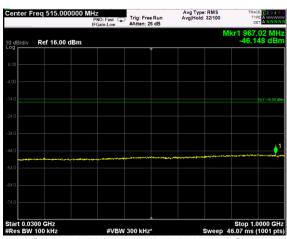


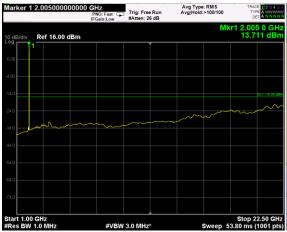
Channel: BOTTOM, Modulation: 16QAM, BW=20MHz, Range: Lower



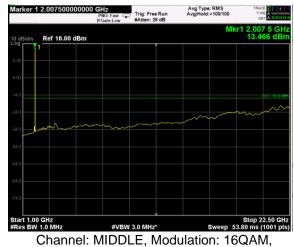
Channel: MIDDLE, Modulation: 16QAM, BW=20MHz, Range: Lower



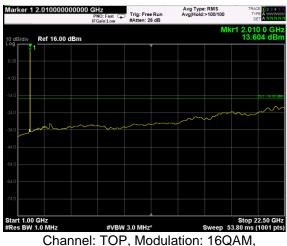
Channel: TOP, Modulation: 16QAN BW=20MHz, Range: Lower



Channel: BOTTOM, Modulation: 16QAM, BW=20MHz, Range: Upper

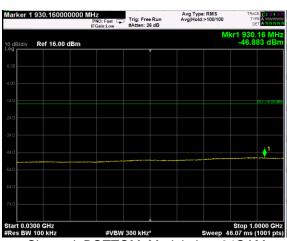


BW=20MHz, Range: Upper

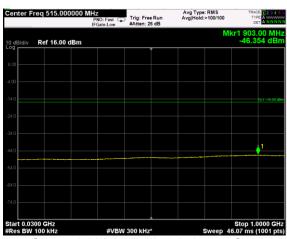


BW=20MHz, Range: Upper





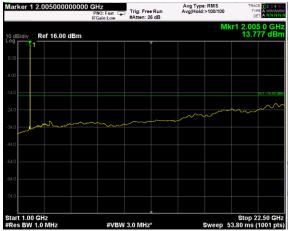
Channel: BOTTOM, Modulation: 64QAM, BW=20MHz, Range: Lower



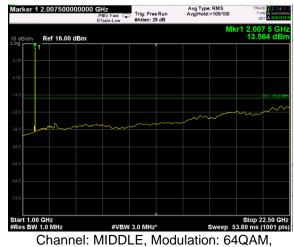
Channel: MIDDLE, Modulation: 64QAM, BW=20MHz, Range: Lower



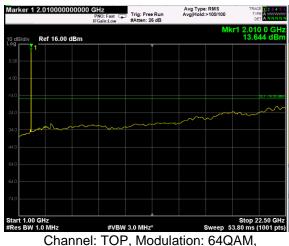
Channel: TOP, Modulation: 64QAN BW=20MHz, Range: Lower



Channel: BOTTOM, Modulation: 64QAM, BW=20MHz, Range: Upper

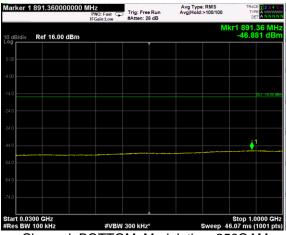


BW=20MHz, Range: Upper



BW=20MHz, Range: Upper





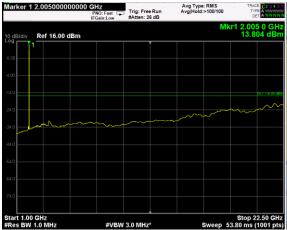
Channel: BOTTOM, Modulation: 256QAM, BW=20MHz, Range: Lower



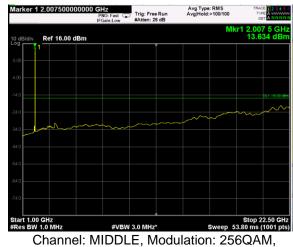
Channel: MIDDLE, Modulation: 256QAM, BW=20MHz, Range: Lower



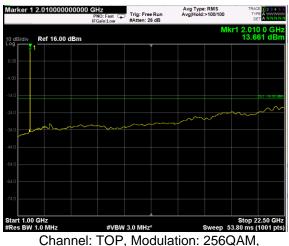
Channel: TOP, Modulation: 256QA BW=20MHz, Range: Lower



Channel: BOTTOM, Modulation: 256QAM, BW=20MHz, Range: Upper



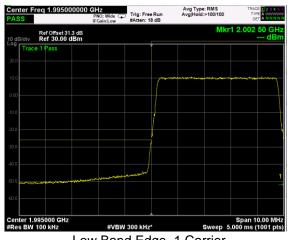
Channel: MIDDLE, Modulation: 256QAM, BW=20MHz, Range: Upper



BW=20MHz, Range: Upper



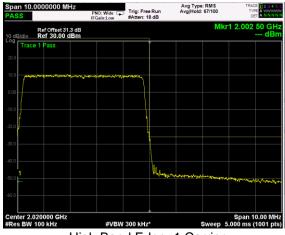
# Test data, continued: band edges Inter modulation **RF PORT 1**



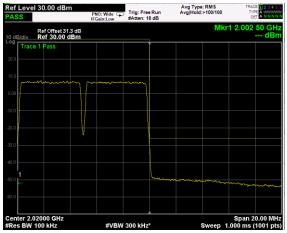
Low Band Edge, 1 Carrier, Modulation: QPSK, BW=5MHz

| TRACE 2 3 4 5<br>TYPE A NNNN<br>DET A NNNN |                    | Avg Type: RMS<br>Avg Hold:>100/100      |    | PNO: Wide Trig: Free Run<br>IFGain:Low #Atten: 18 dB |         |      | PASS                                    |                      |          |
|--|--------------------|---|----|--|---------|------|---|----------------------|----------|
|  |                    |   |    |  |         |      | 31.3 dB<br>) dBm                        | Ref Offset           | 0 dB/div |
|  |                    |   |    |  |         |      |   | e 1 Pass             | og Trac  |
|  |                    |   |    |  |         |      |   |                      | 20.0     |
|  |                    |   |    |  |         |      |   |                      | 10.0     |
|  | ·····              | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | un | Lun  |         |      |   |                      |          |
|  |                    |   |    |  |         |      |   |                      | 0.00     |
|  |                    | /                                       |    |  |         |      |   |                      | 10.0     |
|  |                    | - V                                     |    |  |         |      |   |                      | 20.0     |
|  |                    |   |    |  |         |      |   |                      |          |
|  |                    |   |    |  |         |      |   |                      | 30.0     |
|  |                    |   |    |  |         |      |   |                      | 40.0     |
|  |                    |   |    |  | hand    |      |   |                      | 50.0     |
|  |                    |   |    |  |         |      | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | ~~~~~~               | ~~~      |
|  |                    |   |    |  |         |      |   |                      | 50.0     |
|  |                    |   |    |  |         |      |   |                      |          |
| 2  | Span 2<br>000 ms ( | Sweep 1.                                |    |  | 300 kHz | #VBW |   | 99500 GHz<br>100 kHz |          |

Low Band Edge, 2 Carrier, Modulation: QPSK, BW=5MHz

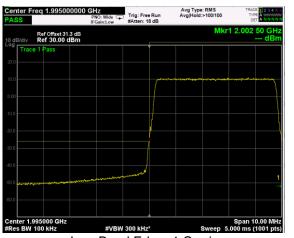


High Band Edge, 1 Carrier, Modulation: QPSK, BW=5MHz

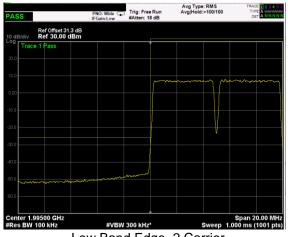


High Band Edge, 2 Carrier, Modulation: QPSK, BW=5MHz

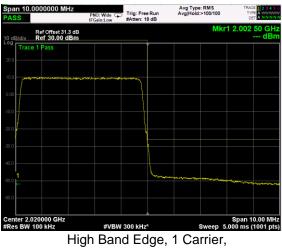




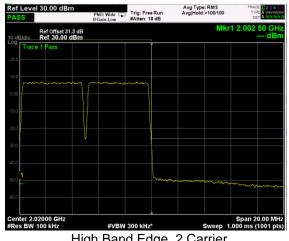
Low Band Edge, 1 Carrier, Modulation: 16QAM, BW=5MHz



Low Band Edge, 2 Carrier, Modulation: 16QAM, BW=5MHz

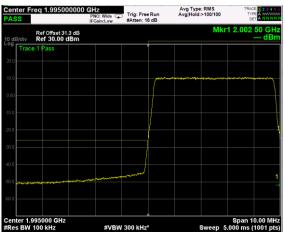


Modulation: 16QAM, BW=5MHz

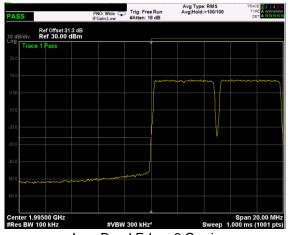


High Band Edge, 2 Carrier, Modulation: 16QAM, BW=5MHz

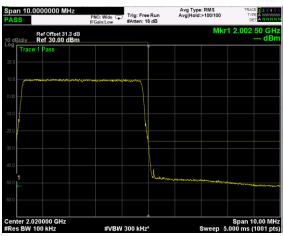




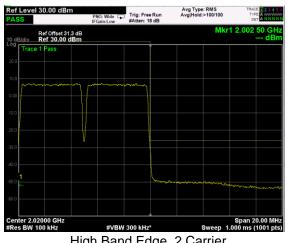
Low Band Edge, 1 Carrier, Modulation: 64QAM, BW=5MHz



Low Band Edge, 2 Carrier, Modulation: 64QAM, BW=5MHz

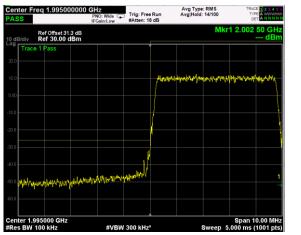


High Band Edge, 1 Carrier, Modulation: 64QAM, BW=5MHz

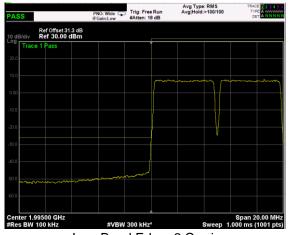


High Band Edge, 2 Carrier, Modulation: 64QAM, BW=5MHz

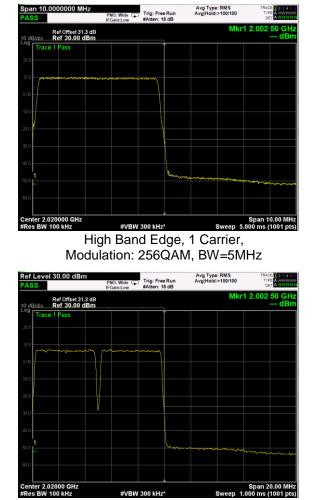




Low Band Edge, 1 Carrier, Modulation: 256QAM, BW=5MHz

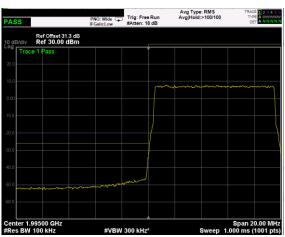


Low Band Edge, 2 Carrier, Modulation: 256QAM, BW=5MHz

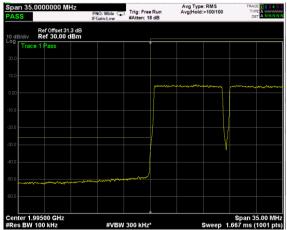


High Band Edge, 2 Carrier, Modulation: 256QAM, BW=5MHz

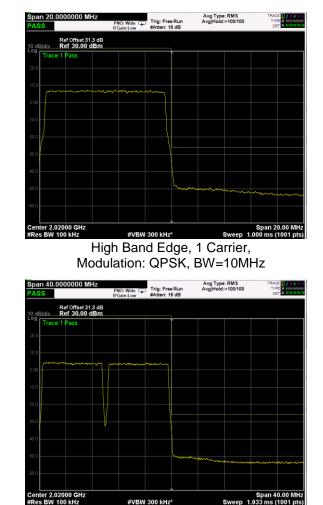




Low Band Edge, 1 Carrier, Modulation: QPSK, BW=10MHz

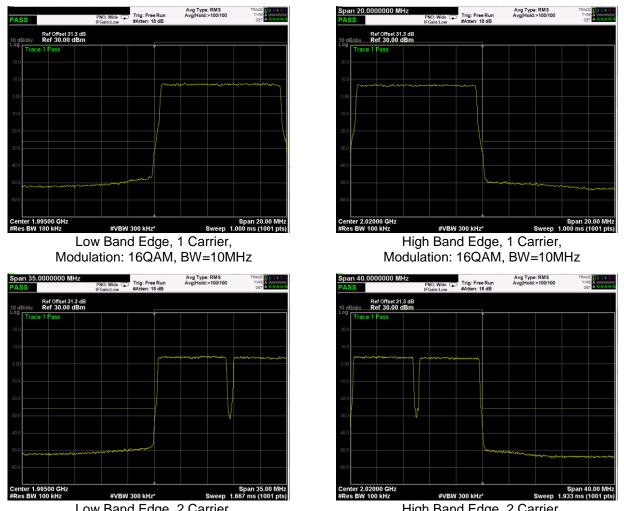


Low Band Edge, 2 Carrier, Modulation: QPSK, BW=10MHz



High Band Edge, 2 Carrier, Modulation: QPSK, BW=10MHz

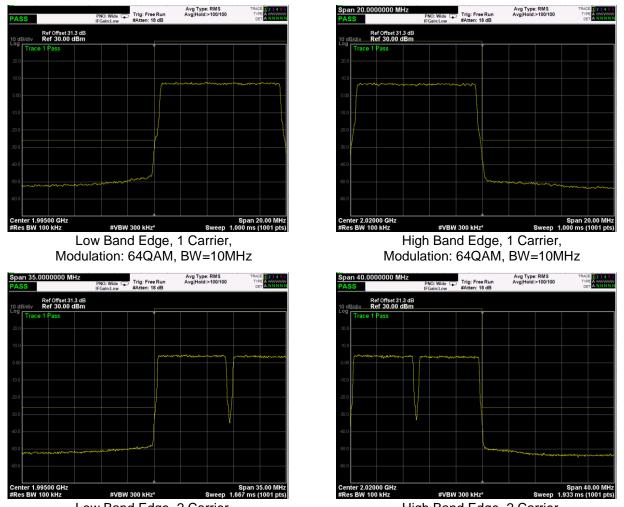




Low Band Edge, 2 Carrier, Modulation: 16QAM, BW=10MHz

High Band Edge, 2 Carrier, Modulation: 16QAM, BW=10MHz

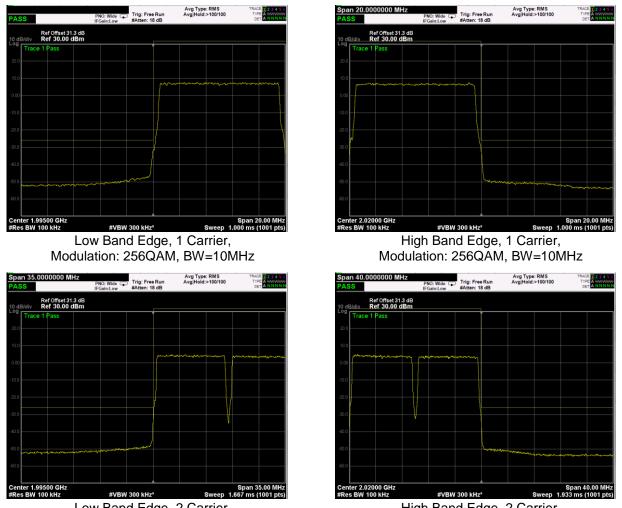




Low Band Edge, 2 Carrier, Modulation: 64QAM, BW=10MHz

High Band Edge, 2 Carrier, Modulation: 64QAM, BW=10MHz





Low Band Edge, 2 Carrier, Modulation: 256QAM, BW=10MHz

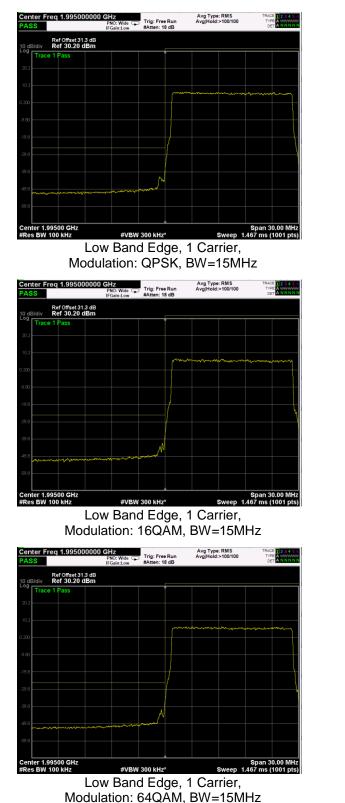
High Band Edge, 2 Carrier, Modulation: 256QAM, BW=10MHz

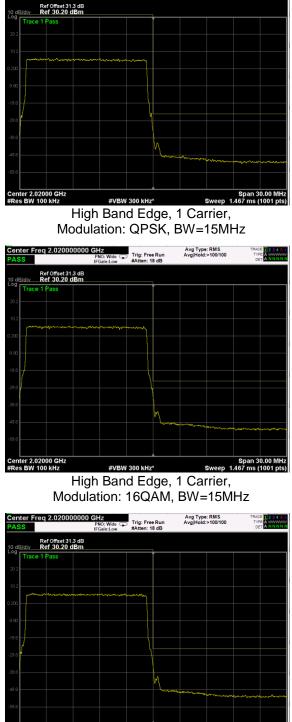
Avg Type: RMS Avg|Hold:>100/100

Trig: Free Run #Atten: 18 dB

eg 2.020000

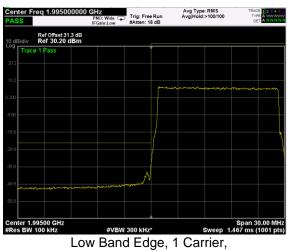
Specification: FCC 27



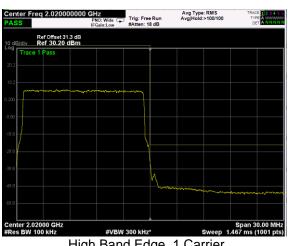


enter 2.02000 GHz tes BW 100 kHz Sweep 1.467 ms (1001 p High Band Edge, 1 Carrier, Modulation: 64QAM, BW=15MHz

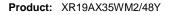




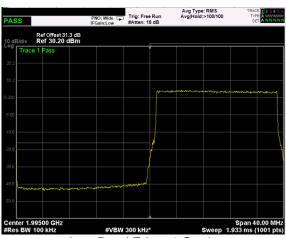
Modulation: 256QAM, BW=15MHz



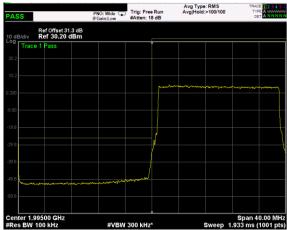
High Band Edge, 1 Carrier, Modulation: 256QAM, BW=15MHz



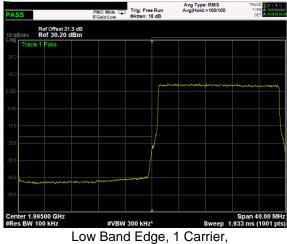




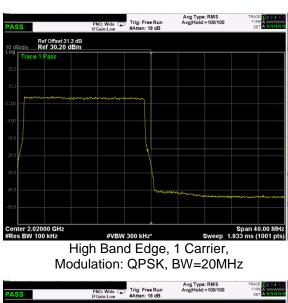
Low Band Edge, 1 Carrier, Modulation: QPSK, BW=20MHz

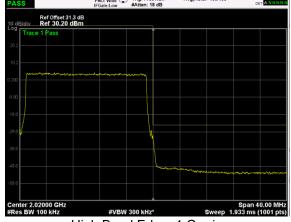


Low Band Edge, 1 Carrier, Modulation: 16QAM, BW=20MHz

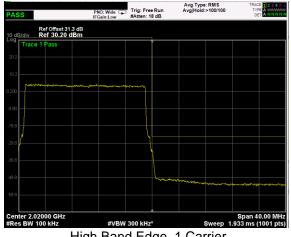


Modulation: 64QAM, BW=20MHz



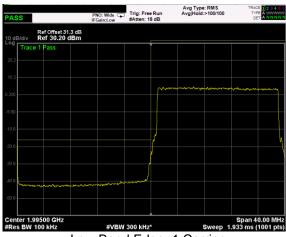


High Band Edge, 1 Carrier, Modulation: 16QAM, BW=20MHz

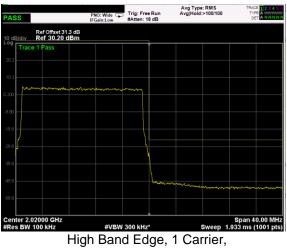


High Band Edge, 1 Carrier, Modulation: 64QAM, BW=20MHz





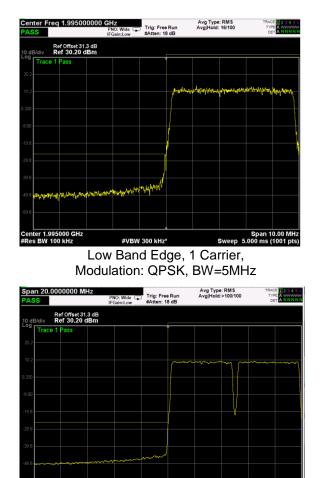
Low Band Edge, 1 Carrier, Modulation: 256QAM, BW=20MHz



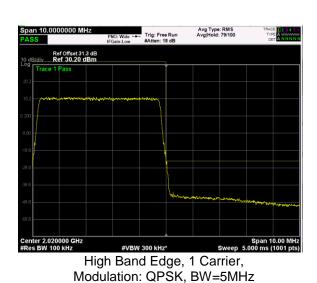
Modulation: 256QAM, BW=20MHz

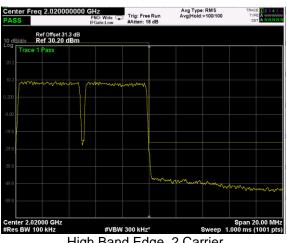


### **RF PORT 2**



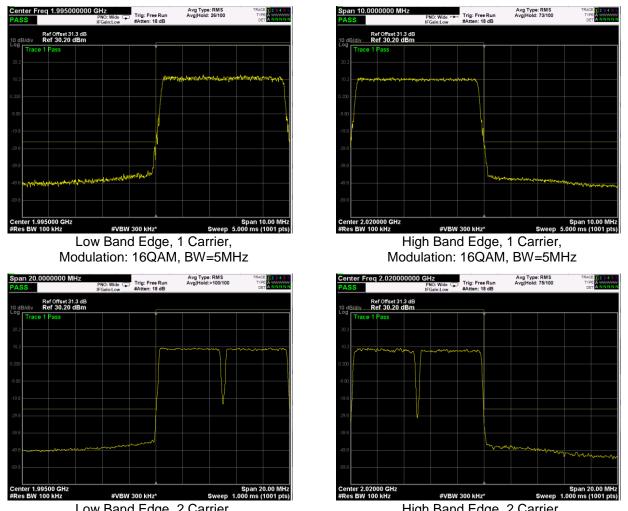
r 1.99500 GHz W 100 kHz #VBW 300 kHz' Sweep 1.000 ms (1001 pts) Low Band Edge, 2 Carrier, Modulation: QPSK, BW=5MHz





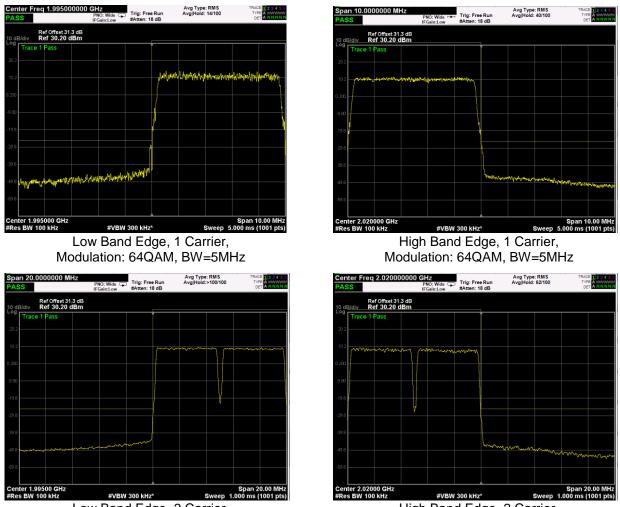
High Band Edge, 2 Carrier, Modulation: QPSK, BW=5MHz



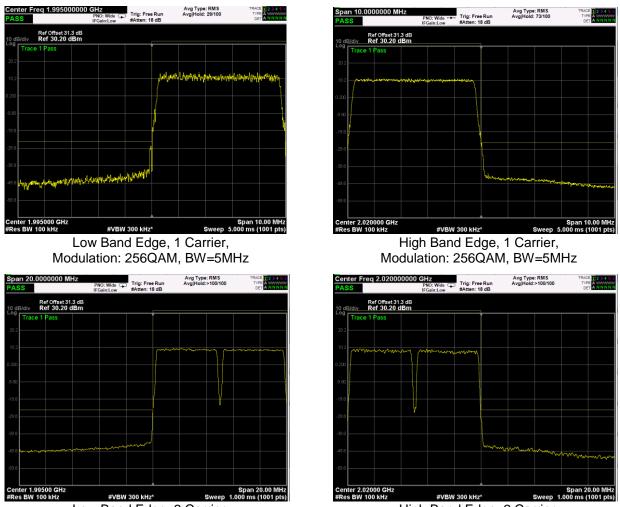


Low Band Edge, 2 Carrier, Modulation: 16QAM, BW=5MHz

High Band Edge, 2 Carrier, Modulation: 16QAM, BW=5MHz

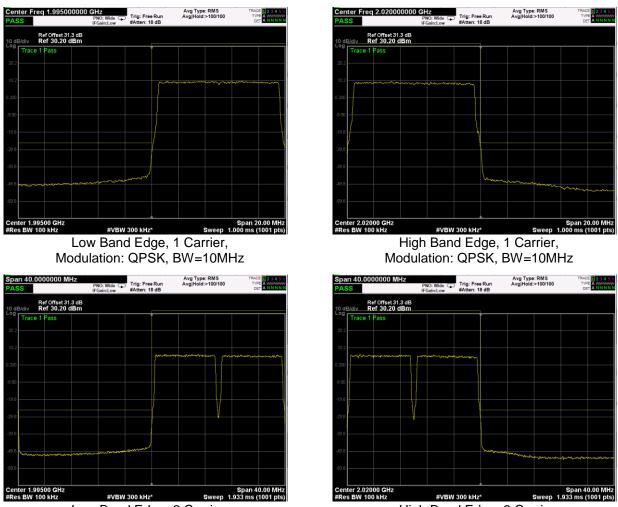


Low Band Edge, 2 Carrier, Modulation: 64QAM, BW=5MHz High Band Edge, 2 Carrier, Modulation: 64QAM, BW=5MHz



Low Band Edge, 2 Carrier, Modulation: 256QAM, BW=5MHz

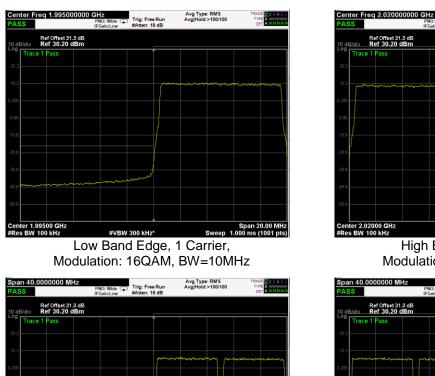
High Band Edge, 2 Carrier, Modulation: 256QAM, BW=5MHz



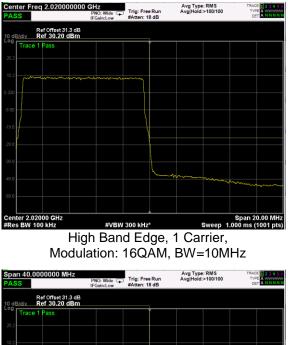
Low Band Edge, 2 Carrier, Modulation: QPSK, BW=10MHz

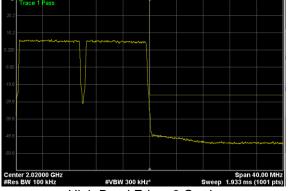
High Band Edge, 2 Carrier, Modulation: QPSK, BW=10MHz





Span 40.00 MHz Sweep 1.933 ms (1001 pts)





High Band Edge, 2 Carrier, Modulation: 16QAM, BW=10MHz

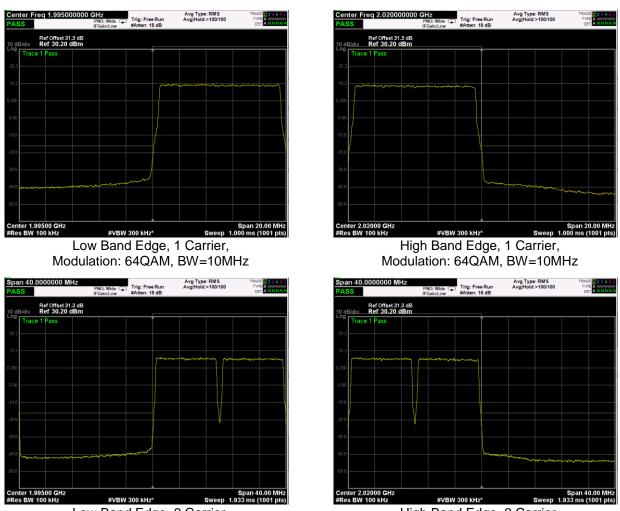
er 1.99500 GHz BW 100 kHz

#VBW 300 kHz\*

Low Band Edge, 2 Carrier,

Modulation: 16QAM, BW=10MHz

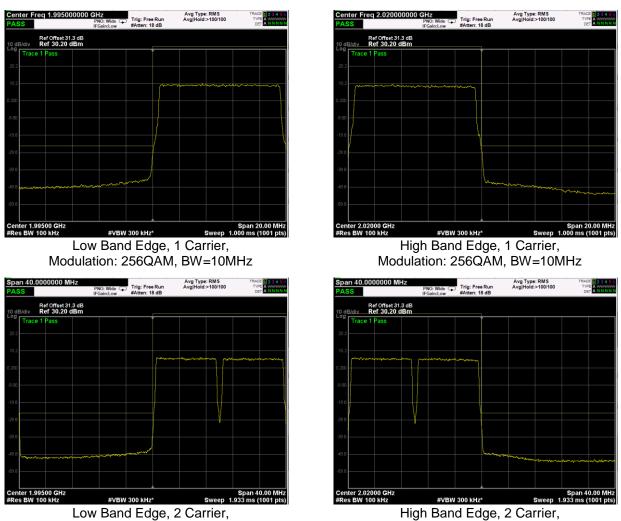




Low Band Edge, 2 Carrier, Modulation: 64QAM, BW=10MHz

High Band Edge, 2 Carrier, Modulation: 64QAM, BW=10MHz



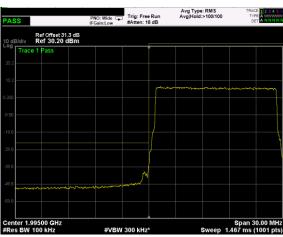


Modulation: 256QAM, BW=10MHz

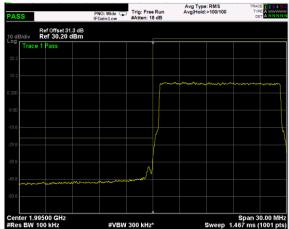
Report reference 387704-2TRFWL

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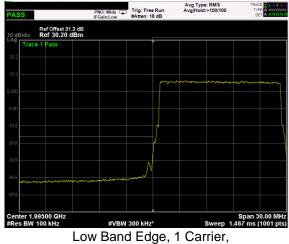
Modulation: 256QAM, BW=10MHz



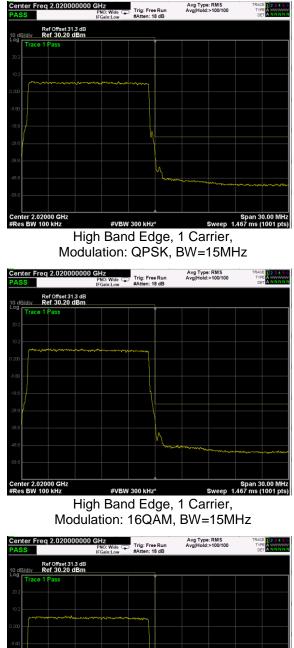
Low Band Edge, 1 Carrier, Modulation: QPSK, BW=15MHz

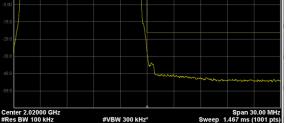


Low Band Edge, 1 Carrier, Modulation: 16QAM, BW=15MHz



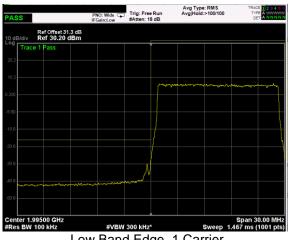
Modulation: 64QAM, BW=15MHz



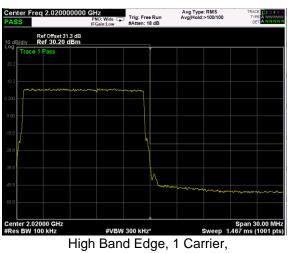


High Band Edge, 1 Carrier, Modulation: 64QAM, BW=15MHz



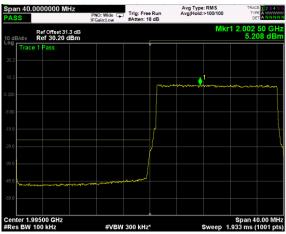


Low Band Edge, 1 Carrier, Modulation: 256QAM, BW=15MHz



Modulation: 256QAM, BW=15MHz

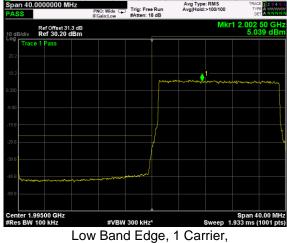




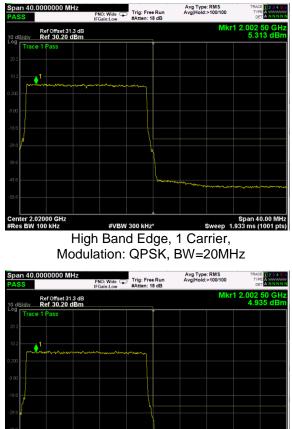
Low Band Edge, 1 Carrier, Modulation: QPSK, BW=20MHz

| 10 gB/div Ref Off<br>Trace 1 Pass<br>20 2<br>10 2<br>-880 | set 31.3 dB<br>0.20 dBm   |                  |   |   | Mkr           | 1 2.002  | 50 GH       |
|---|---------------------------|------------------|---|---|---------------|--|-------------|
| 20.2<br>10.2<br>2020                                      | ;                         |                  |   |   |               | 5.5  | 48 dBi      |
| 10.2  |                           |                  |   |   |               |  |             |
| 200   |                           |                  |   |   |               |  |             |
|   |                           |                  |   | - |               |  |             |
| 9.80  |                           |                  |   | m | Alger Andrews | ar and the second s | nuManarivi. |
|   |                           |                  |   |   |               |  |             |
| 19.8  |                           |                  |   |   |               |  |             |
| 29.8  |                           |                  | [ |   |               |  |             |
|   |                           | 1                | ľ |   |               |  |             |
| 39.8  |                           |                  |   |   |               |  |             |
| 49.8  | weight work of the second | <br>agent of the |   |   |               |  |             |
| 59.8  |                           |                  |   |   |               |  |             |
| Center 1.99500 G<br>#Res BW 100 kH                        |                           |                  |   |   |               |  |             |

Low Band Edge, 1 Carrier, Modulation: 16QAM, BW=20MHz

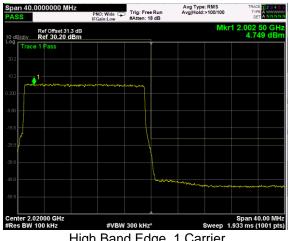


Modulation: 64QAM, BW=20MHz



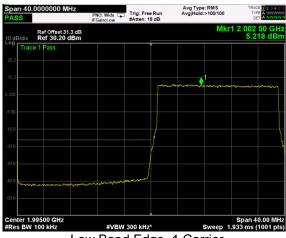
enter 2.02000 GHz Res BW 100 kHz Span 40.00 MHz 1.933 ms (1001 pts) #VBW 300 kHz

High Band Edge, 1 Carrier, Modulation: 16QAM, BW=20MHz

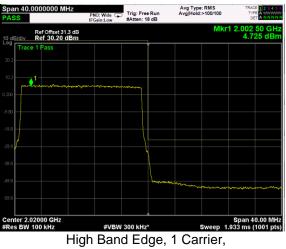


High Band Edge, 1 Carrier, Modulation: 64QAM, BW=20MHz





Low Band Edge, 1 Carrier, Modulation: 256QAM, BW=20MHz



Modulation: 256QAM, BW=20MHz

## Clause 27.53(h) Radiated Spurious emissions

(h) AWS emission limits:

- (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.
- (2) Additional protection levels. Notwithstanding the foregoing paragraph (h)(1) of this section:
- (ii) For operations in the 2000-2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.
- (3) Measurement procedure.
- (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.
- (ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
- (iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.
- (4) Private agreements. (i) For AWS operations in the 2000-2020 MHz and 2180-2200 MHz bands, to the extent a licensee establishes unified operations across the AWS blocks, that licensee may choose not to observe the emission limit specified in paragraph (h)(1), above, strictly between its adjacent block licenses in a geographic area, so long as it complies with other Commission rules and is not adversely affecting the operations of other parties by virtue of exceeding the emission limit.

Test date: 04/03/2019 to 05/10/2019 Test results: Pass

#### Special notes

Based on discussion in docket no. DA 13-2409 (para. 25 and 47) for operations in 2000-2020MHz in downlink, only 27.53 (h)(1) and 27.53 (h)(3) apply.



#### Clause 27.53(h) Radiated spurious emissions, continued

#### Test data

The D.U.T. was positioned according to the radiated emissions set-up

The D.U.T. antenna connector was terminated by a 50  $\Omega$  shielded dummy load.

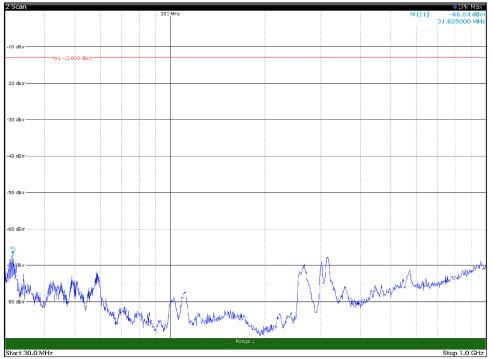
The spectrum was searched from 30 MHz to 1 GHz (RBW 100 kHz) & 1 GHz (RBW 1 MHz) to the tenth harmonic of the carrier.

There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.

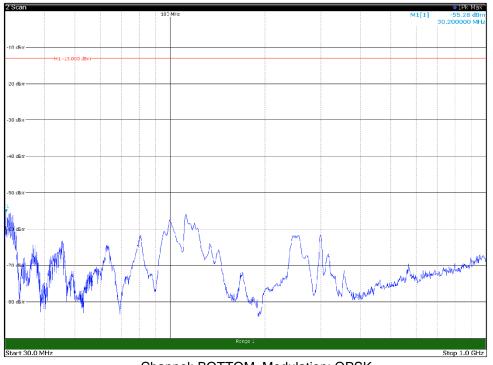
Spurious emissions measurement results:

| Frequency     | Polarization. | Field strength | Limit | Margin |
|---------------|---------------|----------------|-------|--------|
| (MHz)         | V/H           | (dBm)          | (dBm) | (dB)   |
| Low channel   |               |                |       |        |
| First Channel | V/H           | Negligible     | -13   |        |
| Mid channel   |               |                |       |        |
|               |               |                |       |        |
| 2007,5        | V/H           | Negligible     | -13   |        |
| High channel  | 1             |                |       |        |
| Last Channel  | V/H           | Negligible     | -13   |        |

Note: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

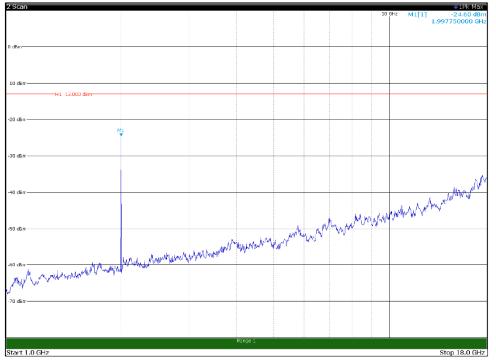


Channel: BOTTOM, Modulation: QPSK, BW=5MHz, Range: 30MHz - 1GHz, Polarization: Horizontal

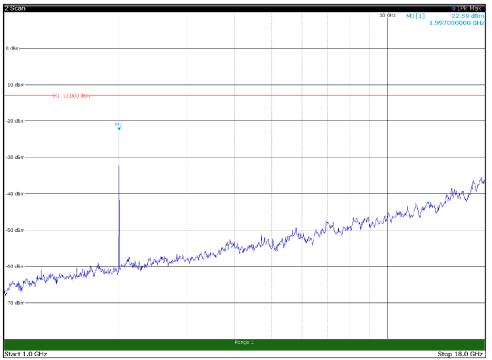


Channel: BOTTOM, Modulation: QPSK, BW=5MHz, Range: 30MHz - 1GHz, Polarization: Vertical



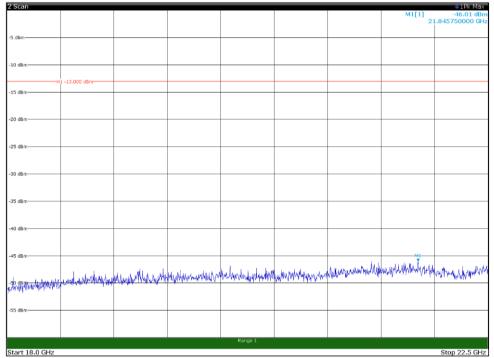


Channel: BOTTOM, Modulation: QPSK, BW=5MHz, Range: 1GHz - 18GHz, Polarization: Horizontal



Channel: BOTTOM, Modulation: QPSK, BW=5MHz, Range: 1GHz - 18GHz, Polarization: Vertical





Channel: BOTTOM, Modulation: QPSK, BW=5MHz, Range: 18GHz - 22.5GHz, Polarization: Horizontal

| Scan          |                      |           |          |   |                      |                   | M1[1]<br>2   | ● 1Pk Max<br>-45.97 dBr<br>1.389750000 GH |
|---------------|----------------------|-----------|----------|---|----------------------|-------------------|--|---|
| 5 dBm         |                      |           |          |   |                      |                   |  |   |
|               |                      |           |          |   |                      |                   |  |   |
| 10 dBm        |                      |           |          |   |                      |                   |  |   |
| 15 dBm        | H1 -13.000 dBm       |           |          |   |                      |                   |  |   |
| J ubm         |                      |           |          |   |                      |                   |  |   |
| 0 dBm         |                      |           |          |   |                      |                   |  |   |
|               |                      |           |          |   |                      |                   |  |   |
| 25 dBm        |                      |           |          |   |                      |                   |  |   |
|               |                      |           |          |   |                      |                   |  |   |
| 0 dBm         |                      |           |          |   |                      |                   |  |   |
| 95 dBm        |                      |           |          |   |                      |                   |  |   |
|               |                      |           |          |   |                      |                   |  |   |
| +0 dBm        |                      |           |          |   |                      |                   |  |   |
|               |                      |           |          |   |                      |                   |  |   |
| 45 dBm        |                      |           |          |   |                      | LI L KILL         | sumbard for  | an and                                    |
| Manna Labor   | h-M-herry March Mar  | humalinan | MANAMANA | here have been been been been been been been be | humbledeendeligneeth | MAR MANY MANY MAR | Monoral and a start of the second s | handstrandfander                          |
| AAAAAAAAAA    | Medi da con el corre |           |          |   |                      |                   |  |   |
| 55 dBm        |                      |           |          |   |                      |                   |  |   |
|               |                      |           |          |   |                      |                   |  |   |
|               |                      |           |          | Range 1   |                      |                   |  |   |
| tart 18.0 GHz |                      |           |          |   |                      |                   |  | Stop 22.5 GH                              |

Channel: BOTTOM, Modulation: QPSK, BW=5MHz, Range: 18GHz - 22.5GHz, Polarization: Vertical