BAND EDGE COMPLIANCE

XMit 2019.09.05

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in the available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

All limits were adjusted by a factor of [-10*log(4)] dB to account for the device operation as a 4 port MIMO transmitter, as per FCC KDB 622911.

Per FCC section 27.53(c), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

FCC section 27.53(c) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range. FCC 27.53(c) requires a >30 kHz measurement bandwidth for emissions between 100 kHz outside of the RRH operating frequency range and band edge of the operating frequency range.

Section 27.53(c)(3) requires an emission limit of -46dBm for any 6.25 kHz bandwidth between frequency bands 763-775 MHz and 793-806MHz. Adjusting for the four port MIMO requirement the emission limit in these frequency ranges is -52 dBm [i.e.: Limit = -46 dBm/6.25kHz (FCC Limit) - 6dB (4 port MIMO)].

BAND EDGE COMPLIANCE

element

XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**28-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	
Attendees:	**John Rattanavong, Mitchell Hill**			**Humidity:**	
Project:	**None**			**Barometric Pres.:**	
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX03**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Tested on highest power antenna port (Port 1). EUT is operated at 100% duty cycle.

DEVIATIONS FROM TEST STANDARD

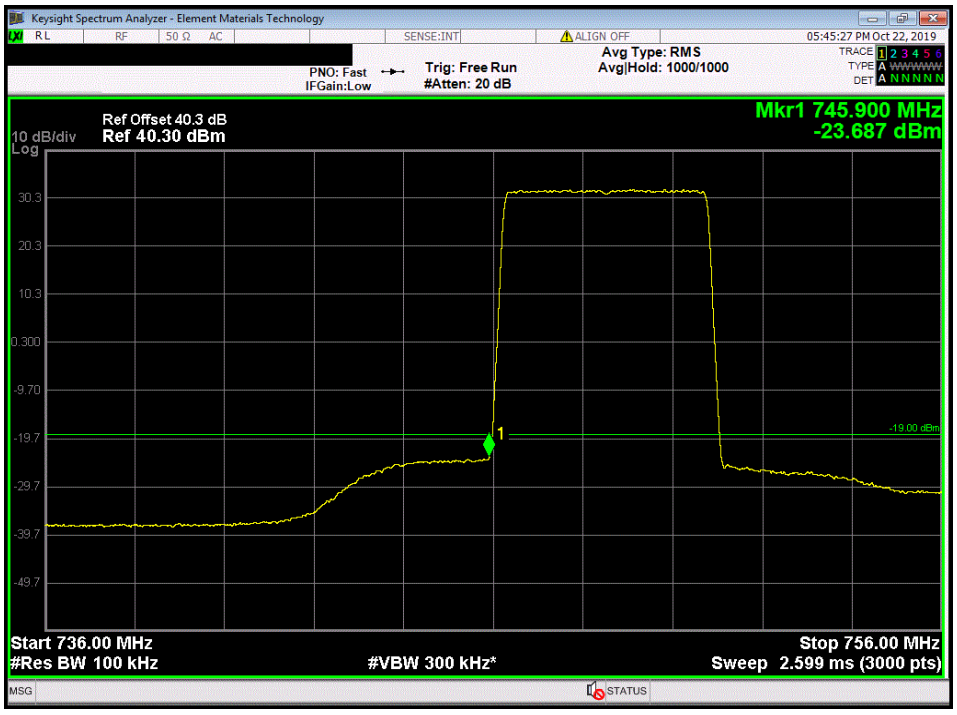
None

Configuration #	**1**	*Signature* Jonathan Kiefer

		Value (dBm)	**Limit (dBm)**	**Result**
Band 13				
QPSK Modulation				
LTE5 Bandwidth				
Lower Band Edge				
	Measurement 1	-25.865	-19	Pass
	Measurement 2	-23.687	-19	Pass
Upper Band Edge				
	Measurement 1	-25.776	-19	Pass
	Measurement 2	-24.416	-19	Pass
	Measurement 3	-57.606	-52	Pass
	Measurement 4	-58.235	-52	Pass
LTE10 Bandwidth				
Lower Band Edge				
	Measurement 1	-27.65	-19	Pass
	Measurement 2	-24.102	-19	Pass
Upper Band Edge				
	Measurement 1	-29.409	-19	Pass
	Measurement 2	-25.892	-19	Pass
	Measurement 3	-56.758	-52	Pass
	Measurement 4	-58.083	-52	Pass
16QAM Modulation				
LTE5 Bandwidth				
Lower Band Edge				
	Measurement 1	-25.963	-19	Pass
	Measurement 2	-23.503	-19	Pass
Upper Band Edge				
	Measurement 1	-26.498	-19	Pass
	Measurement 2	-24.257	-19	Pass
	Measurement 3	-57.623	-52	Pass
	Measurement 4	-58.195	-52	Pass
LTE10 Bandwidth				
Lower Band Edge				
	Measurement 1	-28.336	-19	Pass
	Measurement 2	-24.248	-19	Pass
Upper Band Edge				
	Measurement 1	-29.497	-19	Pass
	Measurement 2	-25.87	-19	Pass
	Measurement 3	-56.768	-52	Pass
	Measurement 4	-58.12	-52	Pass
64QAM Modulation				
LTE5 Bandwidth				
Lower Band Edge				
	Measurement 1	-25.735	-19	Pass
	Measurement 2	-23.88	-19	Pass
Upper Band Edge				
	Measurement 1	-26.166	-19	Pass
	Measurement 2	-23.806	-19	Pass
	Measurement 3	-57.512	-52	Pass
	Measurement 4	-58.162	-52	Pass
LTE10 Bandwidth				
Lower Band Edge				
	Measurement 1	-27.953	-19	Pass
	Measurement 2	-24.215	-19	Pass
Upper Band Edge				
	Measurement 1	-28.889	-19	Pass
	Measurement 2	-25.53	-19	Pass
	Measurement 3	-56.895	-52	Pass
	Measurement 4	-58.07	-52	Pass
256QAM Modulation				
LTE5 Bandwidth				
Lower Band Edge				
	Measurement 1	-26.028	-19	Pass
	Measurement 2	-24.035	-19	Pass
Upper Band Edge				
	Measurement 1	-25.861	-19	Pass
	Measurement 2	-24.416	-19	Pass
	Measurement 3	-57.572	-52	Pass
	Measurement 4	-58.101	-52	Pass
LTE10 Bandwidth				
Lower Band Edge				
	Measurement 1	-27.372	-19	Pass
	Measurement 2	-24.164	-19	Pass
Upper Band Edge				
	Measurement 1	-29.039	-19	Pass
	Measurement 2	-25.674	-19	Pass
	Measurement 3	-56.847	-52	Pass
	Measurement 4	-58.101	-52	Pass

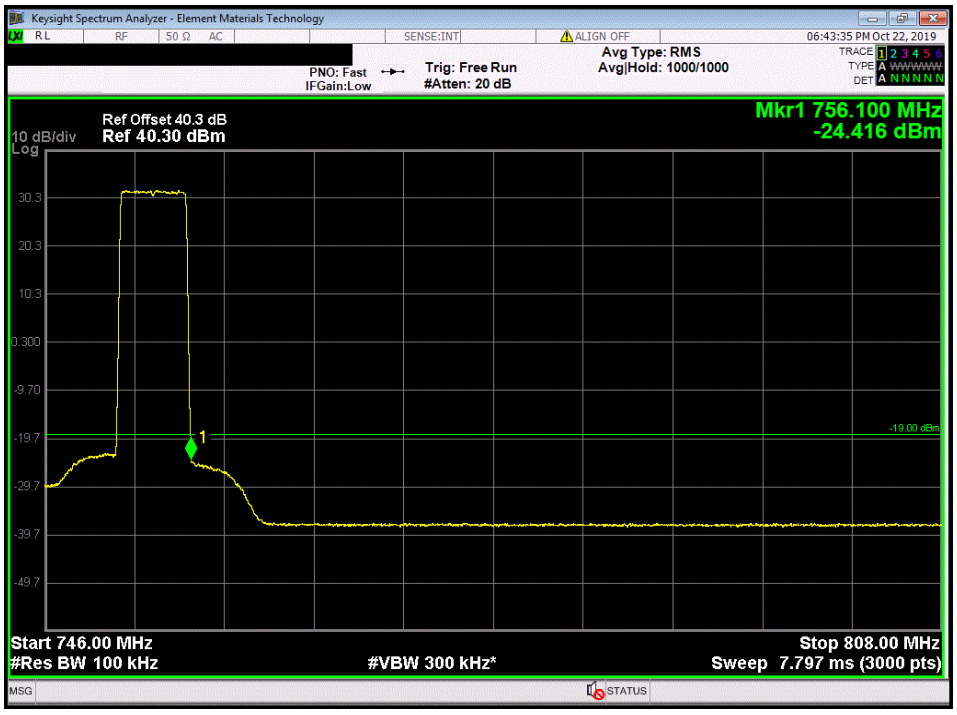
Band 13, QPSK Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-25.865	-19	Pass

Band 13, QPSK Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-23.687	-19	Pass

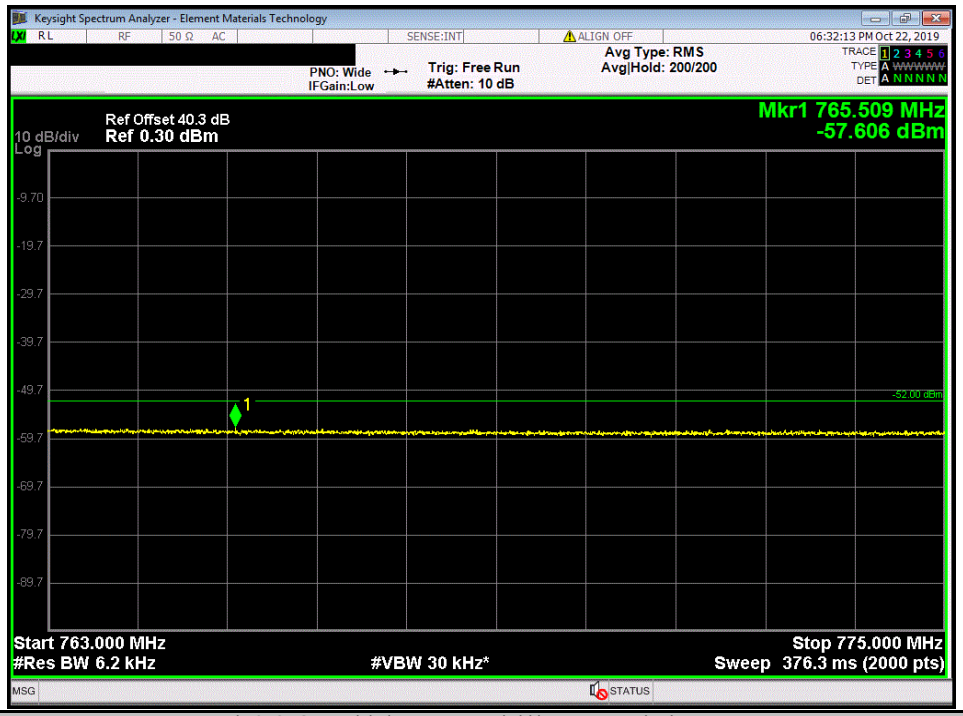


Band 13, QPSK Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-25.776	-19	Pass

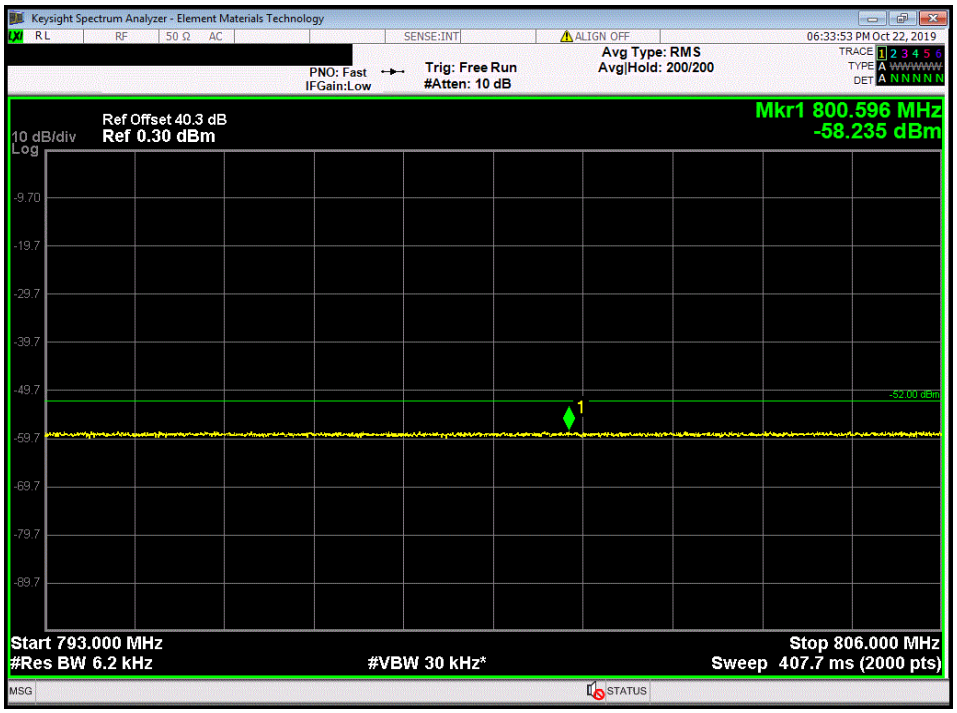
Band 13, QPSK Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-24.416	-19	Pass



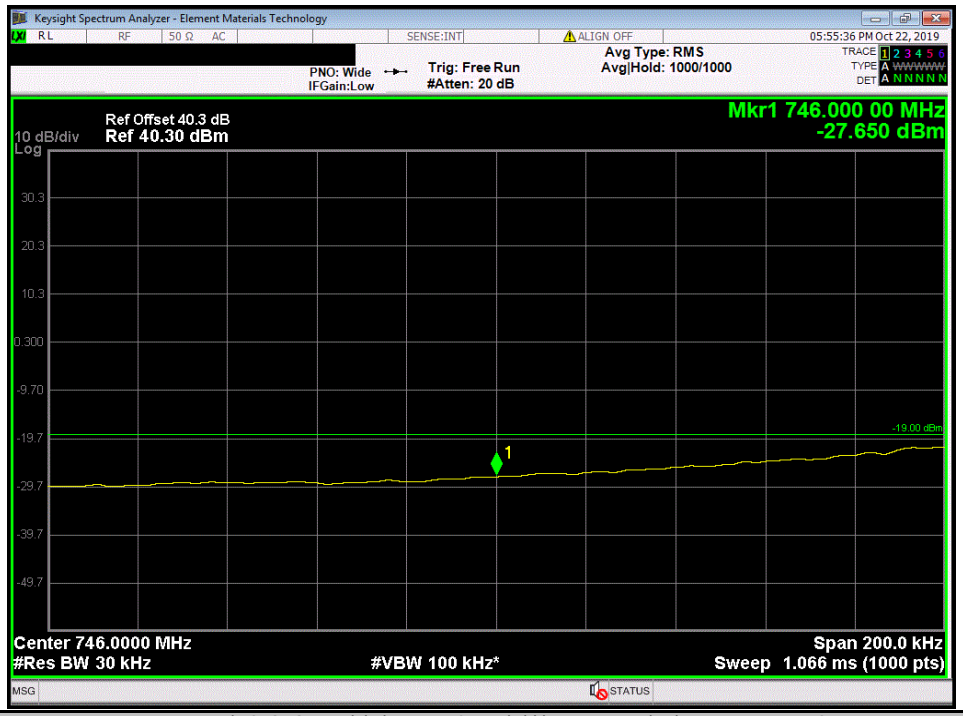
Band 13, QPSK Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-57.606	-52	Pass



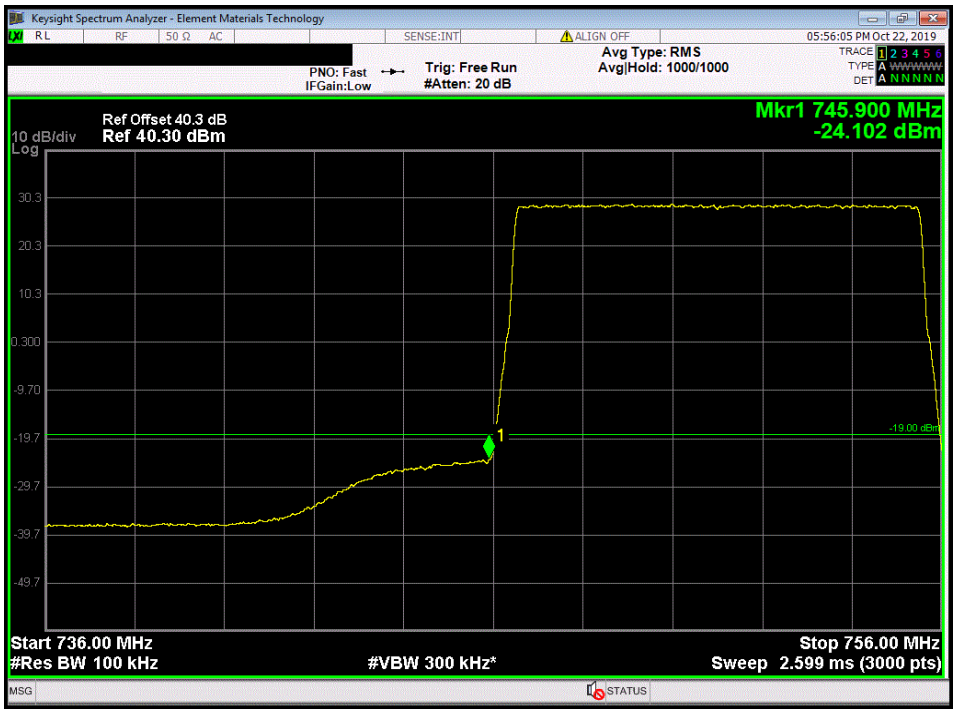
Band 13, QPSK Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.235	-52	Pass



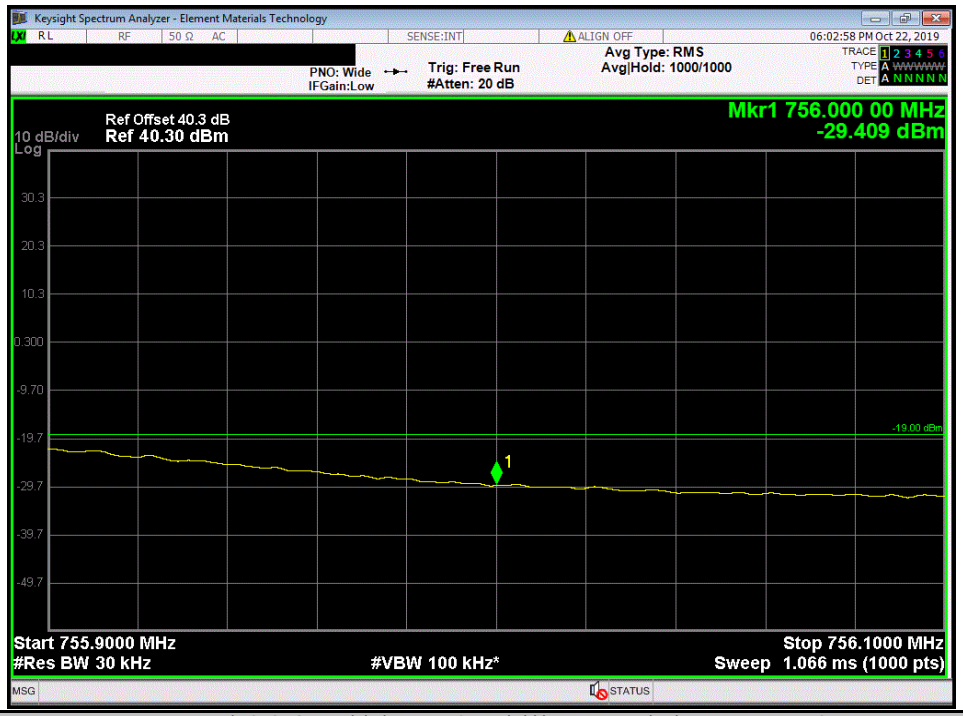
Band 13, QPSK Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-27.65	-19	Pass



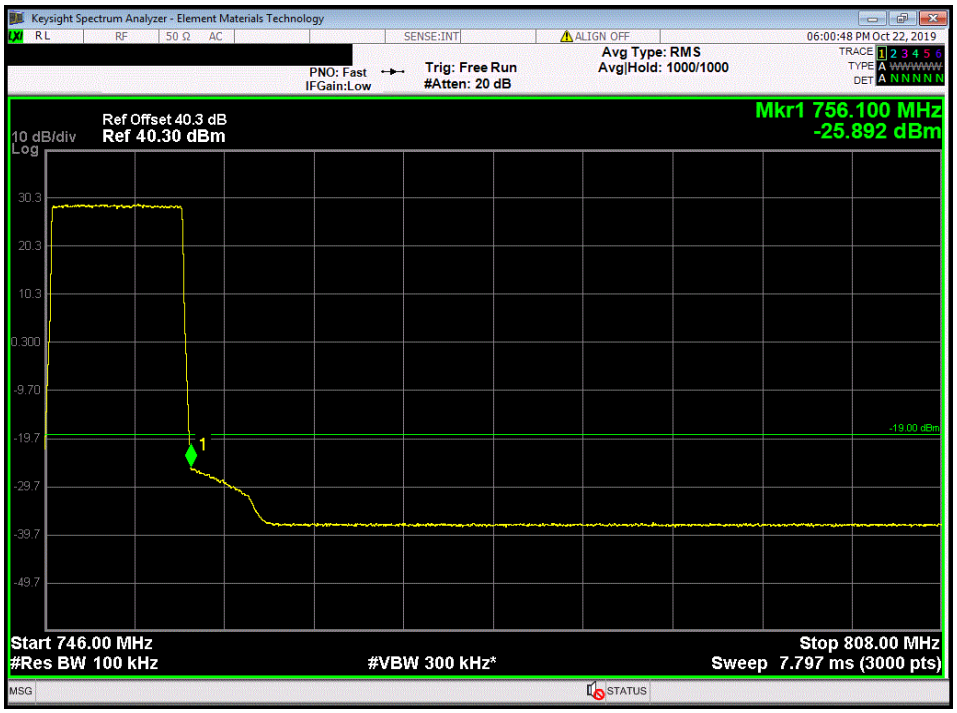
Band 13, QPSK Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-24.102	-19	Pass



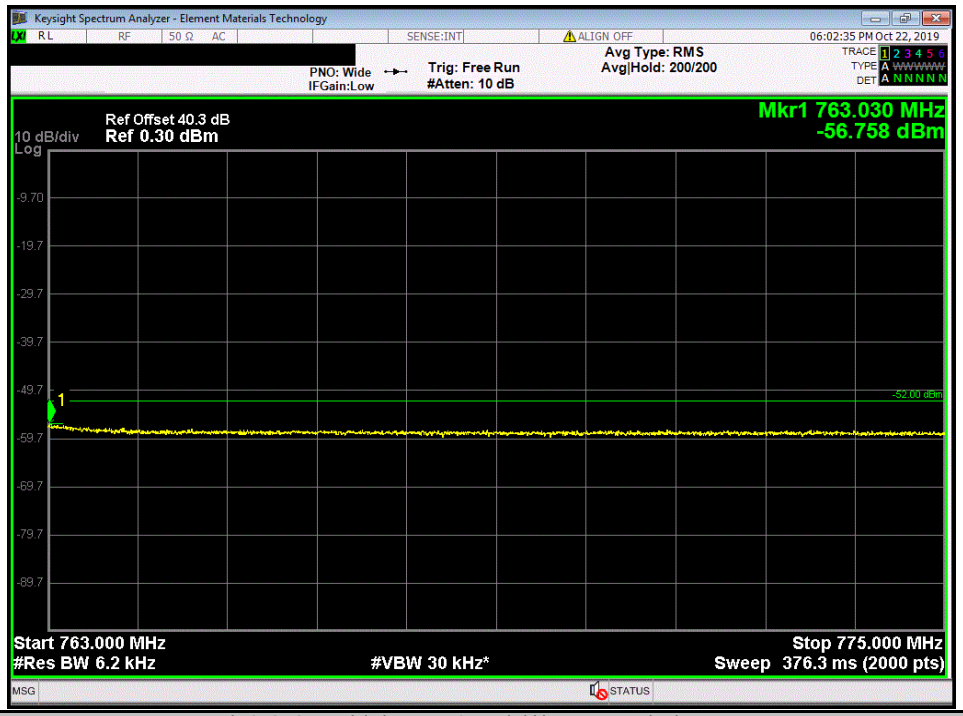
Band 13, QPSK Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-29.409	-19	Pass



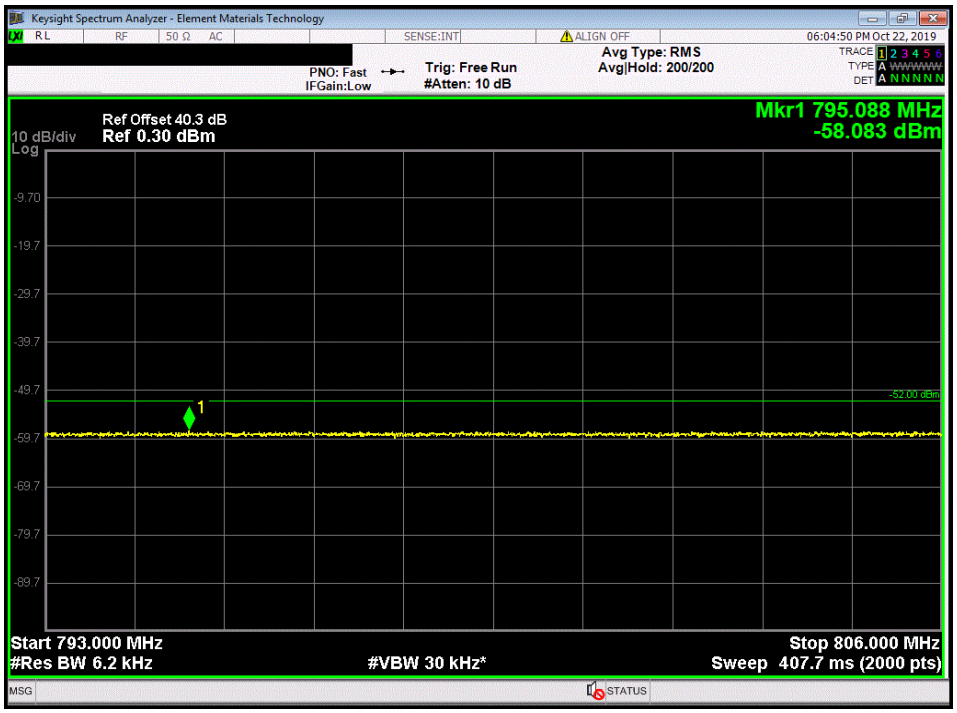
Band 13, QPSK Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-25.892	-19	Pass



Band 13, QPSK Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-56.758	-52	Pass

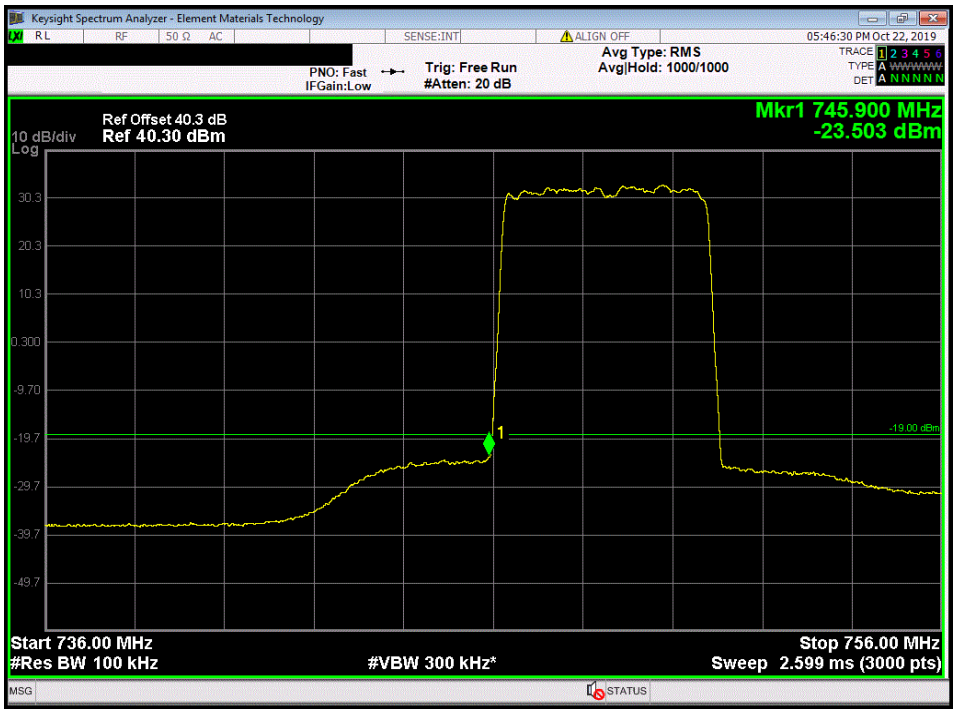


Band 13, QPSK Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.083	-52	Pass



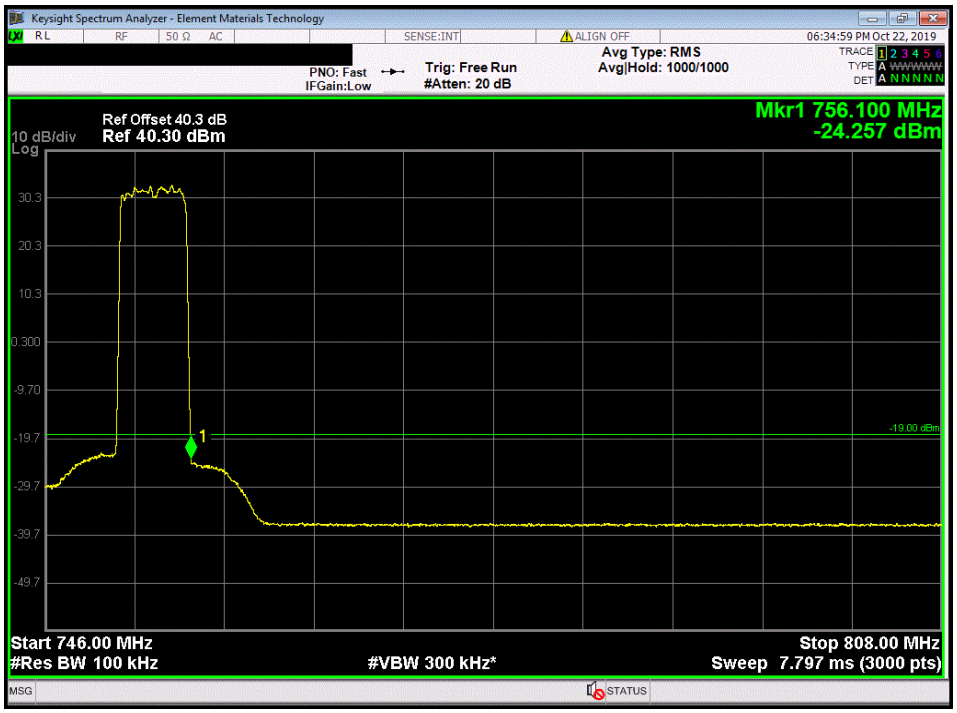
Band 13, 16QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-25.963	-19	Pass

Band 13, 16QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-23.503	-19	Pass

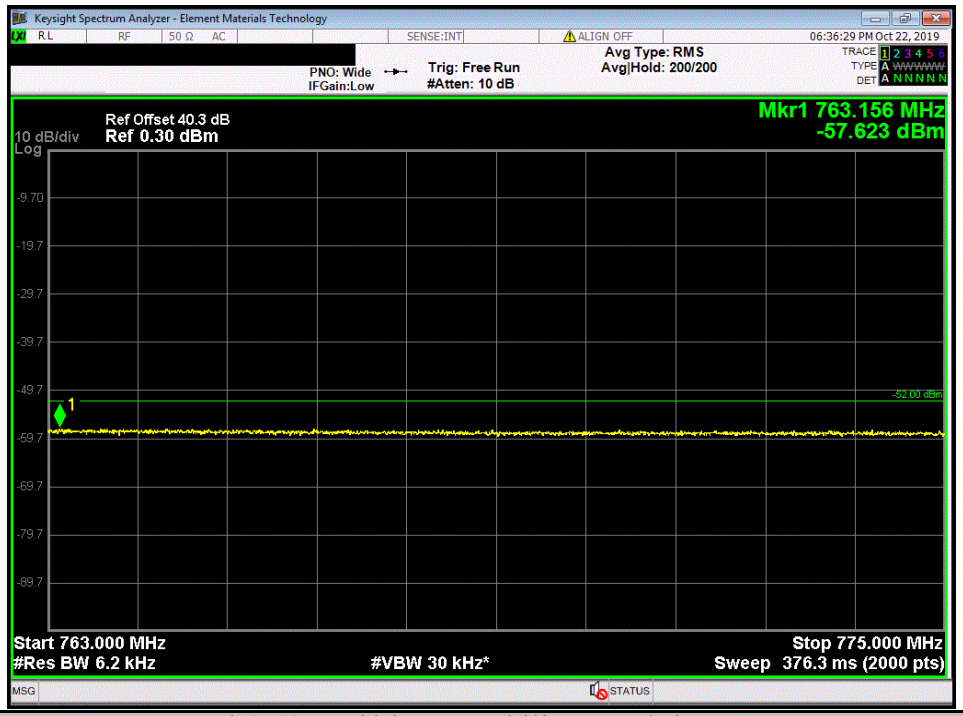


Band 13, 16QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-26.498	-19	Pass

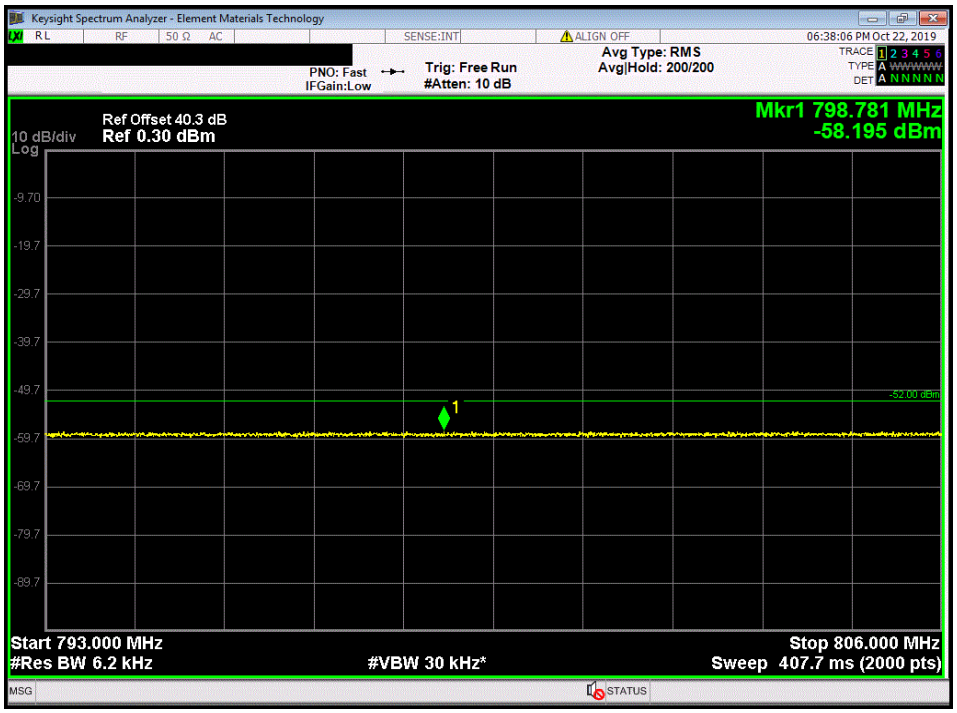
Band 13, 16QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-24.257	-19	Pass



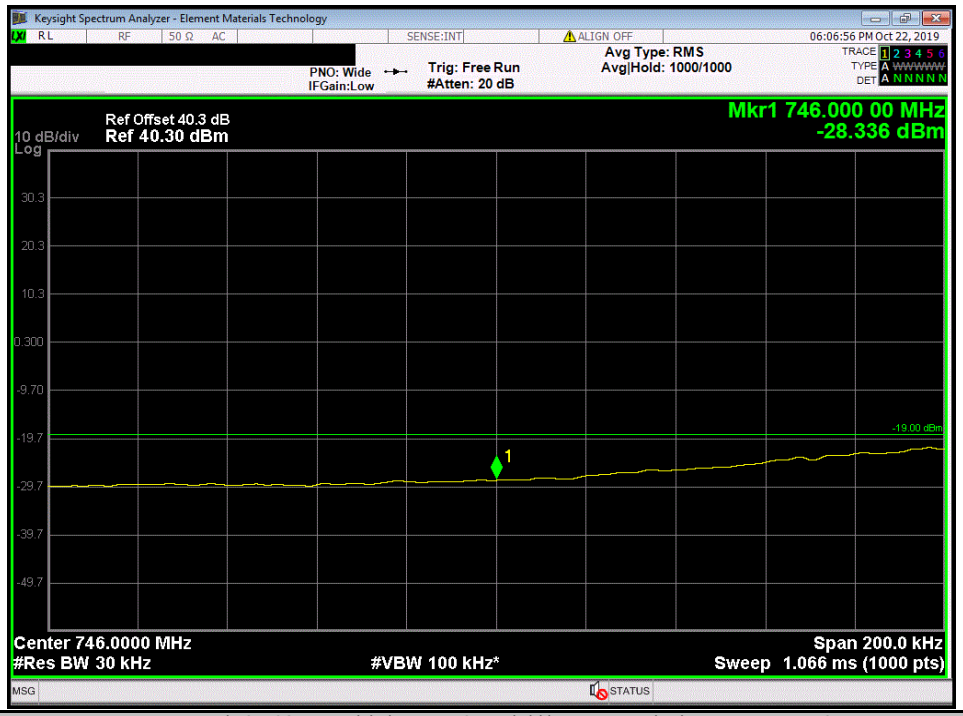
Band 13, 16QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-57.623	-52	Pass



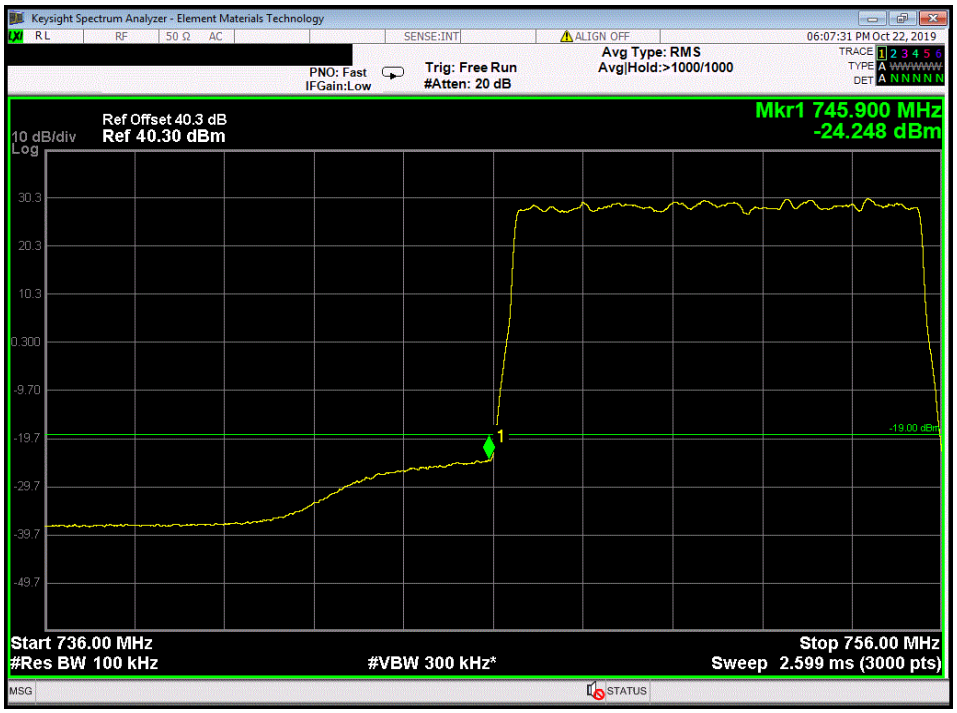
Band 13, 16QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.195	-52	Pass



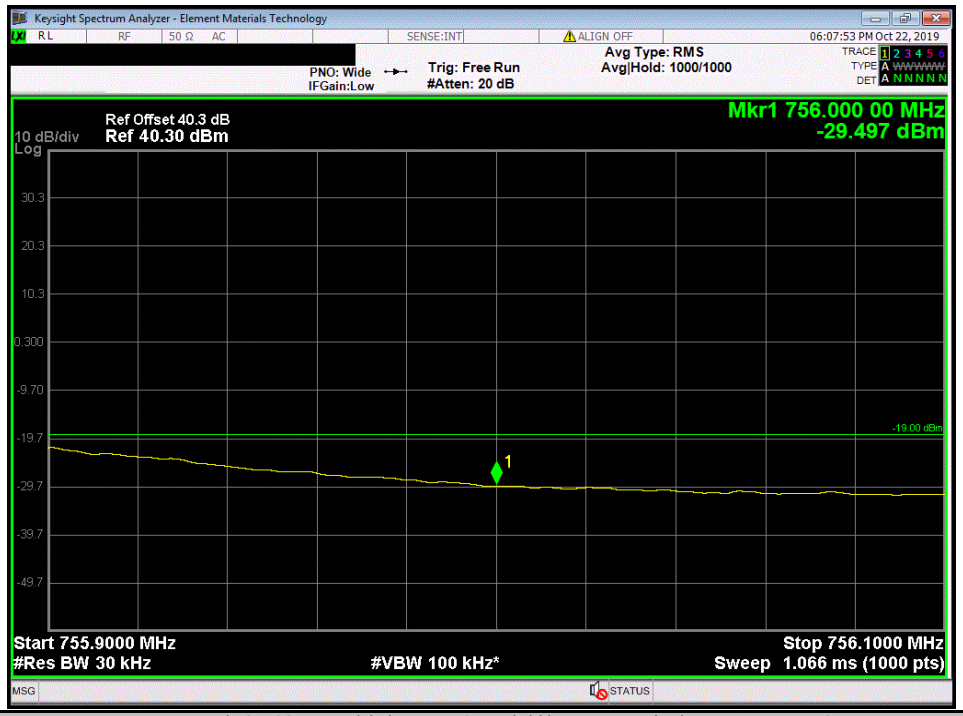
Band 13, 16QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-28.336	-19	Pass



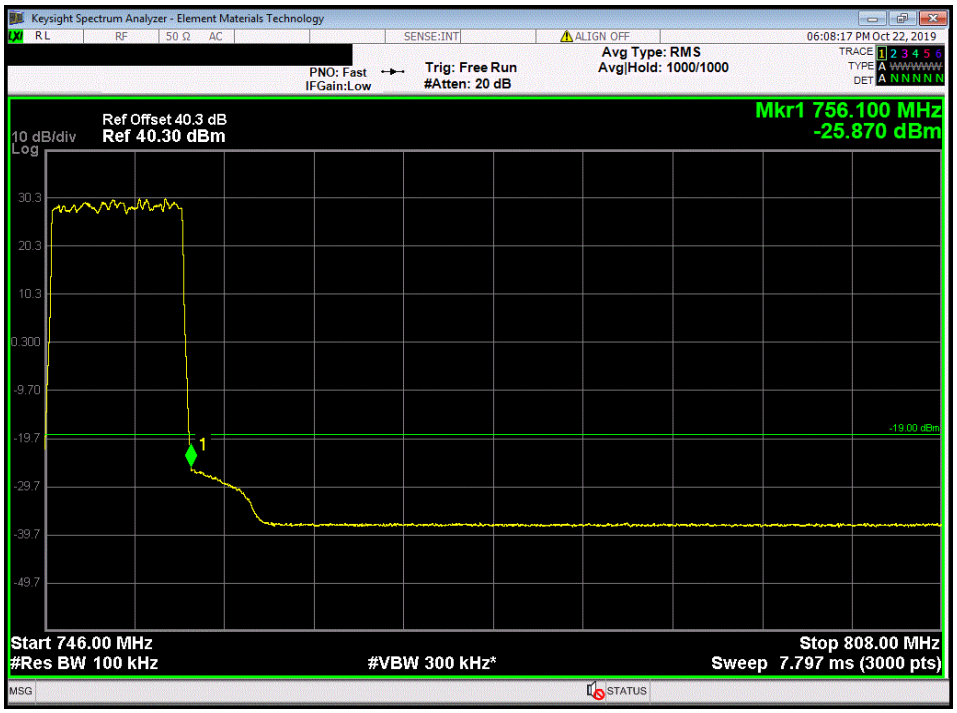
Band 13, 16QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-24.248	-19	Pass



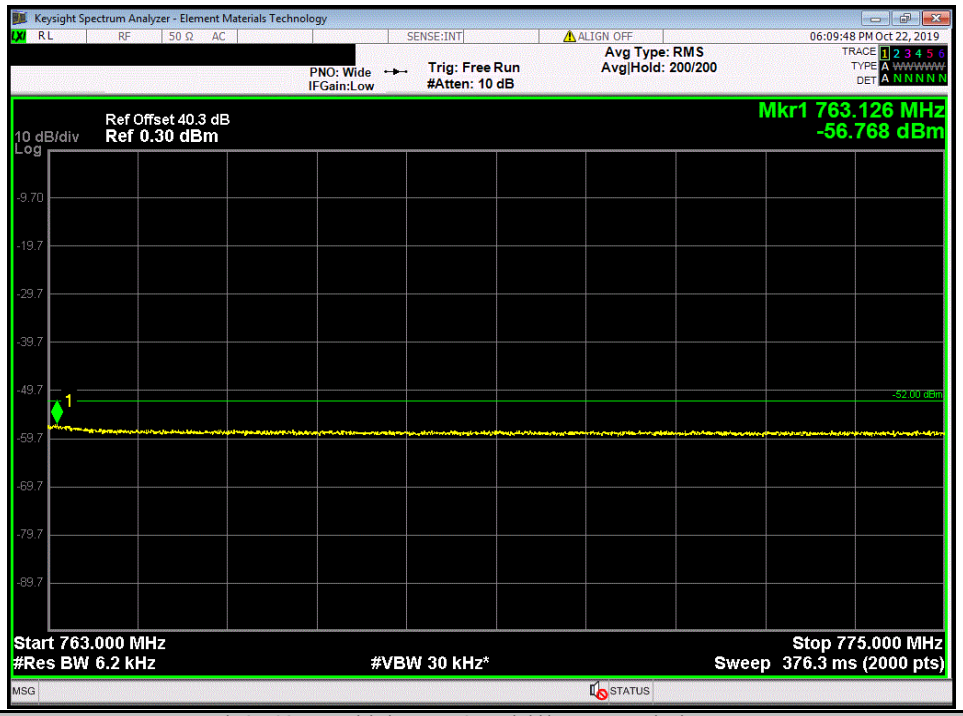
Band 13, 16QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-29.497	-19	Pass



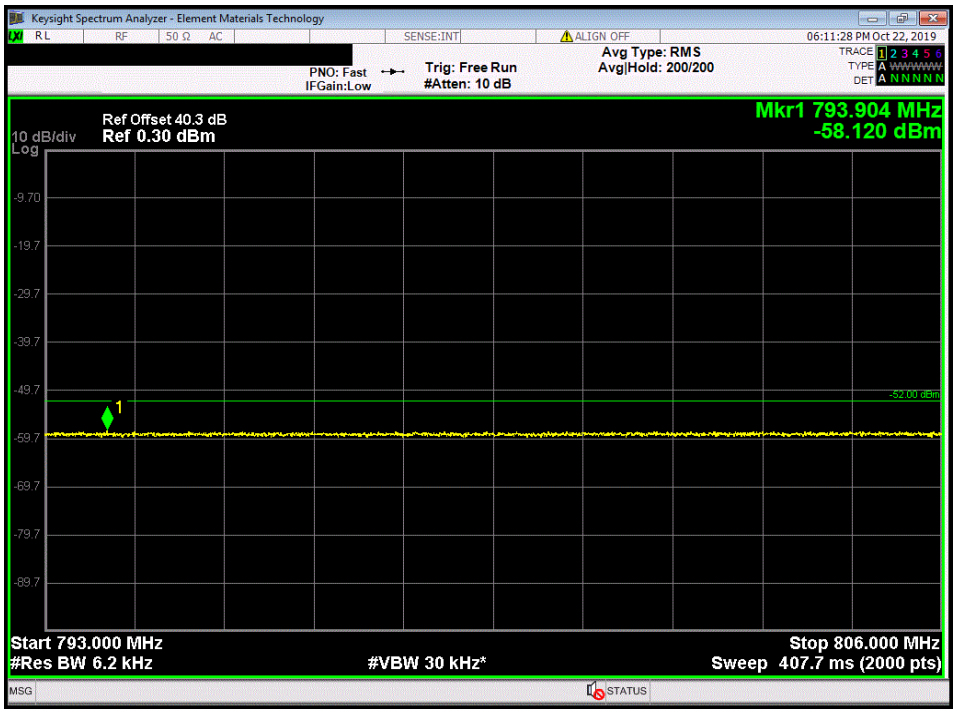
Band 13, 16QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-25.87	-19	Pass



Band 13, 16QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-56.768	-52	Pass

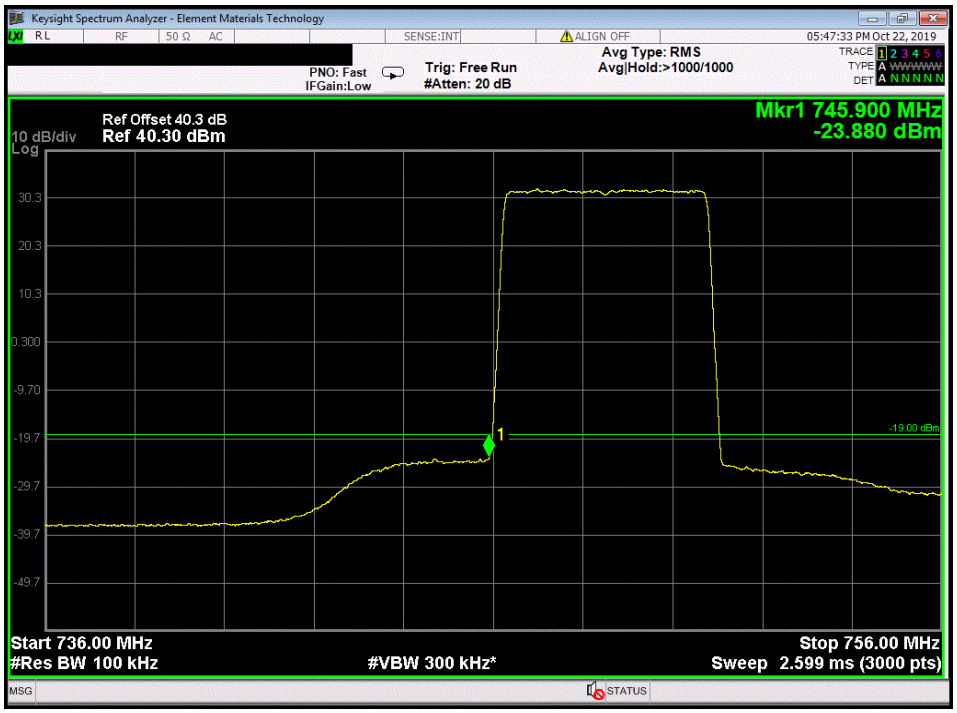


Band 13, 16QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.12	-52	Pass



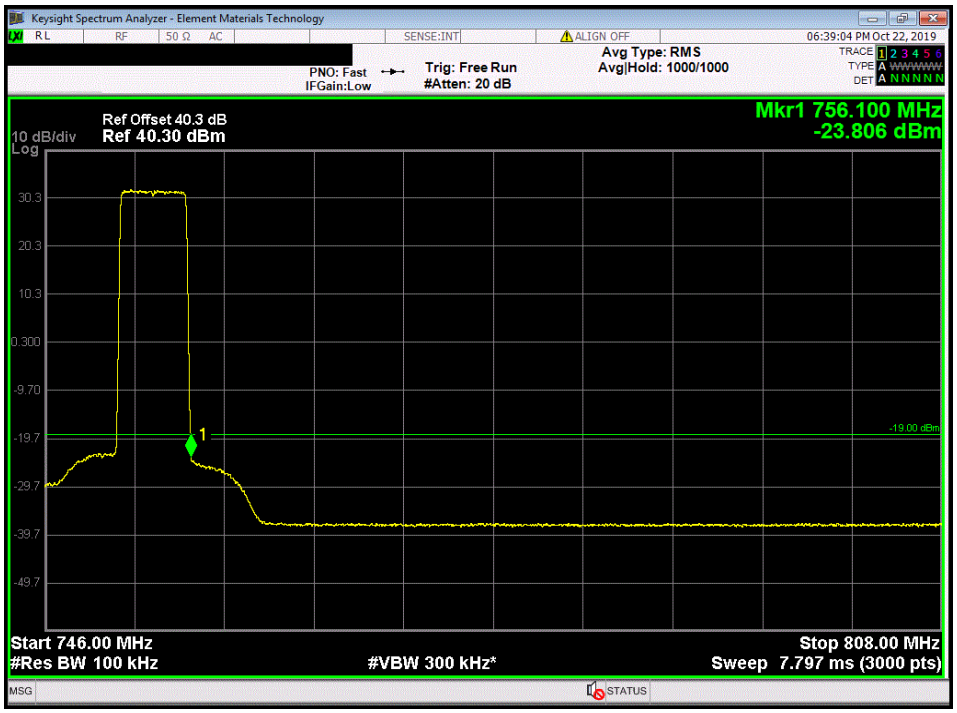
Band 13, 64QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-25.735	-19	Pass

Band 13, 64QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-23.88	-19	Pass

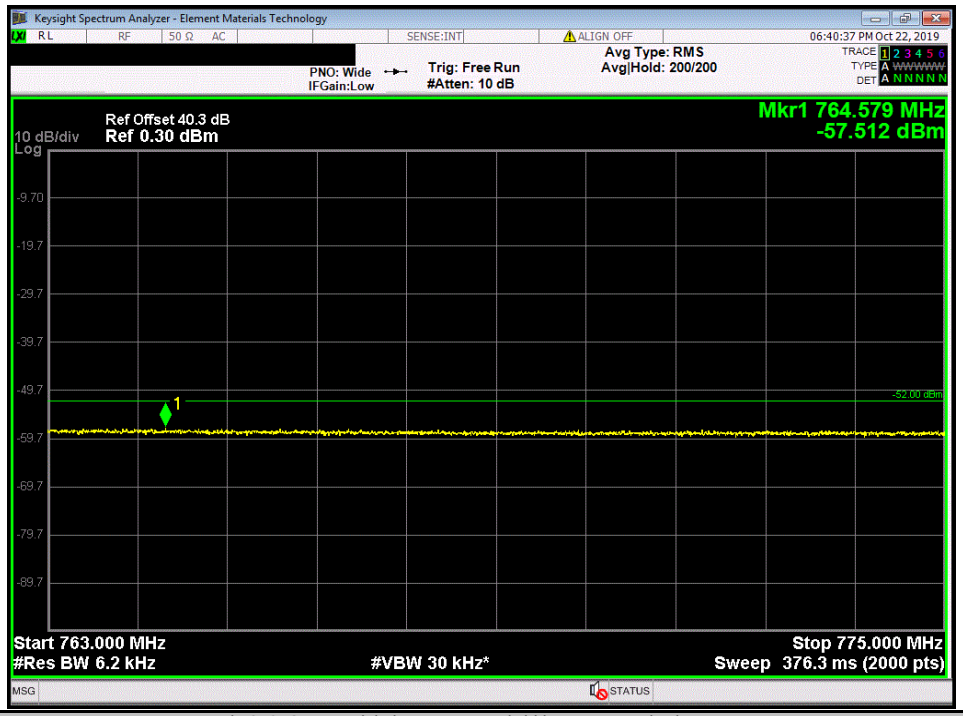


Band 13, 64QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-26.166	-19	Pass

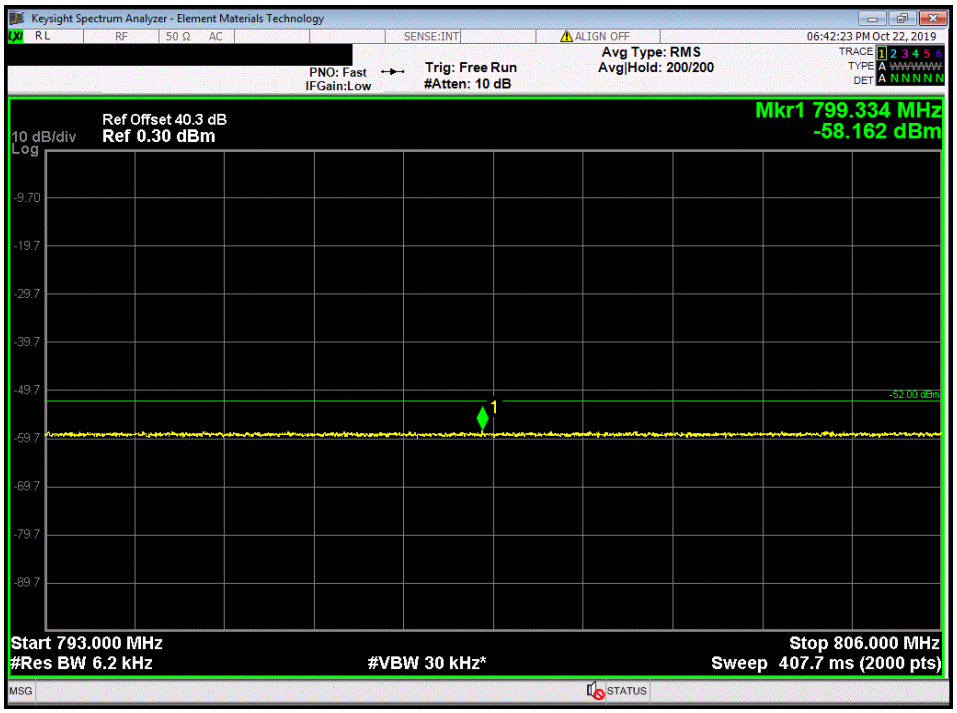
Band 13, 64QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-23.806	-19	Pass



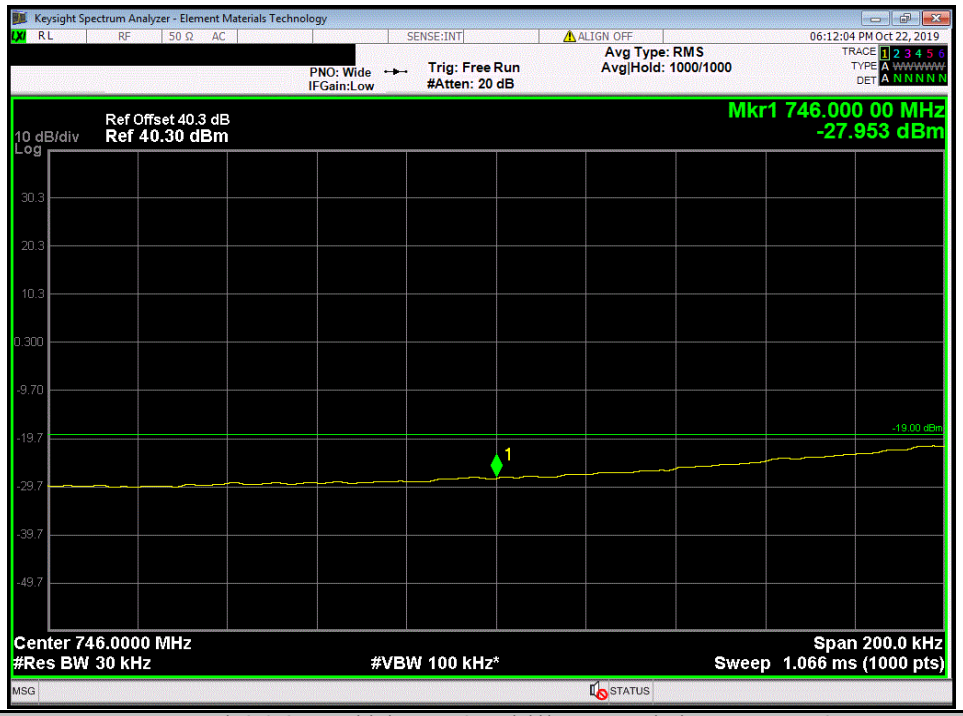
Band 13, 64QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-57.512	-52	Pass



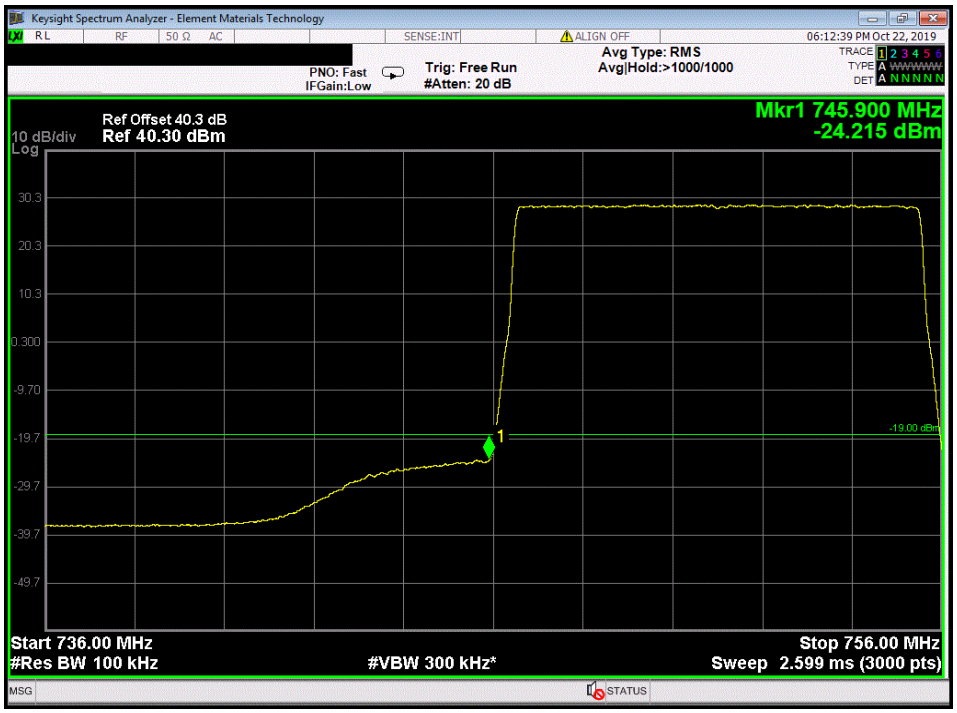
Band 13, 64QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.162	-52	Pass



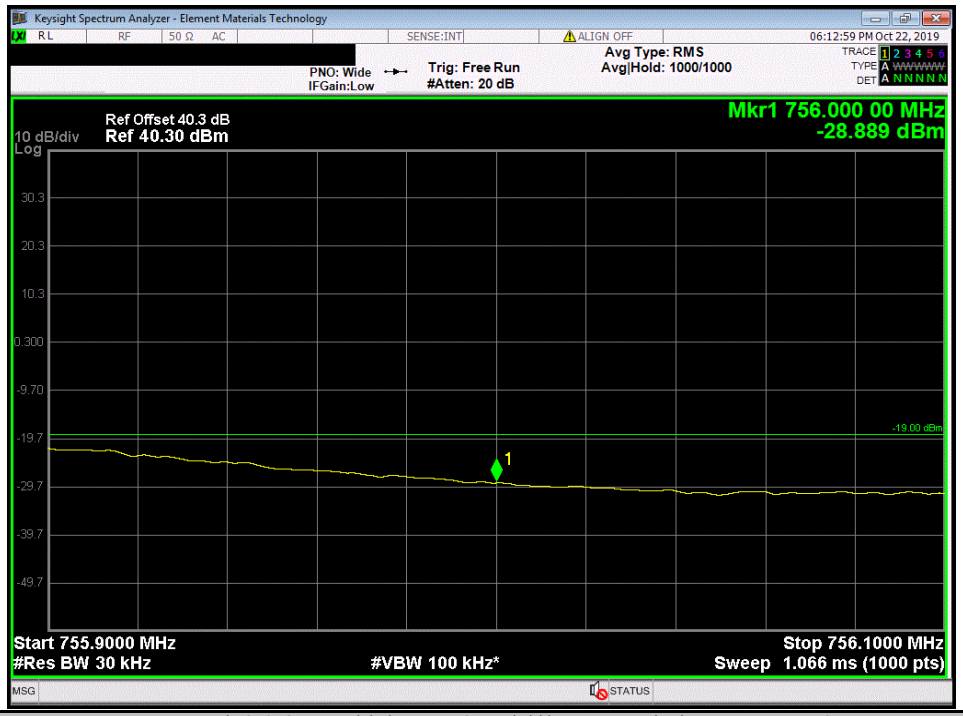
Band 13, 64QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-27.953	-19	Pass



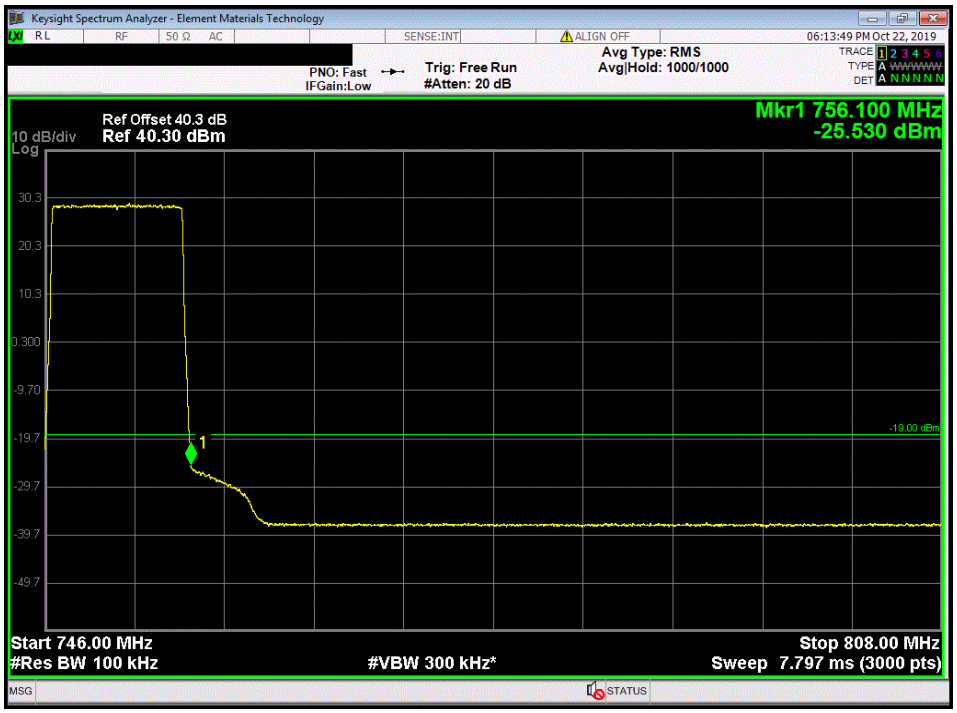
Band 13, 64QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-24.215	-19	Pass



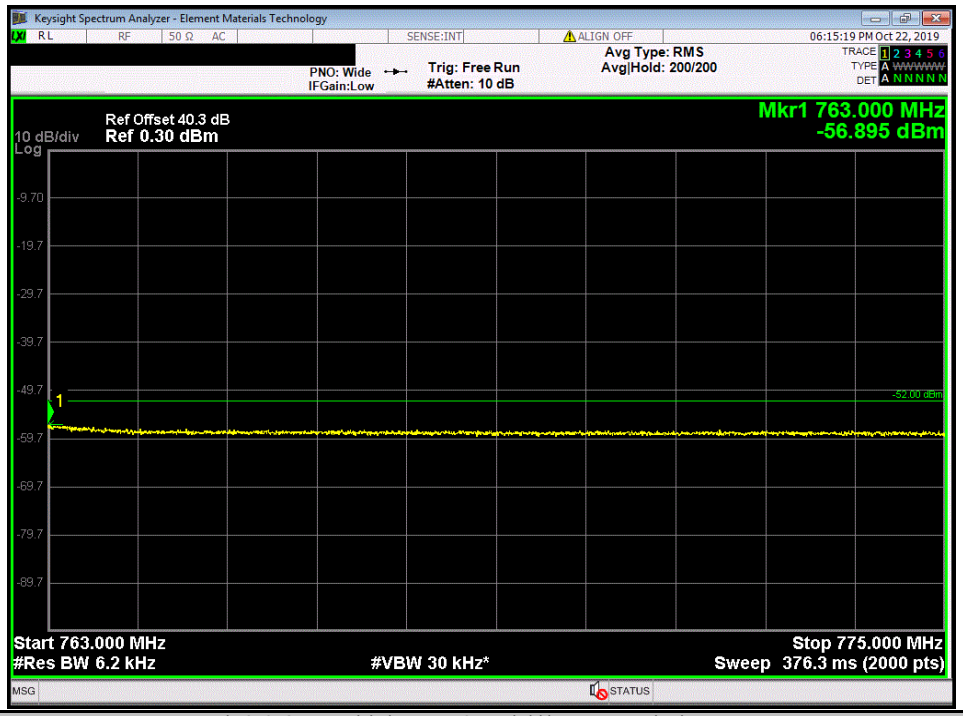
Band 13, 64QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-28.889	-19	Pass



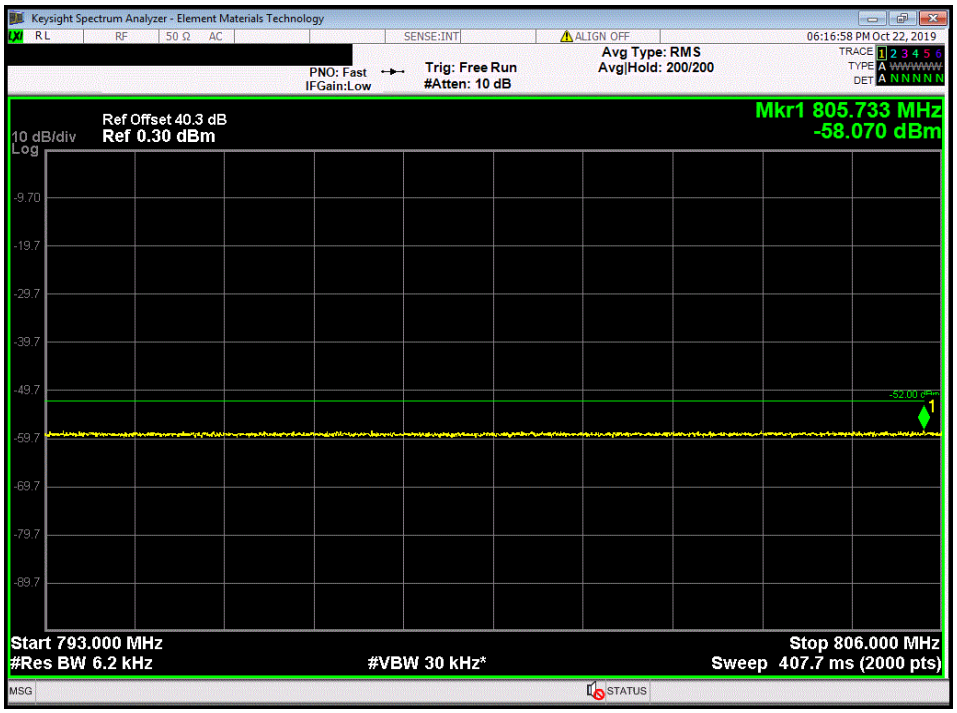
Band 13, 64QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-25.53	-19	Pass



Band 13, 64QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-56.895	-52	Pass

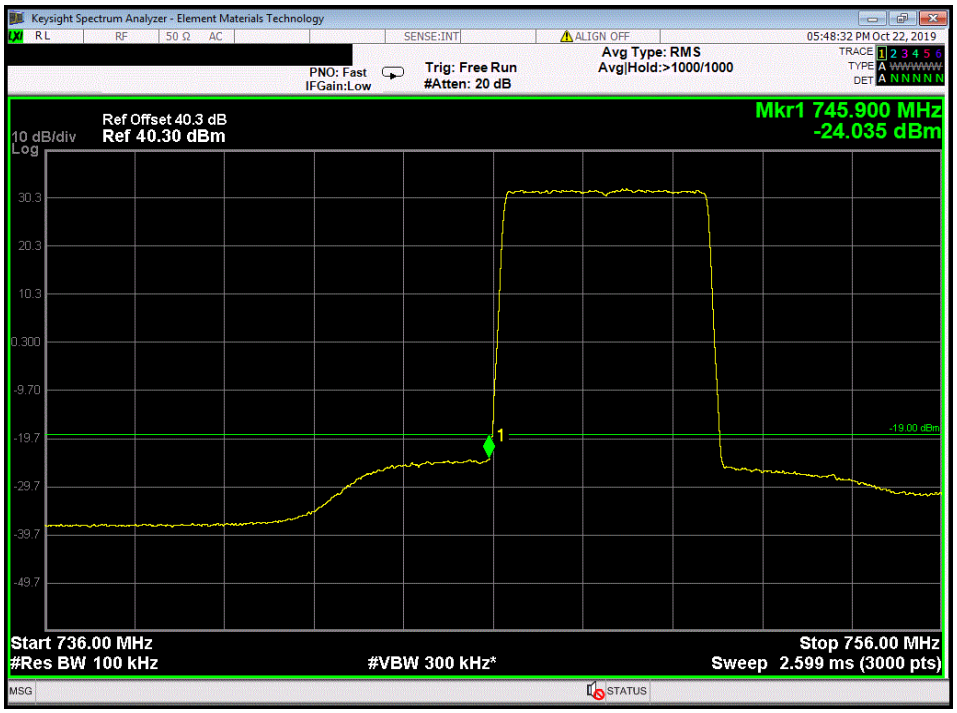


Band 13, 64QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.07	-52	Pass



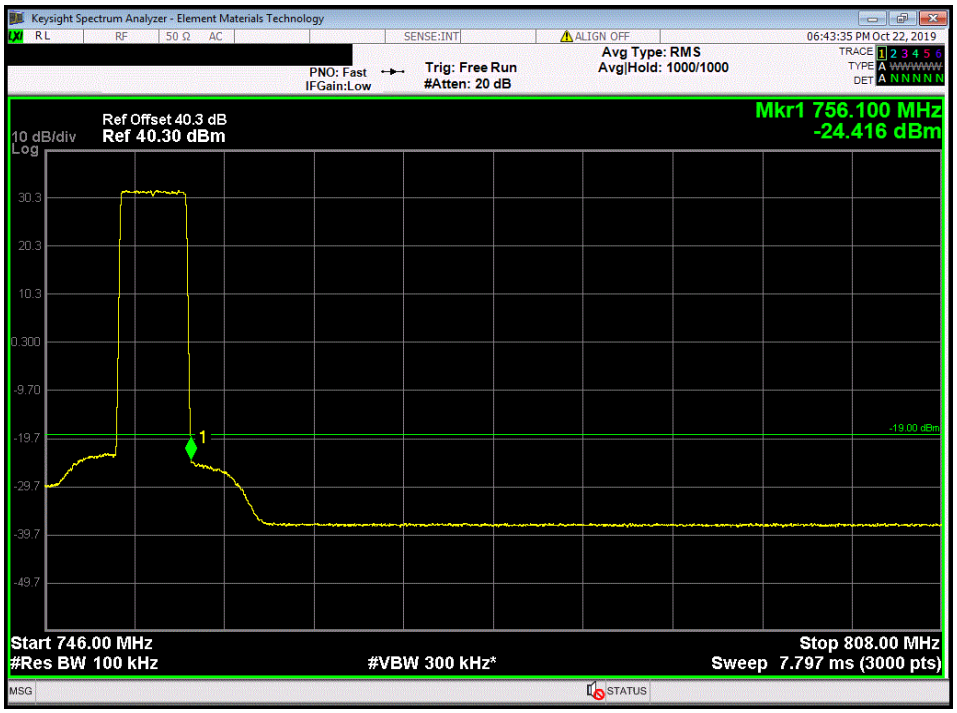
Band 13, 256QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-26.028	-19	Pass

Band 13, 256QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-24.035	-19	Pass

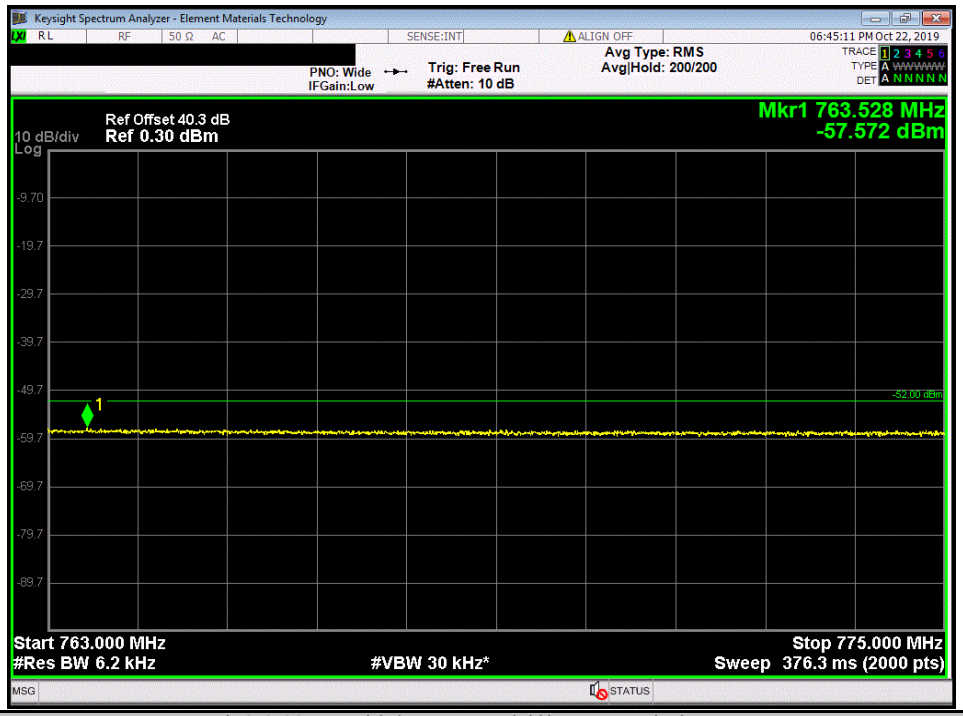


Band 13, 256QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-25.861	-19	Pass

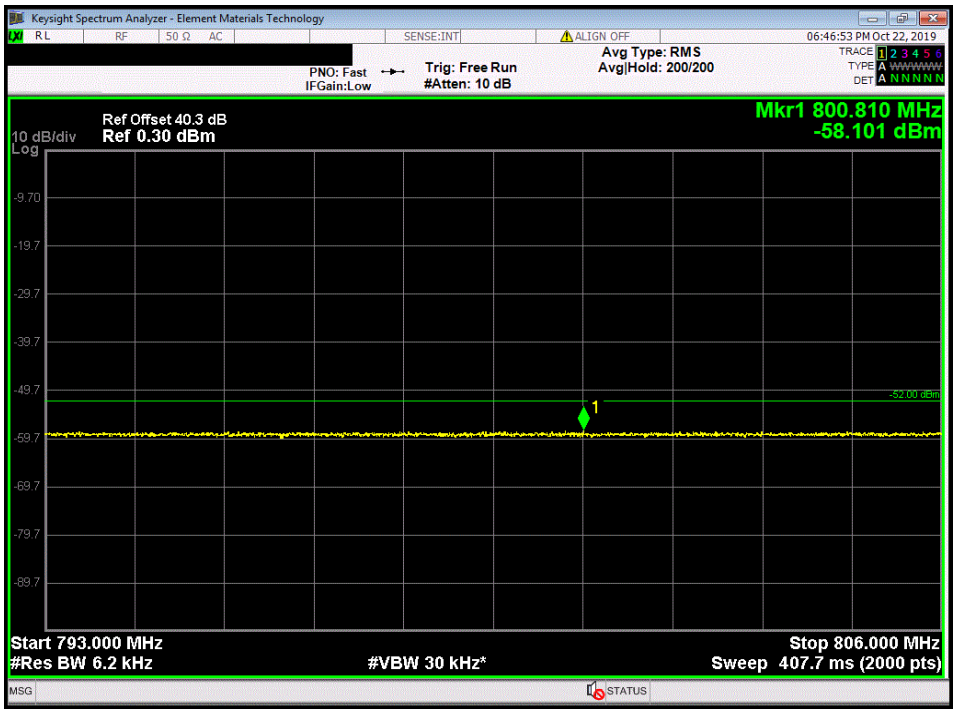
Band 13, 256QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-24.416	-19	Pass



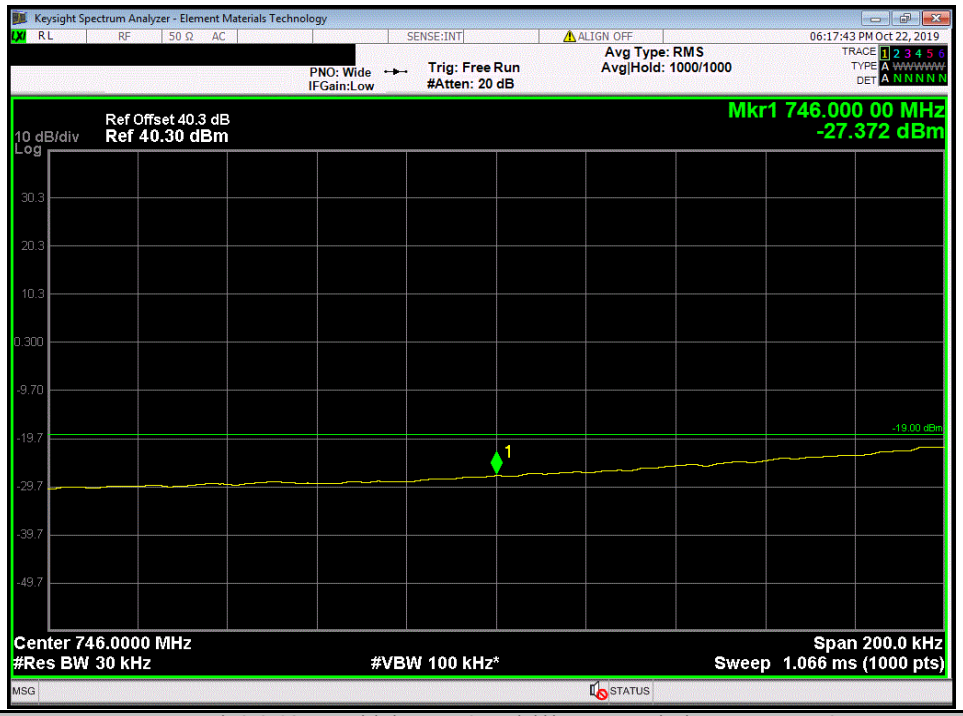
Band 13, 256QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-57.572	-52	Pass



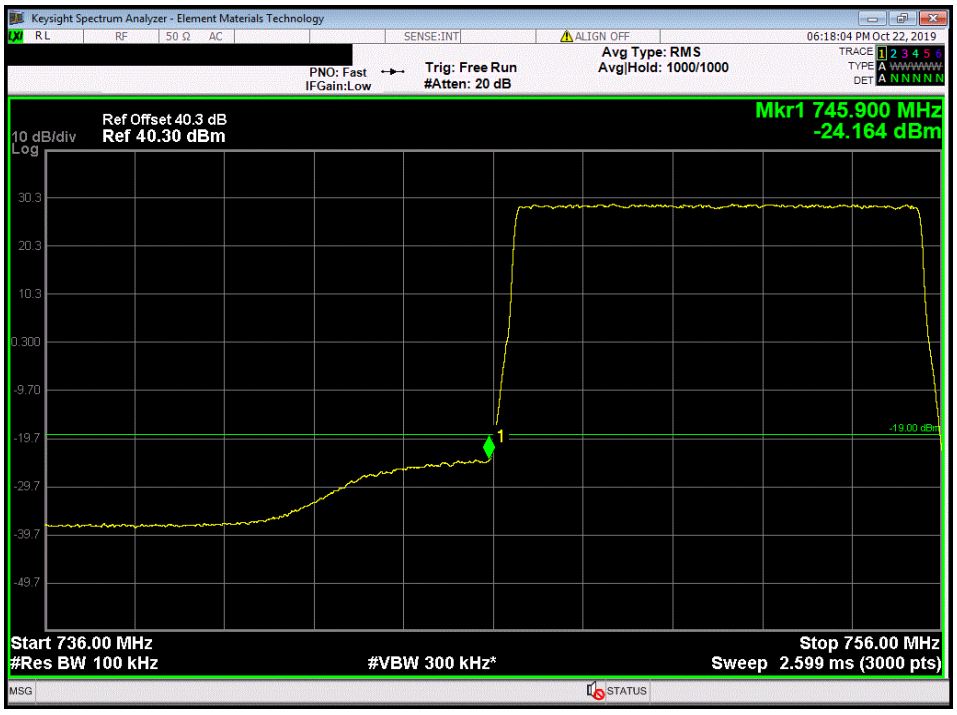
Band 13, 256QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.101	-52	Pass



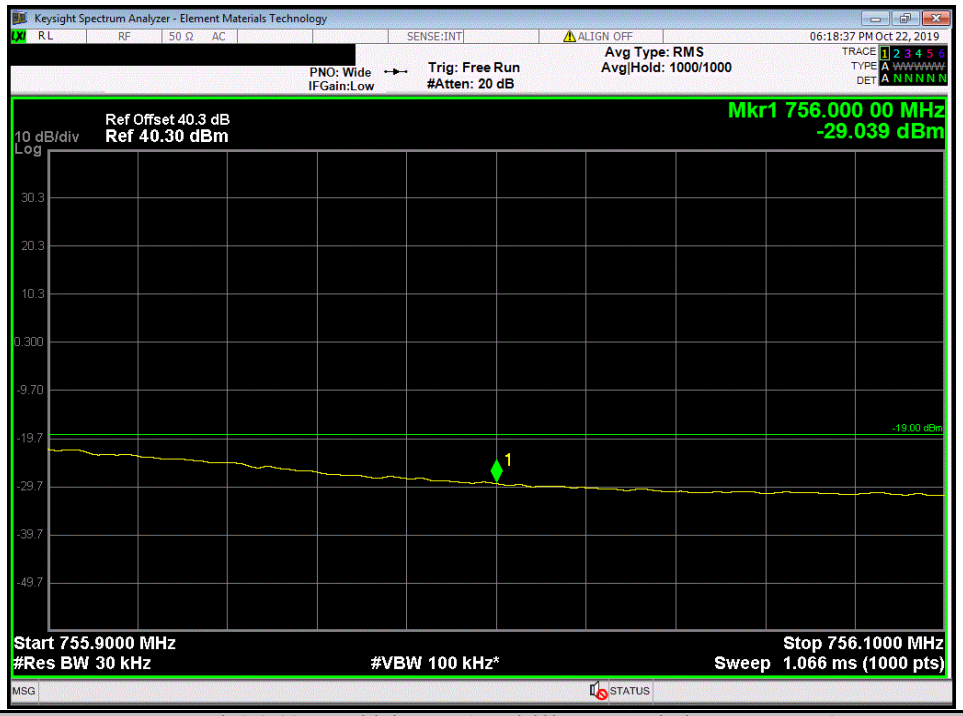
Band 13, 256QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-27.372	-19	Pass



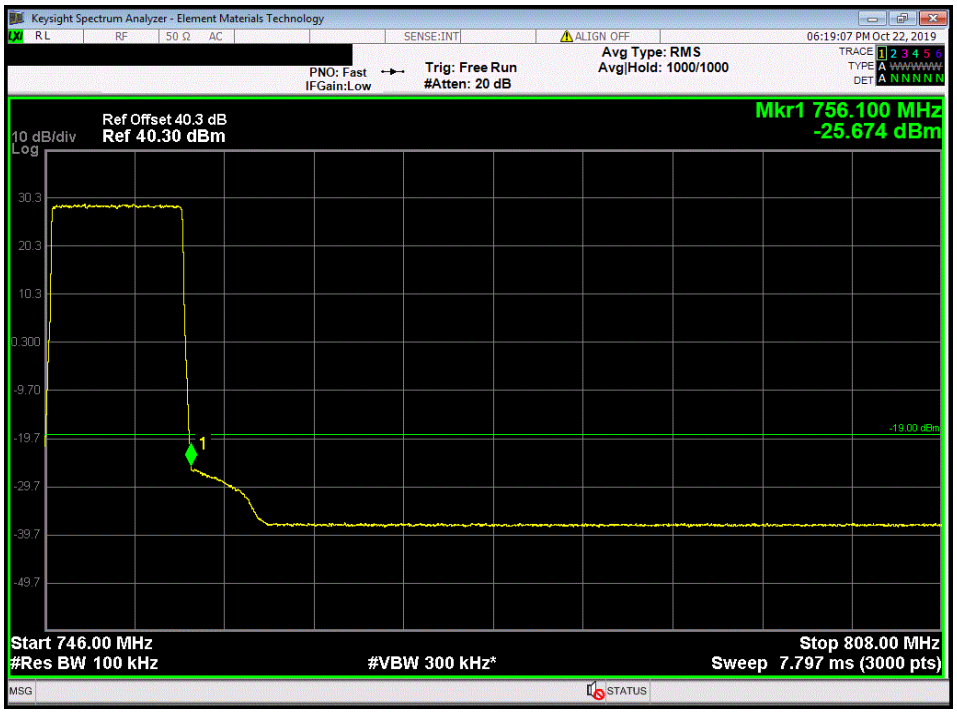
Band 13, 256QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-24.164	-19	Pass



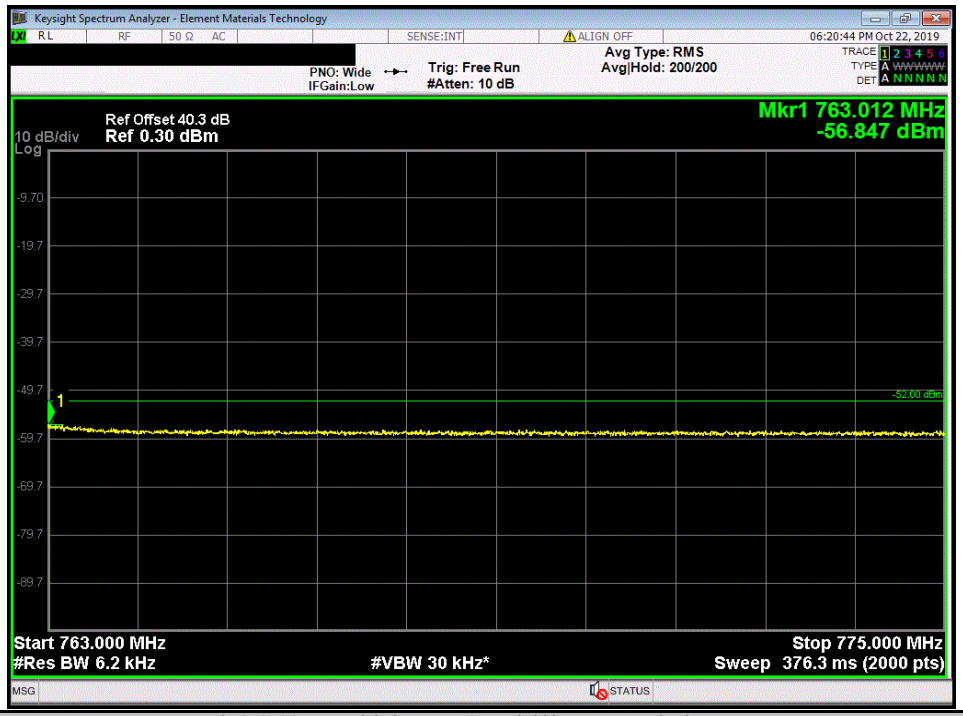
Band 13, 256QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-29.039	-19	Pass



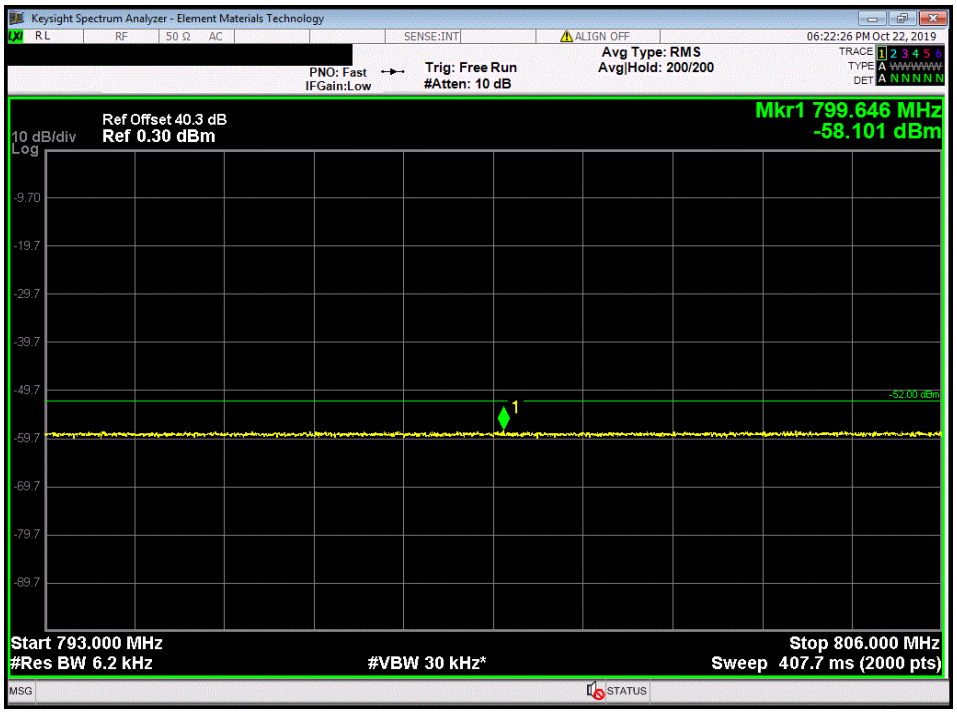
Band 13, 256QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-25.674	-19	Pass



Band 13, 256QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-56.847	-52	Pass



Band 13, 256QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.101	-52	Pass



BAND EDGE COMPLIANCE

XMit 2019.09.05

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in the available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

All limits were adjusted by a factor of [-10*log(4)] dB to account for the device operation as a 4 port MIMO transmitter, as per FCC KDB 622911.

Per FCC section 27.53(c), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

FCC section 27.53(c) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range. FCC 27.53(c) requires a >30 kHz measurement bandwidth for emissions between 100 kHz outside of the RRH operating frequency range and band edge of the operating frequency range.

Section 27.53(c)(3) requires an emission limit of -46dBm for any 6.25 kHz bandwidth between frequency bands 763-775 MHz and 793-806MHz. Adjusting for the four port MIMO requirement the emission limit in these frequency ranges is -52 dBm [i.e.: Limit = -46 dBm/6.25kHz (FCC Limit) - 6dB (4 port MIMO)].

BAND EDGE COMPLIANCE

element

XMit 2019.09.05

EUT:	**AHBOA Remote Radio Head (RRH)**			**Work Order:**	**NOKI0003**
Serial Number:	**BL1934X1001**			**Date:**	**28-Oct-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**22.3 °C**
Attendees:	**John Rattanavong, Mitchell Hill**			**Humidity:**	**49.5% RH**
Project:	**None**			**Barometric Pres.:**	**1019 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**48VDC**	**Job Site:**	**TX03**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015

COMMENTS

Tested on highest power antenna port (Port 1). EUT is operated at 100% duty cycle. Band Edge measurements were made for a Band 13 multicarrier test case on four modulation types (QPSK, 16QAM, 64QAM, 256QAM). Two LTE5 carriers were enabled at the lower and upper Band 13 band edge channels [748.5MHz and 753.5MHz]. Two LTE5 carriers cover the entire channel bandwidth so three carrier operation is not available.

DEVIATIONS FROM TEST STANDARD

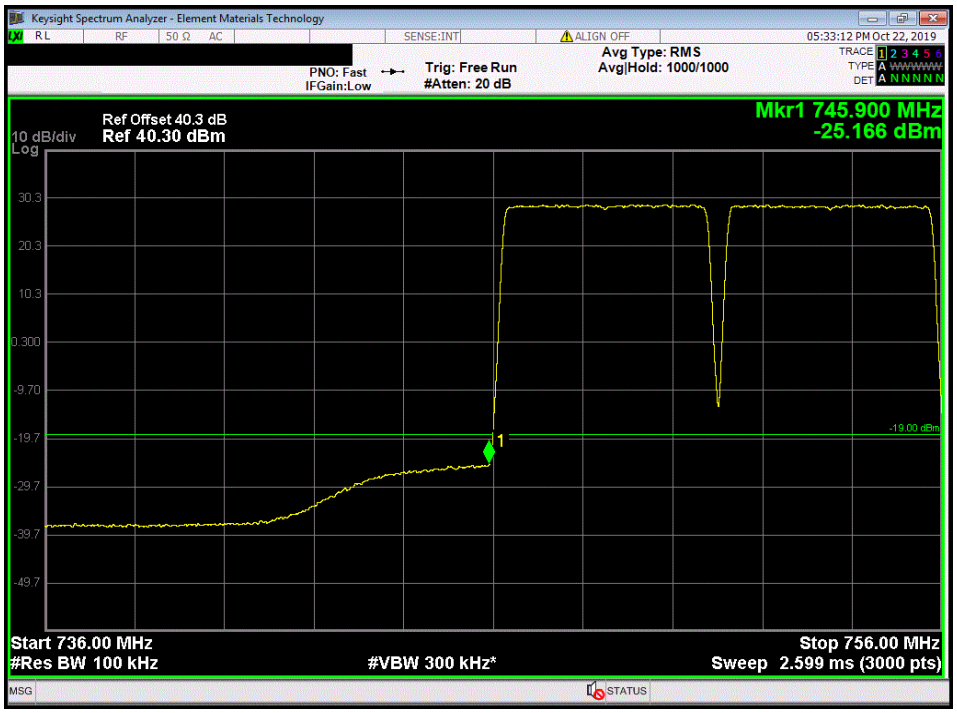
None

Configuration #	**1**	*Signature* Jonathan Kiefer

	Value (dBm)	**Limit (dBm)**	**Result**
Band 13			
QPSK Modulation			
Band 13 Multicarrier			
Lower Band Edge			
Measurement 1	-27.467	-19	Pass
Measurement 2	-25.166	-19	Pass
Upper Band Edge			
Measurement 1	-23.382	-19	Pass
Measurement 2	-26.095	-19	Pass
Measurement 3	-55.668	-52	Pass
Measurement 4	-58.045	-52	Pass
16QAM Modulation			
Band 13 Multicarrier			
Lower Band Edge			
Measurement 1	-27.411	-19	Pass
Measurement 2	-25.356	-19	Pass
Upper Band Edge			
Measurement 1	-28.751	-19	Pass
Measurement 2	-26.65	-19	Pass
Measurement 3	-55.583	-52	Pass
Measurement 4	-58.184	-52	Pass
64QAM Modulation			
Band 13 Multicarrier			
Lower Band Edge			
Measurement 1	-27.863	-19	Pass
Measurement 2	-25.187	-19	Pass
Upper Band Edge			
Measurement 1	-28.036	-19	Pass
Measurement 2	-26.315	-19	Pass
Measurement 3	-55.6	-52	Pass
Measurement 4	-58.134	-52	Pass
256QAM Modulation			
Band 13 Multicarrier			
Lower Band Edge			
Measurement 1	-27.124	-19	Pass
Measurement 2	-25.188	-19	Pass
Upper Band Edge			
Measurement 1	-28.693	-19	Pass
Measurement 2	-26.466	-19	Pass
Measurement 3	-55.677	-52	Pass
Measurement 4	-58.013	-52	Pass

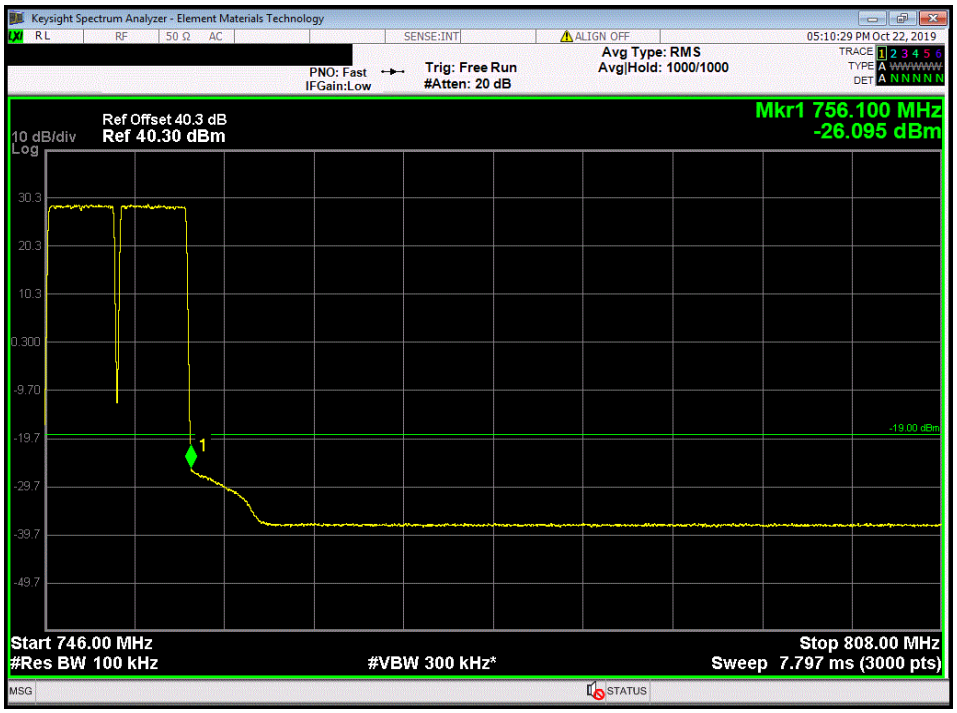
Band 13, QPSK Modulation, Band 13 Multicarrier, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-27.467	-19	Pass

Band 13, QPSK Modulation, Band 13 Multicarrier, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-25.166	-19	Pass

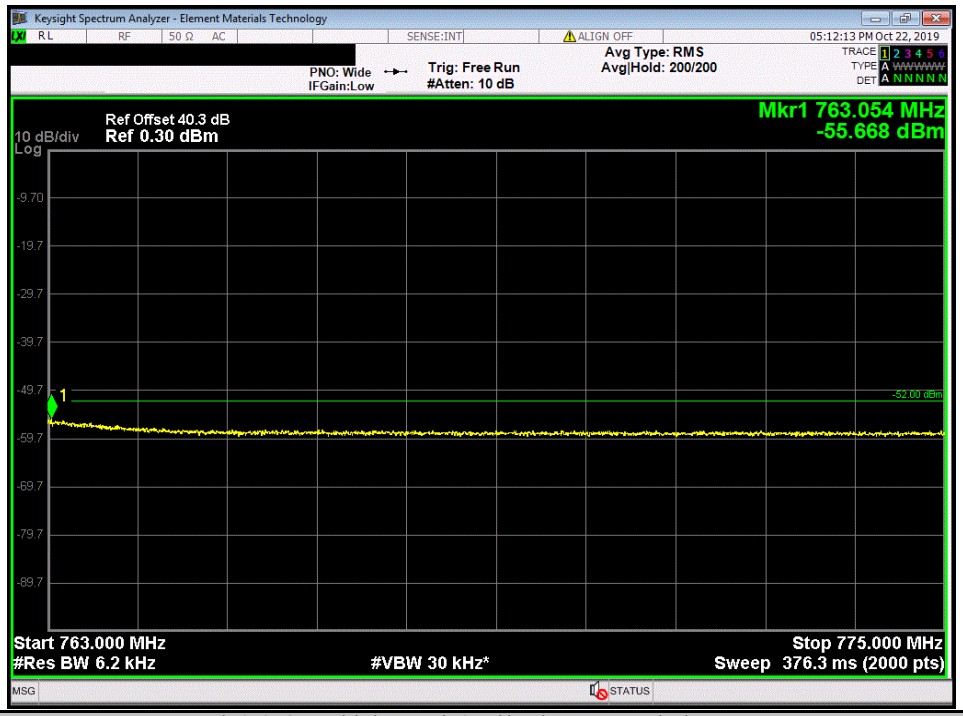


Band 13, QPSK Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-23.382	-19	Pass

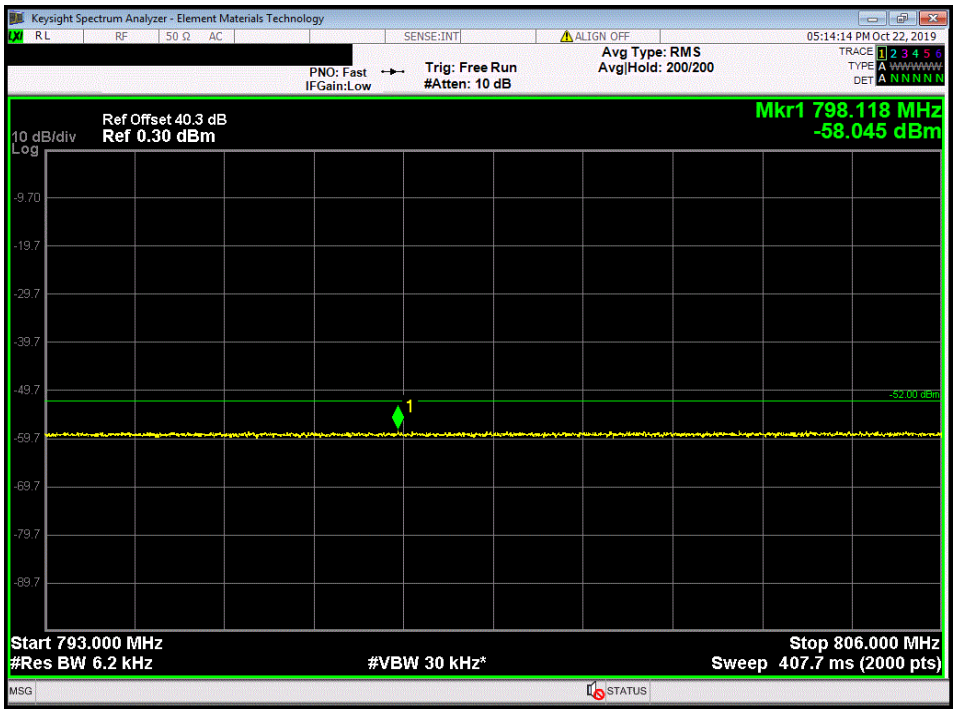
Band 13, QPSK Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-26.095	-19	Pass



Band 13, QPSK Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-55.668	-52	Pass

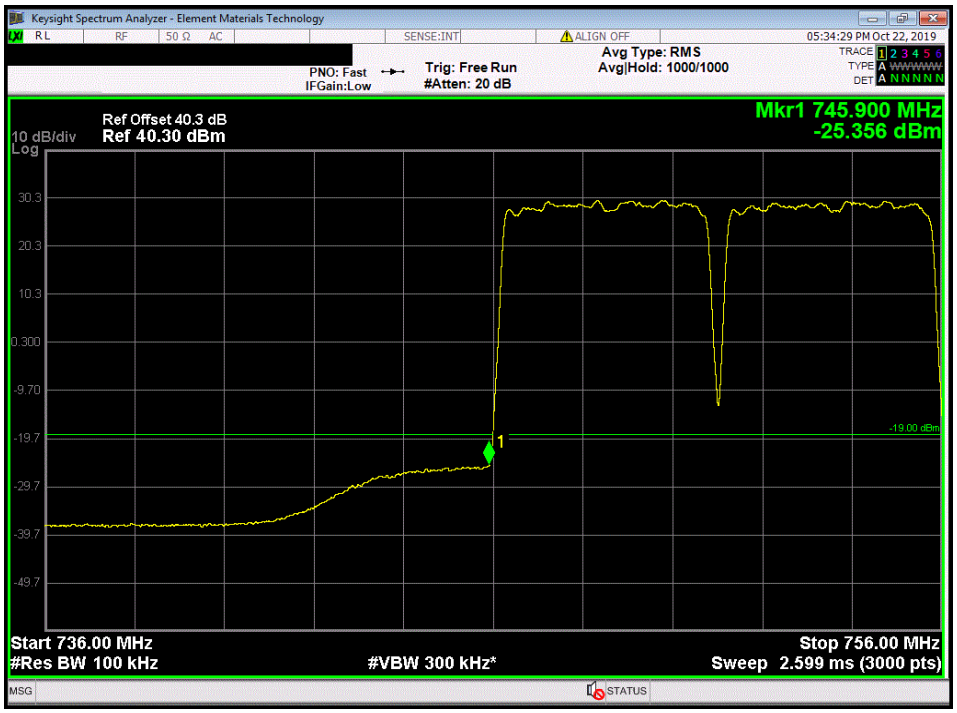


Band 13, QPSK Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.045	-52	Pass



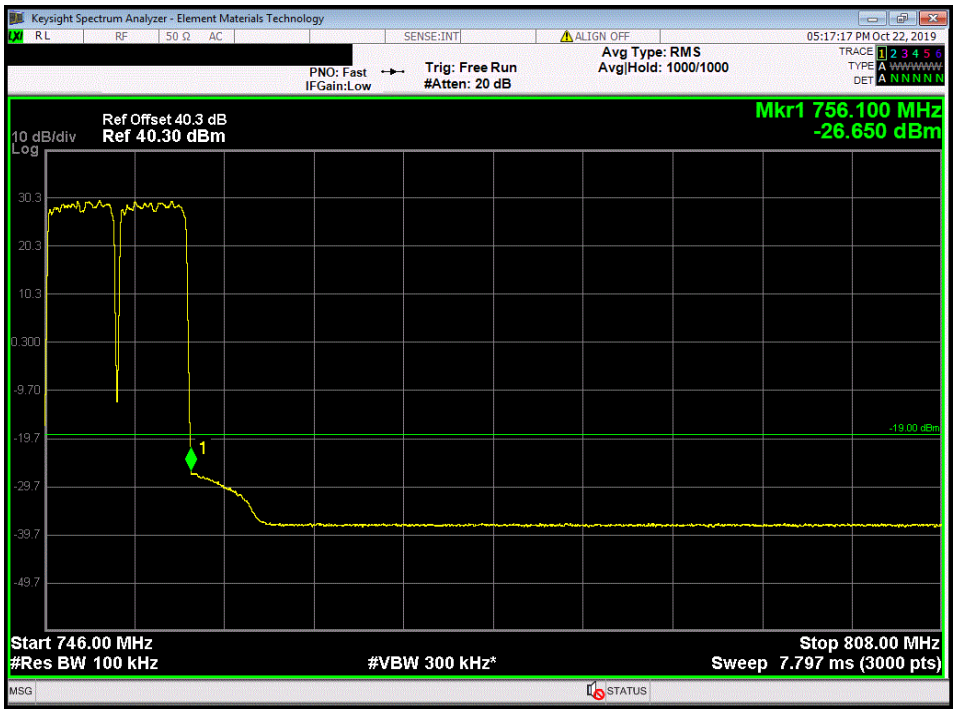
Band 13, 16QAM Modulation, Band 13 Multicarrier, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-27.411	-19	Pass

Band 13, 16QAM Modulation, Band 13 Multicarrier, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-25.356	-19	Pass

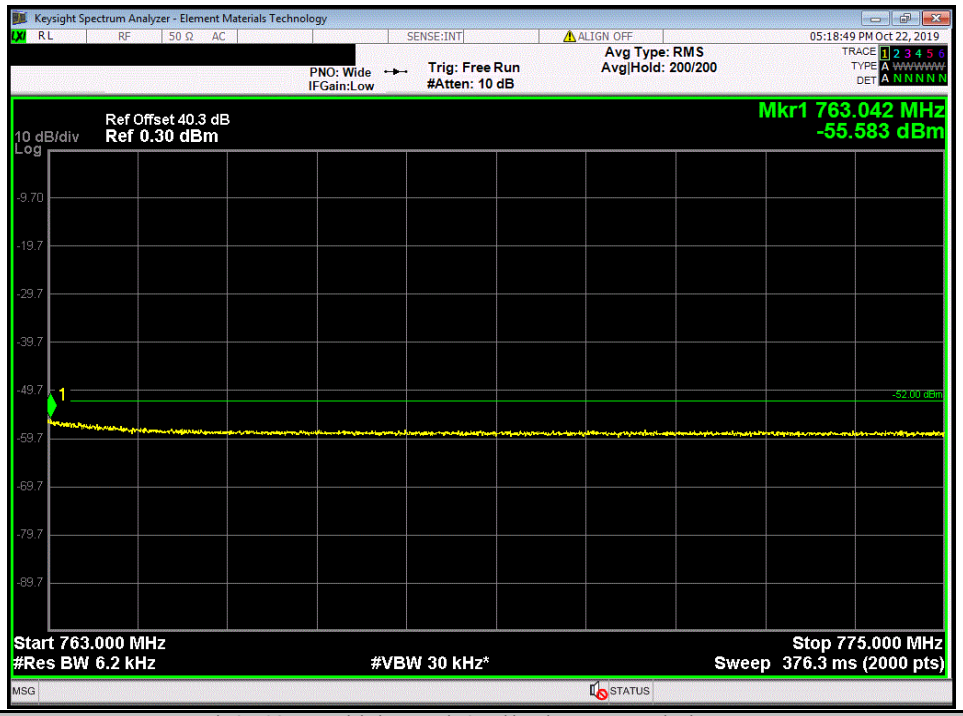


Band 13, 16QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-28.751	-19	Pass

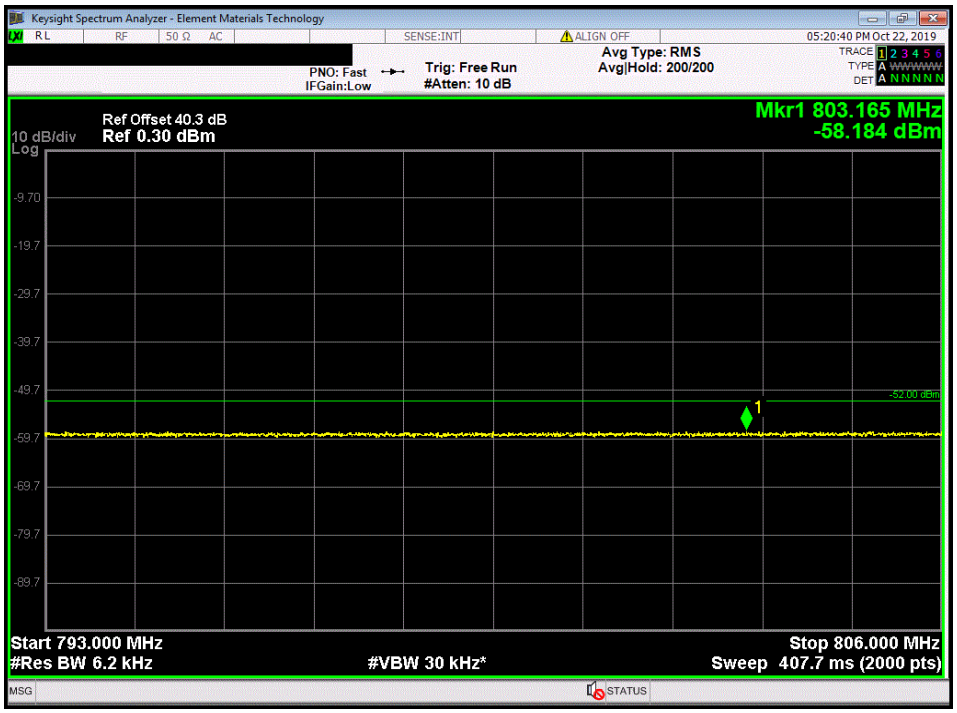
Band 13, 16QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-26.65	-19	Pass



Band 13, 16QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-55.583	-52	Pass

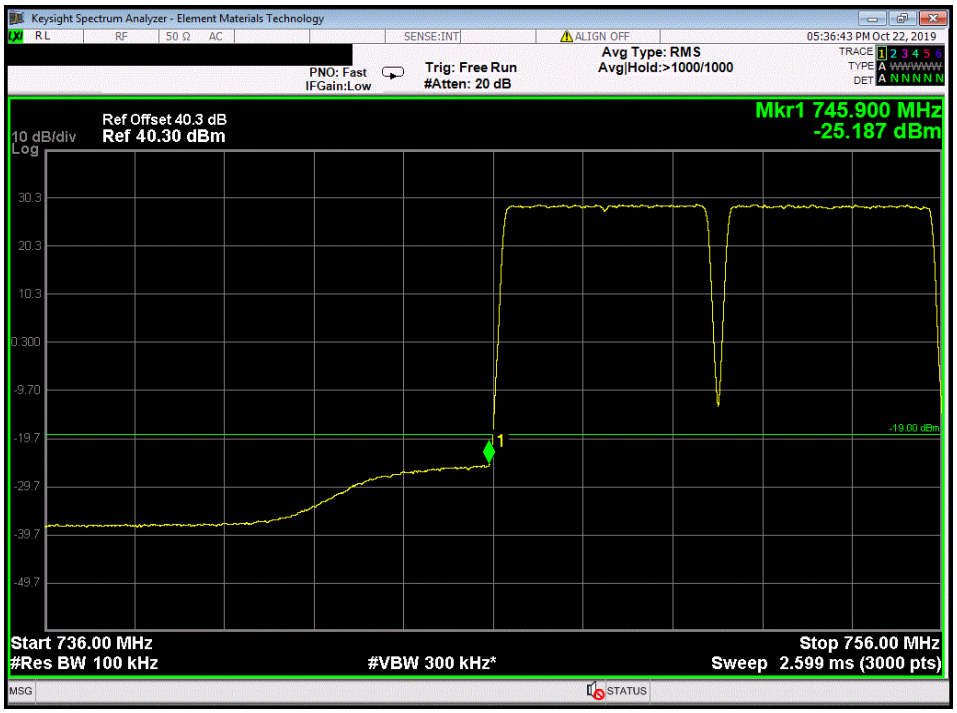


Band 13, 16QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.184	-52	Pass



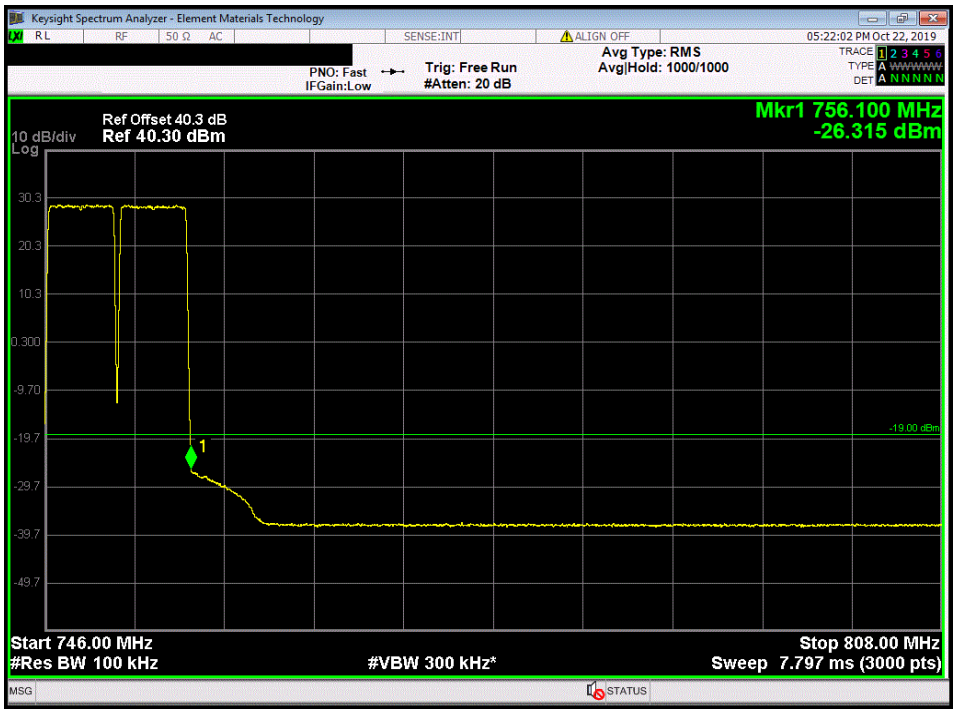
Band 13, 64QAM Modulation, Band 13 Multicarrier, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-27.863	-19	Pass

Band 13, 64QAM Modulation, Band 13 Multicarrier, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-25.187	-19	Pass

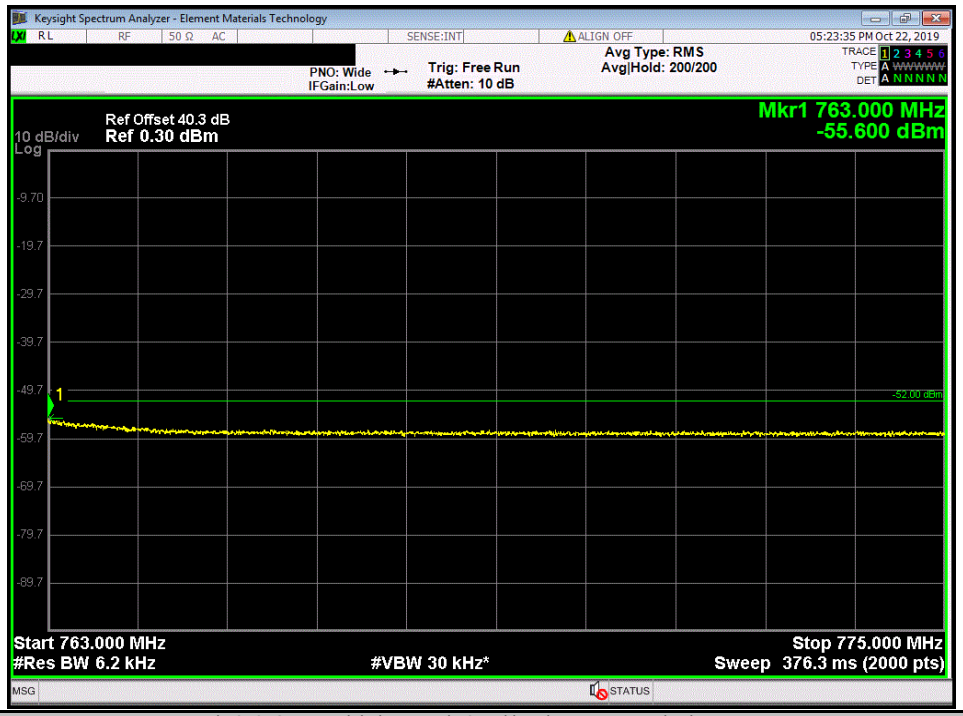


Band 13, 64QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-28.036	-19	Pass

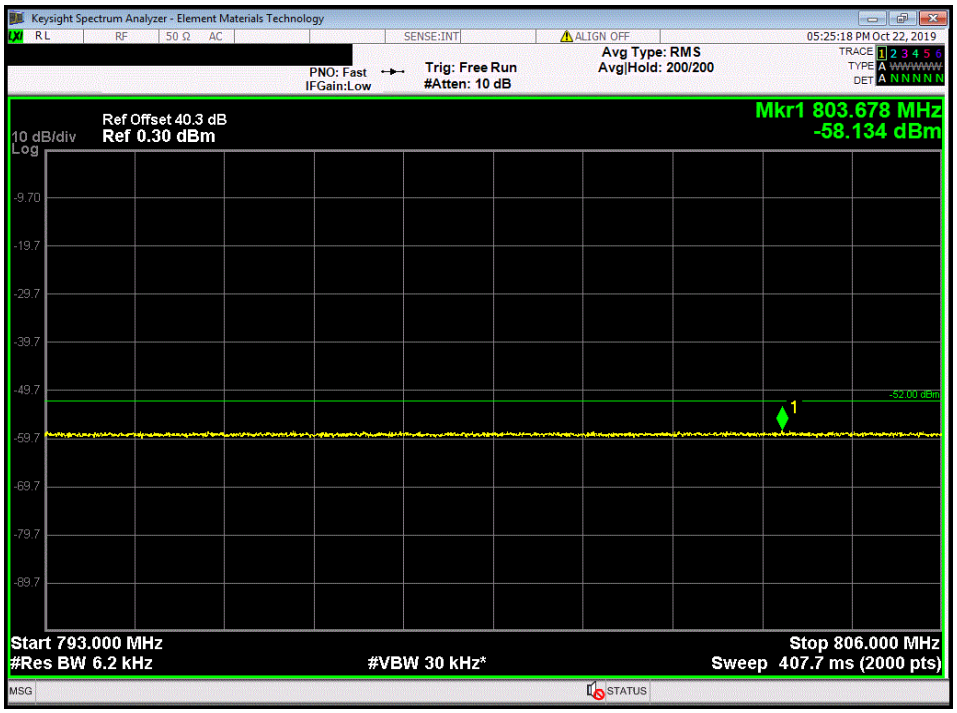
Band 13, 64QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-26.315	-19	Pass



Band 13, 64QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-55.6	-52	Pass

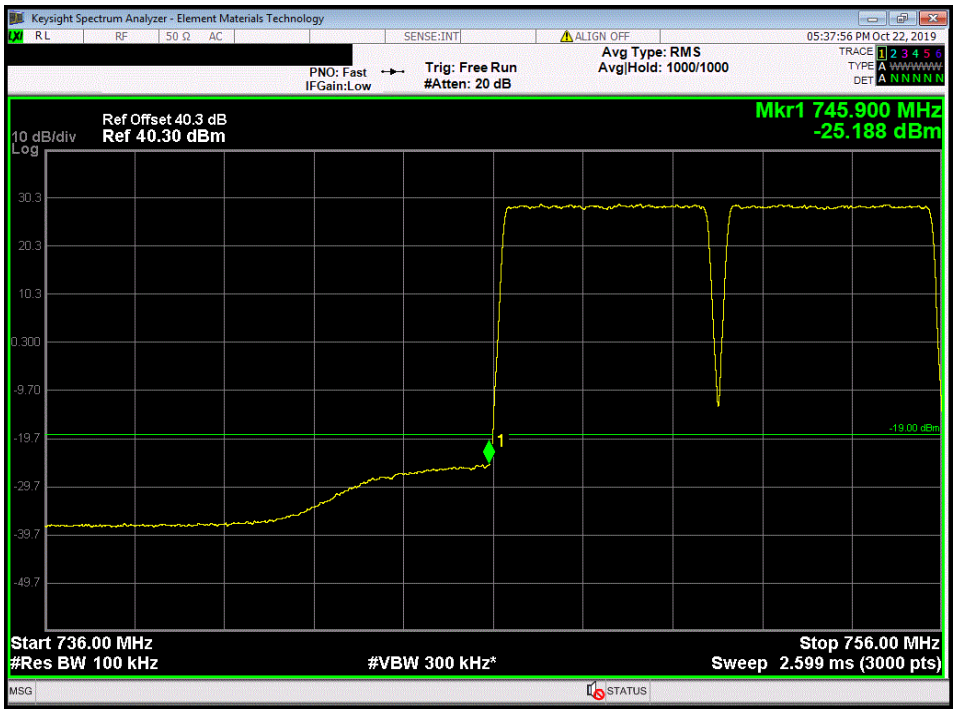


Band 13, 64QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.134	-52	Pass



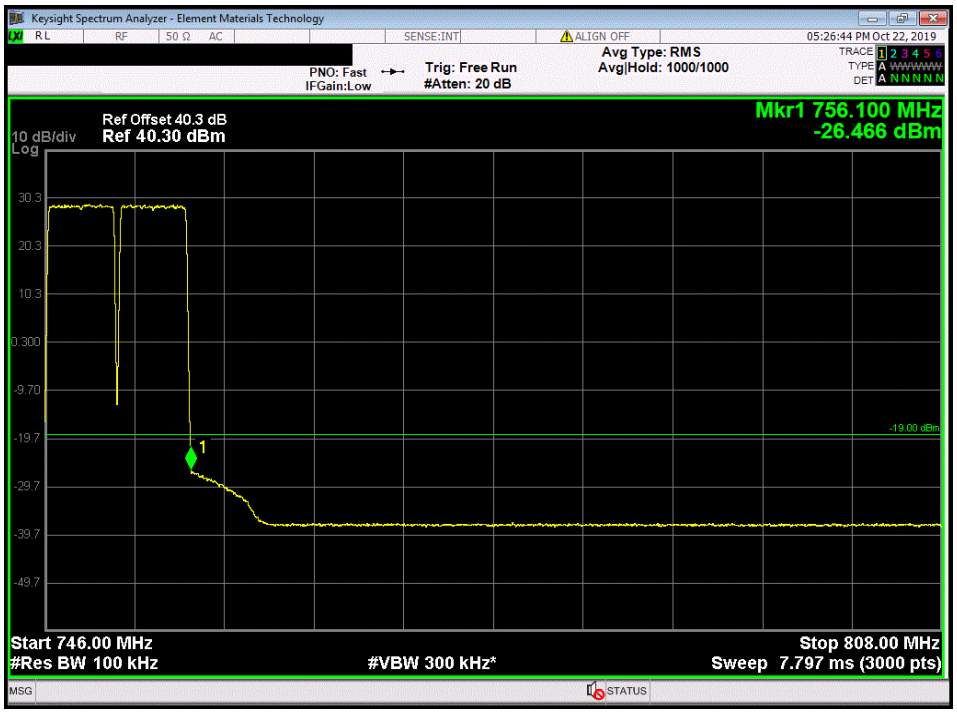
Band 13, 256QAM Modulation, Band 13 Multicarrier, Lower Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-27.124	-19	Pass

Band 13, 256QAM Modulation, Band 13 Multicarrier, Lower Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-25.188	-19	Pass

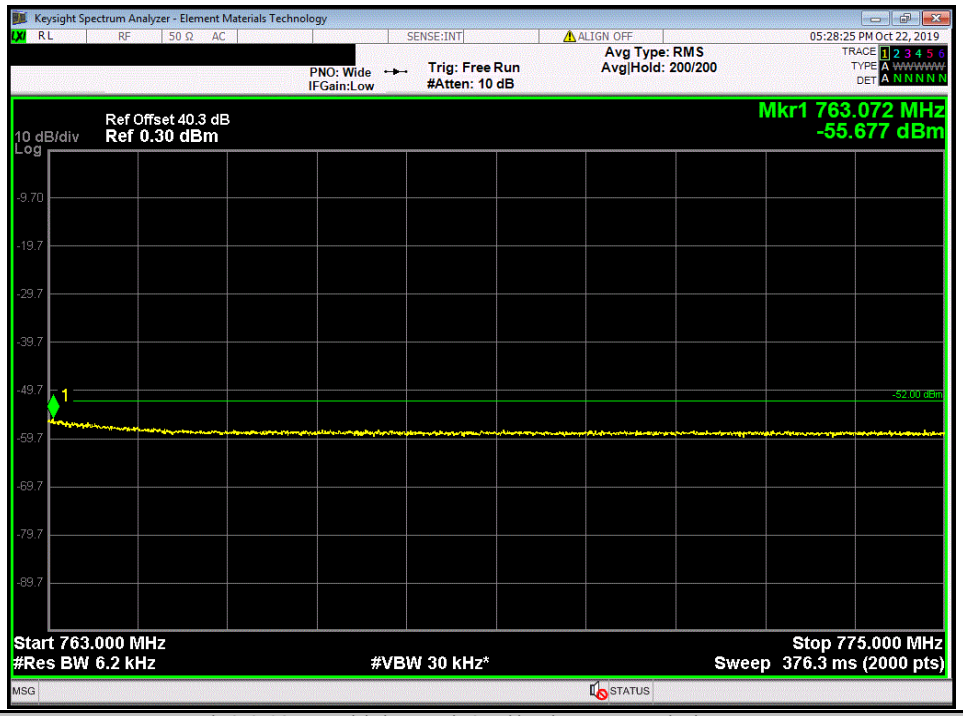


Band 13, 256QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 1						
				Value (dBm)	Limit (dBm)	Result
				-28.693	-19	Pass

Band 13, 256QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 2						
				Value (dBm)	Limit (dBm)	Result
				-26.466	-19	Pass



Band 13, 256QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 3						
				Value (dBm)	Limit (dBm)	Result
				-55.677	-52	Pass



Band 13, 256QAM Modulation, Band 13 Multicarrier, Upper Band Edge, Measurement 4						
				Value (dBm)	Limit (dBm)	Result
				-58.013	-52	Pass