

7. SPURIOUS EMISSION AT ANTENNA TERMINAL

Test Requirements:

§ 2.1051 Measurements required: Spurious emissions at antenna terminals:

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§27.53 Emission limits.

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

- (1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;
- (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;
- (3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations;
- (4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations;
- (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;
- (6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

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

(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 $43 + 10 \log_{10}(P)$ dB.

(2) *Additional protection levels.* Notwithstanding the foregoing paragraph (h)(1) of this section:

- (i) Operations in the 2180-2200 MHz band are subject to the out-of-band emission requirements set forth in §27.1134 for the protection of federal government operations operating in the 2200-2290 MHz band.
- (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 $70 + 10 \log_{10}(P)$ dB.
- (iii) For operations in the 1915-1920 MHz band, the power of any emission between 1930-1995 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ dB.
- (iv) For operations in the 1995-2000 MHz band, the power of any emission between 2005-2020 MHz shall be attenuated below the transmitter power (P) in watts by at least $70 + 10 \log_{10}(P)$ 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.
- (ii) For AWS operations in the 2000-2020 MHz band, a licensee may enter into private

agreements with all licensees operating between 1995 and 2000 MHz to allow the $70 + 10 \log_{10}(P)$ dB limit to be exceeded within the 1995-2000 MHz band.

(iii) An AWS licensee who is a party to a private agreement described in this section (4) must maintain a copy of the agreement in its station files and disclose it, upon request, to prospective AWS assignees, transferees, or spectrum lessees and to the Commission.

Test Procedures:

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 KHz (Under 1 GHz), 1MHz (Above 1 GHz). Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Notes:

1. In 9 KHz-150 KHz and 150 KHz-30 MHz bands, RBW was reduced to 1% and 10% of the reference bandwidth for measuring unwanted emission level (typically, 100KHz if the authorized frequency band is below 1GHz) and power was integrated. (1% = +20 dB, 10% = +10 dB)
2. Because the test results are similar trend value for each port, attached plots were only the worst case test results.

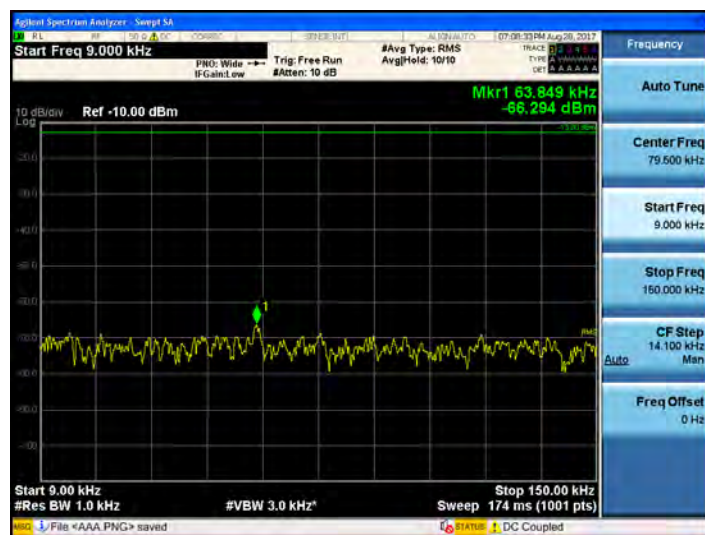
Test Result:

LTE Band 13 (10 MHz)

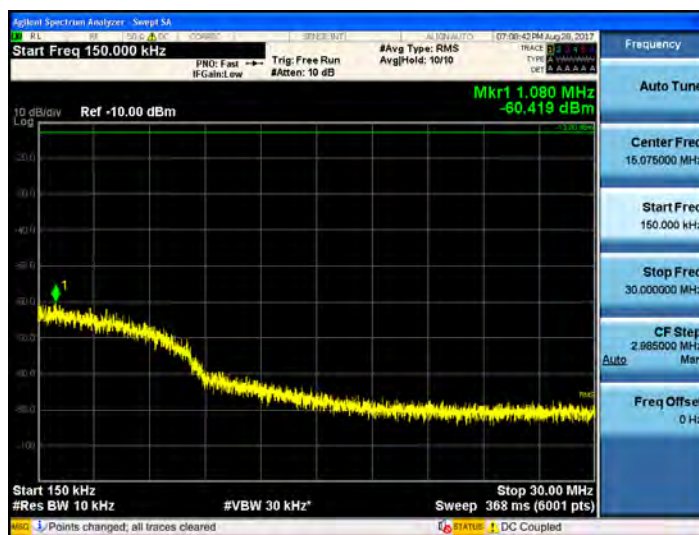
Test Data at Output Port 1

(QPSK)

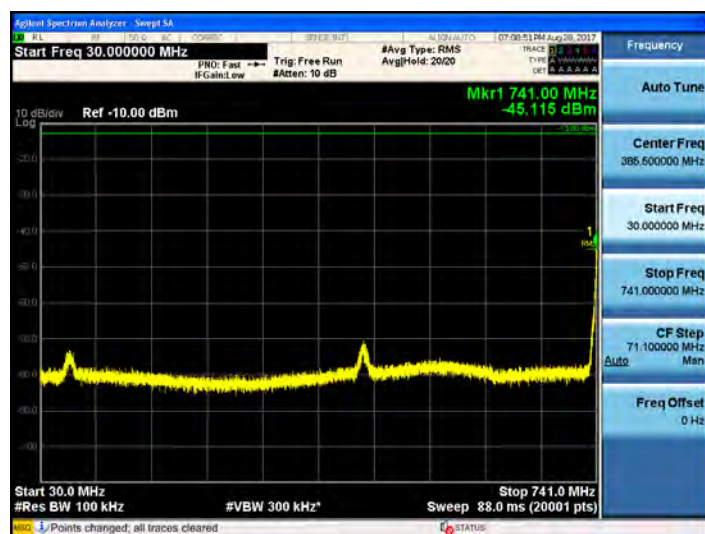
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 741 MHz



741 MHz ~ 745.9 MHz



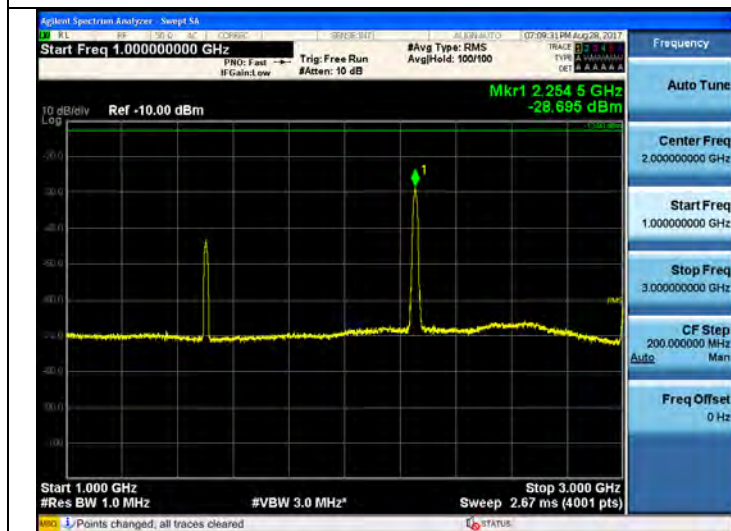
757.1 MHz ~ 762 MHz



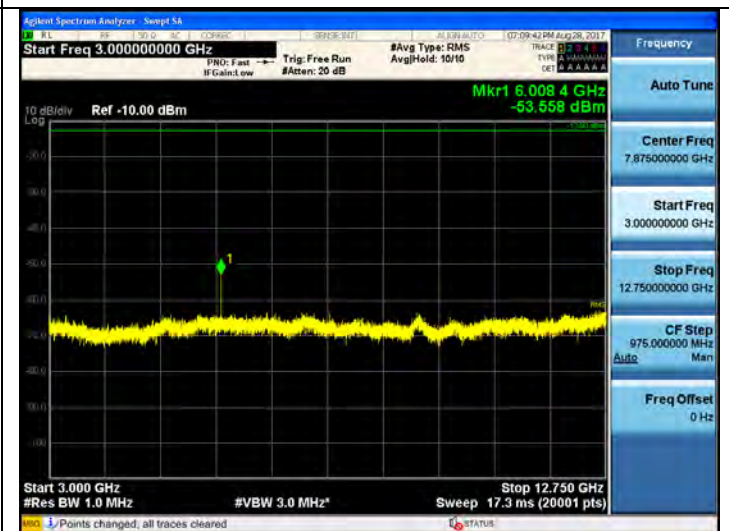
762 MHz ~ 1 GHz



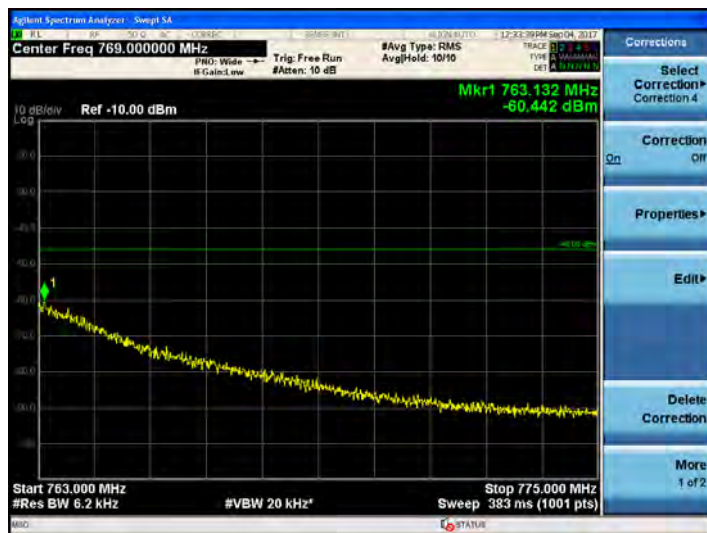
1 GHz ~ 3 GHz



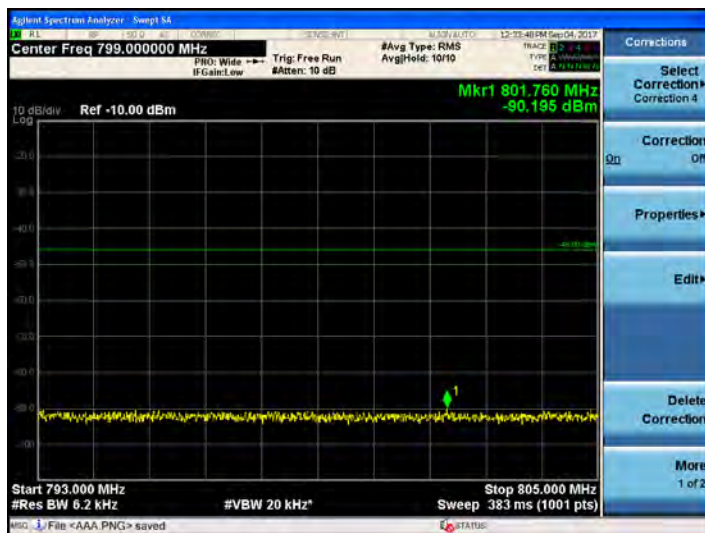
3 GHz ~ 12.75 GHz



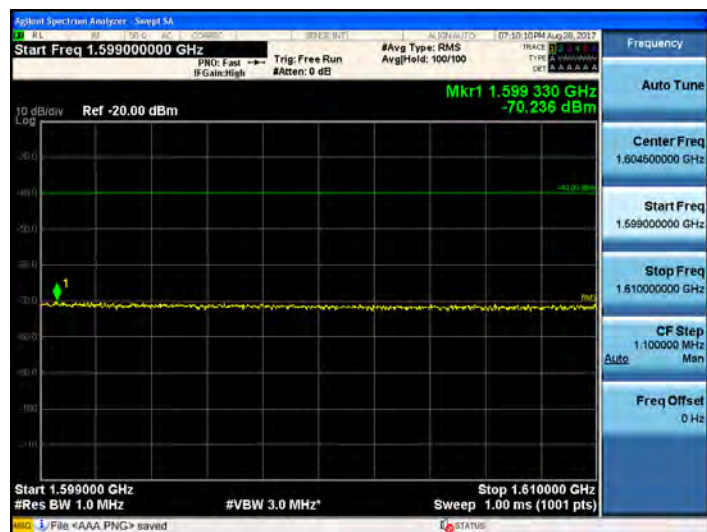
763 MHz ~ 775 MHz



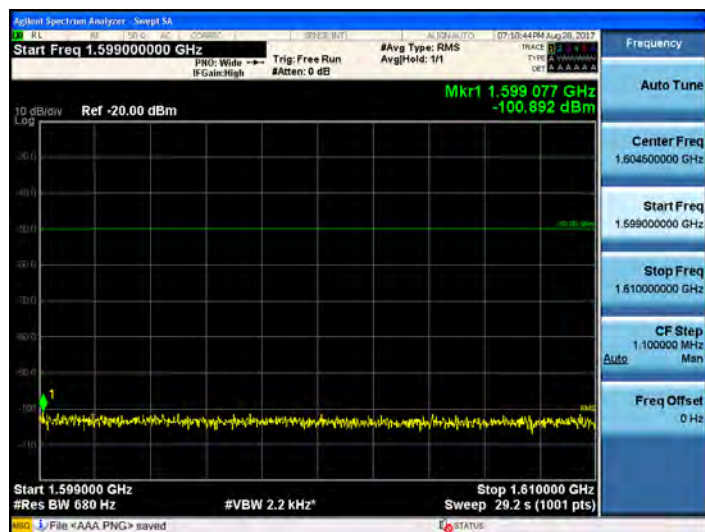
793 MHz ~ 805 MHz



1 599 MHz ~ 1 610 MHz (1)

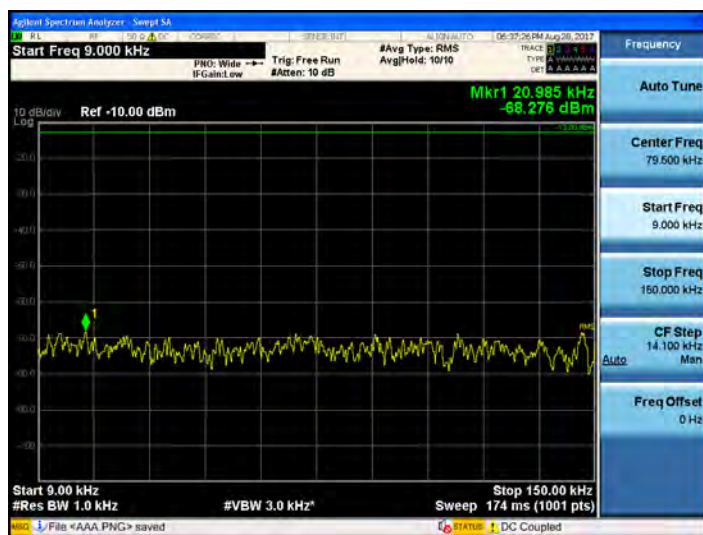


1 599 MHz ~ 1 610 MHz (2)

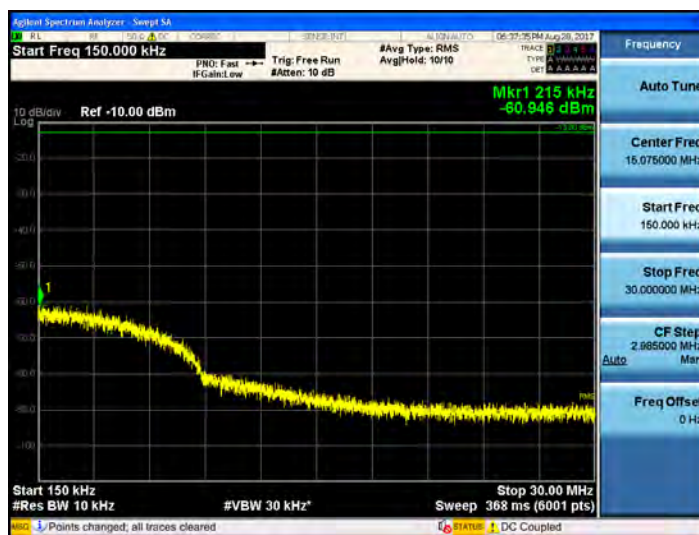


Test Data at Output Port 1
(16QAM)

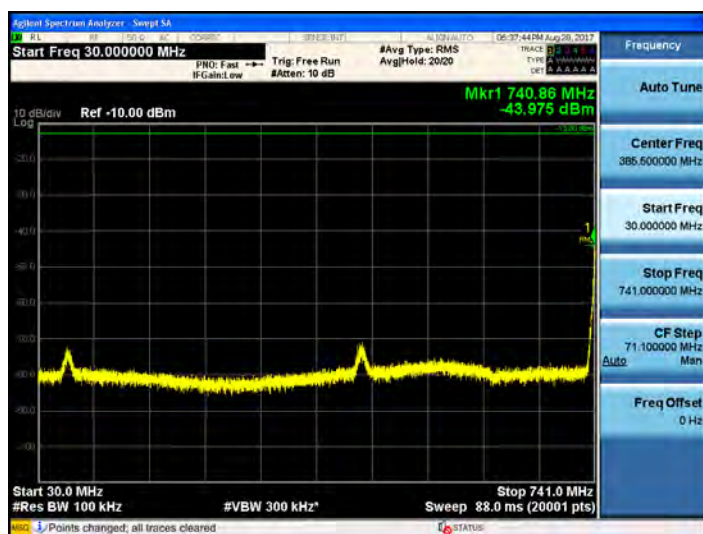
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 741 MHz



741 MHz ~ 745.9 MHz



757.1 MHz ~ 762 MHz



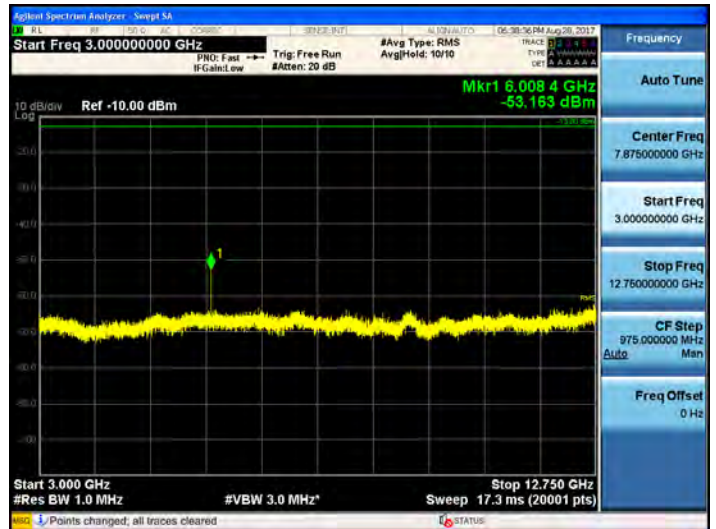
762 MHz ~ 1 GHz



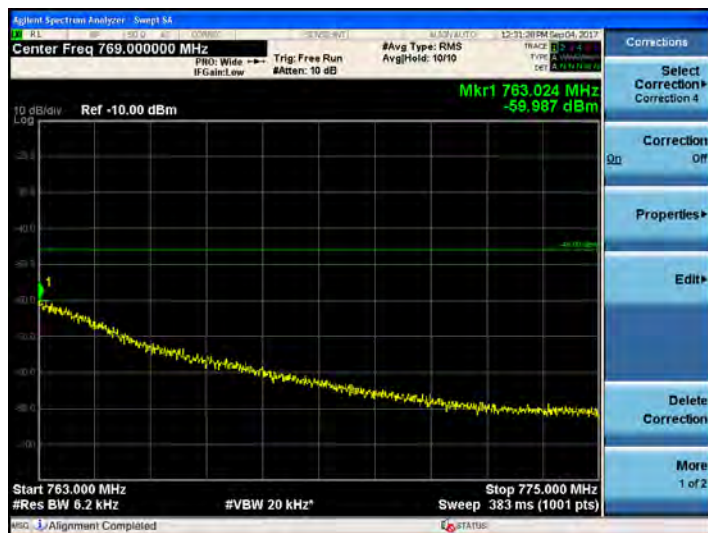
1 GHz ~ 3 GHz



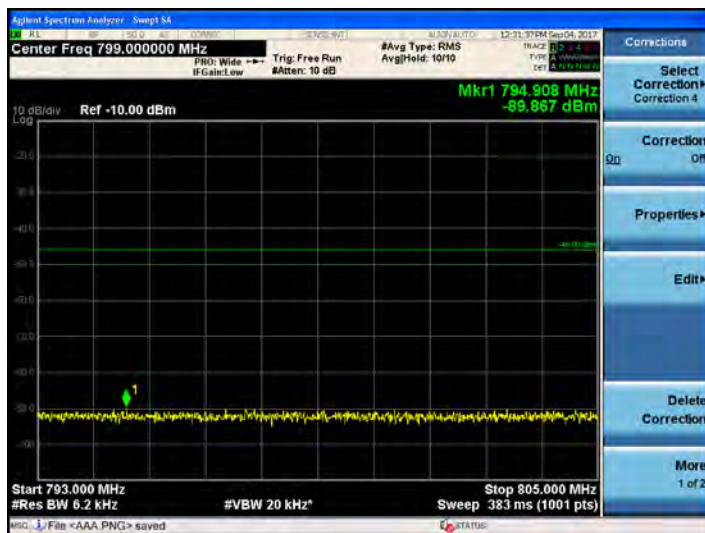
3 GHz ~ 12.75 GHz



763 MHz ~ 775 MHz



793 MHz ~ 805 MHz



1 599 MHz ~ 1 610 MHz (1)

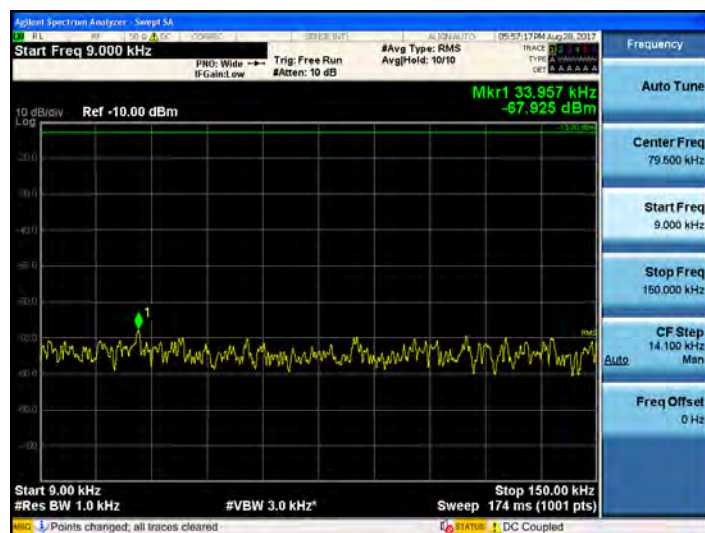


1 599 MHz ~ 1 610 MHz (2)

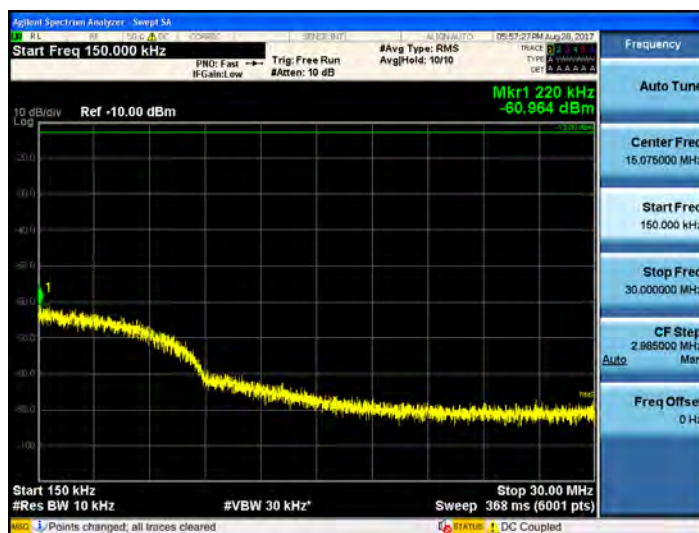


Test Data at Output Port 1
(64QAM)

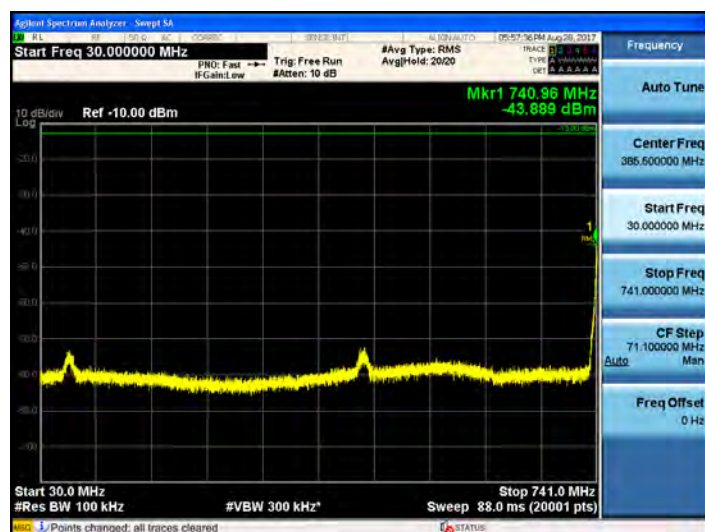
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 741 MHz



741 MHz ~ 745.9 MHz



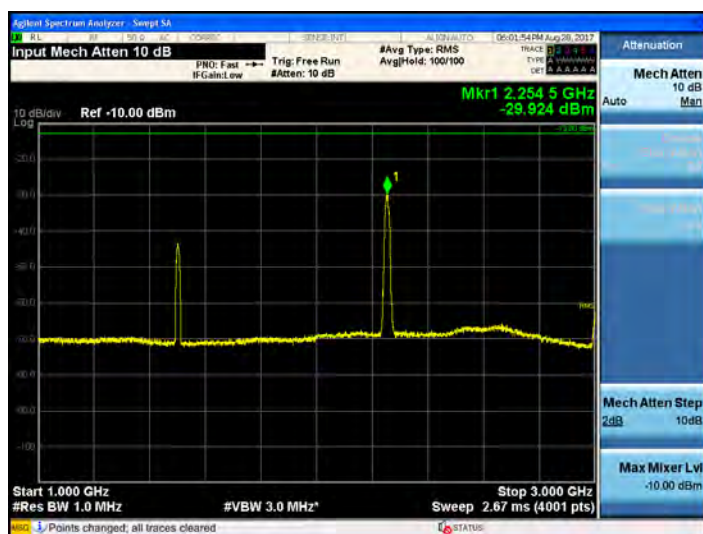
757.1 MHz ~ 762 MHz



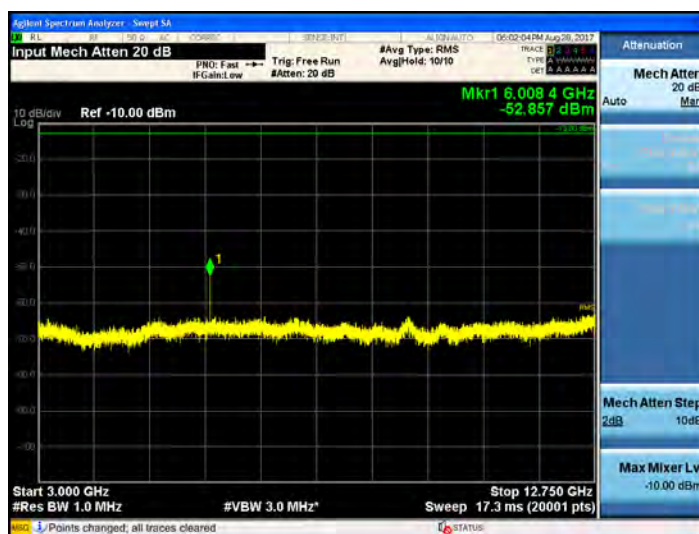
762 MHz ~ 1 GHz



1 GHz ~ 3 GHz



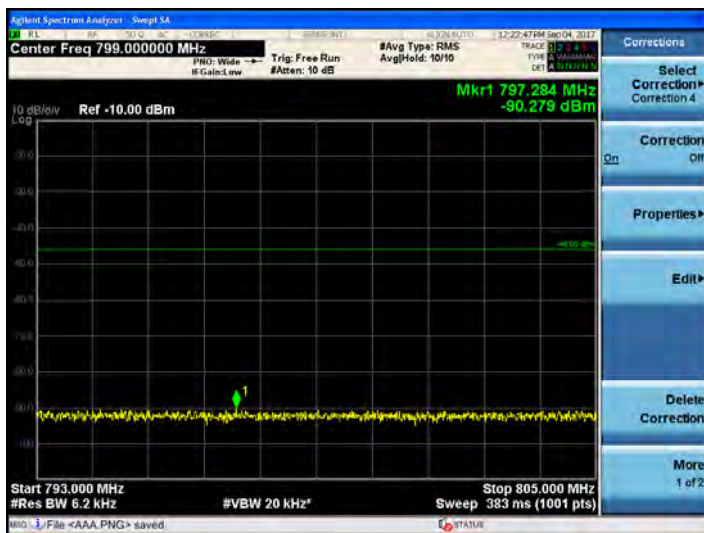
3 GHz ~ 12.75 GHz



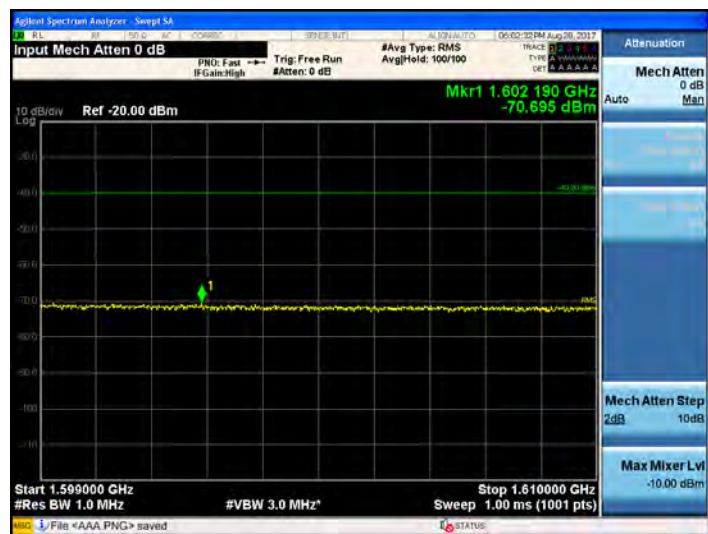
763 MHz ~ 775 MHz



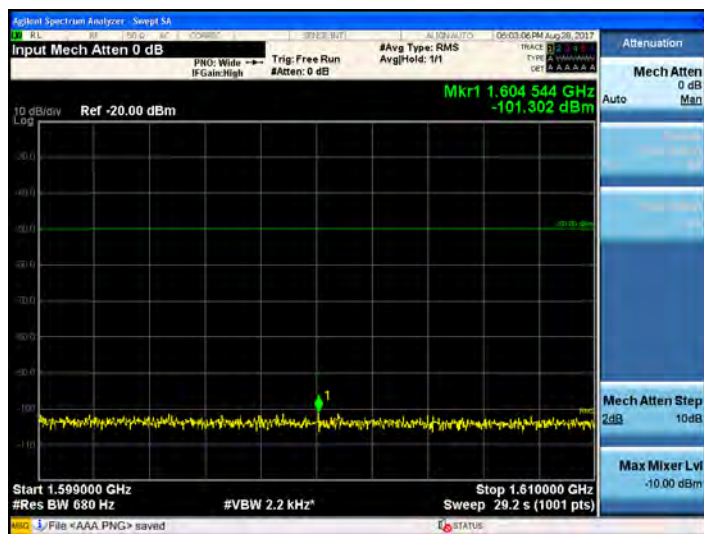
793 MHz ~ 805 MHz



1 599 MHz ~ 1 610 MHz (1)

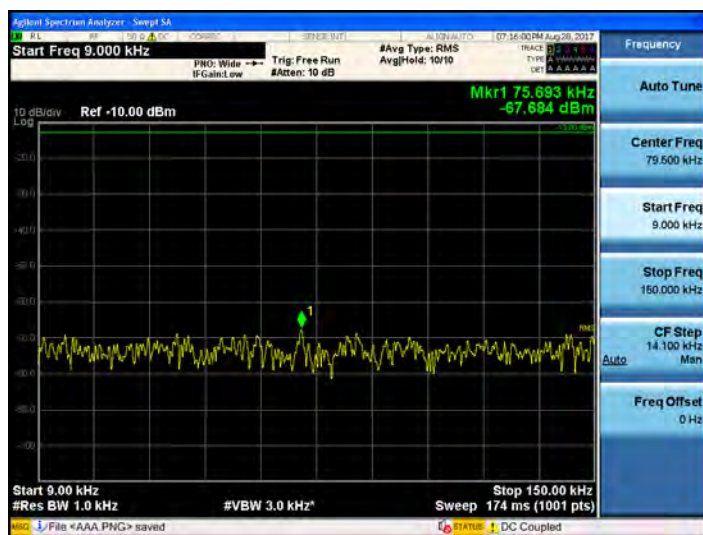


1 599 MHz ~ 1 610 MHz (2)

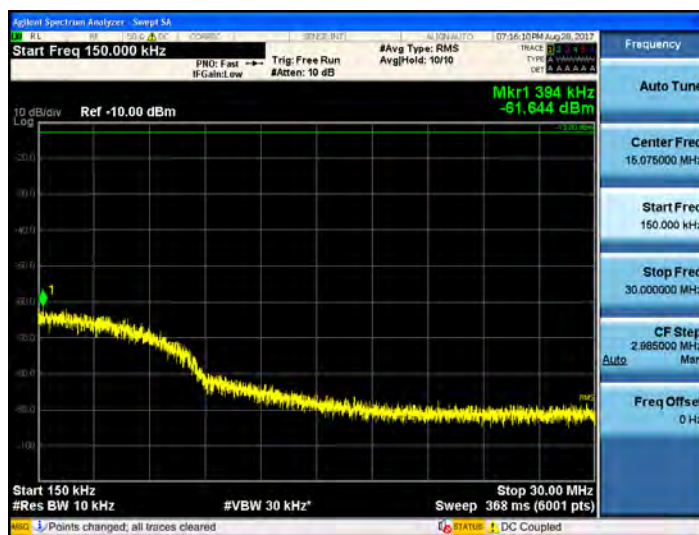


Test Data at Output Port 2 (QPSK)

9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 741 MHz



741 MHz ~ 745.9 MHz



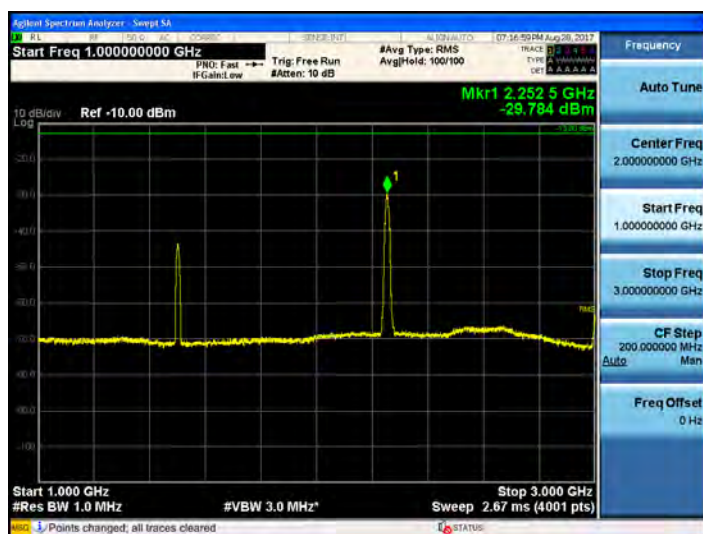
757.1 MHz ~ 762 MHz



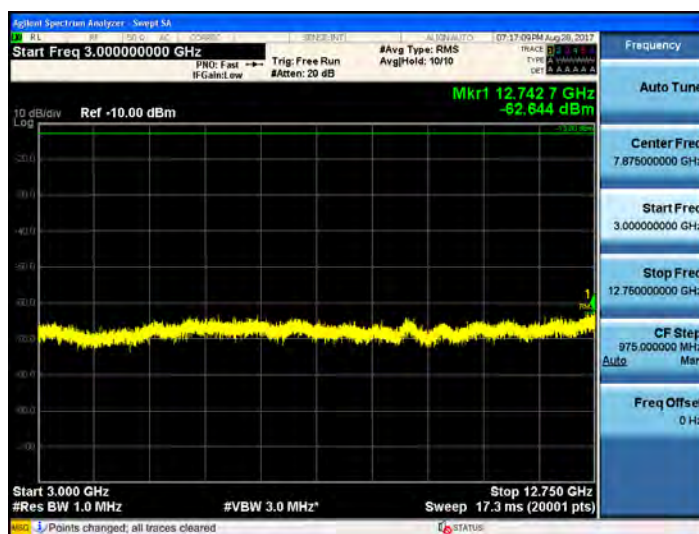
762 MHz ~ 1 GHz



1 GHz ~ 3 GHz



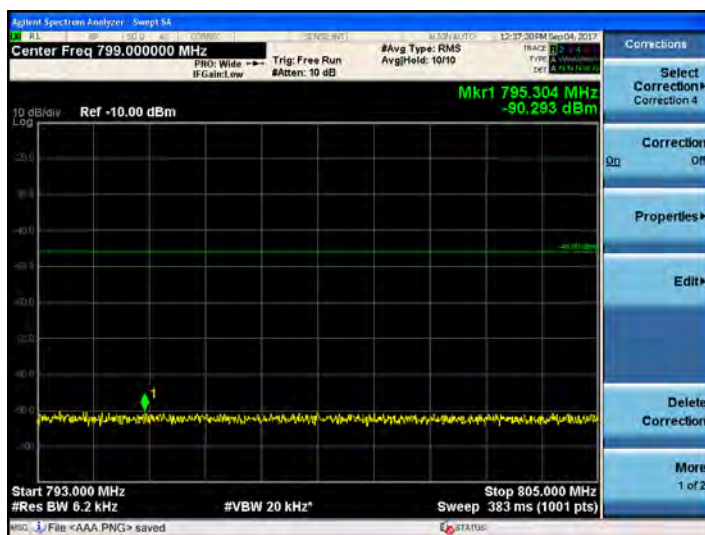
3 GHz ~ 12.75 GHz



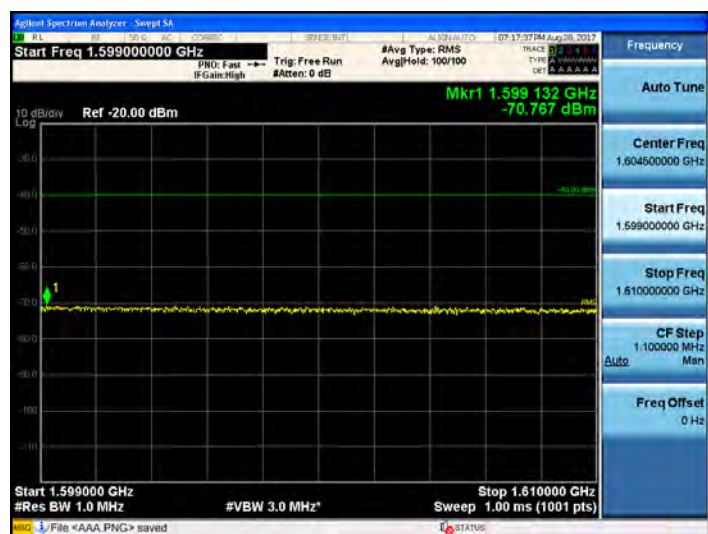
763 MHz ~ 775 MHz



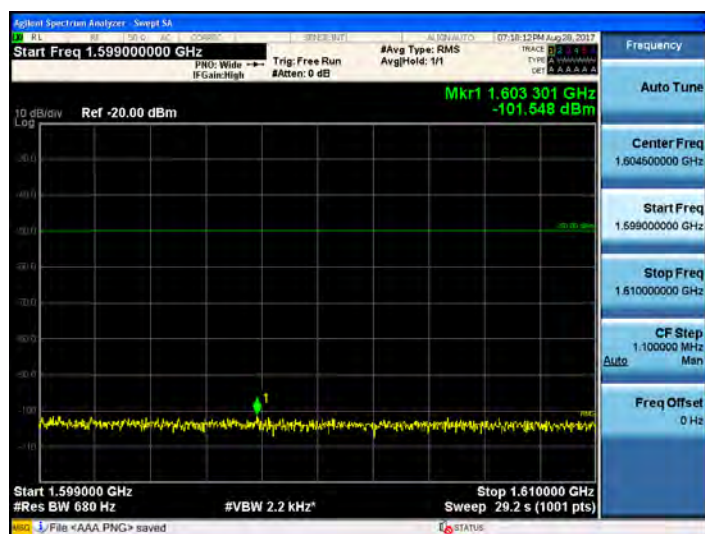
793 MHz ~ 805 MHz



1 599 MHz ~ 1 610 MHz (1)

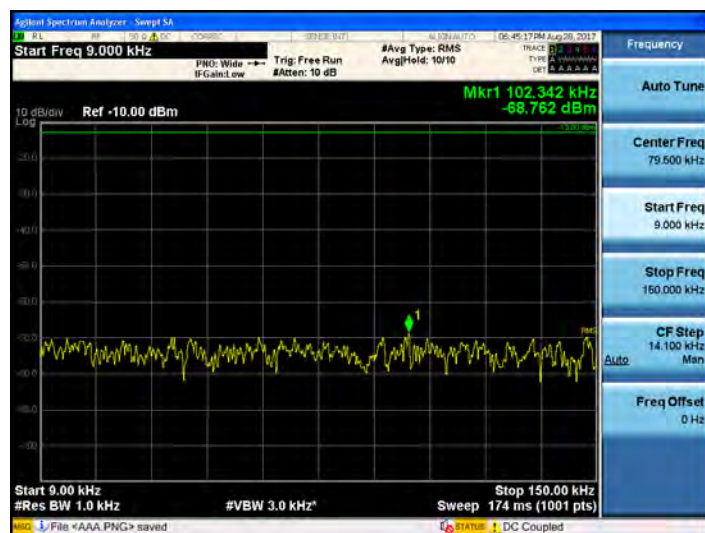


1 599 MHz ~ 1 610 MHz (2)

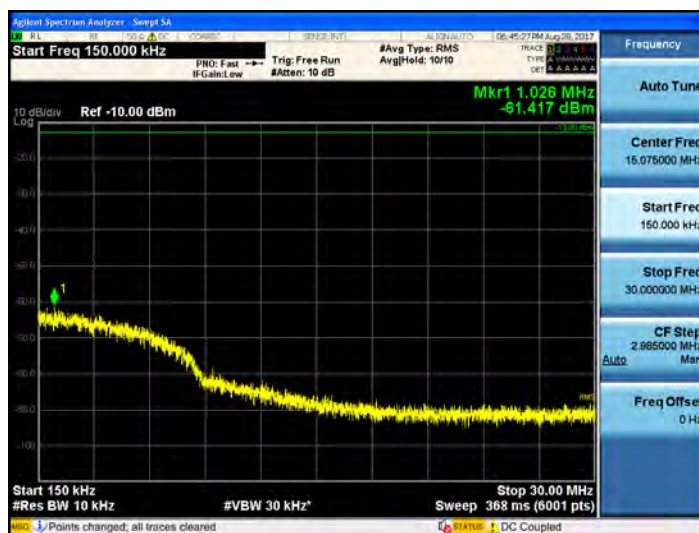


Test Data at Output Port 2 (16QAM)

9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 741 MHz



741 MHz ~ 745.9 MHz



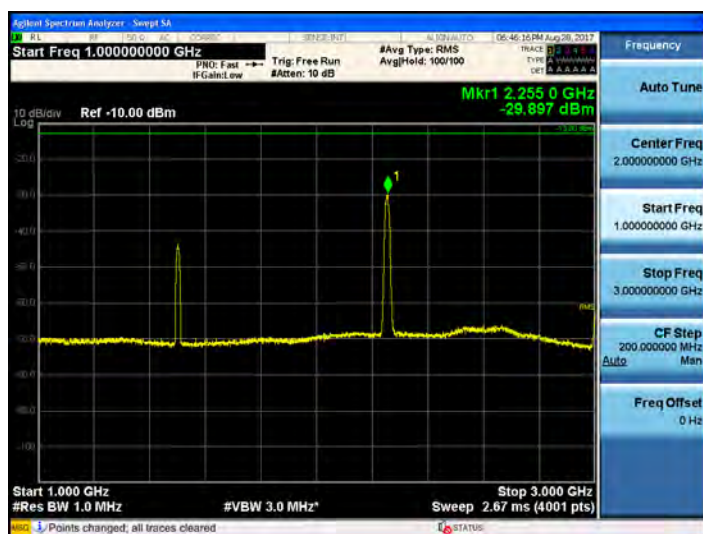
757.1 MHz ~ 762 MHz



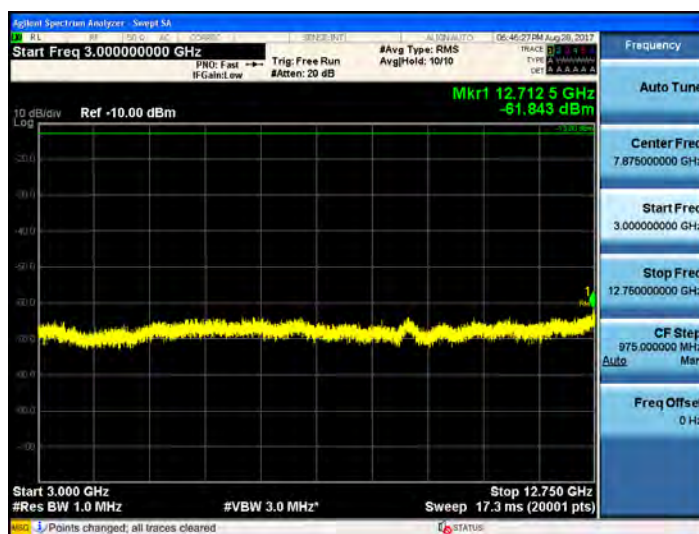
762 MHz ~ 1 GHz



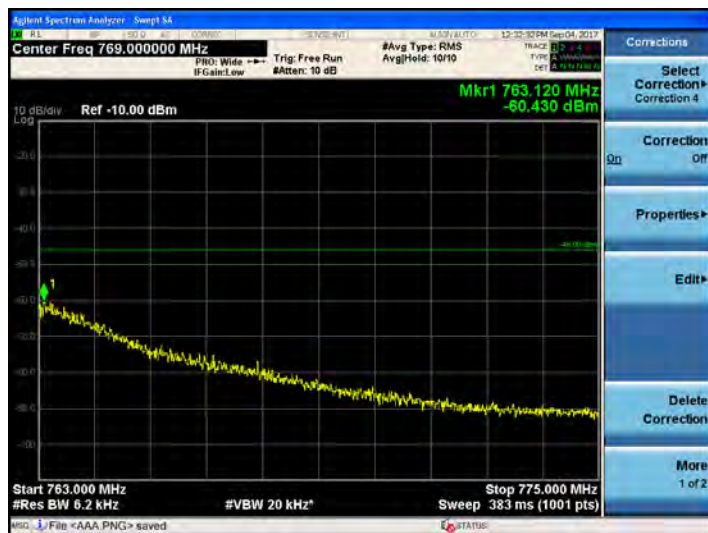
1 GHz ~ 3 GHz



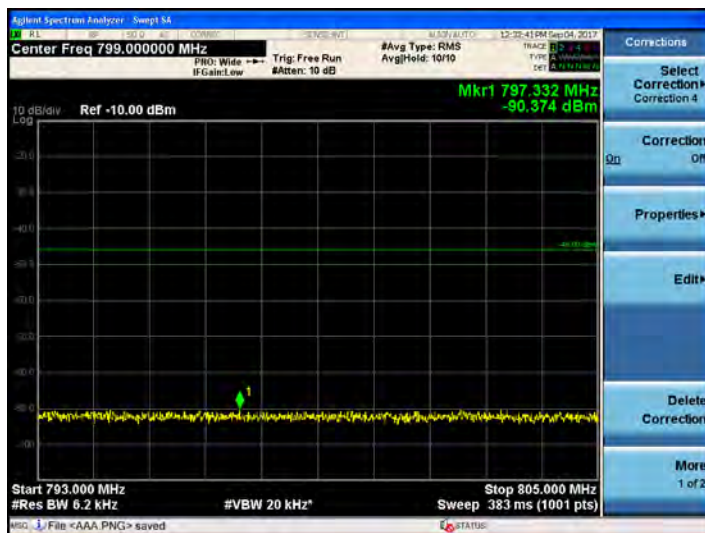
3 GHz ~ 12.75 GHz



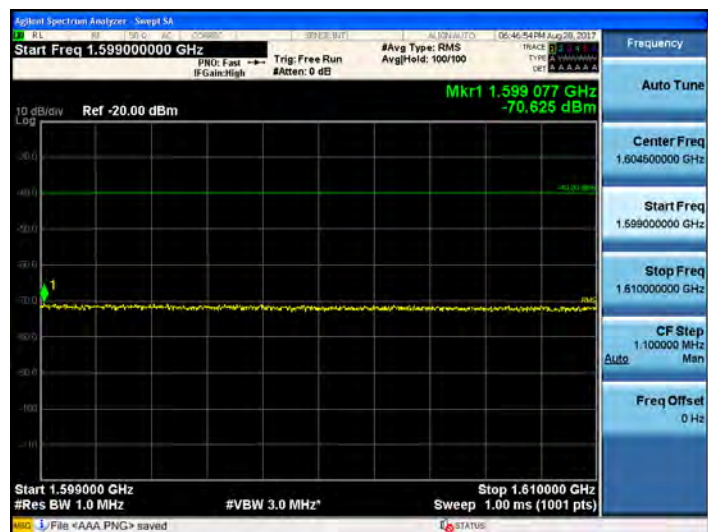
763 MHz ~ 775 MHz



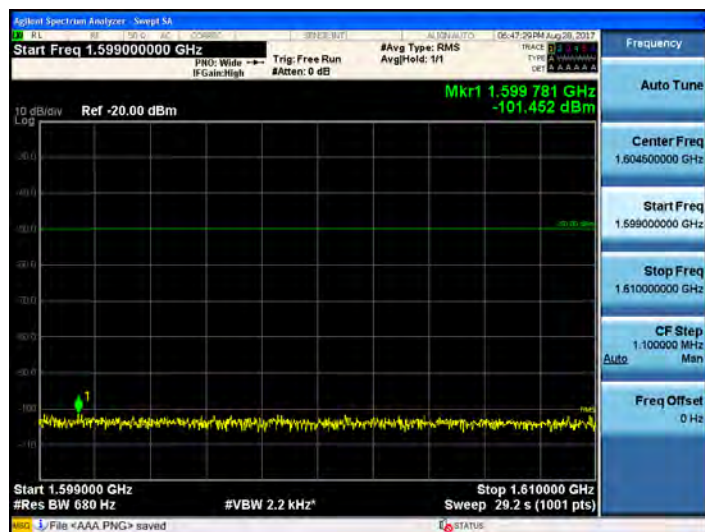
793 MHz ~ 805 MHz



1 599 MHz ~ 1 610 MHz (1)

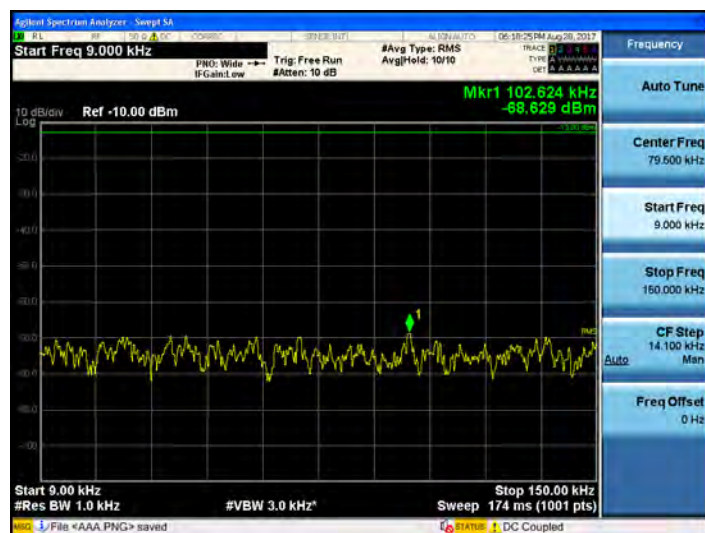


1 599 MHz ~ 1 610 MHz (2)

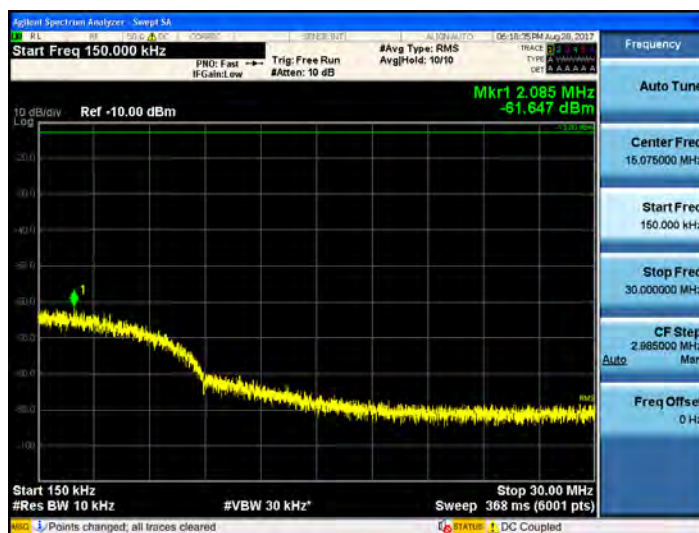


Test Data at Output Port 2
(64QAM)

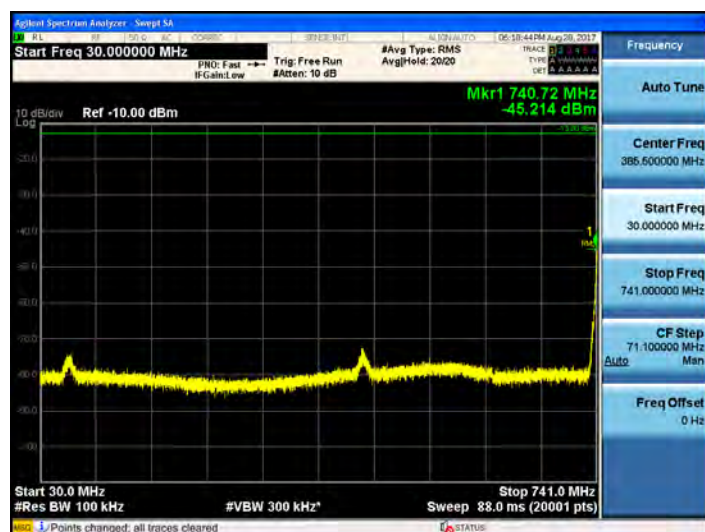
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 741 MHz



741 MHz ~ 745.9 MHz



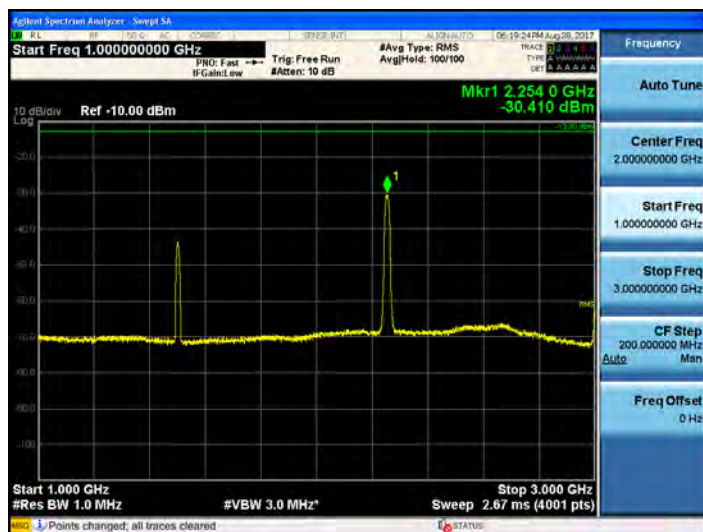
757.1 MHz ~ 762 MHz



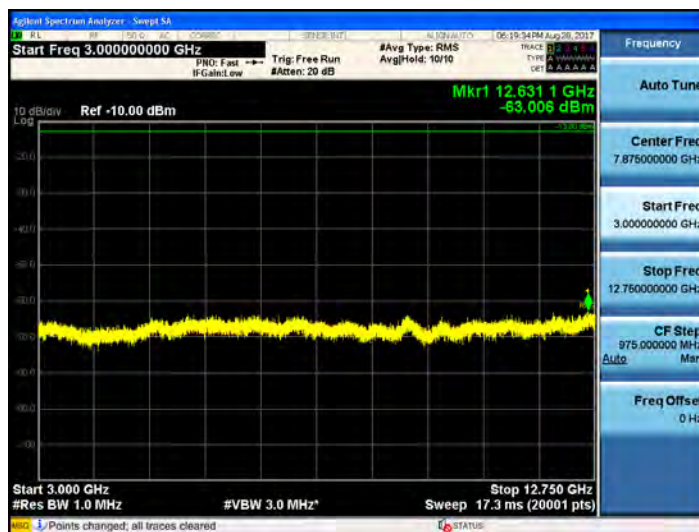
762 MHz ~ 1 GHz



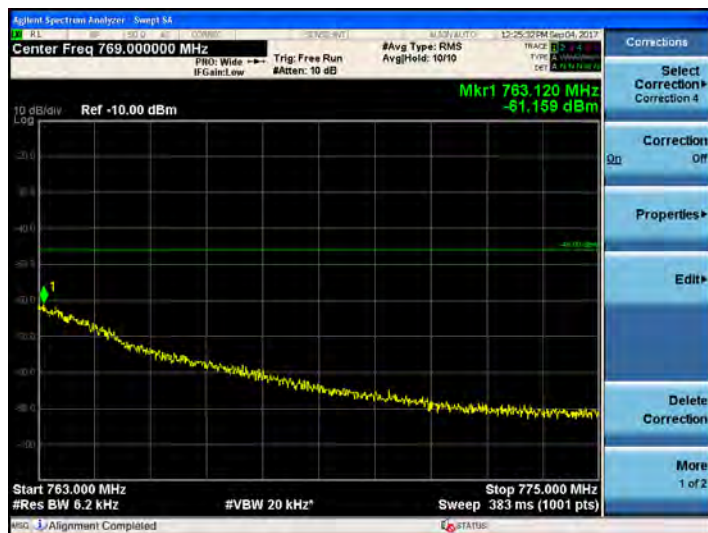
1 GHz ~ 3 GHz



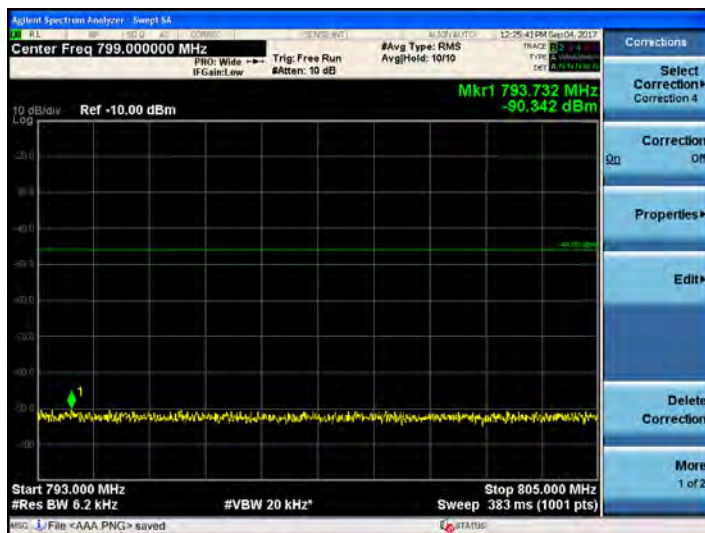
3 GHz ~ 12.75 GHz



763 MHz ~ 775 MHz



793 MHz ~ 805 MHz



1 599 MHz ~ 1 610 MHz (1)



1 599 MHz ~ 1 610 MHz (2)

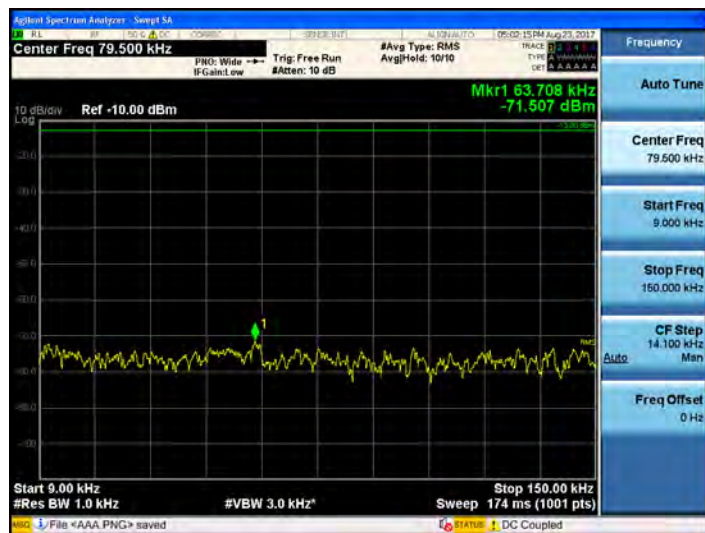


LTE Band 4 (10 MHz)

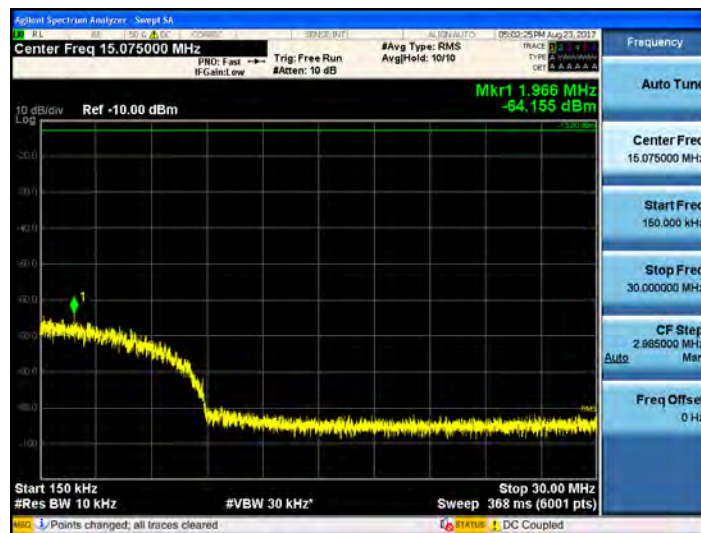
Test Data at Output Port 1

(QPSK Low channel)

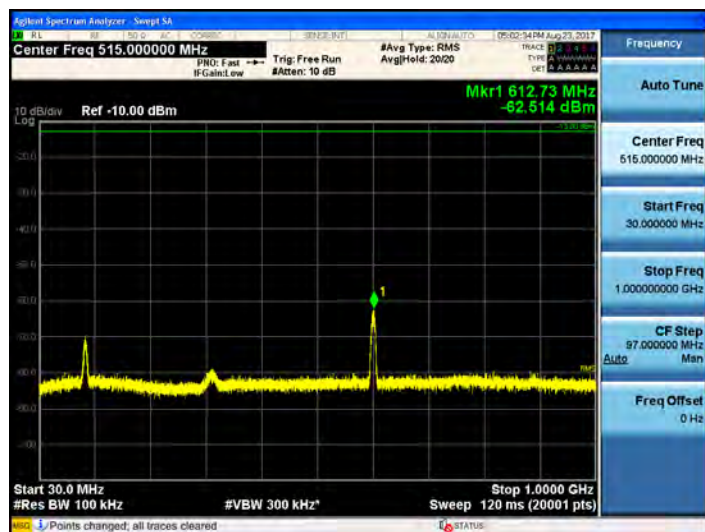
9 kHz ~ 150 kHz



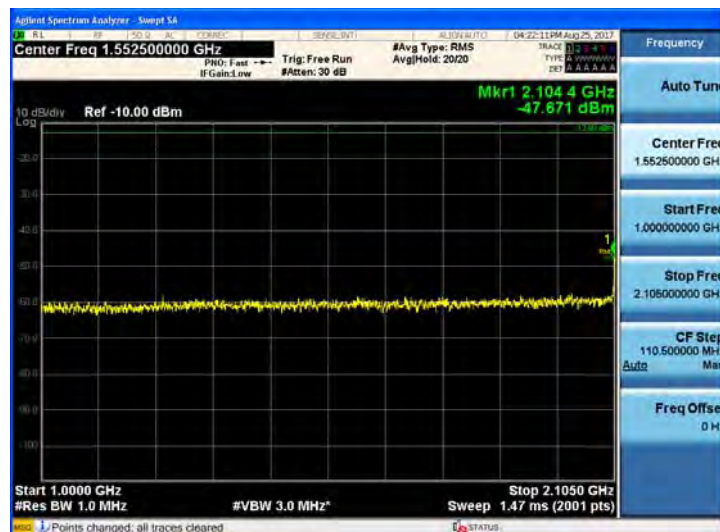
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

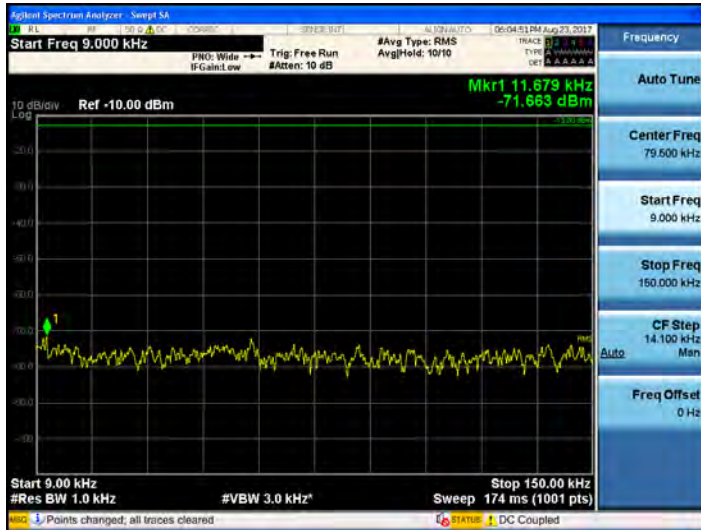


12.75 GHz ~ 26.5 GHz

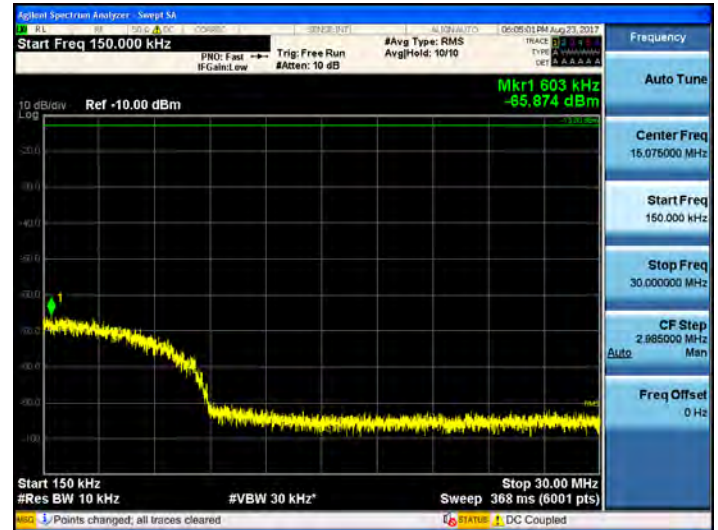


(QPSK Middle channel)

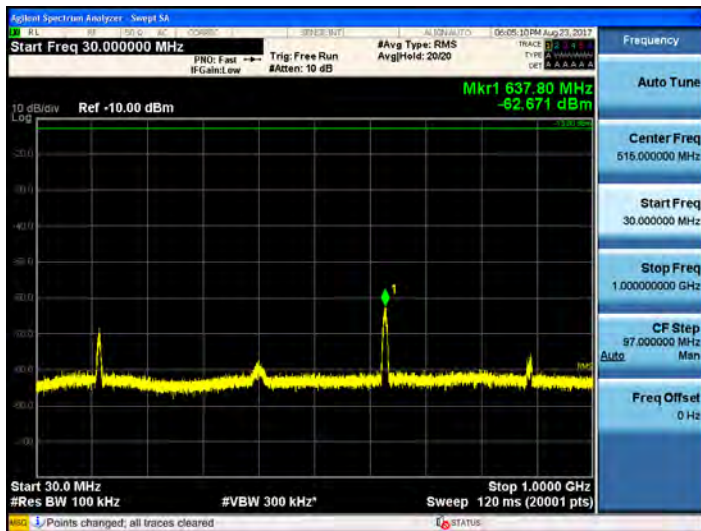
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



12.75 GHz ~ 26.5 GHz

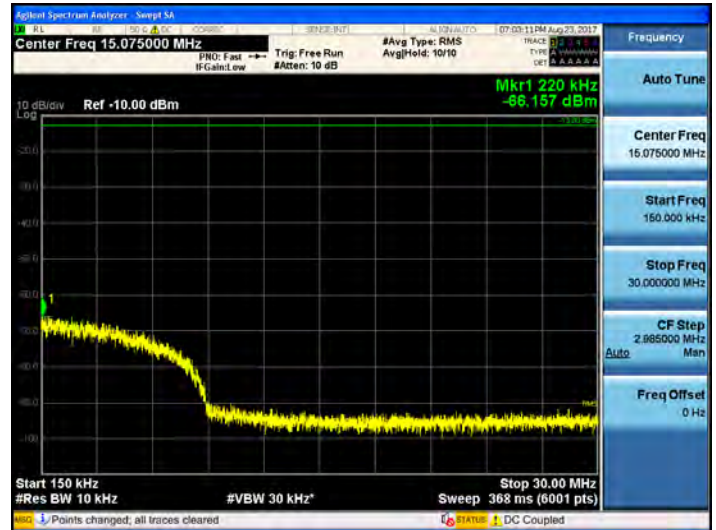


(QPSK High channel)

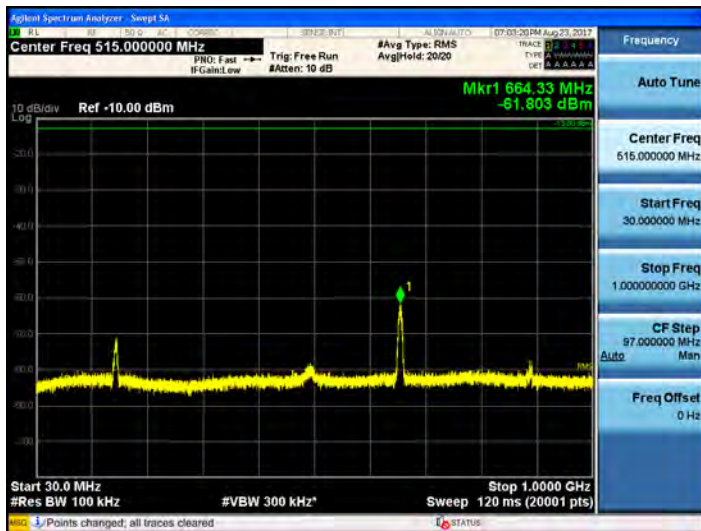
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



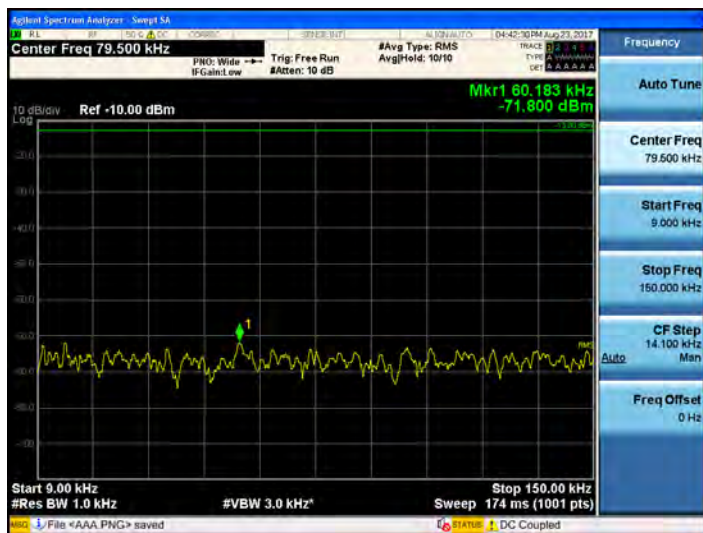
12.75 GHz ~ 26.5 GHz



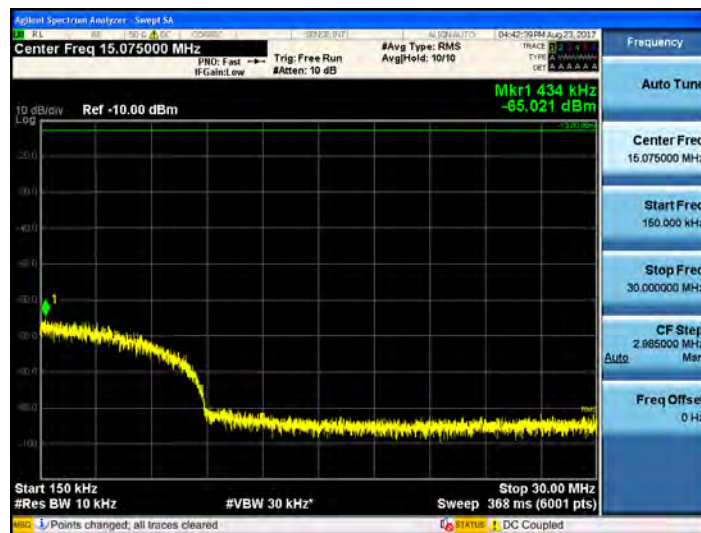
Test Data at Output Port 1

(16QAM Low channel)

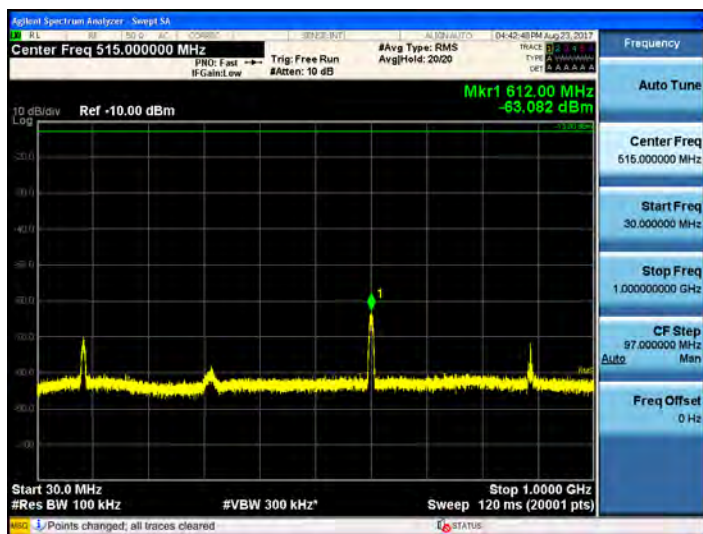
9 kHz ~ 150 kHz



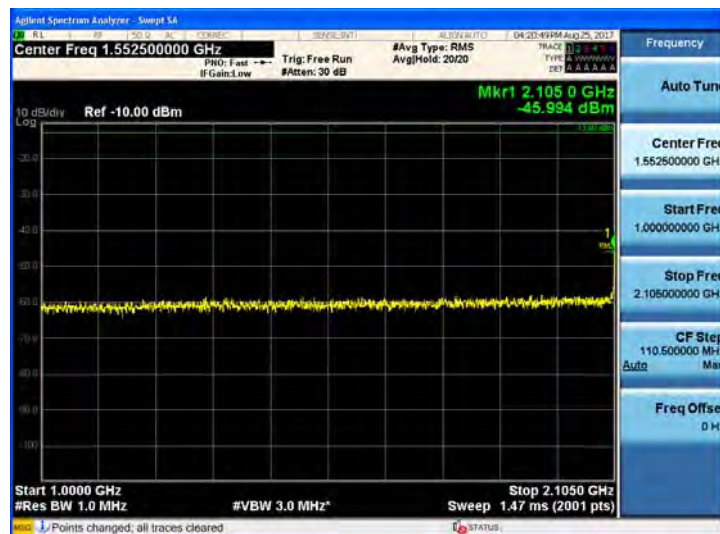
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

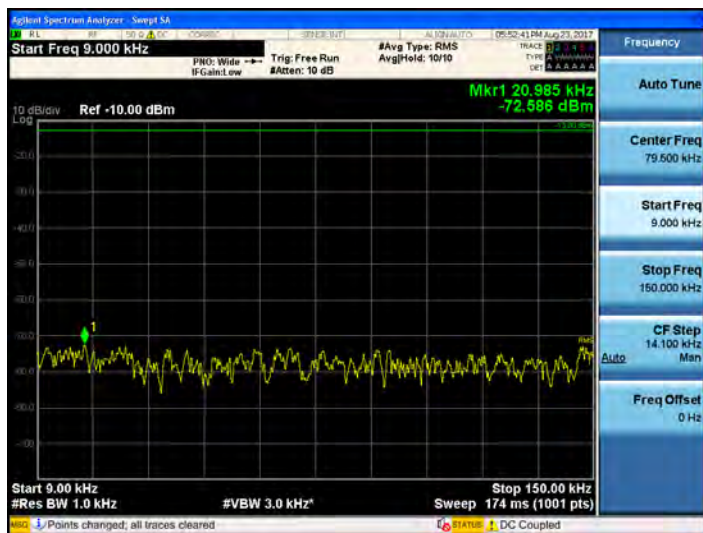


12.75 GHz ~ 26.5 GHz

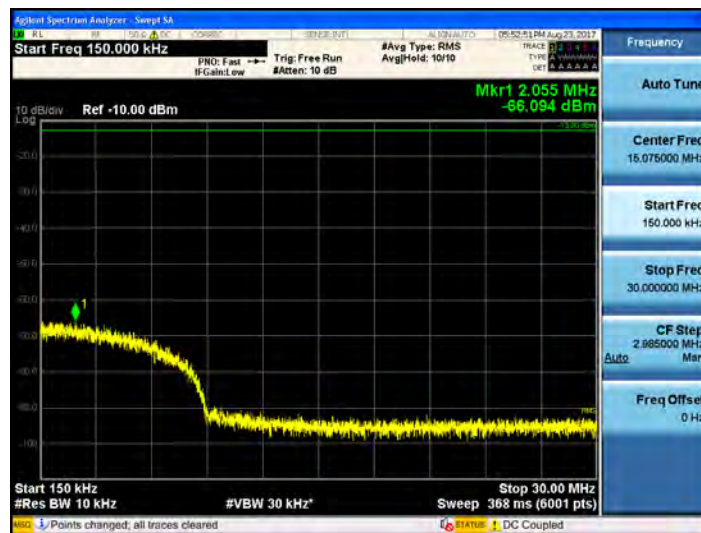


(16QAM Middle channel)

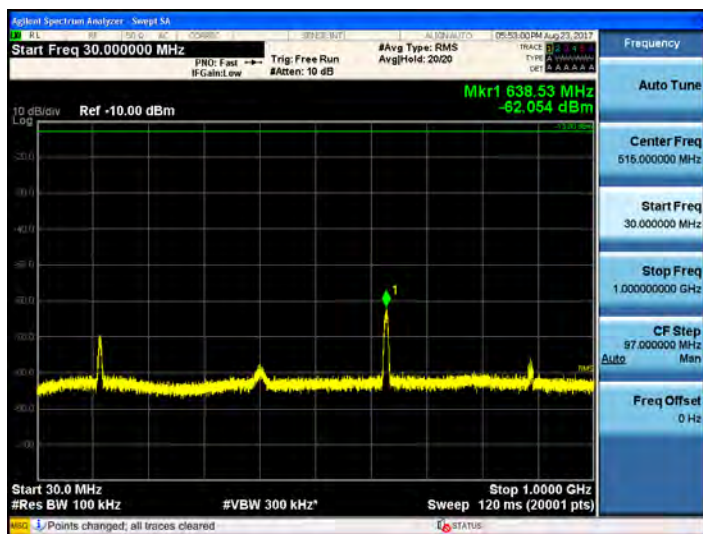
9 kHz ~ 150 kHz



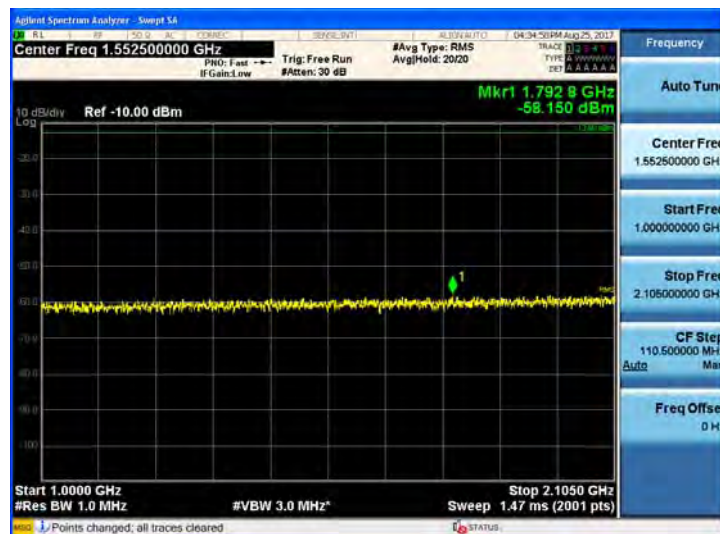
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

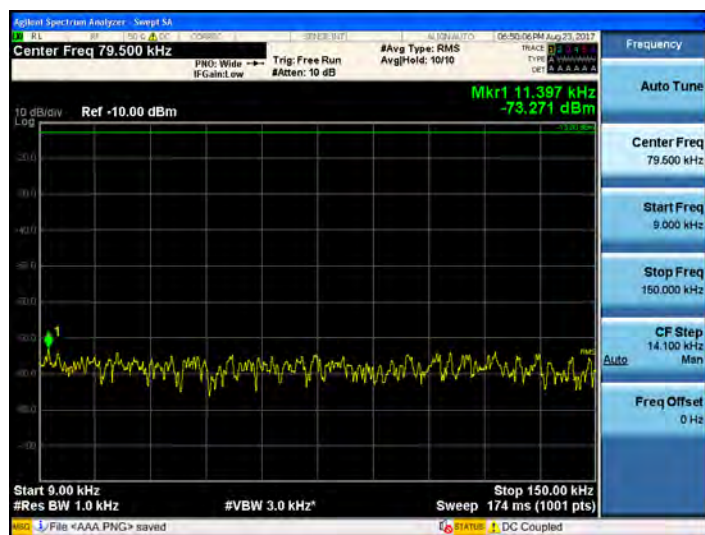


12.75 GHz ~ 26.5 GHz

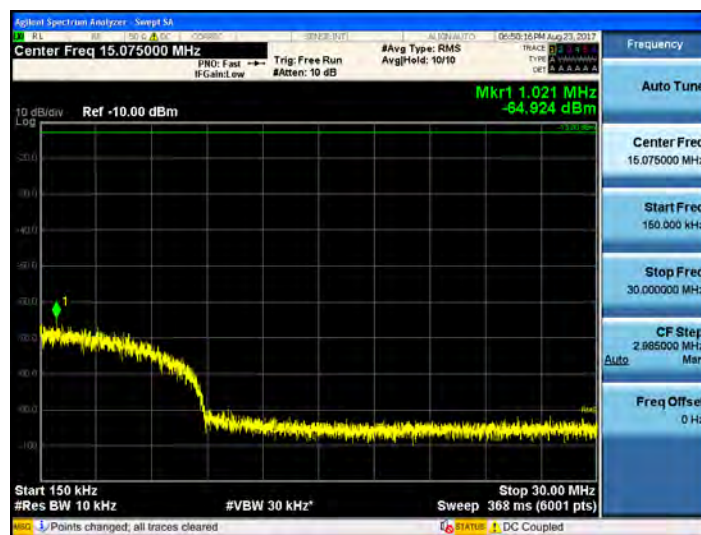


(16QAM High channel)

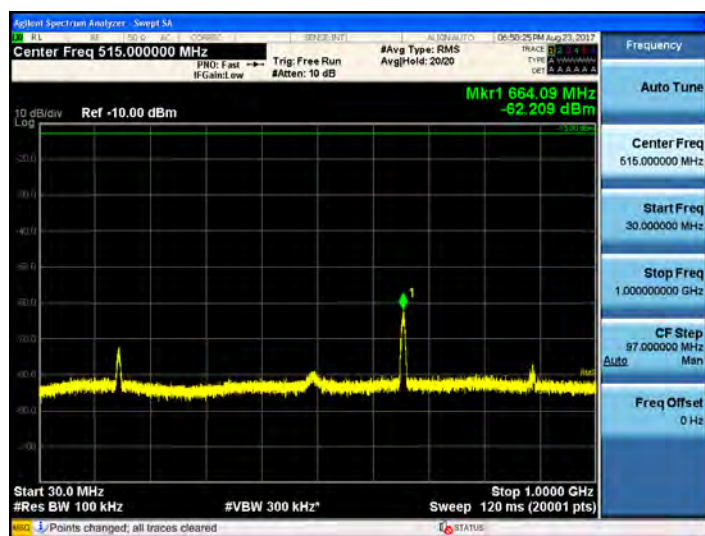
9 kHz ~ 150 kHz



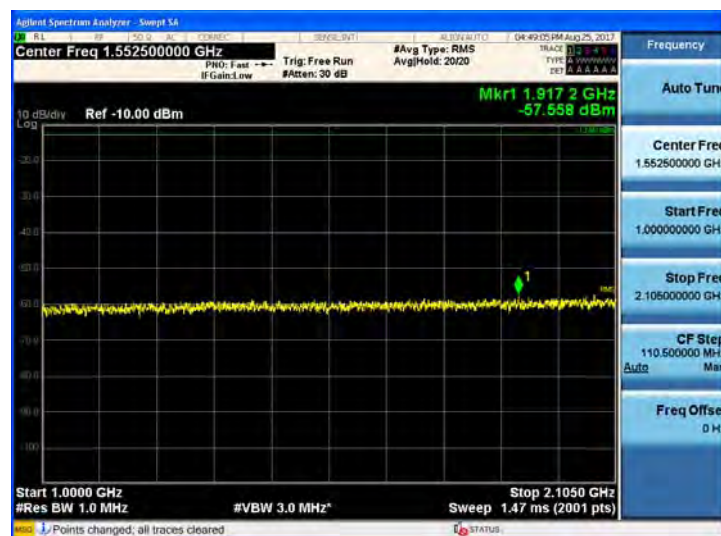
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



12.75 GHz ~ 26.5 GHz



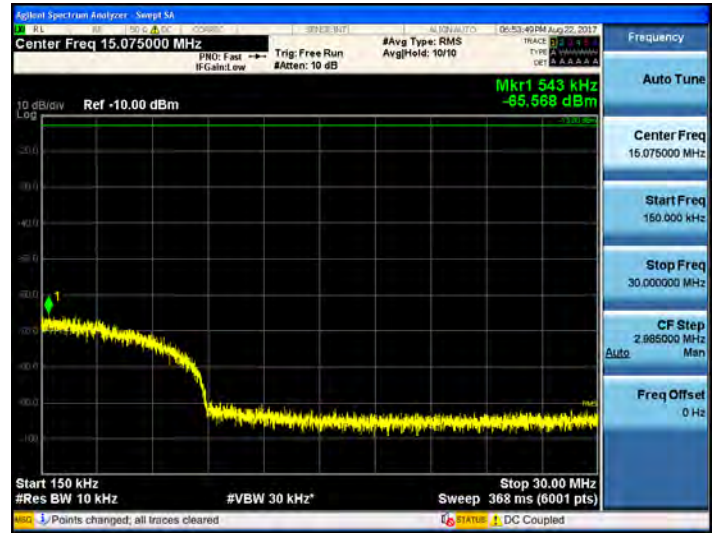
Test Data at Output Port 1

(64QAM Low channel)

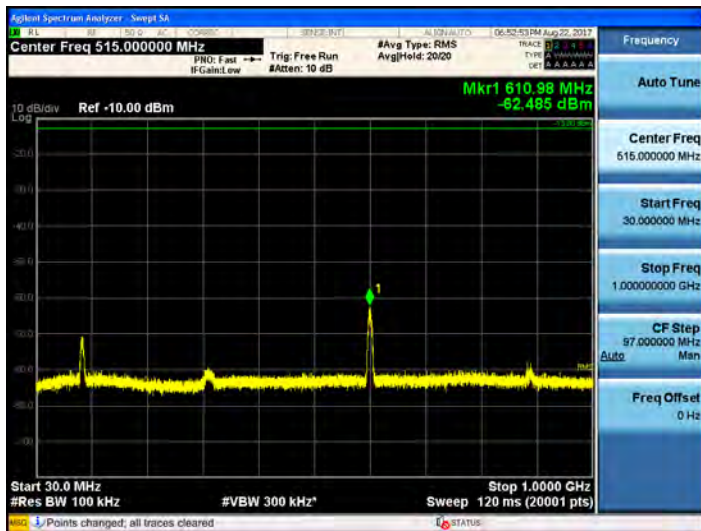
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

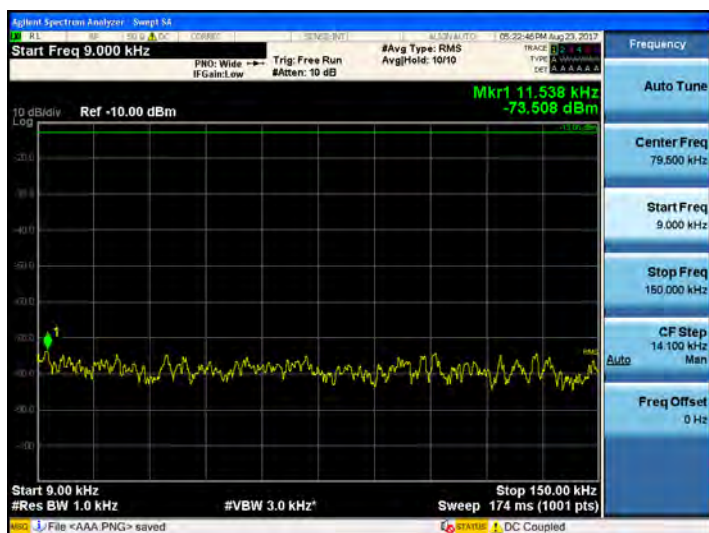


12.75 GHz ~ 26.5 GHz

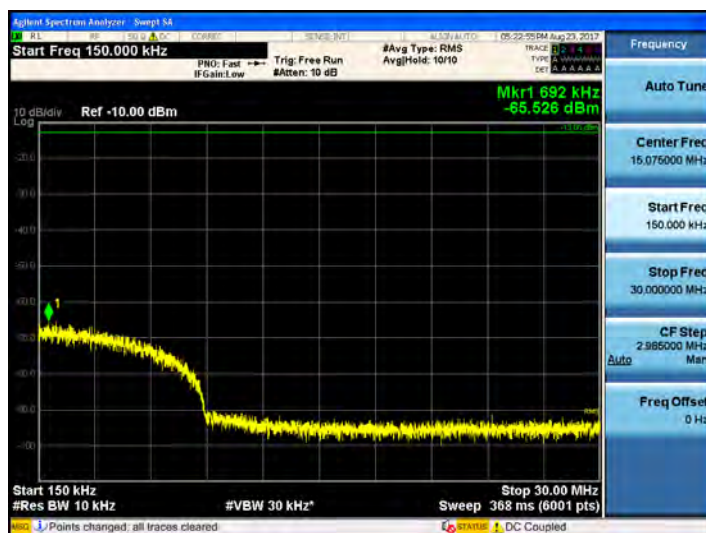


(64QAM Middle channel)

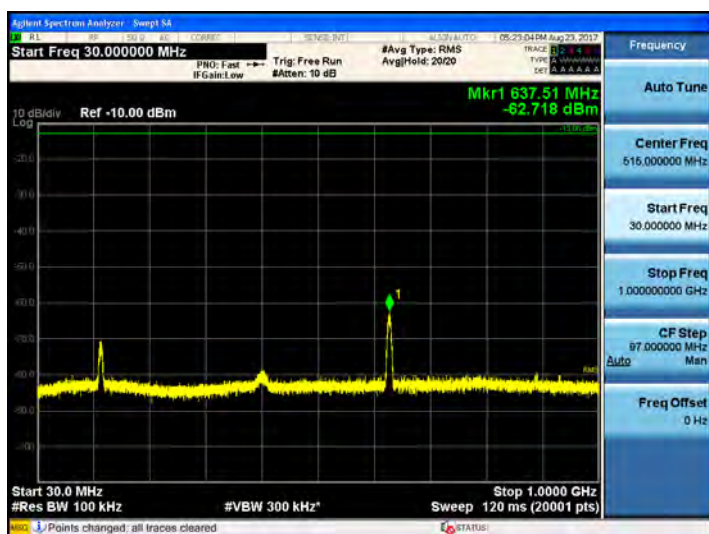
9 kHz ~ 150 kHz



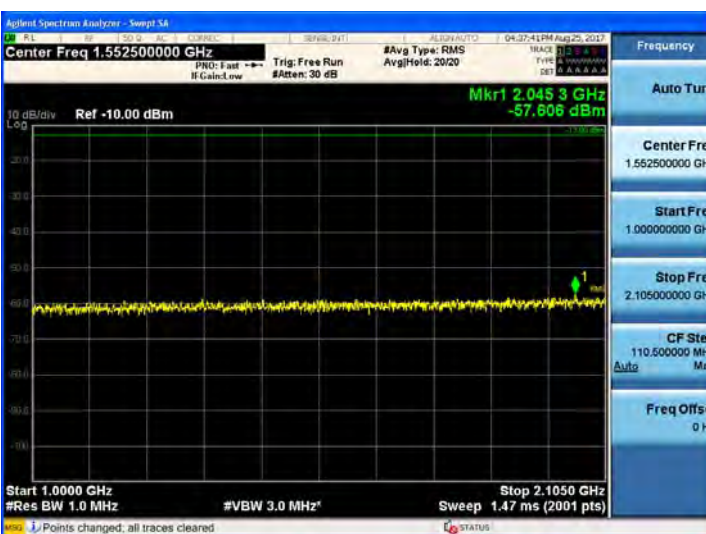
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

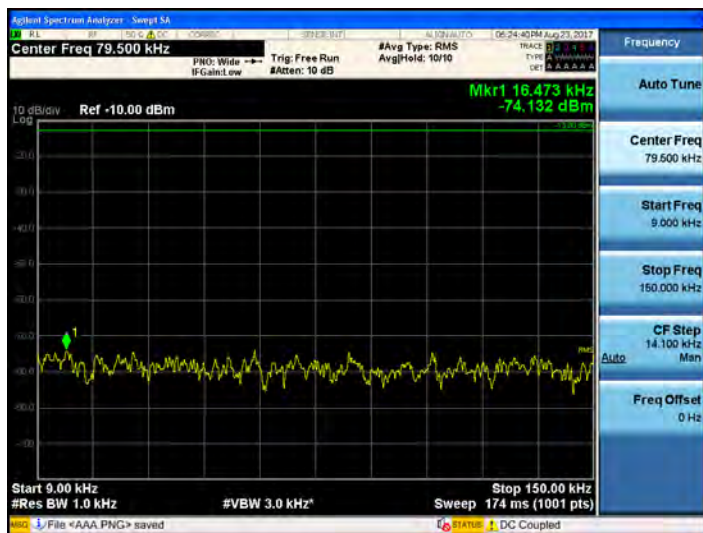


12.75 GHz ~ 26.5 GHz

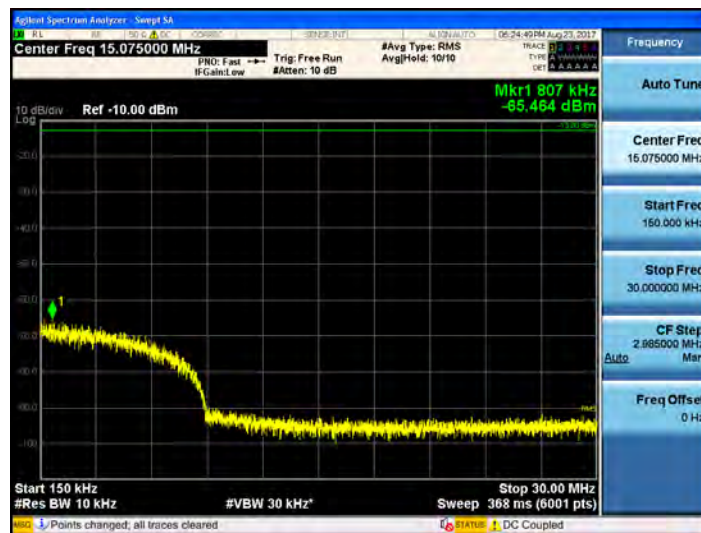


(64QAM High channel)

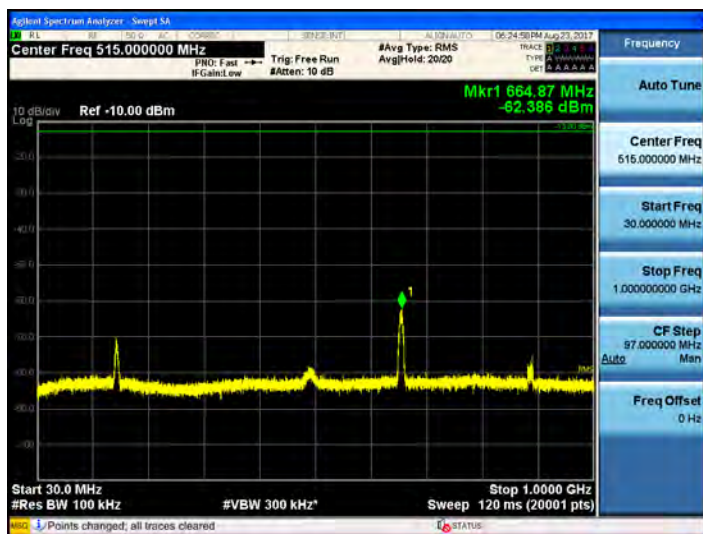
9 kHz ~ 150 kHz



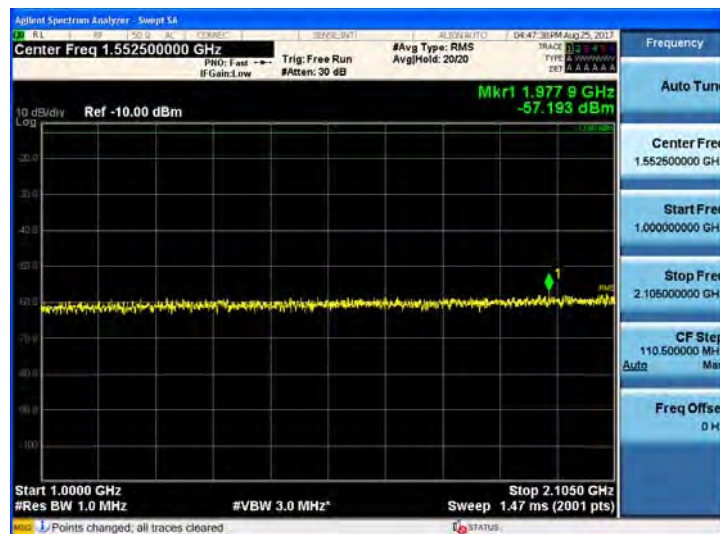
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



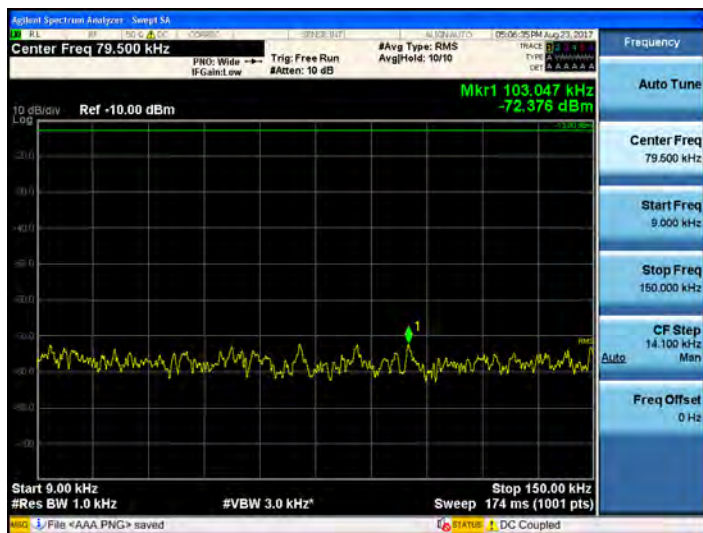
12.75 GHz ~ 26.5 GHz



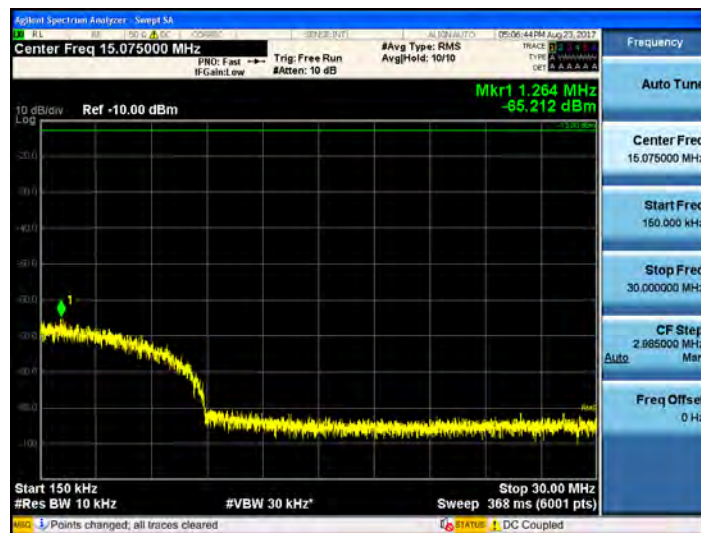
Test Data at Output Port 2

(QPSK Low channel)

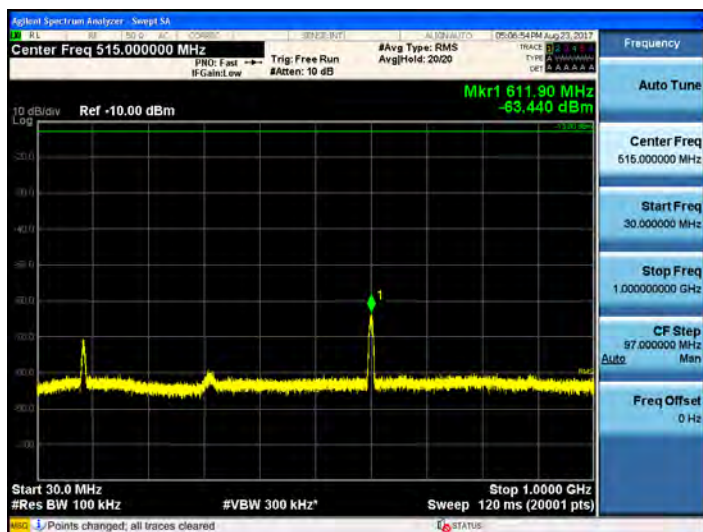
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



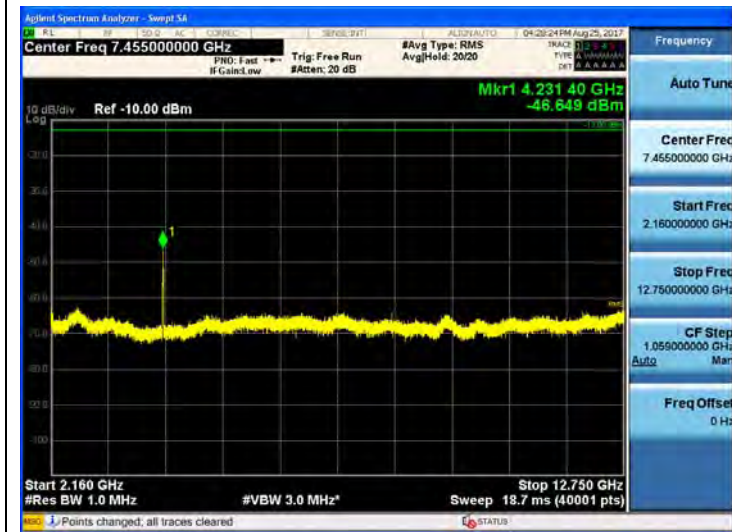
30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

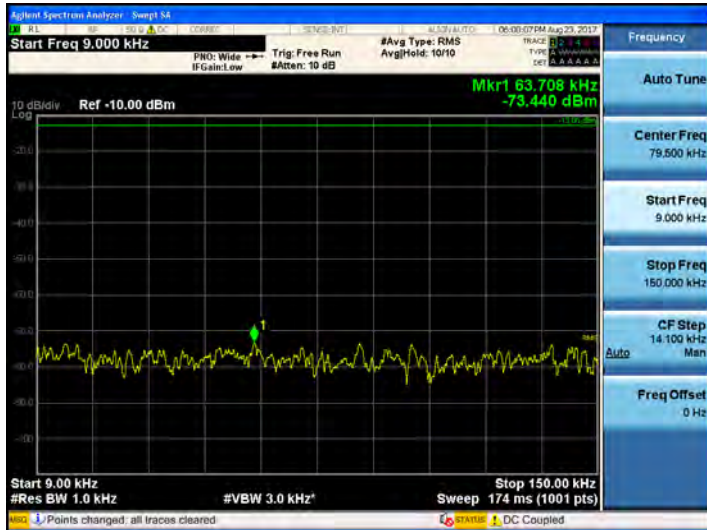


12.75 GHz ~ 26.5 GHz

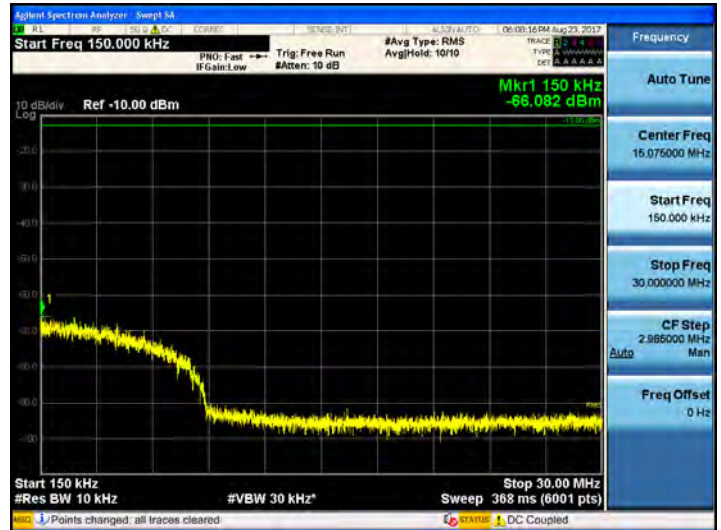


(QPSK Middle channel)

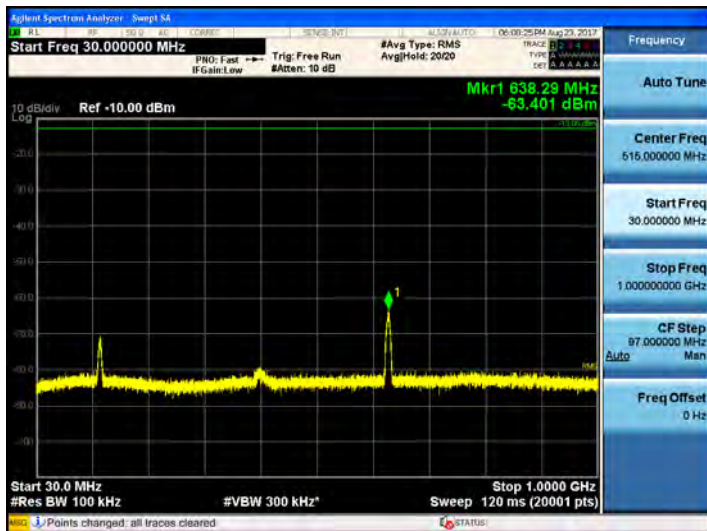
9 kHz ~ 150 kHz



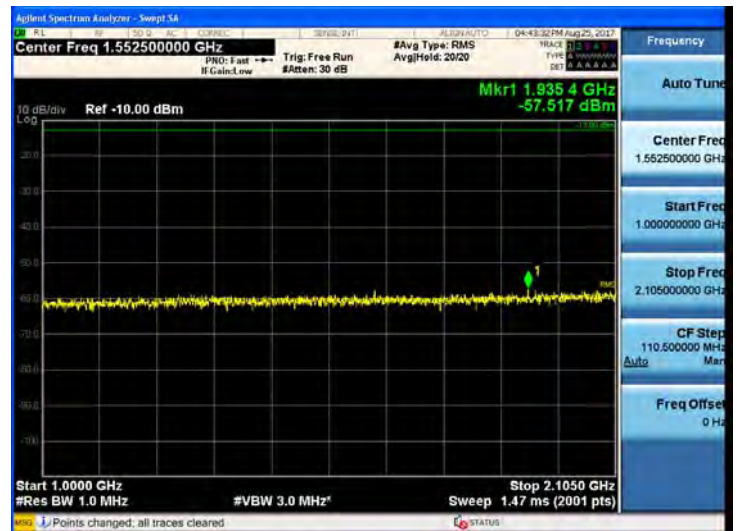
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

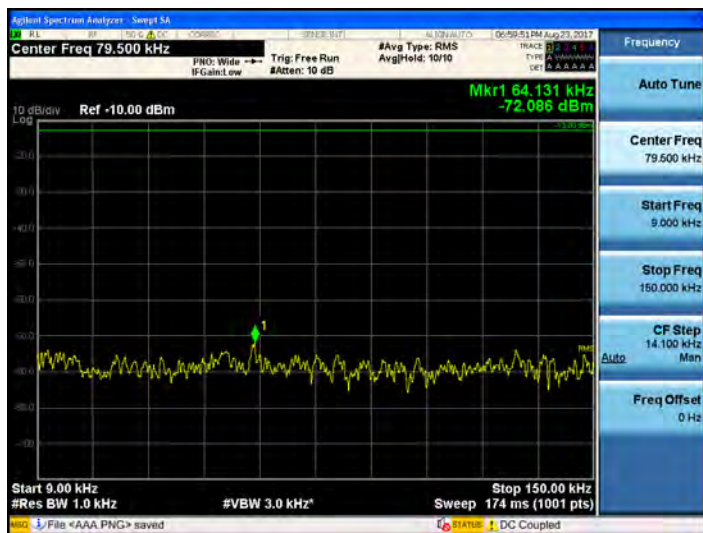


12.75 GHz ~ 26.5 GHz

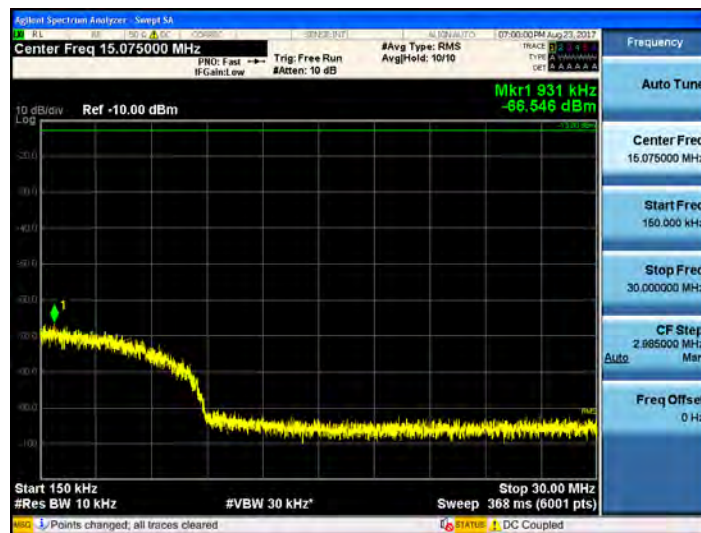


(QPSK High channel)

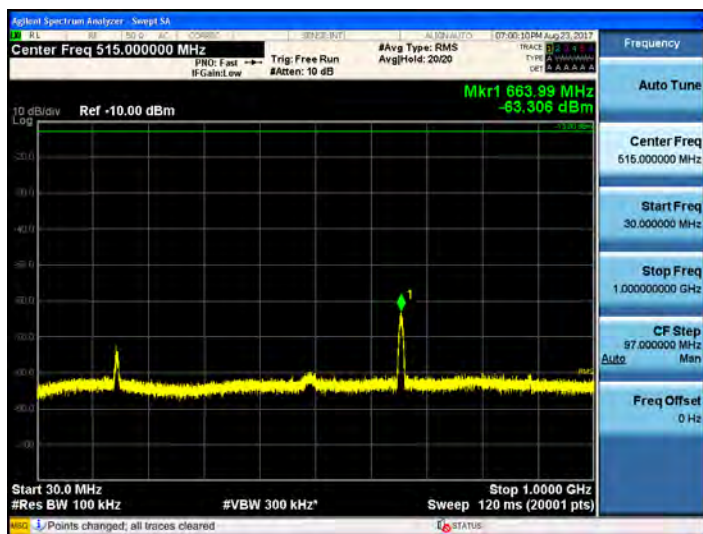
9 kHz ~ 150 kHz



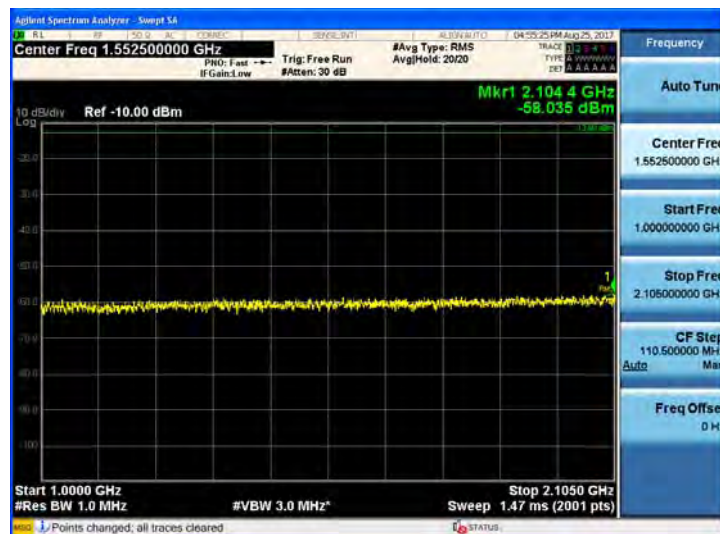
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

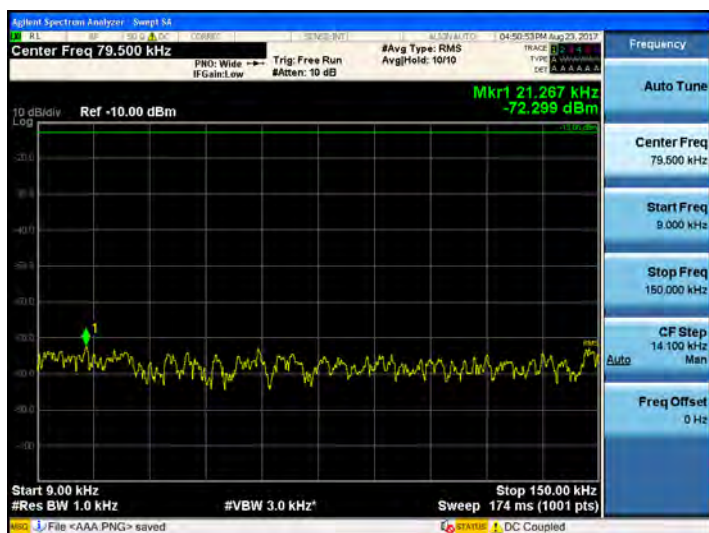


12.75 GHz ~ 26.5 GHz

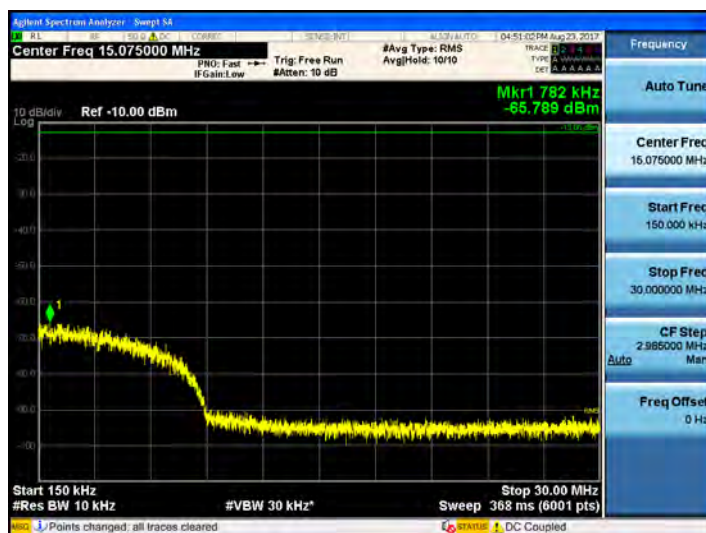


Test Data at Output Port 2
(16QAM Low channel)

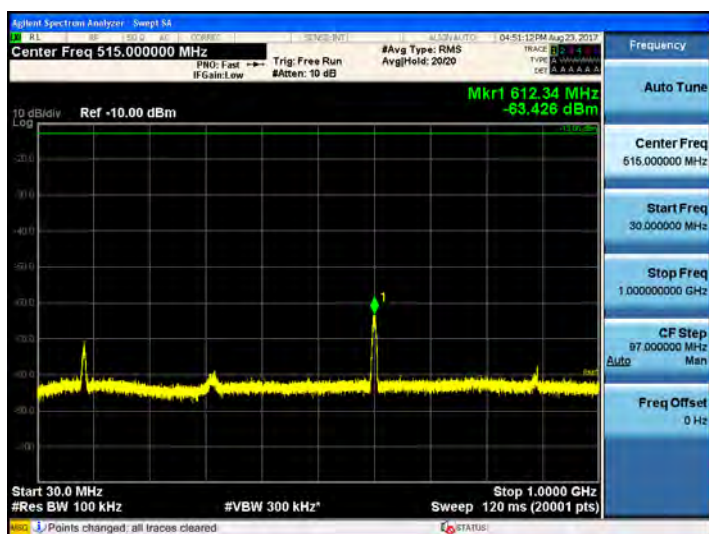
9 kHz ~ 150 kHz



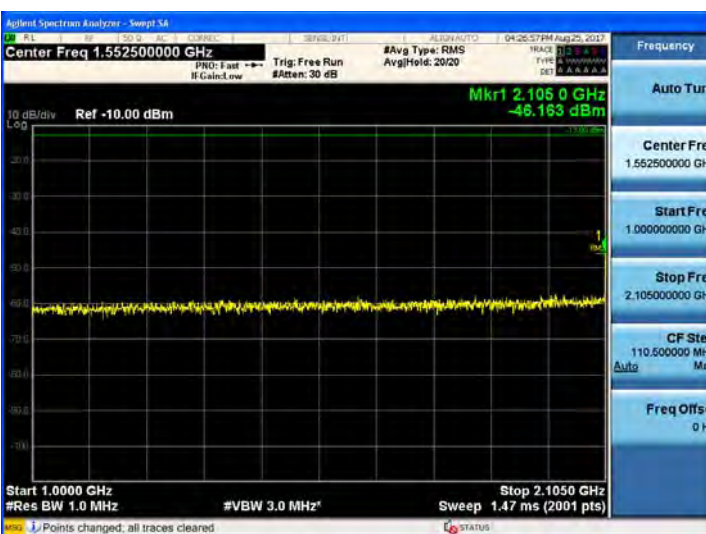
150 kHz ~ 30 MHz



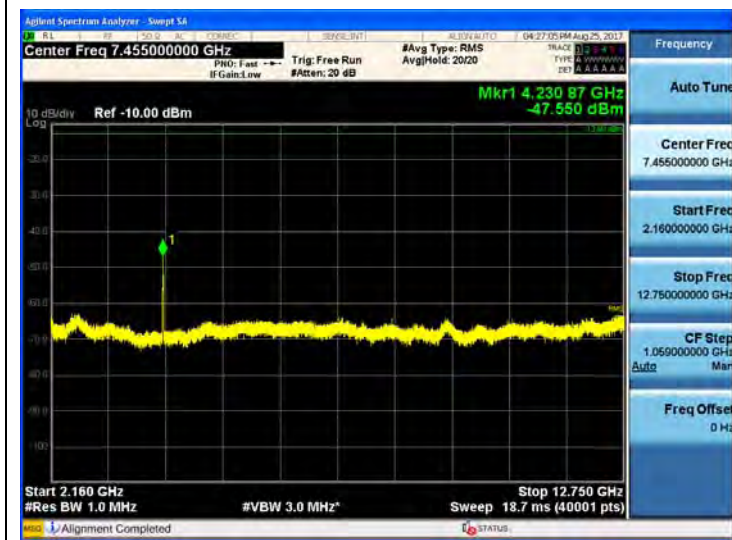
30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

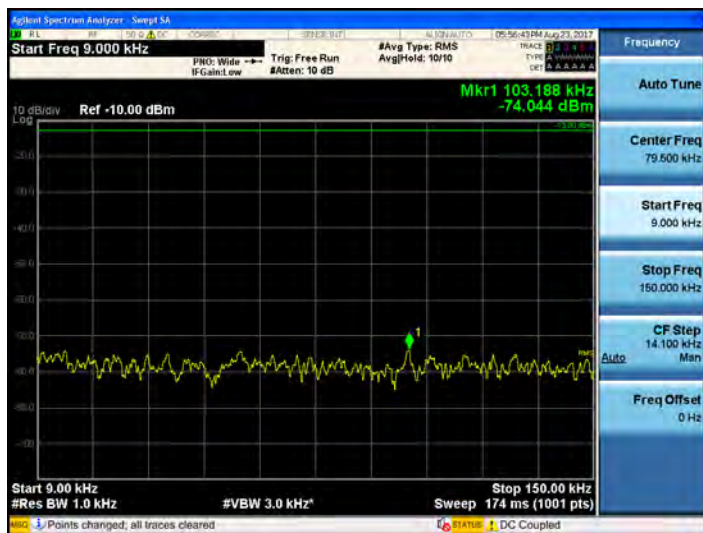


12.75 GHz ~ 26.5 GHz

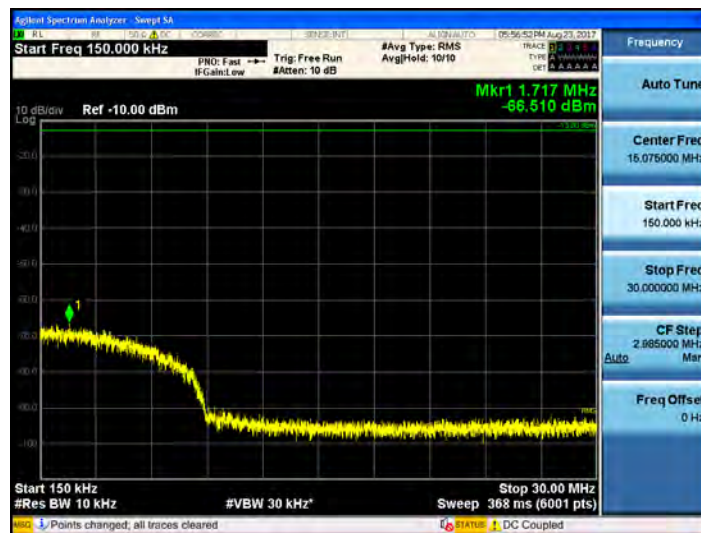


(16QAM Middle channel)

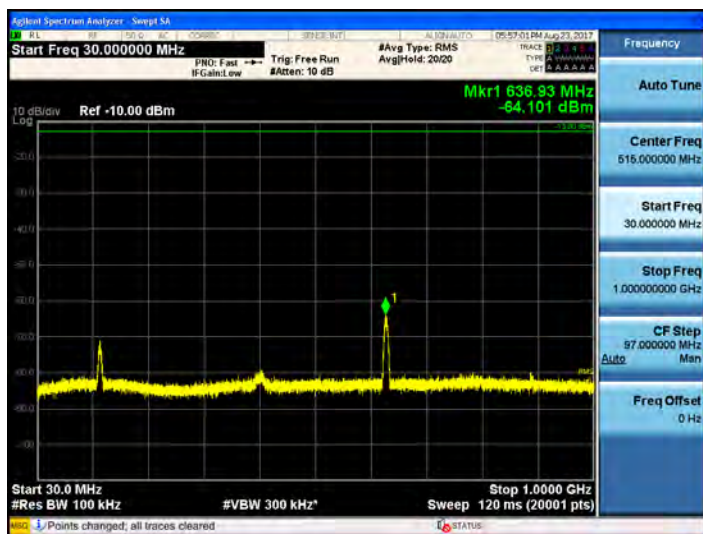
9 kHz ~ 150 kHz



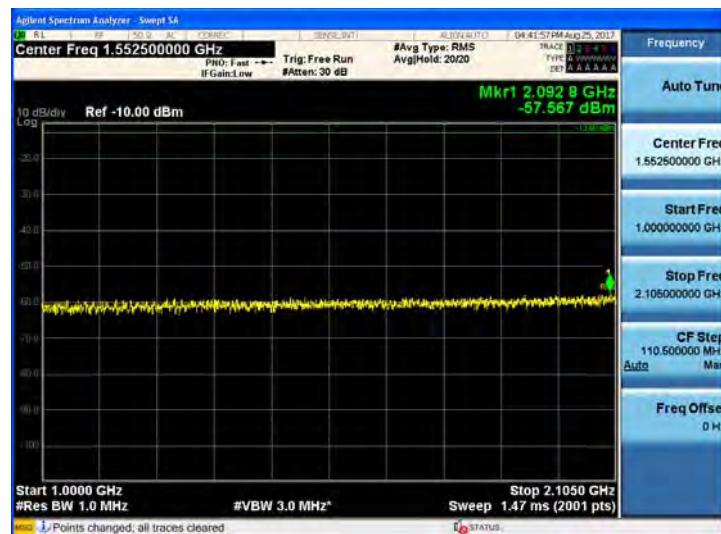
150 kHz ~ 30 MHz



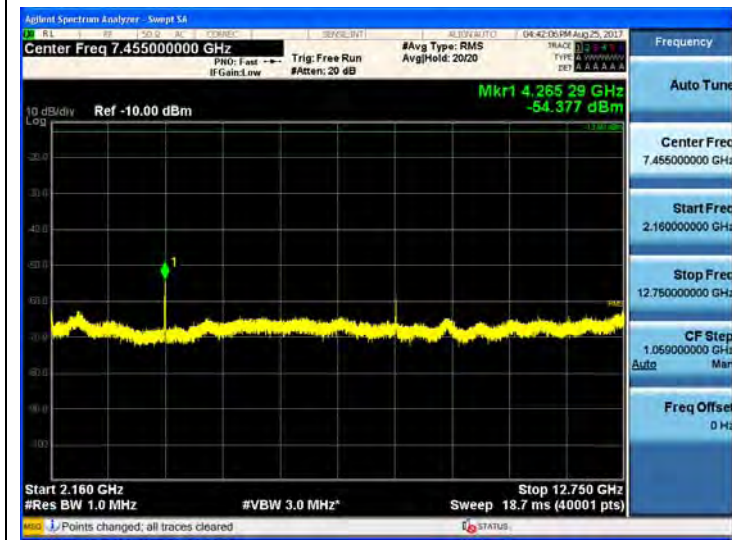
30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

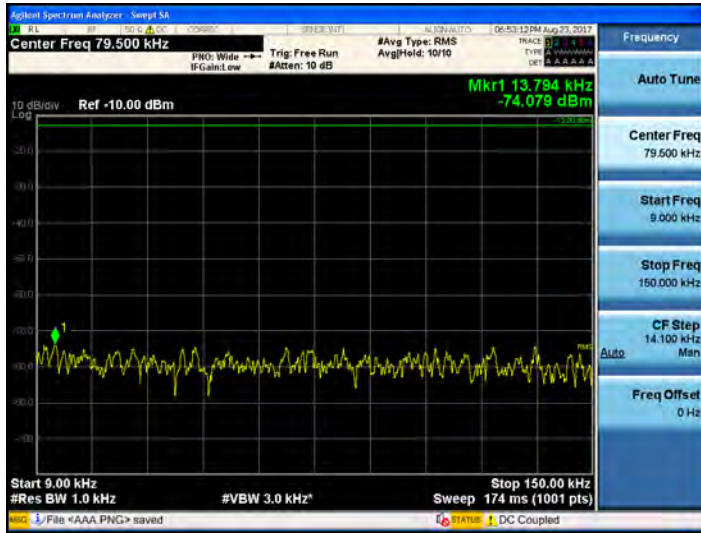


12.75 GHz ~ 26.5 GHz



(16QAM High channel)

9 kHz ~ 150 kHz



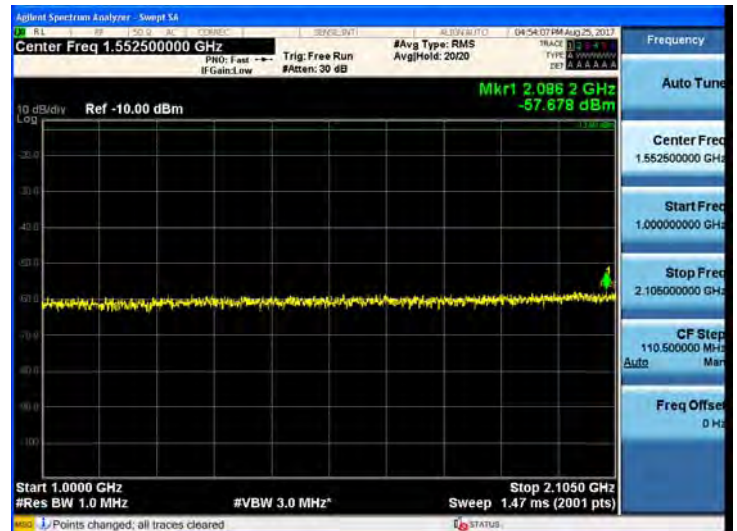
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



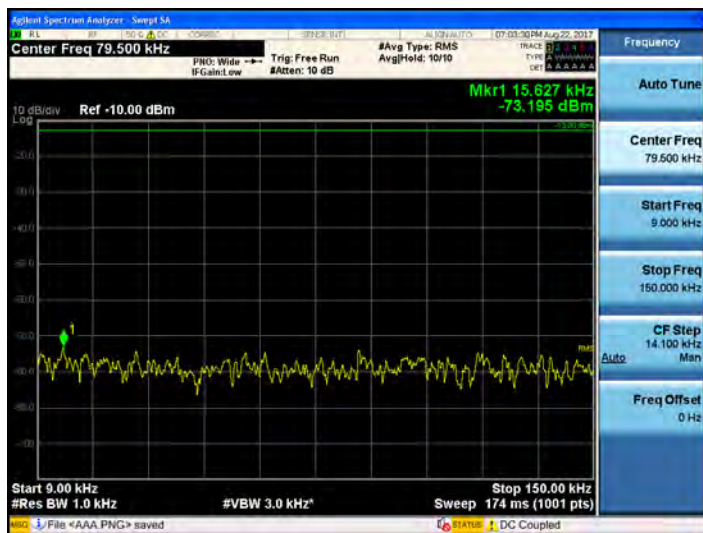
12.75 GHz ~ 26.5 GHz



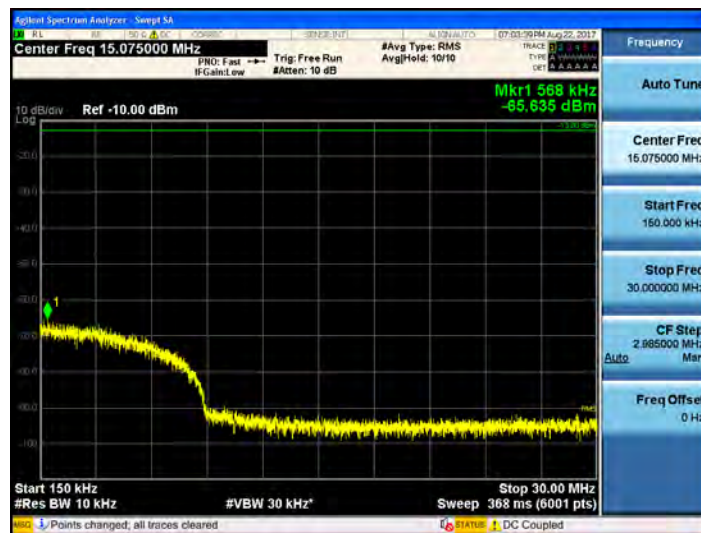
Test Data at Output Port 2

(64QAM Low channel)

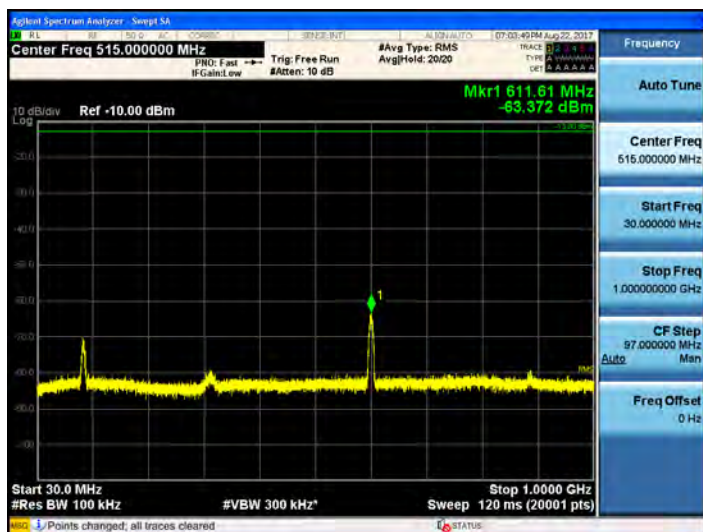
9 kHz ~ 150 kHz



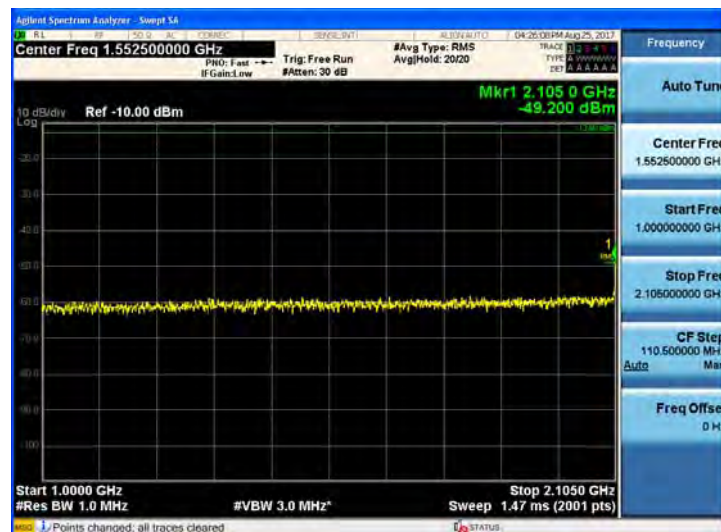
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

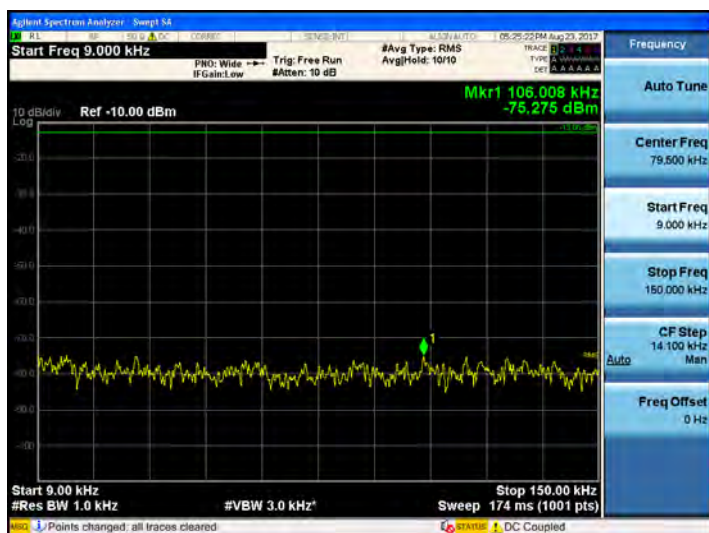


12.75 GHz ~ 26.5 GHz



(64QAM Middle channel)

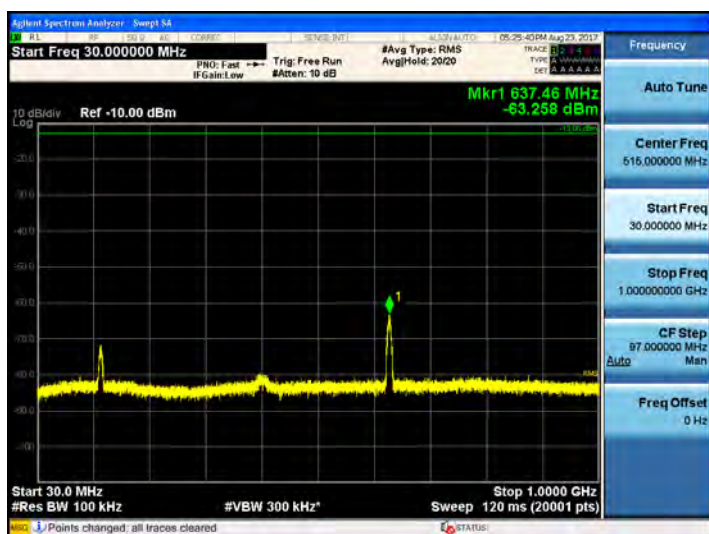
9 kHz ~ 150 kHz



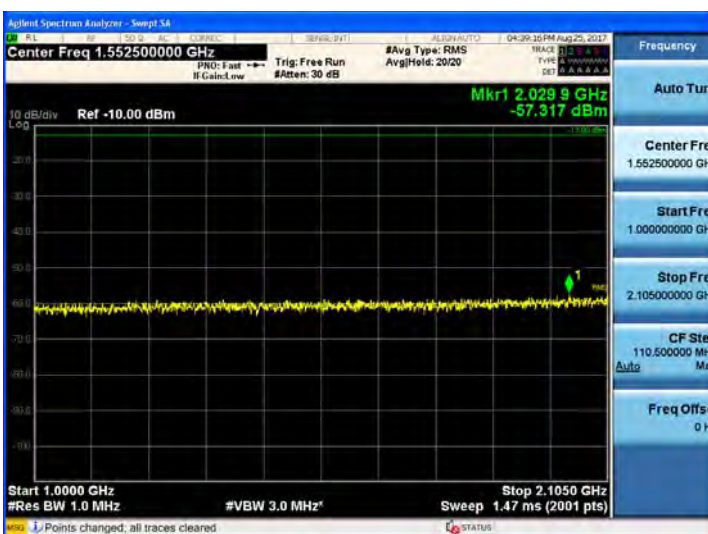
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



12.75 GHz ~ 26.5 GHz

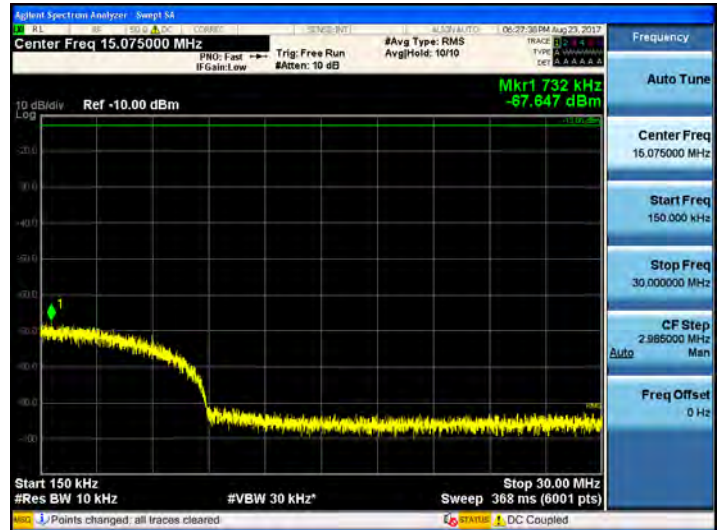


(64QAM High channel)

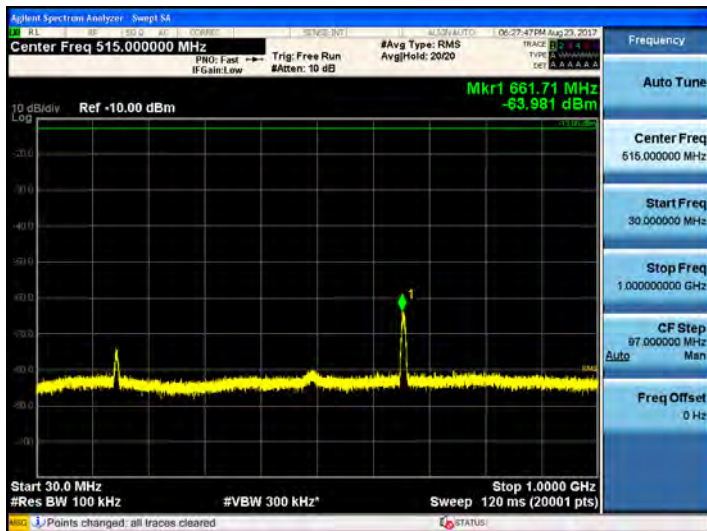
9 kHz ~ 150 kHz



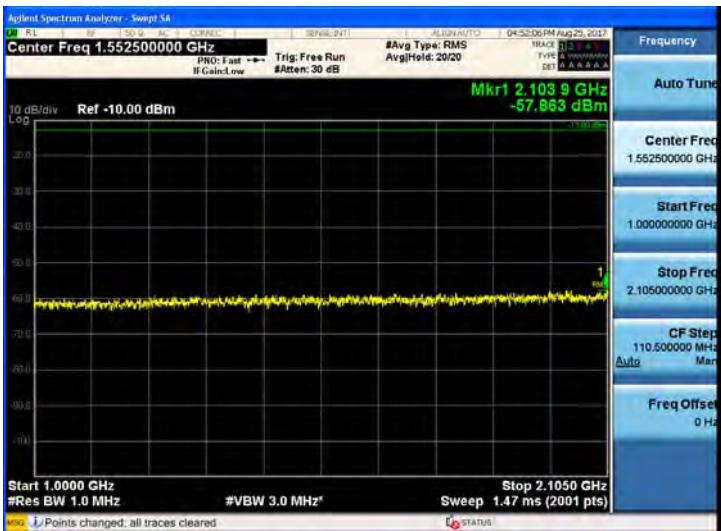
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



12.75 GHz ~ 26.5 GHz

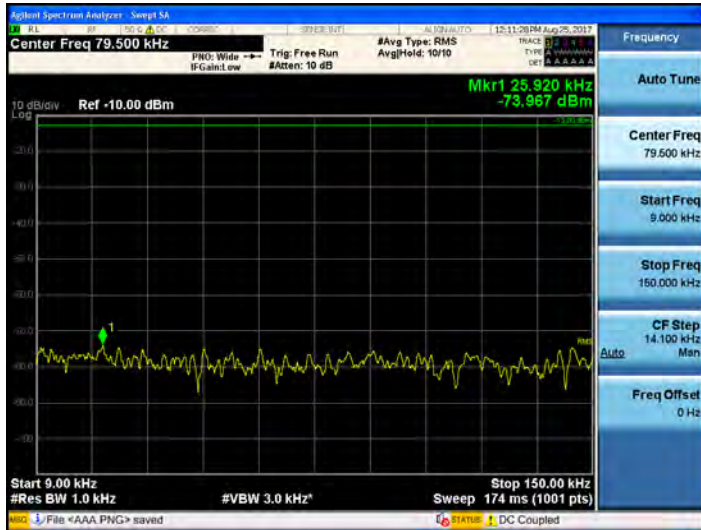


LTE Band 4 (15 MHz)

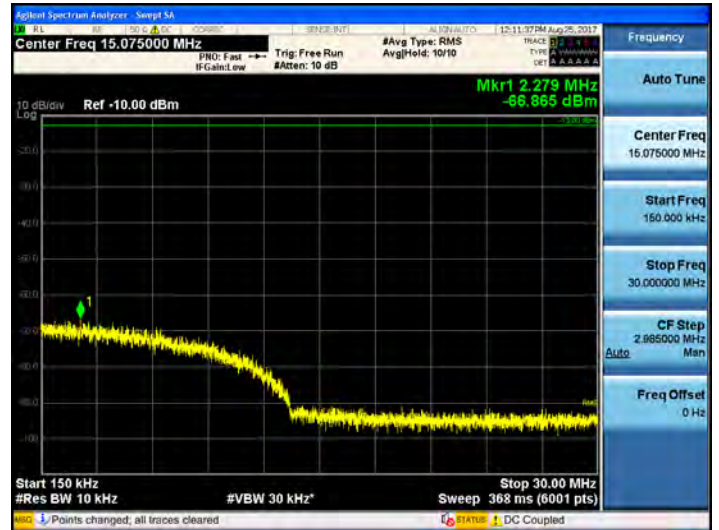
Test Data at Output Port 1

(QPSK Low channel)

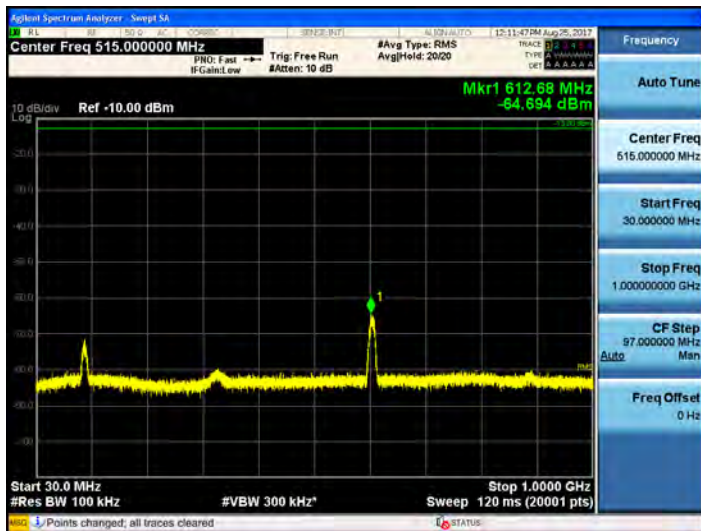
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



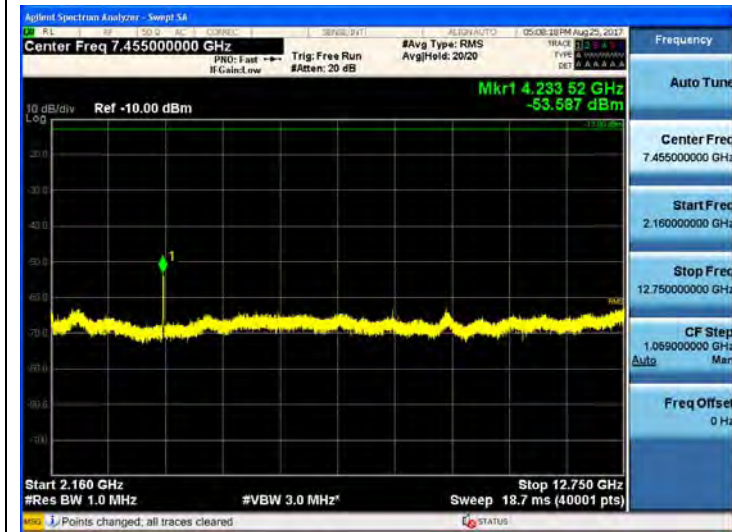
30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

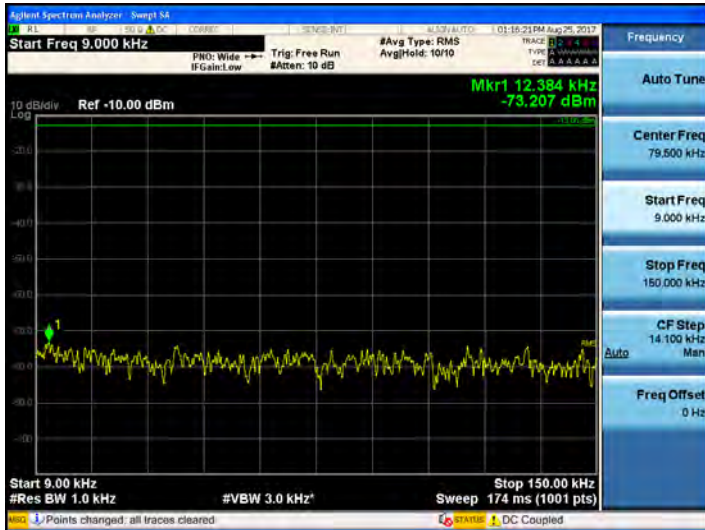


12.75 GHz ~ 26.5 GHz

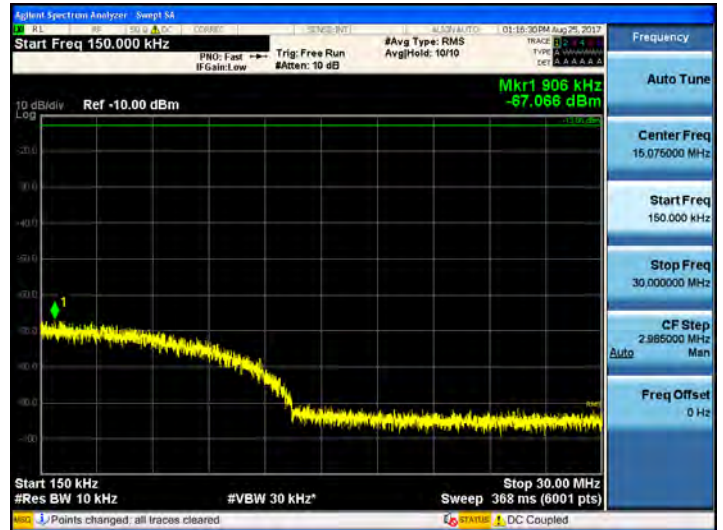


(QPSK Middle channel)

9 kHz ~ 150 kHz



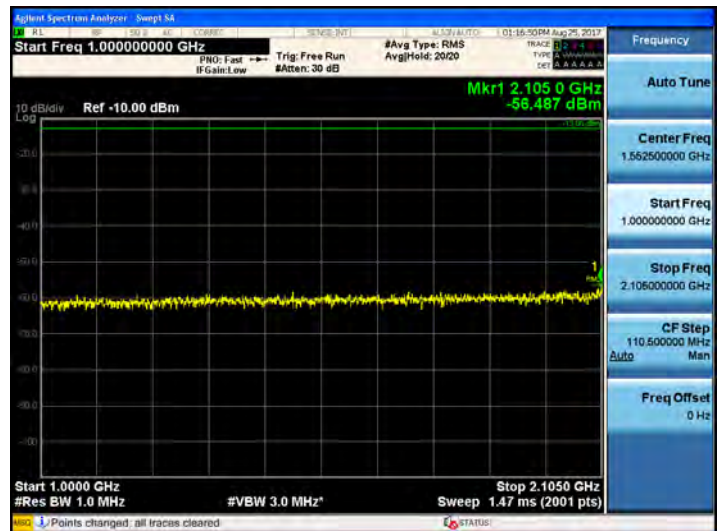
150 kHz ~ 30 MHz



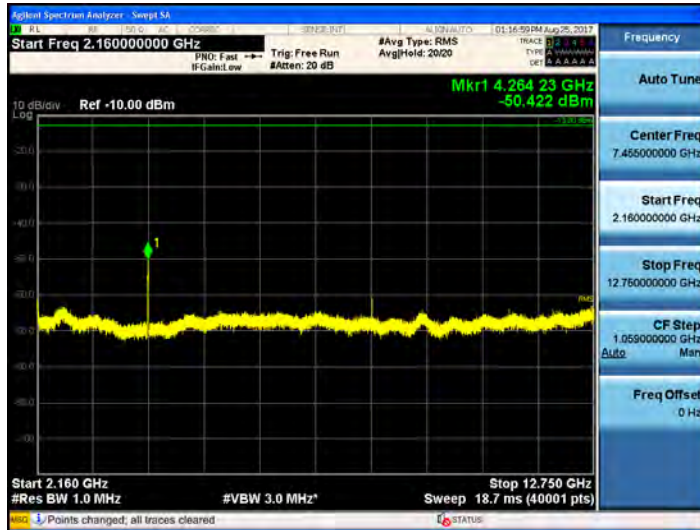
30 MHz ~ 1 GHz



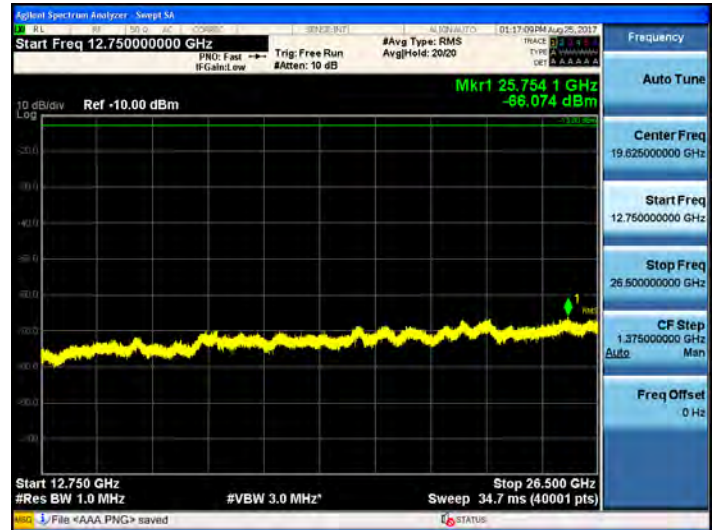
1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



12.75 GHz ~ 26.5 GHz



(QPSK High channel)

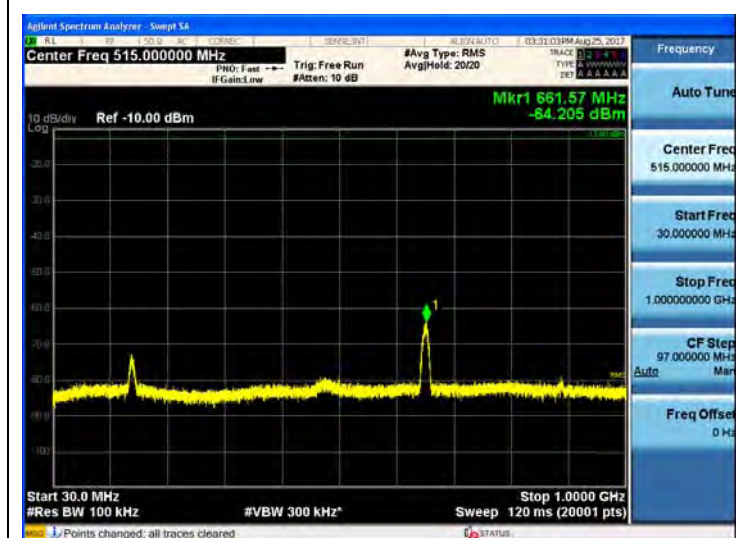
9 kHz ~ 150 kHz



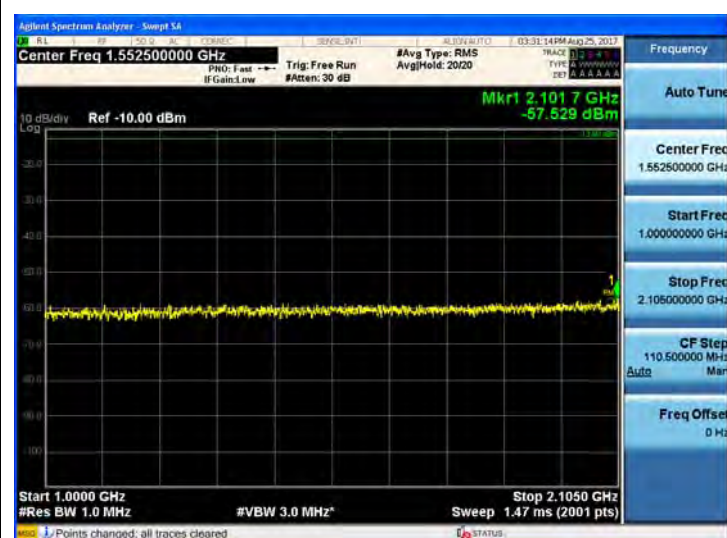
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



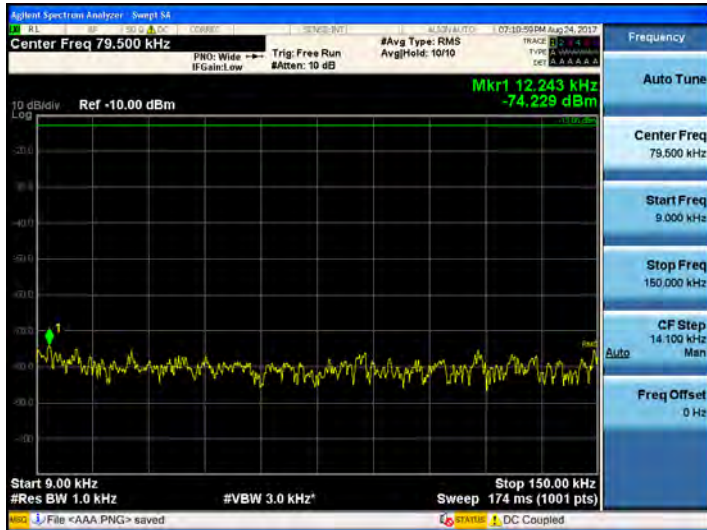
12.75 GHz ~ 26.5 GHz



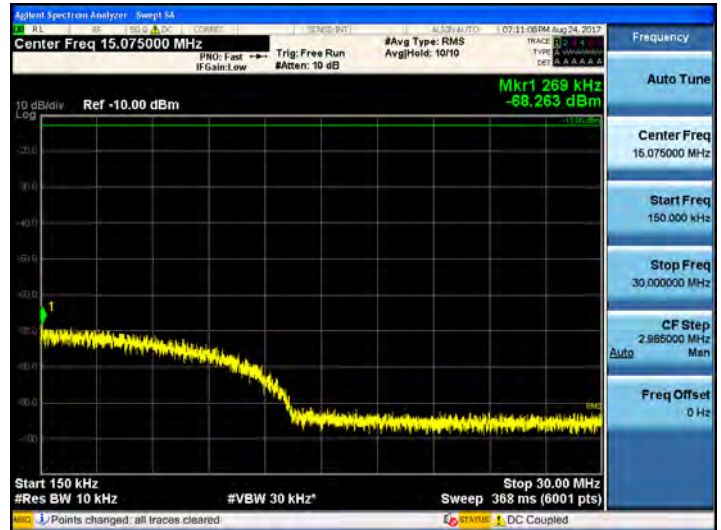
Test Data at Output Port 1

(16QAM Low channel)

9 kHz ~ 150 kHz



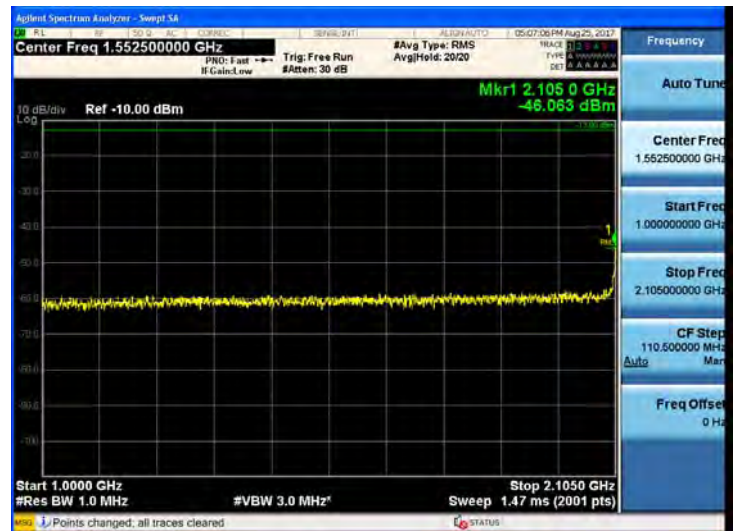
150 kHz ~ 30 MHz



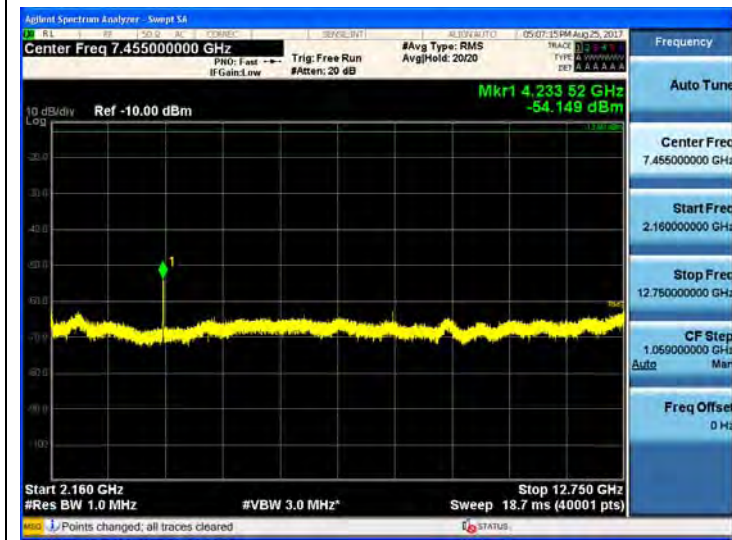
30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

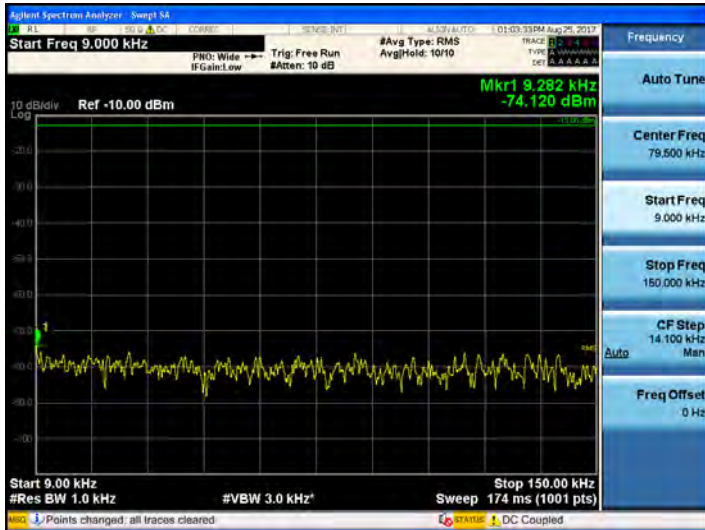


12.75 GHz ~ 26.5 GHz

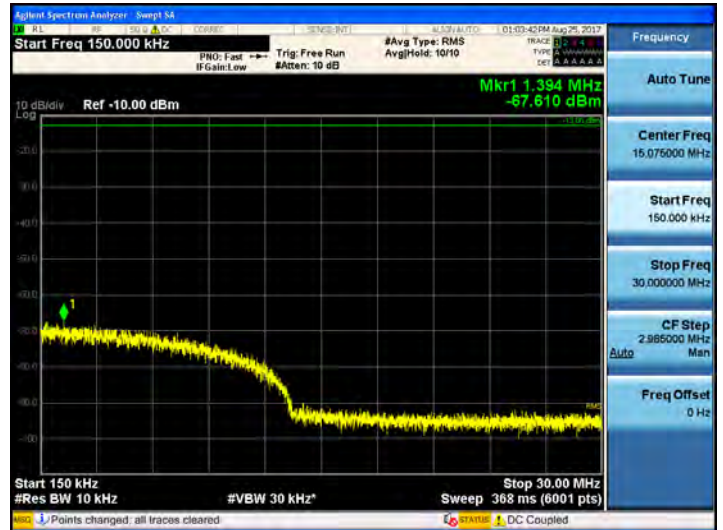


(16QAM Middle channel)

9 kHz ~ 150 kHz



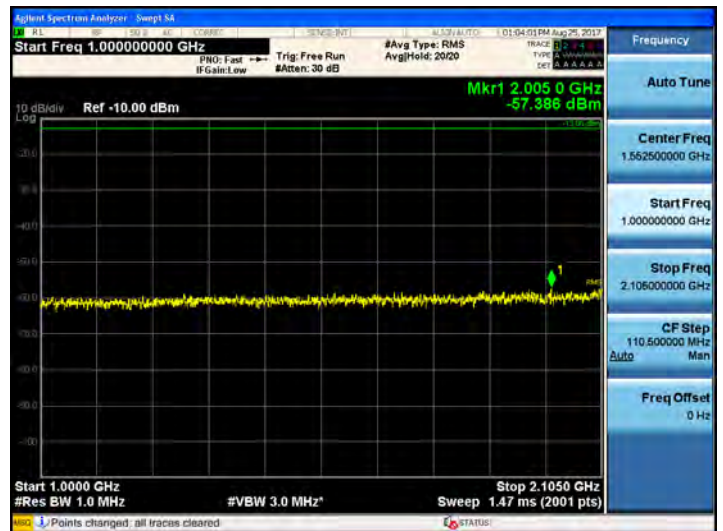
150 kHz ~ 30 MHz



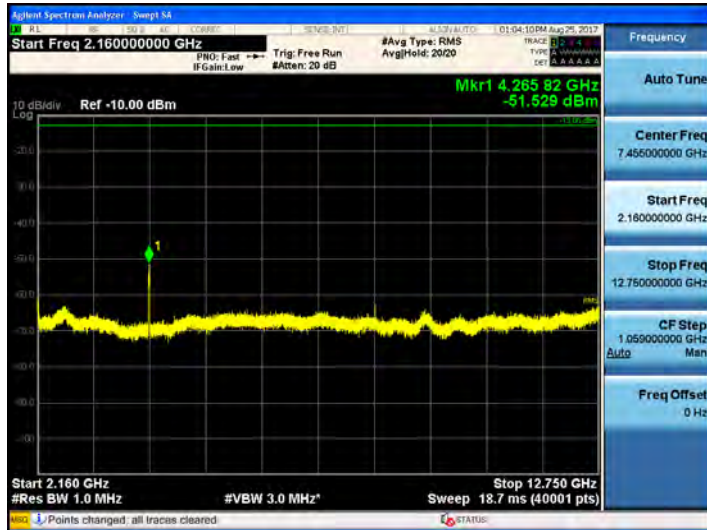
30 MHz ~ 1 GHz



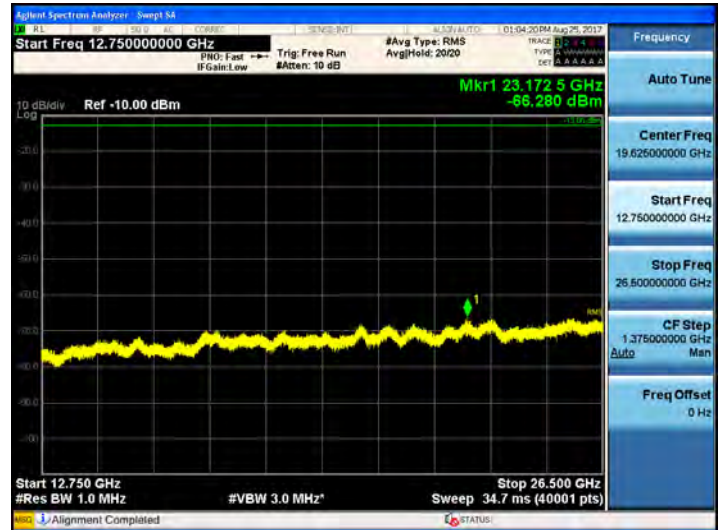
1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

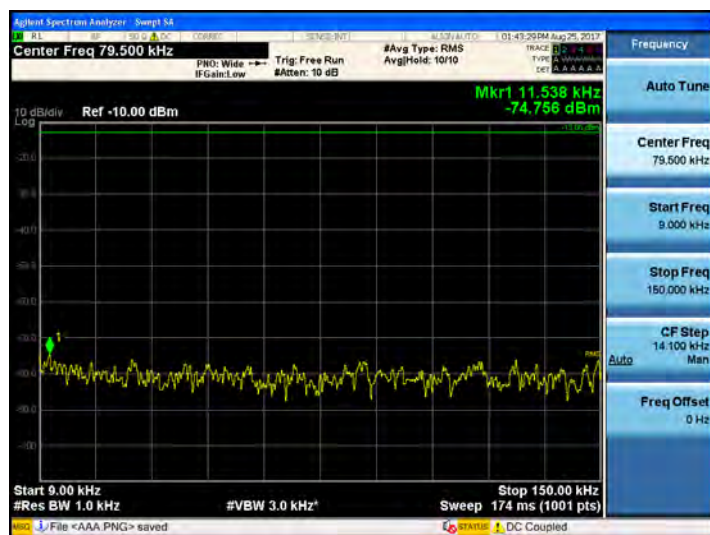


12.75 GHz ~ 26.5 GHz



(16QAM High channel)

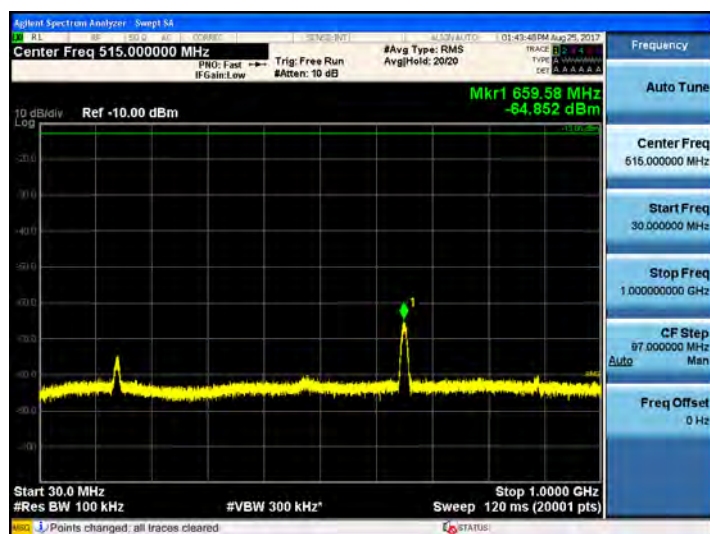
9 kHz ~ 150 kHz



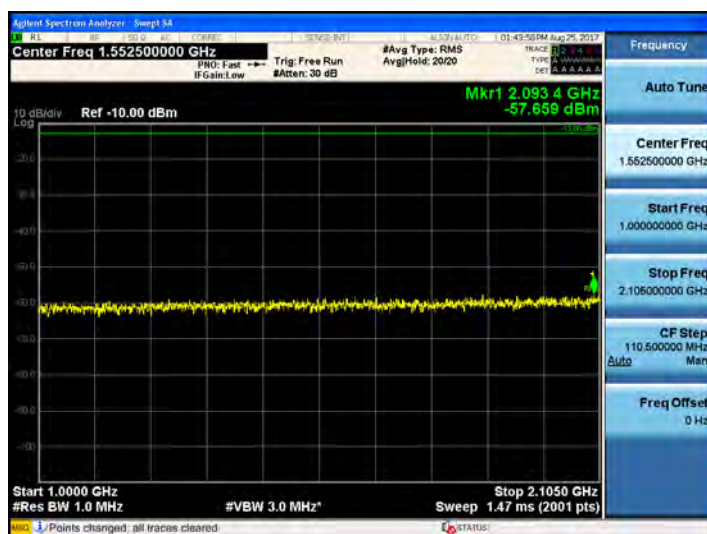
150 kHz ~ 30 MHz



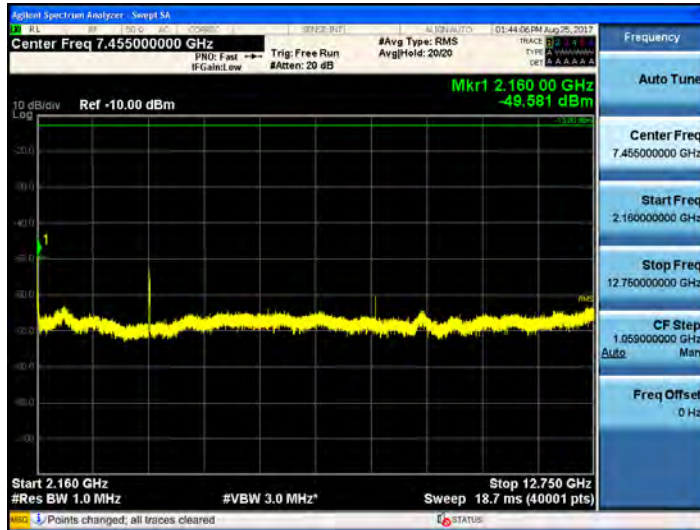
30 MHz ~ 1 GHz



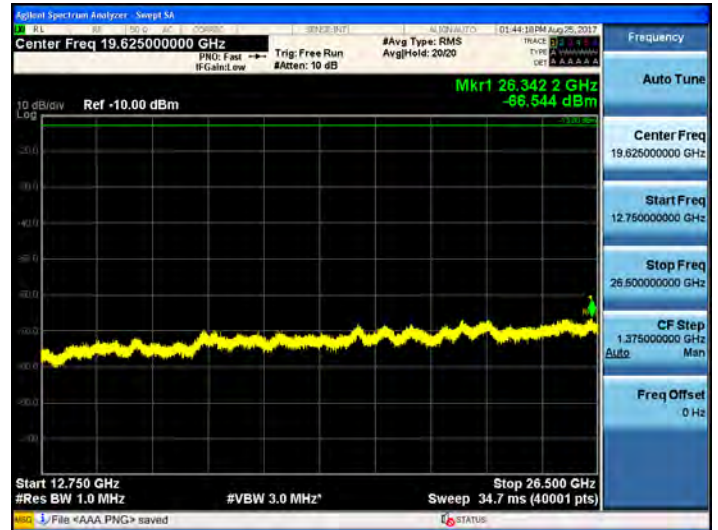
1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



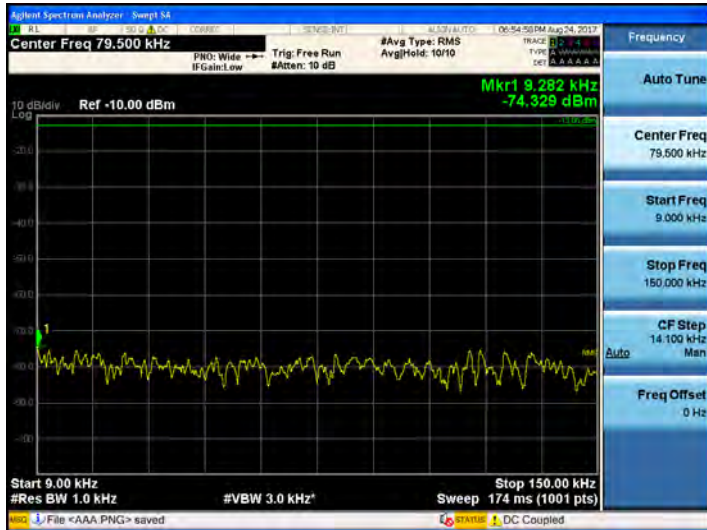
12.75 GHz ~ 26.5 GHz



Test Data at Output Port 1

(64QAM Low channel)

9 kHz ~ 150 kHz



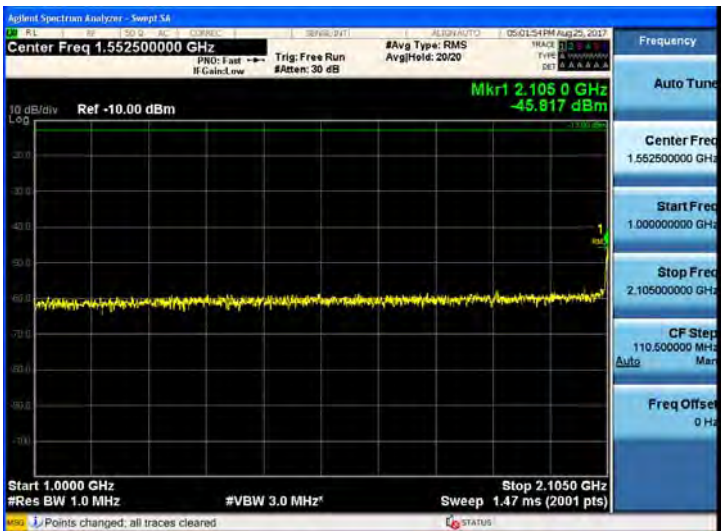
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

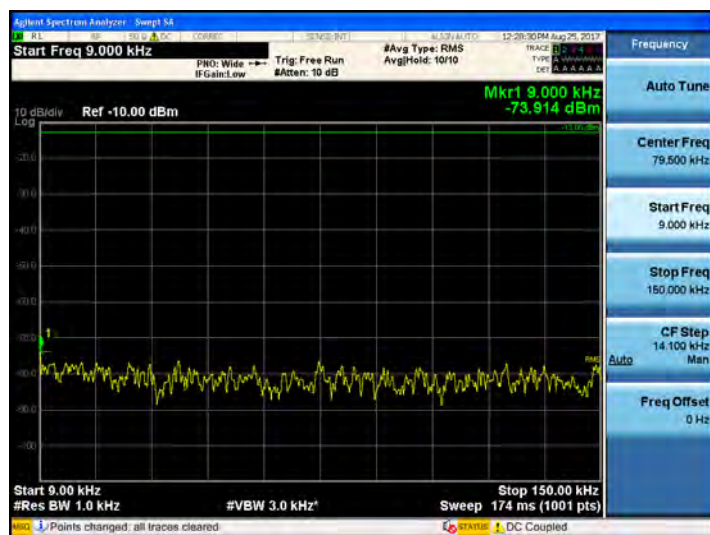


12.75 GHz ~ 26.5 GHz

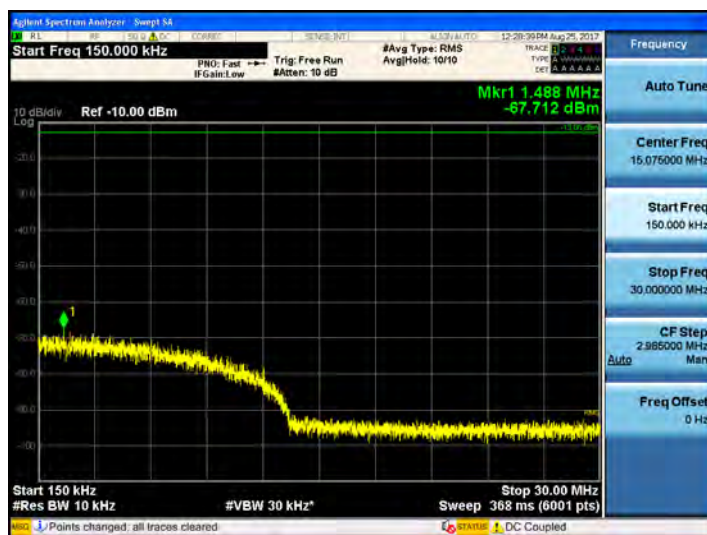


(64QAM Middle channel)

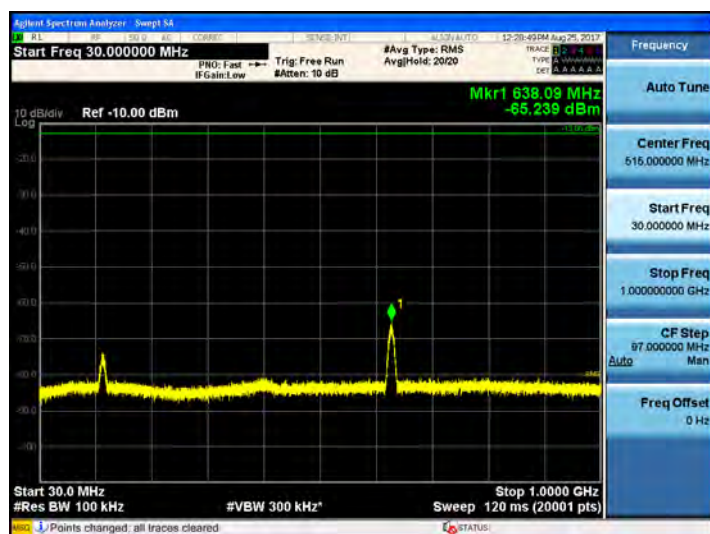
9 kHz ~ 150 kHz



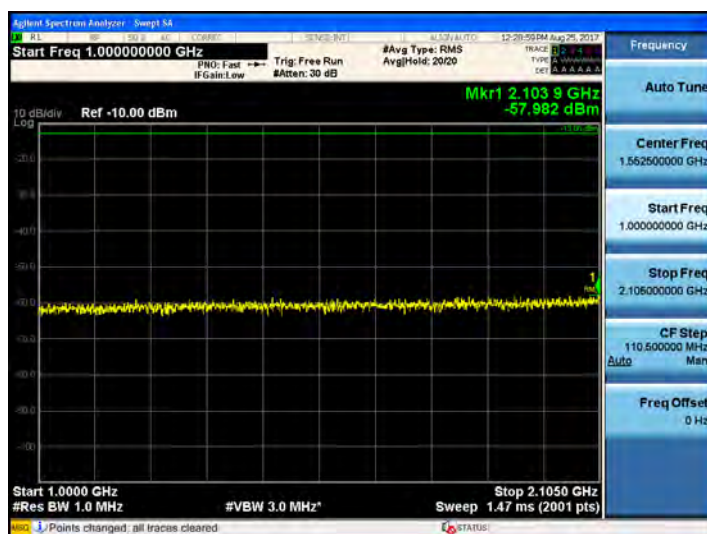
150 kHz ~ 30 MHz



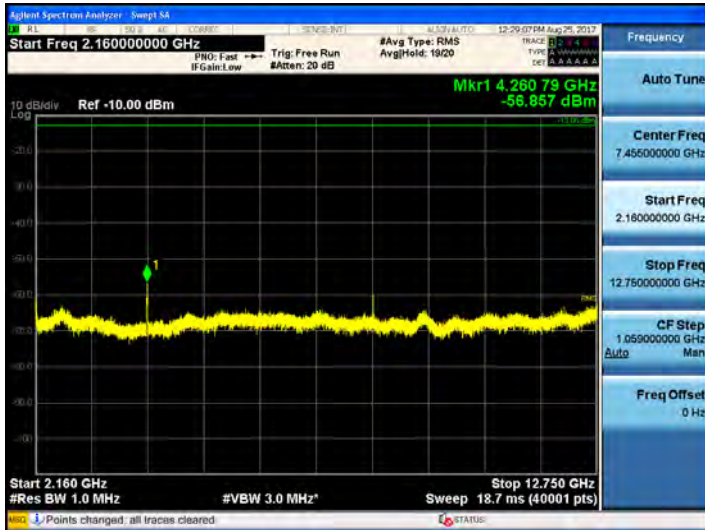
30 MHz ~ 1 GHz



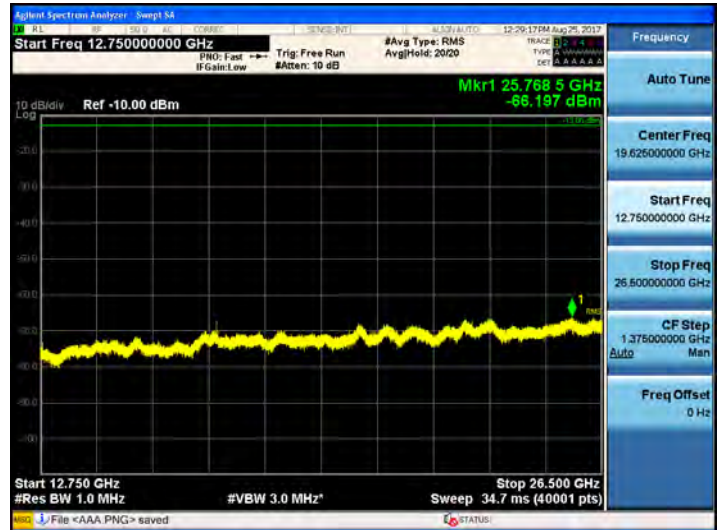
1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

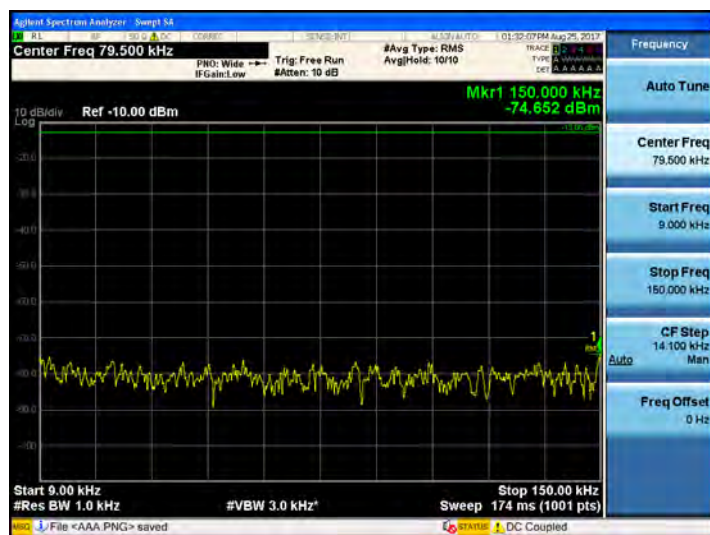


12.75 GHz ~ 26.5 GHz



(64QAM High channel)

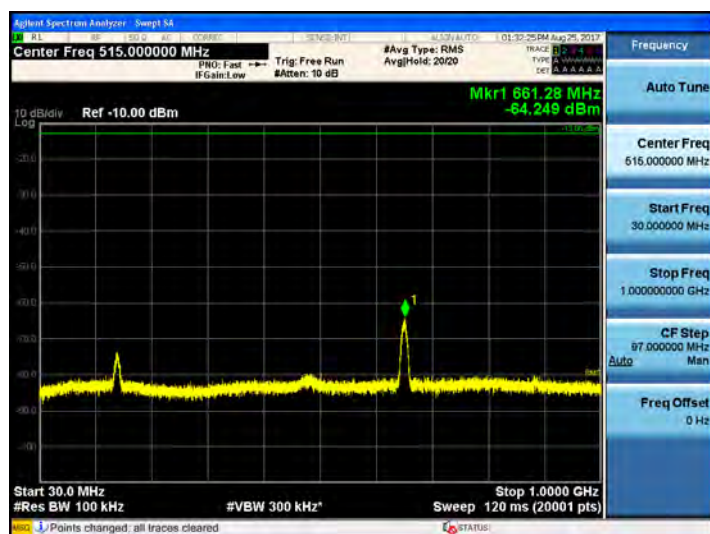
9 kHz ~ 150 kHz



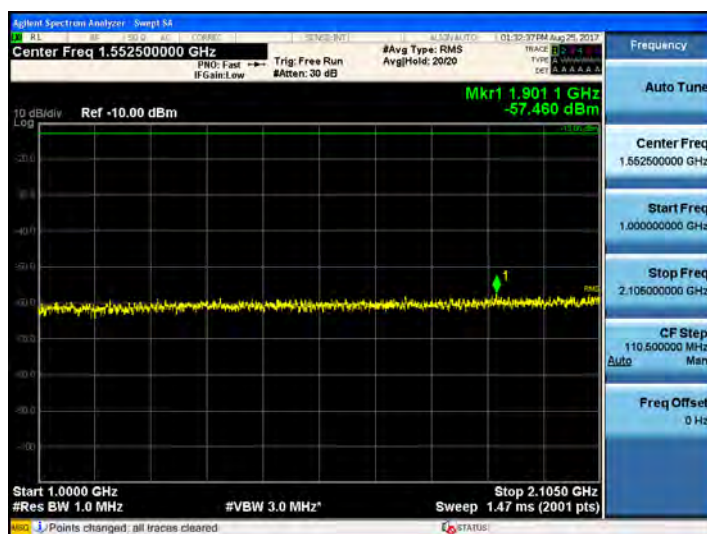
150 kHz ~ 30 MHz



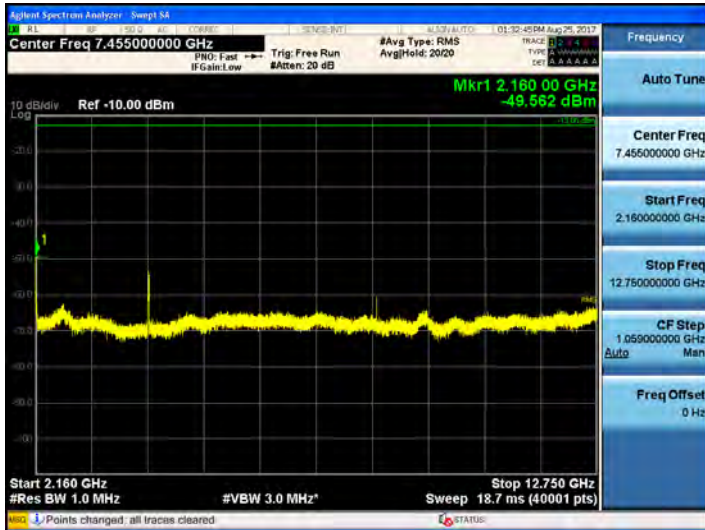
30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



12.75 GHz ~ 26.5 GHz



Test Data at Output Port 2

(QPSK Low channel)

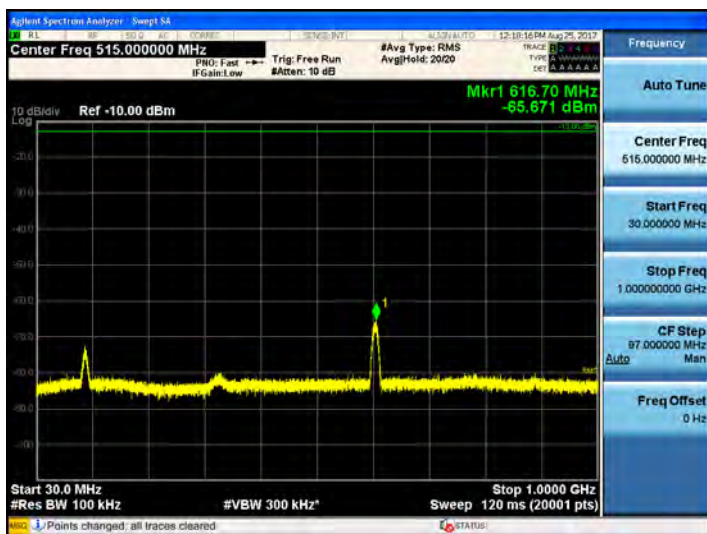
9 kHz ~ 150 kHz



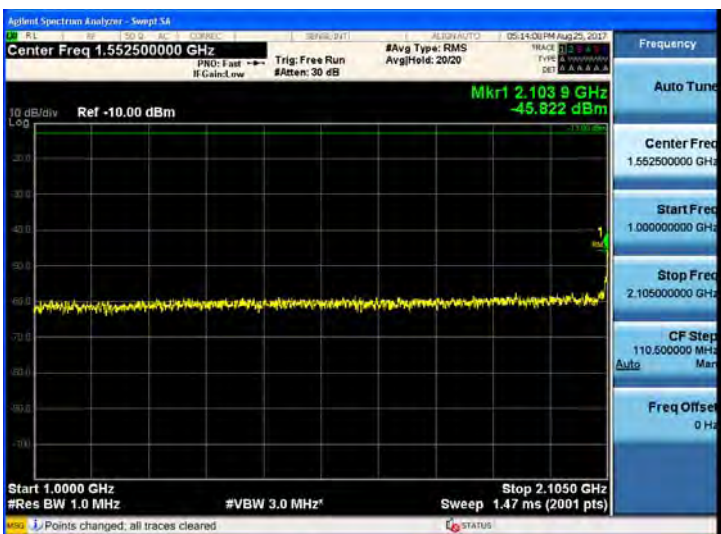
150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz

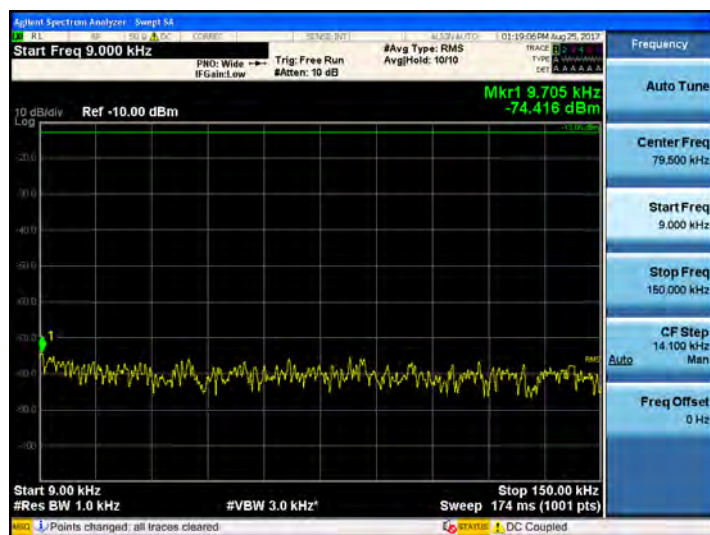


12.75 GHz ~ 26.5 GHz

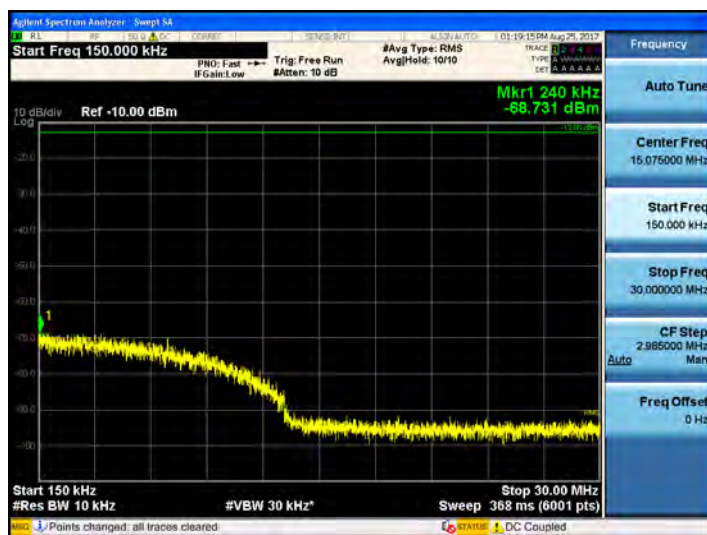


(QPSK Middle channel)

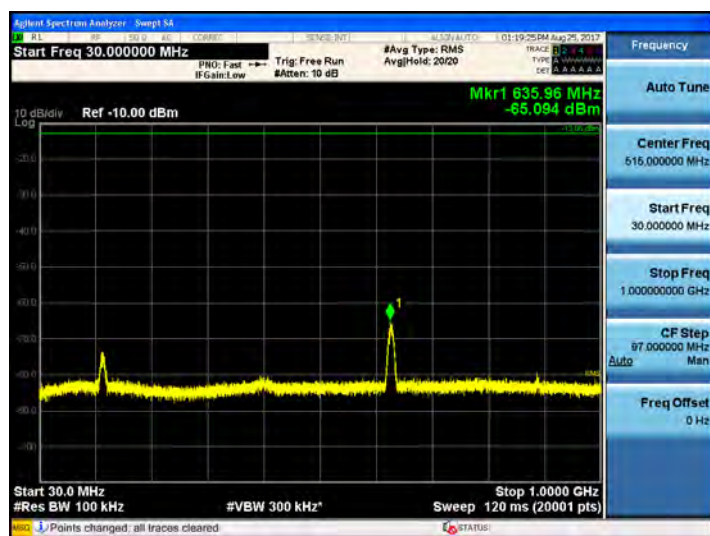
9 kHz ~ 150 kHz



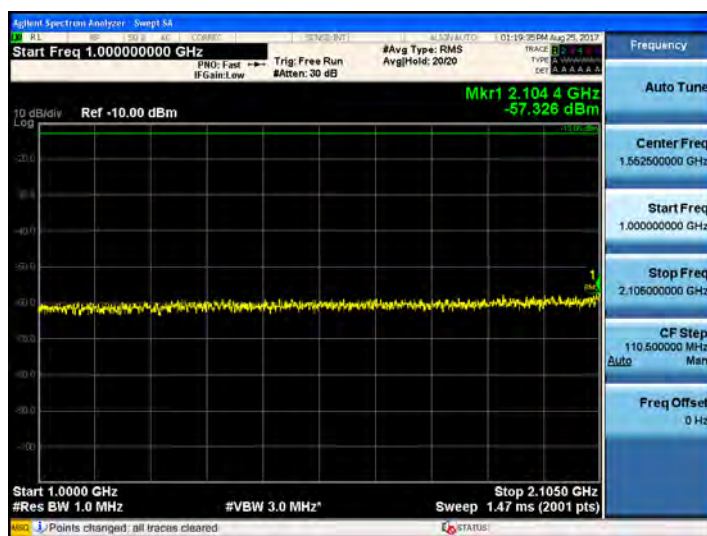
150 kHz ~ 30 MHz



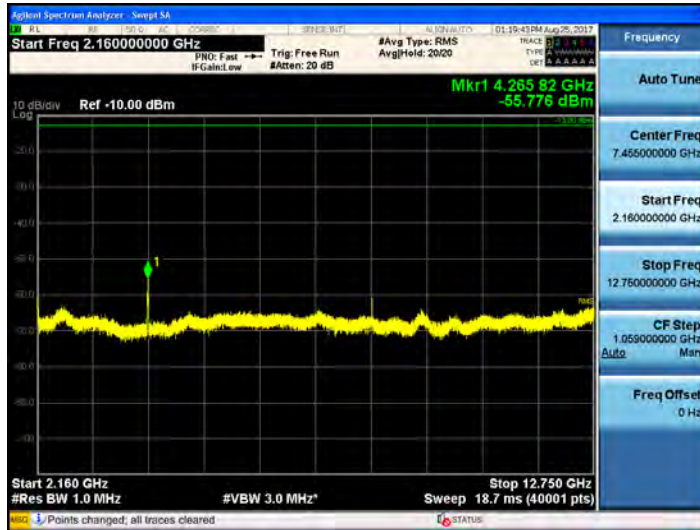
30 MHz ~ 1 GHz



1 GHz ~ 2.105 GHz



2.16 GHz ~ 12.75 GHz



12.75 GHz ~ 26.5 GHz

