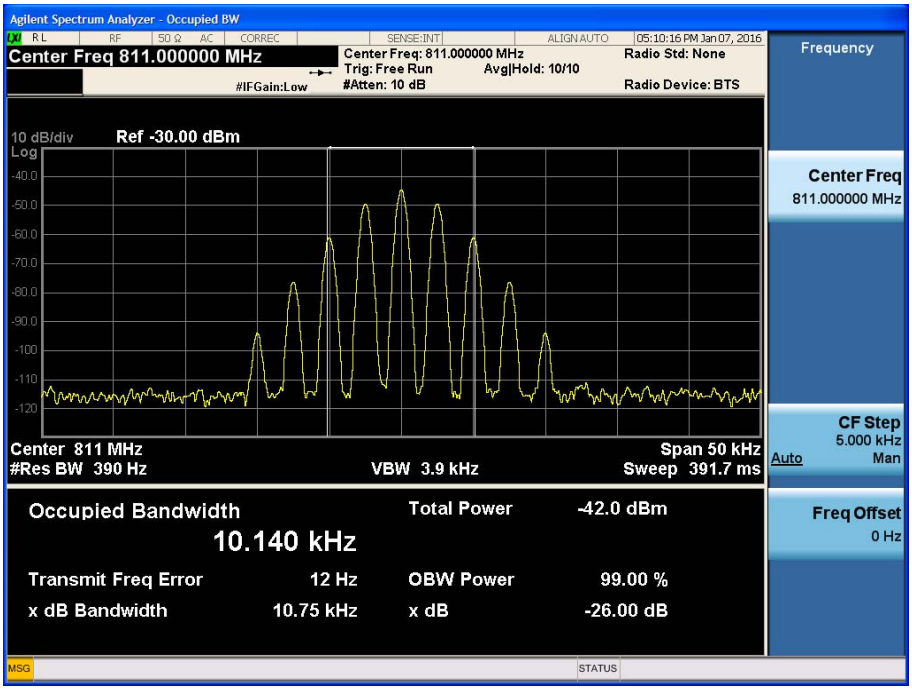
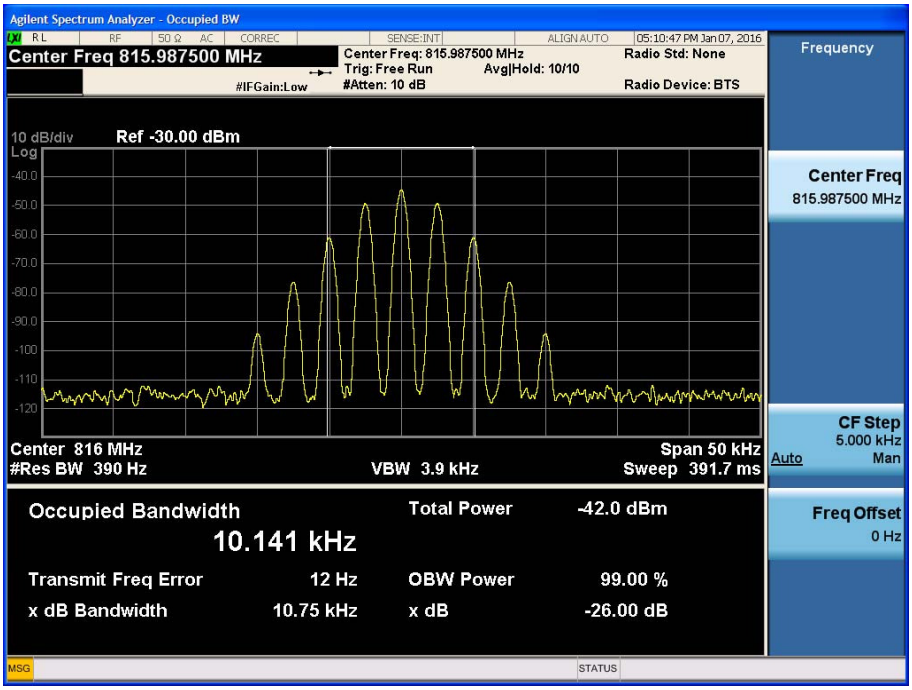
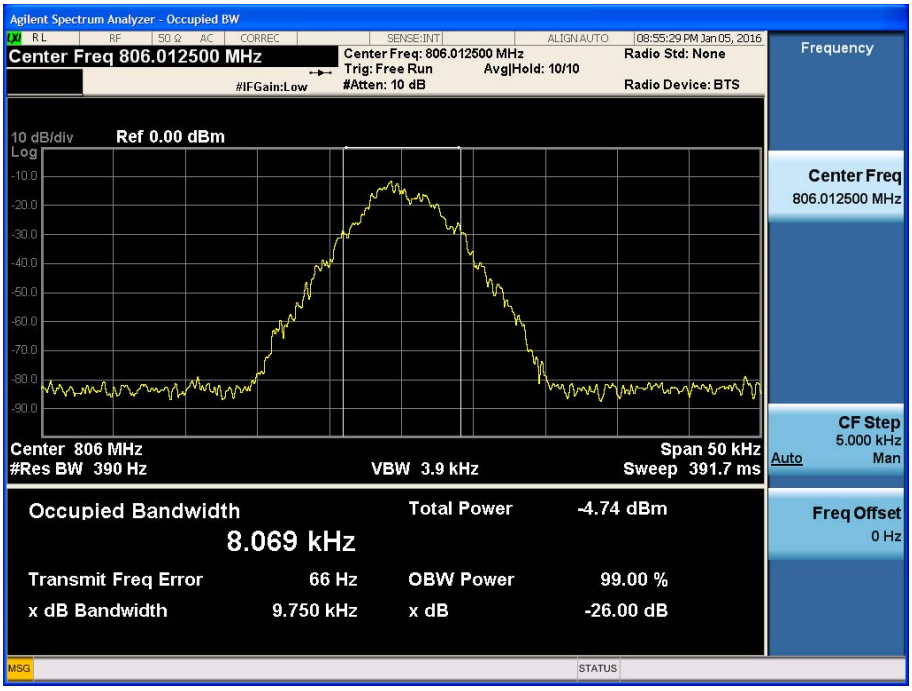
[800 Band AGC threshold Uplink Input FM Middle]



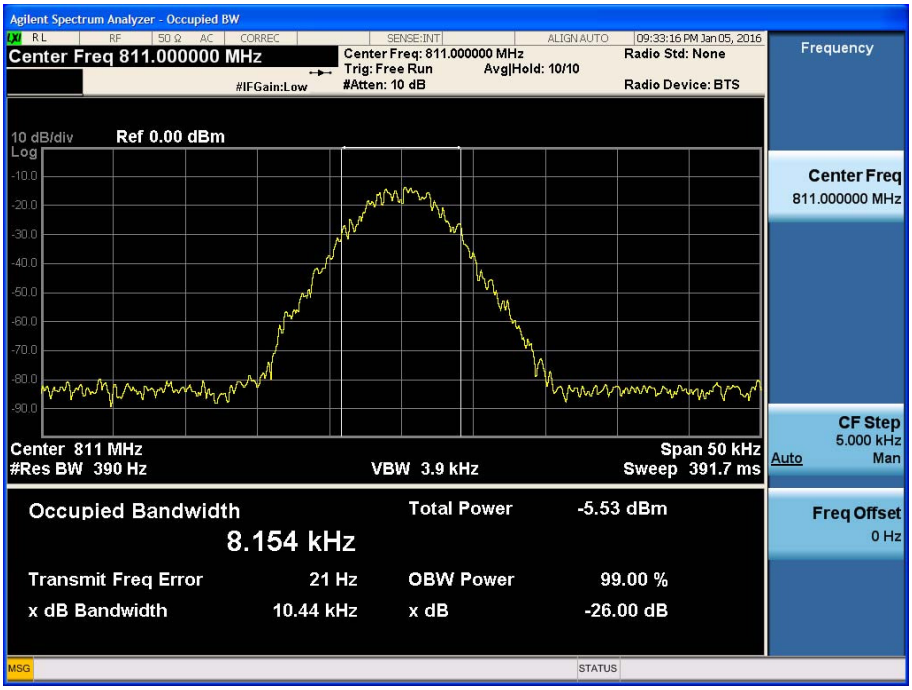
[800 Band AGC threshold Uplink Input FM High]



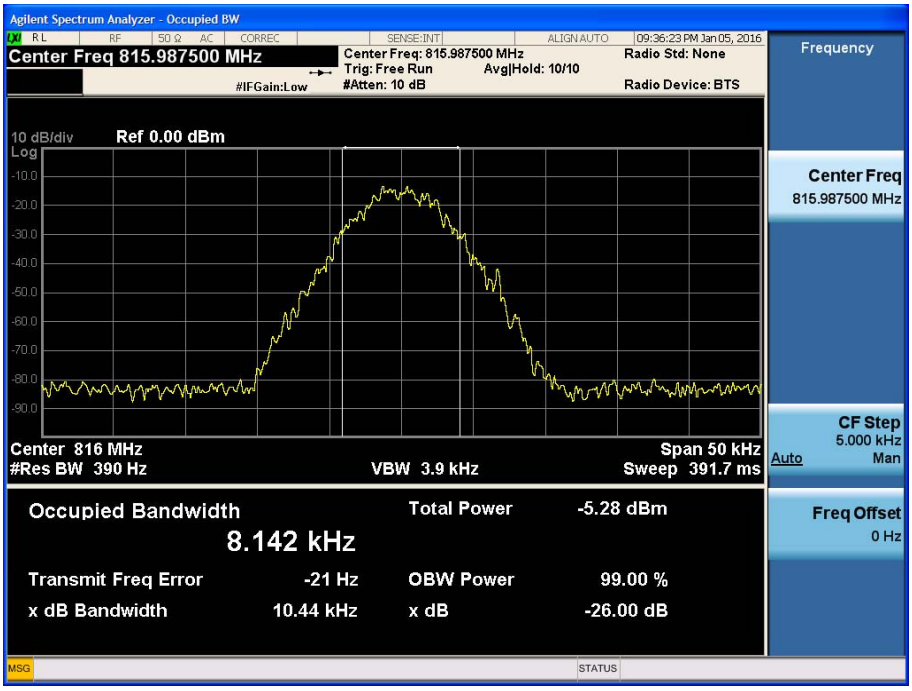
[800 Band AGC threshold Uplink Output P25 Low]



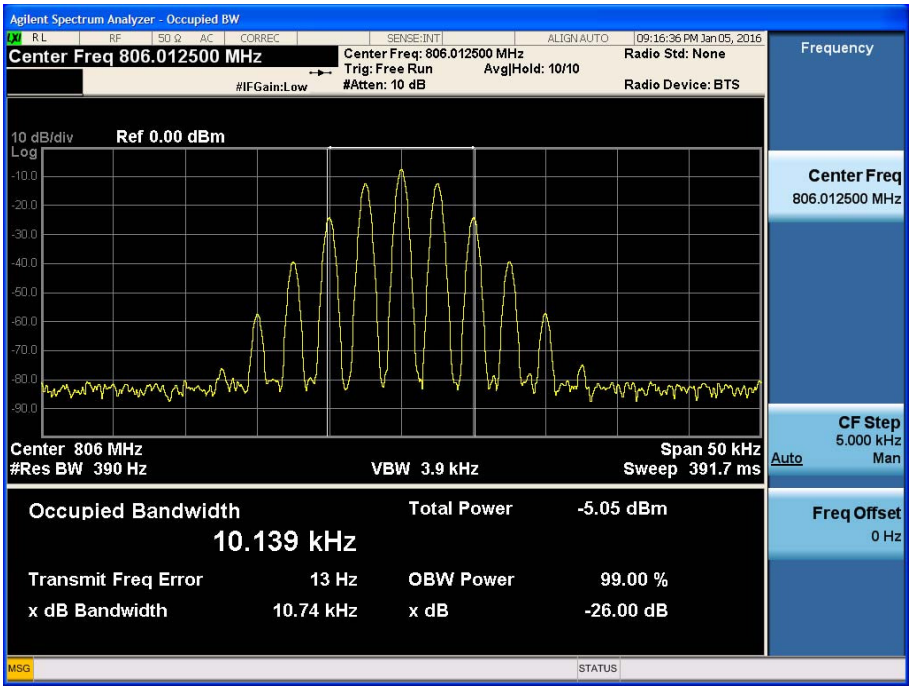
[800 Band AGC threshold Uplink Output P25 Middle]



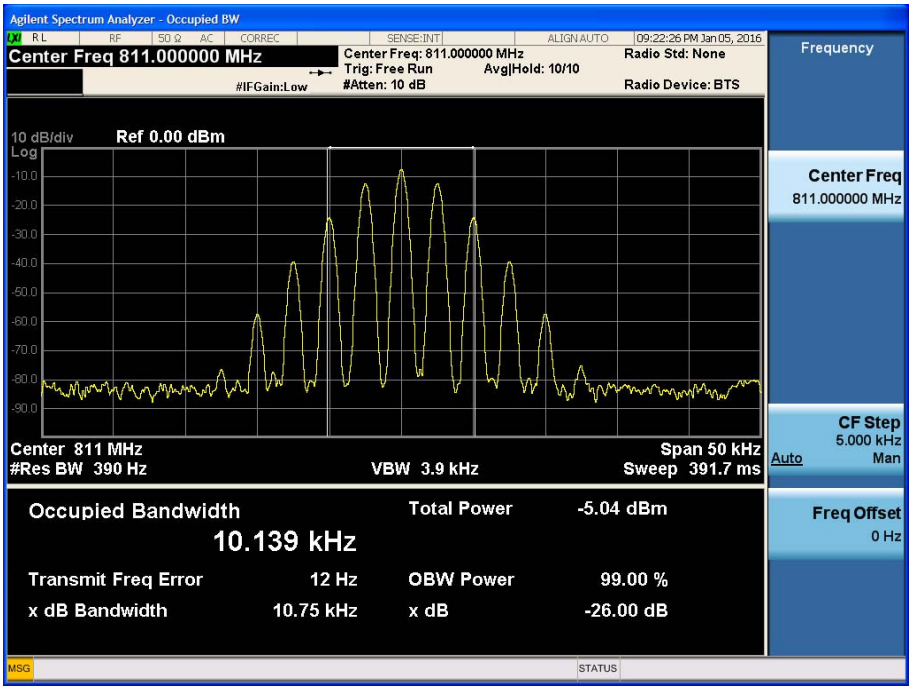
[800 Band AGC threshold Uplink Output P25 High]



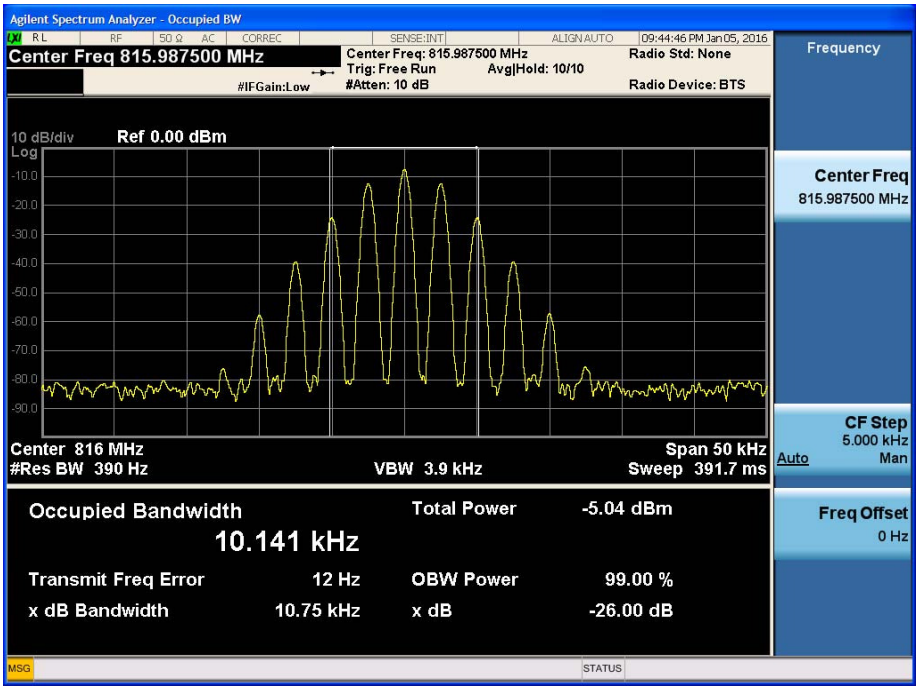
[800 Band AGC threshold Uplink Output FM Low]



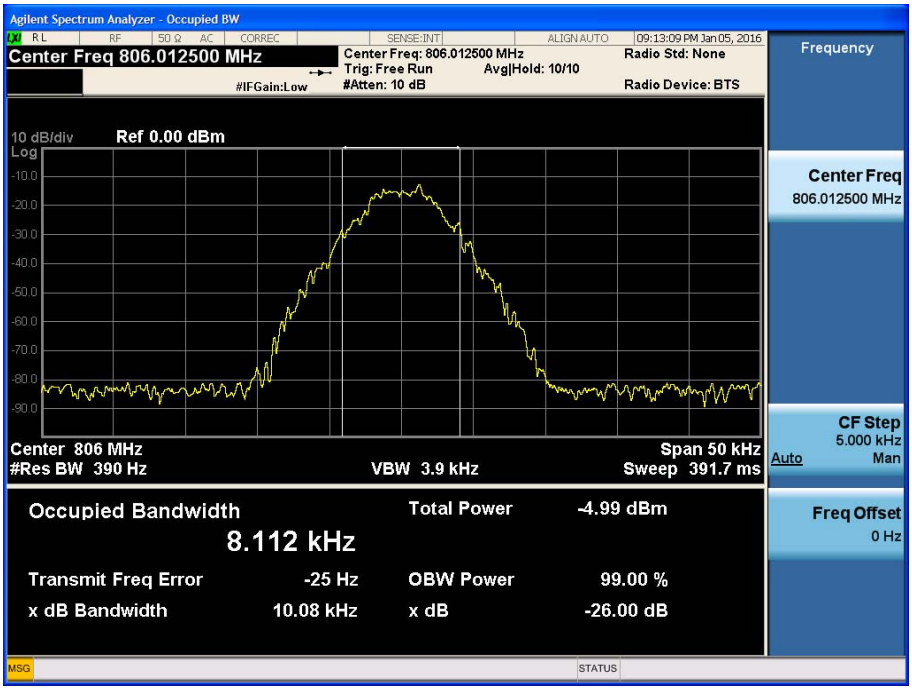
[800 Band AGC threshold Uplink Output FM Middle]



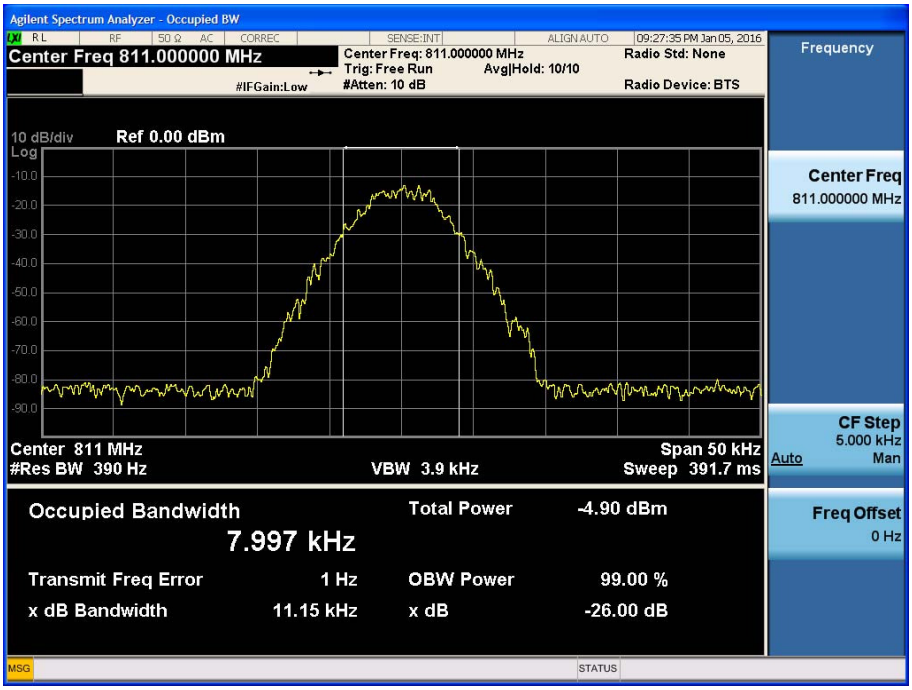
[800 Band AGC threshold Uplink Output FM High]



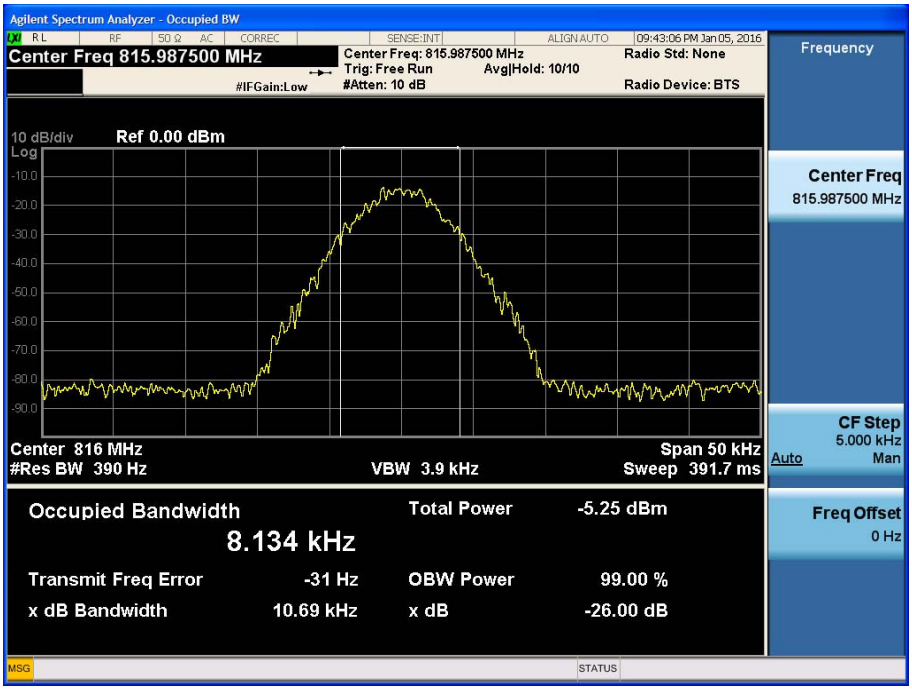
[800 Band +3 dB above the AGC threshold Uplink Output P25 Low]



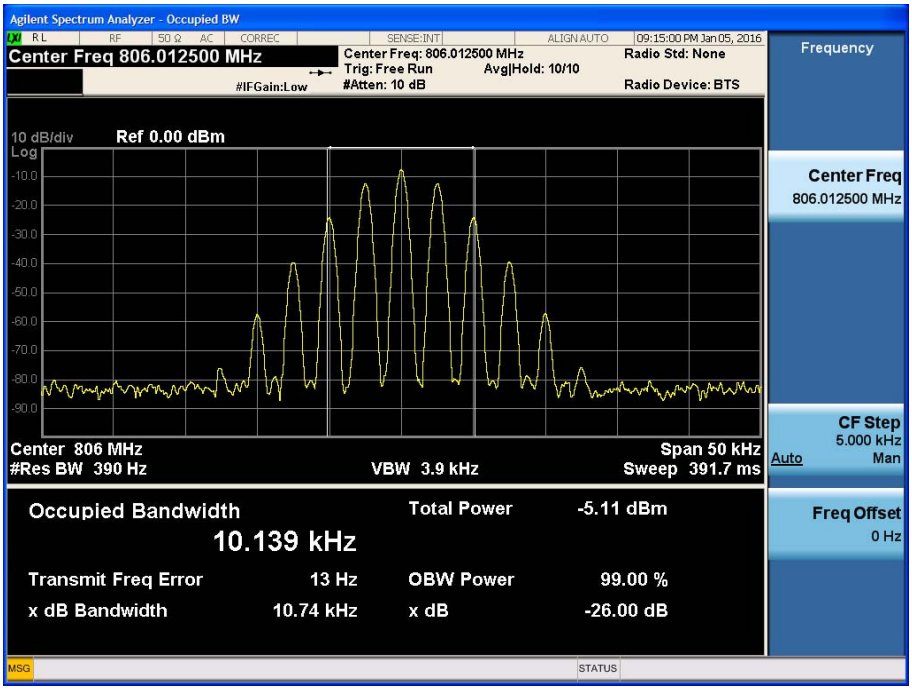
[800 Band +3 dB above the AGC threshold Uplink Output P25 Middle]



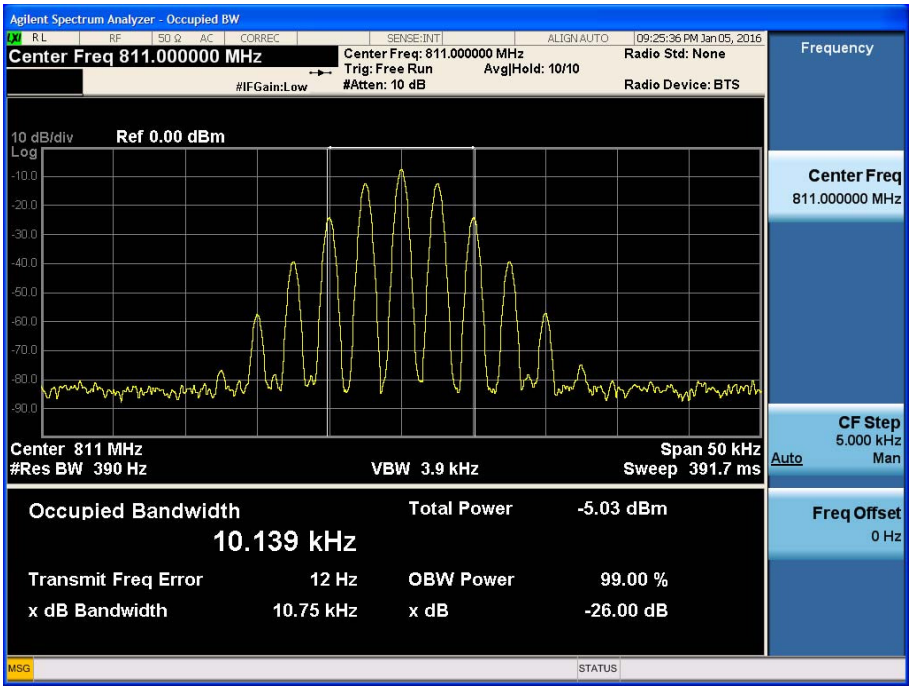
[800 Band +3 dB above the AGC threshold Uplink Output P25 High]



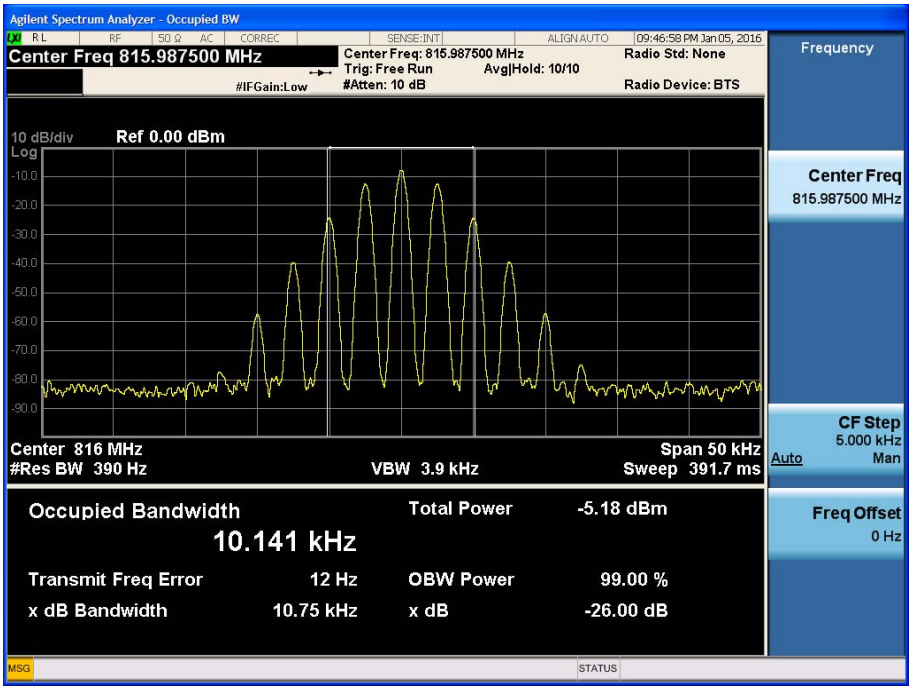
[800 Band +3 dB above the AGC threshold Uplink Output FM Low]



[800 Band +3 dB above the AGC threshold Uplink Output FM Middle]



[800 Band +3 dB above the AGC threshold Uplink Output FM High]



8. PASSBAND GAIN AND BANDWIDTH & OUT OF BAND REJECTION

FCC Rules

Test Requirement(s): KDB 935210 D05 v01r01

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 v01r01.

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 = ± 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 = SPAN/(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 ≥ 3 × 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 f0.

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:

c) Frequency range = ± 250 % of the manufacturer's pass band.

d) The CW amplitude will be 3 dB below the AGC threshold (see 4.2) and but not activate the AGC threshold throughout the test.

e) Dwell time = approx. 10 ms.

f) Frequency step = 50 kHz.

g) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.

h) Set the resolution bandwidth of the spectrum analyzer between 1 % and 5 % of the manufacturer's pass band with the video bandwidth set to 3 × RBW.

i) Set the detector to Peak and the trace to Max-Hold.

j) After the trace is completely filled, place a marker at the peak amplitude, which is designated as f0, and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the gain has fallen by 20 dB).

k) Capture the frequency response plot and for inclusion in the test report.

Test Results: The EUT complies with the requirements of this section.

Input Signal	Input Level (dBm)	Maximum Amp Gain
LTE 5 MHz	UL : -42 dBm	UL : 37 dB
LTE 10 MHz		
CDMA 1.25 MHz		
P25 12.5 kHz		
FM		

700 MHz Band

[Upnlink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
787 ~ 805.54	-8.034	37.034

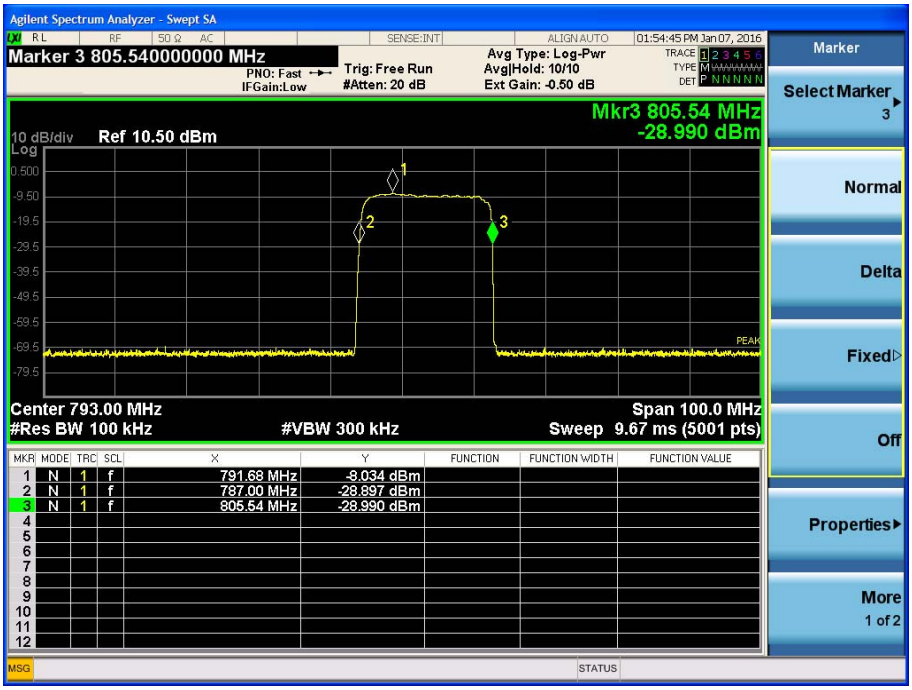
800 MHz Band

[Upnlink]

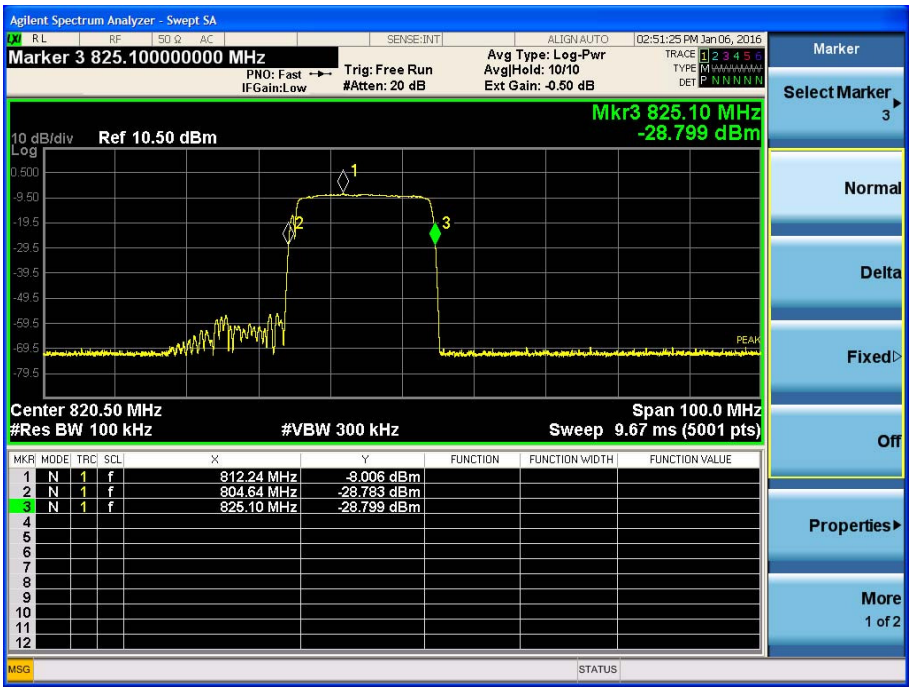
20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
804.64 ~ 825.10	8.006	37.034

Plots of Passband Gain and Bandwidth & Out of Band Rejection

[700M Band Uplink]



[800M Band Uplink]



9. NOISE FIGURE

FCC Rules

Test Requirement(s):

§ 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.
EUT GAIN = Output signal level – 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
Measured to Noise power.

NF=NP-G-BCF+PNAD
NF=NP-G-60+174
NF=NP-G+114

NF=Noise Figure(dB)
NP=Noise power(dBm/MHz)
G=Maximum gain
BCF=Bandwidth Correction Factor=10log(1 MHz/1 Hz)=60
PNAD=Noise Power Density=174 dBm/Hz

Test Results: The EUT complies with the requirements of this section.

Input Signal	Maximum Amp Gain
Without input signal	UL : 37 dB

700 MHz Band

Noise Figure = -38.732-67+114 = 8.268 dB

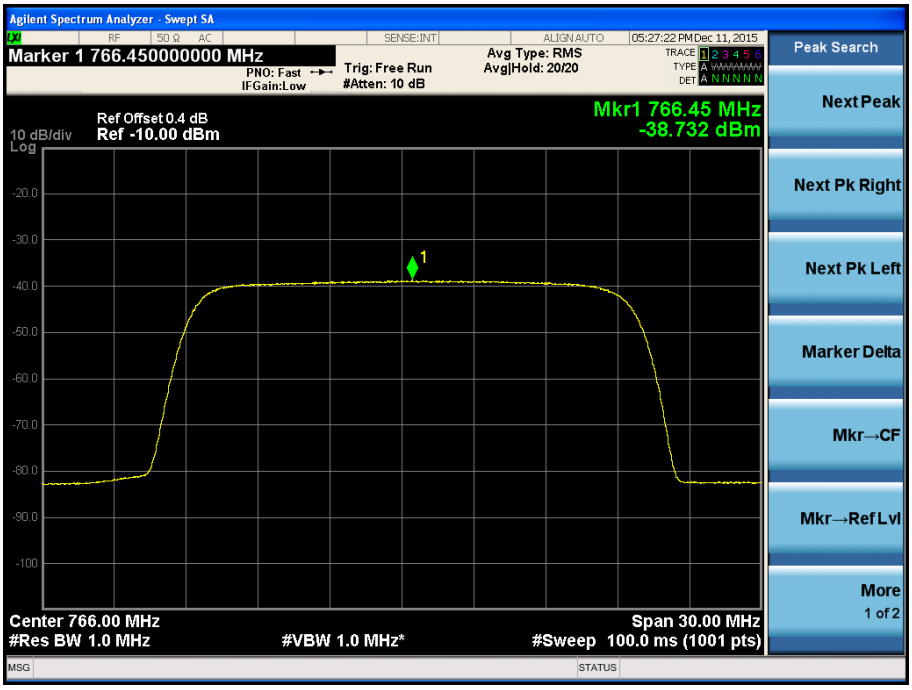
800 MHz Band

Noise Figure = -39.289-67+114 = 7.711 dB

Plots of Noise power

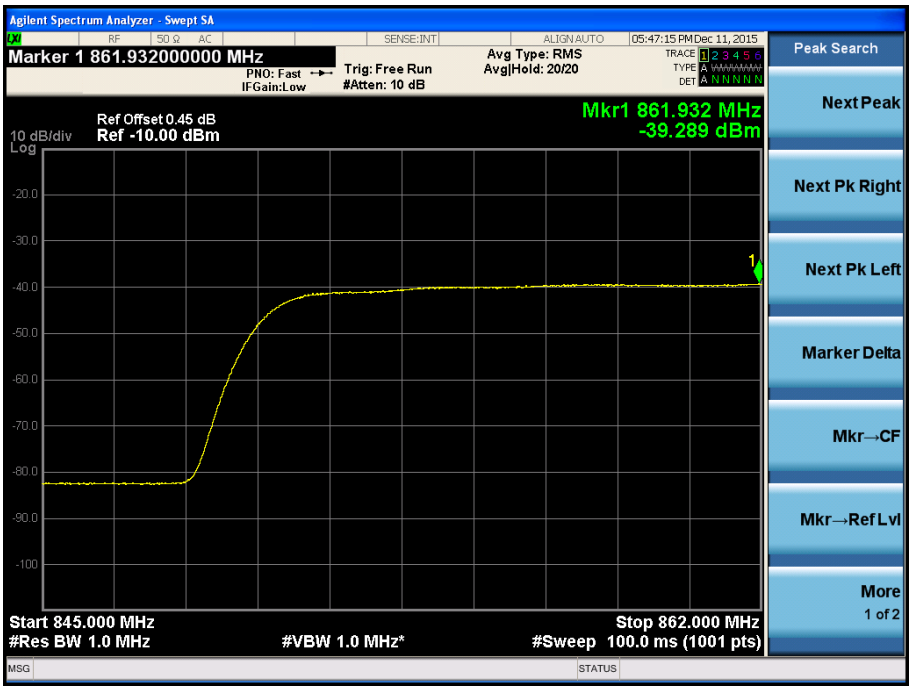
700 MHz Band

[700 MHz Band Uplink]



800 MHz Band

[800 MHz Band Uplink]



10. EMISSION MASKS

FCC Rules

Test Requirement(s):

§ 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[1]	A or B	A or C
25-50	B	C
72-76	B	C
150-174[2]	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512[2 5]	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854	B	H
809-824/854-869[3 5]	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[4]		
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^2/11) 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 (fd in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least 116 log (fd/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 + log (P) dB.

Test Procedures:

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 f0.
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.

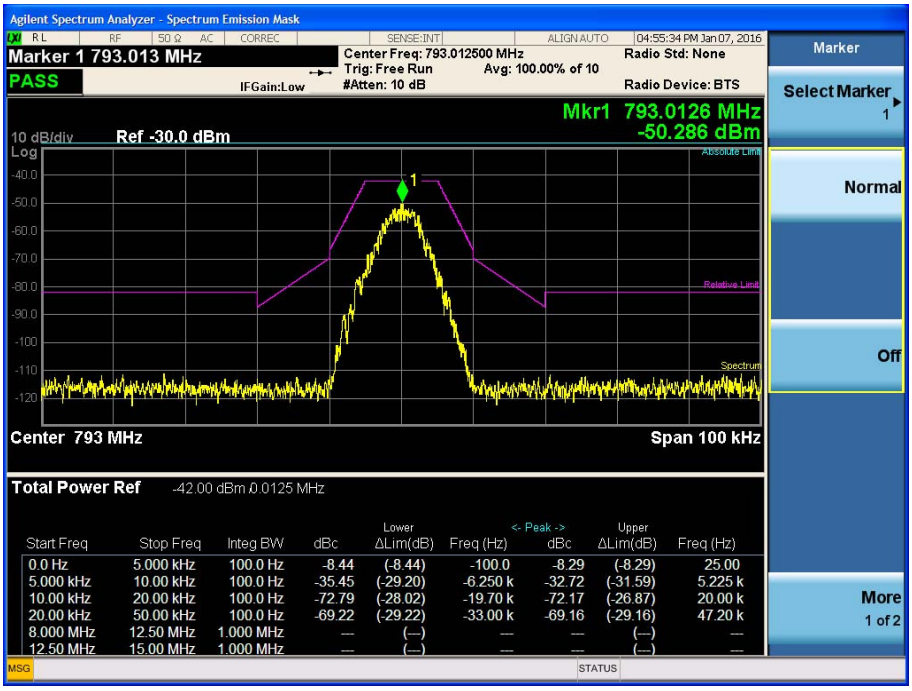
Test Results: The EUT complies with the requirements of this section.

Input Signal	Input Level (dBm)	Maximum Amp Gain
FM modulation	UL : -42 dBm	UL : 37 dB
P25 12.5 kHz	UL : -42 dBm	UL : 37 dB

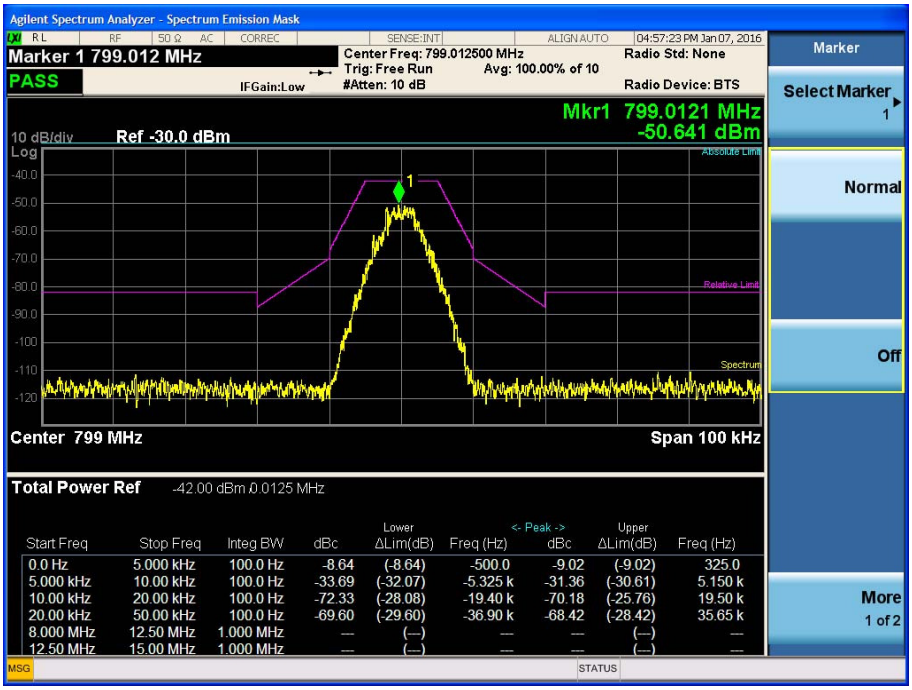
Plots of Emission Mask

700 MHz Band UL

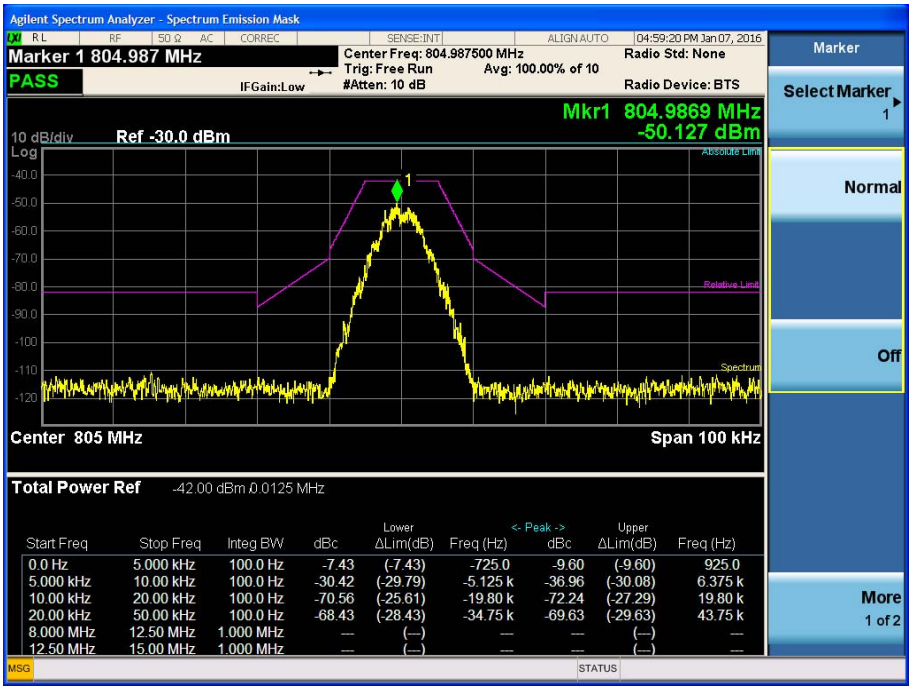
[793 MHz ~ 805 MHz Uplink Input P25 Low Emission Mask C]



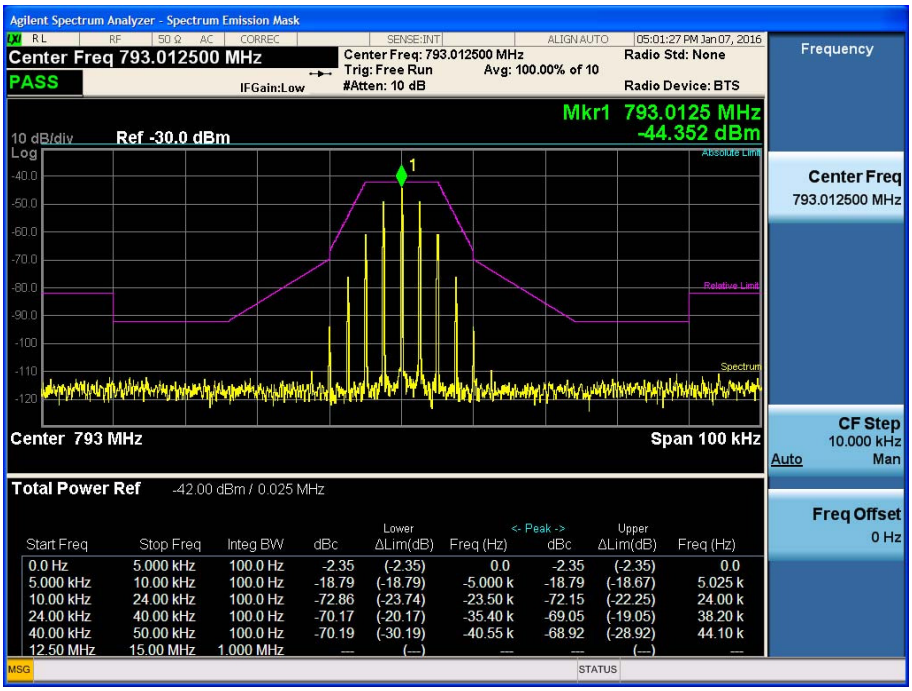
[793 MHz ~ 805 MHz Uplink Input P25 Middle Emission Mask C]



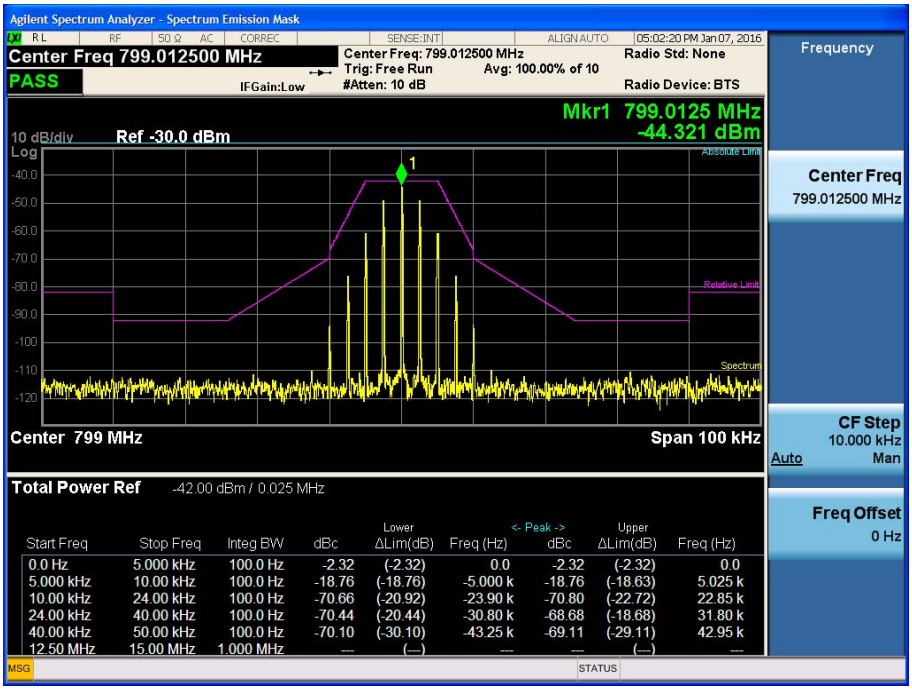
[793 MHz ~ 805 MHz Uplink Input P25 High Emission Mask C]



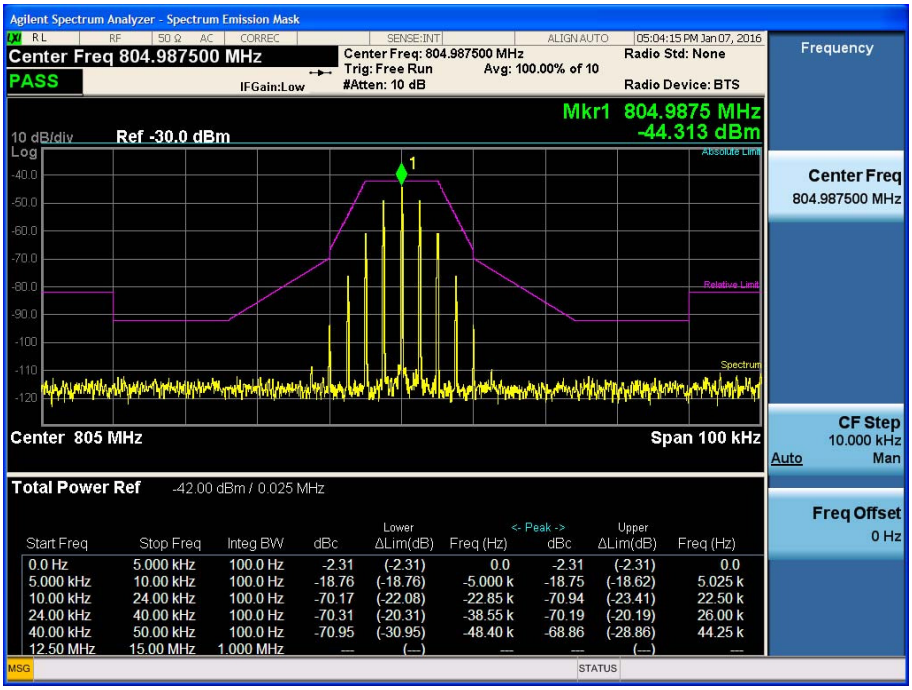
[793 MHz ~ 805 MHz Uplink Input FM Low Emission Mask C]



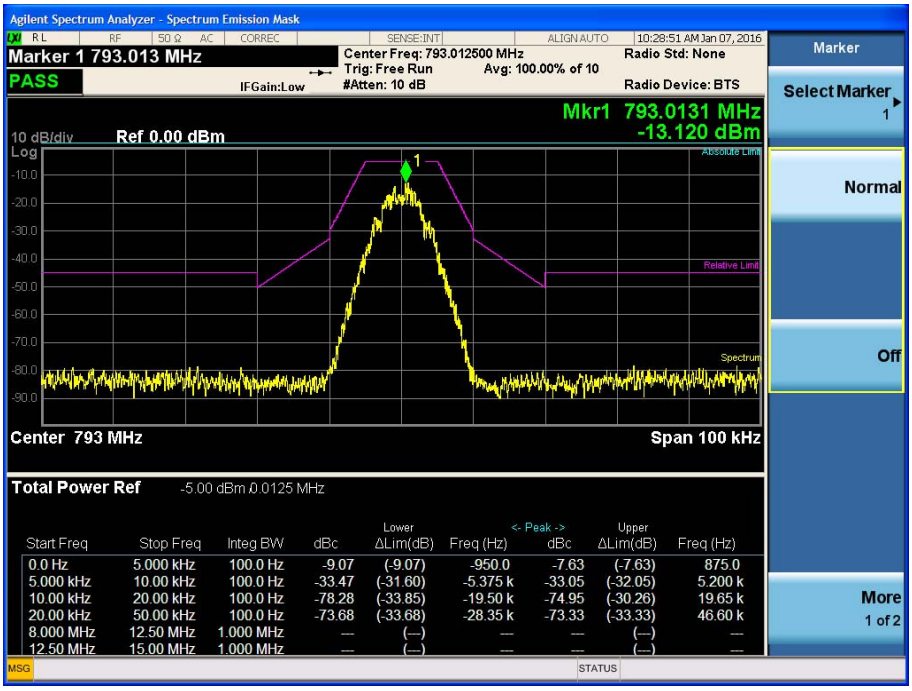
[793 MHz ~ 805 MHz Uplink Input FM Middle Emission Mask C]



[793 MHz ~ 805 MHz Uplink Input FM High Emission Mask C]

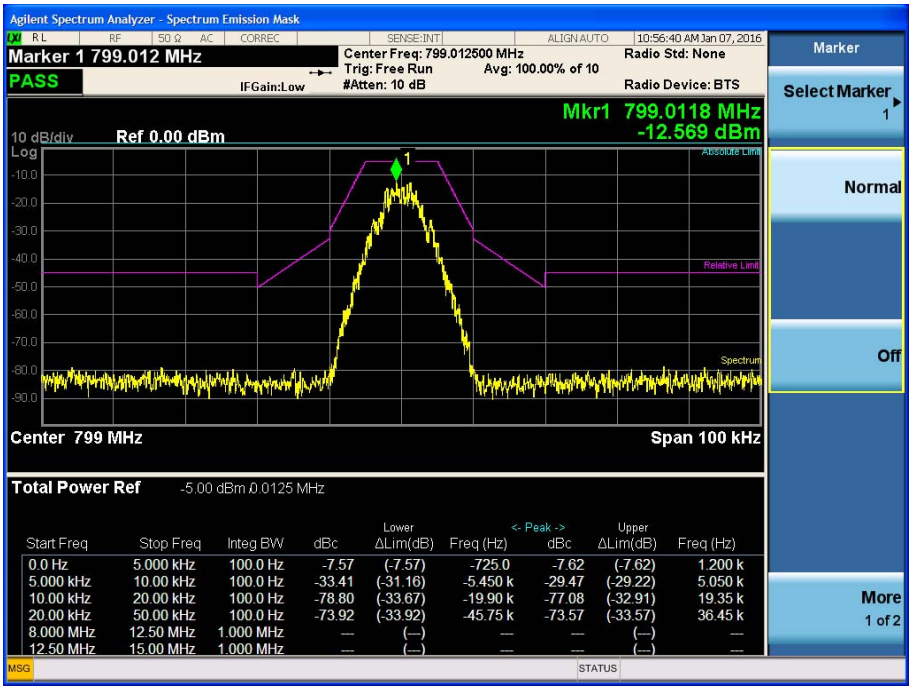


[793 MHz ~ 805 MHz Uplink Output P25 Low Emission Mask C]



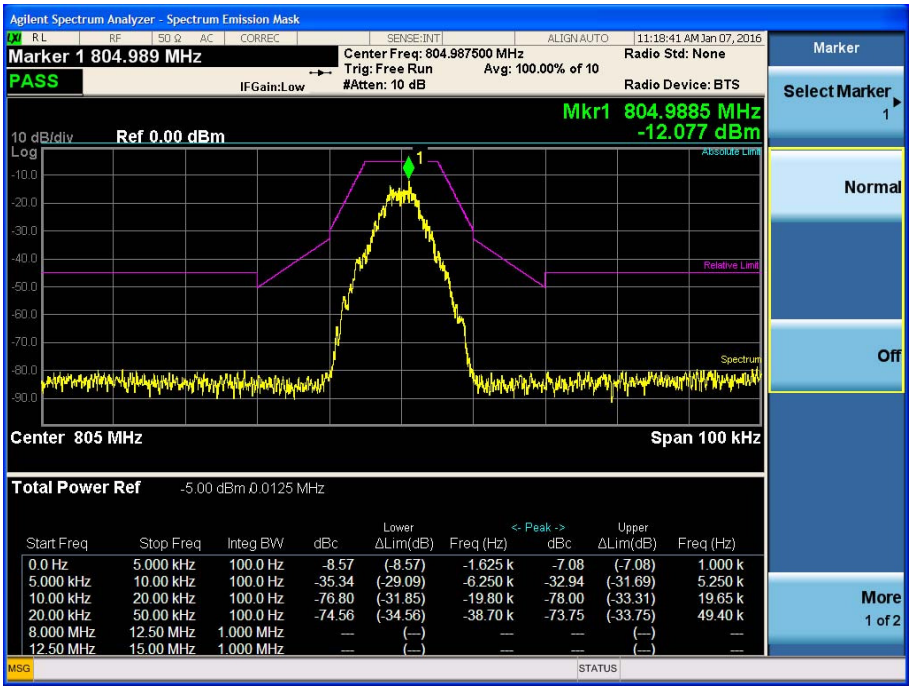
Start Freq	Stop Freq	Integ BW	dBc	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBc	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	5.000 kHz	100.0 Hz	-9.07	(-9.07)	-950.0	-7.63	(-7.63)	875.0
5.000 kHz	10.00 kHz	100.0 Hz	-33.47	(-31.60)	-5.375 k	-33.05	(-32.05)	5.200 k
10.00 kHz	20.00 kHz	100.0 Hz	-78.28	(-33.85)	-19.50 k	-74.95	(-30.26)	19.65 k
20.00 kHz	50.00 kHz	100.0 Hz	-73.68	(-33.68)	-28.35 k	-73.33	(-33.33)	46.60 k
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

[793 MHz ~ 805 MHz Uplink Output P25 Middle Emission Mask C]

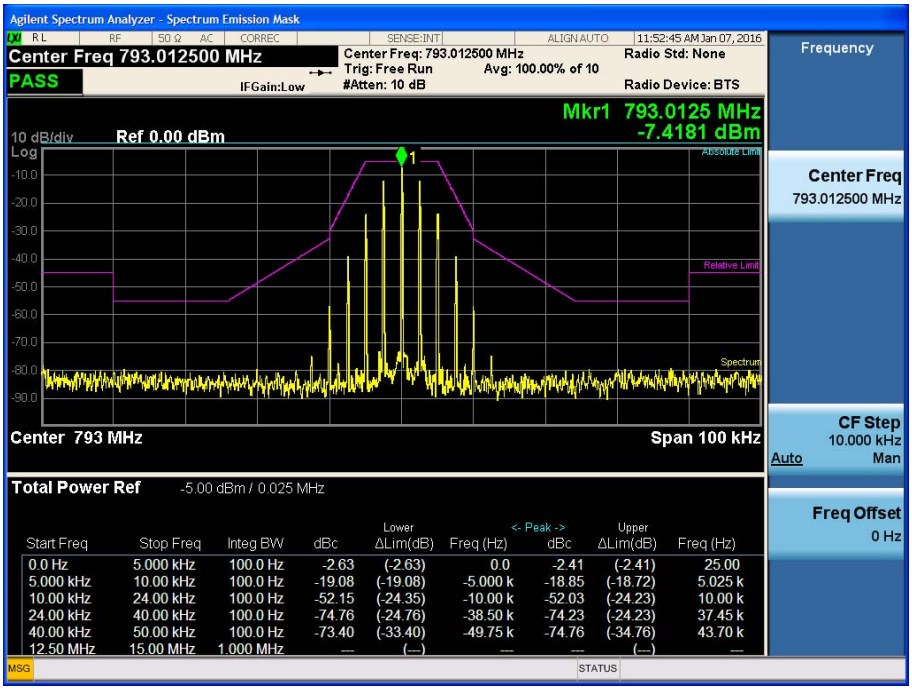


Start Freq	Stop Freq	Integ BW	dBc	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBc	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	5.000 kHz	100.0 Hz	-7.57	(-7.57)	-725.0	-7.62	(-7.62)	1.200 k
5.000 kHz	10.00 kHz	100.0 Hz	-33.41	(-31.16)	-5.450 k	-29.47	(-29.22)	5.050 k
10.00 kHz	20.00 kHz	100.0 Hz	-78.80	(-33.67)	-19.90 k	-77.08	(-32.91)	19.35 k
20.00 kHz	50.00 kHz	100.0 Hz	-73.92	(-33.92)	-45.75 k	-73.57	(-33.57)	36.45 k
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

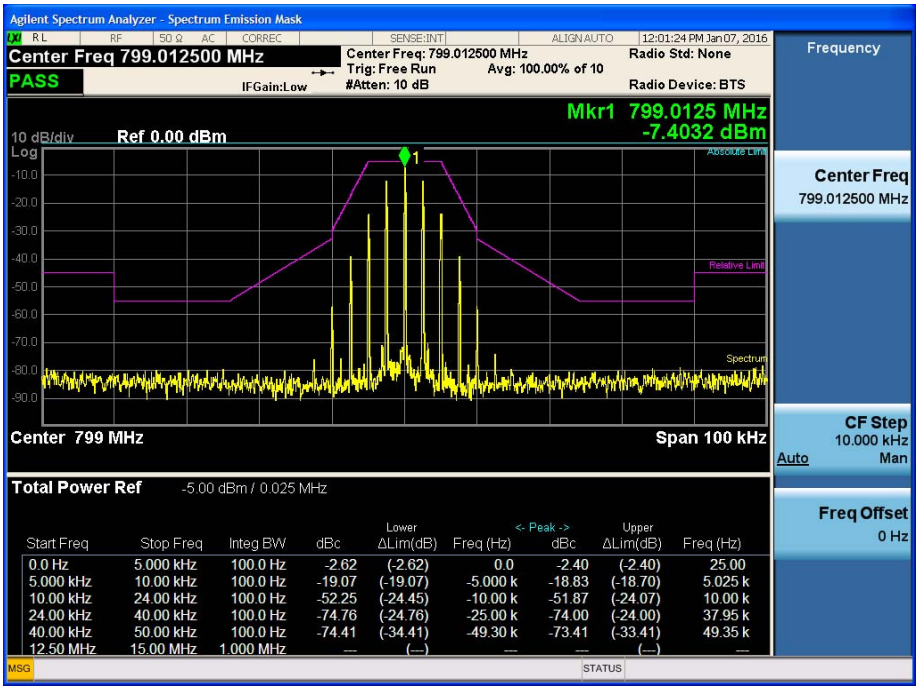
[793 MHz ~ 805 MHz Uplink Output P25 High Emission Mask C]



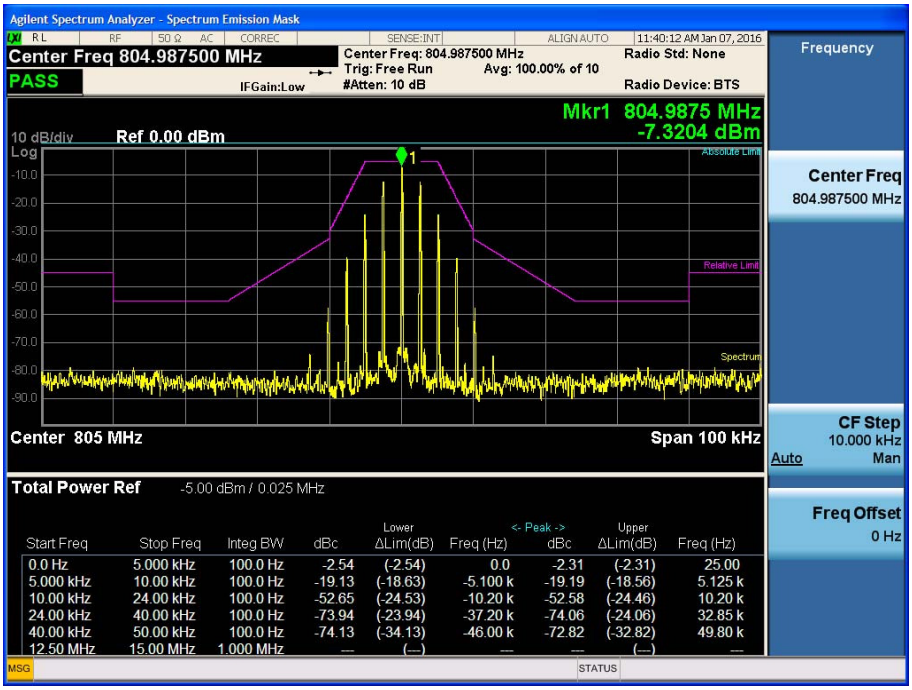
[793 MHz ~ 805 MHz Uplink Output FM Low Emission Mask C]



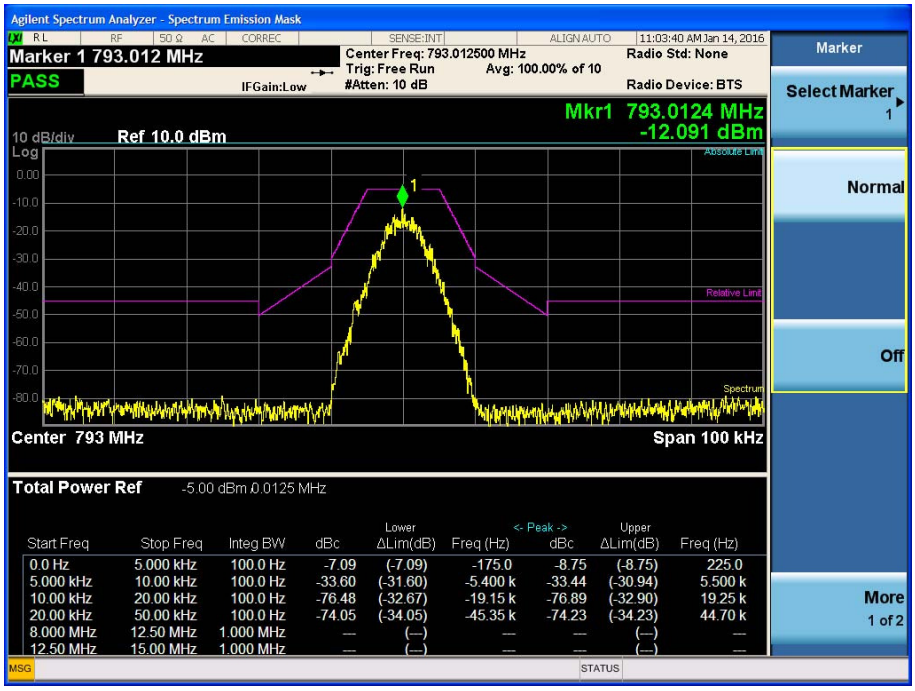
[793 MHz ~ 805 MHz Uplink Output FM Middle Emission Mask C]



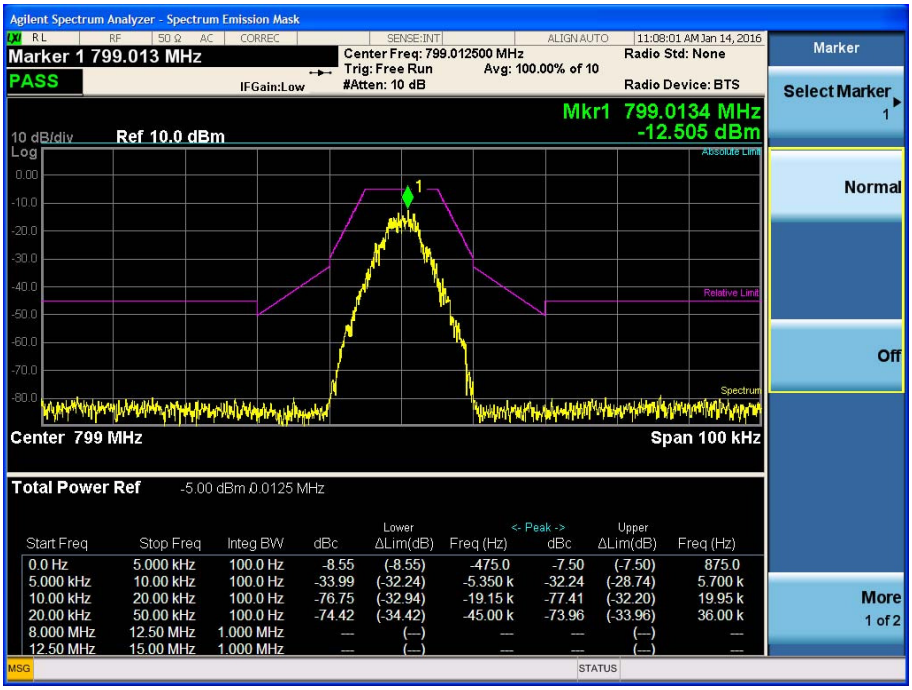
[793 MHz ~ 805 MHz Uplink Output FM High Emission Mask C]



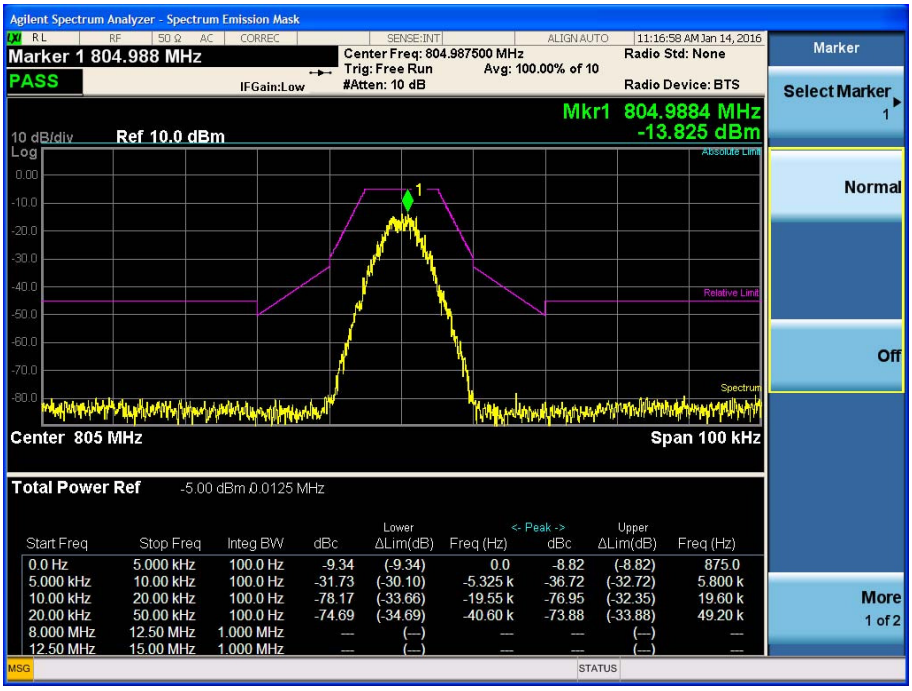
[+3 dB Above the AGC Threshold Uplink Output P25 Low Emission Mask C]



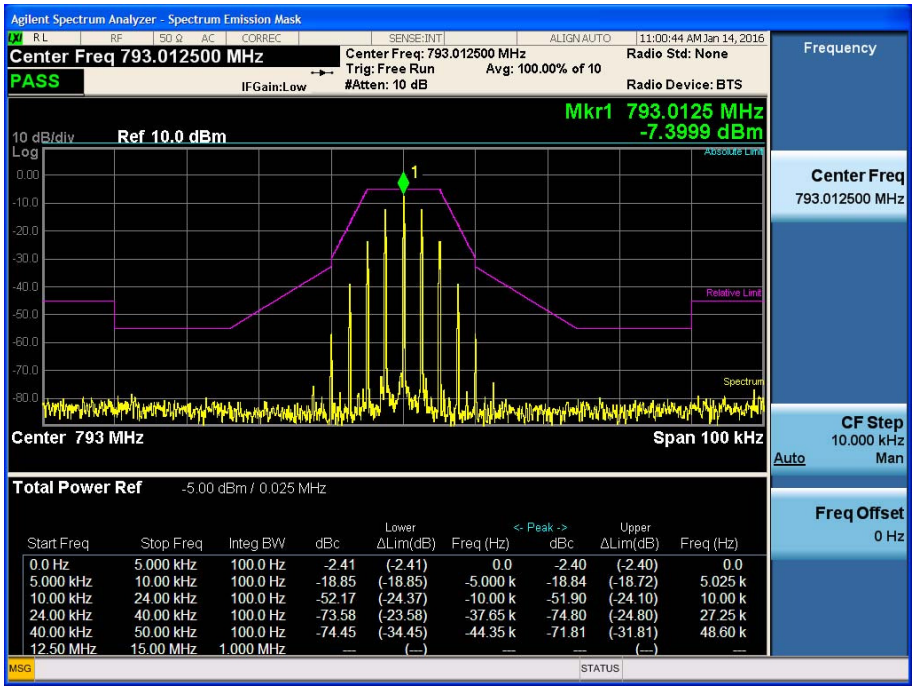
[+3 dB Above the AGC Threshold Uplink Output P25 Middle Emission Mask C]



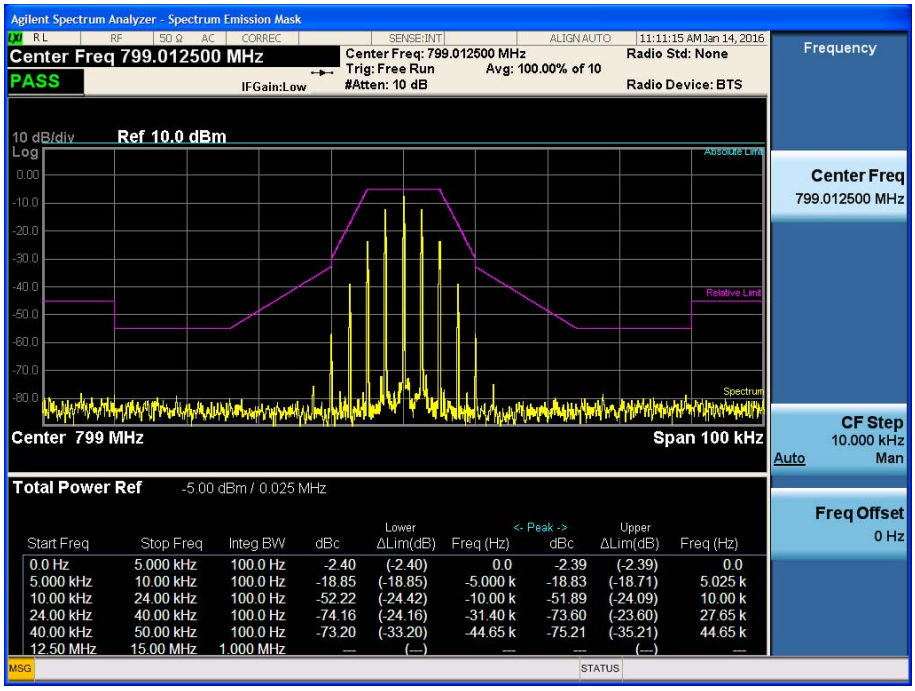
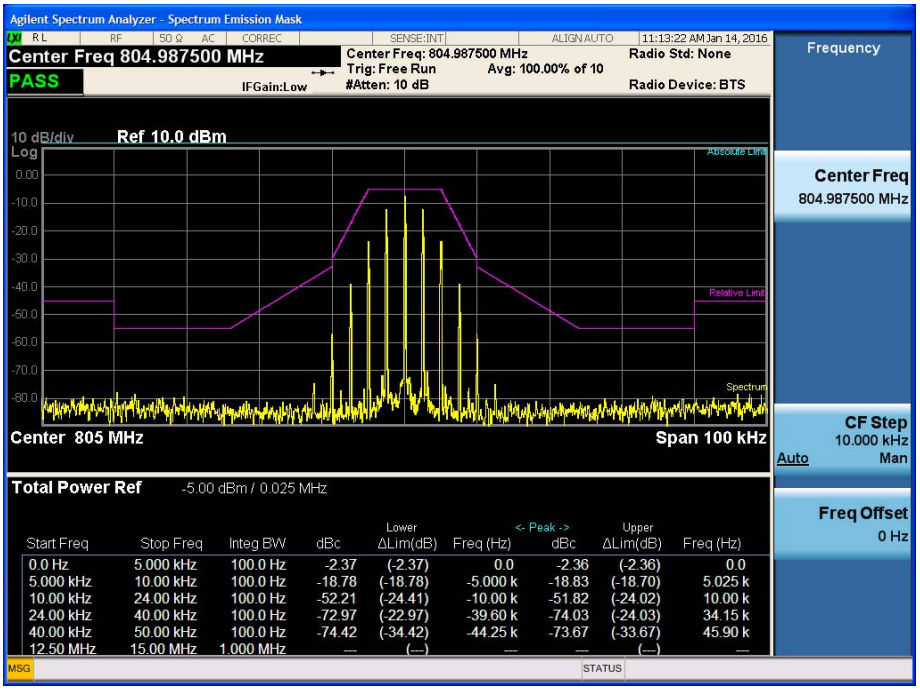
[+3 dB Above the AGC Threshold Uplink Output P25 High Emission Mask C]



[+3 dB Above the AGC Threshold Uplink Output FM Low Emission Mask C]



[+3 dB Above the AGC Threshold Uplink Output FM Middle Emission Mask C]



[+3 dB Above the AGC Threshold Uplink Output FM High Emission Mask C]