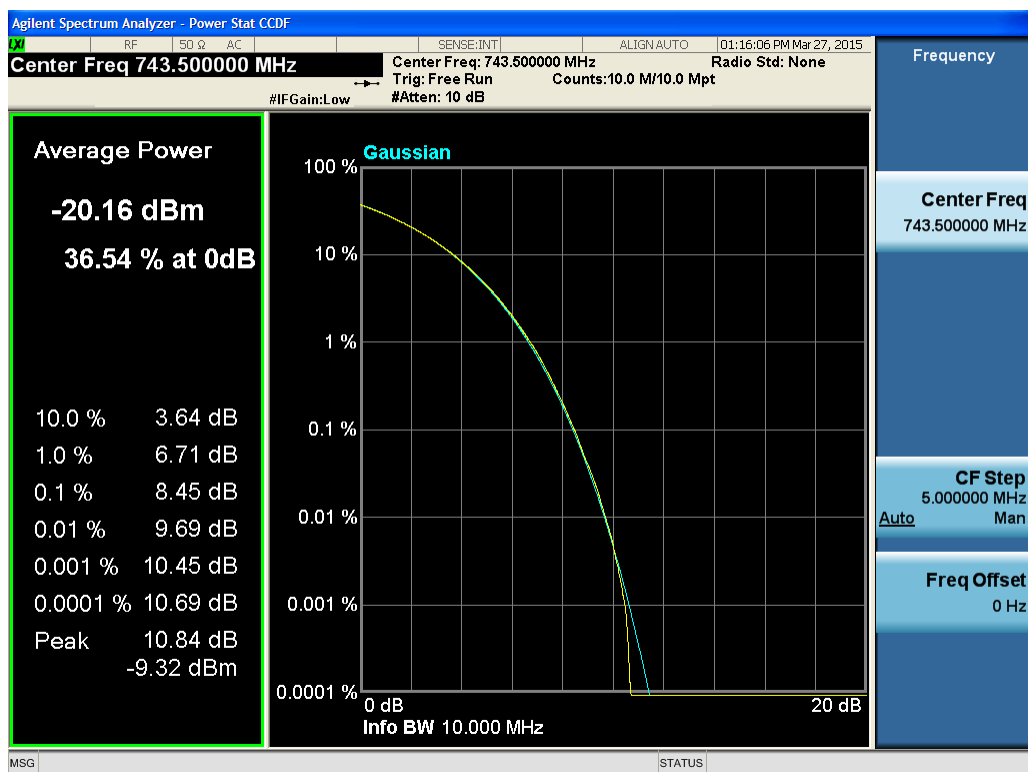
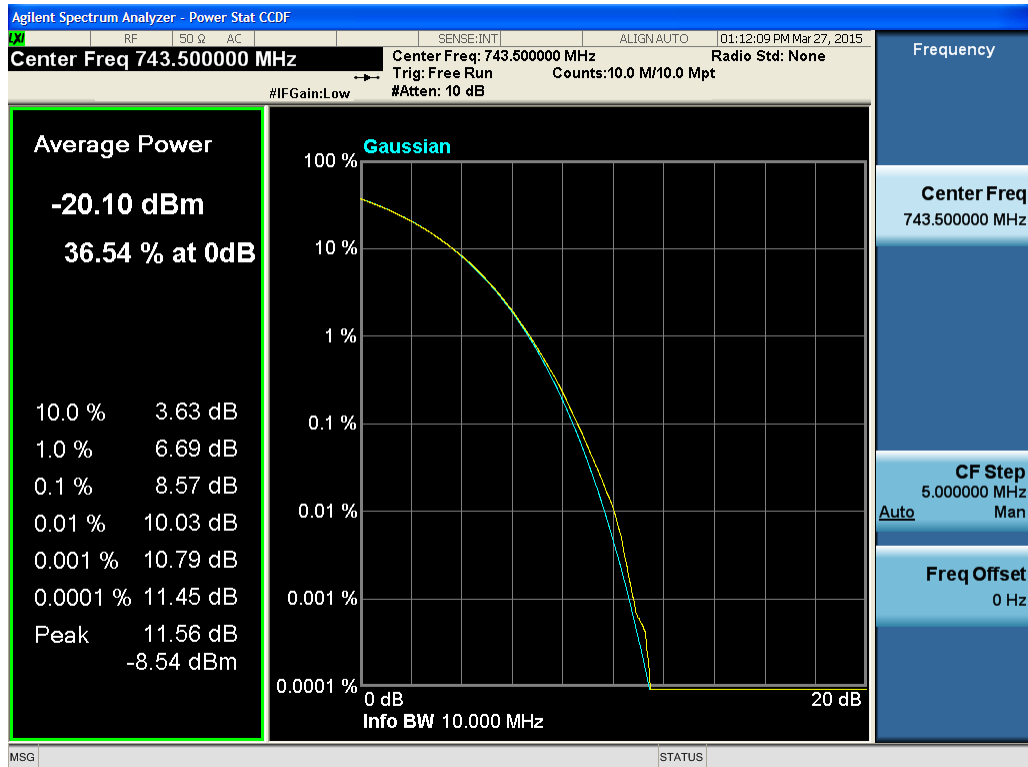
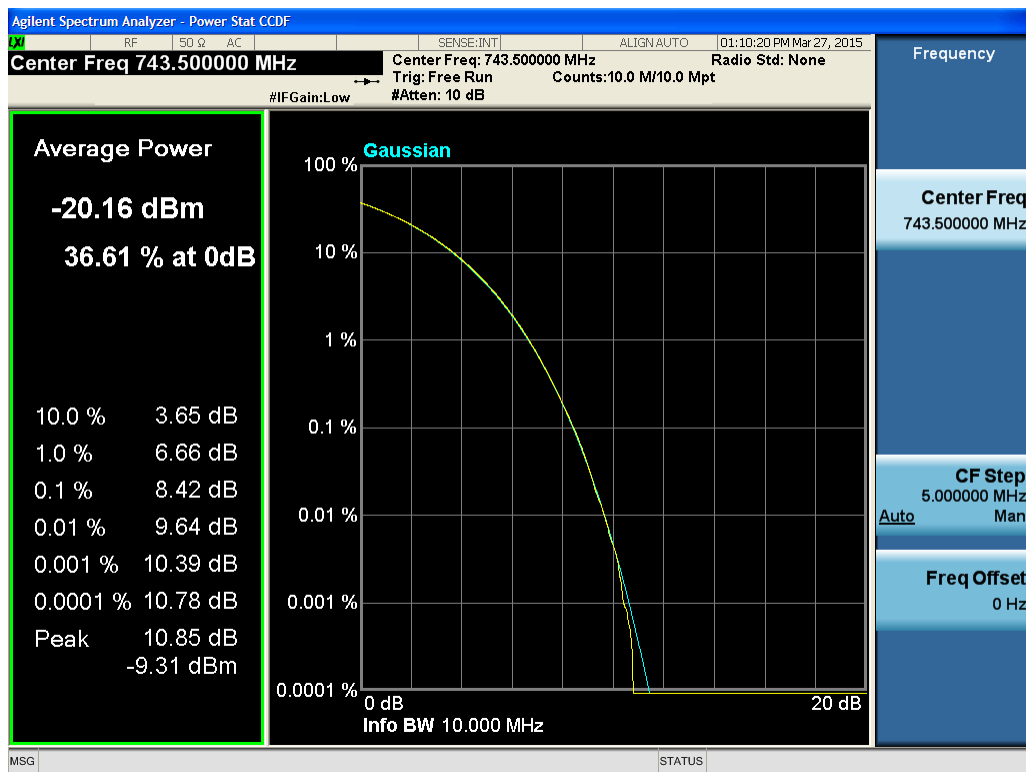




Band 12 - 5MHz BW – High Channel – QPSK



Band 12 - 5MHz BW – High Channel – 16QAM



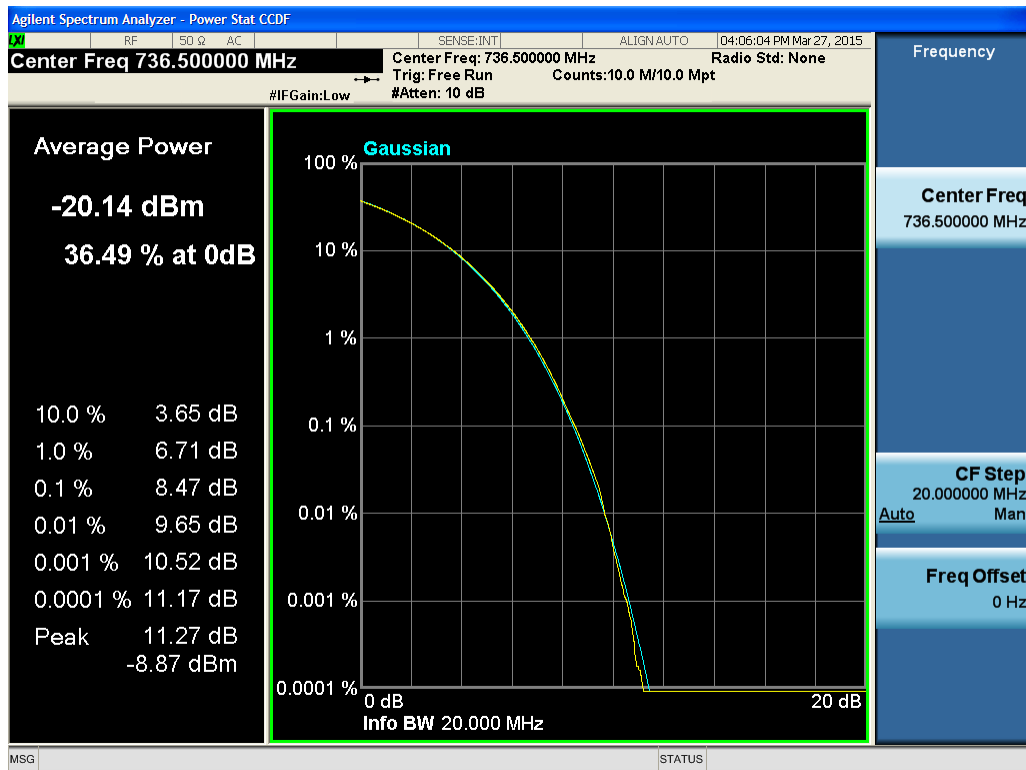
Band 12 - 5MHz BW – High Channel – 64QAM



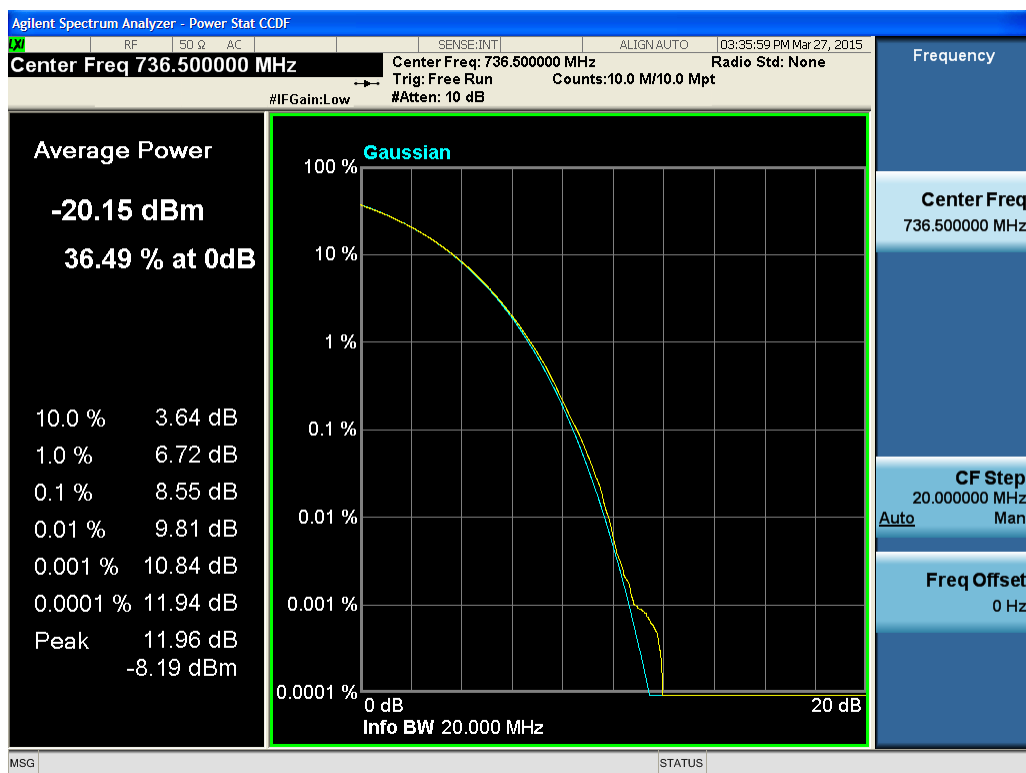
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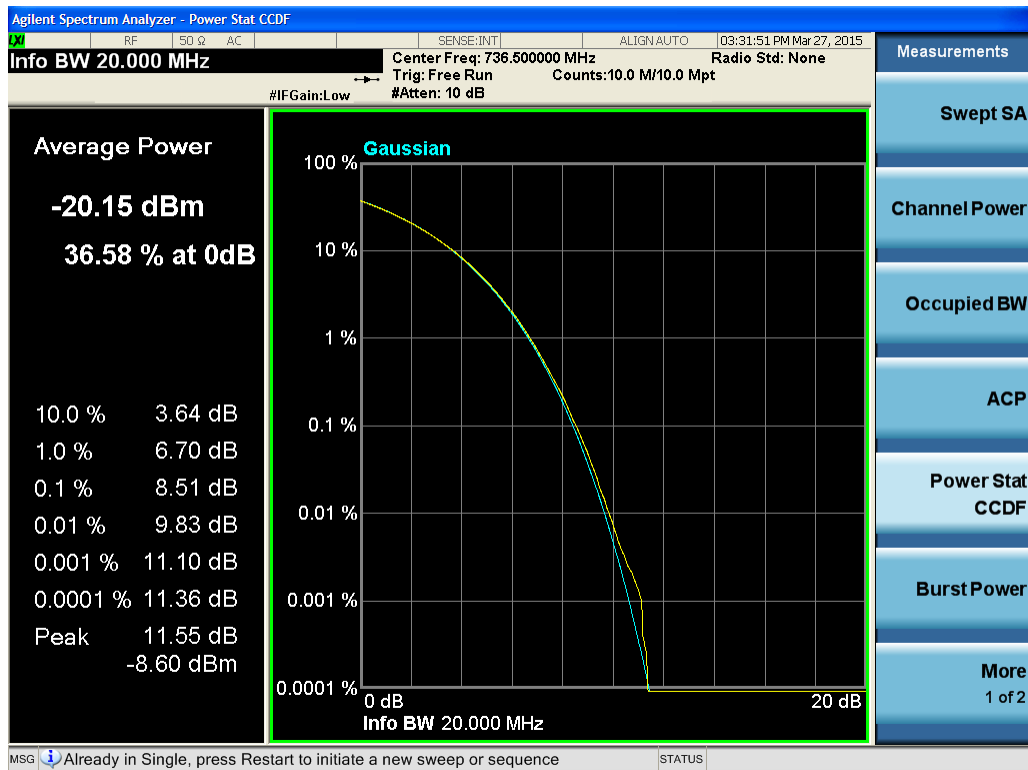
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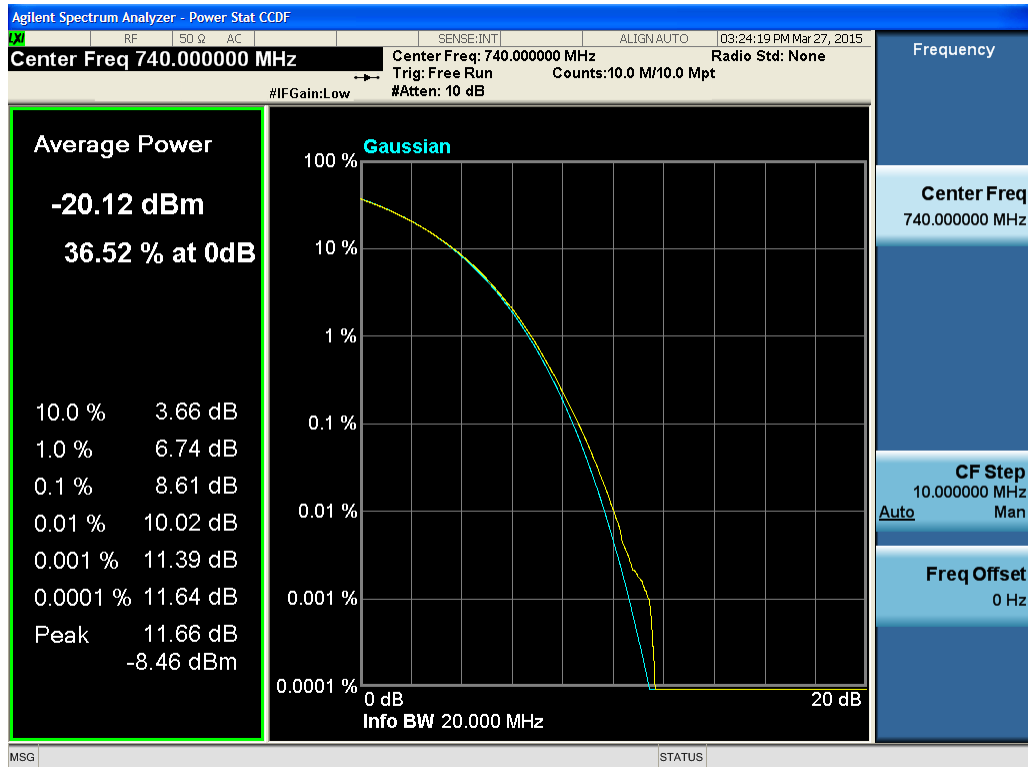
Band 17 - 5MHz BW – Low Channel – QPSK



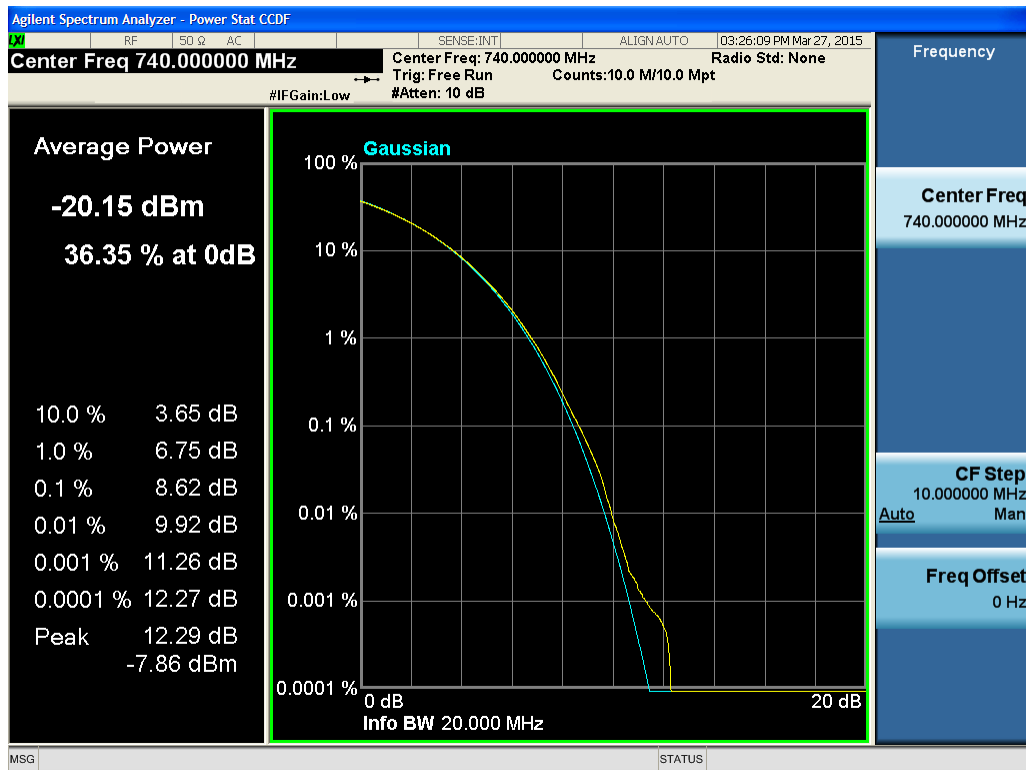
Band 17 - 5MHz BW – Low Channel – 16QAM



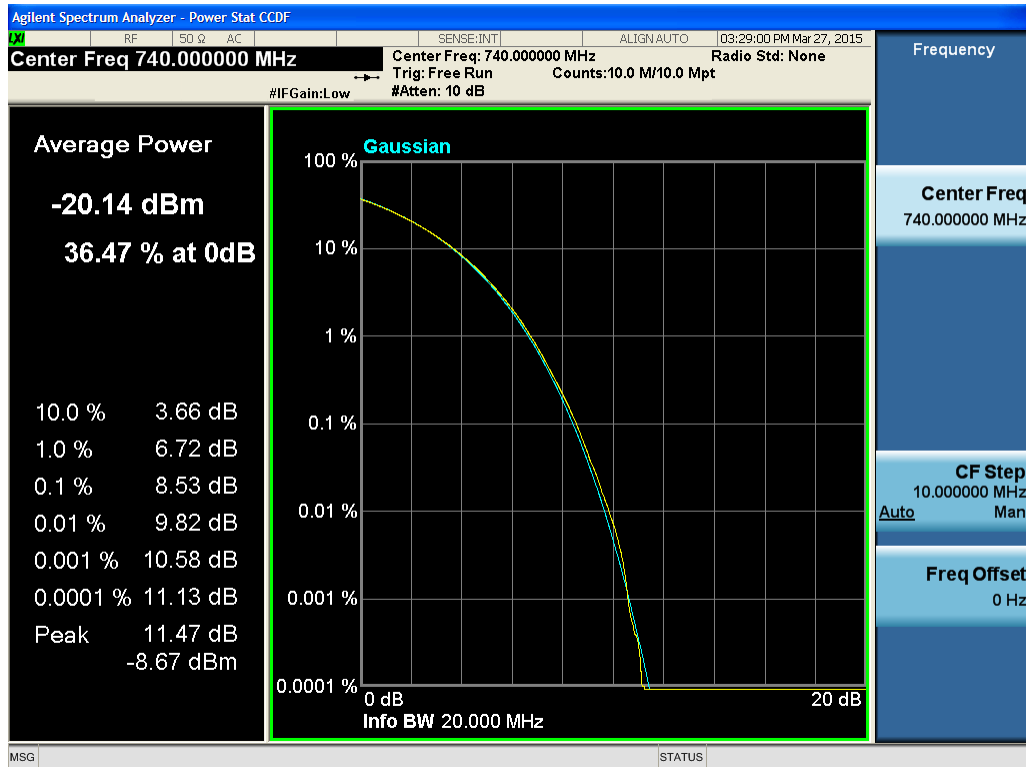
Band 17 - 5MHz BW – Low Channel – 64QAM



Band 17 - 5MHz BW – Mid Channel – QPSK



Band 17 - 5MHz BW – Mid Channel – 16QAM



Band 17 - 5MHz BW – Mid Channel – 64QAM

Power and PAPR: 10MHz Operating Bandwidth

FCC 27.50(c)(9): "Control and mobile stations in the 698-746MHz band are limited to 30 watts ERP."

Output Power (E.R.P.)														Work Order: P0152			
Date: 24-Jul-15				Company: Airvana				EUT Desc: Switched IQ Radio Point Domestic				EUT Operating Voltage/Frequency: POE					
Engineer: Arik Zulmer				Humidity: 53%				Pressure: 1010mBar									
Frequency Range: Low, Mid and High Channels																	
Notes: 30W = 44.77dBm. Multiple antenna calacations using formula from FCC KDB 662911 Section 4(2)(a)(i). ERP = EIRP - 2.15dB																	
Two antennas each with gain 0dBi in this range are installed on the EUT. For MIMO calculations, N _{ant} =2 is used to calculate overall directional gain: 0dBi + 10log(N _{ant})dB = 0dBi + 3.0dB = 3.0dBi.																	
Band	Bandwidth (MHz)	Modulation	Channel	Frequency (MHz)	Peak Power Reading (dBm)	Average Power Reading (dBm)	PAPR (limit: 13dB)	Power Combiner (dB)	20dB Attenuator (dB)	Cable Factor (dB)	Adjusted Peak Power Reading (dBm)	Directional Antenna Gain (dB)	ERP (dBm)	FCC Part 27.50(c)(9); Limit: 30W = 44.77dBm			
														Limit (dBm)	ERP (dB)	Margin (dB)	Result (Pass/Fail)
12	10	QPSK	Low	733.0	7.97	-1.81	9.78	4.0	19.5	0.3	31.77	3.0	34.8	44.77	32.6	-12.2	Pass
12	10	QPSK	Mid	737.0	8.32	-1.71	10.03	4.0	19.5	0.3	32.12	3.0	35.1	44.77	33.0	-11.8	Pass
12	10	QPSK	High	741.0	7.91	-1.68	9.59	4.0	19.5	0.3	31.71	3.0	34.7	44.77	32.6	-12.2	Pass
12	10	16QAM	Low	733.0	8.17	-1.76	9.93	4.0	19.5	0.3	31.97	3.0	35.0	44.77	32.8	-12.0	Pass
12	10	16QAM	Mid	737.0	8.34	-1.71	10.05	4.0	19.5	0.3	32.14	3.0	35.1	44.77	33.0	-11.8	Pass
12	10	16QAM	High	741.0	8.03	-1.94	9.97	4.0	19.5	0.3	31.83	3.0	34.8	44.77	32.7	-12.1	Pass
12	10	64QAM	Low	733.0	8.69	-1.81	10.50	4.0	19.5	0.3	32.49	3.0	35.5	44.77	33.3	-11.4	Pass
12	10	64QAM	Mid	737.0	8.65	-1.71	10.36	4.0	19.5	0.3	32.45	3.0	35.5	44.77	33.3	-11.5	Pass
12	10	64QAM	High	741.0	8.39	-2.01	10.40	4.0	19.5	0.3	32.19	3.0	35.2	44.77	33.0	-11.7	Pass
17	10	QPSK	Low	739.0	7.91	-1.57	9.48	4.0	19.5	0.3	31.71	3.0	34.7	44.77	32.6	-12.2	Pass
17	10	QPSK	Mid	740.0	8.32	-1.62	9.94	4.0	19.5	0.3	32.12	3.0	35.1	44.77	33.0	-11.8	Pass
17	10	QPSK	High	741.0	See Band 12												
17	10	16QAM	Low	739.0	8.33	-1.59	9.92	4.0	19.5	0.3	32.13	3.0	35.1	44.77	33.0	-11.8	Pass
17	10	16QAM	Mid	740.0	8.27	-1.66	9.93	4.0	19.5	0.3	32.07	3.0	35.1	44.77	32.9	-11.9	Pass
17	10	16QAM	High	741.0	See Band 12												
17	10	64QAM	Low	739.0	8.79	-1.59	10.38	4.0	19.5	0.3	32.59	3.0	35.6	44.77	33.4	-11.3	Pass
17	10	64QAM	Mid	740.0	8.72	-1.68	10.4	4.0	19.5	0.3	32.52	3.0	35.5	44.77	33.4	-11.4	Pass
17	10	64QAM	High	741.0	See Band 12												
Table Result: Pass																	
Test Site: ESD-1				Cable: 1509				20dB Attenuator: Asset 791									
Analyzer: Agilent M/N 9038A				Power Combiner: Asset 1939													

Spectrum analyzer plots are on the following pages.

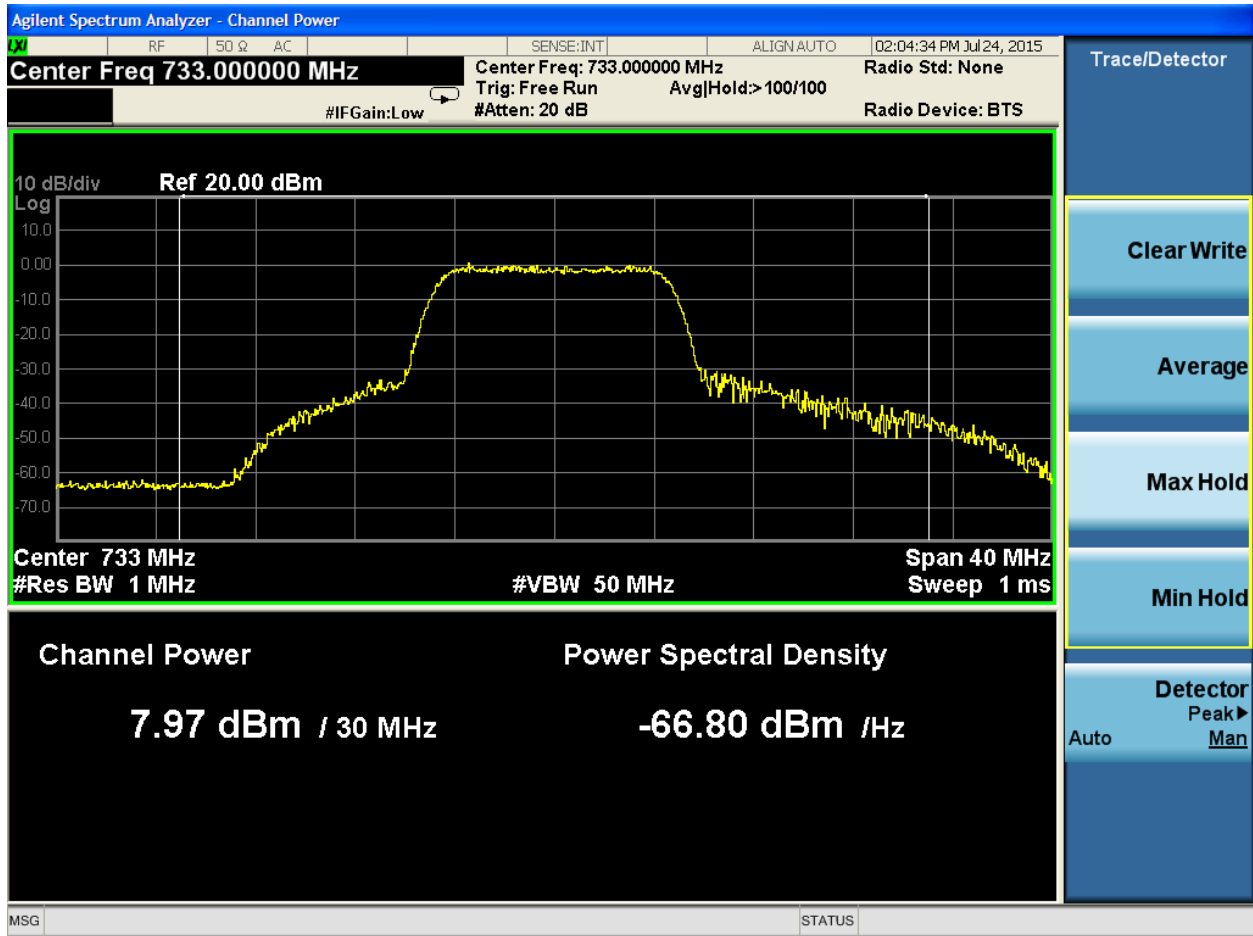


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Band 12 Peak Readings:



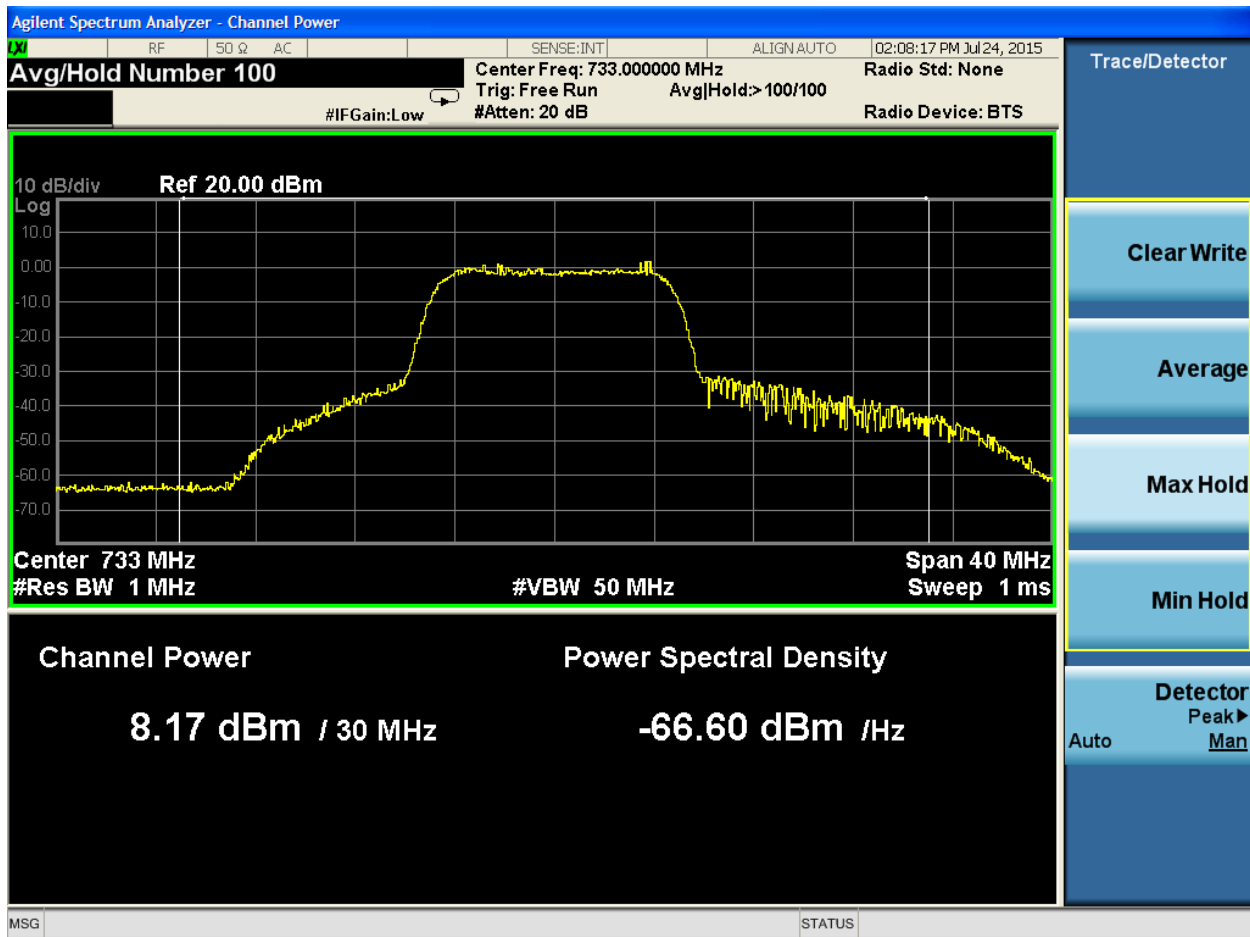
Band 12, Low Channel, QPSK



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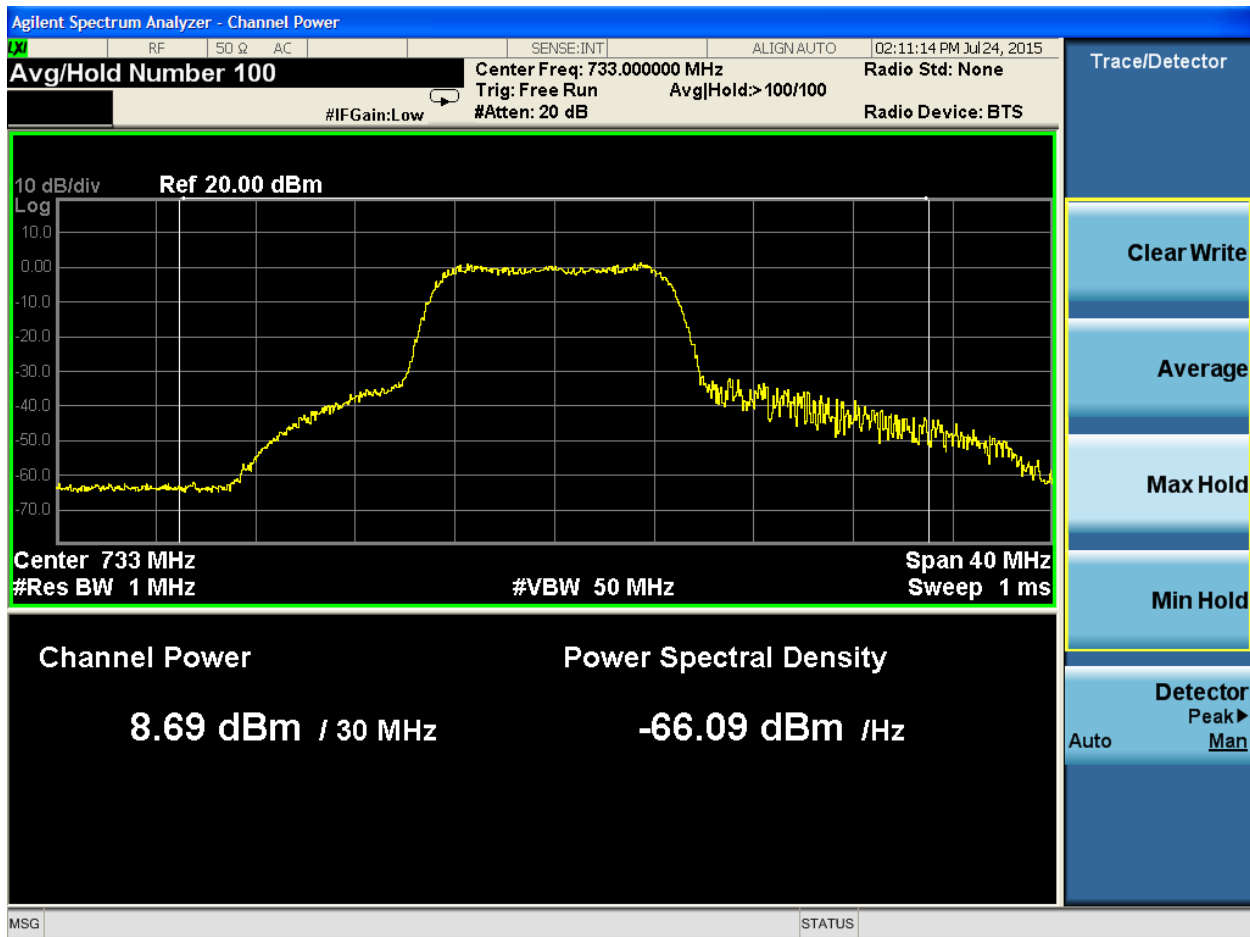
Band 12, Low Channel, 16QAM



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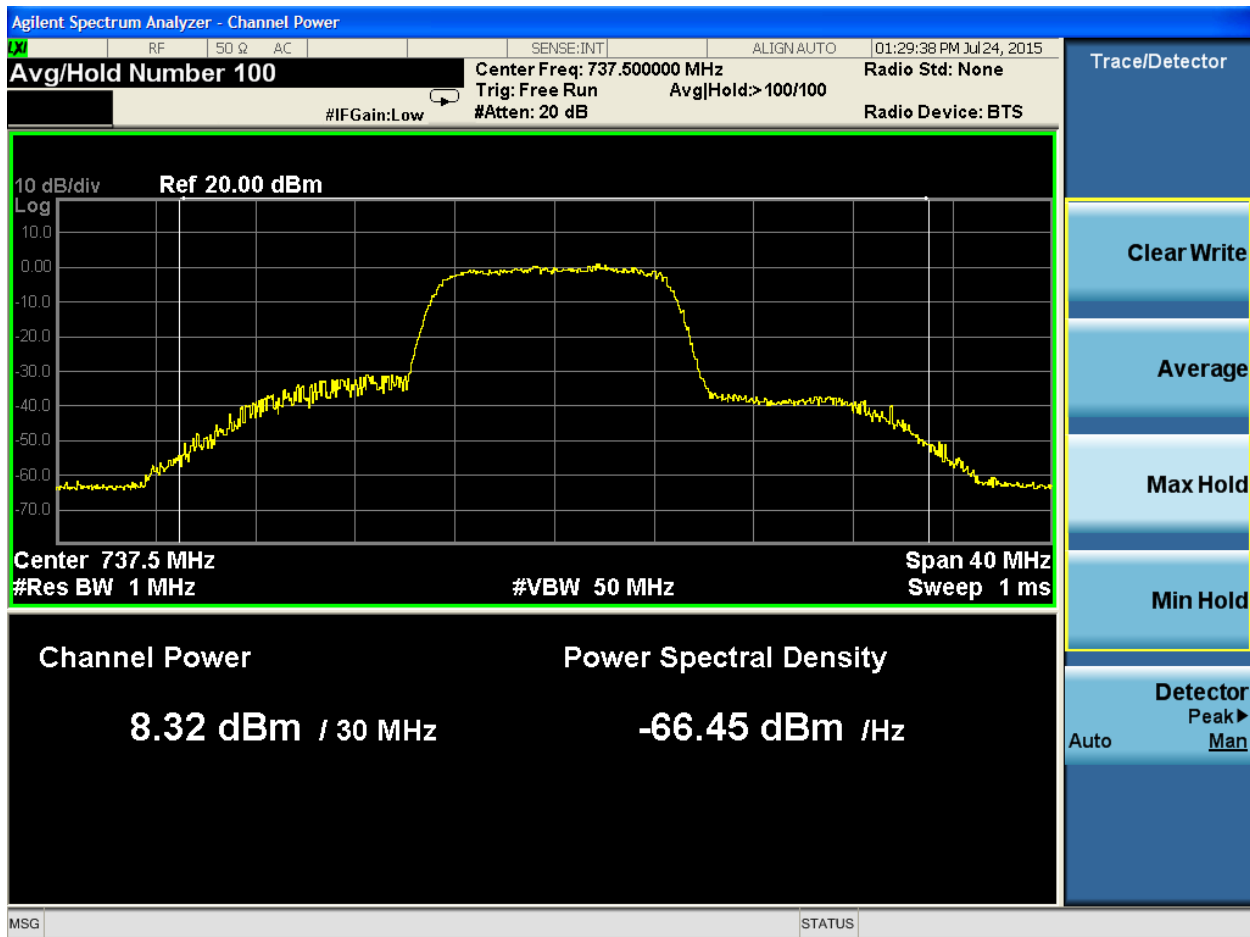
Band 12, Low Channel, 64QAM



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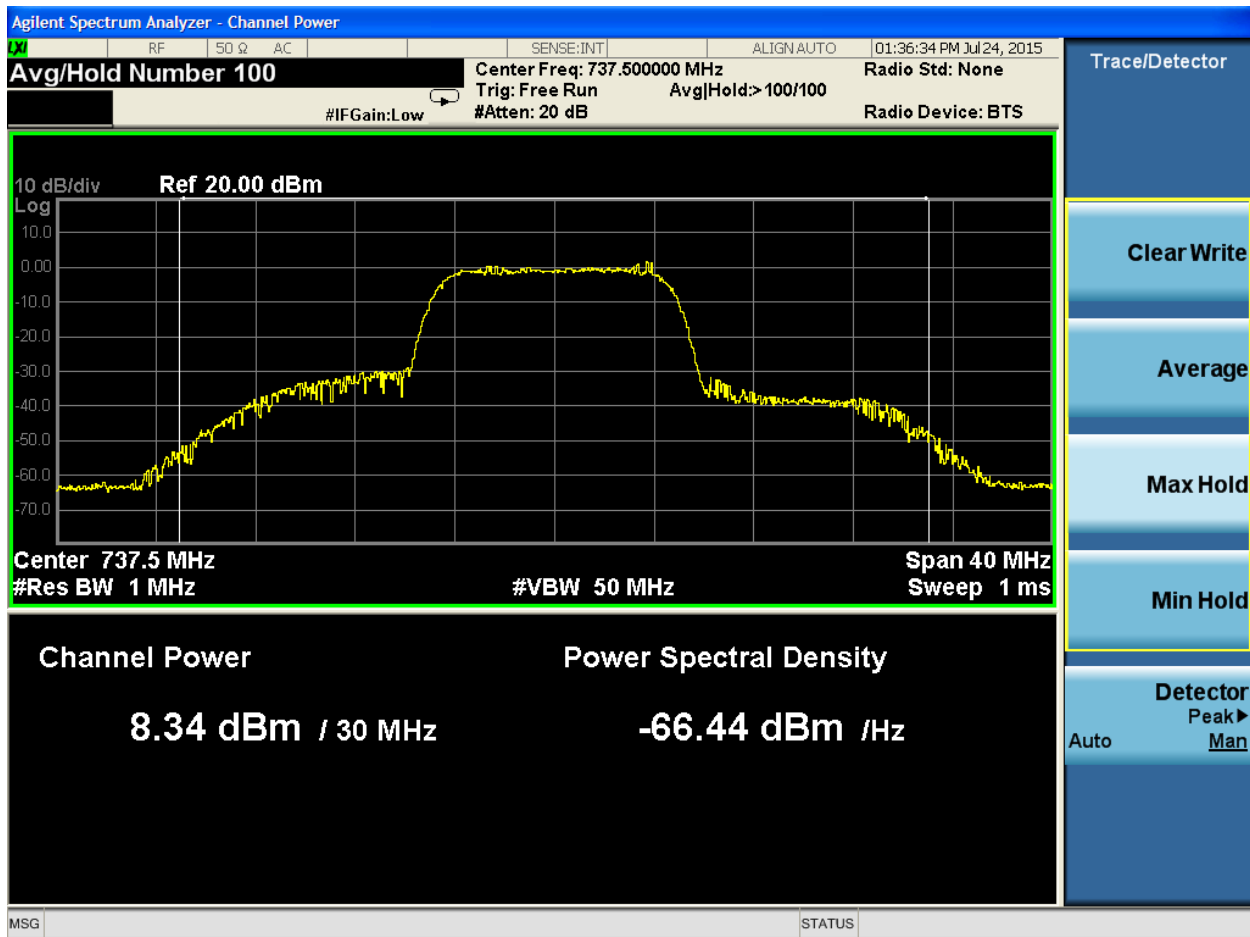
Band 12, Mid Channel, QPSK



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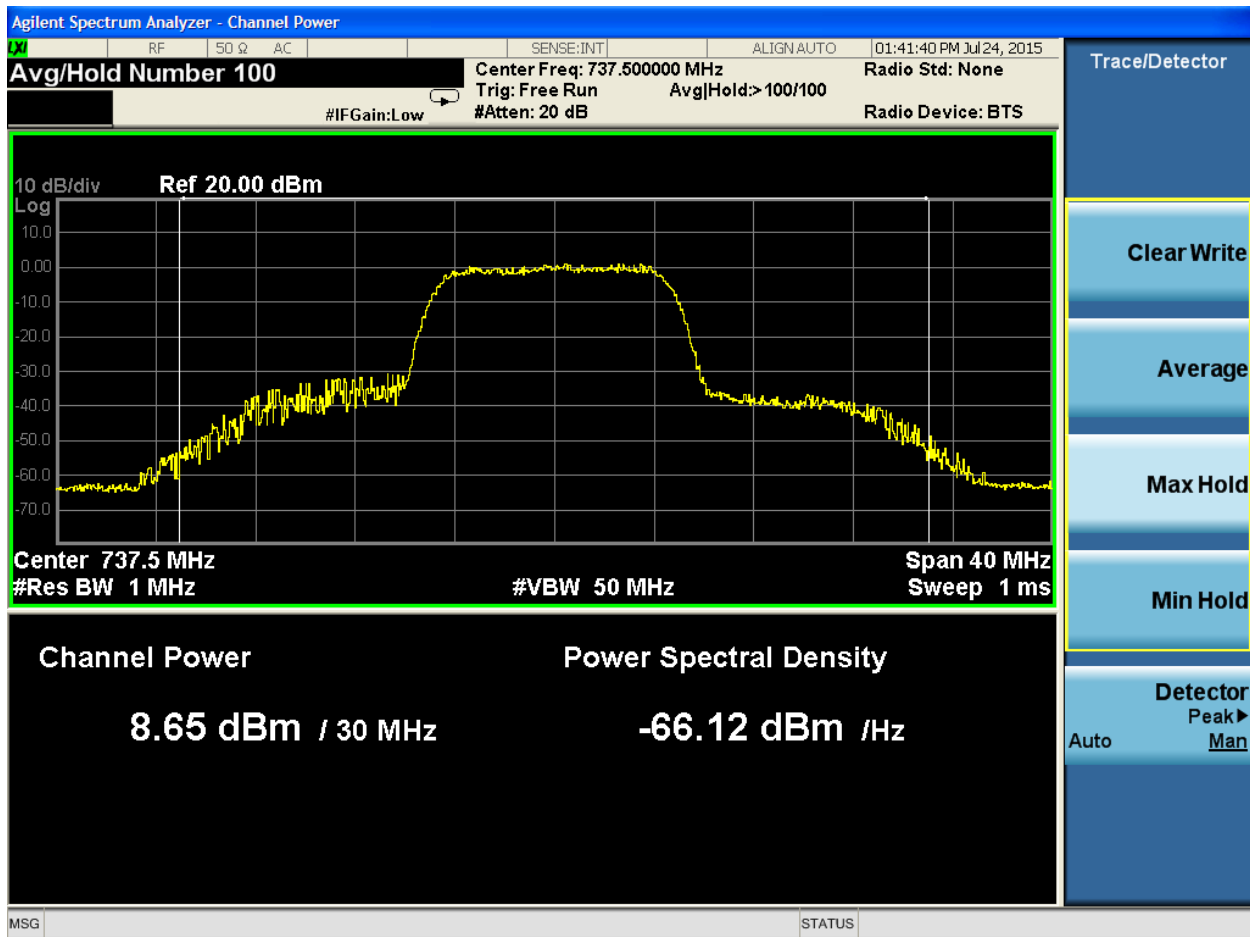
Band 12, Mid Channel, 16QAM



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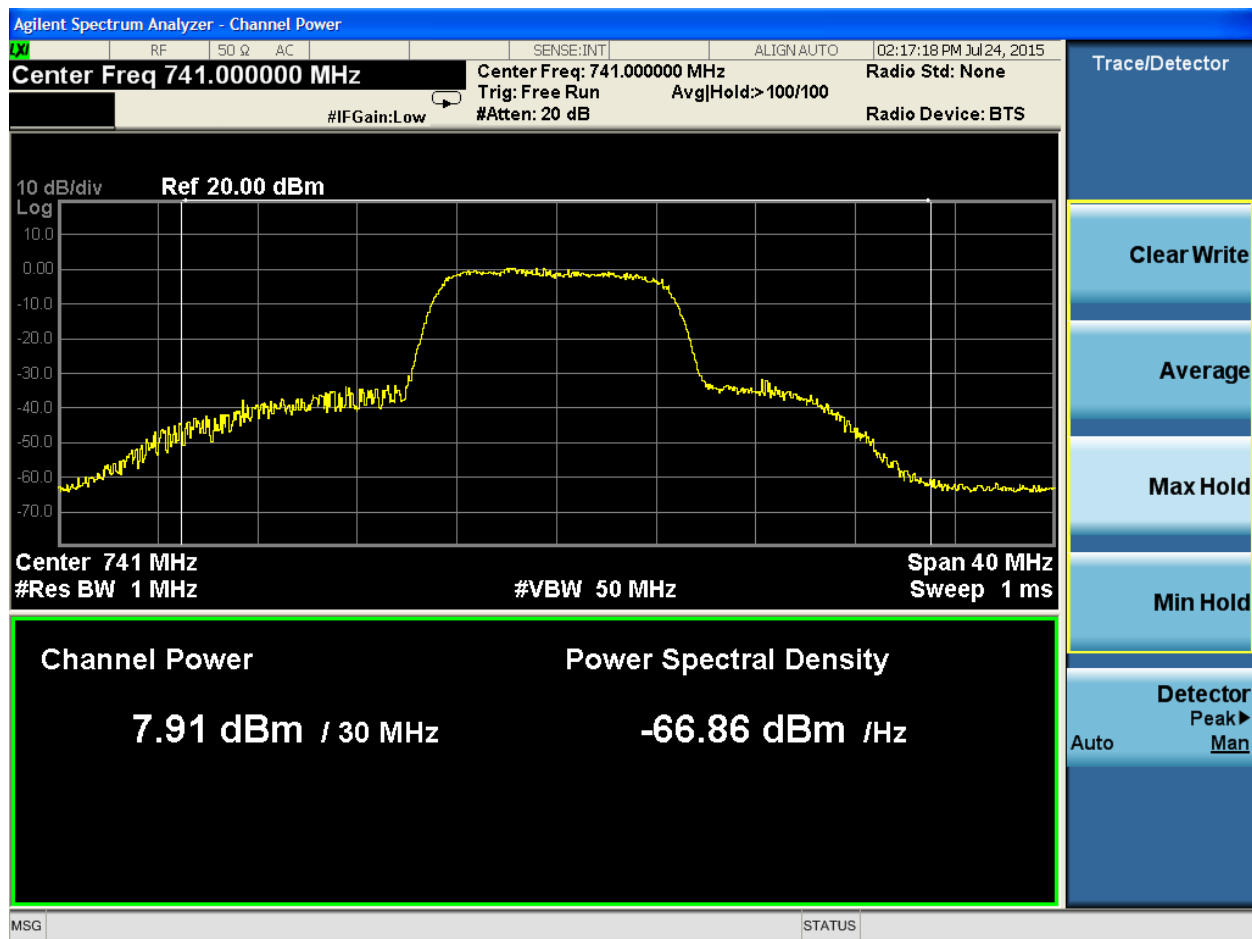
Band 12, Mid Channel, 64QAM



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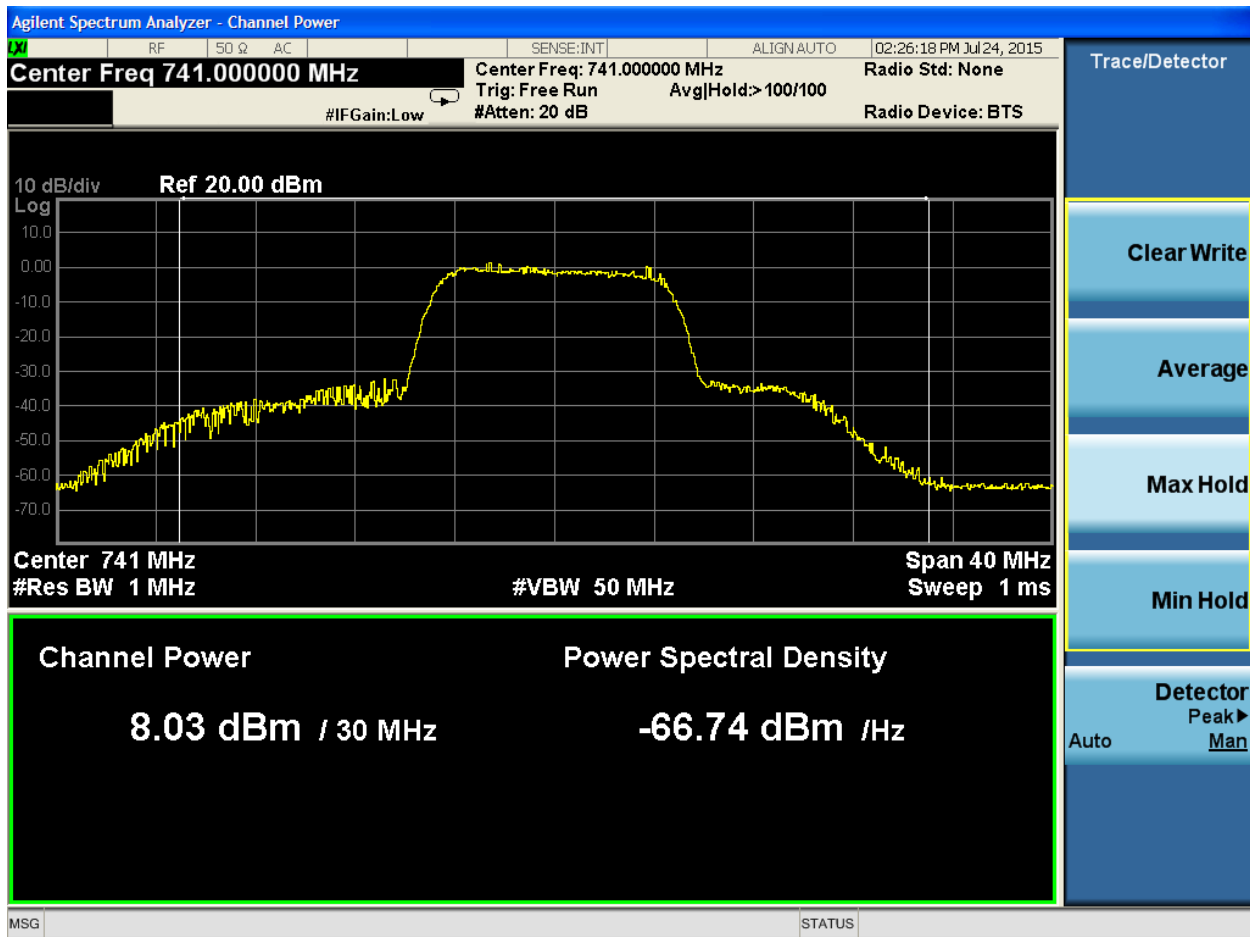
Band 12, High Channel, QPSK



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Band 12, High Channel, 16QAM

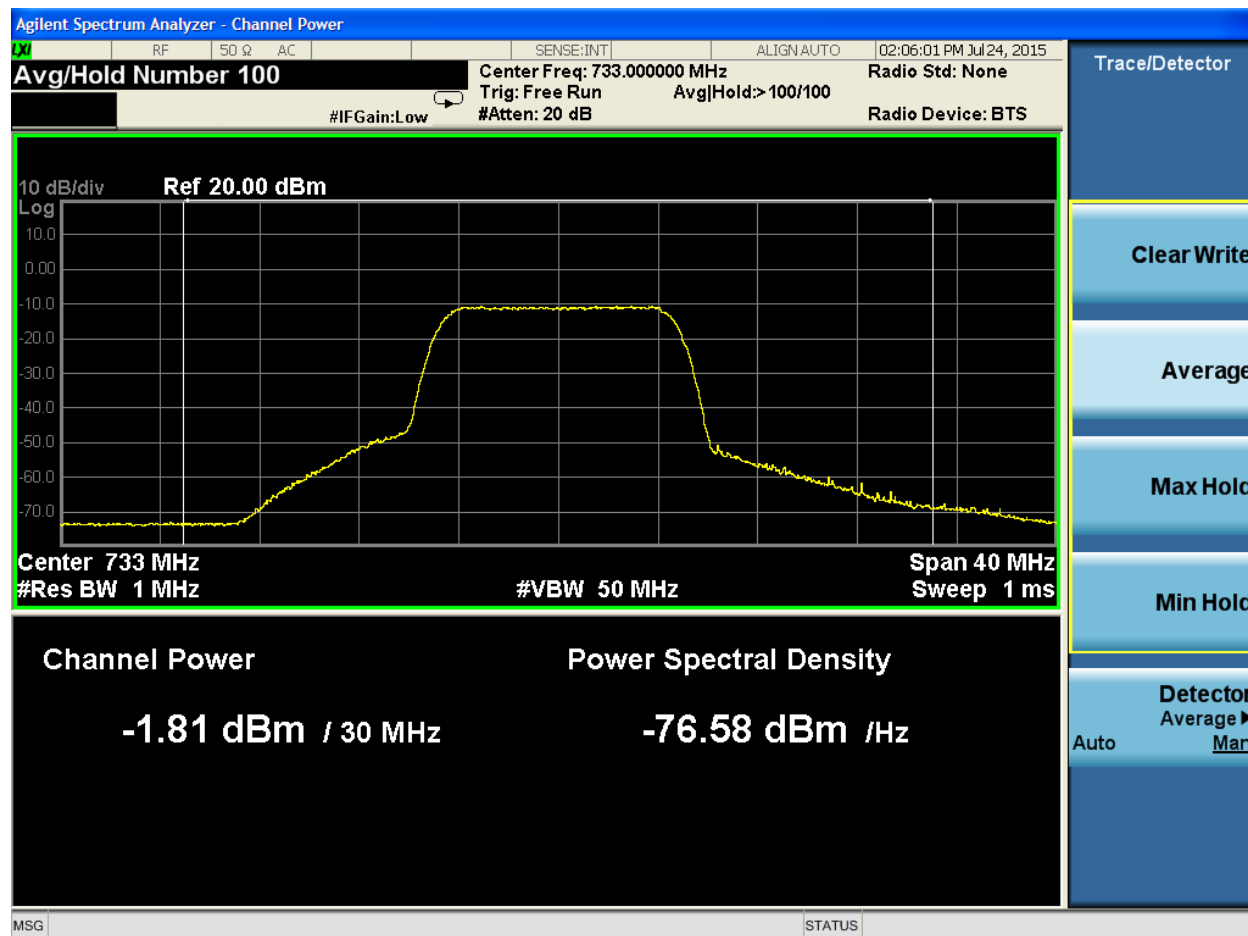


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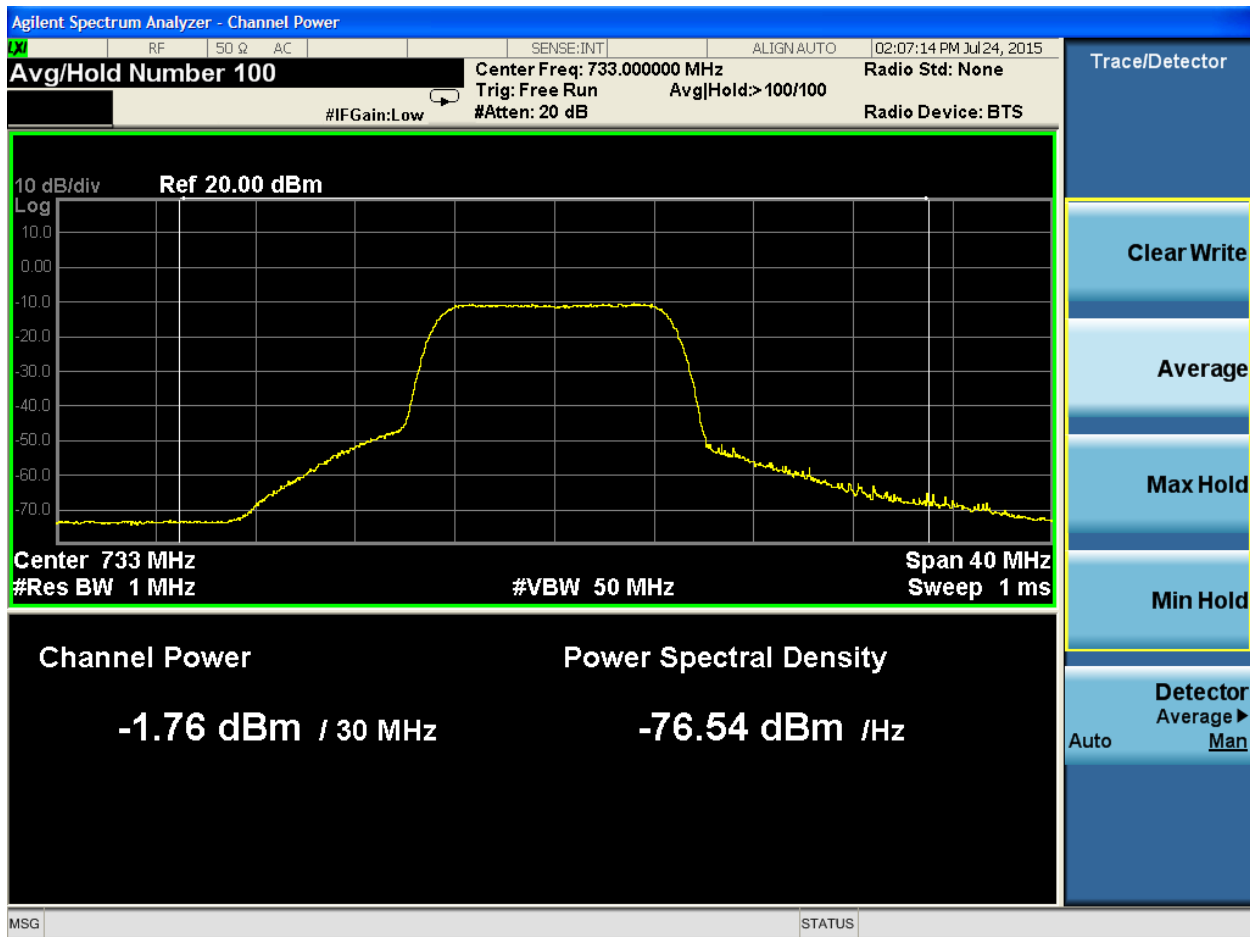
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396

Band 12 Average Readings:



Band 12, Low Channel, QPSK





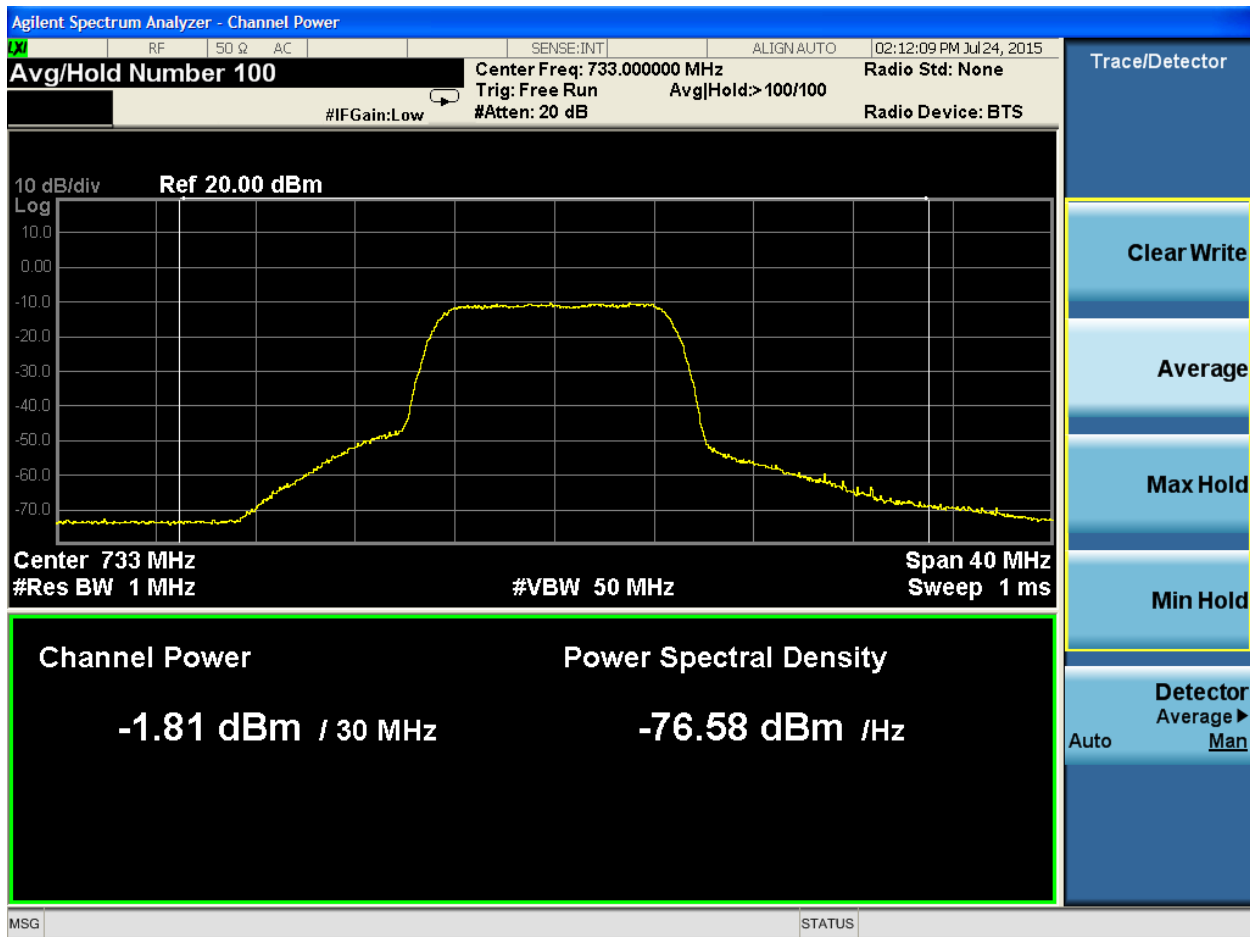
Band 12, Low Channel, 16QAM



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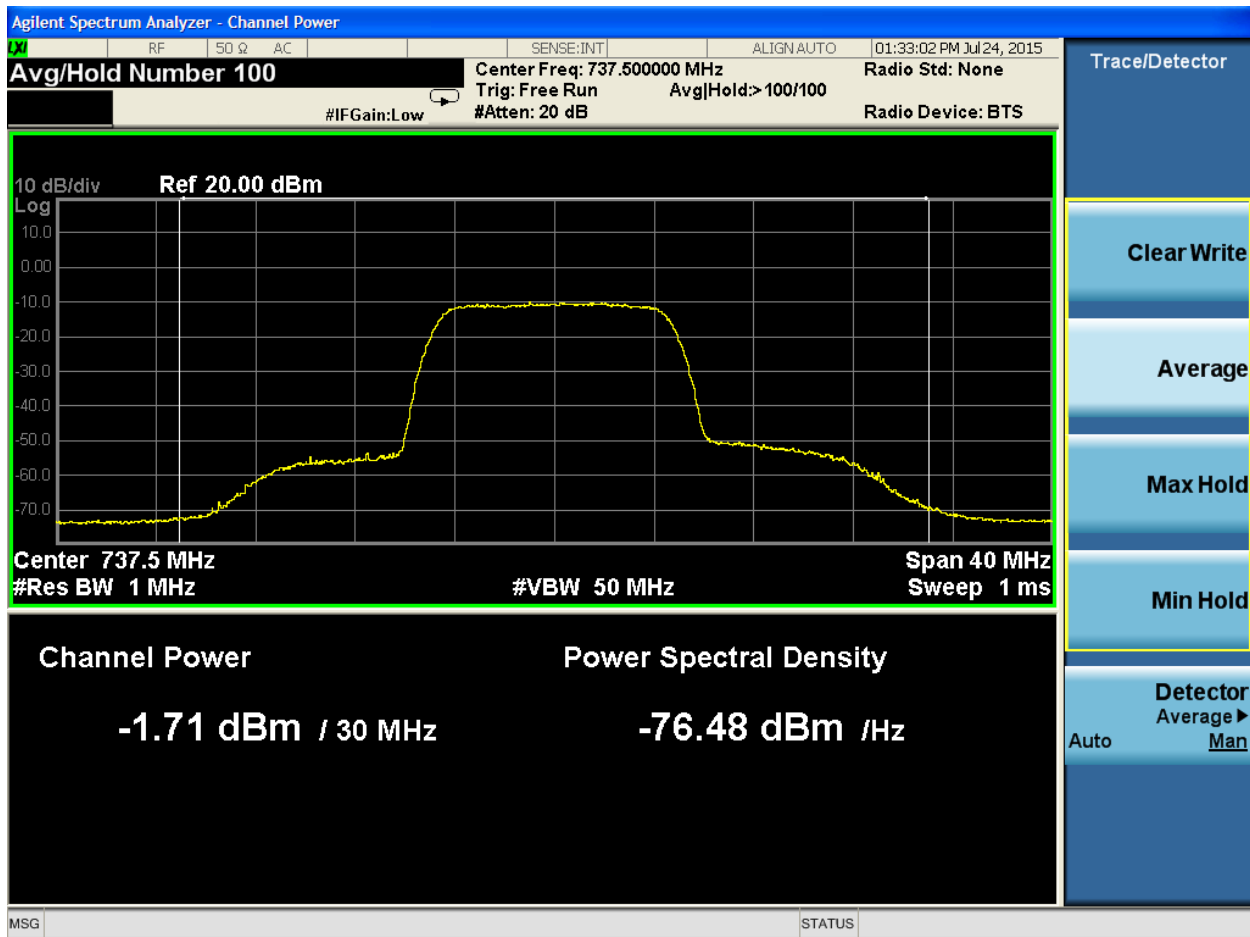
Band 12, Low Channel, 64QAM



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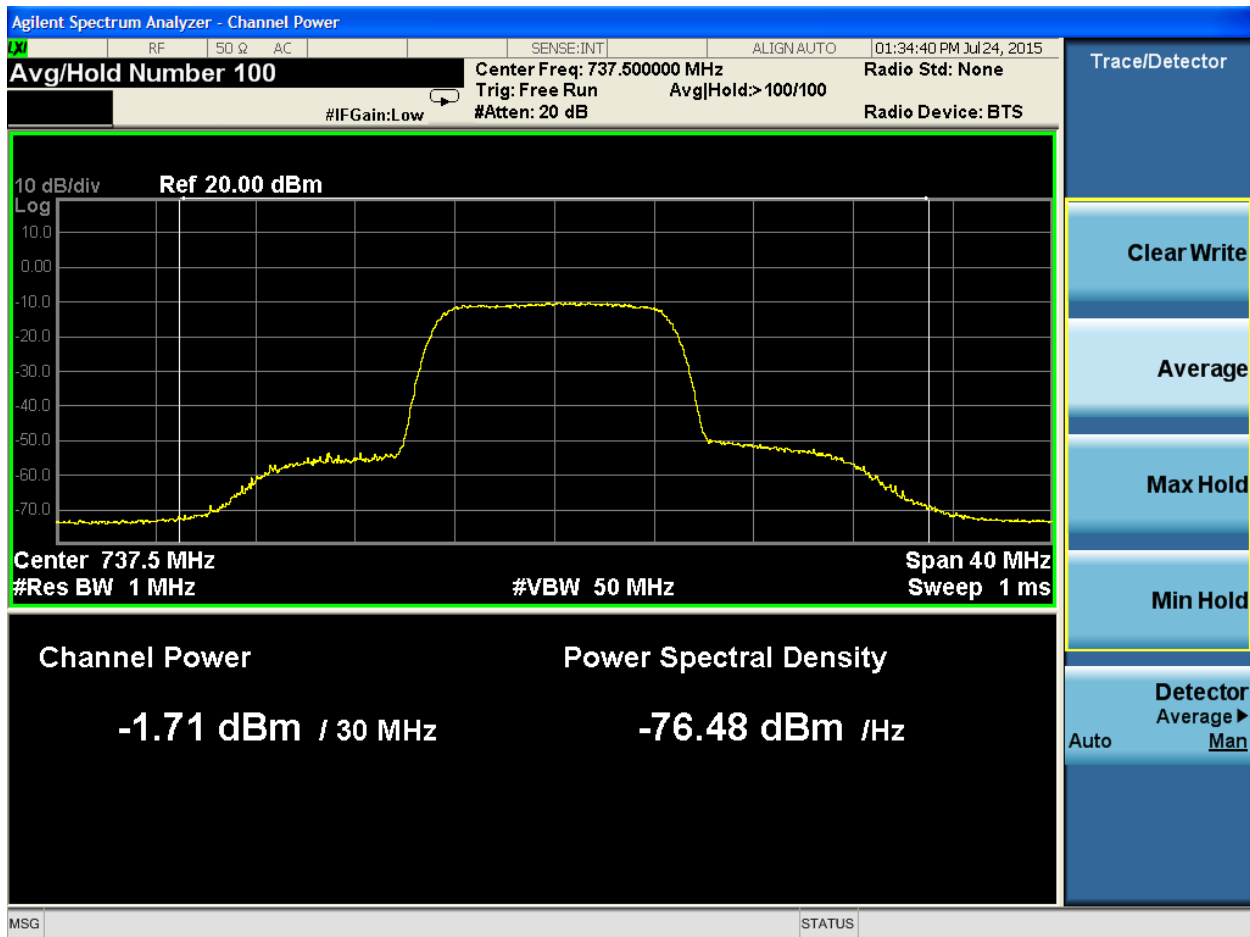
Band 12, Mid Channel, QPSK



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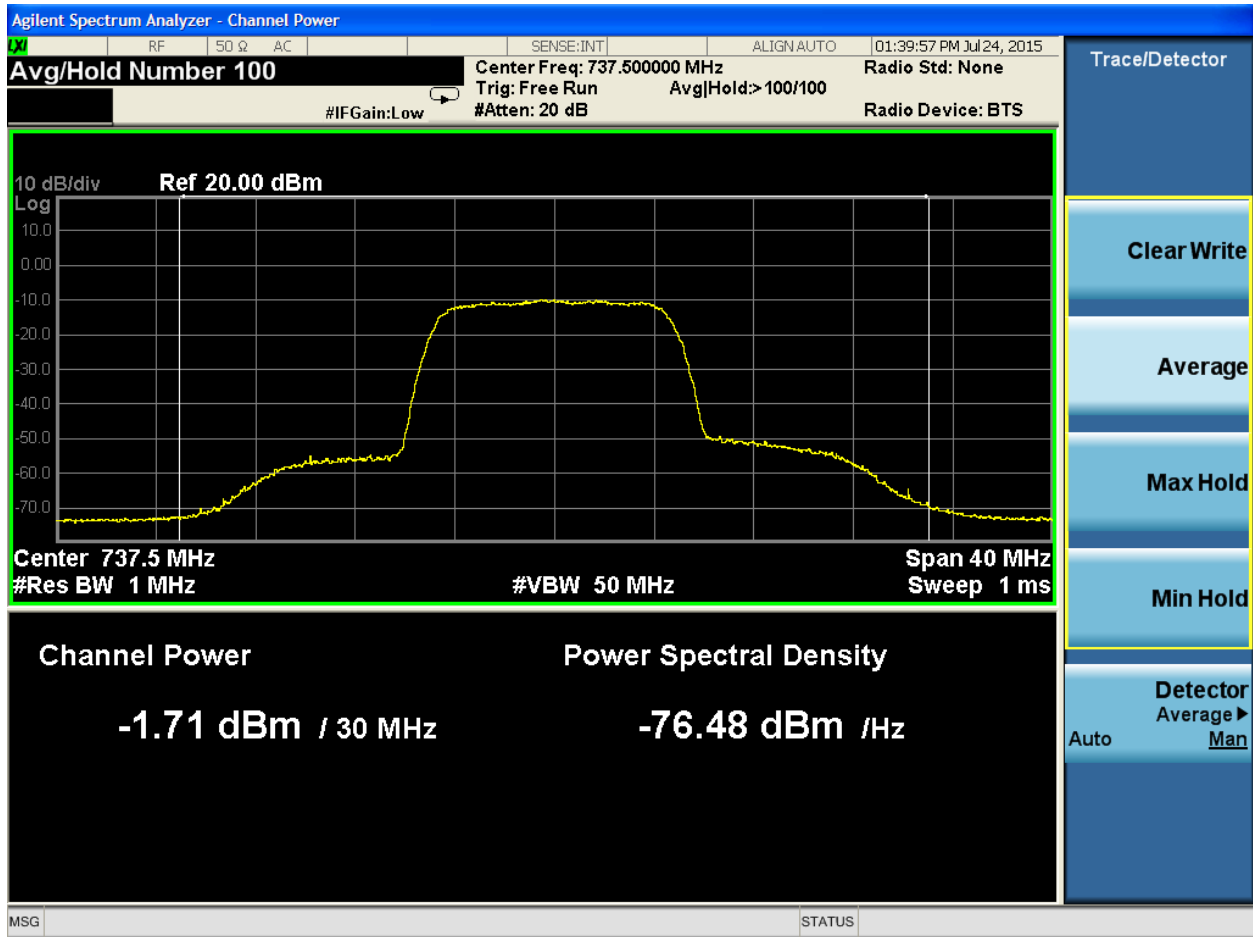
Band 12, Mid Channel, 16QAM



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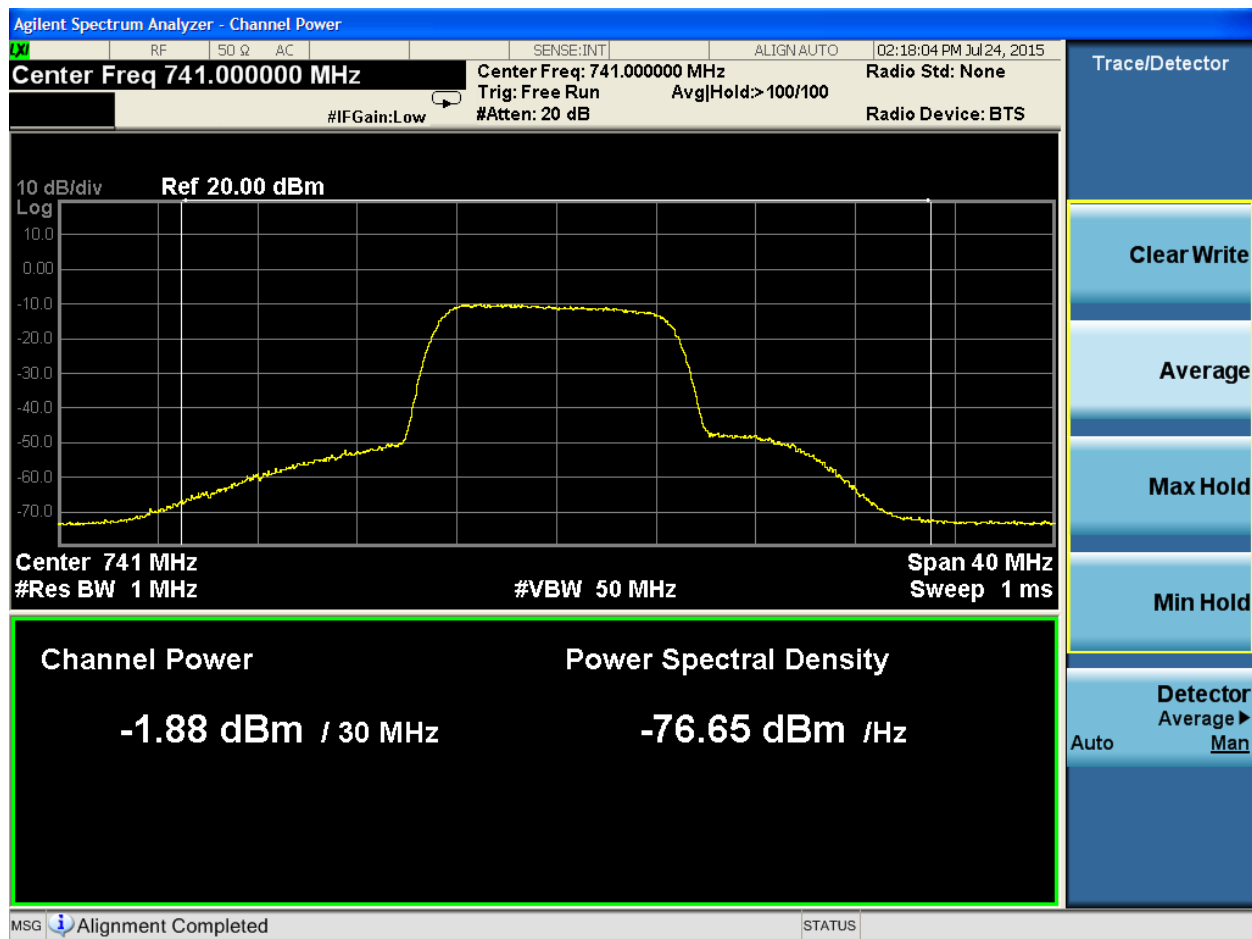
Band 12, Mid Channel, 64QAM



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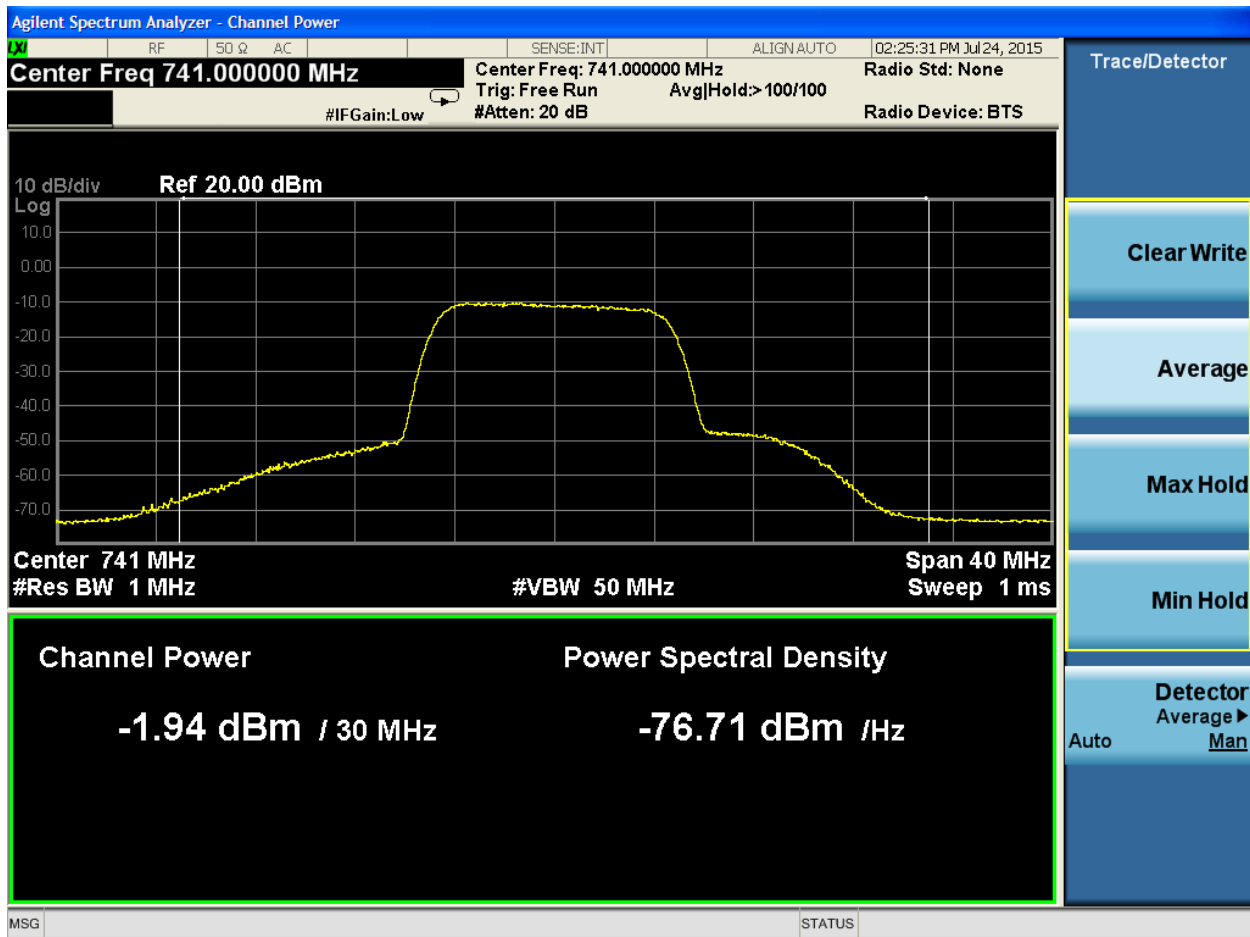
Band 12, High Channel, QPSK



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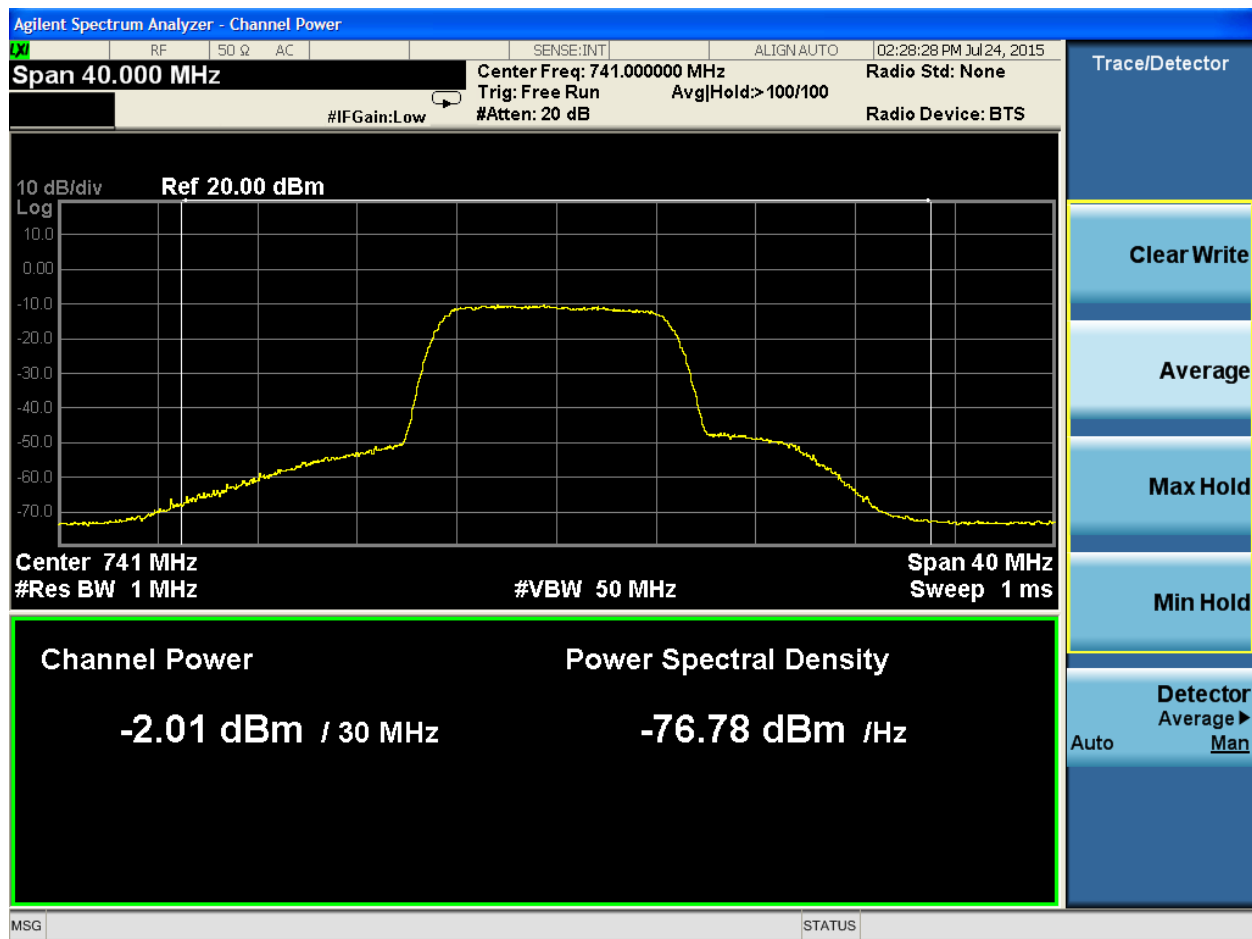


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Band 12, High Channel, 16QAM





Band 12, High Channel, 64QAM

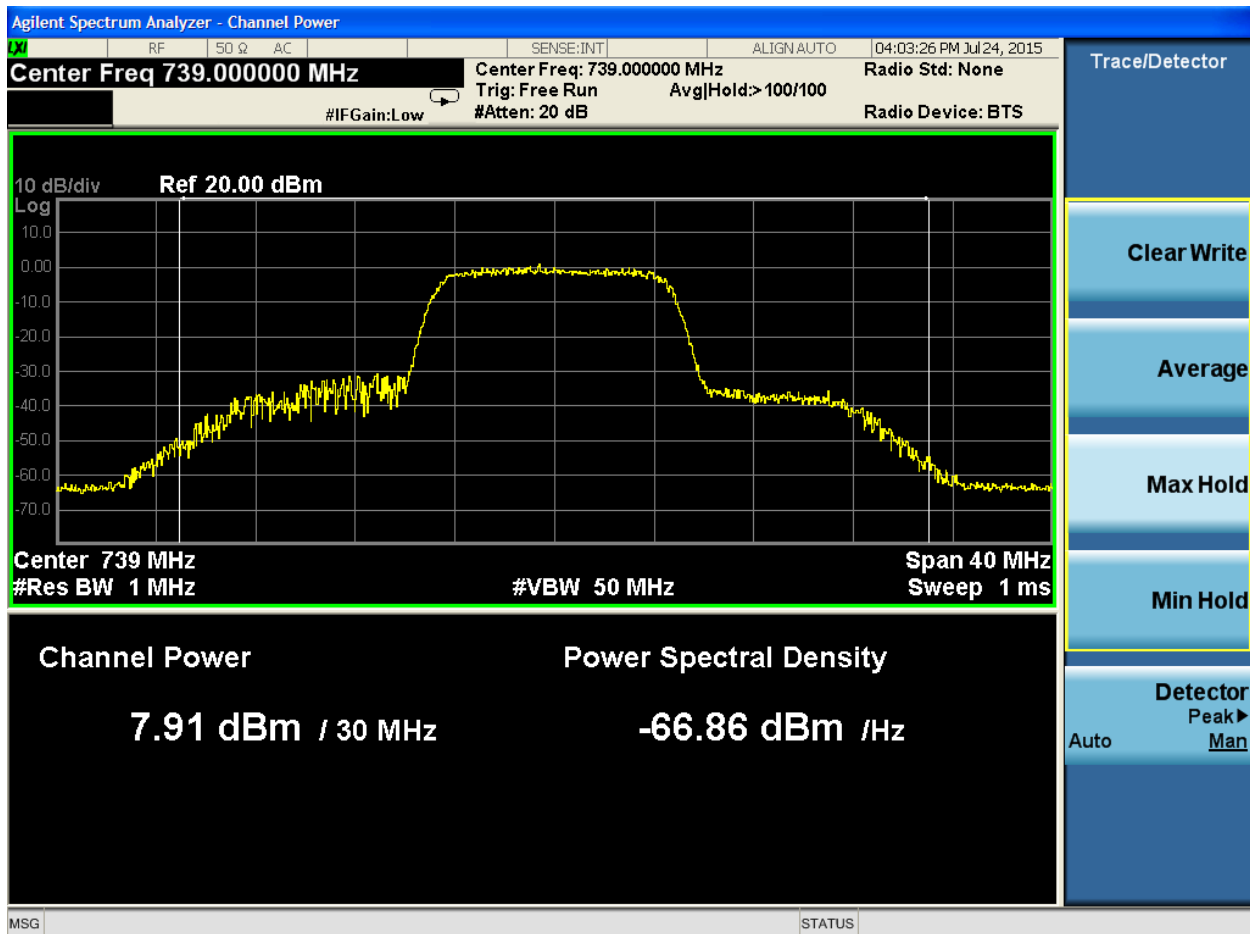


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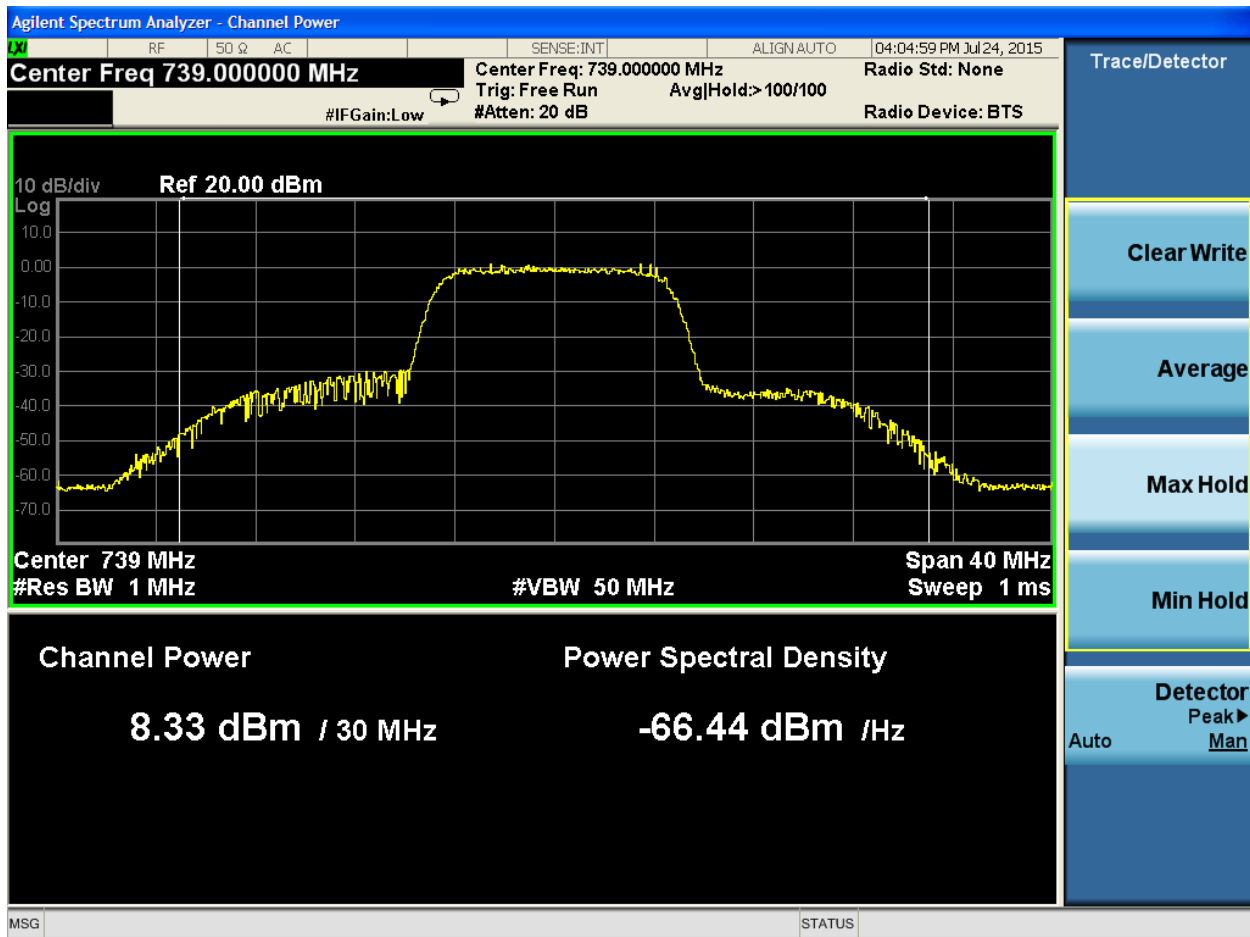


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Band 17 Peak Readings:



Band 17, Mid Channel, QPSK



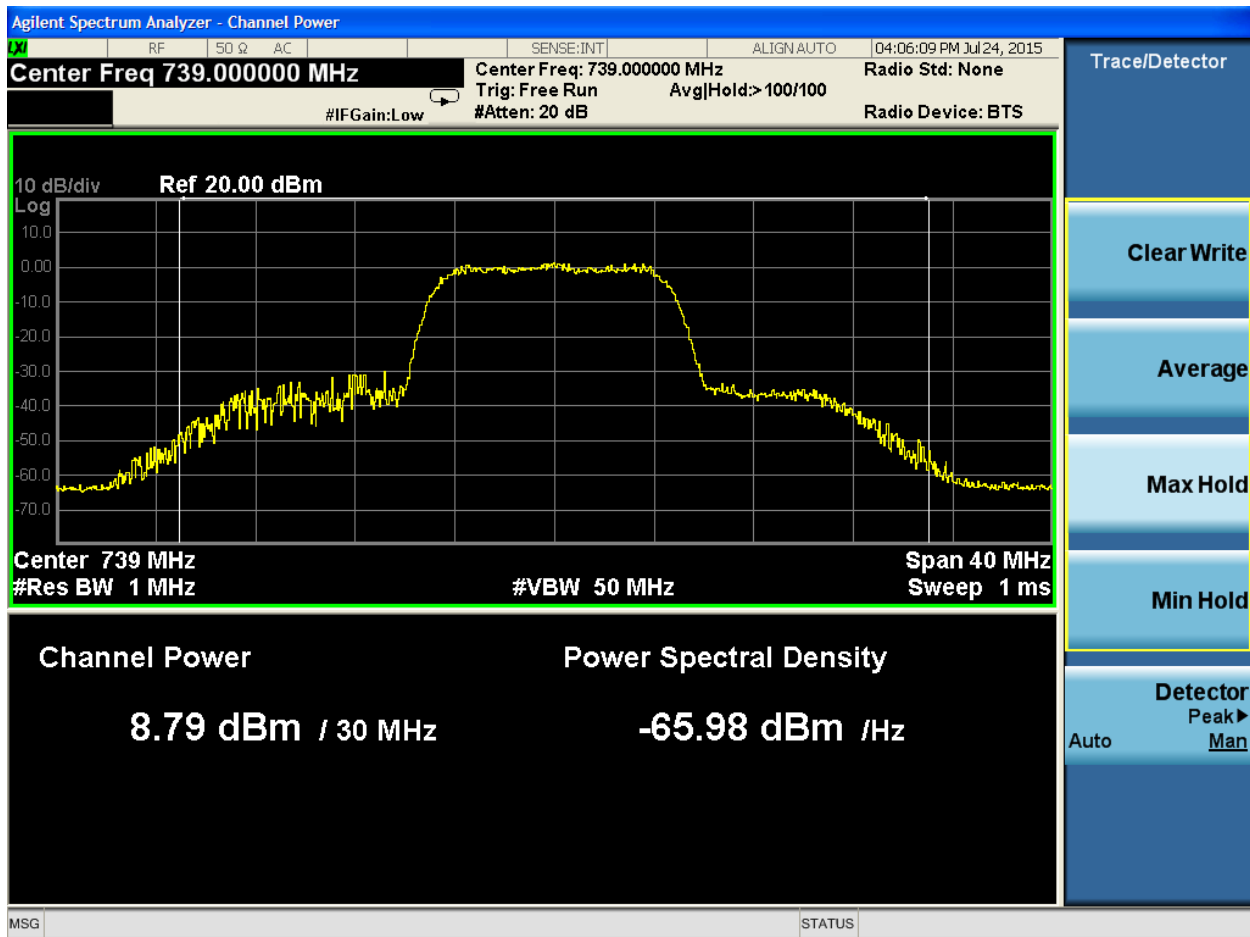
Band 17, Mid Channel, 16QAM



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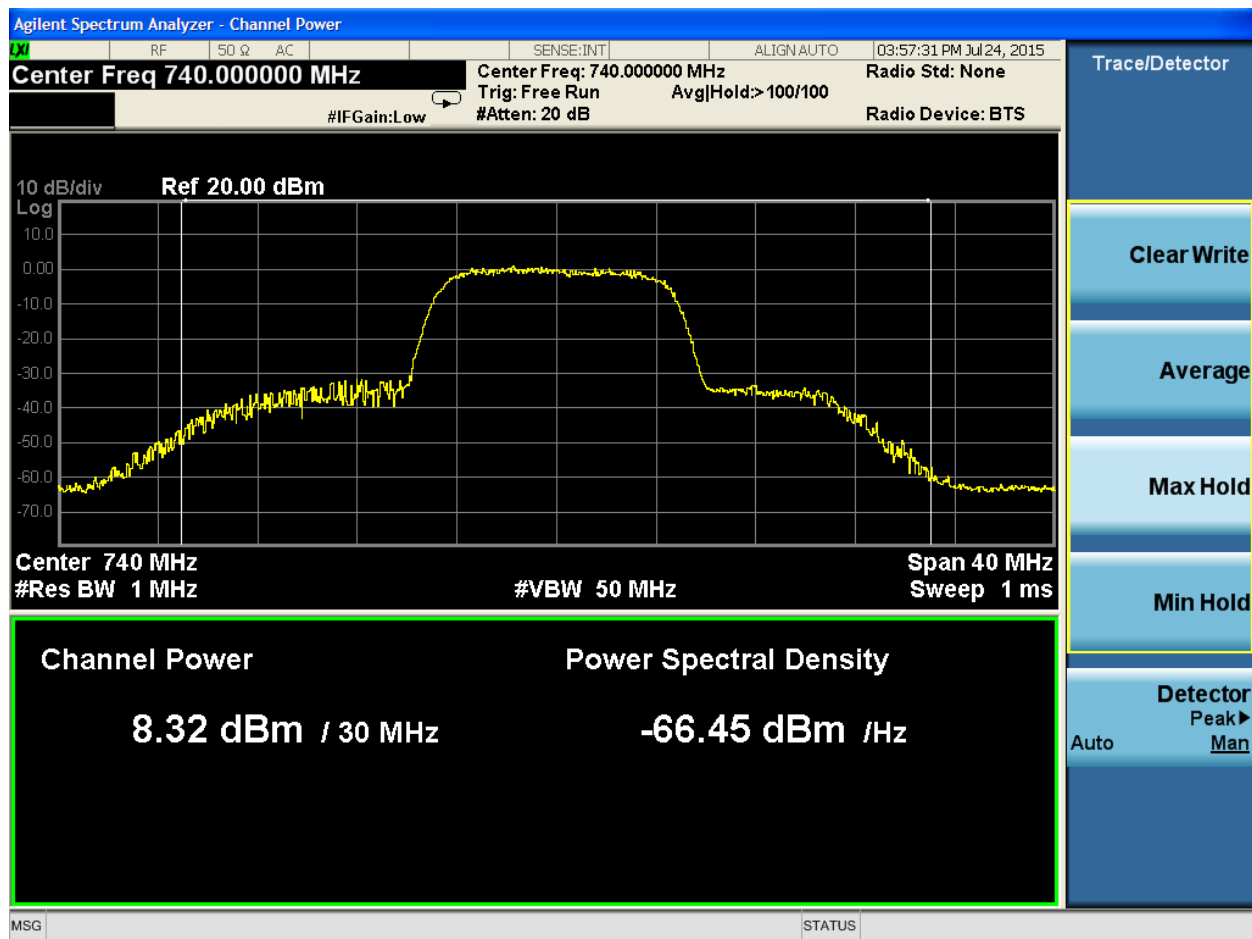
Band 17, Mid Channel, 64QAM



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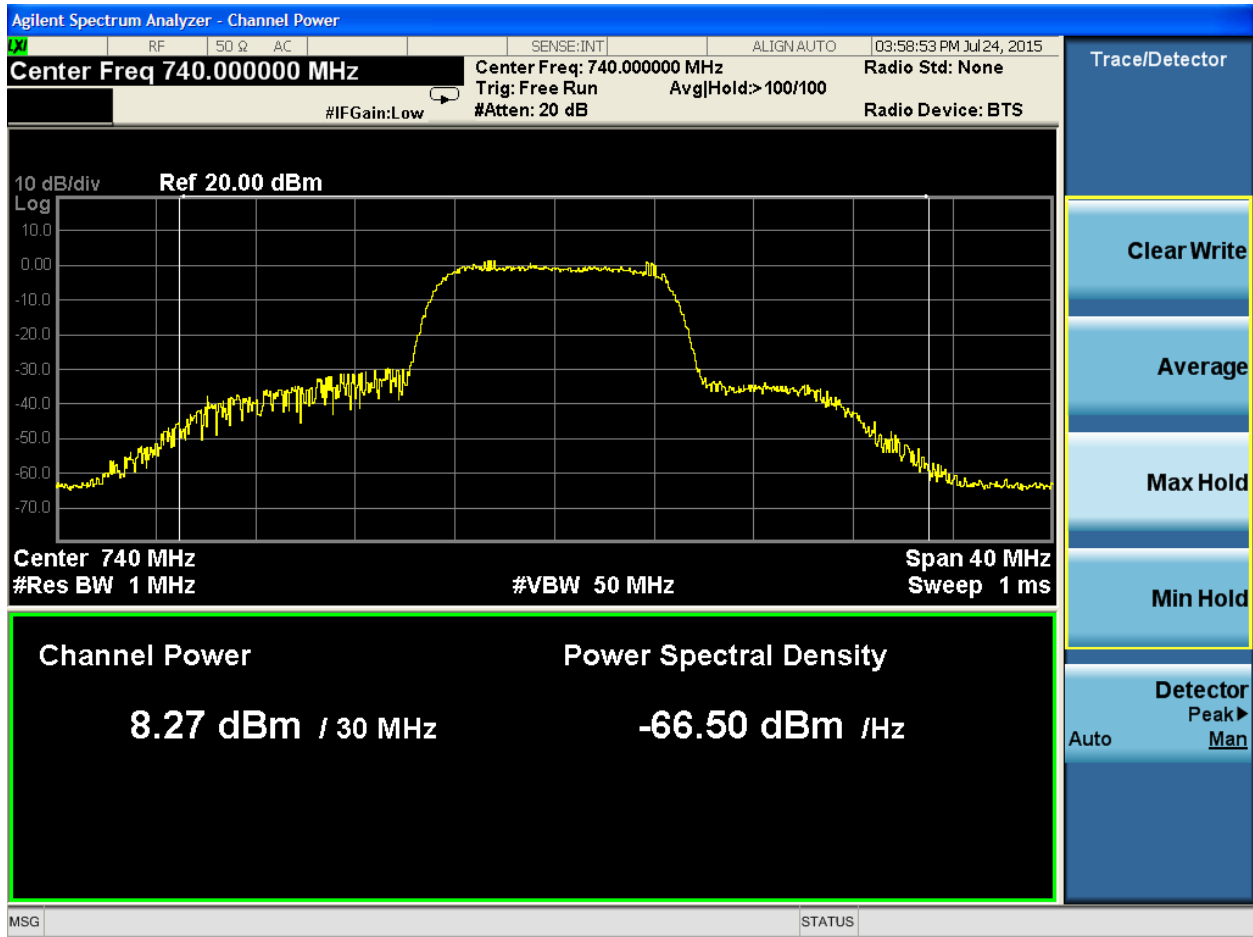


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Band 17, High Channel, QPSK





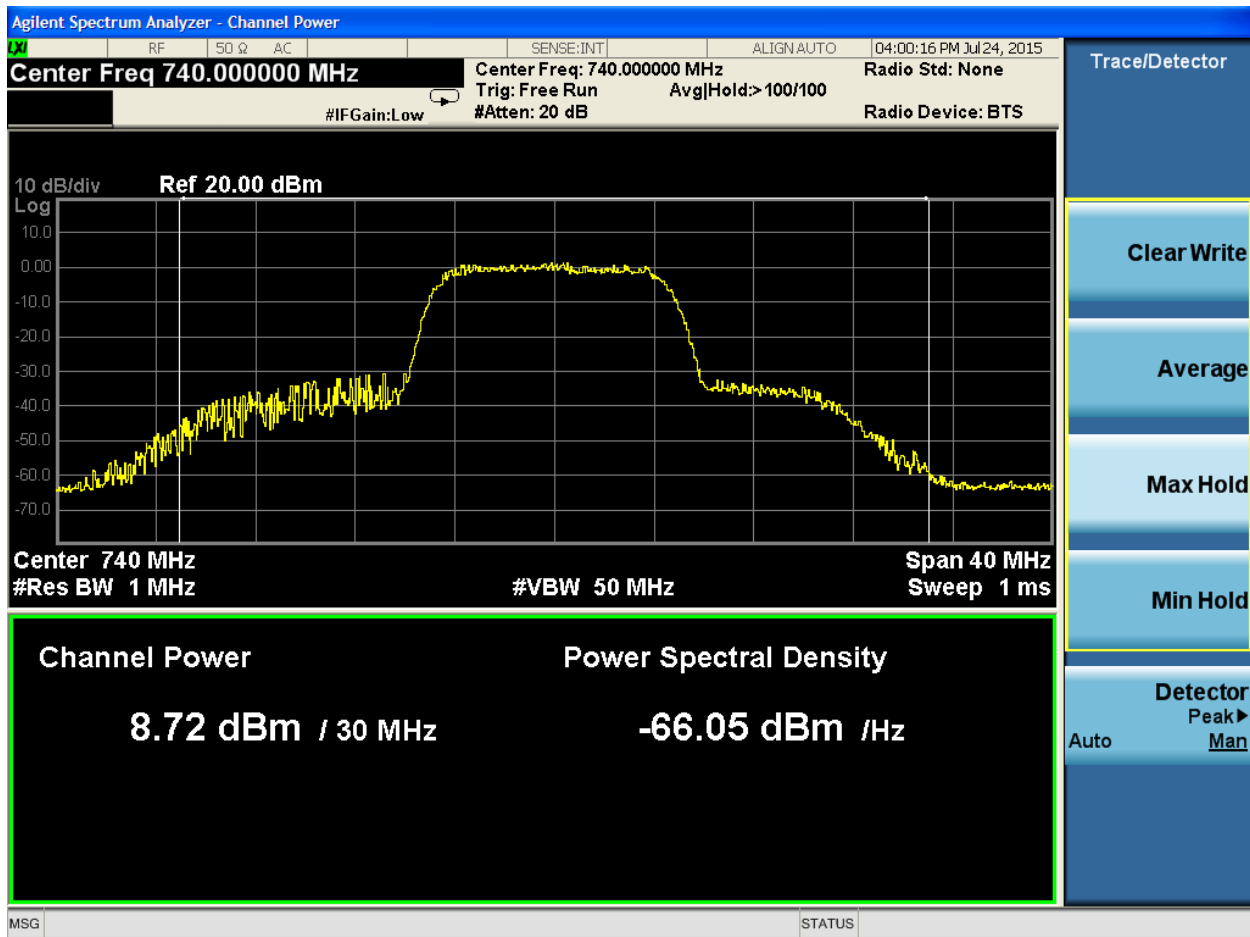
Band 17, High Channel, 16QAM



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Band 17, High Channel, 64QAM

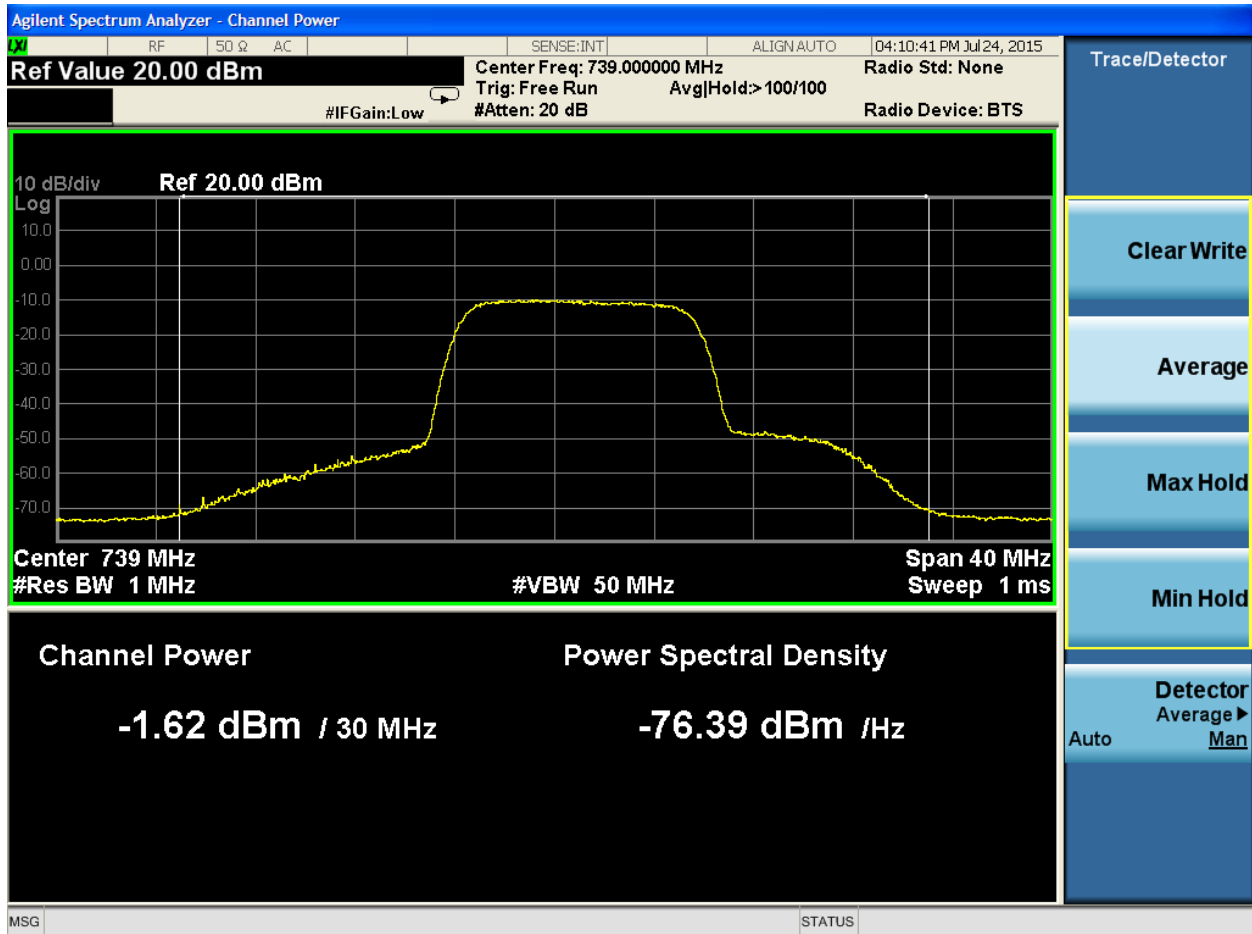


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Band 17 Average Readings:



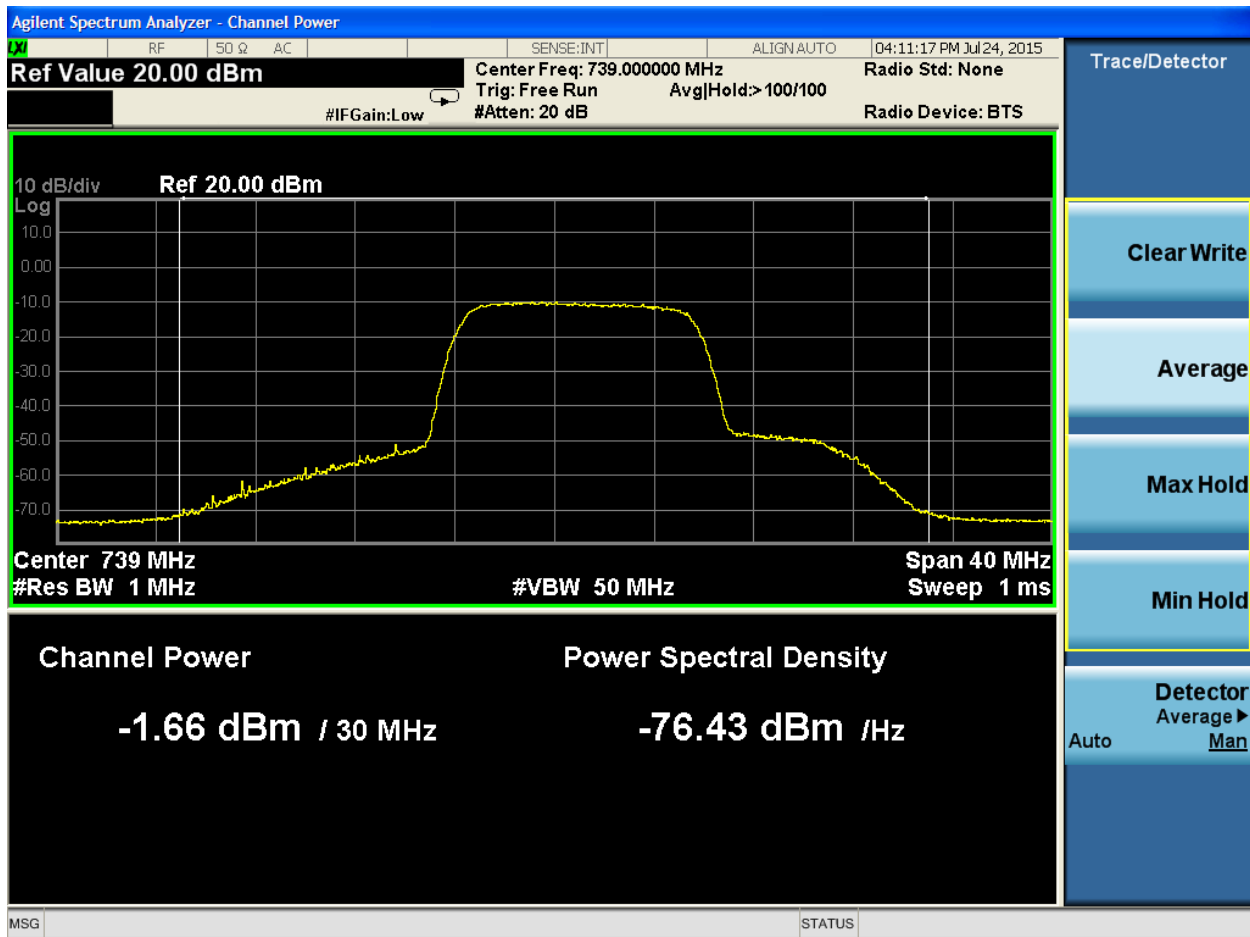
Band 17, Mid Channel, QPSK



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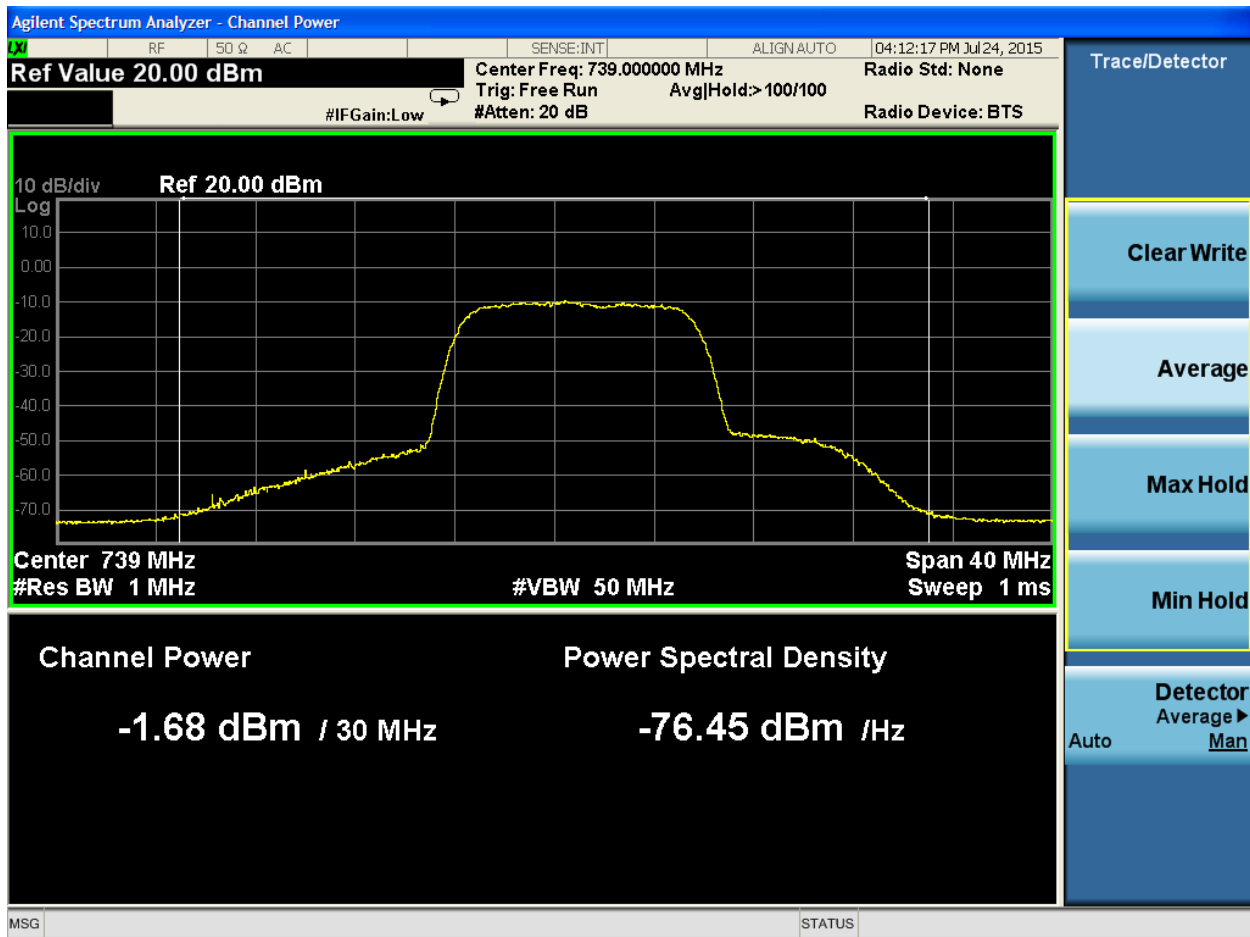


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Band 17, Mid Channel, 16QAM





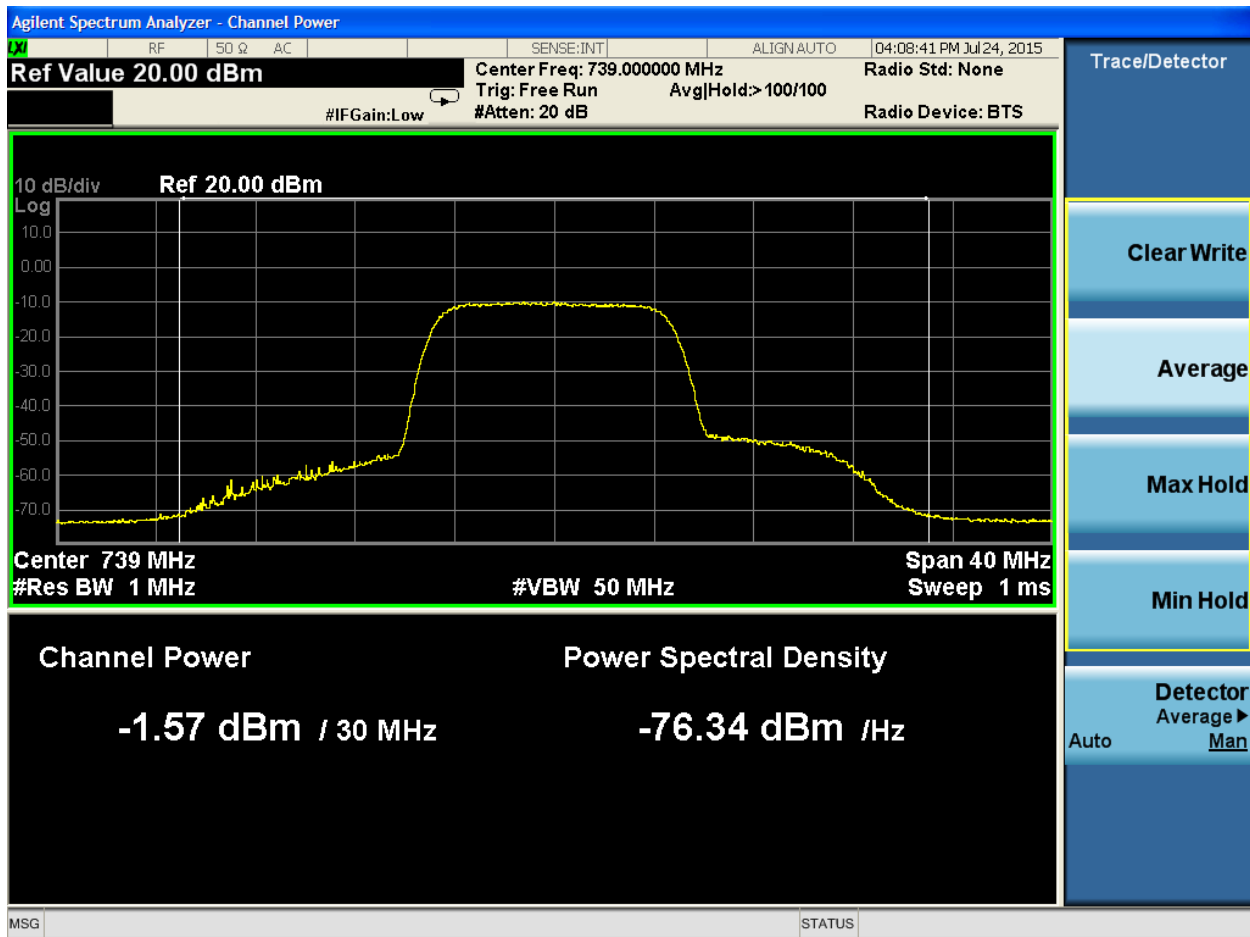
Band 17, Mid Channel, 64QAM



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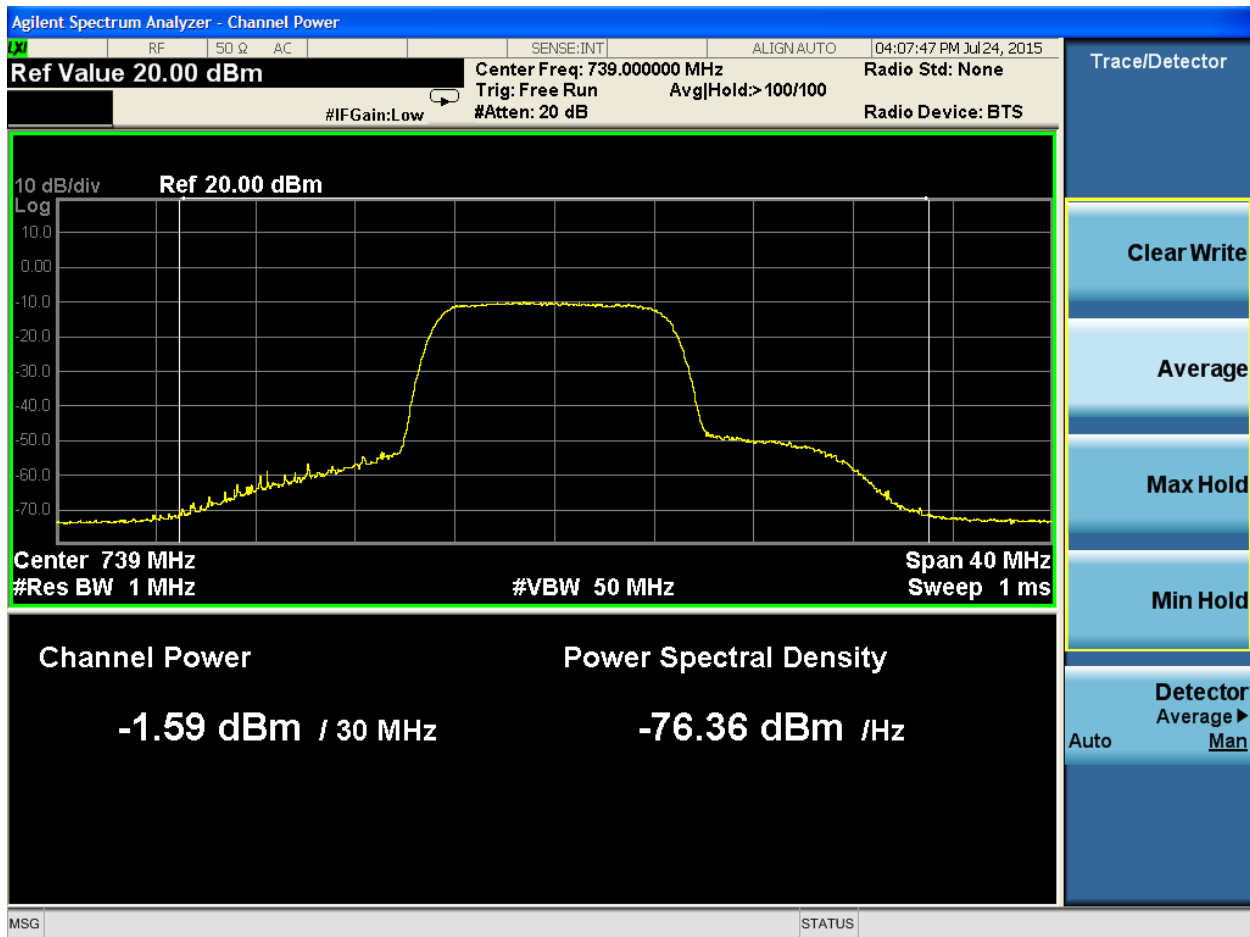
Band 17, High Channel, QPSK



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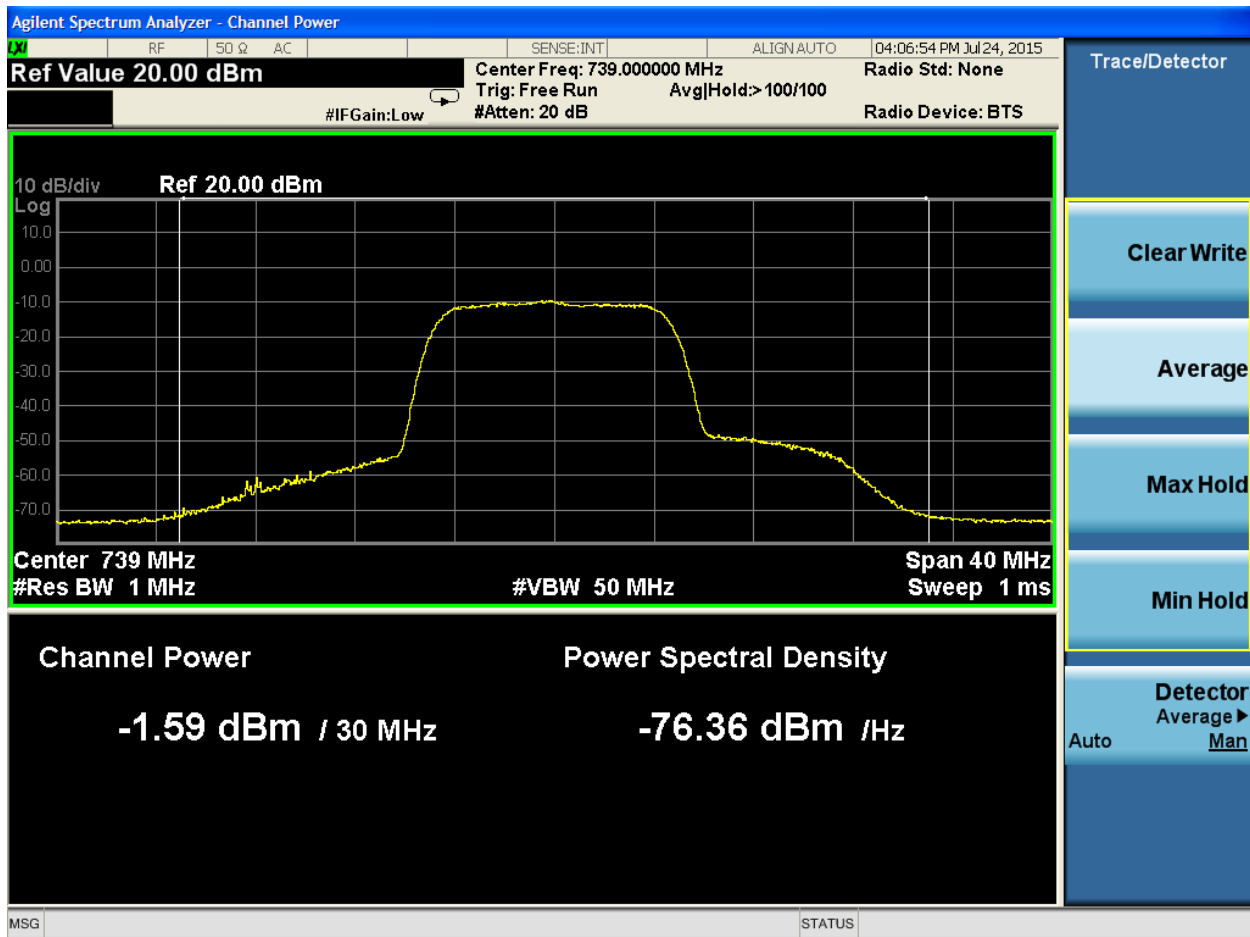
Band 17, High Channel, 16QAM



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Band 17, High Channel, 64QAM



Band Edge Measurements

LIMITS

FCC 27.53(g):

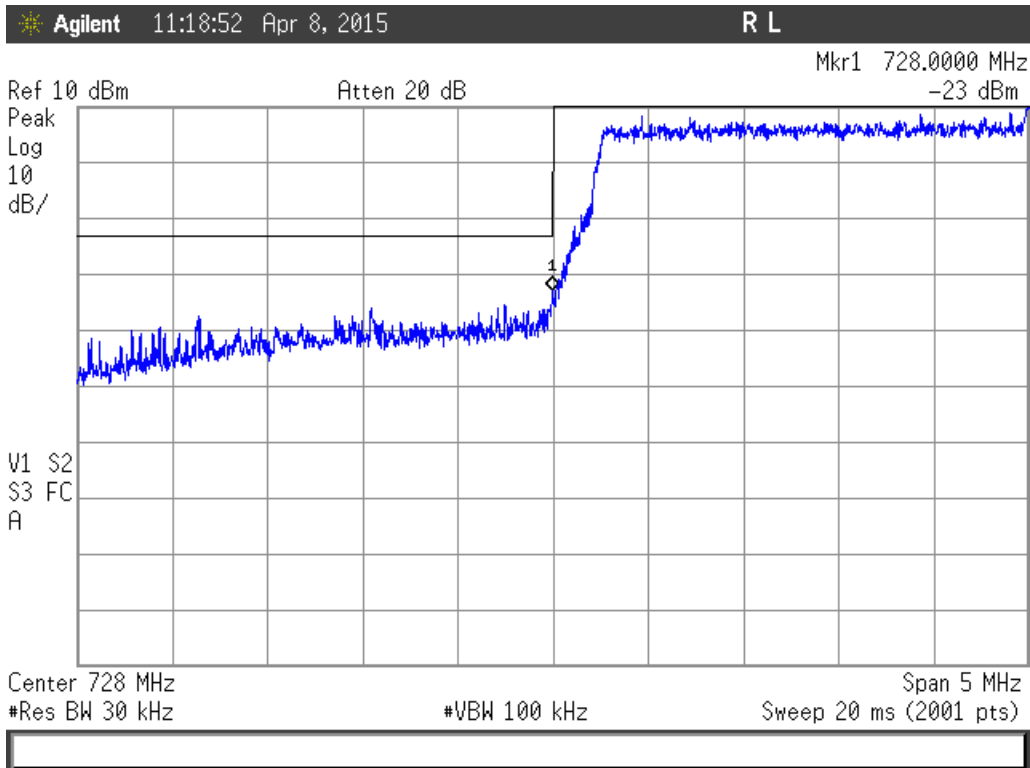
For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

MEASUREMENTS / RESULTS

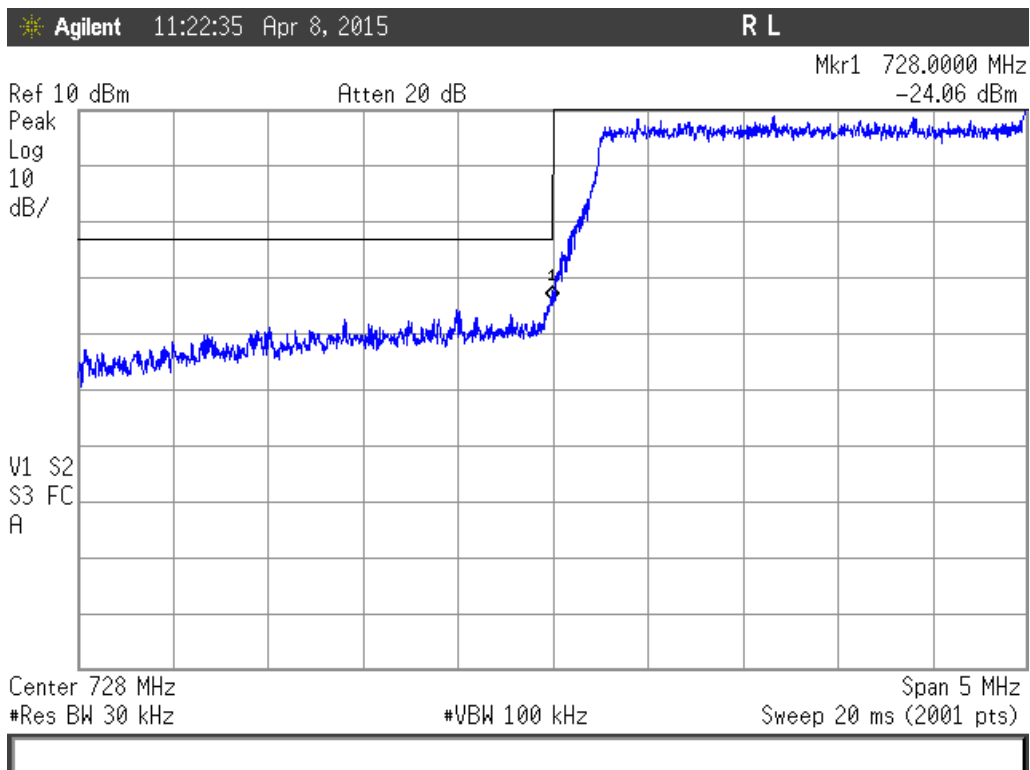
Note: Mask lines are set to -13dBm.

Spectrum analyzer screen plots are shown on the following pages.

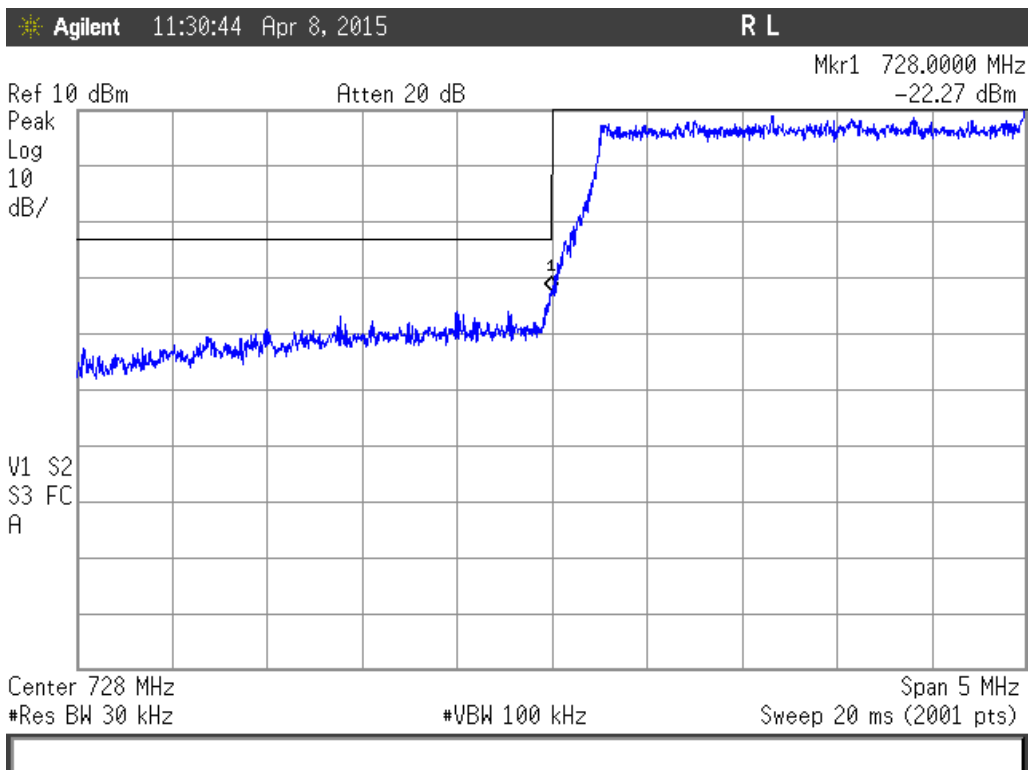




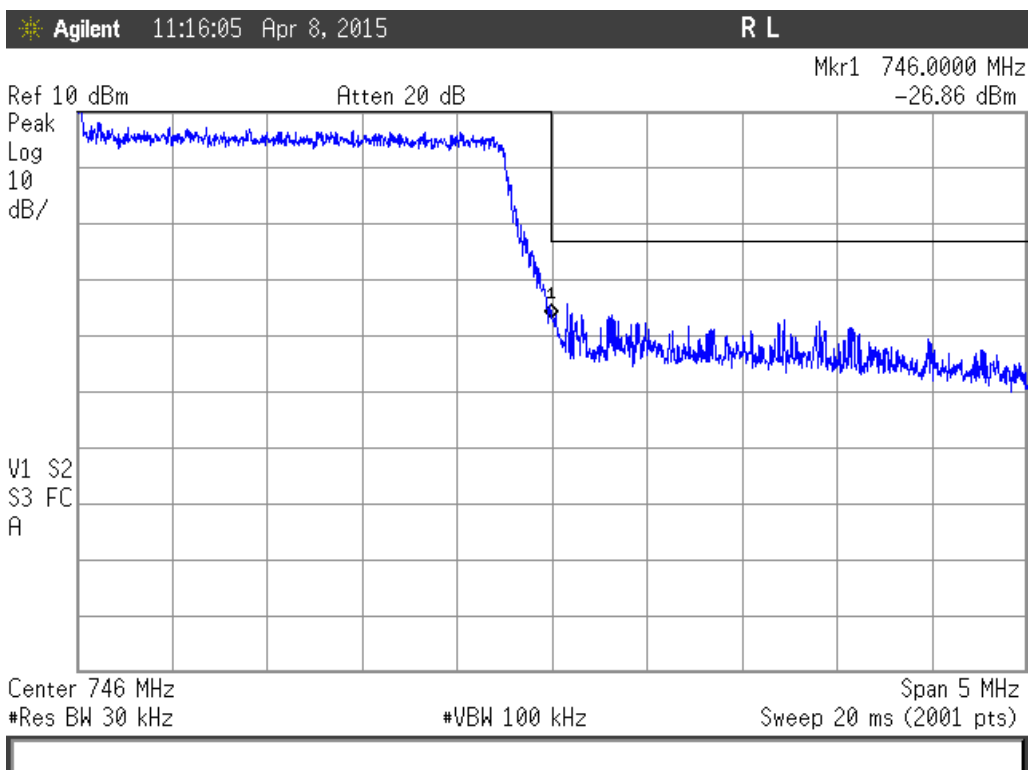
Lower Band Edge - Band 12 – 5MHz BW – QPSK – Port J1



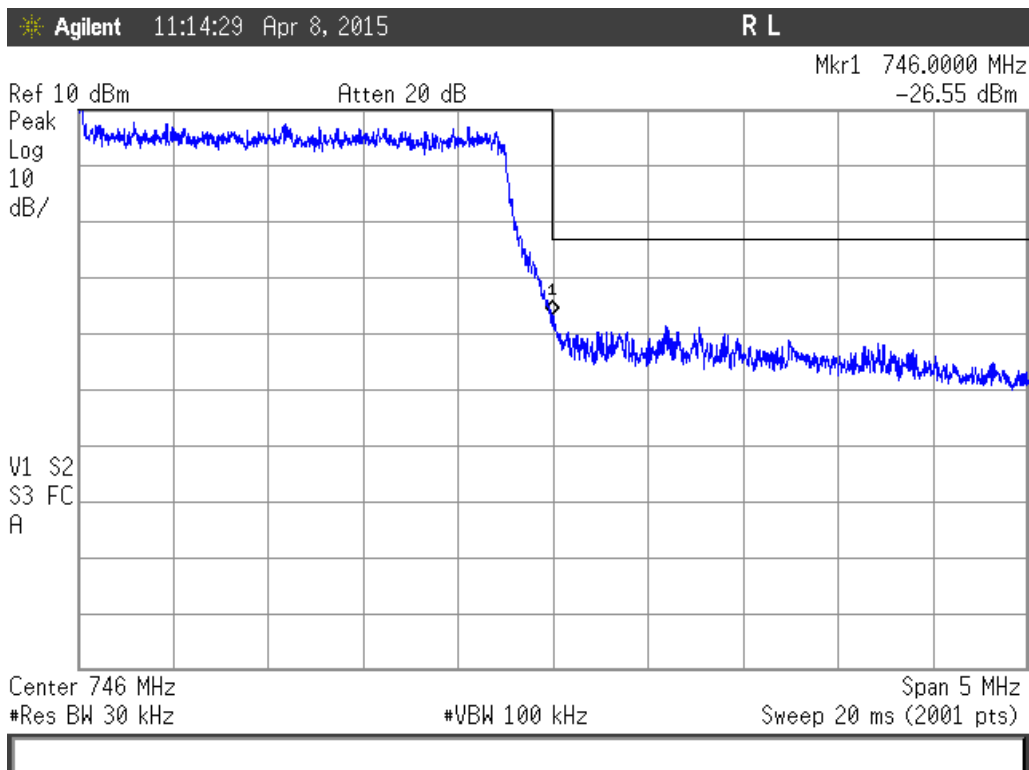
Lower Band Edge - Band 12 – 5MHz BW – 16QAM – Port J1



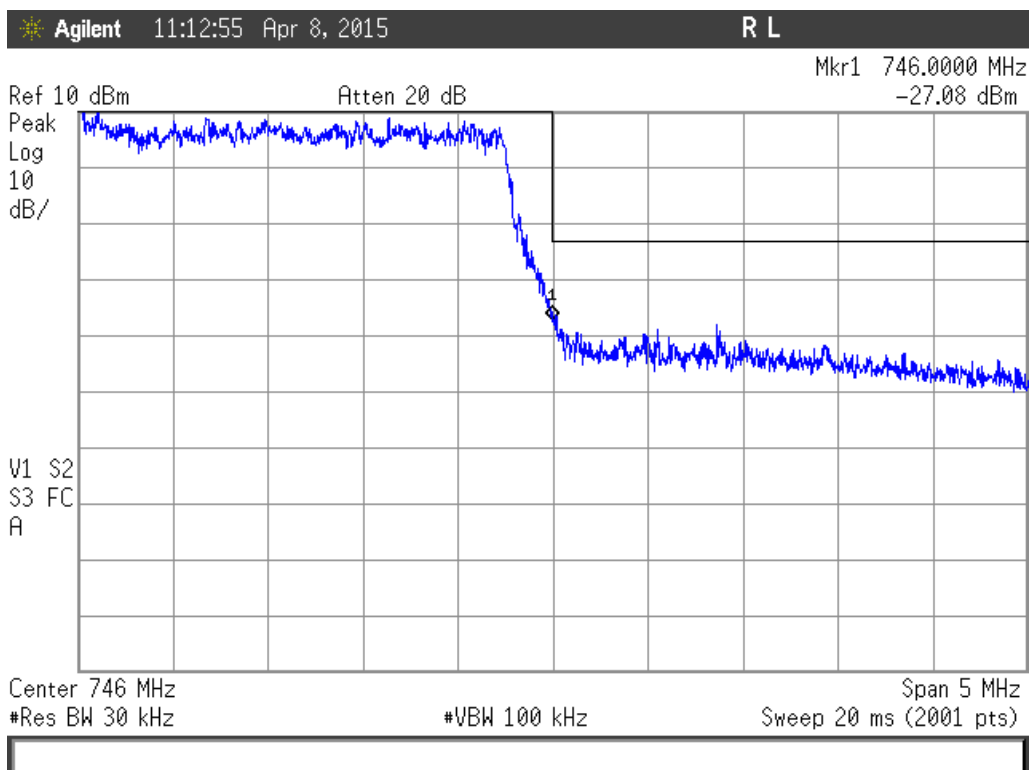
Lower Band Edge - Band 12 – 5MHz BW – 64QAM – Port J1



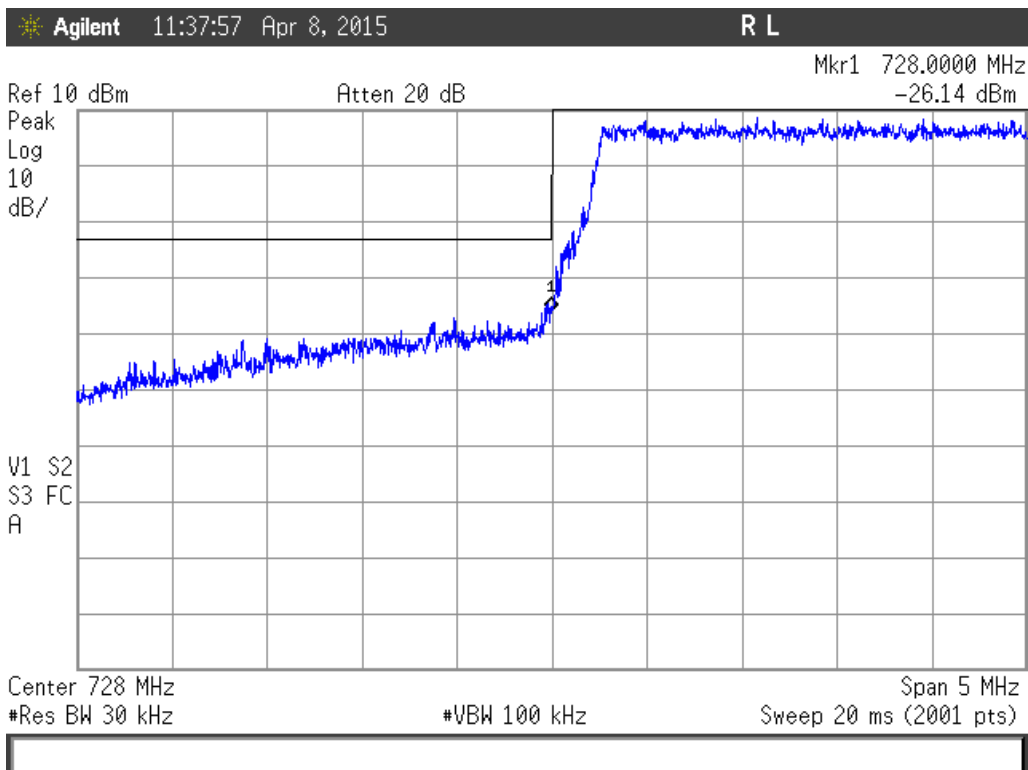
Upper Band Edge - Band 12 – 5MHz BW – QPSK – Port J1



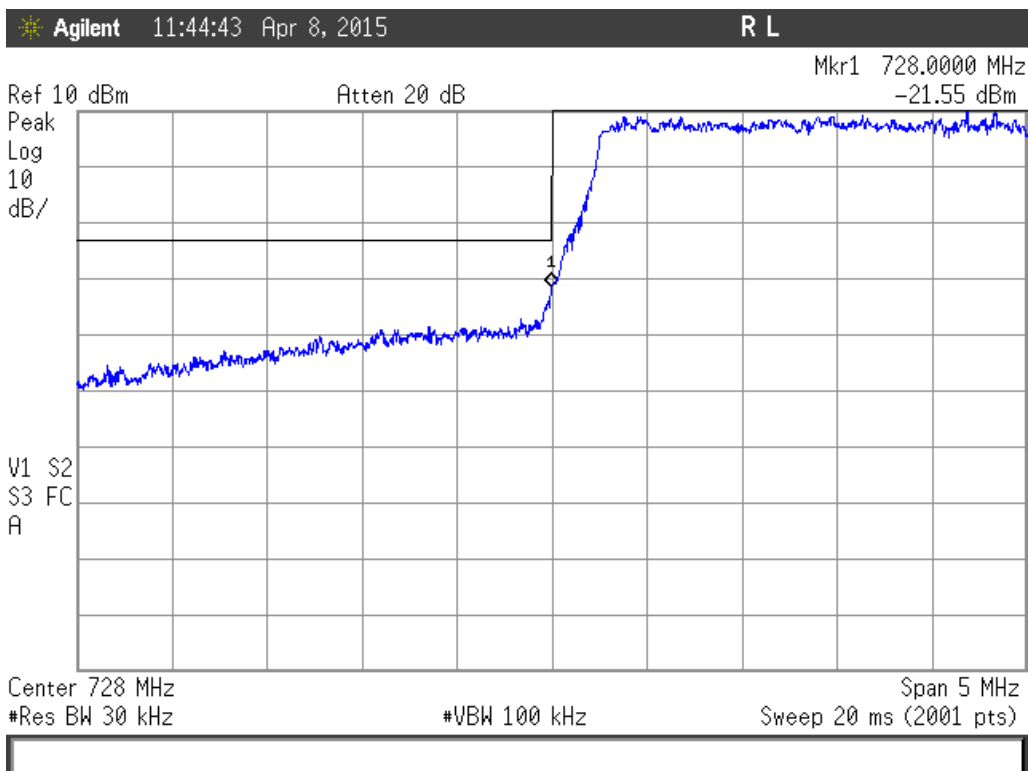
Upper Band Edge - Band 12 – 5MHz BW – 16QAM – Port J1



Upper Band Edge - Band 12 – 5MHz BW – 64QAM – Port J1

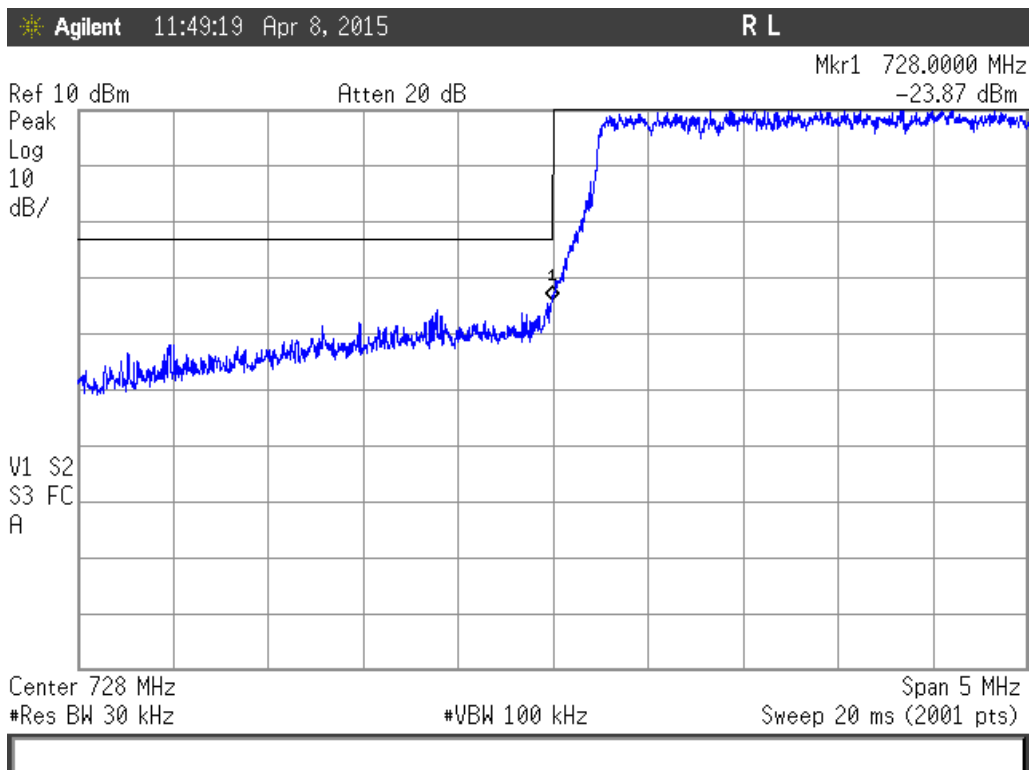


Lower Band Edge - Band 12 – 5MHz BW – QPSK – Port J2

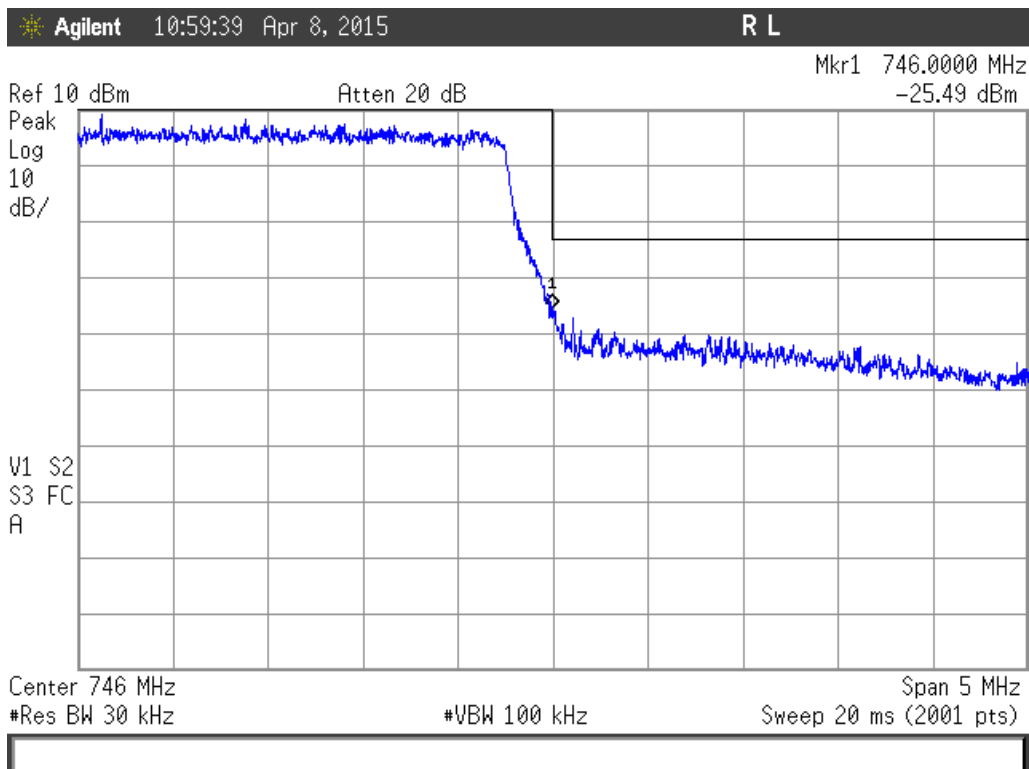


Lower Band Edge - Band 12 – 5MHz BW – 16QAM – Port J2



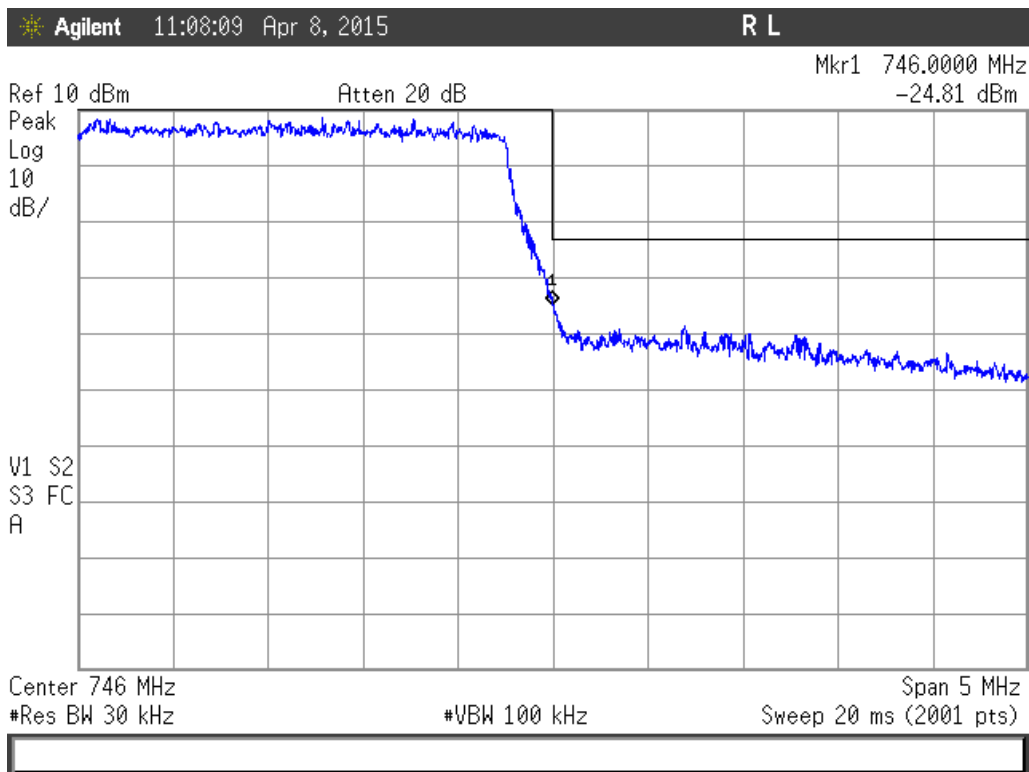


Lower Band Edge - Band 12 – 5MHz BW – 64QAM – Port J2

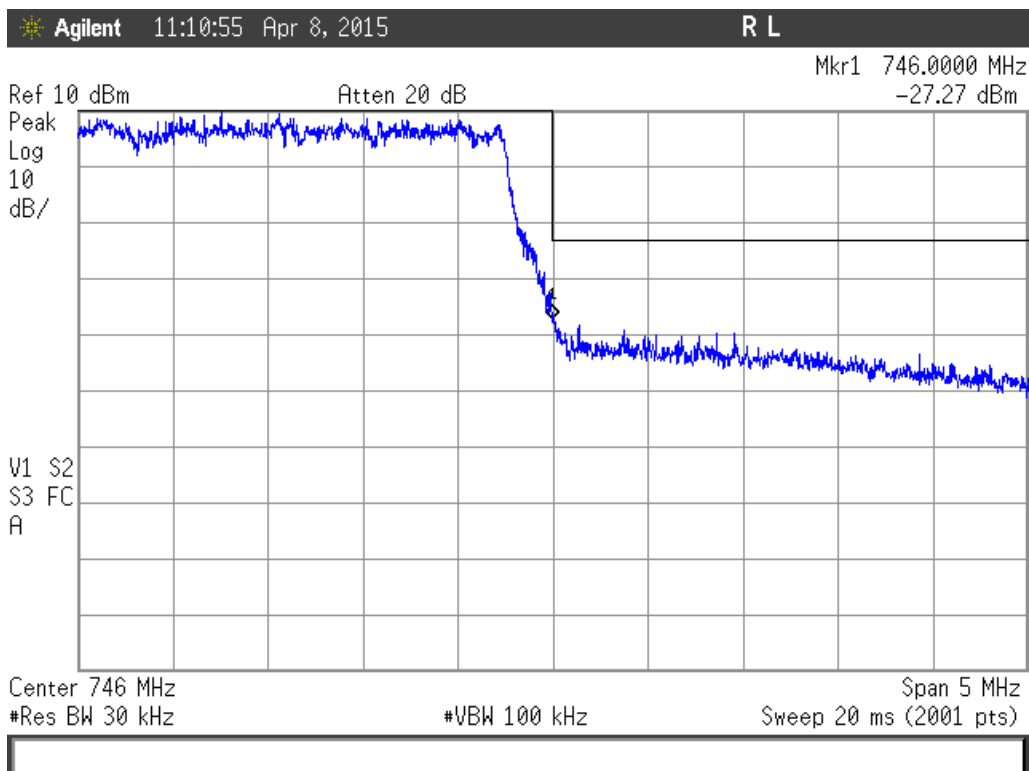


Upper Band Edge - Band 12 – 5MHz BW – QPSK – Port J2



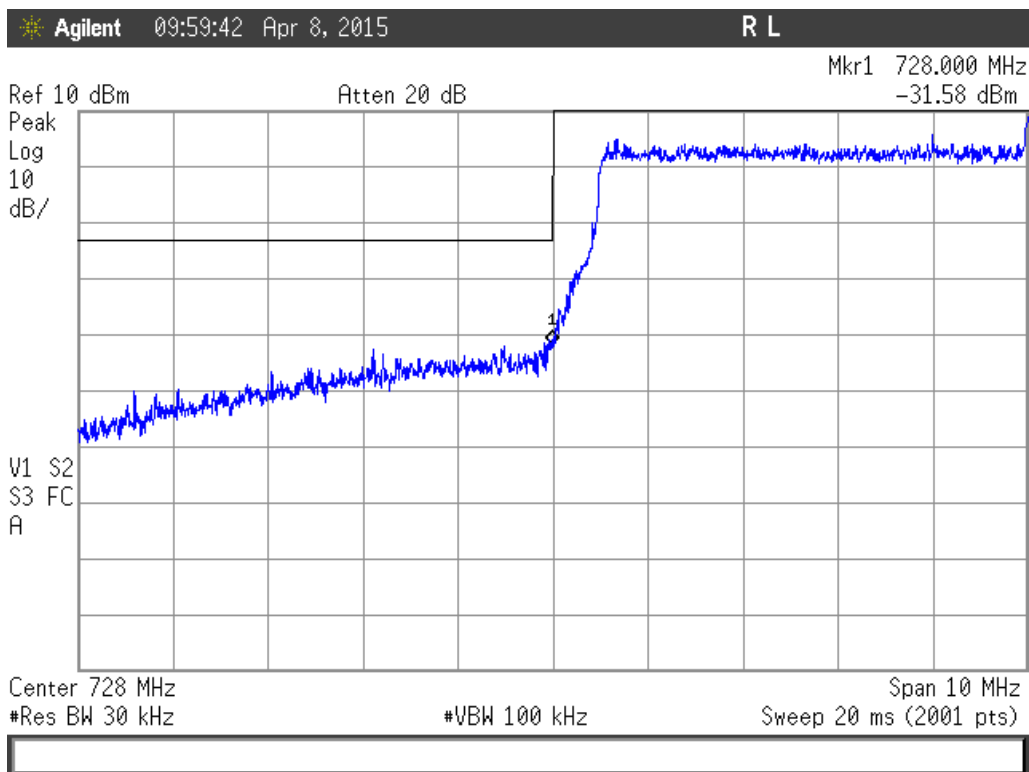


Upper Band Edge - Band 12 – 5MHz BW – 16QAM – Port J2

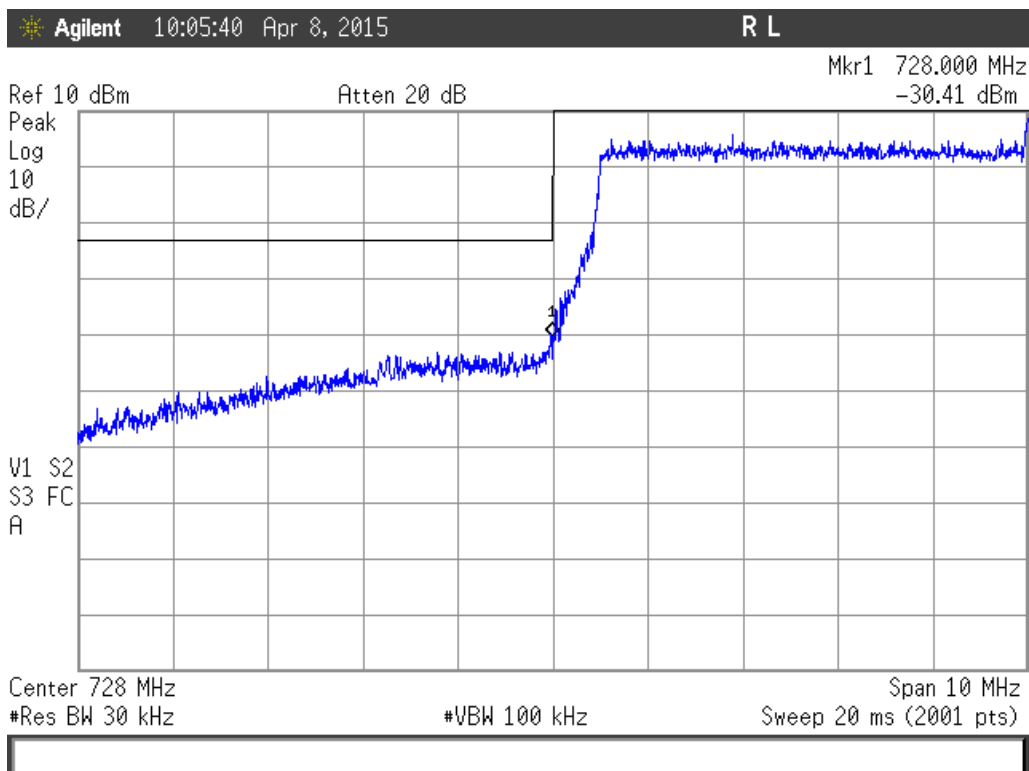


Upper Band Edge - Band 12 – 5MHz BW – 64QAM – Port J2





Lower Band Edge - Band 12 – 10MHz BW – QPSK – Port J1

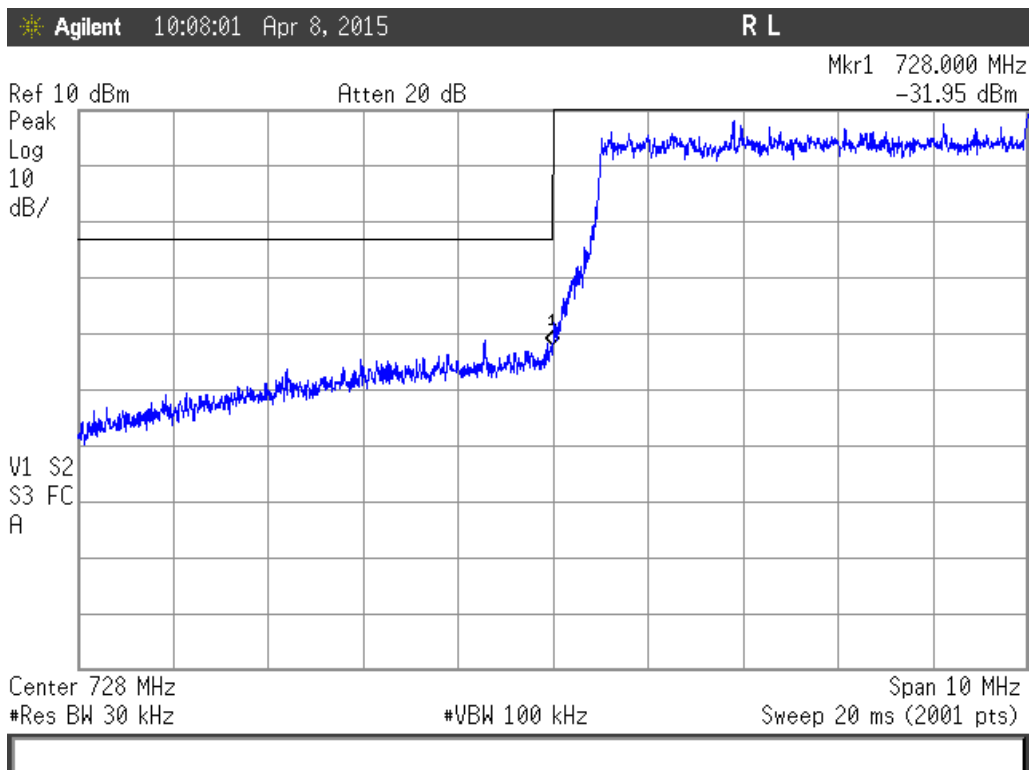


Lower Band Edge - Band 12 – 10MHz BW – 16QAM – Port J1

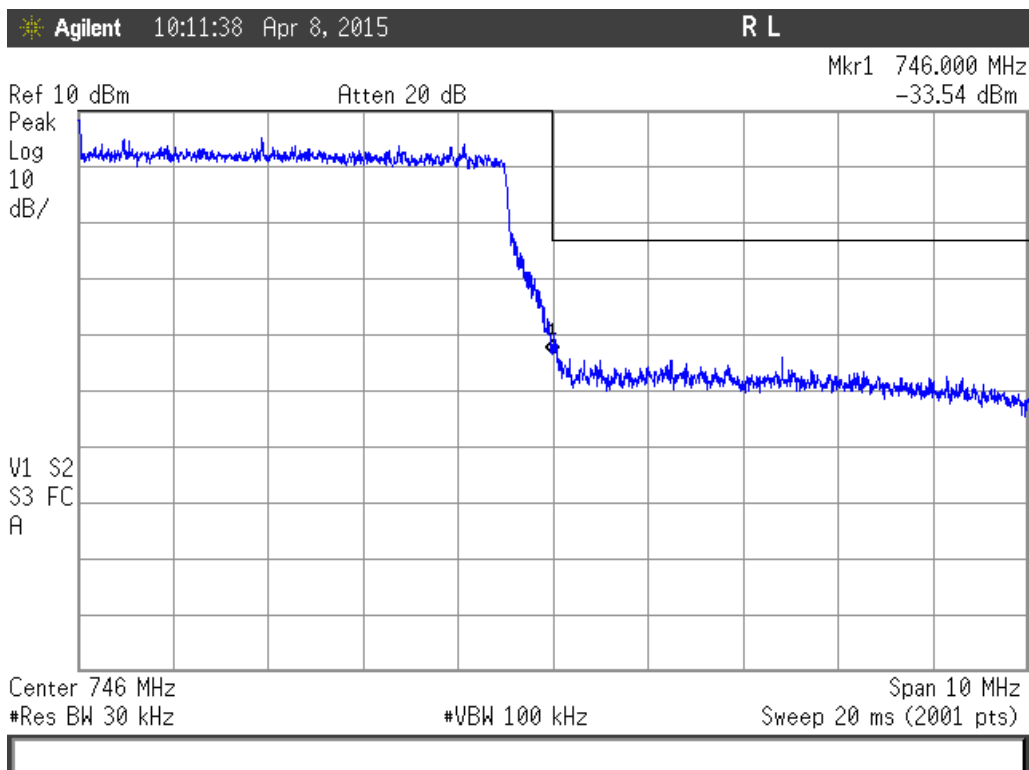


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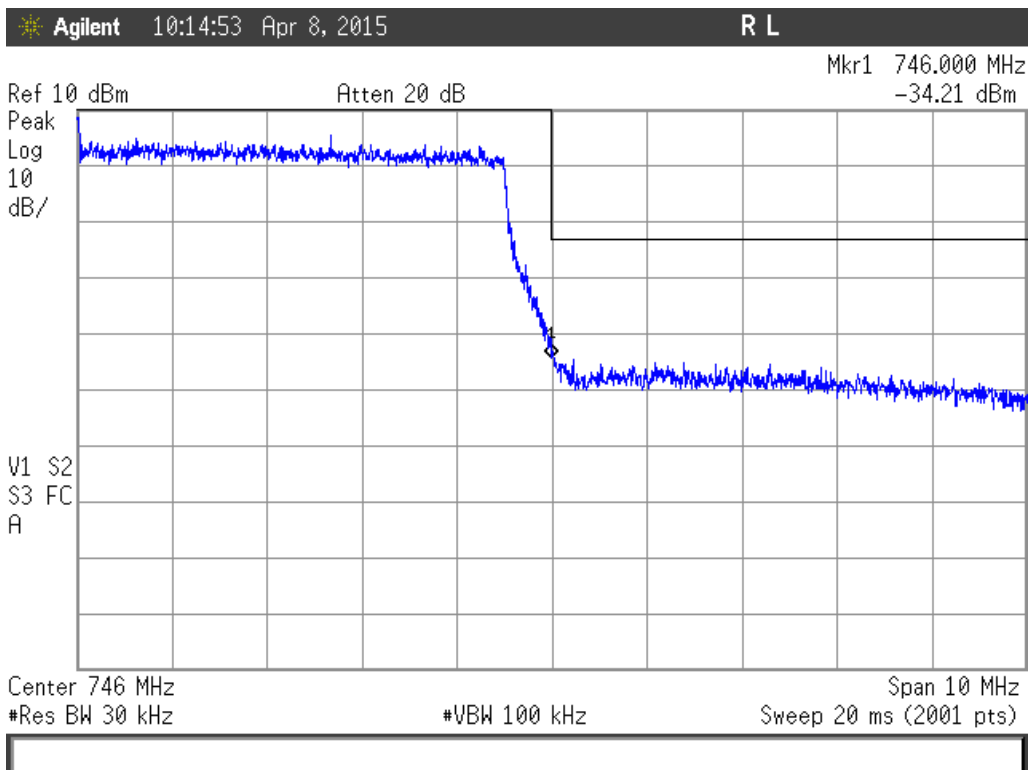




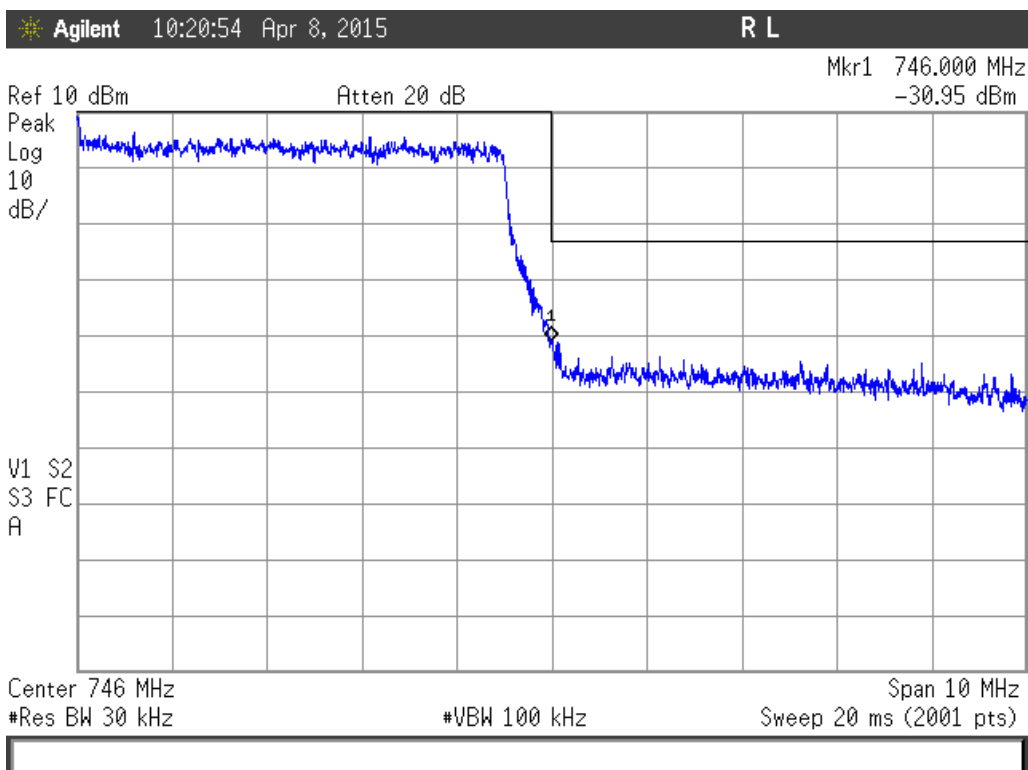
Lower Band Edge - Band 12 – 10MHz BW – 64QAM – Port J1



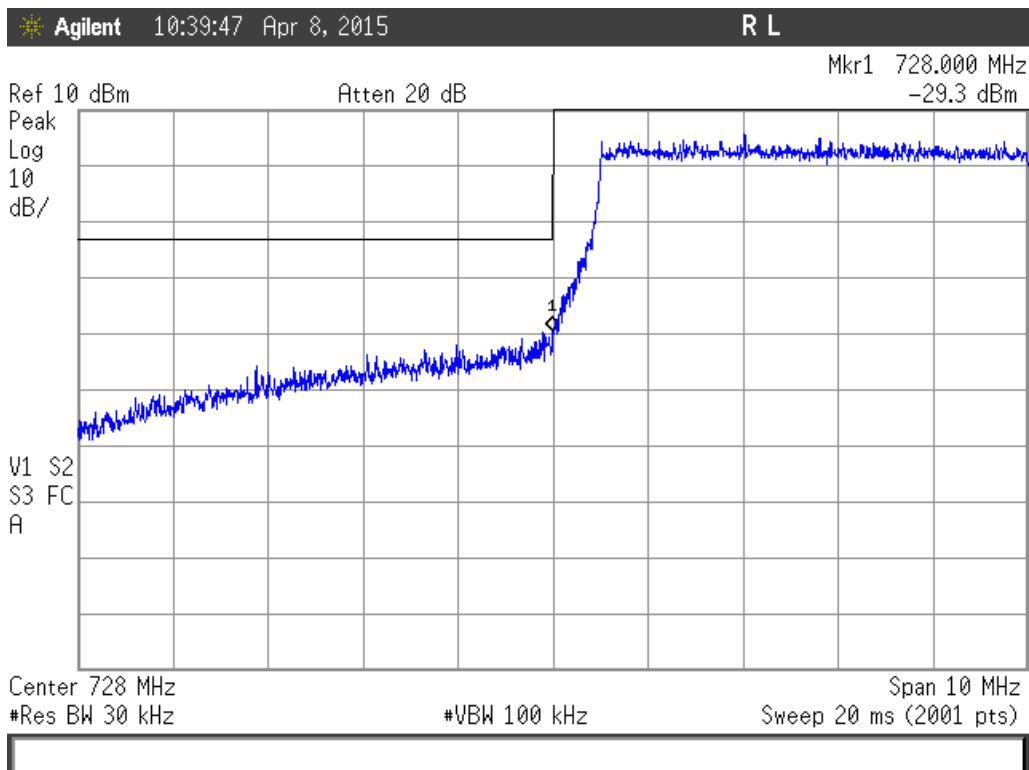
Upper Band Edge - Band 12 – 10MHz BW – QPSK – Port J1



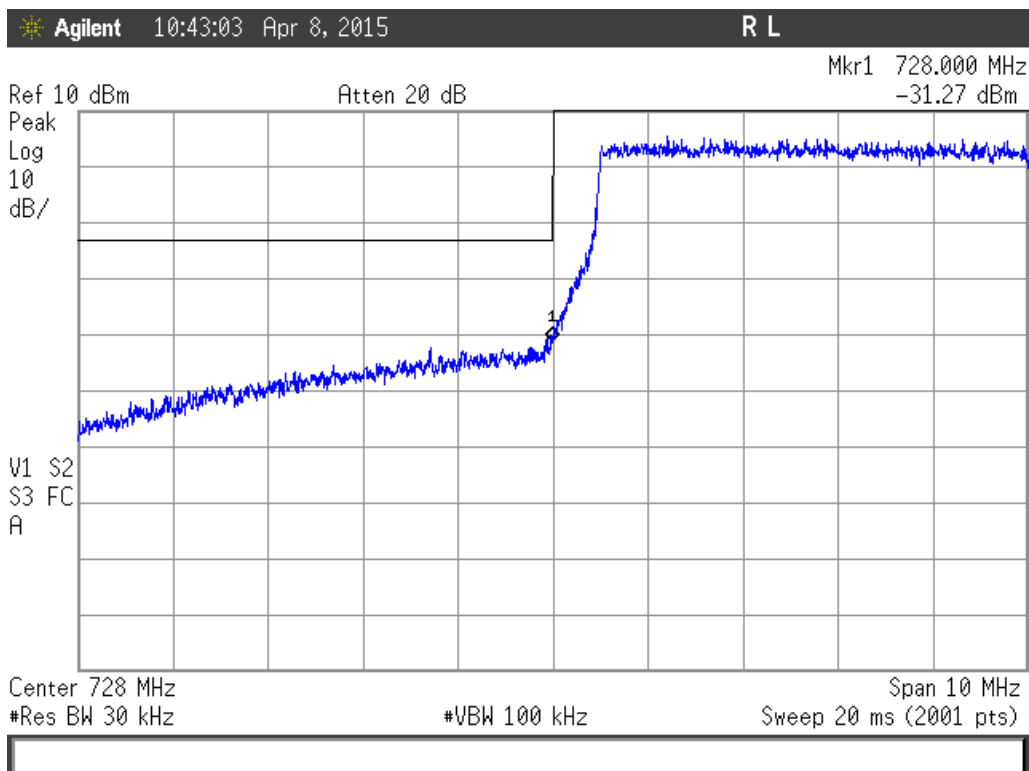
Upper Band Edge - Band 12 – 10MHz BW – 16QAM – Port J1



Upper Band Edge - Band 12 – 10MHz BW – 64QAM – Port J1

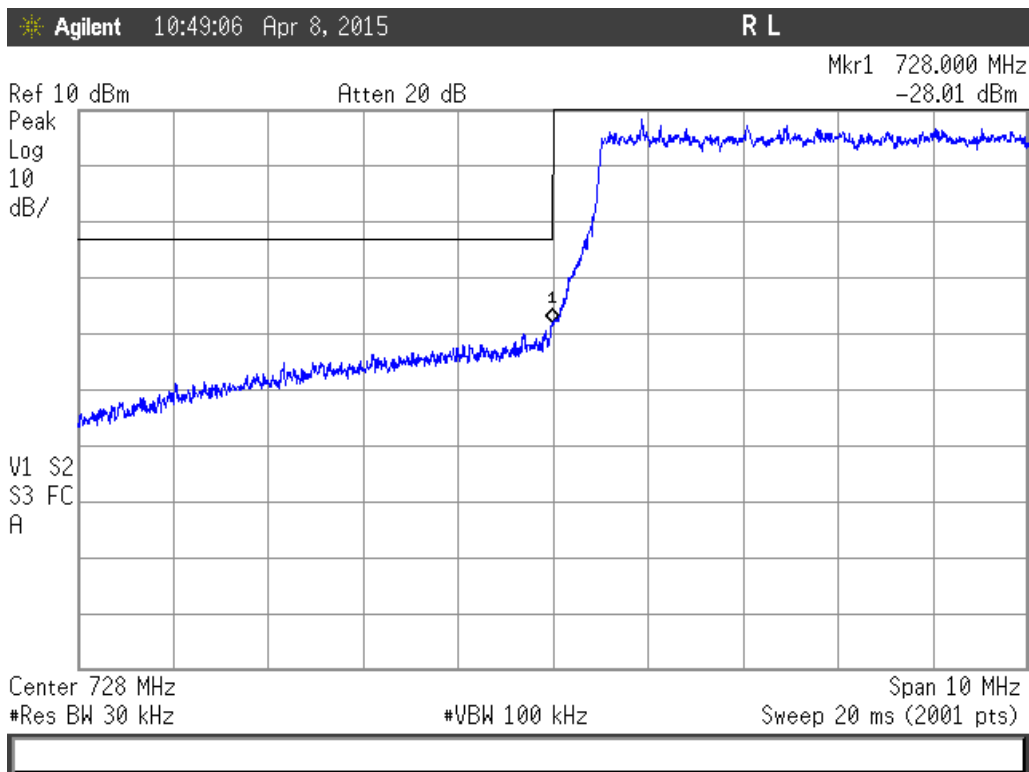


Lower Band Edge - Band 12 – 10MHz BW – QPSK – Port J2

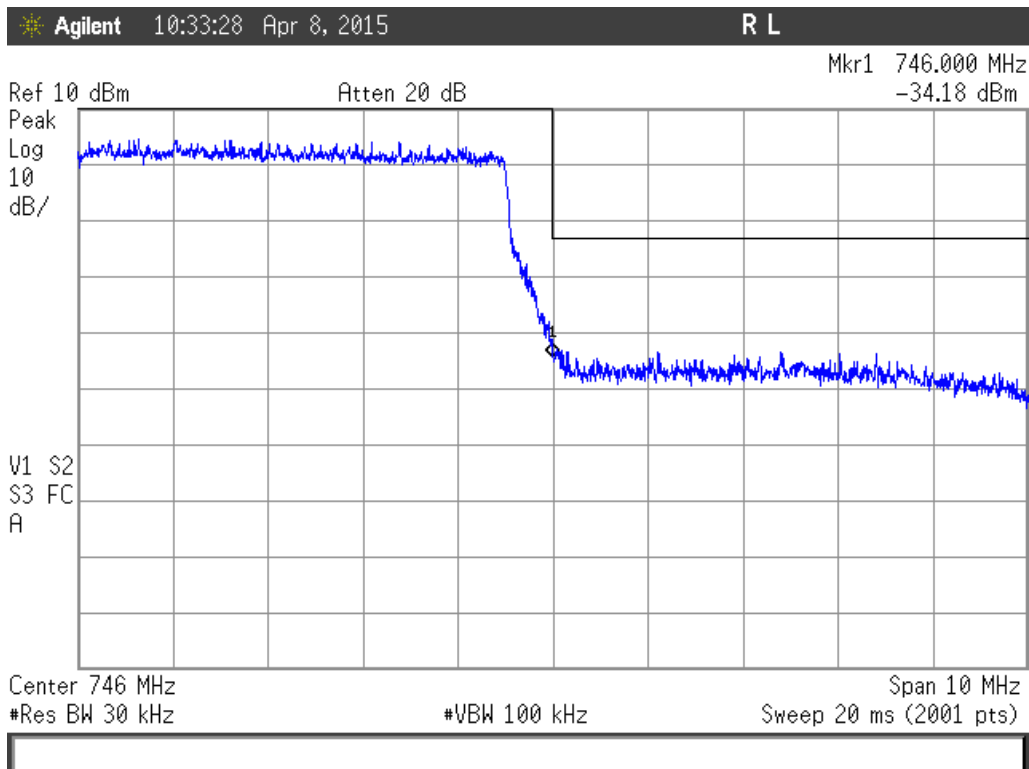


Lower Band Edge - Band 12 – 10MHz BW – 16QAM – Port J2



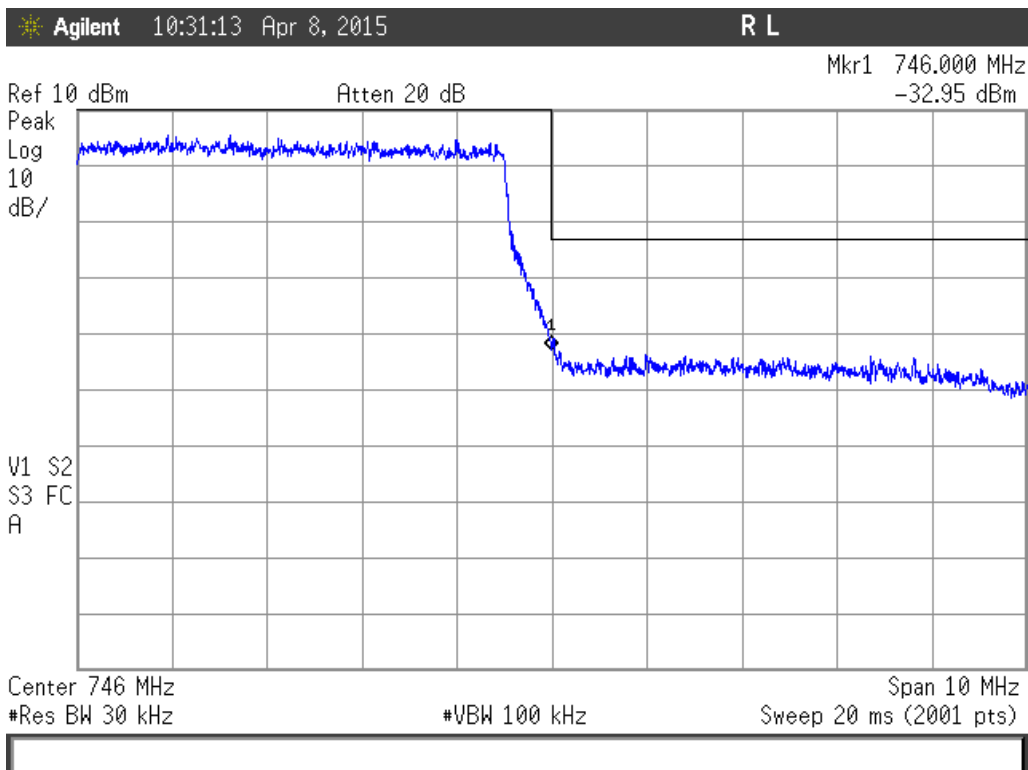


Lower Band Edge - Band 12 – 10MHz BW – 64QAM – J2

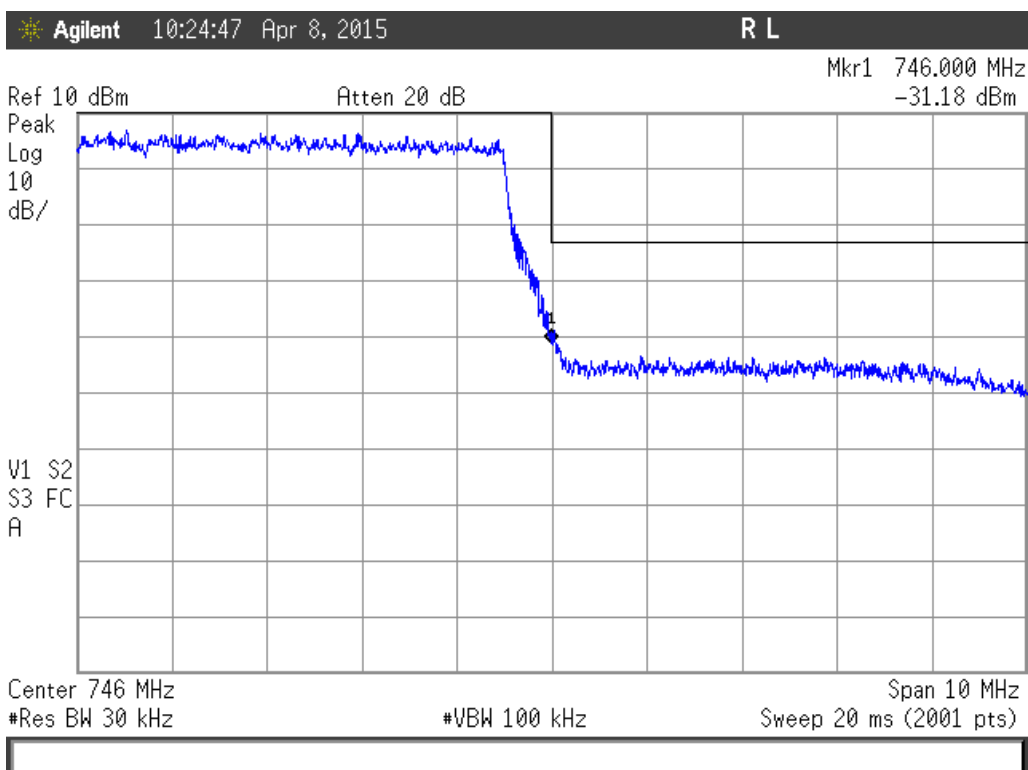


Upper Band Edge - Band 12 – 10MHz BW – QPSK – Port J2

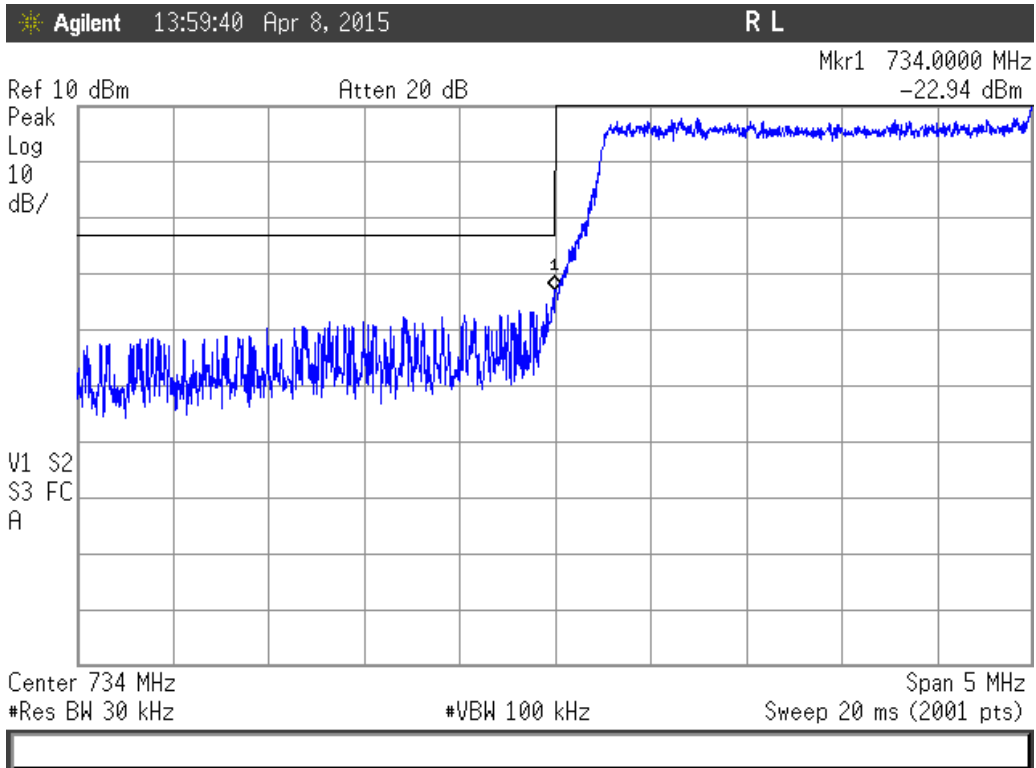




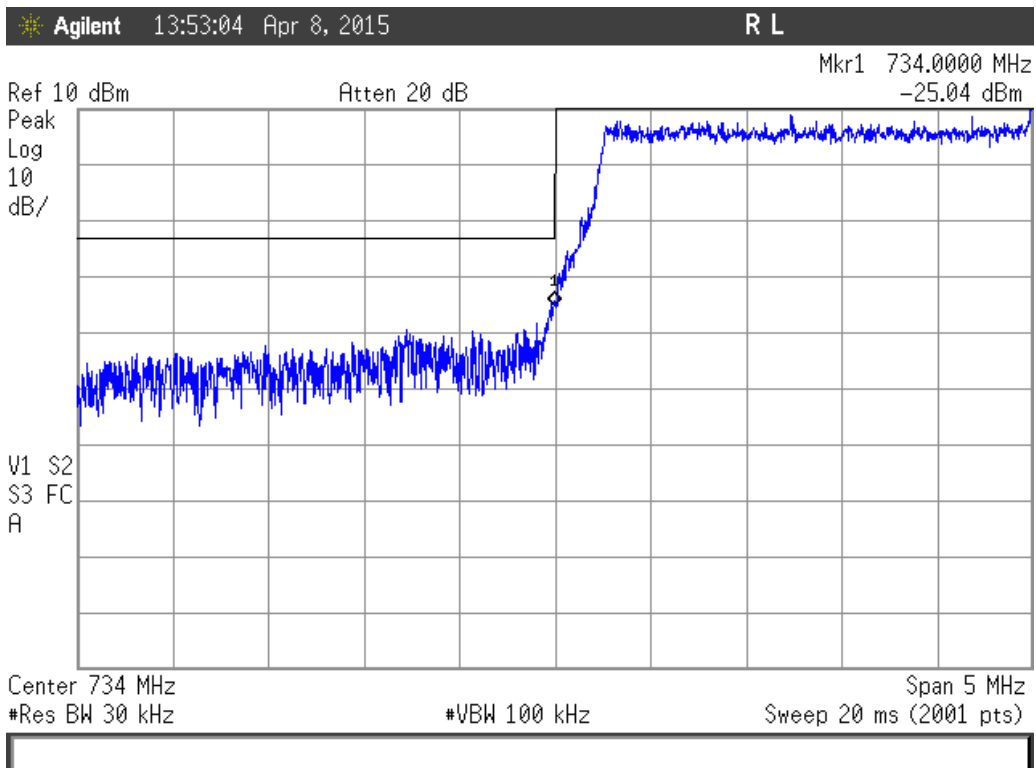
Upper Band Edge - Band 12 – 10MHz BW – 16QAM – Port J2



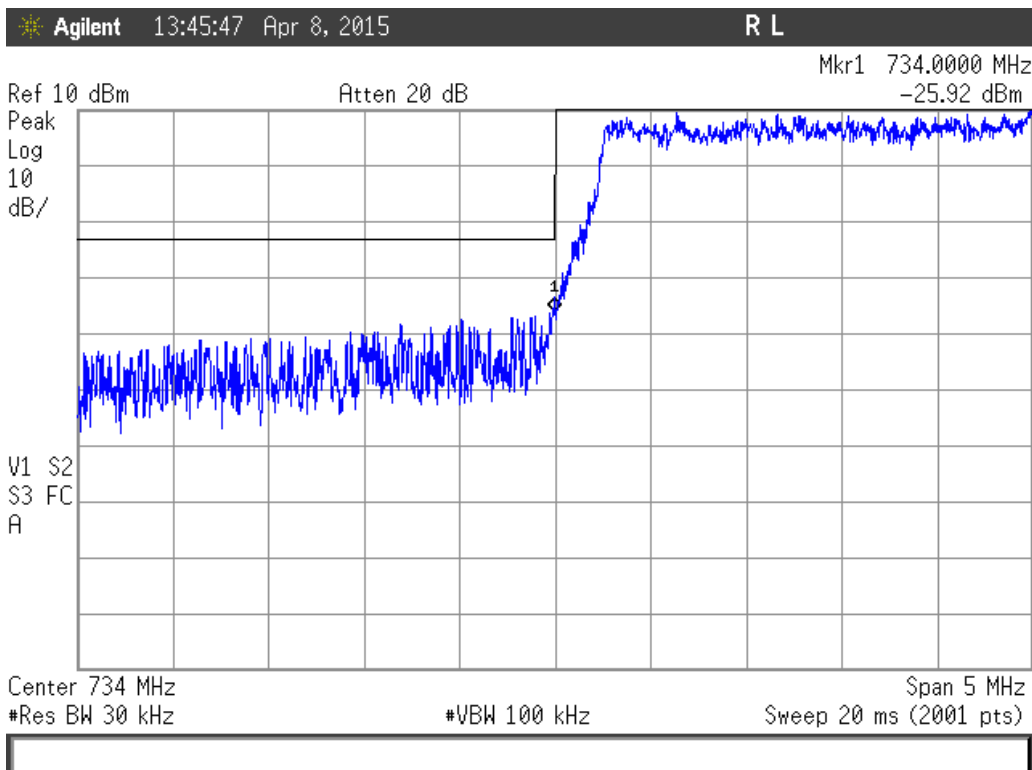
Upper Band Edge - Band 12 – 10MHz BW – 64QAM – Port J2



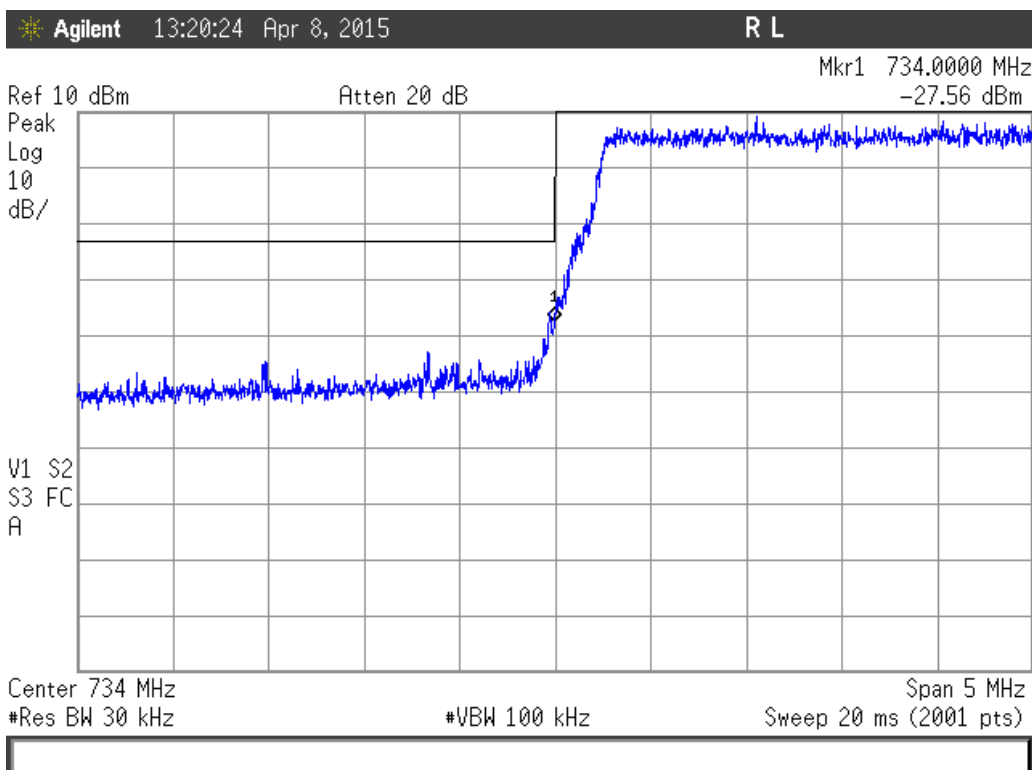
Lower Band Edge - Band 17 – 5MHz BW – QPSK – Port J1



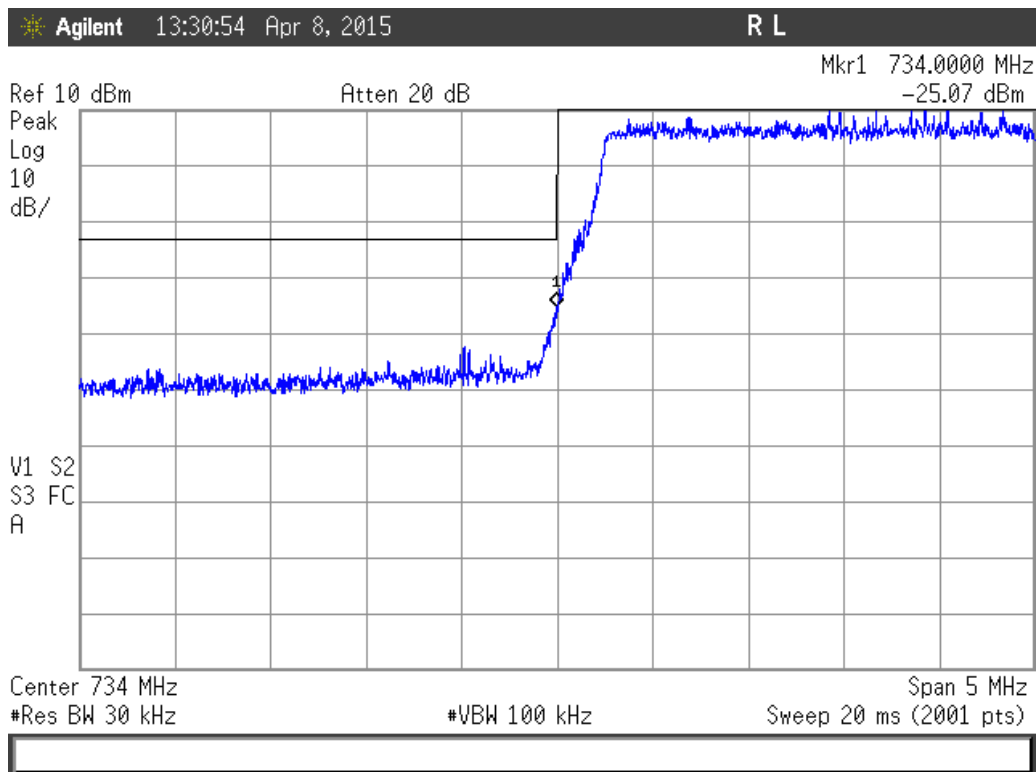
Lower Band Edge - Band 17 – 5MHz BW – 16QAM – Port J1



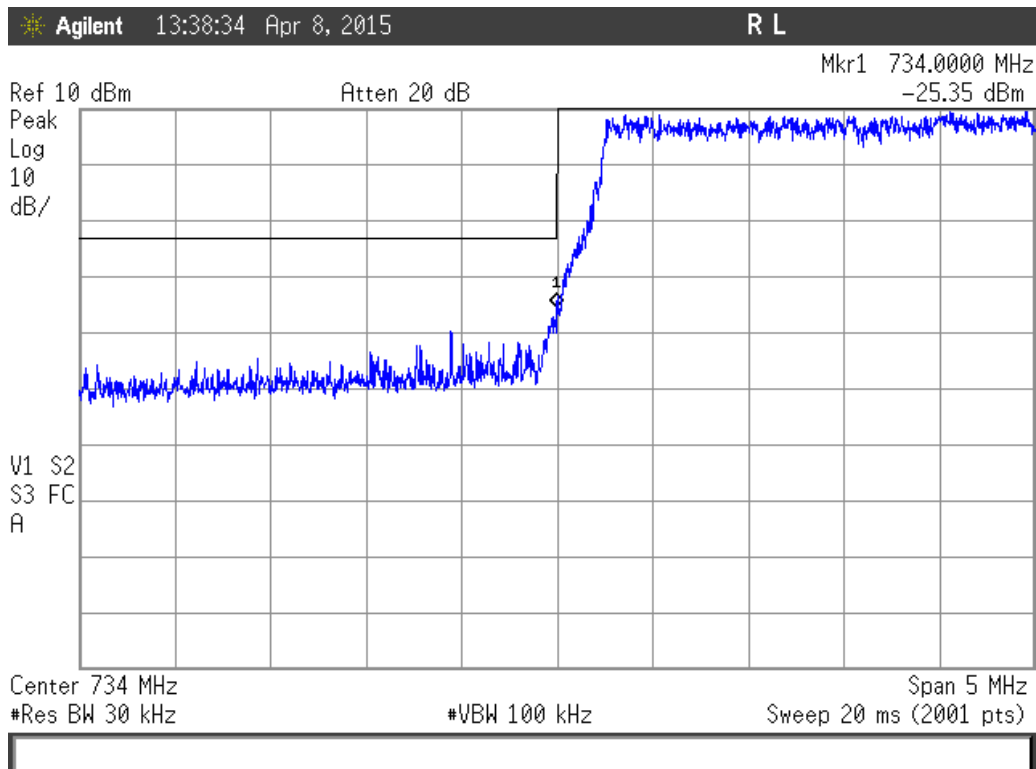
Lower Band Edge - Band 17 – 5MHz BW – 64QAM – Port J1



Lower Band Edge - Band 17 – 5MHz BW – QPSK – Port J2

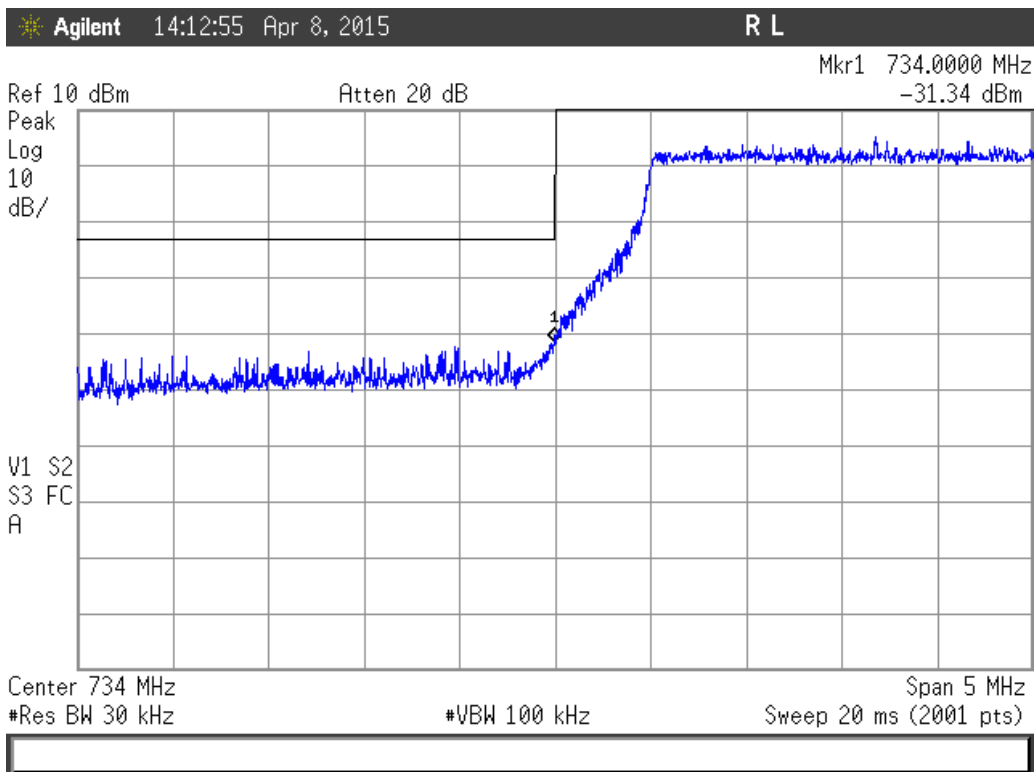


Lower Band Edge - Band 17 – 5MHz BW – 16QAM – Port J2

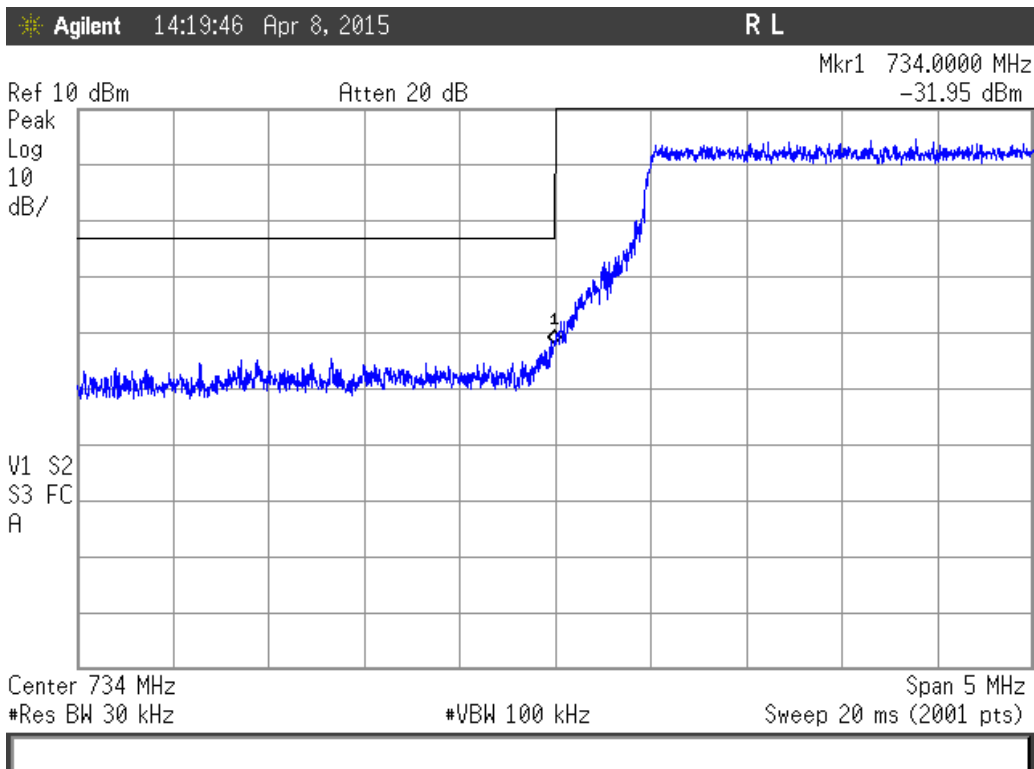


Lower Band Edge - Band 17 – 5MHz BW – 64QAM – Port J2



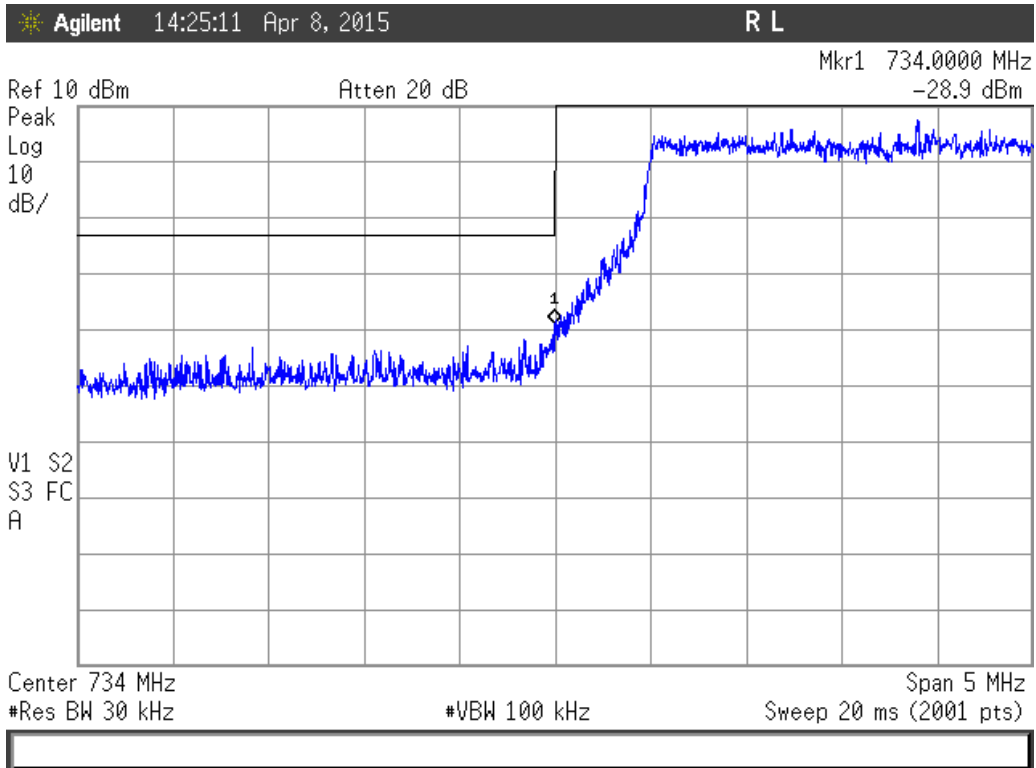


Lower Band Edge - Band 17 – 10MHz BW – QPSK – Port J1

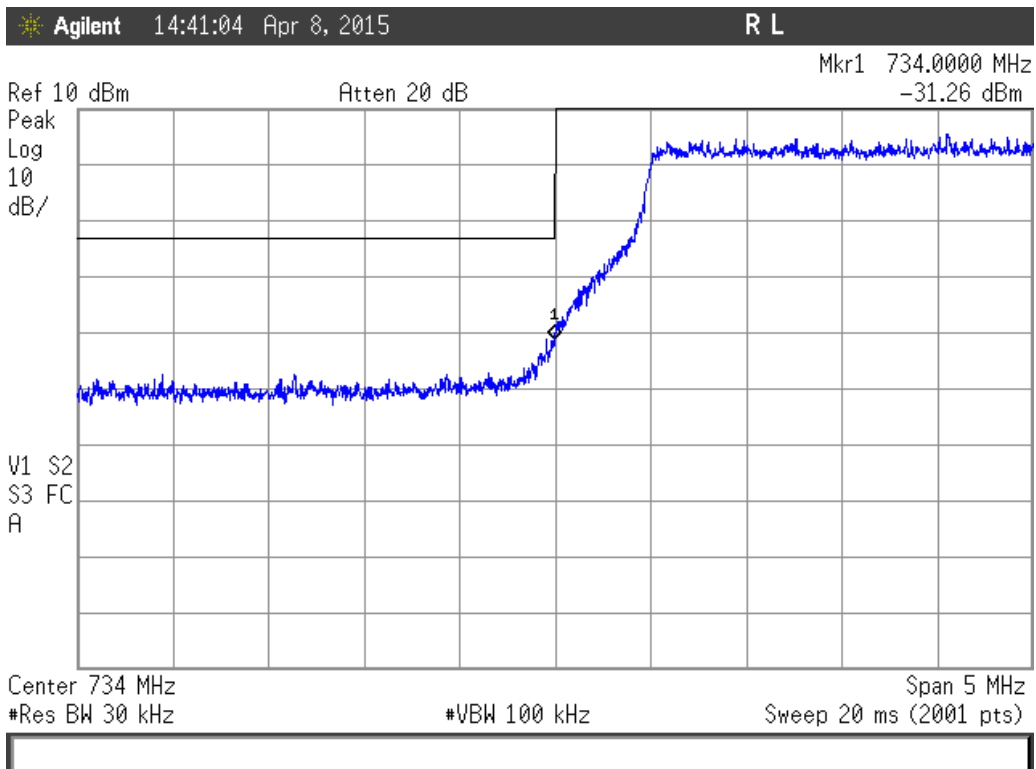


Lower Band Edge - Band 17 – 10MHz BW – 16QAM – Port J1





Lower Band Edge - Band 17 – 10MHz BW – 64QAM – Port J1

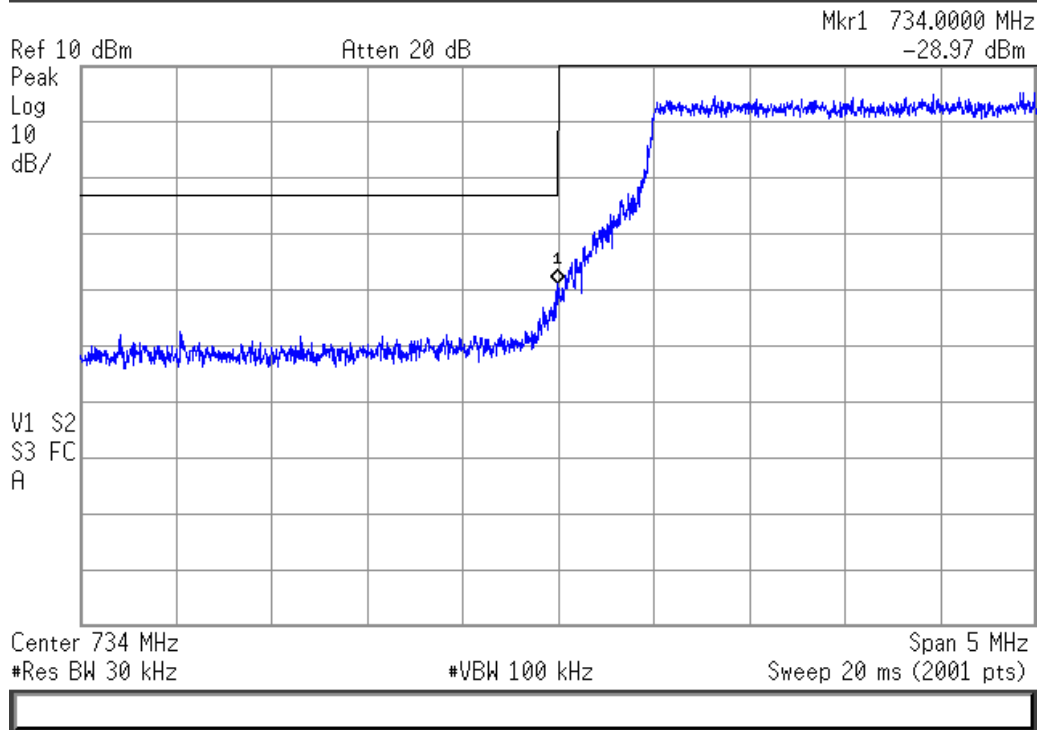


Lower Band Edge - Band 17 – 10MHz BW – QPSK – Port J2

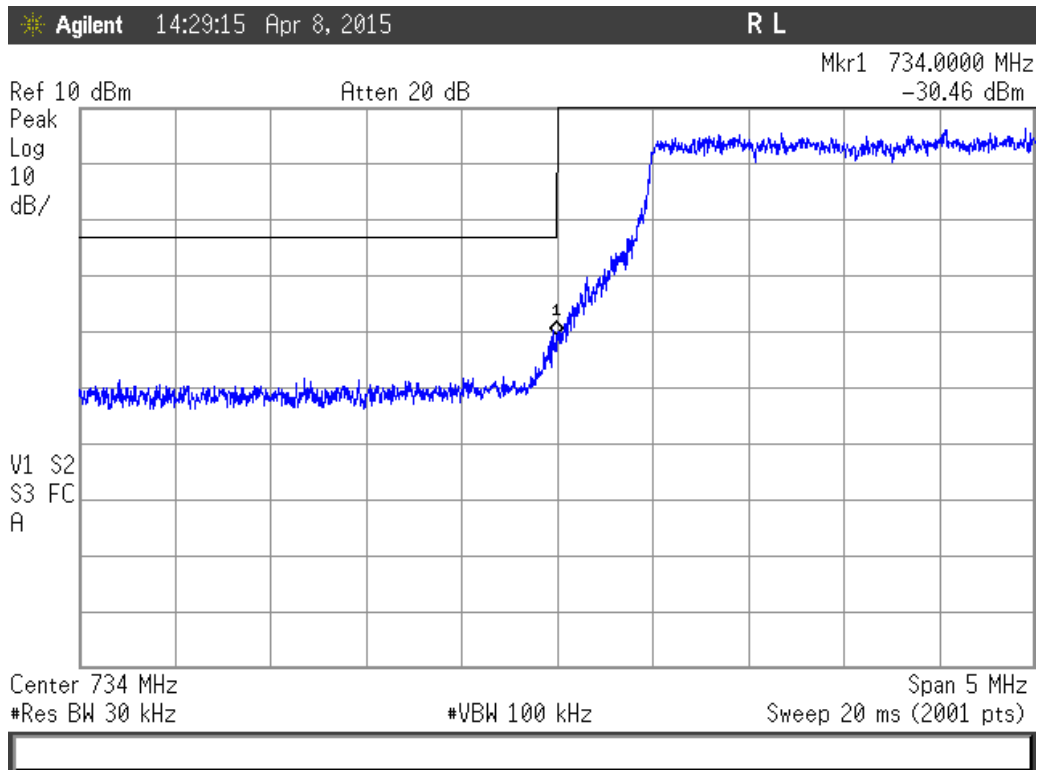


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Lower Band Edge - Band 17 – 10MHz BW – 16QAM – Port J2



Lower Band Edge - Band 17 – 10MHz BW – 64QAM – J2

Note: Only Lower Band Edge – Band 17 plots were taken. For Upper Band Edge (see band 12)

Conducted Spurious Emissions at Antenna Port

LIMITS

FCC 27.53(g):

For operations in the 600 MHz band and 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. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

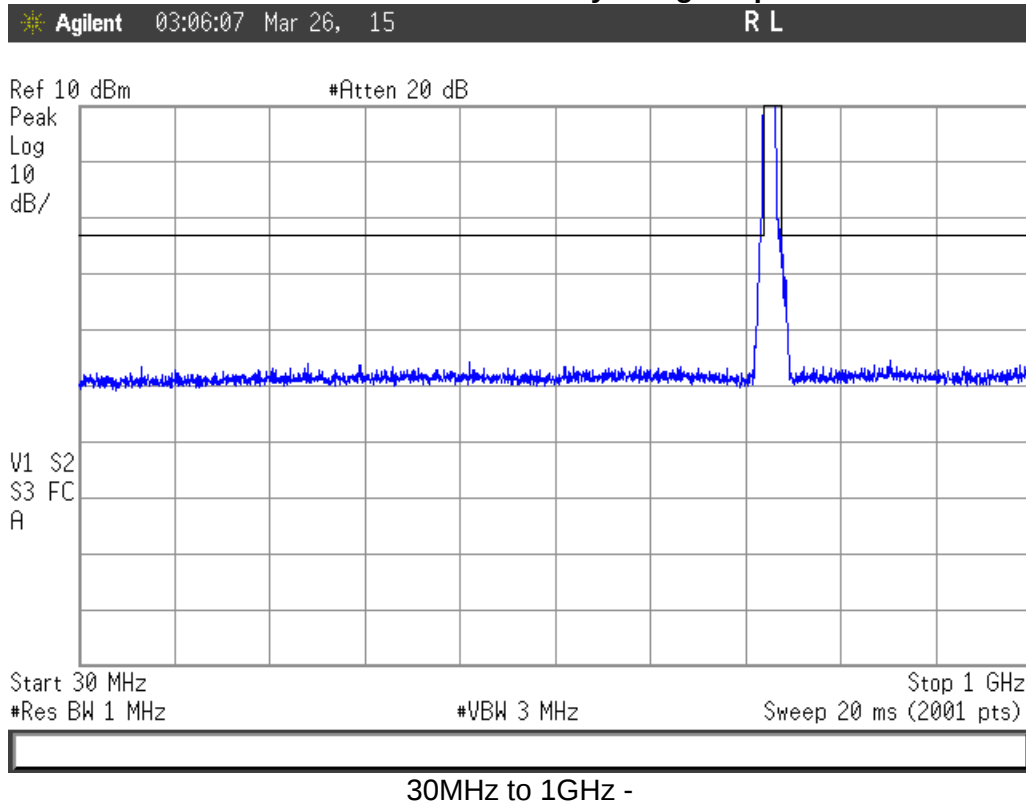
$$\text{Limit} = 10 \cdot \log(P[\text{mW}]) - (43 + 10 \cdot \log(P[\text{W}])) = -13\text{dBm}$$

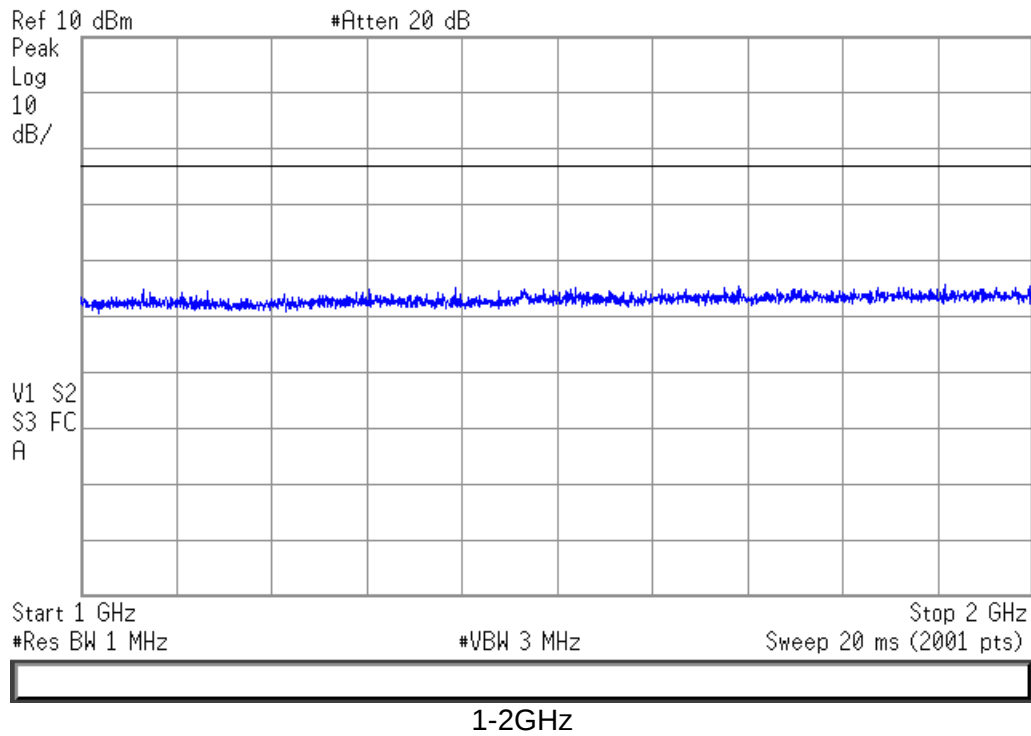
Spectrum analyzer screen plots for LTE Bands 12 & 17 are shown on the following pages. The operating frequency was 733MHz, which was taken to represent both bands as Band 17 is a subset of Band 12. The two antenna ports, J1 & J2, were connected through an RF combiner to the spectrum analyzer for the range 30MHz-2GHz. For 2-10GHz, the antenna ports were tested separately. The correction factors for the combiner, external attenuator, and cables were entered into the spectrum analyzer and are included in the displayed values.



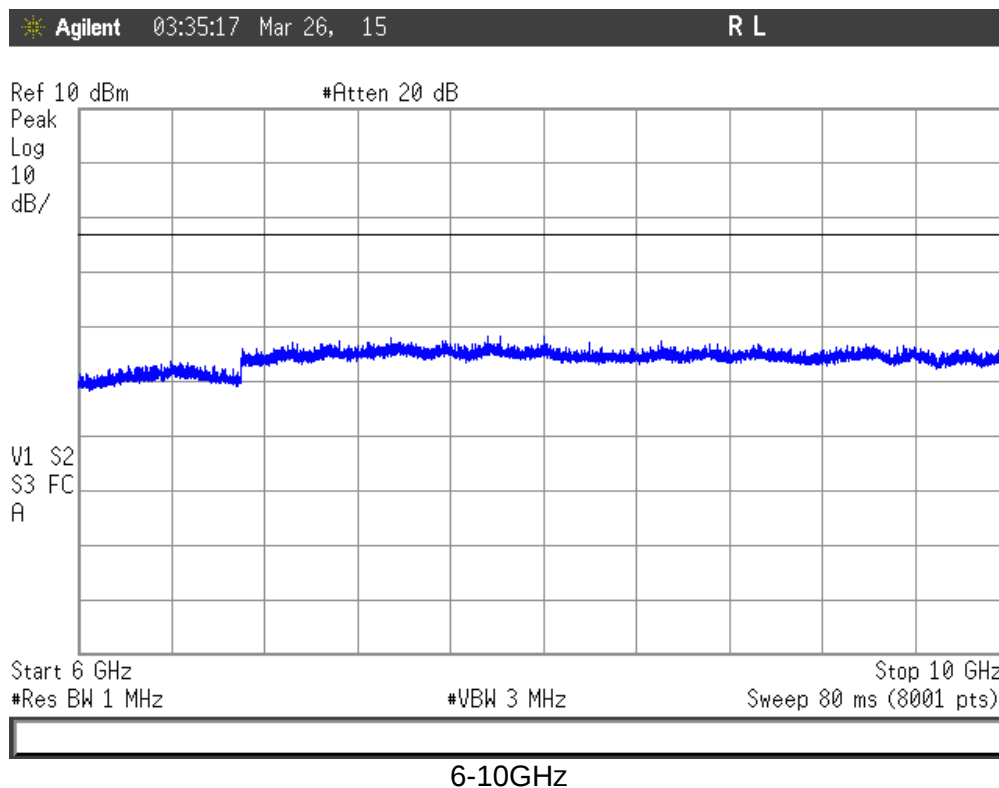
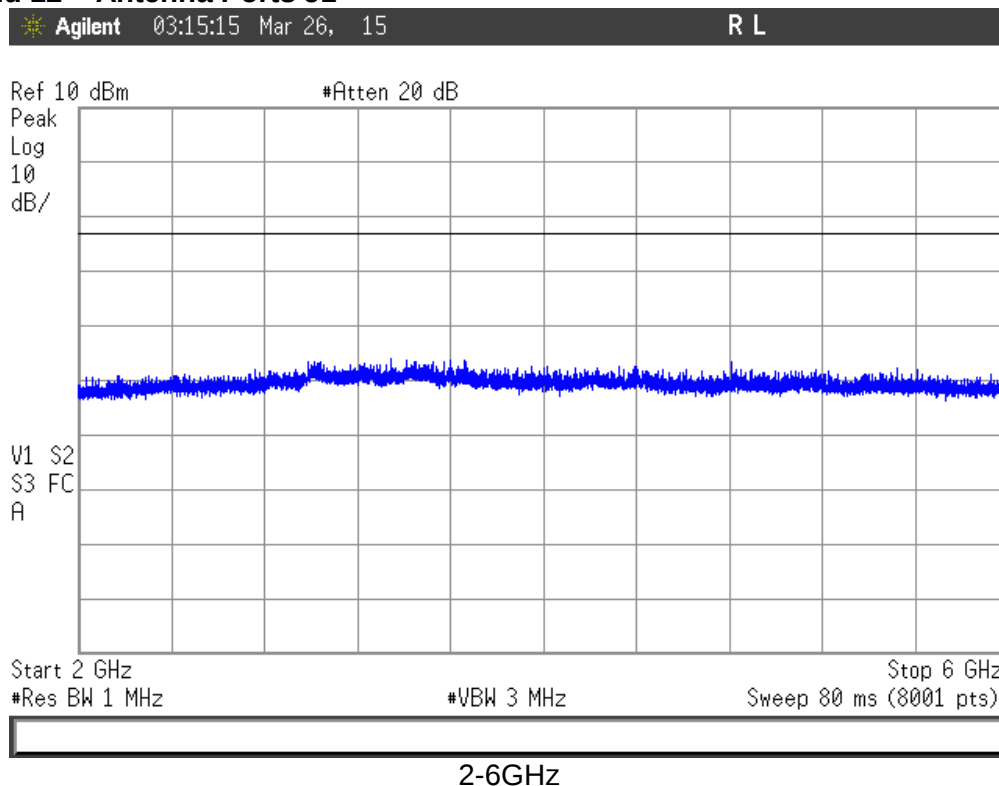
PLOTS

LTE Band 12 – Antenna Ports J1 & J2 combined by using coupler

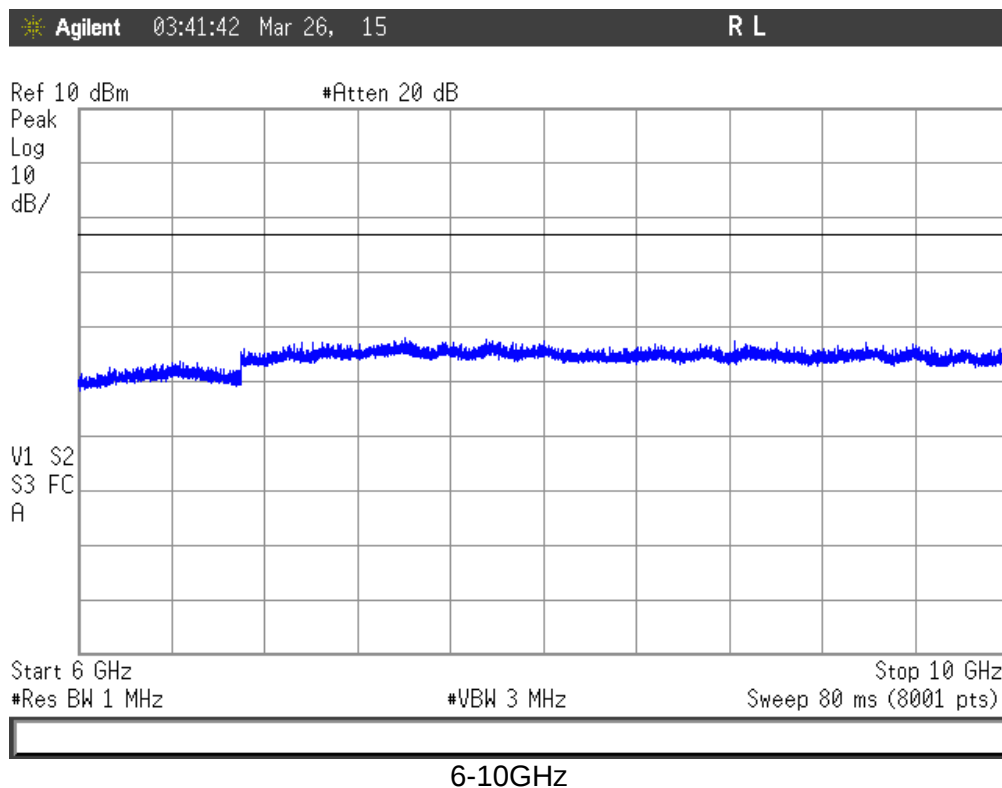
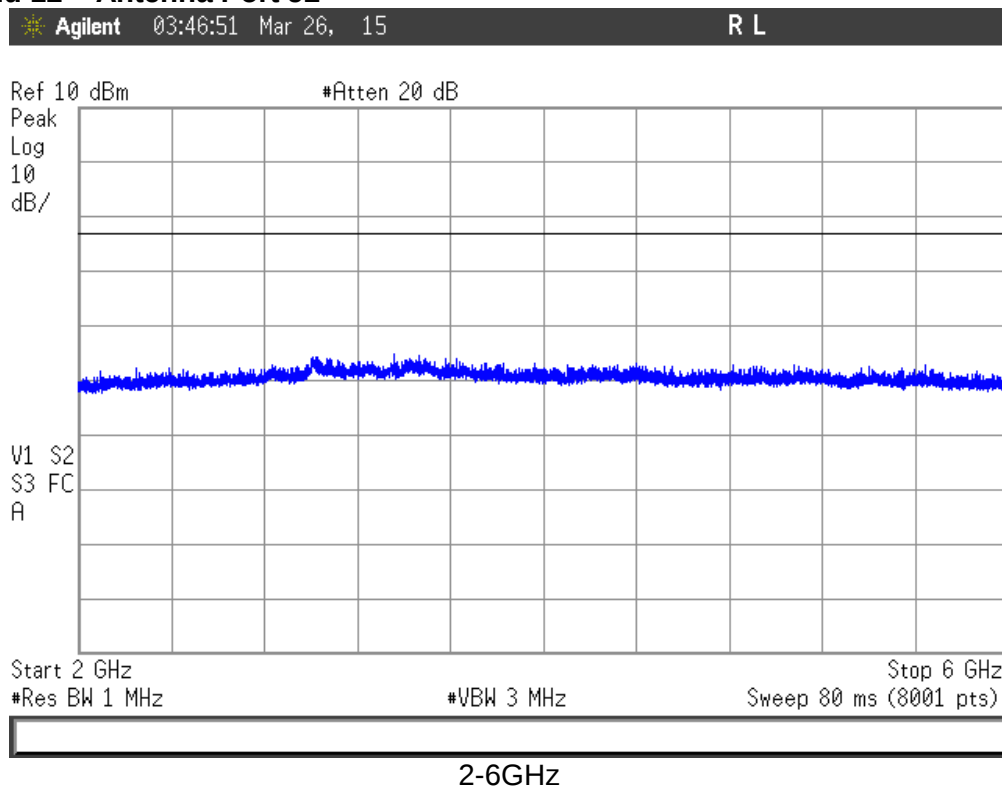




LTE Band 12 – Antenna Ports J1



LTE Band 12 – Antenna Port J2



Radiated Spurious Emissions Measurements

MEASUREMENTS / RESULTS

Note that the EUT passes the FCC Class B limit, which is much lower than the -13dBm limit (82.2dBuV/m at 3 meters) for licensed transmitter spurious emissions. Only worst-case radiated spurious data is presented.

Radiated Emissions Table												
Date: 18-Mar-15			Company: Airvana					Work Order: P0152				
Engineer: Tuyen Truong			EUT Desc: Switched IQ Radio Point Domestic					EUT Operating Voltage/Frequency: POE				
Temp: 21°C			Humidity: 30%			Pressure: 1005mBar						
Frequency Range: 30 to 1000MHz							Measurement Distance: 3 m					
Notes: BW = 10MHz, Band 12, QPSK , Low Channel (733MHz)							EUT Max Freq: 200MHz					
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)	FCC Class B					
										Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
v	60.64	49.2	25.3	7.5	1.5	32.9				40.0	-7.1	Pass
h	62.06	39.2	25.3	7.6	1.5	23.0				40.0	-17.0	Pass
h	200.0	44.7	25.5	12.6	2.7	34.5				43.5	-9.0	Pass
v	200.0	49.3	25.5	12.6	2.7	39.1				43.5	-4.4	Pass
h	250.0	42.8	25.6	11.7	2.8	31.7				46.0	-14.3	Pass
h	333.3	51.4	25.6	14.0	3.0	42.8				46.0	-3.2	Pass
v	333.3	49.2	25.6	14.0	3.0	40.6				46.0	-5.4	Pass
h	375.0	45.2	25.5	15.1	3.1	37.9				46.0	-8.1	Pass
h	500.0	49.8	25.7	18.0	2.7	44.8				46.0	-1.2	Pass
h	625.0	43.8	25.6	19.3	3.0	40.5				46.0	-5.5	Pass
v	625.0	44.8	25.6	19.3	3.0	41.5				46.0	-4.5	Pass
h	875.0	41.2	25.9	22.1	3.5	40.9				46.0	-5.1	Pass
Table Result:			Pass		by		-1.2 dB		Worst Freq: 500.0 MHz			
Test Site: EMI Chamber 1			Cable 1: Asset #2051			Cable 2: Asset #2053			Cable 3: ---			
Analyzer: Rental SA#2			Preamp: Red-White			Antenna: Red-Brown			Preselector: Asset #1511			



Radiated Emissions Table

Date: 18-Mar-15				Company: Airvana				Work Order: P0152						
Engineer: Tuyen Truong				EUT Desc: Switched IQ Radio Point Domestic				EUT Operating Voltage/Frequency: POE						
Temp: 21°C				Humidity: 30%				Pressure: 1005mBar						
Frequency Range: 1-8GHz								Measurement Distance: 3 m (1-6GHz) and 1m (6-8GHz)						
Notes: HPF 1310 in line								EUT Max Freq: 200MHz						
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBμV)	Average Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBμV/m)	Adjusted Avg Reading (dBμV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
BW = 10MHz, Band 12, QPSK , Low Channel (733MHz)														
v	1472.5	35.39	22.9	20.9	25.3	2.3	42.1	29.6	74.0	-31.9	Pass	54.0	-24.4	Pass
h	1737.5	38.62	28.6	20.6	26.3	2.6	46.9	36.9	74.0	-27.1	Pass	54.0	-17.1	Pass
h	1912.5	42.89	25.0	20.6	27.3	2.7	52.3	34.4	74.0	-21.7	Pass	54.0	-19.6	Pass
v	2210.0	38.64	27.2	21.4	27.6	3.1	47.9	36.5	74.0	-26.1	Pass	54.0	-17.5	Pass
v	2460.0	41.7	38.1	21.8	28.3	3.3	51.5	47.9	74.0	-22.5	Pass	54.0	-6.1	Pass
h	2462.5	44.46	37.0	21.8	28.3	3.3	54.3	46.8	74.0	-19.7	Pass	54.0	-7.2	Pass
v	2950.0	42.35	33.4	21.5	29.8	3.7	54.4	45.4	74.0	-19.6	Pass	54.0	-8.6	Pass
v	5900.0	31.12	26.7	19.4	34.4	5.7	51.8	47.4	74.0	-22.2	Pass	54.0	-6.6	Pass

BW = 10MHz, Band 12, 16QAM , Low Channel (733MHz)														
v	1475.7	36.78	21.0	20.8	25.3	2.3	43.6	27.8	74.0	-30.4	Pass	54.0	-26.2	Pass

BW = 10MHz, Band 12, 64QAM , Low Channel (733MHz)														
v	1469.0	42.59	21.2	20.9	25.3	2.3	49.3	27.9	74.0	-24.7	Pass	54.0	-26.1	Pass

BW = 5MHz, Band 12, QPSK , Low Channel (733MHz)														
v	1473.7	37.1	21.0	20.8	25.3	2.3	43.9	27.8	74.0	-30.1	Pass	54.0	-26.2	Pass

BW = 10MHz, Band 12, QPSK , Mid Channel (737MHz)														
v	1468.6	39.96	21.0	20.9	25.3	2.3	46.7	27.7	74.0	-27.3	Pass	54.0	-26.3	Pass

BW = 10MHz, Band 12, QPSK , High Channel (741MHz)														
v	1487.6	40.7	20.6	20.8	25.4	2.4	47.7	27.6	74.0	-26.3	Pass	54.0	-26.4	Pass

Table Result: Pass by -6.1 dB Worst Freq: 2460.0 MHz														
Test Site: EMI Chamber 1				Cable 1: Asset #2051				Cable 2: Asset #2053				Cable 3: ---		
Analyzer: Rental SA#2				Preamp: Asset #1517				Antenna: Yellow Horn				Preselector: ---		



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Conducted Spurious Emissions on AC Mains

AC Conducted Emissions Data Table														
Date: 06-Apr-15 Engineer: Tuyen Truong Temp: 21.0 °C				Company: Aivana EUT Desc: Switched IQ Radio Point Domestic Humidity: 27%				Work Order: P0152 Pressure: 1019mBar						
Notes: Tested AC side of DC Power Brick of support POE Linksys Switch (checked both power, 120Vac/60Hz and 230Vac/50Hz) Peak readings.														
Frequency Range: 0.15-30MHz								EUT Input Voltage/Frequency: POE						
Frequency (MHz)	Quasi-Peak Readings		Average Readings		LISN Factors		Cable Factor (dB)	ATTN Factor (dB)	FCC/CISPR Class B			FCC/CISPR Class B		
	QP1 (dBµV)	QP2 (dBµV)	AVG1 (dBµV)	AVG2 (dBµV)	L1 (dB)	L2 (dB)			QP Limit (dBµV)	Margin (dB)	Result (Pass/Fail)	AVG Limit (dBµV)	Margin (dB)	Result (Pass/Fail)
BW = 10MHz, Band 12, QPSK, Low Channel (733MHz)														
0.22	13.3	11.4	13.3	11.4	-0.1	-0.1	0.0	-20.4	63.0	-29.3	Pass	53.0	-19.3	Pass
1.64	11.5	8.9	11.5	8.9	0.0	0.0	0.0	-20.4	56.0	-24.1	Pass	46.0	-14.1	Pass
3.96	10.7	10.8	10.7	10.8	0.0	0.0	-0.1	-20.4	56.0	-24.7	Pass	46.0	-14.7	Pass
11.42	11.3	11.4	11.3	11.4	-0.1	-0.1	-0.2	-20.3	60.0	-28.0	Pass	50.0	-18.0	Pass
16.94	11.3	8.3	11.3	8.3	-0.1	-0.1	-0.2	-20.4	60.0	-28.1	Pass	50.0	-18.1	Pass
26.12	10.1	8.2	10.1	8.2	-0.1	-0.1	-0.4	-20.4	60.0	-29.0	Pass	50.0	-19.0	Pass
Result: Pass					Worst Margin: -14.1 dB					Frequency: 1.640 MHz				
Measurement Device: LISN ASSET 1726(Line 1) LISN ASSET 1727(Line 2)							Cable: CEMI-09 Attenuator: 20dB Atten-4		Spectrum Analyzer: SA EMI Chamber (1328) Site: CEMI 3					



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Frequency Stability

REQUIREMENTS

From FCC Part 27:

§27.54 Frequency stability.

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

MEASUREMENTS / RESULTS

Note that the high frequency edge is the same for Band 12 and Band 17, so Band 12 high edge results cover Band 17. The low edge frequencies are different, so low edge plots are included for both bands. Measurements were done on port J1, since the same frequency-generating circuit is used for J1 and J2. All were tested at 64QAM, 5MHz.

Band 12:



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-30°C, Low Frequency Edge



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-30°C, High Frequency Edge



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-20°C, Low Frequency Edge



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-20°C, High Frequency Edge



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-10°C, Low Frequency Edge



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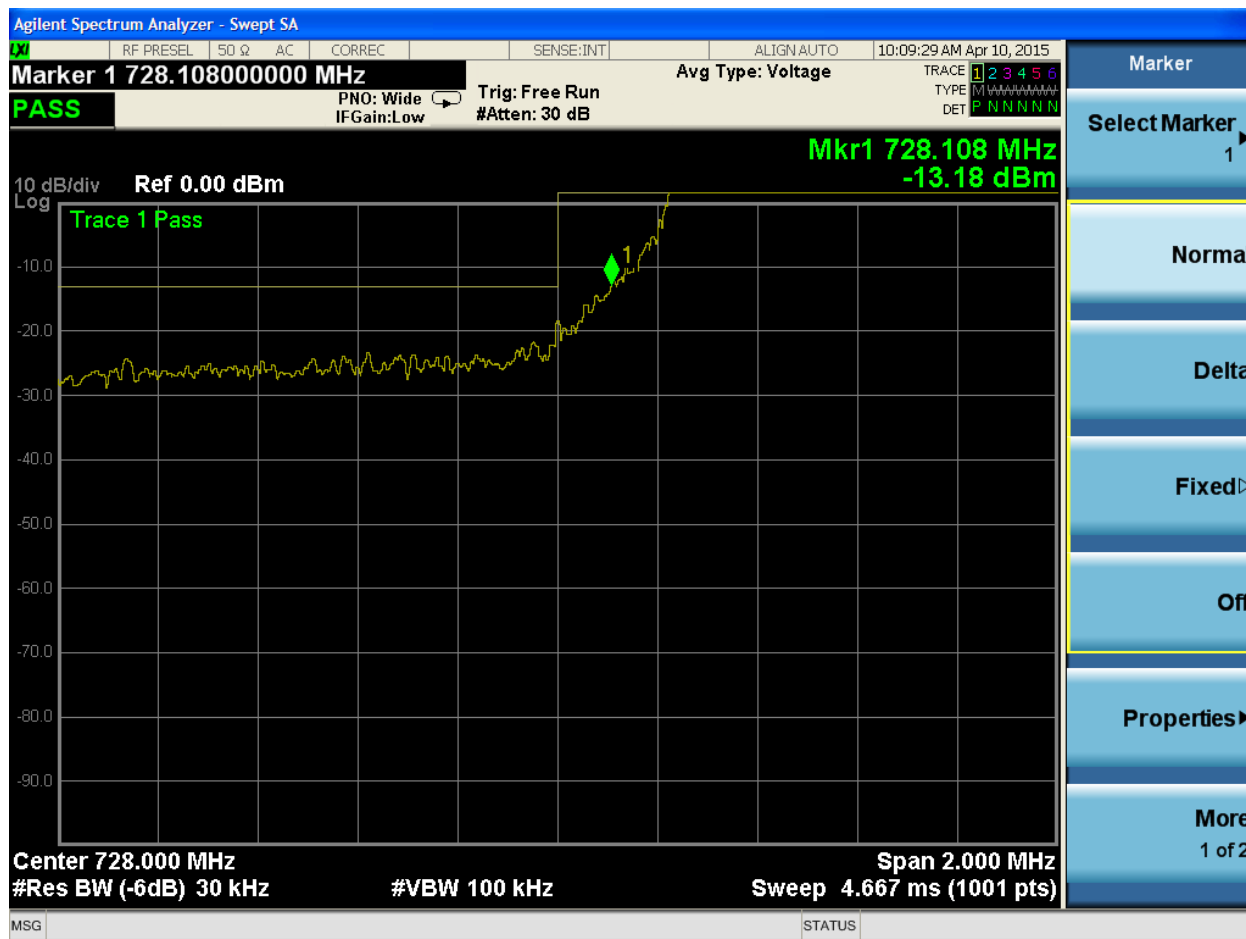
-10°C, High Frequency Edge



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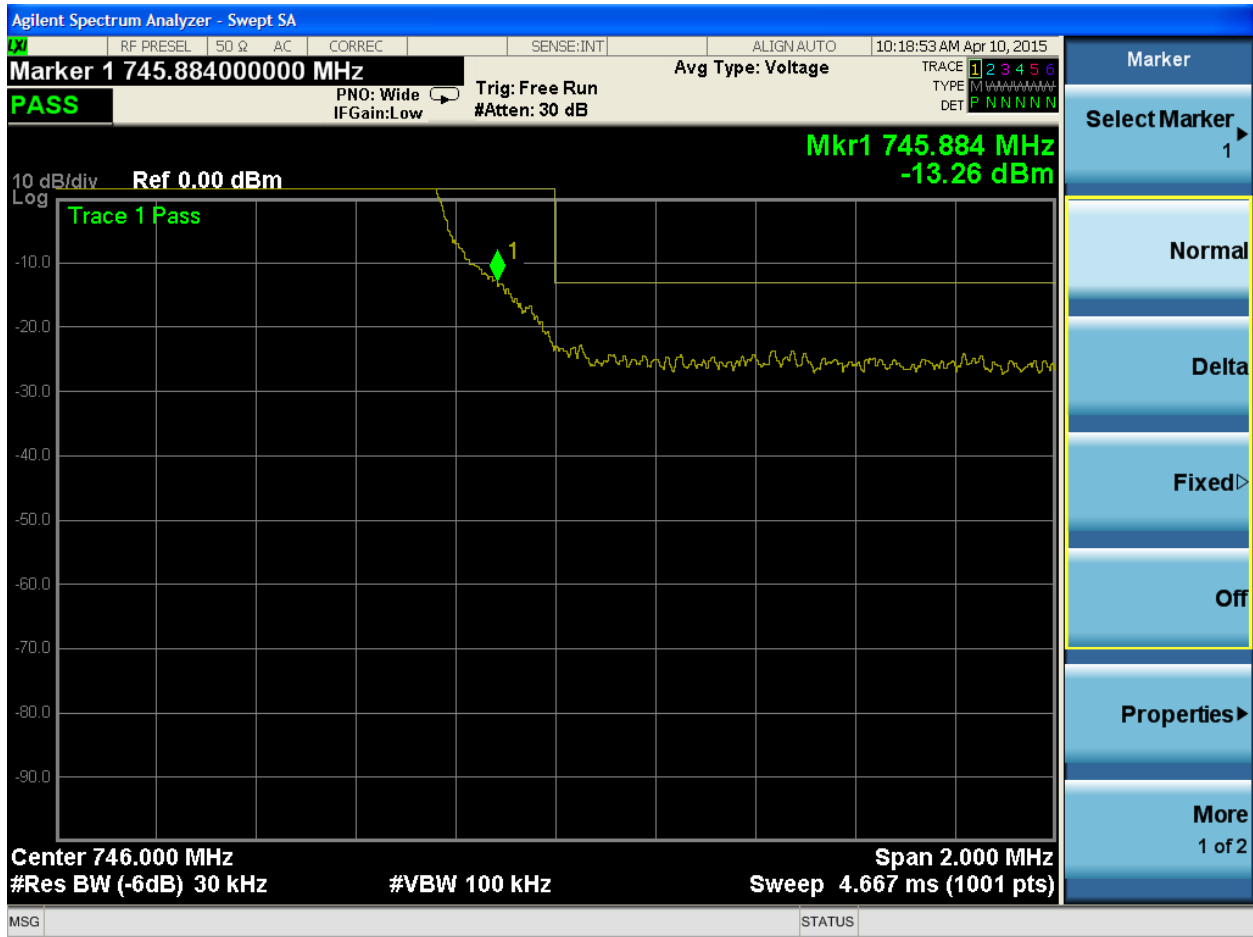
0°C, Low Frequency Edge



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0°C, High Frequency Edge



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10°C, Low Frequency Edge



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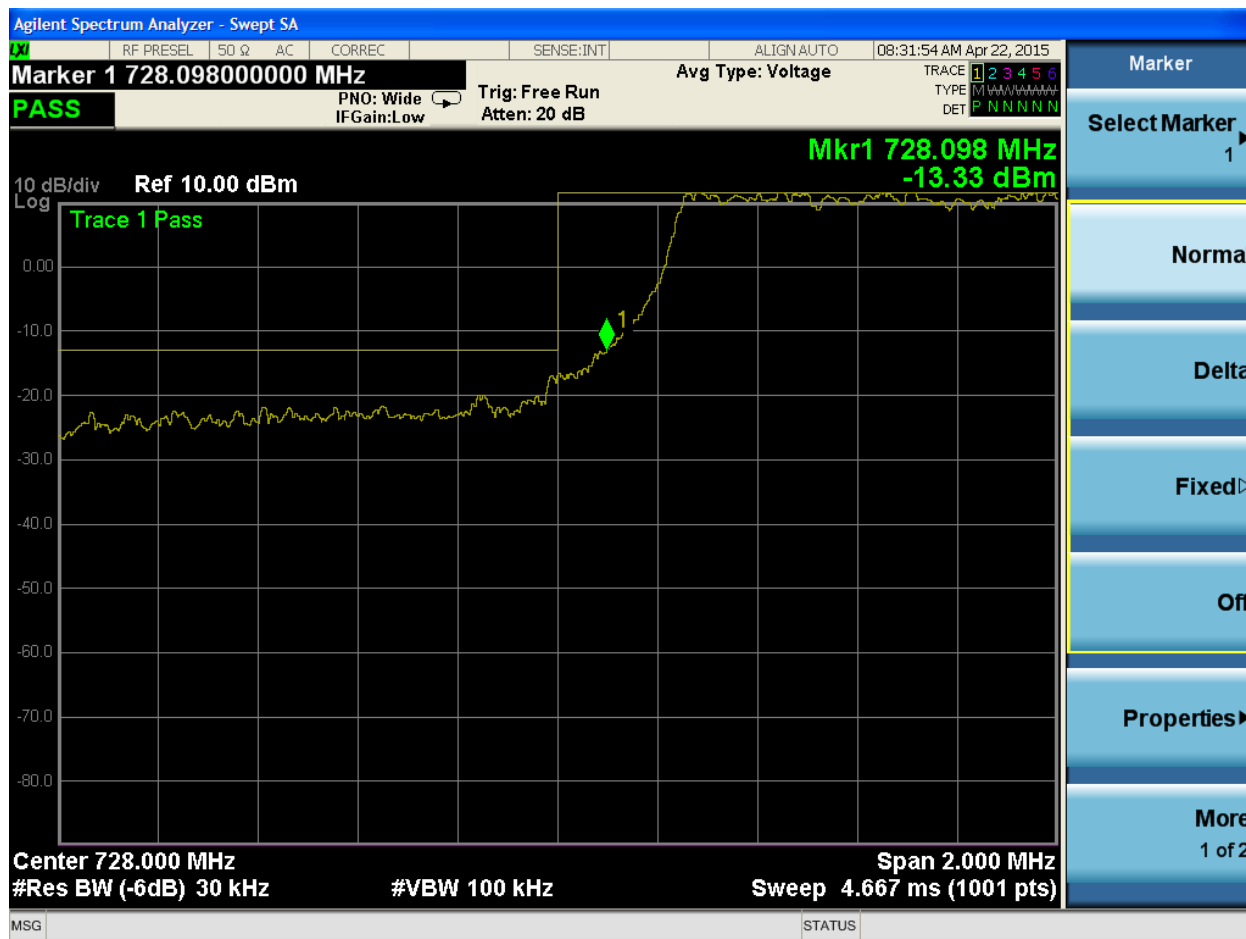
10°C, High Frequency Edge



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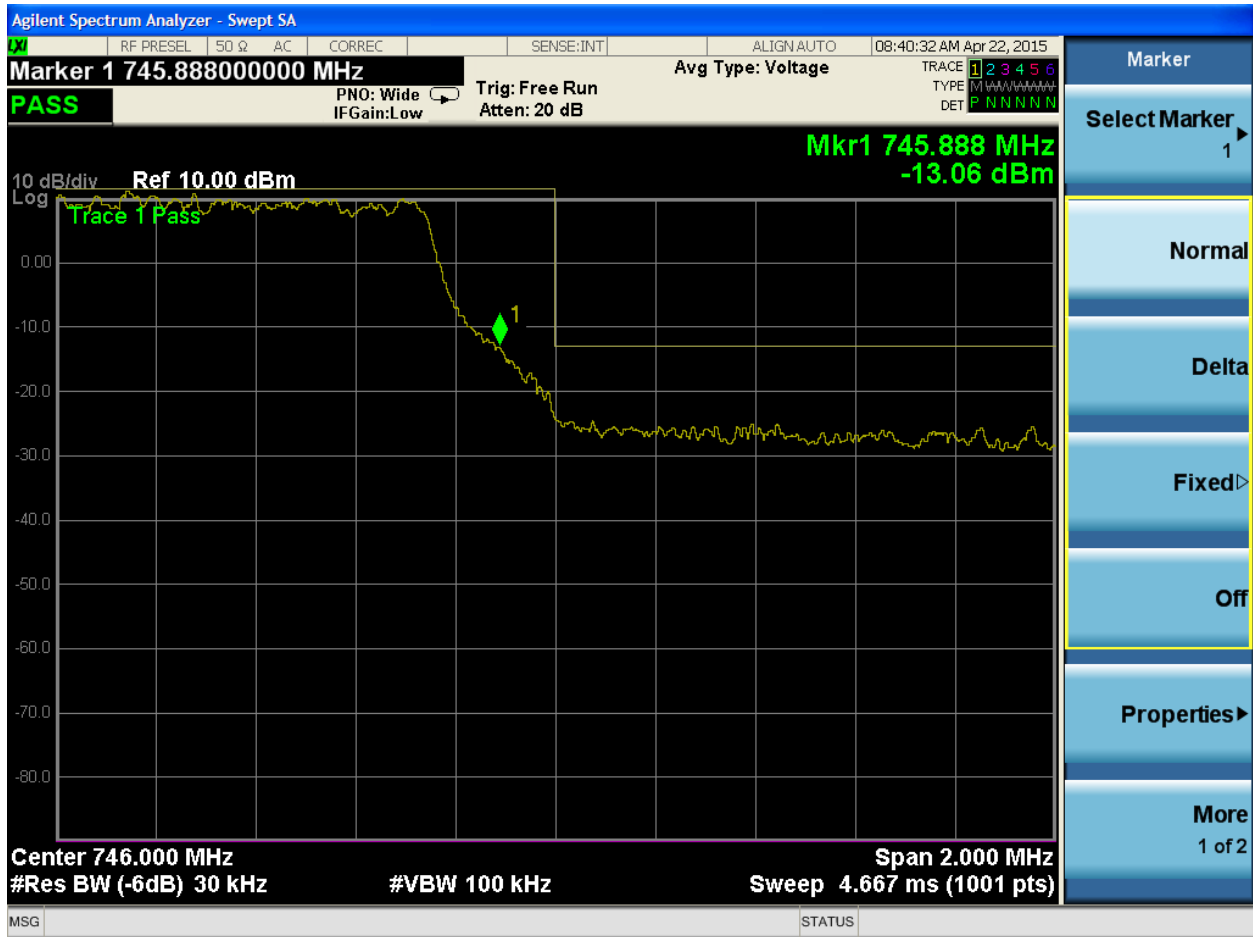
20°C, Low Frequency Edge, 120Vac



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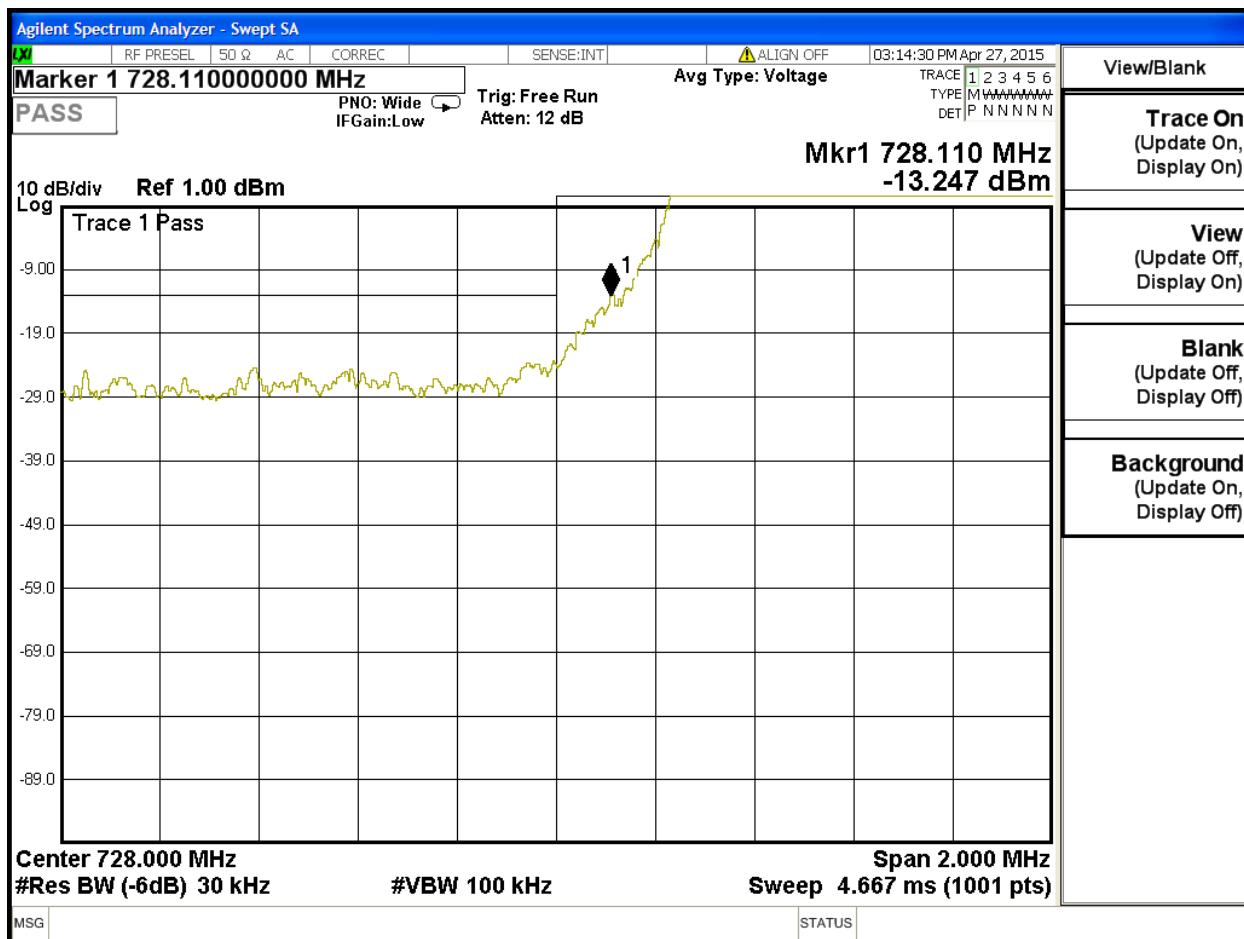
20°C, High Frequency Edge, 120Vac



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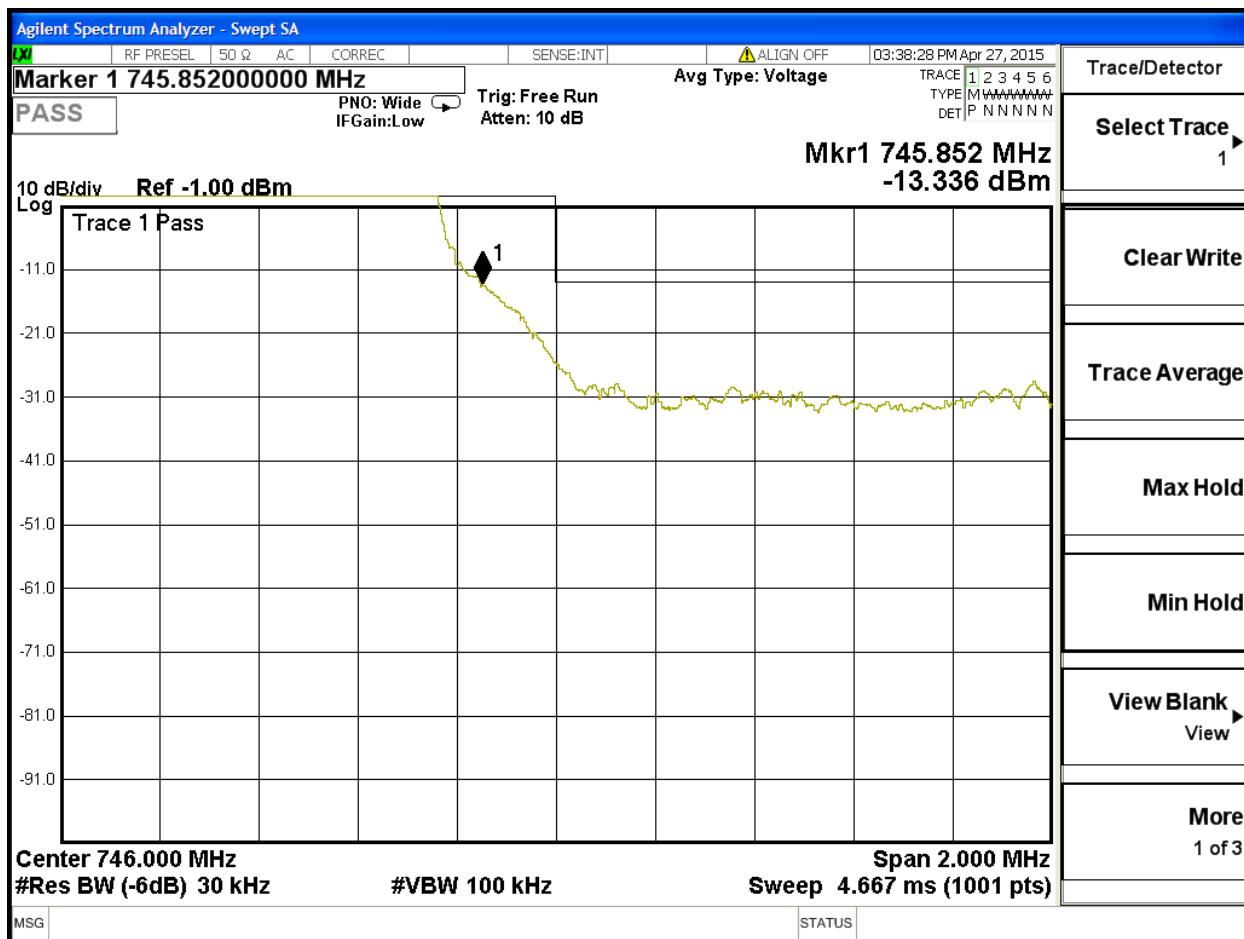
20°C, Low Frequency Edge, 102Vac (-15% from nominal)



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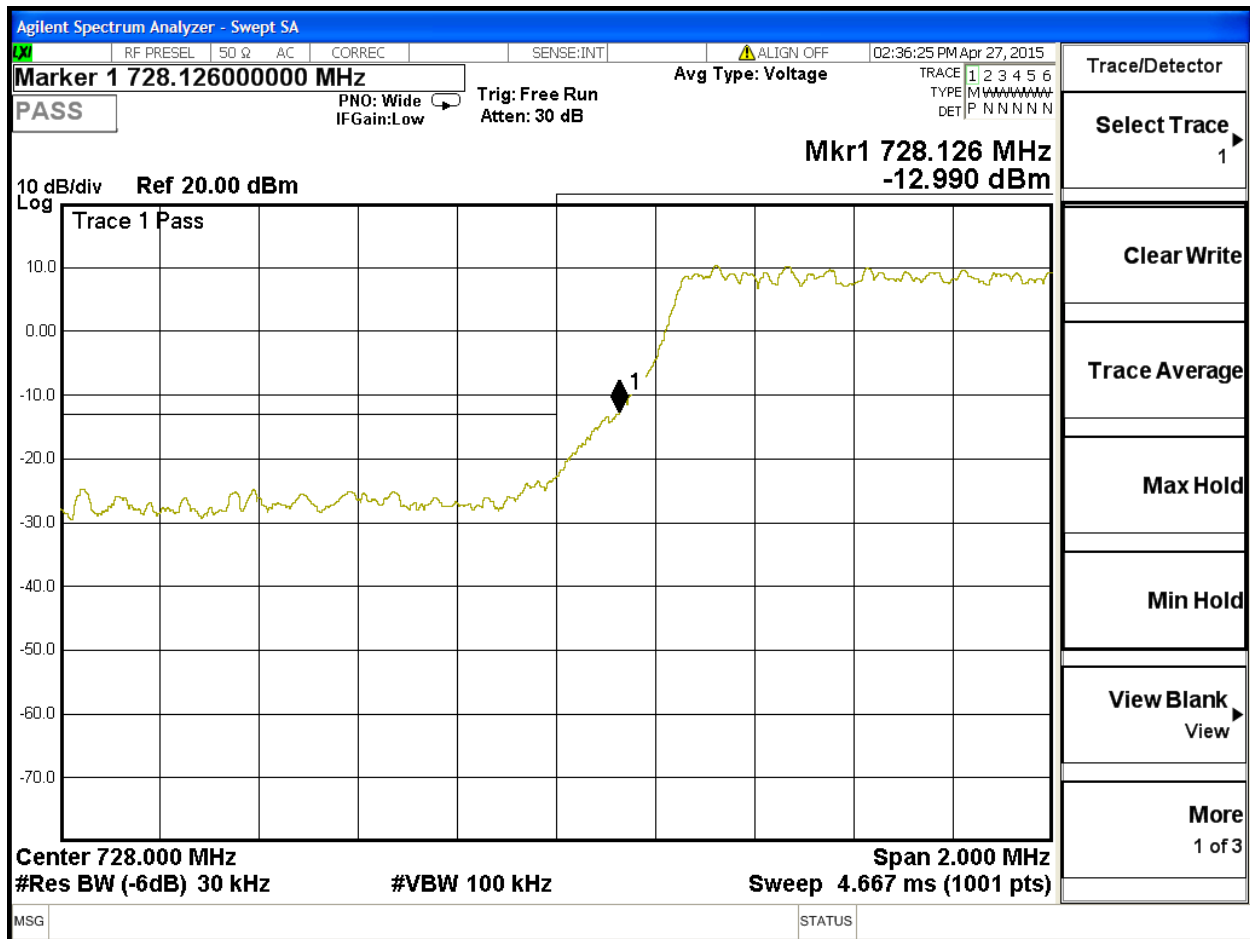
20°C, High Frequency Edge, 102Vac (-15% from nominal)



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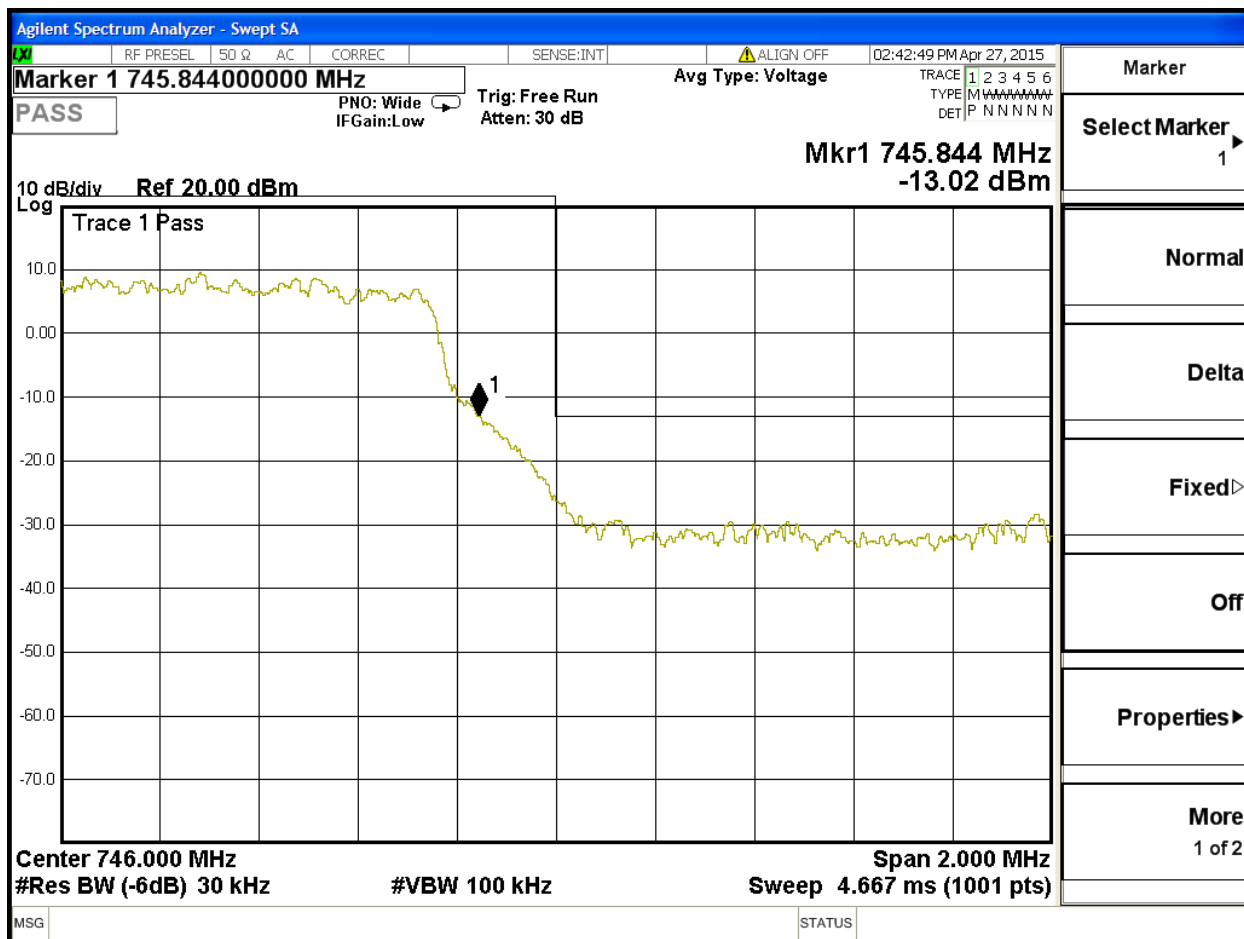
20°C, Low Frequency Edge, 138Vac (+15% from nominal)



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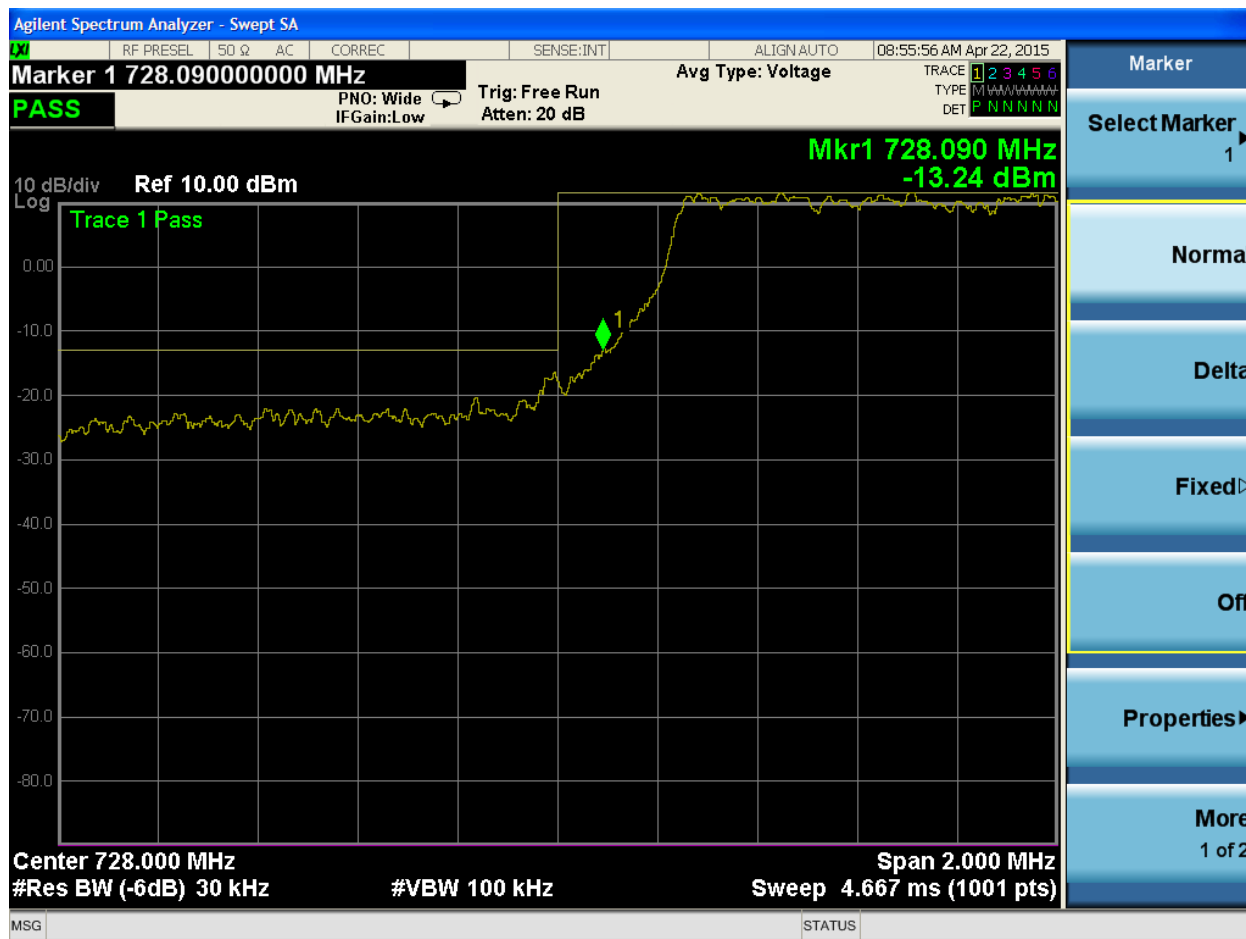
20°C, High Frequency Edge, 138Vac (+15% from nominal)



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30°C, Low Frequency Edge



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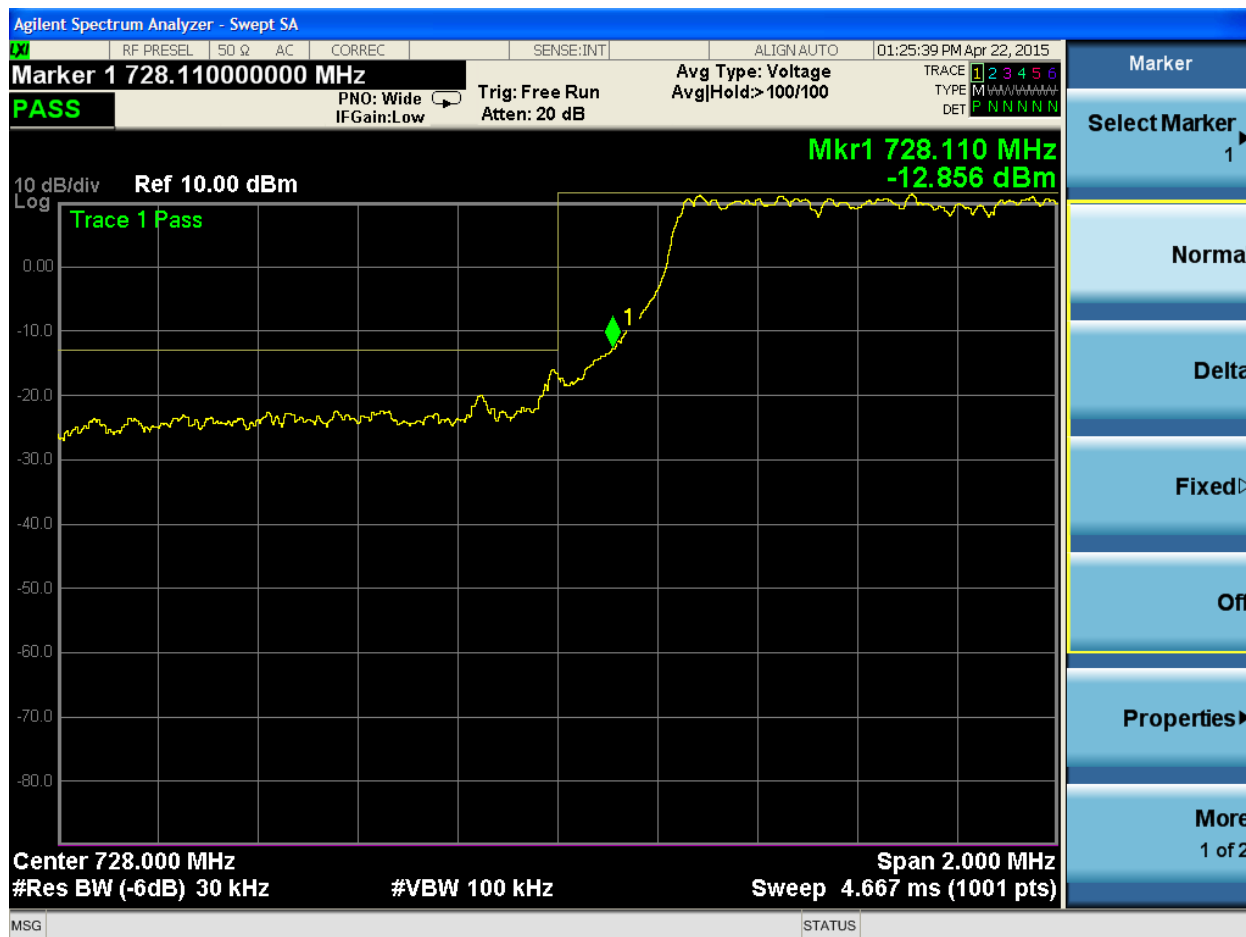
30°C, High Frequency Edge



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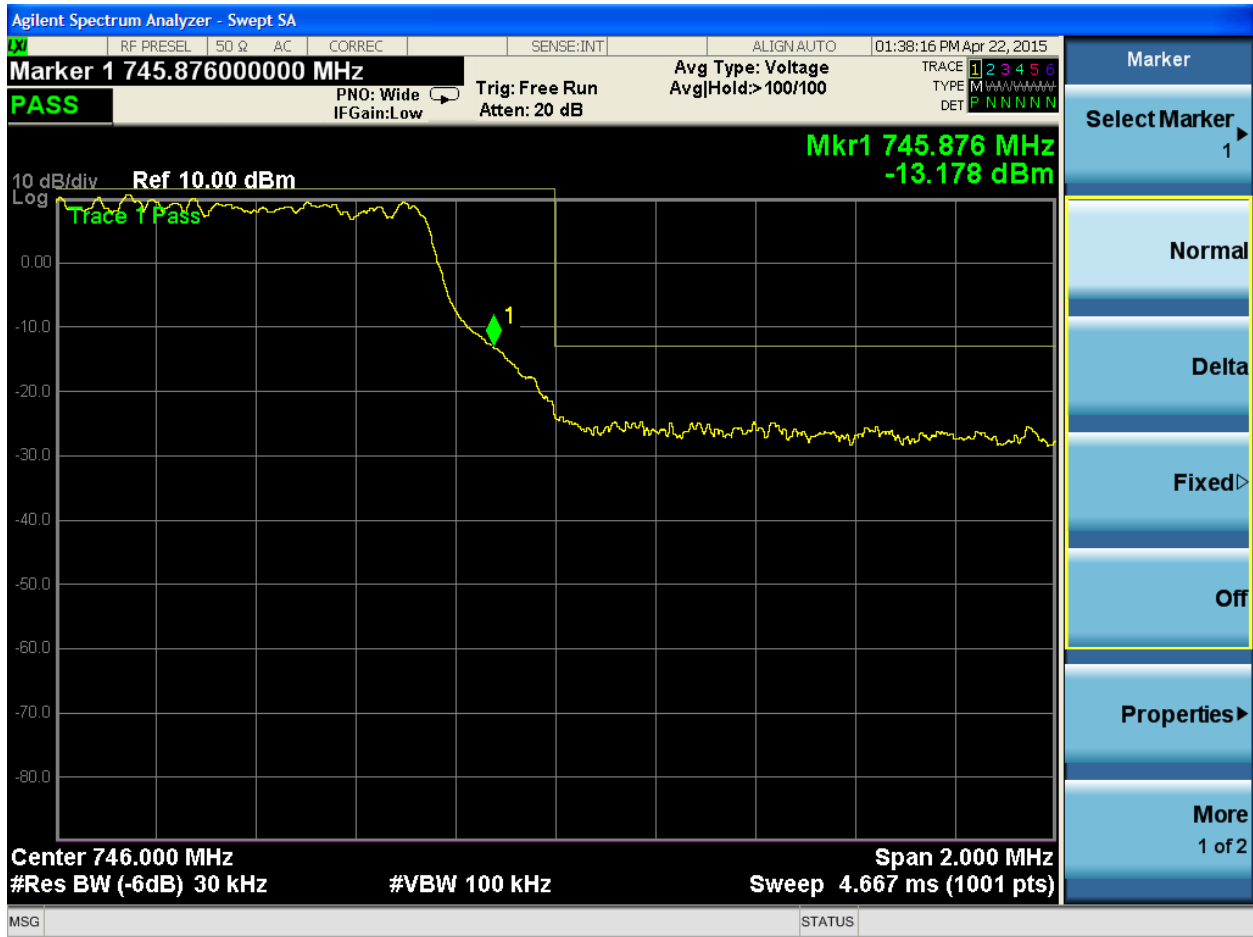
40°C, Low Frequency Edge



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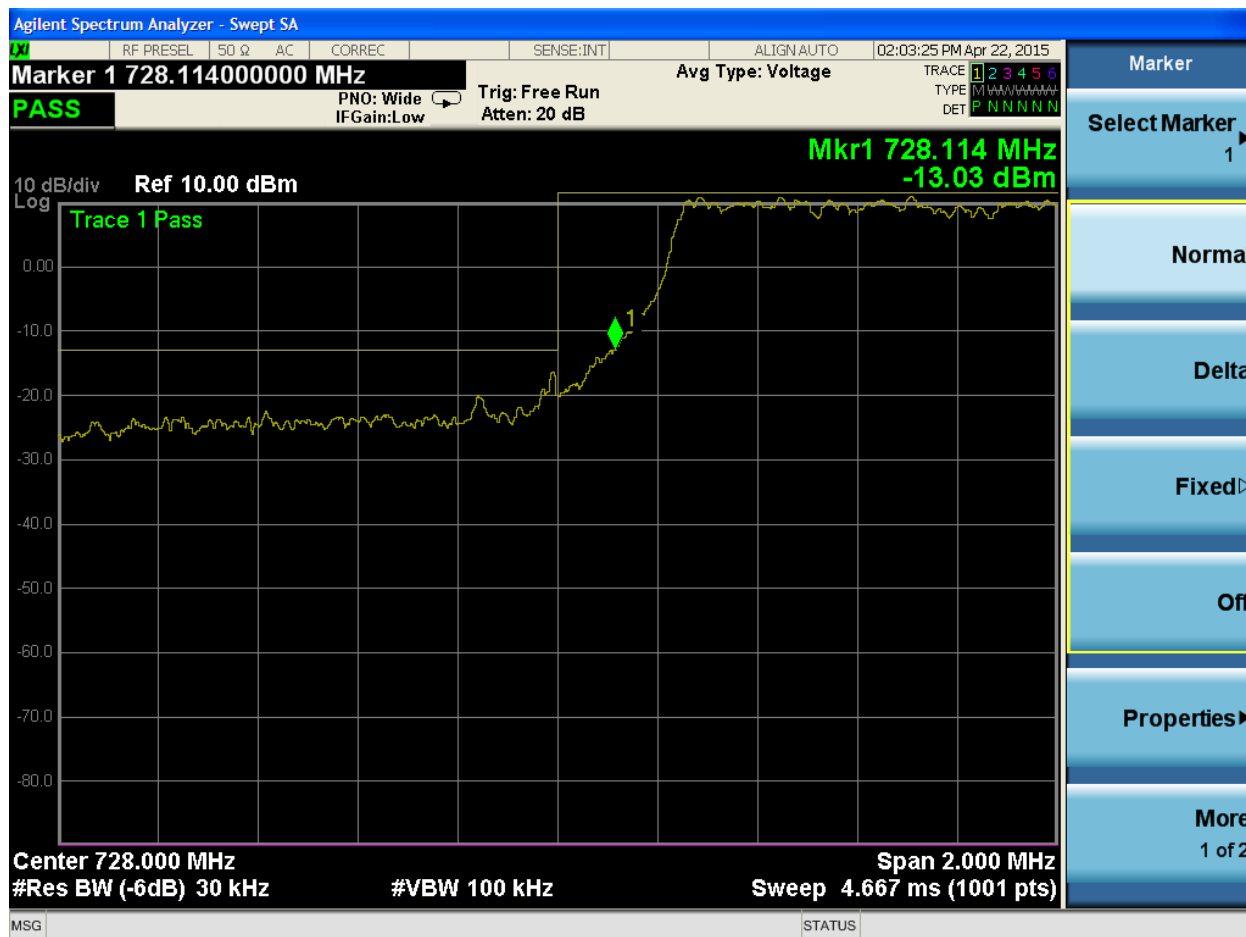
40°C, High Frequency Edge



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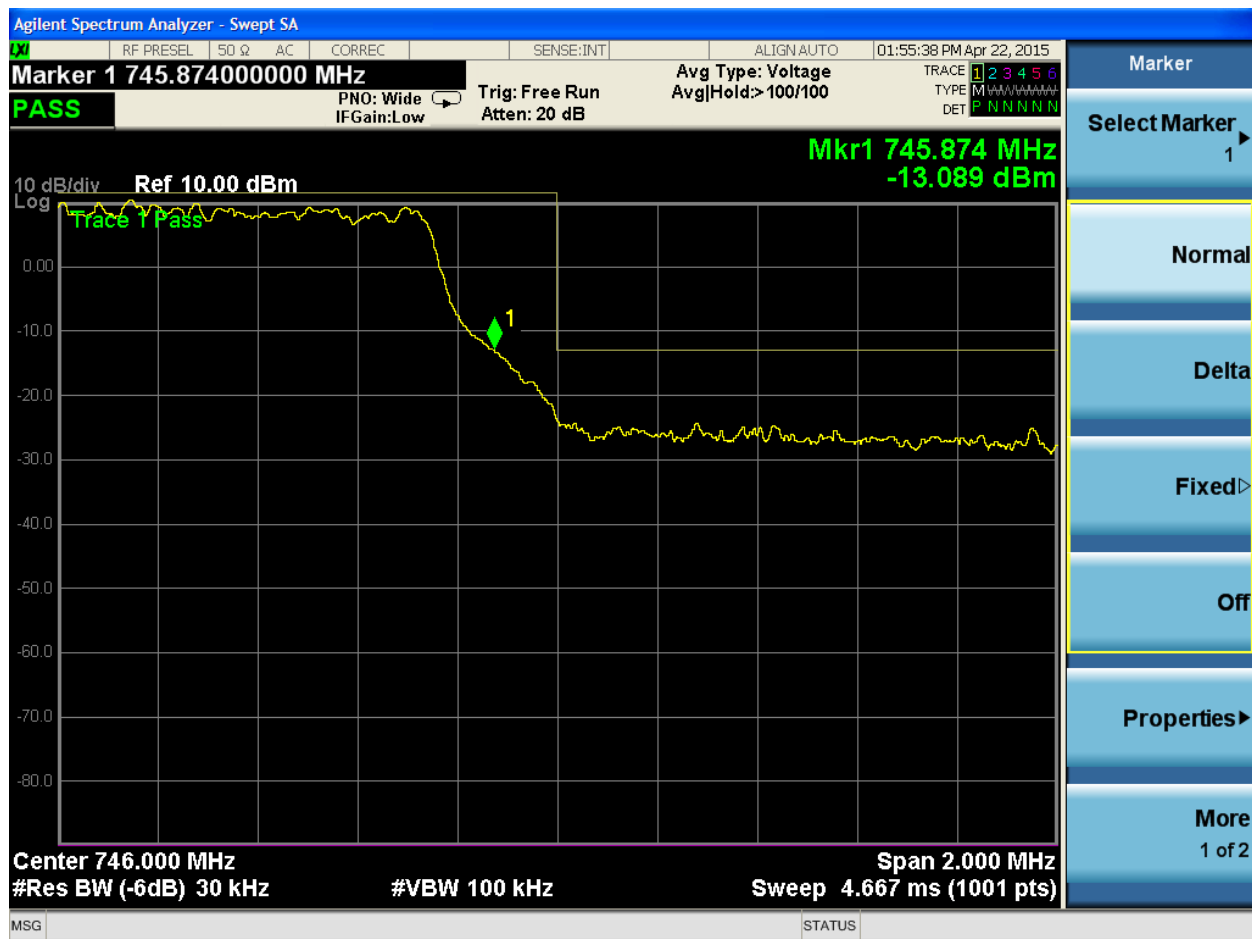
50°C, Low Frequency Edge



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50°C, High Frequency Edge

Band 17:



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-30°C, Low Frequency Edge



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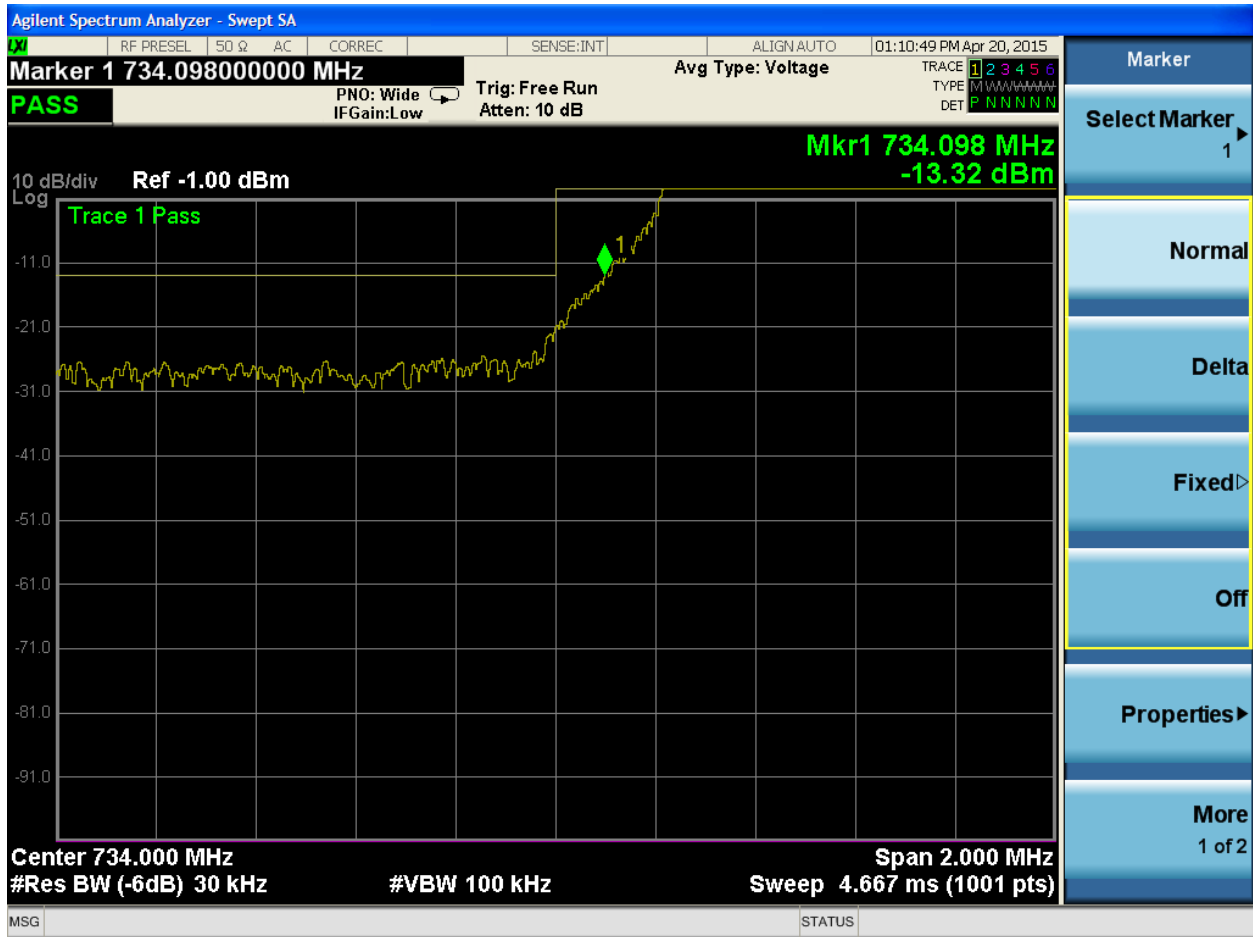
-20°C, Low Frequency Edge



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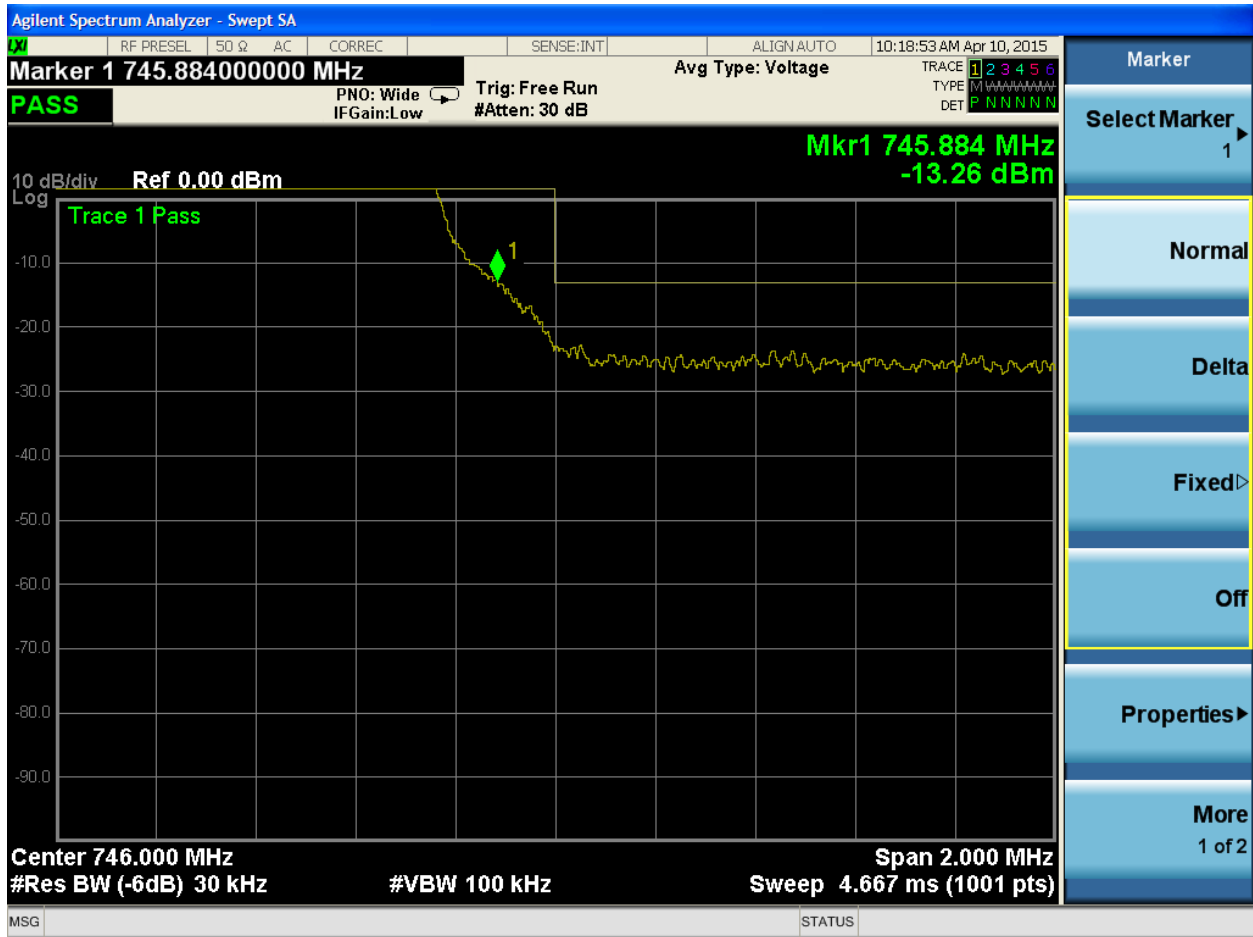


-10°C, Low Frequency Edge



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0°C, Low Frequency Edge



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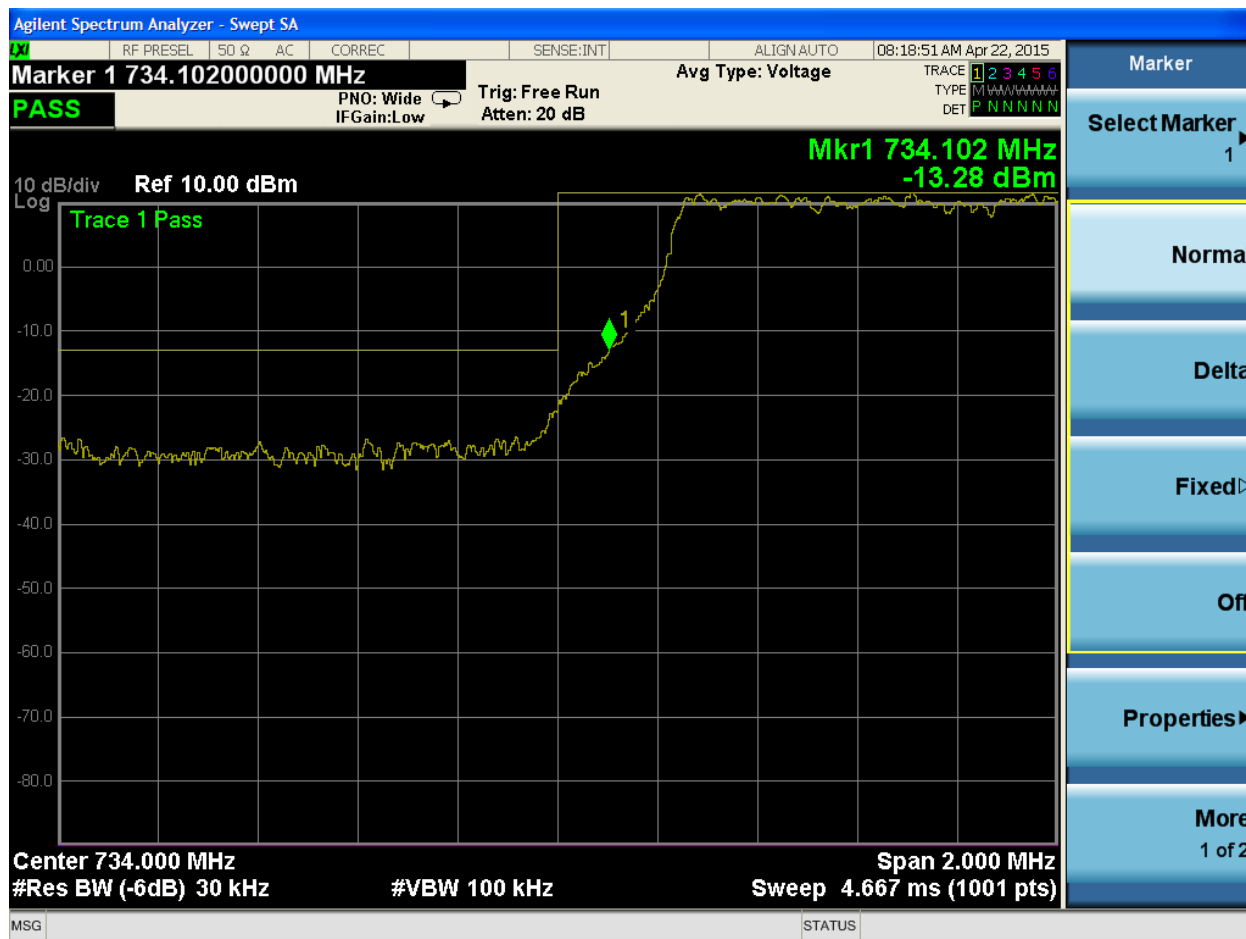
10°C, Low Frequency Edge



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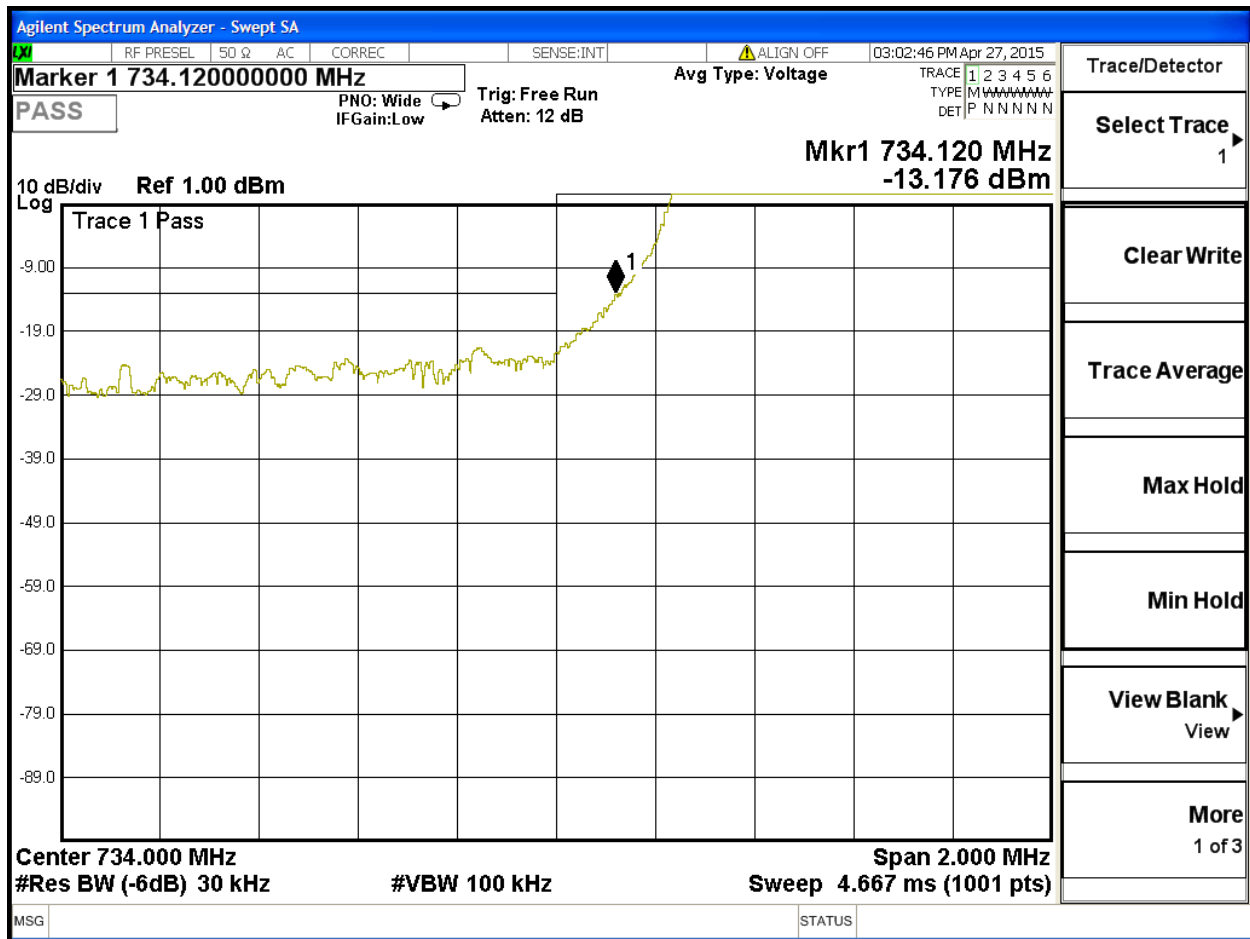
20°C, Low Frequency Edge, 120Vac



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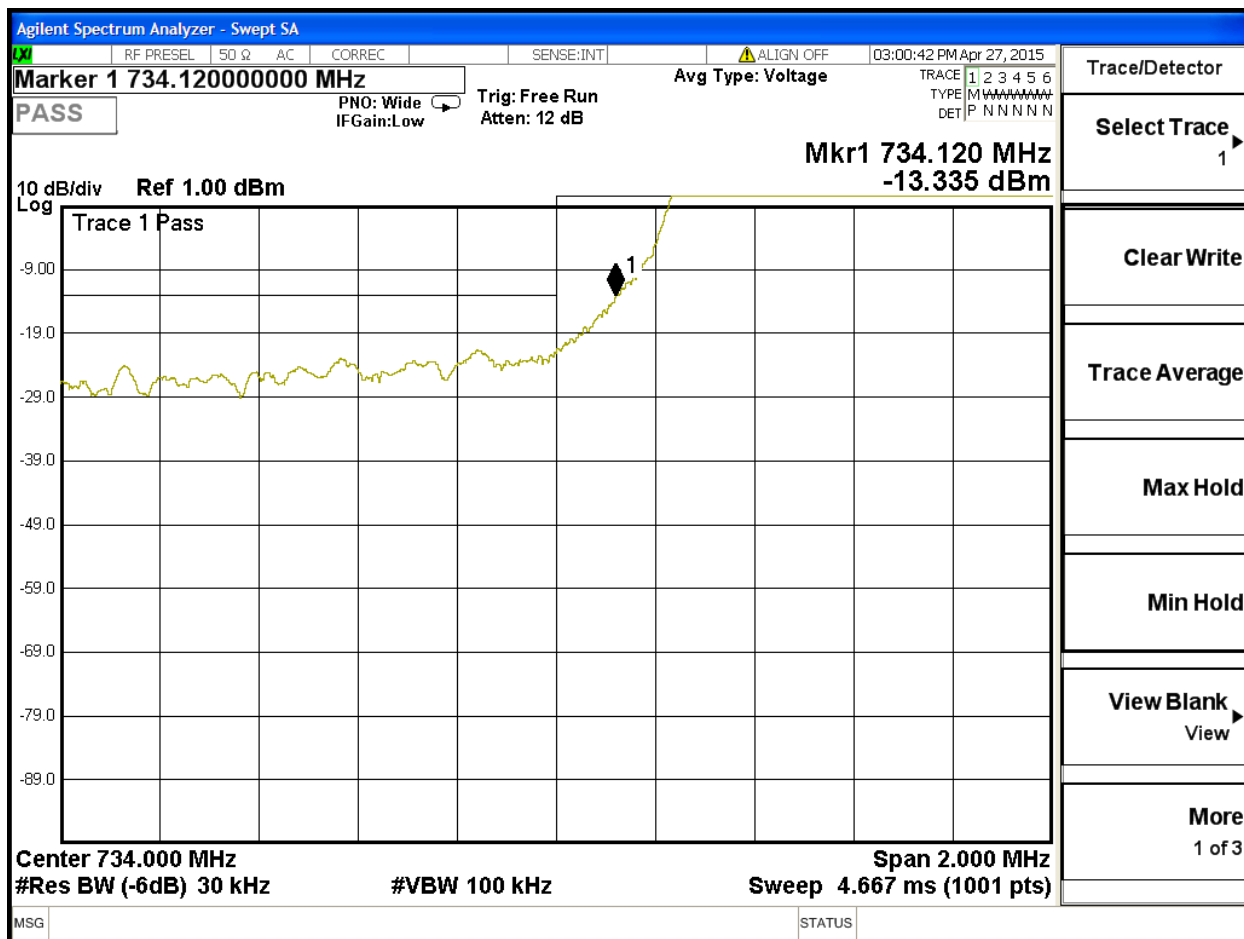
20°C, Low Frequency Edge, 102Vac (-15% from nominal)



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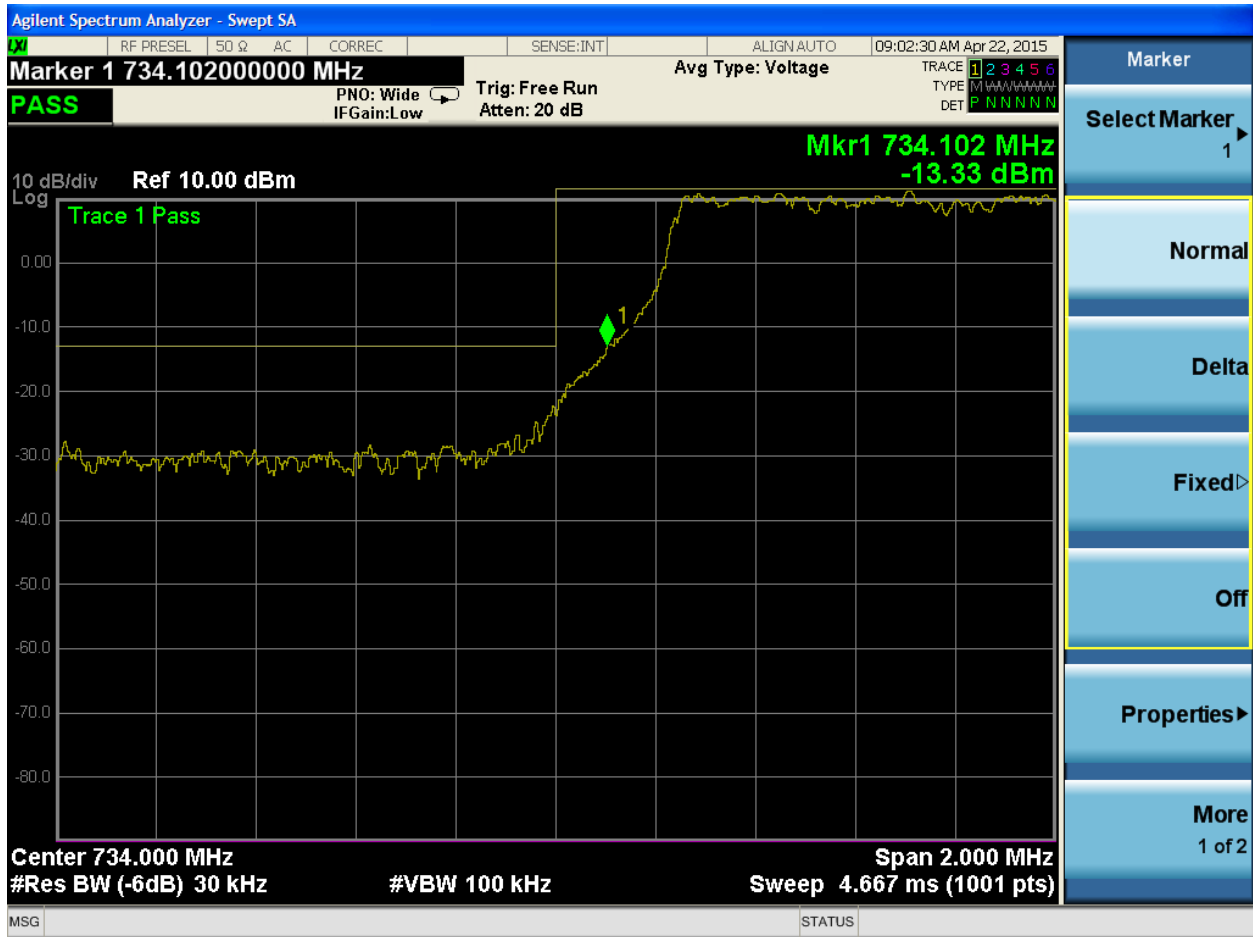
20°C, Low Frequency Edge, 138Vac (+15% from nominal)



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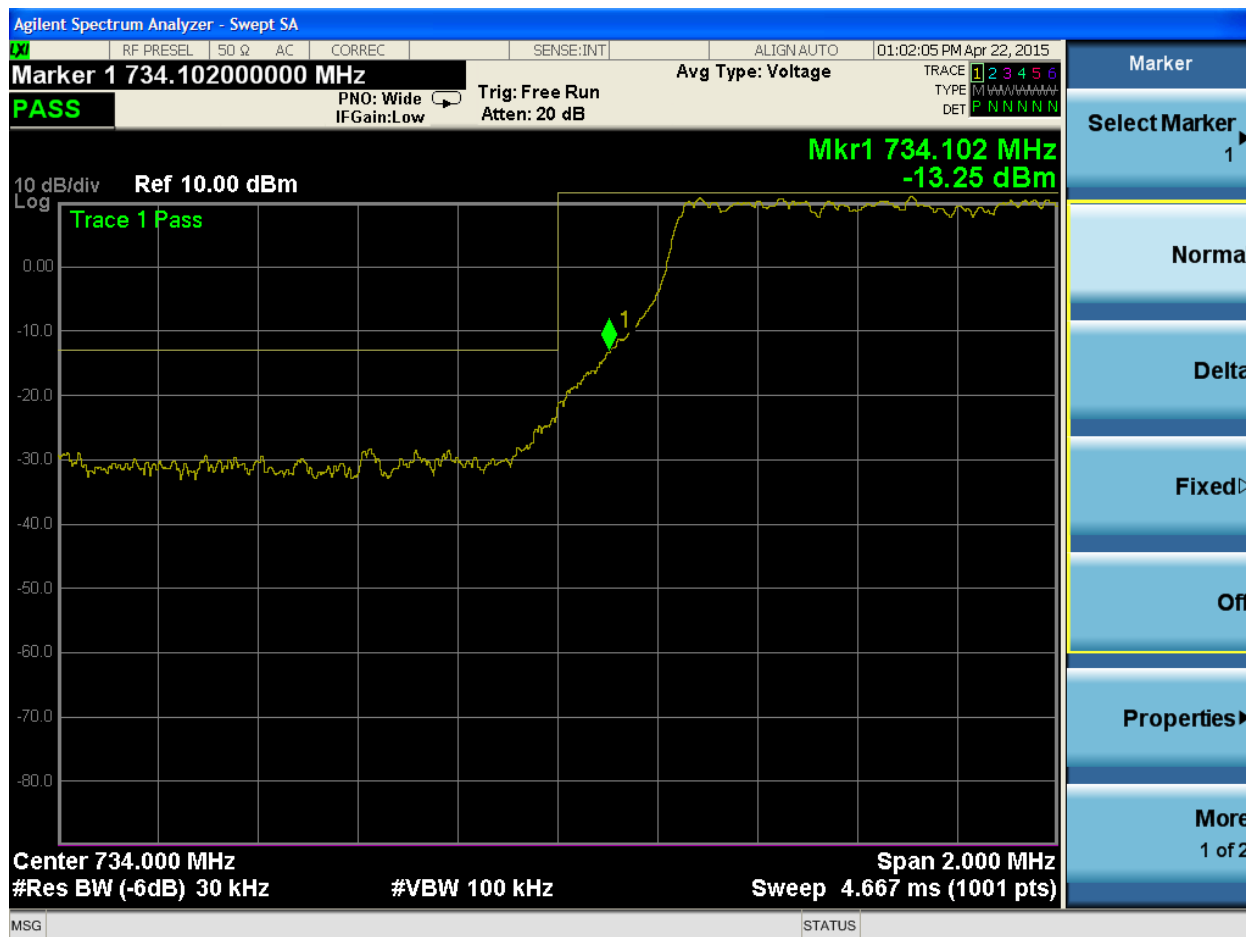
30°C, Low Frequency Edge



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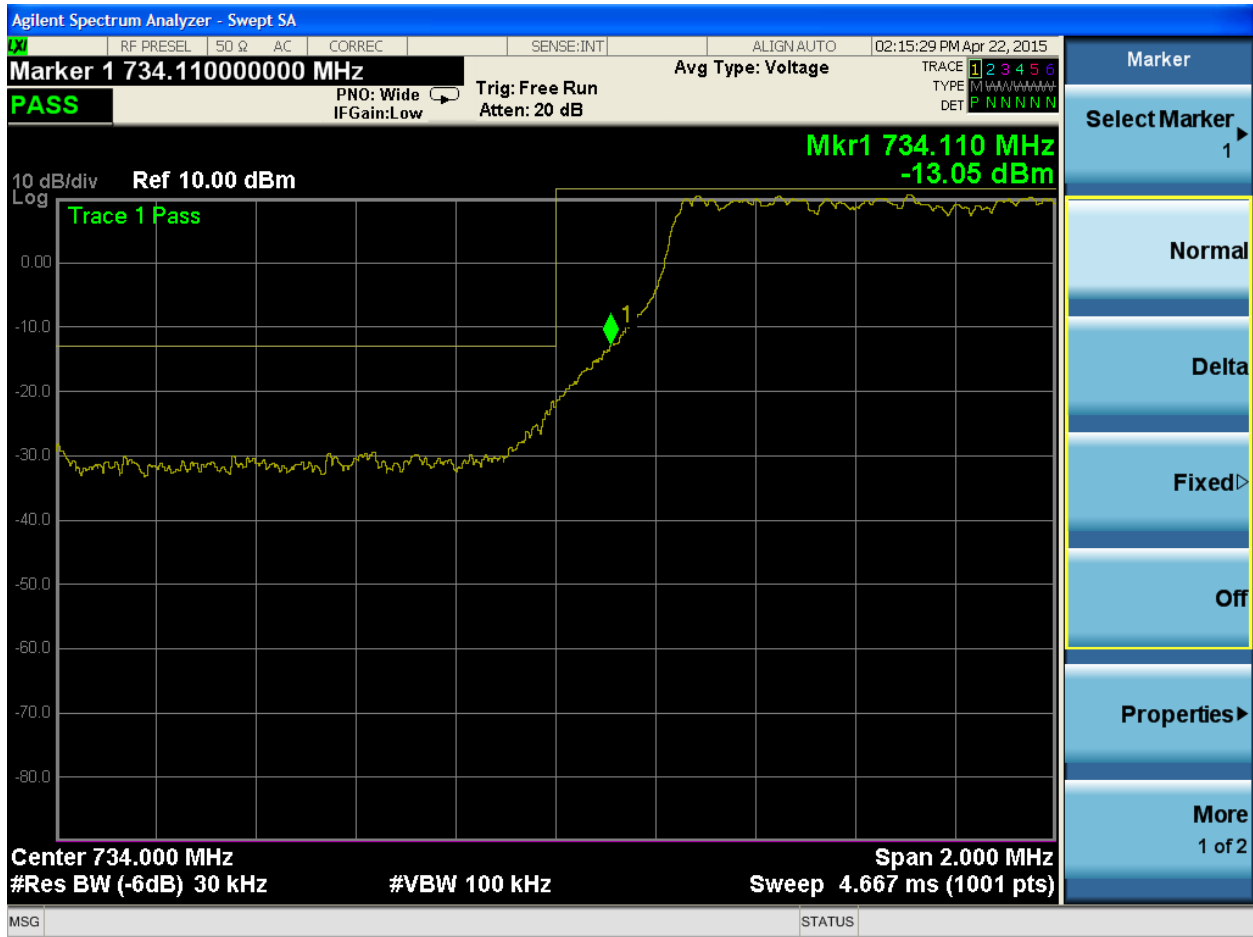
40°C, Low Frequency Edge



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50°C, Low Frequency Edge



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LTE Band 13 (FCC Part 27)

Occupied Bandwidth

LIMIT

"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." [27.53(a)(5)]

MEASUREMENTS / RESULTS

Occupied Bandwidth

Date: 17-Mar-15		Company: Airvana			
Engineer: Tuyen Truong		EUT: Switched IQ Radio Point Domestic (750748)			
WO# P0152		EUT Operating Voltage: POE			
Temp: 22°C		Humidity: 33%		Pressure: 1005mBar	
Note: FCC part 27.53(a)(5)					
Modulation	Bandwidth Setting (MHz)	Band	Channel	Frequency (MHz)	26 dB BW (MHz)
QPSK	5	13	Low	748.5	5.011
QPSK	5	13	Mid	751	4.926
QPSK	5	13	High	753.5	4.938
16QAM	5	13	Low	748.5	4.967
16QAM	5	13	Mid	751	4.914
16QAM	5	13	High	753.5	4.928
64QAM	5	13	Low	748.5	4.877
64QAM	5	13	Mid	751	4.917
64QAM	5	13	High	753.5	4.866
QPSK	10	13	Low	NA	NA
QPSK	10	13	Mid	751	15.357
QPSK	10	13	High	NA	NA
16QAM	10	13	Low	NA	NA
16QAM	10	13	Mid	751	11.560
16QAM	10	13	High	NA	NA
64QAM	10	13	Low	NA	NA
64QAM	10	13	Mid	751	11.461
64QAM	10	13	High	NA	NA



Power and PAPR: 5MHz Operating Bandwidth

FCC 27.50(b)(9):

Control stations and mobile stations transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands and fixed stations transmitting in the 787-788 MHz and 805-806 MHz bands are limited to 30 watts ERP.

Power Data (EPR):

Output Power (E.R.P.)															
Date: 16-Mar-15				Company: Airvana				Work Order: P0152							
Engineer: Tuyen Truong				EUT Desc: Switched IQ Radio Point Domestic				EUT Operating Voltage/Frequency: POE							
Temp: 22°C				Humidity: 33%				Pressure: 1005mBar							
Frequency Range: Low, Mid and High Channels															
Notes: 30W = 44.77dBm. Multiple antenna calclations using formula from FCC KDB 662911 Section I(2)(a)(i). ERP = EIRP - 2.15dB															
Two antennas each with gain 0dBi in this range are installed on the EUT. For MIMO calculations, N(ant.)=2 is used to calculate overall directional gain: 0dBi + 10log(N)dBi = 0dBi + 3.0dB = 3.0dBi.															
FCC Part 27.50(b)(9); Limit: 30W = 44.77dBm															
Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Frequency	Peak Power Reading (dBm)	Power Combiner (dB)	20dB Attenuator (dB)	Cable Factor (dB)	Adjusted Peak Power Reading (dBm)	Directional Antenna Gain	ERP (dBm)	Limit (dBm)	ERP (dB)	Margin (dB)	Result (Pass/Fail)
13	5	QPSK	Low	748.5	11.8	4.0	19.5	0.6	35.9	3.0	38.9	44.77	36.8	-8.9	Pass
13	5	QPSK	Mid	751.0	11.6	4.0	19.5	0.6	35.7	3.0	38.7	44.77	36.6	-9.1	Pass
13	5	QPSK	High	753.5	11.2	4.0	19.5	0.6	35.3	3.0	38.3	44.77	36.2	-9.5	Pass
13	5	16QAM	Low	748.5	12.7	4.0	19.5	0.6	36.8	3.0	39.8	44.77	37.7	-8.0	Pass
13	5	16QAM	Mid	751.0	11.9	4.0	19.5	0.6	36.0	3.0	39.0	44.77	36.9	-8.8	Pass
13	5	16QAM	High	753.5	11.4	4.0	19.5	0.6	35.5	3.0	38.5	44.77	36.4	-9.3	Pass
13	5	64QAM	Low	748.5	11.6	4.0	19.5	0.6	35.7	3.0	38.7	44.77	36.6	-9.1	Pass
13	5	64QAM	Mid	751.0	11.5	4.0	19.5	0.6	35.6	3.0	38.6	44.77	36.5	-9.2	Pass
13	5	64QAM	High	753.5	11.1	4.0	19.5	0.6	35.2	3.0	38.2	44.77	36.1	-9.6	Pass
Table Result: Pass															
Test Site: EMI Chamber 1				Cable: Asset# 1787				20dB Attenuator: Asset #2053				Asset#791			
Analyzer: Rental SA#2				Power Combiner: Asset# 1939											

Peak to Average Power Ratio Data:

PEAK TO AVERAGE RATIO											
Date: March 20, 24, 2015				Company: Airvana				Work Order: P0152			
Engineer: Tuyen Truong / Ryan Brown				EUT Desc: Switched IQ Radio Point Domestic				EUT Operating Voltage/Frequency: POE			
Temp: 22°C				Humidity: 33%				Pressure: 1005mBar			
(March 24) Temp: 24°C				Humidity: 10%				Pressure: 1011mBar			
Test Equipments: Brown SA, Cable (#1787), 20dB Attenuation (#791), Mini Circuit (#1939), 3m Indoor											
Note:											
Band	BW (MHz)	Channel (MHz)	Frequency (MHz)	0.1% Peak to Average Ratio (dB)			Limit (dB)	Margin (dB)			Result Pass / Fail
				QPSK	16QAM	64QAM		QPSK	16QAM	64QAM	
12	5	Low	730.5	8.66	8.75	8.61	13	-4.34	-4.25	-4.39	Pass
12	5	Mid	737	8.49	8.61	8.47	13	-4.51	-4.39	-4.53	Pass
12	5	High	743.5	8.45	8.57	8.42	13	-4.55	-4.43	-4.58	Pass
17	5	Low	736.5	8.47	8.55	8.51	13	-4.53	-4.45	-4.49	Pass
17	5	Mid	740	8.61	8.62	8.53	13	-4.39	-4.38	-4.47	Pass
17	5	High	See band 12	na	na	na	13	na	na	na	na

Spectrum analyzer plots are on the following pages.

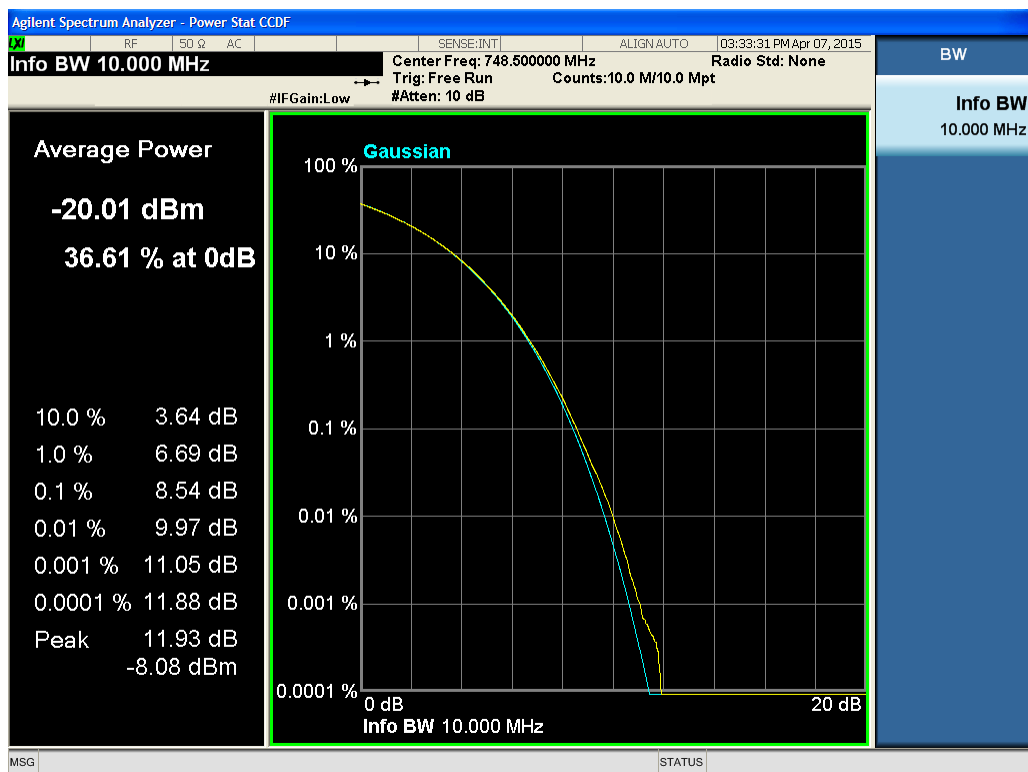


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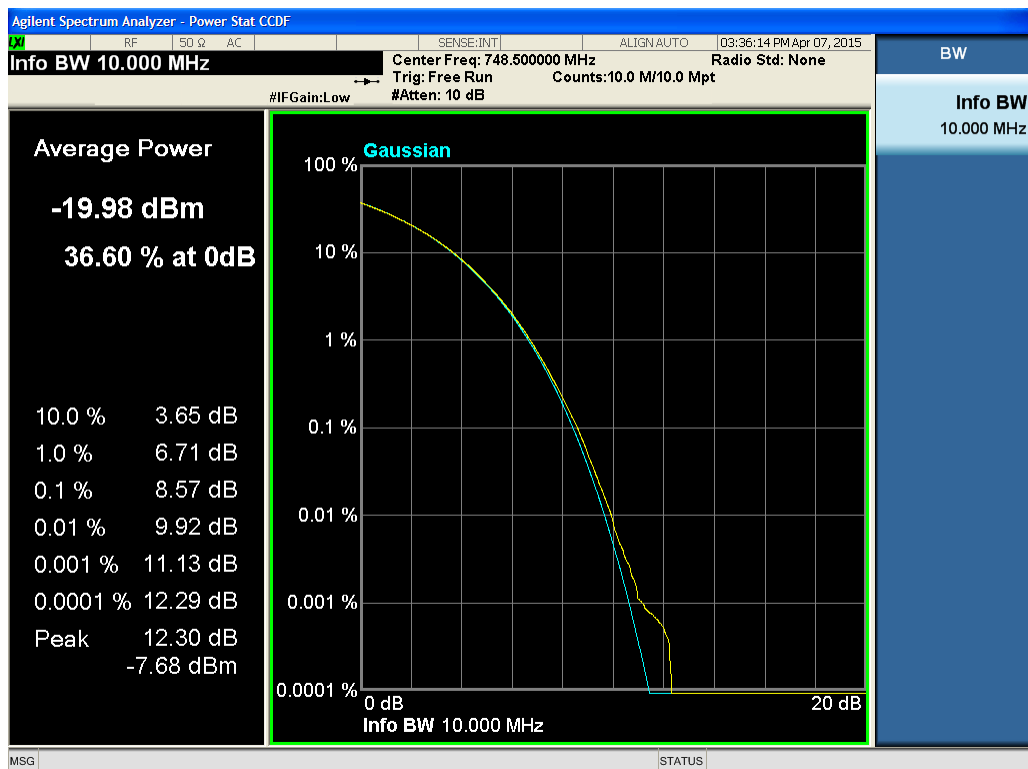


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PLOTS



Band 13 - 5MHz BW – Low Channel – QPSK



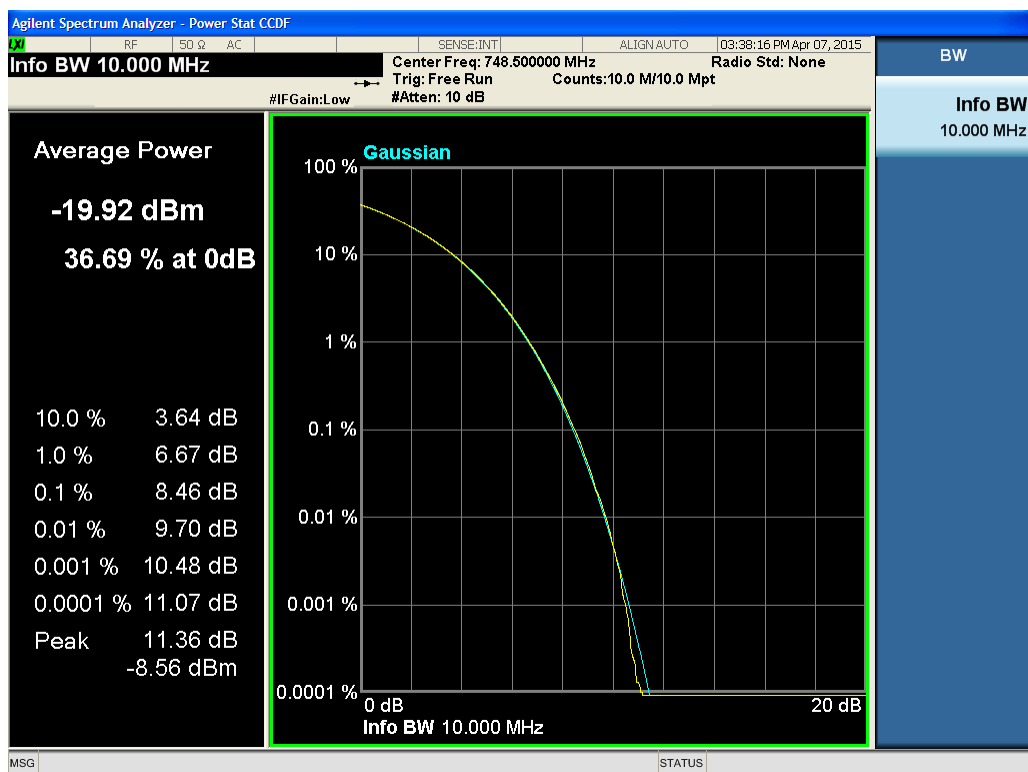
Band 13 - 5MHz BW – Low Channel – 16QAM



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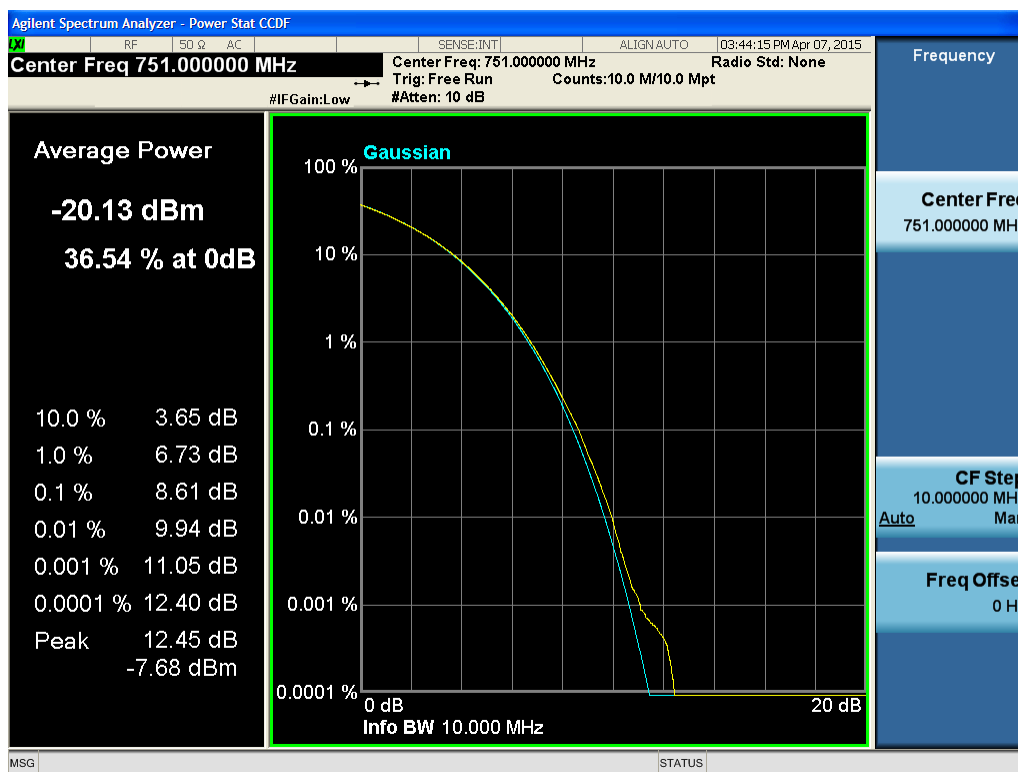
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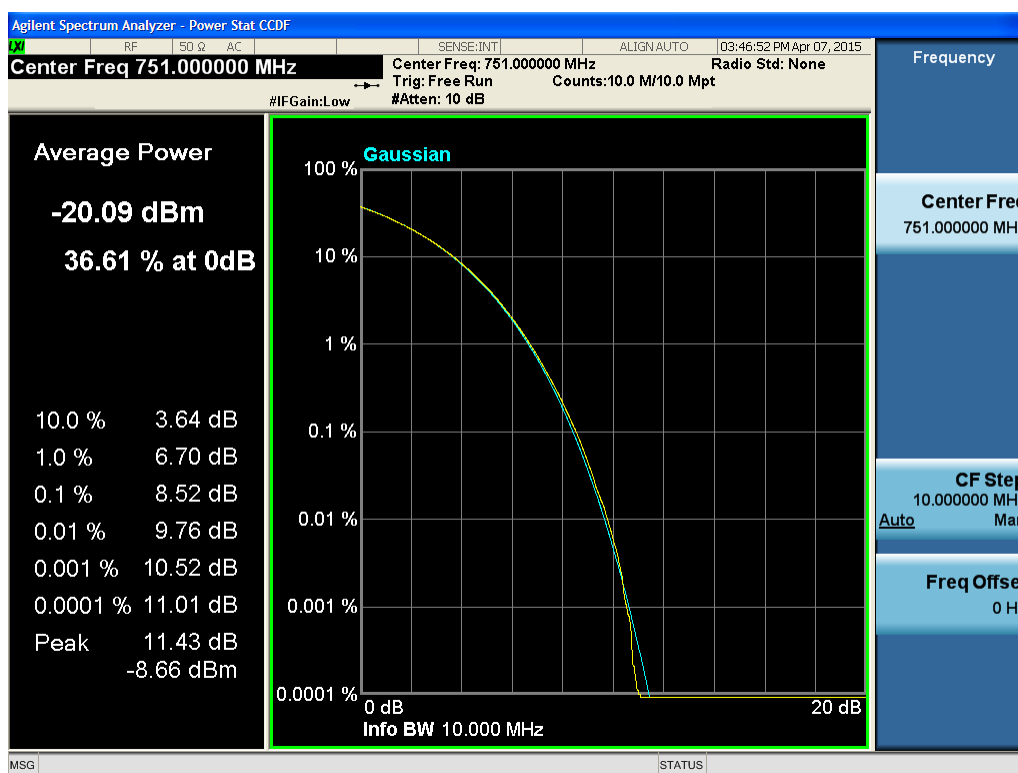
Band 13 - 5MHz BW – Low Channel – 64QAM



Band 13 - 5MHz BW – Mid Channel - QPSK

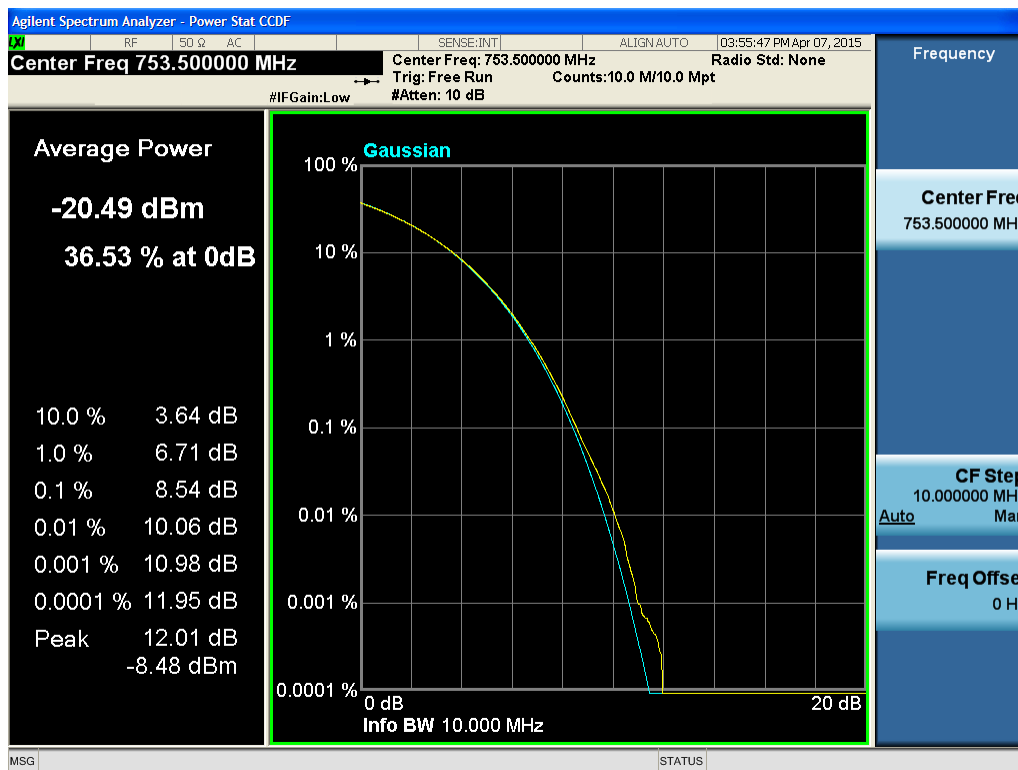


Band 13 - 5MHz BW – Mid Channel – 16QAM

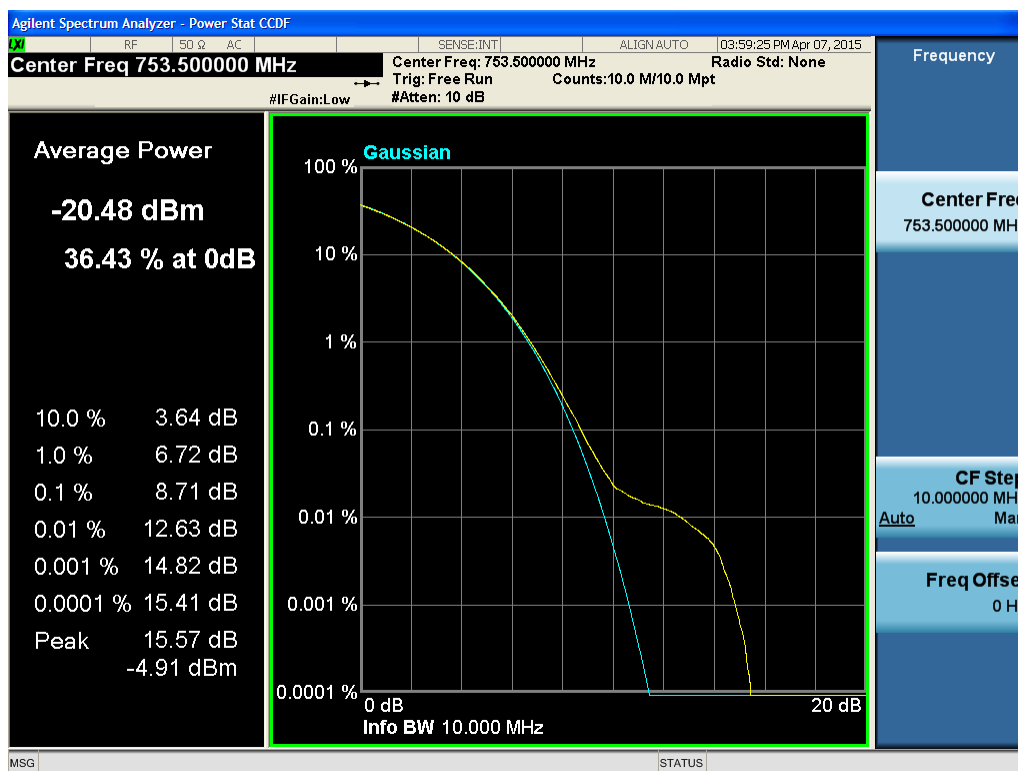


Band 13 - 5MHz BW – Mid Channel – 64QAM



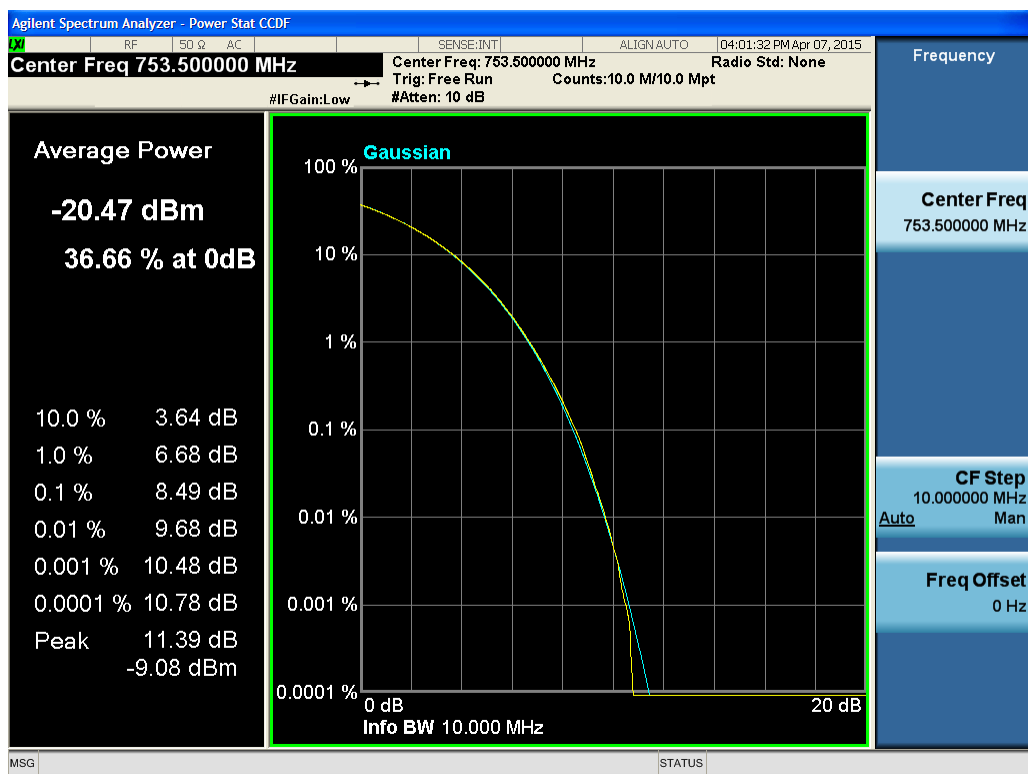


Band 13 - 5MHz BW – High Channel – QPSK



Band 13 - 5MHz BW – High Channel – 16QAM





Band 13 - 5MHz BW – High Channel – 64QAM



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Power and PAPR: 10MHz Operating Bandwidth

FCC 27.50(b)(9):

Control stations and mobile stations transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands and fixed stations transmitting in the 787-788 MHz and 805-806 MHz bands are limited to 30 watts ERP.

Output Power (E.R.P.)															Work Order: P0152		
Date: 27-3-15			Company: Airvana												EUT Operating Voltage/Frequency: POE		
Engineer: Ryan Brown			EUT Desc: Switched IQ Radio Point Domestic														
Temp: 27°C			Humidity: 51%			Pressure: 1008 mBar											
Frequency Range: Low, Mid and High Channels																	
Notes: 30W = 44.77dBm. Multiple antenna calculations using formula from FCC KDB 662911 Section 62(a)(i). ERP = EIRP - 2.15dB Two antennas each with gain 0dBi in this range are installed on the EUT. For MIMO calculations, N _{ant} =2 is used to calculate overall directional gain: 0dBi + 10log(N) _{ant} = 0dBi + 3.0dB = 3.0dBi. Note: Band 13 contains only one channel at 10MHz bandwidth.																	
Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Frequency (MHz)	Average Power Reading (dBm)	Peak Power Reading (dBm)	PAPR Limit: 13dB (dB)	Power Combiner (dB)	20dB Attenuator (dB)	Cable Factor (dB)	Adjusted Peak Power Reading (dBm)	Directional Antenna Gain (dBi)	ERP (dBm)	FCC Part 27.50(b)(9); Limit: 30W = 44.77dBm			
														Limit (dBm)	ERP (dB)	Margin (dB)	Result (Pass/Fail)
13	10	QPSK	Mid	751.0	-1.6	8.04	9.6	4.0	19.5	0.3	31.8	3.0	34.8	44.77	32.7	-12.9	Pass
13	10	16QAM	Mid	751.0	-1.6	8.23	9.8	4.0	19.5	0.3	32.0	3.0	35.0	44.77	32.9	-12.7	Pass
13	10	64QAM	Mid	751.0	-1.6	8.79	10.4	4.0	19.5	0.3	32.6	3.0	35.6	44.77	33.4	-12.2	Pass
Table Result: Pass																	
Test Site: ESD-1			Cable: 1509			20dB Attenuator: Asset#791											
Analyzer: MXE EMI Receiver			Power Combiner: 1939														

Spectrum Analyzer plots of peak and average readings are on the following pages.

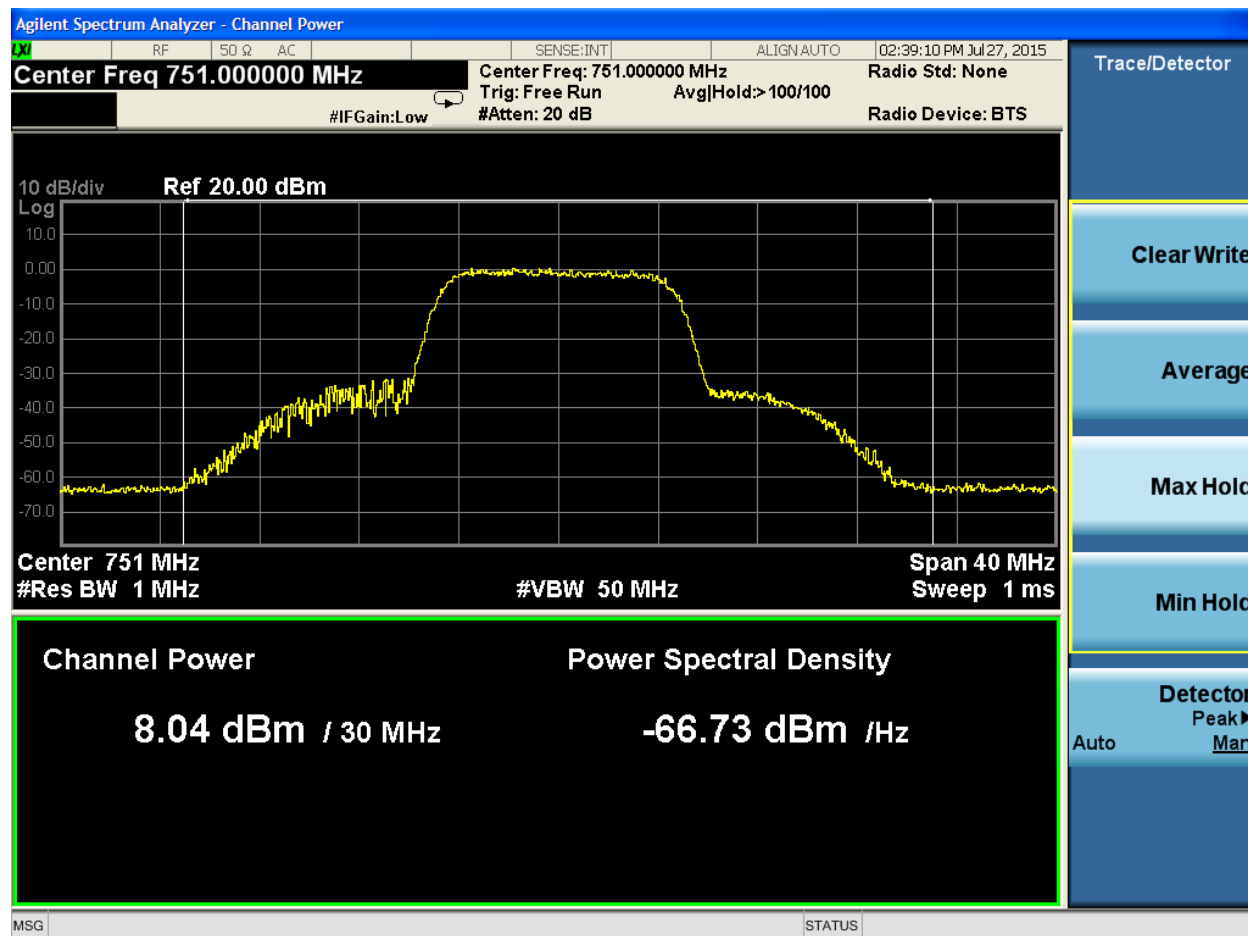


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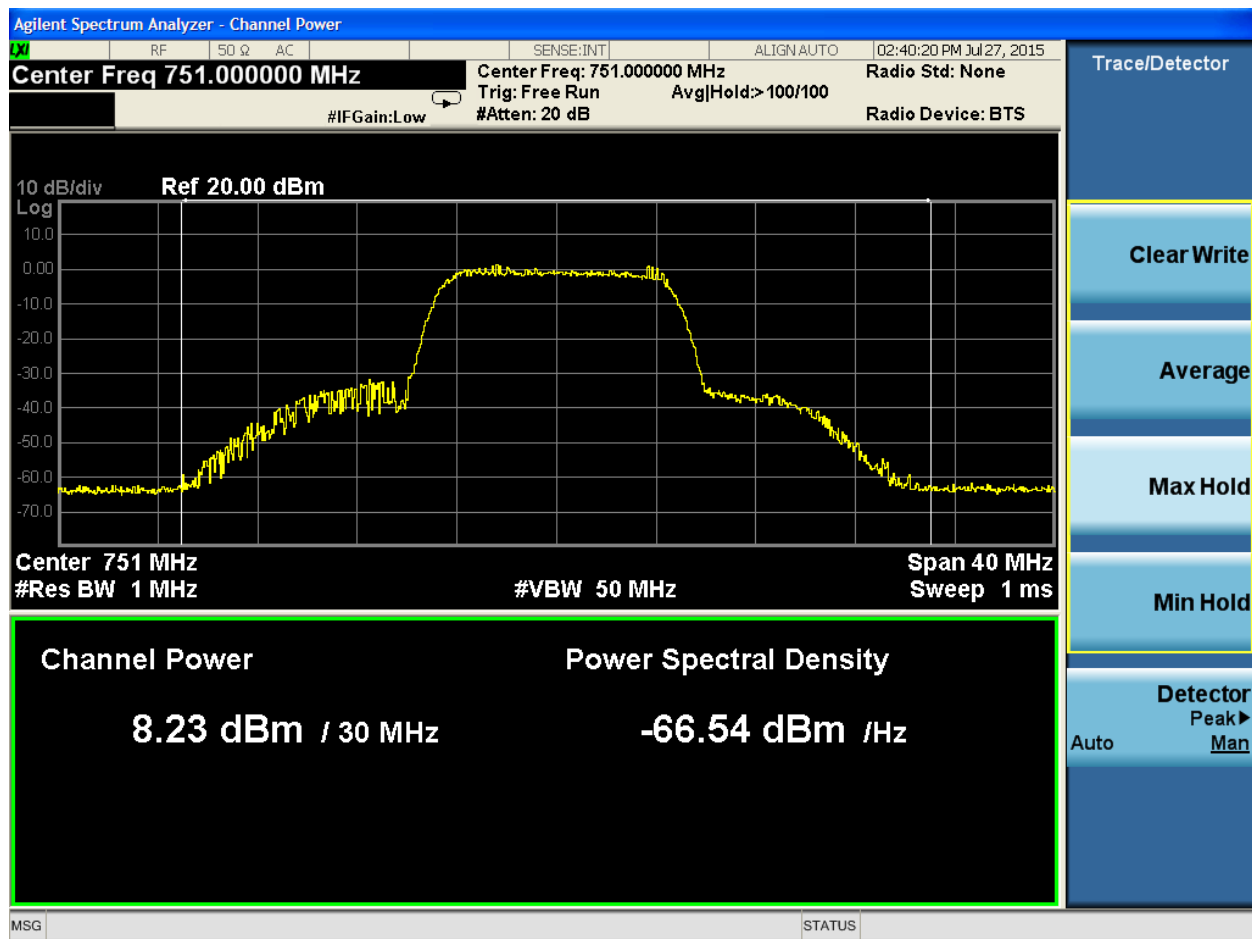


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Band 13 Peak Readings:



10MHz (single channel), QPSK



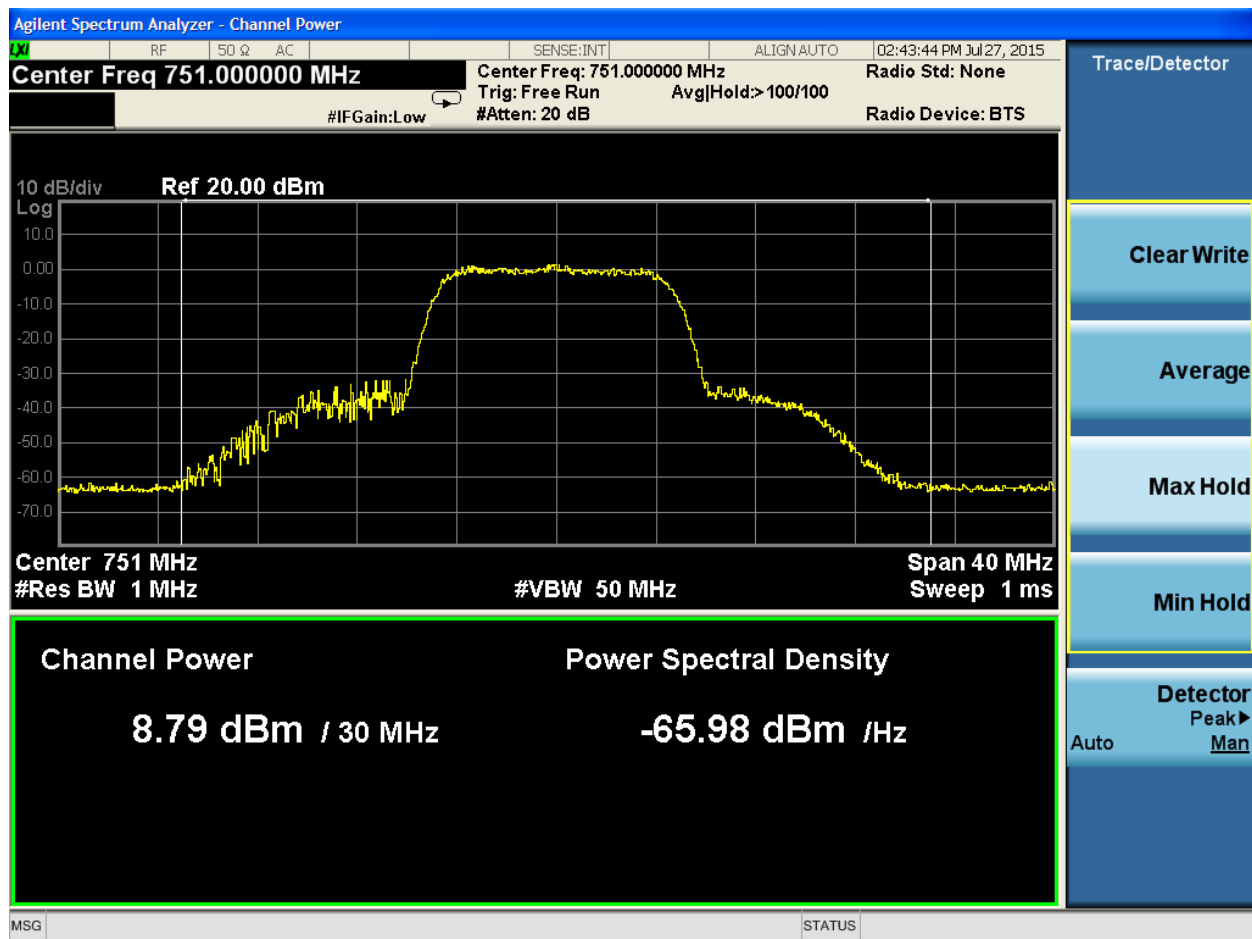
10MHz (single channel), 16QAM



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10MHz (single channel), 64QAM

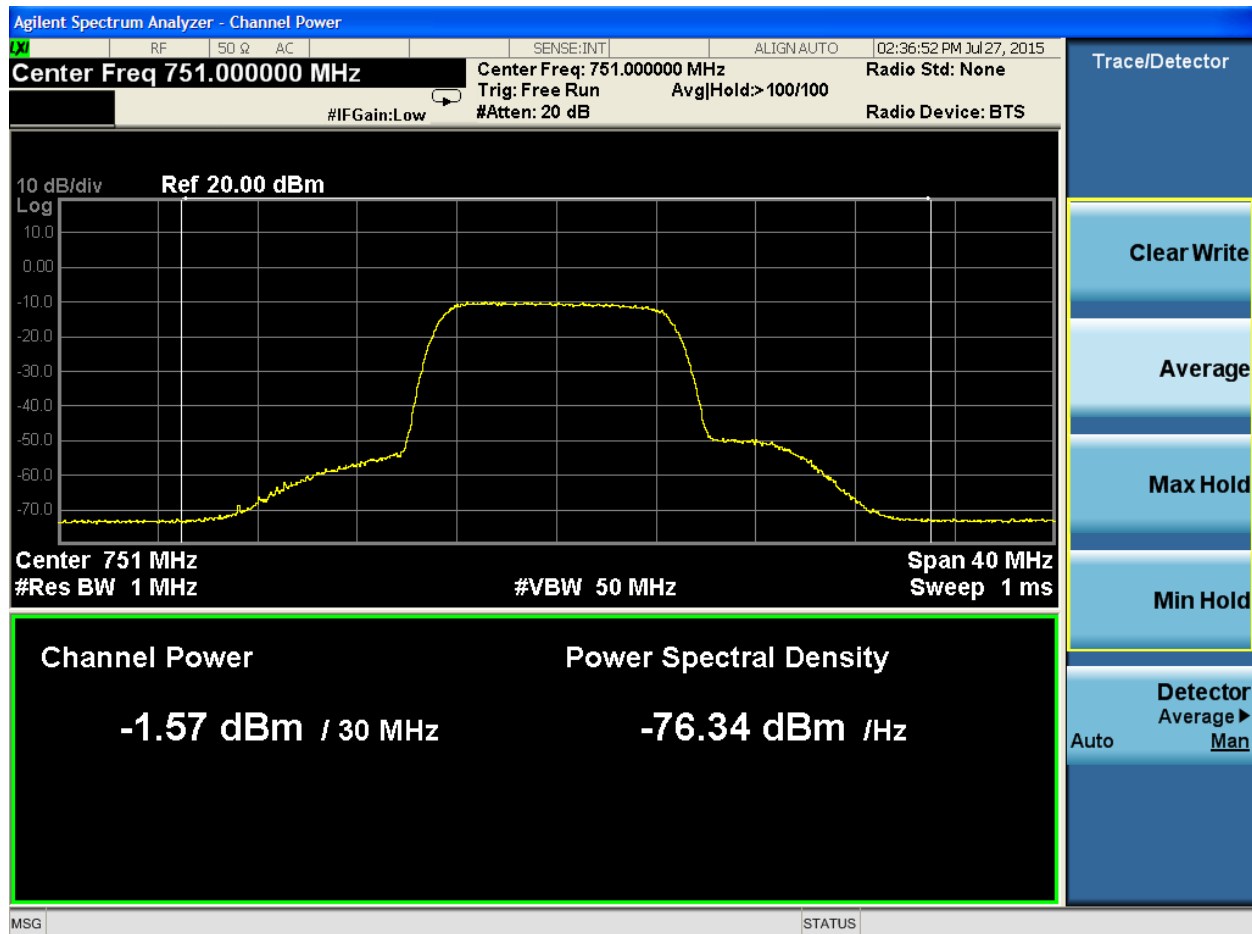


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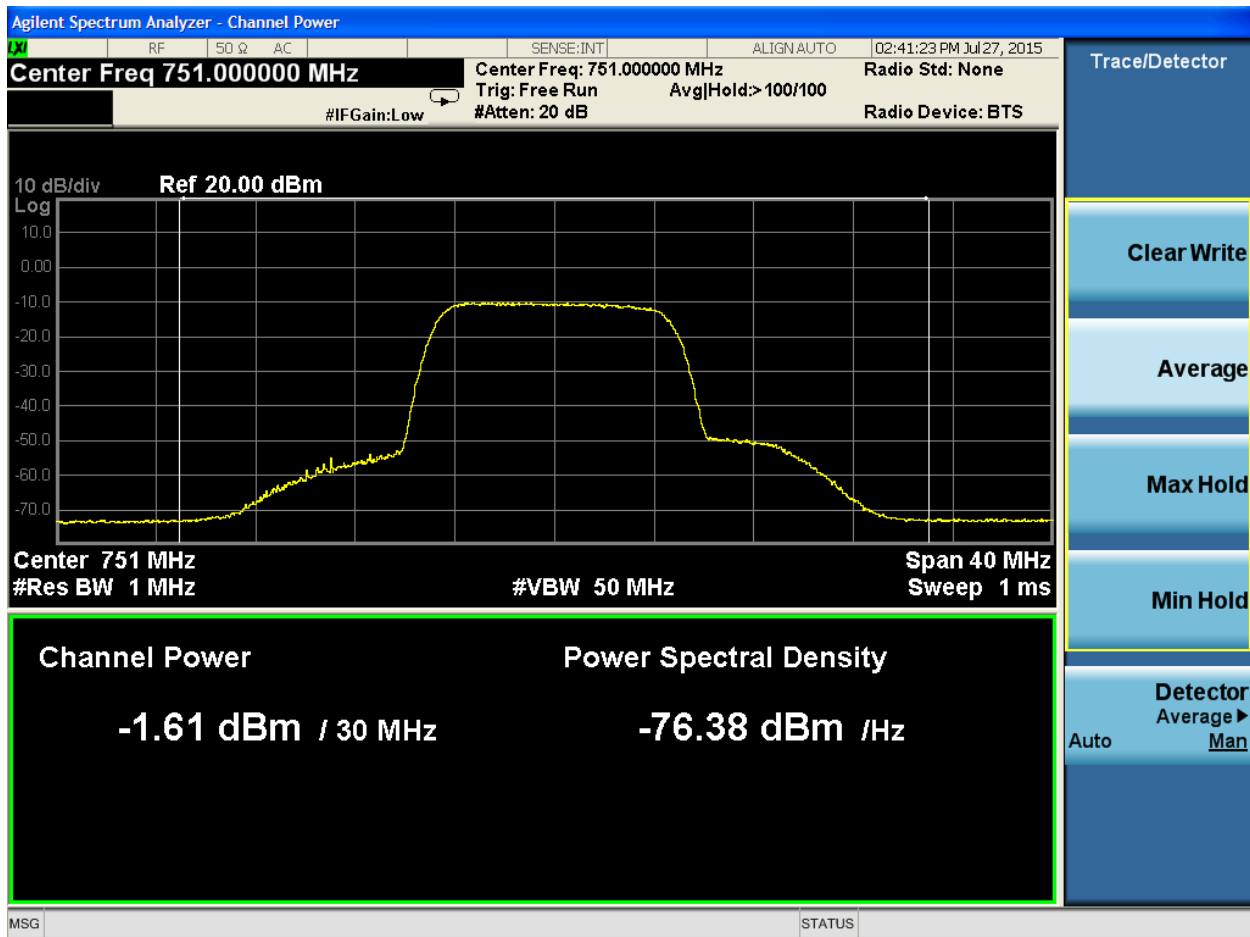


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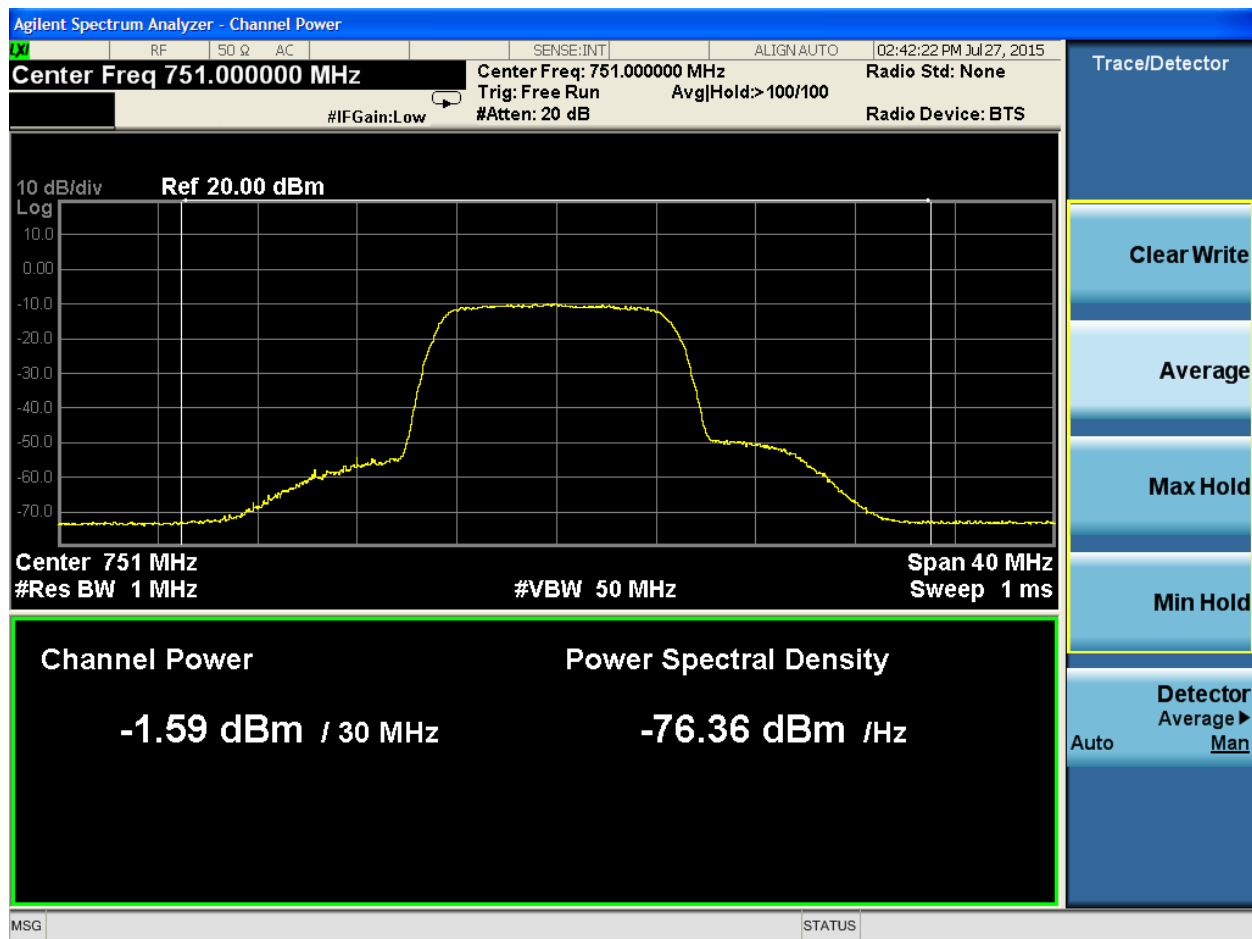
Band 13 Average Readings:



10MHz (single channel), QPSK



10MHz (single channel), 16QAM



10MHz (single channel), 64QAM



Band Edge Measurements

LIMITS

FCC 27.53(c):

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the 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, in accordance with the following:

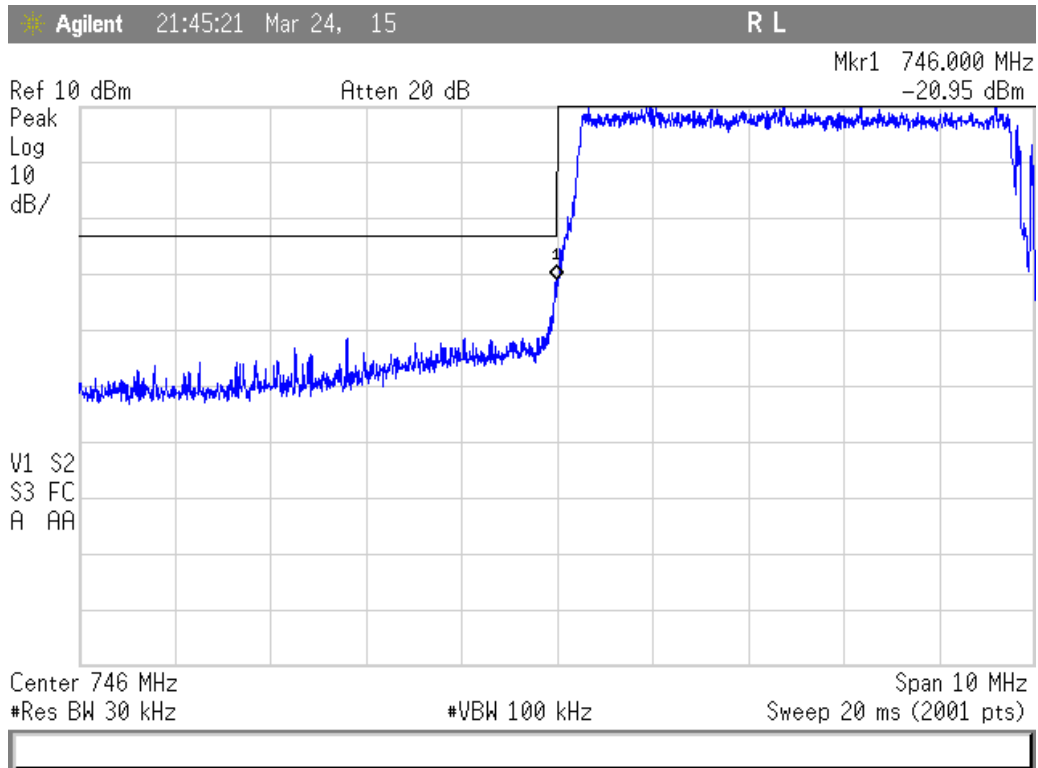
(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;

MEASUREMENTS / RESULTS

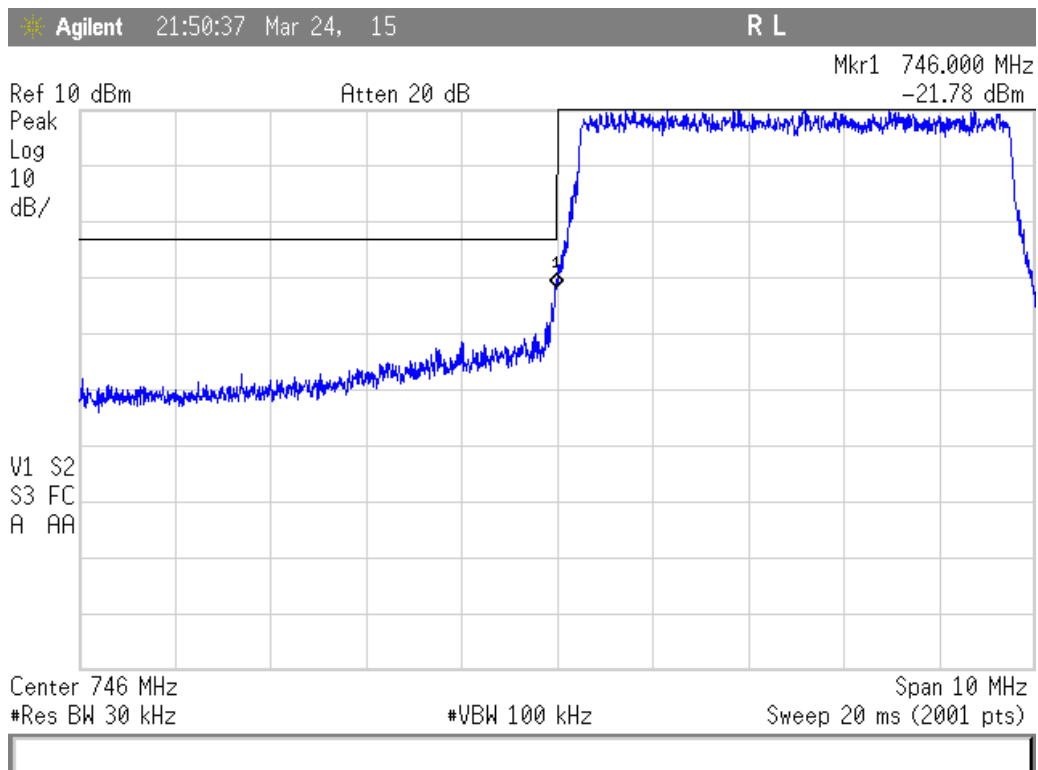
Note: Mask lines are set to -13dBm.

$$\text{Limit} = 10 \cdot \log(P[\text{mW}]) - (43 + 10 \cdot \log(P[\text{W}])) = -13\text{dBm}$$

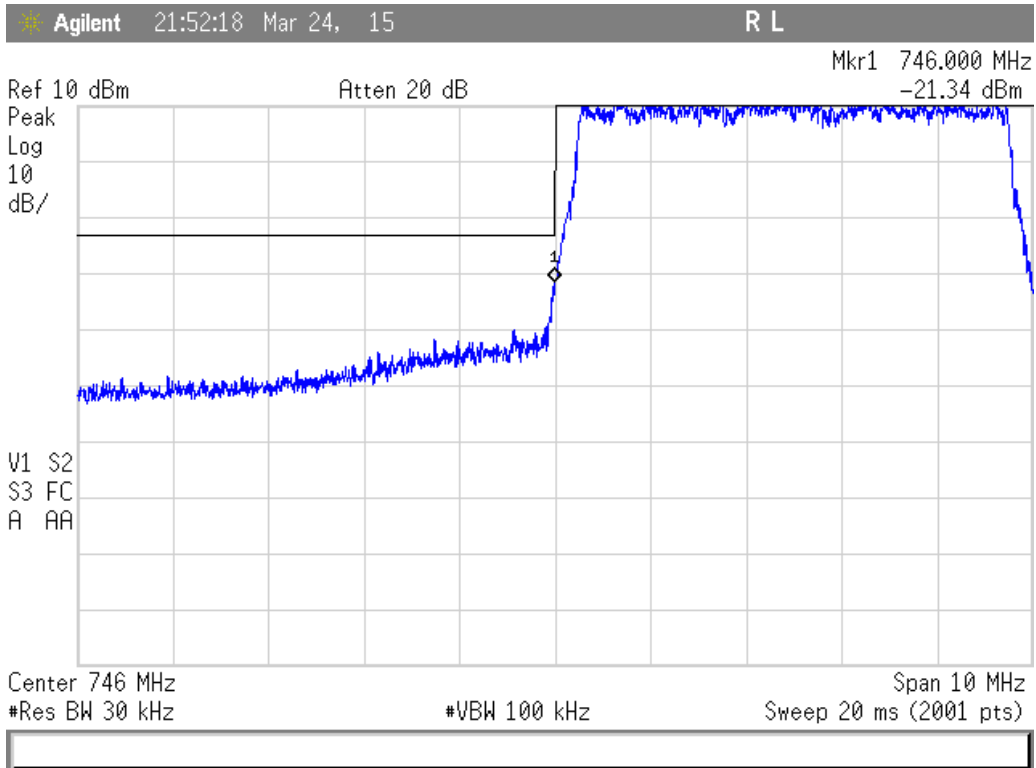
Correction factors for cables and attenuators are applied to the displayed amplitude.



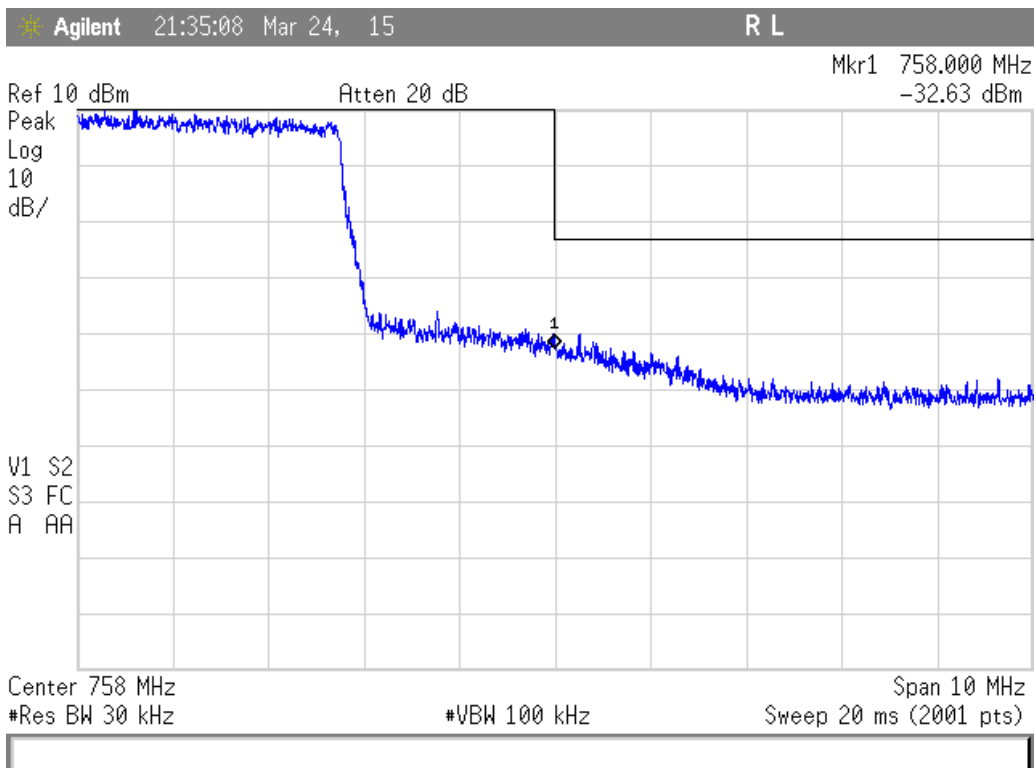
Lower Band Edge - Band 13 – 5MHz BW – QPSK – Port J1



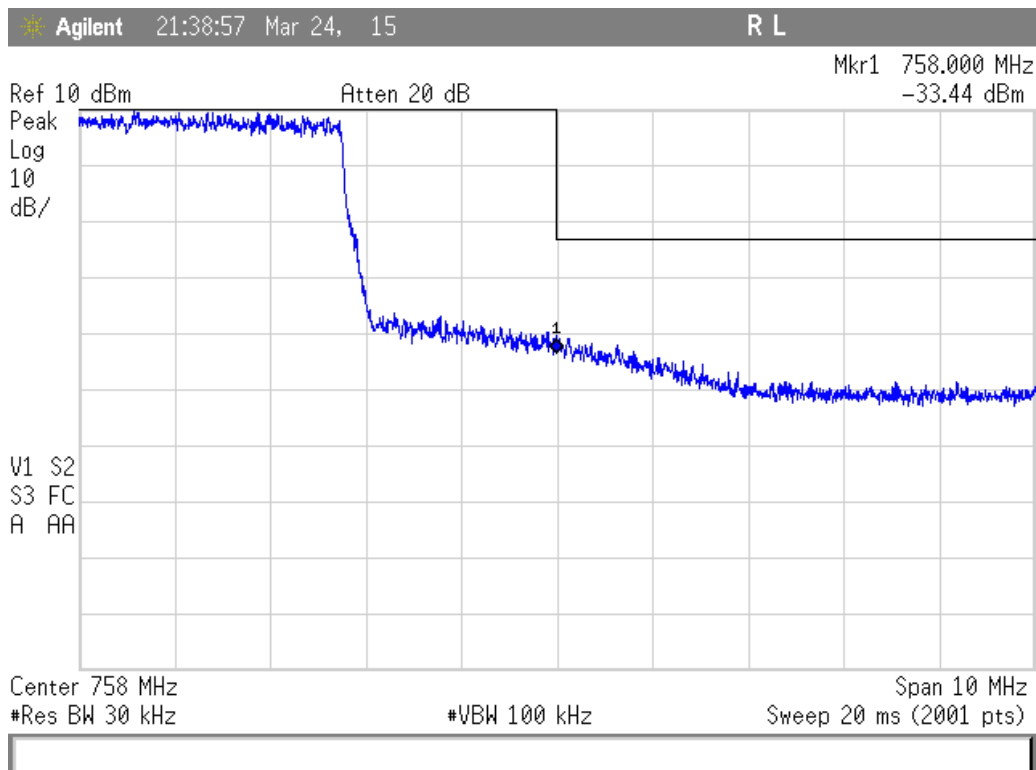
Lower Band Edge - Band 13 – 5MHz BW – 16QAM – Port J1



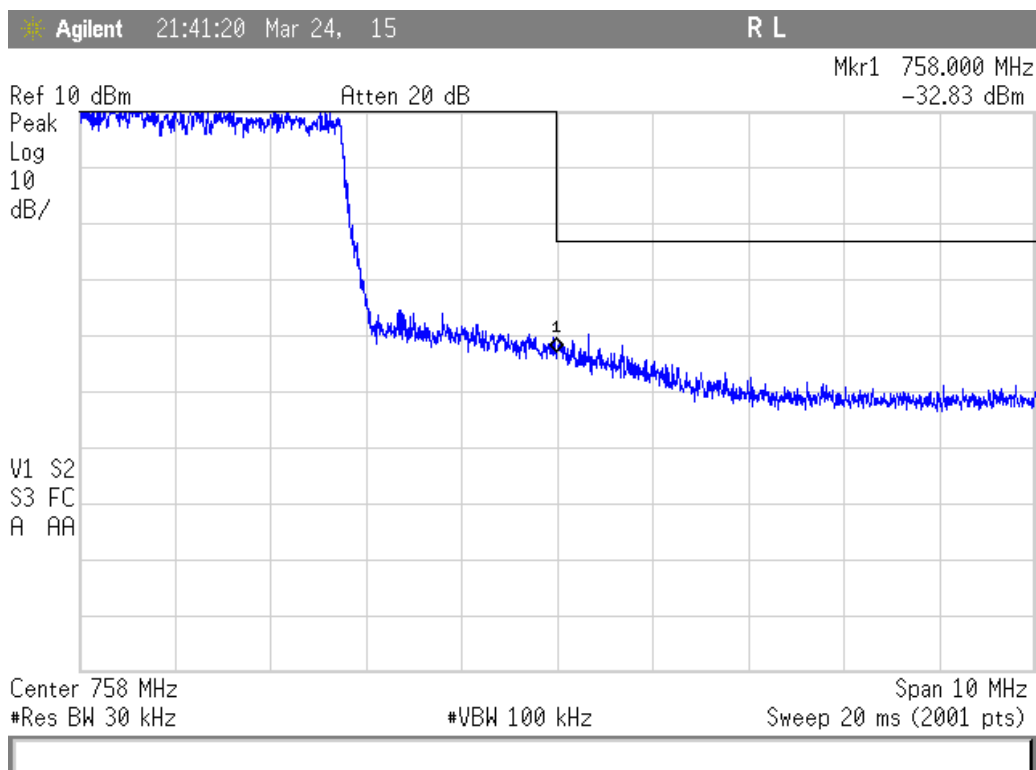
Lower Band Edge - Band 13 – 5MHz BW – 64QAM – Port J1



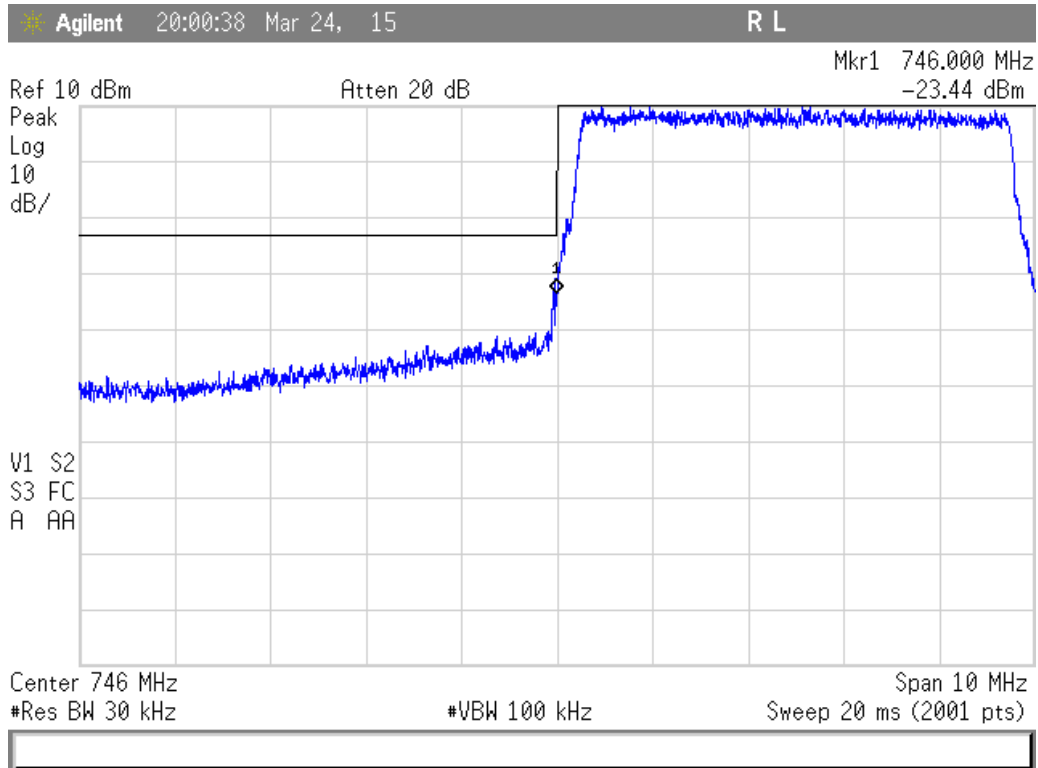
Upper Band Edge - Band 13 – 5MHz BW – QPSK – Port J1



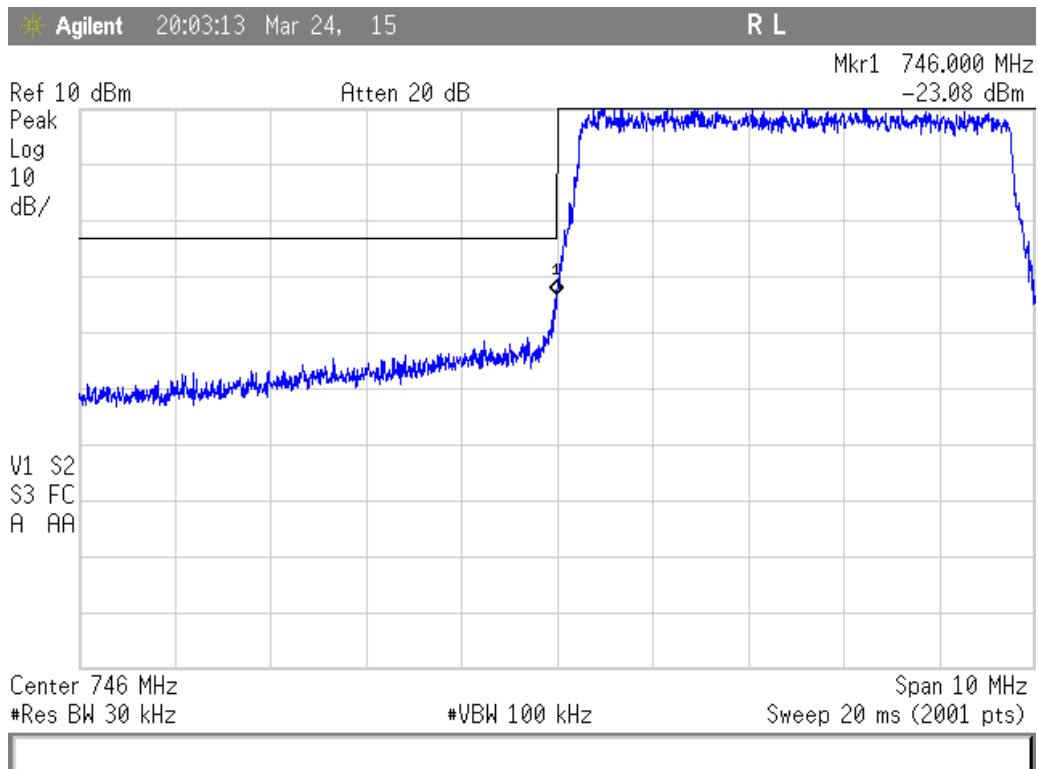
Upper Band Edge - Band 13 – 5MHz BW – 16QAM – Port J1



Upper Band Edge - Band 13 – 5MHz BW – 64QAM – Port J1

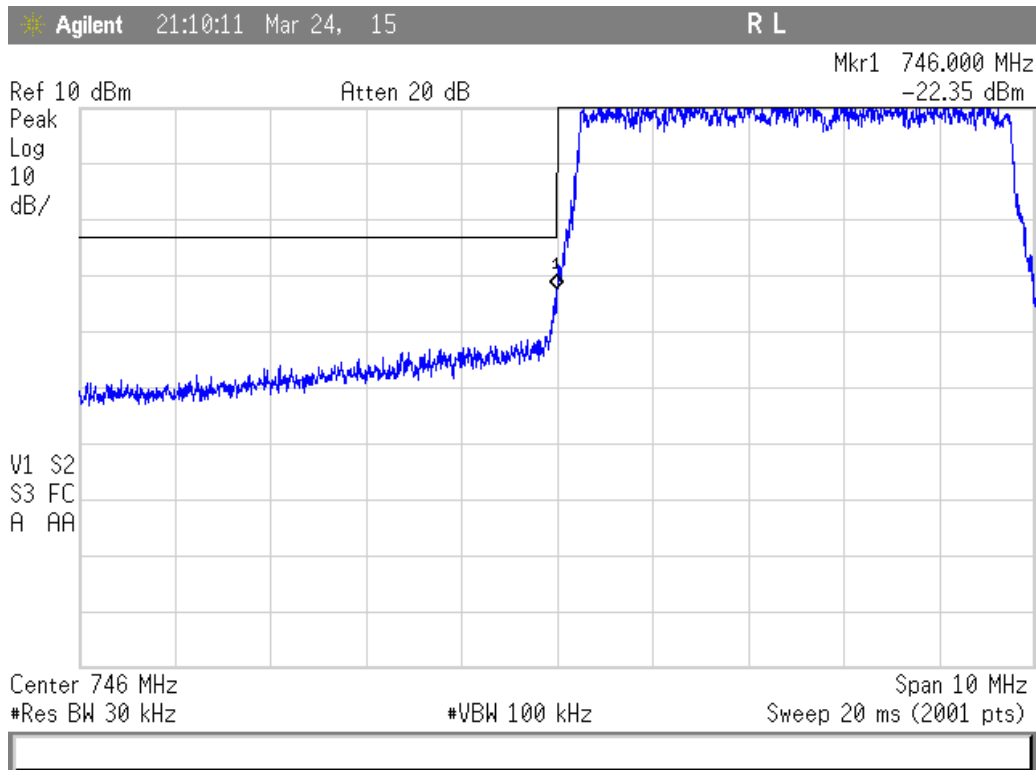


Lower Band Edge - Band 13 – 5MHz BW – QPSK – Port J2

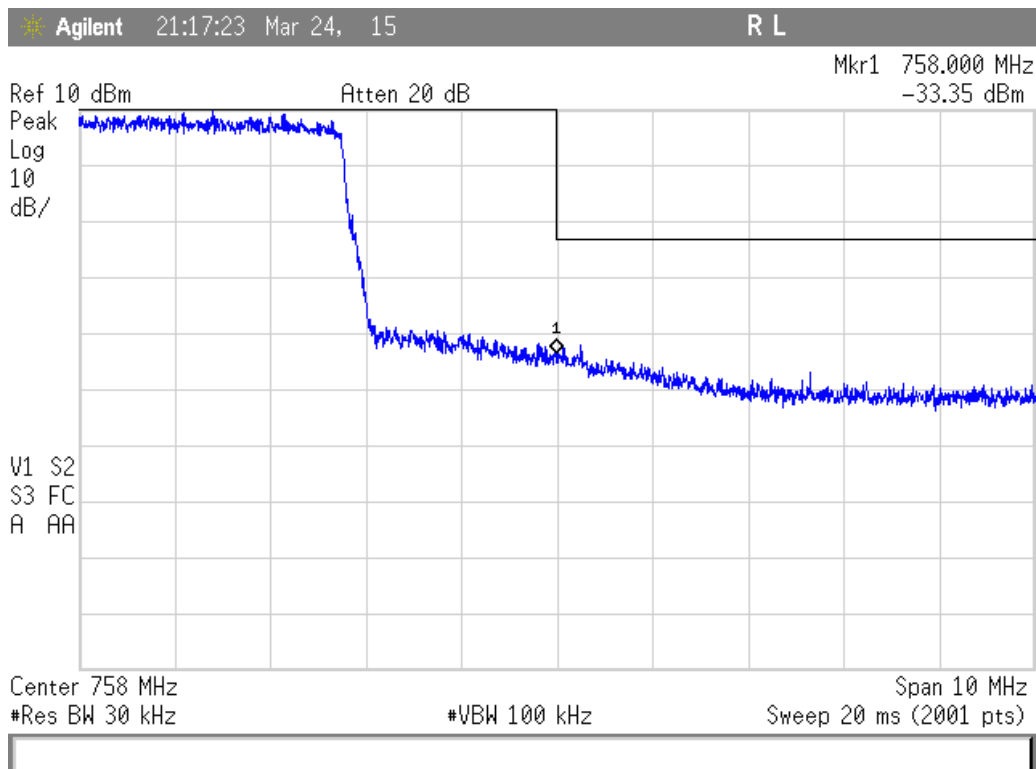


Lower Band Edge - Band 13 – 5MHz BW – 16QAM – Port J2

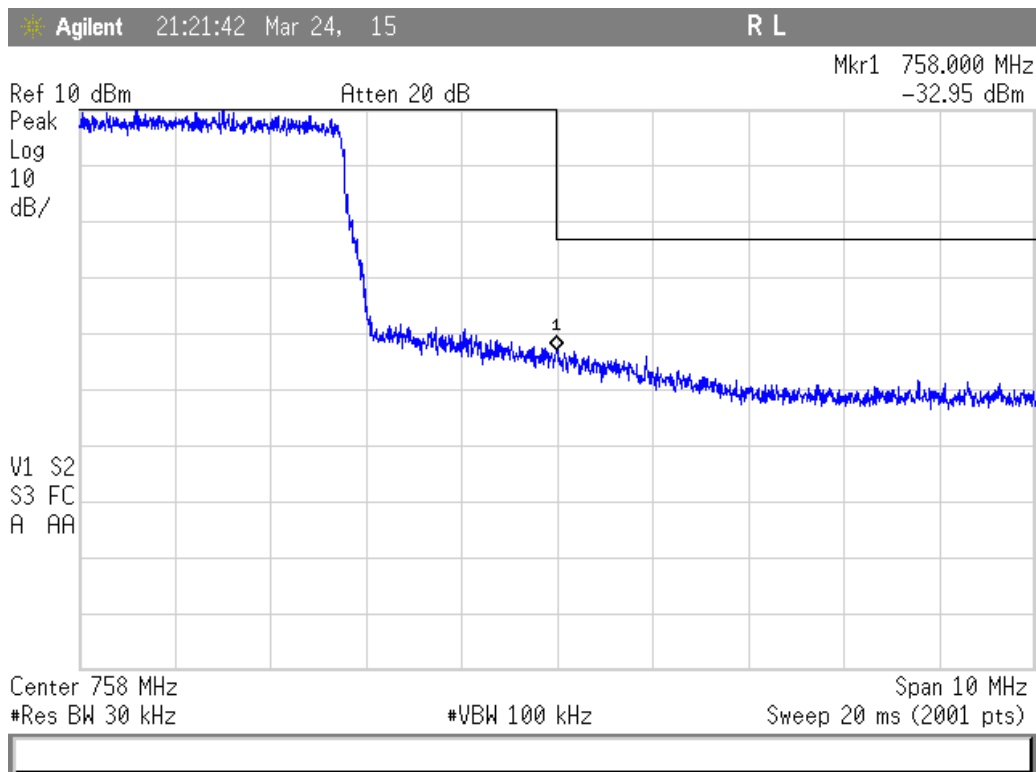




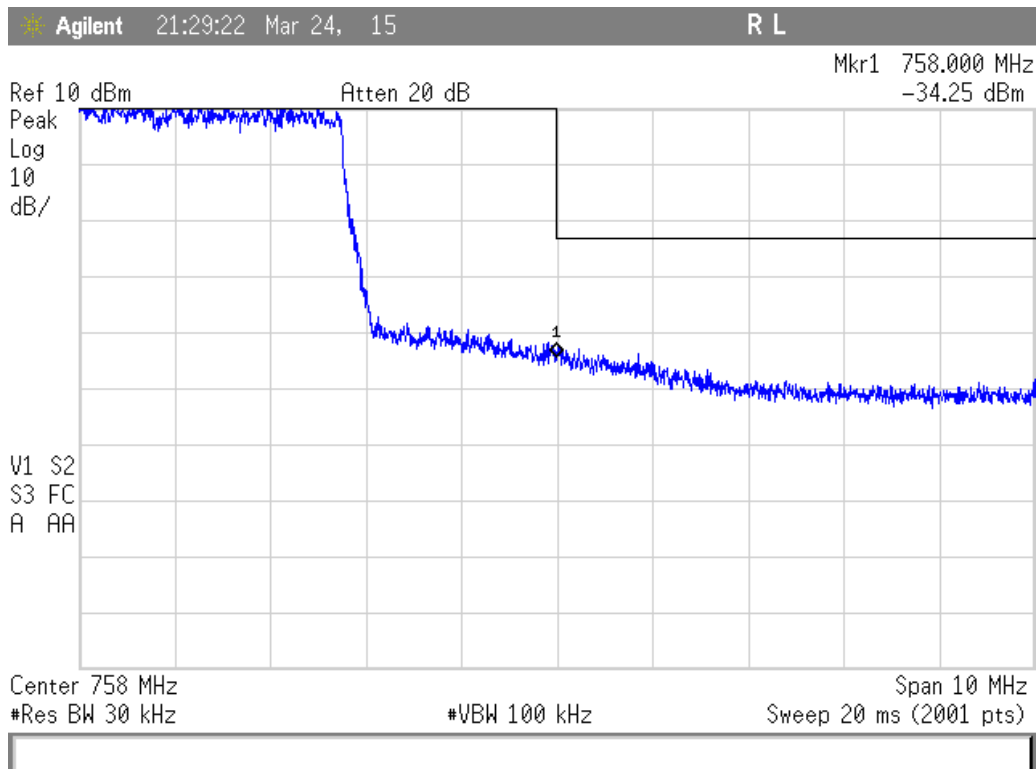
Lower Band Edge - Band 13 – 5MHz BW – 64QAM – Port J2



Upper Band Edge - Band 13 – 5MHz BW – QPSK – Port J2

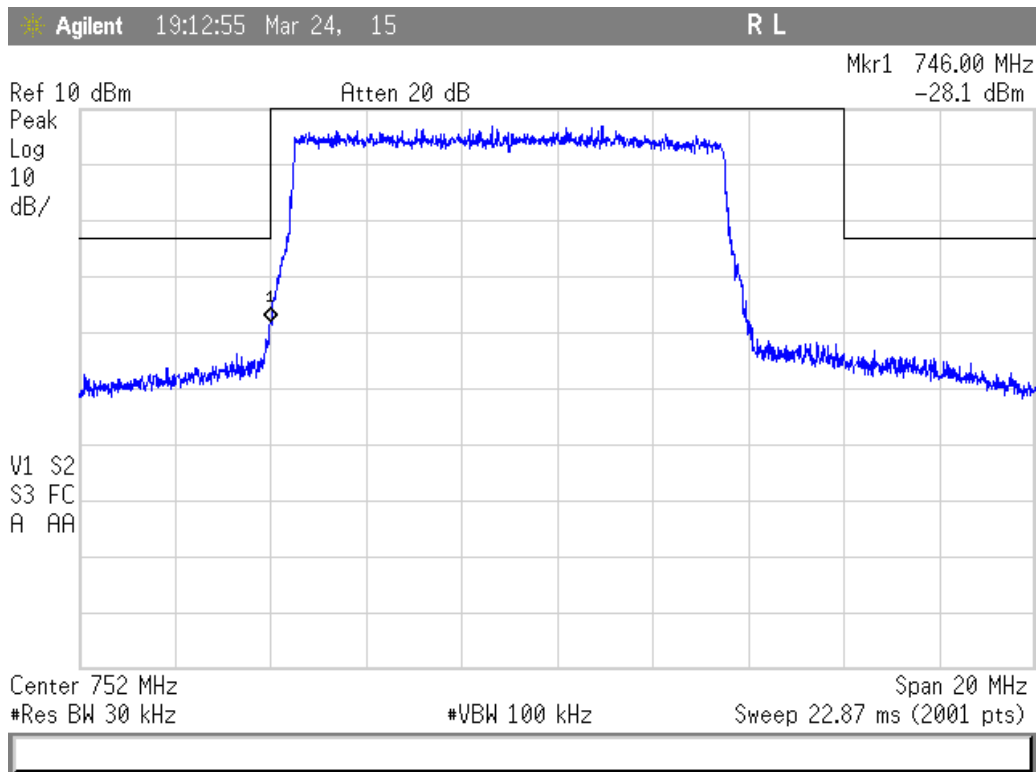


Upper Band Edge - Band 13 – 5MHz BW – 16QAM – Port J2

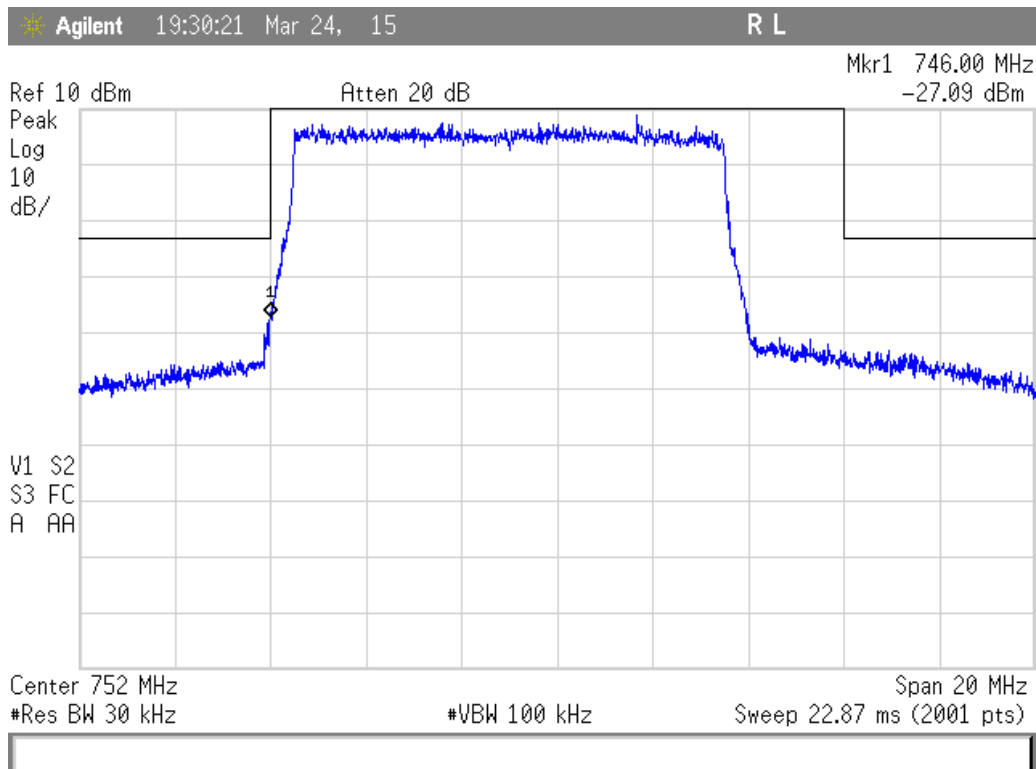


Upper Band Edge - Band 13 – 5MHz BW – 64QAM – Port J2



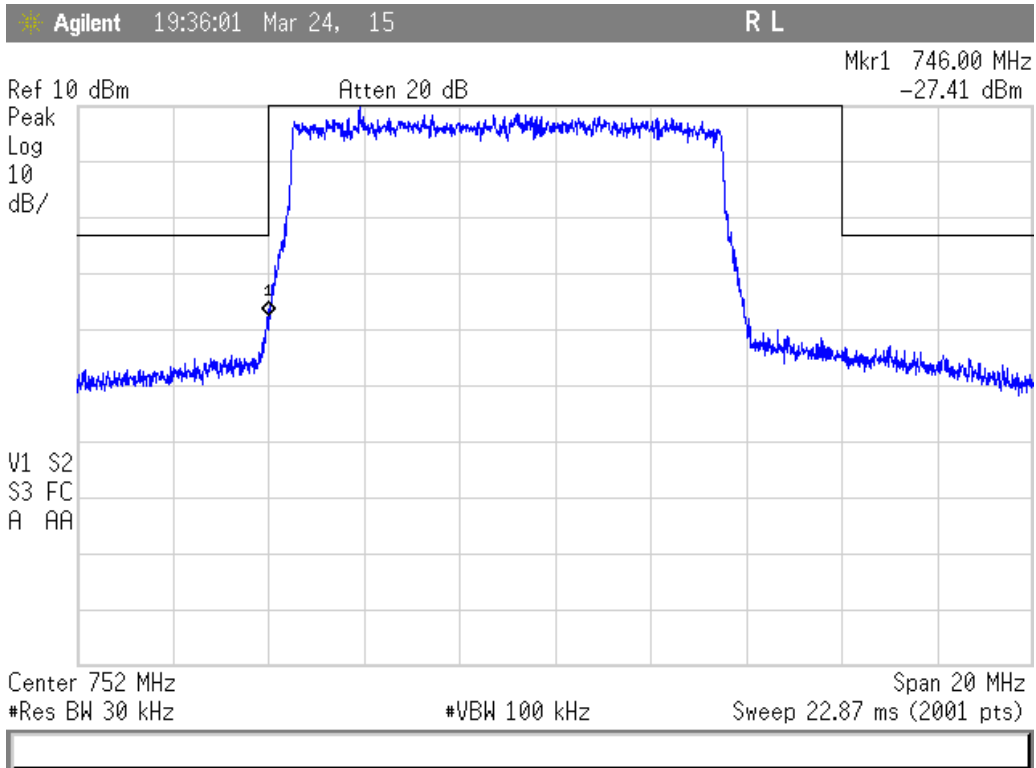


Lower & Upper Band Edge - Band 13 – 10MHz BW – QPSK – Port J1

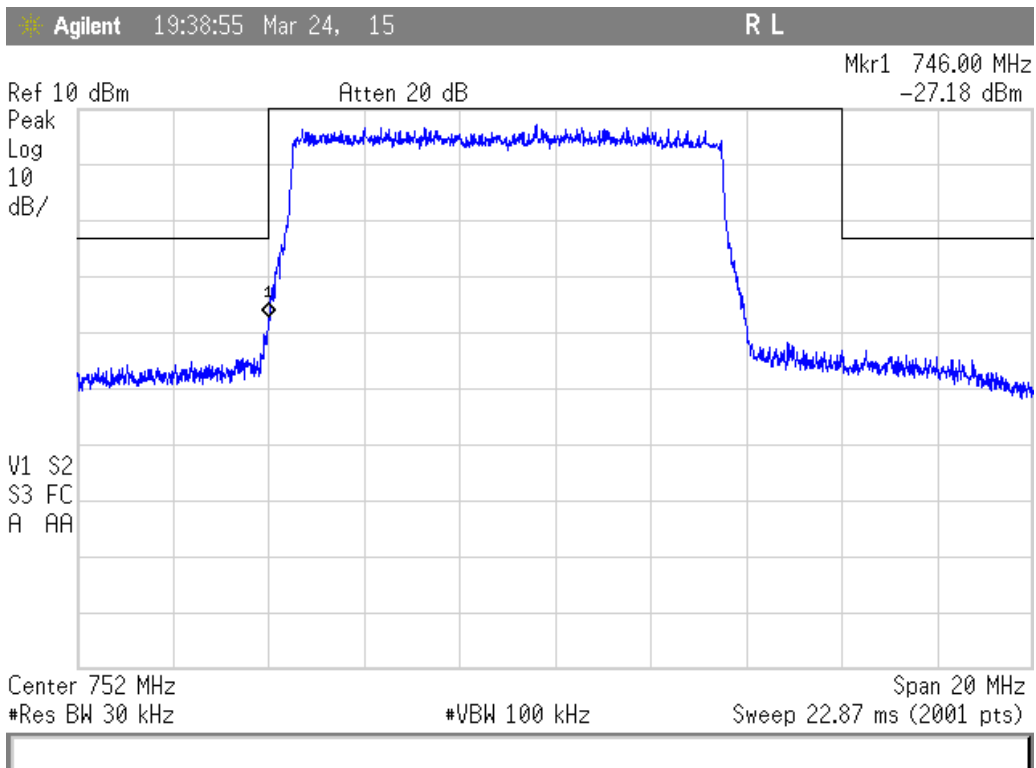


Lower & Upper Band Edge - Band 13 – 10MHz BW – 16QAM – Port J1

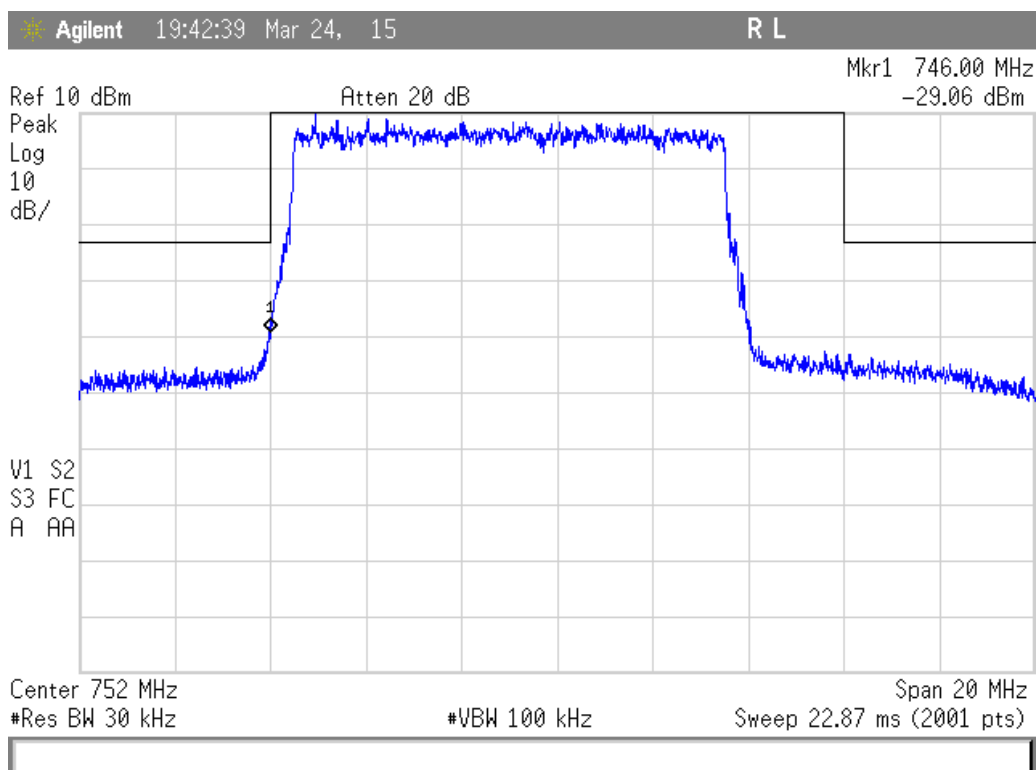
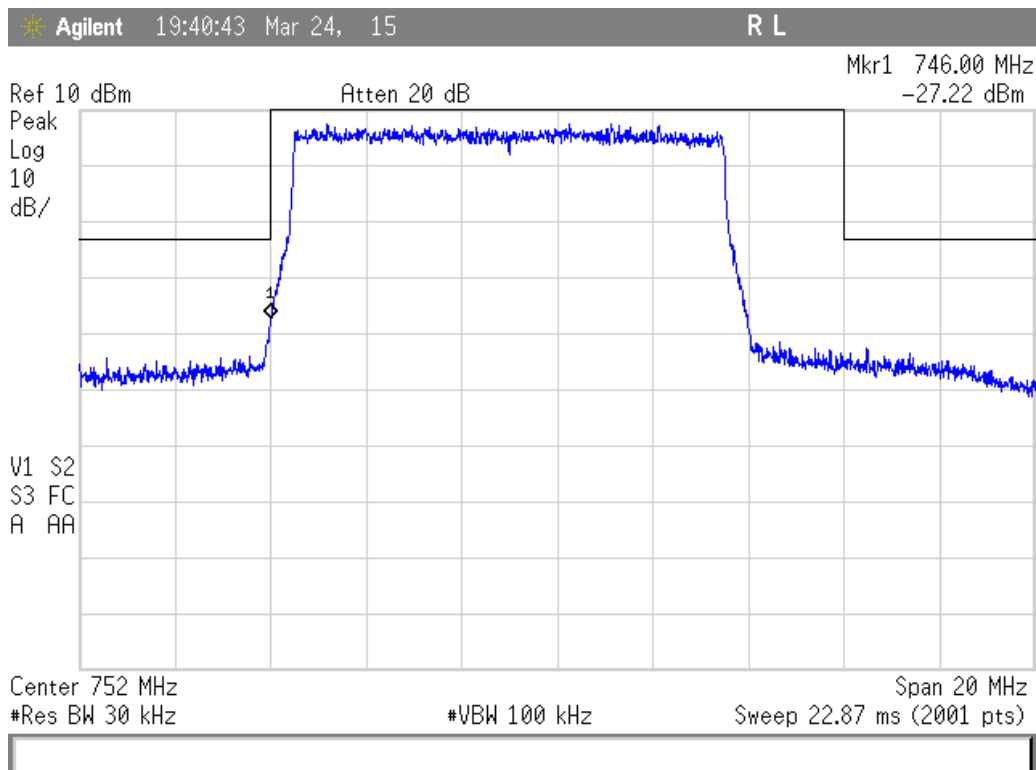




Lower & Upper Band Edge - Band 13 – 10MHz BW – 64QAM – Port J1



Lower & Upper Band Edge - Band 13 – 10MHz BW – QPSK – Port J2



Conducted Spurious Emissions at Antenna Port

LIMITS:

FCC 27.53(c):

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the 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, in accordance with the following:

(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;

(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations;

(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;

FCC 27.53(f):

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Test Methods:

Spectrum analyzer screen plots for LTE Band 13 are shown on the following pages. The operating frequency was 748.5MHz, which was taken to represent Band 13.

The range 30MHz-10GHz was tested for 27.53(c)(1) with a 1 MHz resolution bandwidth.

$$\text{Limit} = 10 \cdot \log(P[\text{mW}]) - (43 + 10 \cdot \log(P[\text{W}])) = -13\text{dBm}$$

The ranges 763-775MHz and 793-805MHz were tested for 27.53(c)(3) with a 9kHz resolution bandwidth.

$$\text{Limit} = 10 \cdot \log(P[\text{mW}]) - (76 + 10 \cdot \log(P[\text{W}])) = -46\text{dBm}$$

The range 1559-1610MHz was tested for 27.53(f) using a 1MHz resolution bandwidth for the -70 dBW/MHz limit and a 1kHz resolution bandwidth for the -80 dBW limit.

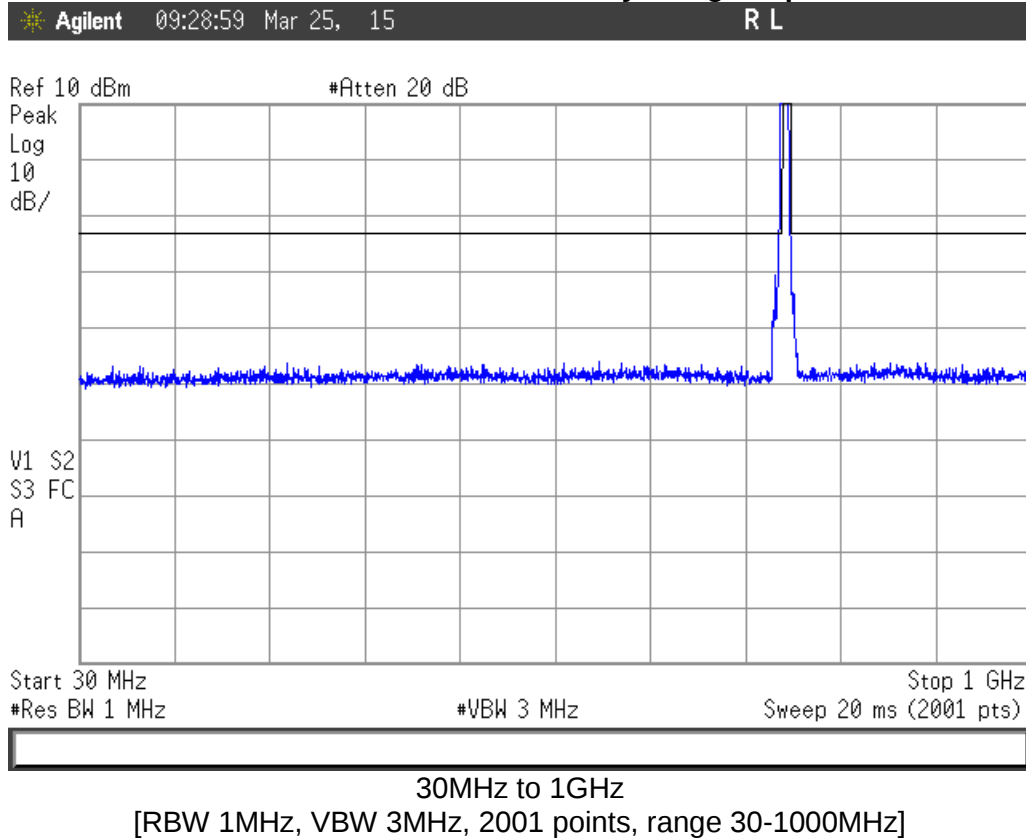
Wideband Limit = -70 dBW/MHz = -40 dBm/MHz, or at 1MHz RBW, a displayed limit of -40 dBm
Discrete Limit = -80 dBW = -50 dBm

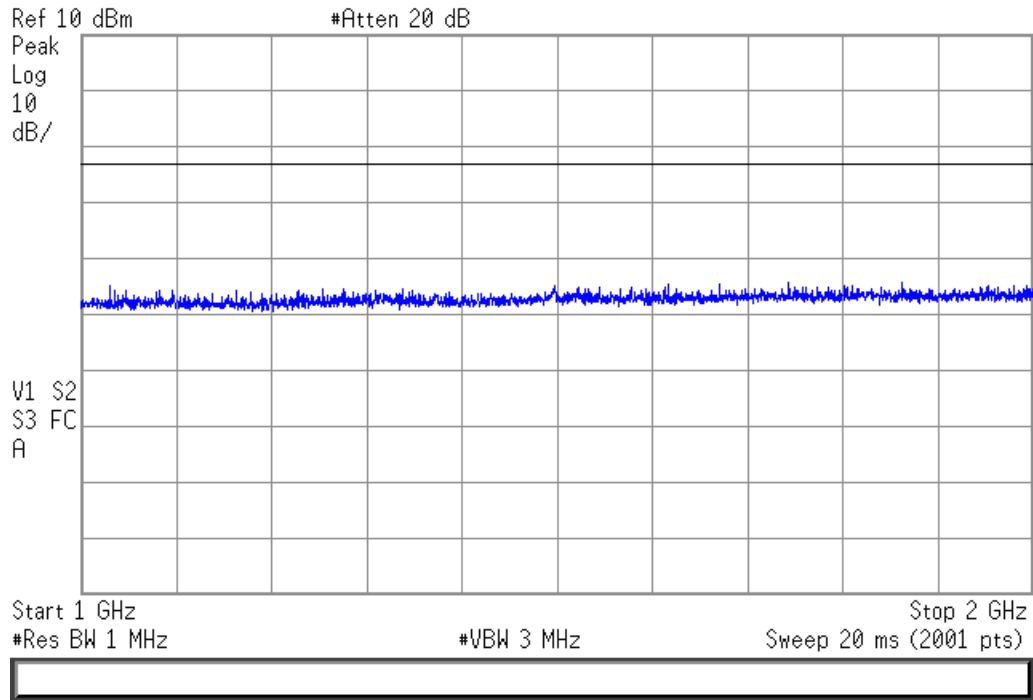


PLOTS

FCC 27.53(c)(1):

LTE Band 13 – Antenna Ports J1 and J2 combined by using coupler

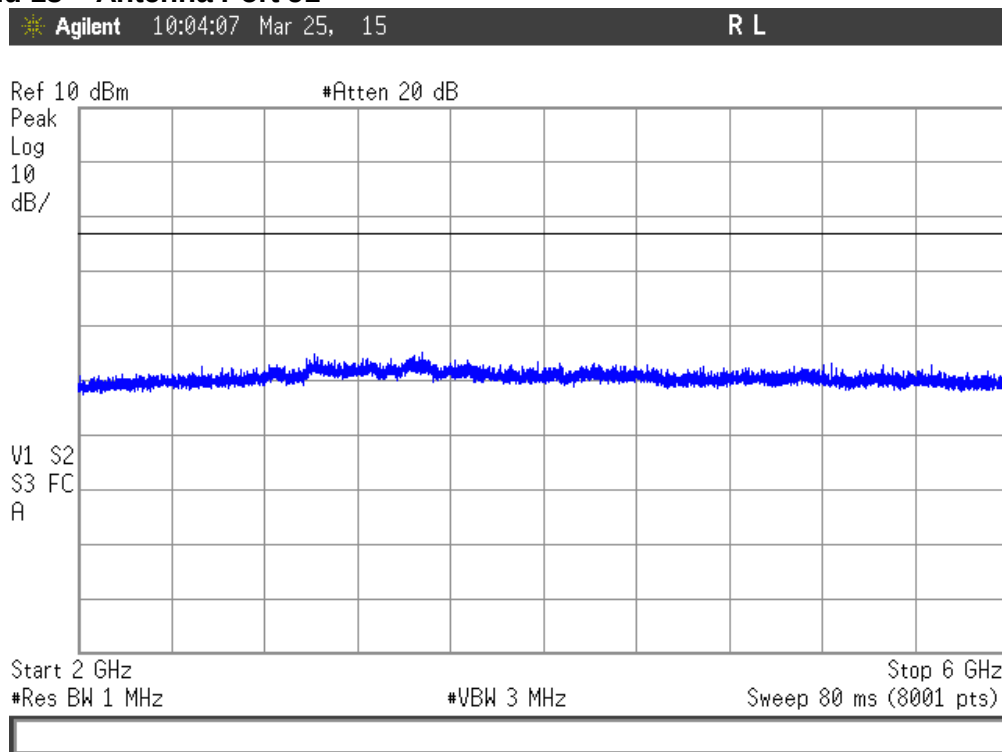




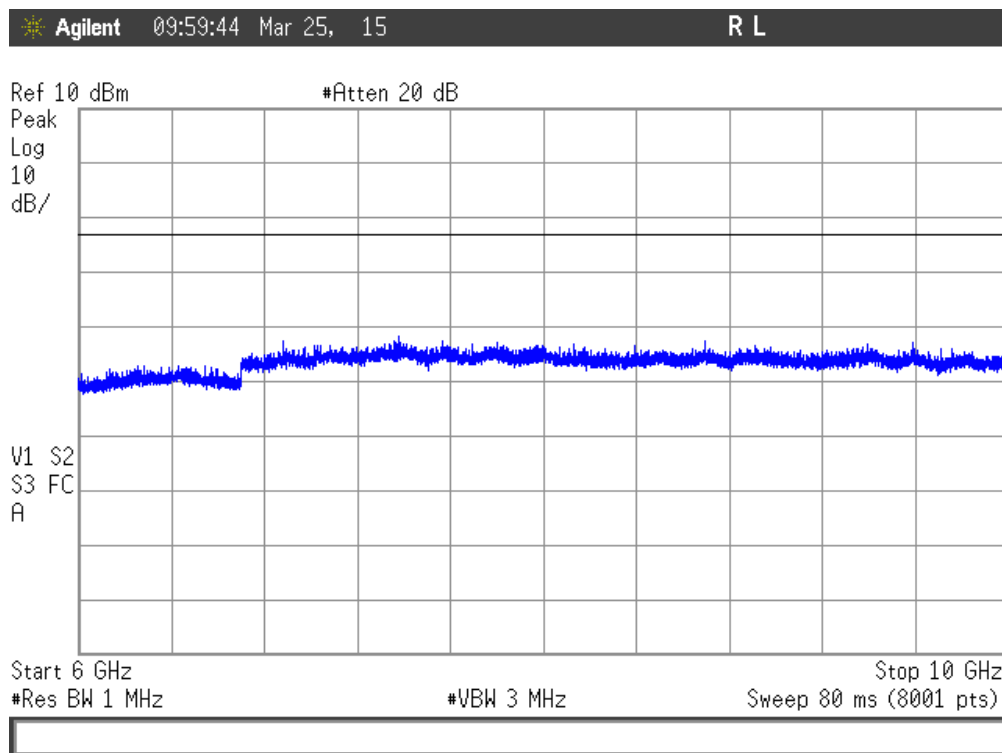
1-2GHz
[RBW 1MHz, VBW 3MHz, 2001 points, range 1-2GHz]

Note: Correction factor was added to the plot (including the coupler, cable factor and 20dB attenuator.)

LTE Band 13 – Antenna Port J1



2-6GHz
[RBW 1MHz, VBW 3MHz, 8001 points, range 2-6GHz]



6-10GHz
[RBW 1MHz, VBW 3MHz, 8001 points, range 6-10GHz]

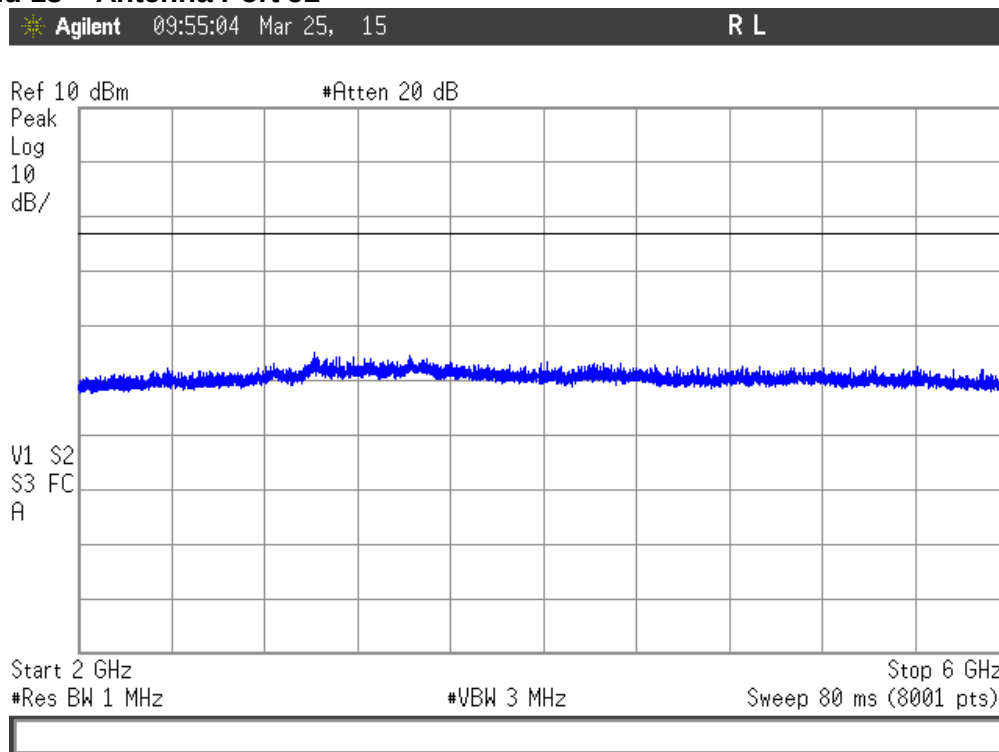


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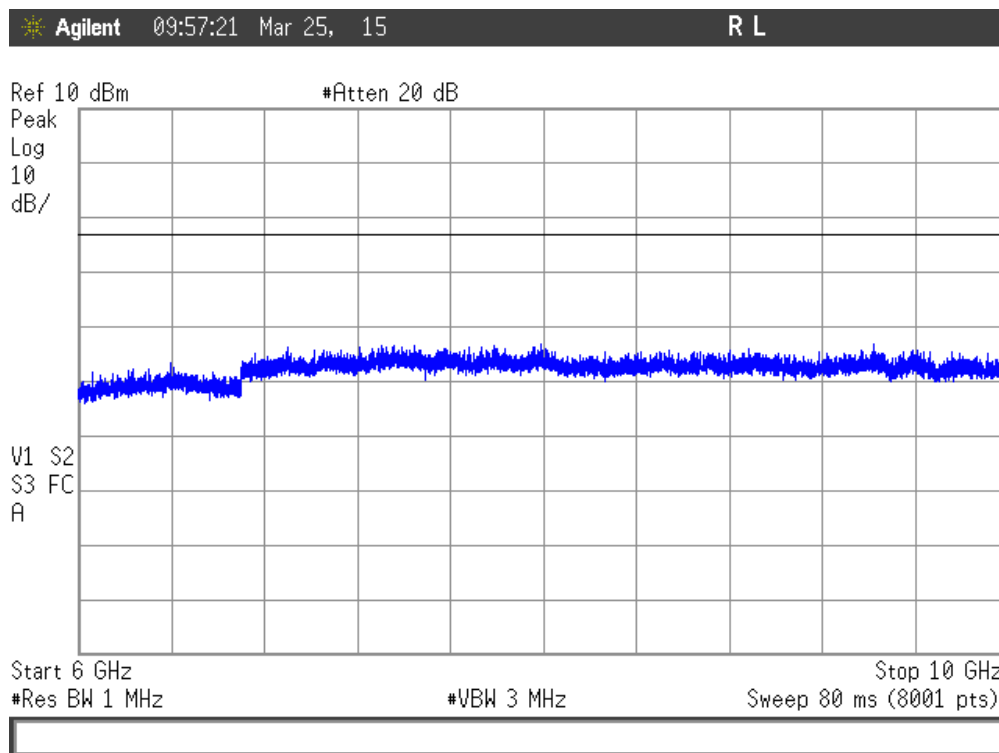


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LTE Band 13 – Antenna Port J2



2-6GHz
[RBW 1MHz, VBW 3MHz, 8001 points, range 2-6GHz]



6-10GHz
[RBW 1MHz, VBW 3MHz, 8001 points, range 6-10GHz]



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FCC 27.53(c)(3):

* Agilent 17:08:33 Dec 43, 55

R T

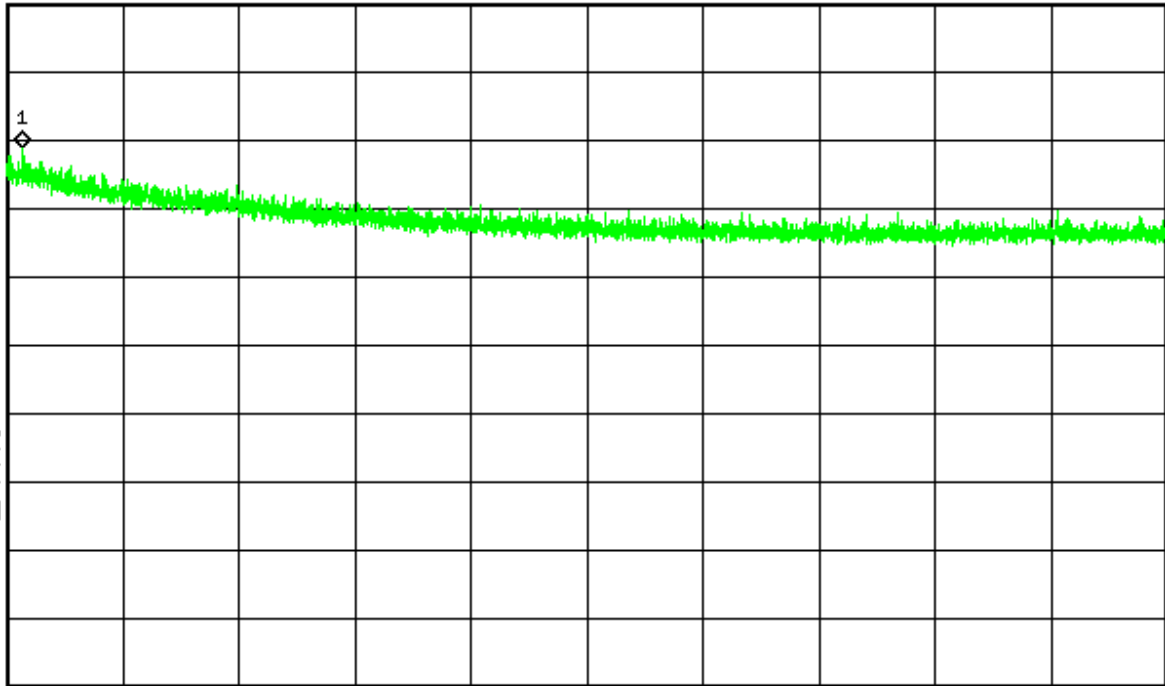
Mkr1 763.1710 MHz
-71.19 dBm

Ref -50 dBm

#Atten 0 dB

Peak
Log
10
dB/

M1 S2
S3 FC
A AA



Start 763 MHz

Stop 775 MHz

#Res BW 9 kHz

#VBW 30 kHz

Sweep 337.7 ms (8001 pts)

C:\temp.gif file saved

Port J1, 763-775MHz



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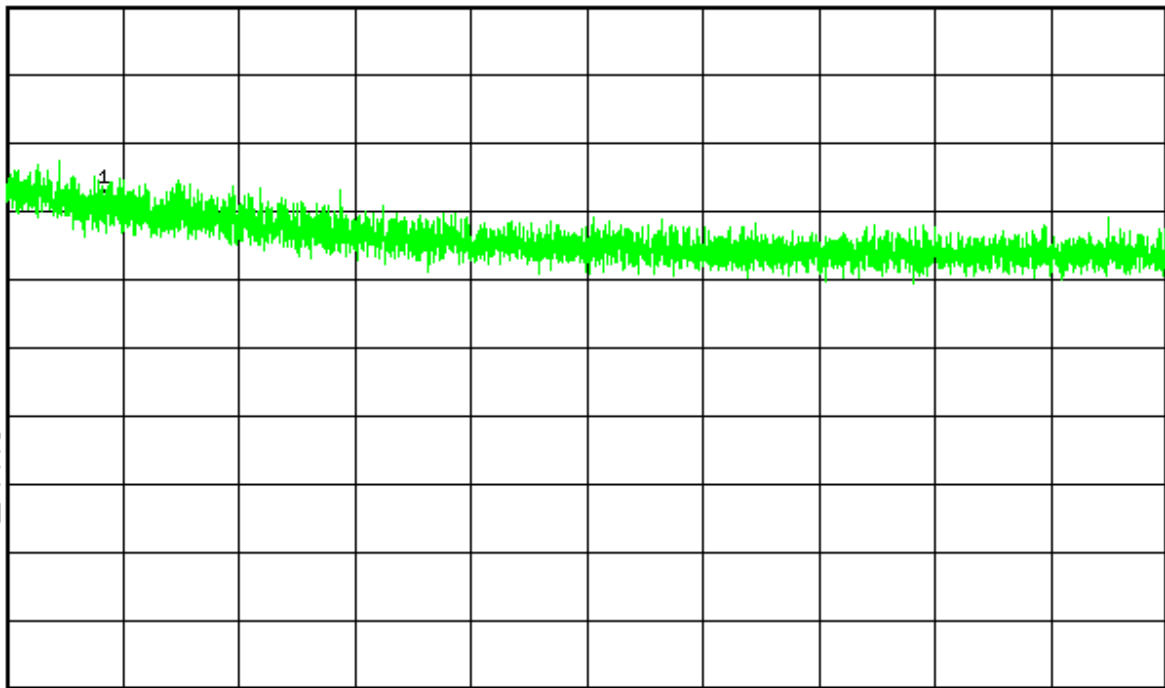
Mkr1 764.0170 MHz
-79.35 dBm

Ref -50 dBm

#Atten 0 dB

Peak
Log
10
dB/

M1 S2
S3 FC
A AA



Start 763 MHz

Stop 775 MHz

#Res BW 9 kHz

#VBW 30 kHz

Sweep 337.7 ms (8001 pts)

C:\temp.gif file saved

Port J2, 763-775MHz

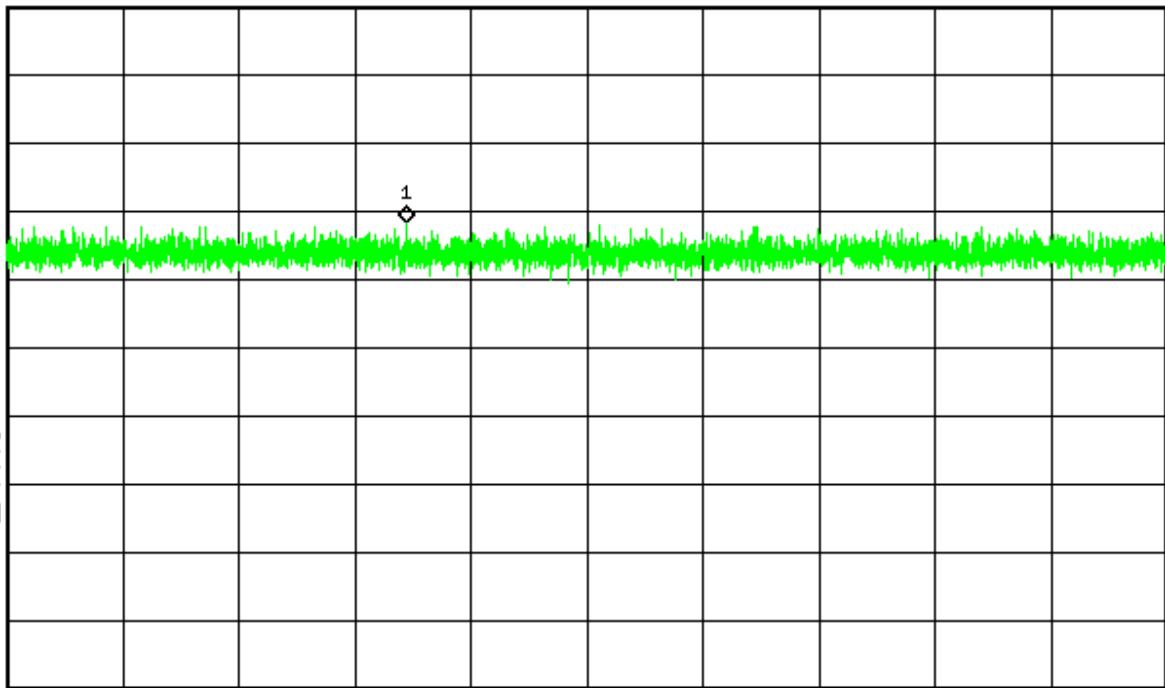


Mkr1 797.4720 MHz
-81.78 dBm

Ref -50 dBm

#Atten 0 dB

Peak
Log
10
dB/



M1 S2
S3 FC
A AA

Start 793 MHz

Stop 806 MHz

#Res BW 9 kHz

#VBW 30 kHz

Sweep 365.8 ms (8001 pts)

C:\temp.gif file saved

Port J1, 793-806MHz



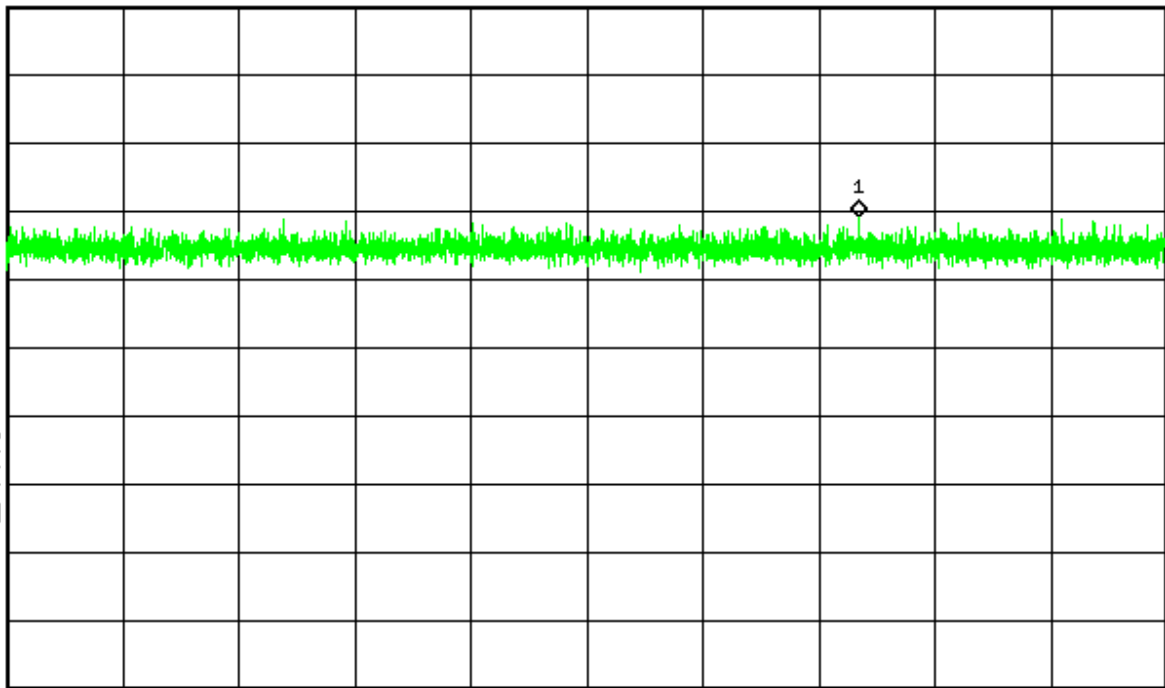
Mkr1 802.5420 MHz
-80.88 dBm

Ref -50 dBm

#Atten 0 dB

Peak
Log
10
dB/

M1 S2
S3 FC
A AA



Start 793 MHz

Stop 806 MHz

#Res BW 9 kHz

#VBW 30 kHz

Sweep 365.8 ms (8001 pts)

C:\temp.gif file saved

Port J2, 793-806MHz



FCC 27.53(f) Wideband Emission Limit:

Agilent 21:16:18 Dec 25, 55

R T

Mkr1 1.599112 GHz
-56.4 dBm

Ref -30 dBm

#Atten 0 dB

Peak
Log
10
dB/

M1 S2
S3 FC
A AA

Start 1.559 GHz

#Res BW 1 MHz

#VBW 3 MHz

Stop 1.61 GHz

Sweep 80 ms (8001 pts)

C:\temp.gif file saved

Port J1, 1559-1610MHz



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