

FCC PART 15E TEST REPORT FOR CERTIFICATION
On Behalf of

TCL Entertainment Solutions Limited

2.0 TCL• Roku TV Wireless Soundbar

Model Number: TSR1

Additional Model: TS120, TS1204, TDS1204, TS1204K, TDS1204K, FS1204, OS1204, AltoR1, Alto R, ***1204, TS7204, TS720, TDS7204, TS7204K, TDS7204K, FS7204, OS7204, AltoR7, ***7204 (“*” can be any alphanumeric character including blank for marketing differences)

FCC ID: 2ARUDTSR1

Prepared for:	TCL Entertainment Solutions Limited
	7/F, building 22E, 22 science park east avenue Hong Kong science park,
	SHATIN, N.T. ,Hong Kong China.
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
	Tel: 86-769-83081888-808

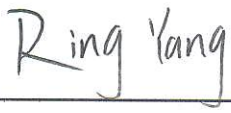
Report Number:	ESTE-R2107154
Date of Test:	Jun. 04~Jul. 27, 2021
Date of Report:	Jul. 28, 2021

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EST Technology Co., Ltd.

Applicant:	TCL Entertainment Solutions Limited		
Address:	7/F, building 22E, 22 science park east avenue Hong Kong science park, SHATIN, N.T., Hong Kong China.		
Manufacturer:	TCL Entertainment Solutions Limited		
Address:	7/F, building 22E, 22 science park east avenue Hong Kong science park, SHATIN, N.T., Hong Kong China.		
Factory:	Zhong Shan City Richsound Electronic Industrial Ltd.		
Address:	No.16, East Shagang Road, Gangkou, Zhongshan, Guangdong, China.		
E.U.T:	2.0 TCL• Roku TV Wireless Soundbar		
Model Number:	TSR1		
Additional Model:	TS120, TS1204, TDS1204, TS1204K, TDS1204K, FS1204, OS1204, AltoR1, Alto R, ***1204, TS7204, TS720, TDS7204, TS7204K, TDS7204K, FS7204, OS7204, AltoR7, ***7204(“*” can be any alphanumeric character including blank for marketing differences)		
Power Supply:	AC 100-240V, 50/60Hz, 30W		
Trade Name:	TCL	Serial No.:	-----
Date of Receipt:	Jun. 04, 2021	Date of Test:	Jun. 04~Jul. 27, 2021
Test Specification:	FCC Part 15 Subpart E 15.407 ANSI C63.10:2013 FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 FCC KDB 662911 D01 Multiple Transmitter Output v02r01		
Test Result:	The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart E requirements. This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd.		
Prepared by:	Reviewed by:	Date: Jul. 28, 2021	
 Ring Yang / Assistant	 Seven Wang / Engineer	Approved by:  Iceman Hu / Manager	
Other Aspects:	None.		
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested			
This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.			

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

FCC ID	:	2ARUDTSR1	
Product Name	:	2.0 TCL• Roku TV Wireless Soundbar	
Model Number	:	TSR1	
Software Version	:	N/A	
Hardware Version	:	N/A	
Operation frequency	:	U-NII-1: 5150 MHz~5250 MHz U-NII-3: 5725 MHz~5850 MHz	
Number of channel	:	U-NII-1: IEEE 802.11a / n HT20 / ac VHT20: 4 Channels; IEEE 802.11n HT40 / ac VHT40: 2 Channels; IEEE 802.11ac VHT80: 1 Channel. U-NII-3: IEEE 802.11a / n HT20 / ac VHT20: 5 Channels; IEEE 802.11n HT40 / ac VHT40: 2 Channels; IEEE 802.11ac VHT80: 1 Channel.	
Modulation	:	OFDM(QPSK, BPSK, 16-QAM, 64-QAM, 256-QAM)	
Transmit Data Rate	:	IEEE 802.11a: 54, 48, 36, 24, 18, 12, 9, 6Mbps; IEEE 802.11n: up to 150Mbps; IEEE 802.11ac: up to 433.3Mbps	
Channels Spacing	:	IEEE 802.11a: 20MHz; IEEE 802.11n HT20: 20MHz; IEEE 802.11n HT40: 40MHz; IEEE 802.11ac VHT20: 20MHz; IEEE 802.11ac VHT40: 40MHz; IEEE 802.11ac VHT80: 80MHz;	
Transmit Power	:	U-NII-1	IEEE 802.11a: 13.11dBm IEEE 802.11n HT20: 17.80dBm IEEE 802.11n HT40: 17.49dBm IEEE 802.11ac VHT20: 17.67dBm IEEE 802.11ac VHT40: 17.46dBm IEEE 802.11ac VHT80: 17.45dBm
		U-NII-3	IEEE 802.11a: 13.94dBm IEEE 802.11n HT20: 18.44dBm IEEE 802.11n HT40: 18.43dBm IEEE 802.11ac VHT20: 18.07dBm IEEE 802.11ac VHT40: 18.43dBm IEEE 802.11ac VHT80: 18.42dBm
Sample Type	:	Prototype production	

Note:

For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

1.2. The antenna information for EUT

Ant No.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Internal	N/A	4.11
2	N/A	N/A	Internal	N/A	4.11

Remark:

- (1) The EUT can work as CDD mode in IEEE 802.11n and IEEE 802.11ac, and can operate with one spatial stream.

According to KDB 662911 F 2) f) (ii):

$$\text{Directional gain} = 10 \times \log[(10^{4/20} + 10^{5/20})^2 / 2] = 7.12 \text{ dBi} > 6 \text{ dBi}$$

So, the output power limit and power spectral density should be reduced.

For output Power:

U-NII-1 Limit is $24 \text{ dBm} - (7.12 \text{ dBi} - 6 \text{ dBi}) = 22.88 \text{ dBm}$

U-NII-2A & U-NII-2C Limit is $24 \text{ dBm} - (7.2 \text{ dBi} - 6 \text{ dBi}) = 22.88 \text{ dBm}$

U-NII-3 Limit is $30 \text{ dBm} - (7.12 \text{ dBi} - 6 \text{ dBi}) = 28.88 \text{ dBm}$

For power spectral density:

U-NII-1 Limit is $11 \text{ dBm/MHz} - (7.12 \text{ dBi} - 6 \text{ dBi}) = 9.88 \text{ dBm/MHz}$

U-NII-2A & U-NII-2C Limit is $11 \text{ dBm/MHz} - (7.12 \text{ dBi} - 6 \text{ dBi}) = 9.88 \text{ dBm/MHz}$

U-NII-3 Limit is $30 \text{ dBm/500KHz} - (7.12 \text{ dBi} - 6 \text{ dBi}) = 28.88 \text{ dBm/500KHz}$

- (2) After pre-test all antenna configurations, the worst case configuration as list below.

TX Mode \ ANT No.	SISO Configuration	MIMO Configuration
IEEE 802.11a	ANT 1 and Ant 2	/
IEEE 802.11n HT20	/	ANT1+ANT2
IEEE 802.11n HT40	/	ANT1+ANT2
IEEE 802.11ac VHT20	/	ANT1+ANT2
IEEE 802.11ac VHT40	/	ANT1+ANT2
IEEE 802.11ac VHT80	/	ANT1+ANT2

2. SUMMARY OF TEST

2.1. Summary of test result

Report Section	Description of Test Item	FCC Standard Section	Results
3	6dB Bandwidth & 26dB Bandwidth & 99% Occupied Bandwidth	15.407(a) 15.407(e)	PASS
4	Maximum Conducted Output Power	15.407(a)	PASS
5	Peak Power Spectral Density	15.407(a)	PASS
6	Unwanted Emissions and Band Edge	15.205 15.209 15.407(b)	PASS
7	Frequency Stability	15.407(g)	PASS
8	AC Power Line Conducted Emissions	15.207 15.407(b)(8)	PASS
9	Antenna Requirement	15.203	PASS

Note:

(1) "N/A" denotes test is not applicable in this test report

2.2. Test Facilities

EMC Lab : Certificated by CNAS, CHINA
Registration No.: L5288
This Certificate is valid until: November 12, 2023

Certificated by FCC, USA
Designation Number: CN1215
This Certificate is valid until: January 31, 2022

Certificated by A2LA, USA
Registration No.: 4366.01
This Certificate is valid until: January 31, 2022

Certificated by Industry Canada
CAB identifier No.: CN0035
This Certificate is valid until: January 31, 2022

Certificated by VCCI, Japan
Registration No.: C-14103; T-20073; R-13663;
R-20103; G-20097
Date of registration: Apr. 20, 2020
This Certificate is valid until: Apr. 19, 2023

Certificated by TUV Rheinland, Germany
Registration No.: UA 50413872 0001
Date of registration: July 31, 2018

Certificated by Intertek
Registration No.: 2011-RTL-L2-64
Date of registration: November 08, 2018

Name of Firm : EST Technology Co., Ltd.

Site Location : Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China

2.3. Measurement uncertainty for EST Technology Co., Ltd.

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.54dB
Uncertainty for Radiation Emission test (30MHz-1GHz)	3.62
Uncertainty for Radiation Emission test (1GHz to 18GHz)	4.86
Uncertainty for spurious emissions test (18GHz to 40GHz)	4.67
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	1.08dB
Uncertainty for Power density test	0.26dB
Temperature	$\pm 0.6^{\circ}\text{C}$
Humidity	$\pm 4.0\%$
Volatage DC	$\pm 1.0\%$
Volatage (AC, <10KHz)	$\pm 1.5\%$

Note:

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

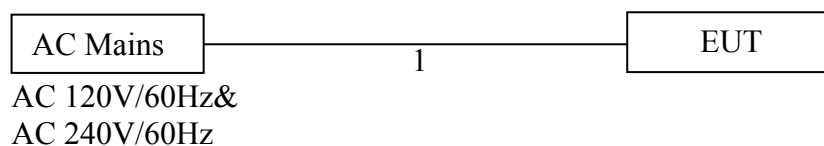
2.4. Assistant equipment used for test

Item	Equipment	Brand	Model Name/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	1.2m	AC Cable

2.5. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground.



(EUT: 2.0 TCL• Roku TV Wireless Soundbar)

2.6. Test Mode

Pre-scan has been combined all possible modulations and data rates to determine the worst case test mode, the worst case test mode was selected for the final test as listed below.

Test Item	Test Mode	Channel	Modulation	Data rate
6dB Bandwidth	IEEE 802.11a	149/157/165	OFDM	6Mbps
	IEEE 802.11n HT20	149/157/165	OFDM	MCS0
	IEEE 802.11n HT40	151/159	OFDM	MCS0
	IEEE 802.11ac VHT20	149/157/165	OFDM	MCS0
	IEEE 802.11ac VHT40	151/159	OFDM	MCS0
	IEEE 802.11ac VHT80	155	OFDM	MCS0
26dB Bandwidth	IEEE 802.11a	36/40/48	OFDM	6Mbps
	IEEE 802.11n HT20	36/40/48	OFDM	MCS0
	IEEE 802.11n HT40	38/46	OFDM	MCS0
	IEEE 802.11ac VHT20	36/40/48	OFDM	MCS0
	IEEE 802.11ac VHT40	38/46	OFDM	MCS0
	IEEE 802.11ac VHT80	42	OFDM	MCS0
99% Occupied Bandwidth	IEEE 802.11a	36/40/48/149/157/165	OFDM	6Mbps
	IEEE 802.11n HT20	36/40/48/149/157/165	OFDM	MCS0
	IEEE 802.11n HT40	38/46//151/159	OFDM	MCS0
	IEEE 802.11ac VHT20	36/40/48/149/157/165	OFDM	MCS0
	IEEE 802.11ac VHT40	38/46/151/159	OFDM	MCS0
	IEEE 802.11ac VHT80	42/155	OFDM	MCS0
Maximum Conducted Output Power	IEEE 802.11a	36/40/48/149/157/165	OFDM	6Mbps
	IEEE 802.11n HT20	36/40/48/149/157/165	OFDM	MCS0
	IEEE 802.11n HT40	38/46//151/159	OFDM	MCS0
	IEEE 802.11ac VHT20	36/40/48/149/157/165	OFDM	MCS0
	IEEE 802.11ac VHT40	38/46/151/159	OFDM	MCS0
	IEEE 802.11ac VHT80	42/155	OFDM	MCS0

Peak Power Spectral Density	IEEE 802.11a	36/40/48/149/157/165	OFDM	6Mbps
	IEEE 802.11n HT20	36/40/48/149/157/165	OFDM	MCS0
	IEEE 802.11n HT40	38/46//151/159	OFDM	MCS0
	IEEE 802.11ac VHT20	36/40/48/149/157/165	OFDM	MCS0
	IEEE 802.11ac VHT40	38/46/151/159	OFDM	MCS0
	IEEE 802.11ac VHT80	42/155	OFDM	MCS0
Unwanted Emissions and Band Edge(Above 1GHz)	IEEE 802.11a	36/40/48/149/157/165	OFDM	6Mbps
	IEEE 802.11n HT20	36/40/48/149/157/165	OFDM	MCS0
	IEEE 802.11n HT40	38/46//151/159	OFDM	MCS0
	IEEE 802.11ac VHT20	36/40/48/149/157/165	OFDM	MCS0
	IEEE 802.11ac VHT40	38/46/151/159	OFDM	MCS0
	IEEE 802.11ac VHT80	42/155	OFDM	MCS0
Unwanted Emissions Below 1GHz	IEEE 802.11a	48	OFDM	6Mbps
Frequency Stability	Unmodulation	36/149	N/A	N/A
AC Power Line Conducted Emissions	IEEE 802.11a	48	OFDM	6Mbps

Note:

1. In radiated measurement,the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane**.

2.7. Channel List

Band	Mode	Channel	Frequency (MHz)
U-NII-1	IEEE 802.11a & n HT20 & ac VHT20	36	5180
		40	5200
		44	5220
		48	5240
	IEEE 802.11n HT40 & ac VHT40	38	5190
		46	5230
	IEEE 802.11ac VHT80	42	5210
U-NII-3	IEEE 802.11a & n HT20 & ac VHT20	149	5745
		153	5765
		157	5785
		161	5805
		165	5825
	IEEE 802.11n HT40 & ac VHT40	151	5755
		159	5795
	IEEE 802.11ac VHT80	155	5775

2.8. Power Setting of Test Software

Software Name	SecureCRT 5.50		
U-NII-1			
Frequency(MHz)	5180	5200	5240
IEEE 802.11a Setting	78,78	78,78	78,78
IEEE 802.11n HT20 Setting	78,78	78,78	78,78
IEEE 802.11ac VHT20 Setting	78,78	78,78	78,78
Frequency(MHz)	5190	5230	
IEEE 802.11n HT40 Setting	78,78	78,78	
IEEE 802.11ac VHT40 Setting	78,78	78,78	
Frequency(MHz)	5210		
IEEE 802.11ac VHT80 Setting	78,78		
U-NII-3			
Frequency(MHz)	5745	5785	5825
IEEE 802.11a Setting	78,78	78,78	78,78
IEEE 802.11n HT20 Setting	78,78	78,78	78,78
IEEE 802.11ac VHT20 Setting	78,78	78,78	78,78
Frequency(MHz)	5755	5795	
IEEE 802.11n HT40 Setting	78,78	78,78	
IEEE 802.11ac VHT40 Setting	78,78	78,78	
Frequency(MHz)	5775		
IEEE 802.11ac VHT80 Setting	78,78		

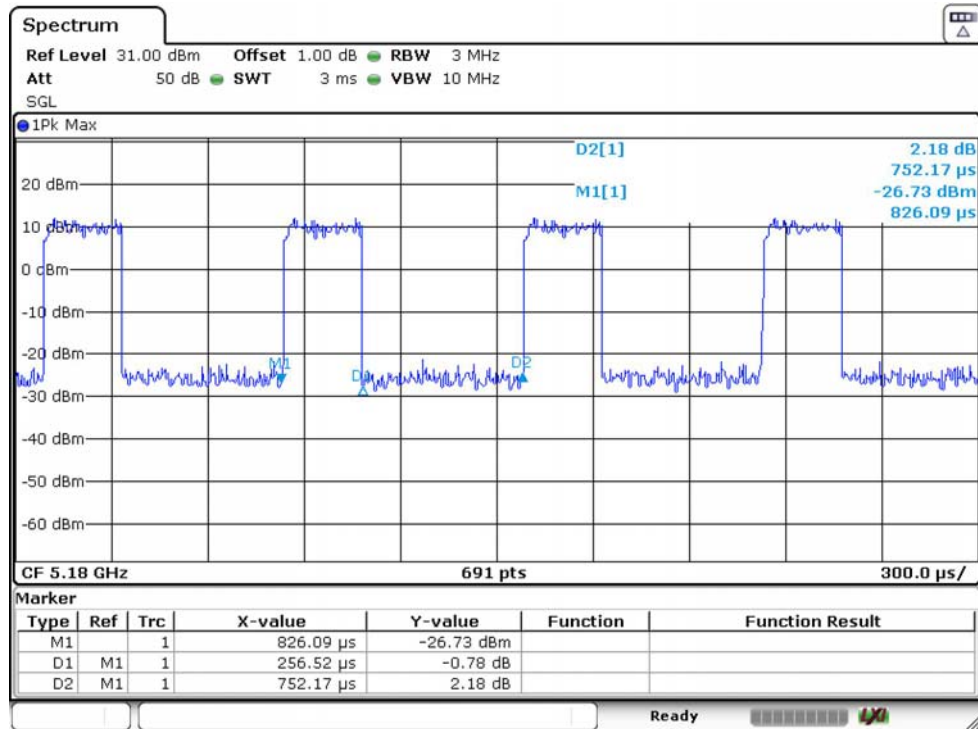
2.9. Duty Cycle of Test Signal

Temperature	24.1℃	Relative Humidity		55%	Test Voltage		AC 120V/60Hz
Mode	Frequency (MHz)	On time (ms)	Total Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T (Hz)	VBW Setting (dB)
IEEE 802.11a	5180	0.25652	0.75217	34.10	4.67	3898	3898
IEEE 802.11n HT20	5180	1.92750	2.39130	80.60	0.94	519	519
IEEE 802.11ac VHT20	5190	1.91300	2.39130	80.00	0.97	523	523
IEEE 802.11n HT40	5180	0.96230	1.44930	66.40	1.78	1039	1039
IEEE 802.11ac VHT40	5190	0.96230	1.43770	66.93	1.74	1039	1039
IEEE 802.11ac VHT80	5210	0.46377	0.95652	48.49	3.14	2156	2156

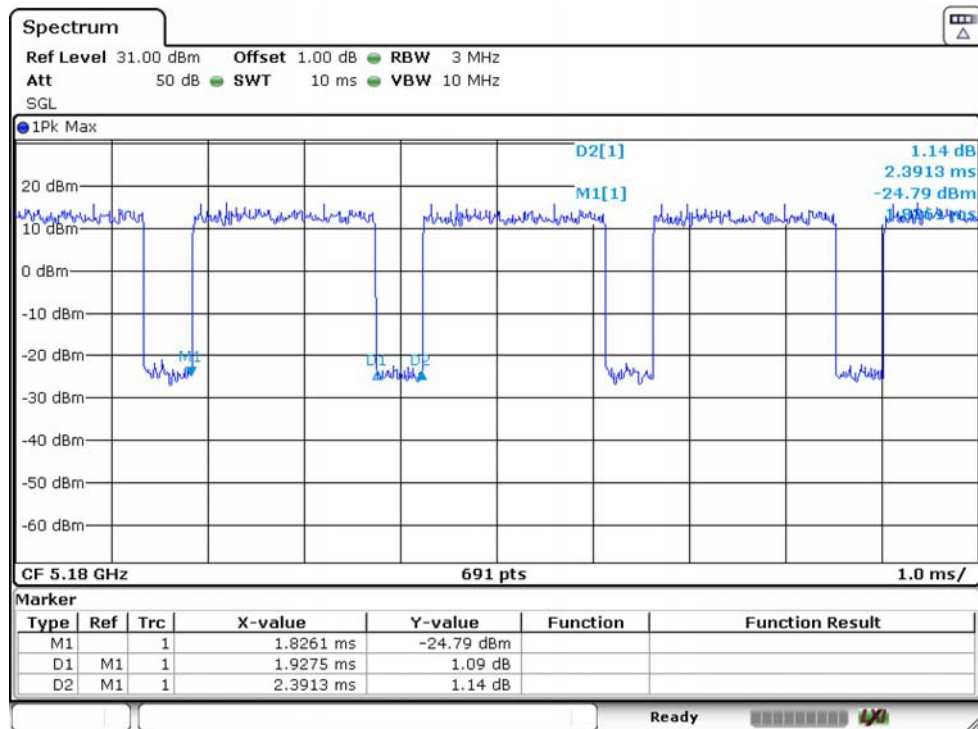
Note:

1. Duty Cycle=On Time/Total Time×100%.
2. Duty Factor= $10 \times \log(1/\text{Duty Cycle})$.
3. If duty cycle <98 %, the conducted average output power and average power spectral density should be add duty factor.
4. If duty cycle ≥ 98 %,the EUT is consider to be transmitting continuously,the conducted average output power and average power spectral density no need to add duty factor.
5. The on-time time is transmission duration(T).
6. The VBW Setting is use for RMS measurement in unwanted emissions and band edge(Above 1GHz) test.

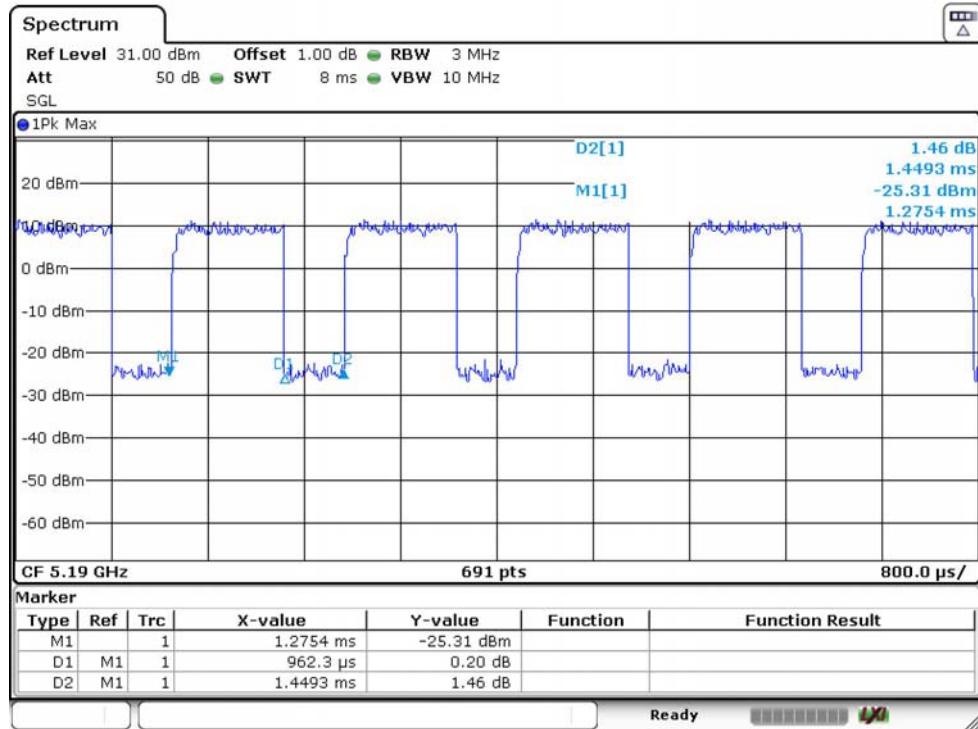
IEEE 802.11a 5180MHz



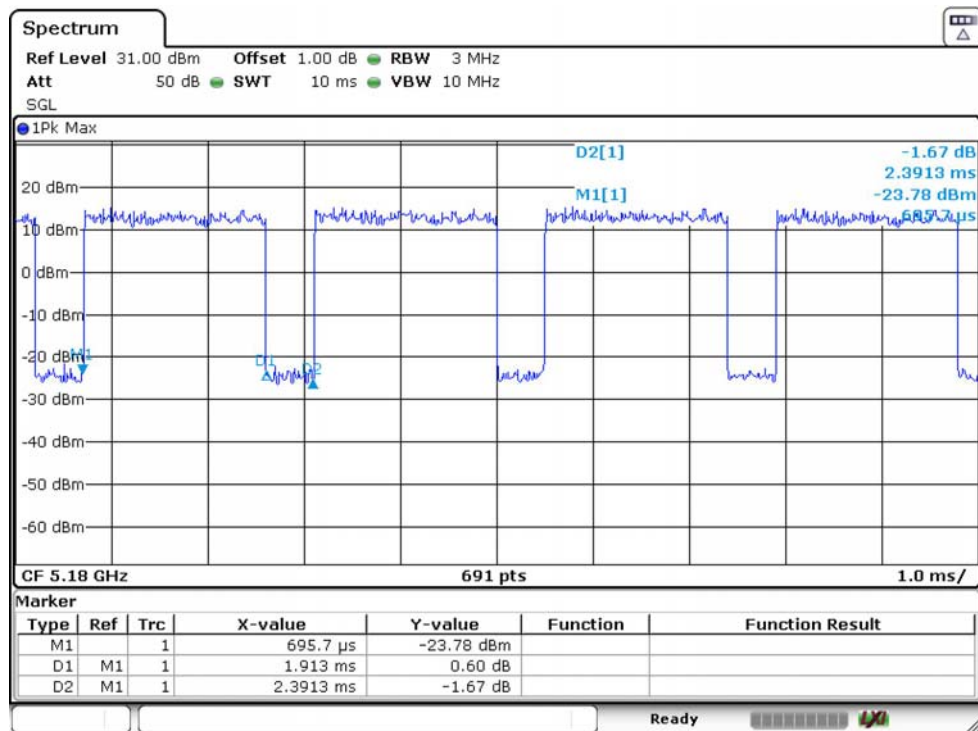
IEEE 802.11n HT20 5180MHz



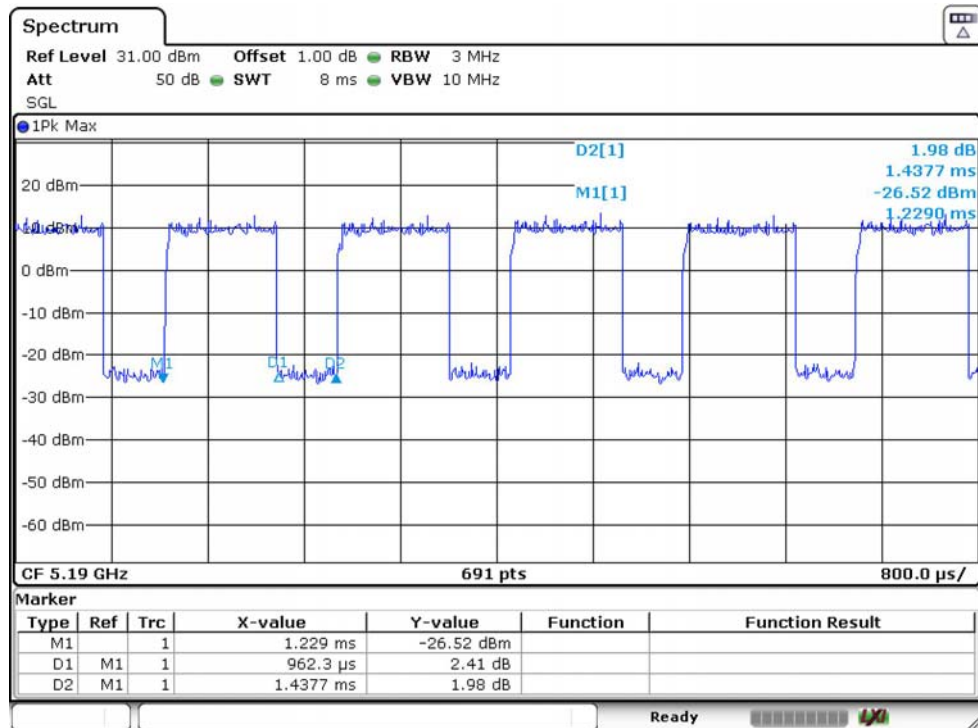
IEEE 802.11n HT40 5190MHz



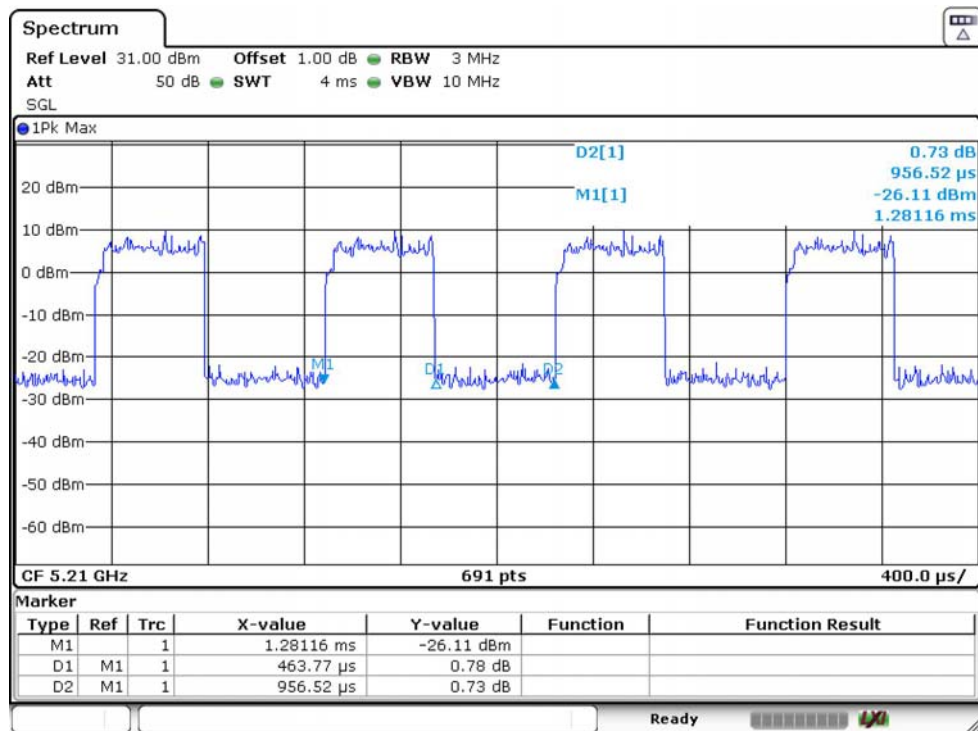
IEEE 802.11ac VHT20 5180MHz



IEEE 802.11ac VHT40 5190MHz



IEEE 802.11ac VHT80 5210MHz



2.10. Test Equipment List

For AC power conducted emissions test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESHS30	EST-E001	LISAI	June 13,21	1 Year
Artificial Mains Network	Rohde & Schwarz	ENV216	EST-E002	LISAI	June 13,21	1 Year
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	EST-E078	LISAI	June 13,21	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A

For radiated emissions test(9KHz-30MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	June 13,21	1 Year
Active Loop Antenna	SCHWARZB ECK	FMZB 1519B	EST-E054	LISAI	June 13,21	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
9kHz-30MHz Cable	N/A	EST-001	N/A	N/A	N/A	N/A

For radiated emissions test(30MHz-1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	June 13,21	1 Year
Bilog Antenna	Teseq	CBL 6111D	EST-E034	LISAI	June 13,21	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
30-1000MHz Cable	N/A	EST-002	N/A	N/A	N/A	N/A

For radiated emissions test(Above 1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Horn Antenna	SCHWARZB ECK	BBHA 9120 D	EST-E031	LISAI	June 13,21	1 Year
Signal Amplifier	SCHWARZB ECK	BBV9718	EST-E032	LISAI	June 13,21	1 Year
Spectrum Analyzer	Rohde & Schwarz	FSV40	EST-E069	LISAI	July 19,21	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
Above 1GHz Cable	N/A	EST-003	N/A	N/A	N/A	N/A

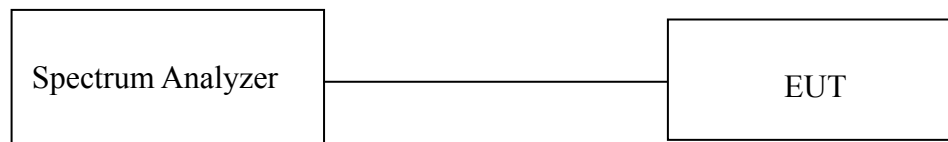
For connect EUT antenna terminal test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
TS 8997	Rohde & Schwarz	/	/	/	/	/
Open Switch and Control Unit	Rohde & Schwarz	OSP-B157WB	EST-E036	LISAI	June 13,21	1 Year
Signal and Spectrum Analyzer	Rohde & Schwarz	FSV	EST-E037	LISAI	June 13,21	1 Year
Signal Generator	Rohde & Schwarz	SMB100A	EST-E038	LISAI	June 13,21	1 Year
Vector Signal Generator	Rohde & Schwarz	SMBV100A	EST-E039	LISAI	June 13,21	1 Year
Test Software	Rohde & Schwarz	WMS32	V10.50.00	N/A	N/A	N/A
Temperature controller	Terchy	MHQ	EST-E101	LISAI	June 13,21	1 Year

3. 6dB BANDWIDTH & 26dB BANDWIDTH & 99% OCCUPIED BANDWIDTH

3.1. Limit

Band	Frequency (MHz)	Test Item	Limit
U-NII-1	5150-5250	26dB Bandwidth&99% Occupied Bandwidth	N/A
U-NII-2A	5250-5350	26dB Bandwidth&99% Occupied Bandwidth	N/A
U-NII-2C	5470-5725	26dB Bandwidth&99% Occupied Bandwidth	N/A
U-NII-3	5725-5850	6dB Bandwidth&99% Occupied Bandwidth	6dB Bandwidth $\geq$ 500KHz

3.2. Test Setup



3.3. Spectrum Analyzer Setting

6dB Bandwidth	
Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	40MHz(20MHz Bandwidth mode) 60MHz(40MHz Bandwidth mode) 120MHz(80MHz Bandwidth mode)
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

26dB Bandwidth	
Spectrum Parameters	Setting
RBW	approximately 1% of the emission bandwidth
VBW	> RBW
Span	40MHz(20MHz Bandwidth mode) 60MHz(40MHz Bandwidth mode) 120MHz(80MHz Bandwidth mode)
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

99% Occupied Bandwidth	
Spectrum Parameters	Setting
RBW	1% to 5% of the OBW
VBW	approximately three times the RBW
Span	between 1.5 times and 5.0 times the OBW
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

3.4. Test Procedure

For 26dB Bandwidth Measurement :

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 3.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the instrument. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
- Repeat above procedures until all modes and channels were measured.
- Record the results in the test report.

For 6dB Bandwidth Measurement :

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 3.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
- Repeat above procedures until all modes and channels were measured.
- Record the results in the test report.

For 99% Occupied Bandwidth Measurement :

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 3.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, use the 99% power bandwidth function to measure bandwidth.
- Repeat above procedures until all modes and channels were measured.
- Record the results in the test report.

3.5. Test Result

Temperature	24.1℃	Relative Humidity			55%	Test Voltage	AC 120V/60Hz	
26dB Bandwidth&99% Occupied Bandwidth								
AND	Test Mode	Fre (MHz)	26dB Bandwidth (MHz)		99% Occupied Bandwidth (MHz)		Calcul ate Power Limit (W)	Calculate Power Limit (dBm)
			Ant 1	Ant 2	Ant 1	Ant 2		
U-NII-1	IEEE 802.11a	5180	18.408	18.524	16.498	16.440		
		5200	18.408	18.466	16.498	16.440		
		5240	18.408	18.408	16.498	16.382		
	IEEE 802.11n HT20	5180	19.624	19.682	17.598	17.598		
		5200	19.566	19.740	17.540	17.540		
		5240	19.682	19.624	17.598	17.656		
	IEEE 802.11ac VHT20	5180	19.855	19.624	17.598	17.540		
		5200	19.797	19.624	17.540	17.540		
		5240	19.797	19.624	17.598	17.598		
	IEEE 802.11n HT40	5190	42.030	41.450	36.816	36.932		
		5230	42.490	42.370	36.932	36.816		
	IEEE 802.11ac VHT40	5190	41.910	41.450	36.469	36.353		
		5230	41.100	40.980	36.469	36.122		
	IEEE 802.11ac VHT80	5210	81.100	81.100	74.501	74.501		

Temperature	24.1℃	Relative Humidity			55%	Test Voltage	AC 120V/60Hz	
6dB Bandwidth&99% Occupied Bandwidth								
BAND	Test Mode	Fre (MHz)	6dB Bandwidth (MHz)		99% Occupied Bandwidth (MHz)		6dB BW Min Limit (MHz)	Result
			Ant 1	Ant 2	Ant 1	Ant 2		
U-NII-3	IEEE 802.11a	5745	16.357	16.405	16.498	16.440	0.5	PASS
		5785	16.357	16.397	16.785	16.382	0.5	PASS
		5825	167.349	16.397	16.497	16.440	0.5	PASS
	IEEE 802.11n HT20	5745	17.525	17.509	17.540	17.540	0.5	PASS
		5785	17.541	17.501	17.540	17.540	0.5	PASS
		5825	17.541	17.525	17.540	17.540	0.5	PASS
	IEEE 802.11ac VHT20	5745	17.525	17.525	17.598	17.540	0.5	PASS
		5785	17.525	17.525	17.540	17.540	0.5	PASS
		5825	17.533	17.525	17.540	17.540	0.5	PASS
	IEEE 802.11n HT40	5755	35.113	35.143	36.585	36.469	0.5	PASS
		5795	35.103	35.123	36.237	36.469	0.5	PASS
	IEEE 802.11ac VHT40	5755	35.443	35.113	36.498	36.440	0.5	PASS
		5795	35.443	35.103	36.498	36.440	0.5	PASS
	IEEE 802.11ac VHT80	5775	75.025	74.945	74.501	74.848	0.5	PASS

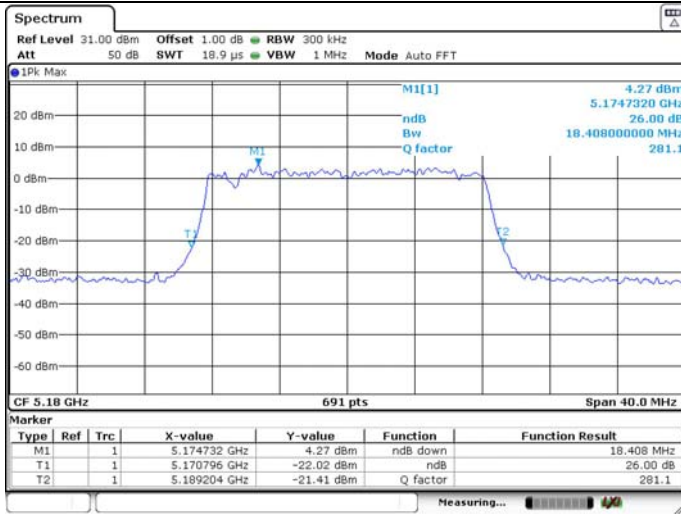
Note :

For Band U-NII-2A and U-NII-2C, the maximum conducted output power limit is 250mw or $11+10 \times \log B$, which is lesser, where B is the 26dB Bandwidth in MHz. So in this section, the maximum conducted output power limit can calculate with 26dB Bandwidth.

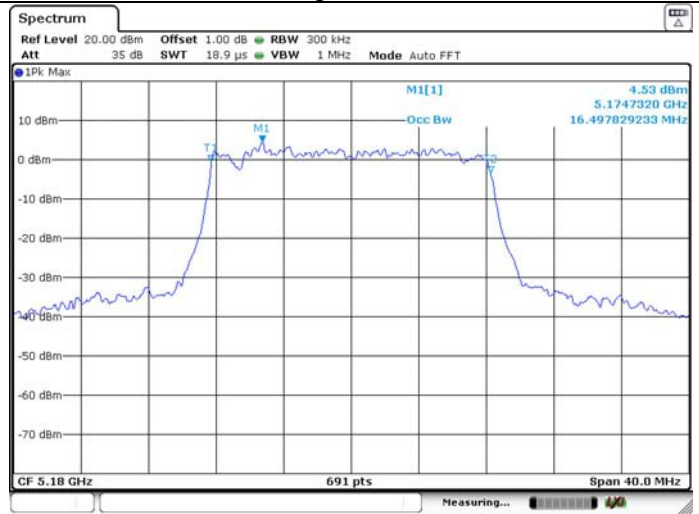
3.6. Test Result

U-NII-1 IEEE 802.11a 5180MHz_Ant 1

26dB Bandwidth

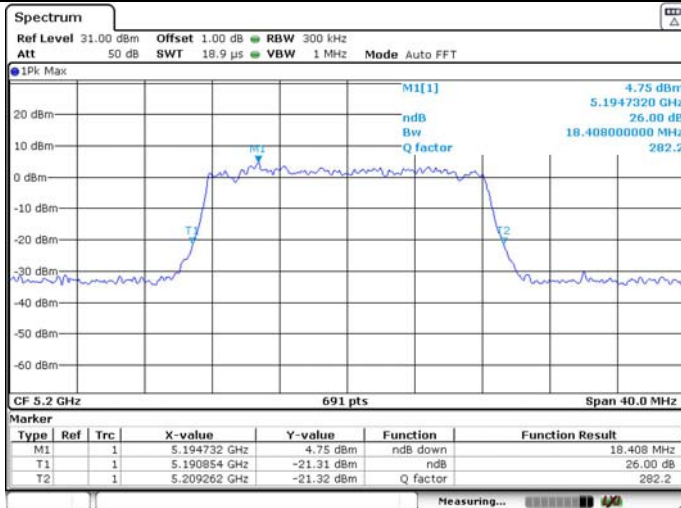


99% Occupied Bandwidth

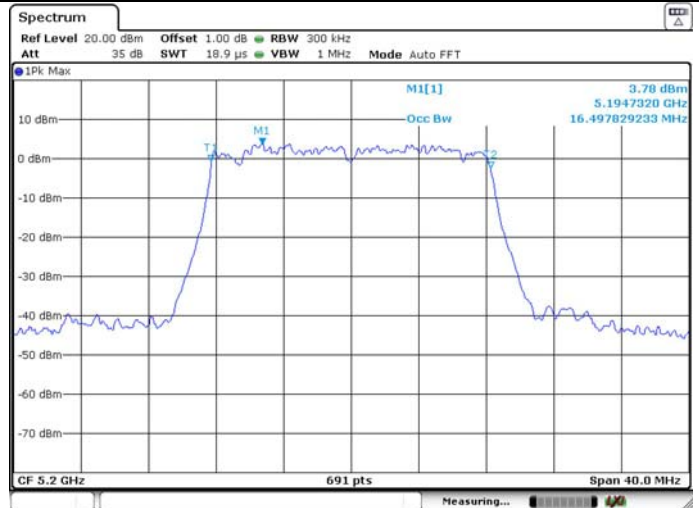


U-NII-1 IEEE 802.11a 5200MHz_Ant 1

26dB Bandwidth

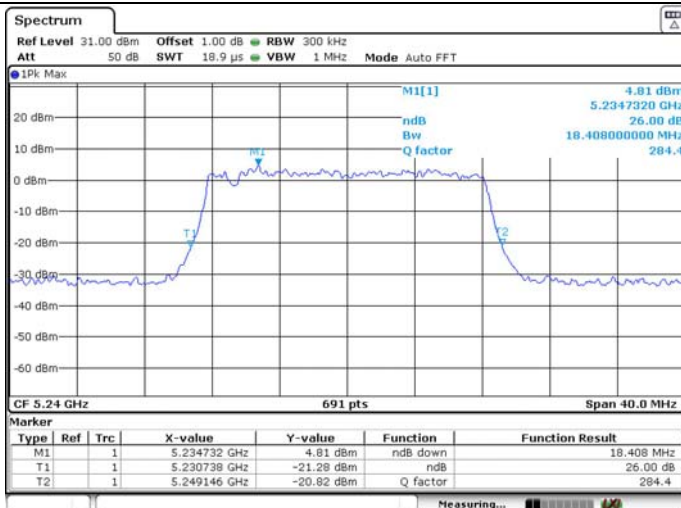


99% Occupied Bandwidth

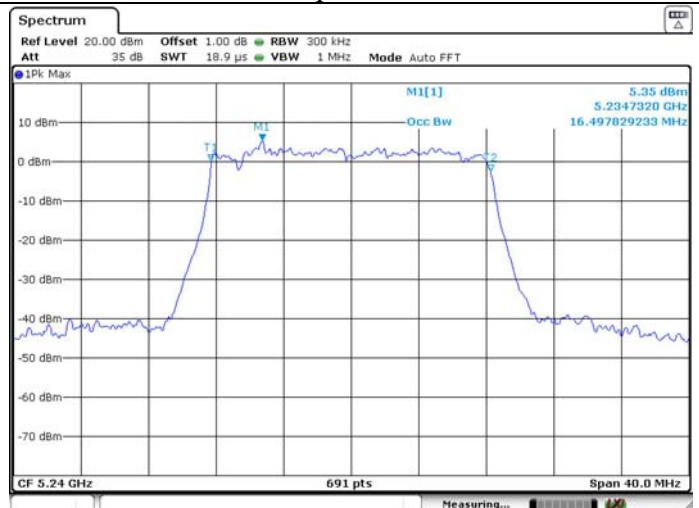


U-NII-1 IEEE 802.11a 5240MHz_Ant 1

26dB Bandwidth

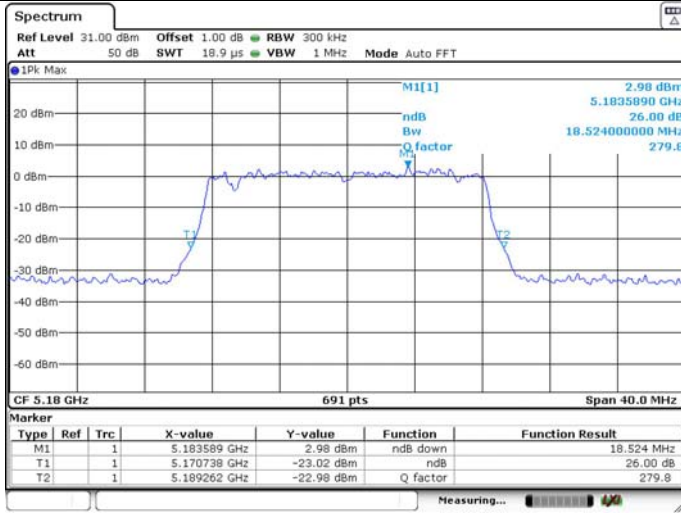


99% Occupied Bandwidth

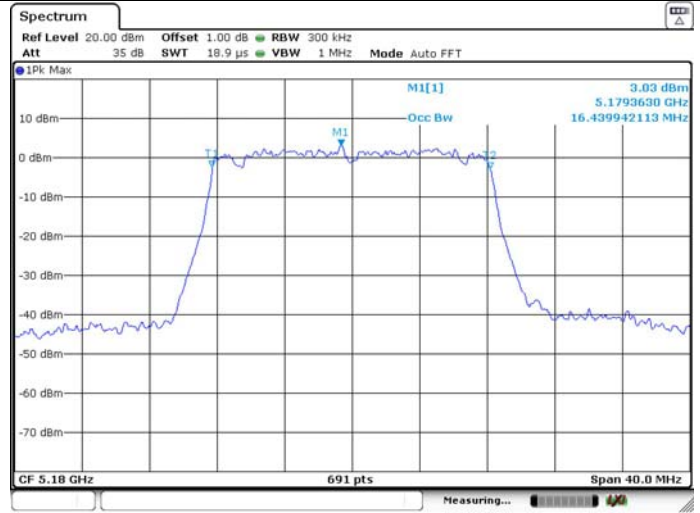


U-NII-1 IEEE 802.11a 5180MHz_Ant 2

26dB Bandwidth

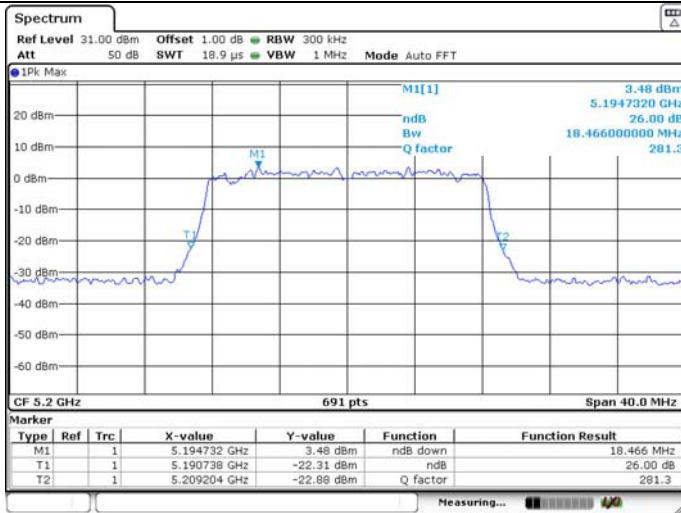


99% Occupied Bandwidth

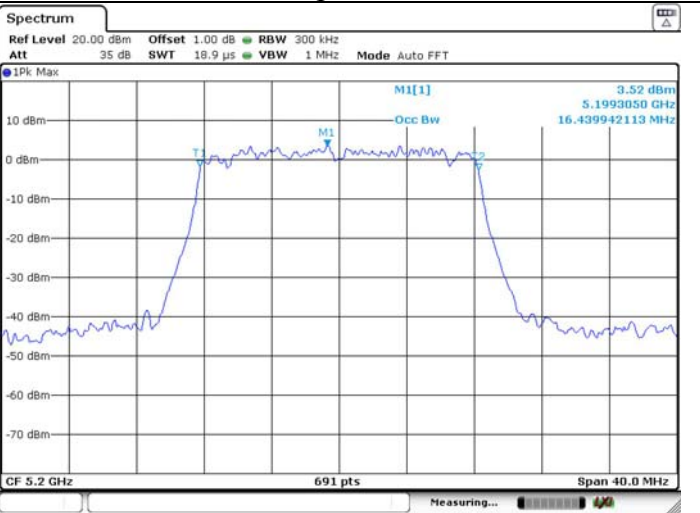


U-NII-1 IEEE 802.11a 5200MHz_Ant 2

26dB Bandwidth

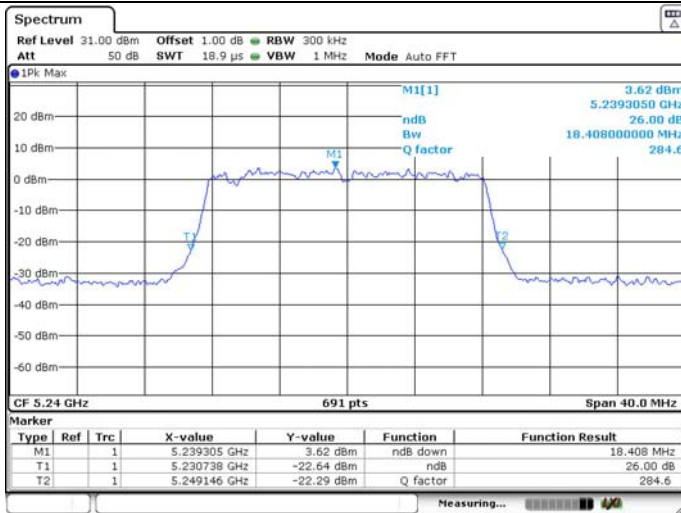


99% Occupied Bandwidth

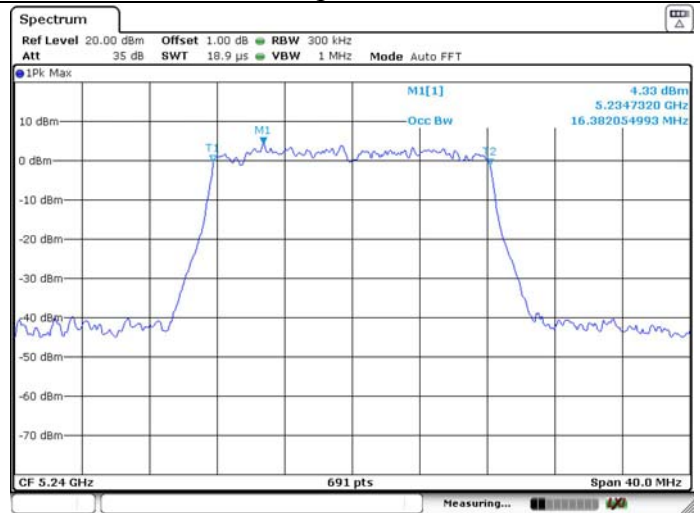


U-NII-1 IEEE 802.11a 5240MHz_Ant 2

26dB Bandwidth

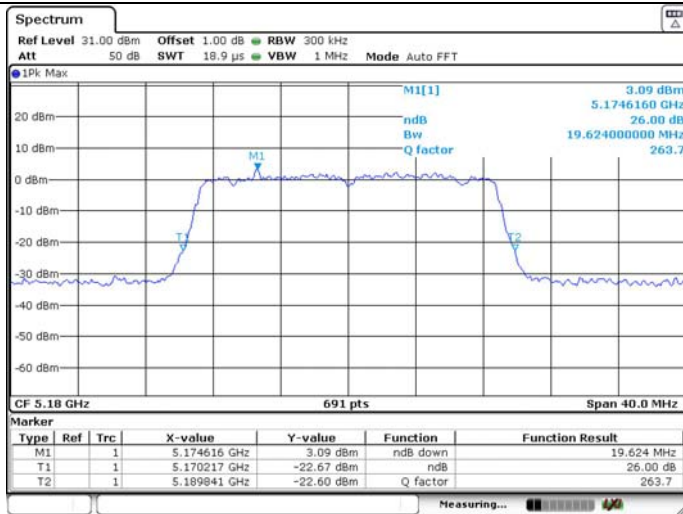


99% Occupied Bandwidth

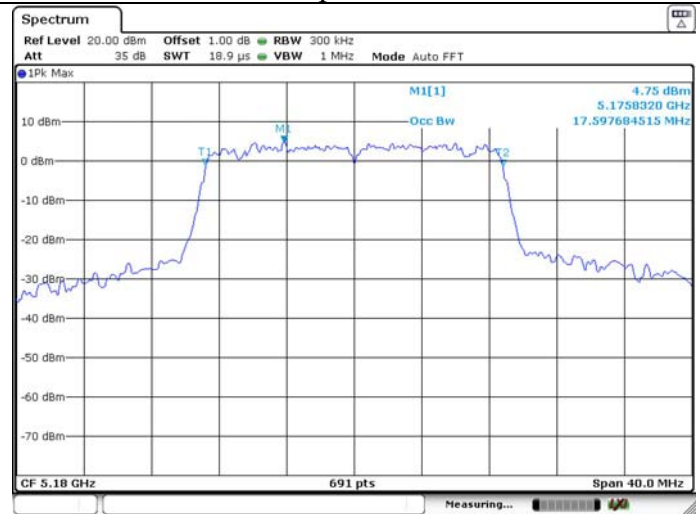


U-NII-1 IEEE 802.11n HT20 5180MHz_Ant 1

26dB Bandwidth

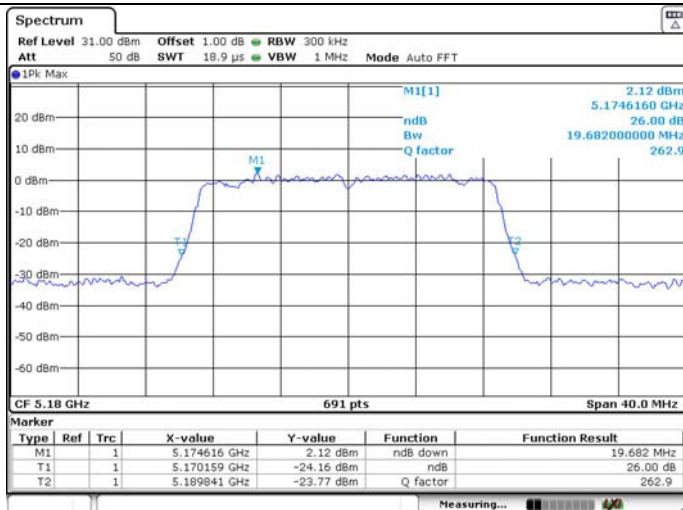


99% Occupied Bandwidth



U-NII-1 IEEE 802.11n HT20 5180MHz_Ant 2

26dB Bandwidth

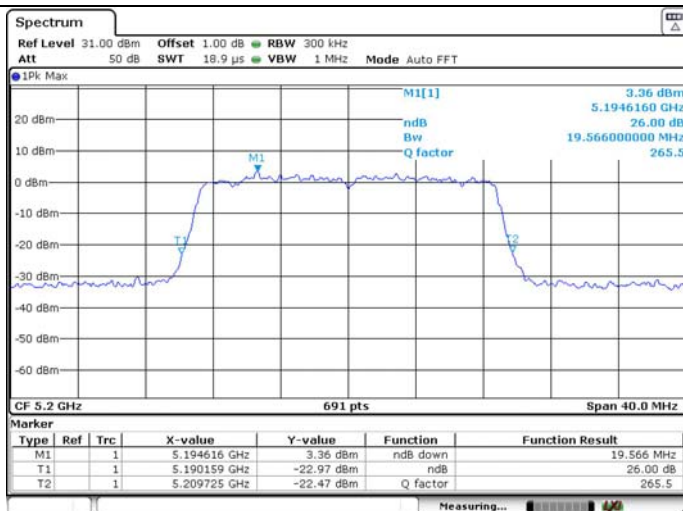


99% Occupied Bandwidth

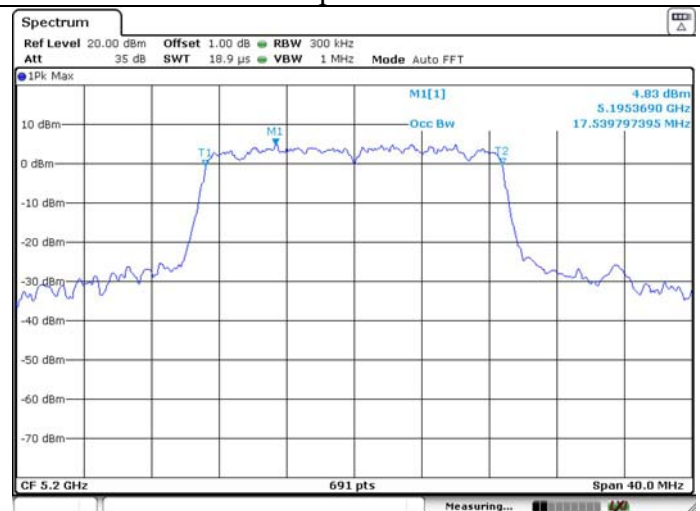


U-NII-1 IEEE 802.11n HT20 5200MHz_Ant 1

26dB Bandwidth

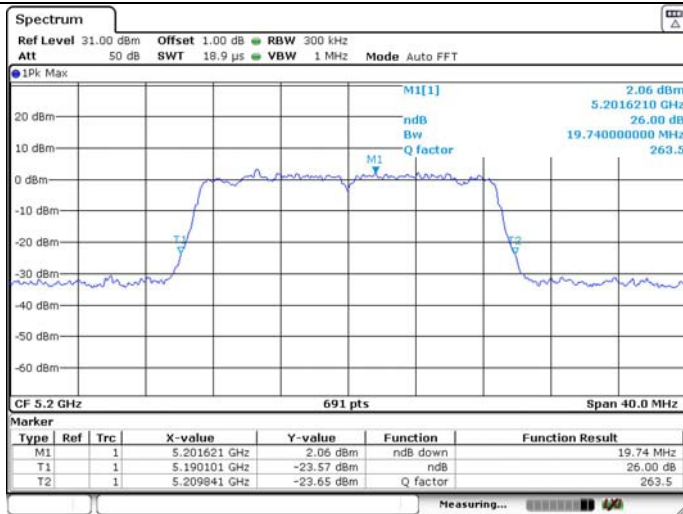


99% Occupied Bandwidth



U-NII-1 IEEE 802.11n HT20 5200MHz_Ant 2

26dB Bandwidth

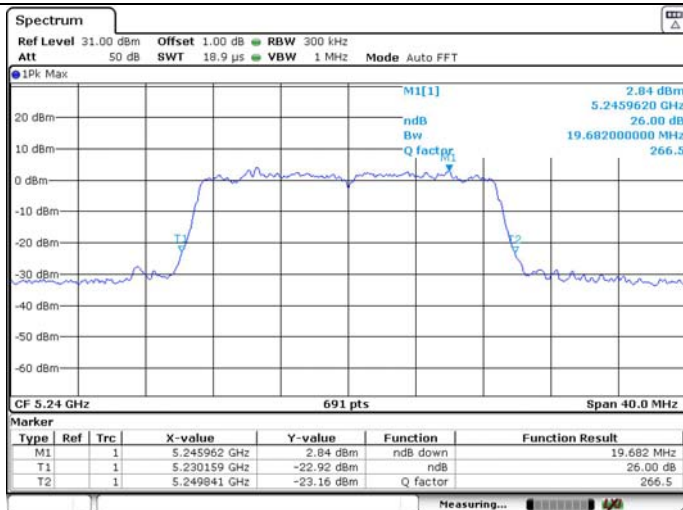


99% Occupied Bandwidth

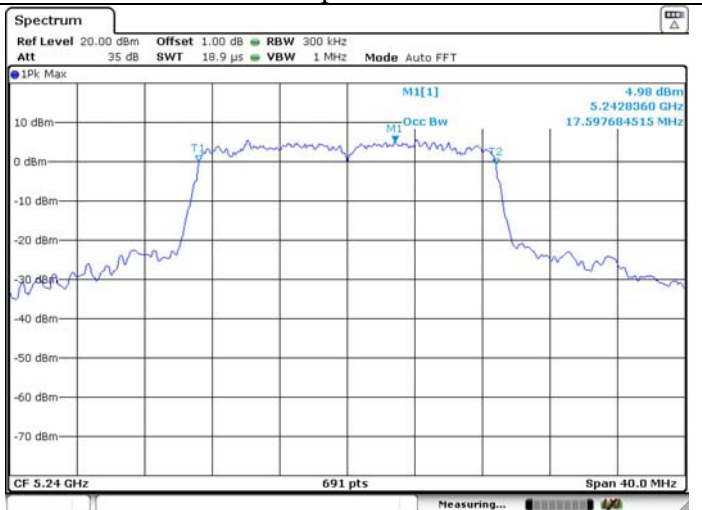


U-NII-1 IEEE 802.11n HT20 5240MHz_Ant 1

26dB Bandwidth

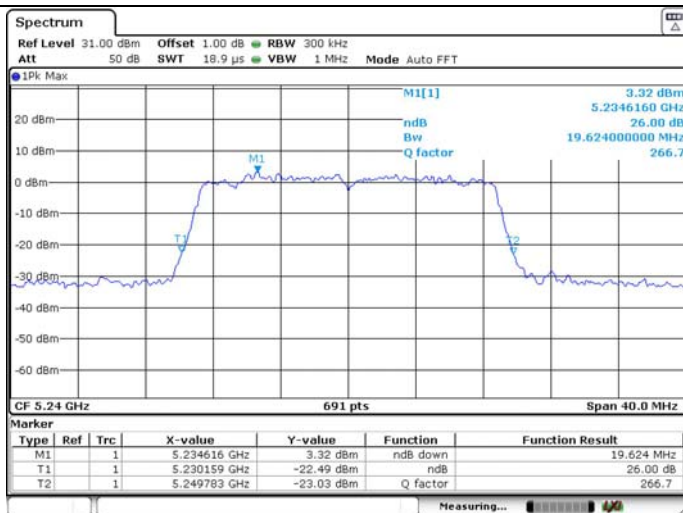


99% Occupied Bandwidth



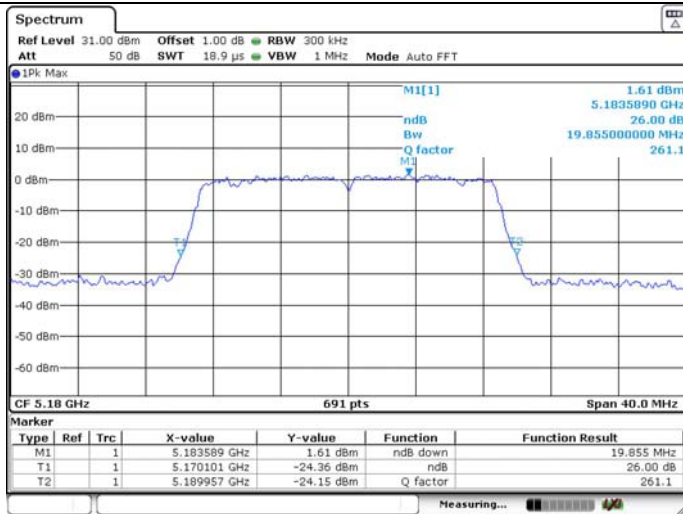
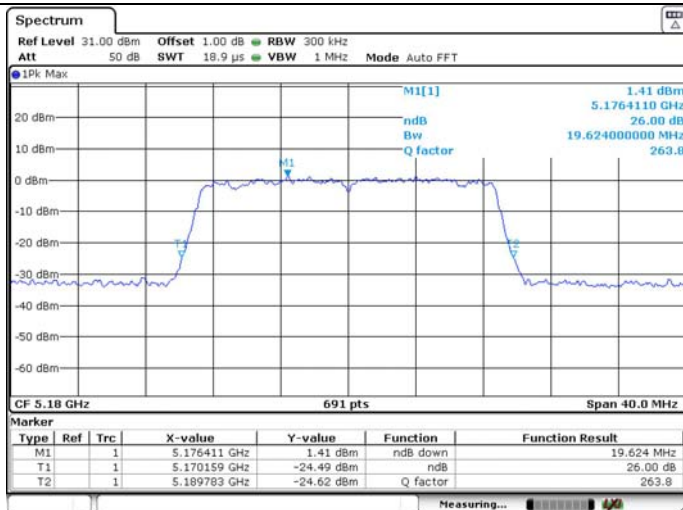
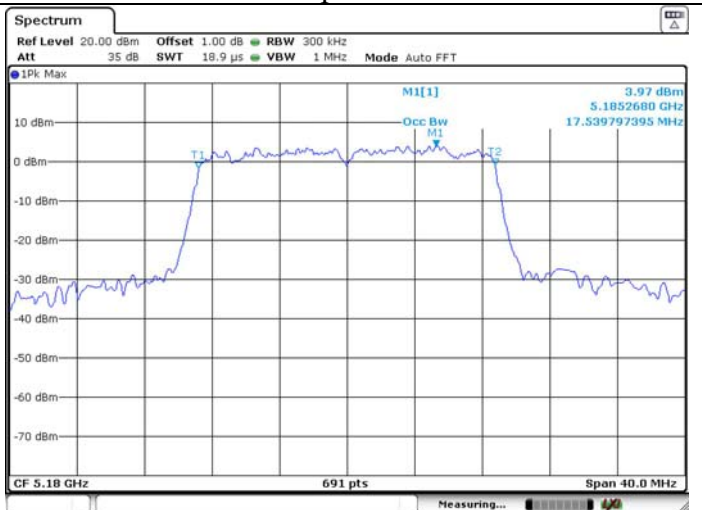
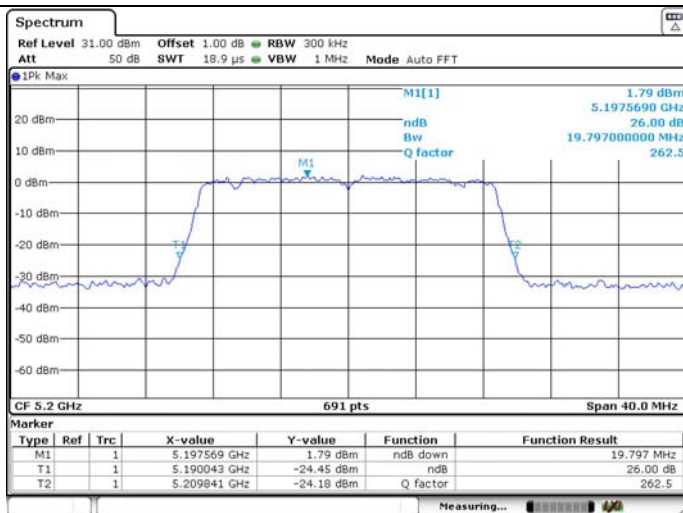
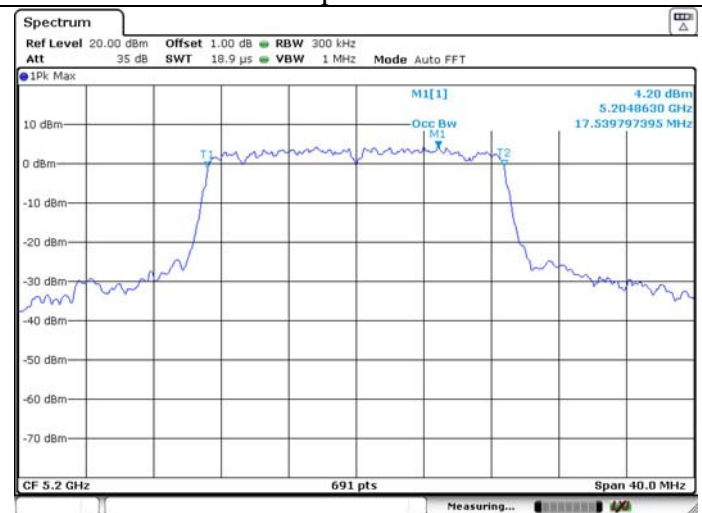
U-NII-1 IEEE 802.11n HT20 5240MHz_Ant 2

26dB Bandwidth



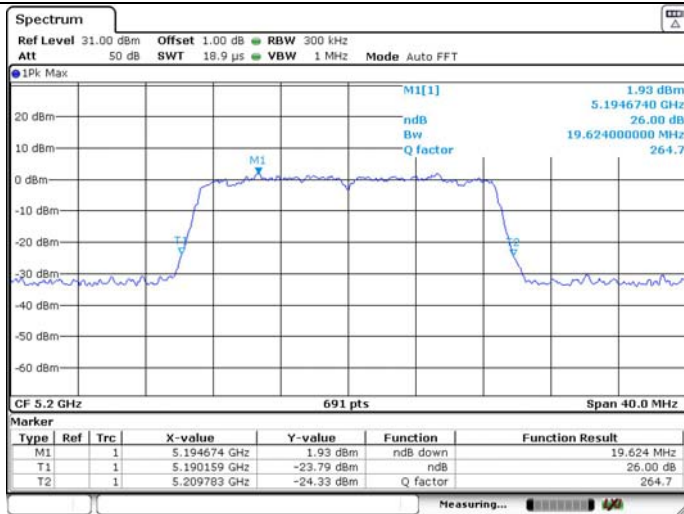
99% Occupied Bandwidth



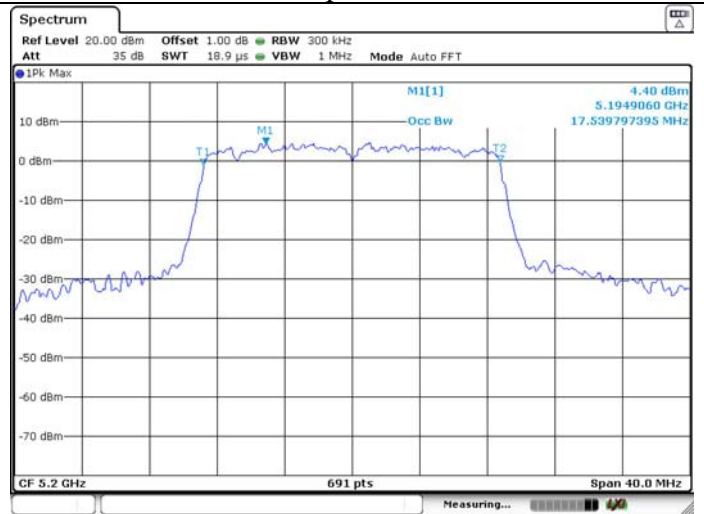
U-NII-1 IEEE 802.11ac VHT20 5180MHz_Ant 1**26dB Bandwidth****99% Occupied Bandwidth****U-NII-1 IEEE 802.11ac VHT20 5180MHz_Ant 2****26dB Bandwidth****99% Occupied Bandwidth****U-NII-1 IEEE 802.11ac VHT20 5200MHz_Ant 1****26dB Bandwidth****99% Occupied Bandwidth**

U-NII-1 IEEE 802.11ac VHT20 5200MHz_Ant 2

26dB Bandwidth

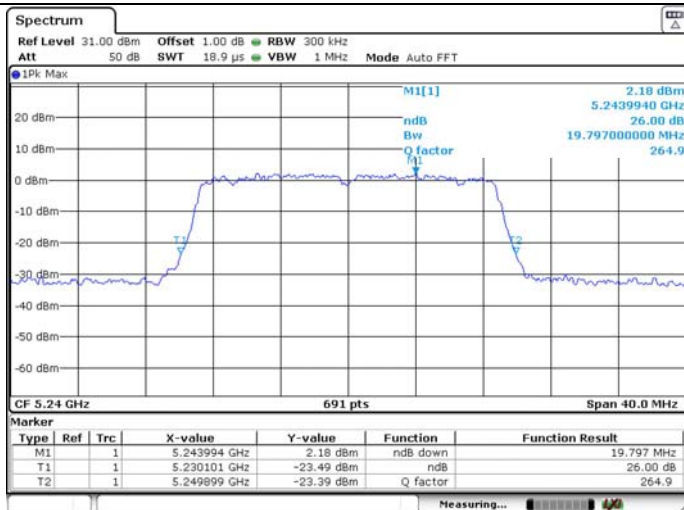


99% Occupied Bandwidth



U-NII-1 IEEE 802.11ac VHT20 5240MHz_Ant 1

26dB Bandwidth

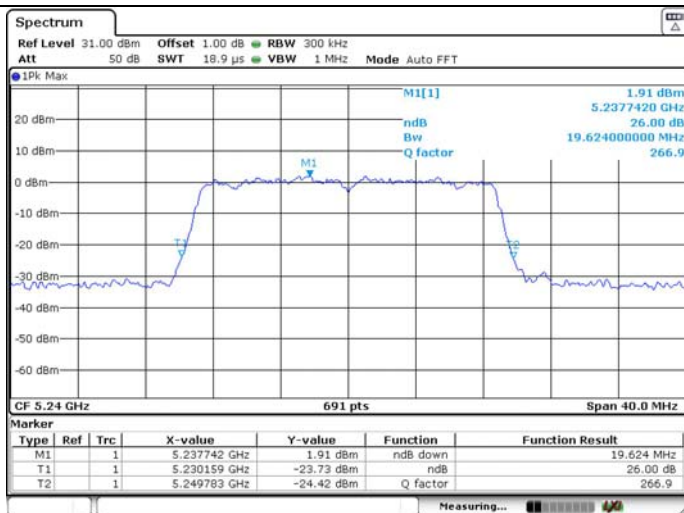


99% Occupied Bandwidth

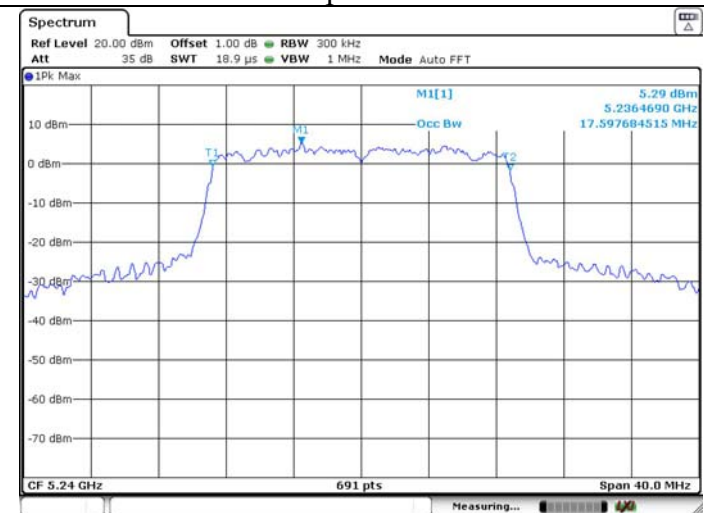


U-NII-1 IEEE 802.11ac VHT20 5240MHz_Ant 2

26dB Bandwidth

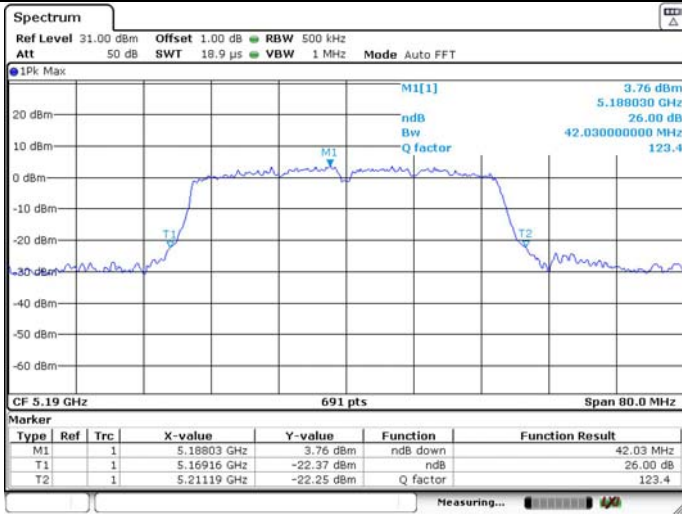


99% Occupied Bandwidth



U-NII-1 IEEE 802.11n HT40 5190MHz_Ant 1

26dB Bandwidth

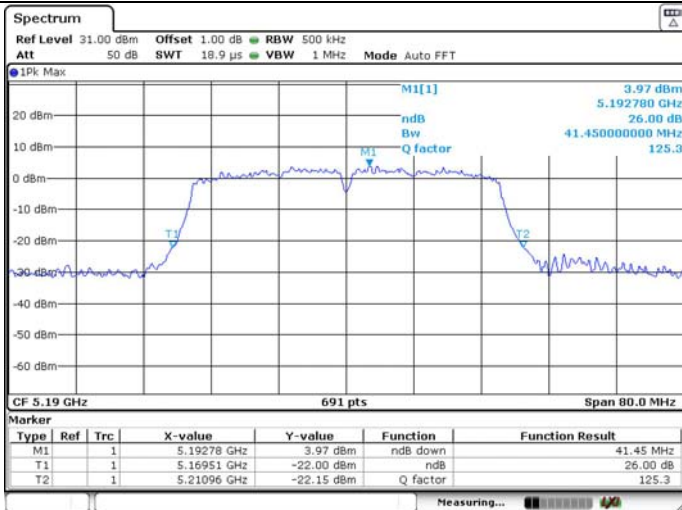


99% Occupied Bandwidth



U-NII-1 IEEE 802.11n HT40 5190MHz_Ant 2

26dB Bandwidth

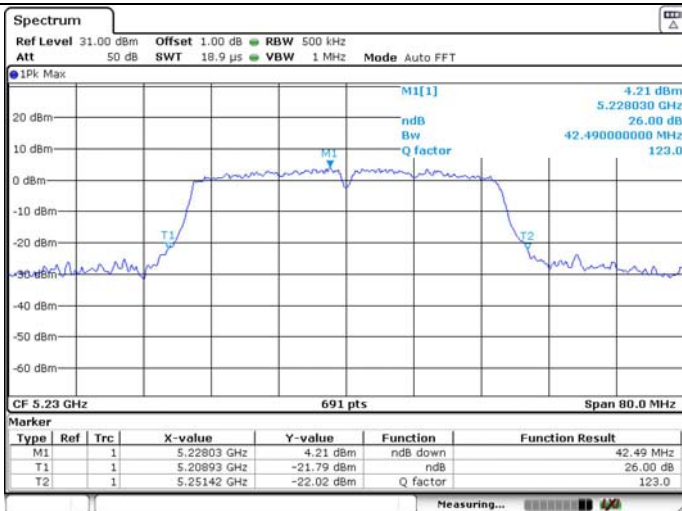


99% Occupied Bandwidth



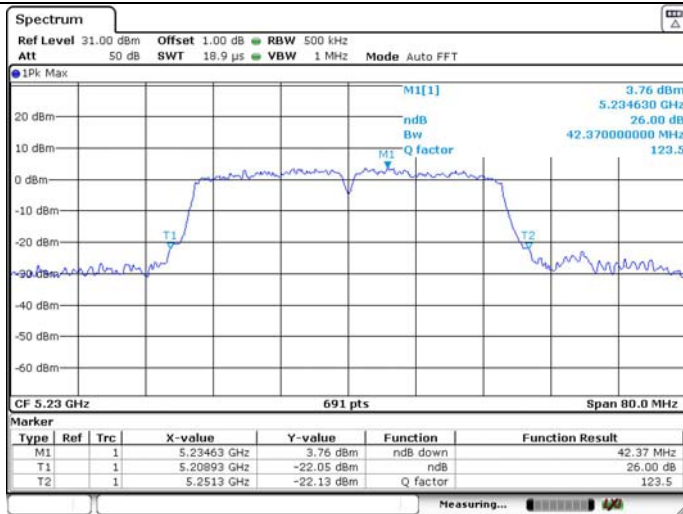
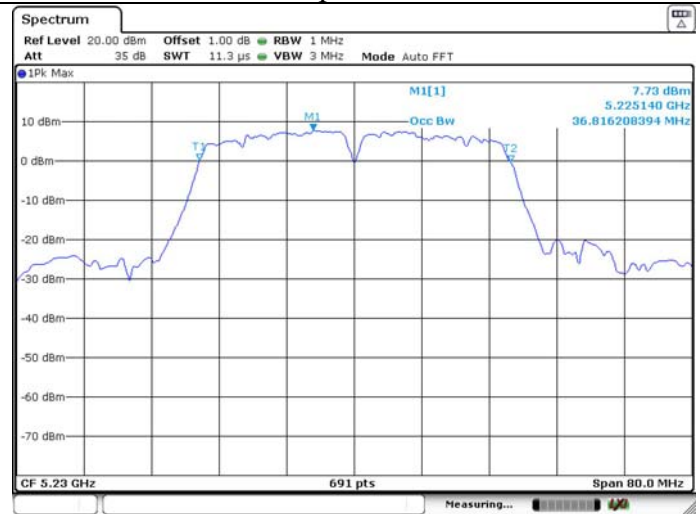
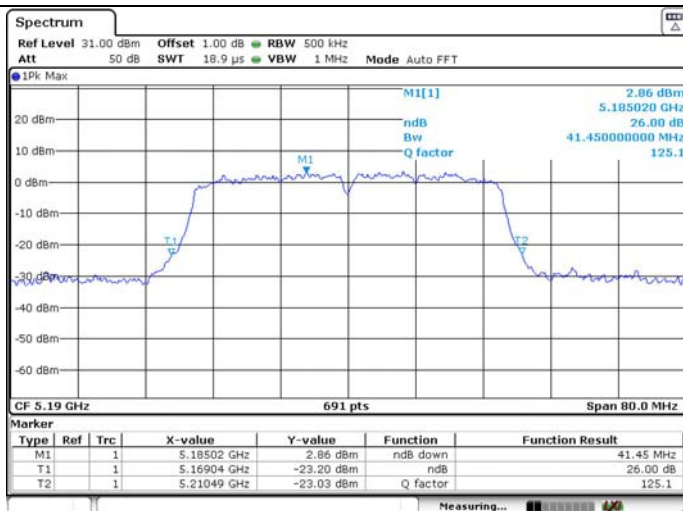
U-NII-1 IEEE 802.11n HT40 5230MHz_Ant 1

26dB Bandwidth



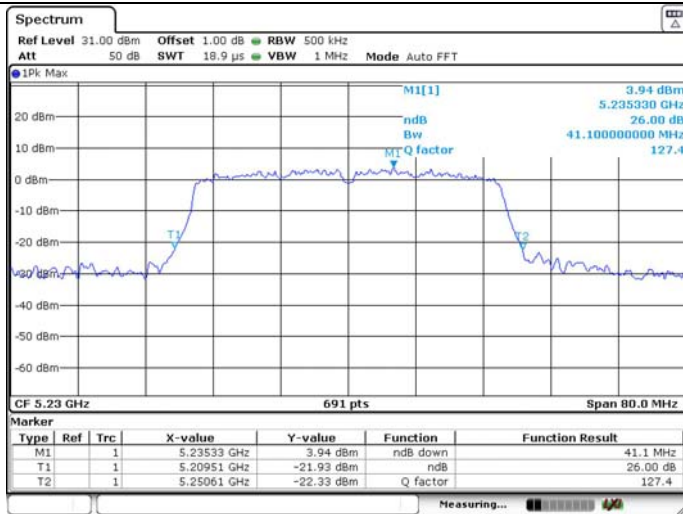
99% Occupied Bandwidth



U-NII-1 IEEE 802.11n HT40 5230MHz_Ant 2**26dB Bandwidth****99% Occupied Bandwidth****U-NII-1 IEEE 802.11ac VHT40 5190MHz_Ant 1****26dB Bandwidth****99% Occupied Bandwidth****U-NII-1 IEEE 802.11ac VHT40 5190MHz_Ant 2****26dB Bandwidth****99% Occupied Bandwidth**

U-NII-1 IEEE 802.11ac VHT40 5230MHz_Ant 1

26dB Bandwidth



99% Occupied Bandwidth

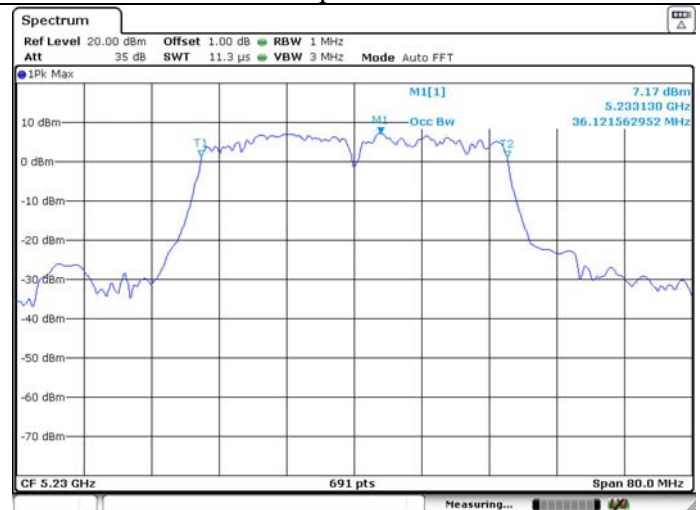


U-NII-1 IEEE 802.11ac VHT40 5230MHz_Ant 2

26dB Bandwidth

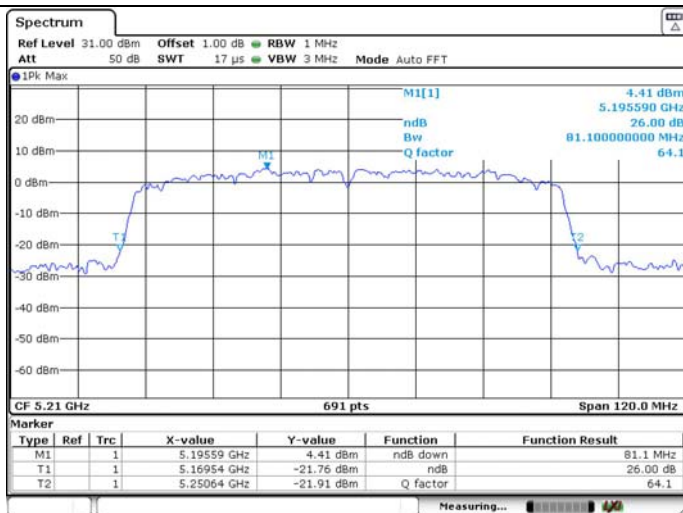


99% Occupied Bandwidth

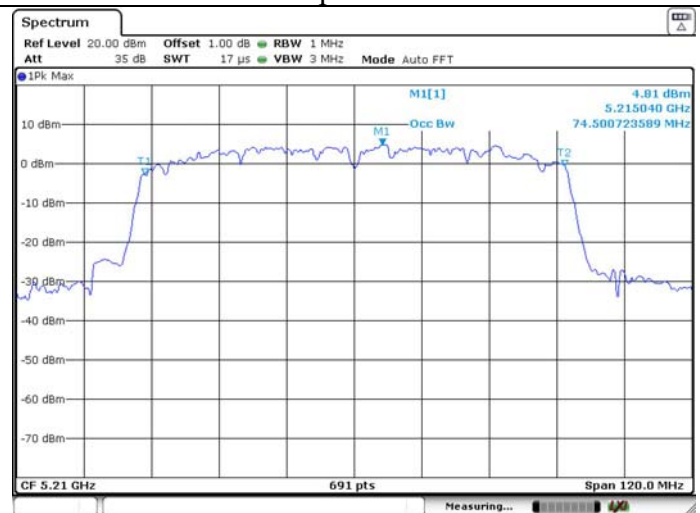


U-NII-1 IEEE 802.11ac VHT80 5210MHz_Ant 1

26dB Bandwidth



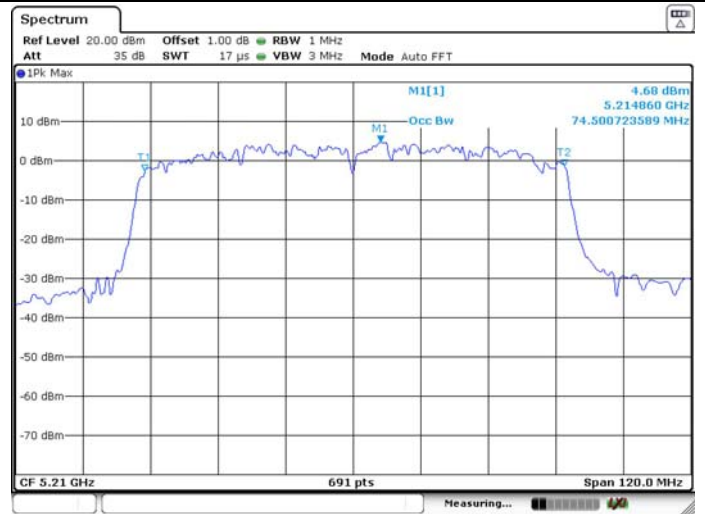
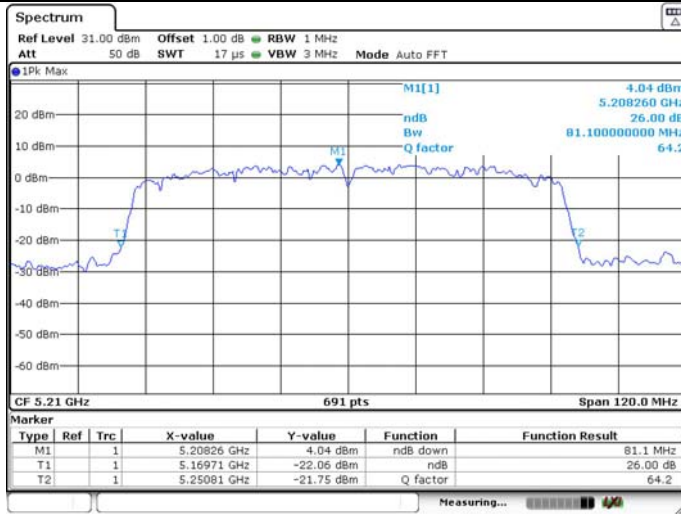
99% Occupied Bandwidth

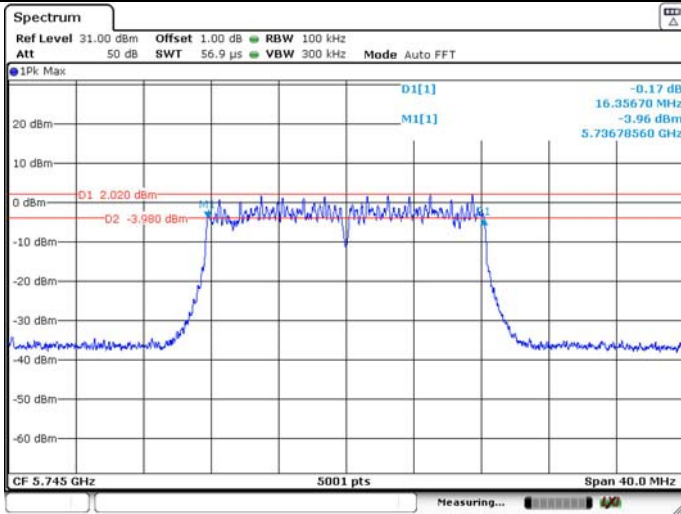
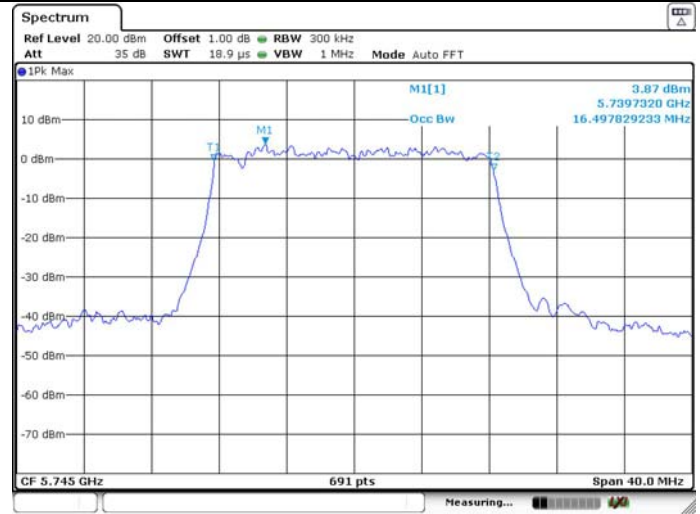
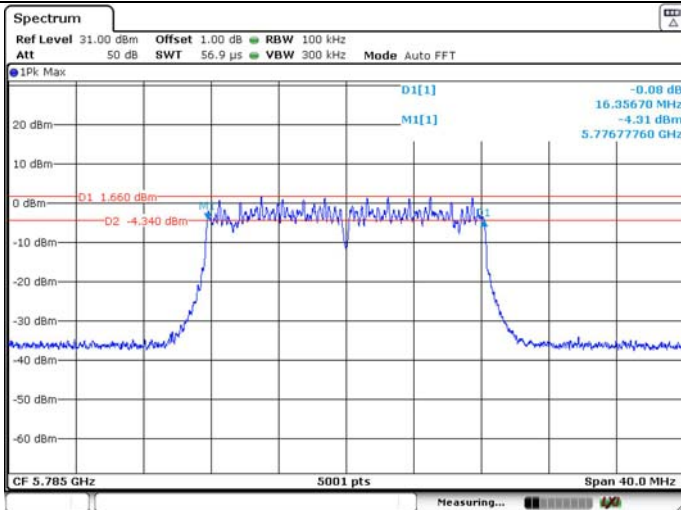
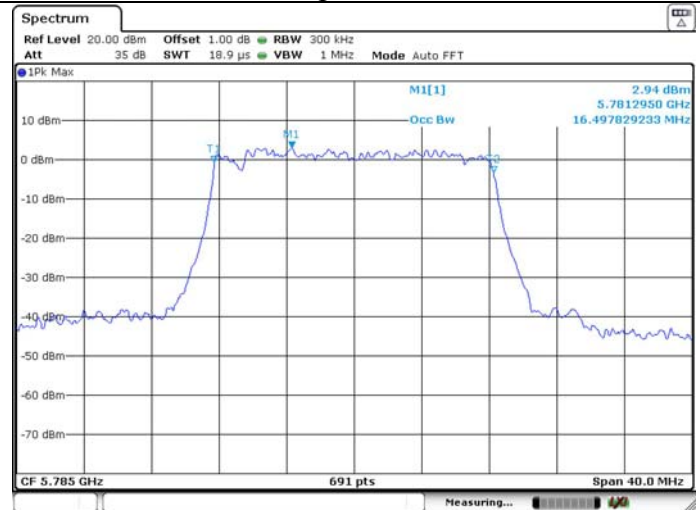
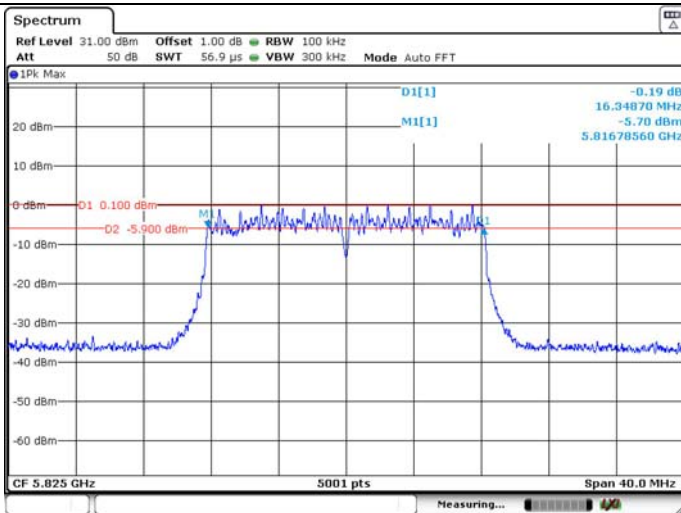
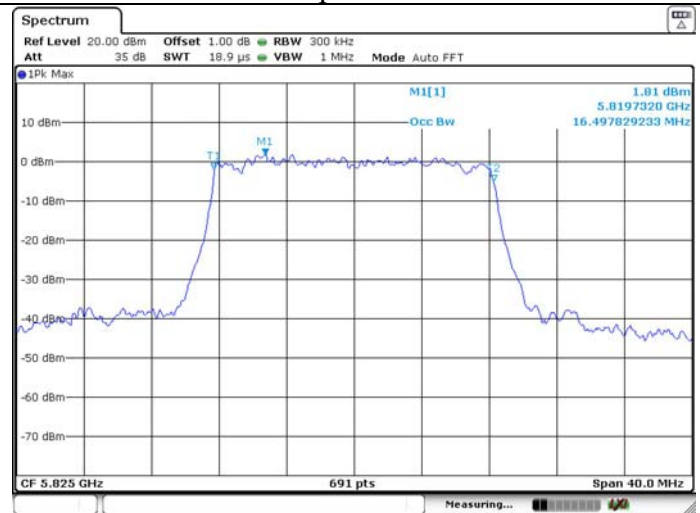


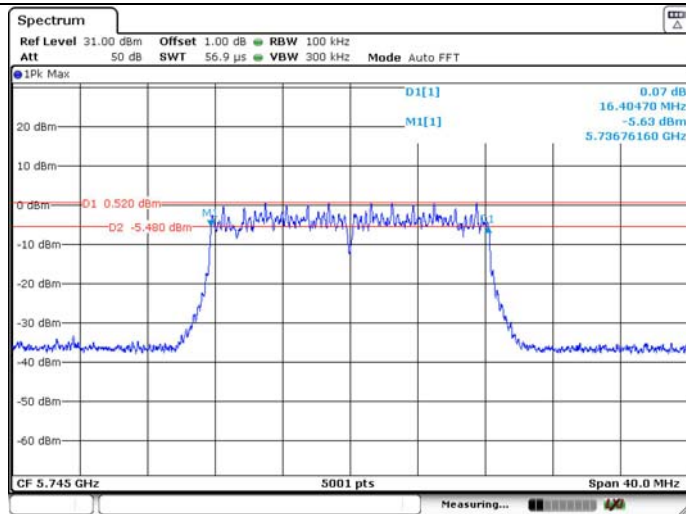
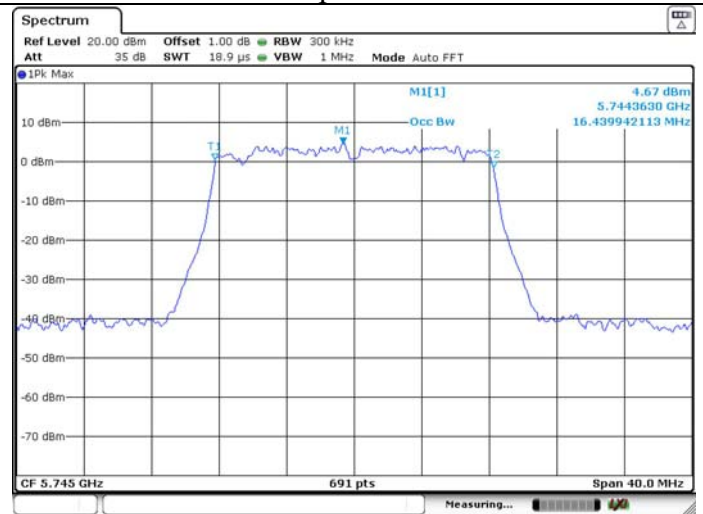
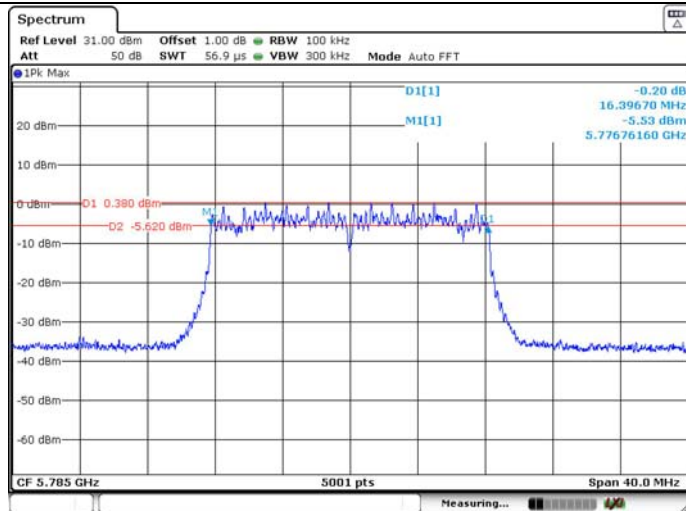
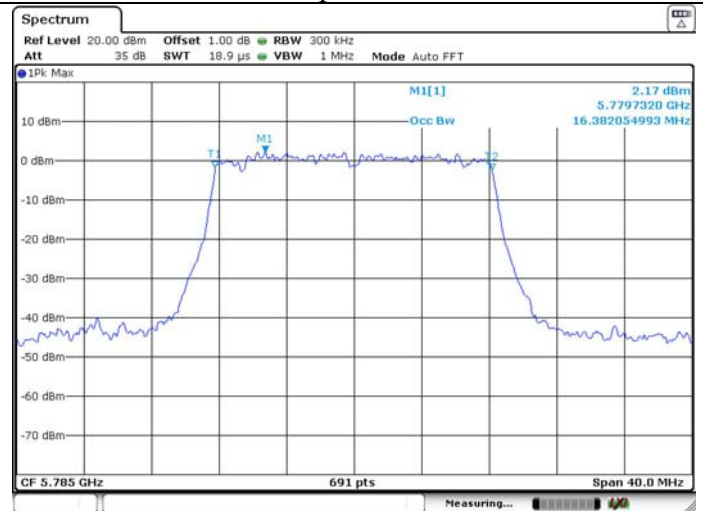
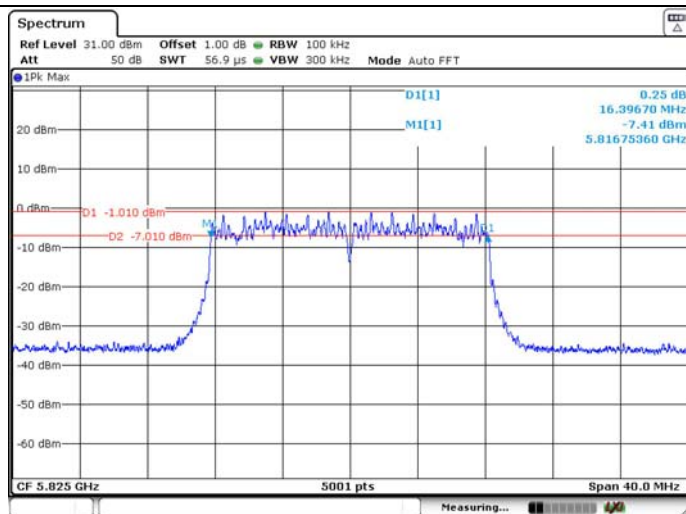
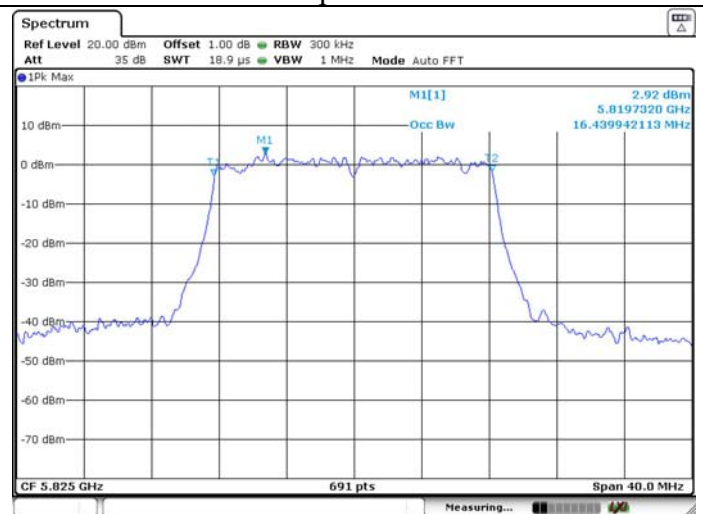
U-NII-1 IEEE 802.11ac VHT80 5210MHz_Ant 2

26dB Bandwidth

99% Occupied Bandwidth

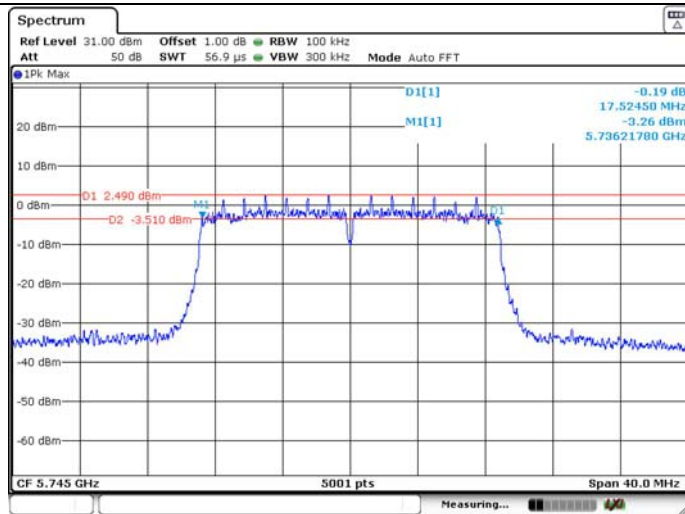


U-NII-3 IEEE 802.11a 5745MHz_Ant 1**6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11a 5785MHz_Ant 1****6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11a 5825MHz_Ant 1****6dB Bandwidth****99% Occupied Bandwidth**

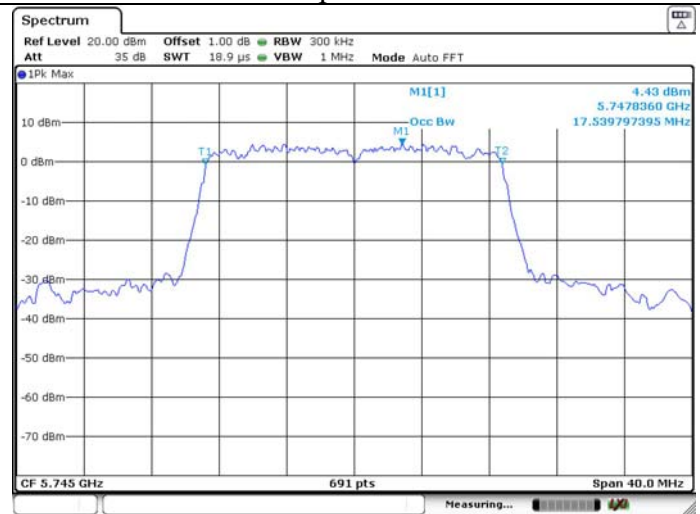
U-NII-3 IEEE 802.11a 5745MHz_Ant 2**6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11a 5785MHz_Ant 2****6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11a 5825MHz_Ant 2****6dB Bandwidth****99% Occupied Bandwidth**

U-NII-3 IEEE 802.11n HT20 5745MHz_Ant 1

6dB Bandwidth

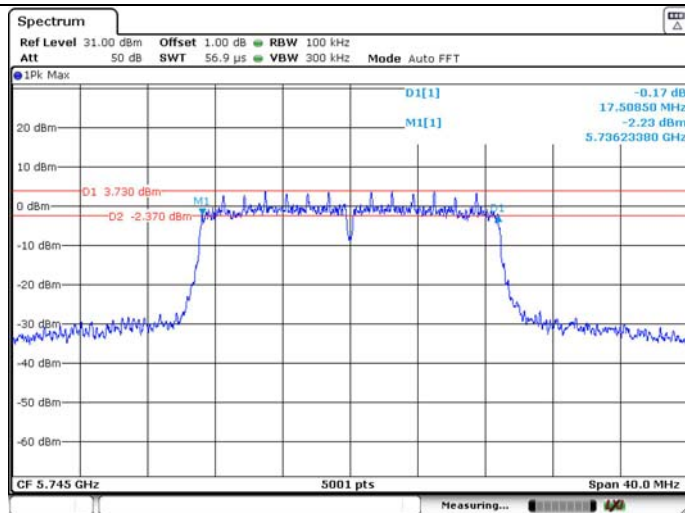


99% Occupied Bandwidth

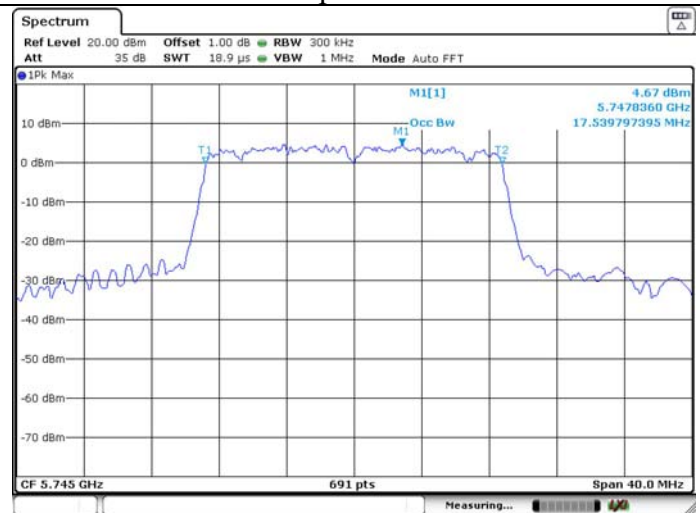


U-NII-3 IEEE 802.11n HT20 5745MHz_Ant 2

6dB Bandwidth

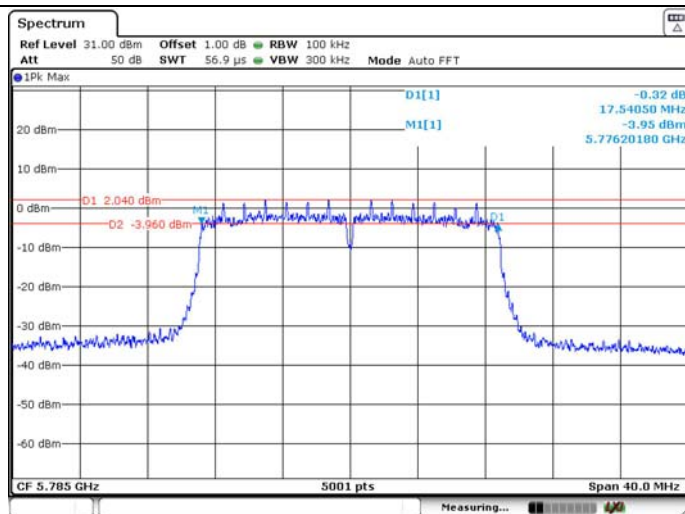


99% Occupied Bandwidth

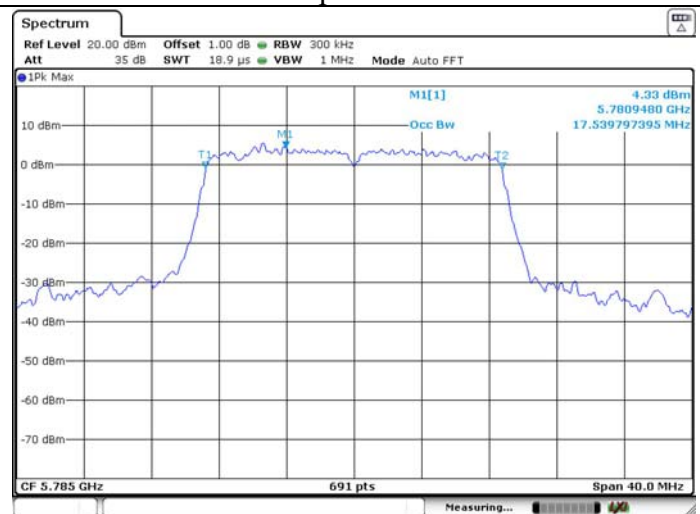


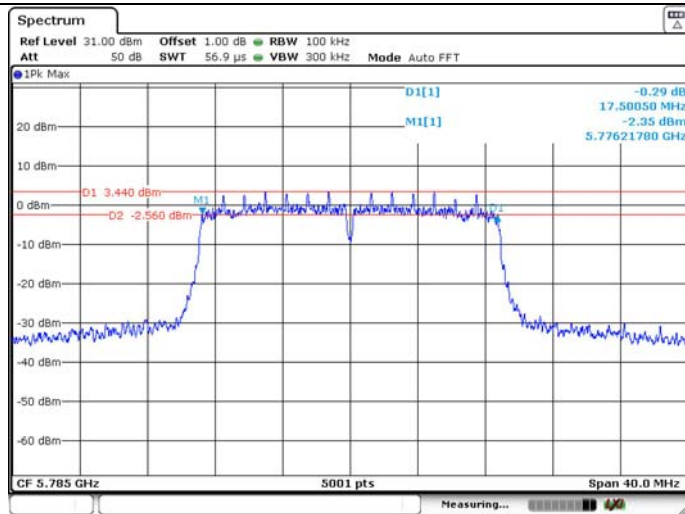
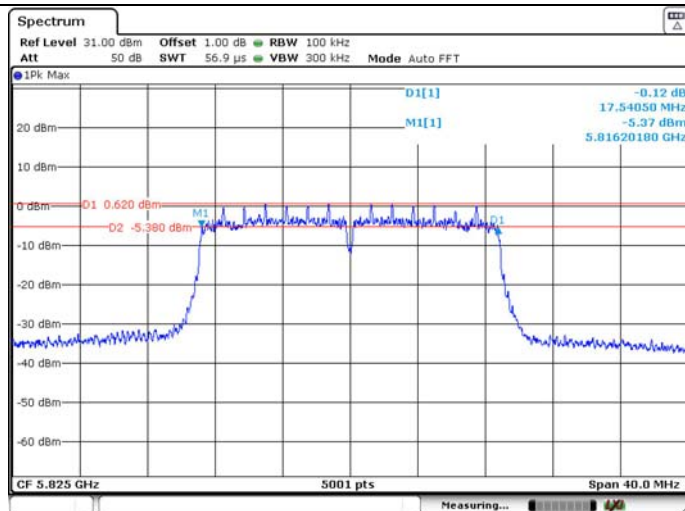
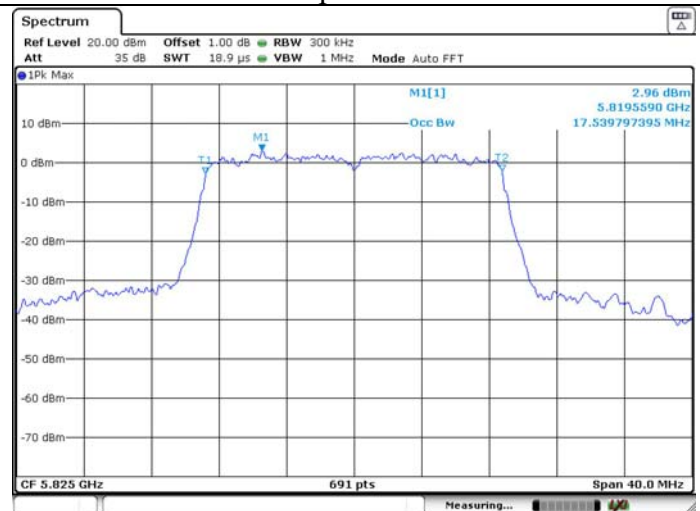
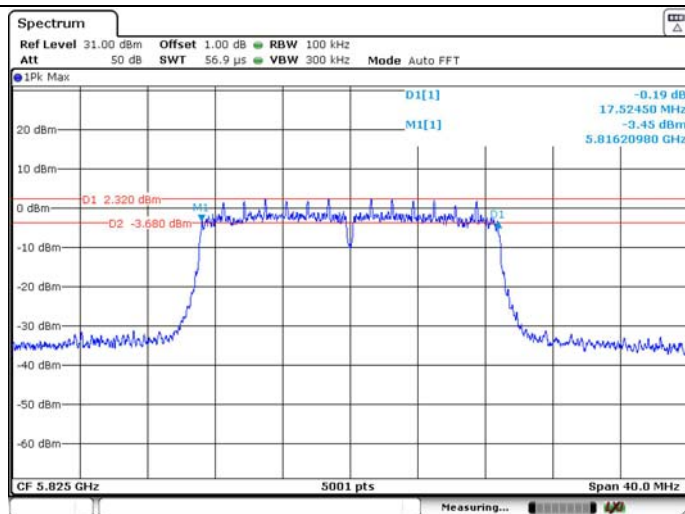
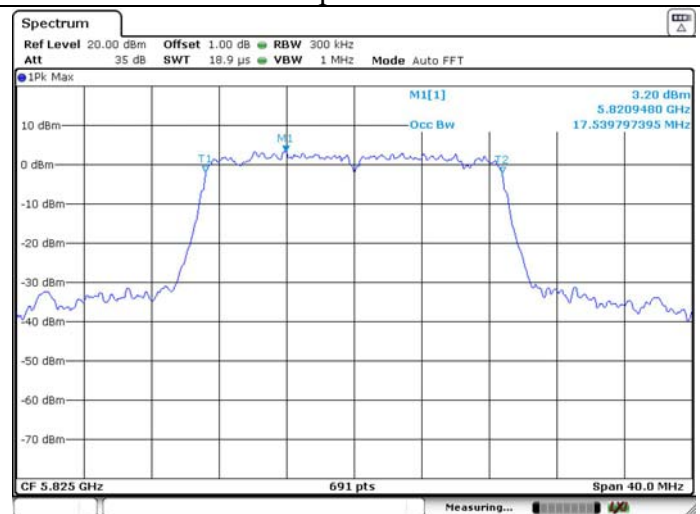
U-NII-3 IEEE 802.11n HT20 5785MHz_Ant 1

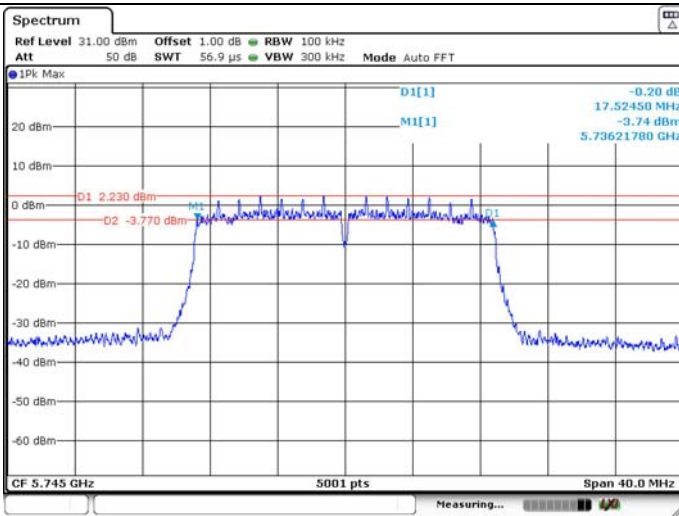
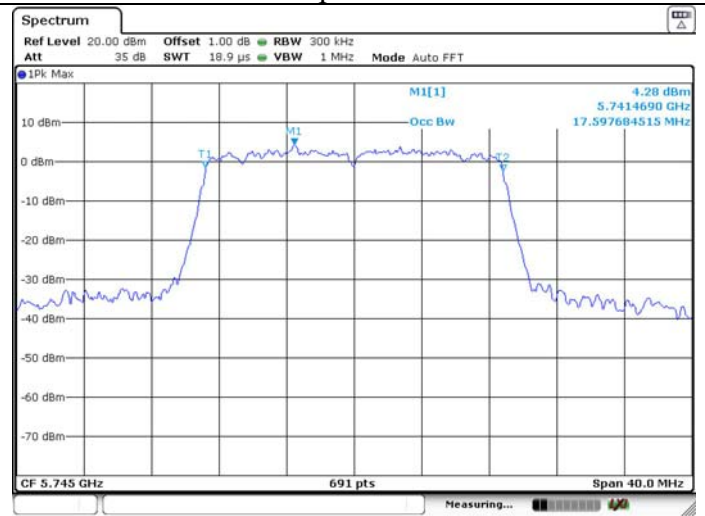
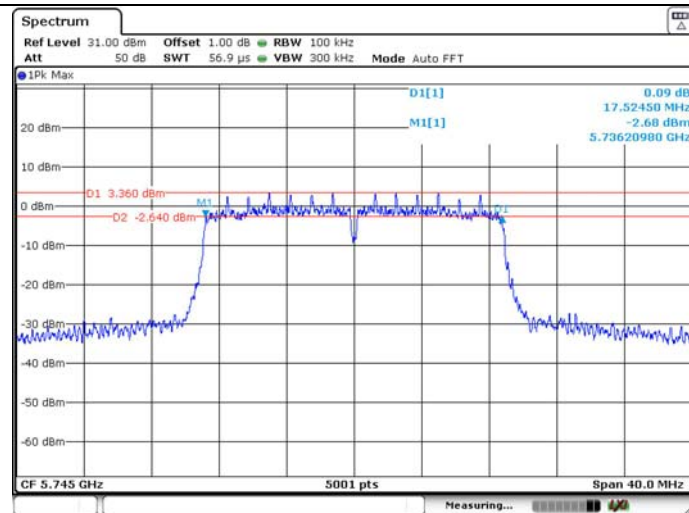
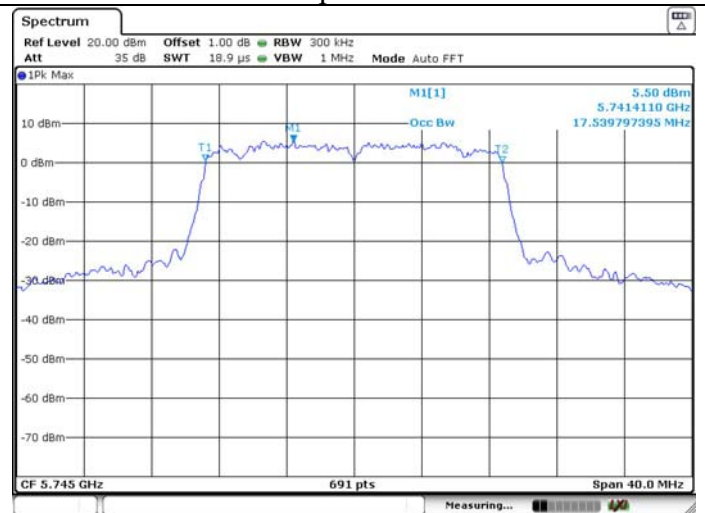
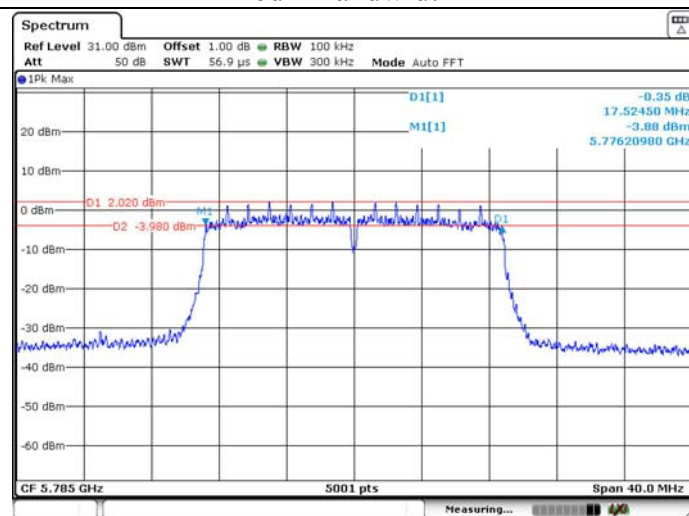
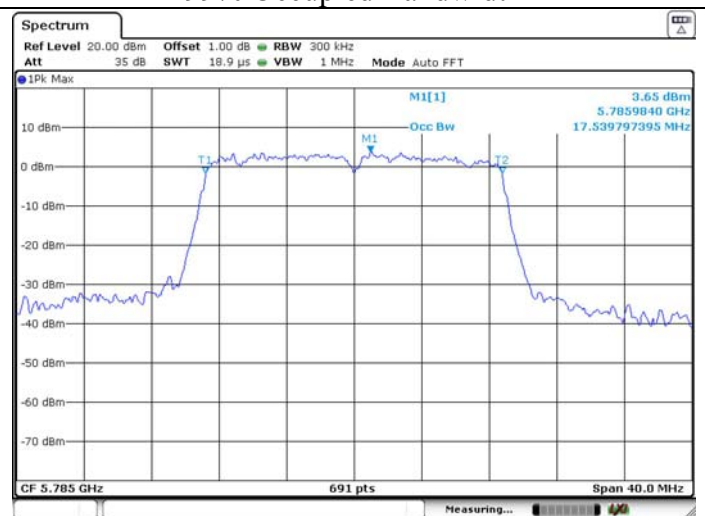
6dB Bandwidth

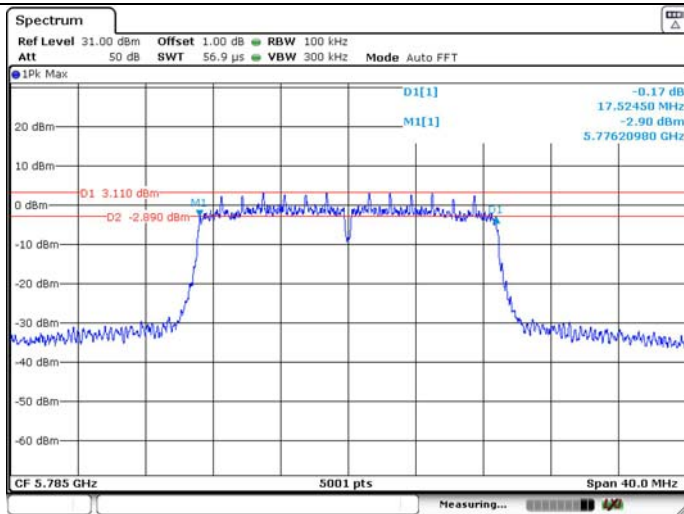
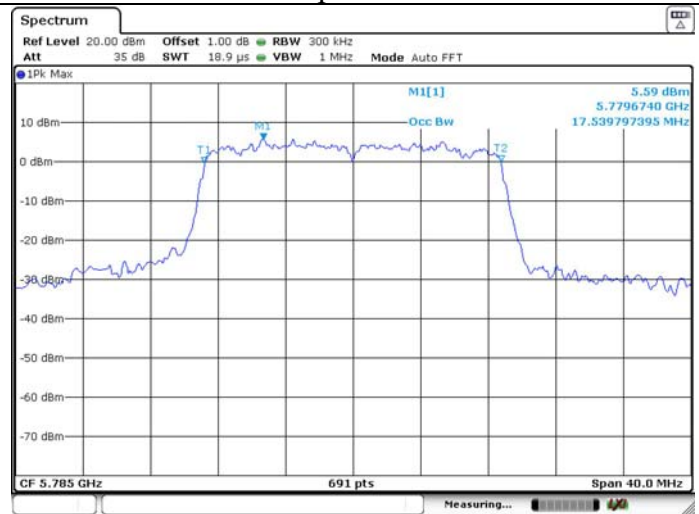
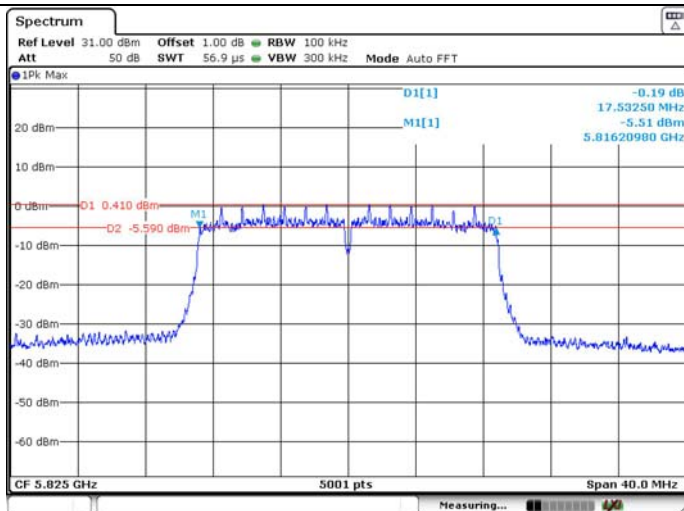
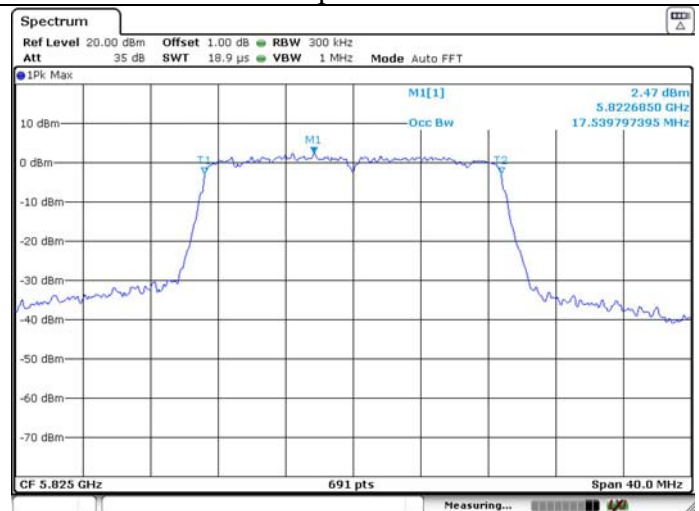
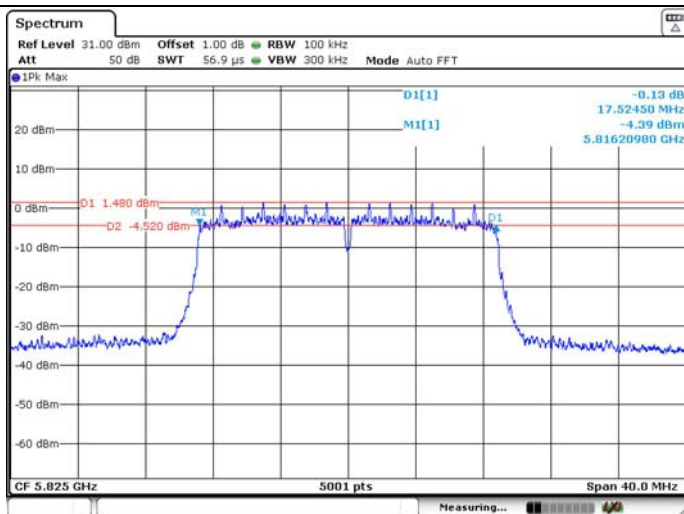
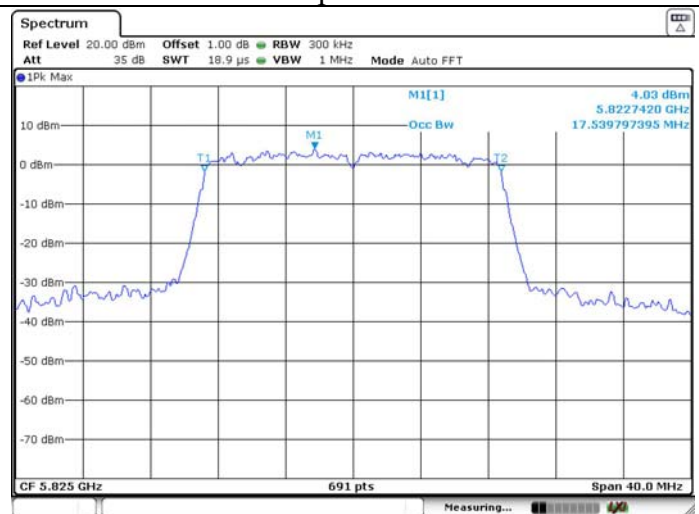


99% Occupied Bandwidth



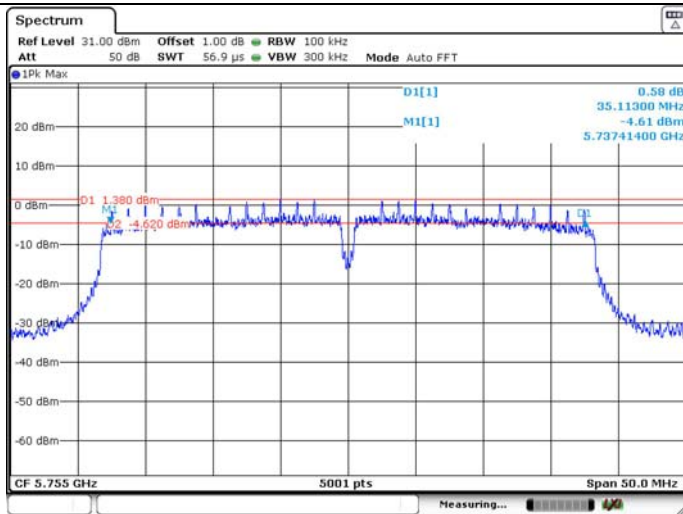
U-NII-3 IEEE 802.11n HT20 5785MHz_Ant 2**6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11n HT20 5825MHz_Ant 1****6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11n HT20 5825MHz_Ant 2****6dB Bandwidth****99% Occupied Bandwidth**

U-NII-3 IEEE 802.11ac VHT20 5745MHz_Ant 1**6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11ac VHT20 5745MHz_Ant 2****6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11ac VHT20 5785MHz_Ant 1****6dB Bandwidth****99% Occupied Bandwidth**

U-NII-3 IEEE 802.11ac VHT20 5785MHz_Ant 2**6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11ac VHT20 5825MHz_Ant 1****6dB Bandwidth****99% Occupied Bandwidth****U-NII-3 IEEE 802.11ac VHT20 5825MHz_Ant 2****6dB Bandwidth****99% Occupied Bandwidth**

U-NII-3 IEEE 802.11n HT40 5755MHz_Ant 1

6dB Bandwidth

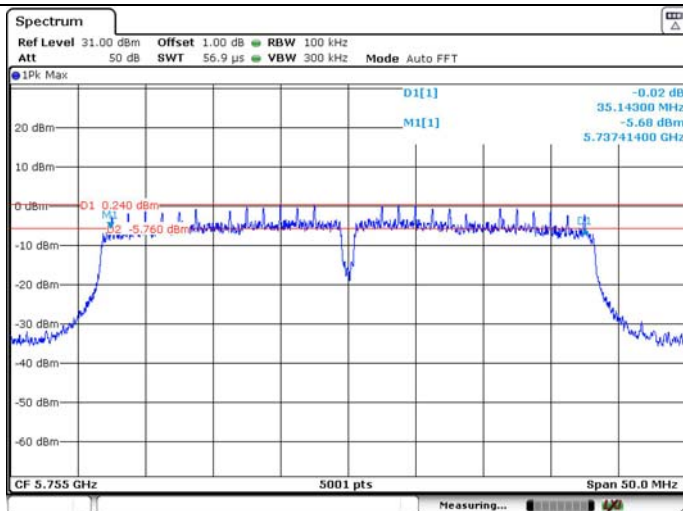


99% Occupied Bandwidth



U-NII-3 IEEE 802.11n HT40 5755MHz_Ant 2

6dB Bandwidth

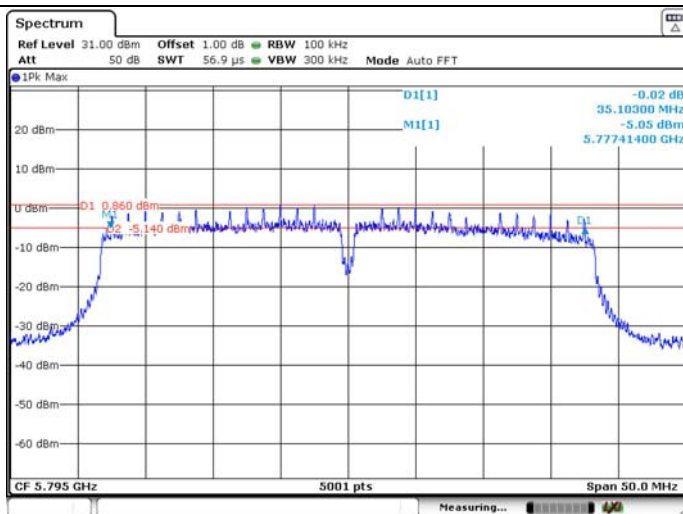


99% Occupied Bandwidth



U-NII-3 IEEE 802.11n HT40 5795MHz_Ant 1

6dB Bandwidth



99% Occupied Bandwidth

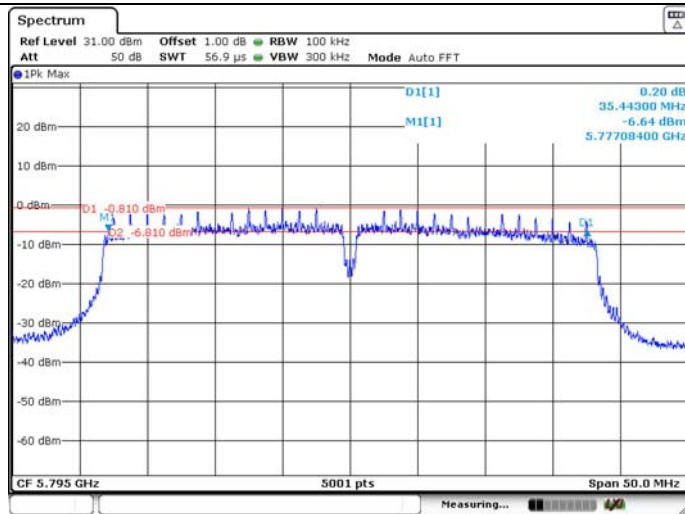


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U-NII-3 IEEE 802.11ac VHT40 5795MHz_Ant 1

6dB Bandwidth

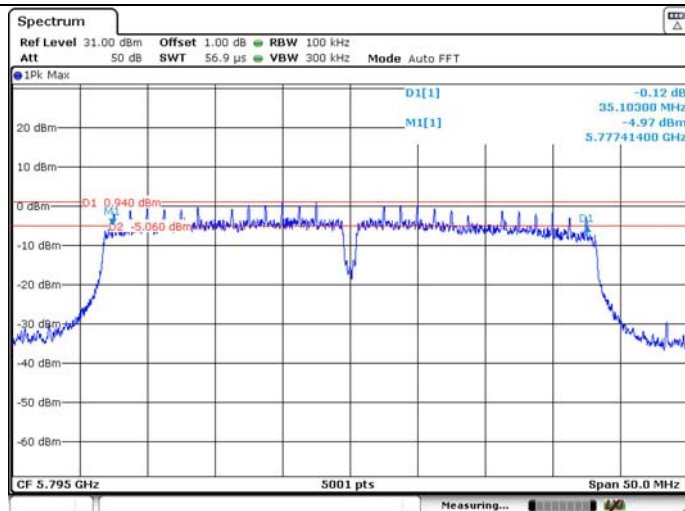


99% Occupied Bandwidth



U-NII-3 IEEE 802.11ac VHT40 5795MHz_Ant 2

6dB Bandwidth

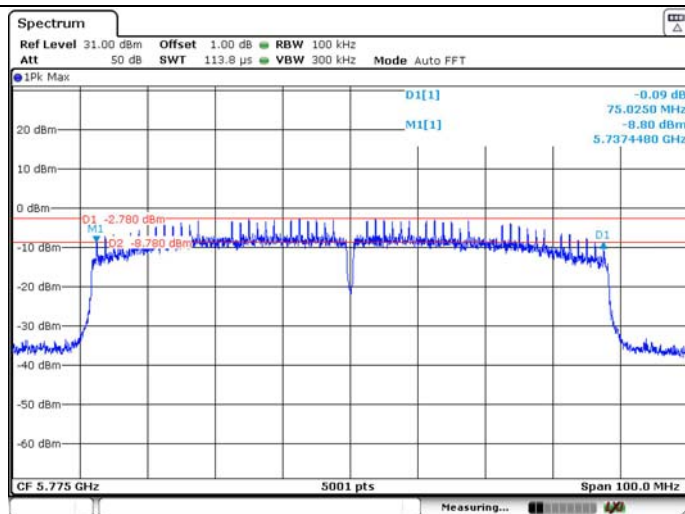


99% Occupied Bandwidth

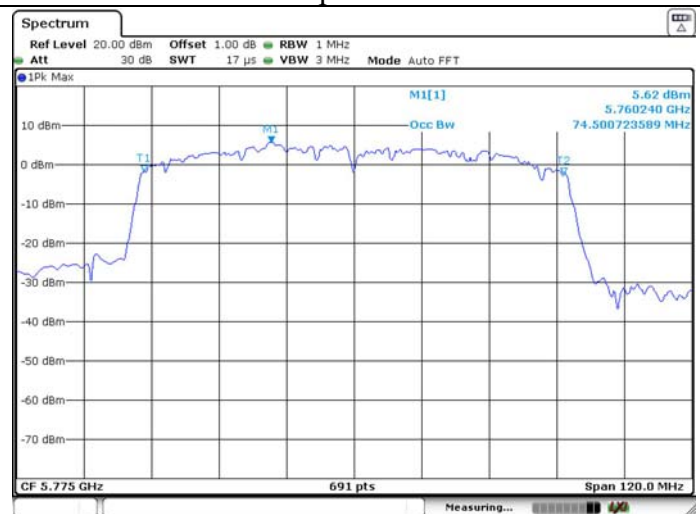


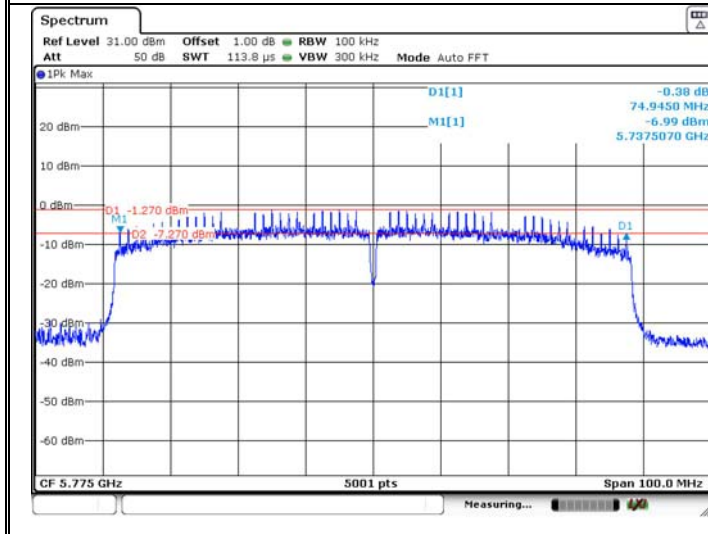
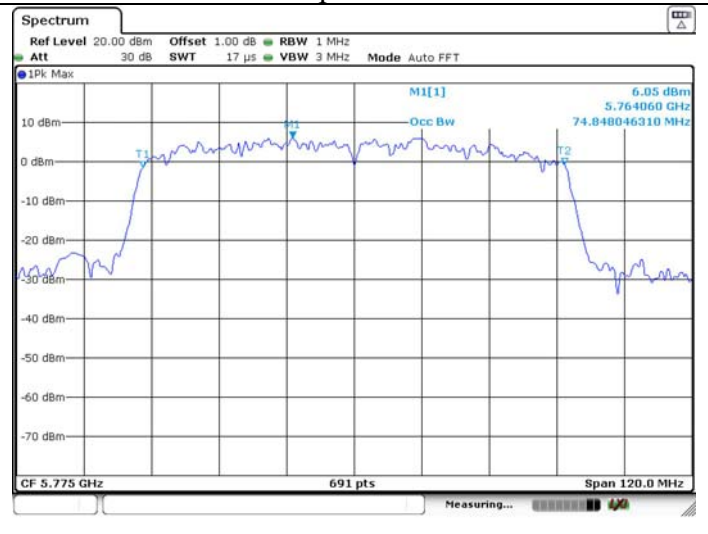
U-NII-3 IEEE 802.11ac VHT80 5775MHz_Ant 1

6dB Bandwidth



99% Occupied Bandwidth



U-NII-3 IEEE 802.11ac VHT80 5775MHz_Ant 2**6dB Bandwidth****99% Occupied Bandwidth**

4. MAXIMUM CONDUCTED OUTPUT POWER

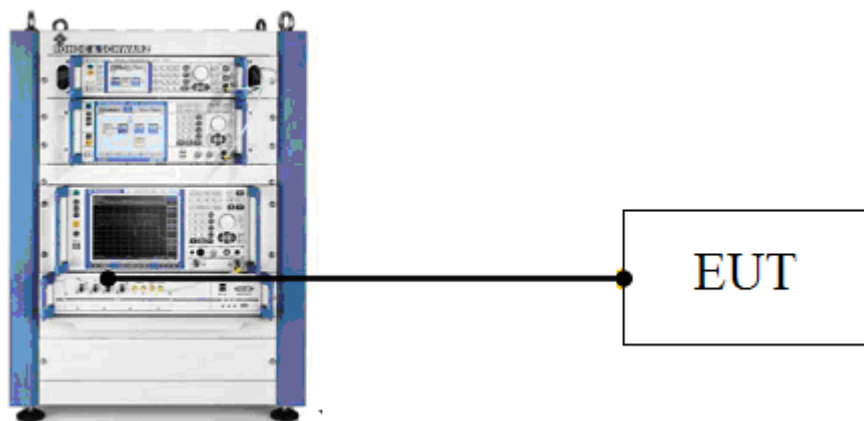
4.1. Limit

Band	EUT Type	Limit
U-NII-1	Outdoor Access Point	1W(30dBm) (Max. e.i.r.p $\leq 125\text{mW}$ at any elevation angle above 30 degrees as measured from the horizon)
	Indoor Access Point	1W(30dBm)
	Fixed point-to-point Access Point	1W(30dBm)
	Mobile and Portable Client Device	250mW(23.98dBm)
U-NII-2A	All Device	250mW(23.98dBm) or $11\text{dBm} + 10 \log B$, Which is lesser. (B is 26dB Bandwidth in MHz)
U-NII-2C	All Device	250mW(23.98dBm) or $11\text{dBm} + 10 \log B$, Which is lesser. (B is 26dB Bandwidth in MHz)
U-NII-3	All Device	1W(30dBm)

Note:

For the Band U-NII-2A and U-NII-2C, the maximum conducted output power limit calculate result refer to section 3.5.

4.2. Test Setup



4.3. Test Procedure

- Connect EUT antenna terminal to the OSP-B157WB with RF cable.
- Set the EUT transmit continuously with maximum output power.
- Through the test software in TS8897 to control a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.
- Repeat above procedures until all modes and channels were measured.
- Record the results in the test report.

4.4. Test Result

Temperature	24.1℃	Relative Humidity			55%	Test Voltage	AC 120V/60Hz	
BAND	Test Mode	Fre (MHz)	Conducted AVG Output Power (dBm)		Total Conducted Output Power (W)	Total Conducted Output Power (dBm)	Limit (dBm)	Result
			Ant 1	Ant 2				
U-NII-1	IEEE 802.11a	5180	12.37	11.57	0.0172	12.37	23.98	PASS
		5200	12.87	12.28	0.0193	12.87	23.98	PASS
		5240	13.11	12.67	0.0205	13.11	23.98	PASS
	IEEE 802.11n HT20	5180	14.29	13.66	0.05010	17.00	23.98	PASS
		5200	14.84	14.31	0.05746	17.59	23.98	PASS
		5240	14.96	14.61	0.06025	17.80	23.98	PASS
	IEEE 802.11ac VHT20	5180	13.96	13.56	0.04756	16.77	23.98	PASS
		5200	14.42	14.28	0.05447	17.36	23.98	PASS
		5240	14.72	14.60	0.05851	17.67	23.98	PASS
	IEEE 802.11n HT40	5190	13.96	13.83	0.04907	16.91	23.98	PASS
		5230	14.45	14.51	0.05615	17.49	23.98	PASS
	IEEE 802.11ac VHT40	5190	10.75	13.80	0.03588	15.55	23.98	PASS
		5230	14.43	14.48	0.05575	17.46	23.98	PASS
	IEEE 802.11ac VHT80	5210	14.97	13.83	0.05558	17.45	23.98	PASS

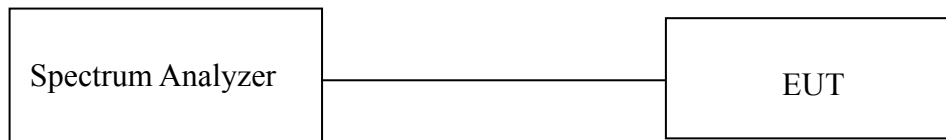
BAND	Test Mode	Fre (MHz)	Conducted AVG Output Power (dBm)		Total Conducted Output Power (W)	Total Conducted Output Power (dBm)	Limit (dBm)	Result
			Ant 1	Ant 2				
U-NII-3	IEEE 802.11a	5745	12.99	13.94	0.01991	12.99	30.00	PASS
		5785	12.00	13.16	0.01585	12.00	30.00	PASS
		5825	10.79	11.53	0.01199	10.79	30.00	PASS
	IEEE 802.11n HT20	5745	14.92	15.88	0.06977	18.44	30.00	PASS
		5785	13.64	14.89	0.05395	17.32	30.00	PASS
		5825	12.37	13.26	0.03844	15.85	30.00	PASS
	IEEE 802.11ac VHT20	5745	14.44	15.60	0.06409	18.07	30.00	PASS
		5785	13.50	14.92	0.05340	17.28	30.00	PASS
		5825	12.23	13.24	0.03779	15.77	30.00	PASS
	IEEE 802.11n HT40	5755	14.75	16.00	0.06966	18.43	30.00	PASS
		5795	12.90	14.33	0.04661	16.68	30.00	PASS
	IEEE 802.11ac VHT40	5755	14.74	16.01	0.06969	18.43	30.00	PASS
		5795	12.89	14.32	0.04648	16.67	30.00	PASS
	IEEE 802.11ac VHT80	5775	14.89	15.87	0.06948	18.42	30.00	PASS

5. PEAK POWER SPECTRAL DENSITY

5.1. Limit

Band	EUT Type	Limit
U-NII-1	Outdoor Access Point	17dBm/MHz
	Indoor Access Point	17dBm/MHz
	Fixed point-to-point Access Point	17dBm/MHz
	Mobile and Portable Client Device	11dBm/MHz
U-NII-2A	All Device	11dBm/MHz
U-NII-2C	All Device	11dBm/MHz
U-NII-3	All Device	30dBm/500KHz

5.2. Test Setup



5.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	1MHz(For U-NII-1&U-NII-2A&U-NII-2C) 500KHz(For U-NII-3)
VBW	3MHz(For U-NII-1&U-NII-2A&U-NII-2C) 2MHz(For U-NII-3)
Span	encompass the entire 26 dB EBW or 99% OBW of the signal
Sweep Time	Auto
Number of Sweep Point	$\geq 2 \times \text{SPAN}/\text{RBW}$
Detector	RMS(power averaging)
Trace Average	≥ 100 traces

5.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 5.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, use the marker-to-peak function to set the marker to the average of the emission.
- If the duty cycle of test signal $< 98\%$, the result = max measured value + $10 \times \log(1/\text{duty cycle})$;
If the duty cycle of test signal $\geq 98\%$, the result = max measured value.
- Repeat above procedures until all modes and channels were measured.
- Record the results in the test report.

5.5. Test Result

Temperature		24.1℃	Relative Humidity		55%	Test Voltage	AC 120V/60Hz	
BAND	Test Mode	Fre (MHz)	Power Density (dBm/MHz)		Duty Factor (dB)	Total Power Density (dBm/MHz)	Limit (dBm/MHz)	Result
			Ant 1	Ant 2				
U-NII-1	IEEE 802.11a	5180	4.46	3.48	4.67	9.13	9.88	PASS
		5200	5.08	4.29	4.67	9.75	9.88	PASS
		5240	5.04	4.70	4.67	9.71	9.88	PASS
	IEEE 802.11n HT20	5180	4.56	4.15	0.94	8.31	9.88	PASS
		5200	4.68	4.63	0.94	8.60	9.88	PASS
		5240	4.95	5.10	0.94	8.97	9.88	PASS
	IEEE 802.11ac VHT20	5180	4.24	4.16	0.97	8.18	9.88	PASS
		5200	4.86	4.18	0.97	8.51	9.88	PASS
		5240	4.68	4.55	0.97	8.59	9.88	PASS
	IEEE 802.11n HT40	5190	4.75	4.41	1.78	9.37	9.88	PASS
		5230	4.94	4.81	1.78	9.66	9.88	PASS
	IEEE 802.11ac VHT40	5190	4.71	4.10	1.74	9.17	9.88	PASS
		5230	4.72	4.33	1.74	9.28	9.88	PASS
	IEEE 802.11ac VHT80	5210	2.80	3.10	3.14	9.11	9.88	PASS

BAND	Test Mode	Fre (MHz)	Power Density (dBm/500KHz)		Duty Factor (dB)	Total Power Density (dBm/500KHz)	Limit (dBm/500KHz)	Result
			Ant 1	Ant 2				
U-NII-3	IEEE 802.11a	5745	6.58	7.09	4.67	19.18	28.88	PASS
		5785	5.89	6.94	4.67	18.47	28.88	PASS
		5825	5.13	5.16	4.67	19.15	28.88	PASS
	IEEE 802.11n HT20	5745	6.68	8.40	0.94	11.57	28.88	PASS
		5785	7.46	8.26	0.94	11.83	28.88	PASS
		5825	6.21	6.94	0.94	10.54	28.88	PASS
	IEEE 802.11ac VHT20	5745	6.35	8.10	0.97	11.29	28.88	PASS
		5785	6.38	9.00	0.97	11.86	28.88	PASS
		5825	4.89	7.10	0.97	10.11	28.88	PASS
	IEEE 802.11n HT40	5755	4.12	5.48	1.78	9.64	28.88	PASS
		5795	3.25	4.51	1.78	8.71	28.88	PASS
	IEEE 802.11ac VHT40	5755	4.65	5.83	1.74	10.03	28.88	PASS
		5795	3.37	4.86	1.74	8.93	28.88	PASS
	IEEE 802.11ac VHT80	5775	2.43	3.41	3.14	9.10	28.88	PASS

U-NII-1 IEEE 802.11a 5180MHz

ANT 1

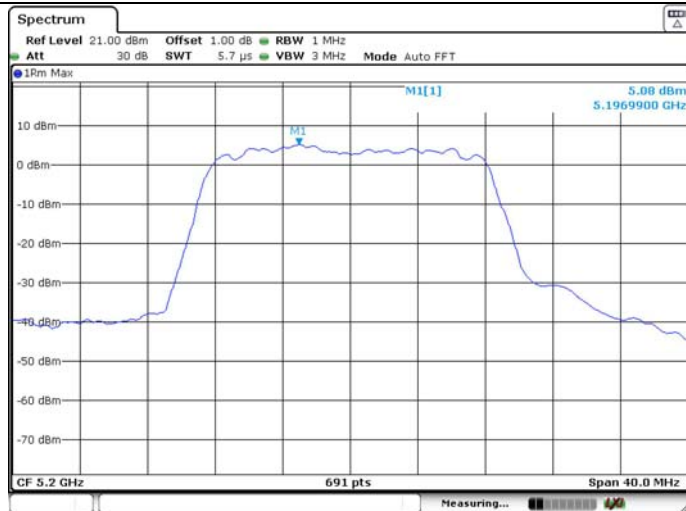


ANT 2

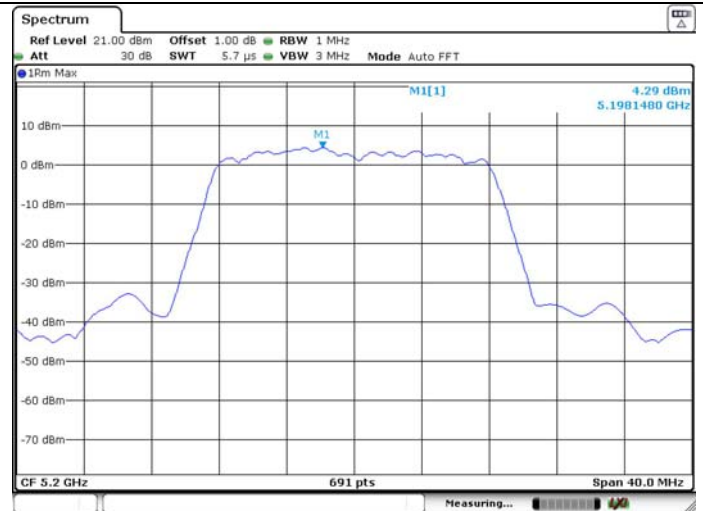


U-NII-1 IEEE 802.11a 5200MHz

ANT 1

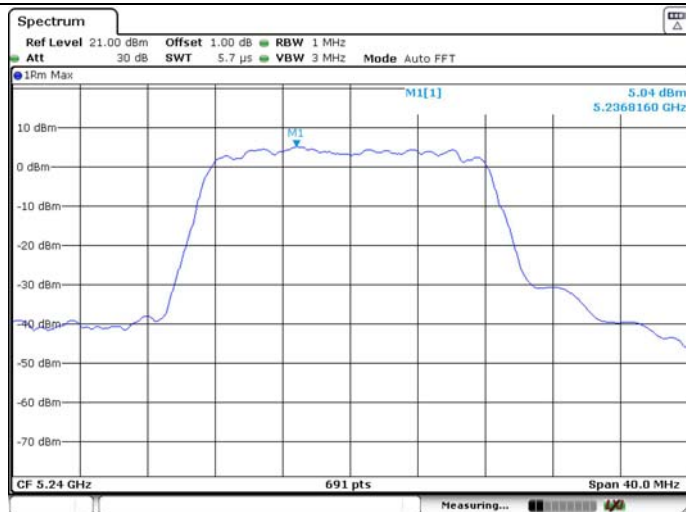


ANT 2



U-NII-1 IEEE 802.11a 5240MHz

ANT 1



ANT 2



U-NII-1 IEEE 802.11n HT20 5180MHz

ANT 1



ANT 2

