# 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. For Multiband operation, measurements were taken at the lower band edge of the lower band and the upper band edge of the upper band.

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((N)] to account for the device operation as a N port MIMO transmitter, as per FCC KDB 622911.

For Bands 12 and 14, the adjustment factor is -10*log(4) = -6 dB. The Bands 12 and 14 adjusted limit is -19 dBm.
For Band 29, the adjustment factor is -10*log(2) = -3 dB. The Band 29 adjusted limit is -16 dBm.

For Band 14 band edge measurements from 769MHz-775MHz and 799MHz-807MHz, reference level offset corrections were applied to the spectrum analyzer, according to the following table:

| **Frequency (MHz)** | 769 | 769.05 | 769.1 | 769.15 | 769.2 | 769.25 | 769.3 | 769.35 | 769.4 |
|---|---|---|---|---|---|---|---|---|---|
| **Correction Factor (dB)** | 50.1 | 49.2 | 48.4 | 47.8 | 47.3 | 46.9 | 46.5 | 46.2 | 45.9 |

| **Frequency (MHz)** | 769.45 | 769.5 | 769.55 | 769.6 | 769.65 | 769.7 | 769.75 | 769.8 | 769.85 |
|---|---|---|---|---|---|---|---|---|---|
| **Correction Factor (dB)** | 45.7 | 45.4 | 45.2 | 45.1 | 44.9 | 44.7 | 44.6 | 44.5 | 44.4 |

| **Frequency (MHz)** | 769.9 | 769.95 | 770 | 770.5 | 771 | 775 | 776 | 798 | 805 |
|---|---|---|---|---|---|---|---|---|---|
| **Correction Factor (dB)** | 44.3 | 4.2 | 44.1 | 43.3 | 42.9 | 41.9 | 41.8 | 41.1 | 41.1 |

Per section 90.543(e)(3), 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 RRH may operate as a 4 port MIMO transmitter for Band 14.

FCC 90.543(e)(5) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range. FCC 90.543(e)(5) 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.

FCC 90.543(e)(1) requires an emission limit of -46dBm for any 6.25 kHz bandwidth between frequency bands 769-775 MHz and 799-805 MHz. The limit is adjusted to -52 dBm per 6.25kHz bandwidth [-46 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

# BAND EDGE COMPLIANCE

element

XMit 2019.09.05

| | | | | | |
|---|---|---|---|---|---|
| **EUT:** | AHLBBA RRH | | | **Work Order:** | NOKI0004 |
| **Serial Number:** | K9193514835 | | | **Date:** | 18-Nov-19 |
| **Customer:** | Nokia Solutions and Networks | | | **Temperature:** | 22.7 °C |
| **Attendees:** | John Rattanavong | | | **Humidity:** | 29.9% RH |
| **Project:** | None | | | **Barometric Pres.:** | 1019 mbar |
| **Tested by:** | Jonathan Kiefer | **Power:** | 54VDC | **Job Site:** | TX09 |

| TEST SPECIFICATIONS | Test Method |
|---|---|
| FCC 90I:2019 | ANSI C63.26:2015 |

**COMMENTS**

Band 14 band edge measurements. Tested on highest power antenna port (Port 1). EUT is operated at 100% duty cycle.

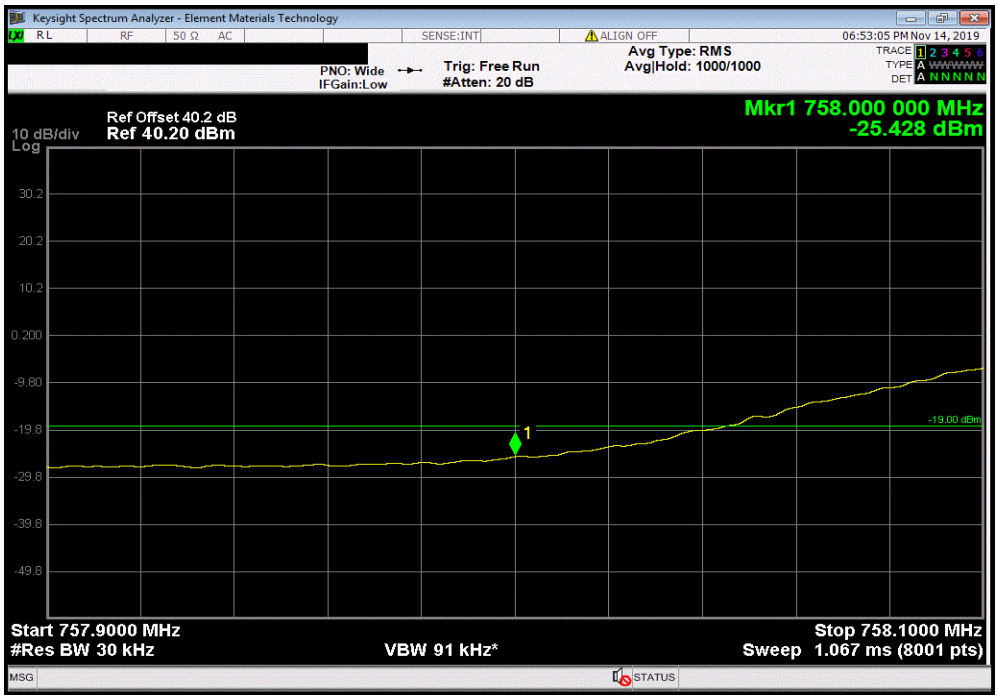
**DEVIATIONS FROM TEST STANDARD**

None

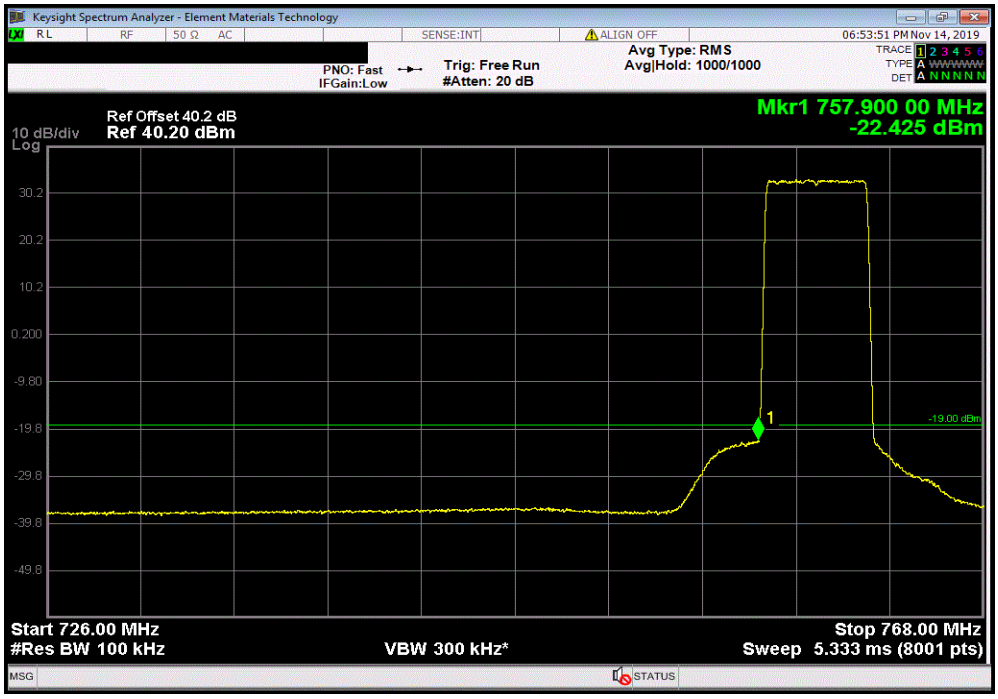
| Configuration # | 2 | Signature | Jonathan Kiefer |
|---|---|---|---|

| | | Value (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| Band 14 | | | | |
| QPSK Modulation | | | | |
| LTE5 Bandwidth | | | | |
| Lower Band Edge | | | | |
| | Measurement 1 | -25.428 | -19 | Pass |
| | Measurement 2 | -22.425 | -19 | Pass |
| Upper Band Edge | | | | |
| | Measurement 1 | -26.856 | -19 | Pass |
| | Measurement 2 | -24.203 | -19 | Pass |
| | Measurement 3 | -57.283 | -52 | Pass |
| | Measurement 4 | -70.007 | -52 | Pass |
| LTE10 Bandwidth | | | | |
| Lower Band Edge | | | | |
| | Measurement 1 | -28.885 | -19 | Pass |
| | Measurement 2 | -24.426 | -19 | Pass |
| Upper Band Edge | | | | |
| | Measurement 1 | -31.837 | -19 | Pass |
| | Measurement 2 | -28.675 | -19 | Pass |
| | Measurement 3 | -58.54 | -52 | Pass |
| | Measurement 4 | -70.076 | -52 | Pass |
| 16QAM Modulation | | | | |
| LTE5 Bandwidth | | | | |
| Lower Band Edge | | | | |
| | Measurement 1 | -25.814 | -19 | Pass |
| | Measurement 2 | -22.237 | -19 | Pass |
| Upper Band Edge | | | | |
| | Measurement 1 | -27.051 | -19 | Pass |
| | Measurement 2 | -24.248 | -19 | Pass |
| | Measurement 3 | -57.633 | -52 | Pass |
| | Measurement 4 | -69.982 | -52 | Pass |
| LTE10 Bandwidth | | | | |
| Lower Band Edge | | | | |
| | Measurement 1 | -29.253 | -19 | Pass |
| | Measurement 2 | -24.445 | -19 | Pass |
| Upper Band Edge | | | | |
| | Measurement 1 | -31.677 | -19 | Pass |
| | Measurement 2 | -28.939 | -19 | Pass |
| | Measurement 3 | -58.833 | -52 | Pass |
| | Measurement 4 | -69.859 | -52 | Pass |
| 64QAM Modulation | | | | |
| LTE5 Bandwidth | | | | |
| Lower Band Edge | | | | |
| | Measurement 1 | -25.731 | -19 | Pass |
| | Measurement 2 | -22.099 | -19 | Pass |
| Upper Band Edge | | | | |
| | Measurement 1 | -26.857 | -19 | Pass |
| | Measurement 2 | -24.189 | -19 | Pass |
| | Measurement 3 | -57.899 | -52 | Pass |
| | Measurement 4 | -69.938 | -52 | Pass |
| LTE10 Bandwidth | | | | |
| Lower Band Edge | | | | |
| | Measurement 1 | -28.445 | -19 | Pass |
| | Measurement 2 | -24.599 | -19 | Pass |
| Upper Band Edge | | | | |
| | Measurement 1 | -32.115 | -19 | Pass |
| | Measurement 2 | -28.687 | -19 | Pass |
| | Measurement 3 | -58.844 | -52 | Pass |
| | Measurement 4 | -70.094 | -52 | Pass |
| 256QAM Modulation | | | | |
| LTE5 Bandwidth | | | | |
| Lower Band Edge | | | | |
| | Measurement 1 | -25.481 | -19 | Pass |
| | Measurement 2 | -22.219 | -19 | Pass |
| Upper Band Edge | | | | |
| | Measurement 1 | -26.722 | -19 | Pass |
| | Measurement 2 | -24.171 | -19 | Pass |
| | Measurement 3 | -56.88 | -52 | Pass |
| | Measurement 4 | -70.042 | -52 | Pass |
| LTE10 Bandwidth | | | | |
| Lower Band Edge | | | | |
| | Measurement 1 | -28.228 | -19 | Pass |
| | Measurement 2 | -24.938 | -19 | Pass |
| Upper Band Edge | | | | |
| | Measurement 1 | -32.435 | -19 | Pass |
| | Measurement 2 | -28.645 | -19 | Pass |
| | Measurement 3 | -58.913 | -52 | Pass |
| | Measurement 4 | -69.947 | -52 | Pass |

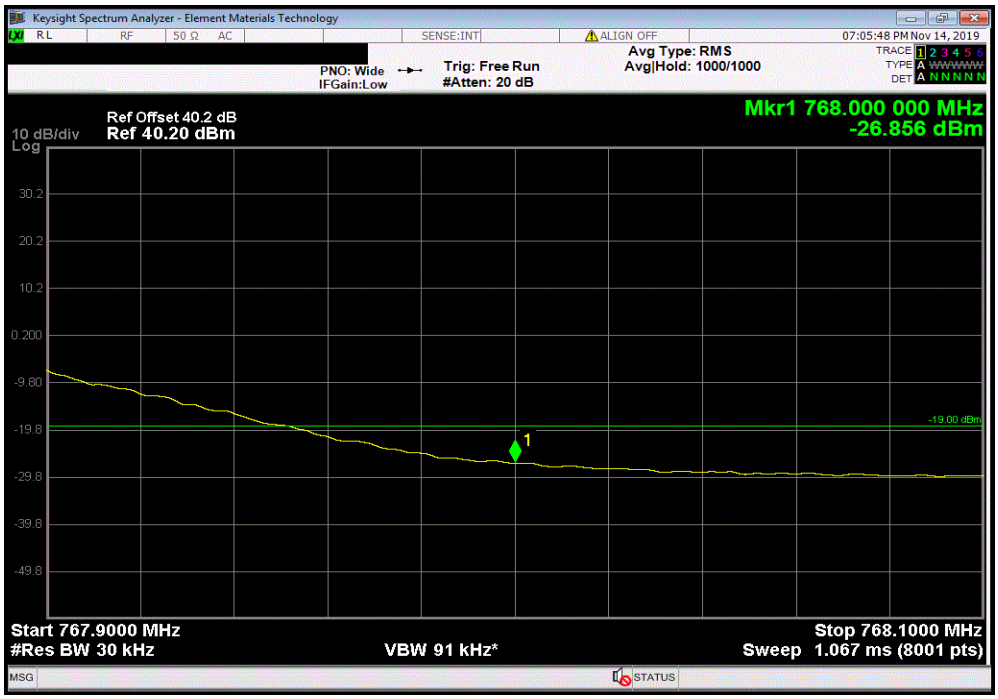
| Band 14, QPSK Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -25.428 | -19 | Pass |



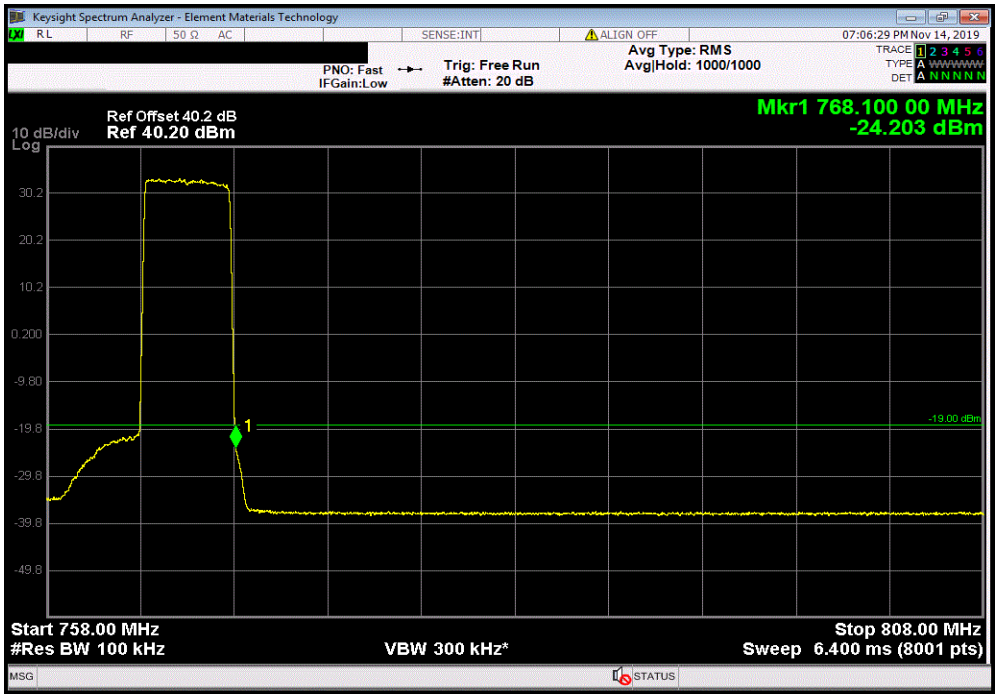

| Band 14, QPSK Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -22.425 | -19 | Pass |



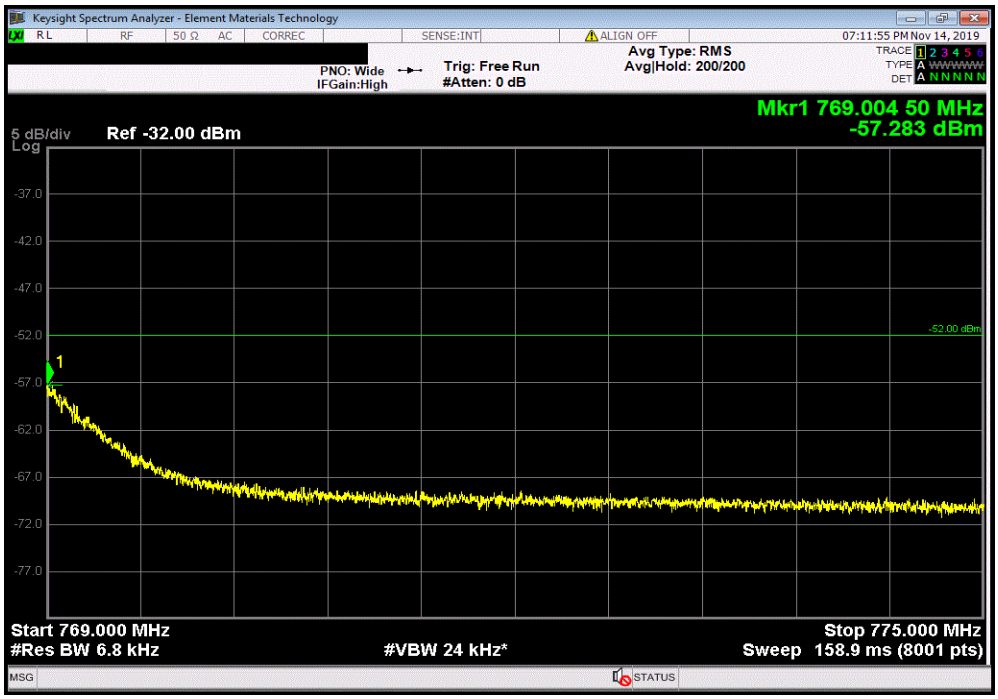
| Band 14, QPSK Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -26.856 | -19 | Pass |



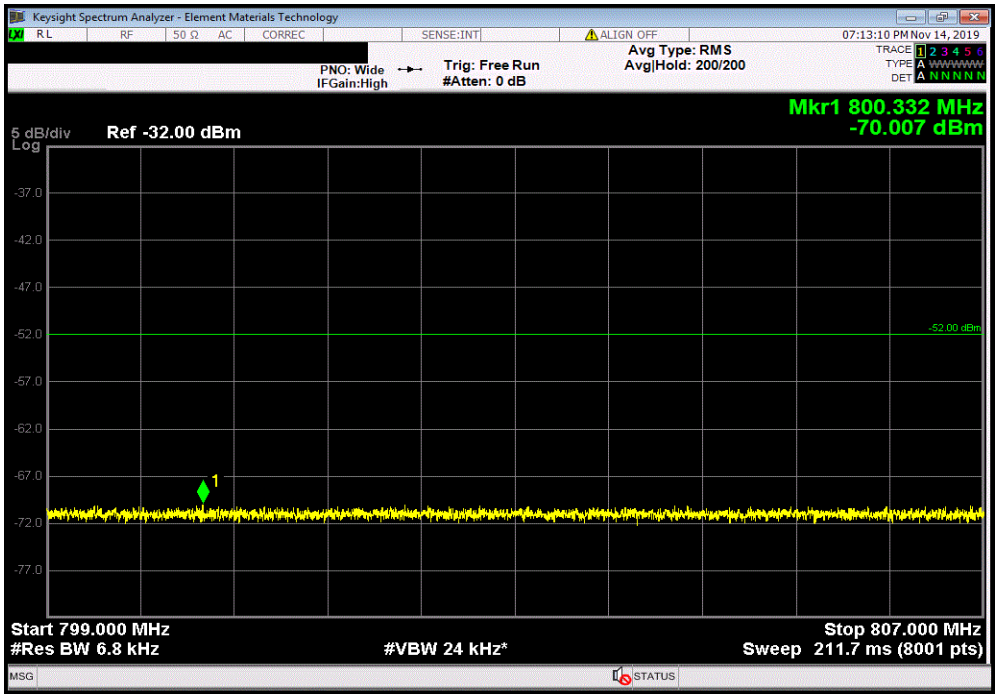

| Band 14, QPSK Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -24.203 | -19 | Pass |



| Band 14, QPSK Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 3 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -57.283 | -52 | Pass |



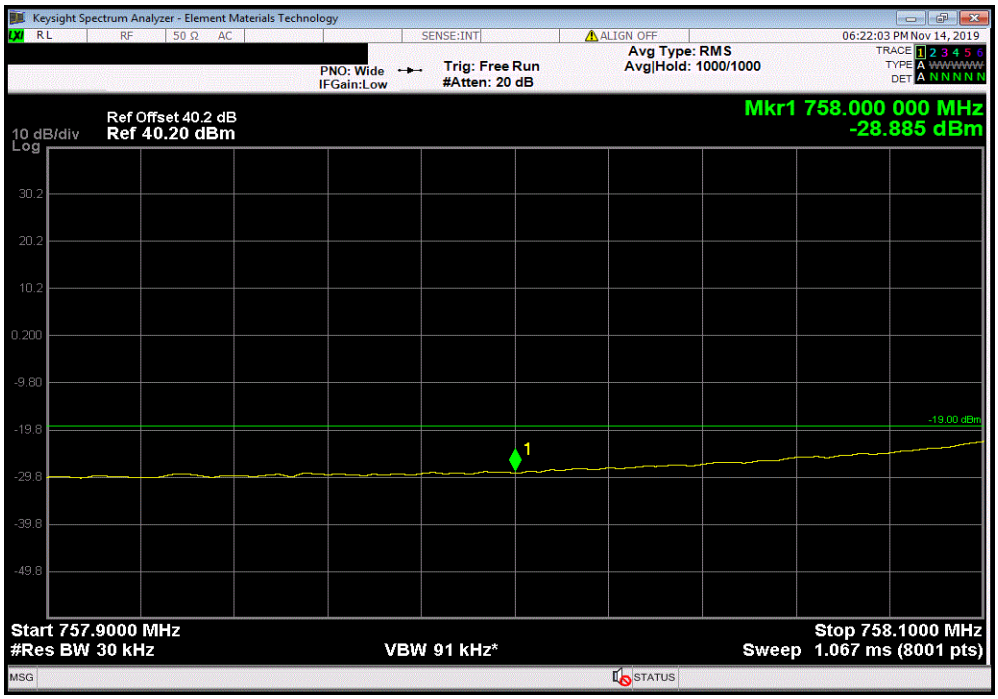

| Band 14, QPSK Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 4 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -70.007 | -52 | Pass |



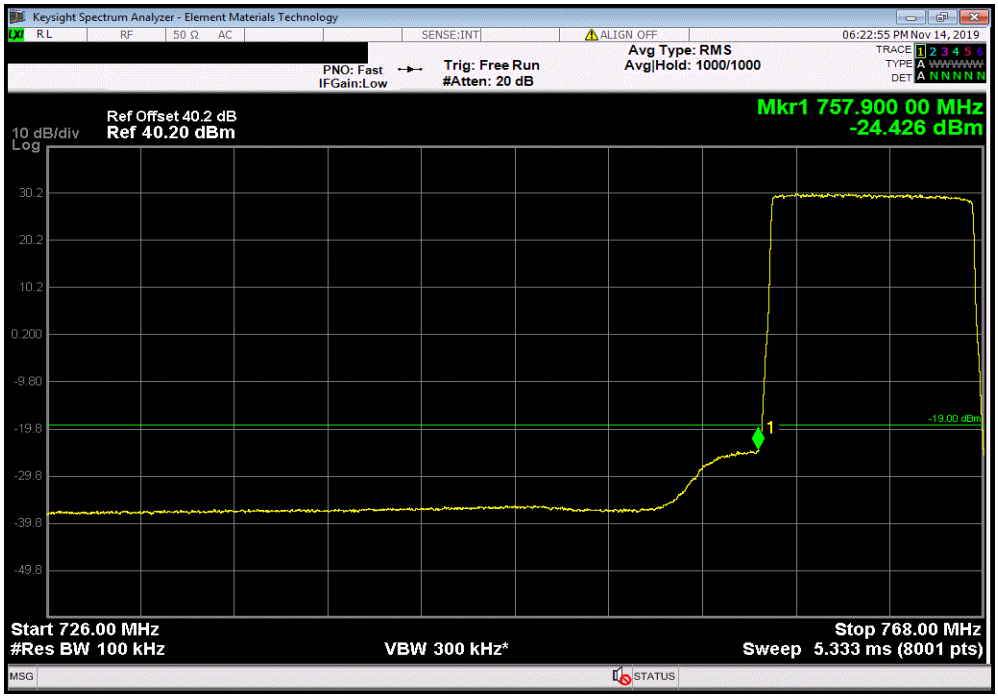
# BAND EDGE COMPLIANCE

XMit 2019.09.05

| Band 14, QPSK Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -28.885 | -19 | Pass |



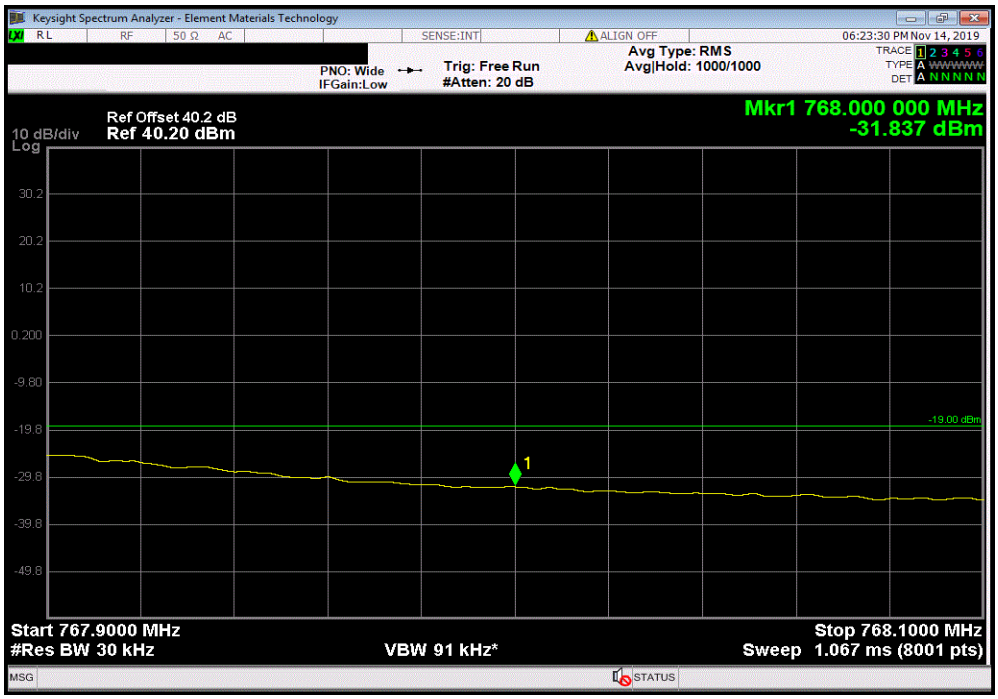

| Band 14, QPSK Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -24.426 | -19 | Pass |



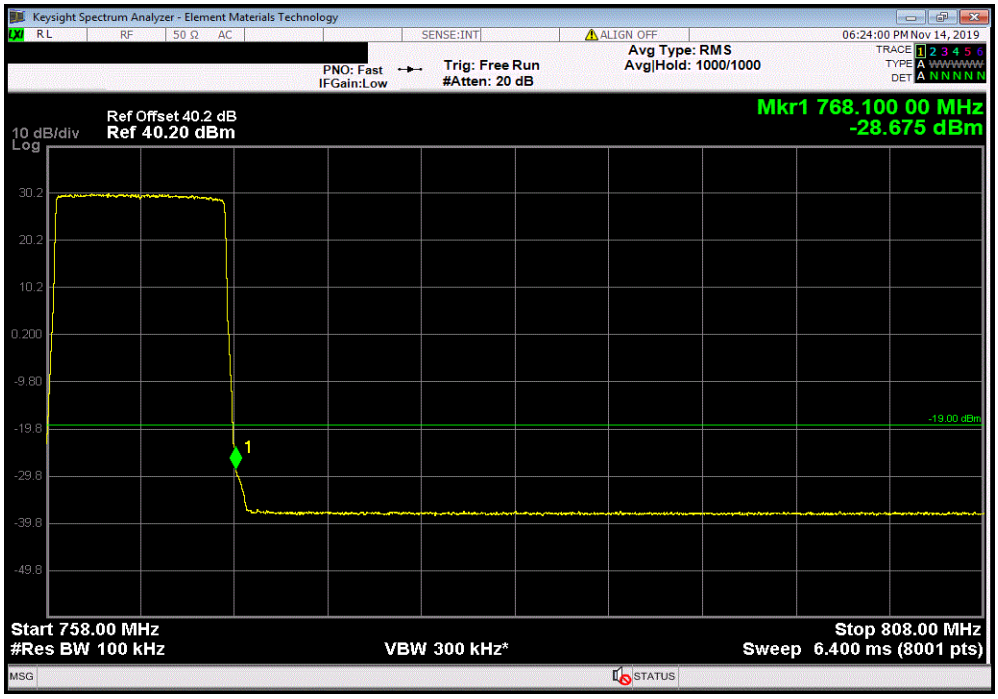
# BAND EDGE COMPLIANCE

XMit 2019.09.05

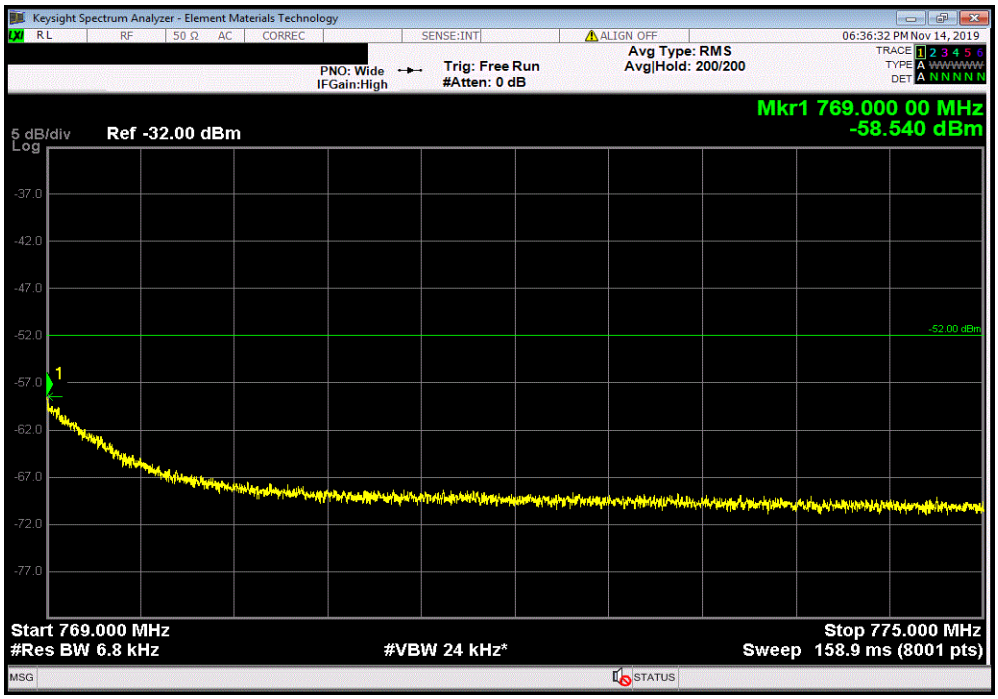
| Band 14, QPSK Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -31.837 | -19 | Pass |



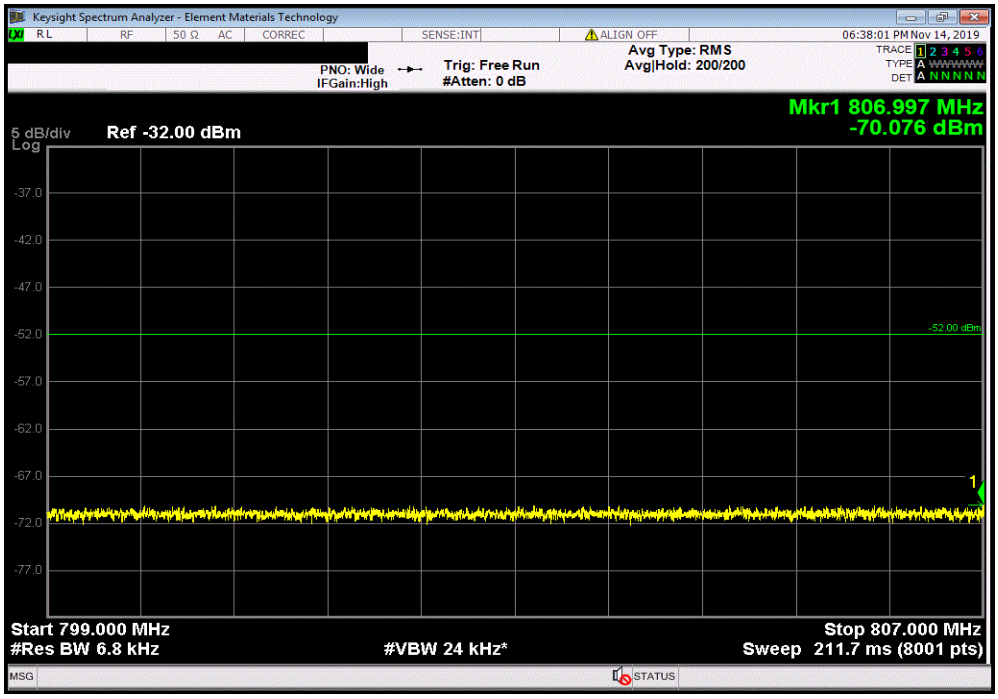

| Band 14, QPSK Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -28.675 | -19 | Pass |



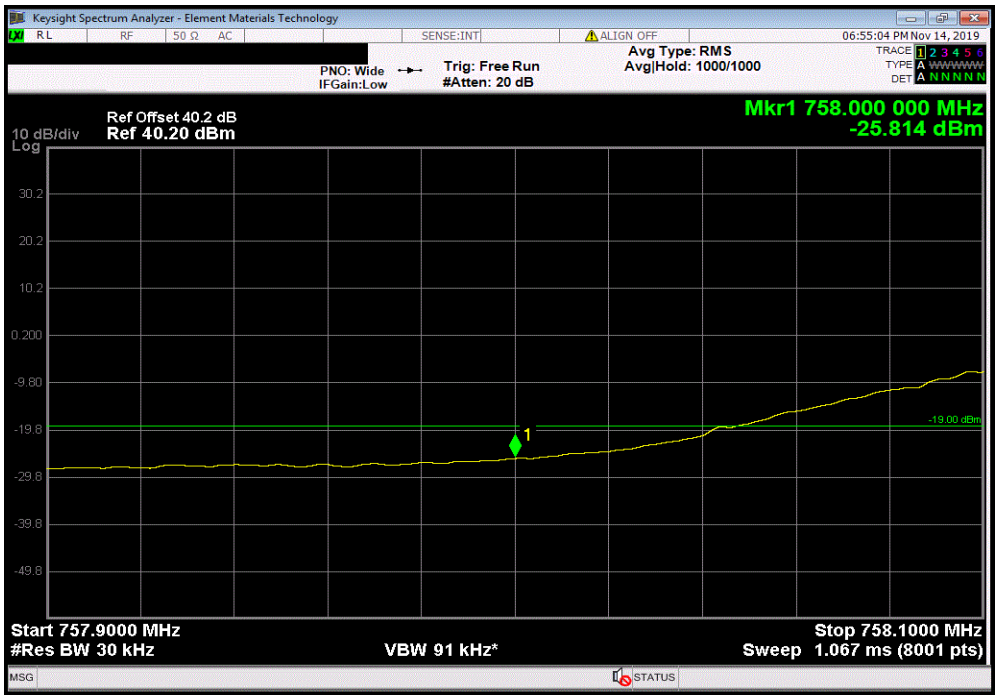
| Band 14, QPSK Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 3 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -58.54 | -52 | Pass |



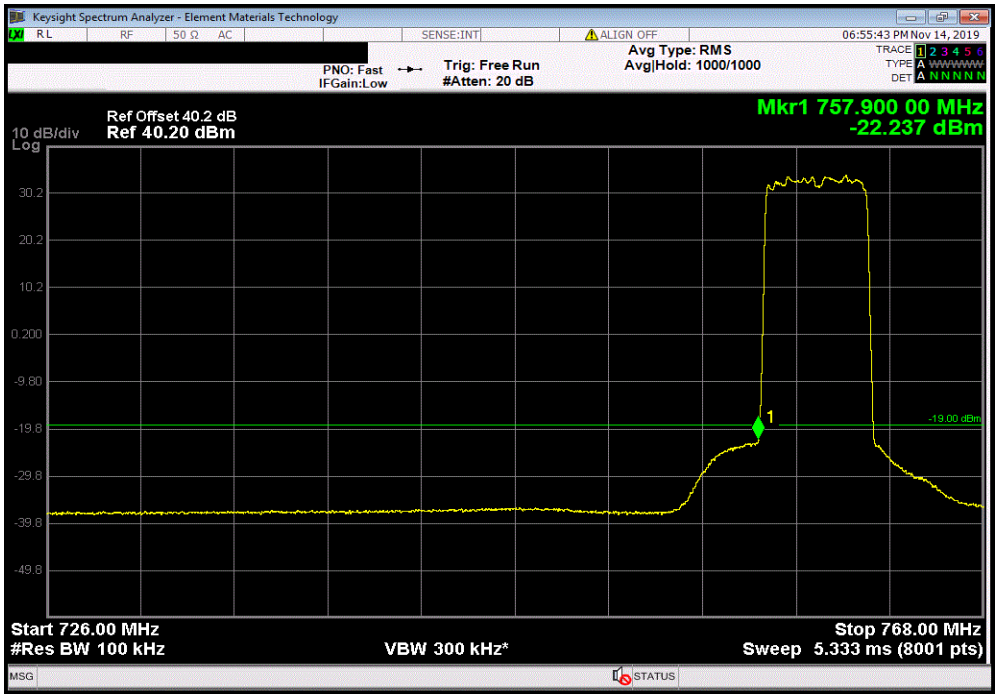

| Band 14, QPSK Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 4 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -70.076 | -52 | Pass |



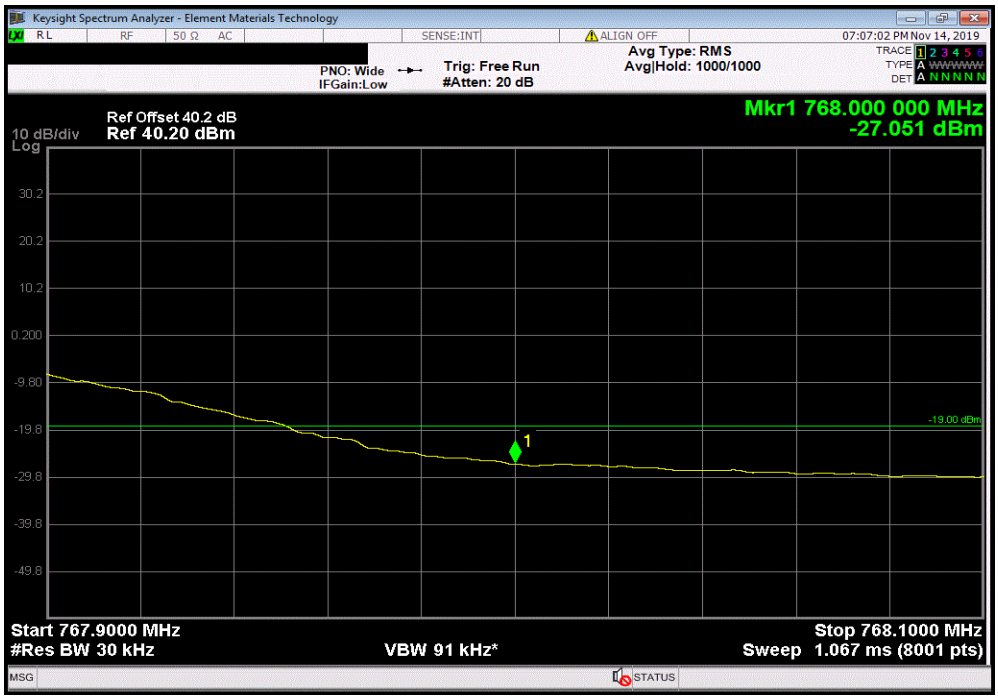
| Band 14, 16QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -25.814 | -19 | Pass |



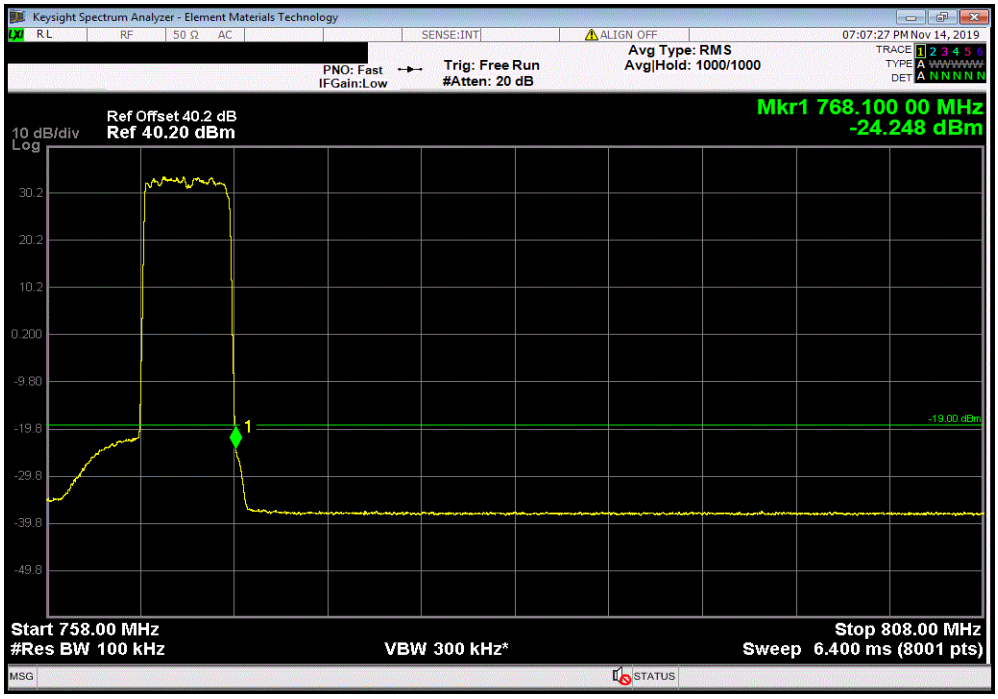

| Band 14, 16QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -22.237 | -19 | Pass |



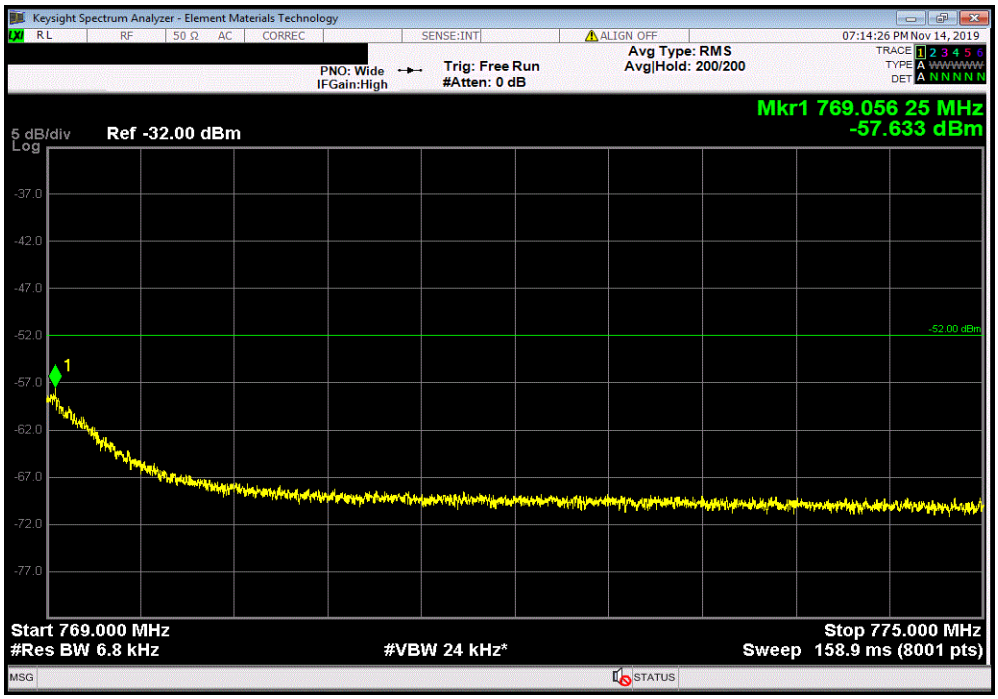
| Band 14, 16QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -27.051 | -19 | Pass |



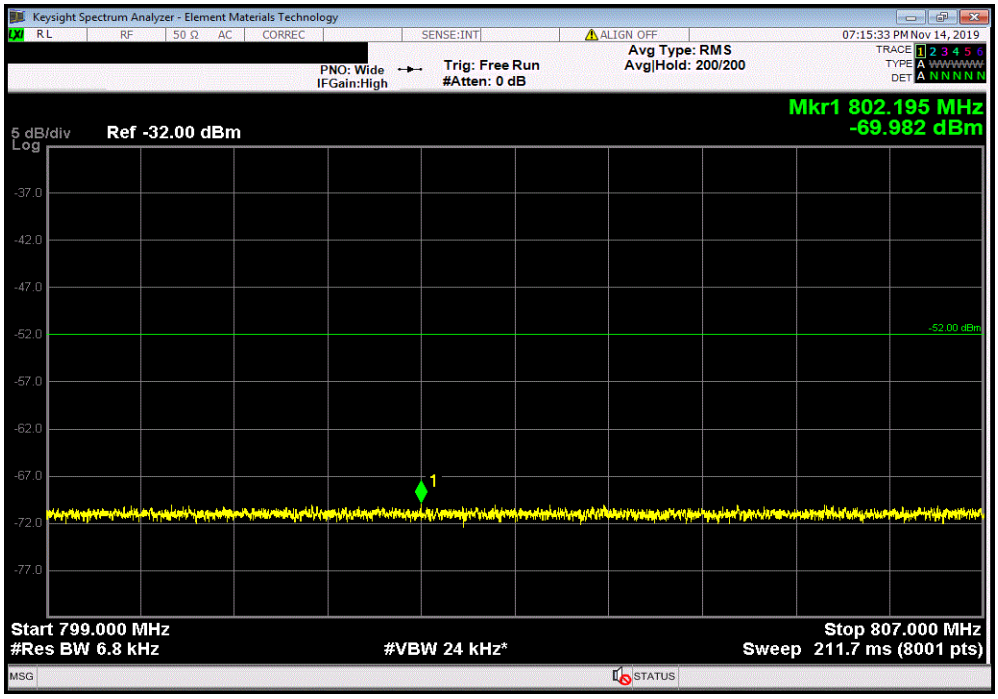

| Band 14, 16QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -24.248 | -19 | Pass |



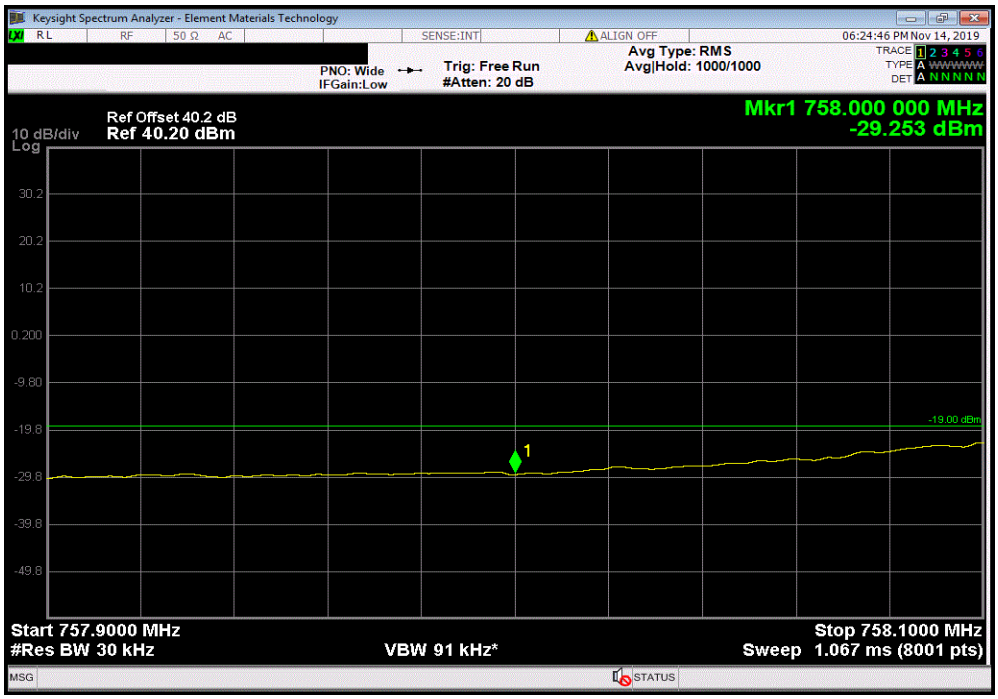
| Band 14, 16QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 3 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -57.633 | -52 | Pass |



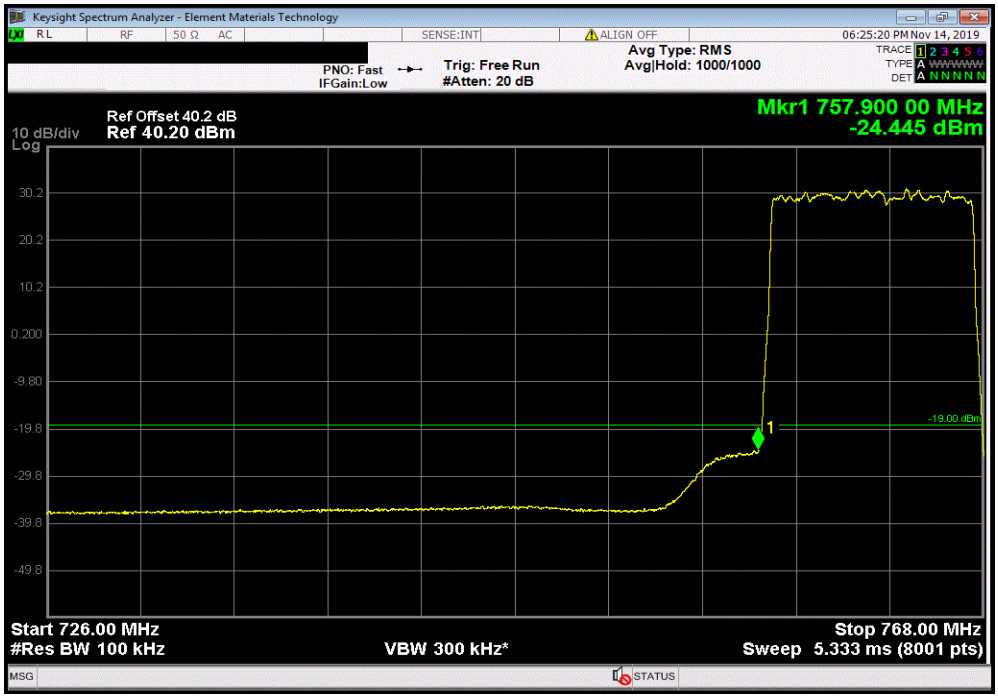

| Band 14, 16QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 4 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -69.982 | -52 | Pass |



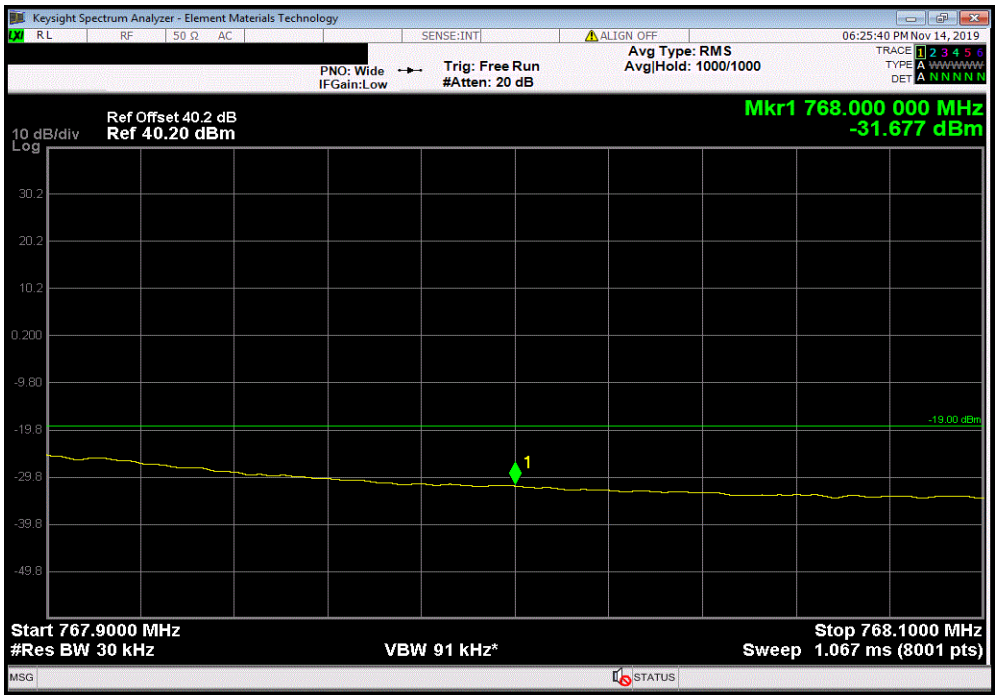
| Band 14, 16QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -29.253 | -19 | Pass |



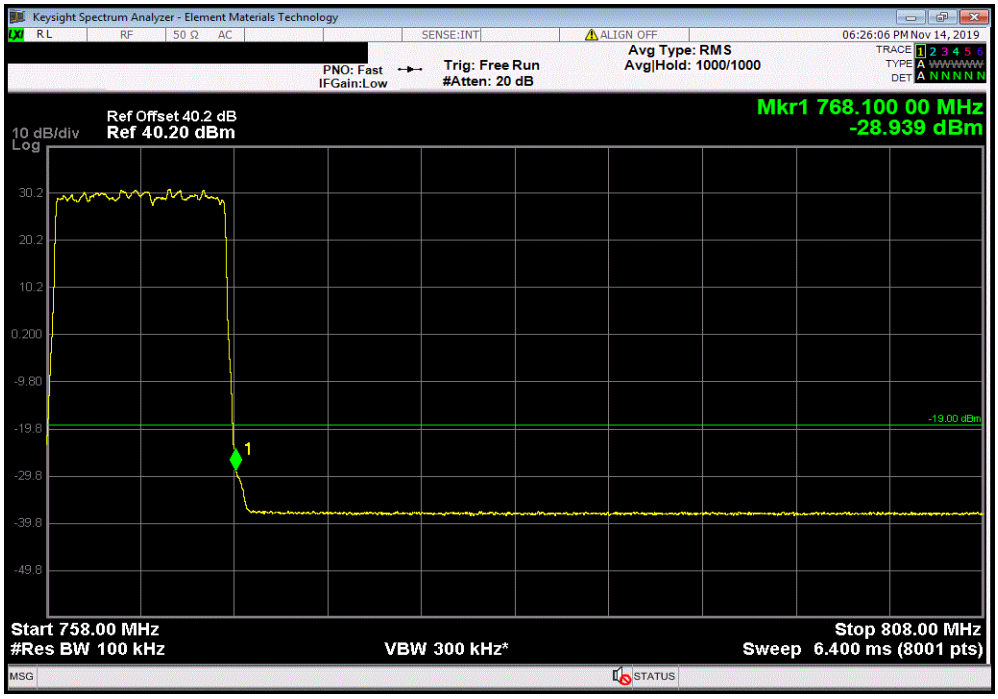

| Band 14, 16QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -24.445 | -19 | Pass |



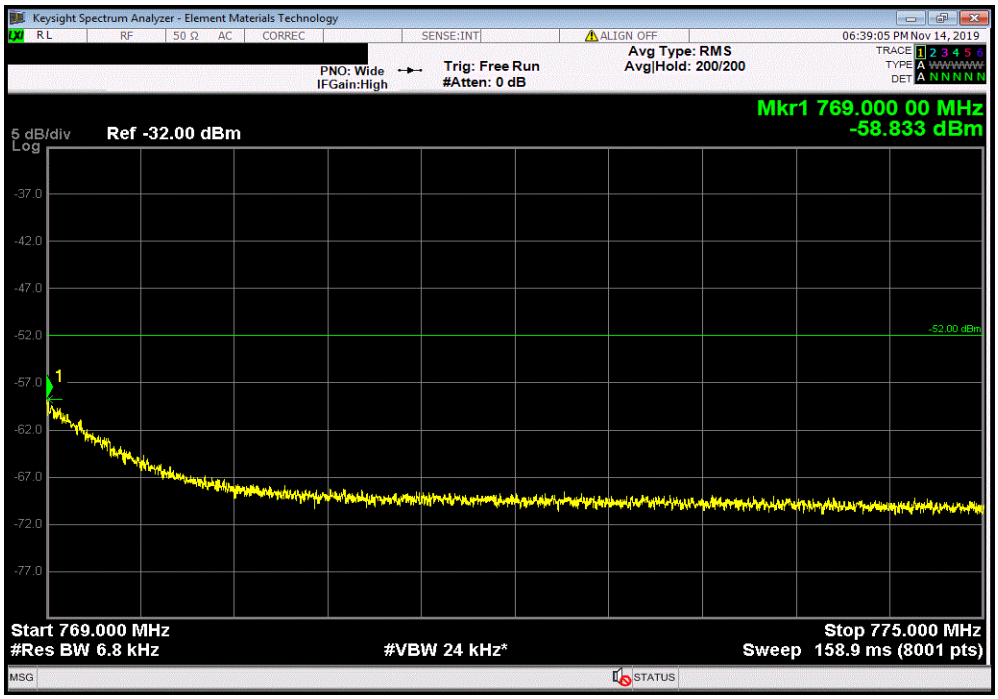
| Band 14, 16QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -31.677 | -19 | Pass |



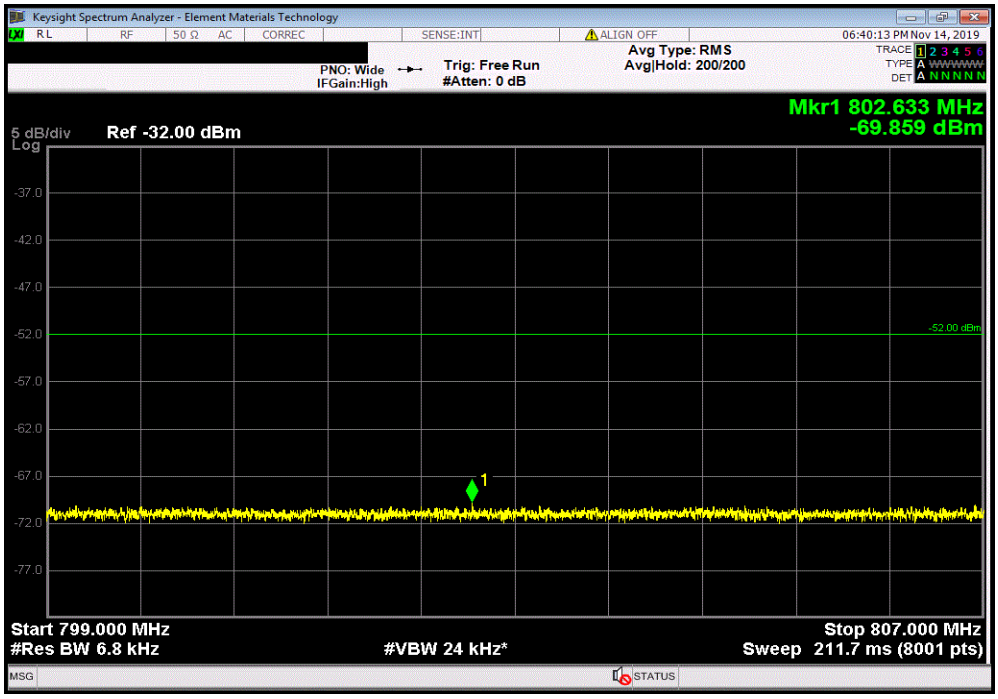

| Band 14, 16QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -28.939 | -19 | Pass |



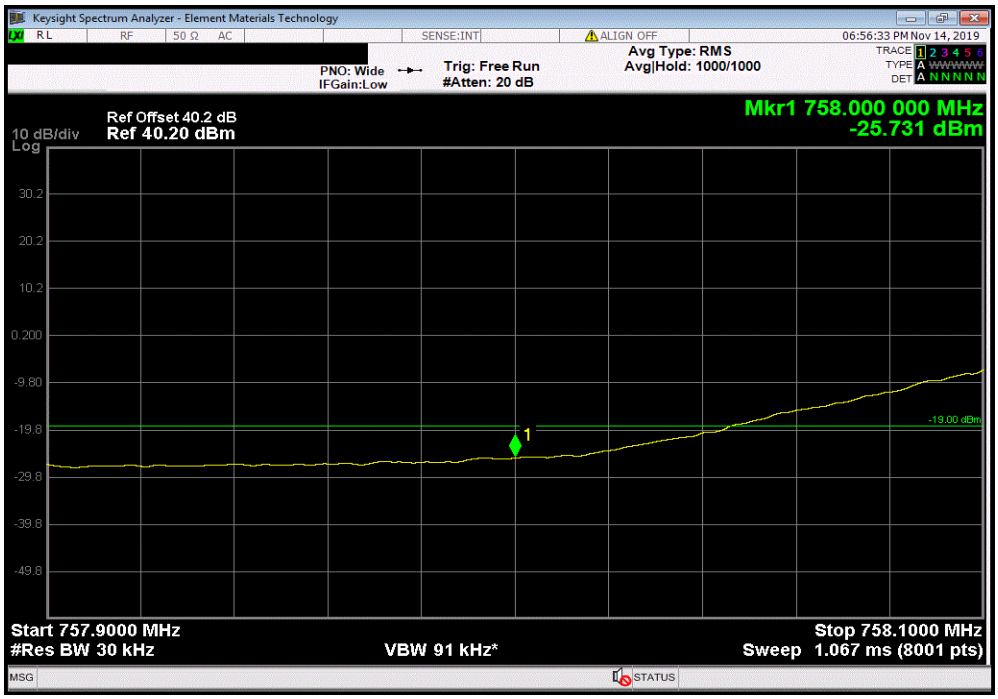
| Band 14, 16QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 3 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -58.833 | -52 | Pass |



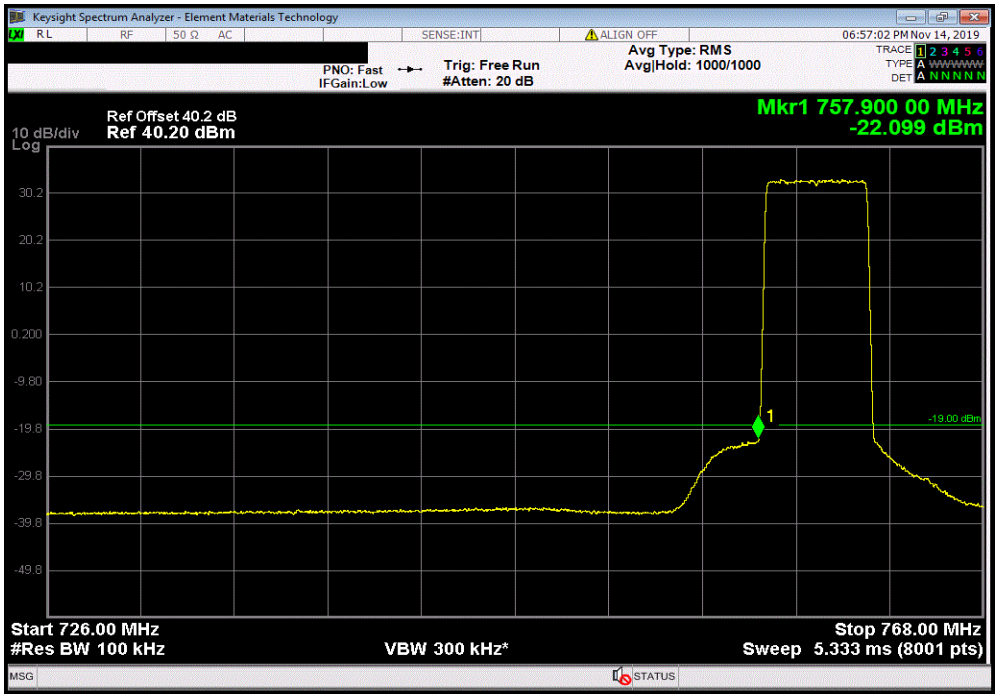

| Band 14, 16QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 4 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -69.859 | -52 | Pass |



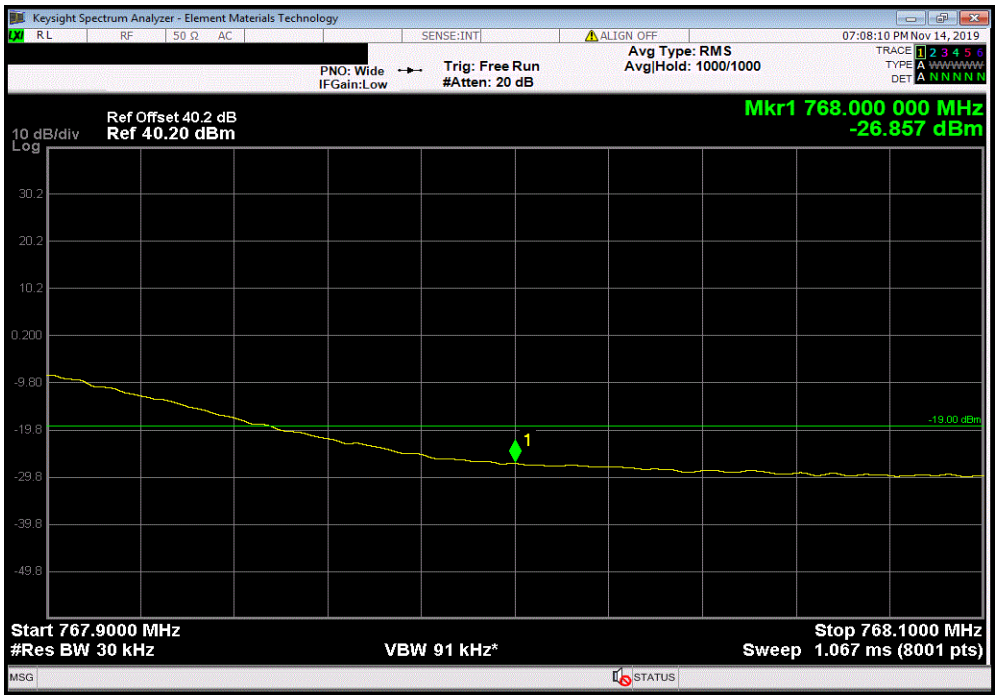
| Band 14, 64QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -25.731 | -19 | Pass |



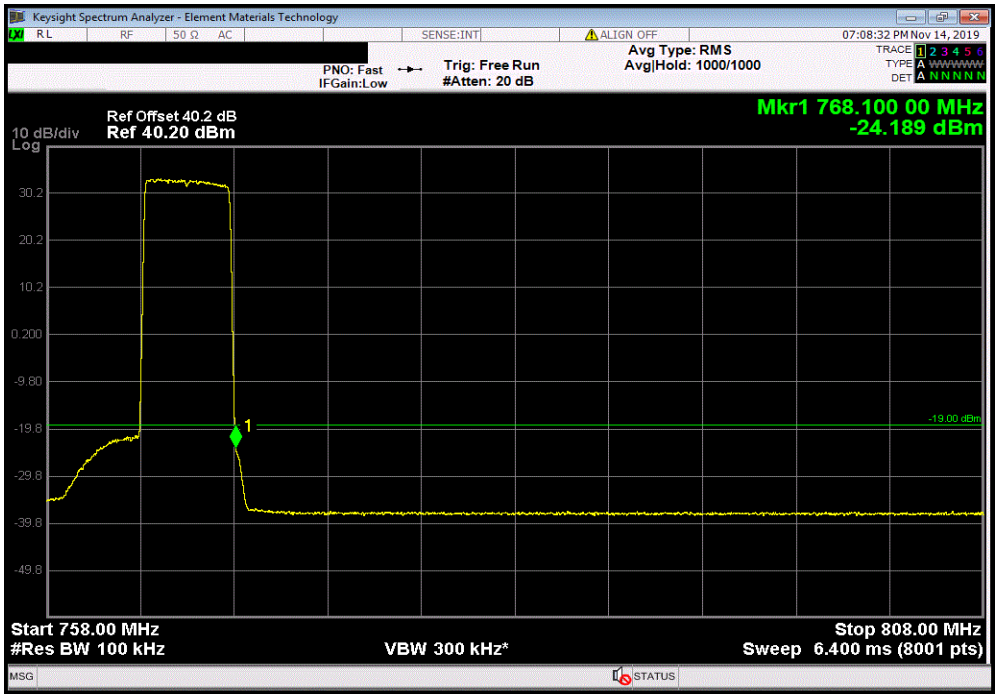

| Band 14, 64QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -22.099 | -19 | Pass |



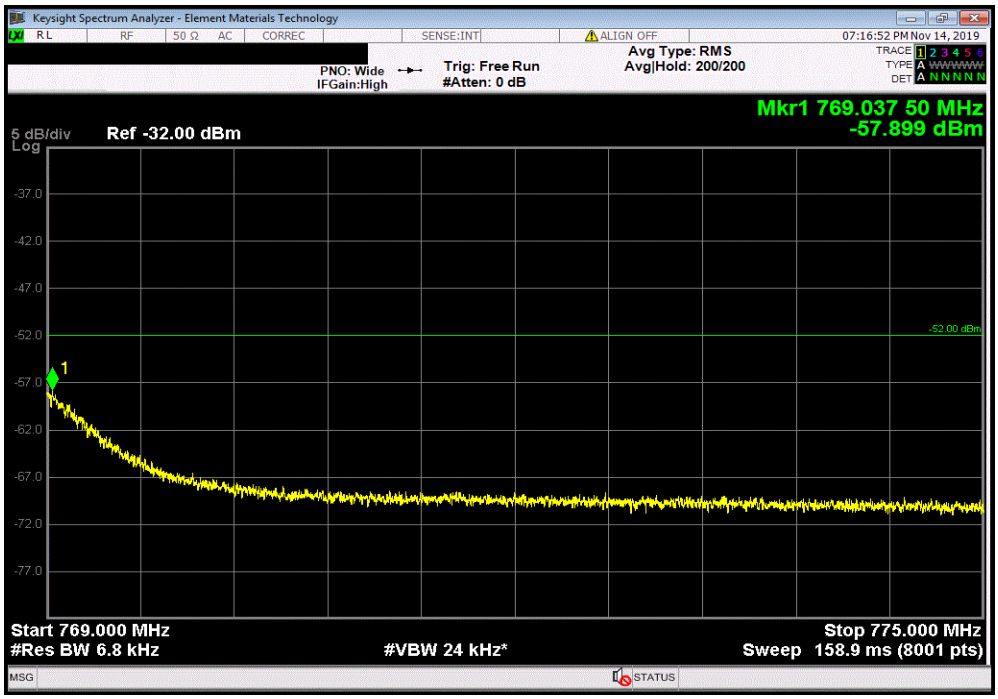
| Band 14, 64QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -26.857 | -19 | Pass |



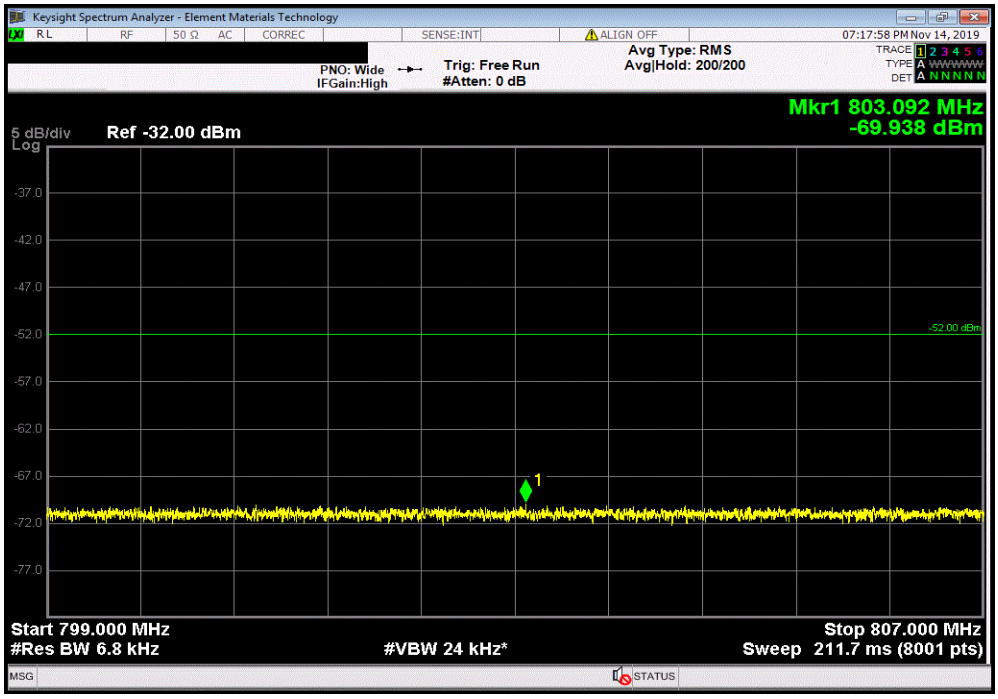

| Band 14, 64QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -24.189 | -19 | Pass |



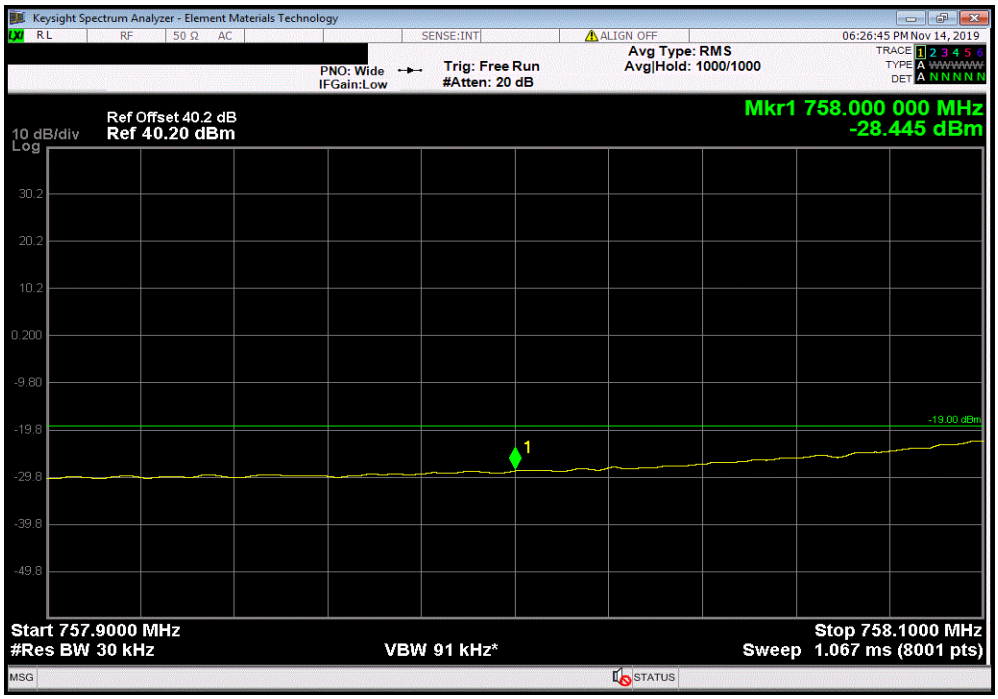
| Band 14, 64QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 3 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -57.899 | -52 | Pass |



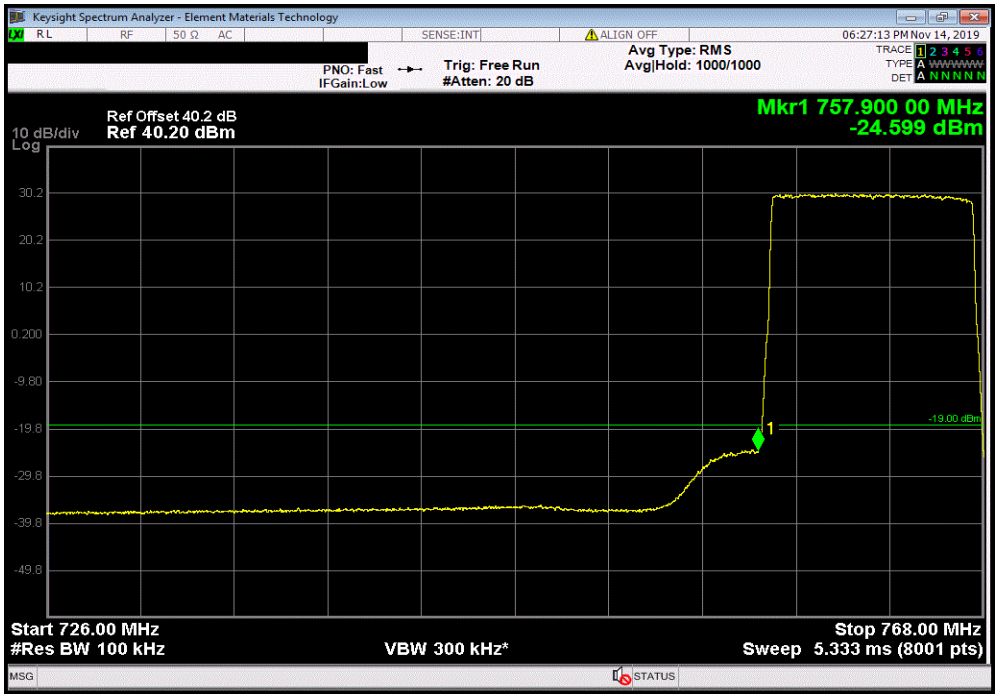

| Band 14, 64QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 4 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -69.938 | -52 | Pass |



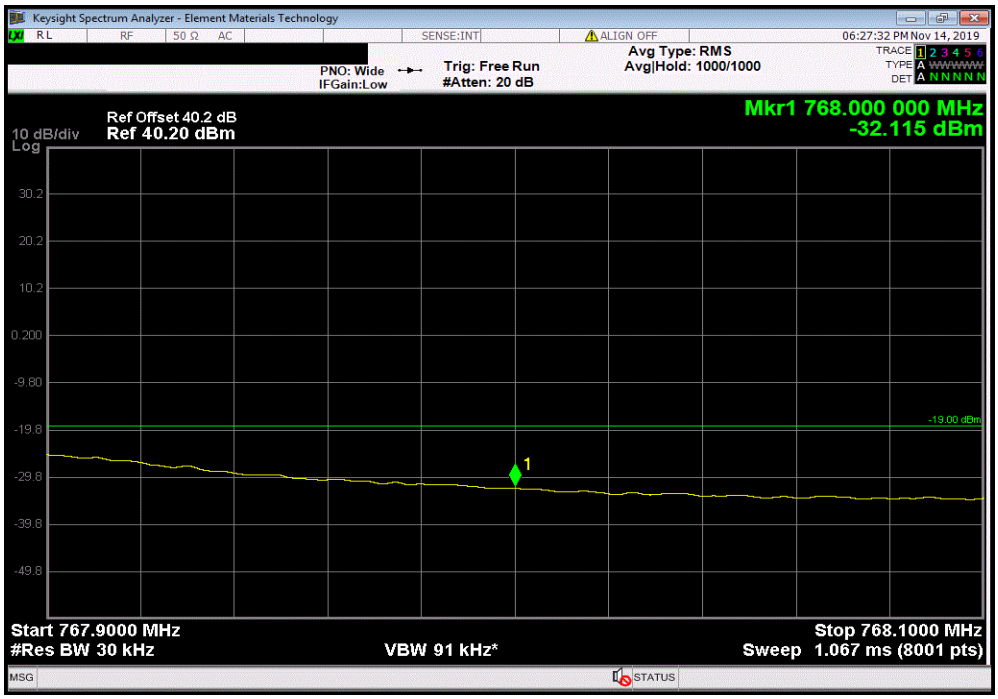
| Band 14, 64QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -28.445 | -19 | Pass |



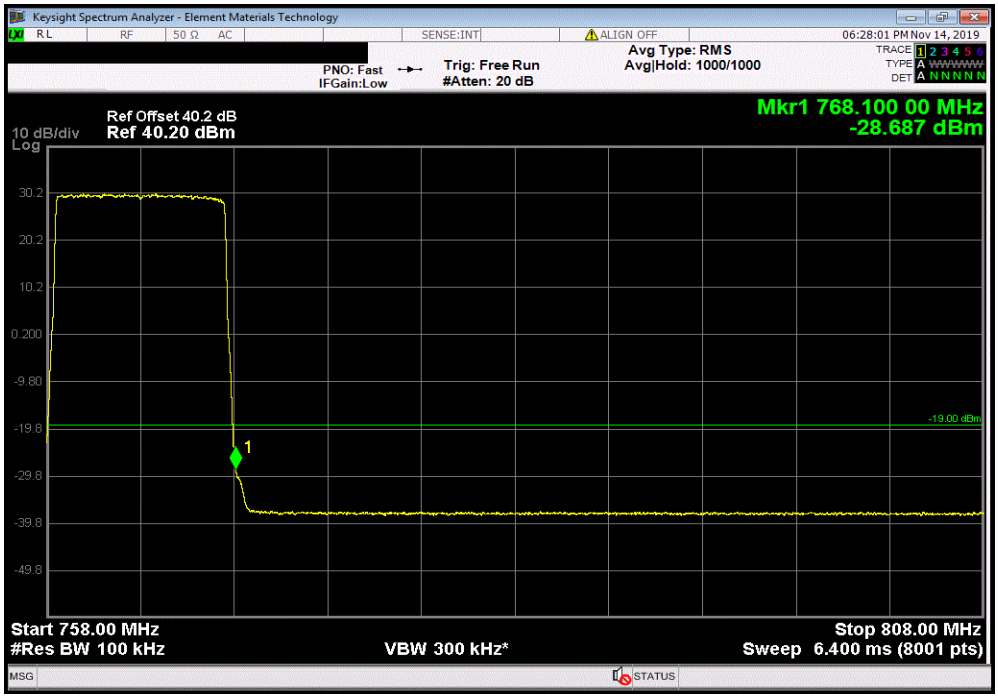

| Band 14, 64QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -24.599 | -19 | Pass |



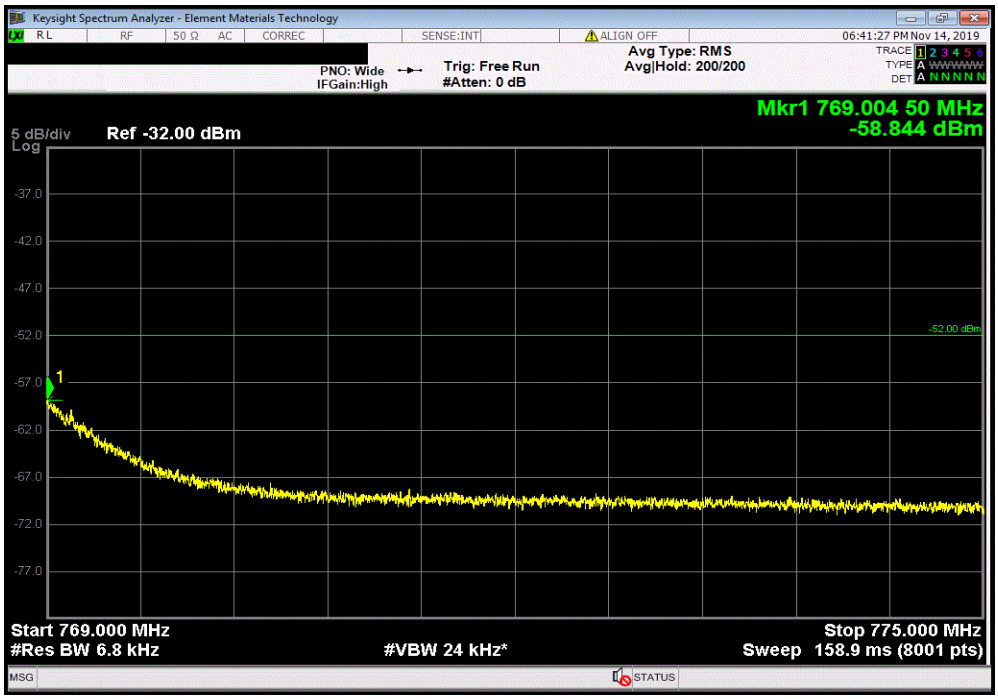
| Band 14, 64QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -32.115 | -19 | Pass |



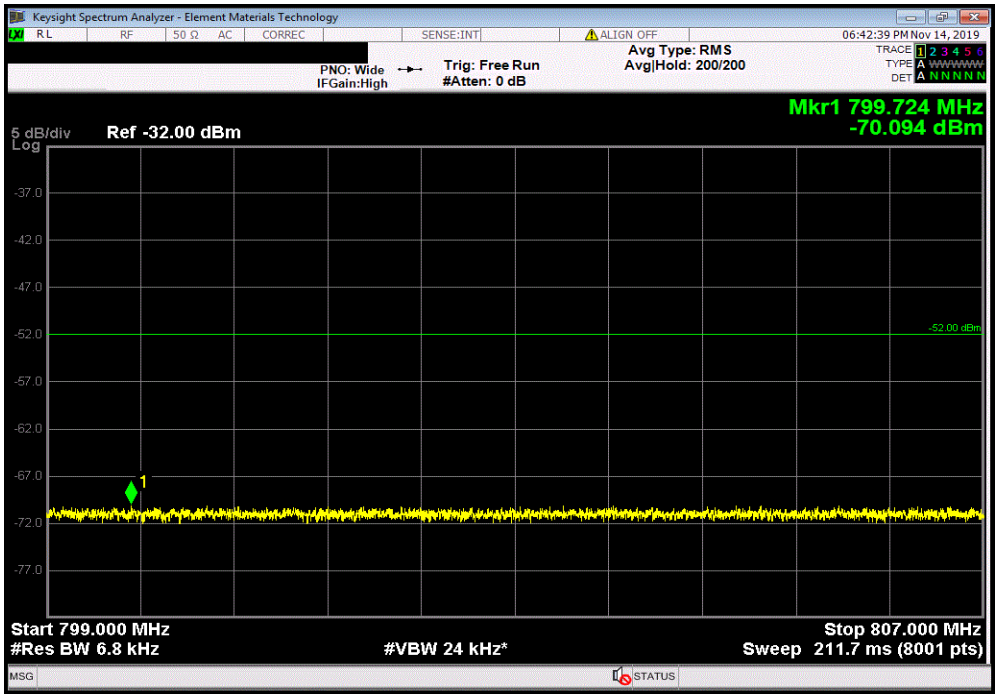

| Band 14, 64QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -28.687 | -19 | Pass |



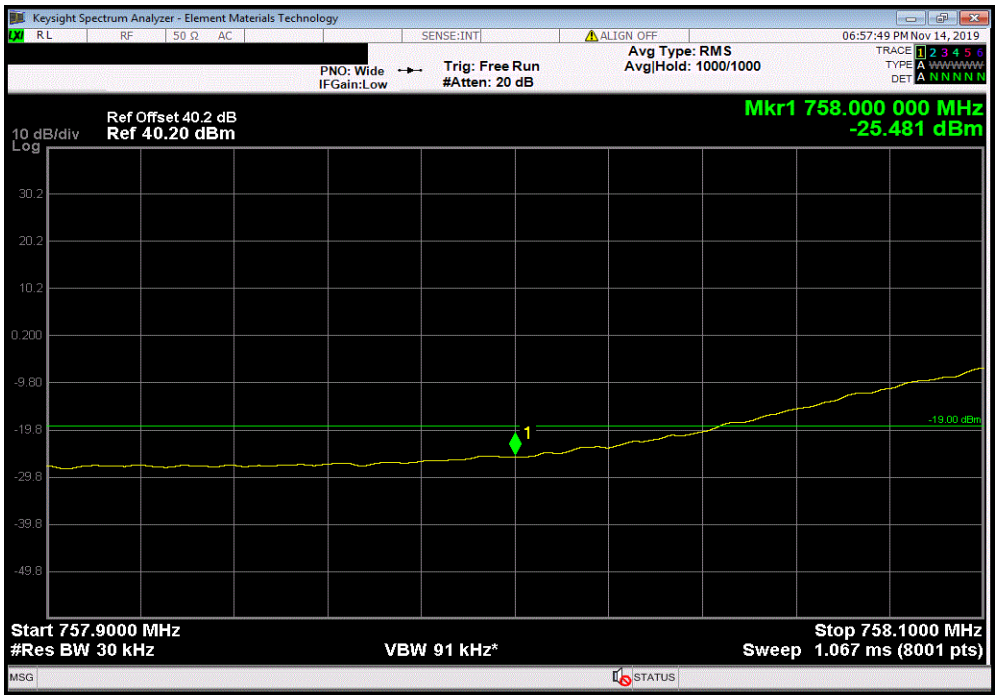
| Band 14, 64QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 3 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -58.844 | -52 | Pass |



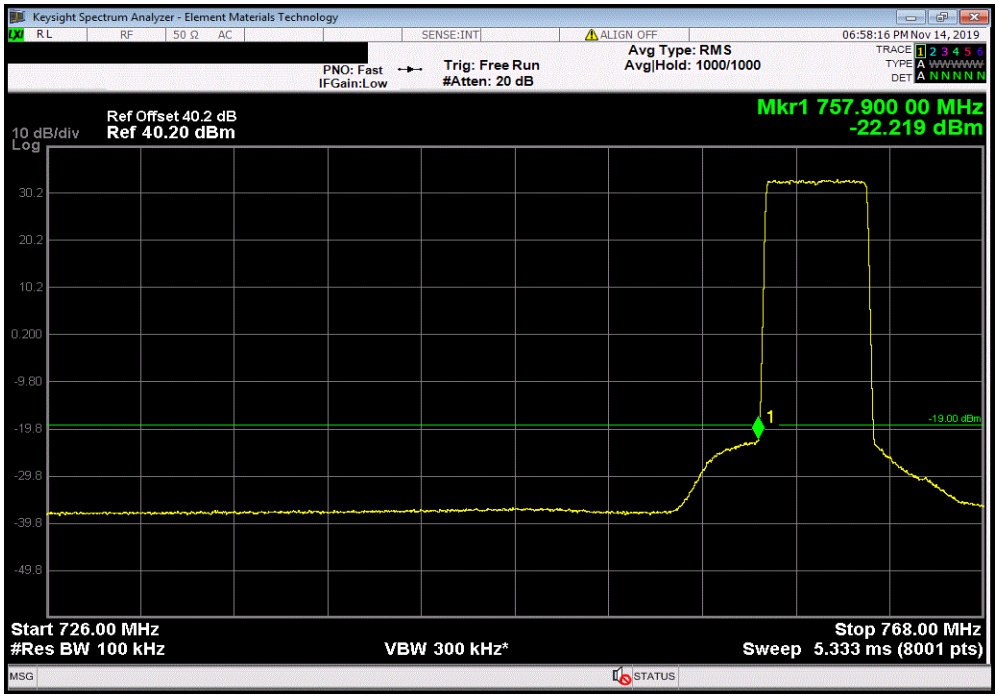

| Band 14, 64QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 4 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -70.094 | -52 | Pass |



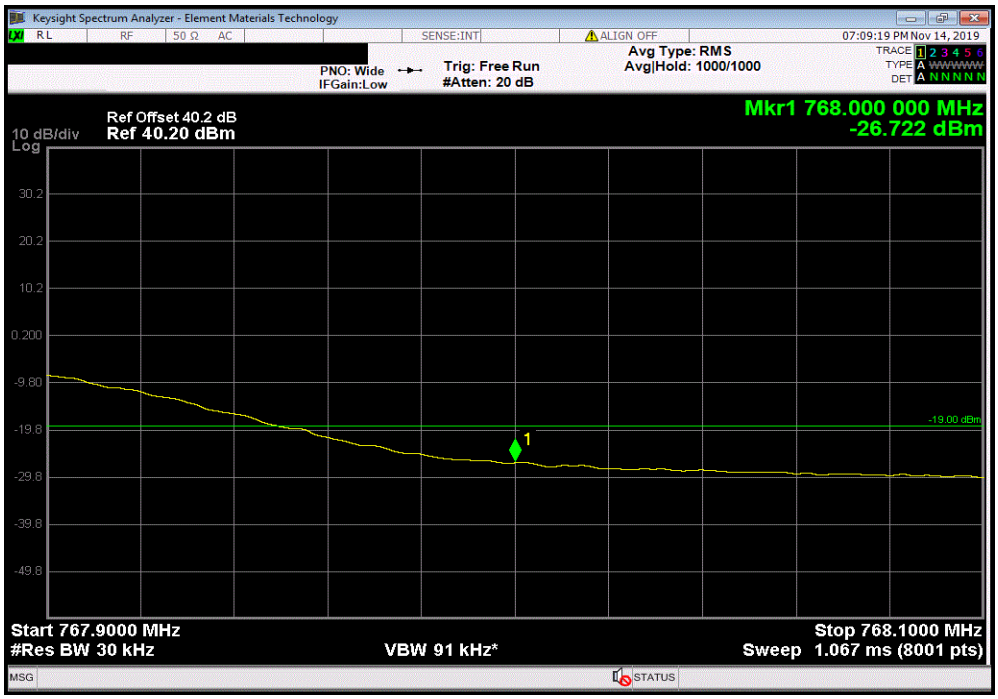
| Band 14, 256QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -25.481 | -19 | Pass |



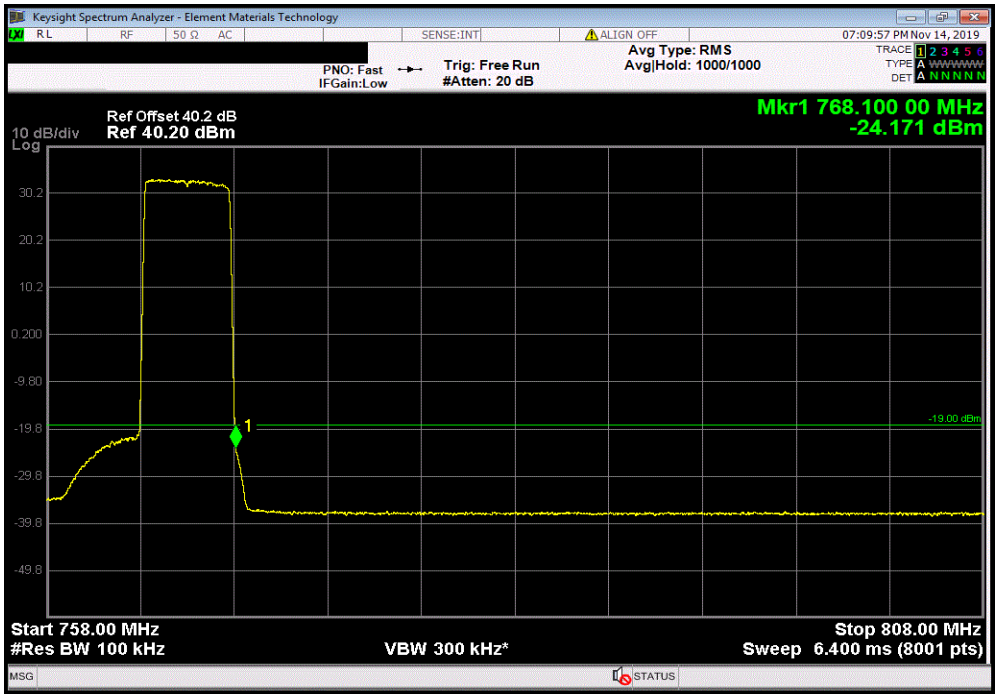

| Band 14, 256QAM Modulation, LTE5 Bandwidth, Lower Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -22.219 | -19 | Pass |



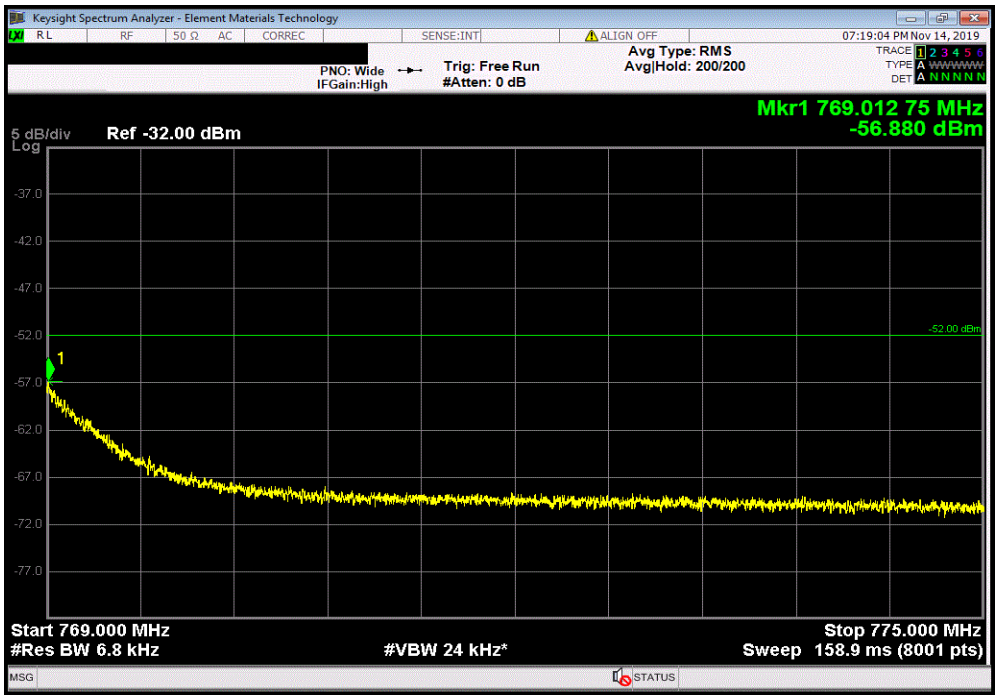
| Band 14, 256QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -26.722 | -19 | Pass |



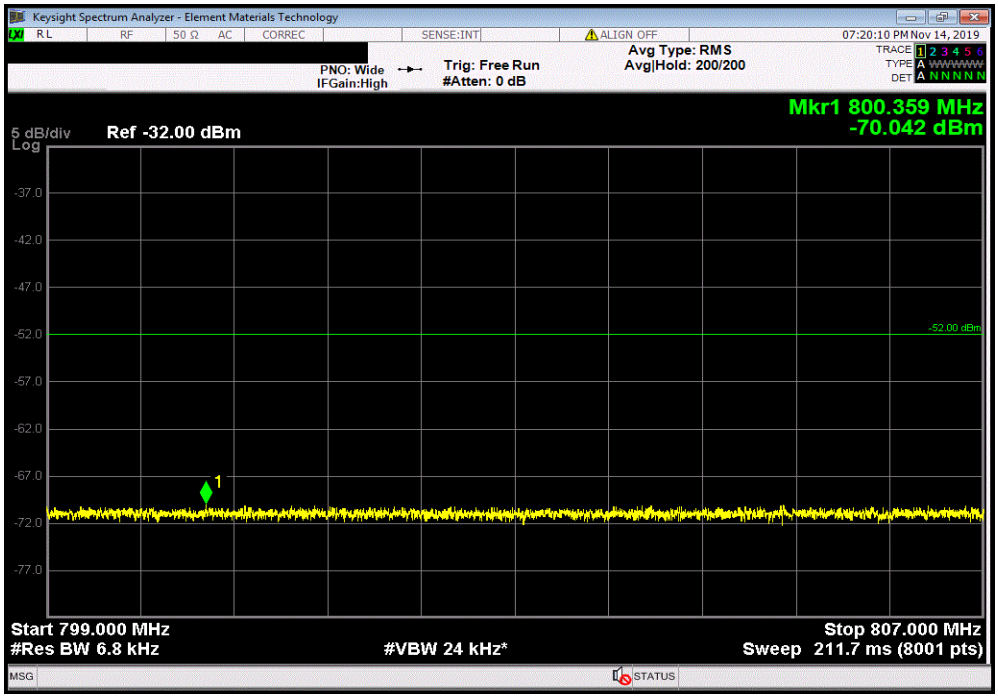

| Band 14, 256QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -24.171 | -19 | Pass |



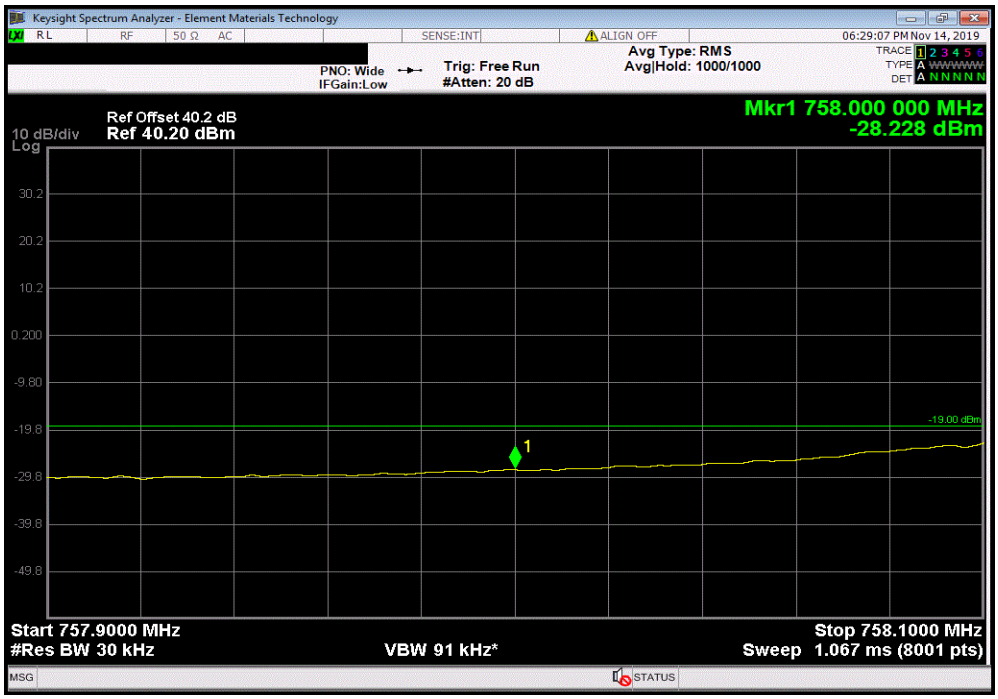
| Band 14, 256QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 3 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -56.88 | -52 | Pass |



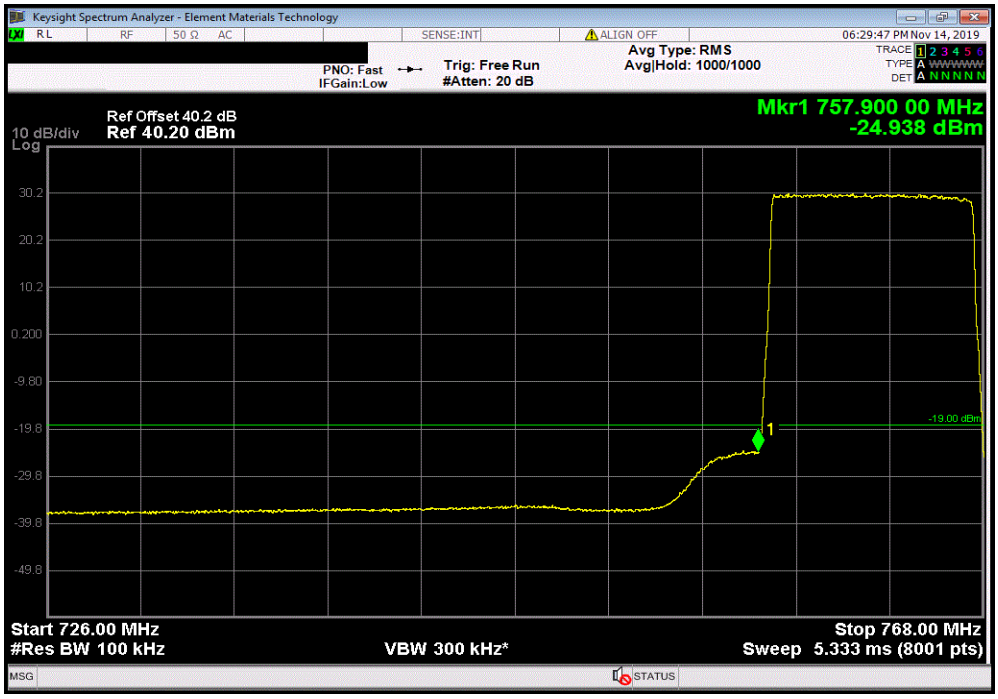

| Band 14, 256QAM Modulation, LTE5 Bandwidth, Upper Band Edge, Measurement 4 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -70.042 | -52 | Pass |



| Band 14, 256QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -28.228 | -19 | Pass |



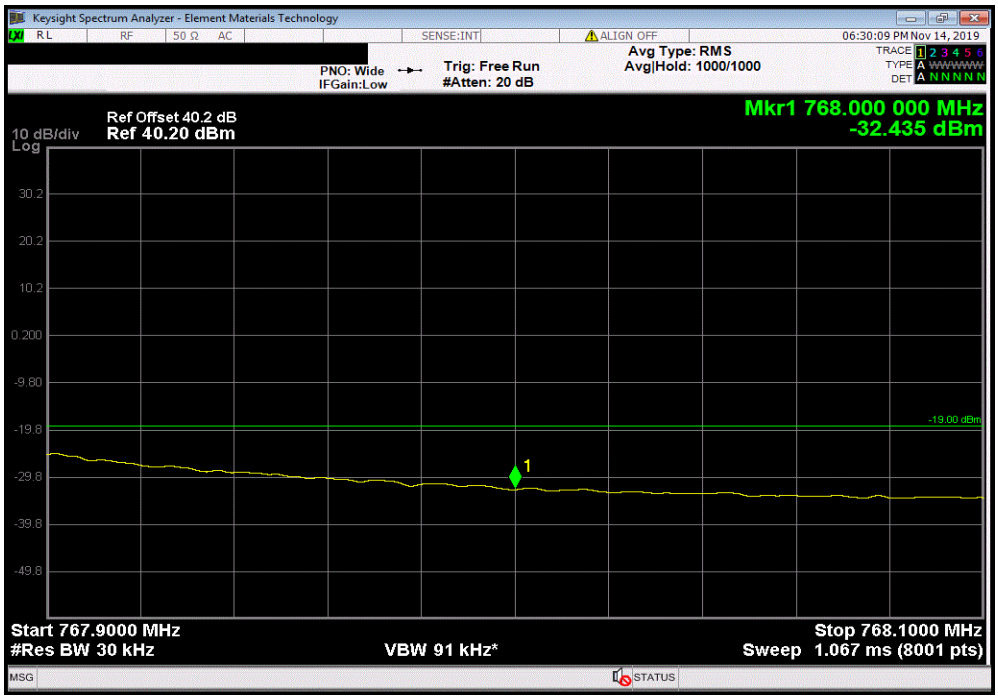

| Band 14, 256QAM Modulation, LTE10 Bandwidth, Lower Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -24.938 | -19 | Pass |



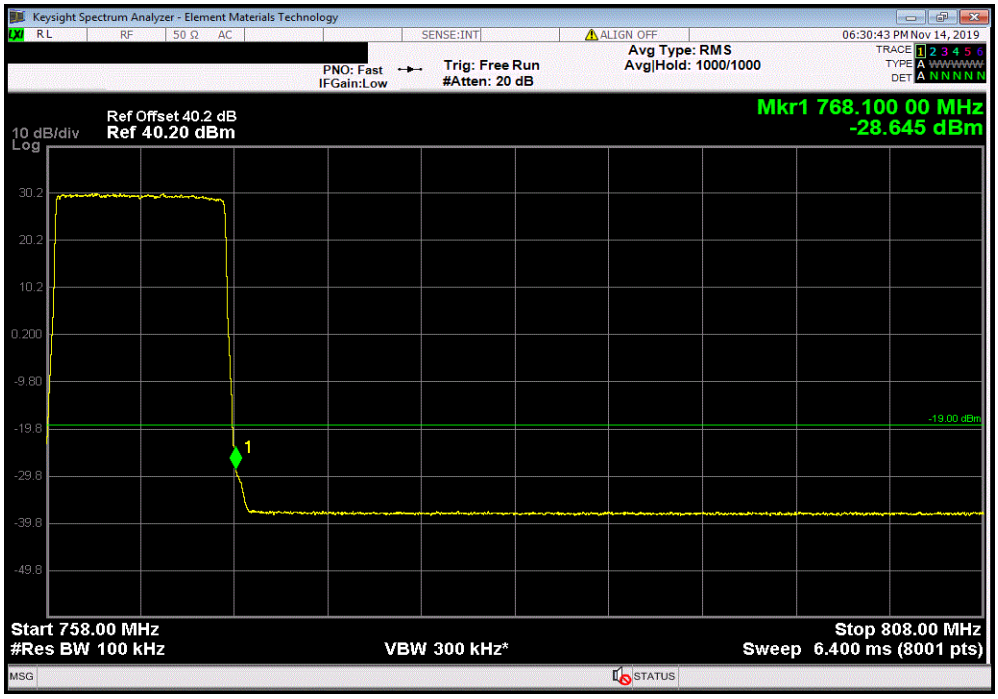
# BAND EDGE COMPLIANCE

XMit 2019.09.05

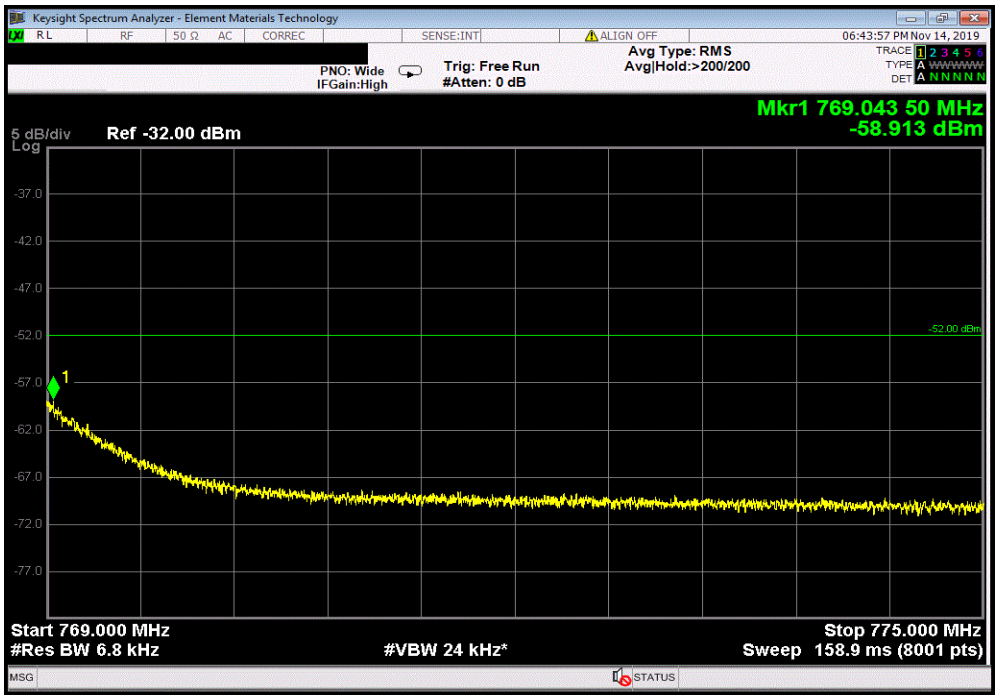
| Band 14, 256QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 1 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -32.435 | -19 | Pass |




| Band 14, 256QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 2 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -28.645 | -19 | Pass |



| Band 14, 256QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 3 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -58.913 | -52 | Pass |




| Band 14, 256QAM Modulation, LTE10 Bandwidth, Upper Band Edge, Measurement 4 | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (dBm) | Limit (dBm) | Result |
| | | | | -69.947 | -52 | Pass |