Radio Test Report

FCC CFR 47 Part 15.407
Industry Canada RSS-Gen, Issue 4
Industry Canada RSS-247, Issue 1

For:

Manufacturer: Delphi Electronics & Safety

Model Number: VRM

FCC ID: L2C0060TR
IC Certification Number: 3432A-0060TR

Test Report #: EMC_ DELPH-004-15001_NA-UNII3

Date: February 25, 2016

CETECOM Inc.
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1 Assessment

The EUT, as identified in section 3 of this test report, was evaluated against the criteria specified in the following standards and no deviations were ascertained during the course of the tests performed.

Standard	Standard Title	Version
FCC CFR 47 Part 15.407	Subpart E—Unlicensed National Information Infrastructure Devices; General technical requirements	Current as of 2016-02-25
Industry Canada RSS-Gen	General Requirements for Compliance or Radio Apparatus	Issue 4, November 2014
Industry Canada RSS-247	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	Issue 1, May 2015

Responsible for Testing Laboratory:

Date	Section	Name	Signature
February 25, 2016	Compliance	Franz Engert (Compliance Manager)	Digitally signed by Franz Engert DN: cn=Franz Engert, c=US, o=CETECOM, ou=Complience, email=franz.engert@cetecom.com

Responsible for the Report:

Date	Section	Name	Signature
February 25, 2016	Compliance	Josie Sabado (Test Lab Manager)	

The test results of this test report relate exclusively to the test item specified in Section3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name	CETECOM Inc.
Department	Compliance
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Telephone	+1 (408) 586-6200
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Test Lab Manager	Franz Engert
Project Manager	James Devasia
Test Engineer	Josie Sabado

2.2 Identification of the Client and Manufacturer

	Client	Manufacturer
Company	Delphi Electronics & Safety	Same as client
Address	One Corporate Center M/S CTC4W Kokomo, IN 46904	
Country	USA	

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model Number	VRM
Product Description	In-Vehicle Entertainment System with 5 GHz WLAN and Bluetooth LE
FCC ID	L2C0060TR
IC Certification Number	3432A-0060TR
Product Marketing Name (PMN)	VRM
Hardware Version Identification Number (HVIN)	VRM
Firmware Version Identification Number (FVIN)	N/A
Host Marketing Name (HMN)	N/A
Radio Evaluated in this Test Report	802.11 a/n/ac - 5 GHz WLAN in the UNII-3 band
UNII-3 WLAN Frequency Range	5725 – 5850 MHz
Number of UNII-3 WLAN Channels	20 MHz Bandwidth: 5 40 MHz Bandwidth: 2 80 MHz Bandwidth: 1
UNII-3 WLAN Modulations	OFDM: BPSK, QPSK, 16QAM, 64QAM, 256-QAM
UNII-3 WLAN MIMO Configuration	2 x 2
UNII-3 WLAN MIMO Diversity Schemes	Cyclic Delay Diversity (CDD)
Declared UNII-3 WLAN Average Output Power	5 dBm ±1 dB per transmit chain
UNII-3 WLAN Antenna Information	■ Internal ☐ External ☐ Beamforming Type: PiFA Maximum Peak Gain: Antenna 1: 5.16 dBi Antenna 2: -0.17 dBi
Power Source(s)	Vehicular DC
Operating Input Voltage Range	Low: 9 VDC
	Nominal: 14.4 VDC
	High: 16 VDC
Operating Temperature Range	Low: -40° C
	Nominal: 25° C
	High: 85° C
Other Radios Supported by the EUT	• Bluetooth v4.1
Test Sample Type	☐ Prototype ■ Pre-Production ☐ Production
Dates of Testing	December 8, 2015; January 5-6, 2016

3.2 Identification of the Equipment Under Test

EUT #	Serial Number	SW Version	HW Version	Comments
1	REGULATORYSAMPLE01	1602.11	28531001AG	Radiated Unit
2	T210510006	1602.11	28531001AG	Conducted Unit

3.3 Identification of Test Support Equipment

The following equipment is used for testing purposes only.

TSE #	Type	Manufacturer	Model	Serial Number	Comments
1	Systems Analysis Interface Tool	DG Technologies	SAINT2	SZ2079	Radiated Testing
2	Power Supply & Product Interface	Delphi	N/A	N/A	Radiated Testing
3	Display Screen	Delphi	28420614A	73	Radiated Testing
4	Ethernet to USB Adapter	D-Link	DUB-E100	US1DB89000317	Radiated Testing
5	Laptop	Dell	Latitude E5500	6XRNYJ1	Radiated Testing
6	Systems Analysis Interface Tool	DG Technologies	SAINT2	SZ2053	Conducted Testing
7	Power Supply & Product Interface	Delphi	N/A	N/A	Conducted Testing
8	Display Screen	Delphi	28420614A	72	Conducted Testing
9	Ethernet to USB Adapter	D-Link	DUB-E100	US1DB89000251	Conducted Testing
10	Laptop	Dell	Latitude E5420	BW21LQ1	Conducted Testing

3.4 Identification of Test Support Software

The following software is provided by the client and used for testing purposes only. The end user does not have access to the software.

TSS #	Developer	Name	Version	Comments
1	Qualcomm Atheros	QCARCT	3.0.138.0	
2	Delphi	Chrysler IVE Simulator	1.0.2.2	
3	Delphi	Saint Bus Monitor 2	4.3.1.7	

3.5 Miscellaneous Testing Information

1. QCARCT is used to put the WLAN radio in a test mode. The software is used to set the operating mode, transmit power, and channel. QCARCT is not accessible to the user under normal operations.
2. Transmit power is manually set to transmit at the maximum conducted average output power including tolerance. All operating modes are set to transmit at 6 dBm.
3. The EUT is normally powered by the DC battery supply of the vehicle. For testing, an AC/DC power supply is provided by Delphi.
4. The EUT is normally grounded when installed in a vehicle. For testing, the EUT was grounded to a ground plane and the ground plane was grounded to the anechoic chamber.

4 Summary of Measurement Results

Test Specification							
FCC §15.407	IC RSS-247	Test Case	Pass	Fail	N/P	N/A	Result
(e)	6.2.4.1	6 dB Bandwidth	■	☐	☐	☐	Complies
(a)(3)	6.2.4.1	Transmitter Output Power and EIRP	■	☐	☐	☐	Complies
(a)(3)	6.2.4.1	Power Spectral Density	■	☐	☐	☐	Complies
(b)	6.2.4.2	Unwanted Emissions	■	☐	☐	☐	Complies
(b)	6.2.4.2	Band Edge	■	☐	☐	☐	Complies
§15.207	RSS-Gen, 7.2.2	AC Power Line Conducted Emissions	☐	☐	☐	■	See Note 2

Notes:
1. N/A = Not Applicable; N/P = Not Performed
2. AC power line conducted emissions is not required for vehicular devices.

5 Measurement Information

5.1 Measurement Procedure Standards

The following standards provided guidance for the measurement procedures used in this test report.

- ANSI C63.10 – 2013 : American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- FCC KDB 789033 D02 v01r01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
- FCC KDB 662911 D01 v02r01: Emissions Testing of Transmitters with Multiple Outputs in the Same Band

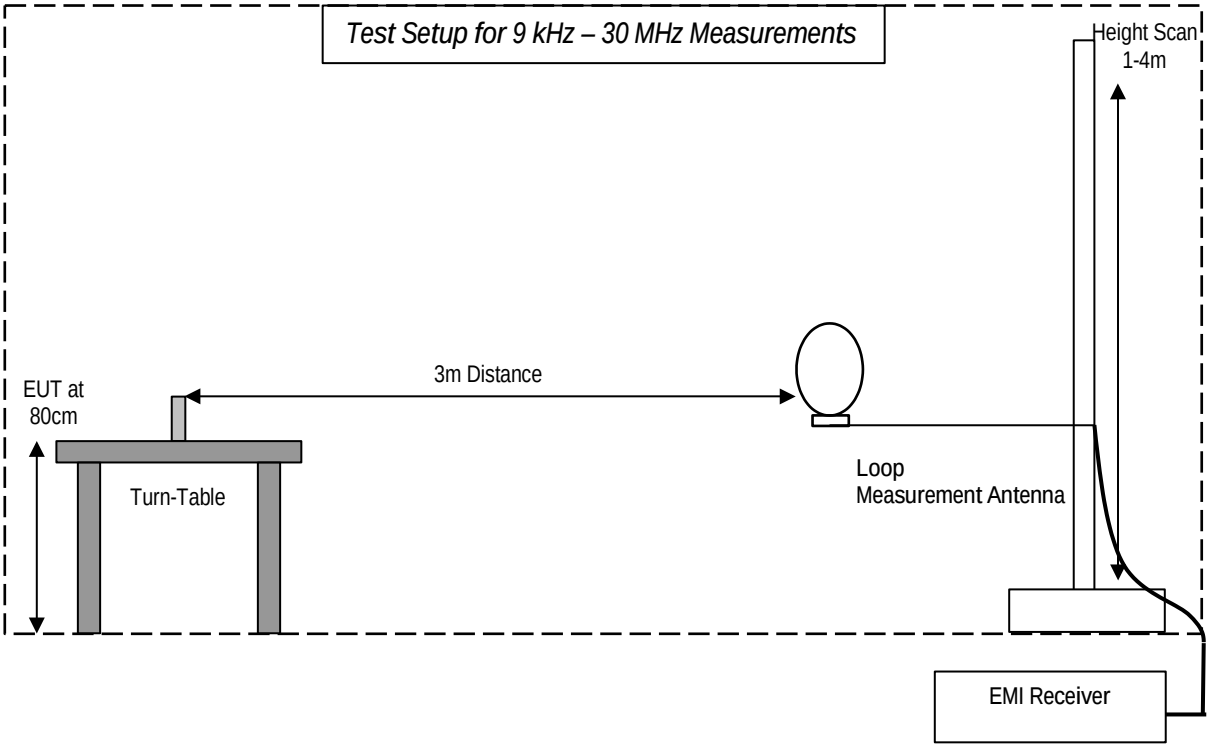
5.2 Radiated Measurements

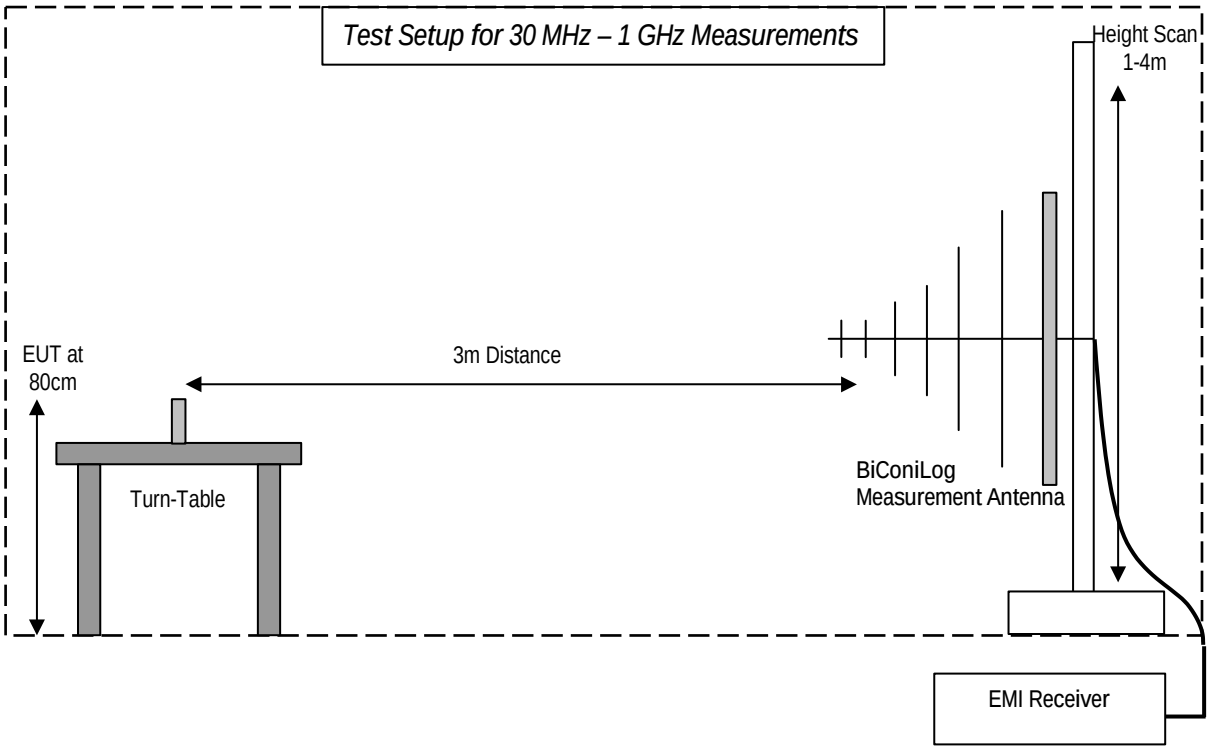
5.2.1 Radiated Measurements Procedure

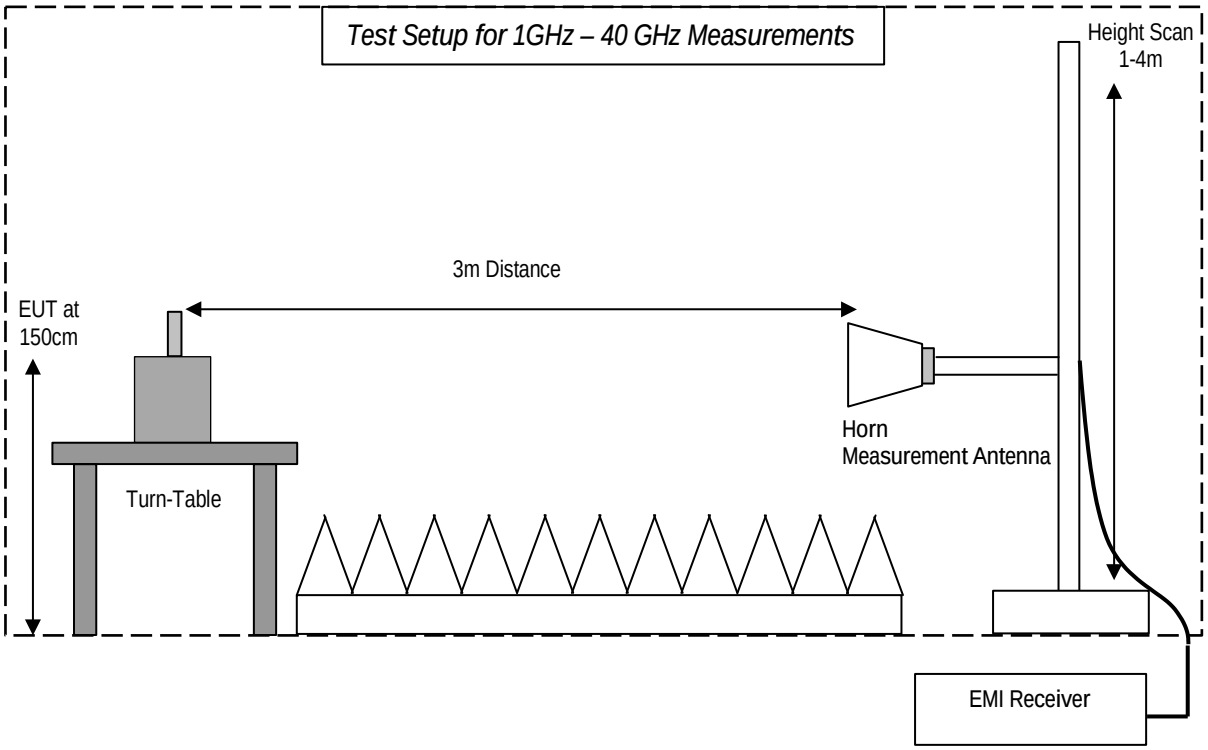
Radiated measurement s is performed according to ANSI C63.10 (2013).

- The exploratory measurement is accomplished by running sweeps at 1 and 4m antenna heights over the required frequency range with R&S Test-SW EMC32 for both antenna polarizations. During each frequency scan the turntable rotates by no more than 10°.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then again maximized through a fine search in the frequency domain, maximized in the 360° range of the turntable, and maximized over the antenna height between 1 m and 4 m and for positioning of the EUT.
- The above procedure is repeated for transmissions in the low and high channels.
- In case there are no emissions above the noise floor level, only the maximum trace is reported as described above.
- The results are split into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used from 1 GHz to 40 GHz.
- All measurements are performed at 3 meter distance.

5.2.2 Radiated Measurement Block Diagrams







5.2.3 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV) - Cable Loss (dB) + Antenna Factor (dB/m)

Example:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

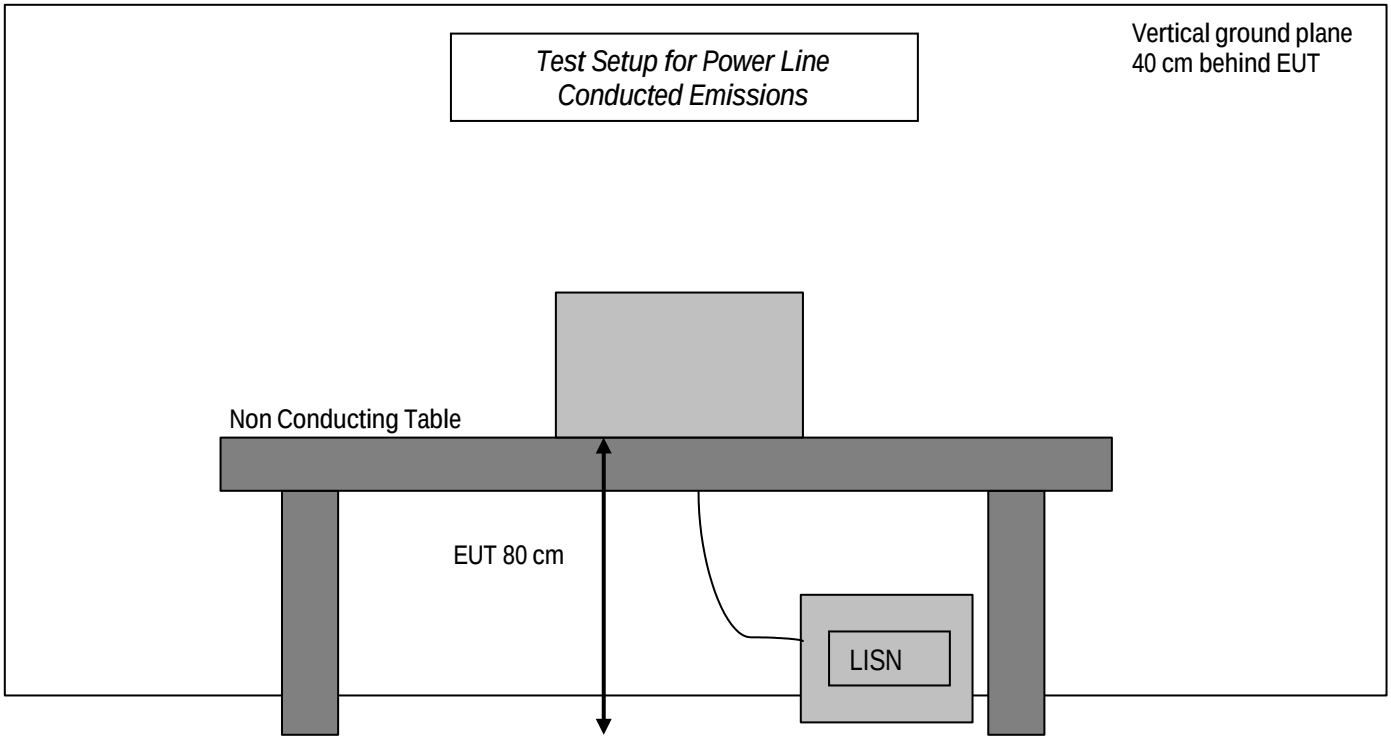
5.3 AC Power Line Conducted Emissions

5.3.1 AC Power Line Conducted Emissions Measurement Procedure

AC Power Line conducted emissions measurements are performed according to ANSI C63.10 (2013).

- The EUT and accessories are placed on a non-conducting table 80 cm above the horizontal ground plane and 40 cm from the vertical ground plane.
- Cables that hang closer than 40 cm to the ground plane are gathered into a 30 cm to 40 cm long bundle.
- The data ports of the EUT are exercised.
- The power cable of the EUT is connected to the LISN.
- The 6 highest emissions within 20 dB of the limit are noted.

5.3.2 AC Power Line Conducted Emissions Block Diagram



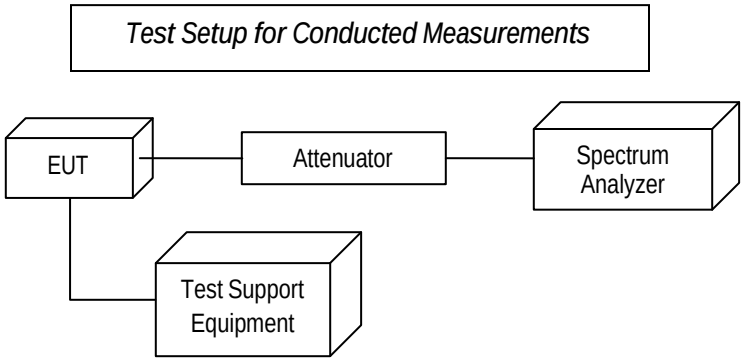
5.4 RF Conducted Measurements

5.4.1 RF Conducted Measurements Procedure

RF conducted measurements are performed according to ANSI C63.10 (2013).

- The antenna ports of the EUT are connected to the measurement equipment by an RF cable.
- The attenuation between the EUT and the measurement equipment is compensated in the measurement equipment.
- See plots for spectrum analyzer settings.

5.4.2 RF Conducted Measurements Block Diagram



5.5 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

	Uncertainty in dB Radiated <30 MHz	Uncertainty in dB Radiated 30 MHz - 1 GHz	Uncertainty in dB Radiated > 1 GHz	Uncertainty in dB Conducted Measurement
Standard Deviation k=1	2.48	1.94	2.16	0.64
95% Confidence Interval in dB	4.86	3.79	4.24	1.25
95% Confidence Interval in dB in delta to Result (rounded up to next decimal point)	+/- 2.5 dB	+/- 2.0 dB	+/- 2.3dB	+/- 0.7dB

5.6 Environmental Conditions During Testing

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25ºC
- Relative humidity: 40-60%

6 Measurement Results

6.1 Duty Cycle

6.1.1 Technical Standard References
KDB 789033, Section II.B

6.1.2 EUT Conditions
Continuous transmission

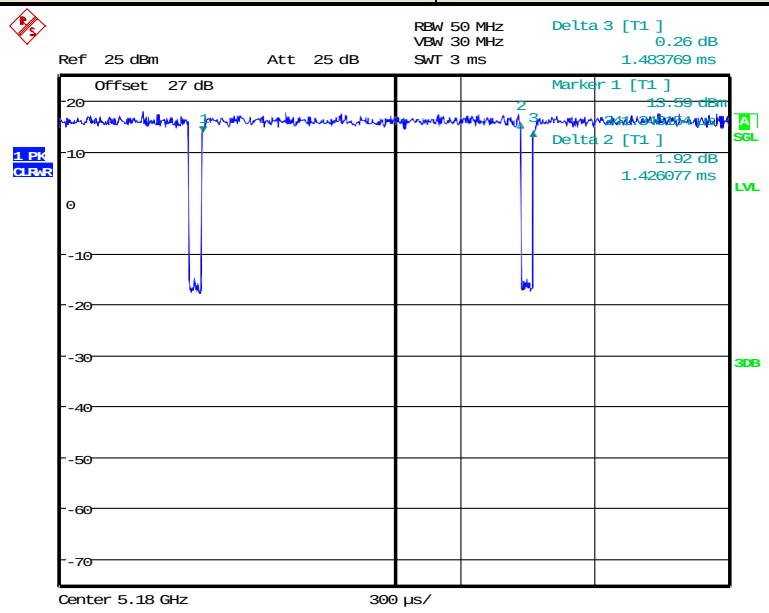
6.1.3 Test Conditions
Measurements are according to FCC KDB 789033, Section B, measurement technique (b).

6.1.4 Test Results

Operating Mode	Tx Chain	Tx On Time	Tx On + Off Time	Duty Cycle
802.11a	0	1.43 ms	1.48 ms	97%
	1	1.43 ms	1.48 ms	97%
802.11n, HT20	0	1.34 ms	1.39 ms	96%
	1	1.34 ms	1.39 ms	96%
802.11ac, VHT20	0	1.4 ms	1.46 ms	96%
	1	1.35 ms	1.4 ms	96%
802.11n, HT40	0	663.46 µs	716.35 µs	93%
	1	663.46 µs	716.35 µs	93%
802.11ac, VHT40	0	670.67 µs	725.96 µs	92%
	1	670.67 µs	723.56 µs	93%
802.11ac, VHT80	0	332.53 µs	385.44 µs	86%
	1	332.53 µs	383.83 µs	87%

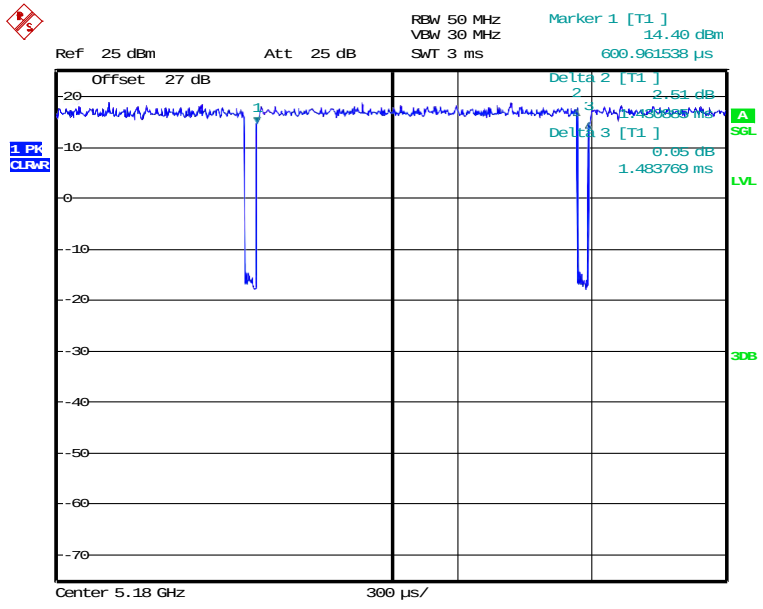
6.1.5 Test Plots

Duty Cycle	
802.11a	Transmit Chain 0



Date: 6.DEC.2015 12:20:42

Duty Cycle	
802.11a	Transmit Chain 1



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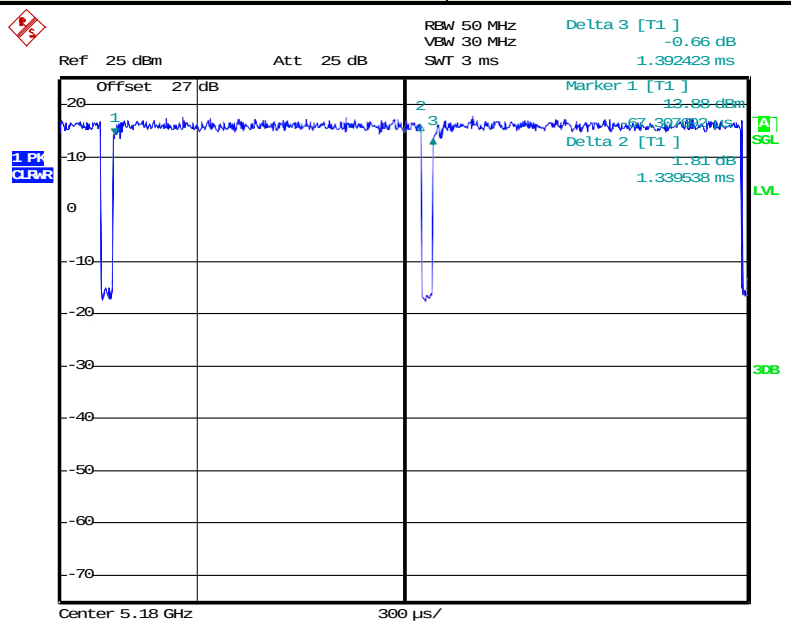
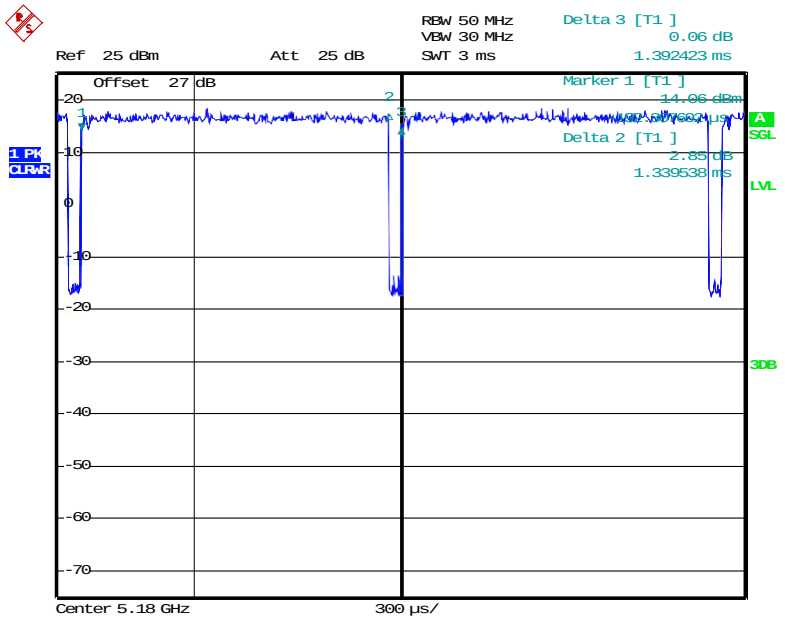
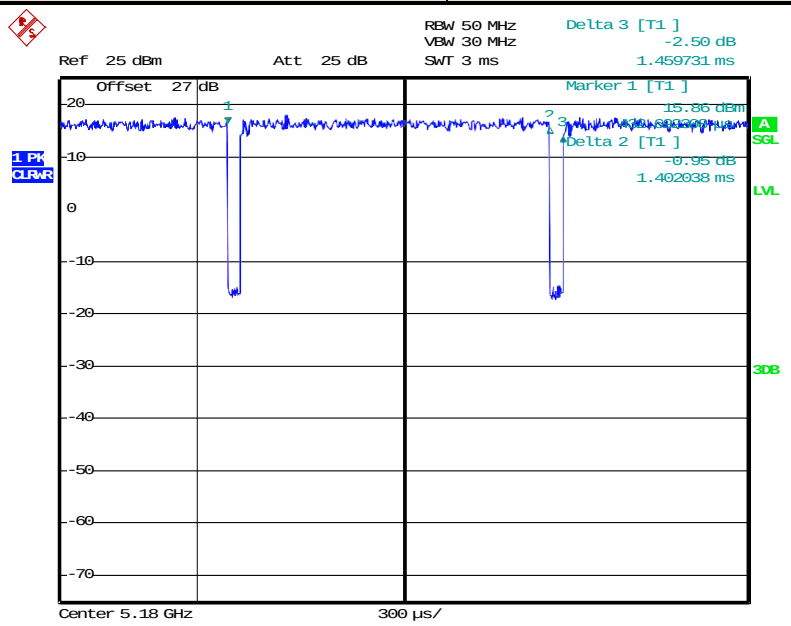
Duty Cycle	
802.11n, HT20	Transmit Chain 0



Duty Cycle	
802.11n, HT20	Transmit Chain 1



Duty Cycle	
802.11ac, VHT20	Transmit Chain 0



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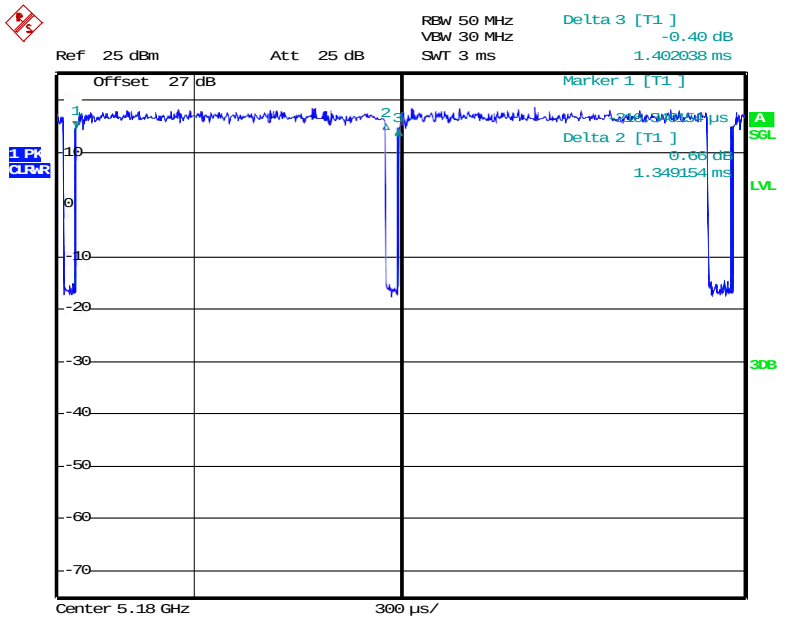
Duty Cycle	
802.11ac, VHT20	Transmit Chain 1



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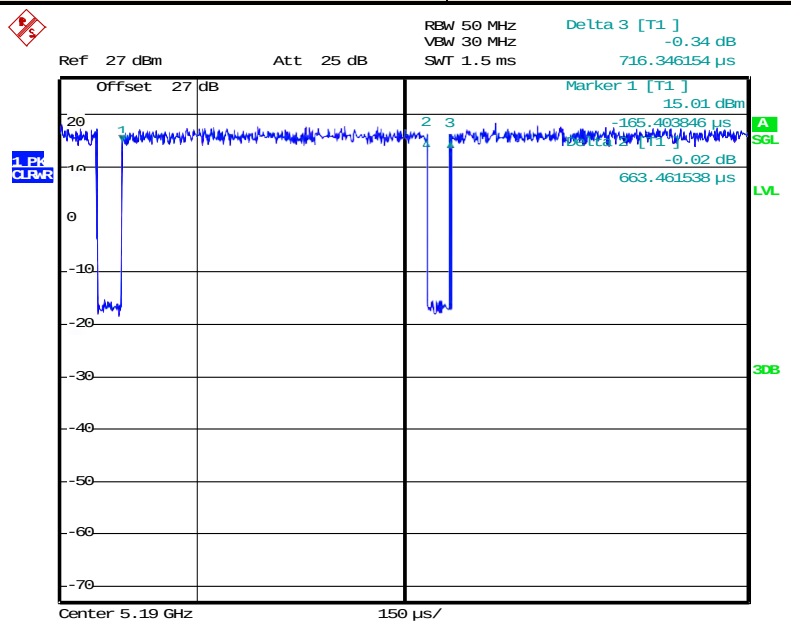
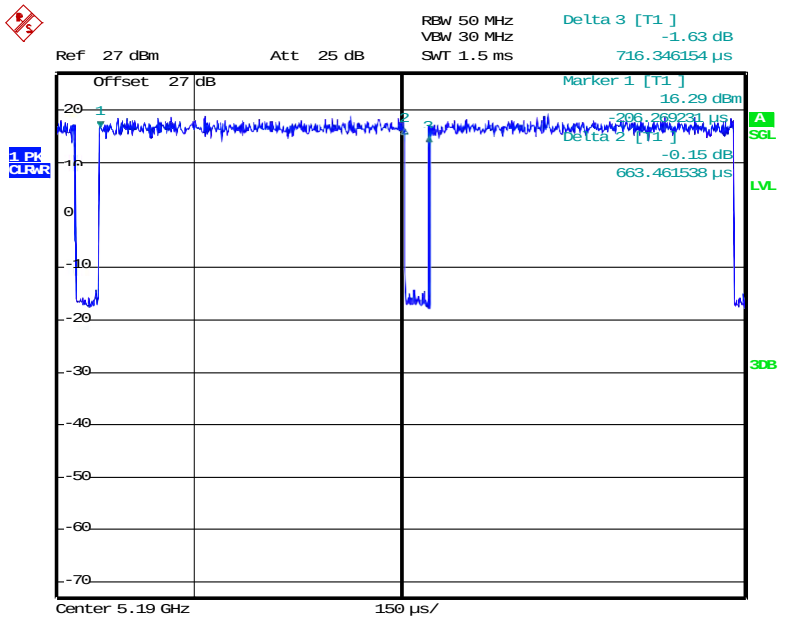
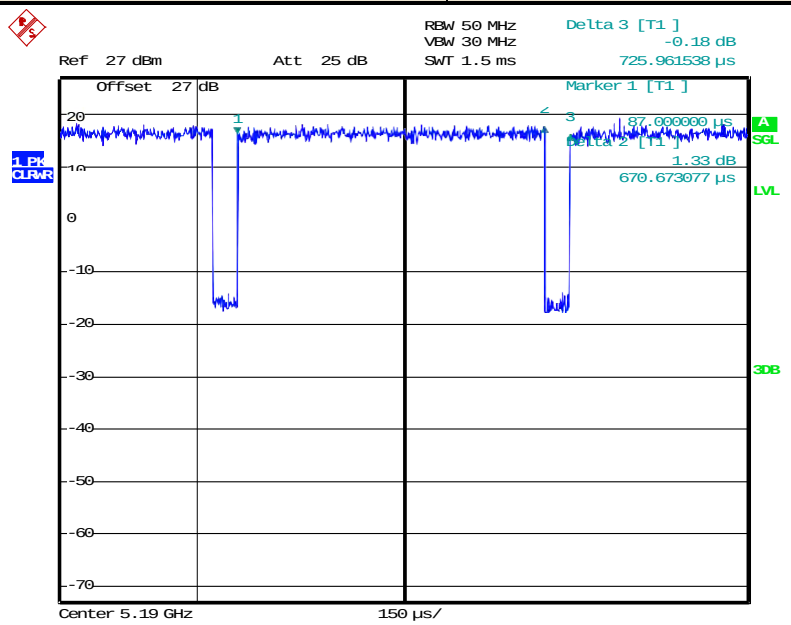
Duty Cycle	
802.11n, HT40	Transmit Chain 0



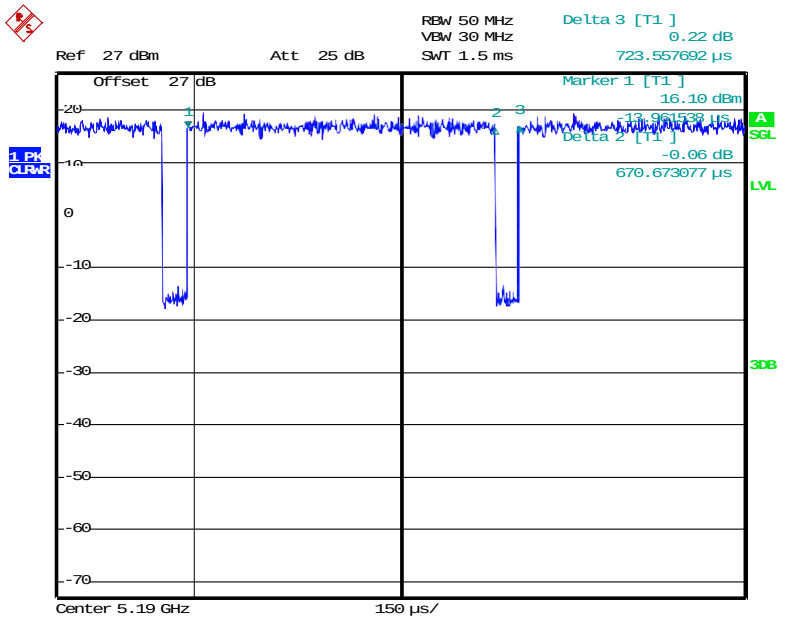
Duty Cycle	
802.11n, HT40	Transmit Chain 1



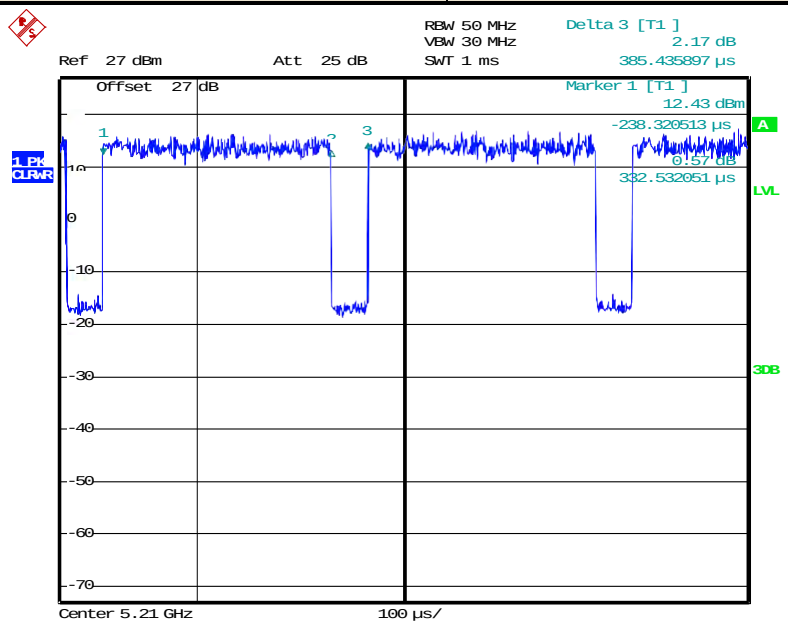
Duty Cycle	
802.11ac, VHT40	Transmit Chain 0



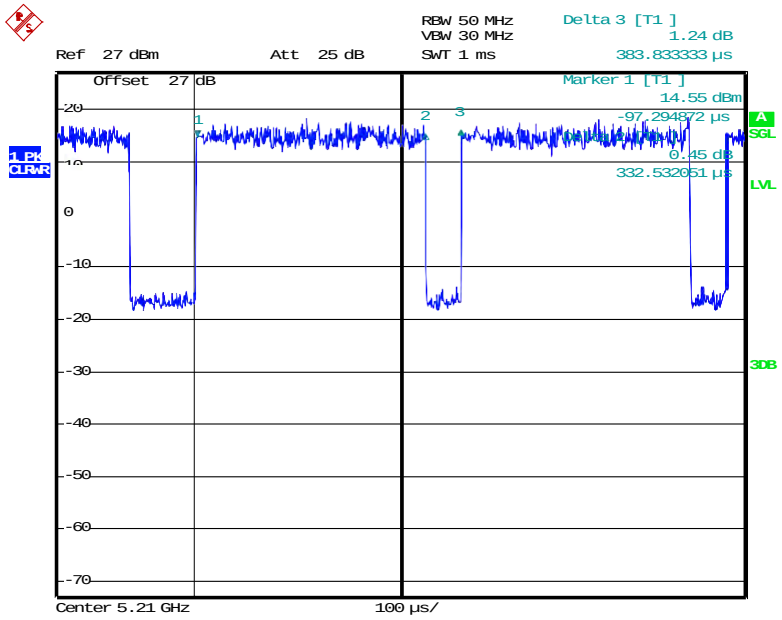
Duty Cycle	
802.11ac, VHT40	Transmit Chain 1



Duty Cycle	
802.11ac, VHT80	Transmit Chain 0



Duty Cycle	
802.11ac, VHT80	Transmit Chain 1



6.2 Emission, Occupied, and 6 dB Bandwidth

6.2.1 Technical Standard References

FCC §15.407, Section (e)
IC RSS-247, Section 6.2.4.1
KDB 789033, Section II.C, II.D

6.2.2 Requirement

Emission Bandwidth: N/A
Occupied Bandwidth: N/A
6 dB Emission Bandwidth: ≥ 500 kHz

6.2.3 EUT Conditions

Continuous Transmission

6.2.4 Test Conditions

Emission bandwidth and 6 dB bandwidth measurements are according to FCC KDB 789033, section C. Occupied bandwidth measurements are according to FCC KDB 789033, section D.

Emission Bandwidth is the -26 dB down bandwidth. Occupied Bandwidth is the 99% bandwidth.

6.2.5 Test Results

Operating Mode	Channel	Frequency (MHz)	Tx Chain	Emission Bandwidth (MHz)	Occupied Bandwidth (MHz)	6 dB Emission Bandwidth (MHz)
802.11a	149	5745	0	19.8	16.3	15.7
			1	19.6	16.3	15.6
	165	5825	0	19.9	16.4	15.3
			1	19.9	16.3	15.3
802.11n, HT20	149	5745	0	20.3	17.5	15.3
			1	20.3	17.4	15.3
	165	5825	0	20.3	17.5	15.3
			1	20.3	17.5	15.1
802.11ac, VHT20	149	5745	0	20.2	17.5	15.1
			1	19.9	17.4	15.1
	165	5825	0	20.2	17.5	15.1
			1	20.2	17.4	15.1
802.11n, HT40	151	5755	0	42.7	35.9	34.9
			1	44.3	35.8	35.1
	159	5795	0	43.2	35.9	35.3
			1	41.6	35.9	35.1
802.11ac, VHT40	151	5755	0	42.3	35.9	35.2
			1	42.3	35.9	35.1
	159	5795	0	46.3	35.9	35.2
			1	41.6	35.9	35.1
802.11ac, VHT80	155	5775	0	80.5	75.2	75.1
			1	80.1	74.8	75

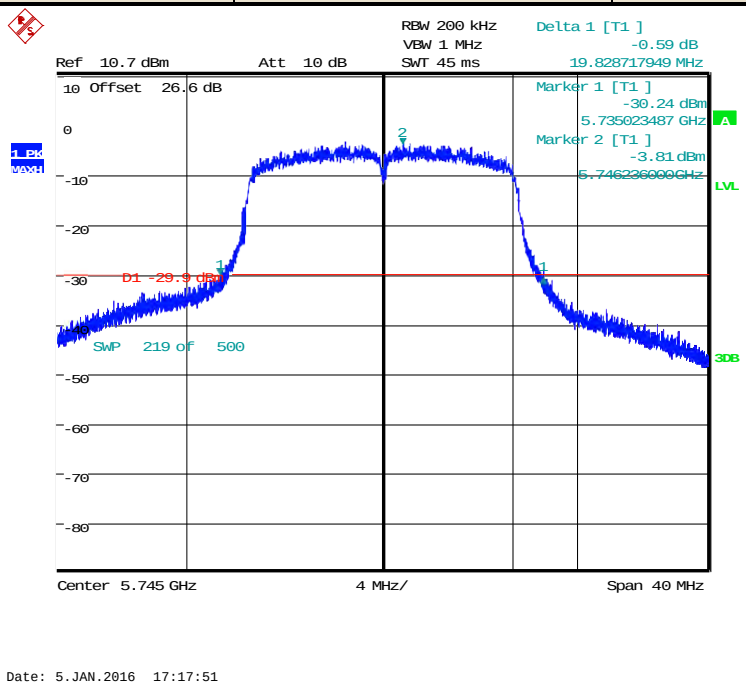
6.2.6 Test Verdict

Pass

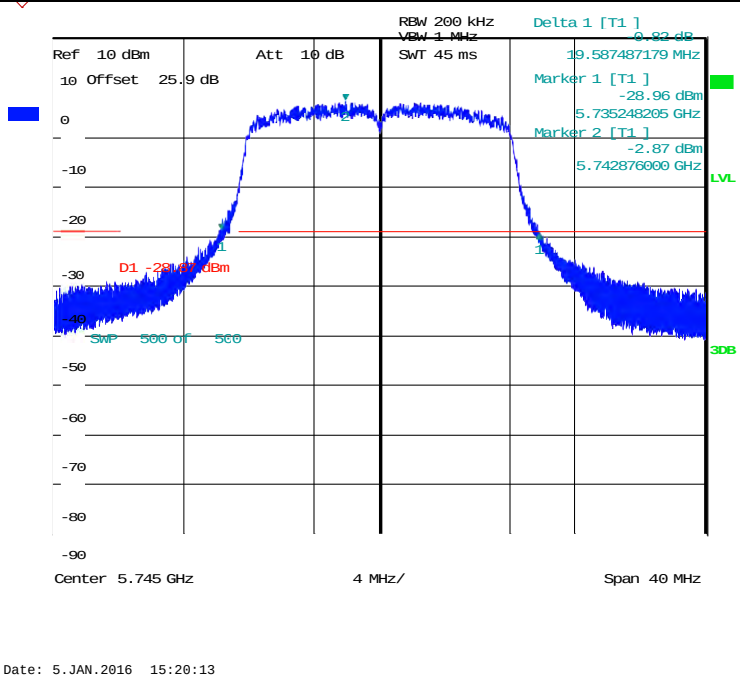
6.2.7 Test Plots

6.2.7.1 Emission Bandwidth

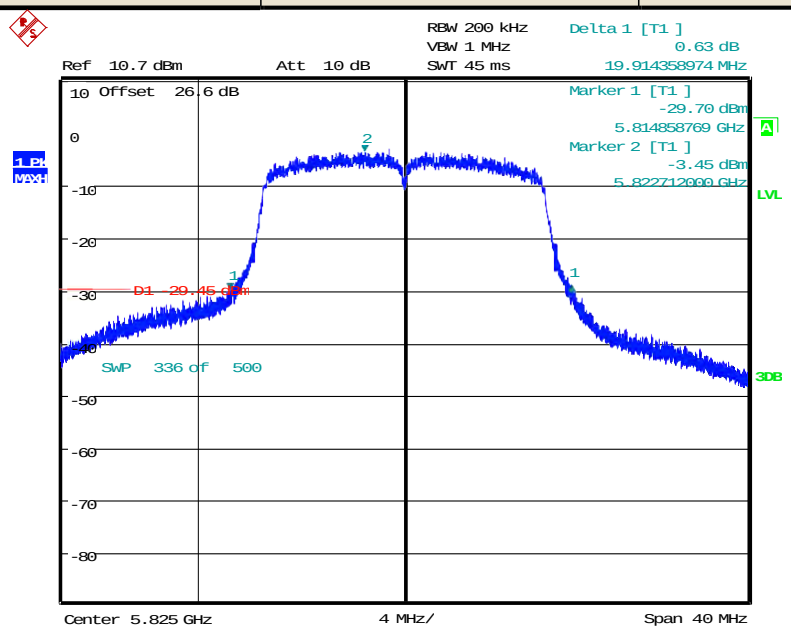
Emission Bandwidth		
802.11a	Channel 149 / 5745 MHz	Tx Chain 0



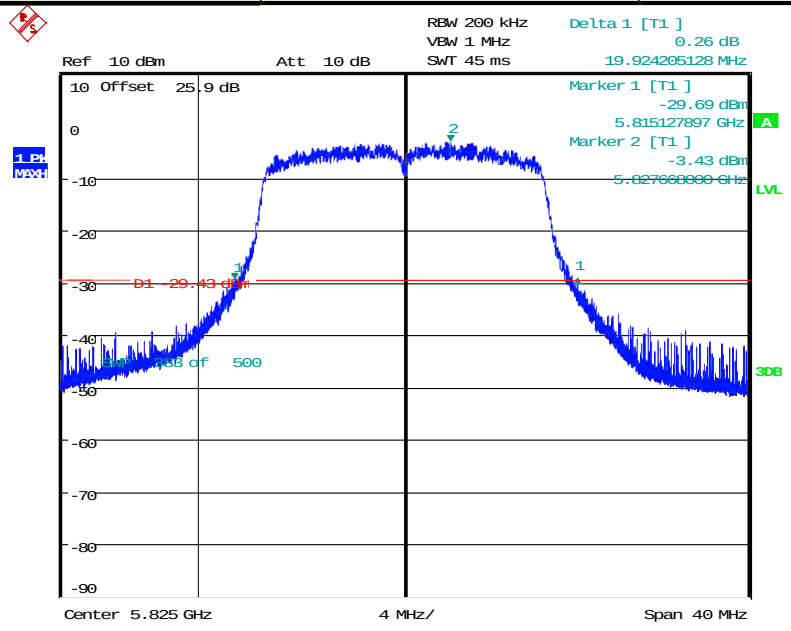
Emission Bandwidth		
802.11a	Channel 149 / 5745 MHz	Tx Chain 1



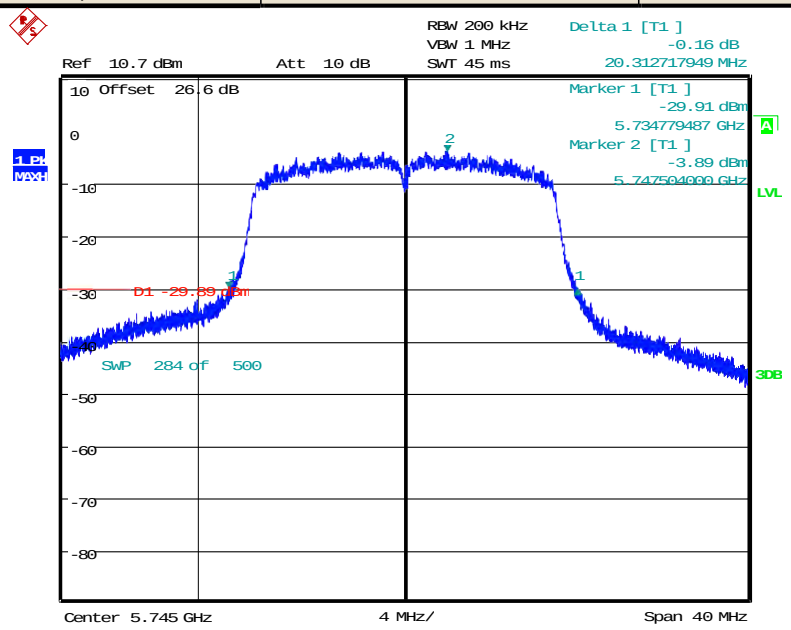
Emission Bandwidth		
802.11a	Channel 165 / 5825 MHz	Tx Chain 0



Emission Bandwidth		
802.11a	Channel 165 / 5825 MHz	Tx Chain 1



Emission Bandwidth		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 0



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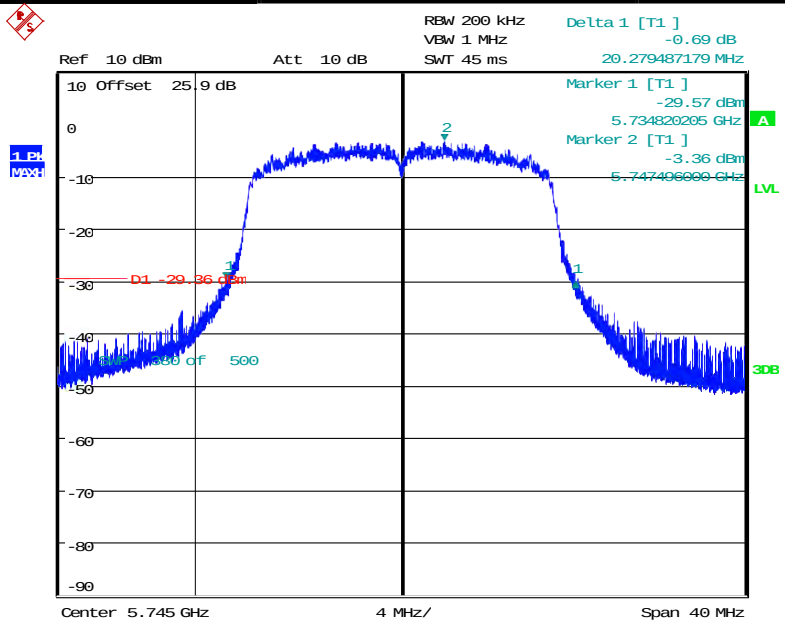

Emission Bandwidth		
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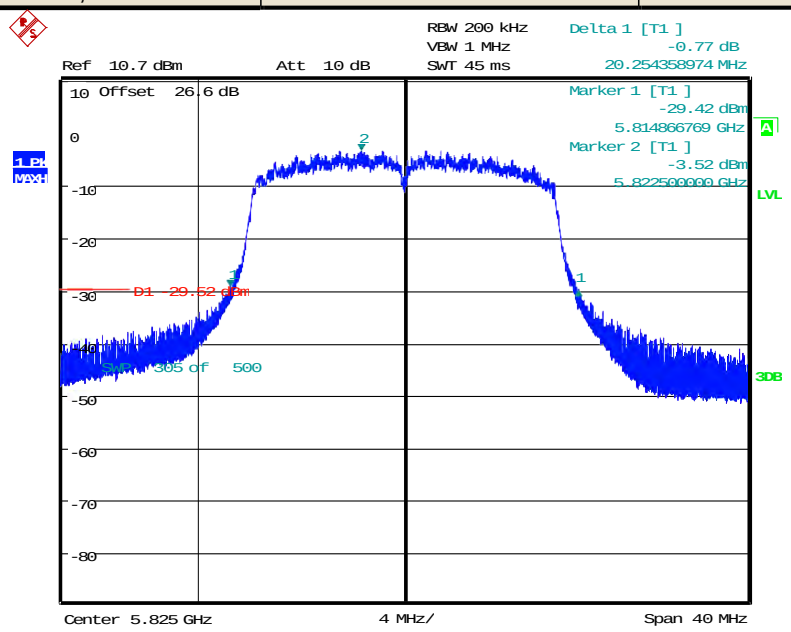
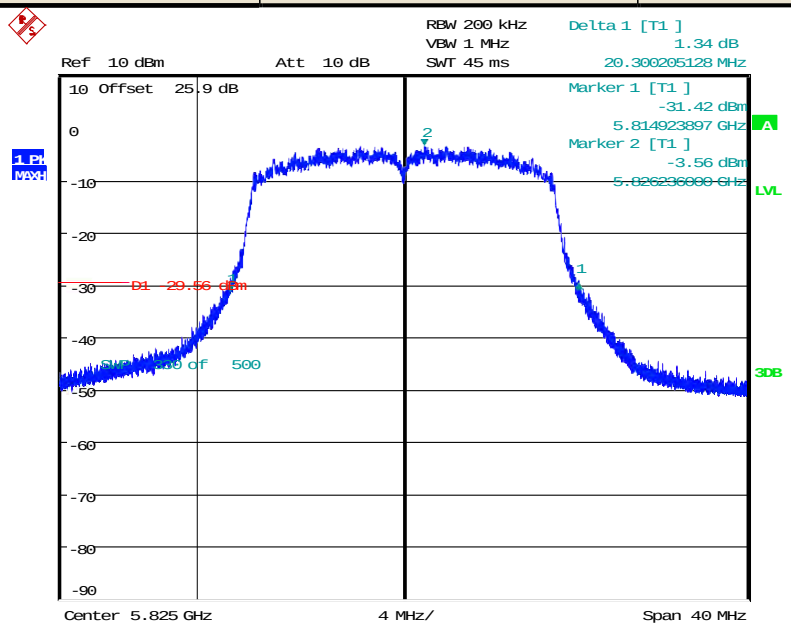
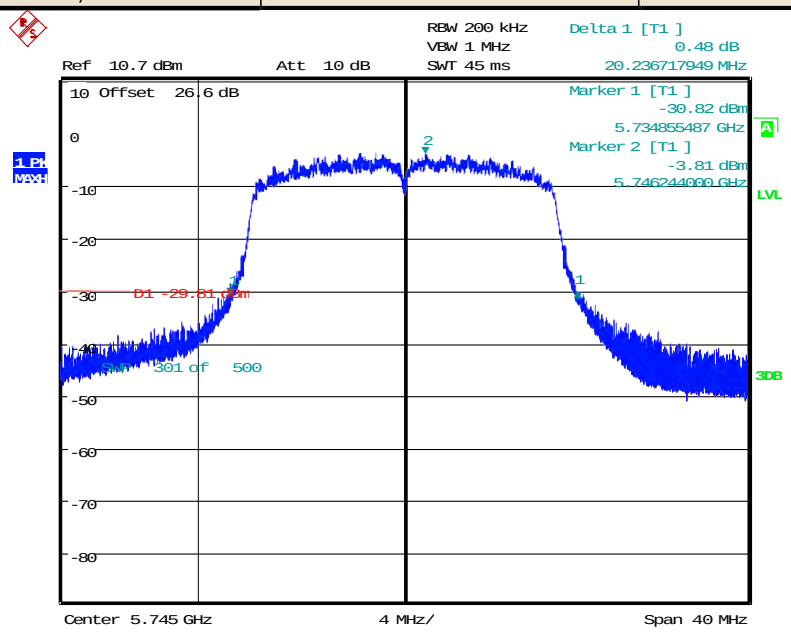


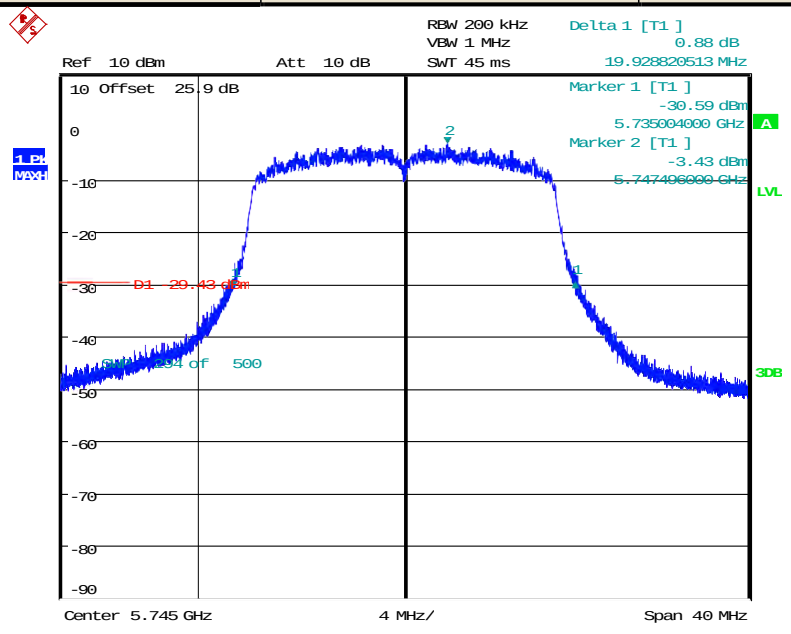
Emission Bandwidth		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 1



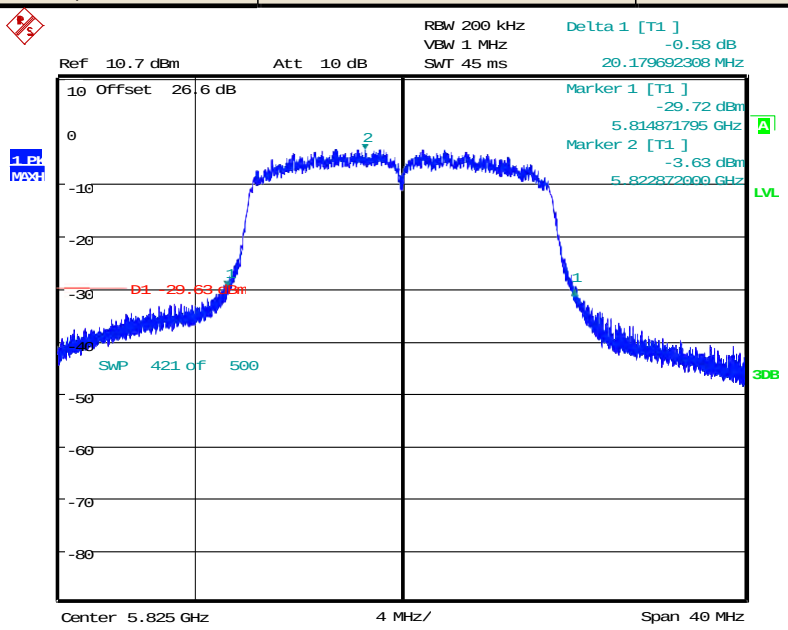
Emission Bandwidth		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 0



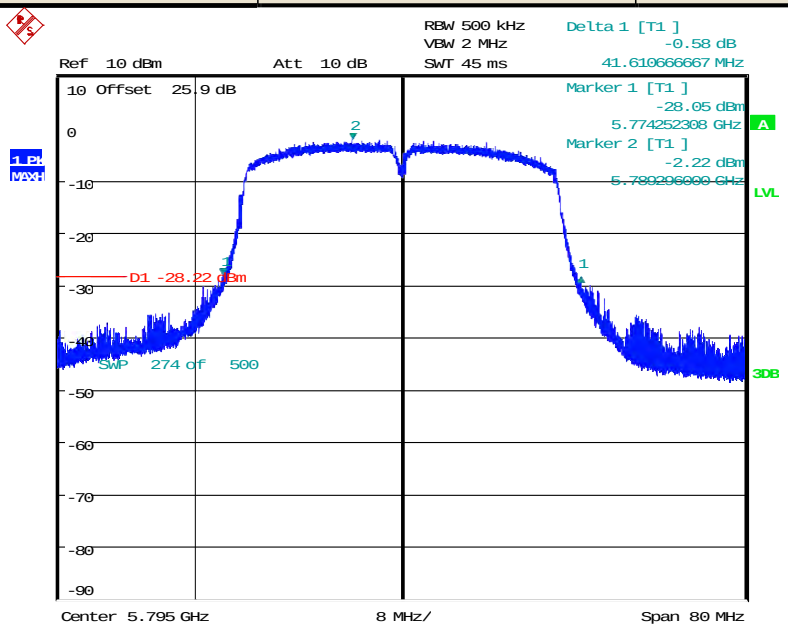
Emission Bandwidth		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 1



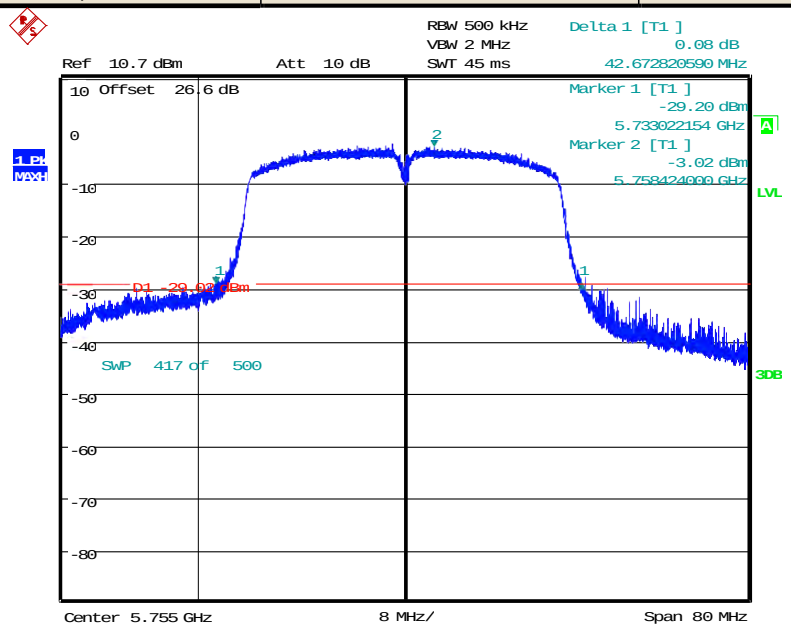
Emission Bandwidth		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 0



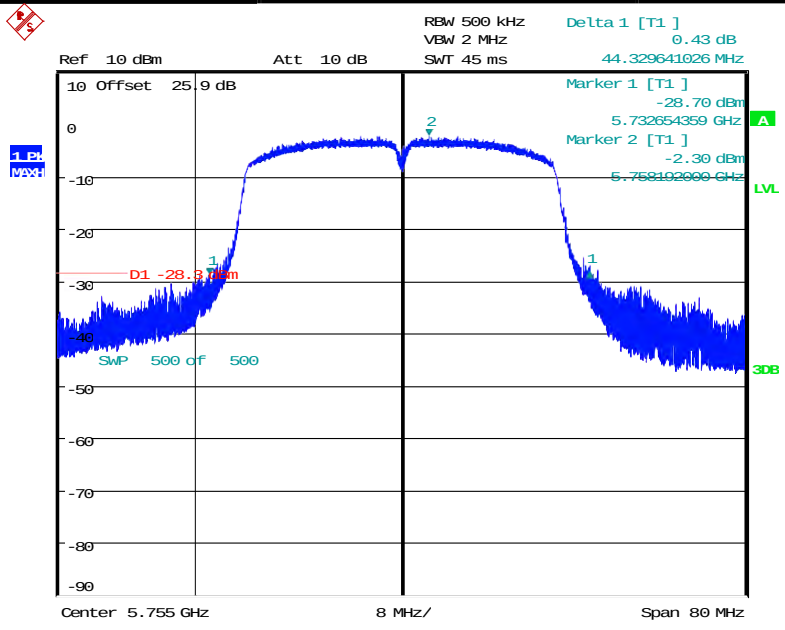
Emission Bandwidth		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 1



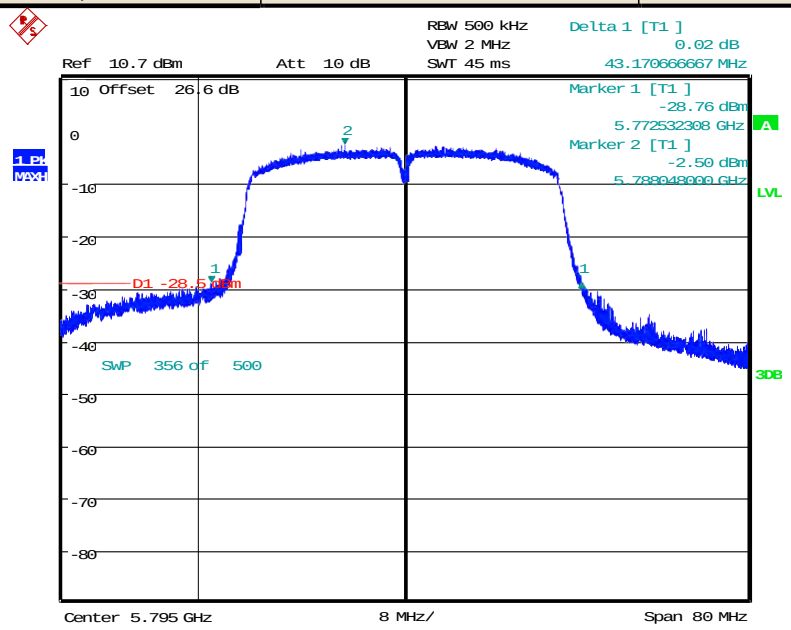
Emission Bandwidth		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 0



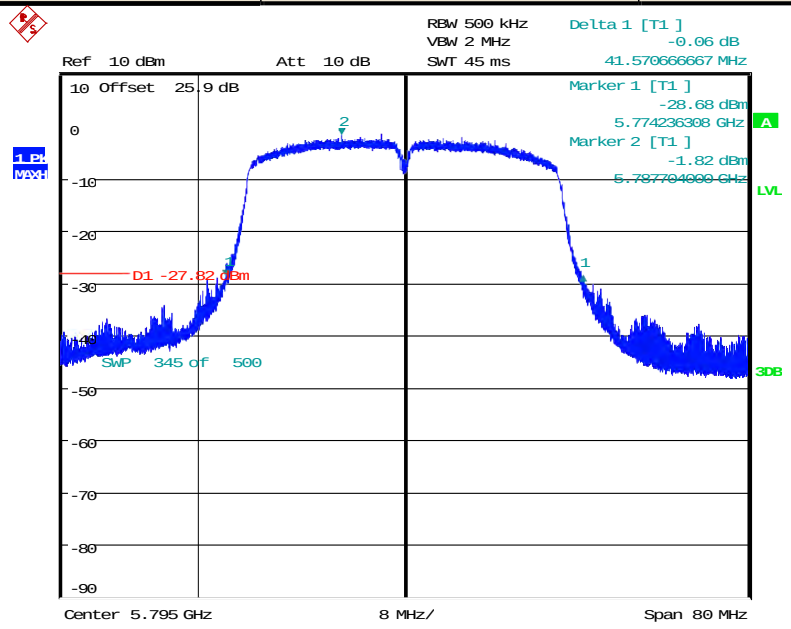
Emission Bandwidth		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 1



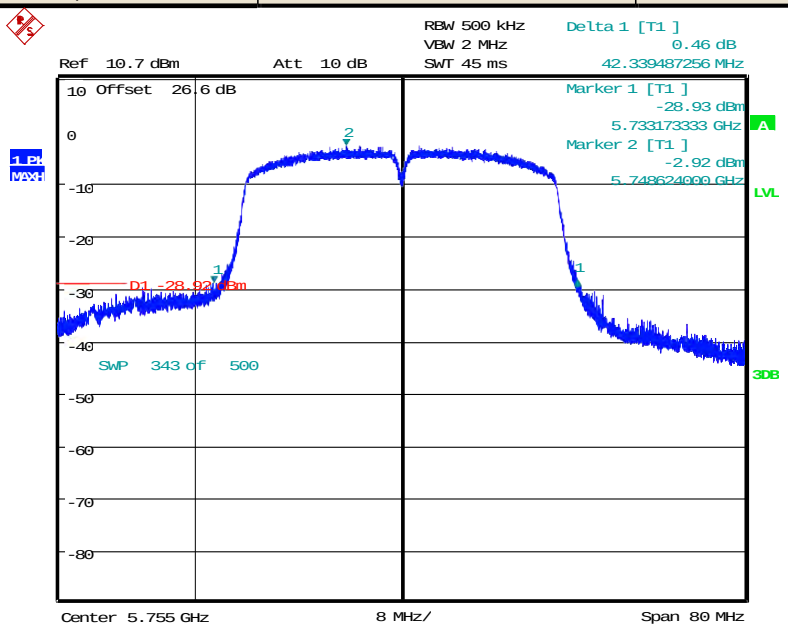
Emission Bandwidth		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 0



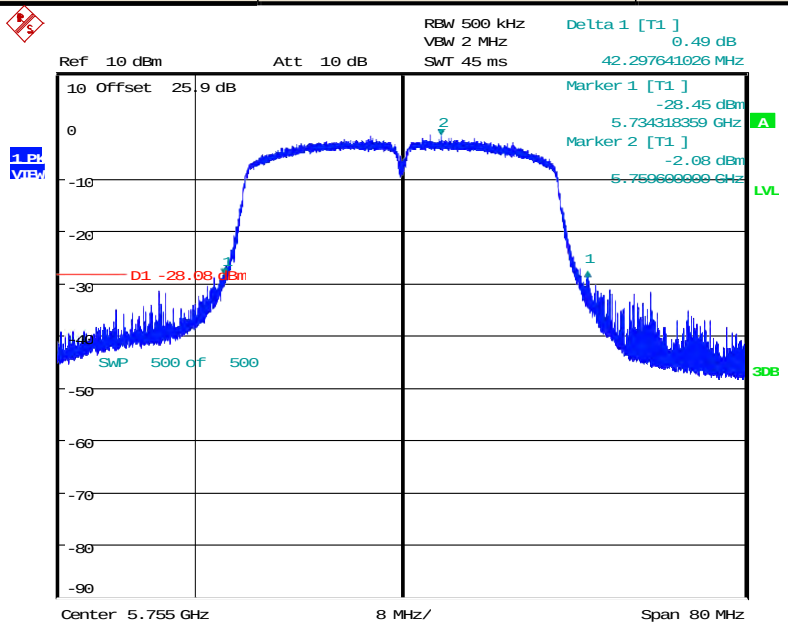
Emission Bandwidth		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 1



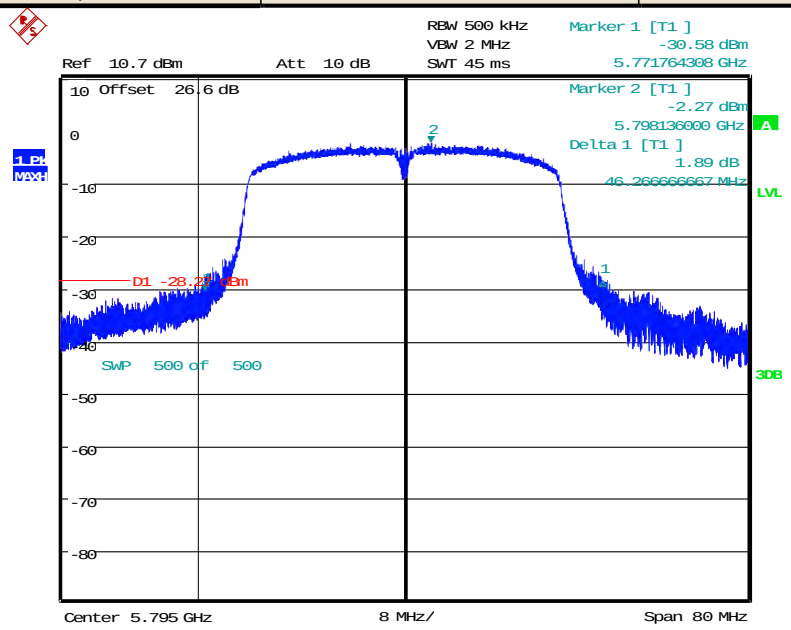
Emission Bandwidth		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 0



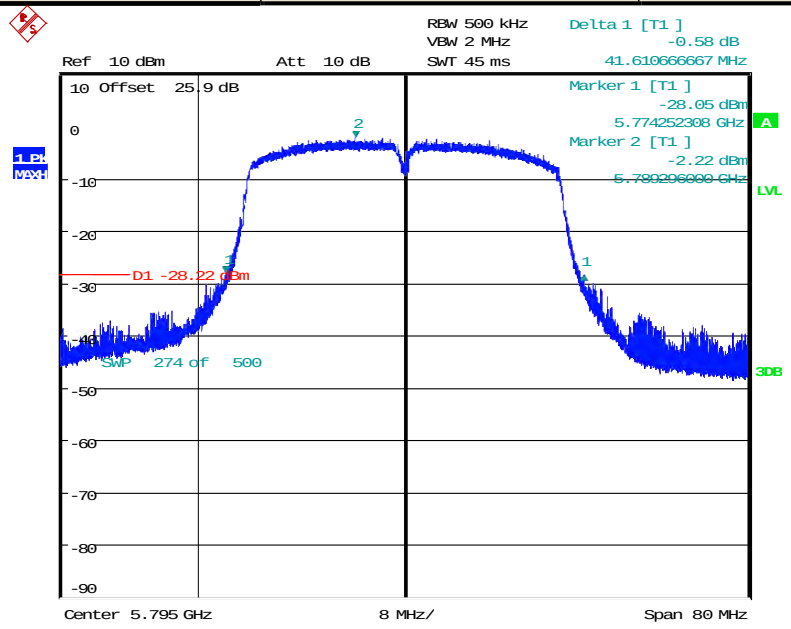
Emission Bandwidth		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 1



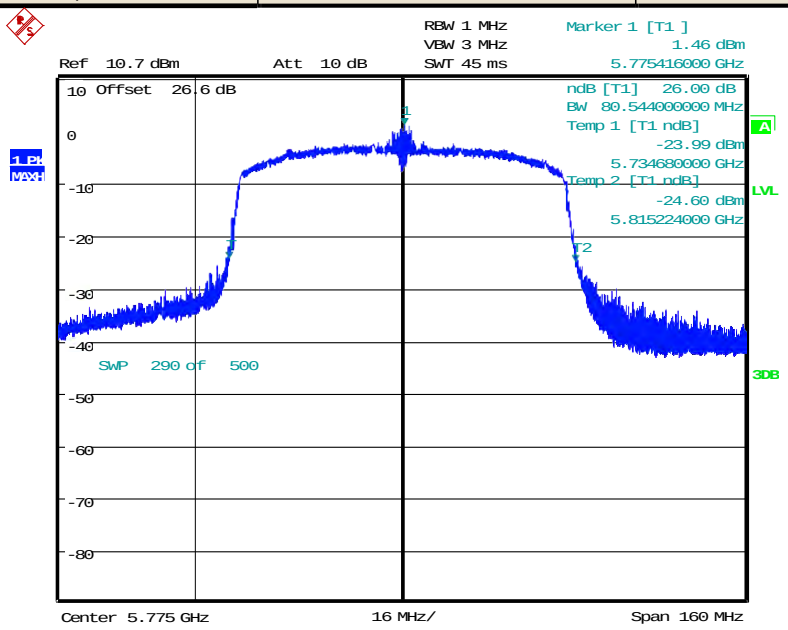
Emission Bandwidth		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 0



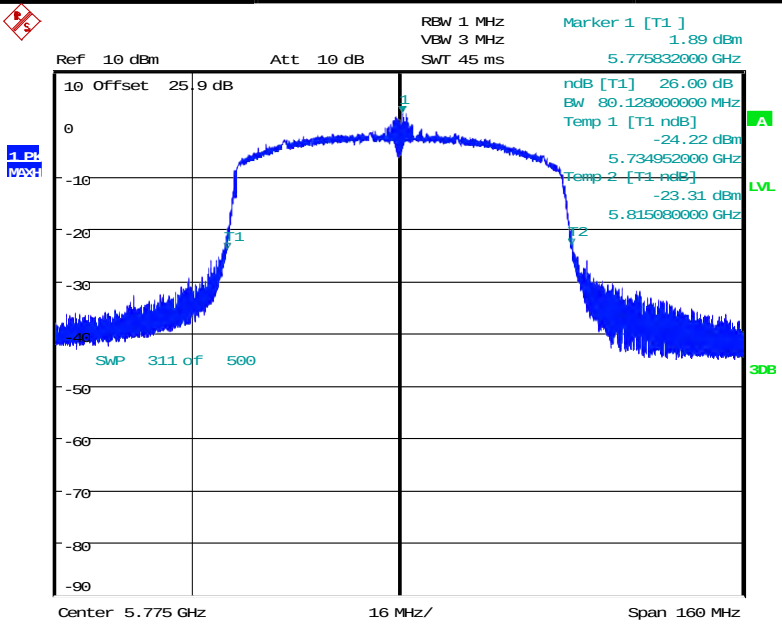
Emission Bandwidth		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 1



Emission Bandwidth		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 0

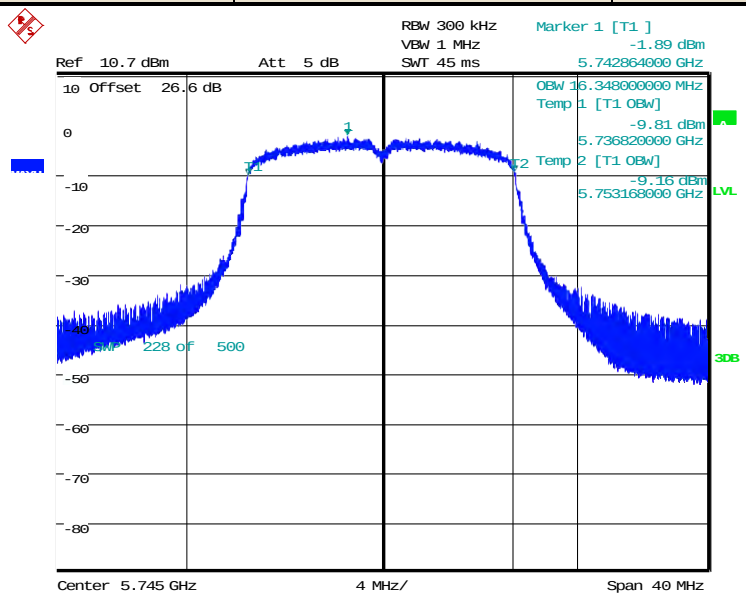


Emission Bandwidth		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 1

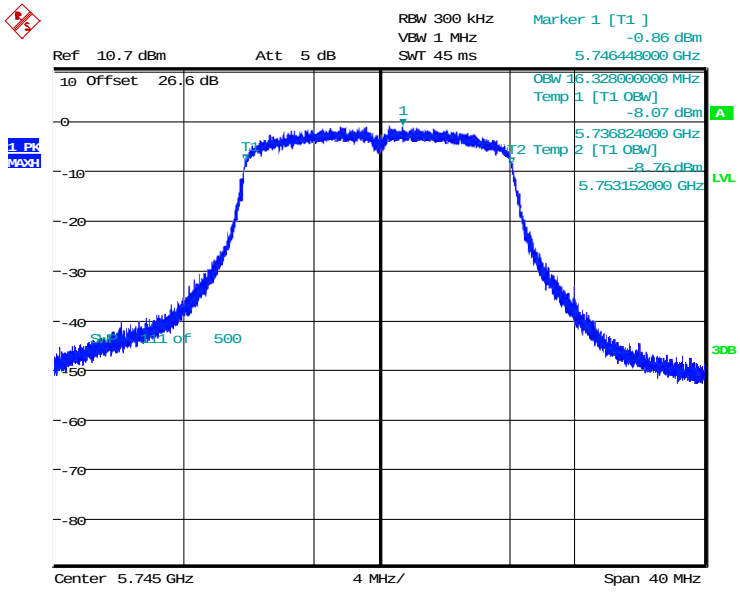


6.2.7.2 Occupied Bandwidth

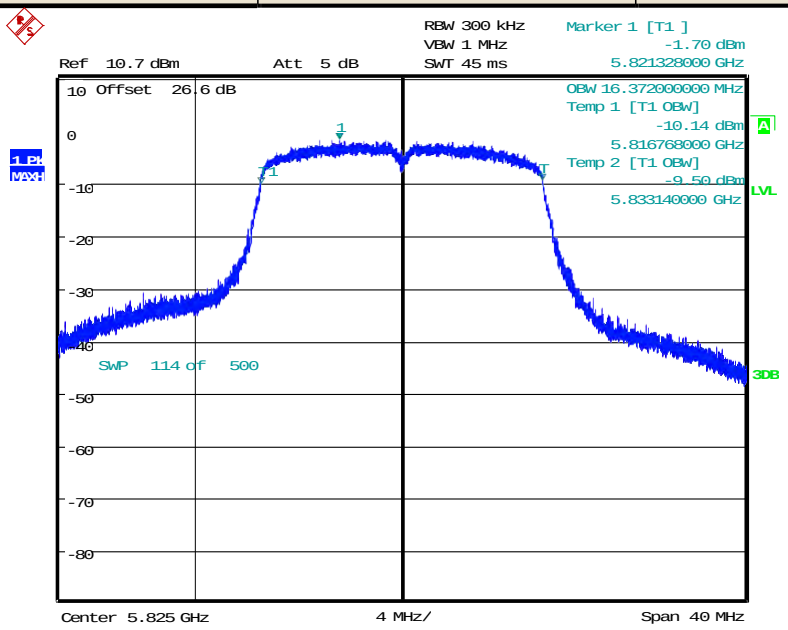
Occupied Bandwidth		
802.11a	Channel 149 / 5745 MHz	Tx Chain 0



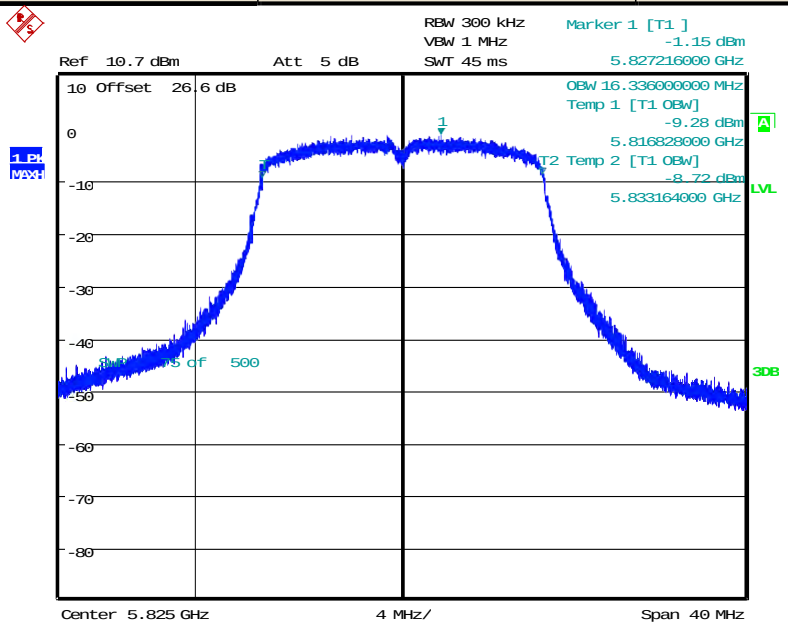
Occupied Bandwidth		
802.11a	Channel 149 / 5745 MHz	Tx Chain 1



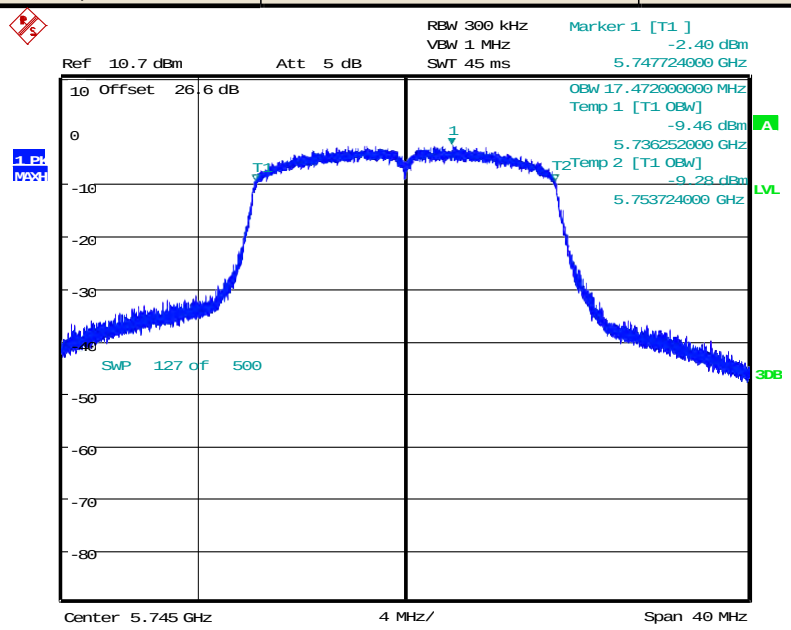
Occupied Bandwidth		
802.11a	Channel 165 / 5825 MHz	Tx Chain 0



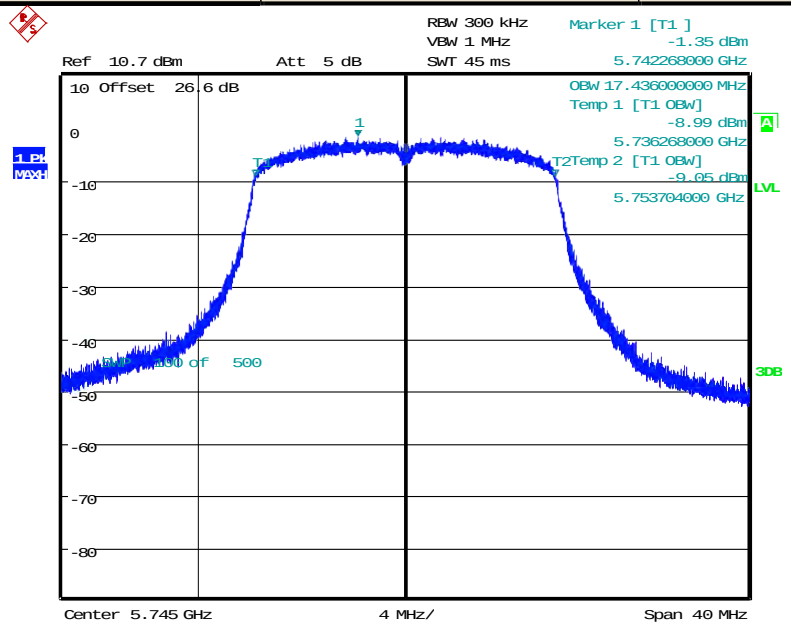
Occupied Bandwidth		
802.11a	Channel 165 / 5825 MHz	Tx Chain 1



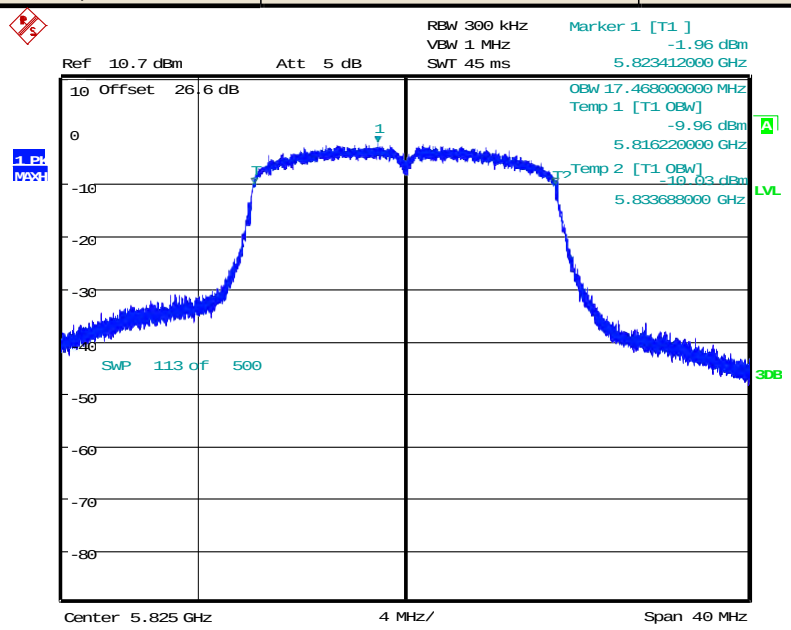
Occupied Bandwidth		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 0



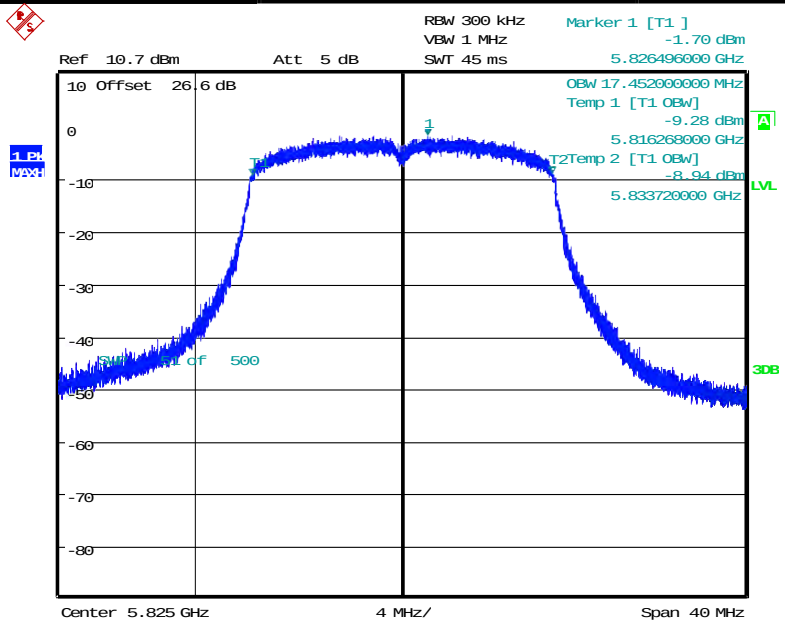
Occupied Bandwidth		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 1



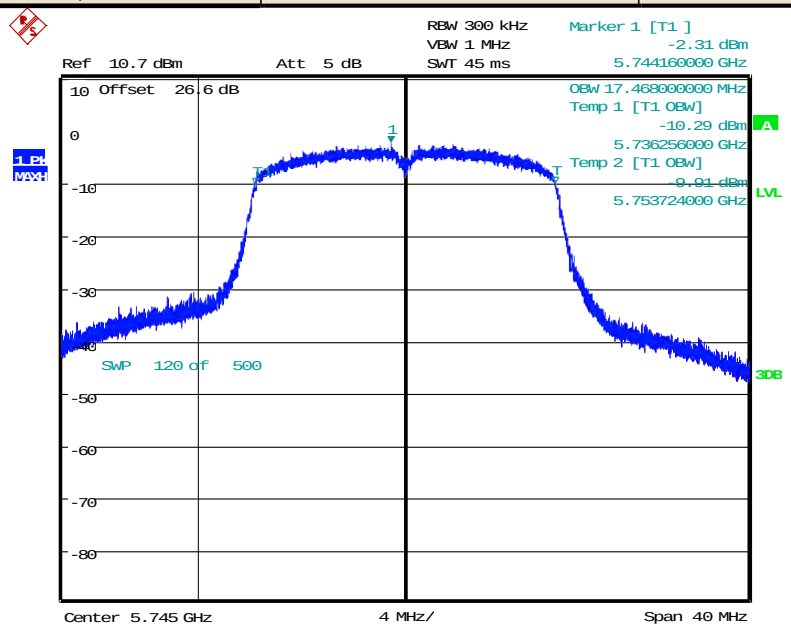
Occupied Bandwidth		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 0



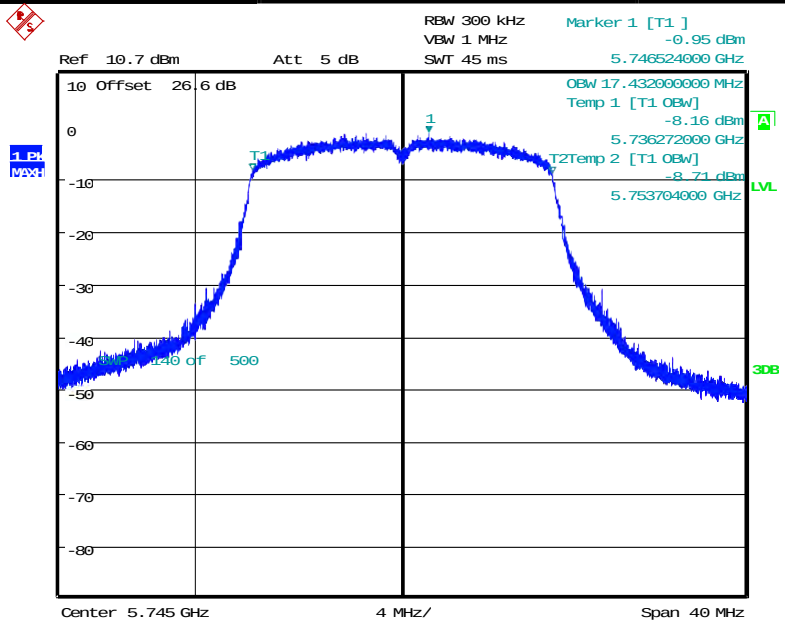
Occupied Bandwidth		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 1



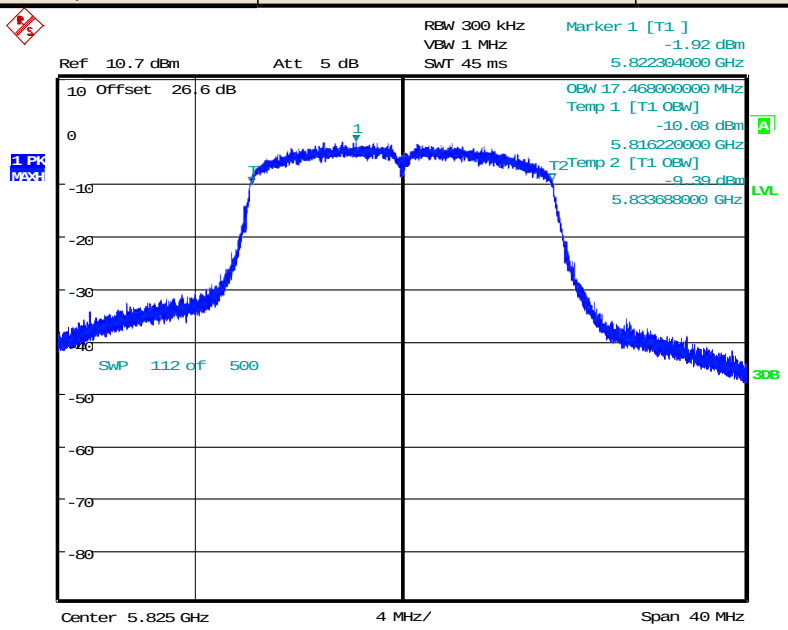
Occupied Bandwidth		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 0



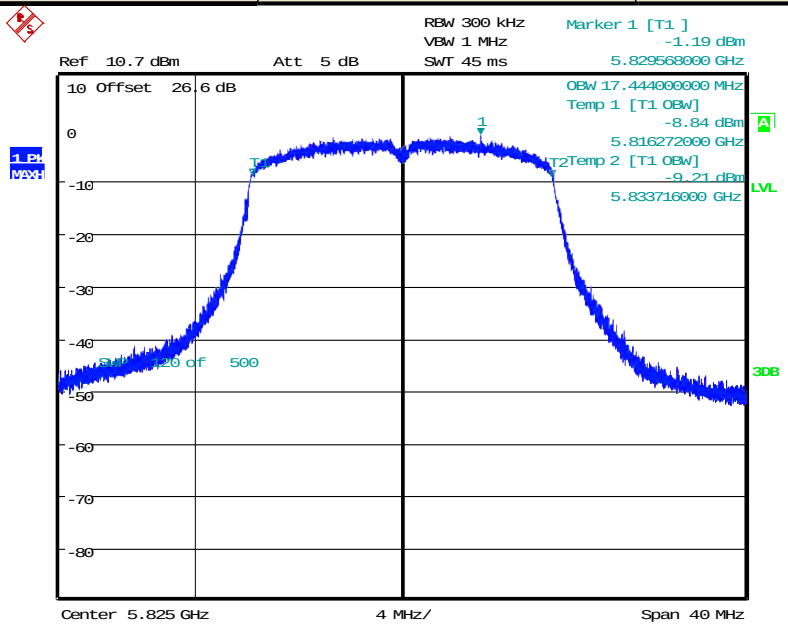
Occupied Bandwidth		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 1



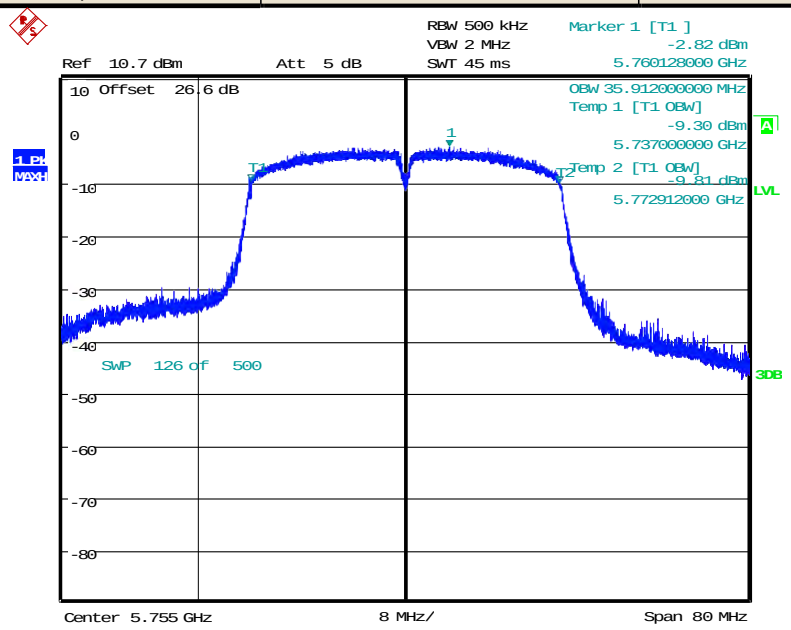
Occupied Bandwidth		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 0



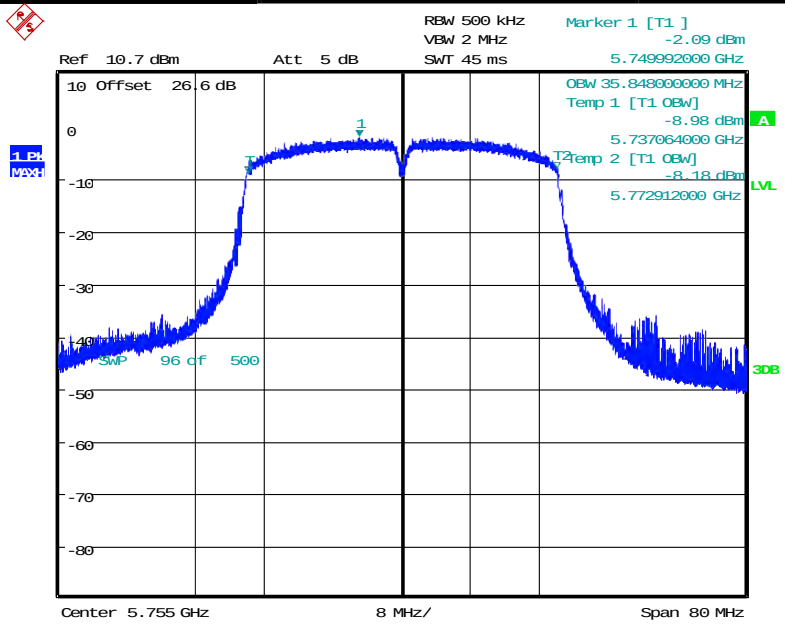
Occupied Bandwidth		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 1



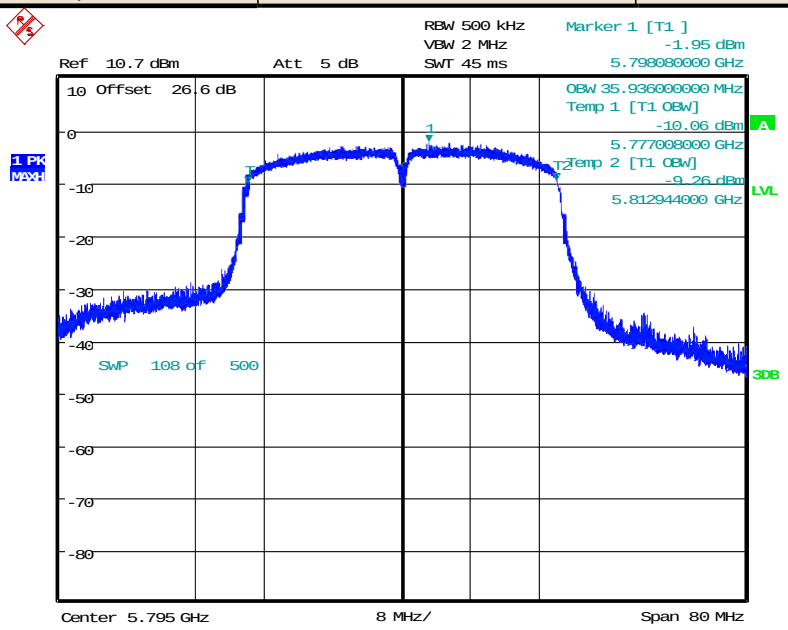
Occupied Bandwidth		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 0



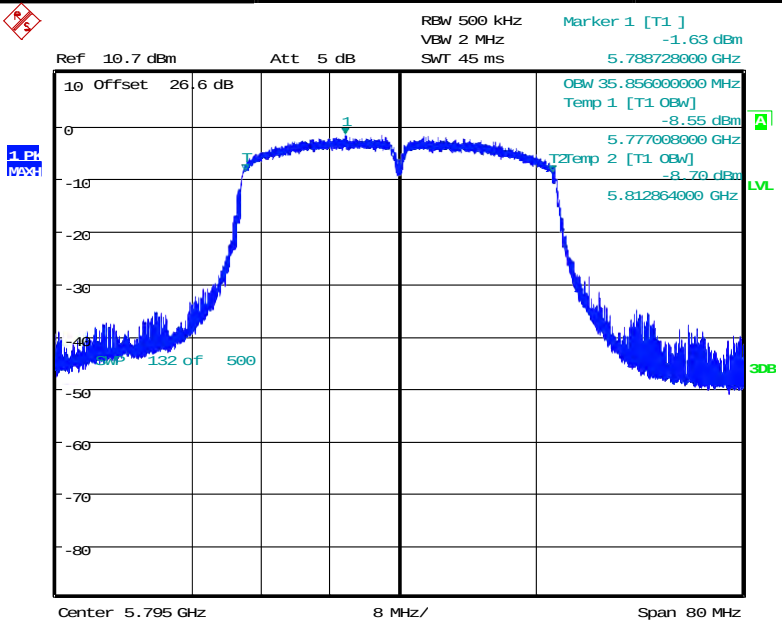
Occupied Bandwidth		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 1



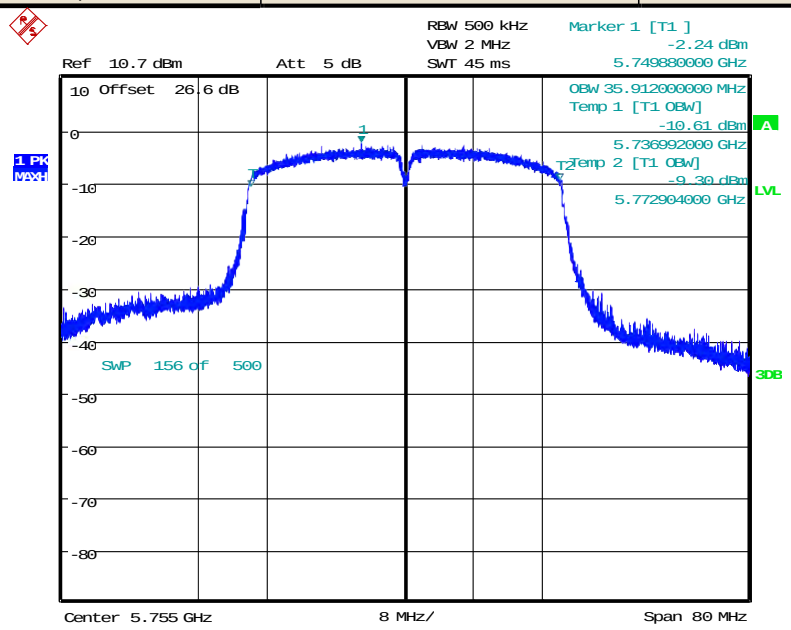
Occupied Bandwidth		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 0



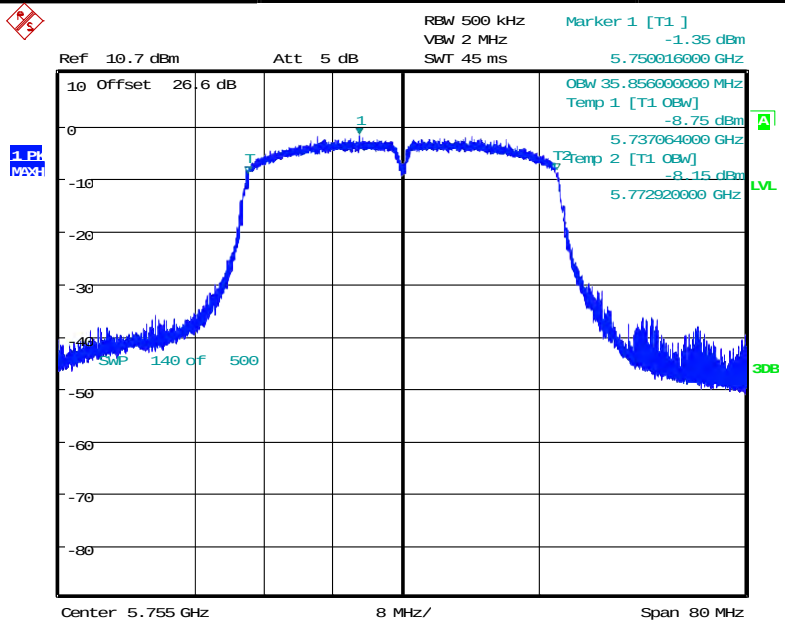
Occupied Bandwidth		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 1



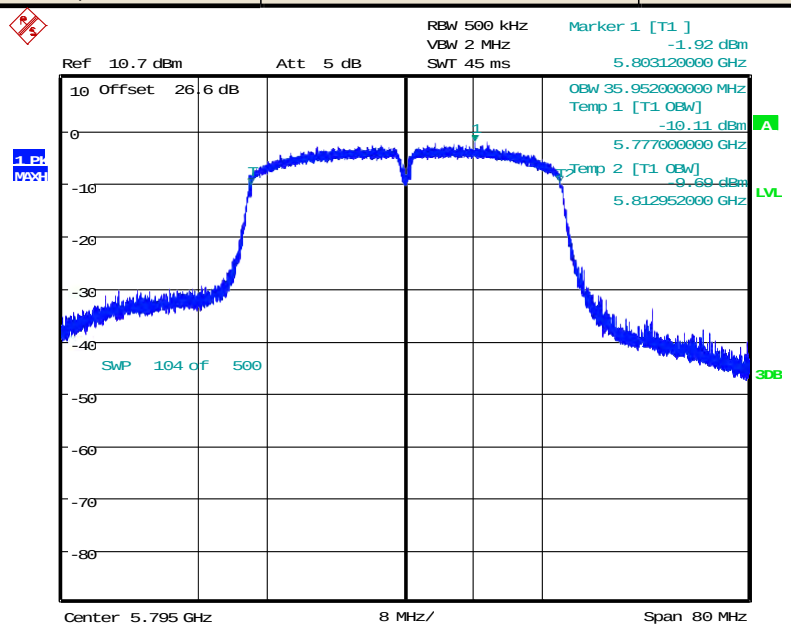
Occupied Bandwidth		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 0



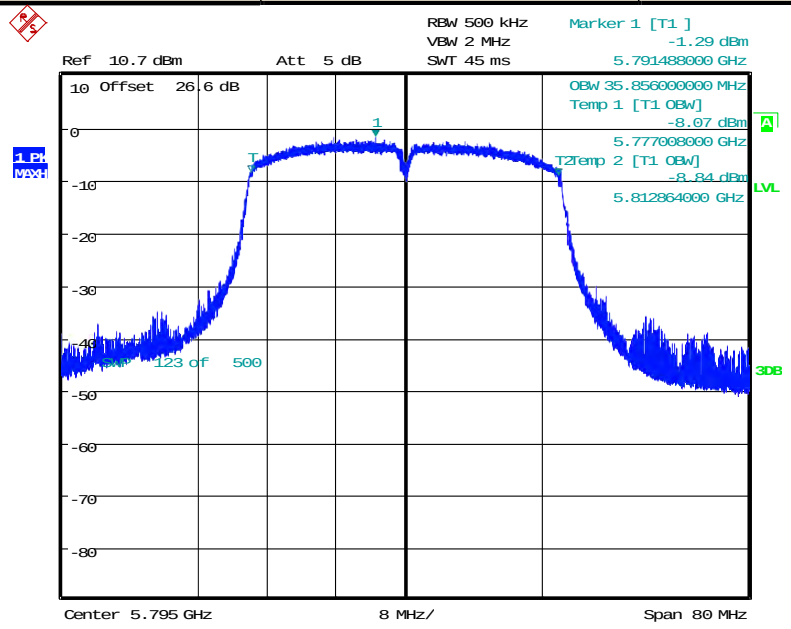
Occupied Bandwidth		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 1



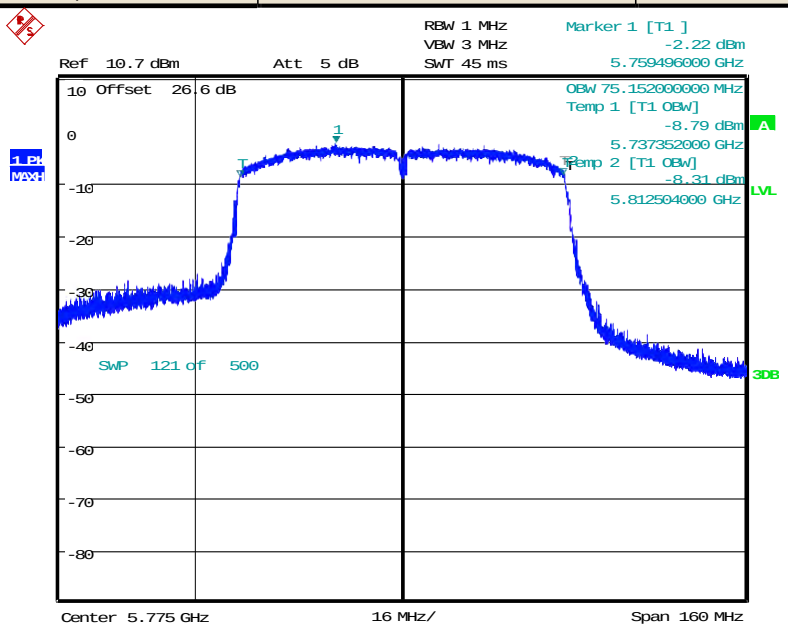
Occupied Bandwidth		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 0



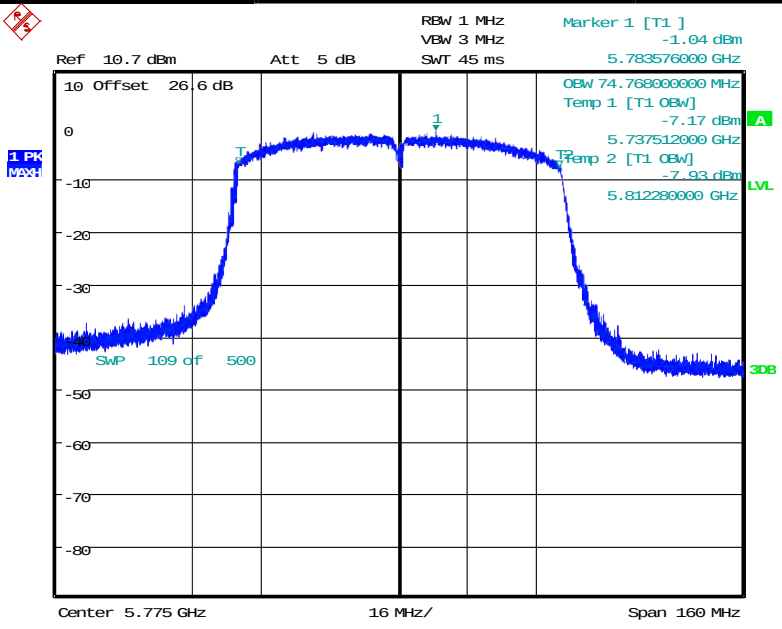
Occupied Bandwidth		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 1



Occupied Bandwidth		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 0

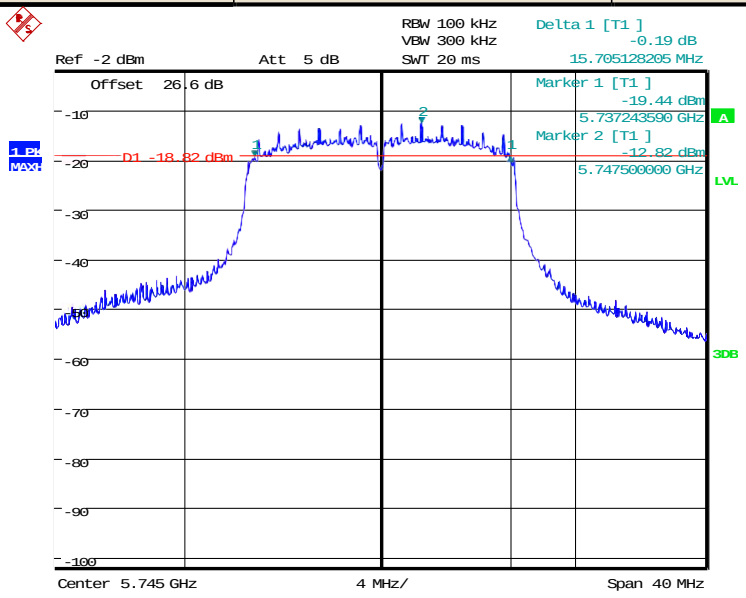


Occupied Bandwidth		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 1

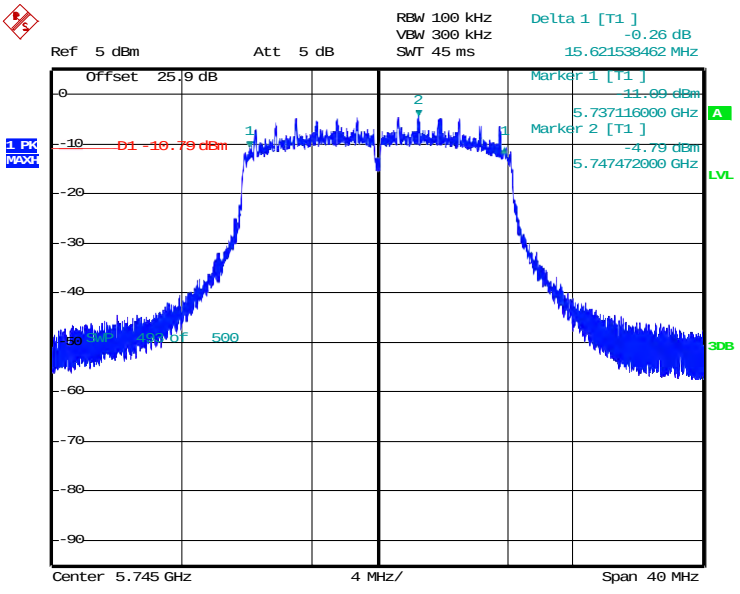


6.2.7.3 6dB Bandwidth

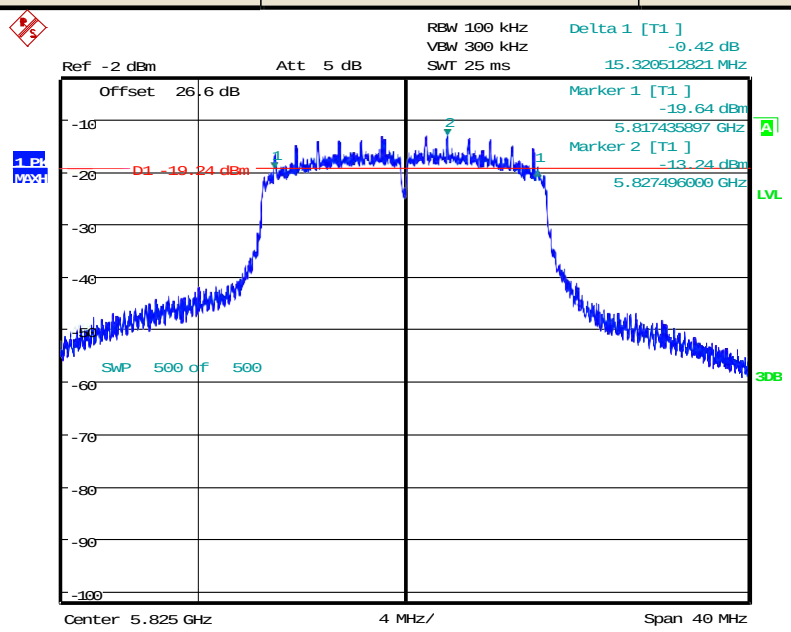
6 dB Bandwidth		
802.11a	Channel 149 / 5745 MHz	Tx Chain 0



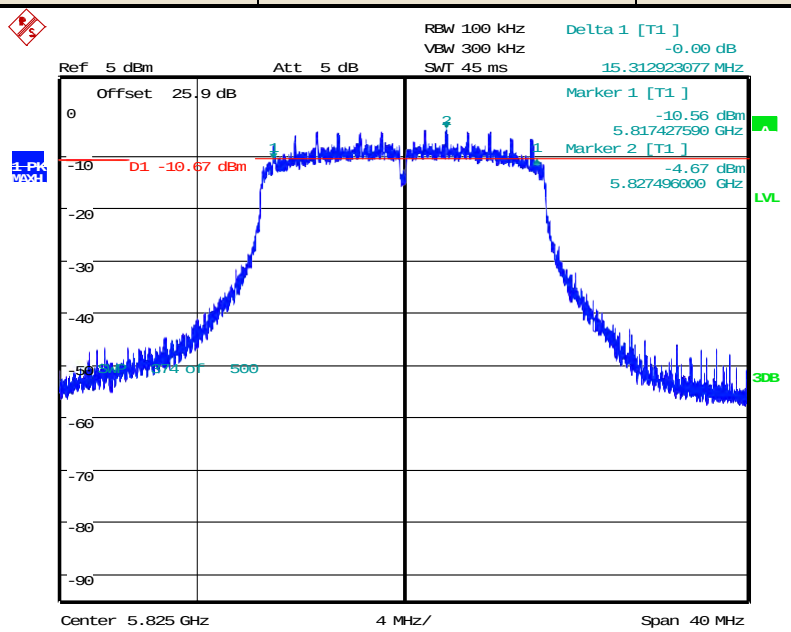
6 dB Bandwidth		
802.11a	Channel 149 / 5745 MHz	Tx Chain 1



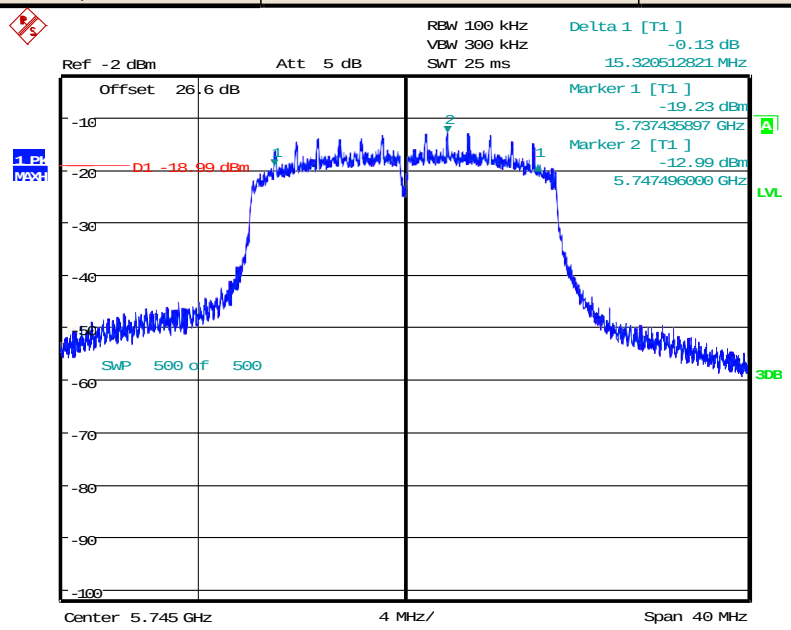
6 dB Bandwidth		
802.11a	Channel 165 / 5825 MHz	Tx Chain 0



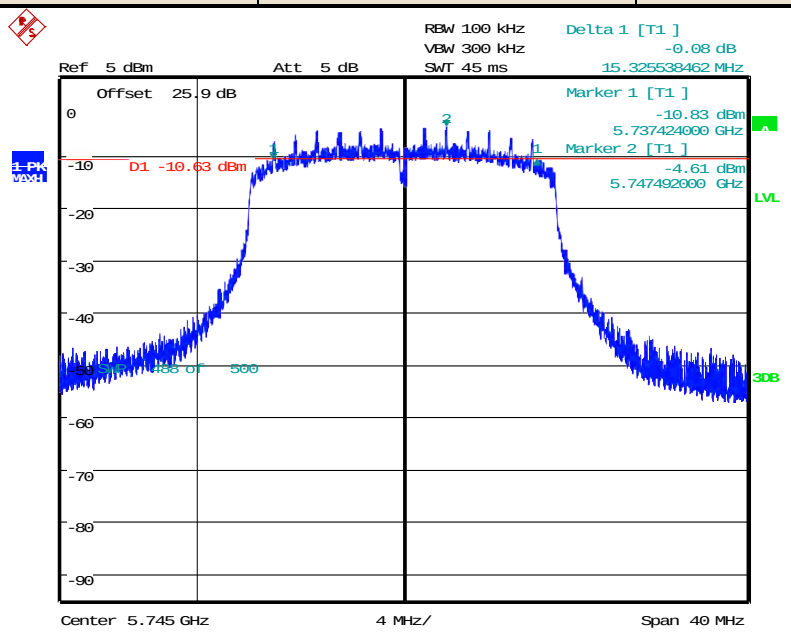
6 dB Bandwidth		
802.11a	Channel 165 / 5825 MHz	Tx Chain 1



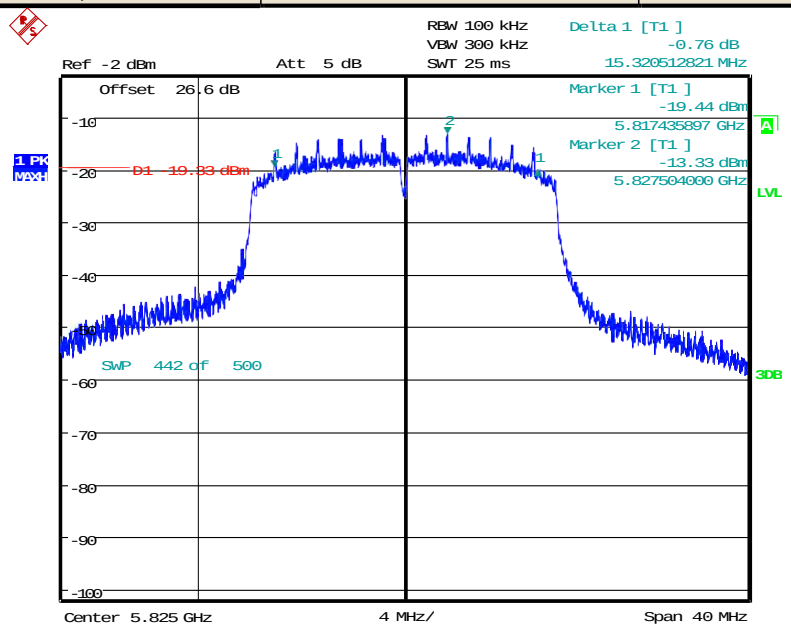
6 dB Bandwidth		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 0



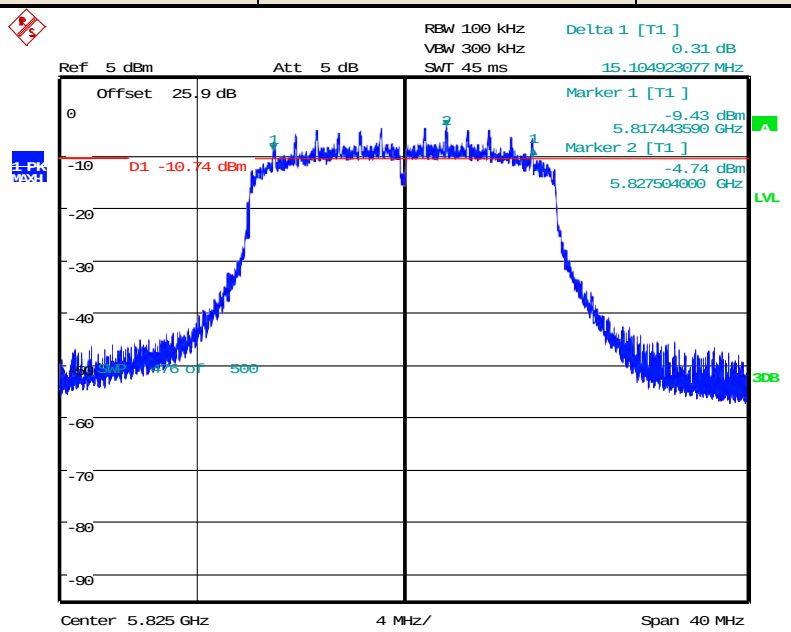
6 dB Bandwidth		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 1



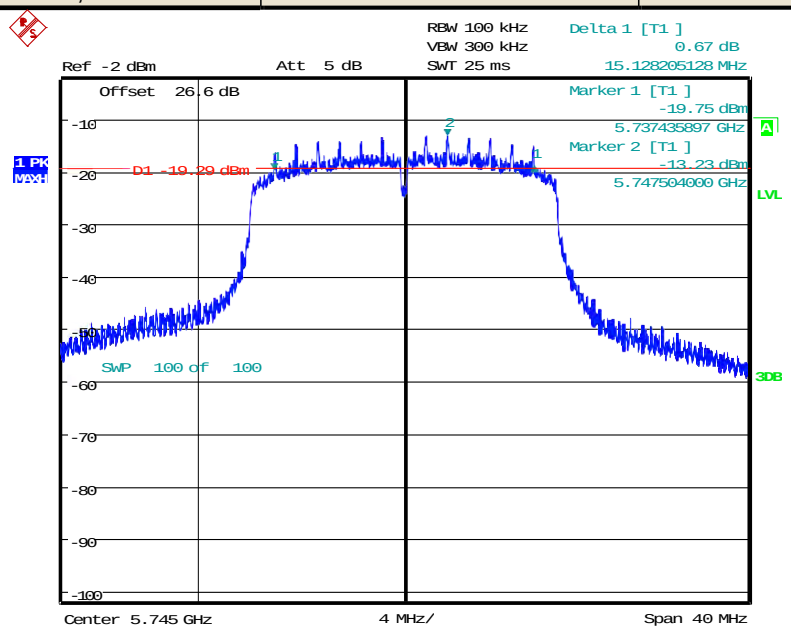
6 dB Bandwidth		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 0



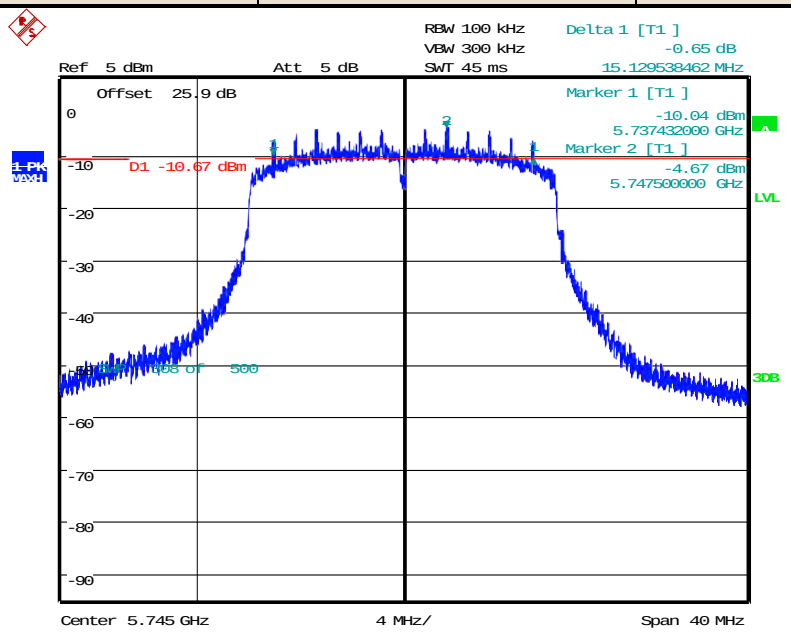
6 dB Bandwidth		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 1



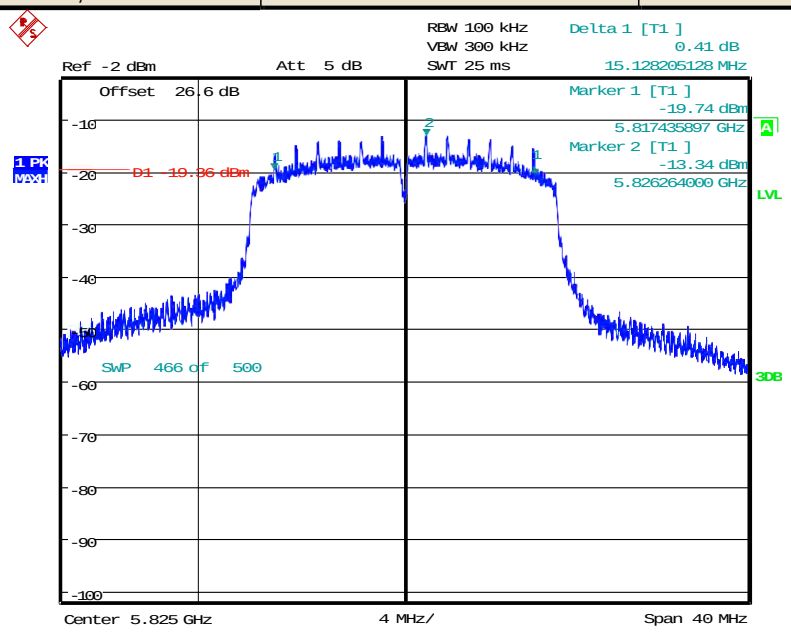
6 dB Bandwidth		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 0



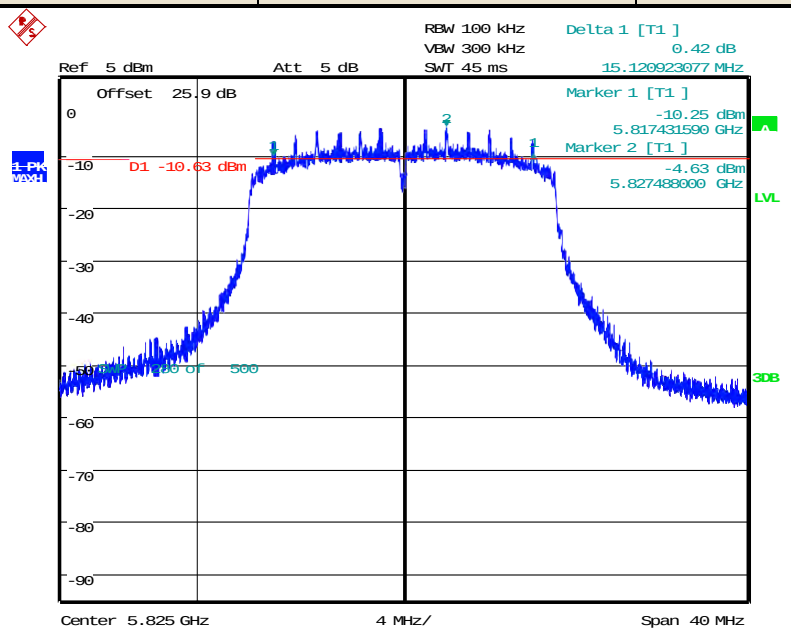
6 dB Bandwidth		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 1



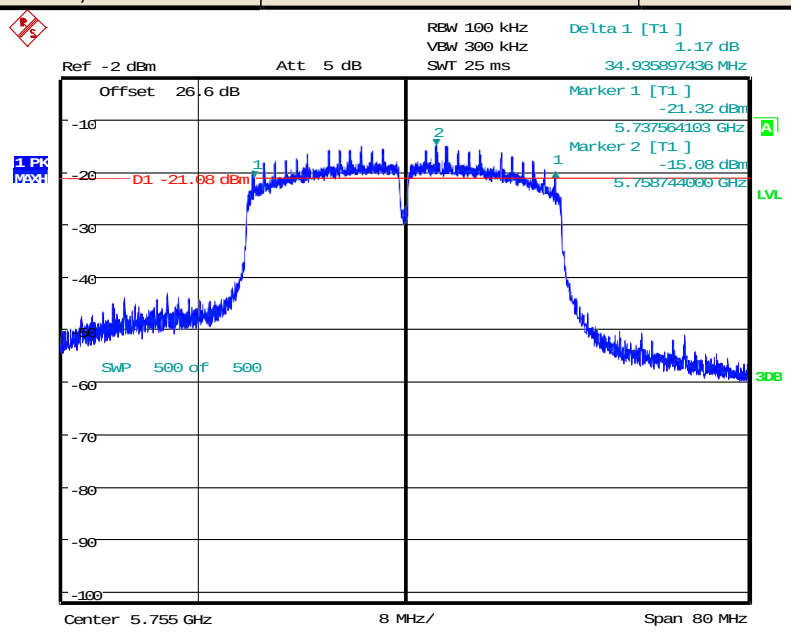
6 dB Bandwidth		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 0



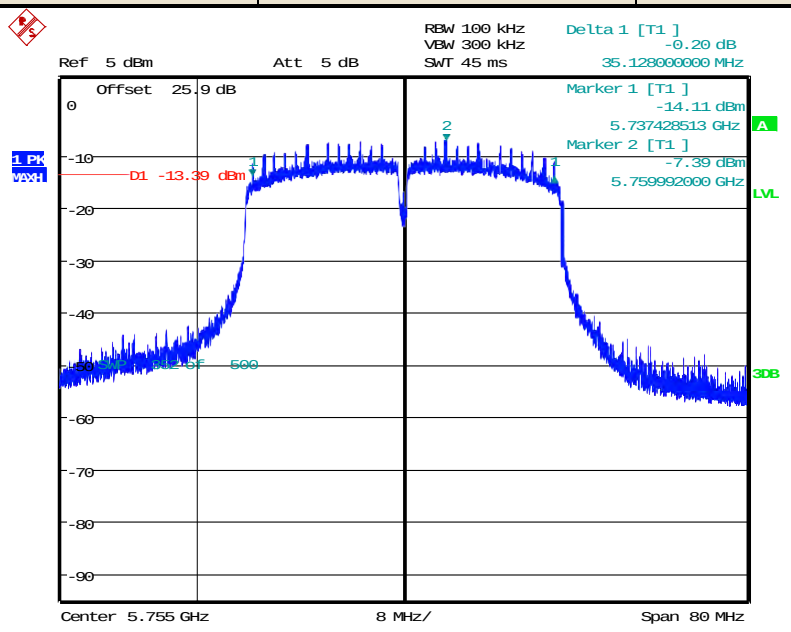
6 dB Bandwidth		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 1



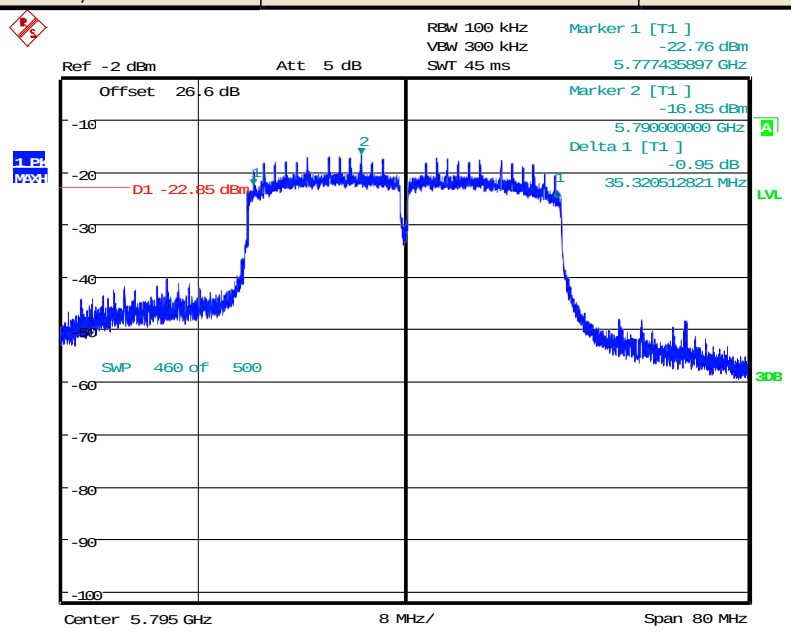
6 dB Bandwidth		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 0



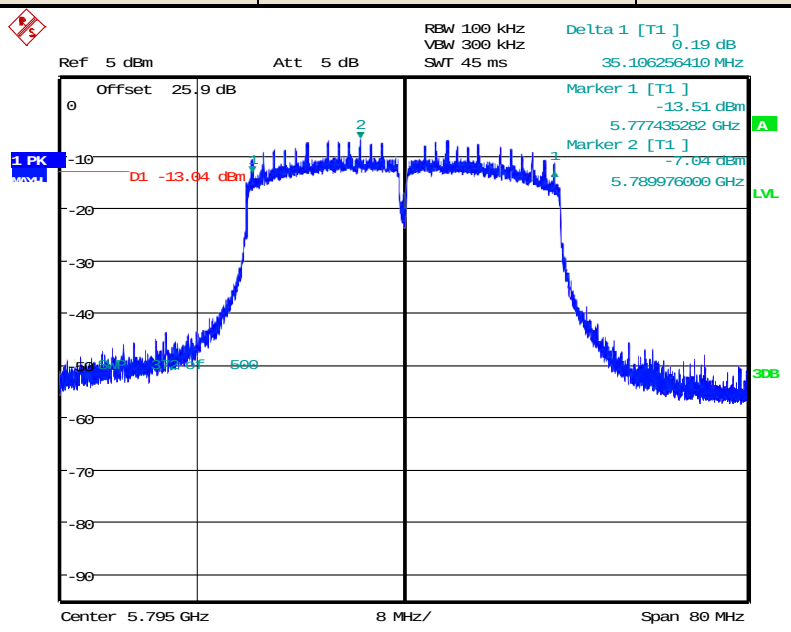
6 dB Bandwidth		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 1



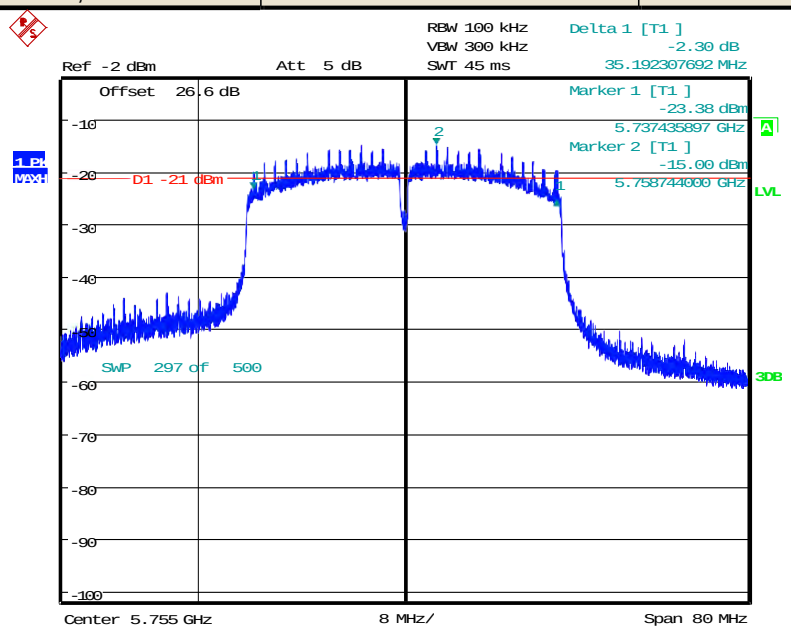
6 dB Bandwidth		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 0



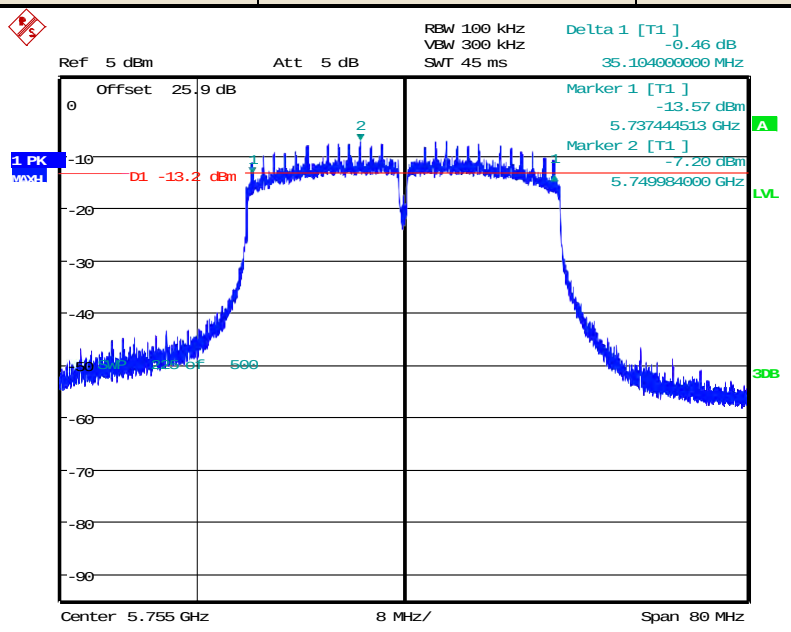
6 dB Bandwidth		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 1



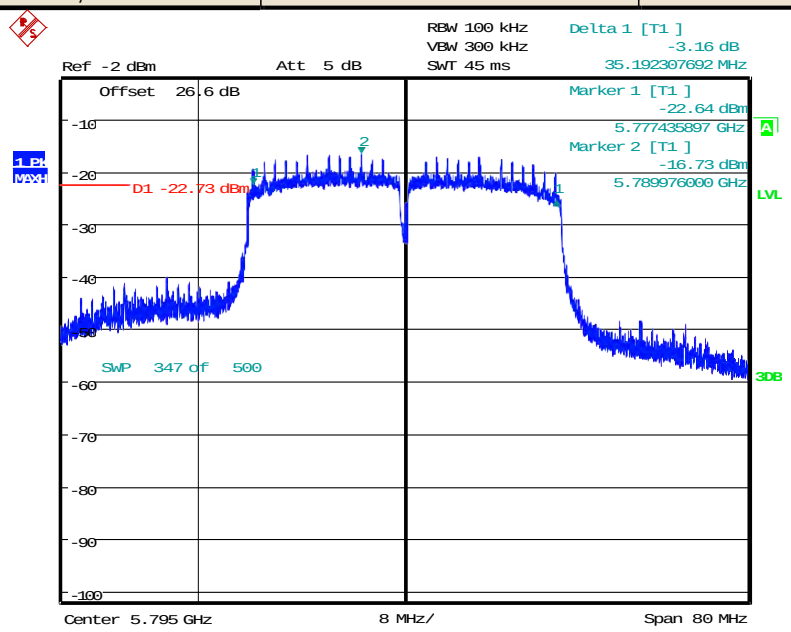
6 dB Bandwidth		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 0



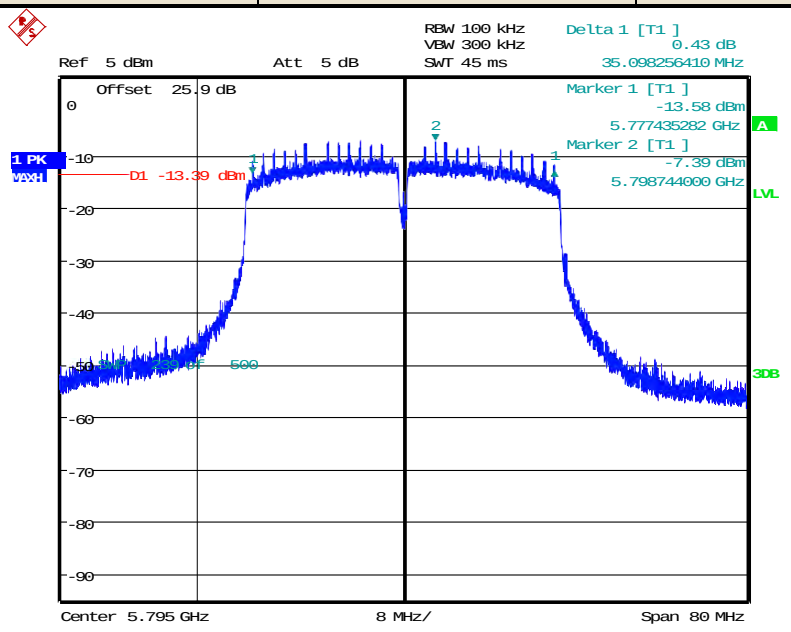
6 dB Bandwidth		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 1



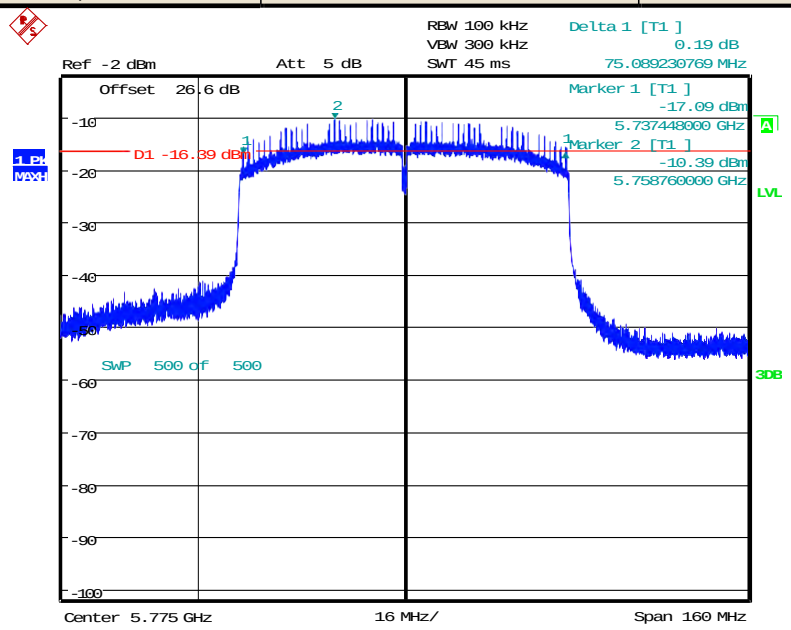
6 dB Bandwidth		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 0



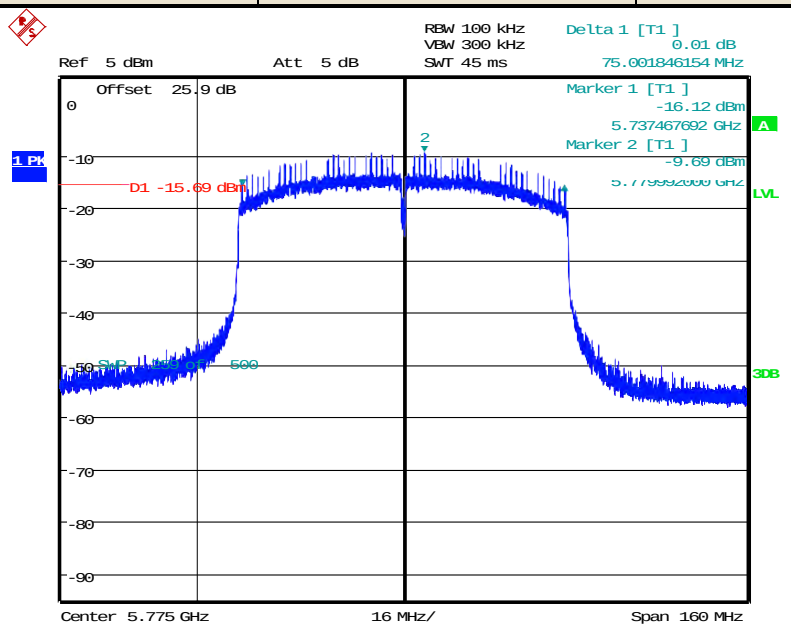
6 dB Bandwidth		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 1



6 dB Bandwidth		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 0



6 dB Bandwidth		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 1



6.3 Transmitter Output Power and EIRP

6.3.1 Technical Standard References

FCC §15.407, Section (a) (3)
IC RSS-247, Section 6.2.4.1
KDB 789033, Section II.E
KDB 662911, Section E(1), F

6.3.2 Requirement

When the antenna gain does not exceed 6 dBi:

Conducted Output Power: 1 W (30 dBm)
EIRP: 4 W (36 dBm)

6.3.3 EUT Conditions

Continuous transmission

6.3.4 Test Conditions

Measurements are according to FCC KDB 789033, section II.E, Method SA-2: trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction

For MIMO operating modes, the correlated antenna gain is calculated as

$$Correlated\ Antenna\ Gain = 10\log\left[\frac{\left(10^{G_1/20}+10^{G_2/20}\right)^2}{N_{Ant}}\right]\ dBi$$

Where

G_1 and G_2: Antenna Gain
N_{Ant}: Number of transmit antennas

EIRP for SISO is calculated as

$$EIRP = Conducted\ Average\ Output\ Power + 10\log\left(\frac{1}{Duty\ Cycle}\right) + Antenna\ Gain$$

EIRP for MIMO is calculated as

$$EIRP = 10\log\left(10^{P_1/10} + 10^{P_2/10}\right) + Correlated\ Antenna\ Gain$$

Where

P_1 and P_2: Conducted average output power corrected for duty cycle

6.3.5 Test Results

Maximum Antenna Gain (dBi)		
Tx Chain 0	Tx Chain 1	Correlated Antenna Gain
5.16	-0.17	5.91

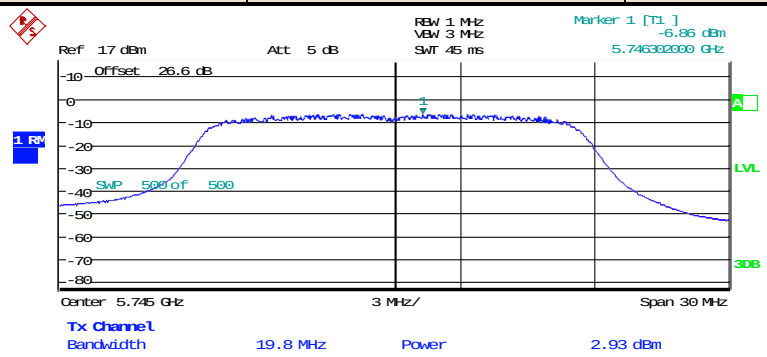
Operating Mode	Channel	Frequency (MHz)	Tx Chain	Duty Cycle (%)	Measured Conducted Average Output Power (dBm)	Duty Cycle Corrected Conducted Average Output Power (dBm)	Calculated SISO EIRP (dBm)	Calculated MIMO Correlated EIRP (dBm)
802.11a	149	5745	0	97%	2.93	3.06	8.22	12.03
			1	97%	3.02	3.15	2.98	
	165	5825	0	97%	3.11	3.24	8.40	12.15
			1	97%	3.09	3.22	3.05	
802.11n, HT20	149	5745	0	96%	2.38	2.56	7.72	11.60
			1	96%	2.63	2.81	2.64	
	165	5825	0	96%	2.76	2.94	8.10	11.85
			1	96%	2.75	2.93	2.76	
802.11ac, VHT20	149	5745	0	96%	2.41	2.59	7.75	11.65
			1	96%	2.7	2.88	2.71	
	165	5825	0	96%	2.76	2.94	8.10	11.85
			1	96%	2.74	2.92	2.75	
802.11n, HT40	151	5755	0	93%	1.16	1.48	6.64	10.55
			1	93%	1.46	1.78	1.61	
	159	5795	0	93%	1.59	1.91	7.07	10.73
			1	93%	1.4	1.72	1.55	
802.11ac, VHT40	151	5755	0	92%	1.27	1.63	6.79	10.61
			1	93%	1.44	1.76	1.59	
	159	5795	0	92%	1.61	1.97	7.13	10.85
			1	93%	1.57	1.89	1.72	
802.11ac, VHT80	155	5775	0	86%	-1.92	-1.26	3.90	7.68
			1	87%	-1.82	-1.22	-1.39	

6.3.6 Test Verdict

Pass

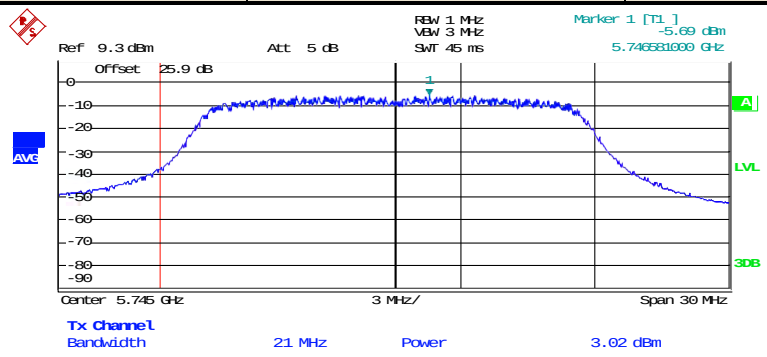
6.3.7 Test Plots

Conducted Average Output Power		
802.11a	Channel 149 / 5745 MHz	Tx Chain 0



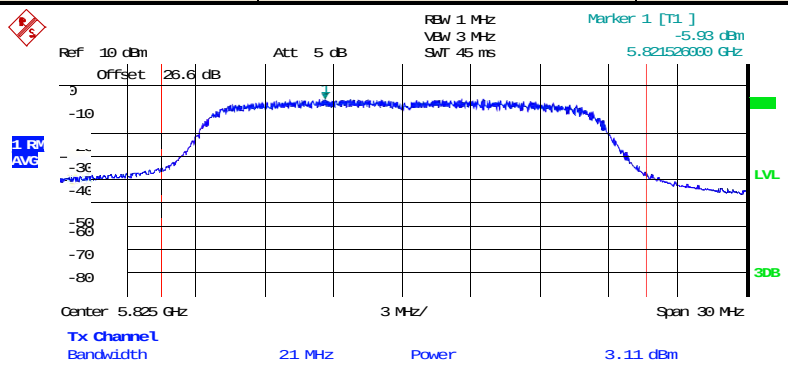
Date: 6.JAN.2016 10:16:12

Conducted Average Output Power		
802.11a	Channel 149 / 5745 MHz	Tx Chain 1



Date: 6.JAN.2016 11:04:34

Conducted Average Output Power		
802.11a	Channel 165 / 5825 MHz	Tx Chain 0



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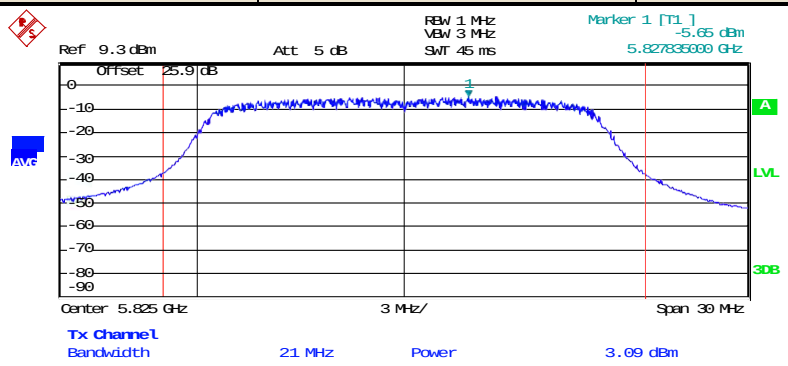
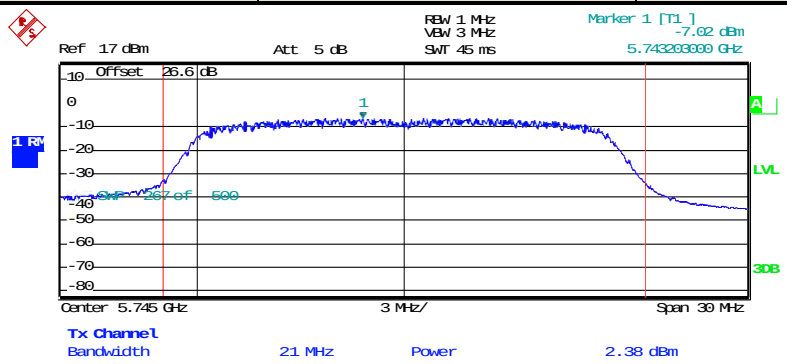
Conducted Average Output Power		
802.11a	Channel 165 / 5825 MHz	Tx Chain 1

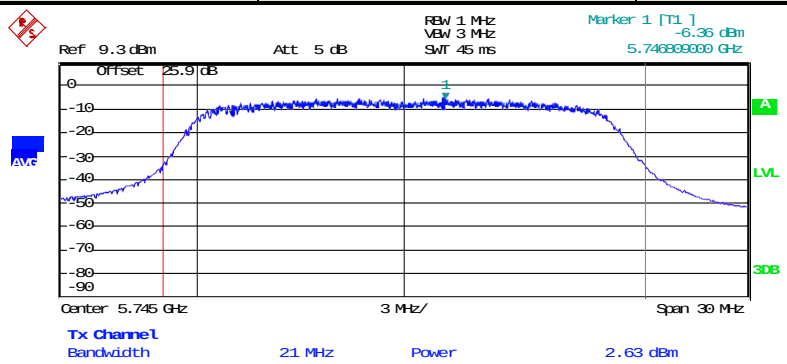


Date: 6.JAN.2016 11:08:20

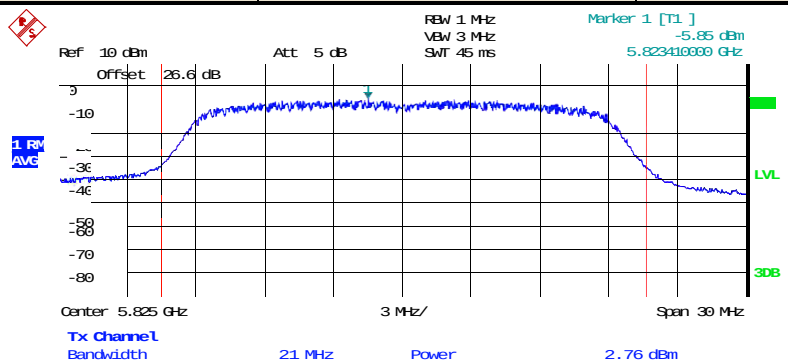
Conducted Average Output Power		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 0



Conducted Average Output Power		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 1

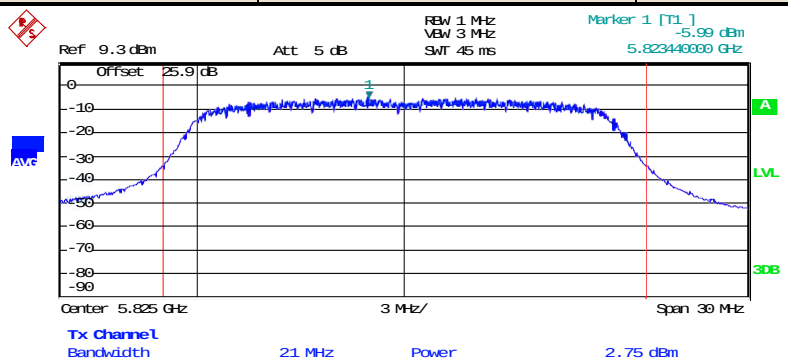


Conducted Average Output Power		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 0



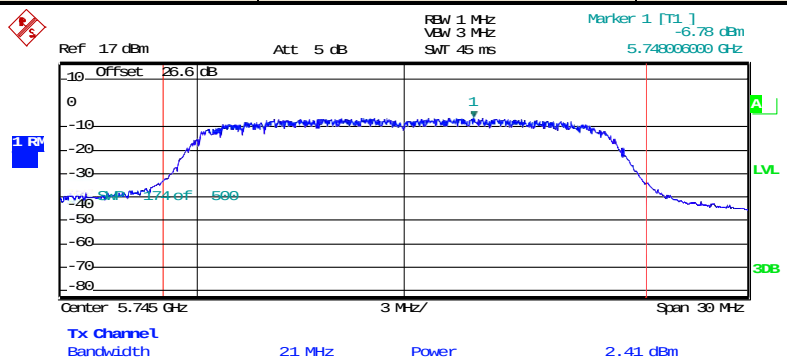
Date: 6.JAN.2016 10:49:58

Conducted Average Output Power		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 1



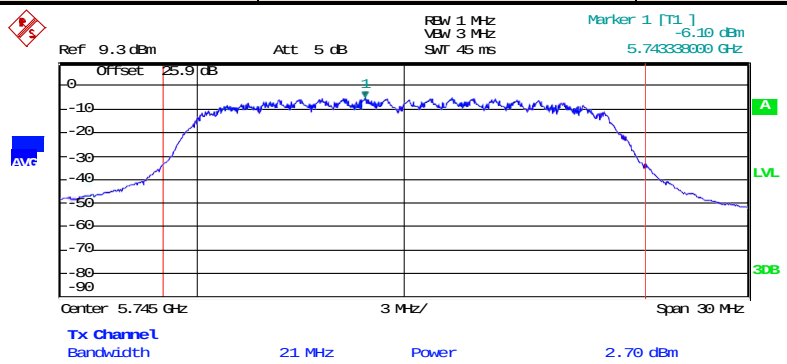
Date: 6.JAN.2016 11:09:15

Conducted Average Output Power		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 0



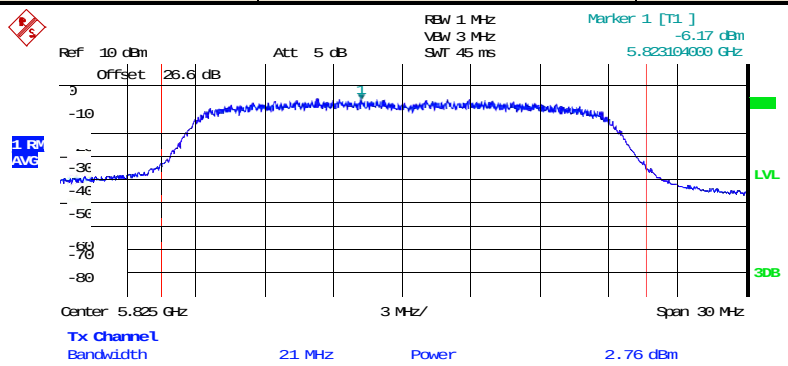
Date: 6.JAN.2016 10:46:54

Conducted Average Output Power		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 1



Date: 6.JAN.2016 11:07:15

Conducted Average Output Power		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 0



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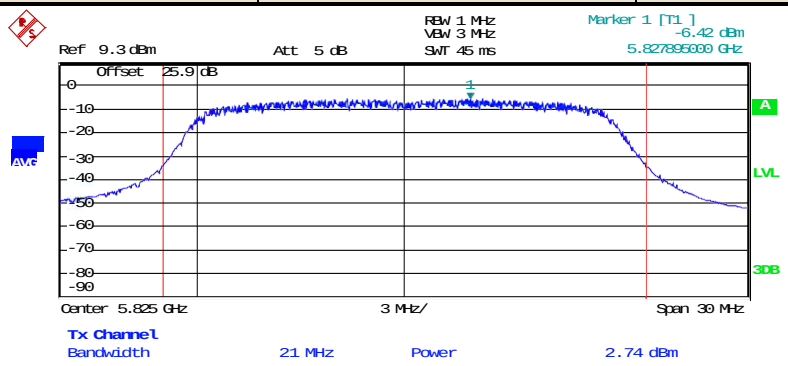
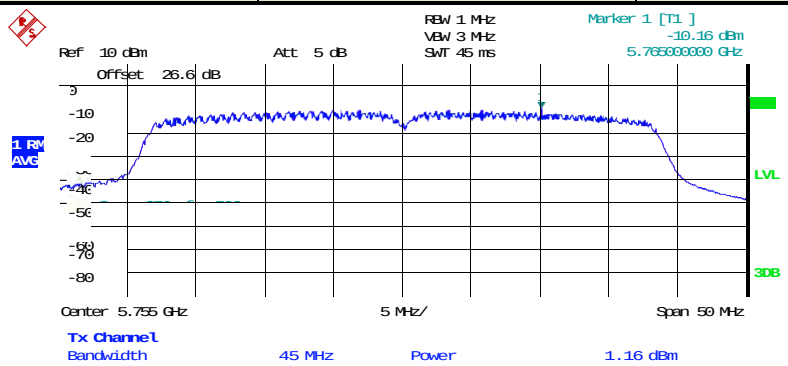
Conducted Average Output Power		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 1



Date: 6.JAN.2016 11:10:10

Conducted Average Output Power		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 0



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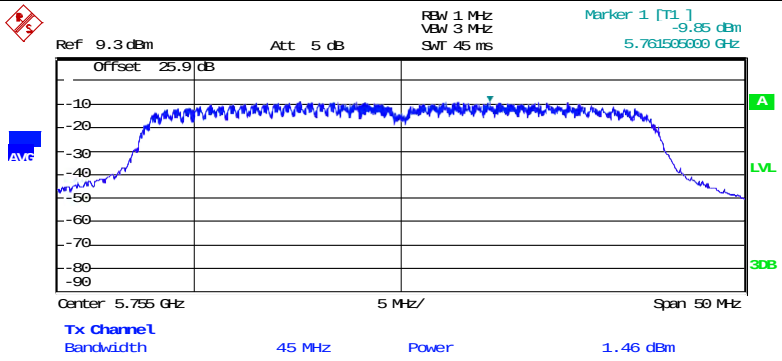
Conducted Average Output Power		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 1



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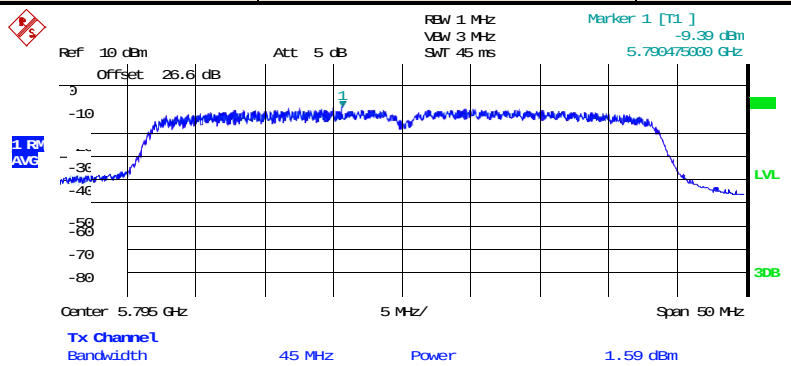
Conducted Average Output Power		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 0



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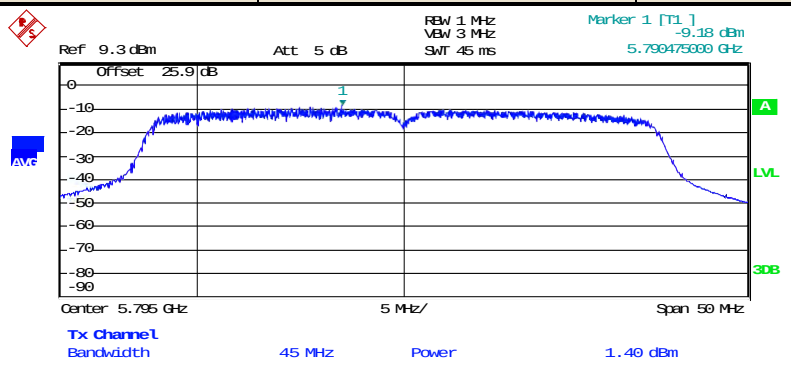
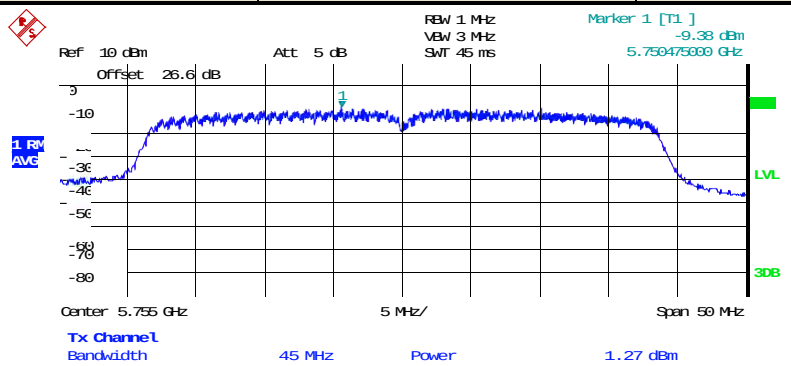
Conducted Average Output Power		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 1



Date: 6.JAN.2016 11:15:35

Conducted Average Output Power		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 0



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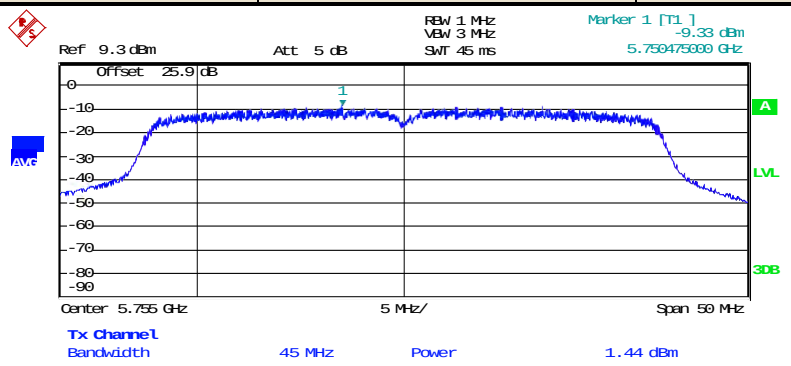
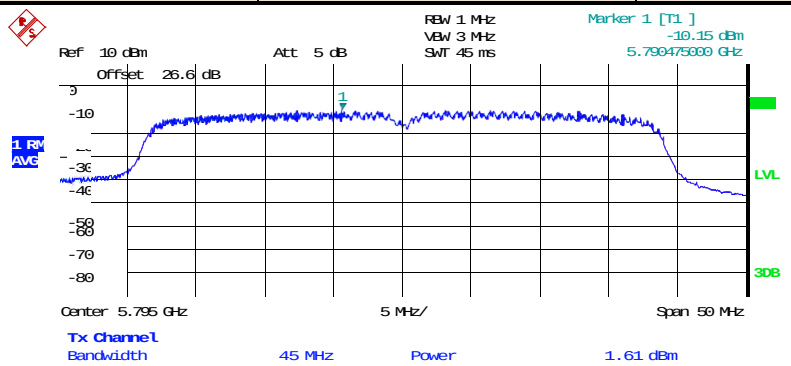
Conducted Average Output Power		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 1



Date: 6.JAN.2016 11:14:30

Conducted Average Output Power		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 0



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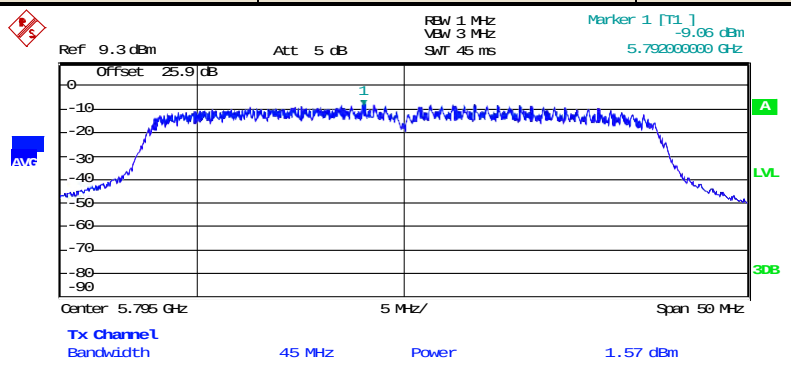
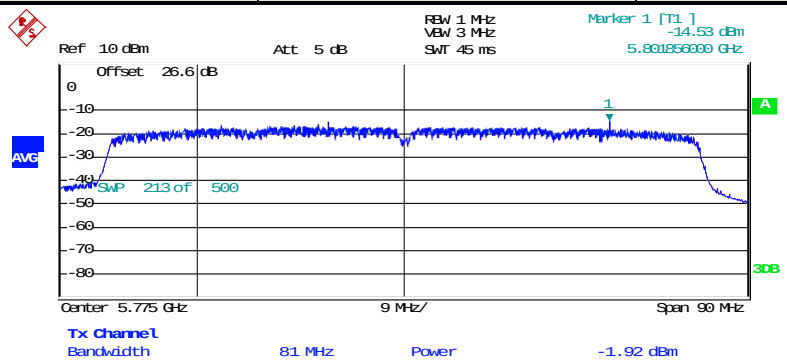
Conducted Average Output Power		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 1



Date: 6.JAN.2016 11:16:38

Conducted Average Output Power		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 0



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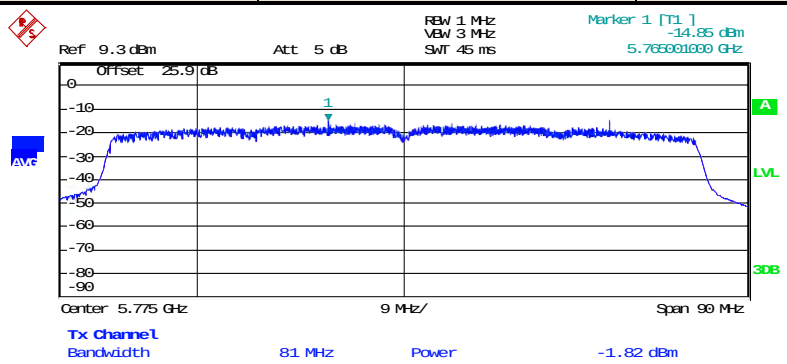
Conducted Average Output Power		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 1



Date: 6.JAN.2016 11:18:19

6.4 Power Spectral Density

6.4.1 Technical Standard References

FCC §15.407, Section (a)(3)
IC RSS-247, Section 6.2.4.1
KDB 789033, Section II.F
KDB 662911, Section E(2)

6.4.2 Requirement

30 dBm in any 500 kHz band

6.4.3 EUT Conditions

Continuous Transmission

6.4.4 Test Conditions

Measurements are according to FCC KDB 789033, section II.F. EIRP PSD is calculated as

$$EIRP\ PSD = Measured\ PSD + 10\log\left(\frac{500\ kHz}{100\ kHz}\right) + 10\ \log\left(\frac{1}{Duty\ Cycle}\right) + Antenna\ Gain$$

For MIMO operating modes, in addition to FCC KDB 789033, section II.F, measurements are according to FCC KDB 662911, Section E(2)(b), Measure and add sum spectral maxima across the outputs. EIRP PSD is calculated as

$$EIRP\ PSD = 10\log\left(10^{P_1/10} + 10^{P_2/10}\right) + Correlated\ Antenna\ Gain$$

Where

P_1 and P_2: PSD corrected for duty cycle and resolution bandwidth

6.4.5 Test Results

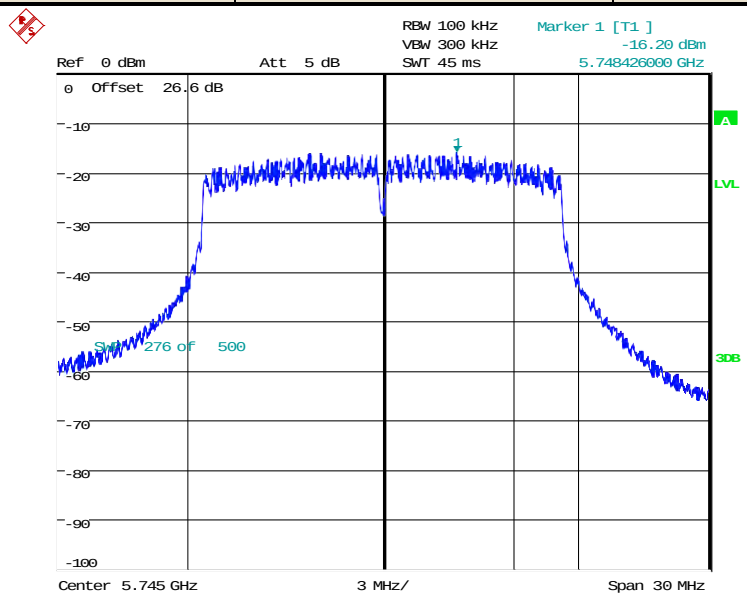
Operating Mode	Channel	Frequency (MHz)	Tx Chain	Duty Cycle (%)	Measured PSD (dBm)	Calculated SISO EIRP PSD (dBm)	Calculated MIMO EIRP PSD (dBm)
802.11a	149	5745	0	97%	-16.2	-3.92	1.60
			1	97%	-16.2	-9.25	
	165	5825	0	97%	-15.7	-3.42	2.11
			1	97%	-15.67	-8.72	
802.11n, HT20	149	5745	0	96%	-16.56	-4.23	1.22
			1	96%	-16.77	-9.77	
	165	5825	0	96%	-16.3	-3.97	1.57
			1	96%	-16.23	-9.23	
802.11ac, VHT20	149	5745	0	96%	-16.51	-4.18	1.34
			1	96%	-16.5	-9.50	
	165	5825	0	96%	-16.04	-3.71	1.75
			1	96%	-16.21	-9.21	
802.11n, HT40	151	5755	0	93%	-19.85	-7.39	-1.96
			1	93%	-20.13	-13.00	
	159	5795	0	93%	-19.67	-7.21	-1.82
			1	93%	-20.09	-12.96	
802.11ac, VHT40	151	5755	0	92%	-20.32	-7.81	-2.21
			1	93%	-20.05	-12.92	
	159	5795	0	92%	-19.07	-6.56	-1.35
			1	93%	-20.02	-12.89	
802.11ac, VHT80	155	5775	0	86%	-24.6	-11.80	-5.80
			1	87%	-23.26	-15.84	

6.4.6 Test Verdict

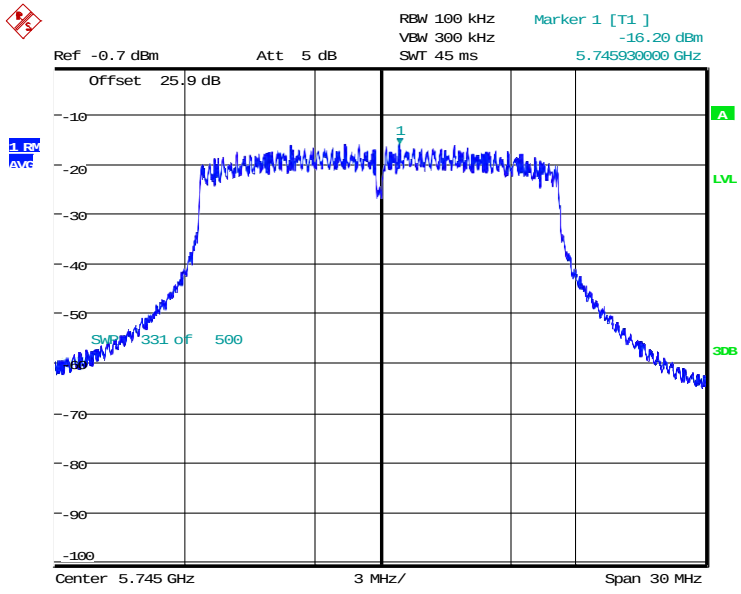
Pass

6.4.7 Test Plots

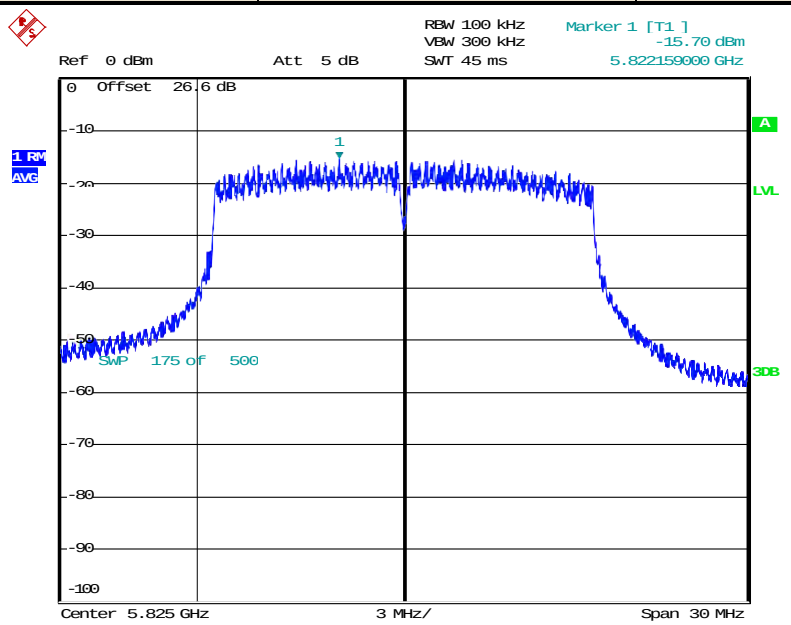
Power Spectral Density		
802.11a	Channel 149 / 5745 MHz	Tx Chain 0



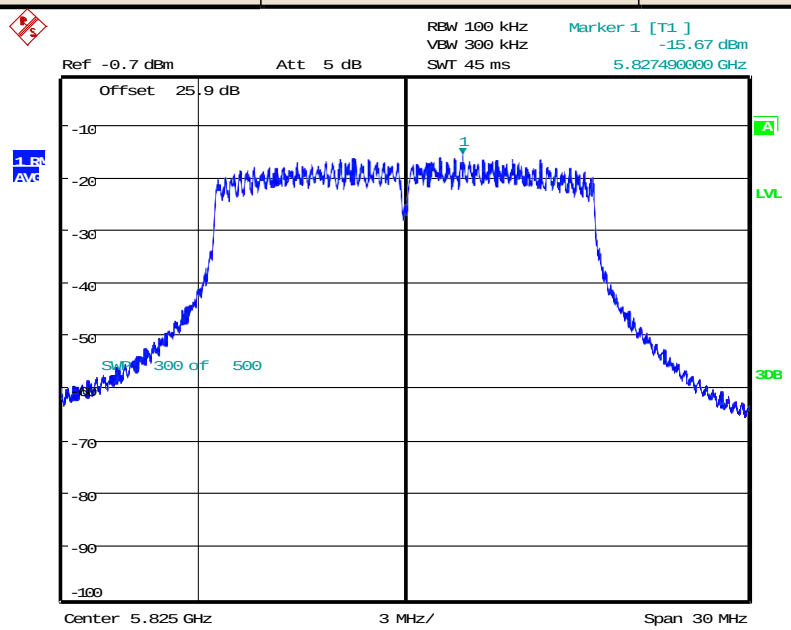
Power Spectral Density		
802.11a	Channel 149 / 5745 MHz	Tx Chain 1



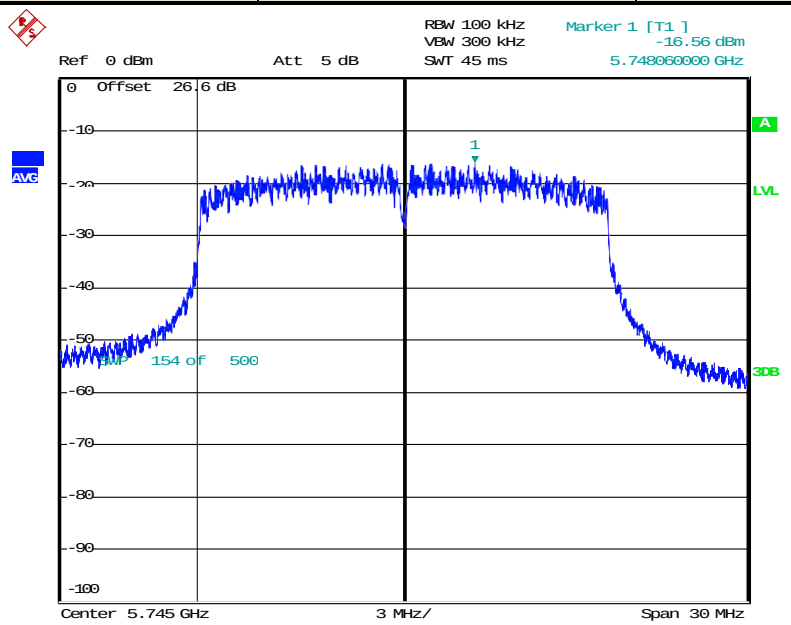
Power Spectral Density		
802.11a	Channel 165 / 5825 MHz	Tx Chain 0



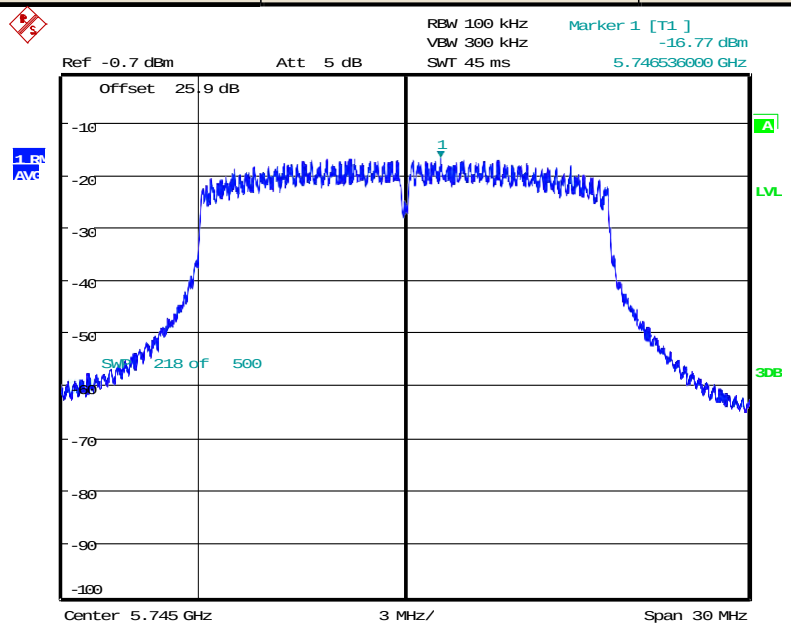
Power Spectral Density		
802.11a	Channel 165 / 5825 MHz	Tx Chain 1



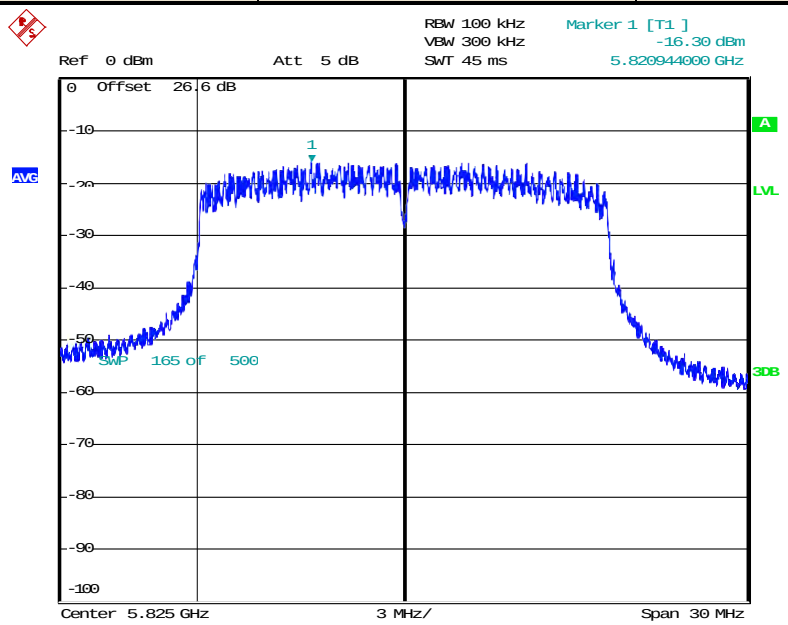
Power Spectral Density		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 0



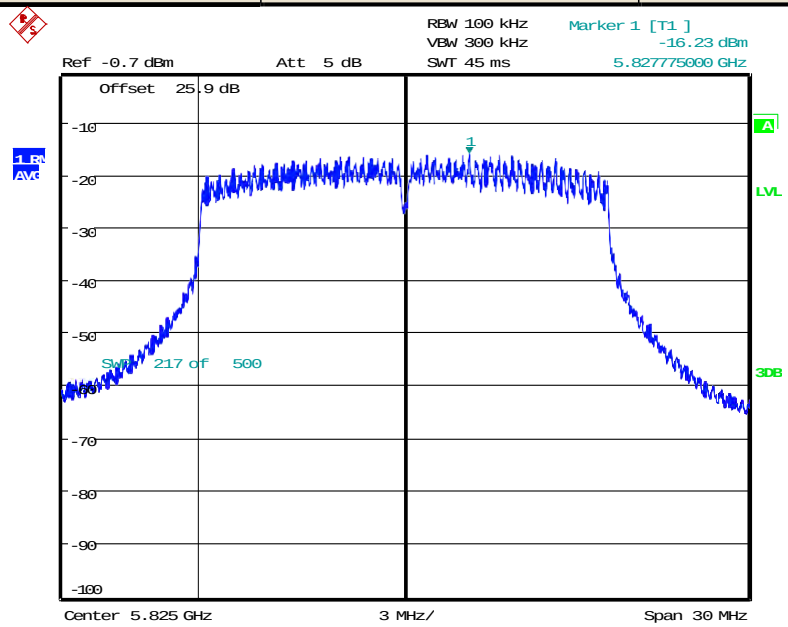
Power Spectral Density		
802.11n, HT20	Channel 149 / 5745 MHz	Tx Chain 1



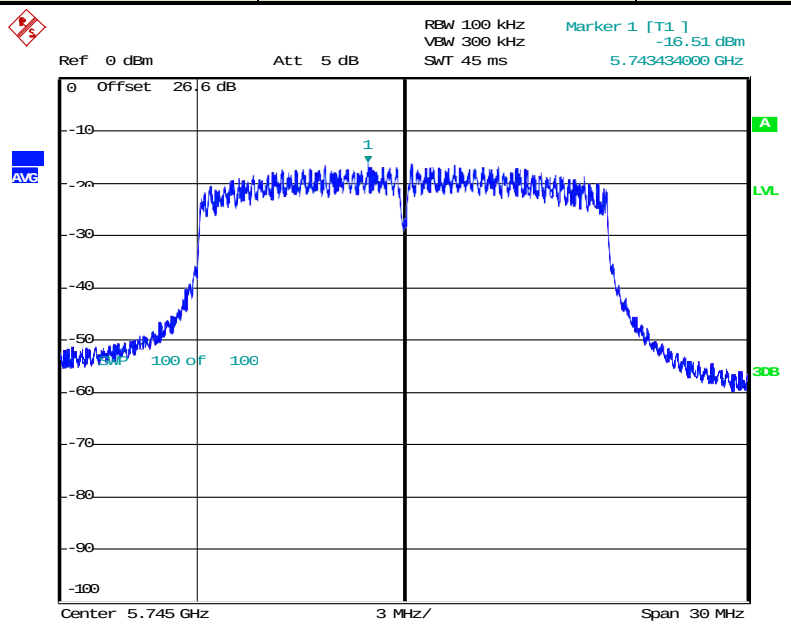
Power Spectral Density		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 0



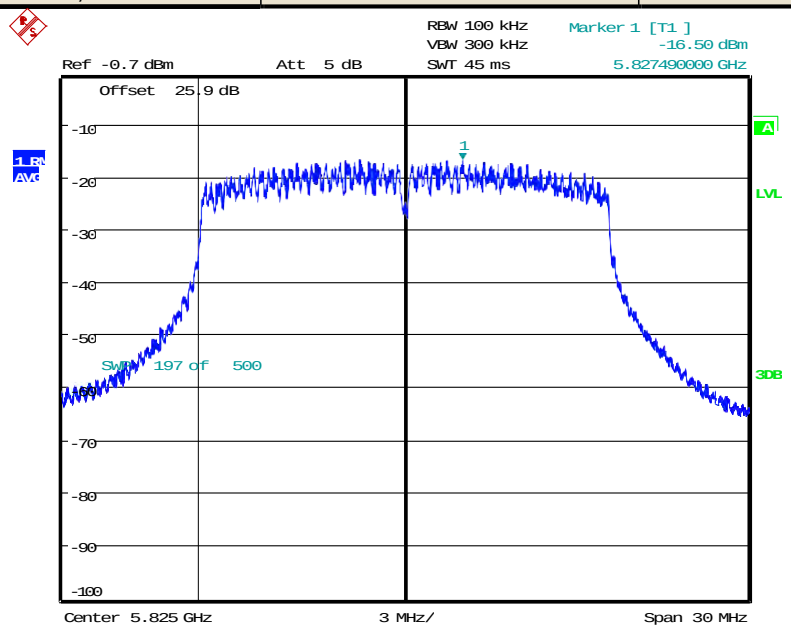
Power Spectral Density		
802.11n, HT20	Channel 165 / 5825 MHz	Tx Chain 1



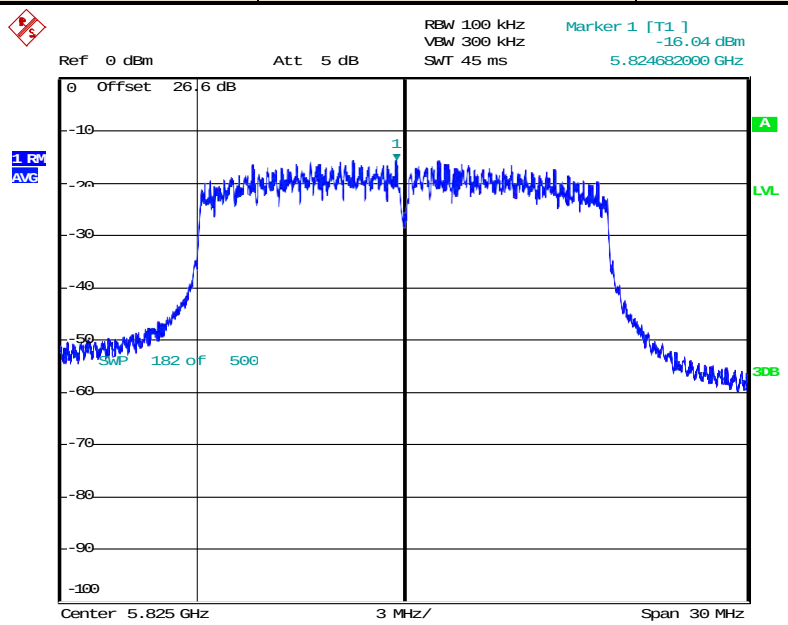
Power Spectral Density		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 0



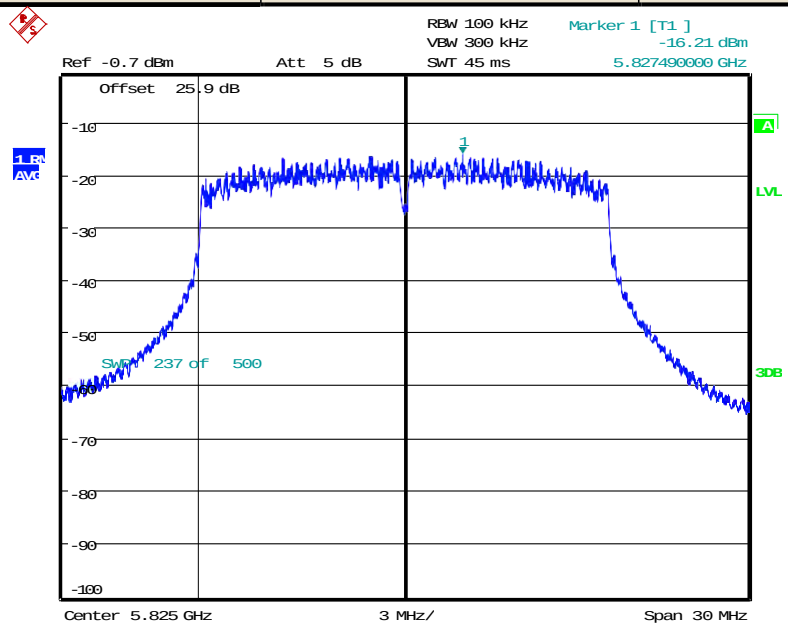
Power Spectral Density		
802.11ac, VHT20	Channel 149 / 5745 MHz	Tx Chain 1



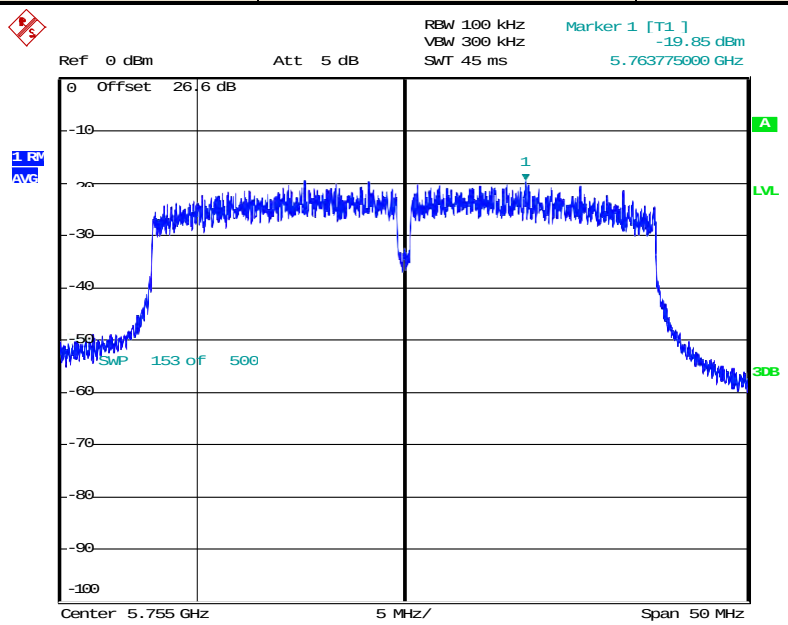
Power Spectral Density		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 0



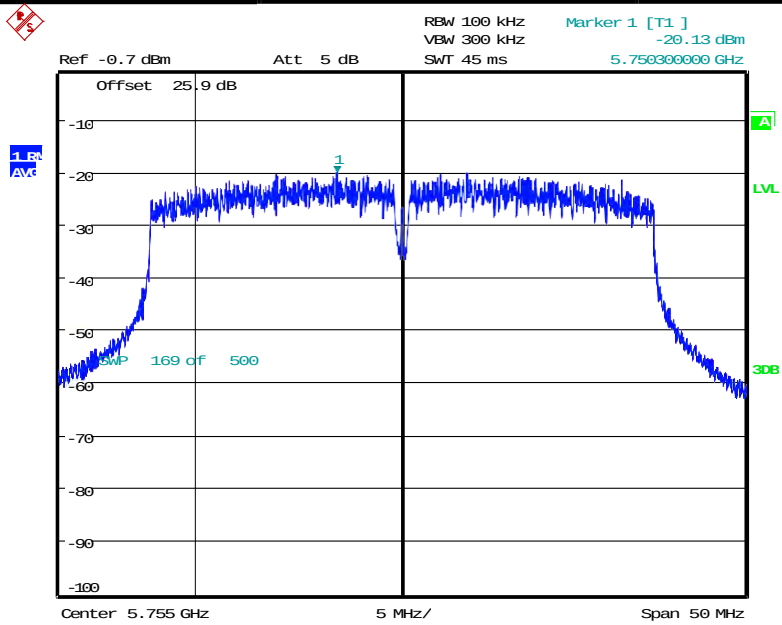
Power Spectral Density		
802.11ac, VHT20	Channel 165 / 5825 MHz	Tx Chain 1



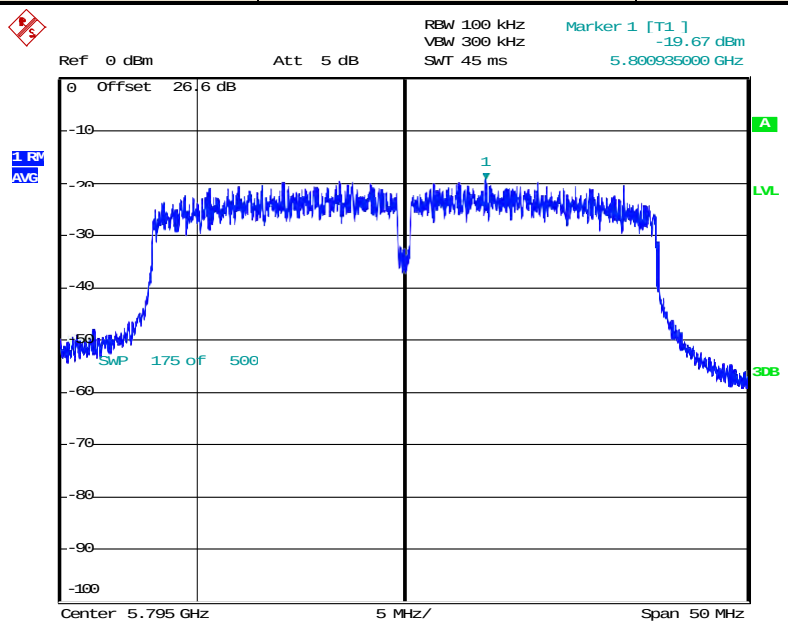
Power Spectral Density		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 0



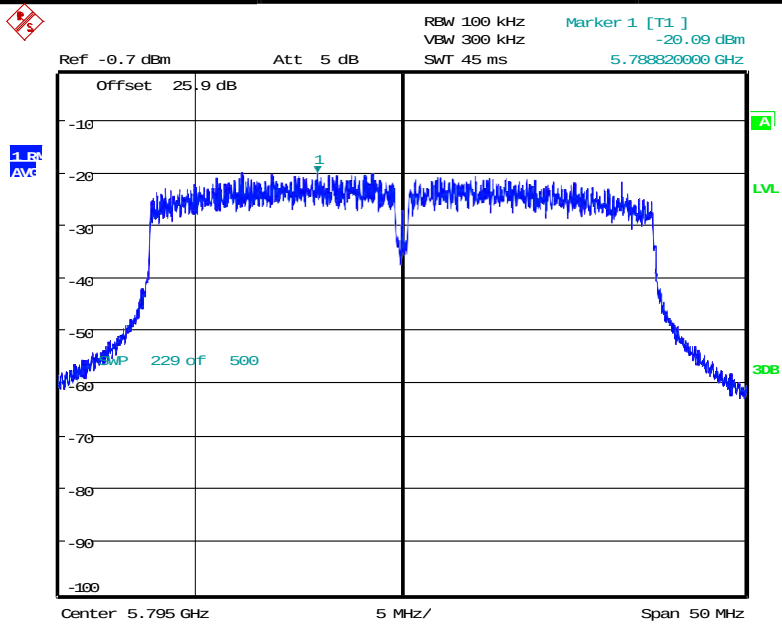
Power Spectral Density		
802.11n, HT40	Channel 151 / 5755 MHz	Tx Chain 1



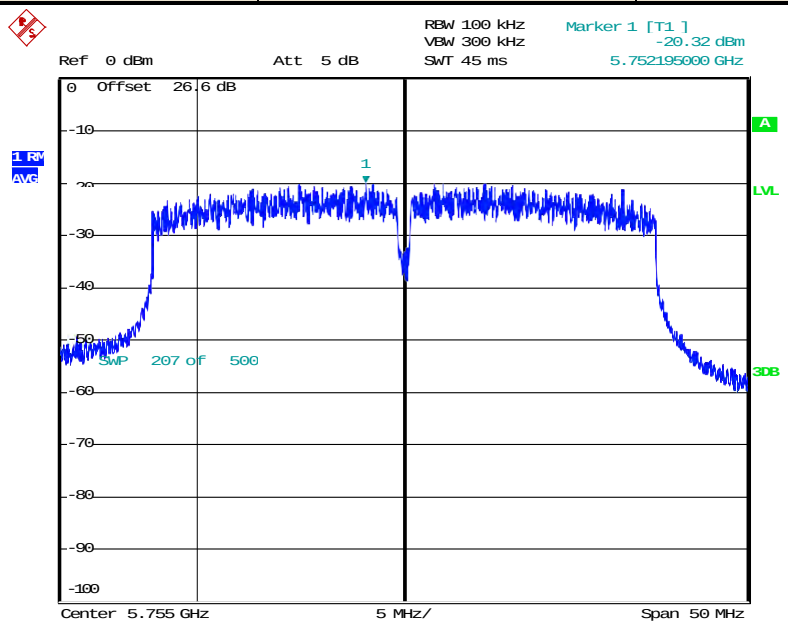
Power Spectral Density		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 0



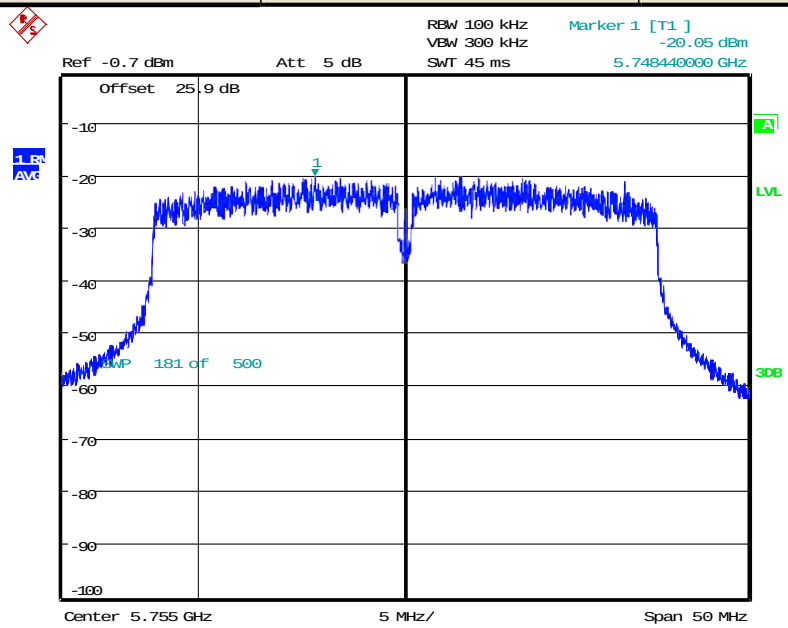
Power Spectral Density		
802.11n, HT40	Channel 159 / 5795 MHz	Tx Chain 1



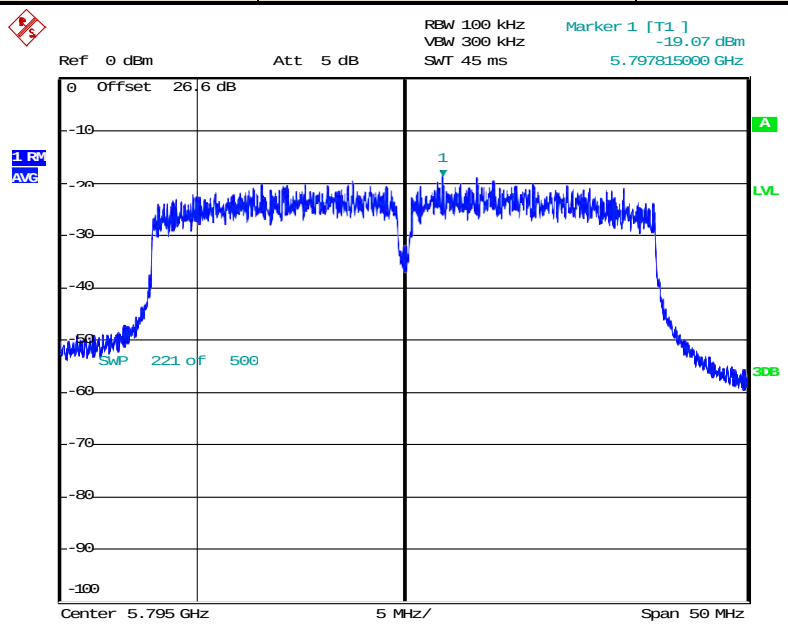
Power Spectral Density		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 0



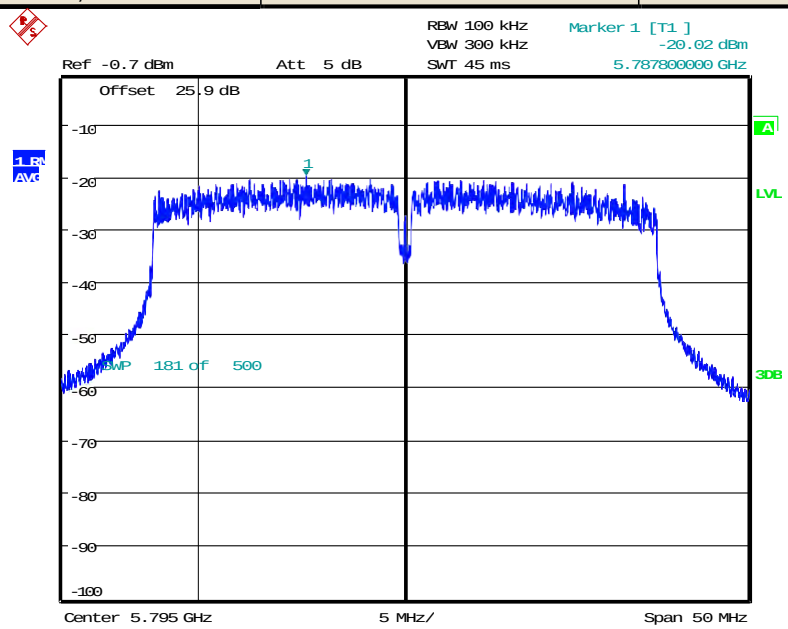
Power Spectral Density		
802.11ac, VHT40	Channel 151 / 5755 MHz	Tx Chain 1



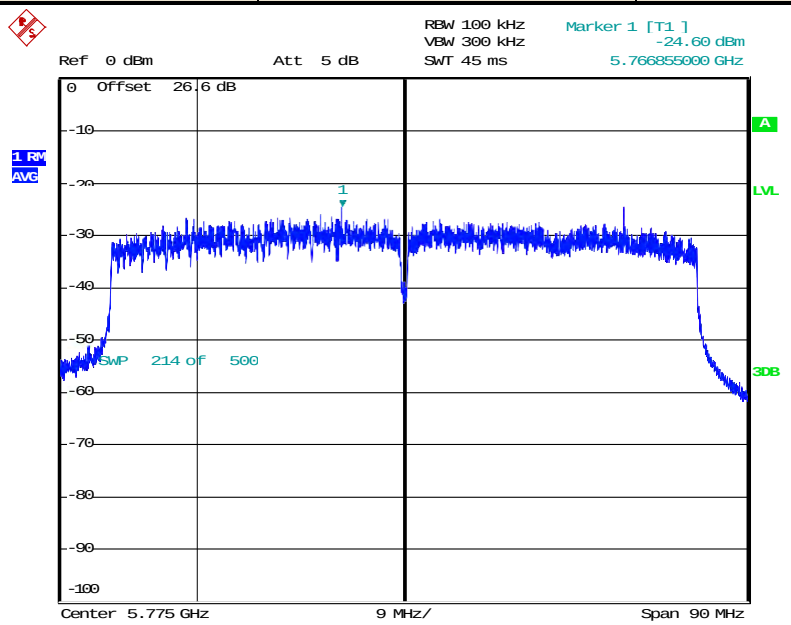
Power Spectral Density		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 0



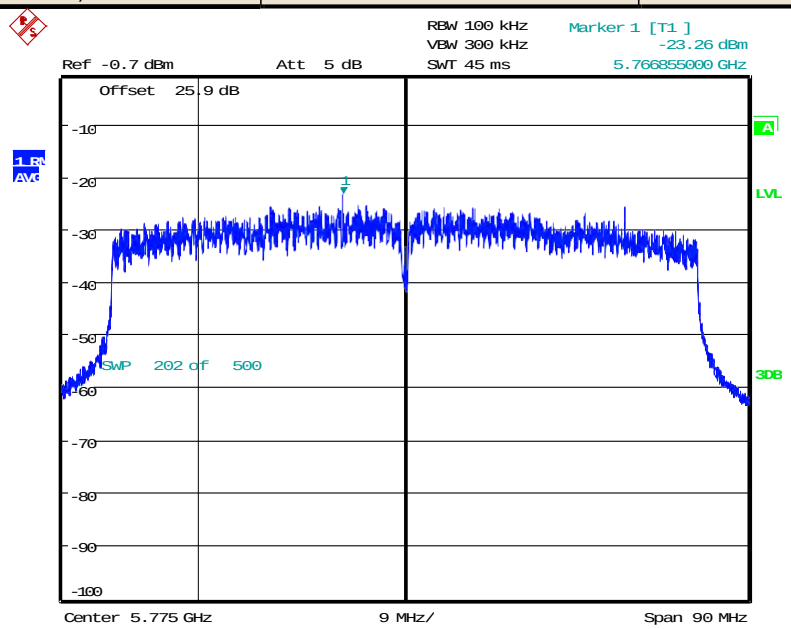
Power Spectral Density		
802.11ac, VHT40	Channel 159 / 5795 MHz	Tx Chain 1



Power Spectral Density		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 0



Power Spectral Density		
802.11ac, VHT80	Channel 155 / 5775 MHz	Tx Chain 1



6.5 Unwanted Emissions

6.5.1 Technical Standard References

FCC §15.407, Section (b) IC
RSS-247, Section 6.2.4.2
KDB 789033, Section II.G

6.5.2 Requirement

The limits are extrapolated to a 3 meter measurement distance as described in the following table.

Frequency	Detector Type	Standard Field Strength Limit (µV/m)	Extrapolated Field Strength Limit at 3 m (dBµV/m)
9 – 490 kHz	Quasi-Peak	2400 / F(kHz) @ 300 m	128.5 – 93.8
490 kHz – 1.705 MHz	Quasi-Peak	24000 / F(kHz) @ 30 m	73.8 – 63
1.705 – 30 MHz	Quasi-Peak	30 @ 30 m	69.5
30 – 88 MHz	Quasi-Peak	100 @ 3 m	40
88 -216 MHz	Quasi-Peak	150 @ 3 m	43.5
216 – 960 MHz	Quasi-Peak	200 @ 3 m	46
Above 960 MHz	Average Peak	500 @ 3 m ---	54 74

6.5.3 EUT Conditions

Continuous transmission
Operating mode with the highest output power and largest bandwidth

6.5.4 Test Conditions

Measurements are according to FCC KDB 789033, section II.G.

Receiver Settings			
Frequency Range	9 kHz – 30 MHz	30 MHz – 1 GHz	1 GHz – 26 GHz
RBW	9 kHz	120 kHz	1 MHz
Sweep Time	Auto	Auto	Auto
Step Size	5 kHz	100 kHz	1 MHz
Detection Mode	Peak	Peak	Peak and Average
Trace Mode	Max Hold	Max Hold	Max Hold

The source of spurious emissions 30 MHz to 1 GHz is determined to come from support test equipment.

6.5.5 Test Results

The following table lists the worst case emissions where worst case is defined as the emission with the smallest margin to the limit.

Operating Mode	Tx Chain	Channel	Frequency (MHz)	Worst Case Spurious Emission Frequency	Worst Case Spurious Emission Level	Margin to the Limit
802.11ac, VHT80; SISO	0	155	5775	1.269 GHz	42.596 dBµV/m	11.4 dB
	1	155	5775	1.279 GHz	41.268 dBµV/m	12.7 dB
802.11ac, VHT80; MIMO	0+1	155	5775	1.193 GHz	64.335 dBµV/m	9.7 dB

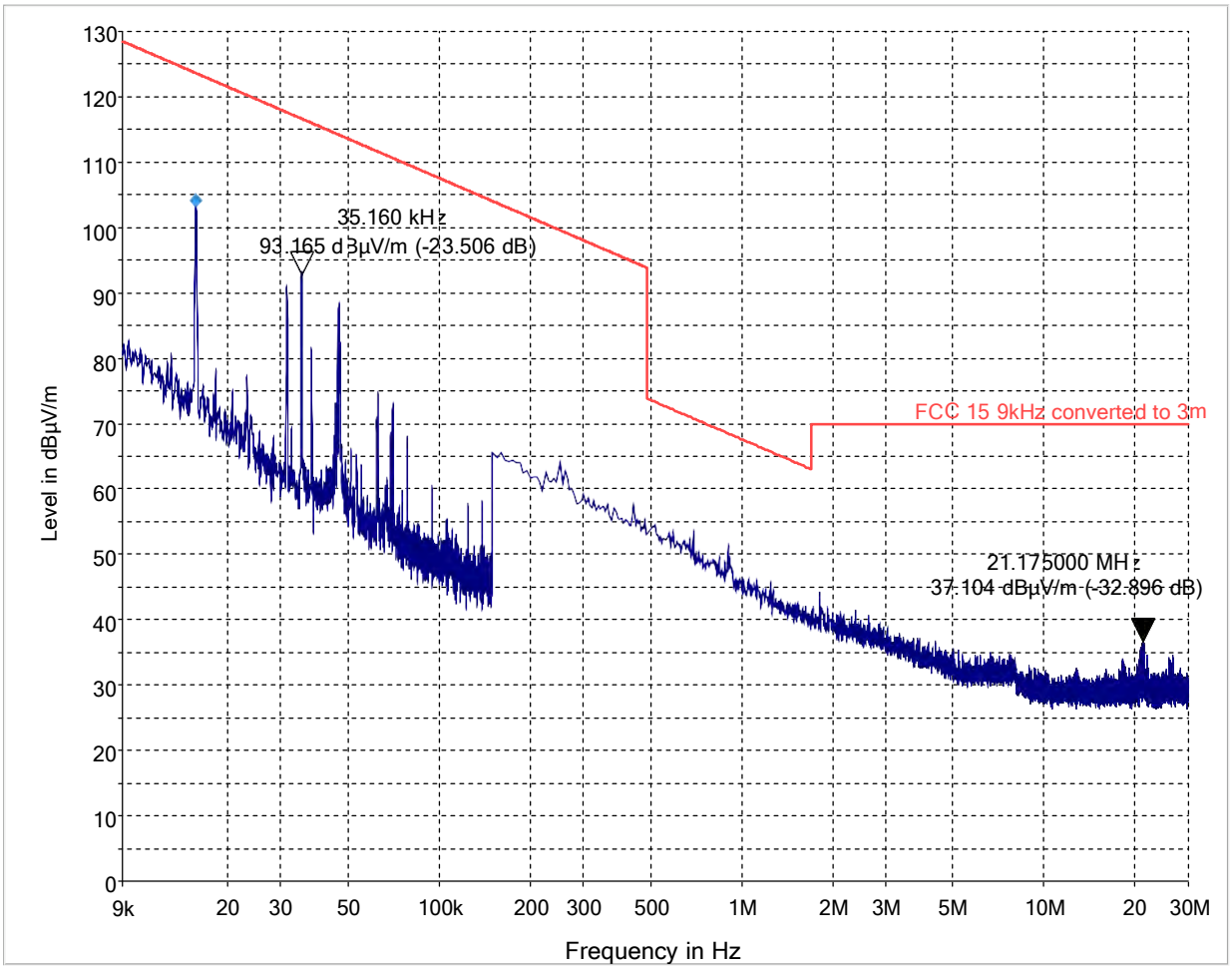
6.5.6 Test Verdict

Pass

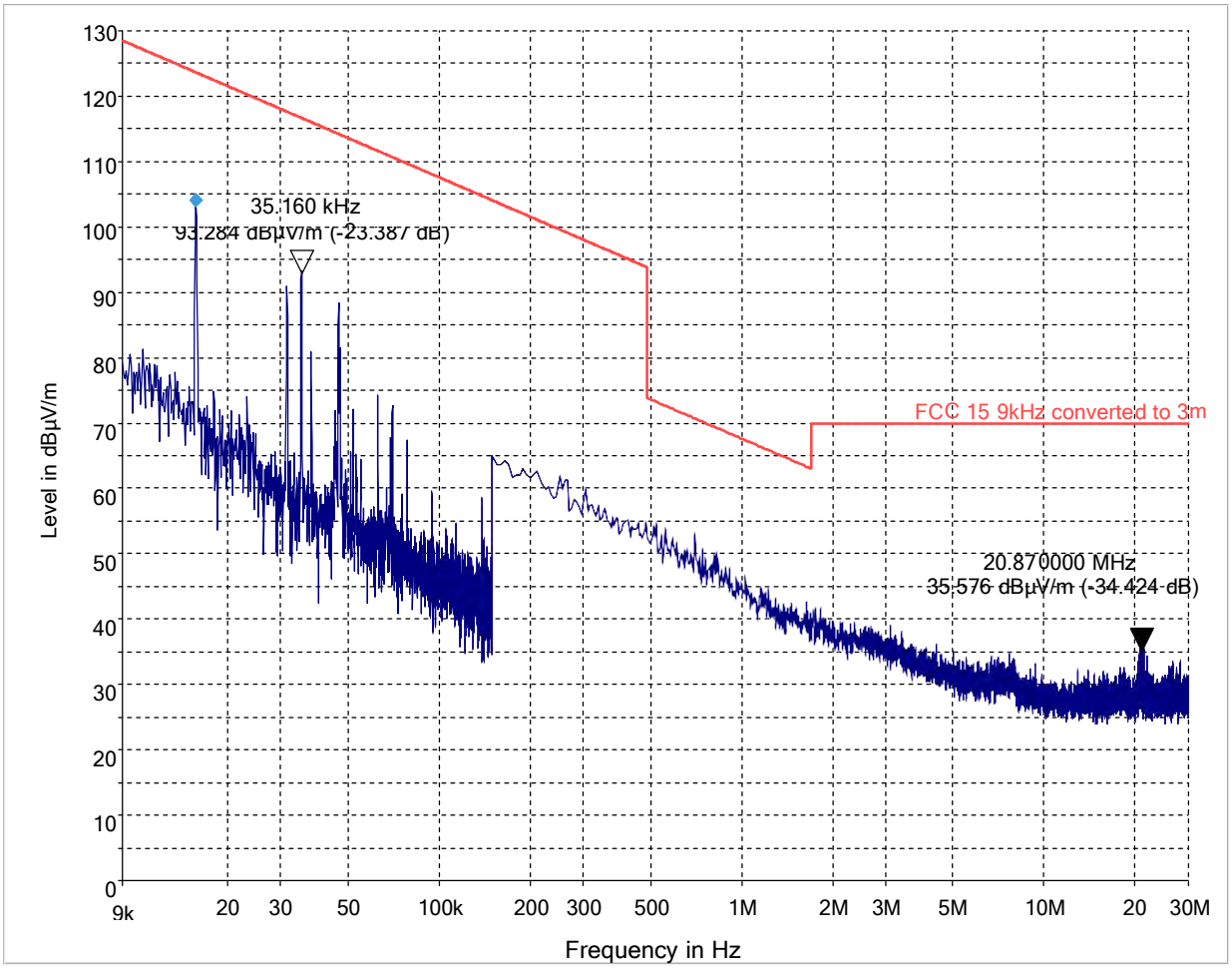
6.5.7 Test Plots

Radiated Emissions 9 kHz – 30 MHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 0

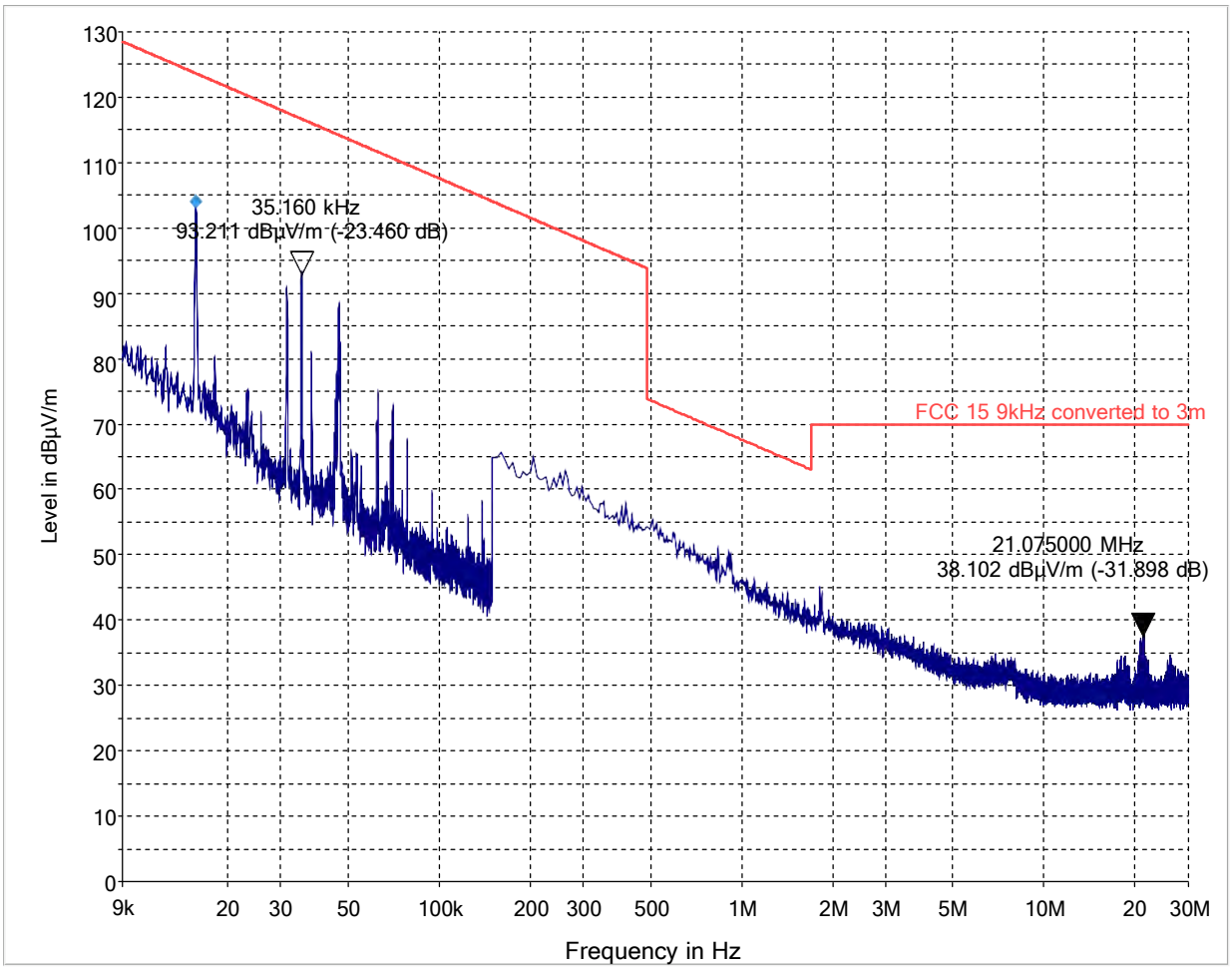
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.015760	104.1	2.0	0.200	130.0	V	172.0	81.6	19.5	123.6



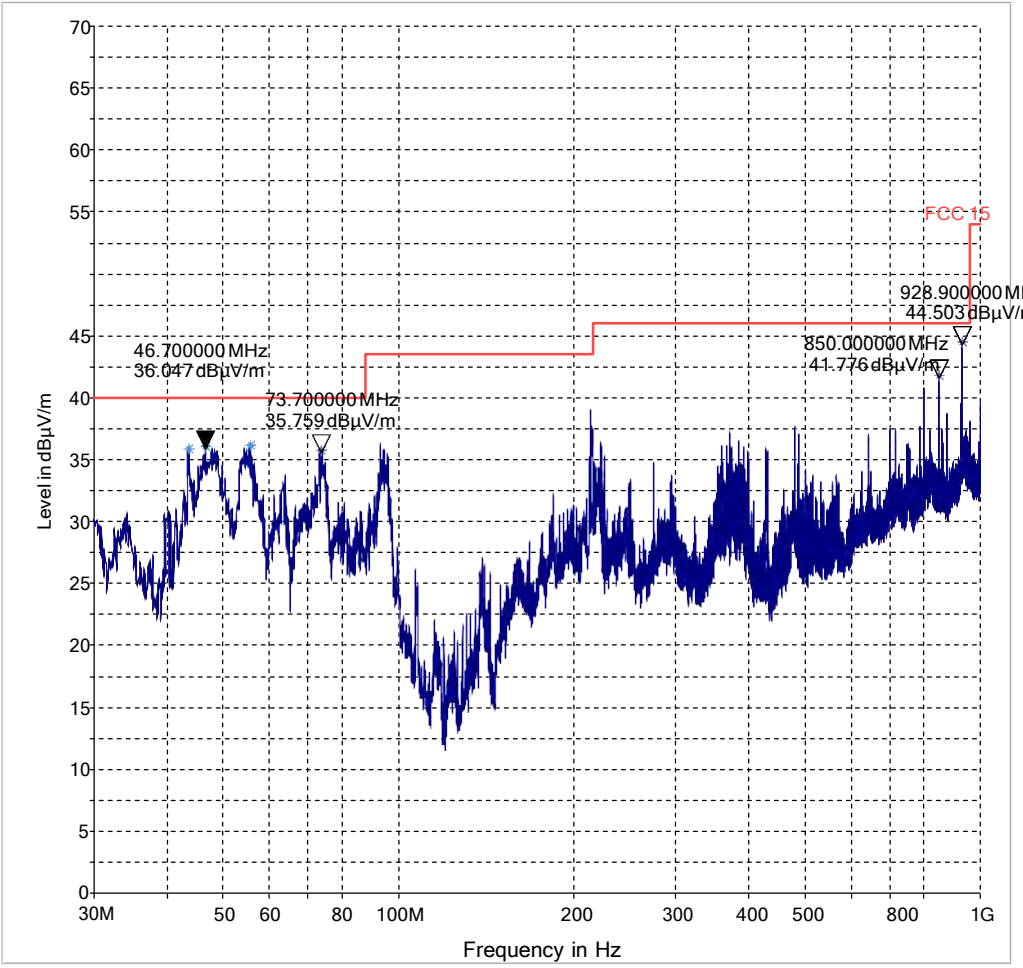
Radiated Emissions 9 kHz – 30 MHz									
802.11ac, VHT80; SISO			Channel 155 / 5775 MHz				Tx Chain 1		
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.015760	104.1	2.0	0.200	130.0	H	-124.0	81.6	19.5	123.6



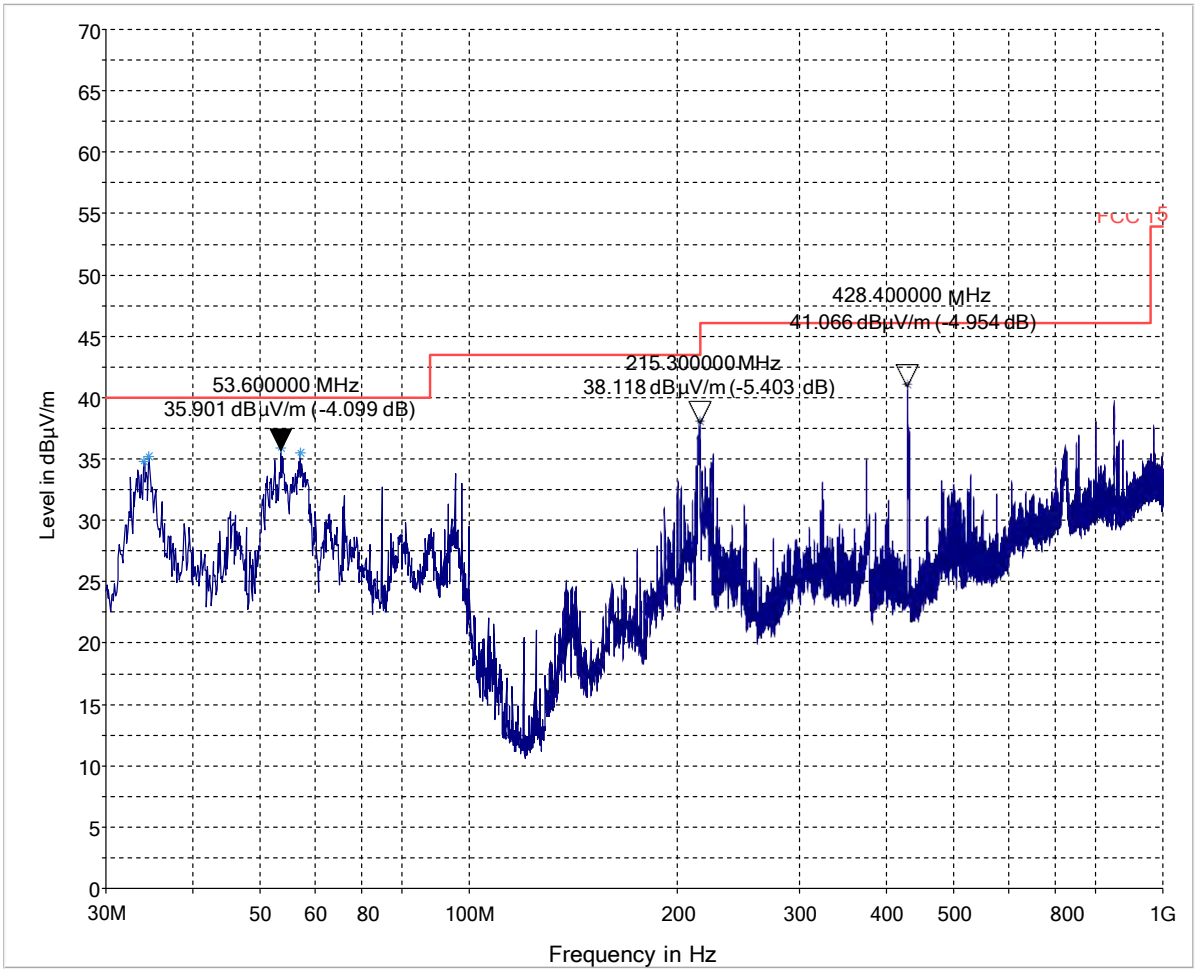
Radiated Emissions 9 kHz – 30 MHz									
802.11ac, VHT80; MIMO			Channel 155 / 5775 MHz			Tx Chain 0+1			
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.015760	104.1	2.0	0.200	130.0	H	122.0	81.6	19.6	123.6



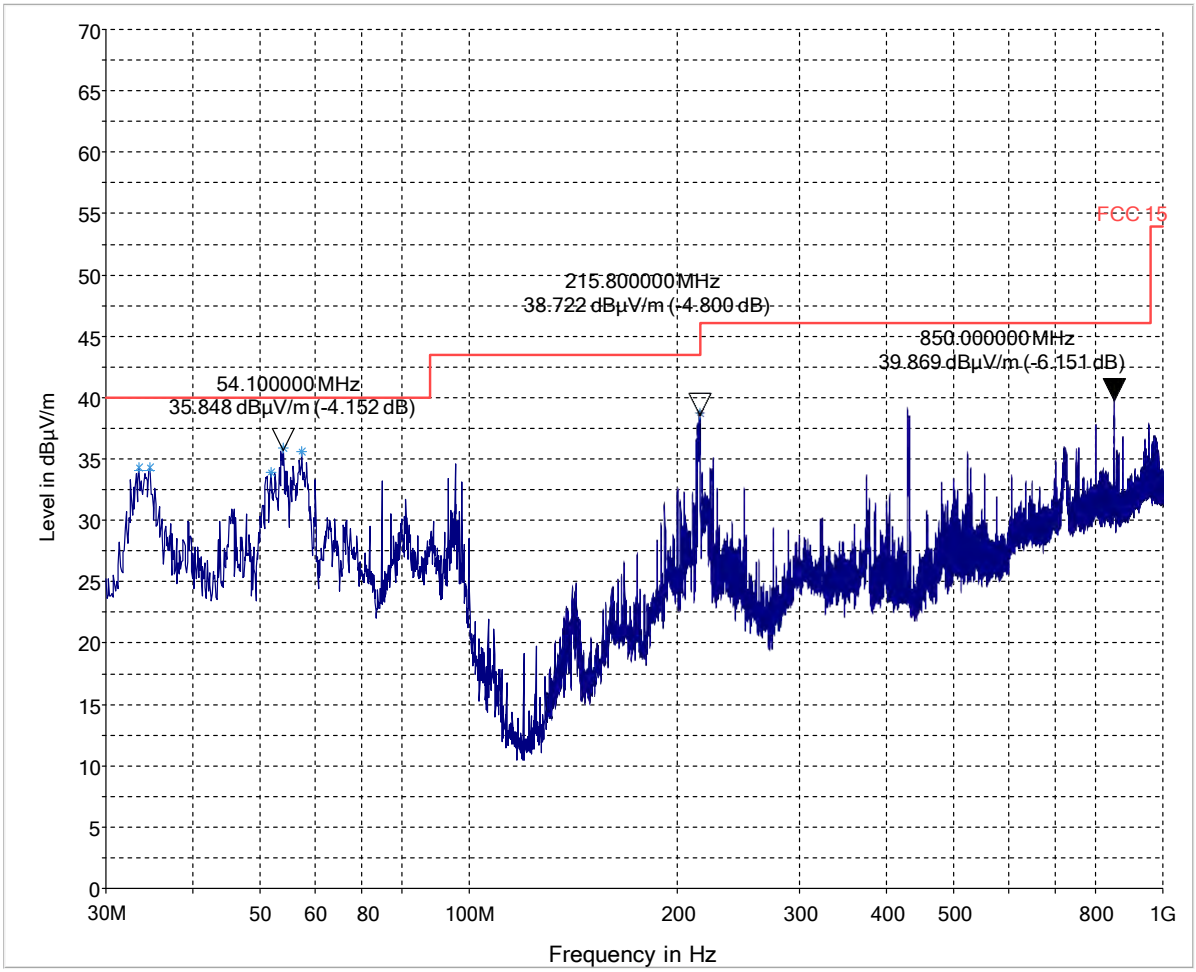
Restricted Bands Emissions 30 MHz – 1 GHz	
Support Test Equipment	EUT Off



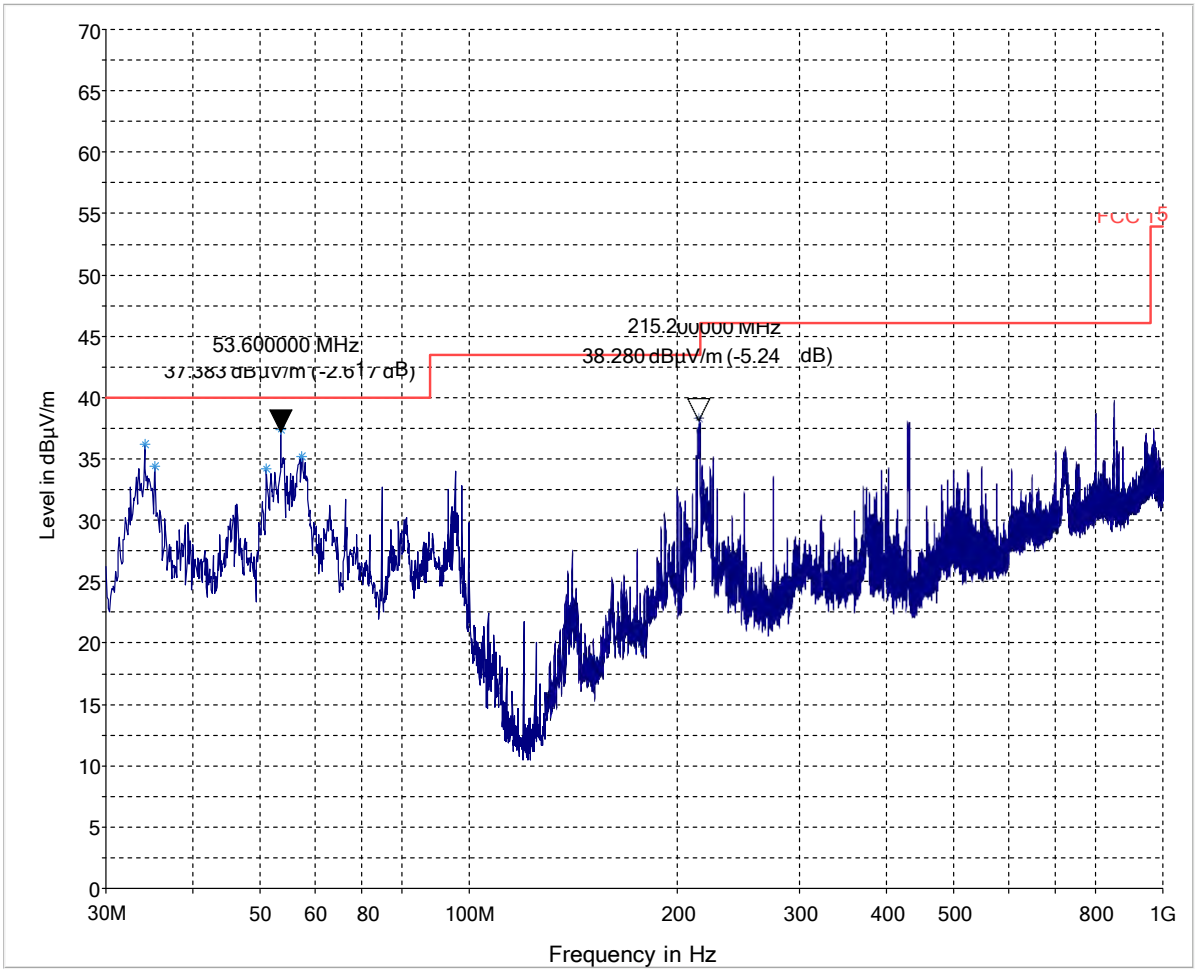
Radiated Emissions 30 MHz – 1 GHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 0



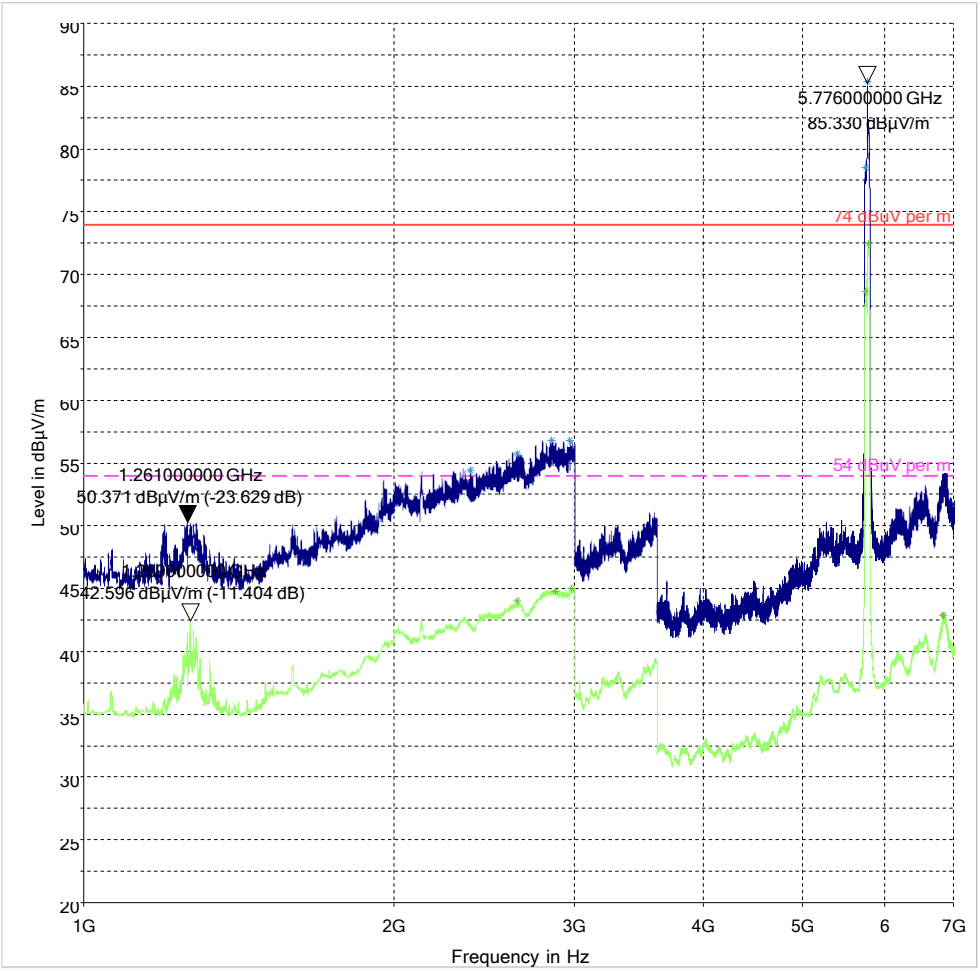
Radiated Emissions 30 MHz – 1 GHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 1



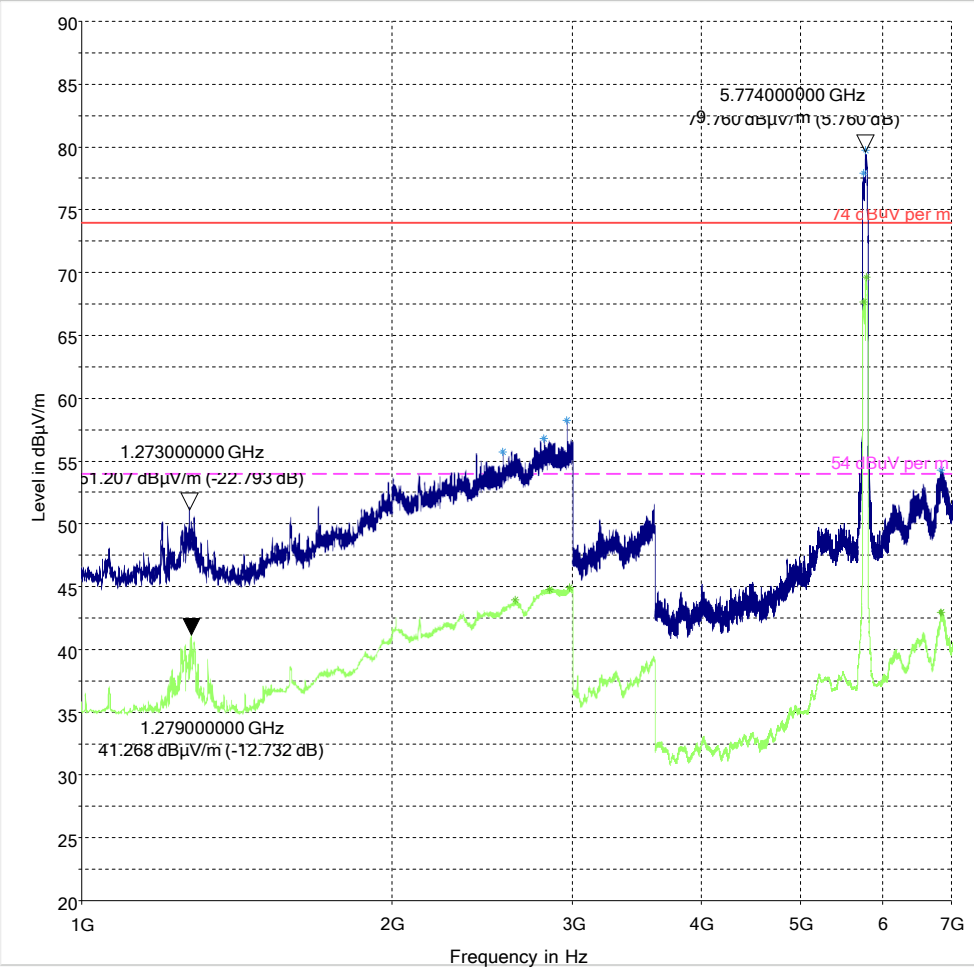
Radiated Emissions 30 MHz – 1 GHz		
802.11ac, VHT80; MIMO	Channel 155 / 5775 MHz	Tx Chain 0+1



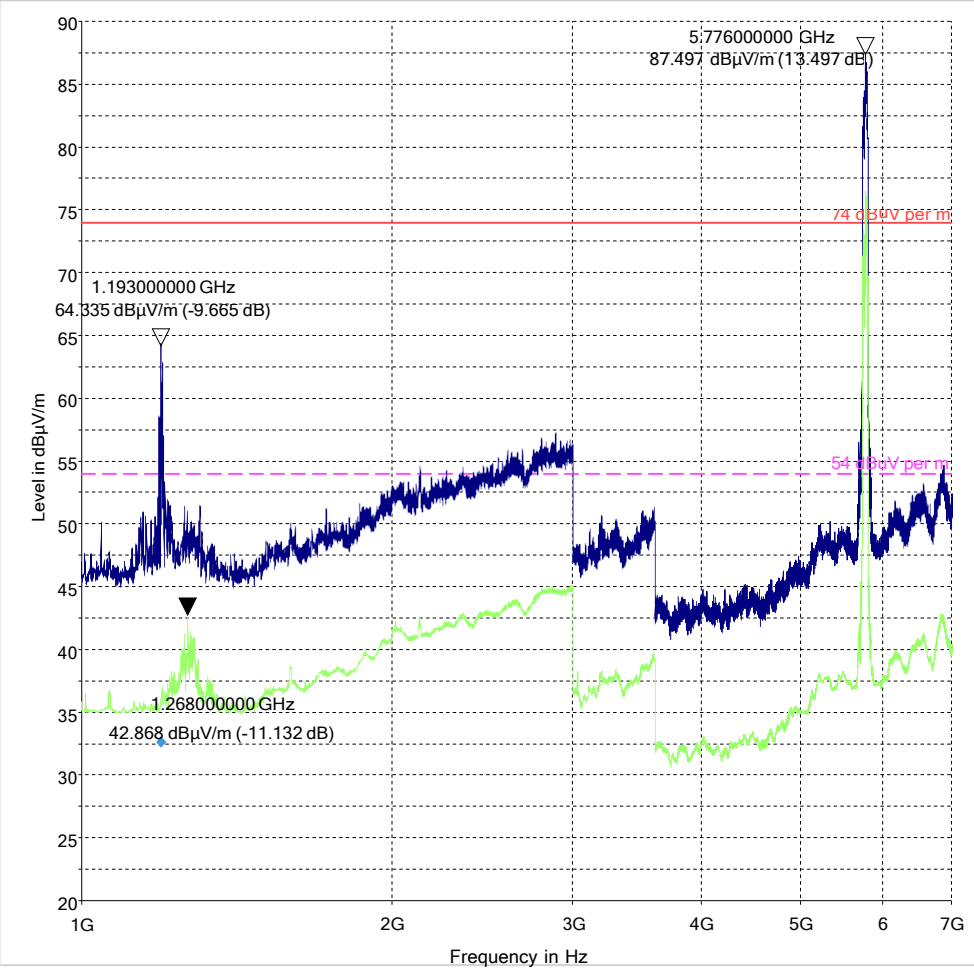
Radiated Emissions 1 GHz – 7 GHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 0
Peak above the limit is the carrier frequency		



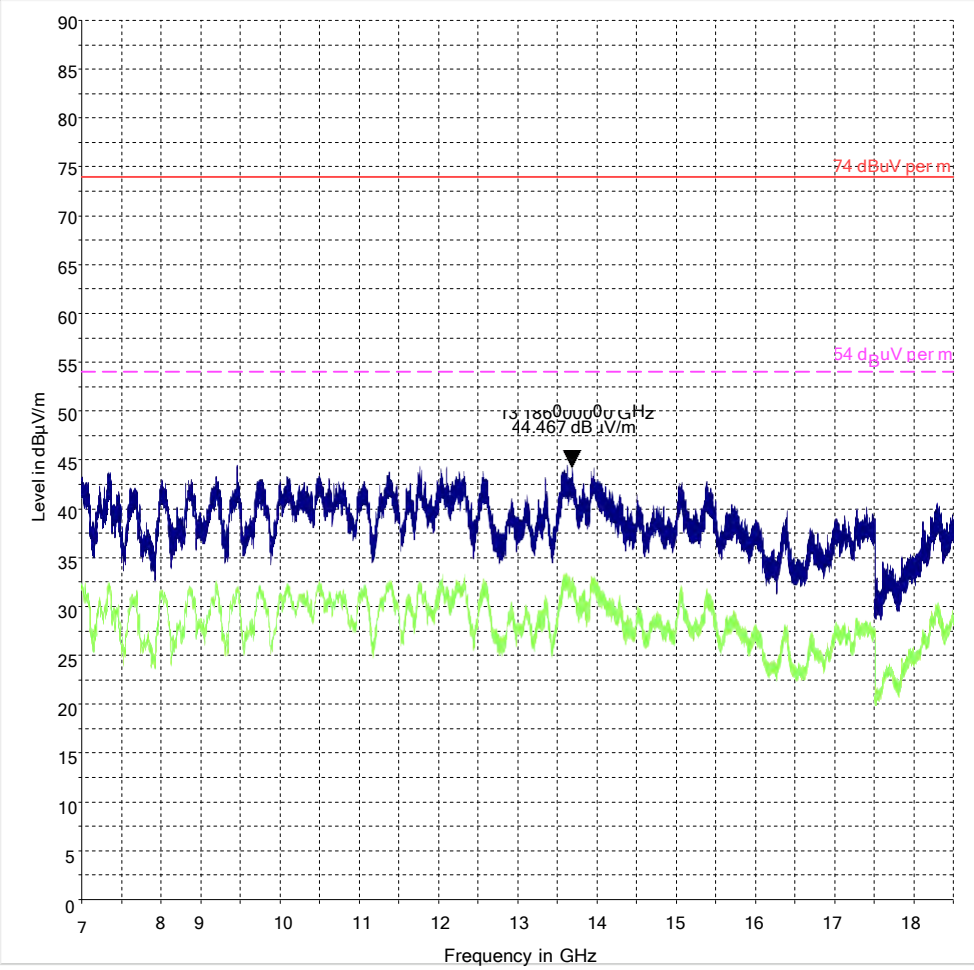
Radiated Emissions 1 GHz – 7 GHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 1
Peak above the limit is the carrier frequency		



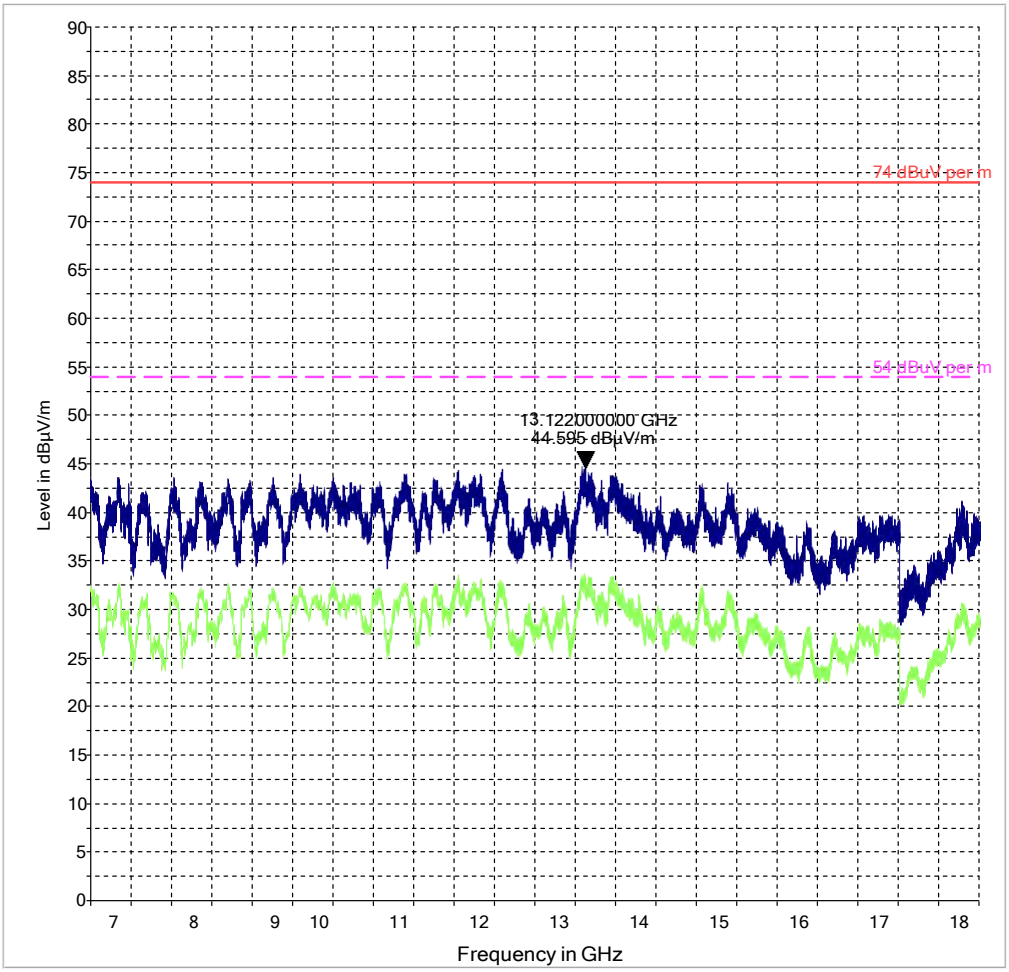
Radiated Emissions 1 GHz – 7 GHz		
802.11ac, VHT80; MIMO	Channel 155 / 5775 MHz	Tx Chain 0+1
Peak above the limit is the carrier frequency		



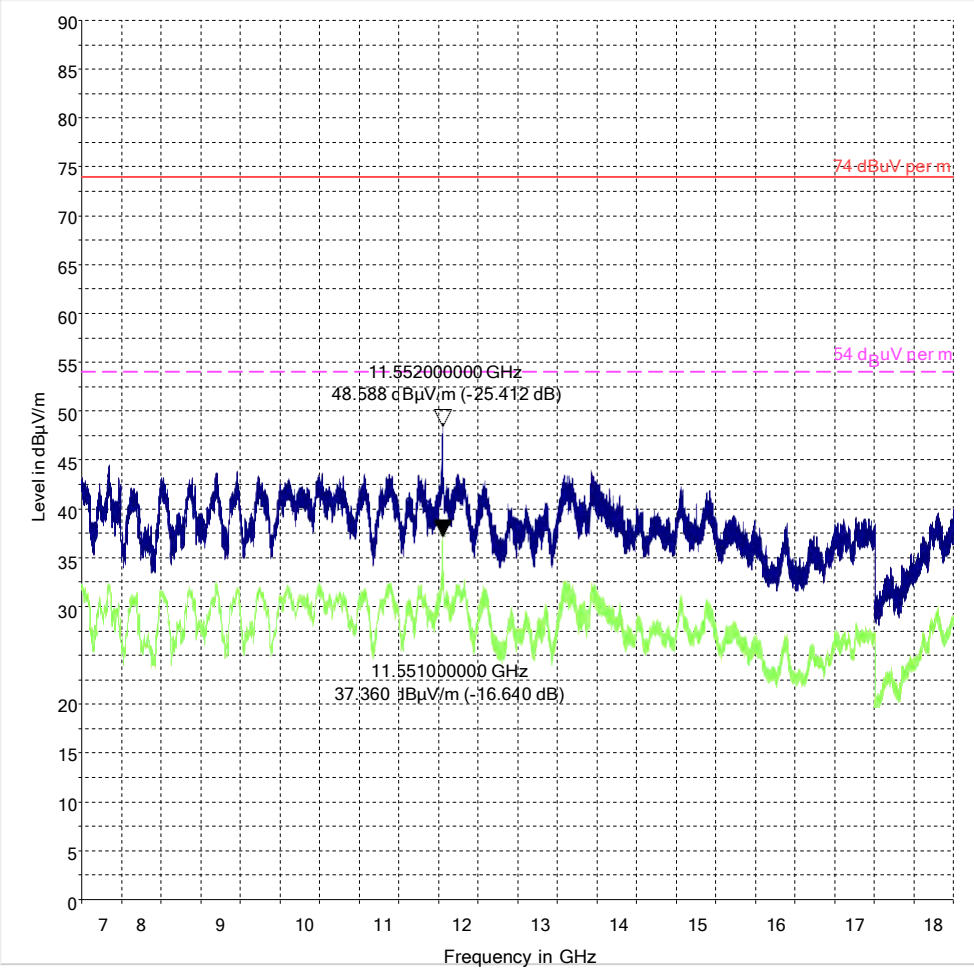
Radiated Emissions 7 GHz – 18 GHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 0



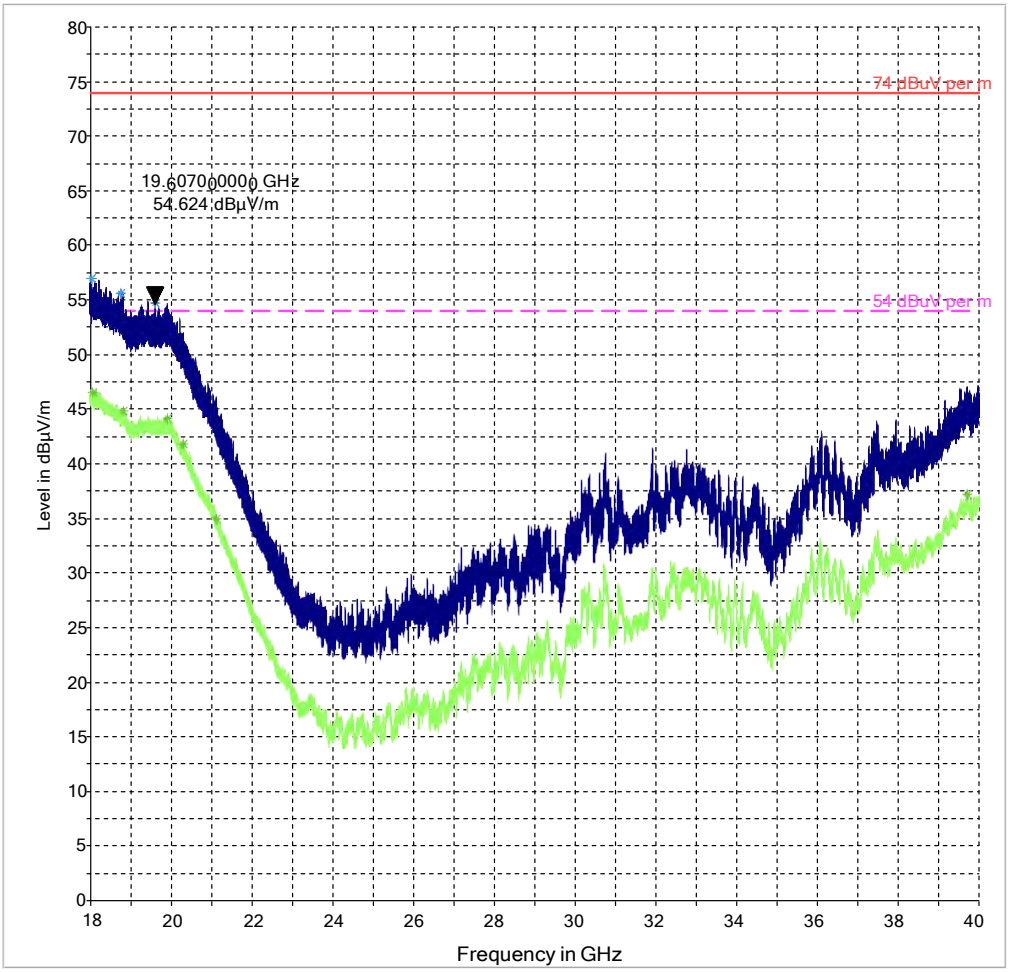
Radiated Emissions 7 GHz – 18 GHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 1



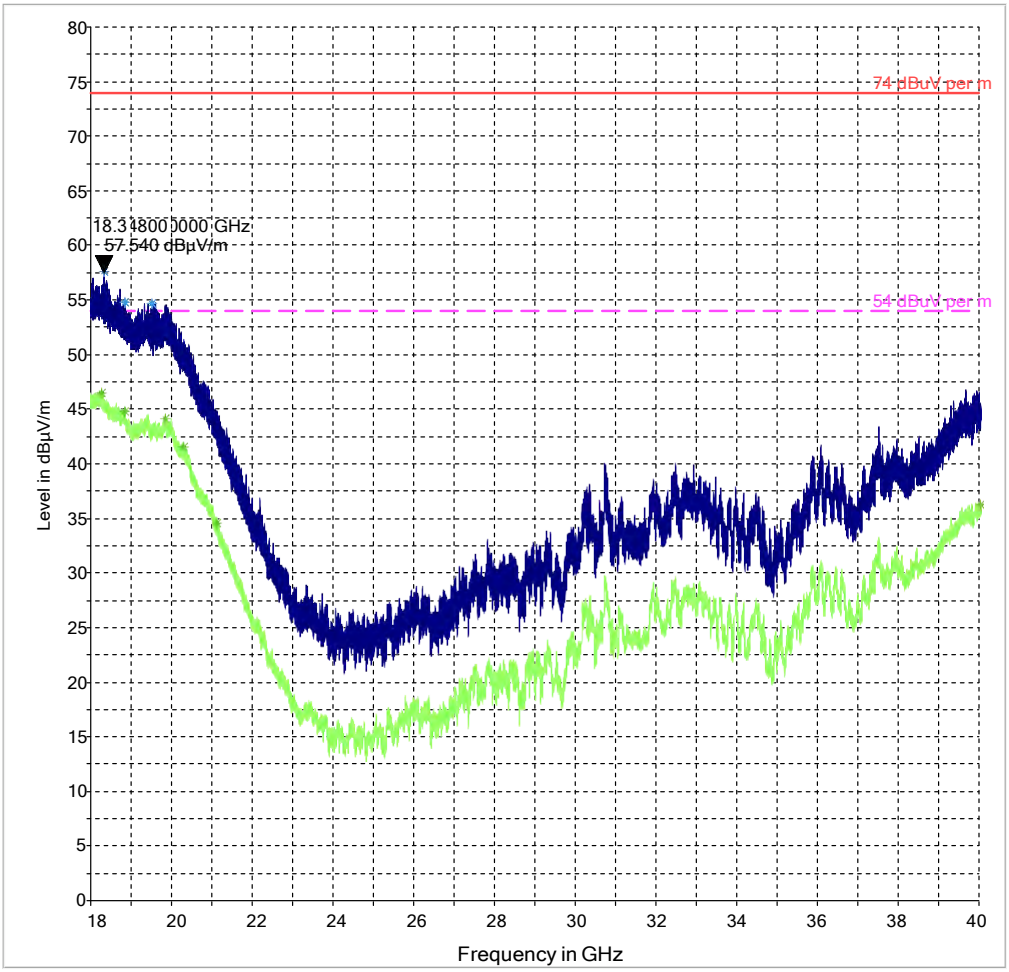
Radiated Emissions 7 GHz – 18 GHz		
802.11ac, VHT80; MIMO	Channel 155 / 5775 MHz	Tx Chain 0+1



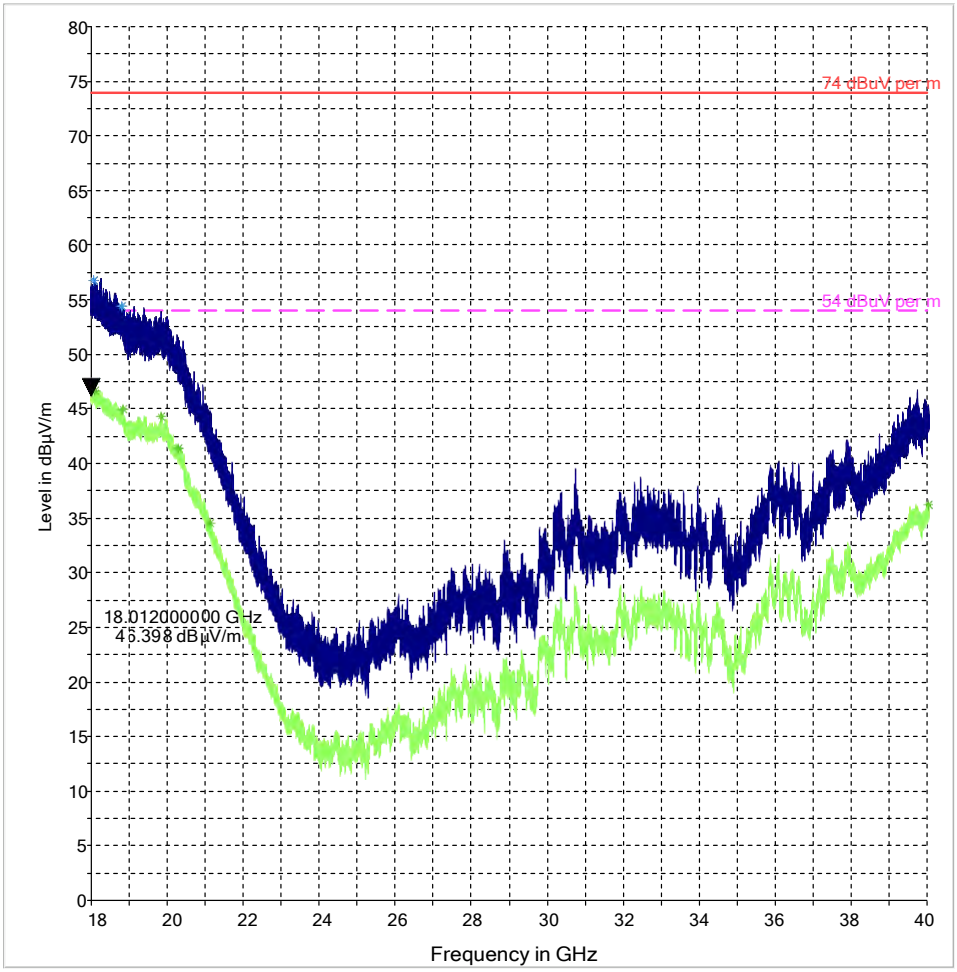
Radiated Emissions 18 GHz – 40 GHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 0



Radiated Emissions 18 GHz – 40 GHz		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 1



Radiated Emissions 18 GHz – 40 GHz		
802.11ac, VHT80; MIMO	Channel 155 / 5775 MHz	Tx Chain 0+1



6.6 Out of Band Emissions at the Band Edge

6.6.1 Technical Standard References

FCC §15.407, Section (b) IC
RSS-247, Section 6.2.4.2
KDB 789033, Section II.G

6.6.2 Requirement

Unwanted Emission Limits According to FCC §15.407, Section (b)(4) and RSS-247, Section 6.2.4.2			
Frequency	Detector Type	Standard Field Strength Limit (dBm/MHz)	Extrapolated Field Strength Limit at 3 m (dBµV/m)
≤ 5715 MHz	Average	-27	68.2
5715 – 5725 MHz	Average	-17	78.2
5850 – 5860 MHz	Average	-17	78.2
≥ 5860 MHz	Average	-27	68.2

6.6.3 EUT Conditions

Continuous Transmission

6.6.4 Test Conditions

Measurements are according to FCC KDB 789033, sections II.G.2 to II.G.5.

Receiver Settings	
RBW	1 MHz
Sweep Time	Auto
Step Size	< 200 kHz
Detection Mode	Peak
Trace Mode	Max Hold

Limits are for an average detector. Measurements are done using a peak detector for worst case measurements.

6.6.5 Test Results

The following table lists the worst case emissions where worst case is the emission with the smallest margin to the limit.

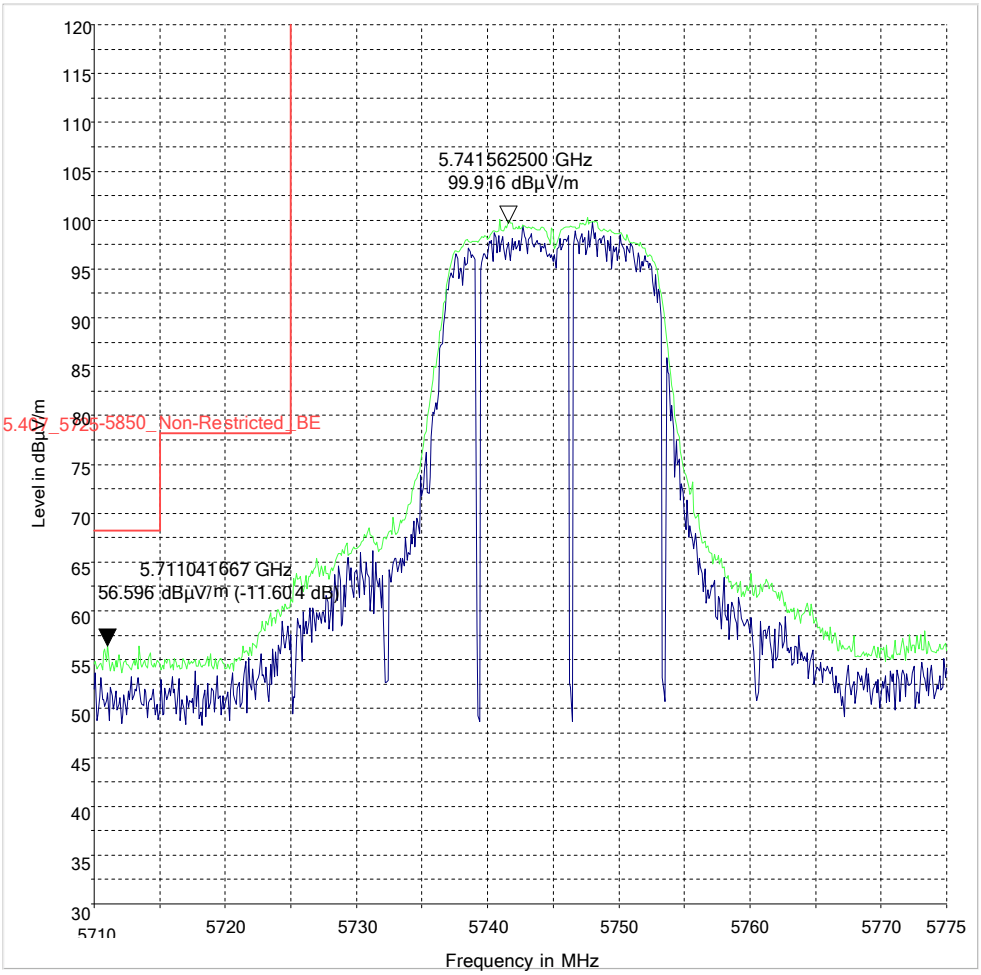
Operating Mode	Channel	Frequency (MHz)	Tx Chain	Worst Case Spurious Emission Frequency	Worst Case Spurious Emission Level	Margin to the Limit
802.11a	149	5745	0	Noise Floor	Noise Floor	N/A
			1	Noise Floor	Noise Floor	N/A
			0+1	5.713 GHz	62.747 dBµV/m	5.5 dB
	165	5825	0	Noise Floor	Noise Floor	N/A
			1	Noise Floor	Noise Floor	N/A
			0+1	Noise Floor	Noise Floor	N/A
802.11n, HT20	149	5745	0	5.715 GHz	63.82 dBµV/m	4.4 dB
			1	Noise Floor	Noise Floor	N/A
			0+1	5.710 GHz	56.188 dBµV/m	12 dB
	165	5825	0	Noise Floor	Noise Floor	N/A
			1	Noise Floor	Noise Floor	N/A
			0+1	Noise Floor	Noise Floor	N/A
802.11ac, VHT20	149	5745	0	Noise Floor	Noise Floor	N/A
			1	Noise Floor	Noise Floor	N/A
			0+1	5.712 GHz	55.526 dBµV/m	12 dB
	165	5825	0	Noise Floor	Noise Floor	N/A
			1	Noise Floor	Noise Floor	N/A
			0+1	Noise Floor	Noise Floor	N/A
802.11n, HT40	151	5755	0	5.715 GHz	64.323 dBµV/m	3.9 dB
			1	5.714 GHz	56.668 dBµV/m	11.5 dB
			0+1	5.715 GHz	63.485 dBµV/m	4.7 dB
	159	5795	0	Noise Floor	Noise Floor	N/A
			1	Noise Floor	Noise Floor	N/A
			0+1	Noise Floor	Noise Floor	N/A
802.11ac, VHT40	151	5755	0	5.714 GHz	65.858 dBµV/m	2.3 dB
			1	5.715 GHz	57.4 dBµV/m	20.8 dB
			0+1	5.715 GHz	65.199 dBµV/m	3 dB
	159	5795	0	Noise Floor	Noise Floor	N/A
			1	Noise Floor	Noise Floor	N/A
			0+1	Noise Floor	Noise Floor	N/A
802.11ac, VHT80 (Low Band Edge)	155	5775	0	5.715 GHz	65.624 dBµV/m	2.6 dB
			1	5.712 GHz	56.478 dBµV/m	11.7 dB
			0+1	5.714 GHz	64.717 dBµV/m	3.5 dB
802.11ac, VHT80 (High Band Edge)	155	5775	0	Noise Floor	Noise Floor	N/A
			1	Noise Floor	Noise Floor	N/A
			0+1	Noise Floor	Noise Floor	N/A

6.6.6 Test Verdict

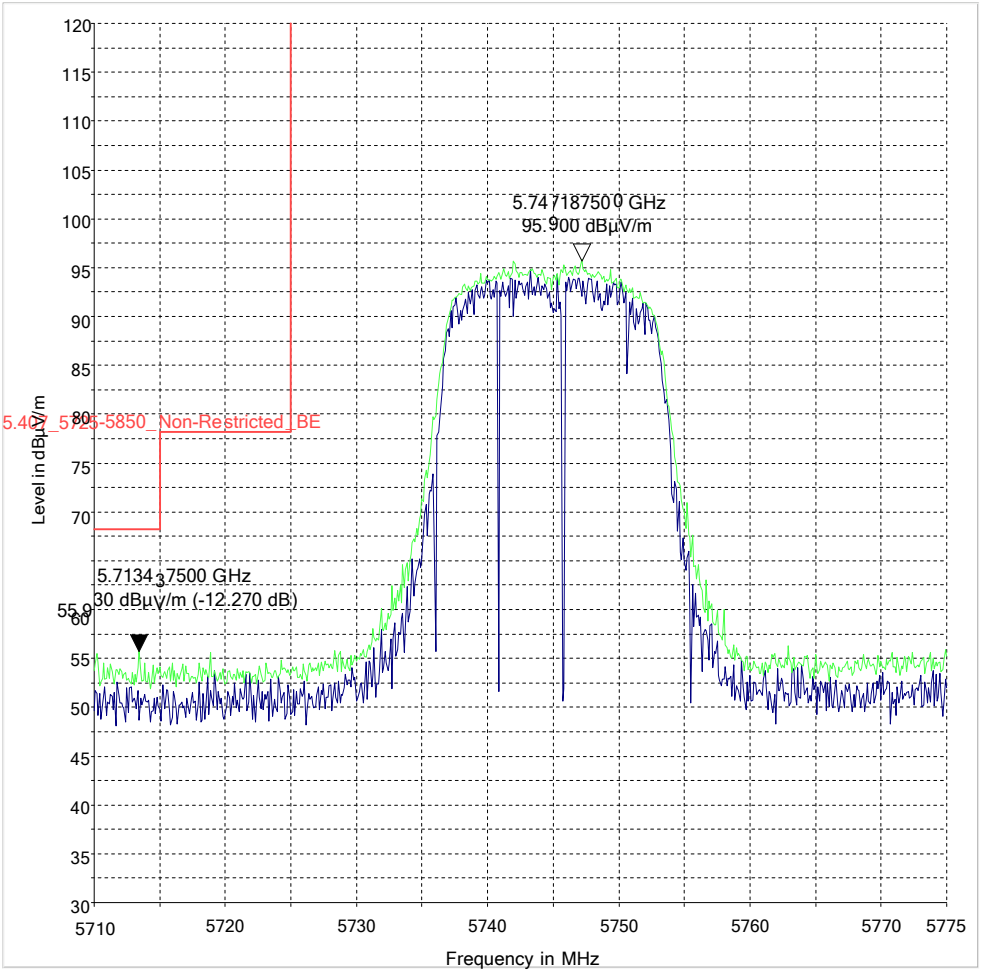
Pass

6.6.7 Test Plots

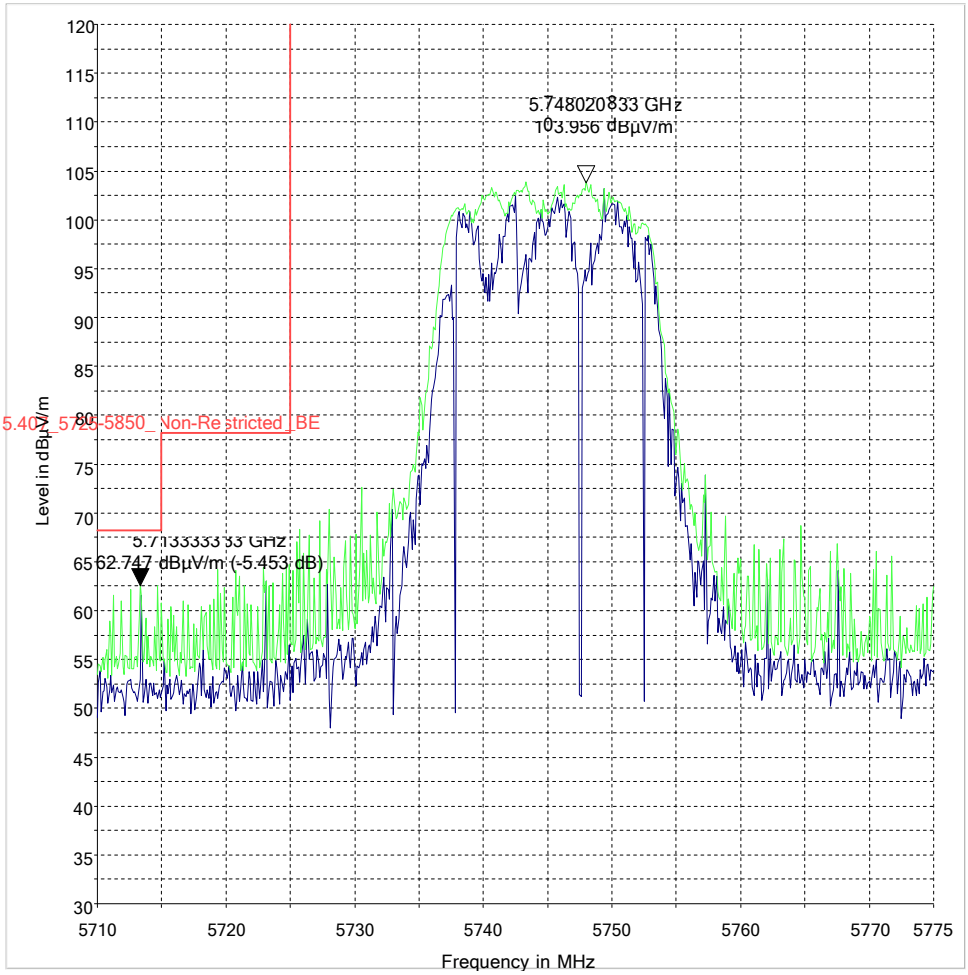
Low Band Edge		
802.11a; SISO	Channel 149 / 5745 MHz	Tx Chain 0



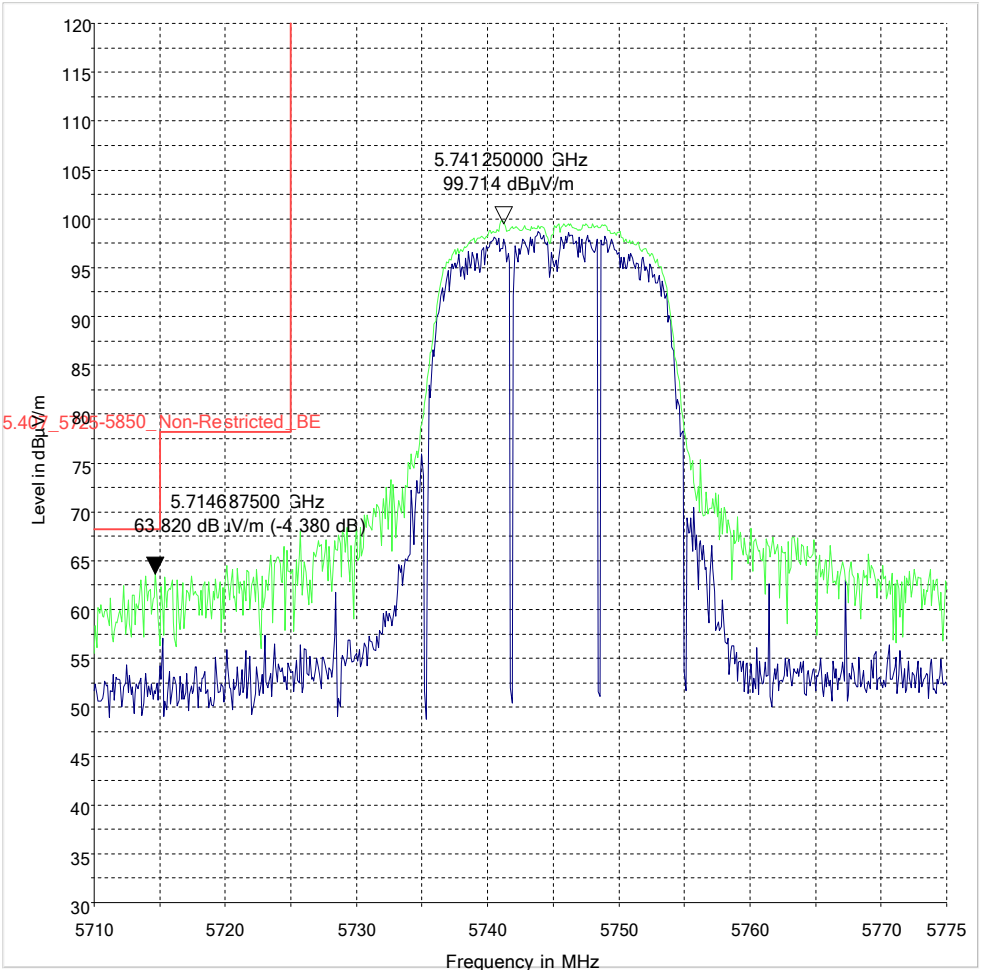
Low Band Edge		
802.11a; SISO	Channel 149 / 5745 MHz	Tx Chain 1



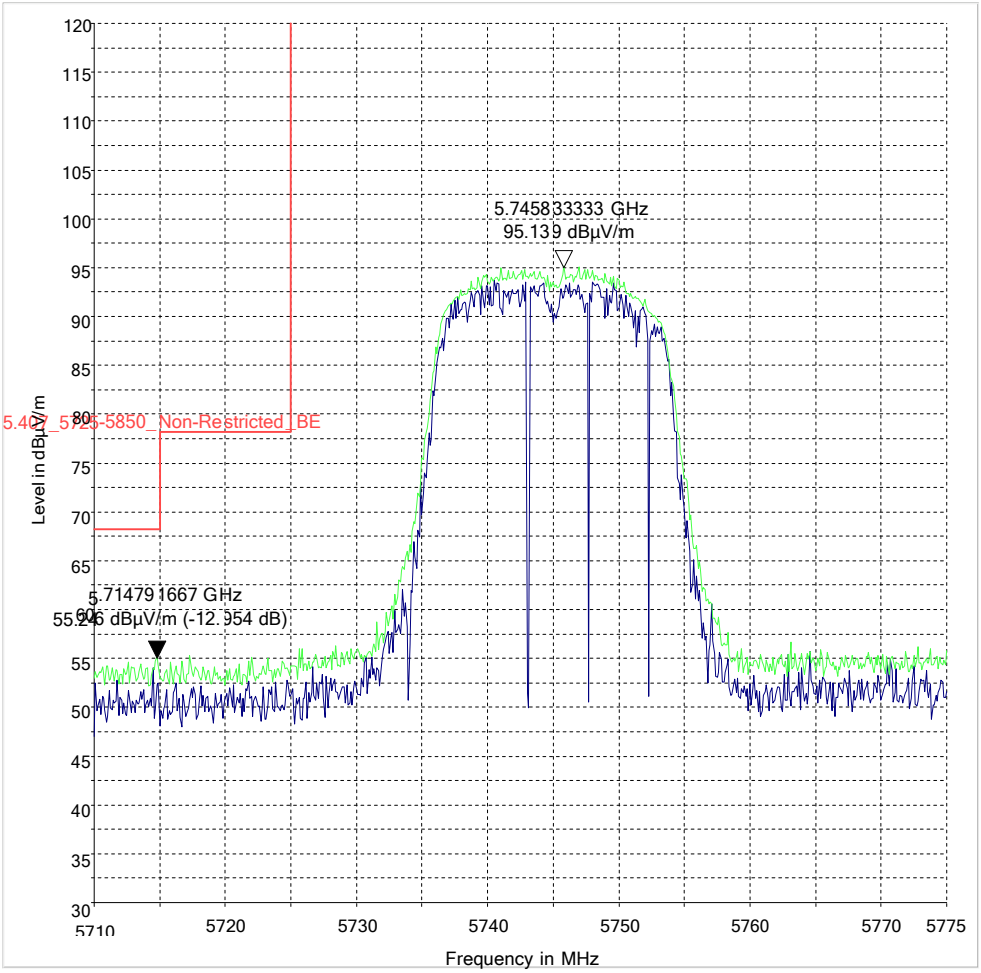
Low Band Edge		
802.11a; MIMO	Channel 149 / 5745 MHz	Tx Chain 0+1



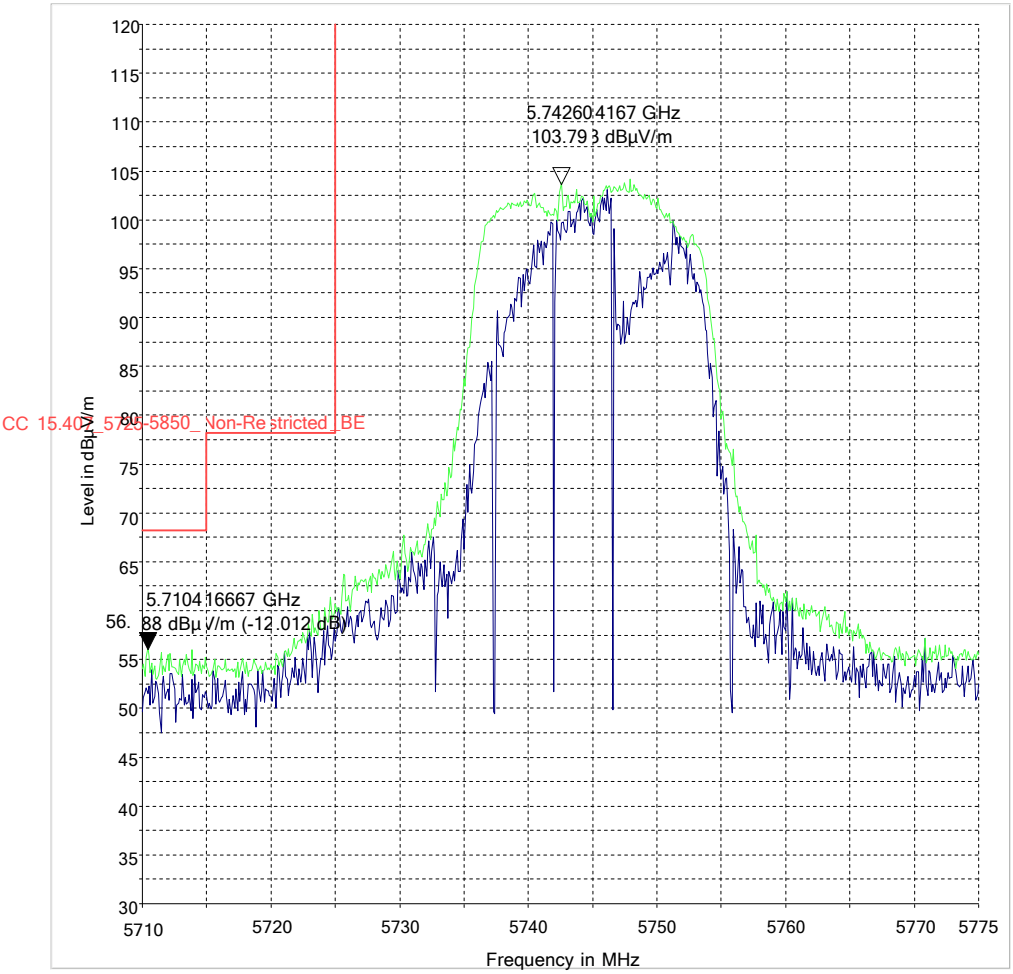
Low Band Edge		
802.11n, HT20; SISO	Channel 149 / 5745 MHz	Tx Chain 0



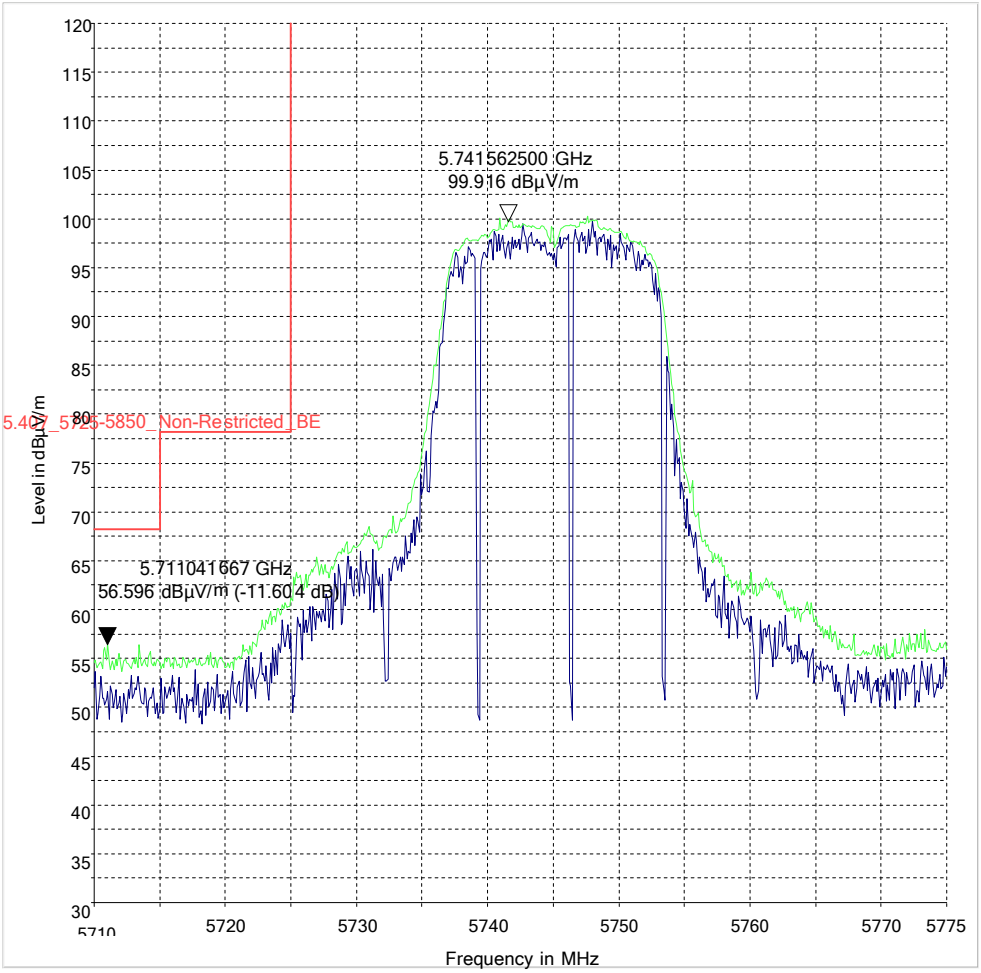
Low Band Edge		
802.11n, HT20; SISO	Channel 149 / 5745 MHz	Tx Chain 1



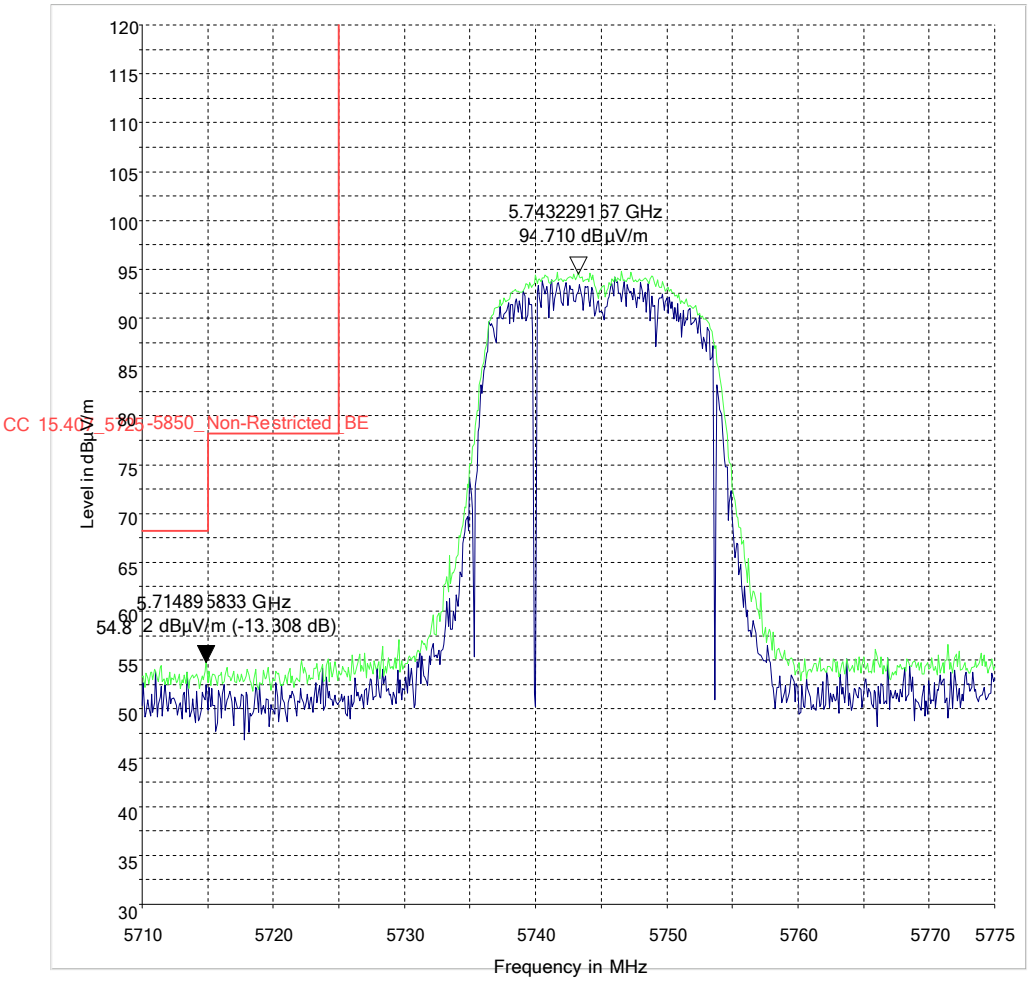
Low Band Edge		
802.11n, HT20; MIMO	Channel 149 / 5745 MHz	Tx Chain 0+1



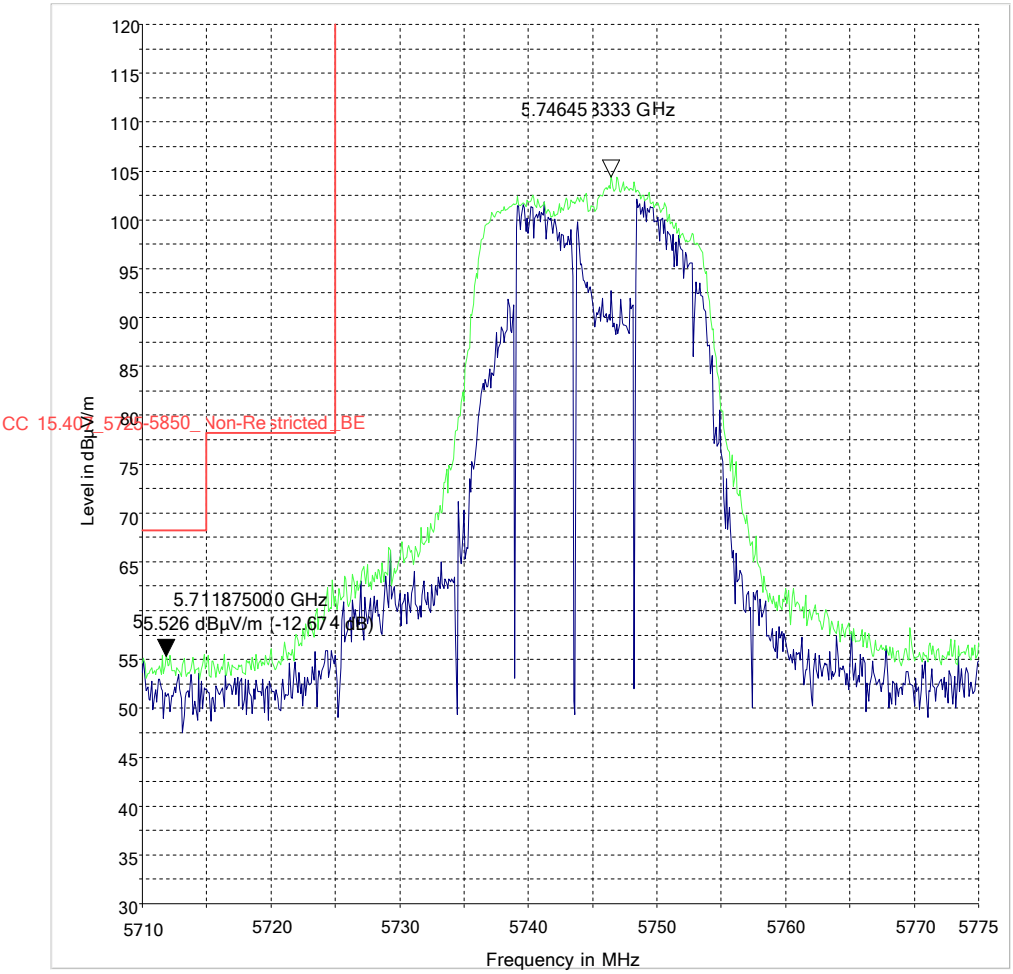
Low Band Edge		
802.11ac, VHT20; SISO	Channel 149 / 5745 MHz	Tx Chain 0



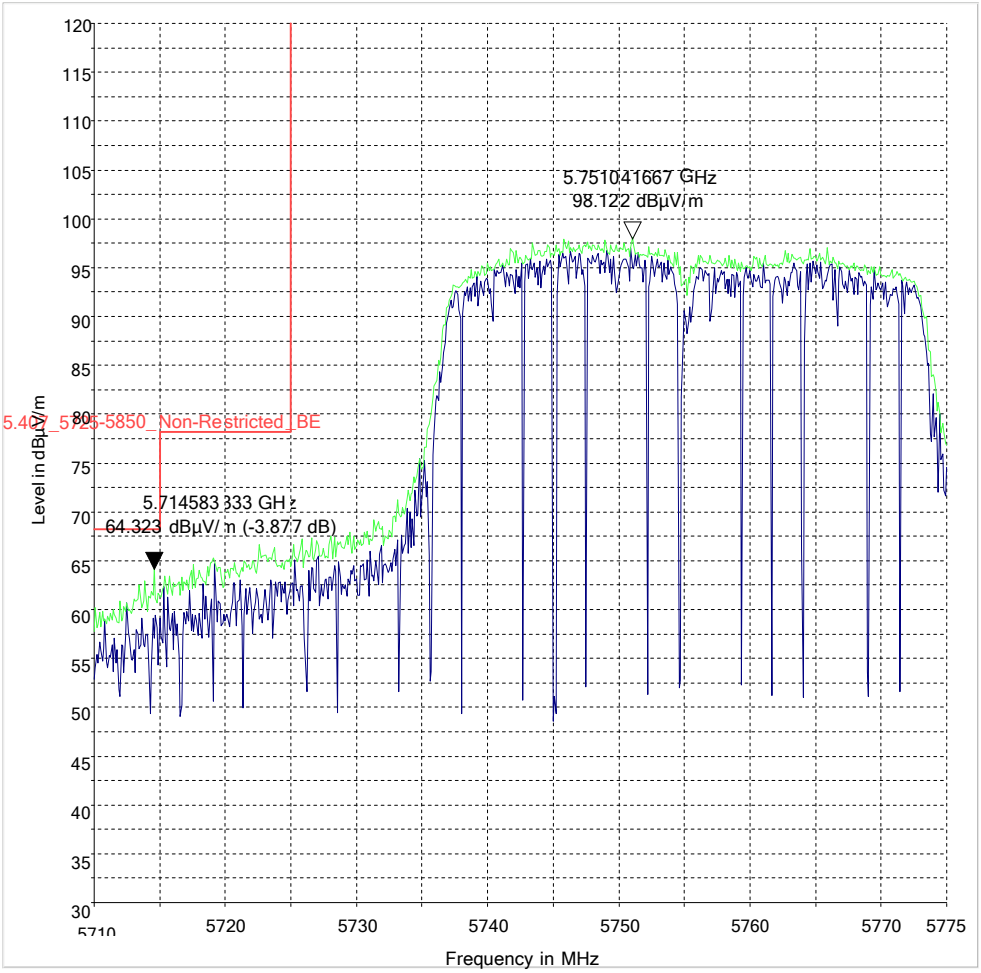
Low Band Edge		
802.11ac, VHT20; SISO	Channel 149 / 5745 MHz	Tx Chain 1



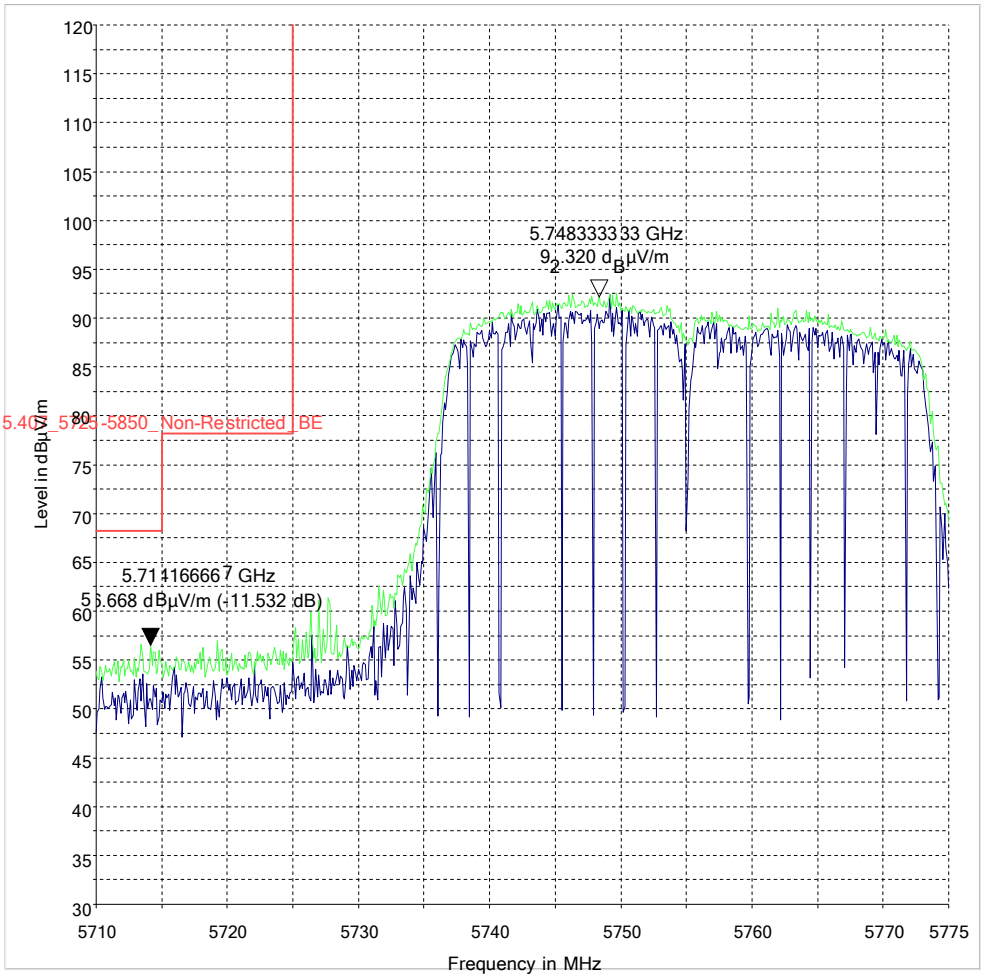
Low Band Edge		
802.11ac, VHT20; MIMO	Channel 149 / 5745 MHz	Tx Chain 0+1



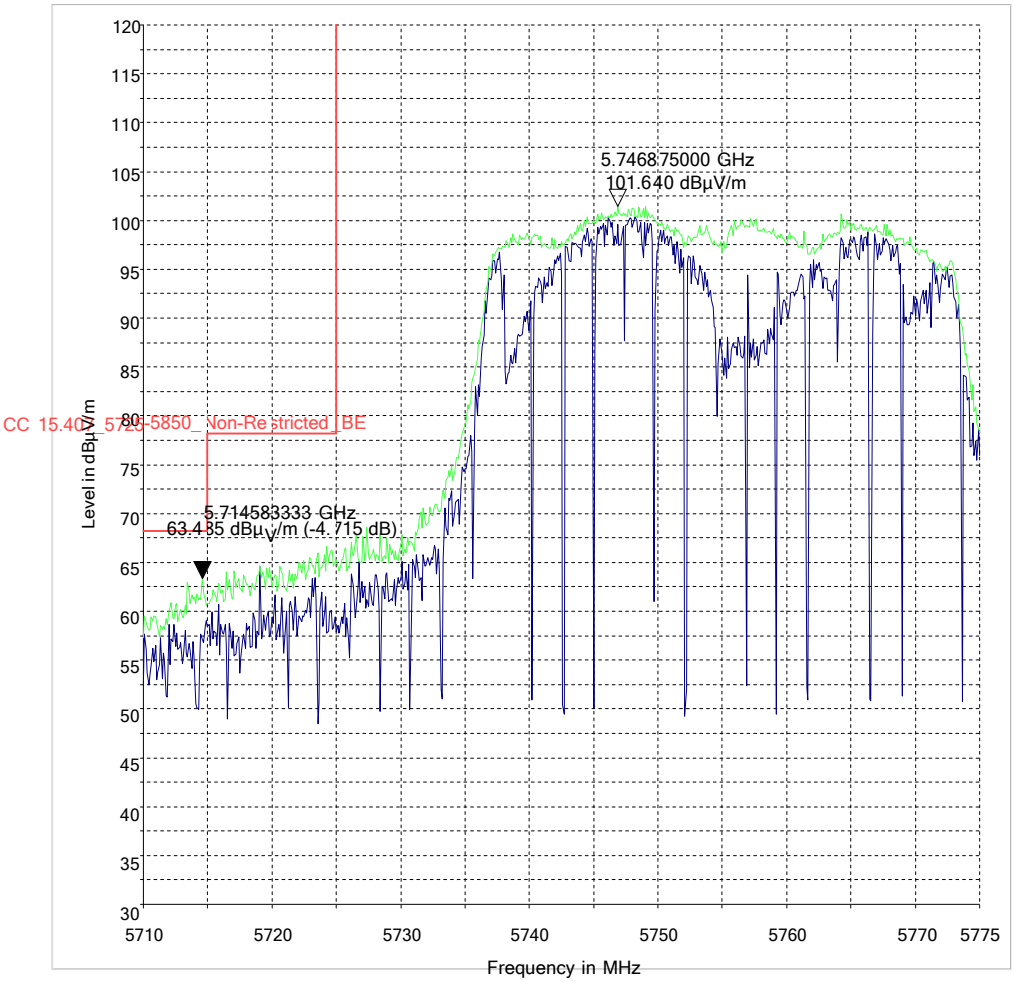
Low Band Edge		
802.11n, HT40; SISO	Channel 151 / 5755 MHz	Tx Chain 0



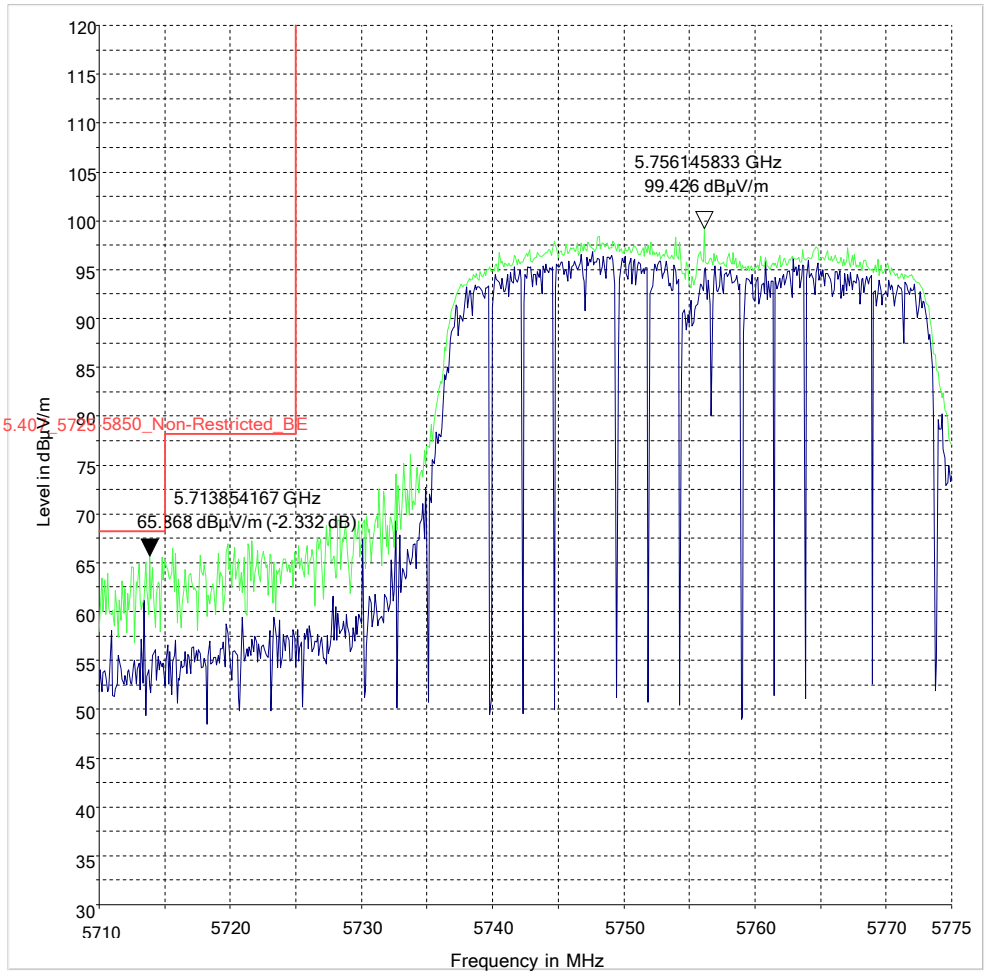
Low Band Edge		
802.11n, HT40; SISO	Channel 151 / 5755 MHz	Tx Chain 1



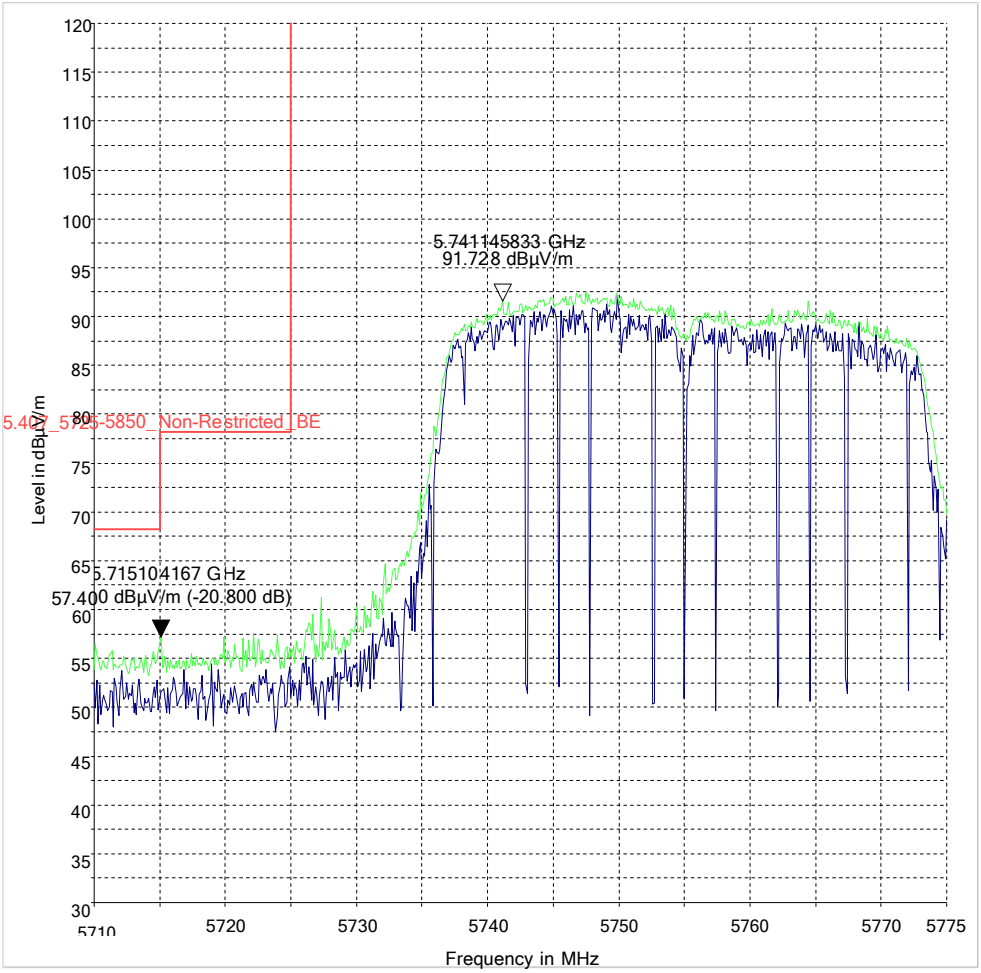
Low Band Edge		
802.11n, HT40; MIMO	Channel 151 / 5755 MHz	Tx Chain 0+1



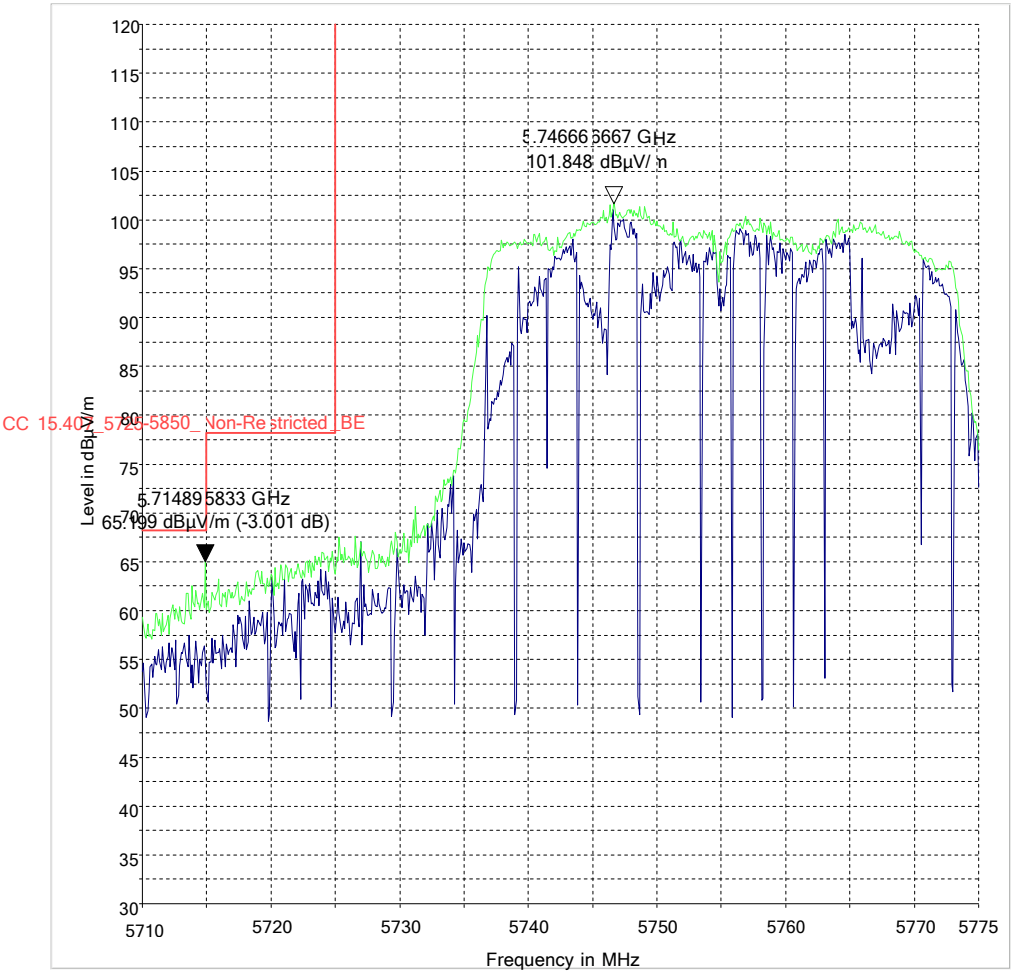
Low Band Edge		
802.11ac, VHT40; SISO	Channel 151 / 5755 MHz	Tx Chain 0



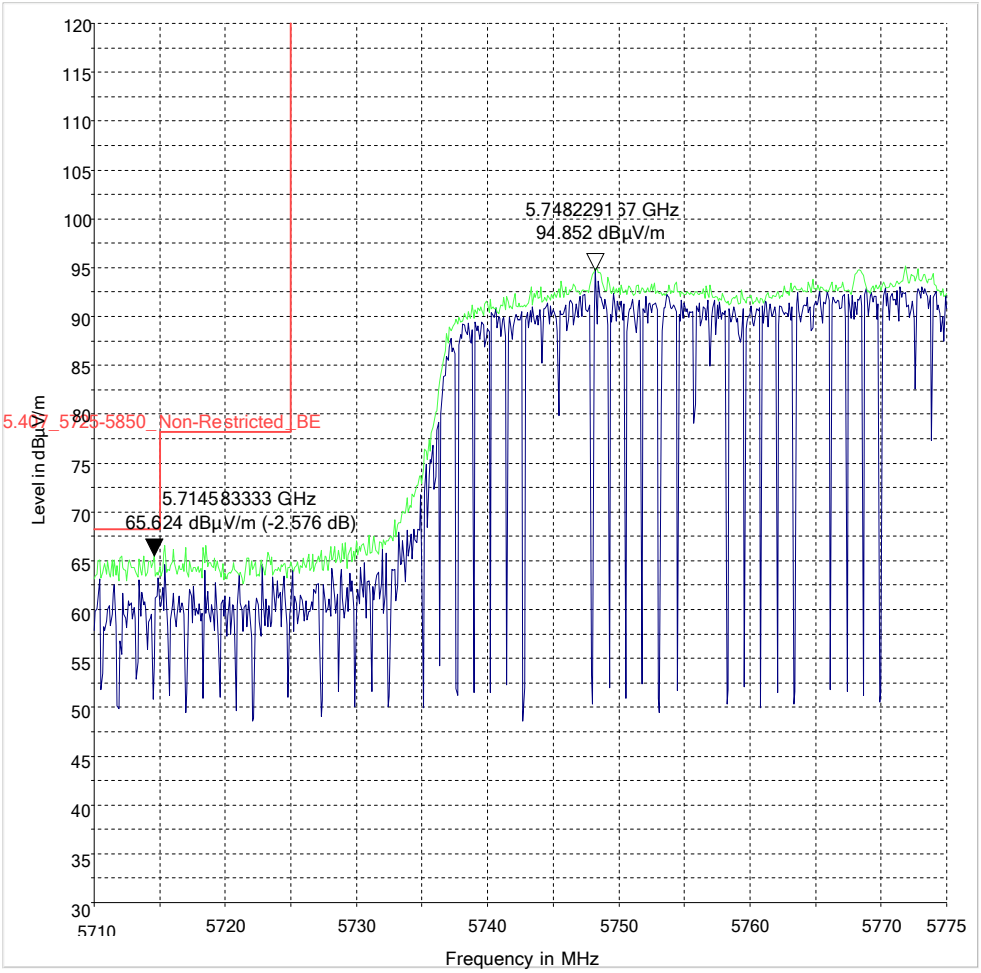
Low Band Edge		
802.11ac, VHT40; SISO	Channel 151 / 5755 MHz	Tx Chain 1



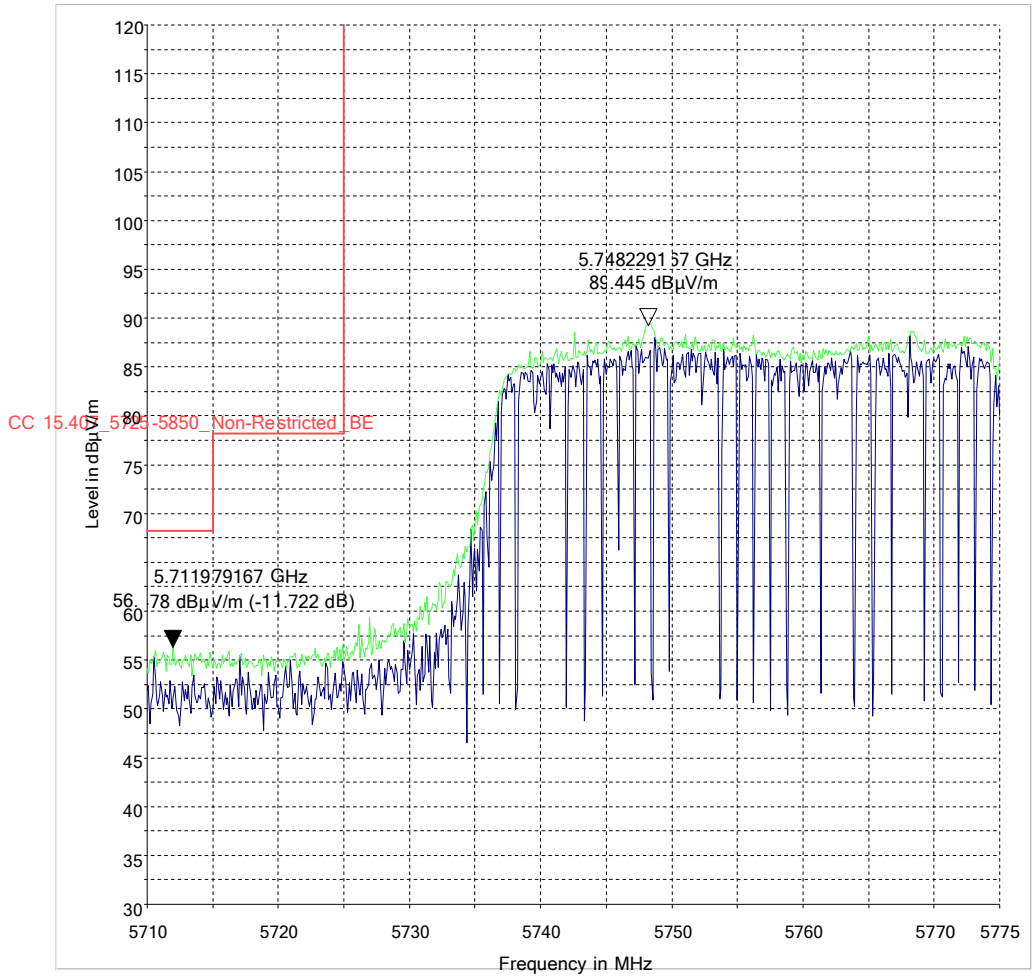
Low Band Edge		
802.11ac, VHT40; MIMO	Channel 151 / 5755 MHz	Tx Chain 0+1



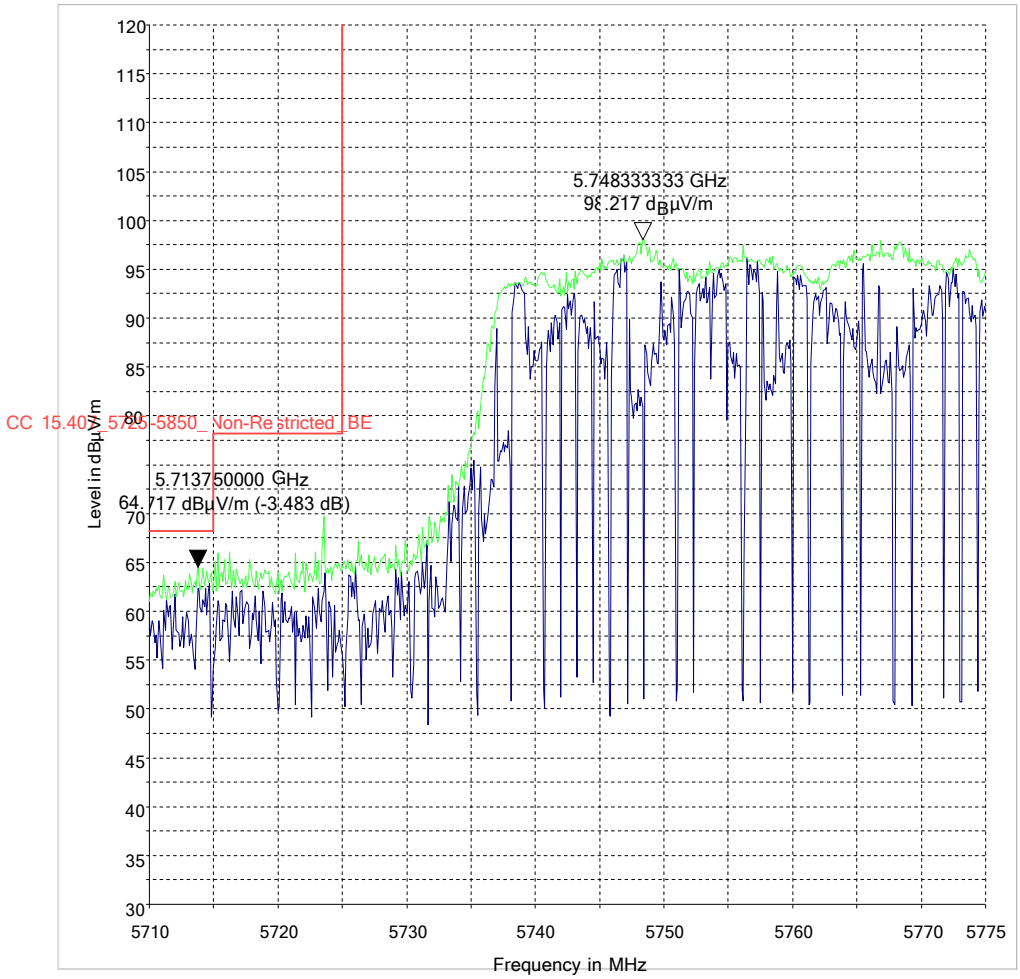
Low Band Edge		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 0



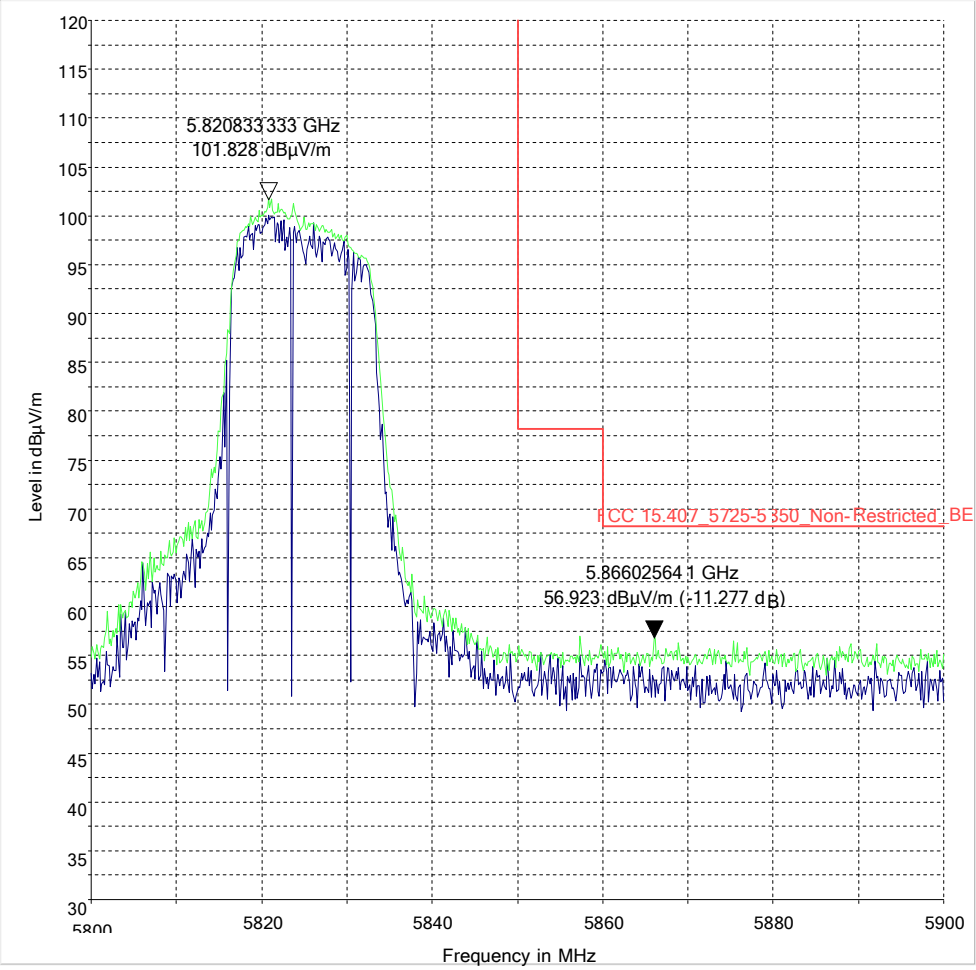
Low Band Edge		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 1



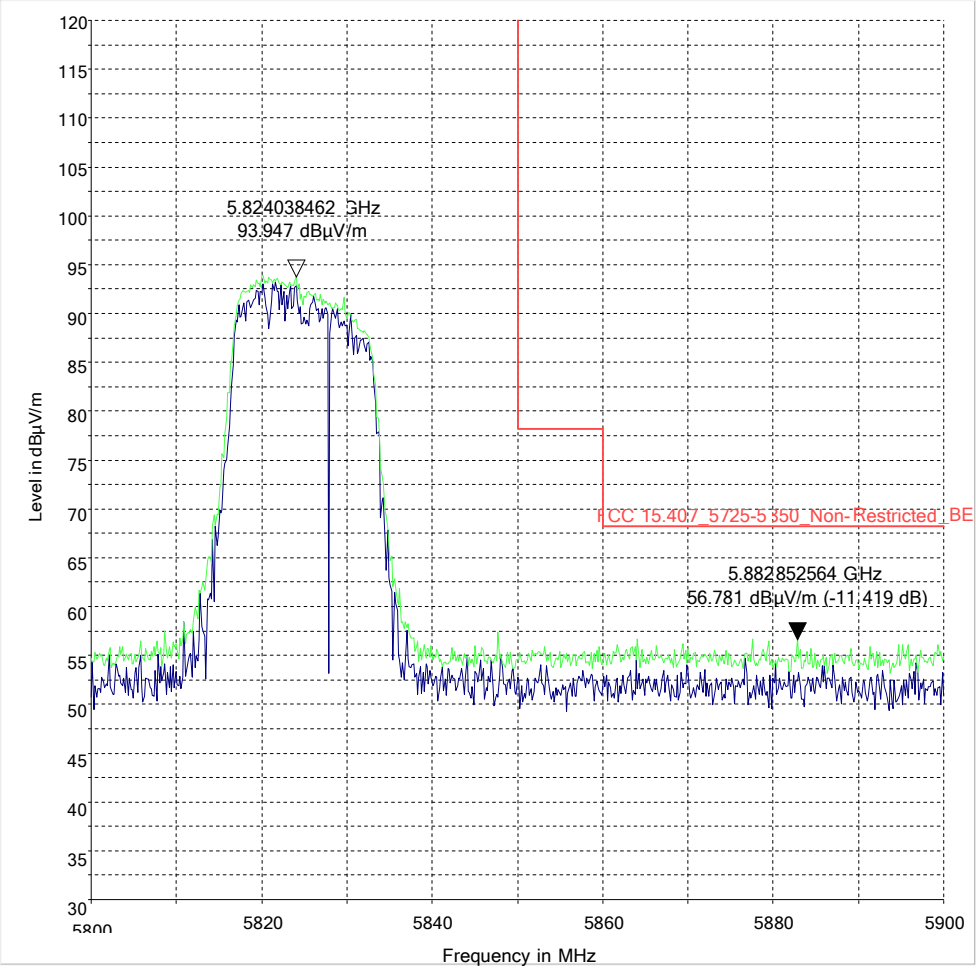
Low Band Edge		
802.11ac, VHT80; MIMO	Channel 155 / 5775 MHz	Tx Chain 0+1



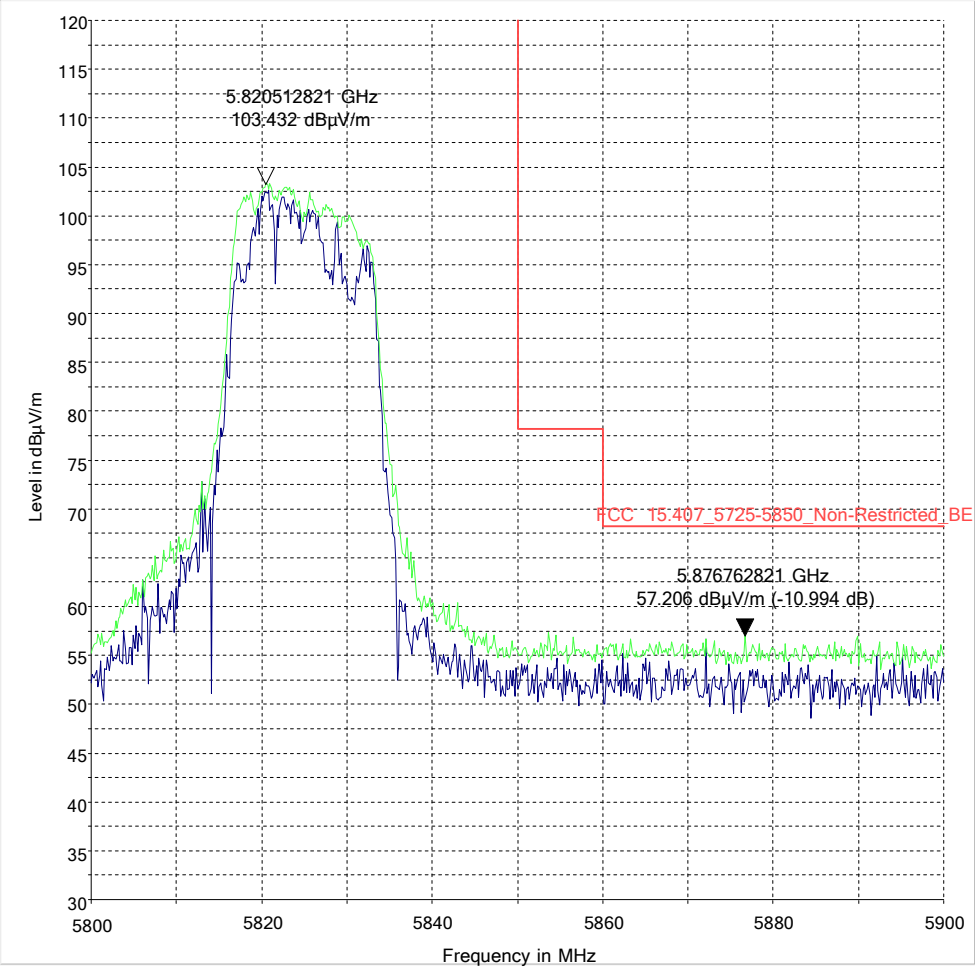
High Band Edge		
802.11a; SISO	Channel 165 / 5825 MHz	Tx Chain 0



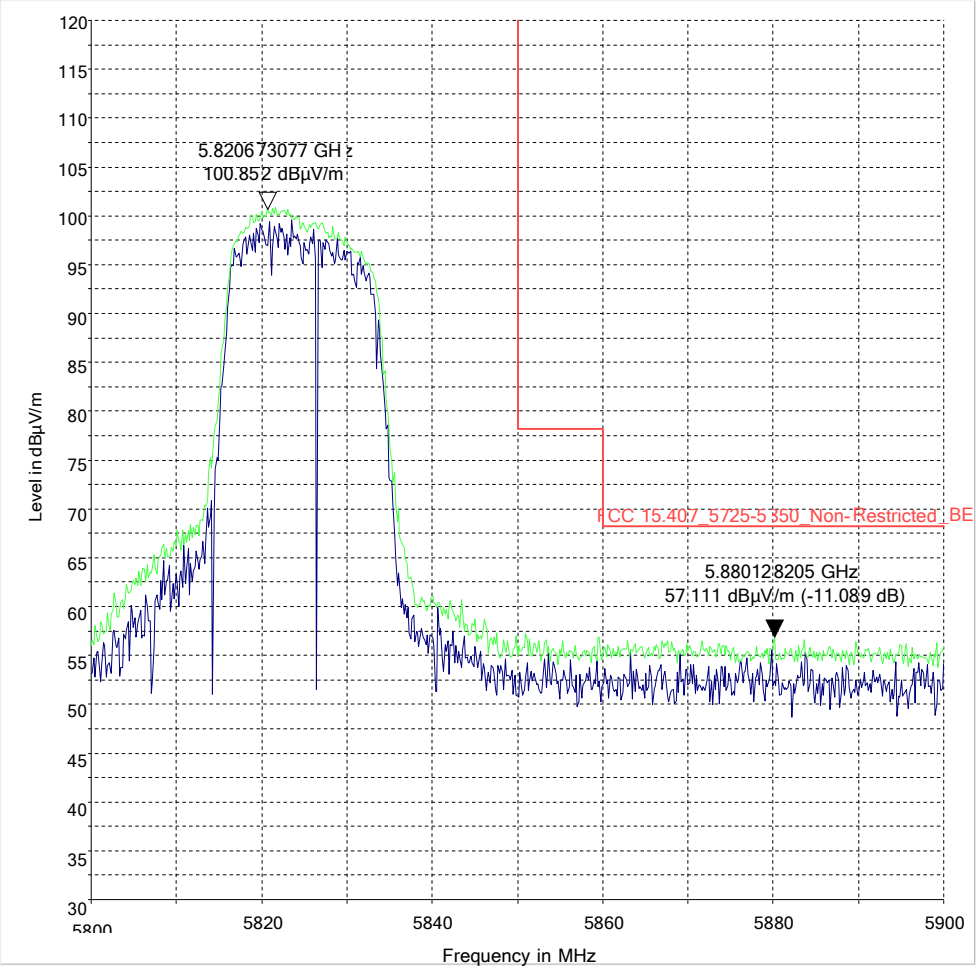
High Band Edge		
802.11a; SISO	Channel 165 / 5825 MHz	Tx Chain 1



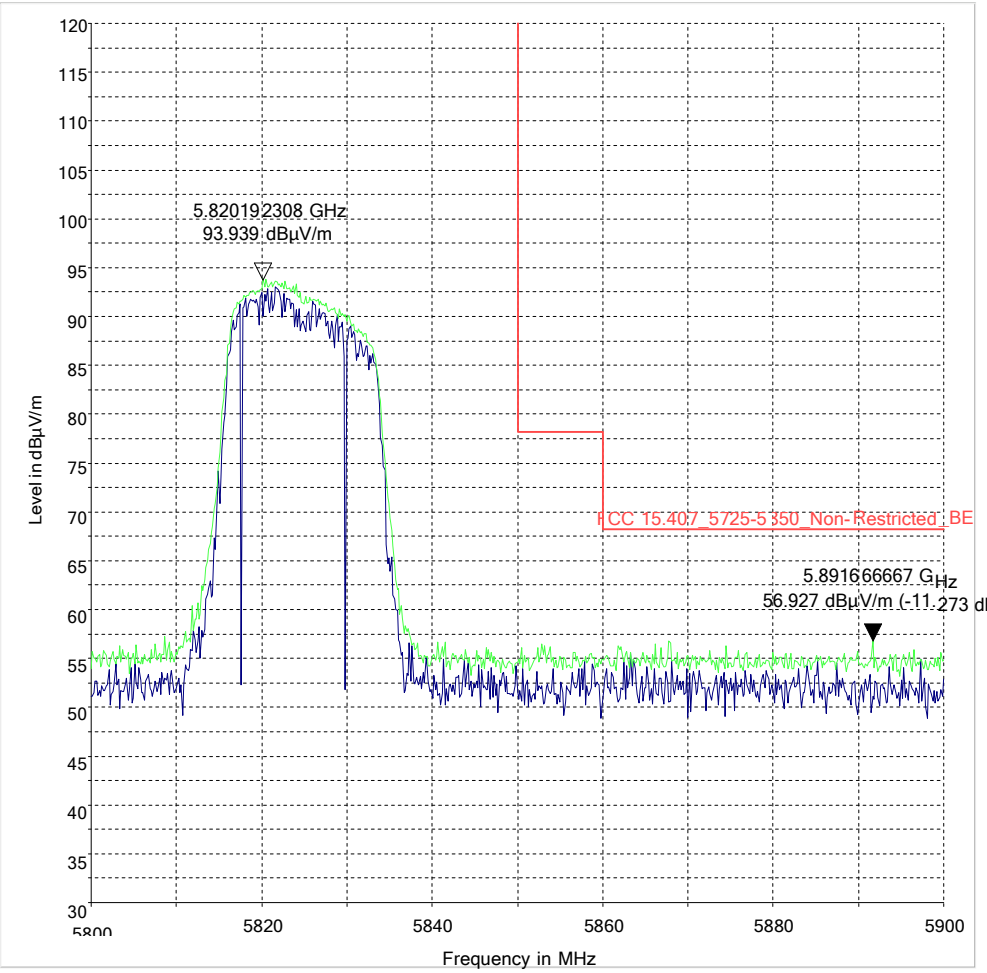
High Band Edge		
802.11a; MIMO	Channel 165 / 5825 MHz	Tx Chain 0+1



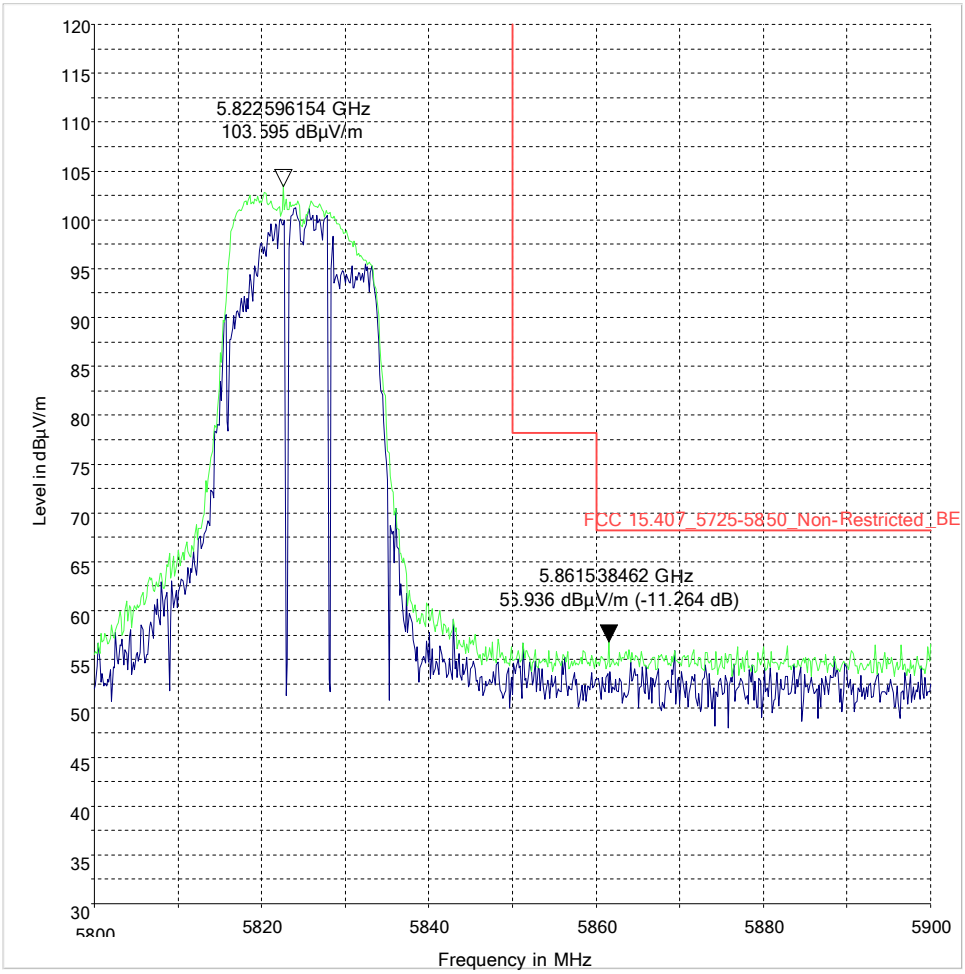
High Band Edge		
802.11n, HT20; SISO	Channel 165 / 5825 MHz	Tx Chain 0



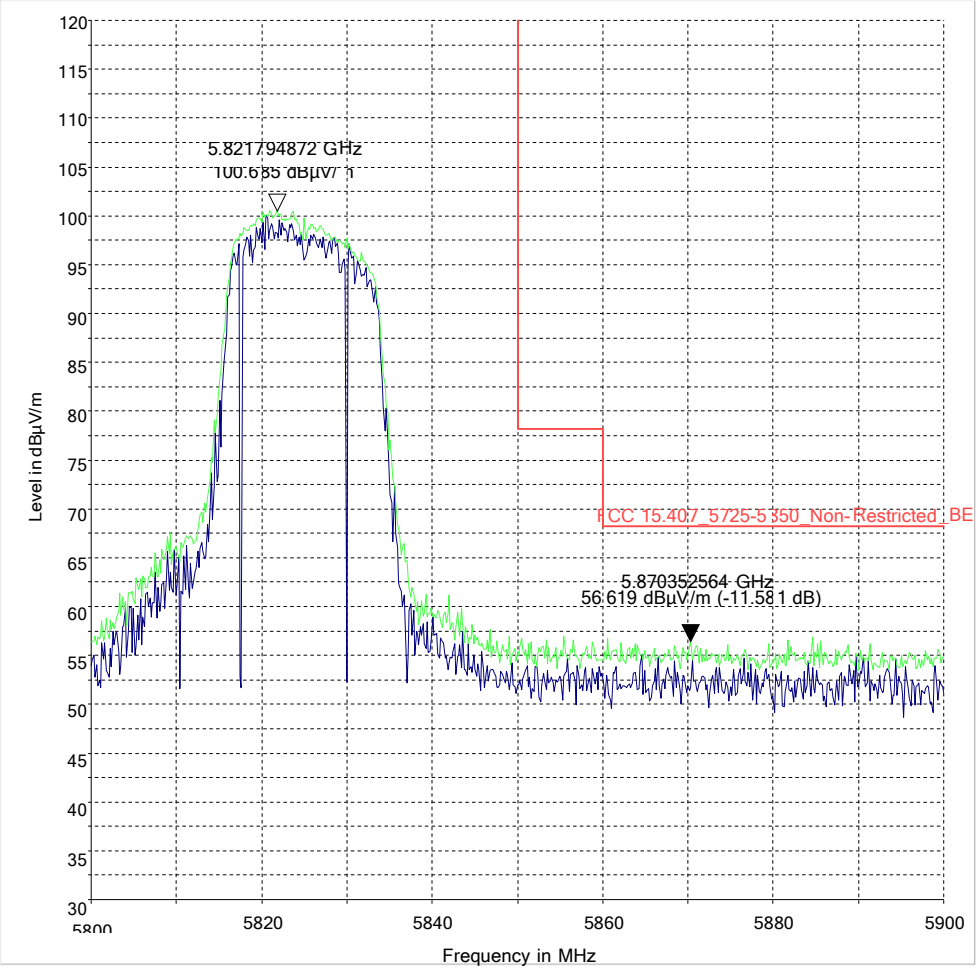
High Band Edge		
802.11n, HT20; SISO	Channel 165 / 5825 MHz	Tx Chain 1



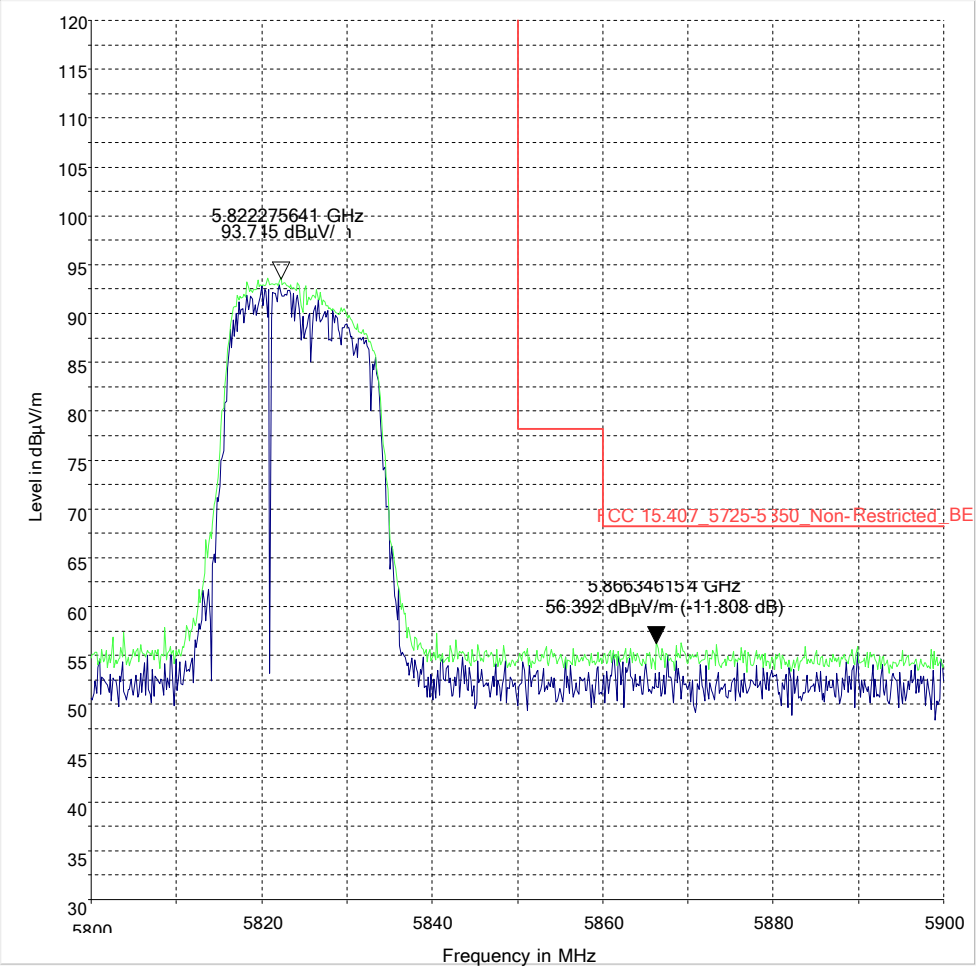
High Band Edge		
802.11n, HT20; MIMO	Channel 165 / 5825 MHz	Tx Chain 0+1



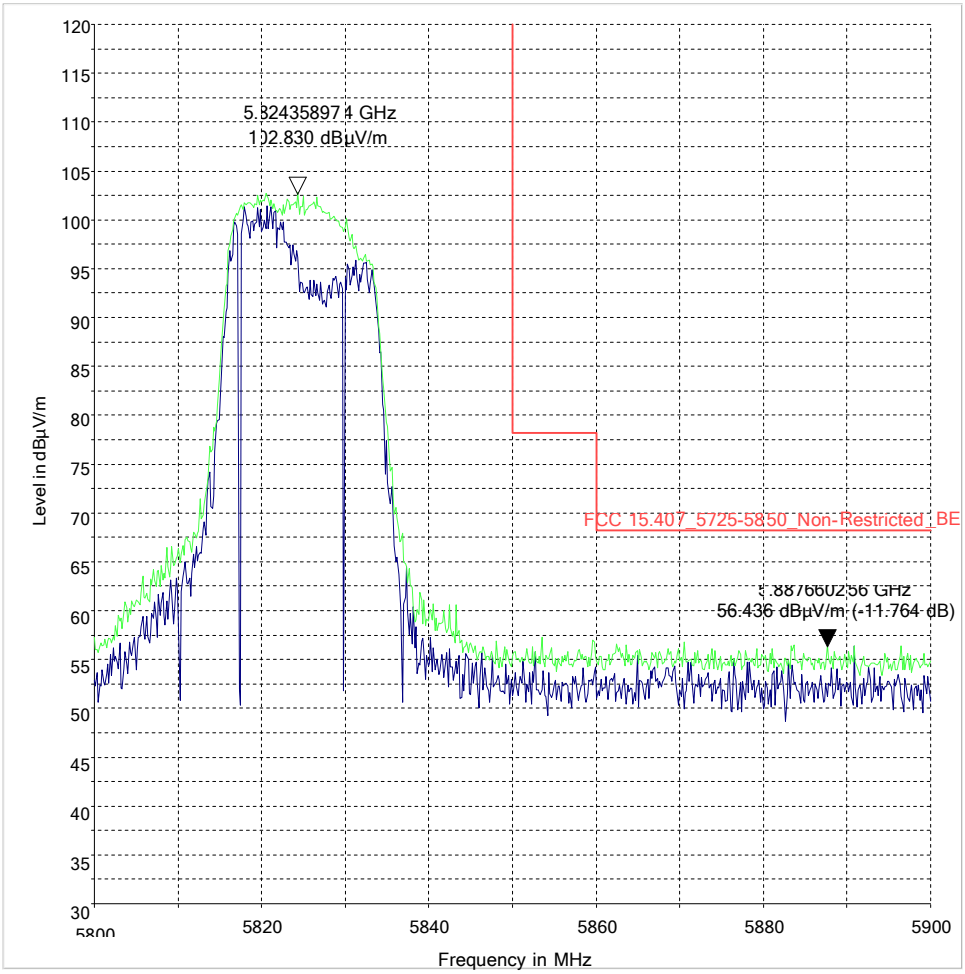
High Band Edge		
802.11ac, VHT20; SISO	Channel 165 / 5825 MHz	Tx Chain 0



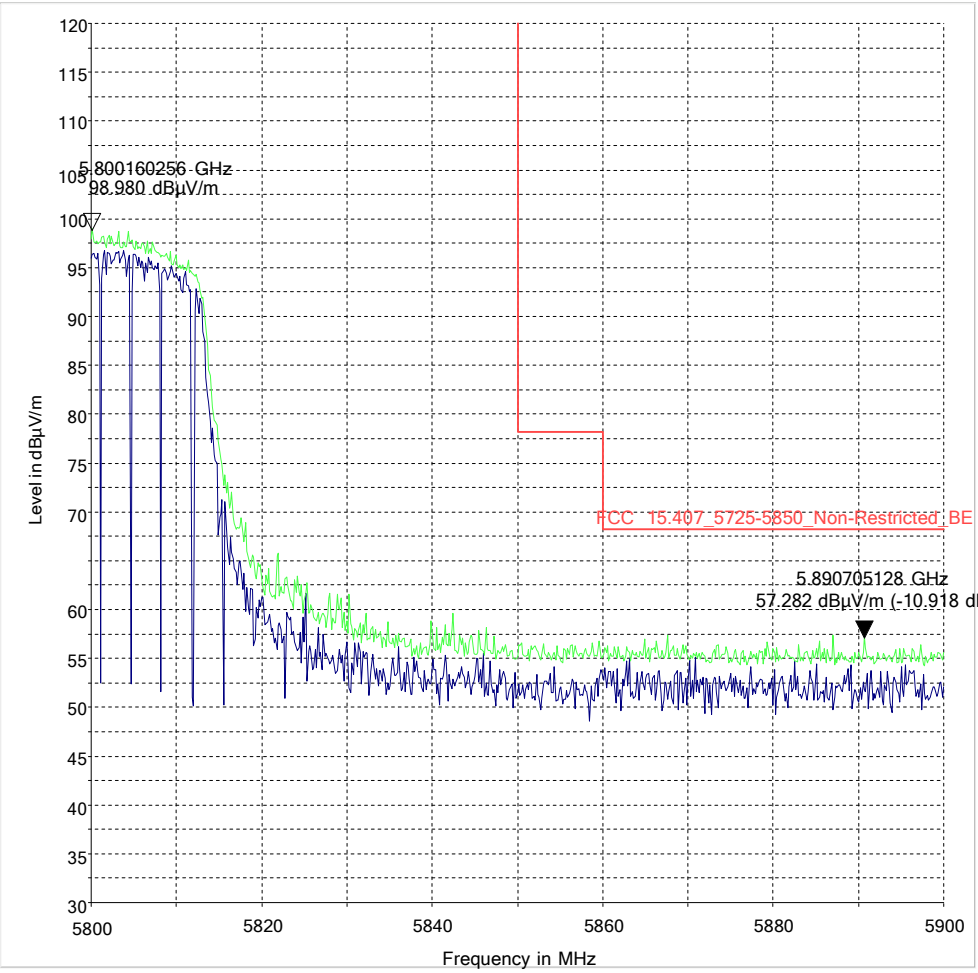
High Band Edge		
802.11ac, VHT20; SISO	Channel 165 / 5825 MHz	Tx Chain 1



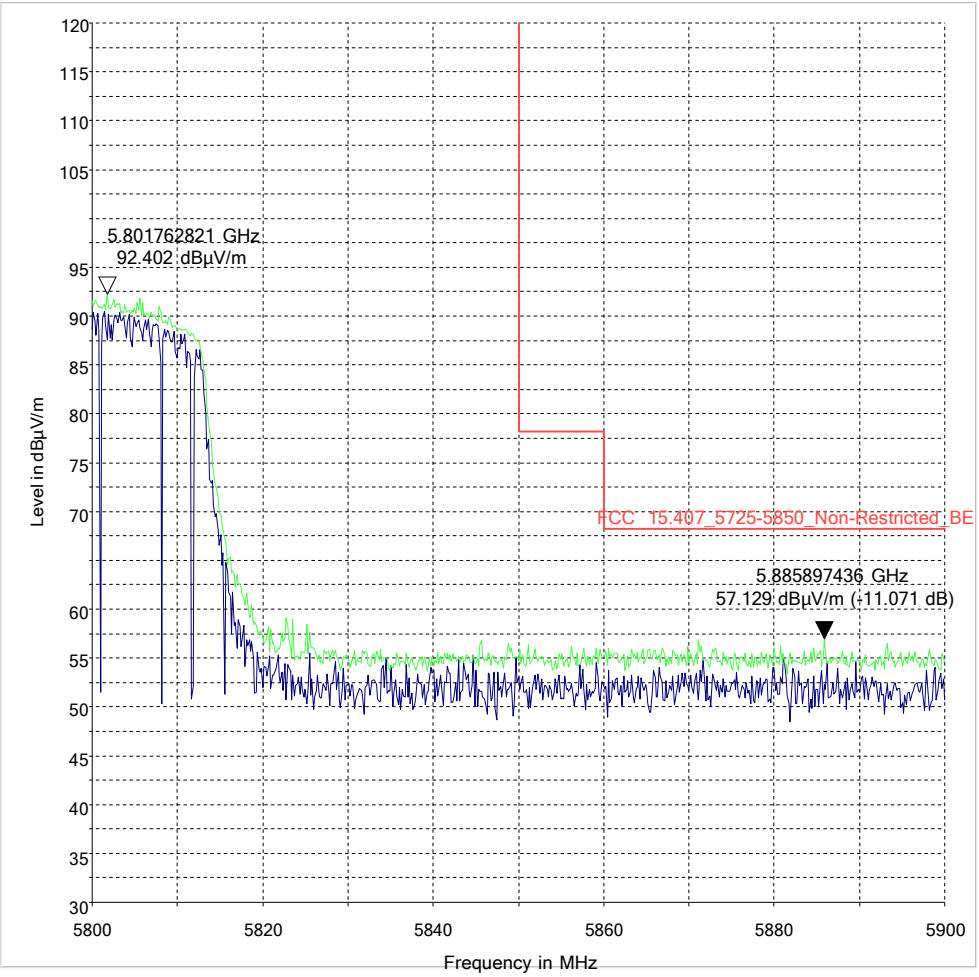
High Band Edge		
802.11ac, VHT20; MIMO	Channel 165 / 5825 MHz	Tx Chain 0+1



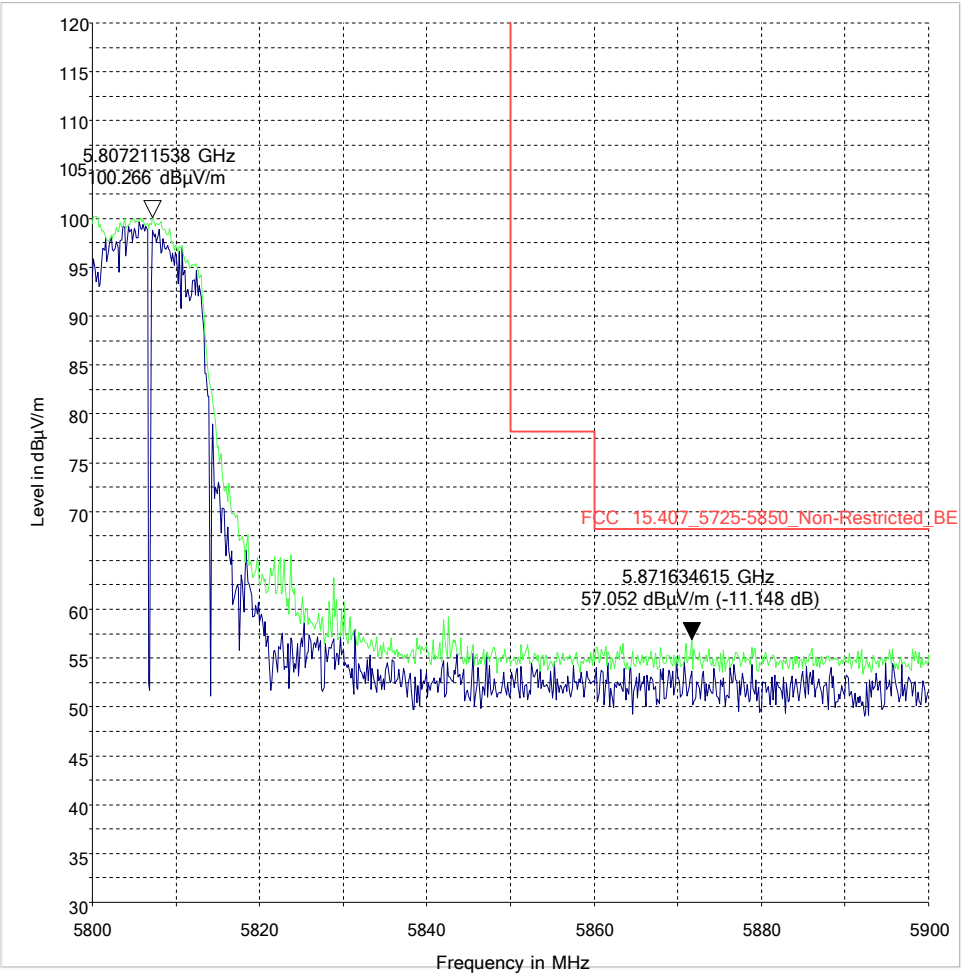
High Band Edge		
802.11n, HT40; SISO	Channel 159 / 5795 MHz	Tx Chain 0



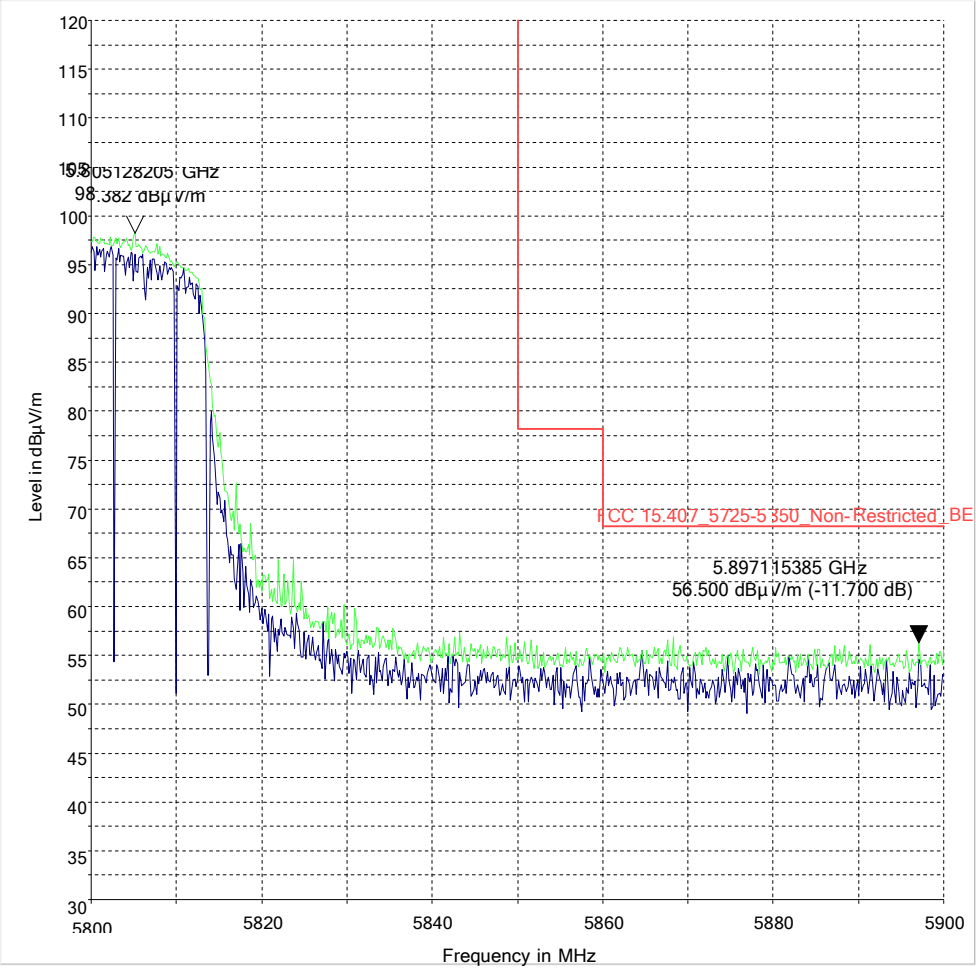
High Band Edge		
802.11n, HT40; SISO	Channel 159 / 5795 MHz	Tx Chain 1



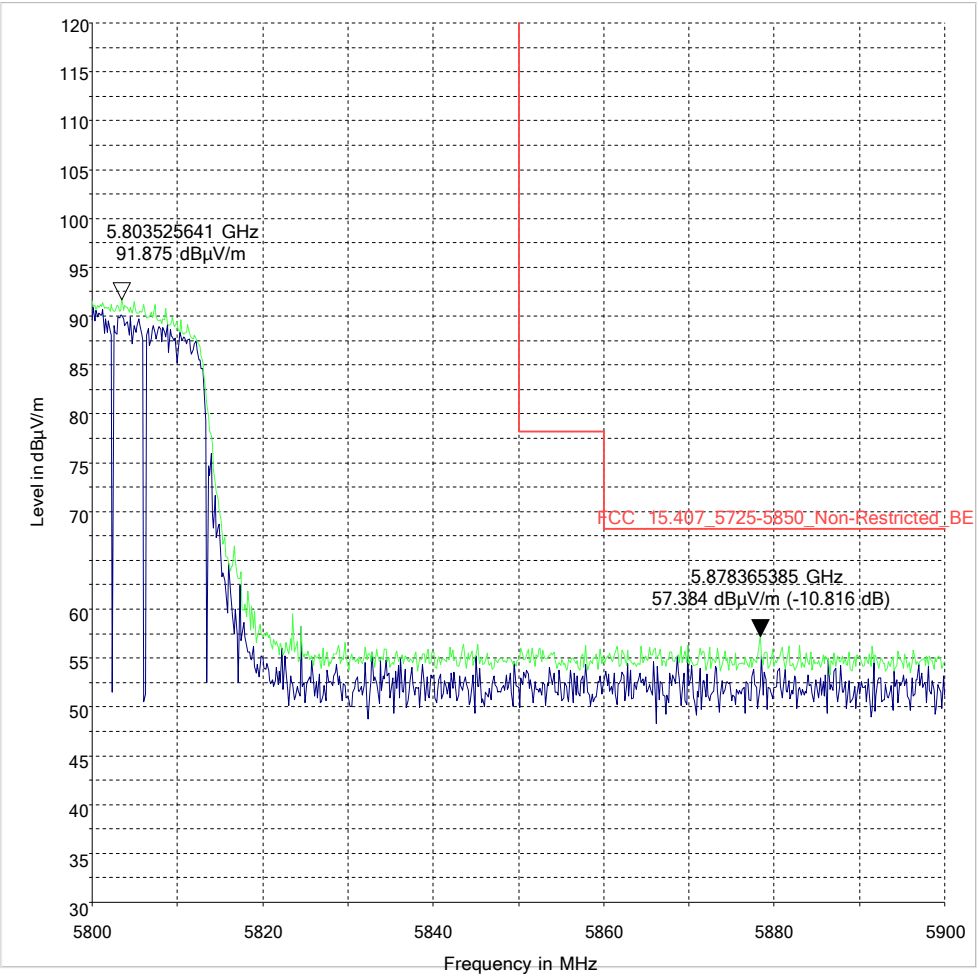
High Band Edge		
802.11n, HT40; MIMO	Channel 159 / 5795 MHz	Tx Chain 0+1



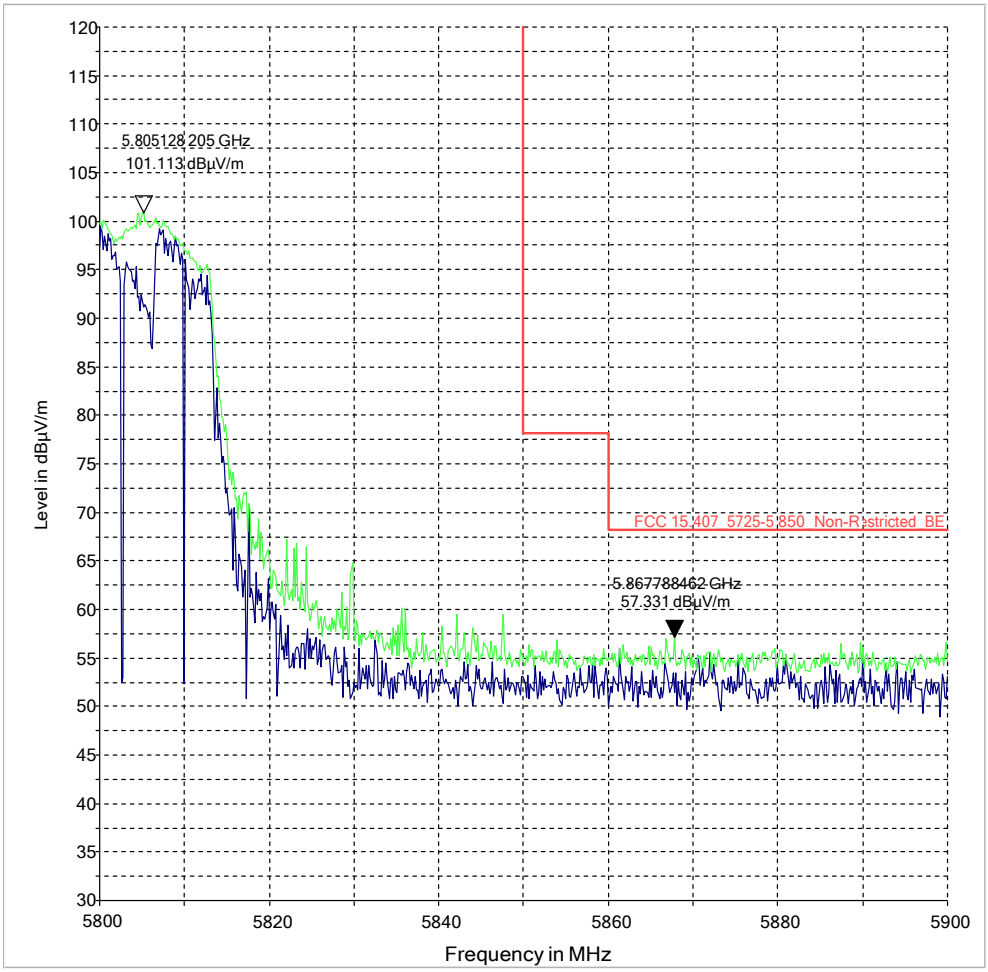
High Band Edge		
802.11ac, VHT40; SISO	Channel 159 / 5795 MHz	Tx Chain 0



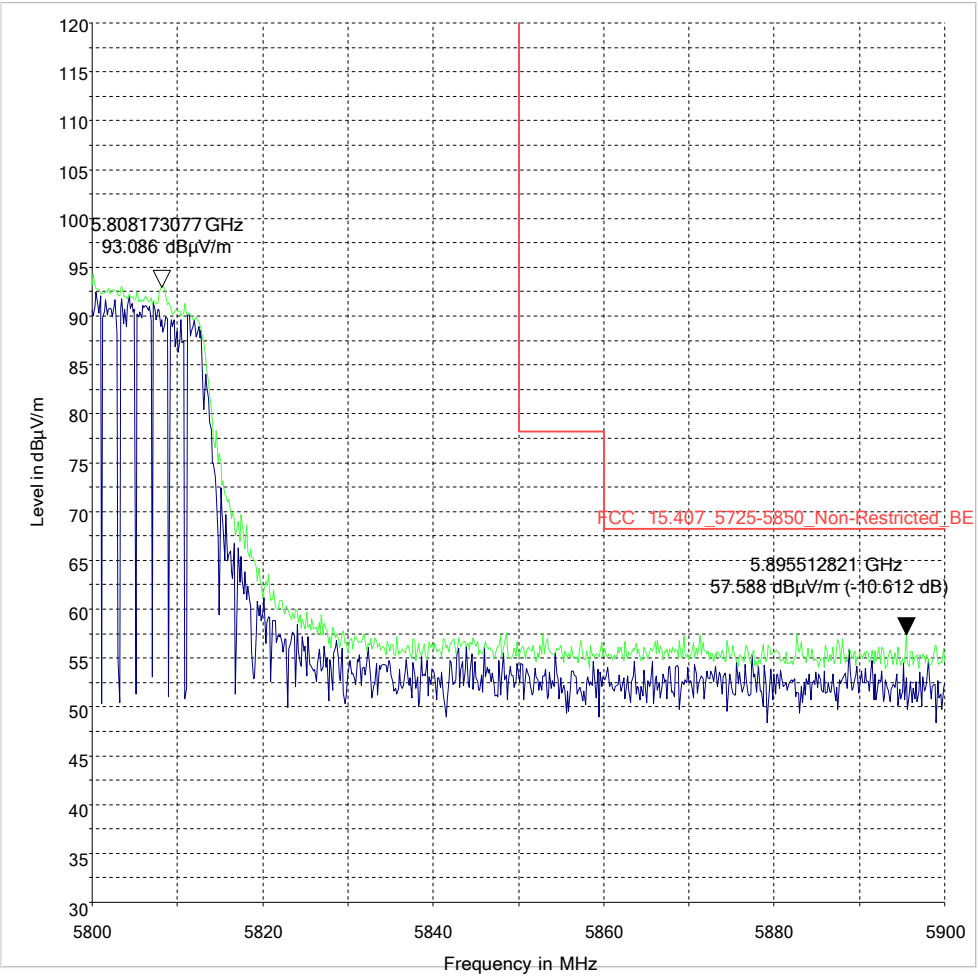
High Band Edge		
802.11ac, VHT40; SISO	Channel 159 / 5795 MHz	Tx Chain 1



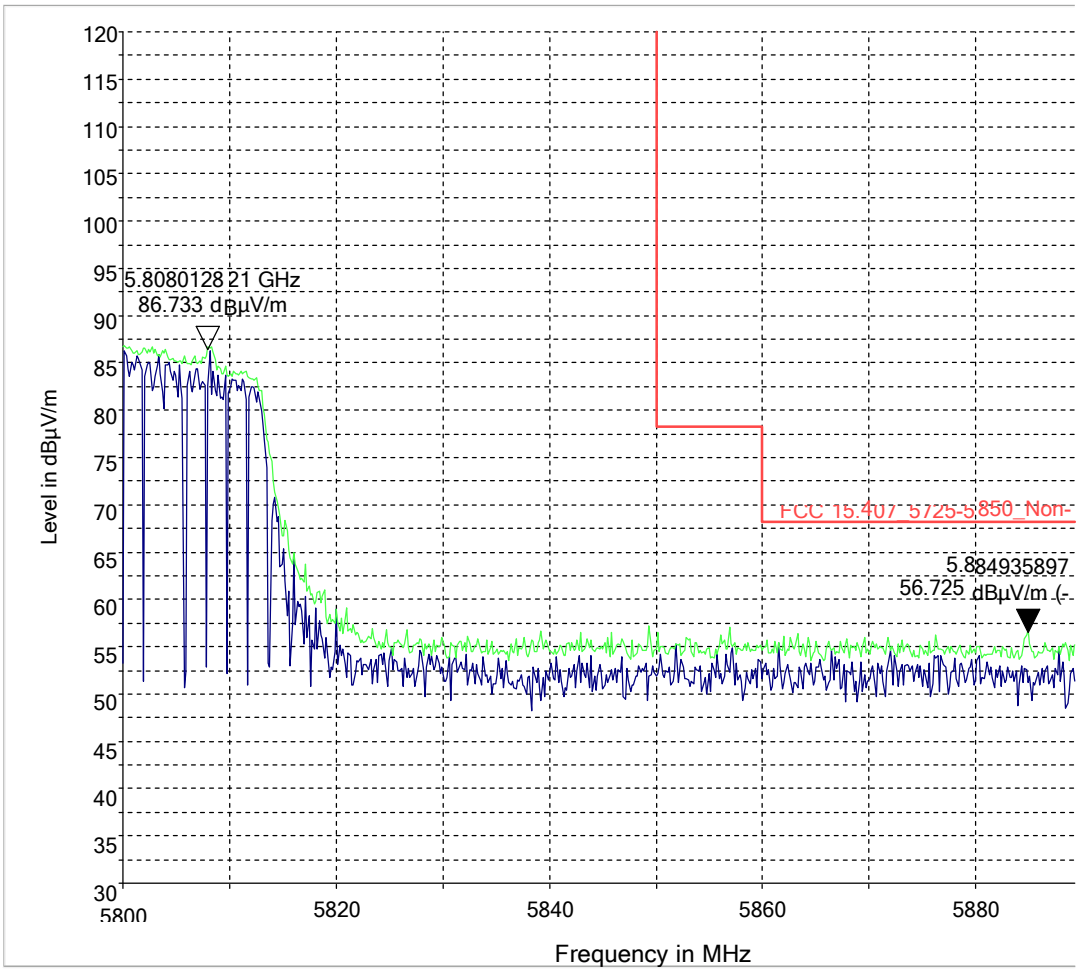
High Band Edge		
802.11ac, VHT40; MIMO	Channel 159 / 5795 MHz	Tx Chain 0+1



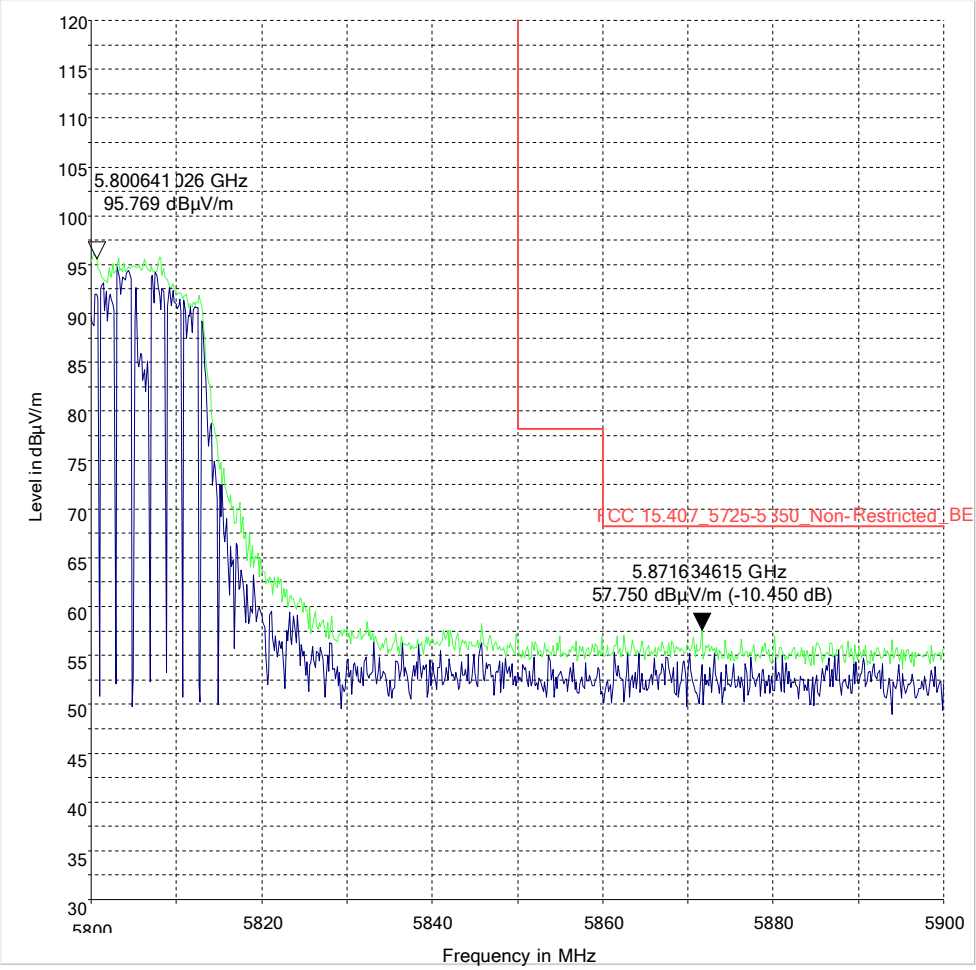
High Band Edge		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 0



High Band Edge		
802.11ac, VHT80; SISO	Channel 155 / 5775 MHz	Tx Chain 1



High Band Edge		
802.11ac, VHT80; MIMO	Channel 155 / 5775 MHz	Tx Chain 0+1



7 Test Equipment and Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial Number	Cal Date	Cal Interval
Turn table	EMCO	2075	N/A	N/A	N/A
MAPS Position Controller	ETS Lindgren	2092	0004-1510	N/A	N/A
Antenna Mast	ETS Lindgren	2171B	N/A	N/A	N/A
Relay Switch Unit	Rohde&Schwarz	RSU	338964/001	N/A	N/A
1500MHz HP Filter	Filtek	HP12/1700	14c48	N/A	N/A
2800 MHz HP Filter	Filtek	HP12/2800	14C47	N/A	N/A
6200 MHz HP Filter	Micro-tronics	HPM50106	1	N/A	N/A
Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
Pre-Amplifier	Rohde&Schwarz	TS-PR18	100053	N/A	N/A
Communication Antenna	Kathrein	IBP5-900/1940	N/A	N/A	N/A
15 dB Attenuator	Huber & Suhner	N/A	N/A	N/A	N/A
Antenna Biconilog	EMCO	3142E	166067	6/14/2014	3 years
Antenna Horn	EMCO	3115	35111	7/24/2015	3 years
Antenna Horn	ETS Lindgren	3116	70497	7/22/2015	3 years
Antenna Loop 6512	ETS Lindgren	6512	49838	3/13/2014	3 years
Digital Barometer	Control Company	35519-055	91119547	4/7/2015	2 Years
Receiver ESU40	R&S	ESU40	100251	6/29/2015	3 years
Spectrum Analyzer	R&S	FSU26	200065	7/4/2015	3 years
Thermometer Humidity	Dickson	TM320	5280063	7/29/2015	1 Year

Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month.
Items indicated “N/A” for cal date or interval either do not specifically require calibration or is internally characterized before use.

The calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements and verifications with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed.

8 Report History

Date	Report Name – Changes to Report	Report Prepared By
February 25, 2016	EMC_DELPH-004-15001_NA-UNII3 1. Original Version	J. Sabado