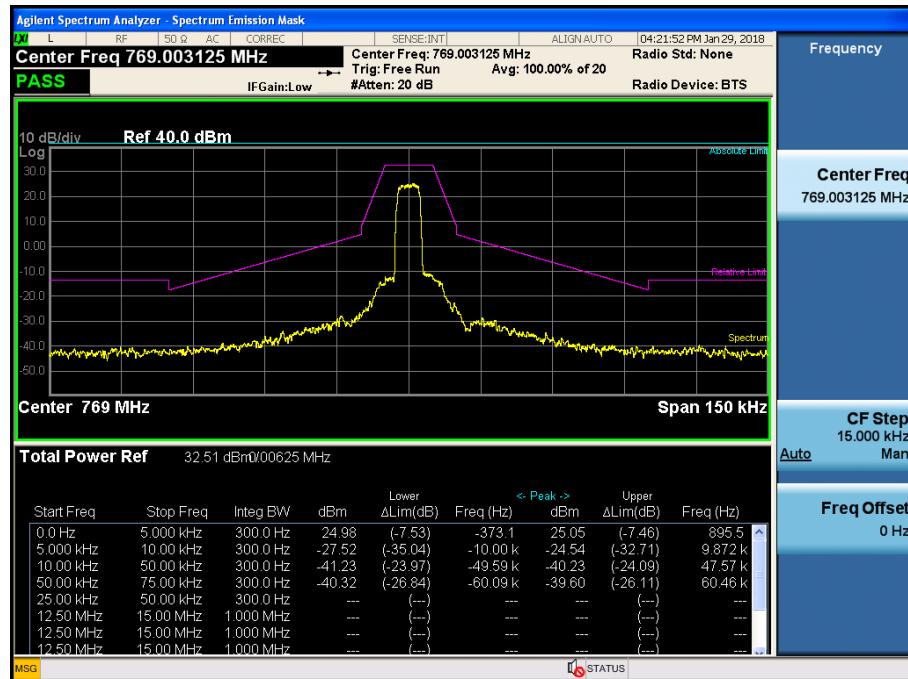


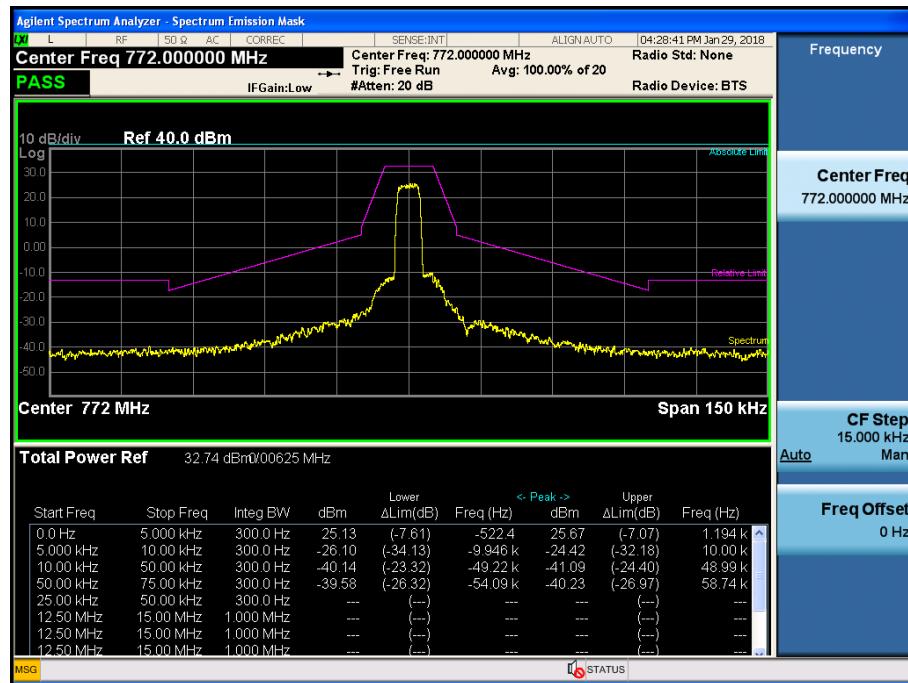
Plots of Emission Mask

700 MHz (6.25 kHz)_Downlink

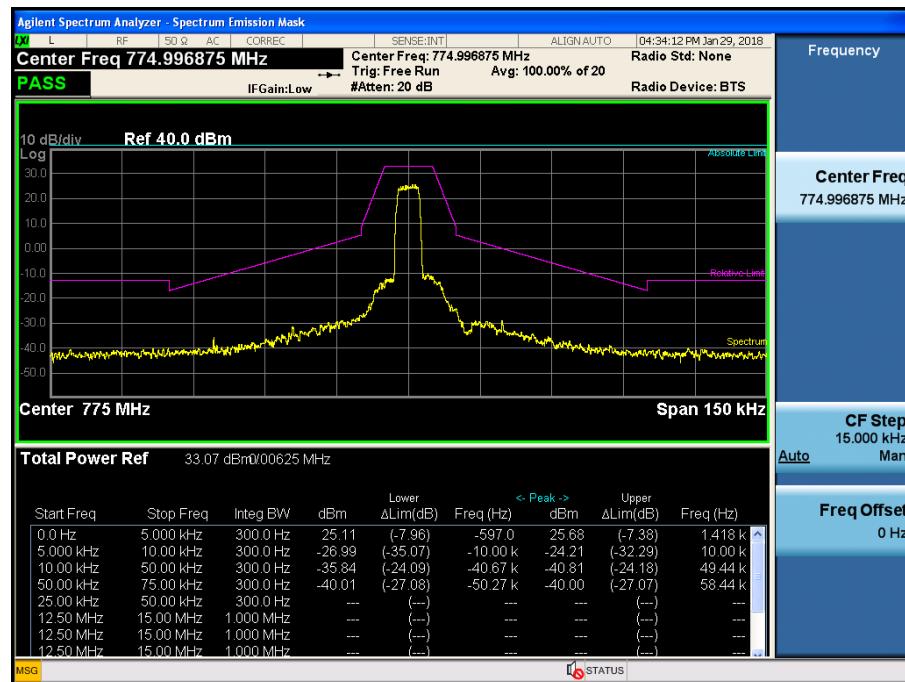
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[Downlink Emission Mask C – Middle]

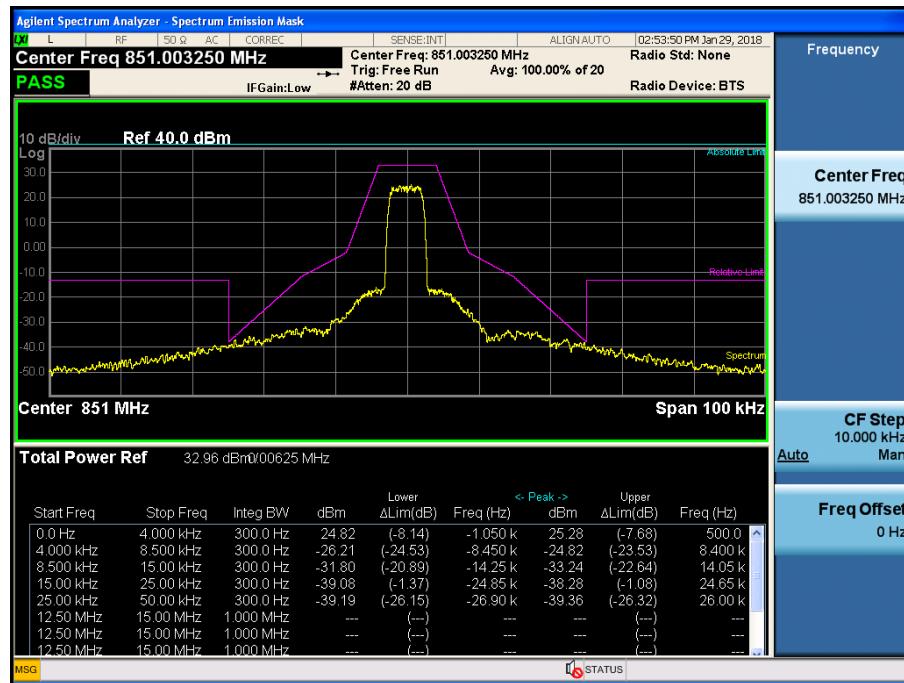


[Downlink Emission Mask C – High]

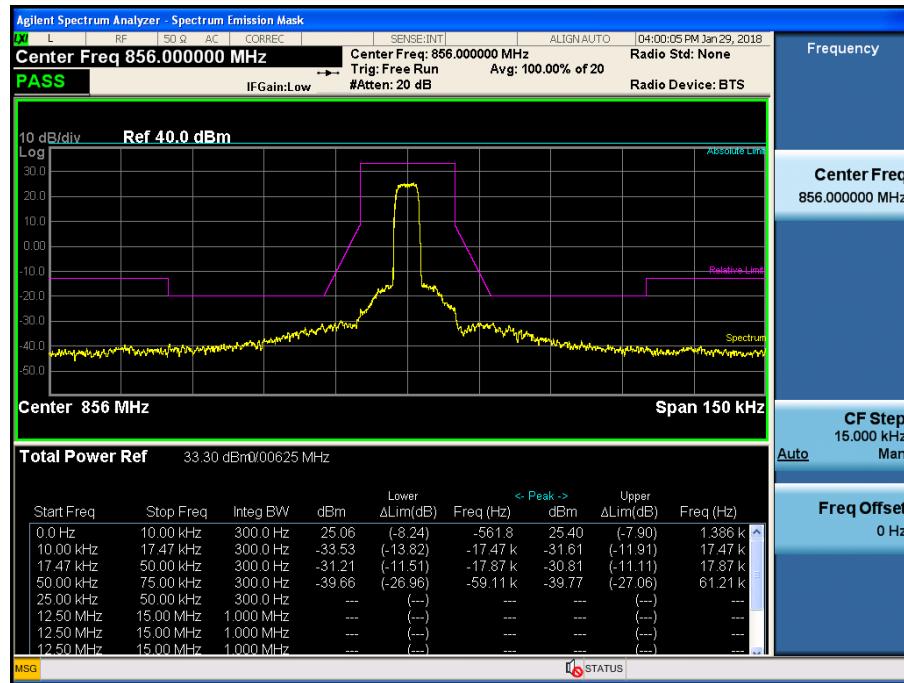


800 MHz (6.25 kHz)_Downlink

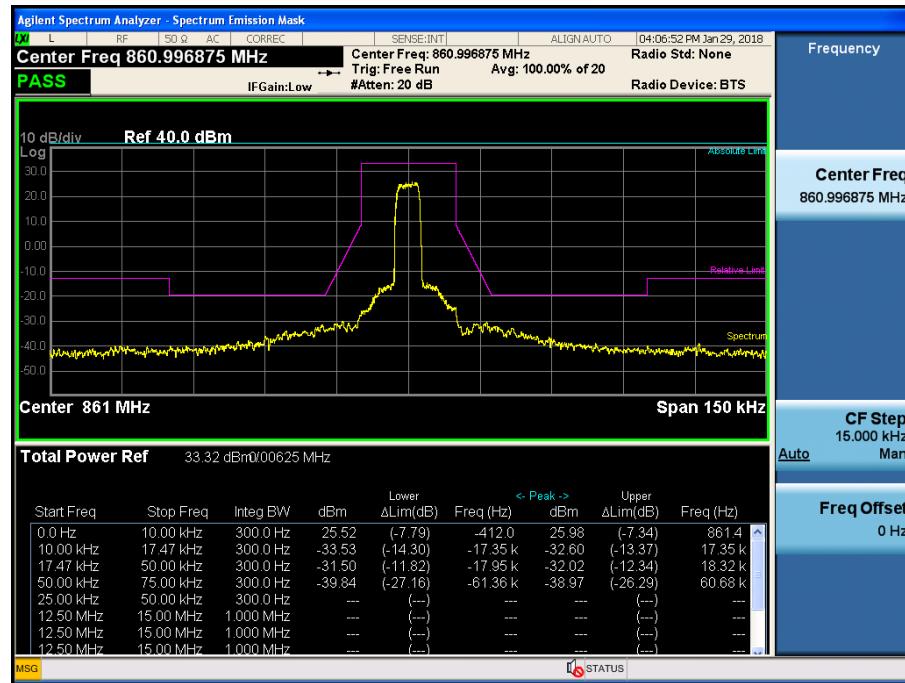
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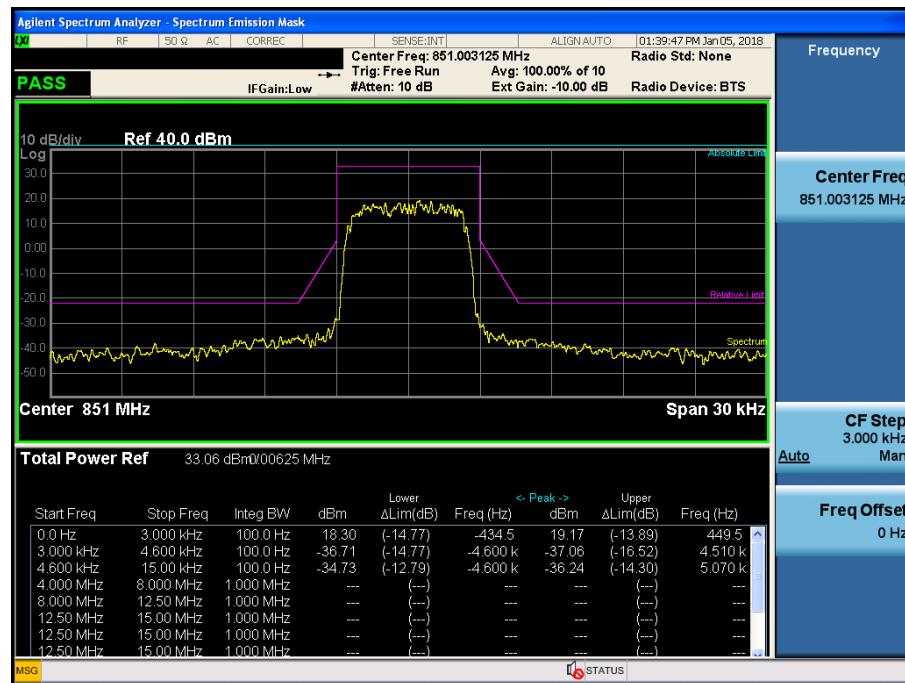
[Downlink Emission Mask G – Middle]



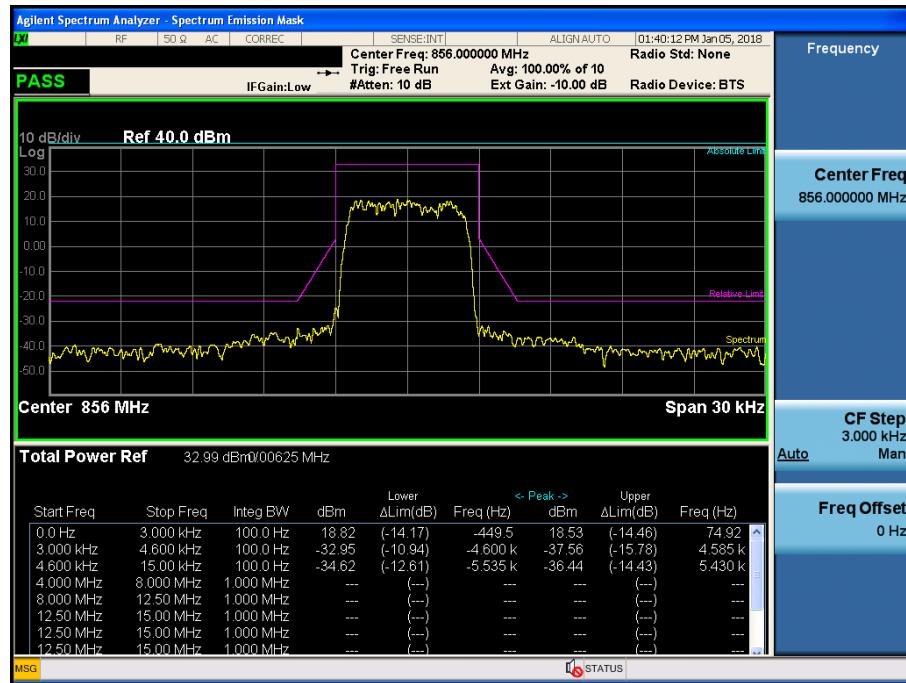
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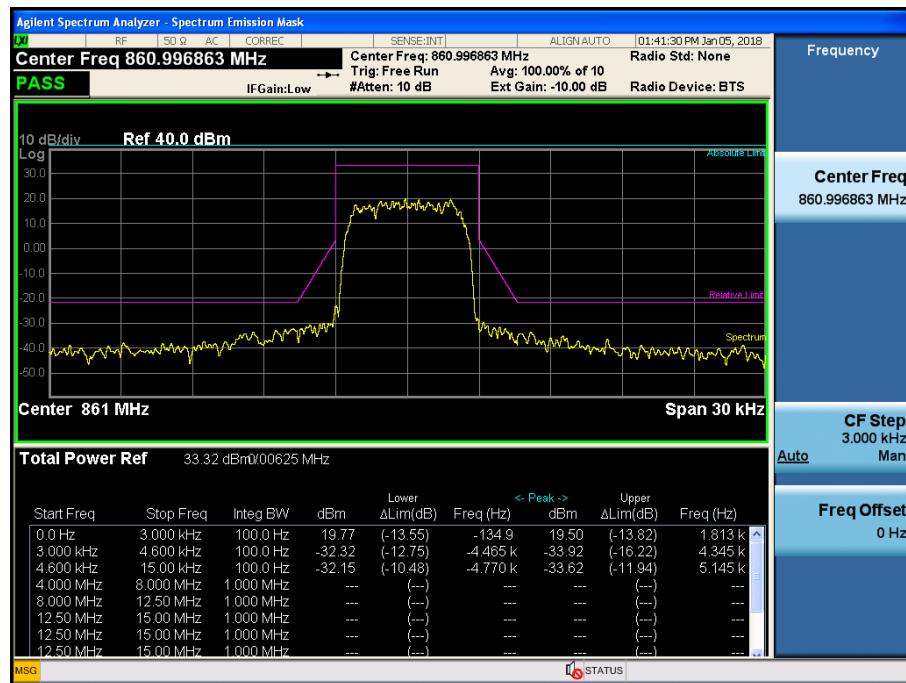
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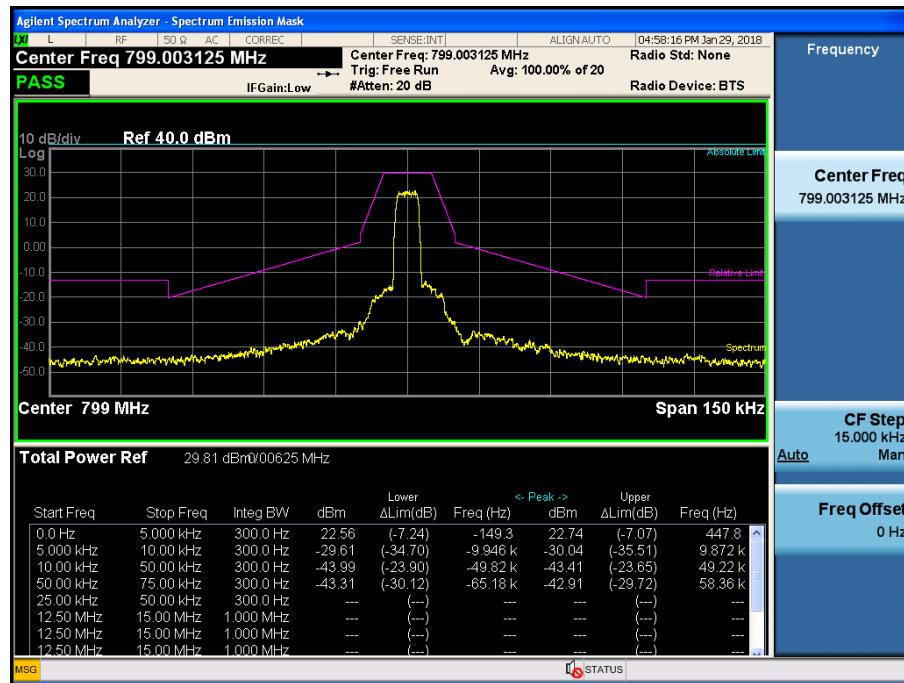


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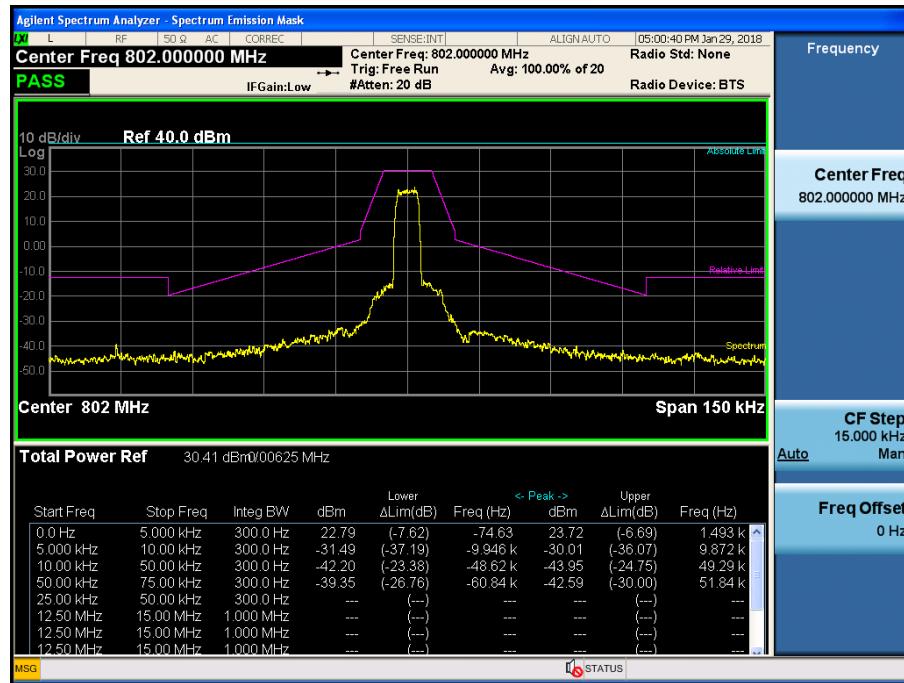


700 MHz (6.25 kHz)_Uplink

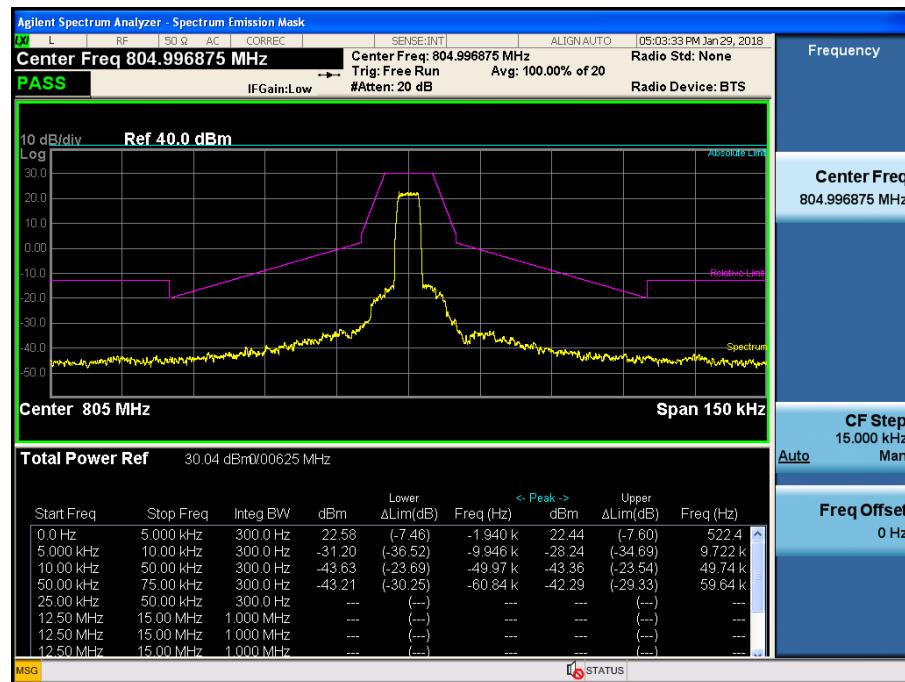
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[Uplink Emission Mask C – Middle]

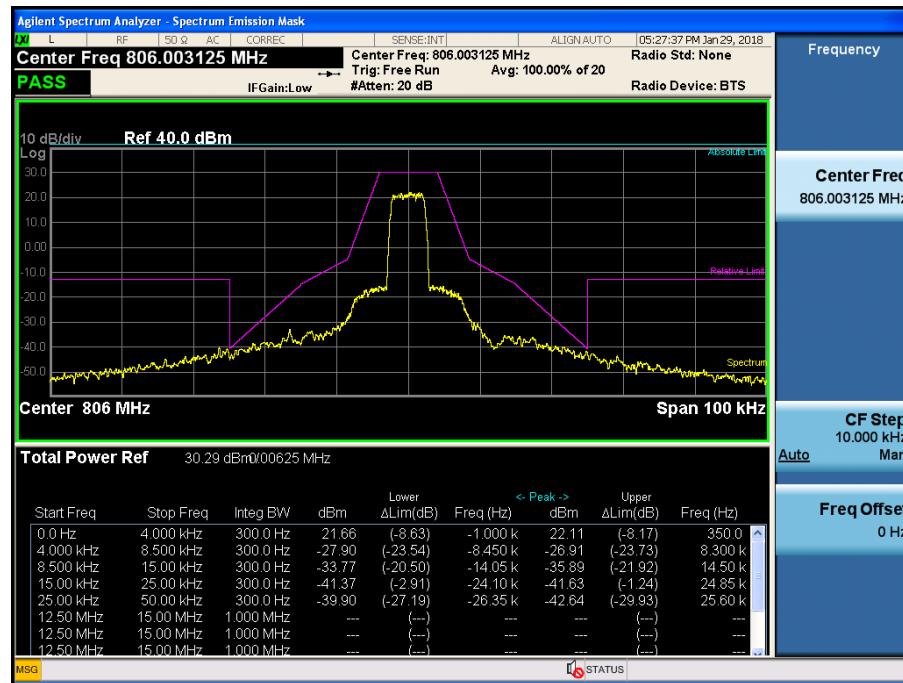


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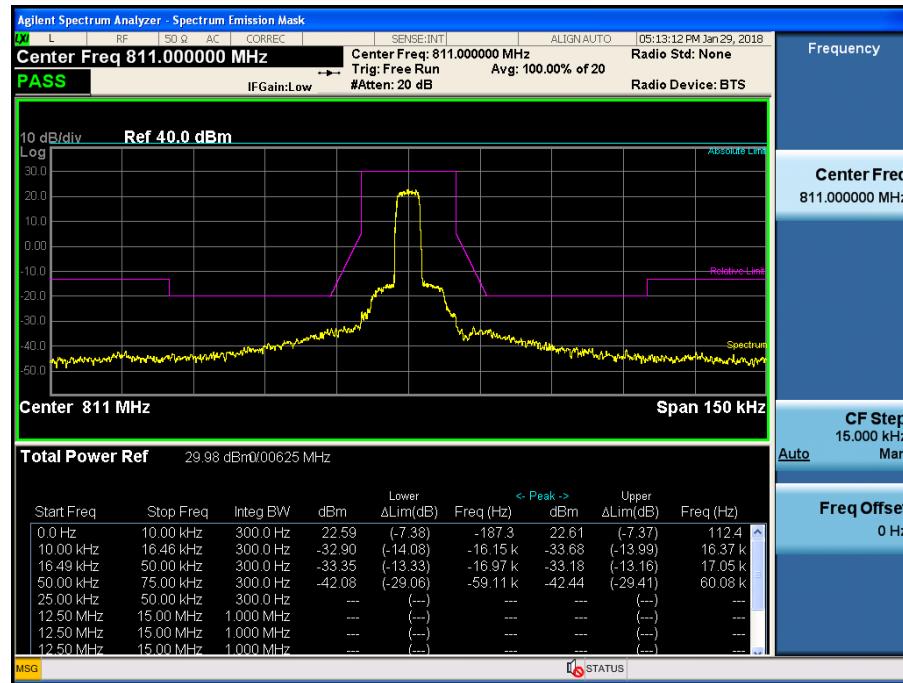


800 MHz (6.25 kHz)_Uplink

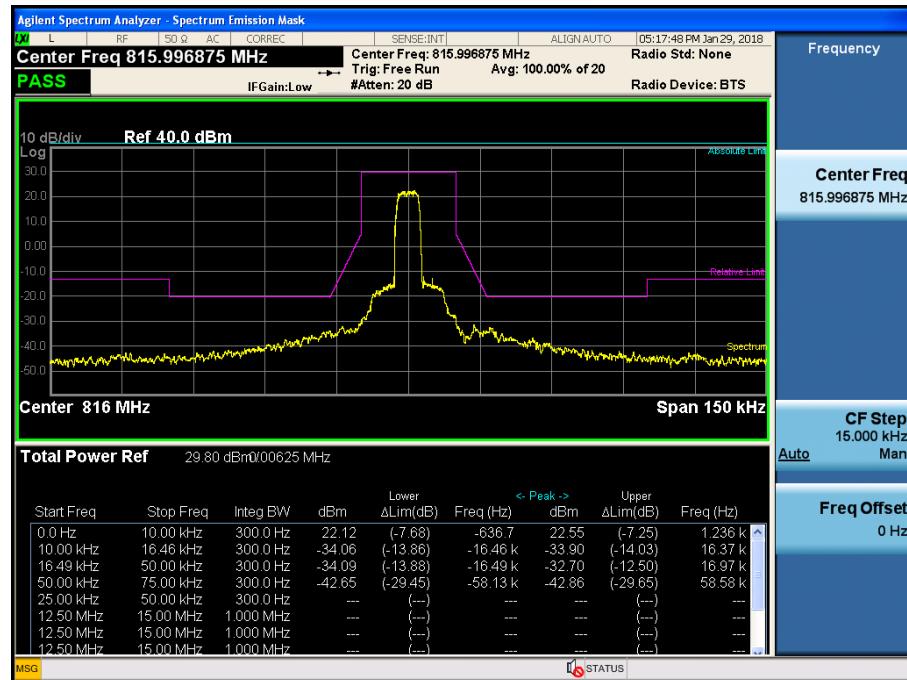
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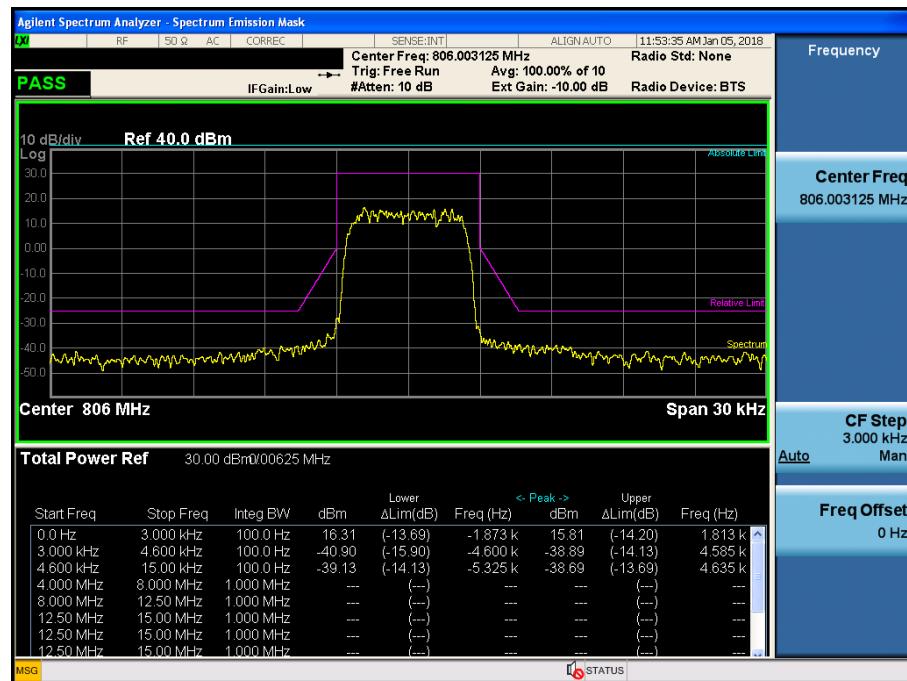
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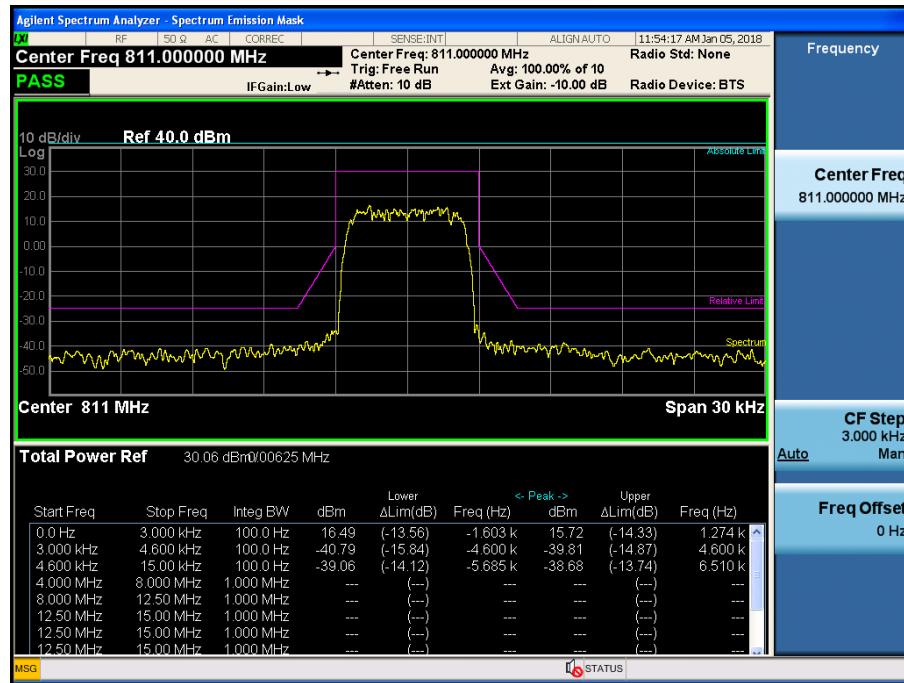
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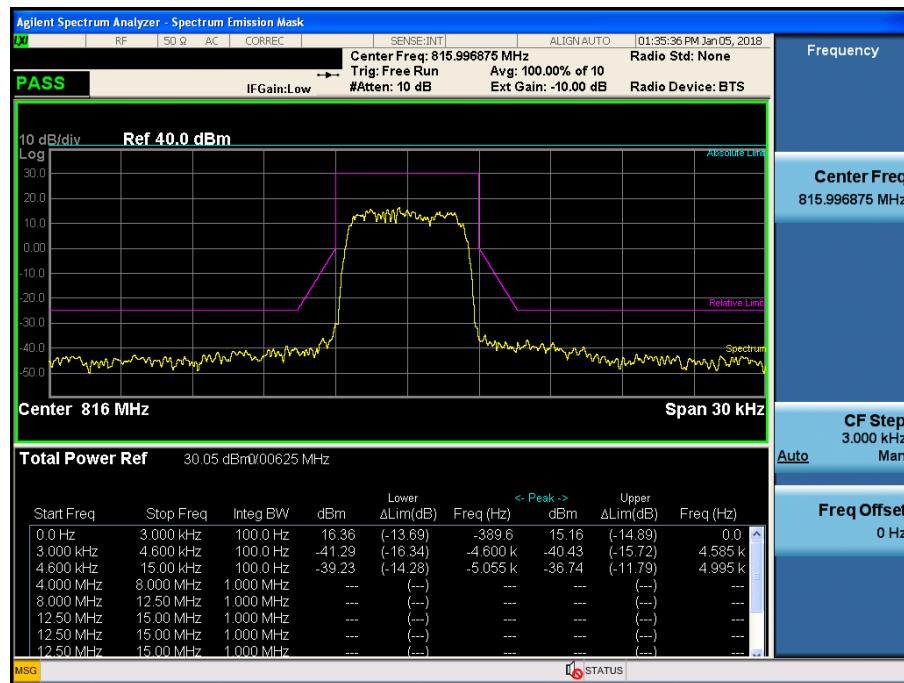
[Uplink Emission Mask E – Low]



[Uplink Emission Mask E – Middle]



[Uplink Emission Mask E – High]



11. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL

FCC Rules

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.

§ 90.219 Use of signal boosters.

(e) *Device Specifications.* In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(3) Spurious emissions from a signal booster must not exceed -13 dBm within any 100 kHz measurement bandwidth.

§ 90.543 Emission limitations.

Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Class A and Class B signal boosters retransmitting signals in the 769-775 MHz and 799-805 MHz frequency bands are exempt from the limits listed in paragraph (a) of this section when simultaneously retransmitting multiple signals and instead shall be subject to the limit listed in paragraph (c) of this section when operating in this manner. Transmitters operating in 758-768 MHz and 788-798 MHz bands must meet the emission limitations in (e) of this section.

(a) The adjacent channel power (ACP) requirements for transmitters designed for various channel sizes are shown in the following tables. Mobile station requirements apply to handheld, car mounted and control station units. The tables specify a value for the ACP as a function of the displacement from the channel center frequency and measurement bandwidth. In the following tables, "(s)" indicates a swept measurement may be used.

6.25 kHz Mobile Transmitter ACP Requirements

| Offset from center frequency (kHz) | Measurement bandwidth (kHz) | Maximum ACP relative (dBc) |
|------------------------------------|-----------------------------|----------------------------|
| 6.25 | 6.25 | -40 |
| 12.5 | 6.25 | -60 |
| 18.75 | 6.25 | -60 |

| | | |
|-------------------------------|--------|------|
| 25.00 | 6.25 | -65 |
| 37.50 | 25.00 | -65 |
| 62.50 | 25.00 | -65 |
| 87.50 | 25.00 | -65 |
| 150.00 | 100.00 | -65 |
| 250.00 | 100.00 | -65 |
| 350.00 | 100.00 | -65 |
| >400 kHz to 12 MHz | 30 (s) | -75 |
| 12 MHz to paired receive band | 30 (s) | -75 |
| In the paired receive band | 30 (s) | -100 |

6.25 kHz Base Transmitter ACP Requirements

| Offset from center frequency (kHz) | Measurement bandwidth (kHz) | Maximum ACP (dBc) |
|------------------------------------|-----------------------------|-------------------|
| 6.25 | 6.25 | -40 |
| 12.50 | 6.25 | -60 |
| 18.75 | 6.25 | -60 |
| 25.00 | 6.25 | -65 |
| 37.50 | 25 | -65 |
| 62.50 | 25 | -65 |
| 87.50 | 25 | -65 |
| 150.00 | 100 | -65 |
| 250.00 | 100 | -65 |
| 350.00 | 100 | -65 |
| >400 to 12 MHz | 30 (s) | -80 |
| 12 MHz to paired receive band | 30 (s) | -80 |
| In the paired receive band | 30 (s) | ¹ -85 |

¹Although we permit individual base transmitters to radiate a maximum ACP of -85 dBc in the paired receive band, licensees deploying these transmitters may not exceed an ACP of -100 dBc in the paired receive band when measured at either the transmitting antenna input port or the output of the transmitter combining network. Consequently, licensees deploying these transmitters may need to use external filters to comply with the more restrictive ACP limit.

(b) *ACP measurement procedure.* The following are the procedures for making the transmitter ACP measurements. For all measurements modulate the transmitter as it would be modulated in

normal operating conditions. For time division multiple access (TDMA) systems, the measurements are to be made under TDMA operation only during time slots when the transmitter is active. All measurements are made at the transmitter's output port. If a transmitter has an integral antenna, a suitable power coupling device shall be used to couple the RF signal to the measurement instrument. The coupling device shall substantially maintain the proper transmitter load impedance. The ACP measurements may be made with a spectrum analyzer capable of making direct ACP measurements. "Measurement bandwidth", as used for non-swept measurements, implies an instrument that measures the power in many narrow bandwidths equal to the nominal resolution bandwidth and integrates these powers to determine the total power in the specified measurement bandwidth.

- (1) *Setting reference level.* Set transmitter to maximum output power. Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth to the channel size. For example, for a 6.25 kHz transmitter set the measurement bandwidth to 6.25 kHz. Set the frequency offset of the measurement bandwidth to zero and adjust the center frequency of the instrument to the assigned center frequency to measure the average power level of the transmitter. Record this power level in dBm as the "reference power level."
- (2) *Non-swept power measurement.* Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth and frequency offset from the assigned center frequency as shown in the tables in §90.543 (a) above. Any value of resolution bandwidth may be used as long as it does not exceed 2 percent of the specified measurement bandwidth. Measure the power level in dBm. These measurements should be made at maximum power. Calculate ACP by subtracting the reference power level measured in (b)(1) from the measurements made in this step. The absolute value of the calculated ACP must be greater than or equal to the absolute value of the ACP given in the table for each condition above.
- (3) *Swept power measurement.* Set a spectrum analyzer to 30 kHz resolution bandwidth, 1 MHz video bandwidth and average, sample, or RMS detection. Set the reference level of the spectrum analyzer to the RMS value of the transmitter power. Sweep above and below the carrier frequency to the limits defined in the tables. Calculate ACP by subtracting the reference power level measured in (b)(1) from the measurements made in this step. The absolute value of the calculated ACP must be greater than or equal to the absolute value of the ACP given in the table for each condition above.
- (c) *Out-of-band emission limit.* On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.
- (d) *Authorized bandwidth.* Provided that the ACP requirements of this section are met, applicants may request any authorized bandwidth that does not exceed the channel size.
- (e) For operations in the 758-768 MHz and the 788-798 MHz bands, 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 all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations.
- (2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.
- (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least $43 + 10 \log (P)$ dB.
- (4) Compliance with the provisions of paragraphs (e)(1) and (2) 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.
- (5) Compliance with the provisions of paragraph (e)(3) 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 30 kHz may be employed.

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics 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.

IC Rules

Test Requirements:

RSS-119

5. Transmitter and Receiver Specifications

5.8 Transmitter Unwanted Emissions

5.8.9 Emission Mask for Equipment in the Bands 768-776 MHz and 798-806 MHz

5.8.9.1 Adjacent Channel Power (ACP)

The ACP of transmitters operating in the bands 768-776 MHz and 798-806 MHz shall comply with the requirements for various transmitter channel sizes provided in tables 13 to 16. Mobile station requirements apply to handheld, car-mounted and control station units. The tables specify a maximum value for the ACP relative to the maximum output power as a function of the displacement f_d from the channel centre frequency. In the tables, "s" indicates that a swept measurement may be used.

| Table 13 — ACP Requirements for 6.25 kHz Bandwidth Transmitters | | | |
|---|----------------------------|--------------|-----------------------------|
| Displacement Frequency, fd (kHz) | Maximum Relative ACP (dBc) | | Measurement Bandwidth (kHz) |
| | Mobile Station | Base Station | |
| 6.25 | -40 | -40 | 6.25 |
| 12.5 | -60 | -60 | |
| 18.75 | | | |
| 25 | -65 | -65 | |
| 37.5 | -65 | -65 | 25 |
| 62.5 | | | |
| 87.5 | | | |
| 150 | -65 | -65 | |
| 250 | | | 100 |
| 350 | | | |
| $400 < fd \leq 12$ MHz | -75 | -80 | 30(s) |
| 12 MHz $< fd \leq$ paired receive band | | | |
| In the paired receive band | -100 | -85 | |

5.8.9.2 Out-of-Band Emission Limit

On any frequency outside of the ranges specified in the ACP tables 13 to 16, the power of any emission shall be attenuated below the mean output power P (dBW) by at least $43 + 10 \log_{10}(p)$, measured in a 100 kHz bandwidth for frequencies less than or equal to 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

In addition, for operations in the bands 768-776 MHz and 798-806 MHz, all emissions (including harmonics in the band 1559-1610 MHz), shall not exceed:

-70 dBW/MHz equivalent isotropically radiated power (e.i.r.p.) for wideband emissions, and -80 dBW/kHz e.i.r.p. for discrete emissions of less than 700 Hz bandwidth.

RSS-131**6. Equipment standard specifications for zone enhancers working with equipment certified under RSS-119****6.5 Spurious emissions**

The spurious emissions of a zone enhancer shall not exceed -13 dBm in any 100 kHz measurement bandwidth.

Test Procedures:

Measurements were in accordance with the test methods section 3.6 and 4.7 of KDB 935210 D05 v01r02.

3.6.1. General

Spurious emissions shall be measured using a single test signal sequentially tuned to the low, middle and high channels or frequencies within each authorized frequency band of operation. Out-of-band/block emissions (including intermodulation products) shall be measured under each of the following two stimulus conditions:

- a) two adjacent test signals sequentially tuned to the lower and upper frequency band/block edges;
- b) a single test signal, sequentially tuned to the lowest and highest frequencies or channels within the frequency band/block under examination.

NOTE—Single channel boosters that cannot accommodate two simultaneous signals within the passband, can be excluded from the test stipulated in step a).

3.6.2. EUT out-of-band/block emissions conducted measurement

- a) Connect a signal generator to the input of the EUT.

NOTE—If the signal generator is not capable of generating two modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support the two-tone test.

- b) Set the signal generator to produce two AWGN signals as previously described (e.g., 4.1 MHz OBW).

c) Set the center frequencies such that the AWGN signals occupy adjacent channels, as defined by industry standards such as 3GPP or 3GPP2, at the upper edge of the frequency band or block of interest.

d) Set the composite power levels such that the input signal is just below the AGC threshold (see 3.2), but not more than 0.5 dB below. The composite power can be measured using the procedures provided in KDB Publication 971168, but it will be necessary to expand the power integration bandwidth so as to include both of the transmit channels. Alternatively, the composite power can be measured using an average power meter as described in KDB Publication 971168.

- e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as

necessary.

- f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band (typically 1 % of the emission bandwidth, 100 kHz, or 1 MHz)
- g) Set the VBW = $3 \times$ RBW.
- h) Set the detector to power averaging (rms) detector.
- i) Set the Sweep time = auto-couple.
- j) Set the analyzer start frequency to the upper block edge frequency and the stop frequency to the upper block edge frequency plus 300 kHz or 3 MHz for frequencies below and above 1 GHz, respectively.
- k) Trace average at least 100 traces in power averaging (i.e., rms) mode.
- l) Use the marker function to find the maximum power level.
- m) Capture the spectrum analyzer trace of the power level for inclusion in the test report.
- n) Repeat the procedure with the composite input power level set to 3 dB above the AGC threshold.
- o) Reset the input signals frequencies to the lower edge of the frequency block or band under examination.
- p) Reset the spectrum analyzer start frequency to the lower block edge frequency minus 300 kHz, or 3 MHz (for frequencies below and above 1 GHz, respectively), and the stop frequency to the lower band or block edge frequency.
- q) Repeat steps k) to n).
- r) Repeat steps a) to q) with the signal generator configured for a single test signal tuned as close as possible to the block edges.
- s) Repeat steps a) to r) with the narrowband test signal.
- t) Repeat steps a) to s) for all authorized frequency bands or blocks used by the EUT.

3.6.3. EUT spurious emissions conducted measurement

- a) Connect a signal generator to the input of the EUT.
- b) Set the signal generator to produce the broadband test signal as previously described (e.g., 4.1 MHz OBW AWGN).
- c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.
- d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.
- e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).
- g) Set the VBW $\geq 3 \times$ RBW.
- h) Set the Sweep time = auto-couple.

- i) Set the analyzer start frequency to the lowest radio frequency signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part.
NOTE—The number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$ which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.
- j) Select the power averaging (rms) detector function.
- k) Trace average at least 10 traces in power averaging (i.e., rms) mode.
- l) Use the peak marker function to identify the highest amplitude level over each measured frequency range. Record the frequency and amplitude and capture a plot for inclusion in the test report.
- m) Reset the analyzer start frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the analyzer stop frequency to 10 times the highest frequency of the fundamental emission (see §2.1057). Note that the number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$ which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.
- n) Trace average at least 10 traces in power averaging (i.e., rms) mode.
- o) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a plot for inclusion in the test report and provide tabular data, if required.
- p) Repeat the procedure with the input test signals tuned to a middle band/block frequency/channel and then a high band/block frequency/channel.
- q) Repeat entire procedure with the narrowband test signal.
- r) Repeat for all authorized frequency bands/blocks used by the EUT.

4.7.2 EUT out-of-band/block emissions conducted measurement

Intermodulation products shall be measured while applying two CW tones spaced in frequency ± 12.5 kHz relative to the center frequency (f_0) as determined from 4.4.

- a) Connect a signal generator to the input of the EUT.

NOTE—If the signal generator is not capable of producing two independent modulated carriers simultaneously, then two discrete signal generators can be connected with an appropriate combining network to support the two-tone test.

- b) Configure the two signal generators to produce CW tones on frequencies spaced at ± 12.5 kHz relative to f_0 with amplitude levels set just below the AGC threshold (see 4.2).
- c) Connect a spectrum analyzer to the EUT output.
- d) Set the span to 100 kHz.
- e) Set the resolution bandwidth to 300 Hz with a video bandwidth $\geq 3 \times \text{RBW}$.

- f) Set the detector to power average (rms).
- g) Place a marker on highest intermodulation product amplitude.
- h) Capture the plot for inclusion in the test report.
- i) Repeat the procedure with the composite input power level set to 3 dB above the AGC threshold.
- j) Repeat steps b) to h) for all operational bands.

4.7.3 EUT spurious emissions conducted measurement

- a) Connect a signal generator to the input of the EUT.
- b) Configure the signal generator to produce a CW signal.
- c) Set the frequency of the CW signal to the center channel of the pass band.
- d) Set the output power level so that the resultant signal is just below the AGC threshold (see 4.2).
- e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- f) Set the RBW to 100 kHz.
- g) Set the VBW = $3 \times$ RBW.
- h) Set the Sweep time = auto-couple.
- i) Set the detector to PEAK.
- j) Set the analyzer start frequency to 30 MHz (or the lowest radio frequency signal generated in the equipment, without going below 9 kHz if the EUT has internal clock frequencies) and the stop frequency to $10 \times$ the highest allowable frequency of the pass band.
- k) Select MAX HOLD and use the marker peak function to find the highest emission(s) outside the pass band. (This could be either at a frequency lesser or greater than the pass band.)
- l) Capture a plot for inclusion in the test report.
- m) Repeat steps c) to l) for each authorized frequency band/block of operation.

Notes: 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)

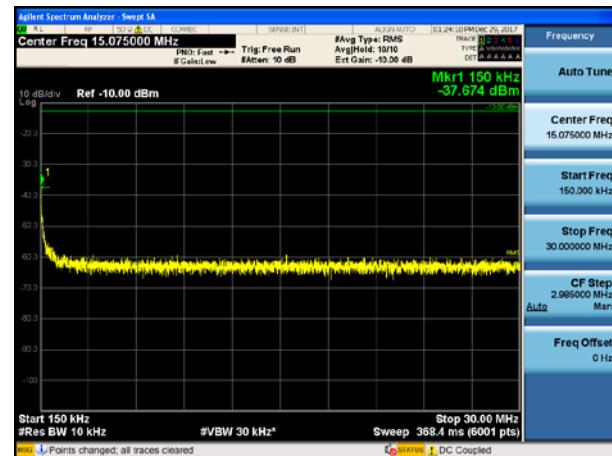
Single channel Enhancer Plots of Spurious Emission

700 P25(6.25 kHz)_DL

[Downlink_Low]

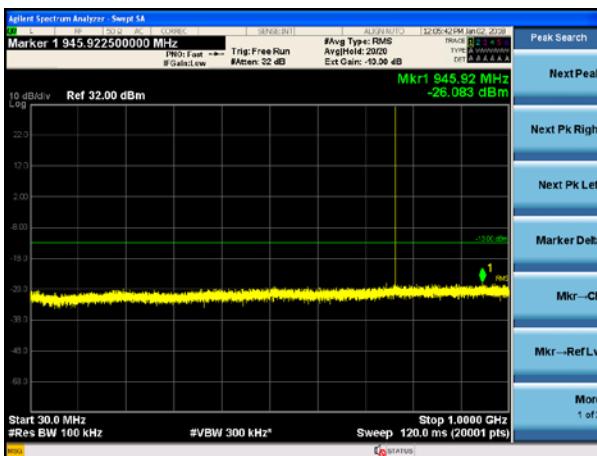
9 kHz ~ 150 kHz

150 kHz ~ 30 MHz



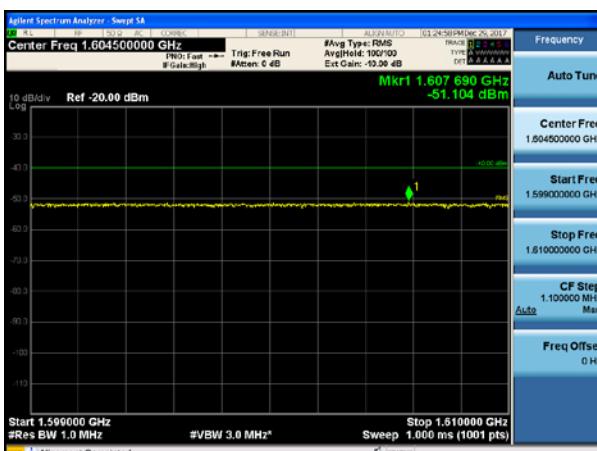
30 MHz ~ 1 GHz

1 GHz ~ 3 GHz

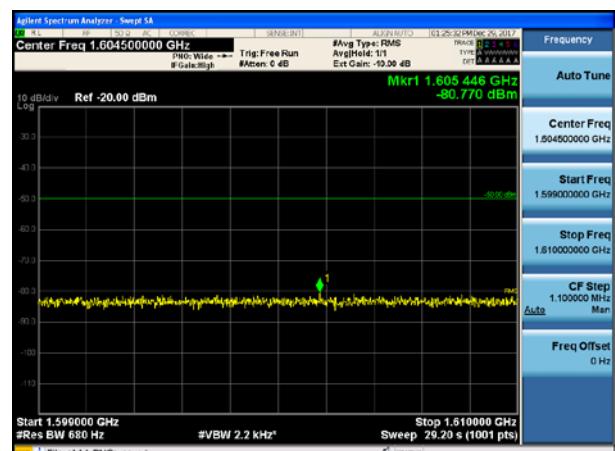




1599 MHz ~ 1610 MHz (1)

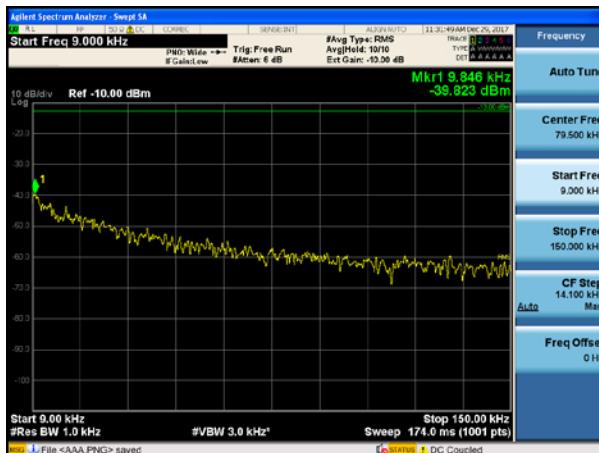


1599 MHz ~ 1610 MHz (2)

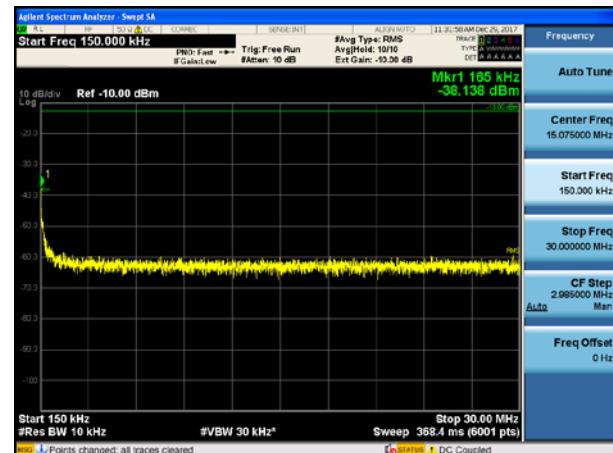


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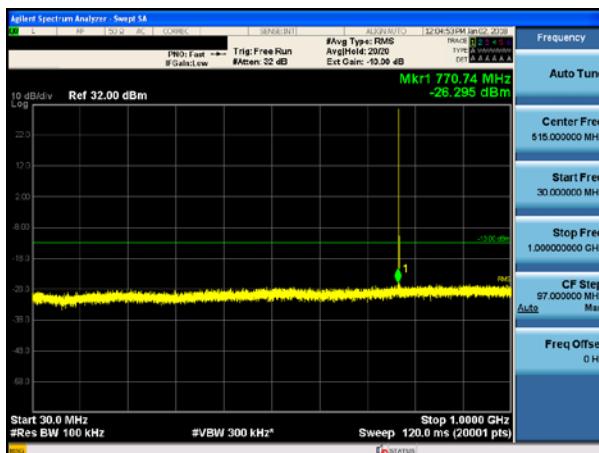
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

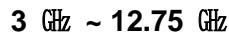


30 MHz ~ 1 GHz

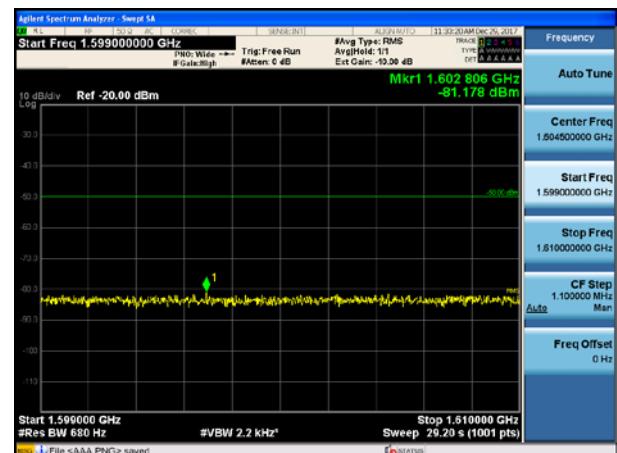
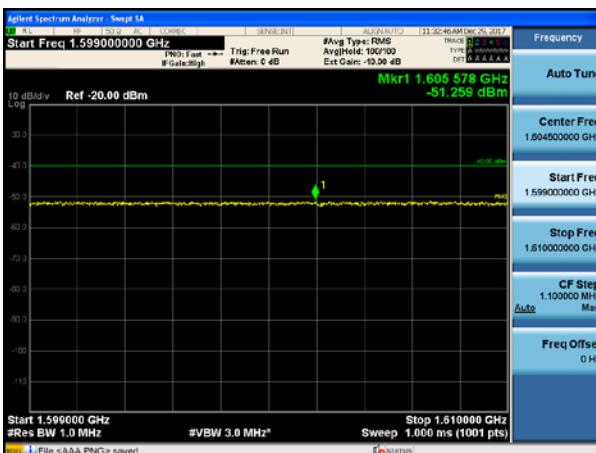


1 GHz ~ 3 GHz

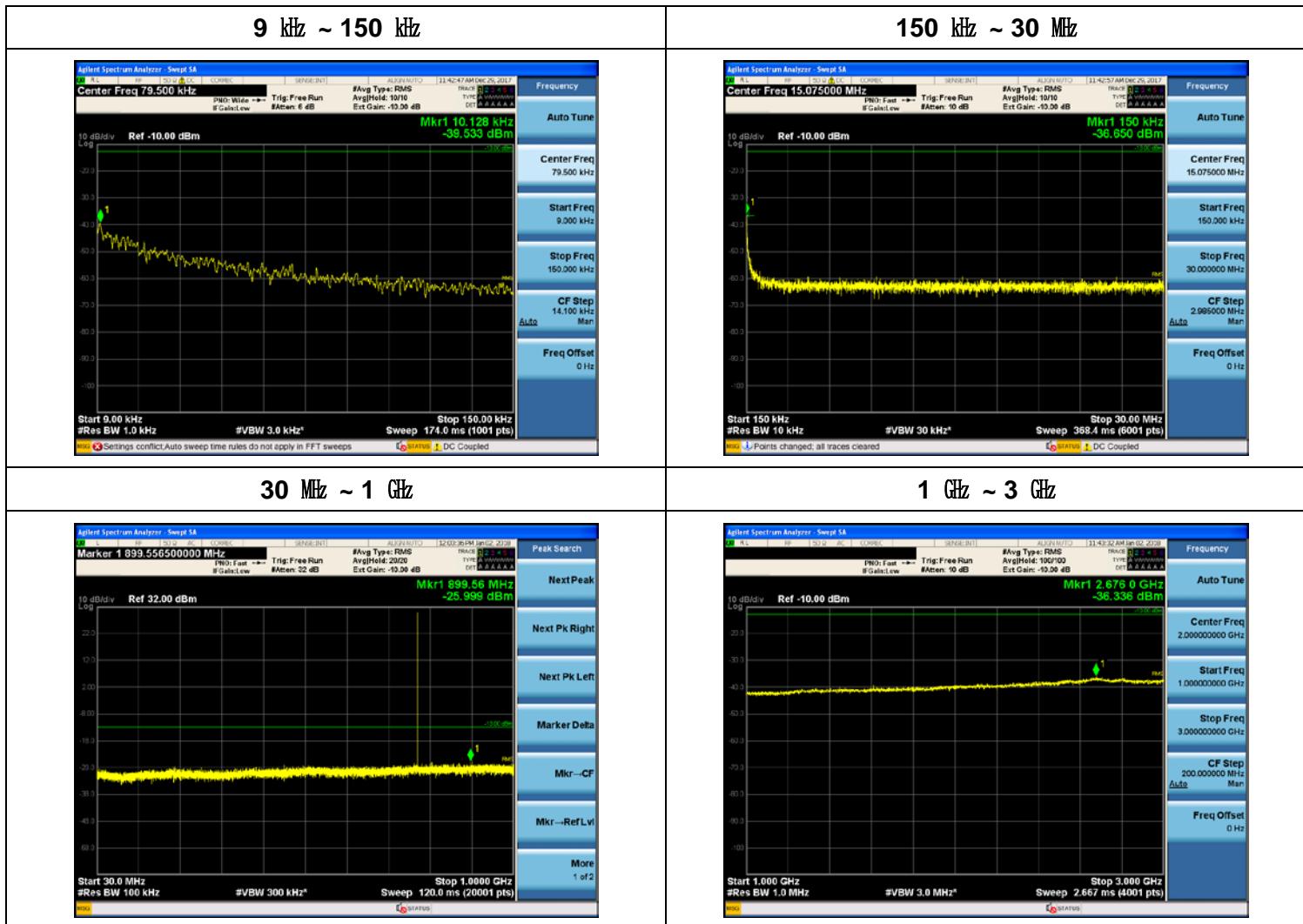




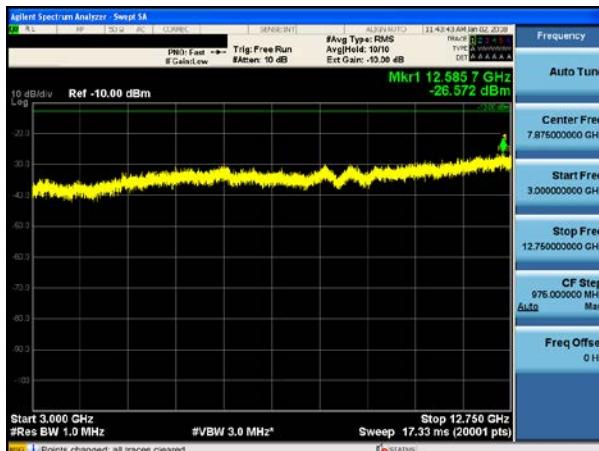
1599 MHz ~ 1610 MHz (1)



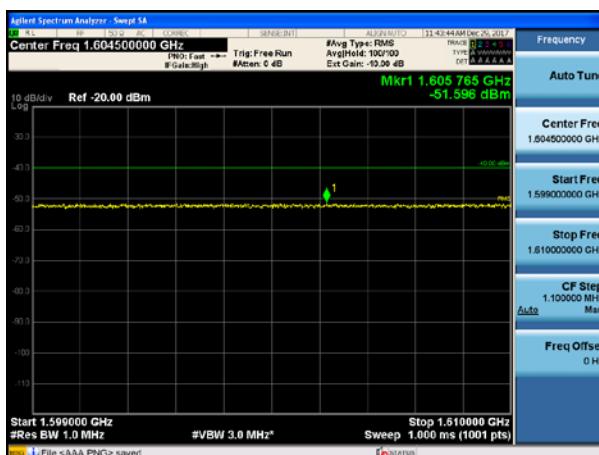
[Downlink_High]



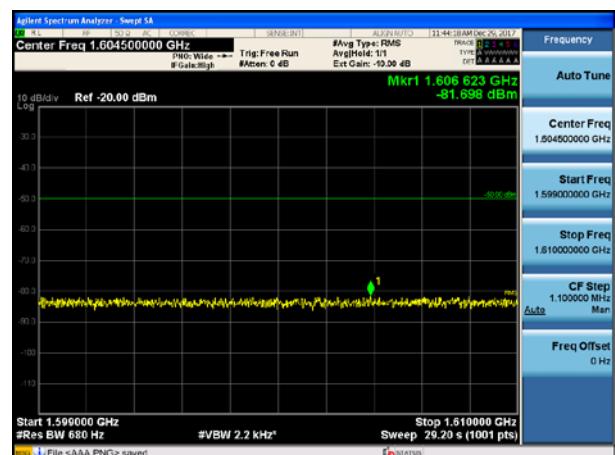
3 GHz ~ 12.75 GHz



1599 MHz ~ 1610 MHz (1)



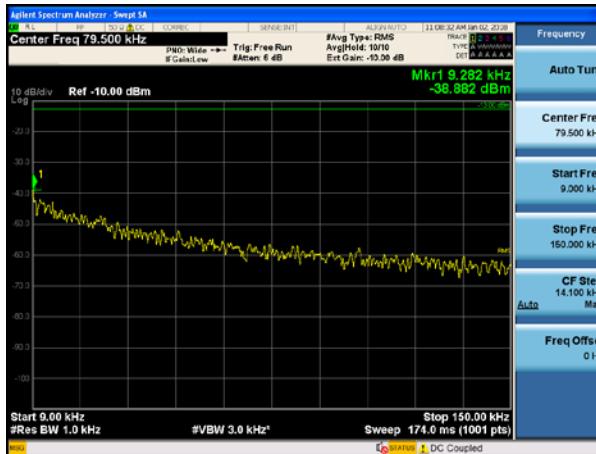
1599 MHz ~ 1610 MHz (2)



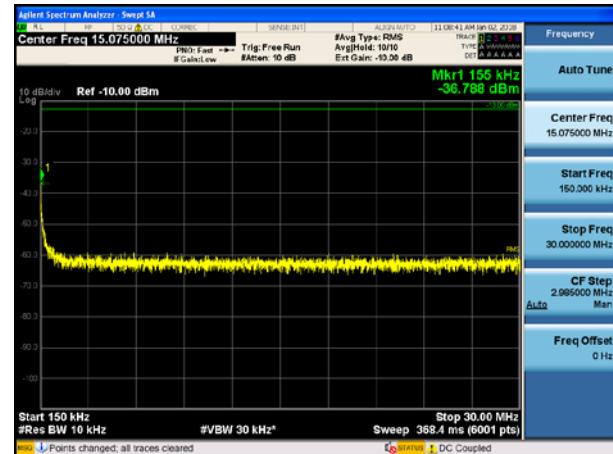
700 P25(6.25 kHz)_UL

[Uplink_Low]

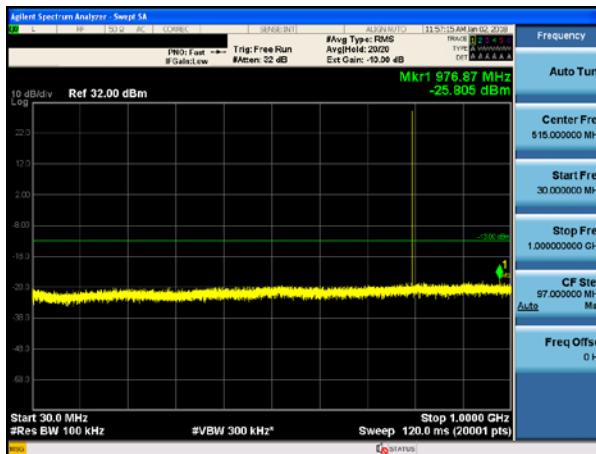
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



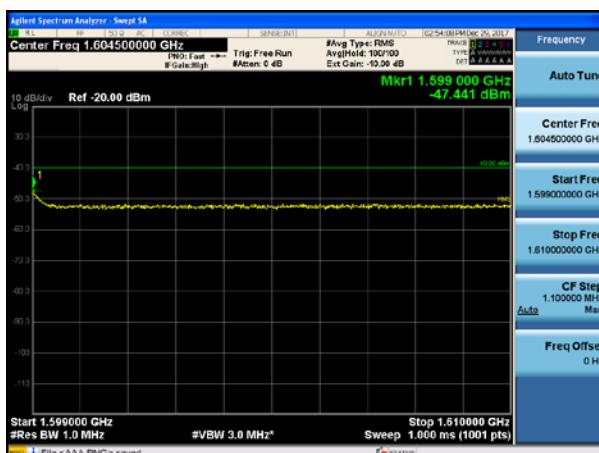
1 GHz ~ 3 GHz



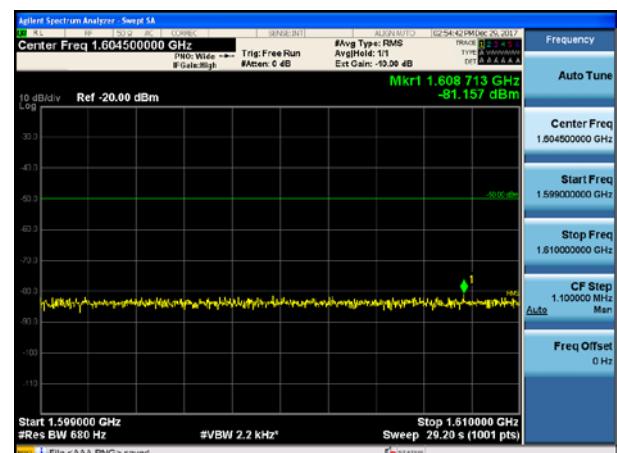
3 GHz ~ 12.75 GHz



1599 MHz ~ 1610 MHz (1)

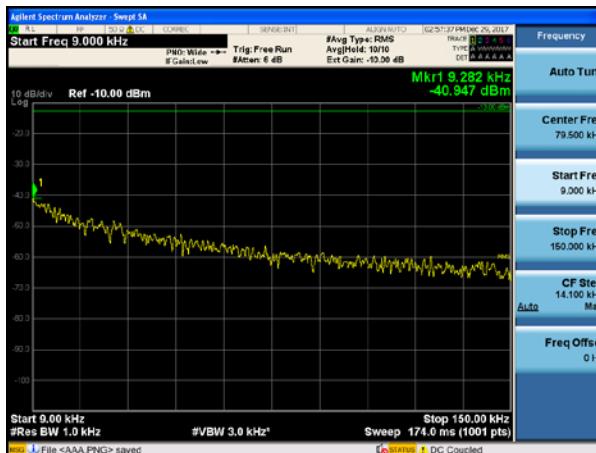


1599 MHz ~ 1610 MHz (2)

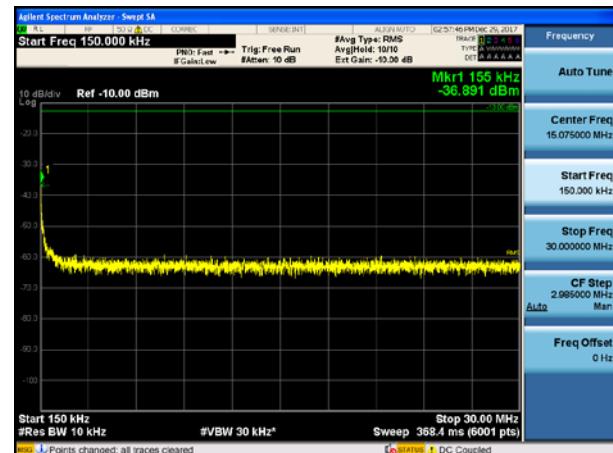


[Uplink_Middle]

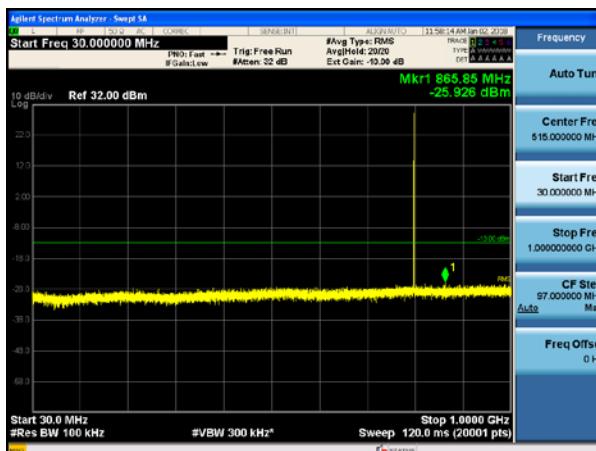
9 kHz ~ 150 kHz



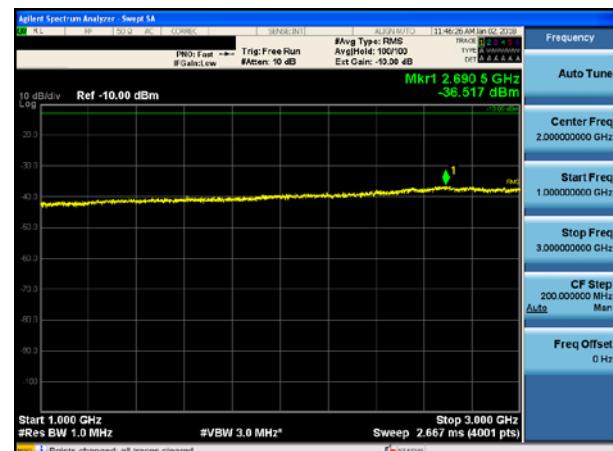
150 kHz ~ 30 MHz



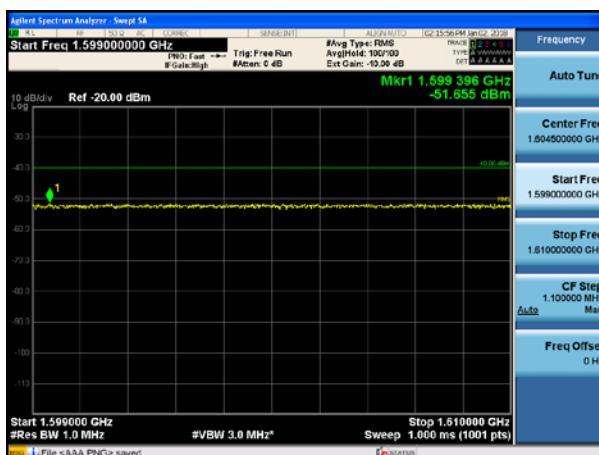
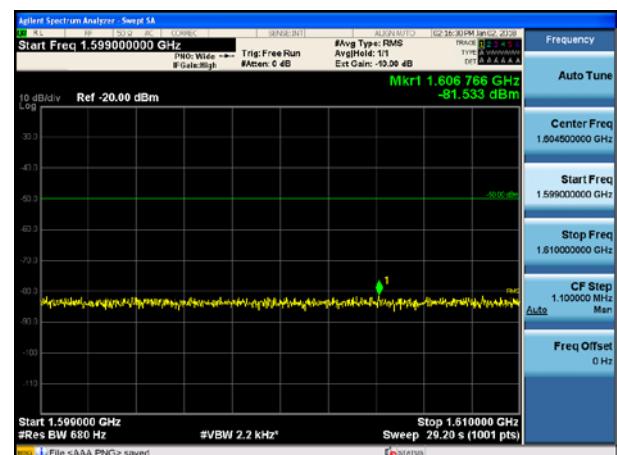
30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



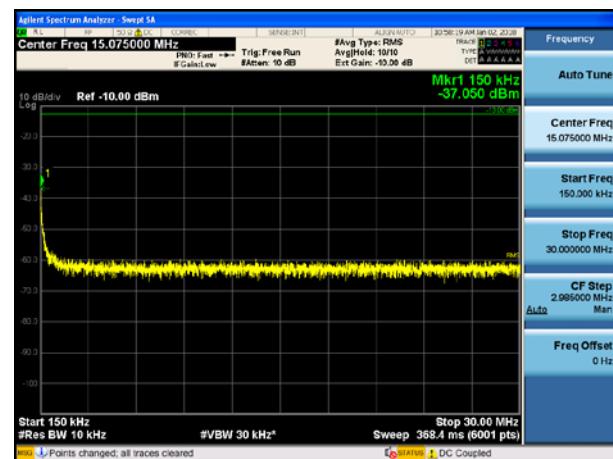
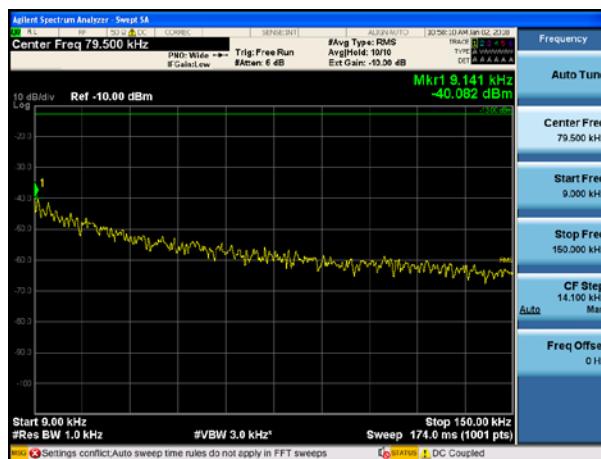
3 GHz ~ 12.75 GHz

1599 MHz ~ 1610 MHz (1)

1599 MHz ~ 1610 MHz (2)


[Uplink_High]

9 kHz ~ 150 kHz

150 kHz ~ 30 MHz



30 MHz ~ 1 GHz

1 GHz ~ 3 GHz

