RF TEST REPORT

Test Equipment	:	Josh.ai Micro
Model Name	:	Josh Micro
FCC ID	:	2AXHA-0104
IC	:	26699-0104
Date of receipt	:	2020-07-14
Test duration	:	2020-07-28 ~ 2020-08-10
Date of issue	:	2020-11-25

Applicant : Josh.ai, Inc.
191 University Blvd. #188, Denver, CO 80206, United States

Test Laboratory : Lab-T, Inc.
2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si
Gyeonggi-do 17036, South Korea

Test specification	:	FCC Part 15 Subpart E 15.407
		RSS-247 Issue 2 (2017-02), RSS-GEN Issue 5 (2019-03)
RF Output Power	:	12.02 dBm
Test result	:	Pass

The above equipment was tested by Lab-T Testing Laboratory for compliance with the requirements of FCC,IC Rules and Regulations.
The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose.
This test report shall not be reproduced except in full, without the written approval of Lab-T, Inc

Tested by:
Engineer
HyunWoo Lee

Reviewed by:
Technical Manager
SangHoon Yu

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1. Applicant Information

Applicant	:	Josh.ai, Inc.
Address	:	191 University Blvd. #188, Denver CO, 80206, United States
Telephone No.	:	1-970-846-8797
Person in charge	:	Scott Allen / scotty@josh.ai
Manufacturer	:	Josh.ai, Inc.
Address	:	191 University Blvd. #188, Denver CO, 80206, United States

2. Laboratory Information

Corporate name	Lab-T, Inc.
Representative	Jong-Young Kim
Address	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si Gyeonggi-do 17036, South Korea
Telephone	+82-31-322-6767
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E-mail	info@lab-t.net
FCC Designation No.	KR0159
FCC Registration No.	133186
IC Site Registration No.	22000

Test Location

Test building	used	Address
Building T	☒	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, 17036, Korea
Building L	☒	2182-40 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, 17036, Korea
Building A	☐	2182-44 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do, 17036, Korea

3. Information About Test Equipment

3.1 Equipment Information

Equipment type	Josh.ai Micro
Equipment model name	Josh Micro
Equipment add model name	-
Frequency range	5 180 MHz ~ 5 825 MHz / 5 190 MHz ~ 5 795 MHz 5 210 MHz ~ 5 775 MHz
Modulation type	OFDM
Power supply	DC 5 V
H/W version	1.0
S/W version	1.0

Note:The above EUT information was declared by the manufacturer.

3.2 Antenna Information

Antenna	Type	Chip Antenna			
	Frequency Band	5 150 ~ 5 250	5 250 ~ 5 350	5 470 ~ 5 725	5 725 ~ 5 850
	Gain	2.32 dBi	1.95 dBi	1.30 dBi	0.64 dBi

3.3 Test Frequency

Test mode	Test frequency (MHz)			
	Band	Lowest Frequency	Middle Frequency	Highest Frequency
802.11a /802.11n_HT20 /802.11ac_VHT20	5150 ~ 5250	5180	5200	5240
	5250 ~ 5350	5260	5300	5320
	5470 ~ 5725	5500	5580	5700
	5725 ~ 5850	5745	5785	5825
802.11n_HT40/ 802.11ac_VHT40	5150 ~ 5250	5190	-	5230
	5250 ~ 5350	5270	-	5310
	5470 ~ 5725	5510	5550	5670
	5725 ~ 5850	5755	-	5795
802.11ac_VHT80	5150 ~ 5250	5210	-	-
	5250 ~ 5350	5290	-	-
	5470 ~ 5725	5530	-	5690
	5725 ~ 5850	5775	-	-

3.4 Worst-Case

802.11a	802.11n_HT20	802.11n_HT40
6 Mbps	MCS0	MCS0
802.11ac_VHT20	802.11ac_VHT40	802.11ac_VHT80
MCS0	MCS0	MCS0

3.5 Tested Companion Device Information

Type	Manufacturer	Model	Note
AC/DC Adapter	Shenzhen Moveforest Electrical Appliance Co., Ltd	MF-05002000	Used Conducted Emission Input : AC 100 ~ 240 V Output : DC 5 V, 2.0 A
-	-	-	-

3.6 Operating conditions for the EUT

Firmware state		1.0
Test software name(version)		-
Test power setting		802.11a : 11.5 dBm 802.11n_HT20 : 11.0 dBm 802.11n_HT40 : 11.0 dBm 802.11ac_VHT20 : 11.0 dBm 802.11ac_VHT40 : 11.0 dBm 802.11ac_VHT80 : 11.0 dBm
Serial number (Setup mode)	EUT #1	F8:8A:3C:70:25:A5 (RF conducted measurement)
	EUT #2	F8:8A:3C:70:25:21 (Radiated Emission, Conducted Emission)

4. Test Report

4.1 Summary

FCC Part 15E 407 & RSS-247 Issue 2 & RSS-GEN Issue 5				
FCC Rules		Parameter	Clause	Status
Transmitter Requirements				
15.203 15.407(a)	-	Antenna Requirement	4.4.1	C
15.407(a)	RSS-247 6.2.1.1 RSS-247 6.2.2.1	Maximum Conducted Output Power	4.4.2	C
15.407(a)	RSS-247 6.2.3.1 RSS-247 6.2.4.1	Maximum Power Spectral Density	4.4.3	C
15.403 15.407(e)	-	Emission Bandwidth	4.4.4	C
-	RSS-GEN 6.7	Occupied Bandwidth	4.4.4	C
15.407(g)	RSS-GEN 6.11	Frequency Stability	4.4.5	C
15.407(h)	RSS-247 6.3	Dynamic Frequency Selection	4.4.6	C
15.407(b) 15.205(a) 15.209(a)	RSS-247 6.2.1.2 RSS-247 6.2.2.2 RSS-247 6.2.3.2 RSS-247 6.2.4.2	Radiated Emission, Band Edge and Restricted bands	4.4.7	C
15.207(a)	RSS-GEN 8.8	Conducted Emissions	4.4.8	C
NOTE 1 : C = Comply N/C = Not Comply N/T = Not Tested N/A = Not Applicable				

* The general test methods used to test this device is ANSI C63.10:2013

4.2 Measurement Uncertainty

Mesurement items	Expanded Uncertainty	
RF Output Power	1.16 dB	(The confidence level is about 95 %, *k*=2)
Power Spectral Density	1.44 dB	(The confidence level is about 95 %, *k*=2)
Occupied Channel Bandwidth	31.26 kHz	(The confidence level is about 95 %, *k*=2)
Conducted Spurious Emissions	0.50 dB	(The confidence level is about 95 %, *k*=2)
Radiated Spurious Emissions (1 GHz under)	4.80 dB	(The confidence level is about 95 %, *k*=2)
Radiated Spurious Emissions (Above 1 GHz)	5.96 dB	(The confidence level is about 95 %, *k*=2)
Conducted emission	2.36 dB	(The confidence level is about 95 %, *k*=2)

4.3 Test Report Version

Test Report No.	Date	Description
TRRFCC20-0017	2020.11.25	Initial issue

4.4 Transmitter Requirements

4.4.1 Antenna Requirement

4.4.1.1 Regulation

Accoding 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.407(a)(1)(2)(3), If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.4.1.2 Result

Comply
(The transmitter has a Internal Chip Antenna. The directional peak gain of the antenna is 2.32 dBi(5 150~5 250 MHz), 1.95 dBi(5 250 ~ 5 350 MHz), 1.30 dBi(5 470 ~ 5 725 MHz), 0.64 dBi(5 725 ~ 5 850 MHz)

4.4.2 Maximum Conducted Output Power

4.4.2.1 Regulation

According to §15.407(a)(1)(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, 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.

According to RSS-247 §6.2.1.1 For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 $\log_{10}$B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

According to §15.407(a)(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, 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.

According to RSS-247 §6.2.2.1 and §6.2.3.1 The maximum conducted output power shall not exceed 250 mW or 11 + 10 $\log_{10}$B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 $\log_{10}$B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to §15.407(a)(3) and RSS-247 §6.2.4.1 For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. 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.

4.4.2.2 Measurement Procedure

These test measurement settings are specified in section E of 789033 D02 General UNII Test Procedures.

4.4.2.2.1 Measurement using a Power Meter (PM)

(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.

The EUT is configured to transmit continuously or to transmit with a constant duty cycle.

At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.

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 II.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., 10 log (1/0.25) if the duty cycle is 25%).

4.4.2.3 Result

Comply (measurement data : refer to the next page)

4.4.2.4 Measurement data

Test mode : 802.11a

Maximum Conducted Output Power						
Band (MHz)	Frequency (MHz)	Measured (dBm)	Measured (mW)	Result (dBm)	Result (mW)	Limit (dBm)
5 150 ~ 5 250	5 180	11.01	12.62	11.01	12.62	23.98
	5 200	11.13	12.97	11.13	12.97	23.98
	5 240	11.33	13.58	11.33	13.58	23.98
5 250 ~ 5 350	5 260	11.43	13.90	11.43	13.90	23.98
	5 300	11.51	14.16	11.51	14.16	23.98
	5 320	11.57	14.35	11.57	14.35	23.98
5 470 ~ 5 725	5 500	10.54	11.32	10.54	11.32	23.98
	5 580	10.84	12.13	10.84	12.13	23.98
	5 700	11.78	15.07	11.78	15.07	23.98
5 725 ~ 5 850	5 745	11.94	15.63	11.94	15.63	30.00
	5 785	12.02	15.92	12.02	15.92	30.00
	5 825	11.97	15.74	11.97	15.74	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : IC Limit(Frequency band 5250-5350 MHz, 5470-5725 MHz) : 250 mW or 11 + 10 $\log_{10}$B dBm, whichever is less.
B is the 99% emission bandwidth in megahertz.
e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 200 mW

Test mode : 802.11n_HT20

Maximum Conducted Output Power						
Band (MHz)	Frequency (MHz)	Measured (dBm)	Measured (mW)	Result (dBm)	Result (mW)	Limit (dBm)
5 150 ~ 5 250	5 180	10.74	11.86	10.74	11.86	23.98
	5 200	10.80	12.02	10.80	12.02	23.98
	5 240	11.22	13.24	11.22	13.24	23.98
5 250 ~ 5 350	5 260	11.11	12.91	11.11	12.91	23.98
	5 300	11.11	12.91	11.11	12.91	23.98
	5 320	11.06	12.76	11.06	12.76	23.98
5 470 ~ 5 725	5 500	10.03	10.07	10.03	10.07	23.98
	5 580	10.47	11.14	10.47	11.14	23.98
	5 700	11.49	14.09	11.49	14.09	23.98
5 725 ~ 5 850	5 745	11.41	13.84	11.41	13.84	30.00
	5 785	11.52	14.19	11.52	14.19	30.00
	5 825	11.47	14.03	11.47	14.03	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.

NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.

NOTE3 : IC Limit(Frequency band 5250-5350 MHz, 5470-5725 MHz) : 250 mW or 11 + 10 $\log_{10}$B dBm, whichever is less.
B is the 99% emission bandwidth in megahertz.
e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 200 mW

Test mode : 802.11n_HT40

Maximum Conducted Output Power						
Band (MHz)	Frequency (MHz)	Measured (dBm)	Measured (mW)	Result (dBm)	Result (mW)	Limit (dBm)
5 150 ~ 5 250	5 190	10.65	11.61	10.79	12.00	23.98
	5 230	10.77	11.94	10.91	12.33	23.98
5 250 ~ 5 350	5 270	10.70	11.75	10.84	12.14	23.98
	5 310	10.83	12.11	10.97	12.50	23.98
5 470 ~ 5 725	5 510	9.97	9.93	10.11	10.26	23.98
	5 550	9.93	9.84	10.07	10.16	23.98
	5 670	11.00	12.59	11.14	13.00	23.98
5 725 ~ 5 850	5 755	11.23	13.27	11.37	13.71	30.00
	5 795	11.38	13.74	11.52	14.19	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : Result : Measured Value + Duty cycle Factor
NOTE4 : Duty cycle Factor : 10*log(1/(on-time/Period)) refer to 4.4.7.7
NOTE5 : IC Limit(Frequency band 5250-5350 MHz, 5470-5725 MHz) : 250 mW or 11 + 10 $\log_{10}$B dBm, whichever is less.
B is the 99% emission bandwidth in megahertz.
e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 200 mW

Test mode : 802.11ac_VHT20

Maximum Conducted Output Power						
Band (MHz)	Frequency (MHz)	Measured (dBm)	Measured (mW)	Result (dBm)	Result (mW)	Limit (dBm)
5 150 ~ 5 250	5 180	10.86	12.19	10.86	12.19	23.98
	5 200	11.03	12.68	11.03	12.68	23.98
	5 240	11.21	13.21	11.21	13.21	23.98
5 250 ~ 5 350	5 260	11.16	13.06	11.16	13.06	23.98
	5 300	11.14	13.00	11.14	13.00	23.98
	5 320	11.21	13.21	11.21	13.21	23.98
5 470 ~ 5 725	5 500	10.07	10.16	10.07	10.16	23.98
	5 580	10.42	11.02	10.42	11.02	23.98
	5 700	11.60	14.45	11.60	14.45	23.98
5 725 ~ 5 850	5 745	11.29	13.46	11.29	13.46	30.00
	5 785	11.41	13.84	11.41	13.84	30.00
	5 825	11.30	13.49	11.30	13.49	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.

NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.

NOTE3 : IC Limit(Frequency band 5250-5350 MHz, 5470-5725 MHz) : 250 mW or 11 + 10 $\log_{10}$B dBm, whichever is less.
B is the 99% emission bandwidth in megahertz.
e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 200 mW

Test mode : 802.11ac_VHT40

Maximum Conducted Output Power						
Band (MHz)	Frequency (MHz)	Measured (dBm)	Measured (mW)	Result (dBm)	Result (mW)	Limit (dBm)
5 150 ~ 5 250	5 190	10.76	11.91	10.89	12.28	23.98
	5 230	10.99	12.56	11.12	12.94	23.98
5 250 ~ 5 350	5 270	10.63	11.56	10.76	11.91	23.98
	5 310	10.79	11.99	10.92	12.36	23.98
5 470 ~ 5 725	5 510	9.94	9.86	10.07	10.16	23.98
	5 550	9.91	9.79	10.04	10.09	23.98
	5 670	10.94	12.42	11.07	12.80	23.98
5 725 ~ 5 850	5 755	11.20	13.18	11.33	13.59	30.00
	5 795	11.36	13.68	11.49	14.10	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : Result : Measured Value + Duty cycle Factor
NOTE4 : Duty cycle Factor : 10*log(1/(on-time/Period)) refer to 4.4.7.7
NOTE5 : IC Limit(Frequency band 5250-5350 MHz, 5470-5725 MHz) : 250 mW or 11 + 10 $\log_{10}$B dBm, whichever is less.
B is the 99% emission bandwidth in megahertz.
e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 200 mW

Test mode : 802.11ac_VHT80

Maximum Conducted Output Power						
Band (MHz)	Frequency (MHz)	Measured (dBm)	Measured (mW)	Result (dBm)	Result (mW)	Limit (dBm)
5 150 ~ 5 250	5 210	10.75	11.89	11.02	12.66	23.98
5 250 ~ 5 350	5 290	10.92	12.36	11.19	13.17	23.98
5 470 ~ 5 725	5 530	9.91	9.79	10.18	10.43	23.98
	5 690	11.20	13.18	11.47	14.04	23.98
5 725 ~ 5 850	5 775	11.26	13.37	11.53	14.24	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : Result : Measured Value + Duty cycle Factor
NOTE4 : Duty cycle Factor : 10*log(1/(on-time/Period)) refer to 4.4.7.7
NOTE5 : IC Limit(Frequency band 5250-5350 MHz, 5470-5725 MHz) : 250 mW or 11 + 10 $\log_{10}$B dBm, whichever is less.
B is the 99% emission bandwidth in megahertz.
e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 200 mW

4.4.3 Maximum Power Spectral Density(PSD)

4.4.3.1 Regulation

According to §15.407(a)(1)(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, 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.

According to RSS-247 §6.2.1.1 For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 $\log_{10}$B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

According to §15.407(a)(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, 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.

According to RSS-247 §6.2.2.1 and §6.2.3.1 The maximum conducted output power shall not exceed 250 mW or 11 + 10 $\log_{10}$B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 $\log_{10}$B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to §15.407(a)(3) and RSS-247 §6.2.4.1 For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. 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.

4.4.3.2 Measurement Procedure

These test measurement settings are specified in section F of 789033 D02 General UNII Test Procedures.

4.4.3.2.1 Maximum Power Spectral Density (PSD)

The rules requires “maximum power spectral density” measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power….” (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)

2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. Make the following adjustments to the peak value of the spectrum, if applicable:

a) If Method SA-2 or SA-2 Alternative was used, add 10 log (1/x), where x is the duty cycle, to the peak of the spectrum.
b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.

4. The result is the Maximum PSD over 1 MHz reference bandwidth.

5. 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 10 log (500 kHz/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 10 log (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.

4.4.3.3 Result

Comply (measurement data : refer to the next page)

4.4.3.4 Measurement data

Test mode : 802.11a

Band(MHz)	Frequency (MHz)	Measured (dBm)	Result (dBm)	Limit (dBm)
5 150 ~ 5 250	5 180	0.51	0.51	11.00
	5 200	0.51	0.51	11.00
	5 240	1.17	1.17	11.00
5 250 ~ 5 350	5 260	0.98	0.98	11.00
	5 300	0.72	0.72	11.00
	5 320	0.87	0.87	11.00
5 470 ~ 5 725	5 500	0.16	0.16	11.00
	5 580	0.42	0.42	11.00
	5 700	1.20	1.20	11.00
5 725 ~ 5 850	5 745	-1.79	-1.79	30.00
	5 785	-1.61	-1.61	30.00
	5 825	-1.66	-1.66	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : 5150MHz ~ 5725MHz : dBm/MHz
5725MHz ~ 5850MHz : dBm/500kHz
NOTE4 : e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 10 dBm/MHz

Test mode : 802.11n_HT20

Band(MHz)	Frequency (MHz)	Measured (dBm)	Result (dBm)	Limit (dBm)
5 150 ~ 5 250	5 180	0.21	0.21	11.00
	5 200	0.12	0.12	11.00
	5 240	0.46	0.46	11.00
5 250 ~ 5 350	5 260	0.20	0.20	11.00
	5 300	0.42	0.42	11.00
	5 320	0.19	0.19	11.00
5 470 ~ 5 725	5 500	-0.27	-0.27	11.00
	5 580	-0.15	-0.15	11.00
	5 700	0.99	0.99	11.00
5 725 ~ 5 850	5 745	-2.30	-2.30	30.00
	5 785	-2.12	-2.12	30.00
	5 825	-2.16	-2.16	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : 5150MHz ~ 5725MHz : dBm/MHz
5725MHz ~ 5850MHz : dBm/500kHz
NOTE4 : e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 10 dBm/MHz

Test mode : 802.11n_HT40

Band(MHz)	Frequency (MHz)	Measured (dBm)	Result (dBm)	Limit (dBm)
5 150 ~ 5 250	5 190	-2.85	-2.71	11.00
	5 230	-2.51	-2.36	11.00
5 250 ~ 5 350	5 270	-2.97	-2.83	11.00
	5 310	-2.90	-2.76	11.00
5 470 ~ 5 725	5 510	-3.91	-3.77	11.00
	5 550	-3.76	-3.62	11.00
	5 670	-2.68	-2.54	11.00
5 725 ~ 5 850	5 755	-5.49	-5.35	30.00
	5 795	-5.46	-5.32	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : Result : Measured Value + Duty cycle Factor
NOTE4 : Dutycycle Factor : 10log(Dutycycle) * Refer to 4.4.7.7
NOTE5 : 5150MHz ~ 5725MHz : dBm/MHz
5725MHz ~ 5850MHz : dBm/500kHz
NOTE6 : e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 10 dBm/MHz

Test mode : 802.11ac_VHT20

Band(MHz)	Frequency (MHz)	Measured (dBm)	Result (dBm)	Limit (dBm)
5 150 ~ 5 250	5 180	-0.14	-0.14	11.00
	5 200	0.09	0.09	11.00
	5 240	0.45	0.45	11.00
5 250 ~ 5 350	5 260	0.11	0.11	11.00
	5 300	0.51	0.51	11.00
	5 320	0.78	0.78	11.00
5 470 ~ 5 725	5 500	-0.51	-0.51	11.00
	5 580	-0.45	-0.45	11.00
	5 700	0.69	0.69	11.00
5 725 ~ 5 850	5 745	-2.28	-2.28	30.00
	5 785	-2.53	-2.53	30.00
	5 825	-2.68	-2.68	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : 5150MHz ~ 5725MHz : dBm/MHz
5725MHz ~ 5850MHz : dBm/500kHz
NOTE4 : e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 10 dBm/MHz

Test mode : 802.11ac_VHT40

Band(MHz)	Frequency (MHz)	Measured (dBm)	Result (dBm)	Limit (dBm)
5 150 ~ 5 250	5 190	-2.79	-2.66	11.00
	5 230	-2.43	-2.29	11.00
5 250 ~ 5 350	5 270	-2.64	-2.51	11.00
	5 310	-3.24	-3.11	11.00
5 470 ~ 5 725	5 510	-3.81	-3.68	11.00
	5 550	-3.63	-3.50	11.00
	5 670	-2.77	-2.64	11.00
5 725 ~ 5 850	5 755	-5.54	-5.41	30.00
	5 795	-5.10	-4.97	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : Result : Measured Value + Duty cycle Factor
NOTE4 : Dutycycle Factor : 10log(Dutycycle) * Refer to 4.4.7.7
NOTE5 : 5150MHz ~ 5725MHz : dBm/MHz
5725MHz ~ 5850MHz : dBm/500kHz
NOTE6 : e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 10 dBm/MHz

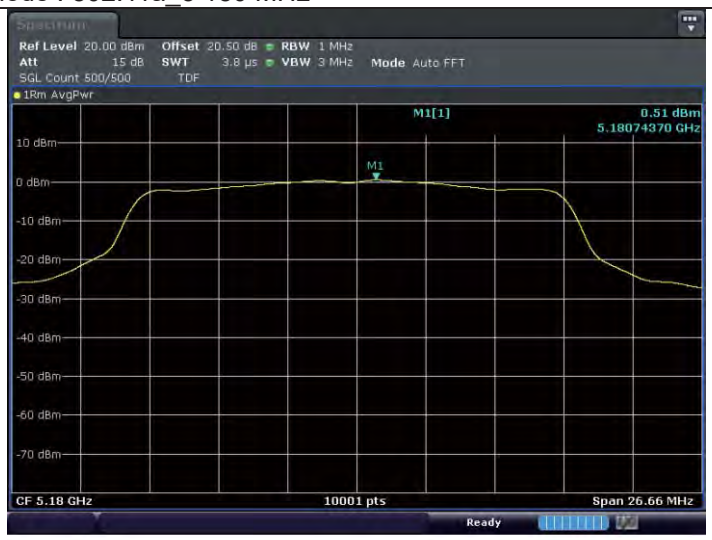
Test mode : 802.11ac_VHT80

Band(MHz)	Frequency (MHz)	Measured (dBm)	Result (dBm)	Limit (dBm)
5 150 ~ 5 250	5 210	-5.63	-5.36	11.00
5 250 ~ 5 350	5 290	-5.51	-5.23	11.00
5 470 ~ 5 725	5 530	-6.56	-6.29	11.00
	5 690	-5.41	-5.13	11.00
5 725 ~ 5 850	5 775	-8.45	-8.18	30.00

NOTE1 : Since the directional gain of the Chip antenna declared by the manufacturer does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : Result : Measured Value + Duty cycle Factor
NOTE4 : Dutycycle Factor : 10log(Dutycycle) * Refer to 4.4.7.7
NOTE5 : 5150MHz ~ 5725MHz : dBm/MHz
5725MHz ~ 5850MHz : dBm/500kHz
NOTE6 : e.i.r.p. IC Limit(Frequency band 5150-5250 MHz) : 10 dBm/MHz

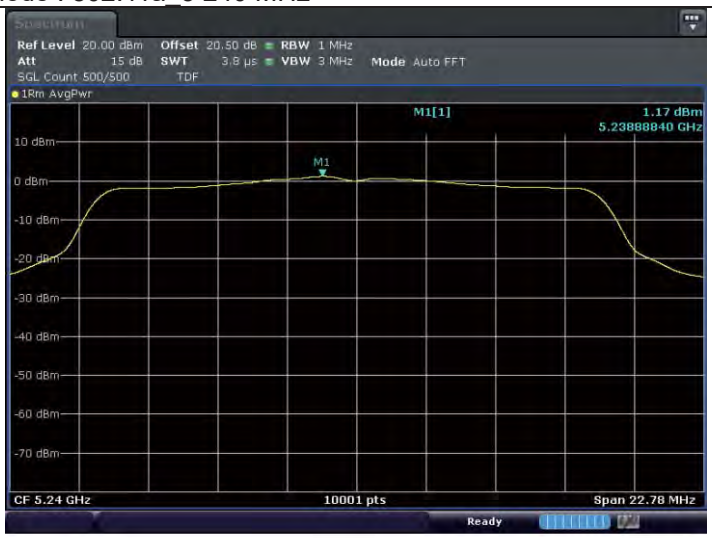
4.4.3.5 Test Plot

Test mode : 802.11a_5 180 MHz

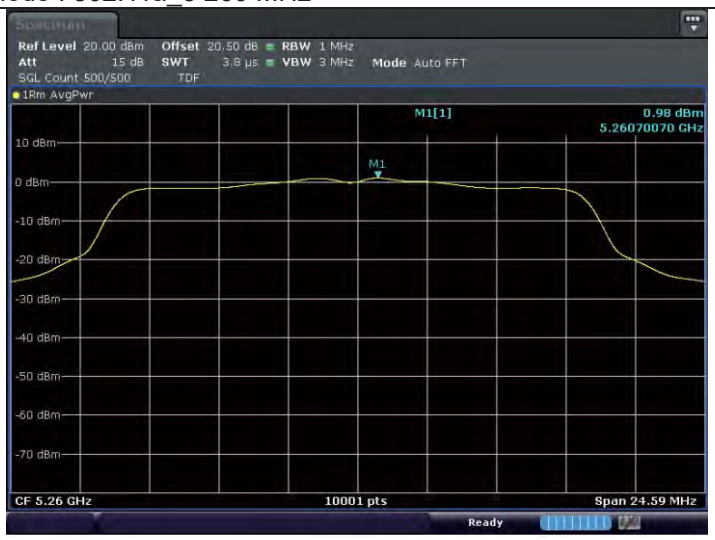


Test mode : 802.11a_5 200 MHz

Test mode : 802.11a_5 240 MHz



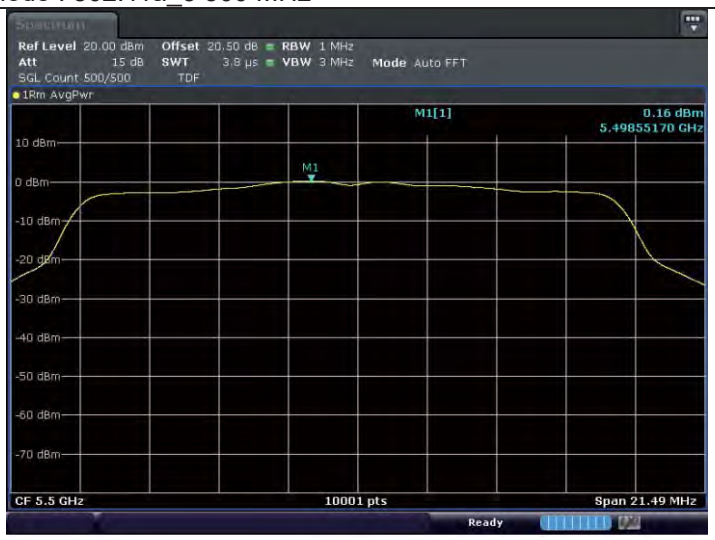
Test mode : 802.11a_5 260 MHz



Test mode : 802.11a_5 300 MHz

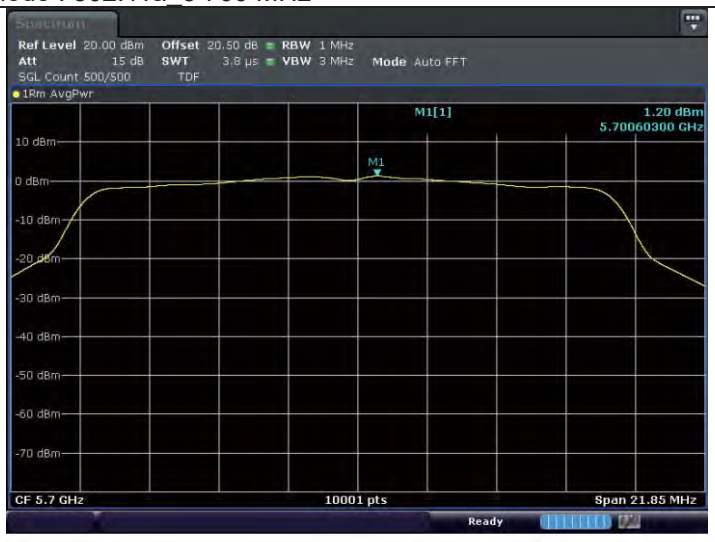
Test mode : 802.11a_5 320 MHz

Test mode : 802.11a_5 500 MHz

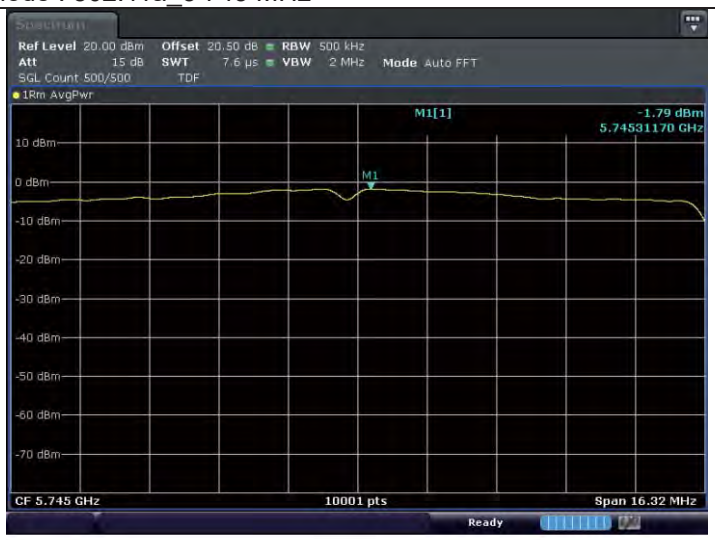


Test mode : 802.11a_5 580 MHz

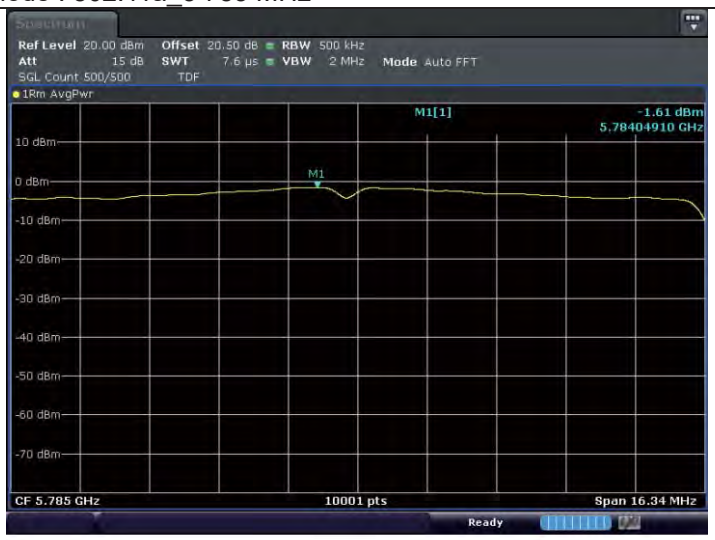
Test mode : 802.11a_5 700 MHz



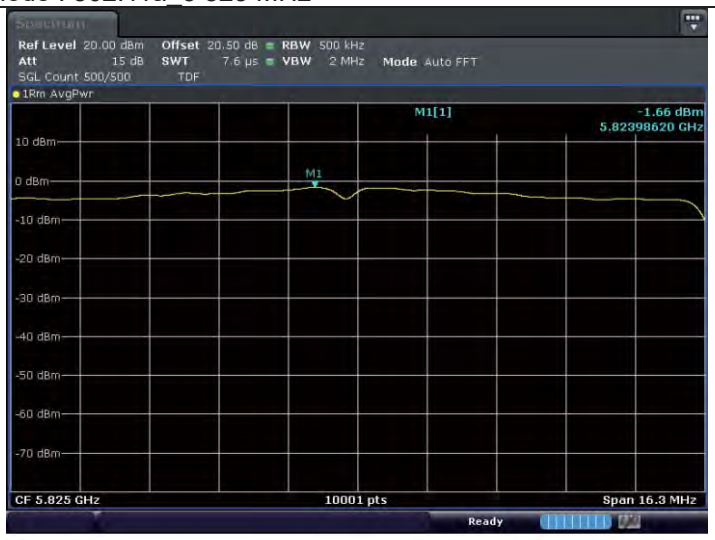
Test mode : 802.11a_5 745 MHz



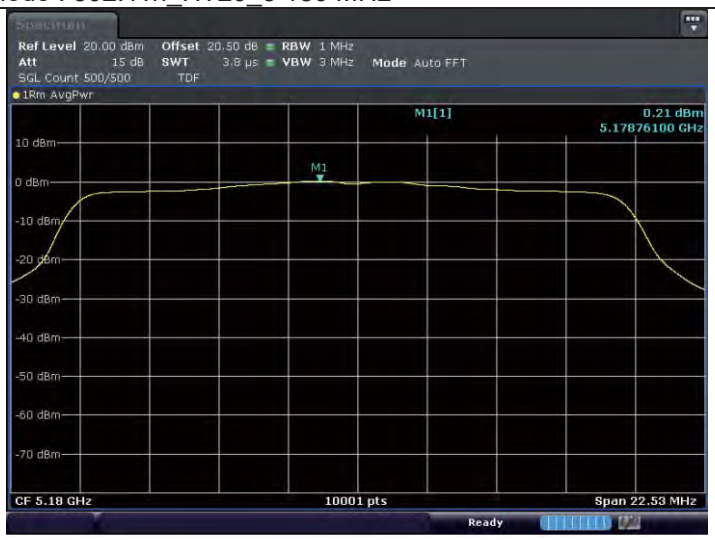
Test mode : 802.11a_5 785 MHz



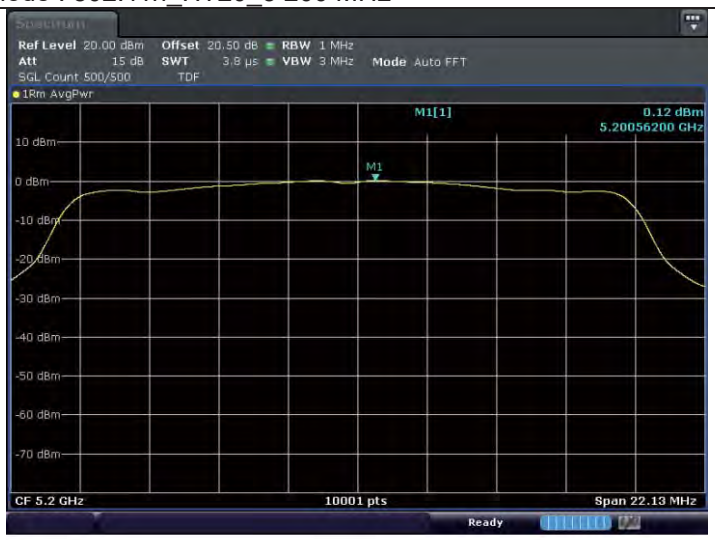
Test mode : 802.11a_5 825 MHz



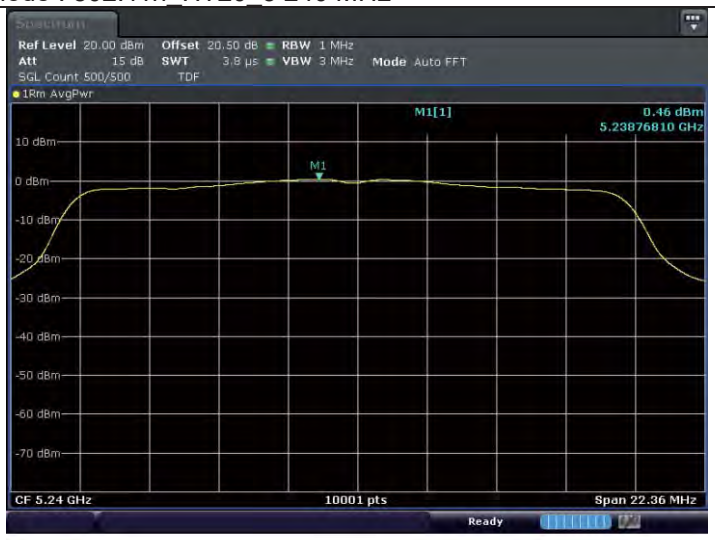
Test mode : 802.11n_HT20_5 180 MHz



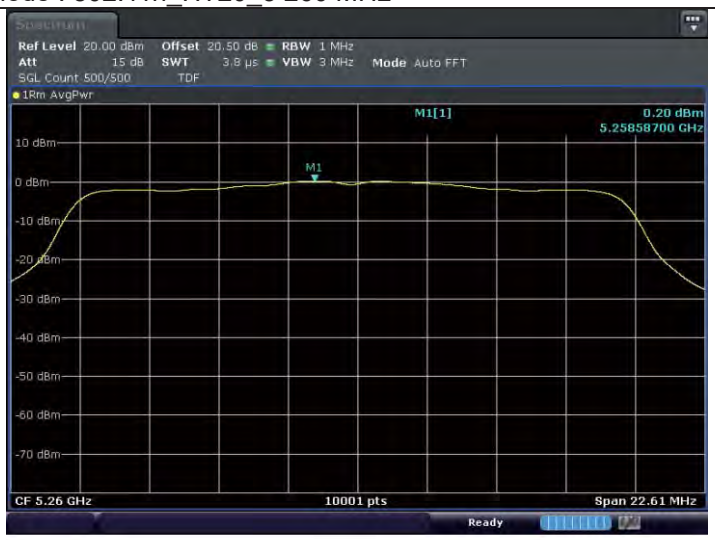
Test mode : 802.11n_HT20_5 200 MHz



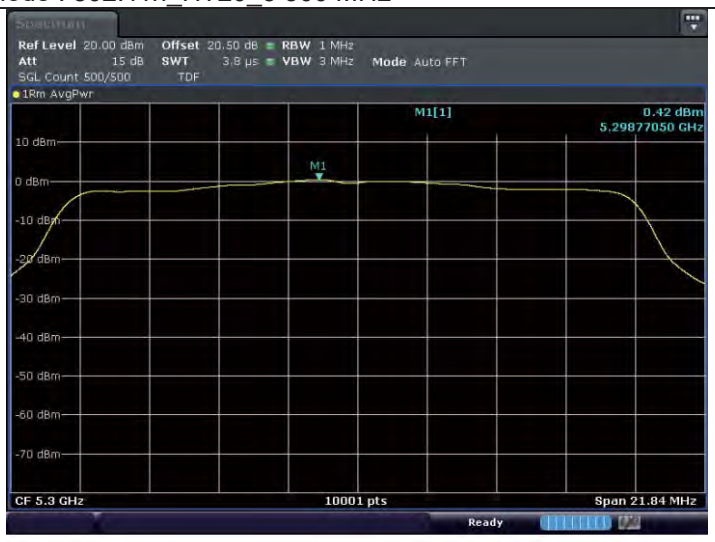
Test mode : 802.11n_HT20_5 240 MHz



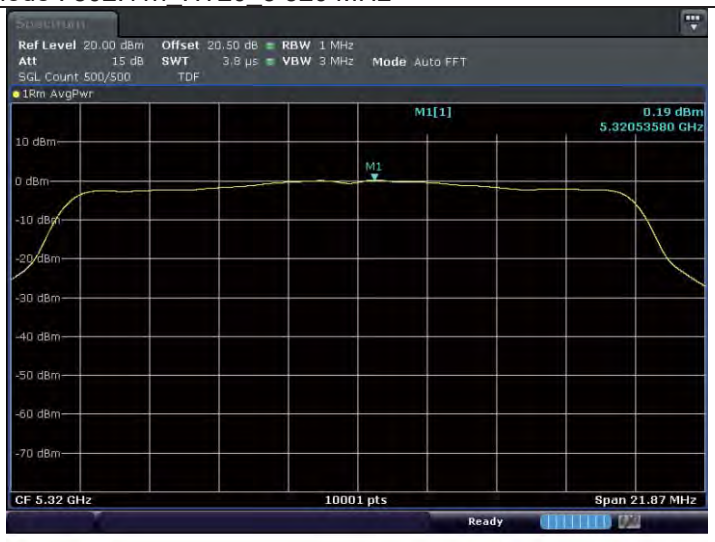
Test mode : 802.11n_HT20_5 260 MHz



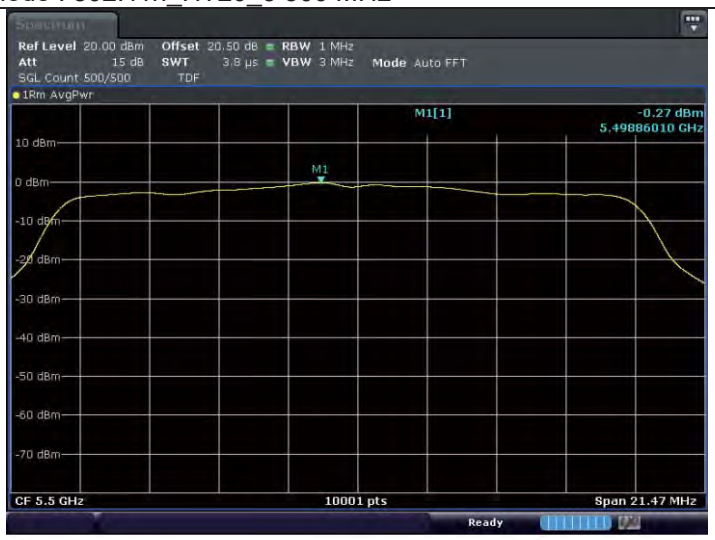
Test mode : 802.11n_HT20_5 300 MHz



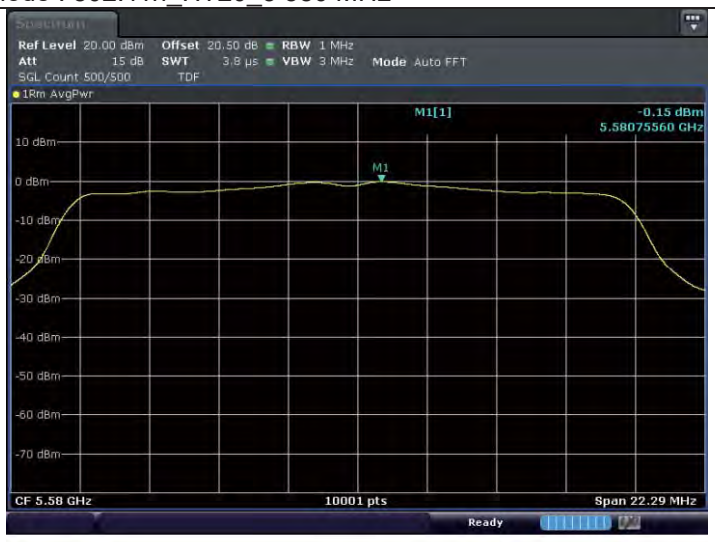
Test mode : 802.11n_HT20_5 320 MHz



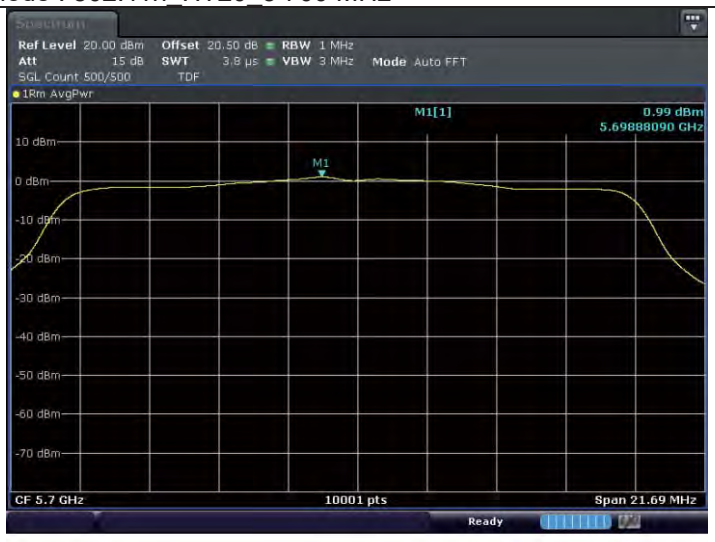
Test mode : 802.11n_HT20_5 500 MHz



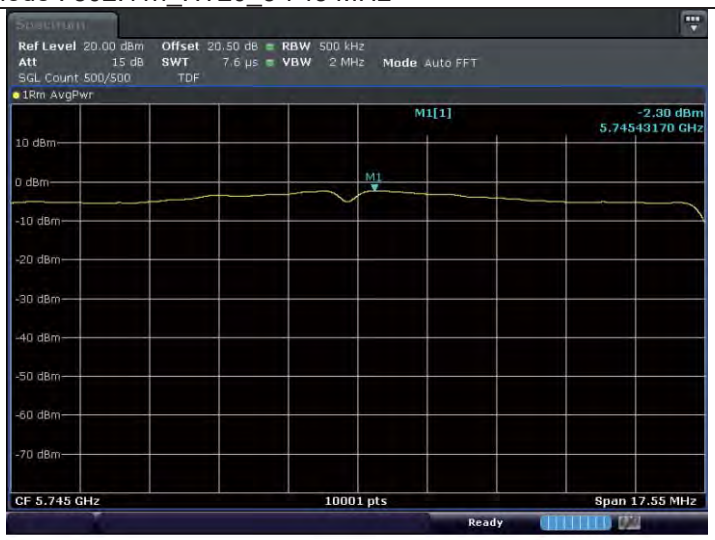
Test mode : 802.11n_HT20_5 580 MHz



Test mode : 802.11n_HT20_5 700 MHz



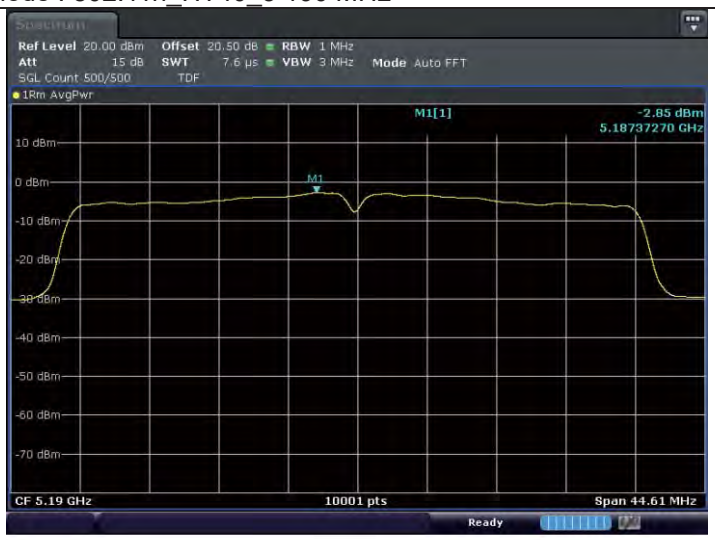
Test mode : 802.11n_HT20_5 745 MHz



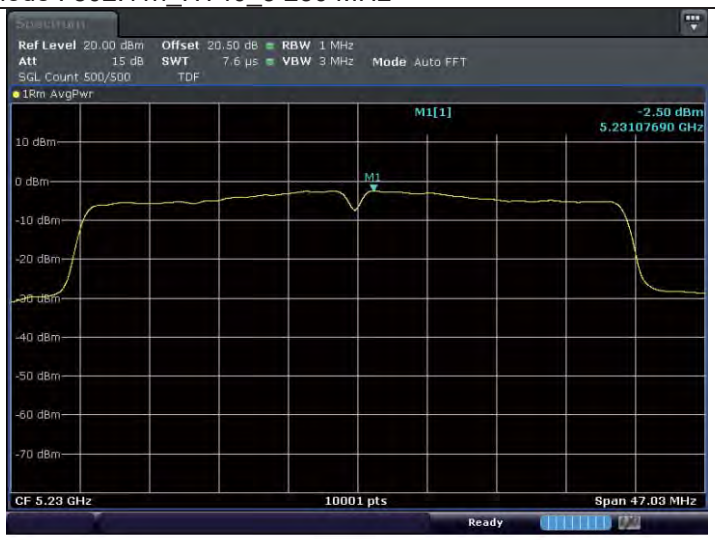
Test mode : 802.11n_HT20_5 785 MHz

Test mode : 802.11n_HT20_5 825 MHz

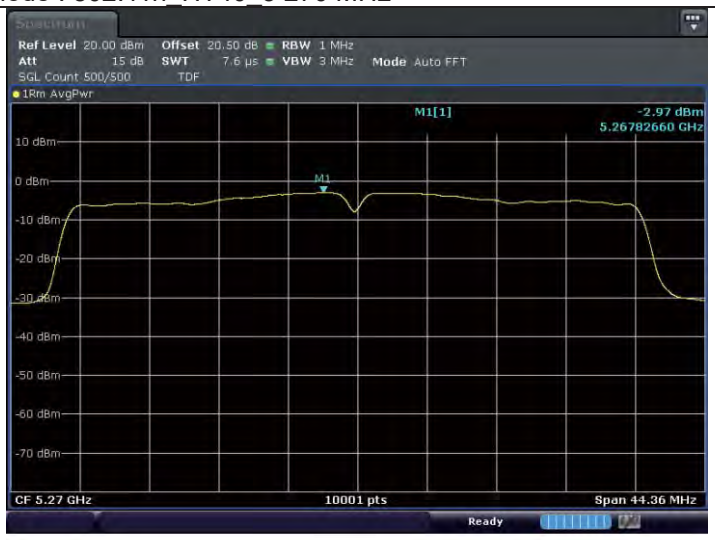
Test mode : 802.11n_HT40_5 190 MHz



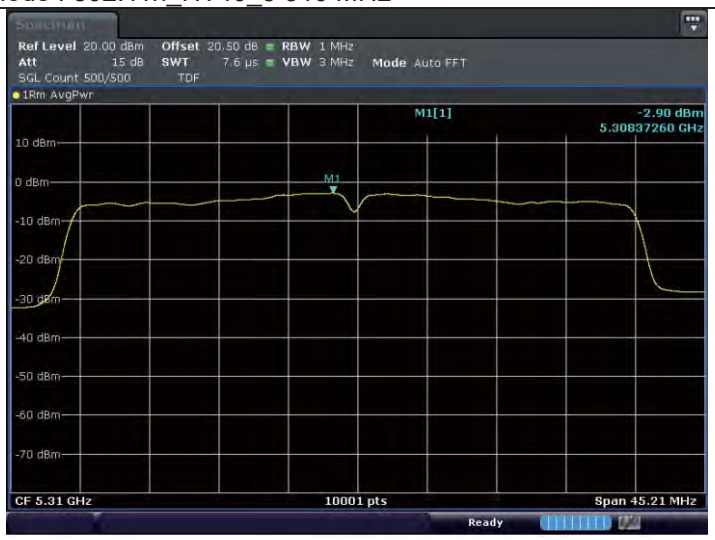
Test mode : 802.11n_HT40_5 230 MHz



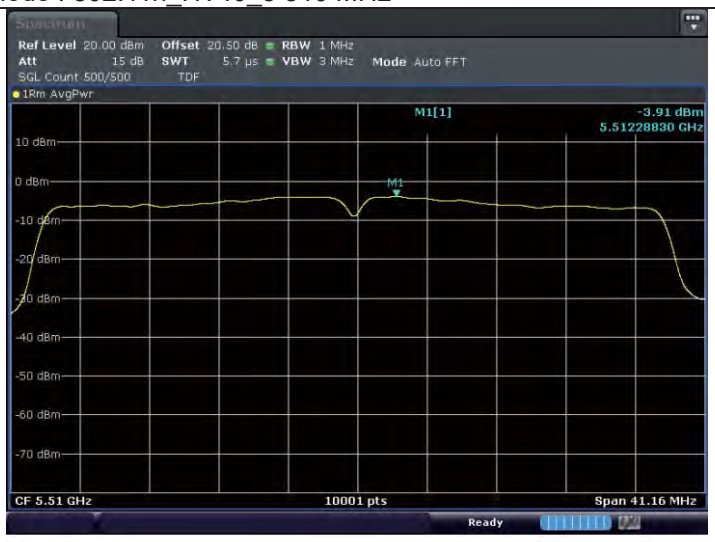
Test mode : 802.11n_HT40_5 270 MHz



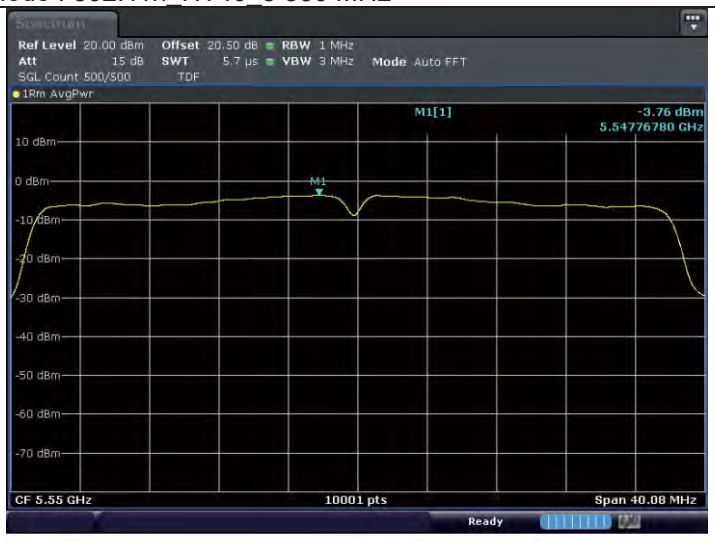
Test mode : 802.11n_HT40_5 310 MHz



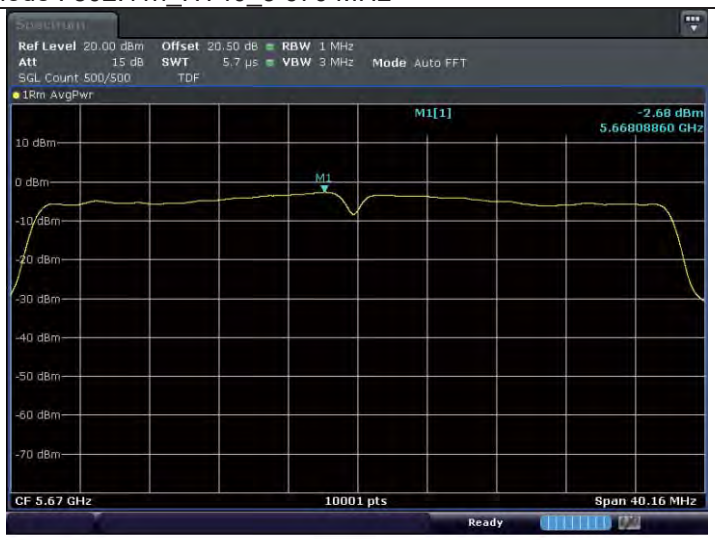
Test mode : 802.11n_HT40_5 510 MHz



Test mode : 802.11n_HT40_5 550 MHz



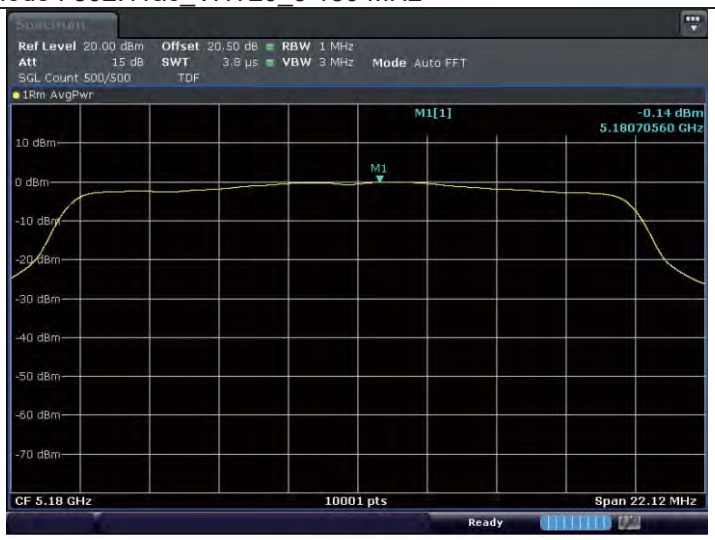
Test mode : 802.11n_HT40_5 670 MHz



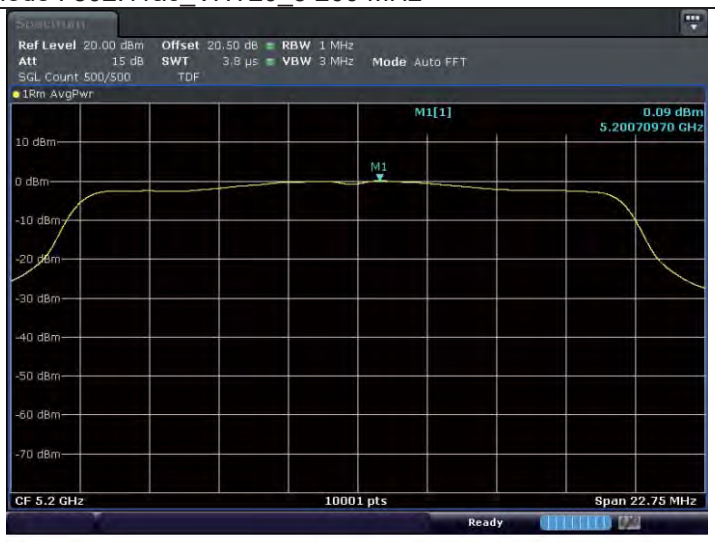
Test mode : 802.11n_HT40_5 755 MHz

Test mode : 802.11n_HT40_5 795 MHz

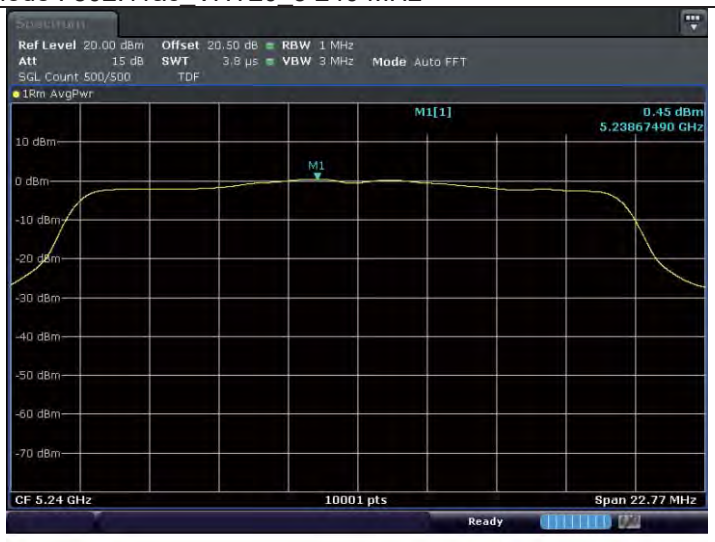
Test mode : 802.11ac_VHT20_5 180 MHz



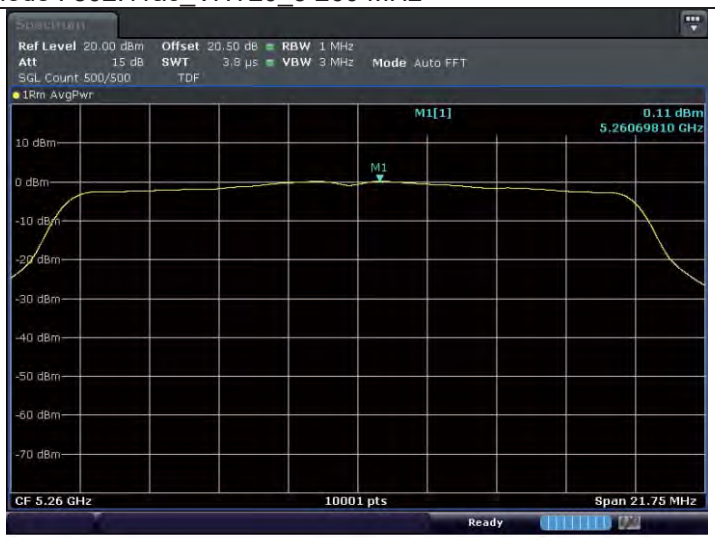
Test mode : 802.11ac_VHT20_5 200 MHz



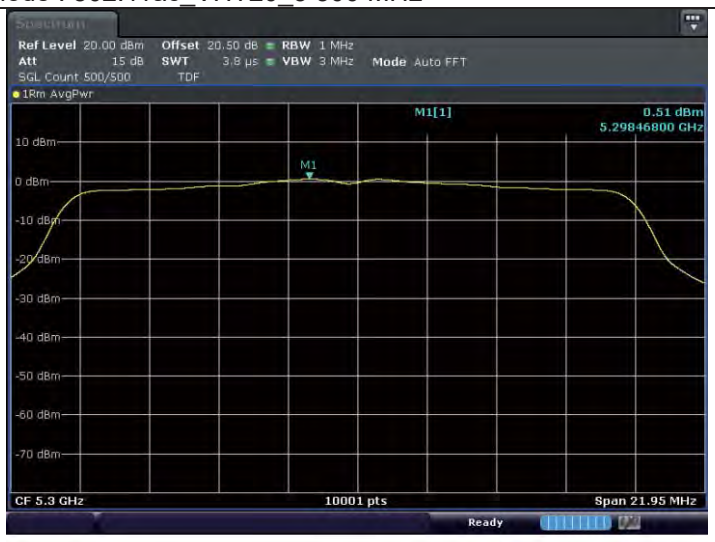
Test mode : 802.11ac_VHT20_5 240 MHz



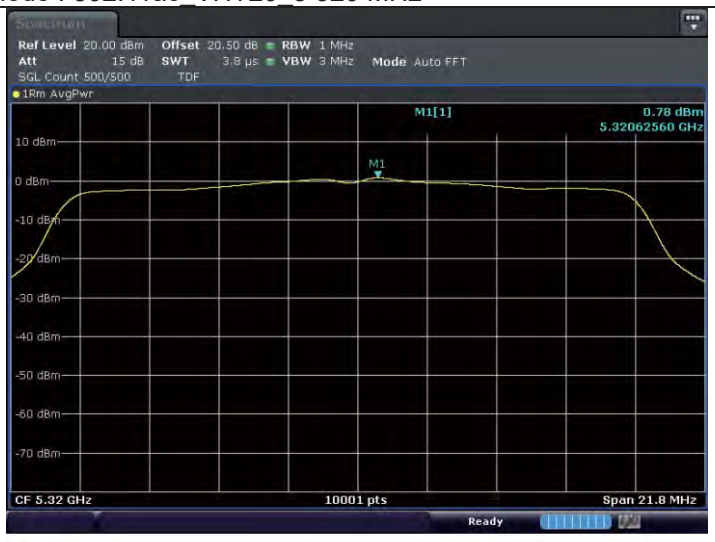
Test mode : 802.11ac_VHT20_5 260 MHz



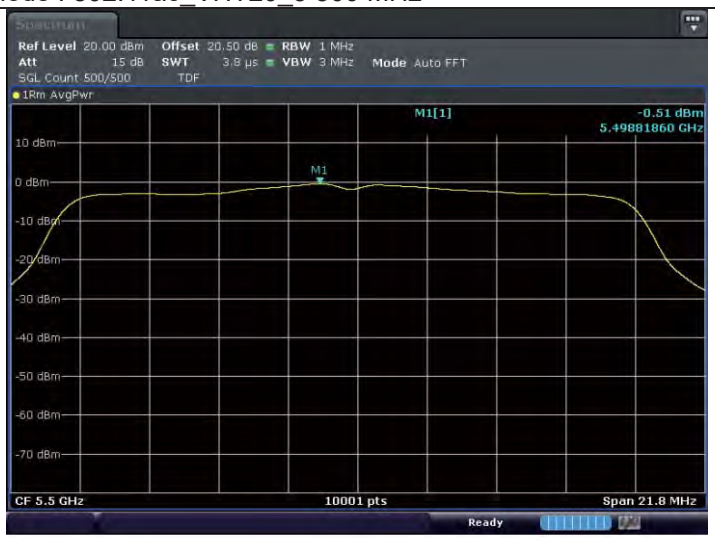
Test mode : 802.11ac_VHT20_5 300 MHz



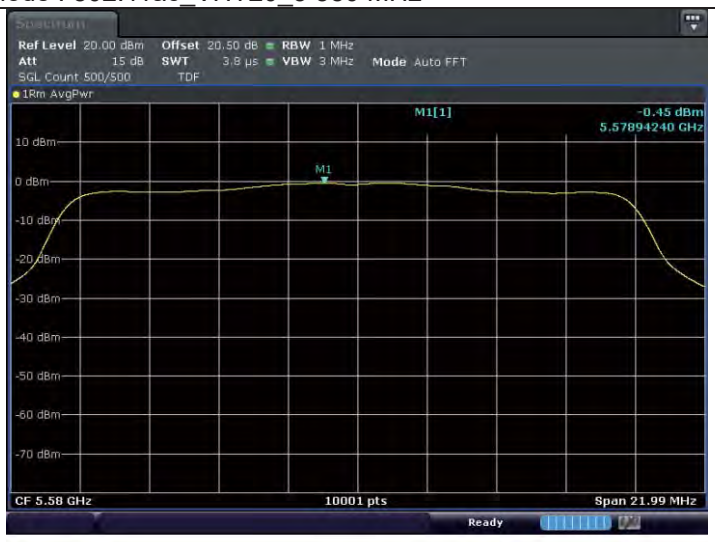
Test mode : 802.11ac_VHT20_5 320 MHz



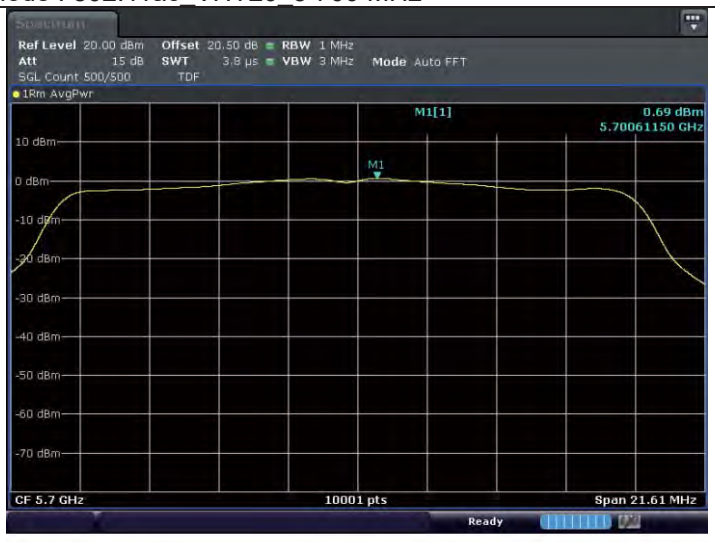
Test mode : 802.11ac_VHT20_5 500 MHz



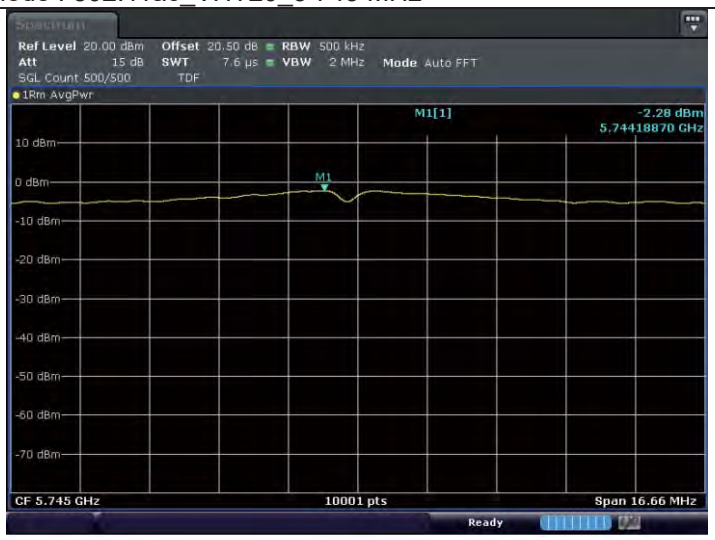
Test mode : 802.11ac_VHT20_5 580 MHz



Test mode : 802.11ac_VHT20_5 700 MHz

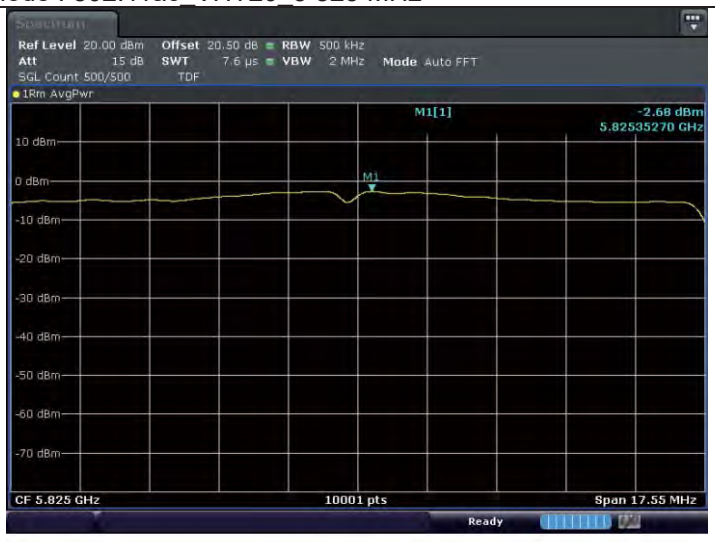


Test mode : 802.11ac_VHT20_5 745 MHz



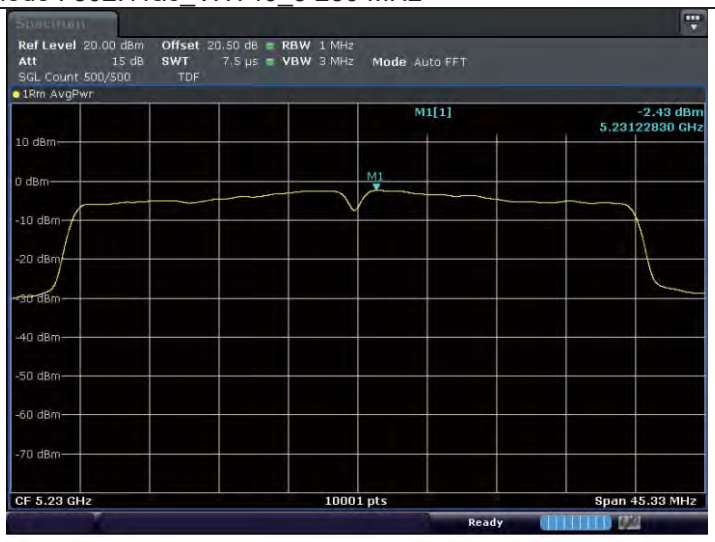
Test mode : 802.11ac_VHT20_5 785 MHz

Test mode : 802.11ac_VHT20_5 825 MHz



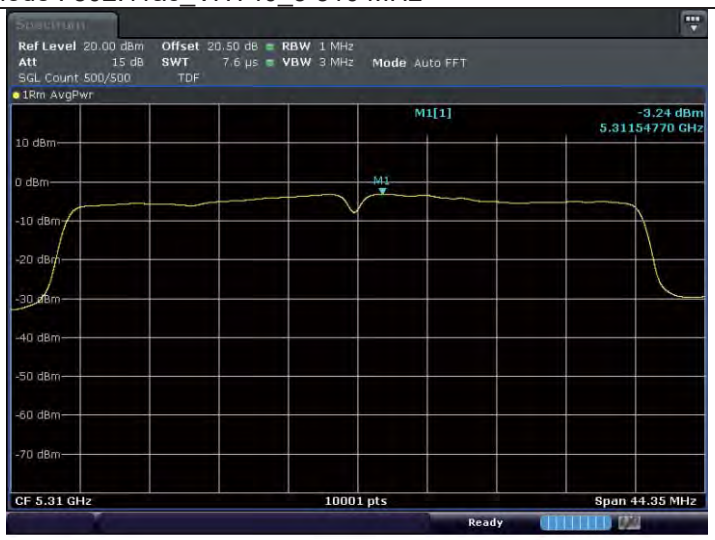
Test mode : 802.11ac_VHT40_5 190 MHz

Test mode : 802.11ac_VHT40_5 230 MHz

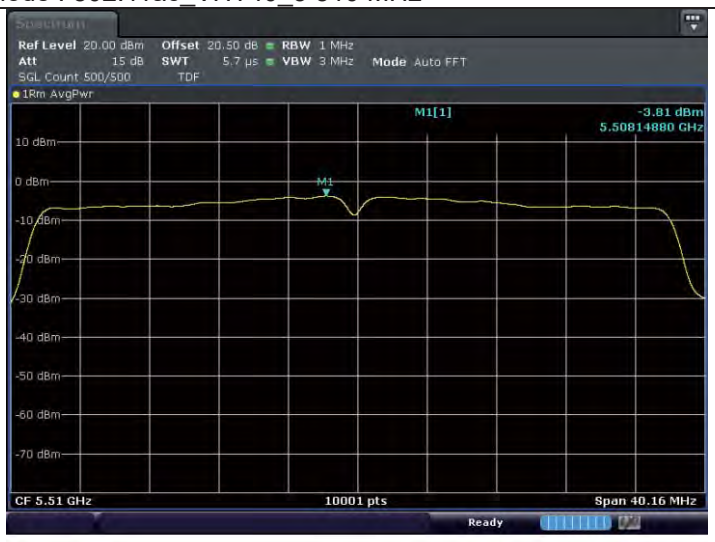


Test mode : 802.11ac_VHT40_5 270 MHz

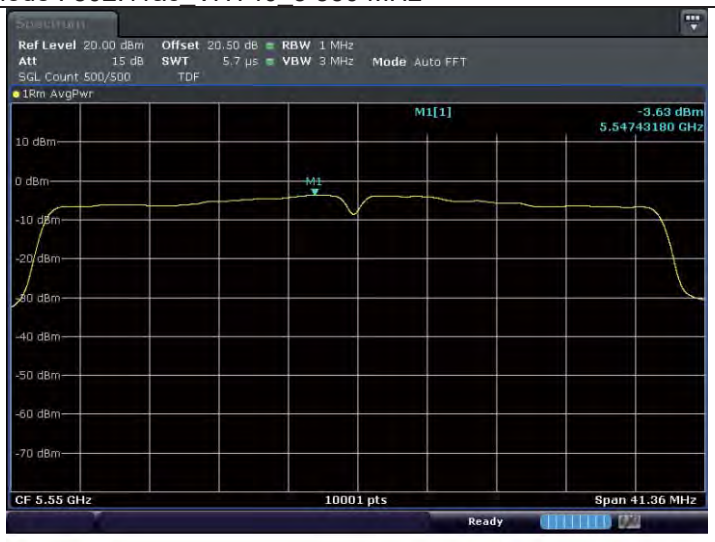
Test mode : 802.11ac_VHT40_5 310 MHz



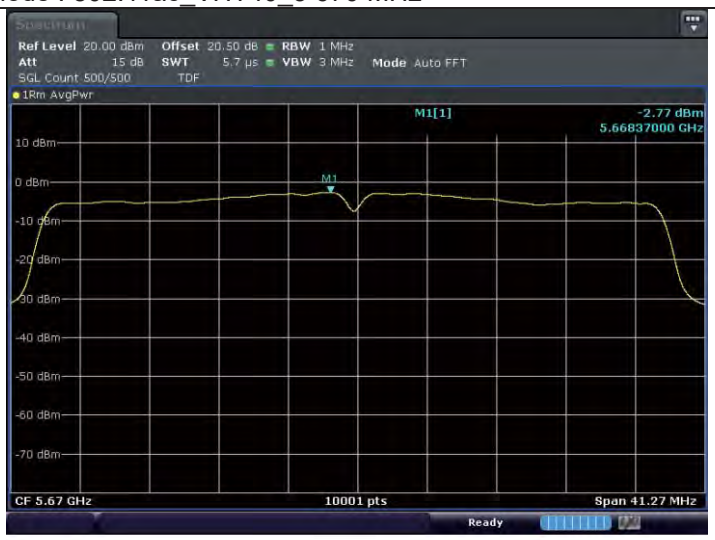
Test mode : 802.11ac_VHT40_5 510 MHz



Test mode : 802.11ac_VHT40_5 550 MHz

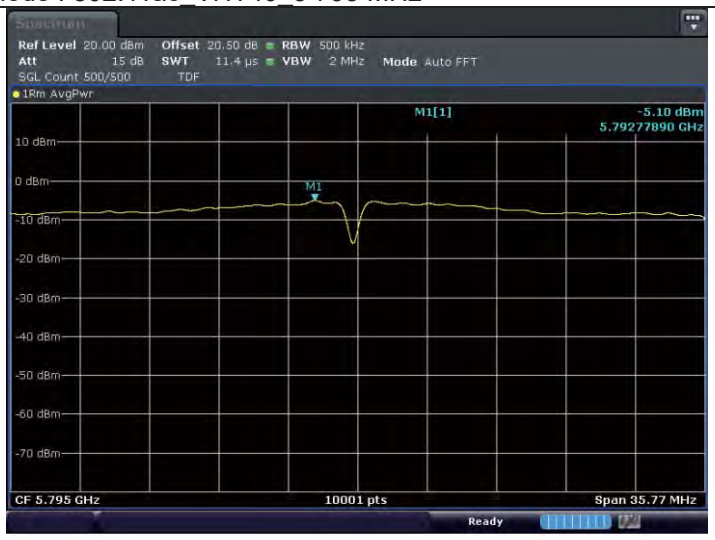


Test mode : 802.11ac_VHT40_5 670 MHz

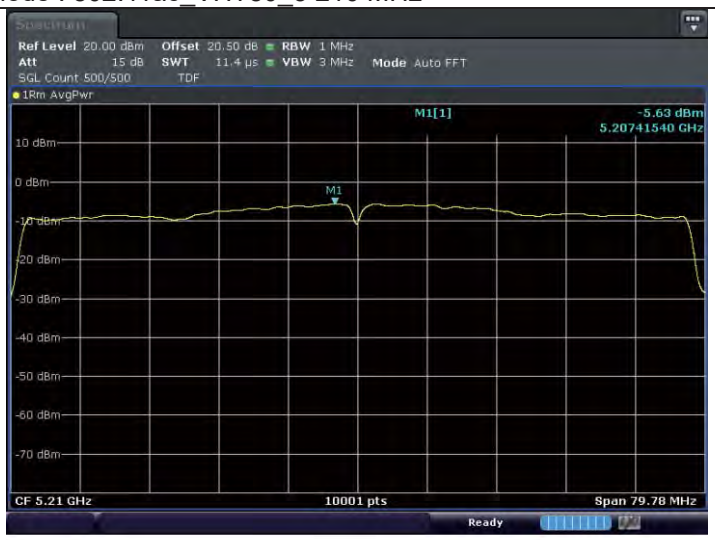


Test mode : 802.11ac_VHT40_5 755 MHz

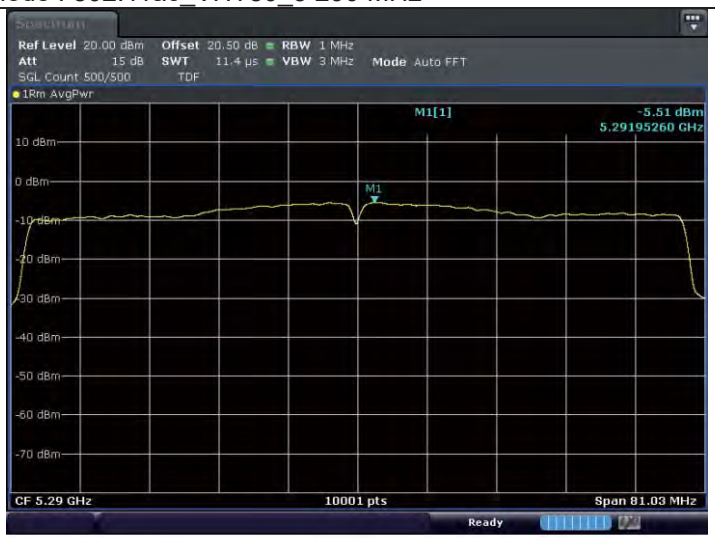
Test mode : 802.11ac_VHT40_5 795 MHz



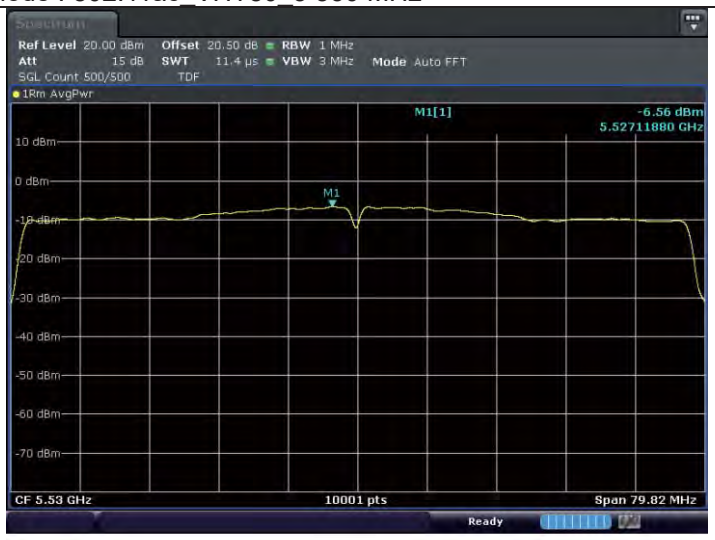
Test mode : 802.11ac_VHT80_5 210 MHz



Test mode : 802.11ac_VHT80_5 290 MHz

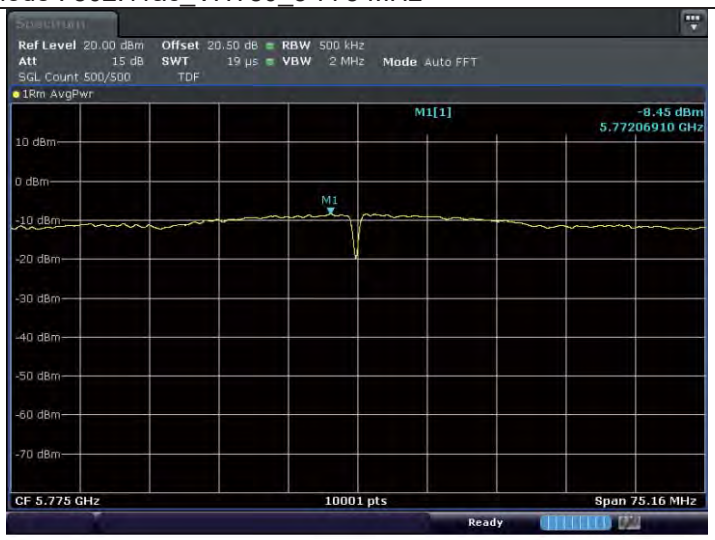


Test mode : 802.11ac_VHT80_5 530 MHz



Test mode : 802.11ac_VHT80_5 690 MHz

Test mode : 802.11ac_VHT80_5 775 MHz



4.4.4 Emission Bandwidth

4.4.4.1 Regulation

According to §15.403 Emission bandwidth. For purposes of this subpart the emission bandwidth is determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier.

According to §15.407(e) and RSS-247 §6.2.4.1 Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

According to §RSS-GEN 6.7 The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

4.4.4.2 Measurement Procedure

These test measurement settings are specified in section C of 789033 D02 General UNII Test Procedures.

4.4.4.2.1 Emission Bandwidth (EBW)

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%.

4.4.4.2.2 Minimum Emission Bandwidth for the band 5.725-5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 x RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

4.4.4.3 Result

Comply (measurement data : refer to the next page)

4.4.4.4 Measurement data

Test mode : 802.11a

Emission Bandwidth(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	26.66	25.90	22.78
5 250 ~ 5 350	24.59	23.34	22.44
5 470 ~ 5 725	21.49	22.15	21.85
5 725 ~ 5 850	16.32	16.34	16.30

NOTE1 : Limit : 5 725 ~ 5 850 Band : >500kHz

Test mode : 802.11n_HT20

Emission Bandwidth(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	22.53	22.13	22.36
5 250 ~ 5 350	22.61	21.84	21.87
5 470 ~ 5 725	21.47	22.29	21.69
5 725 ~ 5 850	17.55	17.25	17.56

NOTE1 : Limit : 5 725 ~ 5 850 Band : >500kHz

Test mode : 802.11n_HT40

Emission Bandwidth(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	44.61	-	47.03
5 250 ~ 5 350	44.36	-	45.21
5 470 ~ 5 725	41.16	40.08	40.16
5 725 ~ 5 850	35.52	-	35.56

NOTE1 : Limit : 5 725 ~ 5 850 Band : >500kHz

Test mode : 802.11ac_VHT20

Emission Bandwidth(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	22.12	22.75	22.77
5 250 ~ 5 350	21.75	21.95	21.80
5 470 ~ 5 725	21.80	21.99	21.61
5 725 ~ 5 850	16.66	16.93	17.55

NOTE1 : Limit : 5 725 ~ 5 850 Band : >500kHz

Test mode : 802.11ac_VHT40

Emission Bandwidth(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	41.10	-	45.33
5 250 ~ 5 350	43.72	-	44.35
5 470 ~ 5 725	40.16	41.36	41.27
5 725 ~ 5 850	36.31	-	35.77

NOTE1 : Limit : 5 725 ~ 5 850 Band : >500kHz

Test mode : 802.11ac_VHT80

Emission Bandwidth(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	-	79.78	-
5 250 ~ 5 350	-	81.03	-
5 470 ~ 5 725	79.82	-	79.82
5 725 ~ 5 850	-	75.16	-

NOTE1 : Limit : 5 725 ~ 5 850 Band : >500kHz

Test mode : 802.11a

Occupied Bandwidth(99 % Bandwidth)(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	17.59	17.53	17.45
5 250 ~ 5 350	17.40	17.04	17.15
5 470 ~ 5 725	16.76	16.86	16.88
5 725 ~ 5 850	16.52	16.57	16.51

Test mode : 802.11n_HT20

Occupied Bandwidth(99 % Bandwidth)(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	18.04	17.89	18.08
5 250 ~ 5 350	17.85	17.99	18.07
5 470 ~ 5 725	17.77	17.84	17.91
5 725 ~ 5 850	17.76	17.67	17.75

Test mode : 802.11n_HT40

Occupied Bandwidth(99 % Bandwidth)(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	36.68	-	37.09
5 250 ~ 5 350	36.66	-	37.00
5 470 ~ 5 725	36.69	36.54	36.44
5 725 ~ 5 850	36.14	-	36.15

Test mode : 802.11ac_VHT20

Occupied Bandwidth(99 % Bandwidth)(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	18.05	18.11	17.83
5 250 ~ 5 350	17.98	18.11	17.90
5 470 ~ 5 725	17.92	17.85	17.97
5 725 ~ 5 850	17.67	17.68	17.73

Test mode : 802.11ac_VHT40

Occupied Bandwidth(99 % Bandwidth)(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	36.84	-	36.84
5 250 ~ 5 350	36.65	-	36.61
5 470 ~ 5 725	36.62	36.41	36.62
5 725 ~ 5 850	36.12	-	36.13

Test mode : 802.11ac_VHT80

Occupied Bandwidth(99 % Bandwidth)(MHz)			
Band(MHz)	Lowest Frequency	Middle Frequency	Highest Frequency
5 150 ~ 5 250	-	75.78	-
5 250 ~ 5 350	-	75.90	-
5 470 ~ 5 725	75.80	-	75.61
5 725 ~ 5 850	-	75.34	-

4.4.4.5 Test Plot

Test mode : 802.11a_5 180 MHz_Emission Bandwidth

Test mode : 802.11a_5 200 MHz_Emission Bandwidth

Test mode : 802.11a_5 240 MHz_Emission Bandwidth

Test mode : 802.11a_5 260 MHz_Emission Bandwidth

Test mode : 802.11a_5 300 MHz_Emission Bandwidth

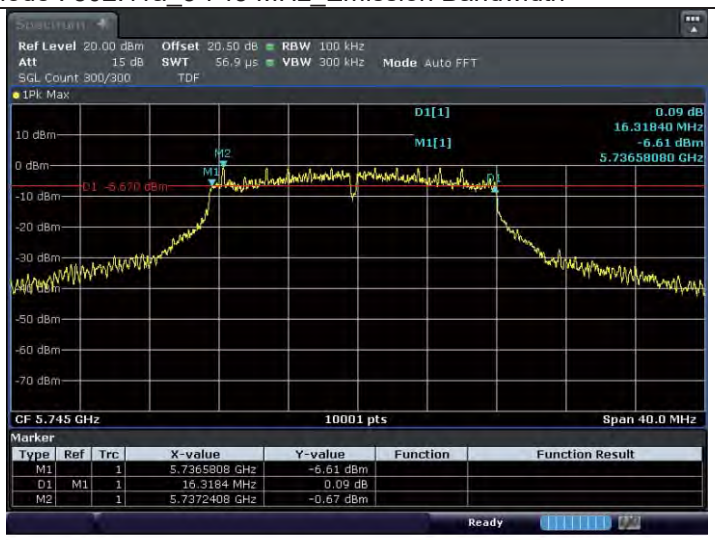
Test mode : 802.11a_5 320 MHz_Emission Bandwidth

Test mode : 802.11a_5 500 MHz_Emission Bandwidth

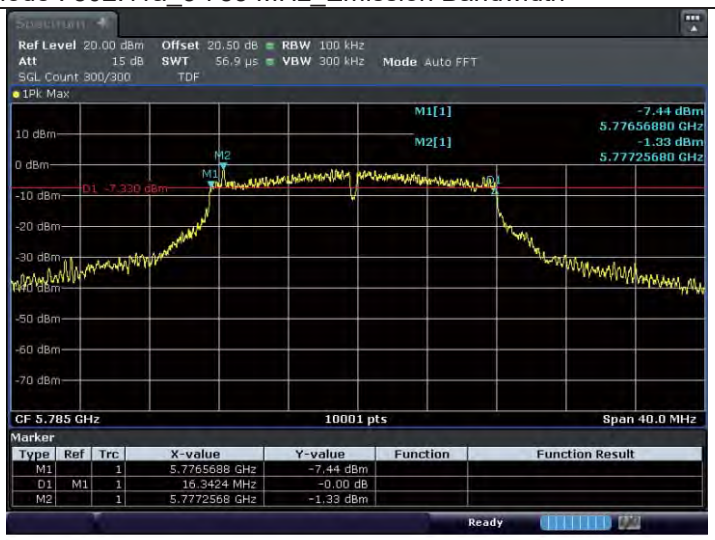
Test mode : 802.11a_5 580 MHz_Emission Bandwidth

Test mode : 802.11a_5 700 MHz_Emission Bandwidth

Test mode : 802.11a_5 745 MHz_Emission Bandwidth



Test mode : 802.11a_5 785 MHz_Emission Bandwidth



Test mode : 802.11a_5 825 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 180 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 200 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 240 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 260 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 300 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 320 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 500 MHz_Emission Bandwidth

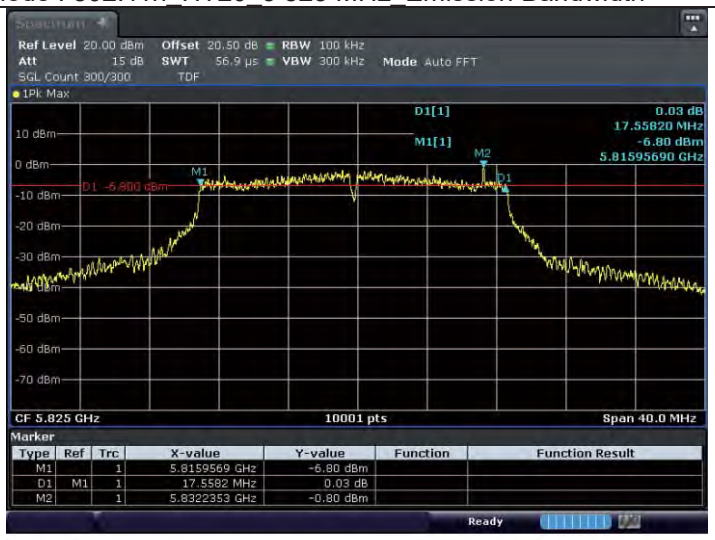
Test mode : 802.11n_HT20_5 580 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 700 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 745 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 785 MHz_Emission Bandwidth

Test mode : 802.11n_HT20_5 825 MHz_Emission Bandwidth



Test mode : 802.11n_HT40_5 190 MHz_Emission Bandwidth

Test mode : 802.11n_HT40_5 230 MHz_Emission Bandwidth

Test mode : 802.11n_HT40_5 270 MHz_Emission Bandwidth

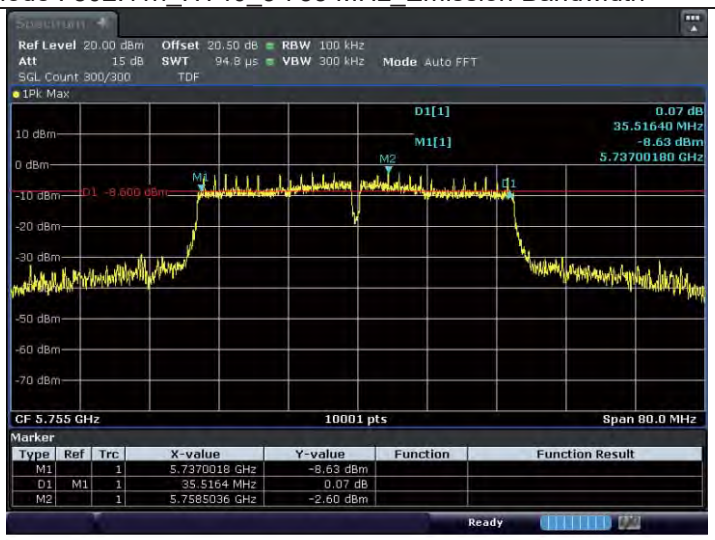
Test mode : 802.11n_HT40_5 310 MHz_Emission Bandwidth

Test mode : 802.11n_HT40_5 510 MHz_Emission Bandwidth

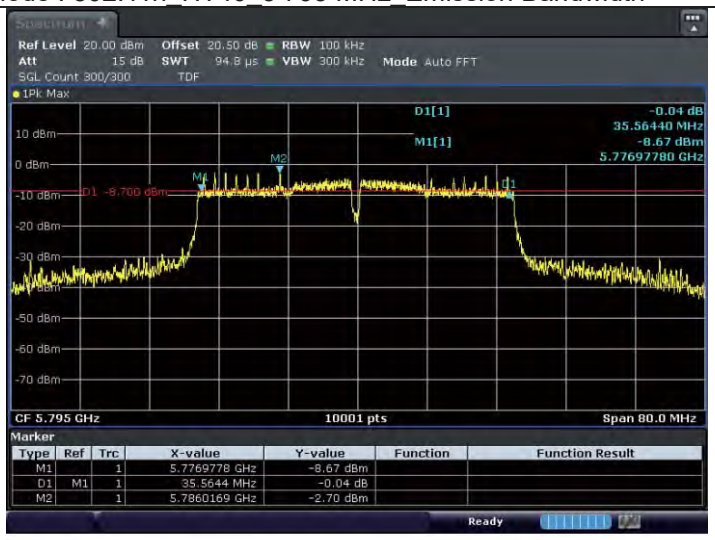
Test mode : 802.11n_HT40_5 550 MHz_Emission Bandwidth

Test mode : 802.11n_HT40_5 670 MHz_Emission Bandwidth

Test mode : 802.11n_HT40_5 755 MHz_Emission Bandwidth



Test mode : 802.11n_HT40_5 795 MHz_Emission Bandwidth



Test mode : 802.11ac_VHT20_5 180 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 200 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 240 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 260 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 300 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 320 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 500 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 580 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 700 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 745 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 785 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT20_5 825 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT40_5 190 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT40_5 230 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT40_5 270 MHz_Emission Bandwidth

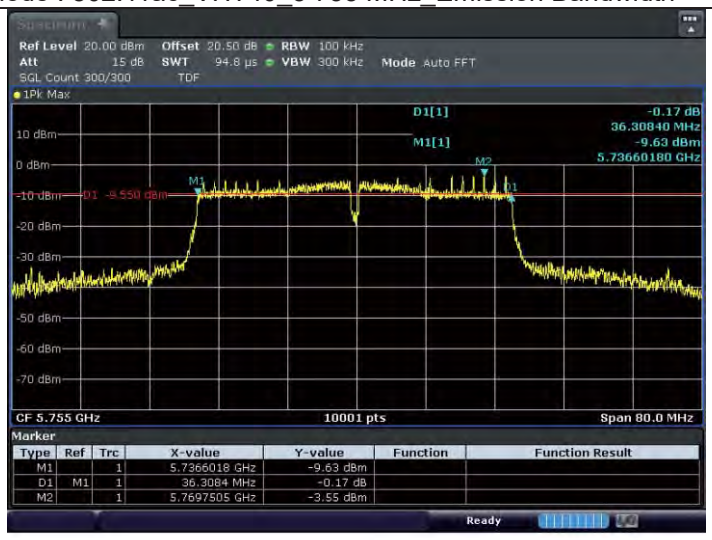
Test mode : 802.11ac_VHT40_5 310 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT40_5 510 MHz_Emission Bandwidth

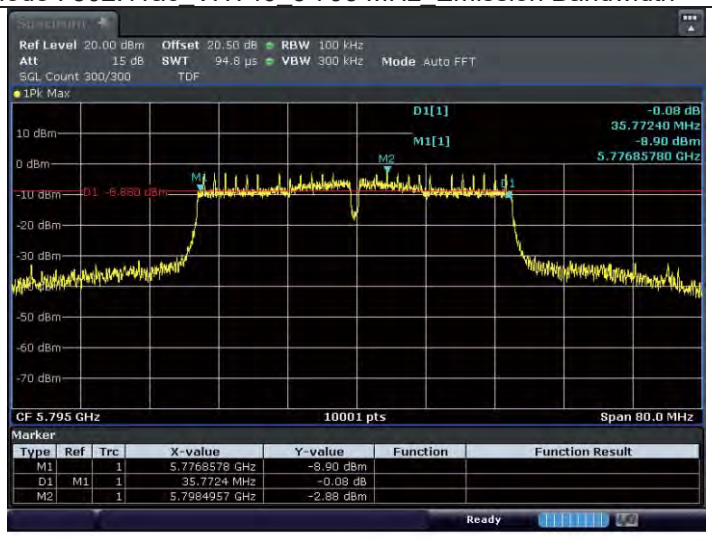
Test mode : 802.11ac_VHT40_5 550 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT40_5 670 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT40_5 755 MHz_Emission Bandwidth



Test mode : 802.11ac_VHT40_5 795 MHz_Emission Bandwidth



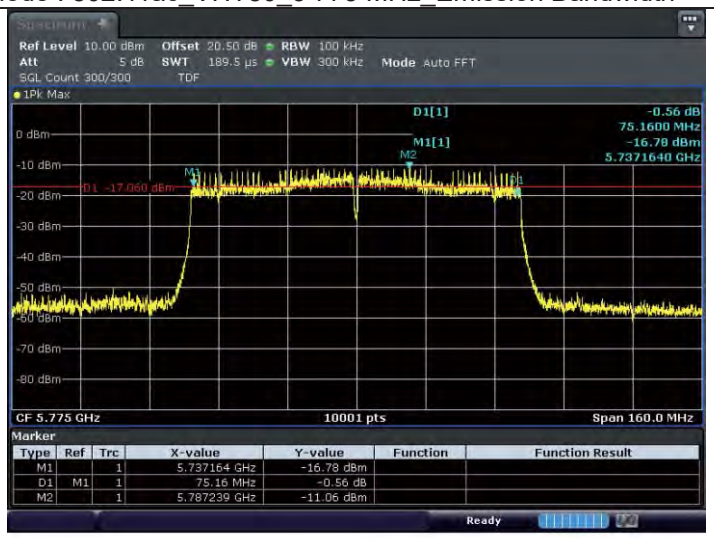
Test mode : 802.11ac_VHT80_5 210 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT80_5 290 MHz_Emission Bandwidth

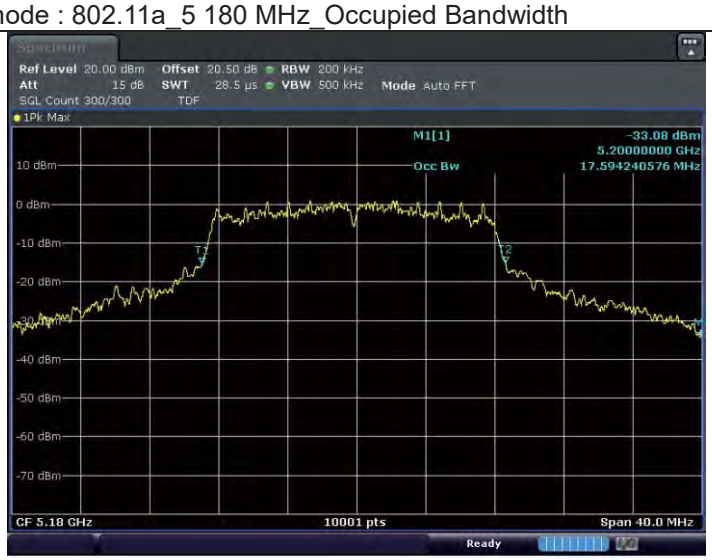
Test mode : 802.11ac_VHT80_5 530 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT80_5 690 MHz_Emission Bandwidth

Test mode : 802.11ac_VHT80_5 775 MHz_Emission Bandwidth



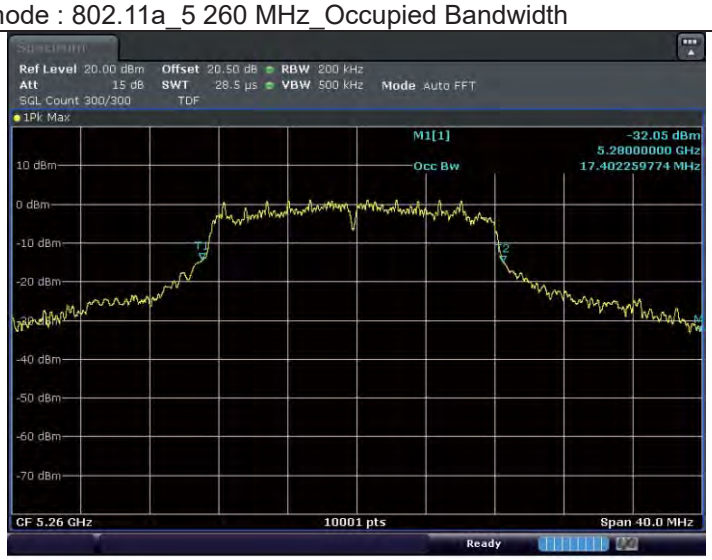
Test mode : 802.11a_5 180 MHz_Occupied Bandwidth



Test mode : 802.11a_5 200 MHz_Occupied Bandwidth

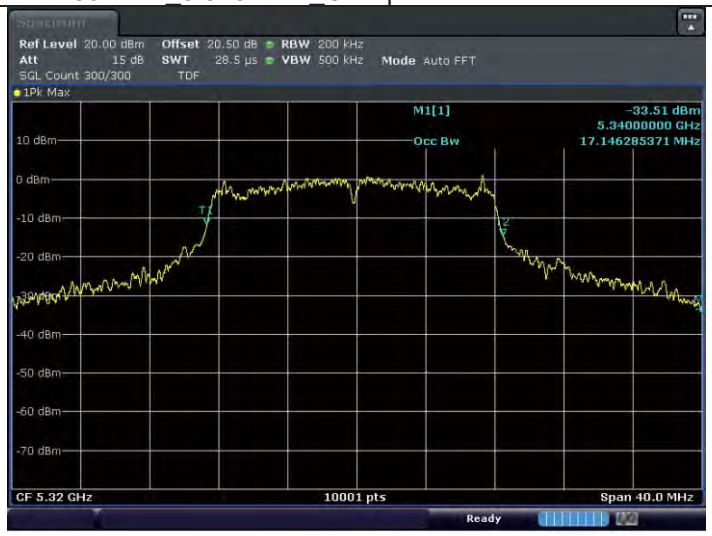
Test mode : 802.11a_5 240 MHz_Occupied Bandwidth

Test mode : 802.11a_5 260 MHz_Occupied Bandwidth

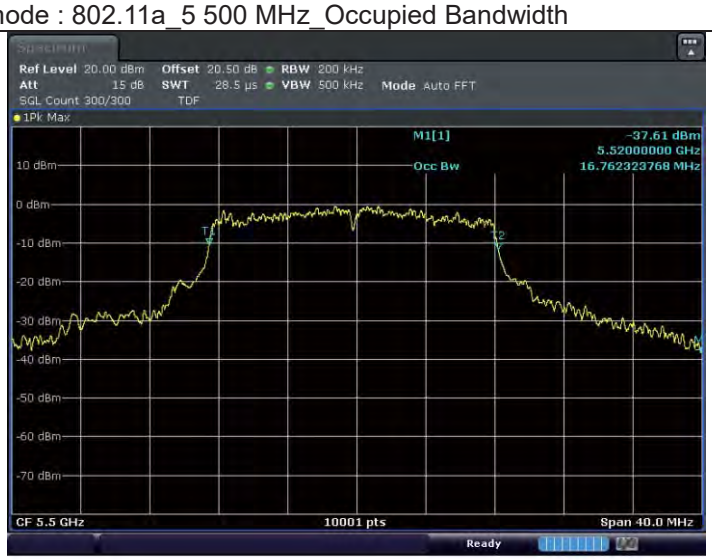


Test mode : 802.11a_5 300 MHz_Occupied Bandwidth

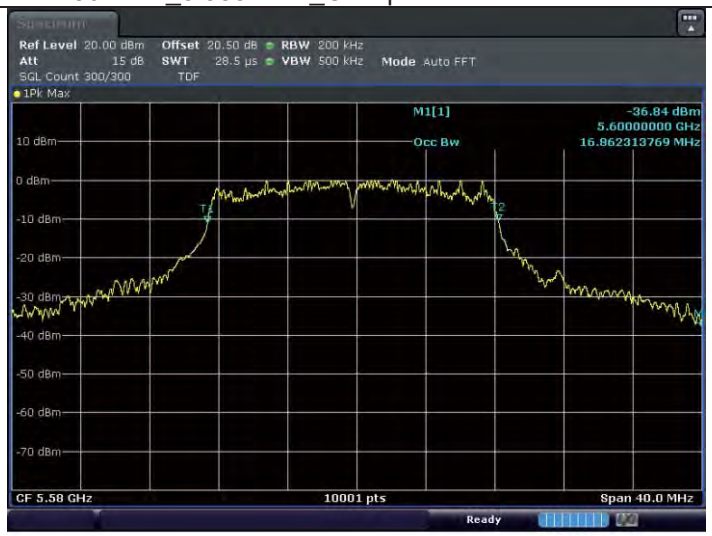
Test mode : 802.11a_5 320 MHz_Occupied Bandwidth



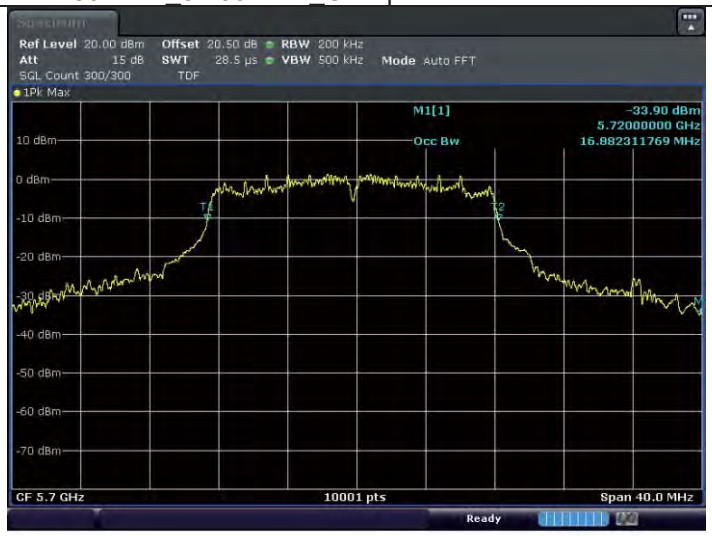
Test mode : 802.11a_5 500 MHz_Occupied Bandwidth



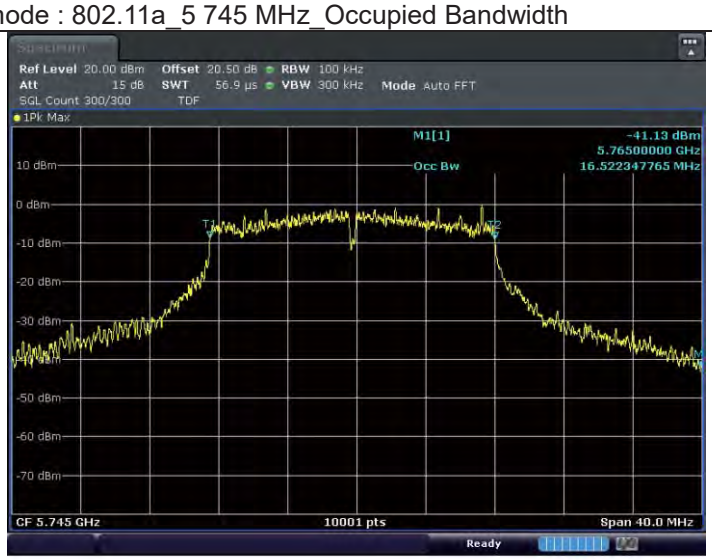
Test mode : 802.11a_5 580 MHz_Occupied Bandwidth



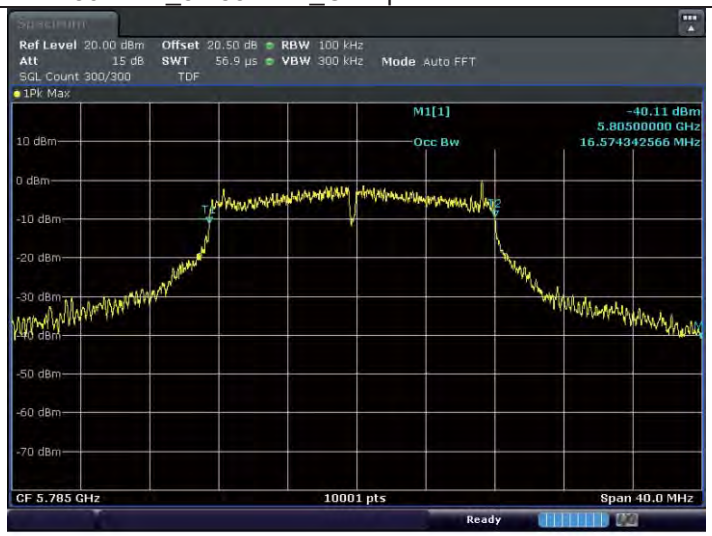
Test mode : 802.11a_5 700 MHz_Occupied Bandwidth



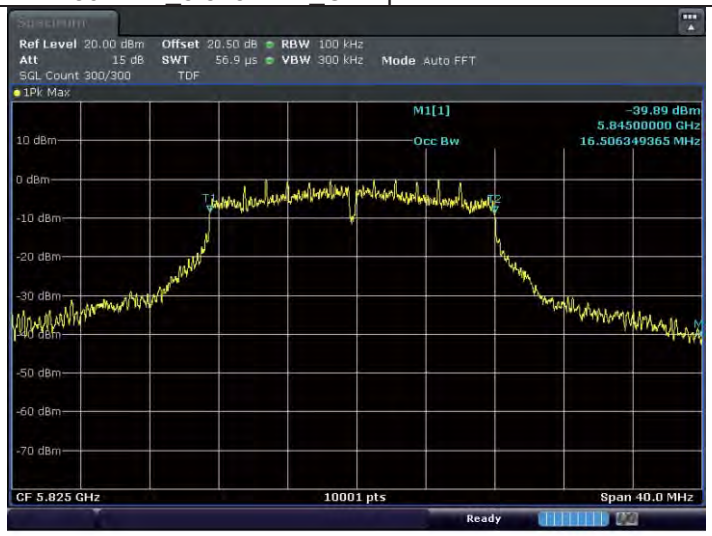
Test mode : 802.11a_5 745 MHz_Occupied Bandwidth



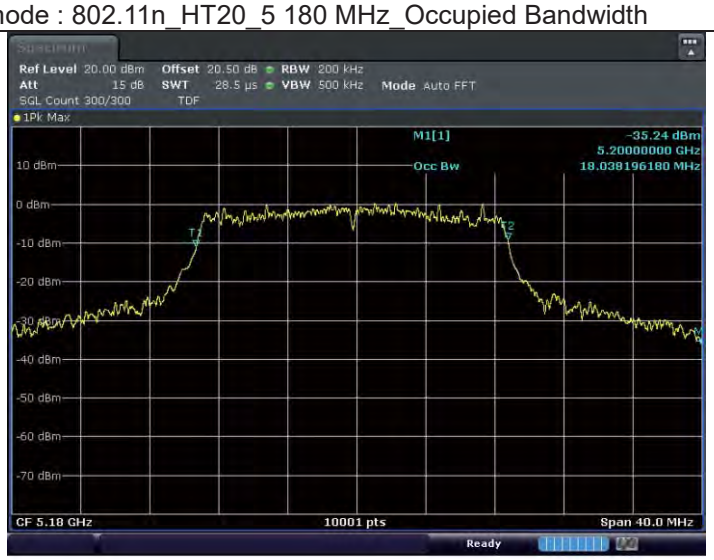
Test mode : 802.11a_5 785 MHz_Occupied Bandwidth



Test mode : 802.11a_5 825 MHz_Occupied Bandwidth

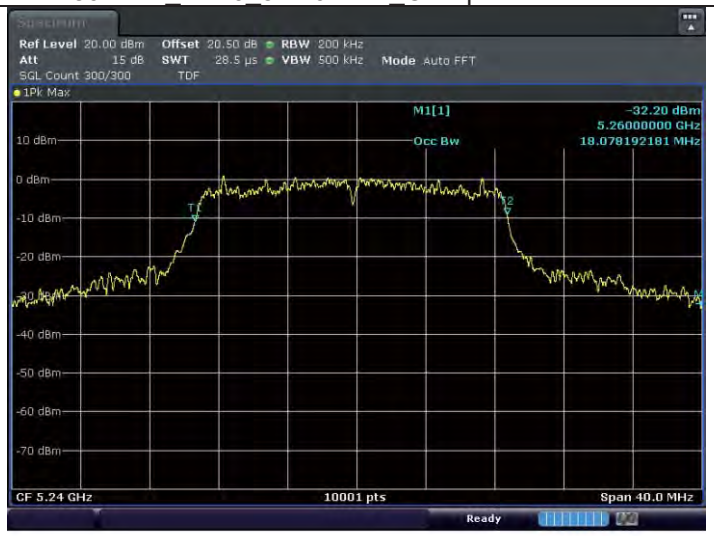


Test mode : 802.11n_HT20_5 180 MHz_Occupied Bandwidth

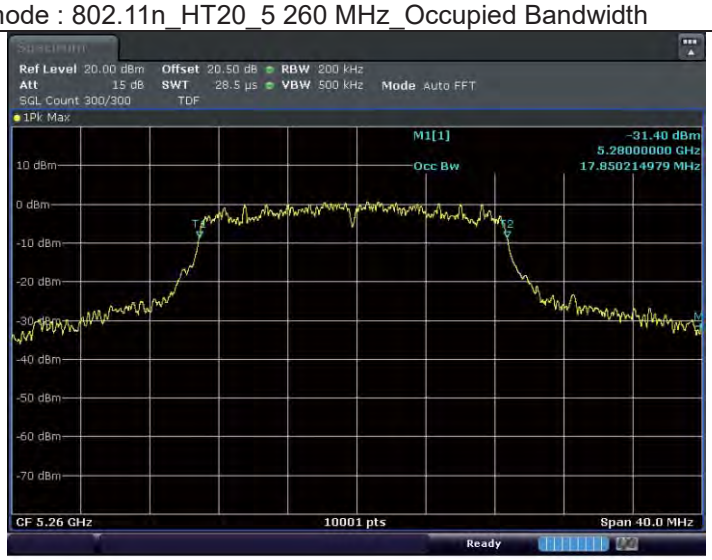


Test mode : 802.11n_HT20_5 200 MHz_Occupied Bandwidth

Test mode : 802.11n_HT20_5 240 MHz_Occupied Bandwidth



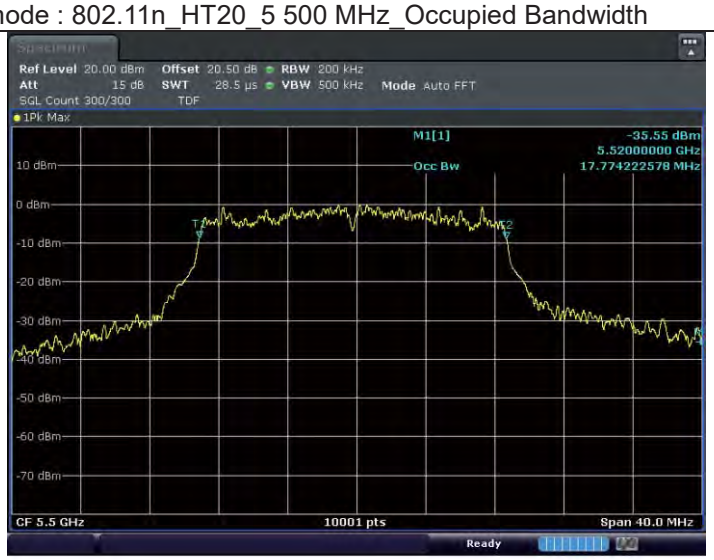
Test mode : 802.11n_HT20_5 260 MHz_Occupied Bandwidth



Test mode : 802.11n_HT20_5 300 MHz_Occupied Bandwidth

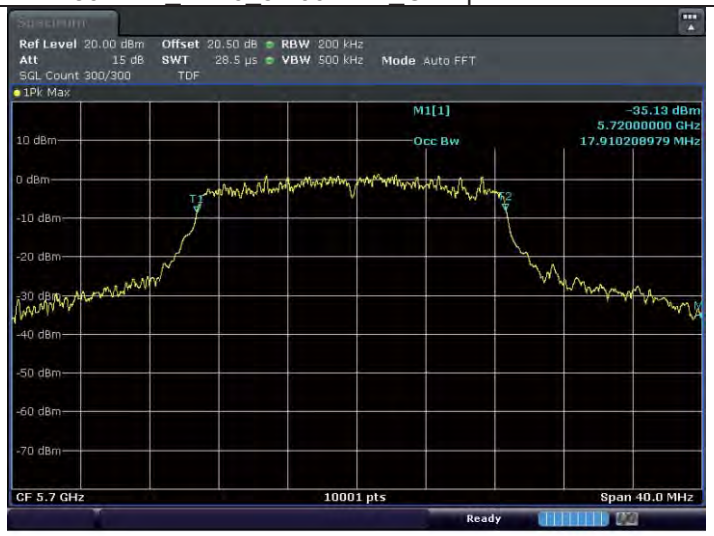
Test mode : 802.11n_HT20_5 320 MHz_Occupied Bandwidth

Test mode : 802.11n_HT20_5 500 MHz_Occupied Bandwidth

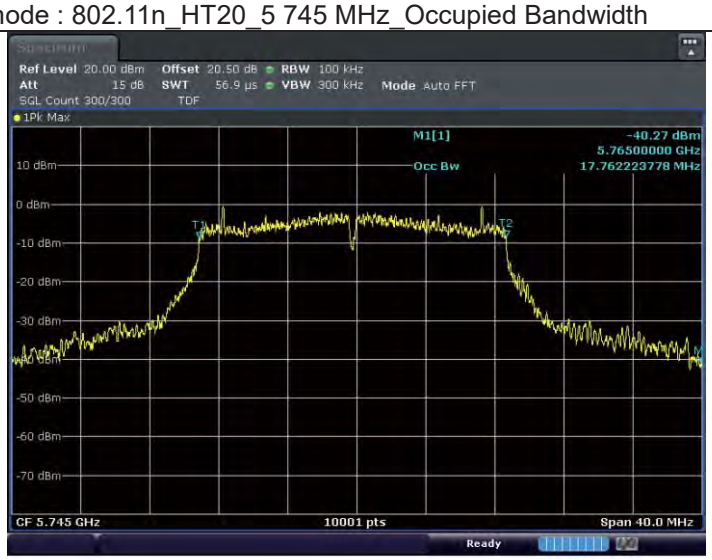


Test mode : 802.11n_HT20_5 580 MHz_Occupied Bandwidth

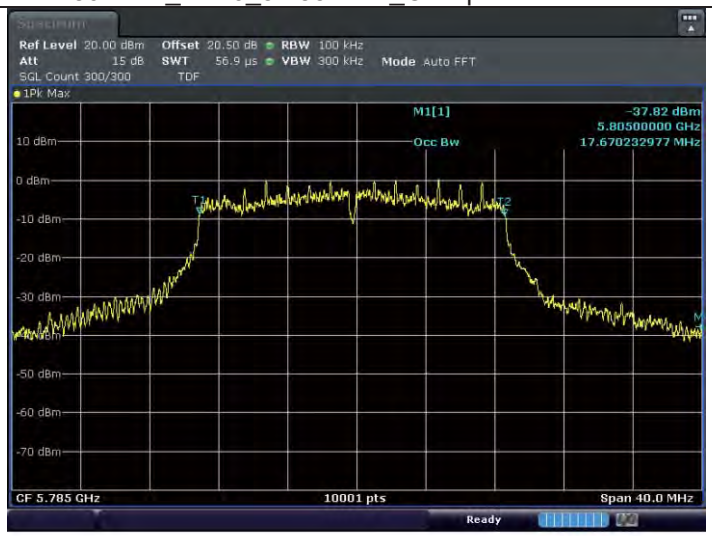
Test mode : 802.11n_HT20_5 700 MHz_Occupied Bandwidth



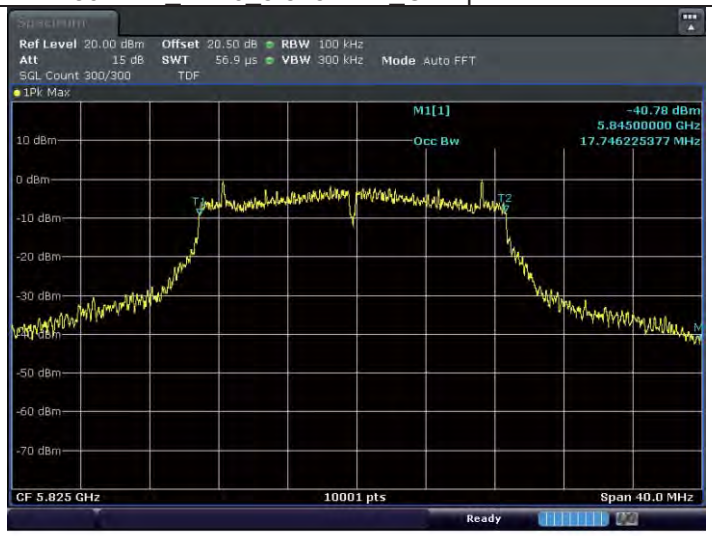
Test mode : 802.11n_HT20_5 745 MHz_Occupied Bandwidth



Test mode : 802.11n_HT20_5 785 MHz_Occupied Bandwidth



Test mode : 802.11n_HT20_5 825 MHz_Occupied Bandwidth

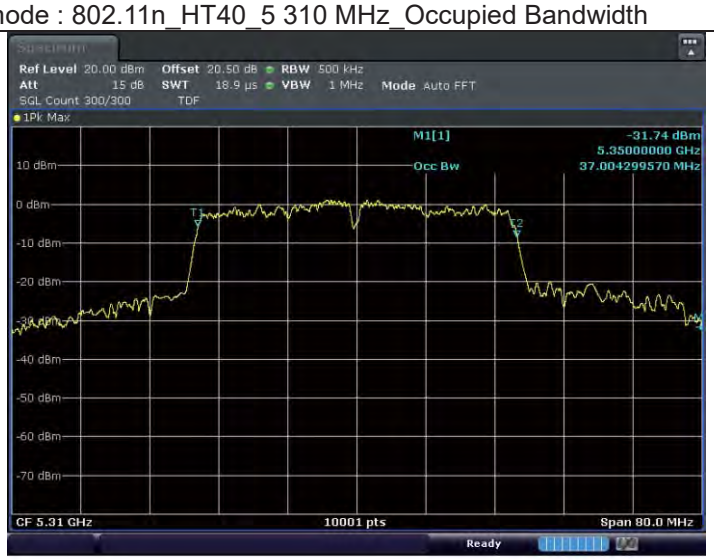


Test mode : 802.11n_HT40_5 190 MHz_Occupied Bandwidth

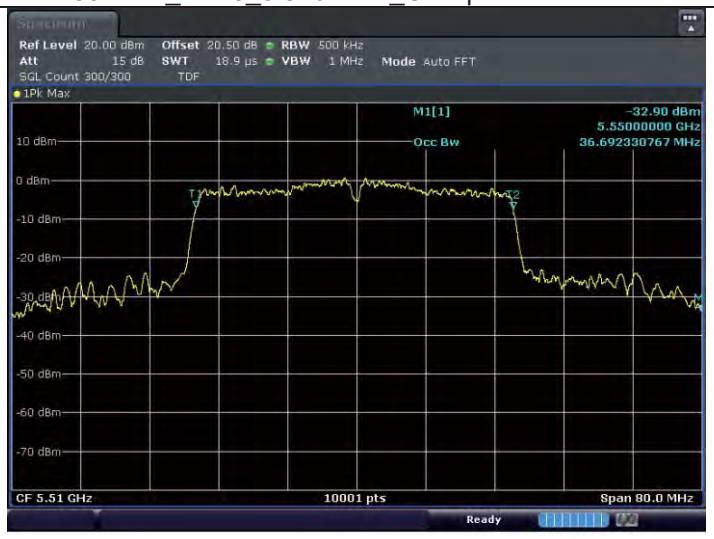
Test mode : 802.11n_HT40_5 230 MHz_Occupied Bandwidth

Test mode : 802.11n_HT40_5 270 MHz_Occupied Bandwidth

Test mode : 802.11n_HT40_5 310 MHz_Occupied Bandwidth

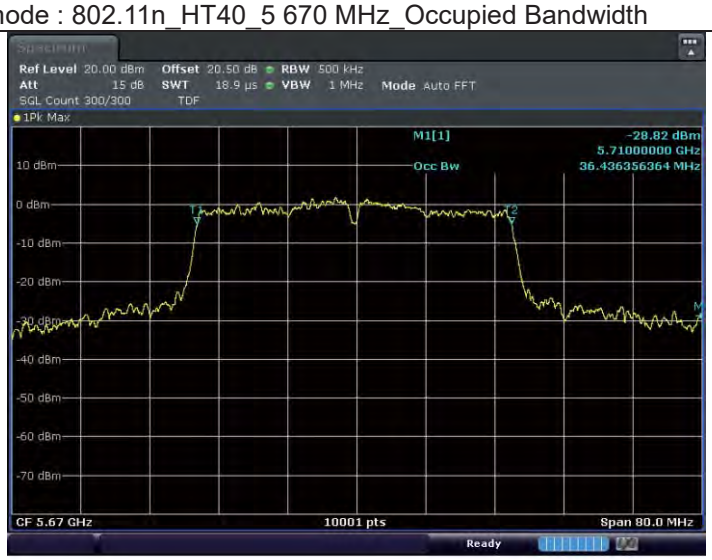


Test mode : 802.11n_HT40_5 510 MHz_Occupied Bandwidth

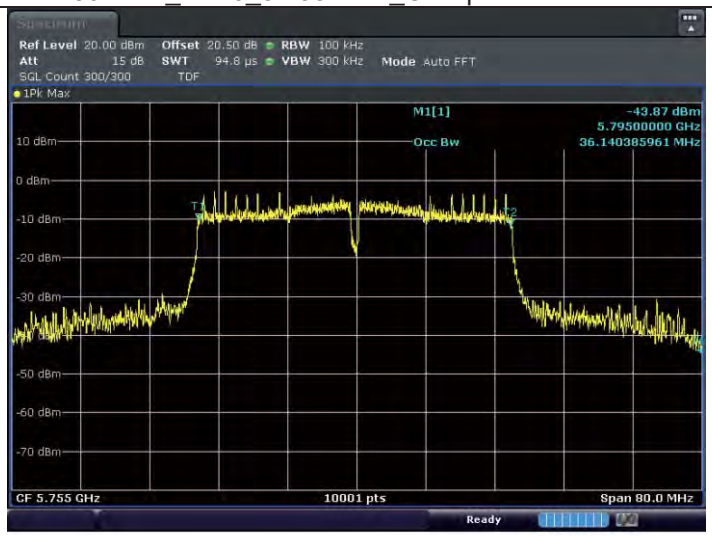


Test mode : 802.11n_HT40_5 550 MHz_Occupied Bandwidth

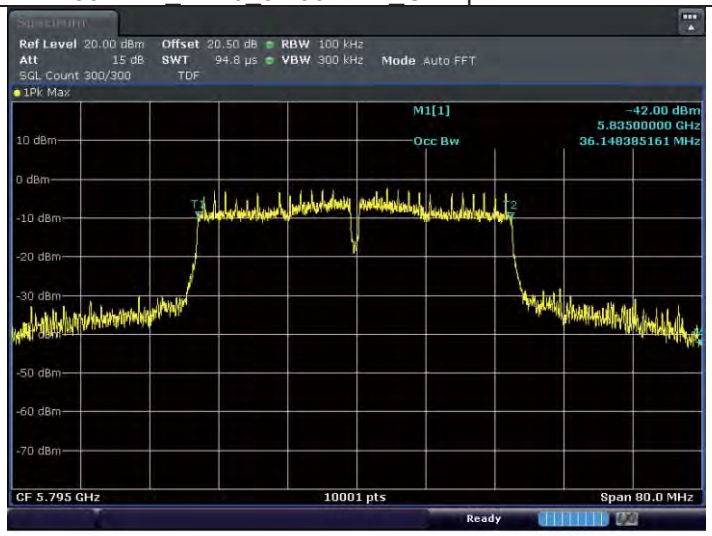
Test mode : 802.11n_HT40_5 670 MHz_Occupied Bandwidth



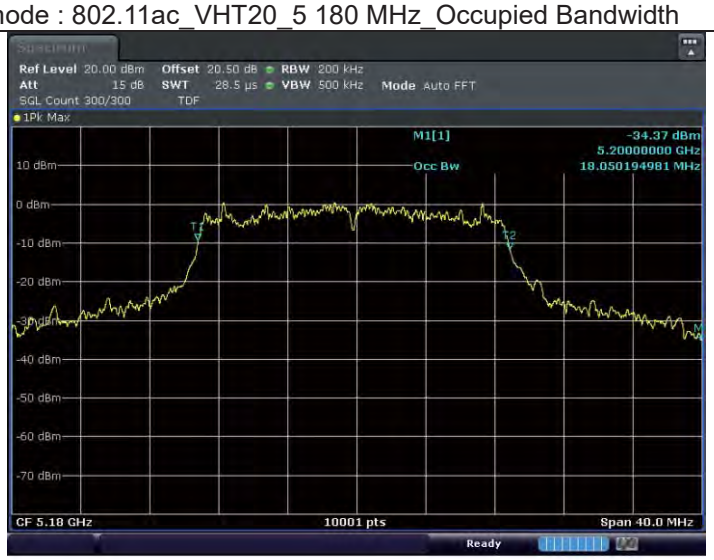
Test mode : 802.11n_HT40_5 755 MHz_Occupied Bandwidth



Test mode : 802.11n_HT40_5 795 MHz_Occupied Bandwidth

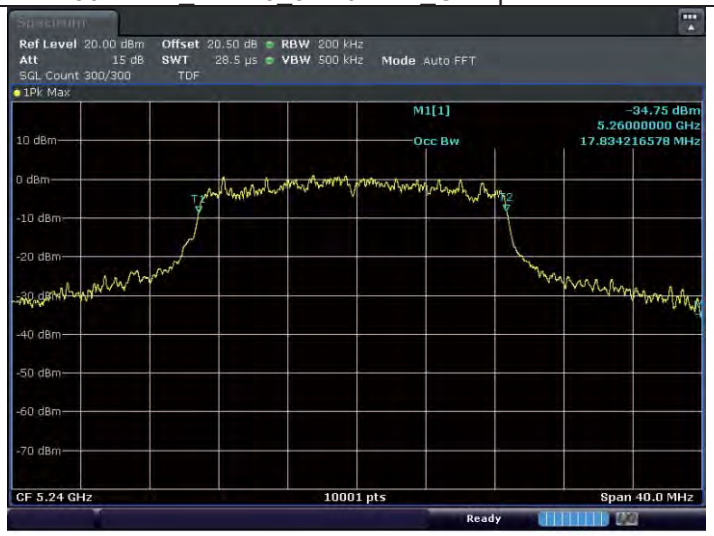


Test mode : 802.11ac_VHT20_5 180 MHz_Occupied Bandwidth

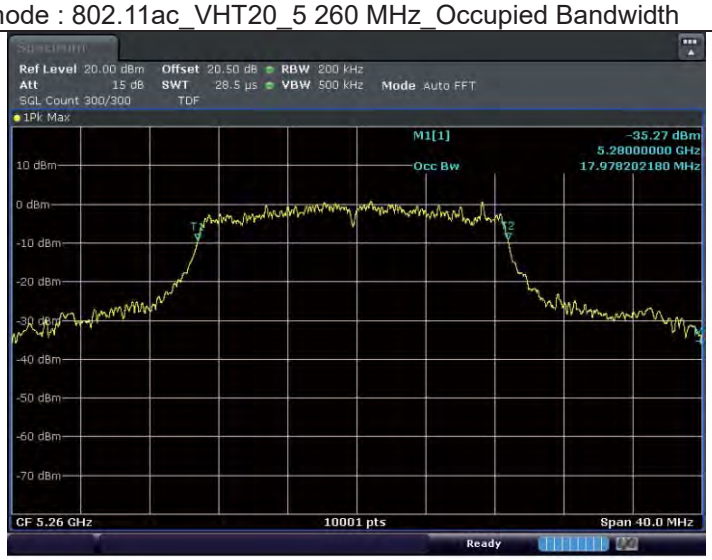


Test mode : 802.11ac_VHT20_5 200 MHz_Occupied Bandwidth

Test mode : 802.11ac_VHT20_5 240 MHz_Occupied Bandwidth

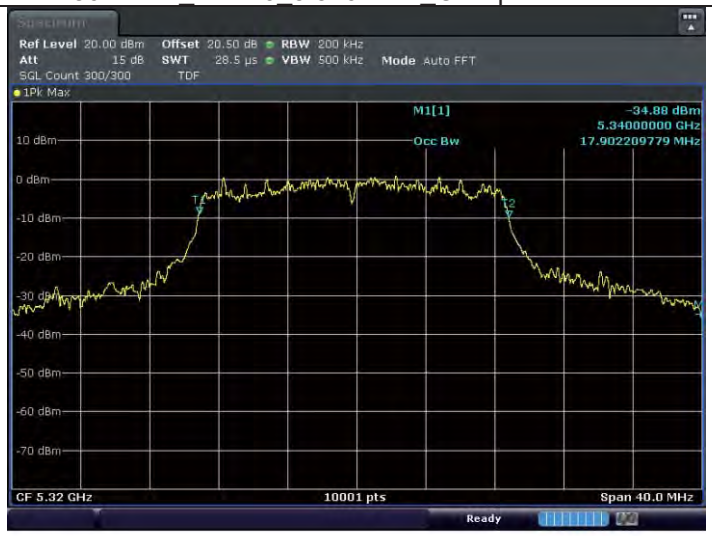


Test mode : 802.11ac_VHT20_5 260 MHz_Occupied Bandwidth

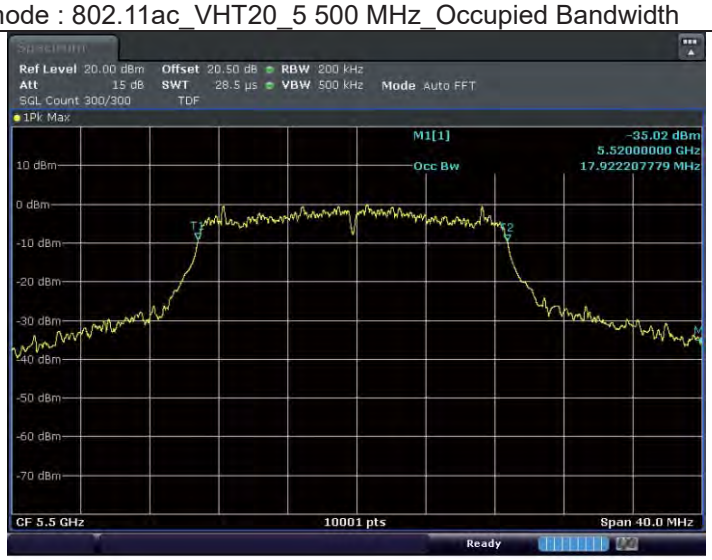


Test mode : 802.11ac_VHT20_5 300 MHz_Occupied Bandwidth

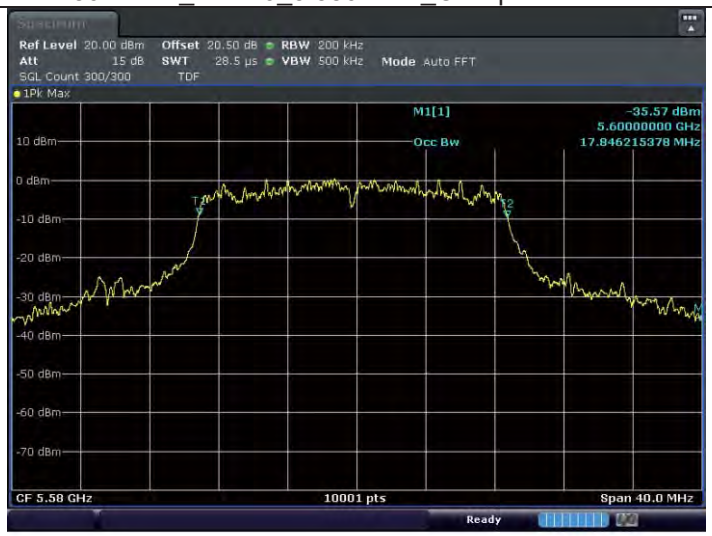
Test mode : 802.11ac_VHT20_5 320 MHz_Occupied Bandwidth



Test mode : 802.11ac_VHT20_5 500 MHz_Occupied Bandwidth

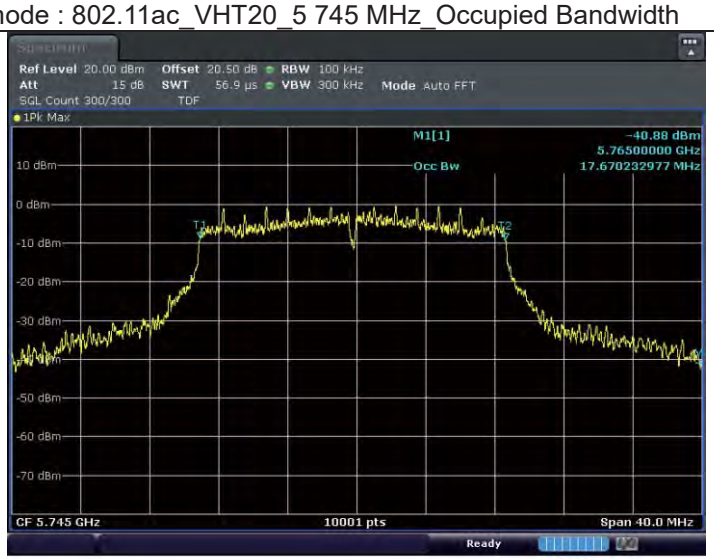


Test mode : 802.11ac_VHT20_5 580 MHz_Occupied Bandwidth

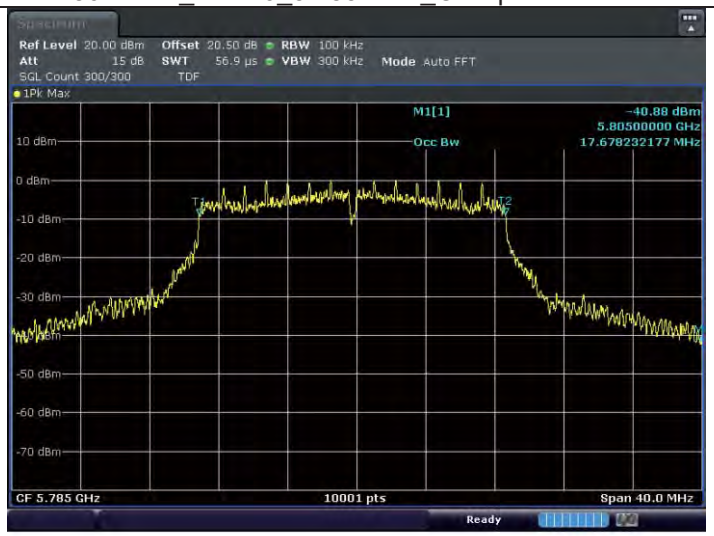


Test mode : 802.11ac_VHT20_5 700 MHz_Occupied Bandwidth

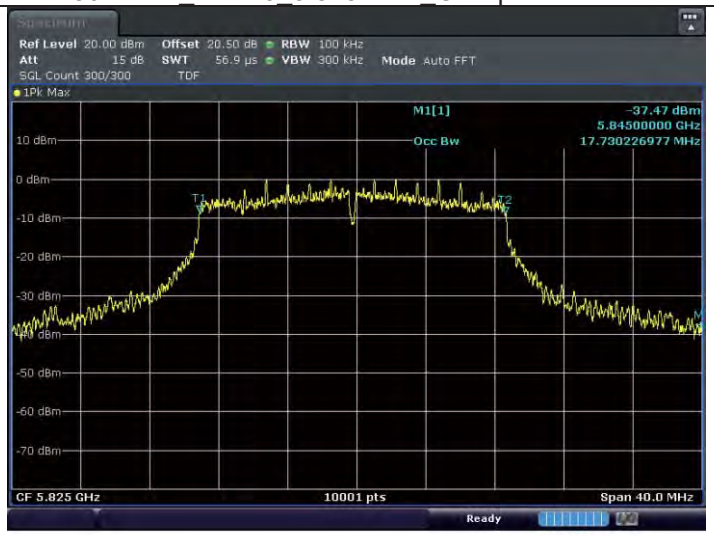
Test mode : 802.11ac_VHT20_5 745 MHz_Occupied Bandwidth



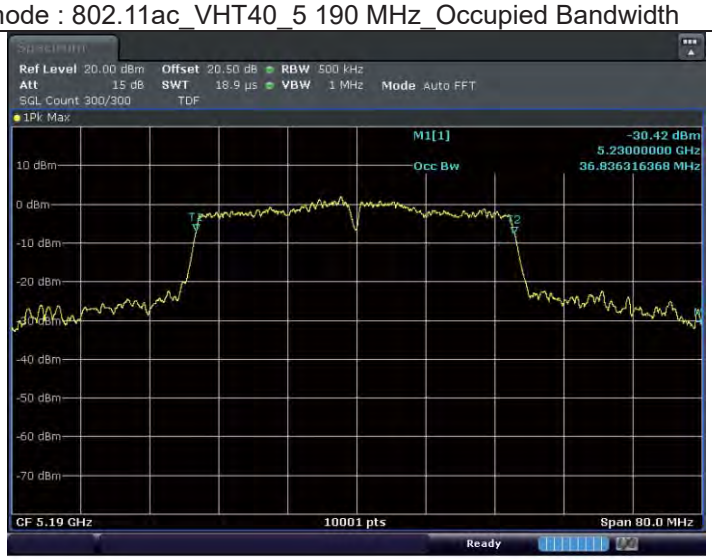
Test mode : 802.11ac_VHT20_5 785 MHz_Occupied Bandwidth



Test mode : 802.11ac_VHT20_5 825 MHz_Occupied Bandwidth



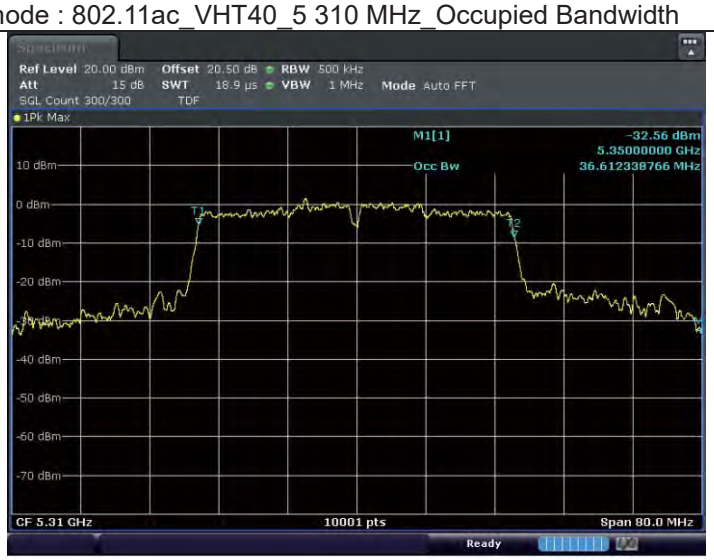
Test mode : 802.11ac_VHT40_5 190 MHz_Occupied Bandwidth



Test mode : 802.11ac_VHT40_5 230 MHz_Occupied Bandwidth

Test mode : 802.11ac_VHT40_5 270 MHz_Occupied Bandwidth

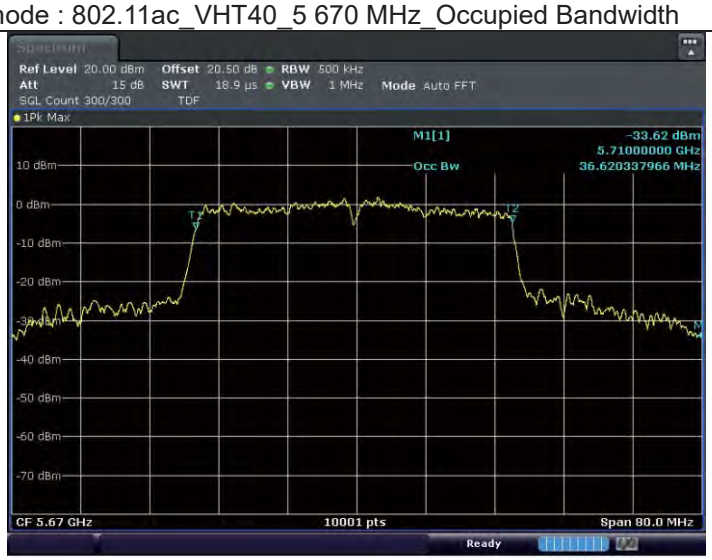
Test mode : 802.11ac_VHT40_5 310 MHz_Occupied Bandwidth



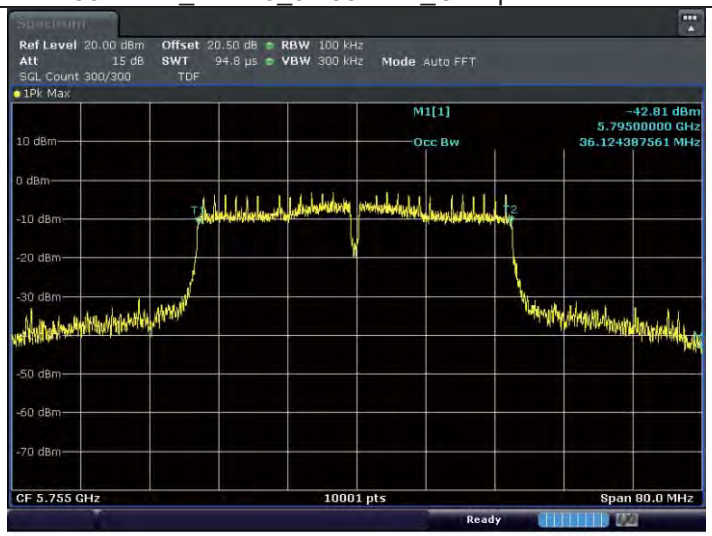
Test mode : 802.11ac_VHT40_5 510 MHz_Occupied Bandwidth

Test mode : 802.11ac_VHT40_5 550 MHz_Occupied Bandwidth

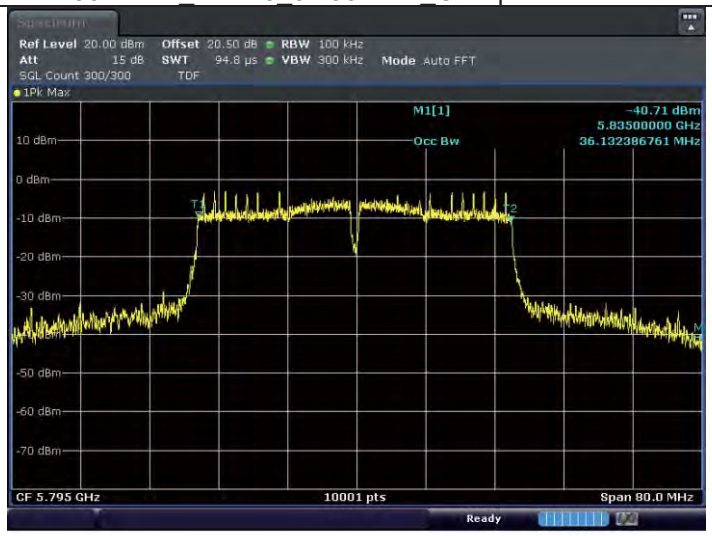
Test mode : 802.11ac_VHT40_5 670 MHz_Occupied Bandwidth



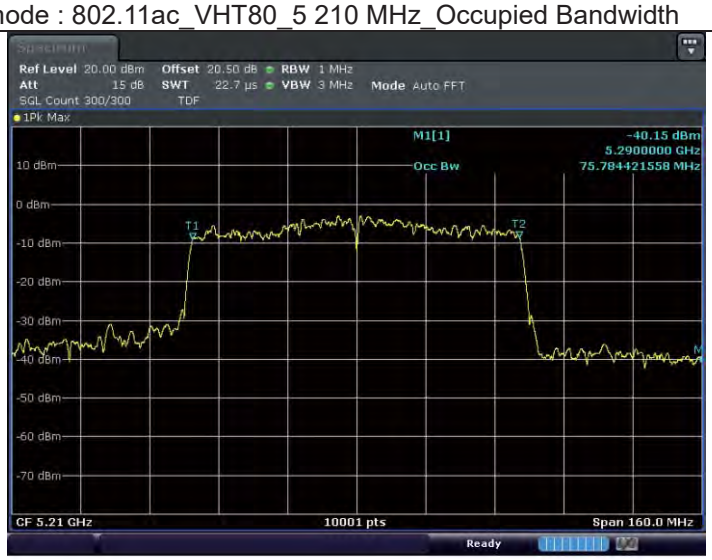
Test mode : 802.11ac_VHT40_5 755 MHz_Occupied Bandwidth



Test mode : 802.11ac_VHT40_5 795 MHz_Occupied Bandwidth



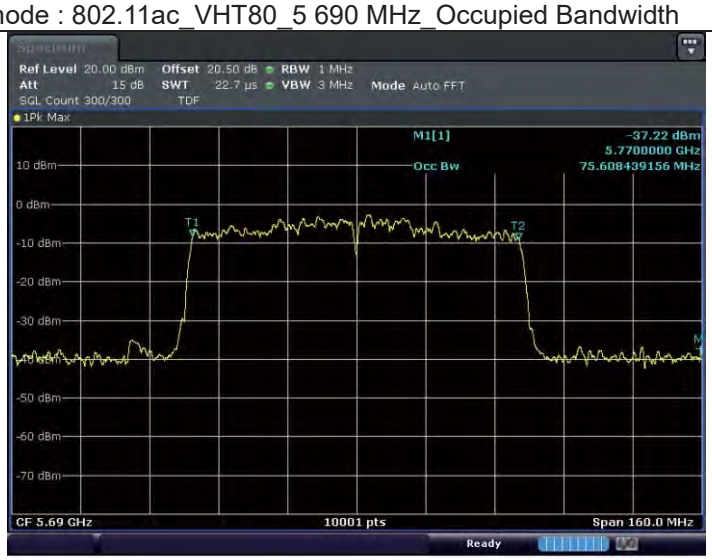
Test mode : 802.11ac_VHT80_5 210 MHz_Occupied Bandwidth



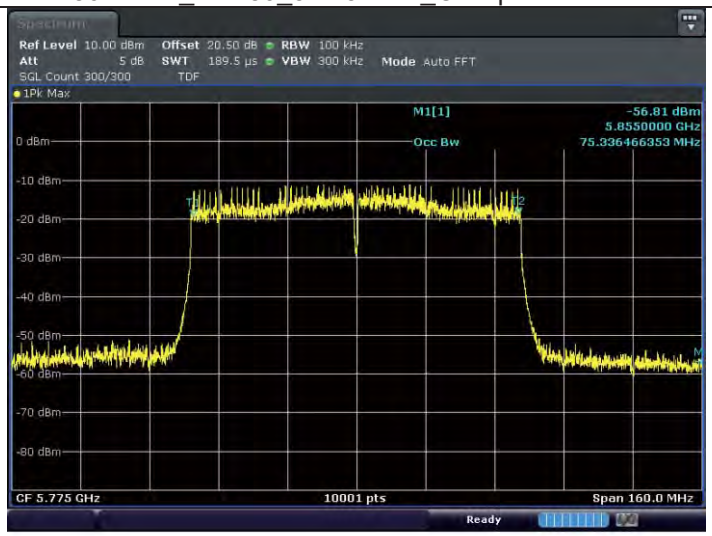
Test mode : 802.11ac_VHT80_5 290 MHz_Occupied Bandwidth

Test mode : 802.11ac_VHT80_5 530 MHz_Occupied Bandwidth

Test mode : 802.11ac_VHT80_5 690 MHz_Occupied Bandwidth



Test mode : 802.11ac_VHT80_5 775 MHz_Occupied Bandwidth



4.4.5 Frequency Stability

4.4.5.1 Regulation

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

According to RSS-GEN §6.11 Frequency stability is a measure of frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.

When the measurement method of transmitter frequency stability is not stated in the applicable RSS or reference standards, the following conditions apply:

(a)The reference temperature for radio transmitters is +20°C (+68°F).

(b)A hand-held device that is only capable of operating using internal batteries shall be tested at the battery's nominal voltage, and again at the battery's operating end-point voltage, which shall be specified by the equipment manufacturer. For this test, either a battery or an external power supply can be used.

(c)The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environmental test chamber, the unmodulated carrier frequency and frequency stability shall be measured under the conditions specified below for licensed and licence-exempt devices, unless specified otherwise in the applicable RSS. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement

4.4.5.2 Measurement Procedure

The frequency stability of the carrier frequency of the intentional radiator shall be maintained all conditions of normal operation as specified in the users manual. The frequency stability shall be maintained over a temperature variation of specified in the users manual at normal supply voltage, and over a variation in the primary supply voltage of specified in the users manual of the rated supply voltage at a temperature of 20 °C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage

1. The EUT was placed inside the environmental test chamber.
2. The temperature was incremented by 10 °C intervals from lowest temperature.
3. Each increase step of temperature measured the frequency.
4. The test temperature was set 20°C and the supply voltage was then adjusted on the EUT from 85 % to 115% and the frequency record.

4.4.5.3 Result

Comply (measurement data : refer to the next page)

4.4.5.4 Measurement data

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 180 MHz	-20	5 179 811 357	-0.004
	-10	5 179 805 507	-0.004
	0	5 179 800 728	-0.004
	10	5 179 783 357	-0.004
	20	5 179 770 365	-0.004
	30	5 179 762 228	-0.005
	40	5 179 760 095	-0.005
	50	5 179 760 115	-0.005
	Voltage(%)		
	85	5 179 769 913	-0.004
	115	5 179 770 268	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 200 MHz	-20	5 199 810 508	-0.004
	-10	5 199 804 847	-0.004
	0	5 199 799 997	-0.004
	10	5 199 782 442	-0.004
	20	5 199 769 520	-0.004
	30	5 199 761 328	-0.005
	40	5 199 759 172	-0.005
	50	5 199 761 502	-0.005
	Voltage(%)		
	85	5 199 769 128	-0.004
	115	5 199 769 324	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 240 MHz	-20	5 239 809 069	-0.004
	-10	5 239 803 458	-0.004
	0	5 239 798 439	-0.004
	10	5 239 780 716	-0.004
	20	5 239 767 752	-0.004
	30	5 239 759 536	-0.005
	40	5 239 757 298	-0.005
	50	5 239 761 849	-0.005
	Voltage(%)		
	85	5 239 767 363	-0.004
	115	5 239 767 583	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 260 MHz	-20	5 259 808 151	-0.004
	-10	5 259 802 682	-0.004
	0	5 259 797 537	-0.004
	10	5 259 779 827	-0.004
	20	5 259 766 679	-0.004
	30	5 259 758 541	-0.005
	40	5 259 756 629	-0.005
	50	5 259 761 630	-0.005
	Voltage(%)		
	85	5 259 766 473	-0.004
	115	5 259 766 611	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 300 MHz	-20	5 299 806 722	-0.004
	-10	5 299 801 187	-0.004
	0	5 299 795 965	-0.004
	10	5 299 778 166	-0.004
	20	5 299 764 717	-0.004
	30	5 299 756 787	-0.005
	40	5 299 754 625	-0.005
	50	5 299 759 950	-0.005
	Voltage(%)		
	85	5 299 764 749	-0.004
	115	5 299 764 773	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 320 MHz	-20	5 319 805 827	-0.004
	-10	5 319 800 450	-0.004
	0	5 319 795 242	-0.004
	10	5 319 777 388	-0.004
	20	5 319 763 855	-0.004
	30	5 319 755 810	-0.005
	40	5 319 753 791	-0.005
	50	5 319 759 499	-0.005
	Voltage(%)		
	85	5 319 763 889	-0.004
	115	5 319 763 947	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 500 MHz	-20	5 499 799 318	-0.004
	-10	5 499 793 886	-0.004
	0	5 499 788 334	-0.004
	10	5 499 769 733	-0.004
	20	5 499 756 003	-0.004
	30	5 499 747 554	-0.005
	40	5 499 745 386	-0.005
	50	5 499 752 577	-0.004
	Voltage(%)		
	85	5 499 755 971	-0.004
	115	5 499 755 919	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 580 MHz	-20	5 579 796 397	-0.004
	-10	5 579 791 008	-0.004
	0	5 579 785 082	-0.004
	10	5 579 766 604	-0.004
	20	5 579 752 484	-0.004
	30	5 579 743 926	-0.005
	40	5 579 741 585	-0.005
	50	5 579 748 871	-0.005
	Voltage(%)		
	85	5 579 752 523	-0.004
	115	5 579 752 396	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 700 MHz	-20	5 699 792 197	-0.004
	-10	5 699 786 770	-0.004
	0	5 699 780 432	-0.004
	10	5 699 762 195	-0.004
	20	5 699 747 194	-0.004
	30	5 699 738 356	-0.005
	40	5 699 735 872	-0.005
	50	5 699 743 773	-0.004
	Voltage(%)		
	85	5 699 747 139	-0.004
	115	5 699 747 047	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 745 MHz	-20	5 744 790 731	-0.004
	-10	5 744 785 067	-0.004
	0	5 744 778 876	-0.004
	10	5 744 760 016	-0.004
	20	5 744 745 194	-0.004
	30	5 744 736 469	-0.005
	40	5 744 734 193	-0.005
	50	5 744 742 297	-0.004
	Voltage(%)		
	85	5 744 745 178	-0.004
	115	5 744 745 074	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 785 MHz	-20	5 784 789 584	-0.004
	-10	5 784 783 495	-0.004
	0	5 784 777 450	-0.004
	10	5 784 758 276	-0.004
	20	5 784 743 471	-0.004
	30	5 784 734 618	-0.005
	40	5 784 731 522	-0.005
	50	5 784 740 549	-0.004
	Voltage(%)		
	85	5 784 743 532	-0.004
	115	5 784 743 316	-0.004

Test mode : 20 MHz Bandwidth(802.11a/n_HT20/ac_VHT20)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 825 MHz	-20	5 824 788 050	-0.004
	-10	5 824 782 039	-0.004
	0	5 824 775 877	-0.004
	10	5 824 756 628	-0.004
	20	5 824 741 740	-0.004
	30	5 824 732 848	-0.005
	40	5 824 730 111	-0.005
	50	5 824 739 005	-0.004
	Voltage(%)		
	85	5 824 741 722	-0.004
	115	5 824 741 583	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 190 MHz	-20	5 189 811 142	-0.004
	-10	5 189 805 647	-0.004
	0	5 189 800 209	-0.004
	10	5 189 782 553	-0.004
	20	5 189 770 135	-0.004
	30	5 189 761 931	-0.005
	40	5 189 759 864	-0.005
	50	5 189 767 703	-0.004
	Voltage(%)		
	85	5 189 769 919	-0.004
	115	5 189 769 847	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 230 MHz	-20	5 229 810 340	-0.004
	-10	5 229 804 178	-0.004
	0	5 229 798 785	-0.004
	10	5 229 780 967	-0.004
	20	5 229 768 386	-0.004
	30	5 229 760 114	-0.005
	40	5 229 757 860	-0.005
	50	5 229 766 196	-0.004
	Voltage(%)		
	85	5 229 768 149	-0.004
	115	5 229 768 027	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 270 MHz	-20	5 269 808 595	-0.004
	-10	5 269 802 589	-0.004
	0	5 269 797 152	-0.004
	10	5 269 779 188	-0.004
	20	5 269 766 529	-0.004
	30	5 269 758 289	-0.005
	40	5 269 756 169	-0.005
	50	5 269 764 206	-0.004
	Voltage(%)		
	85	5 269 766 360	-0.004
	115	5 269 766 247	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 310 MHz	-20	5 309 807 055	-0.004
	-10	5 309 801 006	-0.004
	0	5 309 795 825	-0.004
	10	5 309 777 477	-0.004
	20	5 309 764 744	-0.004
	30	5 309 756 484	-0.005
	40	5 309 754 326	-0.005
	50	5 309 762 541	-0.004
	Voltage(%)		
	85	5 309 764 569	-0.004
	115	5 309 764 447	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 510 MHz	-20	5 509 799 578	-0.004
	-10	5 509 793 575	-0.004
	0	5 509 788 135	-0.004
	10	5 509 769 283	-0.004
	20	5 509 755 932	-0.004
	30	5 509 747 201	-0.005
	40	5 509 744 765	-0.005
	50	5 509 754 313	-0.004
	Voltage(%)		
	85	5 509 755 783	-0.004
	115	5 509 755 685	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 550 MHz	-20	5 549 798 022	-0.004
	-10	5 549 792 133	-0.004
	0	5 549 786 500	-0.004
	10	5 549 767 605	-0.004
	20	5 549 754 206	-0.004
	30	5 549 745 373	-0.005
	40	5 549 742 863	-0.005
	50	5 549 752 202	-0.004
	Voltage(%)		
	85	5 549 754 050	-0.004
	115	5 549 753 885	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 670 MHz	-20	5 669 793 524	-0.004
	-10	5 669 787 569	-0.004
	0	5 669 781 919	-0.004
	10	5 669 762 351	-0.004
	20	5 669 748 870	-0.004
	30	5 669 739 892	-0.005
	40	5 669 737 392	-0.005
	50	5 669 747 002	-0.004
	Voltage(%)		
	85	5 669 748 694	-0.004
	115	5 669 748 540	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 755 MHz	-20	5 754 790 658	-0.004
	-10	5 754 784 411	-0.004
	0	5 754 778 650	-0.004
	10	5 754 758 950	-0.004
	20	5 754 745 155	-0.004
	30	5 754 736 094	-0.005
	40	5 754 733 809	-0.005
	50	5 754 743 407	-0.004
	Voltage(%)		
	85	5 754 744 951	-0.004
	115	5 754 744 830	-0.004

Test mode : 40 MHz Bandwidth(802.11n_HT40/ac_VHT40)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 795 MHz	-20	5 794 789 012	-0.004
	-10	5 794 782 921	-0.004
	0	5 794 777 189	-0.004
	10	5 794 757 343	-0.004
	20	5 794 743 397	-0.004
	30	5 794 734 272	-0.005
	40	5 794 731 975	-0.005
	50	5 794 741 646	-0.004
	Voltage(%)		
	85	5 794 743 206	-0.004
	115	5 794 743 078	-0.004

Test mode : 80 MHz Bandwidth(802.11ac_VHT80)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 210 MHz	-20	5 209 810 442	-0.004
	-10	5 209 803 925	-0.004
	0	5 209 799 588	-0.004
	10	5 209 781 608	-0.004
	20	5 209 769 387	-0.004
	30	5 209 761 210	-0.005
	40	5 209 758 927	-0.005
	50	5 209 768 287	-0.004
	Voltage(%)		
	85	5 209 769 446	-0.004
	115	5 209 769 528	-0.004

Test mode : 80 MHz Bandwidth(802.11ac_VHT80)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 290 MHz	-20	5 289 807 368	-0.004
	-10	5 289 800 769	-0.004
	0	5 289 796 418	-0.004
	10	5 289 778 274	-0.004
	20	5 289 765 730	-0.004
	30	5 289 757 282	-0.005
	40	5 289 755 528	-0.005
	50	5 289 764 565	-0.004
	Voltage(%)		
	85	5 289 765 834	-0.004
	115	5 289 765 906	-0.004

Test mode : 80 MHz Bandwidth(802.11ac_VHT80)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 530 MHz	-20	5 529 798 562	-0.004
	-10	5 529 791 822	-0.004
	0	5 529 787 032	-0.004
	10	5 529 768 404	-0.004
	20	5 529 755 199	-0.004
	30	5 529 746 243	-0.005
	40	5 529 744 053	-0.005
	50	5 529 753 850	-0.004
	Voltage(%)		
	85	5 529 755 318	-0.004
	115	5 529 755 295	-0.004

Test mode : 80 MHz Bandwidth(802.11ac_VHT80)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 690 MHz	-20	5 689 792 607	-0.004
	-10	5 689 786 294	-0.004
	0	5 689 780 840	-0.004
	10	5 689 761 972	-0.004
	20	5 689 748 058	-0.004
	30	5 689 738 818	-0.005
	40	5 689 736 674	-0.005
	50	5 689 746 753	-0.004
	Voltage(%)		
	85	5 689 748 154	-0.004
	115	5 689 748 230	-0.004

Test mode : 80 MHz Bandwidth(802.11ac_VHT80)

Frequency (MHz)	Temp (℃)	Center Frequency (Hz)	Tolerance (%)
5 775 MHz	-20	5 774 789 793	-0.004
	-10	5 774 783 072	-0.004
	0	5 774 777 859	-0.004
	10	5 774 758 372	-0.004
	20	5 774 744 353	-0.004
	30	5 774 735 112	-0.005
	40	5 774 733 125	-0.005
	50	5 774 743 385	-0.004
	Voltage(%)		
	85	5 774 744 476	-0.004
	115	5 774 744 536	-0.004

4.4.6 Dynamic Frequency Selection

4.4.6.1 Regulation

According to §15.407(h) and RSS-247 6.3 Dynamic Frequency Selection (DFS).

(2) Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W is −64 dBm. For devices that operate with less than 200 mW e.i.r.p. and a power spectral density of less than 10 dBm in a 1 MHz band, the minimum detection threshold is −62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

(i) Operational Modes. The DFS requirement applies to the following operational modes:
(A) The requirement for channel availability check time applies in the master operational mode.
(B) The requirement for channel move time applies in both the master and slave operational modes.

(ii) Channel Availability Check Time. A U-NII device shall check if there is a radar system already operating on the channel before it can initiate a transmission on a channel and when it has to move to a new channel. The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values listed in paragraph (h)(2) of this section, is detected within 60 seconds.

(iii) Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

(iv) Non-occupancy Period. A channel that has been flagged as containing a radar system, either by a channel availability check or in-service monitoring, is subject to a non-occupancy period of at least 30 minutes. The non-occupancy period starts at the time when the radar system is detected.

(i) Device Security. All U-NII devices must contain security features to protect against modification of software by unauthorized parties.

(1) Manufacturers must implement security features in any digitally modulated devices capable of operating in any of the U-NII bands, so that third parties are not able to reprogram the device to operate outside the parameters for which the device was certified. The software must prevent the user from operating the transmitter with operating frequencies, output power, modulation types or other radio frequency parameters outside those that were approved for the device. Manufacturers may use means including, but not limited to the use of a private network that allows only authenticated users to download software, electronic signatures in software or coding in hardware that is decoded by software to verify that new software can be legally loaded into a device to meet these requirements and must describe the methods in their application for equipment authorization.

(2) Manufacturers must take steps to ensure that DFS functionality cannot be disabled by the operator of the U-NII device.

TECHNICAL REQUIREMENTS FOR DFS IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS

Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

DFS Detection Thresholds

below provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP ≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

Response Requirements

provides the response requirements for Master and Client Devices incorporating DFS

DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

RADAR TEST WAVEFORMS

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

Short Pulse Radar Test Waveforms

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066 µsec is selected, the number of pulses would be $\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{3066}\right)\right\} = \text{Round up}\ \{17.2\} = 18.$

Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4.

Long Pulse Radar Test Waveform

Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

Frequency Hopping Radar Test Waveform

Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μsec)	PRI (μsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	30	70%	30

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

4.4.6.2 Client Devices requreiment

a) A Client Device will not transmit before having received appropriate control signals from a Master Device.

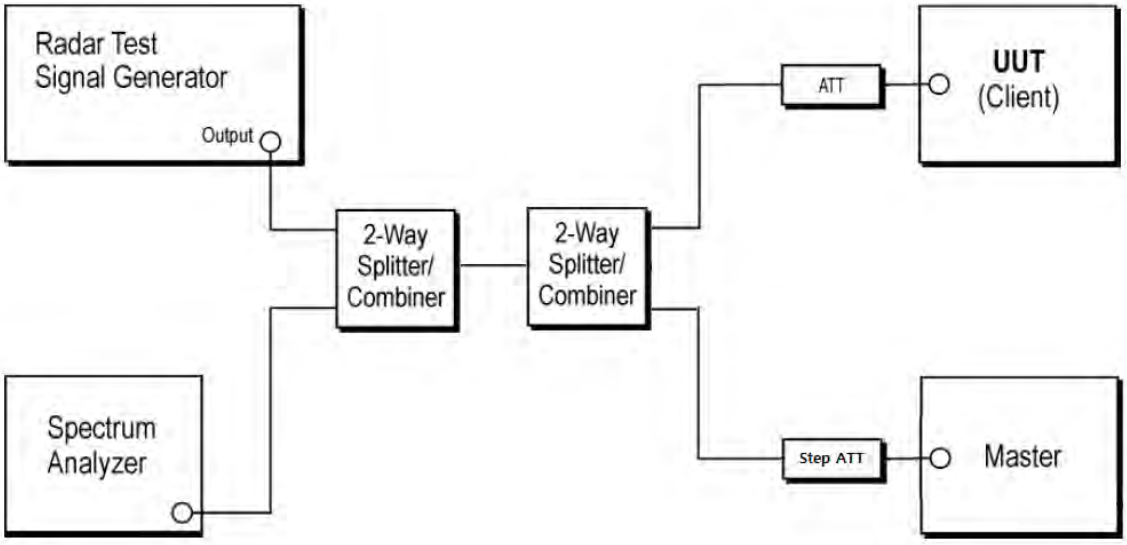
b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.

c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.

d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.

e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear.

4.4.6.3 Conduct test setup



4.4.6.4 In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

4.4.6.4.1 Measurement Procedure

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device (In- Service Monitoring).

a) One frequency will be chosen from the Operating Channels of the UUT within the 5250-5350 MHz or 5470-5725 MHz bands. For 802.11 devices, the test frequency must contain control signals. This can be verified by disabling channel loading and monitoring the spectrum analyzer. If no control signals are detected, another frequency must be selected within the emission bandwidth where control signals are detected.

b) In case the UUT is a U-NII device operating as a Client Device (with or without DFS), a U-NII device operating as a Master Device will be used to allow the UUT (Client device) to Associate with the Master Device. In case the UUT is a Master Device, a U-NII device operating as a Client Device will be used and it is assumed that the Client will Associate with the UUT (Master). In both cases for conducted tests, the Radar Waveform generator will be connected to the Master Device. For radiated tests, the emissions of the Radar Waveform generator will be directed towards the Master Device. If the Master Device has antenna gain, the main beam of the antenna will be directed toward the radar emitter. Vertical polarization is used for testing.

c) Stream the channel loading test file from the Master Device to the Client Device on the test Channel for the entire period of the test.

d) At time T0 the Radar Waveform generator sends a Burst of pulses for one of the Radar Type 0 in Table 5 at levels defined in Table 3, on the Operating Channel. An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors.

e) Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Measure and record the Channel Move Time and Channel Closing Transmission Time if radar detection occurs. Figure 17 illustrates Channel Closing Transmission Time.

f) When operating as a Master Device, monitor the UUT for more than 30 minutes following instant T2 to verify that the UUT does not resume any transmissions on this Channel. Perform this test once and record the measurement result.

g) In case the UUT is a U-NII device operating as a Client Device with In-Service Monitoring, perform steps a) to f).

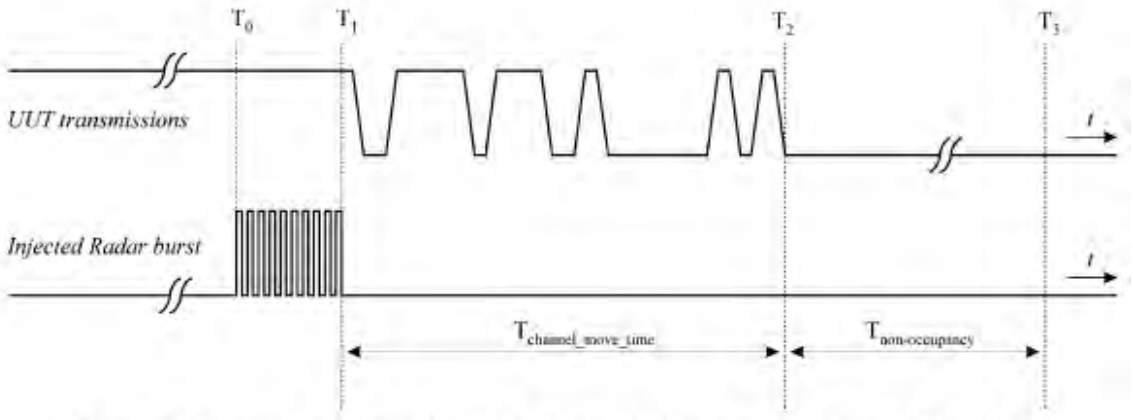


Figure 17: Example of Channel Closing Transmission Time & Channel Closing Time

4.4.6.4.2 Result

Comply
(This device is Client Device without radar detection)

4.4.6.4.3 Measurement data

Client Device without radar detection

Channel Move Time			
Bandwidth (MHz)	Frequency (MHz)	Channel Move Time (s)	Limit (s)
80	5 290	4.00	10.00
	5 530	4.08	10.00

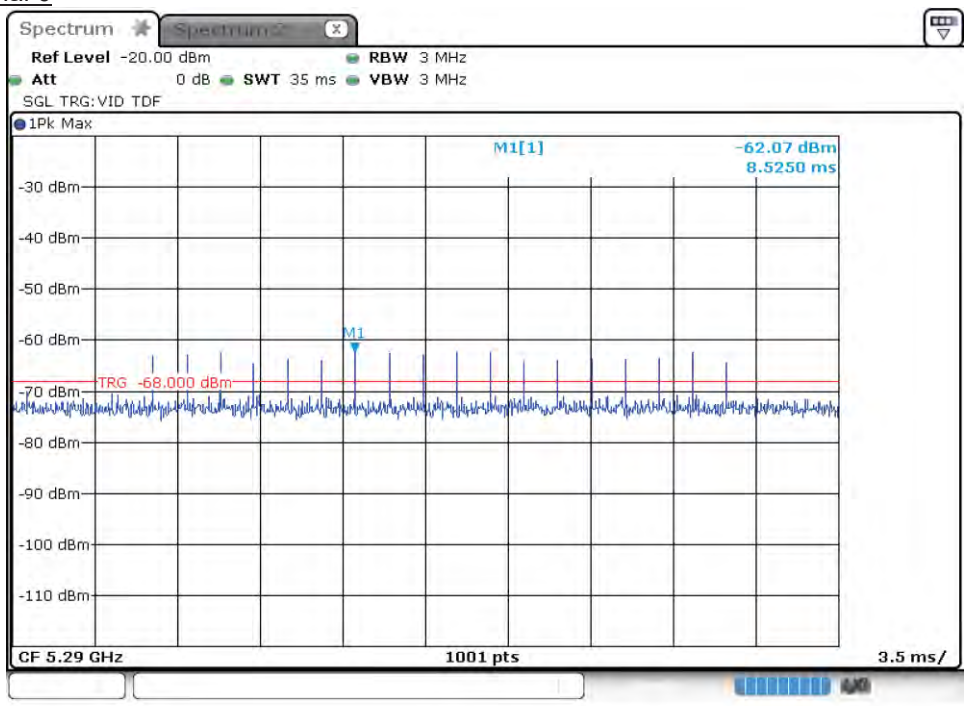
Channel Closing Transmission Time			
Bandwidth (MHz)	Frequency (MHz)	Channel Closing Transmission Time (ms)	Limit (ms)
80	5 290	22.00	60.00
	5 530	18.00	60.00

Note : In case of Channel Close Transmission Time, ASC II trace data was exported to Excel and calculated.

Non-Occupancy Period			
Bandwidth (MHz)	Frequency (MHz)	Non-Occupancy Period (min)	Limit (min)
80	5 290	> 30	30
	5 530	> 30	30

4.4.6.4.4 Test Plot_DFS Detection Threshold

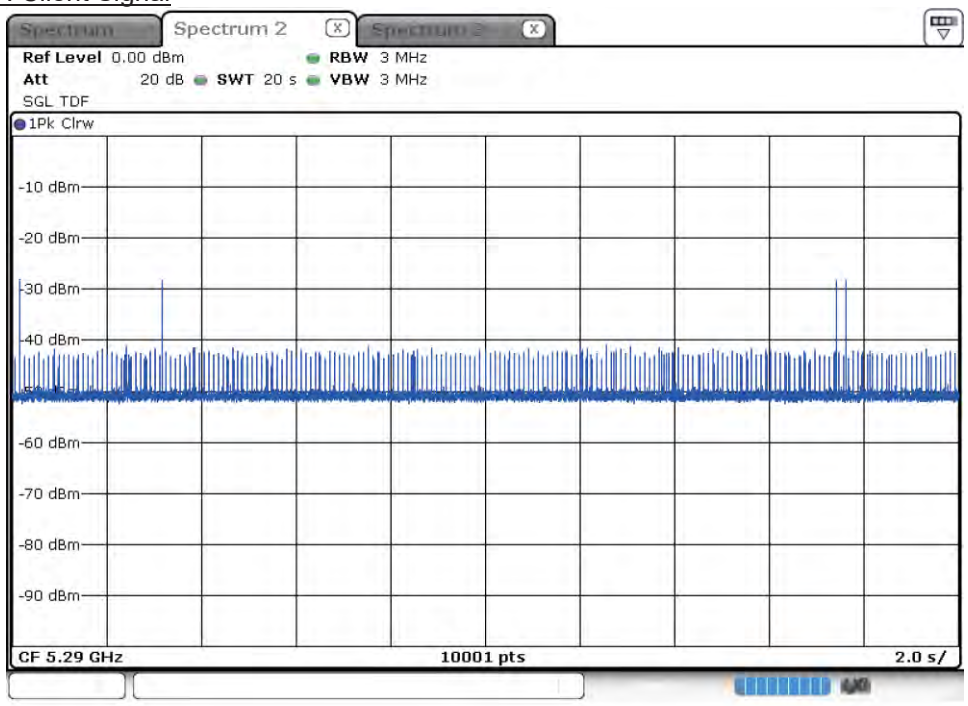
Radar Signal 0



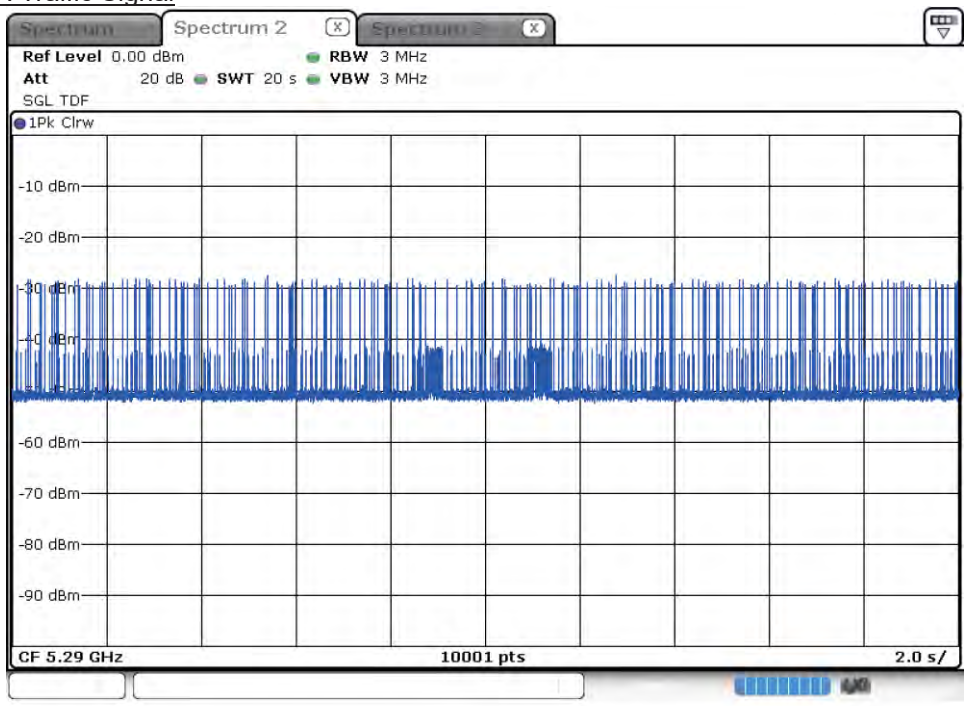
Note : The Interference Radar Detection Threshold Level is -62.00 dBm.
The tested level is lower than required level hence it provides margin to the limit.

4.4.6.4.5 Test Plot_Test Channel Loading

Test mode : Client Signal

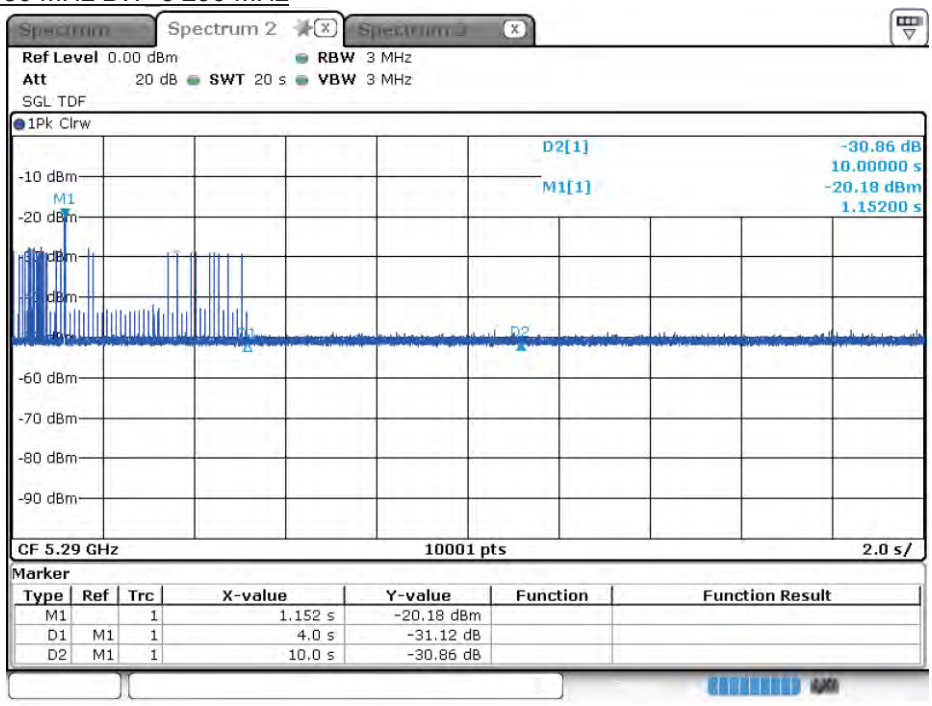


Test mode : Traffic Signal

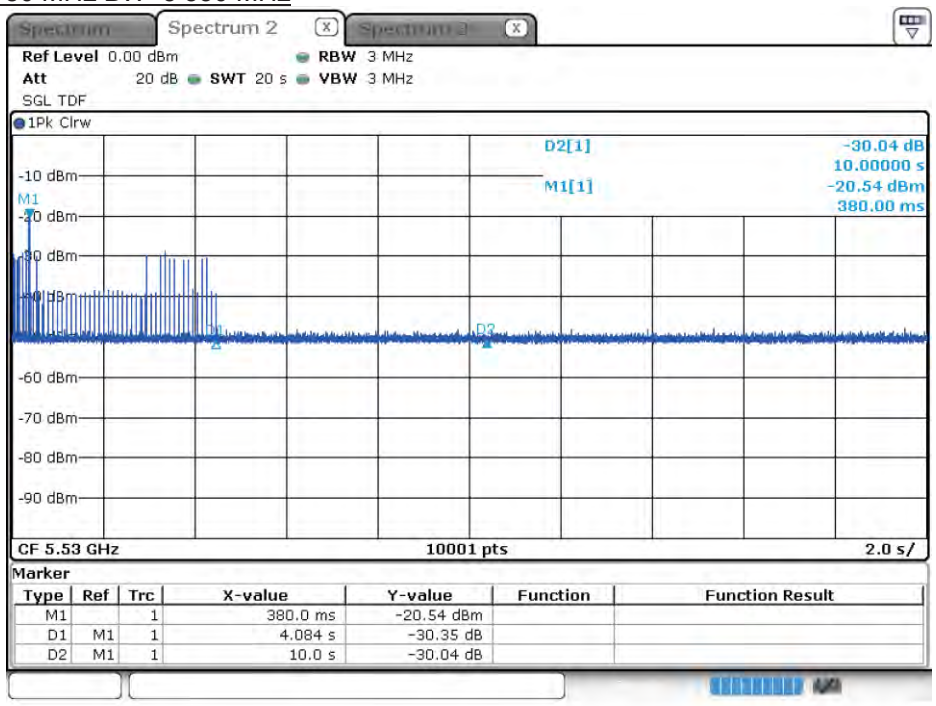


4.4.6.4.6 Test Plot_Channel move time

Test mode : 80 MHz BW_5 290 MHz

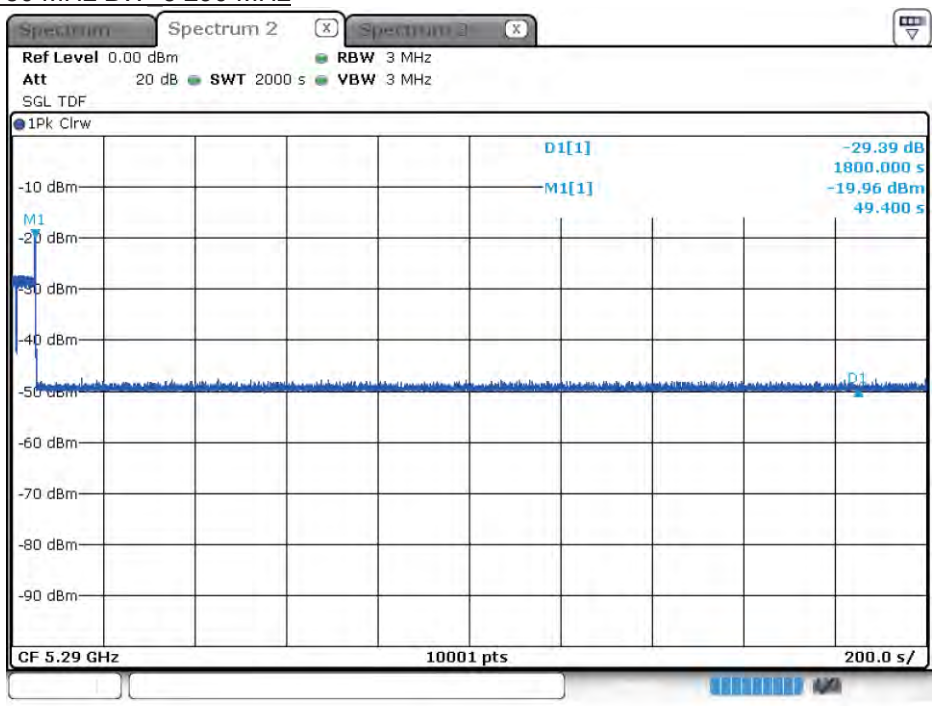


Test mode : 80 MHz BW_5 530 MHz

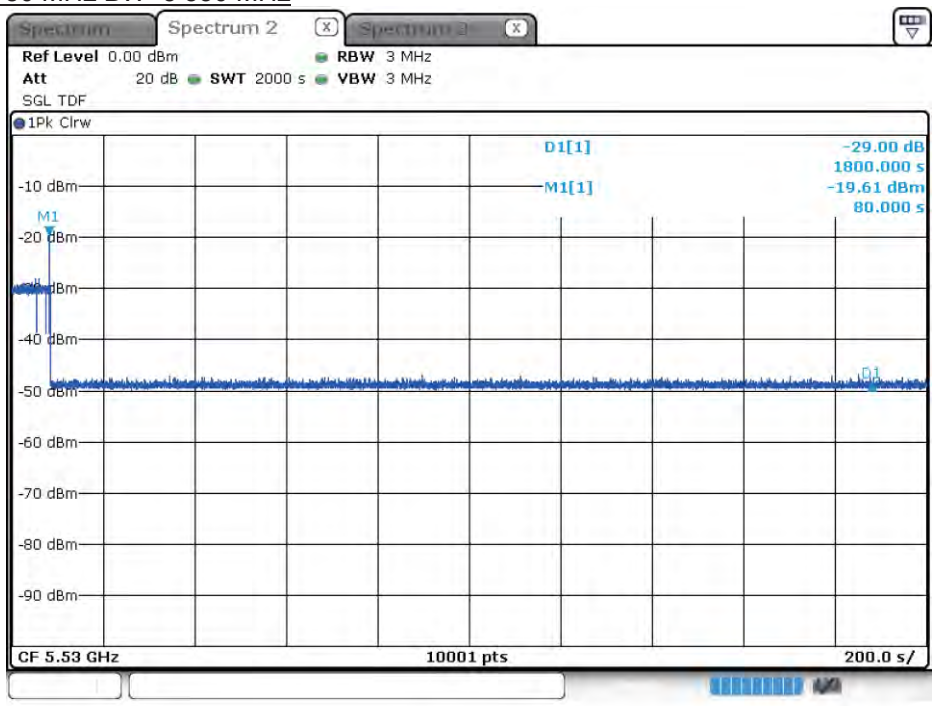


4.4.6.4.7 Test Plot_Non-Occupancy Period

Test mode : 80 MHz BW_5 290 MHz



Test mode : 80 MHz BW_5 530 MHz



4.4.7 Spurious Emission, Band Edge, and Restricted bands

4.4.7.1 Regulation

According to §15.407(b) and RSS-247 6.2 Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(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 e.i.r.p. 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 e.i.r.p. of −27 dBm/MHz.

(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 e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

According to §RSS-247 6.2.1.2 For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26 dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band.

According to §RSS-247 6.2.2.2 a) All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or
b) All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device, except devices installed in vehicles, shall be labelled or include in the user manual the following text “for indoor use only.”

According to §RSS-247 6.2.3.2 Emissions outside the band 5470-5725 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p. at 5850 MHz instead of 5725 MHz.

According to §RSS-247 6.2.4.2 Devices operating in the band 5725-5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:
a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5

MHz above or below the band edges;
b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

According to §15.209(a) and RSS-GEN §8.9 Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shallnot be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§15.231 and 15.241.

According to §15.205(a) and (b) only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6
13.36 - 13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the

average value of the measured emissions. The provisions in §15.35 apply to these measurement

According to RSS-GEN 8.10(c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

MHz	MHz	MHz	GHz
0.009 - 0.110	13.36 - 13.41	960 – 1 427	9.0 - 9.2
0.495 - 0.505	16.42 - 16.423	1 435 – 1 626.5	9.3 - 9.5
2.173 5 - 2.190 5	16.694 75 - 16.695 25	1 645.5 – 1 646.5	10.6 - 12.7
4.125 - 4.128	16.804 25 - 16.804 75	1 660 – 1 710	13.25 - 13.4
3.020 -3.026	25.5 - 25.67	1 718.8 – 1 722.2	14.47 - 14.5
4.177 25 - 4.177 75	37.5 - 38.25	2 200 – 2 300	15.35 - 16.2
4.207 25 - 4.207 75	73 - 74.6	2 310 – 2 390	17.7 - 21.4
5.677 - 5.683	74.8 - 75.2	2 483.5 – 2 500	22.01 - 23.12
6.215 - 6.218	108 - 138	2 655 – 2 900	23.6 - 24.0
6.267 75 - 6.268 25	149.9 - 150.05	3 260 – 3 267	31.2 - 31.8
6.311 75 - 6.312 25	156.524 75 - 156.525 25	3 332 – 3 339	36.43 - 36.5
8.291 - 8.294	156.7 - 156.9	3 345.8 – 3 358	Above 38.6
8.362 - 8.366	162.012 5 - 167.17	3 500 – 4 400	
8.376 25 - 8.386 75	167.72 - 173.2	4 500 - 5 150	
8.414 25 - 8.414 75	240 - 285	5 350 - 5 460	
12.29 - 12.293	322 - 335.4	7 250 - 7 750	
12.519 75 - 12.520 25	399.9 - 410	8 025 - 8 500	
12.576 75 - 12.577 25	608 - 614		

4.4.7.2 Measurement Procedure

These test measurement settings are specified in section G of 789033 D02 General UNII Test Procedures
For all radiated emissions tests, measurements must correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

4.4.7.2.1 Unwanted Emissions in the Restricted Bands & Outside of the Restricted Bands

(1) For all measurements, follow the requirements in section II.G.3.,
“General Requirements for Unwanted Emissions Measurements”.
(2) At frequencies below 1000 MHz, use the procedure described in section II.G.4.,
“Procedure for Unwanted Emissions Measurements Below 1000 ㎒”.
(3) At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.

(4) Unwanted Emissions that fall Outside of the Restricted Bands
As specified in §15.407(b)(1-3), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of −27 dBm/MHz.
15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask

is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

a) If radiated measurements are performed, field strength is then converted to EIRP as follows:

(i) EIRP = ((E*d)^2) / 30
where: • E is the field strength in V/m;
• d is the measurement distance in meters;
• EIRP is the equivalent isotropically radiated power in watts.

(ii) Working in dB units, the above equation is equivalent to:
EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77

(iii) or, if d is 3 meters:
EIRP[dBm] = E[dBμV/m] - 95.2

4.4.7.2.2 Radiated Spurious Emissions

1) The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2) The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the TRILOG broadband antenna, and from 1 000 MHz to 40 000 MHz using the horn antenna.
4) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

NOTE1 : The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
NOTE2 : The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1 kHz(1/T) for Average detection (AV) at frequency above 1 GHz. (where T = pulse width)

4.4.7.3 Note

- Below 1GHz

Note 1 : Measured the worst case. * Refer to 3.4
Note 2 : Loss : Cable loss - Amp gain
Note 3 : Result : Reading + Ant Factor + Loss
Note 4 : Measured distance : 3 m

- Above 1GHz

Note 1 : Measured the worst case. * Refer to 3.4
Note 2 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor
Note 3 : Peak Result : Reading + Factor
Note 4 : Average Reasult : Average Reading + Factor + Average Factor
Note 5 : Average Factor : 10log(1/Dutycycle) * Refer to 4.4.7.7
Note 6 : Measured distance : 1 m, Distance Factor = 20log(1 / 3) = -9.54
Note 7 : Average measurement did not take place because the peak data did not exceed Average Limit.
Note 8 : Not Detected means that peak data does not exceed the average limit.

4.4.7.4 Result

Comply (measurement data : refer to the next page)

4.4.7.5 Measurement data

Test mode : Below 1 GHz (Worst case : 802.11a_5 745 MHz)

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Ant Factor (dB)	Loss (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
249.942	QP	H	53.20	17.80	-27.10	43.90	46.00	2.10
285.588	QP	H	49.10	19.10	-26.80	41.40	46.00	4.60
349.970	QP	H	47.30	20.40	-26.60	41.10	46.00	4.90
449.998	QP	V	41.80	23.10	-26.40	38.50	46.00	7.50

Test mode : 802.11a_Above 1 GHz_5 180 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 146.26	PK	V	57.50	0.96	-	58.46	74.00	15.54
	AV	V	46.20	0.96	-	47.16	54.00	6.84
5 146.63	PK	H	58.40	0.96	-	59.36	74.00	14.64
	AV	H	46.70	0.96	-	47.66	54.00	6.34
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 200 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 146.20	PK	V	45.60	0.96	-	46.56	74.00	27.44
5 147.41	PK	H	47.70	0.96	-	48.66	74.00	25.34
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 240 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 387.29	PK	H	41.90	1.66	-	43.56	74.00	30.44
5 395.20	PK	V	42.50	1.66	-	44.16	74.00	29.84
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 260 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 300 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 350.49	PK	H	52.00	1.66	-	53.66	74.00	20.34
5 351.23	PK	V	47.20	1.66	-	48.86	74.00	25.14
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 320 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 351.91	PK	V	58.90	1.66	-	60.56	74.00	13.44
	AV	V	46.90	1.66	-	48.56	54.00	5.44
5 352.98	PK	H	58.70	1.66	-	60.36	74.00	13.64
	AV	H	45.80	1.66	-	47.46	54.00	6.54
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 500 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 457.30	PK	H	50.40	1.86	-	52.26	74.00	21.74
5 458.02	PK	V	50.10	1.86	-	51.96	74.00	22.04
5 468.61	PK	H	57.90	1.96	-	59.86	74.00	14.14
	AV	H	45.00	1.96	-	46.96	54.00	7.04
5 469.65	PK	V	54.20	1.96	-	56.16	74.00	17.84
	AV	V	44.40	1.96	-	46.36	54.00	7.64
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 580 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 700 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 745 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 785 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11a_Above 1 GHz_5 825 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 852.46	PK	V	50.40	2.56	-	52.96	74.00	21.04
	AV	V	40.20	2.56	-	42.76	54.00	11.24
5 854.55	PK	H	53.20	2.56	-	55.76	74.00	18.24
	AV	H	42.30	2.56	-	44.86	54.00	9.14
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 180 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 144.92	PK	V	55.60	0.96	-	56.56	74.00	17.44
	AV	V	45.20	0.96	-	46.16	54.00	7.84
5 146.46	PK	H	60.50	0.96	-	61.46	74.00	12.54
	AV	H	46.00	0.96	-	46.96	54.00	7.04
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 200 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 146.61	PK	H	47.70	0.96	-	48.66	74.00	25.34
5 149.12	PK	V	46.10	0.96	-	47.06	74.00	26.94
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 240 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 260 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 300 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 320 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 351.32	PK	H	54.40	1.66	-	56.06	74.00	17.94
	AV	H	45.50	1.66	-	47.16	54.00	6.84
5 353.00	PK	V	54.70	1.66	-	56.36	74.00	17.64
	AV	V	45.60	1.66	-	47.26	54.00	6.74
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 500 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 459.04	PK	H	47.90	1.96	-	49.86	74.00	24.14
	AV	H	37.10	1.96	-	39.06	54.00	14.94
5 459.04	PK	V	44.90	1.96	-	46.86	74.00	27.14
	AV	V	35.90	1.96	-	37.86	54.00	16.14
5 466.02	PK	H	51.60	1.96	-	53.56	74.00	20.44
	AV	H	39.50	1.96	-	41.46	54.00	12.54
5 469.60	PK	V	52.00	1.96	-	53.96	74.00	20.04
	AV	V	40.10	1.96	-	42.06	54.00	11.94
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 580 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 700 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 745 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 785 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT20_Above 1 GHz_5 825 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 850.22	PK	H	51.20	2.56	-	53.76	74.00	20.24
	AV	H	39.50	2.56	-	42.06	54.00	11.94
5 850.58	PK	V	49.10	2.56	-	51.66	74.00	22.34
	AV	V	38.80	2.56	-	41.36	54.00	12.64
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 190 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 148.38	PK	V	61.50	0.96	-	62.46	74.00	11.54
	AV	V	48.20	0.96	0.14	49.30	54.00	4.70
5 148.38	PK	H	62.30	0.96	-	63.26	74.00	10.74
	AV	H	49.80	0.96	0.14	50.90	54.00	3.10
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 230 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 139.61	PK	V	45.70	0.96	-	46.66	74.00	27.34
5 148.32	PK	H	49.80	0.96	-	50.76	74.00	23.24
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 270 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 355.72	PK	H	48.30	1.66	-	49.96	74.00	24.04
5 357.49	PK	V	49.30	1.66	-	50.96	74.00	23.04
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 310 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 351.37	PK	V	65.10	1.66	-	66.76	74.00	7.24
	AV	V	50.10	1.66	0.14	51.90	54.00	2.10
5 354.89	PK	H	62.40	1.66	-	64.06	74.00	9.94
	AV	H	49.30	1.66	0.14	51.10	54.00	2.90
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 510 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 459.07	PK	H	51.40	1.96	-	53.36	74.00	20.64
	AV	H	39.50	1.96	0.14	41.60	54.00	12.40
5 459.07	PK	V	50.60	1.96	-	52.56	74.00	21.44
	AV	V	40.30	1.96	0.14	42.40	54.00	11.60
5 461.66	PK	V	55.80	1.96	-	57.76	74.00	16.24
	AV	V	41.30	1.96	0.14	43.40	54.00	10.60
5 469.62	PK	H	56.10	1.96	-	58.06	74.00	15.94
	AV	H	41.40	1.96	0.14	43.50	54.00	10.50
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 550 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 670 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 755 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11n_HT40_Above 1 GHz_5 795 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 855.30	PK	V	44.00	2.56	-	46.56	74.00	27.44
	AV	V	32.90	2.56	0.14	35.60	54.00	18.40
5 864.15	PK	H	47.50	2.56	-	50.06	74.00	23.94
	AV	H	34.50	2.56	0.14	37.20	54.00	16.80
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 180 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 145.75	PK	V	55.20	0.96	-	56.16	74.00	17.84
	AV	V	42.60	0.96	-	43.56	54.00	10.44
5 149.66	PK	H	57.80	0.96	-	58.76	74.00	15.24
	AV	H	44.30	0.96	-	45.26	54.00	8.74
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 200 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 240 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 260 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 300 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 320 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 353.21	PK	H	54.50	1.66	-	56.16	74.00	17.84
	AV	H	43.90	1.66	-	45.56	54.00	8.44
5 353.21	PK	V	54.20	1.66	-	55.86	74.00	18.14
	AV	V	43.50	1.66	-	45.16	54.00	8.84
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 500 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 455.52	PK	H	45.90	1.86	-	47.76	74.00	26.24
	AV	H	35.50	1.86	-	37.36	54.00	16.64
5 459.39	PK	V	44.90	1.96	-	46.86	74.00	27.14
	AV	V	35.10	1.96	-	37.06	54.00	16.94
5 467.71	PK	V	49.40	1.96	-	51.36	74.00	22.64
	AV	V	39.90	1.96	-	41.86	54.00	12.14
5 467.78	PK	H	54.30	1.96	-	56.26	74.00	17.74
	AV	H	42.10	1.96	-	44.06	54.00	9.94
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 580 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 700 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 745 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 785 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT20_Above 1 GHz_5 825 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 851.16	PK	V	46.00	2.56	-	48.56	74.00	25.44
	AV	V	37.70	2.56	-	40.26	54.00	13.74
5 852.74	PK	H	49.10	2.56	-	51.66	74.00	22.34
	AV	H	39.60	2.56	-	42.16	54.00	11.84
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 190 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 147.78	PK	H	61.80	0.96	-	62.76	74.00	11.24
	AV	H	48.50	0.96	0.13	49.59	54.00	4.41
5 149.71	PK	V	61.00	0.96	-	61.96	74.00	12.04
	AV	V	48.30	0.96	0.13	49.39	54.00	4.61
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 230 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 270 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 310 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 351.33	PK	H	65.20	1.66	-	66.86	74.00	7.14
	AV	H	49.80	1.66	0.13	51.59	54.00	2.41
5 354.04	PK	V	63.70	1.66	-	65.36	74.00	8.64
	AV	V	49.20	1.66	0.13	50.99	54.00	3.01
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 510 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 456.35	PK	V	49.90	1.86	-	51.76	74.00	22.24
	AV	V	37.50	1.86	0.13	39.49	54.00	14.51
5 459.02	PK	H	52.40	1.96	-	54.36	74.00	19.64
	AV	H	40.10	1.96	0.13	42.19	54.00	11.81
5 460.73	PK	V	58.10	1.96	-	60.06	74.00	13.94
	AV	V	40.80	1.96	0.13	42.89	54.00	11.11
5 463.40	PK	H	56.50	1.96	-	58.46	74.00	15.54
	AV	H	40.60	1.96	0.13	42.69	54.00	11.31
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 550 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 670 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 755 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT40_Above 1 GHz_5 795 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 855.36	PK	H	45.80	2.56	-	48.36	74.00	25.64
5 868.55	PK	V	44.20	2.56	-	46.76	74.00	27.24
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT80_Above 1 GHz_5 210 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 122.13	PK	V	53.80	0.86	-	54.66	74.00	19.34
	AV	V	36.40	0.86	0.27	37.53	54.00	16.47
5 142.21	PK	H	56.30	0.96	-	57.26	74.00	16.74
	AV	H	37.70	0.96	0.27	38.93	54.00	15.07
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT80_Above 1 GHz_5 290 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 350.57	PK	V	54.30	1.66	-	55.96	74.00	18.04
	AV	V	38.60	1.66	0.27	40.53	54.00	13.47
5 351.34	PK	H	54.60	1.66	-	56.26	74.00	17.74
	AV	H	38.80	1.66	0.27	40.73	54.00	13.27
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT80_Above 1 GHz_5 530 MHz

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 439.86	PK	H	42.60	1.76	-	44.36	74.00	29.64
5 455.54	PK	V	43.90	1.86	-	45.76	74.00	28.24
5 461.74	PK	H	45.50	1.96	-	47.46	74.00	26.54
5 469.46	PK	V	43.90	1.96	-	45.86	74.00	28.14
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT80_Above 1 GHz_5 690 MHz

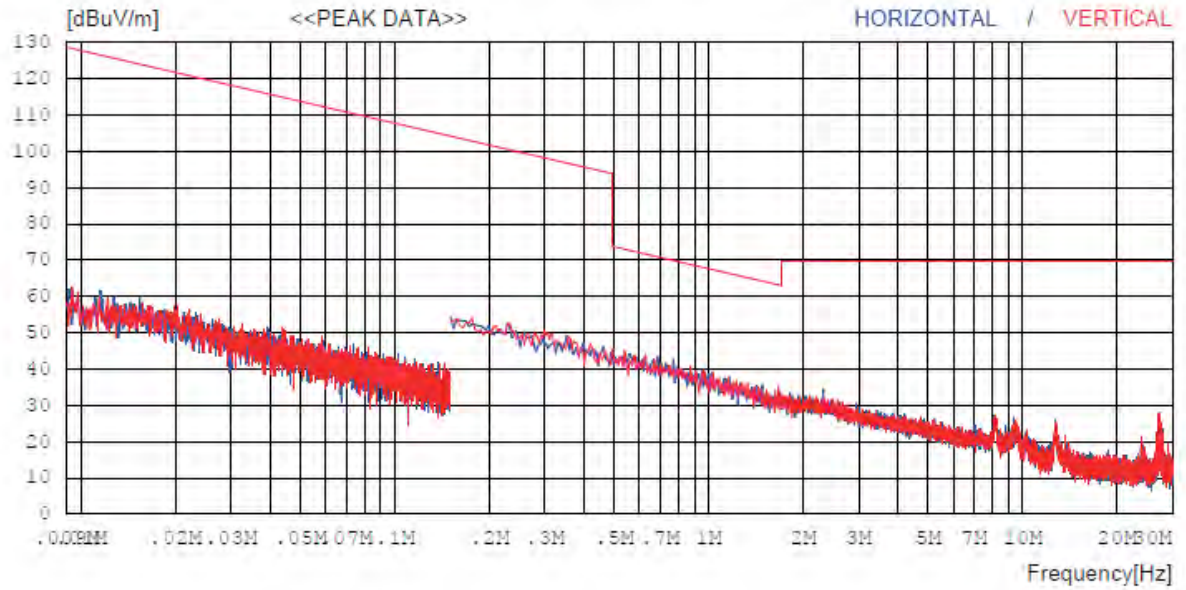
Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Above 1 GHz	Not Detected	-	-	-	-	-	-	-

Test mode : 802.11ac_VHT80_Above 1 GHz_5 775 MHz

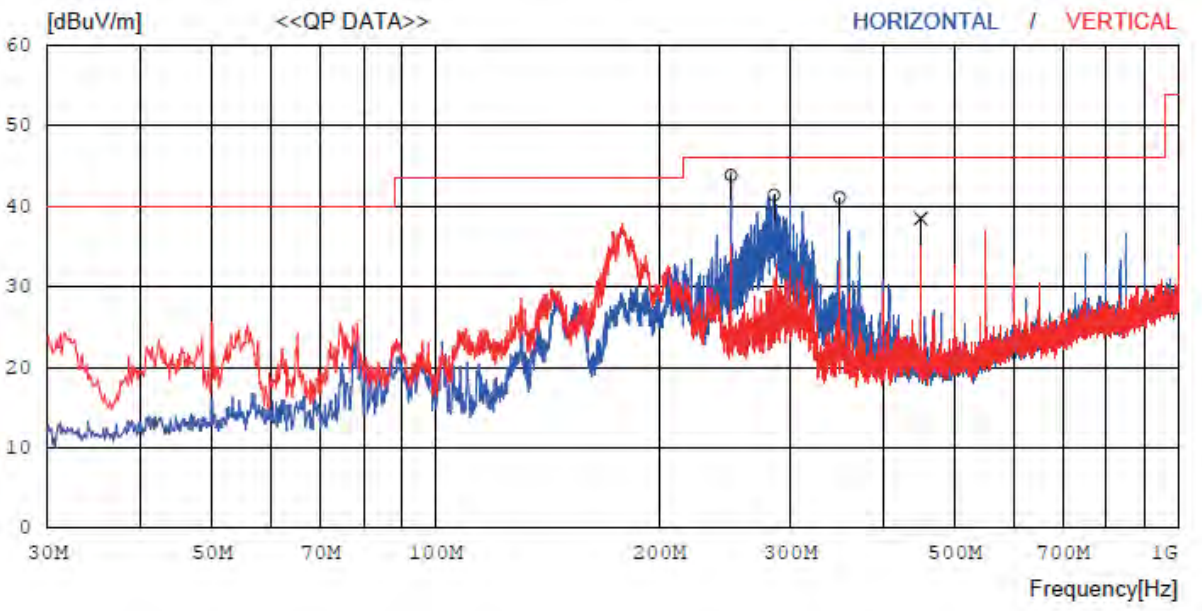
Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Dutycycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5 861.52	PK	H	42.80	2.56	-	45.36	74.00	28.64
5 873.82	PK	V	42.90	2.56	-	45.46	74.00	28.54
Above 6 GHz	Not Detected	-	-	-	-	-	-	-

4.4.7.6 Measurement Plot

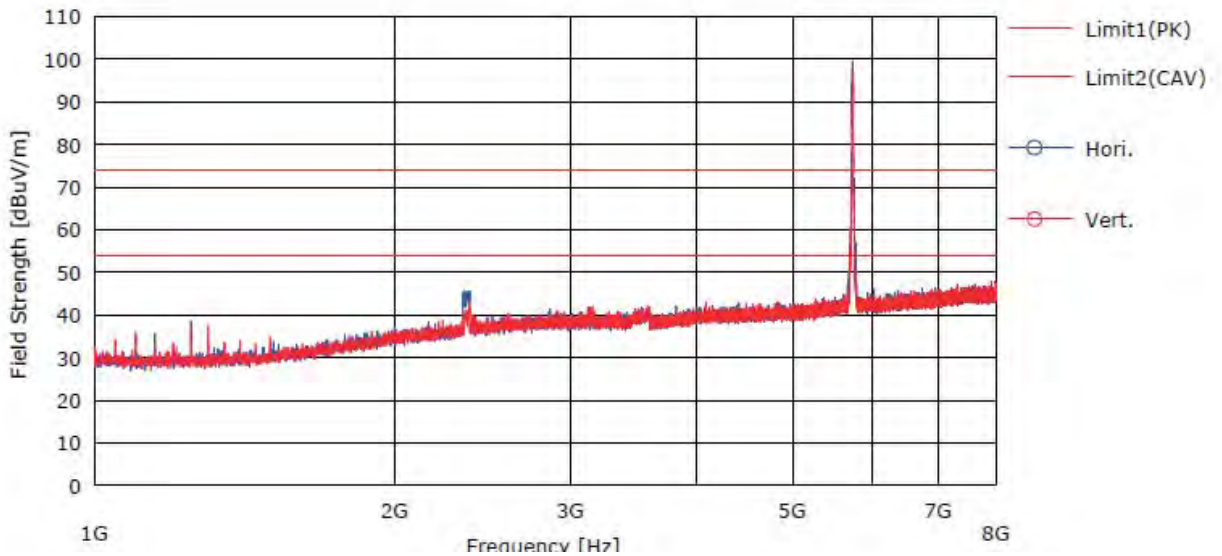
Test mode : 9 kHz ~ 30 MHz (Worst case : 802.11a_5 745 MHz)



Test mode : 30 MHz ~ 1 GHz(Worst case : 802.11a_5 745 MHz)

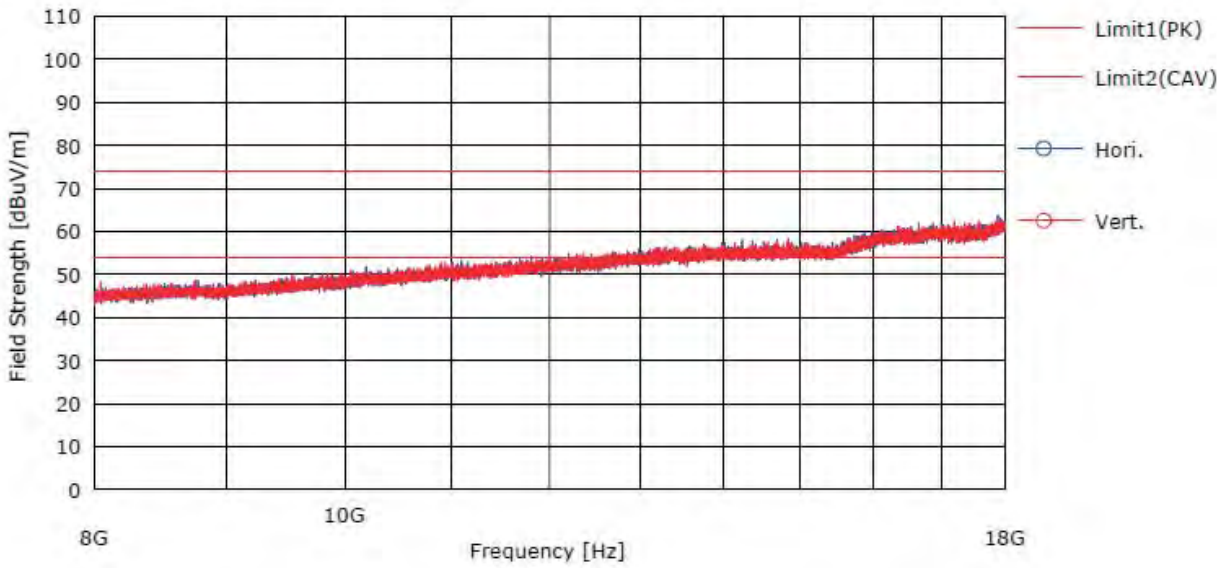


Test mode : 1 GHz ~ 8 GHz (Worst case : 802.11a_5 745 MHz)



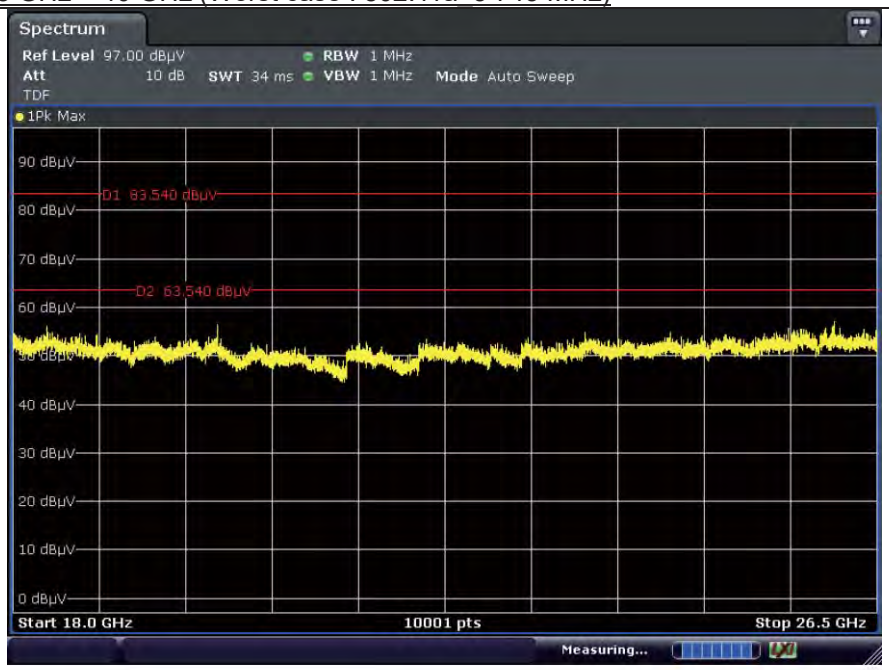
Note 1 : Measured distance : 1 m
Note 2 : Limit : Peak : 83.5 dBµV/m
Average : 63.5 dBµV/m

Test mode : 8 GHz ~ 18 GHz (Worst case : 802.11a_5 745 MHz)



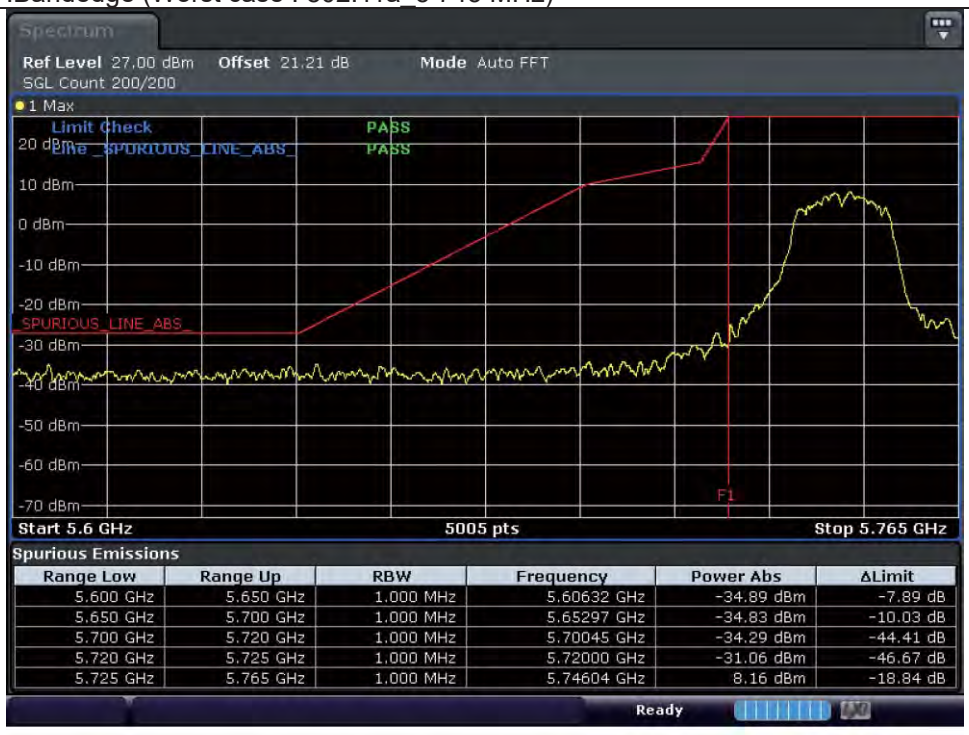
Note 1 : Measured distance : 1 m
Note 2 : Limit : Peak : 83.5 dBµV/m
Average : 63.5 dBµV/m

Test mode : 18 GHz ~ 40 GHz (Worst case : 802.11a_5 745 MHz)



NOTE 1 : Measured distance : 1 m
NOTE 2 : Limit : Peak : 83.5 dBµV/m
Average : 63.5 dBµV/m

Test mode :Bandedge (Worst case : 802.11a_5 745 MHz)



F1 : 5 725 MHz
Offset : Attenuator + Peak antenna gain + dutycycle factor

4.4.7.7 Measurement Plot_Dutycycle

Test mode : 802.11a

Note Duty cycle : 0.984

Test mode : 802.11n_HT20

Note Duty Cycle : 0.983

Test mode : 802.11n_HT40

Note Duty cycle : 0.968 / Dutycycle Factor : 10log(1 / 0.968) = 0.14

Test mode : 802.11ac_VHT20

Note Duty Cycle : 0.984

Test mode : 802.11ac_VHT40

Note Duty cycle : 0.970 / Dutycycle Factor : 10log(1 / 0.970) = 0.13

Test mode : 802.11ac_VHT80

Note Duty Cycle : 0.939 / Dutycycle Factor : 10log(1 / 0.939) = 0.27

4.4.8 Conducted Emission

4.4.8.1 Regulation

According to §15.207(a), and RSS-GEN §8.8 for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN).
Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 - 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

4.4.8.2 Measurement Procedure

1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5 m away from the side wall of the shielded room.

2) Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω/50 μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.

3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.

4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.

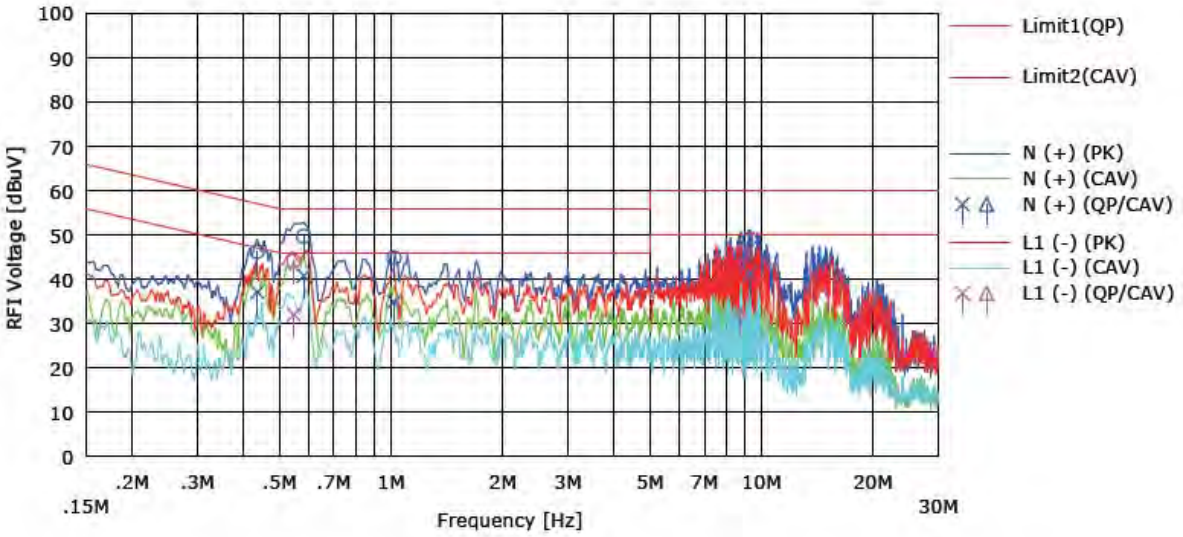
5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASIPEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

4.4.8.3 Result

Comply (measurement data : refer to the next page)

4.4.8.4 Measurement data

Test mode : 802.11a_5 745 MHz (Worst case)



NO	FREQ	READING QP	READING CAV	C.FACTOR	RESULT QP	RESULT CAV	LIMIT QP	LIMIT CAV	MARGIN QP	MARGIN CAV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.43524	25.9	16.8	20.4	46.3	37.2	57.2	47.2	10.9	10.0	N (+)
2	0.58078	29.4	20.5	20.3	49.7	40.8	56.0	46.0	6.3	5.2	N (+)
3	1.01850	24.7	14.8	20.2	44.8	35.0	56.0	46.0	11.2	11.0	N (+)
4	9.30683	28.6	20.8	20.6	49.1	41.4	60.0	50.0	10.9	8.6	N (+)
5	0.54595	23.8	11.8	20.3	44.1	32.1	56.0	46.0	11.9	13.9	L1 (-)
6	8.77132	25.3	12.1	20.6	45.9	32.7	60.0	50.0	14.1	17.3	L1 (-)

APPENDIX I

TEST EQUIPMENT USED FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

Equipment	Manufacturer	Model	Serial No.	Cal. Date (yy.mm.dd)	Next Cal.Date (yy.mm.dd)
FSV Signal Analyzer	ROHDE&SCHWARZ	FSV30	103370	2019-10-15	2020-10-15
PXA Signal Analyzer	KEYSIGHT	N9030A	MY54410264	2020-01-10	2021-01-10
Power Sensor	KEYSIGHT	U2022XA	MY55320008	2019-08-19	2020-08-19
ATTENUATOR	INMET	26A-20	TR011	2019-10-14	2020-10-14
DC Power Supply	AGILENT	E3632A	MY51160055	2020-04-23	2021-04-23
Digital MultiMeter	HP	34401A	US36025428	2020-01-14	2021-01-14
Signal Generator	ROHDE&SCHWARZ	SMB100A	178384	2019-10-14	2020-10-14
EMI Test Receiver	ROHDE&SCHWARZ	ESU40	100445	2019-12-13	2020-12-13
BiLog Antenna	Schwarzbeck	VULB9160	9160-3381	2019-06-14	2021-06-14
Preamplifier	TSJ	MLA-10k01-b01-27	1870369	2020-04-22	2021-04-22
Antenna Mast(10 m)	TOKIN	5977	-	-	-
Antenna Mast(10 m)	Innco	MA4640-XPET-0800	578	-	-
Controller(10 m)	TOKIN	5909L	141909L-1	-	-
Controller(10 m)	Innco	CO3000	40040217	-	-
Turn Table(10 m)	TOKIN	5983-1.5	-	-	-
10 m Semi-Anechoic Chamber	SY CORPORATION	-	-	-	-
Active Loop H-Field	ETS	6502	00150598	2019-05-24	2021-05-24
Double Ridege Horn Antenna	ETS	3117	00168719	2019-08-29	2021-08-29
Double Ridege Horn Antenna	A.H Systems, Inc	SAS-574	465	2019-04-25	2021-04-25
PREAMPLIFIER	Agilent	8449B	3008A02110	2020-01-10	2021-01-10
PREAMPLIFIER	A.H Systems, Inc	PAM-1840VH	166	2020-01-10	2021-01-10
FSV Signal Analyzer	ROHDE&SCHWARZ	FSV40	101010	2020-04-23	2021-04-23
EMI Test Receiver	ROHDE&SCHWARZ	ESR7	101440	2019-12-13	2020-12-13
LISN	ROHDE&SCHWARZ	ENV216	101883	2020-04-22	2021-04-22
Pulse Limiter	Schwarzbeck	VTSD 9561-F	9561-F189	2020-04-22	2021-04-22
Access Point	Cisco Systems, Inc.	AIR-AP2802E-B-K9	FJC2116M3Q3	-	- (FCC ID : LDK102099)
POWER DIVIDER	1580	WEINSCHEL	RZ183	2019-10-15	2020-10-15
POWER DIVIDER	1580-1	WEINSCHEL	SQ747	2020-04-23	2021-04-23
STEP ATTENUATOR	8494B	Agilent	MY42145885	2020-04-23	2021-04-23
STEP ATTENUATOR	8495B	Agilent	MY42143360	2020-04-23	2021-04-23
TERMINATION	909D	HP	00737	2019-08-19	2020-08-19
TERMINATION	909D	Agilent	51640	2019-08-19	2020-08-19
Vector Signal Generator	SMBV100A	ROHDE&SCHWARZ	261413	2019-10-14	2020-10-14