

TEST REPORT


of

FCC Part 15 Subpart E §15.407
RSS-247 Issue 2, RSS-Gen Issue 5

FCC ID: TQ8-ATC40S8AN
IC Certification: 5074A-ATC40S8KN

Equipment Under Test : DIGITAL CAR AVN SYSTEM
 FCC Model Name : ATC40S8AN
 IC Model Name : ATC40S8KN
 FCC Variant Model Name : ATC41S8AN
 IC Variant Model Name : ATC41S8KN
 Applicant : Hyundai Mobis Co., Ltd.
 Manufacturer : Hyundai Mobis Co., Ltd.
 Date of Receipt : 2018.09.03
 Date of Test(s) : 2018.10.01 ~ 2018.11.23
 Date of Issue : 2018.11.27

In the configuration tested, the EUT complied with the standards specified above.

Tested By:  **Date:** 2018.11.27

 Nancy Park

Technical Manager:  **Date:** 2018.11.27

 Jungmin Yang

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

-Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807

-Designation number: KR0150

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Phone No. : +82 31 688 0901

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1.2. Details of Applicant

Applicant : Hyundai Mobis Co., Ltd.

Address : 203, Teheran-ro, Gangnam-gu, Seoul, South Korea, 06141

Contact Person : Choe, Seung-hoon

Phone No. : +82 31 260 0098

1.3. Details of Manufacturer

Company : Same as applicant

Address : Same as applicant

1.4. Description of EUT

Kind of Product	DIGITAL CAR AVN SYSTEM	
Model Name	FCC : ATC40S8AN IC : ATC40S8KN	
Variant Model Name	FCC : ATC41S8AN IC : ATC41S8KN	
Power Supply	DC 14.4 V	
Frequency Range	2 402 MHz ~ 2 480 MHz (Bluetooth), 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20), 5 745 MHz ~ 5 825 MHz (Band 3: 11a/n_HT20, 11ac_VHT20), 5 755 MHz ~ 5 795 MHz (Band 3: 11n_HT40, 11ac_VHT40), 5 775 MHz (Band 3: 11ac_VHT80), 5 180 MHz ~ 5 240 MHz (Band 1: 11a/n_HT20, 11ac_VHT20), 5 190 MHz ~ 5 230 MHz (Band 1: 11n_HT40, 11ac_VHT40), 5 210 MHz (Band 1: 11ac_VHT80), 5 260 MHz ~ 5 320 MHz (Band 2A: 11a/n_HT20, 11ac_VHT20), 5 270 MHz ~ 5 310 MHz (Band 2A: 11n_HT40, 11ac_VHT40), 5 290 MHz (Band 2A: 11ac_VHT80), 5 500 MHz ~ 5 720 MHz (Band 2C: 11a/n_HT20, 11ac_VHT20), 5 510 MHz ~ 5 710 MHz (Band 2C: 11n_HT40, 11ac_VHT40), 5 530 MHz ~ 5 690 MHz (Band 2C: 11ac_VHT80)	
Modulation Technique	DSSS, OFDM, GFSK, π/4DQPSK, 8DPSK	
Number of Channels	79 channel (Bluetooth), 11 channel (11b/g/n_HT20), 5 channel (Band 3: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 3: 11n_HT40, 11ac_VHT40), 1 channel (Band 3: 11ac_VHT80), 4 channel (Band 1: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 1: 11n_HT40, 11ac_VHT40), 1 channel (Band 1: 11ac_VHT80), 4 channel (Band 2A: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 2A: 11n_HT40, 11ac_VHT40), 1 channel (Band 2A: 11ac_VHT80), 9 channel (Band 2C: 11a/n_HT20, 11ac_VHT20), 4 channel (Band 2C: 11n_HT40, 11ac_VHT40), 2 channel (Band 2C: 11ac_VHT80)	
Antenna Type	PCB pattern antenna	
Antenna Gain	Bluetooth	2 400 MHz ~ 2 4835 MHz: 0.29 dB i
	WLAN	2 400 MHz ~ 2 4835 MHz: -0.70 dB i, 5 150 MHz ~ 5 250 MHz: 3.51 dB i, 5 250 MHz ~ 5 350 MHz: 3.12 dB i, 5 470 MHz ~ 5 725 MHz: 2.28 dB i, 5 725 MHz ~ 5 850 MHz: -0.84 dB i

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1.5. Declaration by the Manufacturer

- The EUT is a slave without radar detection and TPC.
- EUT is not supported TDWR(5.6 - 5.65 GHz) band.

1.6. Automatically Discontinue Transmission

1.6.1. Limit of Automatically Discontinue Transmission

The device shall automatically discontinue transmission in case of either absence of information to transmit or operating failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

1.6.2. Test Result of Automatically Discontinue Transmission

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

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1.7. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	Agilent	E8257D	MY51501169	Jul. 03, 2018	Annual	Jul. 03, 2019
Signal Generator	R&S	SMBV100A	255834	Jun. 15, 2018	Annual	Jun. 15, 2019
Spectrum Analyzer	R&S	FSV30	100955	Mar. 12, 2018	Annual	Mar. 12, 2019
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 21, 2018	Annual	Sep. 21, 2019
Spectrum Analyzer	Agilent	N9030A	US51350132	Sep. 21, 2018	Annual	Sep. 21, 2019
Power Meter	Anritsu	ML2495A	1223004	Jun. 12, 2018	Annual	Jun. 12, 2019
Power Sensor	Anritsu	MA2411B	1207272	Jun. 12, 2018	Annual	Jun. 12, 2019
Attenuator	MCLI	FAS-23-20	23834	Jun. 12, 2018	Annual	Jun. 12, 2019
Coaxial Fixed Attenuator	Agilent	8491A-006	MY39264893	Jan. 15, 2018	Annual	Jan. 15, 2019
Low Pass Filter	Mini-Circuits	NLP-1200+	V 8979400903-2	Feb. 22, 2018	Annual	Feb. 22, 2019
High Pass Filter	Wainwright Instrument GmbH	WHKX6.0/18G-10SS	51	Jun. 11, 2018	Annual	Jun. 11, 2019
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	11	May 27, 2018	Annual	May 27, 2019
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 15, 2018	Annual	Mar. 15, 2019
Preamplifier	H.P.	8447F	2944A03909	Aug. 07, 2018	Annual	Aug. 07, 2019
Preamplifier	R&S	SCU-18	10117	Aug. 07, 2018	Annual	Aug. 07, 2019
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 13, 2018	Annual	May 13, 2019
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 23, 2017	Biennial	Aug. 23, 2019
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	01126	Mar. 26, 2018	Biennial	Mar. 26, 2020
Horn Antenna	R&S	HF906	100326	Feb. 14, 2018	Biennial	Feb. 14, 2020
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	BBHA9170431	Sep. 10, 2018	Biennial	Sep. 10, 2020
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/L	N.C.R.	N/A	N.C.R.
Test Receiver	R&S	ESU26	100109	Feb. 07, 2018	Annual	Feb. 07, 2019
Anechoic Chamber	SY Corporation	L x W x H (9.6 m x 6.4 m x 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	SUCOFLEX	104 (3 m)	MY3258414	Jul. 04, 2018	Semi-annual	Jan. 04, 2019
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jul. 04, 2018	Semi-annual	Jan. 04, 2019
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 01/20	Sep. 04, 2018	Semi-annual	Mar. 04, 2019

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1.8. Summary of Test Result

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart E, RSS-247 Issue 2, RSS-Gen Issue 5			
Section		Test Item(s)	Result
15.205(a) 15.209(a) 15.407(b)(1) 15.407(b)(2) 15.407(b)(3) 15.407(b)(4)	RSS-Gen Issue 5 8.9 RSS-247 Issue 2 6.2.1.2 RSS-247 Issue 2 6.2.2.2 RSS-247 Issue 2 6.2.3.2 RSS-247 Issue 2 6.2.4.2	Transmitter radiated spurious emissions	Complied
15.407(a)	RSS-Gen Issue 5 6.7	26 dB Bandwidth & 99 % Bandwidth	Complied
15.407(e)	RSS-247 Issue 2 6.2.4.1	6 dB Bandwidth	Complied
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	RSS-247 Issue 2 6.2.1.1 RSS-247 Issue 2 6.2.2.1 RSS-247 Issue 2 6.2.3.1 RSS-247 Issue 2 6.2.4.1	Maximum Conducted Output Power	Complied
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	RSS-247 Issue 2 6.2.1.1 RSS-247 Issue 2 6.2.2.1 RSS-247 Issue 2 6.2.3.1 RSS-247 Issue 2 6.2.4.1	Peak Power Spectral Density	Complied

1.9. Test Report Revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL013164	2018.11.27	Initial

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1.10. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB789033 D02 v02r01 were used in the measurement of the DUT.

1.11. Sample Calculation

Where relevant, the following sample calculation is provided:

1.11.1. Conducted Test

Offset value (dB) = Attenuator (dB) + Cable loss (dB)

1.11.2. Radiation Test

Field strength level (dB μ V/m) = Measured level (dB μ V) + Antenna factor (dB) + Cable loss (dB) - Amplifier gain (dB)

1.12. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty (dB)
Radiated Disturbance, 9 kHz to 30 MHz	± 3.59
Radiated Disturbance, below 1 GHz	± 5.88
Radiated Disturbance, above 1 GHz	± 5.94

Uncertainty figures are valid to a confidence level of 95 %.

1.13. Information of Variant Model

Model Name		Description
FCC basic model	ATC40S8AN	- Basic Model
FCC variant model	ATC41S8AN	- Same to basic model, but software is difference depending on the type of vehicle.
IC basic model	ATC40S8KN	- Basic Model
IC variant model	ATC41S8KN	- Same to basic model, but software is difference depending on the type of vehicle.

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1.14. Duty Cycle of EUT

Regarding to KDB789033 D02 v02r01, B, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value, Set VBW ≥ RBW.

Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100.

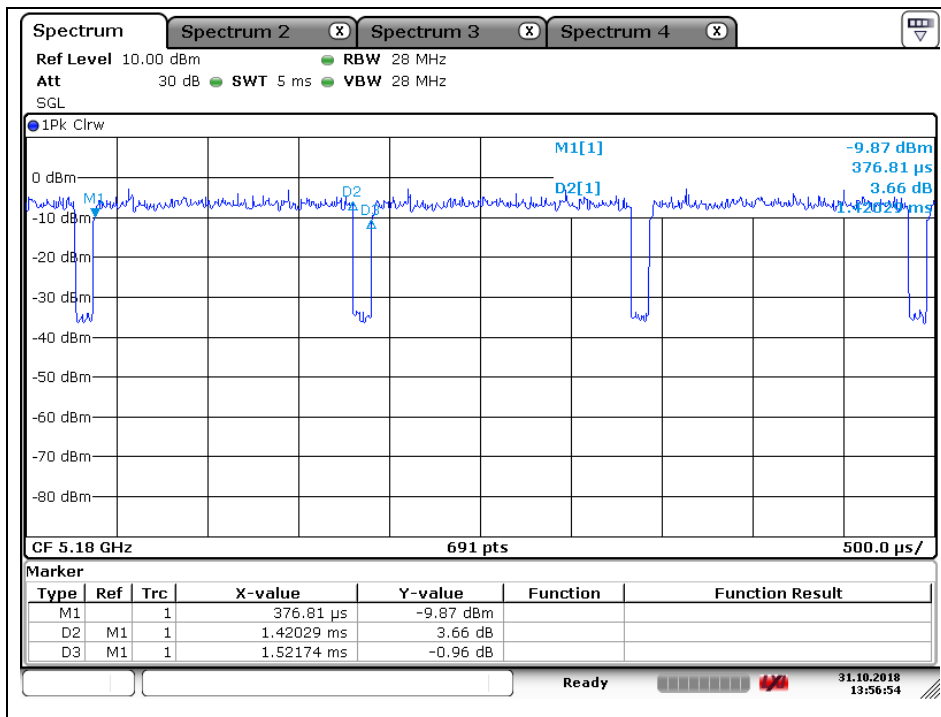
Mode	Data Rate (Mbps)	Mode	Data Rate (Mbps)	Mode	Data Rate (Mbps)	Mode	Data Rate (Mbps)
11a	6	11n_HT20	MCS0	11n_HT40	MCS0	11ac_VHT80	MCS0
Duty Cycle (%)	93	Duty Cycle (%)	93	Duty Cycle (%)	87	Duty Cycle (%)	77
Correction factor (dB)	0.32	Correction factor (dB)	0.32	Correction factor (dB)	0.60	Correction factor (dB)	1.14

Remark;

1. As measured duty cycles of EUT, all of mode and data rate keep constant period and are converted to log scale (power averaging) to compensate correction factor to result of average test items.
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (dB) = 10 log (1 / Duty cycle)

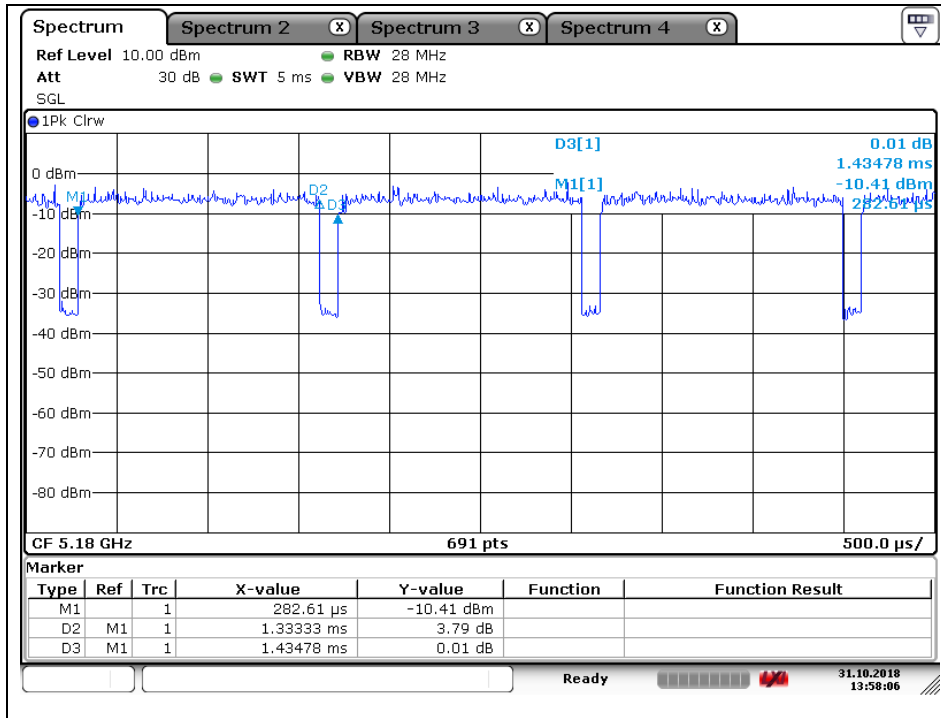
- Test plots

802.11a

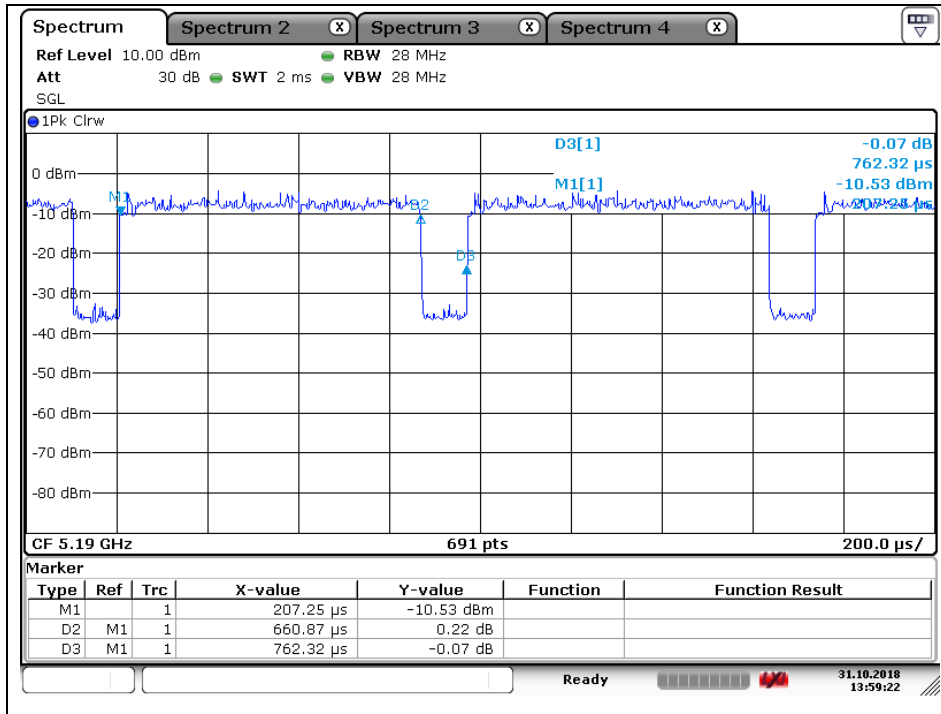


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802.11n_HT20

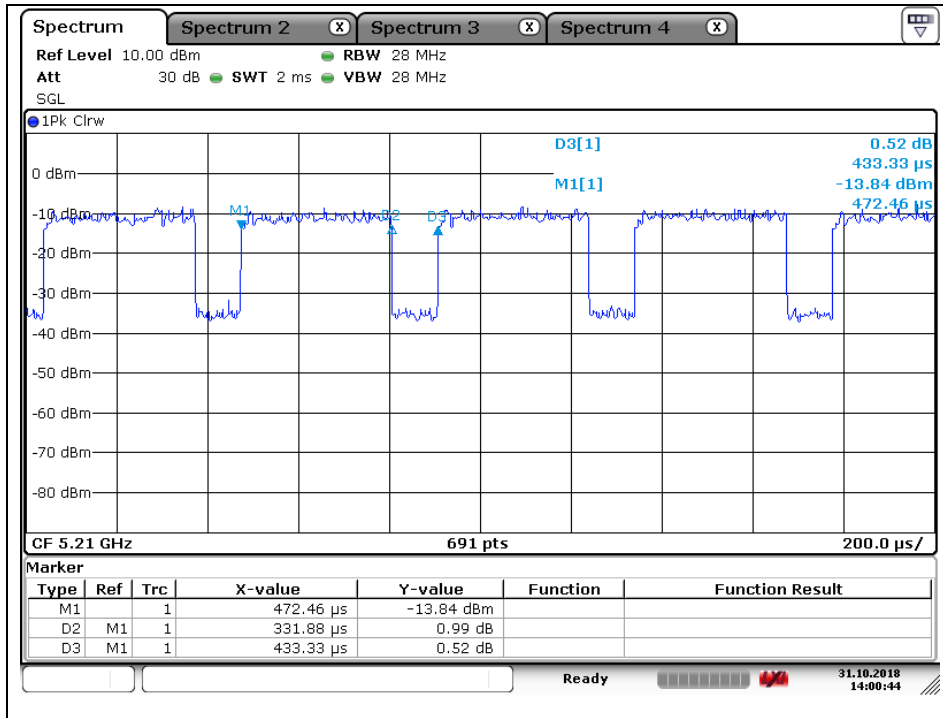


802.11n_HT40



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802.11ac_VHT80



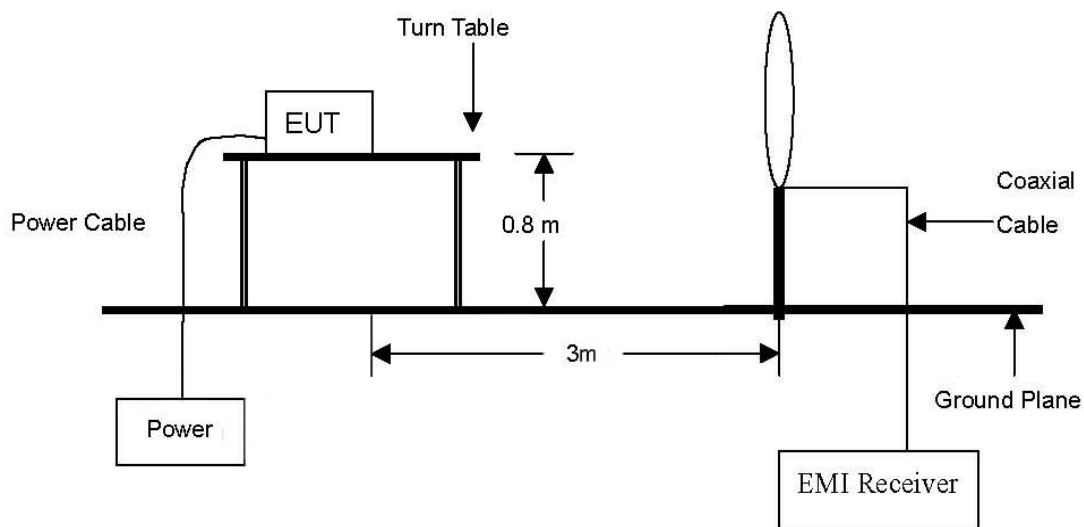
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2. Transmitter Radiated Spurious Emissions

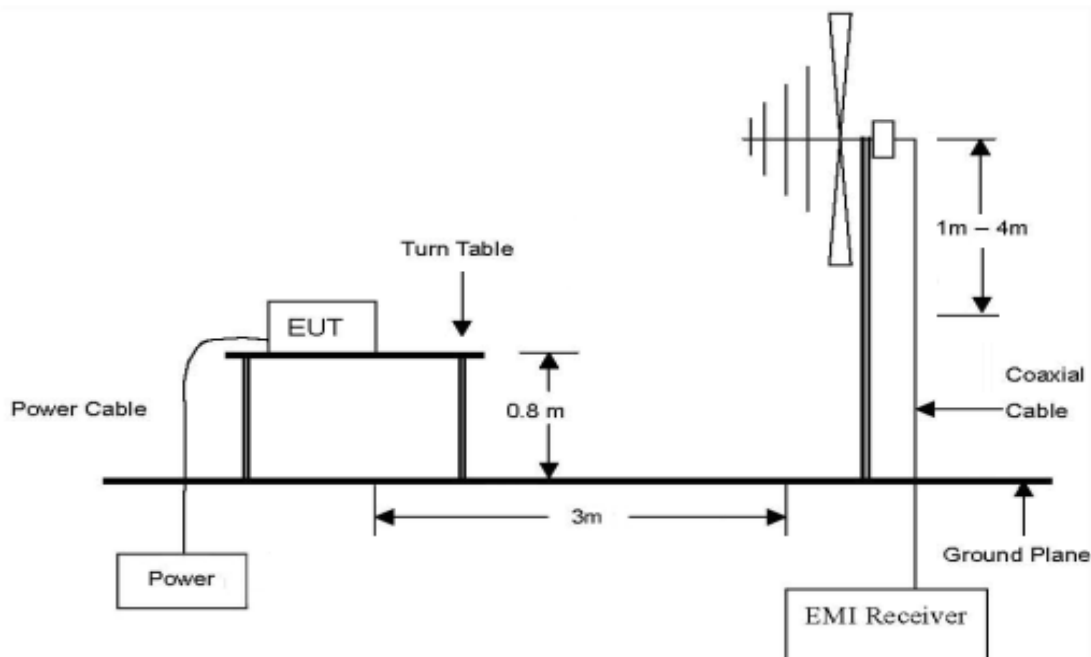
2.1. Test Setup

2.1.1. Transmitter radiated spurious emissions

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz emissions.

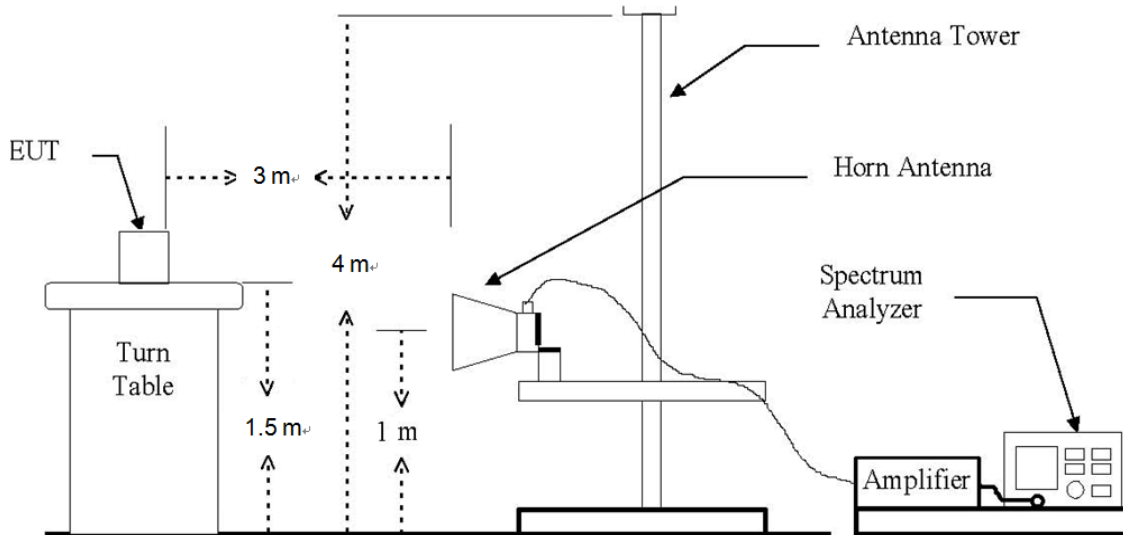


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



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The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated from 1 GHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



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2.2. Limit

2.2.1. FCC

According to § 15.407(b)

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dB m/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dB m/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dB m/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of -27 dB m/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dB m/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dB m/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dB m/MHz at the band edge.

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measurement Distance (Meters)
0.009-0.490	2 400/F(kHz)	300
0.490-1.705	24 000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

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2.2.2. IC

According to RSS-247 issue2,

6.2.1.2 Frequency band 5 150-5 250 MHz

For transmitters with operating frequencies in the band 5 150-5 250 MHz, all emissions outside the band 5 150-5 350 MHz shall not exceed -27 dB m/MHz e.i.r.p. Any unwanted emissions that fall into the band 5 250-5 350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5 % of the occupied bandwidth (i.e. 99% bandwidth), above 5 250 MHz. The 26 dB bandwidth may fall into the 5 250-5 350 MHz band; however, if the occupied bandwidth also falls within the 5 250- 5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5 250-5 350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5 250-5 350 MHz band.

6.2.2.2 Frequency band 5 250-5 350 MHz

Devices shall comply with the following:

a) All emissions outside the band 5 250-5 350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or

b) All emissions outside the band 5 150-5 350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5 150-5 250 MHz. The device, except devices installed in vehicles, shall be labelled or include in the user manual the following text “for indoor use only.”

6.2.3.2 Frequency band 5 470-5 600 MHz and 5 650-5 725 MHz

Emissions outside the band 5 470-5 725 MHz shall not exceed -27 dB m/MHz e.i.r.p. However, devices with bandwidth overlapping the band edge of 5 725 MHz can meet the emission limit of -27 dB m/MHz e.i.r.p. at 5 850 MHz instead of 5 725 MHz.

6.2.4.2 Frequency band 5 725-5 850 MHz

Devices operating in the band 5 725-5 850 MHz with antenna gain greater than 10 dBi can have unwanted emissions that comply with either the limits in this section or in section 5.5 until six (6) months after the publication date of this standard for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2018.

Devices operating in the band 5 725-5 850 MHz with antenna gain of 10 dBi or less can have unwanted emissions that comply with either the limits in this section or in section 5.5 until April 1, 2018 for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2020.

Devices operating in the band 5 725-5 850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;

b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;

c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and

d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

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2.3. Test Procedures

Radiated spurious emissions from the EUT were measured according to the dictates in section G of KDB 789033 D02 v02r01 and ANSI C63.10-2013.

2.3.1. Test Procedures for emission below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from above 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 GHz and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

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Note;

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

- II.G.4. Unwanted emissions measurements below 1 GHz.

Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

- II.G.5. Unwanted maximum emissions measurements above 1 GHz.

Peak emission levels are measured by setting the analyzer as follows:

Set to RBW = 1 MHz, VBW ≥ 3 MHz, Detector = Peak, Sweep time = auto, Trace mode = Max hold.

- II.G.6. Average unwanted emissions measurements above 1 GHz.

Set to RBW = 1 MHz, VBW ≥ 3 MHz, Detector = power averaging (rms), Averaging type = power averaging (rms), Sweep time = auto, Perform a trace average of at least 100 traces. If the transmission is continuous, if the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 % duty cycle, at least 200 traces shall be averaged.

If tests are performed with the EUT transmitting at a duty cycle less than 98 %, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 % duty cycle. The correction factor is computed as follows:

- If power averaging (rms) mode was used in II.G.6.c)(iv), the correction factor is $10 \log(1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50 %, then 3 dB must be added to the measured emission levels.

- Definition of the test orthogonal plan for EUT was described in the test setup photo.

The test orthogonal plan of EUT is **X – axis** during radiation test.

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2.4. Test result

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

2.4.1. Radiated Spurious Emission below 1 000 MHz

The frequency spectrum from 9 kHz to 1 000 MHz was investigated. All reading values are peak values.

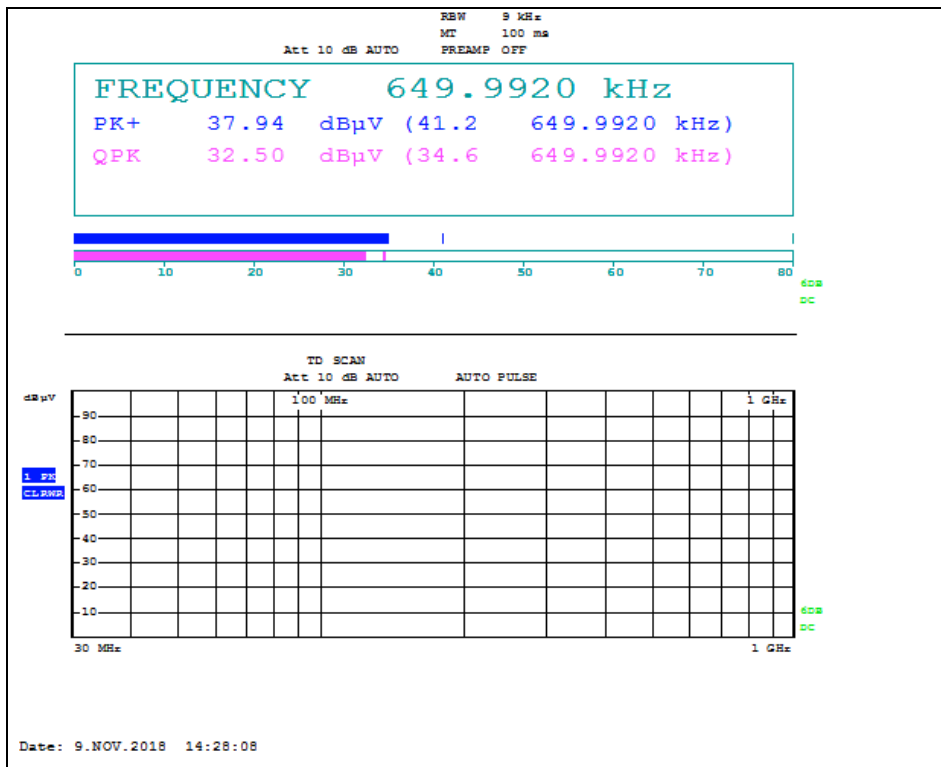
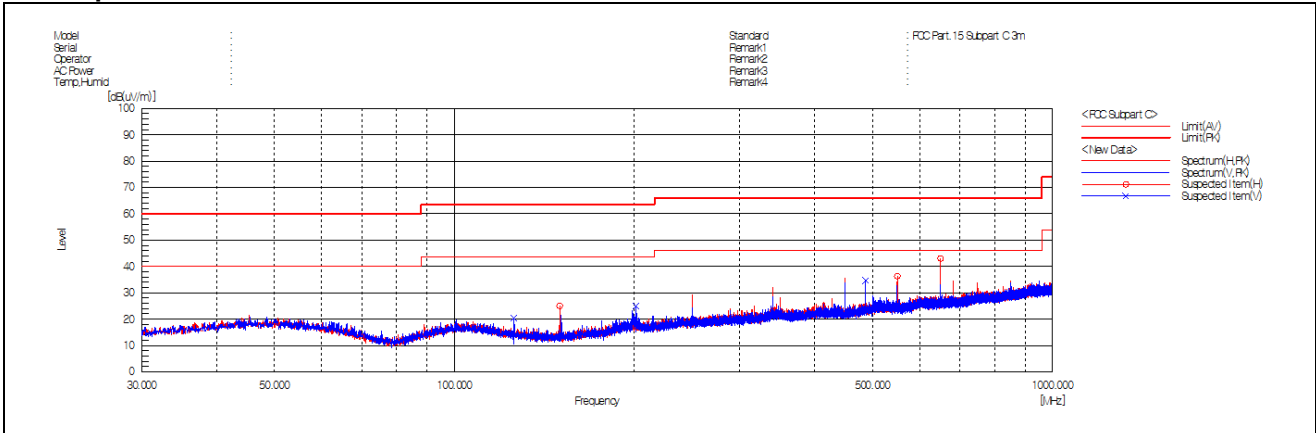
Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
150.00	42.40	Peak	H	8.20	-25.46	25.14	43.50	18.36
201.21	38.70	Peak	V	11.18	-25.36	24.52	43.50	18.98
486.71	42.30	Peak	V	17.13	-24.66	34.77	46.00	11.23
550.00	43.00	Peak	H	17.90	-24.47	36.43	46.00	9.57
649.99	34.60	Quasi-Peak	H	19.50	-24.03	30.07	46.00	15.93
Above 700.00	Not detected	-	-	-	-	-	-	-

Remark;

- Spurious emissions for all channels and modes were investigated and almost the same below 1 GHz.
- Reported spurious emissions are in **11a (Band 1) / 6Mbps / High channel** as worst case among other modes.
- Radiated spurious emission measurement as below.
(Actual = Reading + AF + AMP + CL)
- According to §15.31(o), emission levels are not report much lower than the limits by over 20 dB.

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- Test plots



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2.4.2. Radiated Spurious Emission above 1 000 MHz

802.11a (Band 1)_6 Mbps

A. Low Channel (5 180 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 541.84	42.61	Peak	V	39.70	-21.66	-	60.65	74.00	13.35
*15 537.04	27.01	Average	V	39.70	-21.68	0.32	45.35	54.00	8.65
Above 15 600.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 220 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 659.28	39.50	Peak	V	39.84	-21.58	-	57.76	74.00	16.24
*15 662.16	24.53	Average	V	39.85	-21.58	0.32	43.12	54.00	10.88
Above 15 700.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 240 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 724.88	39.87	Peak	V	40.05	-21.52	-	58.40	74.00	15.60
*15 724.32	25.39	Average	V	40.05	-21.52	0.32	44.24	54.00	9.76
Above 15 800.00	Not detected	-	-	-	-	-	-	-	-

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802.11a (Band 2A)_6 Mbps

A. Low Channel (5 260 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 776.40	42.69	Peak	V	40.15	-21.48	-	61.36	74.00	12.64
*15 780.70	27.31	Average	V	40.16	-21.48	0.32	46.31	54.00	7.69
Above 15 800.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 300 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 902.60	42.62	Peak	V	40.11	-21.38	-	61.35	74.00	12.65
*15 900.90	27.71	Average	V	40.10	-21.38	0.32	46.75	54.00	7.25
Above 16 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 320 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 961.30	43.29	Peak	V	32.09	-21.34	-	54.04	74.00	19.96
*15 957.90	27.07	Average	V	34.53	-21.34	0.32	40.58	54.00	13.42
Above 16 000.00	Not detected	-	-	-	-	-	-	-	-

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802.11a (Band 2C)_6 Mbps

A. Low Channel (5 500 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
16 501.50	42.16	Peak	V	41.60	-20.49	-	63.27	68.23	4.96
Above 16 600.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 580 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
16 732.00	42.50	Peak	V	41.63	-20.17	-	63.96	68.23	4.27
Above 16 800.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 720 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 161.50	40.67	Peak	V	42.22	-19.49	-	63.40	68.23	4.83
Above 17 200.00	Not detected	-	-	-	-	-	-	-	-

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802.11a (Band 3)_6 Mbps

A. Low Channel (5 745 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 236.30	39.96	Peak	V	42.30	-19.34	-	62.92	68.23	5.31
Above 17 300.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 357.00	40.62	Peak	V	42.56	-19.12	-	64.06	68.23	4.17
Above 17 400.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 825 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 476.60	38.58	Peak	V	43.21	-18.89	-	62.90	68.23	5.33
Above 17 500.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT20 (Band 1)_MCS0

A. Low Channel (5 180 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 535.20	43.02	Peak	V	39.70	-21.68	-	61.04	74.00	12.96
*15 537.28	26.84	Average	V	39.70	-21.68	0.32	45.18	54.00	8.82
Above 15 600.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 200 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 660.32	41.11	Peak	V	39.84	-21.58	-	59.37	74.00	14.63
*15 664.32	23.81	Average	V	39.86	-21.56	0.32	42.43	54.00	11.57
Above 15 700.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 240 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 719.60	42.52	Peak	V	40.04	-21.52	-	61.04	74.00	12.96
*15 720.72	24.80	Average	V	40.04	-21.52	0.32	43.64	54.00	10.36
Above 15 800.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT20 (Band 2A)_MCS0

A. Low Channel (5 260 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 769.70	44.70	Peak	V	40.14	-21.48	-	63.36	74.00	10.64
*15 778.40	27.27	Average	V	40.16	-21.48	0.32	46.27	54.00	7.73
Above 15 800.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 300 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 894.10	44.00	Peak	V	40.10	-21.38	-	62.72	74.00	11.28
*15 900.10	26.92	Average	V	40.10	-21.38	0.32	45.96	54.00	8.04
Above 16 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 320 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 954.30	44.78	Peak	V	37.11	-21.34	-	60.55	74.00	13.45
*15 954.90	26.71	Average	V	36.68	-21.34	0.32	42.37	54.00	11.63
Above 16 000.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT20 (Band 2C)_MCS0

A. Low Channel (5 500 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
16 495.30	43.57	Peak	V	41.60	-20.49	-	64.68	68.23	3.55
Above 16 500.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 580 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
16 733.10	43.18	Peak	V	41.63	-20.17	-	64.64	68.23	3.59
Above 16 800.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 720 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 153.10	40.70	Peak	V	42.21	-19.50	-	63.41	68.23	4.82
Above 17 200.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT20 (Band 3)_MCS0

A. Low Channel (5 745 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 232.60	39.41	Peak	V	42.30	-19.35	-	62.36	68.23	5.87
Above 17 300.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 351.10	41.53	Peak	V	42.51	-19.13	-	64.91	68.23	3.32
Above 17 400.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 825 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 468.20	38.98	Peak	V	43.17	-18.91	-	63.24	68.23	4.99
Above 17 500.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT40 (Band 1)_MCS0

A. Low Channel (5 190 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. High Channel (5 230 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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802. 11n_HT40 (Band 2A)_MCS0

A. Low Channel (5 270 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 801.60	40.73	Peak	V	40.20	-21.46	-	59.47	74.00	14.53
*15 806.25	24.52	Average	V	40.19	-21.46	0.60	43.85	54.00	10.15
Above 15 900.00	Not detected	-	-	-	-	-	-	-	-

B. High Channel (5 310 MHz)

Radiated Emissions			Ant.	Correction Factors				Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	Atten. (dB)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*5 350.00	49.31	Peak	V	33.70	6.17	-31.90	-	57.28	74.00	16.72
*5 350.00	36.01	Average	V	33.70	6.17	-31.90	0.60	44.58	54.00	9.42
*5 350.20	55.20	Peak	V	33.70	6.17	-31.90	-	63.17	74.00	10.83
*5 350.20	36.44	Average	V	33.70	6.17	-31.90	0.60	45.01	54.00	8.99

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*15 941.85	40.53	Peak	V	40.18	-21.34	-	59.37	74.00	14.63
*15 939.45	24.53	Average	V	40.18	-21.34	0.60	43.97	54.00	10.03
Above 16 000.00	Not detected	-	-	-	-	-	-	-	-

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802. 11n_HT40 (Band 2C)_MCS0

A. Low Channel (5 510 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
16 522.30	43.56	Peak	V	41.56	-20.46	-	64.66	68.23	3.57
Above 16 600.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 550 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
16 641.80	44.02	Peak	V	41.40	-20.29	-	65.13	68.23	3.10
Above 16 700.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 710 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 122.40	39.30	Peak	V	42.09	-19.56	-	61.83	68.23	6.40
Above 17 200.00	Not detected	-	-	-	-	-	-	-	-

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802.11n_HT40 (Band 3)_MCS0

A. Low Channel (5 755 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 257.40	35.60	Peak	V	42.31	-19.31	-	58.60	68.23	9.63
Above 17 300.00	Not detected	-	-	-	-	-	-	-	-

B. High Channel (5 795 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
17 376.80	37.73	Peak	V	42.71	-19.08	-	61.36	68.23	6.87
Above 17 400.00	Not detected	-	-	-	-	-	-	-	-

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802.11ac_VHT80 (Band 1)_MCS0

A. Low Channel (5 210 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

802.11ac_VHT80 (Band 2A)_MCS0

A. Middle Channel (5 290 MHz)

Radiated Emissions			Ant.	Correction Factors				Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	Atten. (dB)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*5 350.00	50.70	Peak	V	33.70	6.17	-31.90	-	58.67	74.00	15.33
*5 350.00	37.80	Average	V	33.70	6.17	-31.90	1.14	46.91	54.00	7.09
*5 353.14	53.51	Peak	V	33.69	6.17	-31.89	-	61.48	74.00	12.52
*5 353.77	38.96	Average	V	33.69	6.17	-31.89	1.14	48.07	54.00	5.93

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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802.11ac_VHT80 (Band 2C)_MCS0

A. Low Channel (5 530 MHz)

Radiated Emissions			Ant.	Correction Factors				Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	Atten. (dB)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
*5 459.34	51.91	Peak	V	33.74	6.17	-31.32	-	60.50	74.00	13.50
*5 458.90	37.87	Average	V	33.74	6.17	-31.32	1.14	47.60	54.00	6.40
*5 460.00	50.39	Peak	V	33.74	6.17	-31.32	-	58.98	74.00	15.02
*5 460.00	37.32	Average	V	33.74	6.17	-31.32	1.14	47.05	54.00	6.95

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
16 572.20	36.88	Peak	V	41.46	-20.39	-	57.95	68.23	10.28
Above 16 600.00	Not detected	-	-	-	-	-	-	-	-

B. High Channel (5 690 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

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802.11ac_VHT80 (Band 3)_MCS0

A. Middle Channel (5 775 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Duty (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

Remark;

1. “*” means the restricted band.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using Peak / average detector mode if frequency was in restricted band. Otherwise the frequency was out of restricted band, only peak detector should be used.
3. Band edge measurement.
(Actual = Reading + AF + Atten. + AMP + CL + Duty cycle)
4. Radiated spurious emission measurement.
(Actual = Reading + AF + AMP + CL + Duty cycle)
5. If frequency was out of restricted band, the calculation method for peak limit is same as below.
 $68.23 \text{ dB}\mu\text{V/m} = \text{EIRP} - 20 \log(d) + 104.77 = -27 - 20 \log(3) + 104.77$
6. In case of the emissions within $\pm 75 \text{ MHz}$ from band edge of band 3, limit should be adjusted to emission mask of 15.407(4)(i).
7. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 dB.
8. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.

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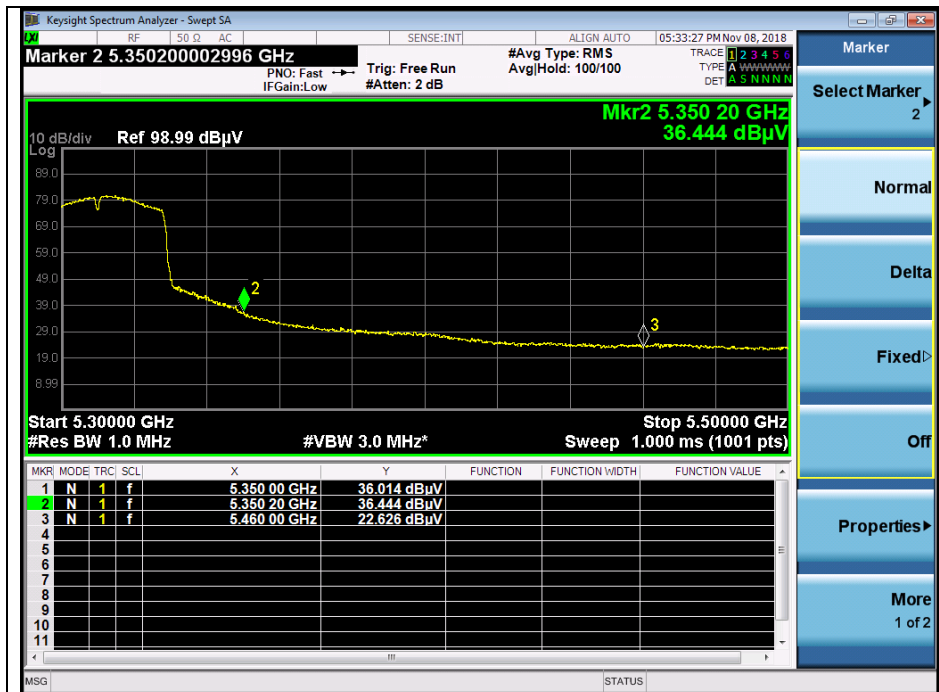
- Test plots

OFDM: 802.11n_HT40(MCS0)

High channel Band edge (Peak) - Band 2A



High channel Band edge (Average) - Band 2A



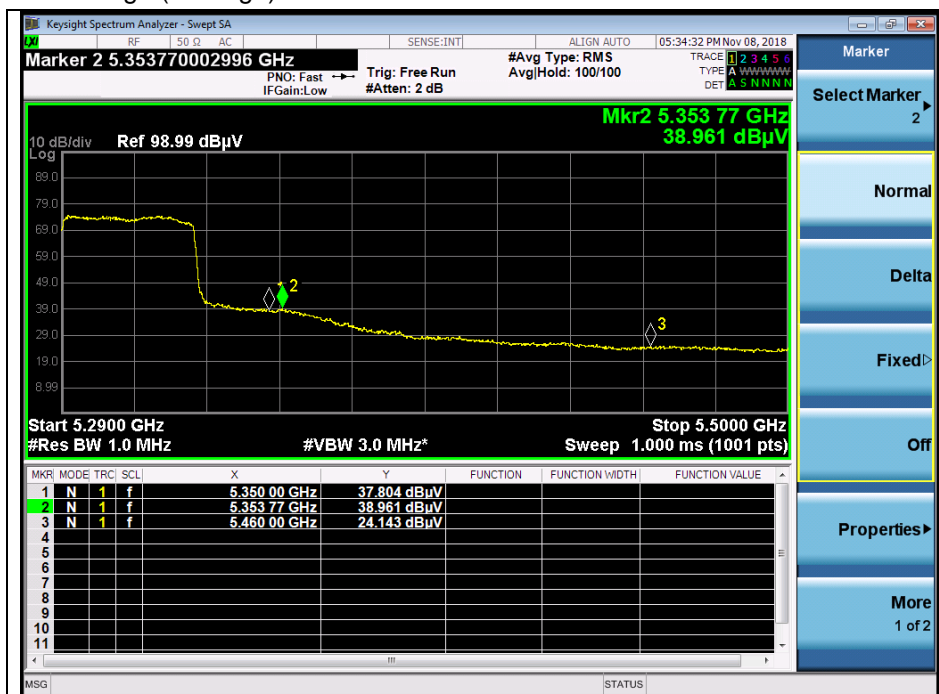
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OFDM: 802.11ac_VHT80(MCS0)

Middle channel Band edge (Peak) - Band 2A



Middle channel Band edge (Average) - Band 2A

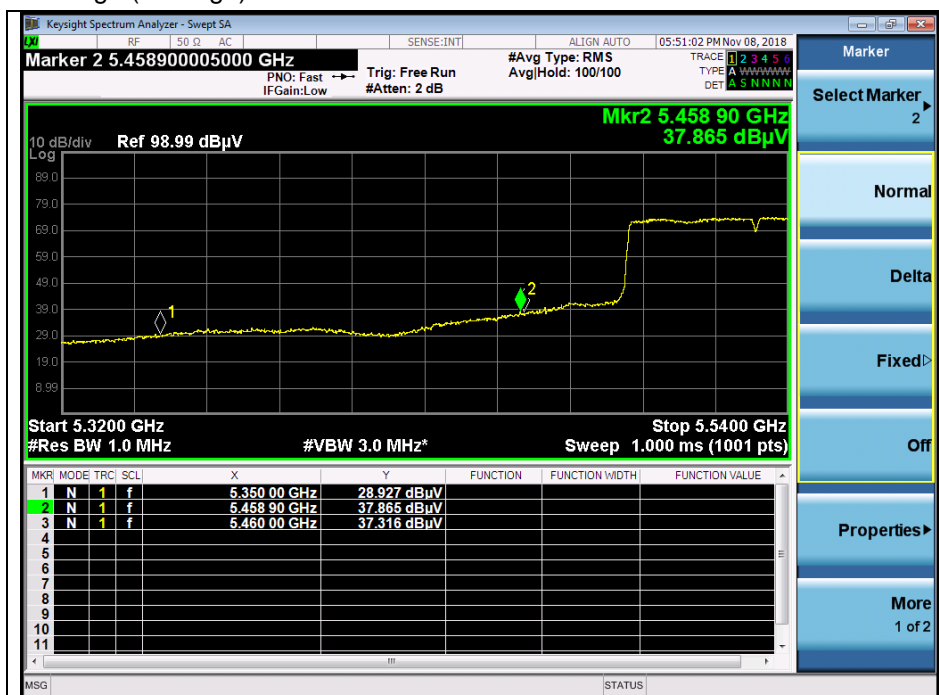


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Low channel Band edge (Peak) - Band 2C



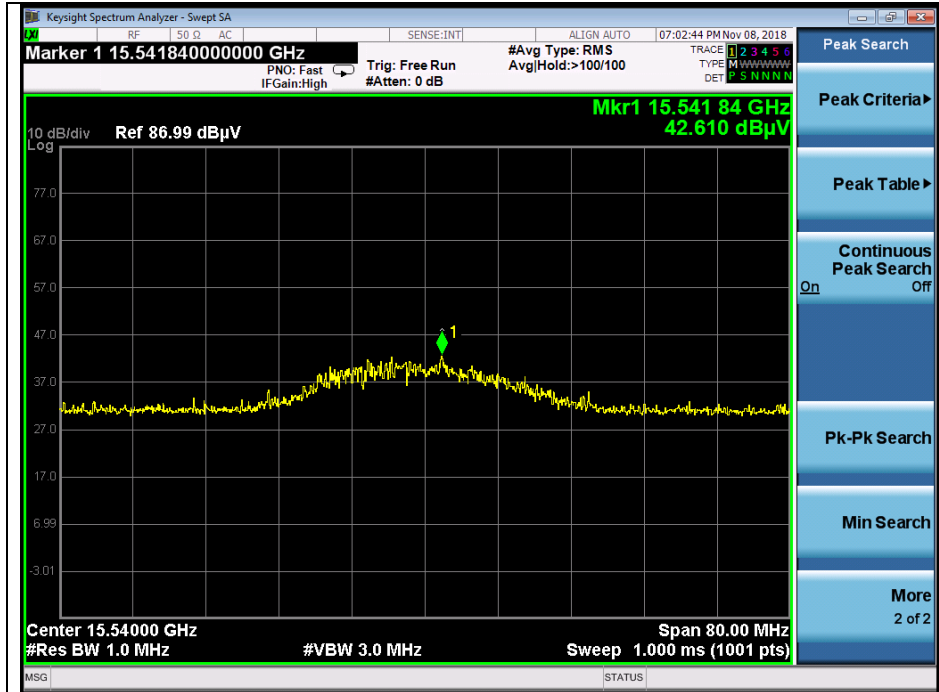
Low channel Band edge (Average) - Band 2C



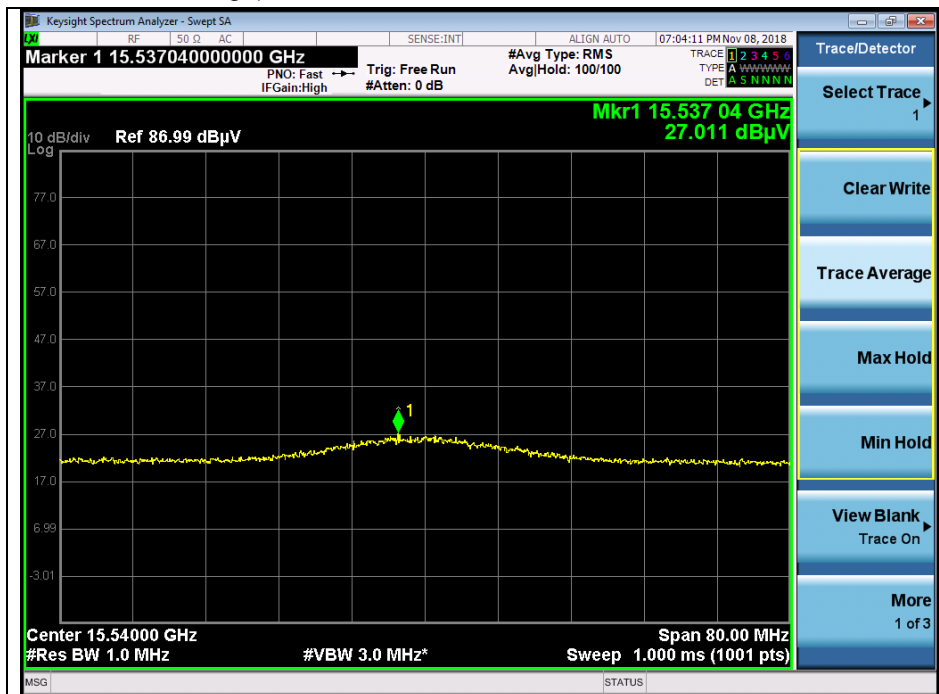
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OFDM: 802.11a(6 Mbps)

Low channel 3rd harmonic (Peak) - Band 1



Low channel 3rd harmonic (Average) - Band 1



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Middle channel 3rd harmonic (Peak) - Band 1

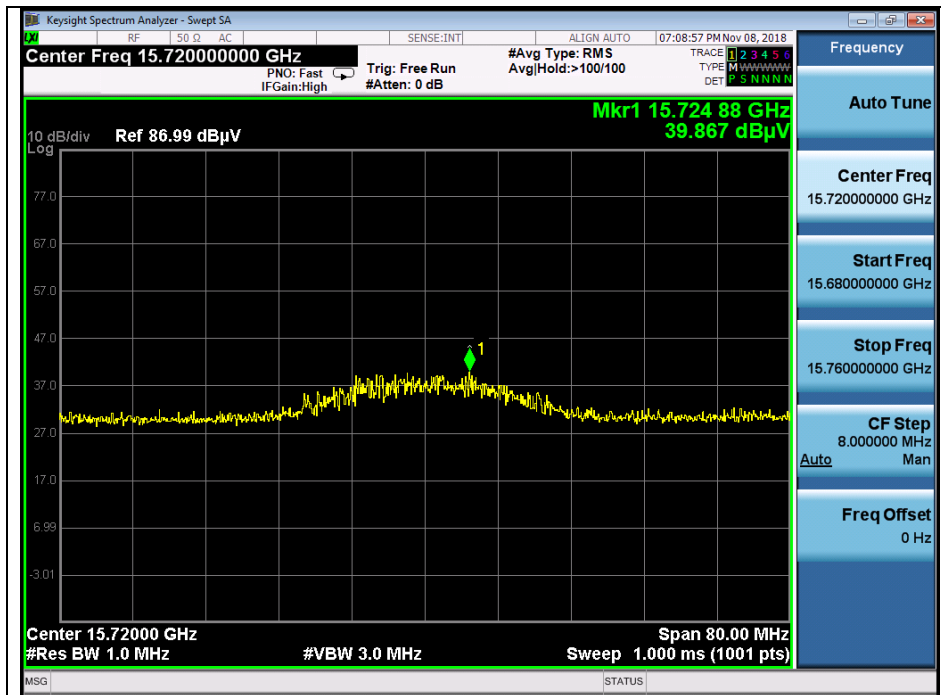


Middle channel 3rd harmonic (Average) - Band 1

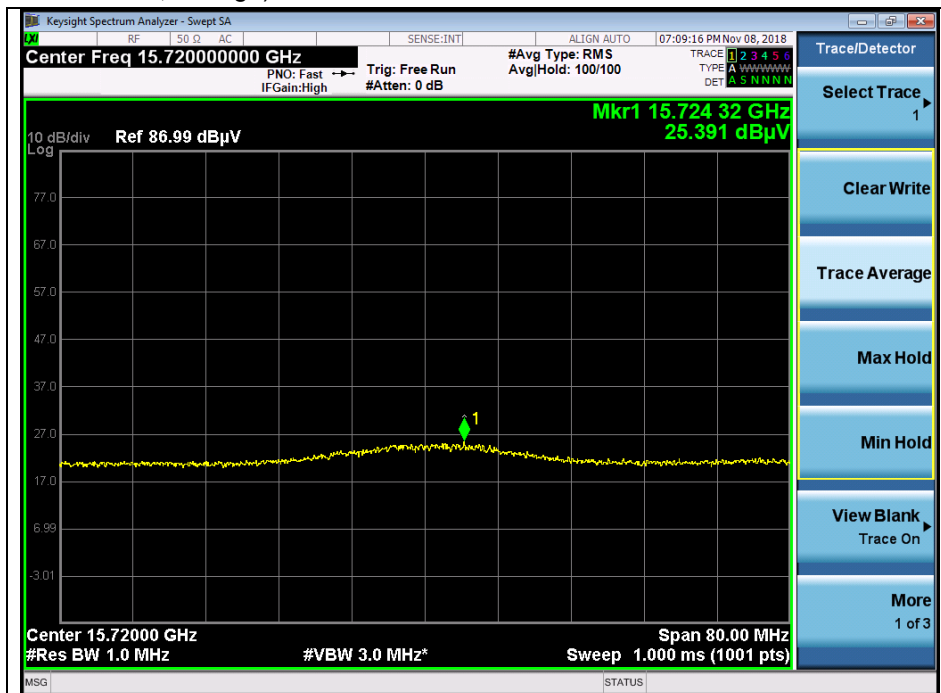


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High channel 3rd harmonic (Peak) - Band 1

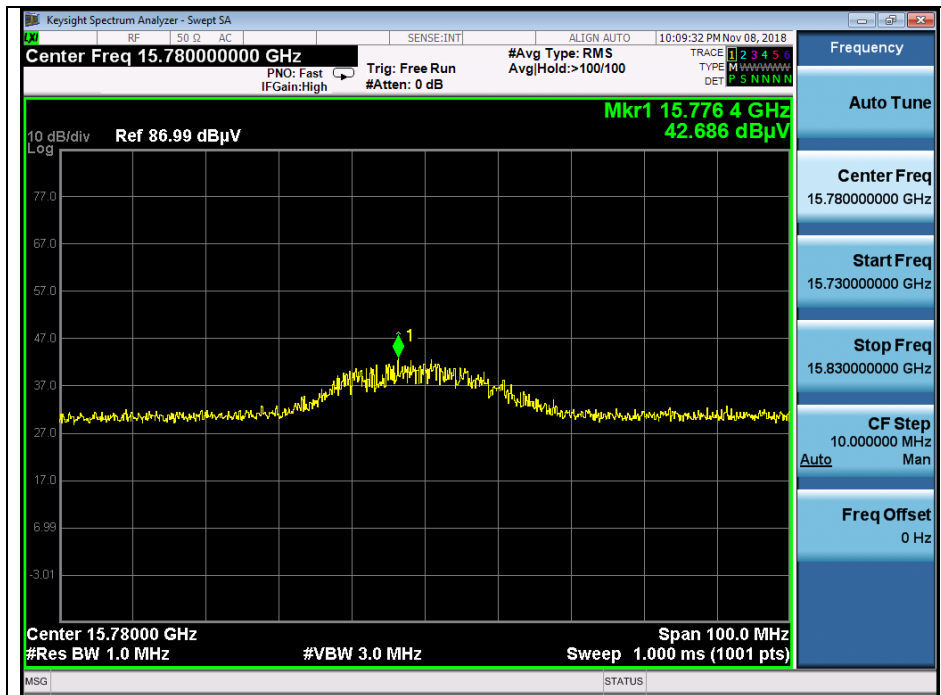


High channel 3rd harmonic (Average) - Band 1

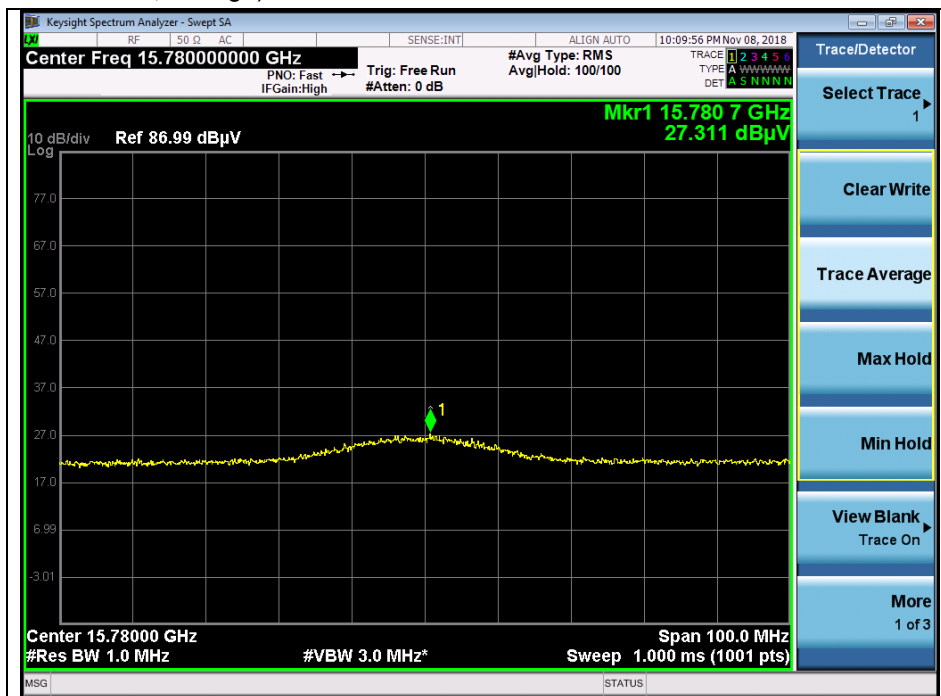


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Low channel 3rd harmonic (Peak) - Band 2A



Low channel 3rd harmonic (Average) - Band 2A

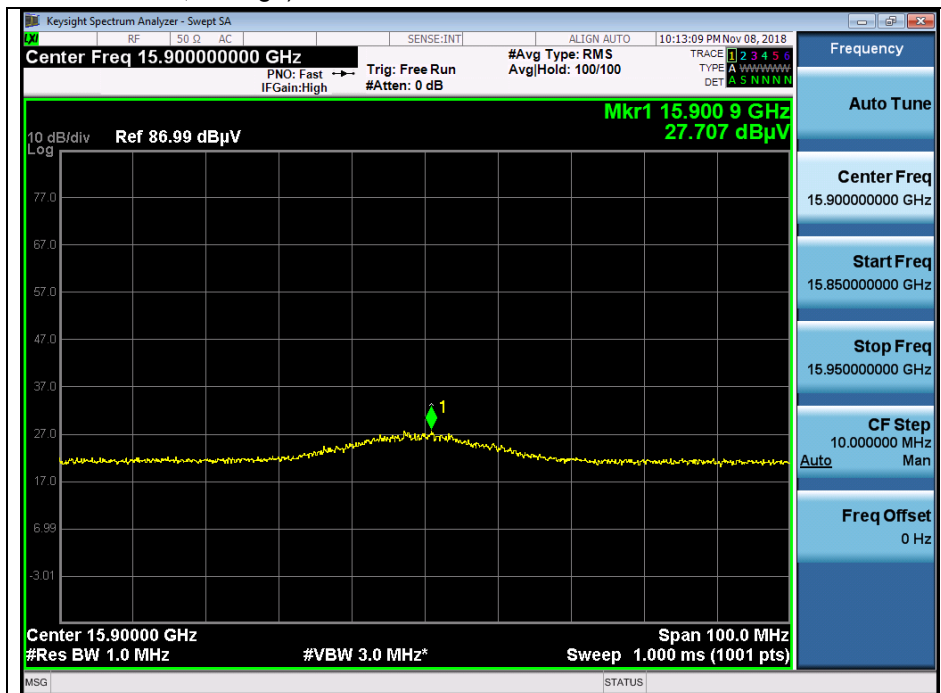


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Middle channel 3rd harmonic (Peak) - Band 2A



Middle channel 3rd harmonic (Average) - Band 2A

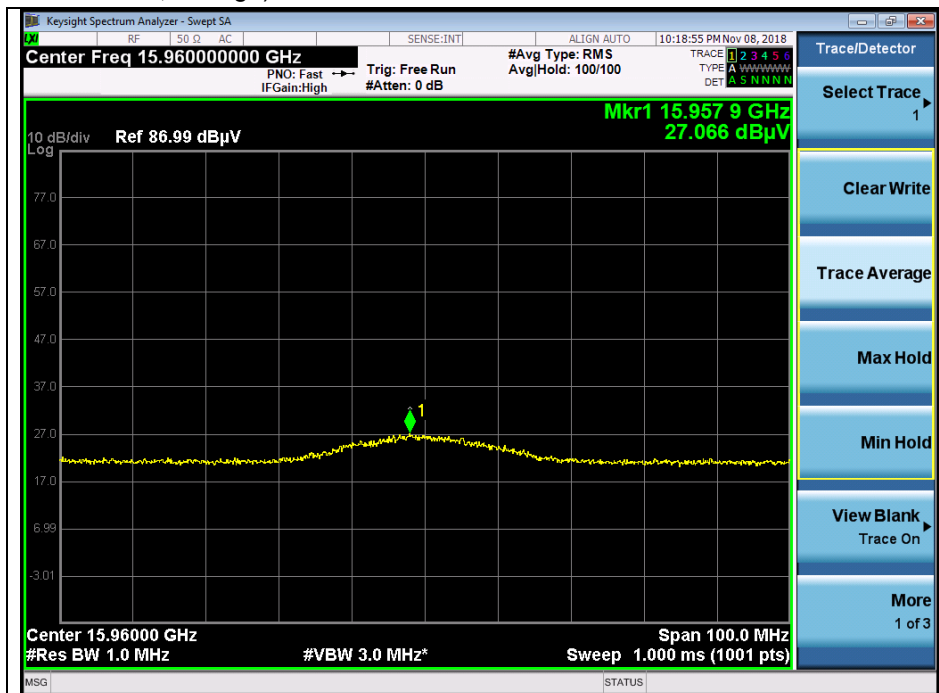


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High channel 3rd harmonic (Peak) - Band 2A

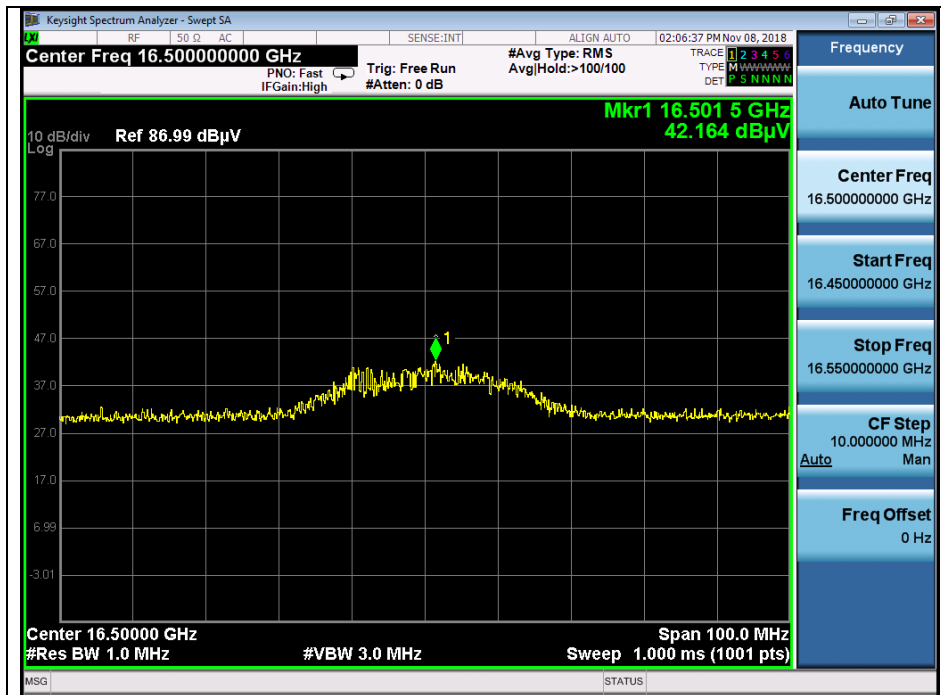


High channel 3rd harmonic (Average) - Band 2A

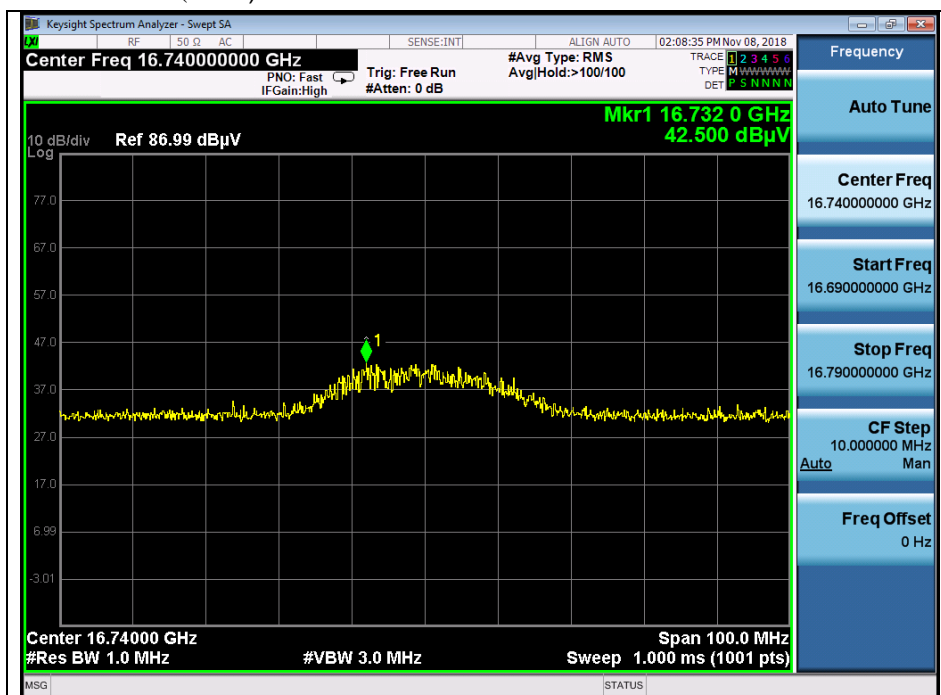


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Low channel 3rd harmonic (Peak) - Band 2C



Middle channel 3rd harmonic (Peak) - Band 2C

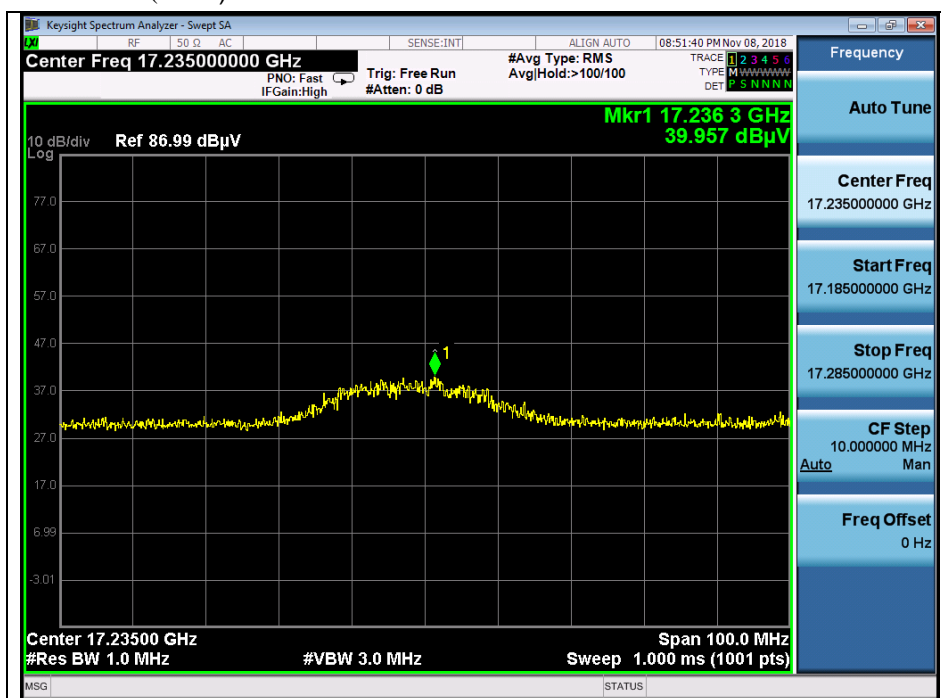


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High channel 3rd harmonic (Peak) - Band 2C

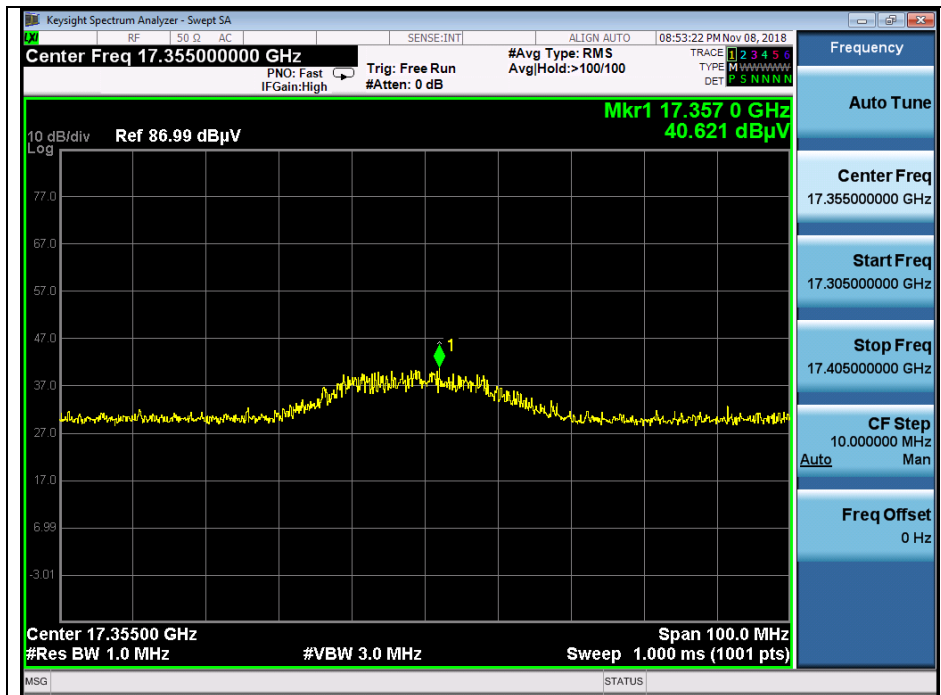


Low channel 3rd harmonic (Peak) - Band 3

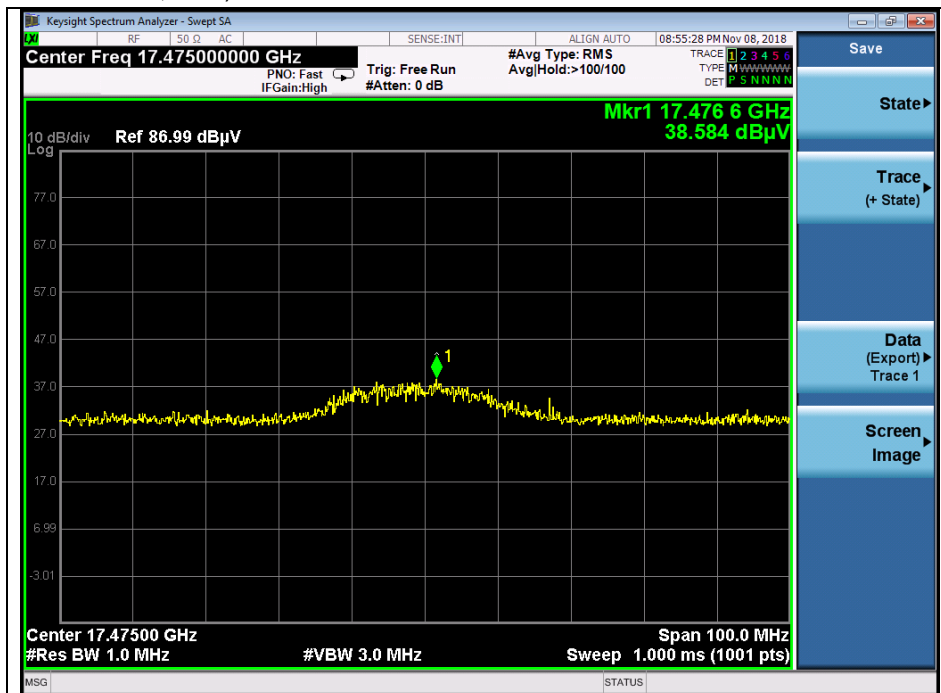


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Middle channel 3rd harmonic (Peak) - Band 3



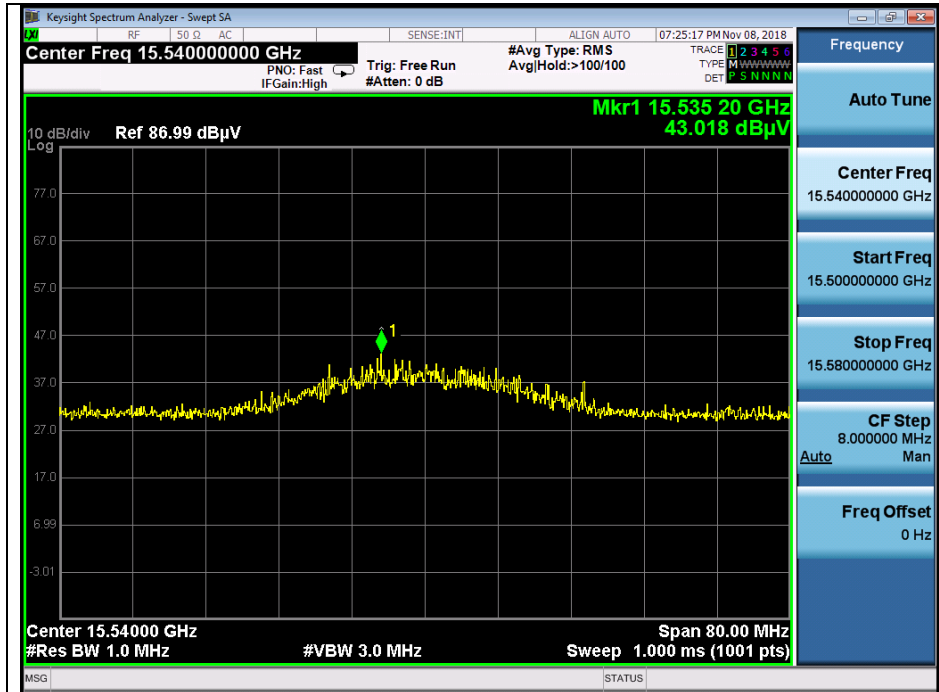
High channel 3rd harmonic (Peak) - Band 3



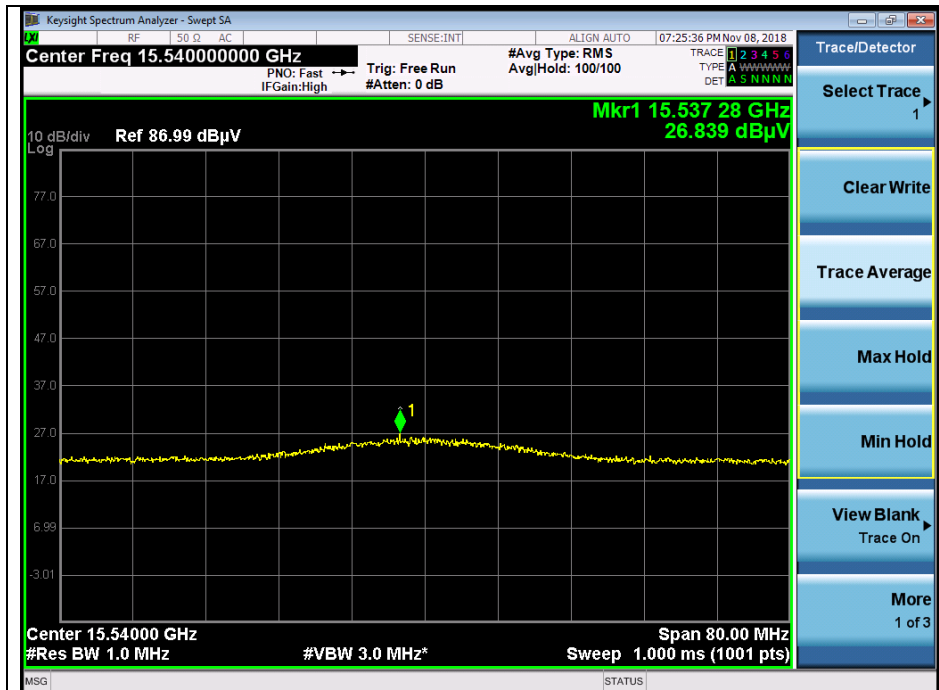
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OFDM: 802.11n_HT20(MCS0)

Low channel 3rd harmonic (Peak) - Band 1

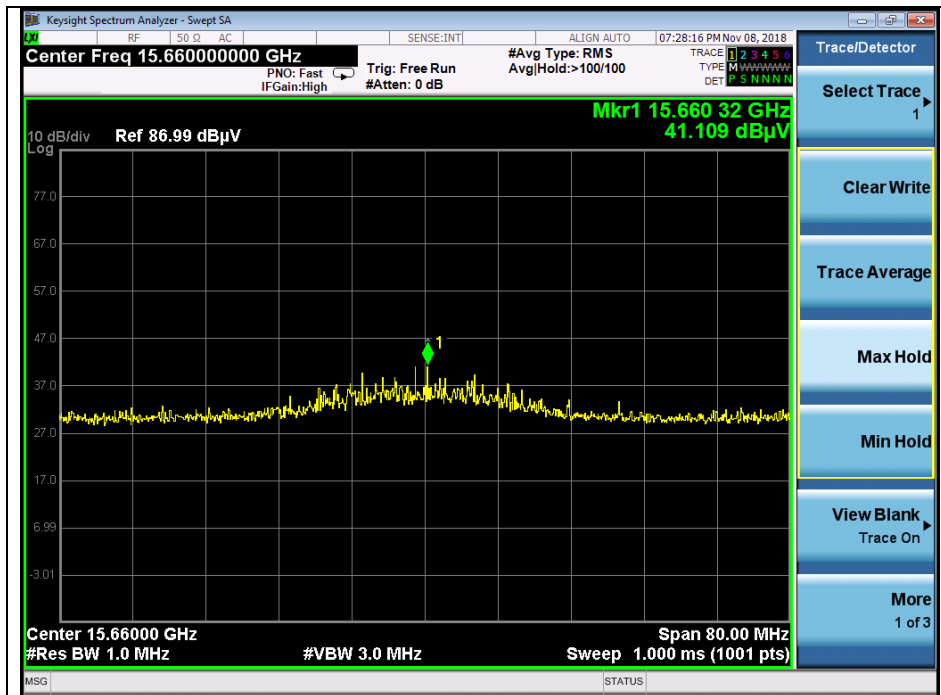


Low channel 3rd harmonic (Average) - Band 1

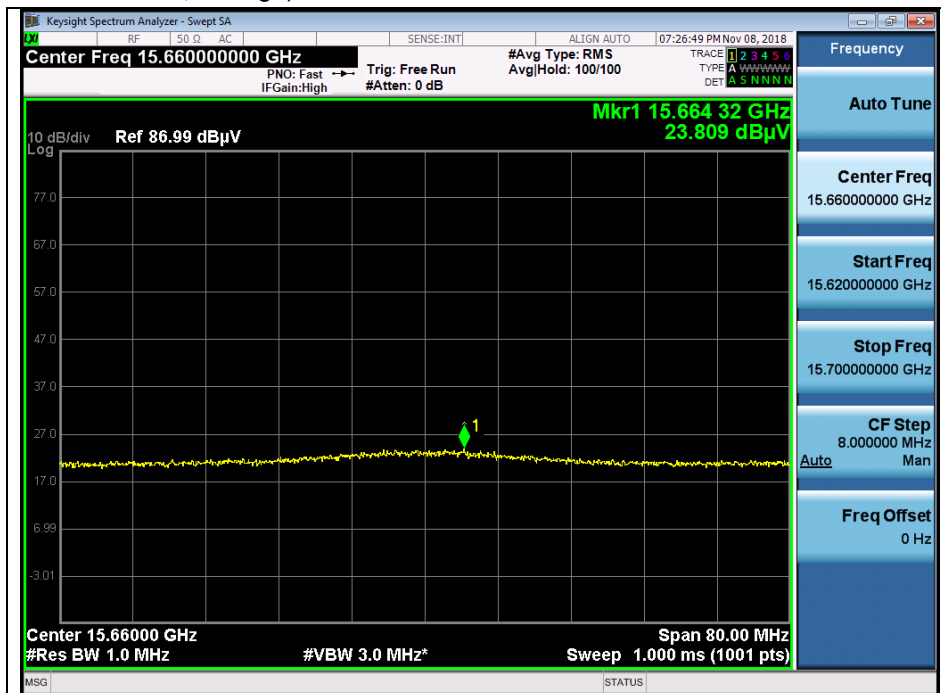


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Middle channel 3rd harmonic (Peak) - Band 1

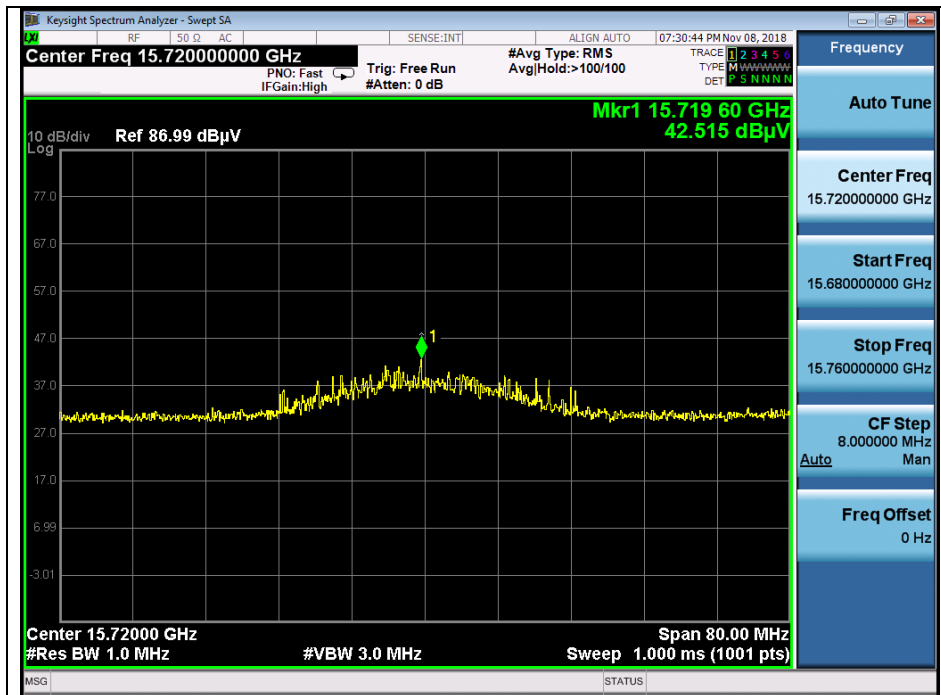


Middle channel 3rd harmonic (Average) - Band 1

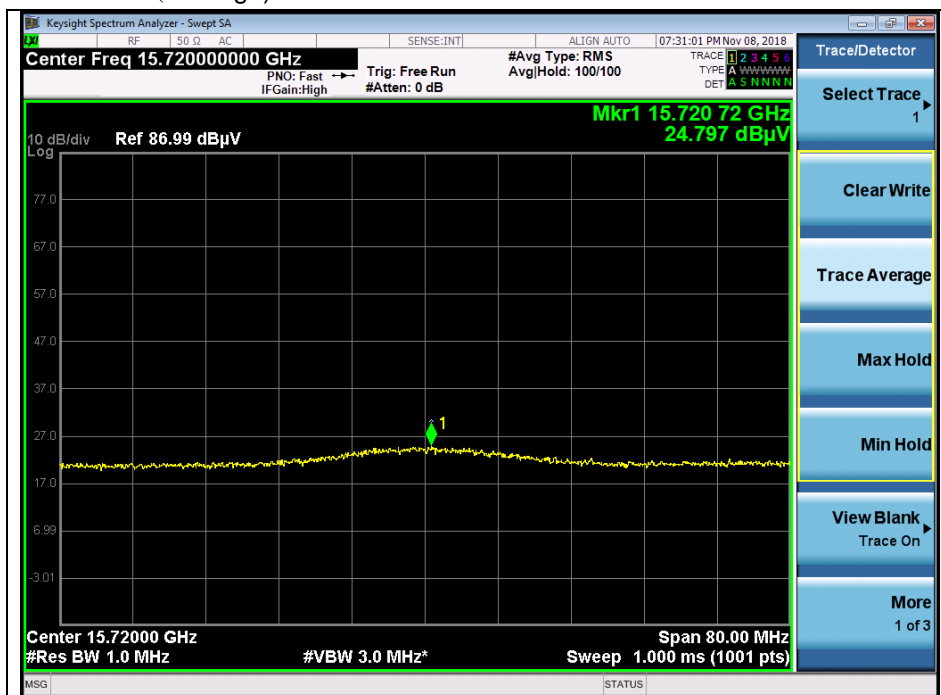


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High channel 3rd harmonic (Peak) - Band 1

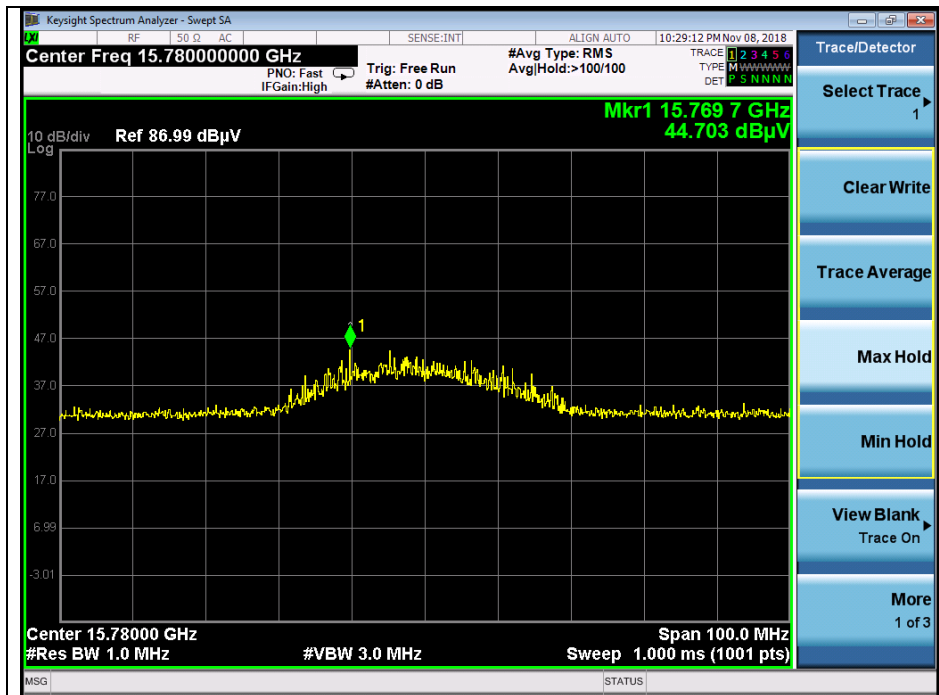


High channel 3rd harmonic (Average) - Band 1

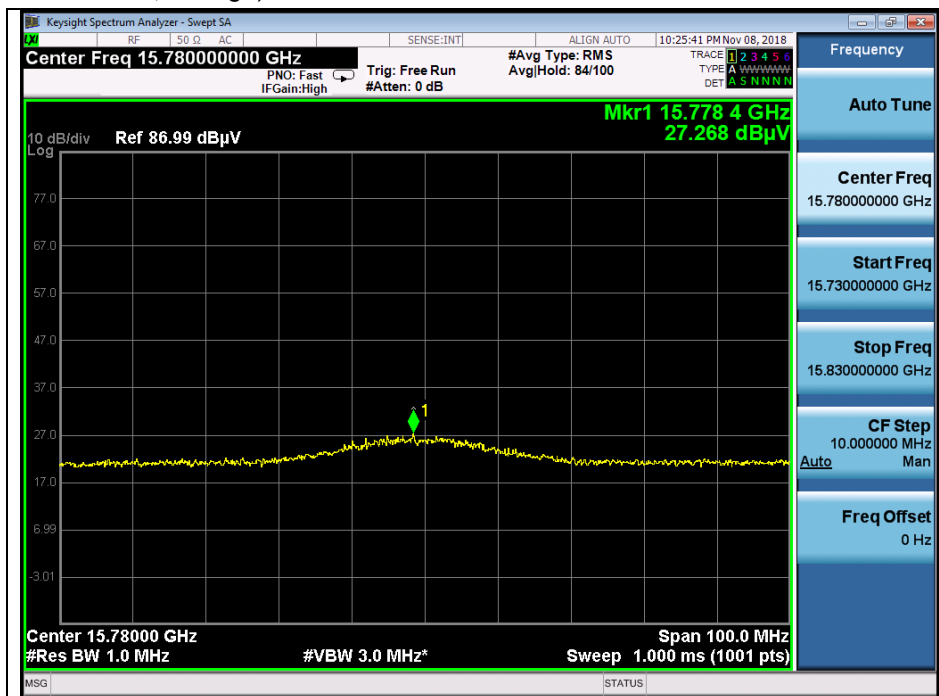


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Low channel 3rd harmonic (Peak) - Band 2A



Low channel 3rd harmonic (Average) - Band 2A

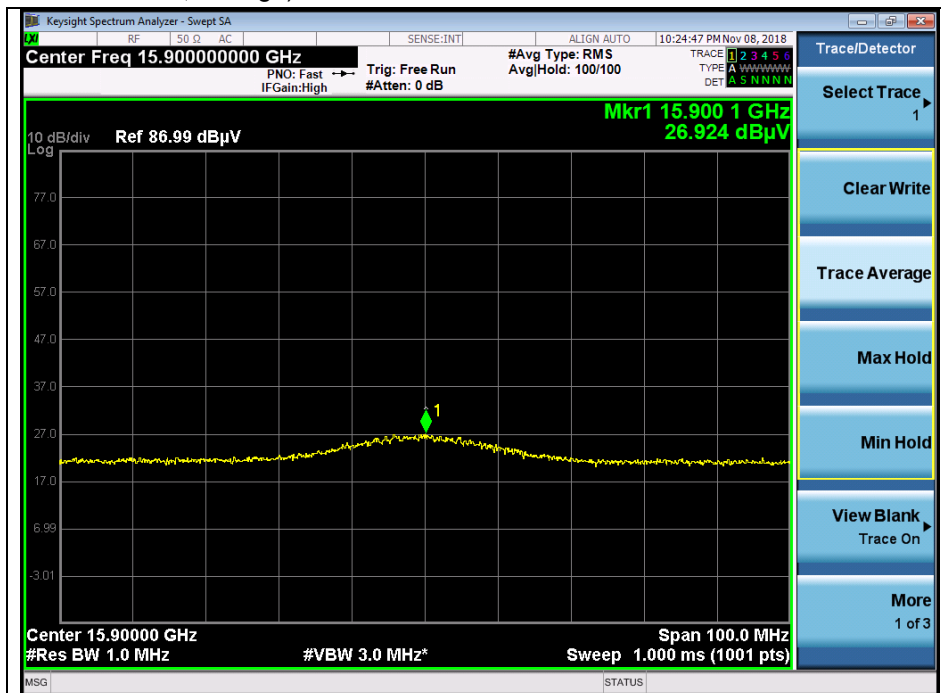


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Middle channel 3rd harmonic (Peak) - Band 2A

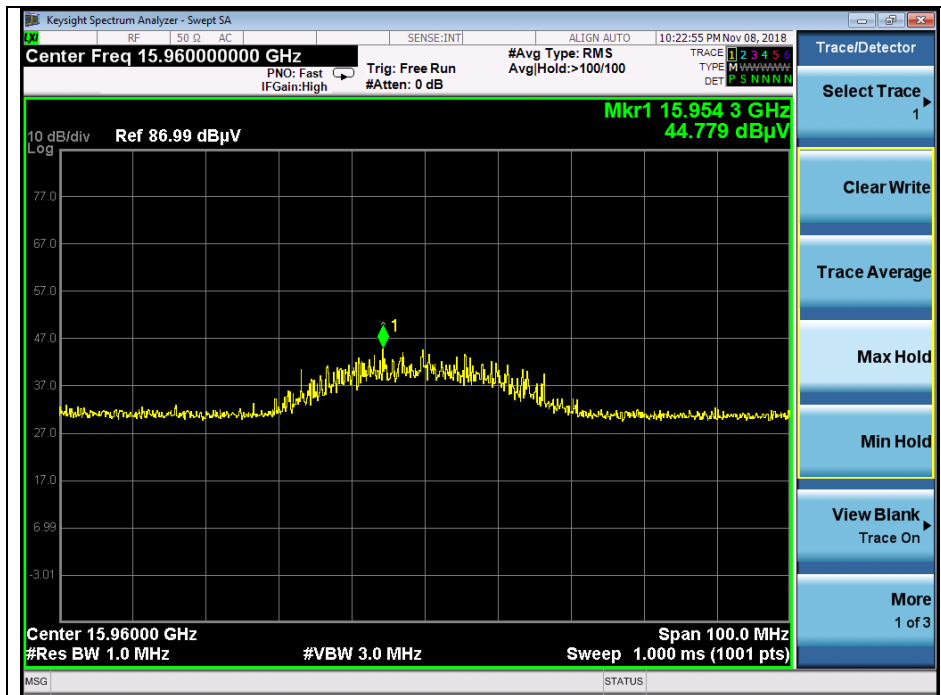


Middle channel 3rd harmonic (Average) - Band 2A



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High channel 3rd harmonic (Peak) - Band 2A

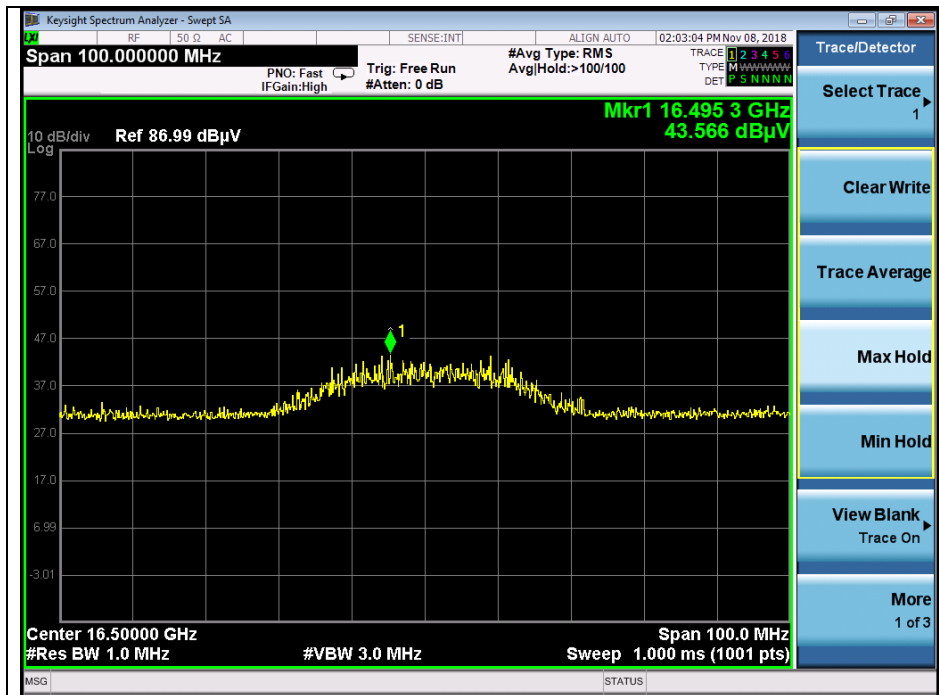


High channel 3rd harmonic (Average) - Band 2A

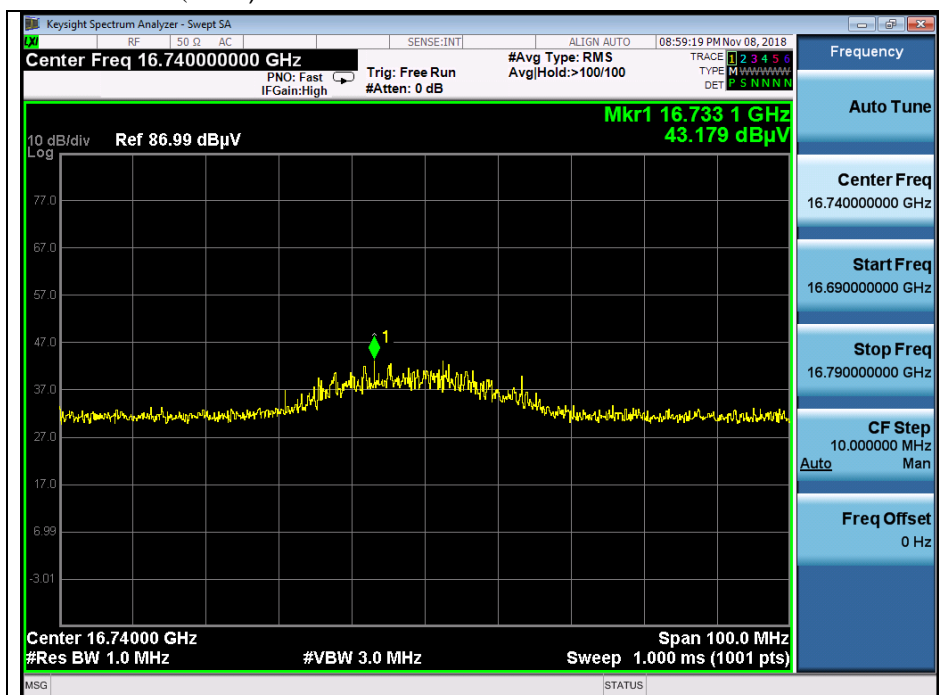


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Low channel 3rd harmonic (Peak) - Band 2C

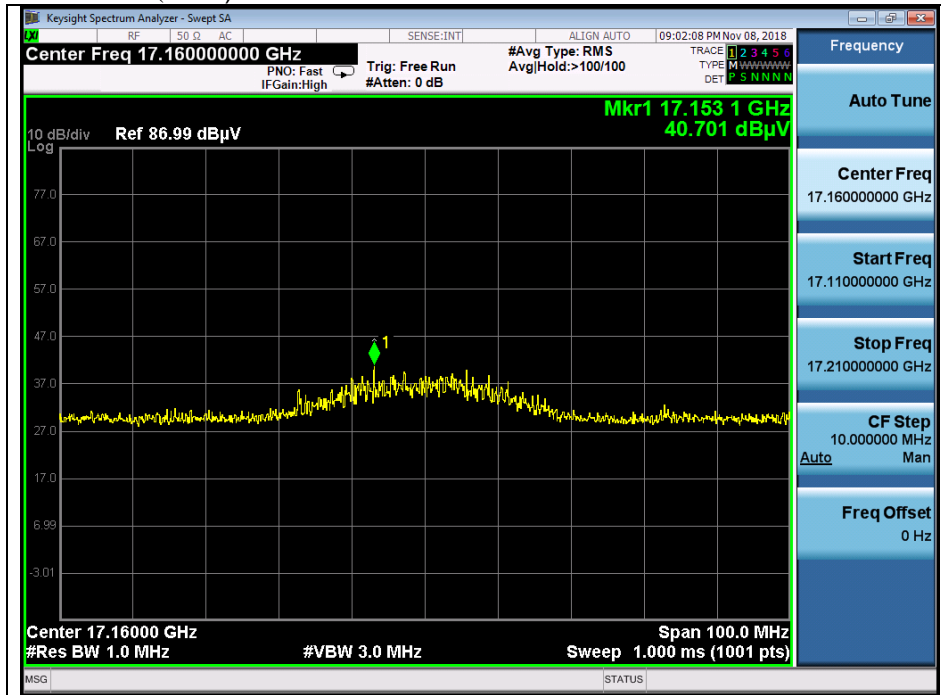


Middle channel 3rd harmonic (Peak) - Band 2C

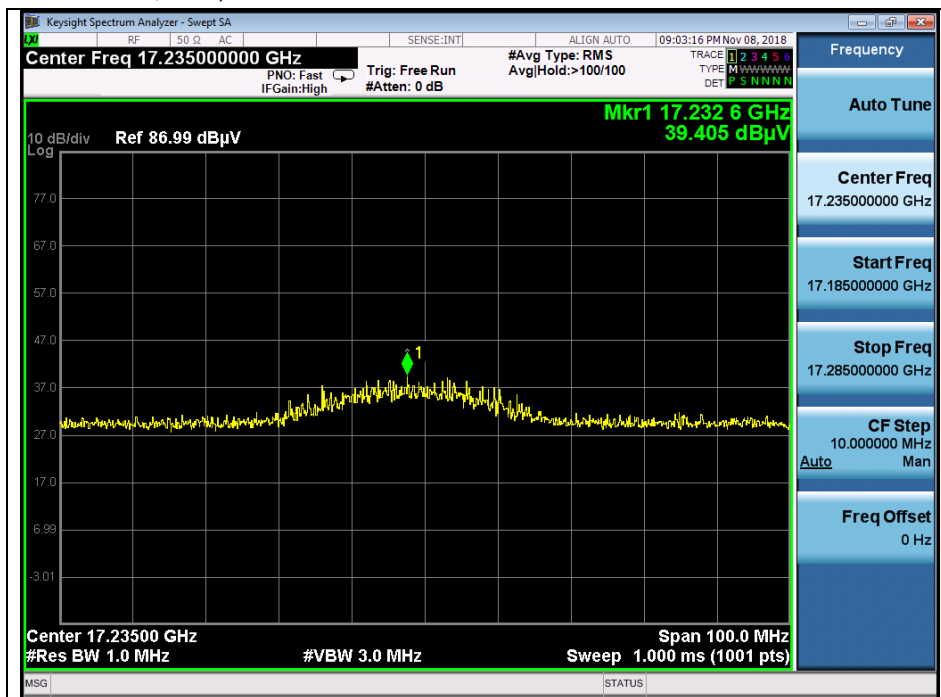


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High channel 3rd harmonic (Peak) - Band 2C

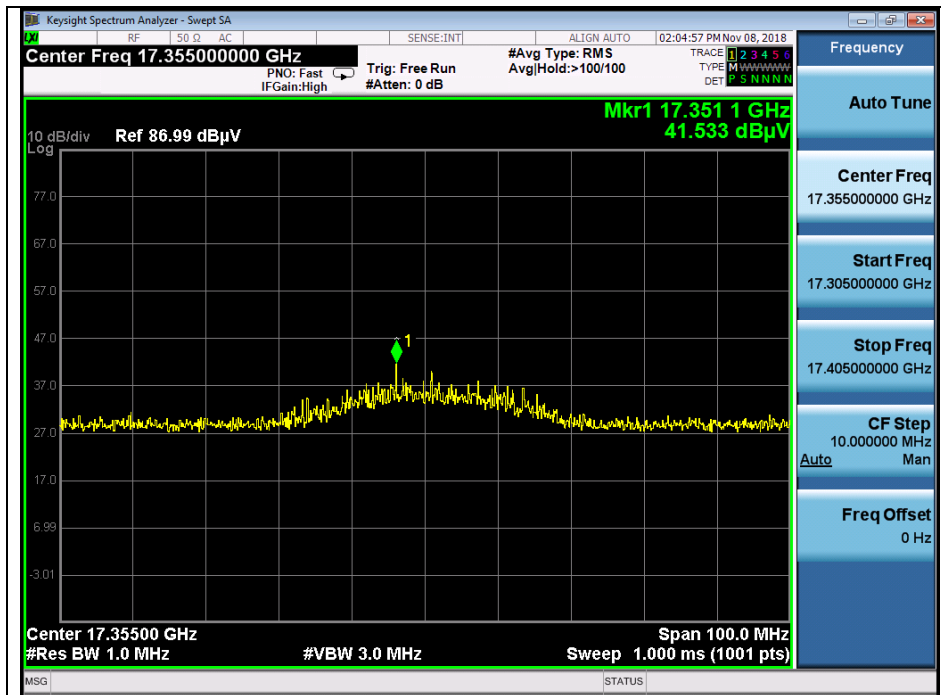


Low channel 3rd harmonic (Peak) - Band 3

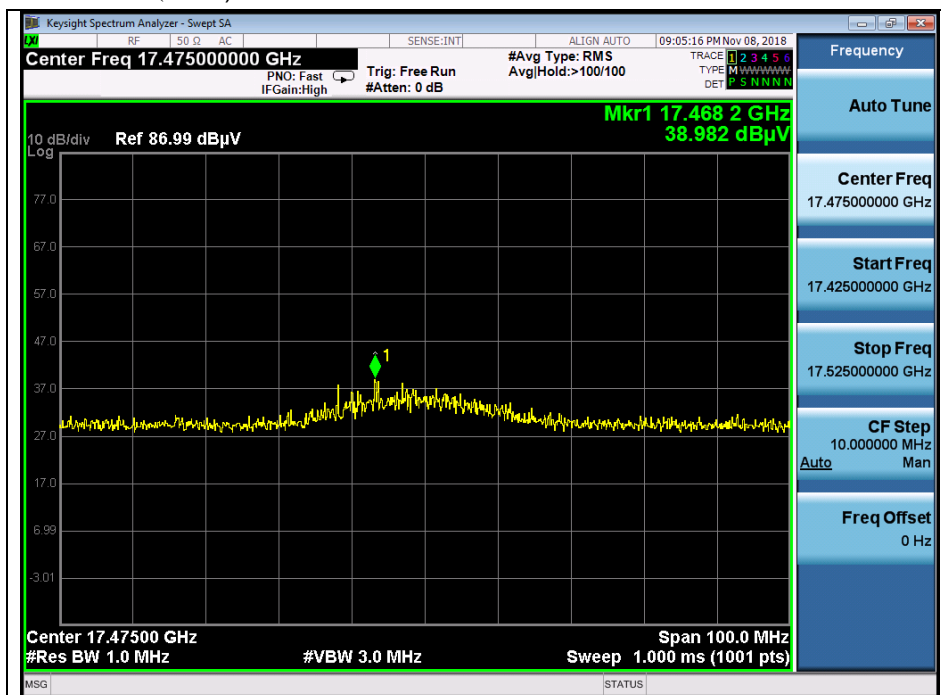


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Middle channel 3rd harmonic (Peak) - Band 3



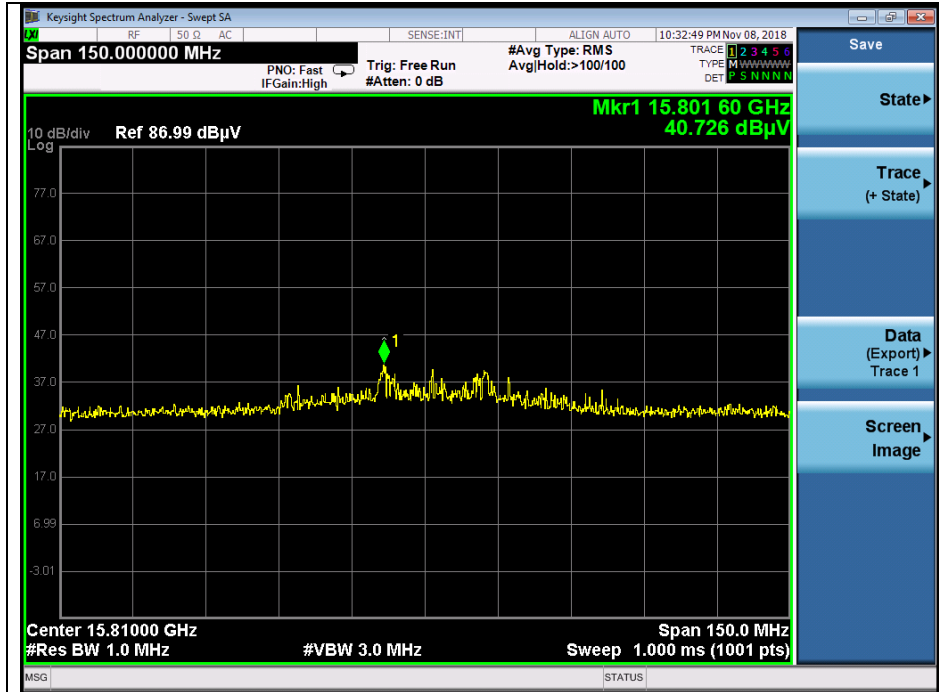
High channel 3rd harmonic (Peak) - Band 3



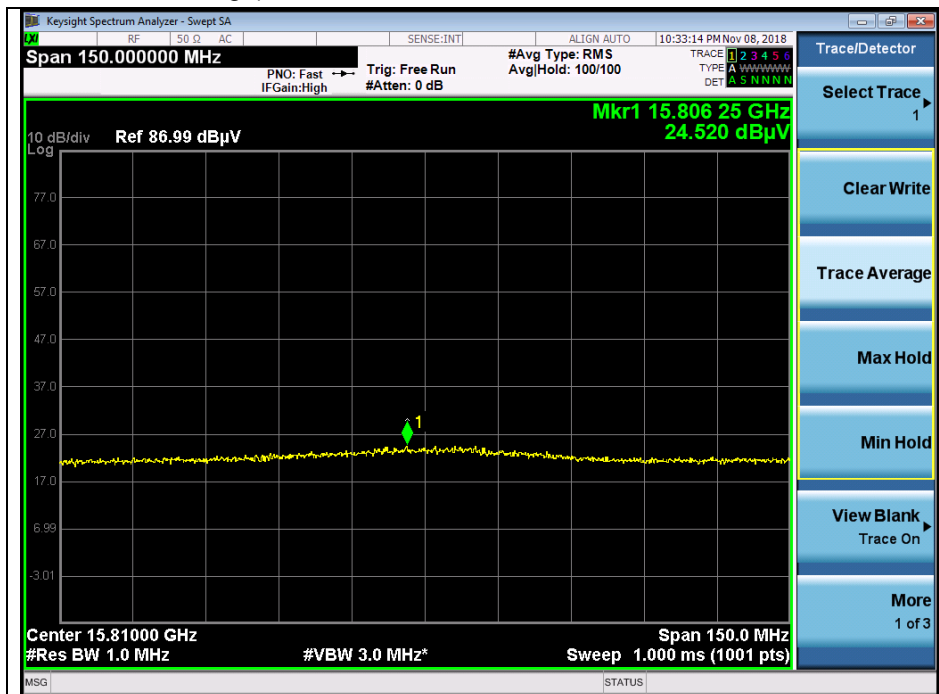
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OFDM: 802.11n_HT40(MCS0)

Low channel 3rd harmonic (Peak) - Band 2A



Low channel 3rd harmonic (Average) - Band 2A

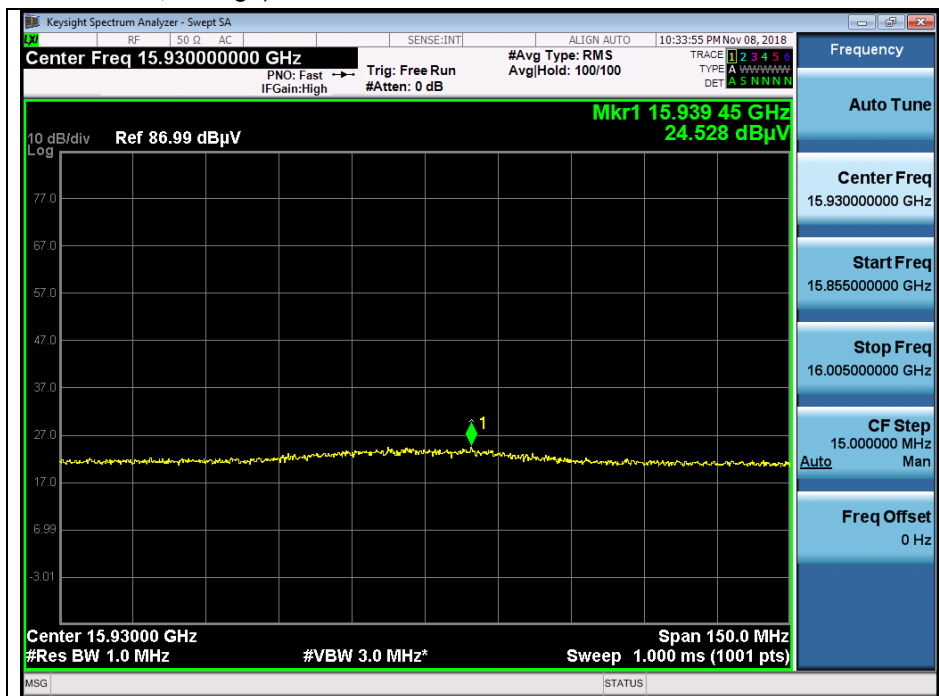


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High channel 3rd harmonic (Peak) - Band 2A

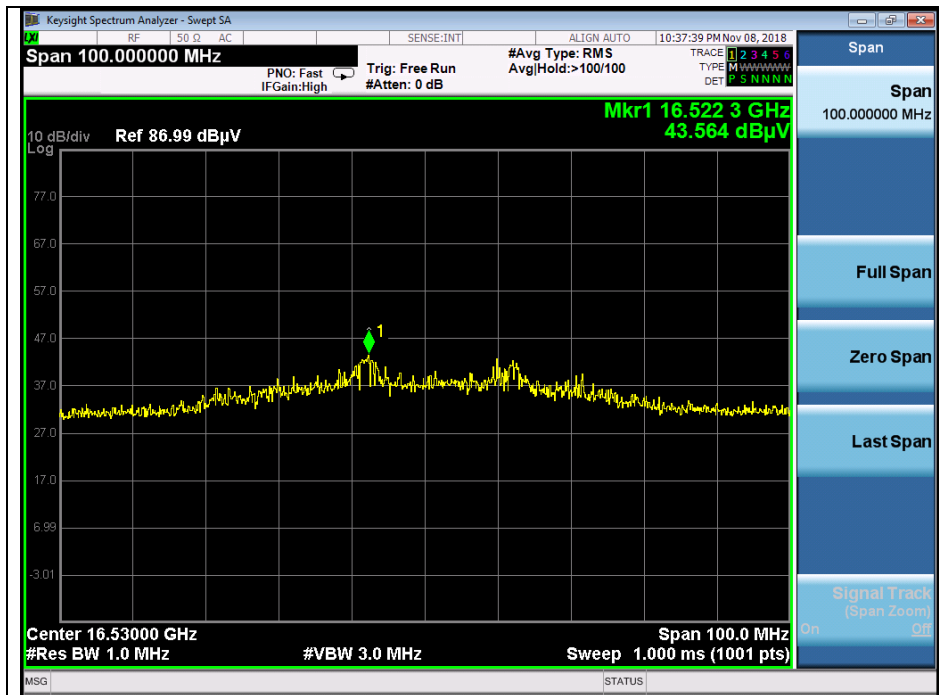


High channel 3rd harmonic (Average) - Band 2A

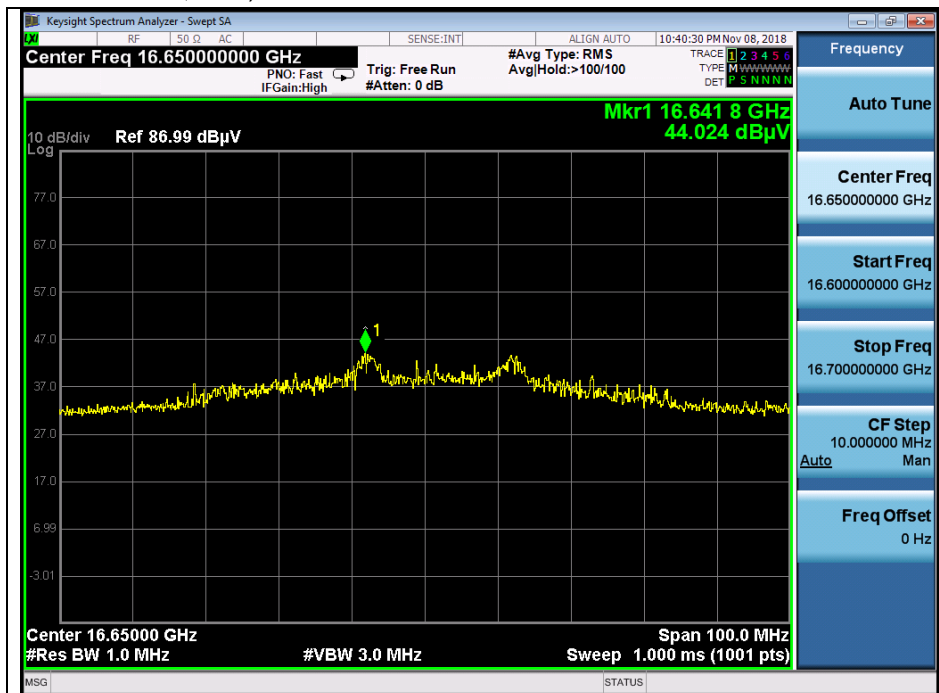


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Low channel 3rd harmonic (Peak) - Band 2C



Middle channel 3rd harmonic (Peak) - Band 2C

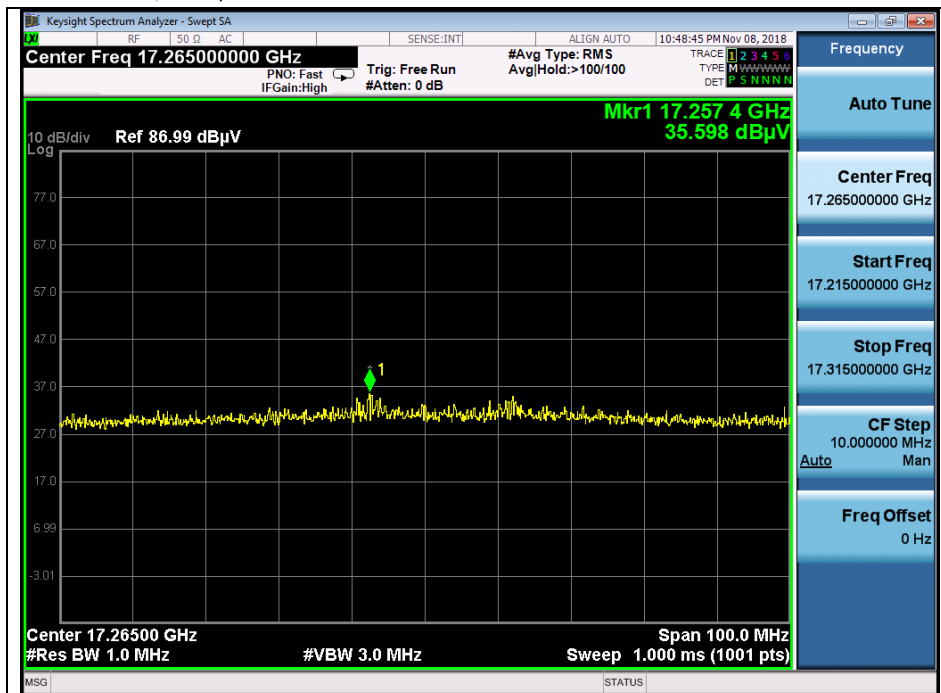


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High channel 3rd harmonic (Peak) - Band 2C

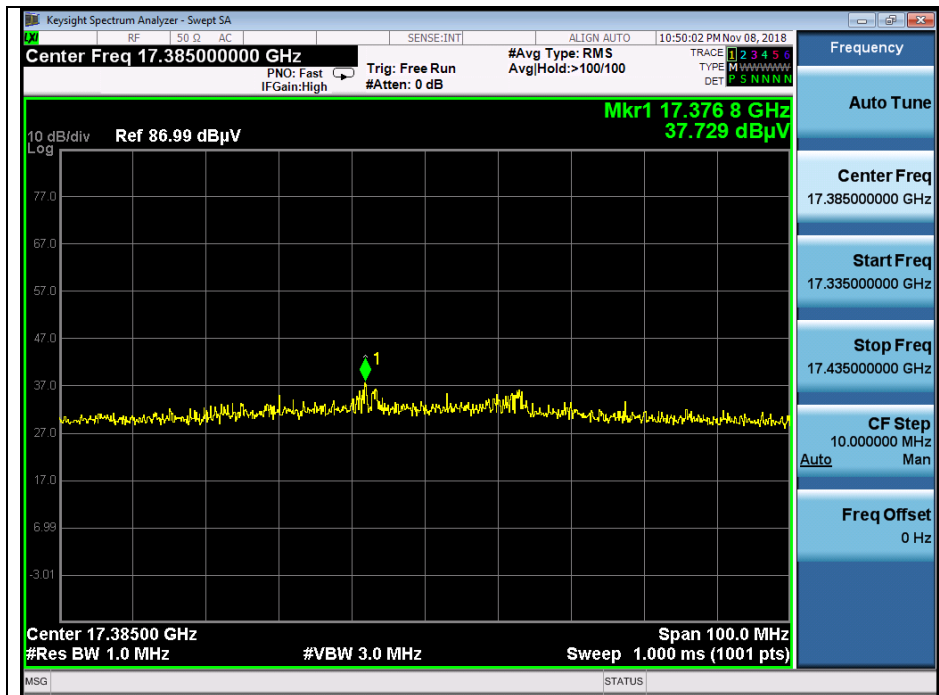


Low channel 3rd harmonic (Peak) - Band 3



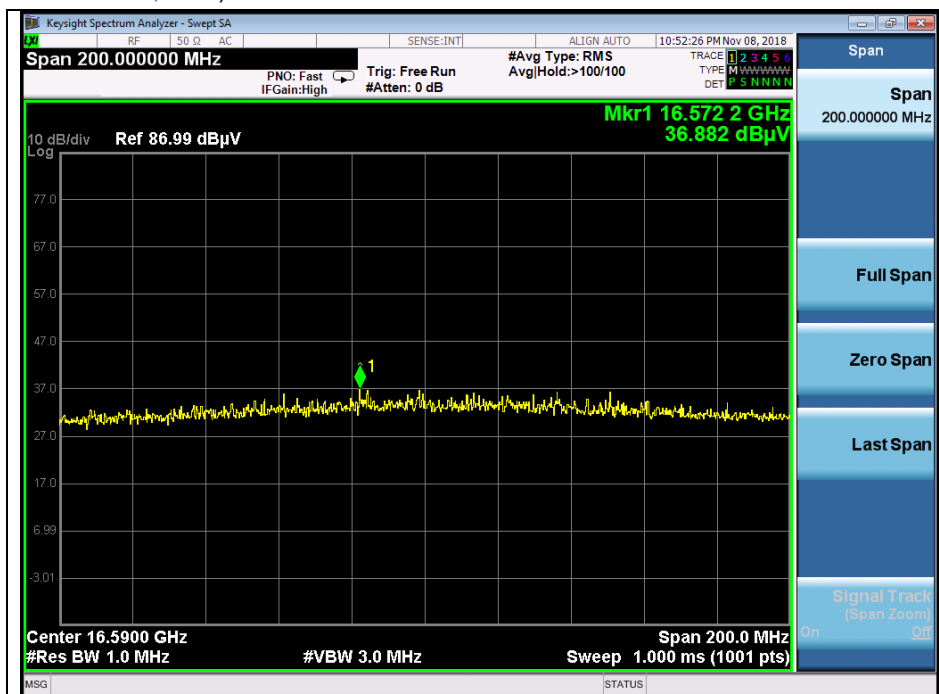
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High channel 3rd harmonic (Peak) - Band 3



OFDM: 802.11ac_VHT80(MCS0)

Low channel 3rd harmonic (Peak) - Band 2C



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3. 26 dB Bandwidth & 99 % Bandwidth

3.1. Test Setup



3.2. Limit

None; for reporting purpose only.

3.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

3.3.1. 26 dB Bandwidth

1. This measurement settings are specified in section C.1 of KDB 789033 D02 v02r01.
2. Set RBW: approximately 1 % of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

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3.2.2. 99 % Bandwidth

3.2.2.1 FCC

1. This measurement settings are specified in section D of KDB 789033 D02 v02r01.
2. Set center frequency to the nominal EUT channel center frequency.
3. Set span = 1.5 times to 5.0 times the OBW.
4. Set RBW = 1 % to 5 % of the OBW.
5. Set VBW $\geq 3 \times$ RBW.
6. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
7. Use the 99 % power bandwidth function of the instrument (if available).
8. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % occupied bandwidth is the difference between these two frequencies.

In the result,

- DFS requirements are not applicable in the 5 150 MHz ~ 5 250 MHz.

Remark;

In case of band crossing channels 138, 142 and 144, the measurement is complied with section III.A of KDB 789033 D02 v02r01.

3.2.2.2 IC

- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

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3.4. Test result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
11a	U-NII 1	5 180	36	6	21.013	17.019
		5 220	44		21.071	16.961
		5 240	48		20.897	16.961
	U-NII 2A	5 260	52		21.013	17.077
		5 300	60		21.071	17.019
		5 320	64		20.955	16.961
	U-NII 2C	5 500	100		21.129	17.019
		5 580	116		21.013	16.961
		5 700	140		21.129	17.019
	U-NII 3	5 745	149		21.071	17.019
		5 785	157		21.071	17.077
		5 825	165		21.071	17.019

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
11n_HT20	U-NII 1	5 180	36	MCS0	21.534	18.119
		5 220	44		21.418	18.119
		5 240	48		21.476	18.119
	U-NII 2A	5 260	52		21.620	18.234
		5 300	60		21.418	18.119
		5 320	64		21.418	18.061
	U-NII 2C	5 500	100		21.360	18.177
		5 580	116		21.360	18.061
		5 700	140		21.360	18.119
	U-NII 3	5 745	149		21.534	18.119
		5 785	157		21.476	18.061
		5 825	165		21.418	18.119

Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
11n_HT40	U-NII 1	5 190	38	MCS0	40.640	36.469
		5 230	46		39.940	36.237
	U-NII 2A	5 270	54		40.520	36.585
		5 310	62		39.940	36.237
	U-NII 2C	5 510	102		40.290	36.353
		5 550	110		40.520	36.585
		5 670	134		40.060	36.237
	U-NII 3	5 755	151		40.230	36.353
		5 795	159		40.340	36.469

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Mode	Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)	99 % Bandwidth (MHz)
11ac_VHT80	U-NII 1	5 210	42	MCS0	82.200	75.485
	U-NII 2A	5 290	58		82.660	75.485
	U-NII 2C	5 530	106		81.740	75.485
		5 690	138		82.200	75.485
	U-NII 3	5 775	155		82.010	75.716

Band	Mode	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)
U-NII 2C (Band-crossing channel)	11a	5 720	144	6	15.456
	11n_HT20	5 720	144	MCS0	15.745
	11n_HT40	5 710	142	MCS0	35.260
	11ac_VHT80	5 690	138	MCS0	76.060

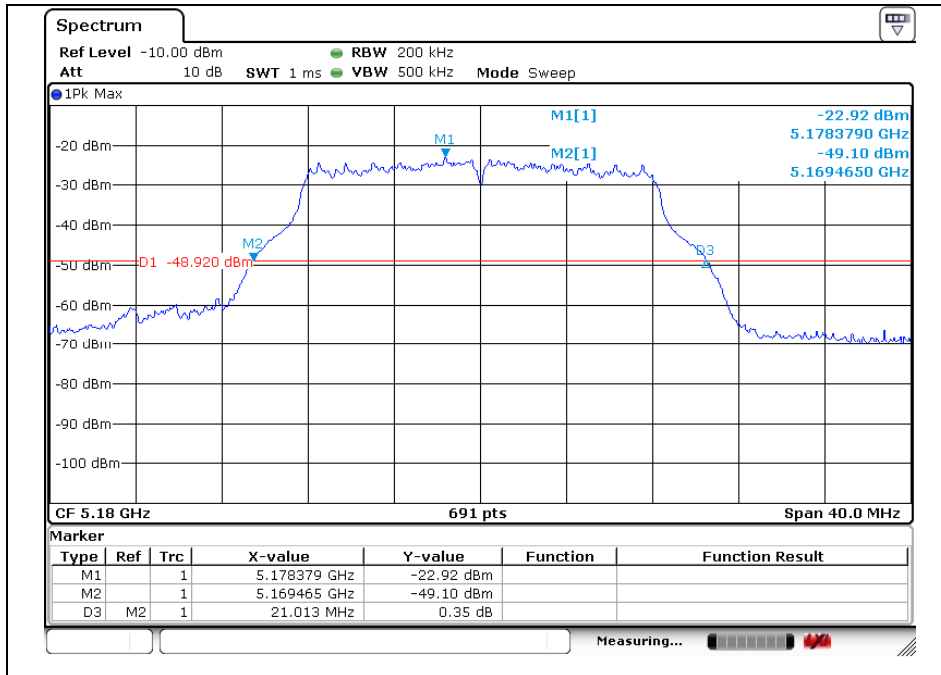
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- Test plots

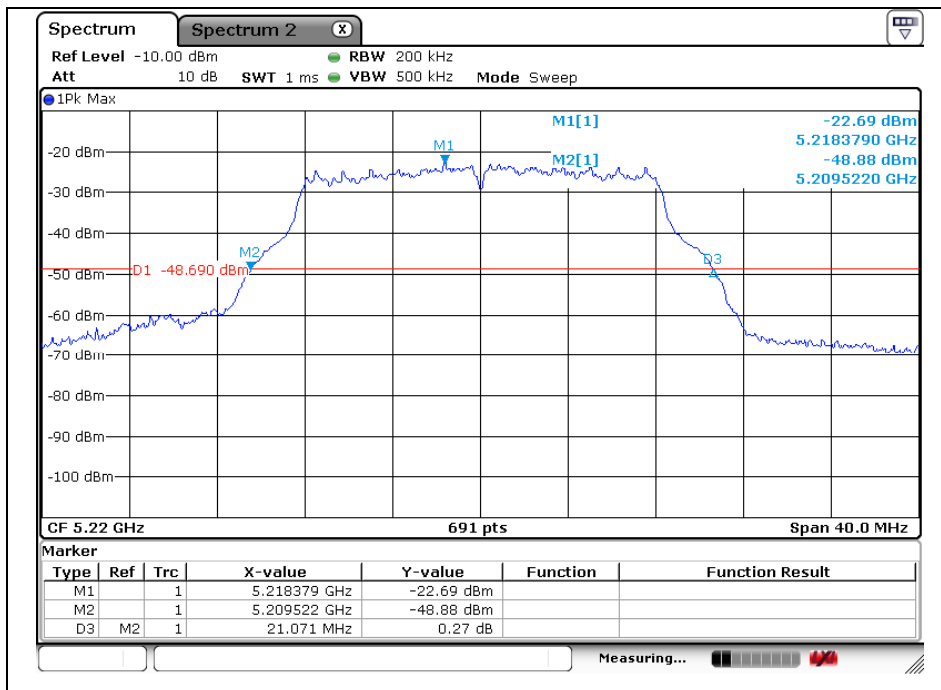
26 dB Bandwidth

802.11a (Band 1)

Low Channel (5 180 MHz)

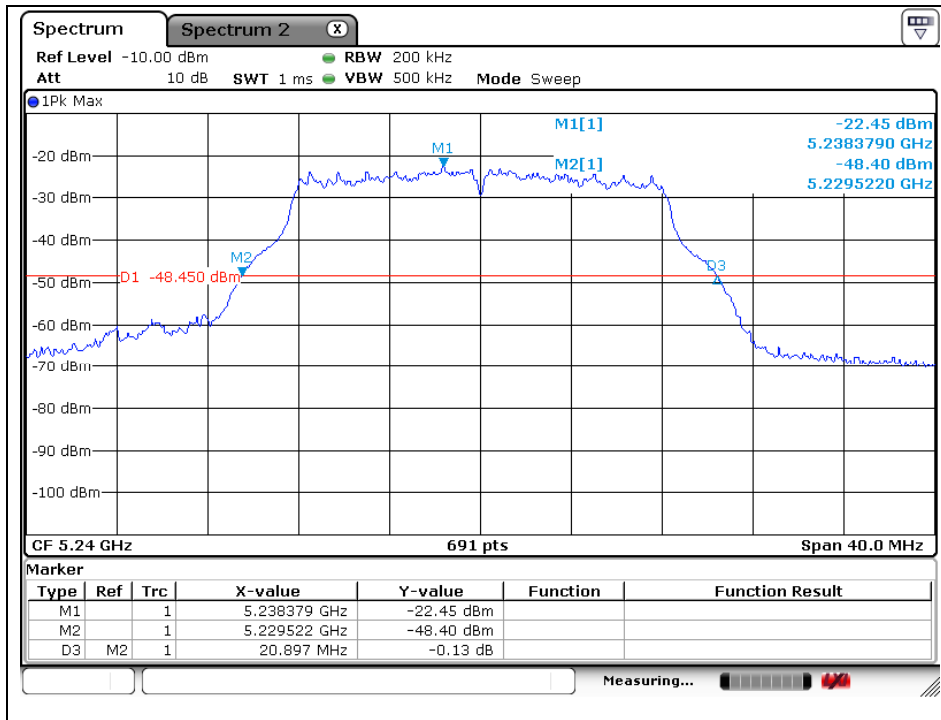


Middle Channel (5 220 MHz)



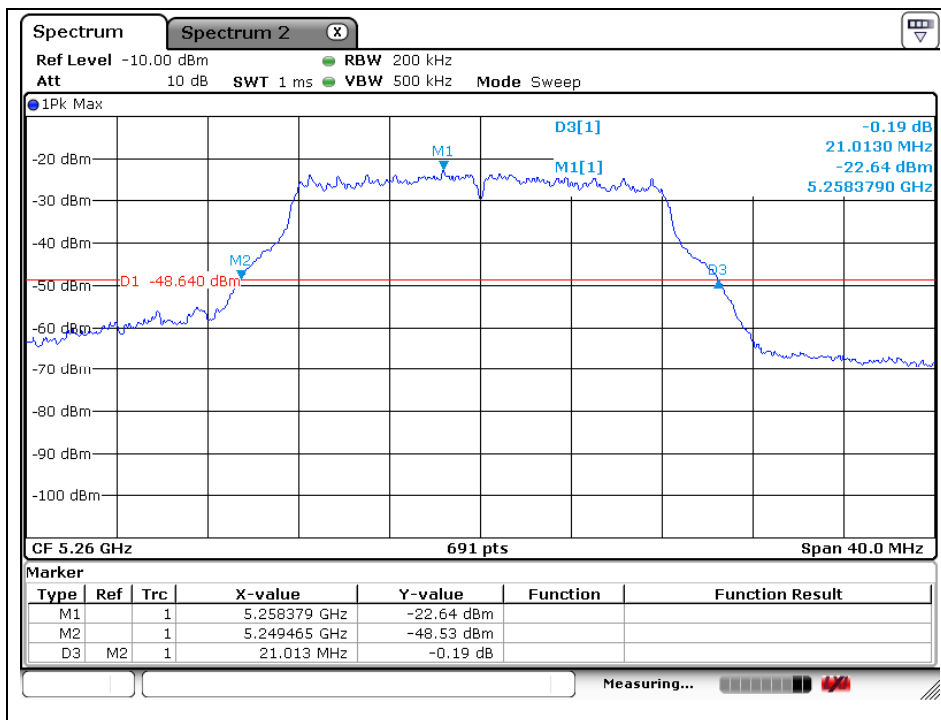
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High Channel (5 240 MHz)



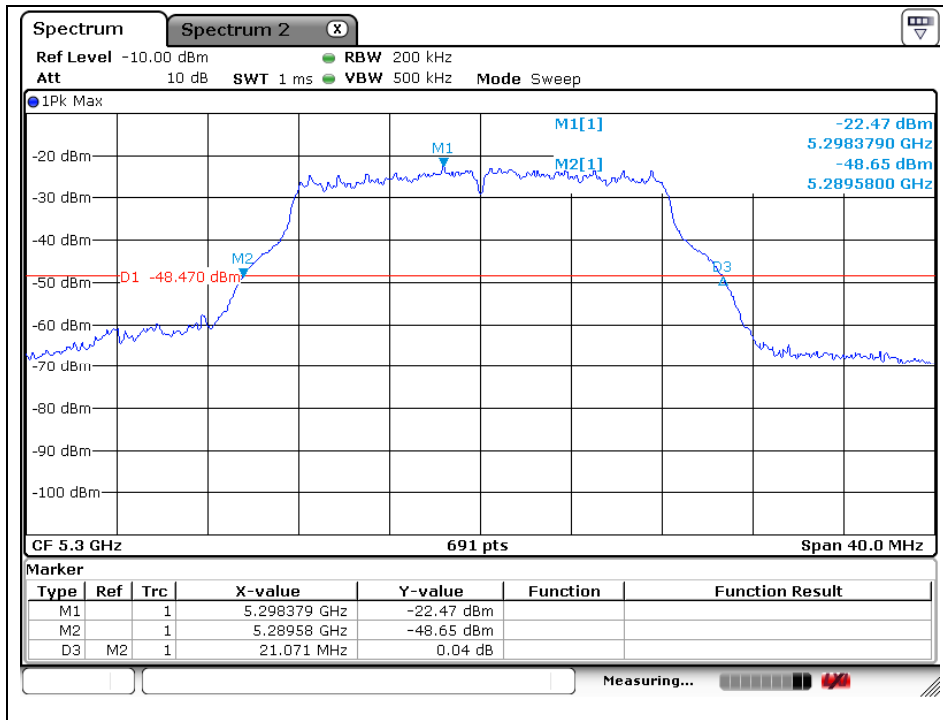
802.11a (Band 2A)

Low Channel (5 260 MHz)

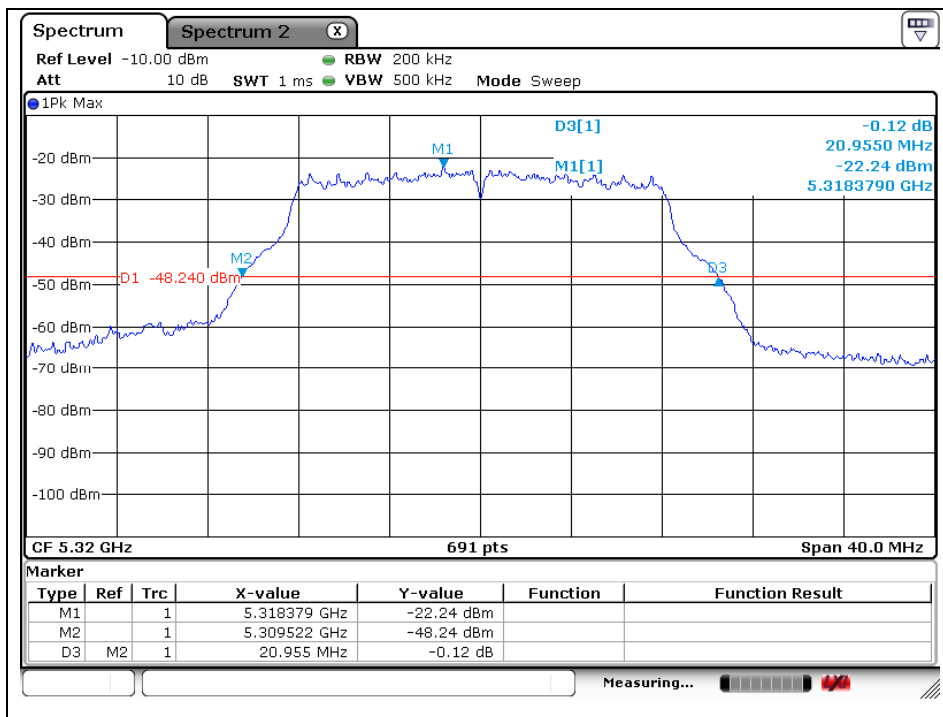


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Middle Channel (5 300 MHz)



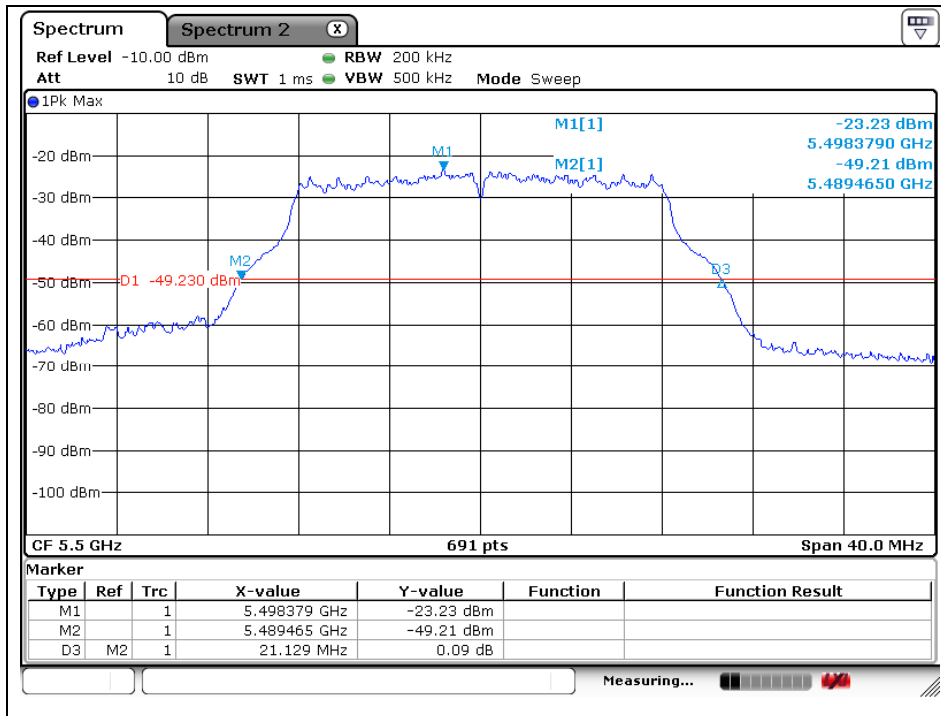
High Channel (5 320 MHz)



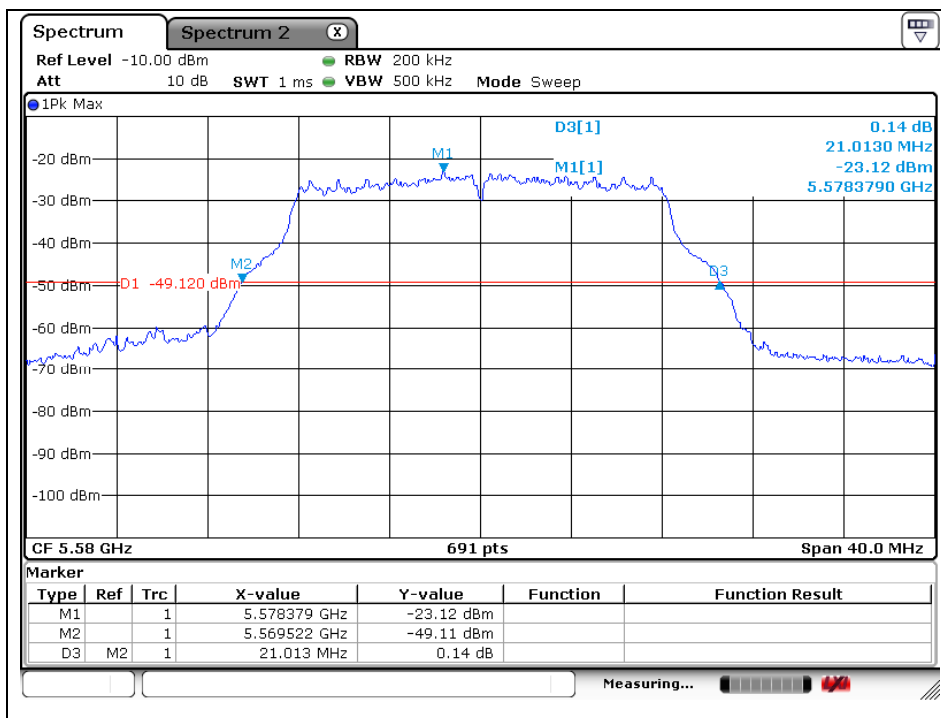
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802.11a (Band 2C)

Low Channel (5 500 MHz)

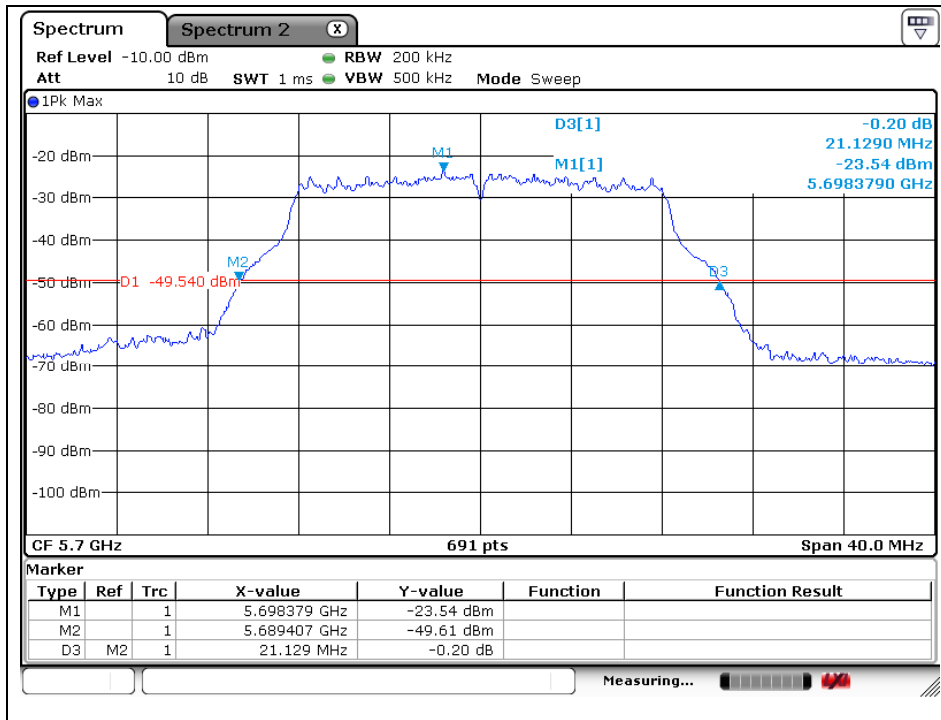


Middle Channel (5 580 MHz)



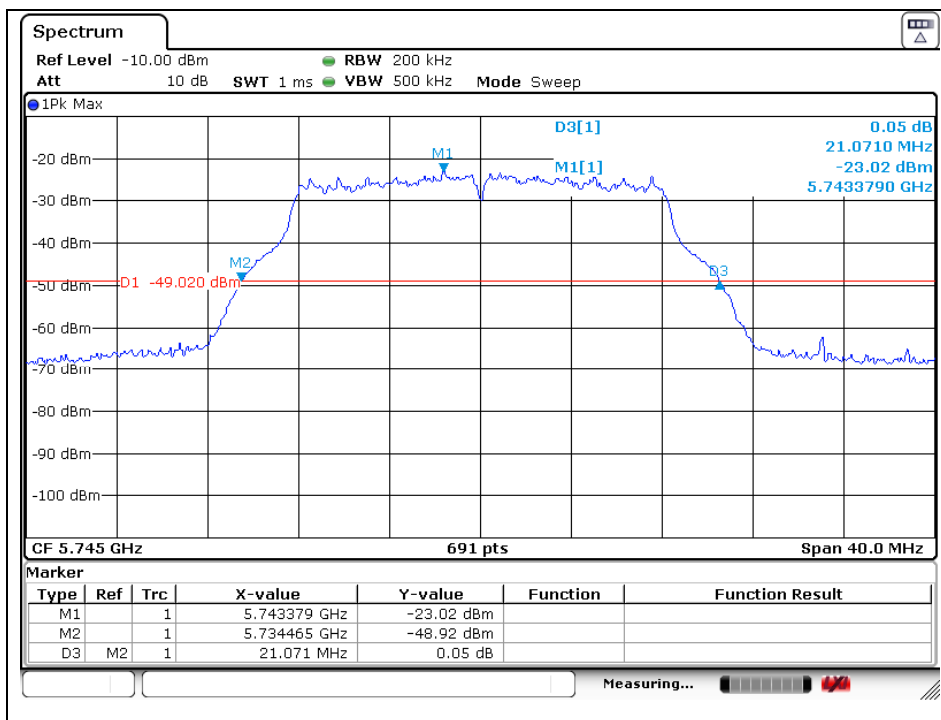
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High Channel (5 700 MHz)



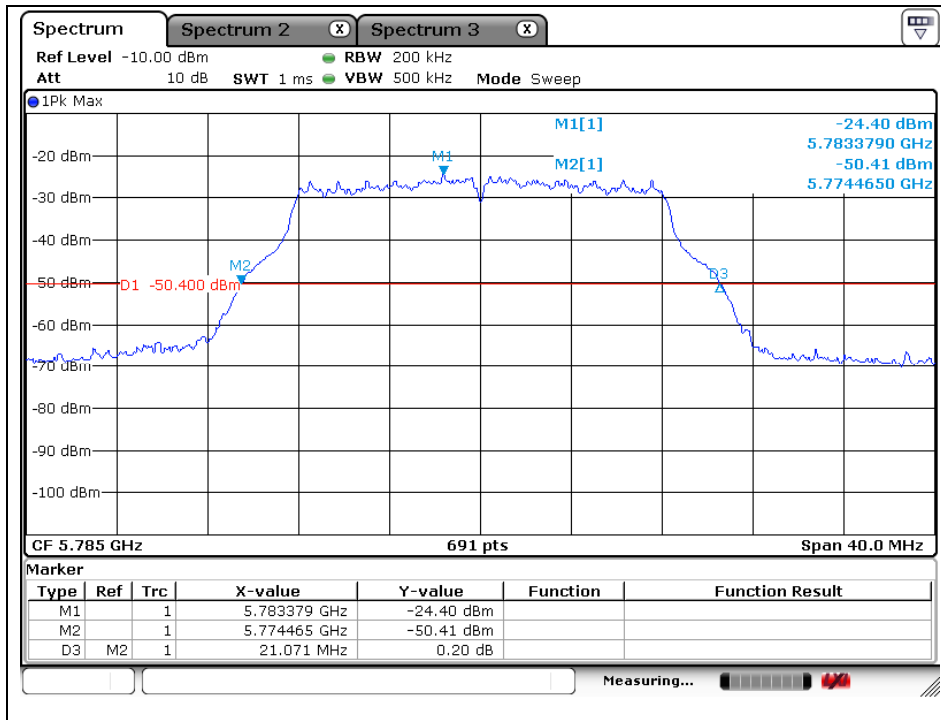
802.11a (Band 3)

Low Channel (5 745 MHz)

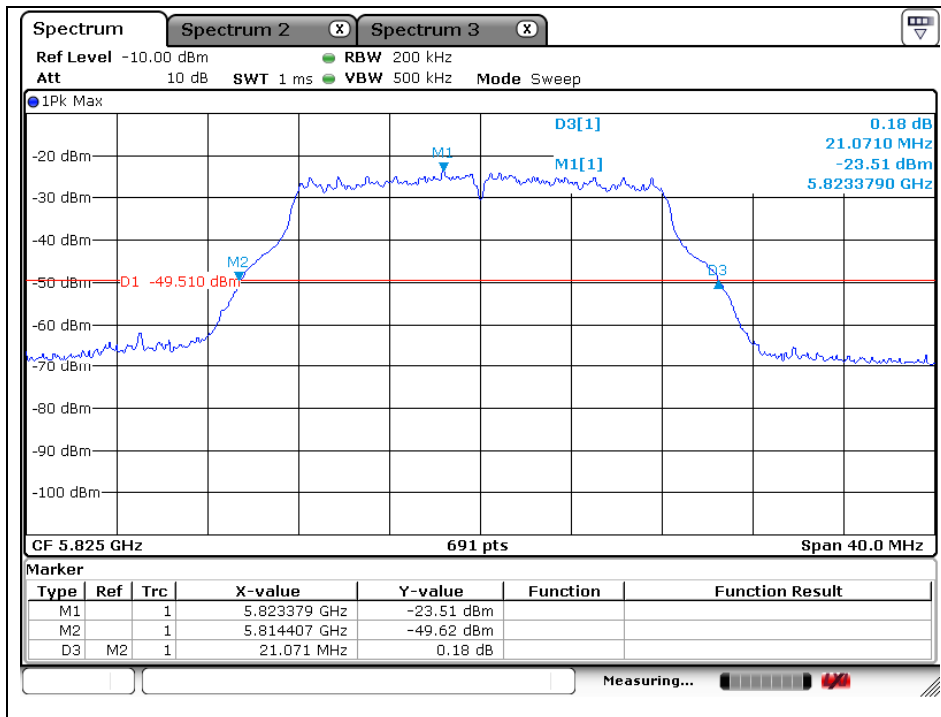


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Middle Channel (5 785 MHz)



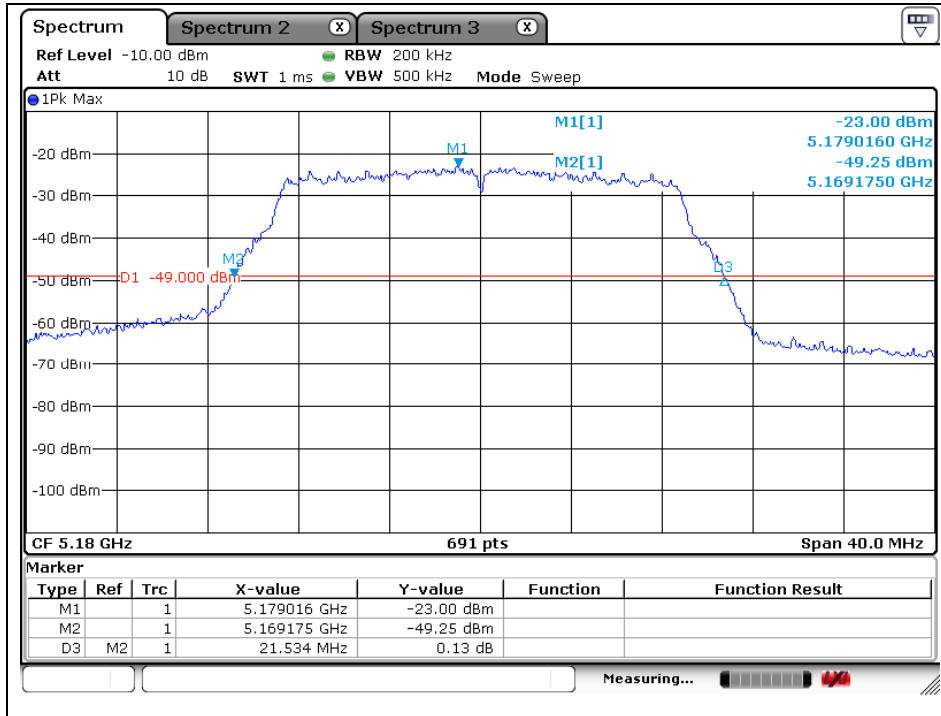
High Channel (5 825 MHz)



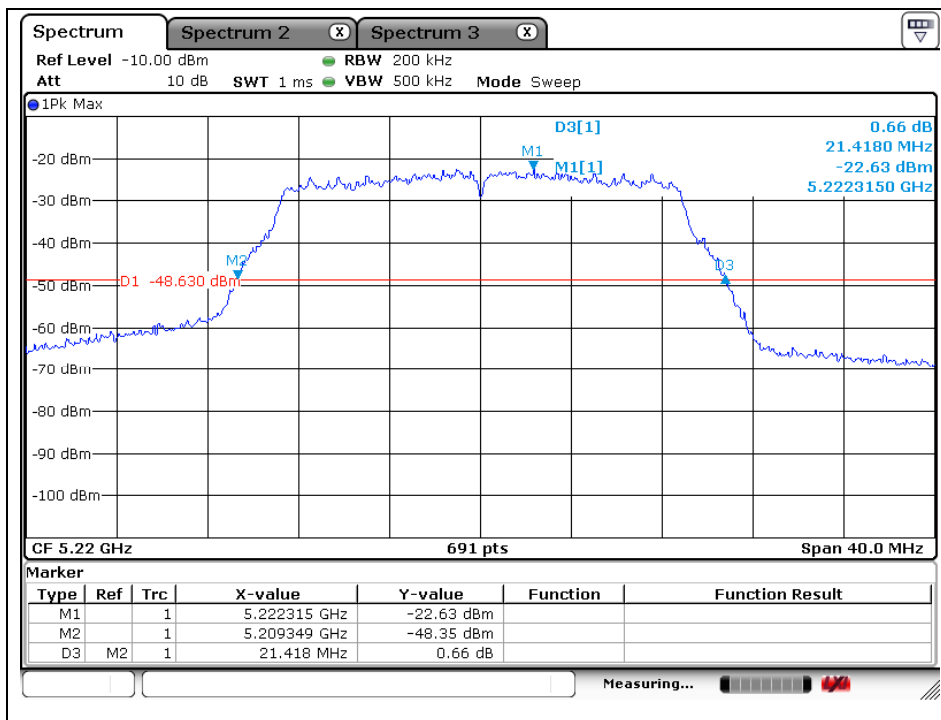
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802.11n_HT20 (Band 1)

Low Channel (5 180 MHz)

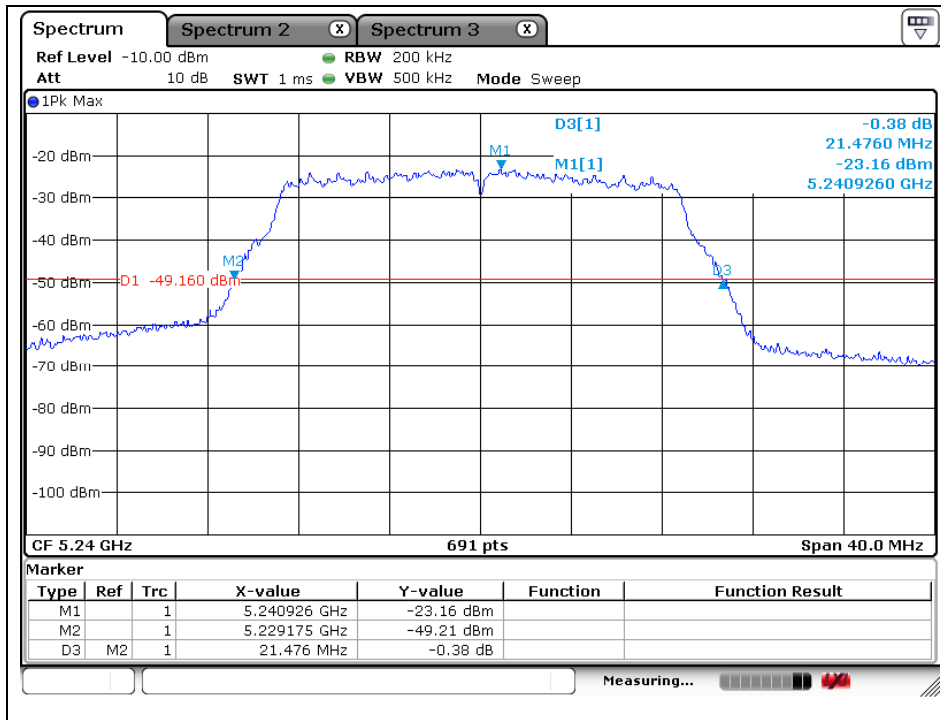


Middle Channel (5 220 MHz)



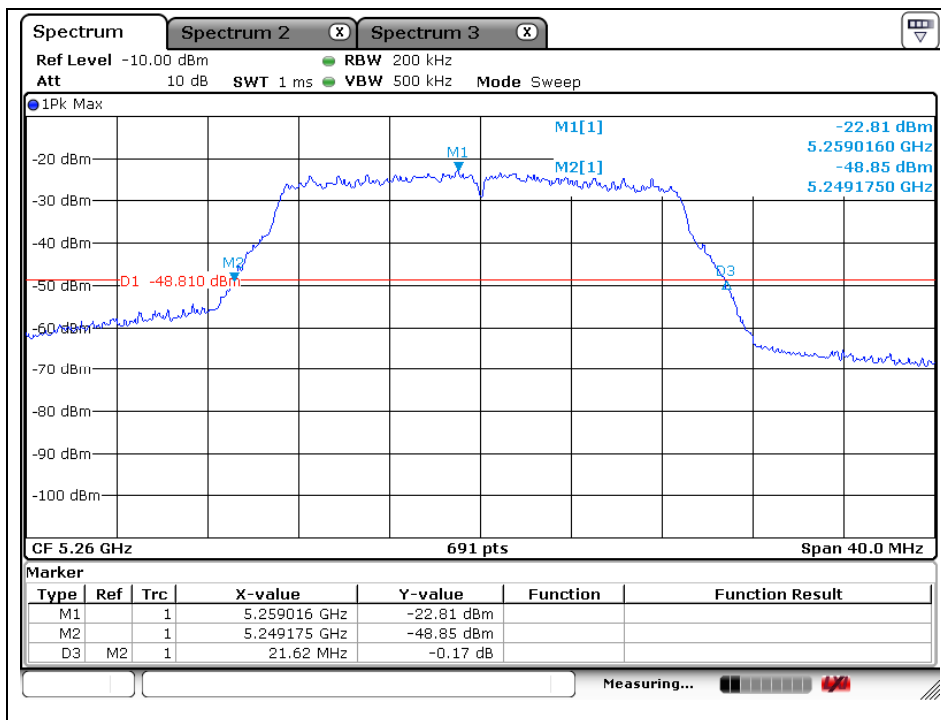
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High Channel (5 240 MHz)



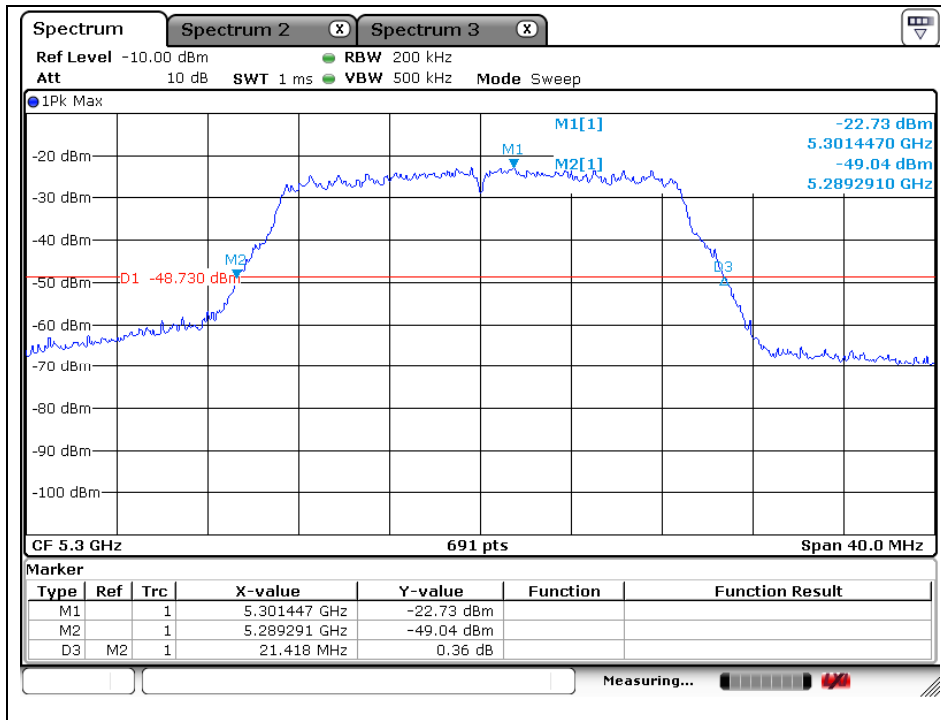
802.11n_HT20 (Band 2A)

Low Channel (5 260 MHz)

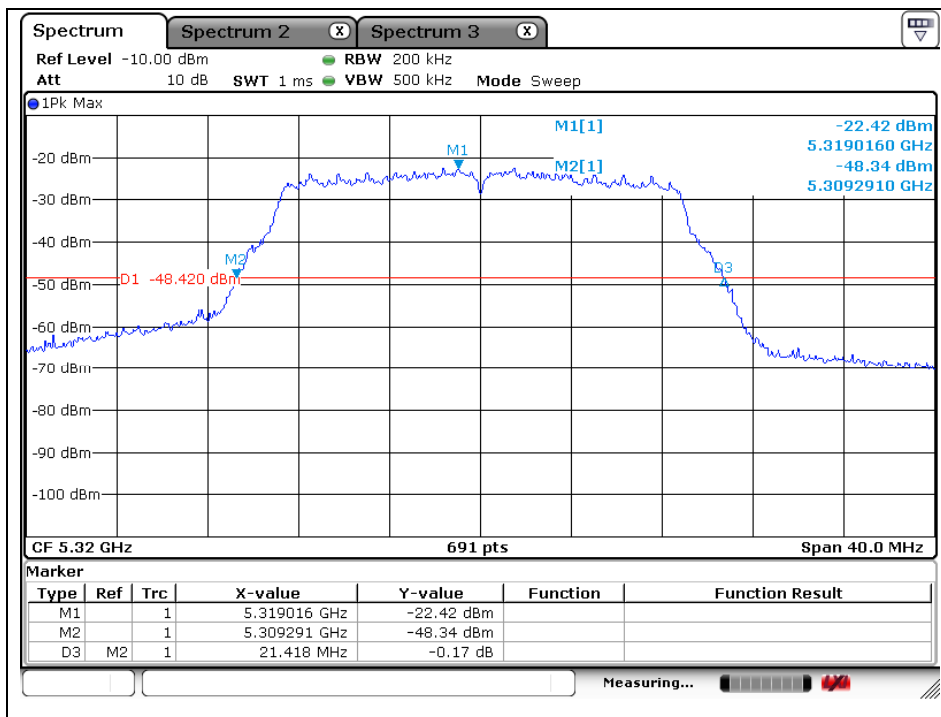


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Middle Channel (5 300 MHz)



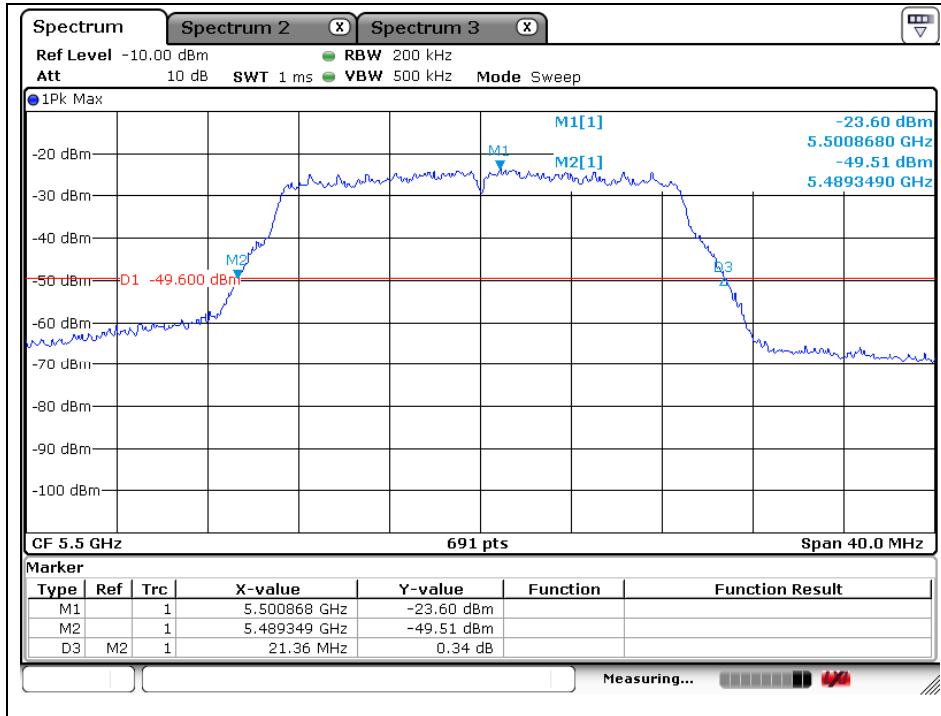
High Channel (5 320 MHz)



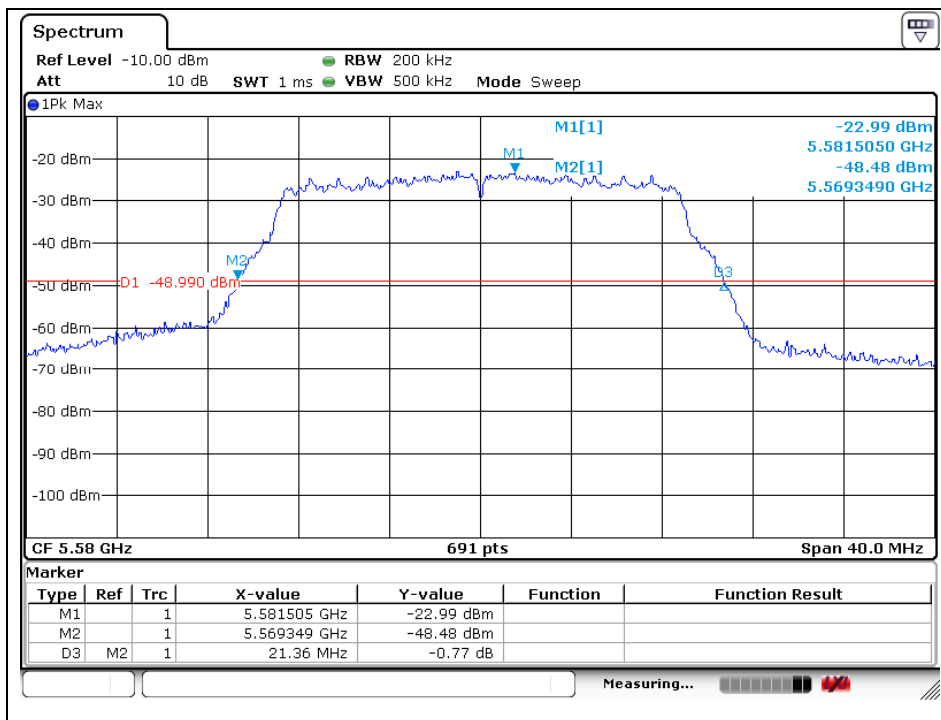
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802.11n_HT20 (Band 2C)

Low Channel (5 500 MHz)

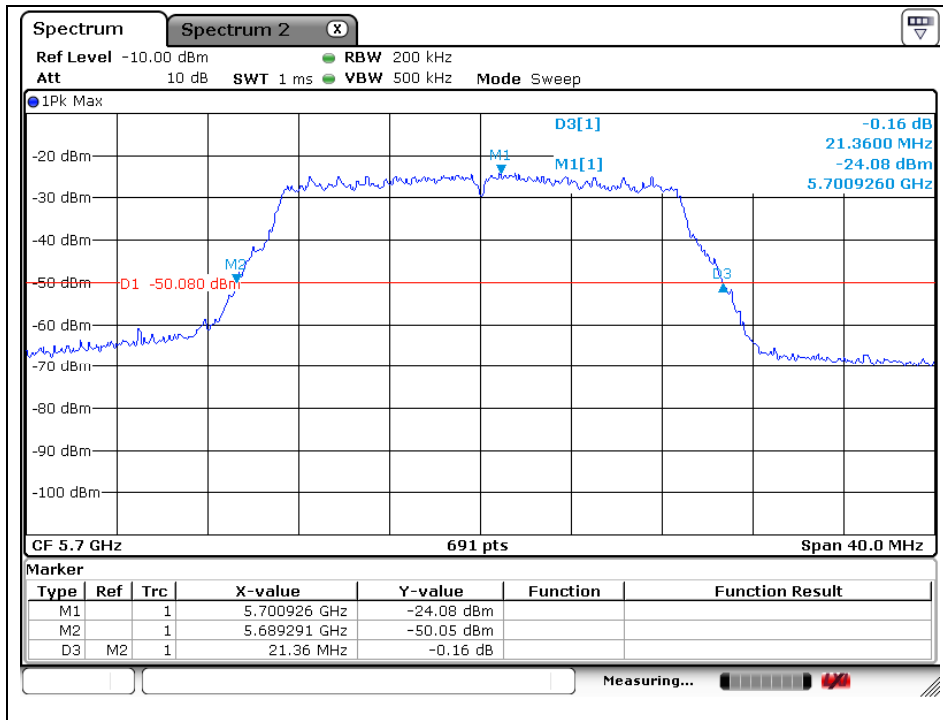


Middle Channel (5 580 MHz)



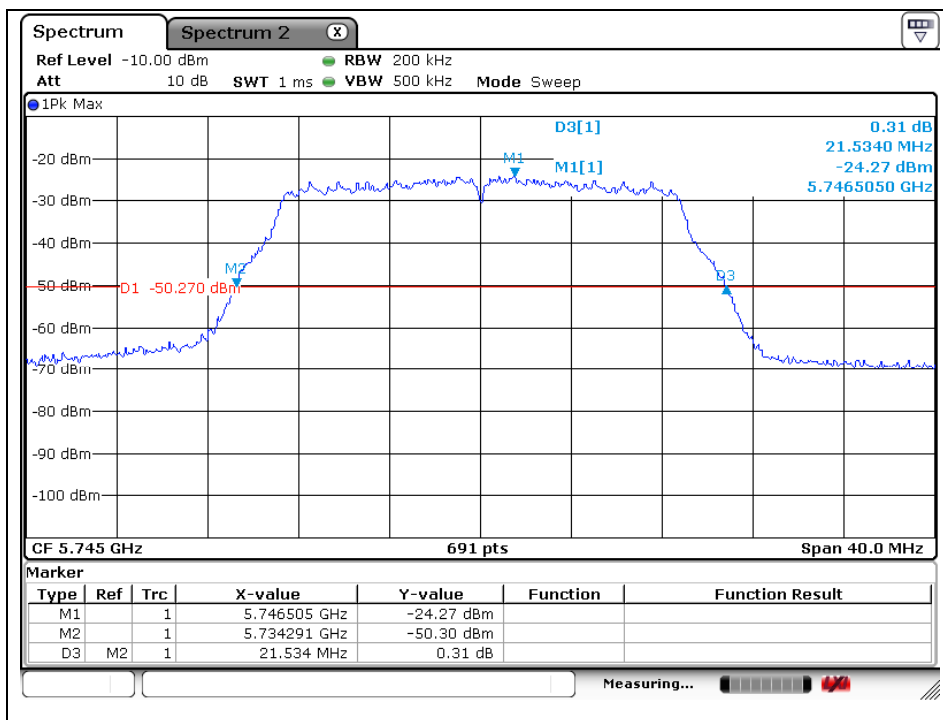
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High Channel (5 700 MHz)



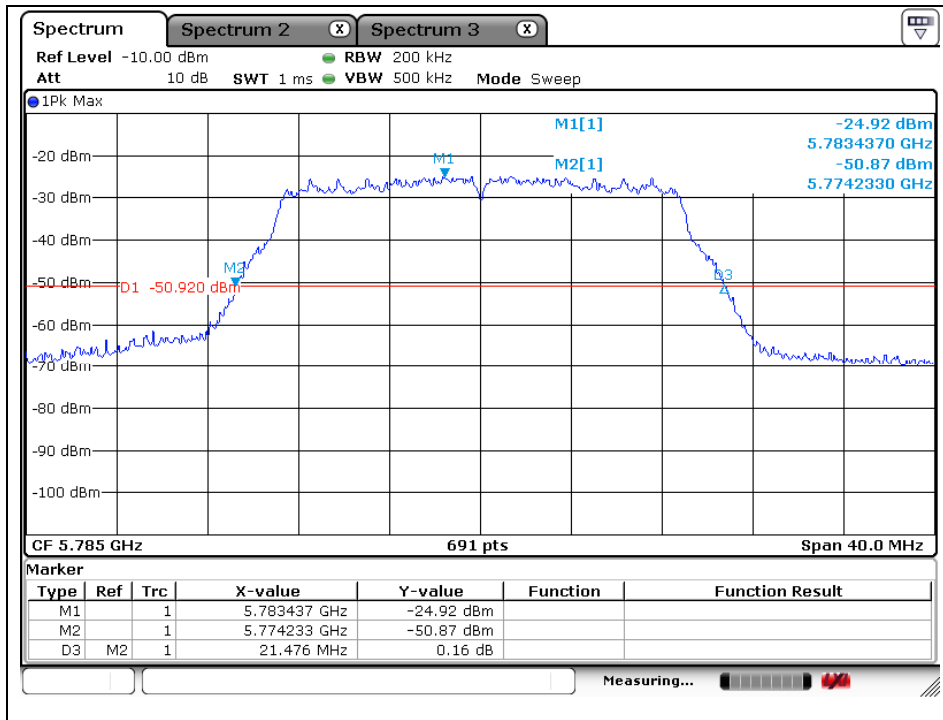
802.11n_HT20 (Band 3)

Low Channel (5 745 MHz)

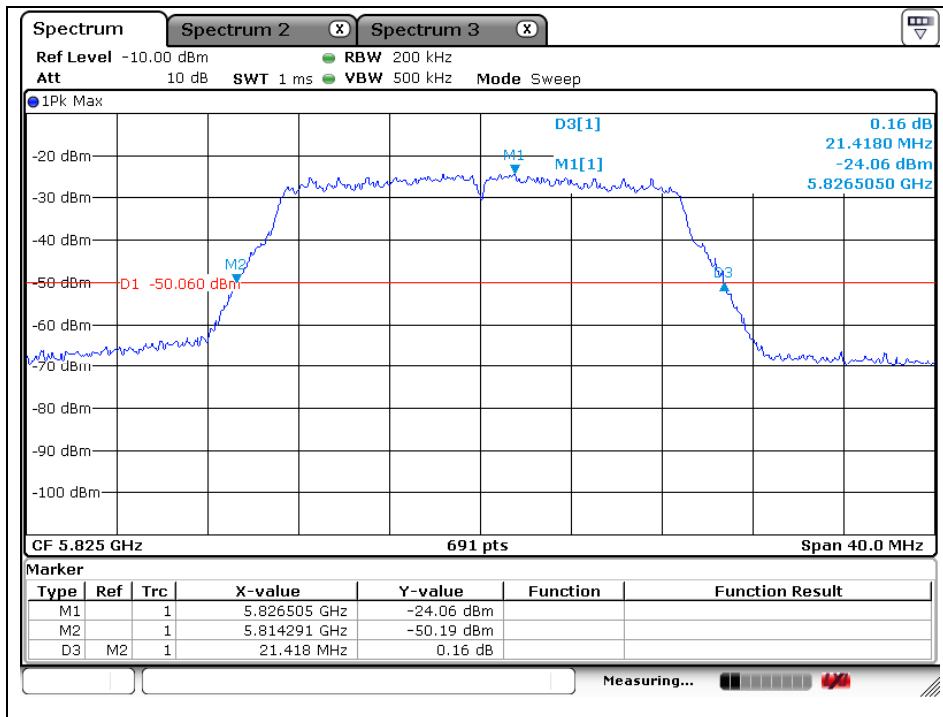


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Middle Channel (5 785 MHz)



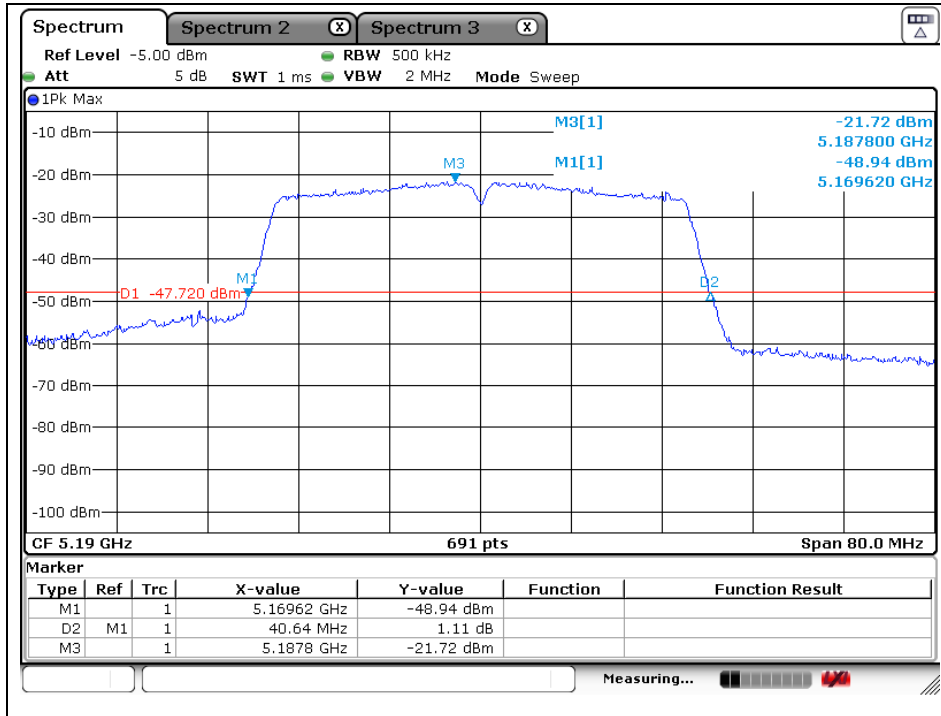
High Channel (5 825 MHz)



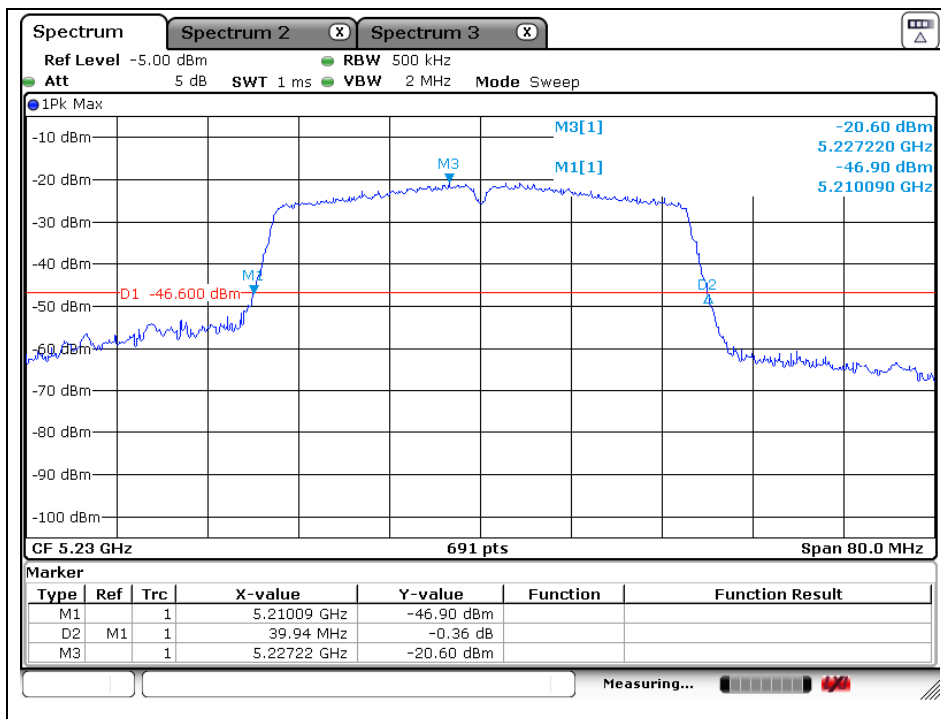
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802.11n_HT40 (Band 1)

Low Channel (5 190 MHz)



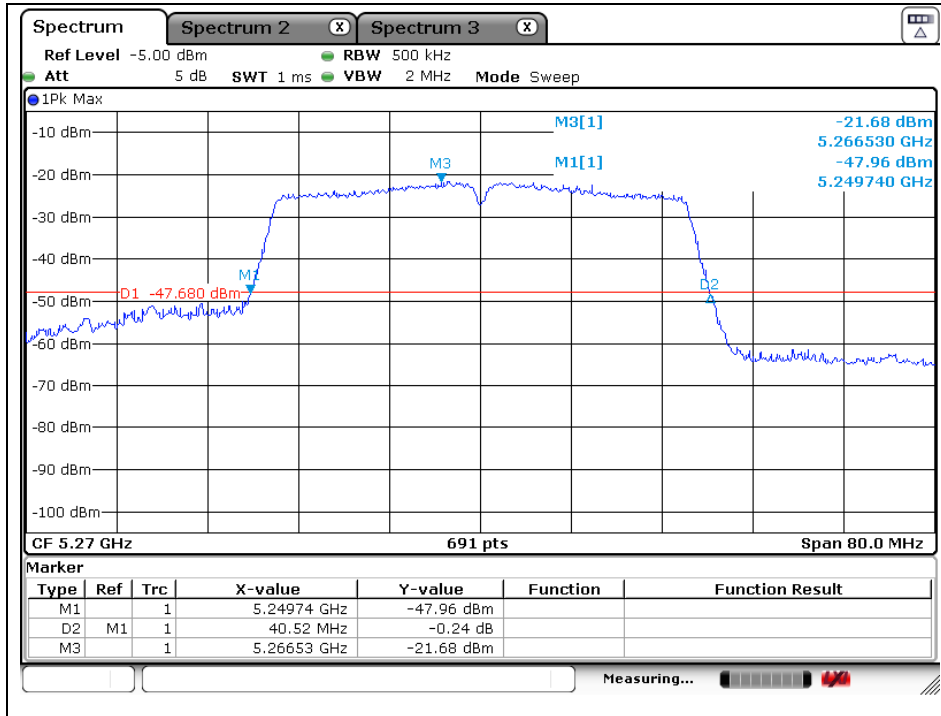
High Channel (5 230 MHz)



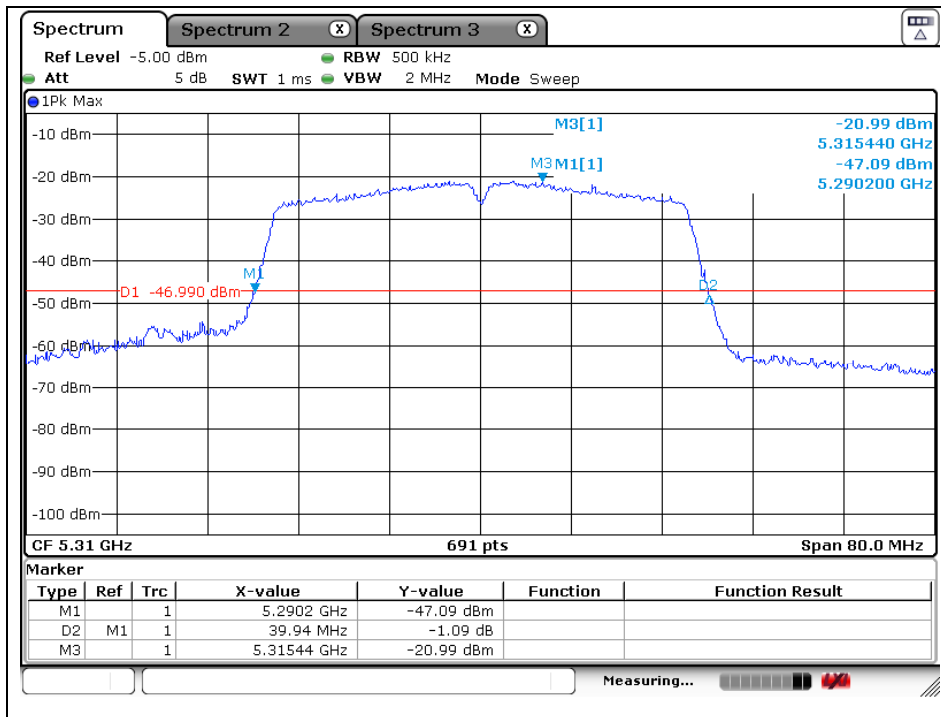
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802.11n_HT40 (Band 2A)

Low Channel (5 270 MHz)



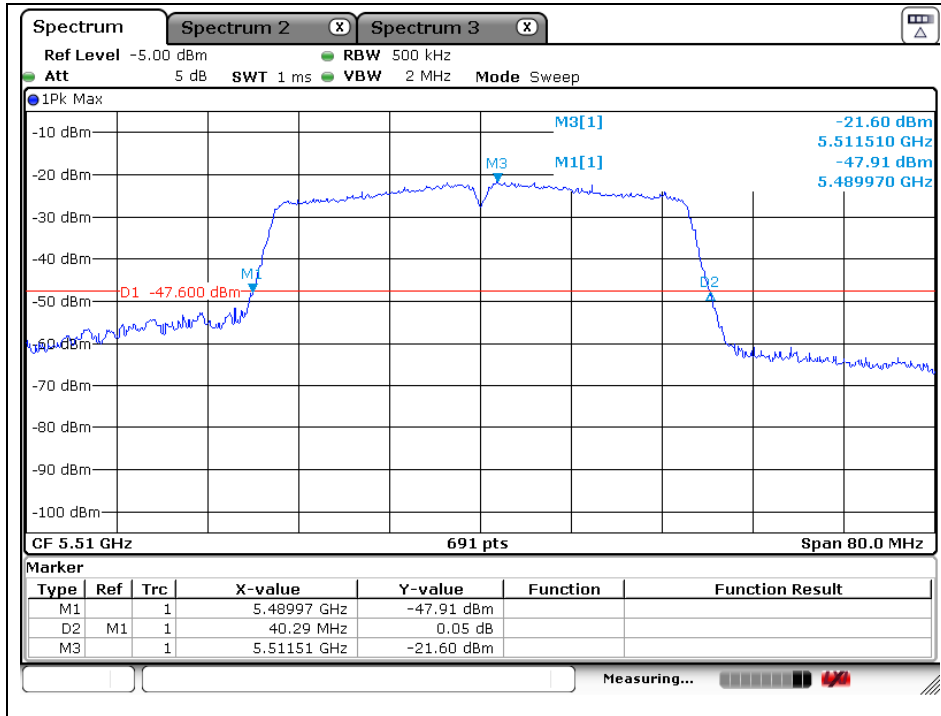
High Channel (5 310 MHz)



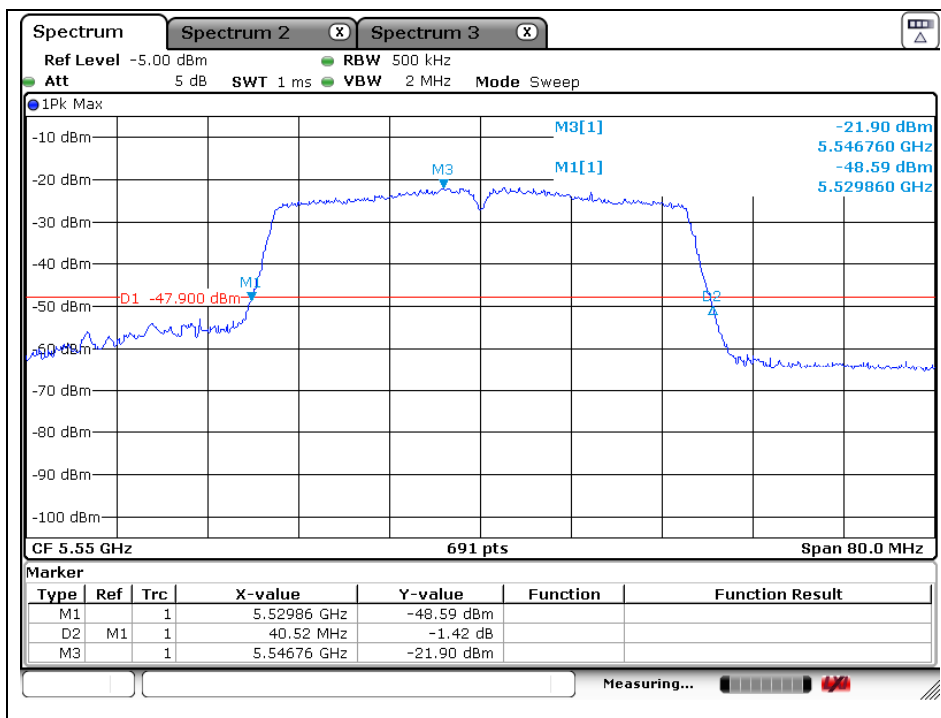
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802.11n_HT40 (Band 2C)

Low Channel (5 510 MHz)

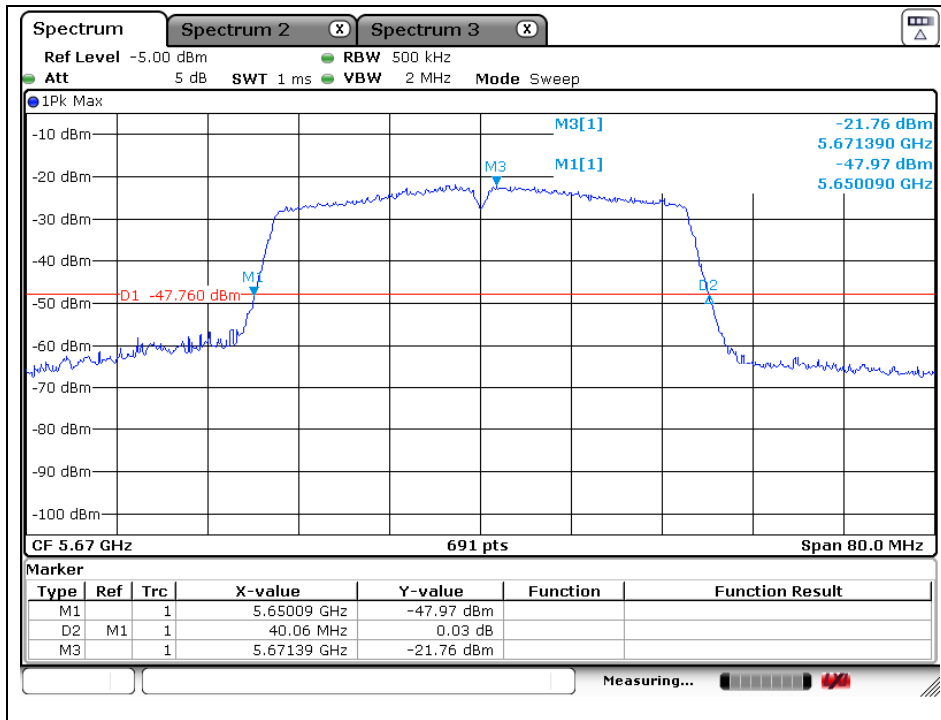


Middle Channel (5 550 MHz)



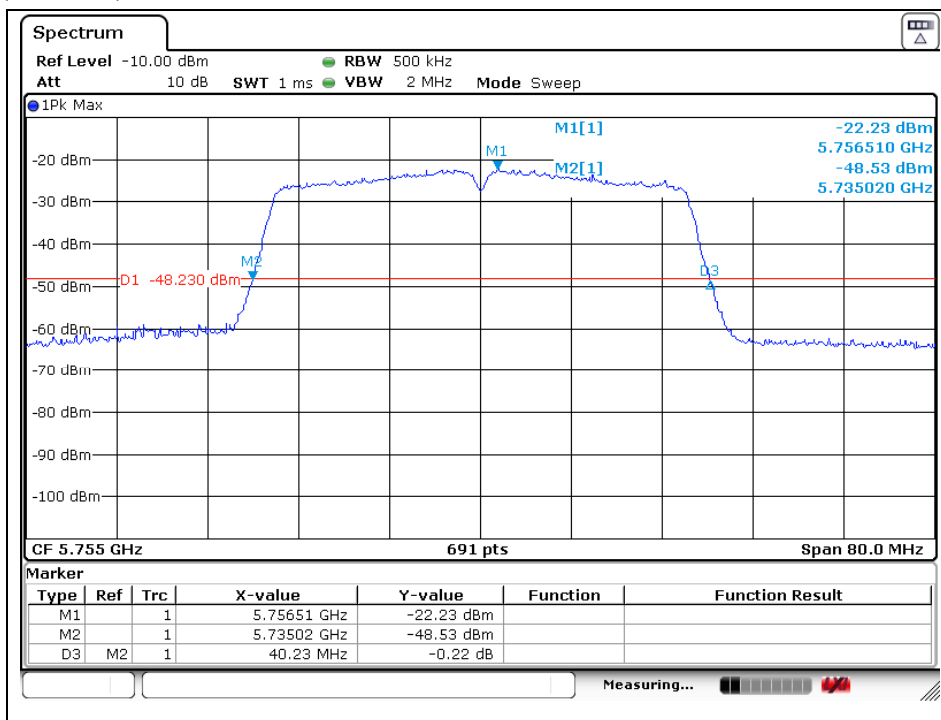
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High Channel (5 670 MHz)



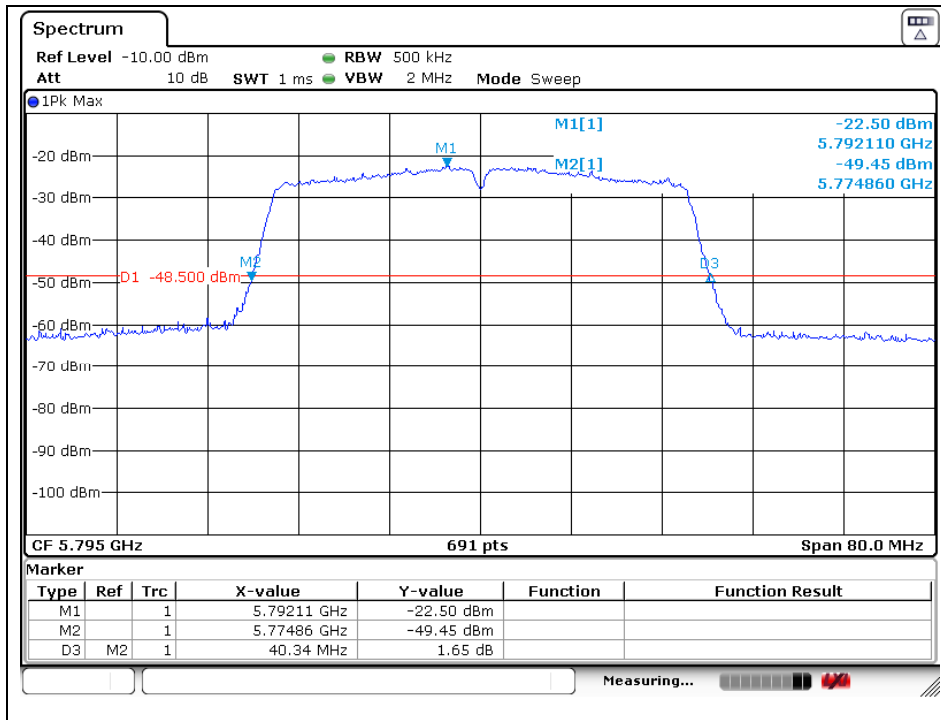
802.11n_HT40 (Band 3)

Low Channel (5 755 MHz)



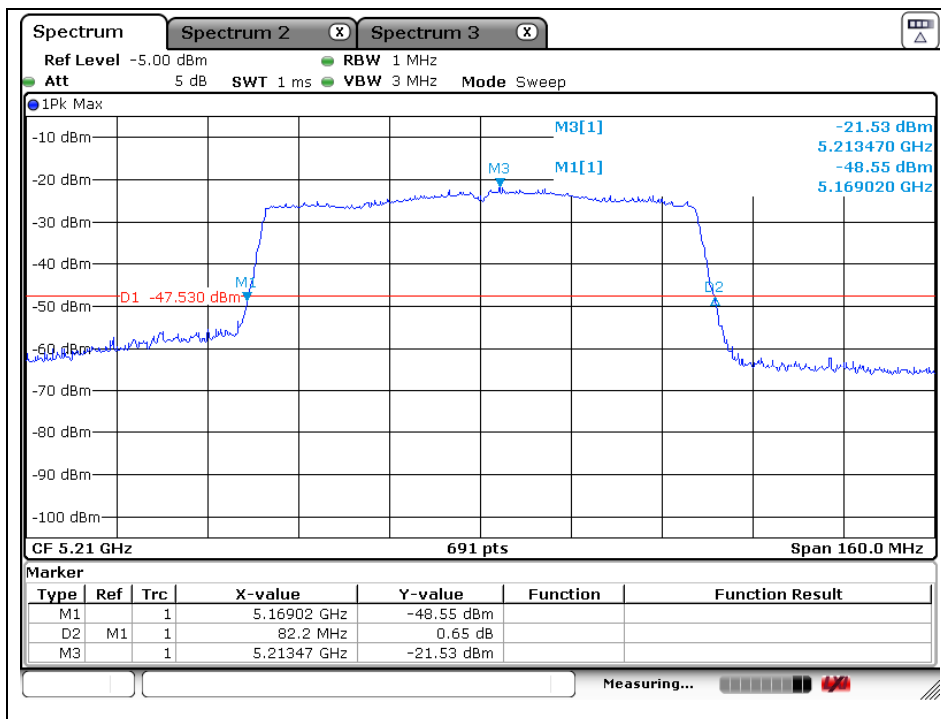
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High Channel (5 795 MHz)



802.11ac_VHT80 (Band 1)

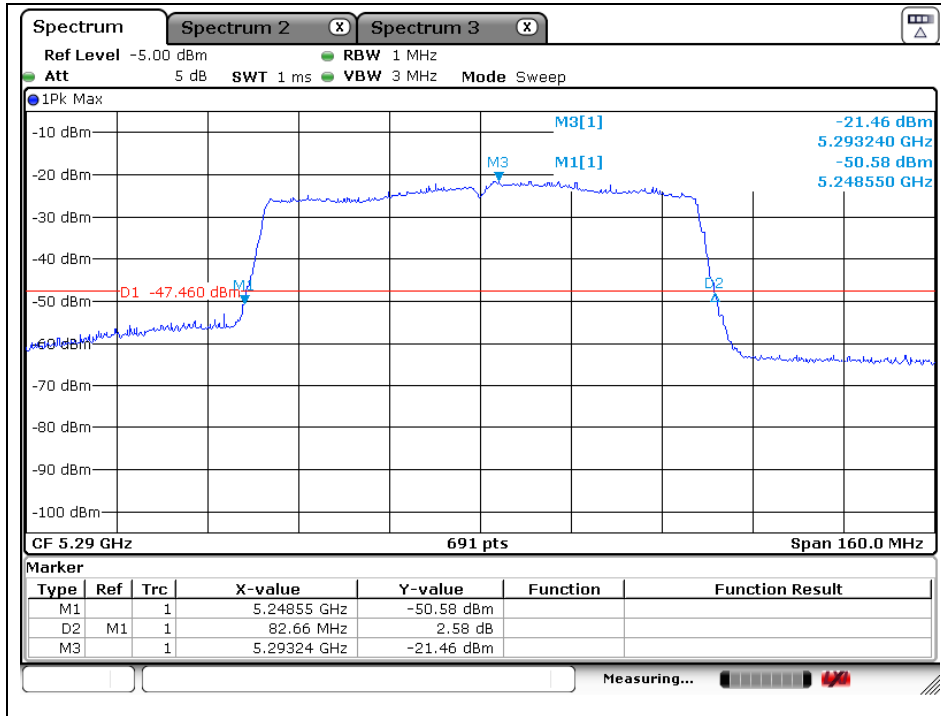
Middle Channel (5 210 MHz)



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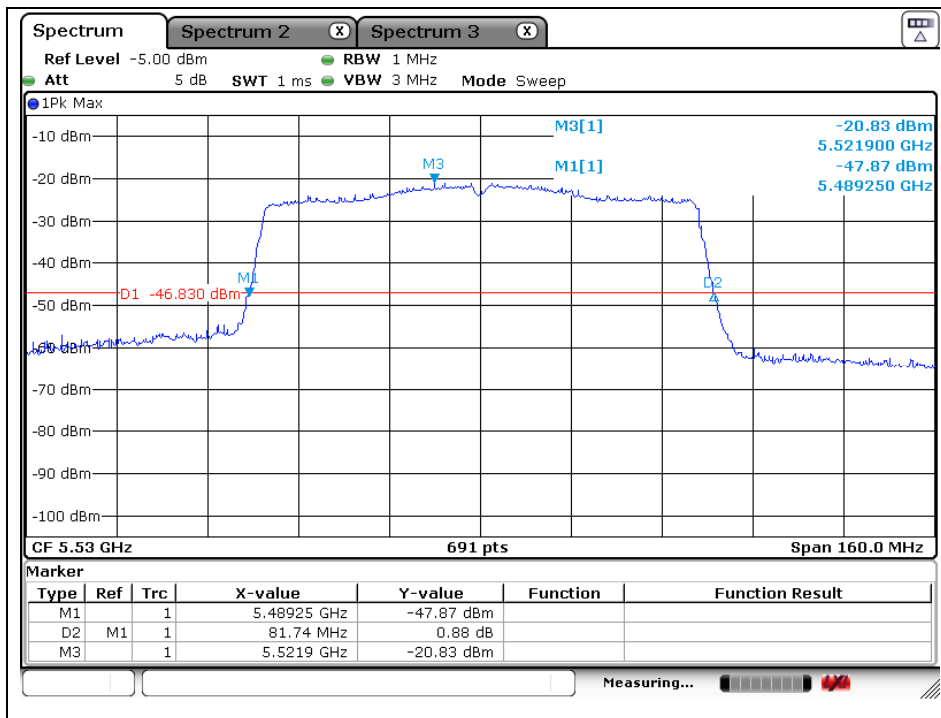
802.11ac_VHT80 (Band 2A)

Middle Channel (5 290 MHz)



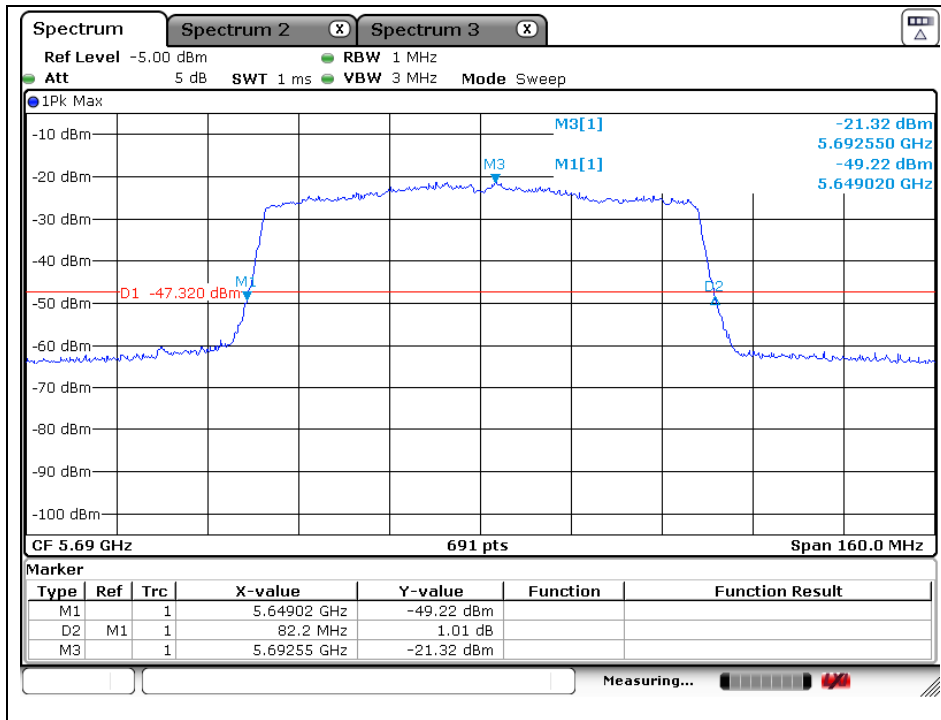
802.11ac_VHT80 (Band 2C)

Low Channel (5 530 MHz)



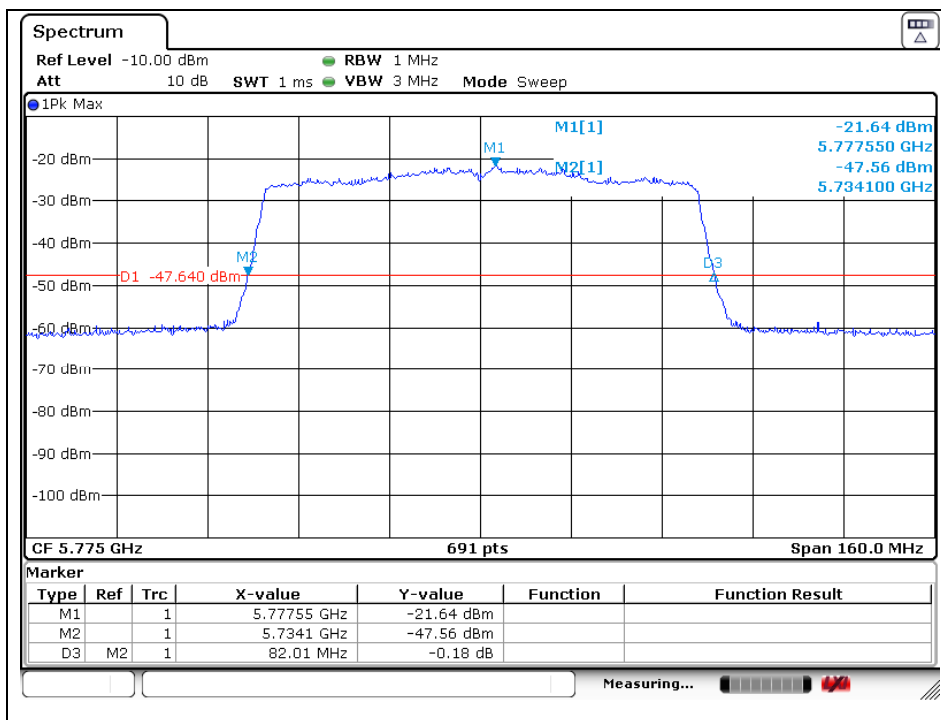
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High Channel (5 690 MHz)



802.11ac_VHT80 (Band 3)

Middle Channel (5 775 MHz)

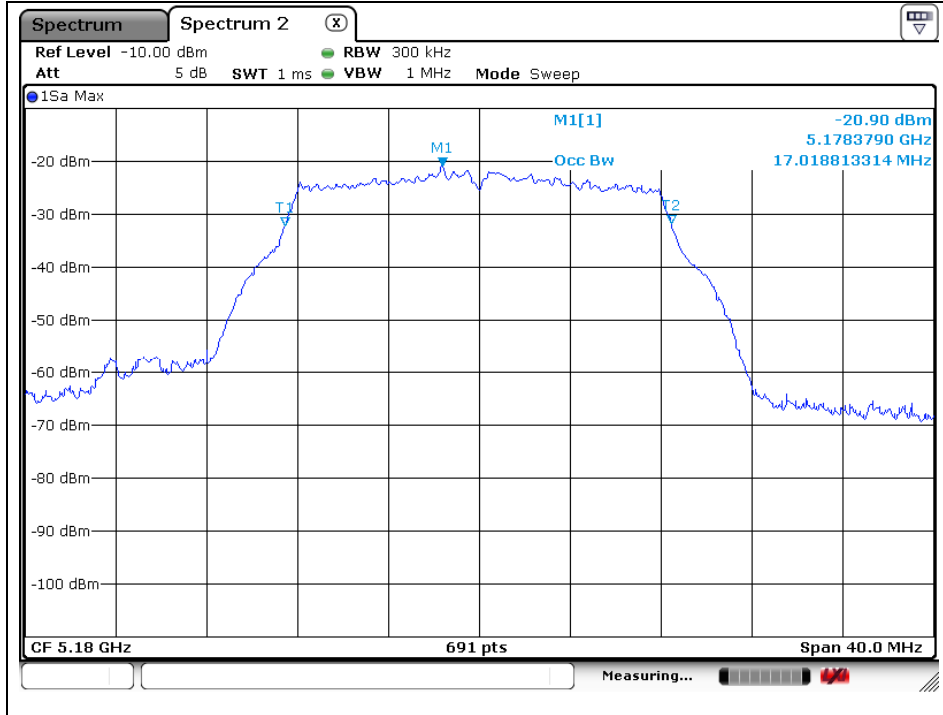


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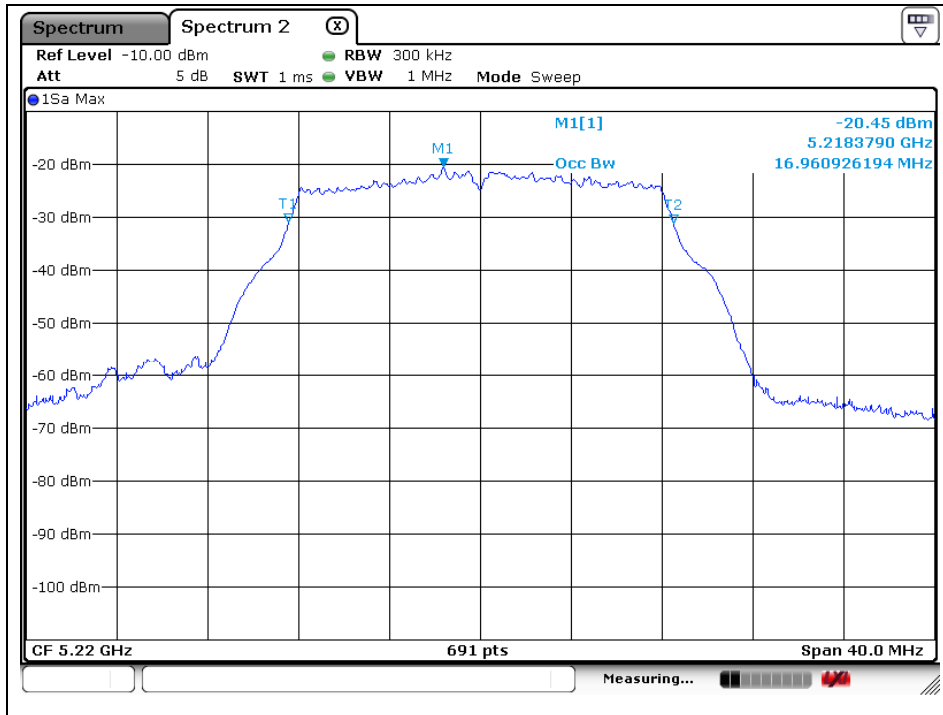
99 % Bandwidth

802.11a (Band 1)

Low Channel (5 180 MHz)

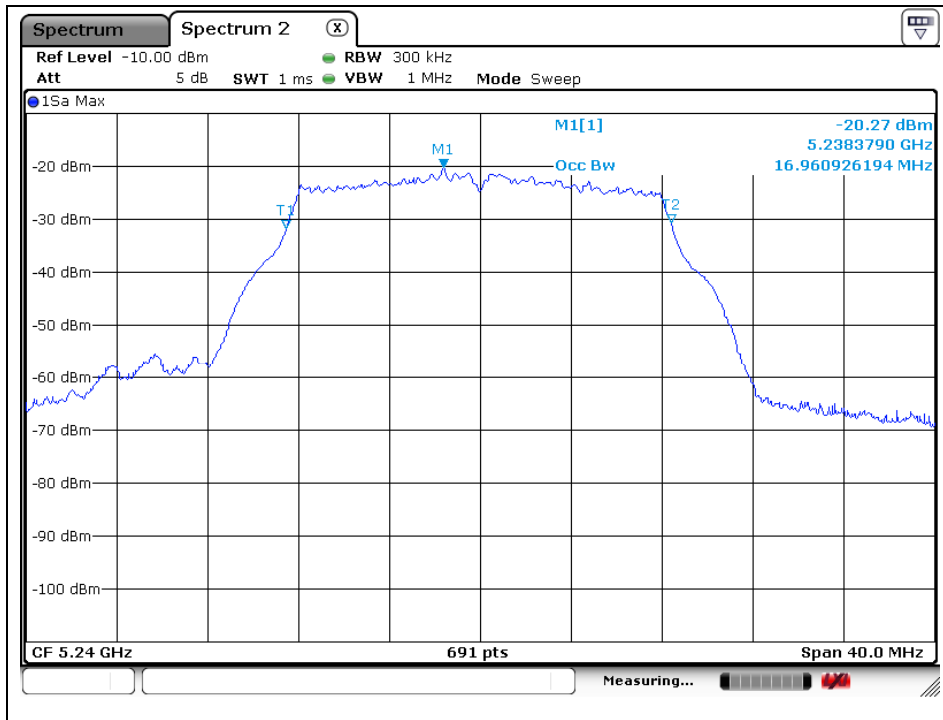


Middle Channel (5 220 MHz)



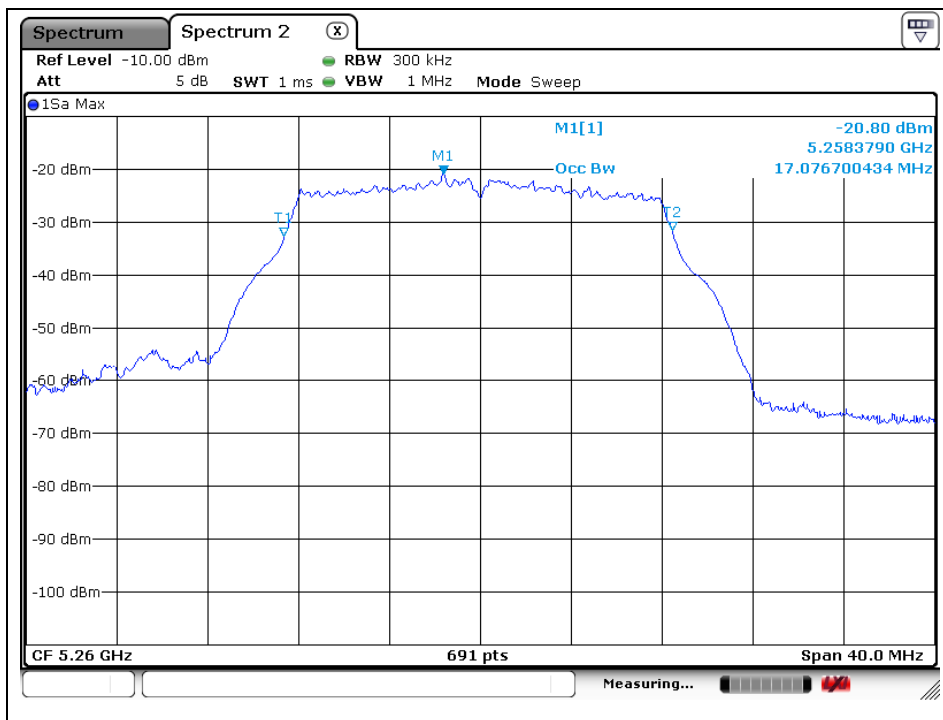
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High Channel (5 240 MHz)



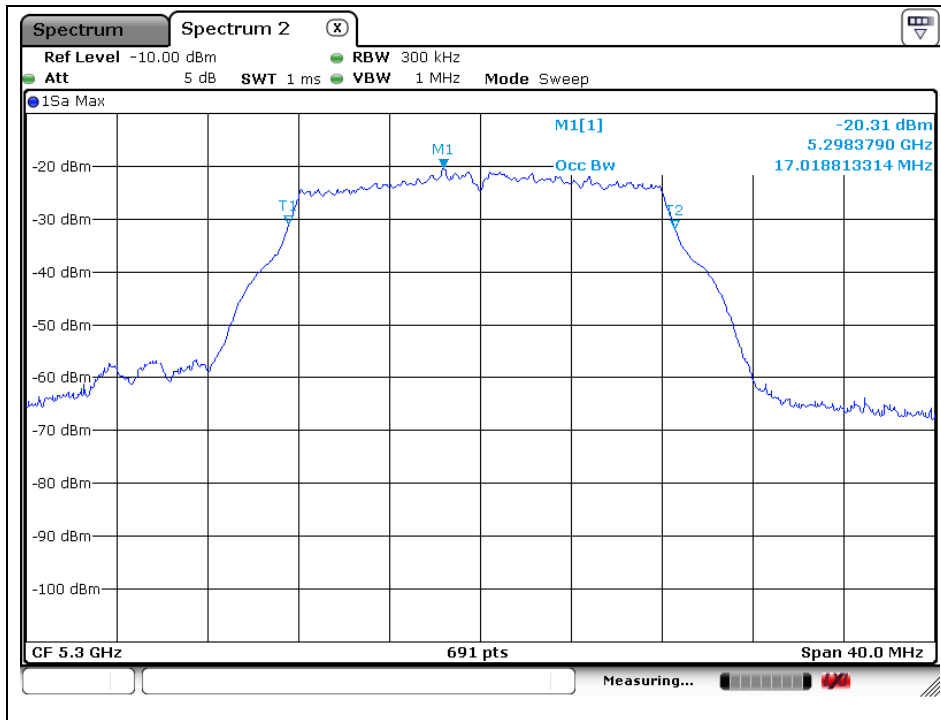
802.11a (Band 2A)

Low Channel (5 260 MHz)

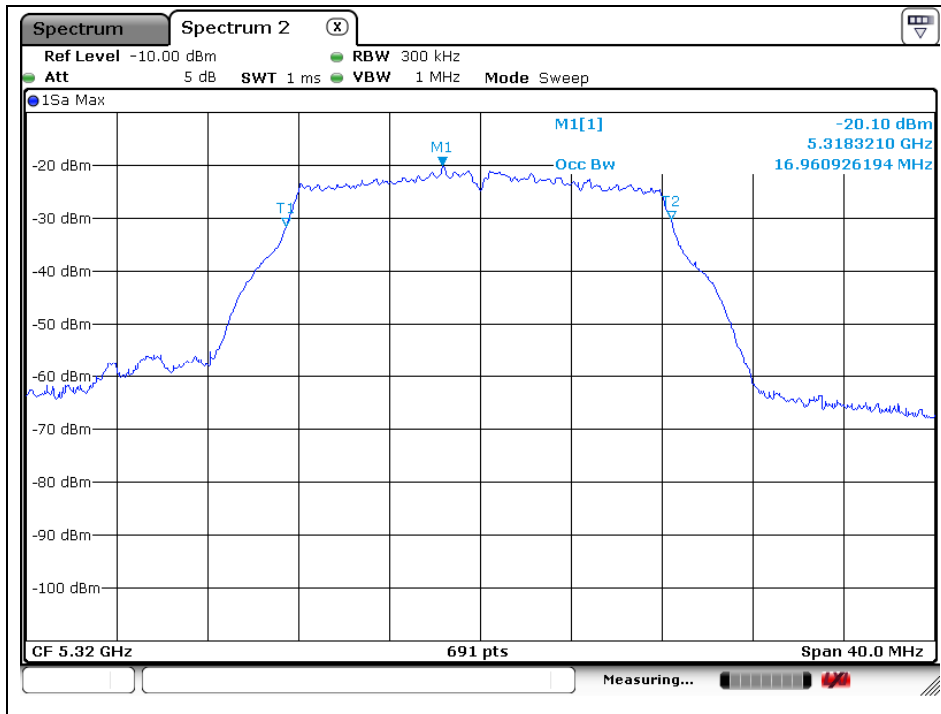


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Middle Channel (5 300 MHz)



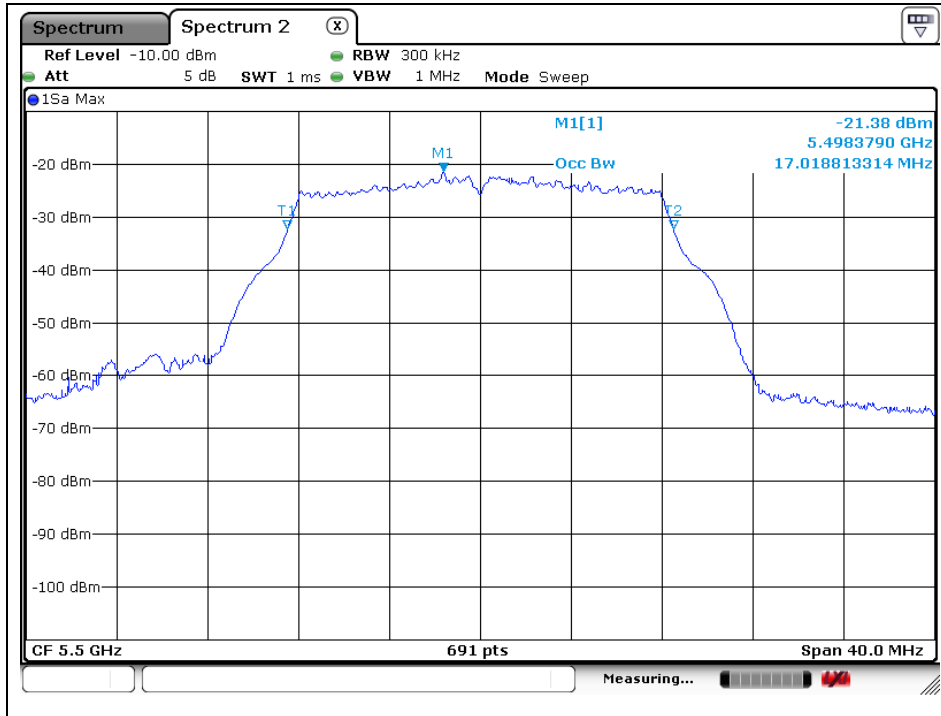
High Channel (5 320 MHz)



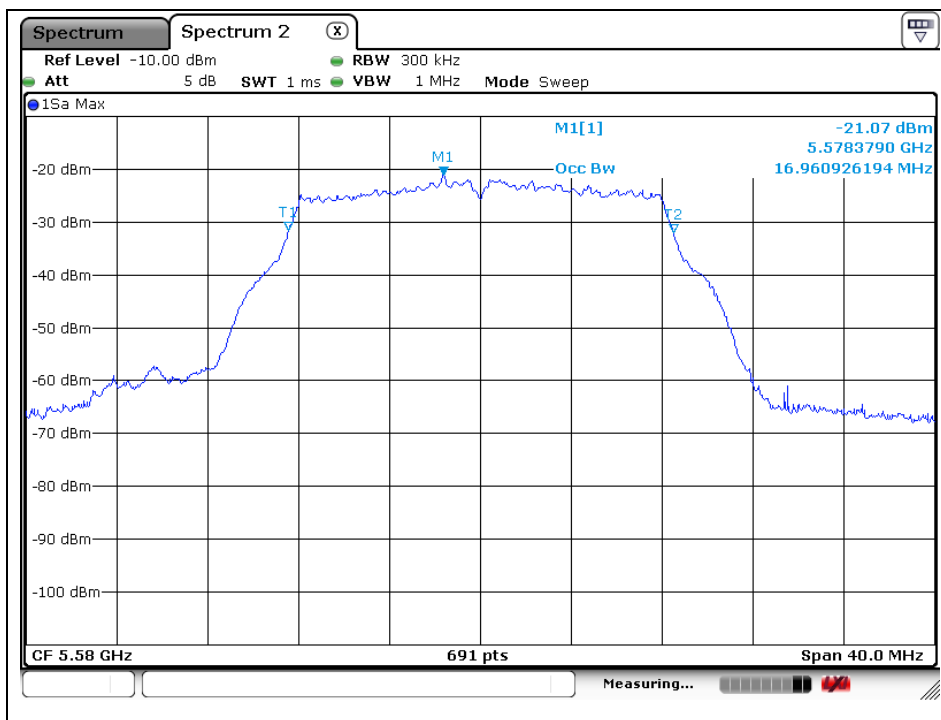
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802.11a (Band 2C)

Low Channel (5 500 MHz)

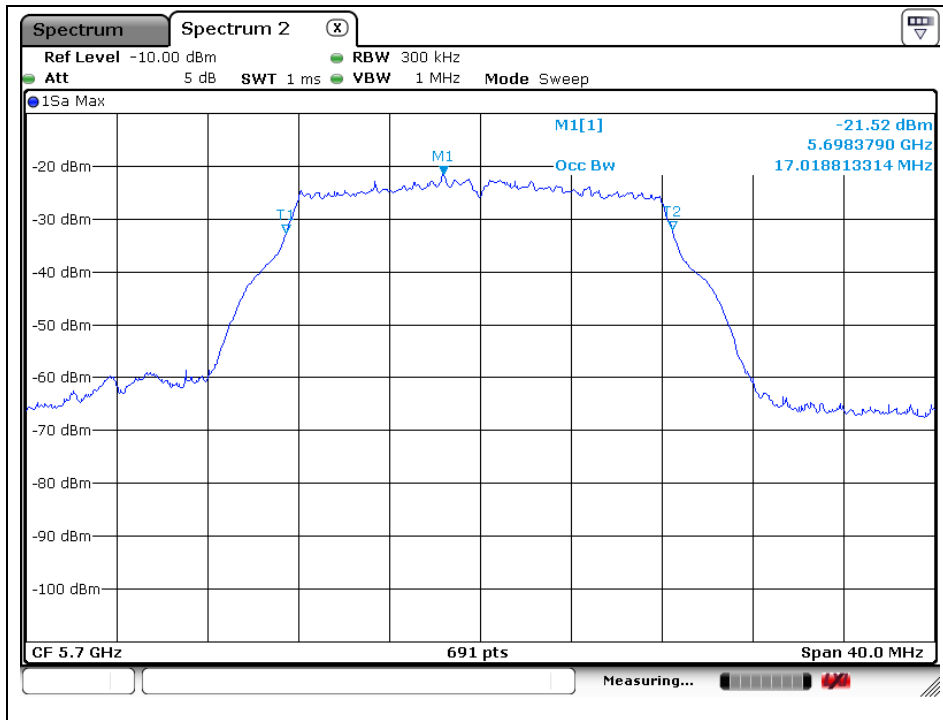


Middle Channel (5 580 MHz)



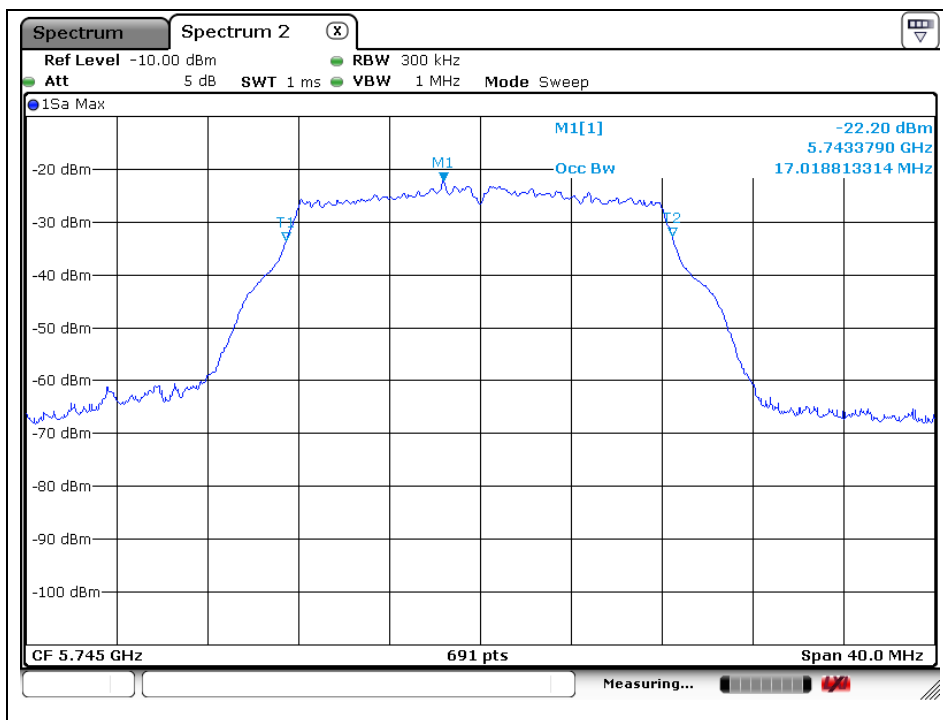
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High Channel (5 700 MHz)



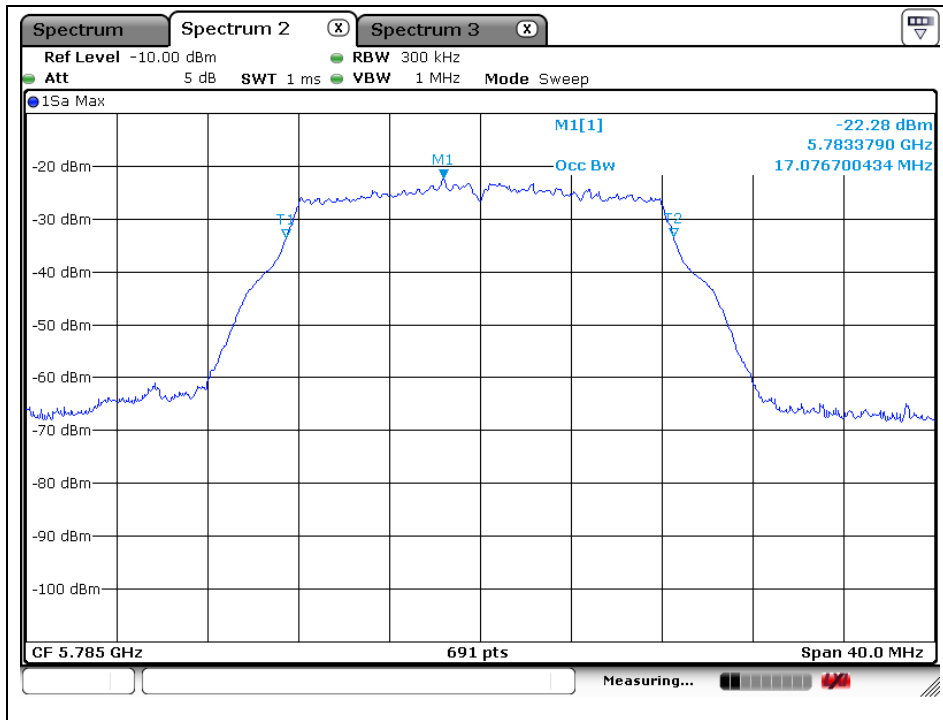
802.11a (Band 3)

Low Channel (5 745 MHz)

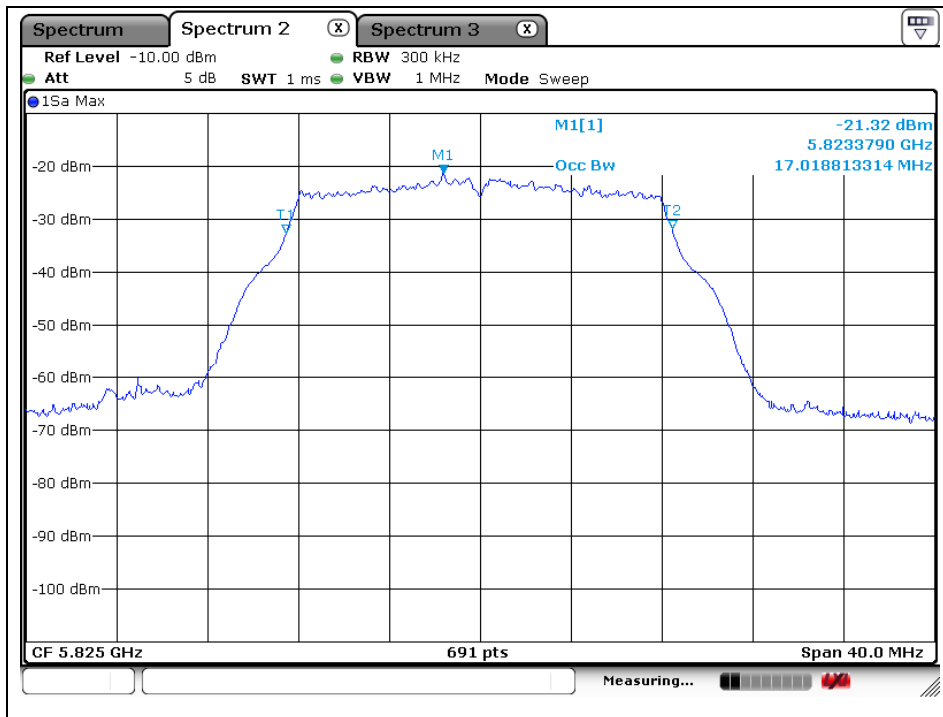


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Middle Channel (5 785 MHz)



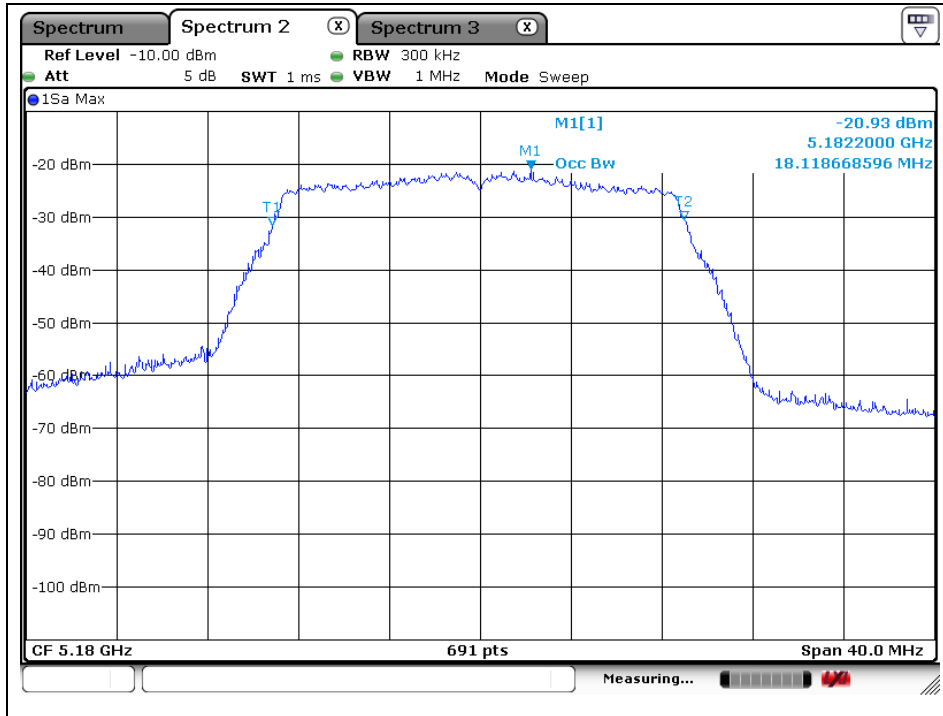
High Channel (5 825 MHz)



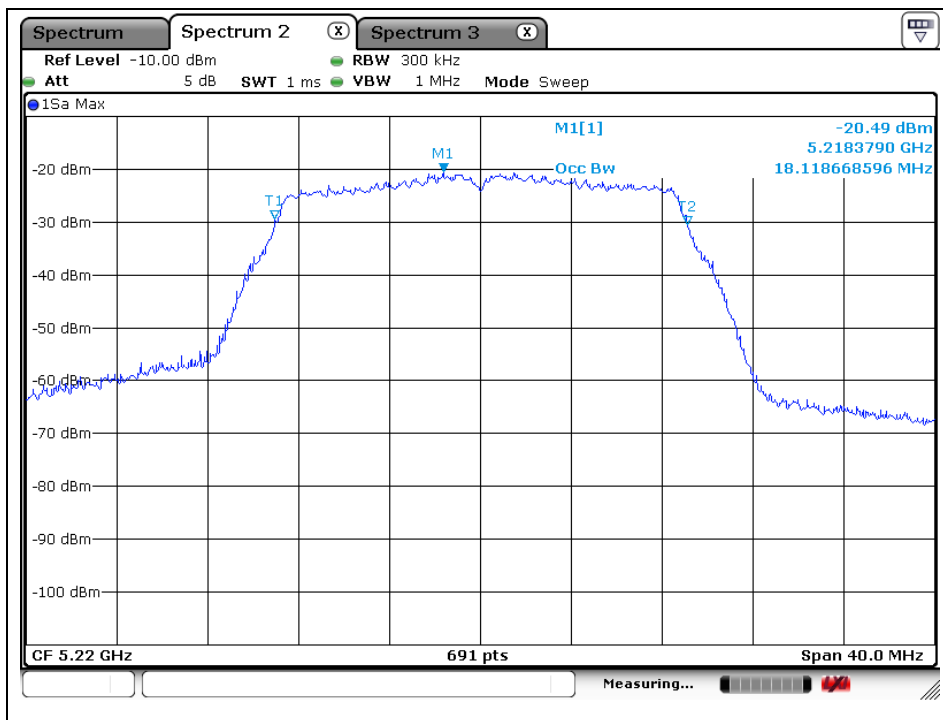
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802.11n_HT20 (Band 1)

Low Channel (5 180 MHz)

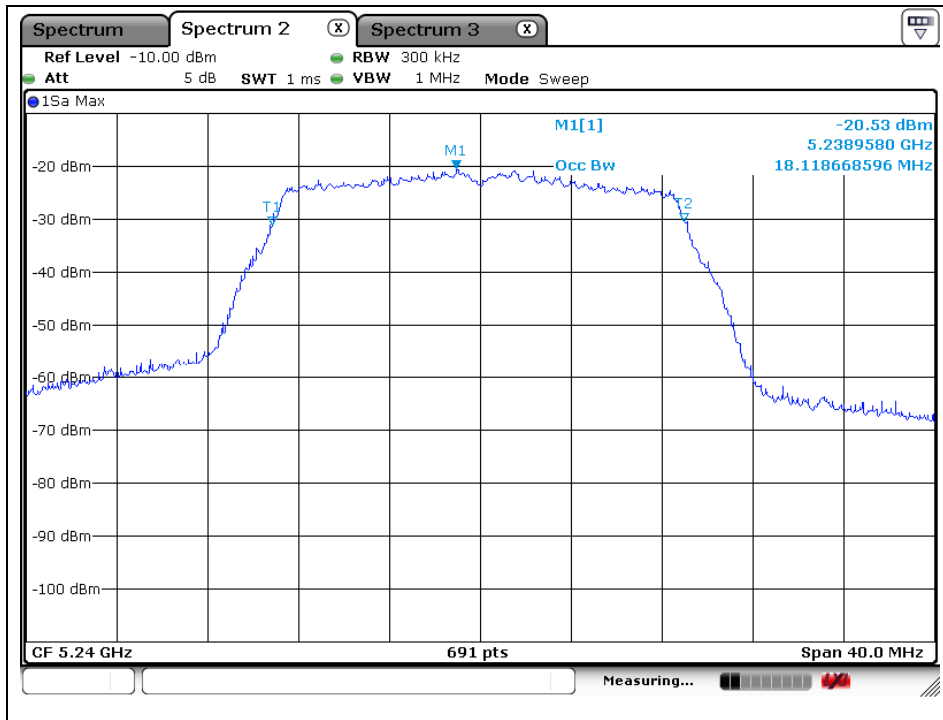


Middle Channel (5 220 MHz)



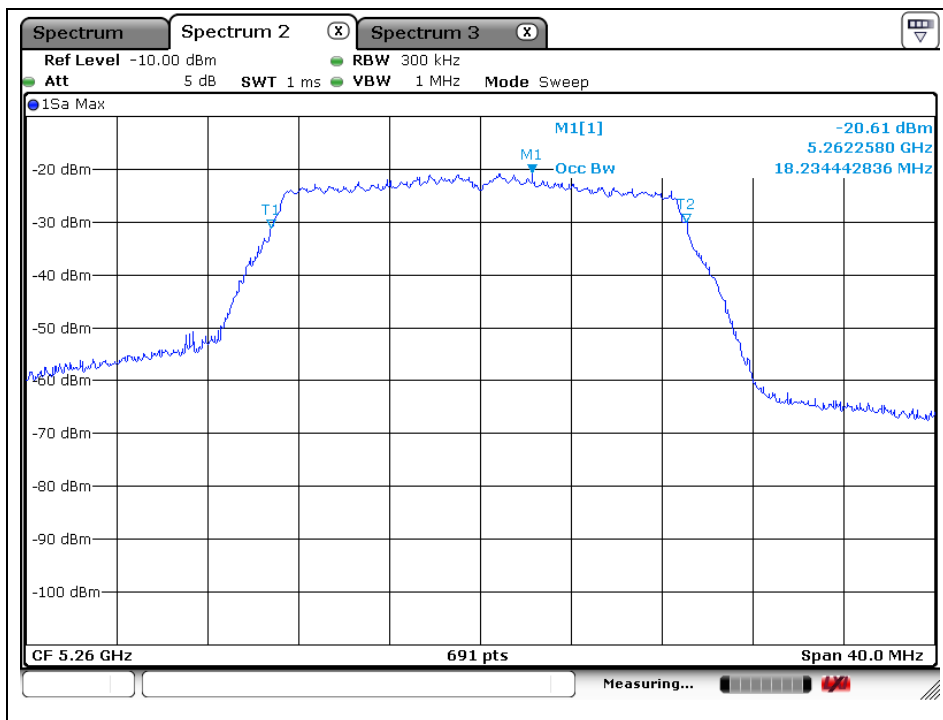
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High Channel (5 240 MHz)



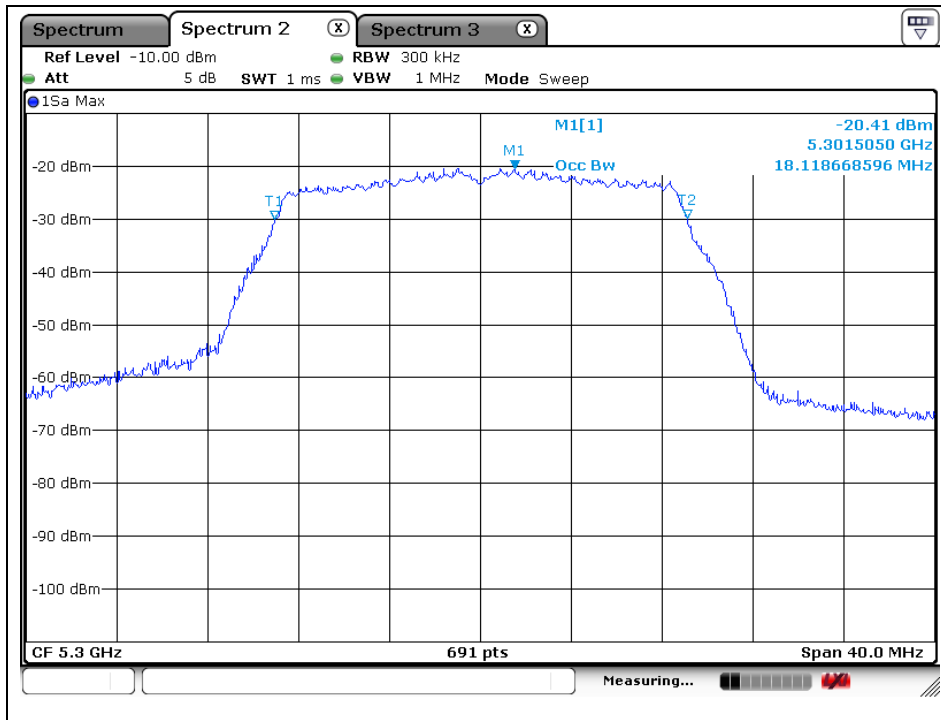
802.11n_HT20 (Band 2A)

Low Channel (5 260 MHz)

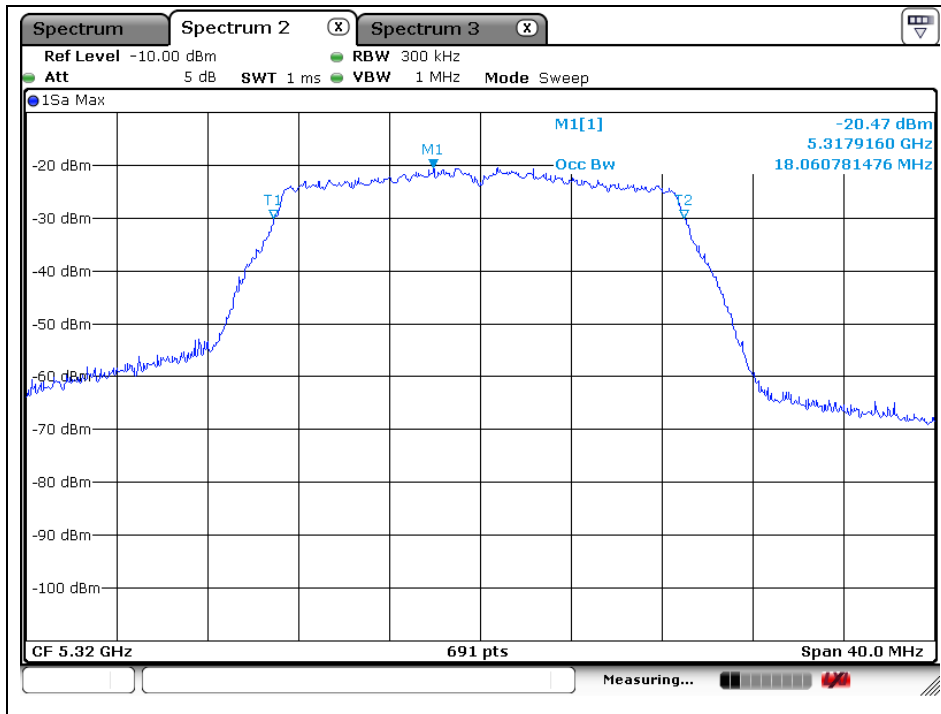


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Middle Channel (5 300 MHz)



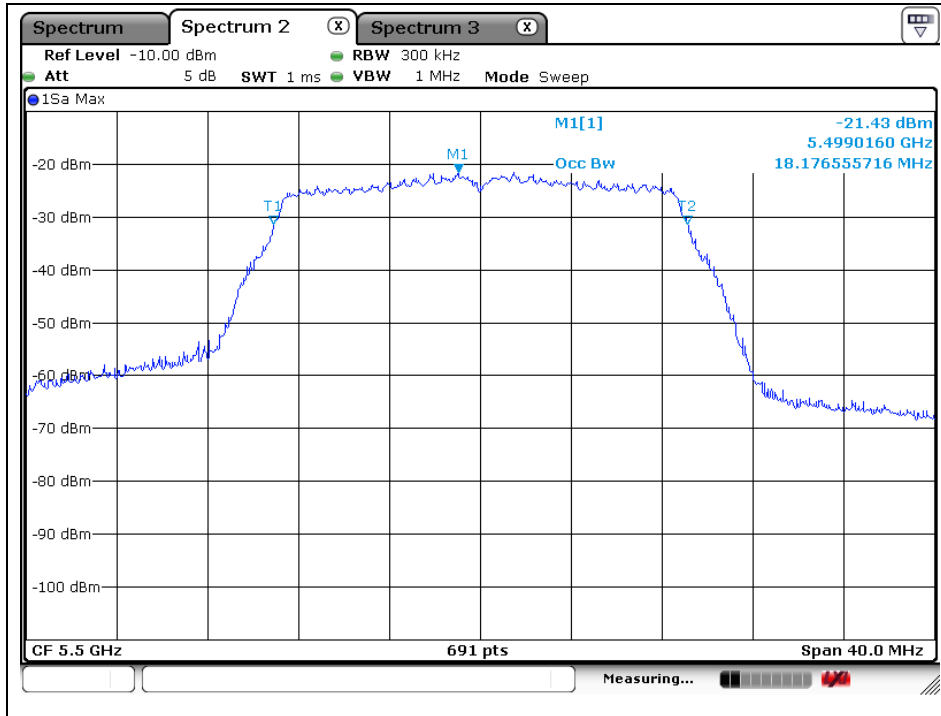
High Channel (5 320 MHz)



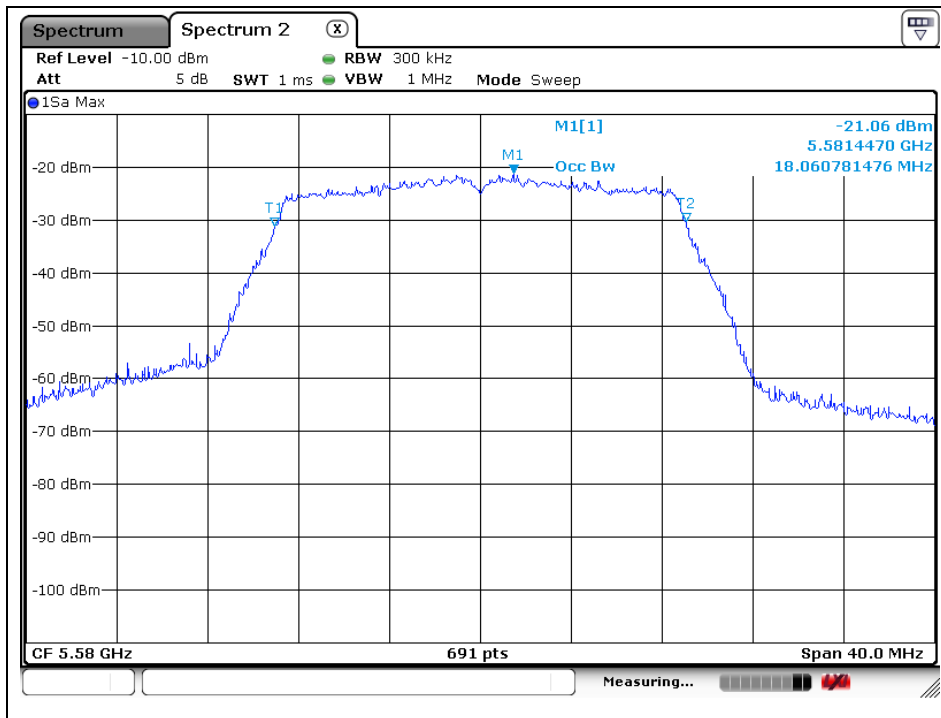
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802.11n_HT20 (Band 2C)

Low Channel (5 500 MHz)

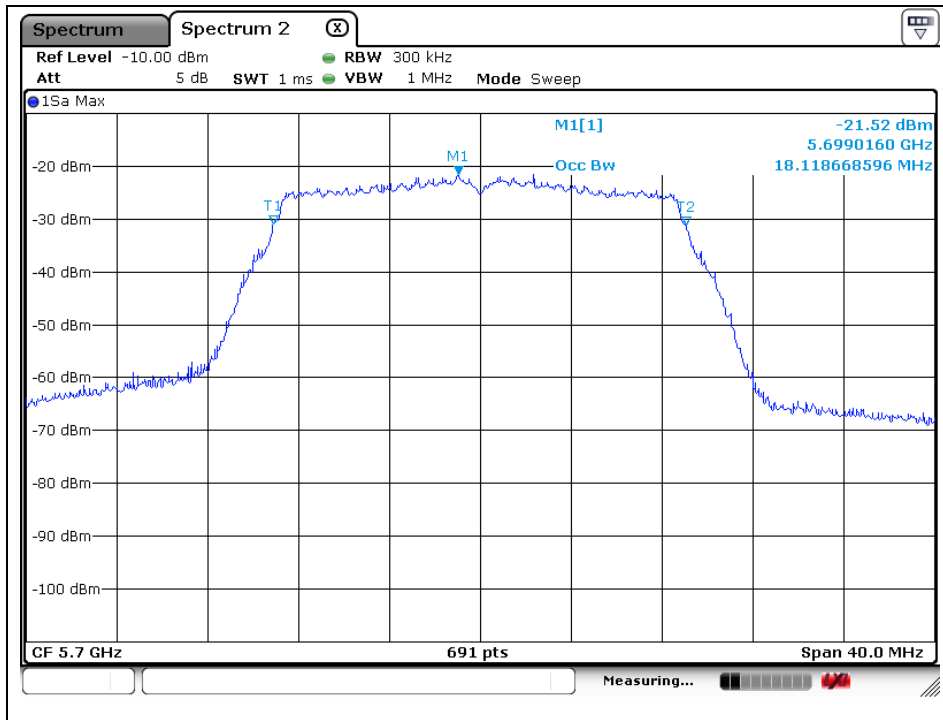


Middle Channel (5 580 MHz)



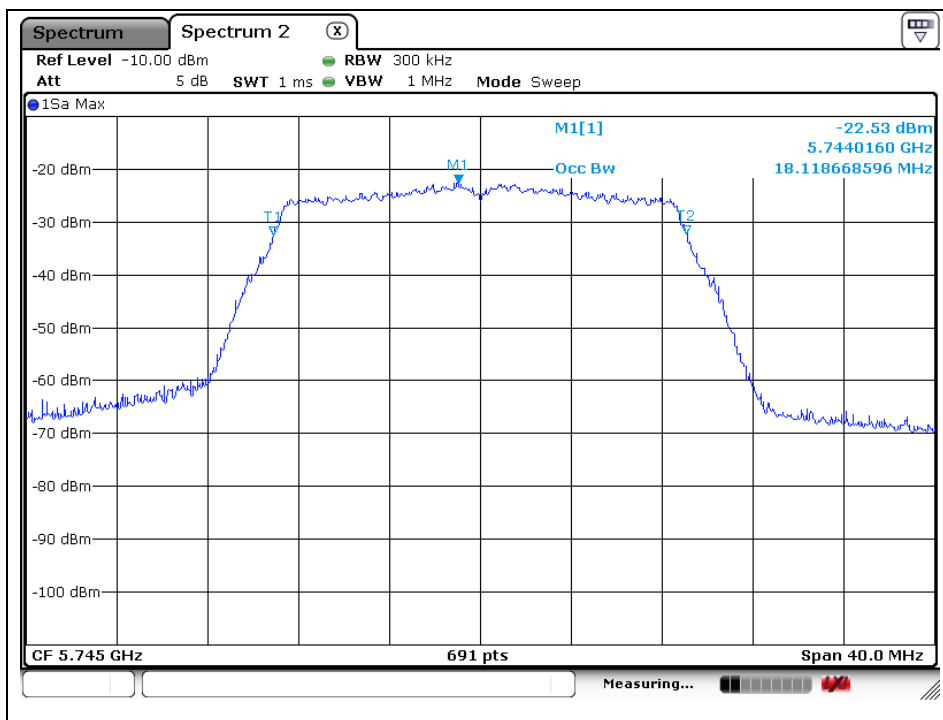
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High Channel (5 700 MHz)



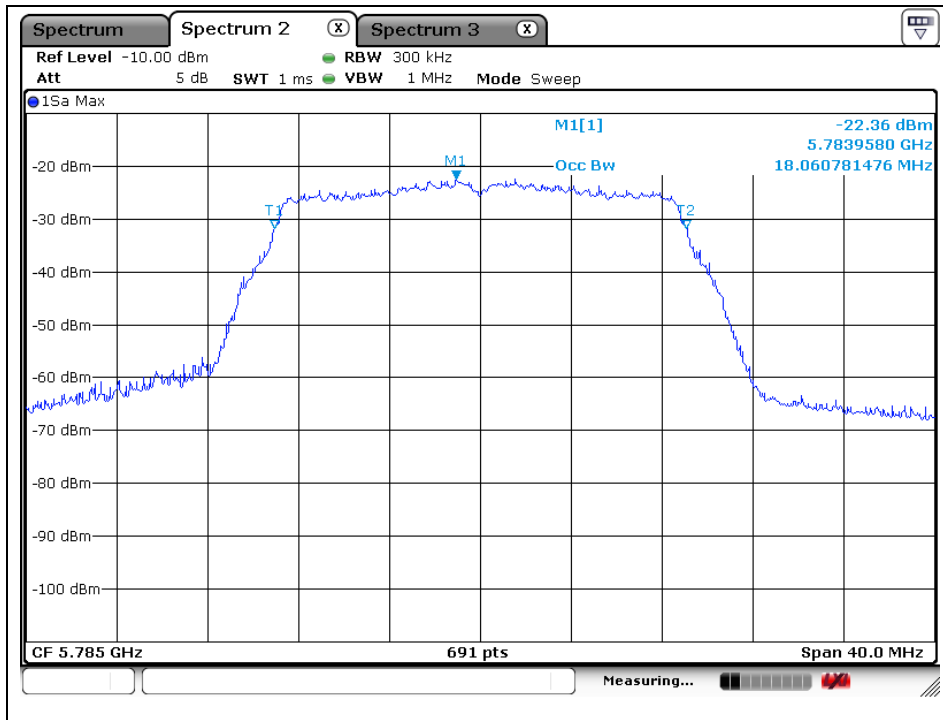
802.11n_HT20 (Band 3)

Low Channel (5 745 MHz)

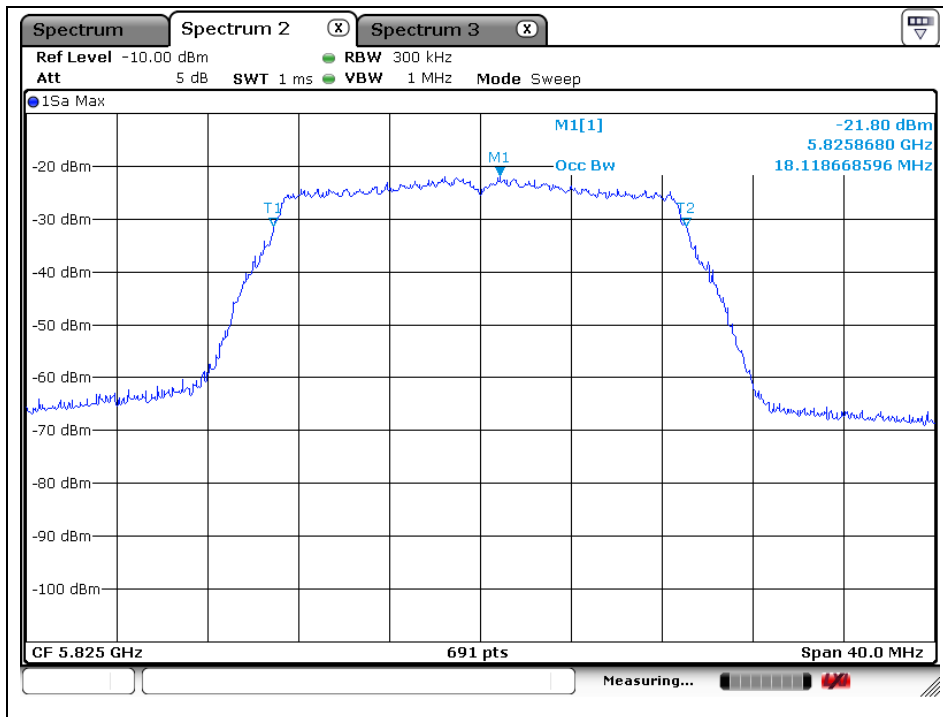


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Middle Channel (5 785 MHz)



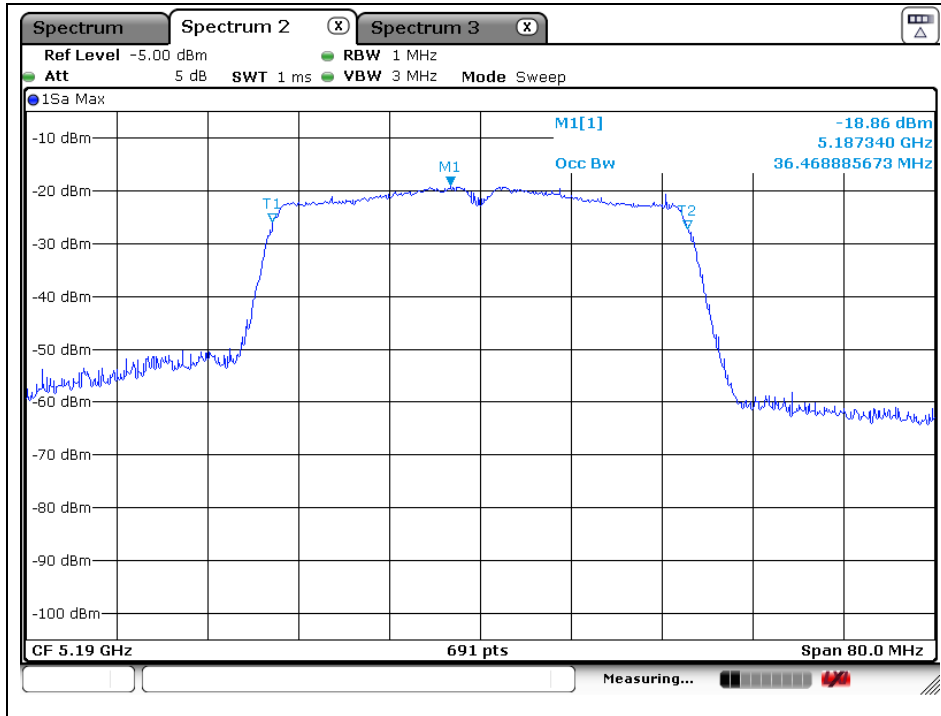
High Channel (5 825 MHz)



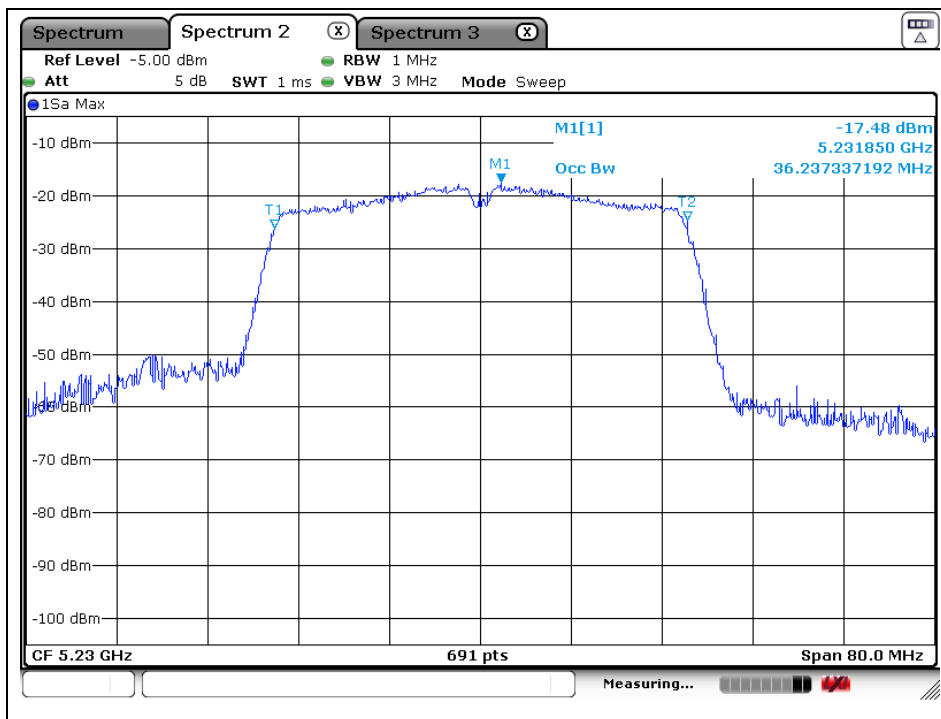
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802.11n_HT40 (Band 1)

Low Channel (5 190 MHz)



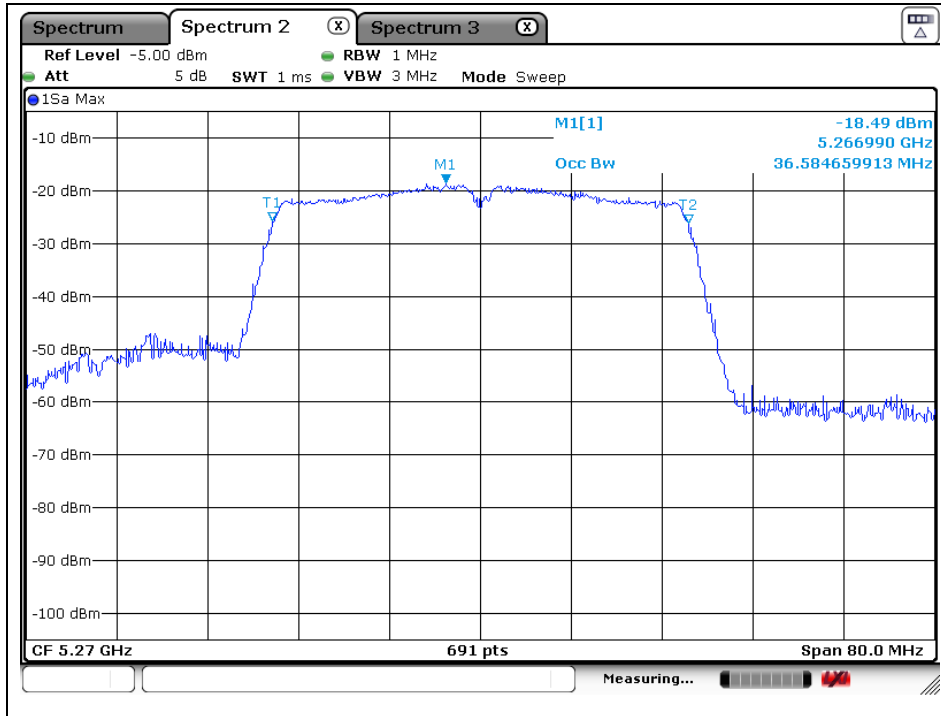
High Channel (5 230 MHz)



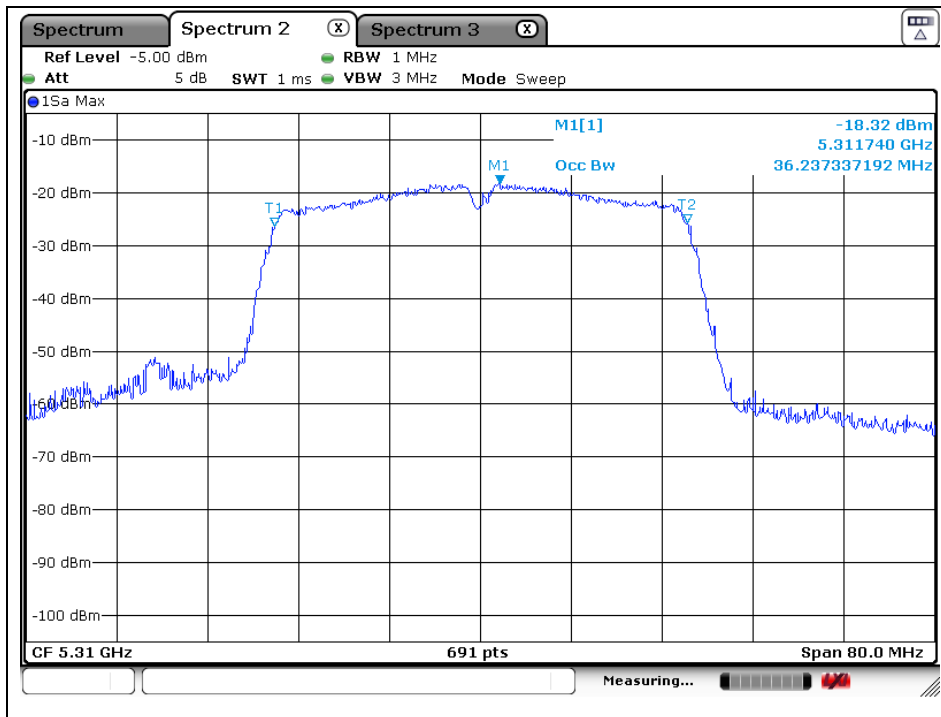
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802.11n_HT40 (Band 2A)

Low Channel (5 270 MHz)



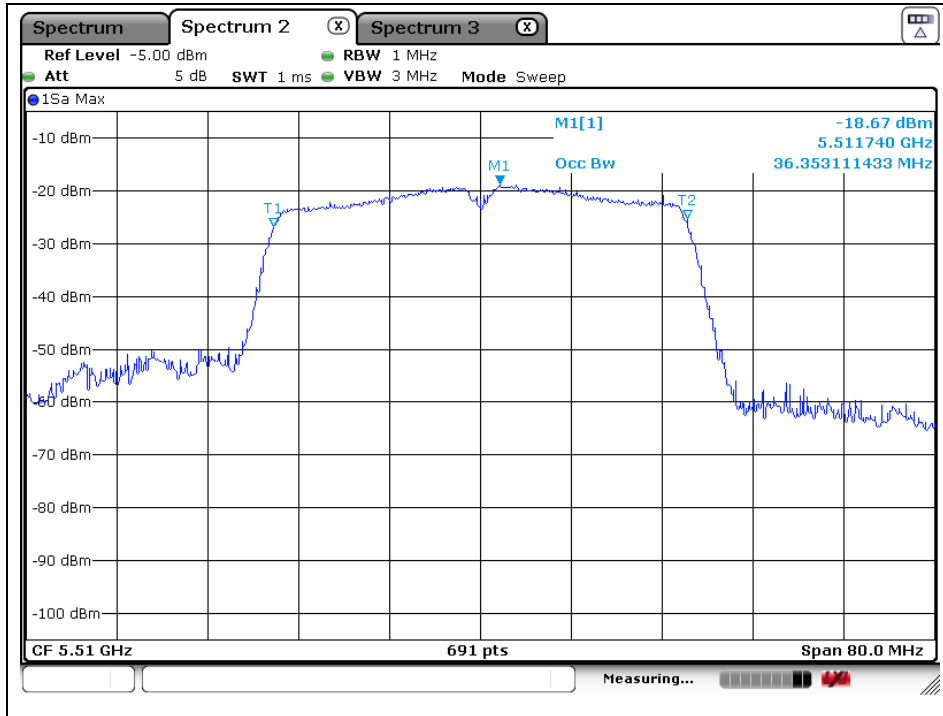
High Channel (5 310 MHz)



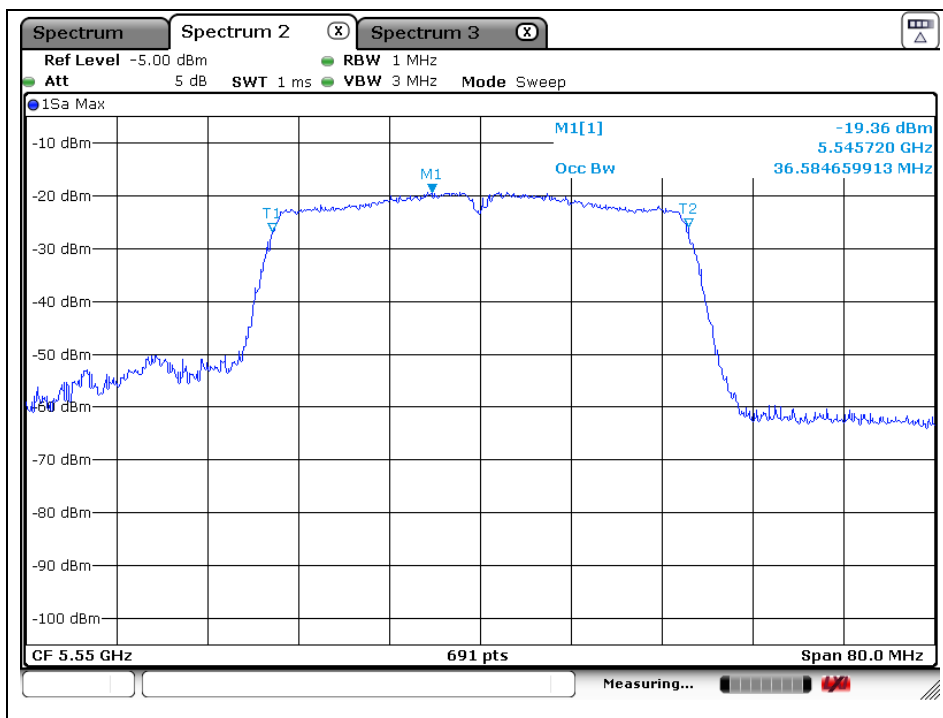
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802.11n_HT40 (Band 2C)

Low Channel (5 510 MHz)

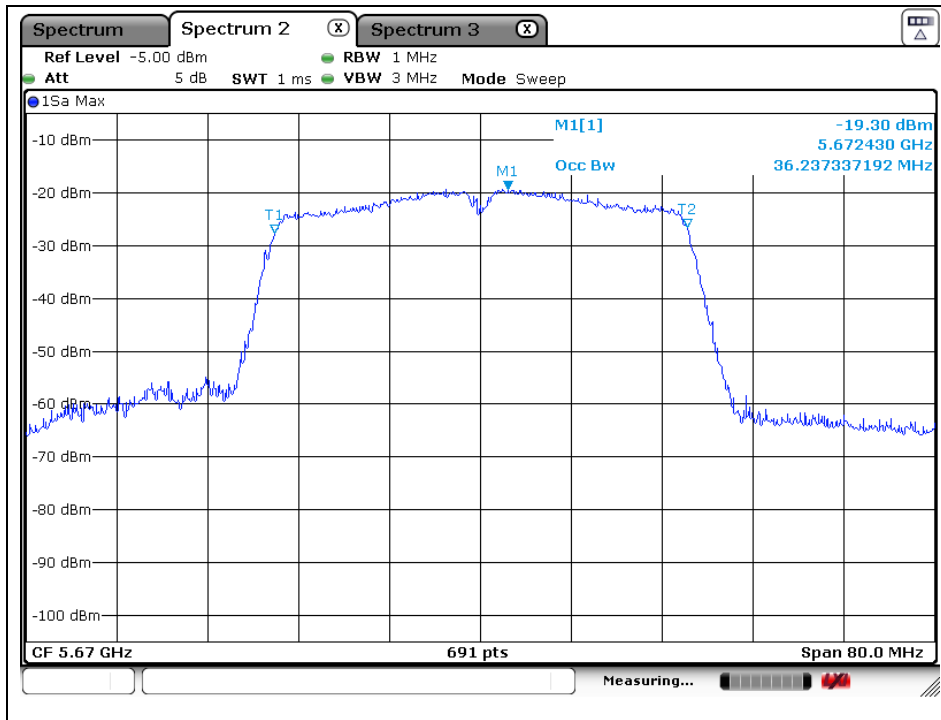


Middle Channel (5 550 MHz)



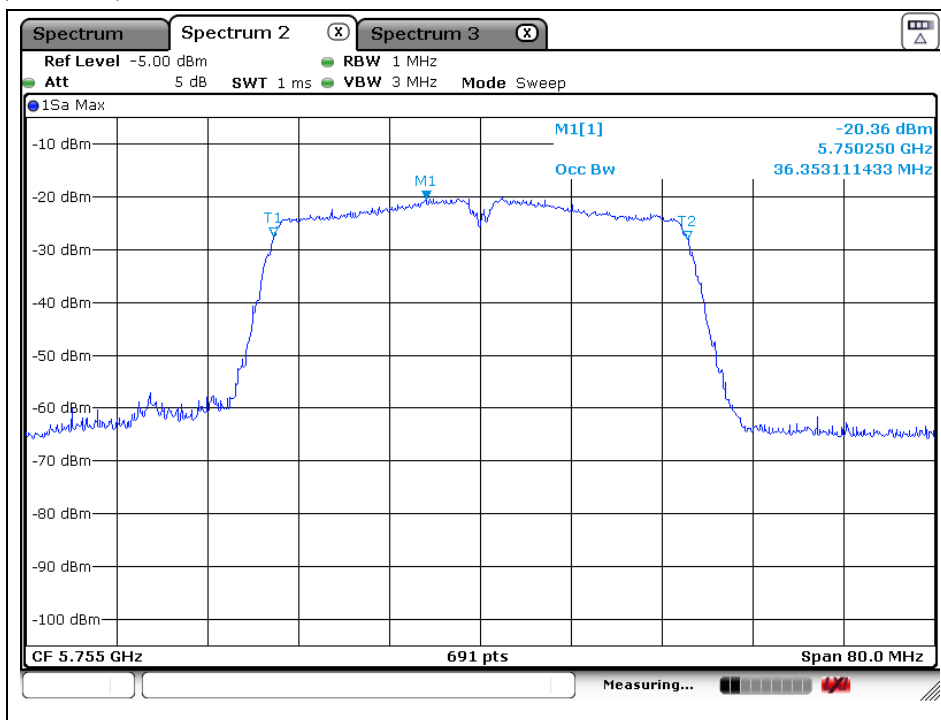
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High Channel (5 670 MHz)



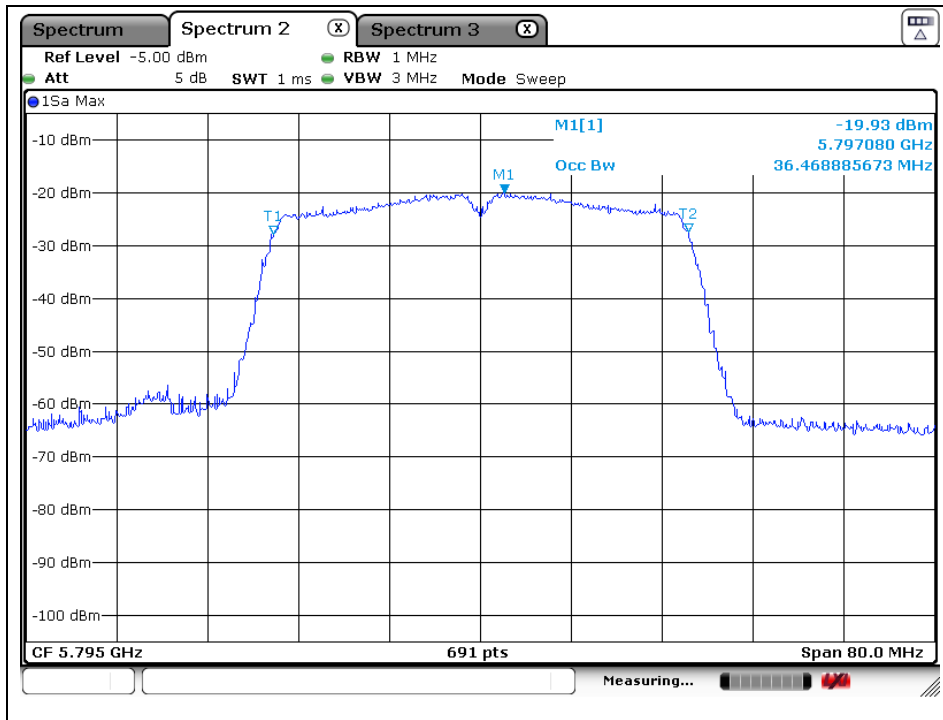
802.11n_HT40 (Band 3)

Low Channel (5 755 MHz)



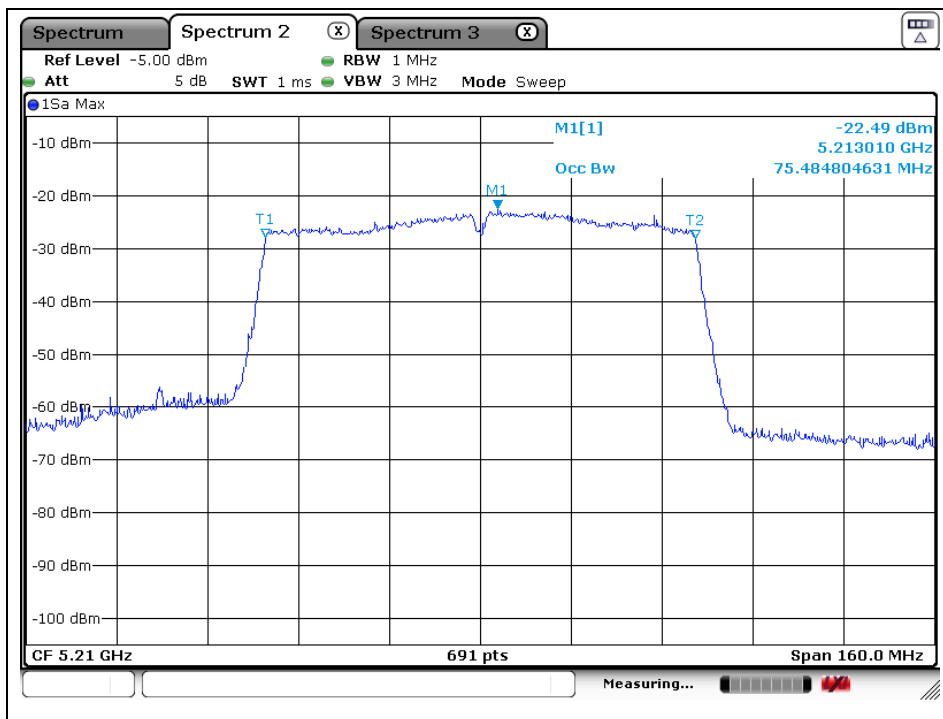
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High Channel (5 795 MHz)



802.11ac_VHT80 (Band 1)

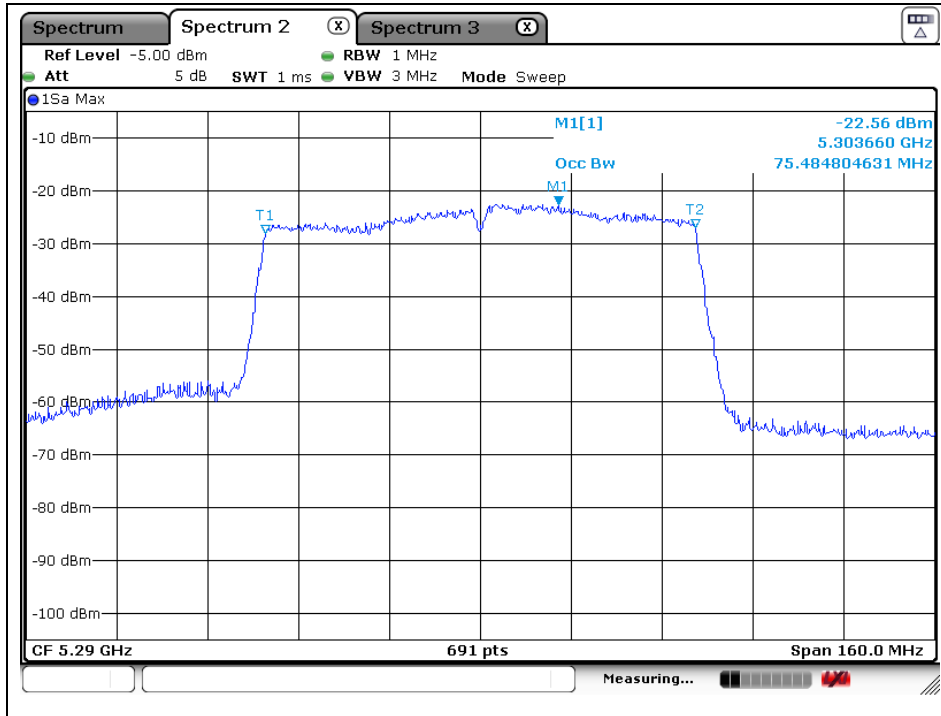
Middle Channel (5 210 MHz)



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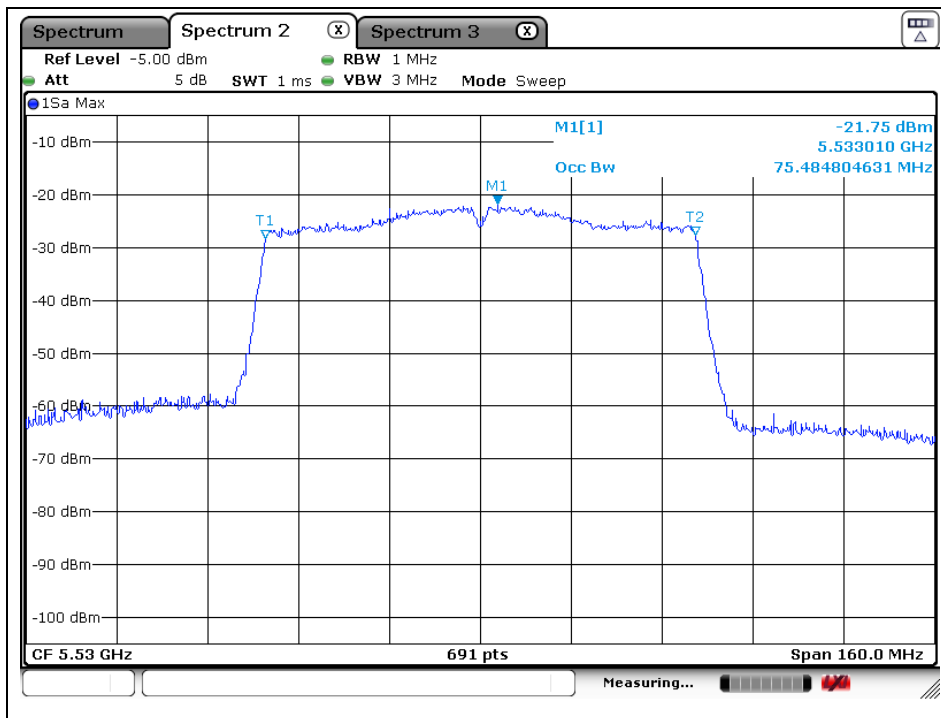
802.11ac_VHT80 (Band 2A)

Middle Channel (5 290 MHz)



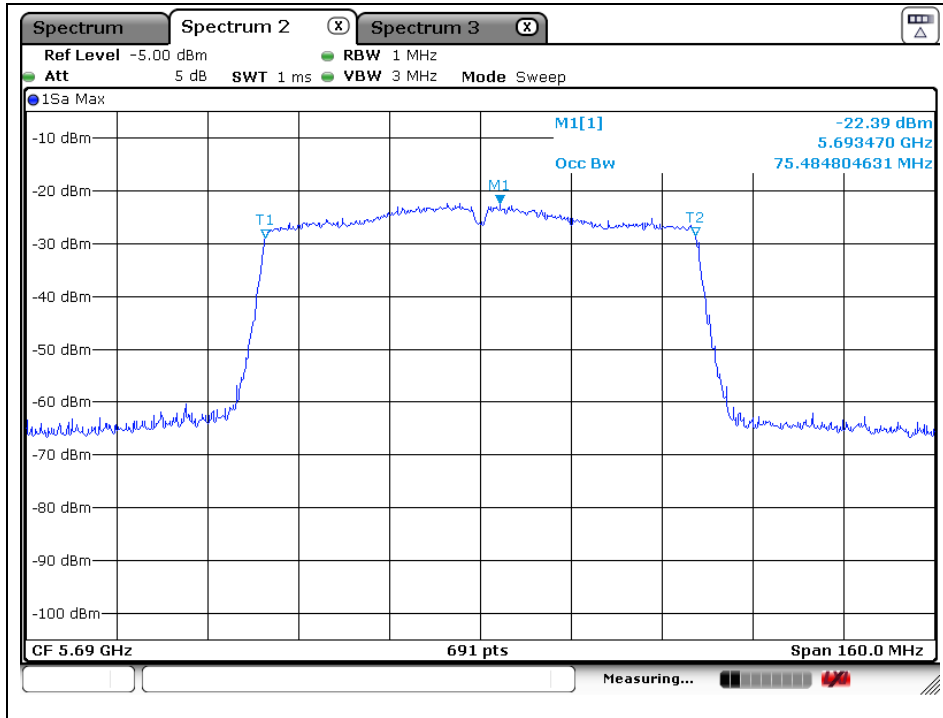
802.11ac_VHT80 (Band 2C)

Low Channel (5 530 MHz)



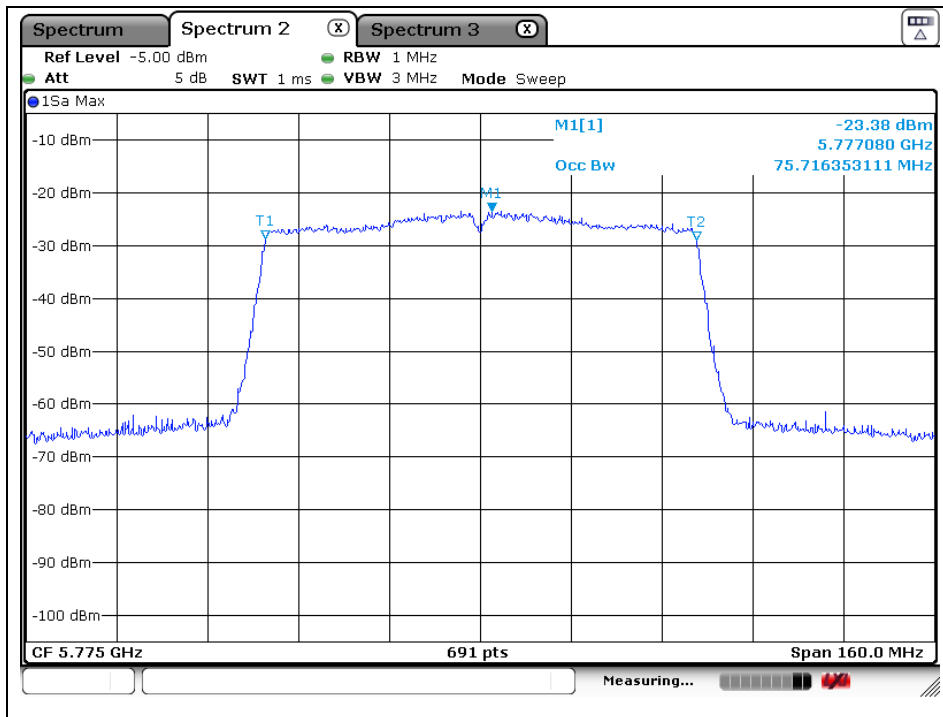
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High Channel (5 690 MHz)



802. 11ac_VHT80 (Band 3)

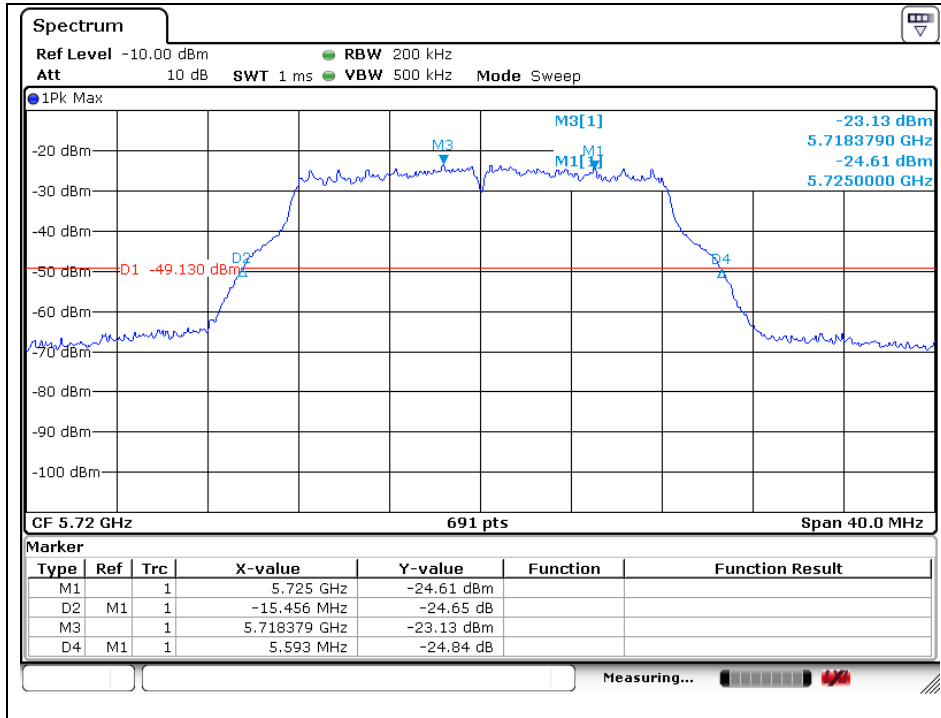
Middle Channel (5 775 MHz)



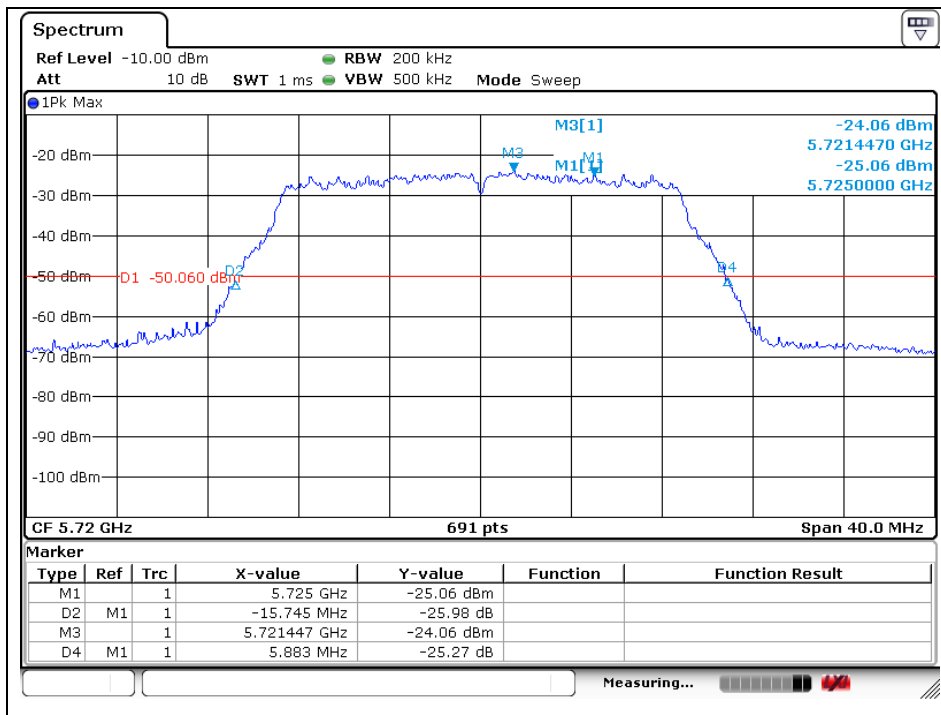
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Band-crossing channels

802.11a (5 720 MHz)

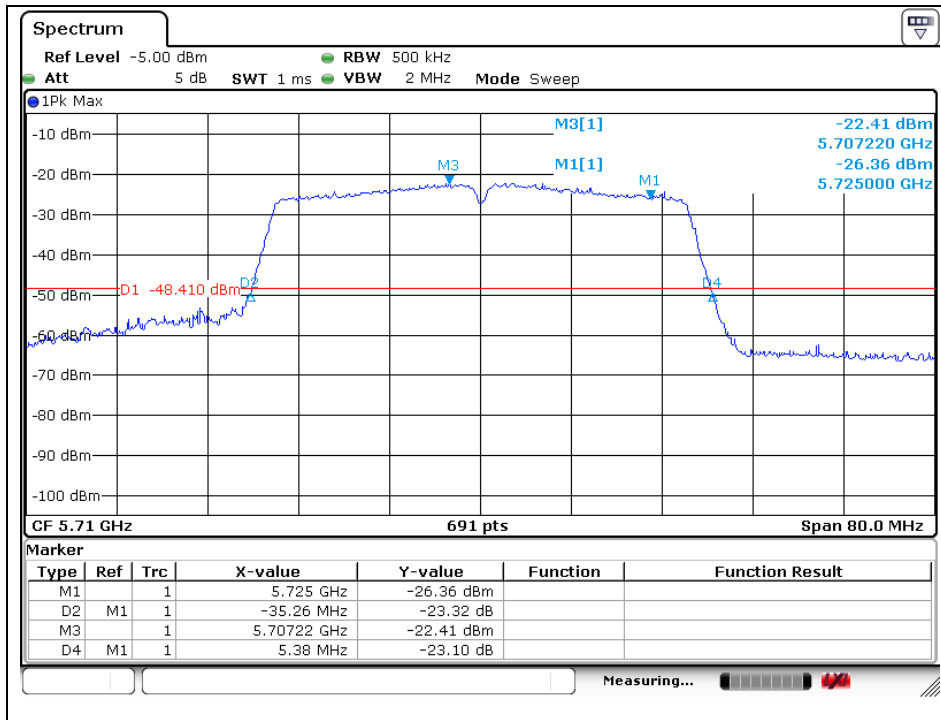


802.11n_HT20 (5 720 MHz)

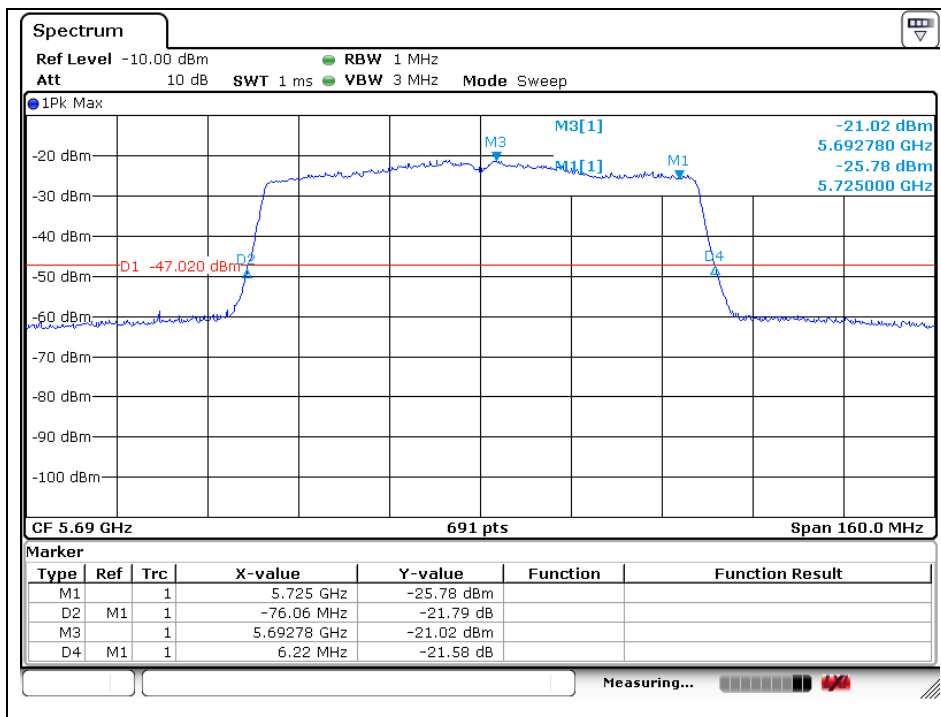


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802.11n_HT40 (5 710 MHz)



802.11ac_VHT80 (5 690 MHz)



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