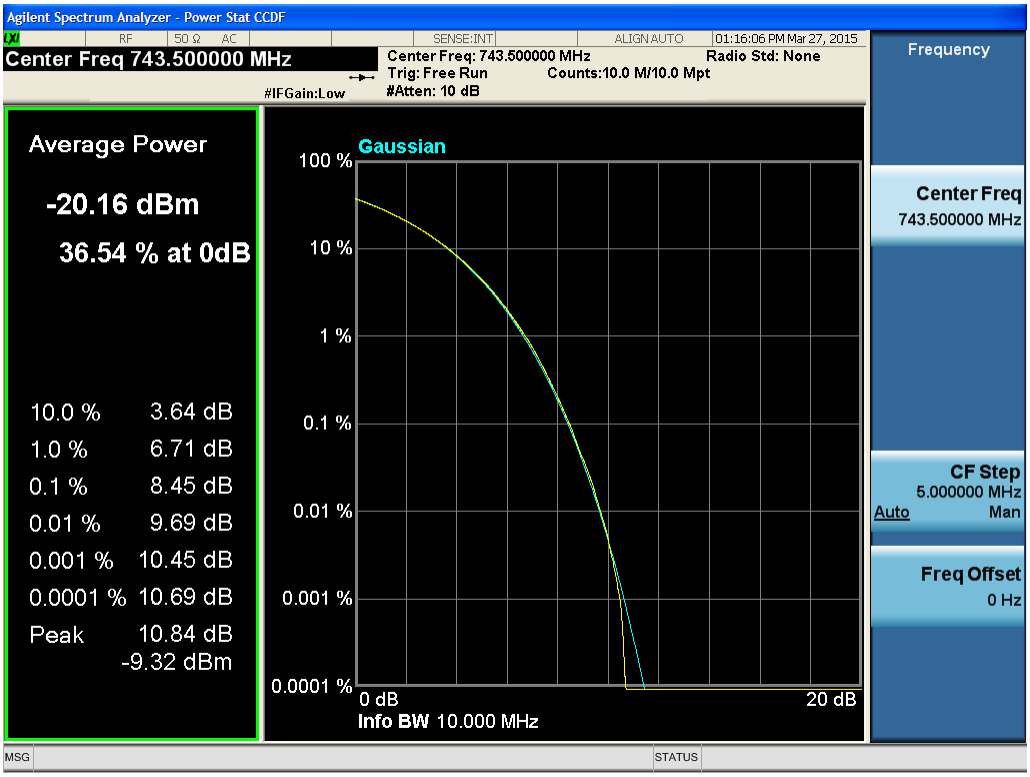
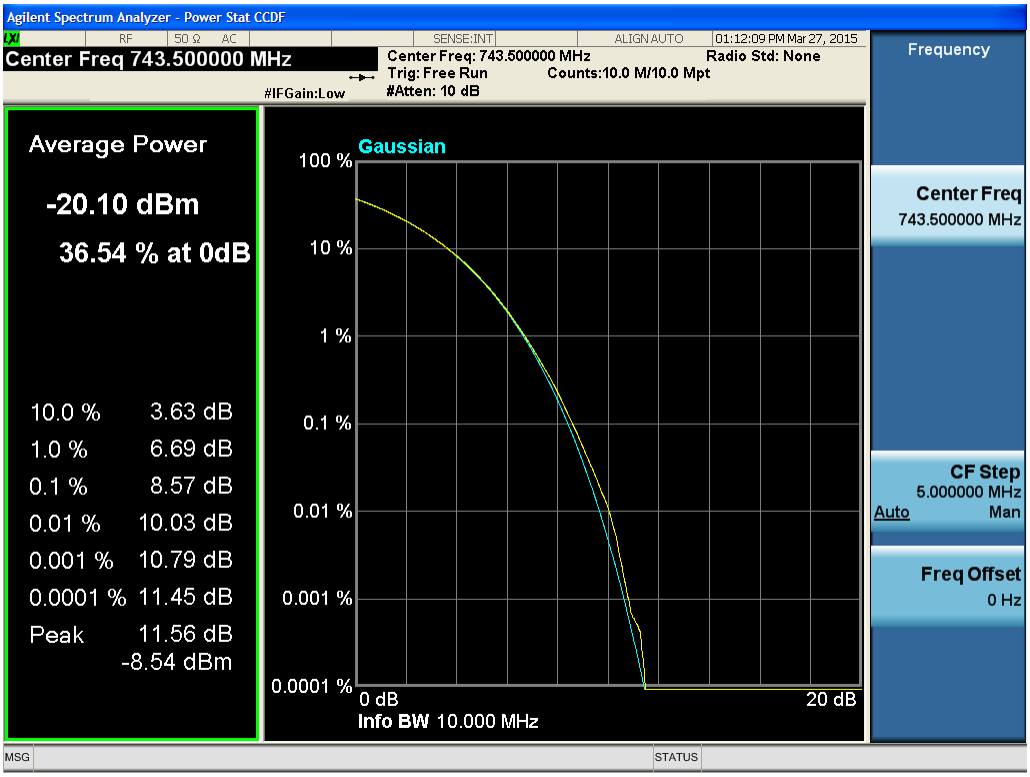
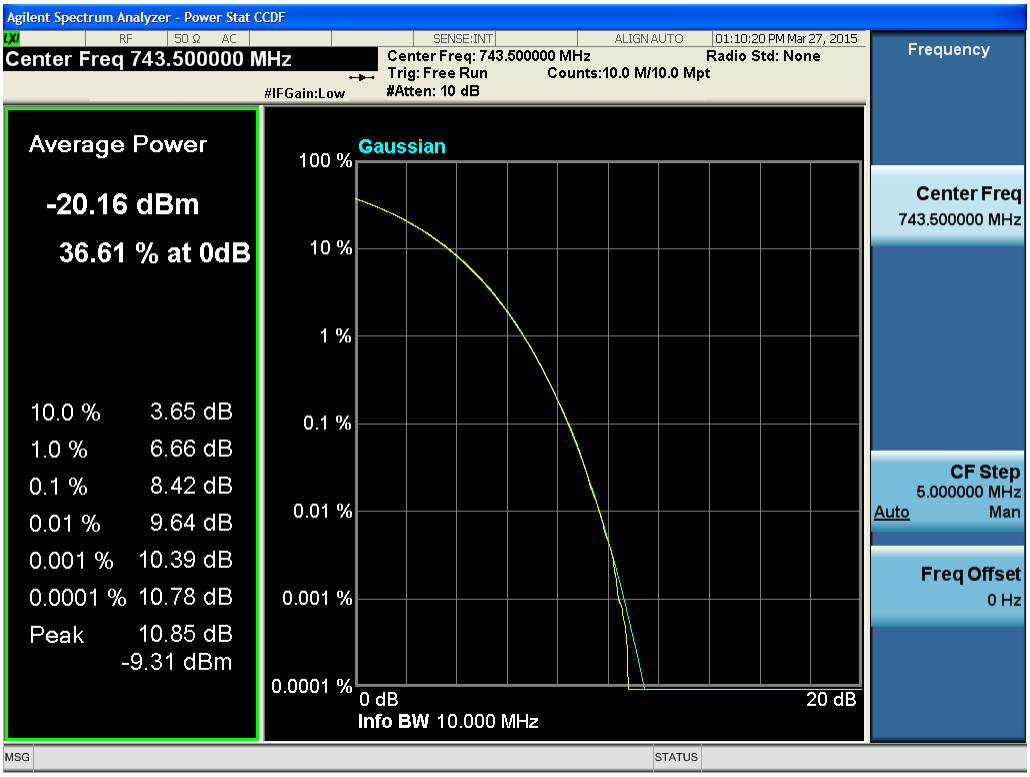


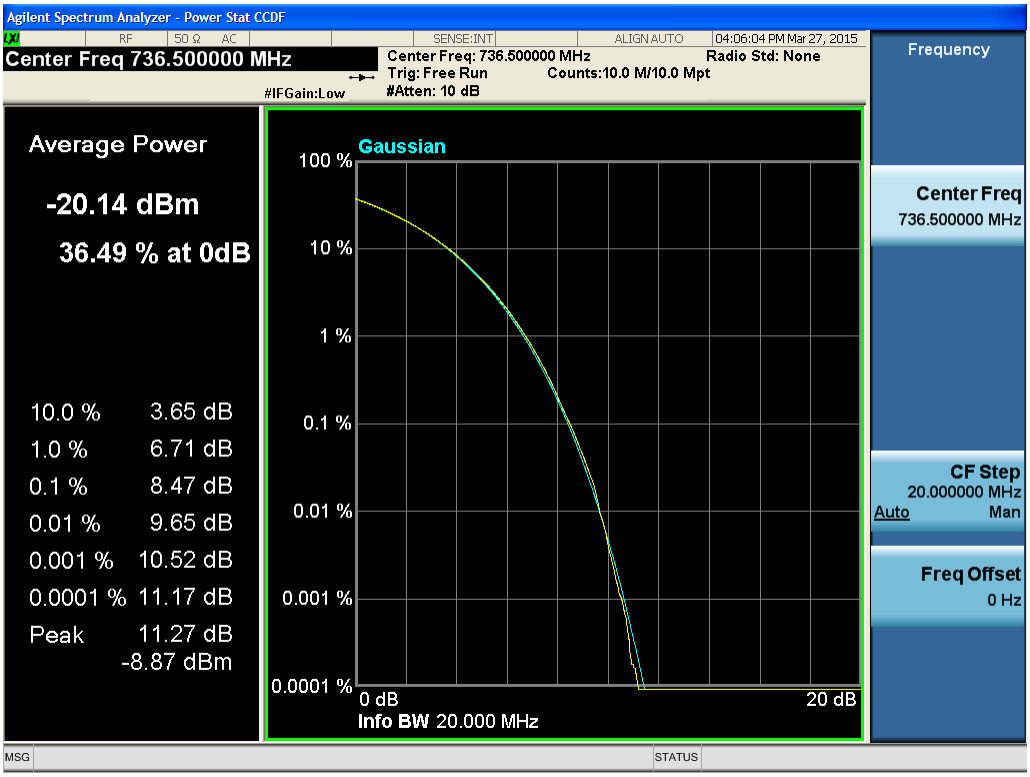
Band 12 - 5MHz BW – High Channel – QPSK



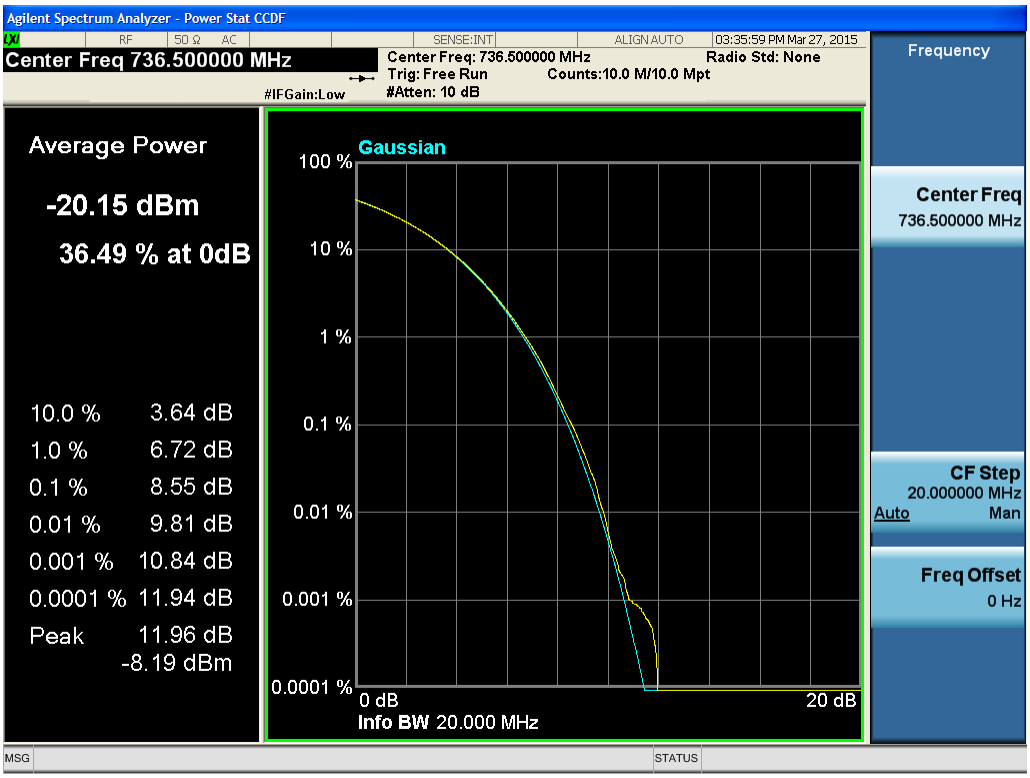
Band 12 - 5MHz BW – High Channel – 16QAM



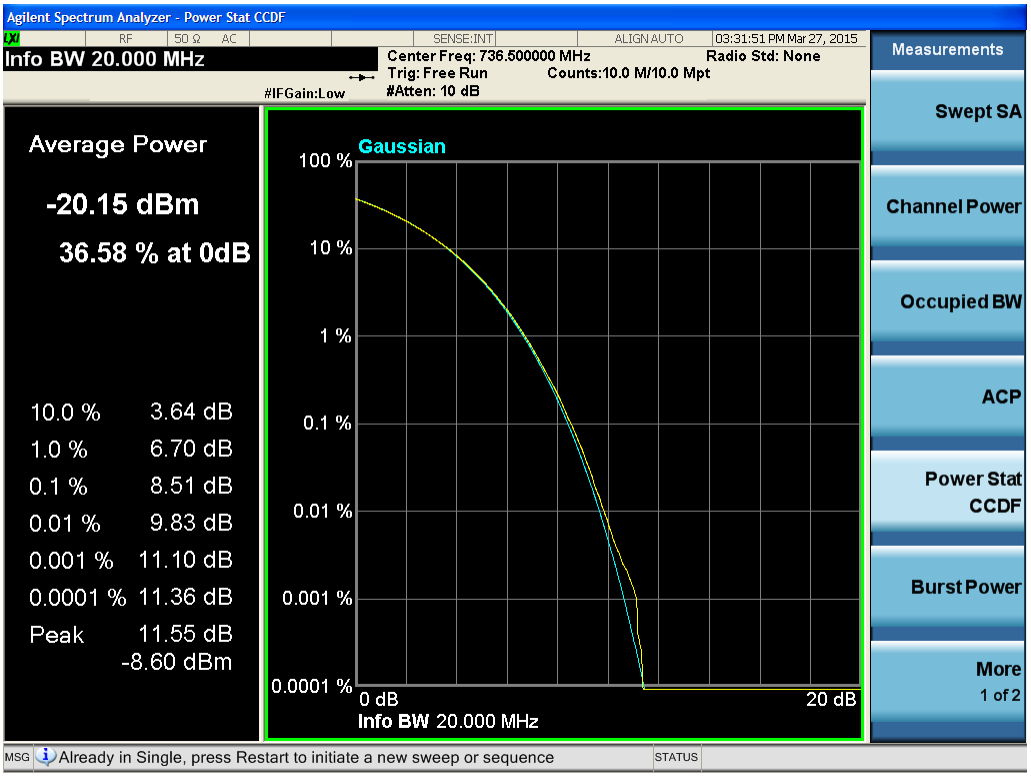
Band 12 - 5MHz BW – High Channel – 64QAM



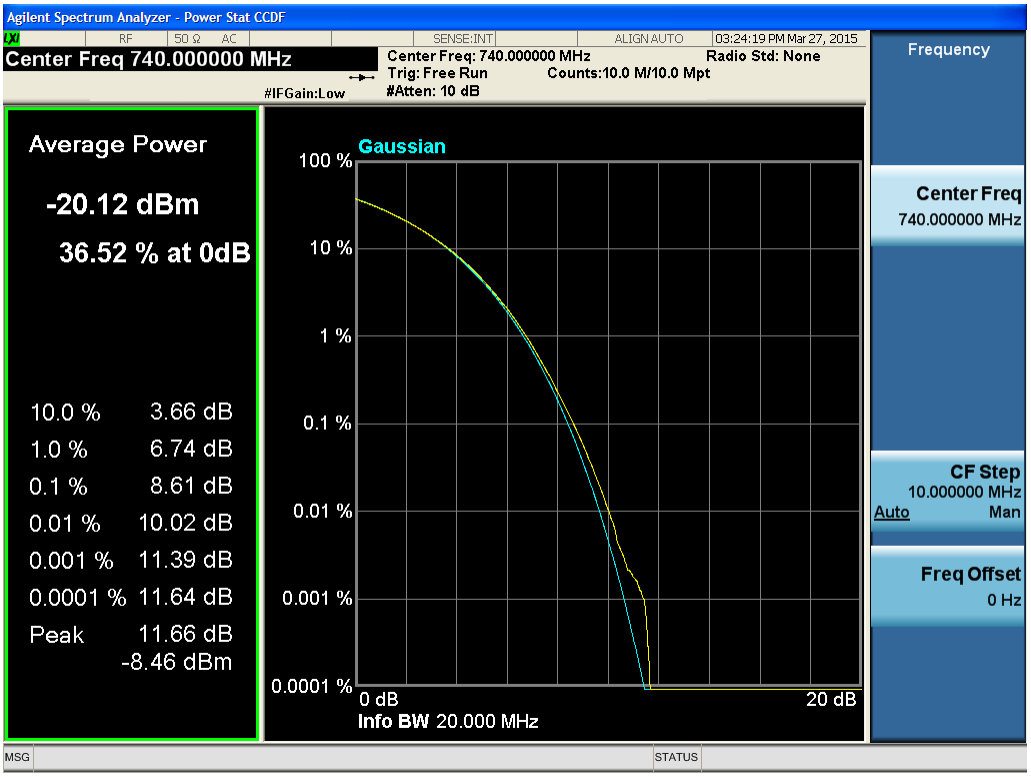
Band 17 - 5MHz BW – Low Channel – QPSK



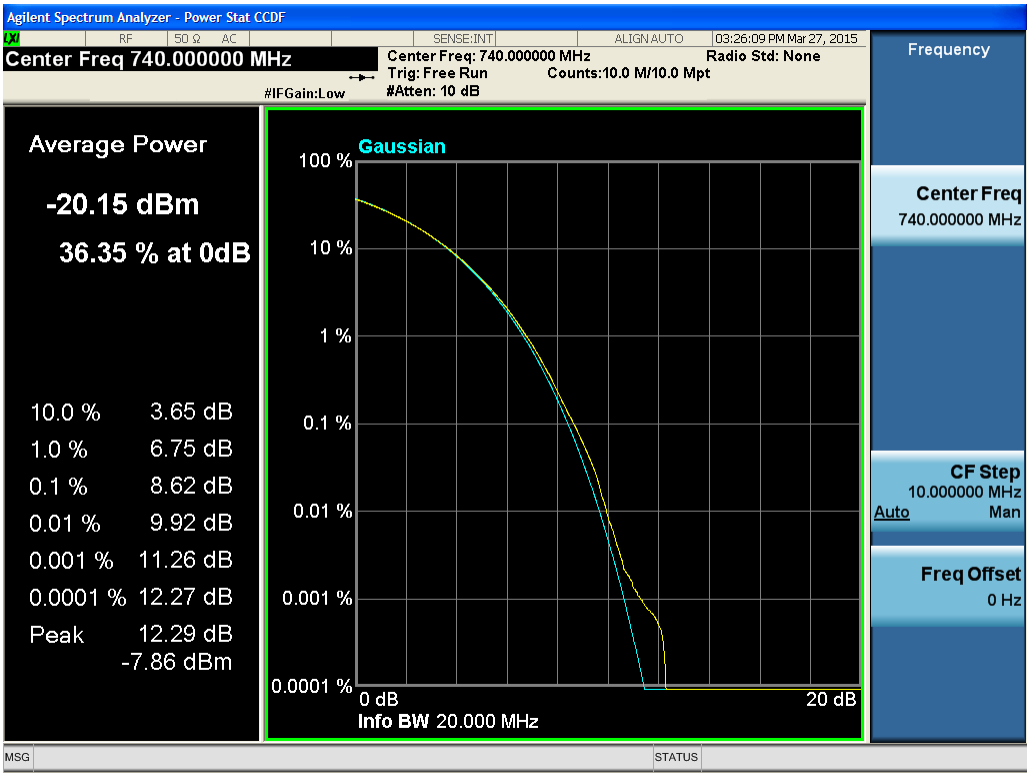
Band 17 - 5MHz BW – Low Channel – 16QAM



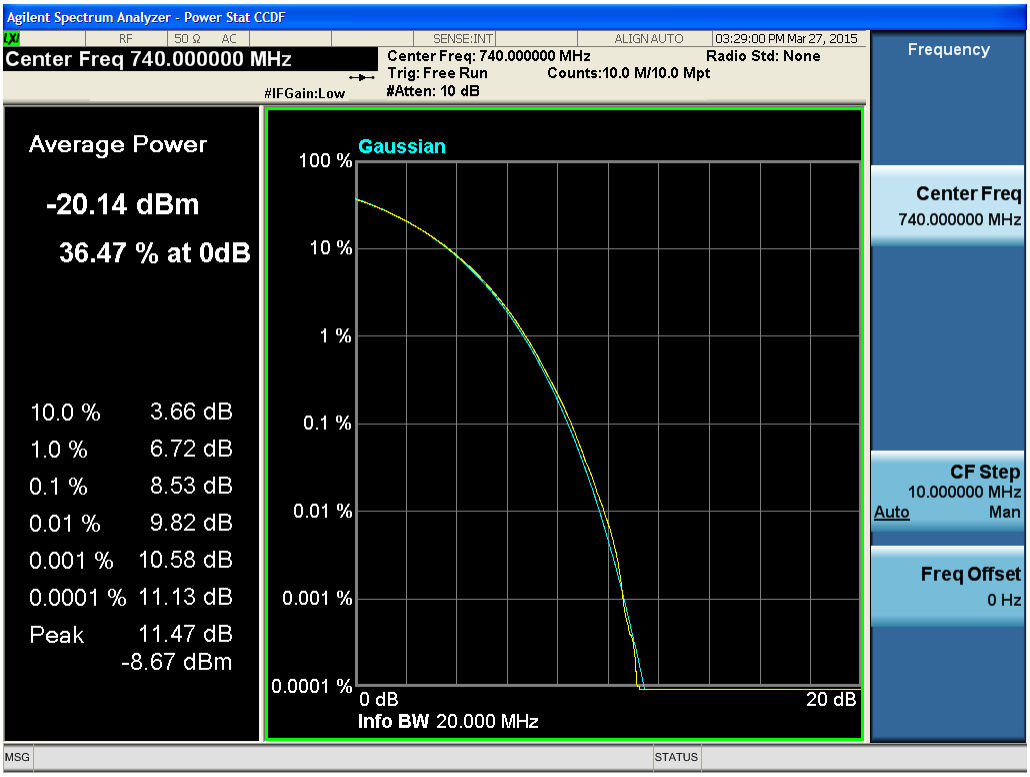
Band 17 - 5MHz BW – Low Channel – 64QAM



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.)

Date: 24-Jul-15 **Company:** Airvana **Work Order:** P0152
Engineer: Arik Zwirner **EUT Desc:** Switched IQ Radio Point Domestic **EUT Operating Voltage/Frequency:** POE
Temp: 24°C **Humidity:** 53% **Pressure:** 1010mBar

Frequency Range: Low, Mid and High Channels

Notes: 30W = 44.77dBm. Multiple antenna calcations using formula from FCC KDB 662911 Section f(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 calculated overall directional gain: 0dBi + 10log(N)dB = 0dBi + 3.0dB = 3.0dBi.

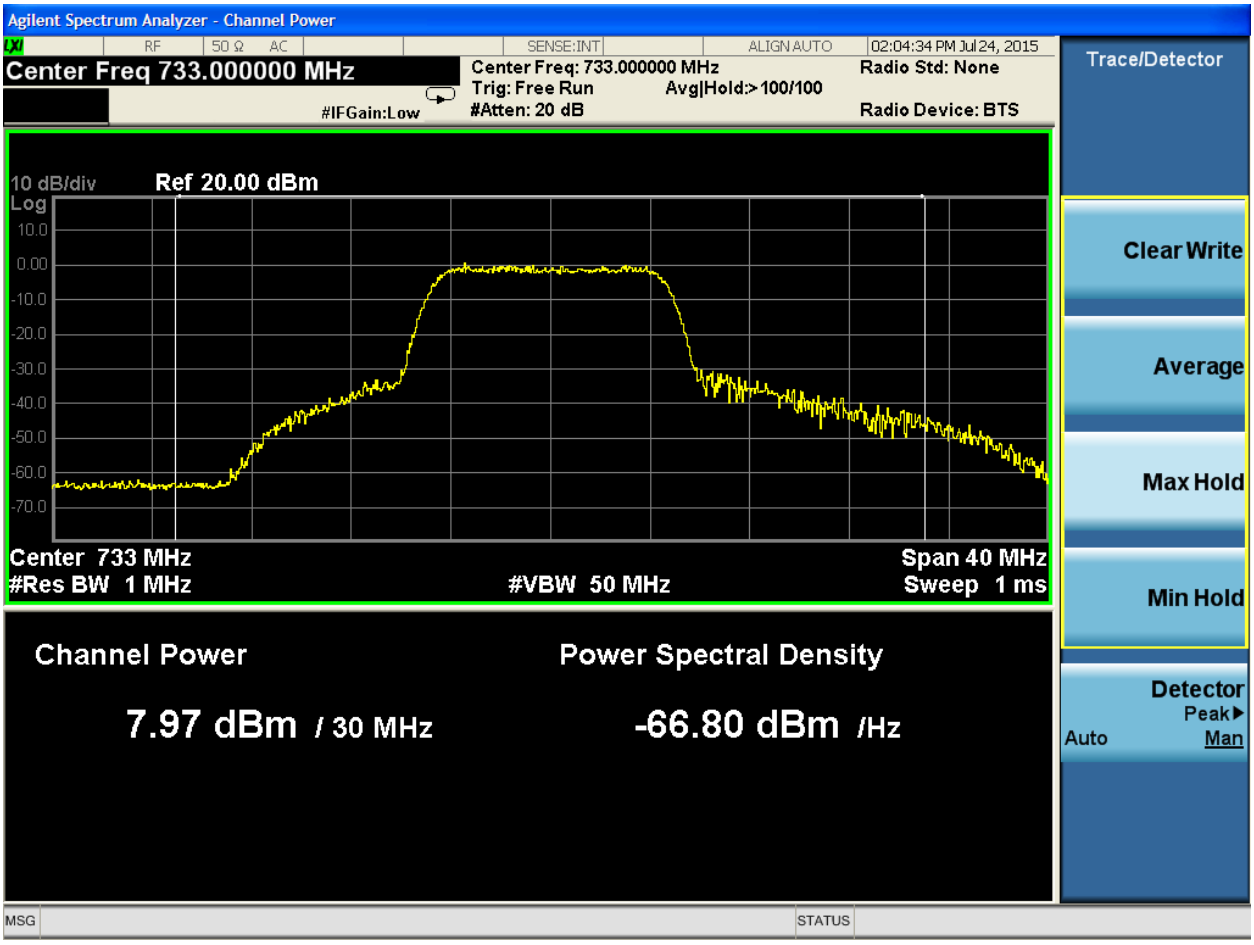
Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Frequency (MHz)	Peak Power Reading (dBm)	Average Power Reading (dBm)	PAPR (limit: 13dB) (dB)	Power Combiner (dB)	20dB Attenuator (dB)	Cable Factor dB)	Adjusted Peak Power Reading (dBm)	Directional Antenna Gain (dBi)	EIRP (dBm)	FCC Part 27.50(c)(9); Limit: 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

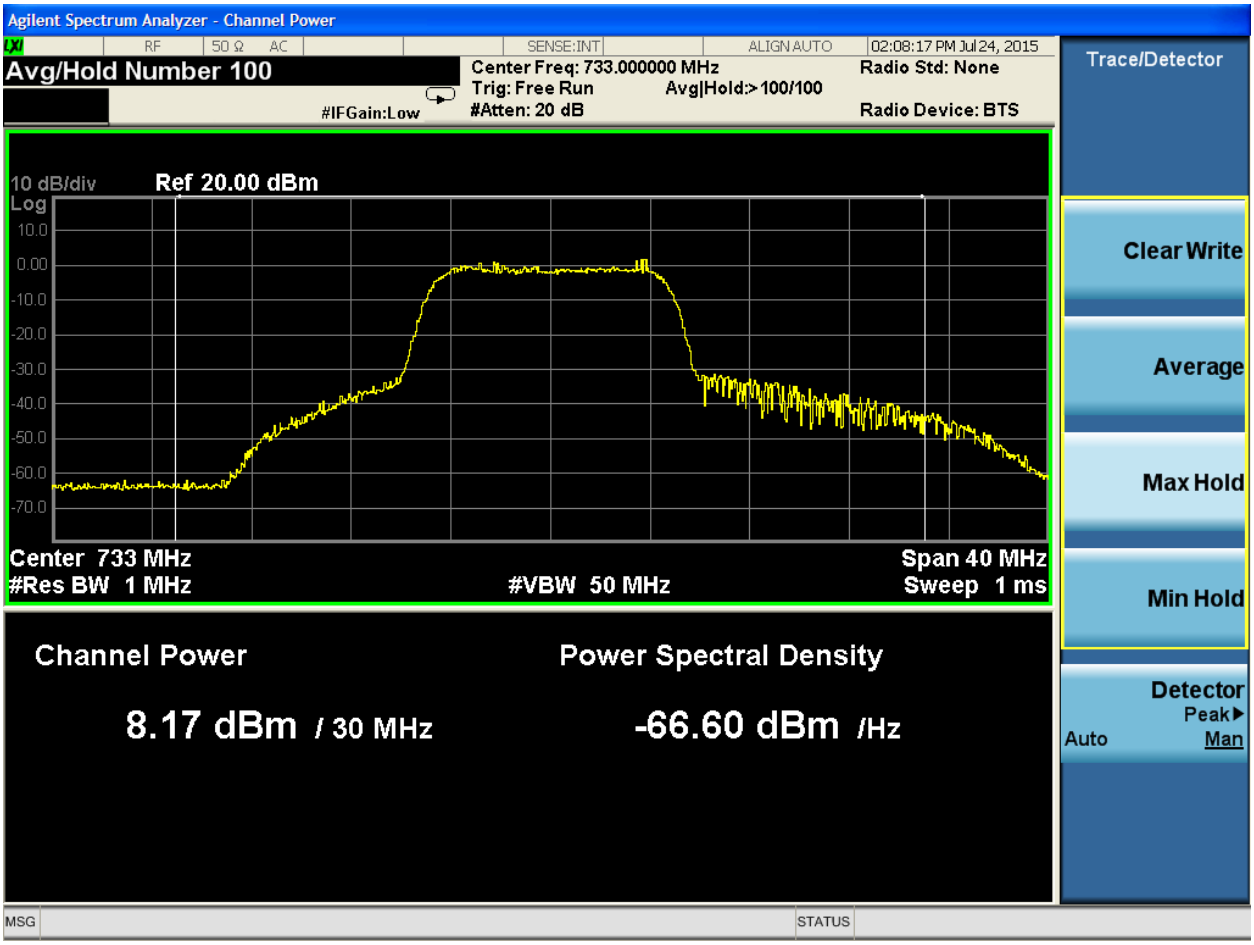
Test Site: ESD-1 **Cable:** 1509 **20dB Attenuator:** Asset 791
Analyzer: Agilent M/N 9038A **Power Combiner:** Asset 1939

Spectrum analyzer plots are on the following pages.

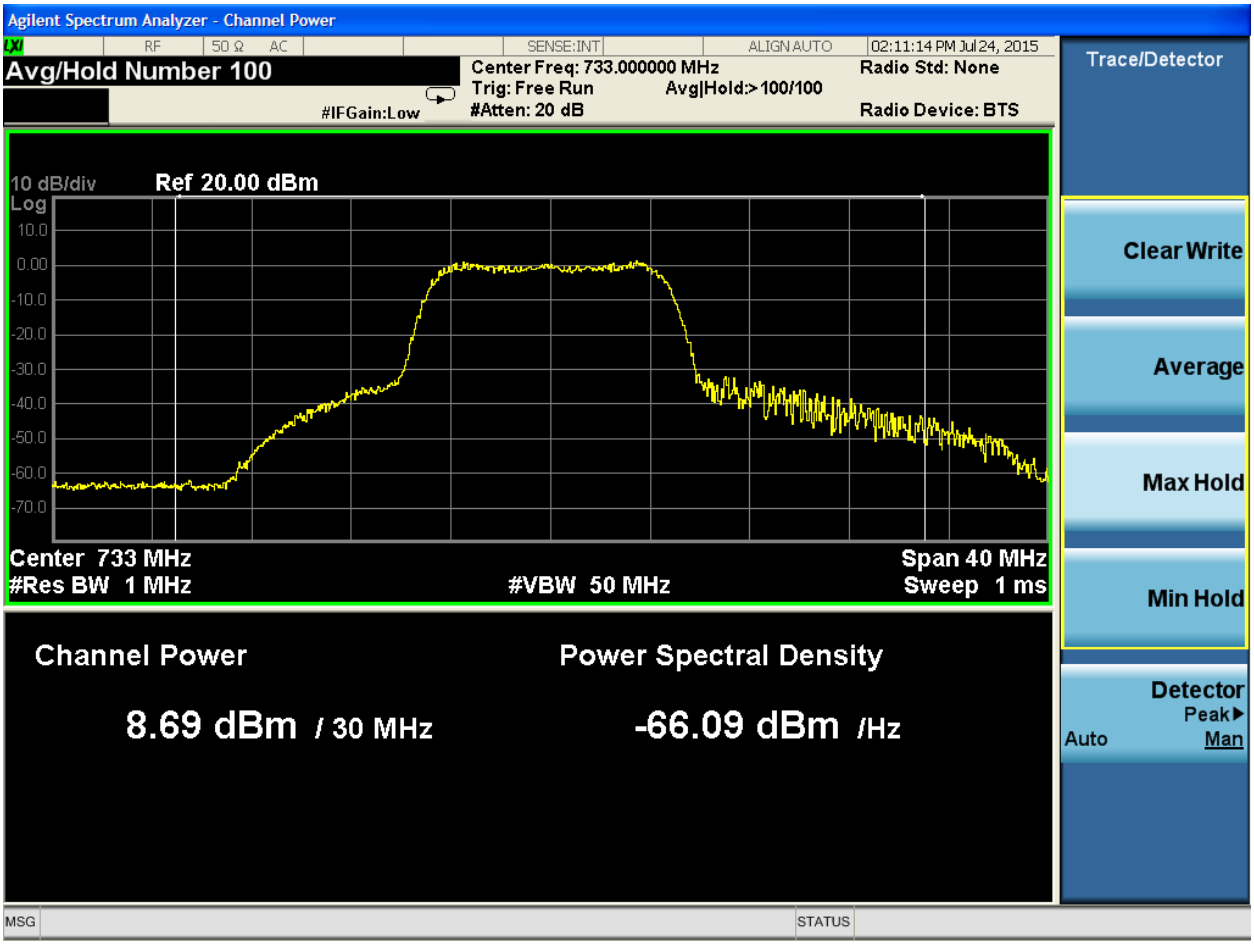
Band 12 Peak Readings:



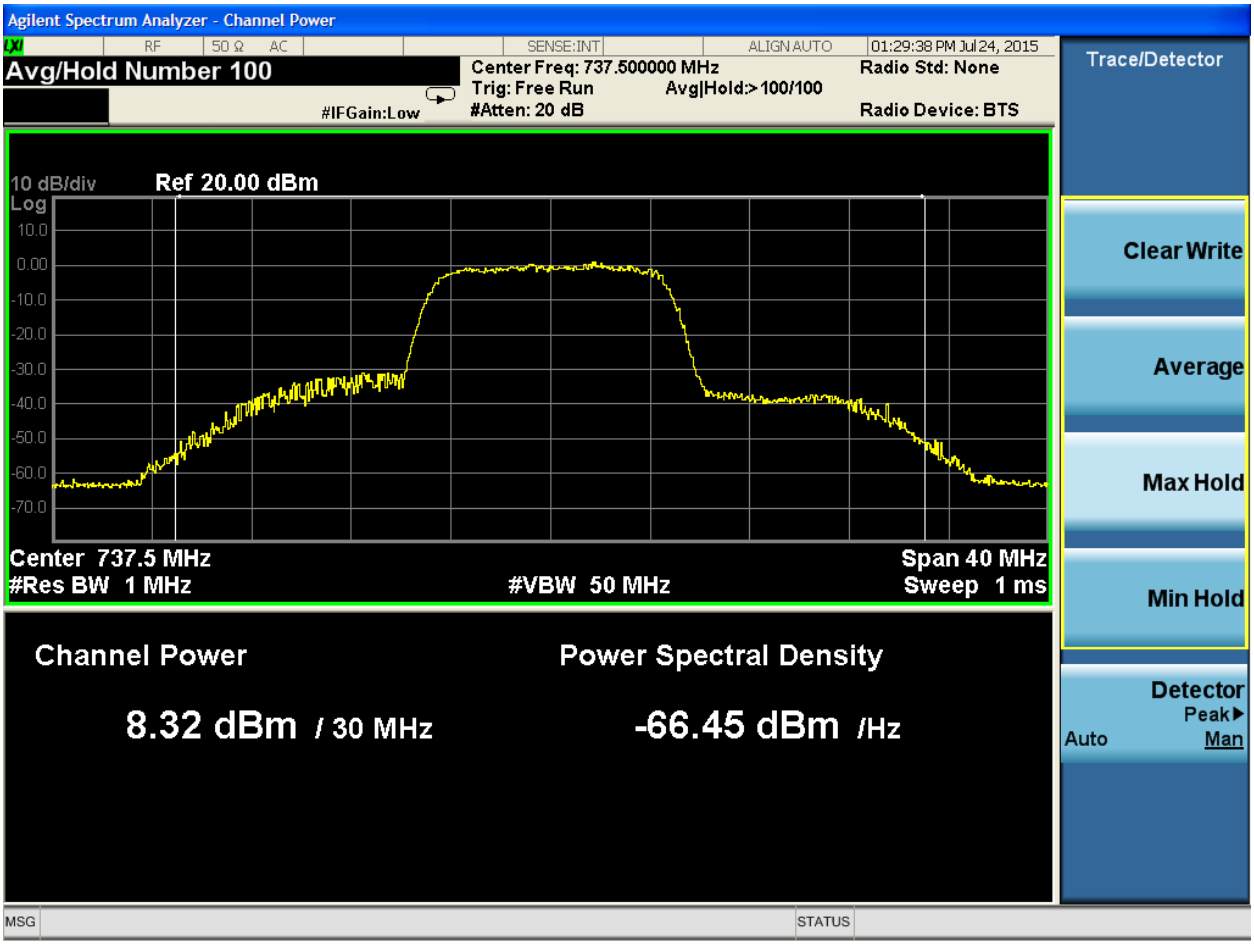
Band 12, Low Channel, QPSK



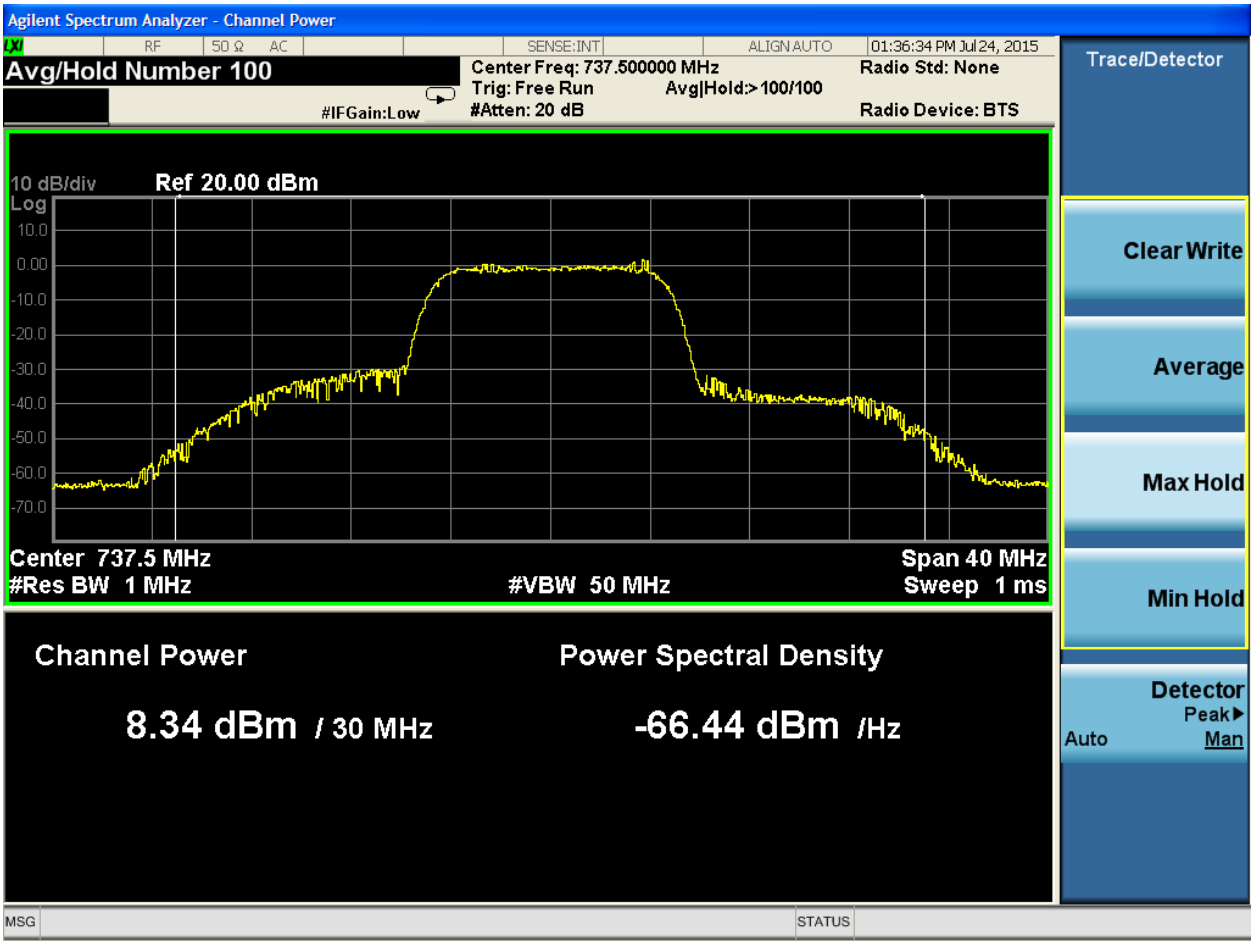
Band 12, Low Channel, 16QAM



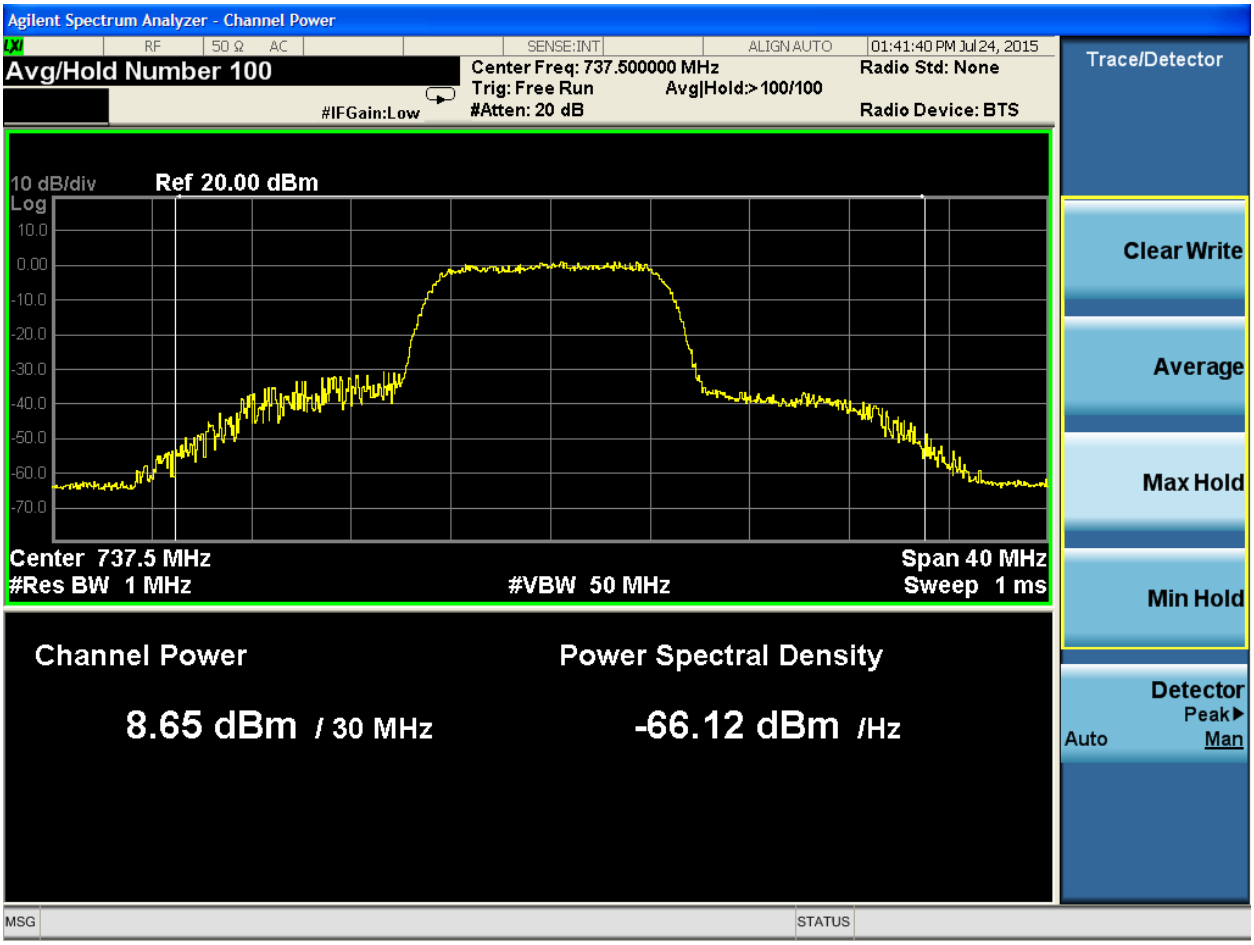
Band 12, Low Channel, 64QAM



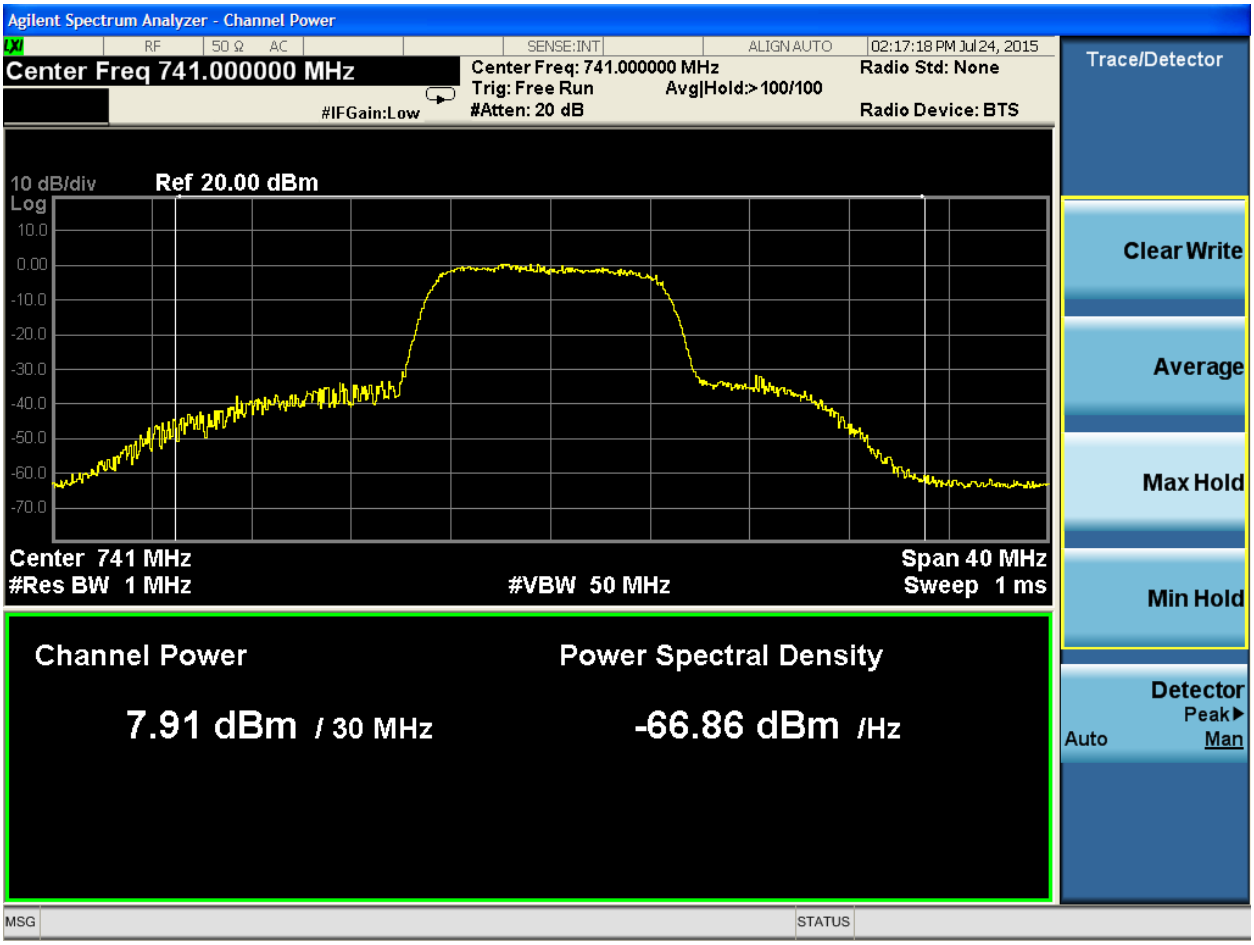
Band 12, Mid Channel, QPSK



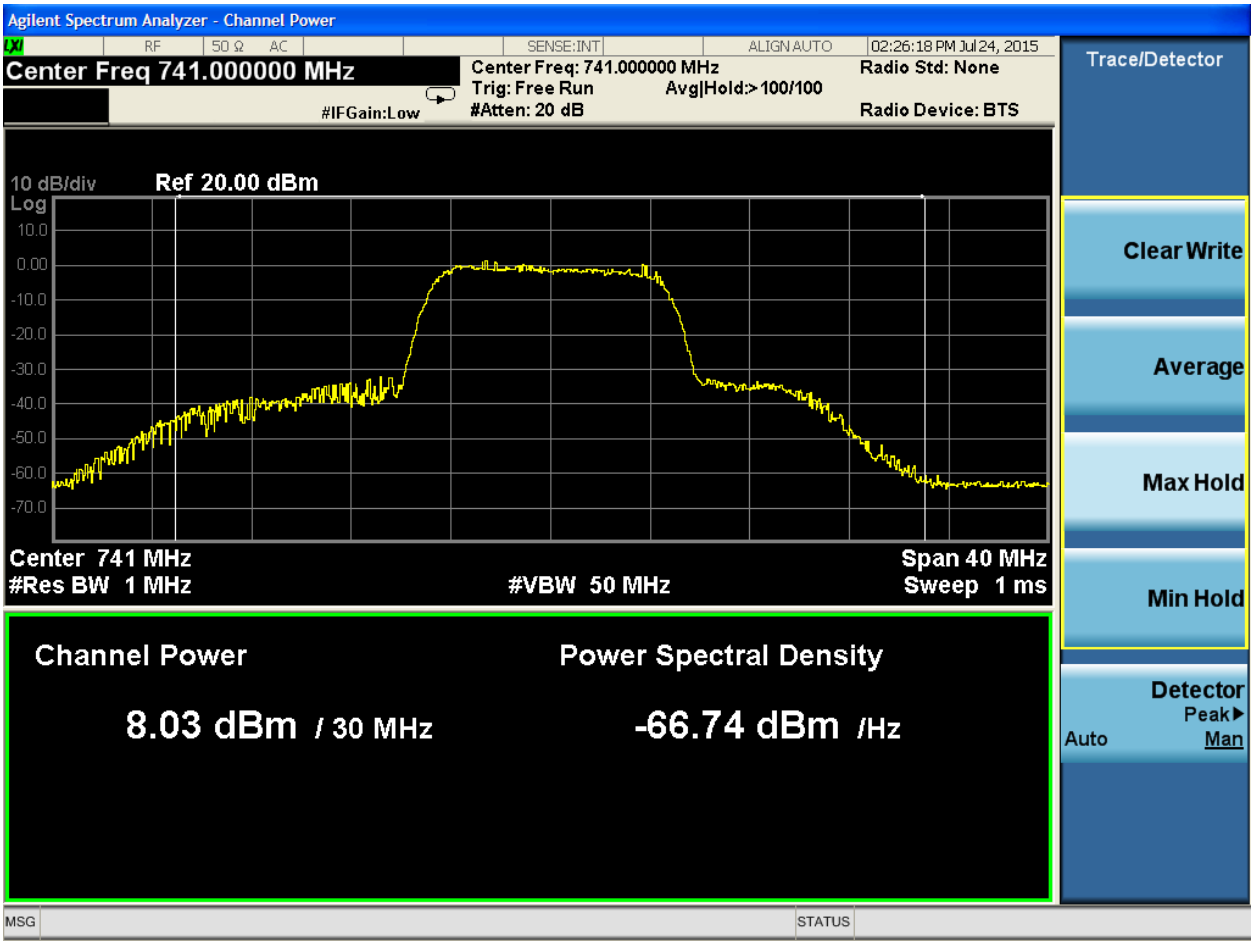
Band 12, Mid Channel, 16QAM



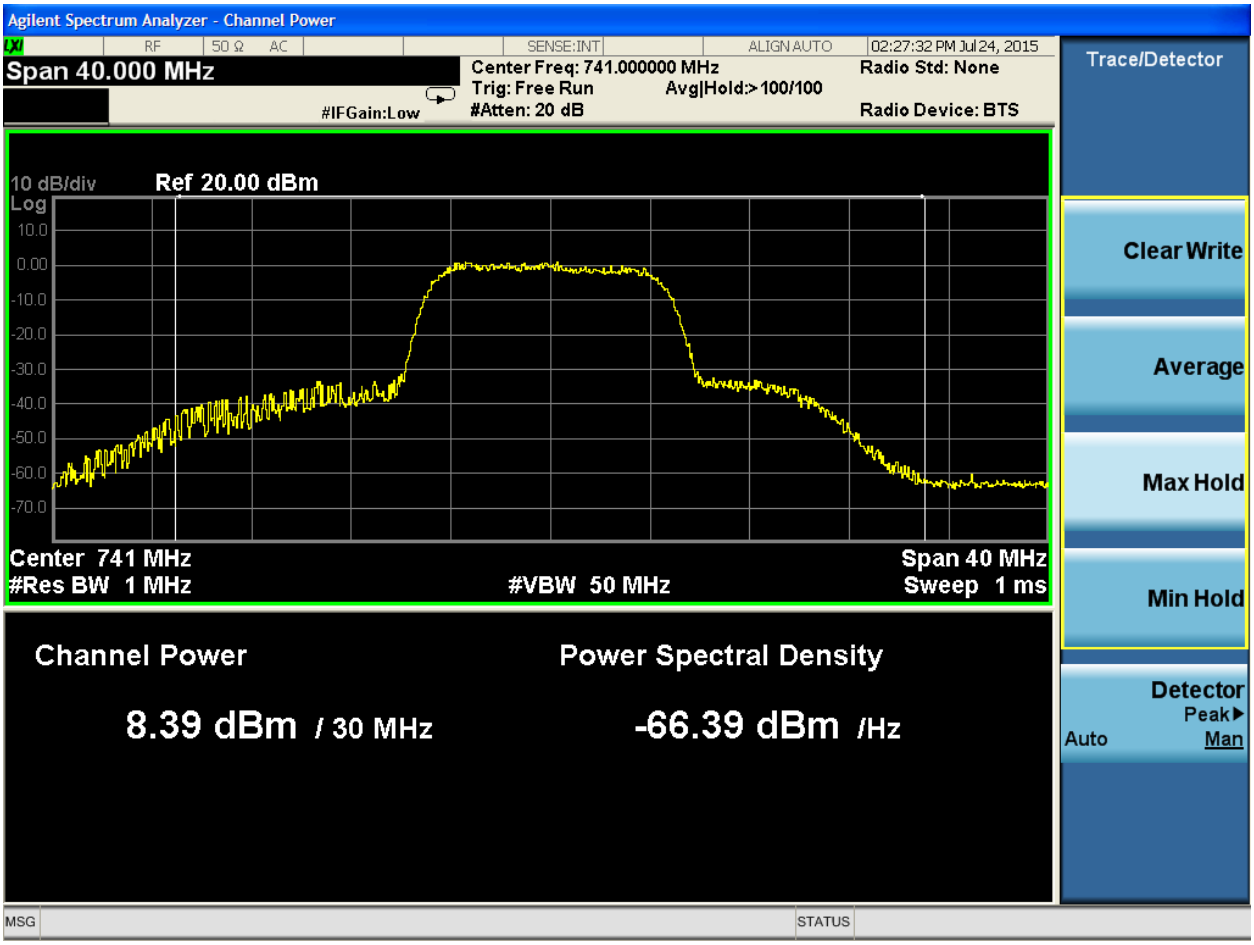
Band 12, Mid Channel, 64QAM



Band 12, High Channel, QPSK

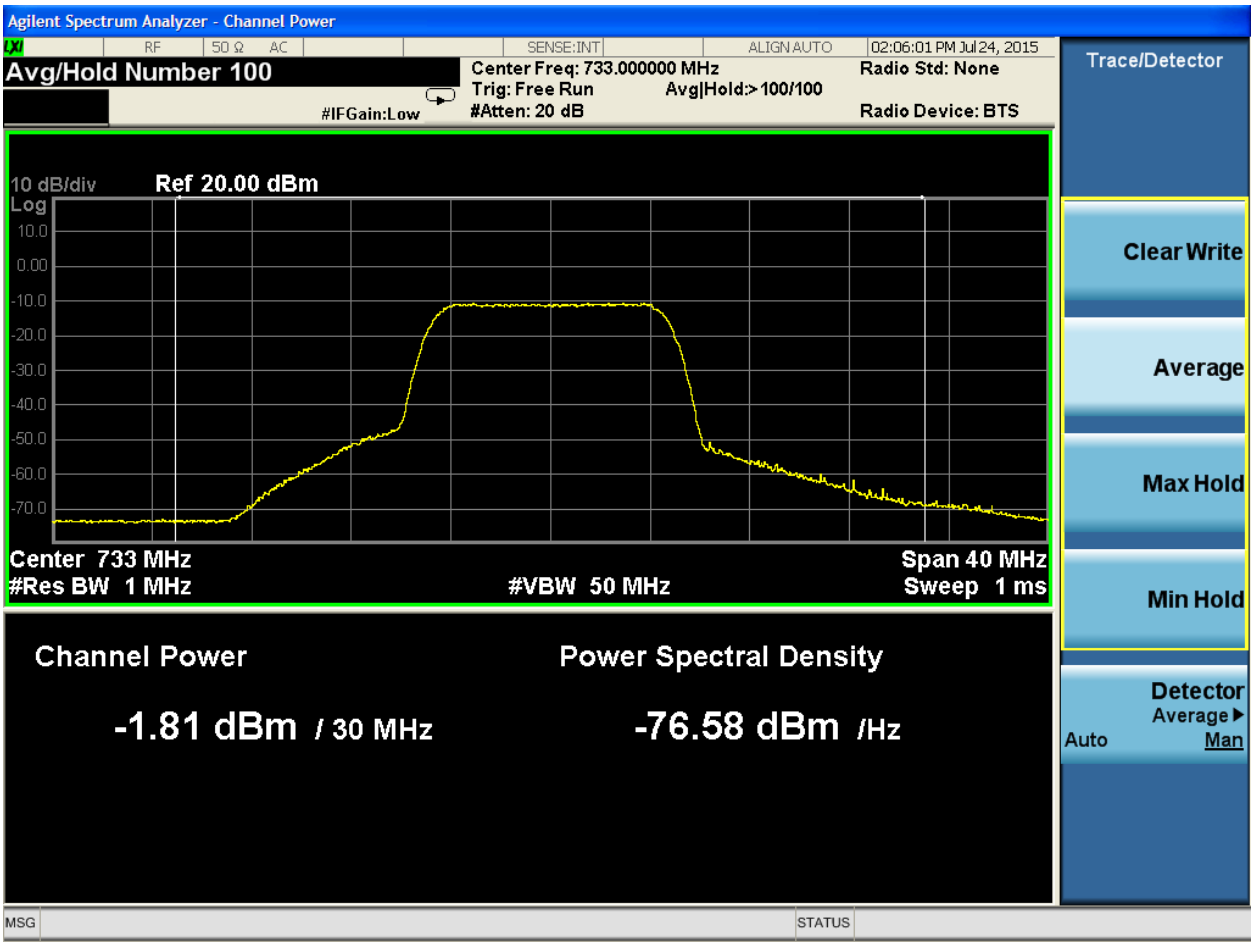


Band 12, High Channel, 16QAM

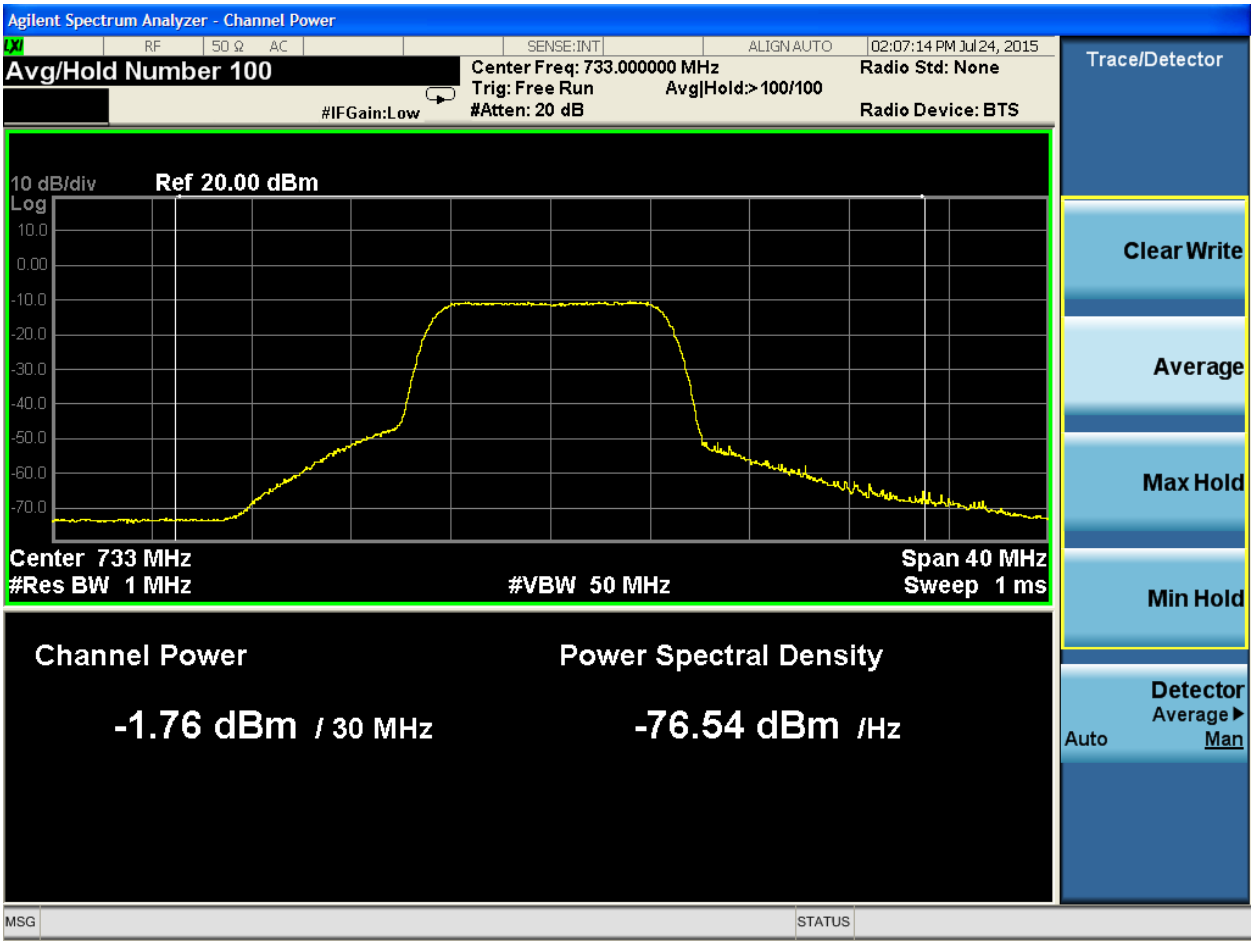


Band 12, High Channel, 64QAM

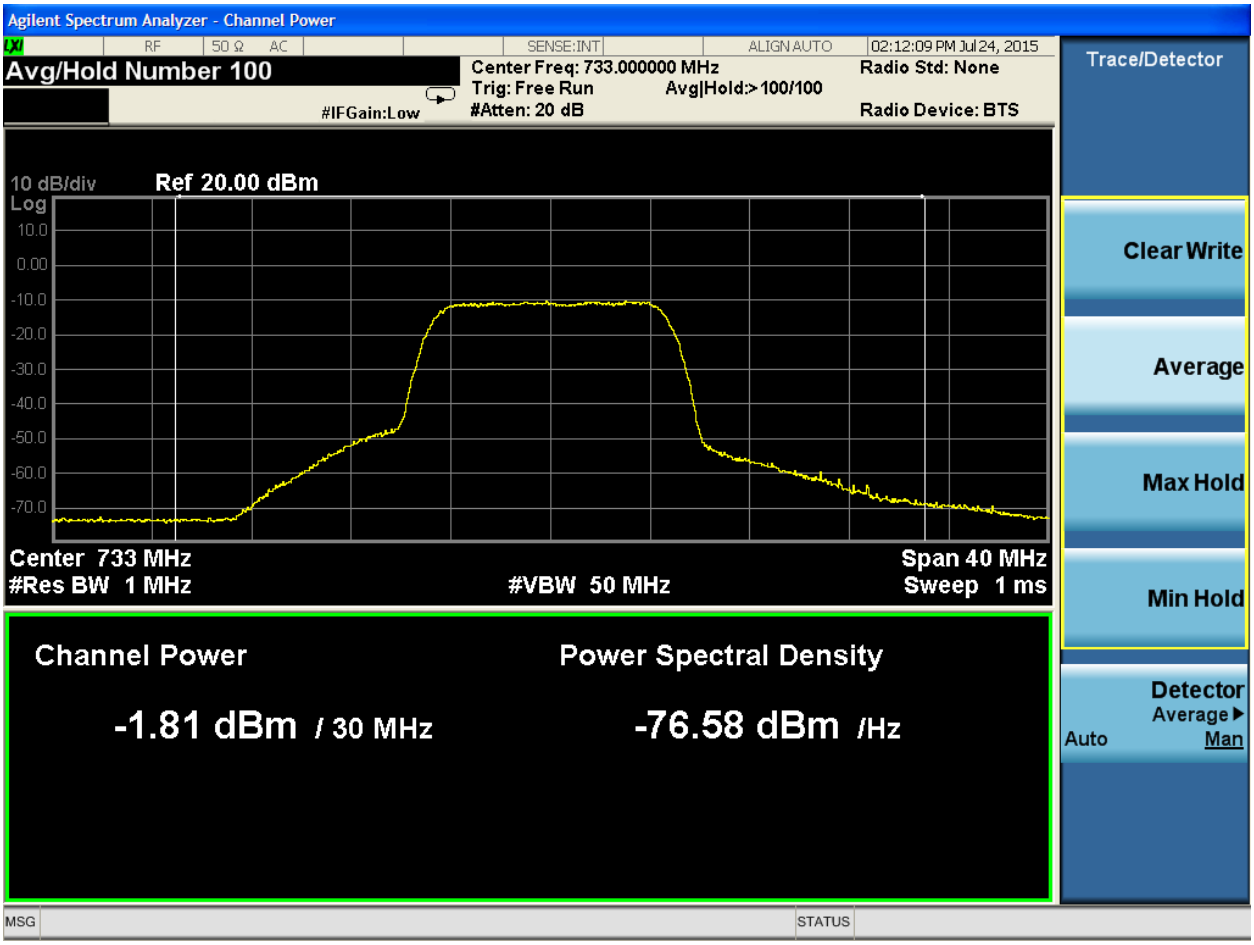
Band 12 Average Readings:



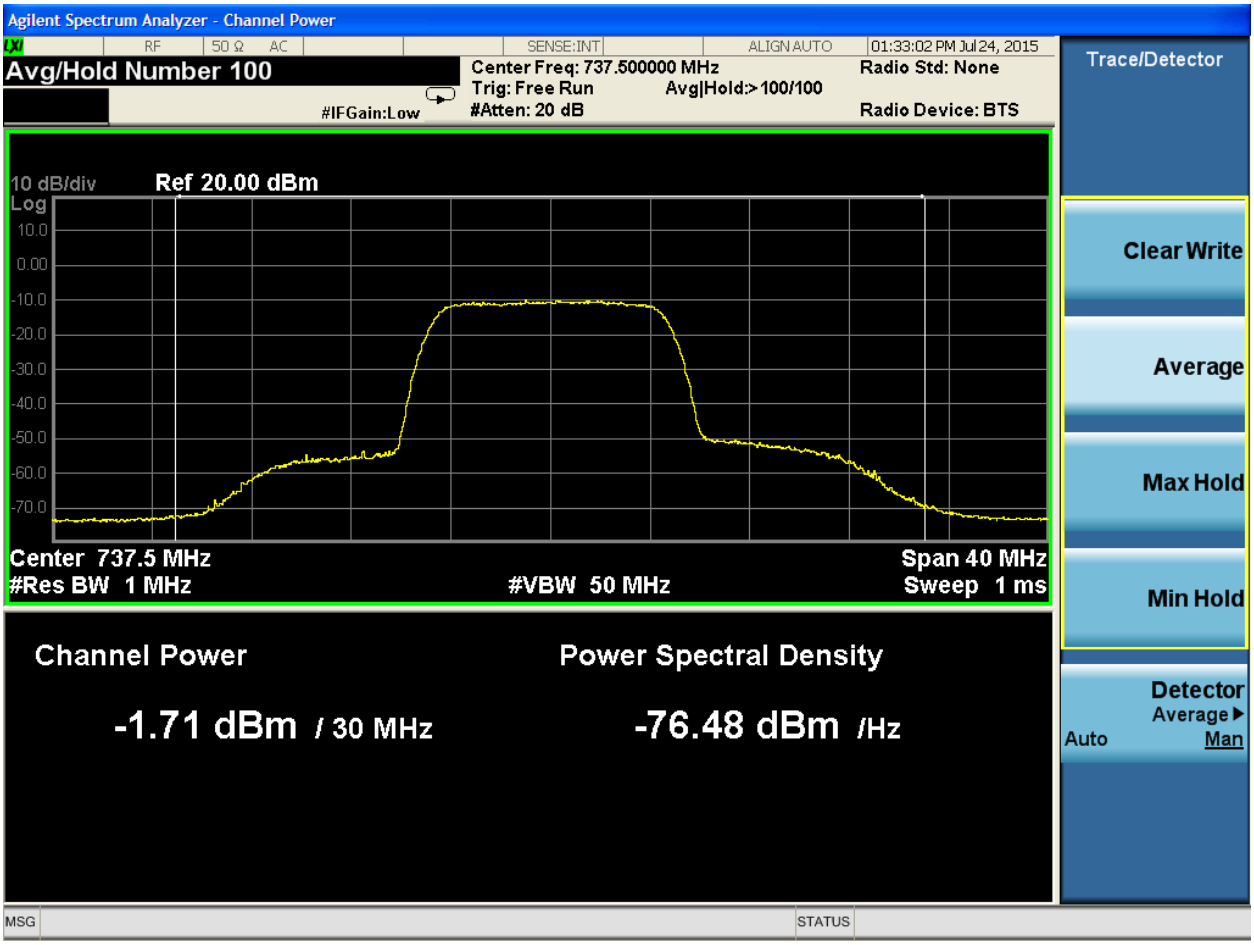
Band 12, Low Channel, QPSK



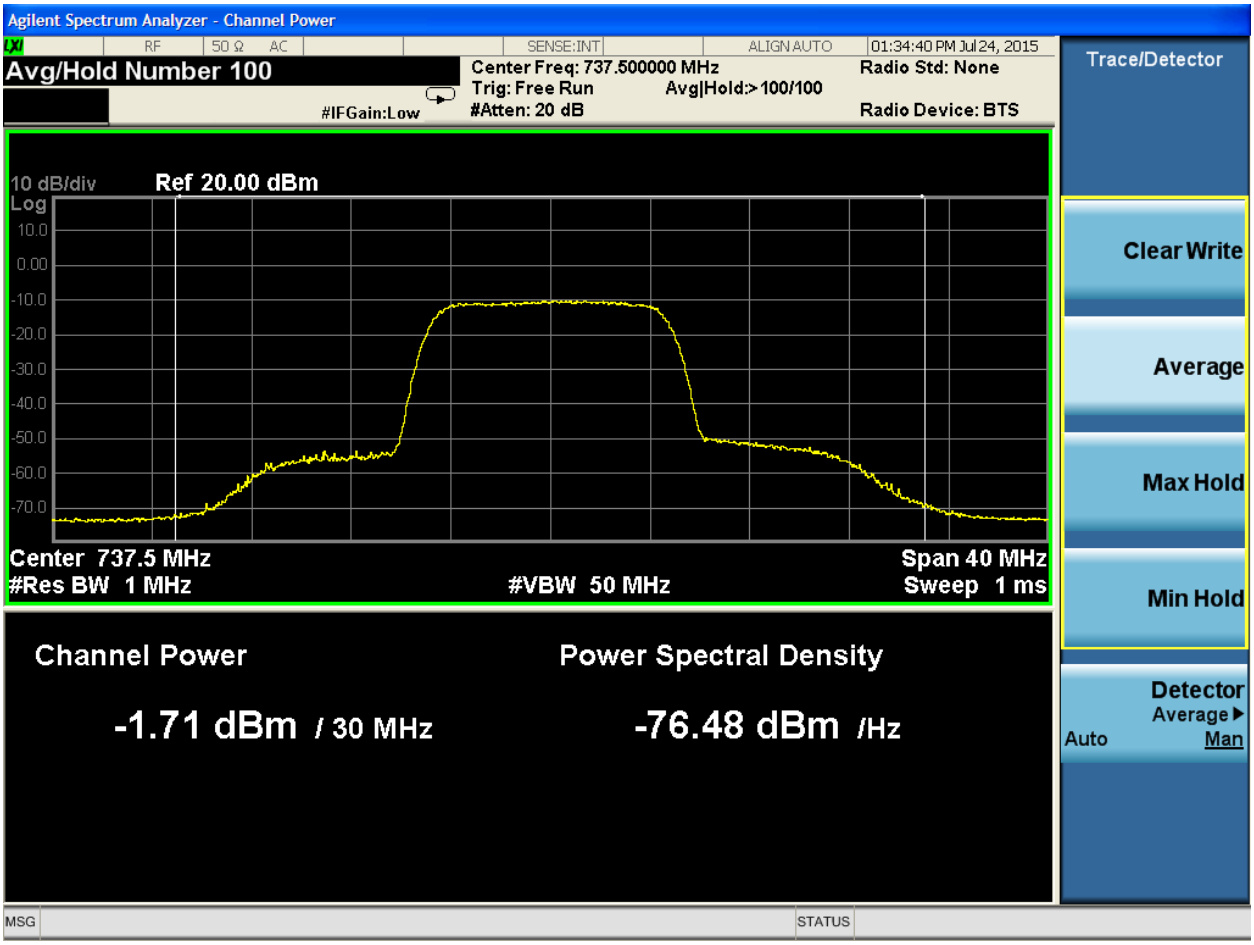
Band 12, Low Channel, 16QAM



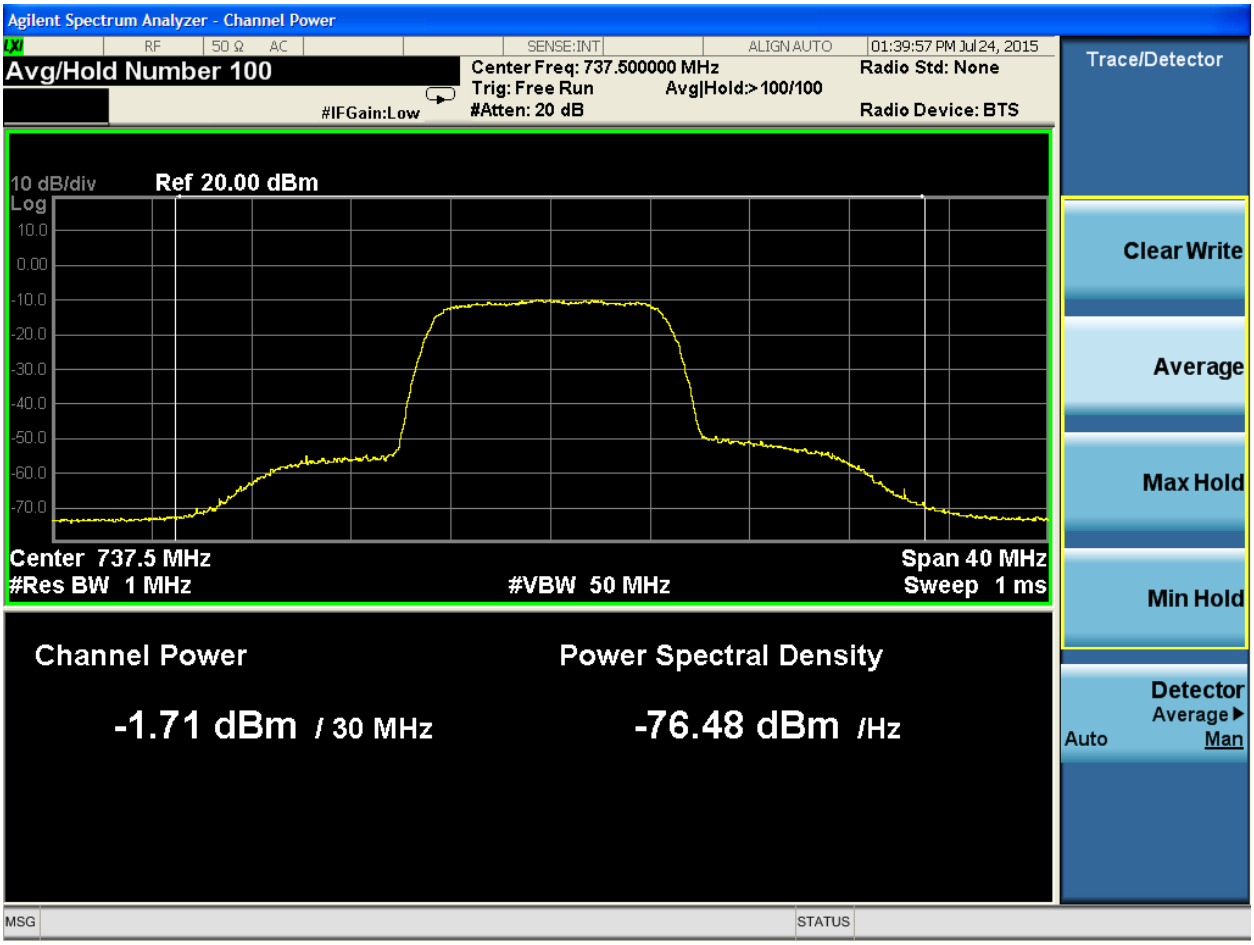
Band 12, Low Channel, 64QAM



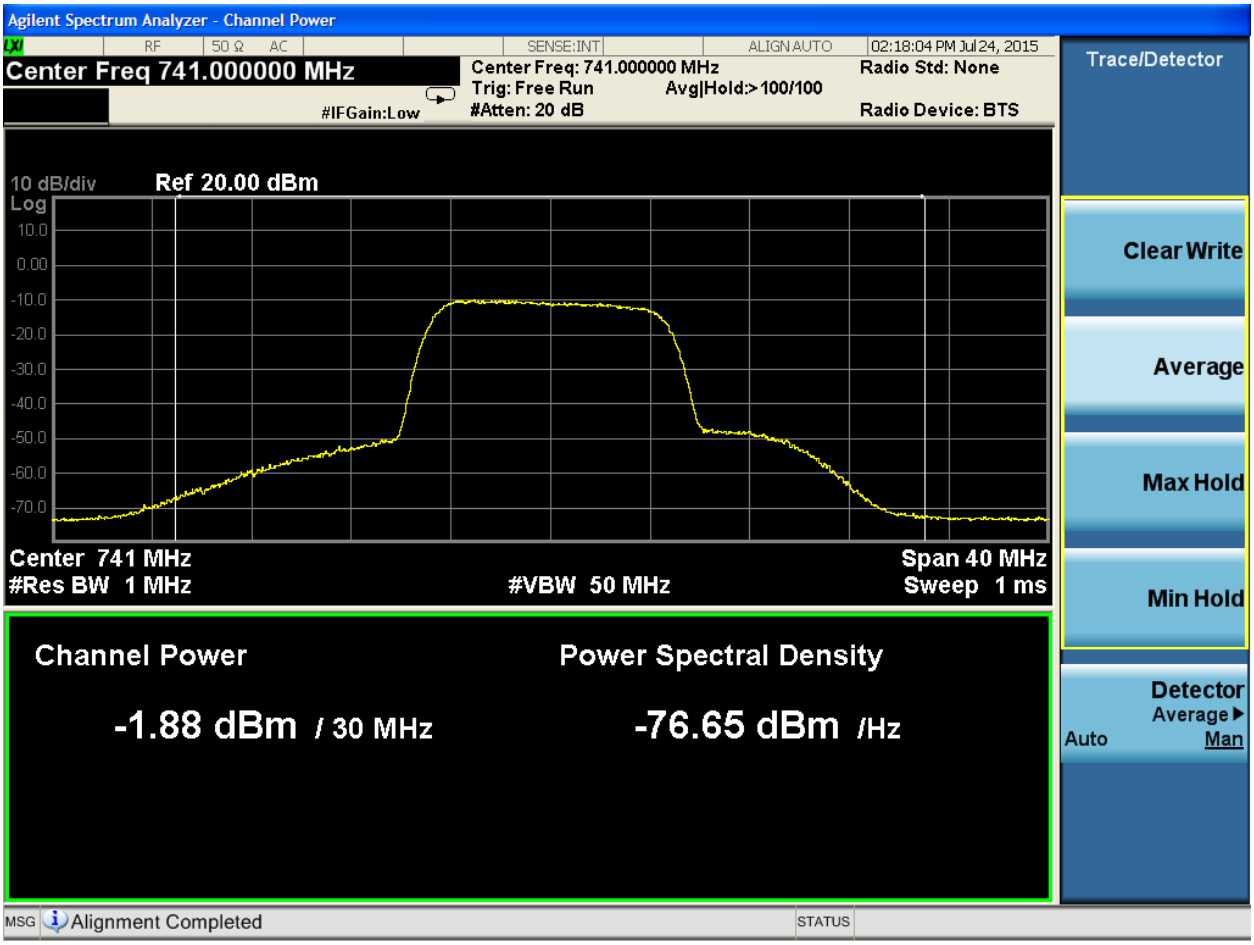
Band 12, Mid Channel, QPSK



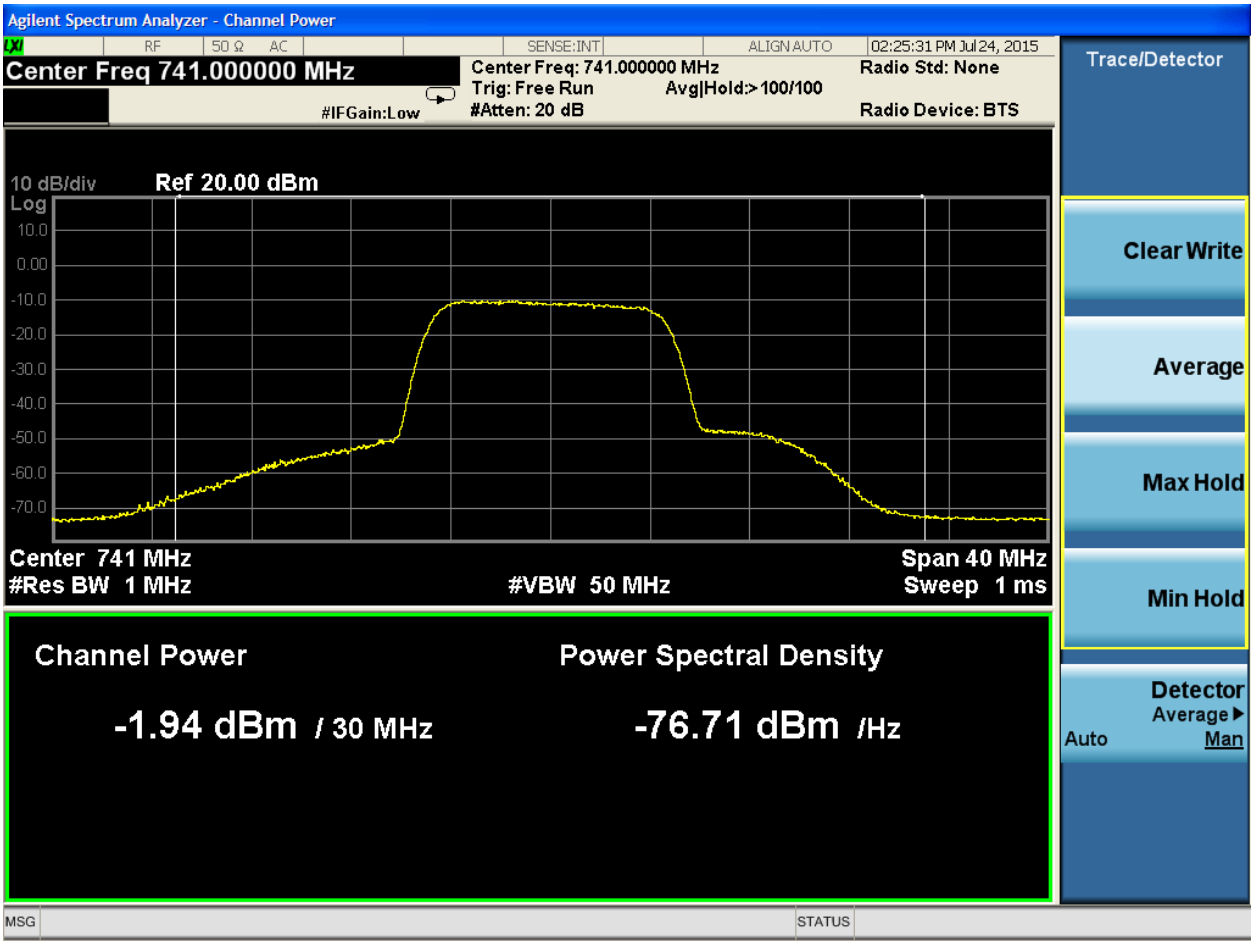
Band 12, Mid Channel, 16QAM



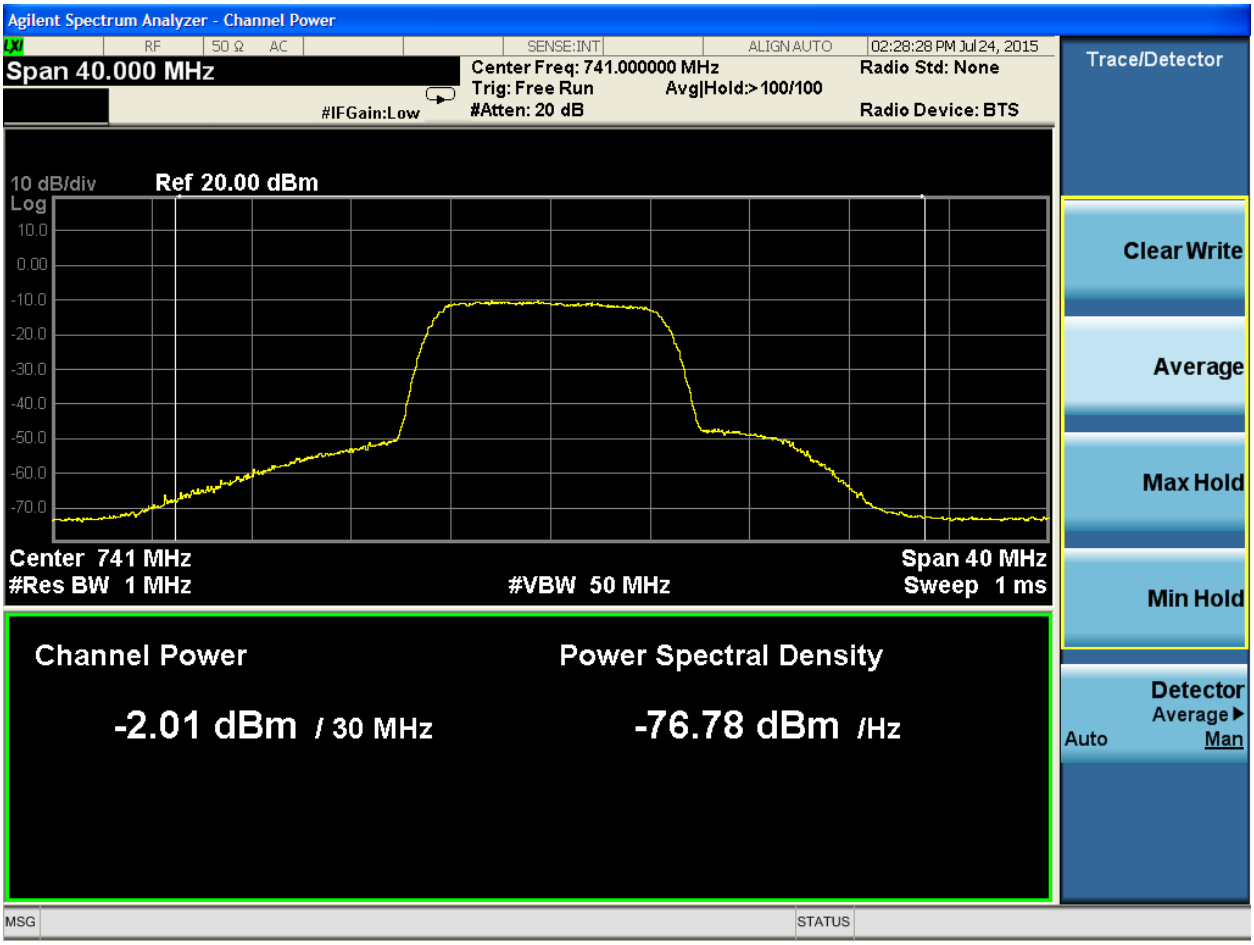
Band 12, Mid Channel, 64QAM



Band 12, High Channel, QPSK

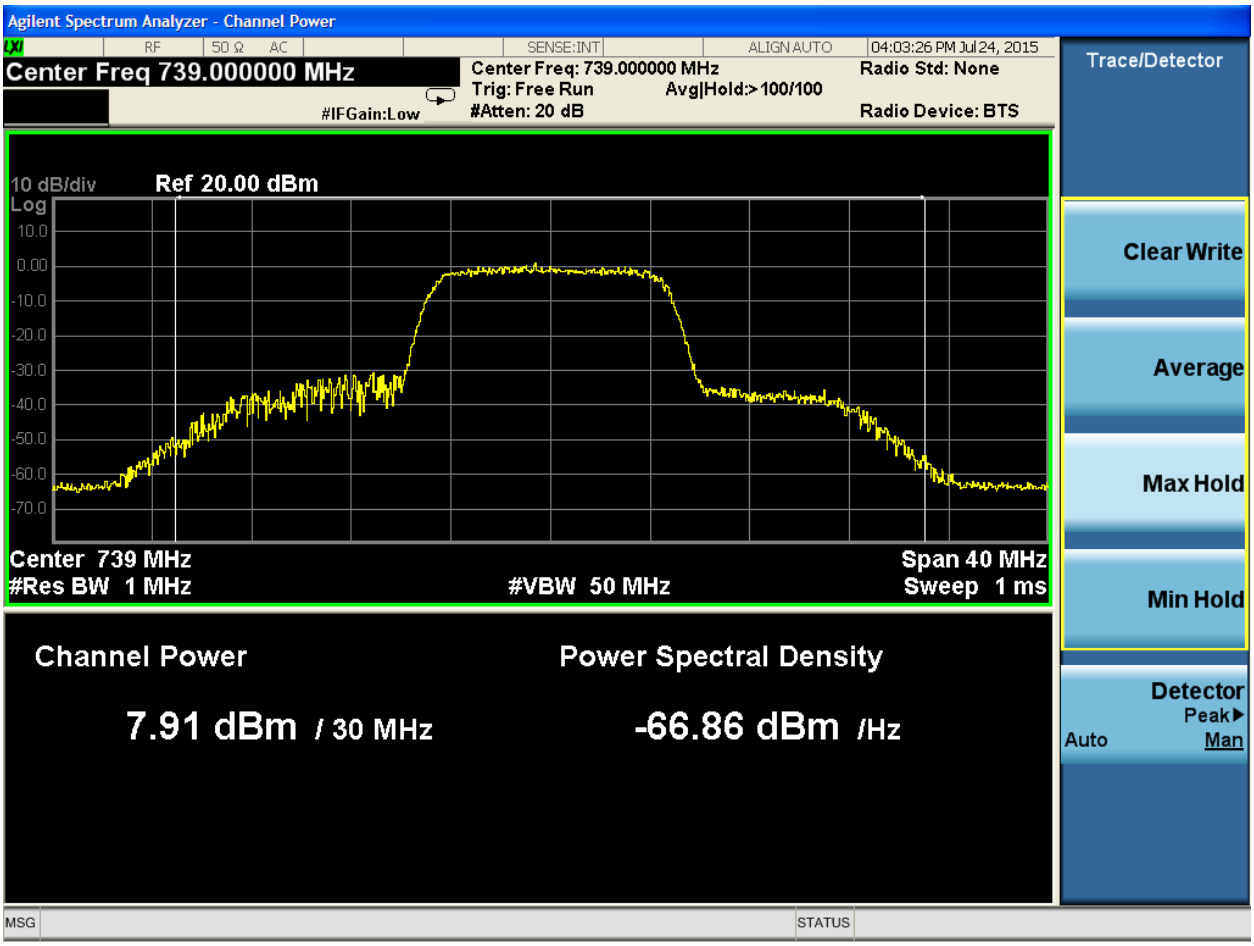


Band 12, High Channel, 16QAM

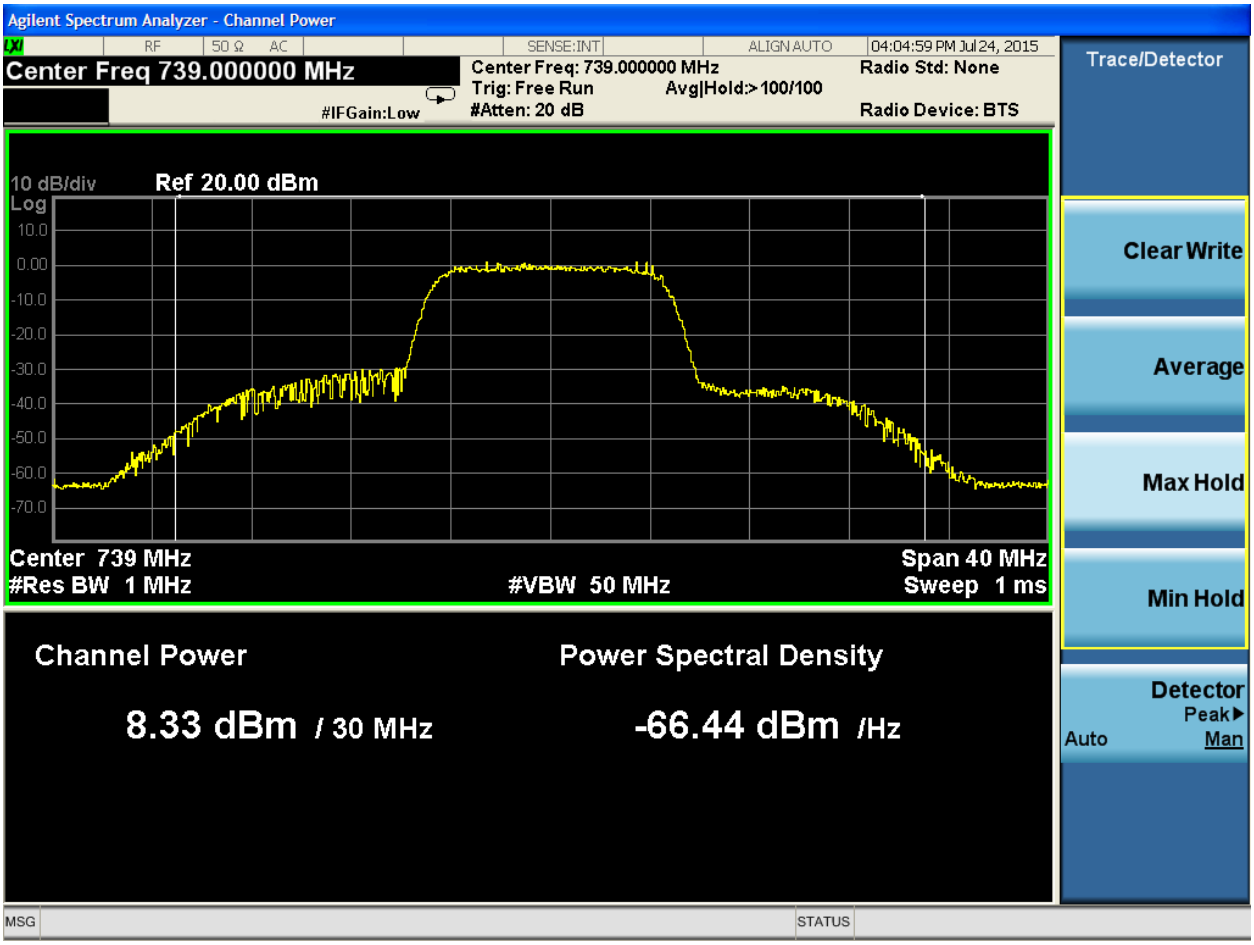


Band 12, High Channel, 64QAM

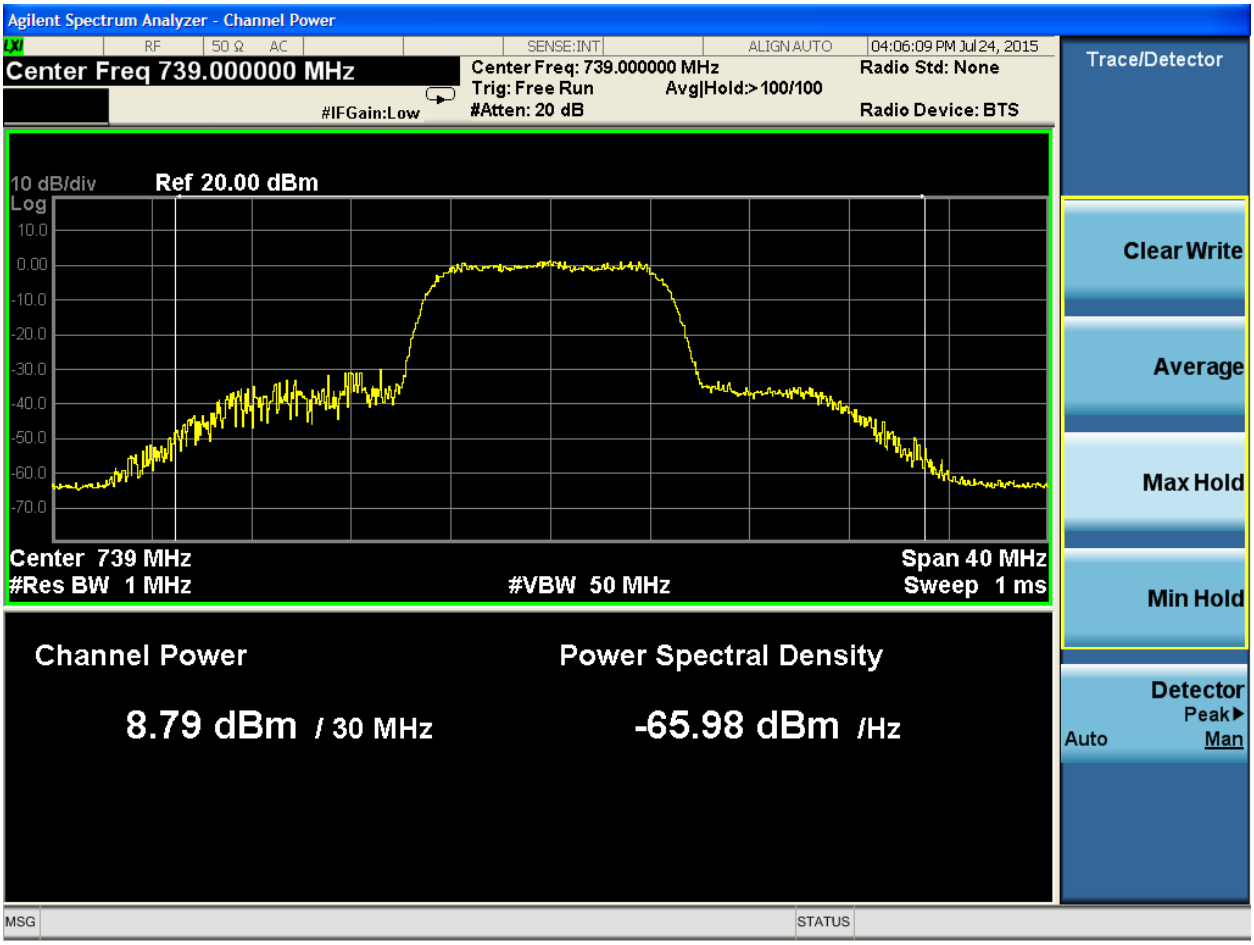
Band 17 Peak Readings:



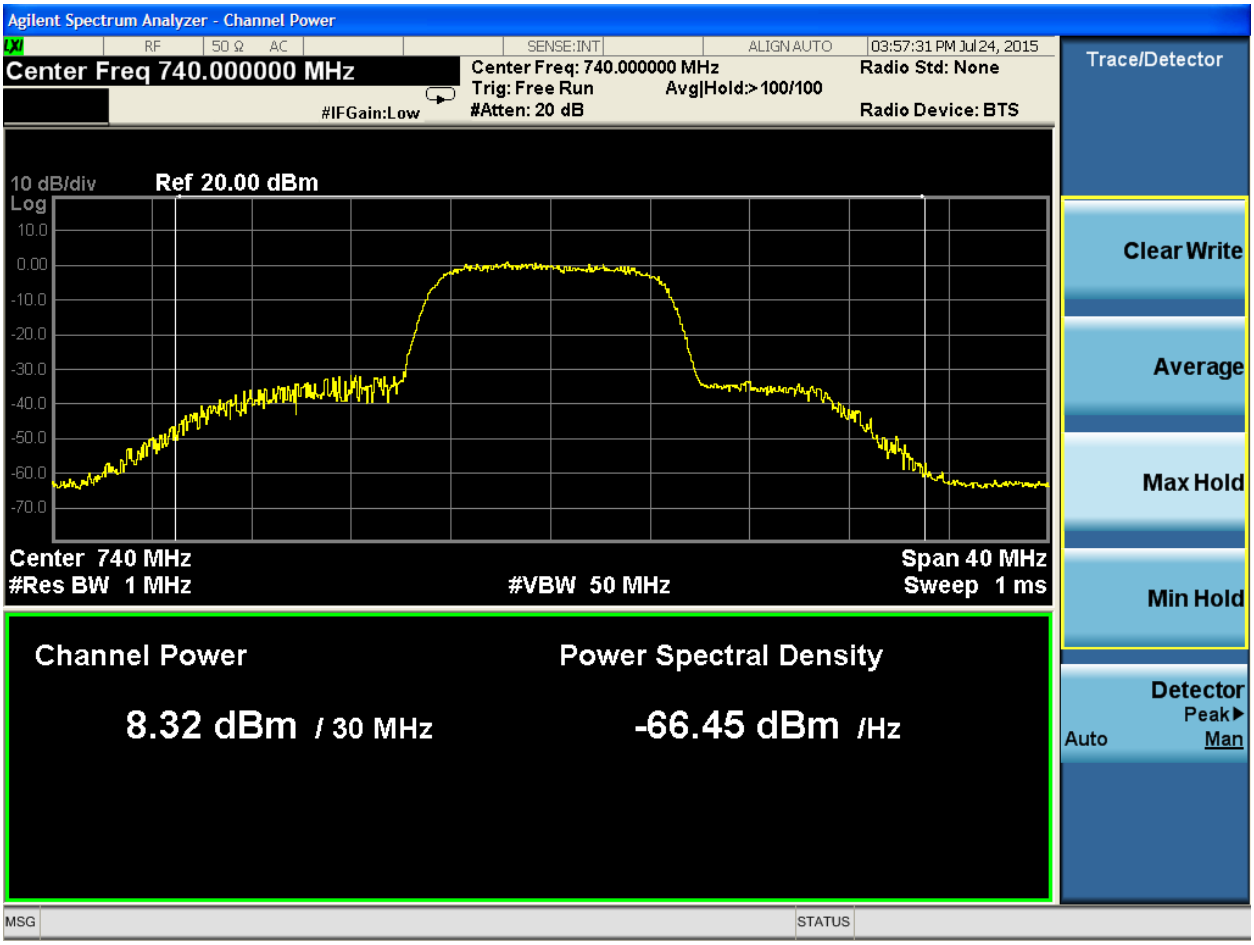
Band 17, Mid Channel, QPSK



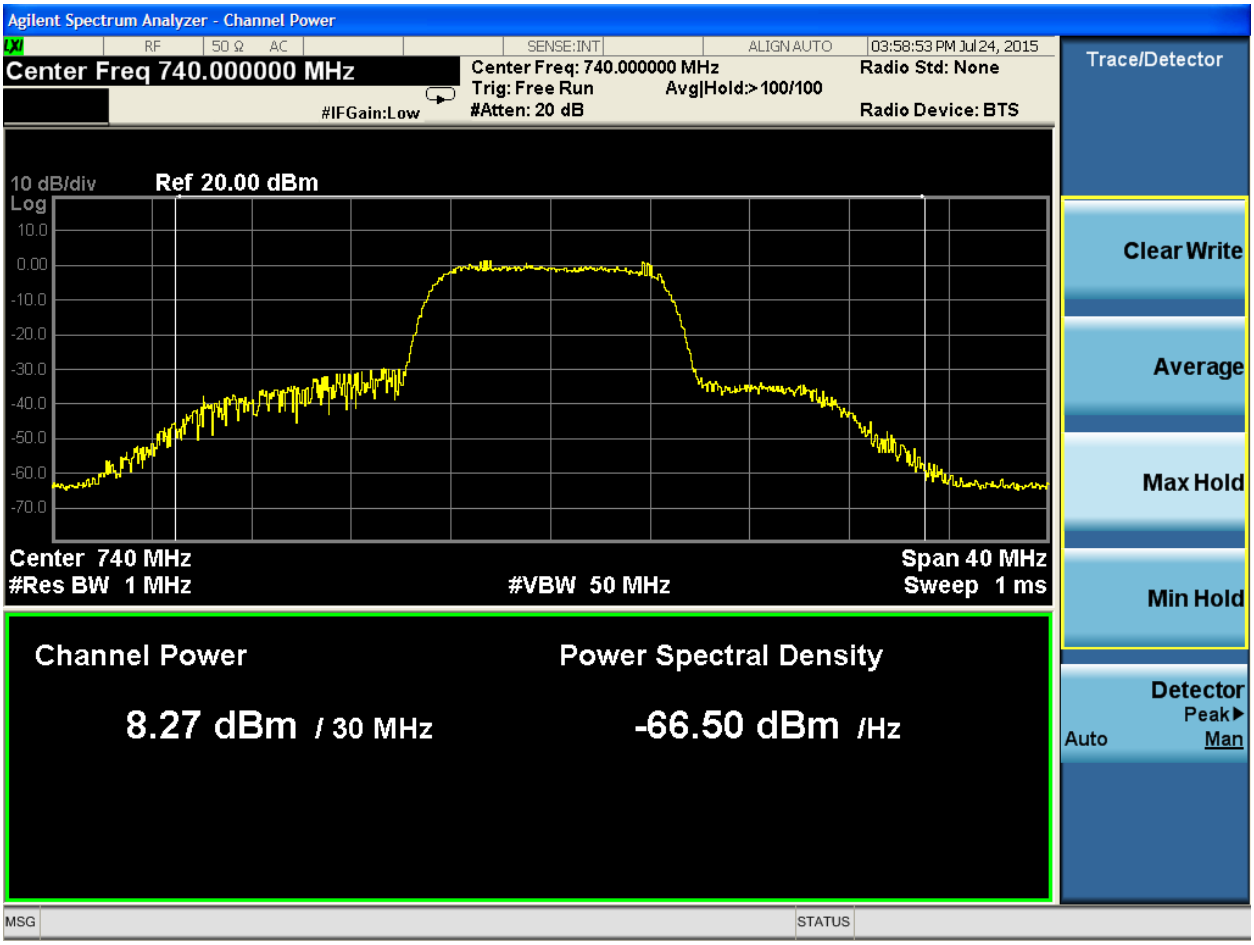
Band 17, Mid Channel, 16QAM



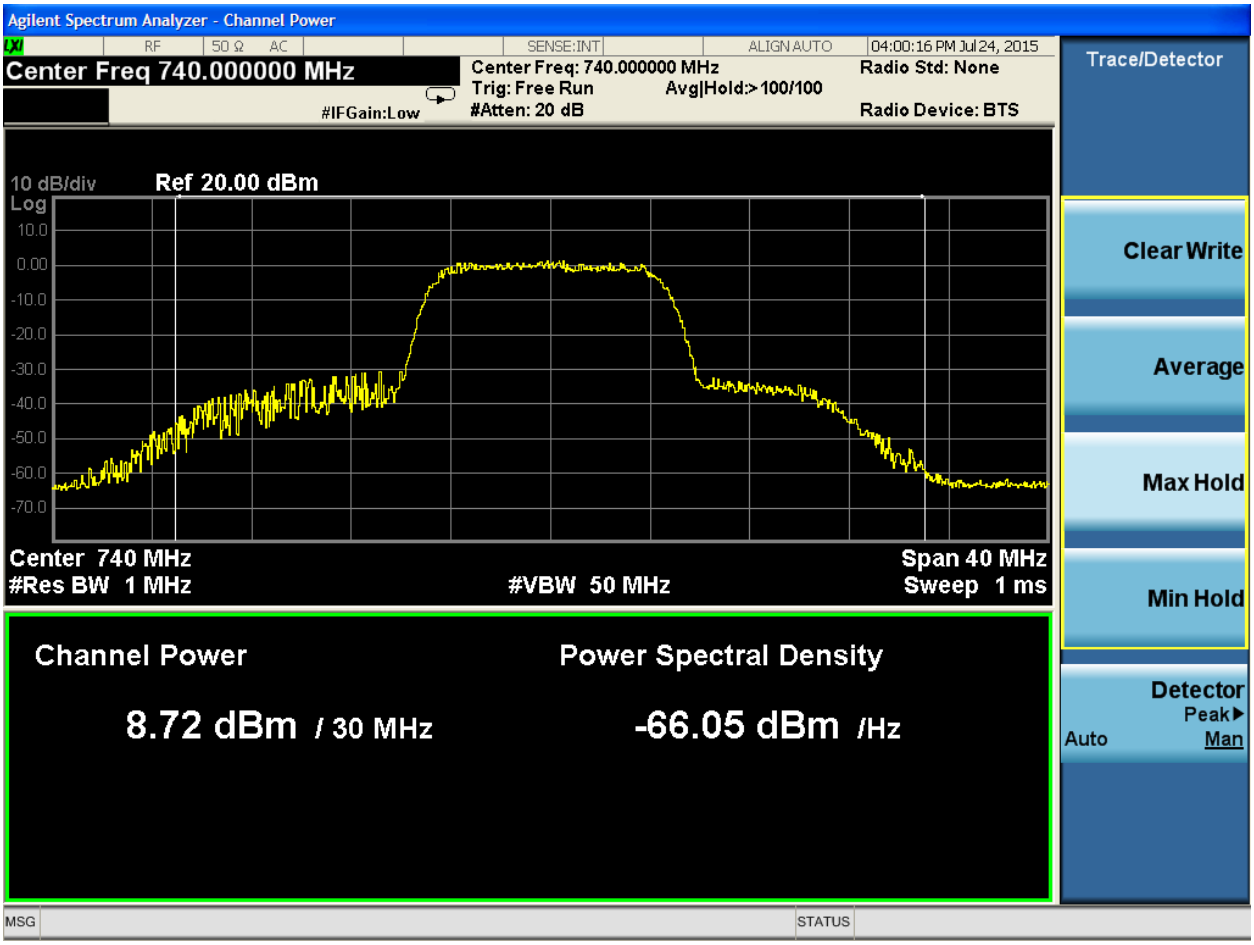
Band 17, Mid Channel, 64QAM



Band 17, High Channel, QPSK

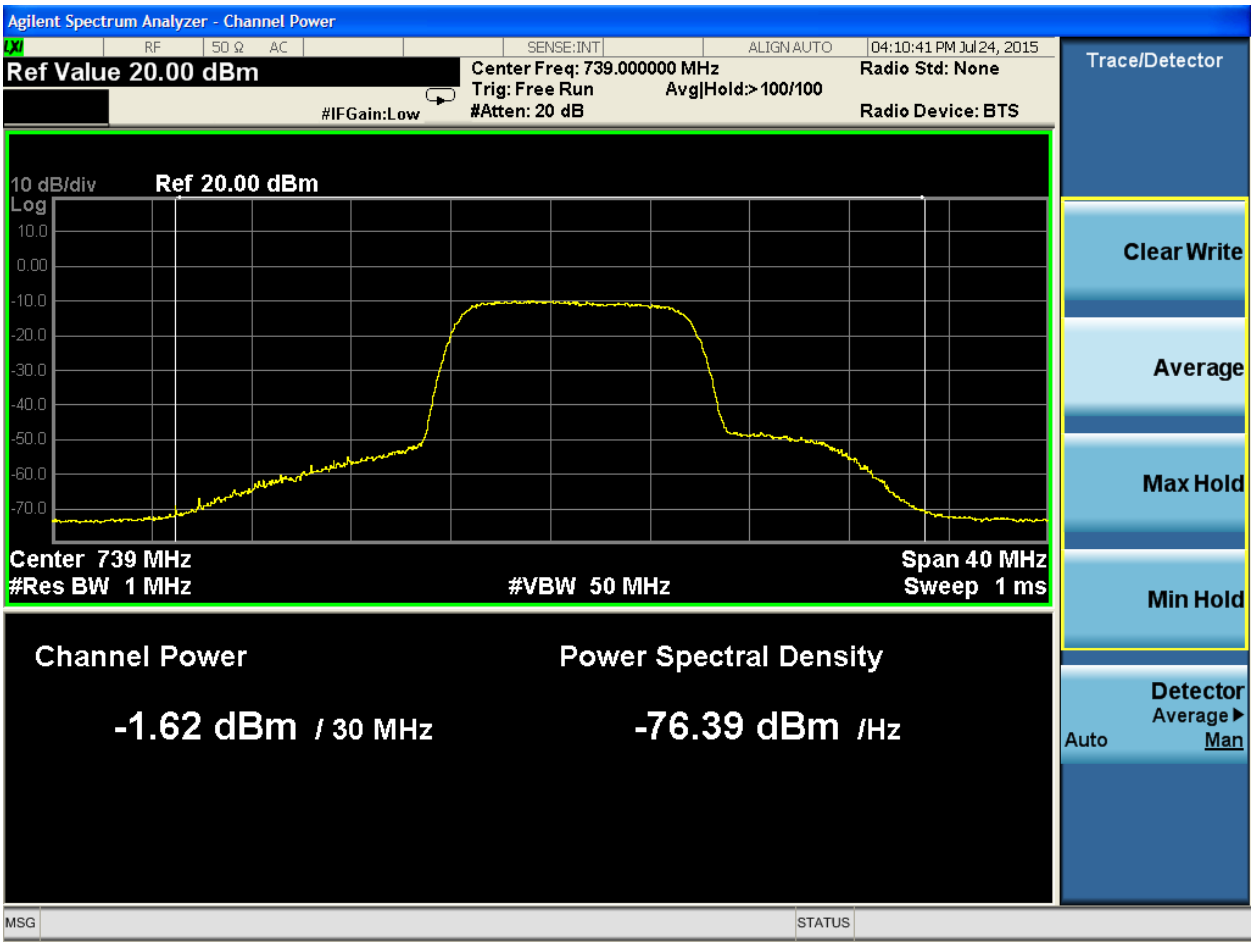


Band 17, High Channel, 16QAM

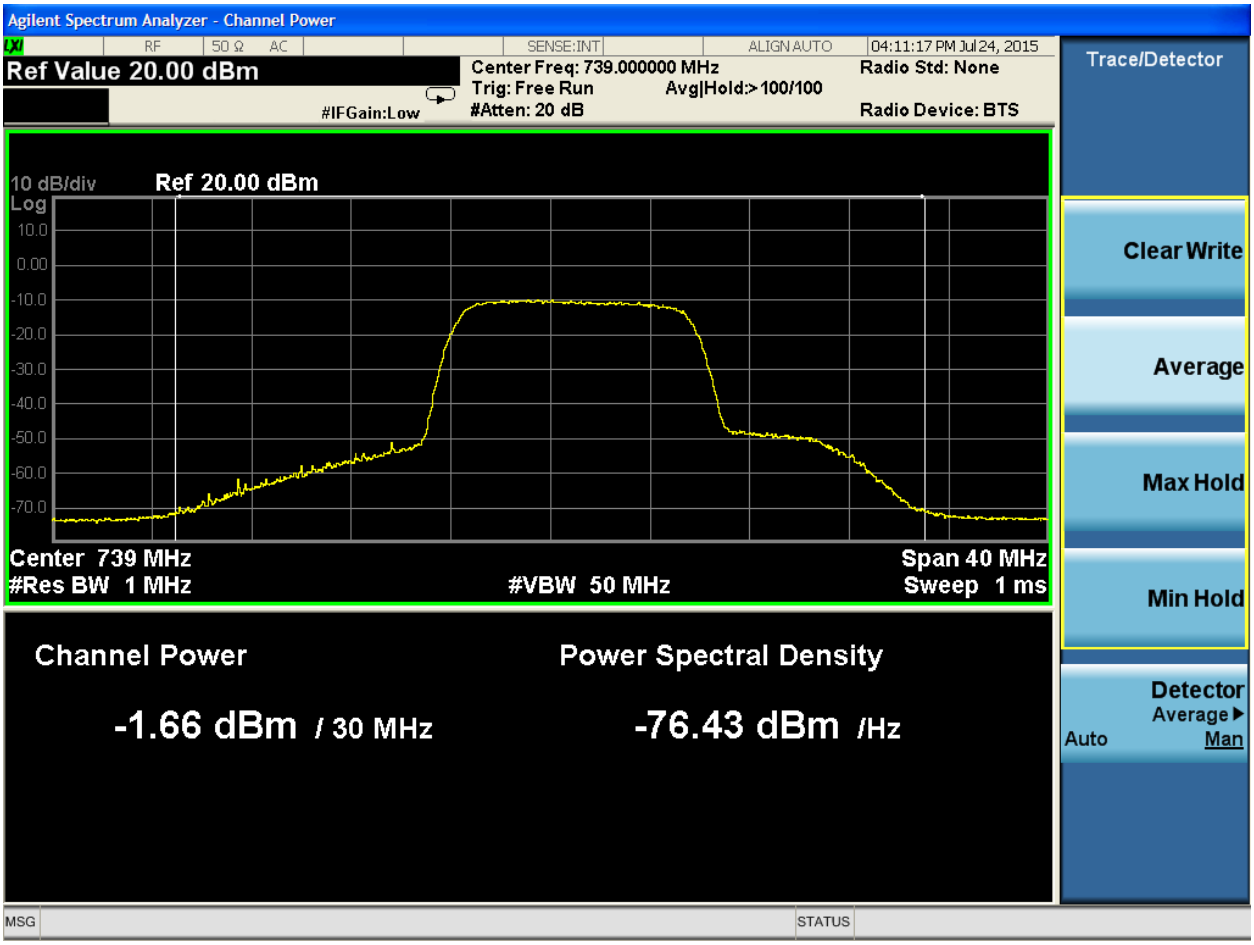


Band 17, High Channel, 64QAM

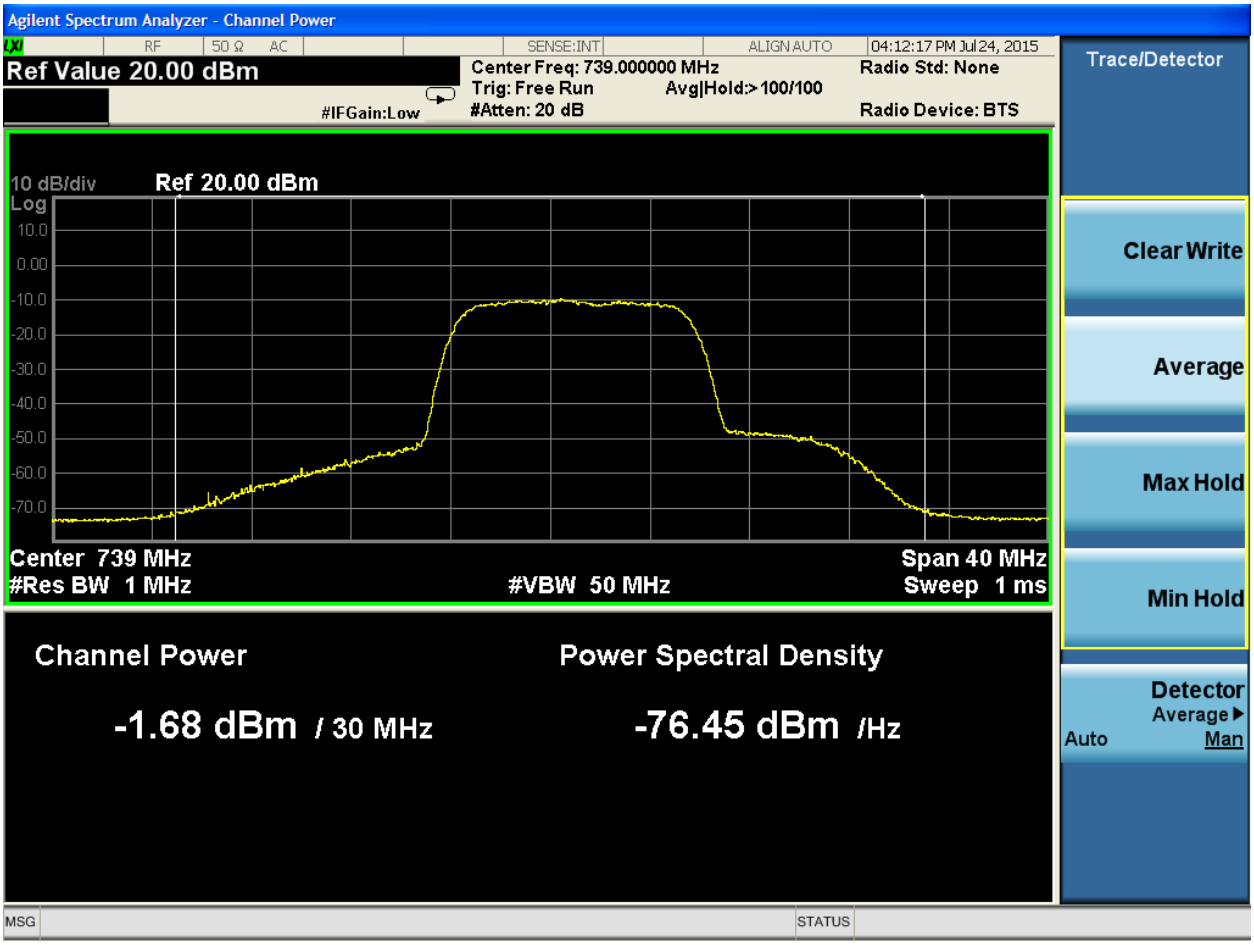
Band 17 Average Readings:



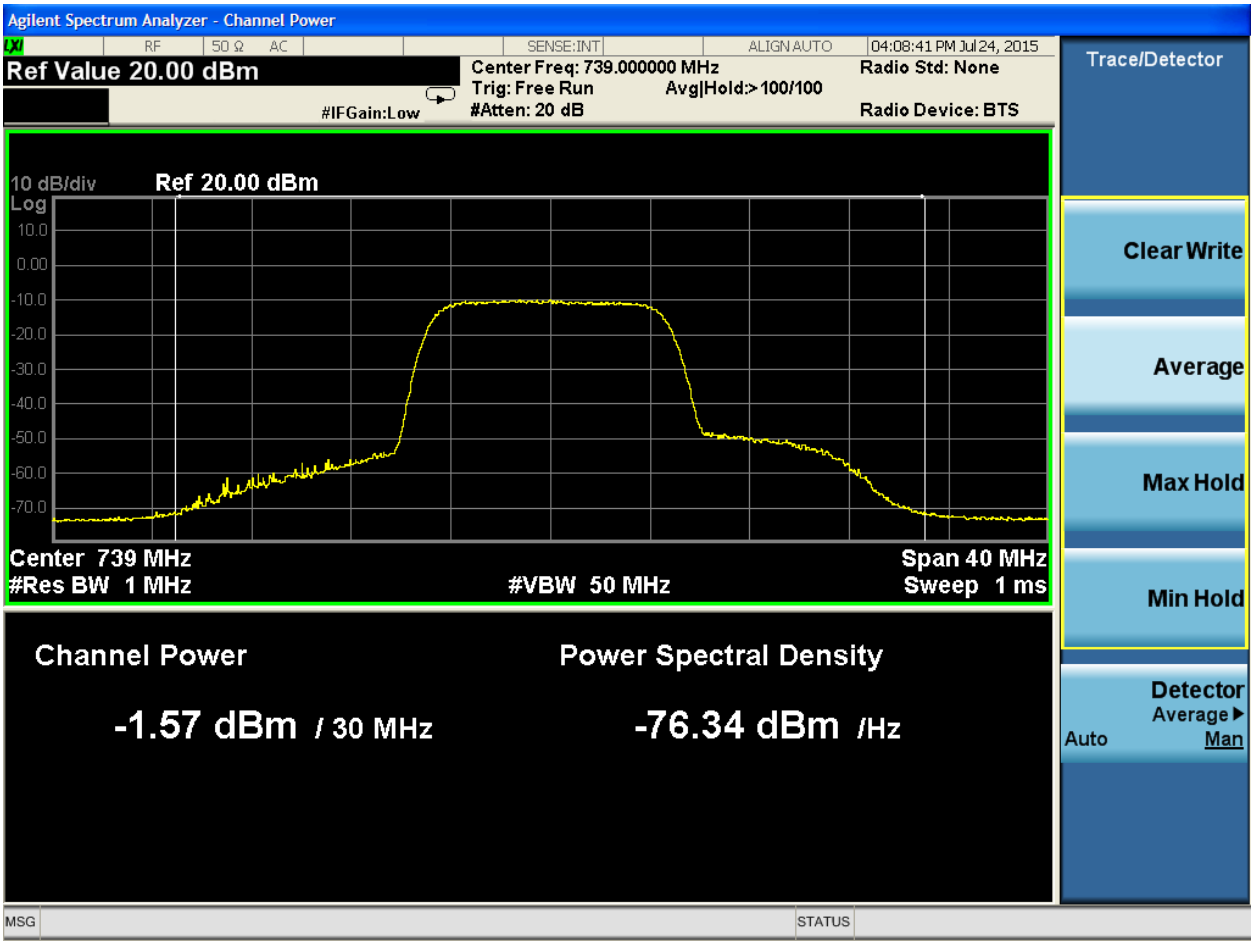
Band 17, Mid Channel, QPSK



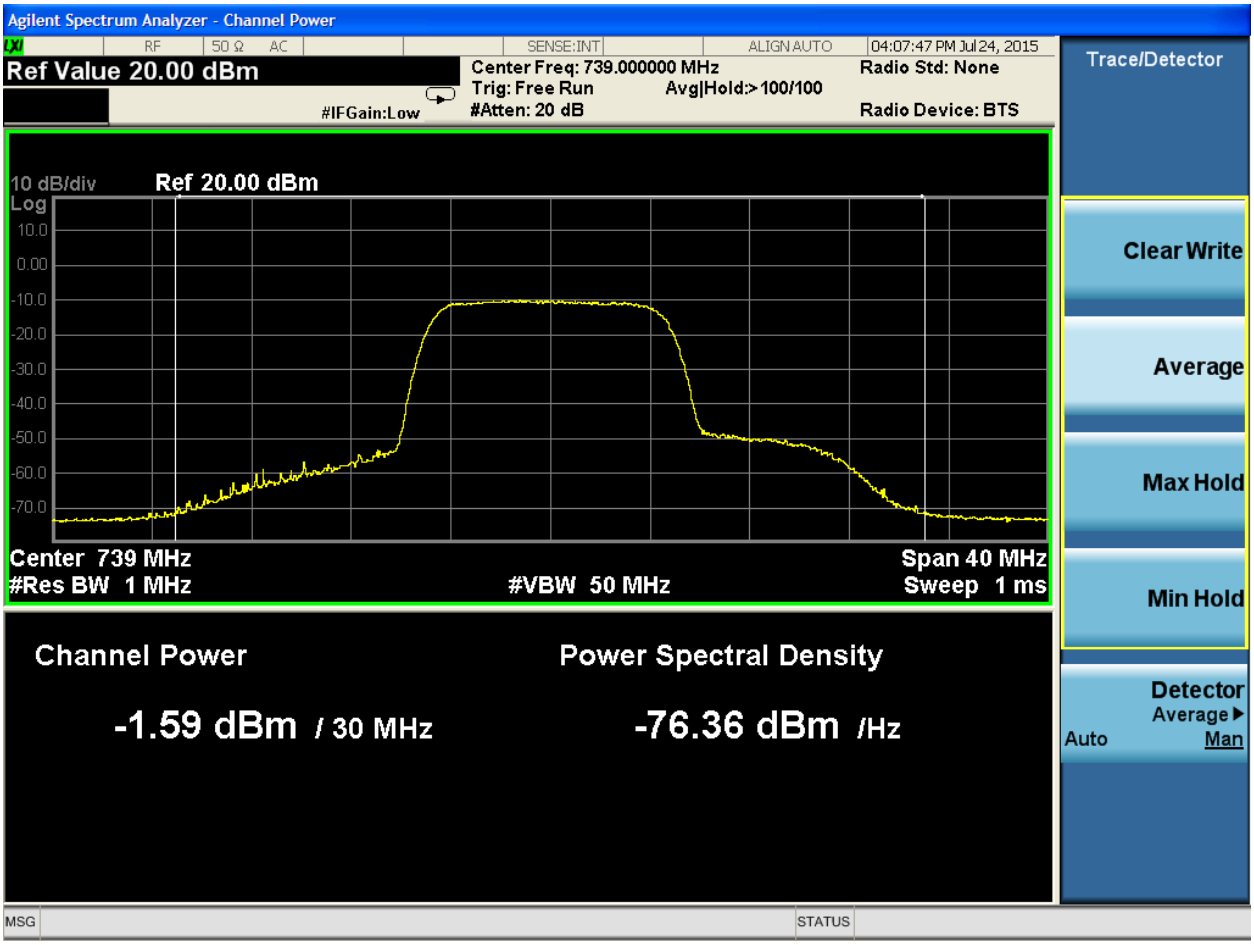
Band 17, Mid Channel, 16QAM



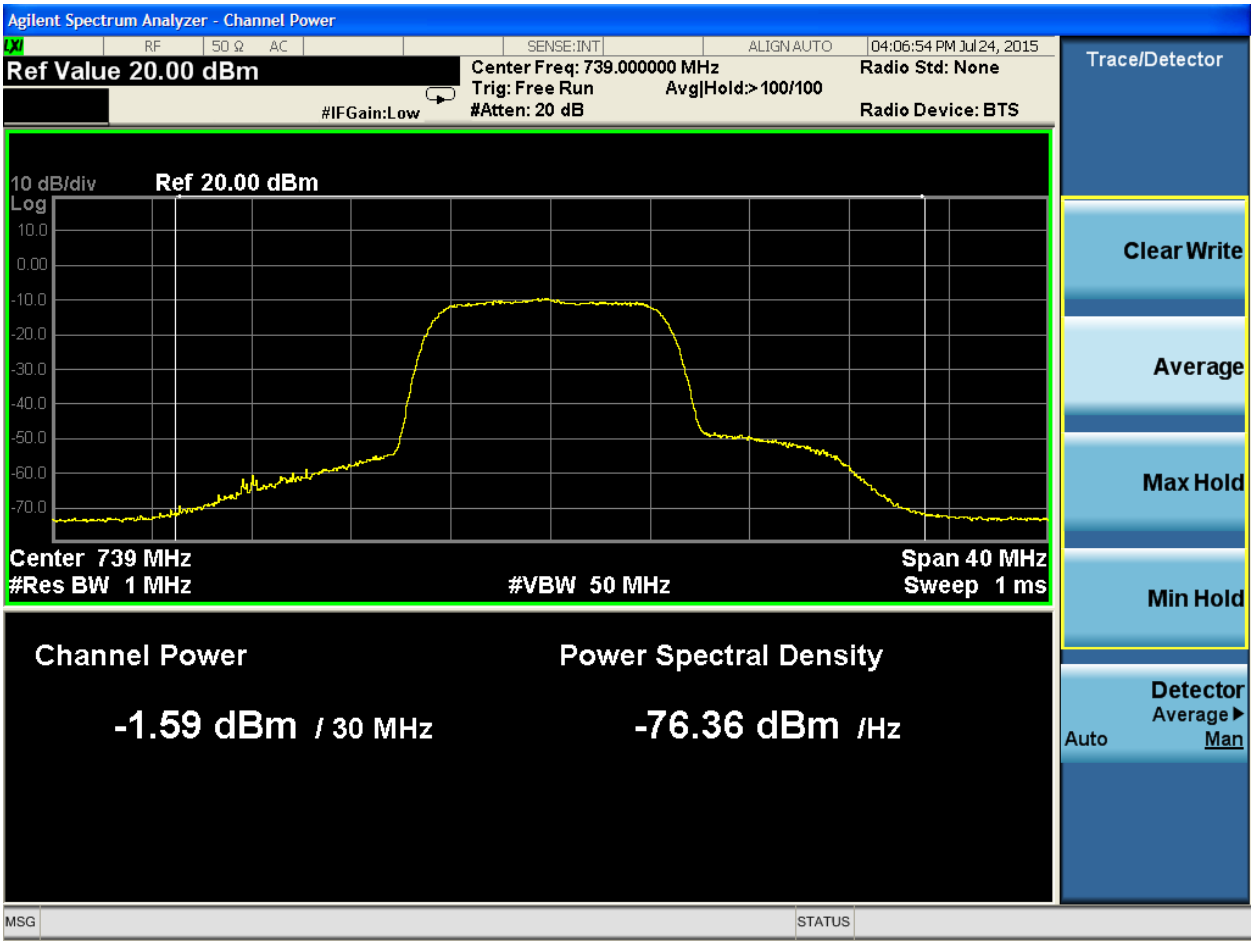
Band 17, Mid Channel, 64QAM



Band 17, High Channel, QPSK



Band 17, High Channel, 16QAM



Band 17, High Channel, 64QAM

Band Edge Measurements

LIMITS

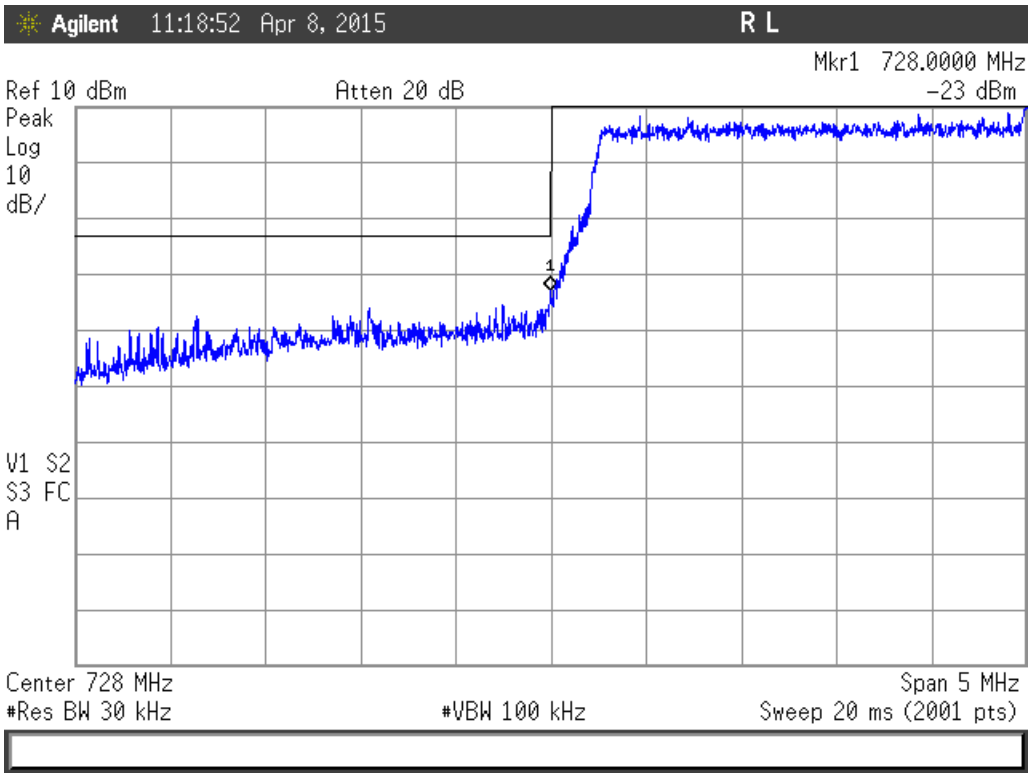
FCC 27.53(g):

> *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.*

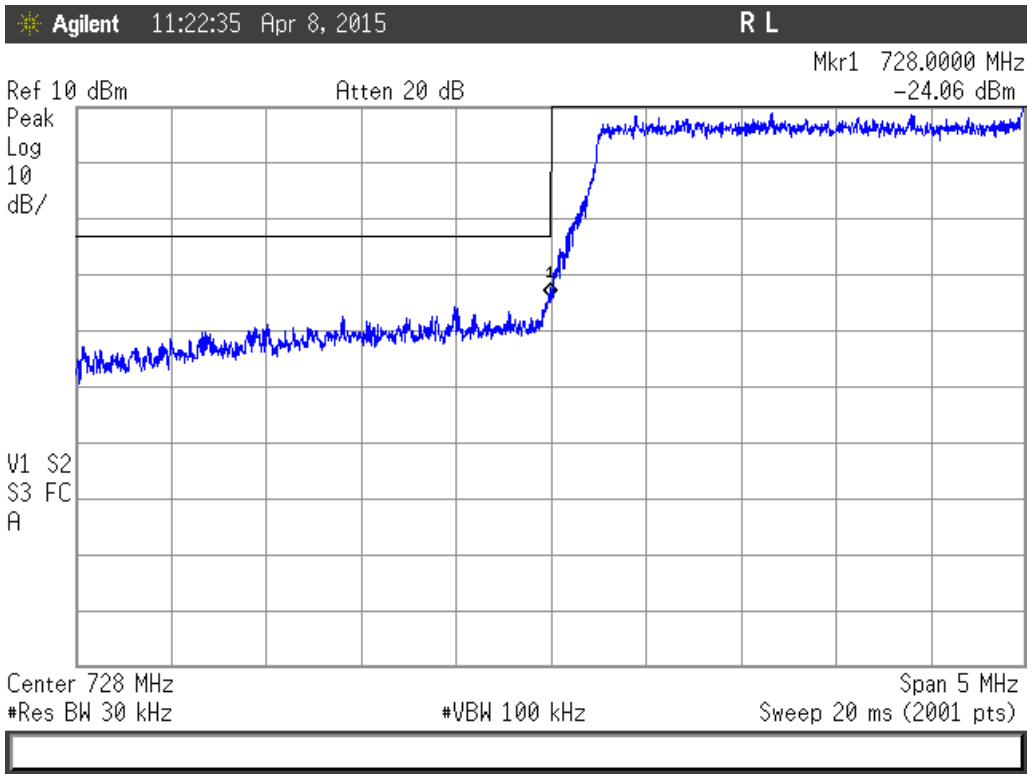
MEASUREMENTS / RESULTS

Note: Mask lines are set to -13dBm.

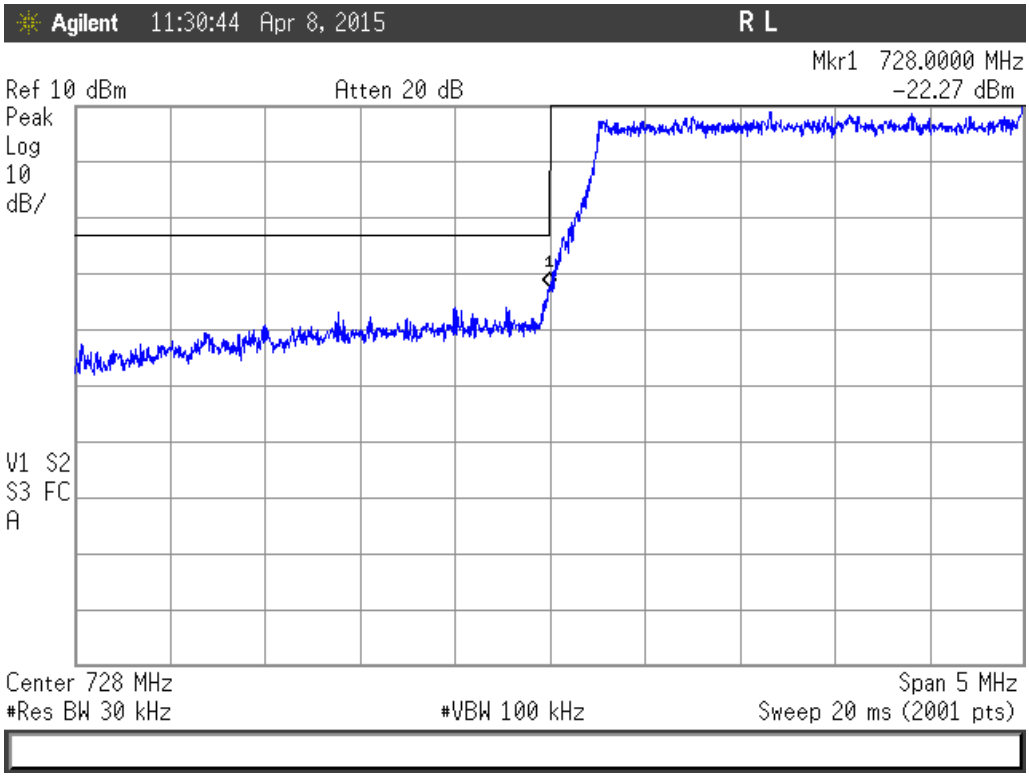
Spectrum analyzer screen plots are shown on the following pages.



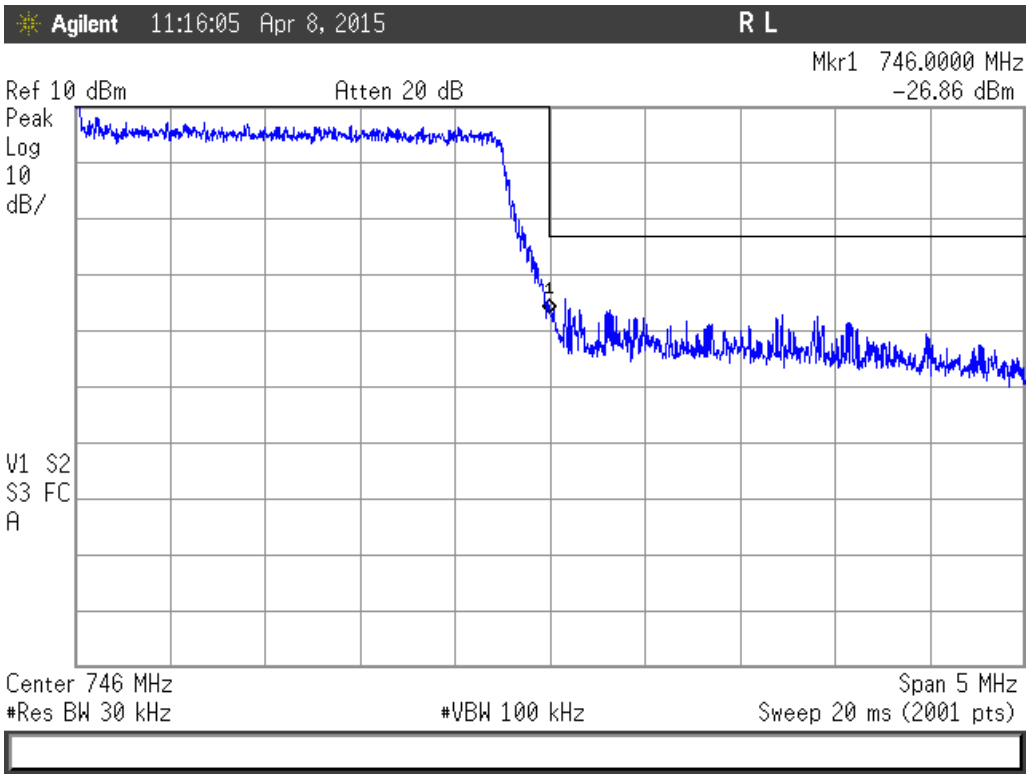
Lower Band Edge - Band 12 – 5MHz BW – QPSK – Port J1



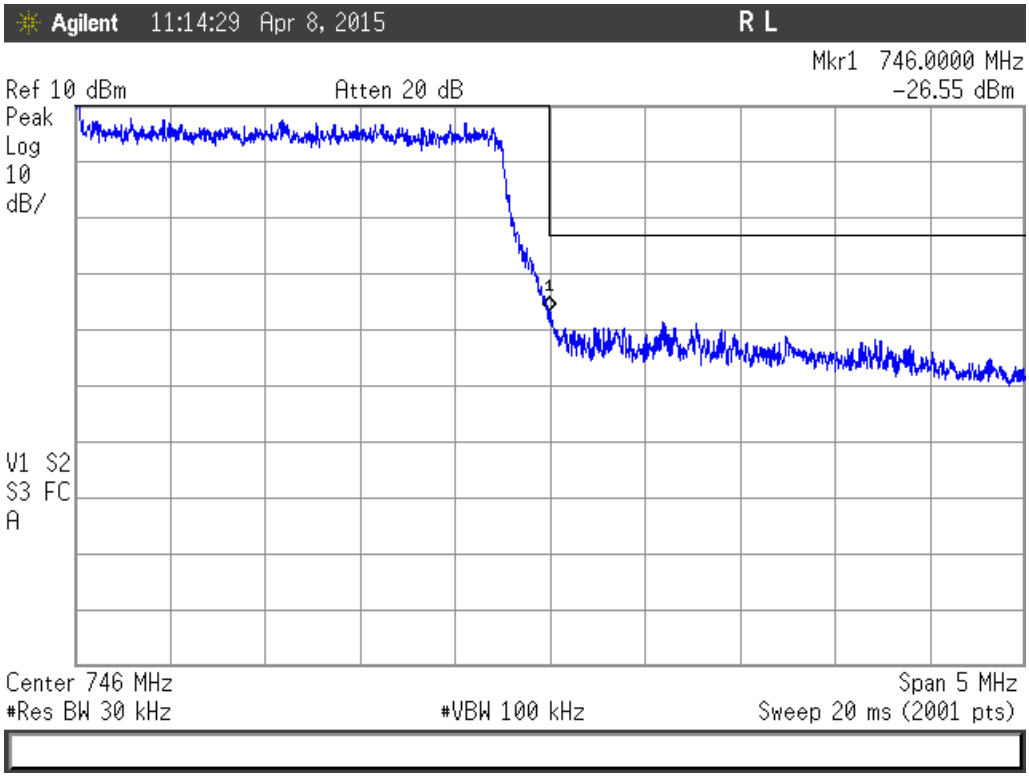
Lower Band Edge - Band 12 – 5MHz BW – 16QAM – Port J1



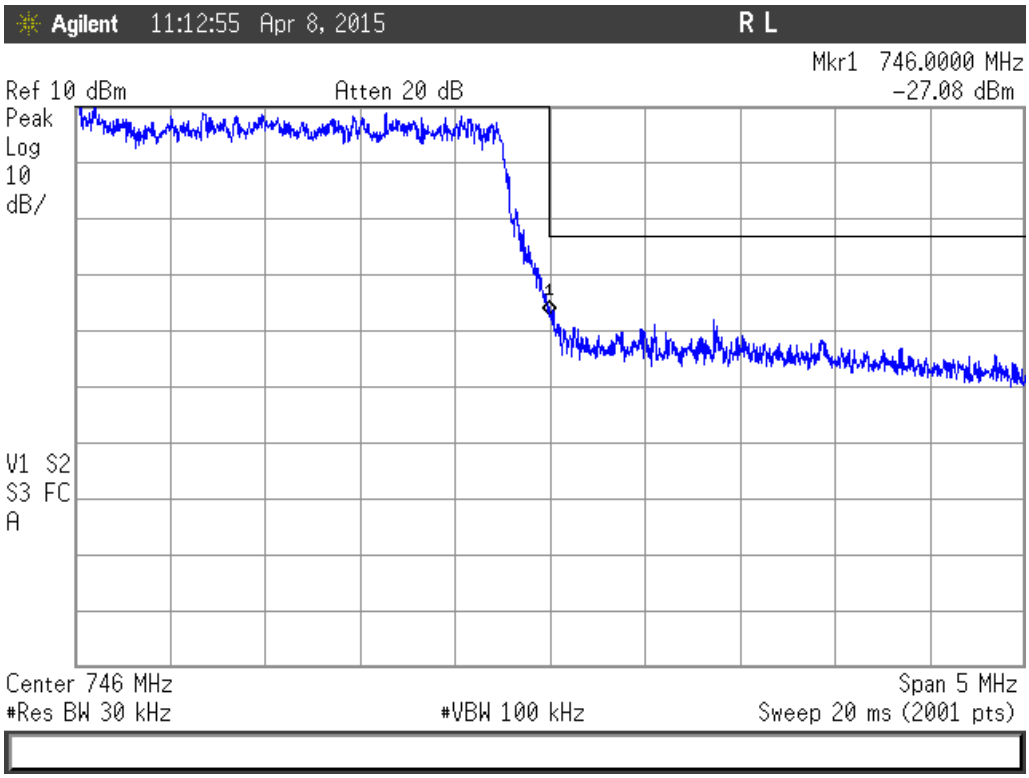
Lower Band Edge - Band 12 – 5MHz BW – 64QAM – Port J1



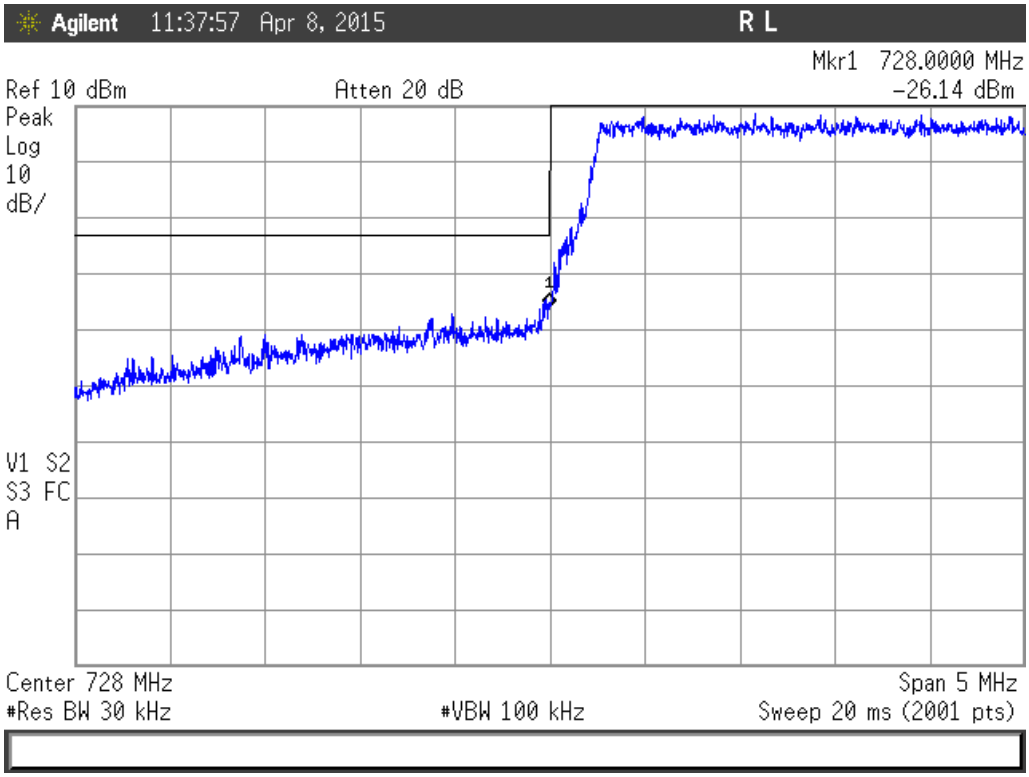
Upper Band Edge - Band 12 – 5MHz BW – QPSK – Port J1



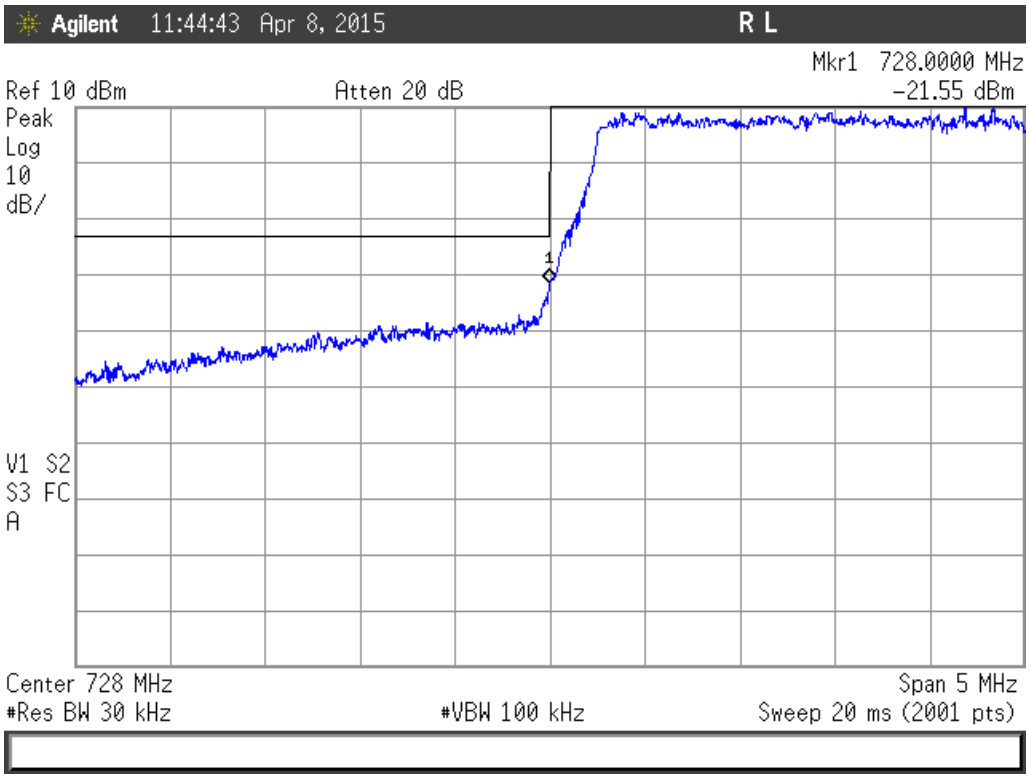
Upper Band Edge - Band 12 – 5MHz BW – 16QAM – Port J1



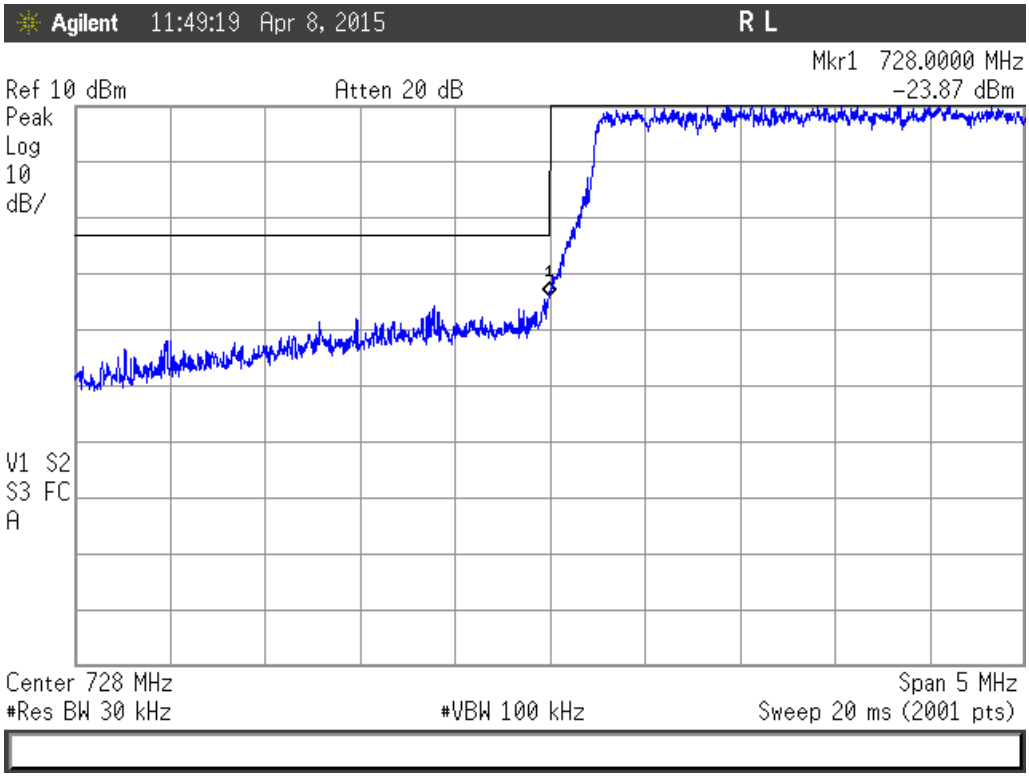
Upper Band Edge - Band 12 – 5MHz BW – 64QAM – Port J1



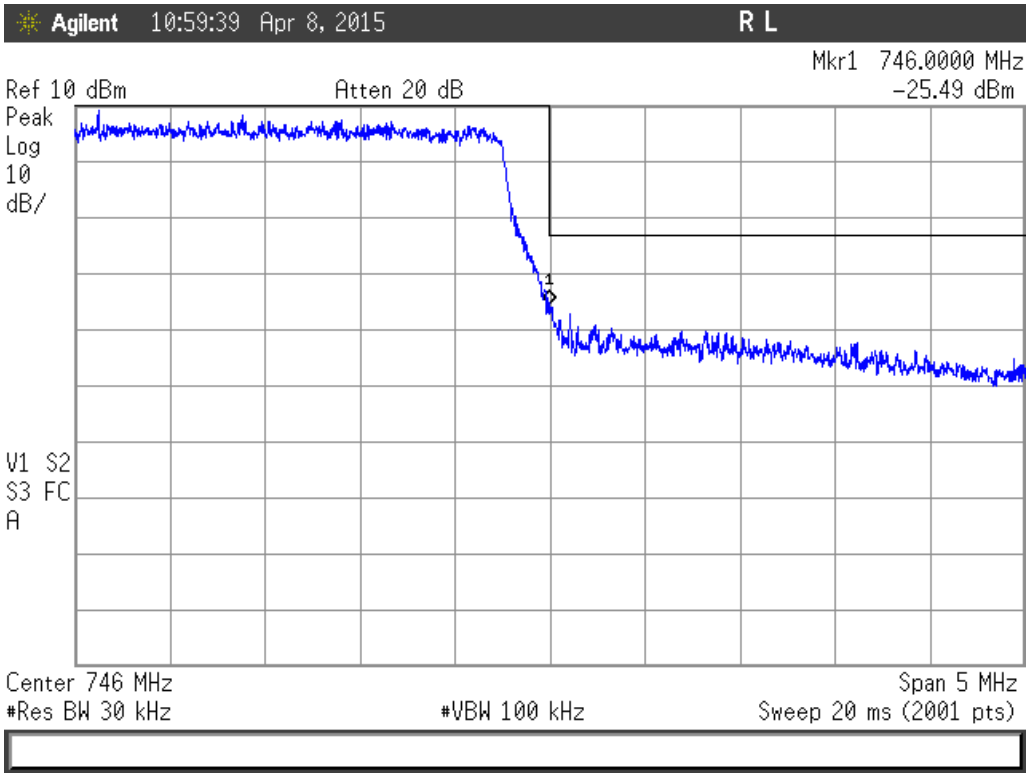
Lower Band Edge - Band 12 – 5MHz BW – QPSK – Port J2



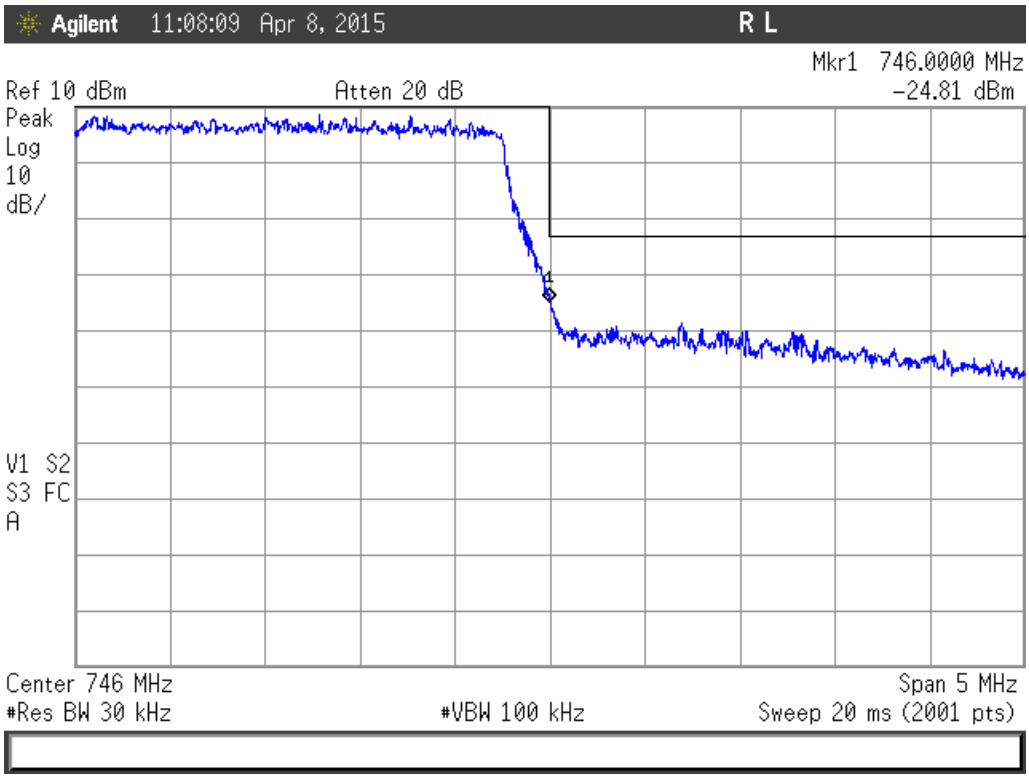
Lower Band Edge - Band 12 – 5MHz BW – 16QAM – Port J2



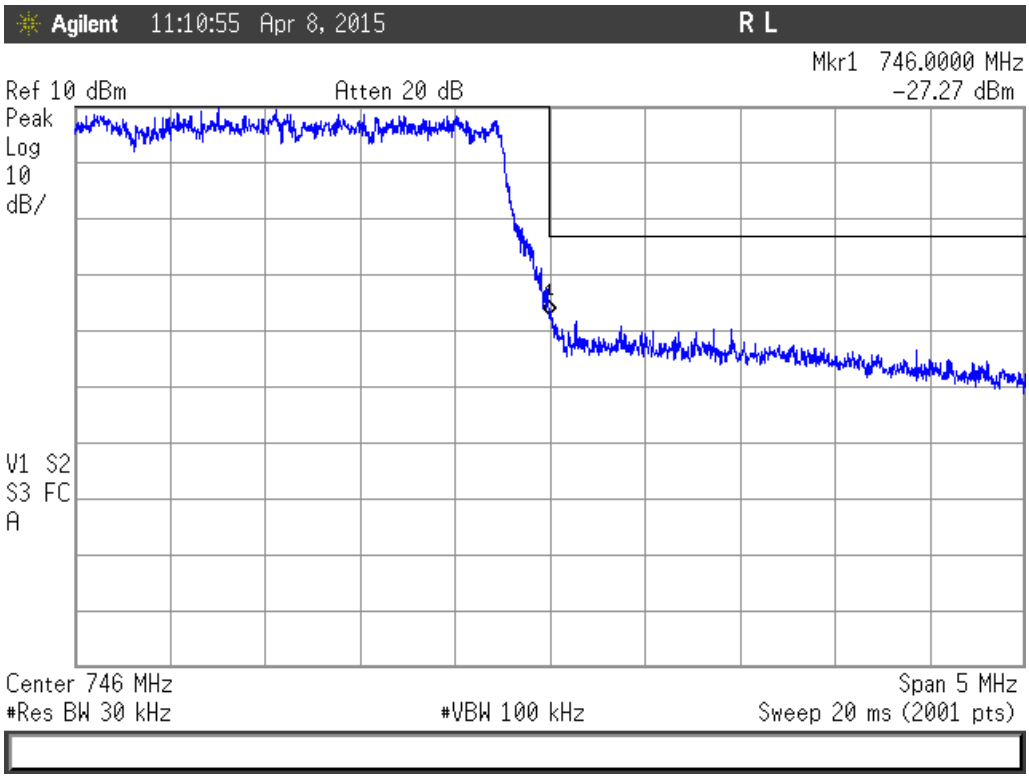
Lower Band Edge - Band 12 – 5MHz BW – 64QAM – Port J2



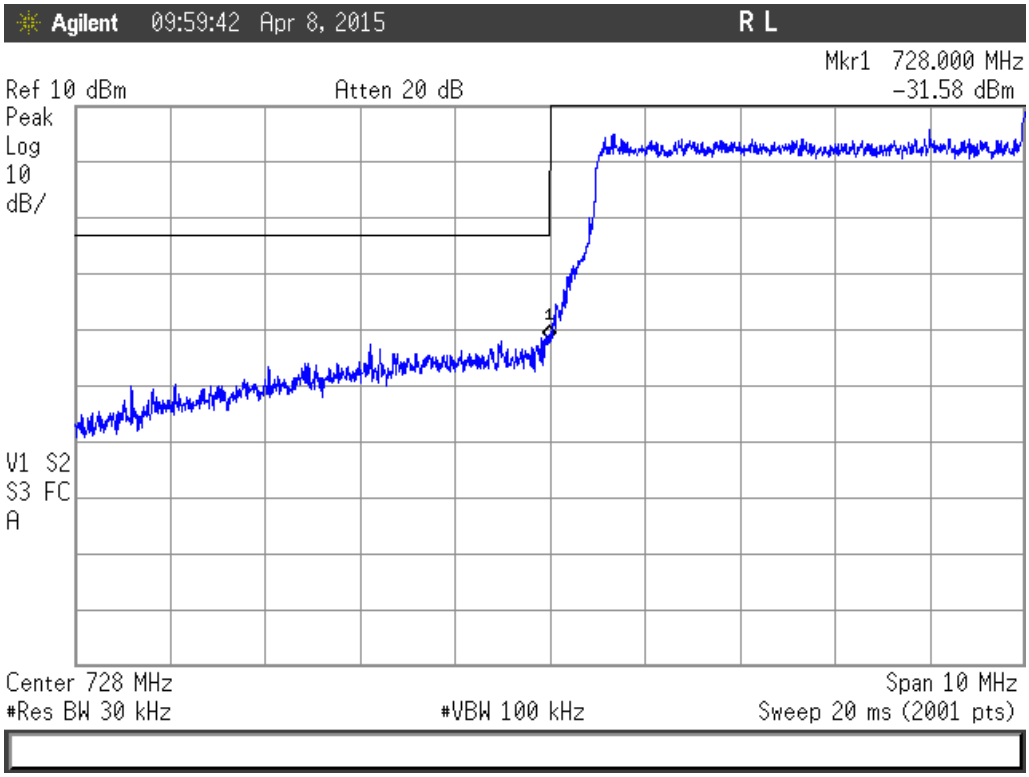
Upper Band Edge - Band 12 – 5MHz BW – QPSK – Port J2



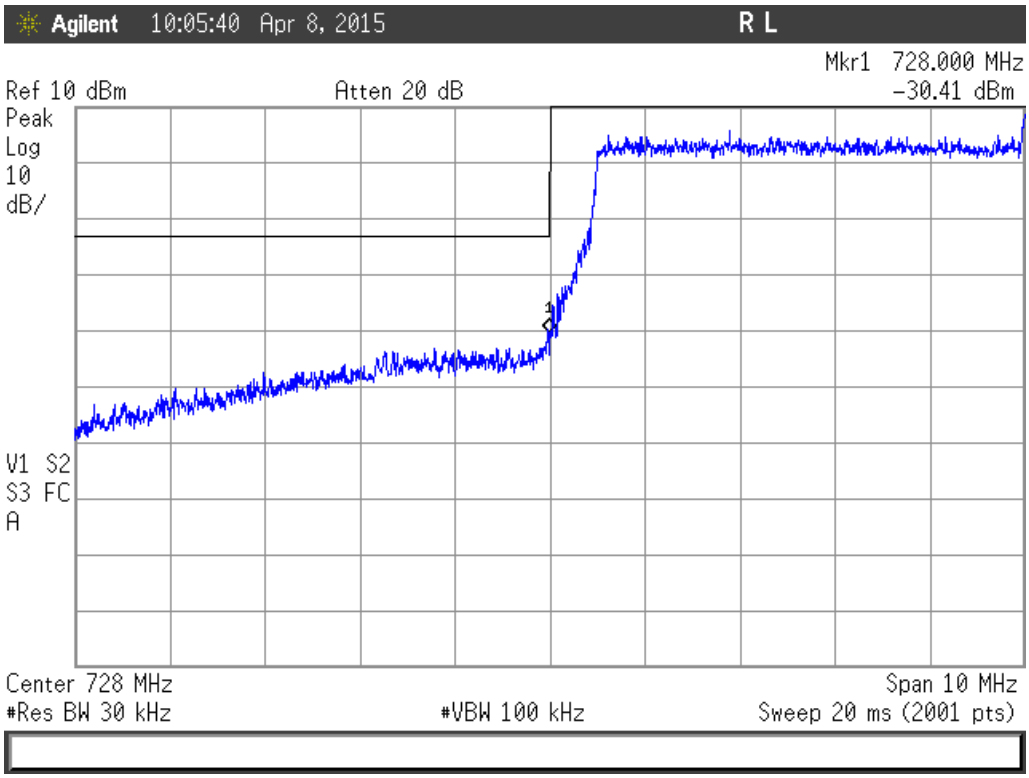
Upper Band Edge - Band 12 – 5MHz BW – 16QAM – Port J2



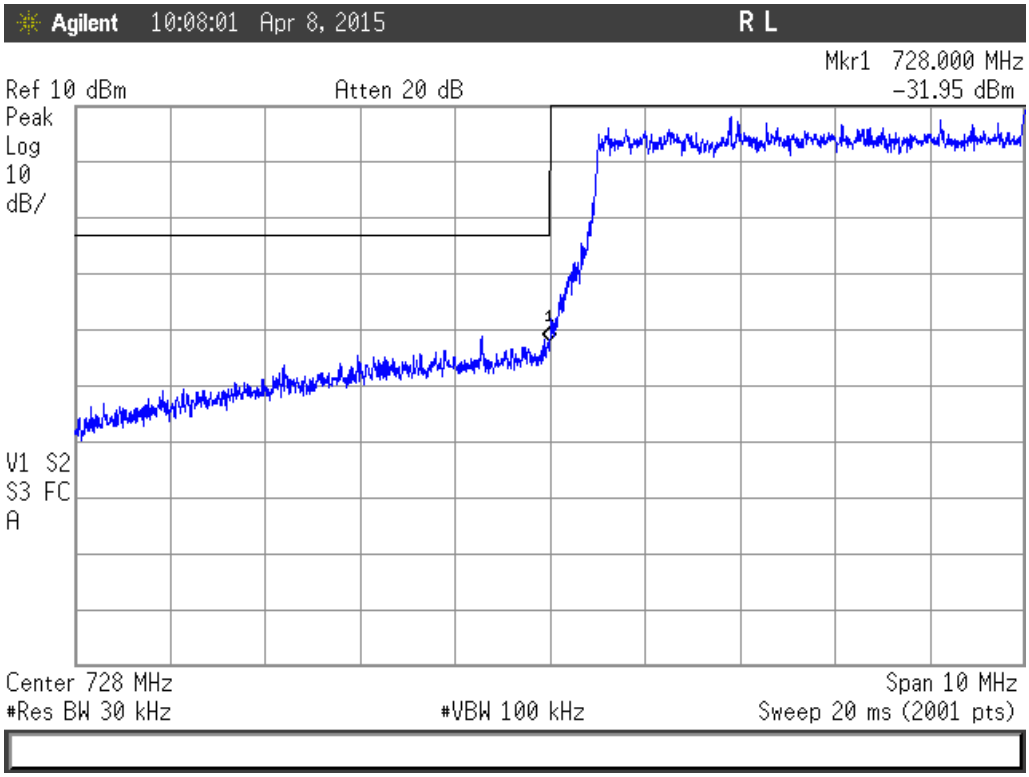
Upper Band Edge - Band 12 – 5MHz BW – 64QAM – Port J2



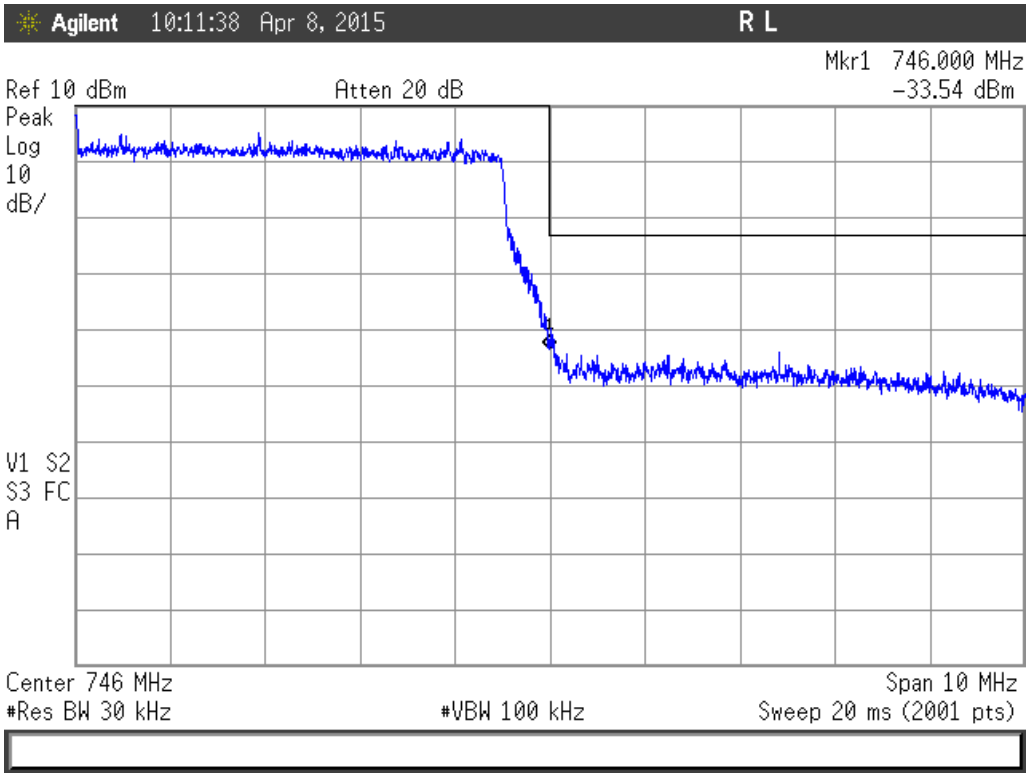
Lower Band Edge - Band 12 – 10MHz BW – QPSK – Port J1



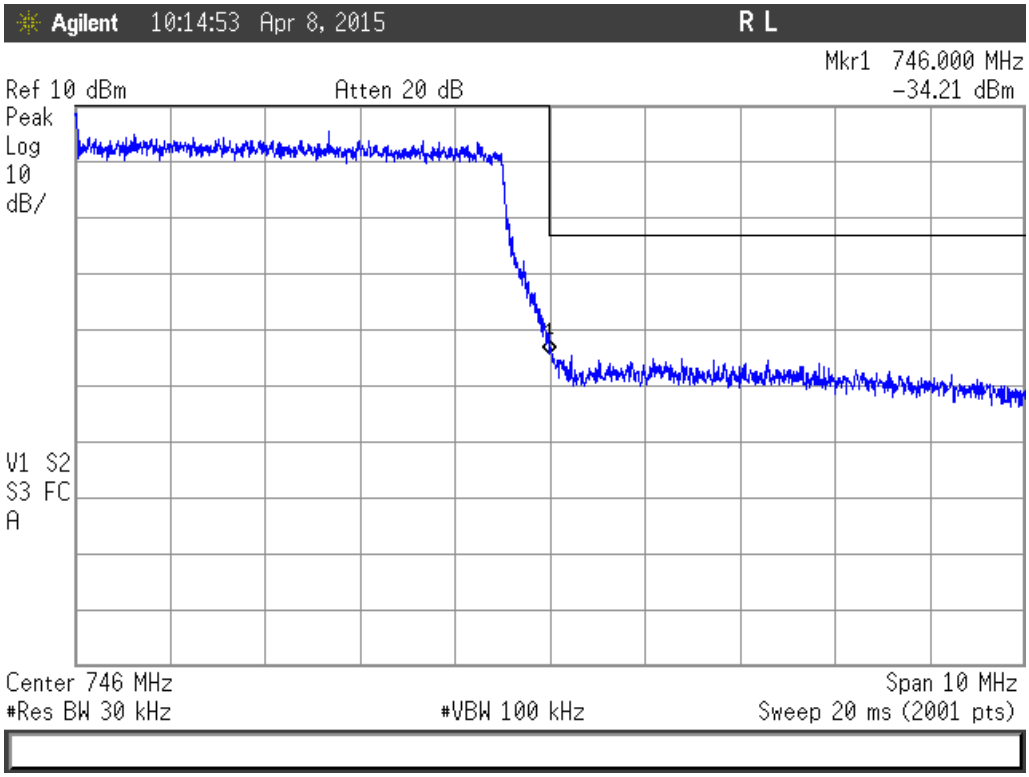
Lower Band Edge - Band 12 – 10MHz BW – 16QAM – Port J1



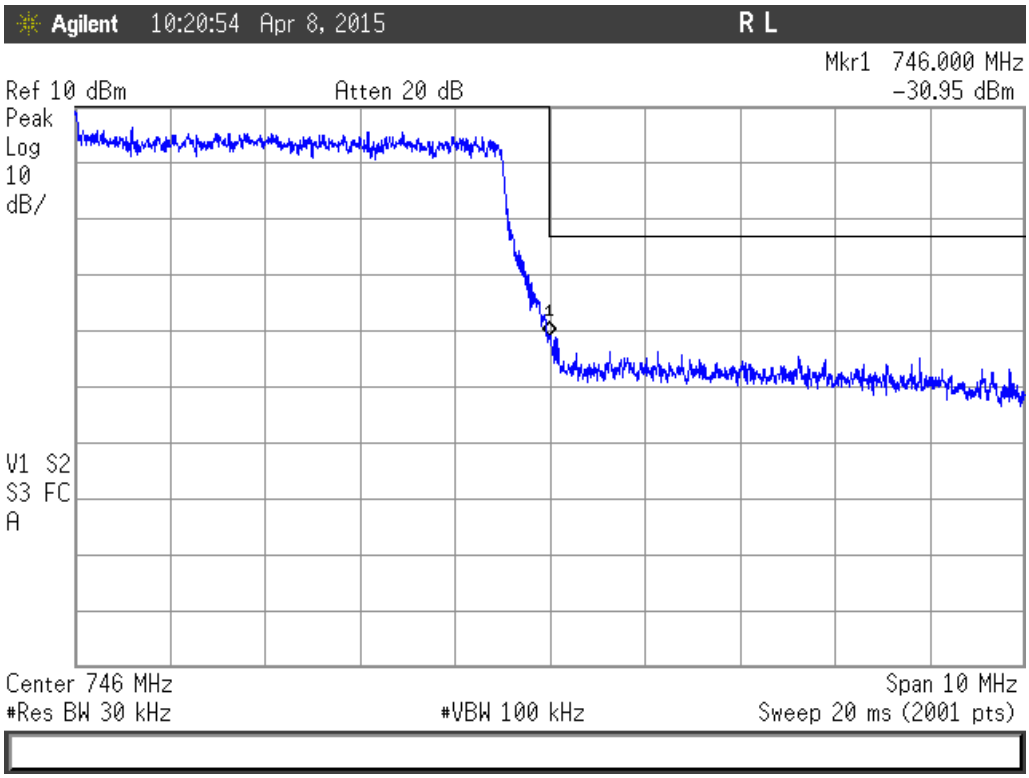
Lower Band Edge - Band 12 – 10MHz BW – 64QAM – Port J1



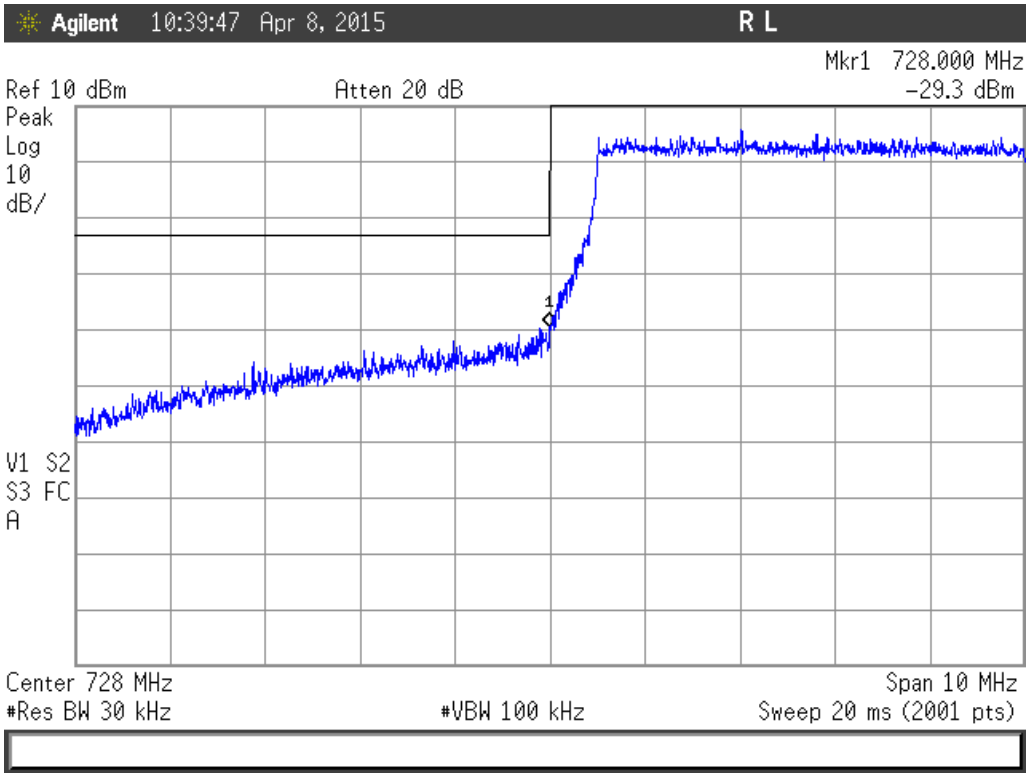
Upper Band Edge - Band 12 – 10MHz BW – QPSK – Port J1



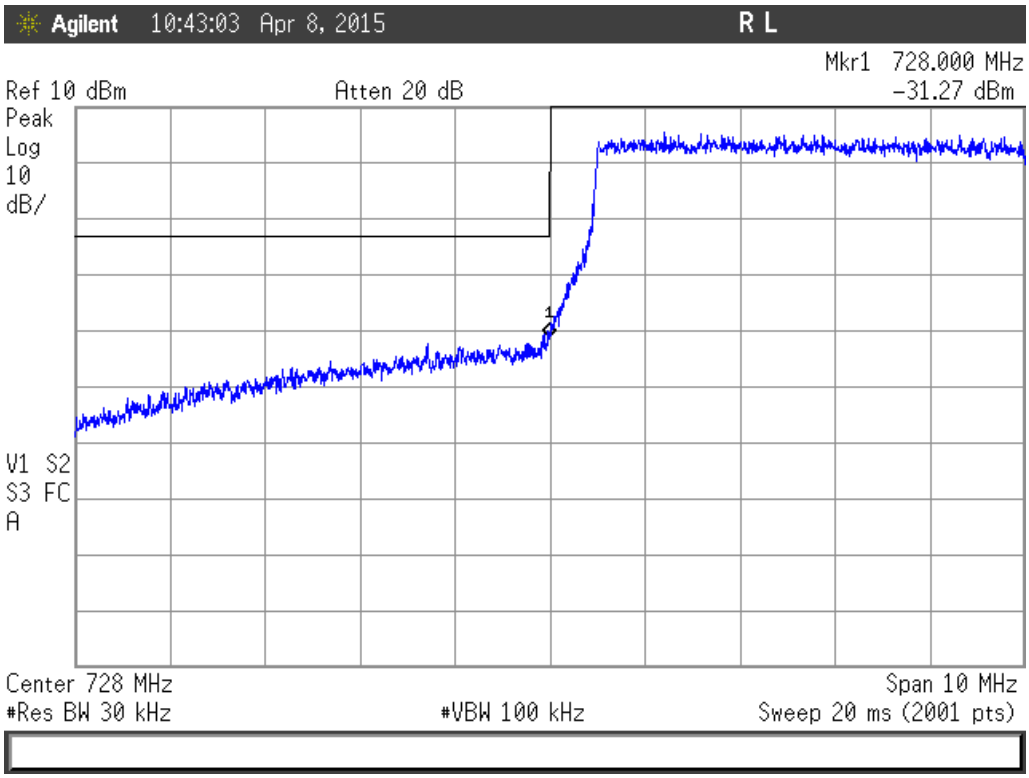
Upper Band Edge - Band 12 – 10MHz BW – 16QAM – Port J1



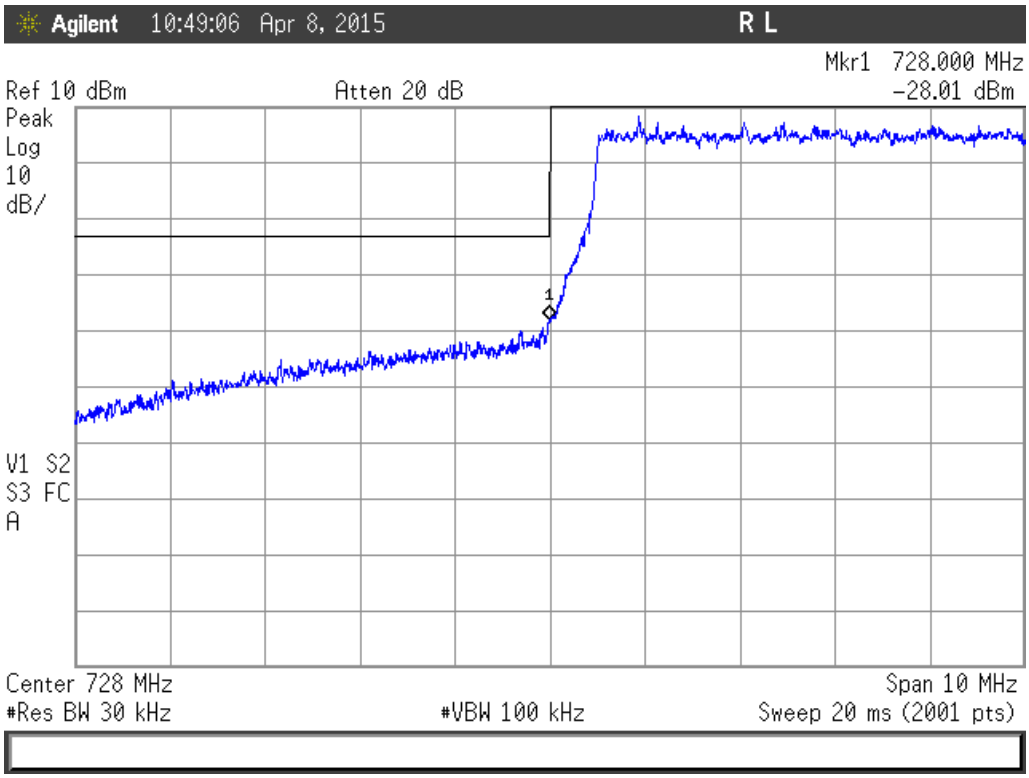
Upper Band Edge - Band 12 – 10MHz BW – 64QAM – Port J1



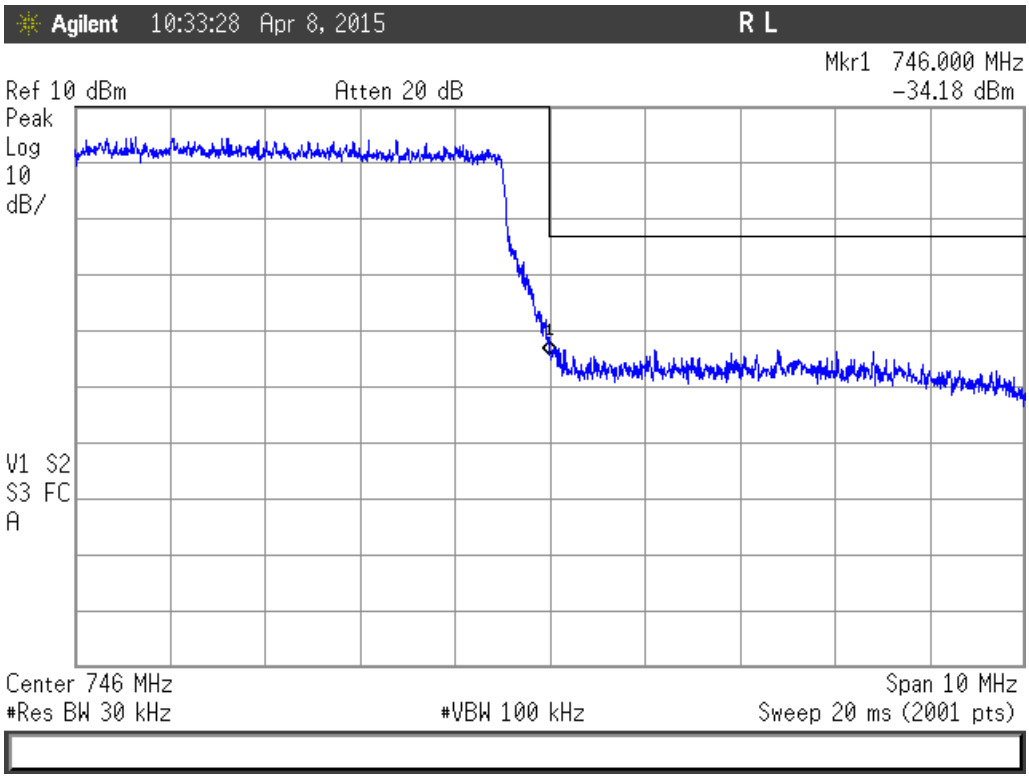
Lower Band Edge - Band 12 – 10MHz BW – QPSK – Port J2



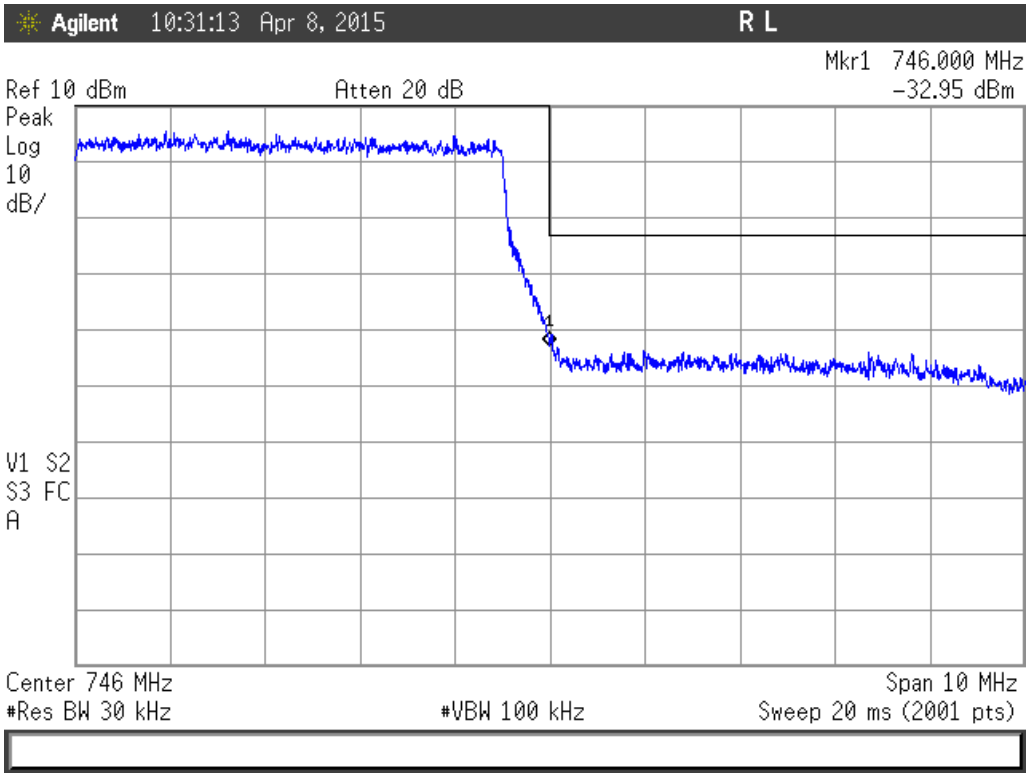
Lower Band Edge - Band 12 – 10MHz BW – 16QAM – Port J2



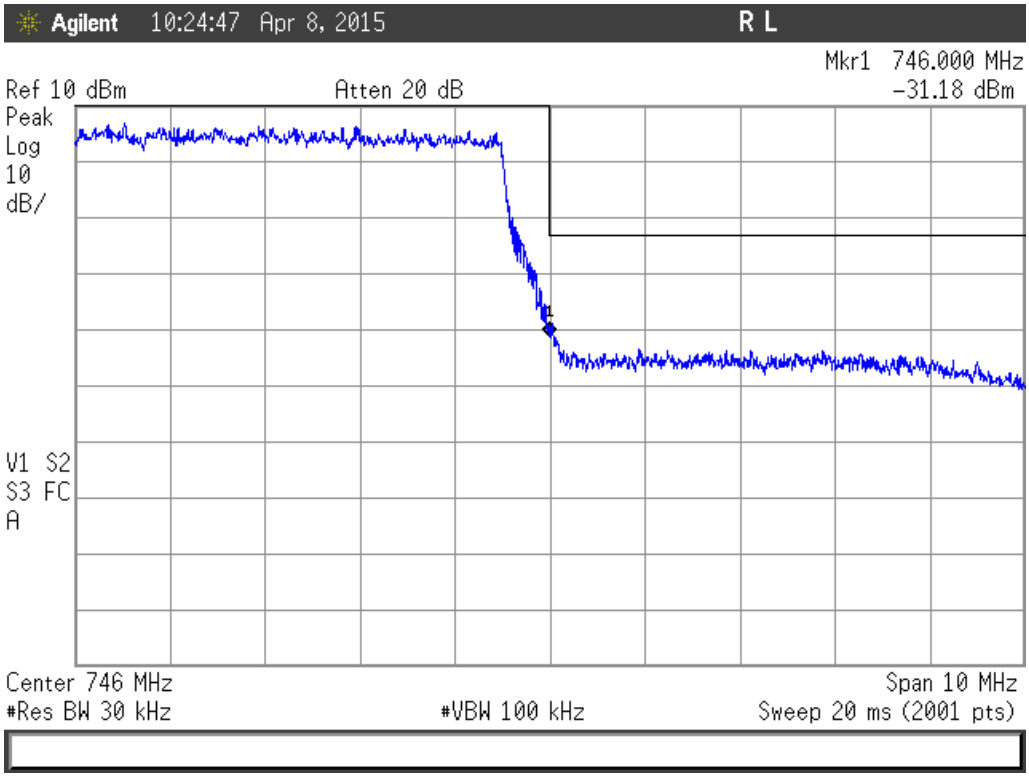
Lower Band Edge - Band 12 – 10MHz BW – 64QAM – J2



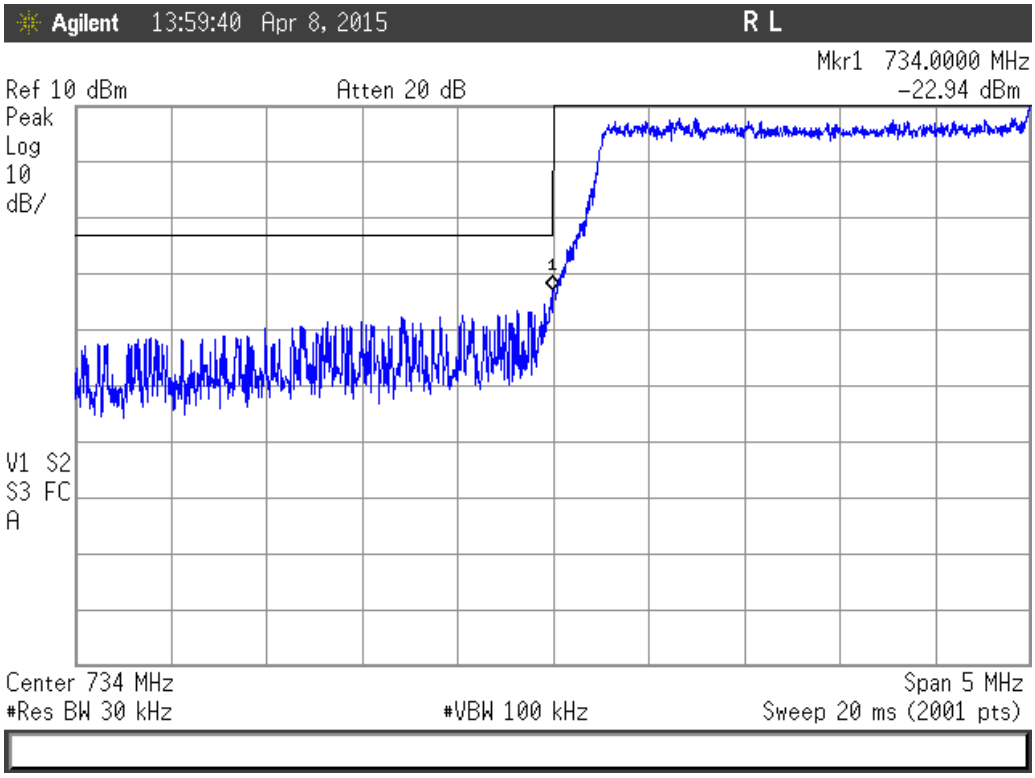
Upper Band Edge - Band 12 – 10MHz BW – QPSK – Port J2



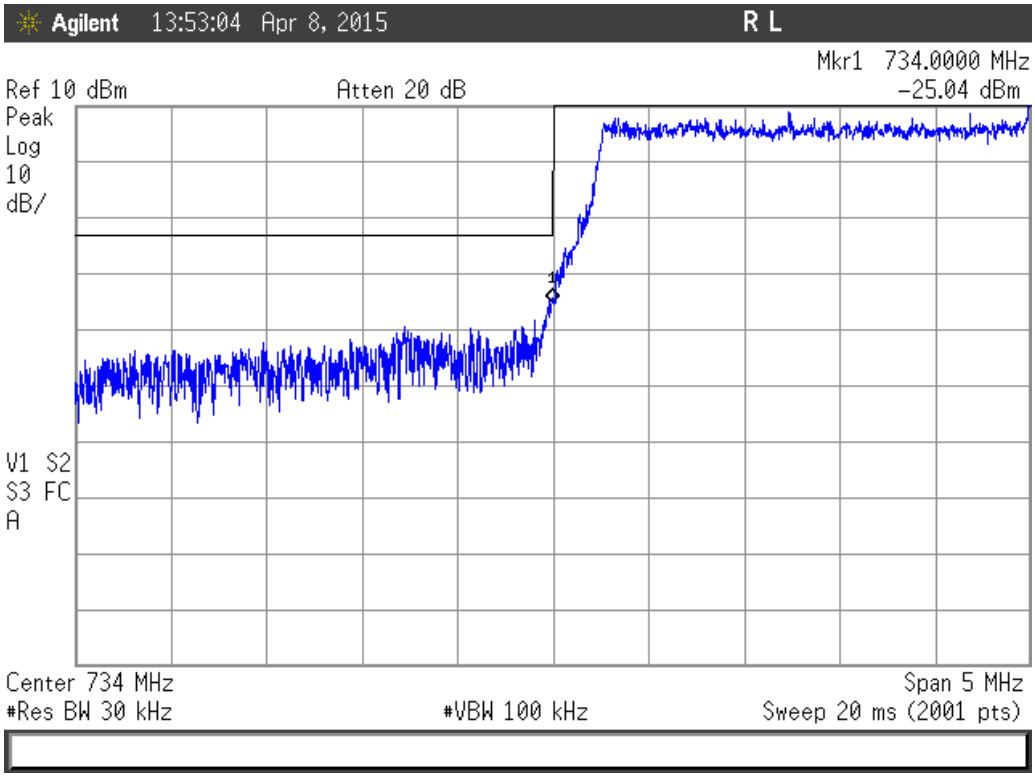
Upper Band Edge - Band 12 – 10MHz BW – 16QAM – Port J2



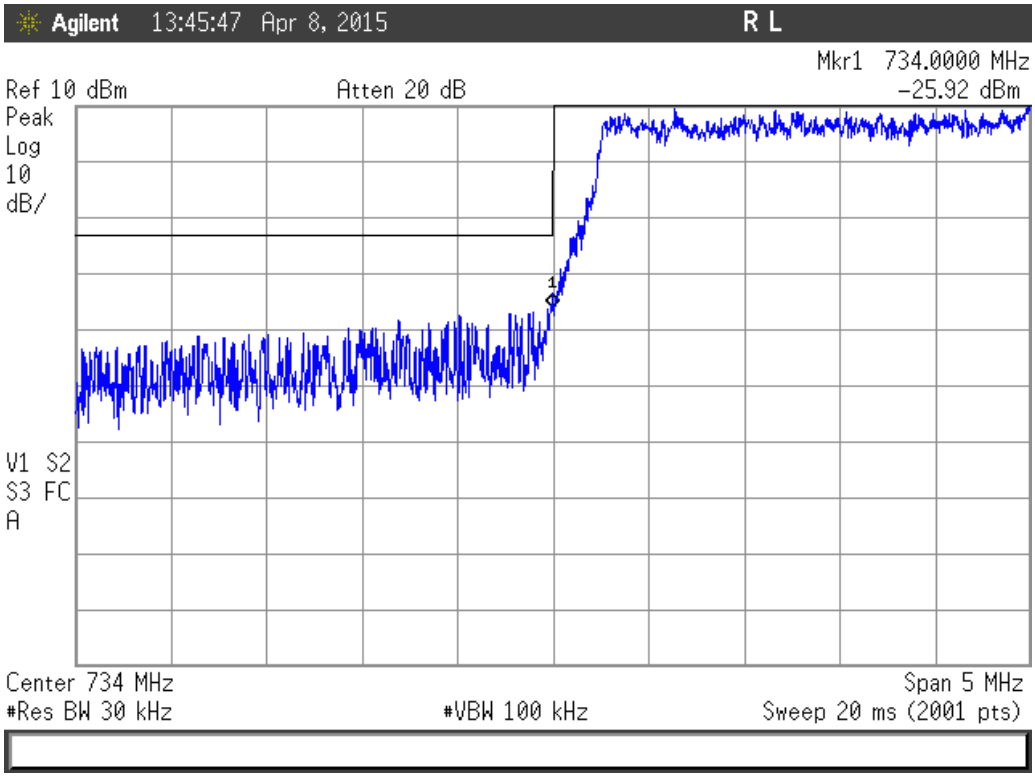
Upper Band Edge - Band 12 – 10MHz BW – 64QAM – Port J2



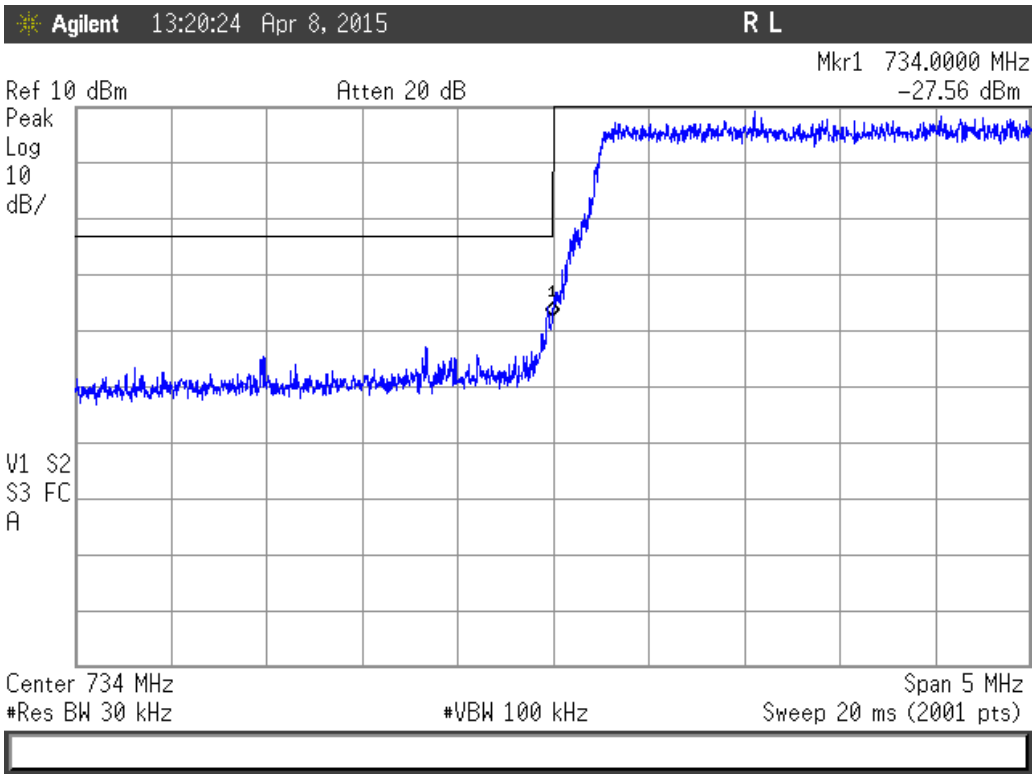
Lower Band Edge - Band 17 – 5MHz BW – QPSK – Port J1



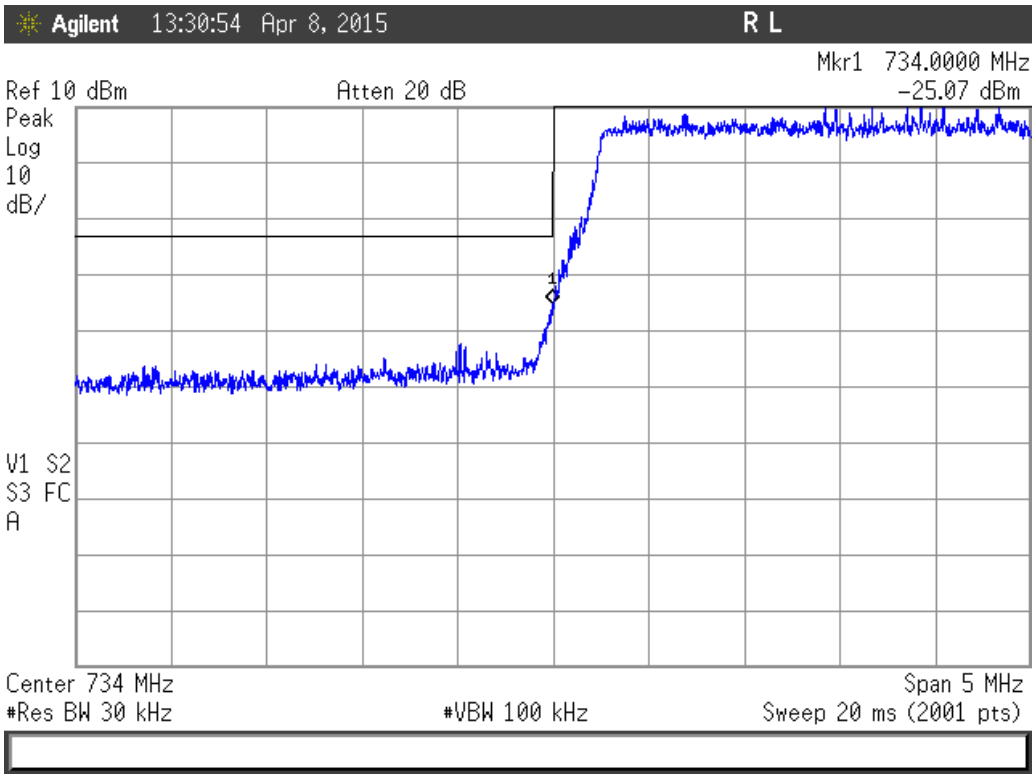
Lower Band Edge - Band 17 – 5MHz BW – 16QAM – Port J1



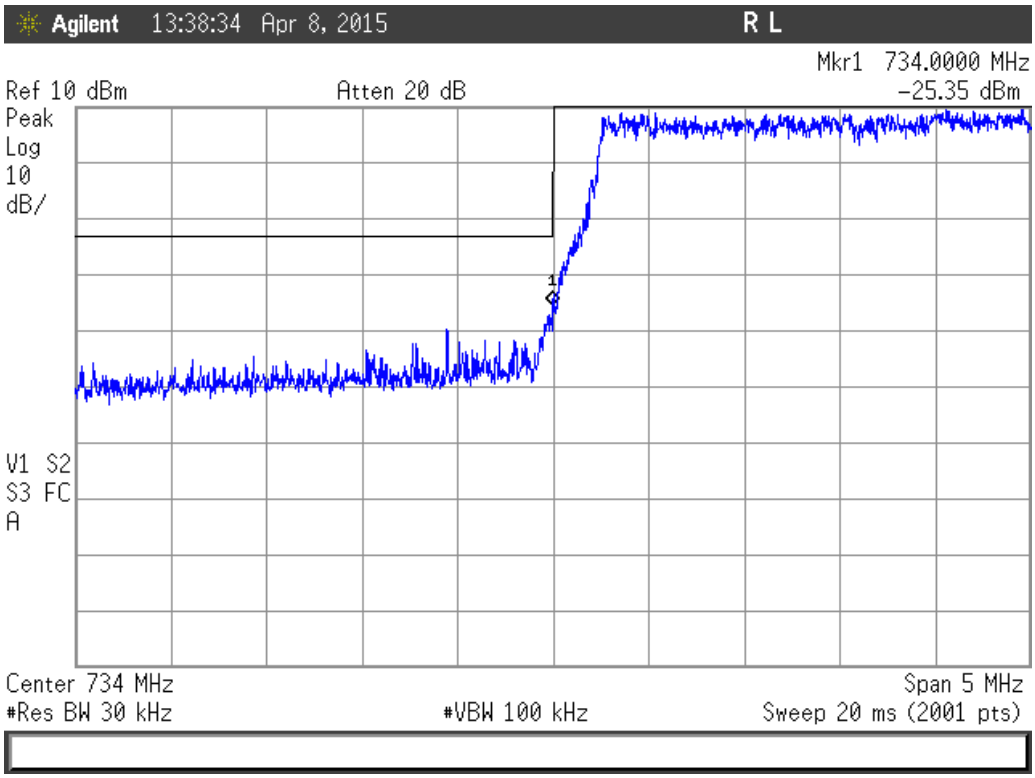
Lower Band Edge - Band 17 – 5MHz BW – 64QAM – Port J1



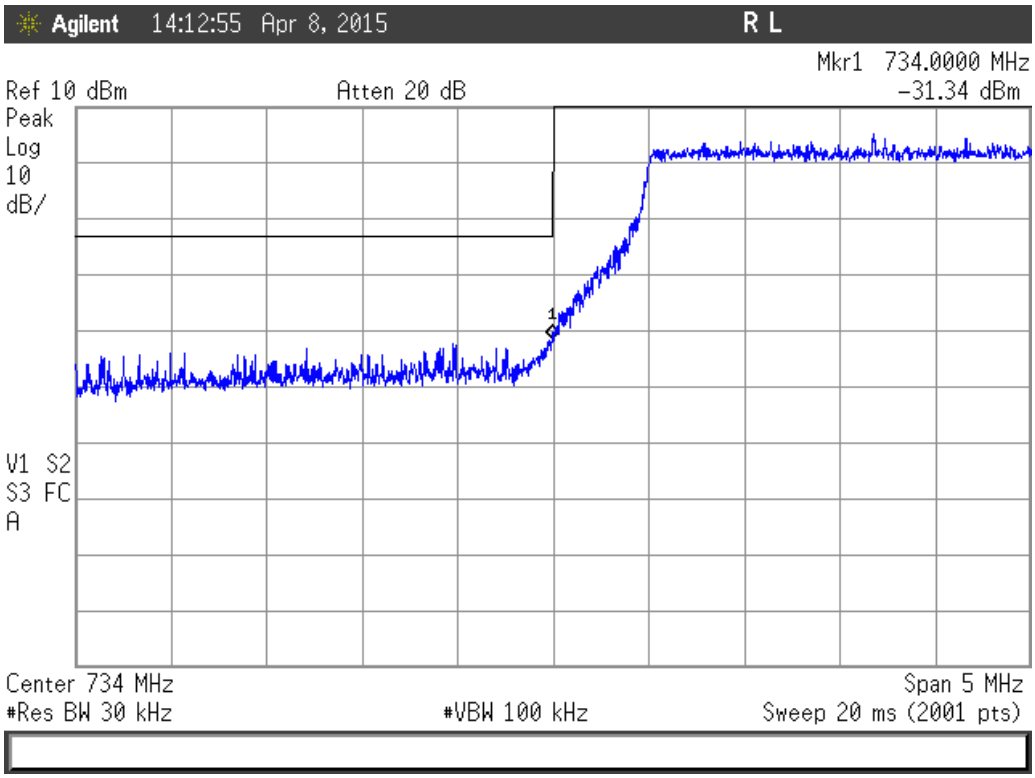
Lower Band Edge - Band 17 – 5MHz BW – QPSK – Port J2



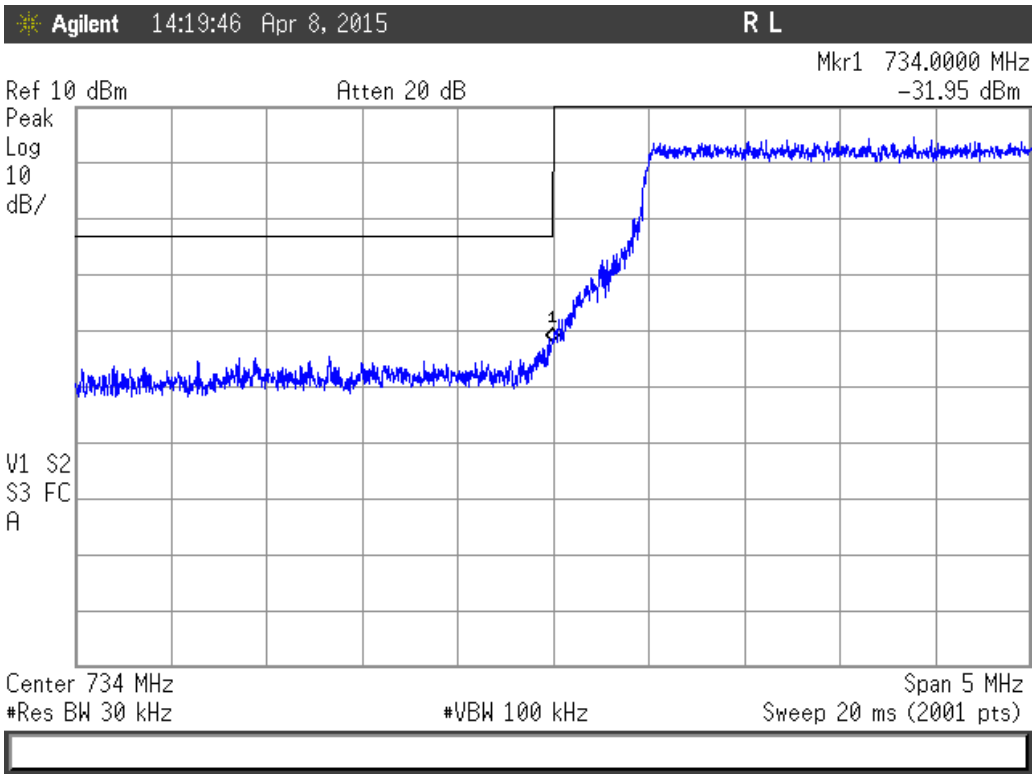
Lower Band Edge - Band 17 – 5MHz BW – 16QAM – Port J2



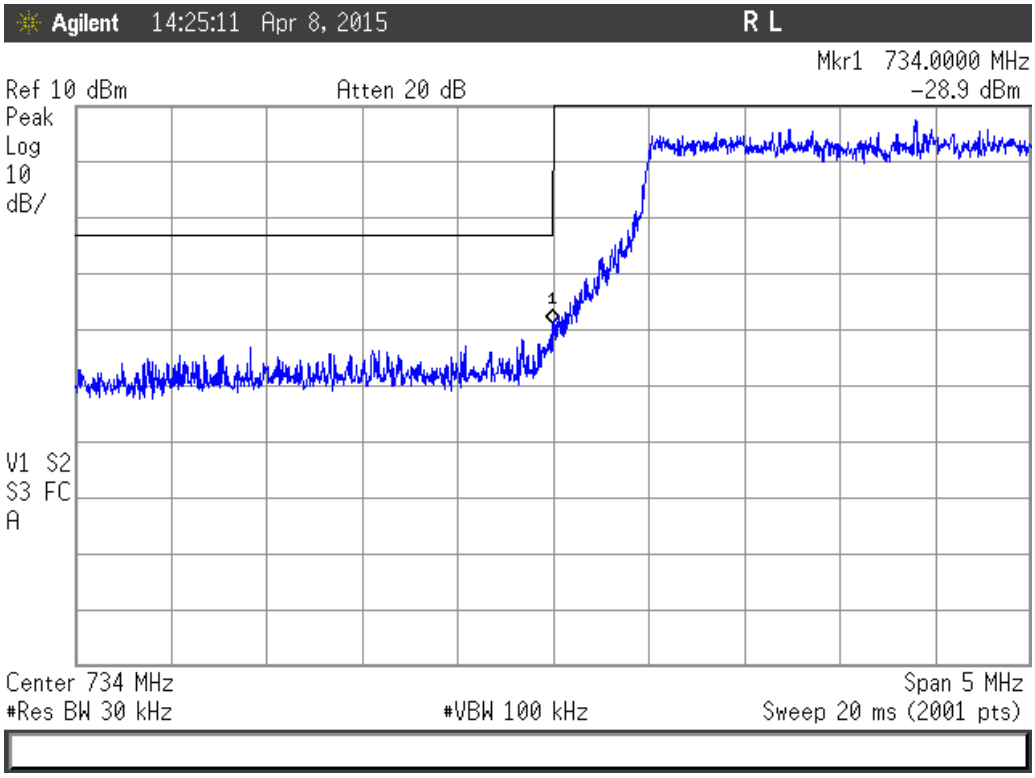
Lower Band Edge - Band 17 – 5MHz BW – 64QAM – Port J2



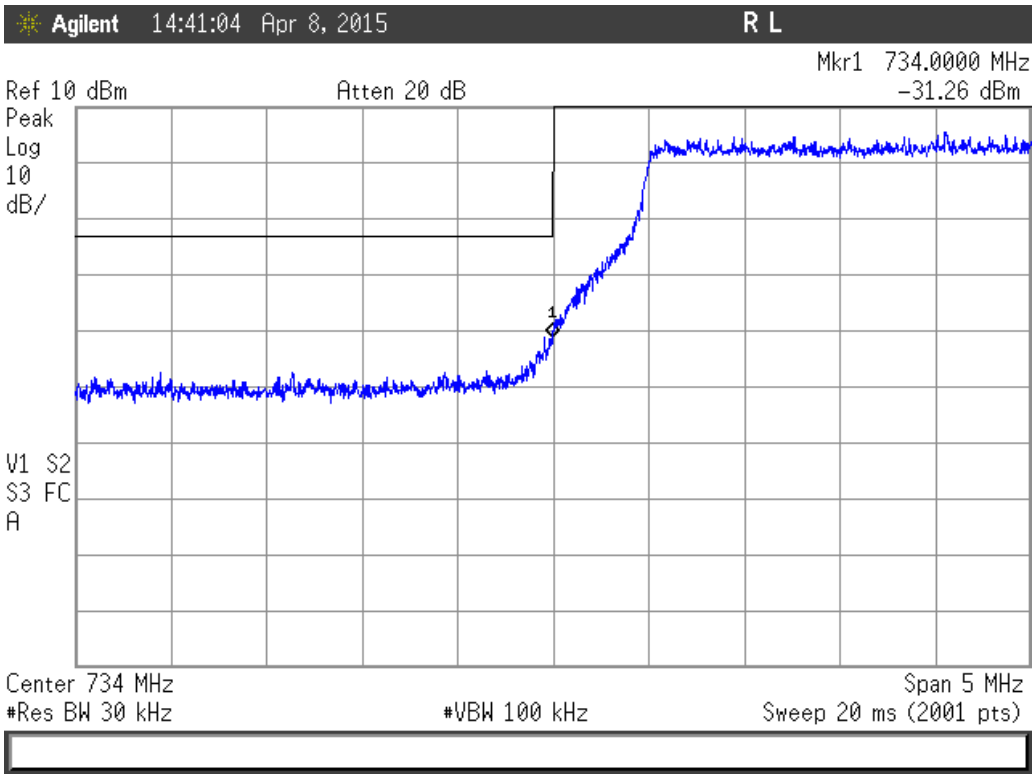
Lower Band Edge - Band 17 – 10MHz BW – QPSK – Port J1



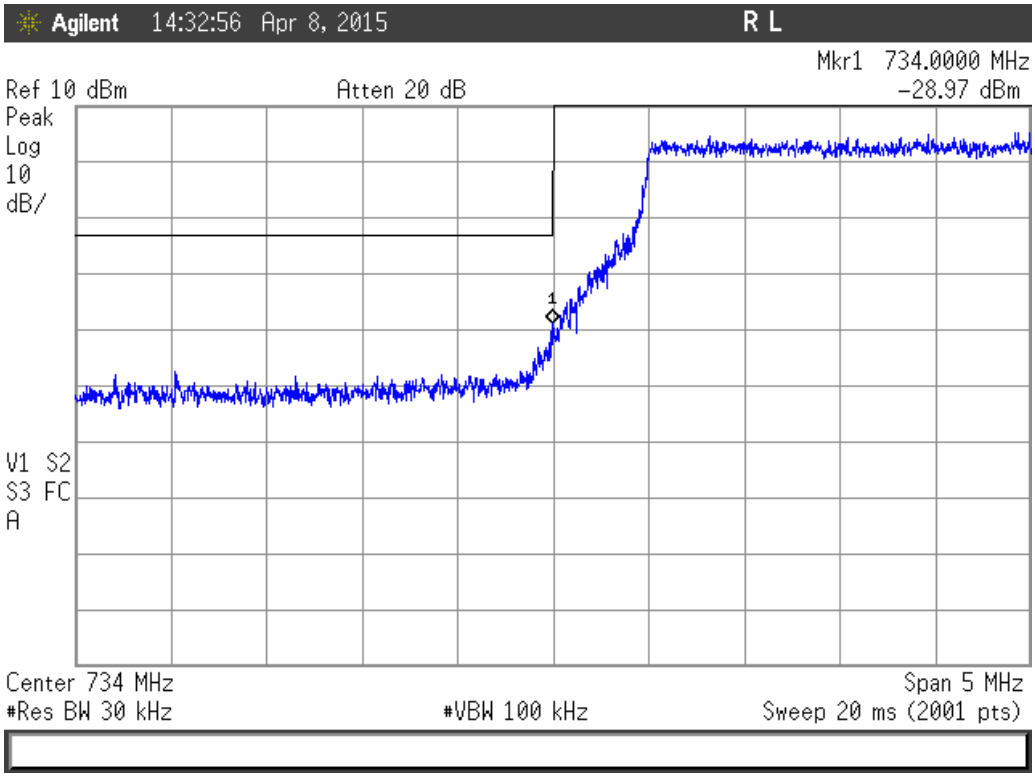
Lower Band Edge - Band 17 – 10MHz BW – 16QAM – Port J1



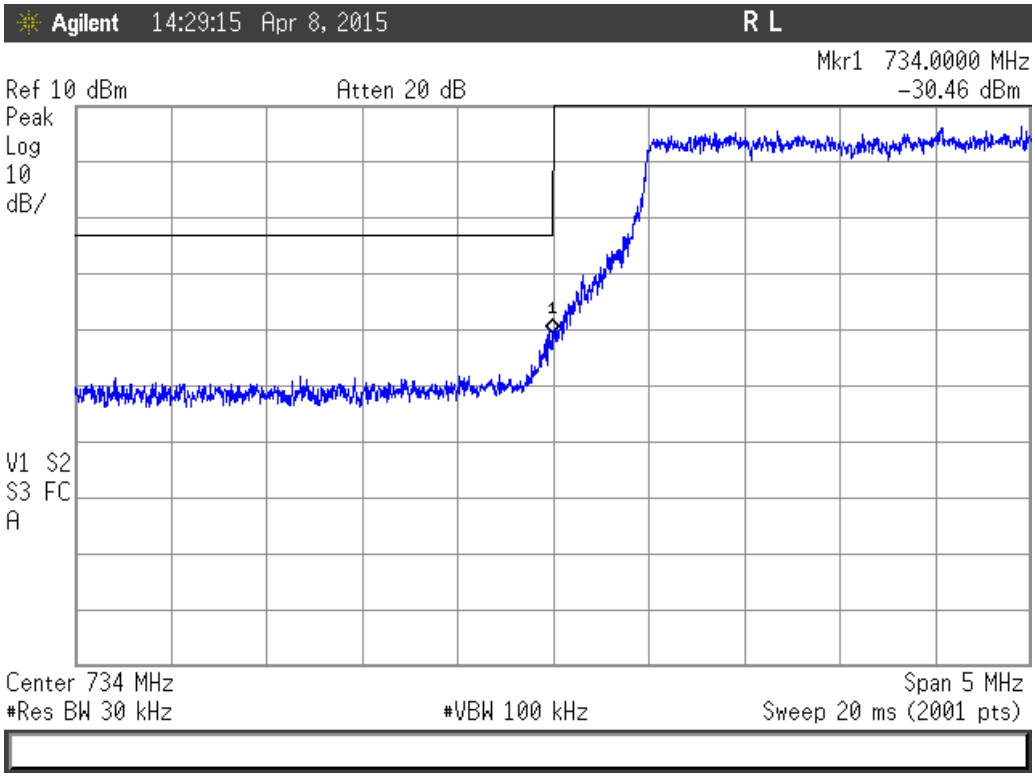
Lower Band Edge - Band 17 – 10MHz BW – 64QAM – Port J1



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



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):

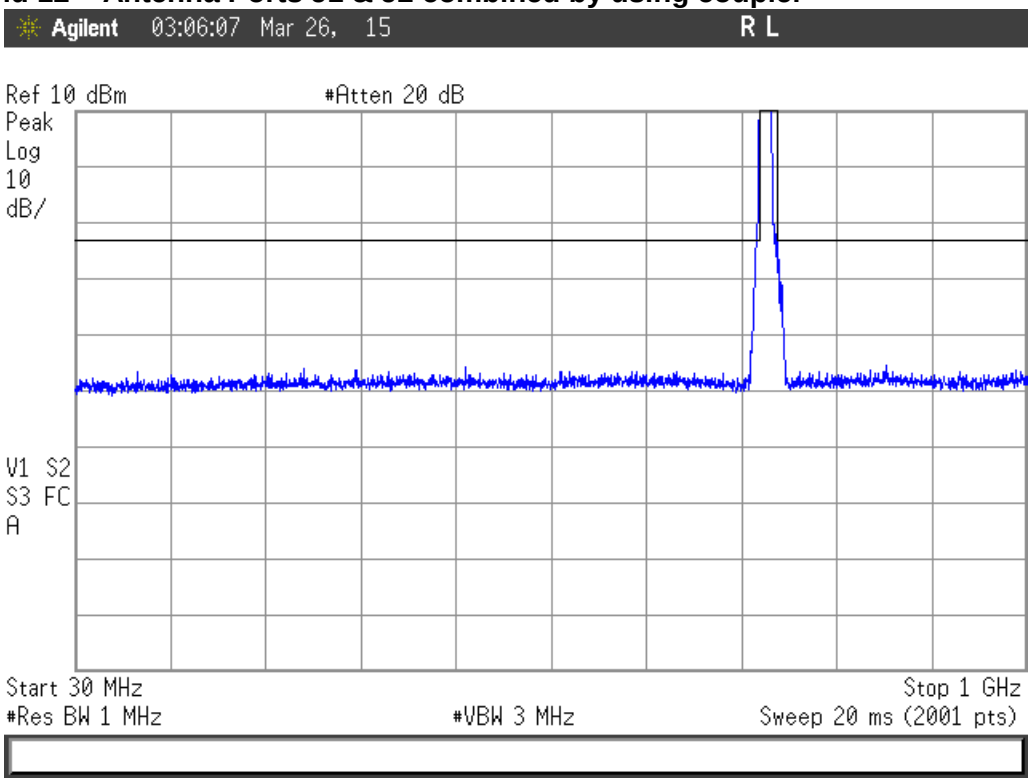
> *For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with 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.*

Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm

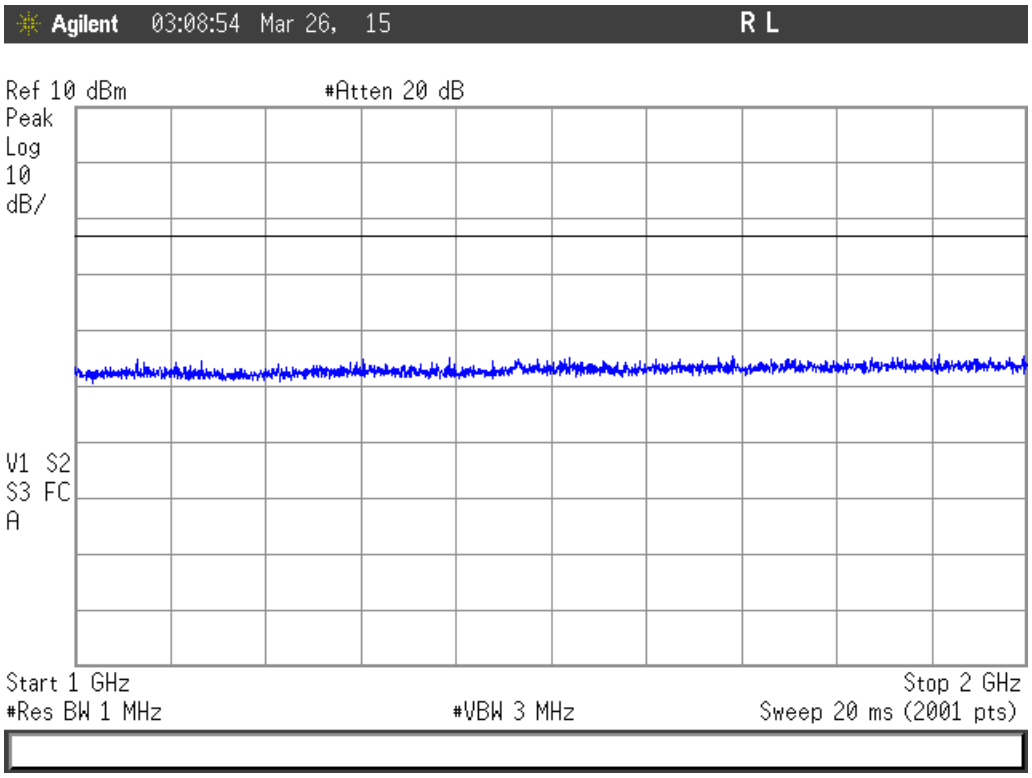
Spectrum analyzer screen plots for LTE Bands 12 & 17 are shown on the following pages. The operating frequency was 733MHz, which was taken to represent both bands as Band 17 is a subset of Band 12. The two antenna ports, J1 & J2, were connected through an RF combiner to the spectrum analyzer for the 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

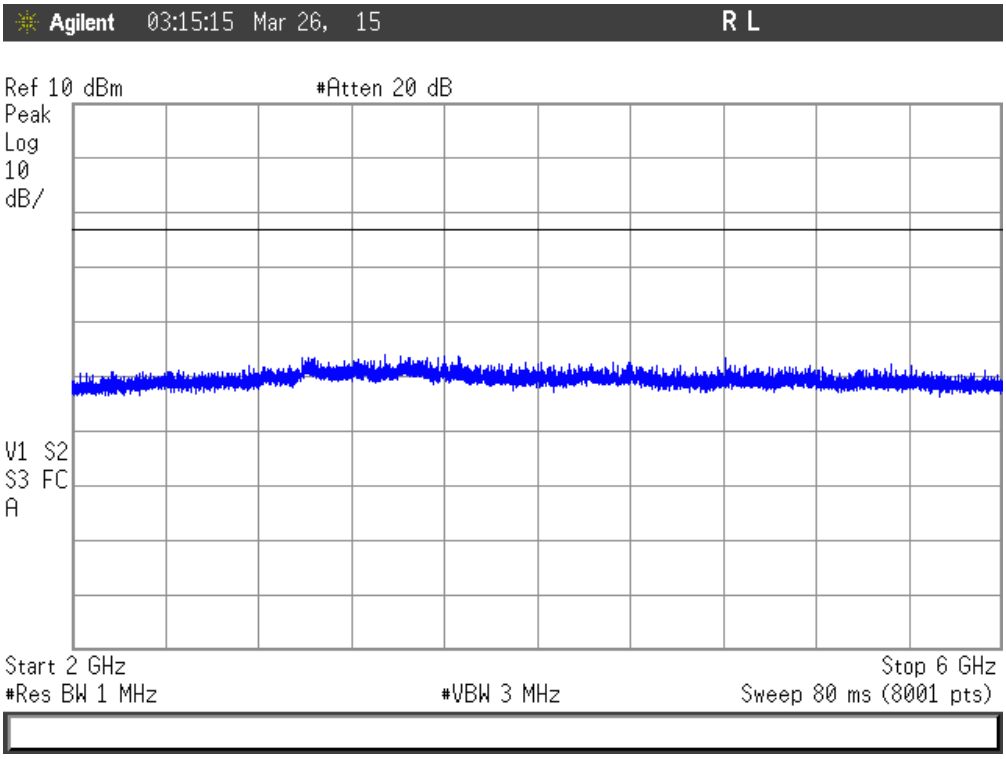


30MHz to 1GHz -

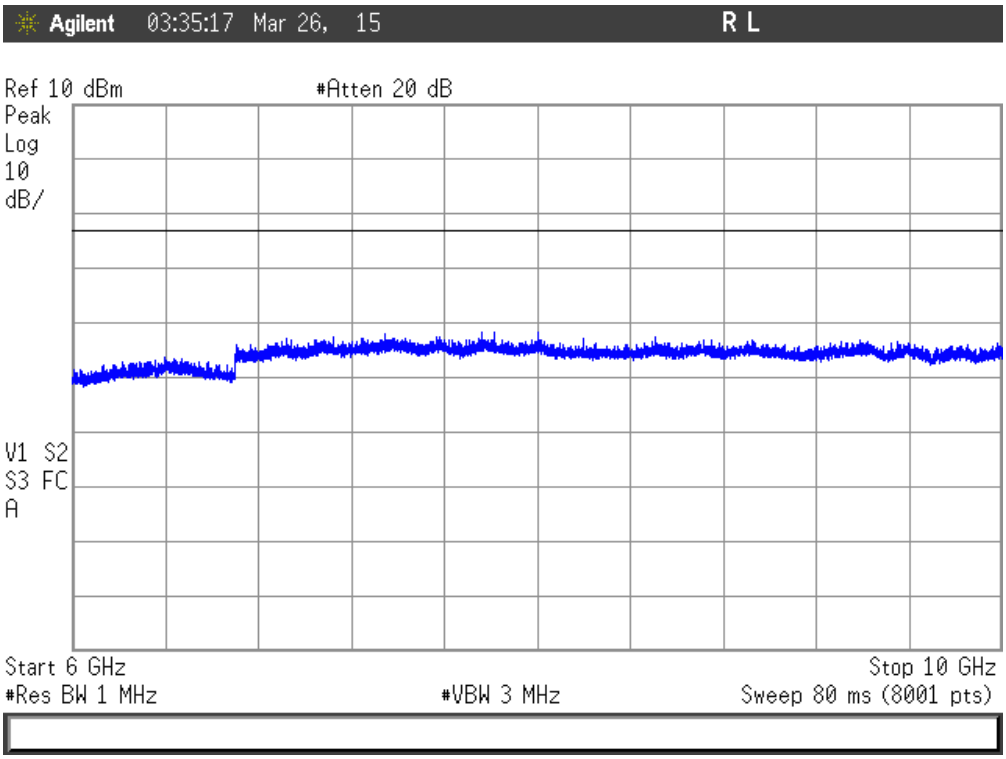

Agilent 03:08:54 Mar 26, 15
R L
Ref 10 dBm
#Atten 20 dB
Peak
Log
10
dB/
V1 S2
S3 FC
A
Start 1 GHz
Stop 2 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 20 ms (2001 pts)

1-2GHz

LTE Band 12 – Antenna Ports J1

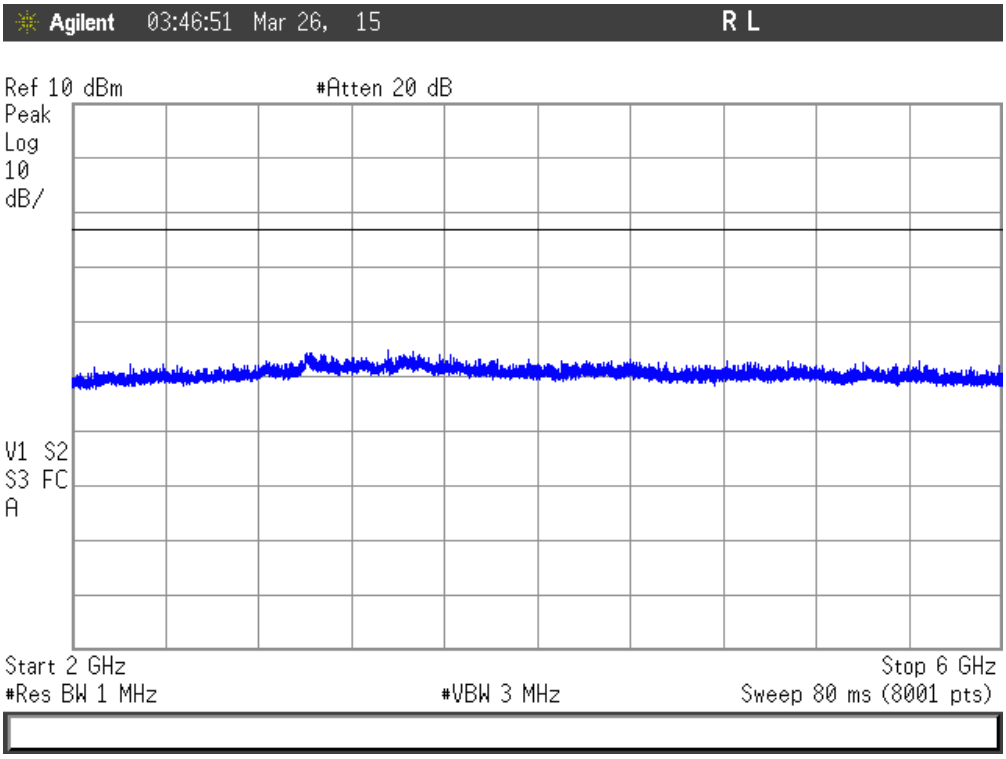


2-6GHz

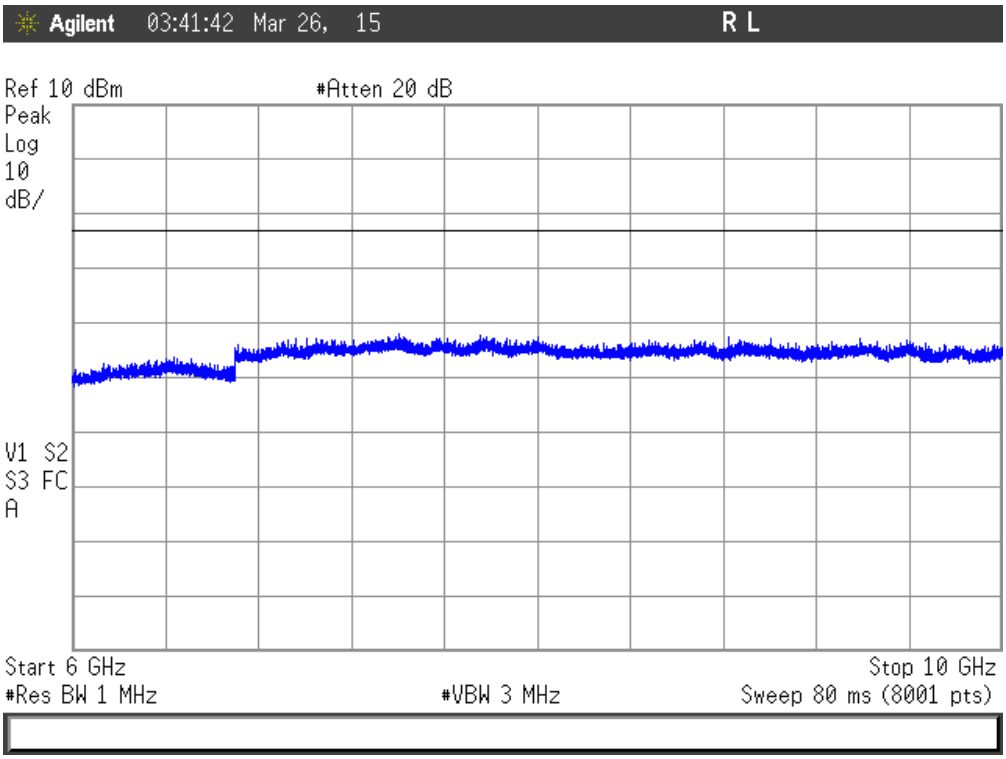


6-10GHz

LTE Band 12 – Antenna Port J2



2-6GHz



6-10GHz

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)	FCC Class B Margin (dB)	FCC Class B 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:** ---

Conducted Spurious Emissions on AC Mains

AC Conducted Emissions Data Table

Date: 06-Apr-15 **Company:** Airvana **Work Order:** P0152
Engineer: Tuyen Truong **EUT Desc:** Switched IQ Radio Point Domestic
Temp: 21.0 ºC **Humidity:** 27% **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

	Quasi-Peak Readings		Average Readings		LISN Factors				FCC/CISPR Class B			FCC/CISPR Class B		
Frequency (MHz)	QP1 (dBµV)	QP2 (dBµV)	AVG1 (dBµV)	AVG2 (dBµV)	L1 (dB)	L2 (dB)	Cable Factor (dB)	ATTN Factor (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 **Spectrum Analyzer:** SA EMI Chamber (1328)
Attenuator: 20dB Atten-4 **Site:** CEMI 3

Frequency Stability

REQUIREMENTS

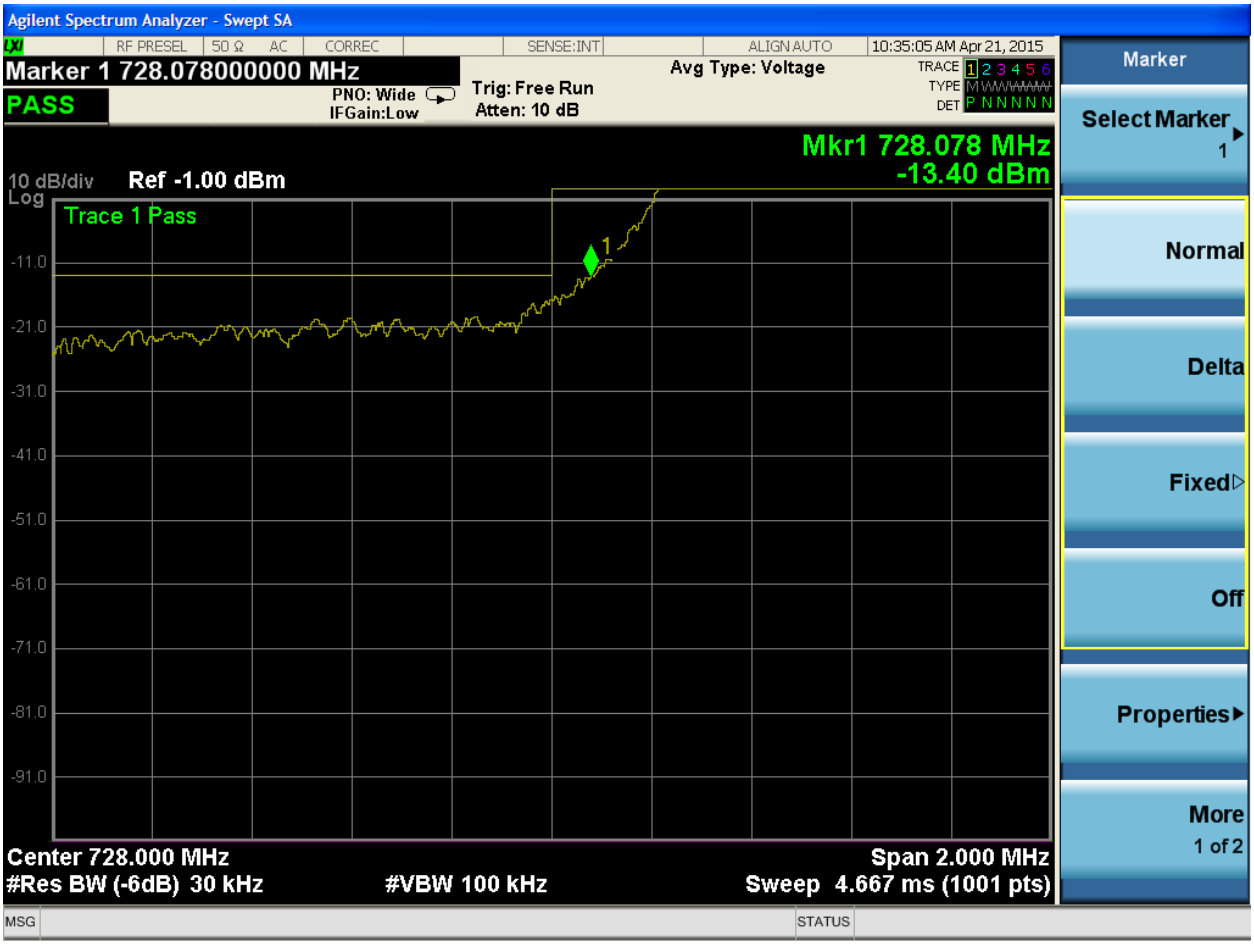
From FCC Part 27:

> *§27.54 Frequency stability.*
> *The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.*

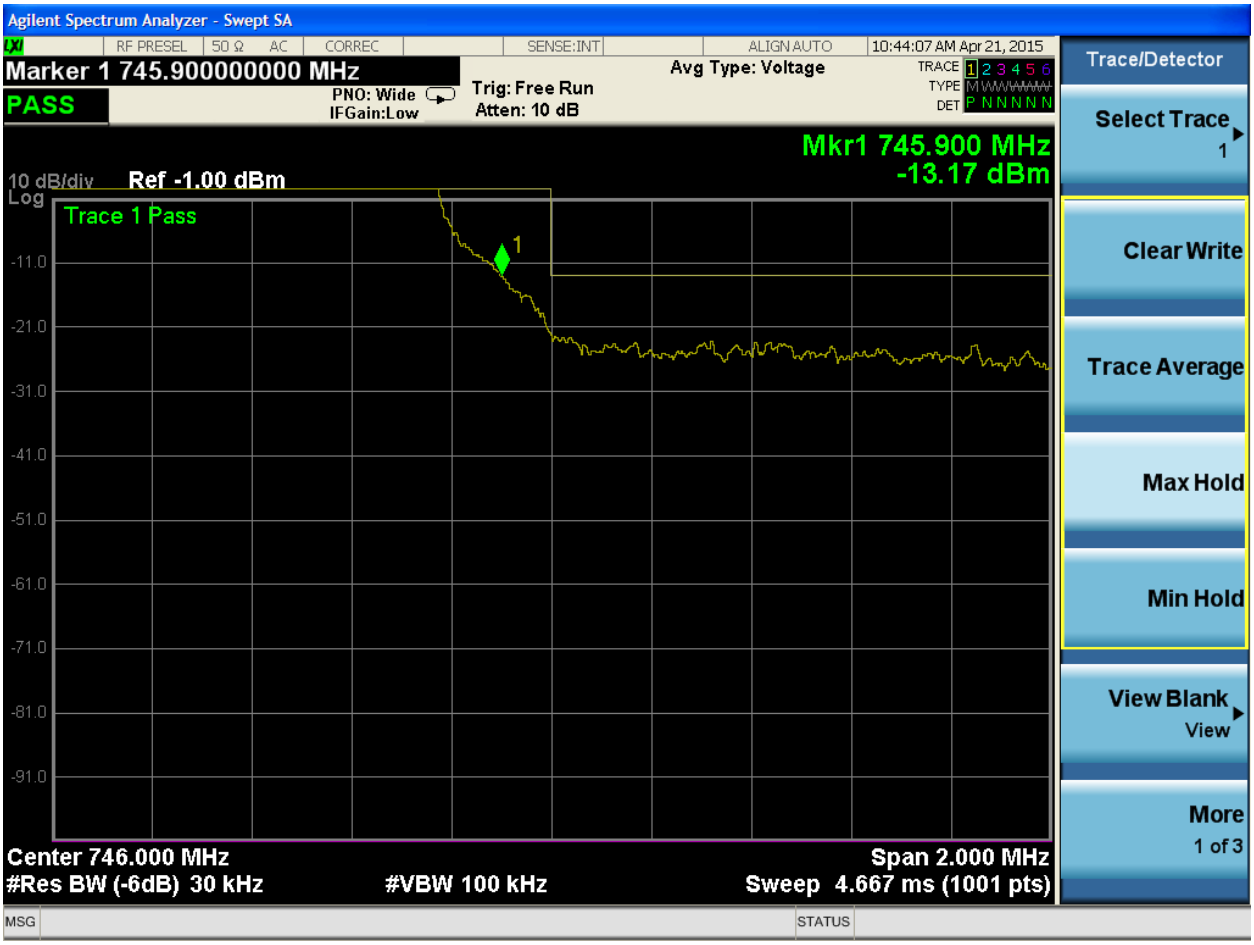
MEASUREMENTS / RESULTS

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:



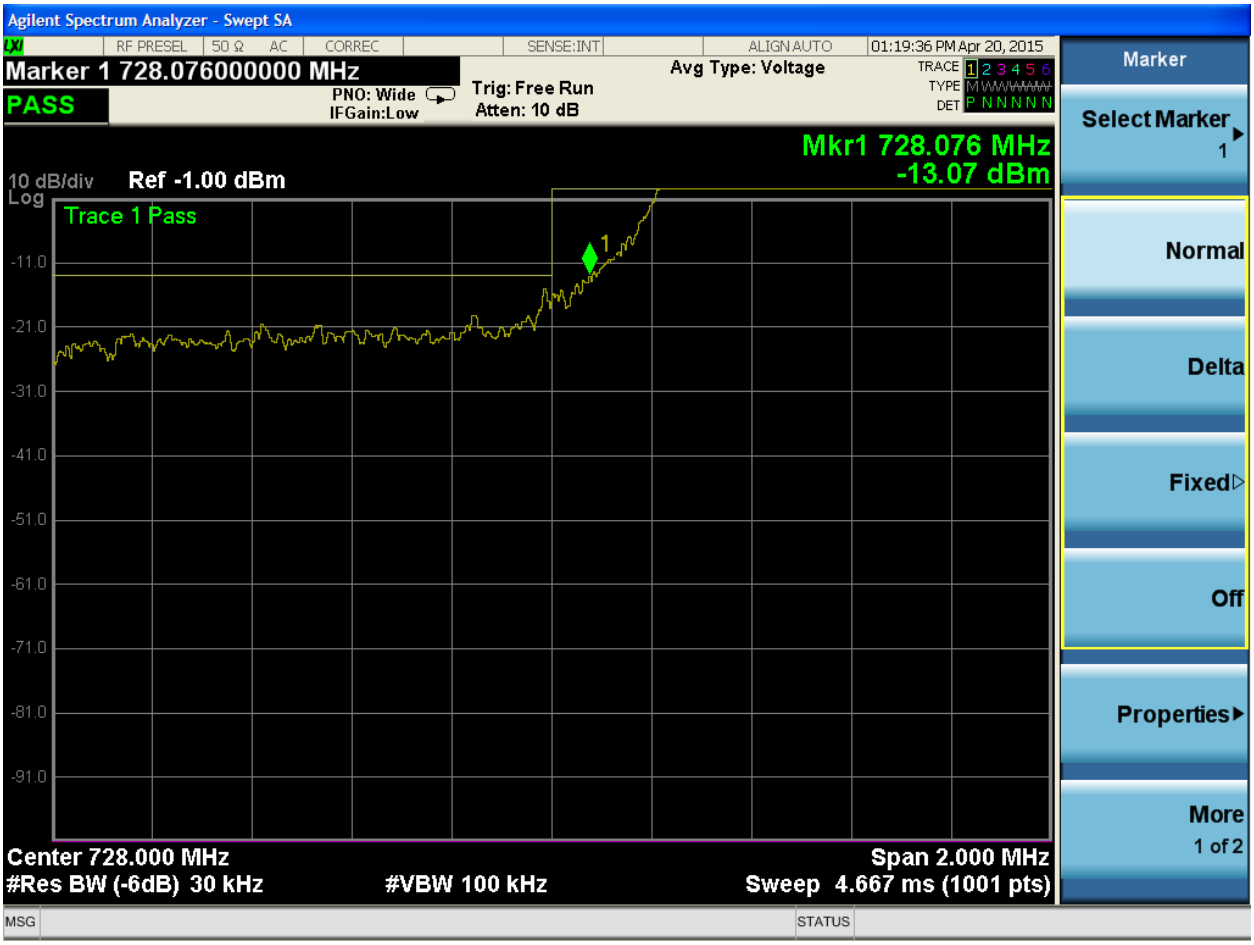
-30°C, Low Frequency Edge



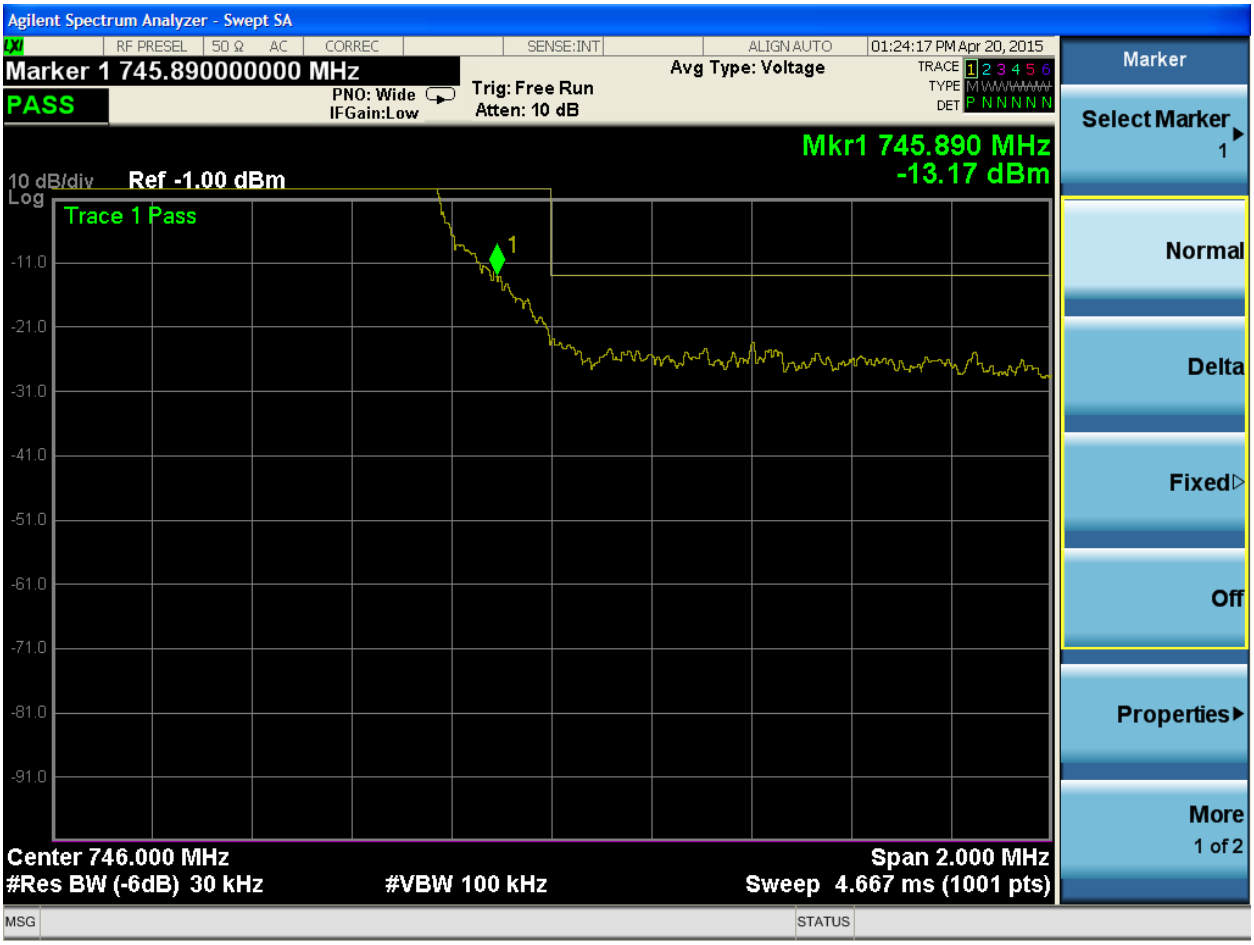
-30°C, High Frequency Edge

-20°C, Low Frequency Edge

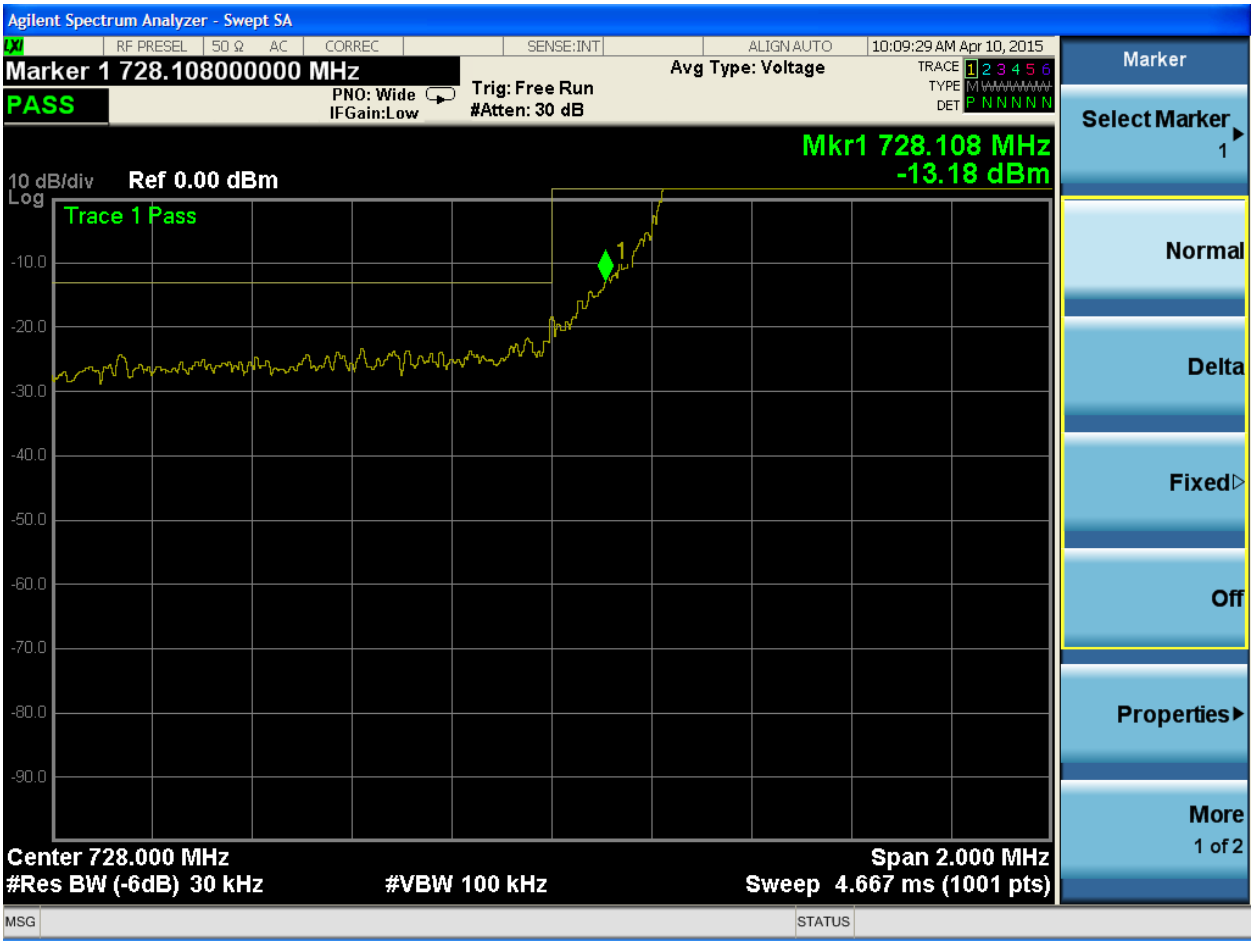
-20°C, High Frequency Edge



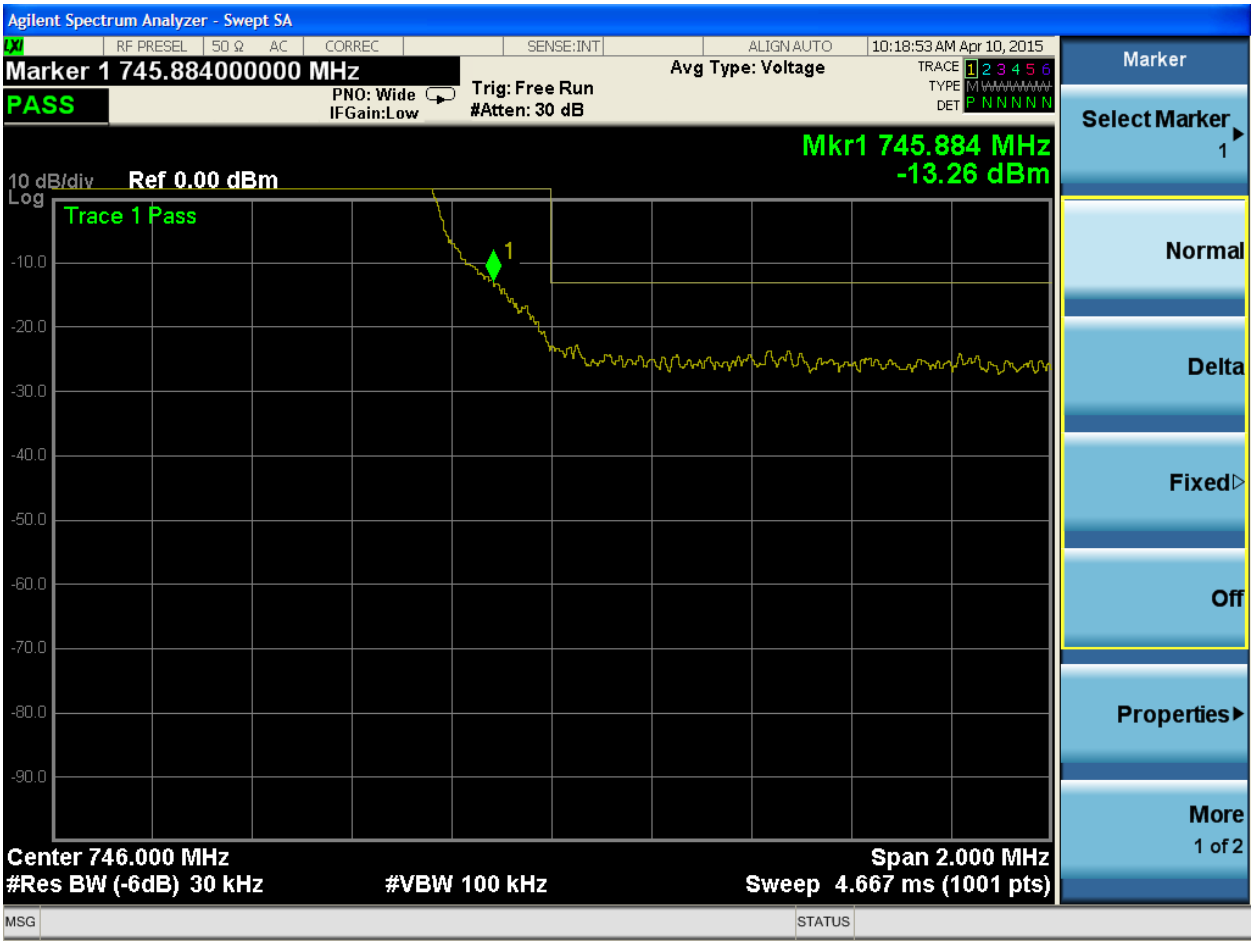
-10°C, Low Frequency Edge



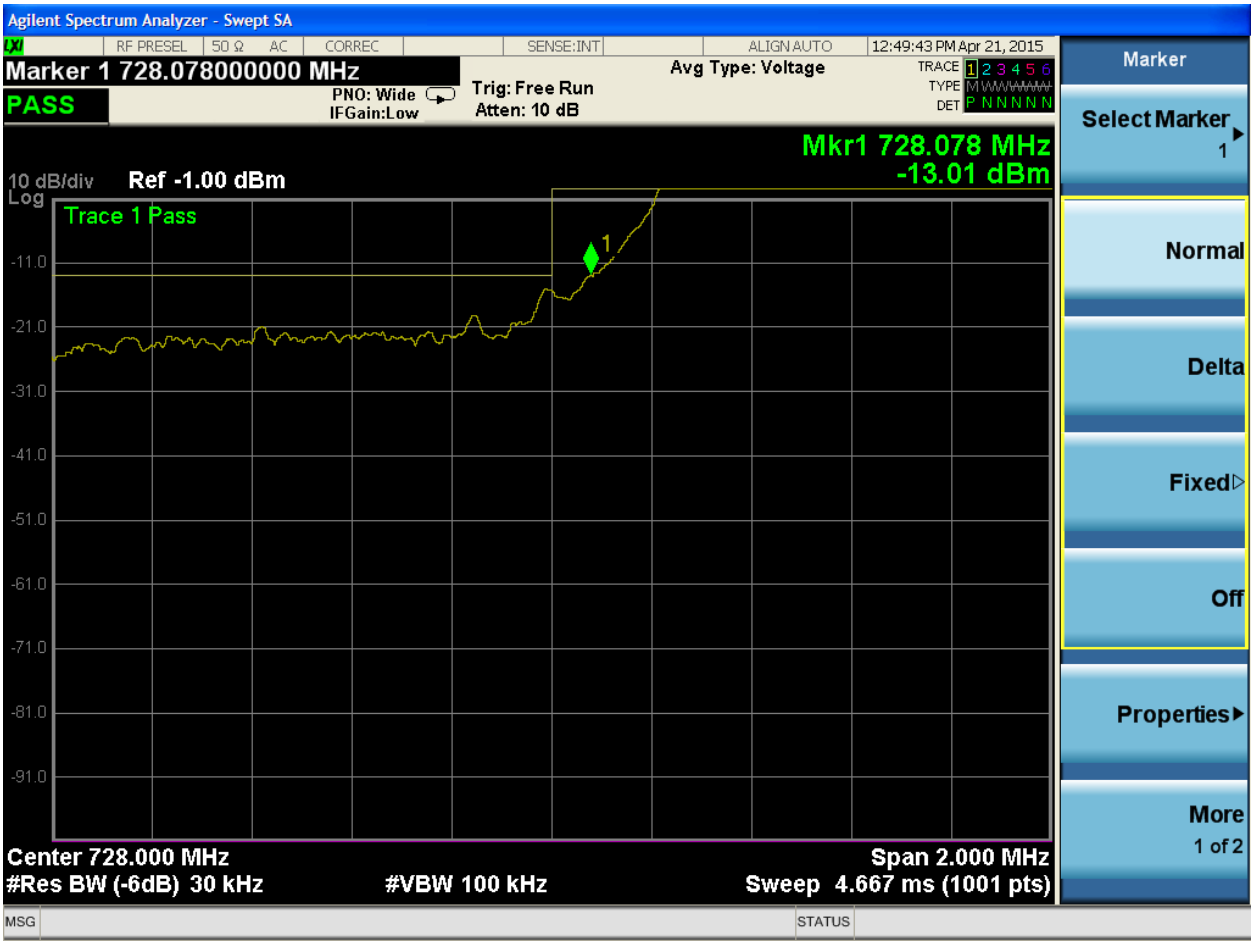
-10°C, High Frequency Edge



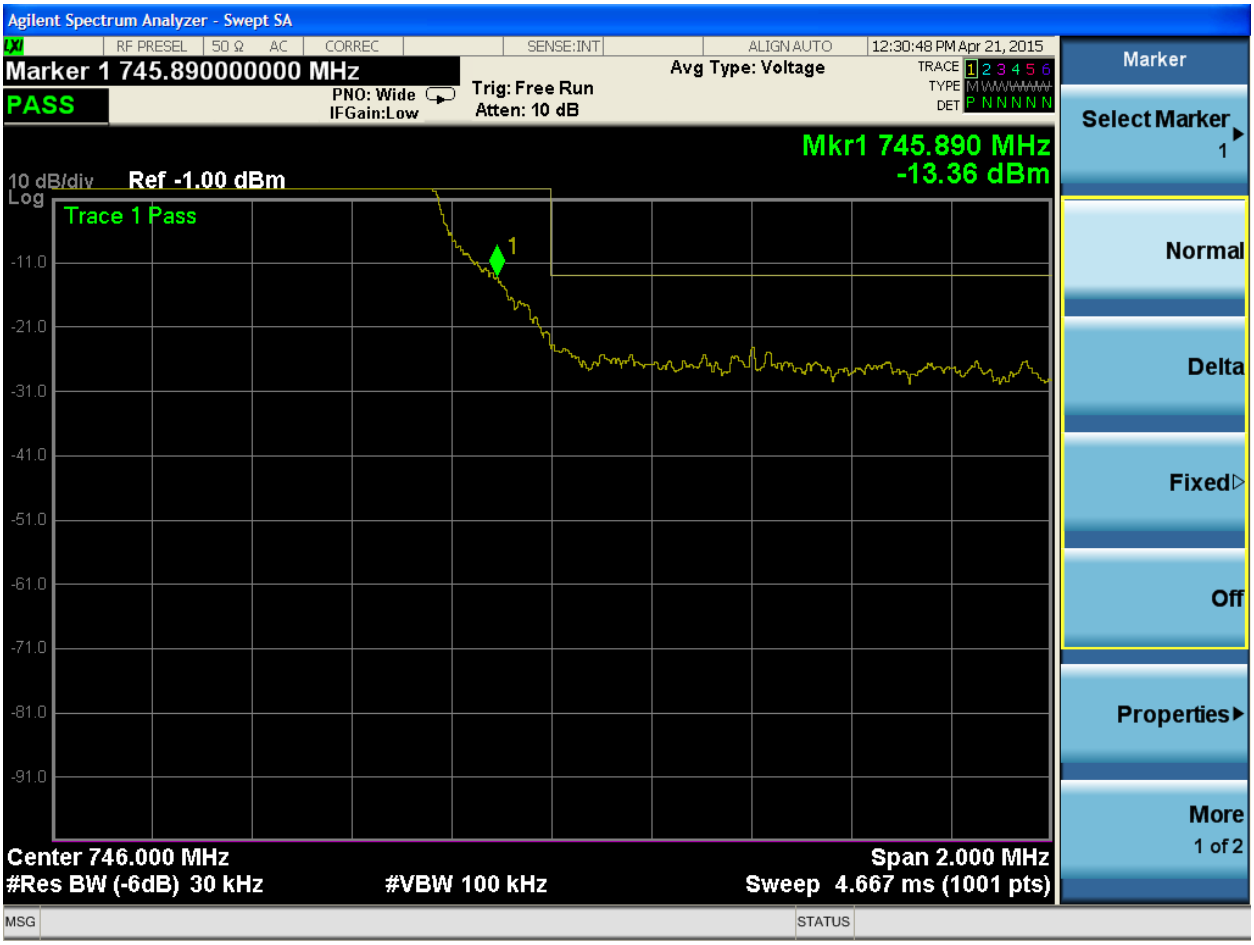
0°C, Low Frequency Edge



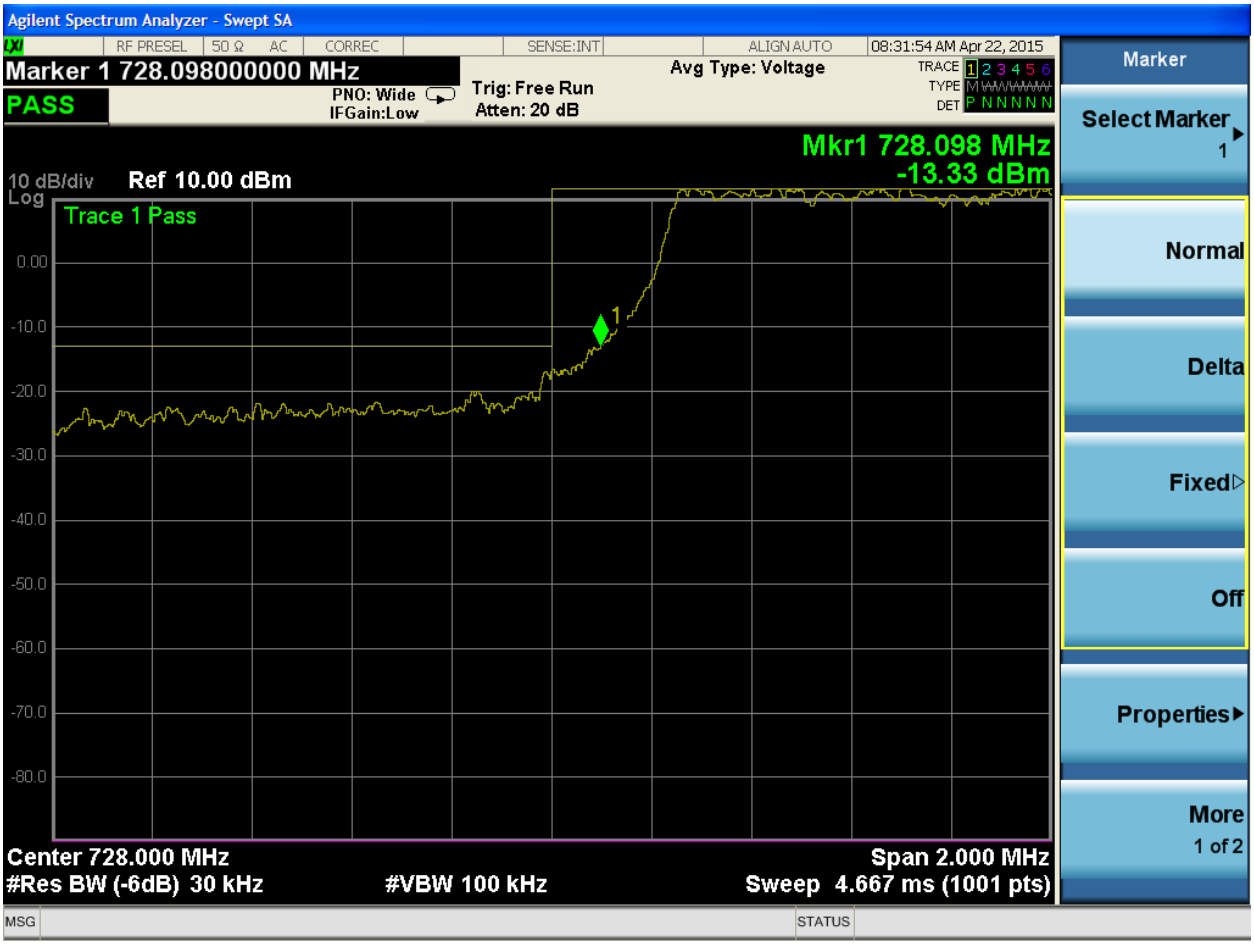
0°C, High Frequency Edge



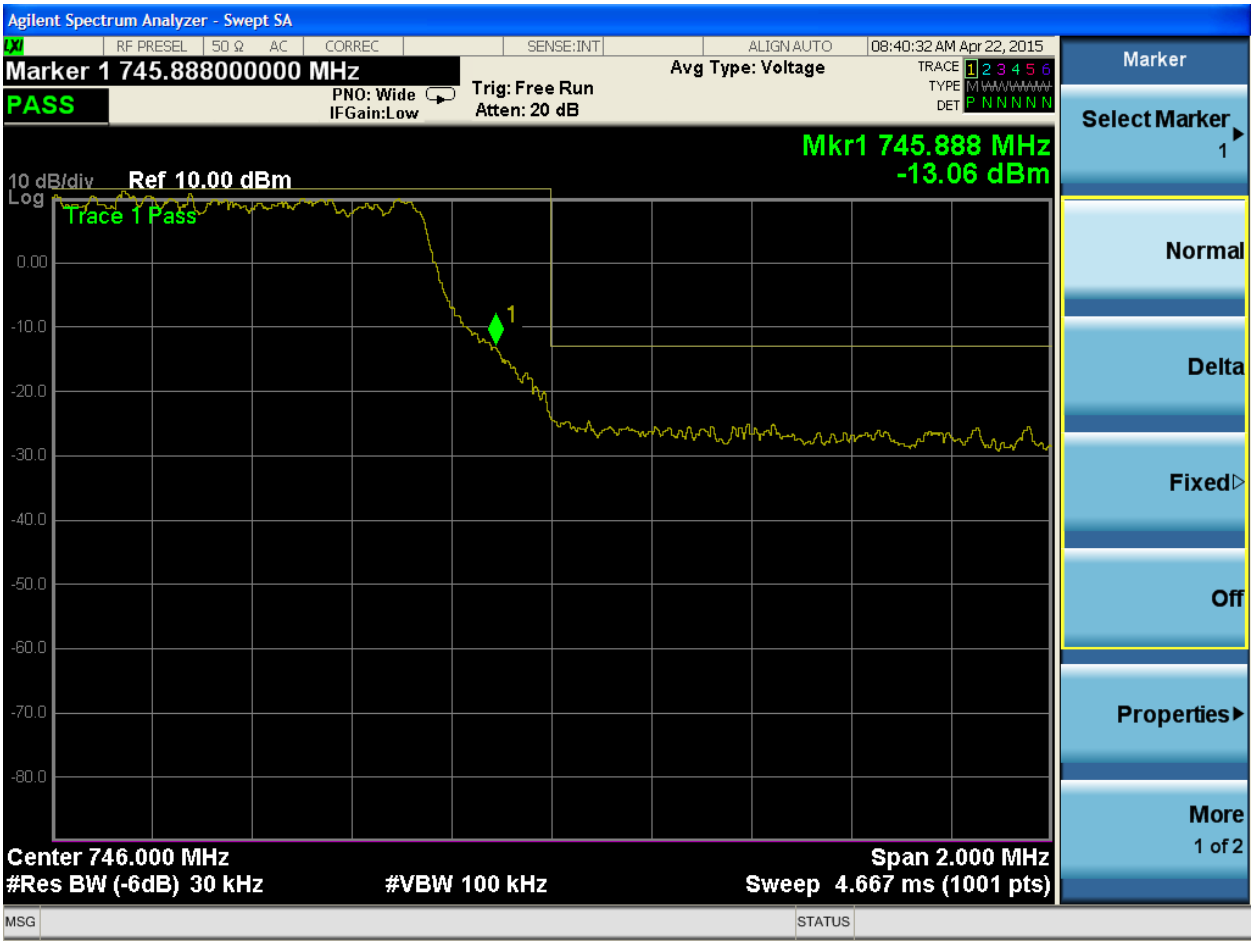
10°C, Low Frequency Edge



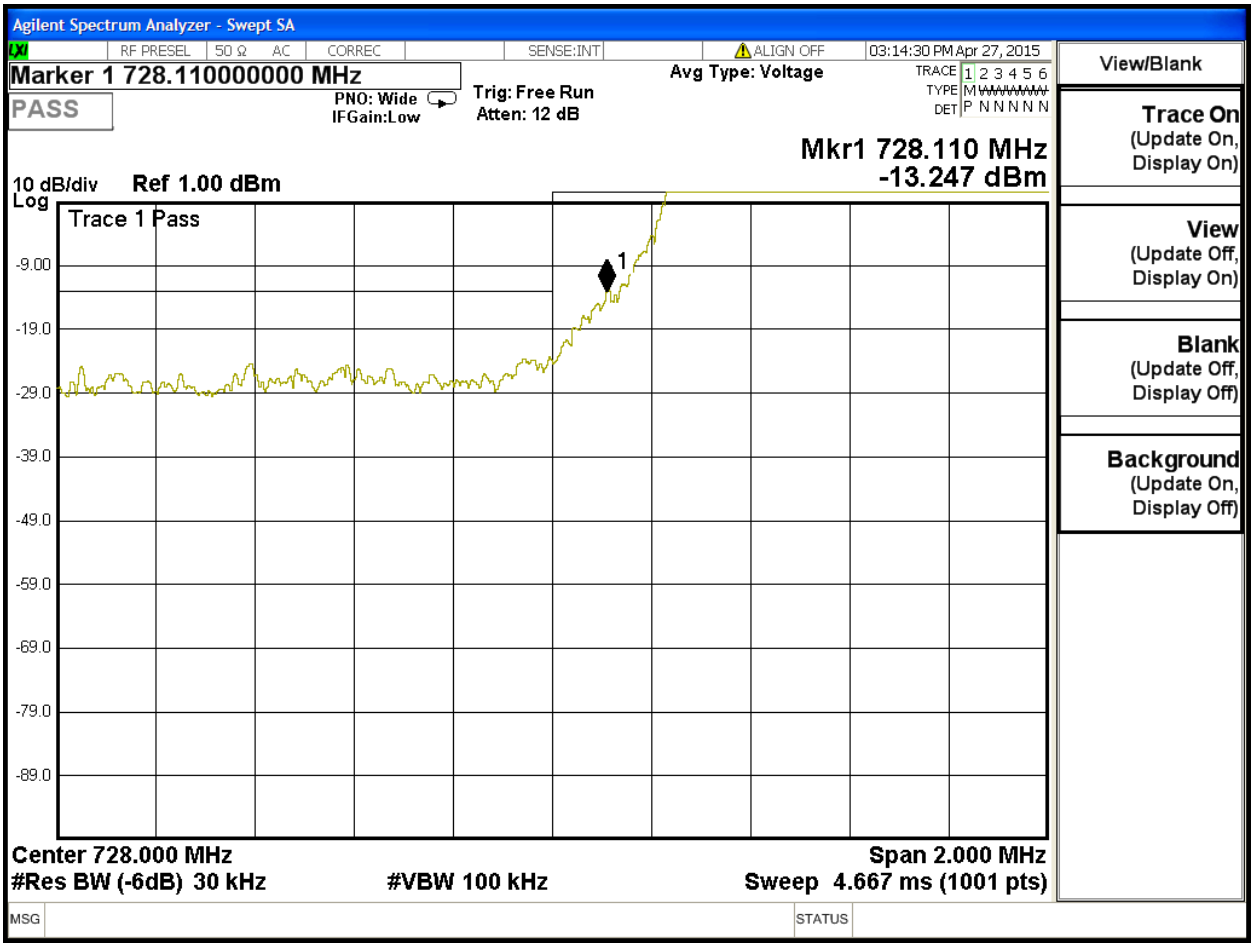
10°C, High Frequency Edge



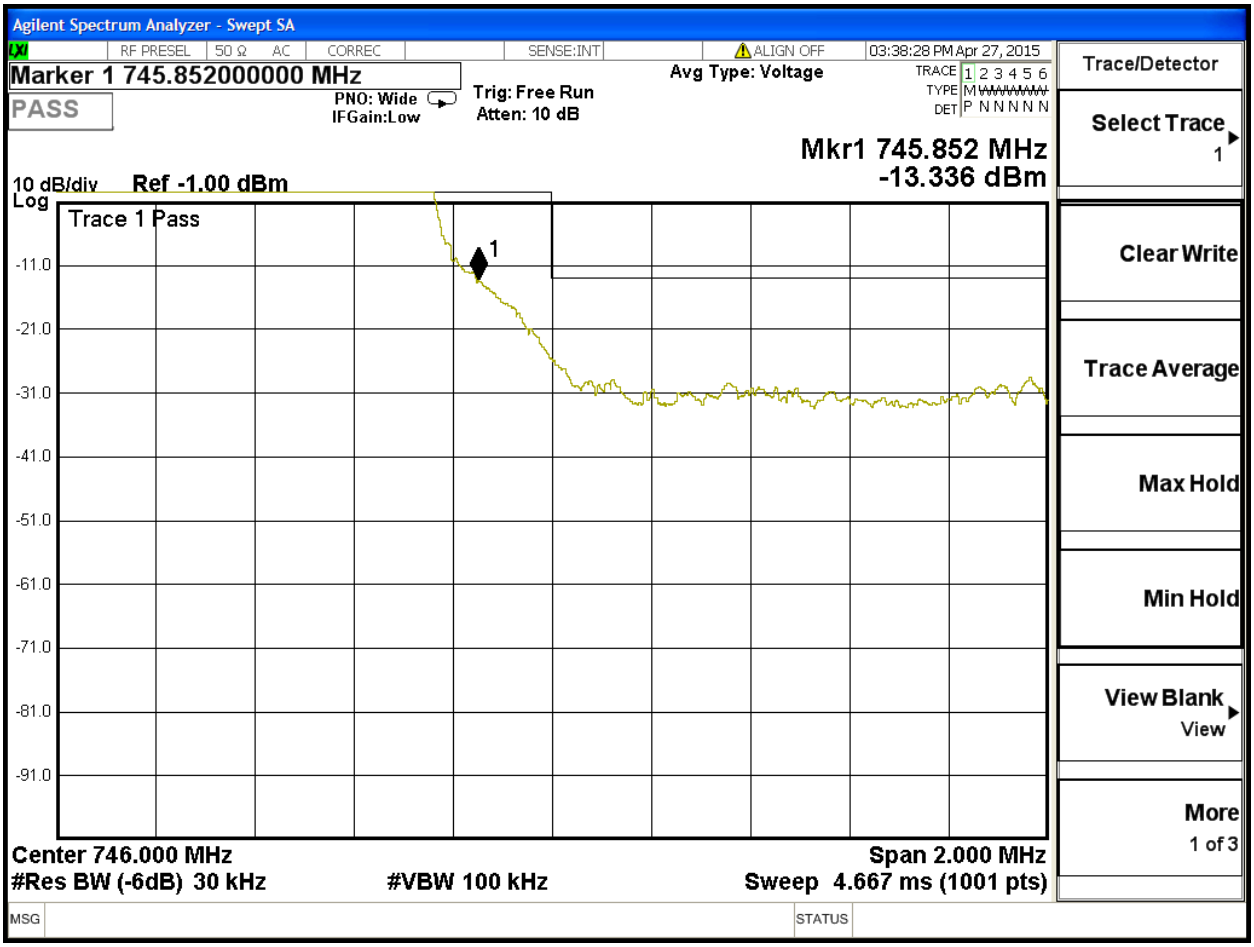
20°C, Low Frequency Edge, 120Vac



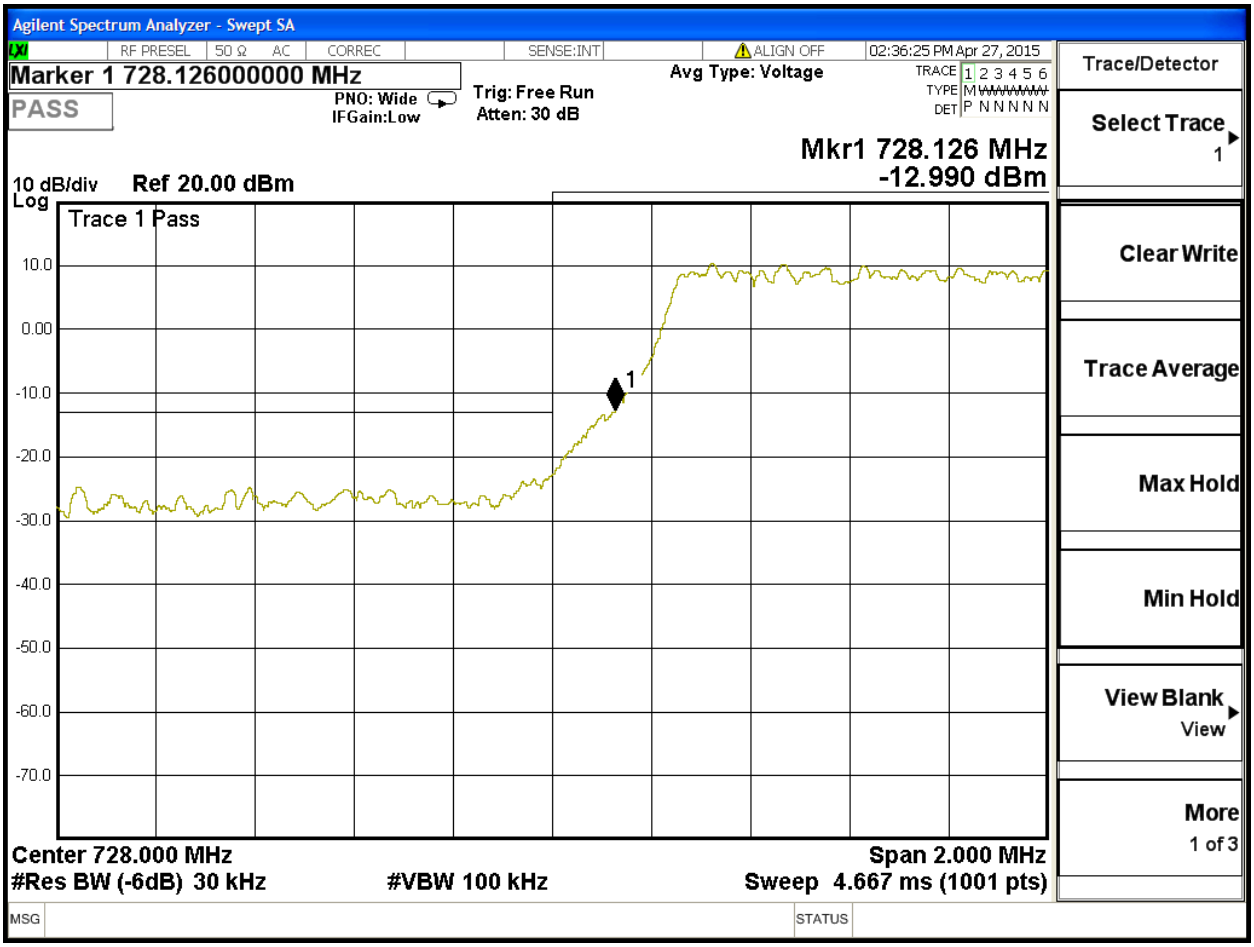
20°C, High Frequency Edge, 120Vac



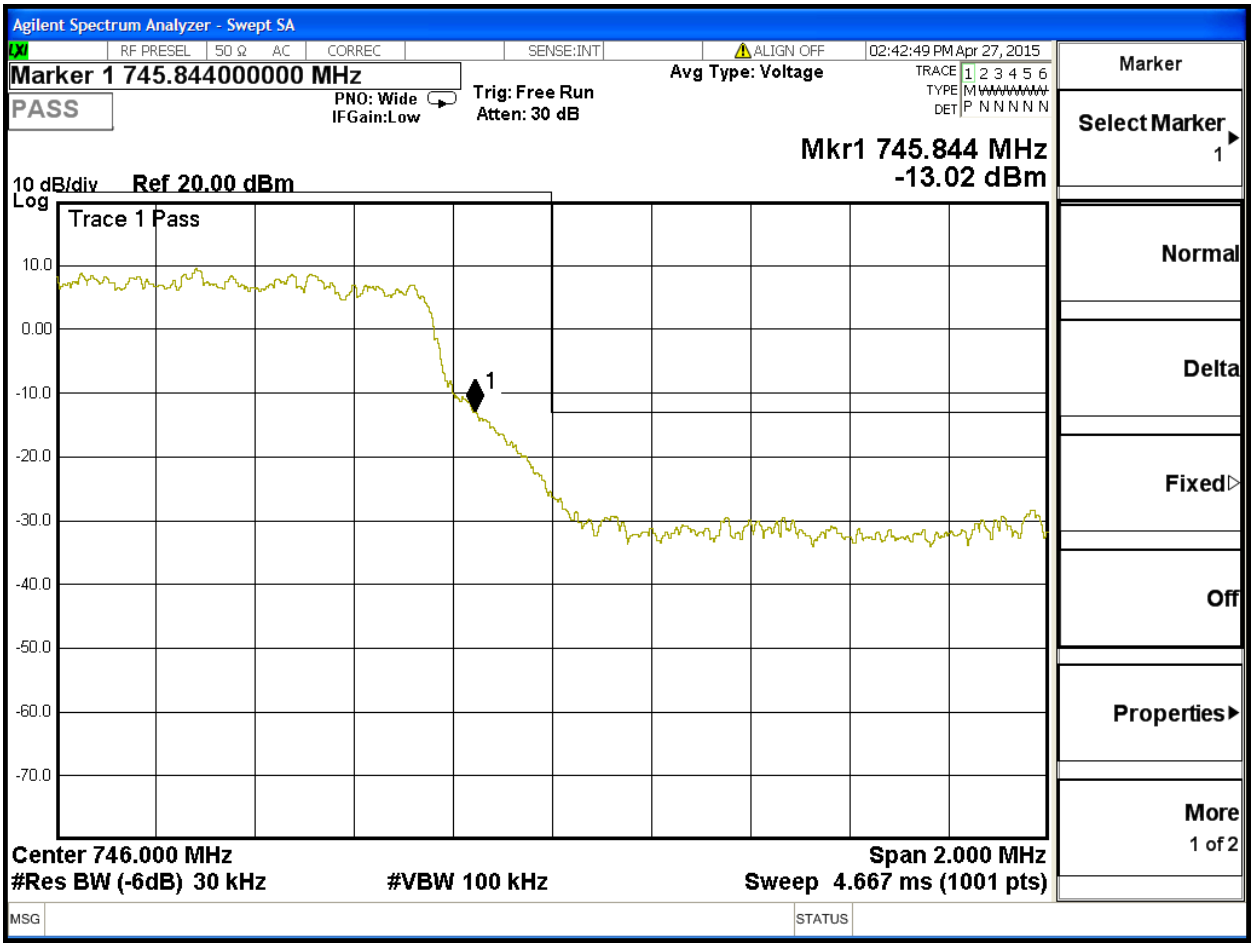
20°C, Low Frequency Edge, 102Vac (-15% from nominal)



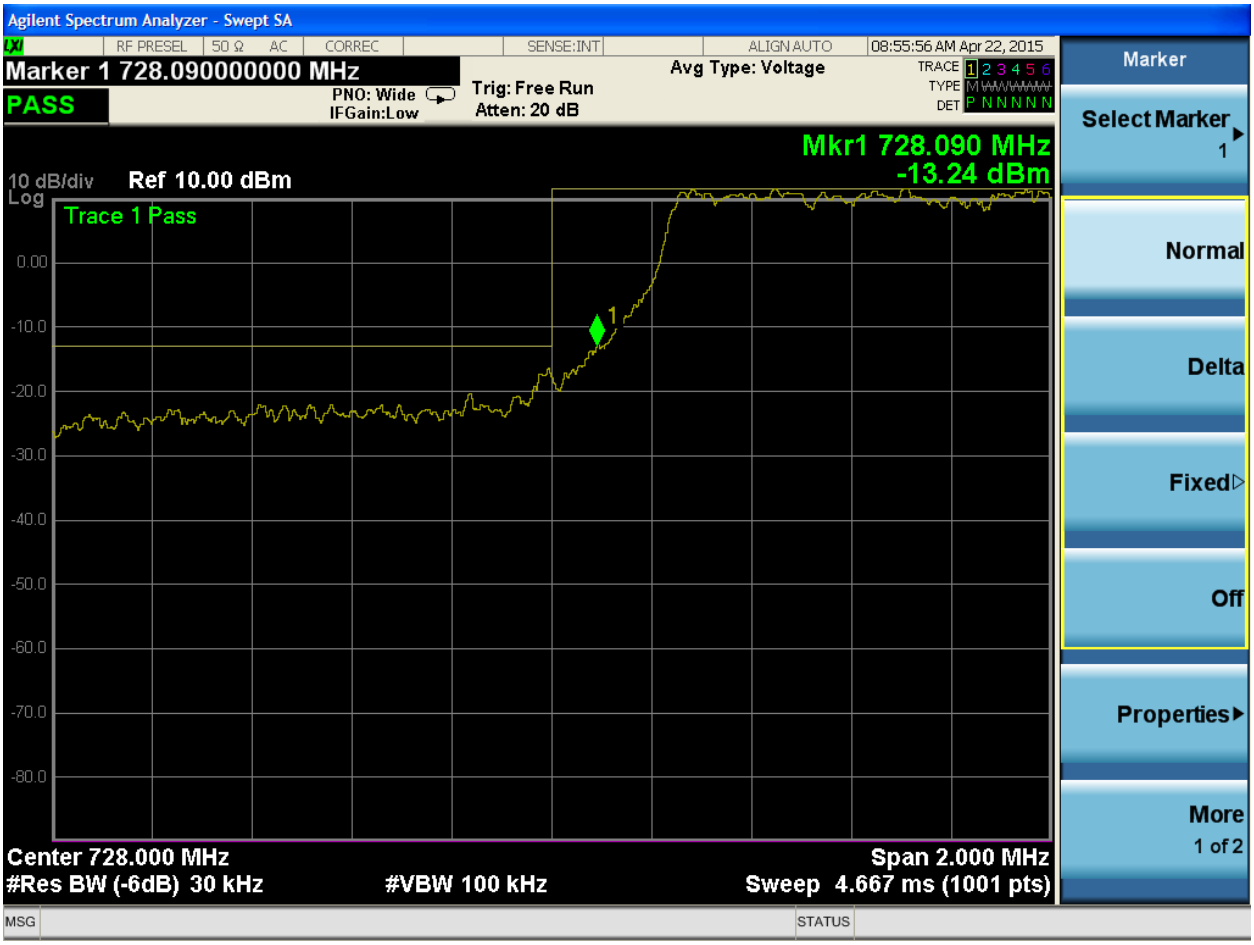
20°C, High Frequency Edge, 102Vac (-15% from nominal)



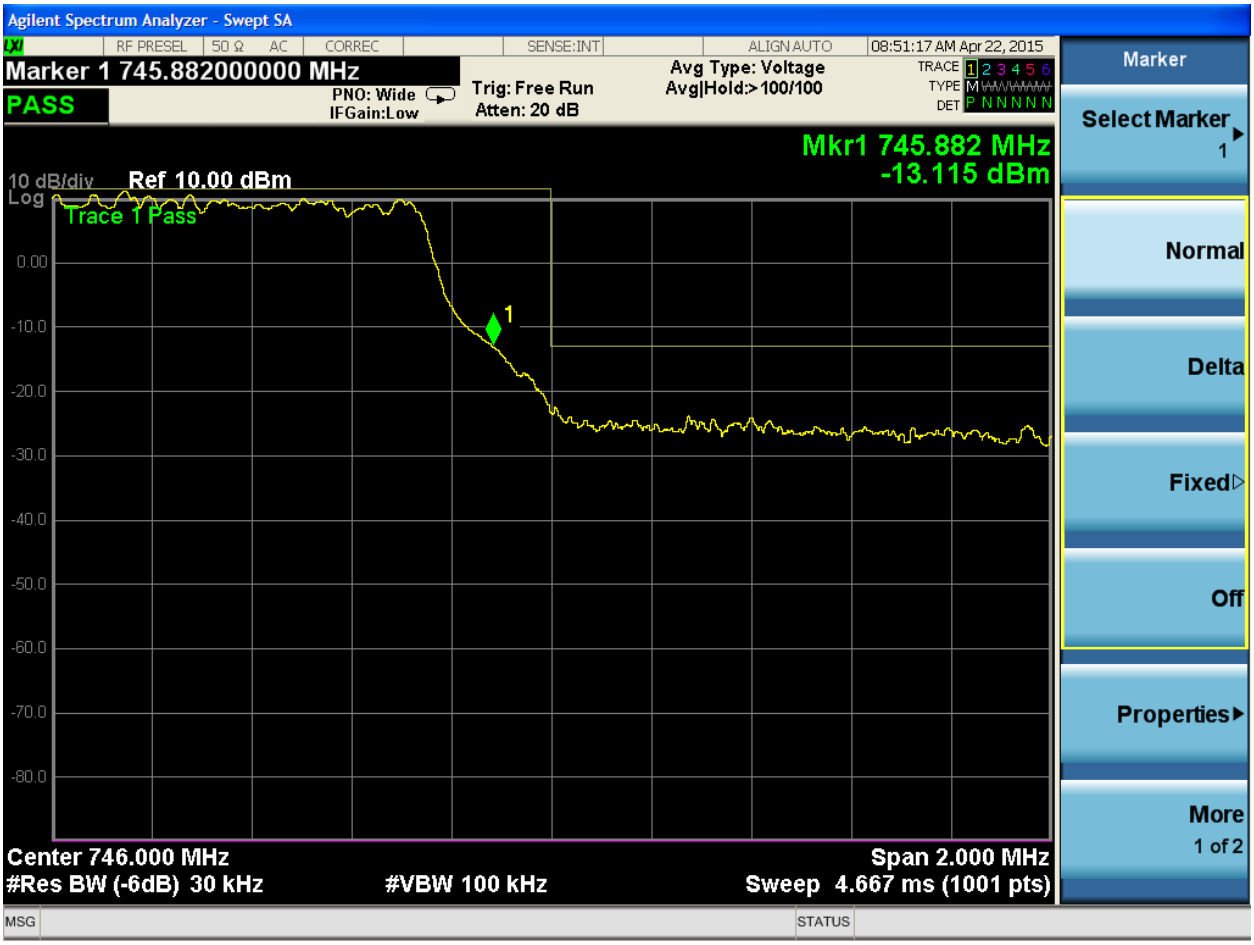
20°C, Low Frequency Edge, 138Vac (+15% from nominal)



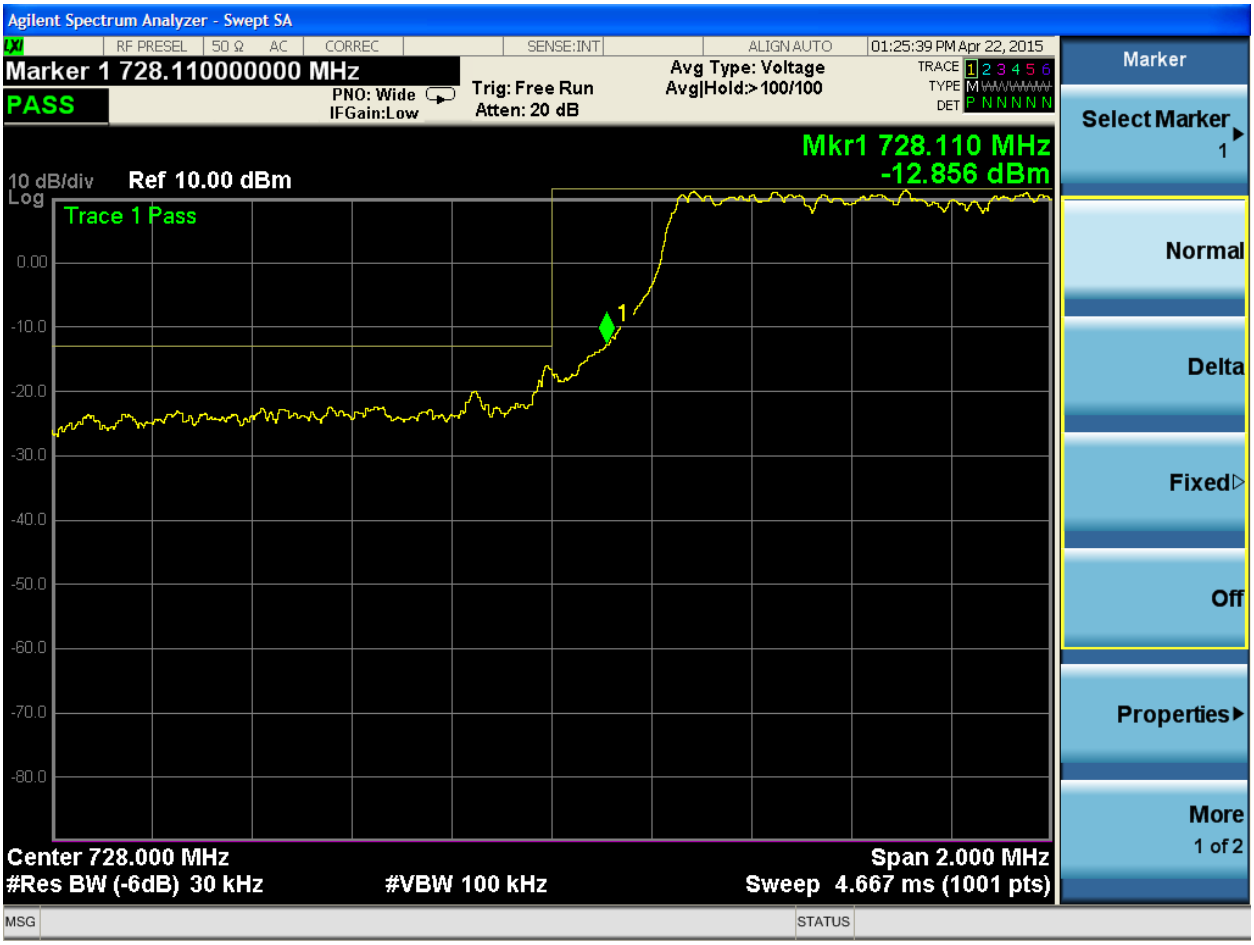
20°C, High Frequency Edge, 138Vac (+15% from nominal)



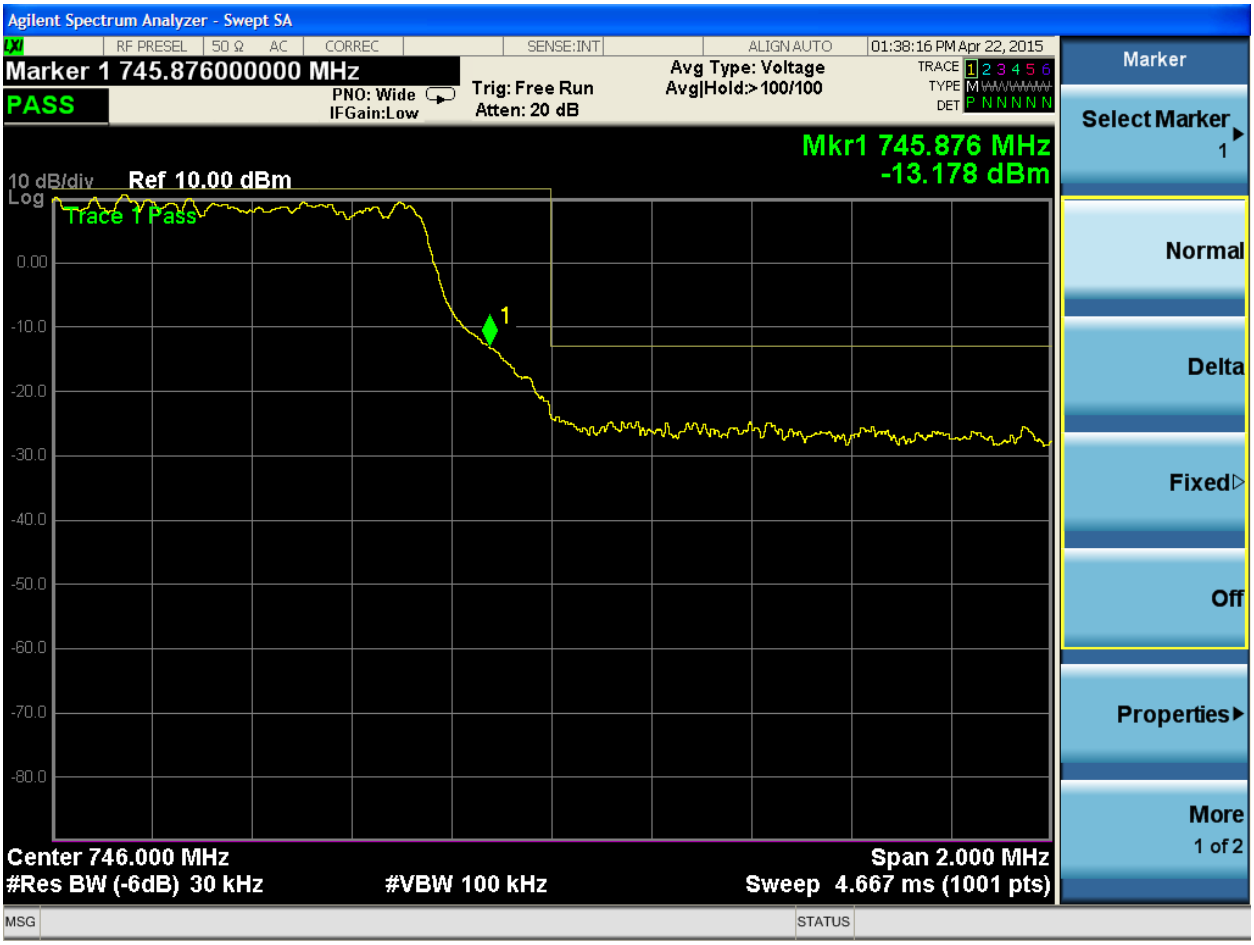
30°C, Low Frequency Edge



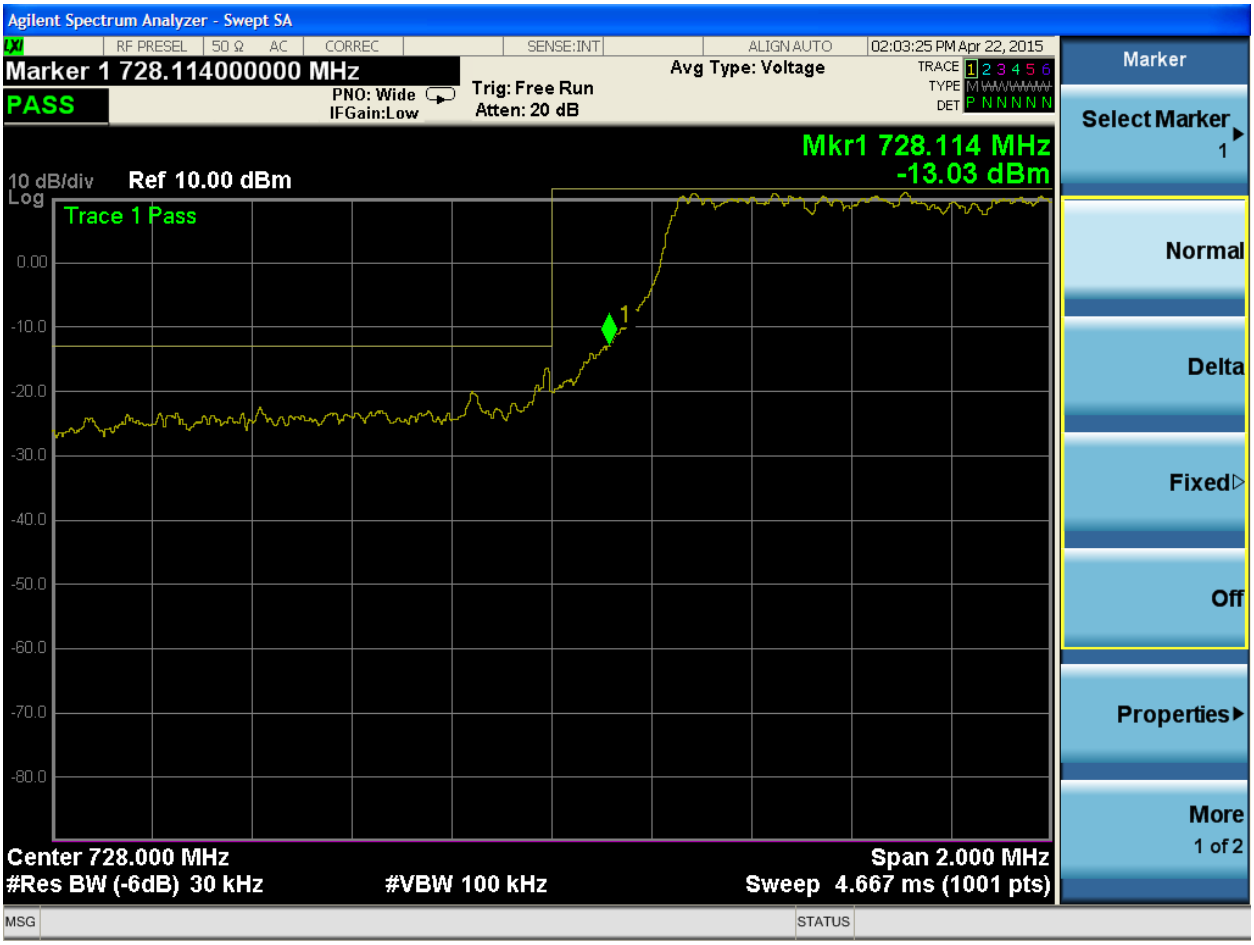
30°C, High Frequency Edge



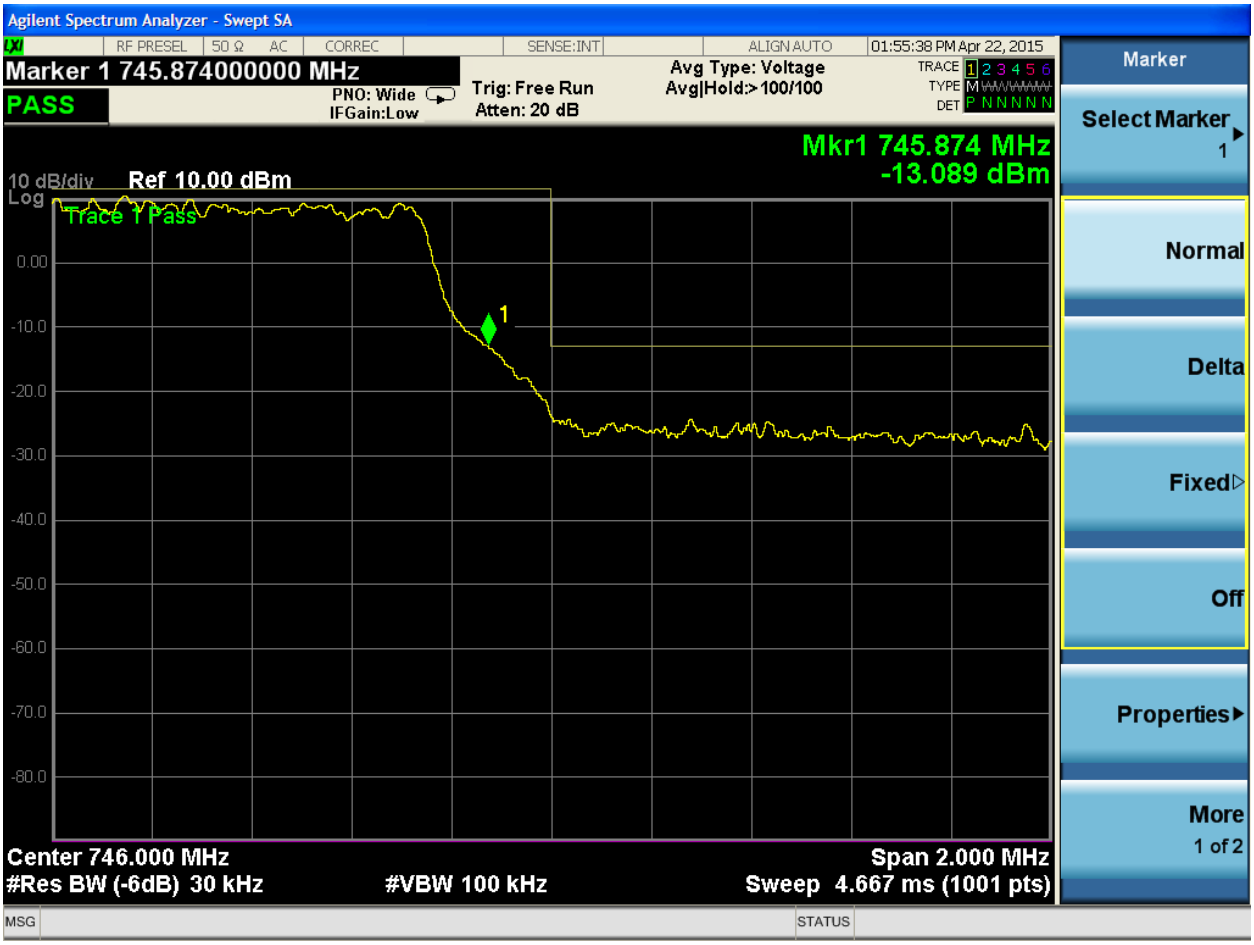
40°C, Low Frequency Edge



40°C, High Frequency Edge



50°C, Low Frequency Edge

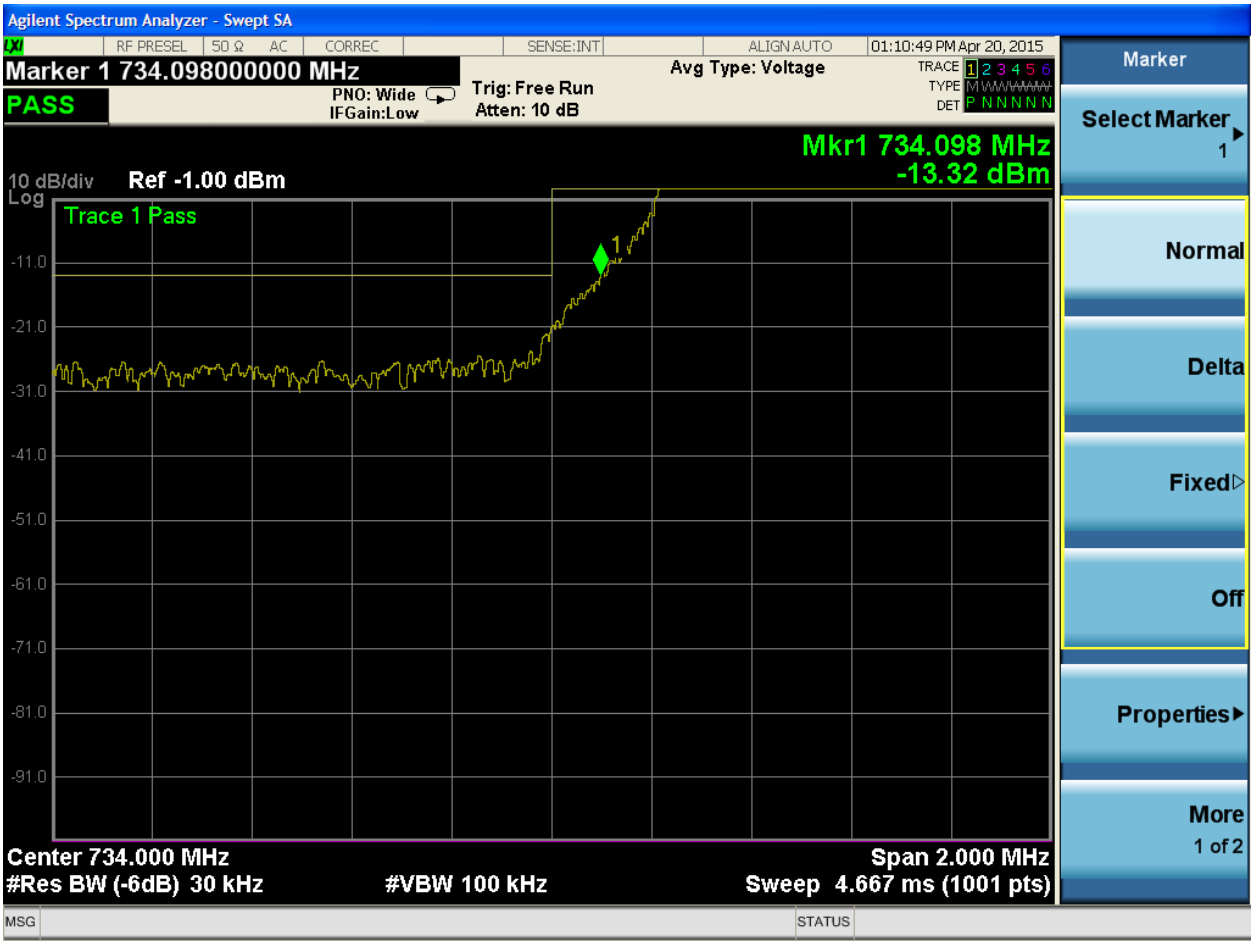


50°C, High Frequency Edge

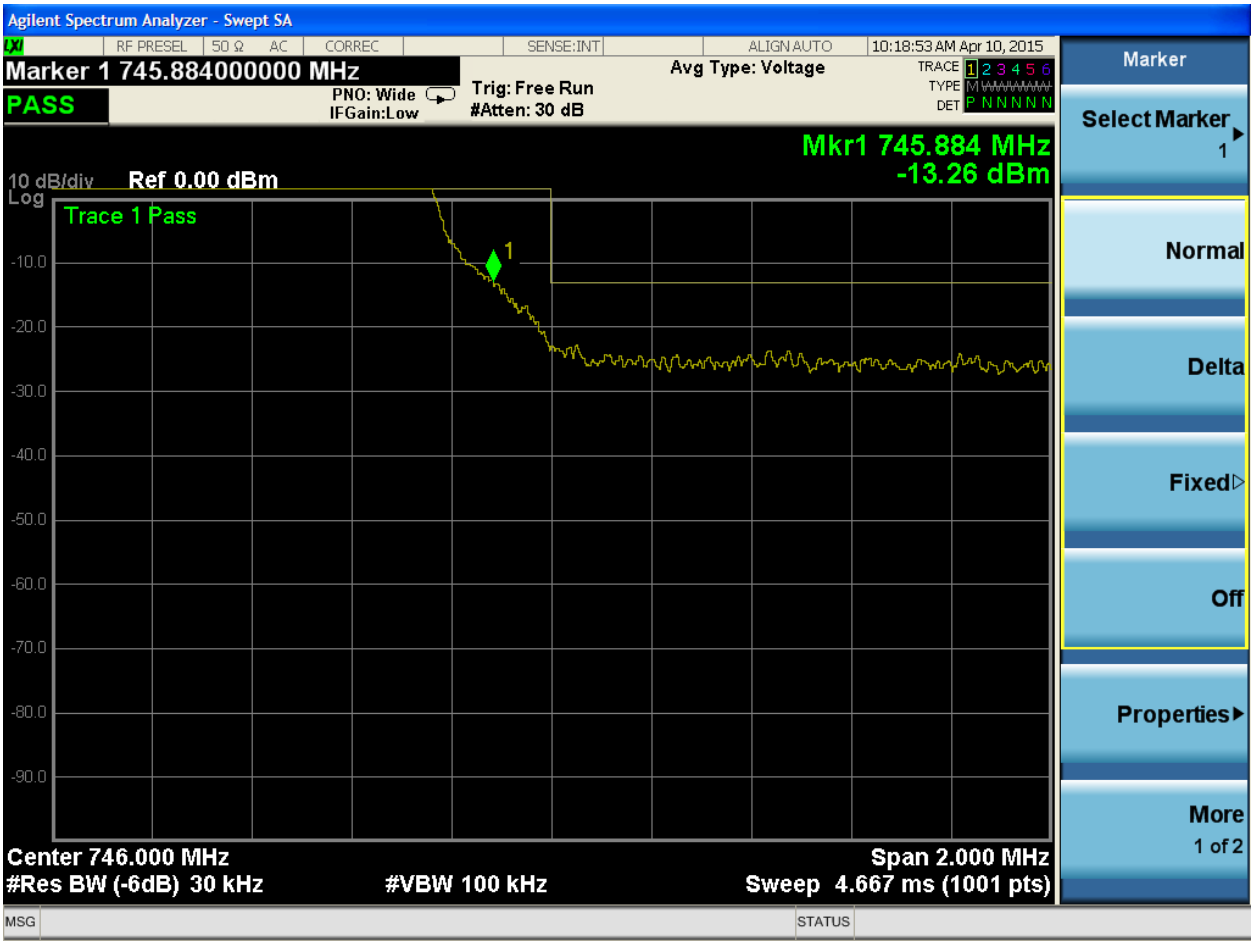
Band 17:

-30°C, Low Frequency Edge

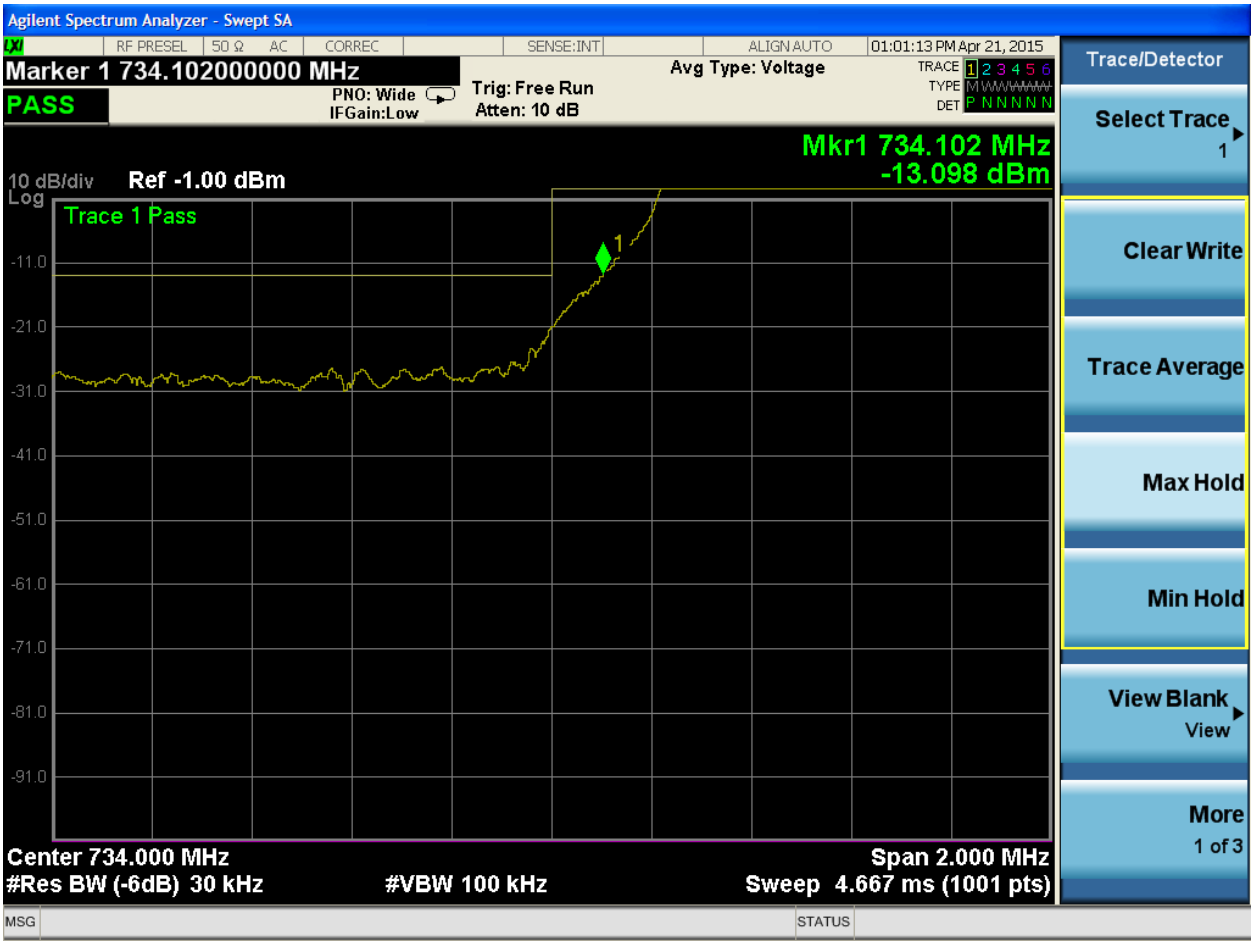
-20°C, Low Frequency Edge



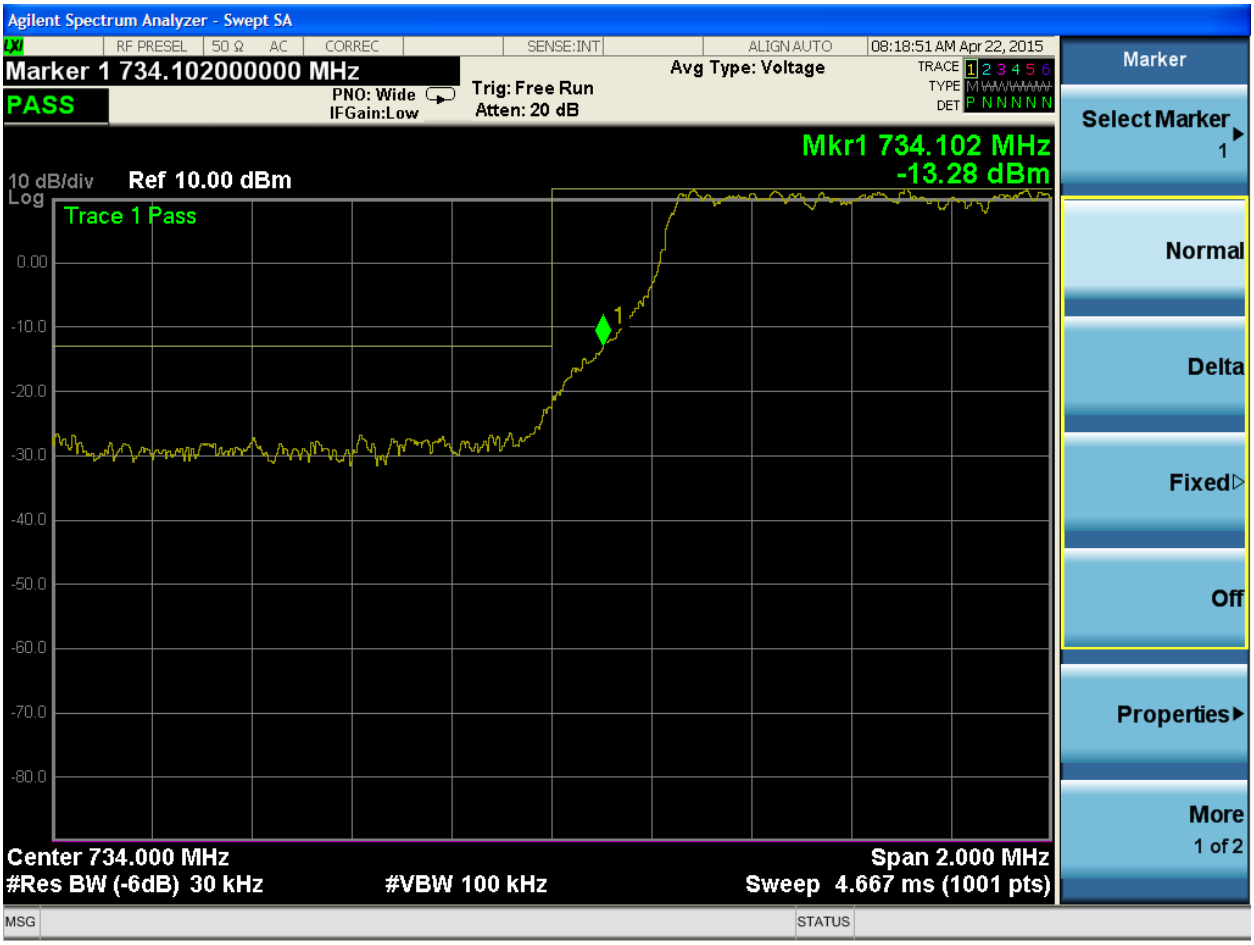
-10°C, Low Frequency Edge



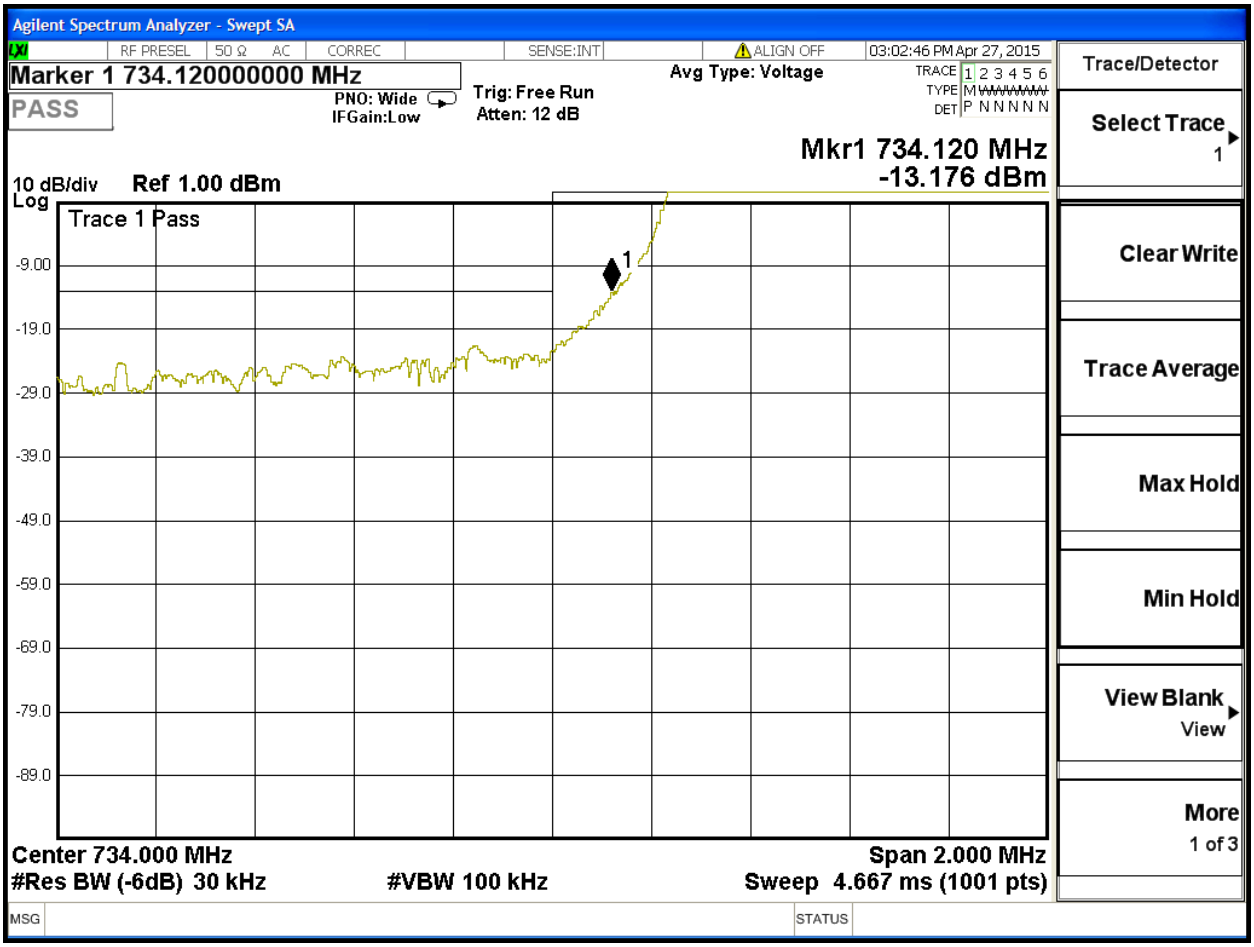
0°C, Low Frequency Edge



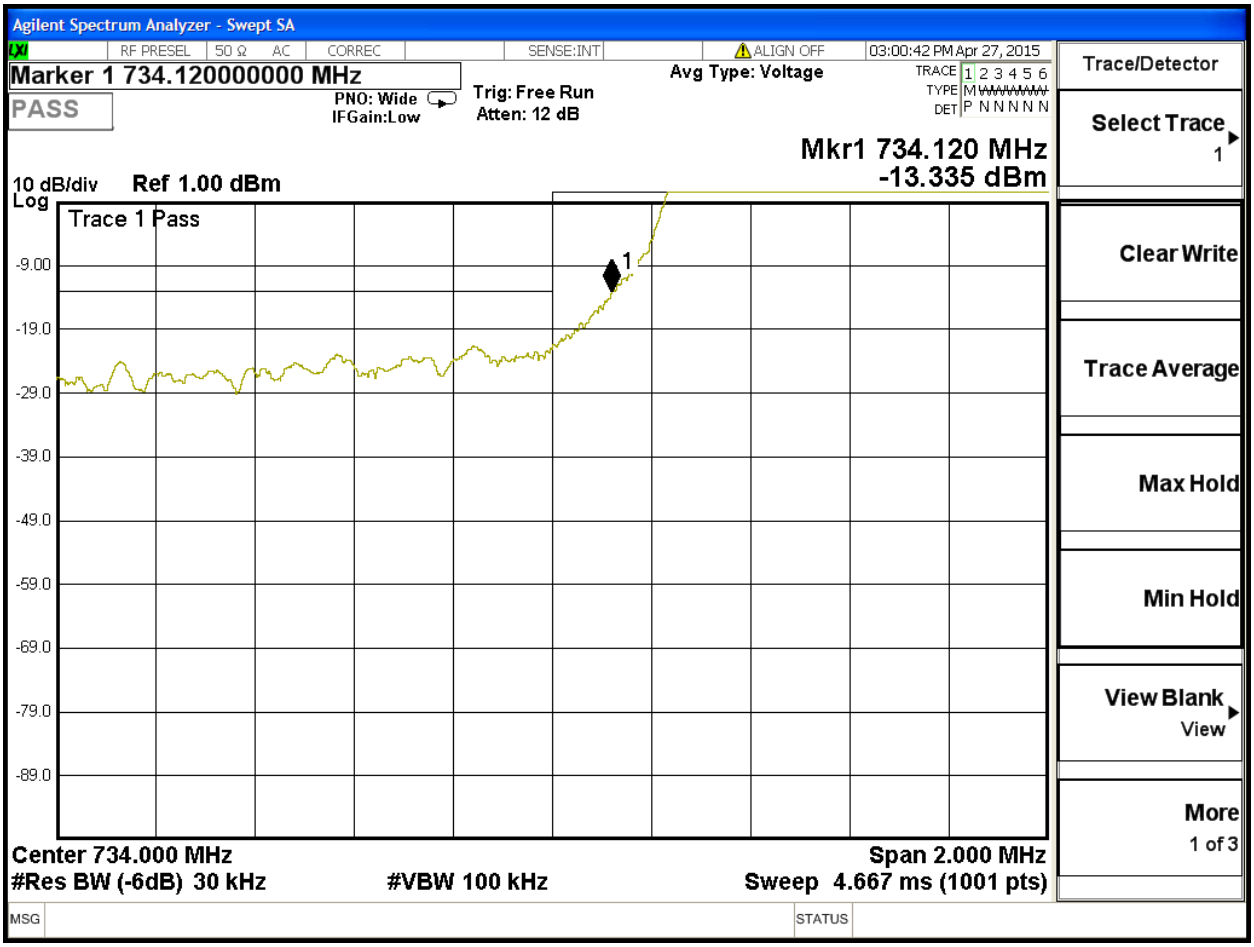
10°C, Low Frequency Edge



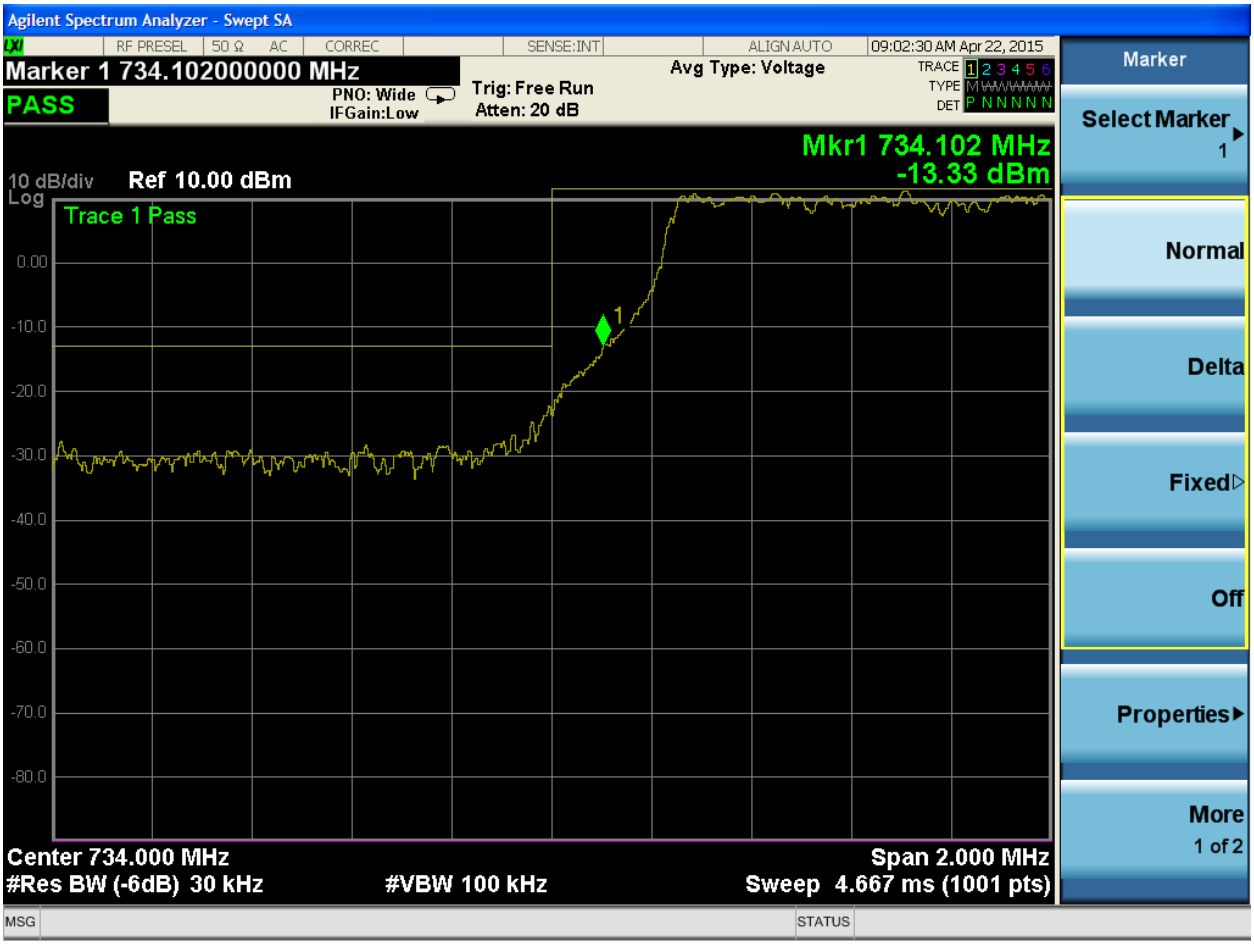
20°C, Low Frequency Edge, 120Vac



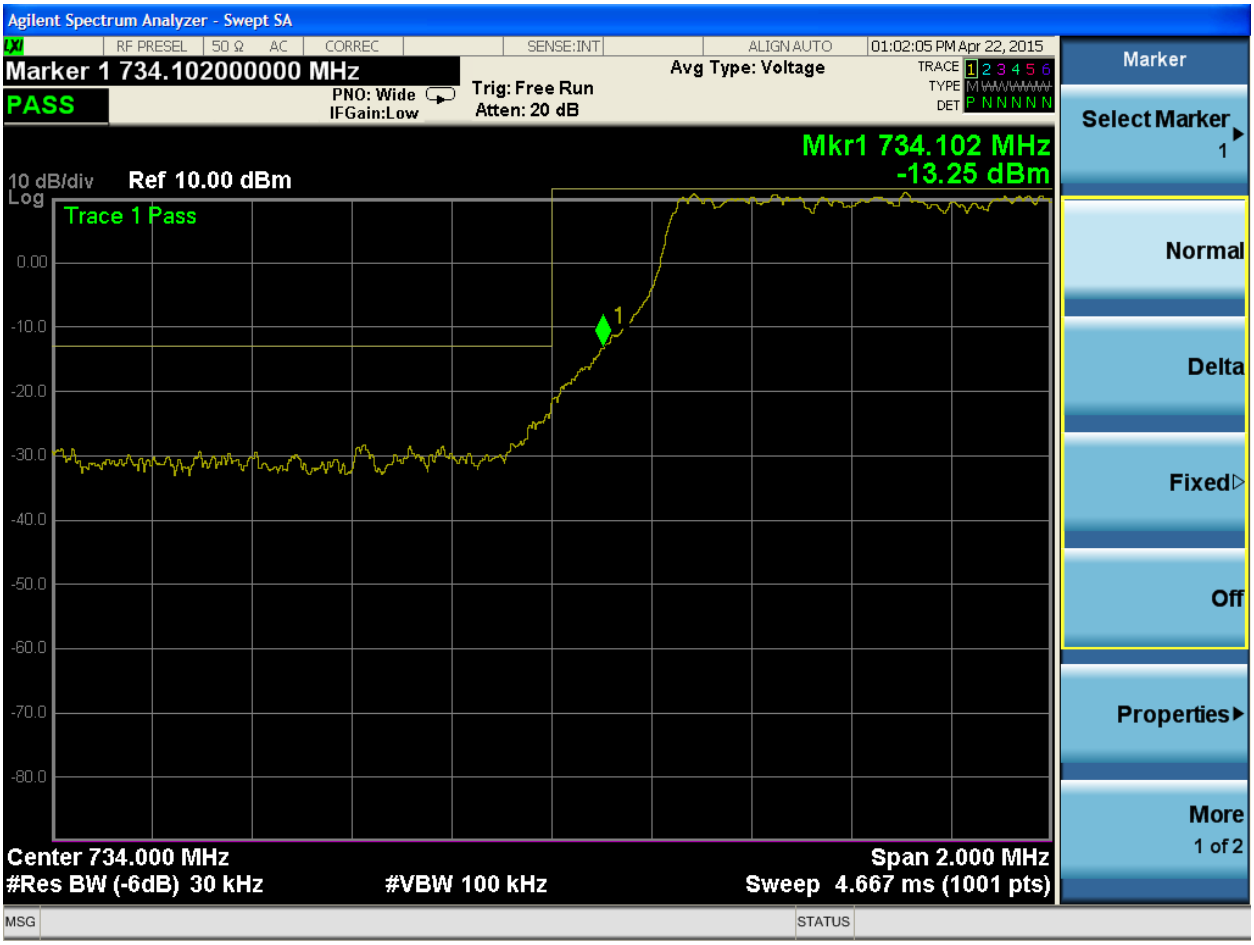
20°C, Low Frequency Edge, 102Vac (-15% from nominal)



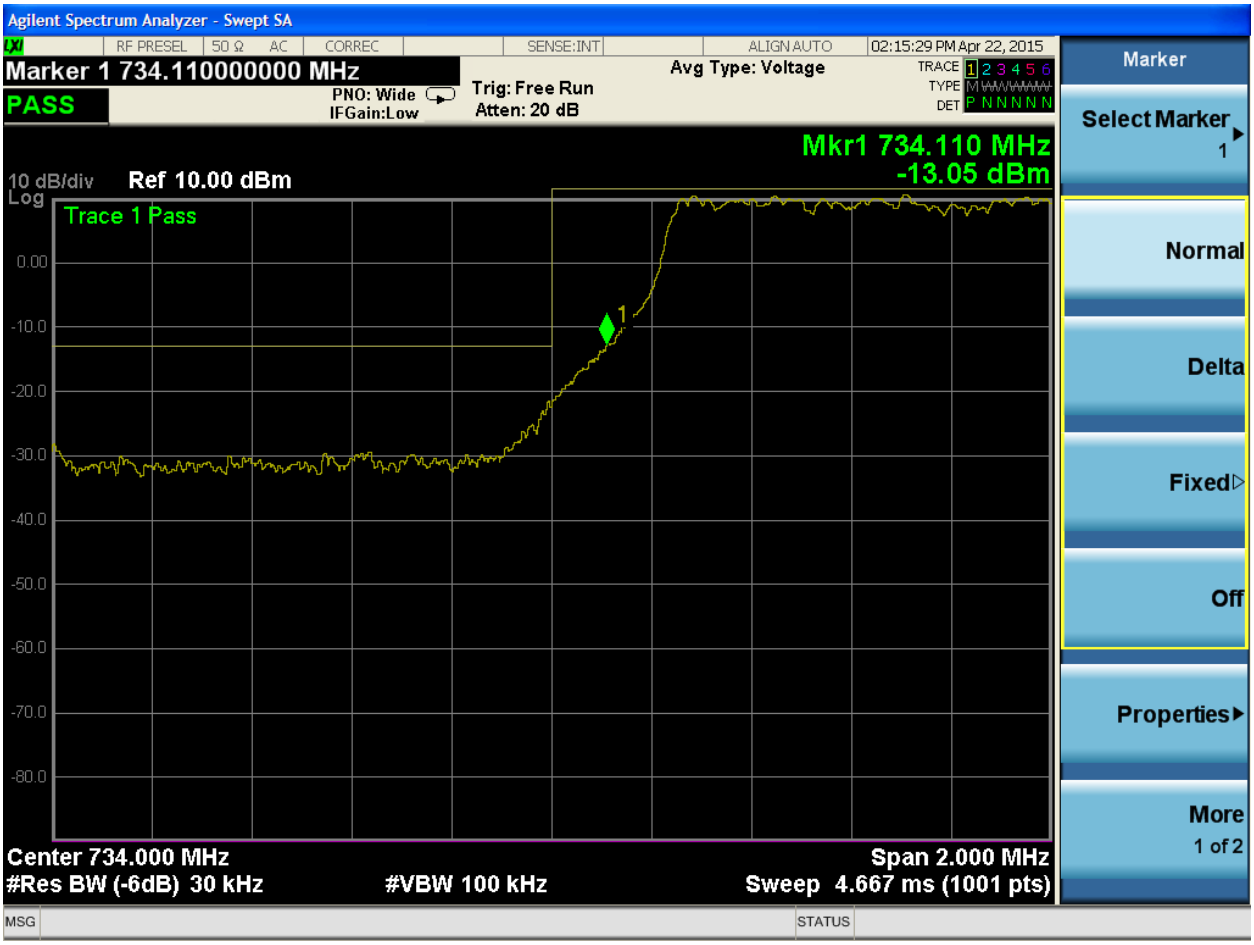
20°C, Low Frequency Edge, 138Vac (+15% from nominal)



30°C, Low Frequency Edge



40°C, Low Frequency Edge



50°C, Low Frequency Edge

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 calcations using formula from FCC KDB 662911 Section f(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 calculated overall directional gain: 0dBi + 10log(N)dB = 0dBi + 3.0dB = 3.0dBi.

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Frequency (MHz)	Peak Power Reading (dBm)	Power Combiner (dB)	20dB Attenuator (dB)	Cable Factor dB)	Adjusted Peak Power Reading (dBm)	Directional Antenna Gain (dBi)	EIRP (dBm)	FCC Part 27.50(b)(9); Limit: 30W = 44.77dBm			
												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

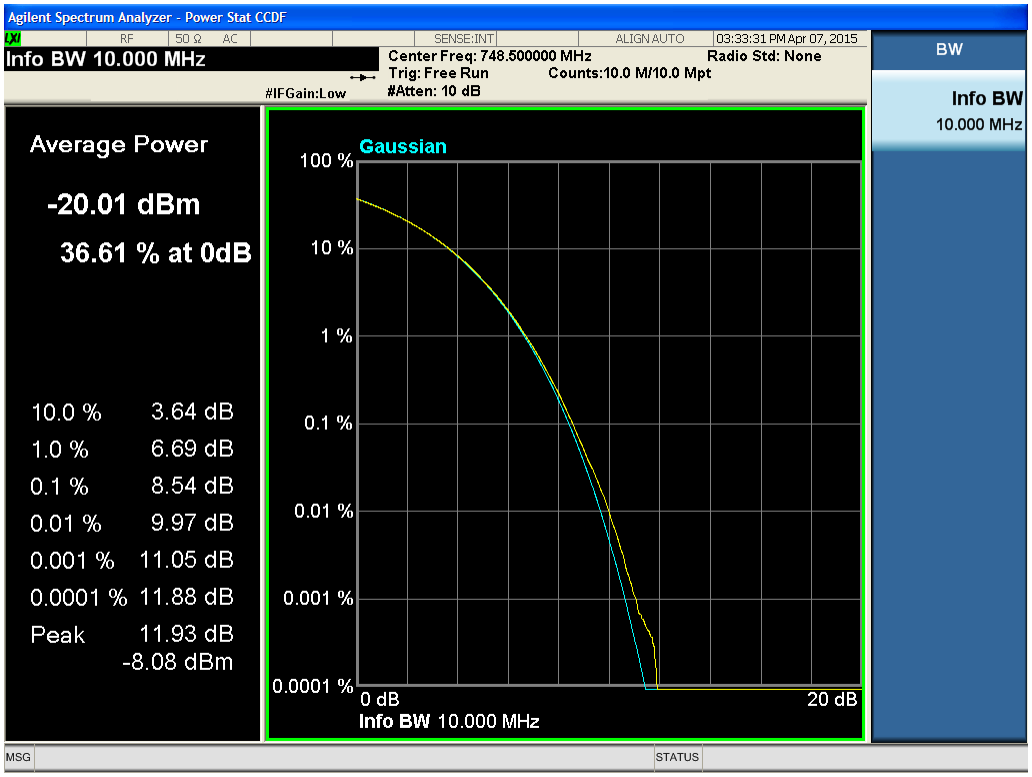
Test Equipments: Brown SA, Cable (#1787), 20dB Attenuation (#791), Mini Circuit (#1939), 3m Indoor

Note:

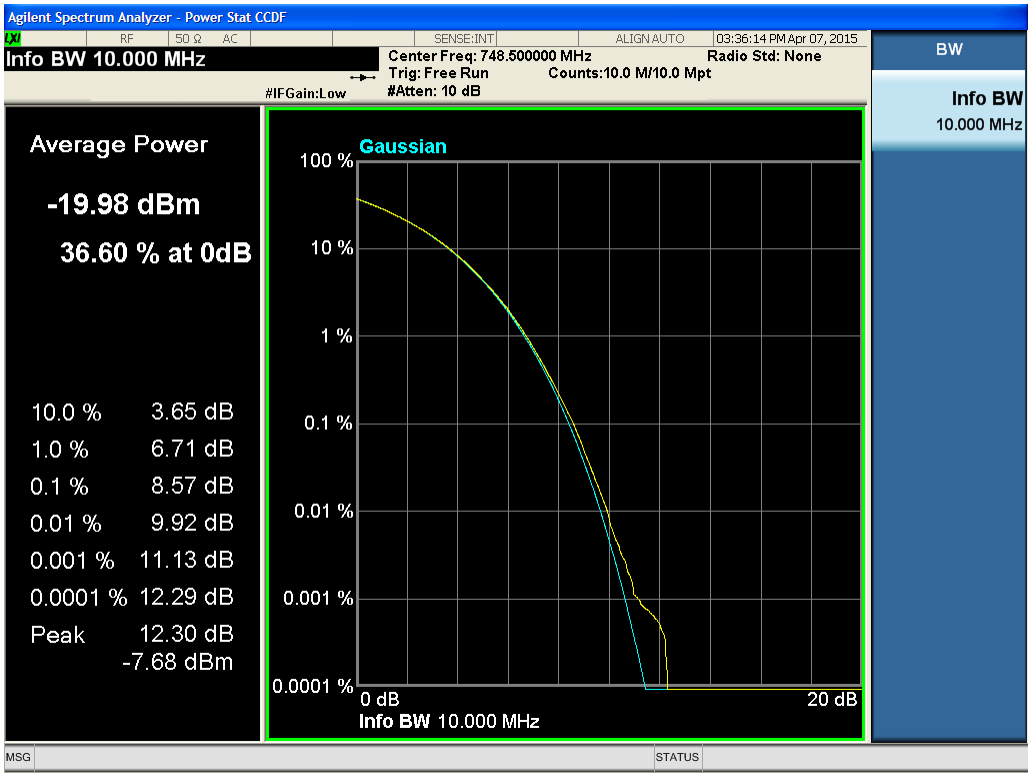
Band	BW (MHz)	Channel (MHz)	Frequency (MHz)	0.1% Peak to Average Ratio (dB)			Limit (dB)	Margin (dB)			Result Pass / Fail
				QPSK	16QAM	64QAM		QPSK	16QAM	64QAM	
12	5	Low	730.5	8.66	8.75	8.61	13	-4.34	-4.25	-4.39	Pass
12	5	Mid	737	8.49	8.61	8.47	13	-4.51	-4.39	-4.53	Pass
12	5	High	743.5	8.45	8.57	8.42	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.

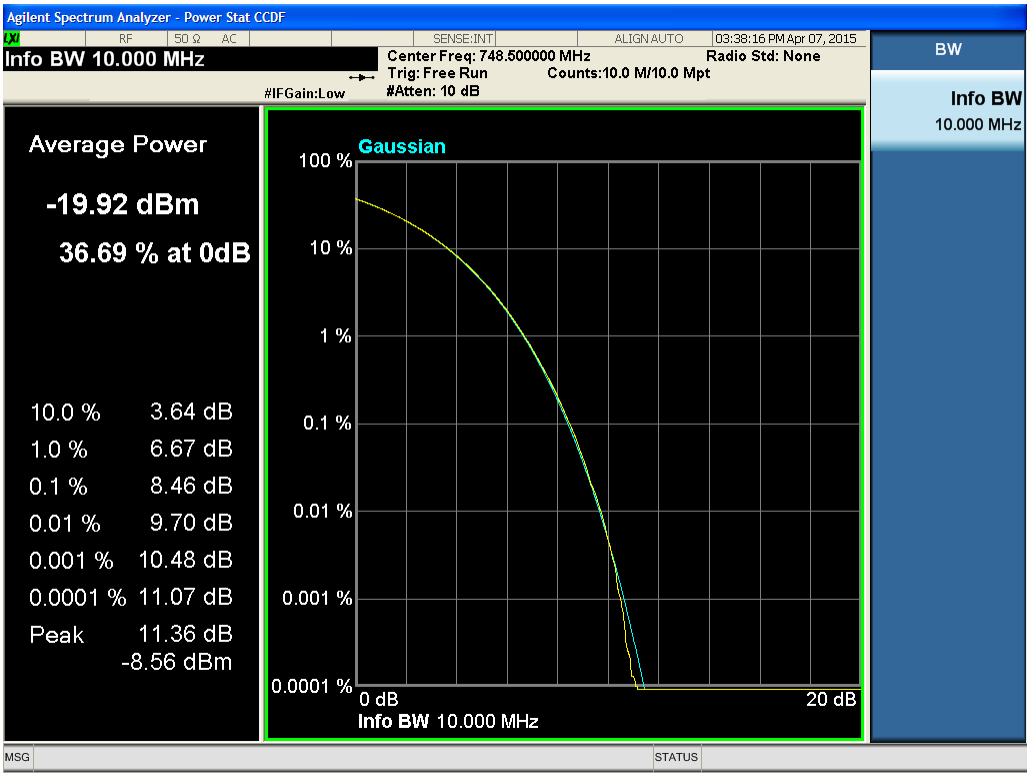
PLOTS



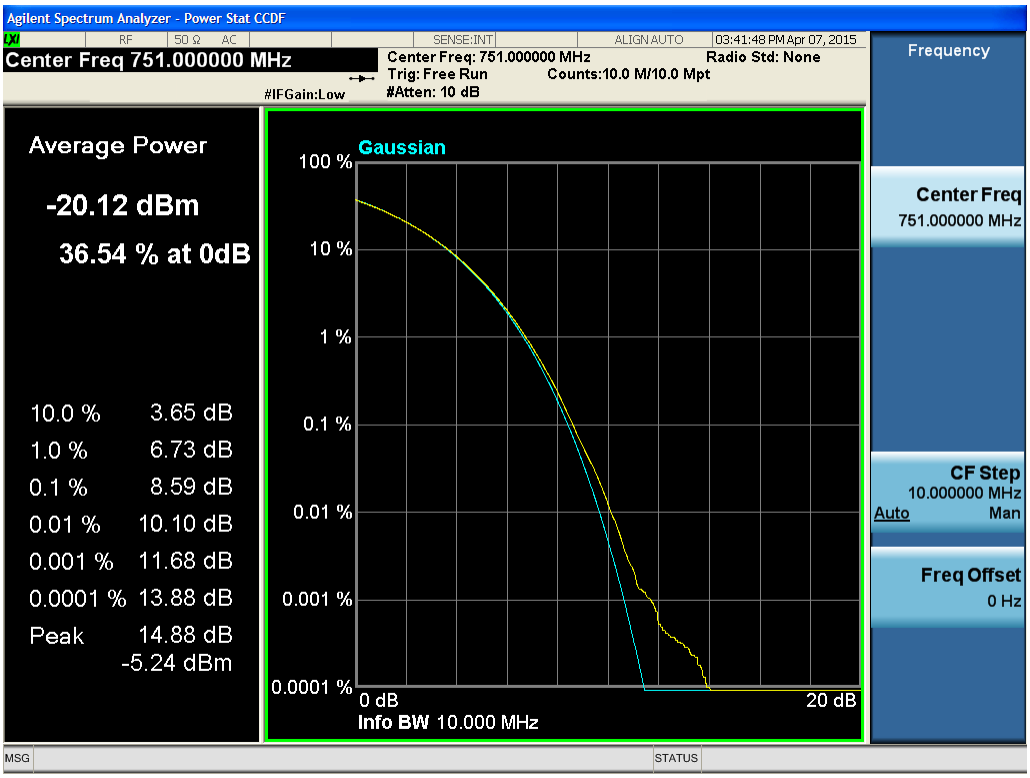
Band 13 - 5MHz BW – Low Channel – QPSK



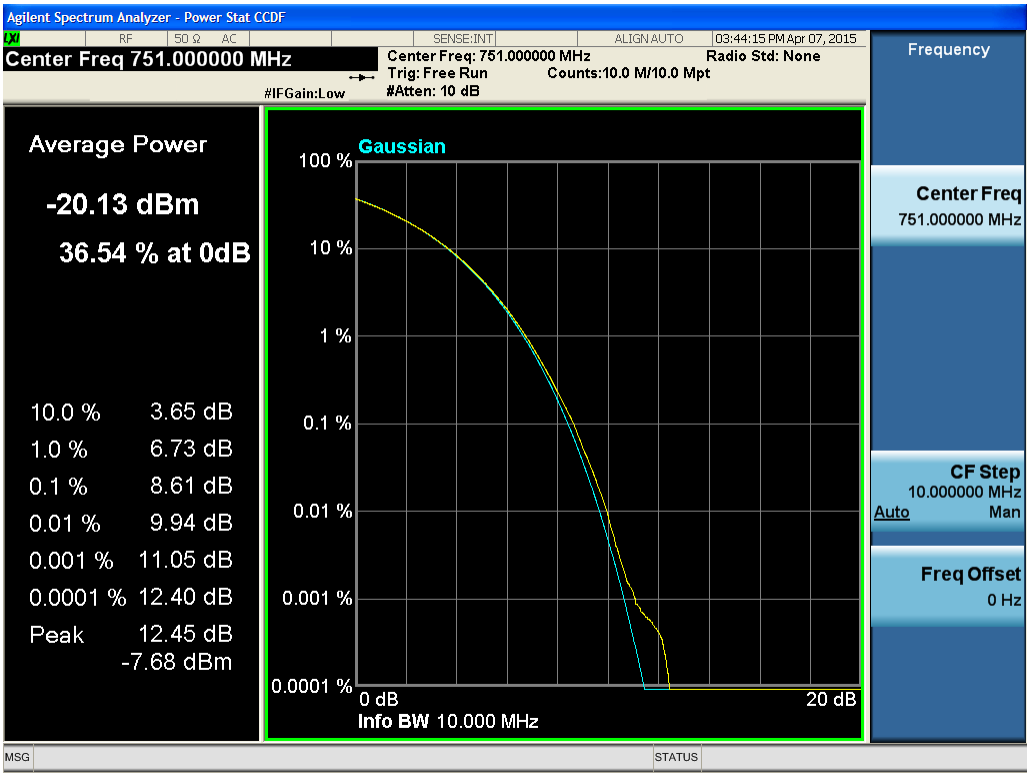
Band 13 - 5MHz BW – Low Channel – 16QAM



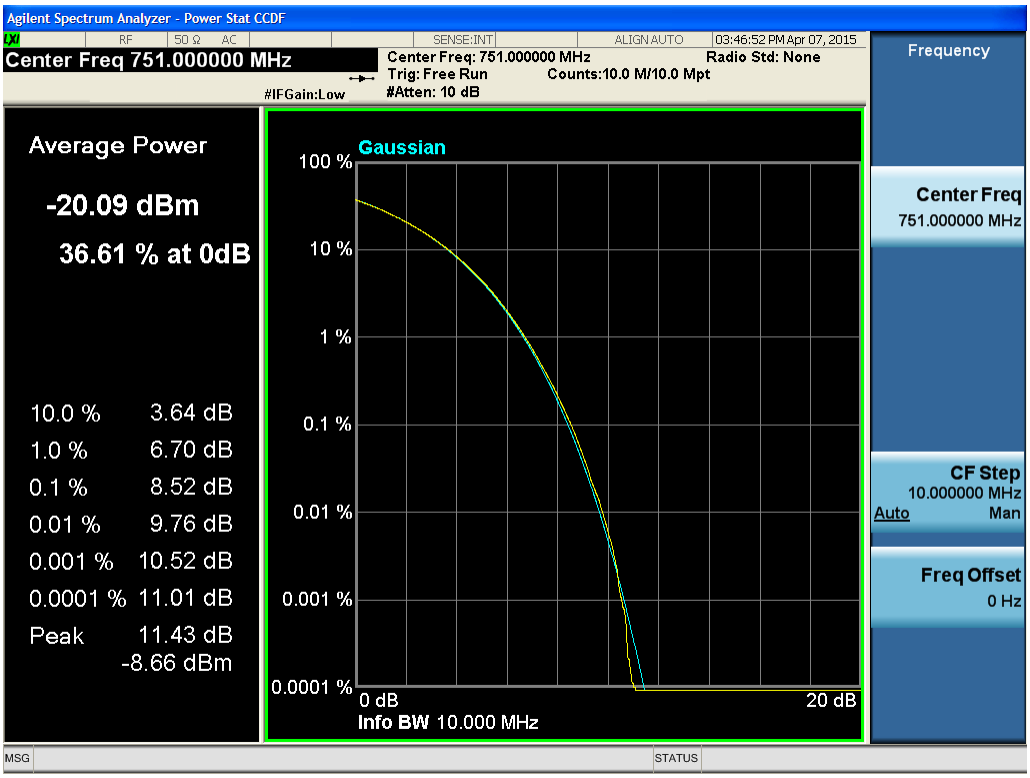
Band 13 - 5MHz BW – Low Channel – 64QAM



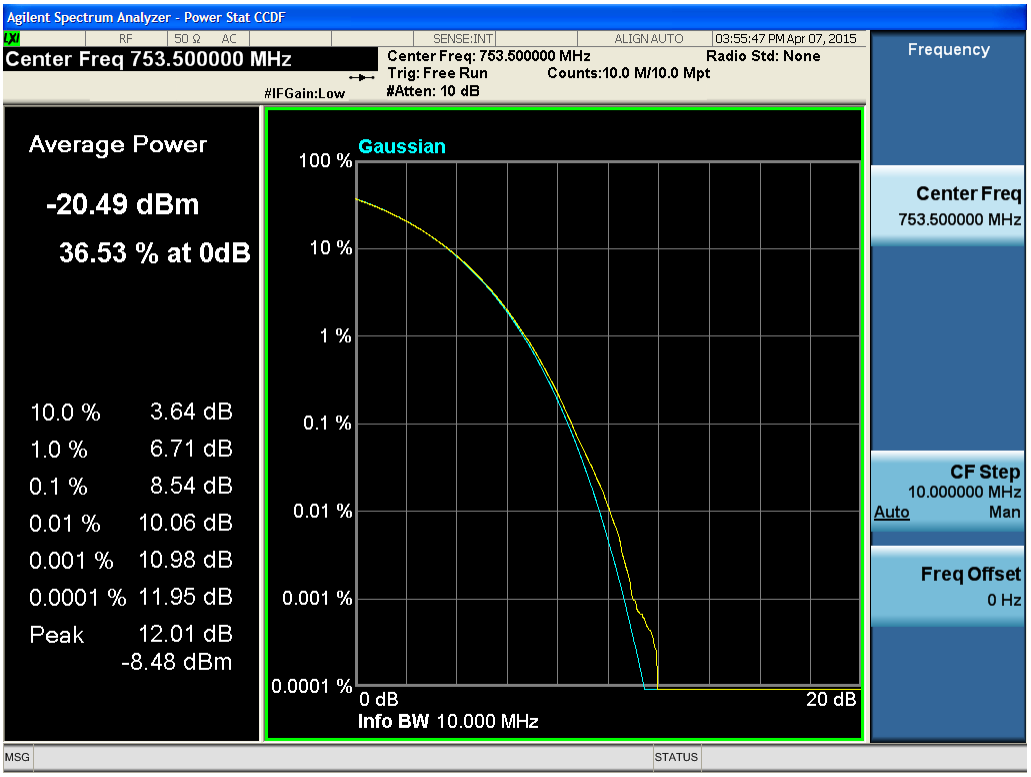
Band 13 - 5MHz BW – Mid Channel - QPSK



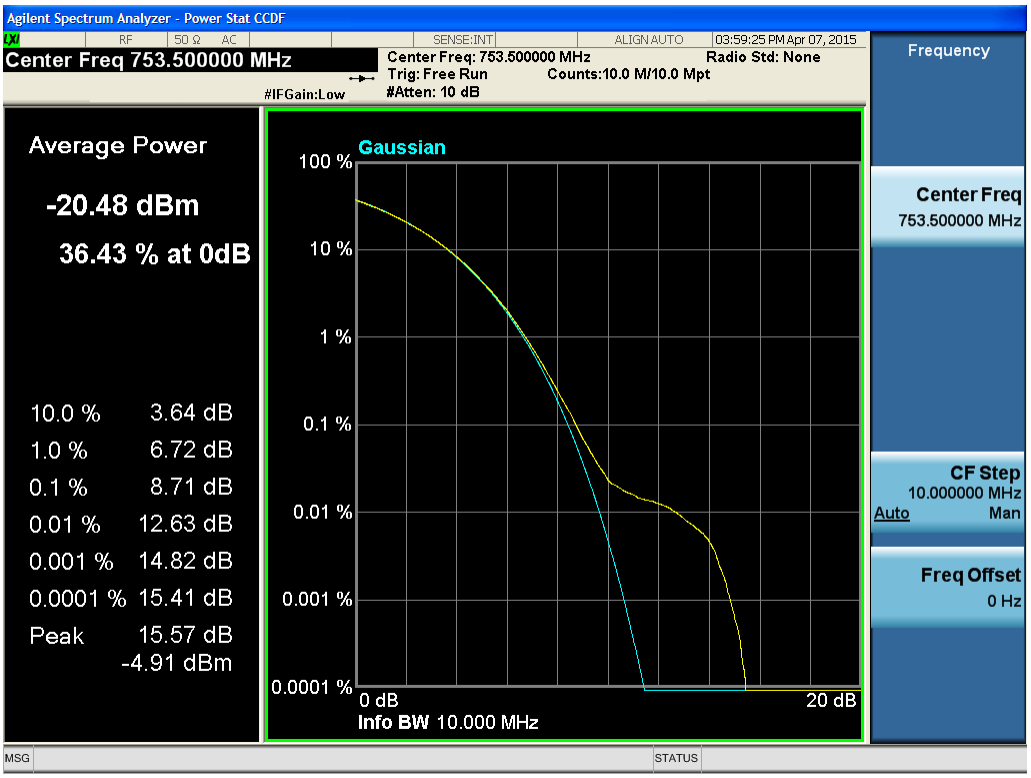
Band 13 - 5MHz BW – Mid Channel – 16QAM



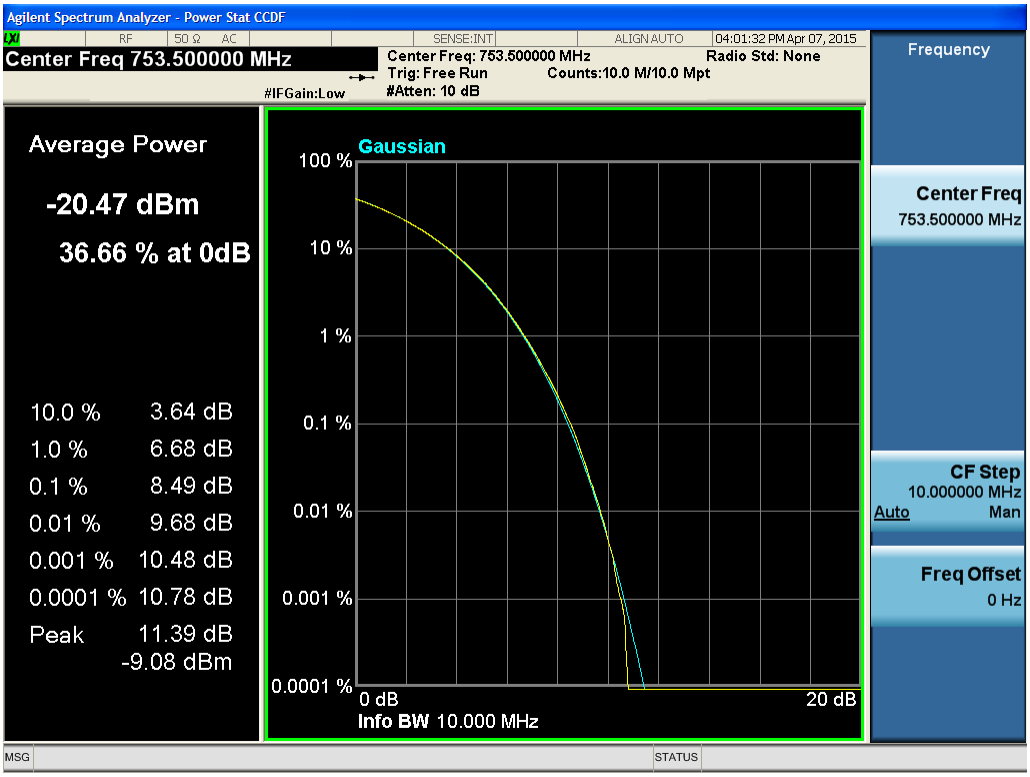
Band 13 - 5MHz BW – Mid Channel – 64QAM



Band 13 - 5MHz BW – High Channel – QPSK



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



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

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.)

Date: 27-Jul-15 **Company:** Airvana **Work Order:** P0152
Engineer: Ryan Brown **EUT Desc:** Switched IQ Radio Point Domestic **EUT Operating Voltage/Frequency:** POE
Temp: 27°C **Humidity:** 51% **Pressure:** 1008 mBar

Frequency Range: Low, Mid and High Channels

Notes: 30W = 44.77dBm. Multiple antenna calcations using formula from FCC KDB 662911 Section f(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 calculated overall directional gain: 0dBi + 10log(N)dB = 0dBi + 3.0dB = 3.0dBi.
Note: Band 13 contains only one channel at 10MHz bandwidth.

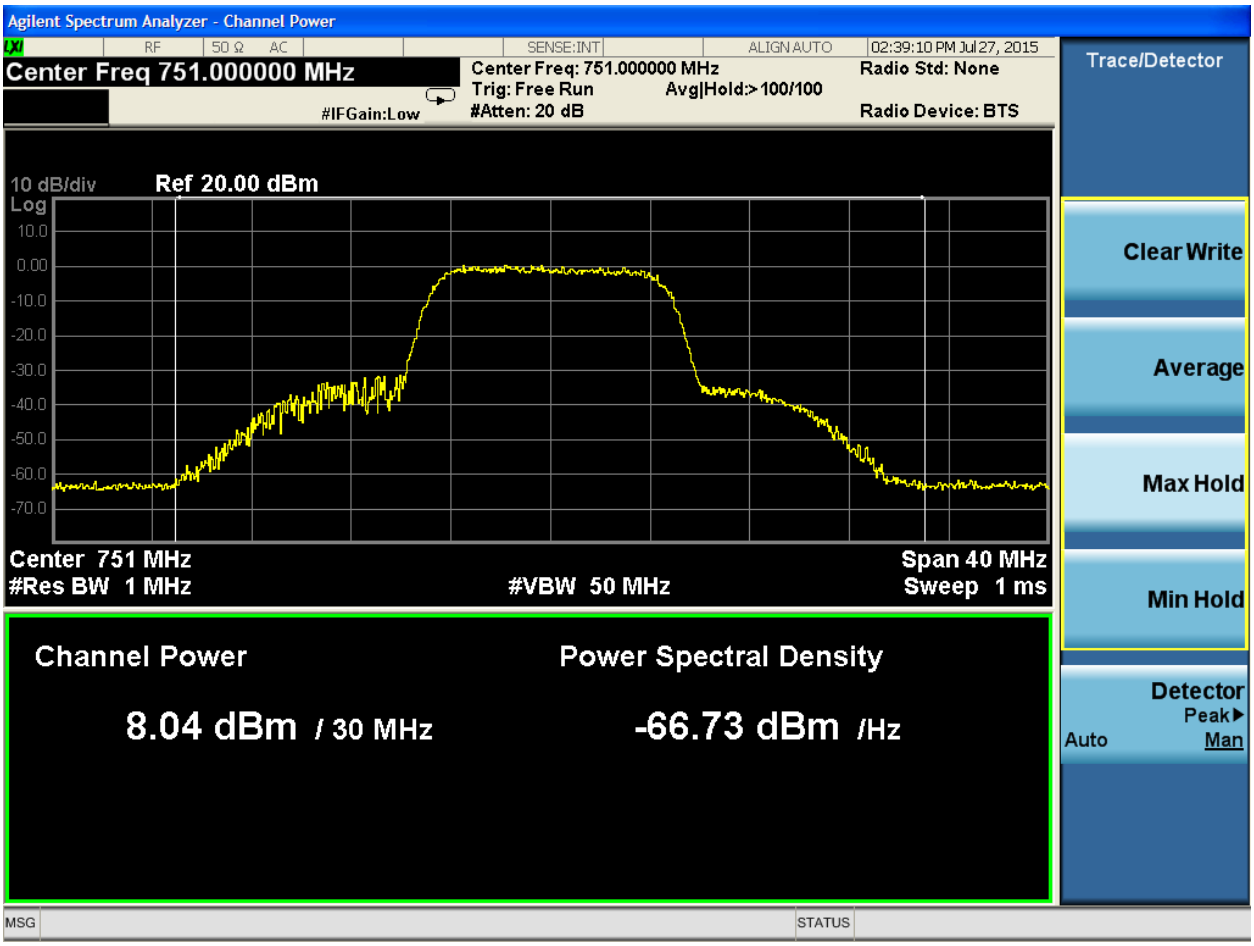
Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Frequency (MHz)	Average Power Reading (dBm)	Peak Power Reading (dBm)	PAPR Limit: 13dB (dB)	Power Combiner (dB)	20dB Attenuator (dB)	Cable Factor dB	Adjusted Peak Power Reading (dBm)	Directional Antenna Gain (dBi)	ERP (dBm)	FCC Part 27.50(b)(9); Limit: 30W = 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

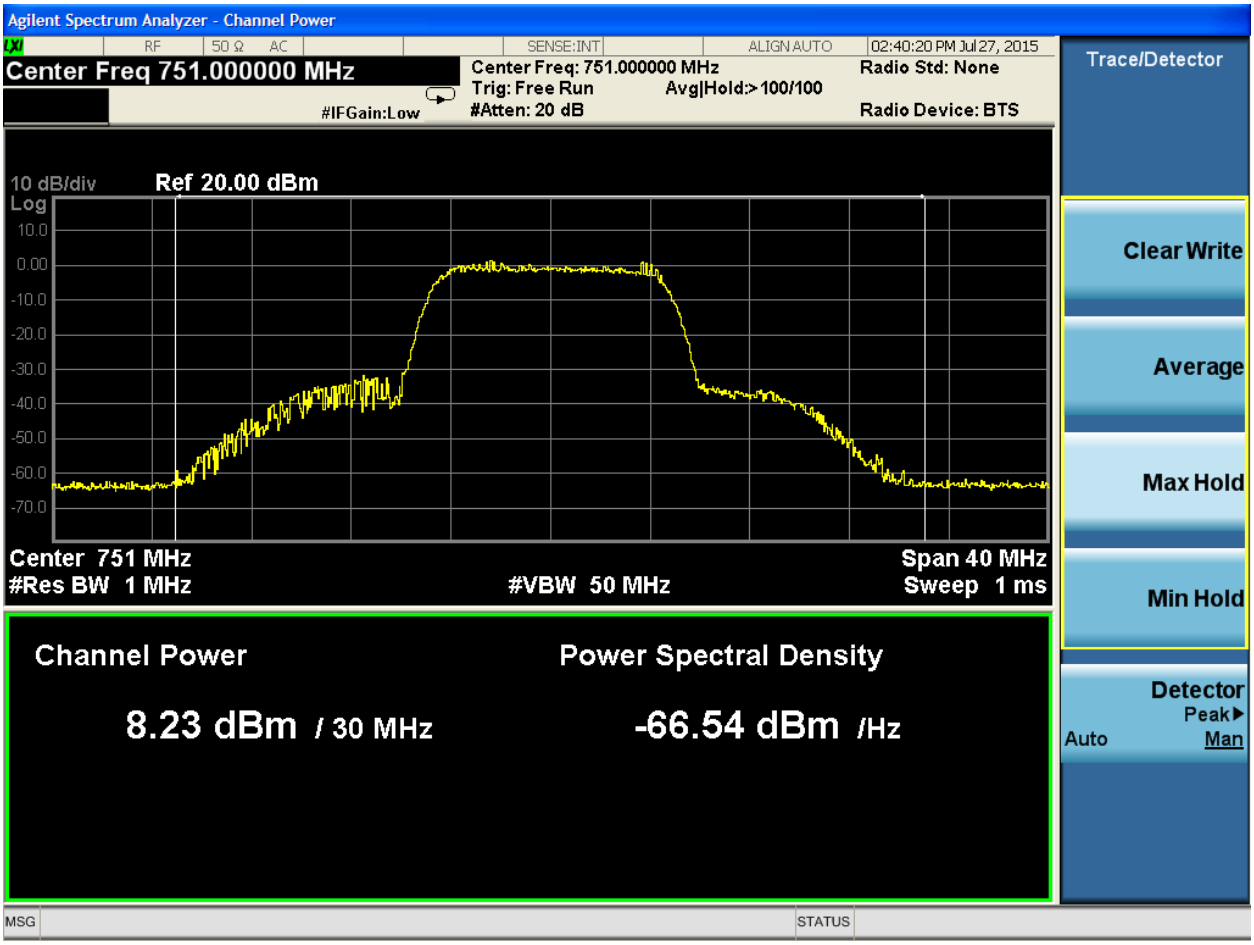
Test Site: ESD-1 **Cable:** 1509 **20dB Attenuator:** Asset#791
Analyzer: MXE EMI Receiver **Power Combiner:** 1939

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

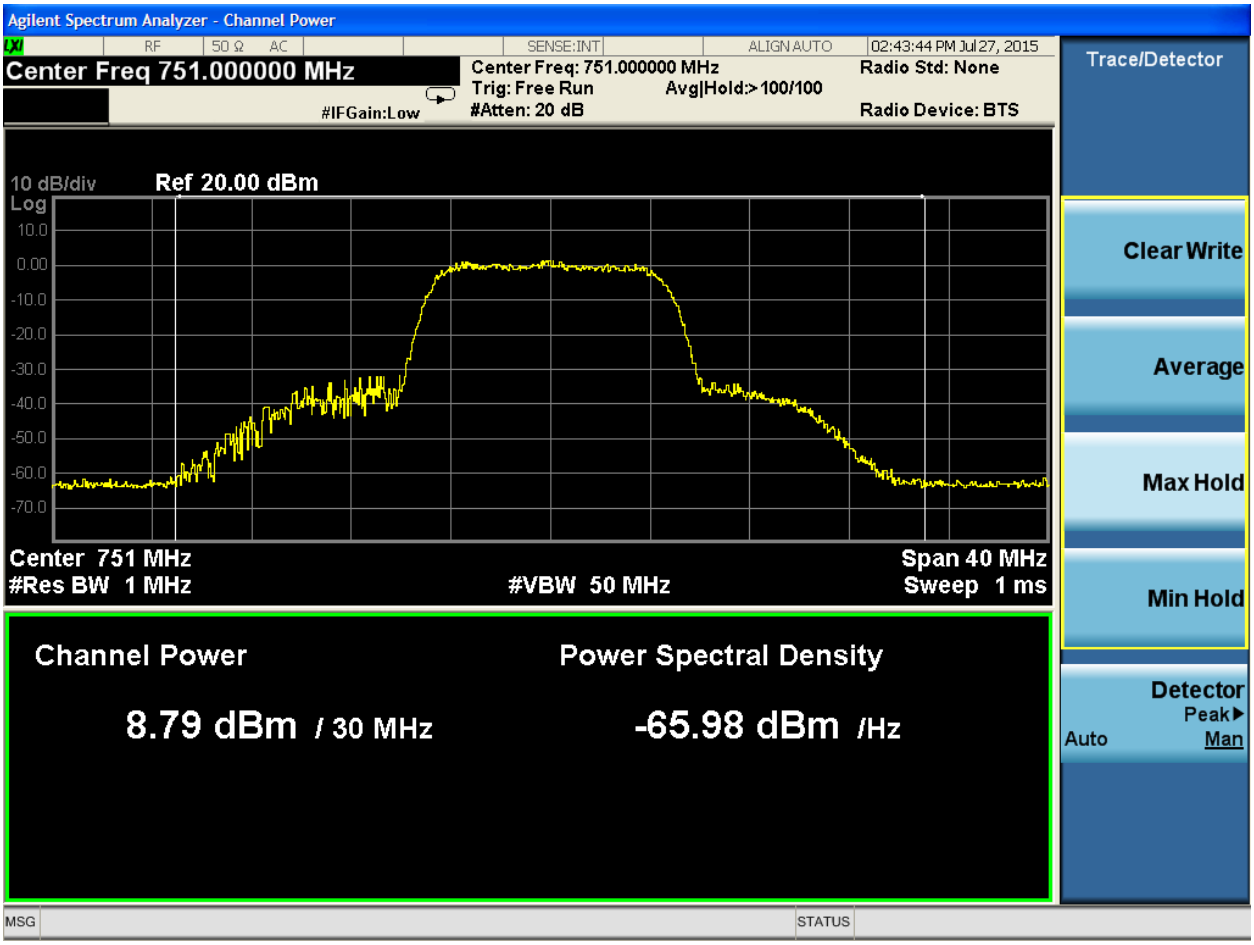
Band 13 Peak Readings:



10MHz (single channel), QPSK

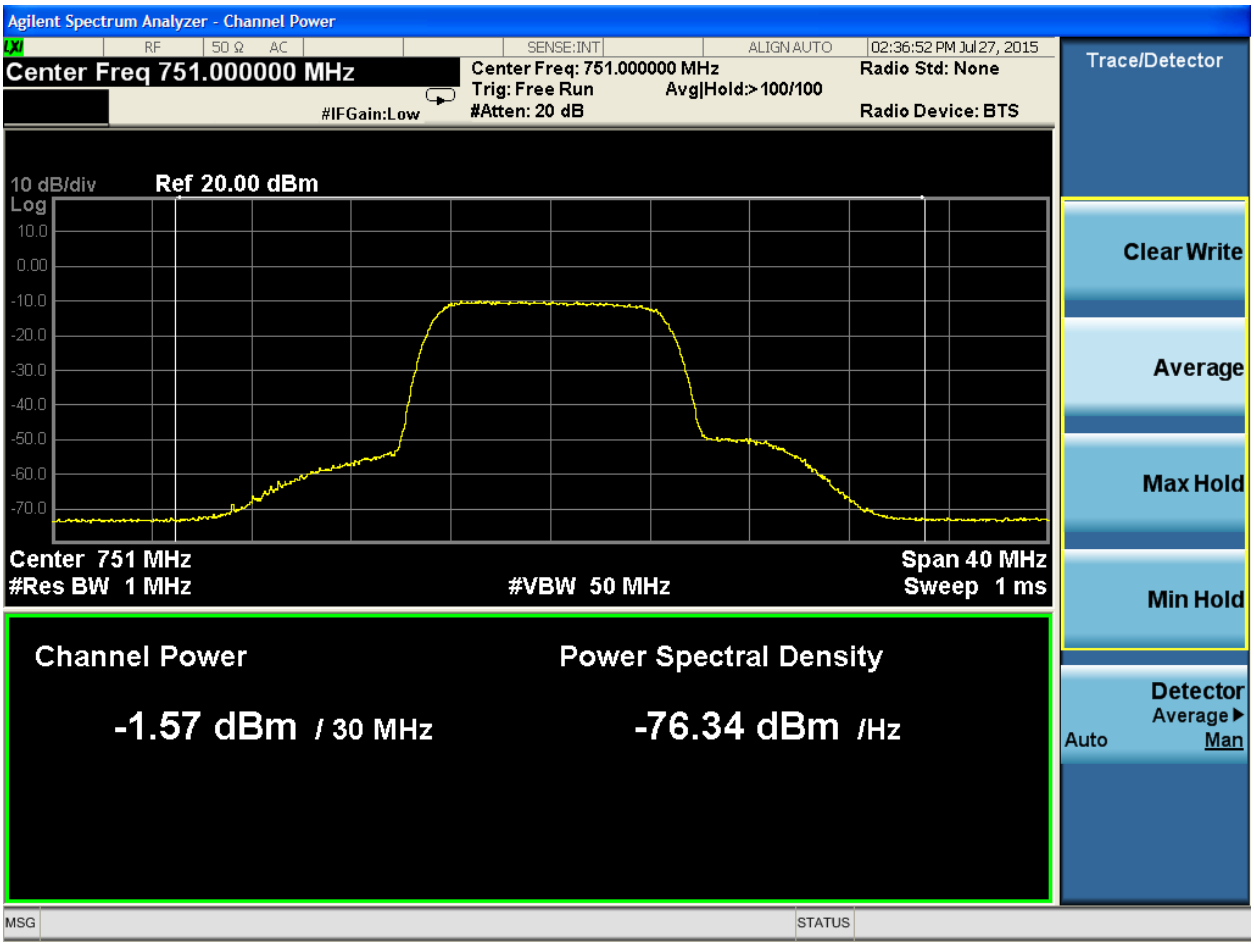


10MHz (single channel), 16QAM

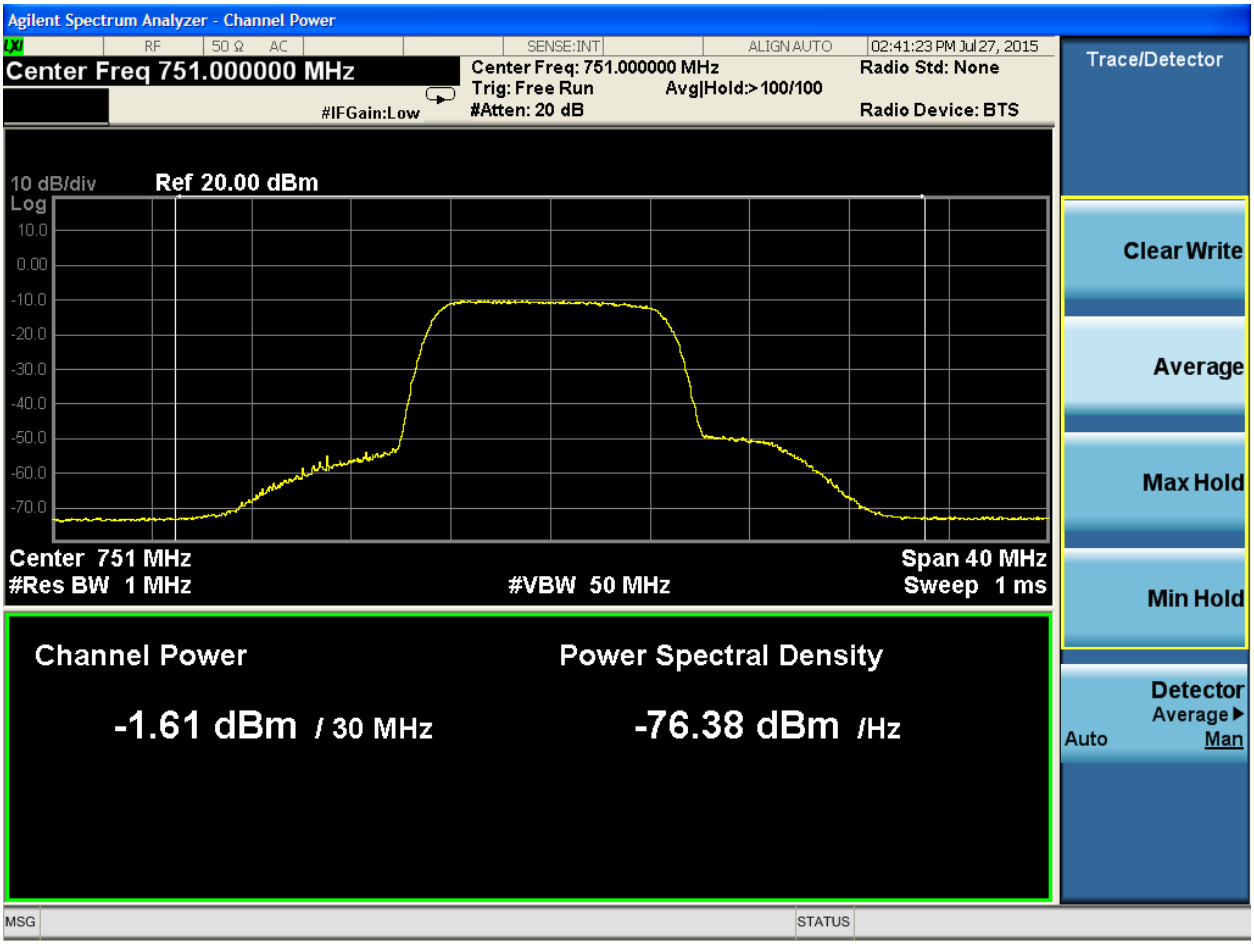


10MHz (single channel), 64QAM

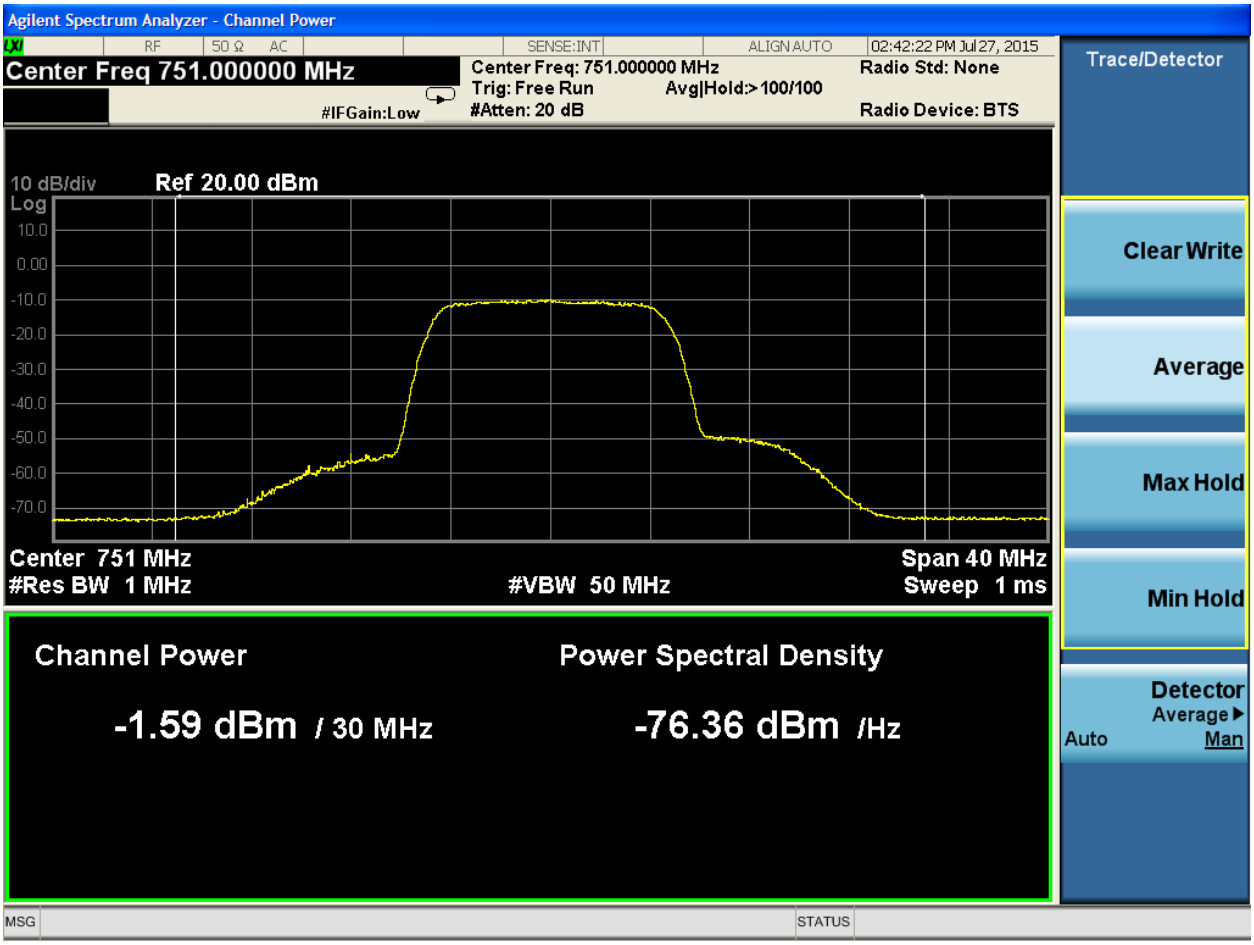
Band 13 Average Readings:



10MHz (single channel), QPSK



10MHz (single channel), 16QAM



10MHz (single channel), 64QAM

Band Edge Measurements

LIMITS

FCC 27.53(c):

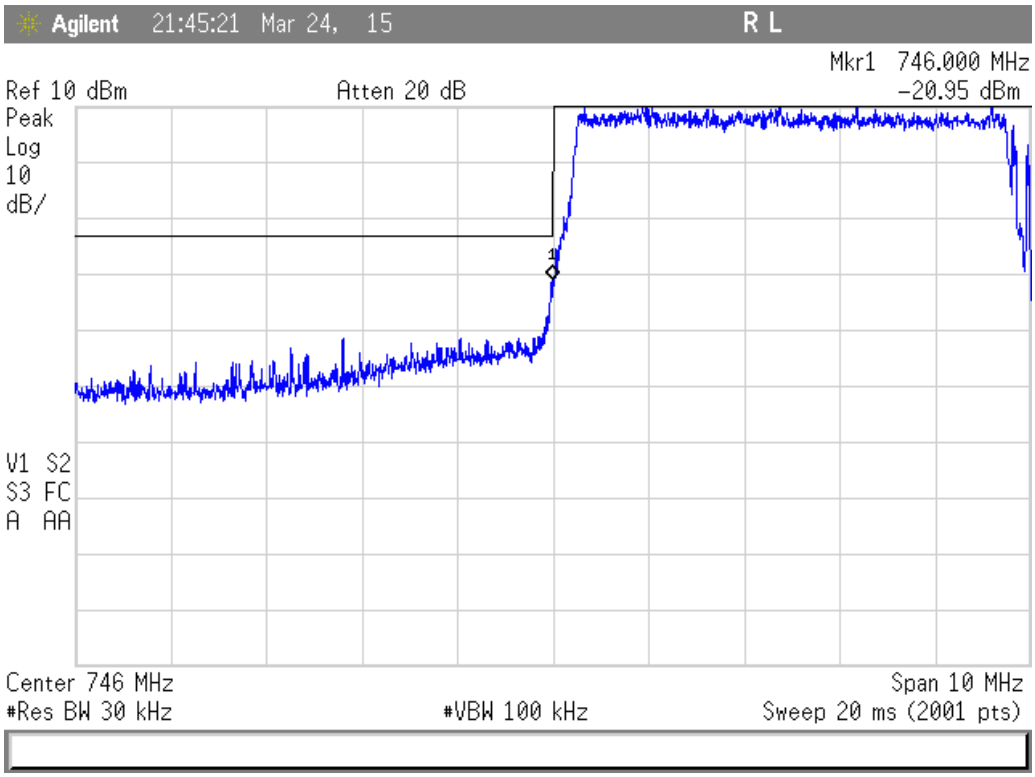
> *(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:*
>
> *(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

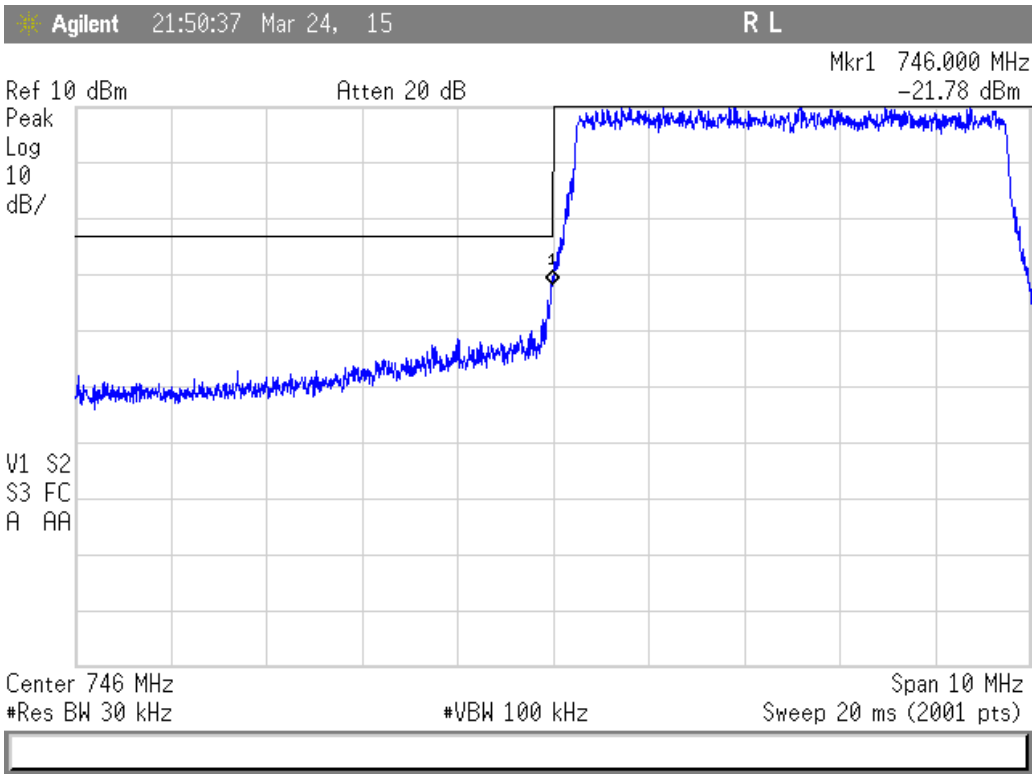
Note: Mask lines are set to -13dBm.

*Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm*

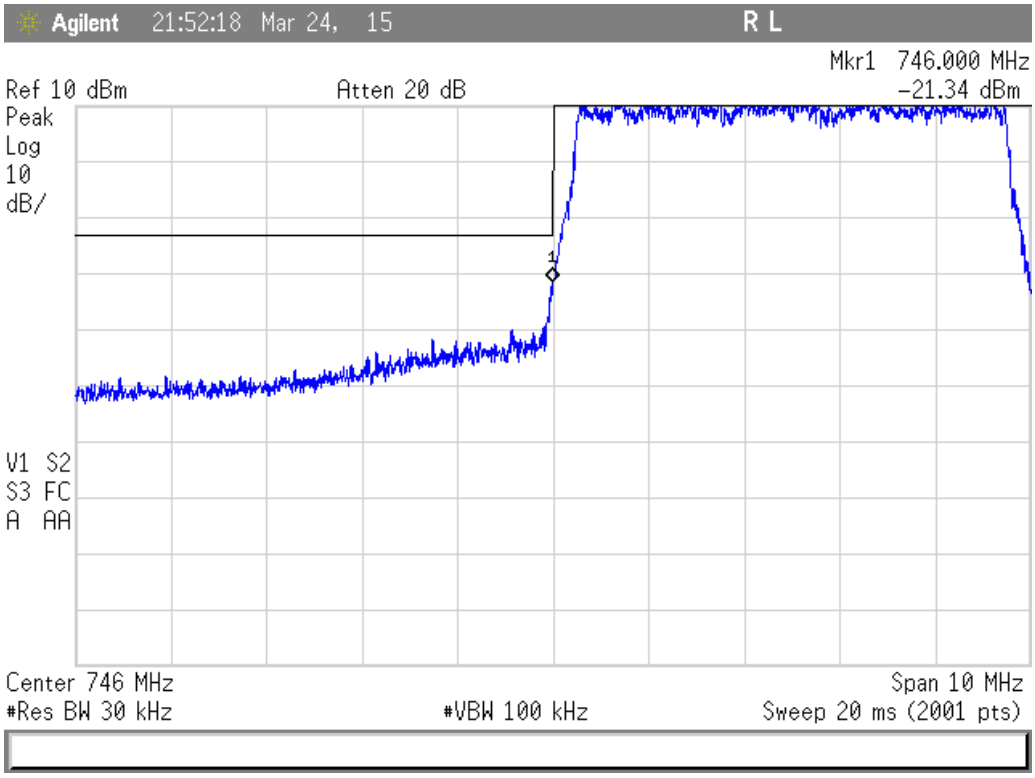
Correction factors for cables and attenuators are applied to the displayed amplitude.



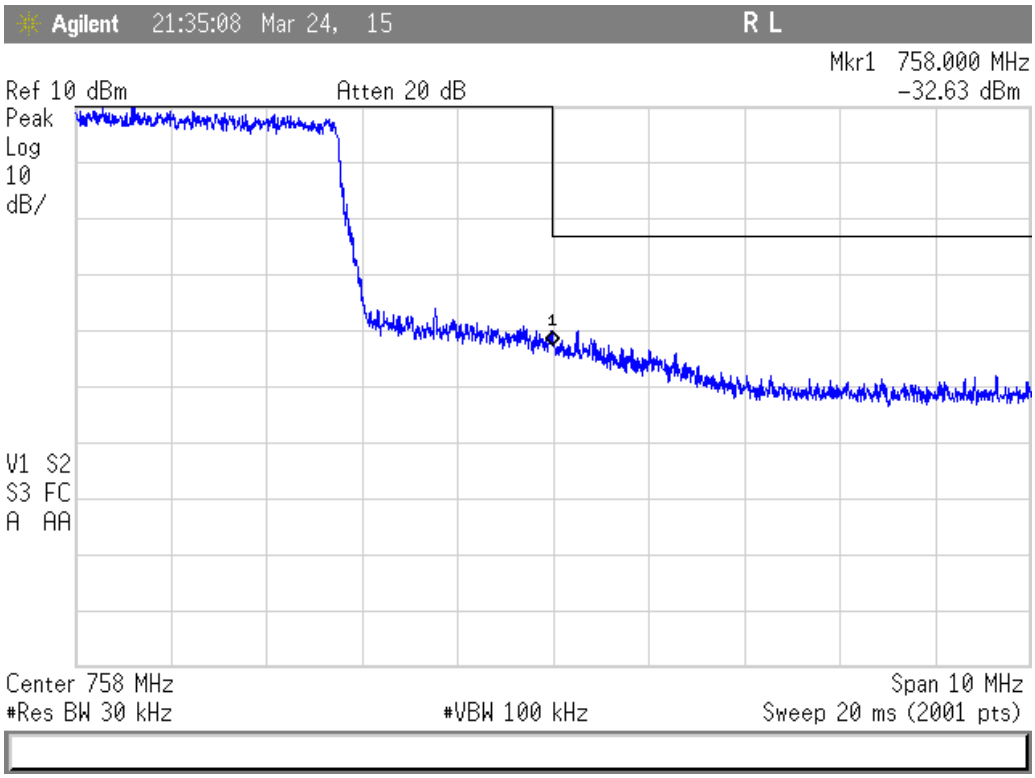
Lower Band Edge - Band 13 – 5MHz BW – QPSK – Port J1



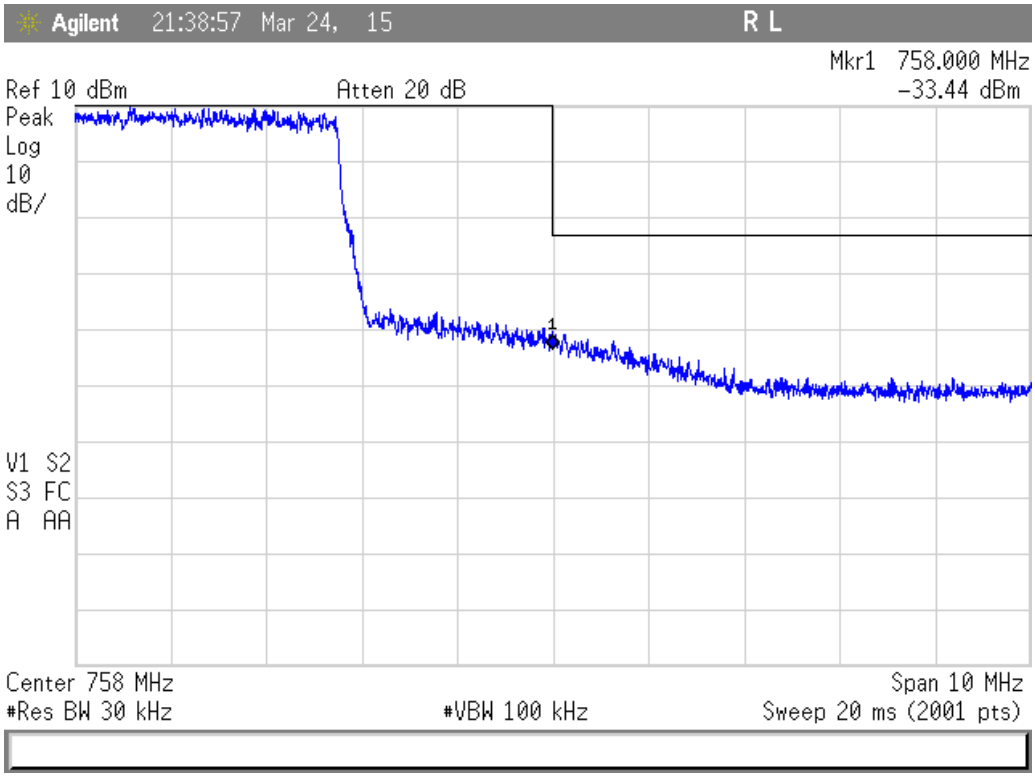
Lower Band Edge - Band 13 – 5MHz BW – 16QAM – Port J1



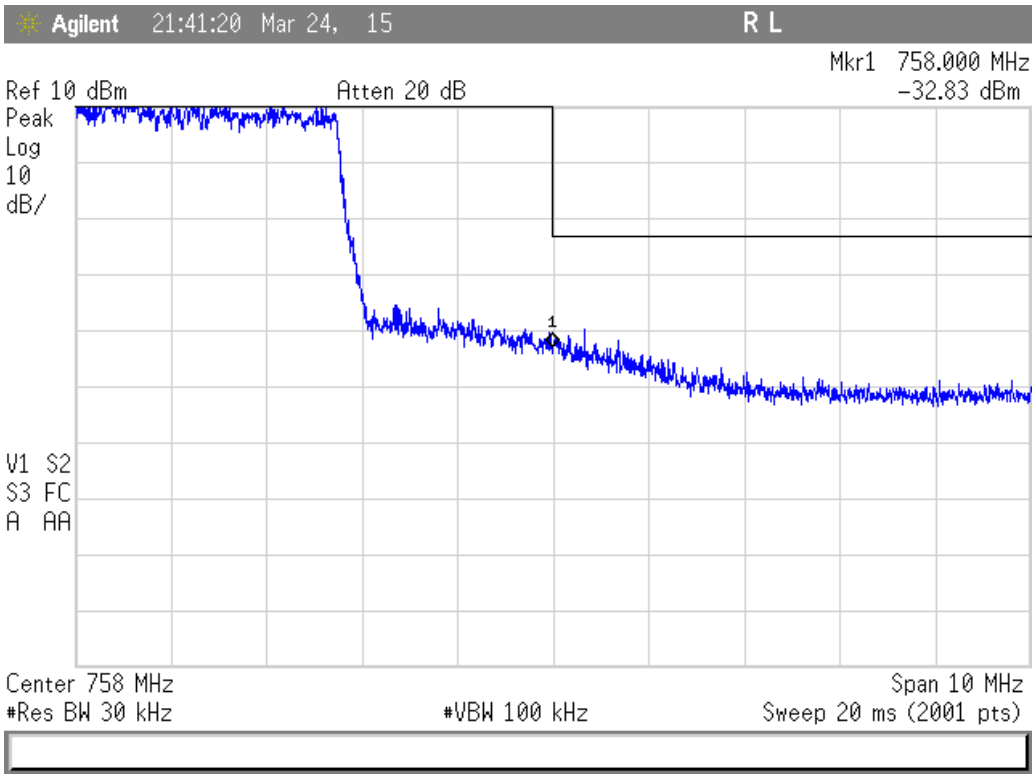
Lower Band Edge - Band 13 – 5MHz BW – 64QAM – Port J1



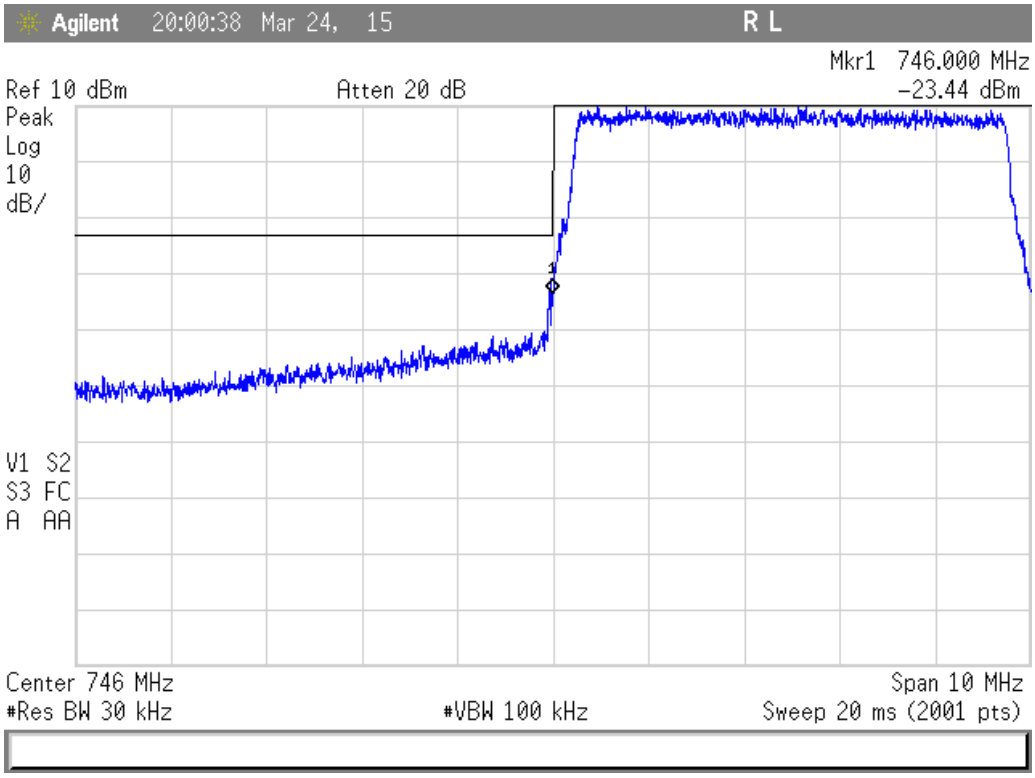
Upper Band Edge - Band 13 – 5MHz BW – QPSK – Port J1



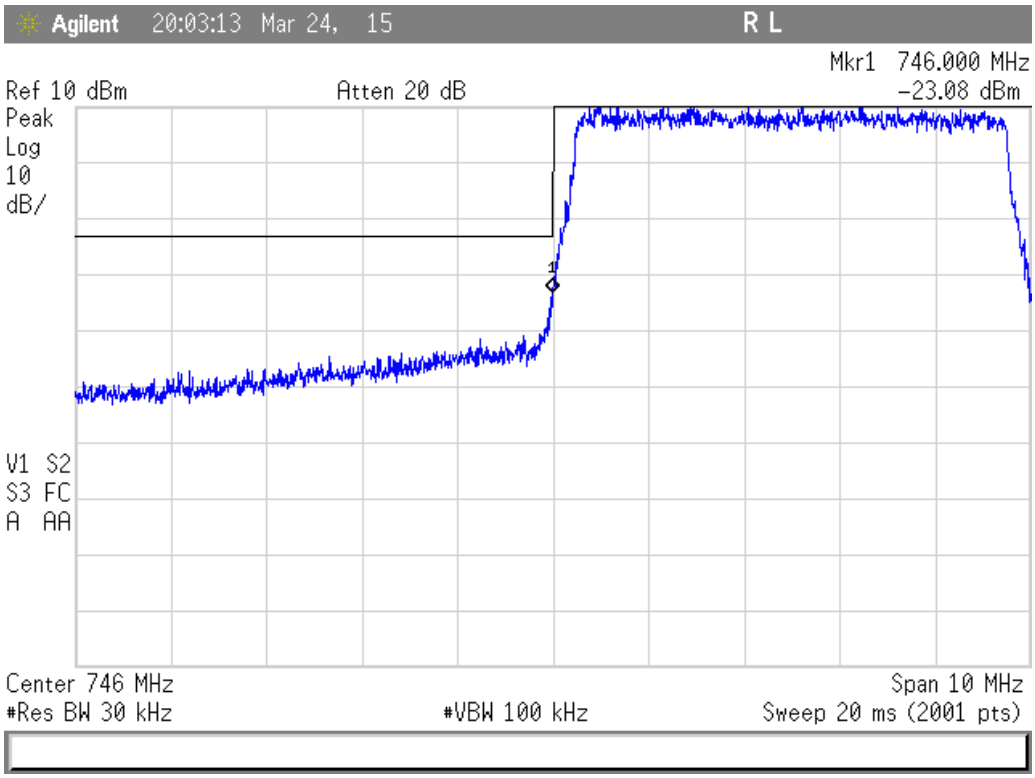
Upper Band Edge - Band 13 – 5MHz BW – 16QAM – Port J1



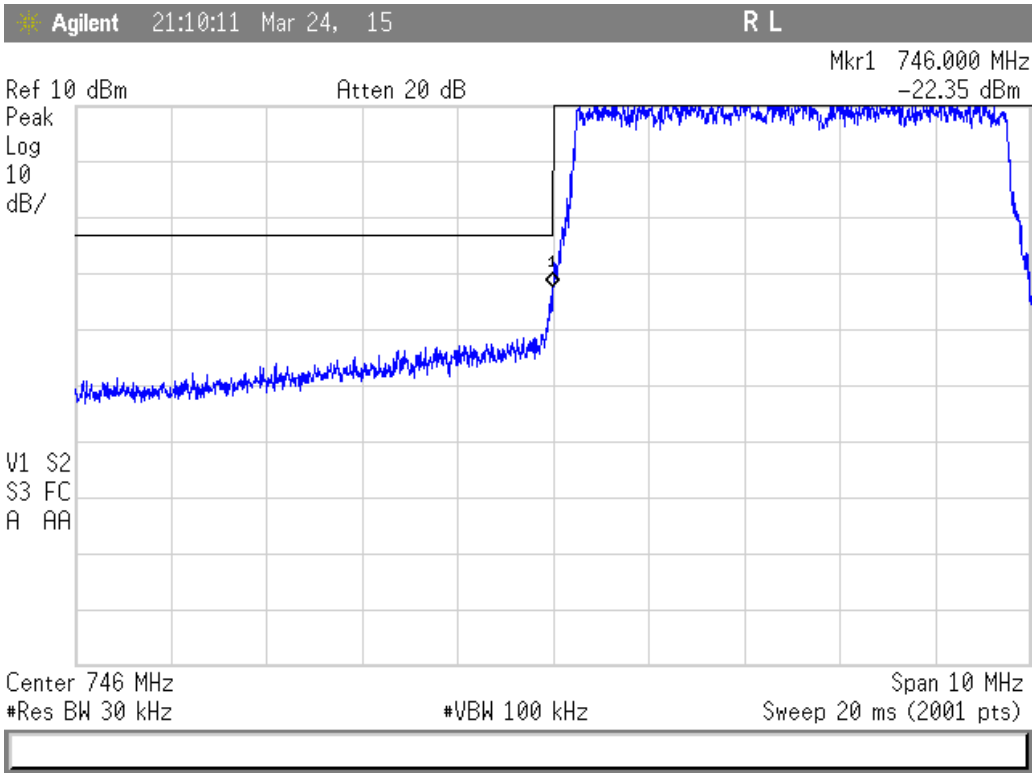
Upper Band Edge - Band 13 – 5MHz BW – 64QAM – Port J1



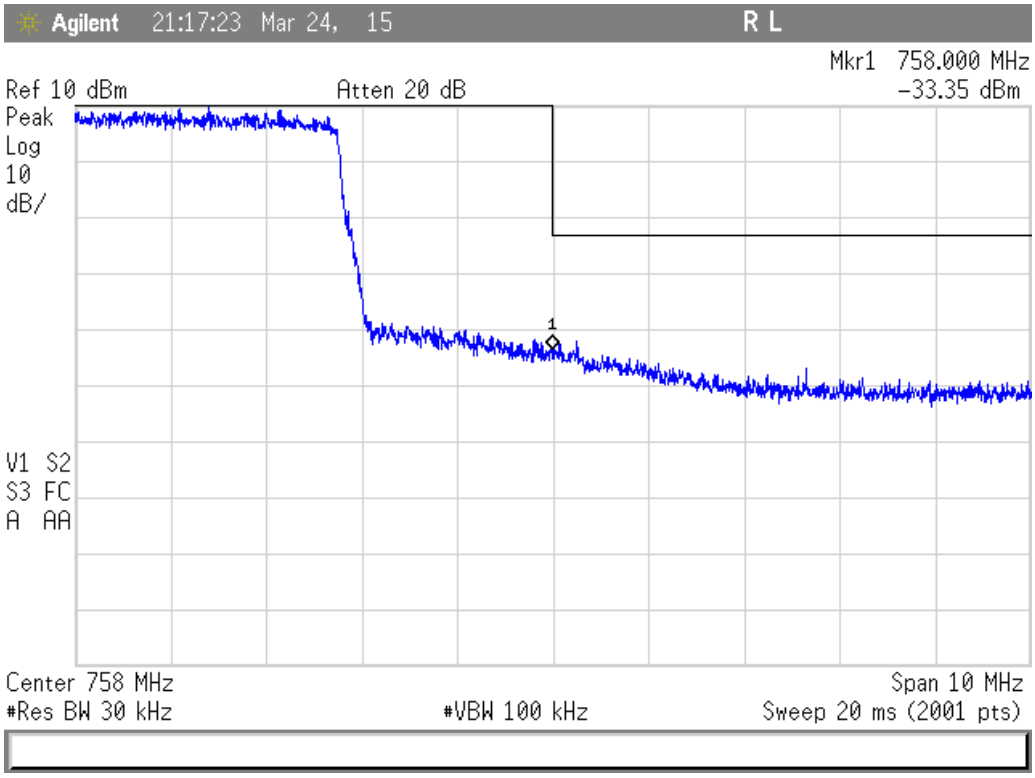
Lower Band Edge - Band 13 – 5MHz BW – QPSK – Port J2



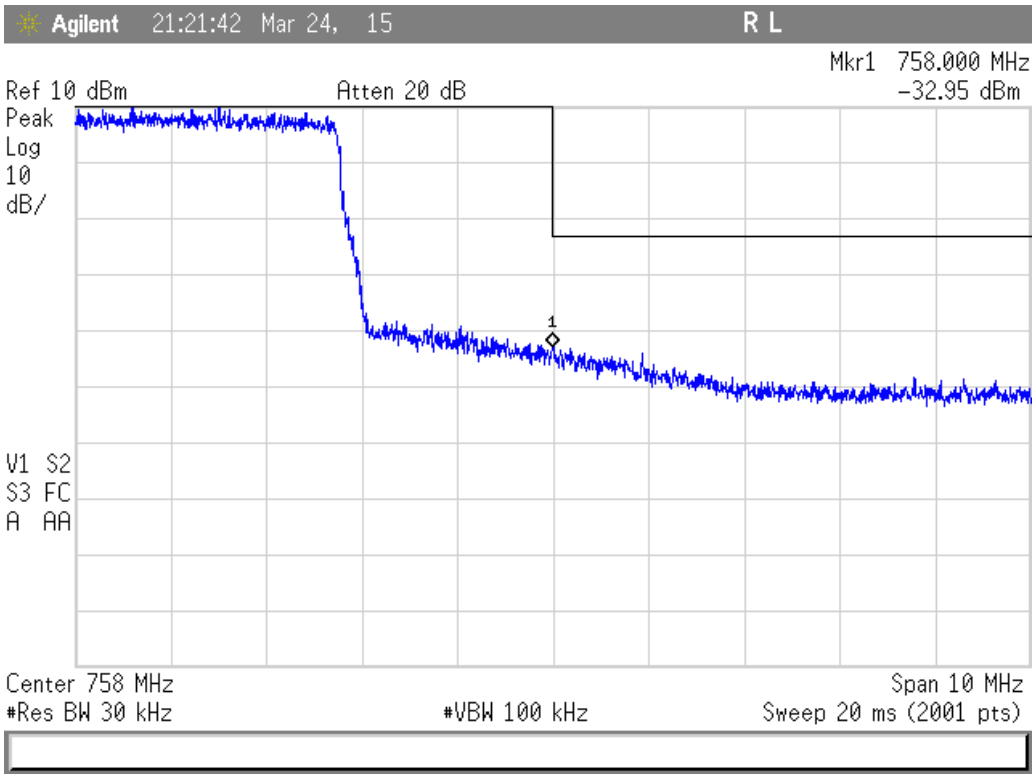
Lower Band Edge - Band 13 – 5MHz BW – 16QAM – Port J2



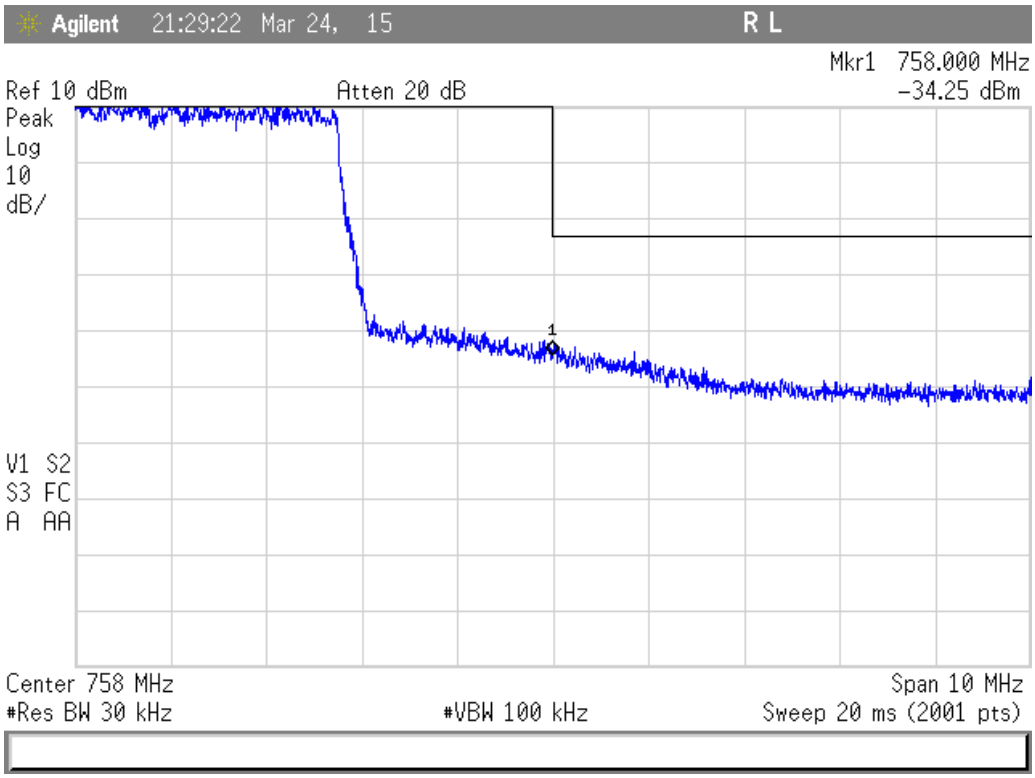
Lower Band Edge - Band 13 – 5MHz BW – 64QAM – Port J2



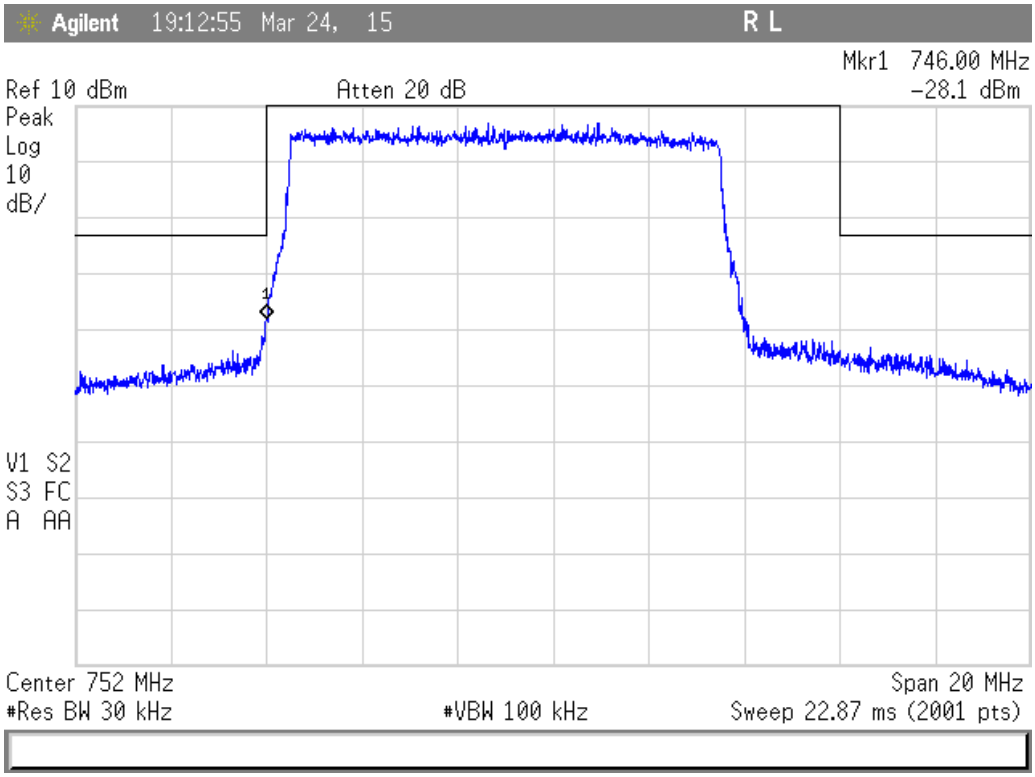
Upper Band Edge - Band 13 – 5MHz BW – QPSK – Port J2



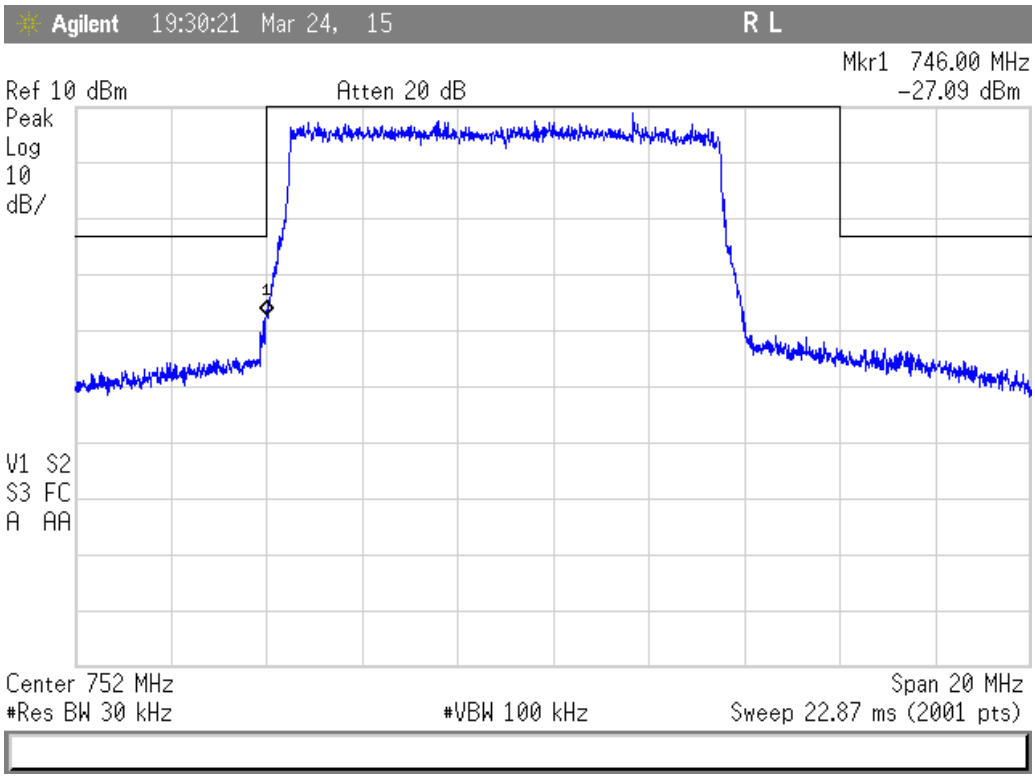
Upper Band Edge - Band 13 – 5MHz BW – 16QAM – Port J2



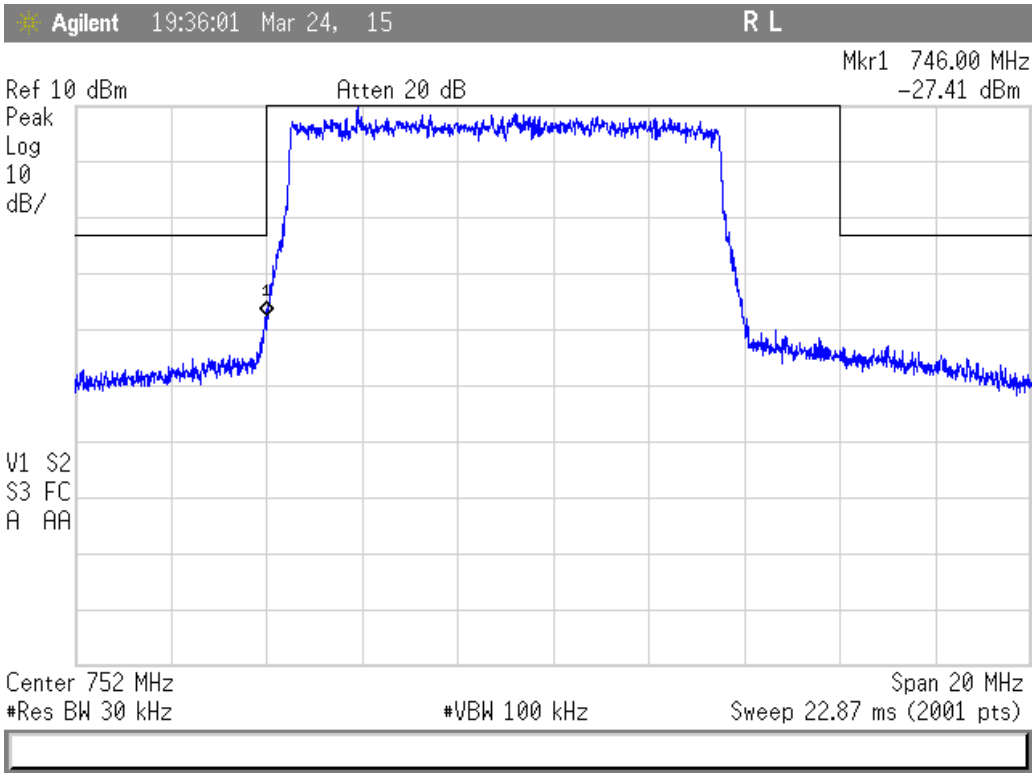
Upper Band Edge - Band 13 – 5MHz BW – 64QAM – Port J2



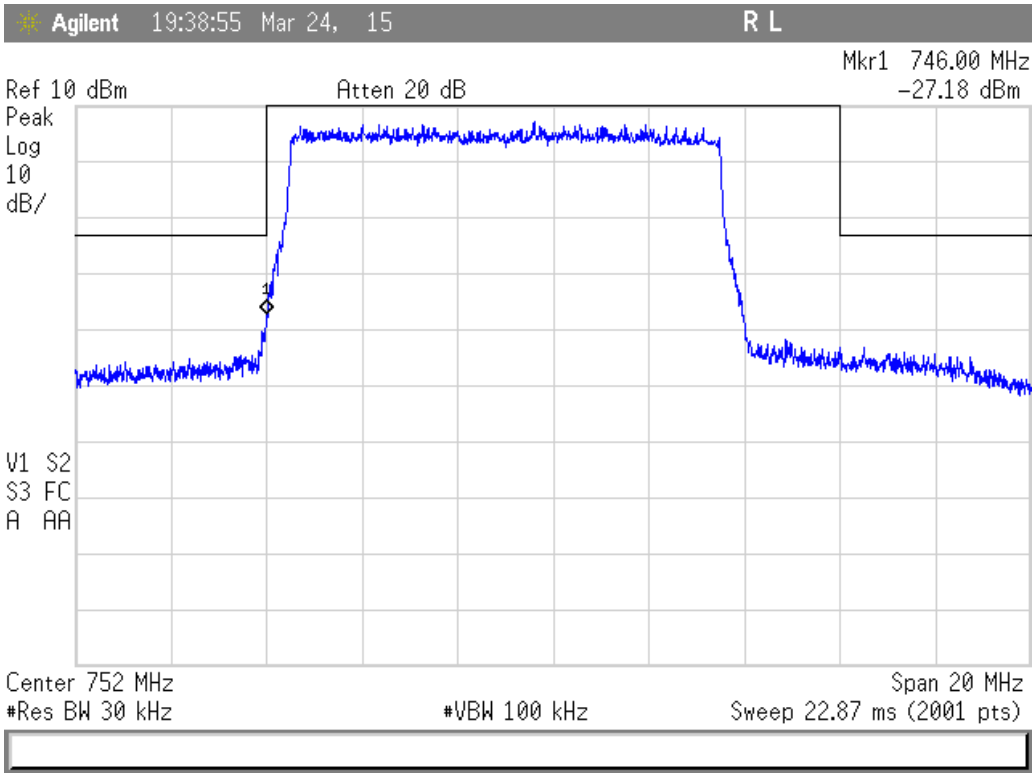
Lower & Upper Band Edge - Band 13 – 10MHz BW – QPSK – Port J1



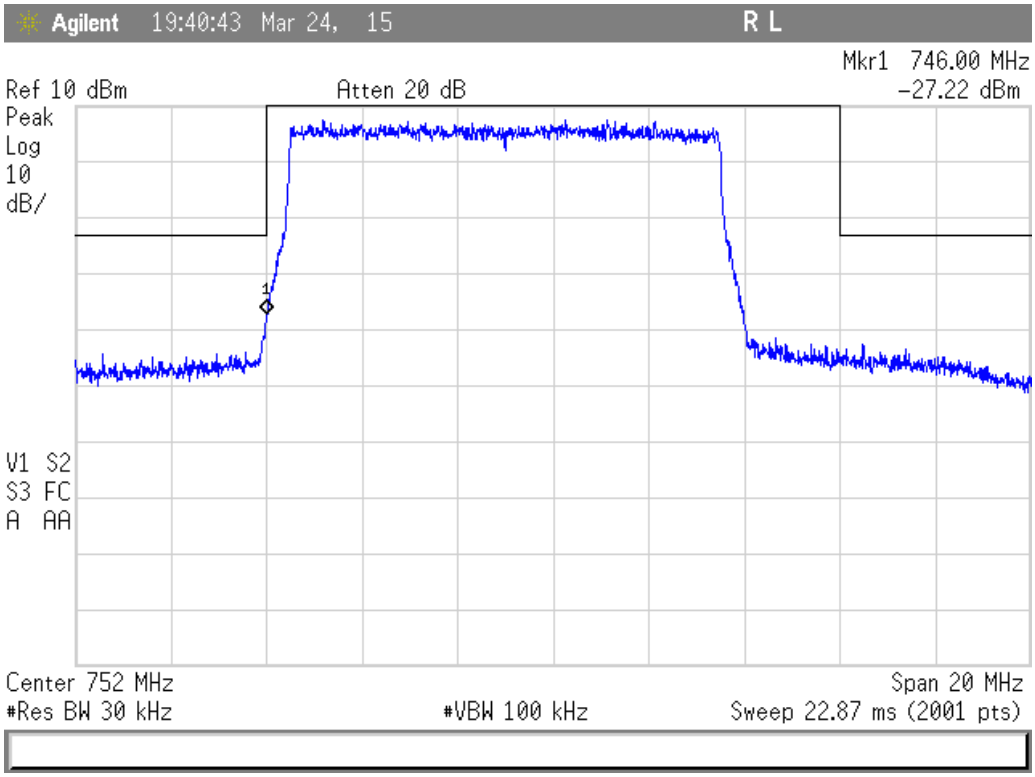
Lower & Upper Band Edge - Band 13 – 10MHz BW – 16QAM – Port J1



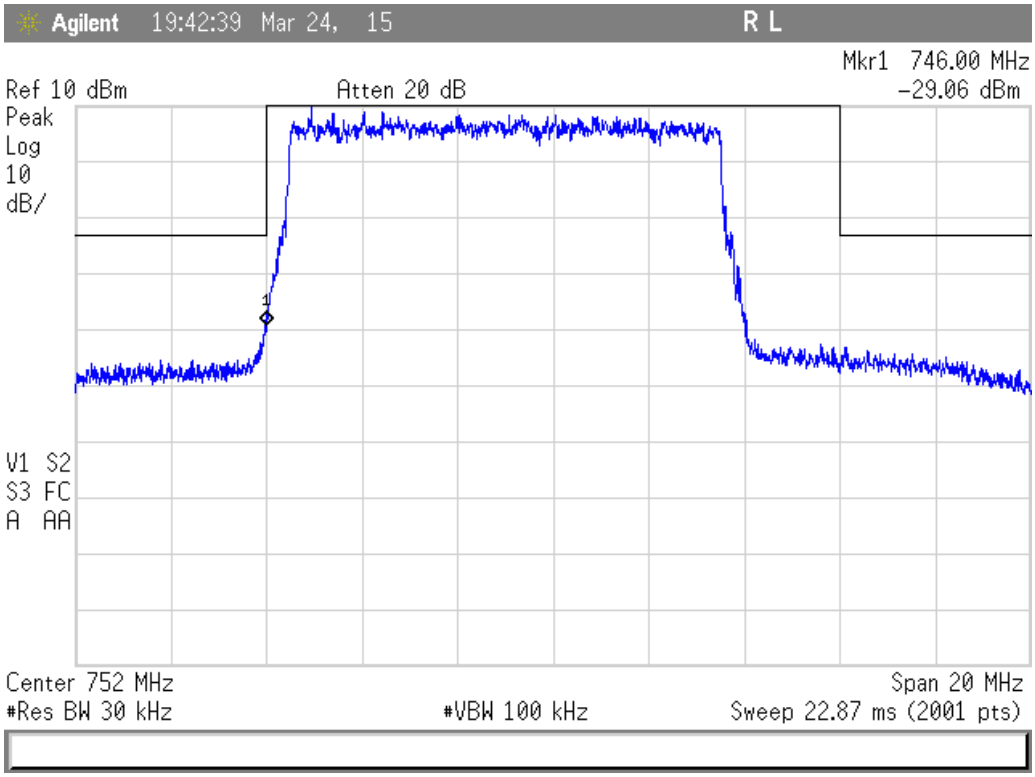
Lower & Upper Band Edge - Band 13 – 10MHz BW – 64QAM – Port J1



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



Lower & Upper Band Edge - Band 13 – 10MHz BW – 16QAM – Port J2



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

*Limit = 10*log(P[mW]) – (43 + 10*log(P[W])) = -13dBm*

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

*Limit = 10*log(P[mW]) – (76 + 10*log(P[W])) = -46dBm*

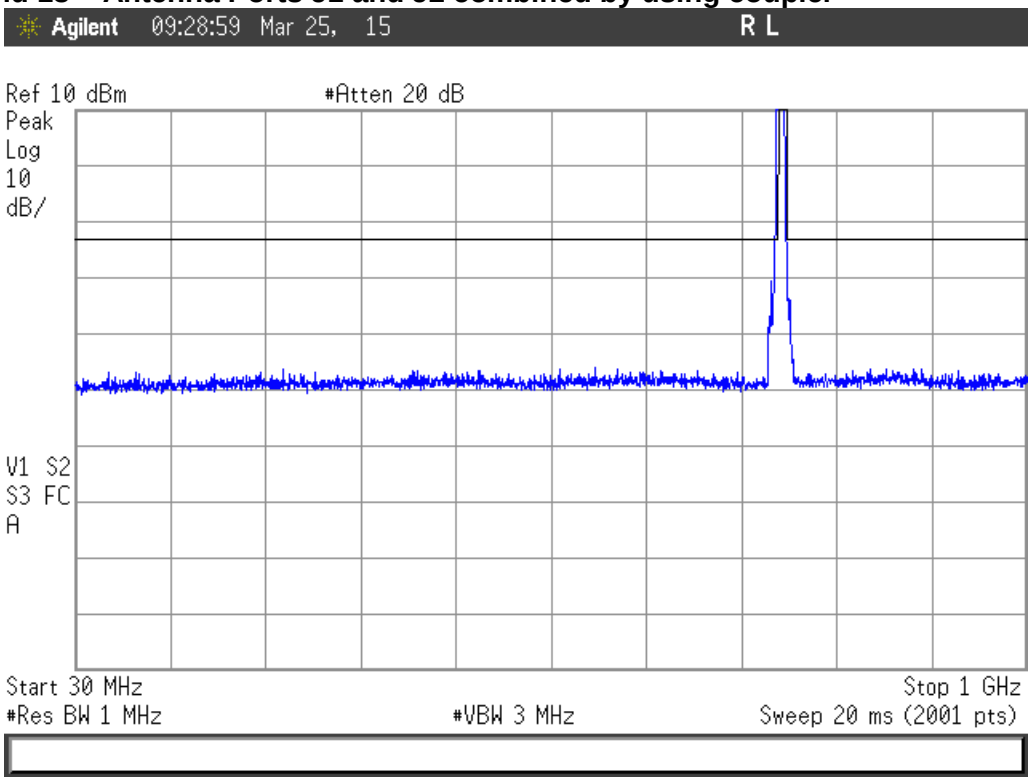
The range 1559-1610MHz was tested for 27.53(f) using a 1MHz resolution bandwidth for the -70dBW/Mhz limit and a 1kHz resolution bandwidth for the -80dBW limit.

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

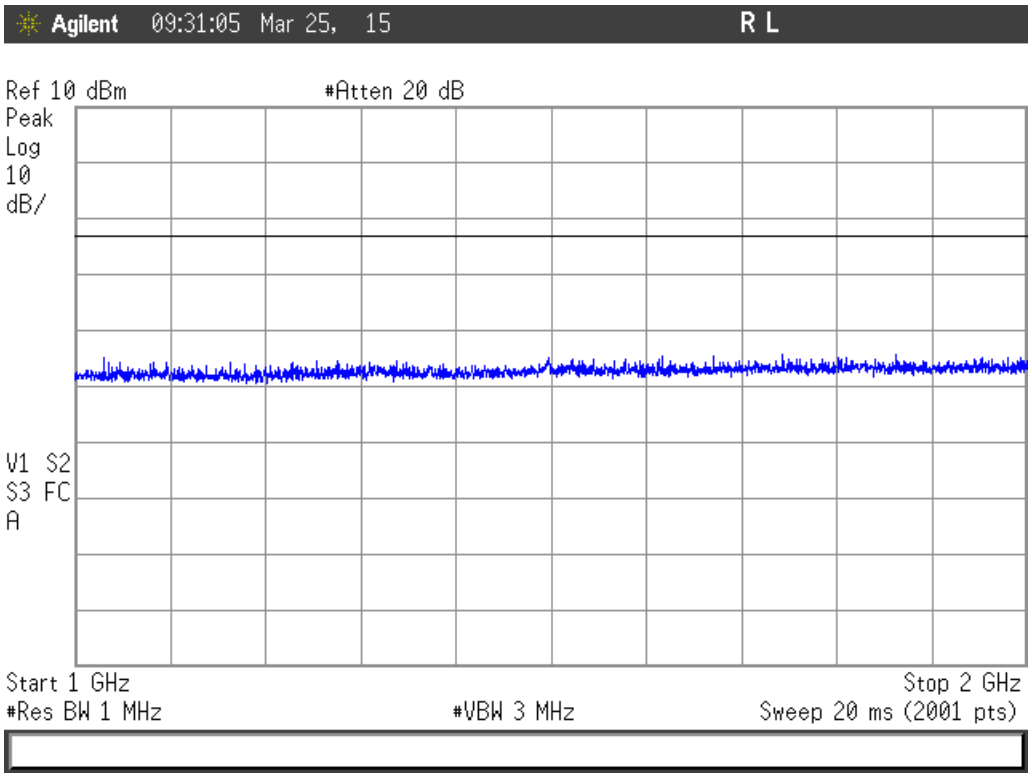
PLOTS

FCC 27.53(c)(1):

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



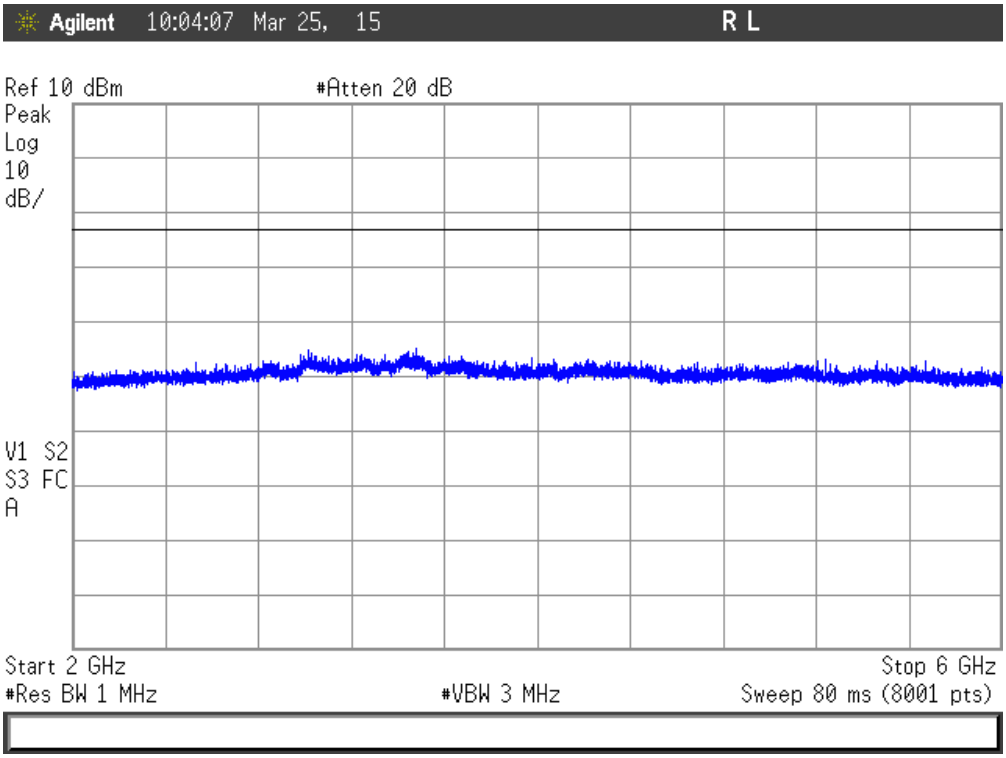
30MHz to 1GHz
[RBW 1MHz, VBW 3MHz, 2001 points, range 30-1000MHz]



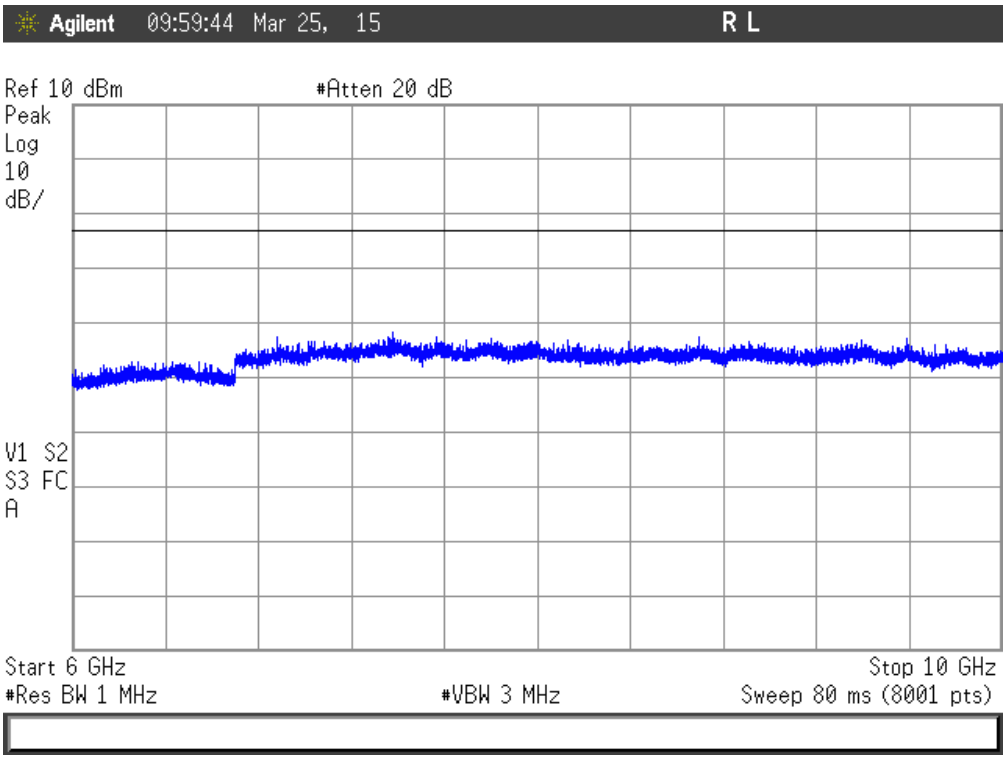
1-2GHz
[RBW 1MHz, VBW 3MHz, 2001 points, range 1-2GHz]

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

LTE Band 13 – Antenna Port J1

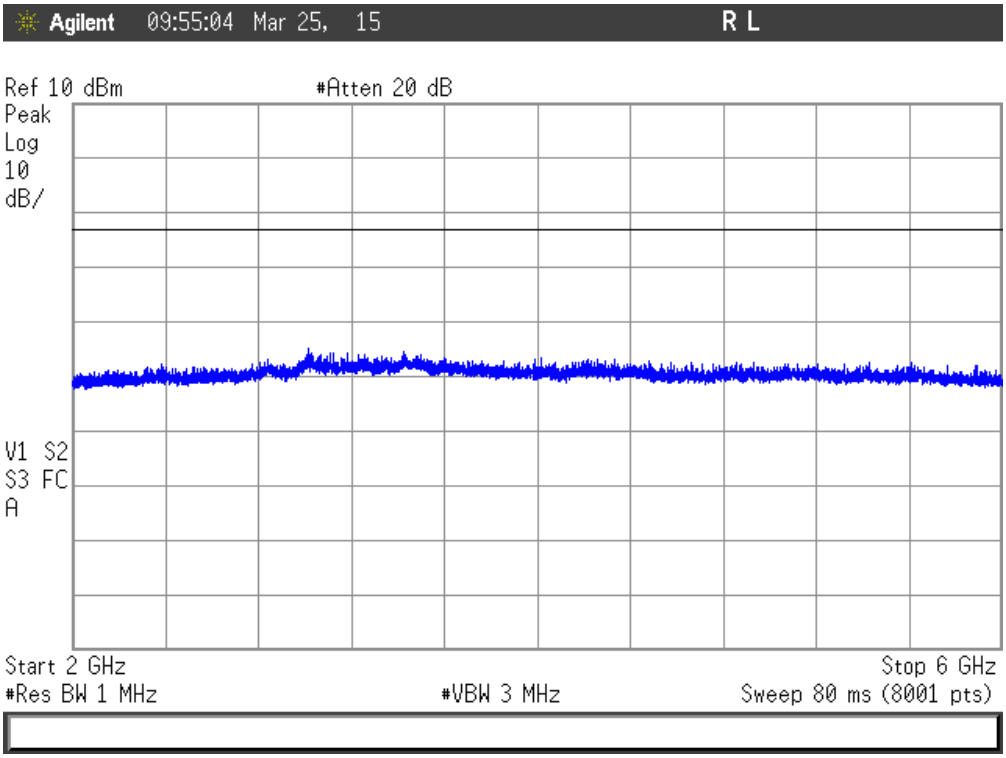


2-6GHz
[RBW 1MHz, VBW 3MHz, 8001 points, range 2-6GHz]



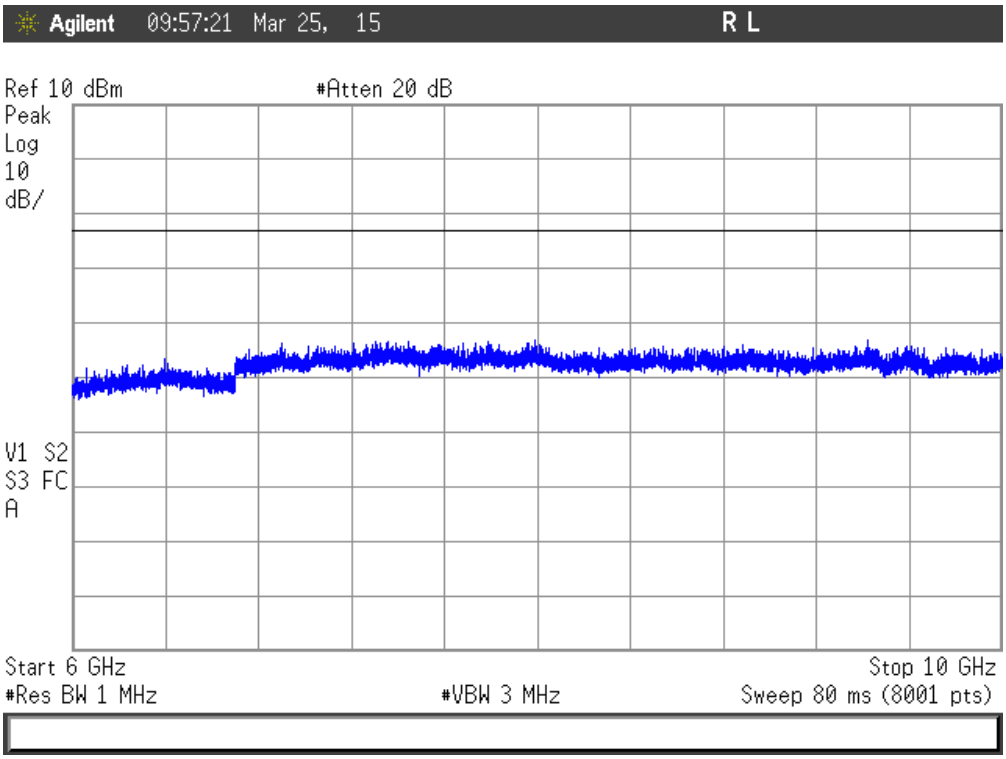
6-10GHz
[RBW 1MHz, VBW 3MHz, 8001 points, range 6-10GHz]

LTE Band 13 – Antenna Port J2



2-6GHz

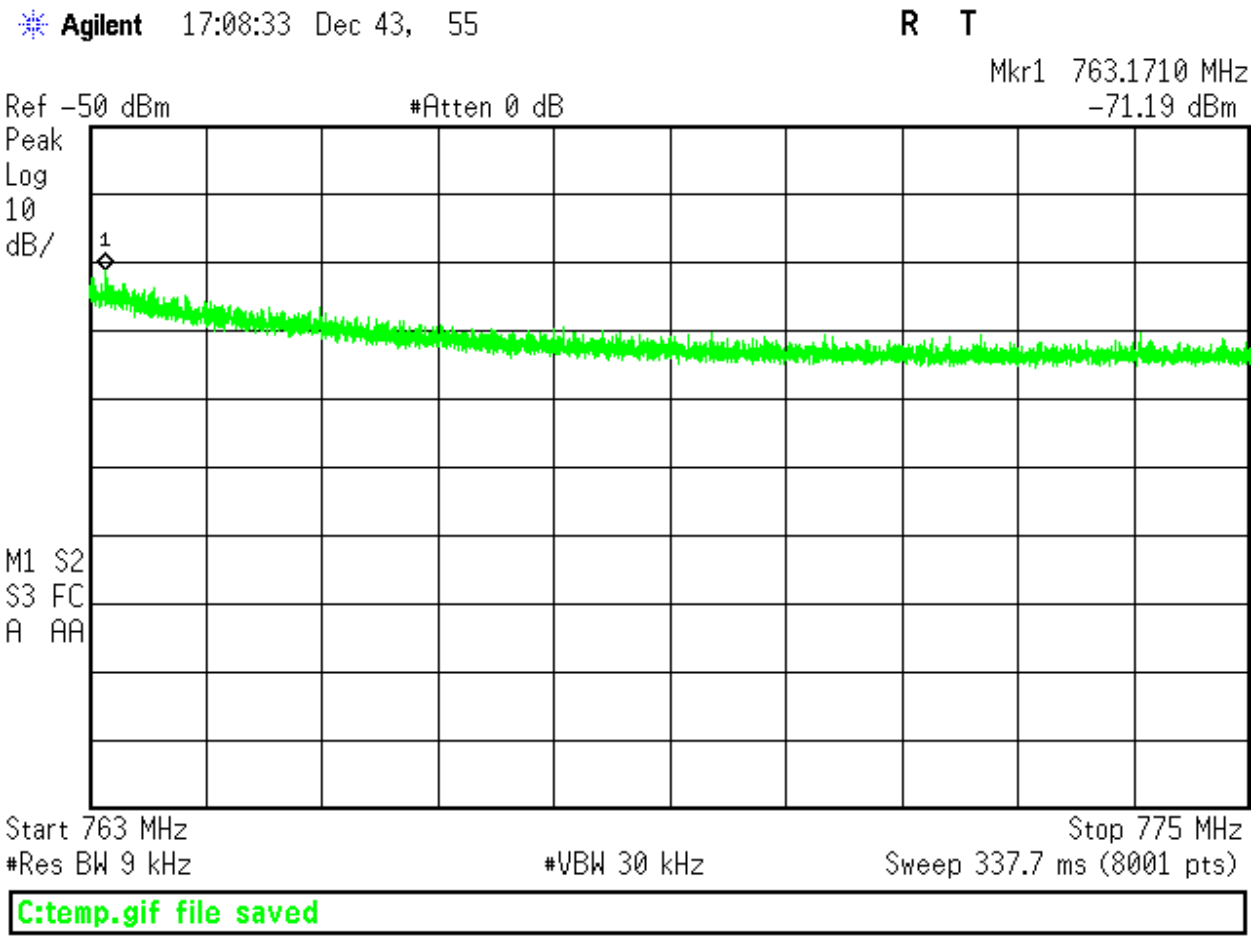
[RBW 1MHz, VBW 3MHz, 8001 points, range 2-6GHz]



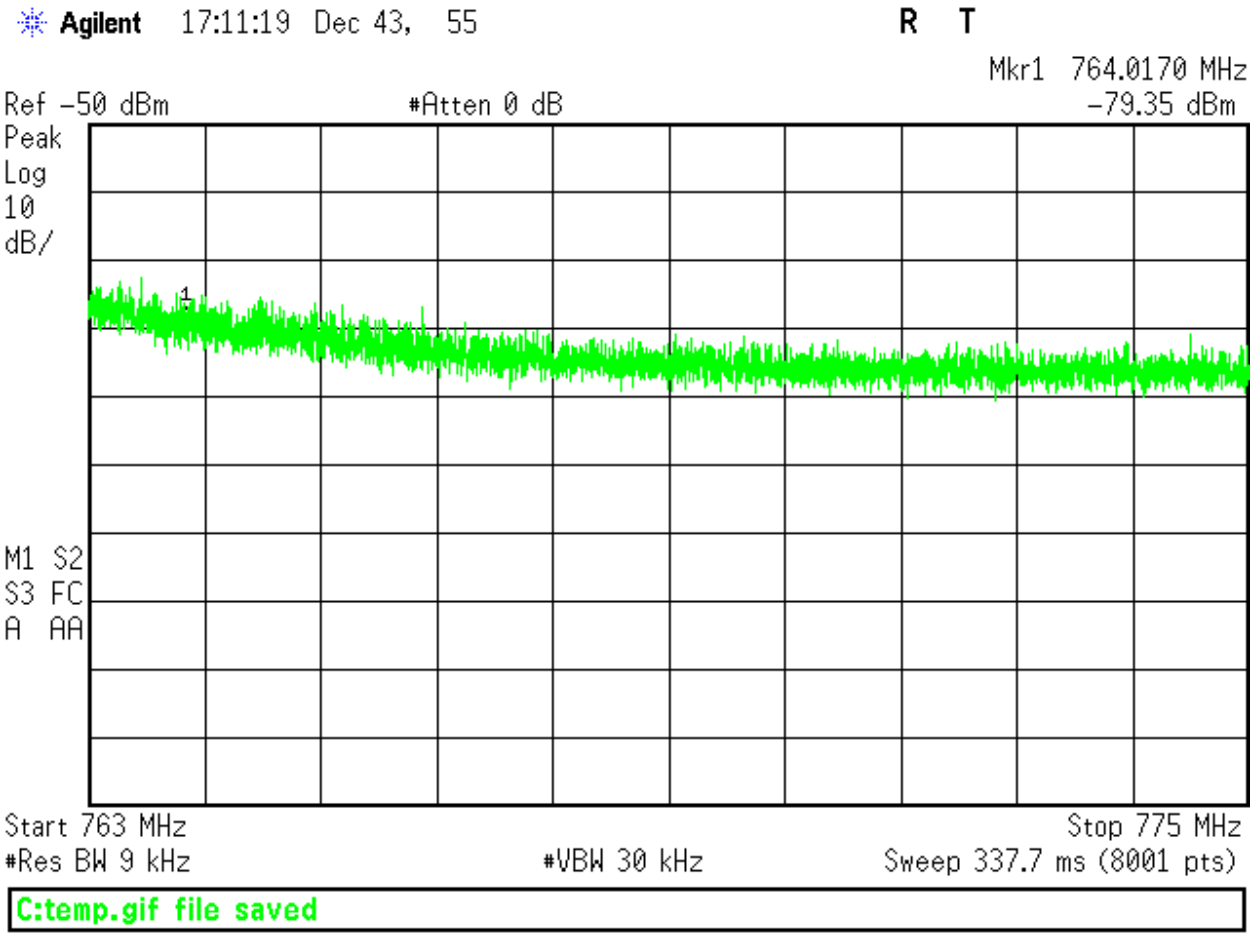
6-10GHz

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

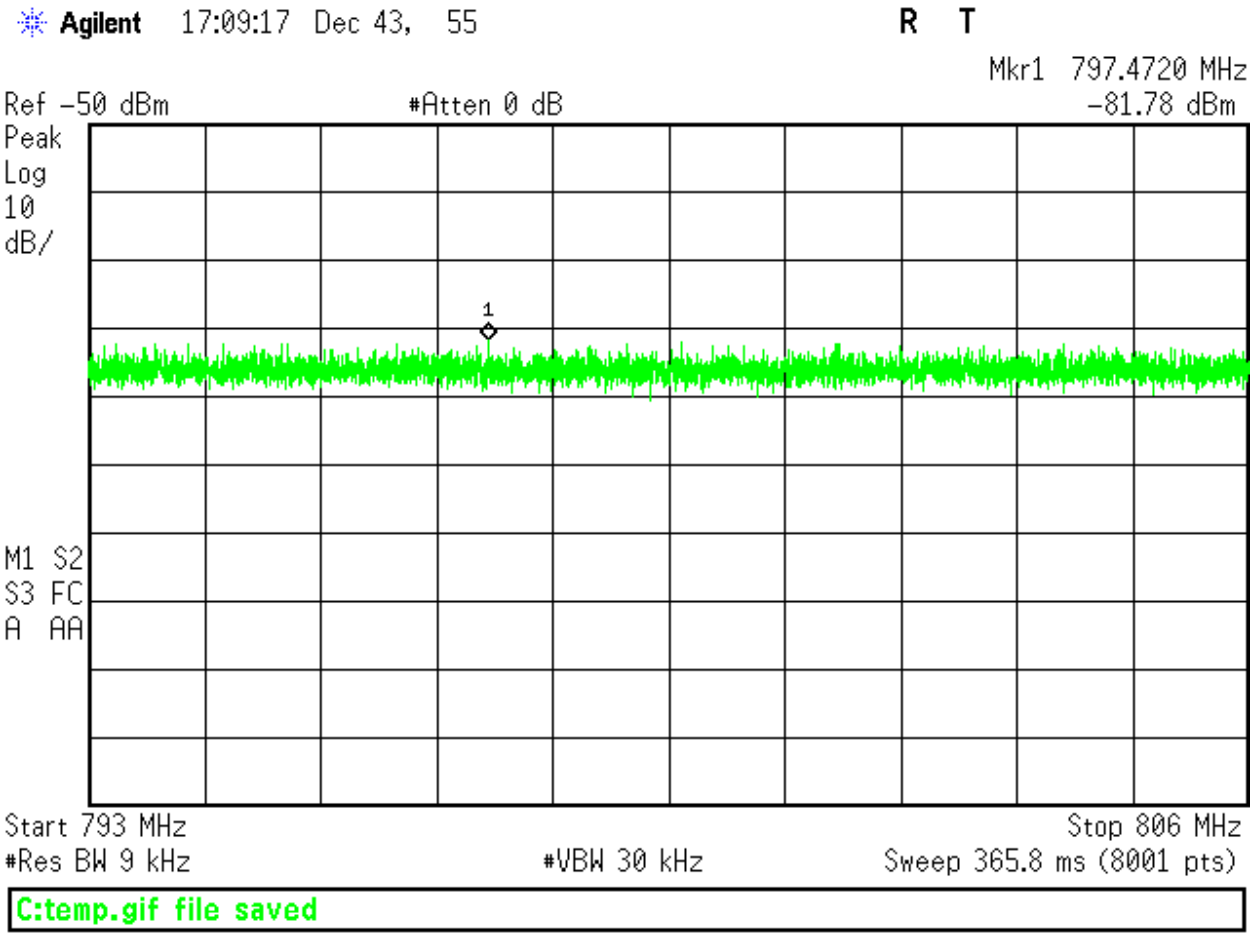
FCC 27.53(c)(3):



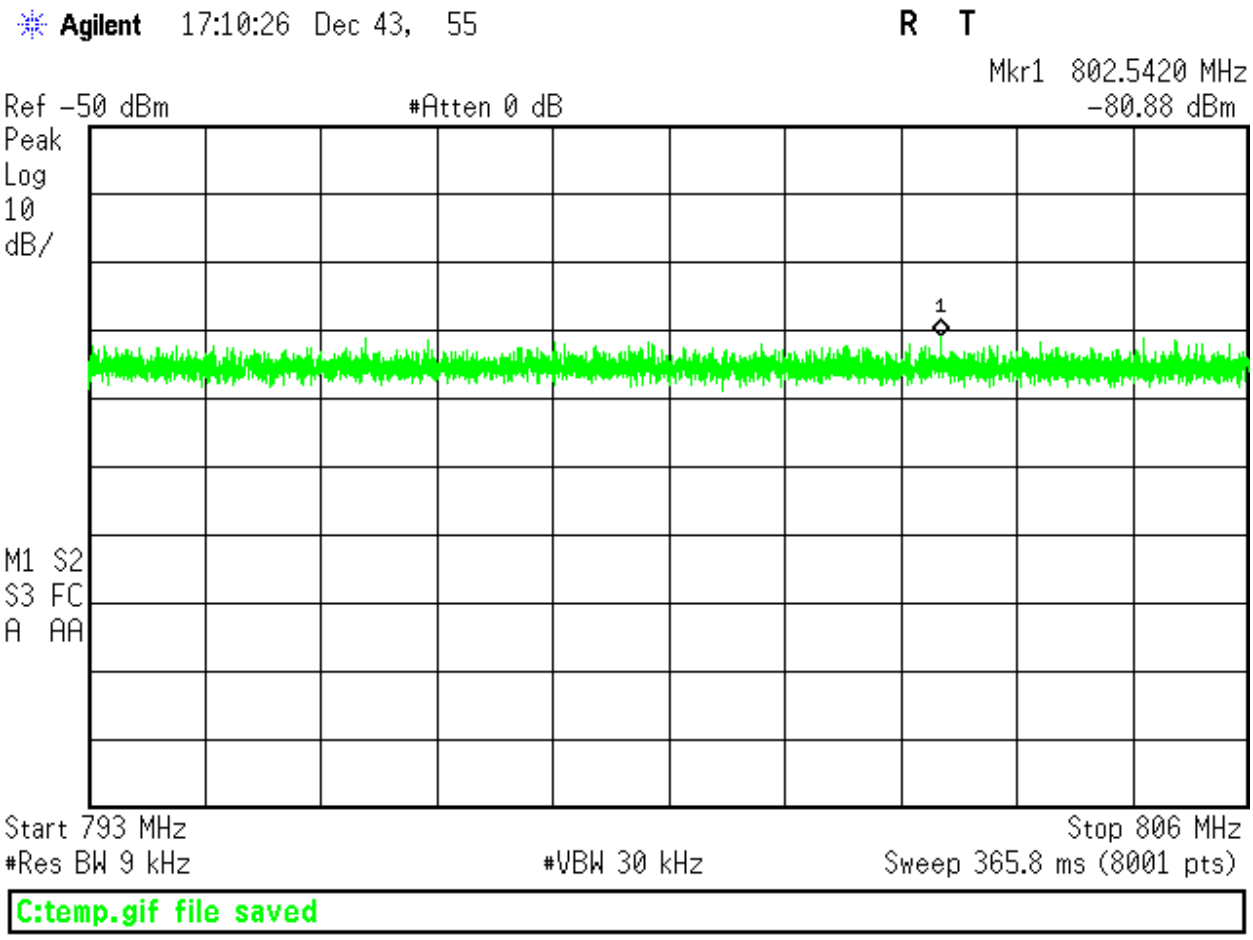
Port J1, 763-775MHz



Port J2, 763-775MHz

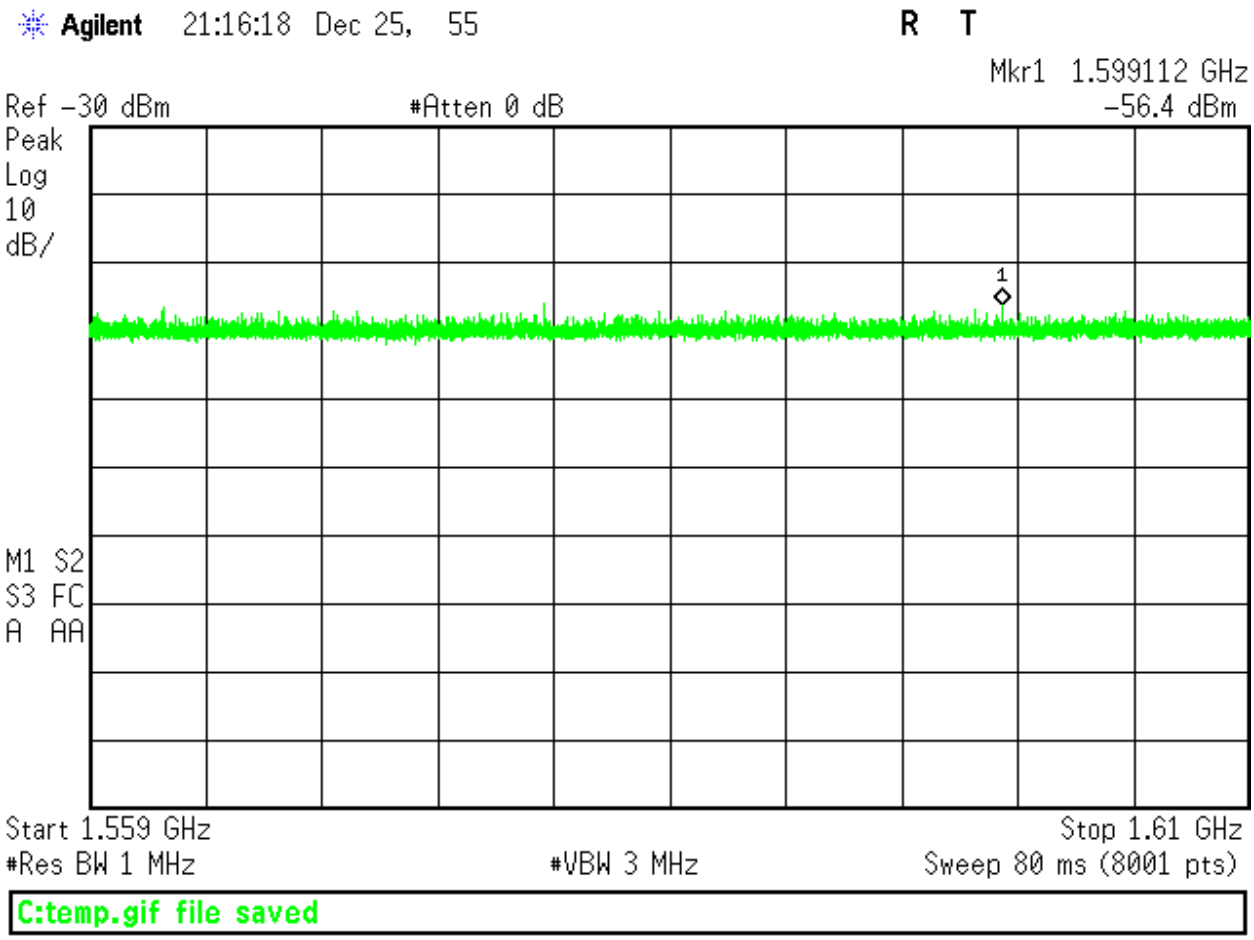


Port J1, 793-806MHz



Port J2, 793-806MHz

FCC 27.53(f) Wideband Emission Limit:



Port J1, 1559-1610MHz