FCC RF Test Report

APPLICANT	:	Sonim Technologies, Inc.
EQUIPMENT	:	Mobile Hotspot
BRAND NAME	:	Sonim
MODEL NAME	:	H700B
FCC ID	:	WYPH700B
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure
TEST DATE(S)	:	Sep. 12, 2024 ~ May 15, 2025

We, Sporton International Inc. (ShenZhen), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (ShenZhen), the test report shall not be reproduced except in full.

Fly Liang

Approved by: Fly Liang

Sporton International Inc. (ShenZhen)

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People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR480204B	Rev. 01	Initial issue of report	May 27, 2025

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit for U-NII-1	Limit for U-NII-3	Result	Remark
3.1	2.1049 & 15.403(i)	6dB, 26dB & 99% Bandwidth	-	6dB Bandwidth > 500kHz	Pass	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 24 dBm	≤ 30 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 11 dBm/MHz	≤ 30 dBm/500kHz	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	15.407(b)(4)(i) &15.209(a)	Pass	Under limit 4.54 dB at 5149.90 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	15.207(a)	Pass	Under limit 15.42 dB at 0.61 MHz
3.6	15.203 & 15.407(a)	Antenna Requirement	15.203 & 15.407(a)	15.203 & 15.407(a)	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

1 General Description

1.1 Applicant

Sonim Technologies, Inc.
4445 Eastgate Mall,Suite200,San Diego, CA92121, USA

1.2 Manufacturer

Sonim Technologies, Inc.
4445 Eastgate Mall,Suite200,San Diego, CA92121, USA

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Hotspot
Brand Name	Sonim
Model Name	H700B
FCC ID	WYPH700B
IMEI Code	Conducted: 351393280001029 Conduction: 351393280007588 Radiation: 351393280007620
HW Version	V3.0
SW Version	H70.0-01-22.3.0-10.25.00
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	5180 MHz ~ 5240 MHz 5745 MHz ~ 5825 MHz
Maximum Output Power to Antenna	**MIMO <Ant. 6 + 7>** **<5180 MHz ~ 5240 MHz>** 802.11a : 18.75 dBm / 0.0750 W 802.11n HT20 : 17.72 dBm / 0.0592 W 802.11n HT40 : 17.25 dBm / 0.0531 W 802.11ac VHT80: 15.03 dBm / 0.0318 W 802.11be EHT20: 12.64 dBm / 0.0184 W 802.11be EHT40: 12.08 dBm / 0.0161 W 802.11be EHT80: 12.14 dBm / 0.0164 W **<5745 MHz ~ 5825 MHz>** 802.11a : 18.39 dBm / 0.0690 W 802.11n HT20 : 17.31 dBm / 0.0538 W 802.11n HT40 : 17.77 dBm / 0.0598 W 802.11ac VHT80: 15.34 dBm / 0.0342 W 802.11be EHT20: 12.51 dBm / 0.0178 W 802.11be EHT40: 12.69 dBm / 0.0371 W 802.11be EHT80: 12.66 dBm / 0.0185 W
99% Occupied Bandwidth	**MIMO <Ant. 6 + 7>** **<5180 MHz ~ 5240 MHz>** 802.11a : 17.334 MHz 802.11n HT20 : 18.790 MHz 802.11n HT40 : 37.524 MHz 802.11ac VHT80 : 77.080 MHz 802.11be EHT20: 19.510 MHz 802.11be EHT40: 38.988 MHz 802.11be EHT80: 78.456 MHz **<5745 MHz ~ 5825 MHz>** 802.11a : 17.370 MHz 802.11n HT20 : 18.734 MHz 802.11n HT40 : 37.484 MHz 802.11ac VHT80 : 77.896 MHz 802.11be EHT20: 49.494 MHz 802.11be EHT40: 38.828 MHz 802.11be EHT80: 78.584 MHz
Antenna Type / Gain	**<5180 MHz ~ 5240 MHz>** <Ant. 6> : PIFA Antenna with gain 3.35 dBi <Ant. 7> : PIFA Antenna with gain 1.67 dBi **<5745 MHz ~ 5825 MHz>** <Ant. 6> : PIFA Antenna with gain 3.14 dBi <Ant. 7> : PIFA Antenna with gain 2.79 dBi
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) 802.11ax : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM) 802.11be : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM / 4096QAM)

Antenna Function Description		Ant. 7	Ant. 6
	802.11 a/n/ac/ax/be SISO	V	V
	802.11 a/n/ac/ax/be CDD 1S2T	V	
	802.11 a/n/ac/ax/be TXBF 1S2T	V	

Note:

1. For WLAN SISO & MIMO mode, the whole testing has assessed only MIMO mode by referring to the higher output power.
2. The device supports WLAN MIMO CDD&TXBF mode.
3. The Tx Beamforming power/EIRP is not greater than CDD mode, so CDD mode covers Tx Beamforming mode, therefore, the all test has assessed CDD mode only.
4. For 802.11n HT20 /ac VHT20 and 802.11n HT40 /ac VHT40 mode, the whole testing have assessed only 802.11n HT20/HT40 by referring to the higher output power.
5. For 802.11ax HE20 /be EHT20, 802.11ax HE40/be EHT40 and 802.11ax HE80/be EHT80 mode, the whole testing have assessed only 802.11be EHT20/EHT40/EHT80 by referring to the higher output power.
6. The device supports multiple spatial streams, the worst cases directional gain will occur when NSS = 1, therefore, the 1S2T(CDD&TXBF) mode is the worst; 1S2T: NSS=1, MIMO 2Tx.
7. 802.11ax/be support OFDMA full RU tone and partial RU tone, both full RU and partial RU-left (for low CH) and partial RU-right (for high CH) test output power, the full RU Power/PSD > partial RU, therefore the full RU perform full test to cover partial RU except for Spurious and bandedge.
8. 802.11be support small size RU, Large size RU and Puncturing modes as below, and these partial RU Power/PSD less than full RU, therefore these partial RU only assess Power Density/RSE.

<Small size RU 52+26 Tone>:

Bandwidth	Tones		Index		For test modes configure
20MHz	26	52	1	38	1
20MHz	52	26	39	7	3

<Small size RU 106+26 Tone>:

Bandwidth	Tones		Index		For test modes configure
20MHz	106	26	53	4	1
20MHz	26	106	4	54	2

<Large size RU 484+242 tone> & <80M BW Puncturing 20MHz>:

Bandwidth	Tones		Index		For test modes configure
80MHz	484	242	65	63	4

9. The worse cases of RSE for partial RU, Large size RU and small size RU are shown in this report.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton International Inc. (ShenZhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International Inc. (ShenZhen)		
Test Site Location	101, 1st Floor, Block B, Building 1, No. 2, Tengfeng 4th Road, Fenghuang Community, Fuyong Street, Baoan District, Shenzhen City, Guangdong Province 518103 People's Republic of China TEL: +86-755-86066985		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	TH01-SZ CO02-SZ 03CH01-SZ	CN1256	421272

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH01-SZ	AUDIX	E3	6.2009-8-24
2.	CO02-SZ	AUDIX	E3	6.120613b

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y/Z plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq.(MHz)	Channel	Freq. (MHz)
5180-5240 MHz U-NII-1	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210	-	-

Frequency Band	Channel	Freq.(MHz)	Channel	Freq. (MHz)
5745-5825 MHz U-NII-3	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155#	5775	165	5825

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

MIMO Mode

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20 (Covered by HT20)	MCS0
802.11ac VHT40 (Covered by HT40)	MCS0
802.11ac VHT80	MCS0
802.11ax HE20 (Covered by EHT20)	MCS0
802.11ax HE40 (Covered by EHT40)	MCS0
802.11ax HE80 (Covered by EHT80)	MCS0
802.11be EHT20	MCS0
802.11be EHT40	MCS0
802.11be EHT80	MCS0

AC Conducted Emission	Mode 1 : WCDMA Band 5 Idle + WLAN Link(5G) + Adapter 1 + USB Cable 1 + Battery 1
Remark: For Radiated Test Cases, The tests were performance with Adapter 1 and USB Cable 1.	

RSE Co-location
802.11b CH01 2412 Tx + 802.11ac VHT80 CH42 5210 Tx + LTE Band14 Link

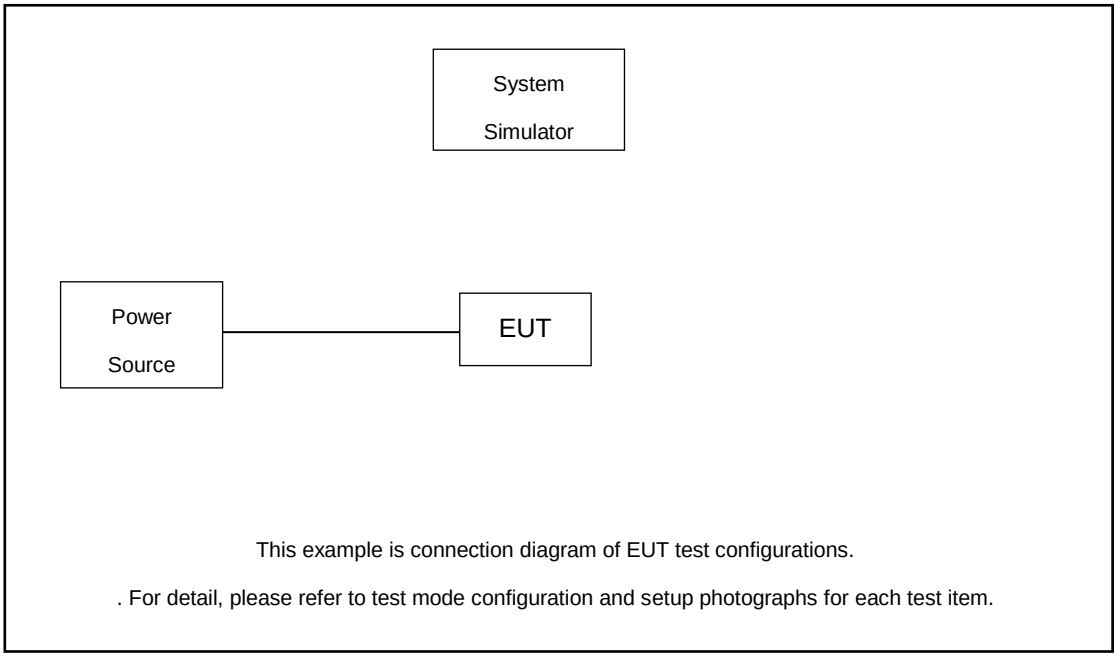
Ch. #		U-NII-1	U-NII-3
		20M BW	20M BW
L	Low	36	149
M	Middle	44	157
H	High	48	165

Ch. #		U-NII-1	U-NII-3
		40M BW	40M BW
L	Low	38	151
M	Middle	-	-
H	High	46	159

Ch. #		U-NII-1	U-NII-3
		80M BW	80M BW
L	Low	-	-
M	Middle	42	155
H	High	-	-

2.3 Connection Diagram of Test System

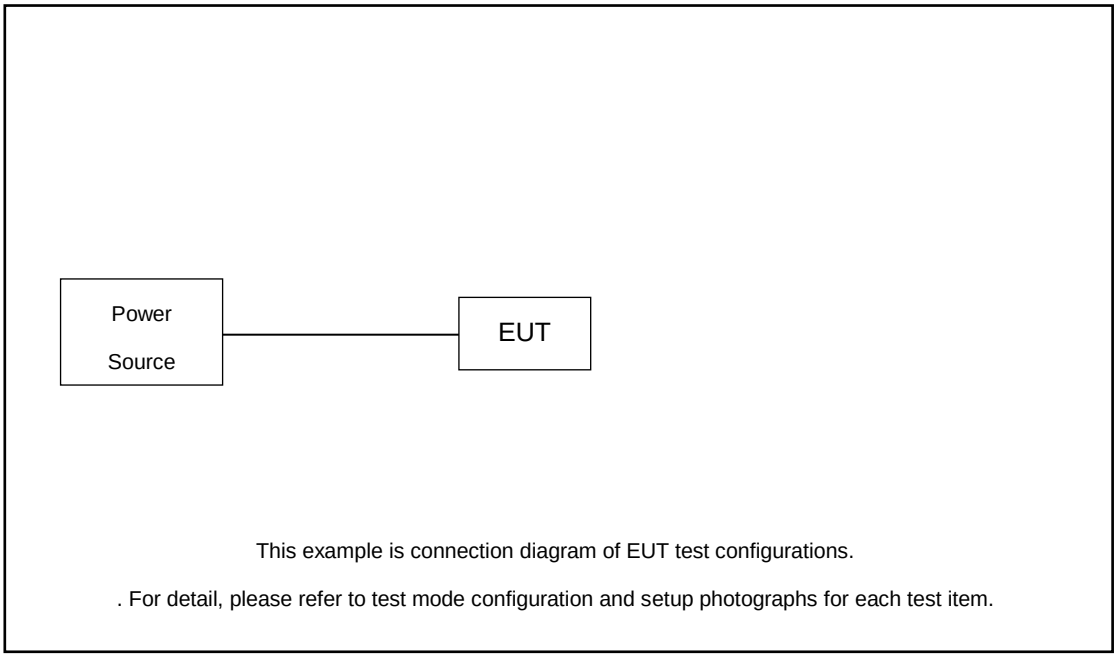
AC Conducted Emission:



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

Radiated Emission:



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Base Station	Anritsu	MT8821C	N/A	N/A	Unshielded,1.8m

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously transmit.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.53 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.53 + 10 = 14.53 (dB)

3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

26dB and 99% Occupied bandwidth are reporting only.

3.1.2 Measuring Instruments

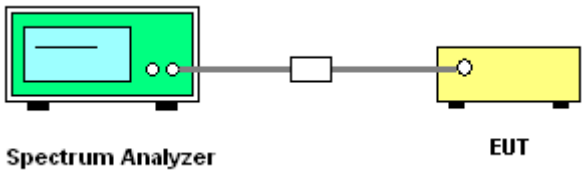
The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

☒	Section C) Bandwidth Measurement 1. Emission Bandwidth (EBW) and 99% OBW
	1. Set RBW = approximately 1% of the emission bandwidth. **2.** Set the VBW > RBW. **3.** Detector = Peak. **4.** Trace mode = max hold **5.** 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%. **6.** For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set to 1%~5% of the OBW and set the Video bandwidth (VBW) ≥ 3 * RBW. **7.** Measure and record the results in the test report.
☒	Section C) Bandwidth Measurement 2. Minimum Emission Bandwidth for the band 5.725 - 5.85 GHz
	1. Set RBW = 100kHz. **2.** Set the VBW ≥ 3 x RBW. **3.** Detector = Peak. **4.** Trace mode = max hold **5.** Measure the maximum width of the emission that is 6 dB down from the peak of the emission. **6.** Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 26dB and 99% Occupied Bandwidth

Please refer to Appendix A.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

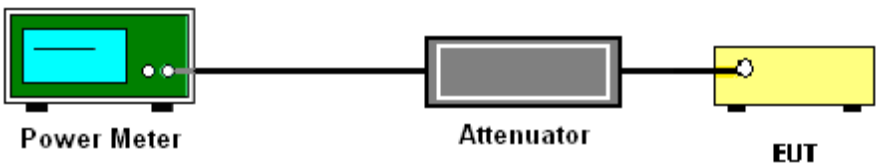
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.
4. For MIMO mode, the measure-and-sum technique should be used for measuring the in-band transmit power of a device.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

UNII-1																
Mod.	Data Rate	NTX	CH.	RU Config	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail	Power Setting
						Ant 7	Ant 6	Ant 7	Ant 6	SUM	Ant 7	Ant 6	Ant 7	Ant 6		
11a	6Mbps	2	36	Full	5180	0.04	0.04	15.58	15.64	18.62	23.98		3.35		Pass	16
11a	6Mbps	2	44	Full	5220	0.04	0.04	15.59	15.88	18.75	23.98		3.35		Pass	16
11a	6Mbps	2	48	Full	5240	0.04	0.04	15.58	15.87	18.74	23.98		3.35		Pass	16
HT20	MCS0	2	36	Full	5180	0.00	0.00	14.52	14.60	17.57	23.98		3.35		Pass	15
HT20	MCS0	2	44	Full	5220	0.00	0.00	14.54	14.88	17.72	23.98		3.35		Pass	15
HT20	MCS0	2	48	Full	5240	0.00	0.00	14.50	14.84	17.68	23.98		3.35		Pass	15
HT40	MCS0	2	38	Full	5190	0.00	0.00	14.08	14.12	17.11	23.98		3.35		Pass	14
HT40	MCS0	2	46	Full	5230	0.00	0.00	14.12	14.35	17.25	23.98		3.35		Pass	14
VHT80	MCS0	2	42	Full	5210	0.00	0.00	12.01	12.03	15.03	23.98		3.35		Pass	12
EHT20	MCS0	2	36	Full	5180	0.00	0.00	9.33	9.67	12.51	23.98		3.35		Pass	10
			44	Full	5220	0.00	0.00	9.40	9.85	12.64	23.98		3.35		Pass	10
			48	Full	5240	0.00	0.00	9.36	9.86	12.63	23.98		3.35		Pass	10
EHT40	MCS0	2	38	Full	5190	0.00	0.00	9.01	9.05	12.04	23.98		3.35		Pass	9
			46	Full	5230	0.00	0.00	9.03	9.10	12.08	23.98		3.35		Pass	9
EHT80	MCS0	2	42	Full	5210	0.00	0.00	9.05	9.20	12.14	23.98		3.35		Pass	9

UNII-3																
Mod.	Data Rate	NTX	CH.	RU Config	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail	Power Setting
						Ant 7	Ant 6	Ant 7	Ant 6	SUM	Ant 7	Ant 6	Ant 7	Ant 6		
11a	6Mbps	2	149	Full	5745	0.04	0.04	15.31	15.06	18.20	30.00		3.14		Pass	16
11a	6Mbps	2	157	Full	5785	0.04	0.04	15.41	15.19	18.31	30.00		3.14		Pass	16
11a	6Mbps	2	165	Full	5825	0.04	0.04	15.49	15.27	18.39	30.00		3.14		Pass	16
HT20	MCS0	2	149	Full	5745	0.00	0.00	14.52	14.02	17.29	30.00		3.14		Pass	15
HT20	MCS0	2	157	Full	5785	0.00	0.00	14.50	14.08	17.31	30.00		3.14		Pass	15
HT20	MCS0	2	165	Full	5825	0.00	0.00	14.32	14.15	17.25	30.00		3.14		Pass	15
HT40	MCS0	2	151	Full	5755	0.00	0.00	14.78	14.58	17.69	30.00		3.14		Pass	15
HT40	MCS0	2	159	Full	5795	0.00	0.00	14.81	14.70	17.77	30.00		3.14		Pass	15
VHT80	MCS0	2	155	Full	5775	0.00	0.00	12.45	12.20	15.34	30.00		3.14		Pass	13
EHT20	MCS0	2	149	Full	5745	0.00	0.00	9.33	9.08	12.22	30.00		3.14		Pass	10
EHT20	MCS0	2	157	Full	5785	0.00	0.00	9.46	9.37	12.43	30.00		3.14		Pass	10
EHT20	MCS0	2	165	Full	5825	0.00	0.00	9.52	9.48	12.51	30.00		3.14		Pass	10
EHT40	MCS0	2	151	Full	5755	0.00	0.00	9.58	9.45	12.53	30.00		3.14		Pass	10
EHT40	MCS0	2	159	Full	5795	0.00	0.00	9.66	9.70	12.69	30.00		3.14		Pass	10
EHT80	MCS0	2	155	Full	5775	0.00	0.00	9.67	9.62	12.66	30.00		3.14		Pass	10

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04. Section F) Maximum power spectral density.

For devices operating in the bands UNII-1

 # Method SA-2 #

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 1 MHz.
- Set VBW ≥ 3 MHz.
- Number of points in sweep ≥ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.

For devices operating in the band UNII-3

 # Method SA-2 #

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 500KHz (or 300 kHz if the SA can’t set RBW=500KHz).
- Set VBW ≥ 1 MHz.
- Number of points in sweep ≥ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- If the SA can’t set RBW=500KHz, then add 10 log(500kHz/RBW) to the test result.
- Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.

1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
3. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

For UNII-1:

Method (a): Measure and sum the spectra across the outputs.

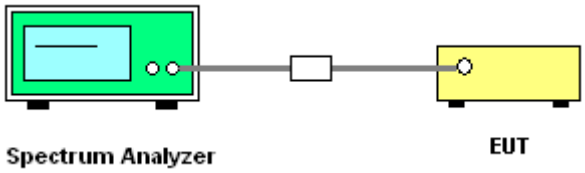
The total final Power Spectral Density is the bin-by-bin summation to obtain the combined spectrum. For the device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

For UNII-3:

Method (b): Measure and sum spectral maxima across the outputs.

The measurement on each individual output were performed with the same span and number on each individual output. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

3.4 Unwanted Emissions Measurement

This section as specified in FCC Part 15.407(b) is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement. The unwanted emissions shall comply with 15.407(b)(1) to (6), and restricted bands per FCC Part15.205.

3.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

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

(3) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/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

(4) EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

Note: The following formula is used to convert the EIRP to field strength.

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m

d_{Meas} is the measurement distance, in m

3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

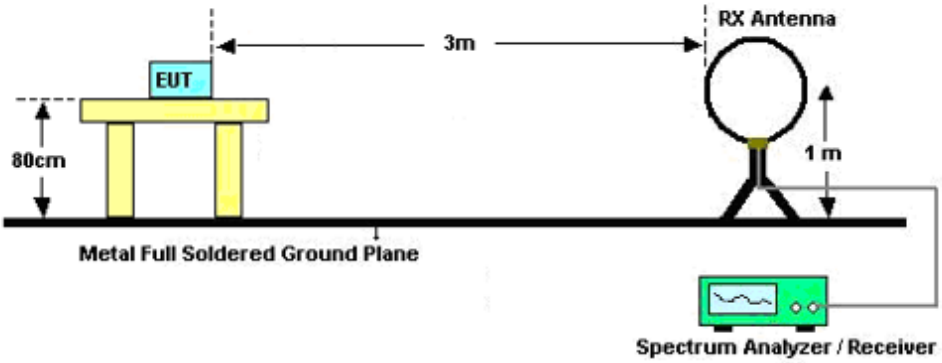
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the

maximum reading.

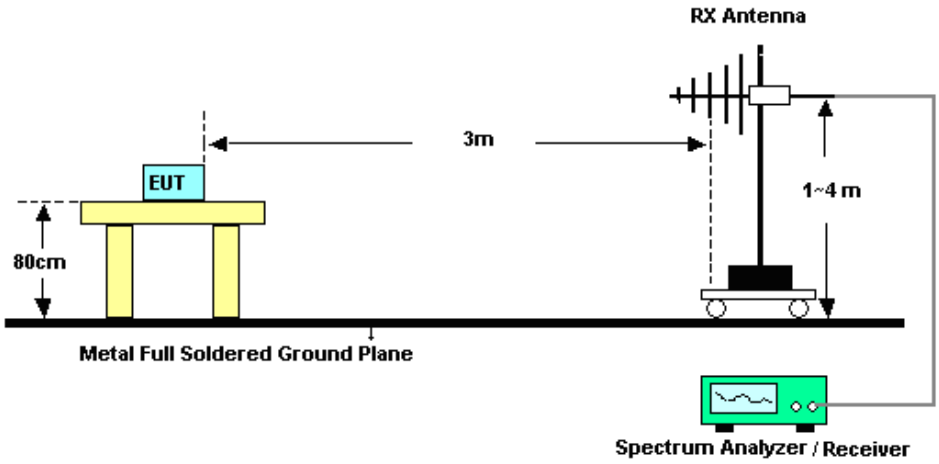
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.4.4 Test Setup

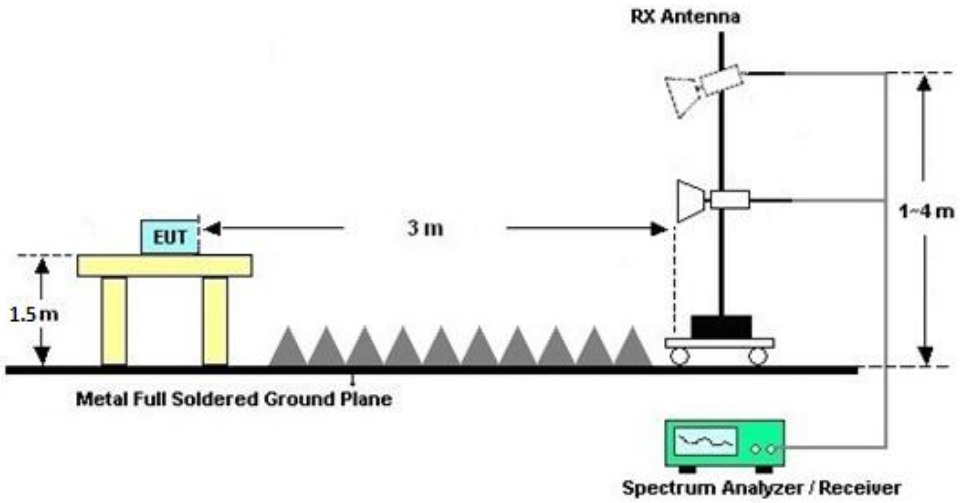
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.4.7 Duty Cycle

Please refer to Appendix D.

3.4.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix C.

3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

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

*Decreases with the logarithm of the frequency.

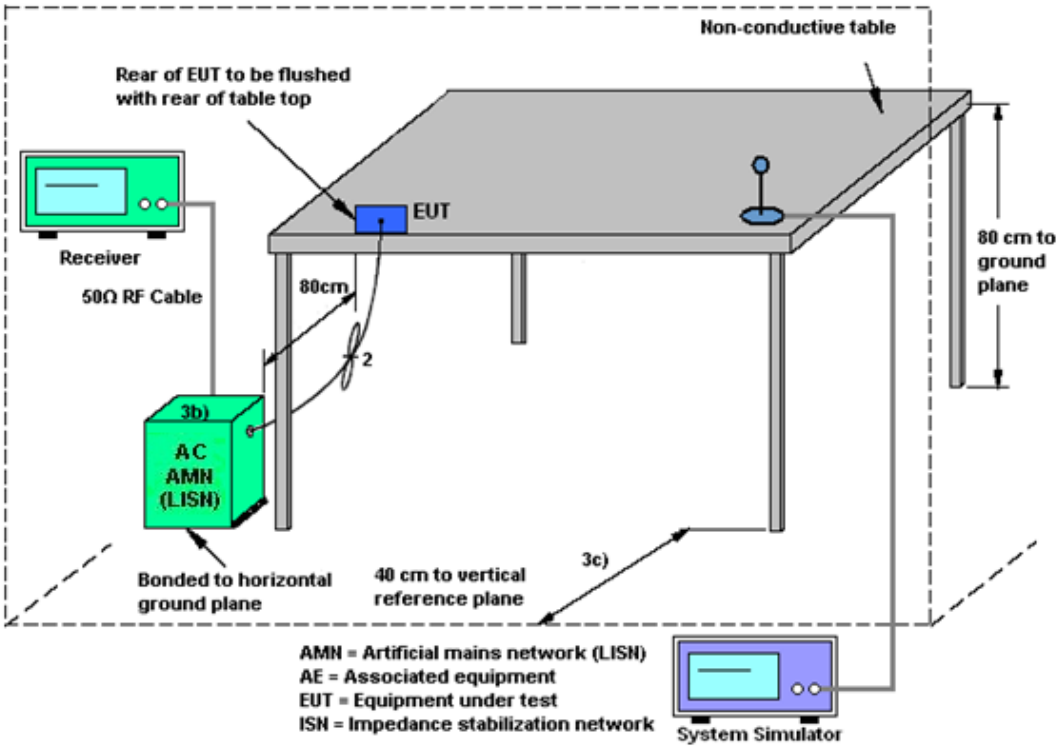
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.5.4 Test Setup



3.5.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.6 Antenna Requirements

3.6.1 Standard Applicable

According to FCC 47 CFR Section 15.407(a)(1)(2) ,if transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = GANT + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(NANT/NSS=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with GANT set equal to the gain of the antenna having the highest gain;

For power, the directional gain GANT is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

<CDD Modes>

	Ant. 6 (dBi)	Ant. 7 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
UNII-1	3.35	1.67	3.35	5.56	0.00	0.00
UNII-3	3.14	2.79	3.14	5.98	0.00	0.00

Power limit reduction = Composite gain – 6dBi, (min = 0)

PSD limit reduction = Composite gain + PSD Array gain – 6dBi, (min = 0)

<TXBF Mode>

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For TXBF transmissions, directional gain is calculated as

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k / 20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

The directional gain calculation is following F)2)e)ii).

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

	Ant 6 (dBi)	Ant 7 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
UNII-1	3.35	1.67	5.56	5.56	0.00	0.00
UNII-3	3.14	2.79	5.98	5.98	0.00	0.00

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver&SA	Agilent	N9038A	MY52260185	20Hz~26.5GHz	Dec. 25, 2024	Mar. 26, 2025~ May 15, 2025	Dec. 24, 2025	Radiation (03CH01-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Jul. 03, 2024	Mar. 26, 2025~ May 15, 2025	Jul. 02, 2025	Radiation (03CH01-SZ)
Loop Antenna	R&S	HFH2-Z2E	101141	9kHz~30MHz	Dec. 28, 2024	Mar. 26, 2025~ May 15, 2025	Dec. 27, 2025	Radiation (03CH01-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz-2GHz	Oct. 24, 2023	Mar. 26, 2025~ May 15, 2025	Oct. 23, 2025	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Jul. 04, 2024	Mar. 26, 2025~ May 15, 2025	Jul. 03, 2025	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Apr. 09, 2024	Mar. 26, 2025~ May 15, 2025	Apr. 08, 2025	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Apr. 03, 2025		Apr. 02, 2026	Radiation (03CH01-SZ)
LF Amplifier	EM Electronics	EM330	060788	20MHz-3GHz	Dec. 25, 2024	Mar. 26, 2025~ May 15, 2025	Dec. 24, 2025	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1943528	1GHz~18GHz	Oct. 14, 2024	Mar. 26, 2025~ May 15, 2025	Oct. 13, 2025	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270105	0.5GHz~26.5Ghz	Oct. 14,2024	Mar. 26, 2025~ May 15, 2025	Oct. 13, 2025	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 03, 2024	Mar. 26, 2025~ May 15, 2025	Jul. 02, 2025	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	Oct. 14, 2024	Mar. 26, 2025~ May 15, 2025	Oct. 13, 2025	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Mar. 26, 2025~ May 15, 2025	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Mar. 26, 2025~ May 15, 2025	NCR	Radiation (03CH01-SZ)
EMI Receiver	R&S	ESR7	102297	9kHz~7GHz;	Jul. 03, 2024	Mar. 30, 2025	Jul. 02, 2025	Conduction (CO02-SZ)
AC LISN	R&S	ENV216	101499	9kHz~30MHz	Jul. 03, 2024	Mar. 30, 2025	Jul. 02, 2025	Conduction (CO02-SZ)
AC Power Source	CHROMA	61601	616010002470	100Vac~250Vac	Dec.25, 2024	Mar. 30, 2025	Dec. 24, 2025	Conduction (CO02-SZ)
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 09, 2024	Sep. 12, 2024~ Apr. 24, 2025	Apr. 08, 2025	Conducted (TH01-SZ)
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 02, 2025		Apr. 01, 2026	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1339473	30MHz~40GHz	Dec. 29, 2023	Sep. 12, 2024~ Apr. 24, 2025	Dec. 28, 2024	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1339473	30MHz~40GHz	Dec. 25, 2024		Dec. 24, 2025	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Oct. 15, 2023	Sep. 12, 2024~ Apr. 24, 2025	Oct. 14, 2024	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Oct. 14, 2024		Oct. 13, 2025	Conducted (TH01-SZ)

NCR: No Calibration Required

5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Spurious Emission & Bandedge	±1.34 dB
Occupied Channel Bandwidth	±0.012 MHz
Conducted Power	±1.34 dB
Conducted Power Spectral Density	±1.32 dB
Frequency	±1.3 Hz

Uncertainty of AC Conducted Emission Measurement (0.15 MHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.5 dB

Uncertainty of Radiated Emission Measurement (9 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.8 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.2 dB

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0 dB

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.3 dB

---------- THE END ----------

Appendix A. Conducted Test Results

Ambient Condition: 24-26 ℃, 45-55 %RH	
Test Date: 2024.09.12~2024.09.13	**Test Engineer:** Wen Shiwei

Emission Bandwidth

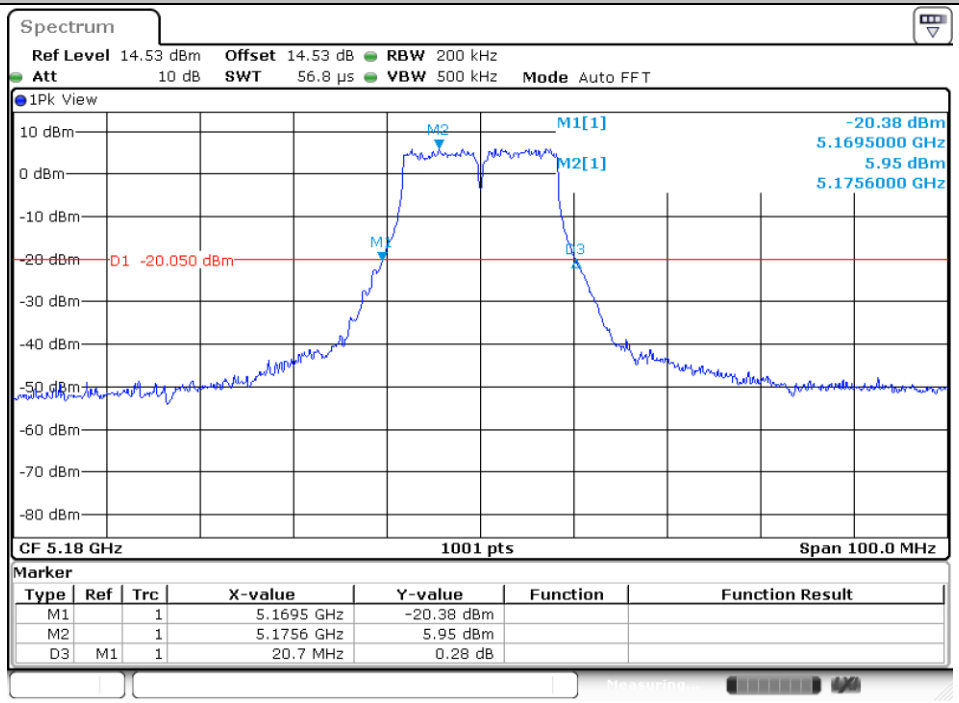
Test Result

TestMode	Antenna	Freq(MHz)	26dB EBW [MHz]	FL[MHz]	FH[MHz]
11A-CDD	Ant7	5180	20.70	5169.50	5190.20
	Ant6	5180	21.00	5169.80	5190.80
	Ant7	5220	20.80	5209.50	5230.30
	Ant6	5220	21.50	5209.10	5230.60
	Ant7	5240	20.90	5229.30	5250.20
	Ant6	5240	21.70	5229.20	5250.90
	Ant7	5745	20.60	5734.50	5755.10
	Ant6	5745	21.20	5734.70	5755.90
	Ant7	5785	20.50	5774.70	5795.20
	Ant6	5785	20.90	5774.70	5795.60
	Ant7	5825	20.90	5814.60	5835.50
	Ant6	5825	21.30	5814.40	5835.70
11N20MIMO	Ant7	5180	23.70	5168.10	5191.80
	Ant6	5180	23.20	5168.40	5191.60
	Ant7	5220	23.00	5208.50	5231.50
	Ant6	5220	23.40	5208.30	5231.70
	Ant7	5240	23.60	5228.10	5251.70
	Ant6	5240	23.50	5228.20	5251.70
	Ant7	5745	23.20	5733.60	5756.80
	Ant6	5745	23.40	5733.00	5756.40
	Ant7	5785	23.20	5773.30	5796.50
	Ant6	5785	23.70	5773.00	5796.70
	Ant7	5825	23.30	5813.30	5836.60
	Ant6	5825	23.50	5813.30	5836.80
11N40MIMO	Ant7	5190	44.80	5167.20	5212.00
	Ant6	5190	45.20	5167.40	5212.60
	Ant7	5230	45.20	5207.60	5252.80
	Ant6	5230	44.80	5207.60	5252.40
	Ant7	5755	45.00	5732.40	5777.40
	Ant6	5755	44.40	5733.00	5777.40
	Ant7	5795	45.00	5772.40	5817.40
	Ant6	5795	45.60	5772.40	5818.00
11AC80MIMO	Ant7	5210	92.00	5164.80	5256.80
	Ant6	5210	92.00	5164.00	5256.00
	Ant7	5775	88.80	5730.60	5819.40

	Ant6	5775	90.00	5730.20	5820.20
11BE20MIMO	Ant7	5180	24.20	5168.00	5192.20
	Ant6	5180	24.00	5168.20	5192.20
	Ant7	5220	23.40	5208.50	5231.90
	Ant6	5220	23.90	5208.10	5232.00
	Ant7	5240	23.20	5228.50	5251.70
	Ant6	5240	23.50	5228.20	5251.70
	Ant7	5745	22.60	5733.70	5756.30
	Ant6	5745	23.60	5733.30	5756.90
	Ant7	5785	23.60	5773.20	5796.80
	Ant6	5785	23.90	5773.20	5797.10
	Ant7	5825	23.40	5813.10	5836.50
	Ant6	5825	23.50	5813.50	5837.00
11BE40MIMO	Ant7	5190	44.00	5168.00	5212.00
	Ant6	5190	44.20	5168.20	5212.40
	Ant7	5230	44.40	5208.00	5252.40
	Ant6	5230	43.80	5208.00	5251.80
	Ant7	5755	44.40	5733.20	5777.60
	Ant6	5755	43.40	5732.80	5776.20
	Ant7	5795	43.00	5773.40	5816.40
	Ant6	5795	44.20	5772.80	5817.00
11BE80MIMO	Ant7	5210	84.40	5167.60	5252.00
	Ant6	5210	86.00	5168.00	5254.00
	Ant7	5775	85.60	5732.60	5818.20
	Ant6	5775	86.80	5731.40	5818.20

Test Graphs

11A-CDD_Ant7_5180



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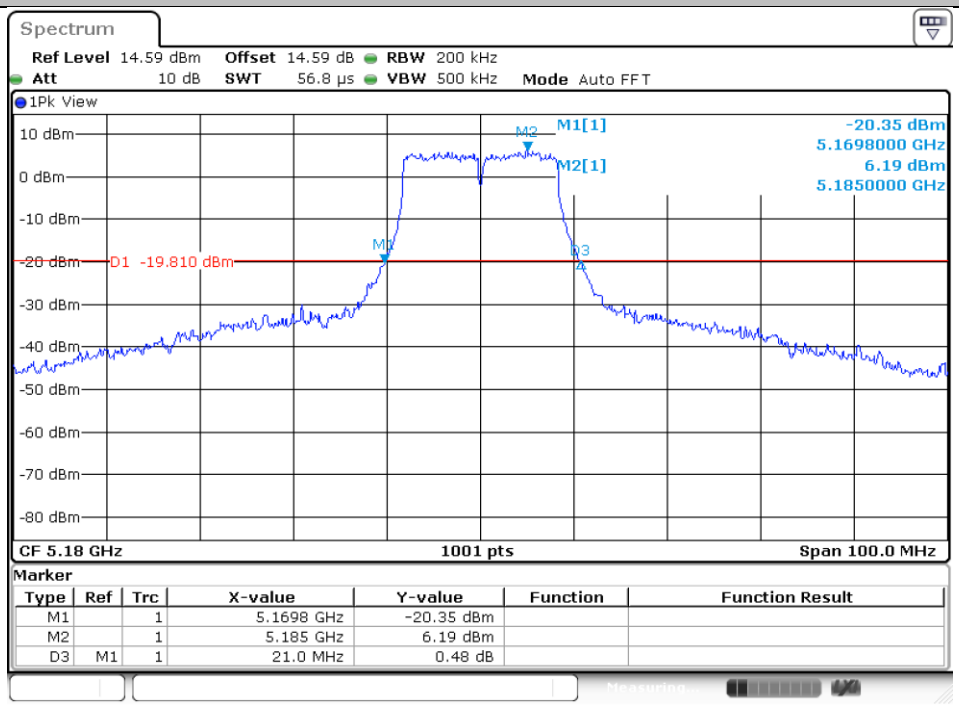

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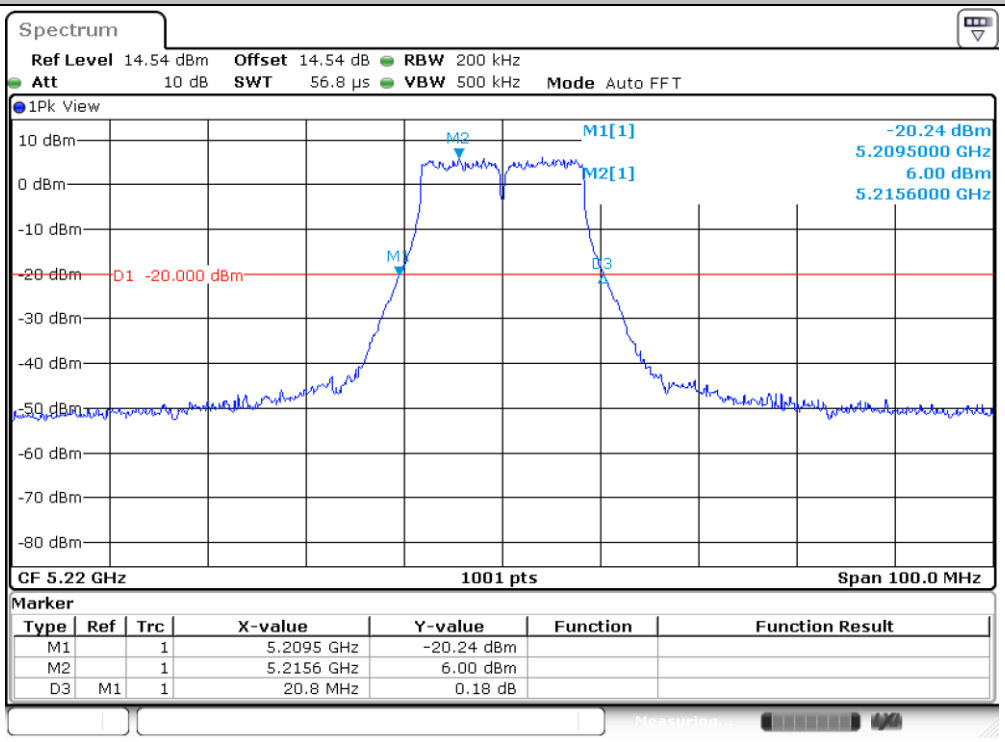

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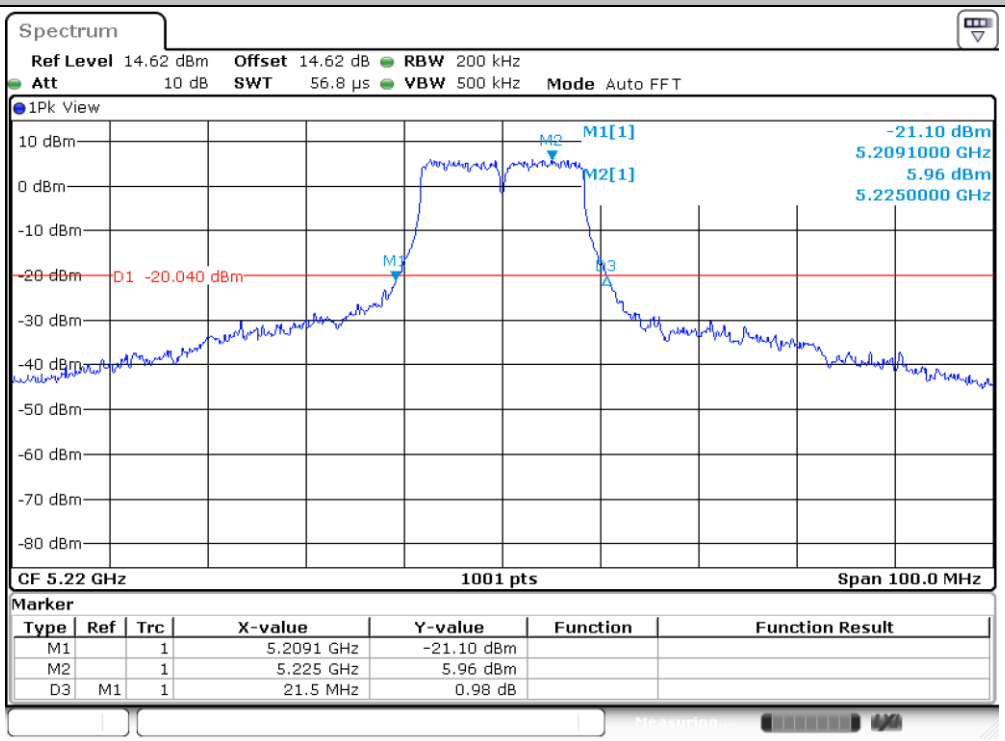

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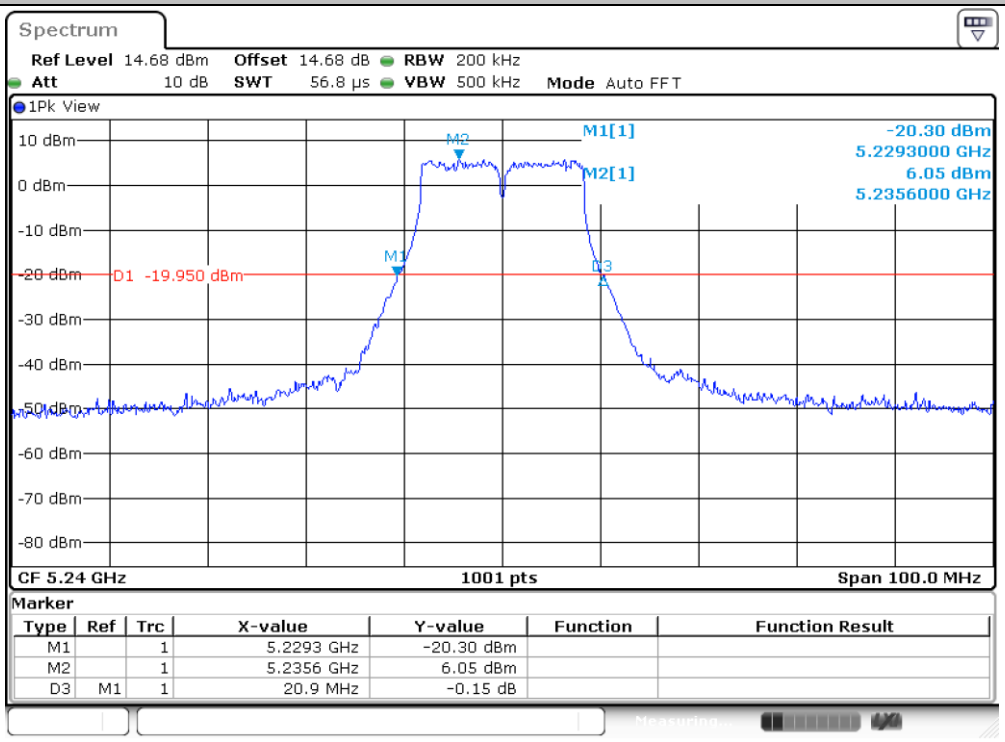

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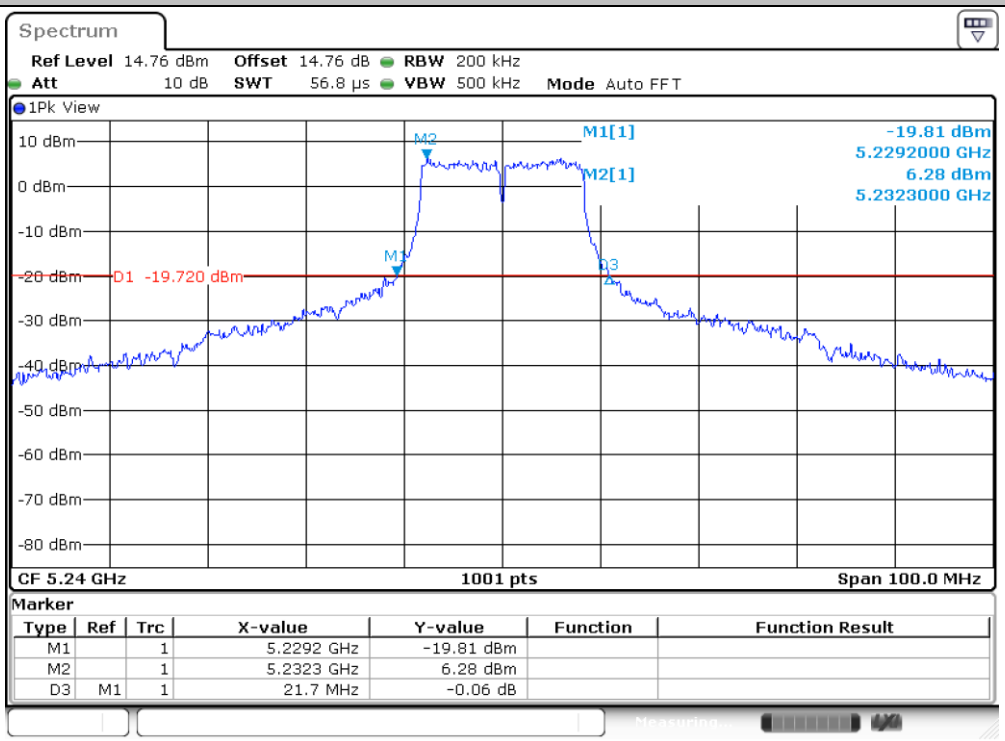

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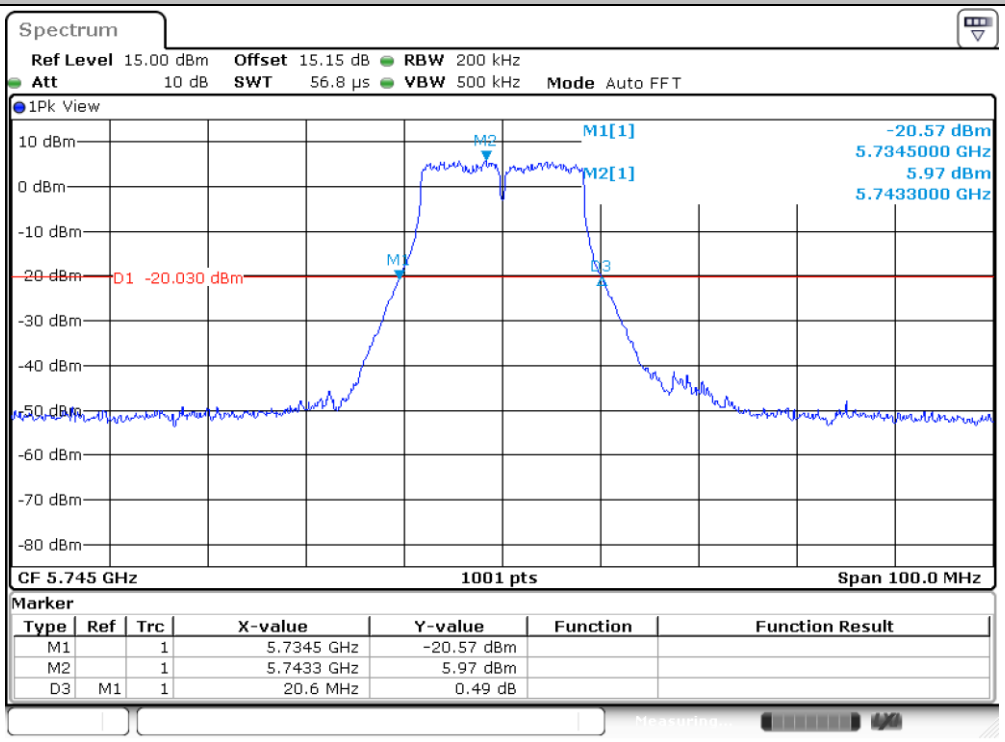

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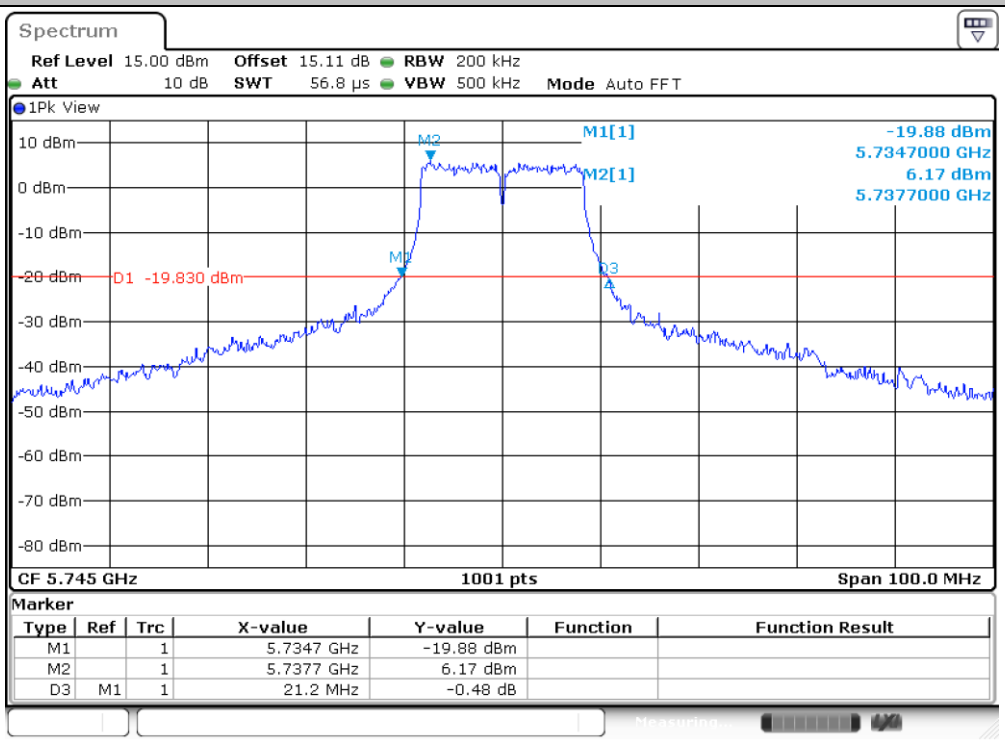

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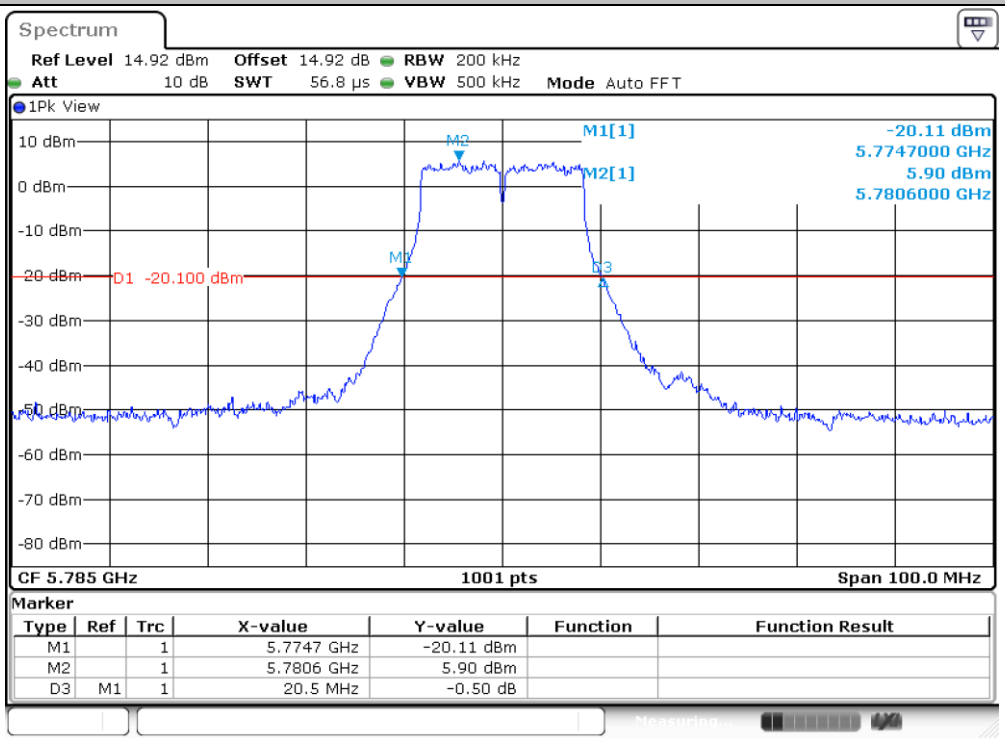

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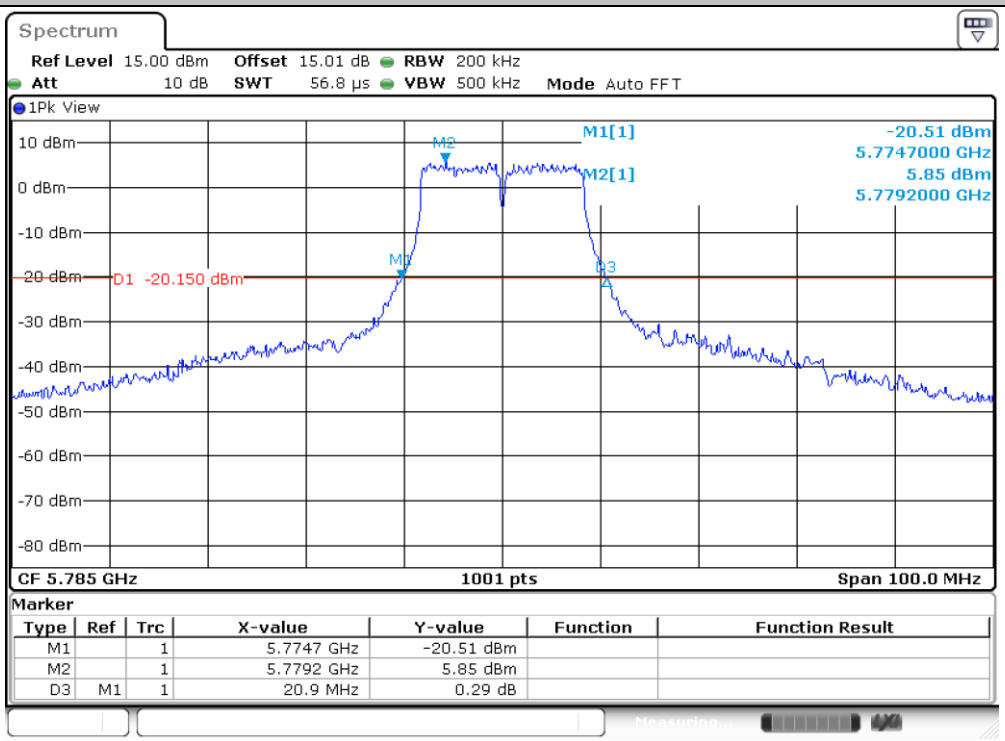

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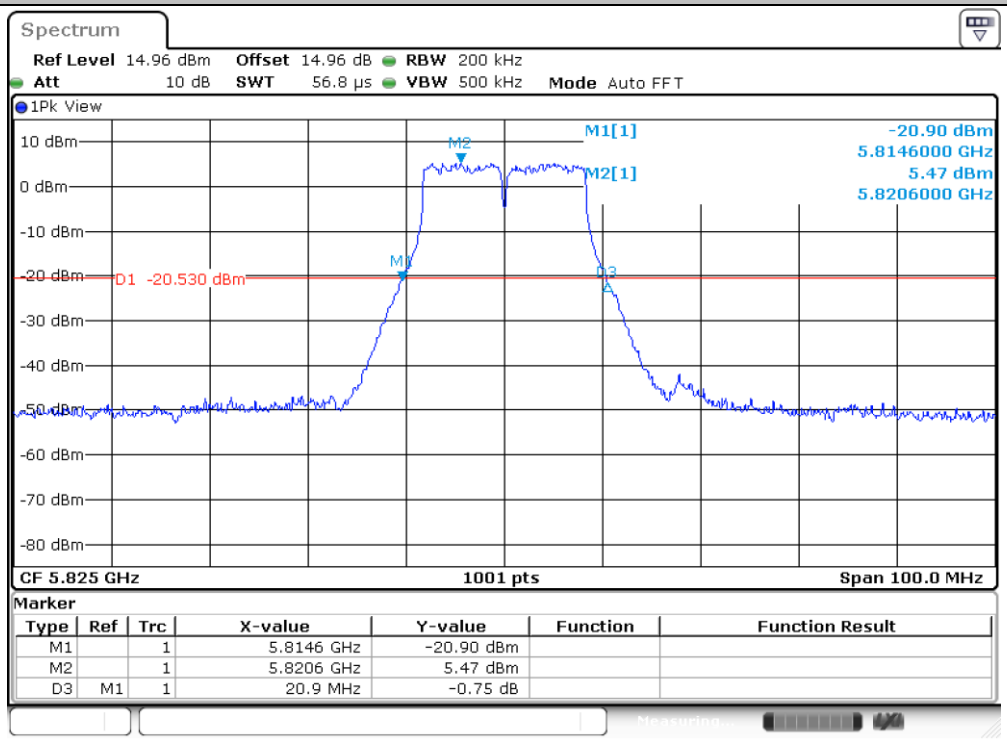
11A-CDD_Ant7_5825



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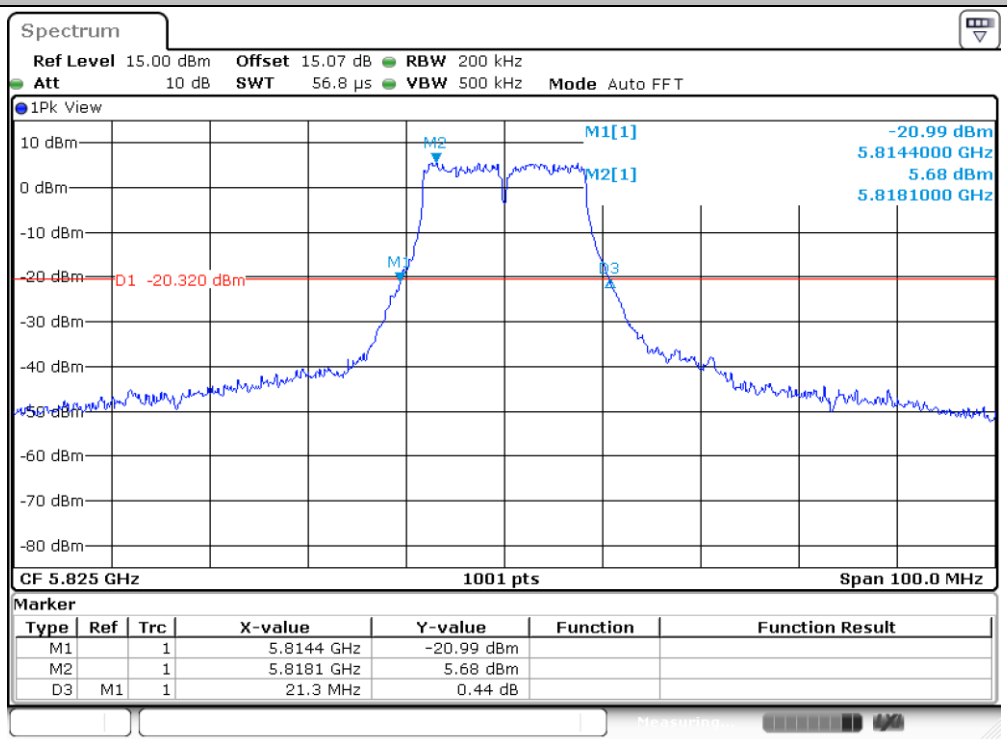
11A-CDD_Ant6_5825



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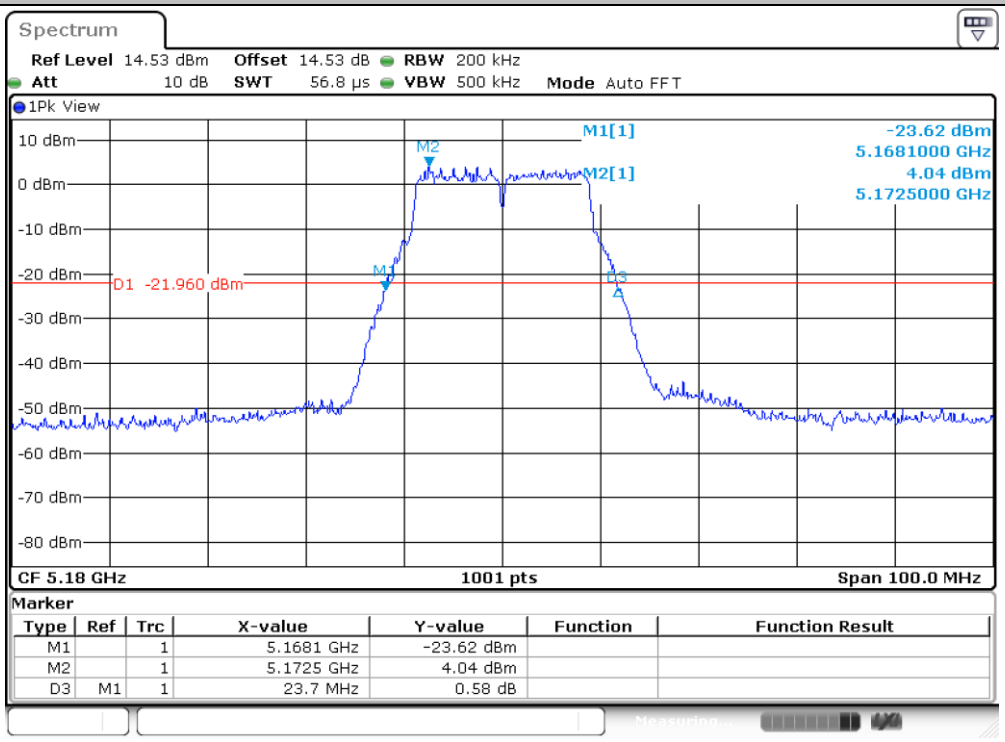
11N20MIMO_Ant7_5180



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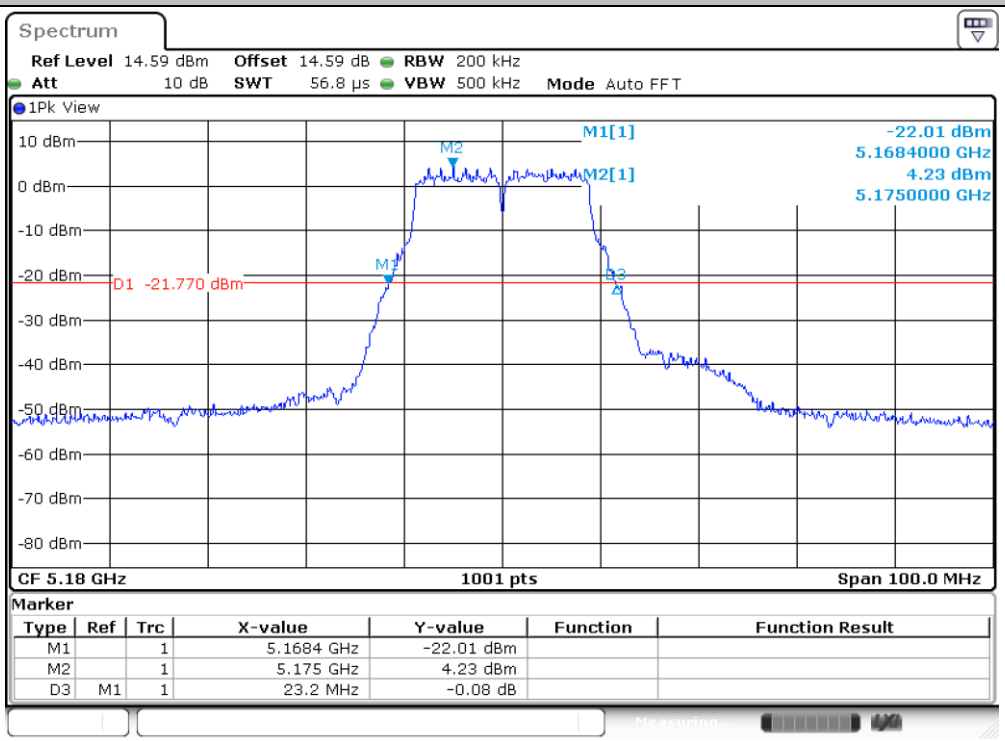

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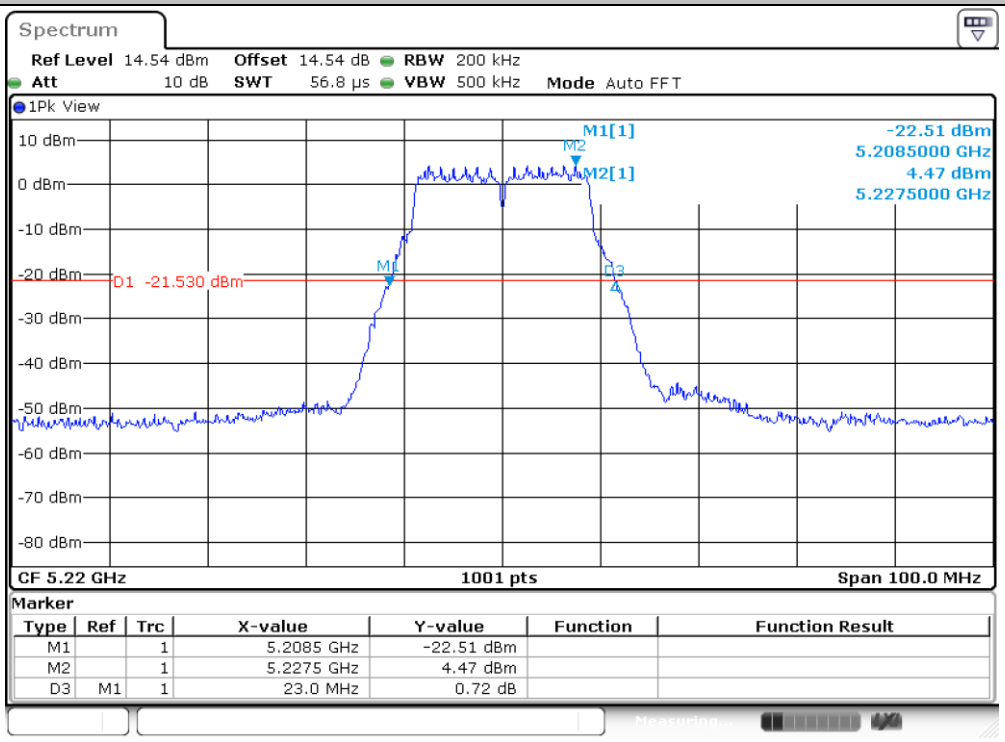

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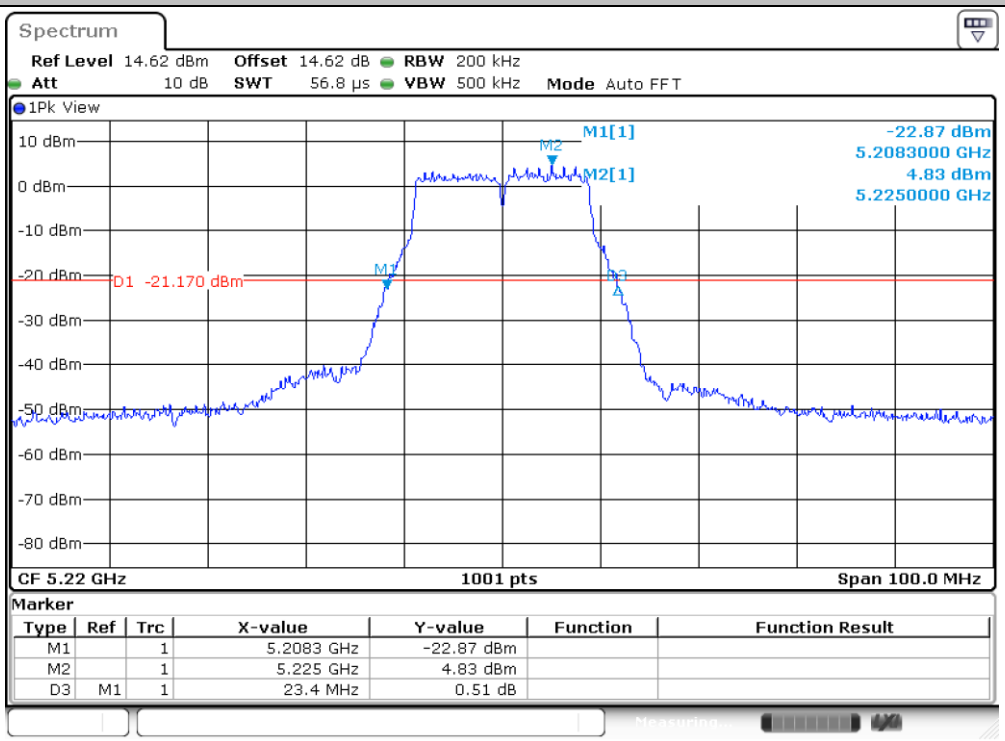

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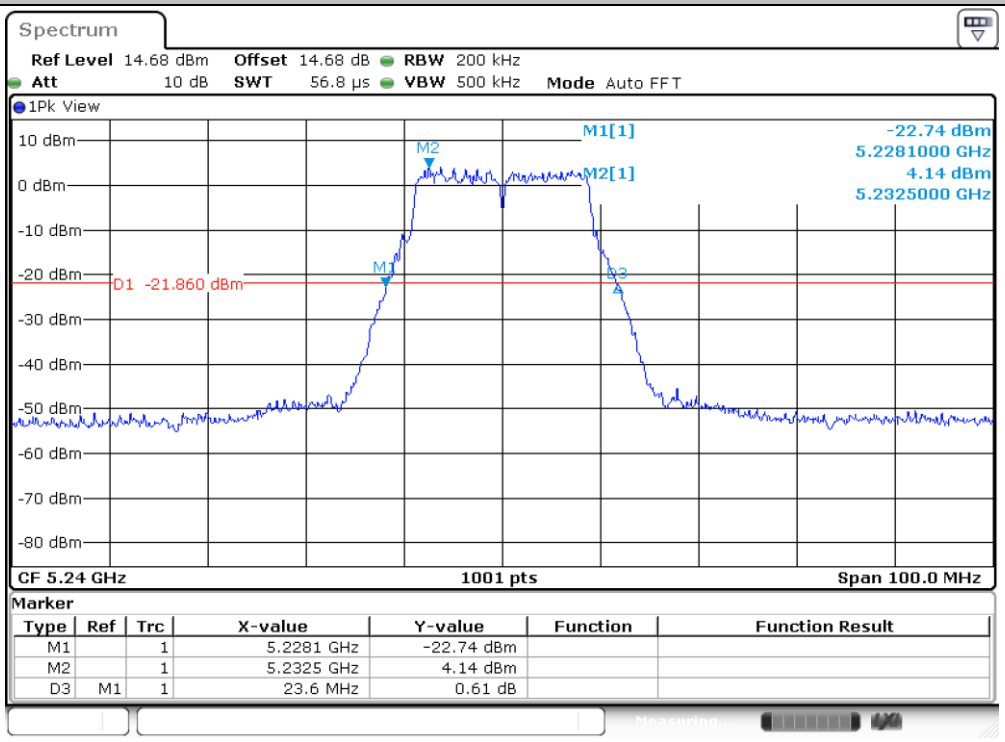
11N20MIMO_Ant7_5240



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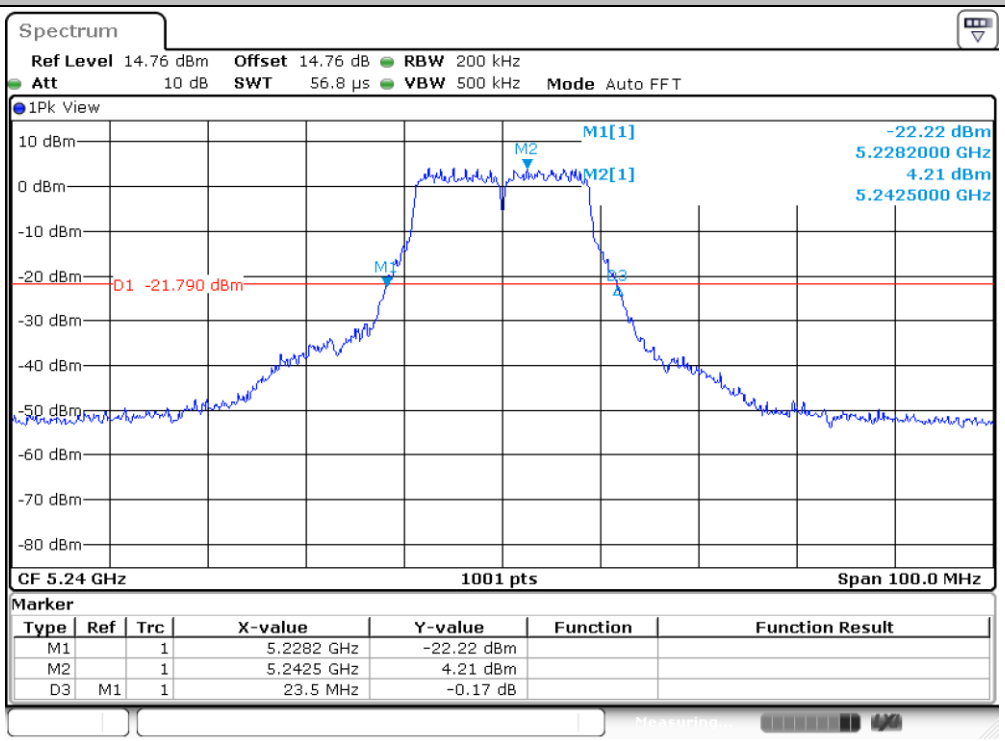

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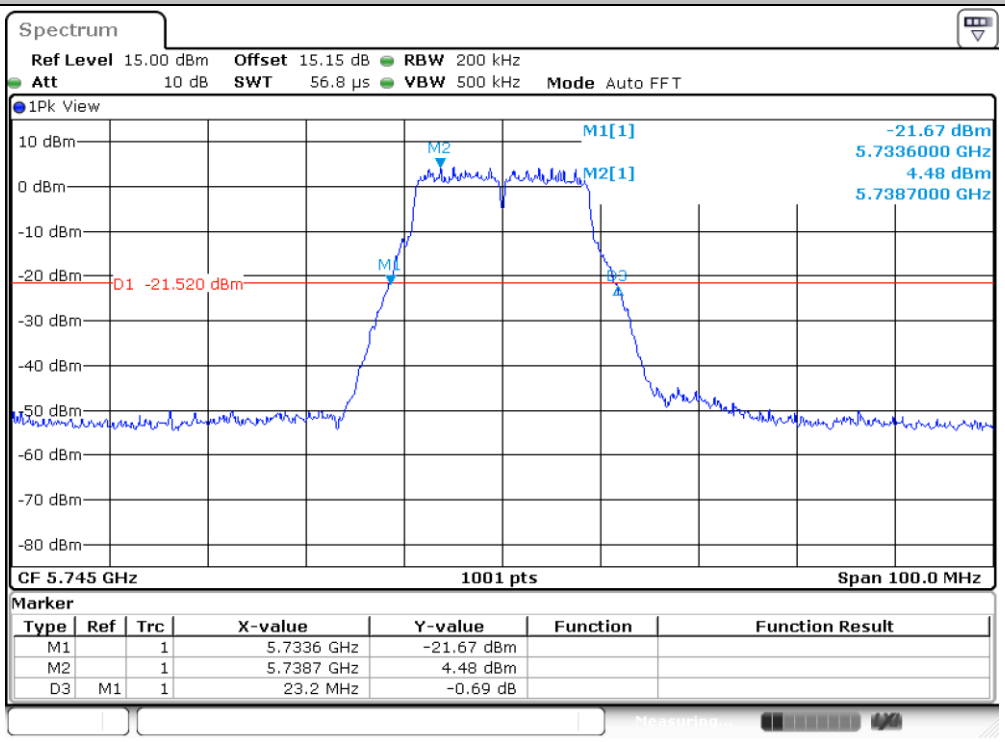
11N20MIMO_Ant7_5745



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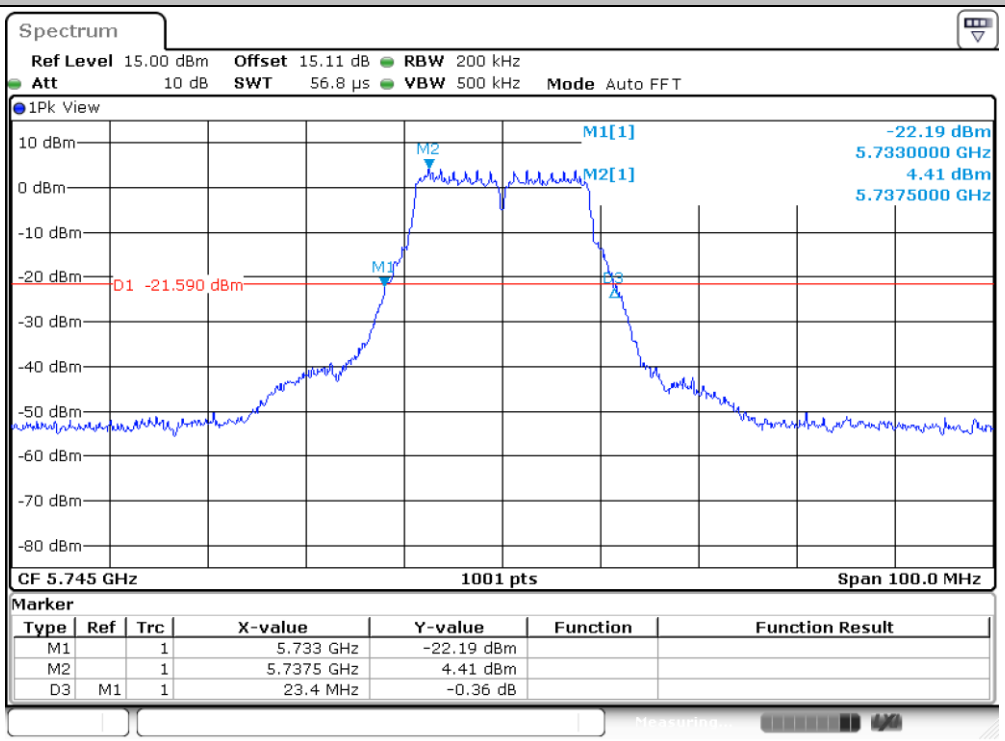

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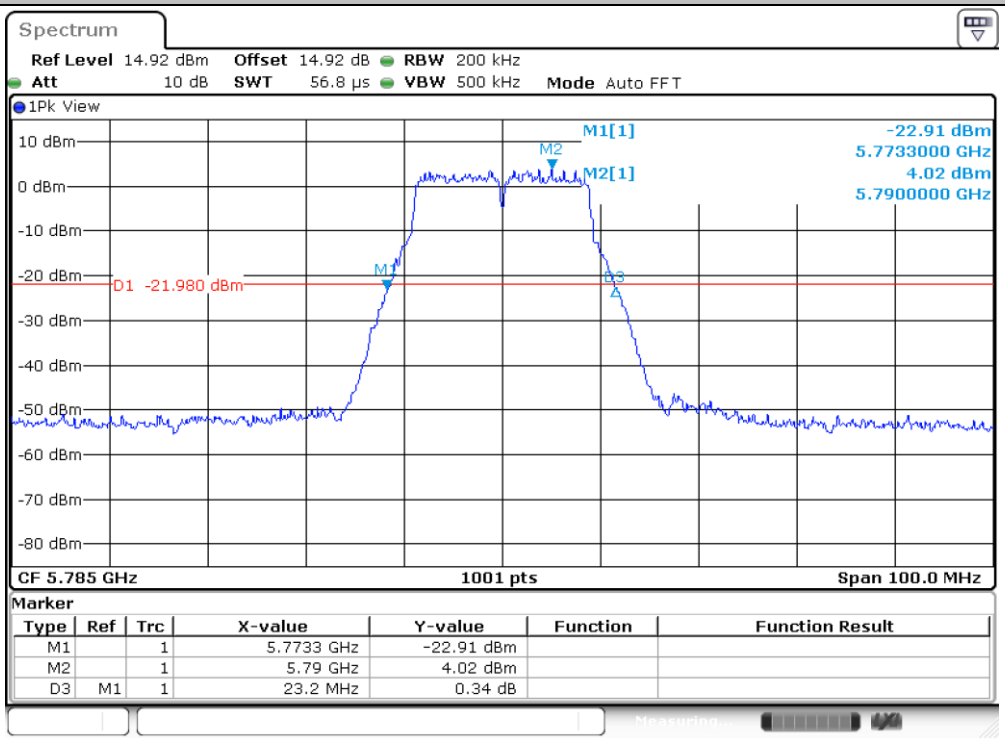
11N20MIMO_Ant7_5785



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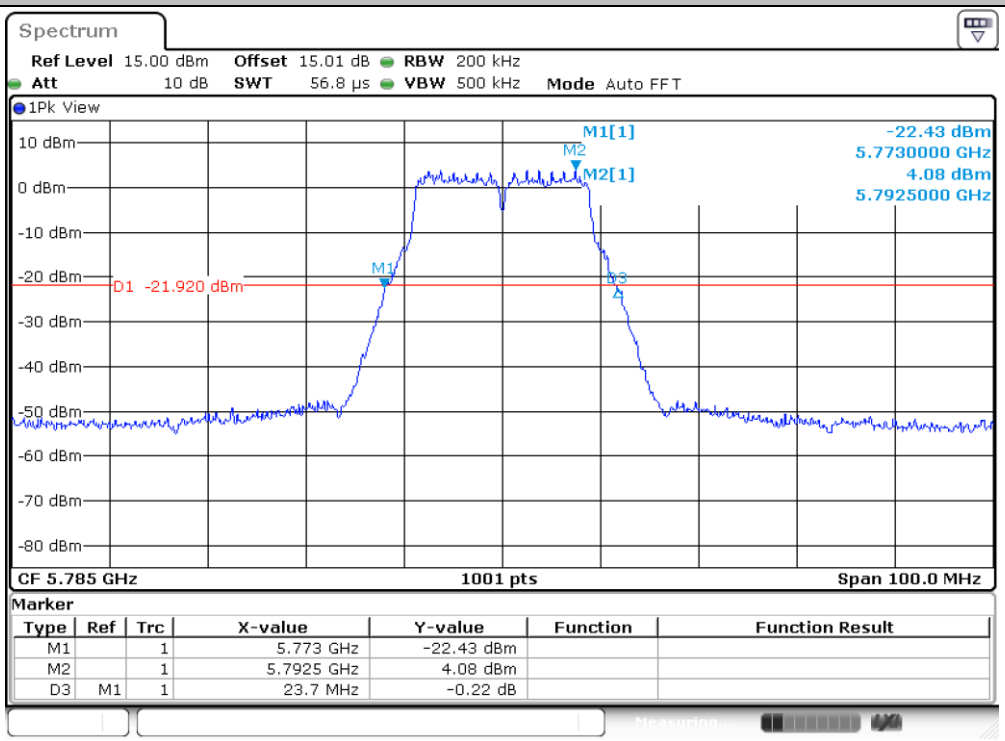

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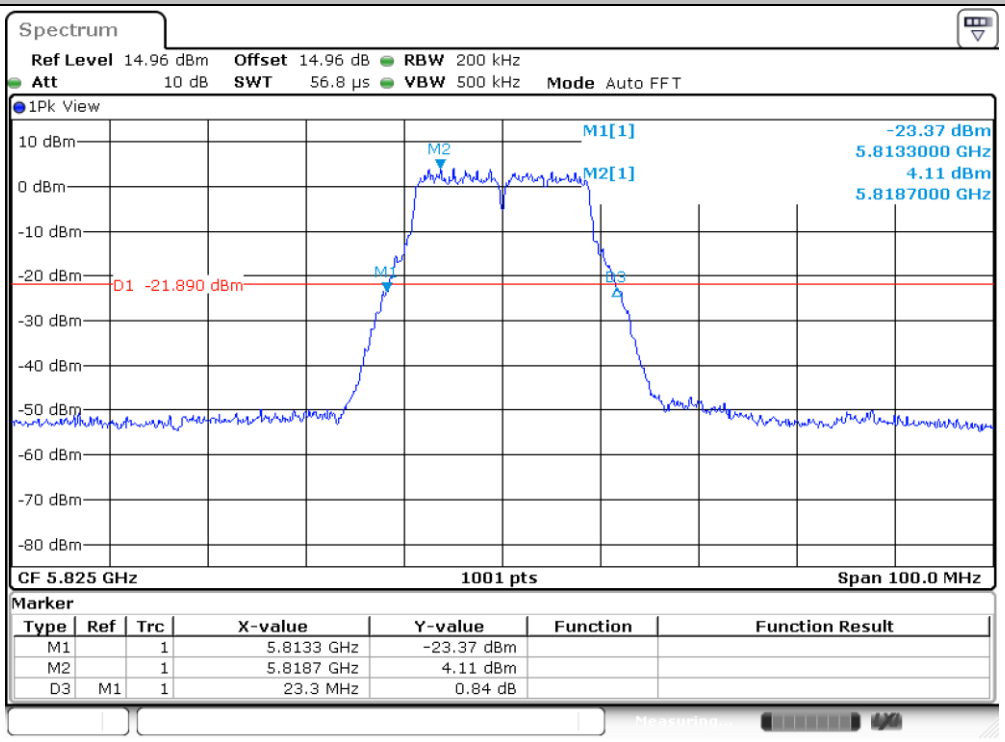
11N20MIMO_Ant7_5825



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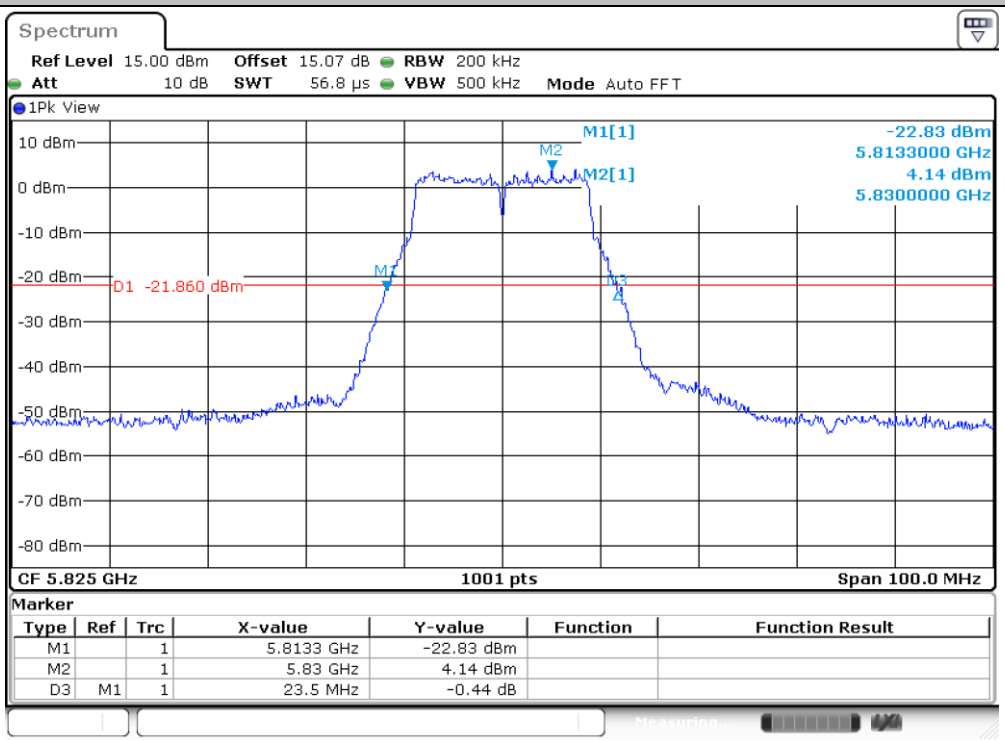

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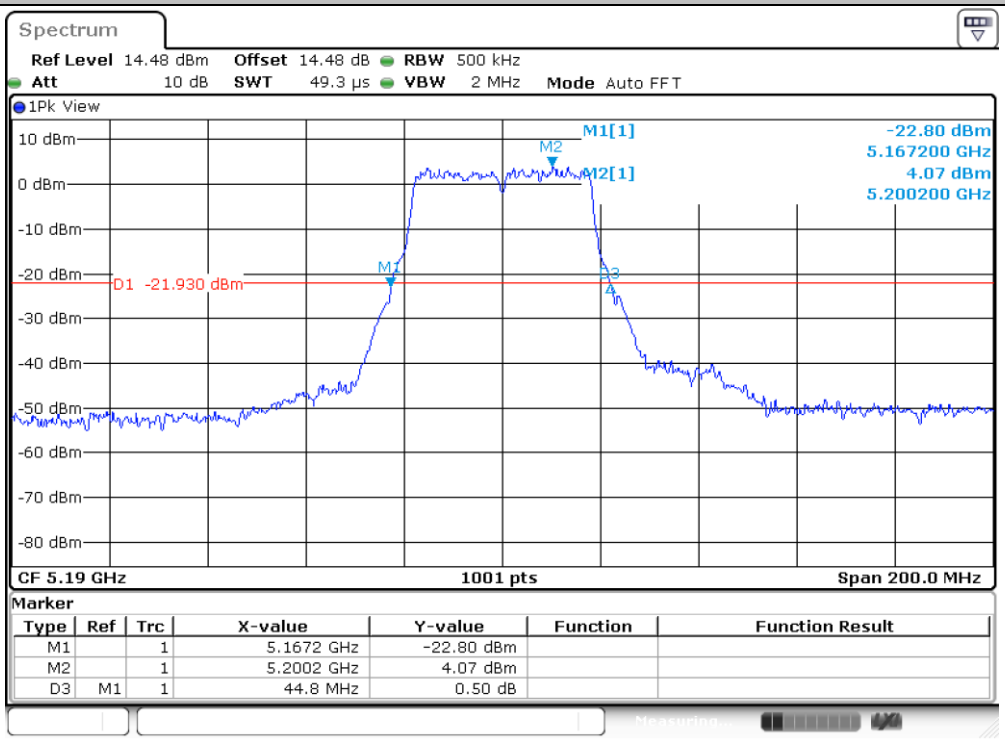

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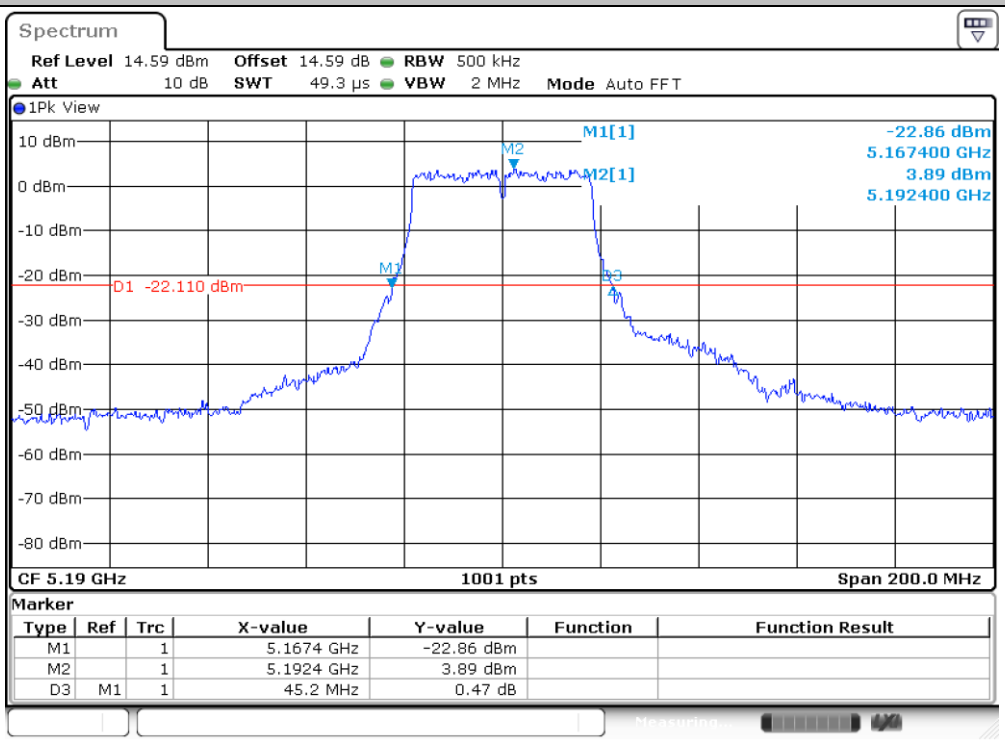

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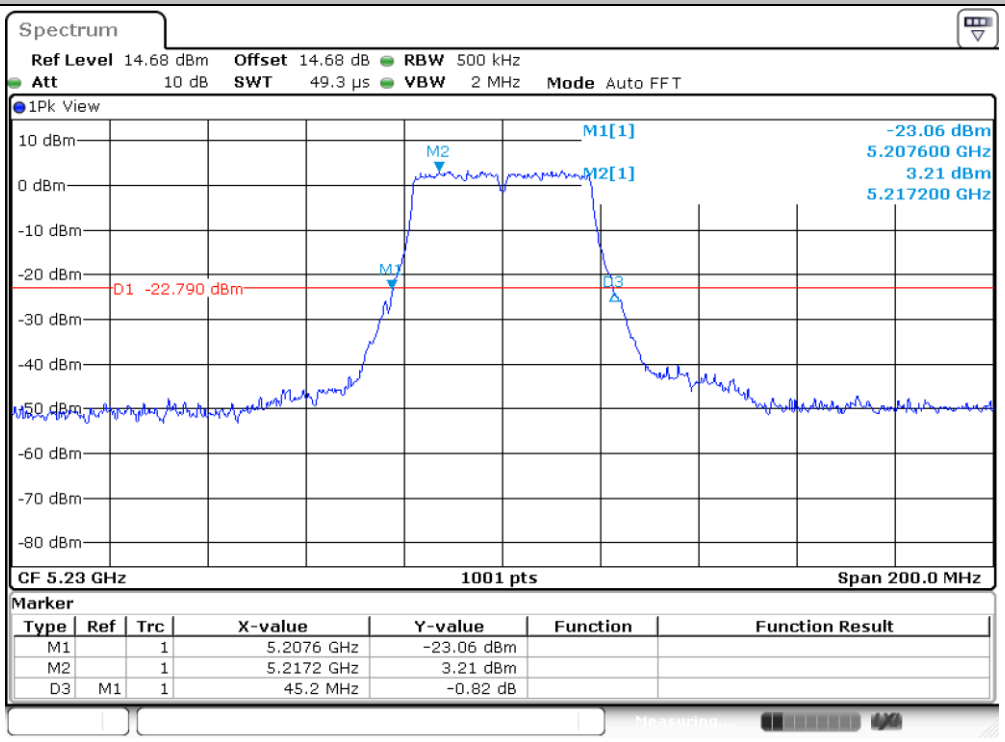
11N40MIMO_Ant7_5230



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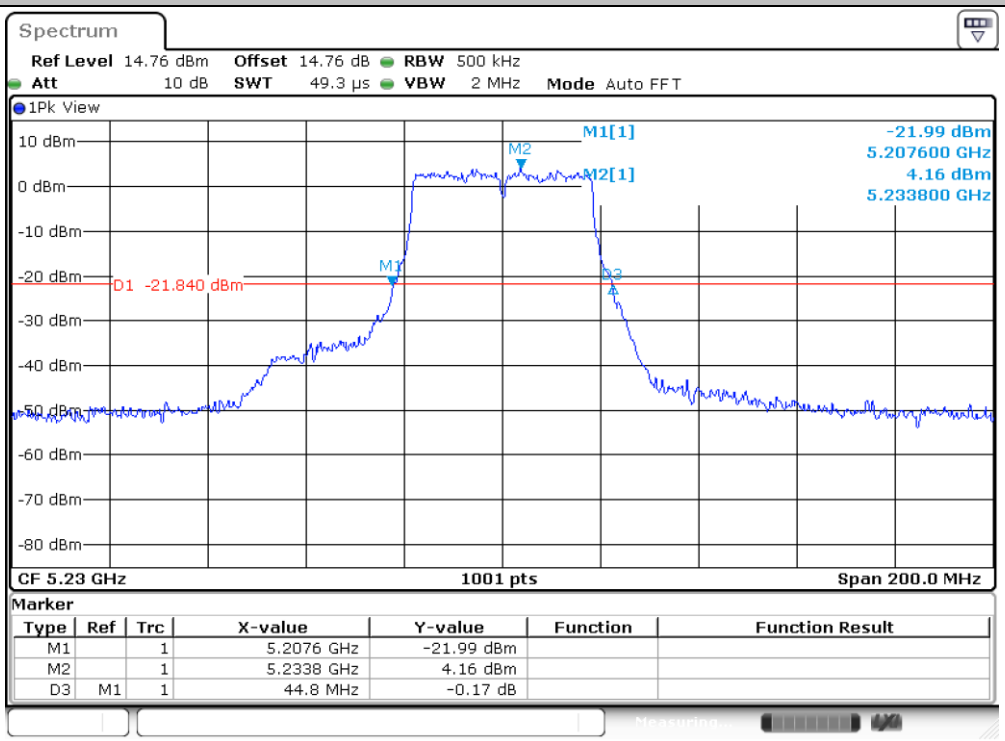
11N40MIMO_Ant6_5230



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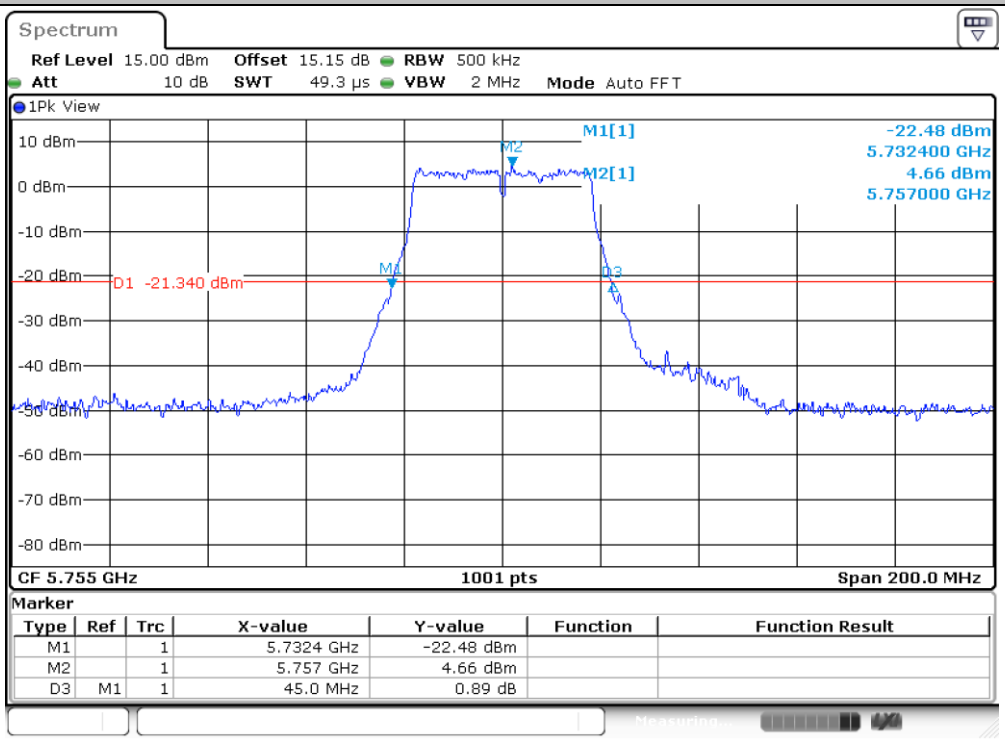
11N40MIMO_Ant7_5755



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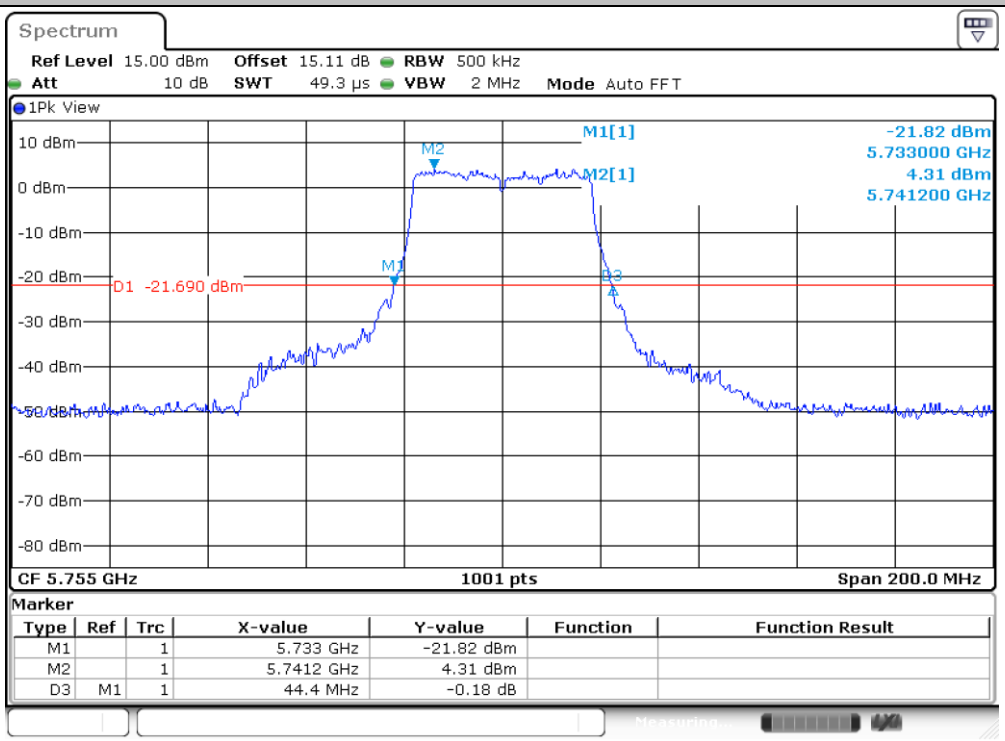

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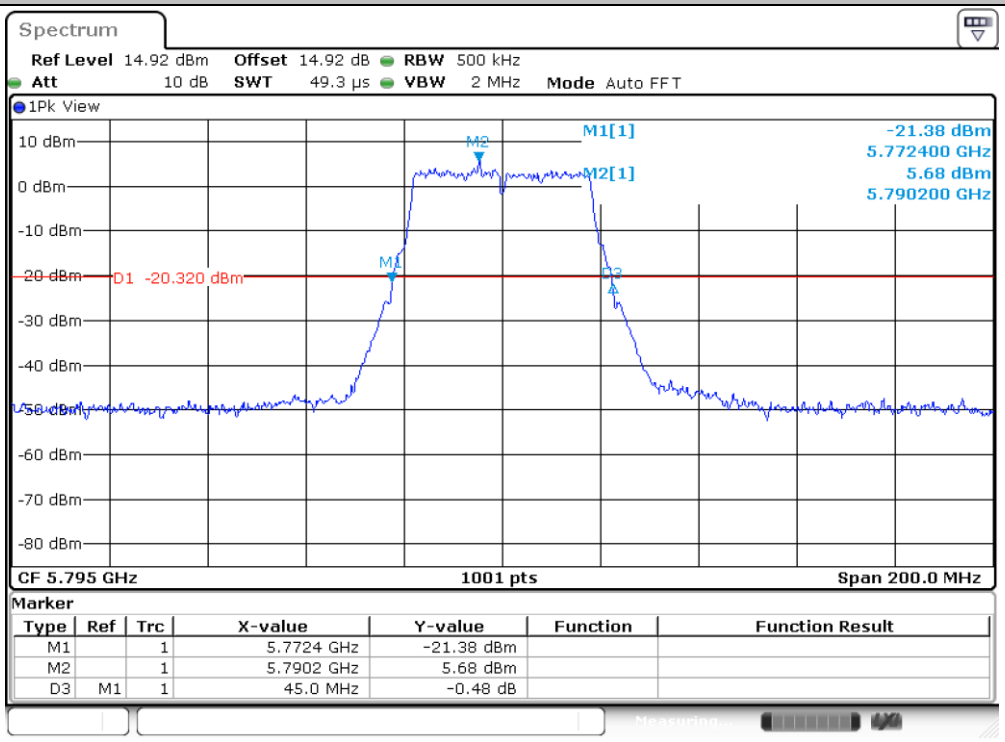

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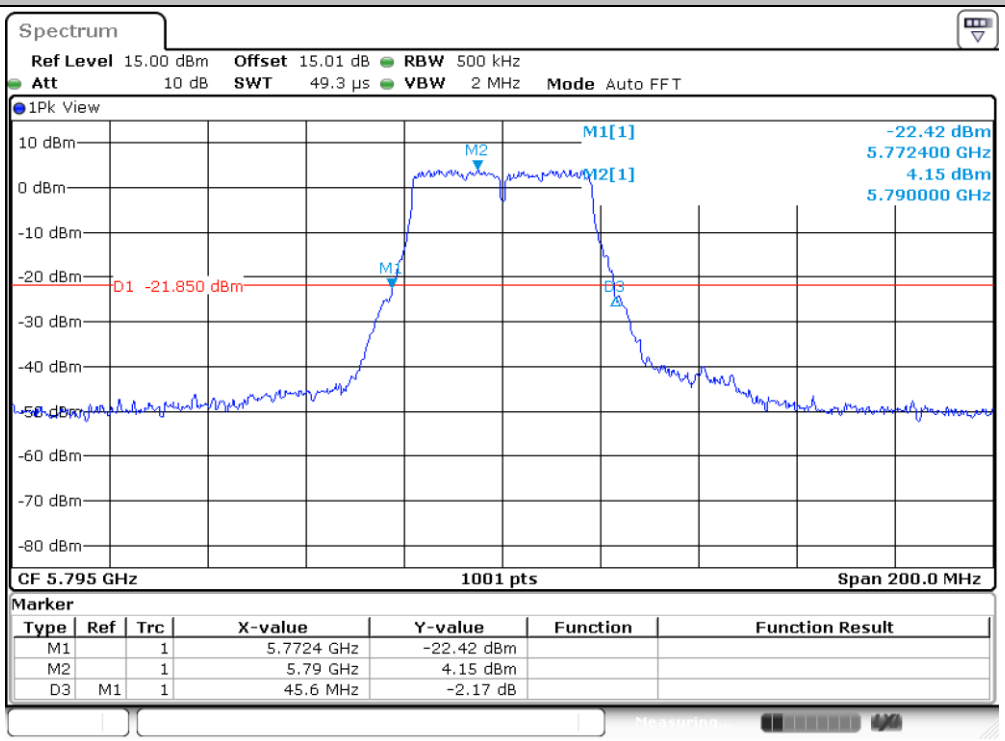
11N40MIMO_Ant6_5795



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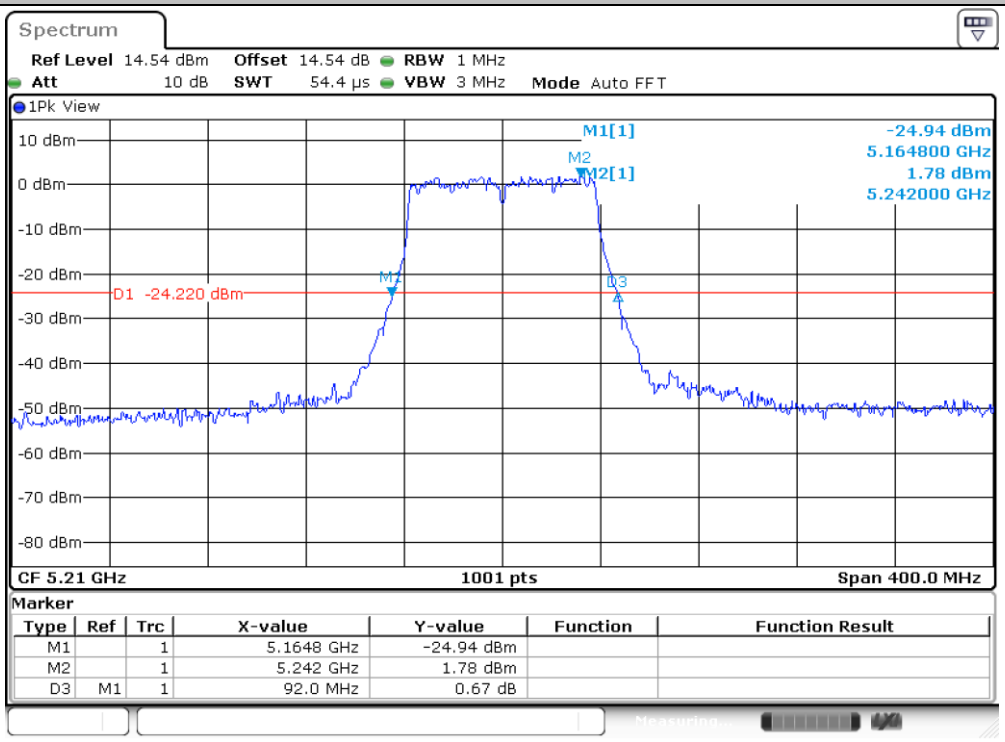

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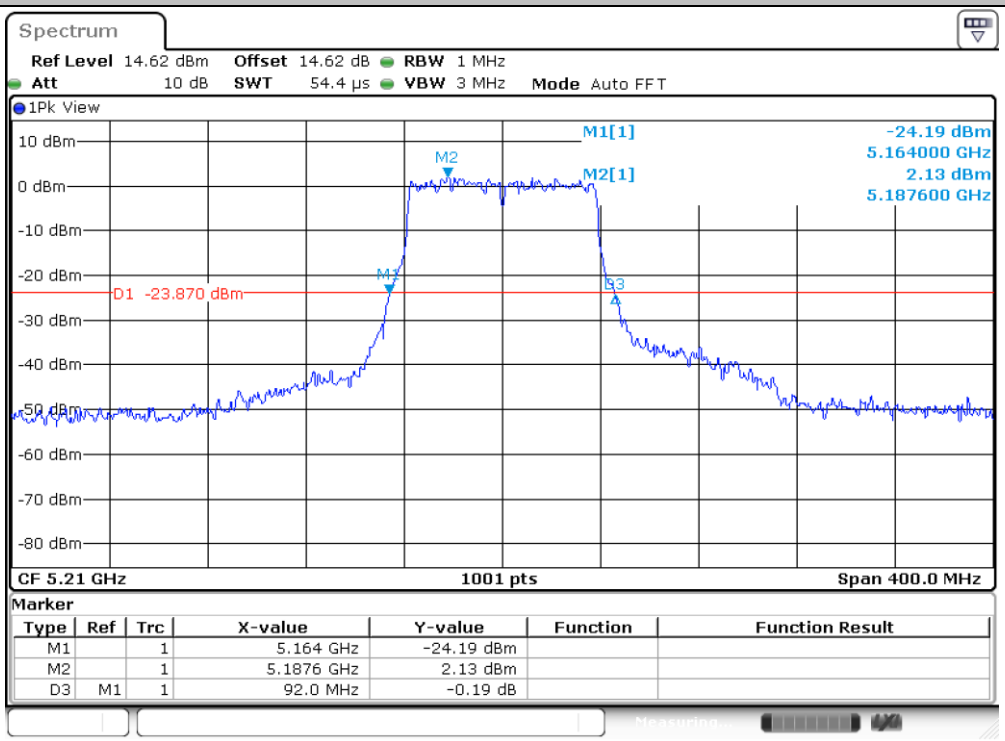

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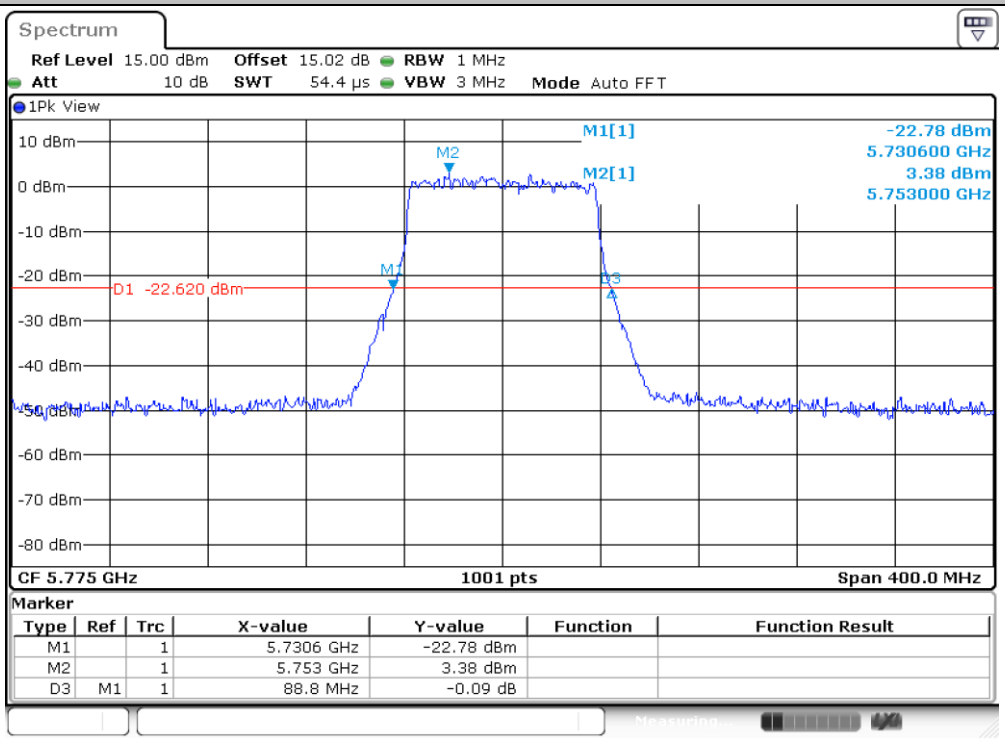

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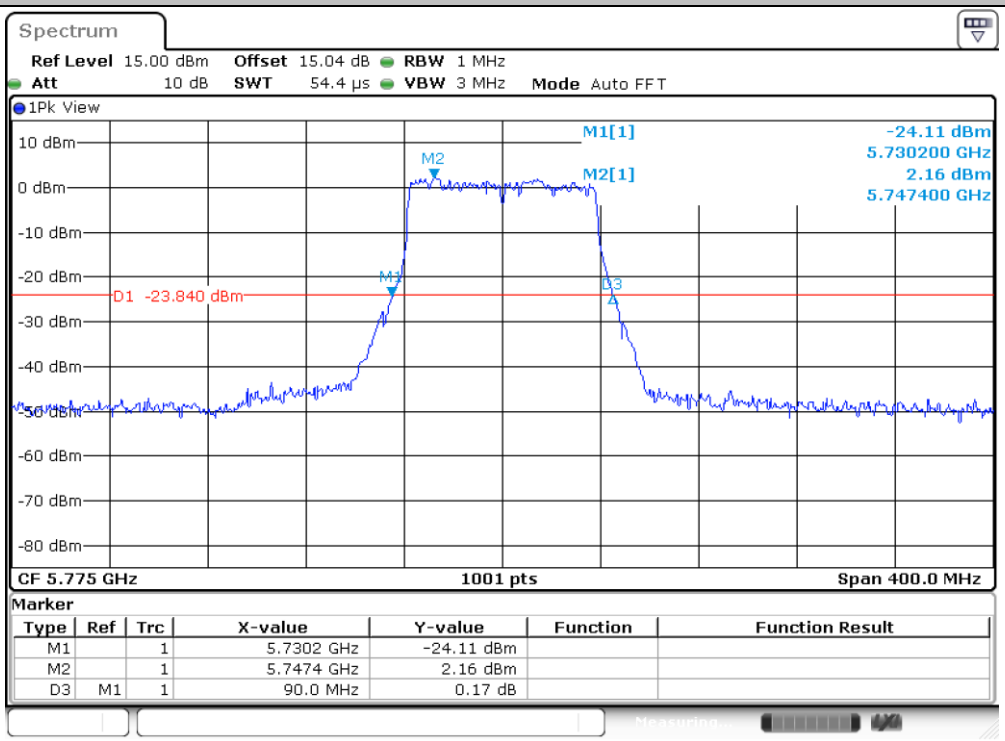
11AC80MIMO_Ant6_5775



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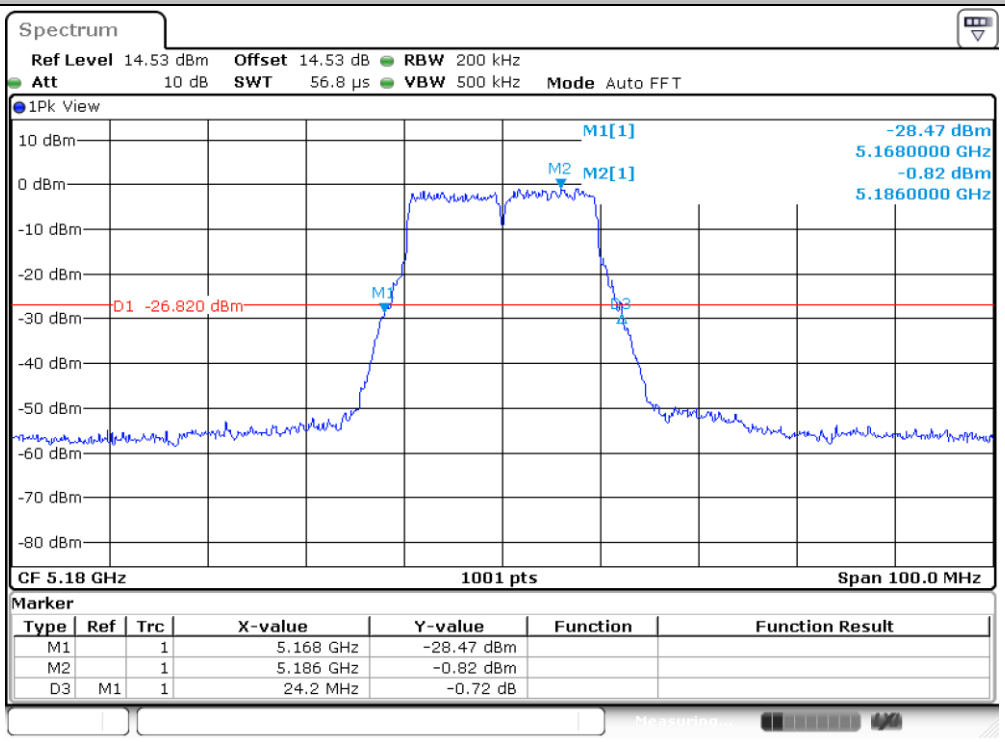
11BE20MIMO_Ant7_5180



Date: 12.SEP.2024 21:03:49

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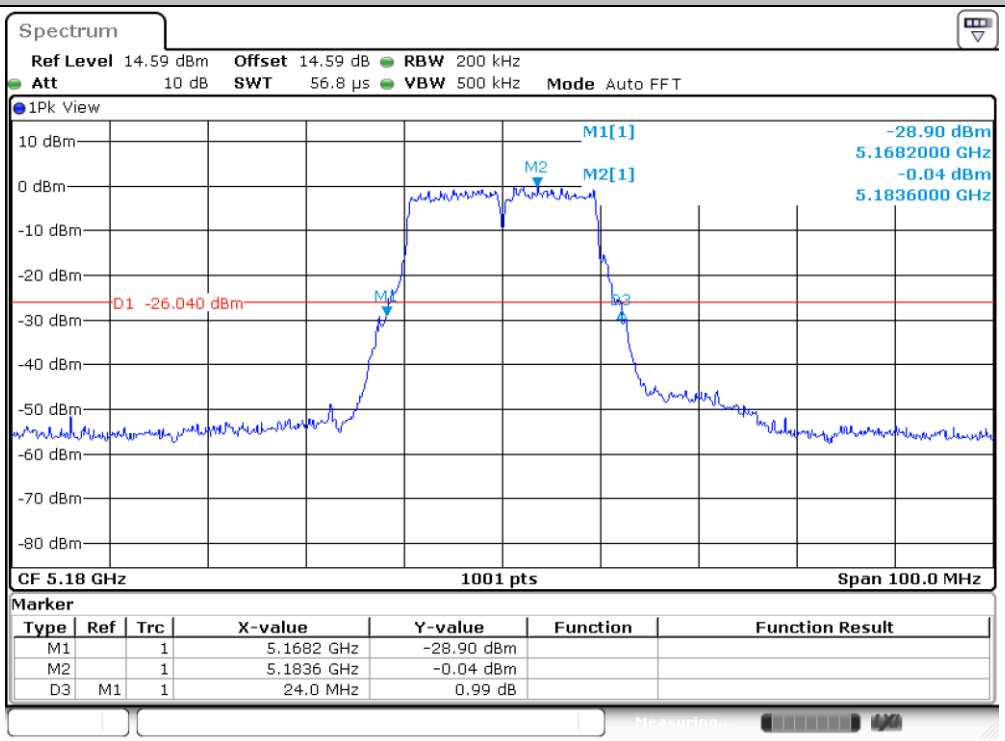

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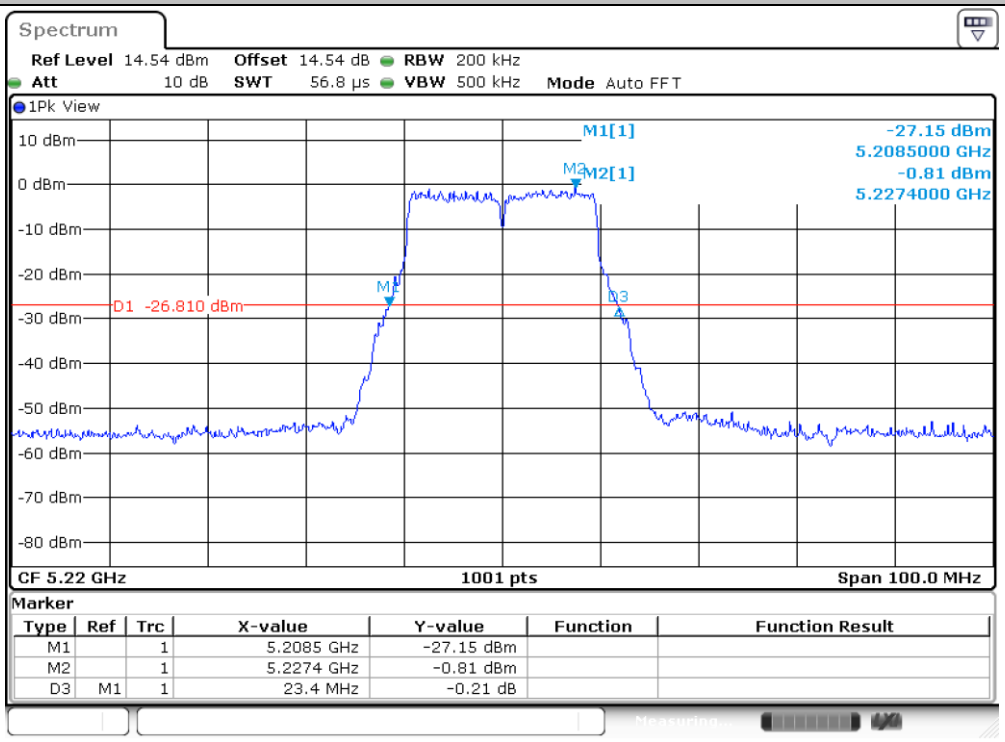
11BE20MIMO_Ant7_5220



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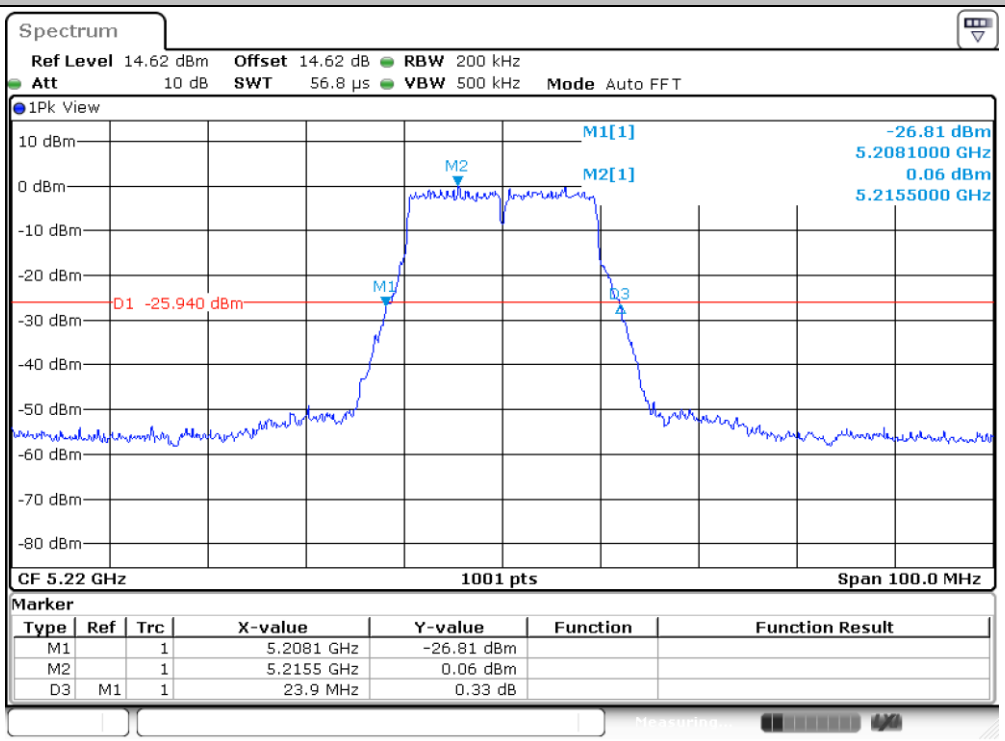

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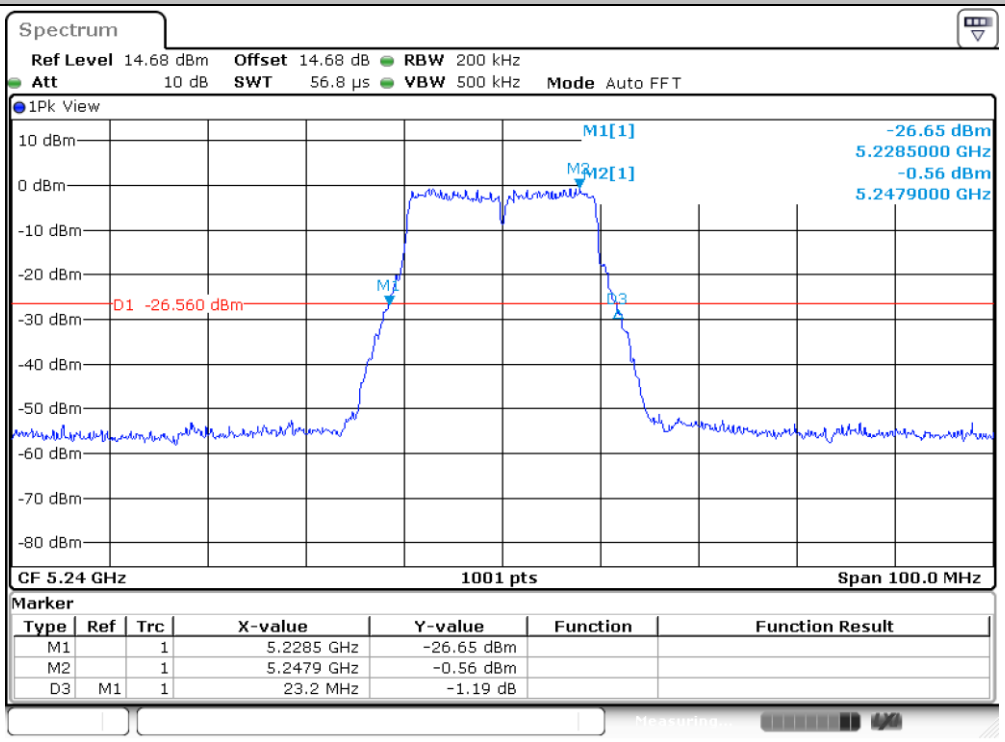

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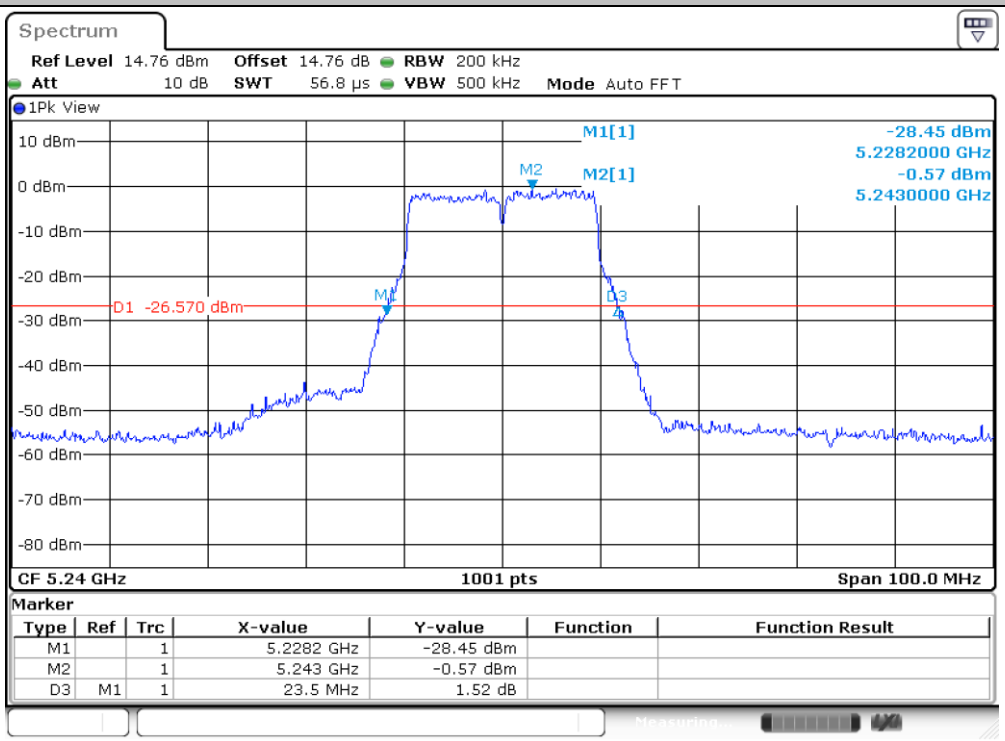

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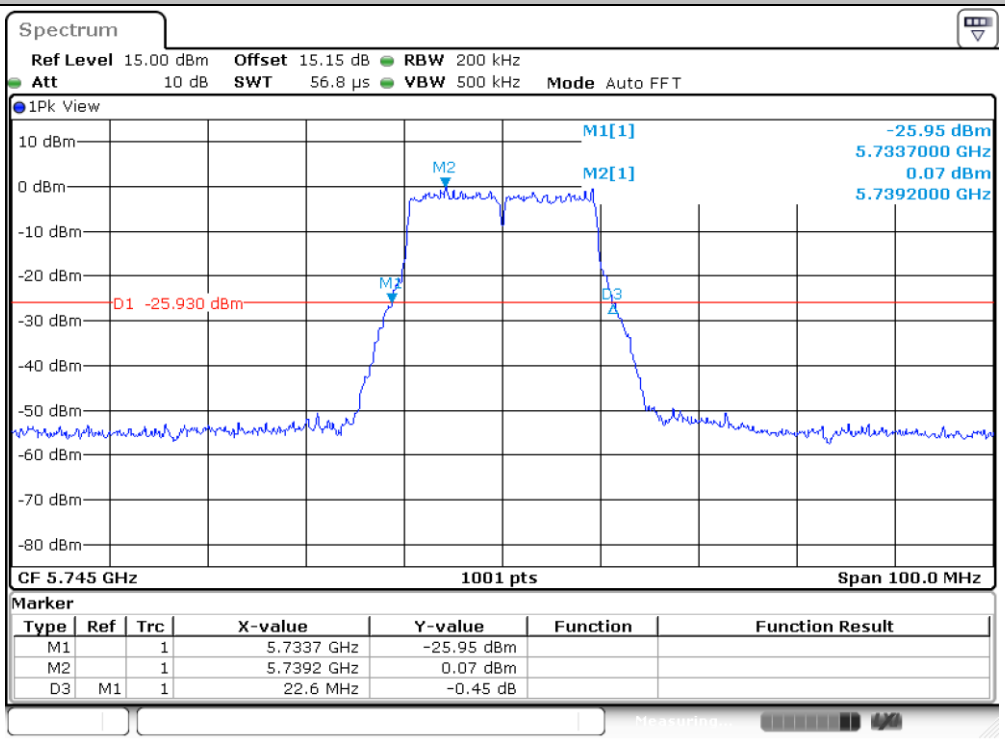

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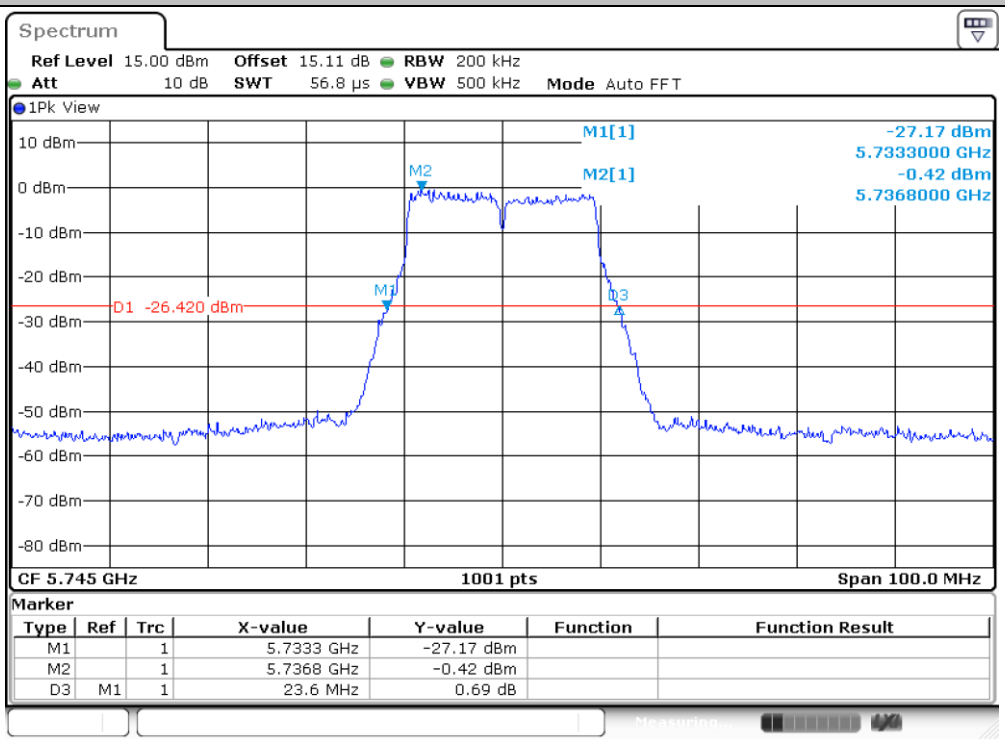

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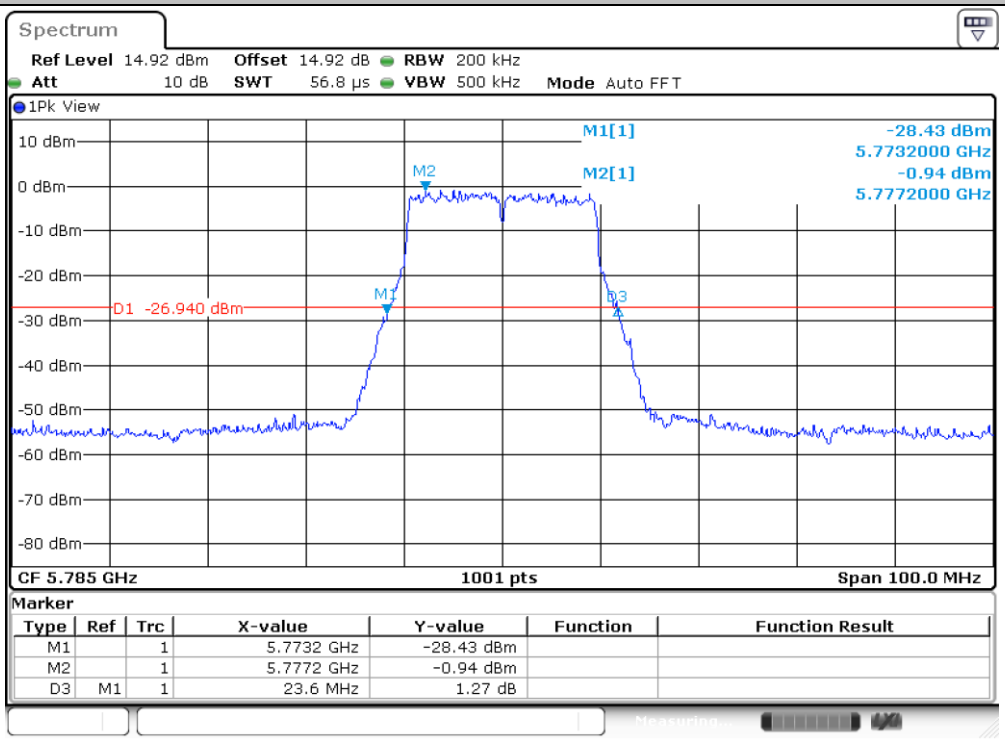

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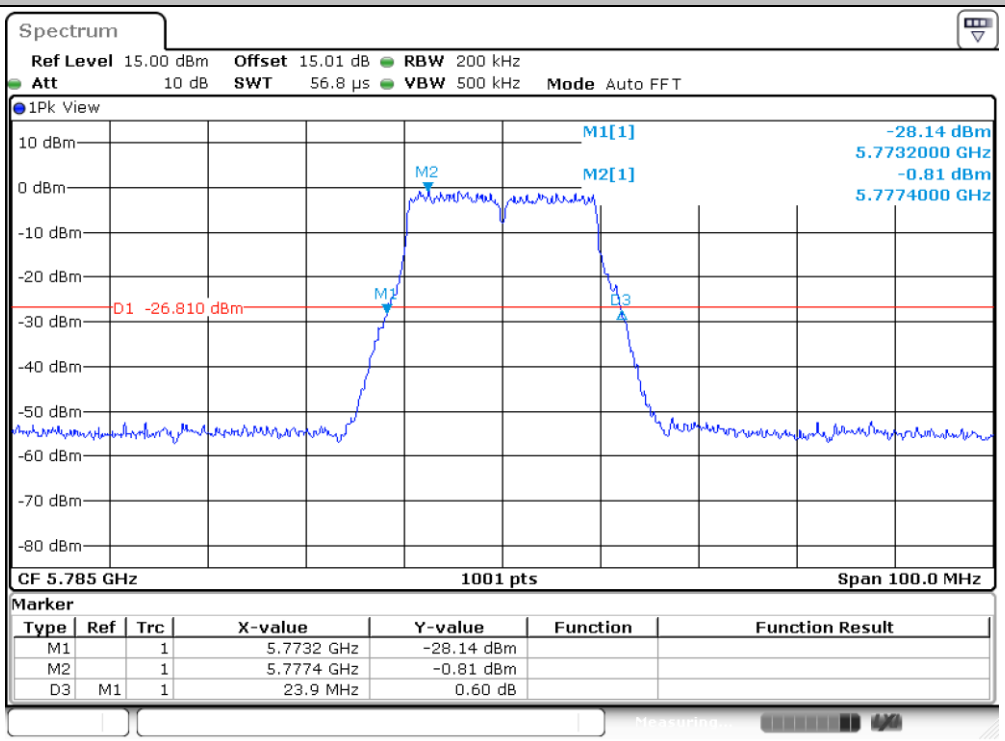

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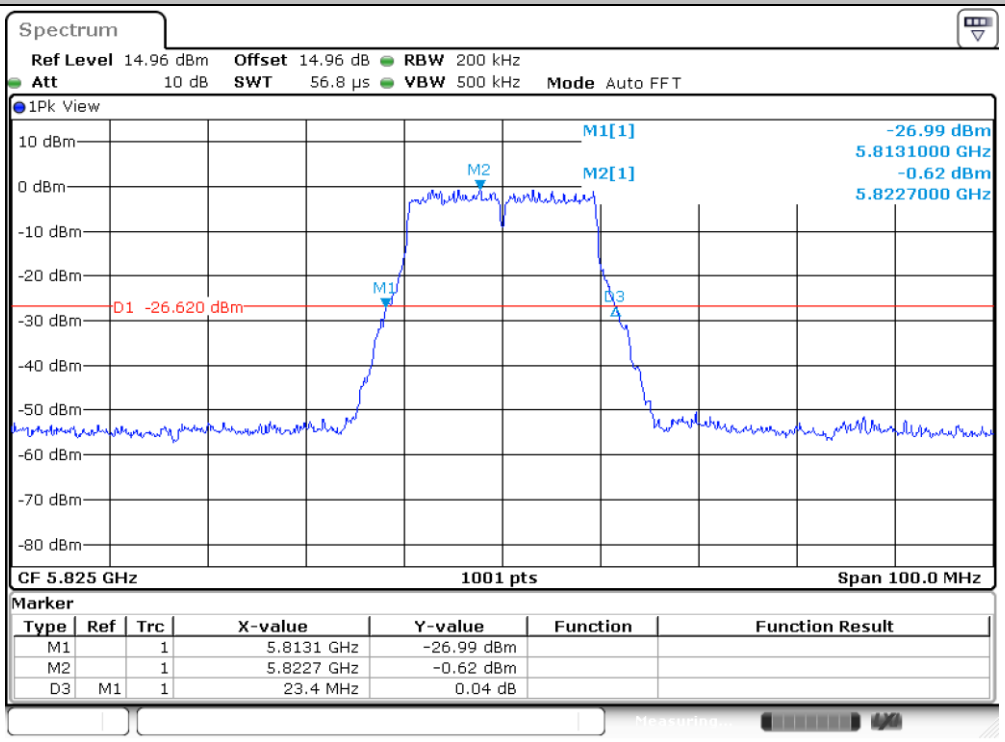

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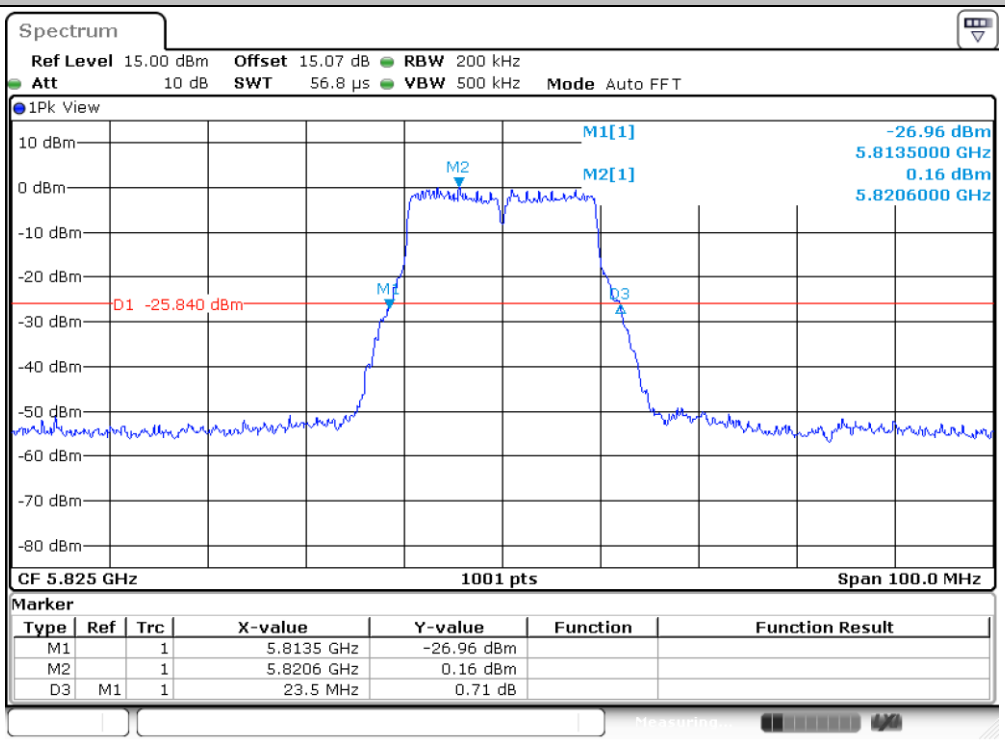

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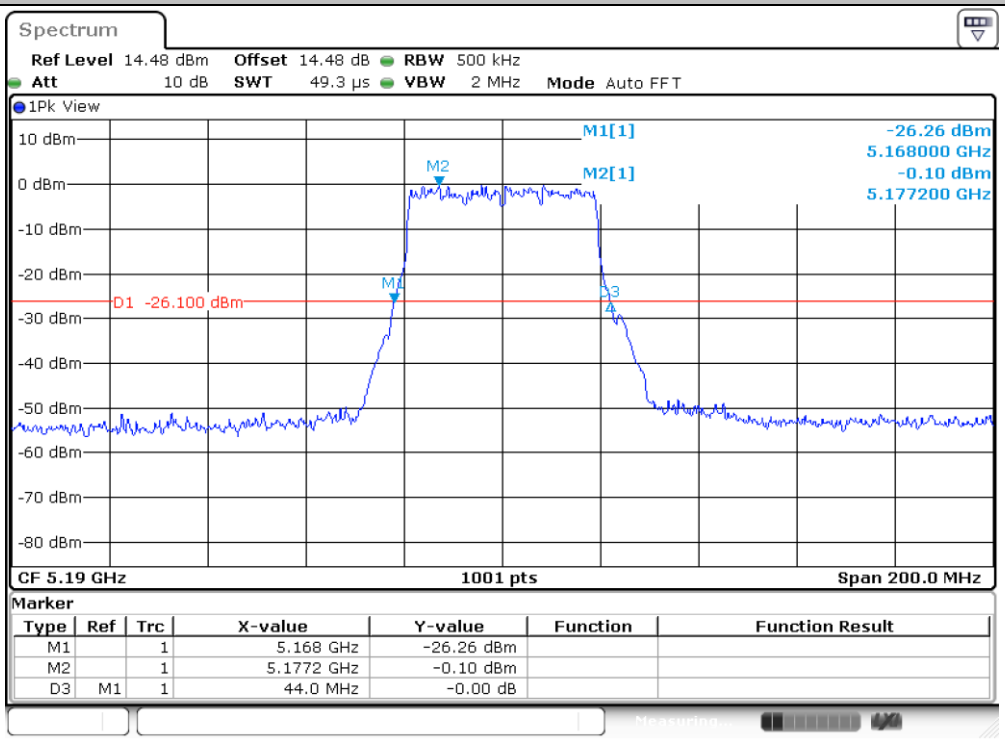

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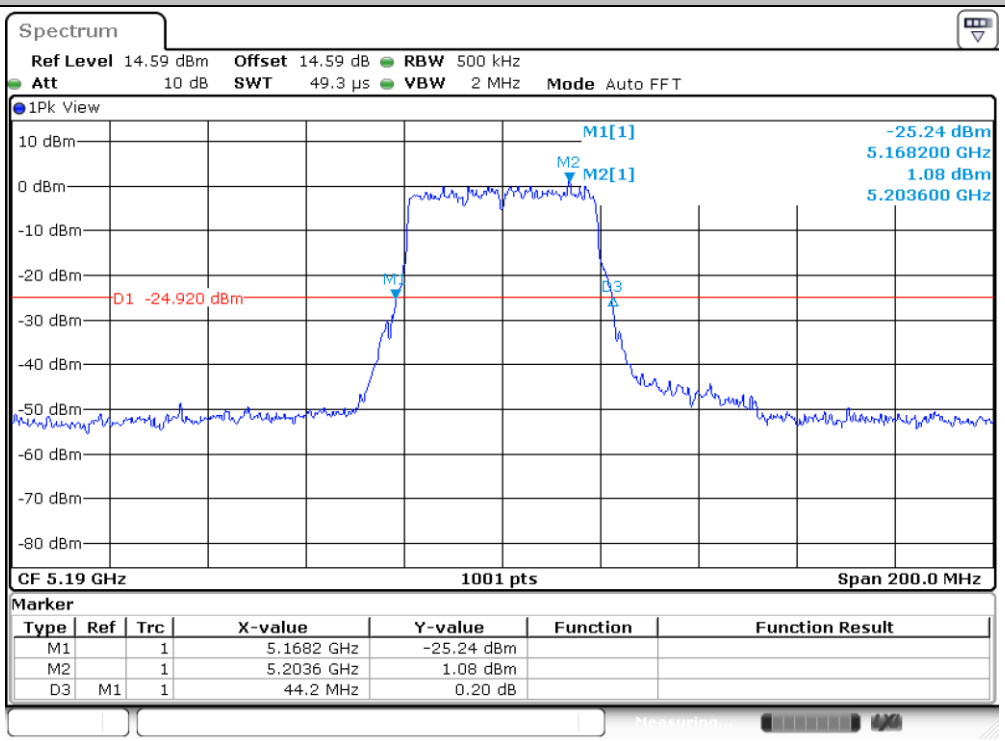

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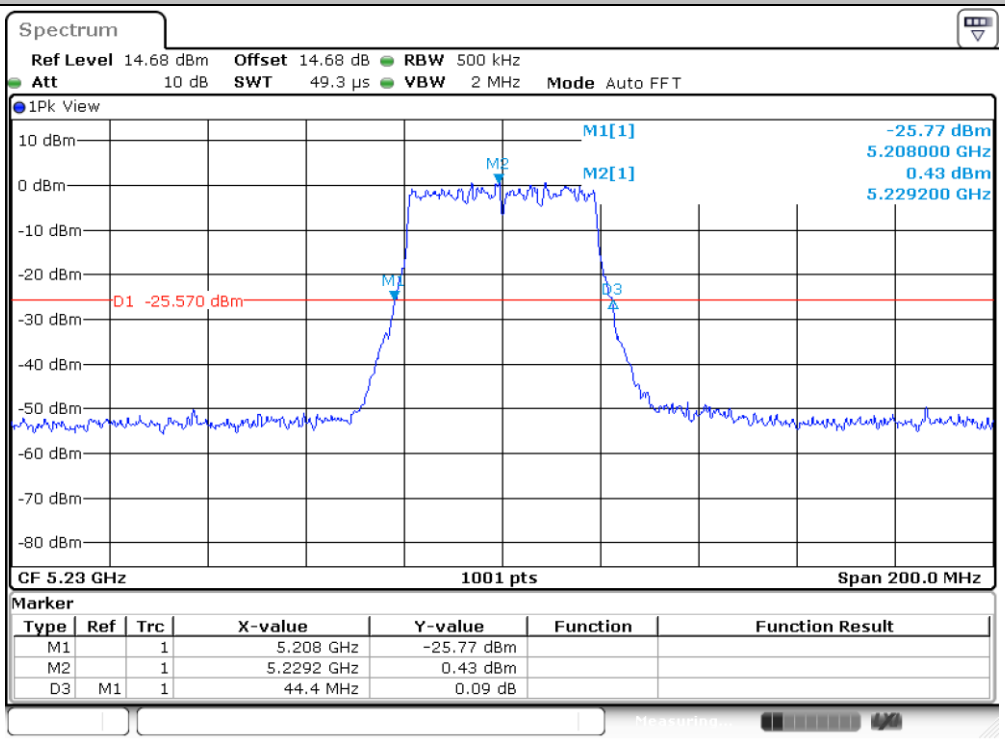
11BE40MIMO_Ant7_5230



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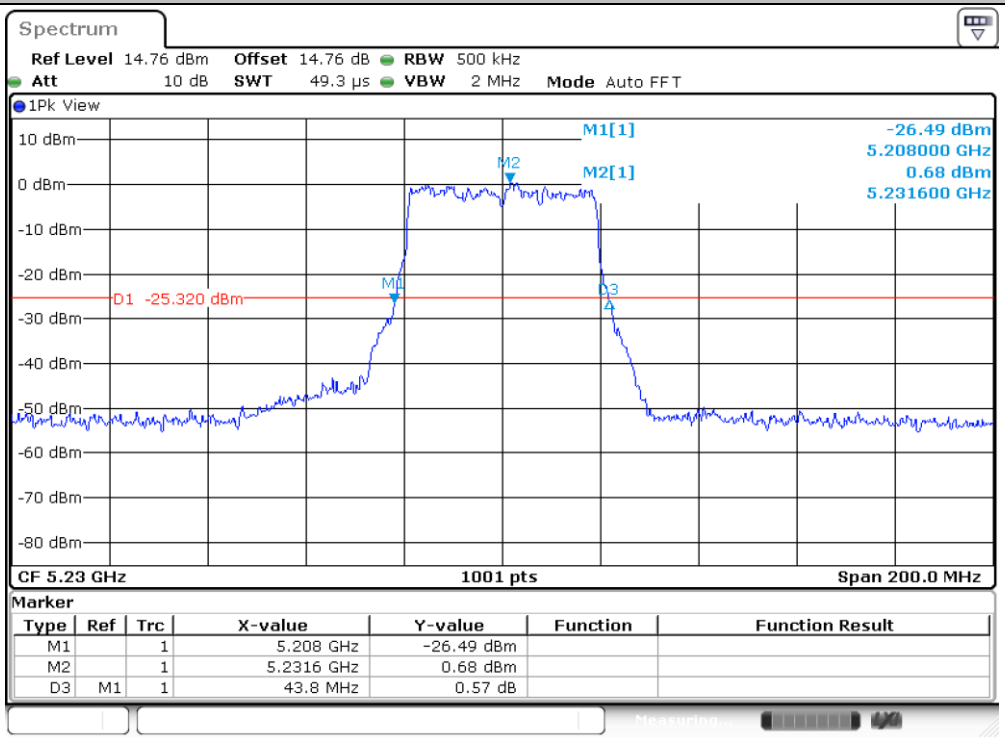

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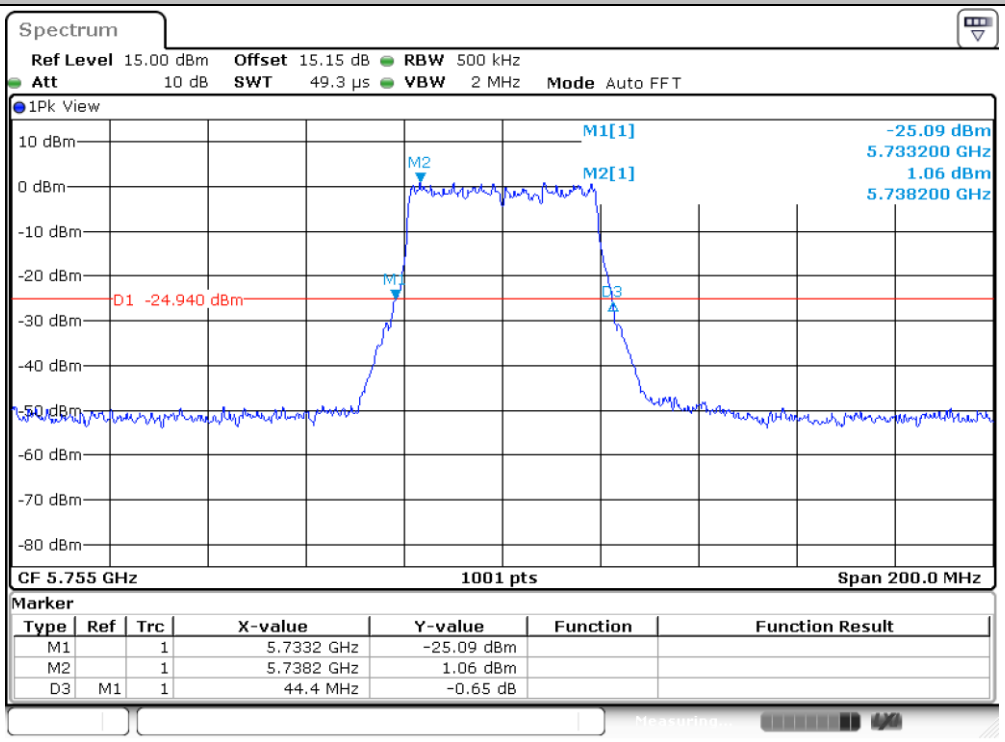

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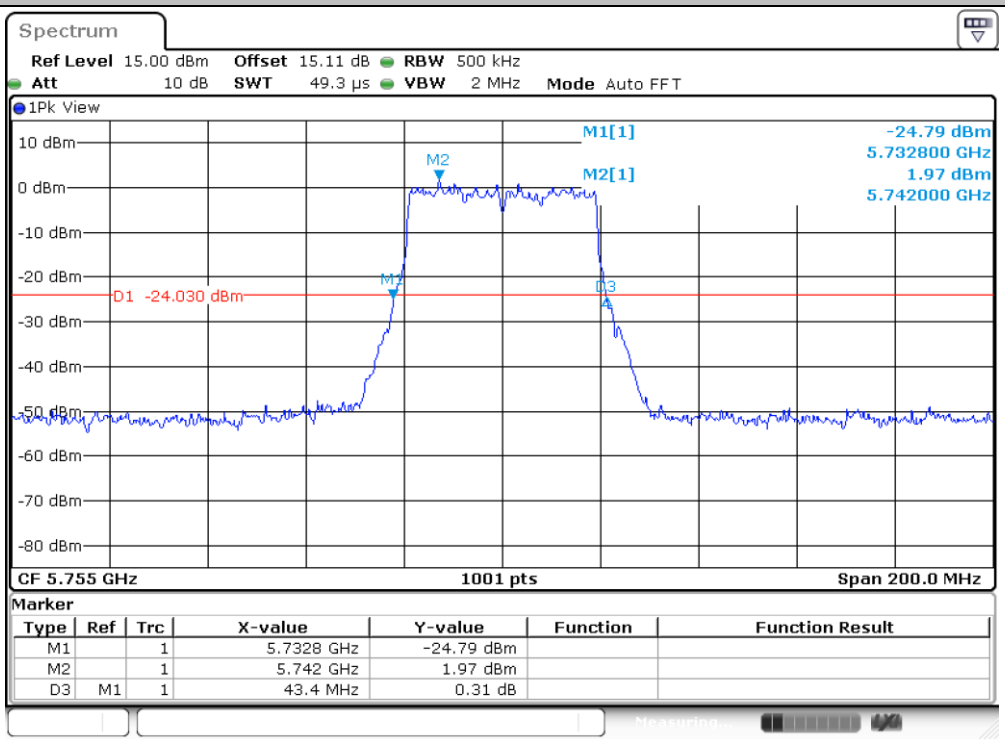

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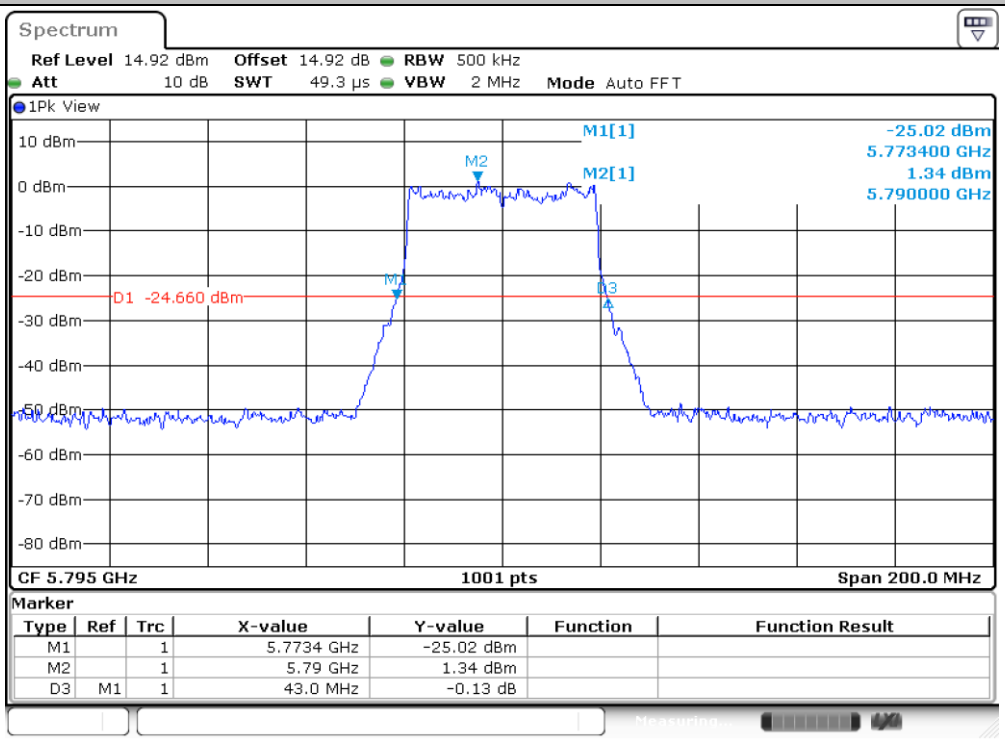

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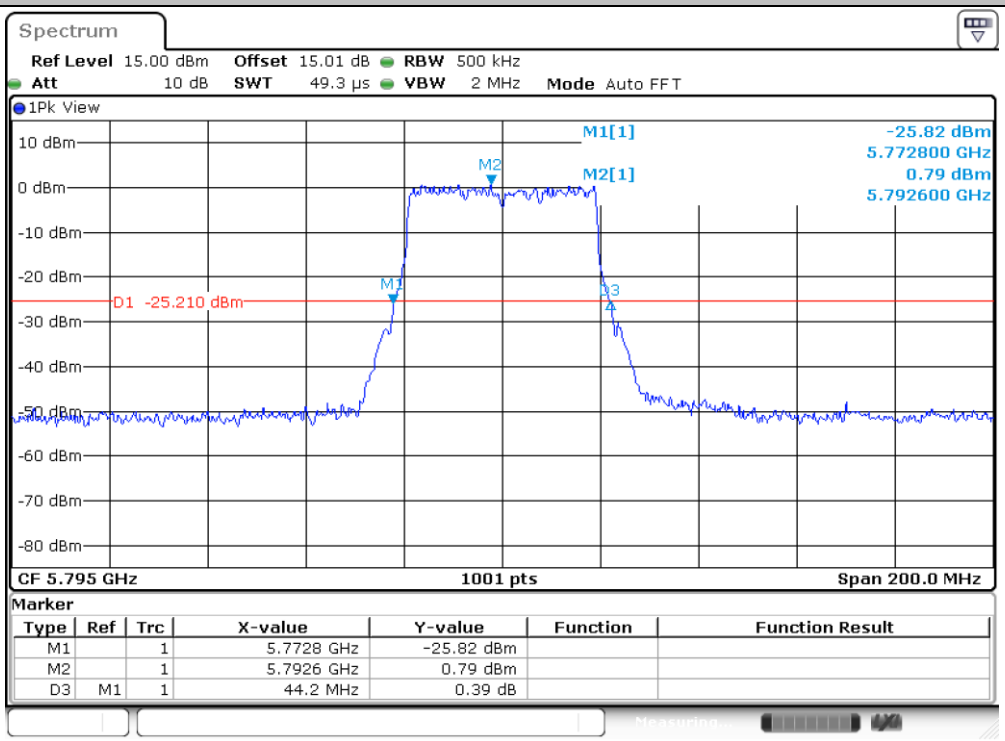

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