

7. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §27.53

LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

For each out of band emissions measurement:

- ☐ Set display line at -13 dBm
- ☐ Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

MODES TESTED

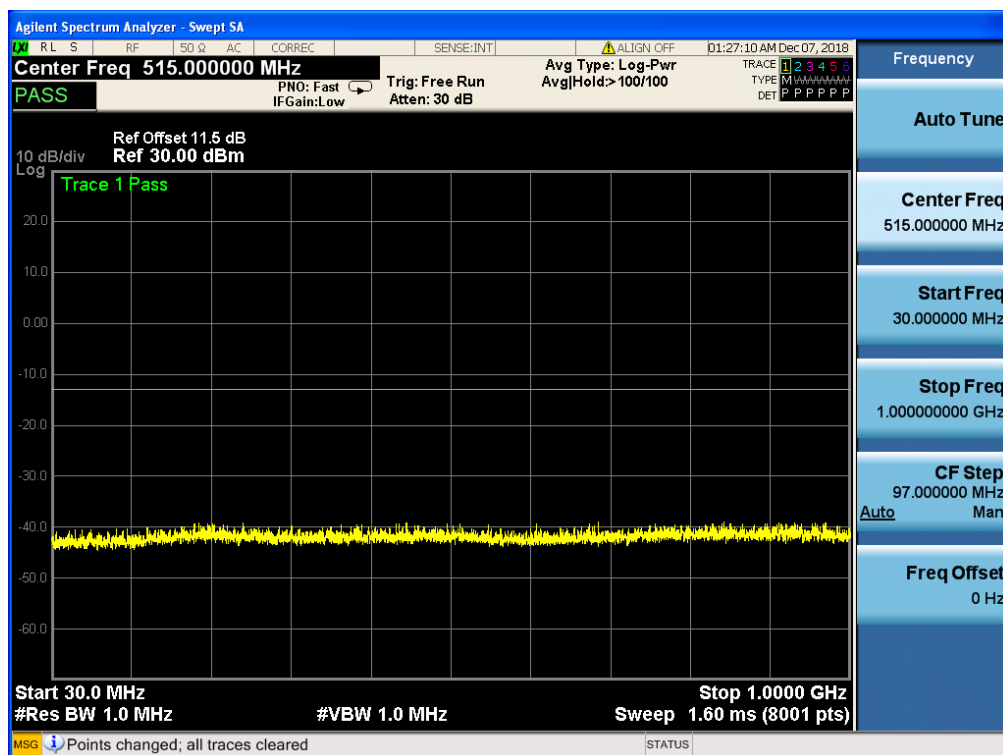
- ☐ LTE Band 4
- ☐ LTE Band 7

7.1 MEASUREMENT METHOD

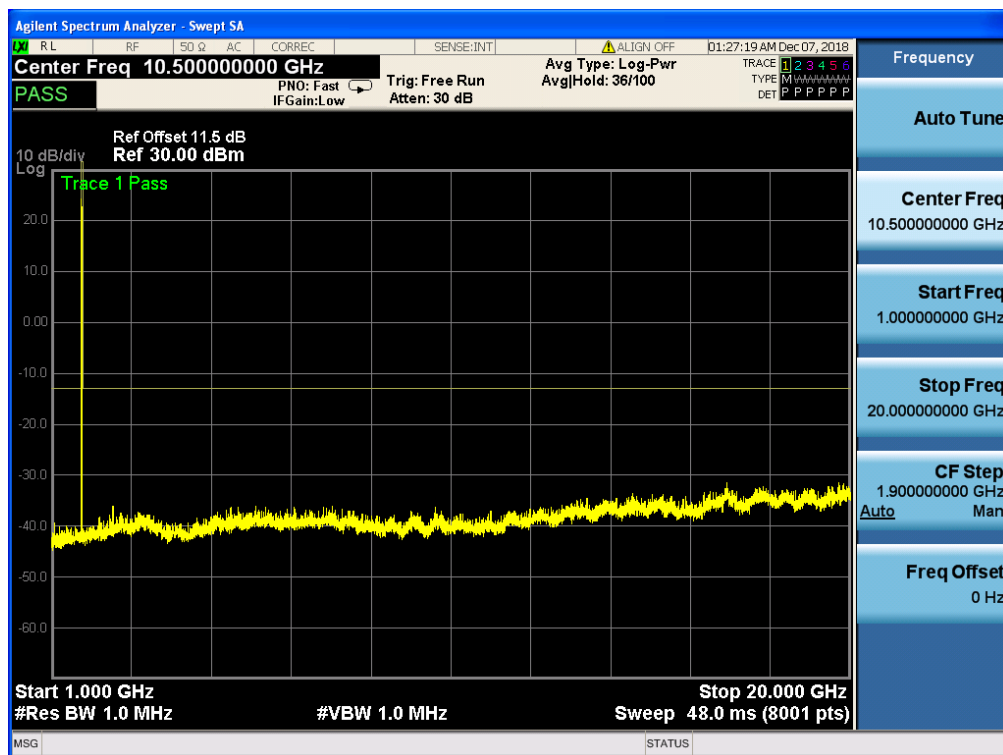
The test set up and general procedure is similar to conducted peak output power test. Only different for setting the measurement configuration of the measuring instrument of Spectrum Analyzer.

7.2 LTE BAND 4

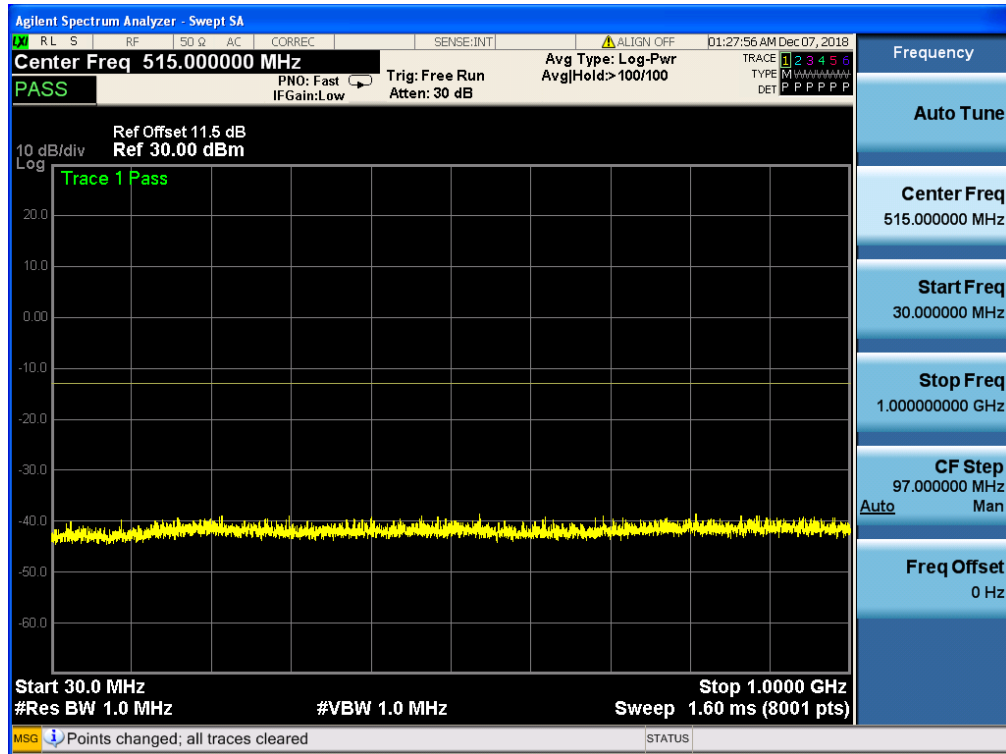
Band 4, UL Channel 19957, UL Frequency 1710.7, BW 1.4, NO. RB 6, RB POS. Low, QPSK



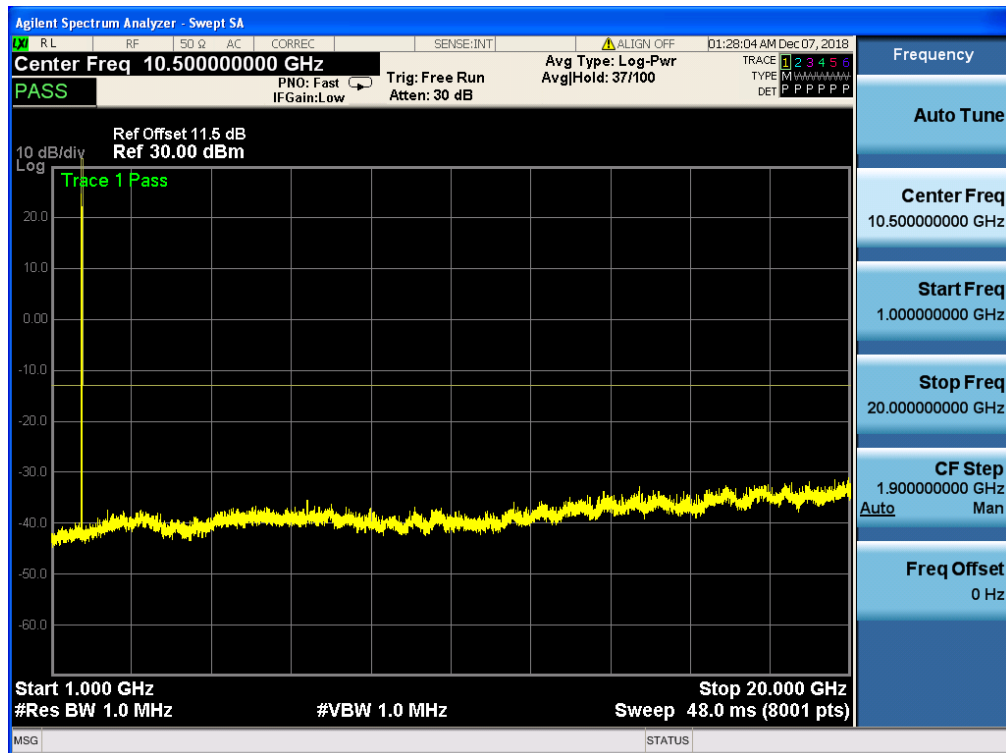
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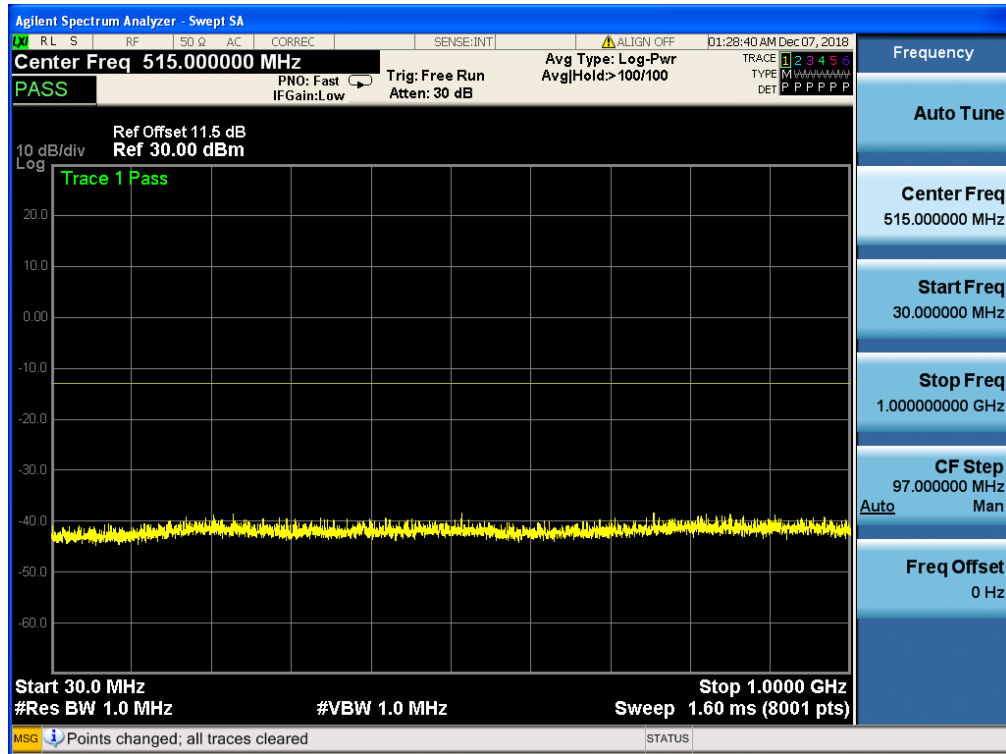
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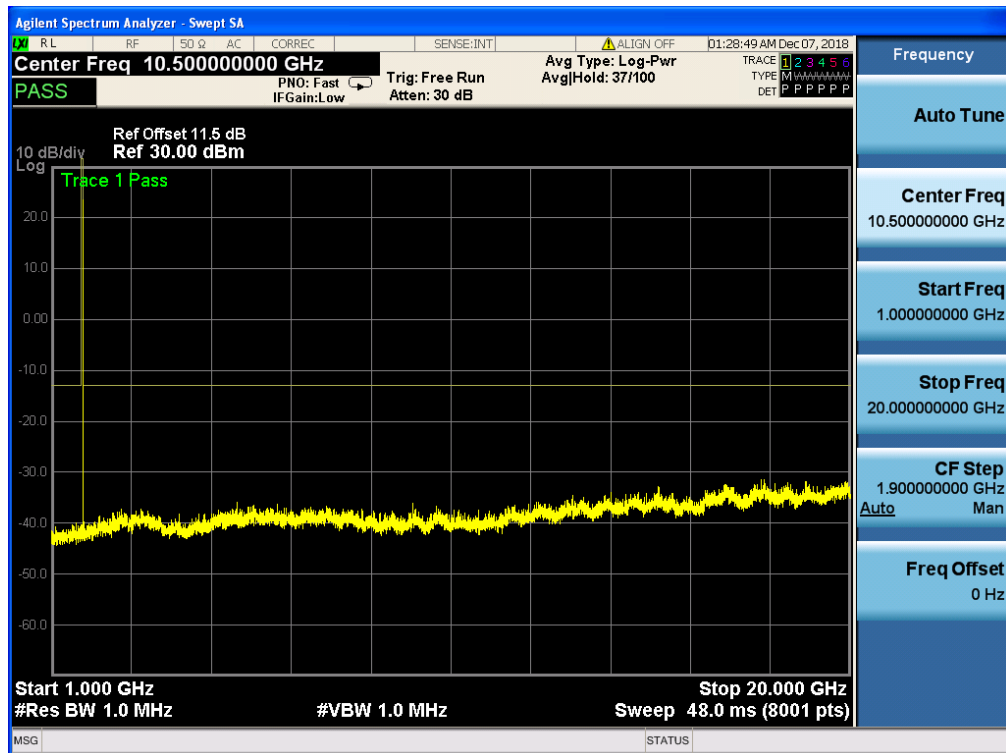
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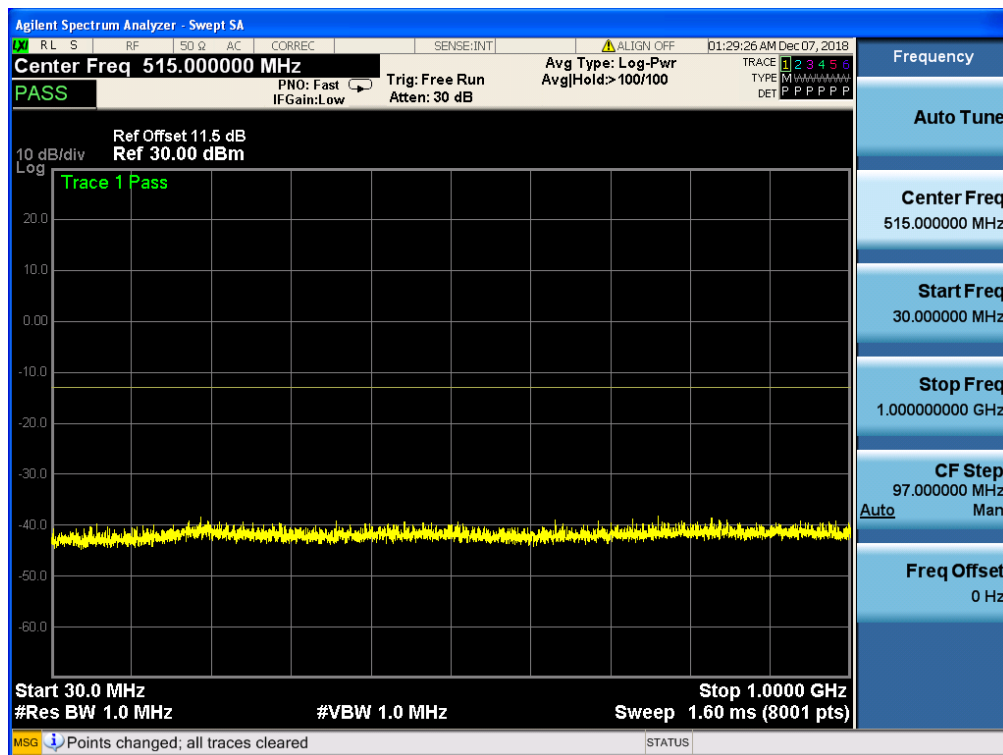
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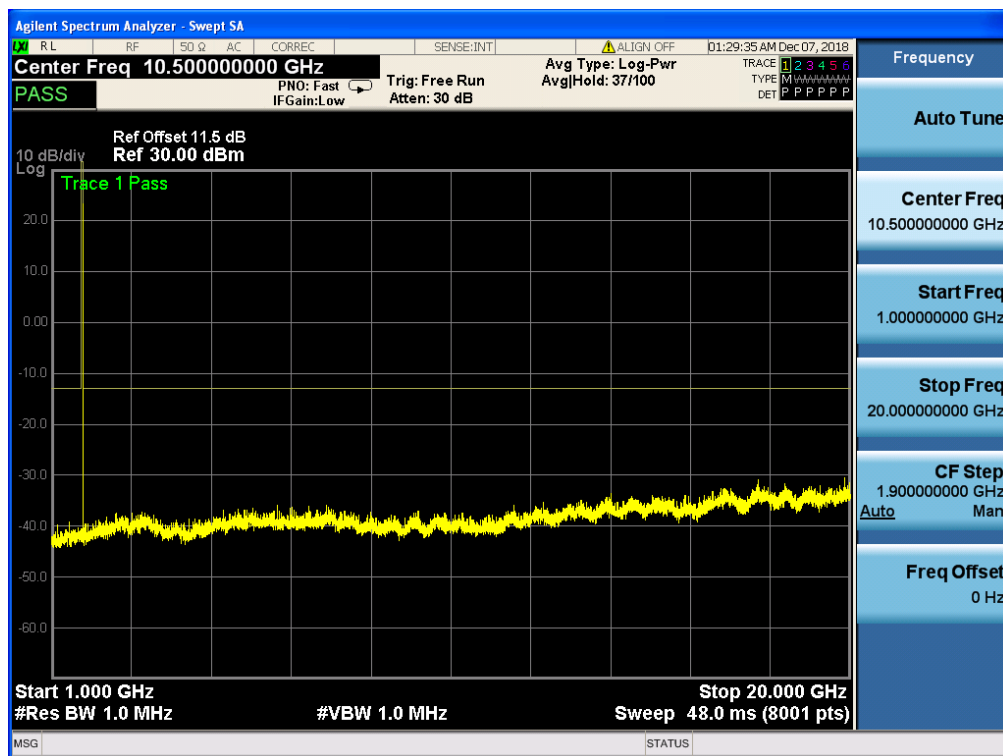
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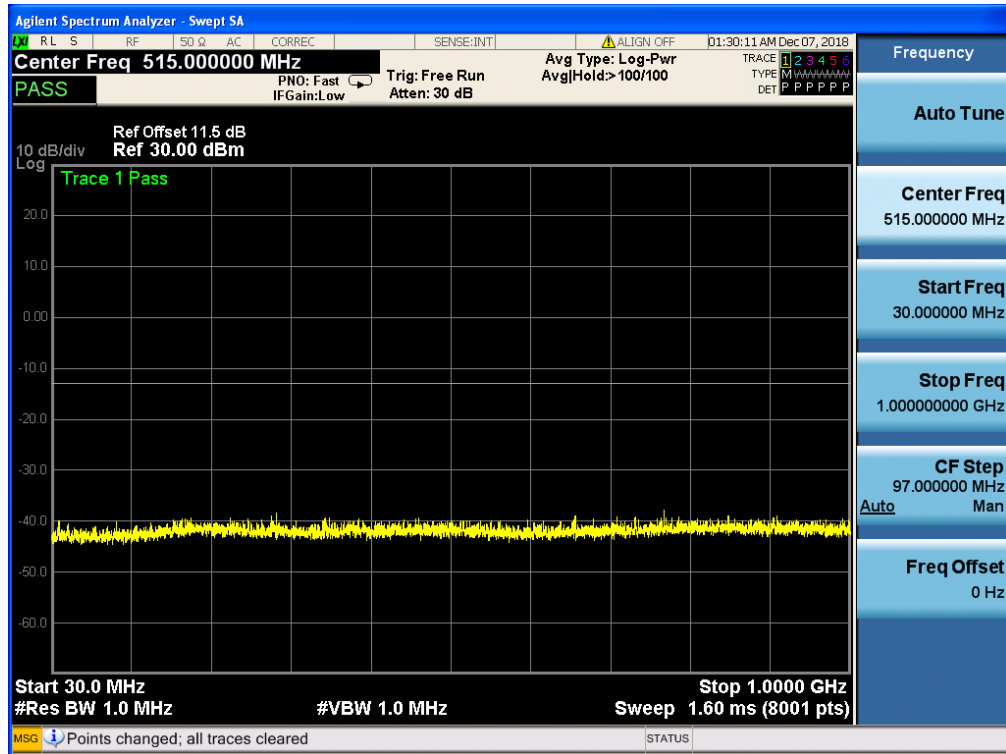
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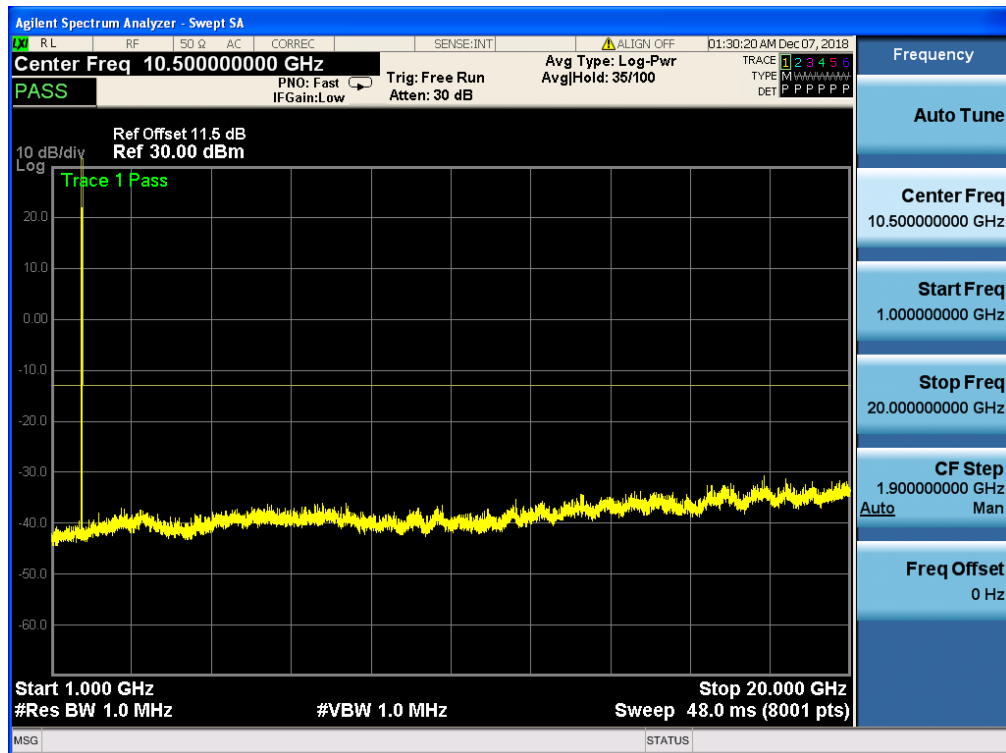
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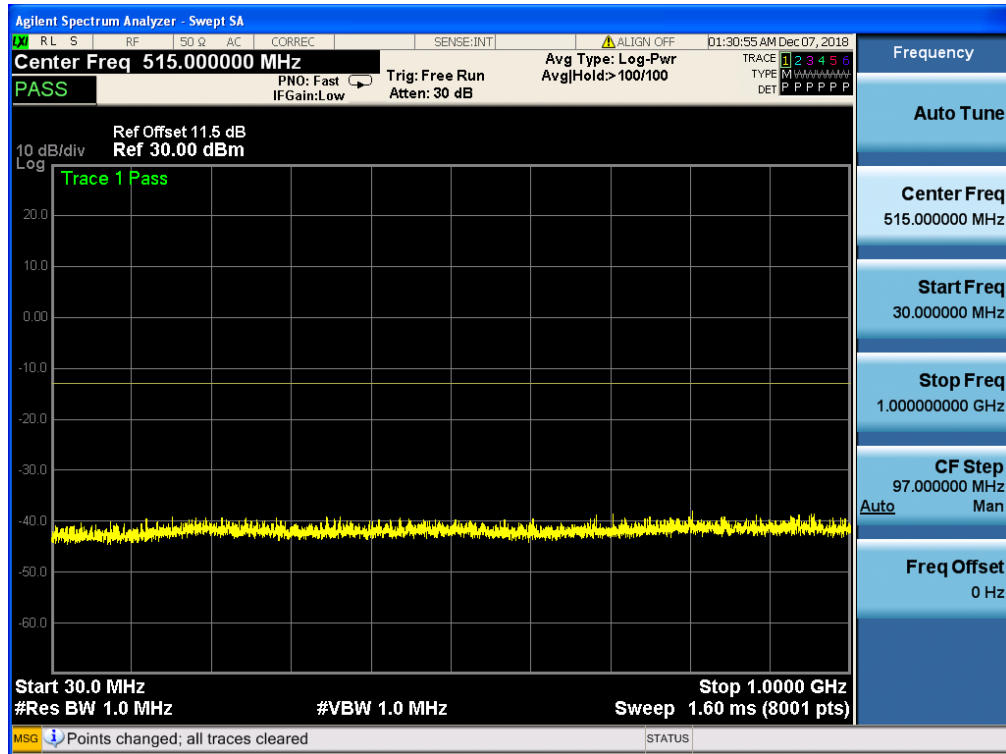
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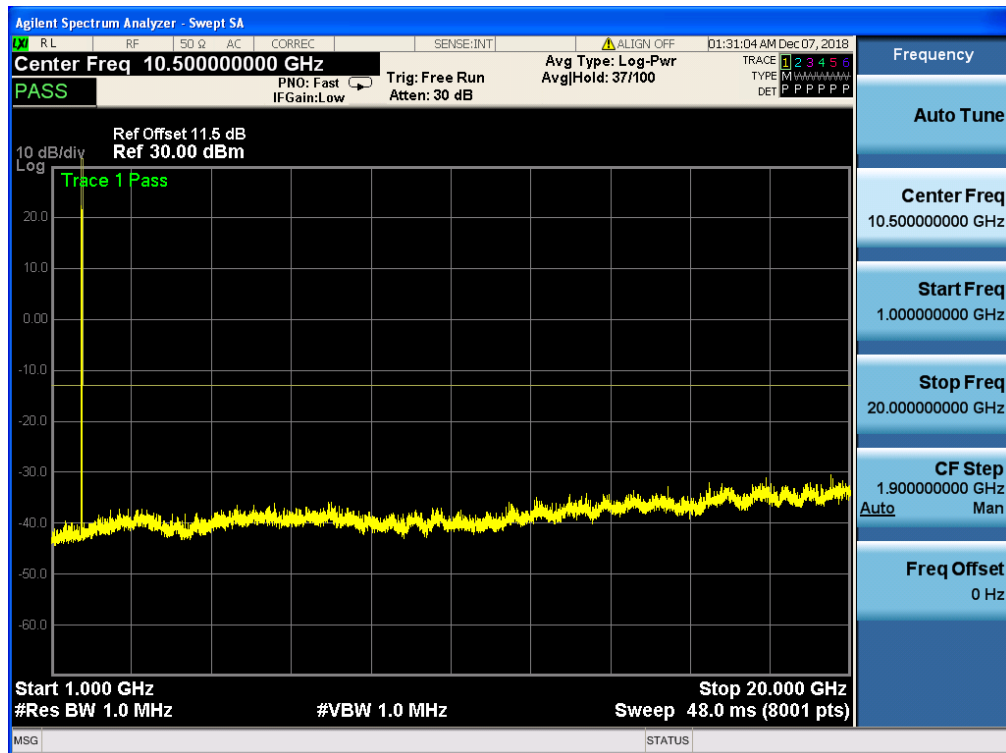
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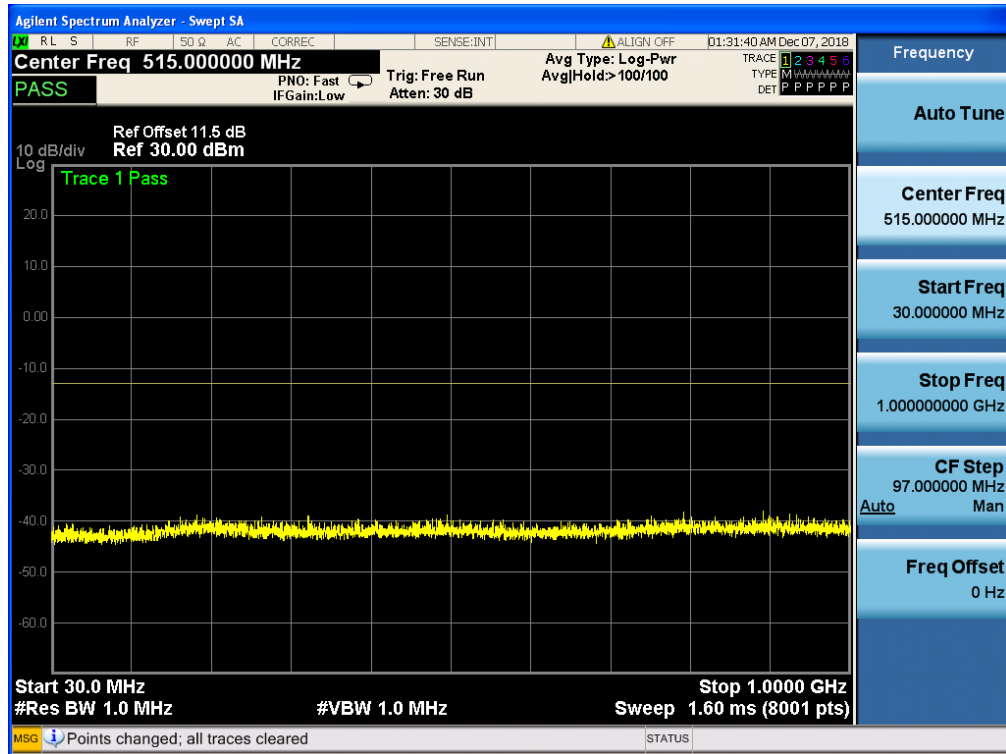
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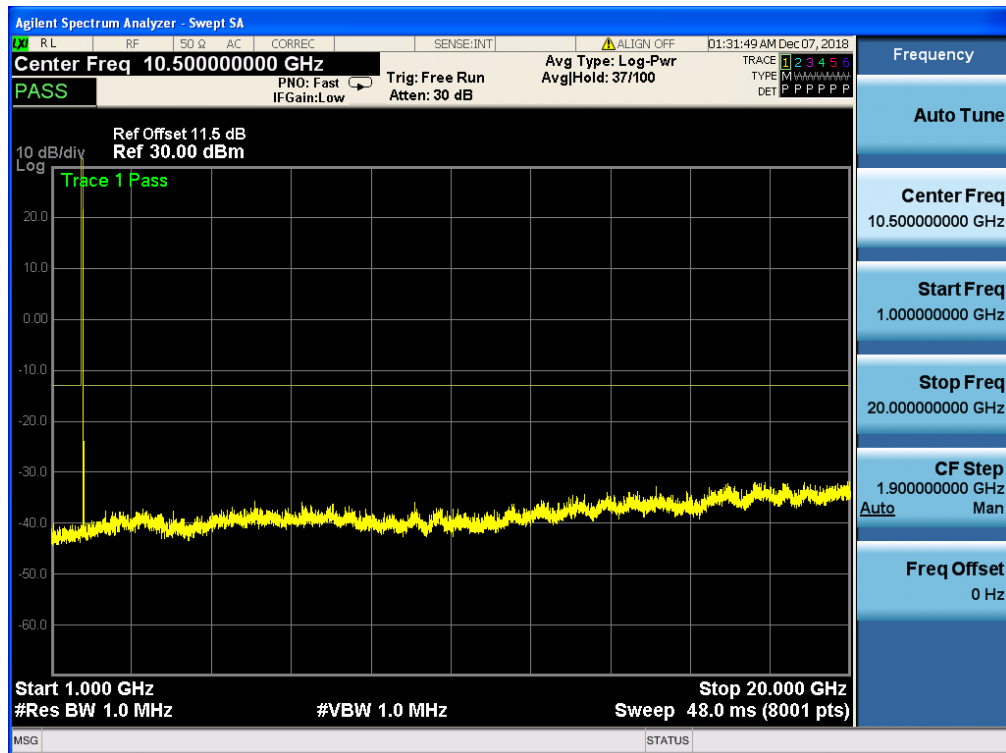
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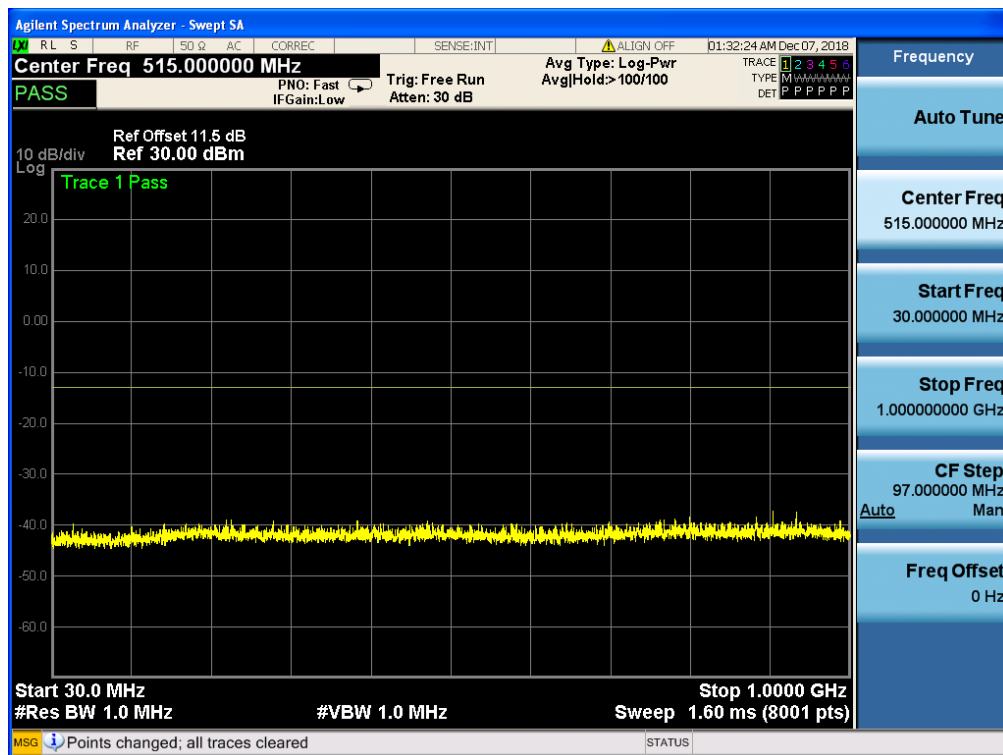
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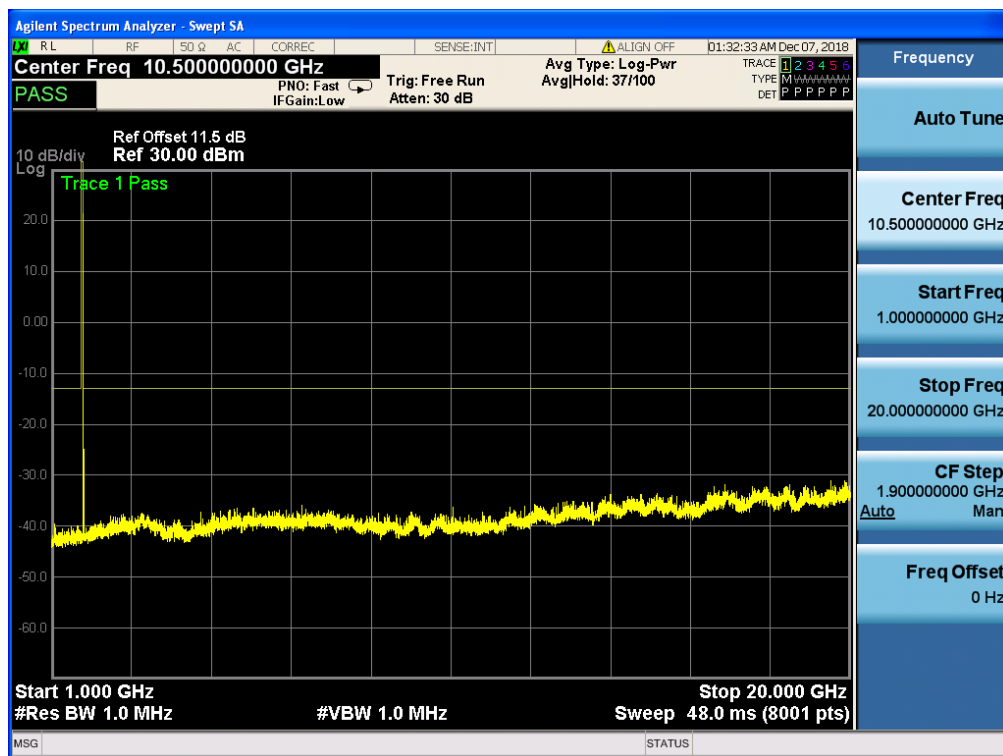
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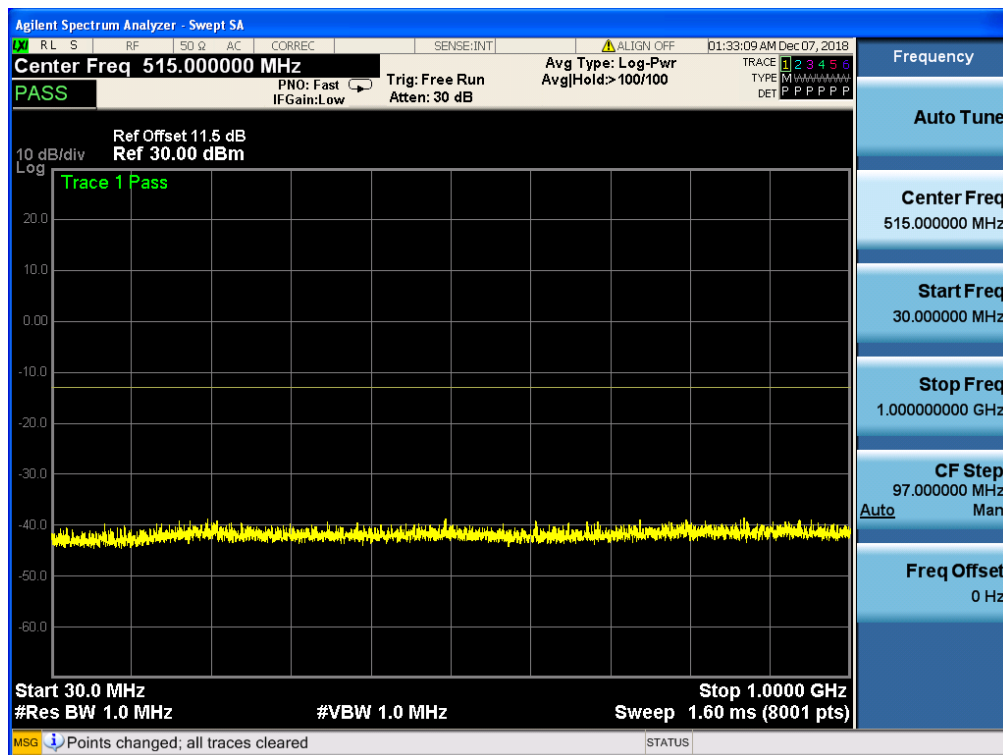
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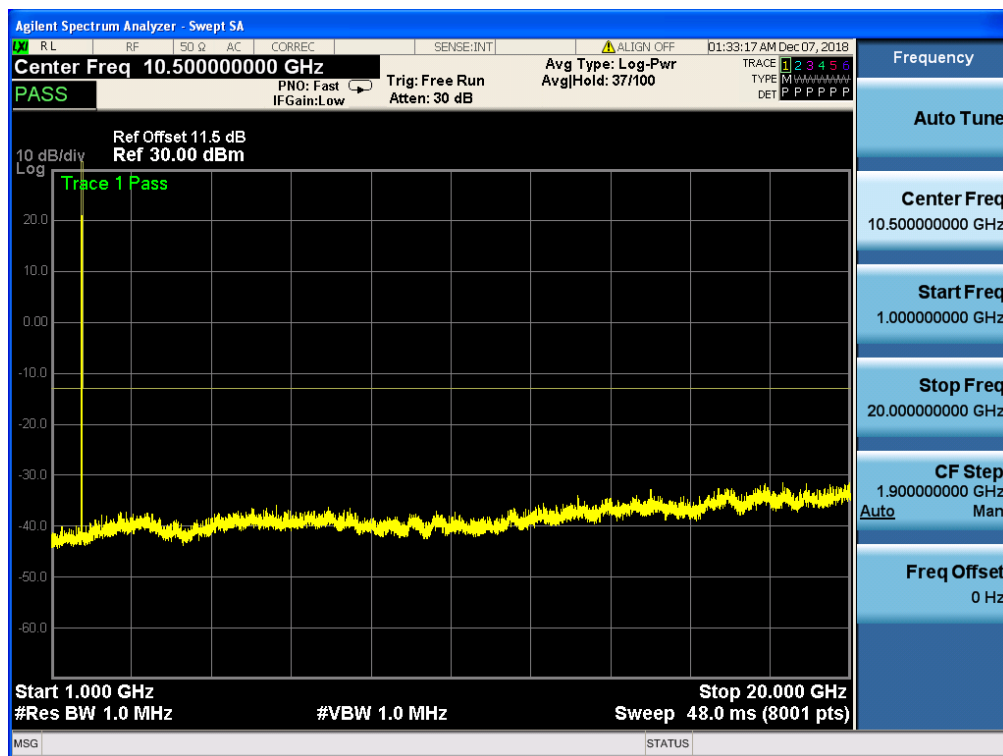
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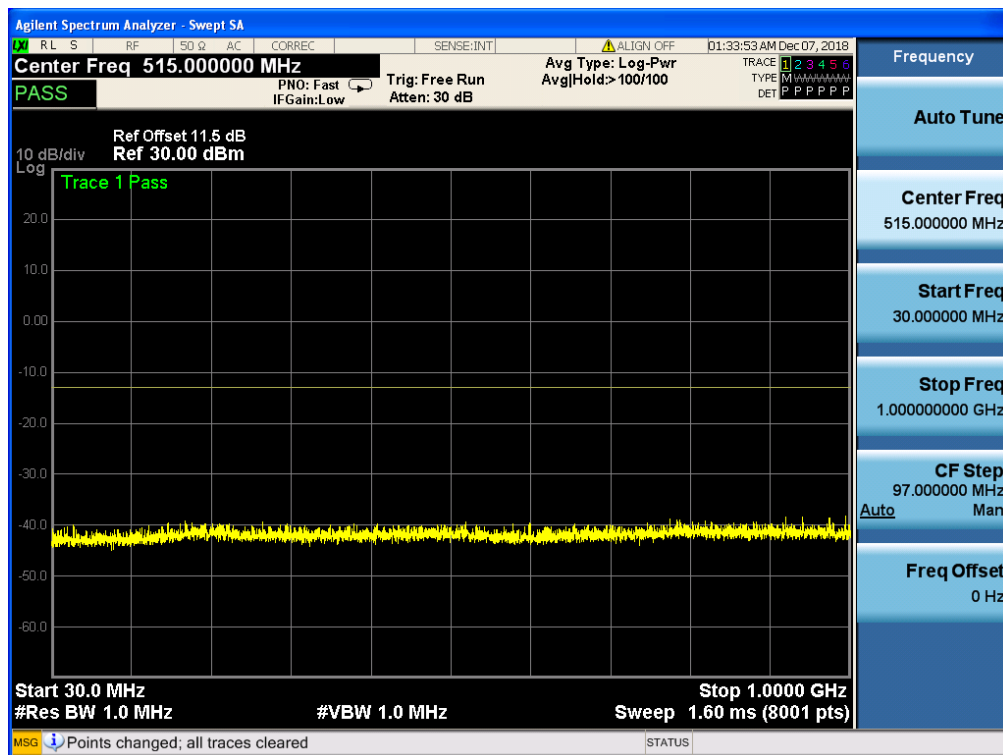
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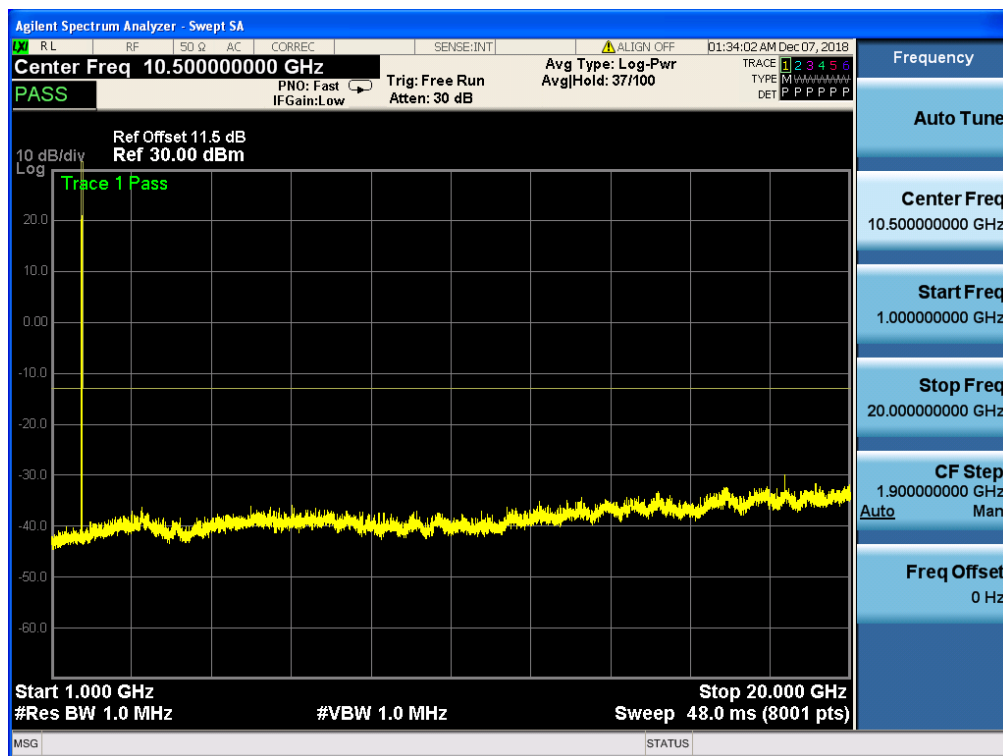
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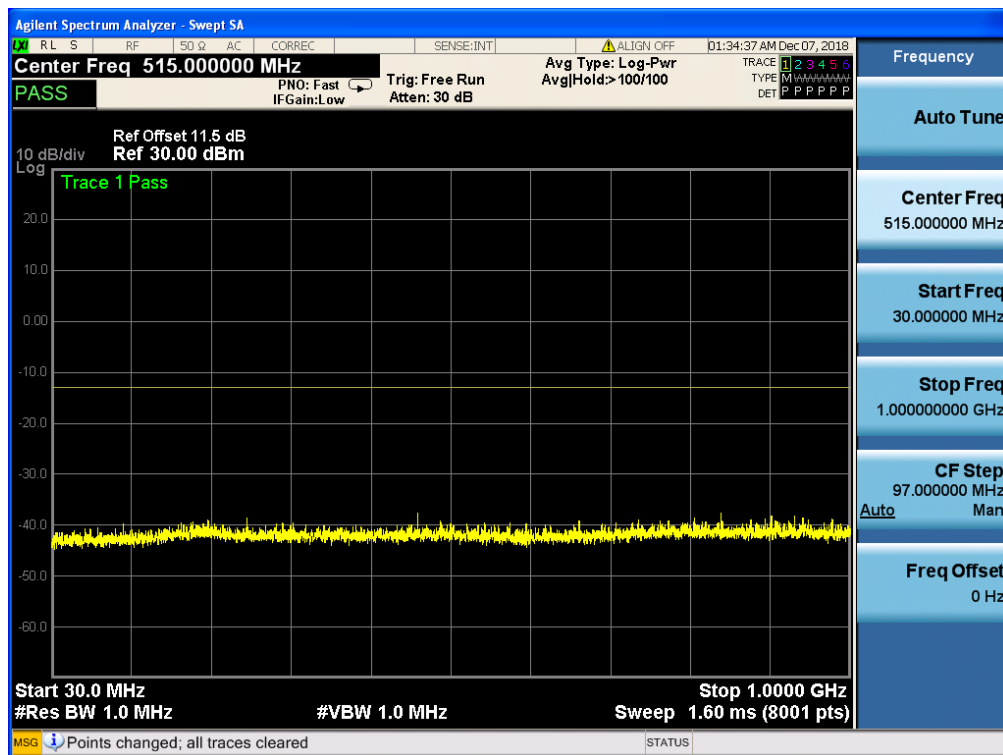
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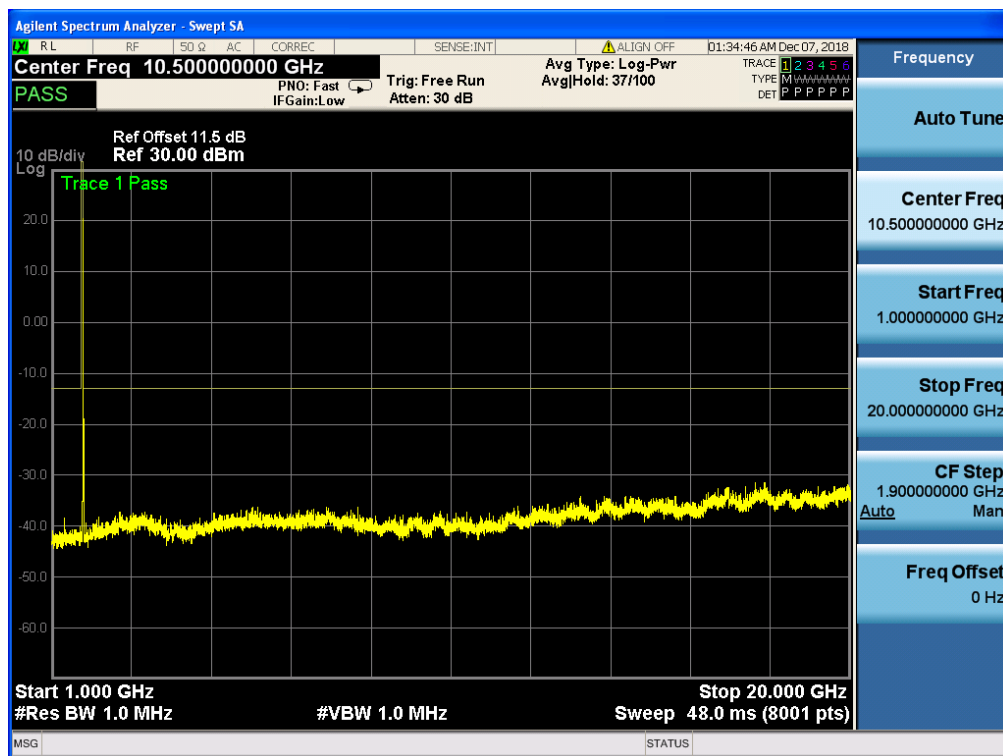
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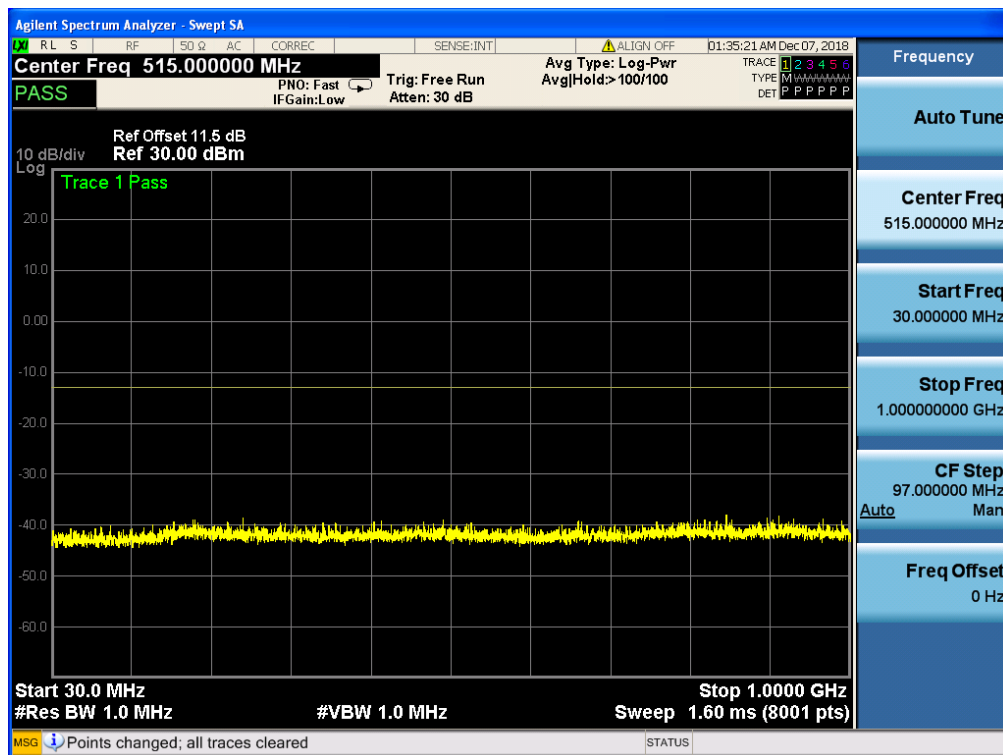
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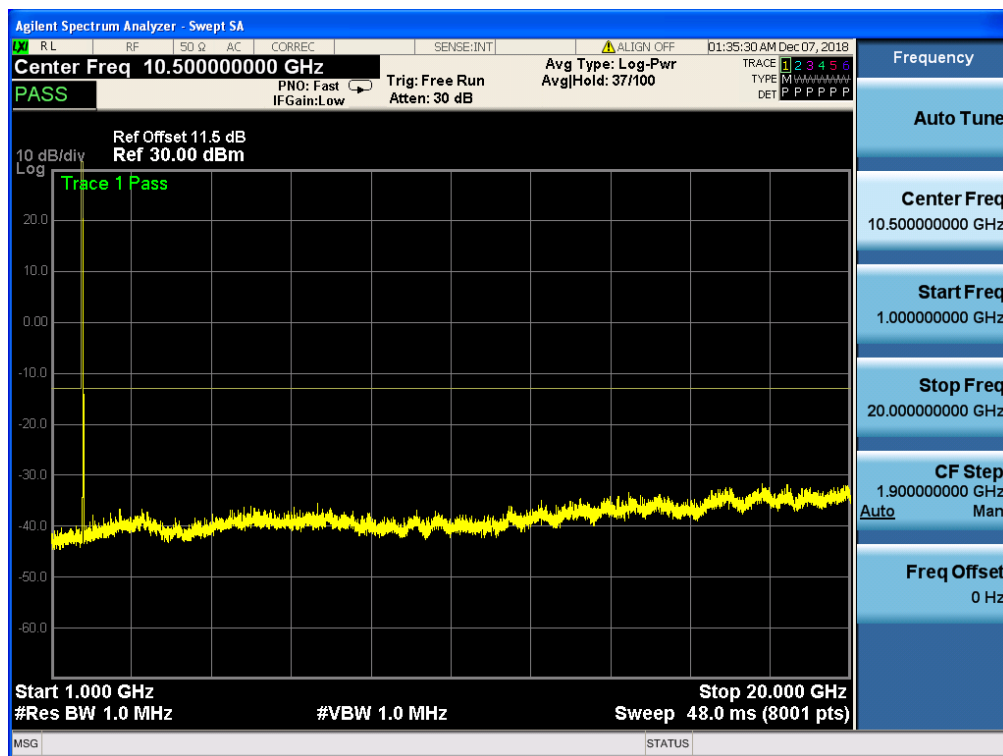
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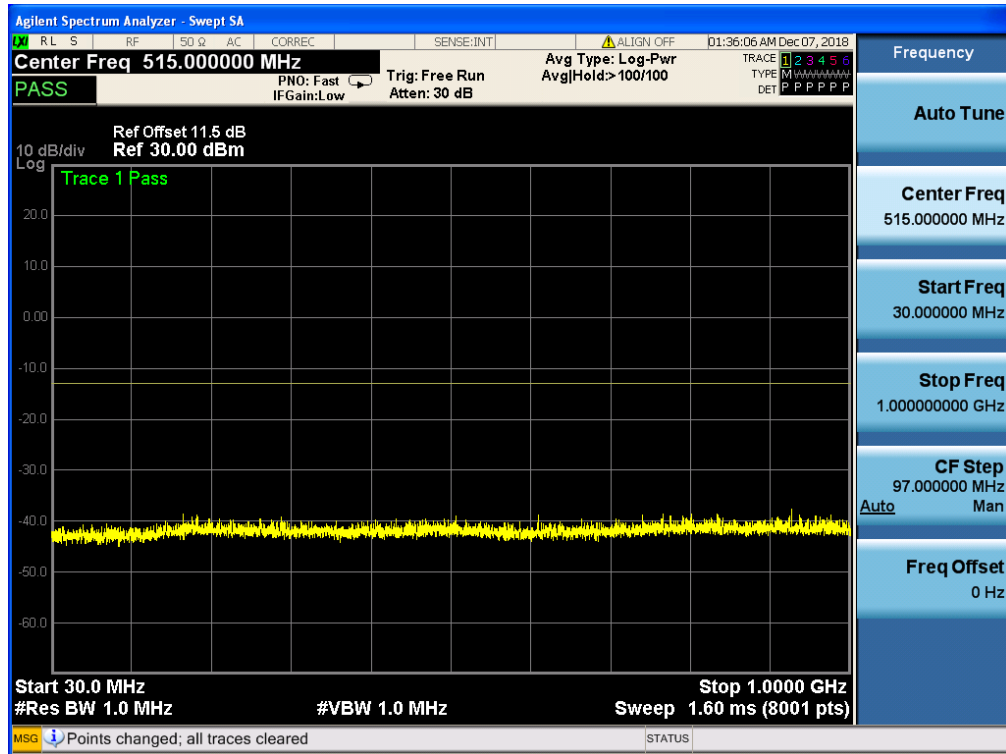
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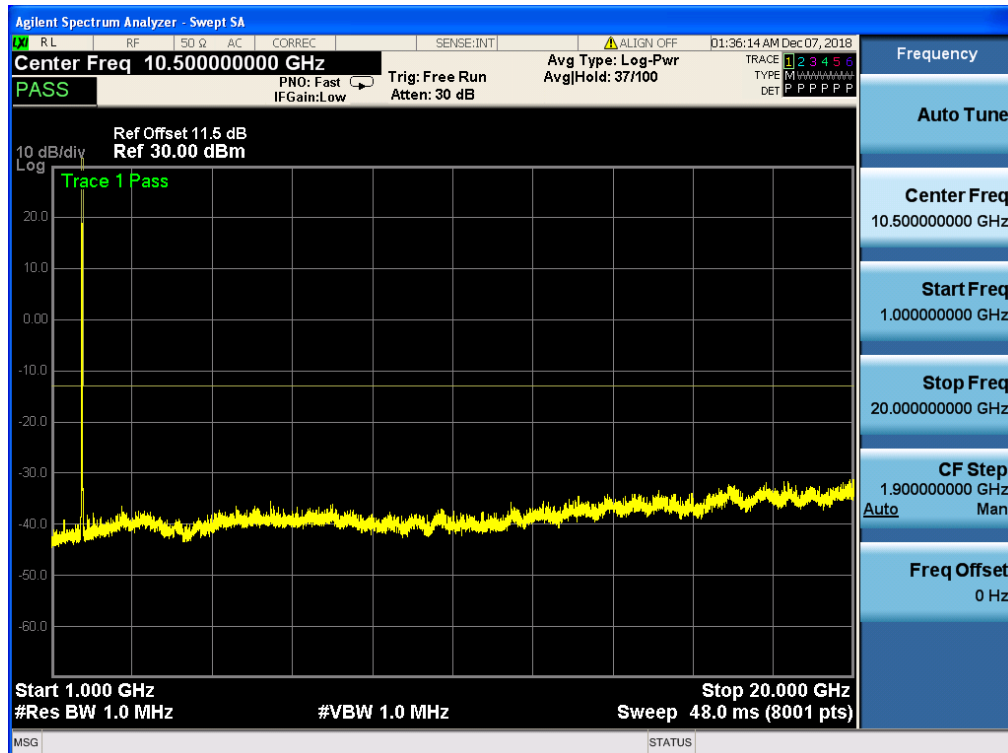
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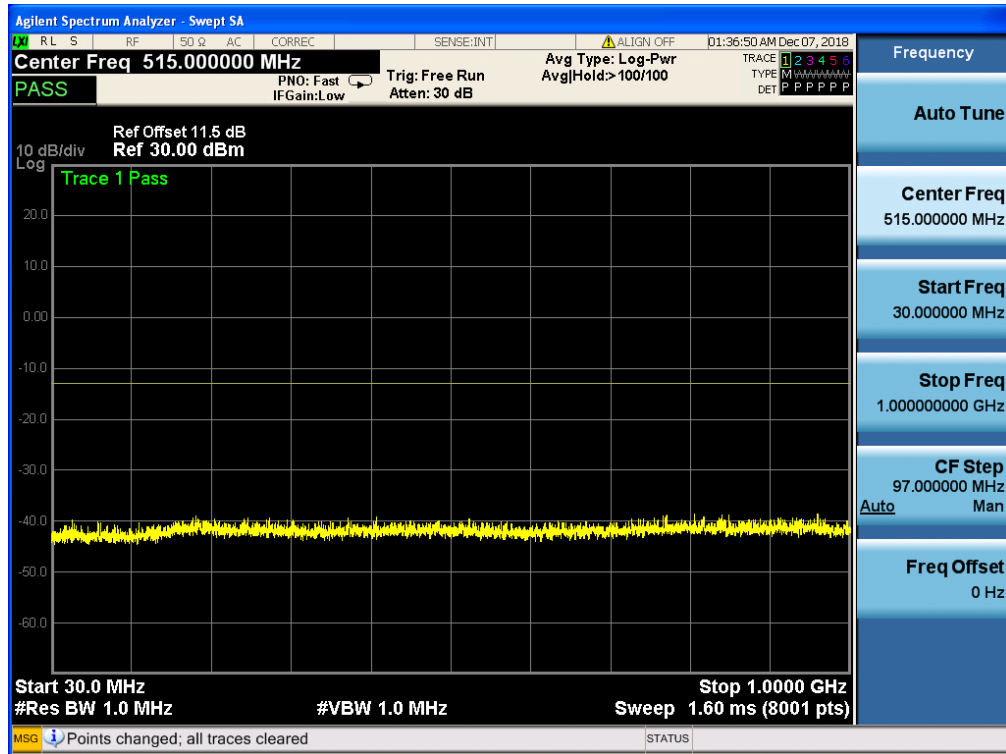
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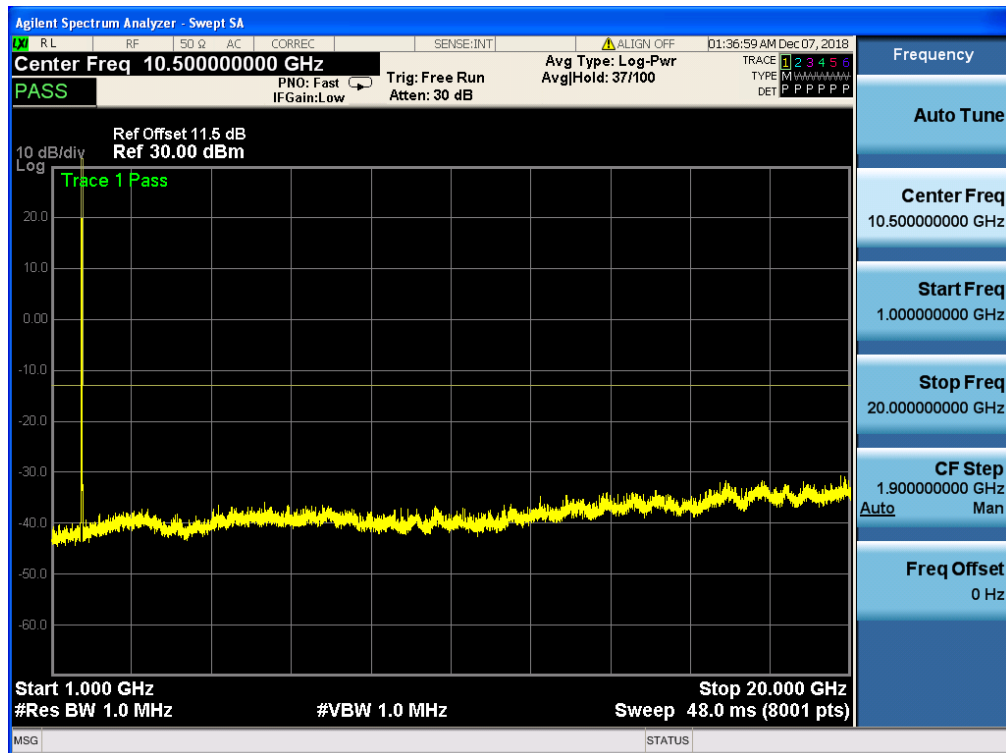
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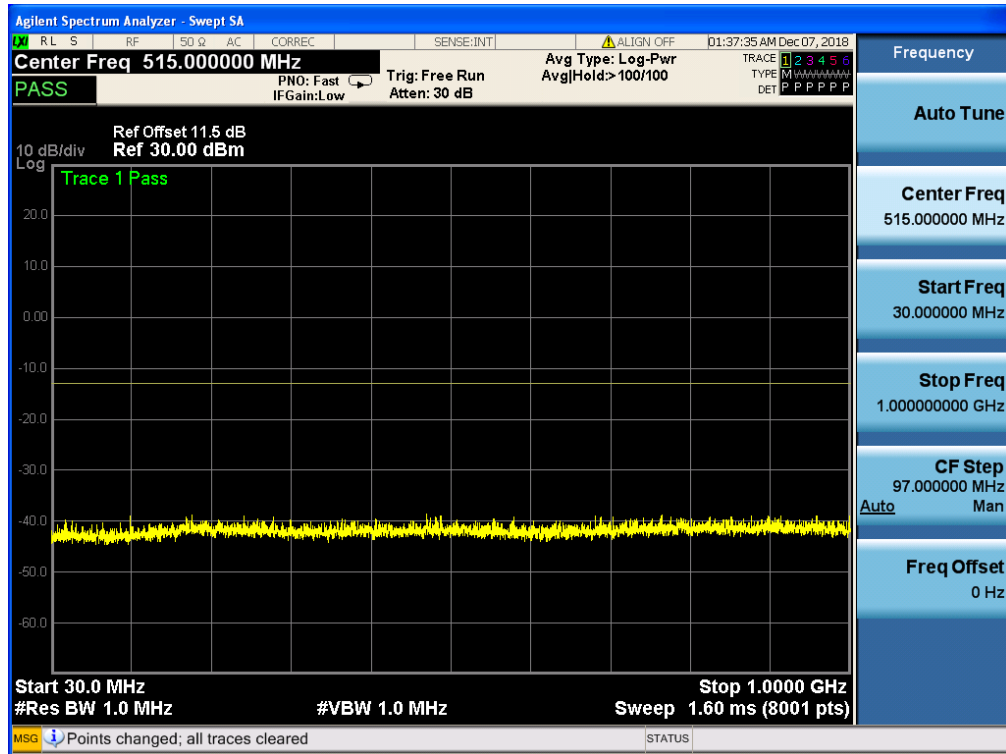
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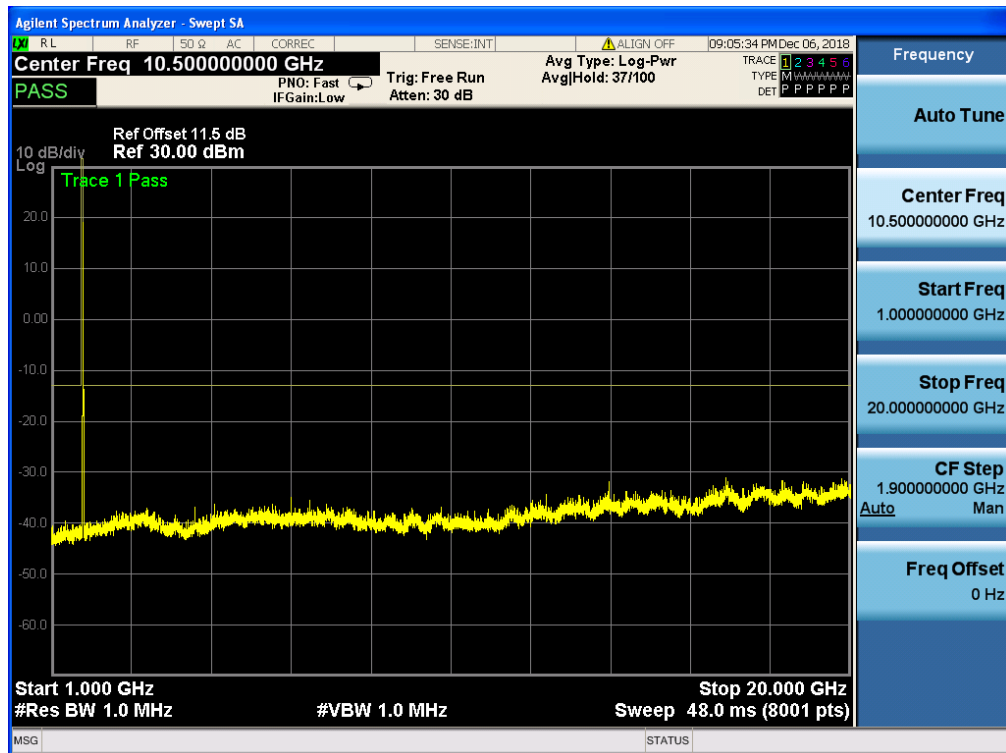
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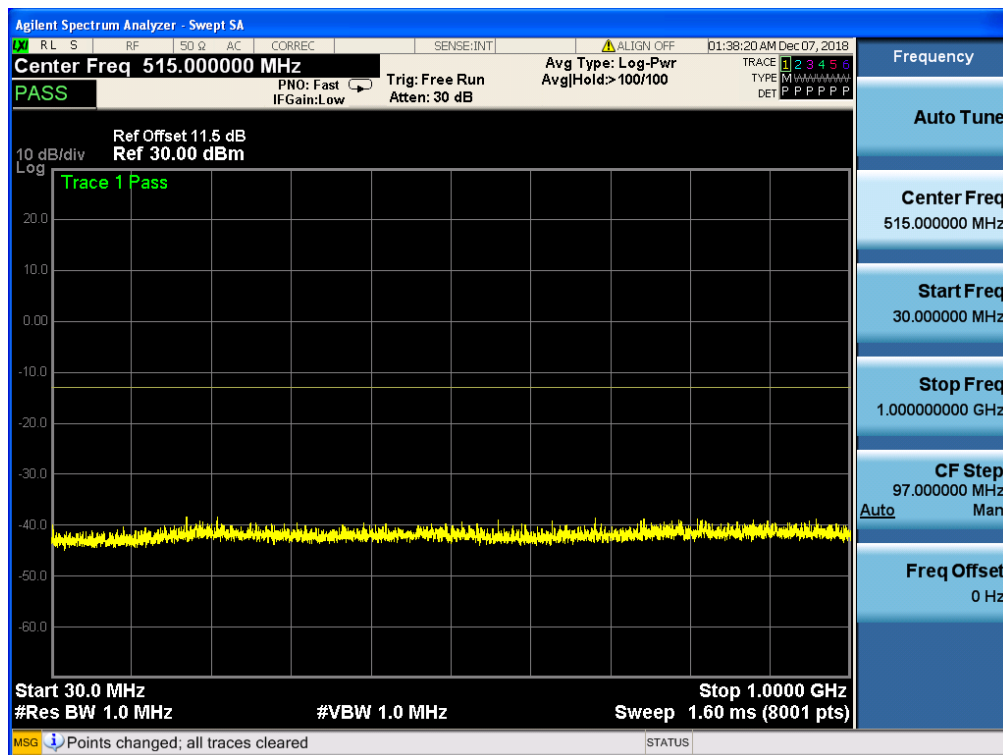
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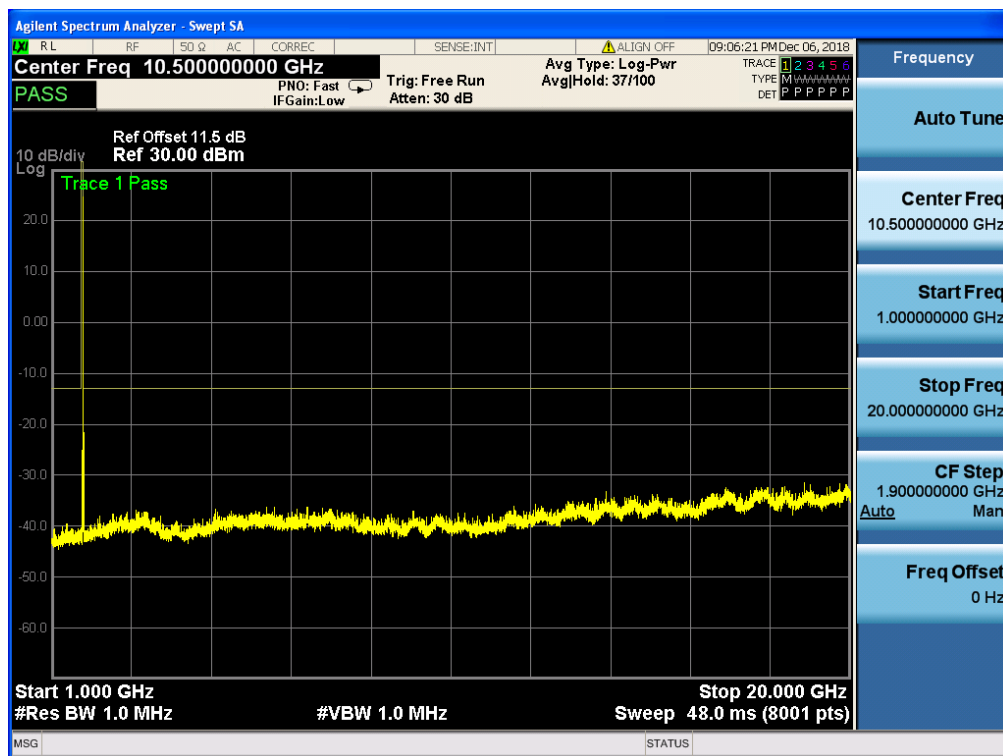
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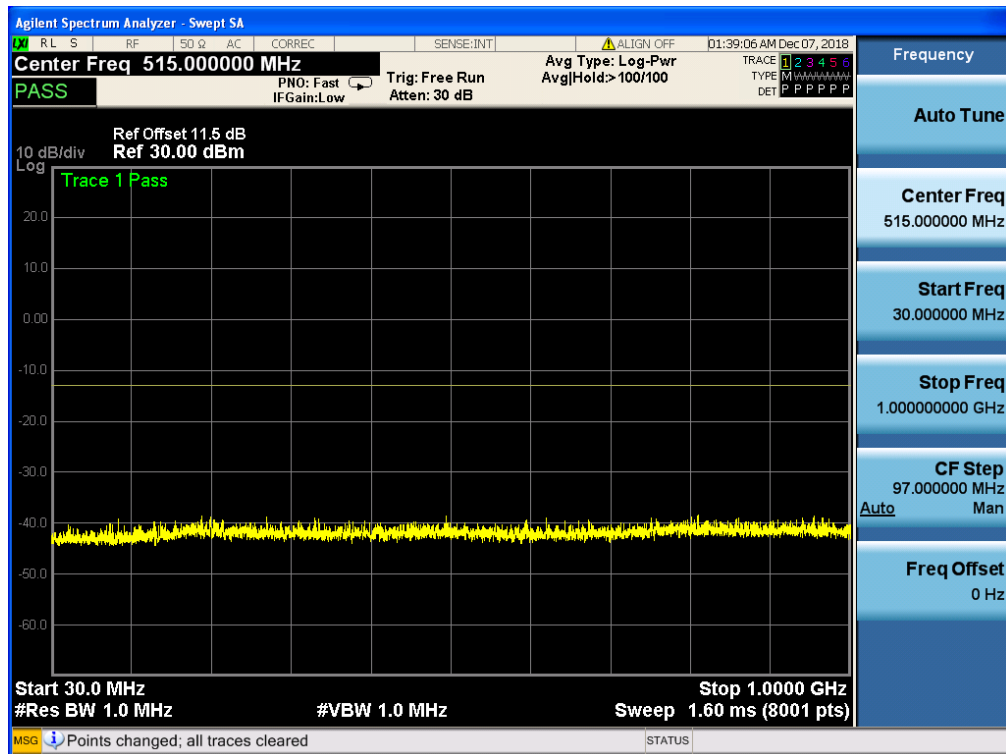
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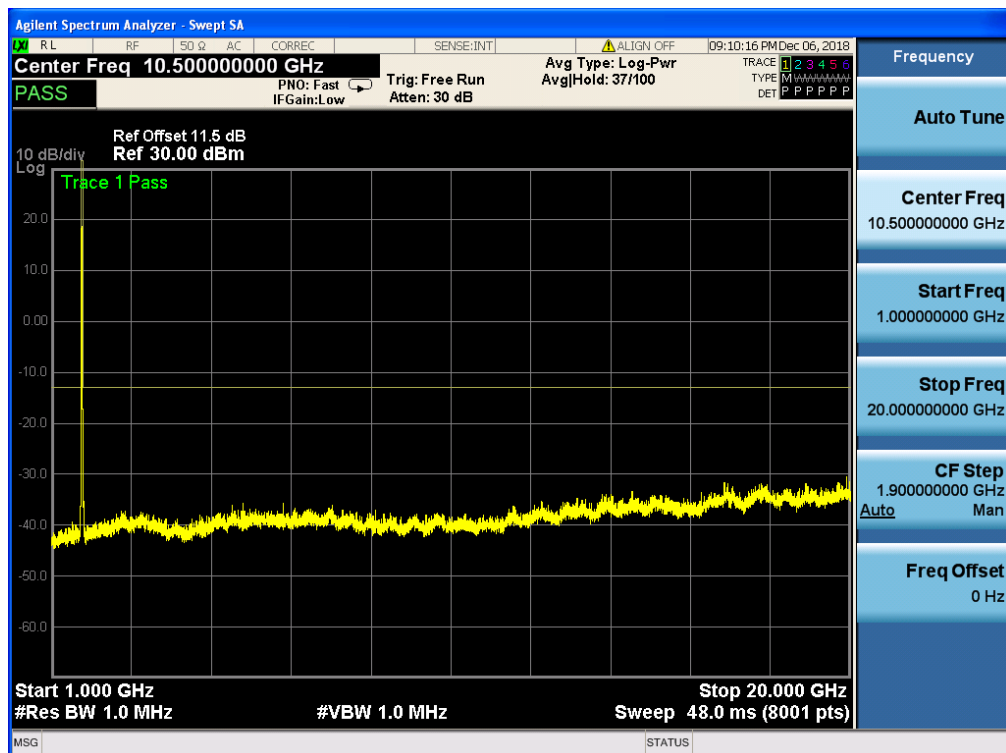
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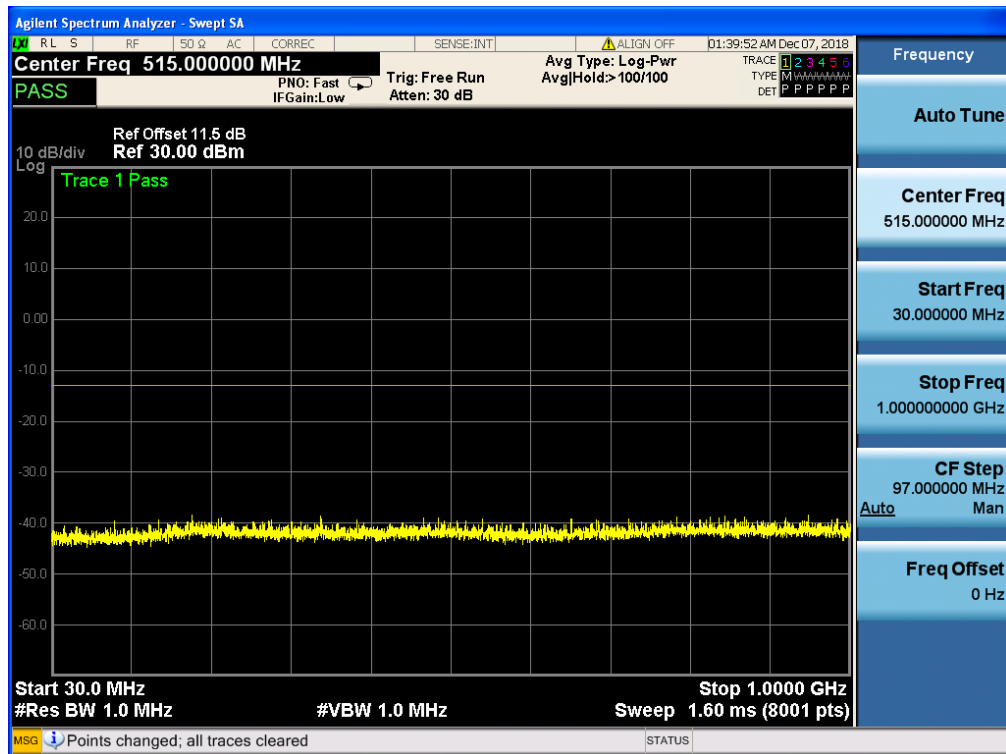
Band 4,UL Channel 20025,UL Frequency 1717.5,BW 15.0,NO. RB 75,RB POS. Low,QPSK



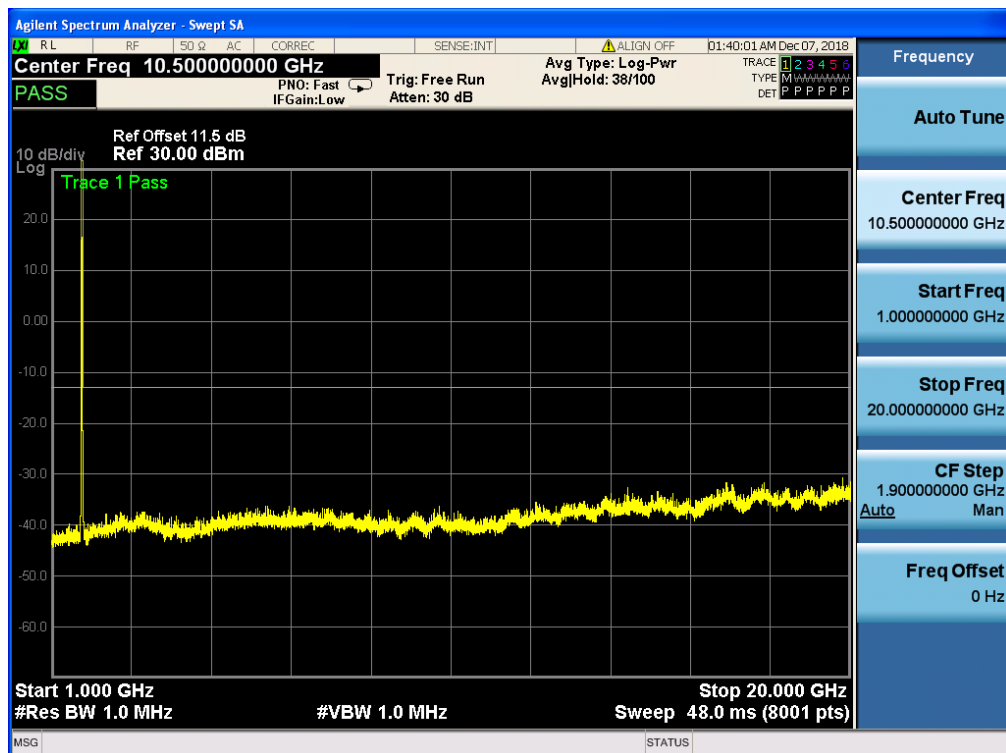
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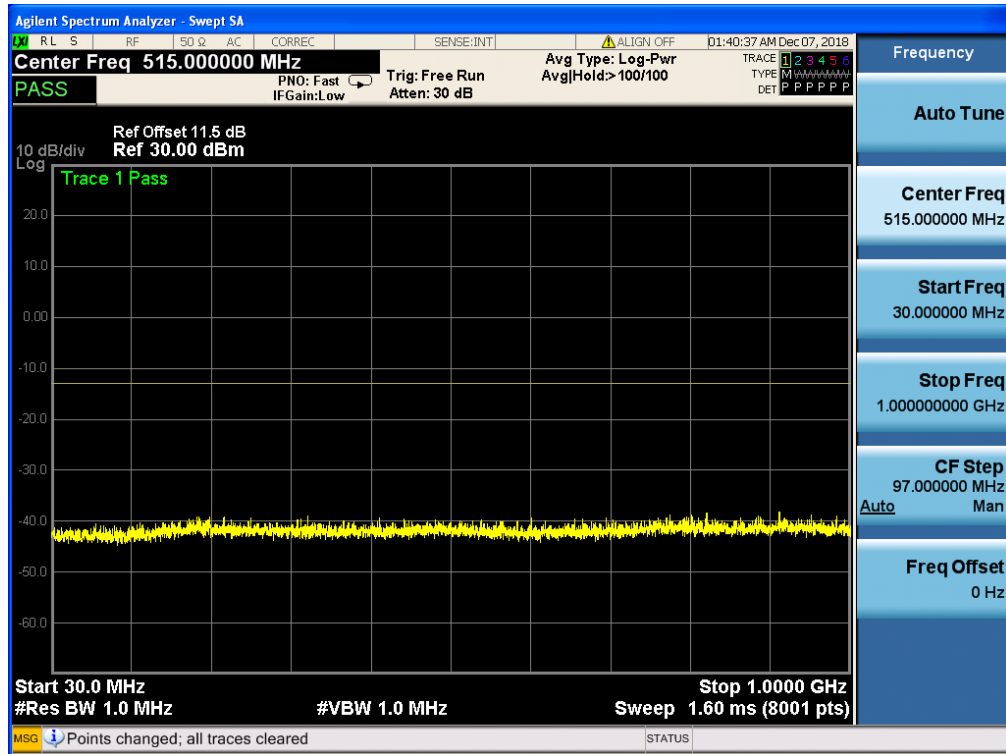
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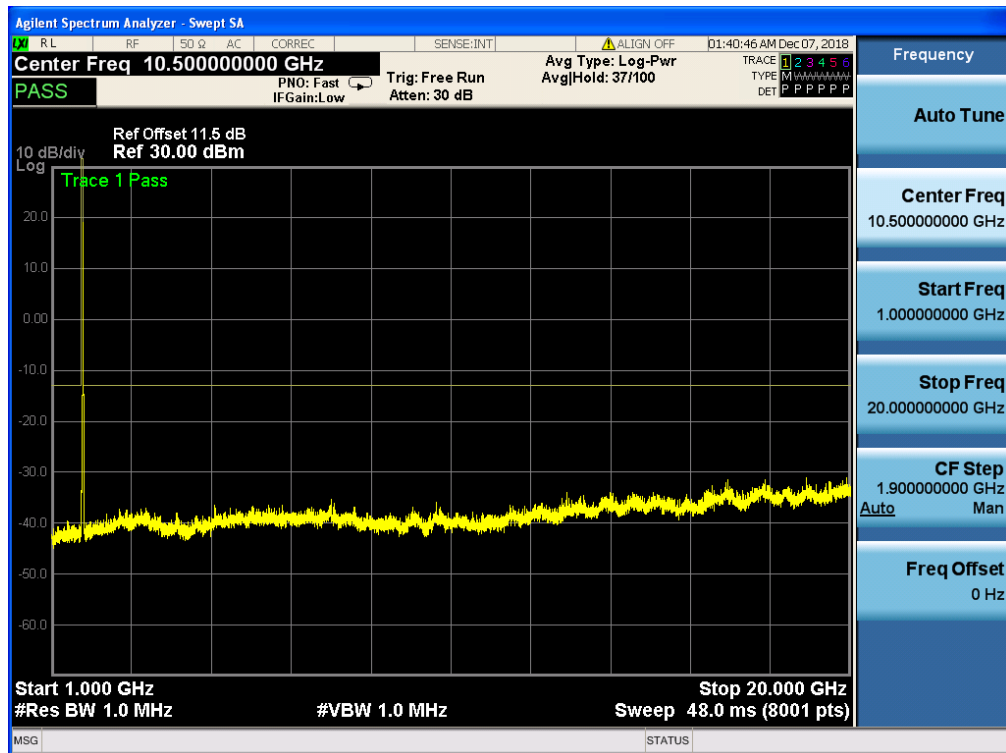
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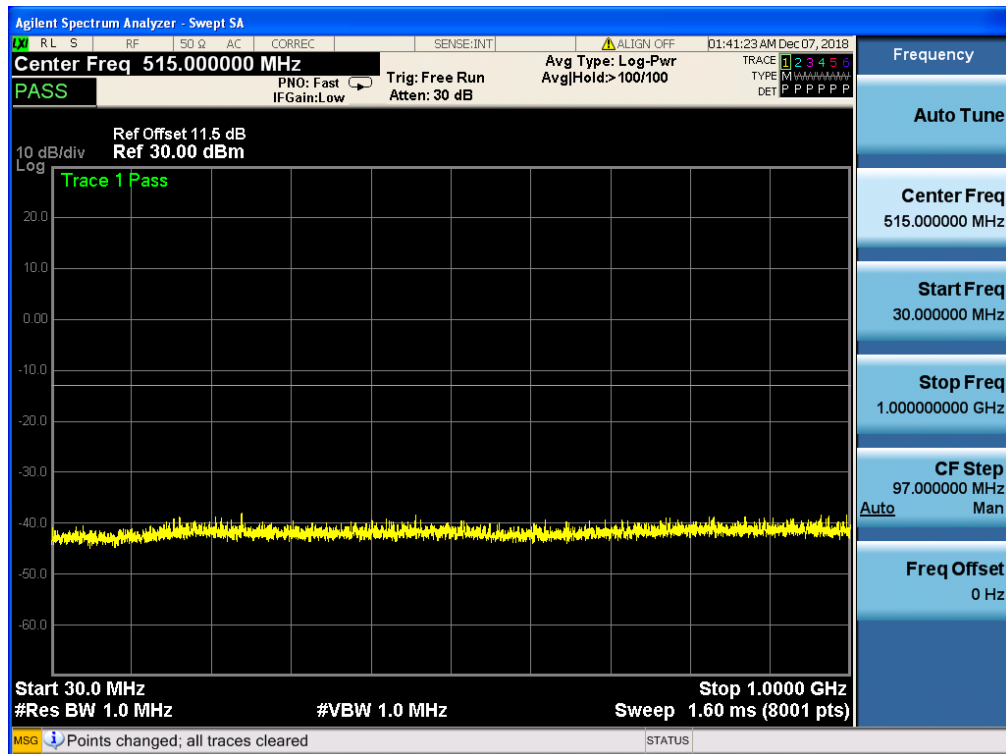
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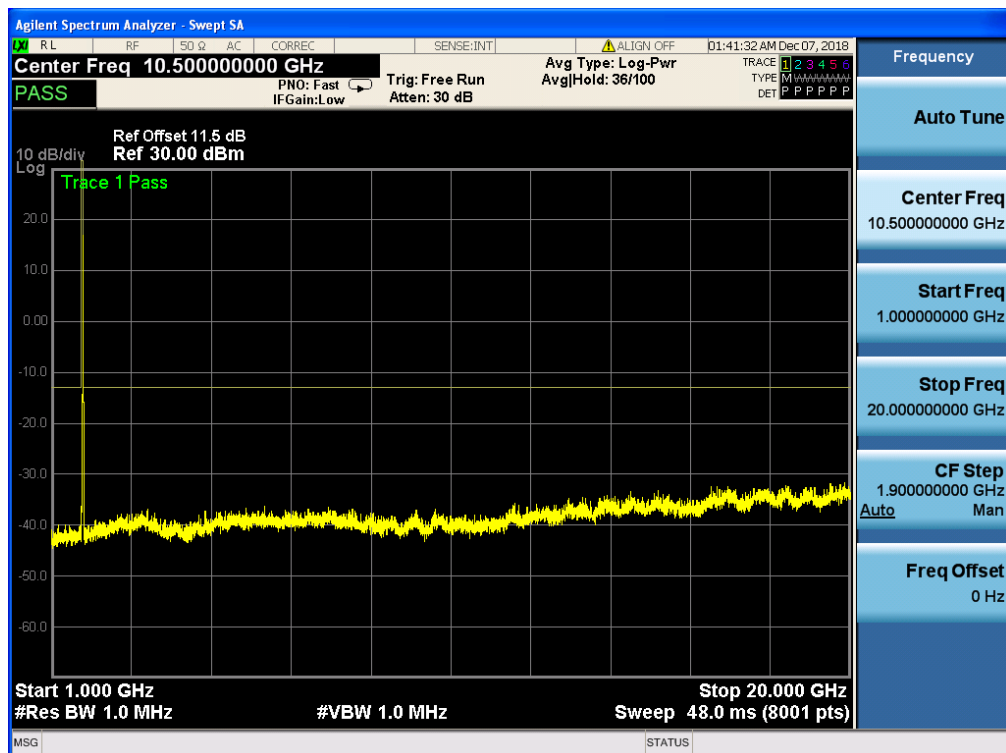
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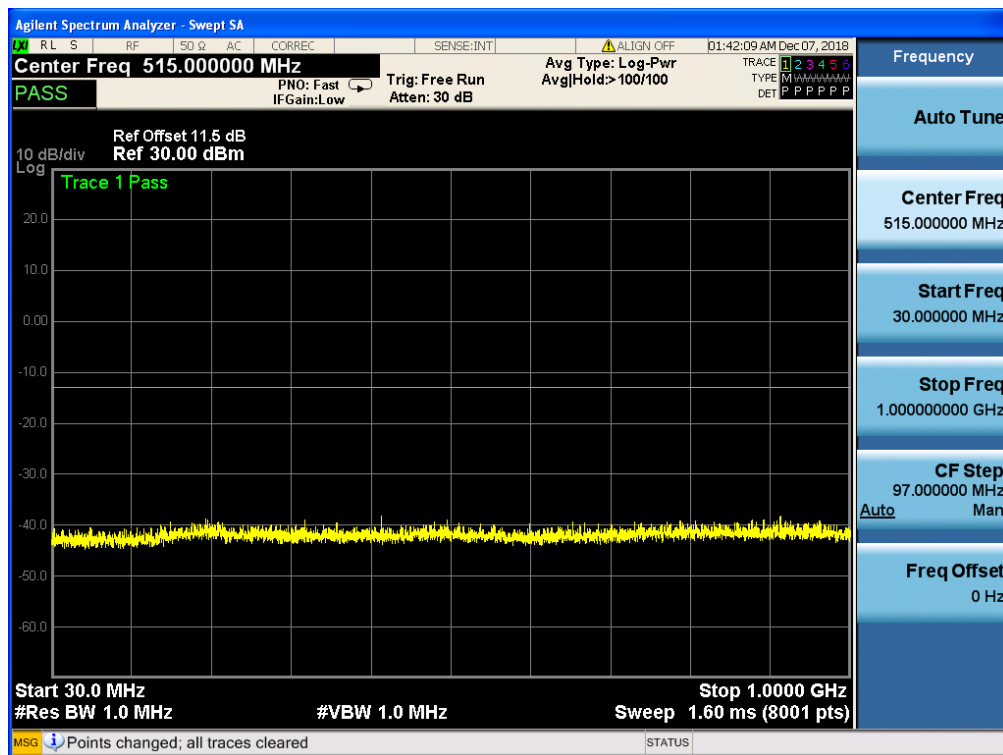
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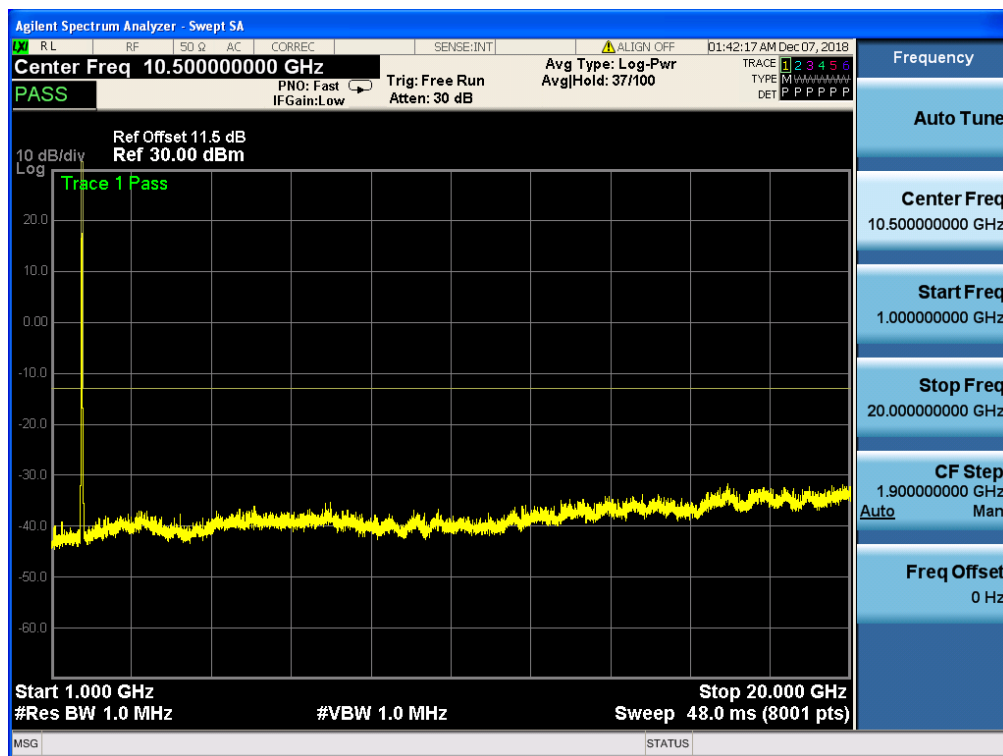
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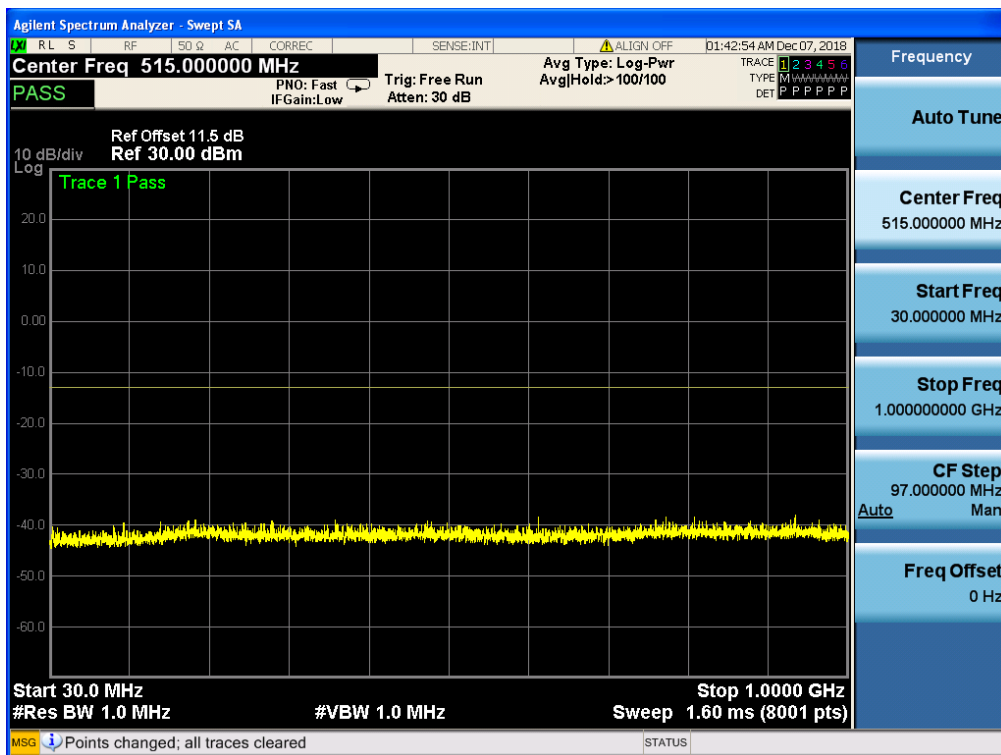
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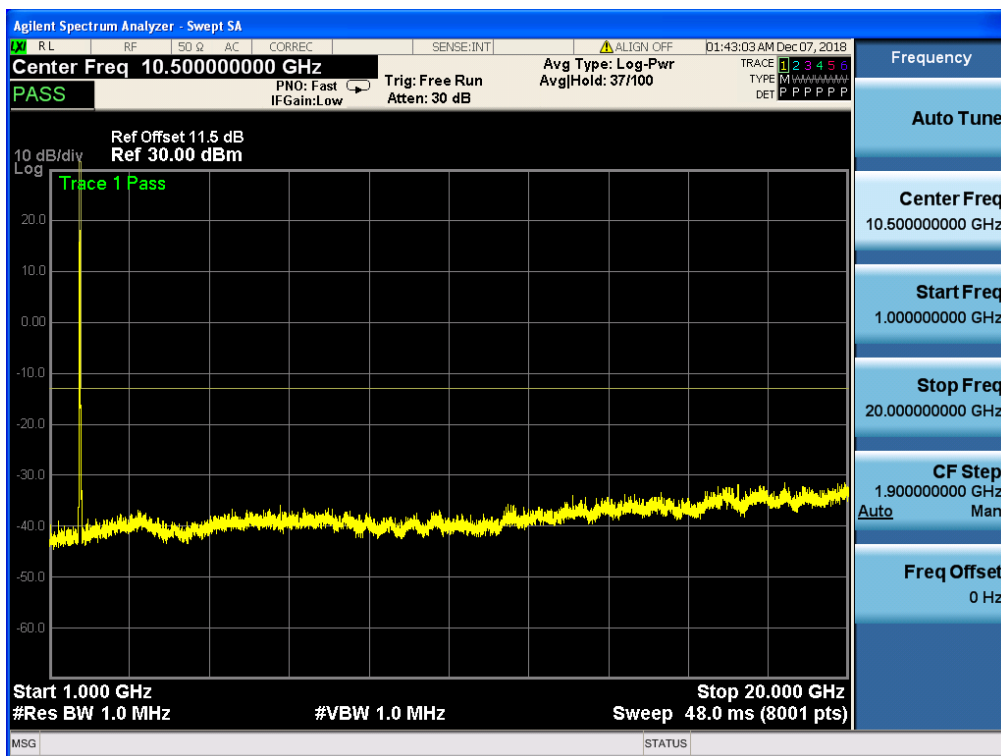
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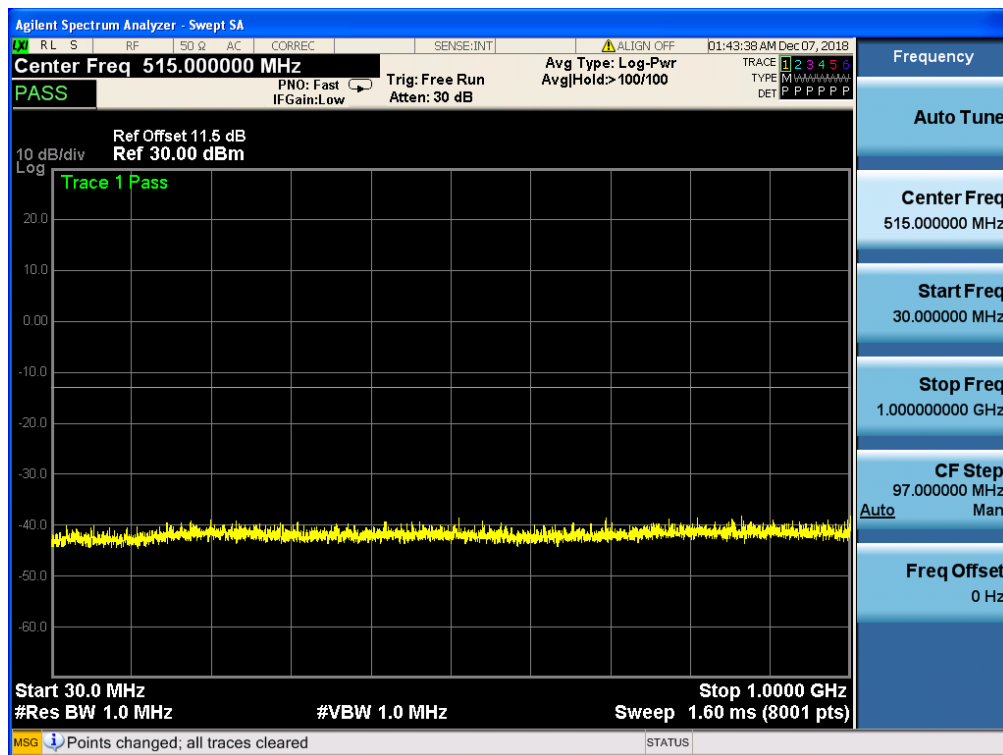
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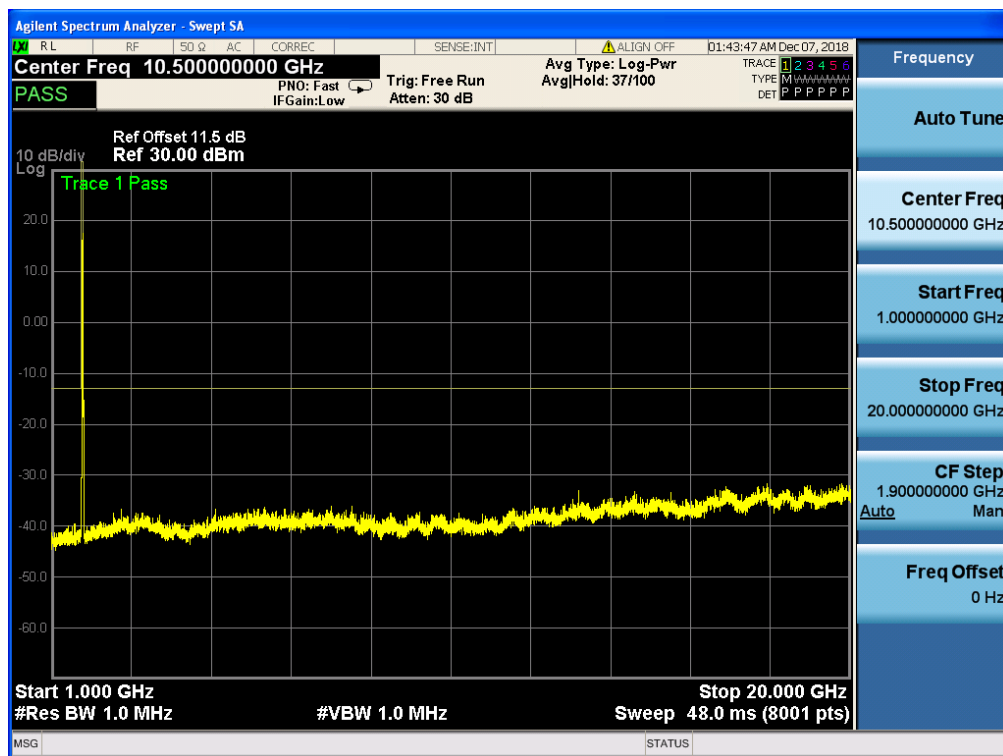
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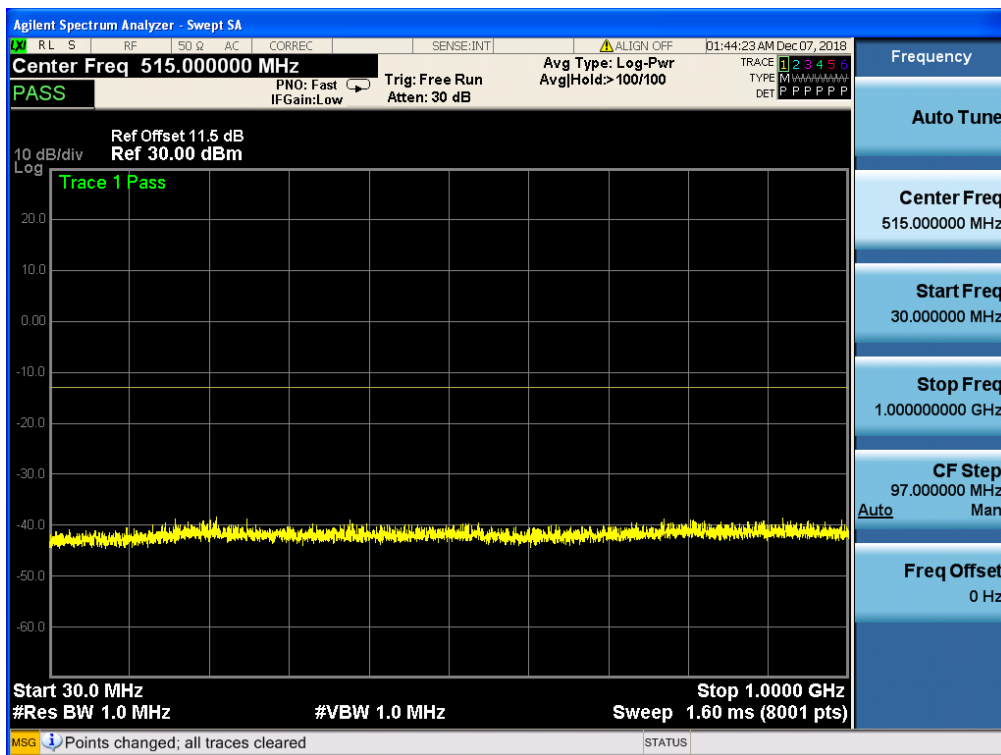
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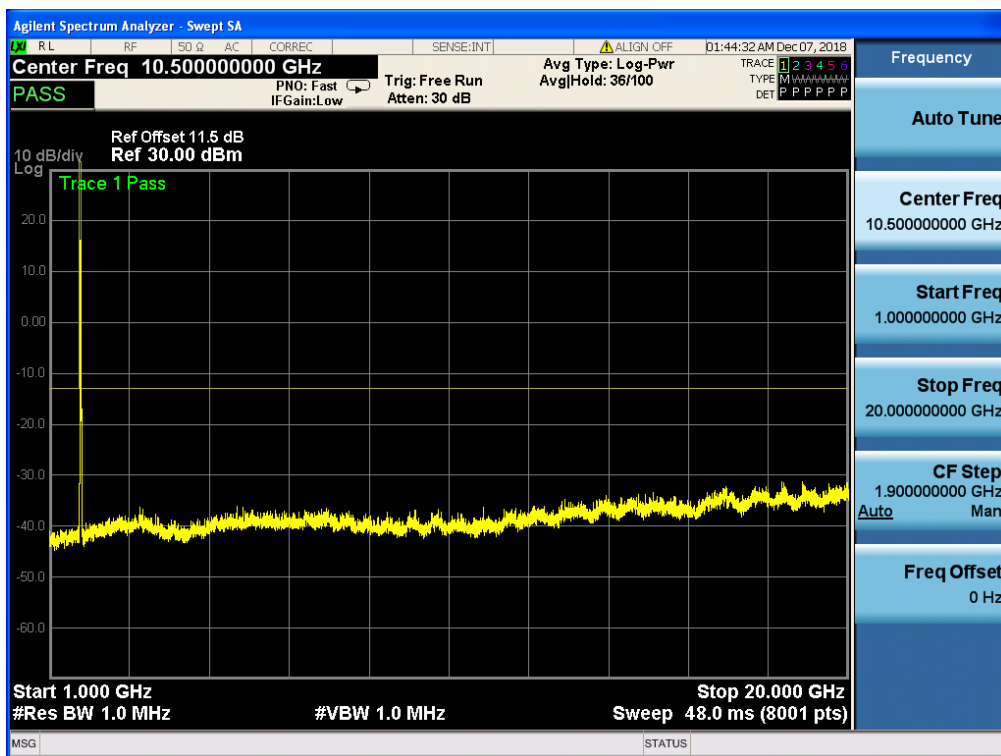
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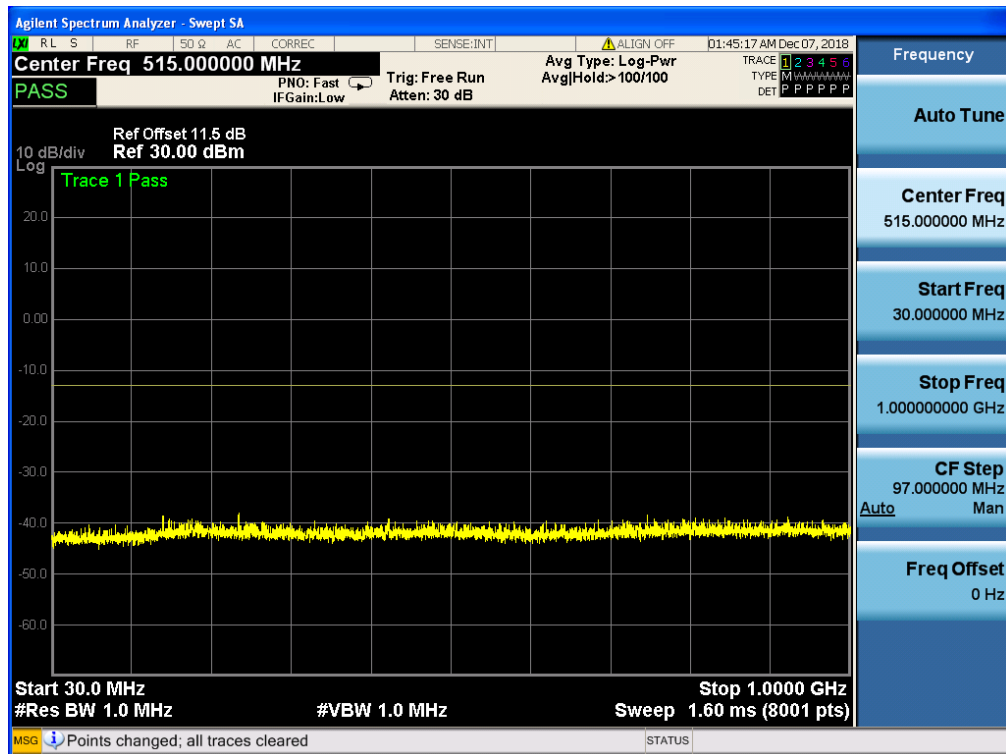


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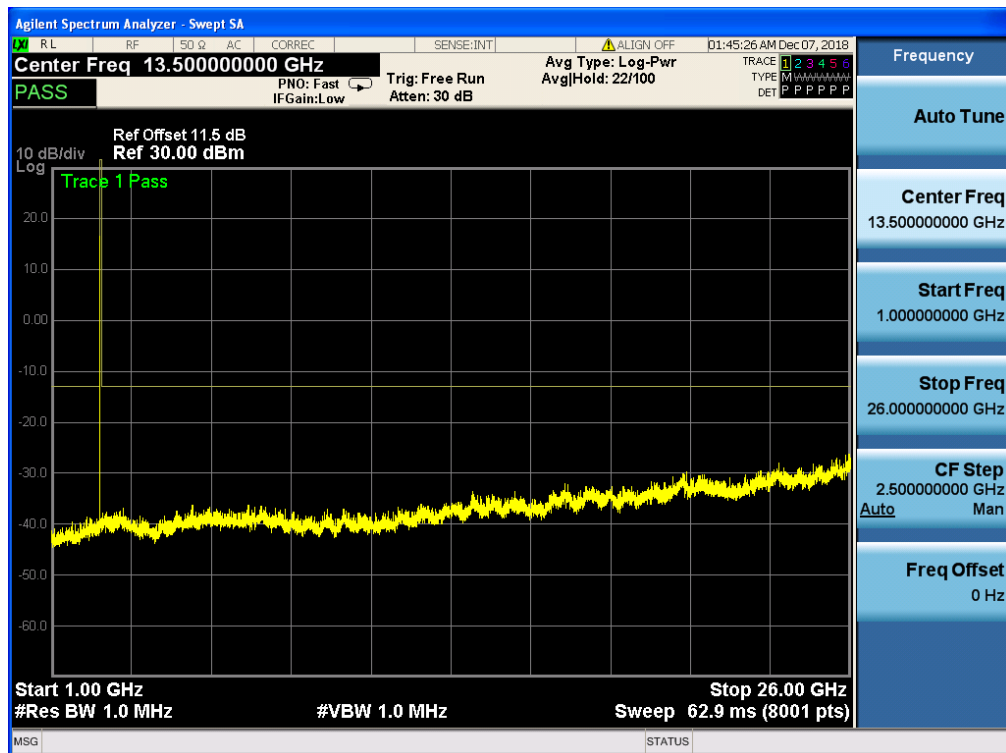


7.3 LTE BAND 7

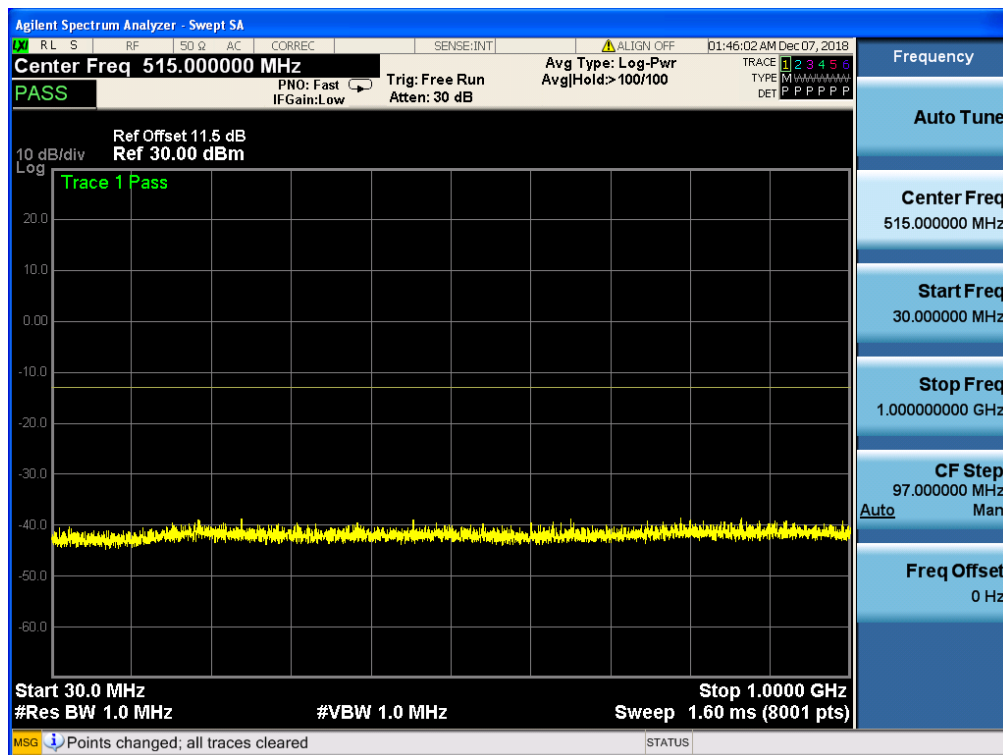
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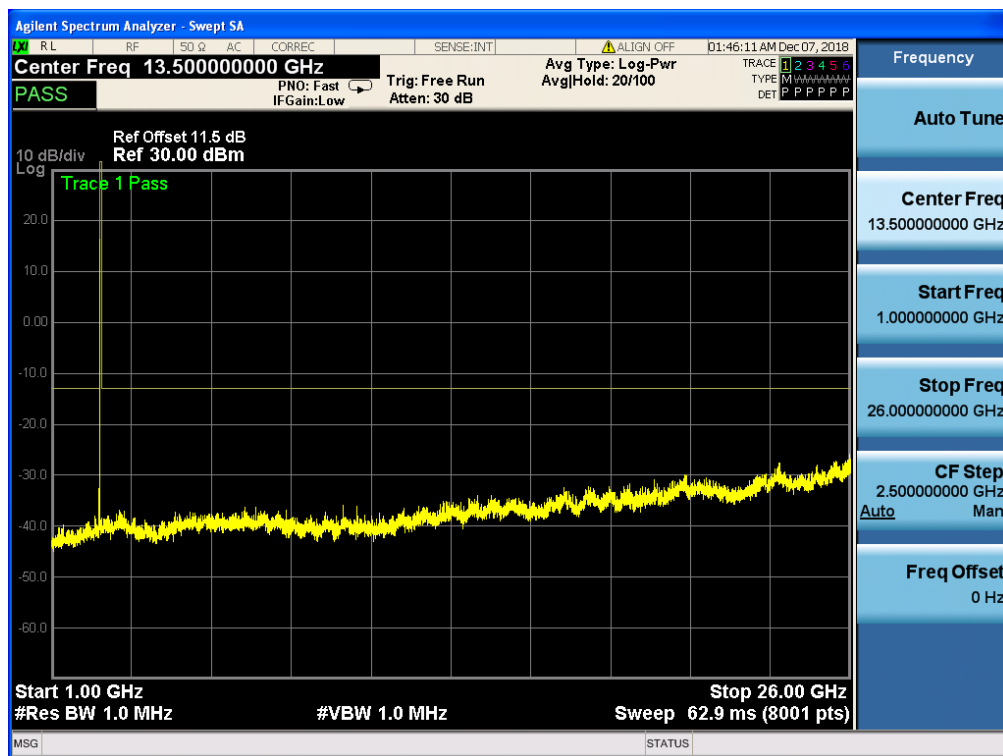
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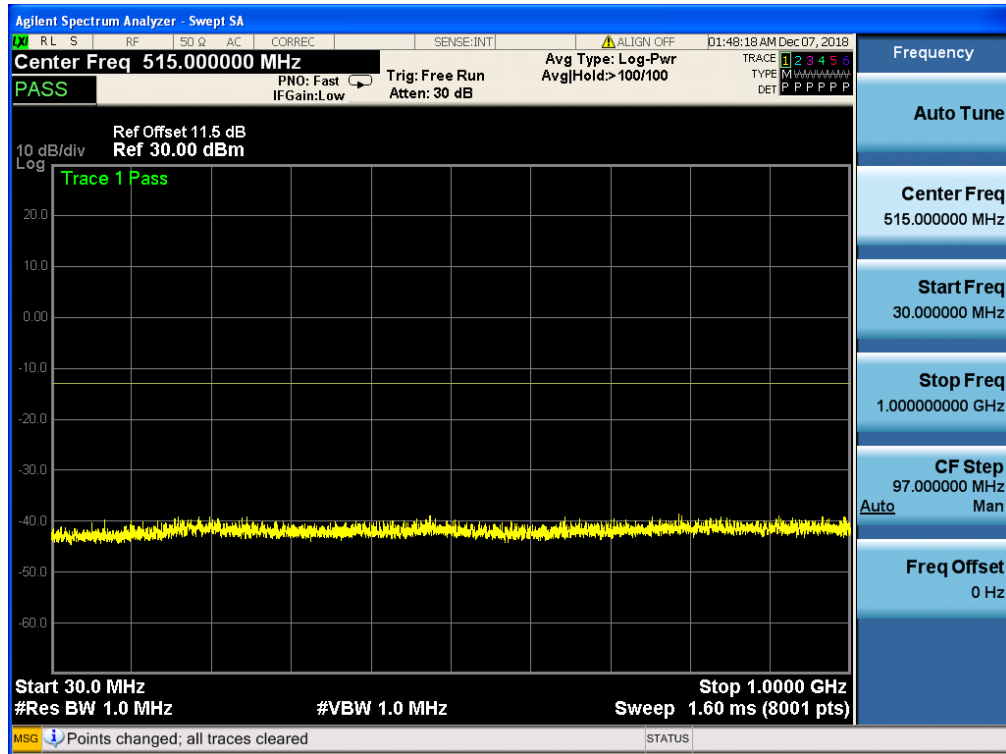
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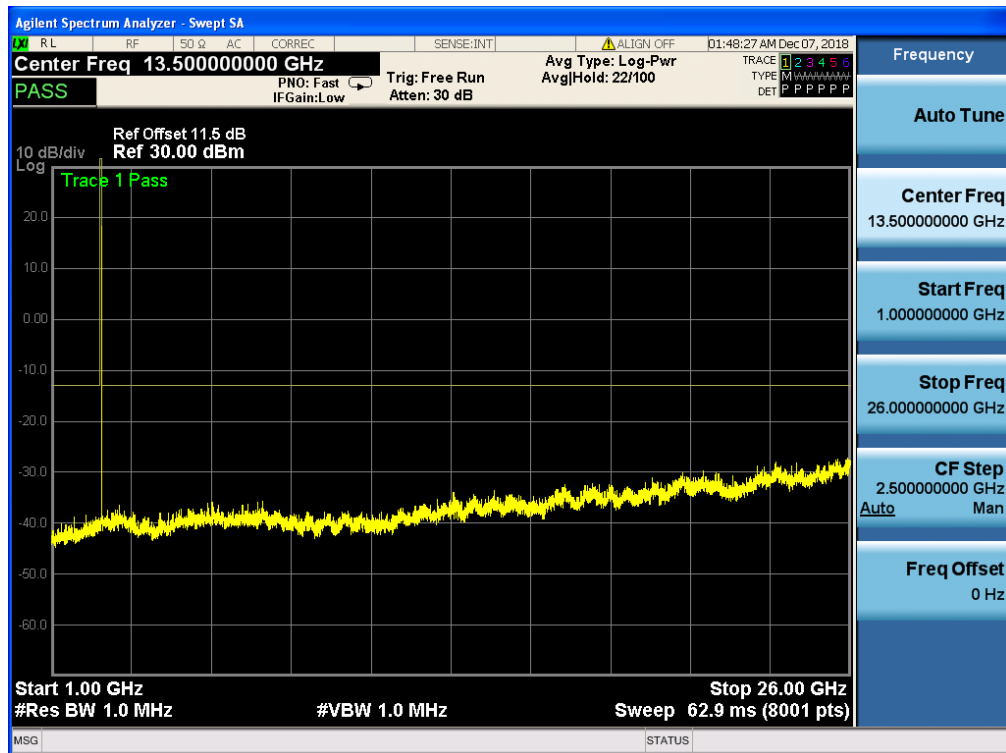
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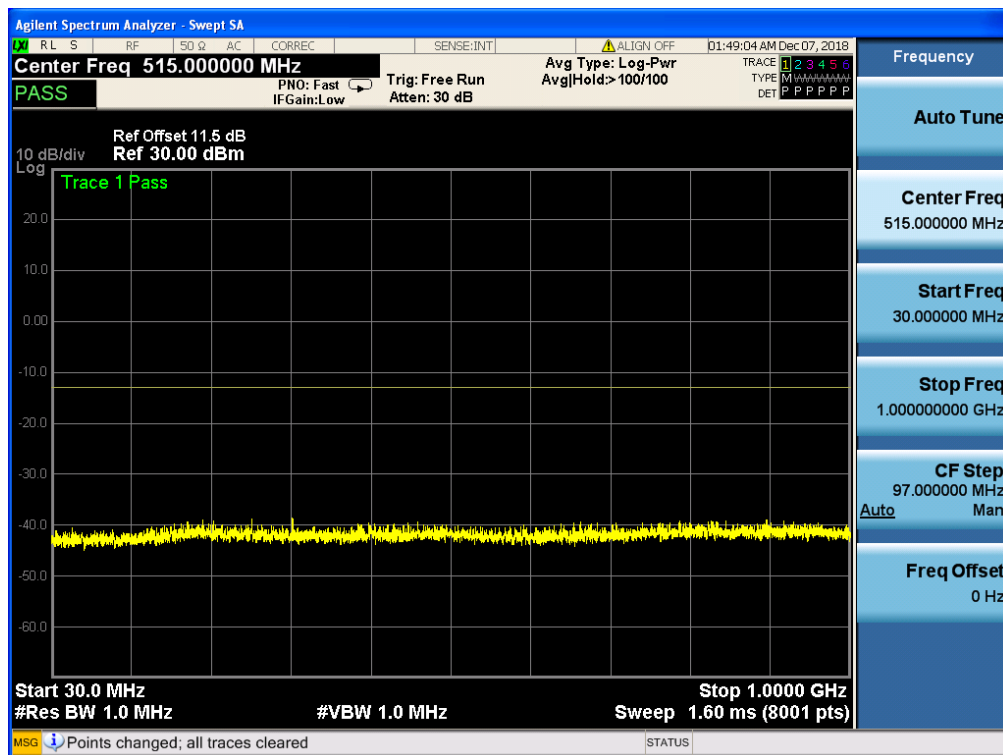
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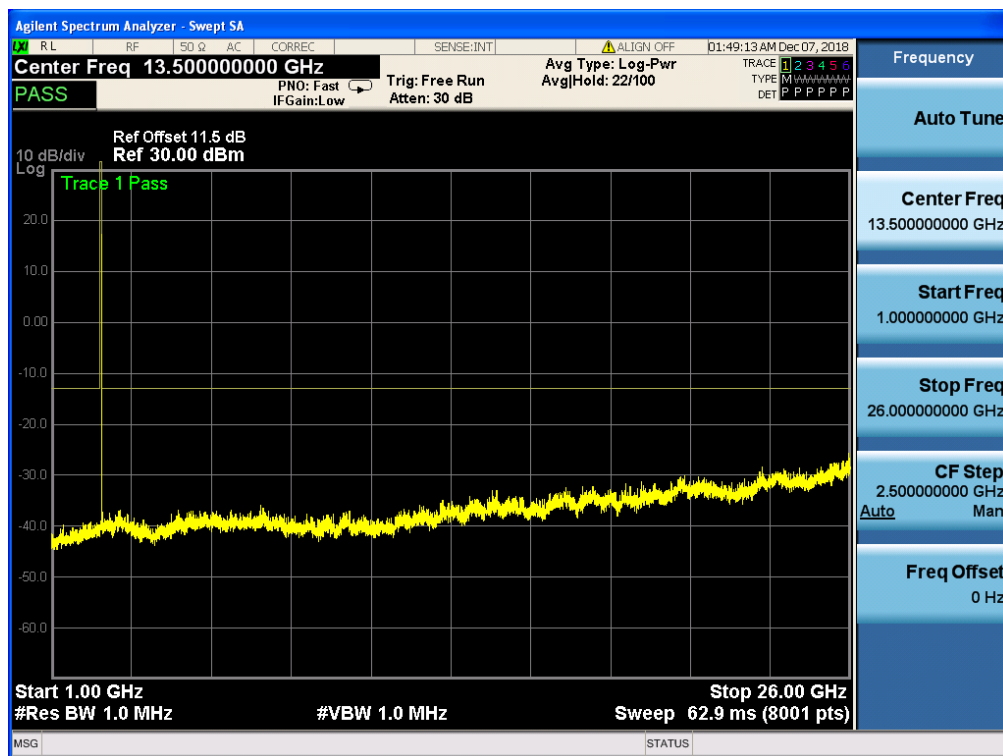
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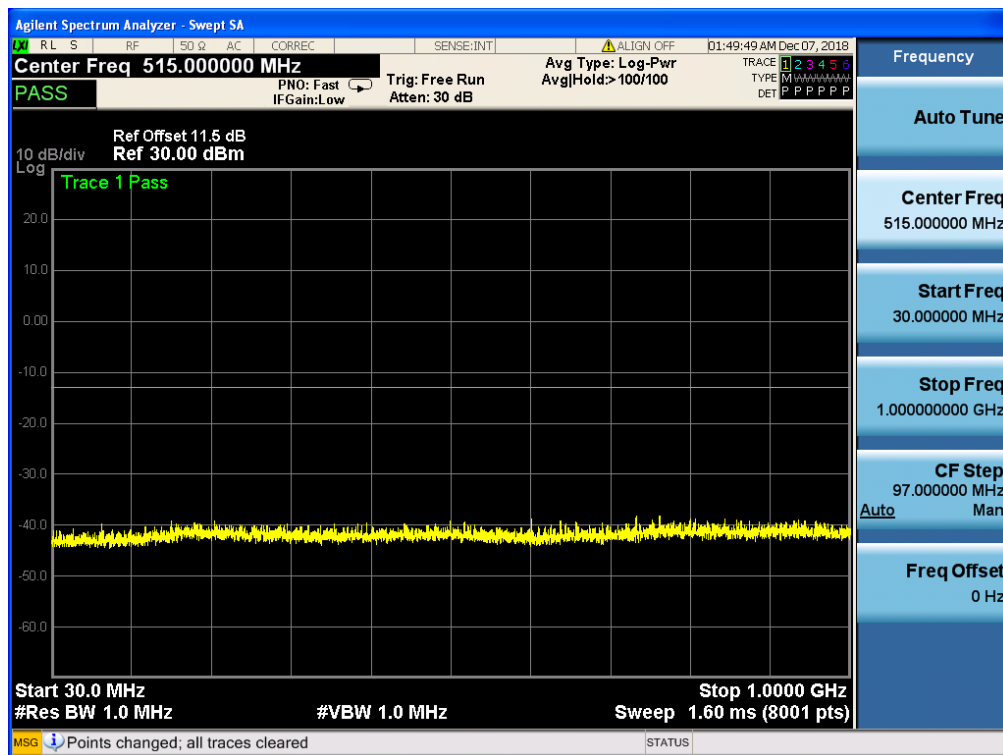
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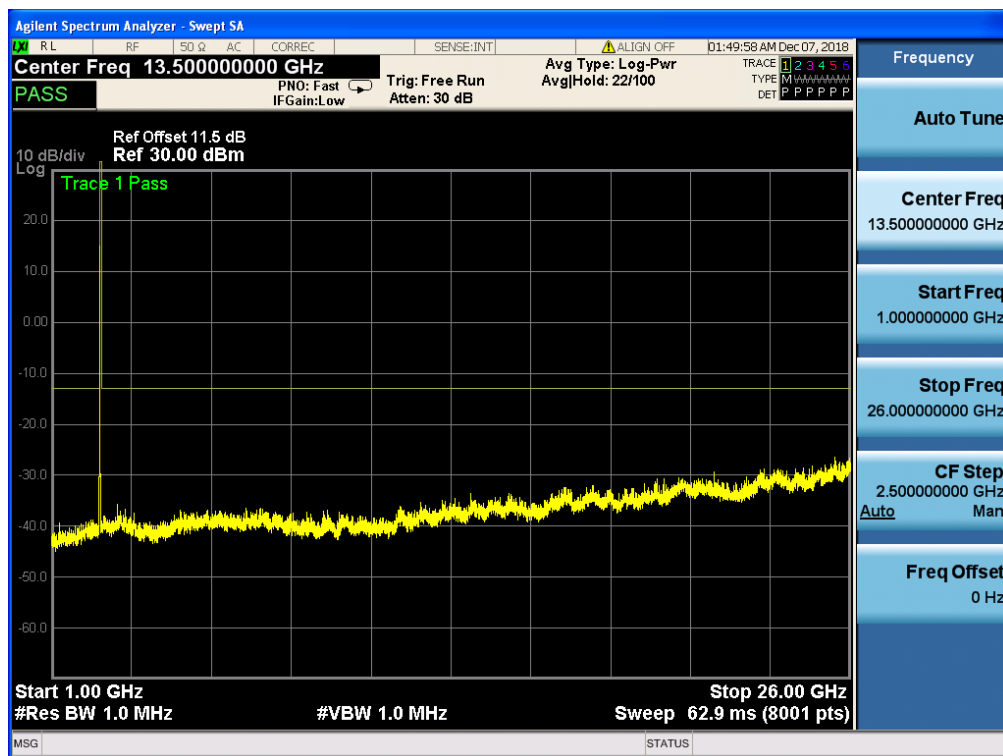
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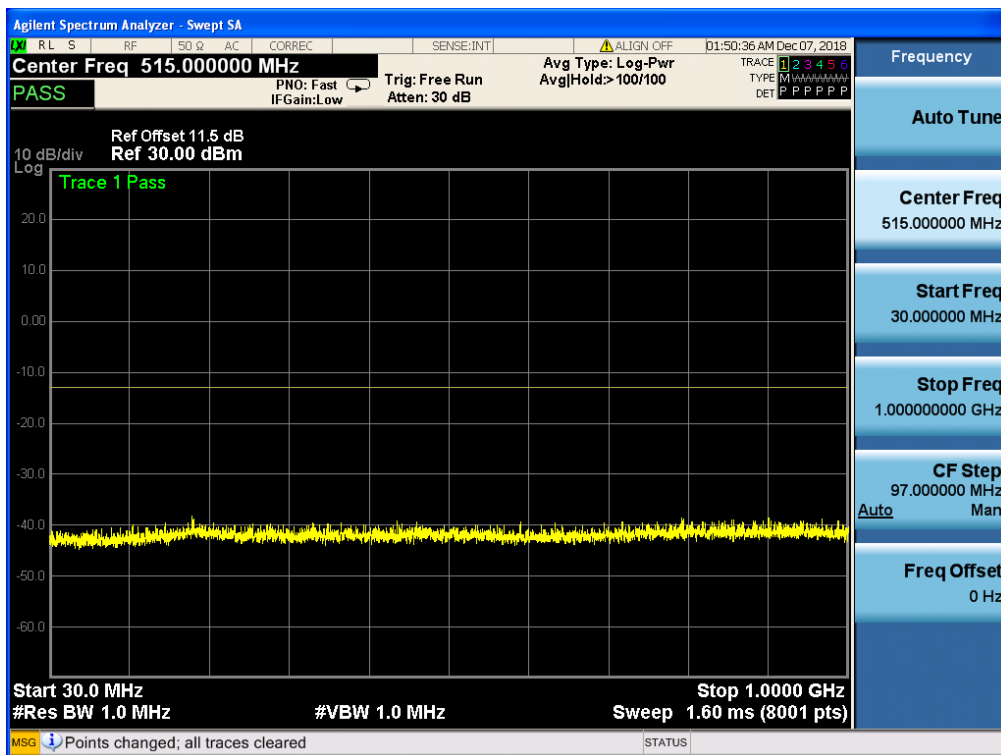
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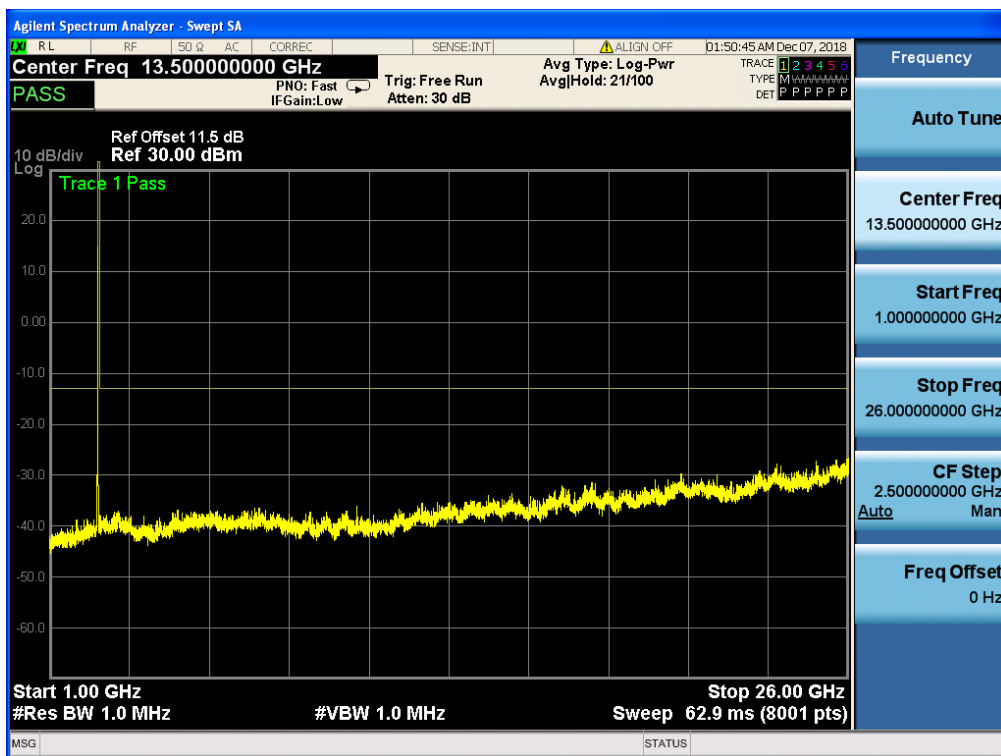
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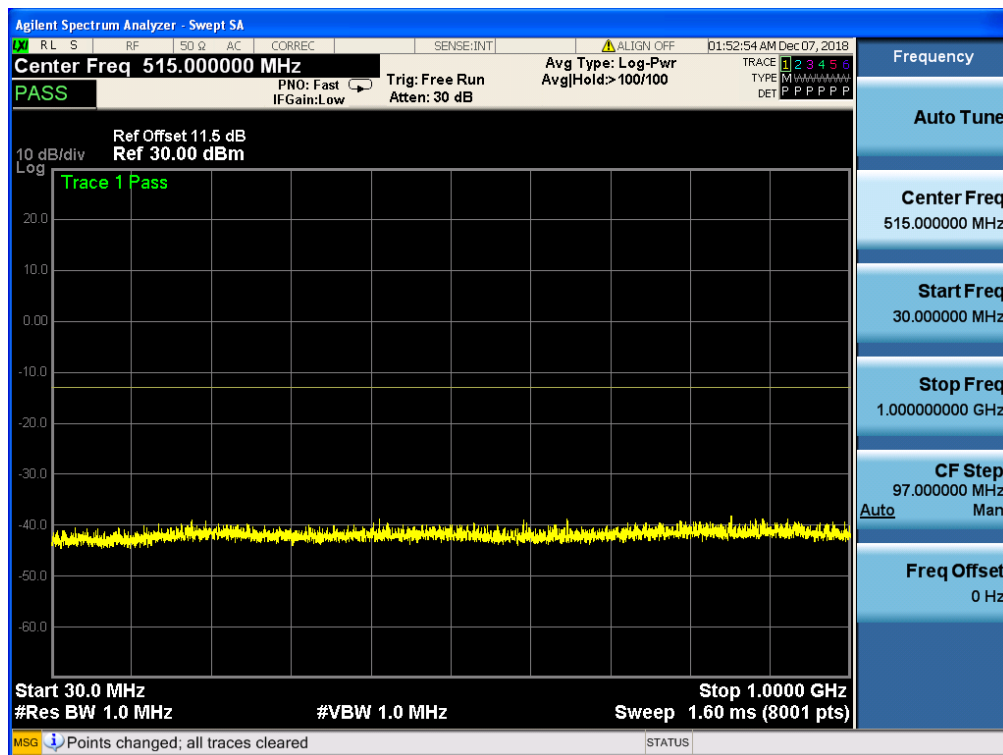
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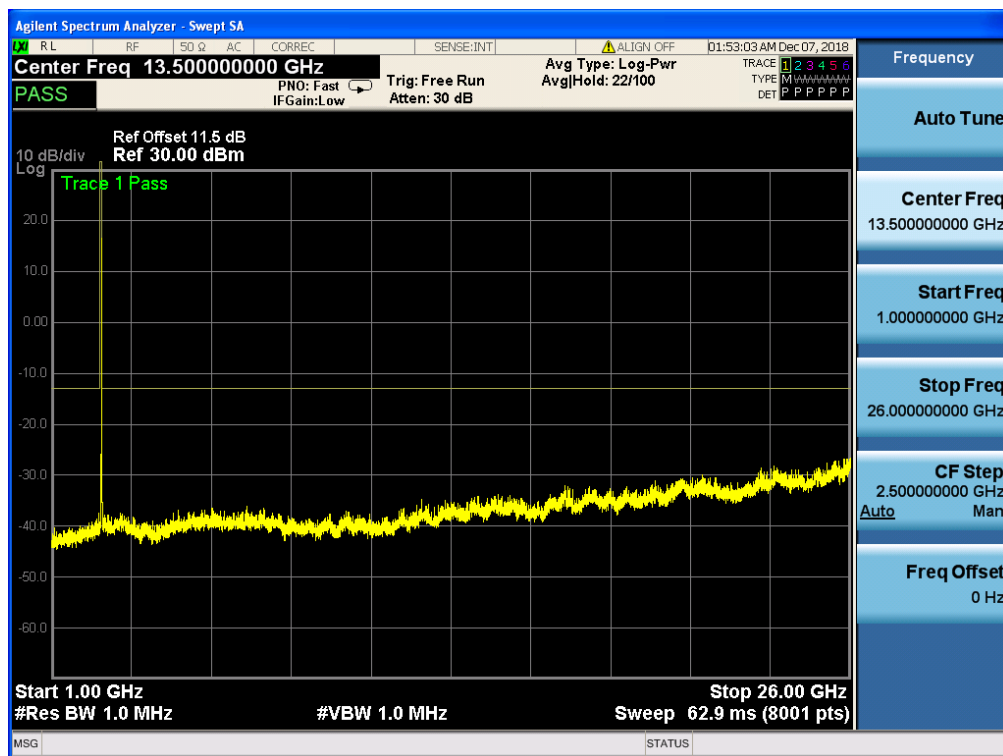
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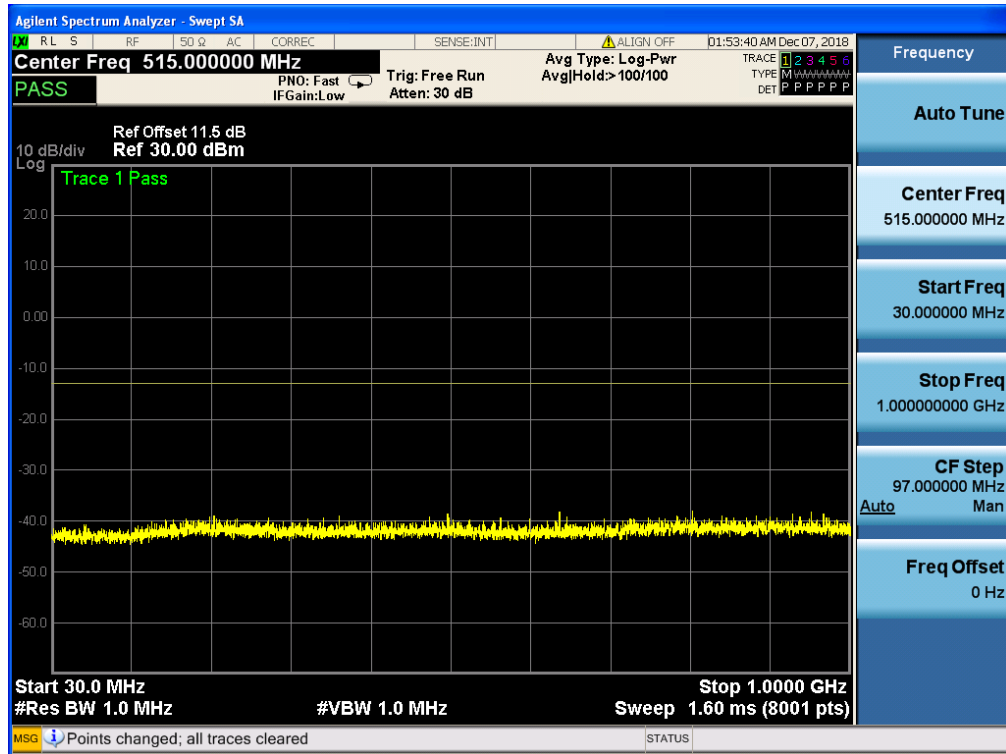
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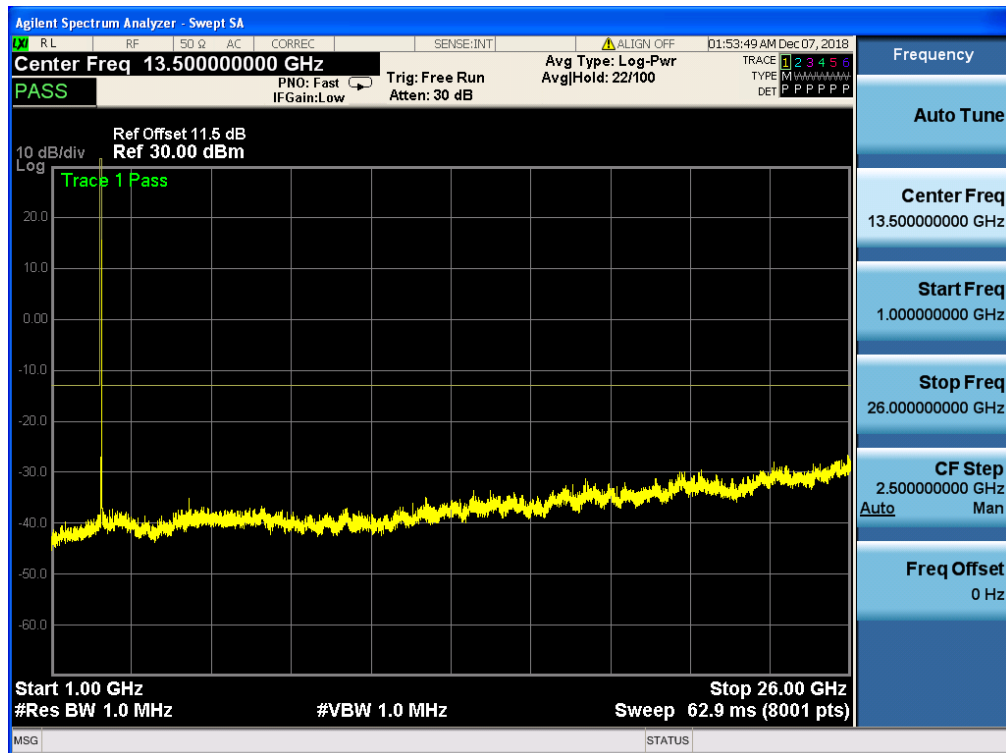
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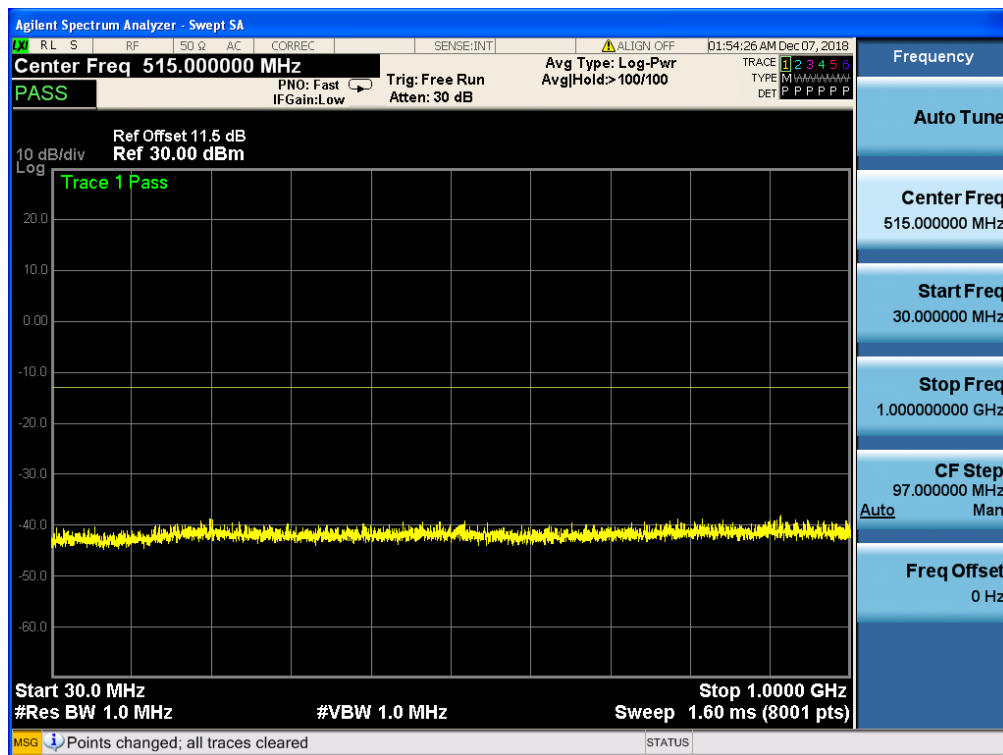
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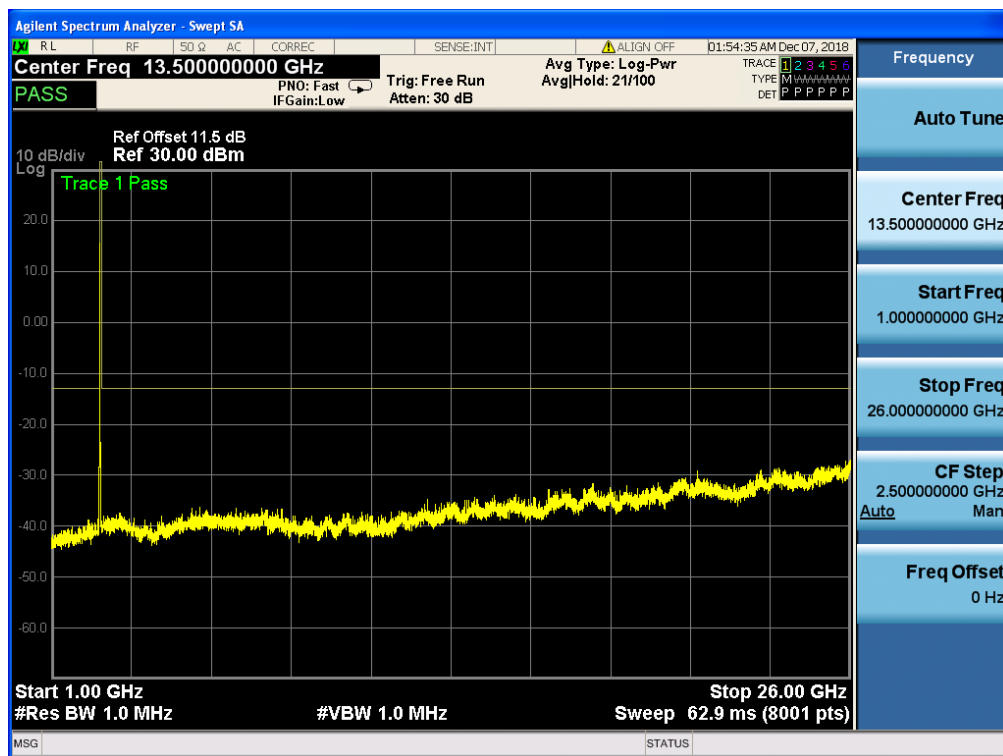
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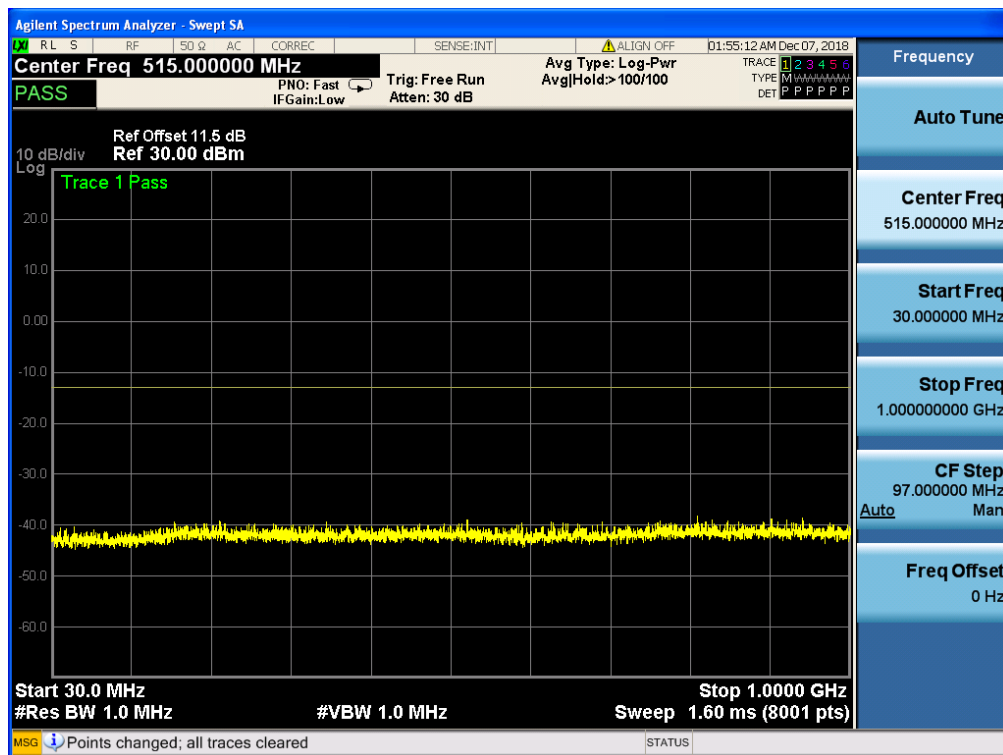
Band 7, UL Channel 20825, UL Frequency 2507.5, BW 15.0, NO. RB 75, RB POS. Low, QPSK



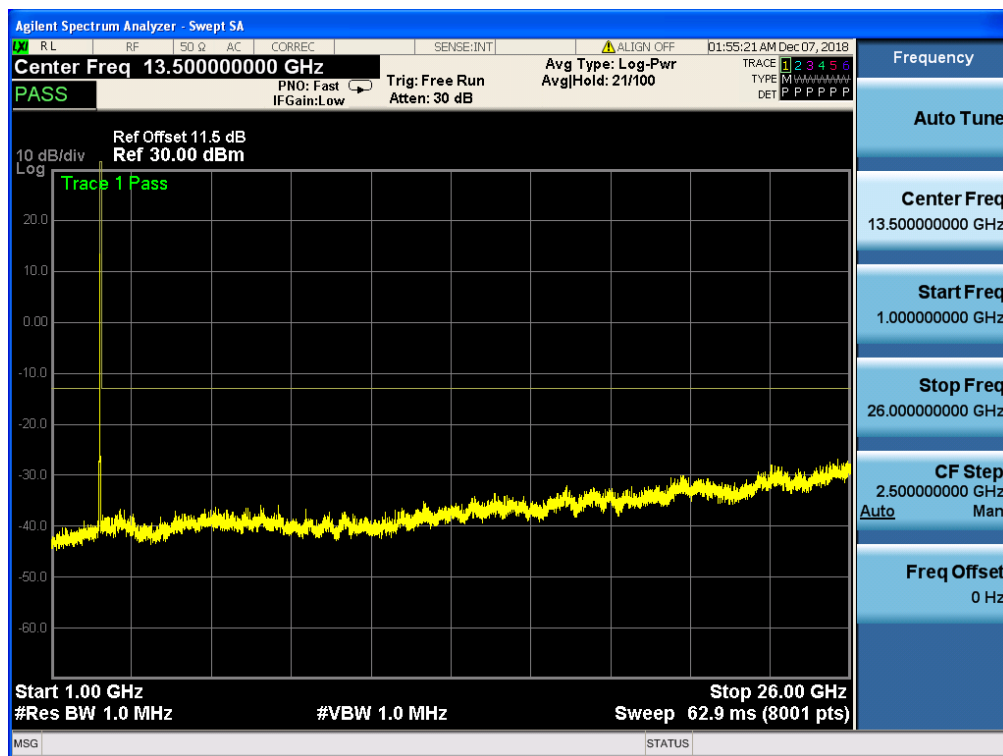
Band 7, UL Channel 20825, UL Frequency 2507.5, BW 15.0, NO. RB 75, RB POS. Low, QPSK



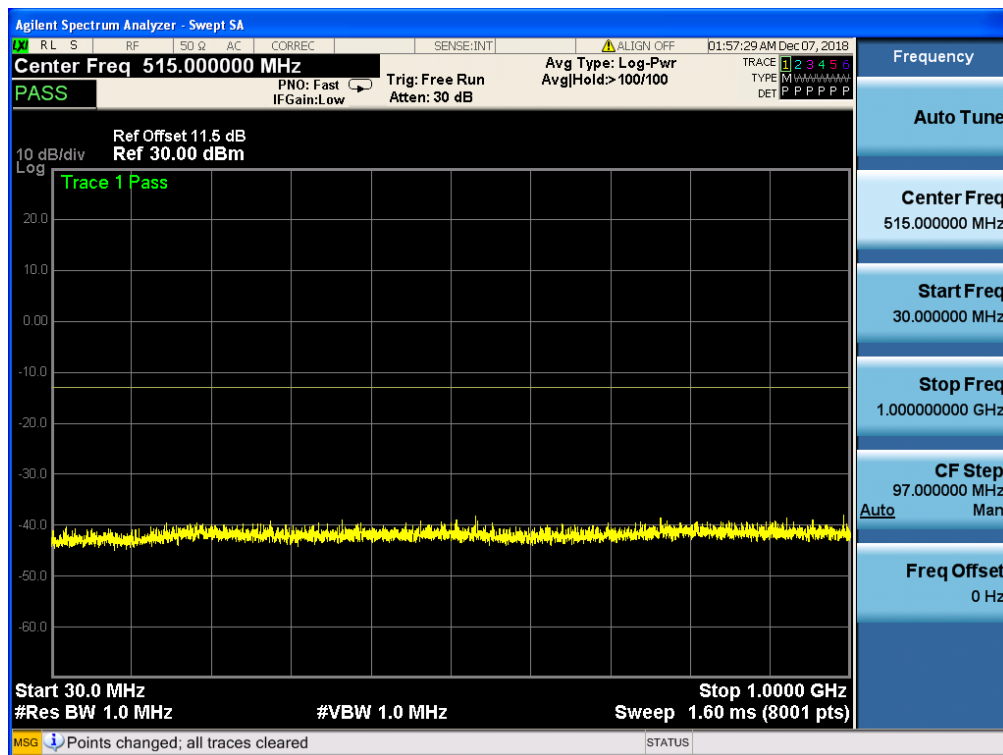
Band 7, UL Channel 20825, UL Frequency 2507.5, BW 15.0, NO. RB 75, RB POS. Low, 16QAM



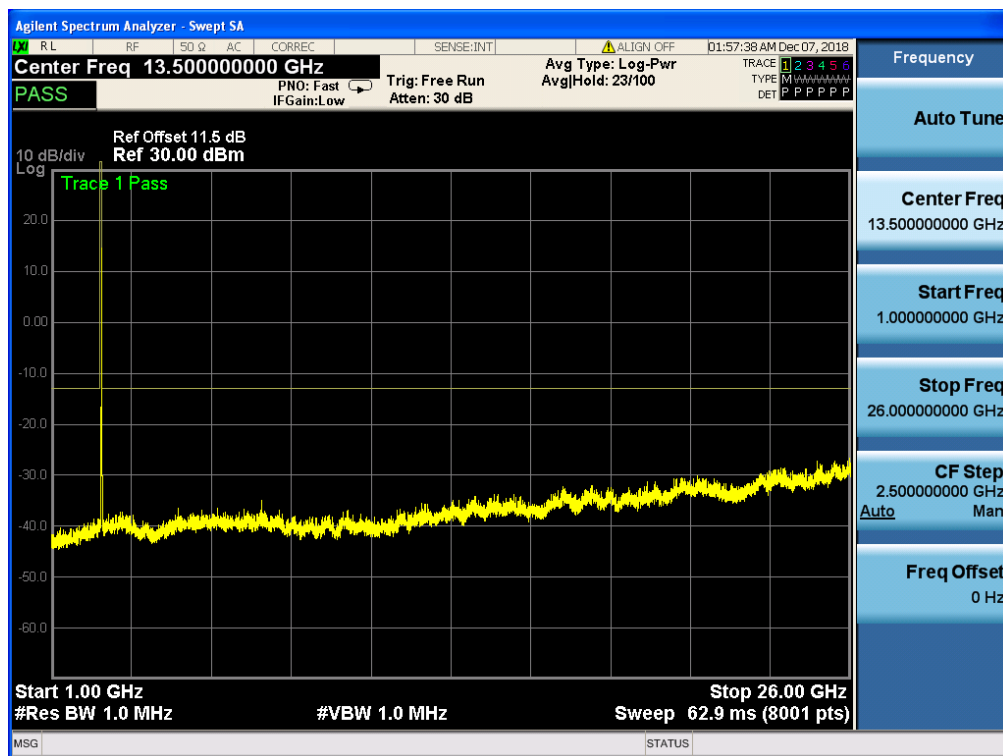
Band 7, UL Channel 20825, UL Frequency 2507.5, BW 15.0, NO. RB 75, RB POS. Low, 16QAM



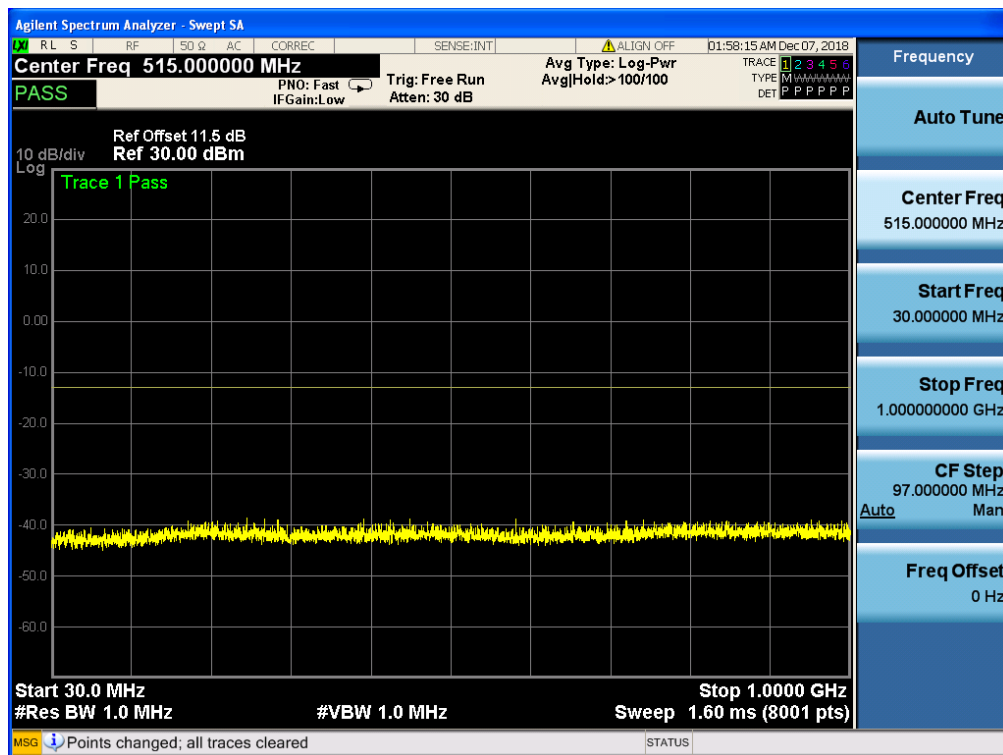
Band 7, UL Channel 21375, UL Frequency 2562.5, BW 15.0, NO. RB 75, RB POS. Low, QPSK



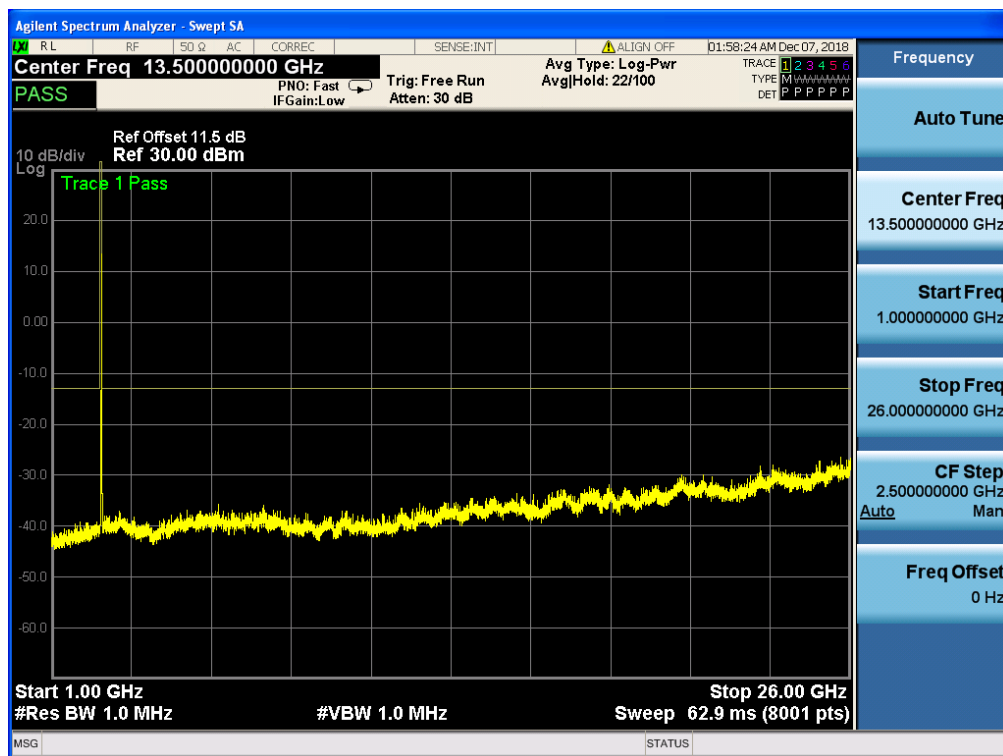
Band 7, UL Channel 21375, UL Frequency 2562.5, BW 15.0, NO. RB 75, RB POS. Low, QPSK



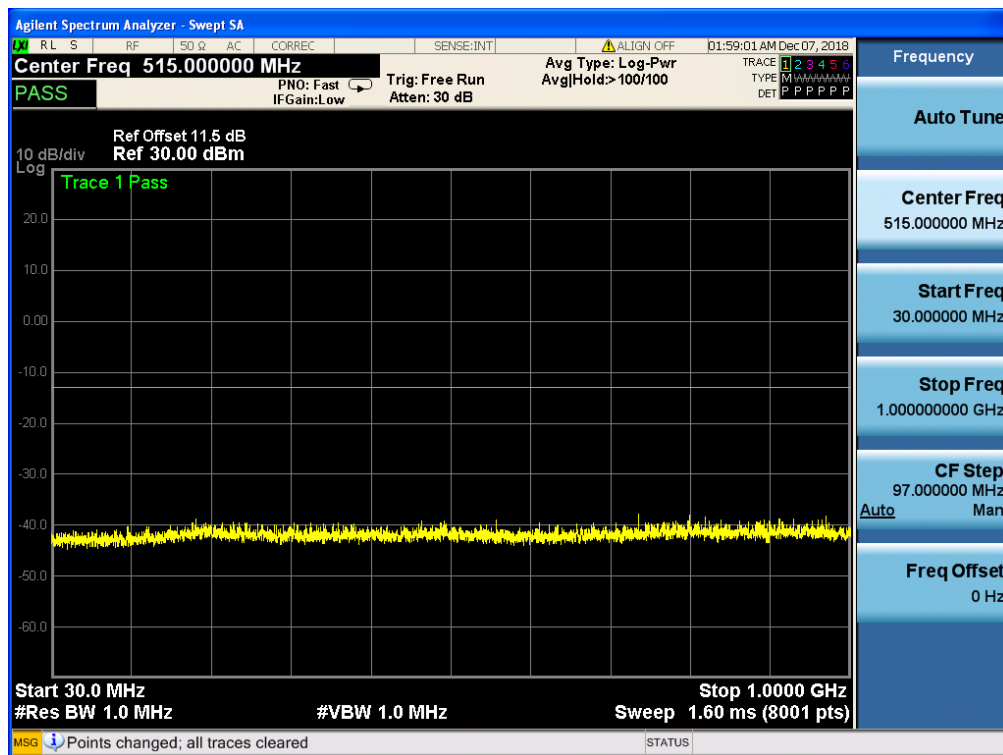
Band 7, UL Channel 21375, UL Frequency 2562.5, BW 15.0, NO. RB 75, RB POS. Low, 16QAM



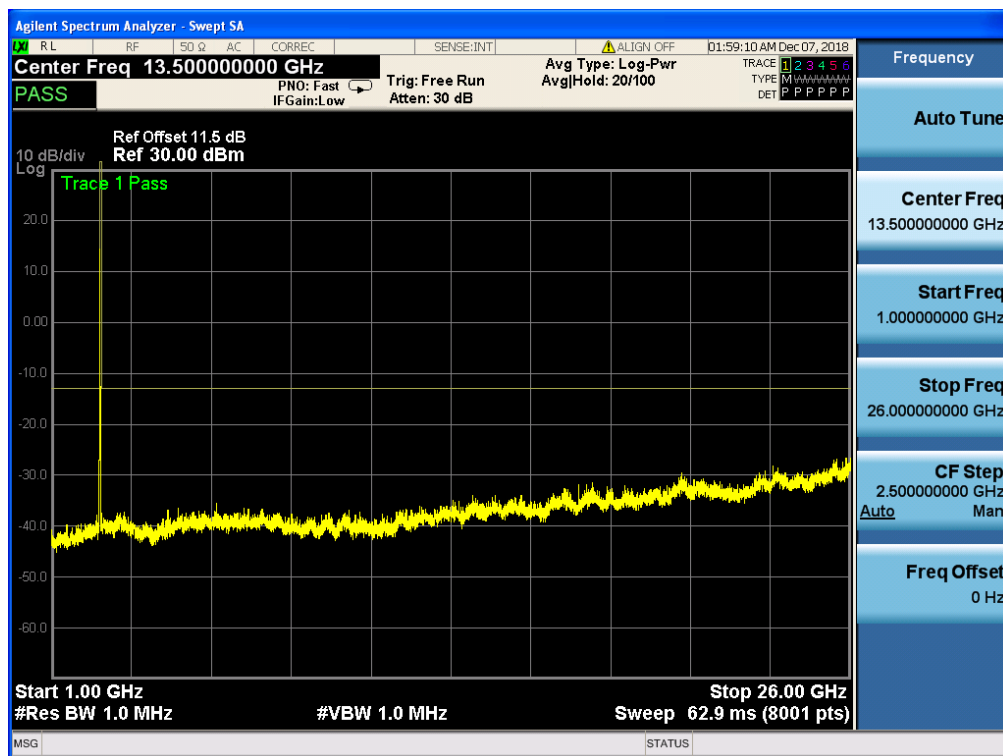
Band 7, UL Channel 21375, UL Frequency 2562.5, BW 15.0, NO. RB 75, RB POS. Low, 16QAM



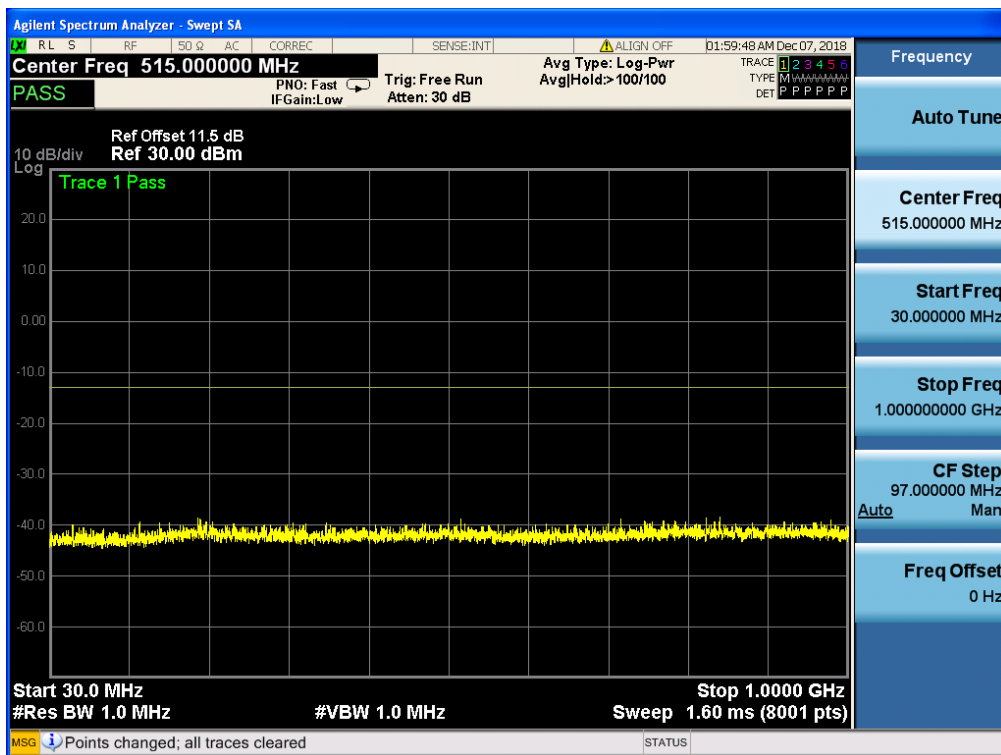
Band 7, UL Channel 20850, UL Frequency 2510.0, BW 20.0, NO. RB 100, RB POS. Low, QPSK



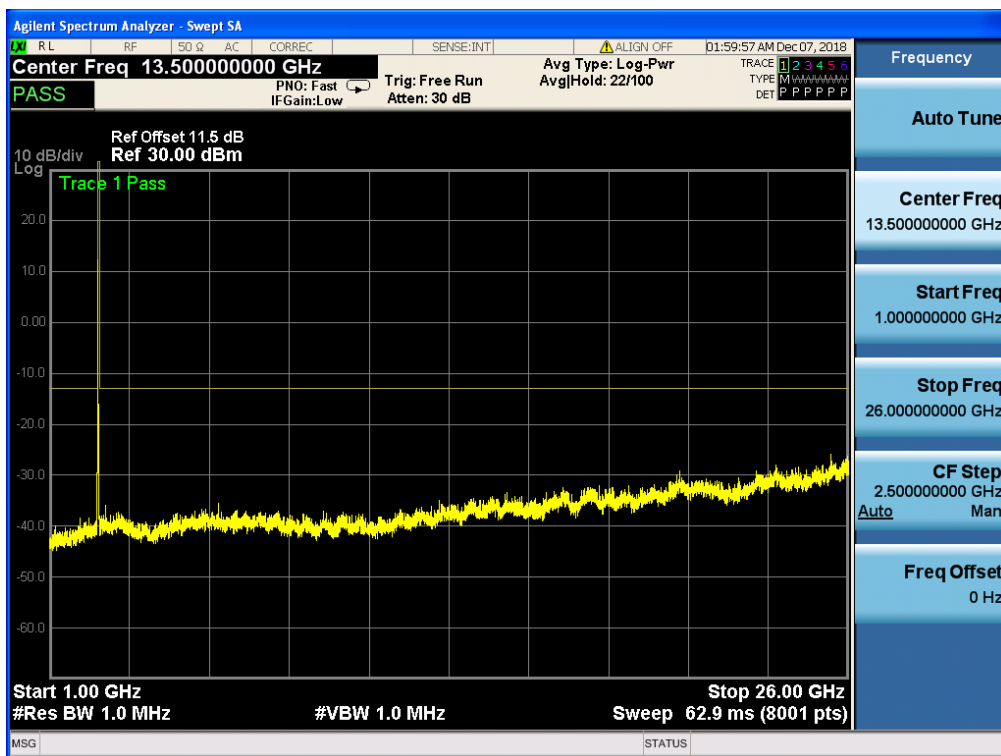
Band 7, UL Channel 20850, UL Frequency 2510.0, BW 20.0, NO. RB 100, RB POS. Low, QPSK



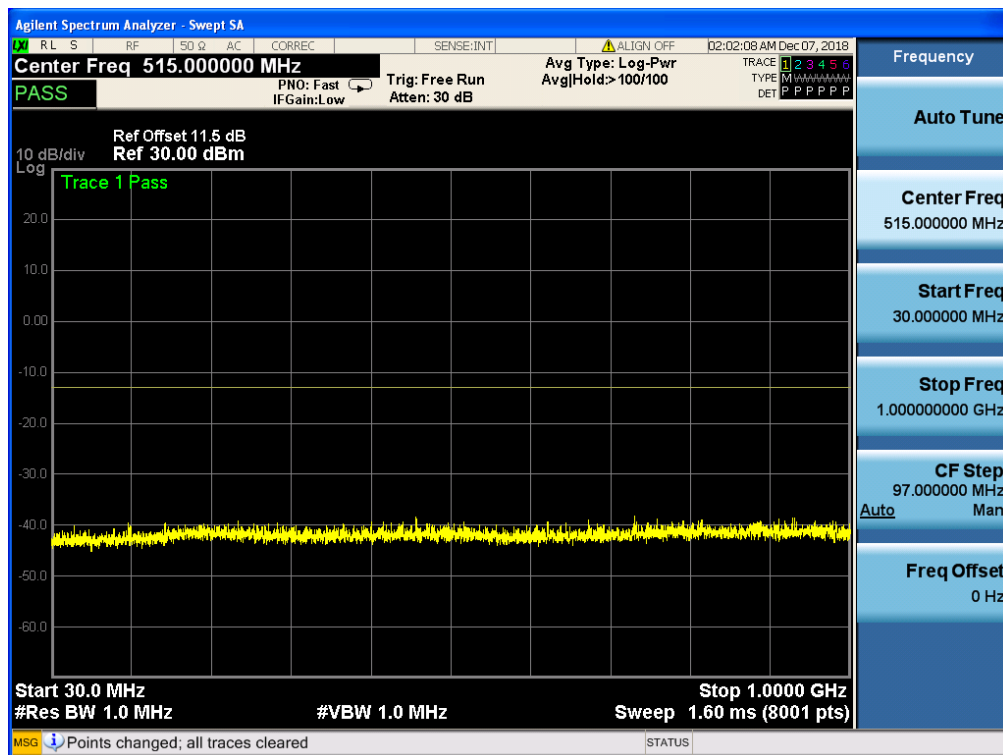
Band 7, UL Channel 20850, UL Frequency 2510.0, BW 20.0, NO. RB 100, RB POS. Low, 16QAM



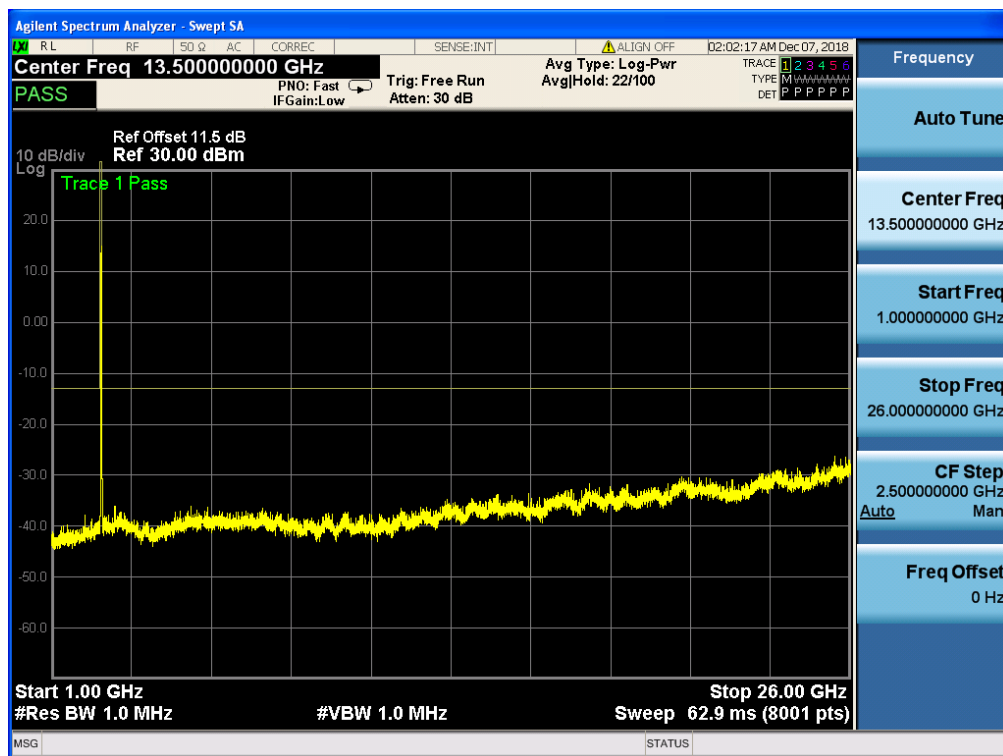
Band 7, UL Channel 20850, UL Frequency 2510.0, BW 20.0, NO. RB 100, RB POS. Low, 16QAM



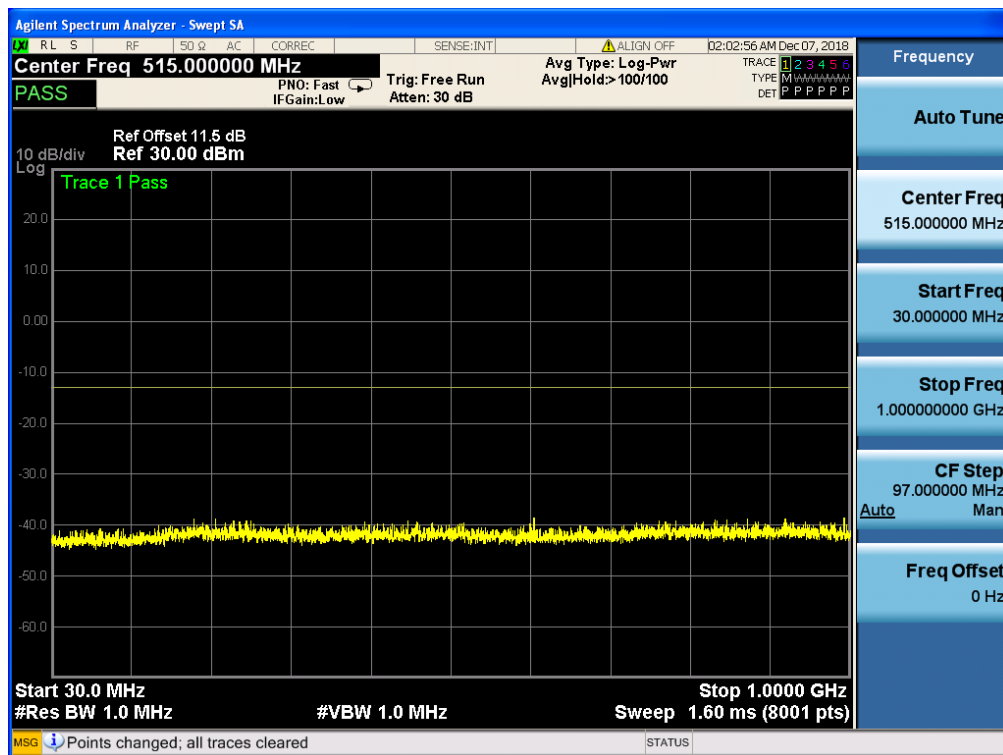
Band 7, UL Channel 21350, UL Frequency 2560.0, BW 20.0, NO. RB 100, RB POS. Low, QPSK



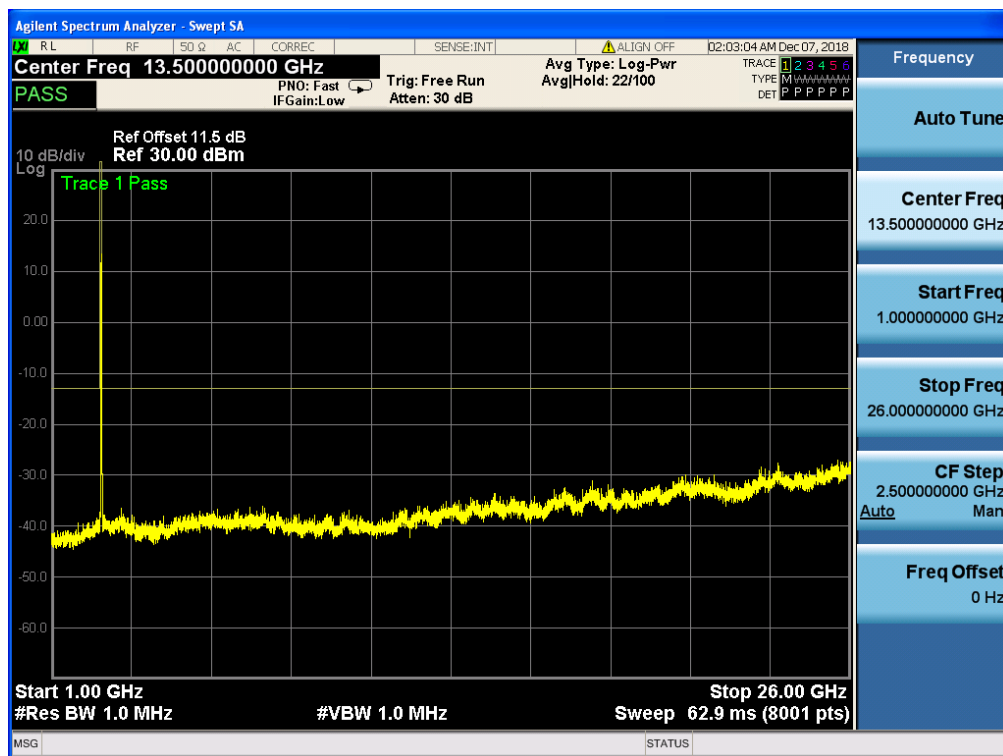
Band 7, UL Channel 21350, UL Frequency 2560.0, BW 20.0, NO. RB 100, RB POS. Low, QPSK



Band 7, UL Channel 21350, UL Frequency 2560.0, BW 20.0, NO. RB 100, RB POS. Low, 16QAM



Band 7, UL Channel 21350, UL Frequency 2560.0, BW 20.0, NO. RB 100, RB POS. Low, 16QAM



8. RADIATED MEASUREMENT

8.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §27.50

LIMITS:

27.50 (c) (10) the following power and antenna height requirements apply to stations transmitting in the 698–746 MHz band, the portable stations (hand-held devices) are limited to 3 watts ERP.

27.50 (b)(10) Portable stations (hand-held devices) transmitting in the 746–757 MHz, 758–763 MHz, 776–793 MHz, and 805–806 MHz bands are limited to 3 watts ERP.

27.50 (d)(4) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands: Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP.

TEST PROCEDURE

ANSI/TIA-603-E Clause 2.2.17

KDB 971168 v02r01 RF power output using broadband peak and average power meter method.

KDB 971168 D01 Power Meas License Digital Systems v02r01, "Measurement Guidance for Certification of Licensed Digital Transmitters"

MODES TESTED

☒ LTE Band 4

☐ LTE Band7

RESULTS

PASS

8.2 LTE BAND 4

Radiated Power (EIRP) for Band 4									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	6/0	1710.7	-2.98	3.12	27.58	21.48	140.605	Horizontal	Pass
		1732.5	-2.93	3.27	27.61	21.41	138.357	Horizontal	Pass
		1754.3	-2.79	3.29	27.63	21.55	142.889	Horizontal	Pass
1.4MHz Band 16 QAM	6/0	1710.7	-3.77	3.12	27.58	20.69	117.220	Horizontal	Pass
		1732.5	-3.77	3.27	27.61	20.57	114.025	Horizontal	Pass
		1754.3	-3.90	3.29	27.63	20.44	110.662	Horizontal	Pass
3.0MHz Band QPSK	15/0	1711.5	-3.14	3.13	27.61	21.34	136.144	Horizontal	Pass
		1732.5	-3.07	3.27	27.61	21.27	133.968	Horizontal	Pass
		1753.5	-2.90	3.30	27.62	21.42	138.676	Horizontal	Pass
3.0MHz Band 16 QAM	15/0	1711.5	-4.26	3.13	27.61	20.22	105.196	Horizontal	Pass
		1732.5	-4.15	3.27	27.61	20.19	104.472	Horizontal	Pass
		1753.5	-3.98	3.30	27.62	20.34	108.143	Horizontal	Pass
5.0MHz Band QPSK	25/0	1712.5	-3.44	3.13	27.63	21.06	127.644	Horizontal	Pass
		1732.5	-3.49	3.27	27.61	20.85	121.619	Horizontal	Pass
		1752.5	-3.17	3.30	27.60	21.13	129.718	Horizontal	Pass
5.0MHz Band 16 QAM	25/0	1712.5	-4.36	3.13	27.63	20.14	103.276	Horizontal	Pass
		1732.5	-4.02	3.27	27.61	20.32	107.647	Horizontal	Pass
		1752.5	-4.04	3.30	27.60	20.26	106.170	Horizontal	Pass
10.0MHz Band QPSK	50/0	1715	-3.70	3.15	27.64	20.79	119.950	Horizontal	Pass
		1732.5	-3.44	3.31	27.61	20.86	121.899	Horizontal	Pass
		1750	-3.35	3.33	27.59	20.91	123.310	Horizontal	Pass
10.0MHz Band 16 QAM	50/0	1715	-2.55	3.15	27.64	21.94	156.315	Horizontal	Pass
		1732.5	-2.42	3.31	27.61	21.88	154.170	Horizontal	Pass
		1750	-2.47	3.33	27.59	21.79	151.008	Horizontal	Pass
15.0MHz Band QPSK	75/0	1717.5	-3.68	3.15	27.65	20.82	120.781	Horizontal	Pass
		1732.5	-3.53	3.31	27.61	20.77	119.399	Horizontal	Pass
		1747.5	-3.38	3.33	27.57	20.86	121.899	Horizontal	Pass
15.0MHz Band 16 QAM	75/0	1717.5	-4.54	3.15	27.65	19.96	99.083	Horizontal	Pass
		1732.5	-4.31	3.31	27.61	19.99	99.770	Horizontal	Pass
		1747.5	-4.41	3.33	27.57	19.83	96.161	Horizontal	Pass

20.0MH z Band QPSK	100/0	1720	-3.97	3.17	27.66	20.52	112.720	Horizontal	Pass
		1732.5	-3.88	3.32	27.61	20.41	109.901	Horizontal	Pass
		1745	-3.83	3.36	27.56	20.37	108.893	Horizontal	Pass
20.0MH z Band 16 QAM	100/0	1720	-4.82	3.17	27.66	19.67	92.683	Horizontal	Pass
		1732.5	-4.61	3.32	27.61	19.68	92.897	Horizontal	Pass
		1745	-4.54	3.36	27.56	19.66	92.470	Horizontal	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

Radiated Power (EIRP) for Band 4									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	6/0	1710.7	-1.88	3.12	27.58	22.58	181.134	Vertical	Pass
		1732.5	-1.73	3.27	27.61	22.61	182.390	Vertical	Pass
		1754.3	-1.87	3.29	27.63	22.47	176.604	Vertical	Pass
1.4MHz Band 16 QAM	6/0	1710.7	-2.79	3.12	27.58	21.67	146.893	Vertical	Pass
		1732.5	-2.50	3.27	27.61	21.84	152.757	Vertical	Pass
		1754.3	-2.63	3.29	27.63	21.71	148.252	Vertical	Pass
3.0MHz Band QPSK	15/0	1711.5	-2.14	3.13	27.61	22.34	171.396	Vertical	Pass
		1732.5	-2.16	3.27	27.61	22.18	165.196	Vertical	Pass
		1753.5	-2.07	3.30	27.62	22.25	167.880	Vertical	Pass
3.0MHz Band 16 QAM	15/0	1711.5	-3.31	3.13	27.61	21.17	130.918	Vertical	Pass
		1732.5	-3.10	3.27	27.61	21.24	133.045	Vertical	Pass
		1753.5	-2.97	3.30	27.62	21.35	136.458	Vertical	Pass
5.0MHz Band QPSK	25/0	1712.5	-2.43	3.13	27.63	22.07	161.065	Vertical	Pass
		1732.5	-2.15	3.27	27.61	22.19	165.577	Vertical	Pass
		1752.5	-2.33	3.30	27.60	21.97	157.398	Vertical	Pass
5.0MHz Band 16 QAM	25/0	1712.5	-3.35	3.13	27.63	21.15	130.317	Vertical	Pass
		1732.5	-3.25	3.27	27.61	21.09	128.529	Vertical	Pass
		1752.5	-3.26	3.30	27.60	21.04	127.057	Vertical	Pass
10.0MHz Band QPSK	50/0	1715	-2.64	3.15	27.64	21.85	153.109	Vertical	Pass
		1732.5	-2.39	3.31	27.61	21.91	155.239	Vertical	Pass
		1750	-2.58	3.33	27.59	21.68	147.231	Vertical	Pass
10.0MHz Band 16 QAM	50/0	1715	-3.64	3.15	27.64	20.85	121.619	Vertical	Pass
		1732.5	-3.43	3.31	27.61	20.87	122.180	Vertical	Pass
		1750	-3.47	3.33	27.59	20.79	119.950	Vertical	Pass
15.0MHz Band QPSK	75/0	1717.5	-2.61	3.15	27.65	21.89	154.525	Vertical	Pass
		1732.5	-2.34	3.31	27.61	21.96	157.036	Vertical	Pass
		1747.5	-2.37	3.33	27.57	21.87	153.815	Vertical	Pass
15.0MHz Band 16 QAM	75/0	1717.5	-3.64	3.15	27.65	20.86	121.899	Vertical	Pass
		1732.5	-3.27	3.31	27.61	21.03	126.765	Vertical	Pass
		1747.5	-3.29	3.33	27.57	20.95	124.451	Vertical	Pass
20.0MHz Band	100/0	1720	-2.71	3.17	27.66	21.78	150.661	Vertical	Pass
		1732.5	-2.62	3.32	27.61	21.67	146.893	Vertical	Pass

QPSK		1745	-2.54	3.36	27.56	21.66	146.555	Vertical	Pass
20.0MHz	100/0	1720	-3.90	3.17	27.66	20.59	114.551	Vertical	Pass
z Band		1732.5	-3.60	3.32	27.61	20.69	117.220	Vertical	Pass
16 QAM		1745	-3.39	3.36	27.56	20.81	120.504	Vertical	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

8.3 LTE BAND 7

Radiated Power (EIRP) for Band 7									
Mode	RB/ RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cabl e Loss (dBm)	Antenn a Gain (dB)	Max. EIRP Averag e (dBm)	Max. EIRP Averag e (mW)	Polarizati on Of Max. ERP	
5.0MHz Band QPSK	25/0	2502.5	-2.26	4.54	27.75	20.95	124.451	Horizontal	Pass
		2535	-2.14	4.69	27.72	20.89	122.744	Horizontal	Pass
		2567.5	-2.16	4.71	27.71	20.84	121.339	Horizontal	Pass
5.0MHz Band 16 QAM	25/0	2502.5	-3.10	4.54	27.75	20.11	102.565	Horizontal	Pass
		2535	-2.90	4.69	27.72	20.13	103.039	Horizontal	Pass
		2567.5	-2.91	4.71	27.71	20.09	102.094	Horizontal	Pass
10.0MH z Band QPSK	50/0	2505	-2.37	4.55	27.76	20.84	121.339	Horizontal	Pass
		2535	-2.29	4.69	27.72	20.74	118.577	Horizontal	Pass
		2565	-2.34	4.72	27.70	20.64	115.878	Horizontal	Pass
10.0MH z Band 16 QAM	50/0	2505	-3.29	4.55	27.76	19.92	98.175	Horizontal	Pass
		2535	-3.20	4.69	27.72	19.83	96.161	Horizontal	Pass
		2565	-3.13	4.72	27.70	19.85	96.605	Horizontal	Pass
15.0MH z Band QPSK	75/0	2507.5	-2.48	4.55	27.77	20.74	118.577	Horizontal	Pass
		2535	-2.42	4.69	27.72	20.61	115.080	Horizontal	Pass
		2562.5	-2.38	4.72	27.69	20.59	114.551	Horizontal	Pass
15.0MH z Band 16 QAM	75/0	2507.5	-3.67	4.55	27.77	19.55	90.157	Horizontal	Pass
		2535	-3.39	4.69	27.72	19.64	92.045	Horizontal	Pass
		2562.5	-3.54	4.72	27.69	19.43	87.700	Horizontal	Pass
20.0MH z Band QPSK	100/0	2510	-2.70	4.57	27.78	20.51	112.460	Horizontal	Pass
		2535	-2.46	4.73	27.72	20.53	112.980	Horizontal	Pass
		2560	-2.44	4.75	27.68	20.49	111.944	Horizontal	Pass
20.0MH z Band 16 QAM	100/0	2510	-3.89	4.57	27.78	19.32	85.507	Horizontal	Pass
		2535	-3.73	4.73	27.72	19.26	84.333	Horizontal	Pass
		2560	-3.46	4.75	27.68	19.47	88.512	Horizontal	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

Radiated Power (EIRP) for Band 7									
Mode	RB/ RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cabl e Loss (dBm)	Antenn a Gain (dB)	Max. EIRP Averag e (dBm)	Max. EIRP Averag e (mW)	Polarizati on Of Max. ERP	
5.0MHz Band QPSK	25/0	2502.5	-1.96	4.54	27.75	21.25	133.352	Vertical	Pass
		2535	-1.70	4.69	27.72	21.33	135.831	Vertical	Pass
		2567.5	-1.71	4.71	27.71	21.29	134.586	Vertical	Pass
5.0MHz Band 16 QAM	25/0	2502.5	-2.79	4.54	27.75	20.42	110.154	Vertical	Pass
		2535	-2.84	4.69	27.72	20.19	104.472	Vertical	Pass
		2567.5	-2.63	4.71	27.71	20.37	108.893	Vertical	Pass
10.0MH z Band QPSK	50/0	2505	-2.02	4.55	27.76	21.19	131.522	Vertical	Pass
		2535	-1.99	4.69	27.72	21.04	127.057	Vertical	Pass
		2565	-1.87	4.72	27.70	21.11	129.122	Vertical	Pass
10.0MH z Band 16 QAM	50/0	2505	-2.85	4.55	27.76	20.36	108.643	Vertical	Pass
		2535	-2.74	4.69	27.72	20.29	106.905	Vertical	Pass
		2565	-2.61	4.72	27.70	20.37	108.893	Vertical	Pass
15.0MH z Band QPSK	75/0	2507.5	-2.21	4.55	27.77	21.01	126.183	Vertical	Pass
		2535	-1.99	4.69	27.72	21.04	127.057	Vertical	Pass
		2562.5	-1.91	4.72	27.69	21.06	127.644	Vertical	Pass
15.0MH z Band 16 QAM	75/0	2507.5	-3.11	4.55	27.77	20.11	102.565	Vertical	Pass
		2535	-2.86	4.69	27.72	20.17	103.992	Vertical	Pass
		2562.5	-2.84	4.72	27.69	20.13	103.039	Vertical	Pass
20.0MH z Band QPSK	100/ 0	2510	-2.34	4.57	27.78	20.87	122.180	Vertical	Pass
		2535	-2.32	4.73	27.72	20.67	116.681	Vertical	Pass
		2560	-2.11	4.75	27.68	20.82	120.781	Vertical	Pass
20.0MH z Band 16 QAM	100/ 0	2510	-3.25	4.57	27.78	19.96	99.083	Vertical	Pass
		2535	-3.25	4.73	27.72	19.74	94.189	Vertical	Pass
		2560	-3.05	4.75	27.68	19.88	97.275	Vertical	Pass

Note:

SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

9. SPURIOUS RADIATION EMISSION

RULE PART(S)

FCC: §2.1053, §22.917, §24.238 and §27.53

LIMIT

§22.917 (e) and §24.238 (a): Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

§27.53 (g) For operations in the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB.

§27.53 (h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

The unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth in the 1 MHz band immediately outside and adjacent to the channel edge of the equipment. Beyond the 1 MHz band immediately outside the channel edge of the equipment, a resolution bandwidth of 1 MHz shall be employed. A narrower resolution bandwidth is allowed to be used provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz or 1% of the occupied bandwidth as applicable.

The power of any unwanted emissions measured from the channel edge of the equipment shall be attenuated below the transmitter power, P (dBW), as follows:

- a. for base station and subscriber equipment, other than mobile subscriber equipment, the attenuation shall not be less than $43 + 10 \log_{10}(p)$, dB; and
- b. for mobile subscriber equipment, the attenuation shall not be less than $43 + 10 \log_{10}(p)$, dB at the channel edges and $55 + 10 \log_{10}(p)$ at 5.5 MHz away and beyond the channel edges where p in (a) and (b) is the transmitter power measured in watts.

MODES TESTED

- ☒ LTE Band 4
- ☐ LTE Band7

RESULTS

PASS

9.1 LTE BAND 4

QPSK EIRP POWER FOR LTE BAND 4 (1.4.0MHZ BANDWIDTH)

Test Results for Low Channel 1710.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
3421.4	-52.98	4.02	29.80	-27.20	-13	-14.20	Horizontal
3421.4	-52.41	4.02	29.80	-26.63	-13	-13.63	Vertical
5132.1	-58.96	5.24	35.84	-28.36	-13	-15.36	Vertical
5132.1	-55.62	5.24	35.84	-25.02	-13	-12.02	Horizontal
Test Results for Mid Channel 1732.5MHz							
3465.0	-53.42	4.03	30.00	-27.45	-13	-14.45	Horizontal
3465.0	-52.98	4.03	30.00	-27.01	-13	-14.01	Vertical
5197.5	-57.96	5.25	35.86	-27.35	-13	-14.35	Vertical
5197.5	-56.32	5.25	35.86	-25.71	-13	-12.71	Horizontal
Test Results for High Channel 1754.3MHz							
3508.6	-53.12	4.05	30.01	-27.16	-13	-14.16	Horizontal
3508.6	-54.18	4.05	30.01	-28.22	-13	-15.22	Vertical
5262.9	-54.49	5.26	35.86	-23.89	-13	-10.89	Vertical
5262.9	-53.62	5.26	35.86	-23.02	-13	-10.02	Horizontal

QPSK EIRP POWER FOR LTE BAND 4 (20.0MHZ BANDWIDTH)

Test Results for Low Channel 1720MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
3440.0	-54.48	4.02	29.80	-28.70	-13	-15.70	Horizontal
3440.0	-52.95	4.02	29.80	-27.17	-13	-14.17	Vertical
5160.0	-58.65	5.24	35.84	-28.05	-13	-15.05	Vertical
5160.0	-56.85	5.24	35.84	-26.25	-13	-13.25	Horizontal
Test Results for Mid Channel 1732.5MHz							
3465.0	-51.62	4.03	30.00	-25.65	-13	-12.65	Horizontal
3465.0	-53.62	4.03	30.00	-27.65	-13	-14.65	Vertical
5197.5	-55.94	5.25	35.86	-25.33	-13	-12.33	Vertical
5197.5	-53.74	5.25	35.86	-23.13	-13	-10.13	Horizontal
Test Results for High Channel 1745MHz							
2490.0	-53.62	2.91	27.68	-28.85	-13	-15.85	Horizontal
3490.0	-52.64	2.91	27.68	-27.87	-13	-14.87	Vertical
5235.0	-55.58	5.26	35.86	-24.98	-13	-11.98	Vertical
5235.0	-54.41	5.26	35.86	-23.81	-13	-10.81	Horizontal

Note: $P_{Mea}(dBm) = Power(dBm) + ARpl(dBm)$

Over Limit = $P_{Mea}(dBm) - Limit(dBm)$

We test both H direction and V direction, recorded worst case direction.

9.2 LTE BAND 7

QPSK EIRP POWER FOR LTE BAND 7 (5.0MHZ BANDWIDTH)

Test Results for Low Channel 2502.5MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
5005.0	-55.49	5.23	35.81	-24.91	-13	-11.91	Horizontal
5005.0	-52.61	5.23	35.81	-22.03	-13	-9.03	Vertical
7507.5	-55.49	5.67	36.85	-24.31	-13	-11.31	Vertical
7507.5	-53.26	5.67	36.85	-22.08	-13	-9.08	Horizontal
Test Results for Mid Channel 2535MHz							
5070.0	-54.18	5.23	35.82	-23.59	-13	-10.59	Horizontal
5070.0	-55.57	5.23	35.82	-24.98	-13	-11.98	Vertical
7605.0	-56.96	5.67	36.85	-25.78	-13	-12.78	Vertical
7605.0	-57.82	5.67	36.85	-26.64	-13	-13.64	Horizontal
Test Results for High Channel 2567.5MHz							
5135.0	-55.26	5.24	35.83	-24.67	-13	-11.67	Horizontal
5135.0	-54.18	5.24	35.83	-23.59	-13	-10.59	Vertical
7702.5	-55.23	5.68	36.87	-24.04	-13	-11.04	Vertical
7702.5	-57.82	5.68	36.87	-26.63	-13	-13.63	Horizontal

QPSK EIRP POWER FOR LTE BAND 7 (20.0MHZ BANDWIDTH)

Test Results for Low Channel 2510MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit (dBm)	Margin(dBm)	Polarity
5020	-58.95	5.23	35.82	-28.36	-13	-15.36	Horizontal
5020	-53.62	5.23	35.82	-23.03	-13	-10.03	Vertical
7530	-52.17	5.67	36.86	-20.98	-13	-7.98	Vertical
7530	-54.96	5.67	36.86	-23.77	-13	-10.77	Horizontal
Test Results for Mid Channel 2535MHz							
5070	-53.28	5.23	35.82	-22.69	-13	-9.69	Horizontal
5070	-55.41	5.23	35.82	-24.82	-13	-11.82	Vertical
7605	-55.26	5.67	36.85	-24.08	-13	-11.08	Vertical
7605	-54.63	5.67	36.85	-23.45	-13	-10.45	Horizontal
Test Results for High Channel 2560MHz							
5120	-57.29	5.24	35.83	-26.70	-13	-13.70	Horizontal
5120	-52.21	5.24	35.83	-21.62	-13	-8.62	Vertical
7680	-56.92	5.7	36.88	-25.74	-13	-12.74	Vertical
7680	-56.63	5.7	36.88	-25.45	-13	-12.45	Horizontal

Note: $P_{Mea}(dBm) = Power(dBm) + ARpl(dBm)$

Over Limit = $P_{Mea}(dBm) - Limit(dBm)$

We test both H direction and V direction, recorded worst case direction.

10. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, §27.54

LIMITS

§22.355 - The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

§24.235 - The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- ☐ Temp. = -30° to $+50^{\circ}\text{C}$
- ☐ Voltage = low voltage, DC 3.2V, Normal, DC 3.7V and High voltage, DC 4.3V.

Frequency Stability vs Temperature:

The EUT is placed inside a temperature chamber. The temperature is set to -30°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until $+50^{\circ}\text{C}$ is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

MODES TESTED

- LTE Band 4
- ☐ LTE Band 7

RESULTS

See the following pages.

10.1 LTE BAND 4

QPSK, (10MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 4 QPSK, (CH 20175 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
3.2	1732.5	3.3	0.001905	2.5
3.7	1732.5	-7.5	-0.004329	2.5
4.3	1732.5	-4.8	-0.002771	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 4 QPSK, (CH 20175 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	1732.5	3.6	0.002078	2.5
Extreme (50C)	1732.5	2.8	0.001616	2.5
Extreme (40C)	1732.5	4.1	0.002367	2.5
Extreme (30C)	1732.5	-6.6	-0.003810	2.5
Extreme (10C)	1732.5	-5.2	-0.003001	2.5
Extreme (0C)	1732.5	-7.4	-0.004271	2.5
Extreme (-10C)	1732.5	3.1	0.001789	2.5
Extreme (-20C)	1732.5	4.7	0.002713	2.5
Extreme (-30C)	1732.5	5.6	0.003232	2.5

16QAM, (20MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 4 16QAM, (CH 20175 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
3.2	1732.5	3.9	0.002251	2.5
3.7	1732.5	4.7	0.002713	2.5
4.3	1732.5	5.1	0.002944	2.5

Frequency error vs. Temperature

Temperature [°C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 4 16QAM, (CH 20175 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	1732.5	3.6	0.002078	2.5
Extreme (50C)	1732.5	3.3	0.001905	2.5
Extreme (40C)	1732.5	3.9	0.002251	2.5
Extreme (30C)	1732.5	-2.1	-0.001212	2.5
Extreme (10C)	1732.5	-4.9	-0.002828	2.5
Extreme (0C)	1732.5	-3.6	-0.002078	2.5
Extreme (-10C)	1732.5	-4.7	-0.002713	2.5
Extreme (-20C)	1732.5	3.6	0.002078	2.5
Extreme (-30C)	1732.5	5.9	0.003405	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

10.2 LTE BAND 7

QPSK, (20MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 7 QPSK, (CH 21100 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
3.2	2535	-7.6	-0.002998	2.5
3.7	2535	-5.2	-0.002051	2.5
4.3	2535	-4.1	-0.001617	2.5

Frequency error vs. Temperature

Temperature [° C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 7 QPSK, (CH 21100 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	2535	3.6	0.001420	2.5
Extreme (50C)	2535	4.9	0.001933	2.5
Extreme (40C)	2535	3.6	0.001420	2.5
Extreme (30C)	2535	3.9	0.001538	2.5
Extreme (10C)	2535	4.1	0.001617	2.5
Extreme (0C)	2535	4.5	0.001775	2.5
Extreme (-10C)	2535	5.2	0.002051	2.5
Extreme (-20C)	2535	5.8	0.002288	2.5
Extreme (-30C)	2535	5.9	0.002327	2.5

16QAM, (20MHz BANDWIDTH)

Frequency error vs. Voltage

Voltage [Vdc]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 7 16QAM, (CH 21100 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
3.2	2535	-11.4	-0.004497	2.5
3.7	2535	-8.5	-0.003353	2.5
4.3	2535	-10.4	-0.004103	2.5

Frequency error vs. Temperature

Temperature [° C]	Frequency [MHz]	Frequency* Error[Hz]	Frequency Error[ppm]	Limit [ppm]
BAND 7 16QAM, (CH 21100 RB size 100 RB Offset 0 20MHz BANDWIDTH)				
Normal (25C)	2535	-11	-0.004339	2.5
Extreme (50C)	2535	9.6	0.003787	2.5
Extreme (40C)	2535	5.8	0.002288	2.5
Extreme (30C)	2535	6	0.002367	2.5
Extreme (10C)	2535	-12.6	-0.004970	2.5
Extreme (0C)	2535	-9.7	-0.003826	2.5
Extreme (-10C)	2535	-8.6	-0.003393	2.5
Extreme (-20C)	2535	-10.6	-0.004181	2.5
Extreme (-30C)	2535	-10.1	-0.003984	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

11. Peak-to-Average Ratio

11.1 Description of the PAR Measurement

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

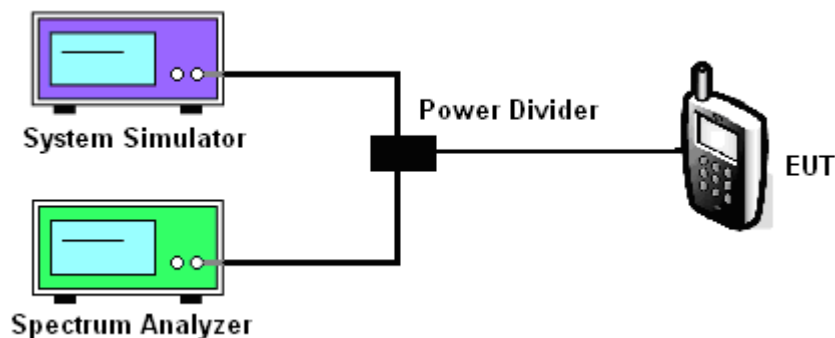
11.2 Measuring Instruments

See list of measuring instruments of this test report.

11.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. For GSM/EGPRS operating modes:
 - a. Set the RBW = 1MHz, VBW = 1MHz, Peak detector in spectrum analyzer.
 - b. Set EUT in maximum power output, and triggered the burst signal.
 - c. Measured respectively the Peak level and Mean level, and the deviation was recorded as Peak to Average Ratio.
4. For UMTS operating modes:
 - a. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
 - b. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.

11.4 Test Setup



MODES TESTED

LTE Band 4

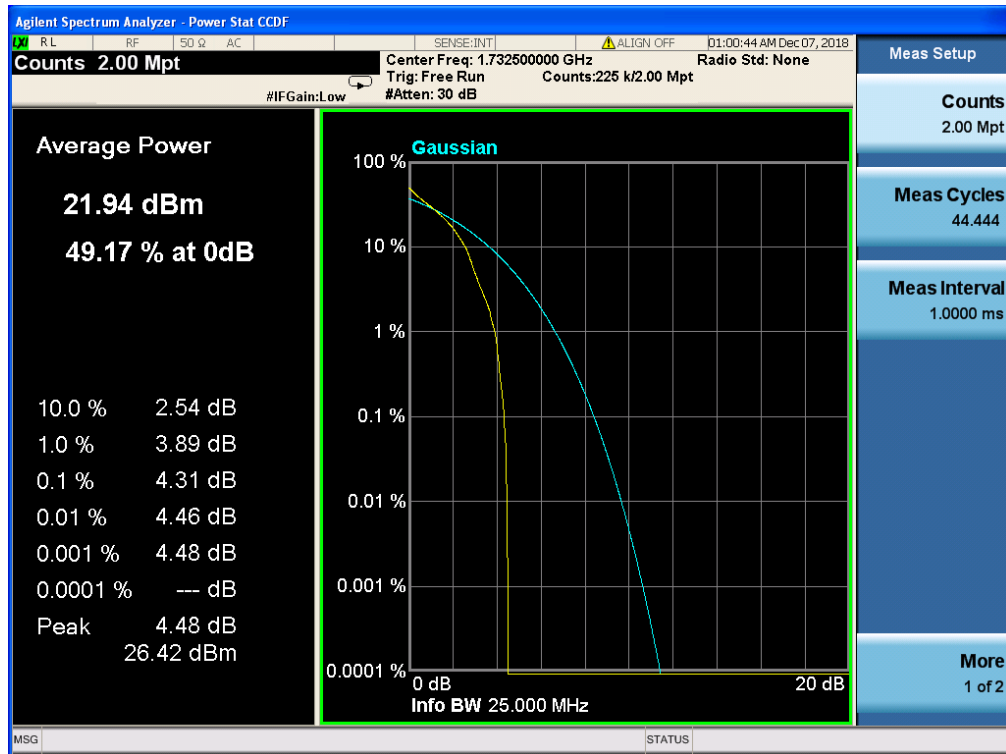
☐ LTE Band7

☐

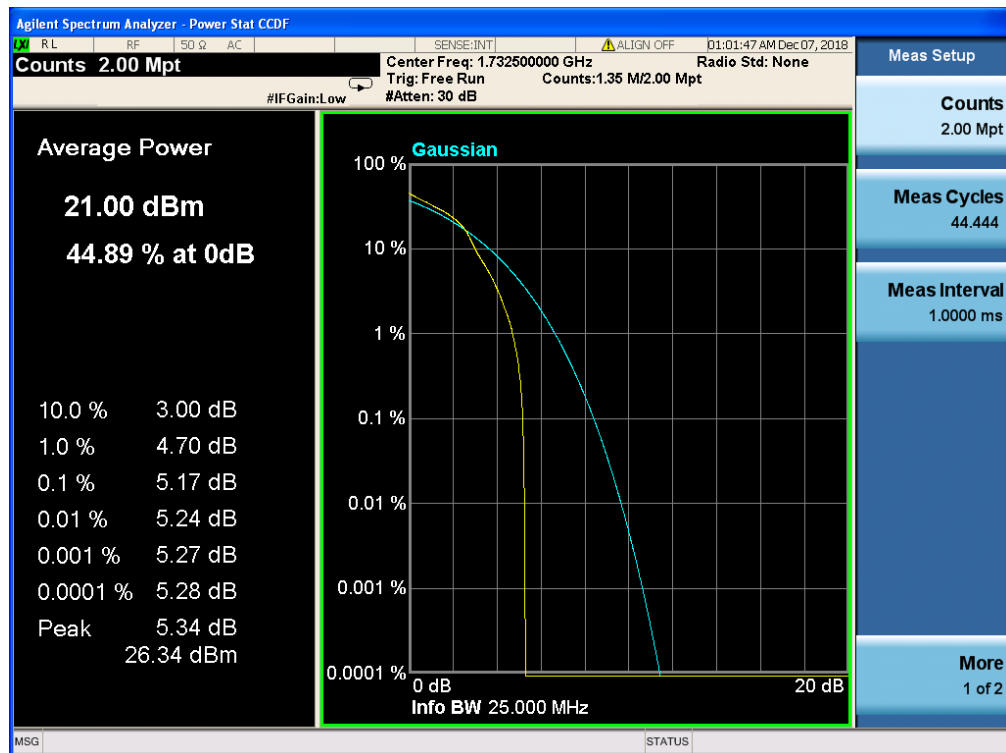
BAND	CHANNEL	Frequency [MHz]	BANDWIDTH	NO. RB	RB POS.	MODULATION	PAR [dB]
4	20175	1732.5	1.4	1	Low	QPSK	4.31
4	20175	1732.5	1.4	1	Low	16-QAM	5.17
4	20175	1732.5	3.0	1	Low	QPSK	4.17
4	20175	1732.5	3.0	1	Low	16-QAM	5.03
4	20175	1732.5	5.0	1	Low	QPSK	5.18
4	20175	1732.5	5.0	1	Low	16-QAM	5.94
4	20175	1732.5	10.0	1	Low	QPSK	5.19
4	20175	1732.5	10.0	1	Low	16-QAM	5.97
4	20175	1732.5	15.0	1	Low	QPSK	3.68
4	20175	1732.5	15.0	1	Low	16-QAM	4.50
4	20175	1732.5	20.0	1	Low	QPSK	3.51
4	20175	1732.5	20.0	1	Low	16-QAM	4.27
7	21100	2535.0	5.0	1	Low	QPSK	5.37
7	21100	2535.0	5.0	1	Low	16-QAM	6.11
7	21100	2535.0	10.0	1	Low	QPSK	5.33
7	21100	2535.0	10.0	1	Low	16-QAM	6.10
7	21100	2535.0	15.0	1	Low	QPSK	4.09
7	21100	2535.0	15.0	1	Low	16-QAM	4.93
7	21100	2535.0	20.0	1	Low	QPSK	3.99
7	21100	2535.0	20.0	1	Low	16-QAM	4.65

11.5 LTE BAND 4

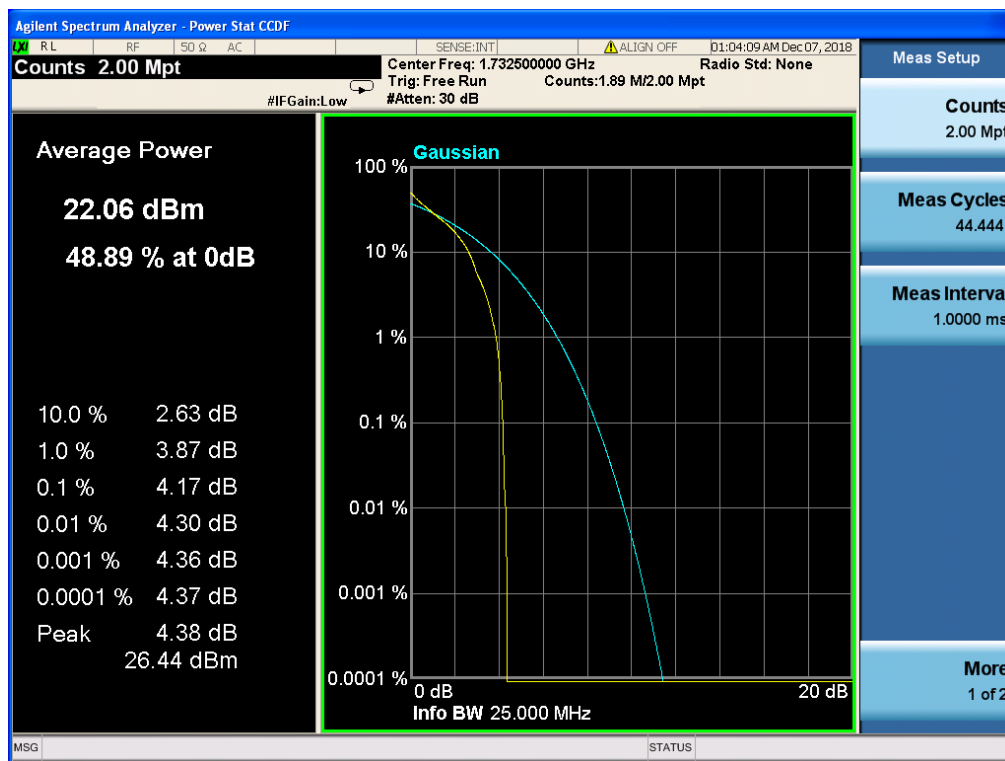
Band 4, UL Channel 20175, UL Frequency 1732.5, BW 1.4, NO. RB 1, RB POS. Low, QPSK



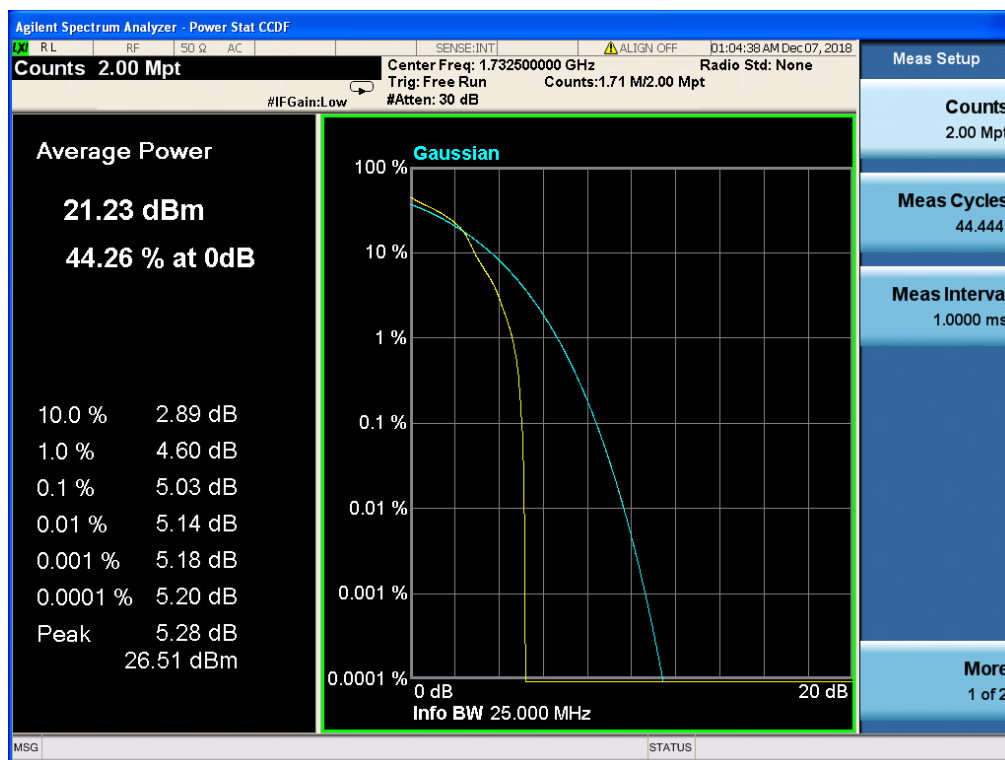
Band 4, UL Channel 20175, UL Frequency 1732.5, BW 1.4, NO. RB 1, RB POS. Low, 16-QAM



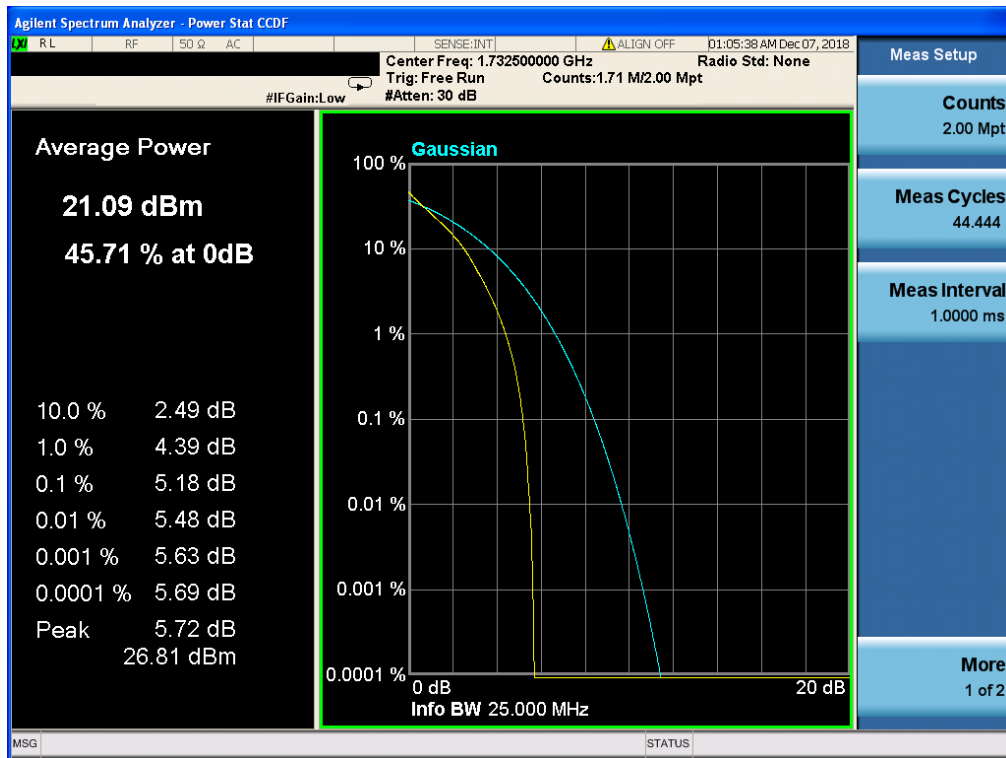
Band 4, UL Channel 20175, UL Frequency 1732.5, BW 3.0, NO. RB 1, RB POS. Low, QPSK



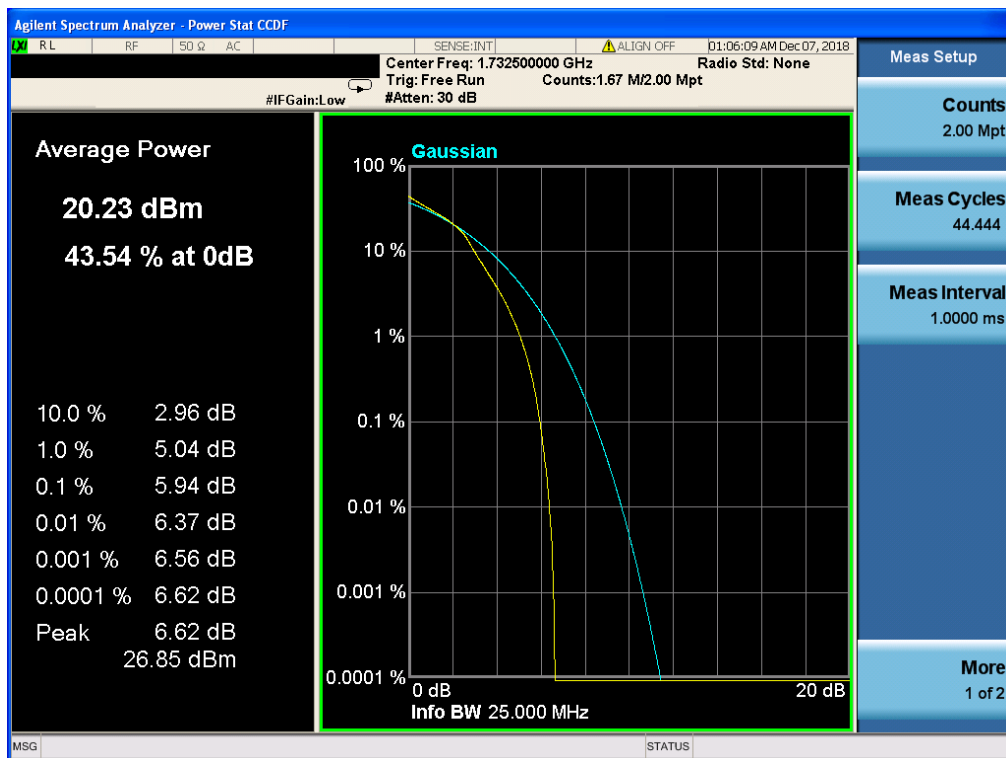
Band 4, UL Channel 20175, UL Frequency 1732.5, BW 3.0, NO. RB 1, RB POS. Low, 16-QAM



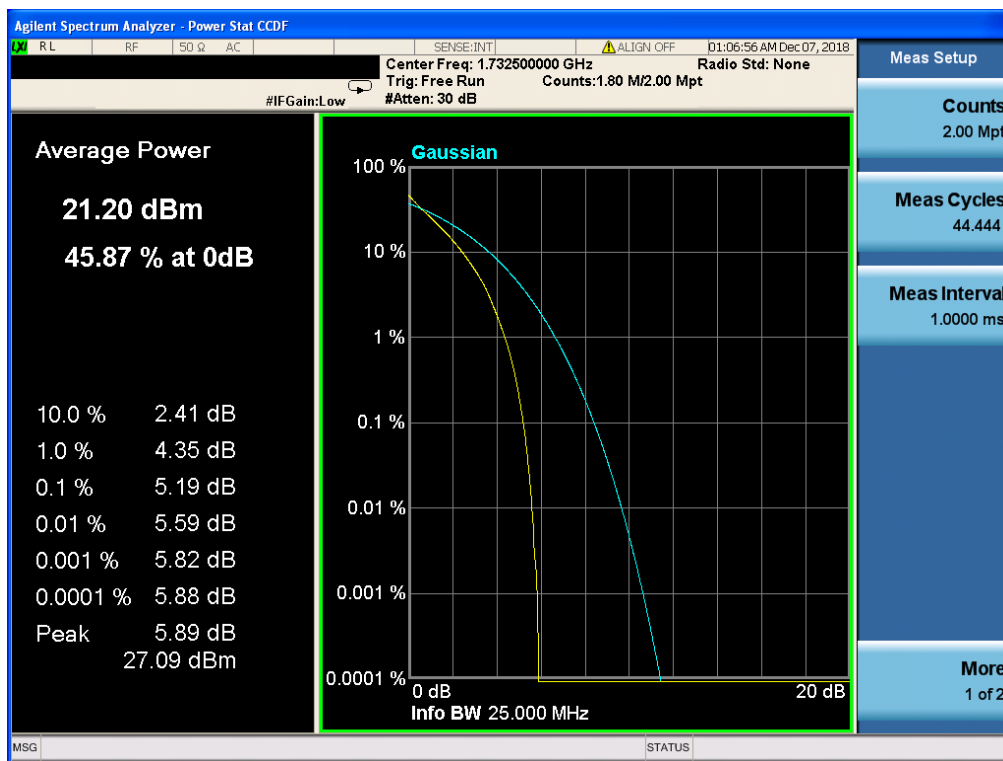
Band 4,UL Channel 20175,UL Frequency 1732.5,BW 5.0,NO. RB 1,RB POS. Low,QPSK



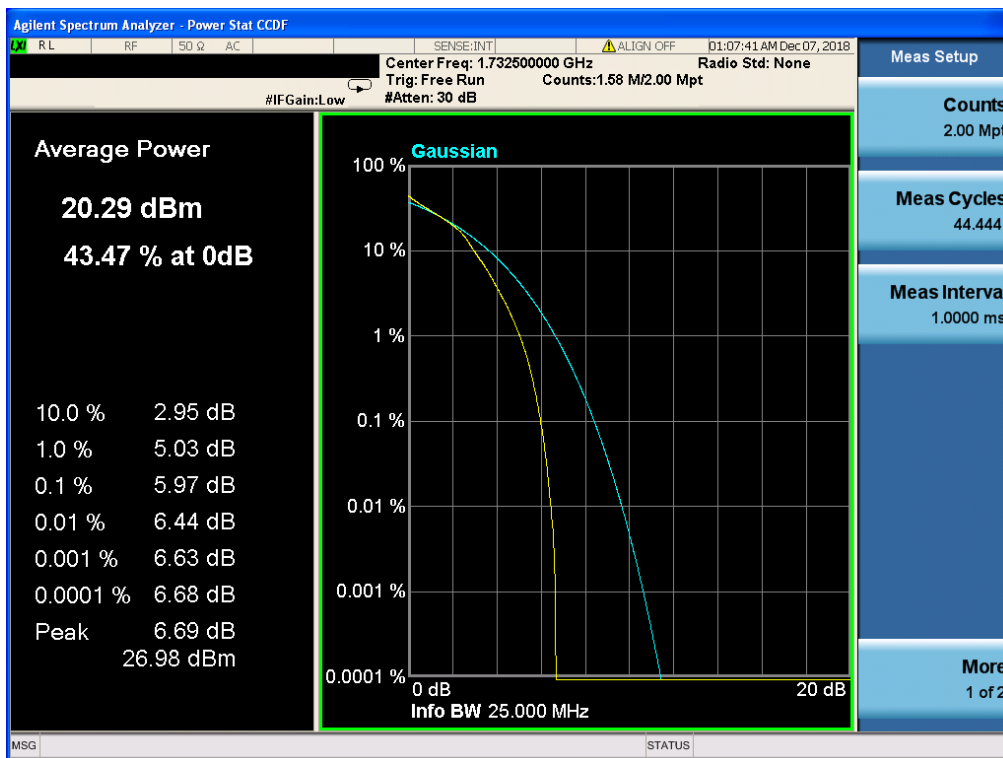
Band 4,UL Channel 20175,UL Frequency 1732.5,BW 5.0,NO. RB 1,RB POS. Low,16-QAM



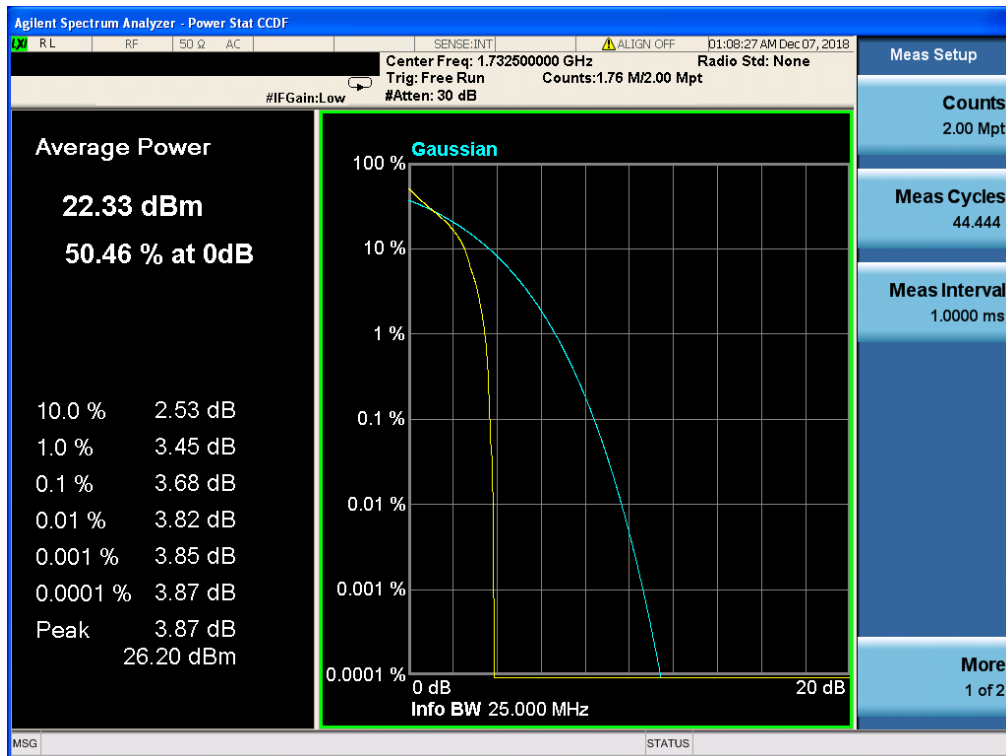
Band 4, UL Channel 20175, UL Frequency 1732.5, BW 10.0, NO. RB 1, RB POS. Low, QPSK



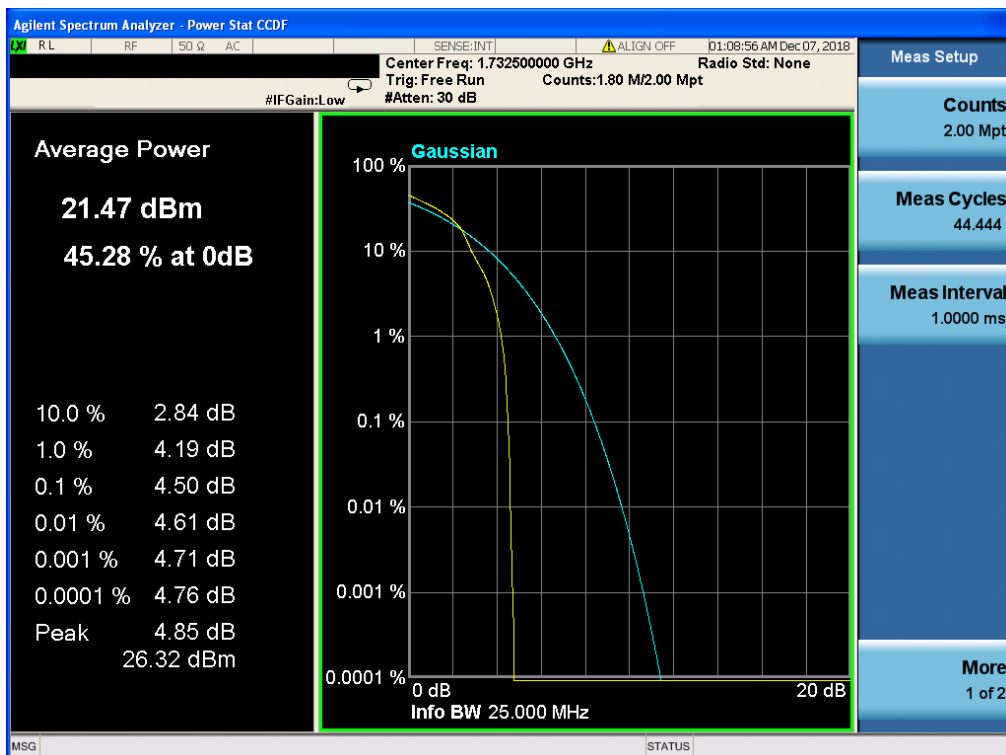
Band 4, UL Channel 20175, UL Frequency 1732.5, BW 10.0, NO. RB 1, RB POS. Low, 16-QAM



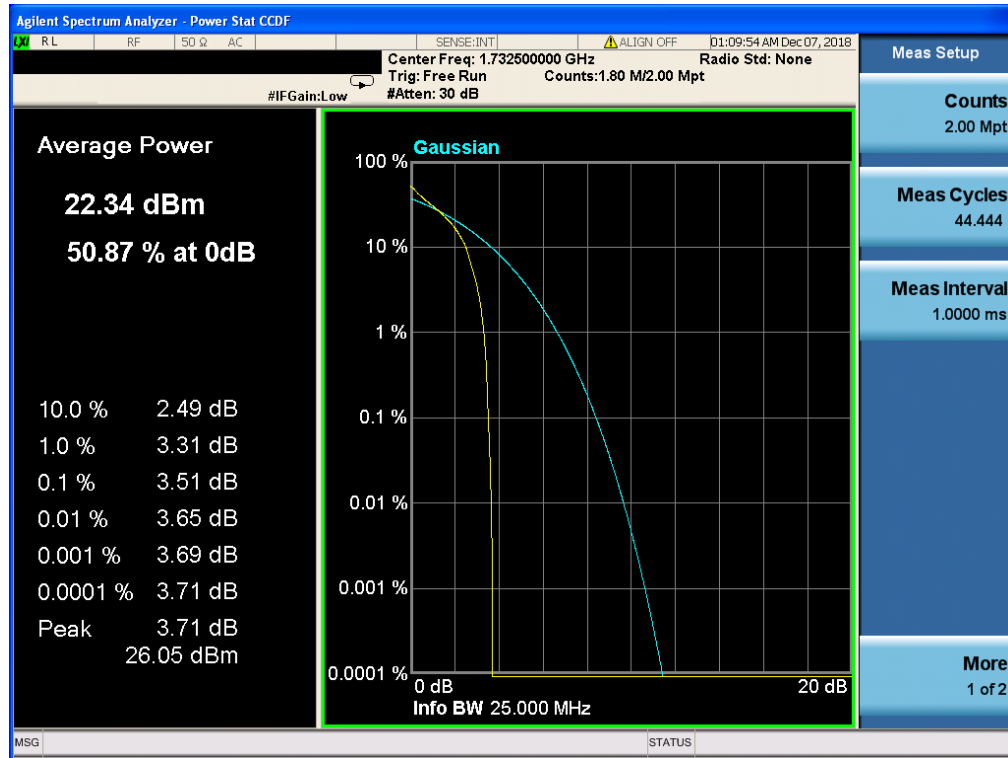
Band 4,UL Channel 20175,UL Frequency 1732.5,BW 15.0,NO. RB 1,RB POS. Low,QPSK



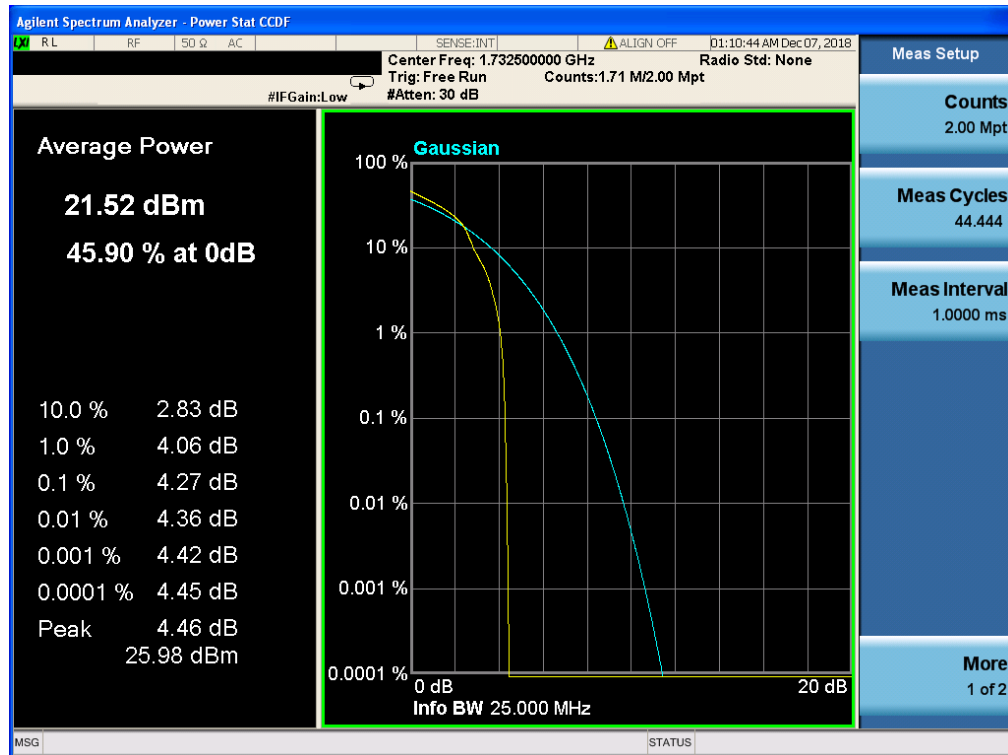
Band 4,UL Channel 20175,UL Frequency 1732.5,BW 15.0,NO. RB 1,RB POS. Low,16-QAM



Band 4,UL Channel 20175,UL Frequency 1732.5,BW 20.0,NO. RB 1,RB POS. Low,QPSK

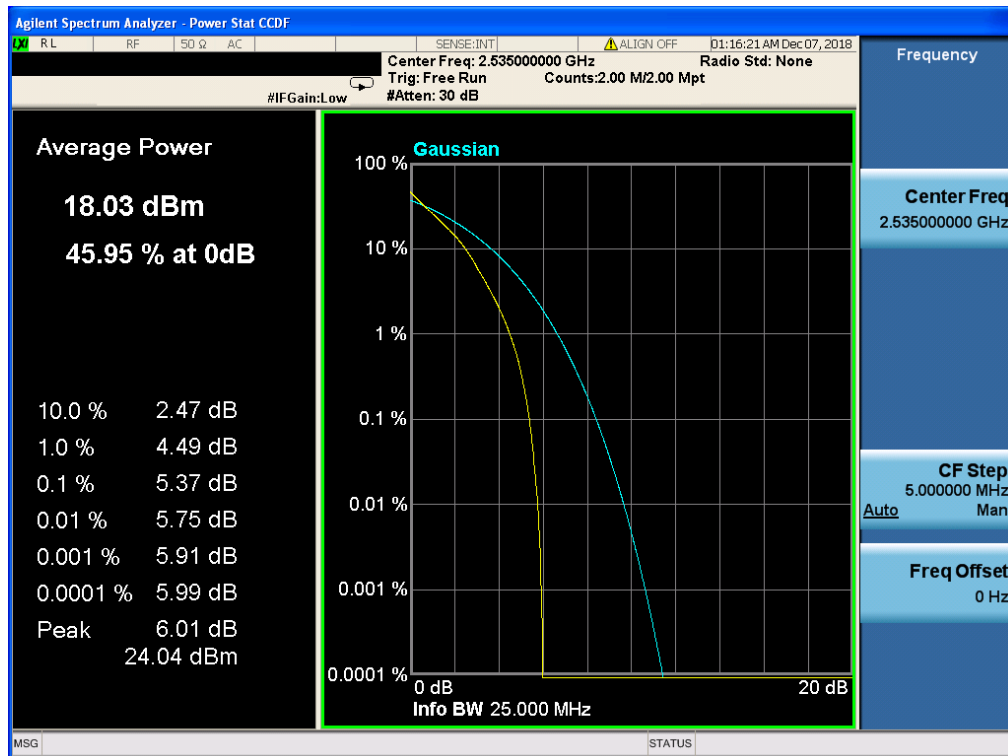


Band 4,UL Channel 20175,UL Frequency 1732.5,BW 20.0,NO. RB 1,RB POS. Low,16-QAM

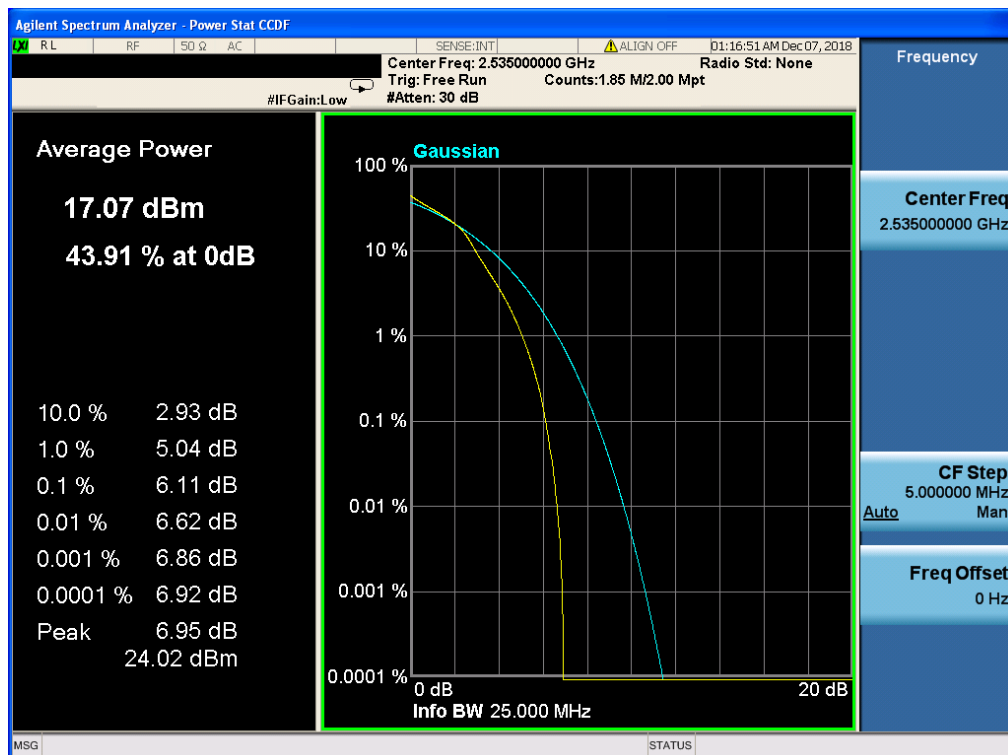


11.6 LTE BAND 7

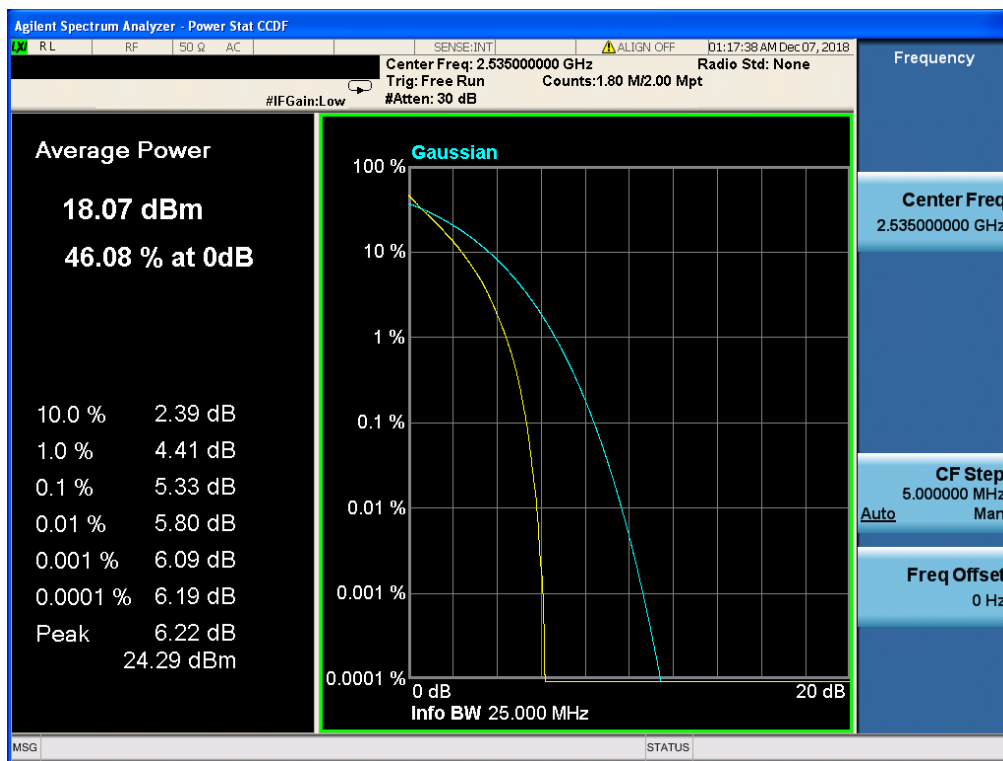
Band 7, UL Channel 21100, UL Frequency 2535.0, BW 5.0, NO. RB 1, RB POS. Low, QPSK



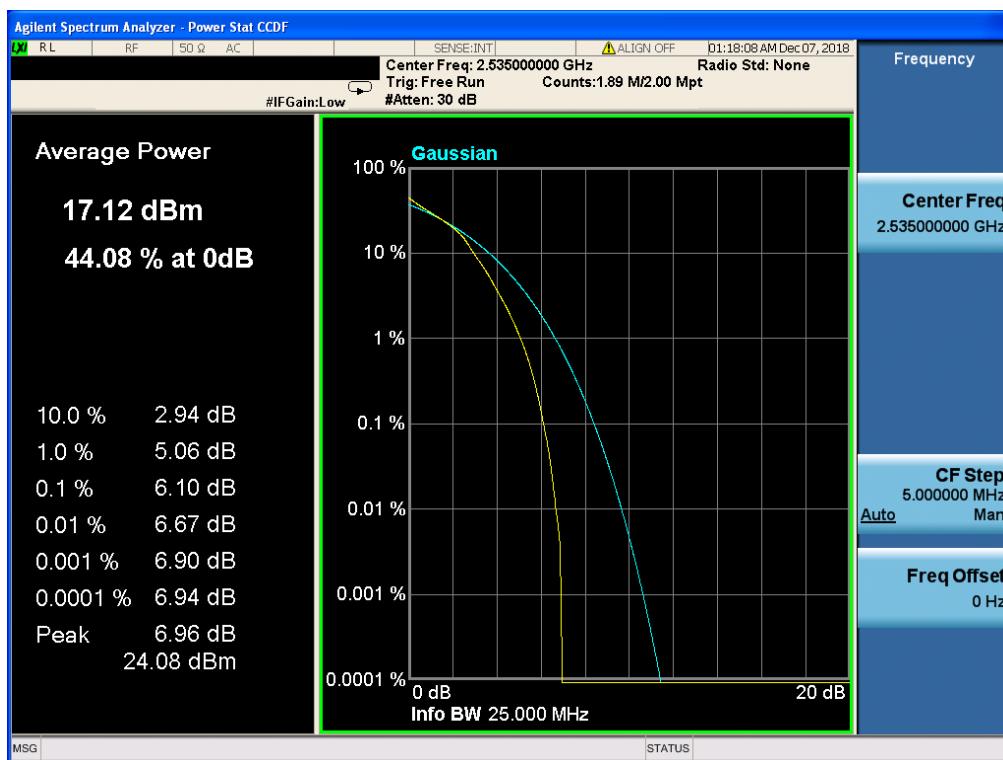
Band 7, UL Channel 21100, UL Frequency 2535.0, BW 5.0, NO. RB 1, RB POS. Low, 16-QAM



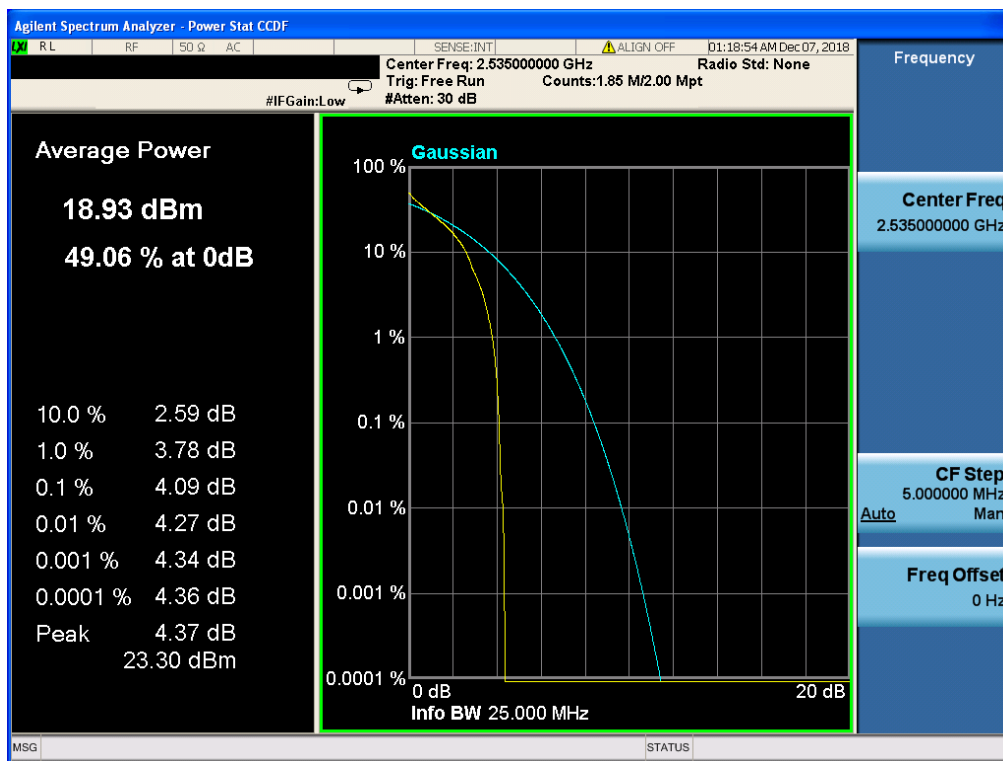
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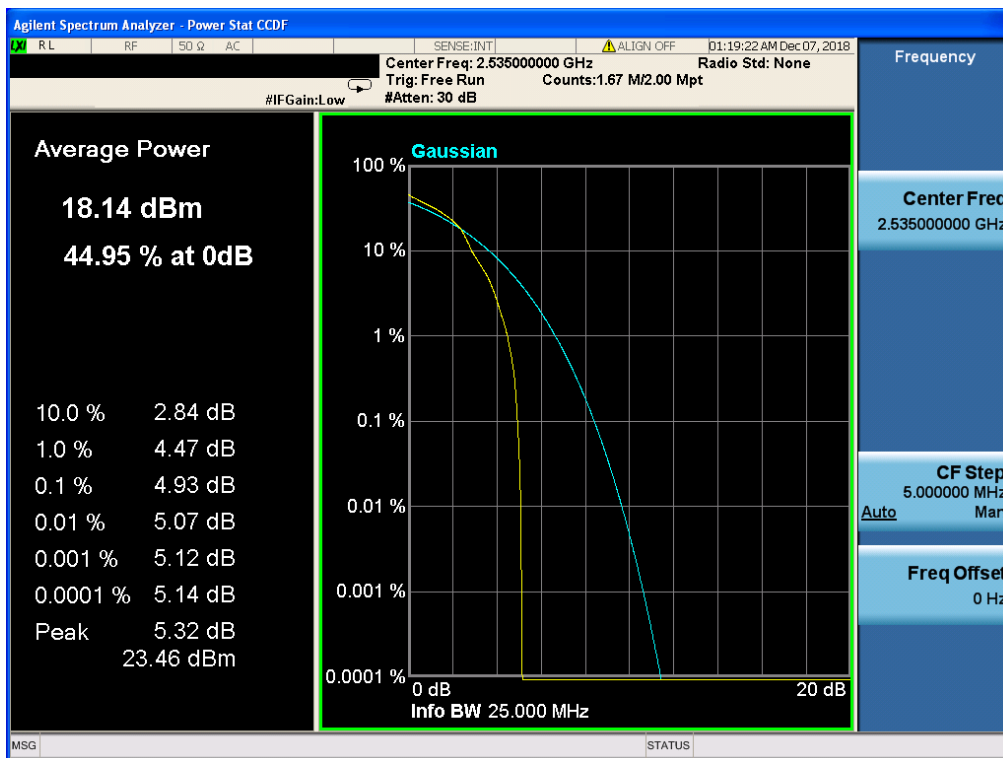
Band 7, UL Channel 21100, UL Frequency 2535.0, BW 10.0, NO. RB 1, RB POS. Low, 16-QAM



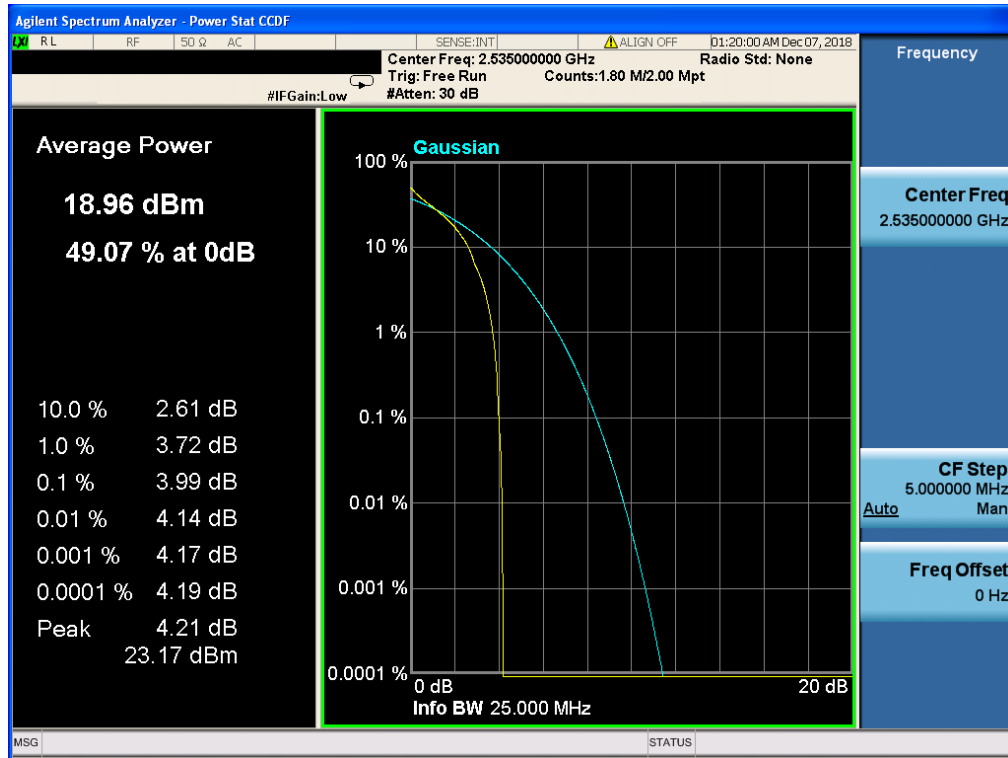
Band 7, UL Channel 21100, UL Frequency 2535.0, BW 15.0, NO. RB 1, RB POS. Low, QPSK



Band 7, UL Channel 21100, UL Frequency 2535.0, BW 15.0, NO. RB 1, RB POS. Low, 16-QAM



Band 7, UL Channel 21100, UL Frequency 2535.0, BW 20.0, NO. RB 1, RB POS. Low, QPSK



Band 7, UL Channel 21100, UL Frequency 2535.0, BW 20.0, NO. RB 1, RB POS. Low, 16-QAM



----END OF REPORT----