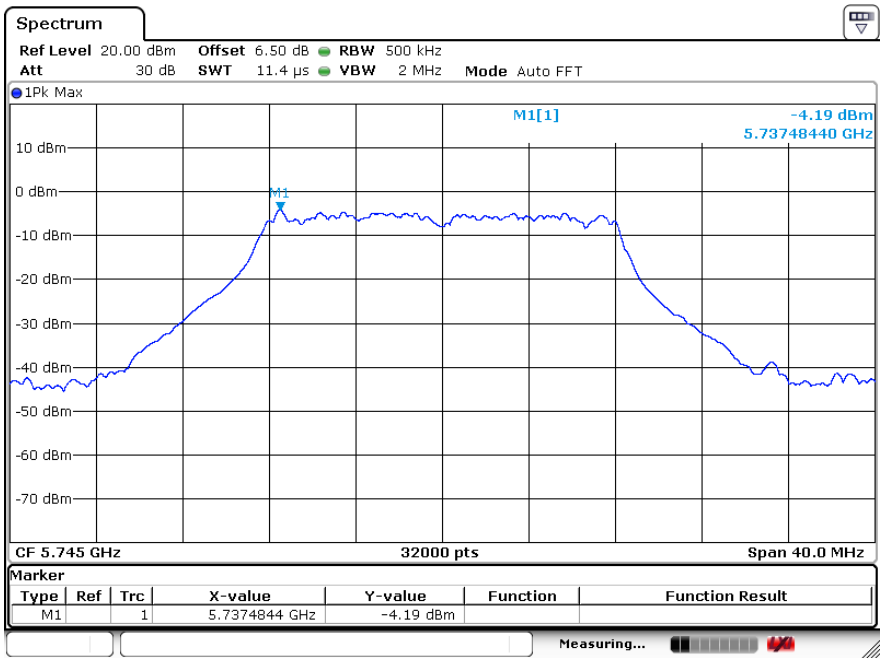
Frequency	Power Density ANT A (dBm/MHz)	Power Density ANT B (dBm/MHz)	Total power density (dBm/MHz)	Limit (dBm/MHz)	Result
TX 802.11 ac(VHT20) Mode					
CH 149	-3.63	-3.87	-0.74	14.29	PASS
CH 157	-6.06	-6.64	-3.33	14.29	PASS
CH 165	-6.61	-6.95	-3.77	14.29	PASS
TX 802.11 ac(VHT40) Mode					
CH 151	-7.67	-7.85	-4.75	14.29	PASS
CH 159	-8.63	-8.73	-5.67	14.29	PASS
TX 802.11 ac(VHT80) Mode					
CH155	-10.93	-10.99	-7.95	14.29	PASS

For 5G mode, Limit =17-8.71+6=14.29

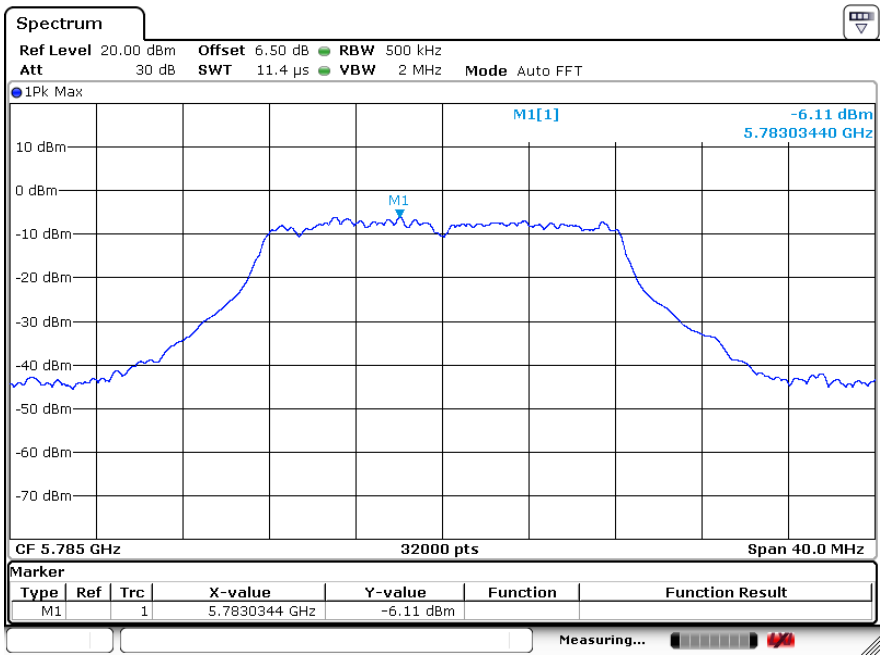
Test plots as followed:

802.11a

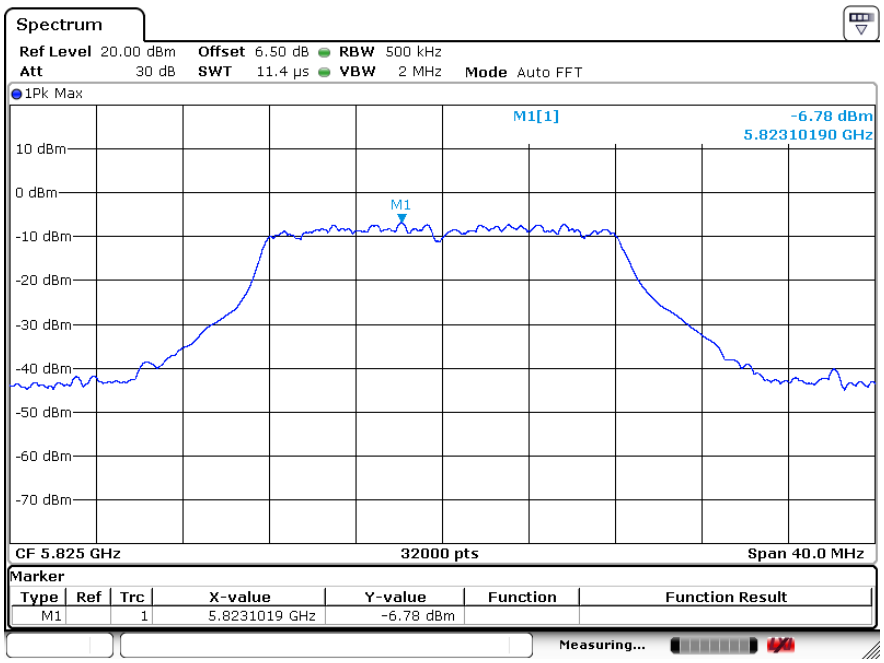
Channel: 149



Channel: 157

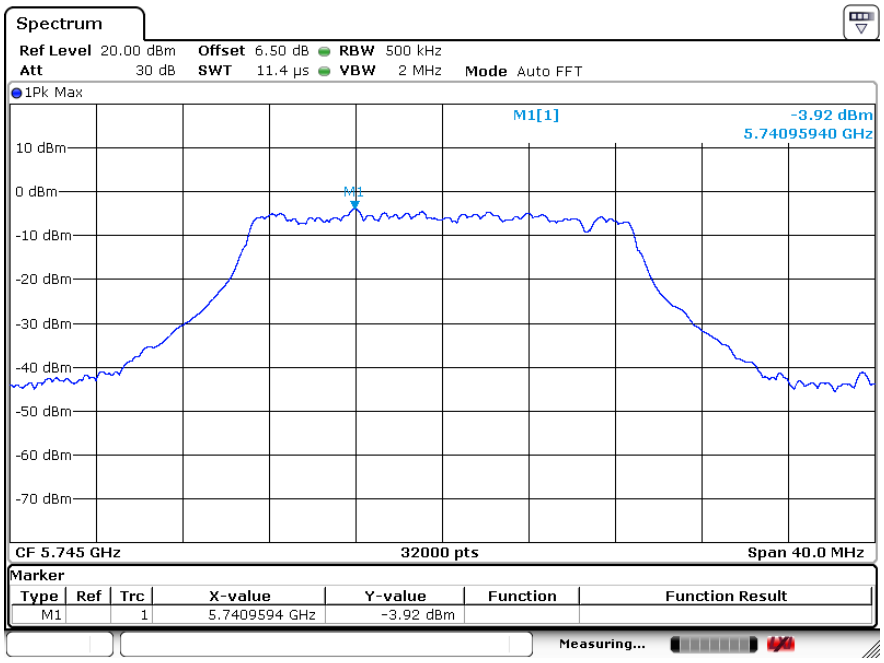


Channel: 165


Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 500 kHz
Att 30 dB SWT 11.4 µs VBW 2 MHz Mode Auto FFT
1Pk Max
M1[1]
-6.78 dBm
5.82310190 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 5.825 GHz
32000 pts
Span 40.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.8231019 GHz -6.78 dBm
Measuring...

802.11n20

Channel: 149



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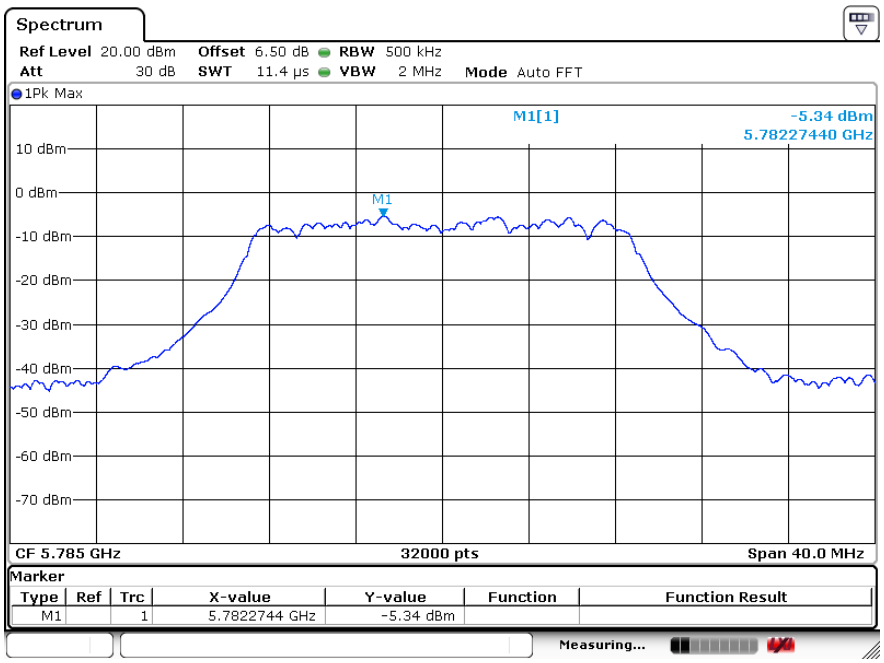
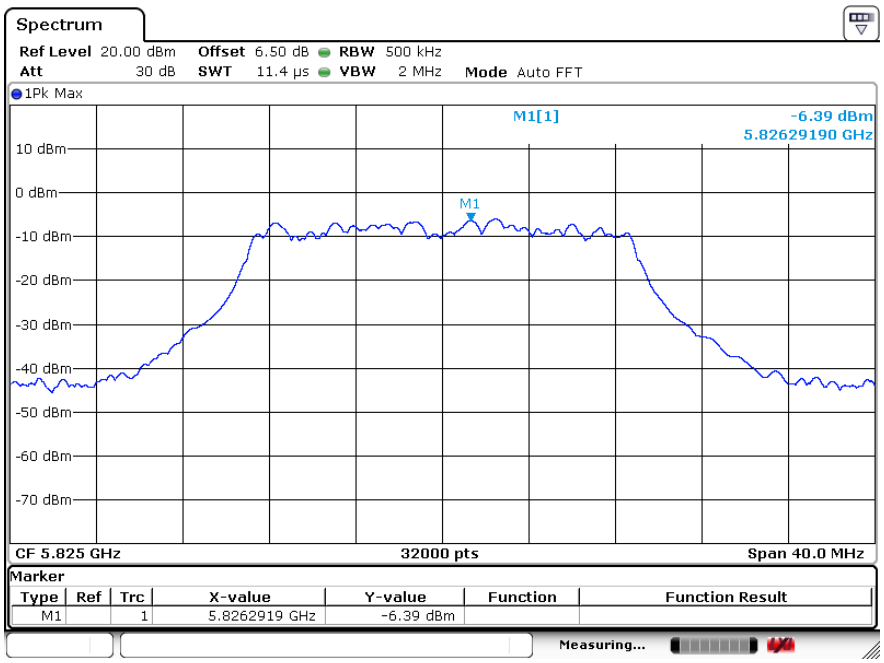
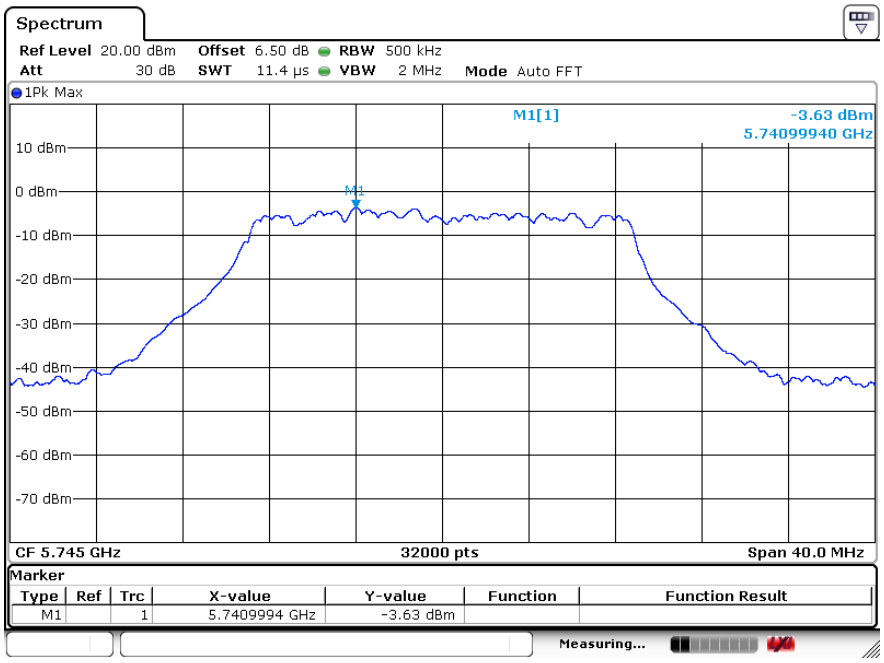


Channel: 165

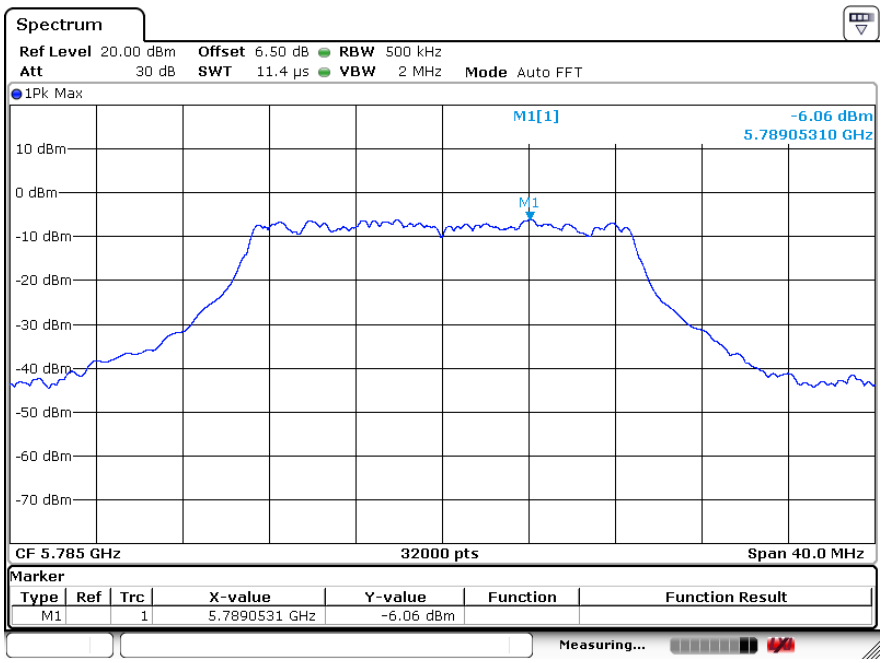

Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 500 kHz
Att 30 dB SWT 11.4 µs VBW 2 MHz Mode Auto FFT
1Pk Max
M1[1]
-6.39 dBm
5.82629190 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 5.825 GHz
32000 pts
Span 40.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.8262919 GHz -6.39 dBm
Measuring...

802.11ac20

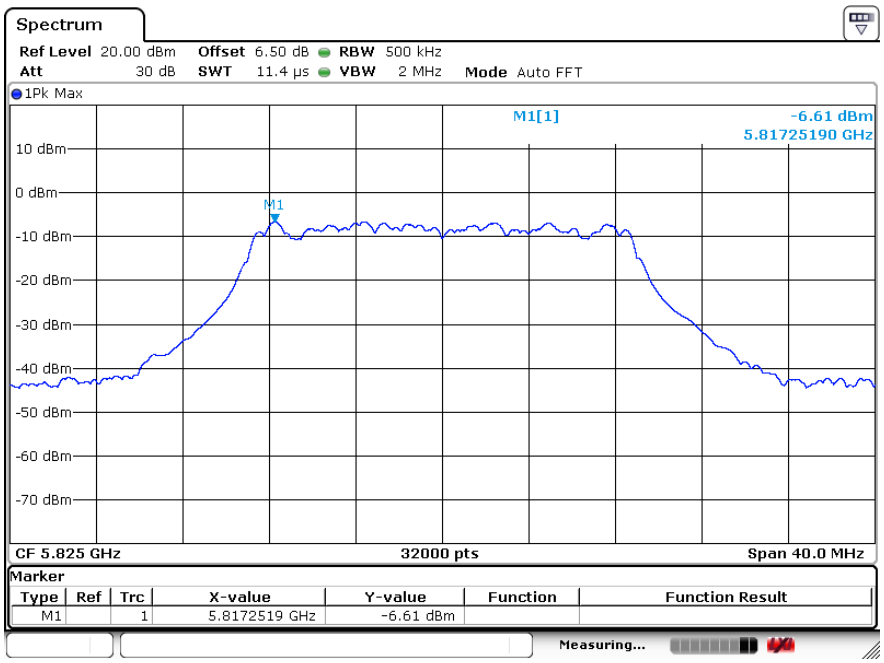
Channel: 149



Channel: 157

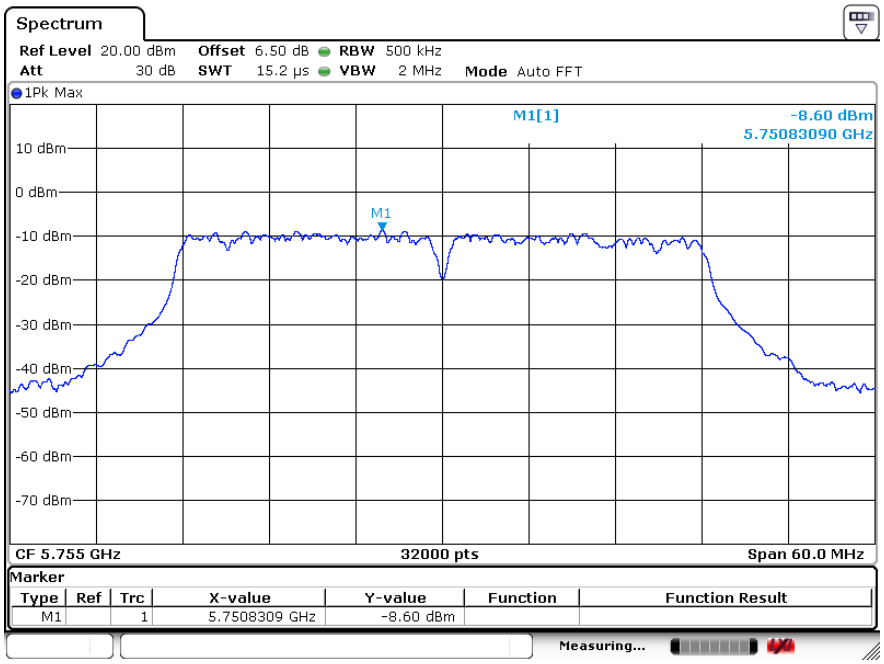


Channel: 165


Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 500 kHz
Att 30 dB SWT 11.4 µs VBW 2 MHz Mode Auto FFT
1Pk Max
M1[1]
-6.61 dBm
5.81725190 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 5.825 GHz
32000 pts
Span 40.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.8172519 GHz -6.61 dBm
Measuring...

802.11n40

Channel: 151



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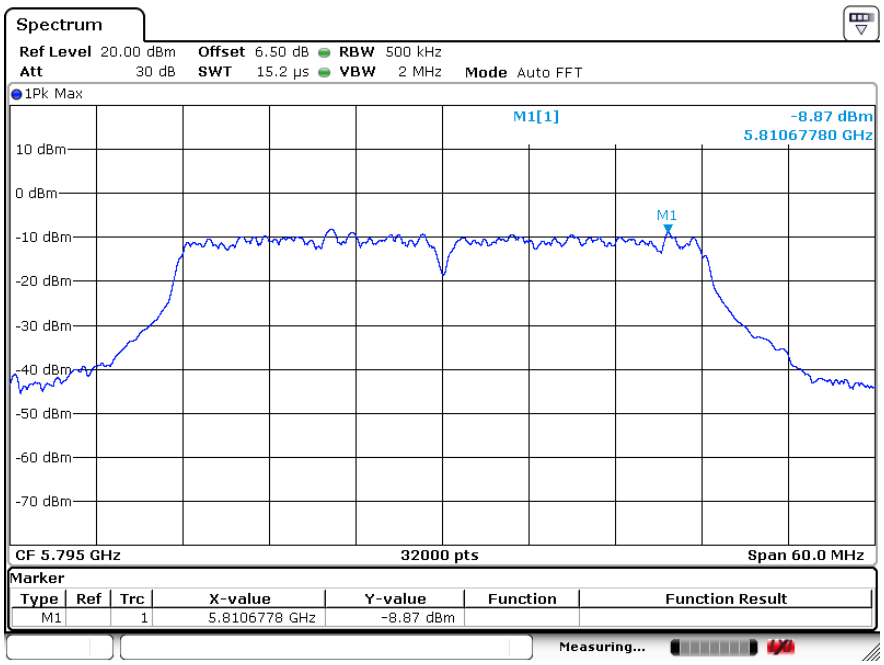
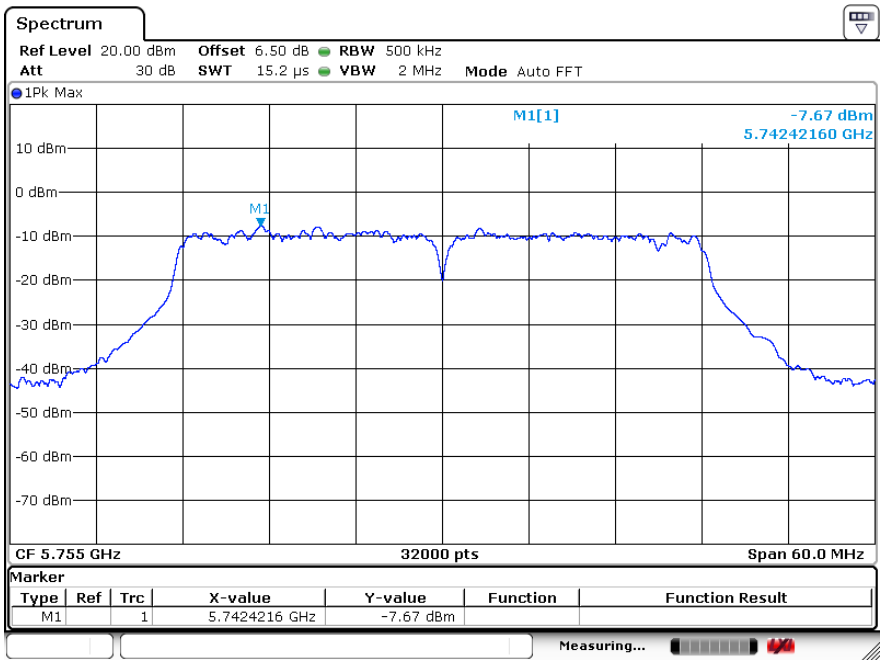


802.11ac40

Channel: 151



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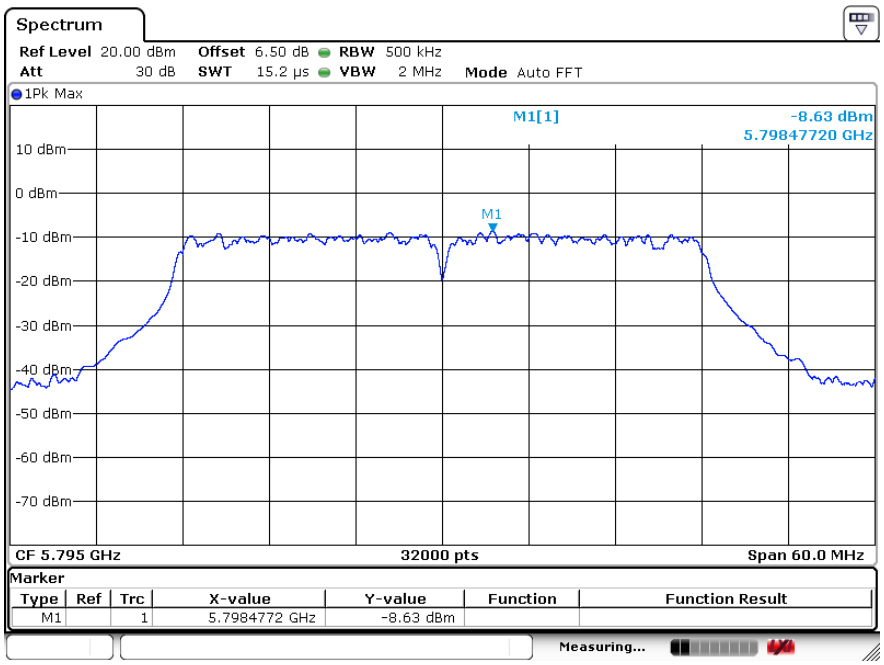
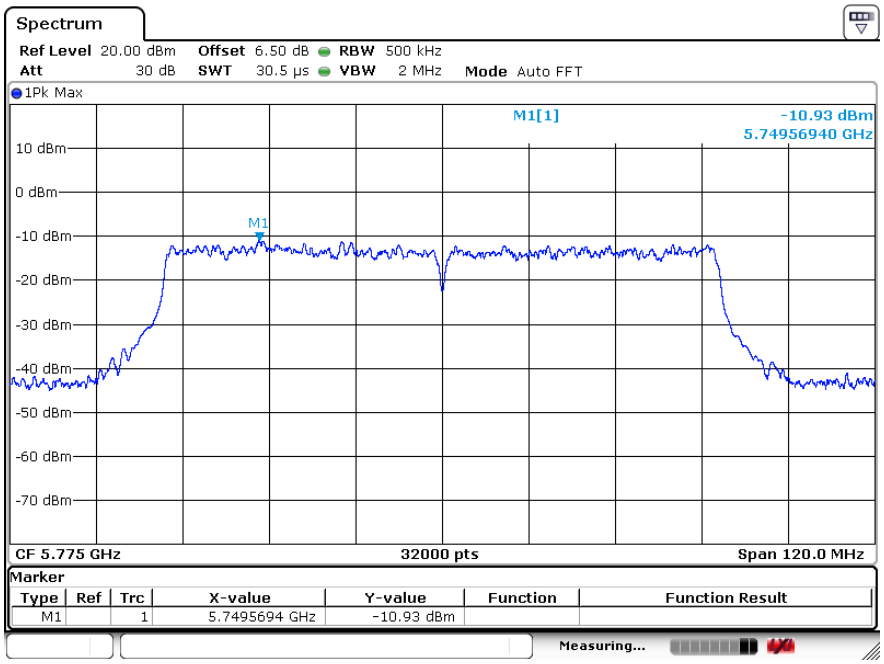


802.11ac80

Channel: 155

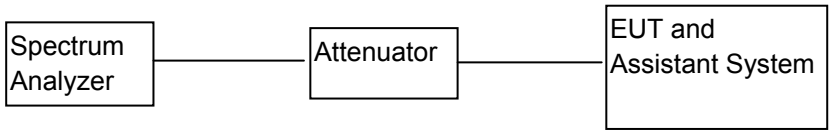


4. 26 dB & 99% Emission Bandwidth

4.1. TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2019/05/25	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2018/12/17	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2018/12/17	1 Year
4	Spectrum analyzer	R&S	FSV40	101470	2019/06/28	1 Year

4.2. BLOCK DIAGRAM OF TEST SETUP



4.3. APPLIED PROCEDURES / LIMIT

The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power
is integrated over the full reference bandwidth.

4.4. TEST PROCEDURE

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) 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%.

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 · RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).

7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as

the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

4.5. TEST RESULT

Antenna A

CH. No.	Frequency (MHz)	6dB Occupied Bandwidth (MHz)			99% Occupied Bandwidth (MHz)		
		802.11a	802.11n (HT20)	802.11ac (VHT20)	802.11a	802.11n (HT20)	802.11ac (VHT20)
149	5745.00	16.34	17.59	17.59	16.49	17.70	17.67
157	5785.00	16.35	17.60	17.58	16.52	17.68	17.71
165	5825.00	16.34	17.60	17.59	16.46	17.69	17.70

CH. No.	Frequency (MHz)	6B Occupied Bandwidth (MHz)		99% Occupied Bandwidth (MHz)	
		802.11n(HT40)	802.11ac(VHT40)	802.11n(HT40)	802.11ac(VHT40)
151	5755.00	36.45	36.41	36.19	36.52
159	5795.00	36.20	36.45	36.24	36.16

CH. No.	Frequency (MHz)	6dB Occupied Bandwidth (MHz) 802.11ac(VHT80)	99% Occupied Bandwidth (MHz) 802.11ac(VHT80)
155	5775	76.37	76.3

Antenna B

CH. No.	Frequency (MHz)	6dB Occupied Bandwidth (MHz)			99% Occupied Bandwidth (MHz)		
		802.11a	802.11n (HT20)	802.11ac (VHT20)	802.11a	802.11n (HT20)	802.11ac (VHT20)
149	5745.00	16.06	17.22	17.41	16.33	17.41	17.54
157	5785.00	16.07	17.23	17.40	16.36	17.39	17.58
165	5825.00	16.06	17.23	17.41	16.3	17.48	17.57

CH. No.	Frequency (MHz)	6B Occupied Bandwidth (MHz)		99% Occupied Bandwidth (MHz)	
		802.11n(HT40)	802.11ac(VHT40)	802.11n(HT40)	802.11ac(VHT40)
151	5755.00	36.17	36.04	35.97	36.36
159	5795.00	35.92	36.08	36.02	36.08

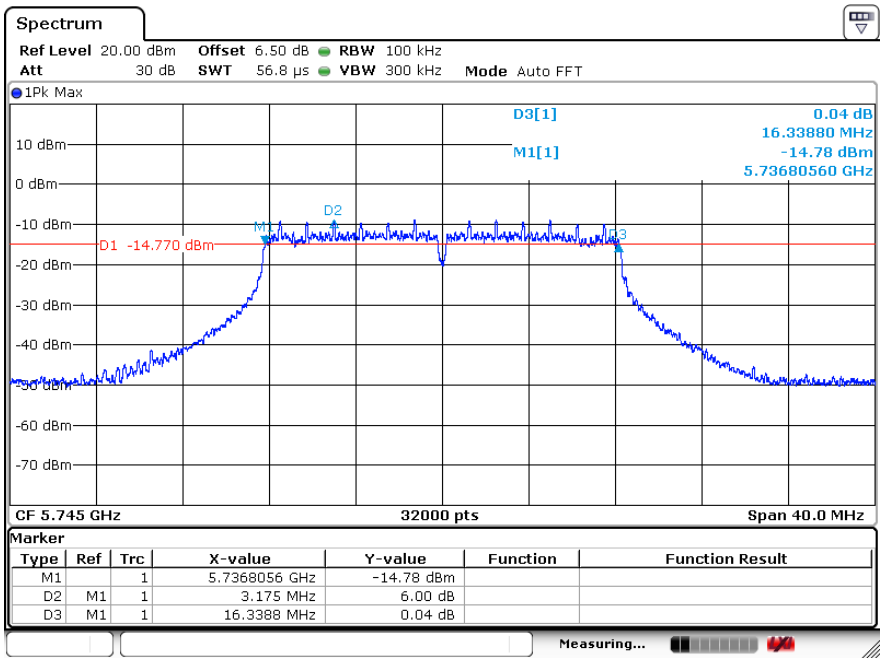
CH. No.	Frequency (MHz)	6dB Occupied Bandwidth (MHz) 802.11ac(VHT80)	99% Occupied Bandwidth (MHz) 802.11ac(VHT80)
155	5775	76.26	76.28

ANT A(B) Represent the value of antenna A and B,The worst data is A Antenna a ,only shown Antenna A Plot.

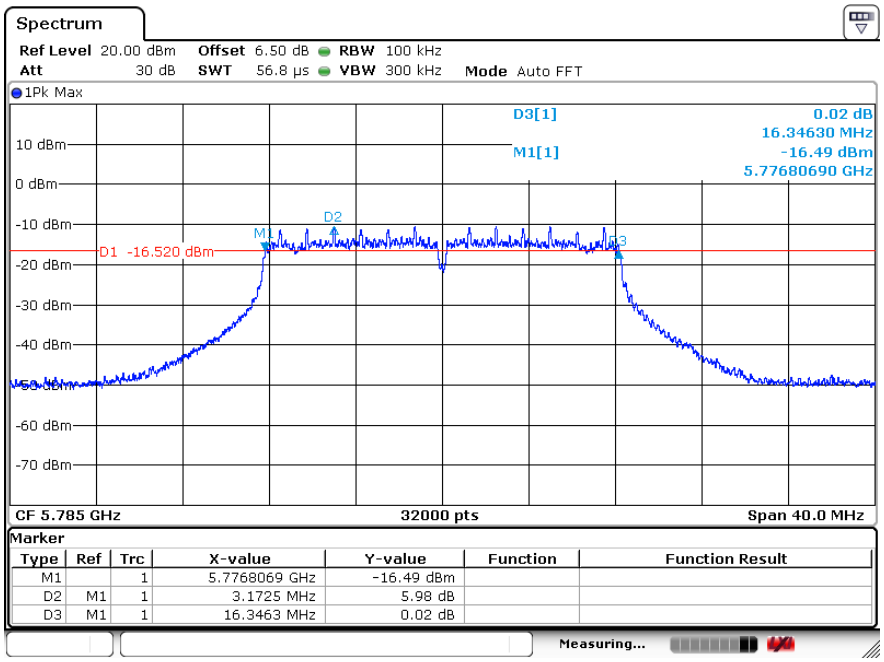
Test plots as followed:

6dB BW 802.11a

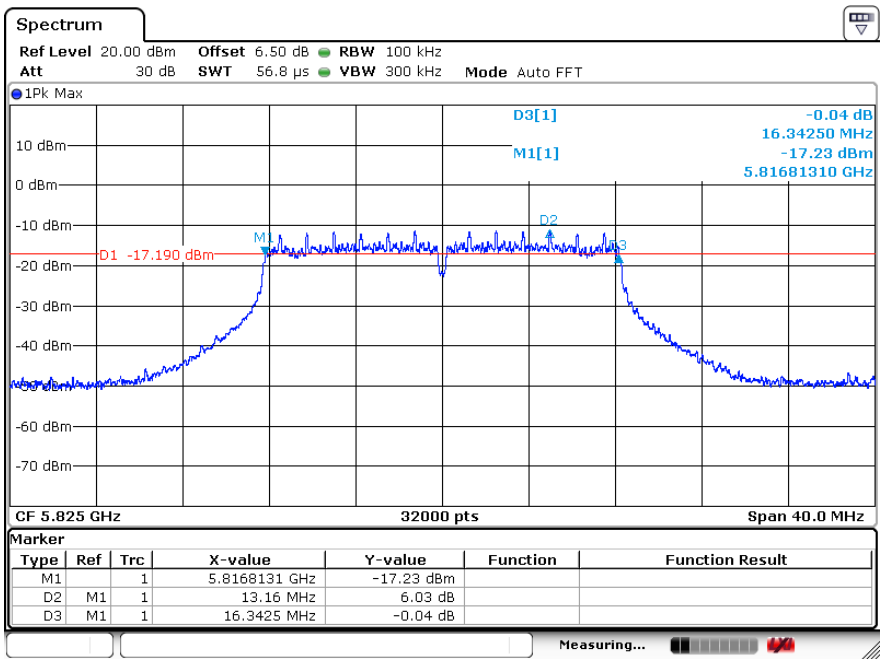
Channel: 149



Channel: 157

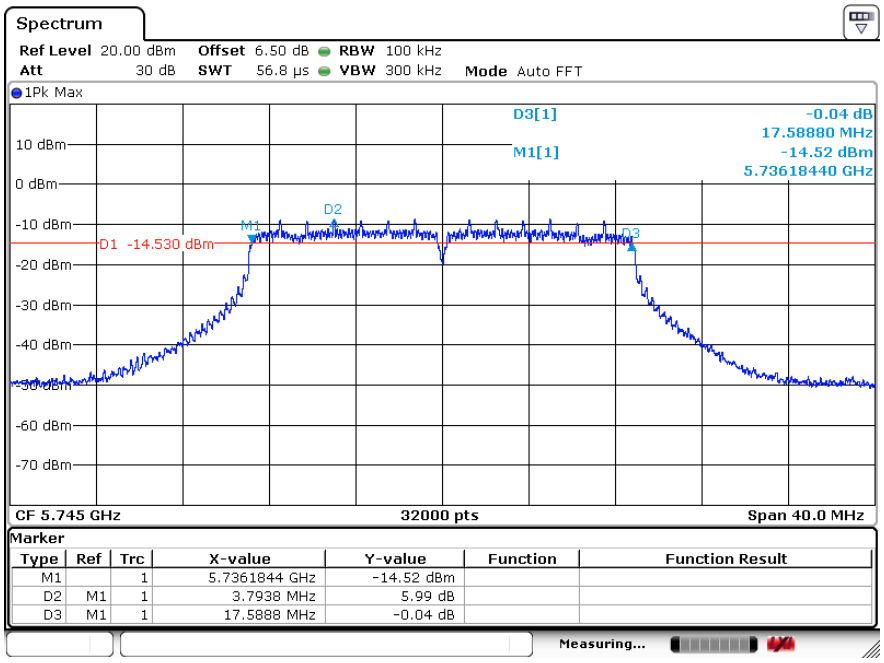


Channel: 165

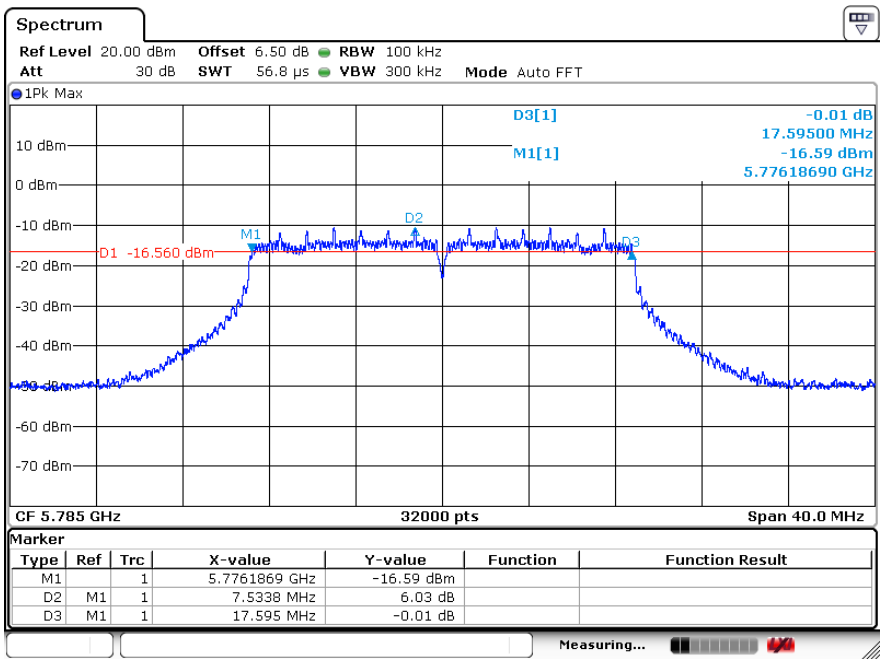

Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 100 kHz
Att 30 dB SWT 56.8 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D3[1] -0.04 dB
16.34250 MHz
M1[1] -17.23 dBm
5.81681310 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
D1 -17.190 dBm
M1
D2
D3
CF 5.825 GHz
32000 pts
Span 40.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.8168131 GHz -17.23 dBm
D2 M1 1 13.16 MHz 6.03 dB
D3 M1 1 16.3425 MHz -0.04 dB
Measuring...

6dB BW 802.11n20

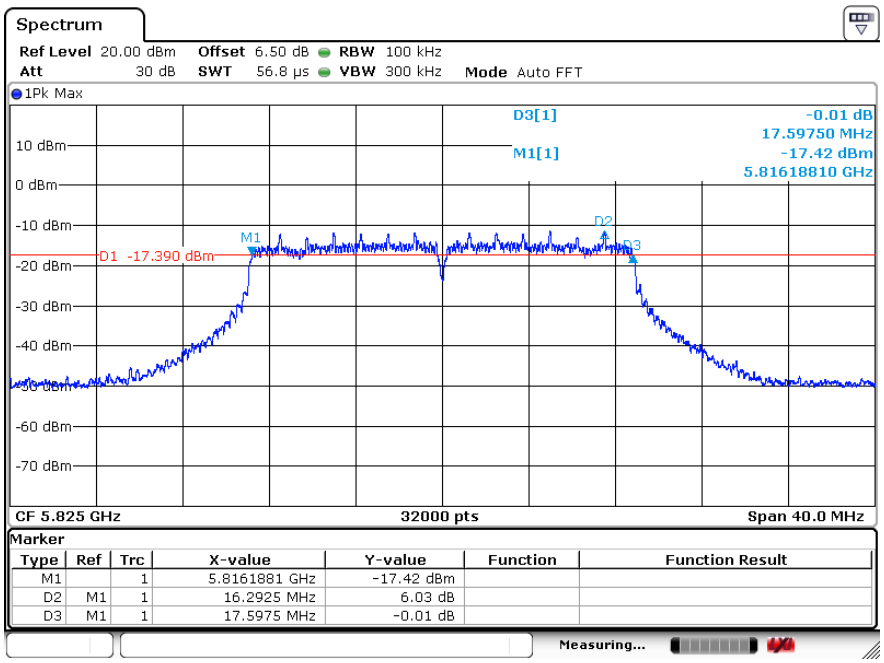
Channel: 149



Channel: 157

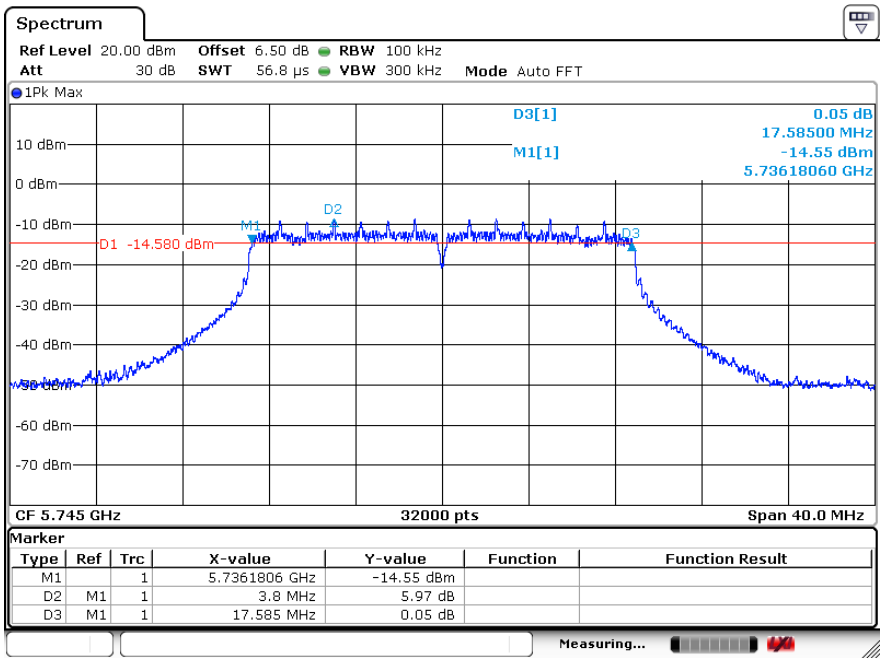


Channel: 165

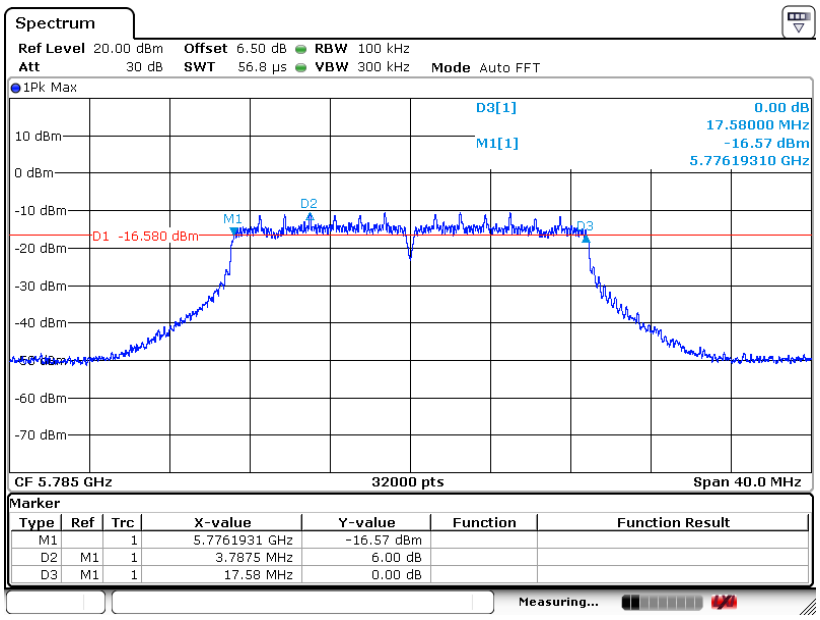

Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 100 kHz
Att 30 dB SWT 56.8 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D3[1] -0.01 dB
17.59750 MHz
M1[1] -17.42 dBm
5.81618810 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
D1 -17.390 dBm
M1
D2
D3
CF 5.825 GHz
32000 pts
Span 40.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.8161881 GHz -17.42 dBm
D2 M1 1 16.2925 MHz 6.03 dB
D3 M1 1 17.5975 MHz -0.01 dB
Measuring...

6dB BW 802.11ac20

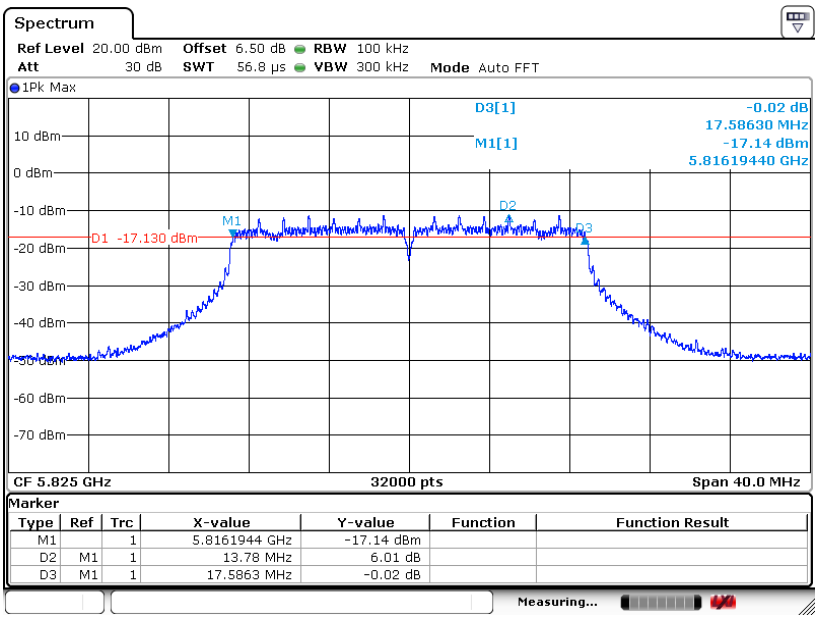
Channel: 149



Channel: 157

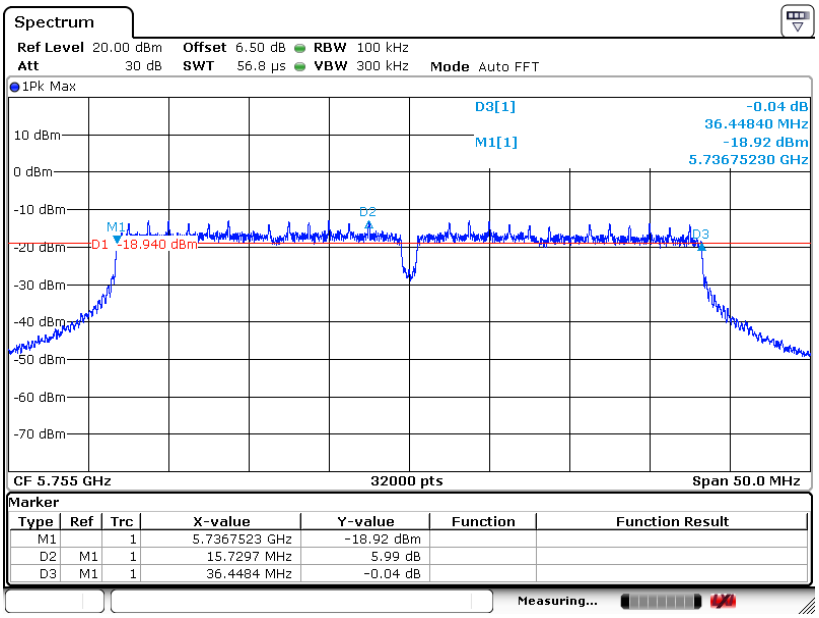


Channel: 165

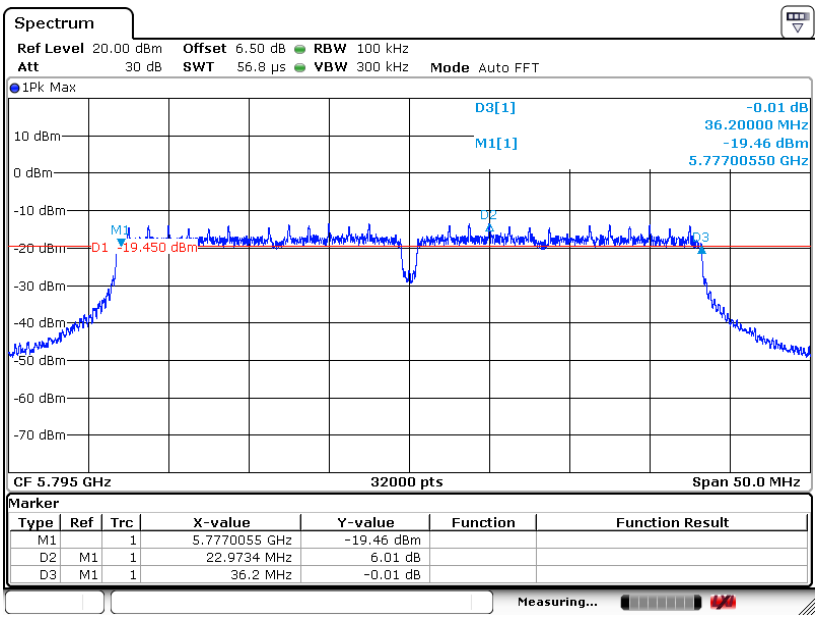

Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 100 kHz
Att 30 dB SWT 56.8 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D3[1] -0.02 dB
17.58630 MHz
M1[1] -17.14 dBm
5.81619440 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
D1 -17.130 dBm
D2
D3
CF 5.825 GHz
32000 pts
Span 40.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.8161944 GHz -17.14 dBm
D2 M1 1 13.78 MHz 6.01 dB
D3 M1 1 17.5863 MHz -0.02 dB
Measuring...

6dB BW 802.11n40

Channel: 151

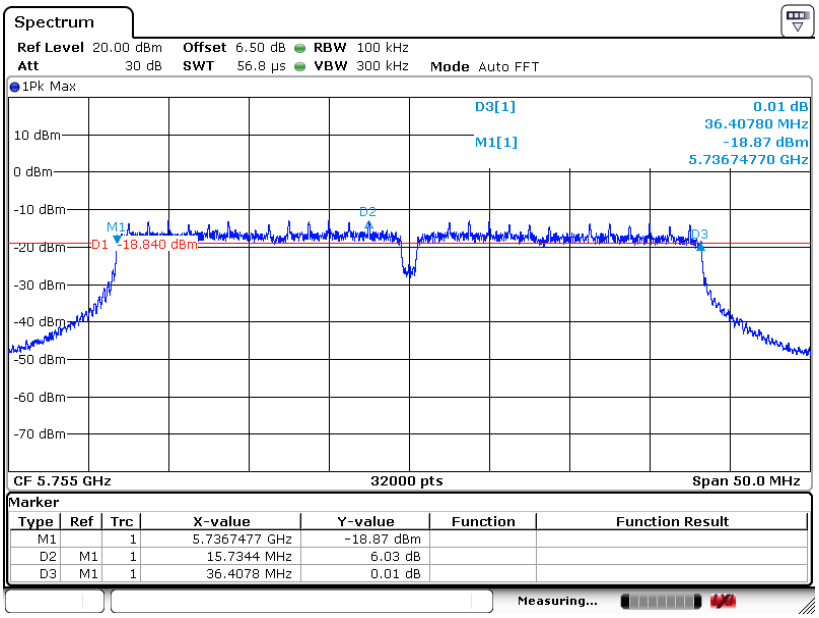


Channel: 159

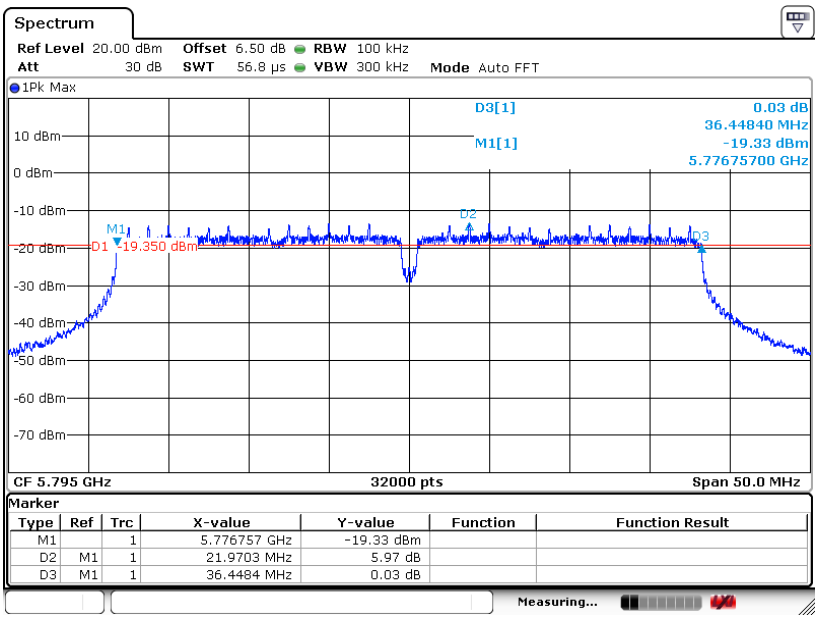


6dB BW 802.11ac40

Channel: 151

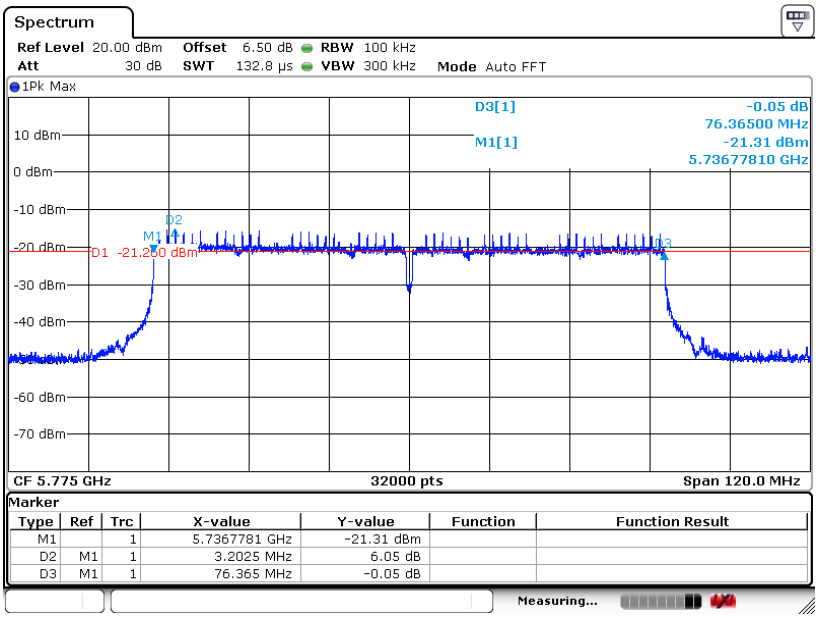


Channel: 159



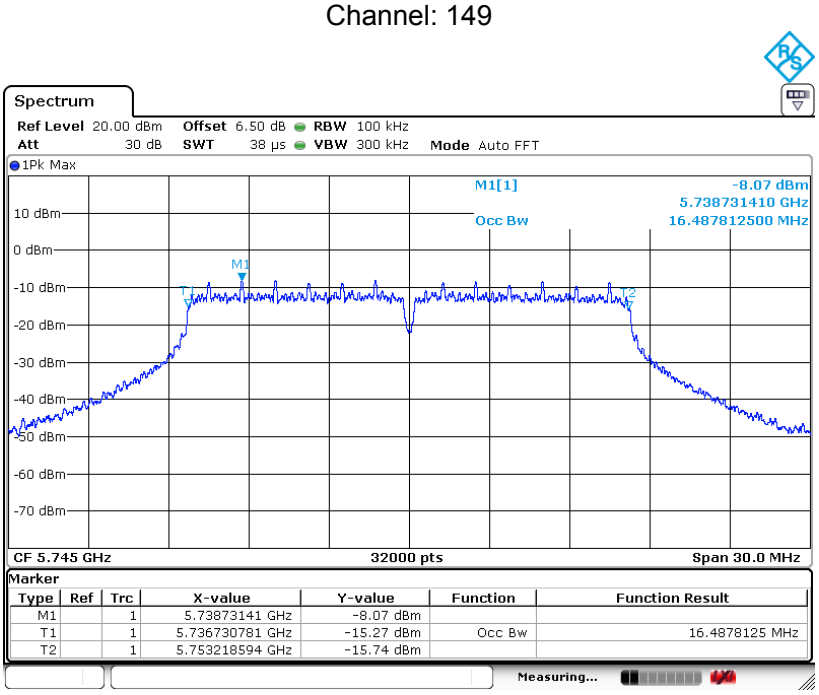
6dB BW 802.11ac80

Channel: 155

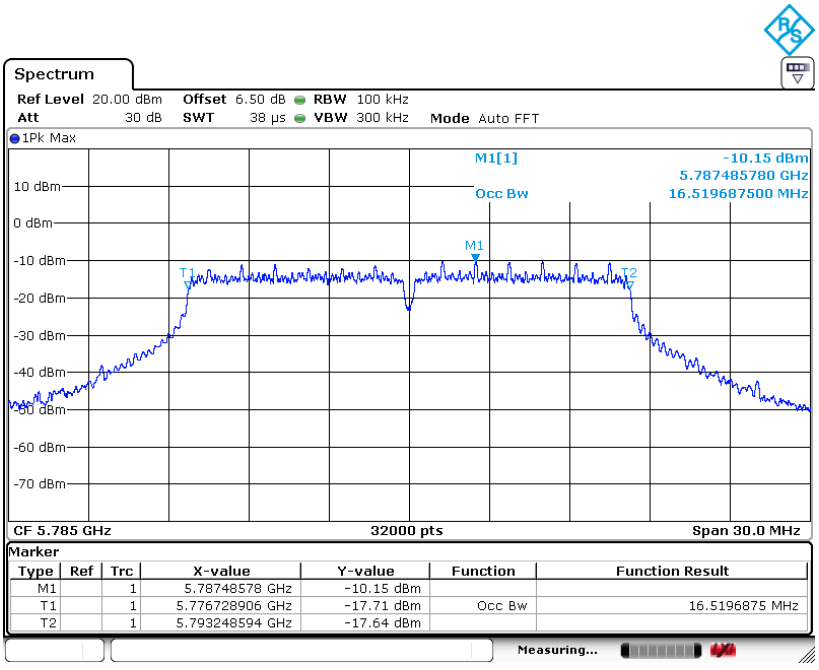


99% OBW 802.11a

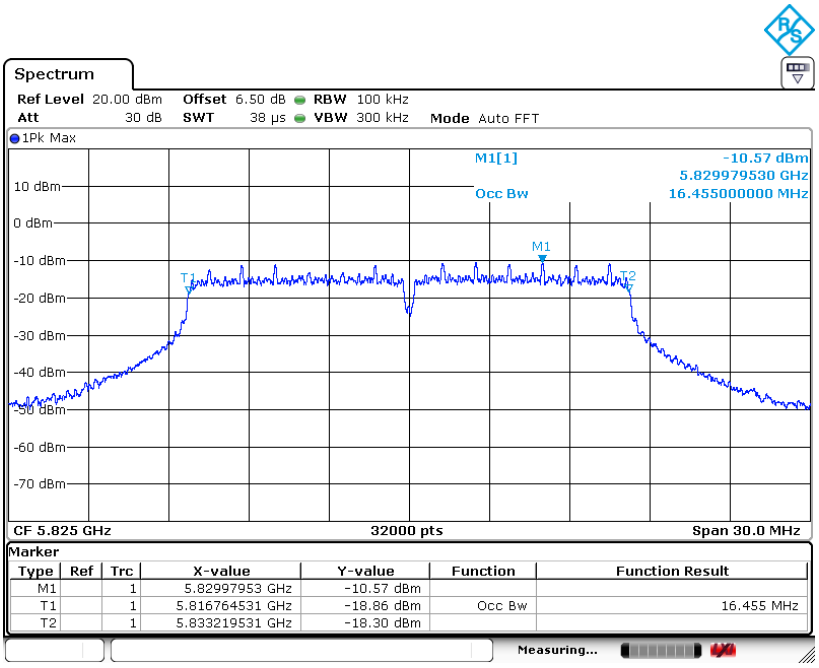
Channel: 149



Channel: 157

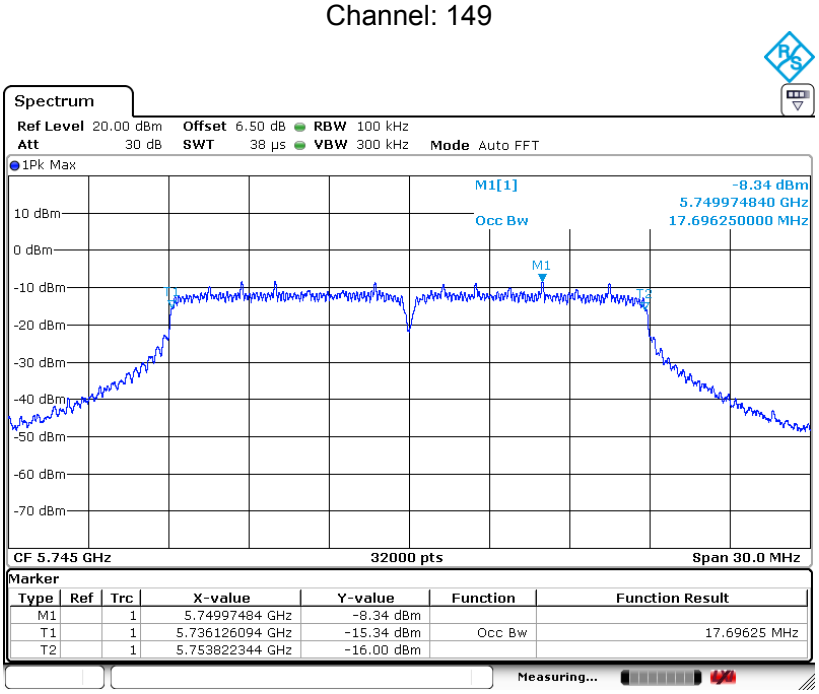


Channel: 165

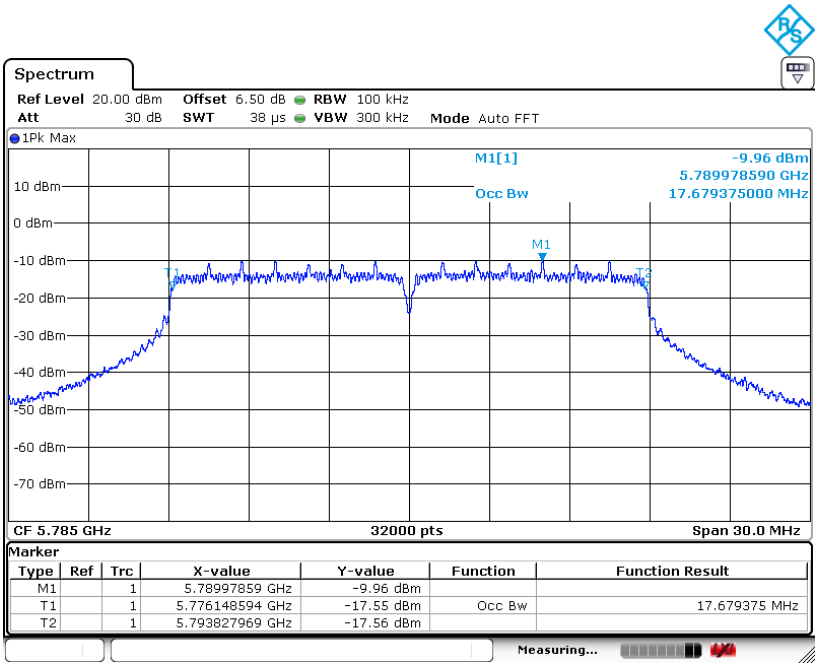

Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 100 kHz
Att 30 dB SWT 38 µs VBW 300 kHz Mode Auto FFT
1Pk Max
M1[1] -10.57 dBm
5.829979530 GHz
Occ Bw 16.455000000 MHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
T1
T2
CF 5.825 GHz
32000 pts
Span 30.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.82997953 GHz -10.57 dBm
T1 1 5.816764531 GHz -18.86 dBm Occ Bw 16.455 MHz
T2 1 5.833219531 GHz -18.30 dBm
Measuring...

99% OBW 802.11n20

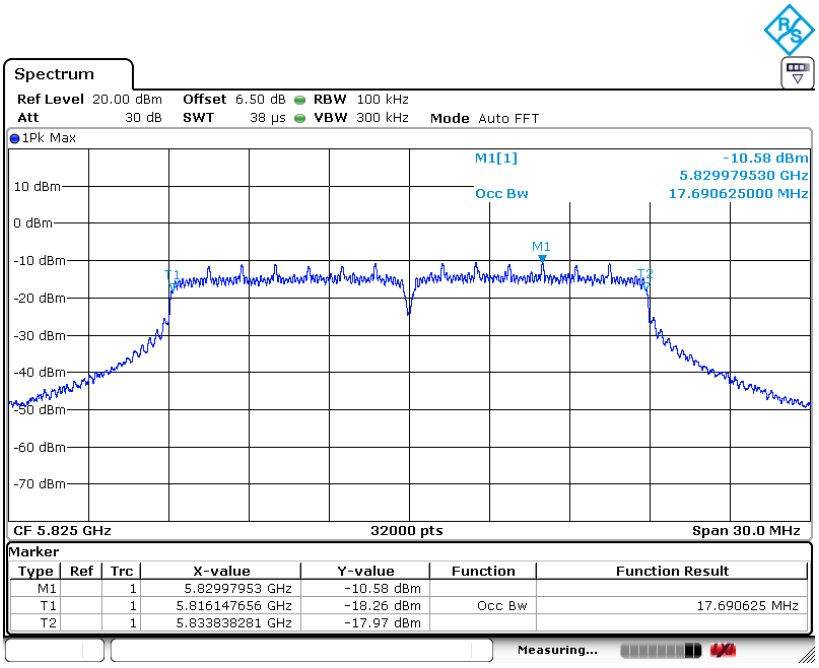
Channel: 149



Channel: 157

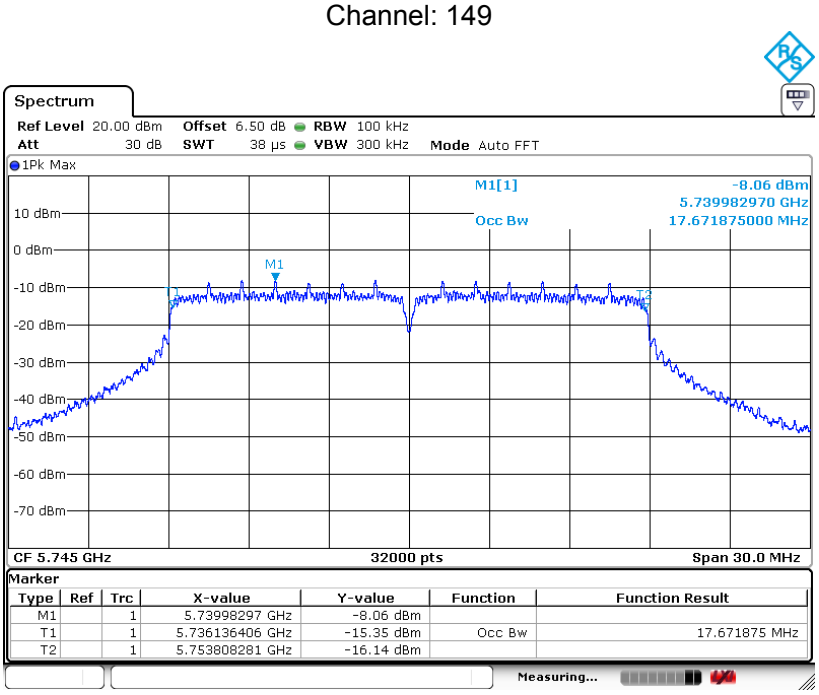


Channel: 165

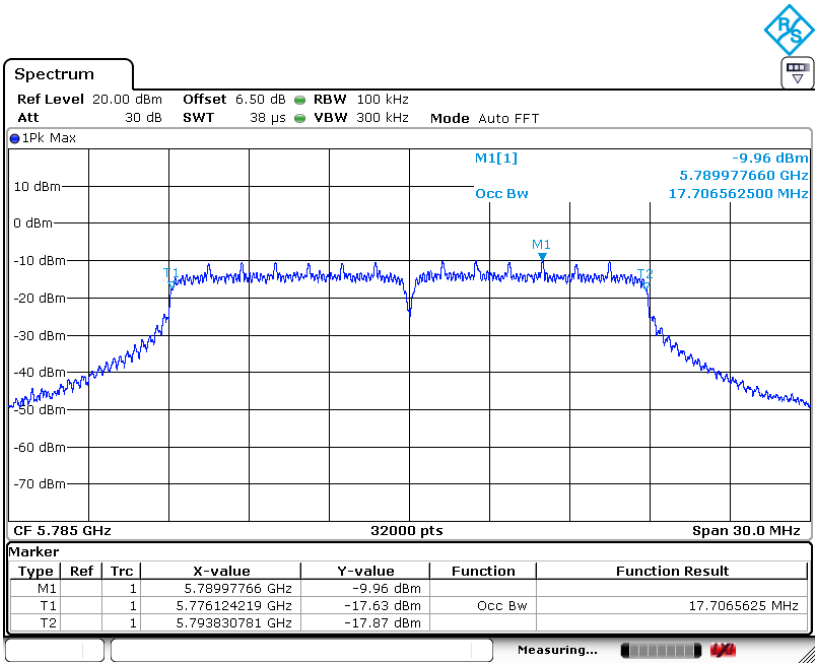

Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 100 kHz
Att 30 dB SWT 38 µs VBW 300 kHz Mode Auto FFT
1Pk Max
M1[1] -10.58 dBm
5.829979530 GHz
Occ Bw 17.690625000 MHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
T1
T2
CF 5.825 GHz
32000 pts
Span 30.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.82997953 GHz -10.58 dBm
T1 1 5.816147656 GHz -18.26 dBm Occ Bw 17.690625 MHz
T2 1 5.833838281 GHz -17.97 dBm
Measuring...

99% OBW 802.11ac20

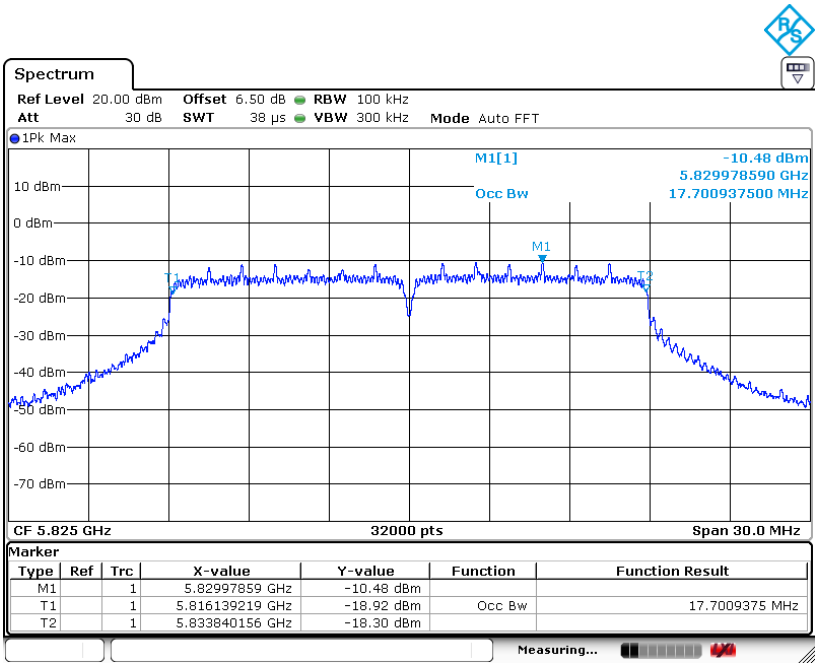
Channel: 149



Channel: 157

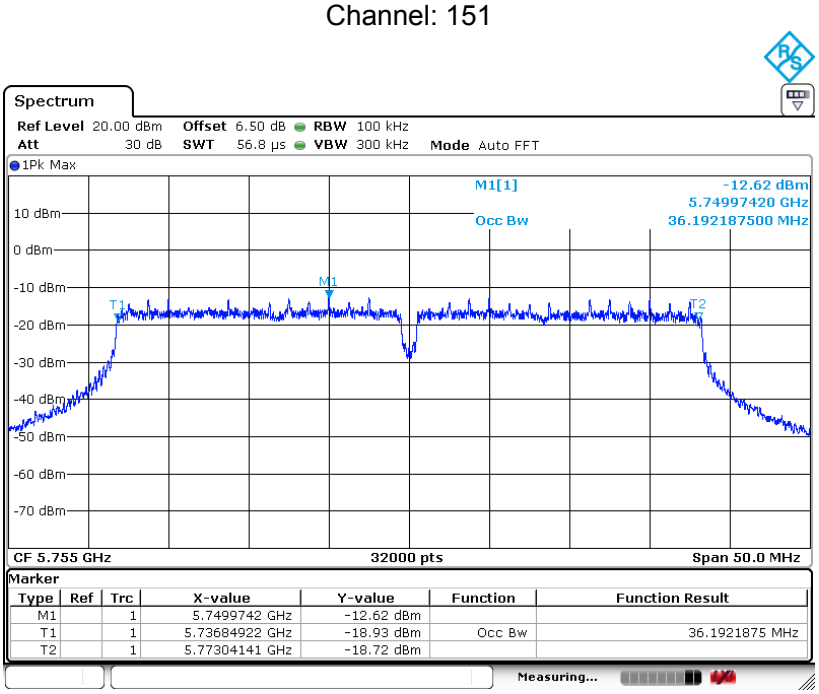


Channel: 165

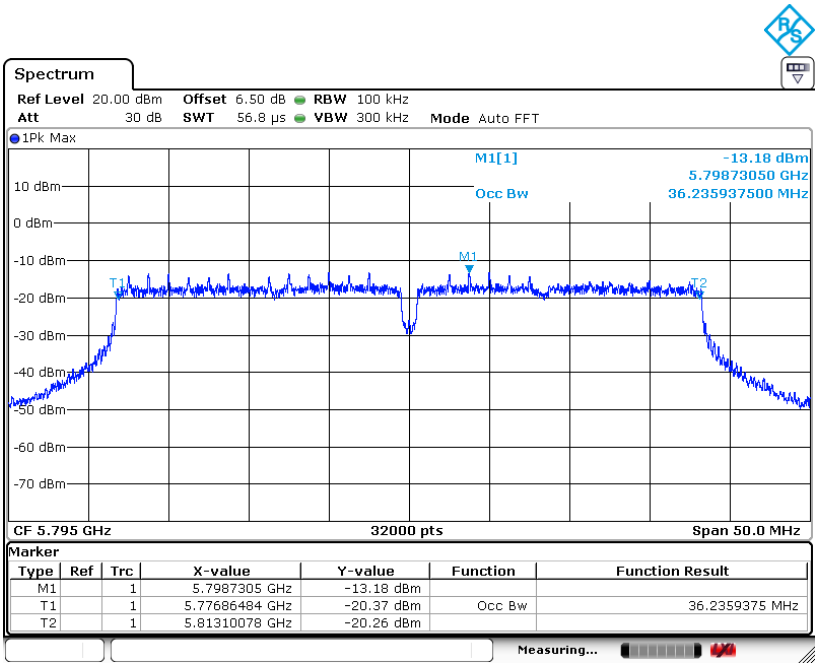

Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 100 kHz
Att 30 dB SWT 38 µs VBW 300 kHz Mode Auto FFT
1Pk Max
M1[1] -10.48 dBm
5.829978590 GHz
Occ Bw 17.700937500 MHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
T1
T2
CF 5.825 GHz
32000 pts
Span 30.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.82997859 GHz -10.48 dBm
T1 1 5.816139219 GHz -18.92 dBm Occ Bw 17.7009375 MHz
T2 1 5.833840156 GHz -18.30 dBm
Measuring...

99% OBW 802.11n40

Channel: 151

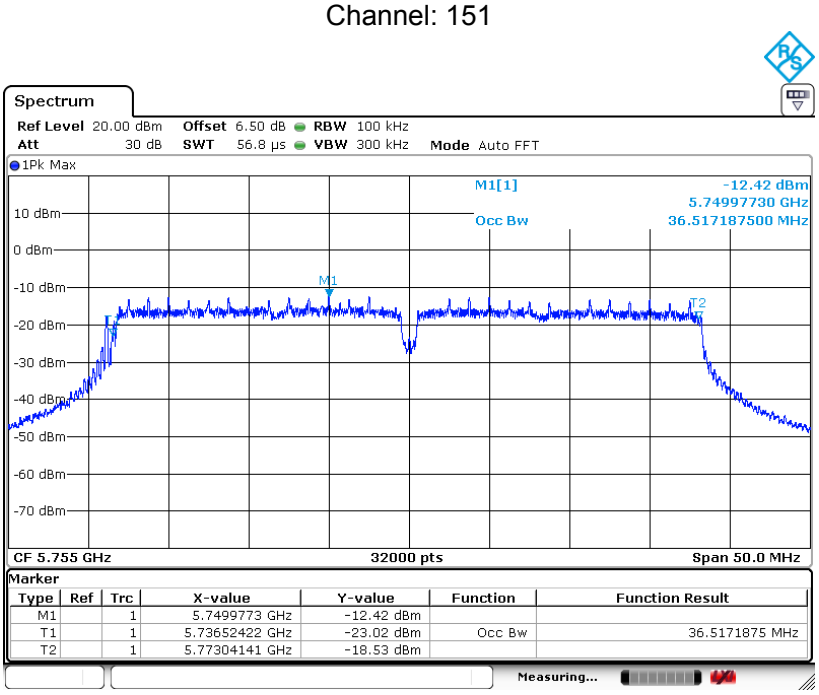


Channel: 159

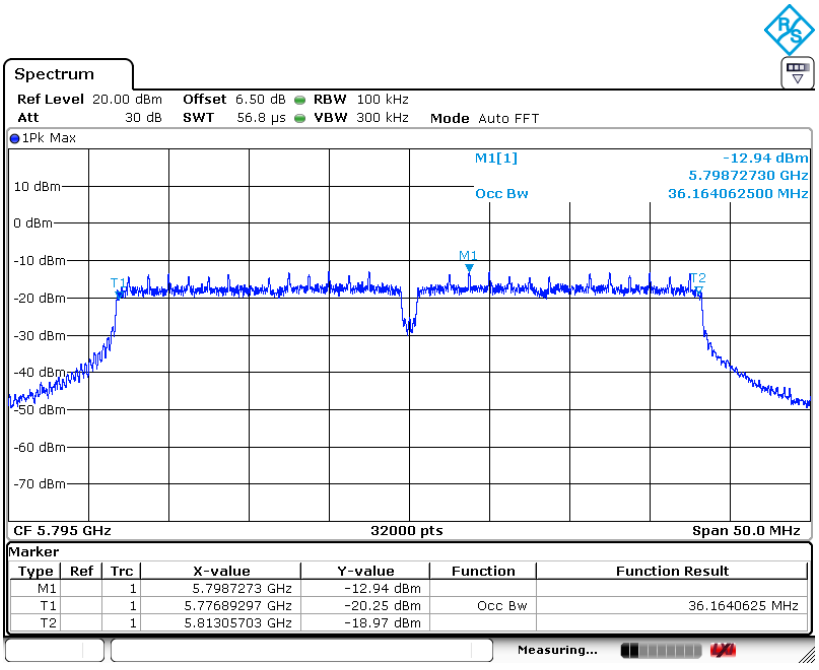


99% OBW 802.11ac40

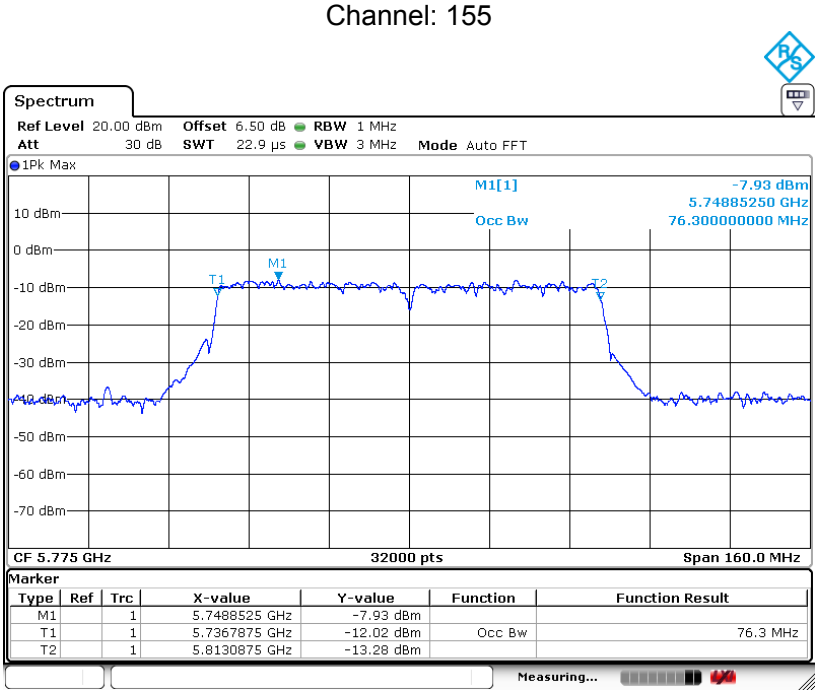
Channel: 151



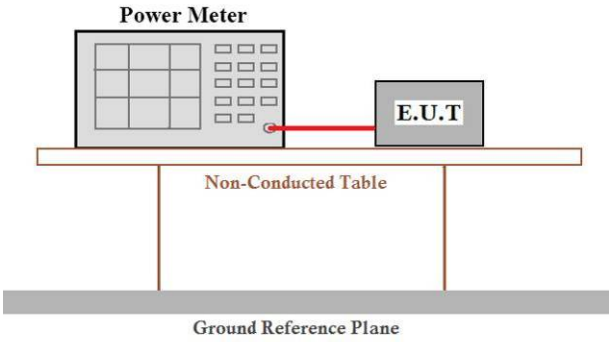
Channel: 159



Channel: 155


Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 1 MHz
Att 30 dB SWT 22.9 µs VBW 3 MHz Mode Auto FFT
1Pk Max
M1[1] -7.93 dBm
5.74885250 GHz
Occ Bw 76.300000000 MHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-50 dBm
-60 dBm
-70 dBm
M1
T1
T2
CF 5.775 GHz
32000 pts
Span 160.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 5.7488525 GHz -7.93 dBm
T1 1 5.7367875 GHz -12.02 dBm Occ Bw 76.3 MHz
T2 1 5.8130875 GHz -13.28 dBm
Measuring...

5. MAXIMUM CONDUCTED OUTPUT POWER

Test Requirement:	FCC Part15 E Section 15.407
Test Method:	KDB 789033 D02 General UNII Test Procedures New Rules v02r01
Limit:	For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency bands of operation shall not exceed 250mW. For the band 5.745-5.850 GHz, the maximum conducted output power over the frequency bands of operation shall not exceed 30dBm
Test setup:	
Test procedure:	**Measurement using an RF average power meter** (i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied a) The EUT is configured to transmit continuously or to transmit with a constant duty cycle. b) At all times when the EUT is transmitting, it must be transmitting at its maximum power control level. c) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five. (ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section B). (iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter. (iv) Adjust the measurement in dBm by adding 10 log(1/x) where x is the duty cycle (e.g., 10log(1/0.25) if the duty cycle is 25 percent).
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details

5.1. TEST RESULT

Frequency	Power ANT A (dBm)	Power ANT B (dBm)	Total power (dBm)	Limit (dBm)	Result
TX 802.11a Mode					
CH 149	11.44	11.29	14.38	27.29	PASS
CH 157	11.91	11.76	14.85	27.29	PASS
CH 165	11.20	11.55	14.39	27.29	PASS
TX 802.11n20 Mode					
CH 149	11.13	11.09	14.12	27.29	PASS
CH 157	11.47	11.24	14.37	27.29	PASS
CH 165	10.61	10.36	13.50	27.29	PASS
TX 802.11n40 Mode					
CH151	10.88	10.66	13.78	27.29	PASS
CH159	10.64	10.45	13.56	27.29	PASS

Frequency	Power ANT A (dBm)	Power ANT B (dBm)	Total power (dBm)	Limit (dBm)	Result
TX 802.11 ac(VHT20) Mode					
CH 149	10.97	10.11	13.57	27.29	PASS
CH 157	10.65	10.61	13.64	27.29	PASS
CH 165	10.87	10.63	13.76	27.29	PASS
TX 802.11 ac(VHT40) Mode					
CH 151	10.64	10.35	13.51	27.29	PASS
CH 159	10.21	10.21	13.22	27.29	PASS
TX 802.11 ac(VHT80) Mode					
CH155	10.64	10.46	13.56	27.29	PASS

For 5G mode, Limit =30-8.71+6=27.29

6. Band Edges Measurement

Test Requirement:	FCC Part15 E Section 15.407 and 5.205
Test Method:	ANSI C63.10:2013
Test site:	Measurement Distance: 3m
Receiver setup:	

Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	AV	1MHz	3MHz	Average Value

Limit:

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Undesirable emission limits:

(1) 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 EIRP of -27 dBm/MHz.

(2) 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 EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

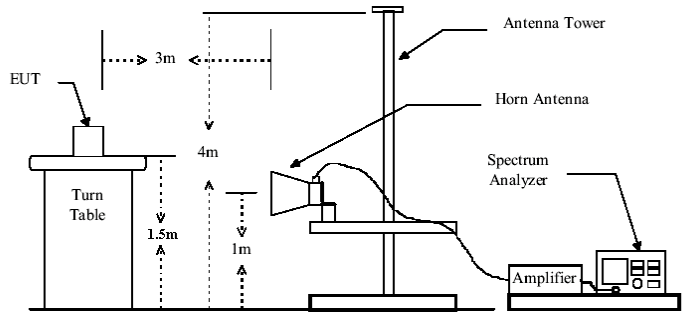
(3) For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

Test Procedure:

a. The EUT was placed on the top of a rotating table 1.5 m above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Test setup:

Above 1GHz

	
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Remark:

According to KDB 789033 v02r01 section G) 1) (d), for For measurements above 1000 MHz @ 3m distance, the limit of field strength is computed as follows:

E[dBuV/m] = EIRP[dBm] + 95.2;

For example, if EIRP = -27dBm

E[dBuV/m] = -27 + 95.2 = 68.2dBuV/m.

6.1. TEST RESULT

Peak value:

Test mode:	802.11a	Test channel:	Lowest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5725	40.13	8.79	48.92	74	-25.08	Horizontal
5741.35	82.03	8.57	90.6	N/A	N/A	Horizontal
5725	40.47	8.79	49.26	74	-24.74	Vertical
5741.35	83.96	8.57	92.53	N/A	N/A	Vertical

Average

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5725	30.03	8.79	38.82	54	-15.18	Horizontal
5741.35	71.88	8.57	80.45	N/A	N/A	Horizontal
5725	29.79	8.79	38.58	54	-15.42	Vertical
5741.35	74.52	8.57	83.09	N/A	N/A	Vertical

Test mode:	802.11a	Test channel:	Highest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5826.2	78.16	8.79	86.95	N/A	N/A	Horizontal
5850	37.88	8.82	46.7	74	-27.3	Horizontal
5826.2	84.76	8.79	93.55	N/A	N/A	Vertical
5850	39.25	8.82	48.07	74	-25.93	Vertical

Average

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5826.2	69.33	8.79	78.12	N/A	N/A	Horizontal
5850	27.86	8.82	36.68	54	-17.32	Horizontal
5826.2	75.64	8.79	84.43	N/A	N/A	Vertical
5850	28.11	8.82	36.93	54	-17.07	Vertical

Test mode:	802.11n(HT20)	Test channel:	Lowest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5725	38.25	8.79	47.04	74	-26.96	Horizontal
5742.19	76.32	8.57	84.89	N/A	N/A	Horizontal
5725	39.44	8.79	48.23	74	-25.77	Vertical
5742.19	84.03	8.57	92.6	N/A	N/A	Vertical

Average

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5725	27.91	8.79	36.7	54	-17.3	Horizontal
5742.19	67.63	8.57	76.2	N/A	N/A	Horizontal
5725	29.22	8.79	38.01	54	-15.99	Vertical
5742.19	75.34	8.57	83.91	N/A	N/A	Vertical

Test mode:	802.11n(HT20)	Test channel:	Highest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5826.2	77.05	8.79	85.84	N/A	N/A	Horizontal
5850	37.76	8.82	46.58	74	-27.42	Horizontal
5826.2	85.29	8.79	94.08	N/A	N/A	Vertical
5850	40.36	8.82	49.18	74	-24.82	Vertical

Average

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5826.2	68.44	8.79	77.23	N/A	N/A	Horizontal
5850	27.93	8.82	36.75	54	-17.25	Horizontal
5826.2	73.61	8.79	82.4	N/A	N/A	Vertical
5850	28.47	8.82	37.29	54	-16.71	Vertical

Test mode: 802.11n(HT40) Test channel: Lowest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5725	38.14	8.52	46.66	74	-27.34	Horizontal
5745	74.25	8.57	82.82	N/A	N/A	Horizontal
5725	37.34	8.52	45.86	74	-28.14	Vertical
5745	84.16	8.57	92.73	N/A	N/A	Vertical

Average

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5725	30.02	8.52	38.54	54	-15.46	Horizontal
5745	68.33	8.57	76.9	N/A	N/A	Horizontal
5725	28.01	8.52	36.53	54	-17.47	Vertical
5745	74.59	8.57	83.16	N/A	N/A	Vertical

Test mode: 802.11n(HT40) Test channel: Highest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5784.88	78.29	8.68	86.97	N/A	N/A	Horizontal
5850	38.18	8.82	47	74	-27	Horizontal
5784.88	84.36	8.68	93.04	N/A	N/A	Vertical
5850	42.41	8.82	51.23	74	-22.77	Vertical

Average

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5784.88	70.41	8.68	79.09	N/A	N/A	Horizontal
5850	28.32	8.82	37.14	54	-16.86	Horizontal
5784.88	74.16	8.68	82.84	N/A	N/A	Vertical
5850	27.22	8.82	36.04	54	-17.96	Vertical

Test mode: 802.11ac(VHT80) Test channel: Middle

Peak value:

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5725.000	37.29	8.52	45.81	74	-28.19	Horizontal
5778.180	78.33	8.68	87.01	N/A	N/A	Horizontal
5850.000	36.14	8.82	44.96	74	-29.04	Horizontal
5725.000	37.28	8.52	45.8	74	-28.2	Vertical
5778.180	82.01	8.68	90.69	N/A	N/A	Vertical
5850.000	40.32	8.82	49.14	74	-24.86	Vertical

Average

Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5725.000	29.44	8.52	37.96	54	-16.04	Horizontal
5778.180	69.63	8.68	78.31	N/A	N/A	Horizontal
5850.000	28.06	8.82	36.88	54	-17.12	Horizontal
5725.000	28.49	8.52	37.01	54	-16.99	Vertical
5778.180	71.32	8.68	80	N/A	N/A	Vertical
5850.000	29.33	8.82	38.15	54	-15.85	Vertical

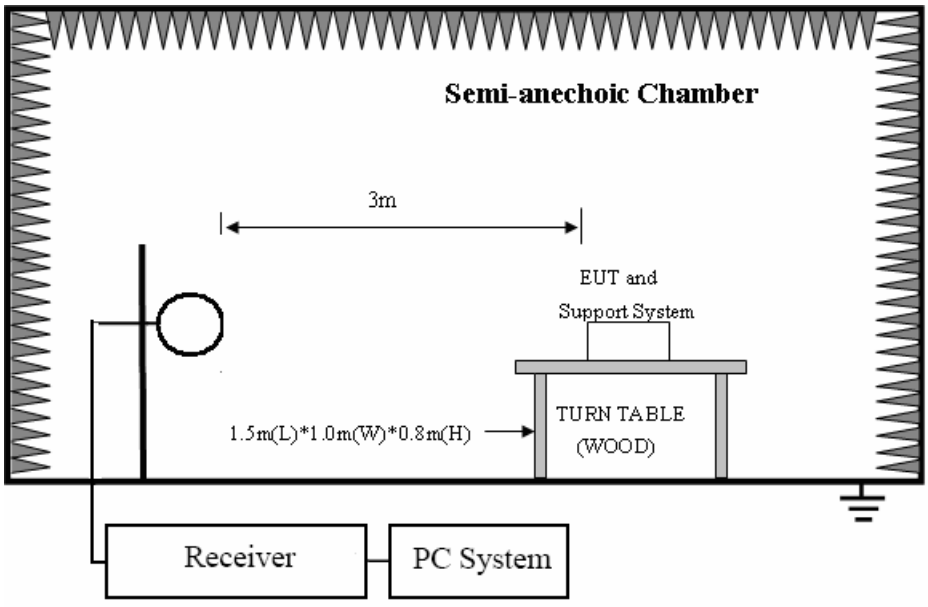
7. RADIATED EMISSION MEASUREMENT

7.1. Test equipment

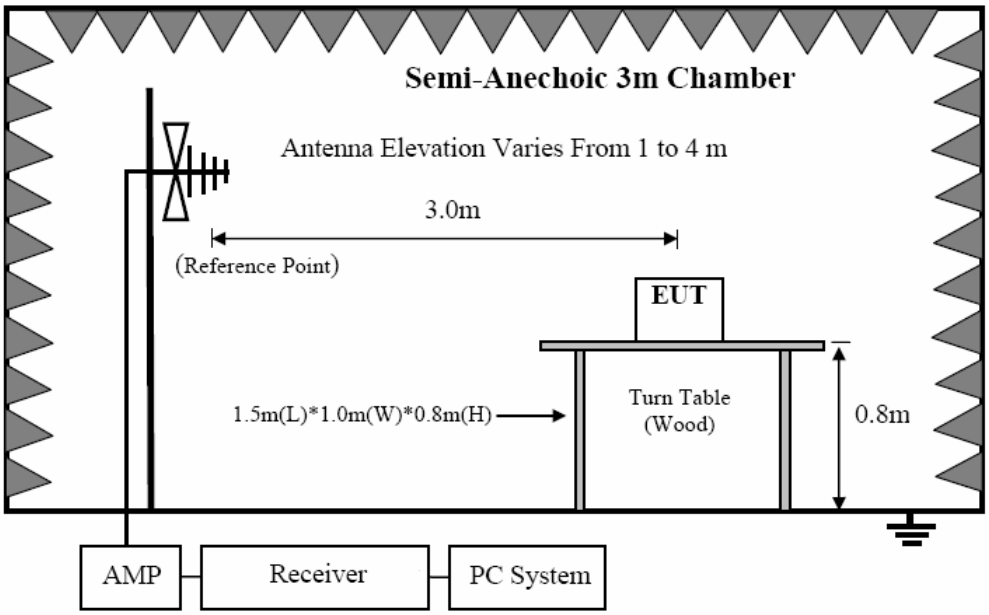
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until	Calibrated Date
1	EMI Test Receiver	R&S	ESCI	101307	12/17/2019	12/18/2018
2	Spectrum analyzer	Agilent	E4407B	US40240708	07/04/2019	07/05/2018
3	Trilog Broadband Antenna	Schwarzbeck	VULB9168	VULB9168 -192	03/04/2019	03/05/2019
4	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D1065	100276	12/17/2019	12/18/2018
5	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D1065	100546	12/17/2019	12/18/2018
6	Dipole antenna	Schwarzbeck	UHAP	1101	12/17/2019	12/18/2018
7	Dipole antenna	Schwarzbeck	VHAP	1118	12/17/2019	12/18/2018
8	Pre-Amplifier	CY	EMC011830	980136	12/17/2019	12/18/2018
9	Pre-amplifier	HP	8447F	3113A05680	12/17/2019	12/18/2018
10	RF Cable	R&S	R01	10403	12/17/2019	12/18/2018
11	RF Cable	R&S	R02	10512	12/17/2019	12/18/2018
12	RF Cable	R&S	R01	10454	12/17/2019	12/18/2018
13	RF Cable	R&S	R02	10343	12/17/2019	12/18/2018
14	Spectrum analyze	R&S	FSV40	101470	26/06/2019	06/27/2018
15	MeasurementSoftware	Farad	EZ-EMC (Ver.ATT-03A)	N/A	N/A	N/A
16	Loop antenna	TESEQ	HLA6120	20129	12/17/2019	12/18/2018

7.2. Block diagram of test setup

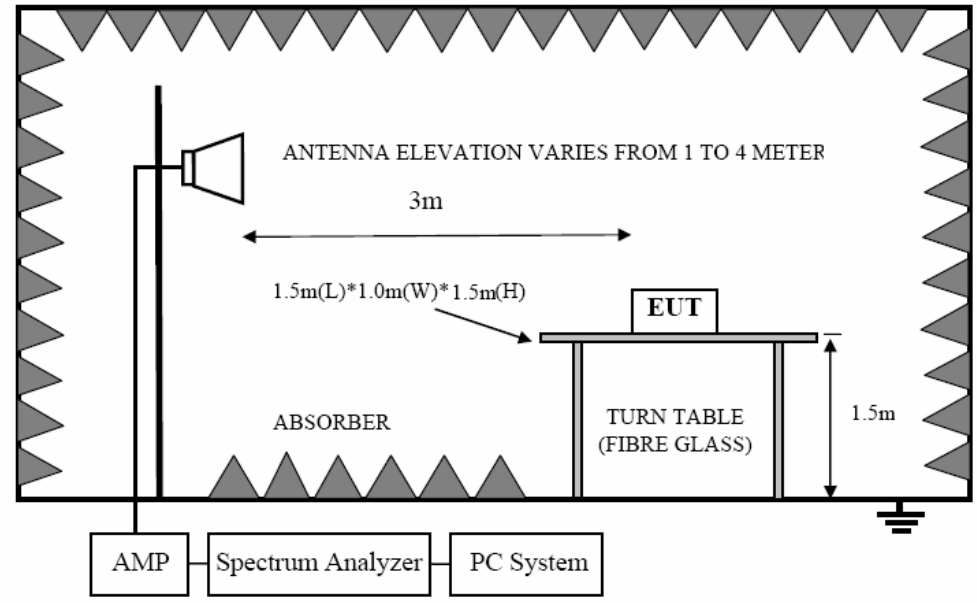
In 3m Anechoic Chamber Test Setup Diagram for 9KHz-30MHz



In 3m Anechoic Chamber Test Setup Diagram for 30MHz-1GHz



In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

7.3. Limit

9.3.1 FCC 15.205 Restricted frequency band

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])

9.3.2. FCC 15.209 Limit.

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(KHz)	67.6-20log(F)
0.490 ~ 1.705	30	24000/F(KHz)	87.6-20log(F)
1.705 ~ 30.0	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90KHz, 110-490KHz and above 1000MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

(2) At frequencies below 30MHz, measurement may be performed at a distance closer then that specified, and the limit at closer measurement distance can be extrapolated by below formula:

$Limit_{3m}(dBuV/m) = Limit_{30m}(dBuV/m) + 40Log(30m/3m)$

9.3.3. Limit for this EUT

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 30dB below the fundamental emissions, or comply with 15.209 limits.

7.4. Test Procedure

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.

(2) Setup EUT and assistant system according clause 2.4 and 7.2

(3) Test antenna was located 3m(except 18GHz-40GHz was 1m) from the EUT on an adjustable mast, and the antenna used as below table.

Test frequency range	Test antenna used
9KHz-30MHz	Active Loop antenna
30MHz-1GHz	Trilog Broadband Antenna
1GHz-18GHz	Double Ridged Horn Antenna(1GHz-18GHz)
18GHz-40GHz	Horn Antenna(18GHz-40GHz)

According ANSI C63.10:2013 clause 6.4.4.2 and 6,5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna also be positioned with its plane horizontal at the specified distance from the EUT. The center of the loop is 1 m above the ground. for measurement above 30MHz, the Trilog Broadband Antenna or Horn Antenna was located 3m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

(4) Below pre-scan procedure was first performed in order to find prominent frequency spectrum radiated emissions from 9KHz to 25GHz:

(a) Scanning the peak frequency spectrum with the antenna specified in step (3), and the EUT was rotated 360 degree, the antenna height was varied from 1m to 4m(Except loop antenna, it's fixed 1m above ground.)

(b) Change work frequency or channel of device if practicable.

(c) Change modulation type of device if practicable.

(d) new battery is used during testing

(e) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions.

Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated, and no any obvious emission were detected from 18GHz to 25GHz, so below final test was performed with frequency range from 9KHz to 18GHz.

(5) For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 2013 on Radiated Emission test.

(6) The emissions from 9KHz to 1GHz were measured based on CISPR QP detector except for the frequency bands 9-90KHz, 110-490KHz, for emissions from 9KHz-90KHz,110KHz-490KHz and above 1GHz were measured based on average detector, for emissions above 1GHz, peak emissions also be measured and need comply with Peak limit.

(7) The emissions from 9KHz to 1GHz, QP or average values were measured with EMI receiver with below RBW

Frequency band	RBW
9KHz-150KHz	200Hz
150KHz-30MHz	9KHz
30MHz-1GHz	120KHz

（8）For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure(according ANSI C63.10:2013 clause 4.2.3.2.3 procedure for average measure). Peak detector is used for Peak and AV measurement both.

7.5. Test result(Below 30MHz)

EUT:	Service-Ready Access Point	**Model No.:**	RA345
Temperature:	24℃	**Relative Humidity:**	55%
Distance:	3m	**Test Power:**	120V 60Hz
Polarization:	--	**Test Result:**	Pass
Test Mode:	Keeping TX mode	**Test By:**	Smile

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

Note:

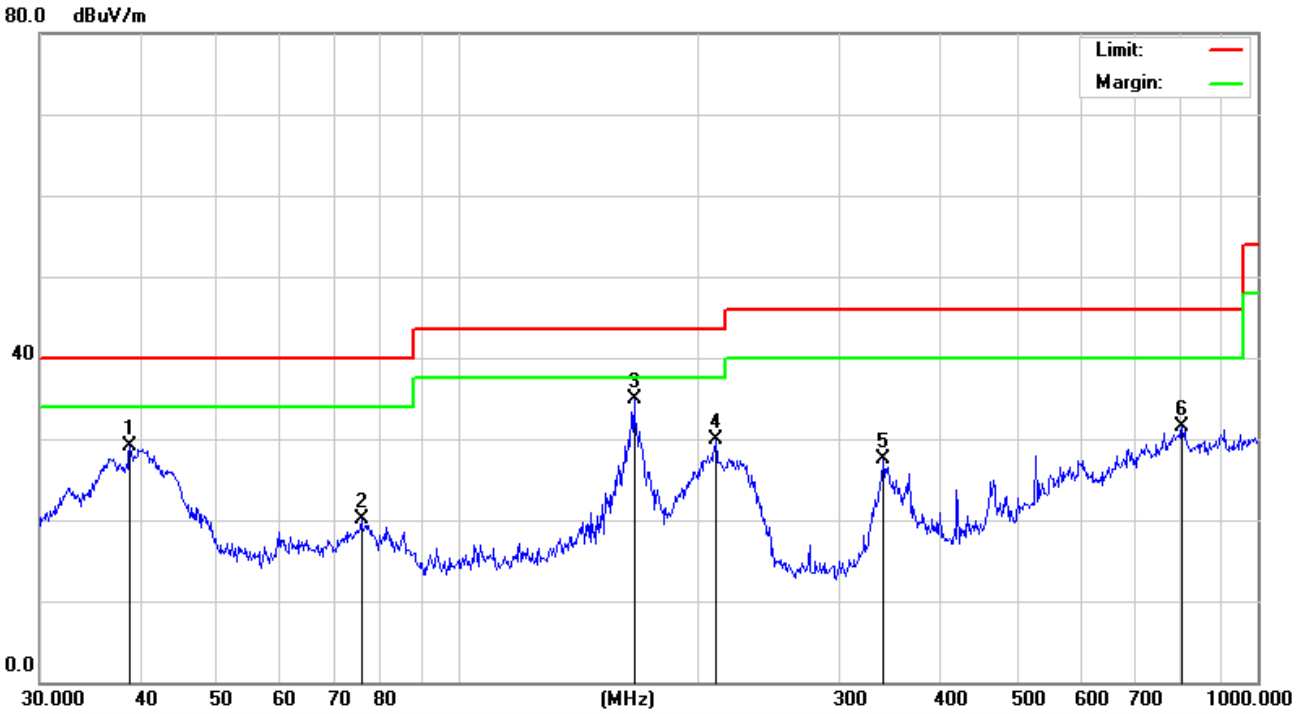
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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

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

TEST RESULTS (Between 30M – 1000 MHz)

EUT:	Service-Ready Access Point	Model No.:	RA345
Temperature:	24	Relative Humidity:	55%
Distance:	3m	Test Power:	AC120V/60Hz
Polarization:	Vertical	Test Result:	Pass
Standard:	(RE)FCC PART 15	Test By:	Smile
Test Mode:	Keeping TX mode		

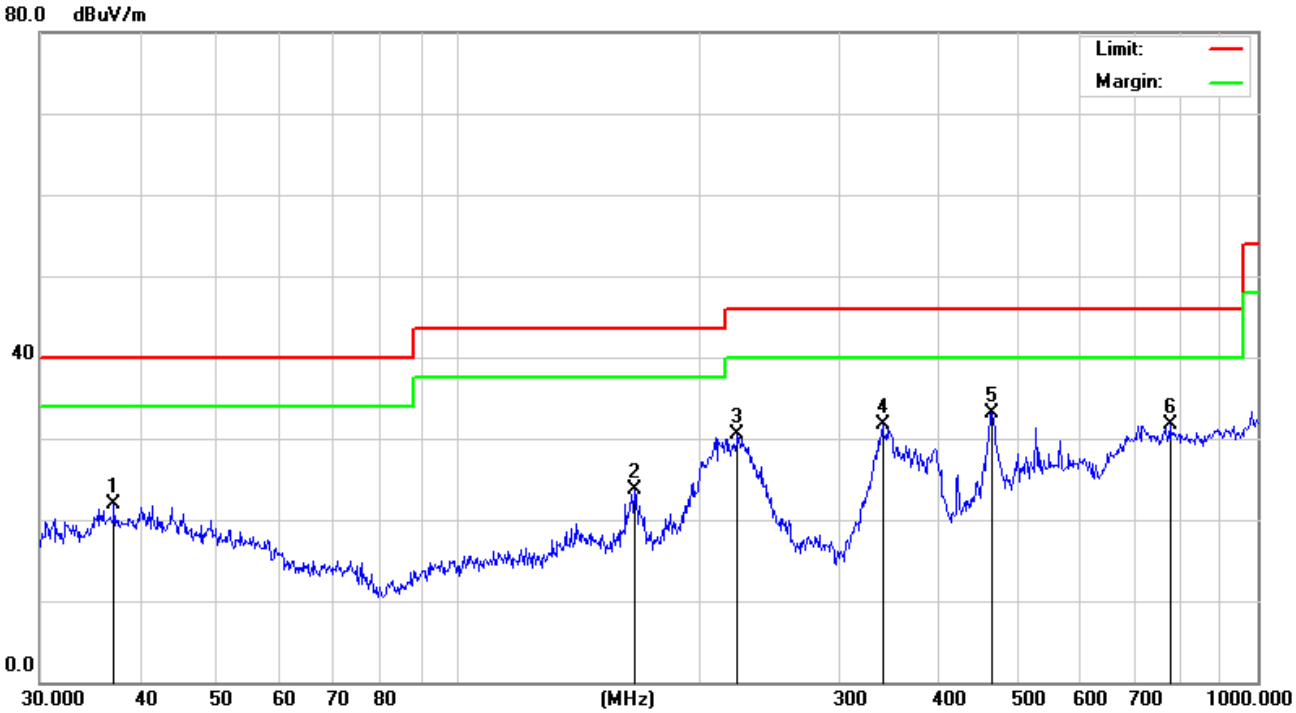


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		38.8878	33.42	-4.33	29.09	40.00	-10.91	QP
2		75.7114	30.53	-10.43	20.10	40.00	-19.90	QP
3	*	166.0680	43.92	-8.97	34.95	43.50	-8.55	QP
4		210.0482	33.65	-3.75	29.90	43.50	-13.60	QP
5		340.7817	32.86	-5.35	27.51	46.00	-18.49	QP
6		804.6028	23.99	7.60	31.59	46.00	-14.41	QP

The test result is calculated as the following:

(1) Result = Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain + Attenuator
(3) Margin = Result - Limit

EUT:	Service-Ready Access Point	Model No.:	RA345
Temperature:	24	Relative Humidity:	55%
Distance:	3m	Test Power:	AC120V/60Hz
Polarization:	**Horizontal**	Test Result:	Pass
Standard:	(RE)FCC PART 15	Test By:	Smile
Test Mode:	Keeping TX mode		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		37.1550	24.92	-3.06	21.86	40.00	-18.14	QP
2		166.0680	31.11	-7.49	23.62	43.50	-19.88	QP
3		223.7333	37.01	-6.52	30.49	46.00	-15.51	QP
4		339.5887	39.27	-7.59	31.68	46.00	-14.32	QP
5	*	465.5994	33.00	0.15	33.15	46.00	-12.85	QP
6		776.8777	24.34	7.41	31.75	46.00	-14.25	QP

The test result is calculated as the following:

(1) Result = Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain + Attenuator
(3) Margin = Result - Limit

TEST RESULTS (Above 1000 MHz)

EUT:	Service-Ready Access Point	Model No.:	RA345
Temperature:	24℃	Relative Humidity:	55%
Distance:	3m	Test Power:	120V 60Hz
Polarization:	H/V	Test Result:	Pass
Test Mode:	TX-802.11a/n20/n40/ac20/ac40/ac/80	Test By:	Smile

Above 1GHz:

Mode	Polar (H/V)	Frequency (MHz)	Reading (dBµV)	Factor (dB)	Result (dBµV)	Limit (dBµV/m)	Margin (dB)	Detector (PK/AV)
802.11a-5745 MHz	H	11490	32.41	16.82	49.23	74.00	-24.77	PEAK
	H	17235	30.06	22.93	52.99	74.00	-21.01	PEAK
	V	11570	31.07	16.82	47.89	74.00	-26.11	PEAK
	V	17235	29.26	22.93	52.19	74.00	-21.81	PEAK
802.11a-5785 MHz	H	11570	31.81	16.71	48.52	74.00	-25.48	PEAK
	H	17355	27.69	24.37	52.06	74.00	-21.94	PEAK
	V	11570	30.15	16.71	46.86	74.00	-27.14	PEAK
	V	17355	28.66	24.37	53.03	74.00	-20.97	PEAK
802.11a-5825 MHz	H	11650	33.71	16.61	50.32	74.00	-23.68	PEAK
	H	17475	27.48	25.01	52.49	74.00	-21.51	PEAK
	V	11650	32.49	16.61	49.10	74.00	-24.90	PEAK
	V	17475	28.19	25.01	53.20	74.00	-20.80	PEAK

Mode	Polar (H/V)	Frequency (MHz)	Reading (dBµV)	Factor (dB)	Result (dBµV)	Limit (dBµV/m)	Margin (dB)	Detector (PK/AV)
802.11n HT20-5745MHz	H	11490	30.89	16.82	47.71	74.00	-26.29	PEAK
	H	17235	29.61	22.93	52.54	74.00	-21.46	PEAK
	V	11570	32.07	16.71	48.78	74.00	-25.22	PEAK
	V	17235	28.23	22.93	51.16	74.00	-22.84	PEAK
802.11n HT20-5785MHz	H	11570	30.11	16.71	46.82	74.00	-27.18	PEAK
	H	17355	27.96	24.37	52.33	74.00	-21.67	PEAK
	V	11570	32.94	16.71	49.65	74.00	-24.35	PEAK
	V	17355	29.26	24.37	53.63	74.00	-20.37	PEAK
802.11n HT20-5825MHz	H	11650	32.30	16.61	48.91	74.00	-25.09	PEAK
	H	17475	27.20	25.01	52.21	74.00	-21.79	PEAK
	V	11650	34.81	16.61	51.42	74.00	-22.58	PEAK
	V	17475	27.51	25.01	52.52	74.00	-21.48	PEAK

Mode	Polar (H/V)	Frequency (MHz)	Reading (dBμV)	Factor (dB)	Result (dBμV)	Limit (dBμV/m)	Margin (dB)	Detector (PK/AV)
802.11n HT40-5755MHz	H	11510	32.49	16.78	49.27	74.00	-24.73	PEAK
	H	17265	28.15	23.29	51.44	74.00	-22.56	PEAK
	V	11510	33.40	16.78	50.18	74.00	-23.82	PEAK
	V	17265	28.66	23.29	51.95	74.00	-22.05	PEAK
802.11n HT40-5795MHz	H	11590	30.41	16.69	47.10	74.00	-26.90	PEAK
	H	17385	27.09	24.73	51.82	74.00	-22.18	PEAK
	V	11590	32.20	16.69	48.89	74.00	-25.11	PEAK
	V	17385	27.61	24.73	52.34	74.00	-21.66	PEAK
802.11ac HT20-5745MHz	H	11490	32.40	16.82	49.22	74.00	-24.78	PEAK
	H	17235	30.01	22.93	52.94	74.00	-21.06	PEAK
	V	11490	31.82	16.82	48.64	74.00	-25.36	PEAK
	V	17235	28.79	22.93	51.72	74.00	-22.28	PEAK

Mode	Polar (H/V)	Frequency (MHz)	Reading (dBμV)	Factor (dB)	Result (dBμV)	Limit (dBμV/m)	Margin (dB)	Detector (PK/AV)
802.11ac HT20-5785MHz	H	11570	33.38	16.71	50.09	74.00	-23.91	PEAK
	H	17355	27.51	24.37	51.88	74.00	-22.12	PEAK
	V	11570	31.00	16.71	47.71	74.00	-26.29	PEAK
	V	17355	27.44	24.37	51.81	74.00	-22.19	PEAK
802.11ac HT20-5825MHz	H	11650	32.19	16.61	48.80	74.00	-25.20	PEAK
	H	17475	26.22	25.01	51.23	74.00	-22.77	PEAK
	V	11650	32.00	16.61	48.61	74.00	-25.39	PEAK
	V	17475	28.30	25.01	53.31	74.00	-20.69	PEAK
802.11ac HT40-5755MHz	H	11510	31.56	16.78	48.34	74.00	-25.66	PEAK
	H	17265	26.78	23.29	50.07	74.00	-23.93	PEAK
	V	11510	31.74	16.78	48.52	74.00	-25.48	PEAK
	V	17265	27.64	23.29	50.93	74.00	-23.07	PEAK
802.11ac HT40-5795MHz	H	11590	32.66	16.69	49.35	74.00	-24.65	PEAK
	H	17385	26.41	24.73	51.14	74.00	-22.86	PEAK
	V	11590	31.10	16.69	47.79	74.00	-26.21	PEAK
	V	17385	27.83	24.73	52.56	74.00	-21.44	PEAK

Mode	Polar (H/V)	Frequency (MHz)	Reading (dBμV)	Factor (dB)	Result (dBμV)	Limit (dBμV/m)	Margin (dB)	Detector (PK/AV)
802.11ac HT80-5775MHz	H	11550	31.57	16.73	48.30	74.00	-25.70	PEAK
	H	17325	26.70	24.01	50.71	74.00	-23.29	PEAK
	V	11550	29.67	16.73	46.40	74.00	-27.60	PEAK
	V	17325	24.97	24.01	48.98	74.00	-25.02	PEAK

The field strength is calculated by adding the Antenna Factor. Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor –Preamplifier Factor.

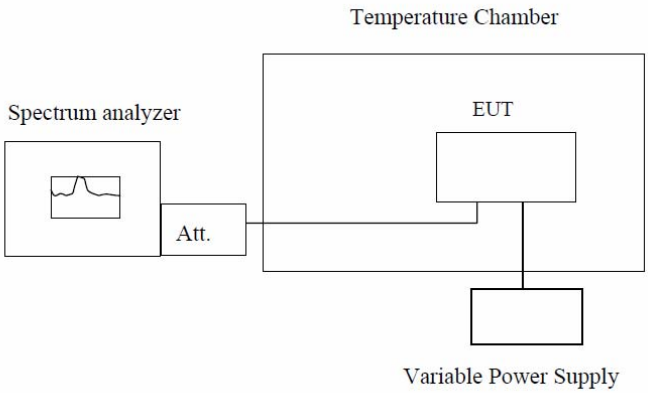
Average measurement was not performed if peak level lower than average limit.

No any other emissions level very low which are attenuated less than 20dB below the limit.

According to 15.31(o), The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this Part.

Hence there no other emissions have been reported.

8. FREQUENCY STABILITY

Test Requirement:	FCC Part15 C Section 15.407(g)
Test Method:	ANSI C63.10:2013, FCC Part 2.1055
Limit:	Manufactures 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
Test Procedure:	The EUT was setup to ANSI C63.4, 2014; tested to 2.1055 for compliance to FCC Part 15.407(g) requirements.
Test setup:	 **Note :** Measurement setup for testing on Antenna connector
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Frequency stability versus Temp.					
Power Supply: DC 12V					
Temp. (°C)	Operating Frequency (MHz)	0 minute Measured Frequency (MHz)	2 minute Measured Frequency (MHz)	5 minute Measured Frequency (MHz)	10 minute Measured Frequency (MHz)
-30	5745	5745.0184	5745.1569	5745.1368	5745.0698
	5785	5784.9686	5784.9815	5784.9179	5784.9725
	5825	5824.9859	5824.9908	5825.0076	5824.8862
-20	5745	5744.9224	5744.9969	5744.9698	5745.0908
	5785	5785.1039	5785.0015	5785.0168	5784.9574
	5825	5824.9406	5825.0615	5824.9710	5824.9163
-10	5745	5745.0793	5745.0545	5744.9769	5745.0763
	5785	5785.1050	5784.8663	5785.1607	5784.9101
	5825	5824.8807	5824.8695	5825.0397	5824.9511
0	5745	5744.8689	5745.0679	5745.0246	5744.9186
	5785	5784.9509	5785.0546	5784.8337	5784.9335
	5825	5825.0672	5824.9837	5825.0114	5824.9055
10	5745	5745.0174	5745.0164	5745.2015	5745.1106
	5785	5785.0984	5785.0063	5784.8768	5785.0976
	5825	5824.9969	5825.0258	5824.9637	5825.0564
20	5745	5744.9396	5744.8485	5745.0864	5745.0018
	5785	5784.9403	5784.9546	5784.9651	5784.9547
	5825	5824.8814	5824.9521	5824.9948	5825.1214
30	5745	5745.0339	5744.9383	5745.0147	5744.9828
	5785	5785.1452	5784.9095	5784.9389	5784.9502
	5825	5825.0934	5824.9870	5824.8597	5824.8385
40	5745	5744.9923	5744.8612	5744.9934	5745.0924
	5785	5784.9668	5785.0959	5784.8730	5785.1487
	5825	5825.0114	5825.1105	5825.0154	5824.9086
50	5745	5745.0314	5744.9894	5745.0170	5744.9261
	5785	5784.9172	5784.8347	5785.0450	5785.0347
	5825	5824.9020	5824.8684	5825.1006	5825.0624

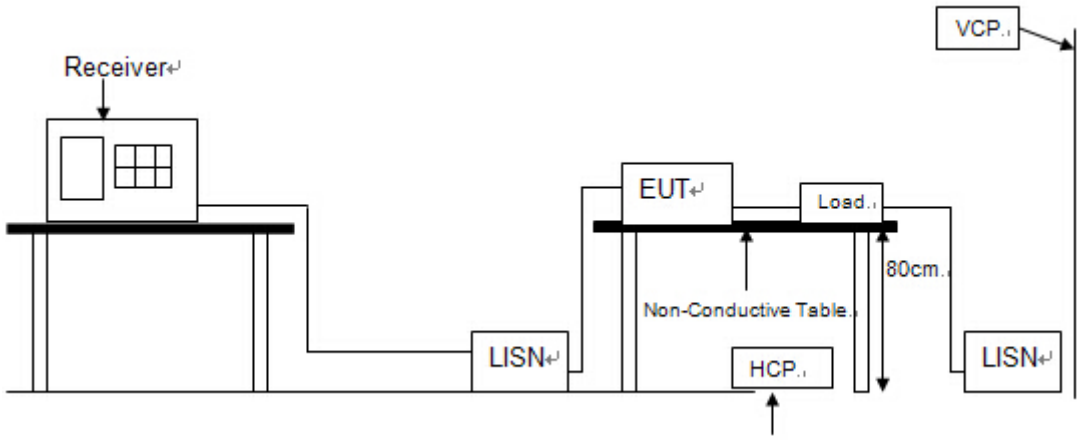
Frequency stability versus Voltage					
Temperature: 25°C					
Power Supply (VDC)	Operating Frequency (MHz)	0 minute Measured Frequency (MHz)	2 minute Measured Frequency (MHz)	5 minute Measured Frequency (MHz)	10 minute Measured Frequency (MHz)
11	5745	5745.0592	5744.8542	5745.0133	5745.0039
	5785	5784.8816	5785.0742	5784.9118	5785.1317
	5825	5825.0136	5824.9883	5824.9287	5825.1481
12	5745	5744.8291	5744.8759	5745.0209	5744.9682
	5785	5784.8823	5785.0205	5784.9916	5785.1383
	5825	5824.9364	5824.7946	5824.9357	5824.9107
13	5745	5744.8189	5745.0002	5744.9994	5744.8712
	5785	5784.8274	5784.9362	5784.9457	5784.9738
	5825	5824.9889	5824.9283	5824.9821	5825.0694

9. POWER LINE CONDUCTED EMISSION

9.1 Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Pulse Limiter	MTS-systemtechnik	MTS-IMP-136	261115-010-0024	12/17/2019
2	EMI Test Receiver	R&S	ESCI	101308	12/17/2019
3	LISN	AFJ	LS16	16011103219	12/17/2019
4	LISN	Schwarzbeck	NSLK 8127	8127-432	12/17/2019
5	Measurement Software	Farad	EZ-EMC (Ver.ATT-03A)	N/A	N/A
6	MeasurementSoftware	Farad	EZ-EMC (Ver.ATT-03A)	N/A	N/A

9.2 Block diagram of test setup



9.3 Power Line Conducted Emission Limits(Class B)

Frequency	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Note 1: * Decreasing linearly with logarithm of frequency.

Note 2: The lower limit shall apply at the transition frequencies.

9.4 TEST PROCEDURE

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 10.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.

All support equipment power received from a second LISN.

Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in clause 2.4 were scanned during the preliminary test.

After the preliminary scan, we found the test mode producing the highest emission level.

The EUT configuration and worse cable configuration of the above highest emission levels were recorded for reference of the final test.

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Neutral and Line, recording at least the six highest emissions.

Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

The bandwidth of test receiver is set at 9 KHz.

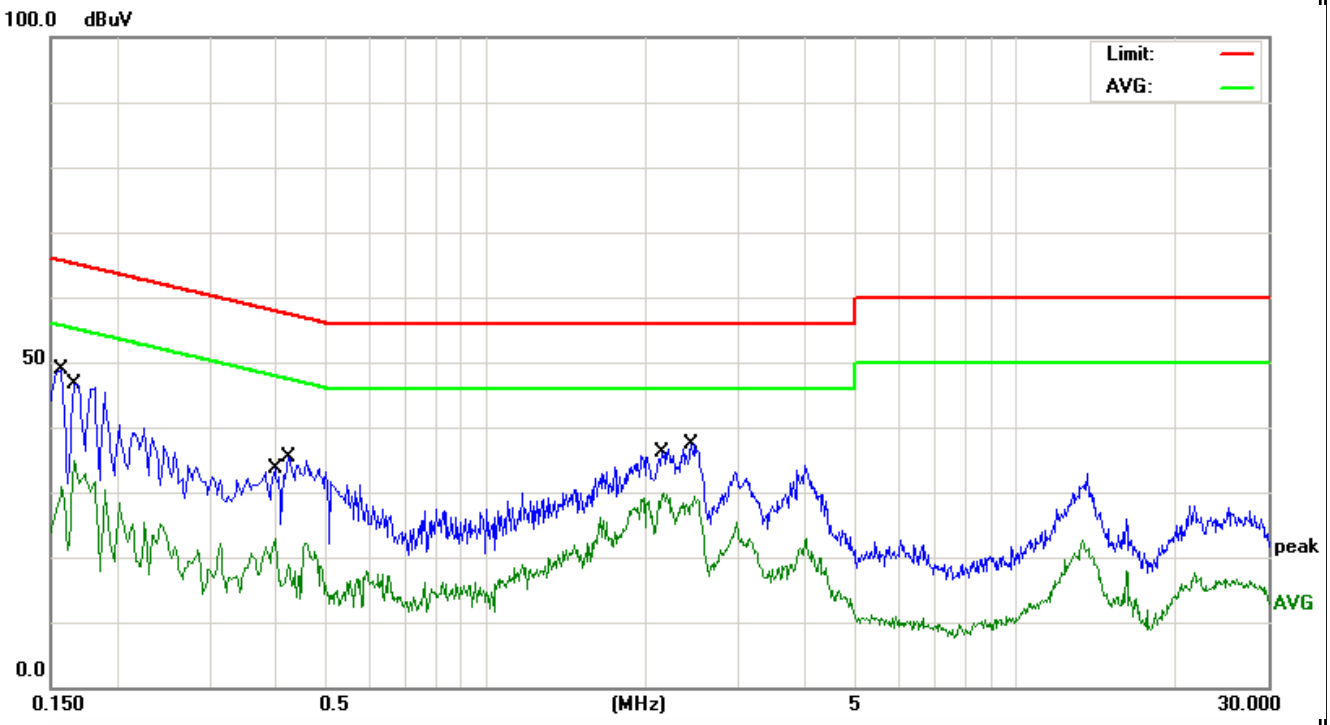
9.5 Test Result

PASS. (See below detailed test result)

Note1: All emissions not reported below are too low against the prescribed limits.

Note2: “-----” means peak detection; “-----” mans average detection

EUT:	Table PC	Model No.:	RA345
Temperature:	23℃	Relative Humidity:	52%
Probe:	N	Test Power:	AC 120V/60Hz
Test Time:	2019-05-20	Test Result:	Pass
Standard:	(CE)FCC PART 15 class B_QP		
Test Mode:	TX		
Note:			



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1580	37.12	11.75	48.87	65.56	-16.69	QP
2		0.1660	23.18	11.61	34.79	55.15	-20.36	AVG
3		0.3980	12.64	10.13	22.77	47.89	-25.12	AVG
4		0.4220	25.24	10.11	35.35	57.41	-22.06	QP
5	*	2.1580	19.86	10.00	29.86	46.00	-16.14	AVG
6		2.4380	27.45	10.01	37.46	56.00	-18.54	QP

The test result is calculated as the following:

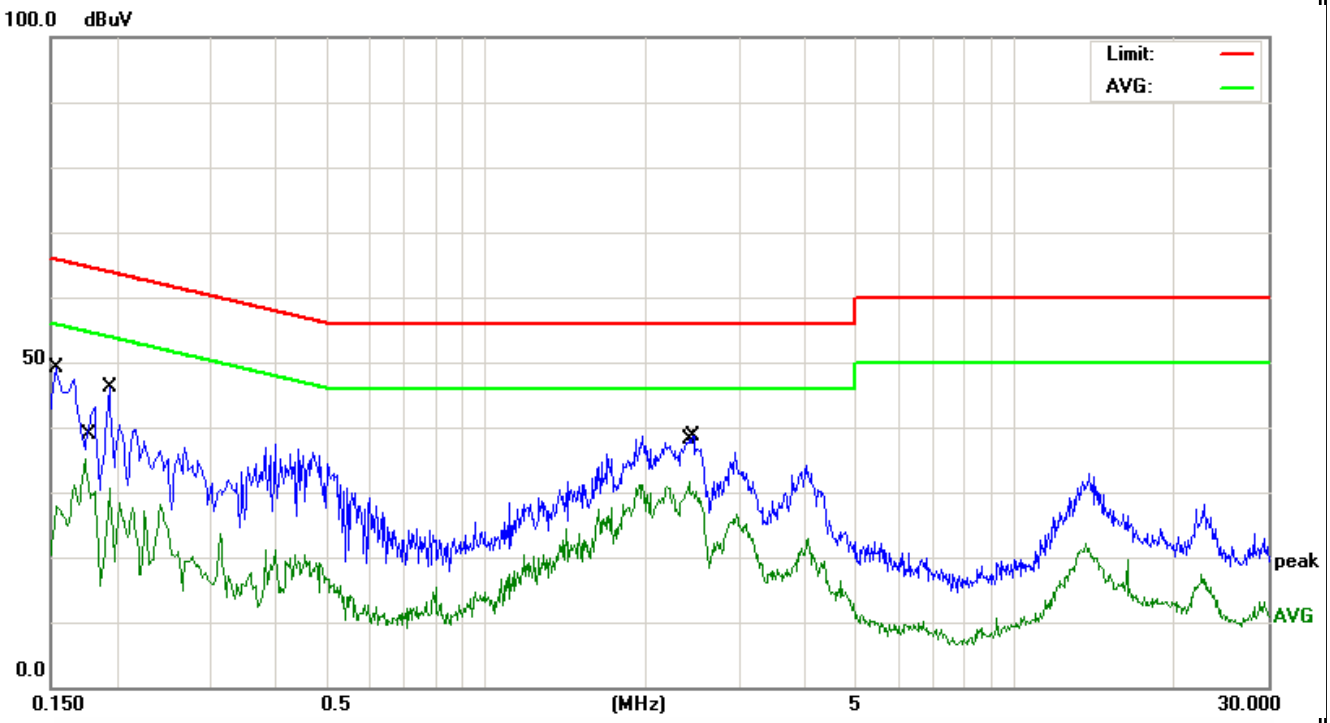
(1) Result = Reading + Correct Factor

(2) Correct Factor = (LISN, ISN, PLC or Current Probe) Factor + Cable Loss +Attenuator

(3) Margin = Result - Limit

EUT:	Table PC	Model No.:	RA345
Temperature:	23℃	Relative Humidity:	52%

Probe:	L1	Test Power:	AC 120V/60Hz
Test Time:	2019-05-20	Test Result:	Pass
Standard:	(CE)FCC PART 15 class B_QP		
Test Mode:	TX		
Note:			



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1539	37.31	11.84	49.15	65.78	-16.63	QP
2		0.1740	23.71	11.48	35.19	54.76	-19.57	AVG
3		0.1940	34.81	11.21	46.02	63.86	-17.84	QP
4		0.1940	19.40	11.21	30.61	53.86	-23.25	AVG
5	*	2.4100	21.53	10.01	31.54	46.00	-14.46	AVG
6		2.4500	28.69	10.01	38.70	56.00	-17.30	QP

The test result is calculated as the following:

(1) Result = Reading + Correct Factor
(2) Correct Factor = (LISN, ISN, PLC or Current Probe) Factor + Cable Loss +Attenuator
(3) Margin = Result - Limit

10. ANTENNA REQUIREMENTS

10.1. Limit

15.203 requirement: For intentional device, according to 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.

10.2. EUT ANTENNA

The EUT antenna is permanent attached antenna. It comply with the standard requirement.