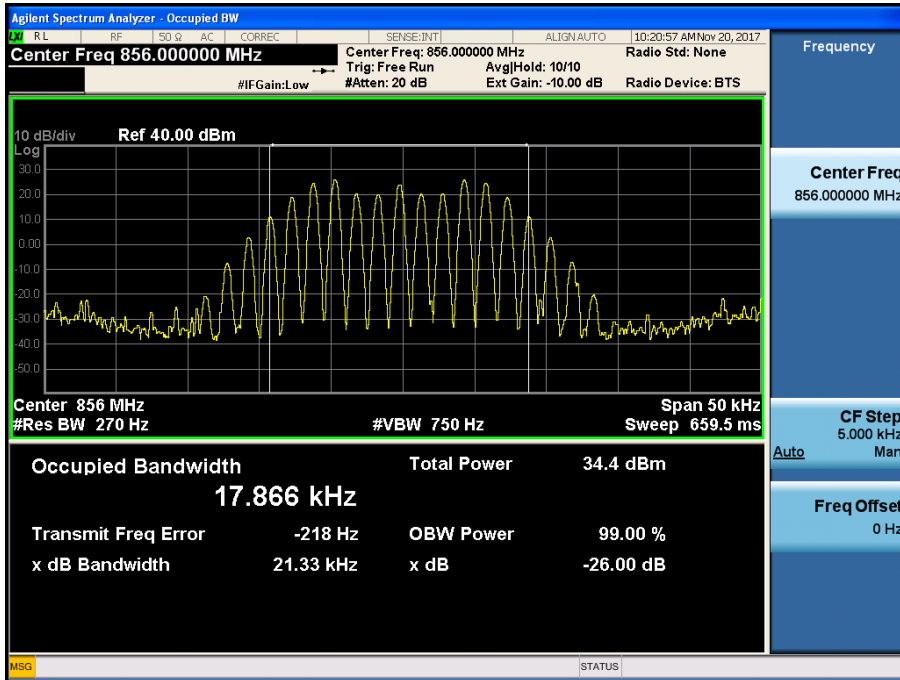
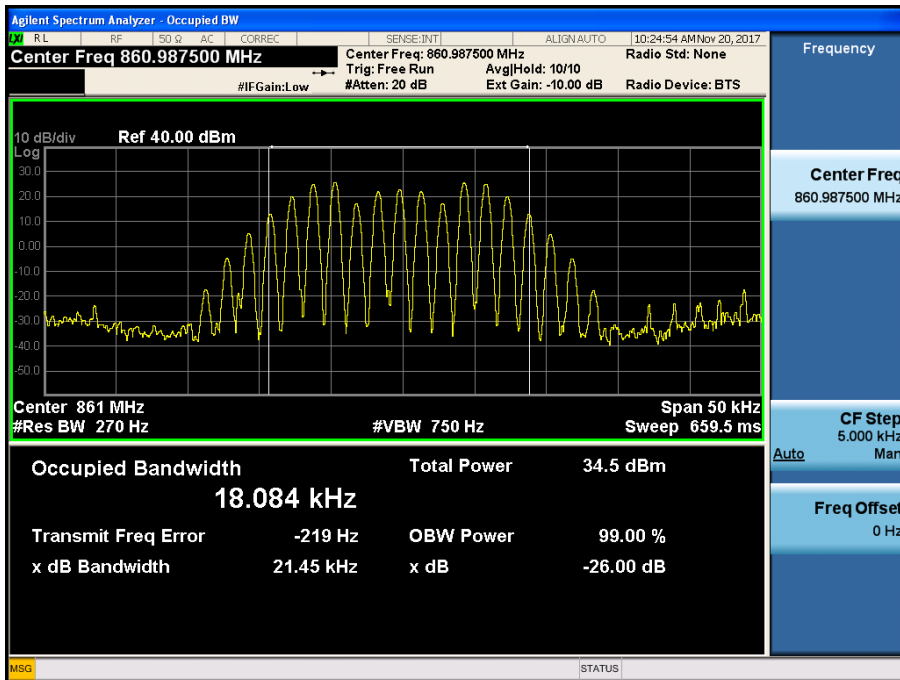


**[+3dB above the AGC threshold Downlink - Middle]**

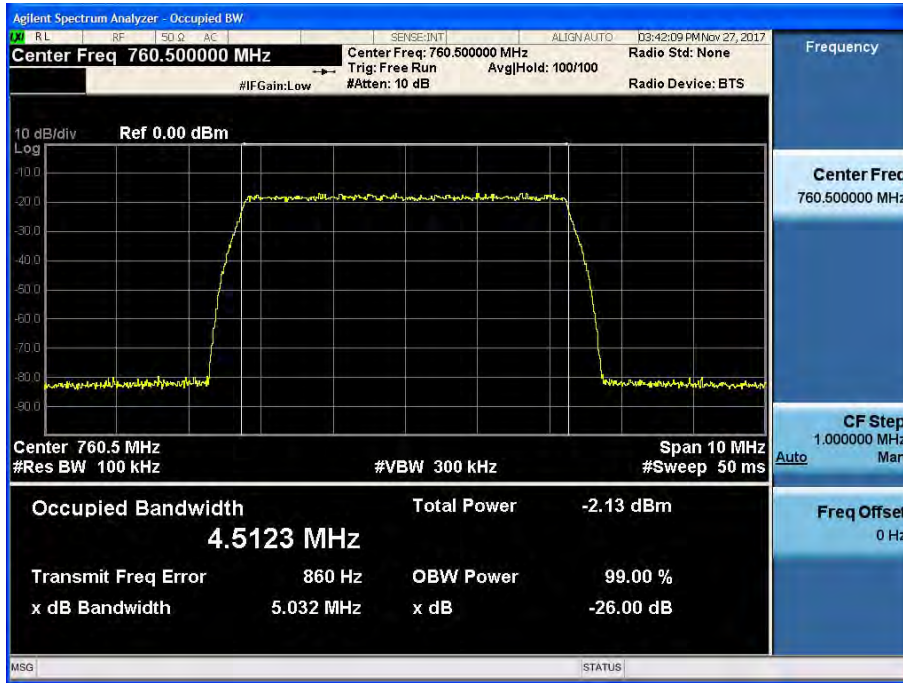


**[+3dB above the AGC threshold Downlink - High]**

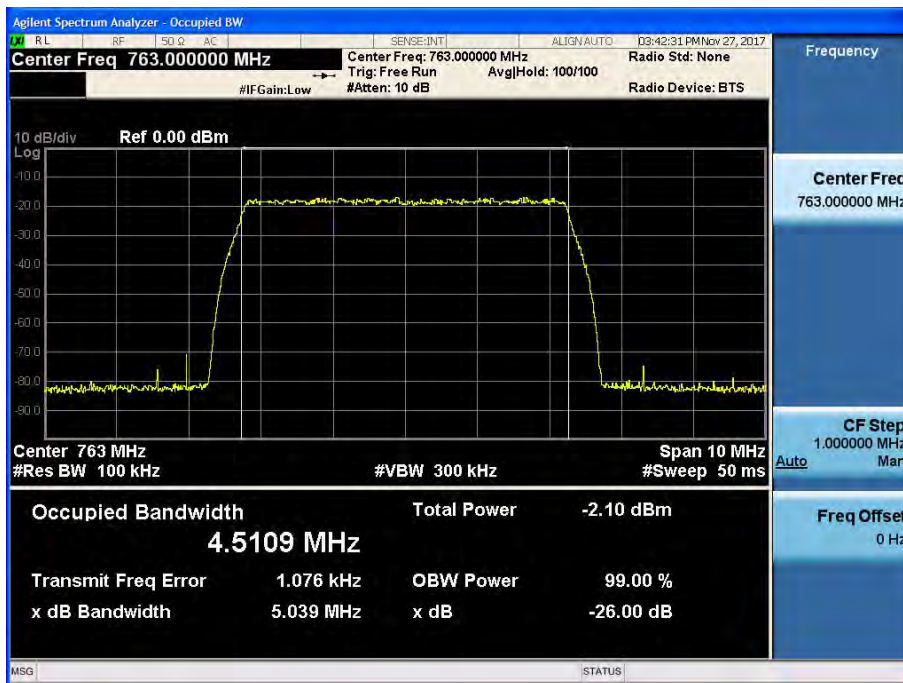


700 LTE(5 MHz)\_DL Input

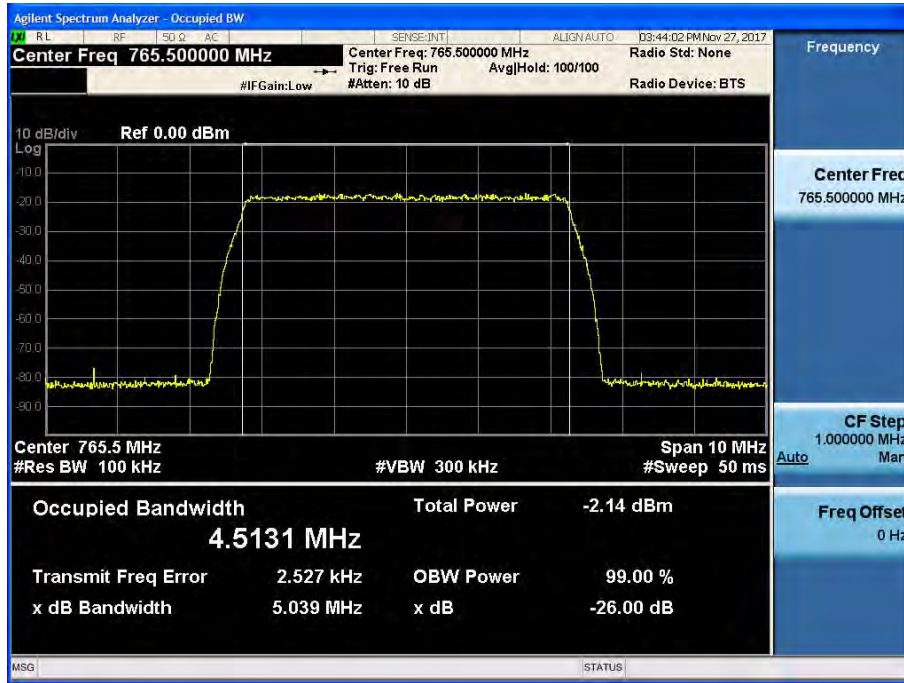
[QPSK Downlink - Low]



[QPSK Downlink - Middle]

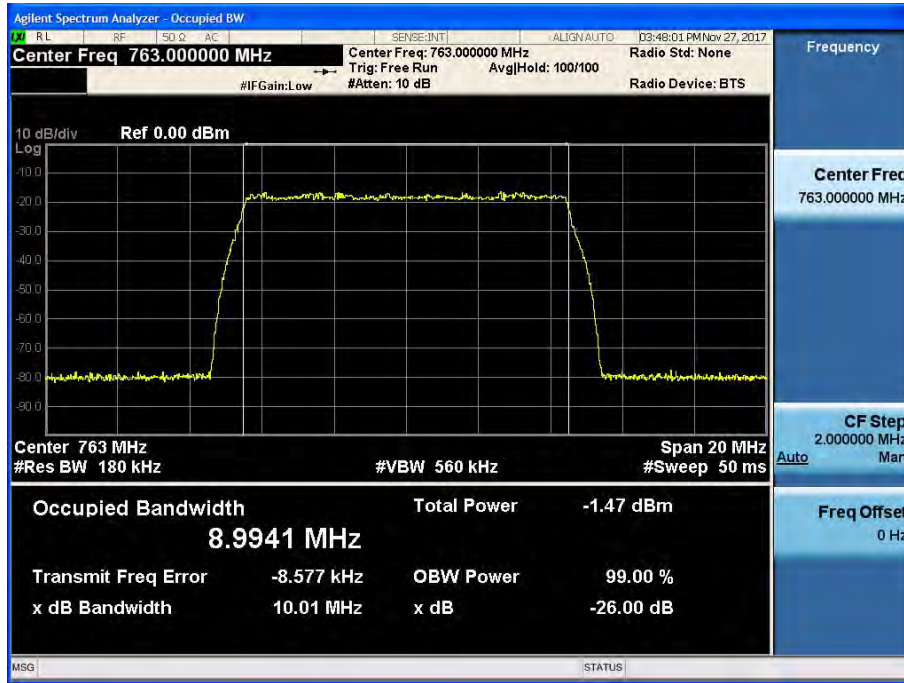


[QPSK Downlink - High]



700 LTE(10 MHz)\_DL Input

[QPSK Downlink - Middle]



700 APCO 25(6.25 kHz)\_DL Input

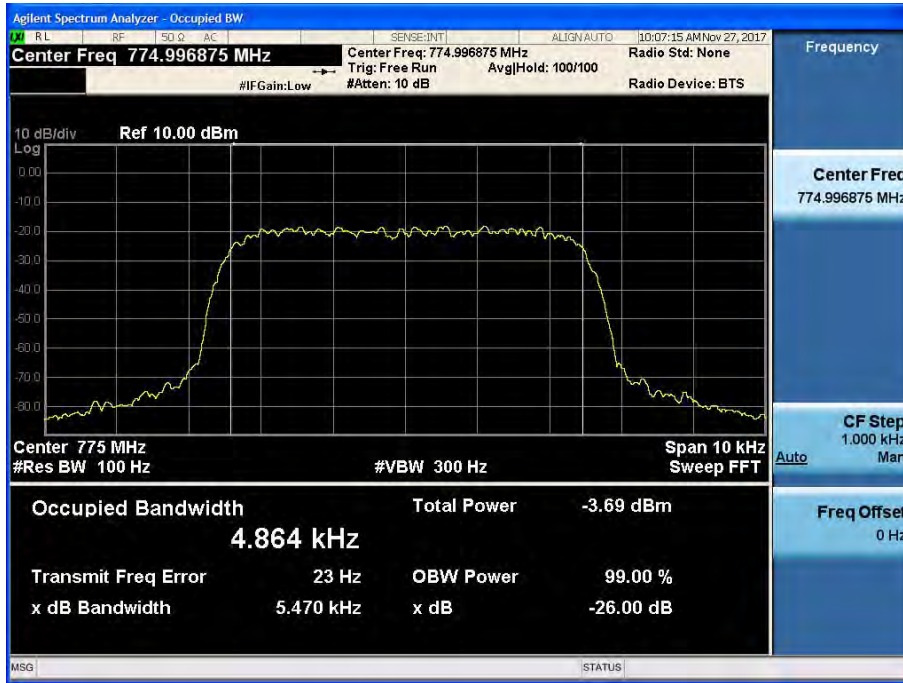
[AGC threshold Downlink - Low]



[AGC threshold Downlink - Middle]



[AGC threshold Downlink - High]



700 APCO 25(12.5 kHz)\_DL Input

[AGC threshold Downlink - Low]



[AGC threshold Downlink - Middle]



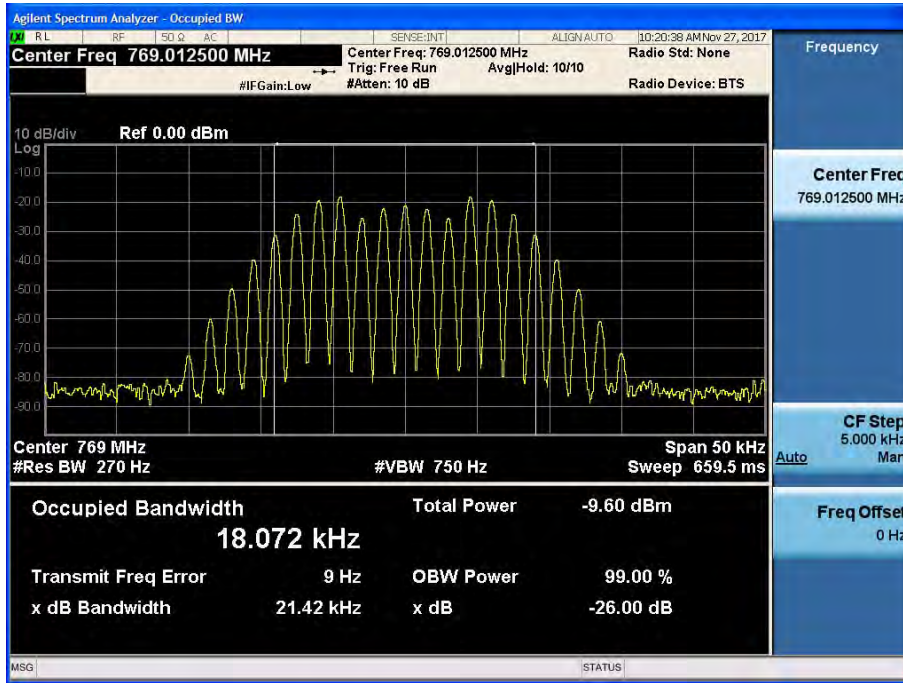
[AGC threshold Downlink - High]



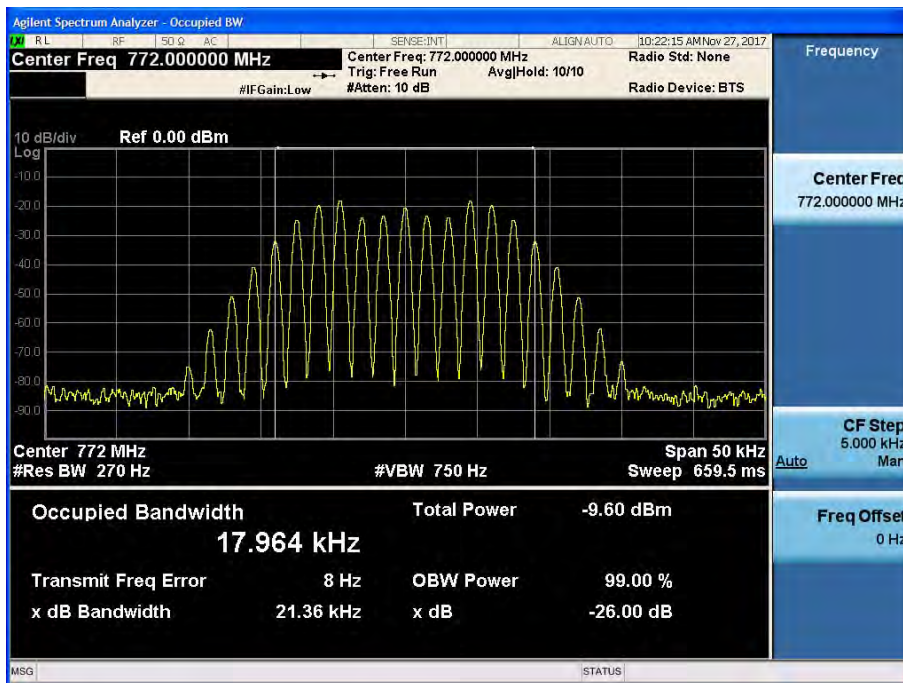


700 APCO 25(25 kHz)\_DL Input

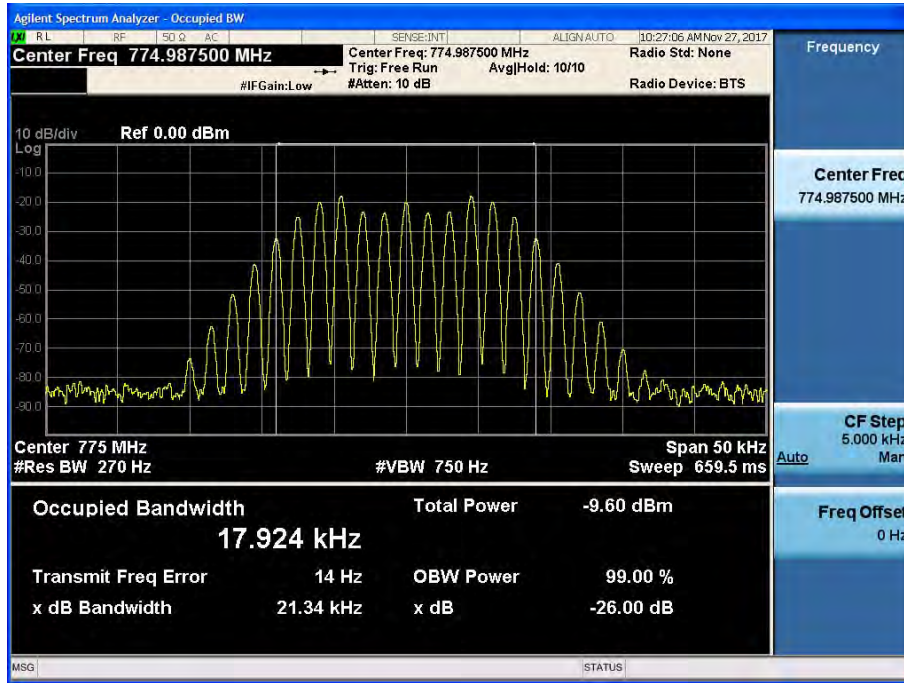
[AGC threshold Downlink - Low]



[AGC threshold Downlink - Middle]

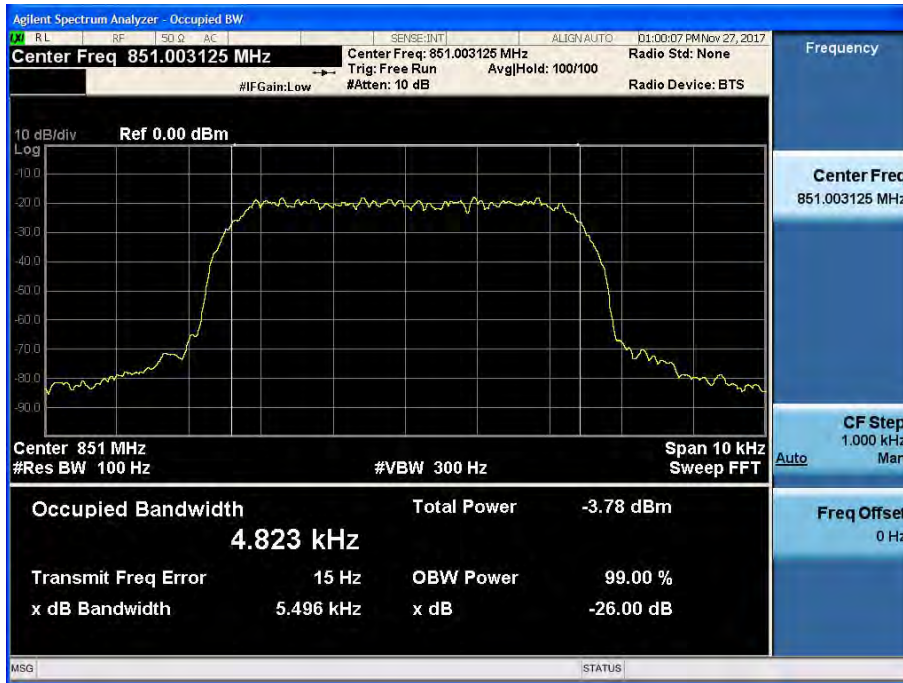


[AGC threshold Downlink - High]



800 APCO 25(6.25 kHz)\_DL Input

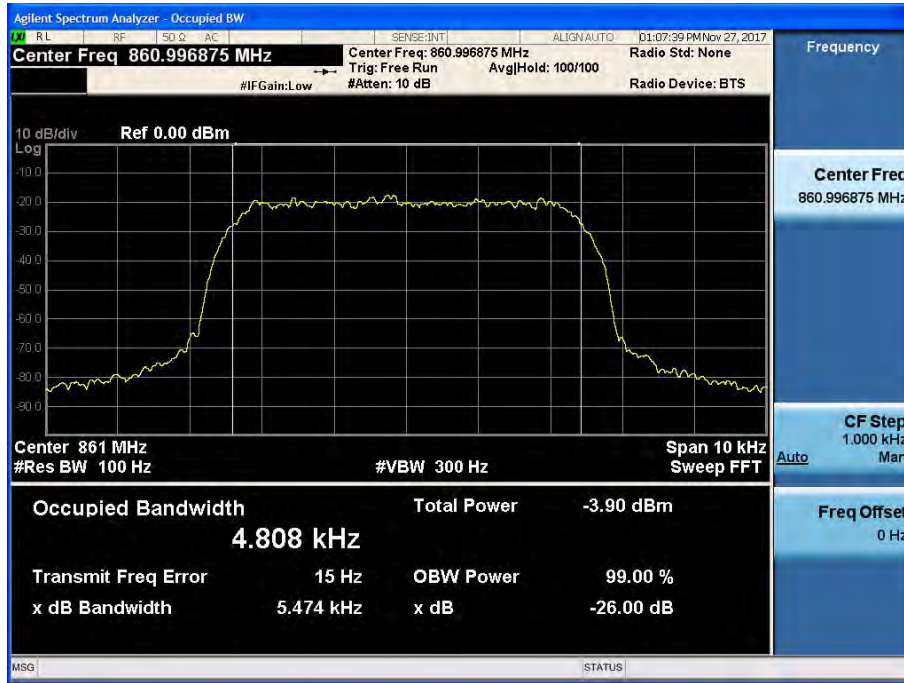
[AGC threshold Downlink - Low]



[AGC threshold Downlink - Middle]

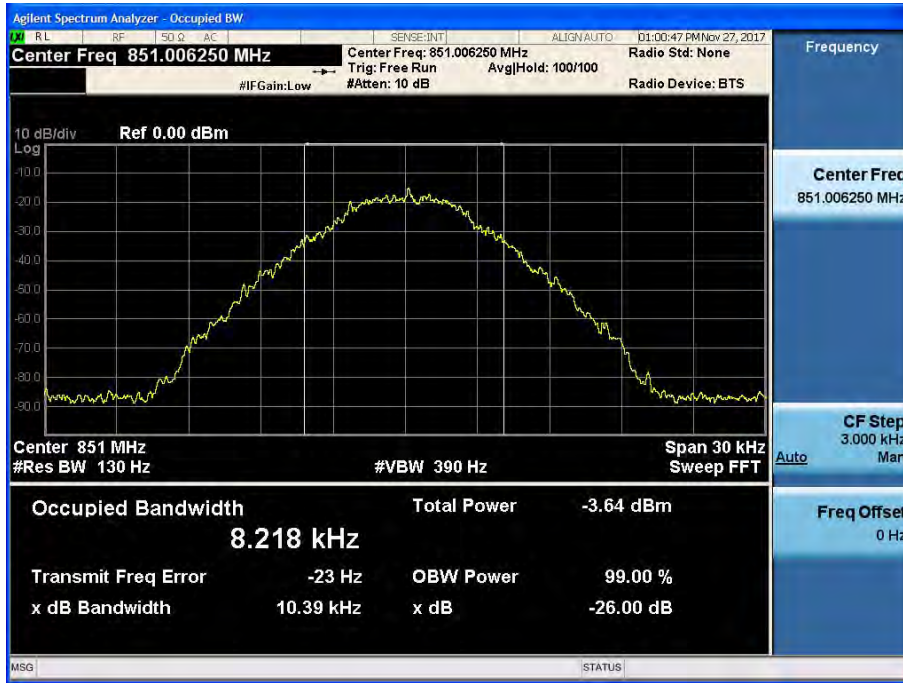


[AGC threshold Downlink - High]



800 APCO 25(12.5 kHz)\_DL Input

[AGC threshold Downlink - Low]



[AGC threshold Downlink - Middle]

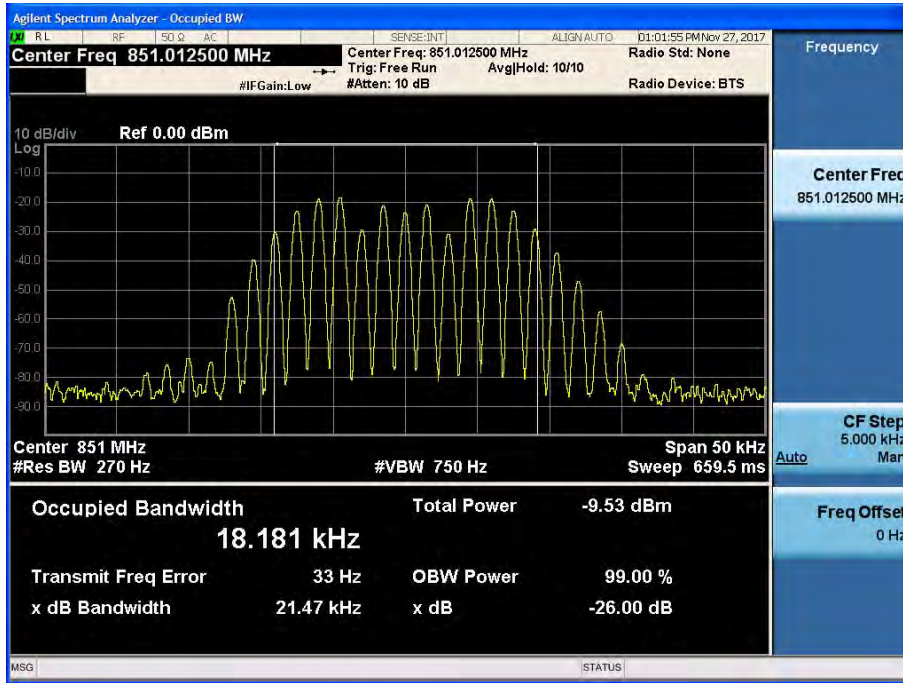


[AGC threshold Downlink - High]

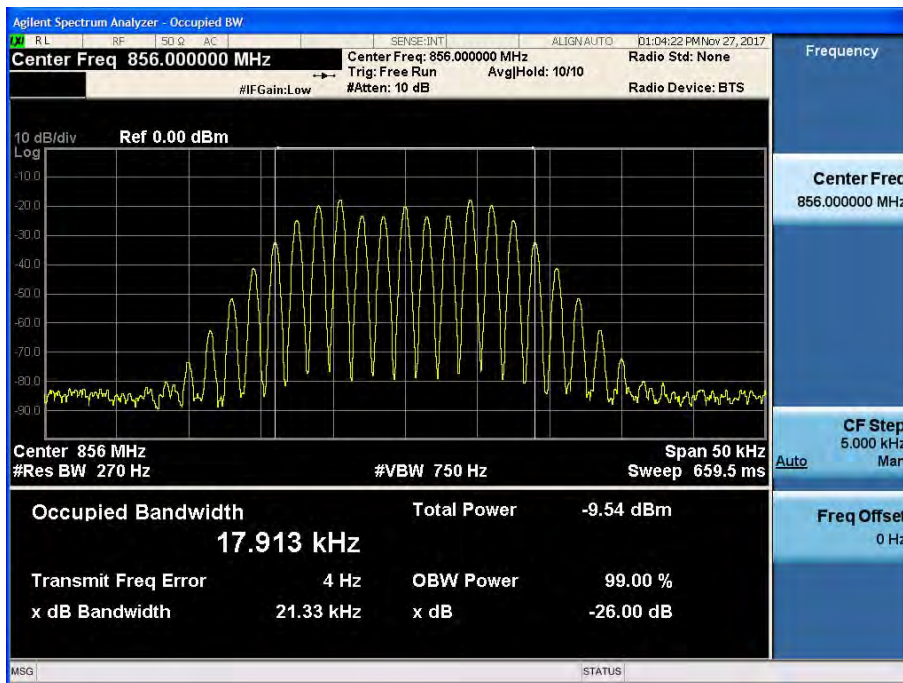


800 APCO 25(25 kHz)\_DL Input

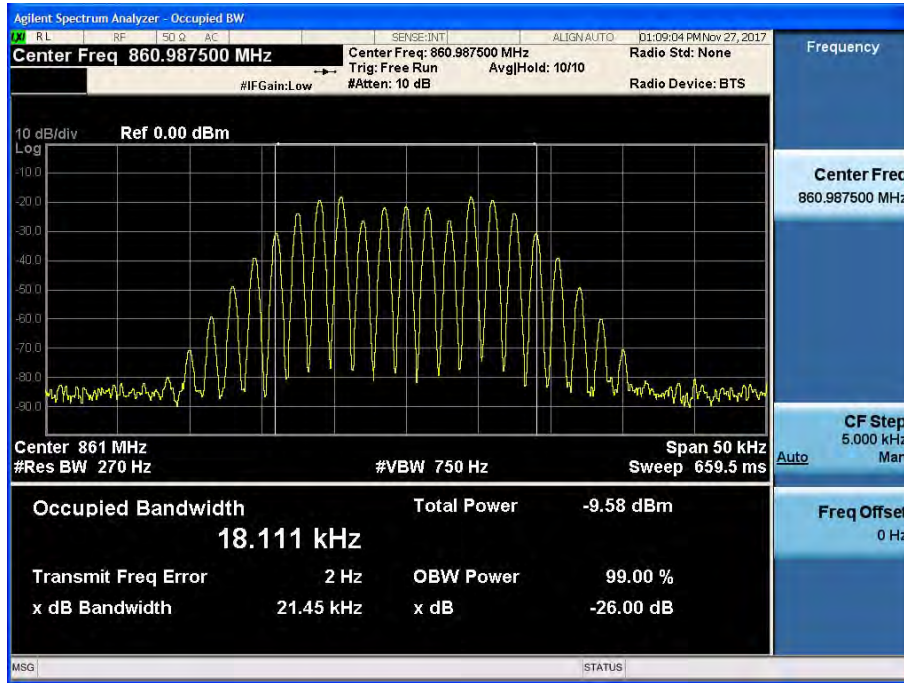
[AGC threshold Downlink - Low]



[AGC threshold Downlink - Middle]



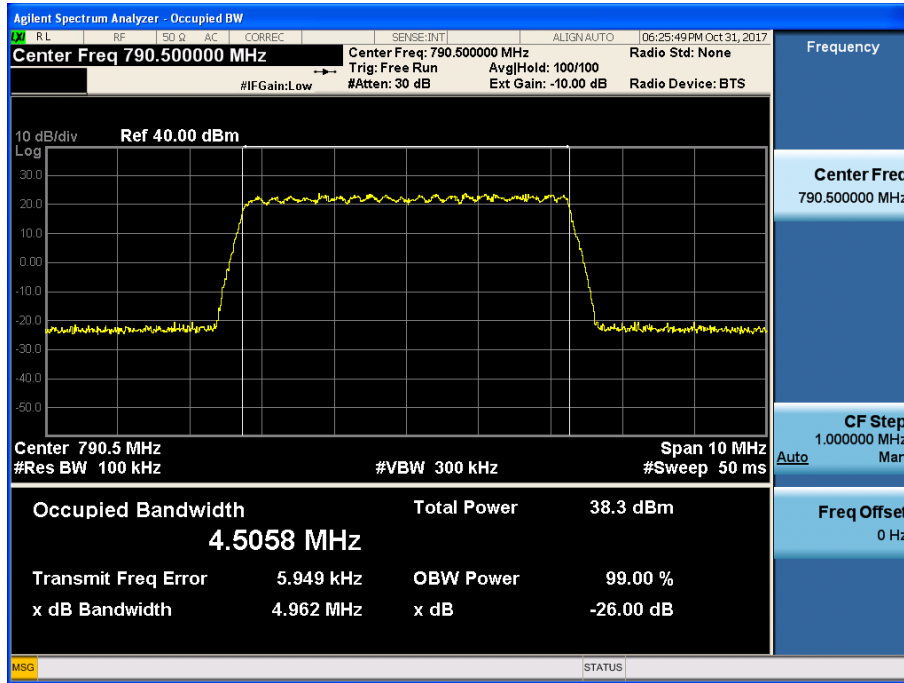
[AGC threshold Downlink - High]



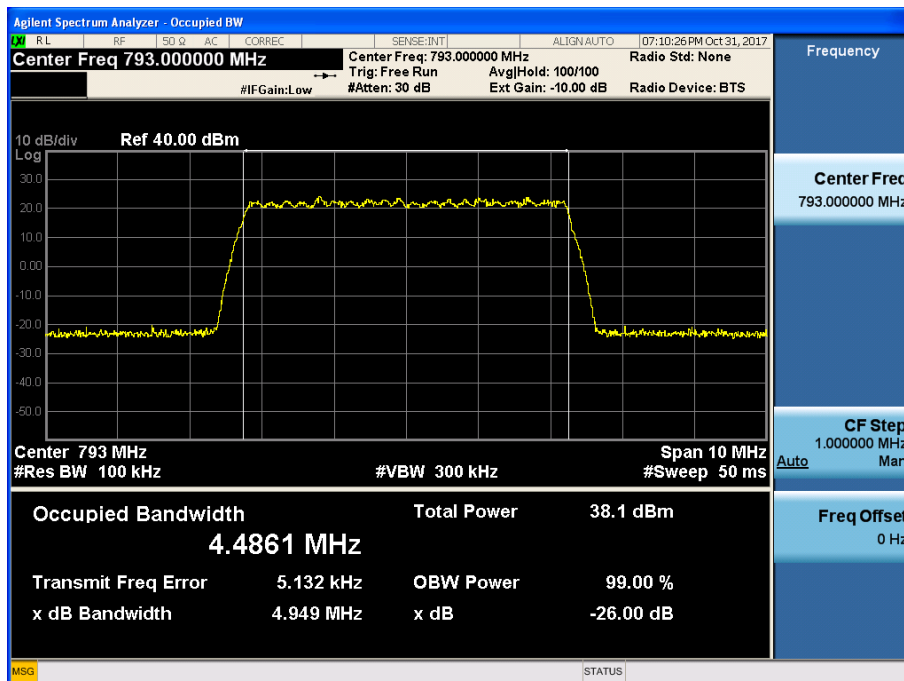


700 LTE(5 MHz)\_UL Output

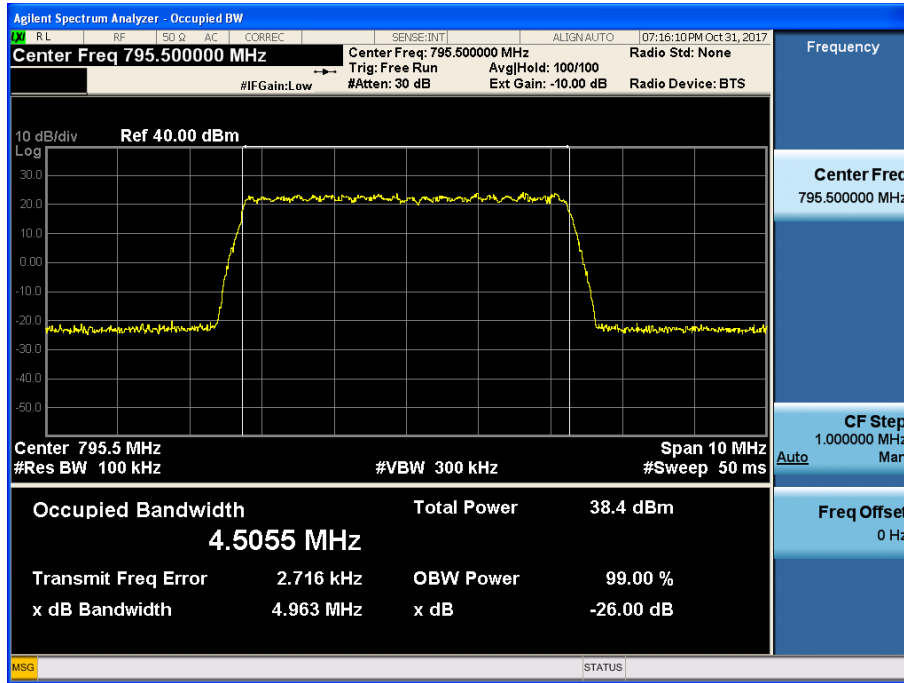
[QPSK Uplink - Low]



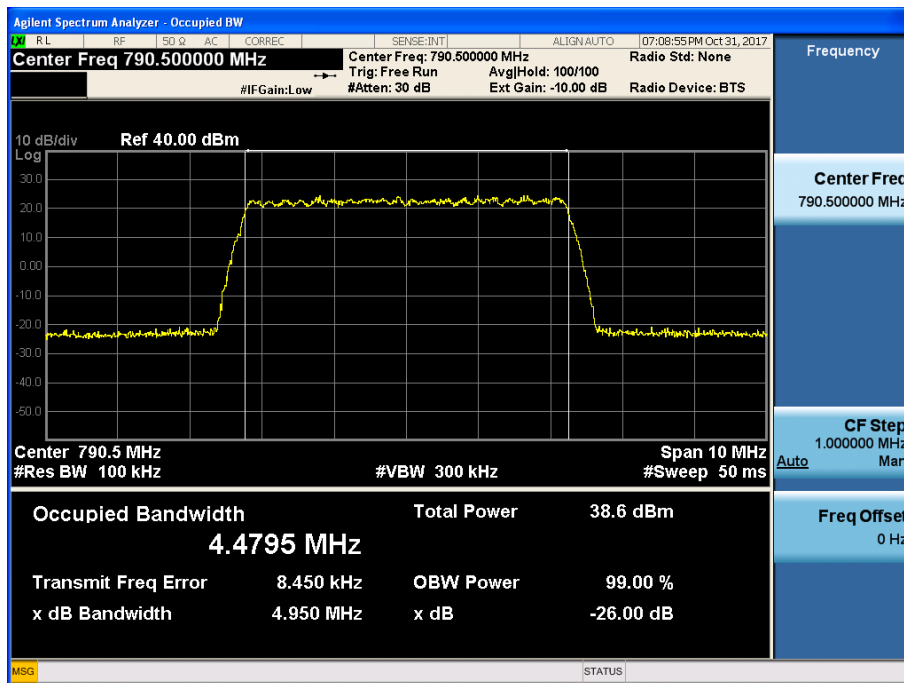
[QPSK Uplink - Middle]



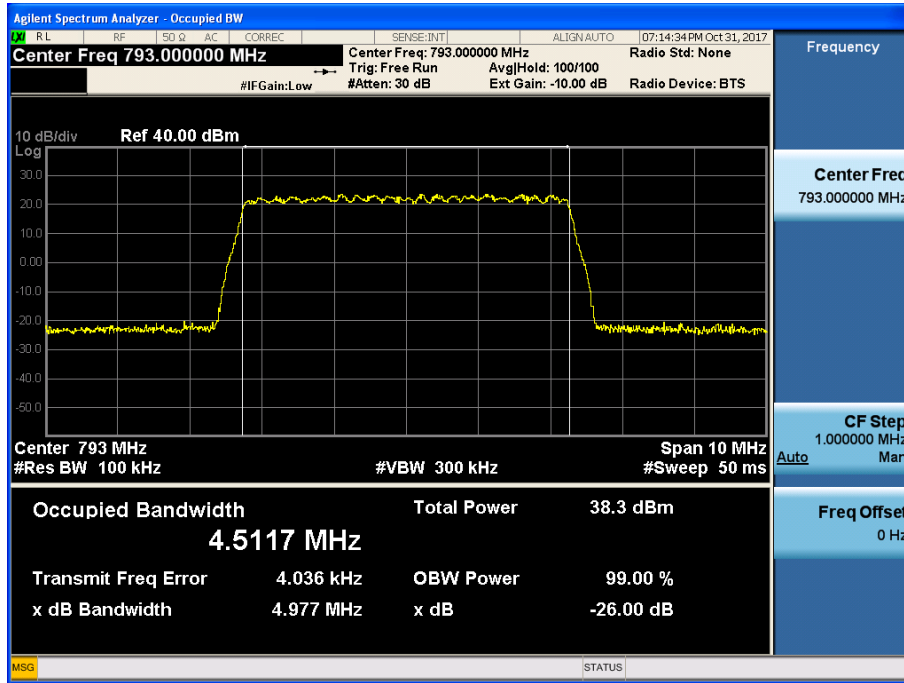
[QPSK Uplink - High]



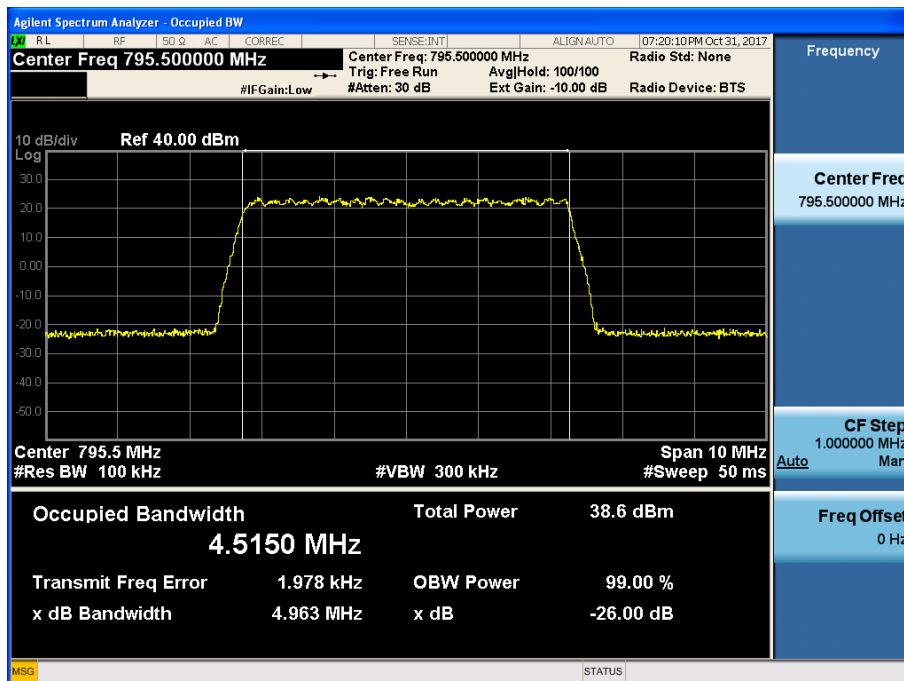
[16QAM Uplink - Low]



[16QAM Uplink - Middle]

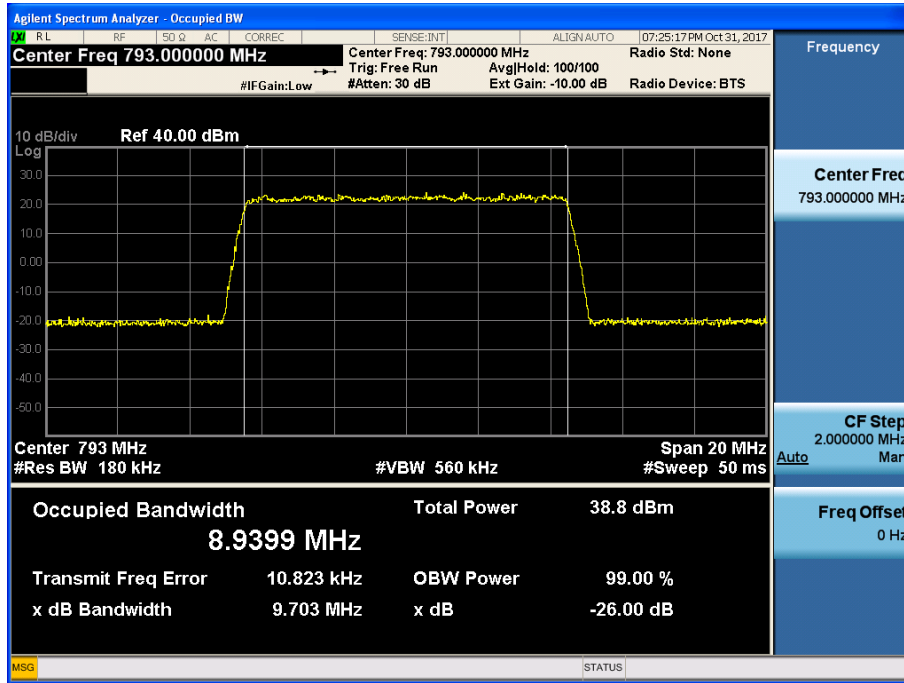


[16QAM Uplink - High]

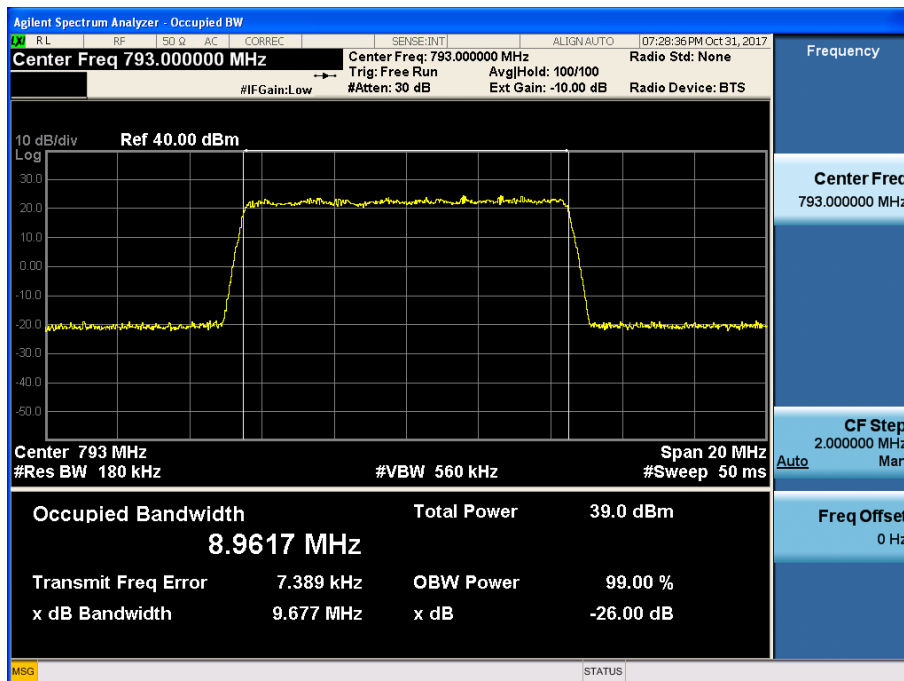


700 LTE(10 MHz)\_UL Output

[QPSK Uplink - Middle]

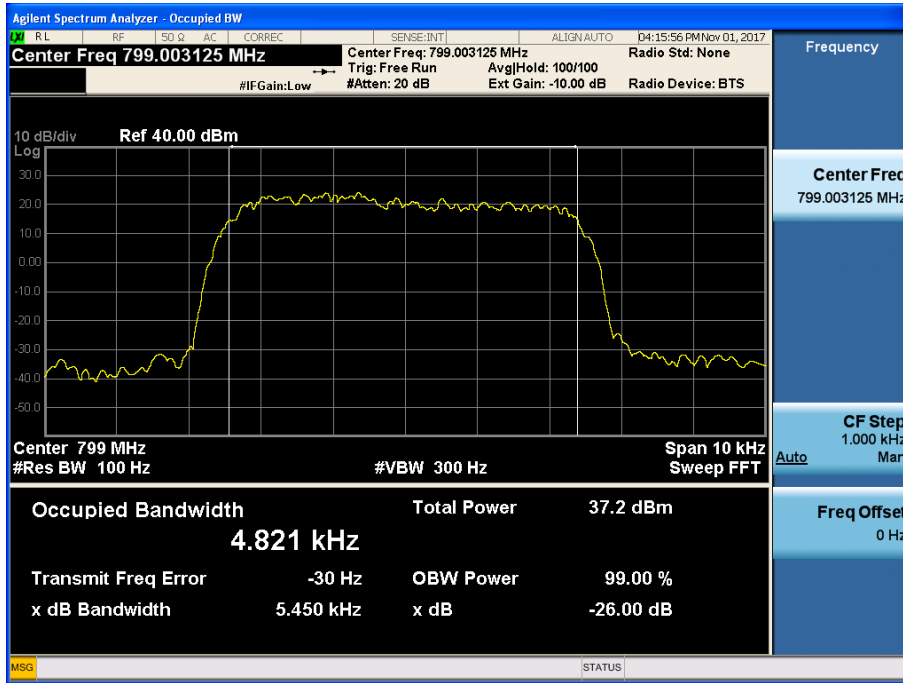


[16QAM Uplink - Middle]

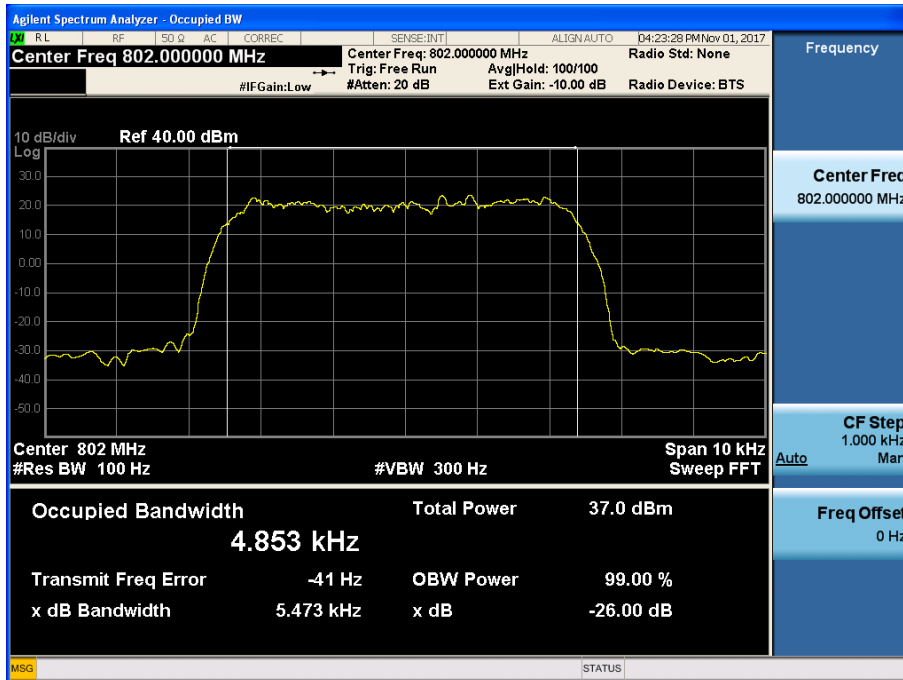


700 APCO 25(6.25 kHz)\_UL Output

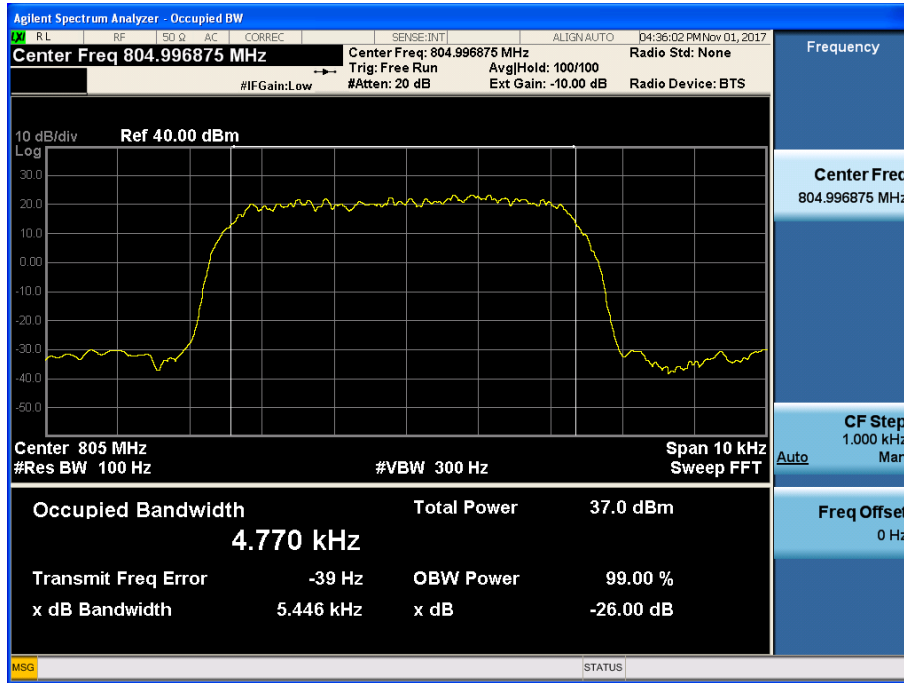
[AGC threshold Uplink - Low]



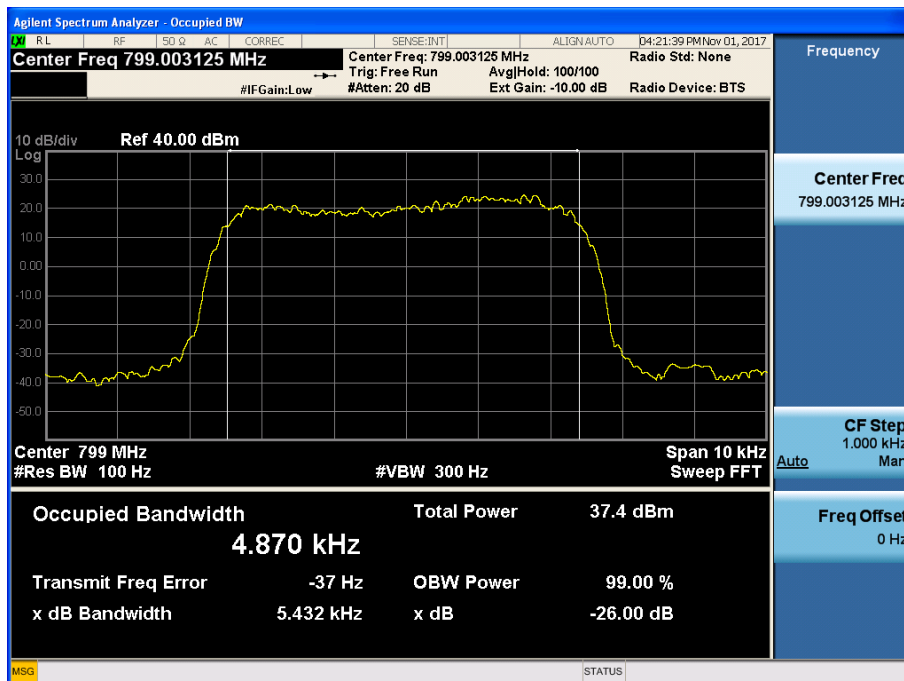
[AGC threshold Uplink - Middle]



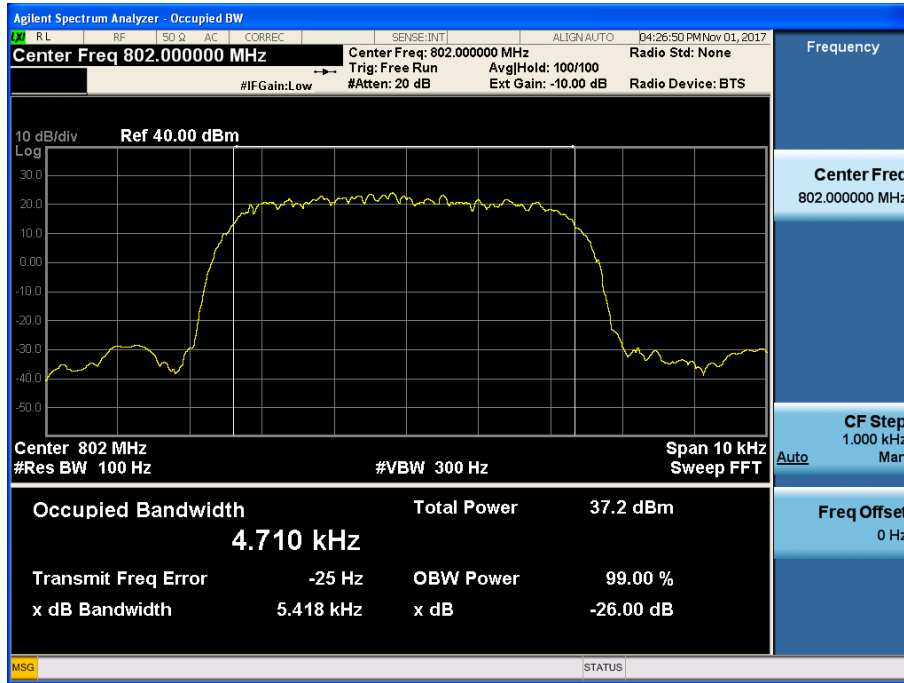
[AGC threshold Uplink - High]



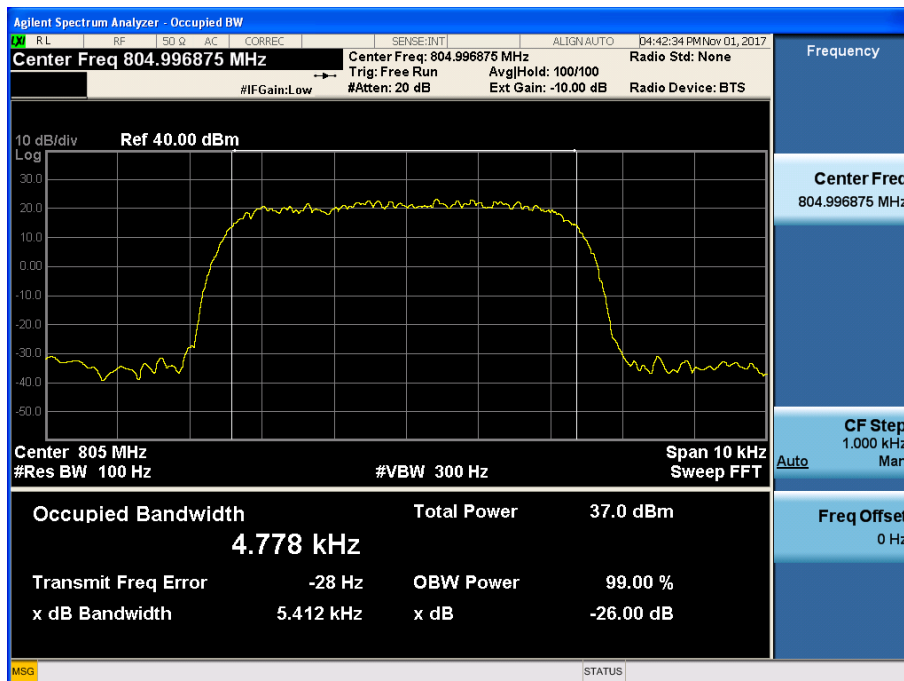
[+3dB above the AGC threshold Uplink - Low]



**[+3dB above the AGC threshold Uplink - Middle]**

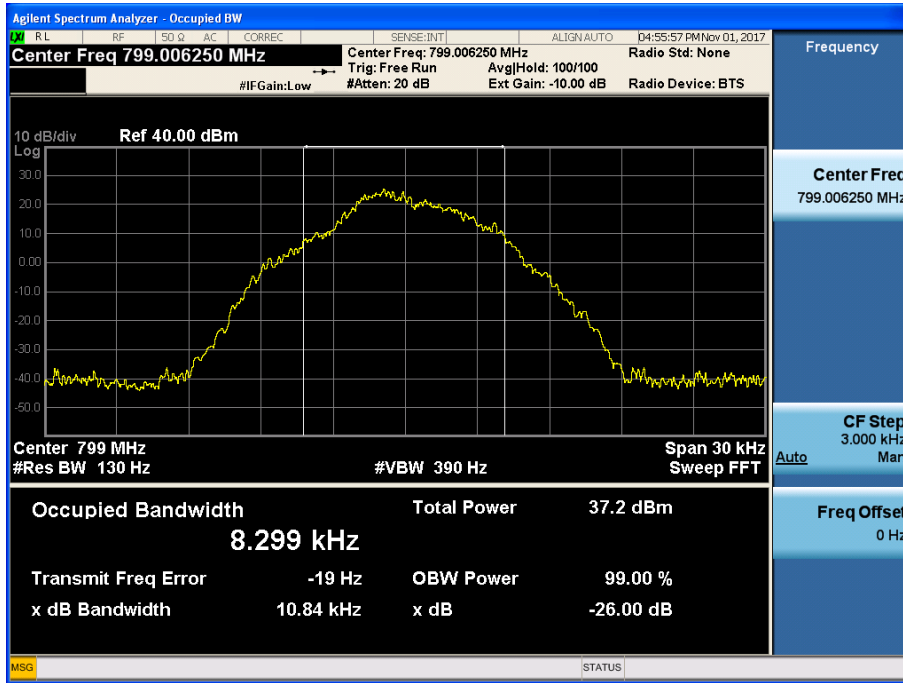


**[+3dB above the AGC threshold Uplink - High]**

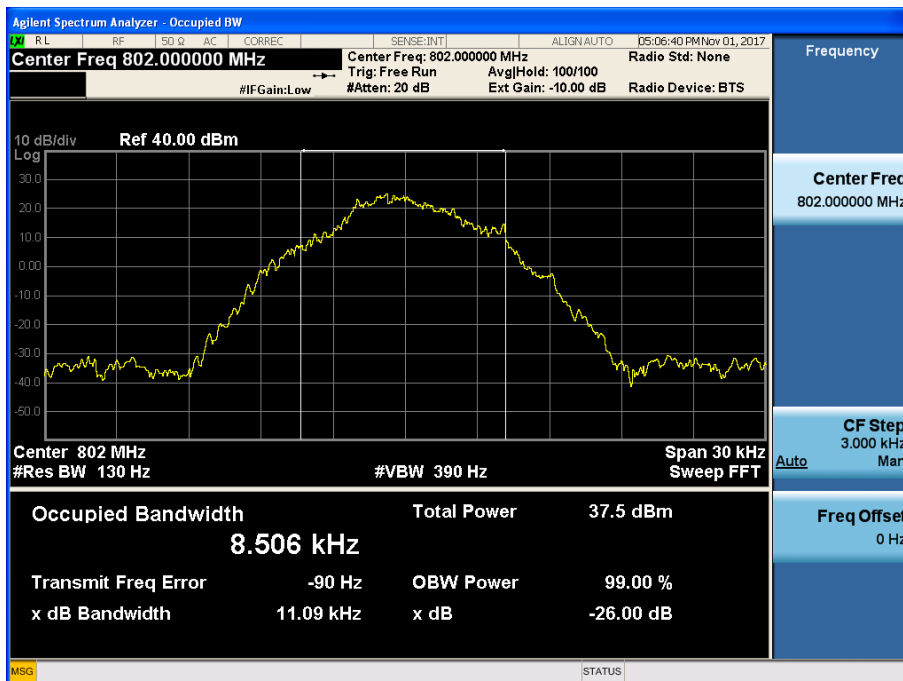


700 APCO 25(12.5 kHz)\_UL Output

[AGC threshold Uplink - Low]

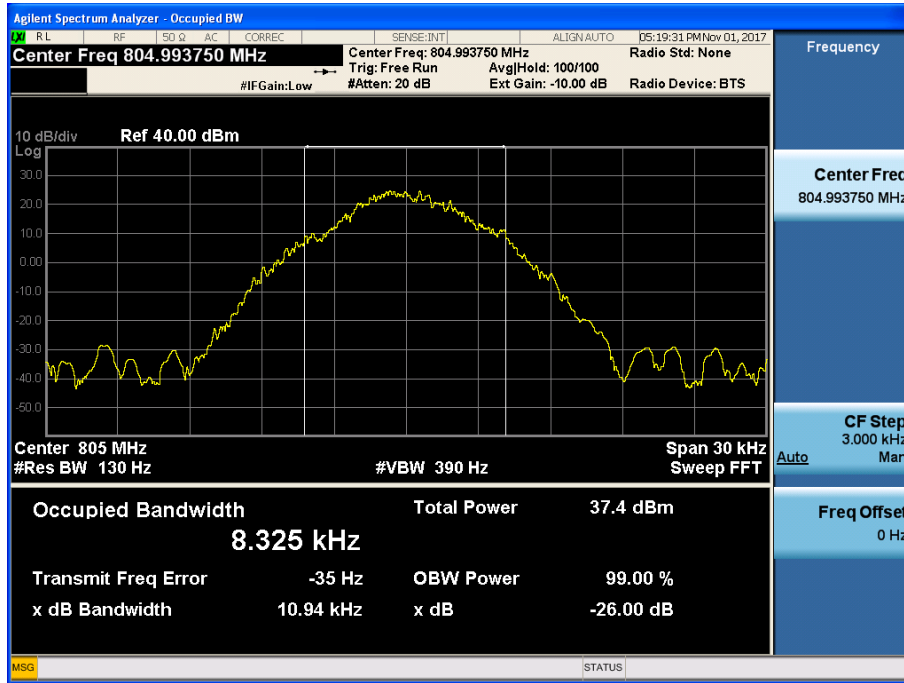


[AGC threshold Uplink - Middle]

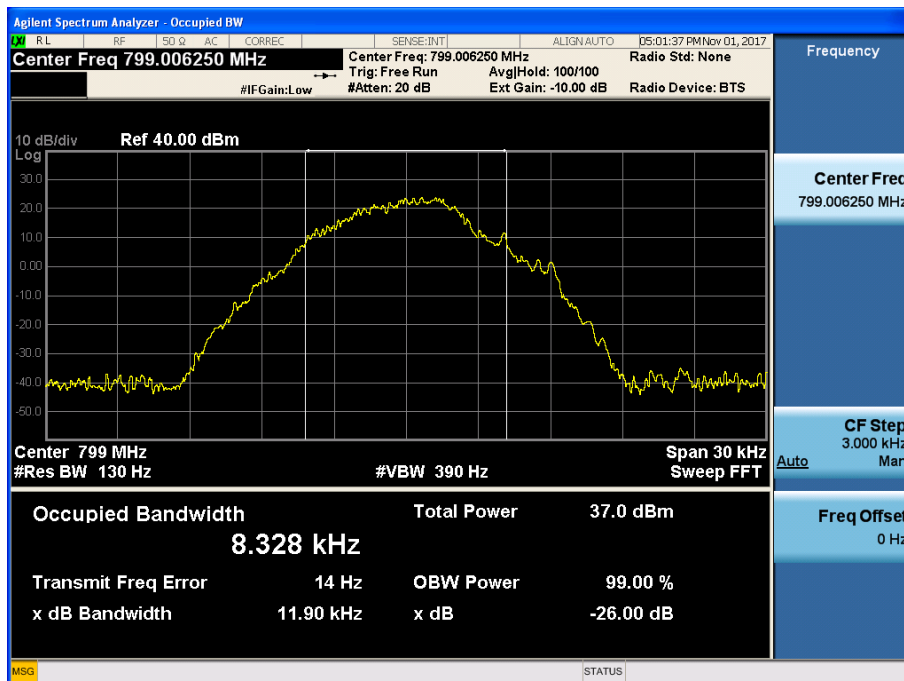




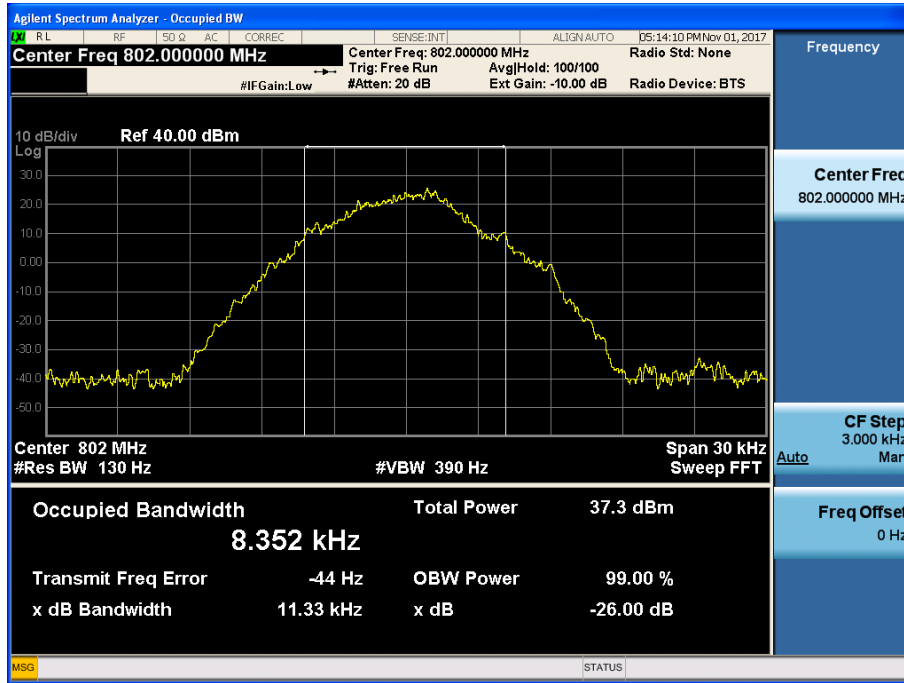
[AGC threshold Uplink - High]



[+3dB above the AGC threshold Uplink - Low]



**[+3dB above the AGC threshold Uplink - Middle]**

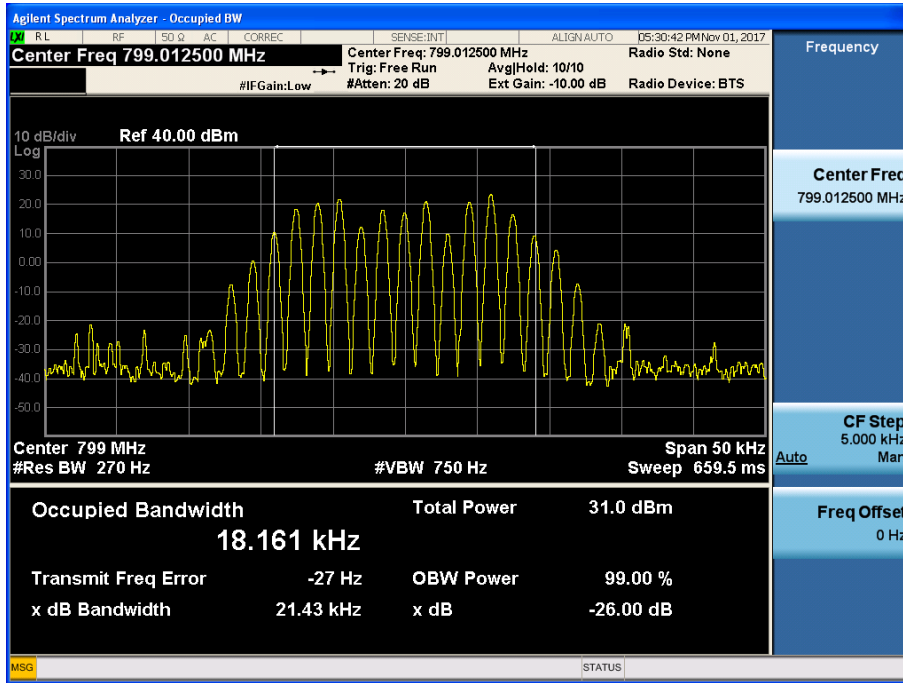


**[+3dB above the AGC threshold Uplink - High]**

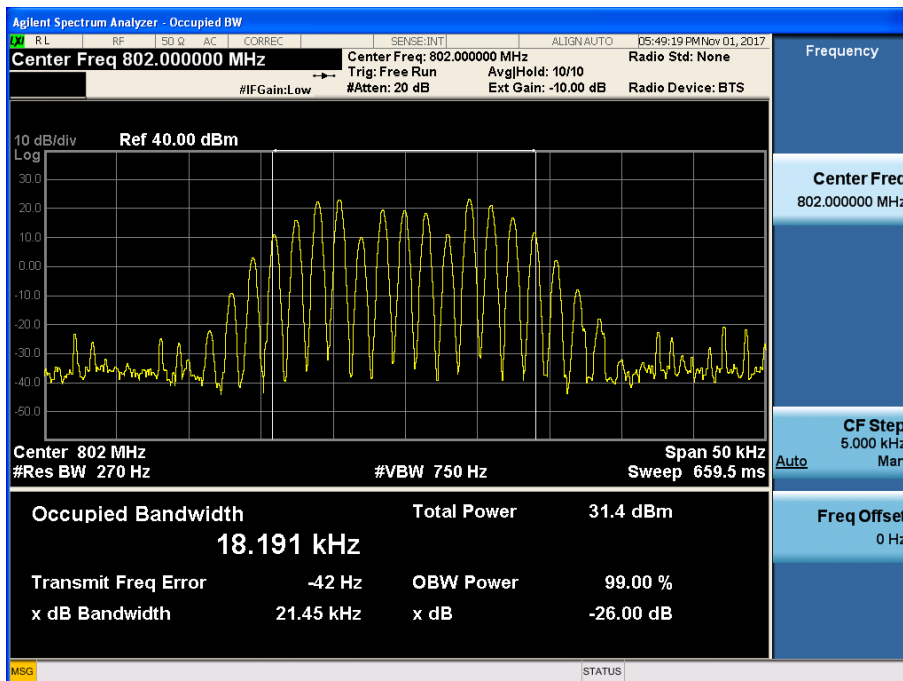


700 APCO 25(25 kHz)\_UL Output

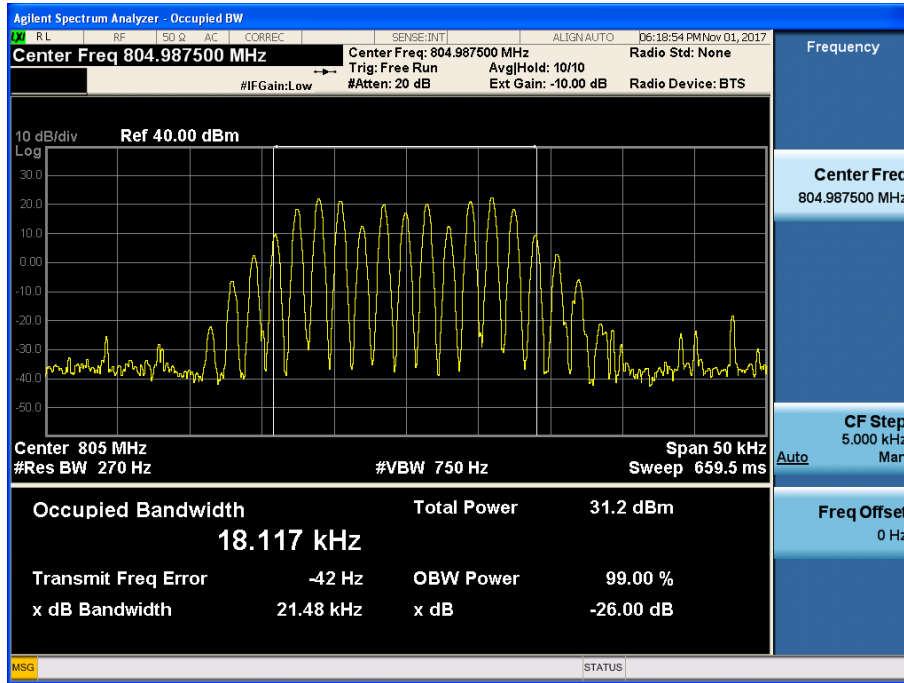
[AGC threshold Uplink - Low]



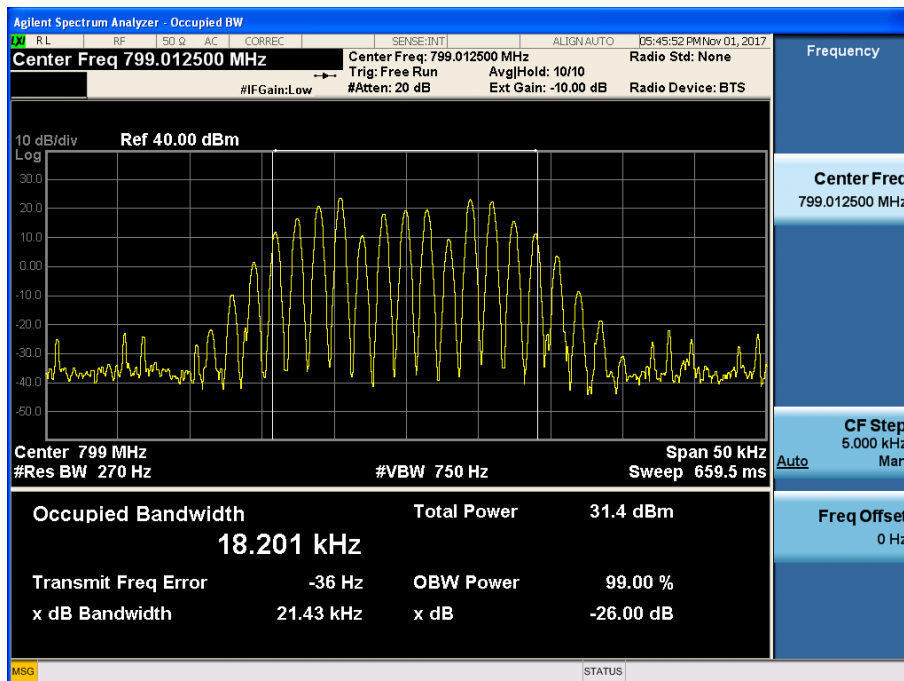
[AGC threshold Uplink - Middle]



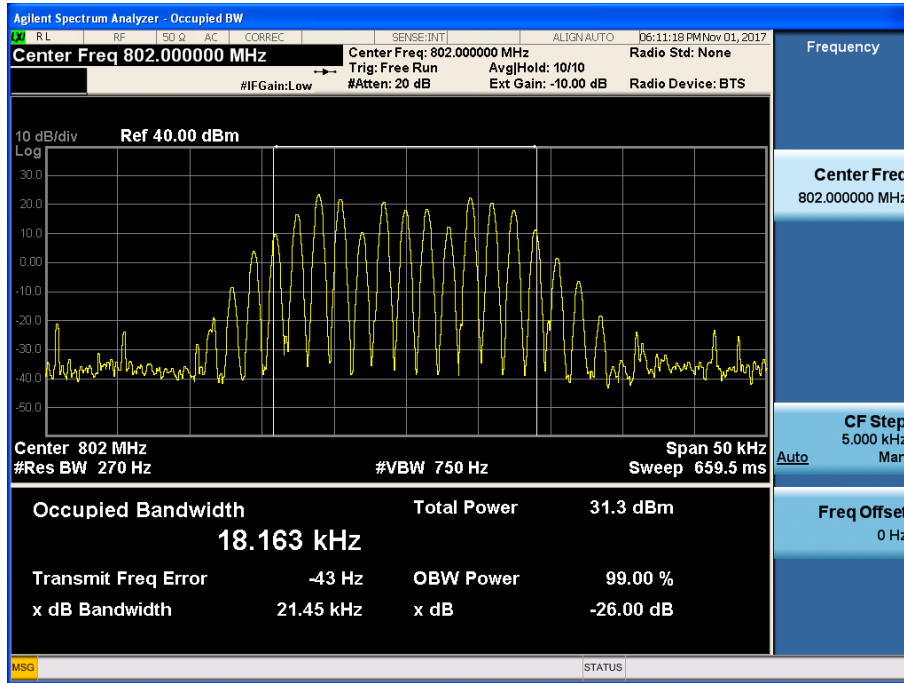
[AGC threshold Uplink - High]



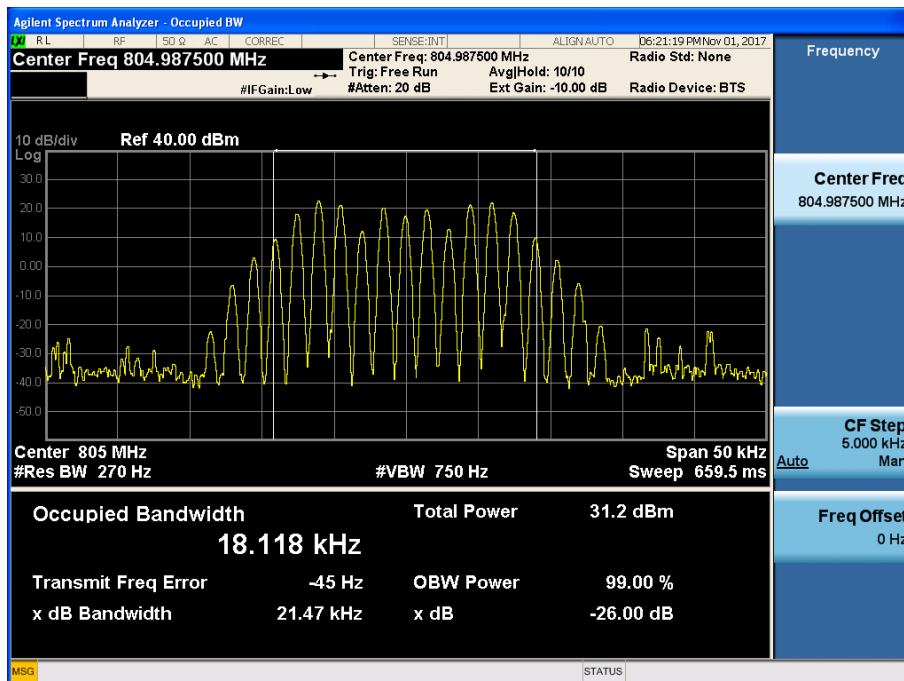
[+3dB above the AGC threshold Uplink - Low]



**[+3dB above the AGC threshold Uplink - Middle]**



**[+3dB above the AGC threshold Uplink - High]**



800 APCO 25(6.25 kHz)\_UL Output

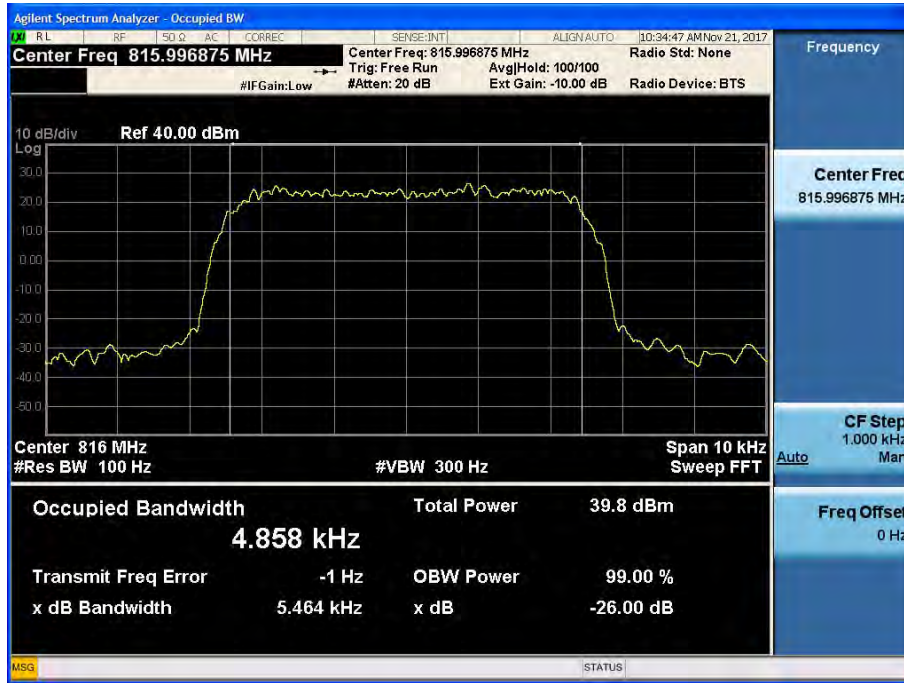
[AGC threshold Uplink - Low]



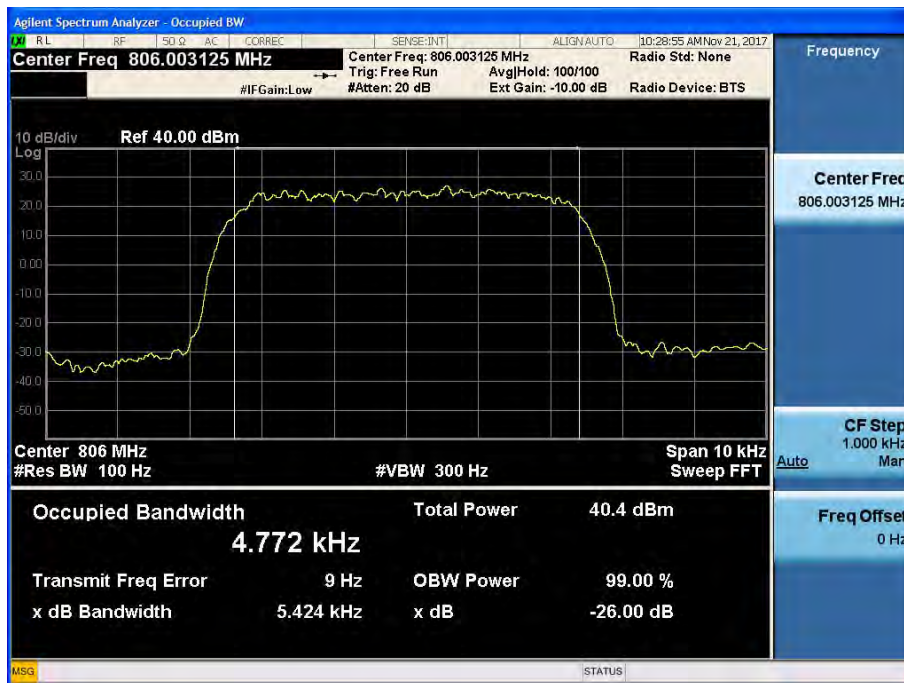
[AGC threshold Uplink - Middle]



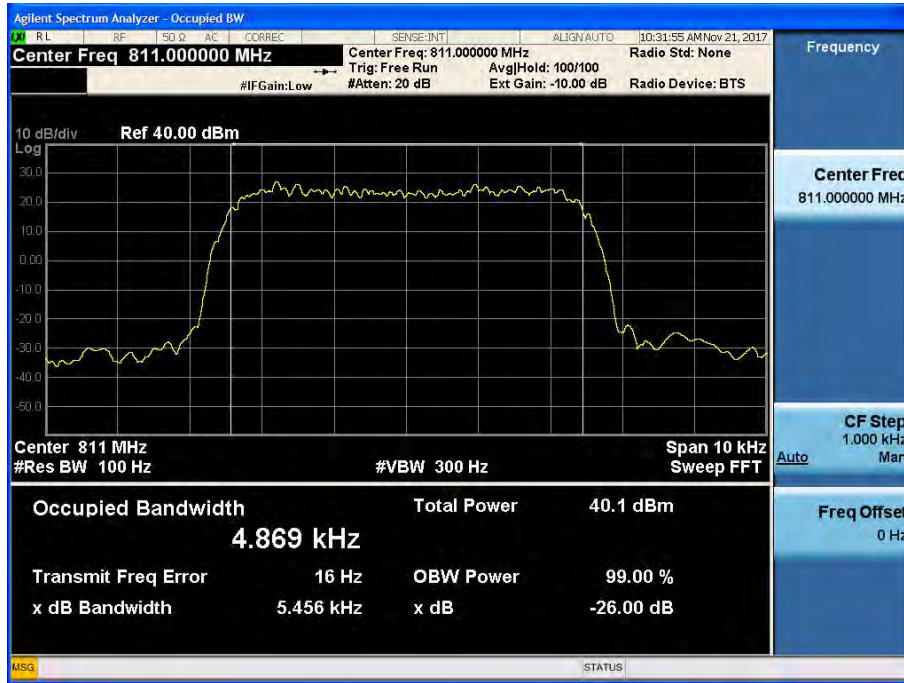
[AGC threshold Uplink - High]



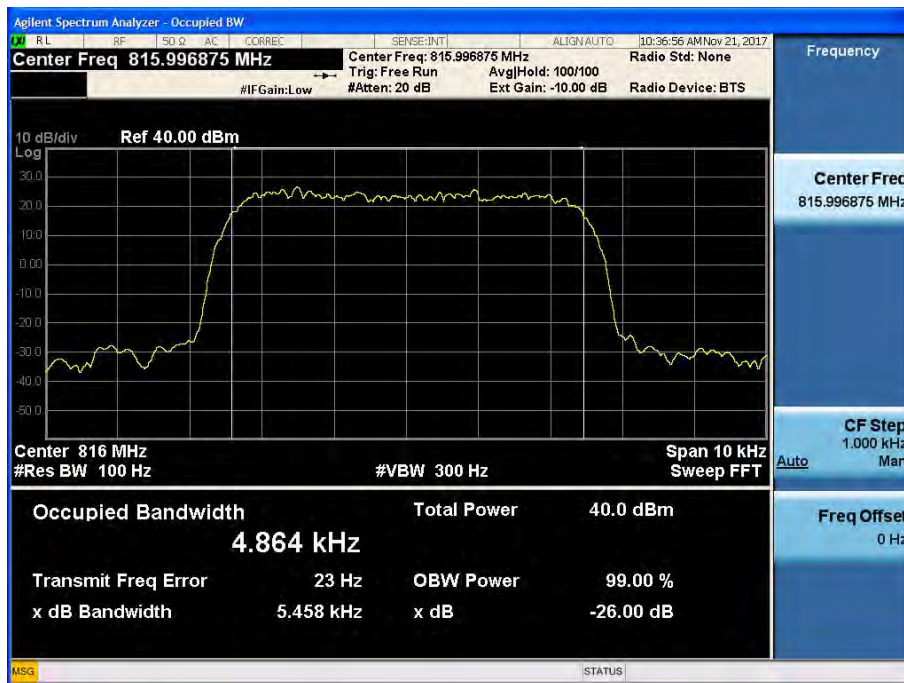
[+3dB above the AGC threshold Uplink - Low]



**[+3dB above the AGC threshold Uplink - Middle]**



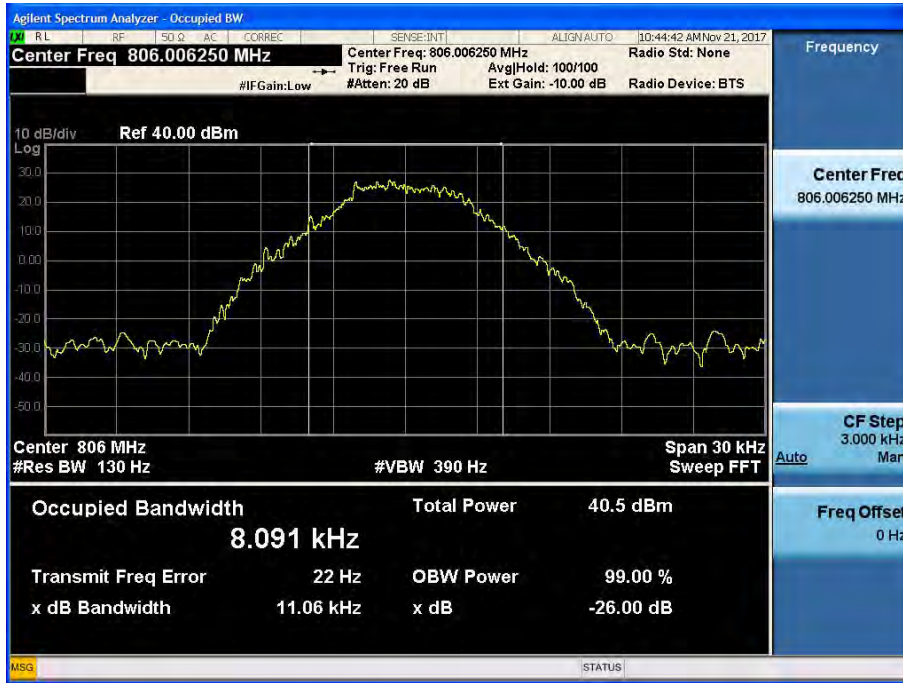
**[+3dB above the AGC threshold Uplink - High]**





**800 APCO 25(12.5 kHz)\_UL Output**

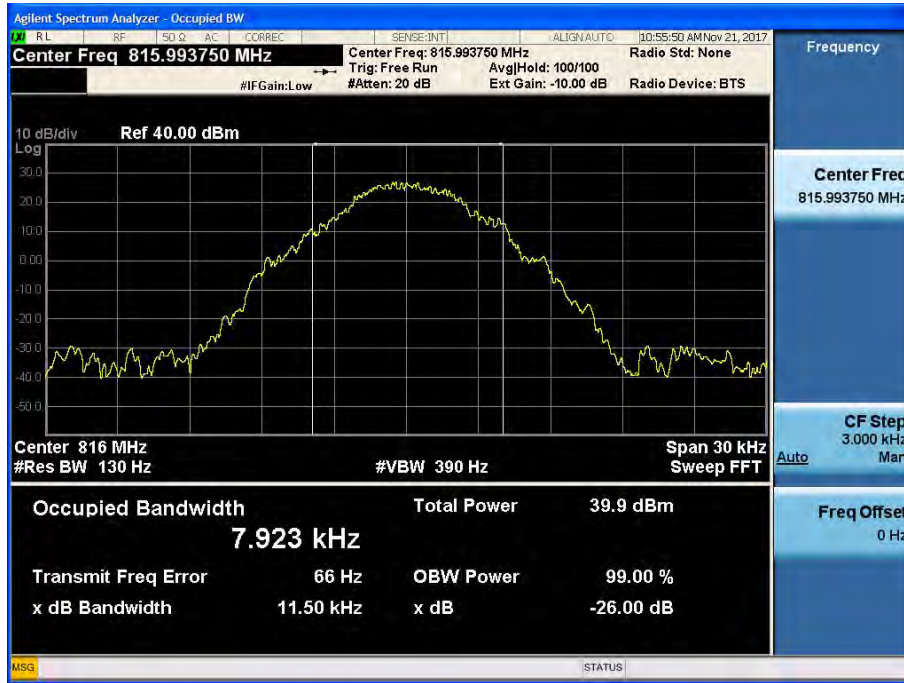
**[AGC threshold Uplink - Low]**



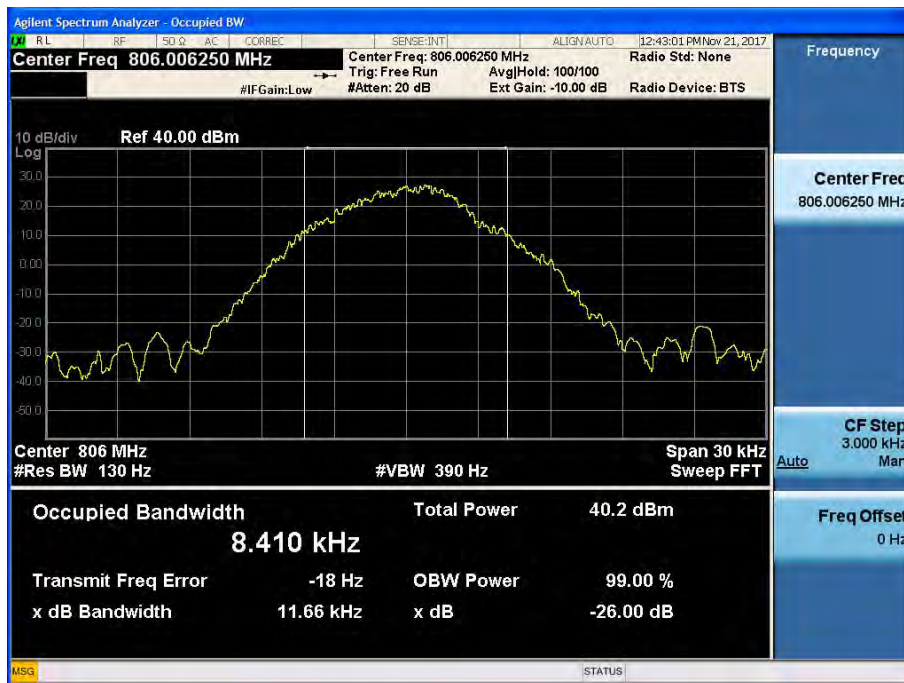
**[AGC threshold Uplink - Middle]**



[AGC threshold Uplink - High]



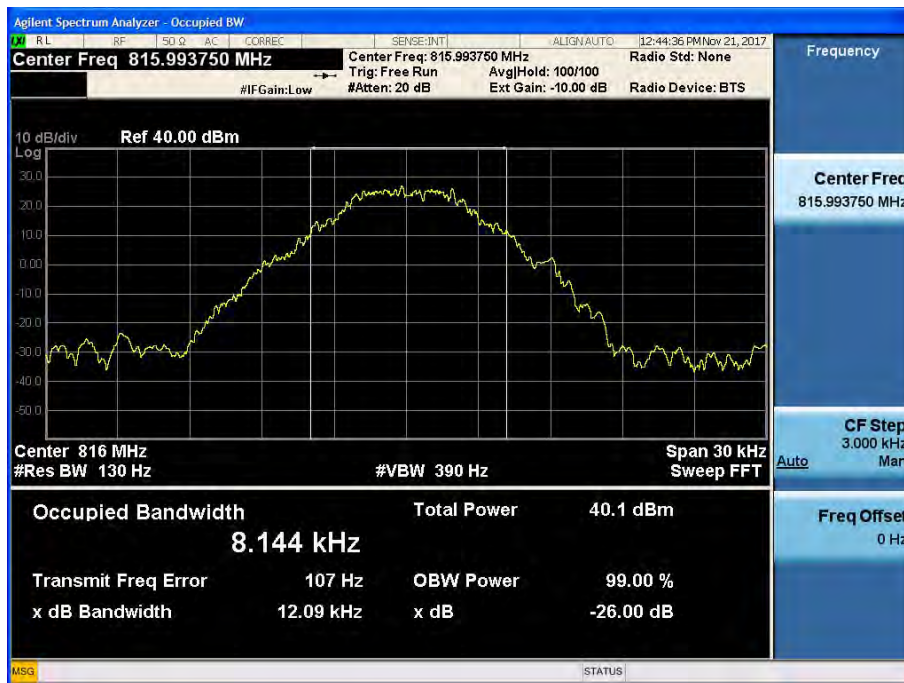
[+3dB above the AGC threshold Uplink - Low]



**[+3dB above the AGC threshold Uplink - Middle]**

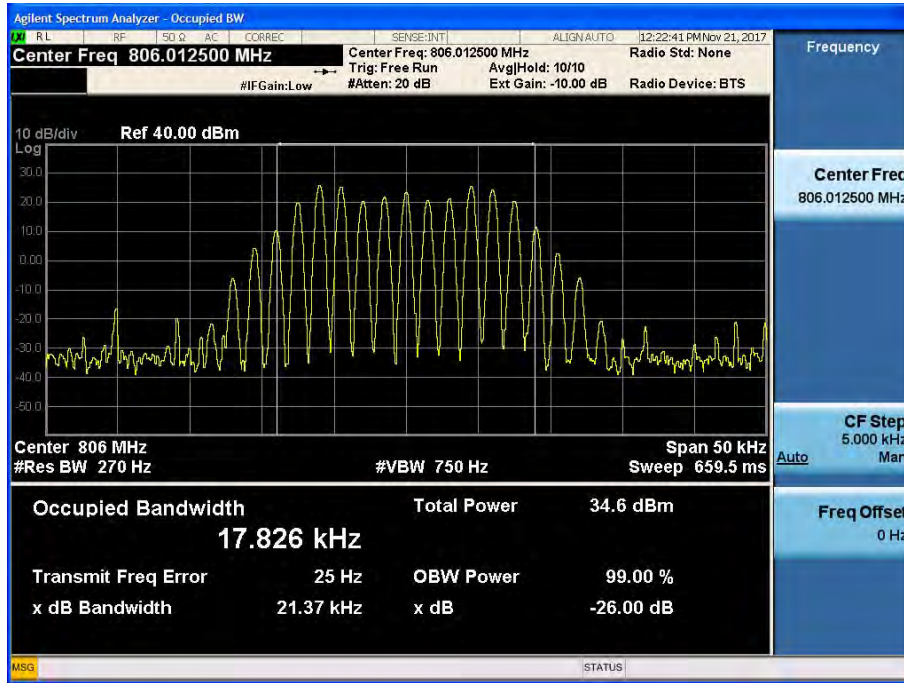


**[+3dB above the AGC threshold Uplink - High]**

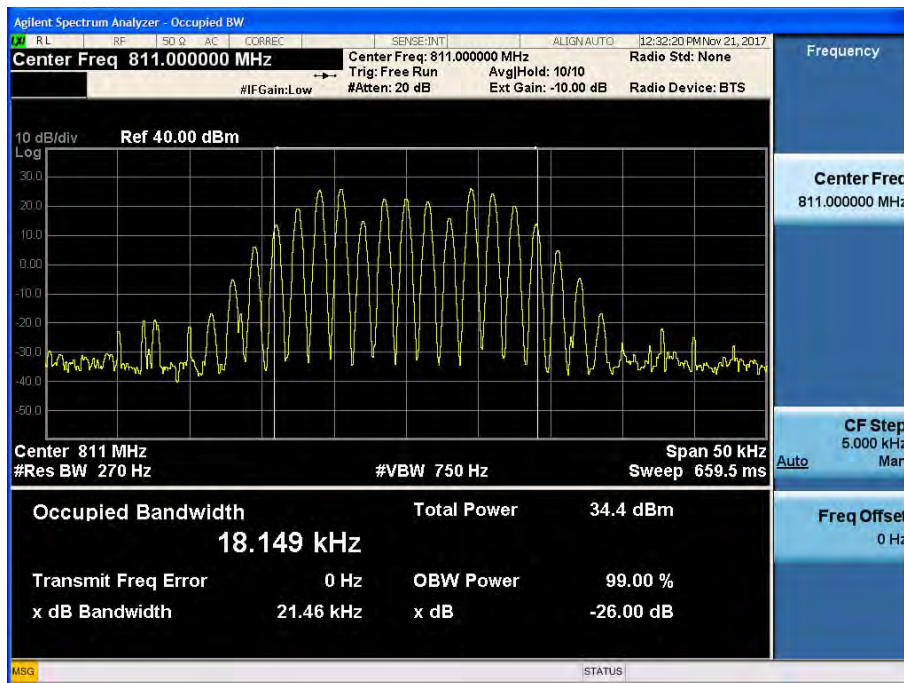


800 APCO 25(25 kHz)\_UL Output

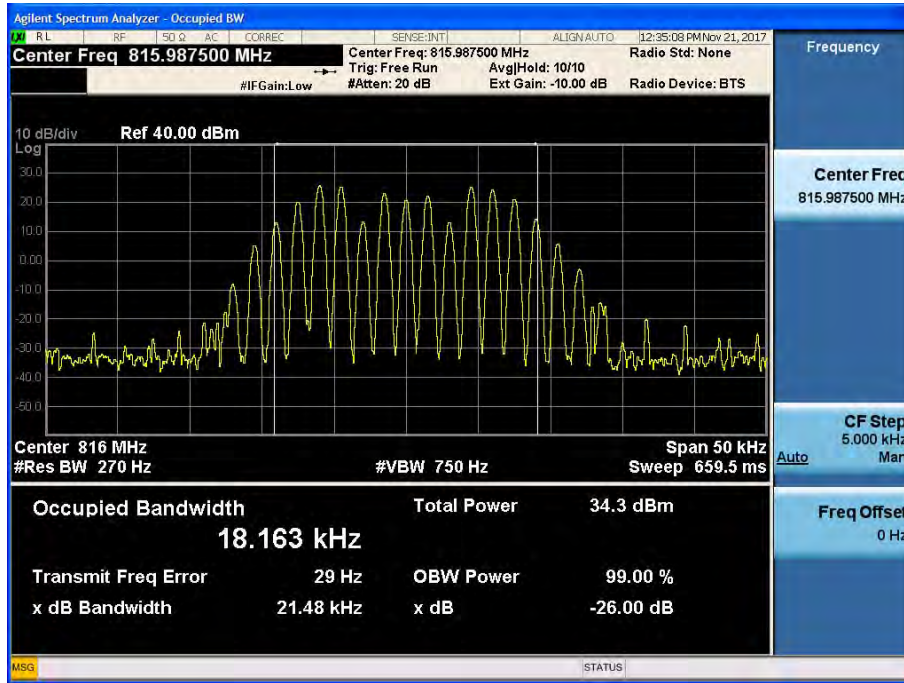
[AGC threshold Uplink - Low]



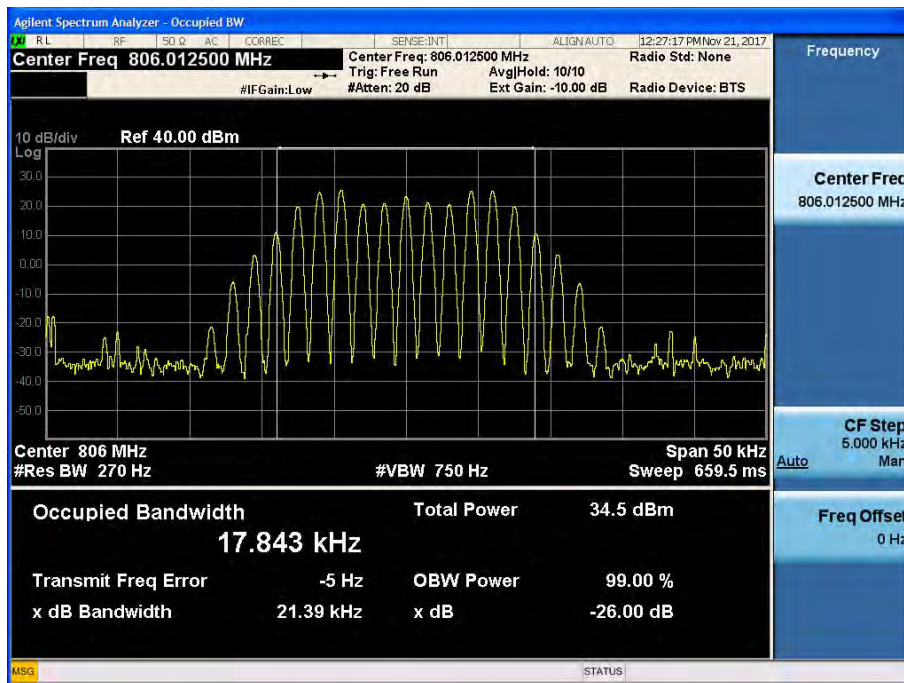
[AGC threshold Uplink - Middle]



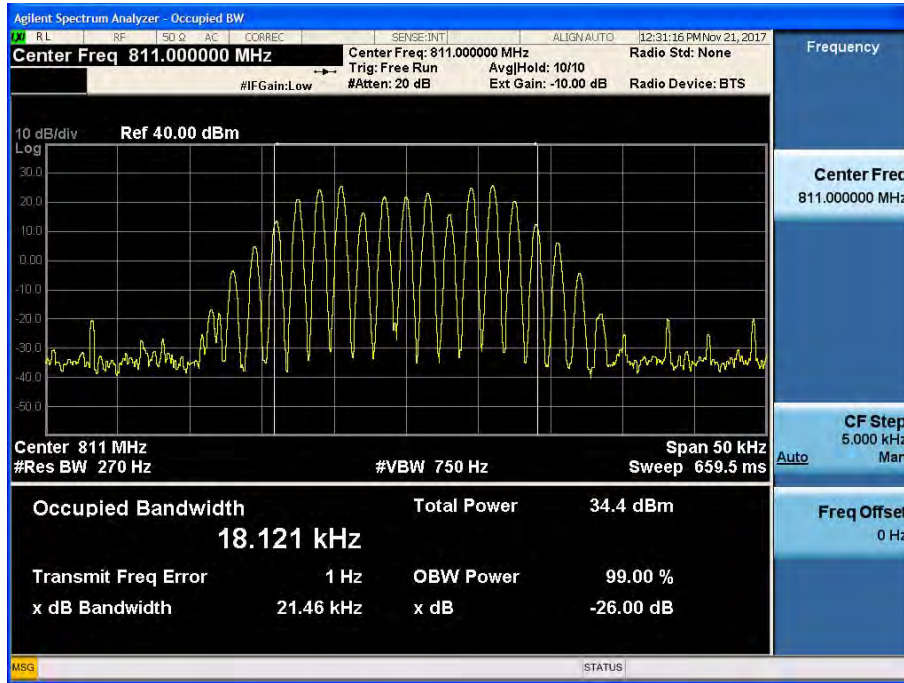
[AGC threshold Uplink - High]



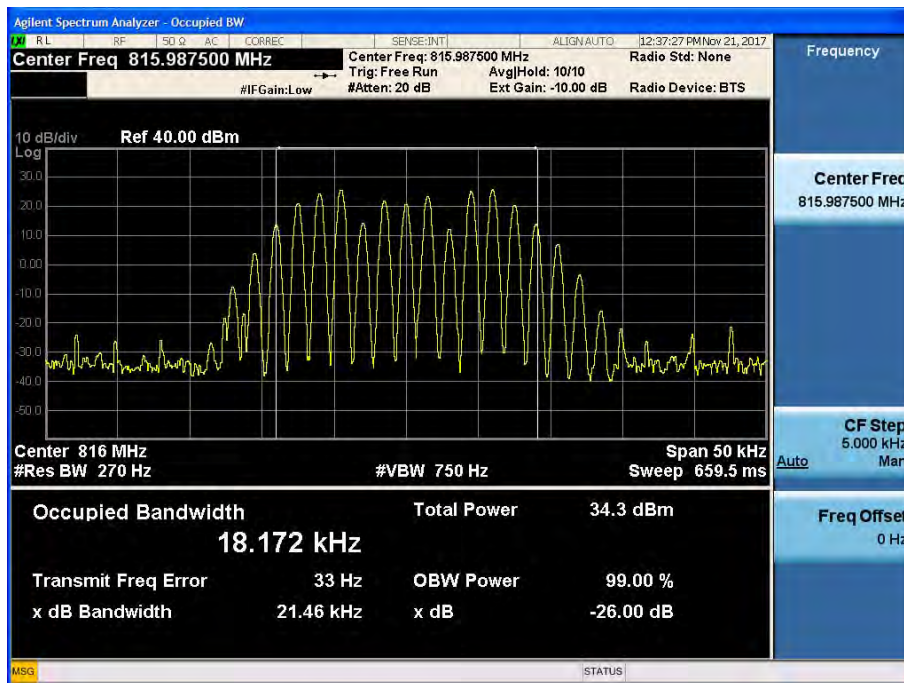
[+3dB above the AGC threshold Uplink - Low]



**[+3dB above the AGC threshold Uplink - Middle]**

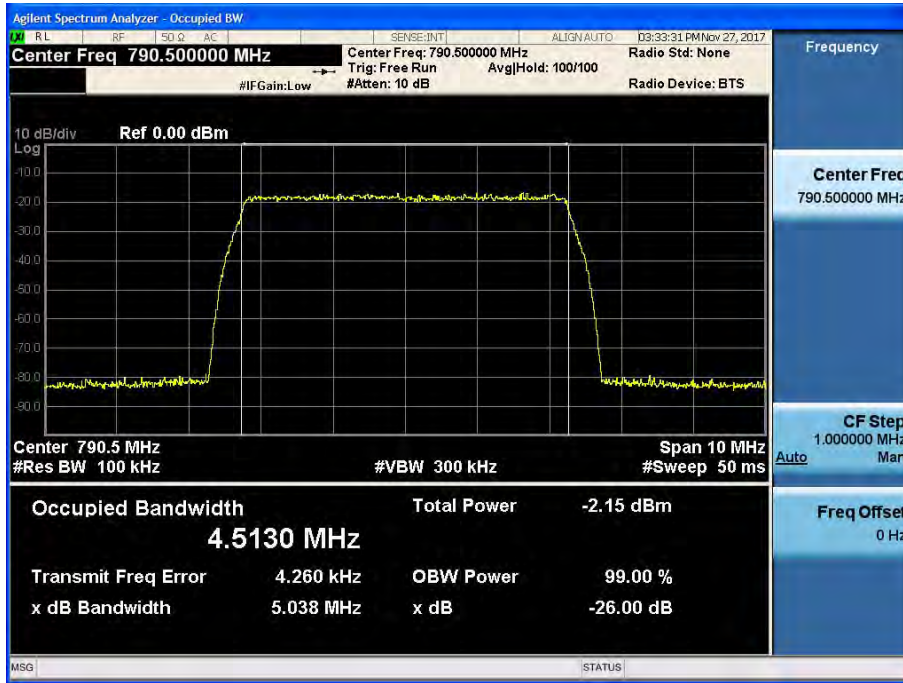


**[+3dB above the AGC threshold Uplink - High]**

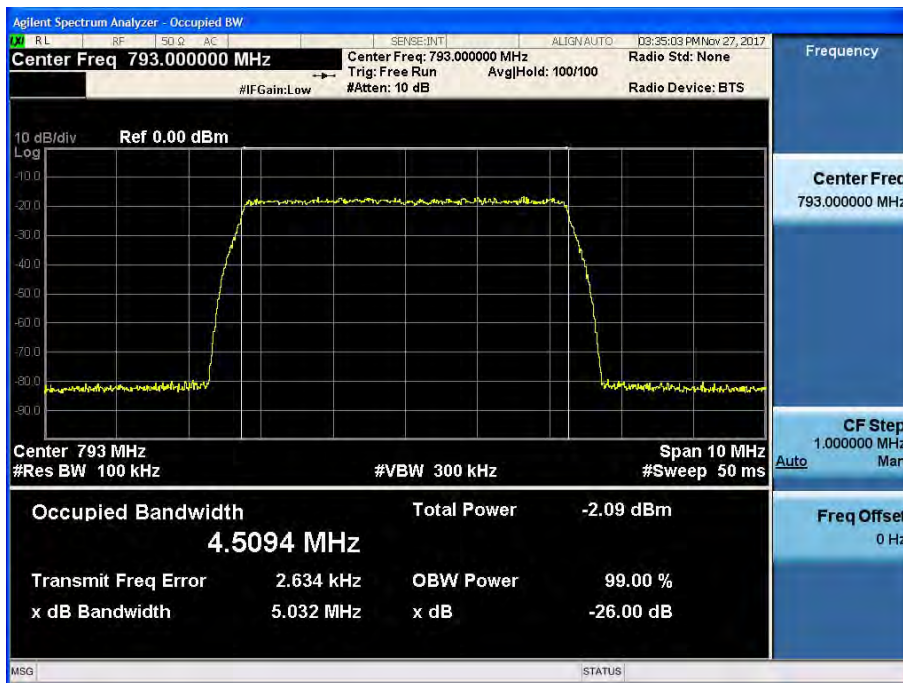


700 LTE(5 MHz)\_UL Input

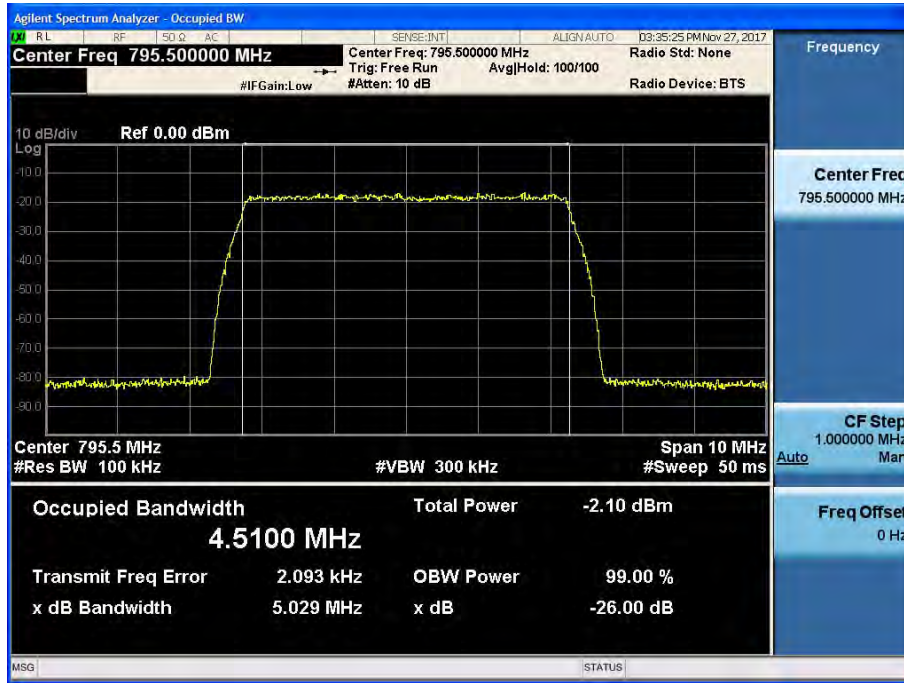
[QPSK Uplink - Low]



[QPSK Uplink - Middle]



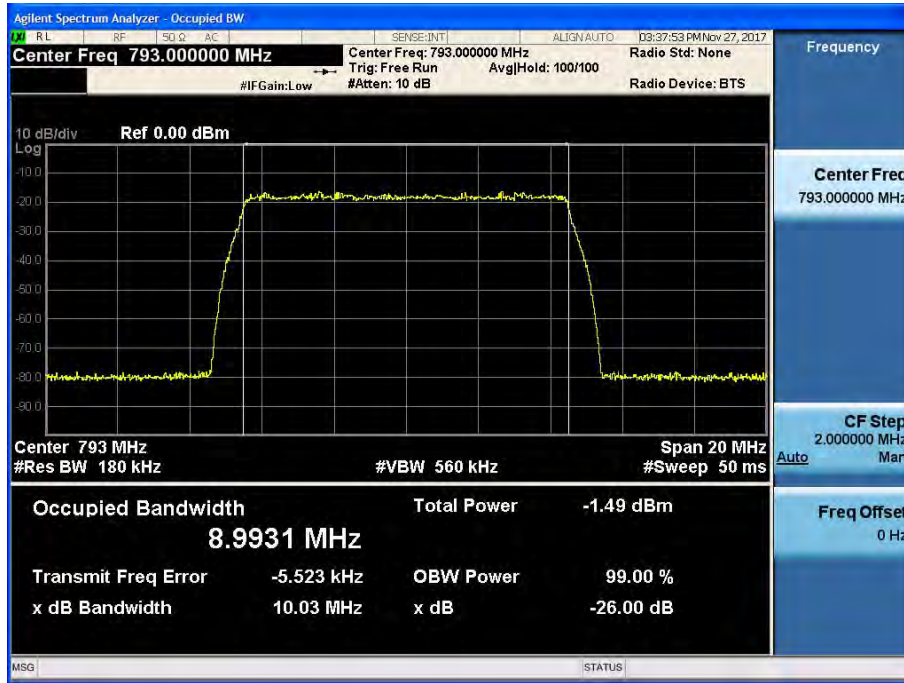
[QPSK Uplink - High]





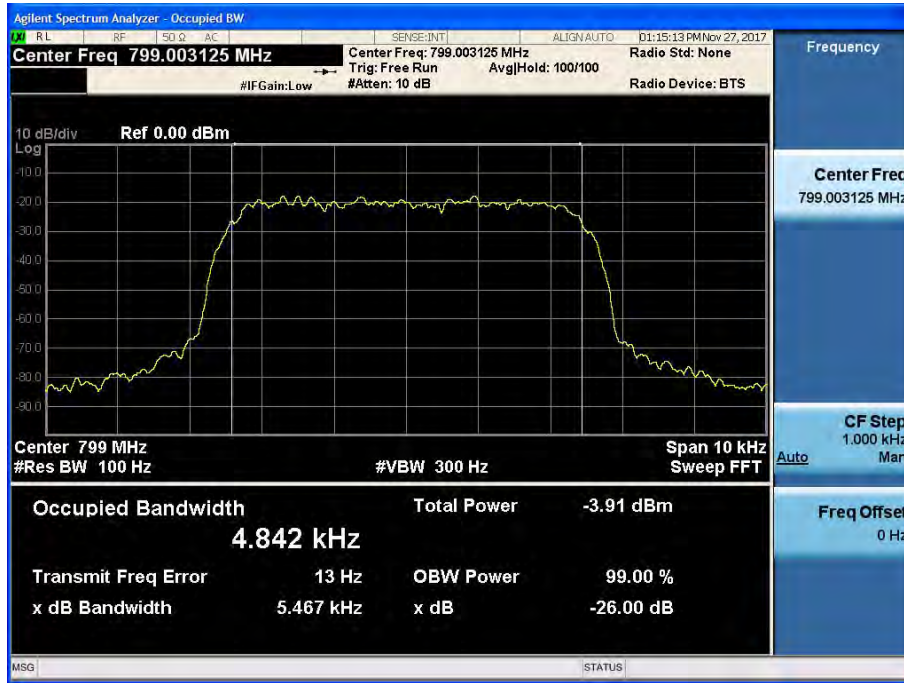
700 LTE(10 MHz)\_UL Input

[QPSK Uplink - Middle]



700 APCO 25(6.25 kHz)\_UL Input

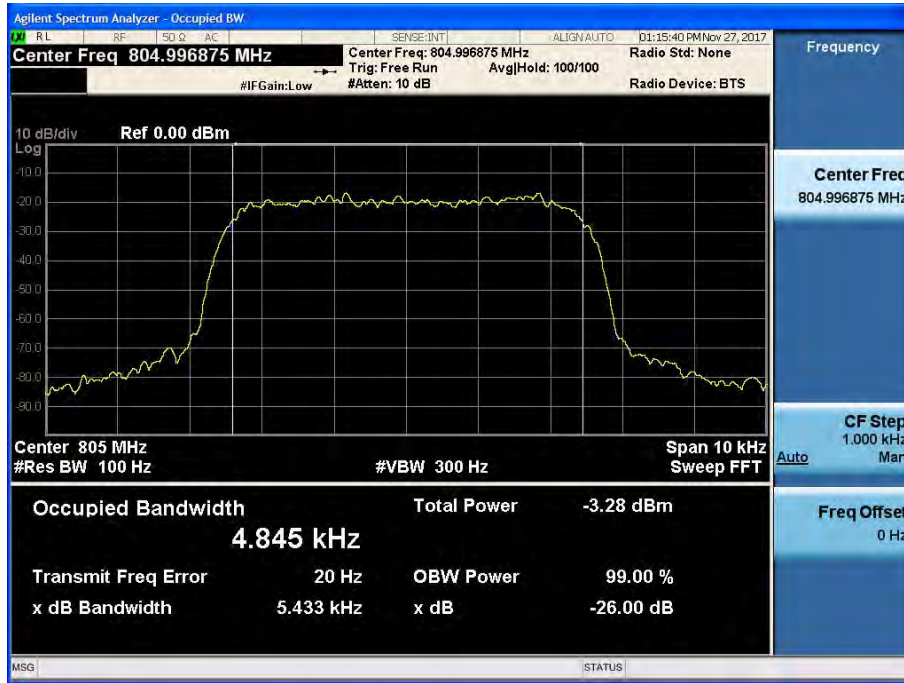
[AGC threshold Uplink - Low]



[AGC threshold Uplink - Middle]



[AGC threshold Uplink - High]



700 APCO 25(12.5 kHz)\_UL Input

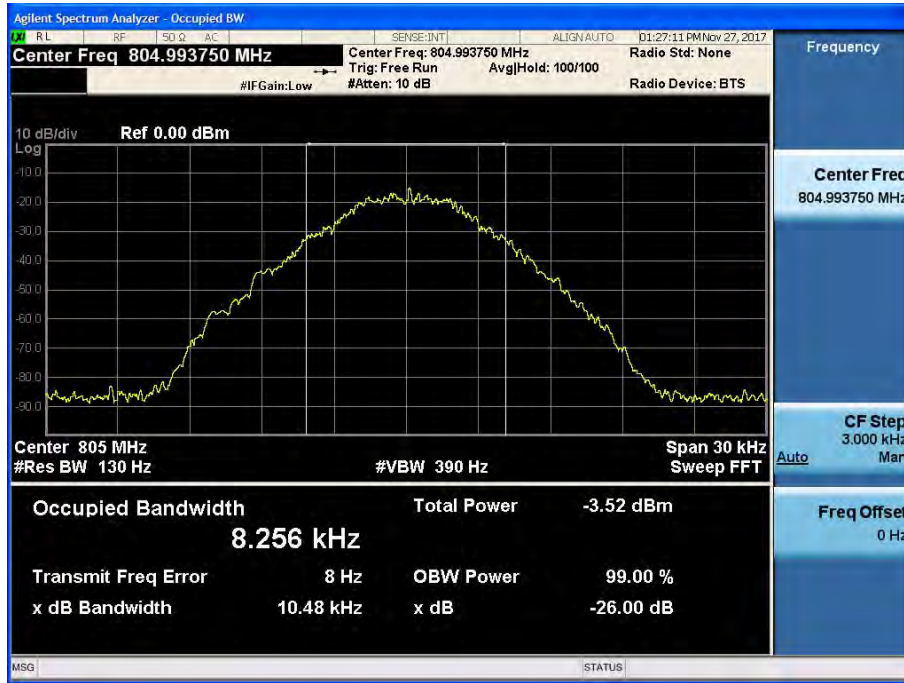
[AGC threshold Uplink - Low]



[AGC threshold Uplink - Middle]

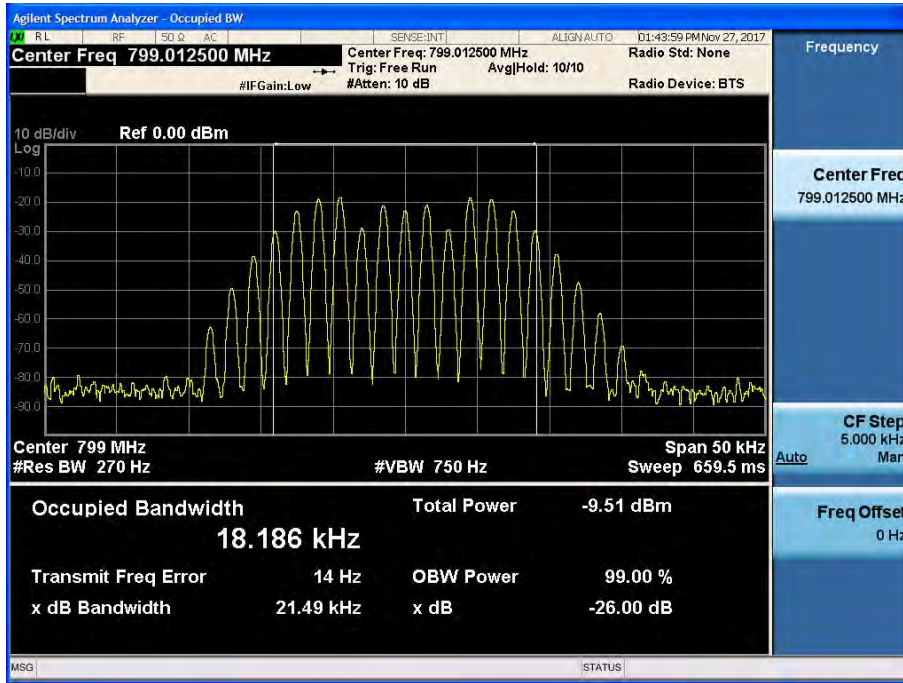


[AGC threshold Uplink - High]

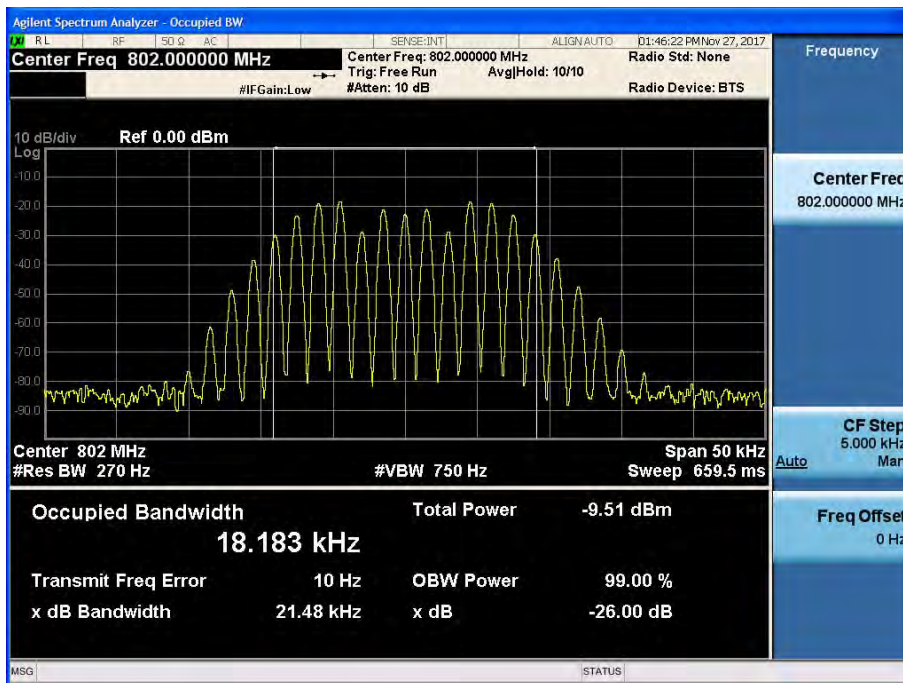


700 APCO 25(25 kHz)\_UL Input

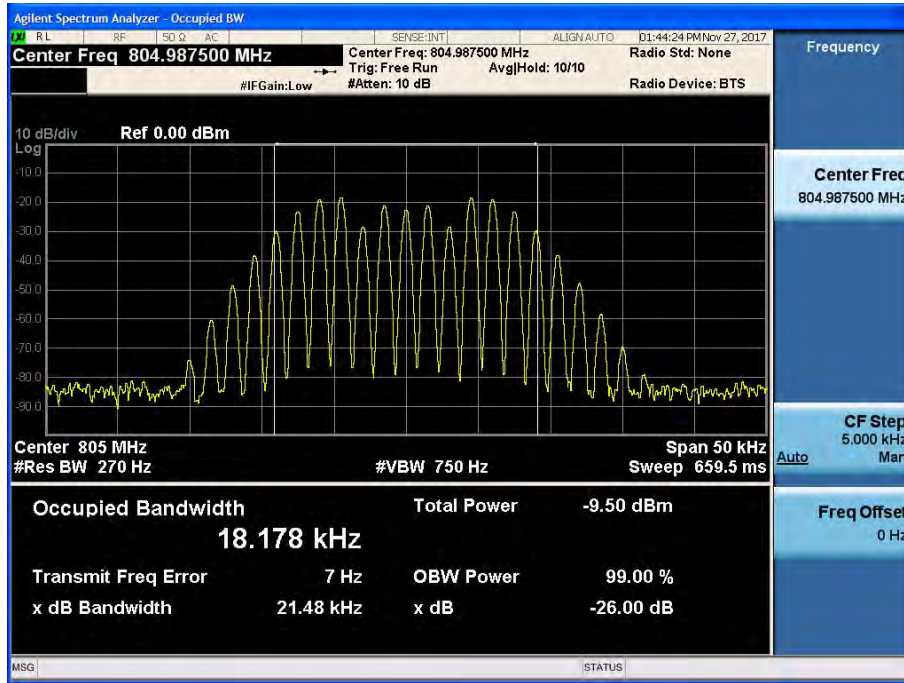
[AGC threshold Uplink - Low]



[AGC threshold Uplink - Middle]



[AGC threshold Uplink - High]

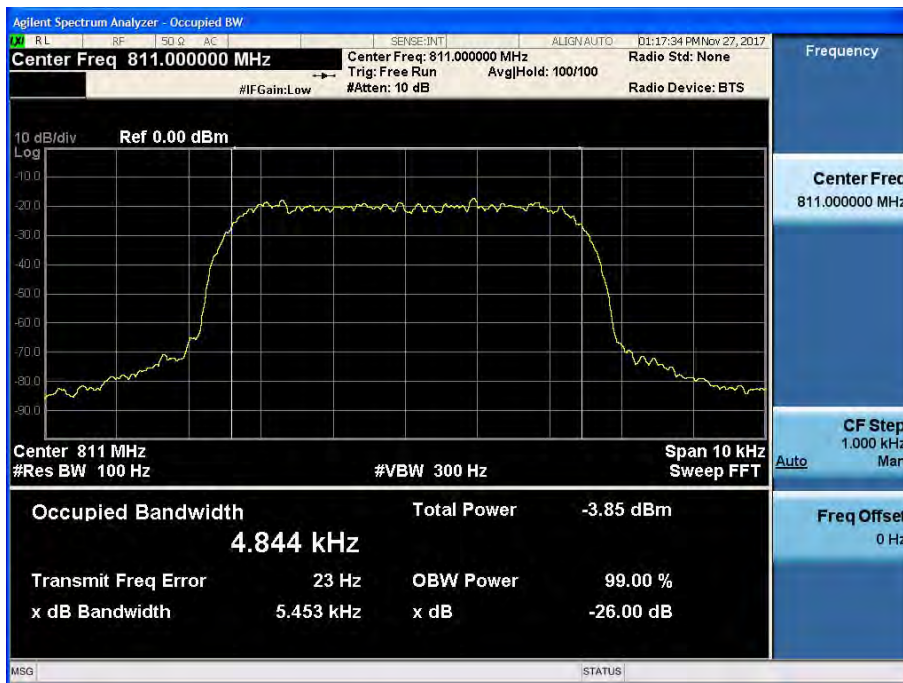


800 APCO 25(6.25 kHz)\_UL Input

[AGC threshold Uplink - Low]

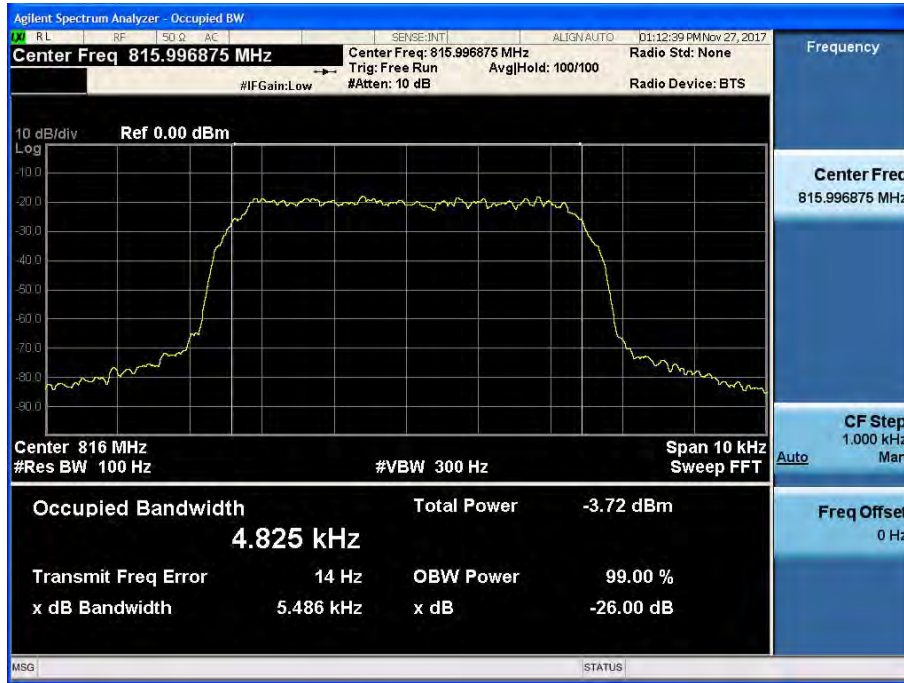


[AGC threshold Uplink - Middle]





[AGC threshold Uplink - High]



800 APCO 25(12.5 kHz)\_UL Input

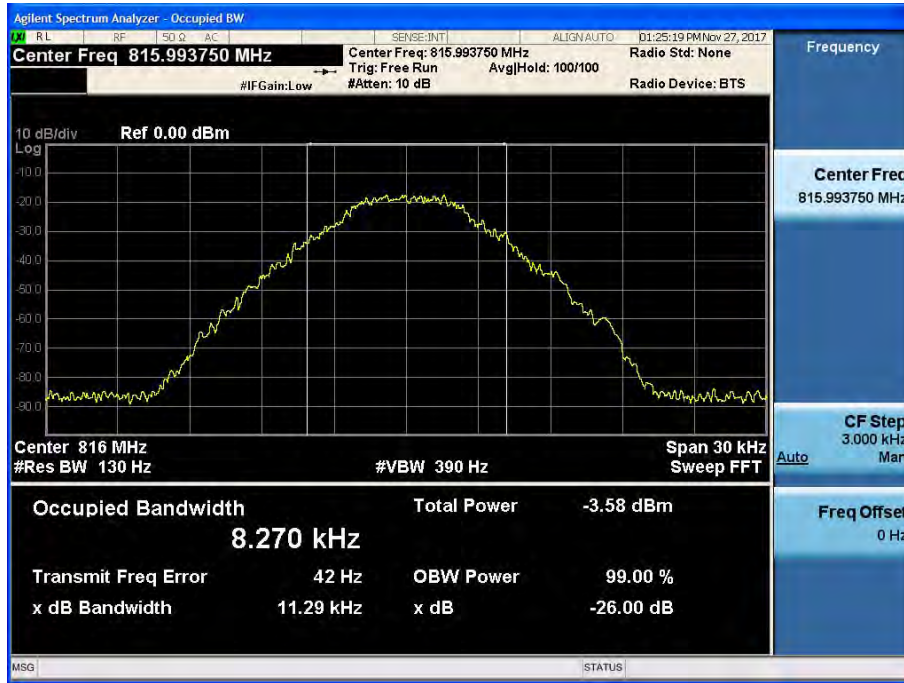
[AGC threshold Uplink - Low]



[AGC threshold Uplink - Middle]

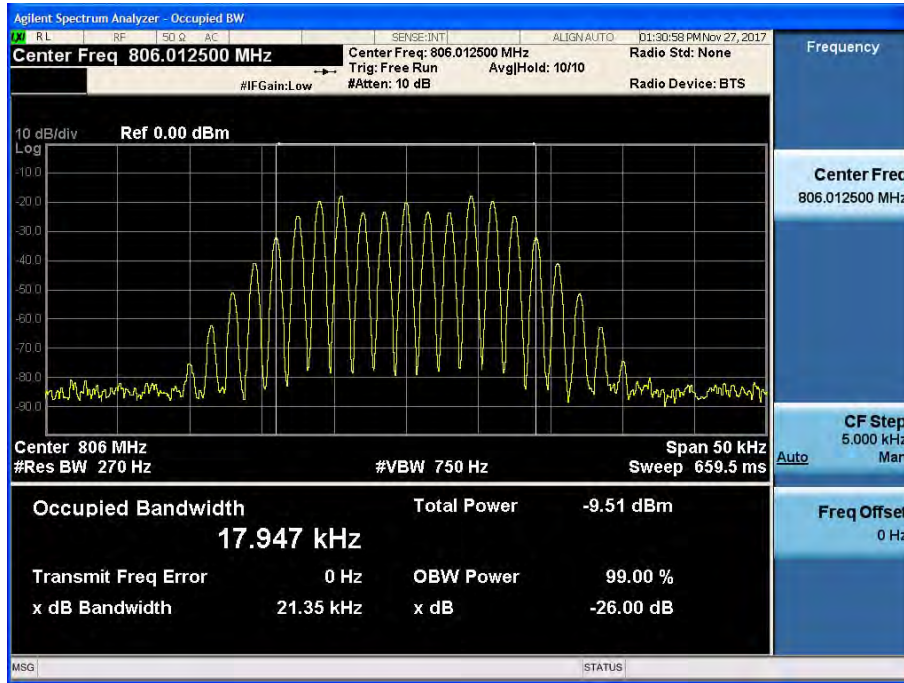


[AGC threshold Uplink - High]

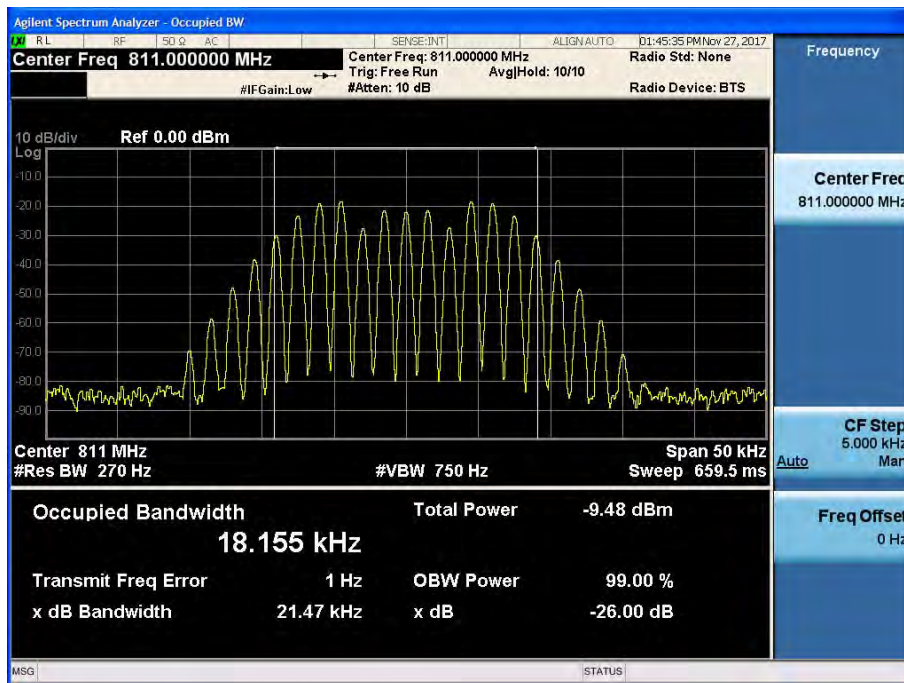


800 APCO 25(25 kHz)\_UL Input

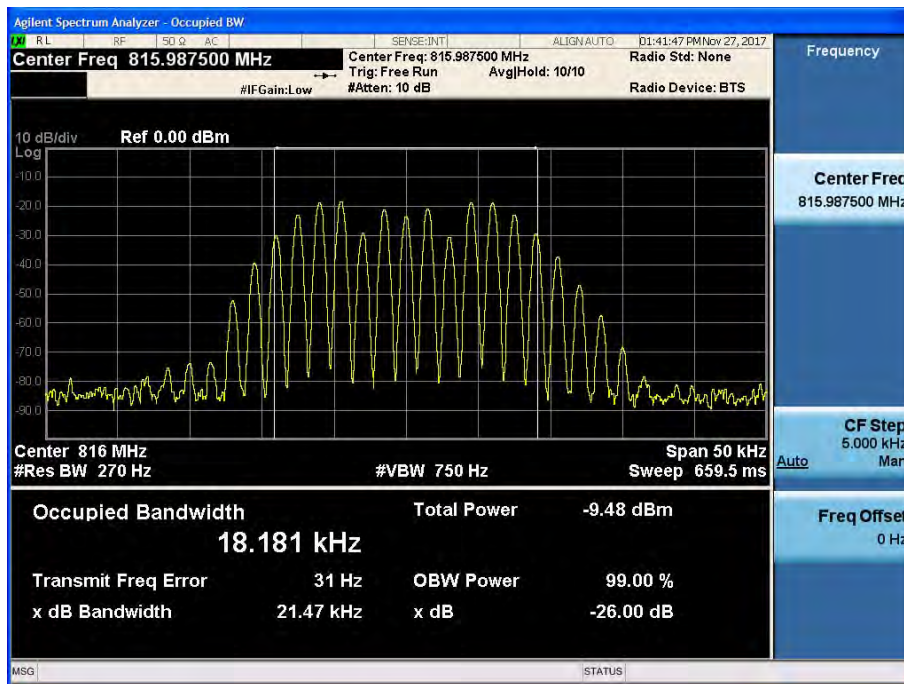
[AGC threshold Uplink - Low]



[AGC threshold Uplink - Middle]



[AGC threshold Uplink - High]



## 8. OUT OF BAND REJECTION

### FCC rules

#### Test Requirements:

#### KDB 935210 D05 v01r02

Out of Band Rejection – Test for rejection of out of band signals. Filter freq. response plots are acceptable.

#### Test Procedures:

Measurements were in accordance with the test methods section 3.3, 4.3 of KDB 935210 D05 v01r02.

#### 3.3 EUT out-of-band rejection

- a) Connect a signal generator to the input of the EUT.
- b) Configure a swept CW signal with the following parameters:
  - 1) Frequency range =  $\pm 250$  % of the passband from the center of the passband.
  - 2) Level = a sufficient level to affirm that the out-of-band rejection is  $> 20$  dB above the noise floor and will not engage the AGC during the entire sweep.
  - 3) Dwell time = approx. 10 ms.
  - 4) Number of points =  $\text{SPAN}/(\text{RBW}/2)$ .
- c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.
- e) Set the resolution bandwidth of the spectrum analyzer to be 1 % to 5 % of the passband and the video bandwidth shall be set to  $\geq 3 \times \text{RBW}$ .
- f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer's spectral display to fill.
- g) Place a marker to the peak of the frequency response and record this frequency as  $f_0$ .
- h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the  $-20$  dB down amplitude to determine the 20 dB bandwidth. Capture the frequency response of the EUT.

#### 4.3 PLMRS device out-of-band rejection

Adjust the internal gain control of the equipment under test to the maximum gain for which equipment certification is sought.

- a) Connect a signal generator to the input of the EUT.
- b) Configure a swept CW signal with the following parameters:
  - 1) Frequency range =  $\pm 250$  % of the manufacturer's specified pass band.
  - 2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.
  - 3) Dwell time = approximately 10 ms.

- 4) Frequency step = 50 kHz.
- c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- d) Set the RBW of the spectrum analyzer to between 1 % and 5 % of the manufacturer's rated passband, and VBW = 3 × RBW.
- e) Set the detector to Peak and the trace to Max-Hold.
- f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as  $f_0$ , and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).
- g) Capture the frequency response plot for inclusion in the test report.

**Test Results:**

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
FirstNet / PS 700	-62	-62	92	92
PS 800	-62	-62	95	95

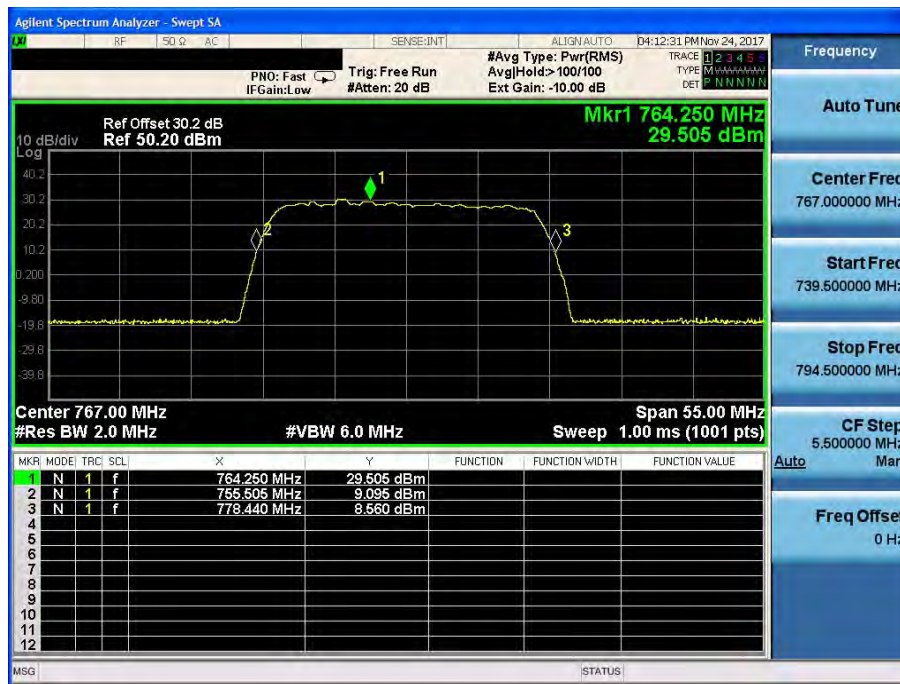
**FirstNet + PS 700**

[Downlink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
755.505 ~ 778.440	29.505	91.505

**Plots of Out of Band Rejection**

[FirstNet + PS 700 Downlink]



\*This device Downlink amplifies FirstNet and PS 700 together.



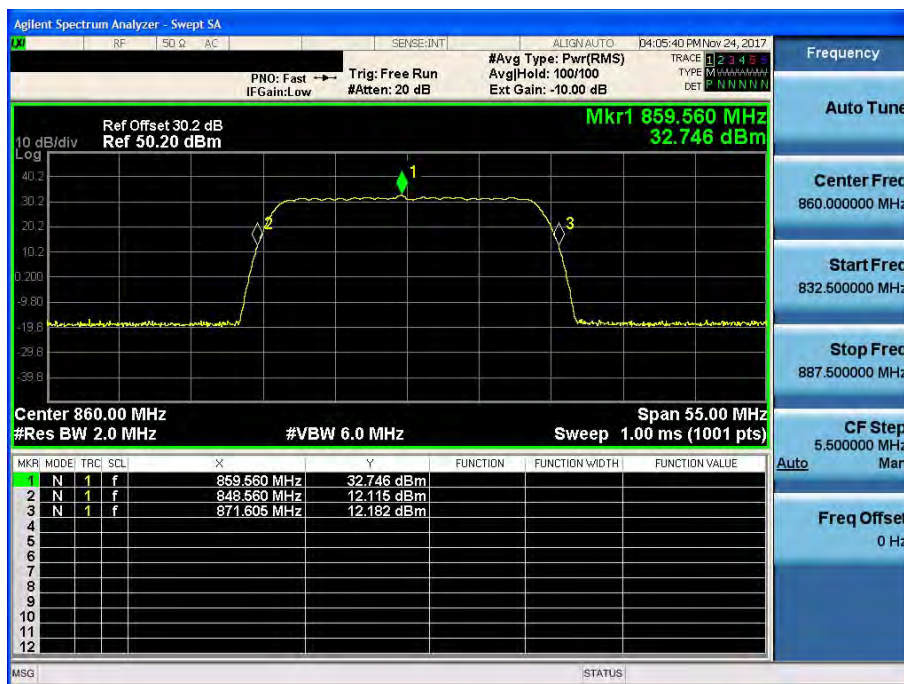
**PS 800**

**[Downlink]**

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
848.560 ~ 871.605	32.746	94.746

**Plots of Out of Band Rejection**

**[PS 800 Downlink]**

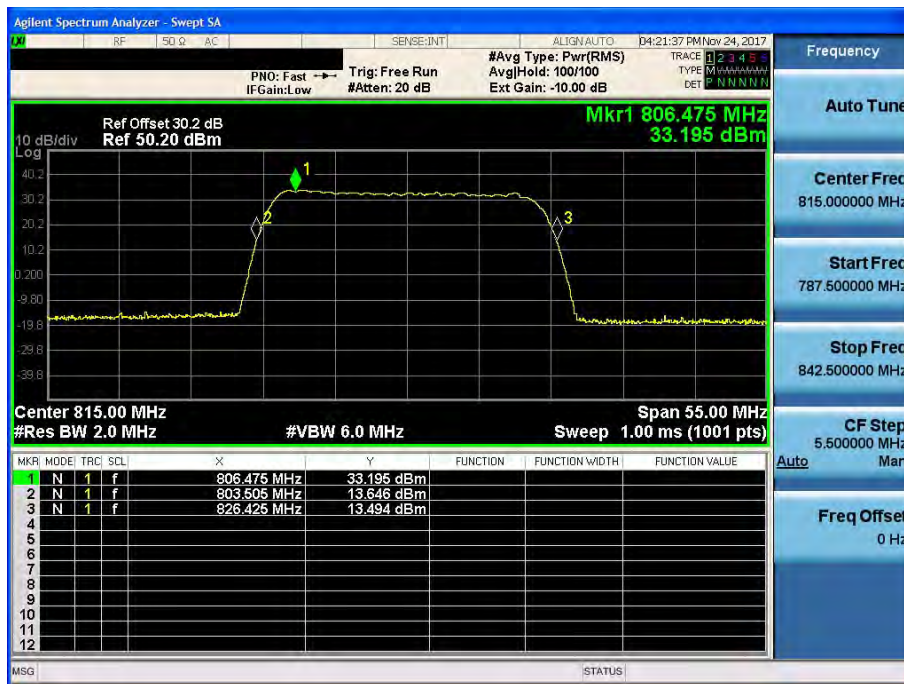


**PS 800**  
**[Uplink]**

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
803.505 ~ 826.425	33.195	95.195

**Plots of Out of Band Rejection**

**[PS 800 Uplink]**



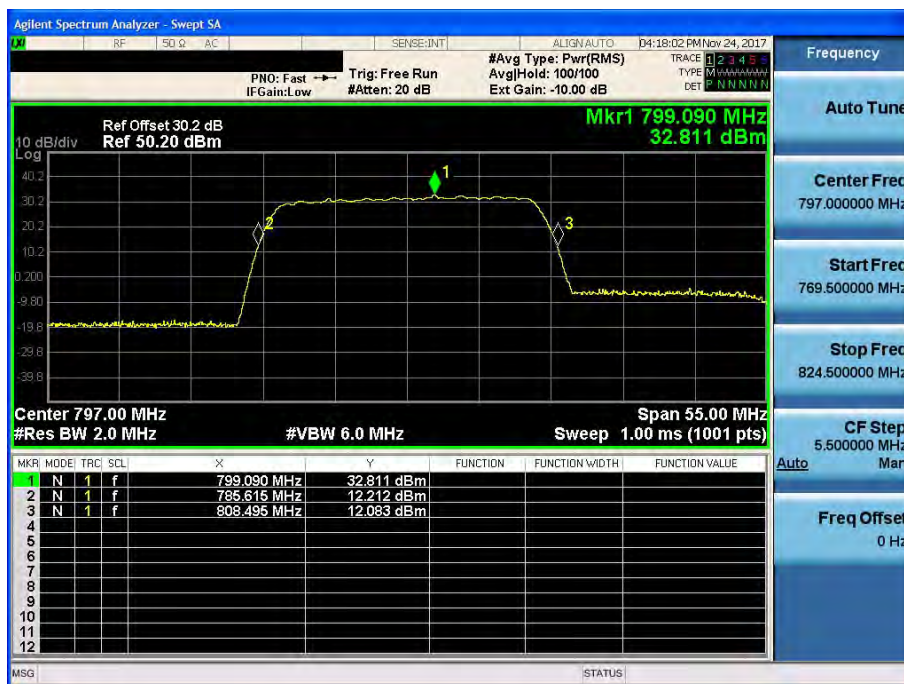
**FirstNet + PS 700 + PS 800**

[Uplink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
785.615 ~ 808.495	32.811	94.811

**Plots of Out of Band Rejection**

[FirstNet + PS 700 + PS 800 Uplink]



\*This device Uplink amplifies FirstNet and PS 700, PS800 together.

## 9. NOISE FIGURE

### FCC Rules

#### Test Requirements:

#### § 90.219 Use of signal boosters:

- (e) (2) The noise figure of a signal booster must not exceed 9 dB in either direction.

#### Test Procedures:

The EUT was tested using Agilent Application Note 57-1, 'The direct noise measurement method'

##### 1. GAIN measurement

EUT in the maximum gain of the repeater state.

The signal generator was connected to RF input port at a maximum level as determined by the spectrum analyzer was connected to RF output port depending on the circuitry being measured.

$$\text{EUT GAIN} = \text{Output signal level} - \text{Input signal level}$$

##### 2. Output Noise level measurement

EUT in the maximum gain of the repeater state.

Without input signal, spectrum analyzer was connected to RF output port and measured to Noise power.

$$\text{NF} = \text{NP} - \text{G} - \text{BCF} + \text{PNAD}$$

$$\text{NF} = \text{NP} - \text{G} - 60 + 174$$

$$\text{NF} = \text{NP} - \text{G} + 114$$

NF=Noise Figure(dB)

NP=Noise power(dBm/MHz)

G=Maximum gain

BCF=Bandwidth Correction Factor= $10\log(1 \text{ MHz}/1 \text{ Hz})=60$

PNAD=Noise Power Density=174 dBm/Hz

**Test Results:**

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
FirstNet / PS 700	Without input signal		92	92
PS 800			95	95

**Downlink**

FirstNet + PS 700: Noise Figure = - 45.134 – 92 + 114 = -23.134 dB

PS 800: Noise Figure = - 43.093 – 95 + 114 = -24.093 dB

**Uplink**

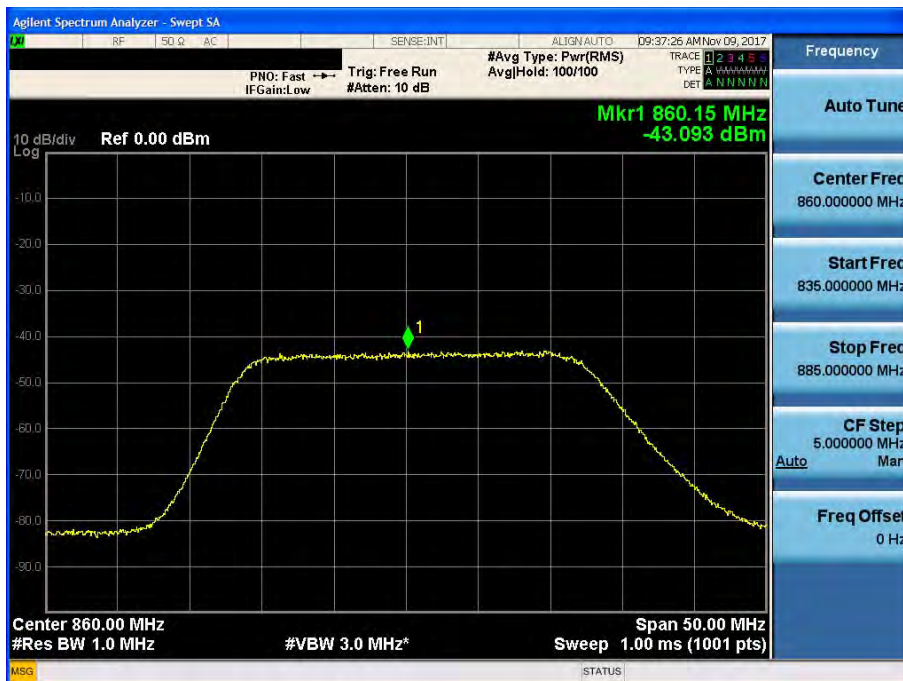
Noise Figure = - 40.556 – 95 + 114 = - 21.556 dB

**Plots of Noise power  
Downlink**

**[FirstNet + PS 700]**

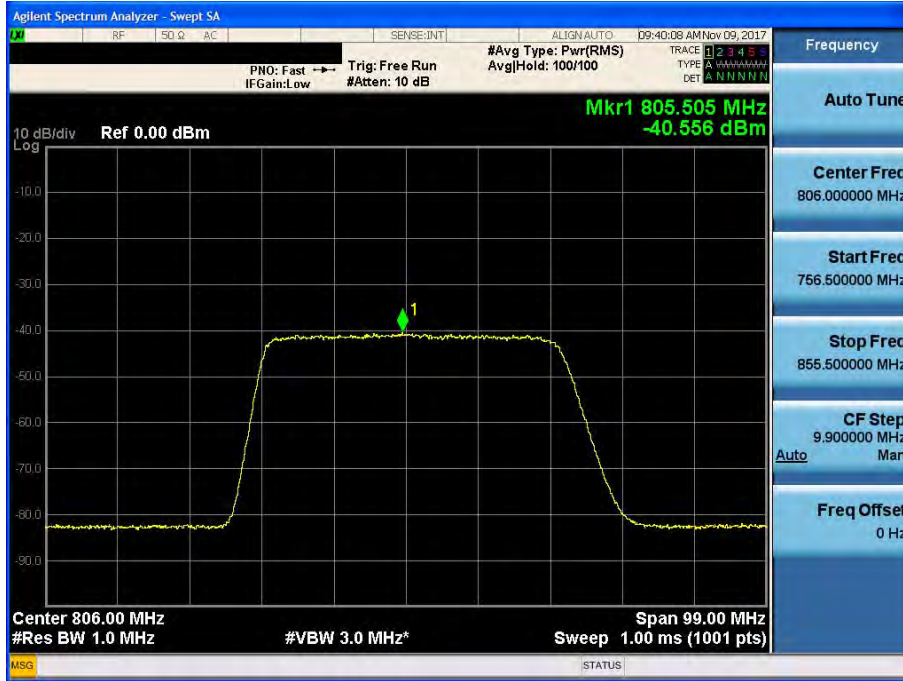


**[PS 800]**



**Uplink**

**[FirstNet + PS 700+ PS 800]**



## 10. EMISSION MASKS

### FCC Rules

#### Test Requirements:

#### § 90.210 Emission masks:

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (o) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating under this part.

**APPLICABLE EMISSION MASKS**

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25	A or B	A or C
25-50	B	C
72-76	B	C
150-174	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512 <sup>2 5</sup>	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854	B	H
809-824/854-869	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925		
All other bands	B	C



(c) *Emission Mask C.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power ( $P$ ) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5 kHz, but not more than 10 kHz: At least  $83 \log (f_d/5)$  dB;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least  $29 \log (f_d/11)$  dB or 50 dB, whichever is the lesser attenuation;
- (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.
- (4) In the 1427-1432 MHz band, licensees are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed the following levels in the 1400-1427 MHz band:
  - (i) For stations of point-to-point systems in the fixed service:  $-45$  dBW/27 MHz.
  - (ii) For stations in the mobile service:  $-60$  dBW/27 MHz.

(g) *Emission Mask G.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power ( $P$ ) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least  $116 \log (f_d/6.1)$  dB, or  $50 + 10 \log (P)$  dB, or 70 dB, whichever is the lesser attenuation;
- (2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

(h) *Emission Mask H.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power ( $P$ ) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of 4 kHz or less: Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 4 kHz, but no more than 8.5 kHz: At least  $107 \log (f_d/4)$  dB;
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 8.5 kHz, but no more than 15 kHz: At least  $40.5 \log (f_d/1.16)$  dB;
- (4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 15 kHz, but no more than 25 kHz: At least  $116 \log (f_d/6.1)$  dB;
- (5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least  $43 + 10 \log (P)$  dB.

**Test Procedures:**

Measurements were in accordance with the test methods section 4.4 of KDB 935210 D05 v01r02.

**4.4 Input-versus-output signal comparison**

Compliance with the emission mask of the EUT output shall be measured for the public safety service signal types as specified in 4.1.

Refer to the applicable regulatory requirements (e.g., § 90.210) for emission mask specifications.

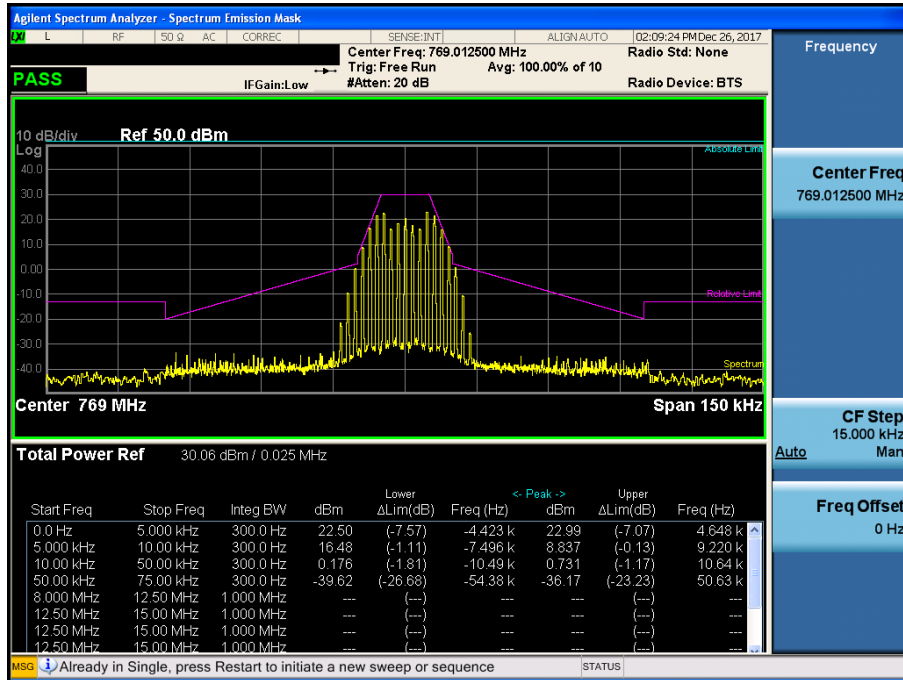
- a) Connect a signal generator to the input of the EUT.
- b) Configure the signal generator to transmit the appropriate test signal associated with the public safety emission designation (see Table 1).
- c) Configure the signal level to be just below the AGC threshold (see results from 4.2).
- d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- e) Set the spectrum analyzer center frequency to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between 2 times to 5 times the EBW (or OBW).
- f) The nominal resolution bandwidth (RBW) shall 300 Hz for 16K0F3E and 100 Hz for all other emissions types.
- g) Set the reference level of the spectrum analyzer to accommodate the maximum input amplitude level.
- h) Set spectrum analyzer detection mode to peak, and trace mode to max hold.
- i) Allow the trace to fully stabilize.
- j) Confirm that the signal is contained within the appropriate emissions mask.
- k) Use the marker function to determine the maximum emission level and record the associated frequency as  $f_0$ .
- l) Capture the emissions mask plot for inclusion in the test report (output signal spectra).
- m) Measure the EUT input signal power (signal generator output signal) directly from the signal generator using power measurement guidance provided in KDB Publication 971168 (input signal spectra).
- n) Compare the spectral plot of the output signal (determined in step k), to the input signal (determined in step l) to affirm they are similar (in passband and rolloff characteristic features and relative spectral locations).
- o) Repeat the procedure for both test signals with the input signal amplitude set 3 dB above the AGC threshold.
- p) Repeat steps b) to n) for all authorized operational bands and emissions types (see applicable regulatory specifications, e.g., §90.210).
- q) Include all accumulated spectral plots depicting EUT input signal and EUT output signal in the test report and note any observed dissimilarities.

**Test Results:**

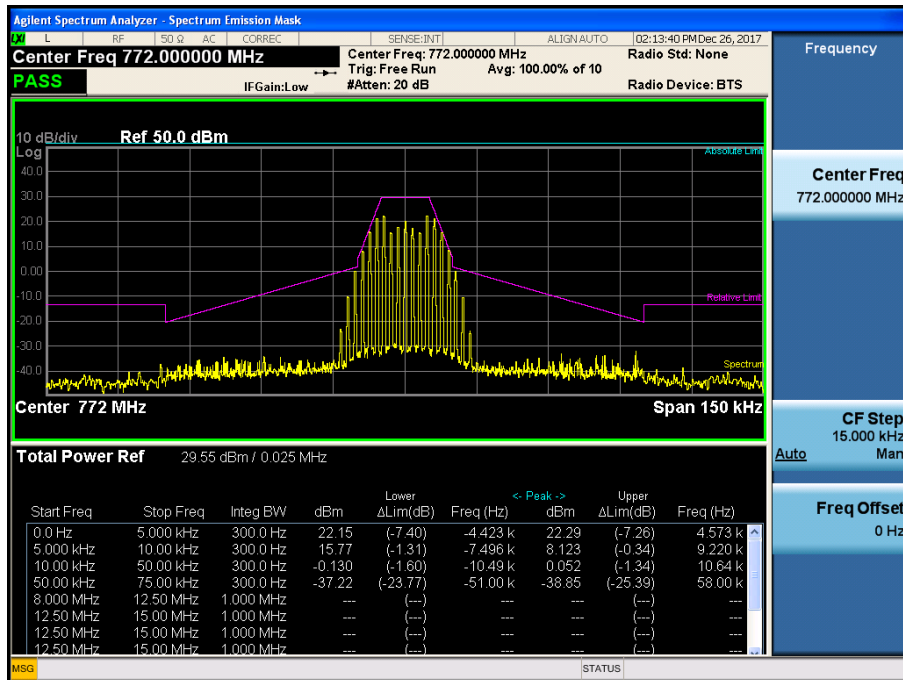
Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
FirstNet / PS 700	-62	-62	92	92
PS 800	-62	-62	95	95

**Plots of Emission Mask**  
**700 APCO25\_Downlink**

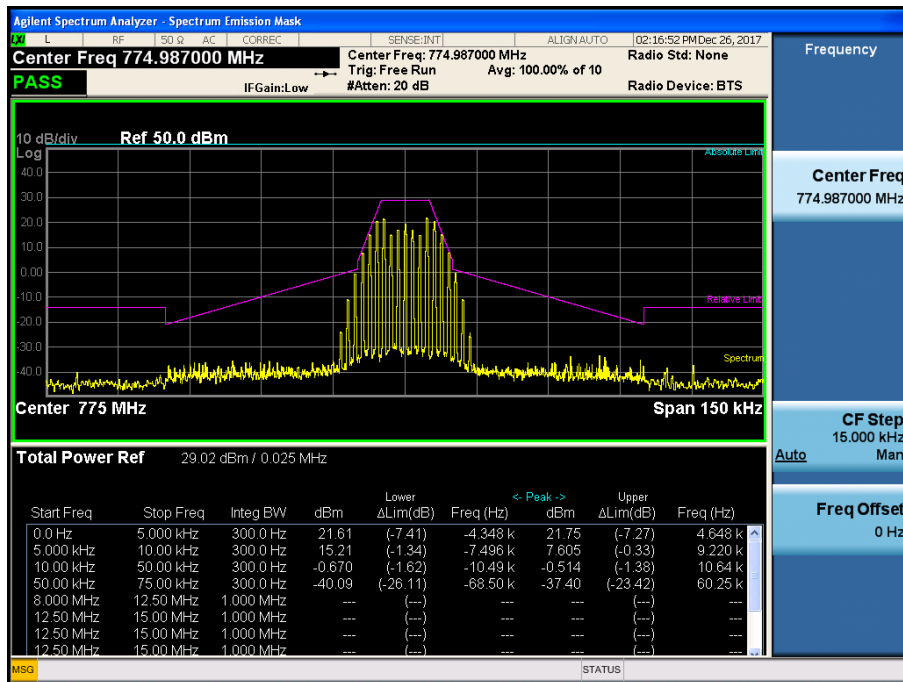
**[Downlink Emission Mask C – Low, 25 kHz]**



**[Downlink Emission Mask C – Middle, 25 kHz]**

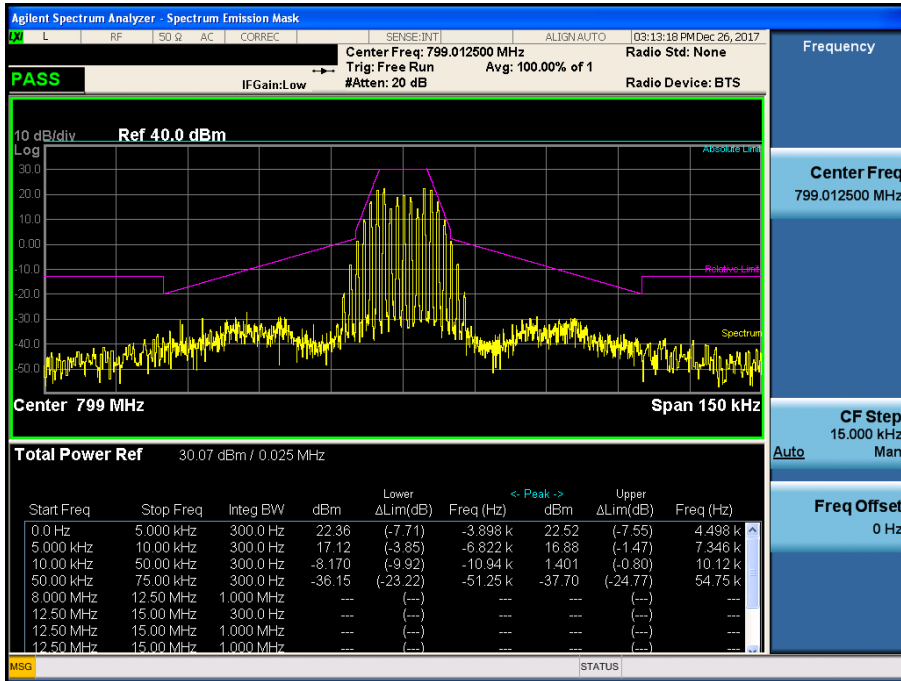


[Downlink Emission Mask C – High, 25 kHz]

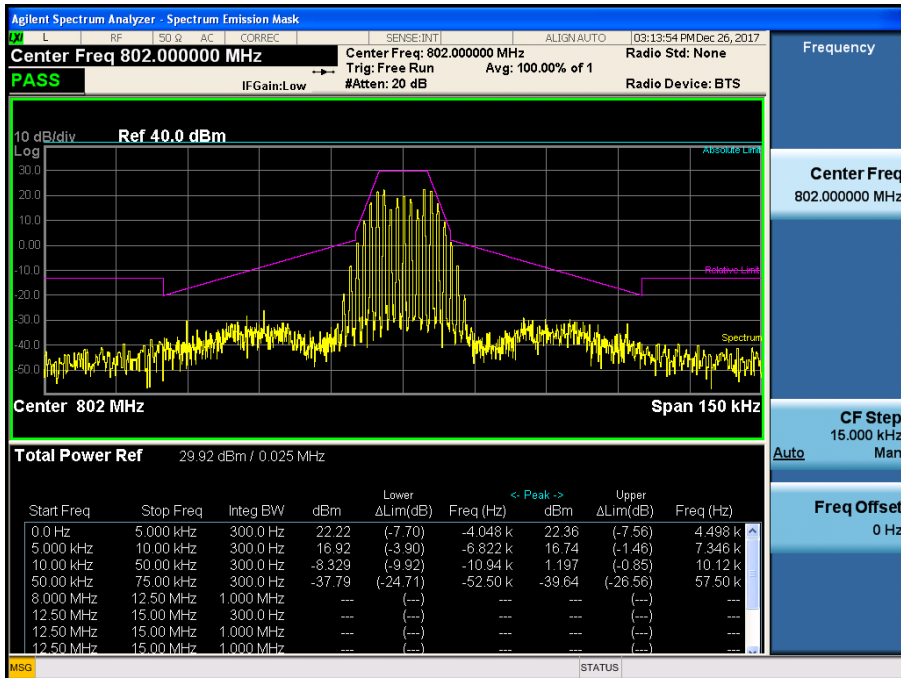


**700 APCO 25\_Uplink**

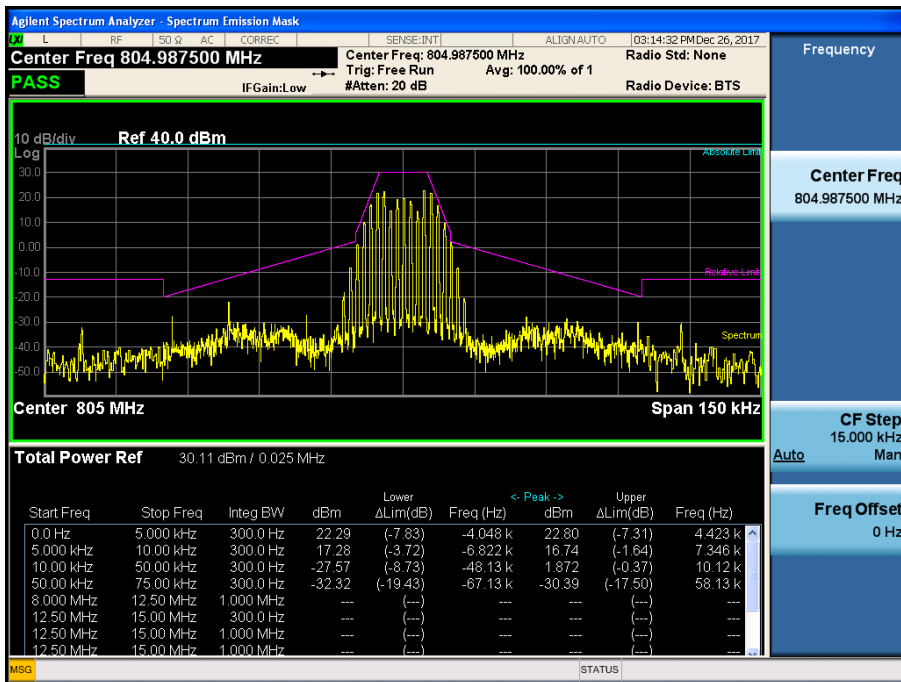
**[Uplink Emission Mask C – Low, 25 kHz]**



**[Uplink Emission Mask C – Middle, 25 kHz]**

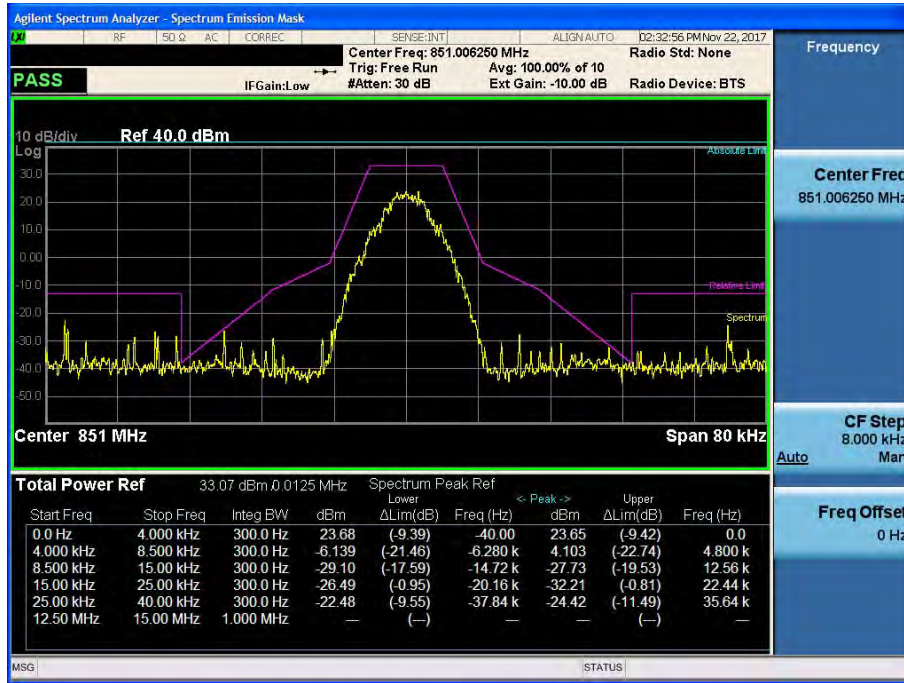


[Uplink Emission Mask C – High, 25 kHz]

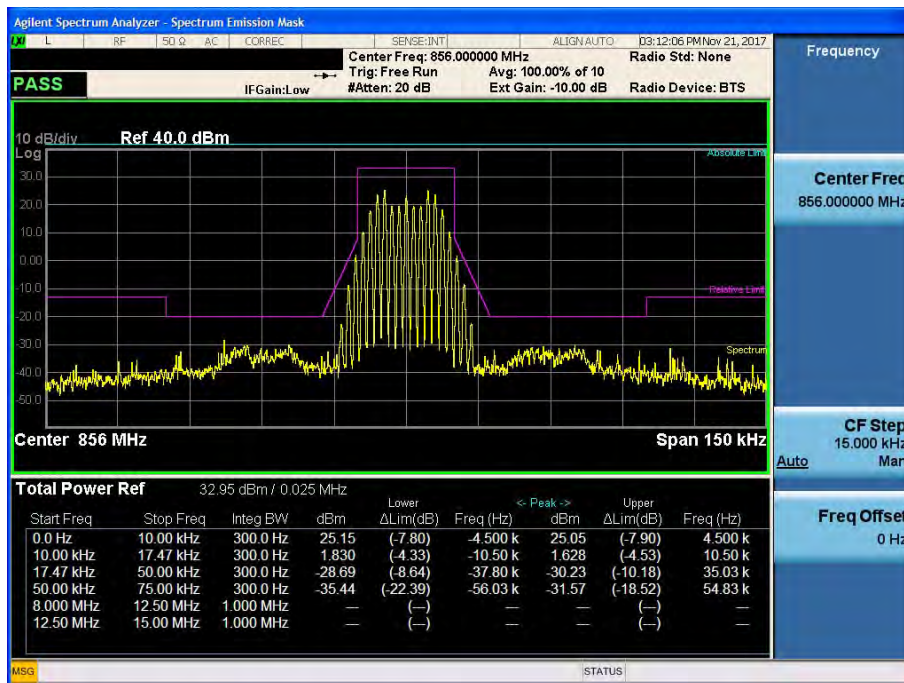


**800 APCO 25\_Downlink**

**[Downlink Emission Mask H – Low, 12.5 kHz]**



**[Downlink Emission Mask G – Middle, 25 kHz]**





**[Downlink Emission Mask G – High, 25 kHz]**

