

Test report No:
 NIE: 66084RRF.021

Partial Test Report

USA FCC Part 15.407, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Automotive infotainment System
(*) Trademark	Mercedes-Benz
(*) Model and /or type reference	NTG6N HIGH2
Other identification of the product	HW version: D9 SW version: E870 FCC ID: T8GNTG6NH2 IC: 6434A-NTG6NH2
(*) Features	FM, AM, DAB,GNSS, USB, Bluetooth, WLAN
Applicant	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16, 76307 KARLSBAD, GERMANY
Test method requested, standard	USA FCC Part 15.407 (10-1-19) Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. USA FCC Part 15.209 (10-1-19) Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 Amendment 1 (March 2019). Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	Rafael López EMC Consumer & RF Lab. Manager
Date of issue	2021-03-12
Report template No	FDT08_23
	(*) "Data provided by the client"

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Competences and guarantees

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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model NTG6N HIGH2 is an automotive head unit to be installed in cars with the following features: FM, AM, DAB,GNSS, USB, Bluetooth, WLAN.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of result.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
66084B/018	Automotive infotainment System	NTG6N HIGH2	HBM736L4999000	2020/12/23
56848G/050	Harness	--	--	2019/01/11

Auxiliary elements used with the Sample S/02:

Control Nº	Description	Model	Serial Nº	Date of reception
56848G/014	Ethernet Cable	--	--	2019/01/08
56848G/144	HMI-CAN Box	--	H0034731	2019/01/11
56848G/102	Antenna	--	--	2019/01/11
56848G/109	Antenna	--	--	2019/01/11
56848G/110	Antenna	--	--	2019/01/11
56848G/111	Antenna	--	--	2019/01/11

Sample S/01 has undergone the following test(s): The Radiated tests indicated in the Appendixes B, C.

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
66084B/018	Automotive infotainment System	NTG6N HIGH2	HBM736L4999000	2020/12/23
56848G/050	Harness	--	--	2019/01/11

Auxiliary elements used with the Sample S/02:

Control Nº	Description	Model	Serial Nº	Date of reception
56848G/014	Ethernet Cable	--	--	2019/01/08
56848G/144	HMI-CAN Box	--	H0034731	2019/01/11

Sample S/02 has undergone the following test(s): The Conducted tests indicated in the Appendixes A, B, C.

Test sample description

Ports.....:	Port name and description		Cable				
			Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
	Car Connector A		>3m ^(x1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Car Connector B		>3m ^(x1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Display Connector CID/PIP / RVC		>3m ^(x1)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	USB Connector		<3m ^(x2)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Eth Connector		>3m ^(x1)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	BT/WLAN-Antenna		>3m ^(x1)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	FM/AM, TV/SDARS Ant		>3m ^(x1)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
GPS Antenna		>3m ^(x1)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Supplementary information to the ports.....:	For EMC-Testing all cables should be connected to the connectors!						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	DC: 12V Car battery / attenuator (9,5-15,5V normal operation)					
<input type="checkbox"/>	DC:						
Rated Power	9,5-15,5V normal operation						
Clock frequencies.....:	see schematics						
Other parameters	FCC ID: T8GNTG6NH / IC: 6434A-NTG6NH						
Software version	E870						
Hardware version	D9						
Dimensions in cm (W x H x D)	182 x 78 x 160 mm						
Mounting position	<input type="checkbox"/>	Table top equipment					
	<input type="checkbox"/>	Wall/Ceiling mounted equipment					
	<input type="checkbox"/>	Floor standing equipment					
	<input type="checkbox"/>	Hand-held equipment					
	<input checked="" type="checkbox"/>	Other: automotive headunit					
Modules/parts.....:	Module/parts of test item		Type	Manufacturer			
	N/A						
Accessories (not part of the test item)	Description		Type	Manufacturer			
	Display		A247 905 69	Daimler OEM Displ.			
	CAN-Box		-	HBAS			
	Cable harness		-	HBAS			
	BT/WLAN-Antenna		A247 905 83	Hirschmann			
	-						
Documents as provided by the applicant	Description		File name	Issue date			
	Technical Description						
	-						

⁽³⁾ Only for Medical Equipment

Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
BECKER-GOERING-STR. 16, 76307 KARLSBAD, GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-01-21
Date (finish)	2021-02-13

Document history

Report number	Date	Description
66084RRF.021	2021-03-12	First release.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Verónica García.

Used instrumentation:

Radiated Measurements

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber FRANKONIA SAC-3	N.A.	N.A.
2. Shielded Room FRANKONIA	N.A.	N.A.
3. Horn Antenna 1-18GHz SCHWARZBECK MESS- ELEKTRONIK BBHA 9120 D	2018/06	2021/06
4. Horn Antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
5. RF Preamplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2020/10	2021/10
6. Preamplifier, G>55dB 1-18GHz NARDA AMF-7D-01001800-22-10P	2020/05	2021/05
7. Low Noise Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
8. EMI Test Receiver 20Hz-26.5GHz ROHDE AND SCHWARZ ESU26	2020/05	2022/05
9. DC Power Supply 150V/22A, AGILENT TECHNOLOGIES N8740A	N.A.	N.A.
10. Digital Multimeter FLUKE 175	2020/11	2021/11
11. Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2018/07	2021/07
12. RF Preamplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	N.A.	N.A.
13. EMI Test Receiver 20Hz-40GHz ROHDE AND SCHWARZ ESU40	2019/09	2021/09
14. DC Power Supply, 30V/5A KEYSIGHT TECHNOLOGIES U8002A	N.A.	N.A.
15. Digital Multimeter FLUKE 179	2020/06	2021/06

Conducted Measurements:

	Last Calibration	Due Calibration
1. Shielded Room ETS LINDGREN S101	N.A.	N.A.
2. Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40	2019/09	2021/09
3. DC Power Supply, GW INSTEK GPS-3030D	N.A.	N.A.
4. Digital Multimeter FLUKE 179	2020/10	2021/10

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

A. Common requirements for all bands

FCC PART 15 PARAGRAPH / RSS-247			
	Test case	Verdict	Remark
FCC 15.35 (c) / RSS-Gen 6.10	Duty Cycle	P	(1)
RSS-Gen 6.6 / RSS-247 6.2	99% Occupied Bandwidth	P	(1)
FCC 15.403 (i)	26 dB Emission Bandwidth (EBW)	N/A	
<u>Supplementary information and remarks:</u> (1) Only tests requested.			

B. U-NII-1 Band: 5.15 - 5.25 GHz

FCC PART 15 PARAGRAPH / RSS-247			
	Requirement – Test case	Verdict	Remark
FCC 15.407 (a)(1)(iv)	Transmitter Maximum conducted Output Power	P	
RSS-247 6.2.1.1	Transmitter Maximum Equivalent Isotropically Radiated Power EIRP	P	
FCC 15.407 (a)(1)(iv)	Transmitter Maximum Power Spectral Density	N/M	(1)
RSS-247 6.2.1.1	Transmitter EIRP Spectral Density	N/M	(1)
FCC 15.407 (b)(1)(6) / RSS-247 6.2.1.2	Transmitter Out of Band Radiated Emissions	P	
FCC 15.407 (b)(1) / RSS-247 6.2.1.2	Transmitter Band Edge Radiated Emissions	P	
<u>Supplementary information and remarks:</u> (1) Tests not requested.			

C. U-NII-3 Band: 5.725 - 5.85 GHz

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407 (a)(3) / RSS-247 6.2.4.1	Transmitter Maximum conducted Output Power	P	
FCC 15.407 (e) / RSS-247 6.2.4.1	6 dB bandwidth.	N/M	(1)
FCC 15.407 (a)(3) / RSS-247 6.2.4.1	Transmitter Maximum Power Spectral Density	N/M	(1)
FCC 15.407 (b)(4)(6) / RSS-247 6.2.4.2	Transmitter Out of Band Radiated Emissions	P	
FCC 15.407 (b)(4) / RSS-247 6.2.4.2	Transmitter Band Edge Radiated Emissions	P	
<u>Supplementary information and remarks:</u>			
(1) Tests not requested.			

Appendix A: Test Common requirements for all bands

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FCC 15.35 (c) / RSS-Gen 6.10. Transmitter Duty Cycle.....	12
RSS-Gen 6.6 / RSS-247 6.2. Transmitter 99% Occupied Bandwidth	19

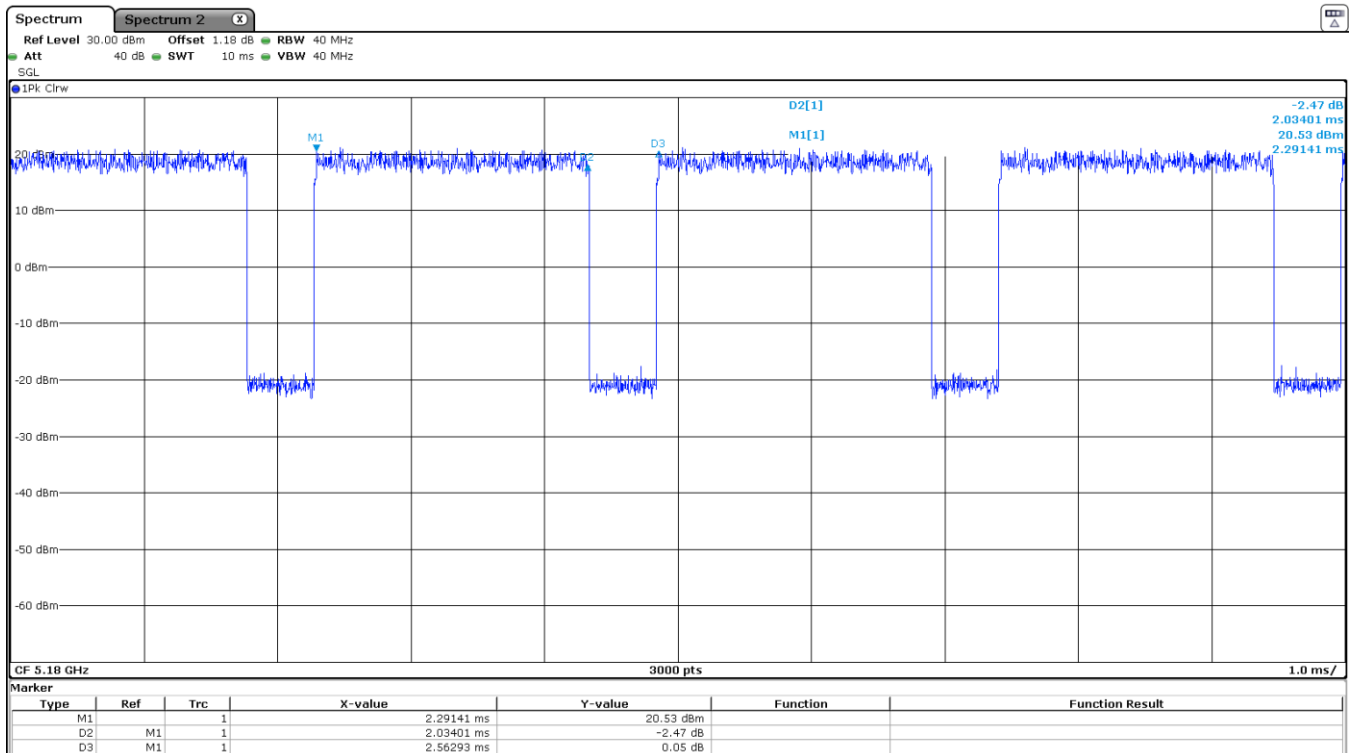
FCC 15.35 (c) / RSS-Gen 6.10. Transmitter Duty Cycle

RESULTS:

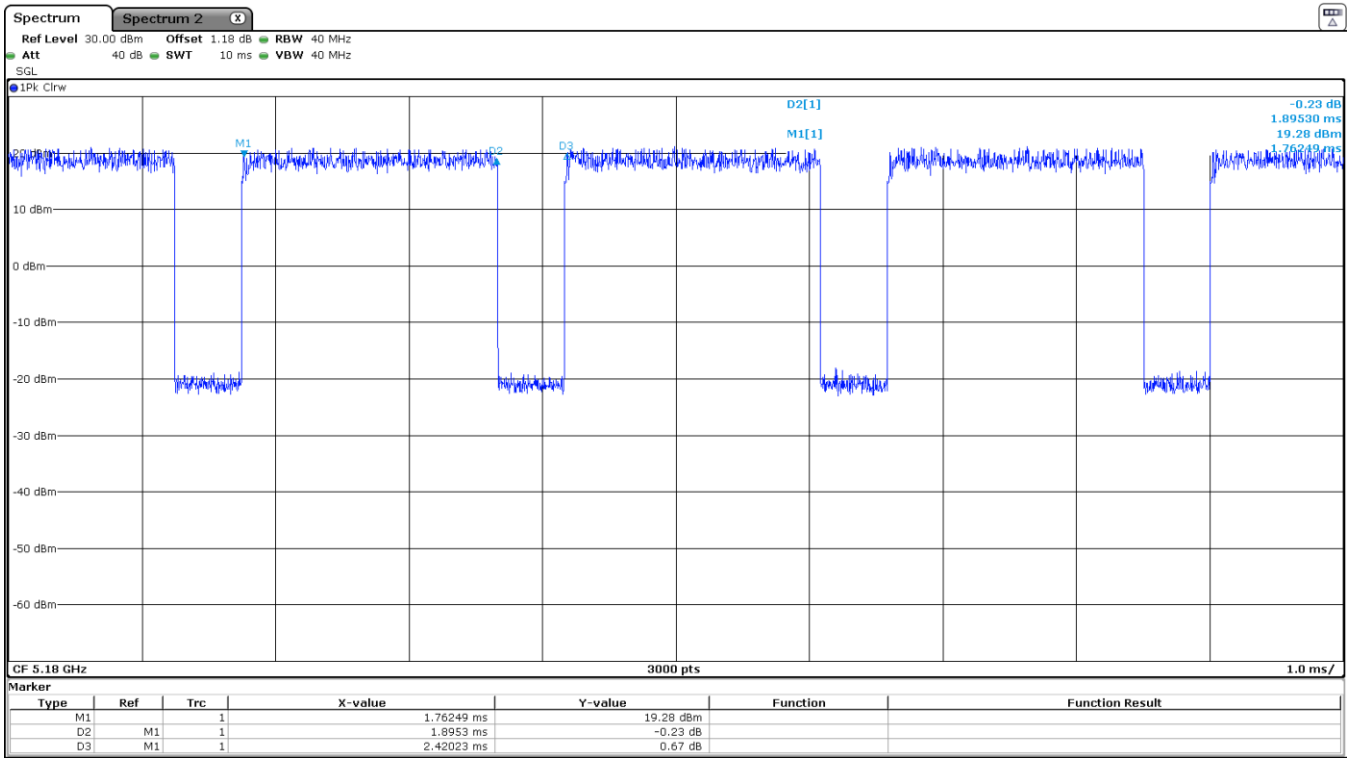
The results below are for data rates with a duty cycle less than 98%. The results for all rest of modes having a value > 98%.

Mode	Sub-band U-NII-1			Sub-band U-NII-3		
	Pulse Duration (ms)	Period (ms)	Duty Cycle Correction (dB)	Pulse Duration (ms)	Period (ms)	Duty Cycle Correction (dB)
802.11a20	2.03401	2.56293	1.003836609	2.05735	2.55919	0.947943492
802.11n20	1.89530	2.42023	1.061786773	1.91397	2.41414	1.008273257
802.11ac20	1.91209	2.43723	1.053881850	1.92564	2.42581	1.002816834
802.11n40	0.91537	1.44223	1.974378502	0.94431	1.44548	1.848974983
802.11ac40	0.92553	1.45096	1.952649395	0.95132	1.45348	1.84082433
802.11ac80	0.45659	0.96097	3.231834343	0.459153	0.96132	3.209105515

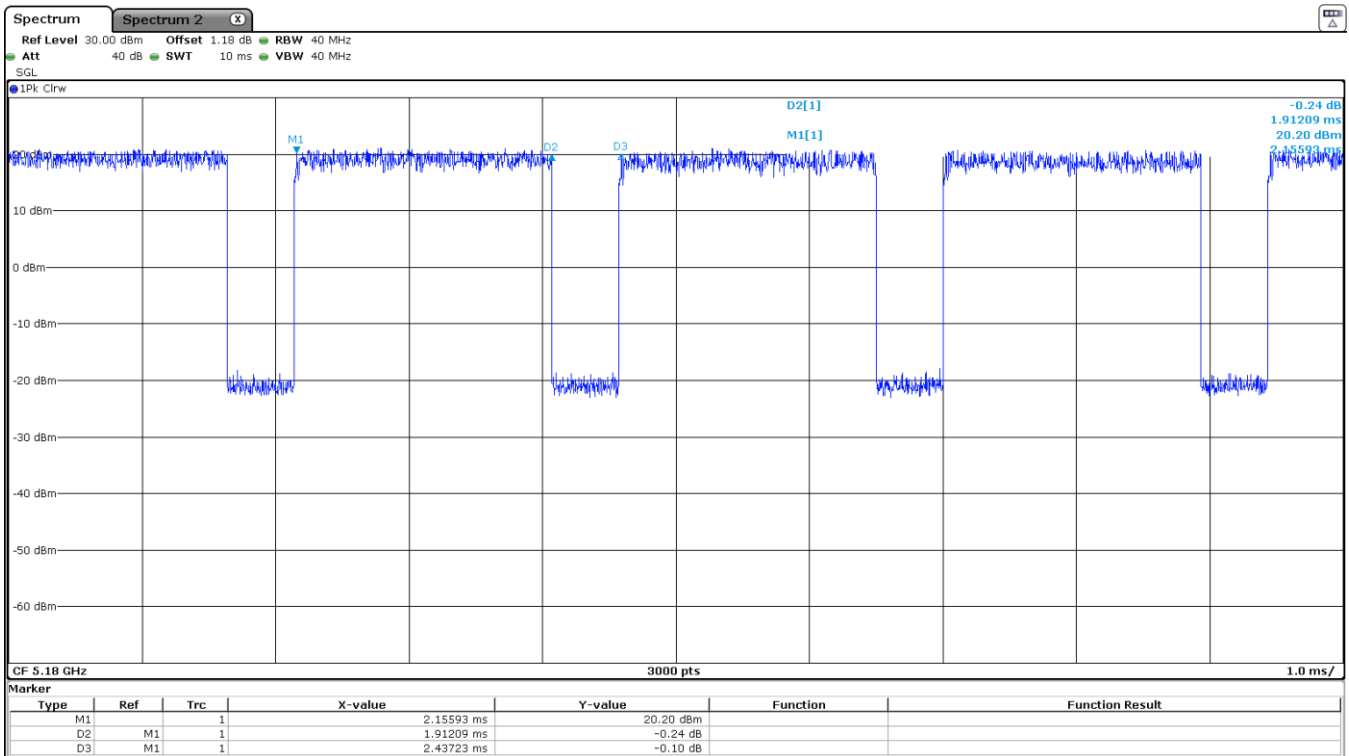
Mode 802.11 a20 (U-NII-1):



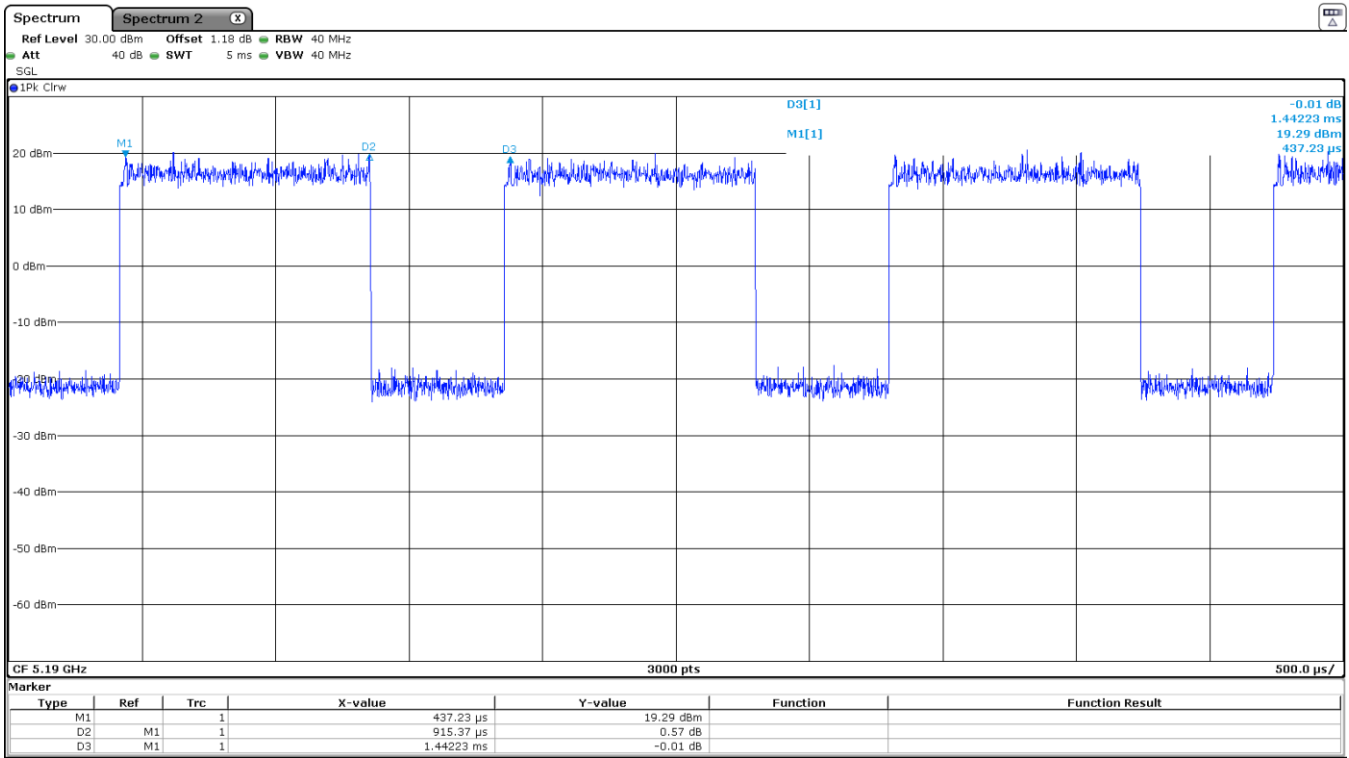
Mode 802.11 n20 (U-NII-1):



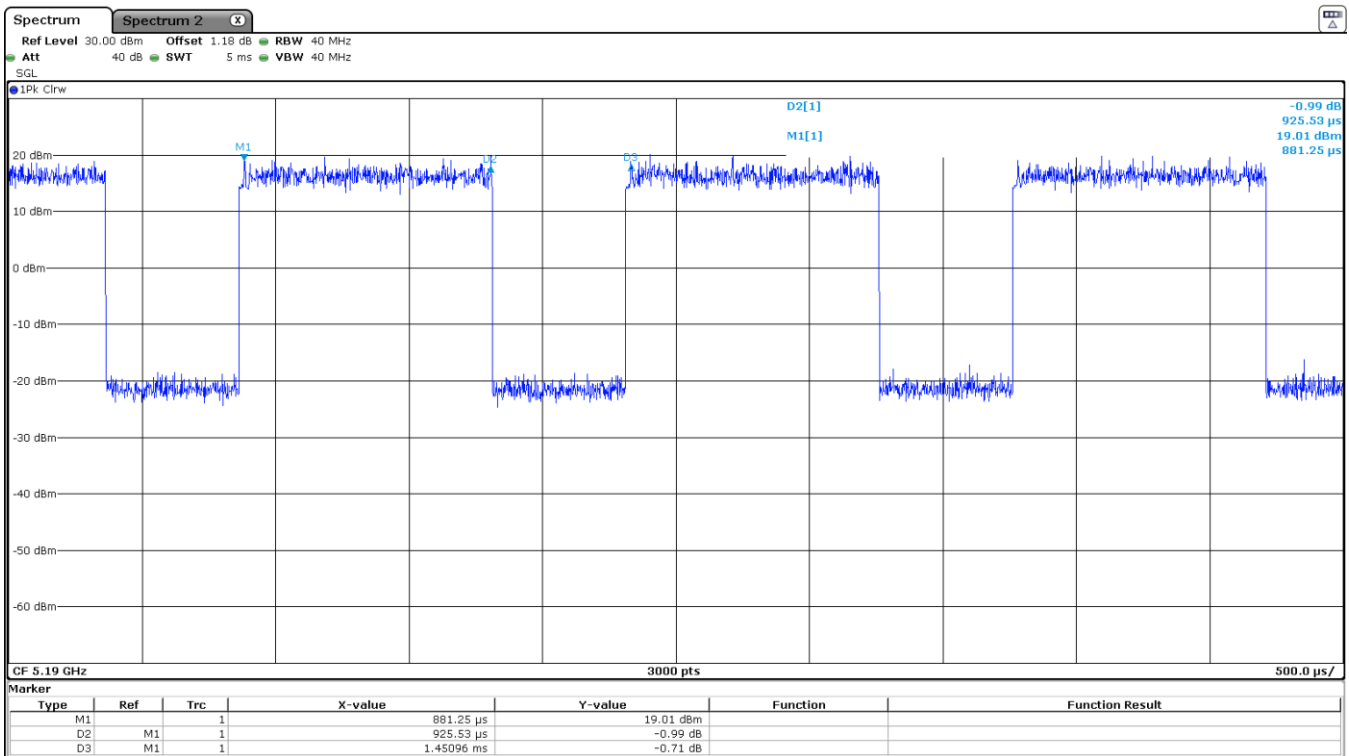
Mode 802.11 ac20 (U-NII-1):



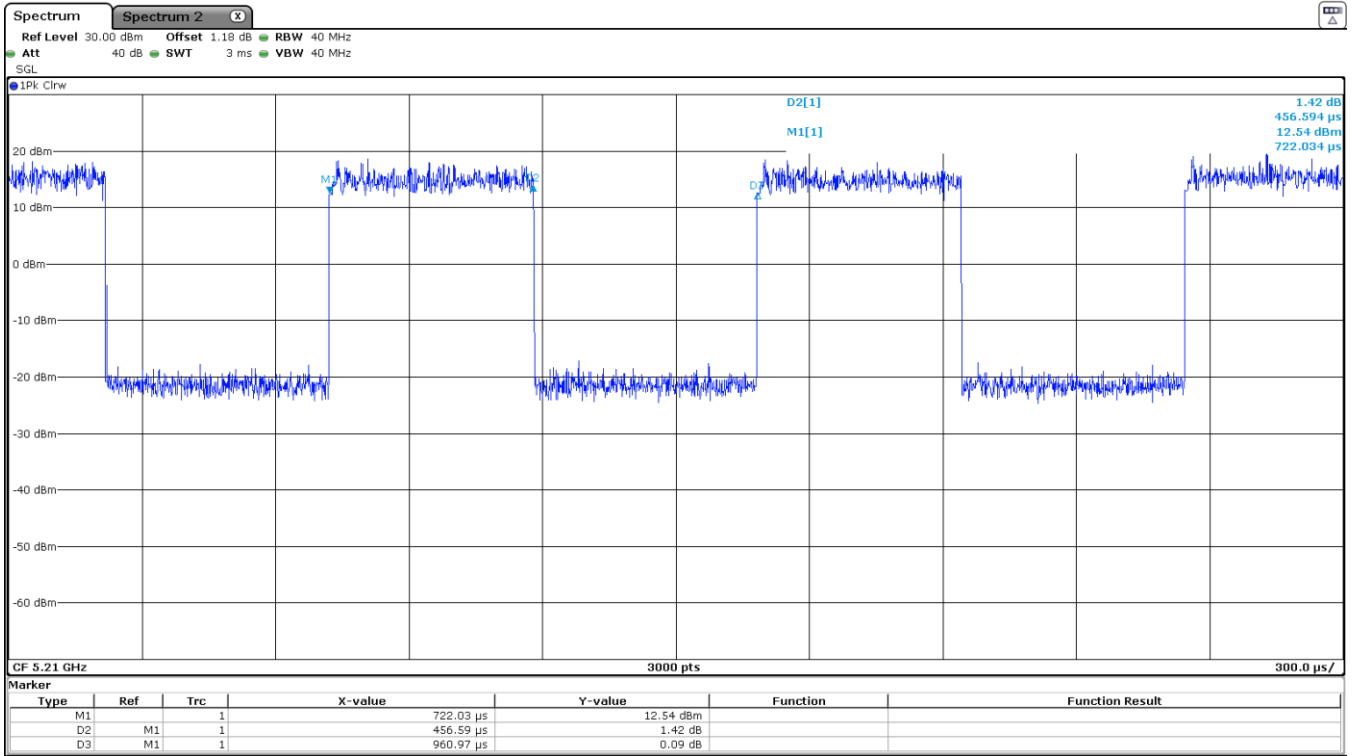
Mode 802.11 n40 (U-NII-1):



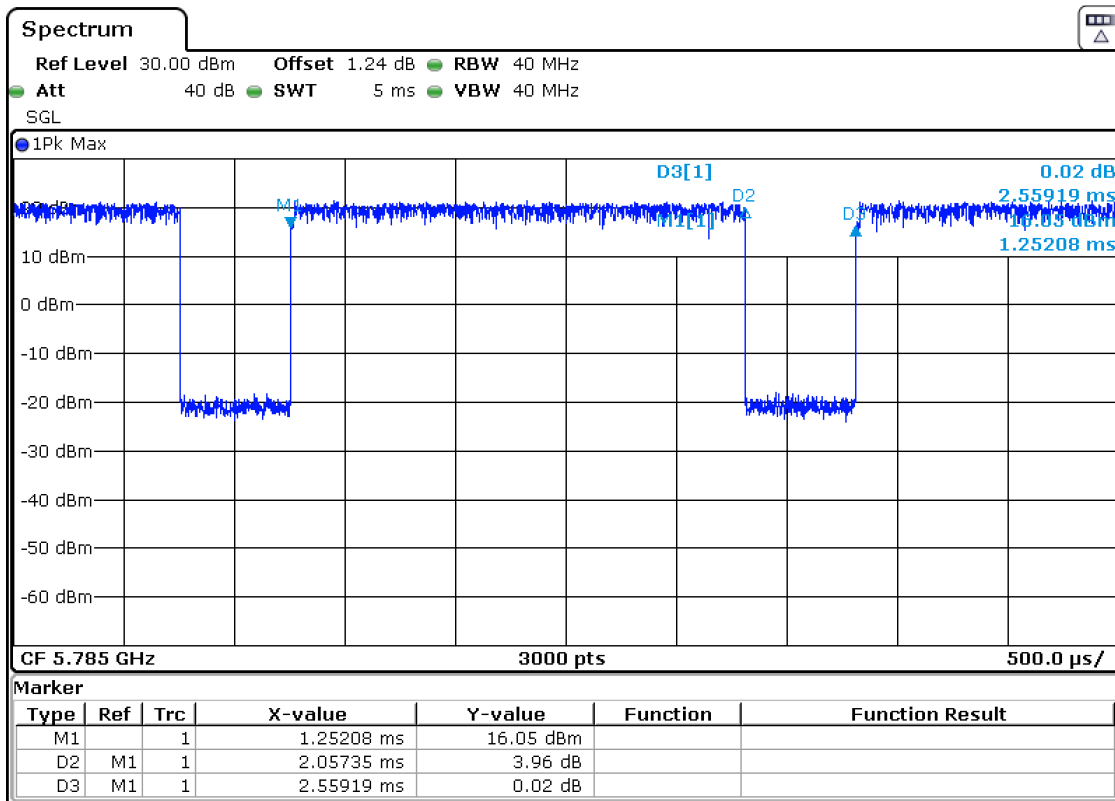
Mode 802.11 ac40 (U-NII-1):



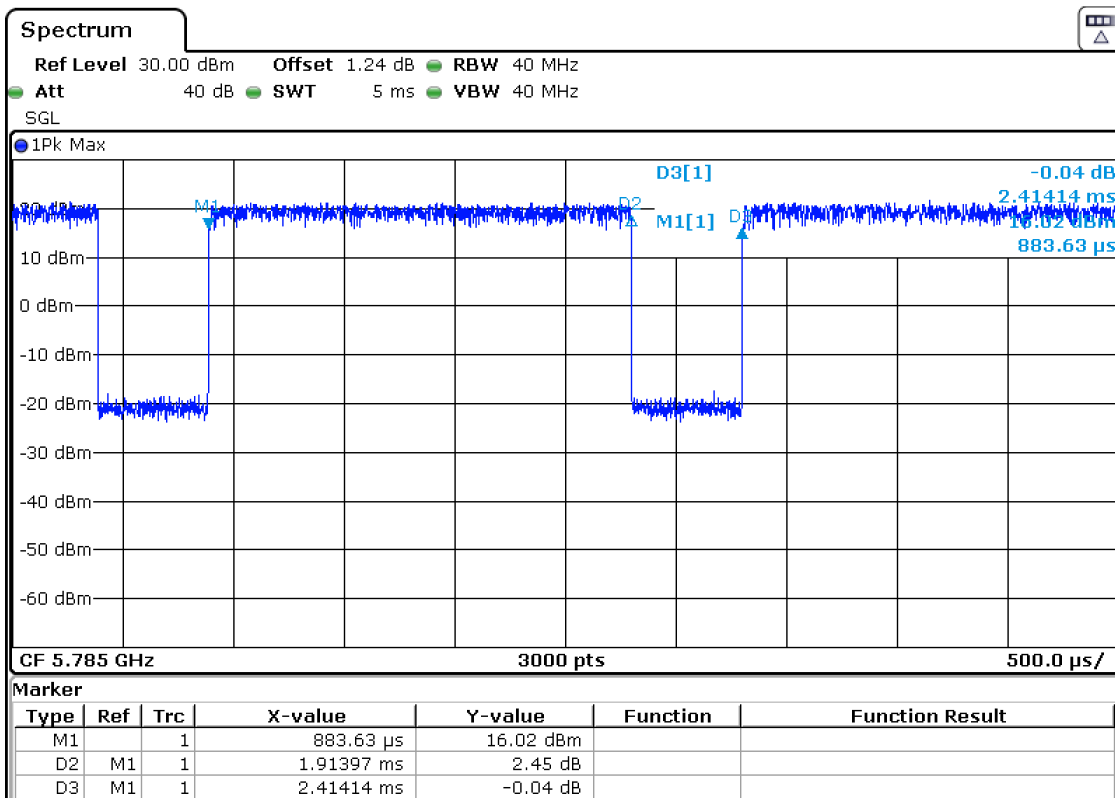
Mode 802.11 ac80 (U-NII-1):



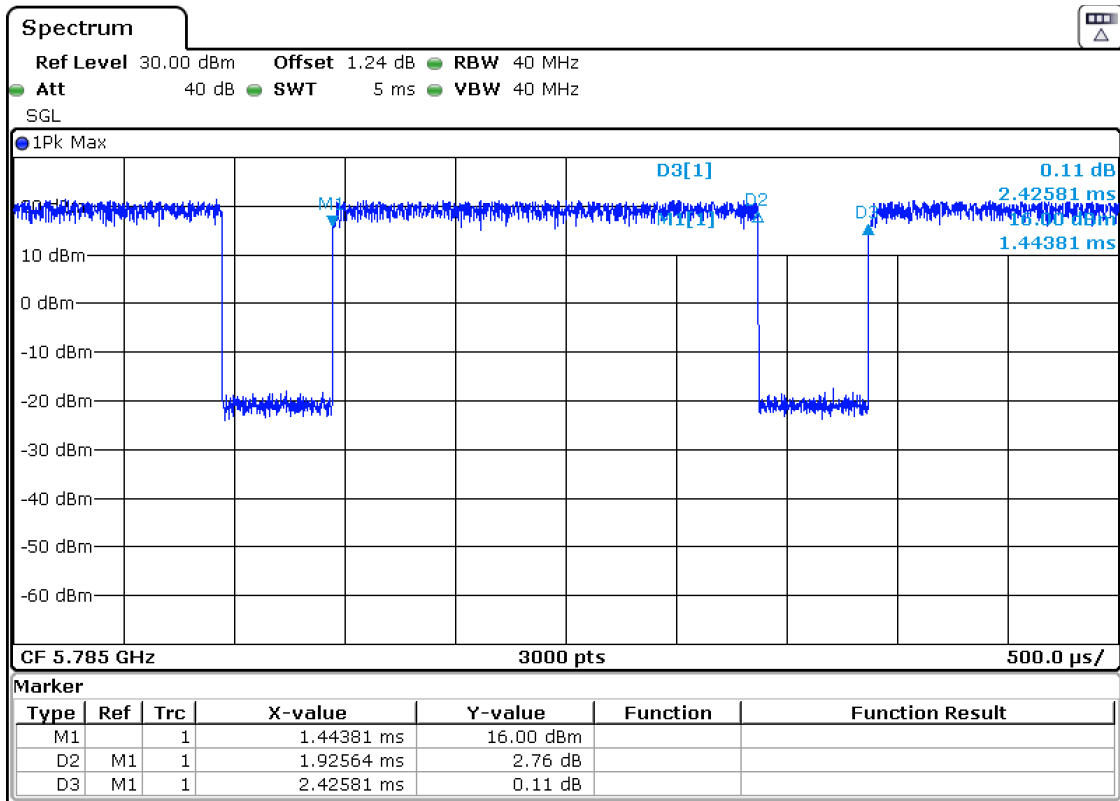
Mode 802.11 a20 (U-NII-3):



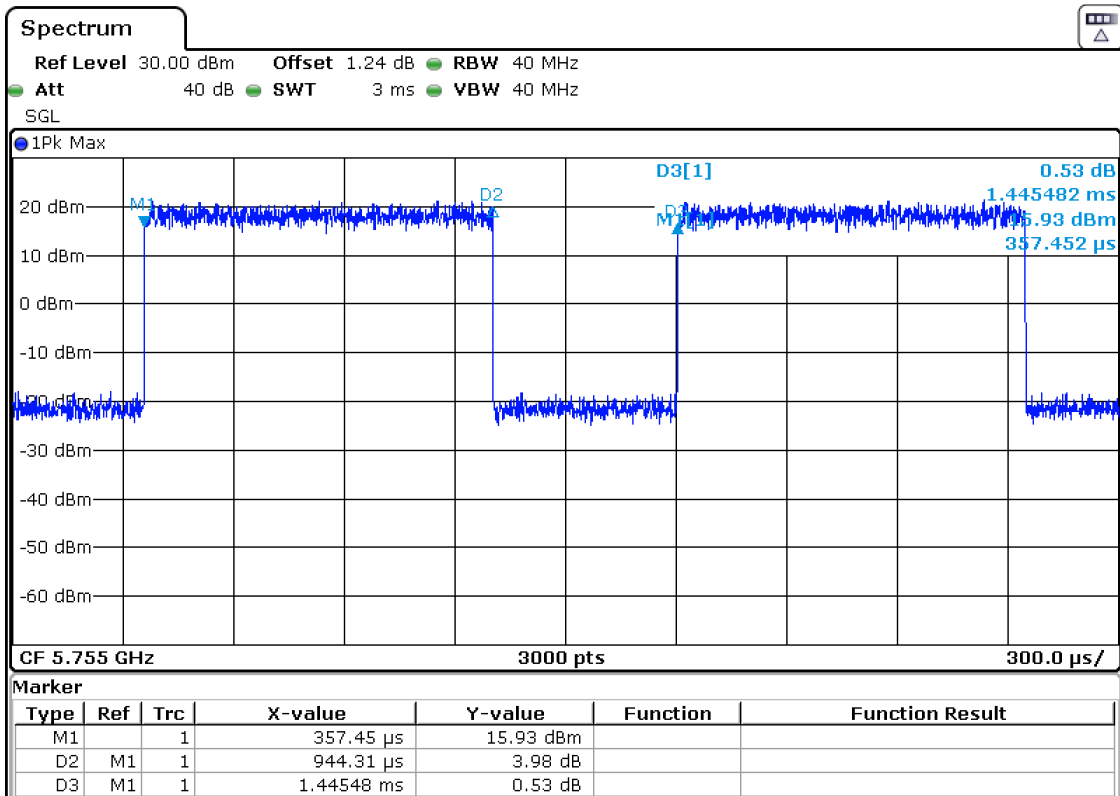
Mode 802.11 n20 (U-NII-3):



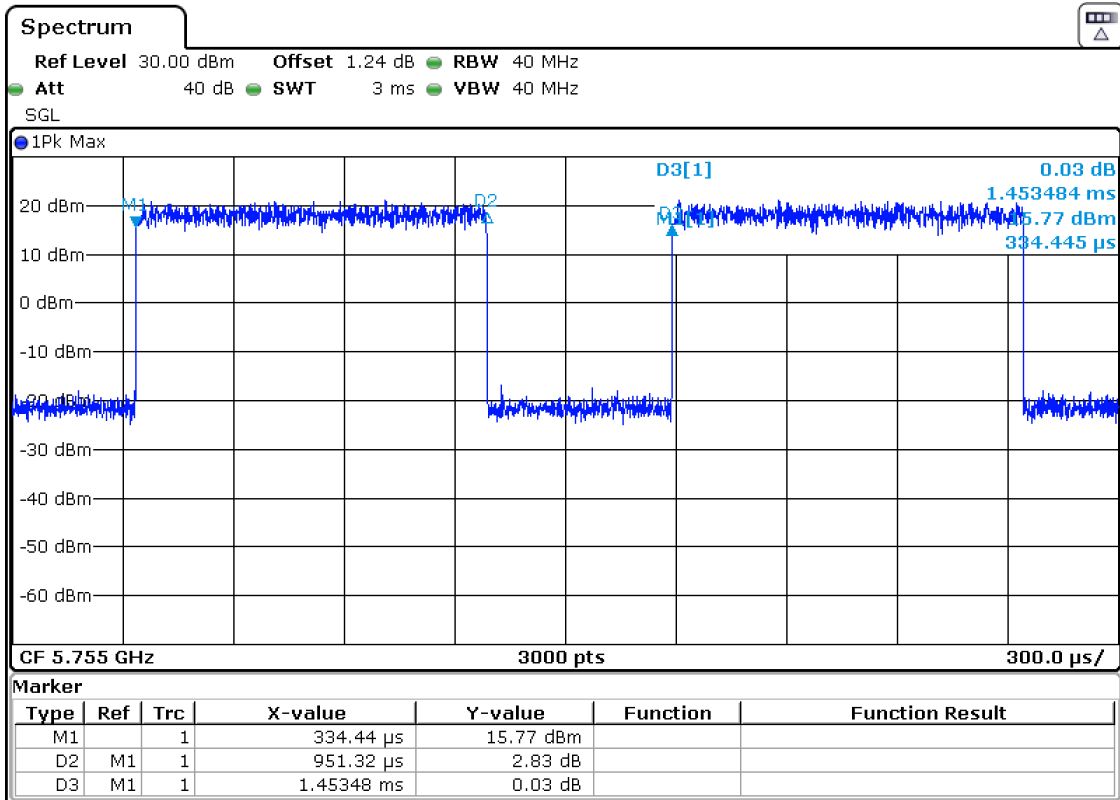
Mode 802.11 ac20 (U-NII-3):



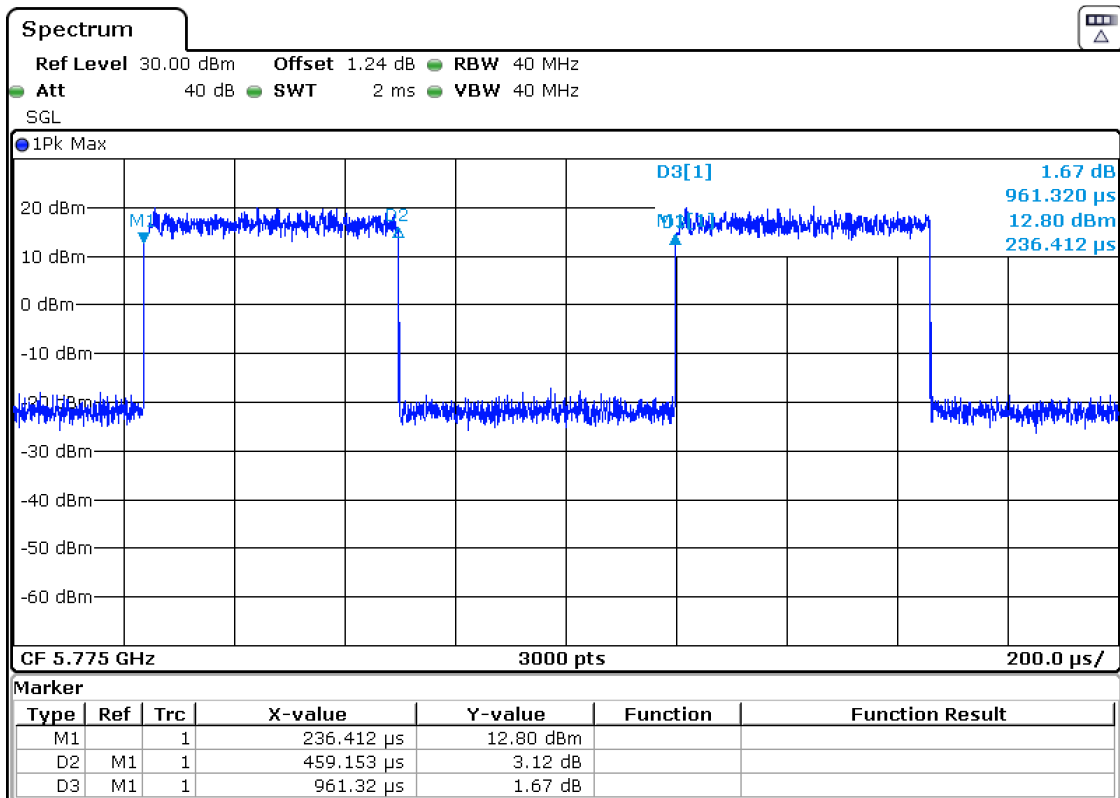
Mode 802.11 n40 (U-NII-3):



Mode 802.11 ac40 (U-NII-3):



Mode 802.11 ac80 (U-NII-3):



RSS-Gen 6.6 / RSS-247 6.2. Transmitter 99% Occupied Bandwidth

RESULTS:

Mode 802.11 a20:

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
99% Occupied Bandwidth (MHz)	17.03	17.00	17.01
Measurement uncertainty (kHz)	<±36.95		

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
99% Occupied Bandwidth (MHz)	17.01	17.02	17.02
Measurement uncertainty (kHz)	<±36.95		

Mode 802.11 n20 (HT20):

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
99% Occupied Bandwidth (MHz)	18.20	18.19	18.21
Measurement uncertainty (kHz)	<±36.95		

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
99% Occupied Bandwidth (MHz)	18.18	18.22	18.23
Measurement uncertainty (kHz)	<±36.95		

Mode 802.11 ac20 (VHT20):

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
99% Occupied Bandwidth (MHz)	18.17	18.20	18.20
Measurement uncertainty (kHz)	<±36.95		

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
99% Occupied Bandwidth (MHz)	18.14	18.17	18.21
Measurement uncertainty (kHz)	<±36.95		

Mode 802.11 n40 (HT40):

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
99% Occupied Bandwidth (MHz)	36.24	36.27
Measurement uncertainty (kHz)	<±62.36	

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
99% Occupied Bandwidth (MHz)	36.32	36.30
Measurement uncertainty (kHz)	<±62.36	

Mode 802.11 ac40 (VHT40):

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
99% Occupied Bandwidth (MHz)	36.21	36.27
Measurement uncertainty (kHz)	<±62.36	

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
99% Occupied Bandwidth (MHz)	36.30	36.28
Measurement uncertainty (kHz)	<±62.36	

Mode 802.11 ac80 (VHT80):

U-NII-1 (5150-5250 MHz)

Channel	Single Channel 42 (5210 MHz)
99% Occupied Bandwidth (MHz)	75.57
Measurement uncertainty (kHz)	<±124.71

U-NII-3 (5725-5850 MHz)

Channels	Single Channel 155 (5775 MHz)
99% Occupied Bandwidth (MHz)	75.65
Measurement uncertainty (kHz)	<±124.71

Appendix B: Tests results for the U-NII-1 Band 5.15 – 5.25 GHz

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal: 12 Vdc.
 Type of Power Supply: DC External (Car Battery).

ANTENNA:

Type of Antenna: External.
 Maximum Declared Antenna Gain: +0.9 dBi (antenna gain plus antenna cable loss).

TEST FREQUENCIES:

Technology Tested:	WLAN (IEEE 802.11 a,n,ac) / U-NII-1	
Modes:	802.11a20: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps	
	802.11n HT20: MCS0 to MCS7	
	802.11n HT40: MCS0 to MCS7	
	802.11ac VHT20: MCS0 to MCS9	
	802.11ac VHT40: MCS0 to MCS9	
	802.11ac VHT80: MCS0 to MCS9	
Setting of cores / ports:	One port.	
Beamforming:	No.	
Frequency Range:	5150 MHz to 5250 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Low: 36	5180
	Middle: 40	5200
	High: 48	5240
Channel Spacing:	40 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Low: 38	5190
	High: 46	5230
Channel Spacing:	80 MHz	
Transmit Channels	Middle: 42	5210

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode on the lowest and highest channels at the rated power for the channel under test.

For all modes, the EUT was configured in test mode using a software application. The application was used to enable a continuous transmission and to select the test channels as required. The client supplied instructions to configure the EUT. The customer supplied a document containing the setup instructions.

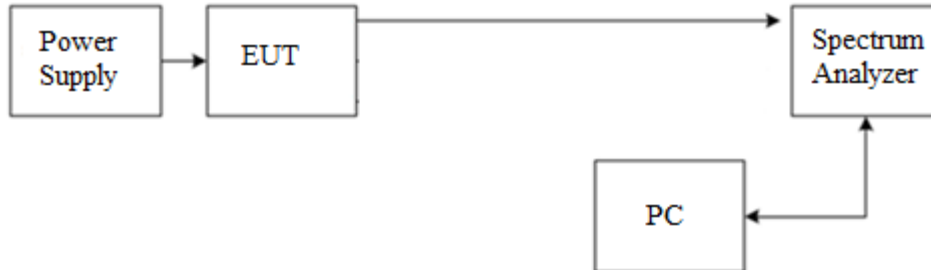
The worst cases for testing were identified for output power and spurious levels at the band edges which were selected based on preliminary testing that correspond to next data rates:

- 802.11 a20: 6 Mbps
- 802.11 n HT20: MCS0
- 802.11 n HT40: MCS0
- 802.11 ac VHT20: MCS0
- 802.11 ac VHT40: MCS0
- 802.11 ac VHT80: MCS0

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and connected to the spectrum analyzer using a low loss RF cable. The reading in the spectrum analyzer is corrected taking into account the internal and external RF cable loss.

For all modes:



The DC supply voltage is applied using an external power supply.

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) and 1 GHz-18 GHz Double ridge horn antenna is situated at a distance of 3 m and a distance of 1m for the frequency range 17 GHz-40 GHz (18 GHz-40 GHz horn antenna).

For radiated emissions in the range 17 GHz-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

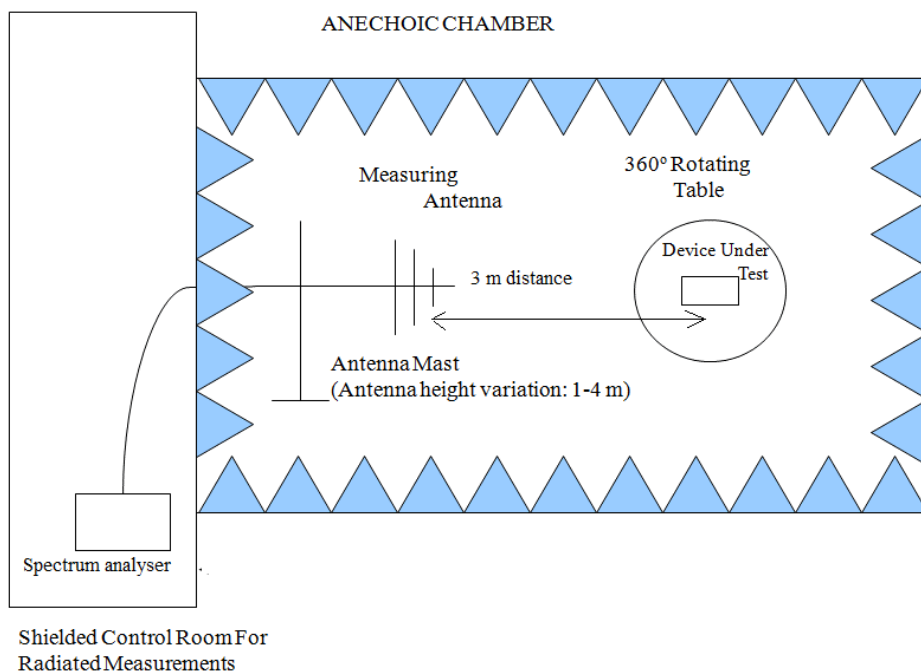
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

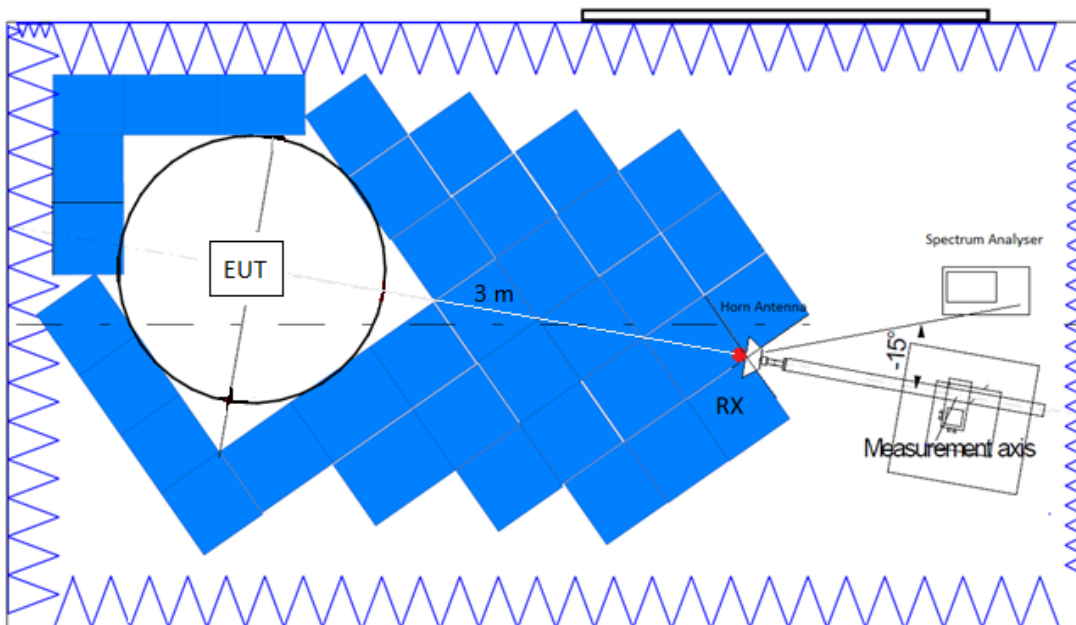
The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

A resolution bandwidth / video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

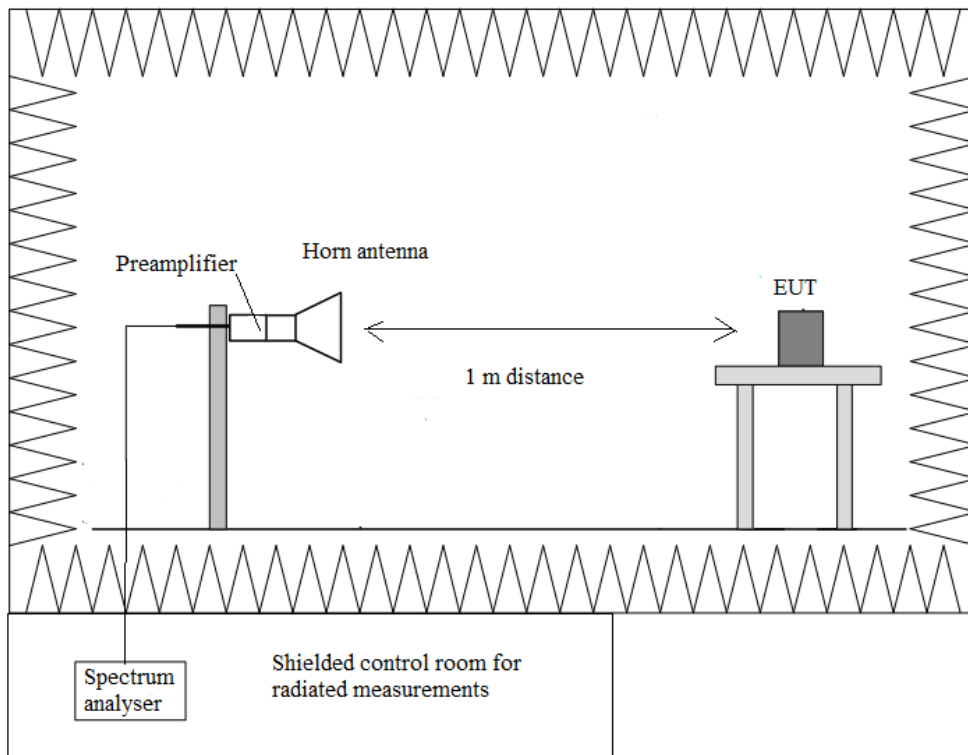
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



FCC 15.407 (a)(1)(iv). Transmitter Maximum Conducted Output Power / RSS-247

6.2.1.1. Transmitter Maximum Equivalent Isotropically Radiated Power

SPECIFICATION:

FCC 15.407: For client devices in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW (24 dBm) provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The maximum e.i.r.p. shall not exceed 200 mW (23 dBm) or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

RESULTS:

The maximum conducted output power was measured using the channel power integration method according to point E) 2) b) (Method SA-1) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is >98% and the channel power integration method according to point E) 2) d) (Method SA-2) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is <98%.

For data rates where the EUT was transmitting at <98% duty cycle, the duty calculated in Appendix A was added to the measured power in order to calculate the total average power during the actual transmission time.

The e.i.r.p. levels are calculated by adding the declared maximum antenna gain (dBi).

For all modes of operation, the antenna gain is less than 6 dBi.

Maximum Declared Antenna Gain: +0.9 dBi

Mode 802.11 a20:

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	10.910	10.920	10.530
Duty Cycle Correction Factor (dB)	1.003836609		
Max. Conducted Power Corrected (dBm)	11.914	11.924	11.534
Max. EIRP power Corrected (dBm)	12.814	12.824	12.434
Measurement uncertainty (dB)	<±1.96		

Mode 802.11 n20 (HT20):

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	10.840	10.770	10.350
Duty Cycle Correction Factor (dB)	1.061786773		
Max. Conducted Power Corrected (dBm)	11.902	11.832	11.412
Max. EIRP power Corrected (dBm)	12.802	12.732	12.312
Measurement uncertainty (dB)	<±1.96		

Mode 802.11 ac20 (VHT20):

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	10.81	10.95	10.26
Duty Cycle Correction Factor (dB)	1.05388185		
Max. Conducted Power Corrected (dBm)	11.864	12.004	11.314
Max. EIRP power Corrected (dBm)	12.764	12.904	12.214
Measurement uncertainty (dB)	<±1.96		

Mode 802.11 n40 (HT40):

	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
Max. Conducted Power (dBm)	8.300	7.850
Duty Cycle Correction Factor (dB)	1.974378502	
Max. Conducted Power Corrected (dBm)	10.274	9.824
Max. EIRP power Corrected (dBm)	11.174	10.724
Measurement uncertainty (dB)	<±1.96	

Mode 802.11 ac40 (VHT40):

	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
Max. Conducted Power (dBm)	8.290	7.880
Duty Cycle Correction Factor (dB)	1.952649395	
Max. Conducted Power Corrected (dBm)	10.243	9.833
Max. EIRP Power Corrected (dBm)	11.143	10.733
Measurement uncertainty (dB)	<±1.96	

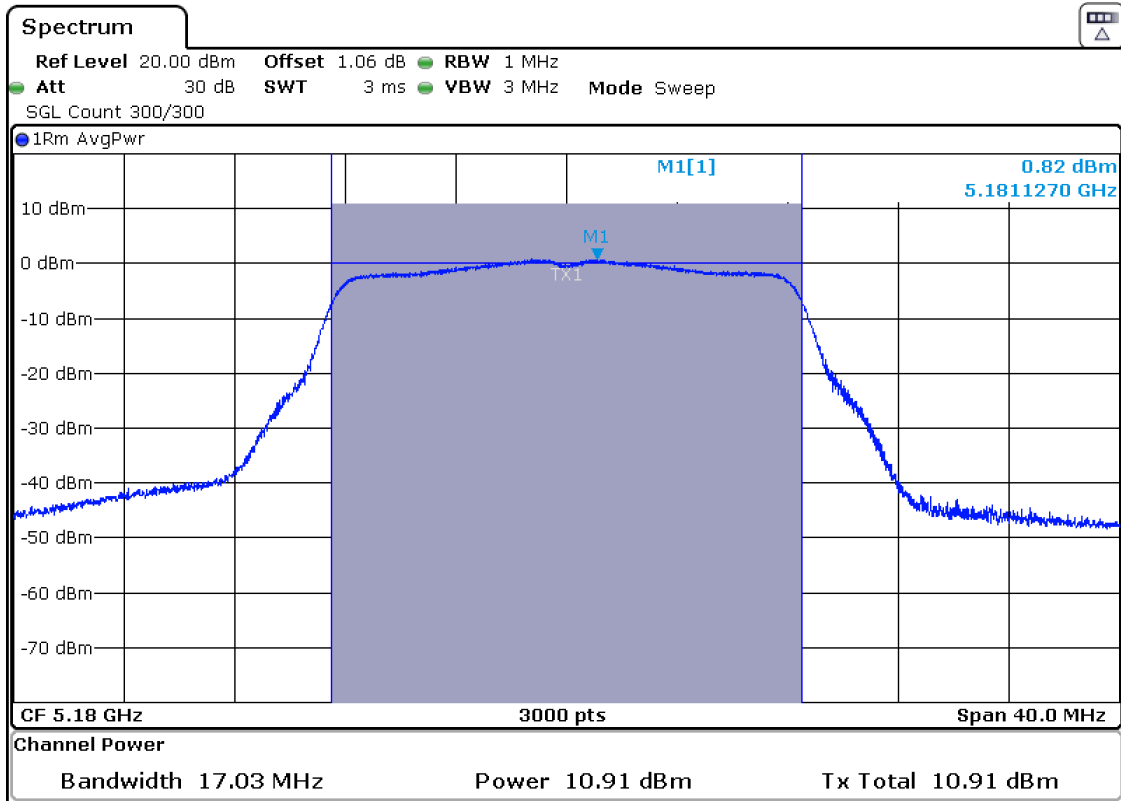
Mode 802.11 ac80 (VHT80):

	Single Channel 42 (5210 MHz)
Max. Conducted Power (dBm)	7.970
Duty Cycle Correction Factor (dB)	3.231834343
Max. Conducted Power Corrected (dBm)	11.202
Max. EIRP Power Corrected (dBm)	12.102
Measurement uncertainty (dB)	<±1.96

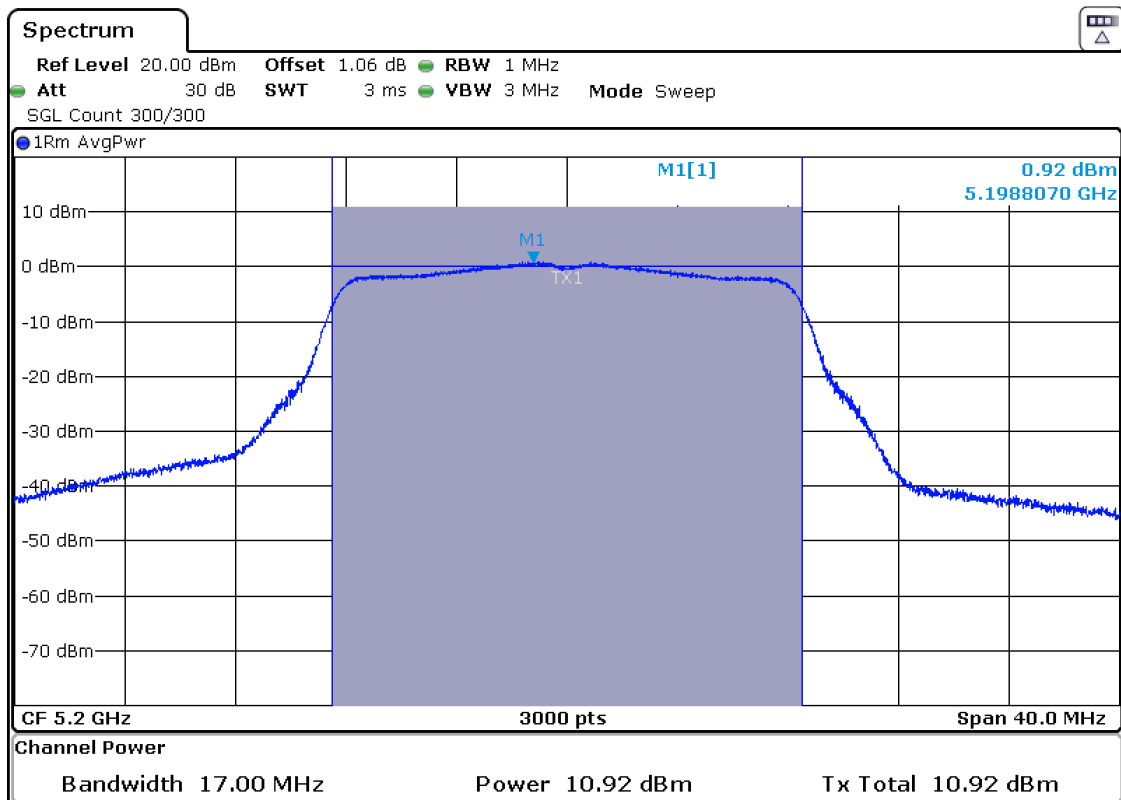
Verdict: PASS

Mode 802.11 a20:

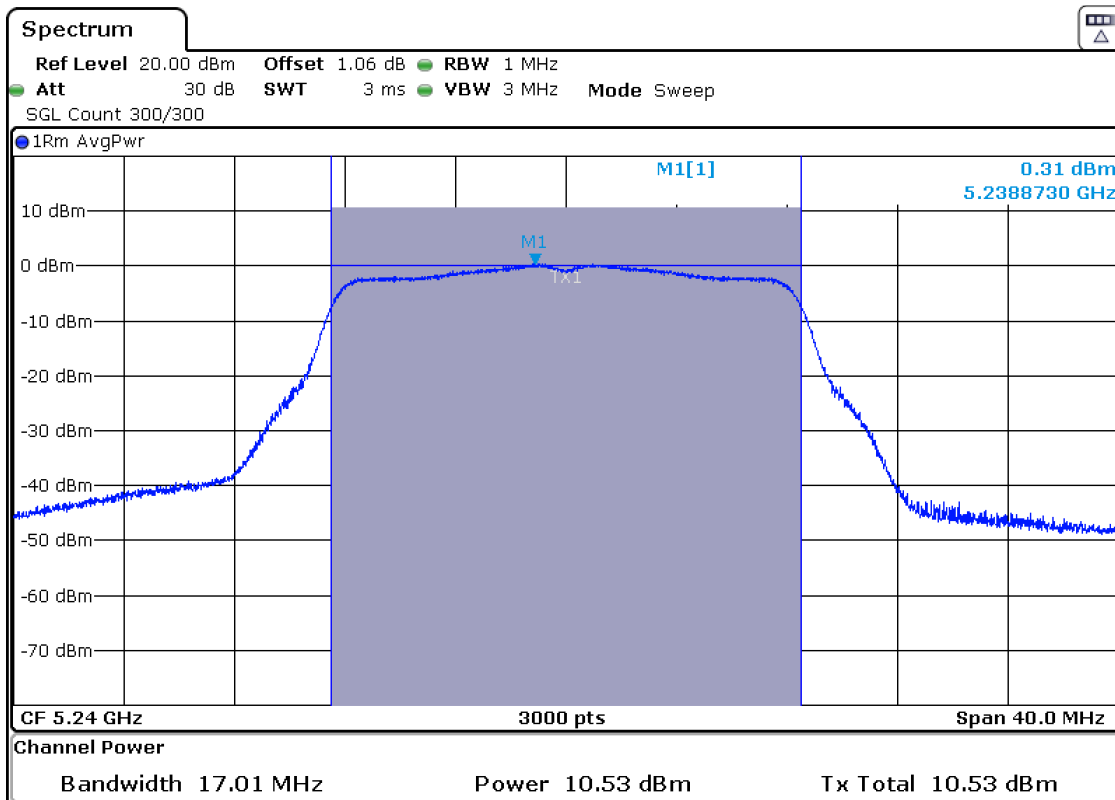
- Low Channel:



- Middle Channel:

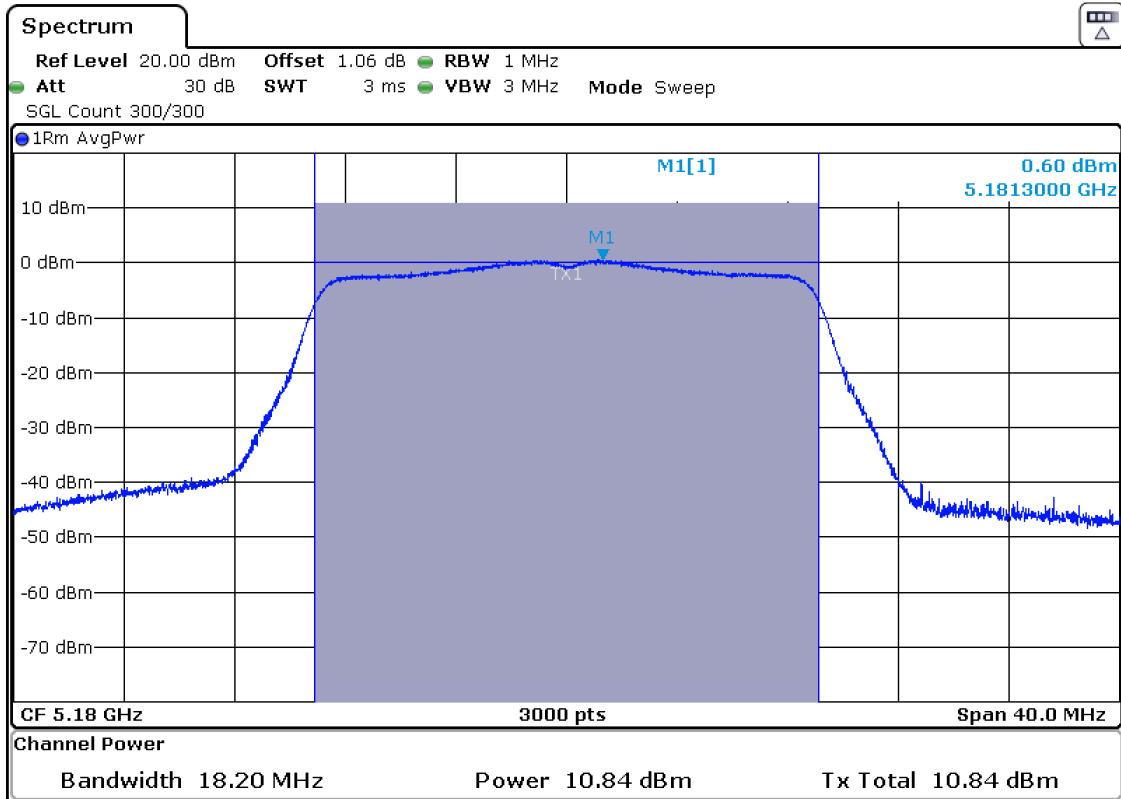


- High Channel:

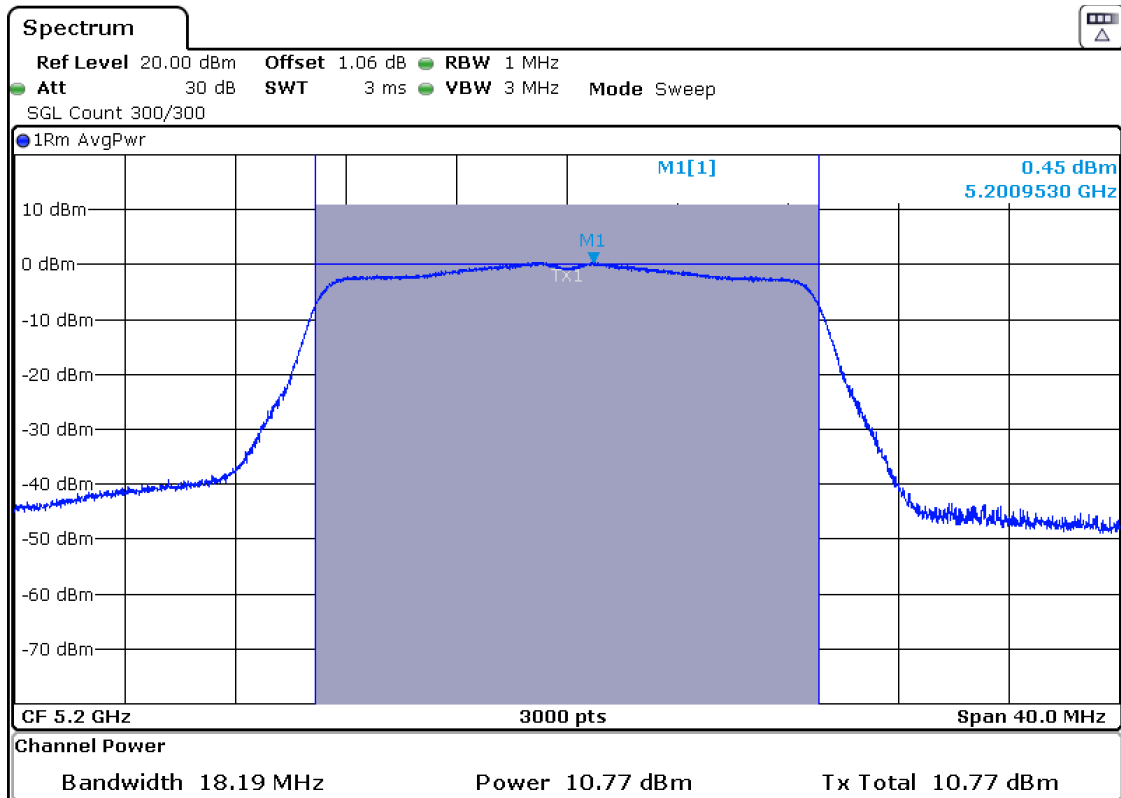


Mode 802.11 n20 (HT20):

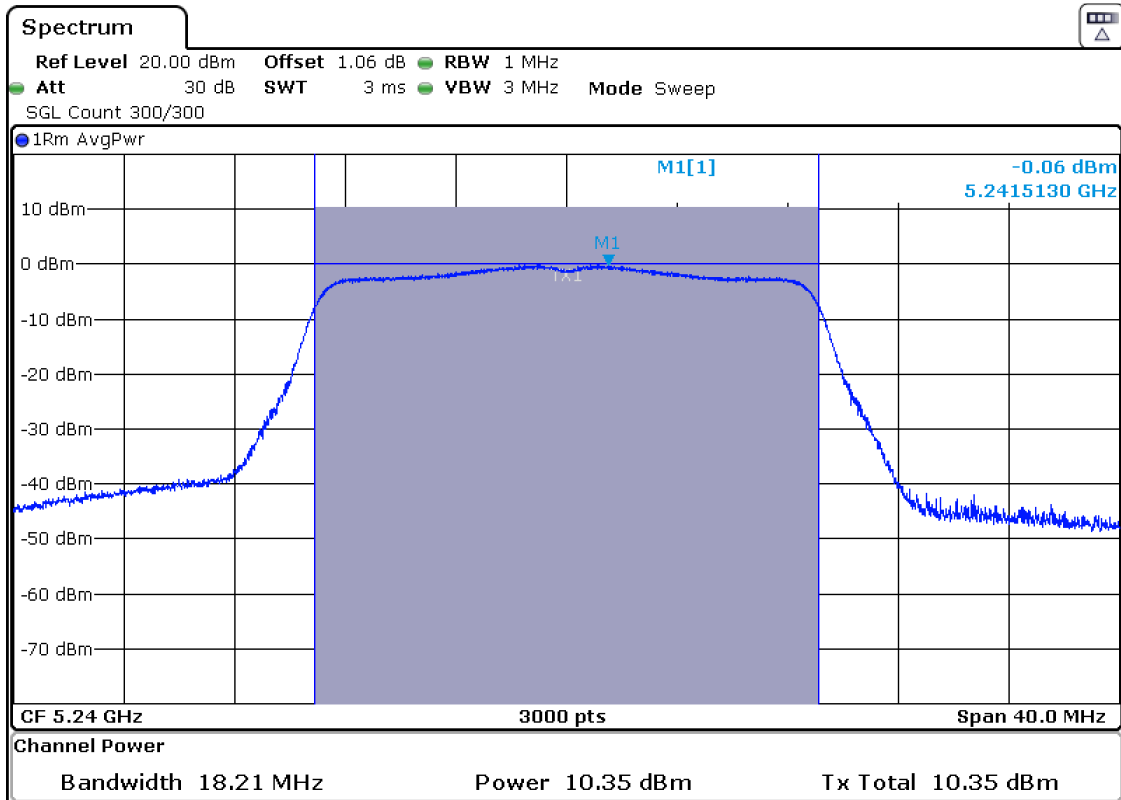
- Low Channel:



- Middle Channel:

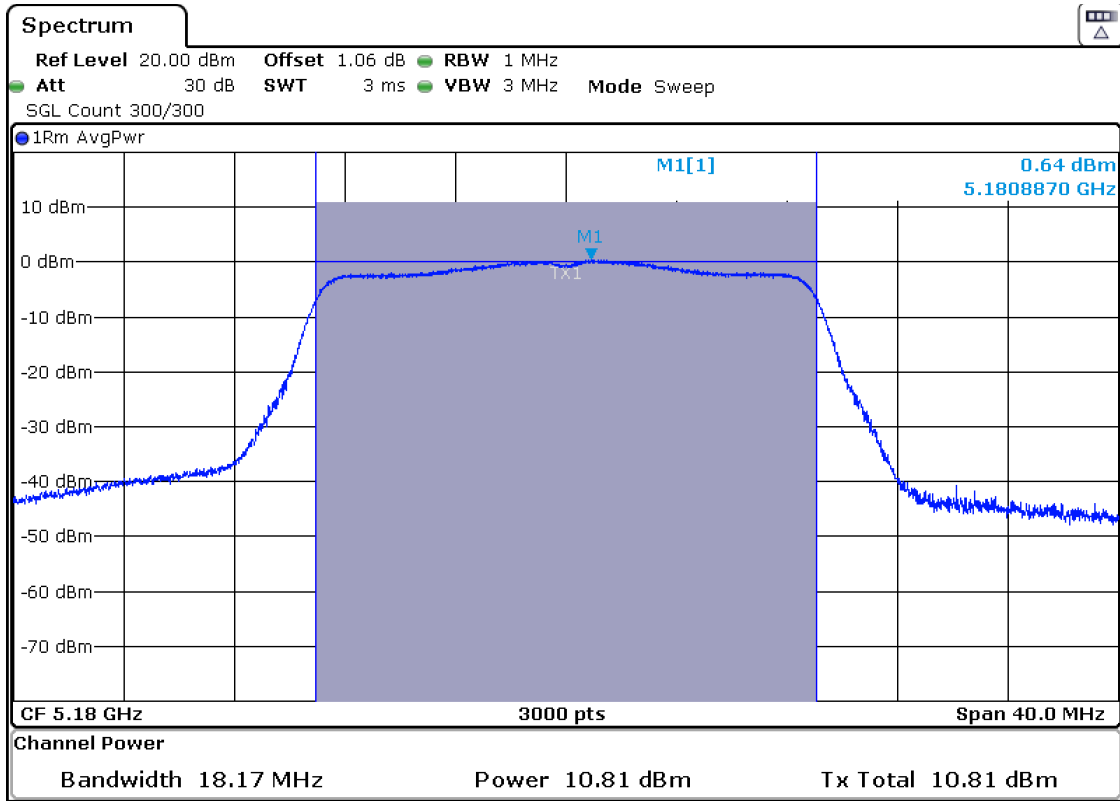


- High Channel:

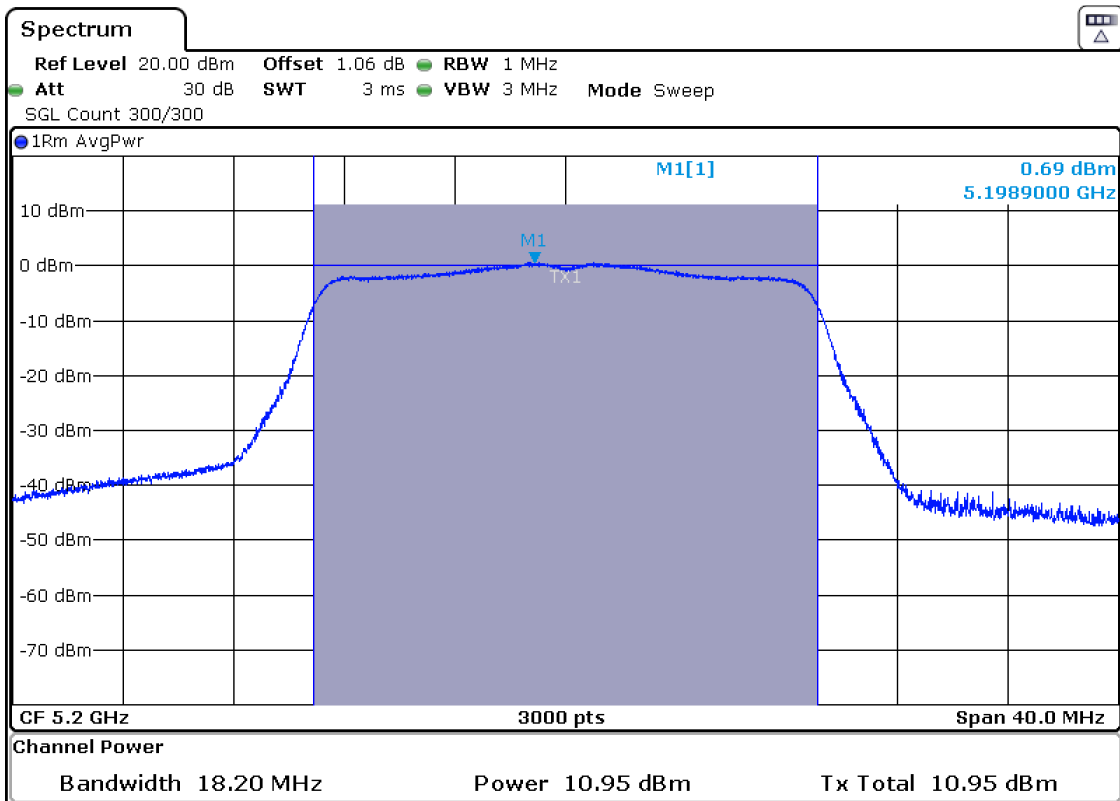


Mode 802.11 ac20 (VHT20):

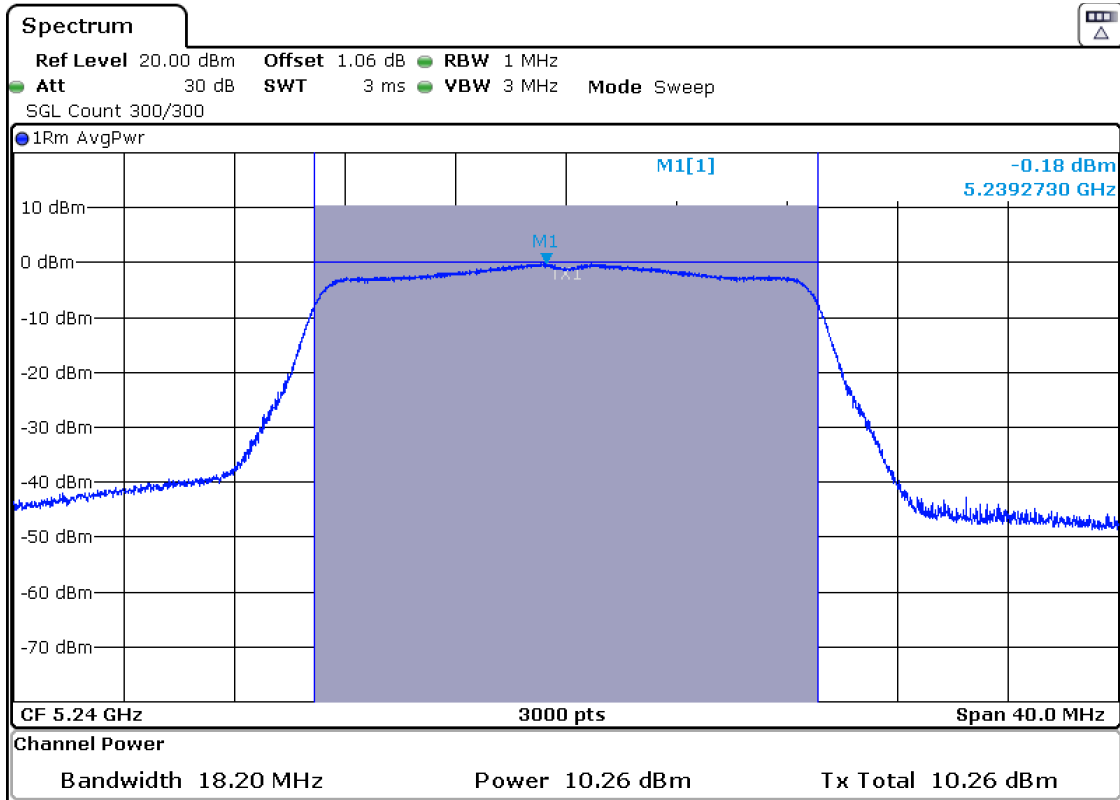
- Low Channel:



- Middle Channel:

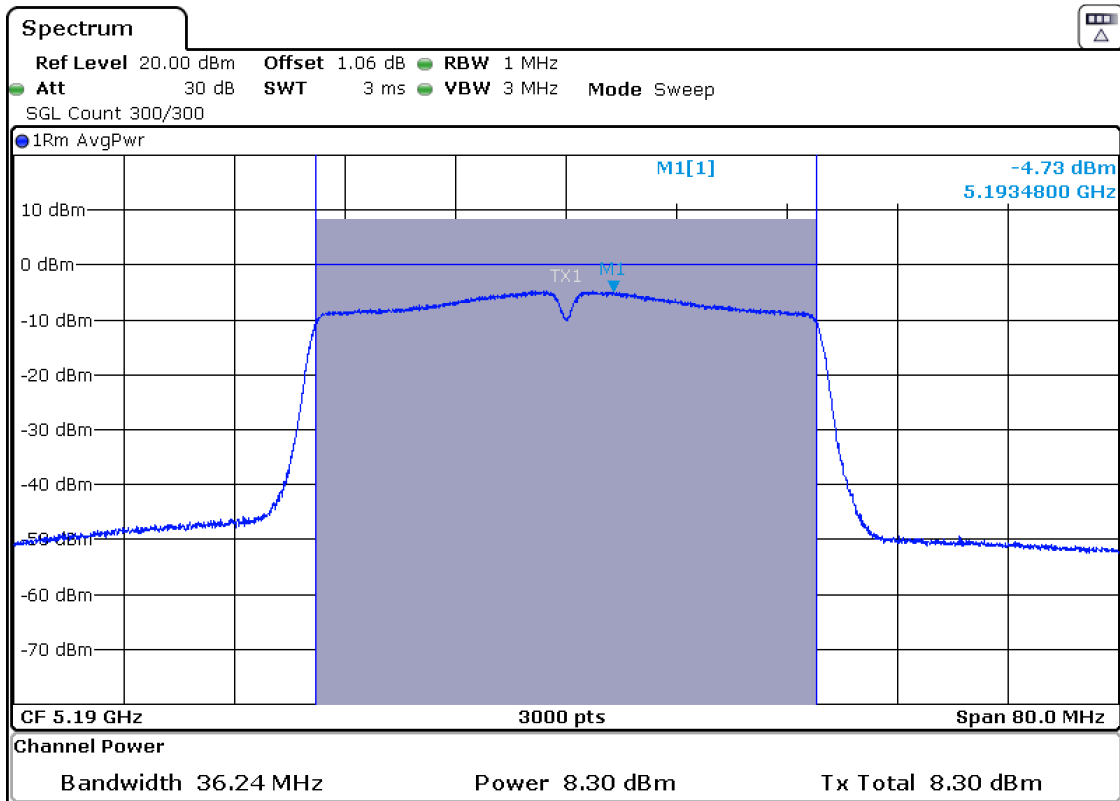


- High Channel:

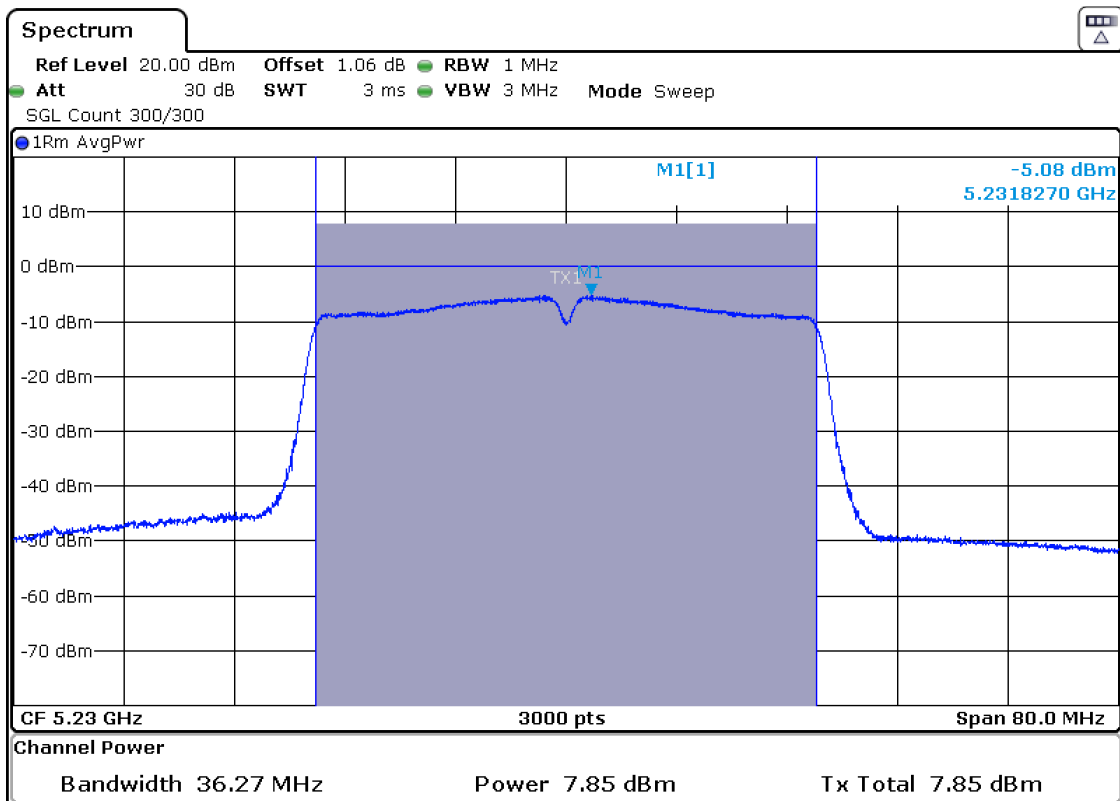


Mode 802.11 n40 (HT40):

- Low Channel:

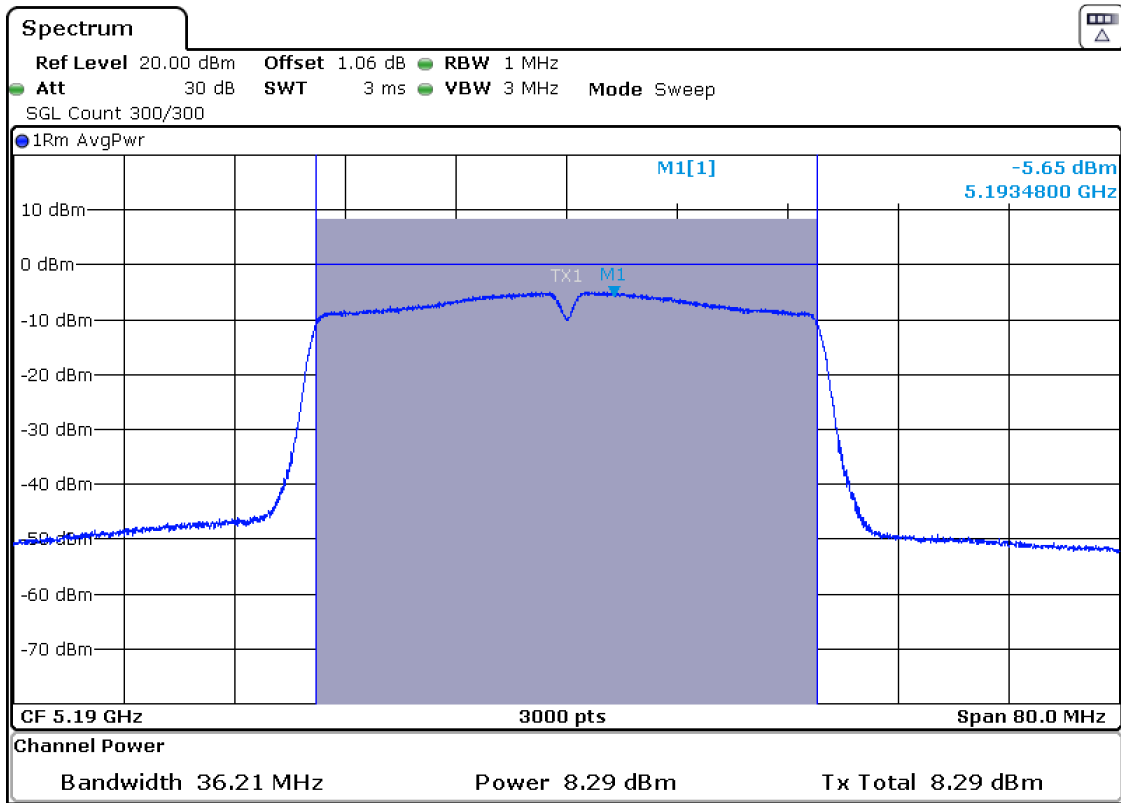


- High Channel:

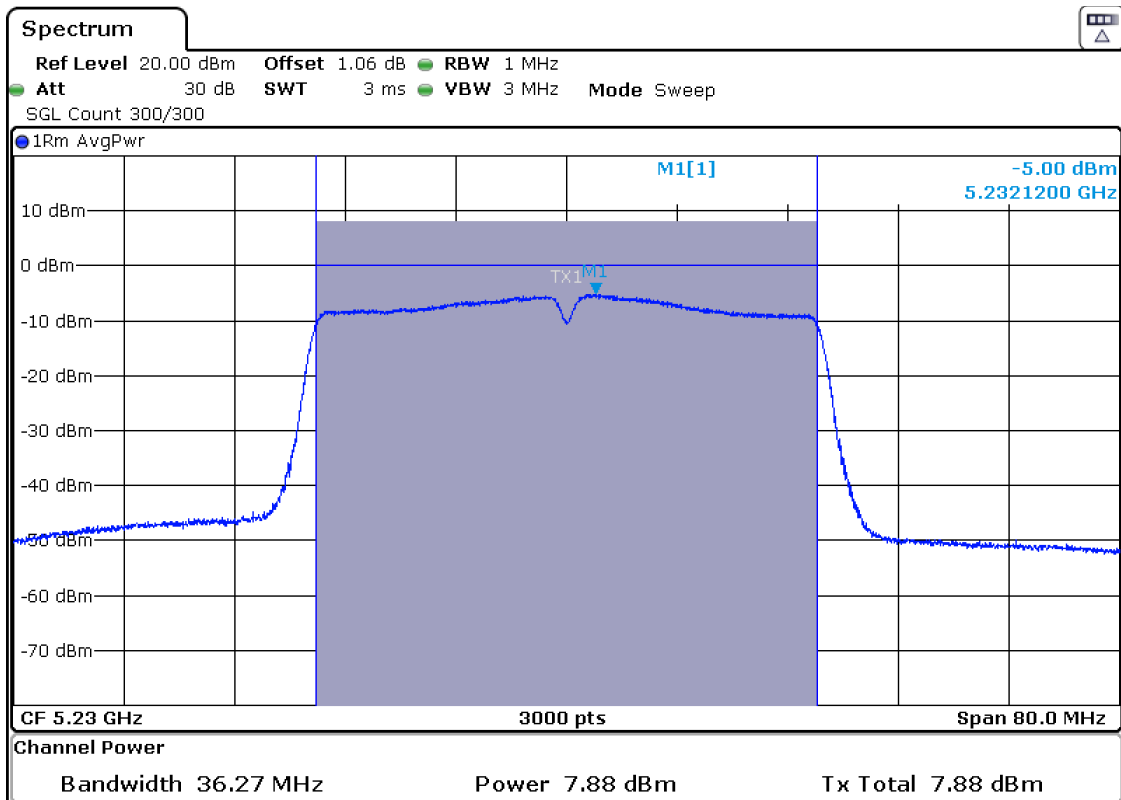


Mode 802.11 ac40 (VHT40):

- Low Channel:

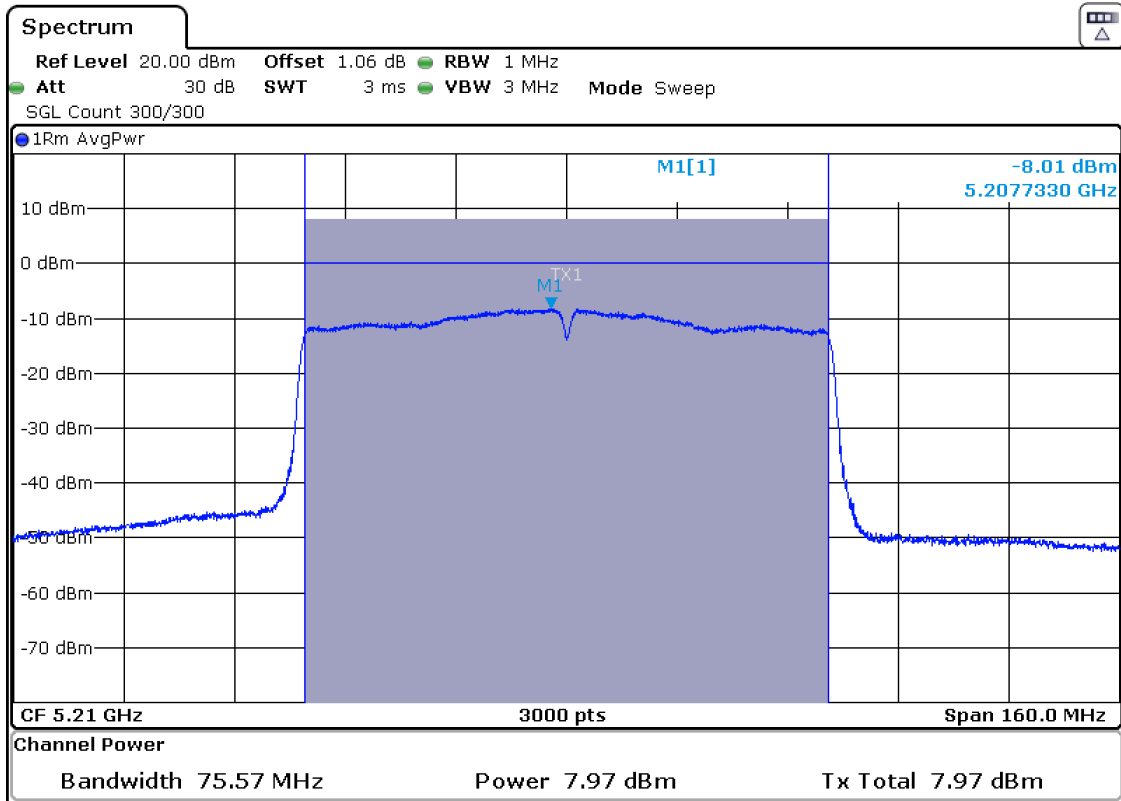


- High Channel:



Mode 802.11 ac80 (VHT80):

- Single Channel:



FCC 15.407 (b)(1)(6) / RSS-247 6.2.1.2. Transmitter Out of Band Radiated Emissions

SPECIFICATION:

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 1m for the frequency range 17 GHz-40 GHz and a distance of 3m for frequency range 30 MHz-17 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

- Test performed on the following worst case: 802.11 a20 (6 Mbps).

The worst case was determined by measuring the e.i.r.p. density (radiated).

Frequency range 30 MHz - 1 GHz (worst case):

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
578.729000	28.61	V	Quasi-Peak	< \pm 5.08
884.764000	31.86	H	Quasi-Peak	< \pm 5.08

Frequency range 1 - 40 GHz (worst case):

The results in the next tables show the maximum measured levels in the 1 - 40 GHz frequency range.

The Low, Middle and High Channels were measured for out-of-band emissions for the worst mode.

Spurious frequencies in the restricted bands with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with an average detector for checking compliance with the average limit.

- LOW CHANNEL. Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
10.35663	65.22	V	Peak	< \pm 5.13
	50.15		Average	< \pm 5.13

- MIDDLE CHANNEL. Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
10.39960	64.84	V	Peak	< \pm 5.13
	49.73		Average	< \pm 5.13

- HIGH CHANNEL. Spurious frequencies at less than 20 dB below the limit:

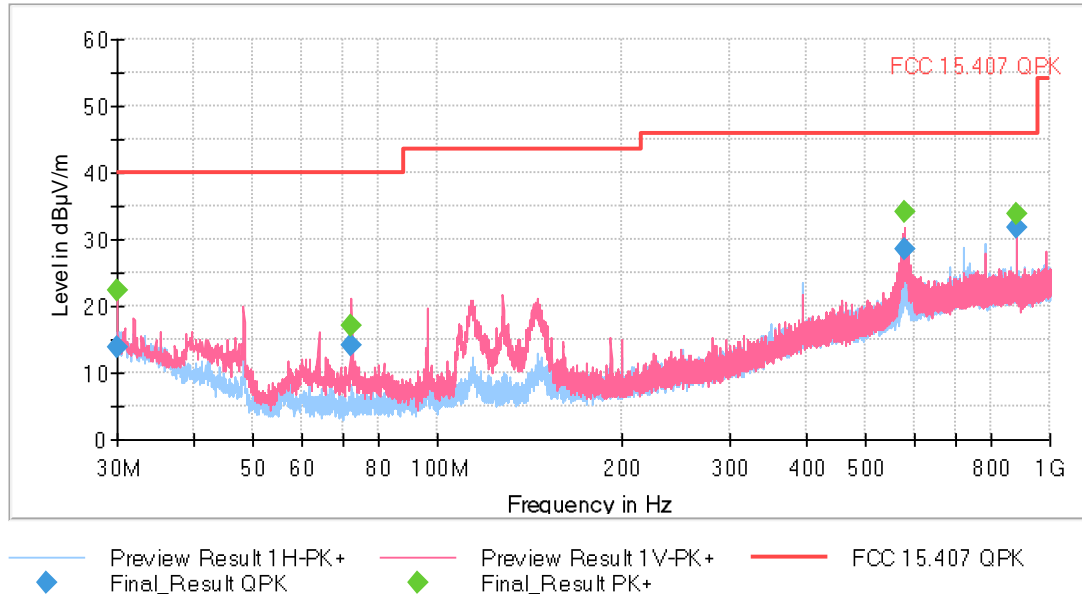
Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
10.47730	62.88	V	Peak	< \pm 5.13
	47.82		Average	< \pm 5.13

Measurement Uncertainty (dB):
 1 GHz - 17 GHz < \pm 5.13
 17 GHz - 26.5 GHz < \pm 4.82
 26.5 GHz - 40 GHz < \pm 5.33

Verdict: PASS

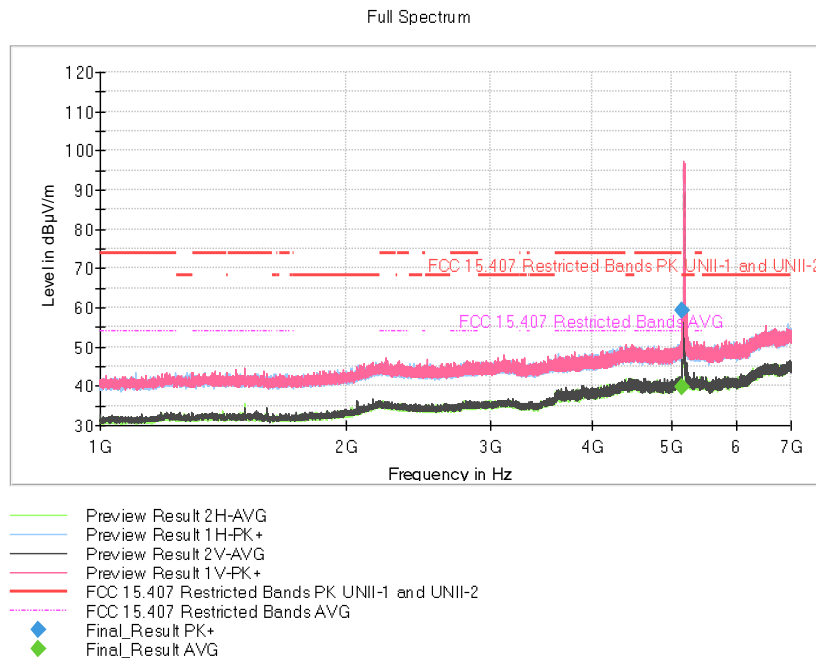
FREQUENCY RANGE 30 MHz - 1 GHz (worst case):

This plot is valid for the Low, Middle and High Channels and all the modulation modes.



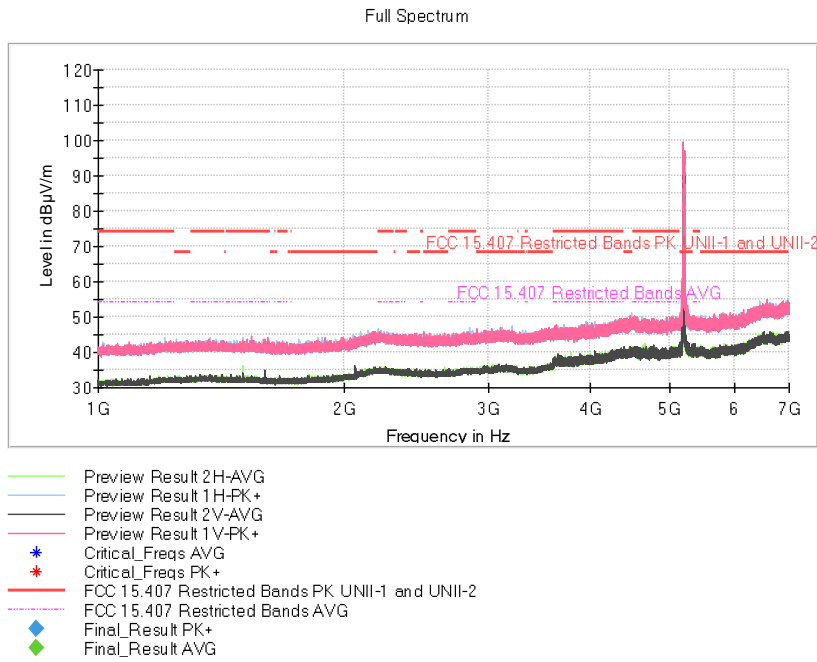
FREQUENCY RANGE 1 - 7 GHz (worst mode):

- Low Channel:



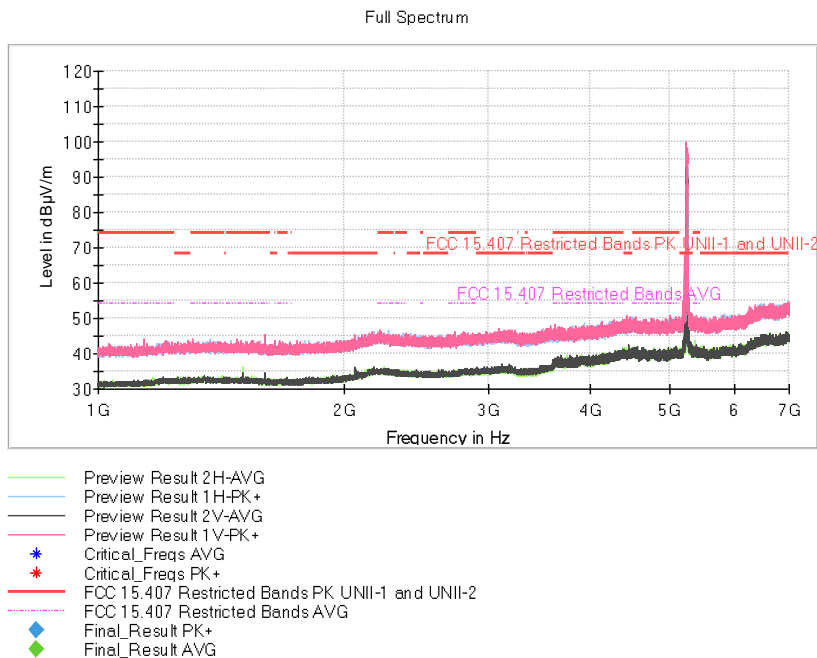
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

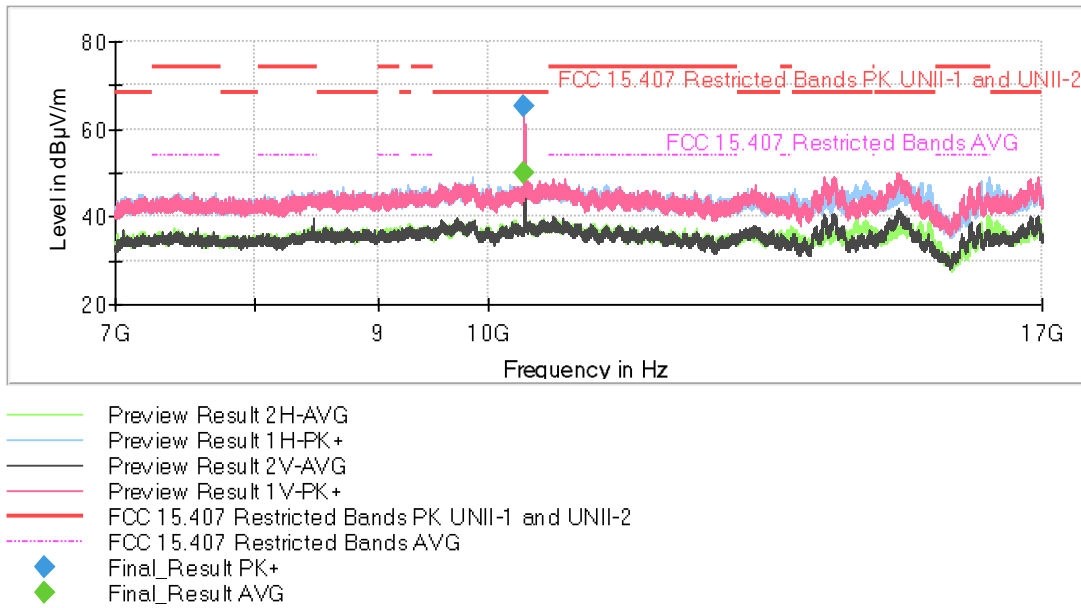
- High Channel:



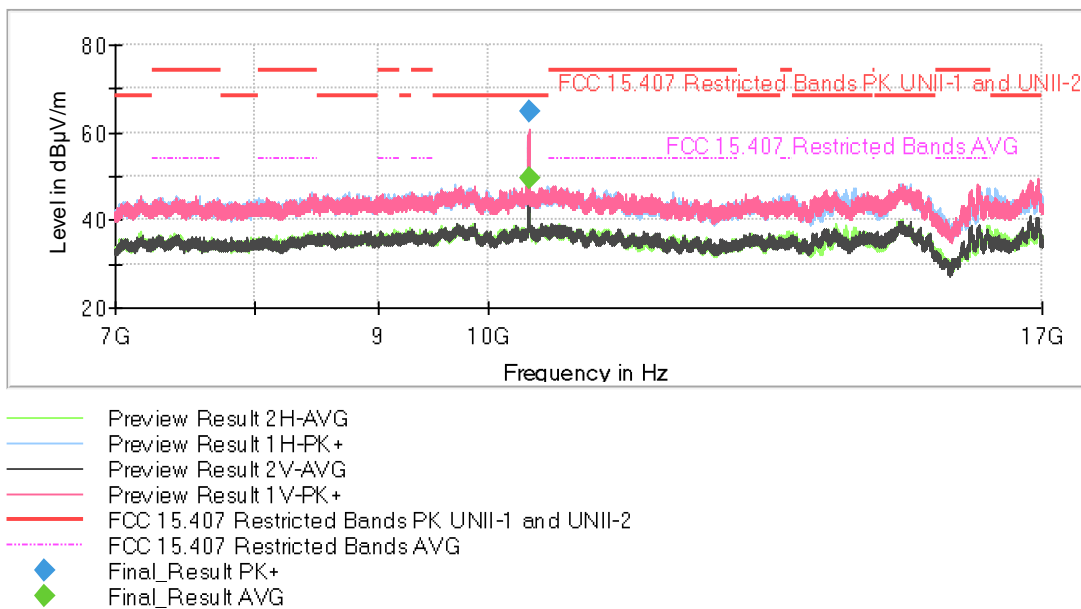
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 7 - 17 GHz (worst mode):

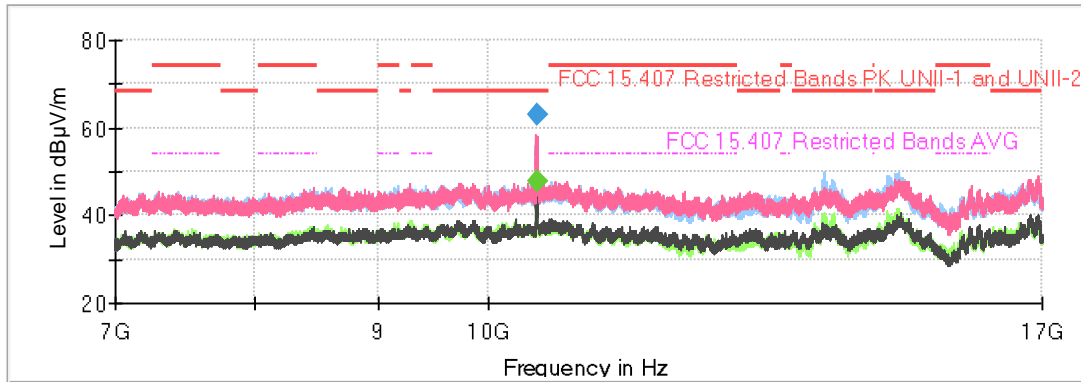
- Low Channel:



- Middle Channel:



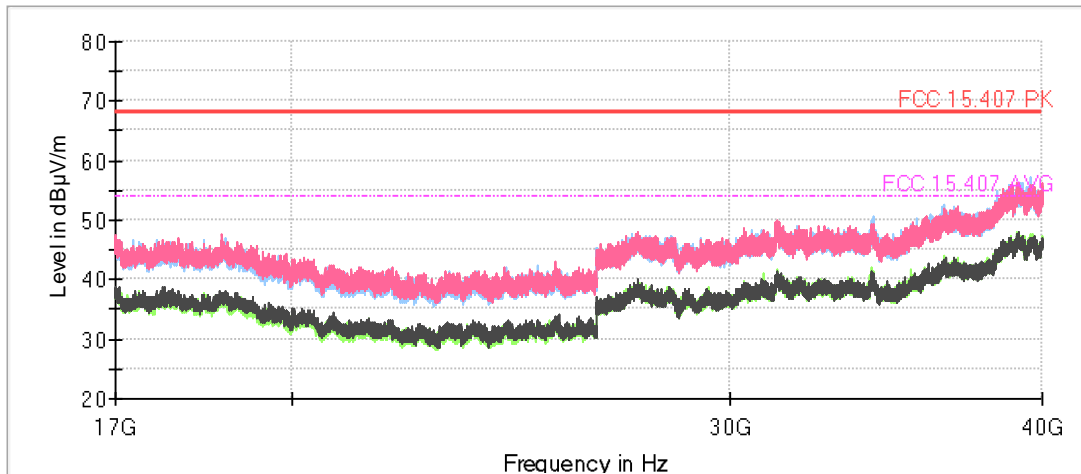
- High Channel:



- Preview Result 2H-AVG
- Preview Result 1H-PK+
- Preview Result 2V-AVG
- Preview Result 1V-PK+
- FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
- FCC 15.407 Restricted Bands AVG
- ◆ Final_Result PK+
- ◆ Final_Result AVG

FREQUENCY RANGE 17 - 40 GHz:

This plot is valid for the Low, Middle and High Channels and all the modulation modes.



- Preview Result 2H-AVG
- Preview Result 1H-PK+
- Preview Result 2V-AVG
- Preview Result 1V-PK+
- FCC 15.407 PK
- ◆ Final_Result AVG
- * Critical_Freqs AVG
- * Critical_Freqs PK+
- ◆ Final_Result PK+

FCC 15.407 (b)(1) / RSS-247 6.2.1.2. Transmitter Band Edge Radiated Emissions

SPECIFICATION:

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Measurements were made in both horizontal and vertical planes of polarization.

All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz. There are restricted bands of operation below band edge at 4.50-5.15 GHz also above the upper band edge at 5.35-5.46 GHz therefore the provision of FCC Part 15.205 apply.

Field strength measurements using peak and average detector performed in the restricted bands below 5.15 GHz and above 5.35 GHz.

Test performed on the following worst cases modes in all relevant tests channels:

- 802.11a: 6 Mbit/s.
- 802.11n HT20: MCS0.
- 802.11ac VHT20: MCS0.
- 802.11n HT40: MCS0.
- 802.11ac VHT40: MCS0.
- 802.11ac VHT80: MCS0.

• **802.11 a20:**

- Lower Band Edge Channel 36 (5180 MHz): Inside 4.50-5.15 GHz.

Spurious emissions at less than 20 dB below the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
5.1490	59.07	V	Peak	<± 5.13
	39.78		Average	<± 5.13

- Upper Band Edge Channel 48 (5240 MHz). Inside 5.35-5.46 GHz.

No spurious frequencies at less than 20 dB below the limit.

• **802.11 n20:**

- Lower Band Edge Channel 36 (5180 MHz). Inside 4.50-5.15 GHz.

No spurious frequencies at less than 20 dB below the limit.

- Upper Band Edge Channel 48 (5240 MHz). Inside 5.35-5.46 GHz.

No spurious frequencies at less than 20 dB below the limit.

• **802.11 ac20:**

- Lower Band Edge Channel 36 (5180 MHz). Inside 4.50-5.15 GHz.

No spurious frequencies at less than 20 dB below the limit.

- Upper Band Edge Channel 48 (5240 MHz). Inside 5.35-5.46 GHz.

No spurious frequencies at less than 20 dB below the limit.

• **802.11 n40:**

- Lower Band Edge Channel 38 (5190 MHz). Inside 4.50-5.15 GHz.

No spurious frequencies at less than 20 dB below the limit.

- Upper Band Edge Channel 46 (5230 MHz). Inside 5.35-5.46 GHz.

No spurious frequencies at less than 20 dB below the limit.

• **802.11 ac40:**

- Lower Band Edge Channel 38 (5190 MHz). Inside 4.50-5.15 GHz.

No spurious frequencies at less than 20 dB below the limit.

- Upper Band Edge Channel 46 (5230 MHz). Inside 5.35-5.46 GHz.

No spurious frequencies at less than 20 dB below the limit.

- **802.11 ac80:**

- Lower Band Edge Channel 42 (5210 MHz). Inside 4.50-5.15 GHz.

No spurious frequencies at less than 20 dB below the limit.

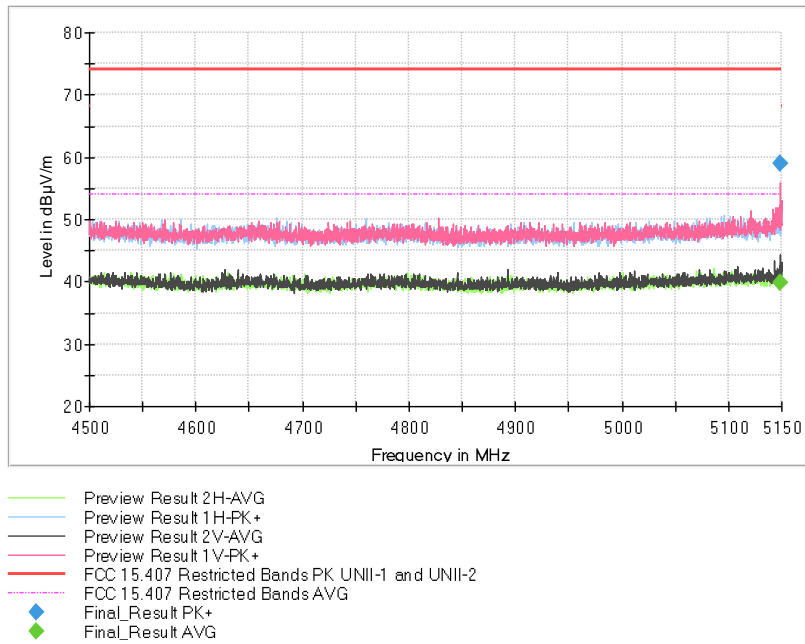
- Upper Band Edge Channel 42 (5210 MHz). Inside 5.35-5.46 GHz.

No spurious frequencies at less than 20 dB below the limit.

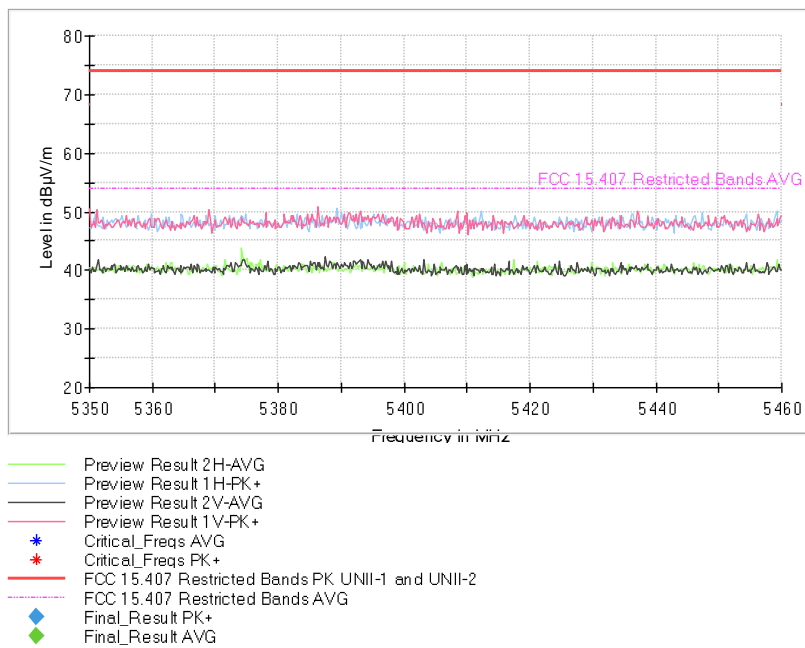
Verdict: PASS

• 802.11 a20:

- Lower Band Edge Channel 36 (Restricted Band 4.50-5.15 GHz)

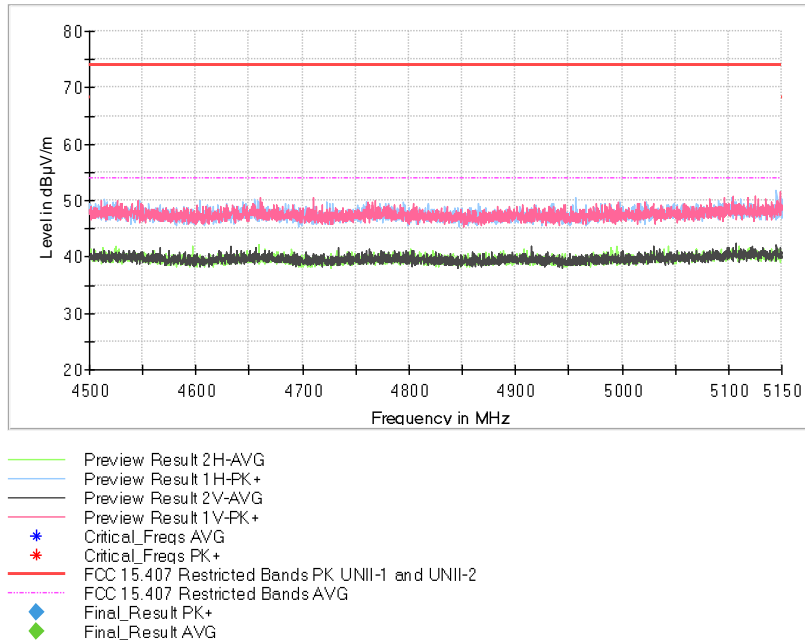


- Upper Band Edge Channel 48 (Restricted Band 5.35-5.46 GHz)

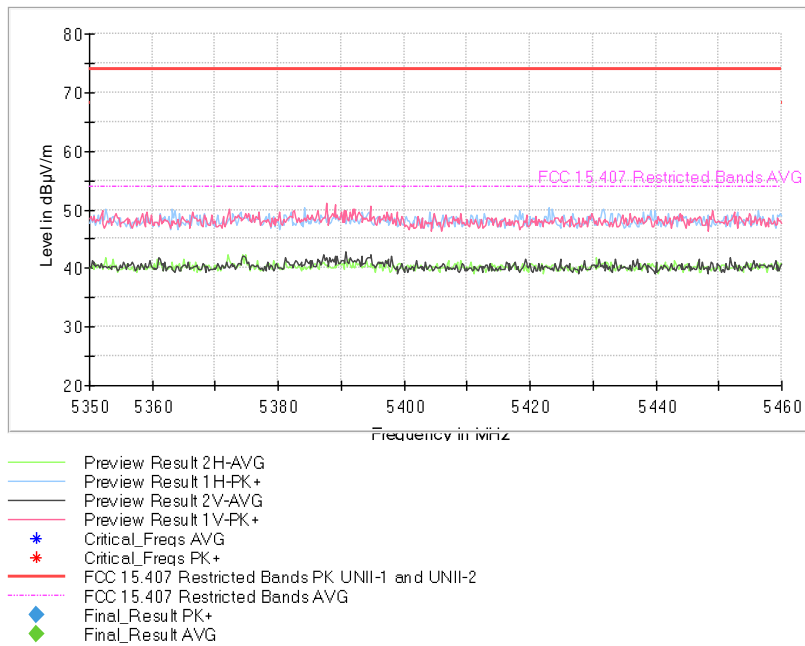


• 802.11 n20:

- Lower Band Edge Channel 36 (Restricted Band 4.50-5.15 GHz)

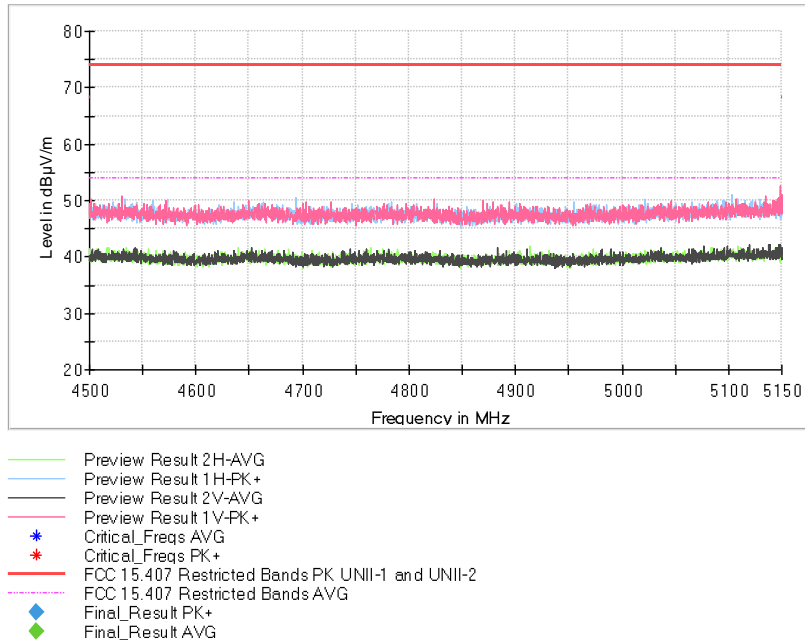


- Upper Band Edge Channel 48 (Restricted Band 5.35-5.46 GHz)

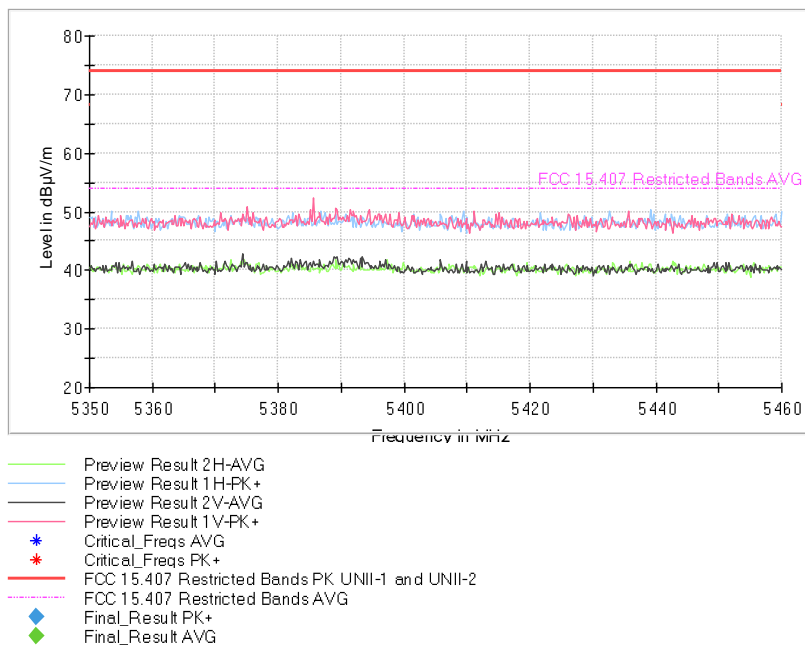


• 802.11 ac20:

- Lower Band Edge Channel 36 (Restricted Band 4.50-5.15 GHz)

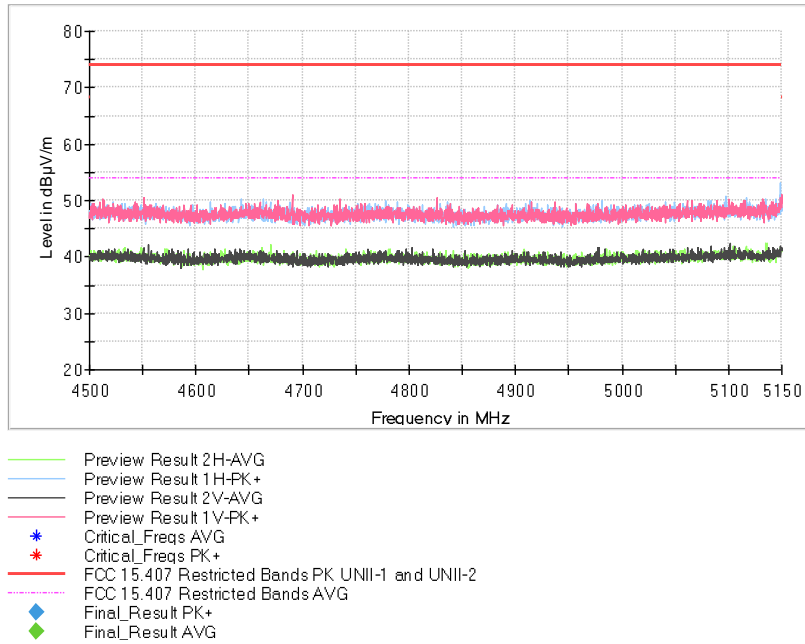


- Upper Band Edge Channel 48 (Restricted Band 5.35-5.46 GHz)

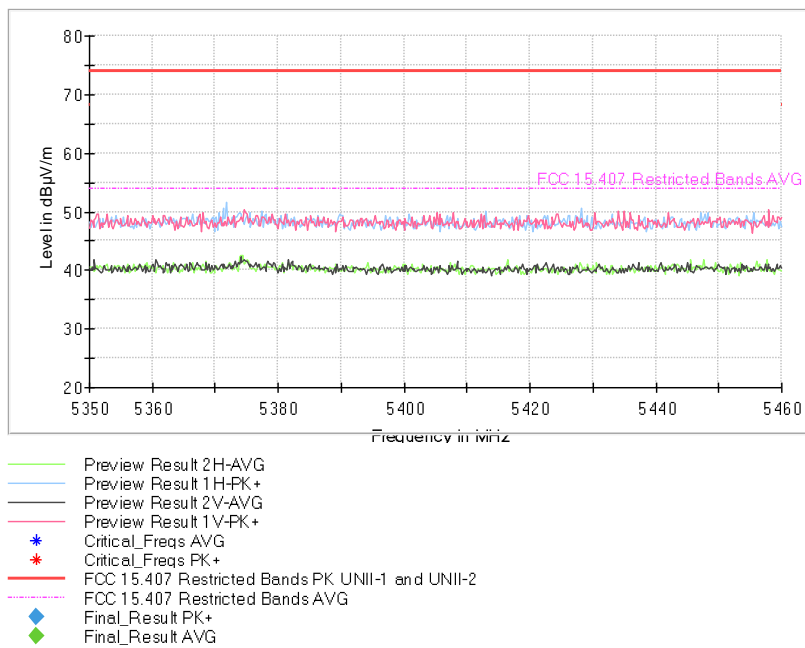


• 802.11 n40:

- Lower Band Edge Channel 38 (Restricted Band 4.50-5.15 GHz)

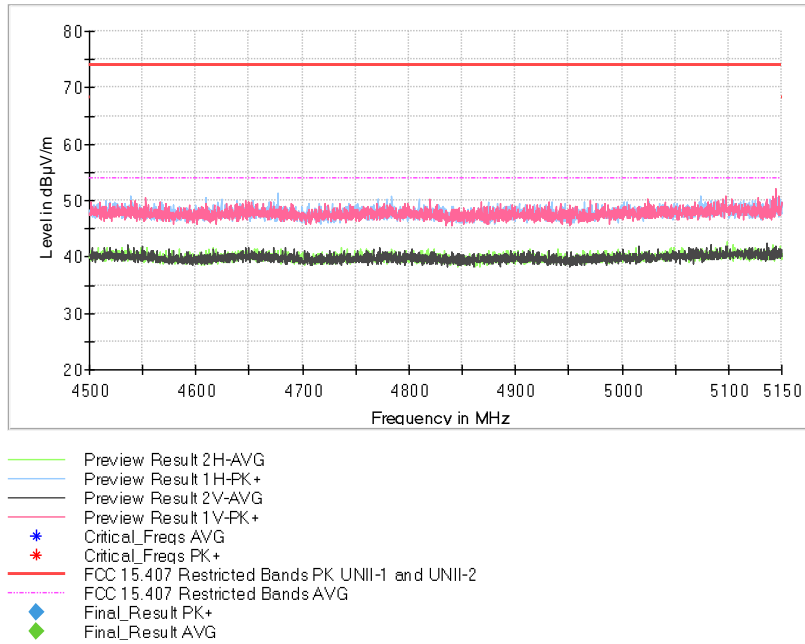


- Upper Band Edge Channel 46 (Restricted Band 5.35-5.46 GHz)

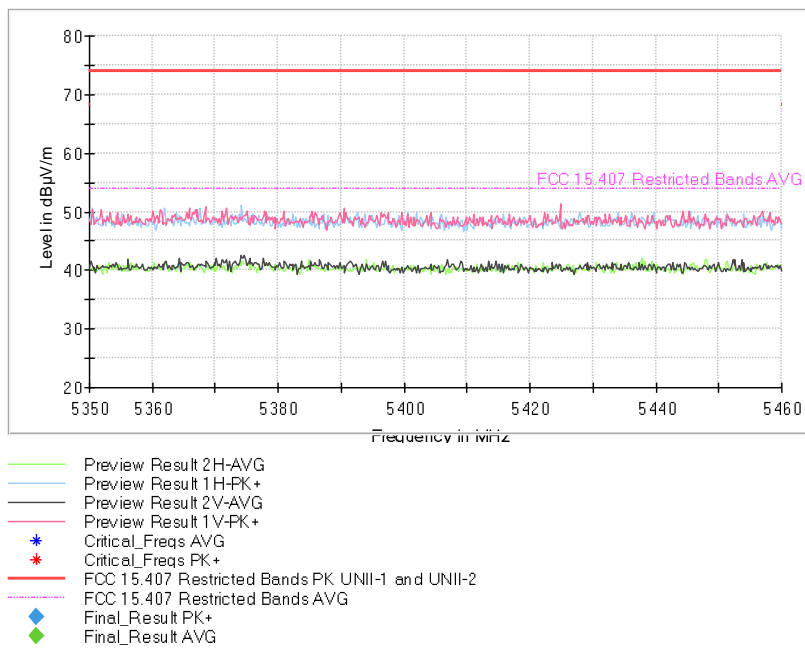


• 802.11 ac40:

- Lower Band Edge Channel 38 (Restricted Band 4.50-5.15 GHz)

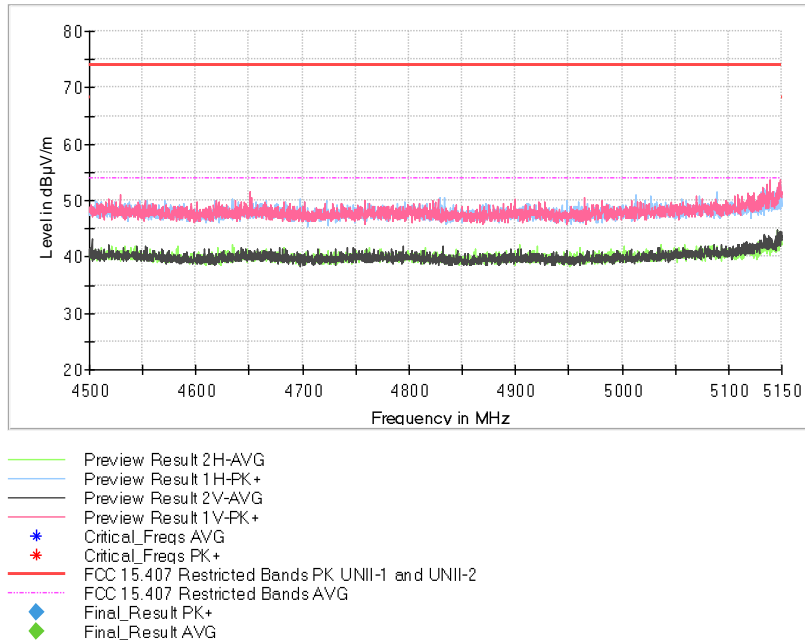


- Upper Band Edge Channel 46 (Restricted Band 5.35-5.46 GHz)



• 802.11 ac80:

- Lower Band Edge Channel 42 (Restricted Band 4.50-5.15 GHz)



- Upper Band Edge Channel 42 (Restricted Band 5.35-5.46 GHz)

