

ZUNIDATA SYSTEMS INC.

TEST REPORT

SCOPE OF WORK:

47 CFR FCC Part 15.407 – Radio Spectrum report

Model:

MB545AXXXXXX(X = 0~9 or A~Z or Blank or -)

REPORT NUMBER

211000232THC-001

ISSUE DATE

Dec. 07, 2021

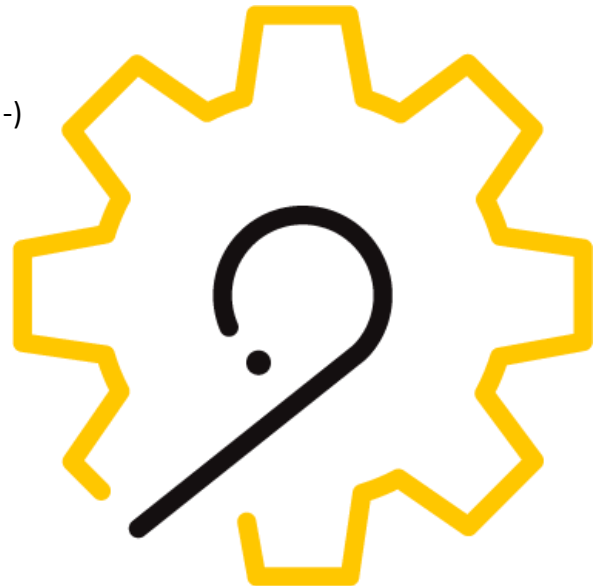
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Radio Spectrum TEST REPORT

Applicant:	ZUNIDATA SYSTEMS INC. 6F, No. 945, Boai Street, Jubei City, Hsinchu, 302045 Taiwan
Product:	Digital Signage Media Box
Model No.:	MB545AXXXXXX (X= 0~9 or A~Z or Blank or -)
FCC ID:	Z28-MB545A
Test Method/ Standard:	47 CFR FCC Part 15.407 KDB 789033 D02 v02r01 ANSI C63.10 2013 KDB 662911 D01 v02r01 KDB 905462 D02 v02
Test By:	Intertek Testing Services Taiwan Ltd., Hsinchu Laboratory No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li, Shiang-Shan District, Hsinchu City, Taiwan



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TEST REPORT**Revision History**

Report No.	Issue Date	Revision Summary
211000232THC-001	Dec. 07, 2021	Original report

Table of Contents

1. General Information	6
1.1 Identification of the EUT	6
1.2 Adapter information	6
1.3 Additional information about the EUT	6
1.4 Antenna description	7
1.5 Description of the EUT	7
1.6 Peripherals equipment	7
1.7 Operation mode	8
2. Maximum Conducted Output Power	9
2.1 Limit for maximum output power	9
2.2 Measuring instrument setting	9
2.3 Test procedure	9
2.4 Test diagram	9
2.5 Test results	10
3. Power Spectrum Density	25
3.1 Limit for power spectrum density	25
3.2 Measuring instrument setting	25
3.3 Test procedure	26
3.4 Test diagram	26
3.5 Test results	27
4. Minimum Bandwidth	42
4.1 Limit for minimum emission bandwidth	42
4.2 Measuring instrument setting	42
4.3 Test procedure	43
4.4 Test diagram	43
4.5 Test results	44
5. Emissions in Restricted Frequency Bands (Radiated emission measurements)	74
5.1 Limit for emission in restricted frequency bands (Radiated emission measurement) ..	74
5.2 Measuring instrument setting	75
5.3 Test procedure	76
5.4 Test configuration	77
5.4.1 Radiated emission from 9 kHz to 30MHz using Loop Antenna	77
5.6 Test results	79
5.6.1 Measurement results: frequencies from 9 kHz to 30MHz	79
5.6.2 Measurement results: frequencies from 30 MHz to 1GHz	81
5.6.3 Measurement results: frequency above 1GHz to 40GHz	82
6. Emission on The Band Edge	85
6.1 Measuring instrument setting	85
6.2 Test procedure	85
6.3 Test Result	86

TEST REPORT

- 7. Dynamic Frequency Selection (DFS) test..... 96
 - 7.1 UNII Device Description..... 96
 - 7.2 Operating mode 97
 - 7.3 Test Protocol and Requirements 97
 - 7.4 DFS Detection Thresholds and Limitations of each Parameter 99
 - 7.5 Radar Test Waveforms 100
 - 7.6 Radar Waveform Calibration 103
 - 7.6.1 Radar Waveform Calibration Plot..... 104
 - 7.7 Test instruments and setup 105
 - 7.7.1 Deviation about the radar waveform 105
 - 7.7.2 Test setup..... 105
 - 7.8 DFS test results 105
 - 7.8.1 Test summary 105
 - 7.8.2 DFS test result..... 106
 - 7.8.2.1 Channel Move & Closing Transmission time 107
 - 7.9 Non-Occupancy Period 108
- 8. AC Power Line Conducted Emission 109
 - 8.1 Measuring instrument setting..... 109
 - 8.2 Test Procedure 109
 - 8.3 Test Diagram 110
 - 8.4 Limit..... 110
 - 8.5 Test Results 111
- Appendix A: Test equipment list..... 115
- Appendix B: Measurement Uncertainty..... 117

Summary of Test Data

Test Requirement	Applicable Rule (Section 15.407)	Result
Maximum Conducted Output Power	15.407 (a)(1)/(2)/(3) KDB 789033 D02 v01r02	Pass
Power Spectrum Density	15.407 (a)(1)/(2)/(3) KDB 789033 D02 v01r02	Pass
Minimum Emission Bandwidth	15.407(a)(5), 15.407(e) KDB 789033 D02 v01r02	Pass
Emissions In Restricted Frequency Bands (Radiated emission measurements)	15.407(b), 15.209	Pass
Emission on The Band Edge	15.407(b), 15.209	Pass
Dynamic Frequency Selection (DFS)	15.407(h)(2)	Pass
AC Line Conducted Emission	15.407(b)(6) 15.207	Pass
Antenna requirement	15.203	Pass

Note: Please note that the test results with statement of conformity, the decision rules which are based on: Safety Testing: the specification, standard or IEC Guide 115.

Other Testing: the specification, standard and not taking into account the measurement uncertainty.

1. General Information

1.1 Identification of the EUT

Product:	Digital Signage Media Box
Model No.:	MB545A
Operating Frequency:	1. 5180MHz~5240MHz 2. 5260MHz~5320MHz 3. 5500MHz~5700MHz 4. 5745MHz~5825MHz
Channel Number:	1. 7 channels for 5180MHz~5240MHz 2. 7 channels for 5260MHz~5320MHz 3. 12 channels for 5500MHz~5700MHz 4. 8 channels for 5745MHz~5825MHz
Access scheme:	OFDM
Rated Power:	DC 12V from adapter
Power Cord:	N/A
Sample receiving date:	2021/10/14
Sample condition:	Workable
Test Date(s):	2021/11/10 ~ 2021/12/2

1.2 Adapter information

The EUT will be supplied with a power supply from below list:

No.	Model no.	Specification
Adapter 1	2AAJ024FC	I/P: 100-240Vac, 50/60Hz, 0.8A O/P: 12Vdc, 2.0A, 24W
Adapter 2	2ABL024F	I/P: 100-240Vac, 50/60Hz, 0.8A O/P: 12Vdc, 2.0A, 24W

1.3 Additional information about the EUT

The customer confirmed MB545AXXXXXX (X=0~9 or A~Z or Blank or -) is a series model to MB545A (EUT), the different model numbers are served as marketing strategy.

For more detail features, please refer to user's Manual.

TEST REPORT

1.4 Antenna description

Antenna Gain : 5 dBi
 Antenna Type : Dipole antenna
 Connector Type : RP-SMA

1.5 Description of the EUT

Modulation mode	Transmit path
	Chain 0 / Main
802.11 a	V
802.11 ac (VHT20)	V
802.11 ac (VHT40)	V
802.11 ac (VHT80)	V

1.6 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Description of Data Cable
Notebook PC	HP	HSTNN-Q96C	5CD8021S9J	(1) RJ-45 UTP Cat.5 0.5 meter (2) mini HDMI to HDMI shielded cable 0.5 meter with 2 core
Earphone	HTC	INNOVATION	N/A	N/A
USB mouse	HP	MOHQQUO	N/A	N/A
USB keyboard	DELL	SK-8115	N/A	N/A
Monitor	ViewSonic	VS16024	N/A	HDMI shielded cable 0.5 meter with 2 core
Monitor	PHILIPS	LTC2915/90	N/A	HDMI shielded cable 0.5 meter with 2 core
Monitor	HP	D2827A	KR91049220	HDMI cable 1m
Wireless AP	Burffalo	WZR-AGL300NH	N/A	N/A
Micro SD card	Transcend	UHS-1 MICRO SD 300S	N/A	N/A

TEST REPORT**1.7 Operation mode**

- (1) Turn on RF TOOL TEST after EUT is powered on and select different frequency and modulation.
- (2) With individual verifying, the maximum output power were found out 6 Mbps data rate for 802.11a mode, 6.5 Mbps data rate for 802.11ac(VHT20) mode, 13.5 Mbps data rate for 802.11ac(VHT40) mode, 29.3 Mbps data rate for 802.11ac(VHT80) mode, the final tests were executed under these conditions recorded in this report individually.

Mode	Data rate(Mbps)	Signal on time(s)	Total signal transmit time (s)	Duty cycle	Duty Cycle factor
802.11a	6	1.389	1.438	0.966	0.151
802.11ac(VHT20)	6.5	1.307	1.356	0.964	0.160
802.11ac(VHT40)	13.5	0.621	0.718	0.865	0.632
802.11ac(VHT80)	29.3	0.284	0.365	0.778	1.091

2. Maximum Conducted Output Power

2.1 Limit for maximum output power

Operating Frequency (MHz)	Conducted output power limit
5150~5725	< 0.25 W (24 dBm)
5725~5850	< 1 W (30 dBm)

Operating Frequency (MHz)	Maximum E.I.R.P. limit
5150~5725	< 1 W (30 dBm)
5725~5850	< 4 W (36 dBm)

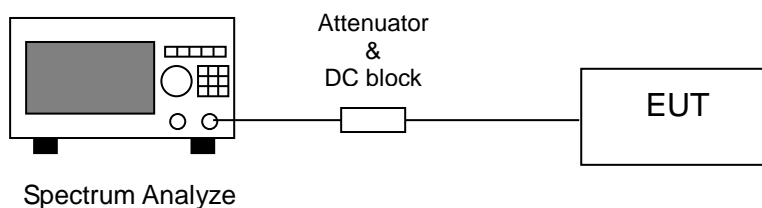
2.2 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	RMS
RBW	=1MHz
VBW	≥ 3 MHz
Sweep	Auto couple
Trace	Average
Span	Encompass the EBW
Attenuation	Auto
Sweep point	≥ 2 Span / RBW

2.3 Test procedure

Test procedures refer to clause E) 2) d) Method SA-2 of KDB 789033 D02 v02r01

2.4 Test diagram



TEST REPORT

2.5 Test results

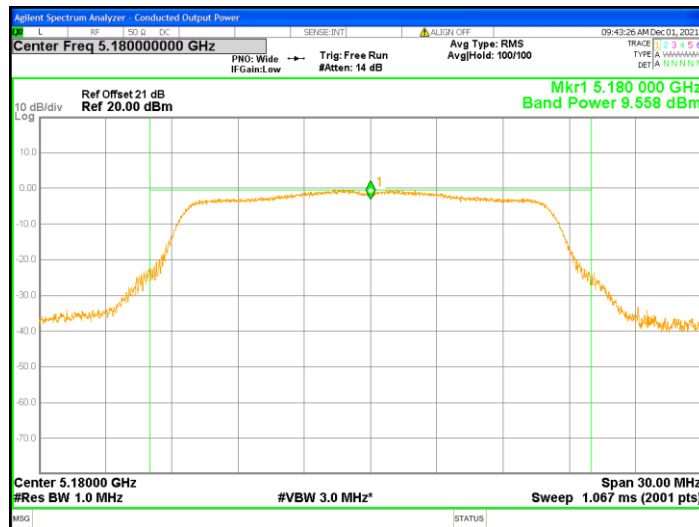
Temperature (°C) :	21
Relative Humidity (%) :	66
Test date :	2021/12/1

Mode	Channel	Frequency (MHz)	Conducted Output Power (AV)		Duty Factor	Result (dBm)	Antenna Gain (dBi)	E.I.R.P. (dBm)	Limit of Conducted Power (dBm)	Margin (dB)	Limit of E.I.R.P. (dBm)	Margin (dB)
			dBm	mW								
802.11a	36	5180	9.558	9.032	0.151	9.709	5	14.709	24	-14.291	30	-15.291
	44	5220	9.019	7.978	0.151	9.170	5	14.170	24	-14.830	30	-15.830
	48	5240	9.003	7.949	0.151	9.154	5	14.154	24	-14.846	30	-15.846
	52	5260	8.695	7.405	0.151	8.846	5	13.846	24	-15.154	30	-16.154
	60	5300	8.473	7.036	0.151	8.624	5	13.624	24	-15.376	30	-16.376
	64	5320	8.360	6.855	0.151	8.511	5	13.511	24	-15.489	30	-16.489
	100	5500	8.311	6.778	0.151	8.462	5	13.462	24	-15.538	30	-16.538
	116	5580	8.264	6.705	0.151	8.415	5	13.415	24	-15.585	30	-16.585
	140	5700	8.199	6.605	0.151	8.350	5	13.350	24	-15.650	30	-16.650
	149	5745	8.037	6.364	0.151	8.188	5	13.188	30	-21.812	36	-22.812
	157	5785	8.266	6.708	0.151	8.417	5	13.417	30	-21.583	36	-22.583
802.11ac (VHT20)	36	5180	9.372	8.654	0.160	9.532	5	14.532	24	-14.468	30	-15.468
	44	5220	8.949	7.851	0.160	9.109	5	14.109	24	-14.891	30	-15.891
	48	5240	8.827	7.633	0.160	8.987	5	13.987	24	-15.013	30	-16.013
	52	5260	8.356	6.849	0.160	8.516	5	13.516	24	-15.484	30	-16.484
	60	5300	8.342	6.827	0.160	8.502	5	13.502	24	-15.498	30	-16.498
	64	5320	8.235	6.660	0.160	8.395	5	13.395	24	-15.605	30	-16.605
	100	5500	8.031	6.355	0.160	8.191	5	13.191	24	-15.809	30	-16.809
	116	5580	7.917	6.190	0.160	8.077	5	13.077	24	-15.923	30	-16.923
	140	5700	8.008	6.321	0.160	8.168	5	13.168	24	-15.832	30	-16.832
	149	5745	7.854	6.101	0.160	8.014	5	13.014	30	-21.986	36	-22.986
	157	5785	7.855	6.102	0.160	8.015	5	13.015	30	-21.985	36	-22.985
802.11ac (VHT40)	38	5190	8.126	6.495	0.632	8.758	5	13.758	24	-15.242	30	-16.242
	46	5230	7.853	6.100	0.632	8.485	5	13.485	24	-15.515	30	-16.515
	54	5270	7.769	5.983	0.632	8.401	5	13.401	24	-15.599	30	-16.599
	62	5310	7.956	6.246	0.632	8.588	5	13.588	24	-15.412	30	-16.412
	102	5510	7.312	5.385	0.632	7.944	5	12.944	24	-16.056	30	-17.056
	110	5500	7.574	5.720	0.632	8.206	5	13.206	24	-15.794	30	-16.794
	134	5670	7.226	5.280	0.632	7.858	5	12.858	24	-16.142	30	-17.142
	151	5755	6.898	4.896	0.632	7.530	5	12.530	30	-22.470	36	-23.470
159	5795	7.390	5.483	0.632	8.022	5	13.022	30	-21.978	36	-22.978	

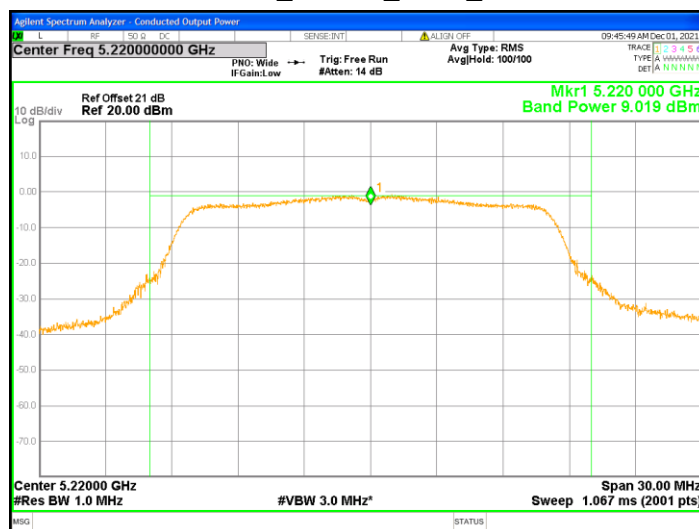
TEST REPORT

Mode	Channel	Frequency (MHz)	Conducted Output Power (AV)		Duty Factor	Result (dBm)	Antenna Gain (dBi)	E.I.R.P. (dBm)	Limit of Conducted Power (dBm)	Margin (dB)	Limit of E.I.R.P. (dBm)	Margin (dB)
			dBm	mW								
802.11ac (VHT80)	42	5210	7.772	5.987	1.091	8.863	5	13.863	24	-15.137	30	-16.137
	58	5290	7.410	5.508	1.091	8.501	5	13.501	24	-15.499	30	-16.499
	106	5530	6.969	4.976	1.091	8.060	5	13.060	24	-15.940	30	-16.940
	155	5775	6.754	4.736	1.091	7.845	5	12.845	30	-22.155	36	-23.155

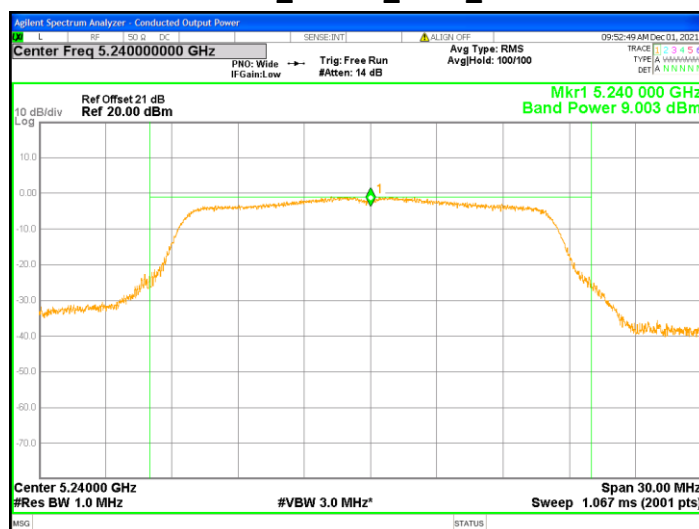
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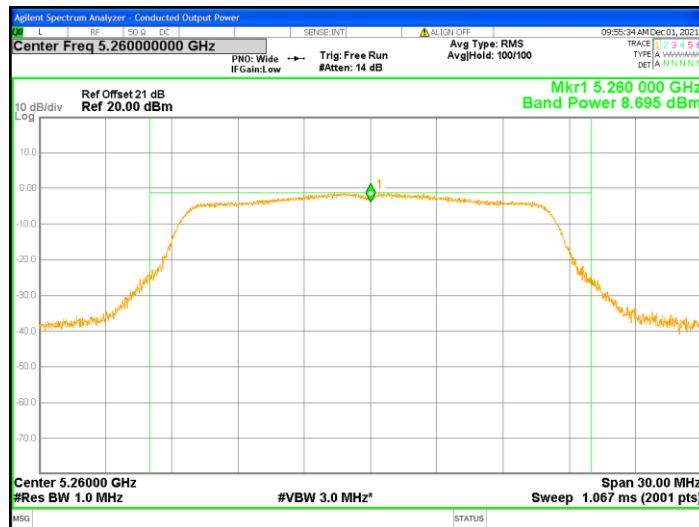
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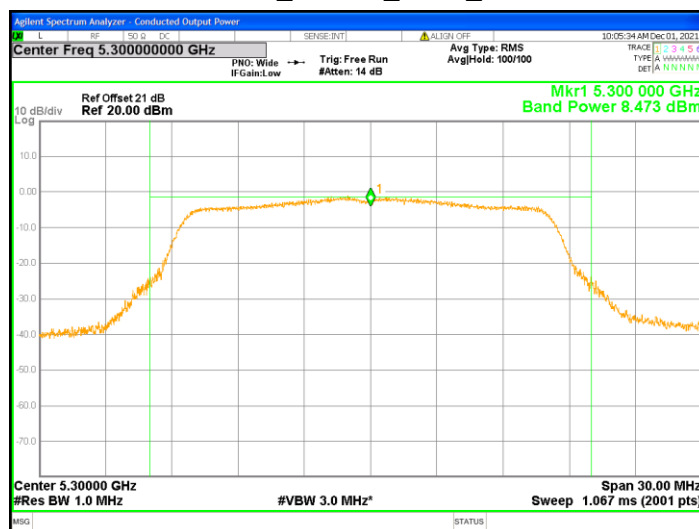
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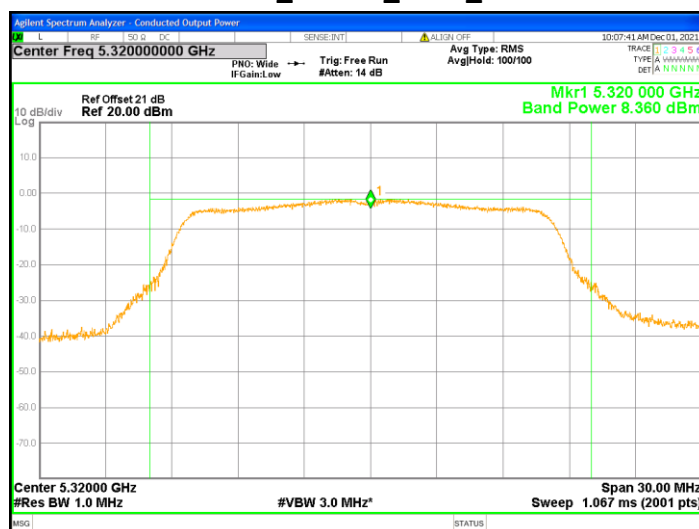
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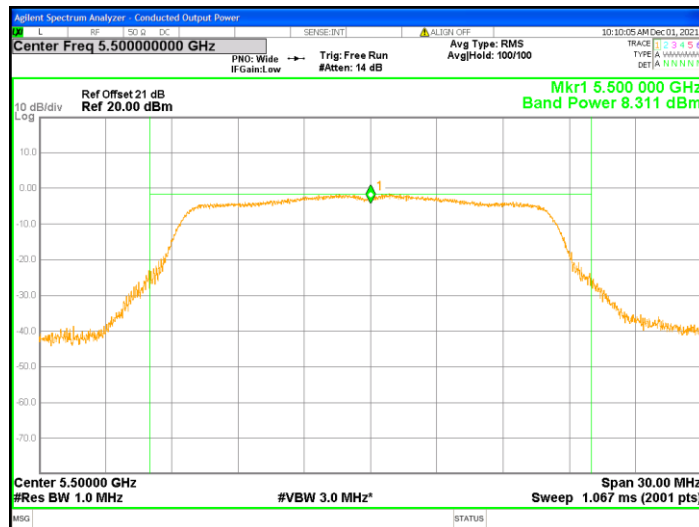
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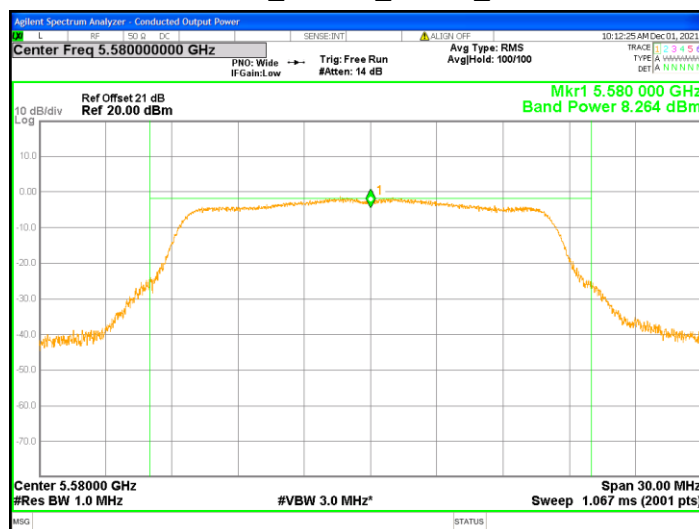
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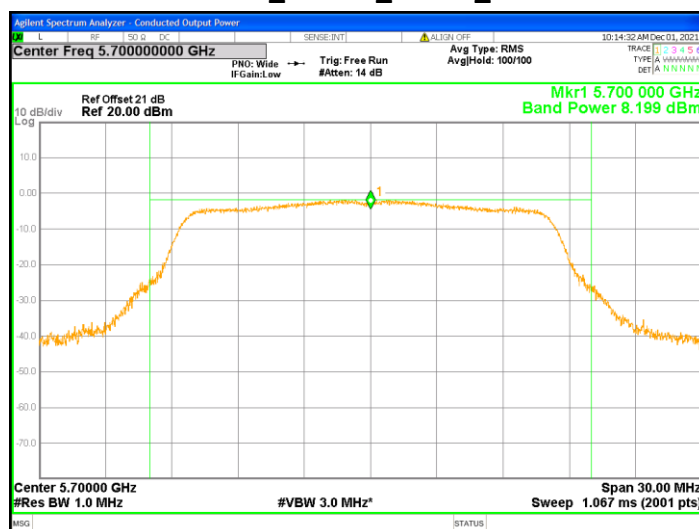
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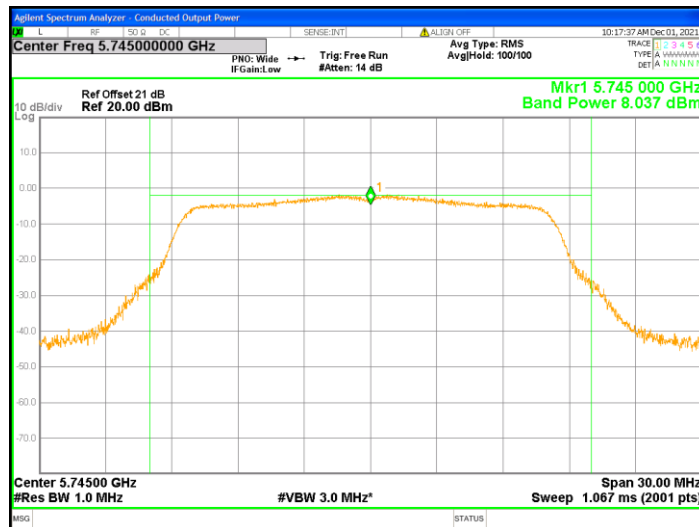
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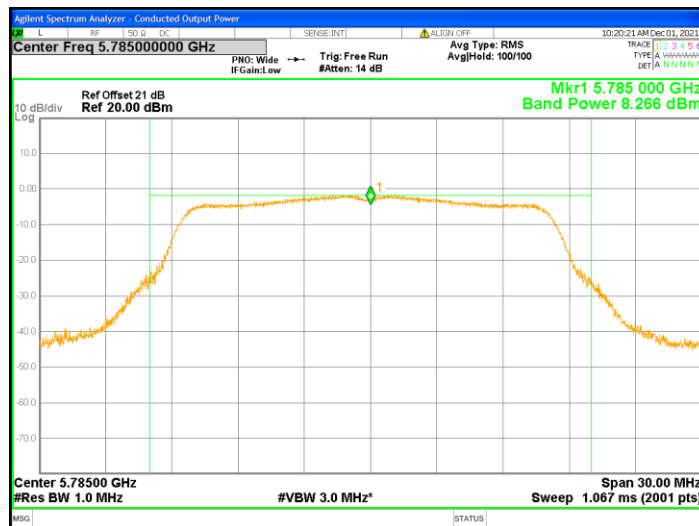
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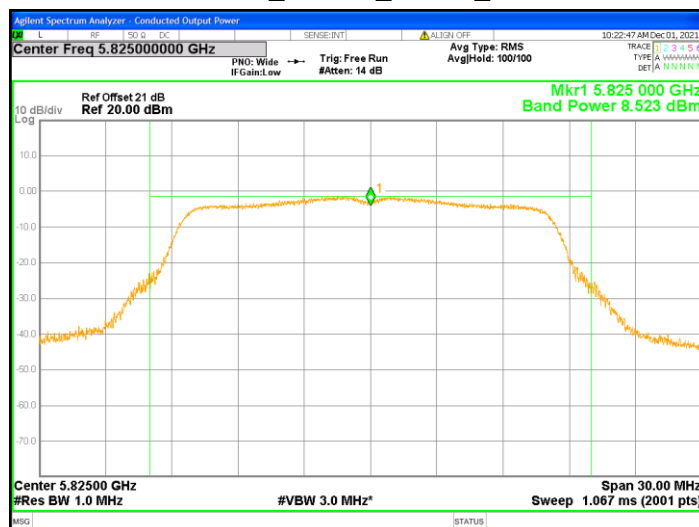
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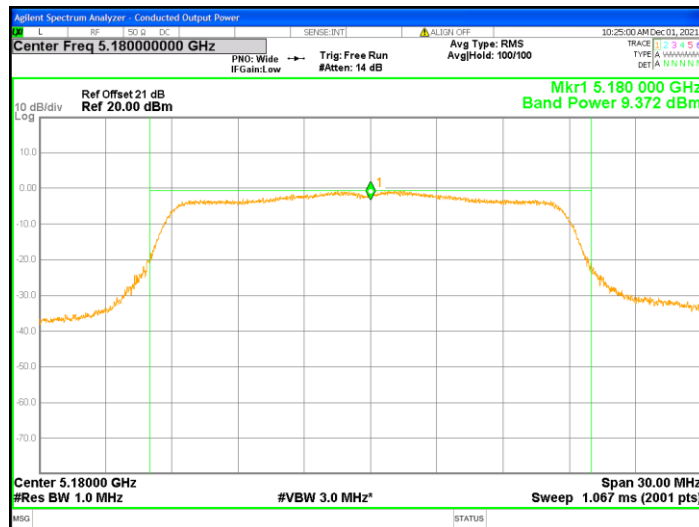
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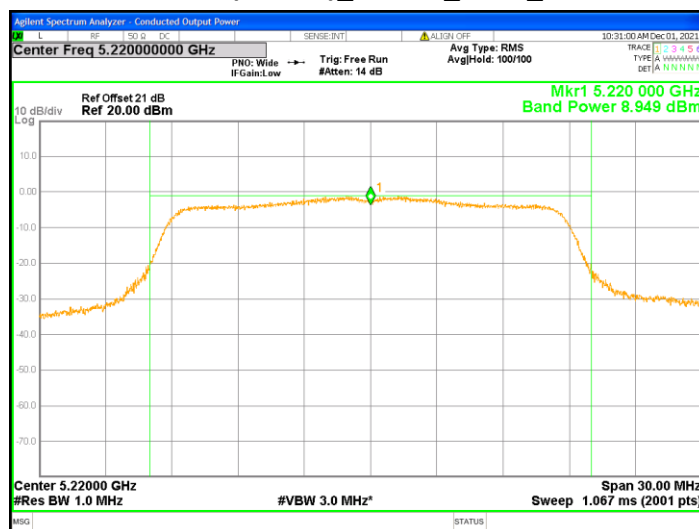
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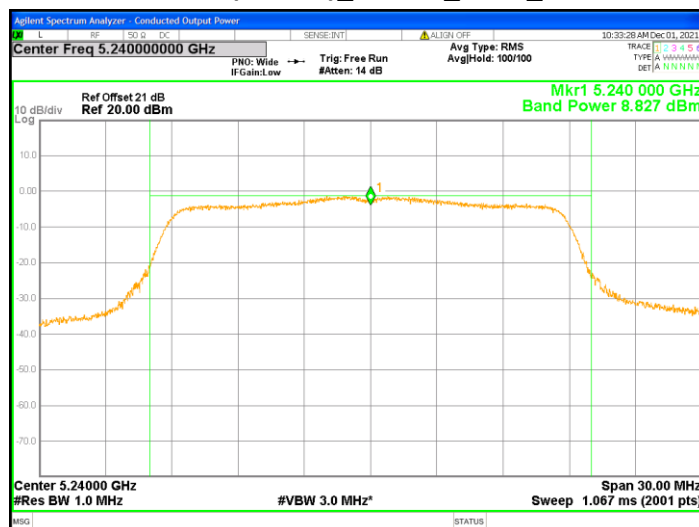
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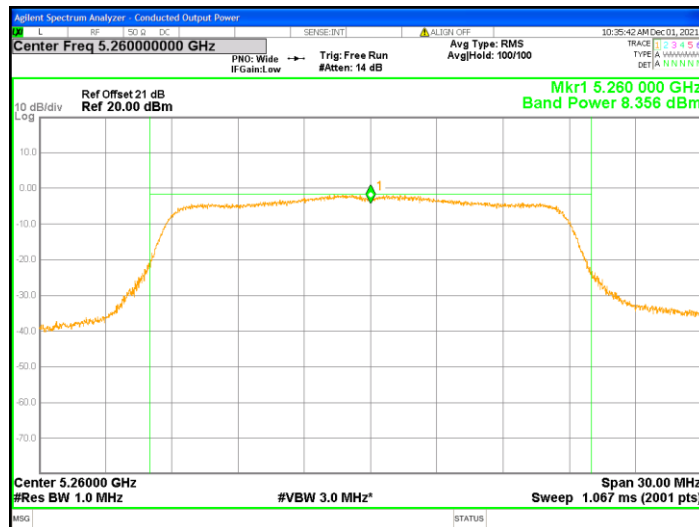
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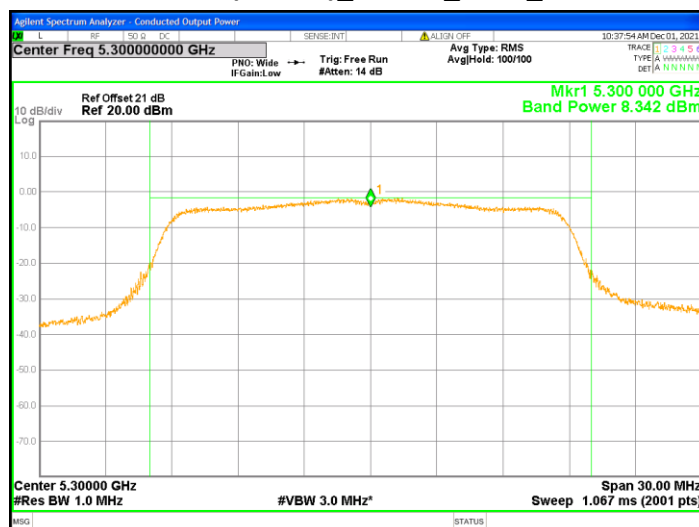
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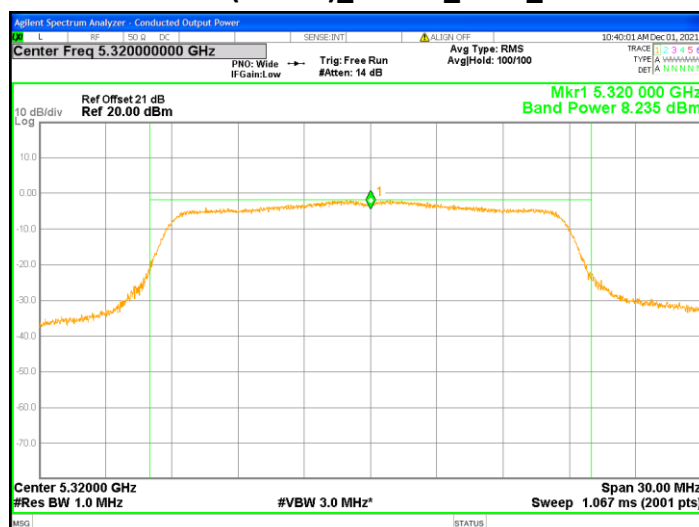
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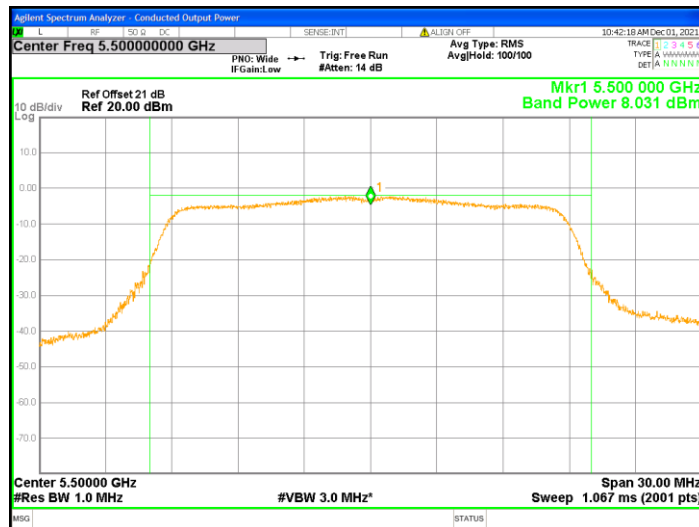
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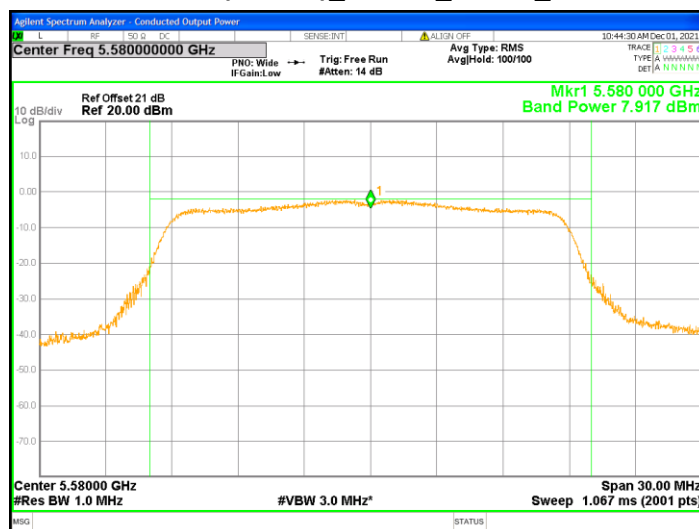
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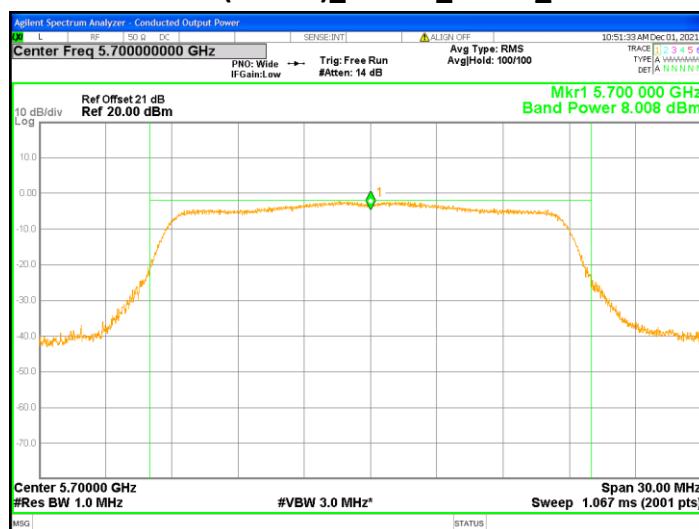
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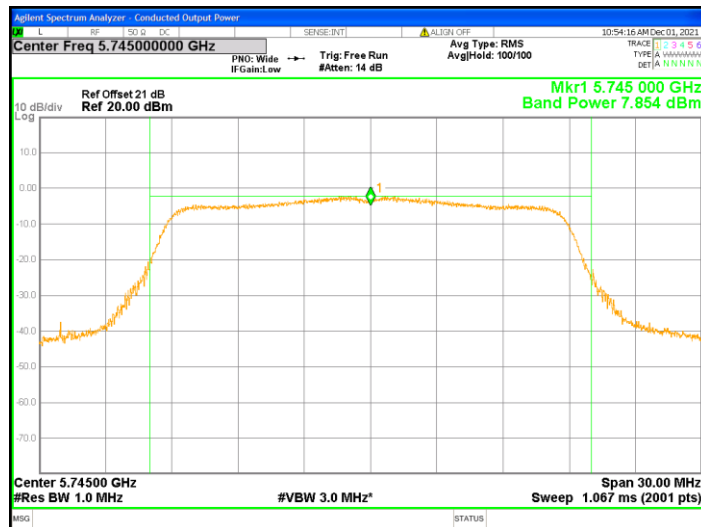
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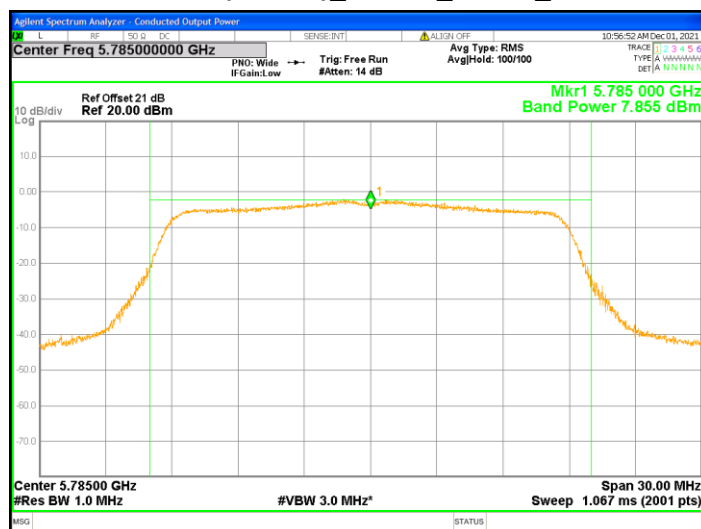
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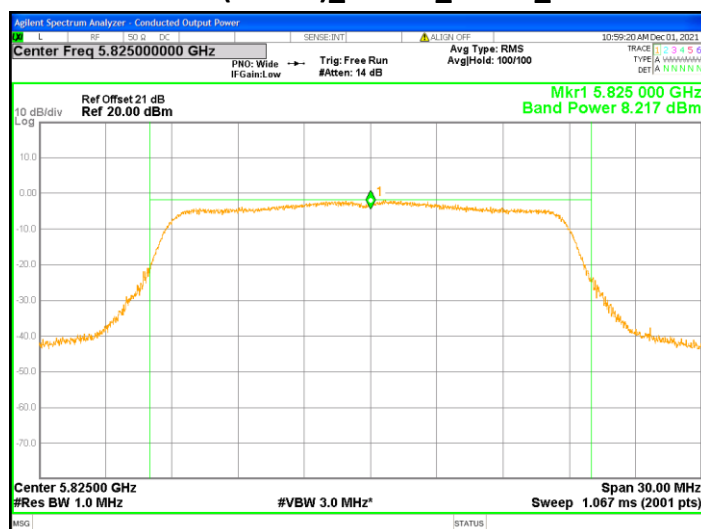
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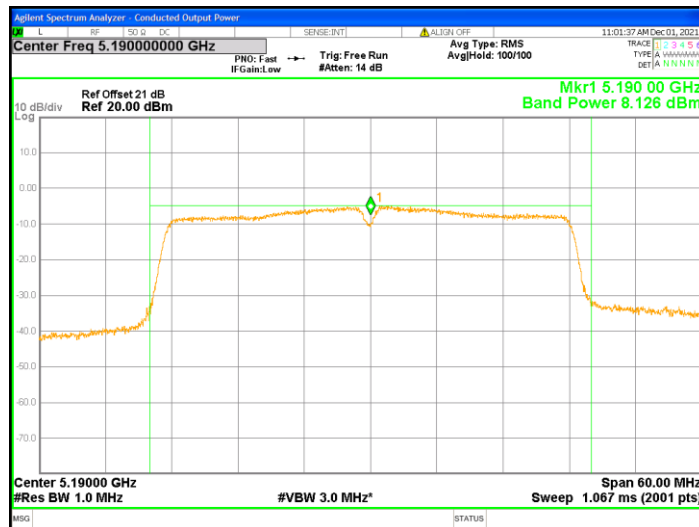
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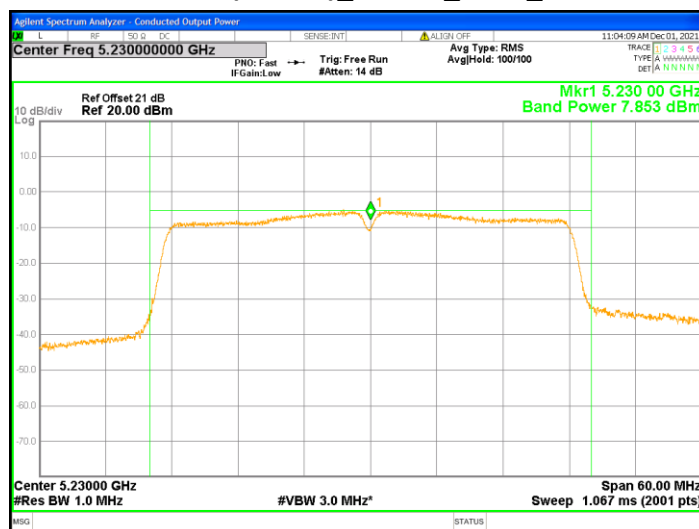
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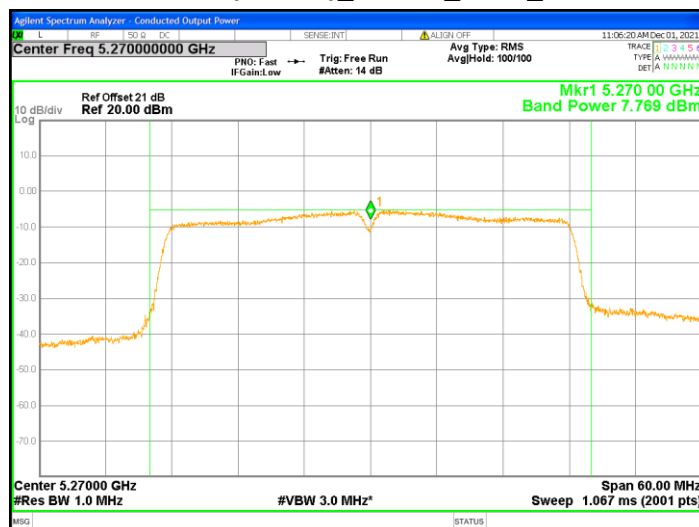
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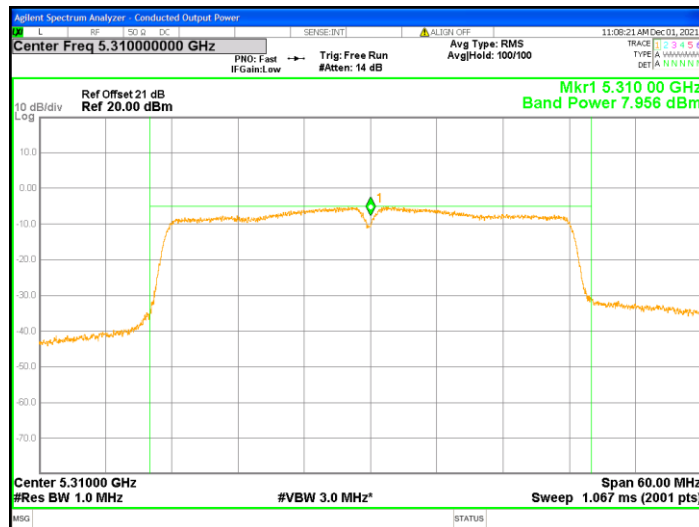
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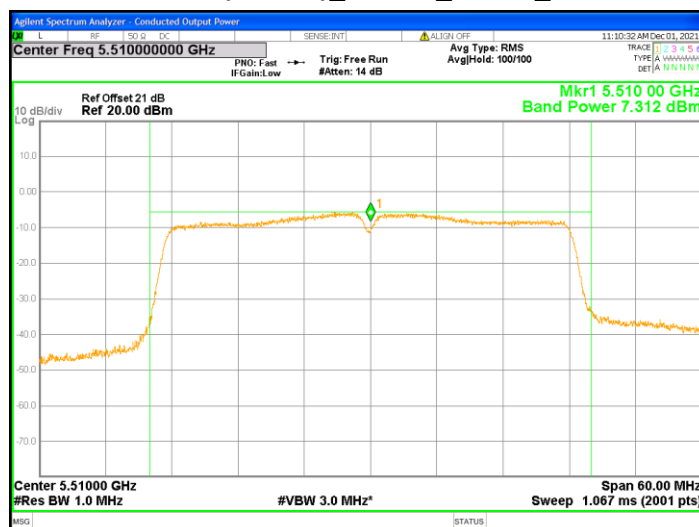
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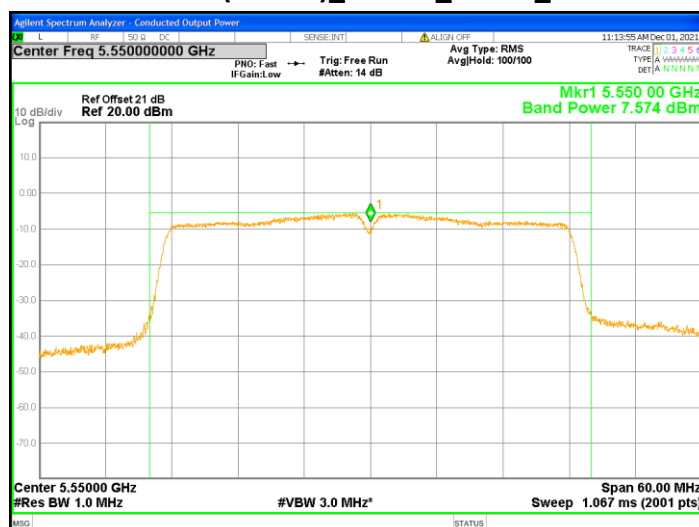
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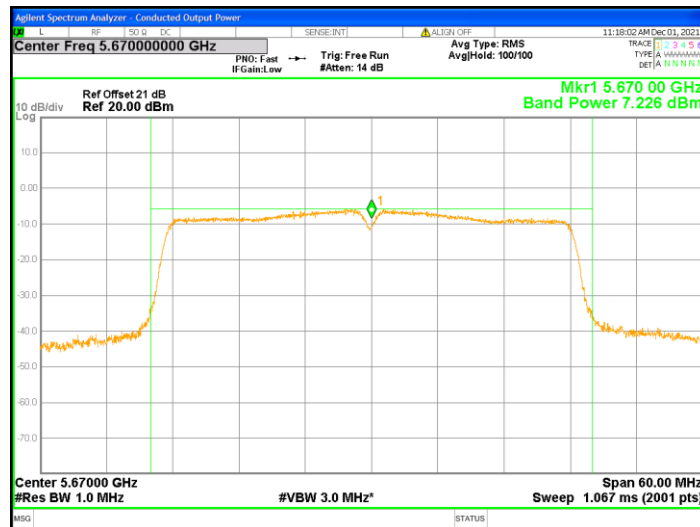
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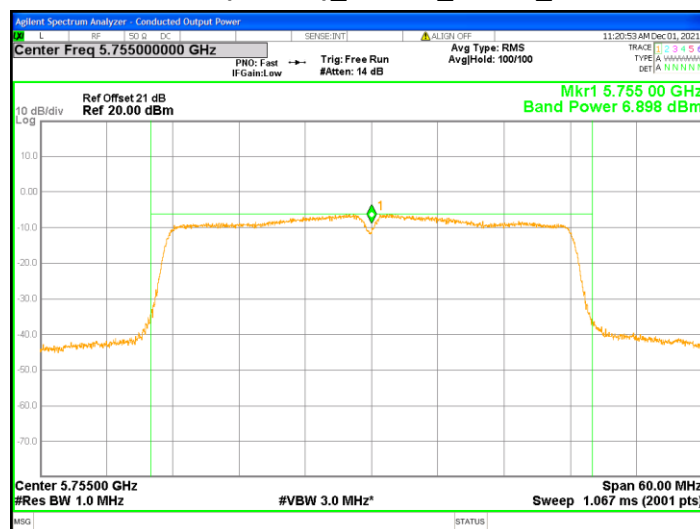
802.11ac(VHT40)_Chain0_Ch110_5550



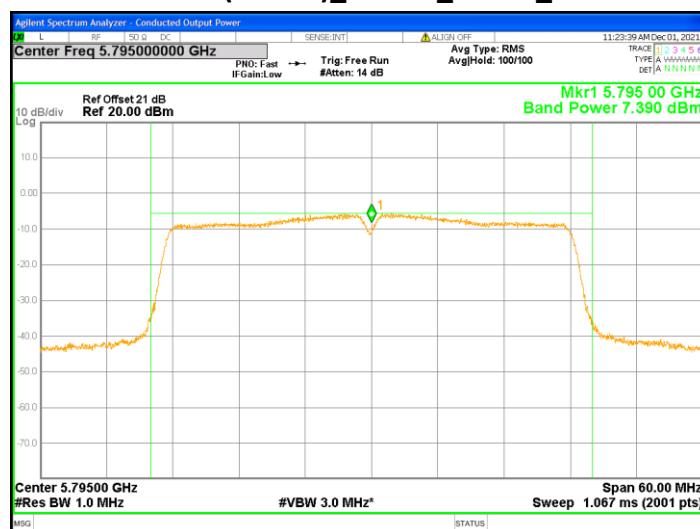
802.11ac(VHT40)_Chain0_Ch134_5670



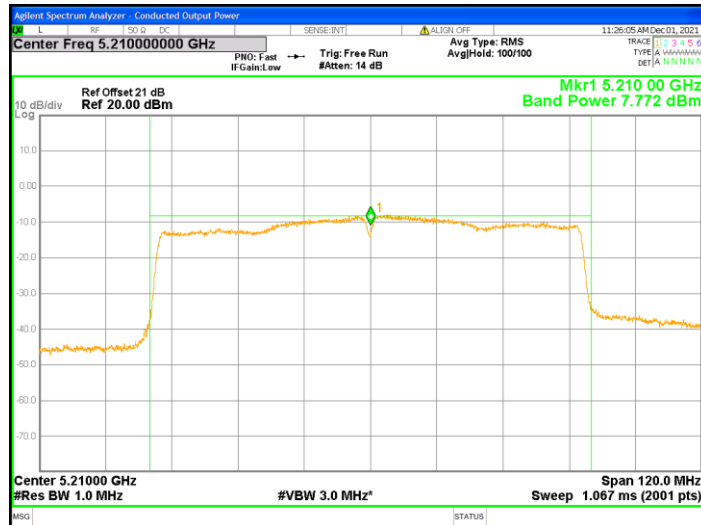
802.11ac(VHT40)_Chain0_Ch151_5755



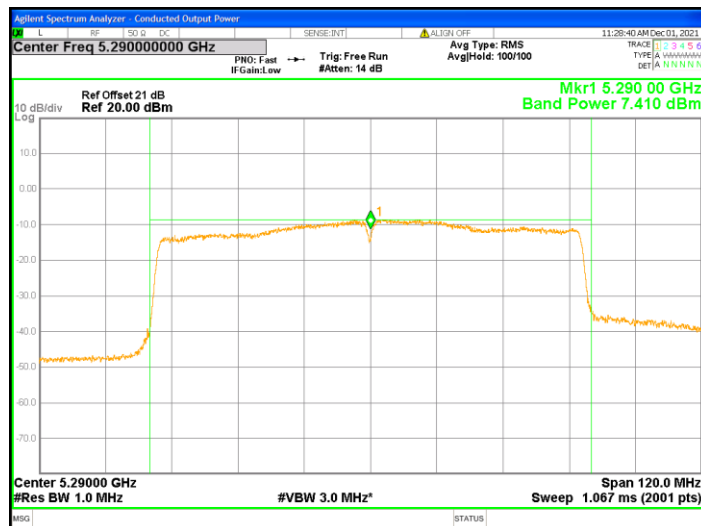
802.11ac(VHT40)_Chain0_Ch159_5795



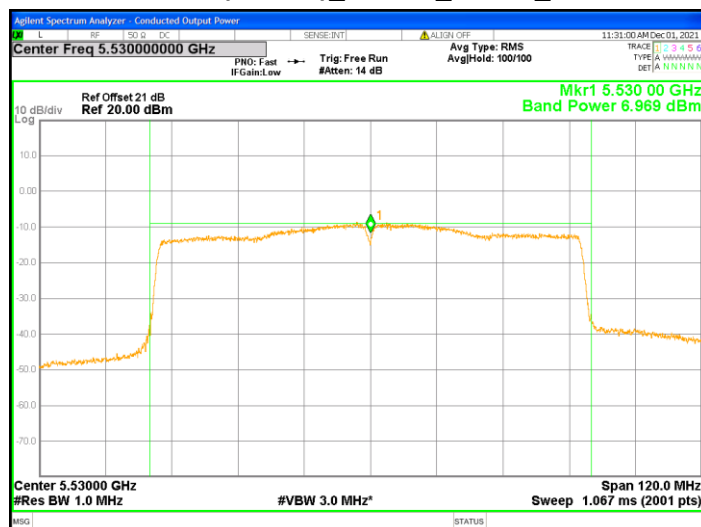
802.11ac(VHT80)_Chain0_Ch42_5210



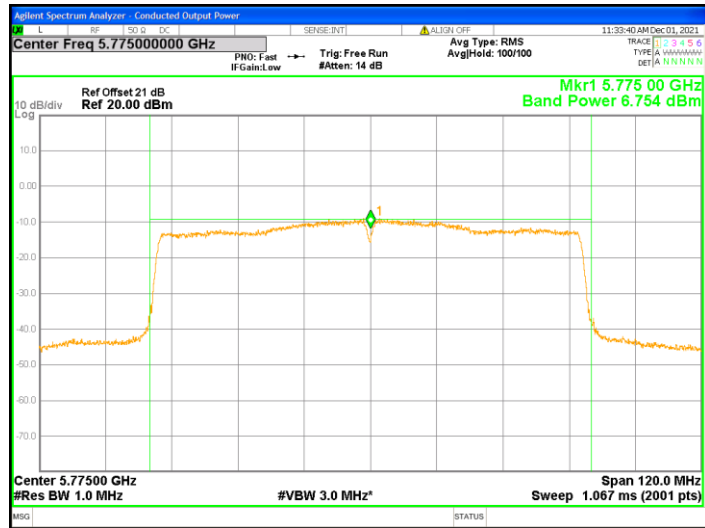
802.11ac(VHT80)_Chain0_Ch58_5290



802.11ac(VHT80)_Chain0_Ch106_5530



802.11ac(VHT80)_Chain0_Ch155_5775



3. Power Spectrum Density

3.1 Limit for power spectrum density

Operating Frequency (MHz)	Power density limit
5150~5725	< 11 dBm/1MHz
5725~5850	< 30 dBm/500kHz

3.2 Measuring instrument setting

Spectrum analyzer settings (5150~5725MHz)	
Spectrum Analyzer function	Setting
Detector	RMS
RBW	=1MHz
VBW	≥ 3 MHz
Sweep	Auto couple
Trace	Average
Span	Encompass the 26 dB EBW
Attenuation	Auto
Sweep point	≥ 2 Span / RBW

Spectrum analyzer settings (5725~5850MHz)	
Spectrum Analyzer function	Setting
Detector	RMS
RBW	=100kHz
VBW	≥ 300 kHz
Sweep	Auto couple
Trace	Average
Span	Encompass the 6 dB EBW
Attenuation	Auto
Sweep point	≥ 2 Span / RBW

3.3 Test procedure

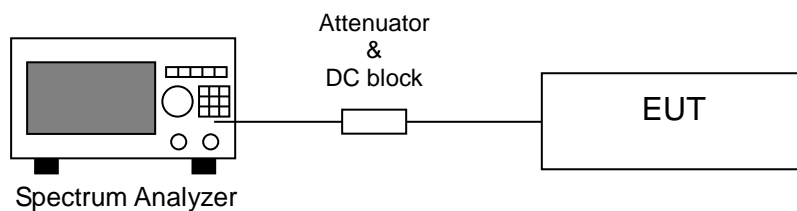
Set relevant parameter according to clause 4.3.

Trace average at least 100 traces in power averaging mode.

Compute power by integrating the spectrum across the 26 dB or 6dB EBW of the signal using the instrument's band power measurement function with band limits set equal to the EBW band edges.

If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/\text{RBW})$ to the measured result, whereas RBW ($< 500 \text{ KHz}$) is the reduced resolution bandwidth of the spectrum analyzer set during measurement. The RBW is 100 kHz. So, we will add 6.989 to the results.

3.4 Test diagram



TEST REPORT

3.5 Test results

Temperature (°C) :	21
Relative Humidity (%) :	66
Test date :	2021/12/01

Mode	Channel	Frequency (MHz)	PSD		Duty Factor	Result	Limit (dBm)	Margin (dB)
			(dBm)	(mW)				
802.11a	36	5180	-0.124	0.972	0.151	0.027	11	-11.124
	44	5220	-0.456	0.900	0.151	-0.305	11	-11.456
	48	5240	-0.655	0.860	0.151	-0.504	11	-11.655
	52	5260	-0.867	0.819	0.151	-0.716	11	-11.867
	60	5300	-1.369	0.730	0.151	-1.218	11	-12.369
	64	5320	-1.250	0.750	0.151	-1.099	11	-12.250
	100	5500	-1.485	0.710	0.151	-1.334	11	-12.485
	116	5580	-1.516	0.705	0.151	-1.365	11	-12.516
140	5700	-1.379	0.728	0.151	-1.228	11	-12.379	

Mode	Channel	Frequency (MHz)	PSD in 100kHz	RBW factor	PSD in 500kHz		Duty Factor	Result	Limit (dBm)	Margin (dB)
					(dBm)	(mW)				
802.11a	149	5745	-10.972	6.990	-3.982	0.400	0.151	-3.831	30	-33.982
	157	5785	-10.958	6.990	-3.968	0.401	0.151	-3.817	30	-33.968
	165	5825	-10.314	6.990	-3.324	0.465	0.151	-3.173	30	-33.324

Mode	Channel	Frequency (MHz)	PSD		Duty Factor	Result	Limit (dBm)	Margin (dB)
			(dBm)	(mW)				
802.11ac (VHT20)	36	5180	-0.413	0.909	0.160	-0.253	11	-11.413
	44	5220	-0.968	0.800	0.160	-0.808	11	-11.968
	48	5240	-1.212	0.756	0.160	-1.052	11	-12.212
	52	5260	-1.563	0.698	0.160	-1.403	11	-12.563
	60	5300	-1.658	0.683	0.160	-1.498	11	-12.658
	64	5320	-1.660	0.682	0.160	-1.500	11	-12.660
	100	5500	-1.826	0.657	0.160	-1.666	11	-12.826
	116	5580	-1.913	0.644	0.160	-1.753	11	-12.913
140	5700	-1.723	0.673	0.160	-1.563	11	-12.723	

Mode	Channel	Frequency (MHz)	PSD in 100kHz	RBW factor	PSD in 500kHz		Duty Factor	Result	Limit (dBm)	Margin (dB)
					(dBm)	(mW)				
802.11ac (VHT20)	149	5745	-11.497	6.990	-4.507	0.354	0.160	-4.347	30	-34.507
	157	5785	-11.579	6.990	-4.589	0.348	0.160	-4.429	30	-34.589
	165	5825	-11.132	6.990	-4.142	0.385	0.160	-3.982	30	-34.142

TEST REPORT

Mode	Channel	Frequency (MHz)	PSD		Duty Factor	Result	Limit (dBm)	Margin (dB)
			(dBm)	(mW)				
802.11ac (VHT40)	38	5190	-4.672	0.341	0.632	-4.040	11	-15.672
	46	5230	-4.952	0.320	0.632	-4.320	11	-15.952
	54	5270	-5.083	0.310	0.632	-4.451	11	-16.083
	62	5310	-4.943	0.320	0.632	-4.311	11	-15.943
	102	5510	-5.499	0.282	0.632	-4.867	11	-16.499
	110	5550	-5.418	0.287	0.632	-4.786	11	-16.418
	134	5670	-5.630	0.274	0.632	-4.998	11	-16.630

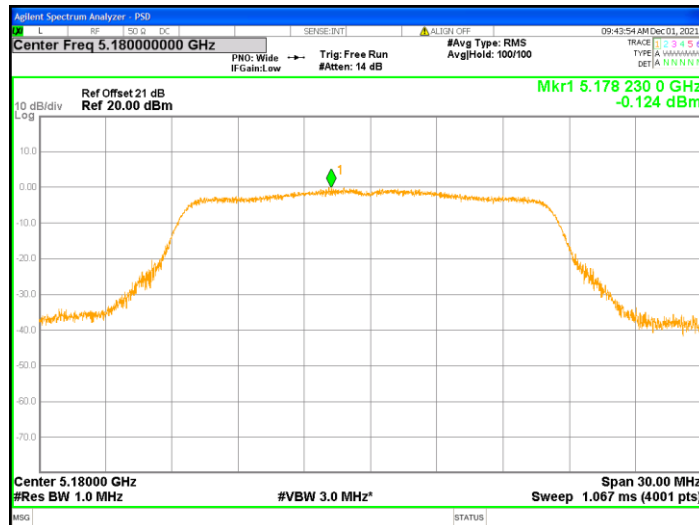
Mode	Channel	Frequency (MHz)	PSD in 100kHz	RBW factor	PSD in 500kHz		Duty Factor	Result	Limit (dBm)	Margin (dB)
					(dBm)	(mW)				
802.11ac (VHT40)	151	5755	-14.599	6.990	-7.609	0.173	0.632	-6.977	30	-37.609
	159	5795	-14.049	6.990	-7.059	0.197	0.632	-6.427	30	-37.059

Mode	Channel	Frequency (MHz)	PSD		Duty Factor	Result	Limit (dBm)	Margin (dB)
			(dBm)	(mW)				
802.11ac (VHT80)	42	5210	-7.688	0.170	1.091	-6.597	11	-18.688
	58	5290	-8.236	0.150	1.091	-7.145	11	-19.236
	106	5530	-8.460	0.143	1.091	-7.369	11	-19.460

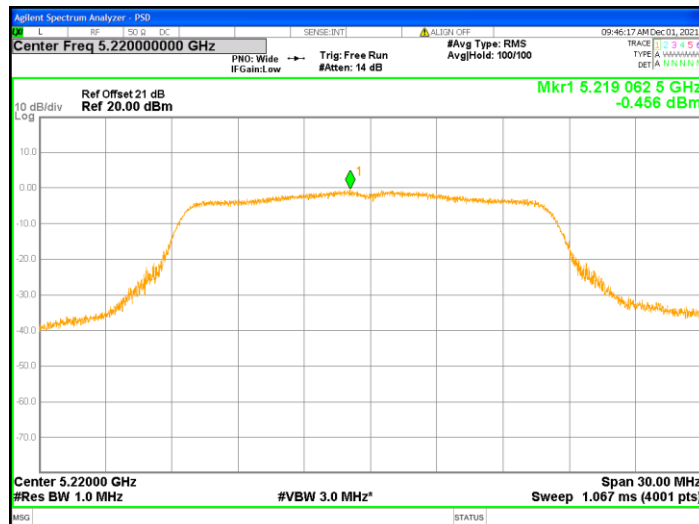
Mode	Channel	Frequency (MHz)	PSD in 100kHz	RBW factor	PSD in 500kHz		Duty Factor	Result	Limit (dBm)	Margin (dB)
					(dBm)	(mW)				
802.11ac (VHT80)	155	5775	-17.746	6.990	-10.756	0.084	1.091	-9.665	30	-40.756

RBW Correction: $10\log(500\text{kHz}/100\text{kHz})$

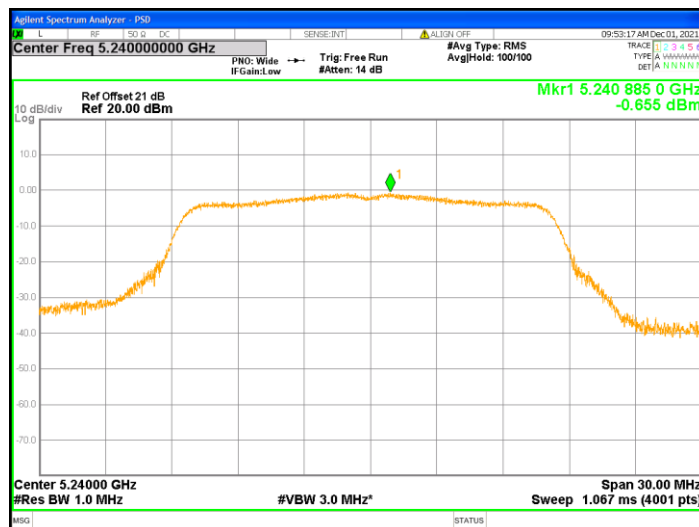
802.11a_Chain0_Ch36_5180



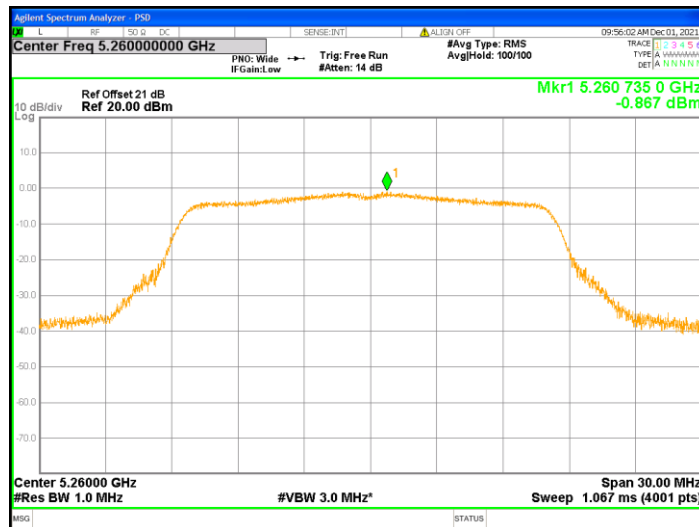
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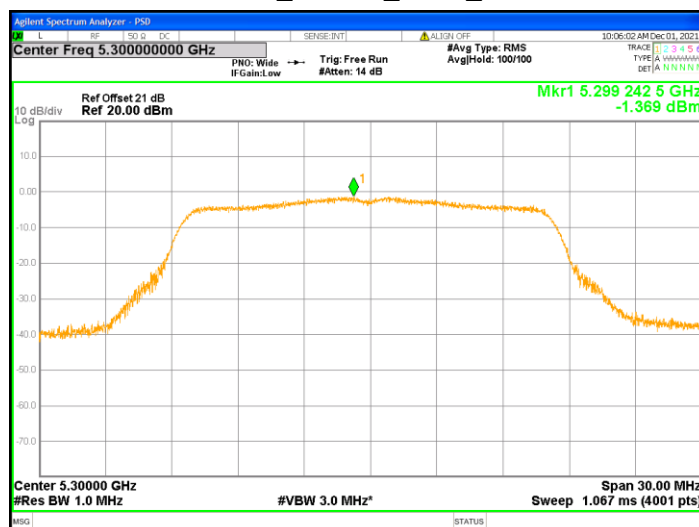
802.11a_Chain0_Ch48_5240



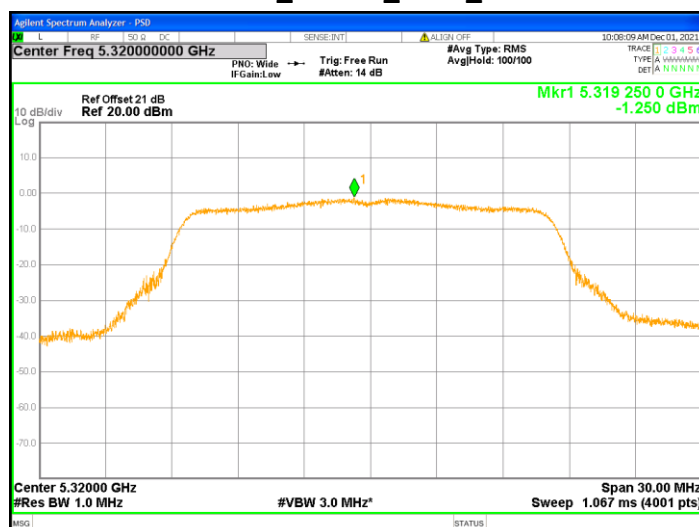
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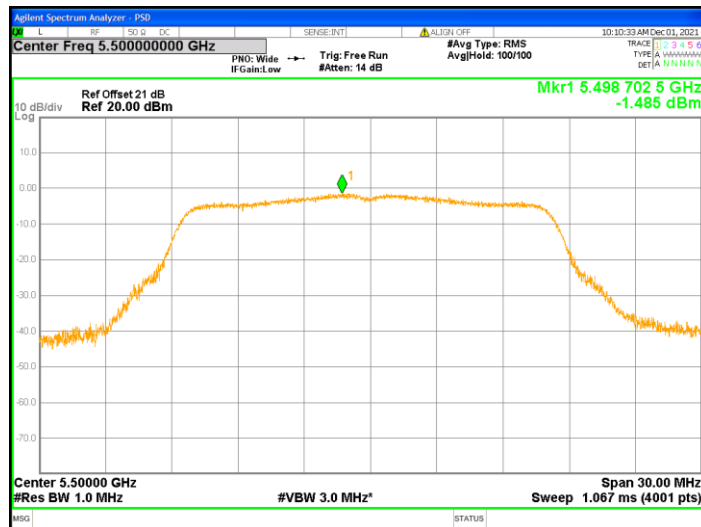
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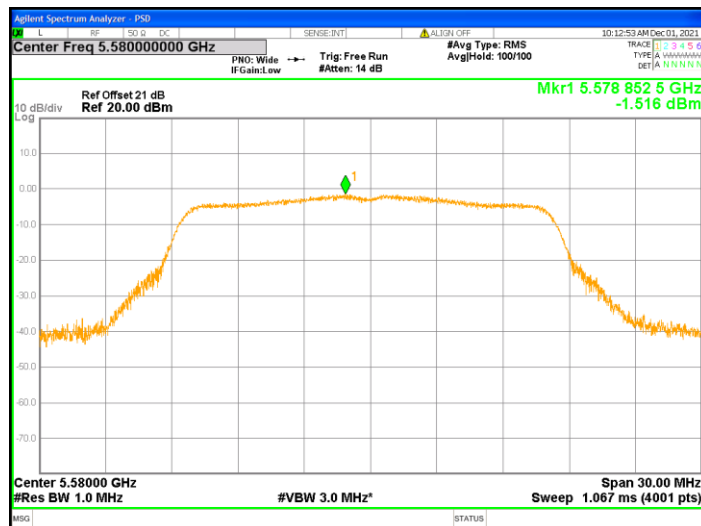
802.11a_Chain0_Ch64_5320



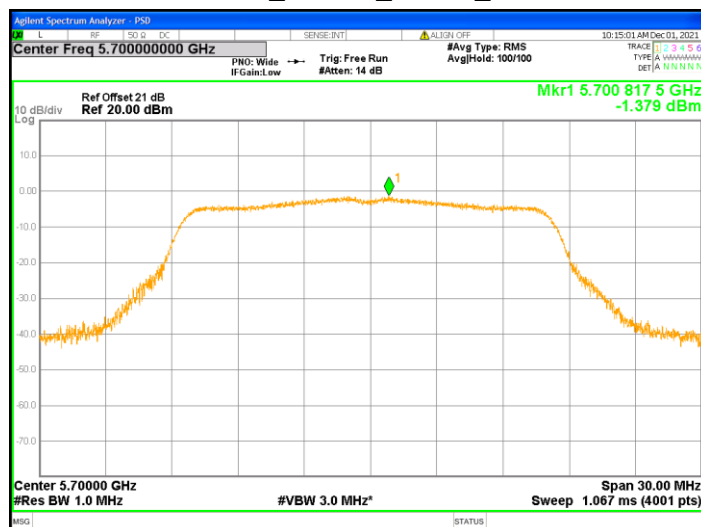
802.11a_Chain0_Ch100_5500



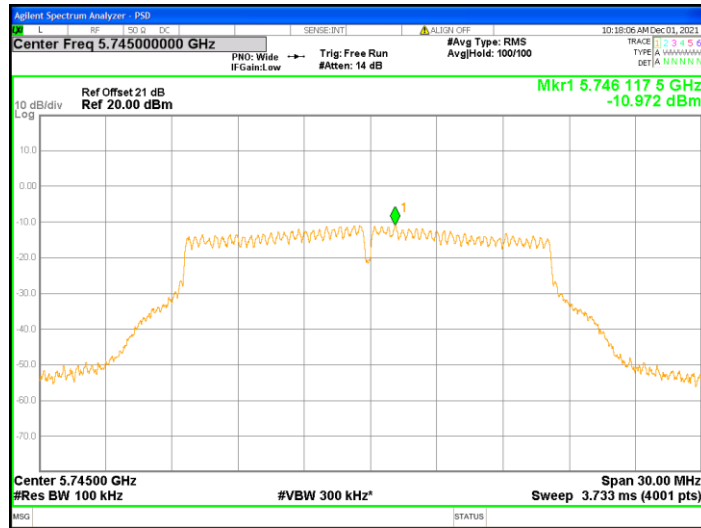
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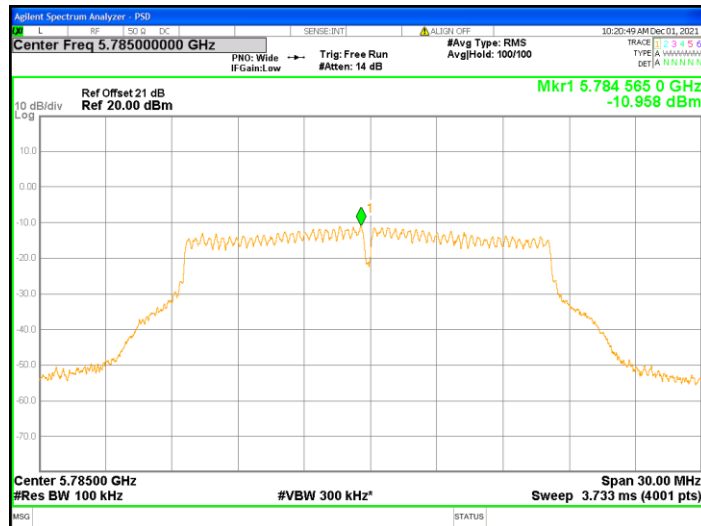
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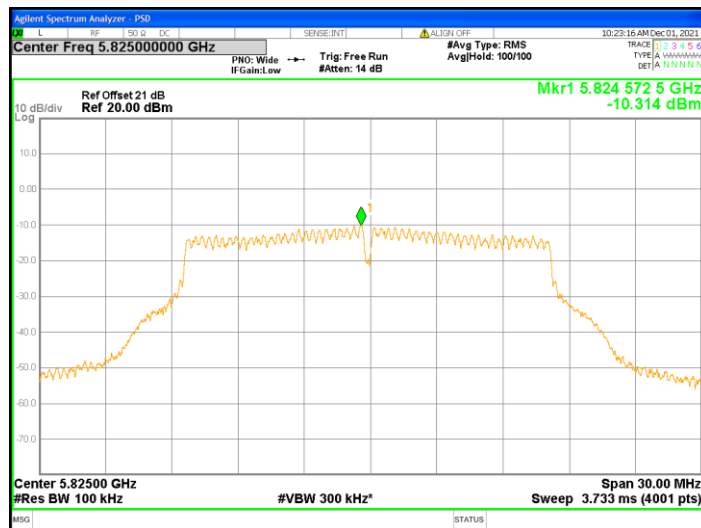
802.11a_Chain0_Ch149_5745



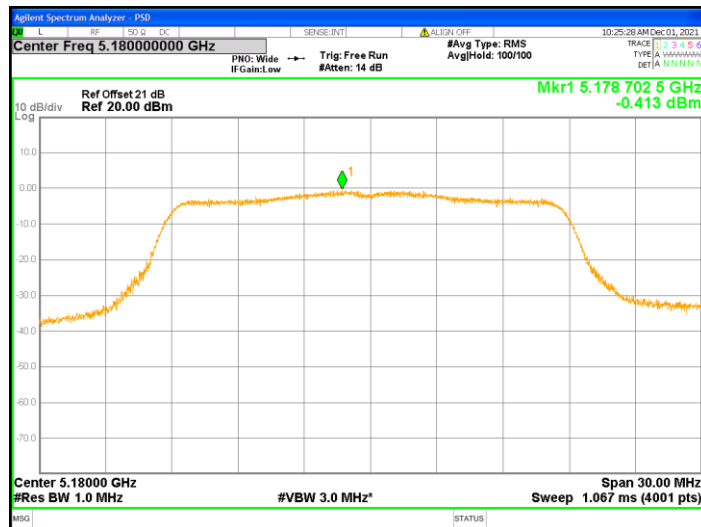
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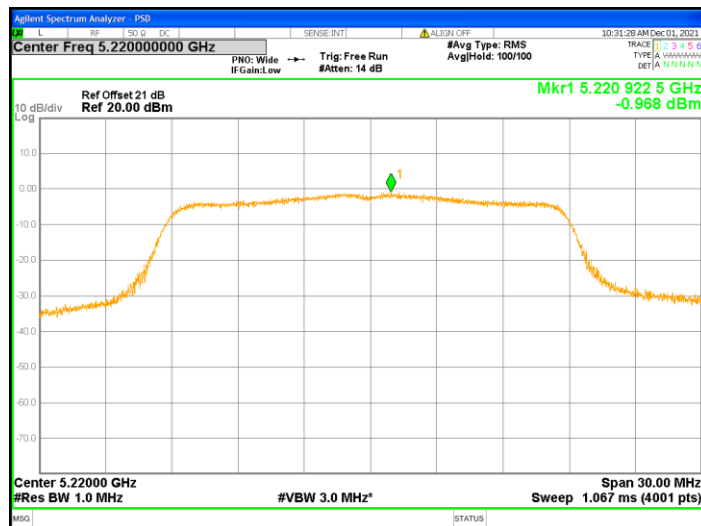
802.11a_Chain0_Ch165_5825



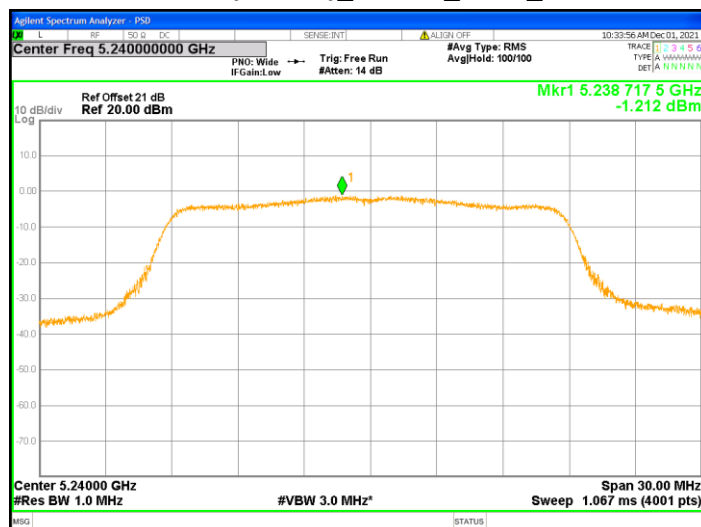
802.11ac(VHT20)_Chain0_Ch36_5180



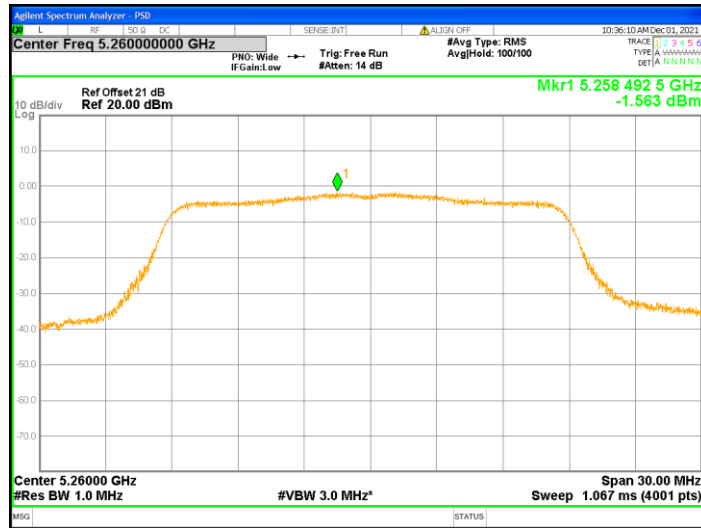
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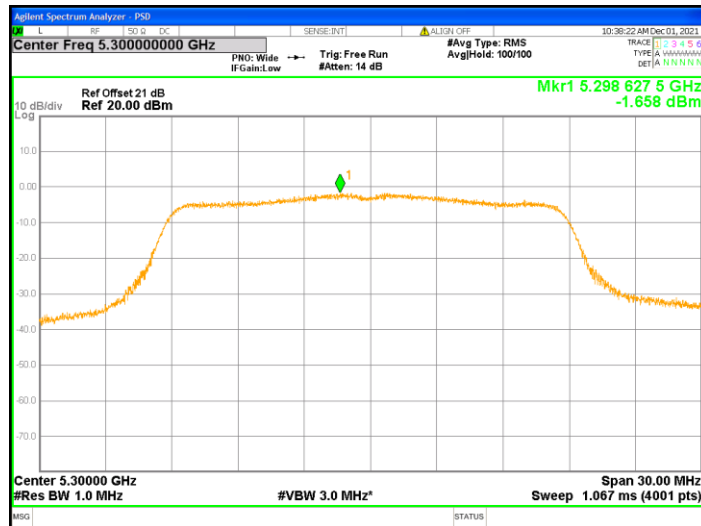
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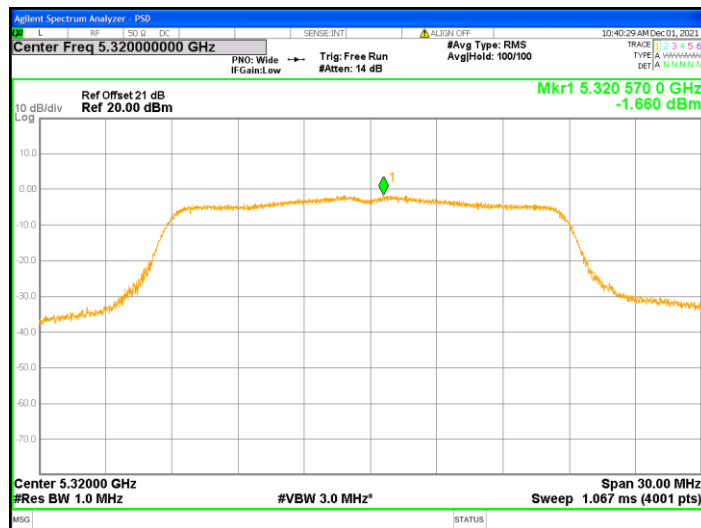
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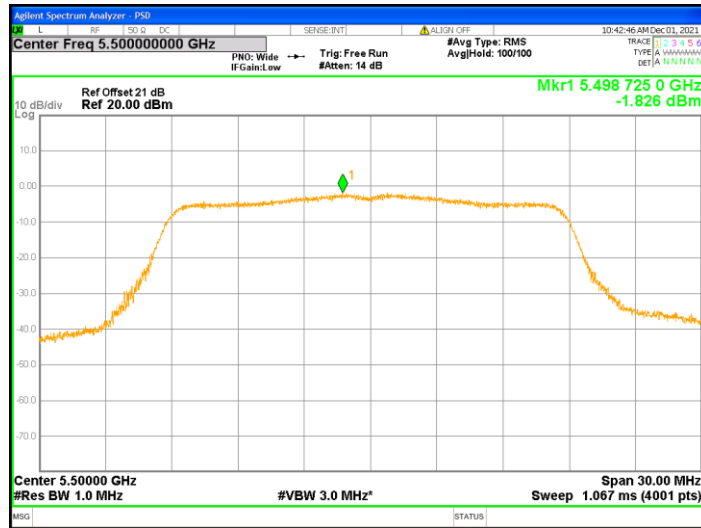
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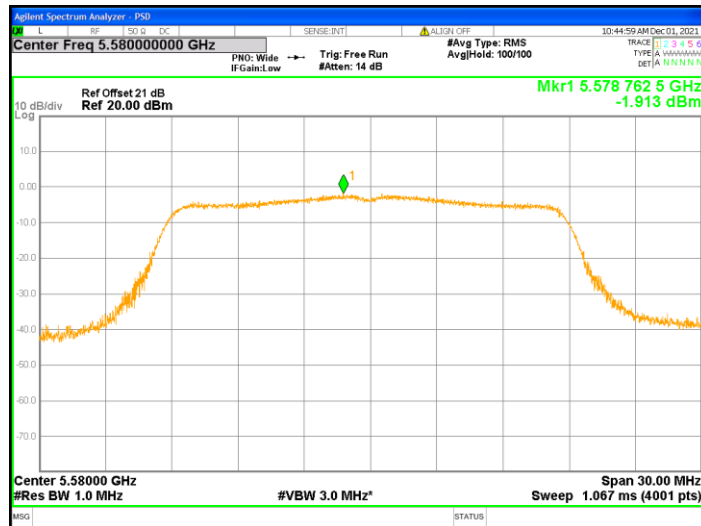
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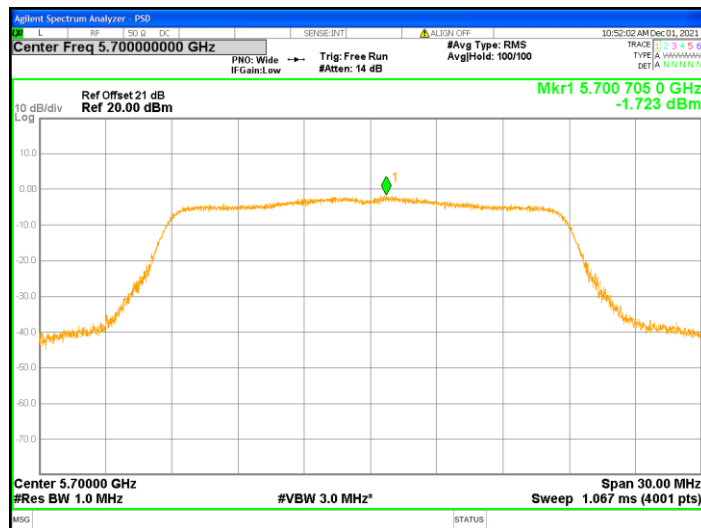
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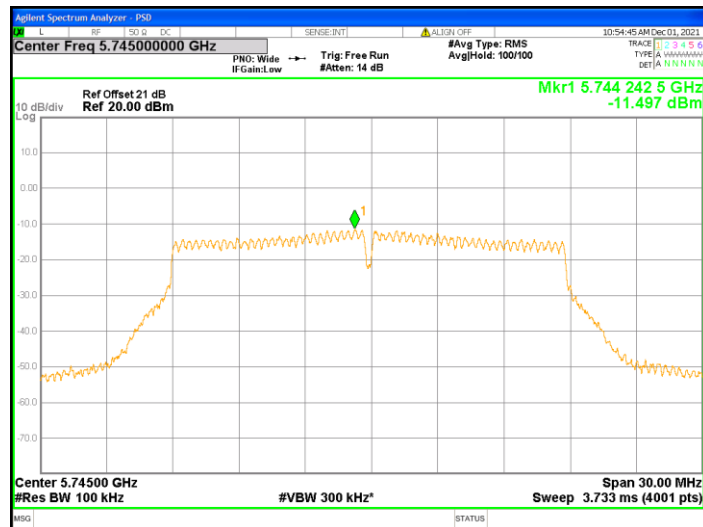
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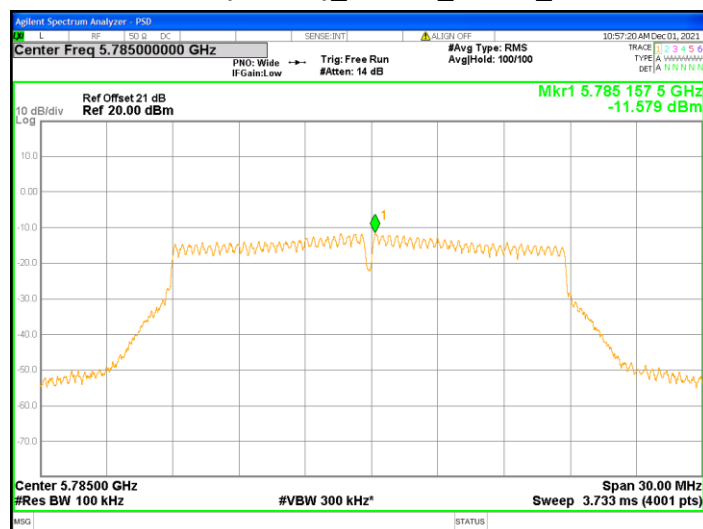
802.11ac(VHT20)_Chain0_Ch140_5700



802.11ac(VHT20)_Chain0_Ch149_5745



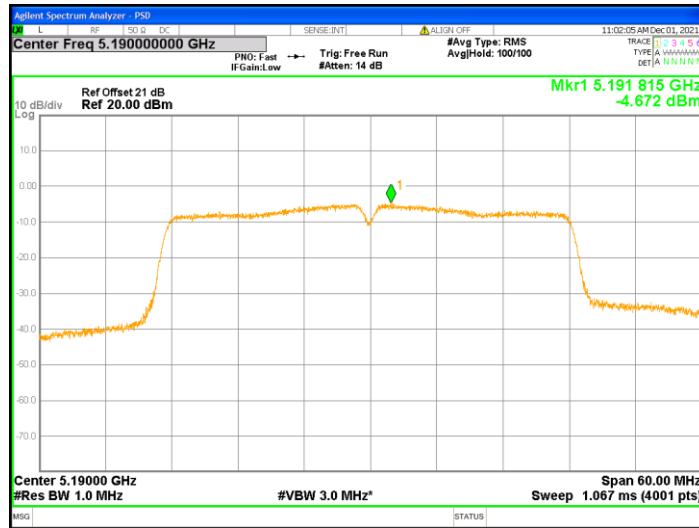
802.11ac(VHT20)_Chain0_Ch157_5785



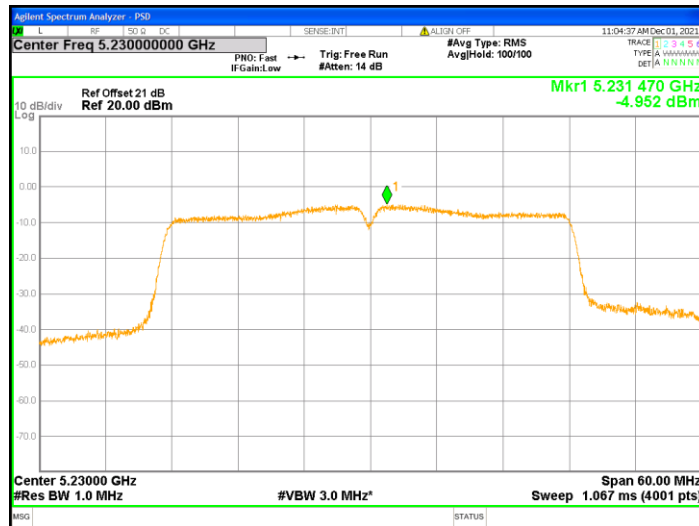
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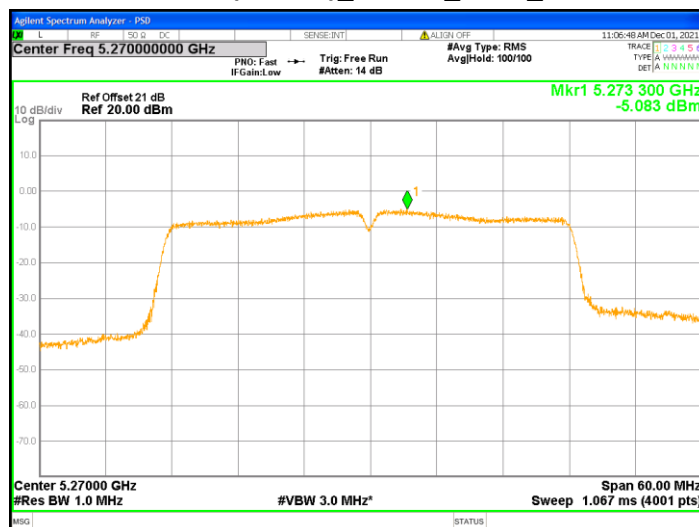
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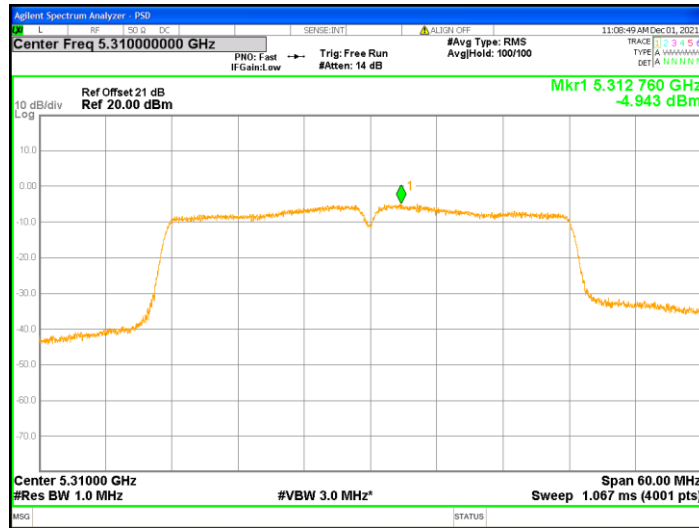
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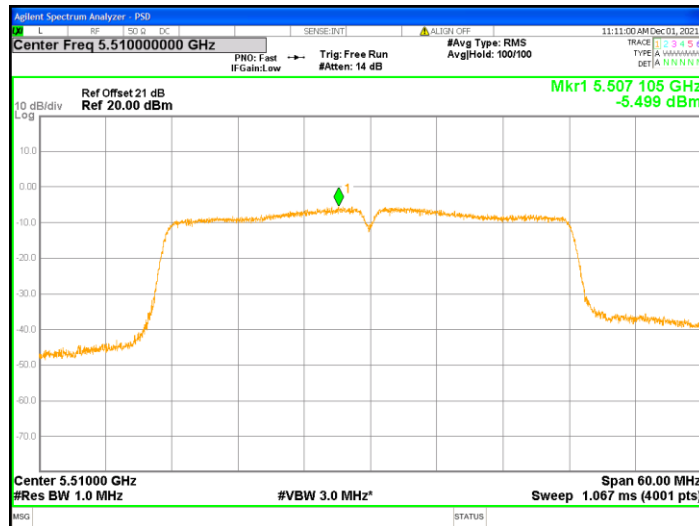
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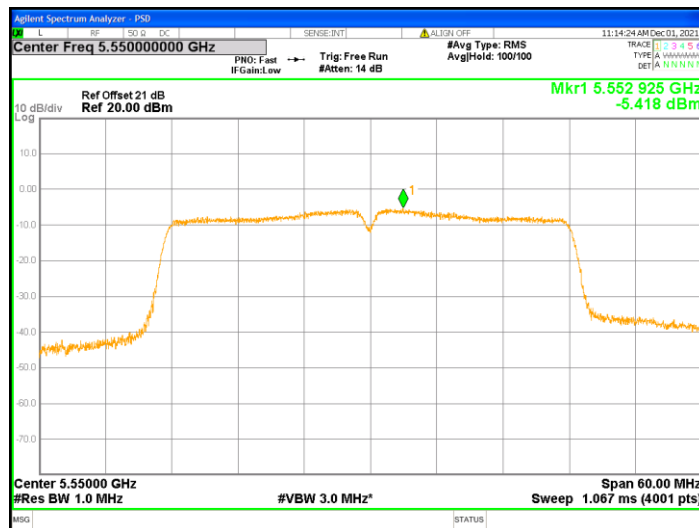
802.11ac(VHT40)_Chain0_Ch62_5310



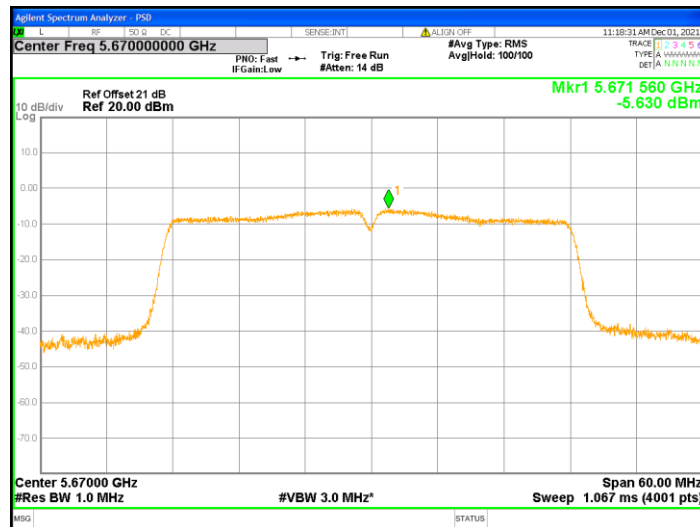
802.11ac(VHT40)_Chain0_Ch102_5510



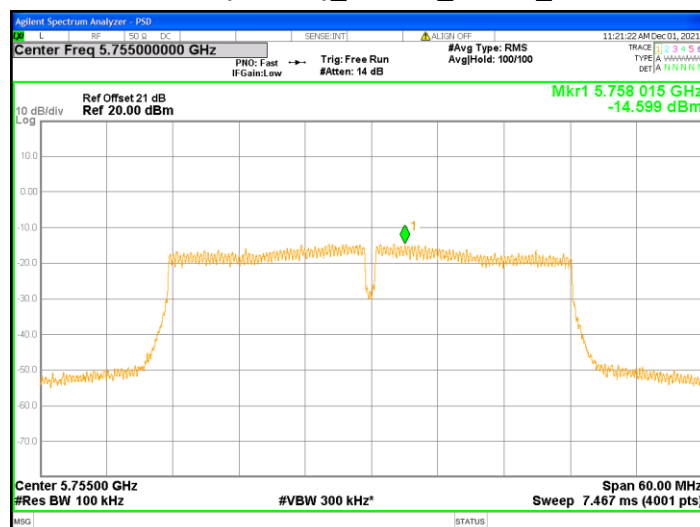
802.11ac(VHT40)_Chain0_Ch110_5550



802.11ac(VHT40)_Chain0_Ch134_5670



802.11ac(VHT40)_Chain0_Ch151_5755



802.11ac(VHT40)_Chain0_Ch159_5795

