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FCC / ISED REPORT

Certification

Applicant Name:
ADVANCED RF TECHNOLOGIES, INC

Address:
3116 WEST VANOWEN STREET, BURBANK, CA 91505, USA

Date of Issue:
May 23, 2017

Test Site/Location:
HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-R-1704-F009-1

HCT FRN: 0005866421

ISED Registration Number: 5944A-5

FCC ID:	**N52-PSR-78-9533A**
IC:	**6416A-PSR789533A**
APPLICANT:	**ADVANCED RF TECHNOLOGIES, INC**

FCC/IC Model(s): PSR-78-9533A

EUT Type: REPEATER

Frequency Ranges :

	Downlink	Uplink
PS 700	769 ~ 775 MHz (for FCC) (768 ~ 769 MHz Guard band) 768 ~ 775 MHz (for ISED)	799 ~ 805 MHz (for FCC) (798 ~ 799 MHz Guard band) 798 ~ 805 MHz (for ISED)
PS 800	851 ~ 861 MHz	806 ~ 816 MHz

Conducted Output Power:

	Downlink	Uplink
PS 700	33 dBm	30 dBm
PS 800	33 dBm	30 dBm
PS 700 + PS 800	36 dBm (33 dBm + 33 dBm)	30 dBm

Date of Test: February 10, 2017 ~ May 23, 2017

FCC Rule Part(s): CFR 47 Part 2, Part 90

IC Rules: RSS-Gen (Issue 4, November 2014),
RSS-119 (Issue 12, May 2015), RSS-131 (Issue 3, January 2017)

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC / IC Rules under normal use and maintenance.

Report prepared by : Kyung Soo Kang
Engineer of Telecommunication testing center

Approved by : Jong Seok Lee
Manager of Telecommunication testing center

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1704-F009	April 18, 2017	- First Approval Report
HCT-R-1704-F009-1	May 23, 2017	- Retest was performed as the frequency range was modified. - Revised the OBW test unit. - Revised the OBW test for PS 800 uplink input low channel. - Added the test result for PS 800 downlink in the section 8. - Added the correction factor table. - Added the test result in the section 10. - Added the rule part 90.543(e) compliane test results. - Retested the frequency stabiliity for PS 700.

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company	ADVANCED RF TECHNOLOGIES, INC 3116 WEST VANOWEN STREET, BURBANK, CA 91505, USA

FCC ID: N52-PSR-78-9533A

IC: 6416A-PSR789533A

EUT Type: REPEATER

FCC/IC Model(s): PSR-78-9533A

Power Supply: 100 ~ 240 VAC

Frequency Ranges :

	Downlink	Uplink
PS 700	769 ~ 775 MHz (for FCC) (768 ~ 769 MHz Guard band) 768 ~ 775 MHz (for ISED)	799 ~ 805 MHz (for FCC) (798 ~ 799 MHz Guard band) 798 ~ 805 MHz (for ISED)
PS 800	851 ~ 861 MHz	806 ~ 816 MHz

Conducted Output Power:

	Downlink	Uplink
PS 700	33 dBm	30 dBm
PS 800	33 dBm	30 dBm
PS 700 + PS 800	36 dBm (33 dBm + 33 dBm)	30 dBm

Antenna Gain(s): Manufacturer does not provide an antenna.

Measurement standard(s): ANSI/TIA-603-D-2010, KDB 971168 D01 v02r02,
KDB 935210 D05 v01r01, RSS-GEN, RSS-119, RSS-131

FCC Rule Part(s): CFR 47 Part 2, Part 90

IC Rules: RSS-Gen (Issue 4, November 2014),
RSS-119 (Issue 12, May 2015), RSS-131 (Issue 3, January 2017)

Place of Tests: HCT CO., LTD.,
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
(ISED Registration Number : 5944A-5)

2. FACILITIES AND ACCREDITATIONS

2.1. FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661).

2.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.
Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

3. TEST SPECIFICATIONS

3.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 2, Part 90, RSS-Gen, RSS-119, RSS-131.

Description	Reference (FCC)	Reference (IC)	Results
Conducted RF Output Power	§2.1046, §90.541, §90.542, §90.635	RSS-119, Section 5.4 RSS-131, Section 6.2	Compliant
Occupied Bandwidth	§2.1049	RSS-Gen, Sectin 6.6	Compliant
Out of Band Rejection	KDB 935210 D05 v01r01	-	Compliant
Noise Figure	§90.219(e)(2)	RSS-131, Section 6.4	Compliant
Emission Masks	§90.210	RSS-119, Section 5.5 RSS-119, Section 5.8	Compliant
Spurious Emissions at Antenna Terminals	§2.1051, §90.219(e)(3), §90.543	RSS-119, Section 5.8 RSS-131, Section 6.5	Compliant
Radiated Spurious Emissions	§2.1053	RSS-Gen, Section 7.1.2	Compliant
Frequency Stability	§2.1055; §90.213. §90.539	RSS-119, Section 5.3 RSS-131, Section 4.5	Compliant

3.2. MODE OF OPERATION DURING THE TEST

The EUT was operated in a manner representative of the typical usage of the equipment.

During all testing, system components were manipulated within the confines of typical usage to maximize each emission.

All modulation modes were tested. Test results are only attached worst cases.

The device does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports for radiated spurious emission testing.

	Downlink Freq.	Uplink Freq.	Modulation
PS 700	769 ~ 775 MHz (768 ~ 769 MHz Guard band) 768 ~ 775 MHz (for ISED)	799 ~805 MHz (798 ~ 799 MHz Guard band) 798 ~ 805 MHz (for ISED)	APCO 25
PS 800	851 ~ 861 MHz	806 ~ 816 MHz	

* The tests results in plots are already including the actual value of loss for the attenuator and cable combination. Please check correction factors below table.

▣ Correction Factor

Freq(MHz)	Factor(dB)
30	30.504
100	29.246
200	29.578
300	29.551
400	29.859
500	29.924
600	29.983
700	29.946
800	30.056
900	30.200
1000	30.263
2000	30.864
2600*	31.408
2700*	31.767
3000	32.243
4000	32.456
5000	30.504
6000	29.246
7000	33.210

8000	33.429
9000	34.210
10000	34.597
11000	35.485
12000	36.128
13000	37.014
14000	37.524
15000	38.070
16000	41.191
17000	41.070
18000	42.726
19000	41.312
20000	41.964
21000	42.616
22000	43.268
23000	43.920
24000	44.572
25000	45.225

3.3. MAXIMUM MEASUREMENT UNCERTAINTY

The value of the measurement uncertainty for the measurement of each parameter.

Coverage factor *k* = 2, Confidence levels of 95 %

Description	Condition	Uncertainty
Conducted RF Output Power	-	± 0.72 dB
Occupied Bandwidth	OBW ≤ 20 MHz	± 52 kHz
Passband Gain and Bandwidth & Out of Band Rejection	Gain 20 dB bandwidth	± 0.89 dB ± 0.58 MHz
Spurious Emissions at Antenna Terminals	-	± 1.08 dB
Noise Figure, Emission Masks	-	± 0.89 dB
Radiated Spurious Emissions	f ≤ 1 GHz f > 1 GHz	± 4.80 dB ± 6.07 dB

4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature :	**+ 15 ℃ to + 35 ℃**
Relative humidity:	**30 % to 60 %**
Air pressure	**860 mbar to 1 060 mbar**

5. TEST EQUIPMENT

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Agilent	E4438C /Signal Generator	12/21/2016	Annual	MY42082646
Agilent	E4438C /Signal Generator	01/24/2017	Annual	US41460432
Agilent	N5182A /Signal Generator	03/29/2017	Annual	MY50141649
Agilent	N5182A /Signal Generator	01/23/2017	Annual	MY47070406
Agilent	N9020A / Signal Analyzer	07/04/2016	Annual	MY49100925
Weinschel	67-30-33 / Fixed Attenuator	02/09/2017	Annual	CC7264
Weinschel	2-10 / 10 dB Attenuator	02/22/2017	Annual	BR0554
Agilent	11636A / Power Divider	08/12/2016	Annual	09109
DEAYOUNG ENT	DFSS60 / AC Power Supply	04/05/2017	Annual	1003030-1
NANGYEUL CO., LTD.	NY-THR18750 / Temperature and Humidity Chamber	10/21/2016	Annual	NY-2009012201A
Innco system	MA4000-EP / Antenna Position Tower	N/A	N/A	N/A
Innco system	CT0800 / Turn Table	N/A	N/A	N/A
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
ETS	2090 / Controller(Turn table)	N/A	N/A	1646
Rohde&Schwarz	Loop Antenna	02/23/2016	Biennial	1513-175
Schwarzbeck	VULB 9160 / Trilog Antenna	10/14/2016	Biennial	9160-3368
Schwarzbeck	BBHA 9120D / Horn Antenna	12/11/2015	Biennial	9120D-1191
Rohde & Schwarz	FSP / Spectrum Analyzer	09/29/2016	Annual	836650/016
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/23/2016	Annual	101068-SZ
Wainwright Instruments	WHK1.2/15G-10EF / Highpass Filter	04/10/2017	Annual	4
Wainwright Instruments	WHK3.0/18G-10EF / Highpass Filter	06/24/2016	Annual	8
CERNEX	CBLU1183540 / Power Amplifier	01/25/2017	Annual	24614
CERNEX	CBL06185030 / Power Amplifier	01/25/2017	Annual	24615
CERNEX	CBL18265035 / Power Amplifier	07/11/2016	Annual	22966

6. RF OUTPUT POWER

FCC Rules

Test Requirements:

§ 2.1046 Measurements required: RF power output:

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8).The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(b) For single sideband, independent sideband, and single channel, controlled carrier radio telephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§ 90.541 Transmitting power and antenna height limits.

The transmitting power and antenna height of base, mobile, portable and control stations operating in the 769-775 MHz and 799-805 MHz frequency bands must not exceed the maximum limits in this section. Power limits are listed in effective radiated power (ERP).

(a) The transmitting power and antenna height of base stations must not exceed the limits given in paragraph (a) of §90.635.

§ 90.542 Broadband transmitting power limits.

(a) The following power limits apply to the 758-768/788-798 MHz band:

(1) Fixed and base stations transmitting a signal in the 758-768 MHz band with an emission bandwidth of 1 MHz or less must not exceed an ERP of 1000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section.

(2) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 758-768 MHz band with an emission bandwidth of 1 MHz or less must not exceed an ERP of 2000 watts and an antenna height of 305 m HAAT,

except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts ERP in accordance with Table 2 of this section.

(3) Fixed and base stations transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP accordance with Table 3 of this section.

(4) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section.

(5) Licensees of fixed or base stations transmitting a signal in the 758-768 MHz band at an ERP greater than 1000 watts must comply with the provisions set forth in paragraph (b) of this section.

(6) Control stations and mobile stations transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 30 watts ERP.

(7) Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

(8) For transmissions in the 758-768 MHz and 788-798 MHz bands, licensees may employ equipment operating in compliance with either of the following measurement techniques:

(i) The maximum composite transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of RMS-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, etc., so as to obtain a true maximum composite measurement for the emission in question over the full bandwidth of the channel.

(ii) A Commission-approved average power technique.

Table 1 to §90.542(a)—Permissible Power and Antenna Heights for Base and Fixed Stations in the 758-768 MHz Band Transmitting a Signal With an Emission Bandwidth of 1 MHz or Less

Antenna height (AAT) in meters (feet)	Effective radiated power (ERP) (watts)
Above 1372 (4500)	65
Above 1220 (4000) To 1372 (4500)	70
Above 1067 (3500) To 1220 (4000)	75
Above 915 (3000) To 1067 (3500)	100
Above 763 (2500) To 915 (3000)	140

Above 610 (2000) To 763 (2500)	200
Above 458 (1500) To 610 (2000)	350
Above 305 (1000) To 458 (1500)	600
Up to 305 (1000)	1000

Table 2 to §90.542(a)—Permissible Power and Antenna Heights for Base and Fixed Stations in the 758-768 MHz Band Transmitting a Signal With an Emission Bandwidth of 1 MHz or Less

Antenna height (AAT) in meters (feet)	Effective radiated power (ERP) (watts)
Above 1372 (4500)	130
Above 1220 (4000) To 1372 (4500)	140
Above 1067 (3500) To 1220 (4000)	150
Above 915 (3000) To 1067 (3500)	200
Above 763 (2500) To 915 (3000)	280
Above 610 (2000) To 763 (2500)	400
Above 458 (1500) To 610 (2000)	700
Above 305 (1000) To 458 (1500)	1200
Up to 305 (1000)	2000

Table 3 to §90.542(a)—Permissible Power and Antenna Heights for Base and Fixed Stations in the 758-768 MHz Band Transmitting a Signal With an Emission Bandwidth Greater Than 1 MHz

Antenna height (AAT) in meters (feet)	Effective radiated power (ERP) per MHz (watts/MHz)
Above 1372 (4500)	65
Above 1220 (4000) To 1372 (4500)	70
Above 1067 (3500) To 1220 (4000)	75
Above 915 (3000) To 1067 (3500)	100
Above 763 (2500) To 915 (3000)	140
Above 610 (2000) To 763 (2500)	200
Above 458 (1500) To 610 (2000)	350
Above 305 (1000) To 458 (1500)	600
Up to 305 (1000)	1000

Table 4 to §90.542(a)—Permissible Power and Antenna Heights for Base and Fixed Stations in the 758-768 MHz Band Transmitting a Signal With an Emission Bandwidth Greater Than 1 MHz

Antenna height (AAT) in meters (feet)	Effective radiated power (ERP) per MHz (watts/MHz)

Above 1372 (4500)	130
Above 1220 (4000) To 1372 (4500)	140
Above 1067 (3500) To 1220 (4000)	150
Above 915 (3000) To 1067 (3500)	200
Above 763 (2500) To 915 (3000)	280
Above 610 (2000) To 763 (2500)	400
Above 458 (1500) To 610 (2000)	700
Above 305 (1000) To 458 (1500)	1200
Up to 305 (1000)	2000

(b) For base and fixed stations operating in the 758-768 MHz band in accordance with the provisions of paragraph (a)(5) of this section, the power flux density that would be produced by such stations through a combination of antenna height and vertical gain pattern must not exceed 3000 microwatts per square meter on the ground over the area extending to 1 km from the base of the antenna mounting structure.

§ 90.635 Limitations on power and antenna height.

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

Table—Equivalent Power and Antenna Heights for Base Stations in the 851-869 MHz and 935-940 MHz Bands Which Have a Requirement for a 32 km (20 mi) Service Area Radius

Antenna height (ATT) meters (feet)	Effective radiated power (watts)
Above 1,372 (4,500)	65
Above 1,220 (4,000) to 1,372 (4,500)	70
Above 1,067 (3,500) to 1,220 (4,000)	75
Above 915 (3,000) to 1,067 (3,500)	100
Above 763 (2,500) to 915 (3,000)	140
Above 610 (2,000) to 763 (2,500)	200
Above 458 (1,500) to 610 (2,000)	350
Above 305 (1,000) to 458 (1,500)	600
Up to 305 (1,000)	1,000

§ 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.

(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

IC Rules

Test Requirements:

RSS-119

5. Transmitter and Receiver Specifications

5.4 Transmitter Output Power

The output power shall be within ±1 dB of the manufacturer's rated power listed in the equipment specifications.

The transmitter output power limits set forth in Table 2 will come into force upon the publication of Issue 12 of this standard and will apply to newly certified equipment.

Table 2 —Transmitter Output Power

Frequency Bands (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
27.41-28 and 29.7-50	300	30
72-76	No limit	1
138-174	110	60
217-218 and 219-220	110	30
220-222	See SRSP-512 for ERP limit	50
406.1-430 and 450-470	110	60
768-776 and 798-806	See SRSP-511 for ERP limit	30 3 W ERP for portable equipment
806-821/851-866 and 821-824/866-869	110	30
896-901/935-940	110	60
929-930/931-932	110	30
928-929/952-953 and 932-932.5/941-941.5	110	30
932.5-935/941.5-944	110	30

RSS-131

6. Equipment standard specifications for zone enhancers working with equipment certified under RSS-119

6.2 Output power

The output power of the zone enhancer shall comply with the transmitter output power of the equipment with which it is to be used (as specified in RSS-119) and shall be within ± 1.0 dB of the zone enhancer manufacturer's rated output power.

Test Procedures:

Measurements were in accordance with the test methods section 3.5.2 of KDB 935210 D05 v01r01.

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

b) Configure to generate the AWGN (broadband) test signal.

c) The frequency of the signal generator shall be set to the frequency of (f0) as determined from 3.3.

d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.

f) Measure the output power of the EUT and record (Power measurement with a spectrum analyzer).

g) Remove the EUT from the measurement setup and using the same signal generator settings, repeat the power measurement on the input signal to the EUT and record as input power.

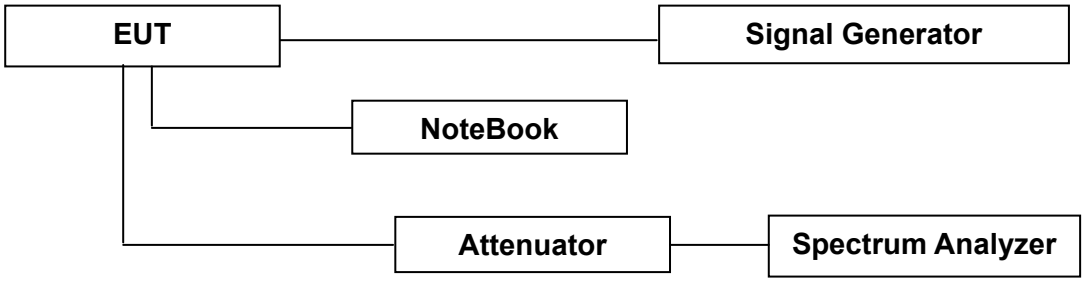
h) Repeat the procedure with the narrowband test signal.

i) Repeat the procedure for both test signals with input signal amplitude set to 3 dB above the AGC threshold level.

j) Repeat for all frequency bands authorized for use by the EUT.

Power measurement Method :

Guidance for performing input/output power measurements using a spectrum or signal analyzer is provided in 5.2 of KDB Publication 971168.



Block Diagram 1. RF Power Output Test Setup

Test Results:

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
PS 700	-62	-65	95	95
PS 800	-62	-65	95	95

Single channel Enhancer

* Due to EUT's ALC function (Auto Level Control), even if input signal is increased,

The same output power is transmit.

[Downlink]

	Channel	Frequency (MHz)	Output Power	
			(dBm)	(W)
700 APCO 25 (6.25 kHz)_ AGC threshold	Low	769.003125	33.07	2.028
	Middle	772.000000	33.02	2.004
	High	774.996875	32.78	1.897
800 APCO 25 (6.25 kHz)_ AGC threshold	Low	851.003125	33.20	2.089
	Middle	856.000000	33.56	2.270
	High	860.996875	33.28	2.128

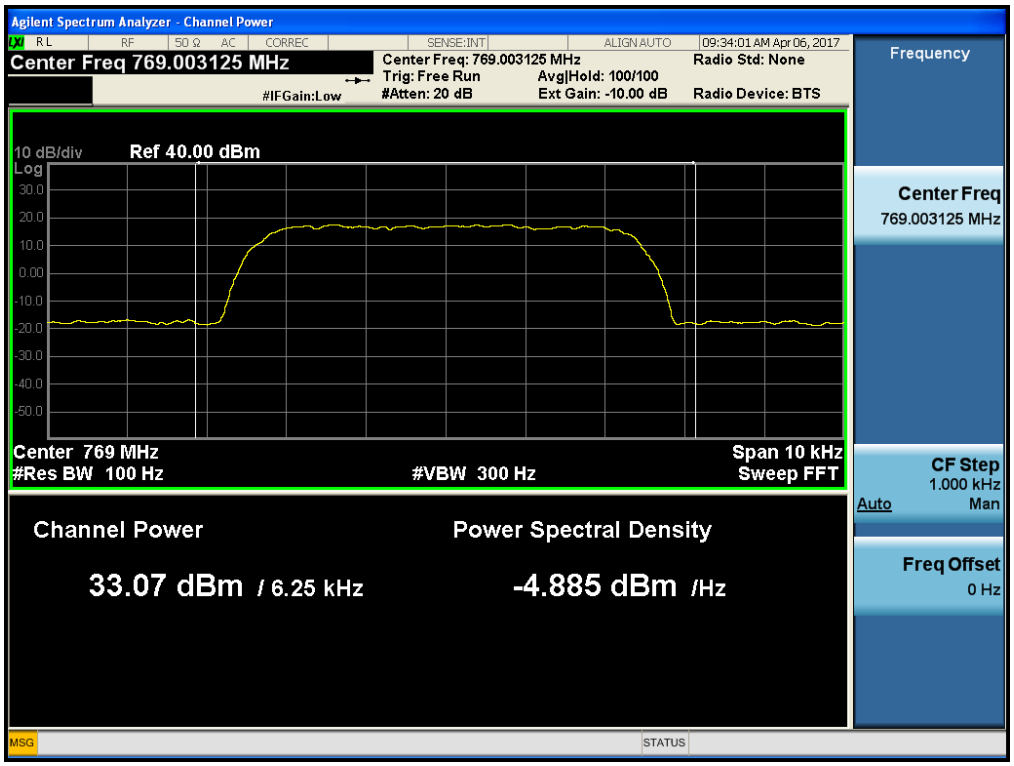
[Uplink]

	Channel	Frequency (MHz)	Output Power	
			(dBm)	(W)
700 APCO 25 (6.25 kHz)_ AGC threshold	Low	799.003125	30.14	1.033
	Middle	802.000000	30.03	1.007
	High	804.996875	30.66	1.164
800 APCO 25 (6.25 kHz)_ AGC threshold	Low	806.003125	30.80	1.202
	Middle	811.000000	30.42	1.102
	High	815.996875	30.17	1.040

Single channel Enhancer Plots of RF Output Power

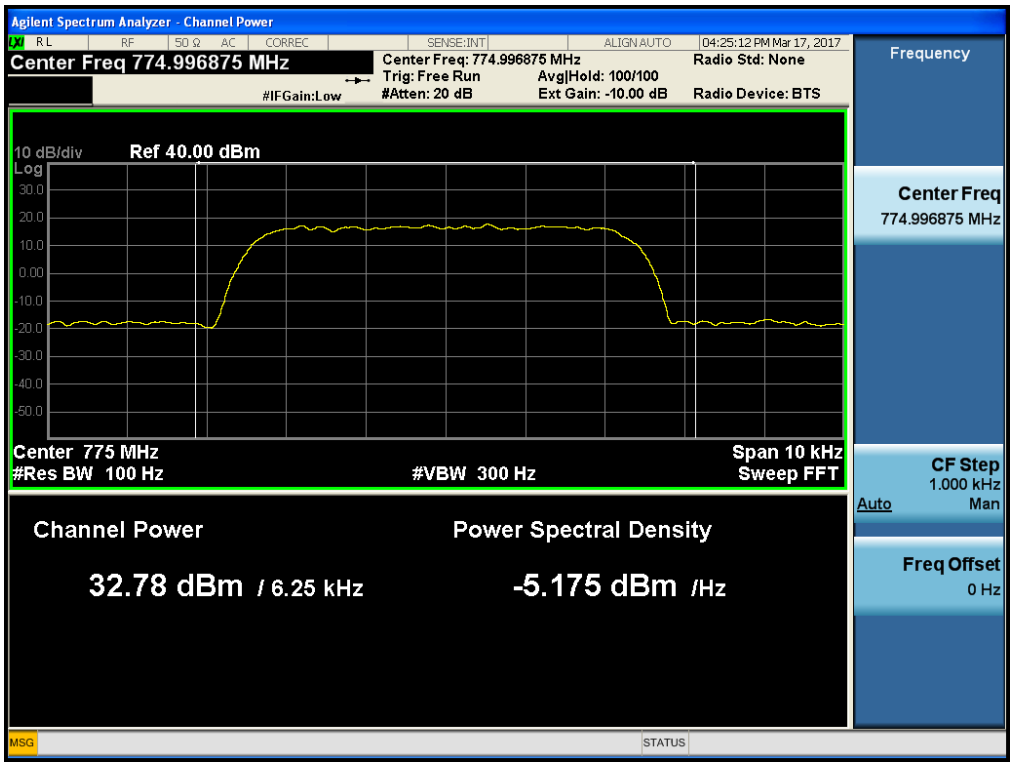
700 APCO 25(6.25 kHz)_DL

[AGC threshold Downlink - Low]



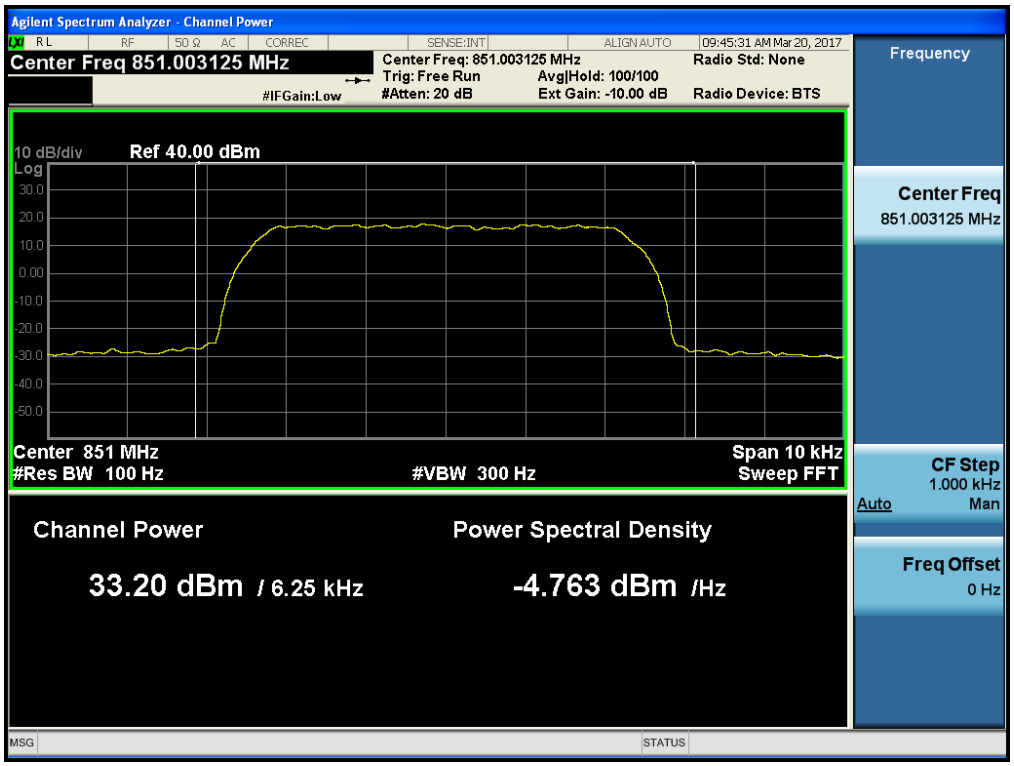
[AGC threshold Downlink - Middle]

[AGC threshold Downlink - High]

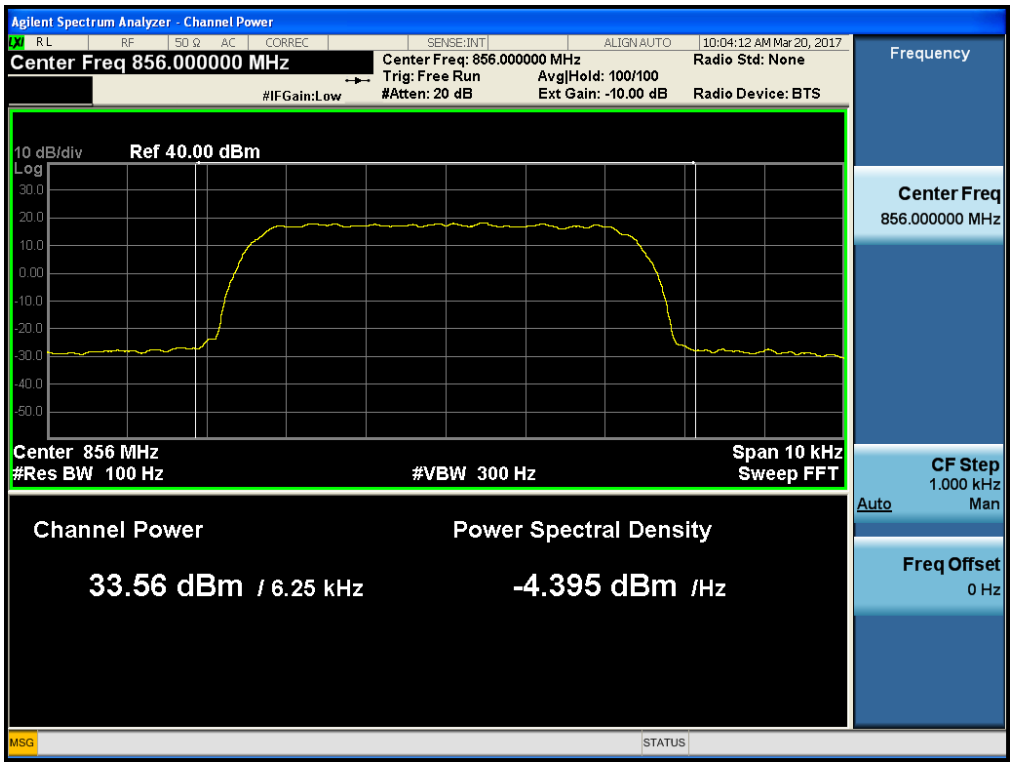


800 APCO 25(6.25 kHz)_DL

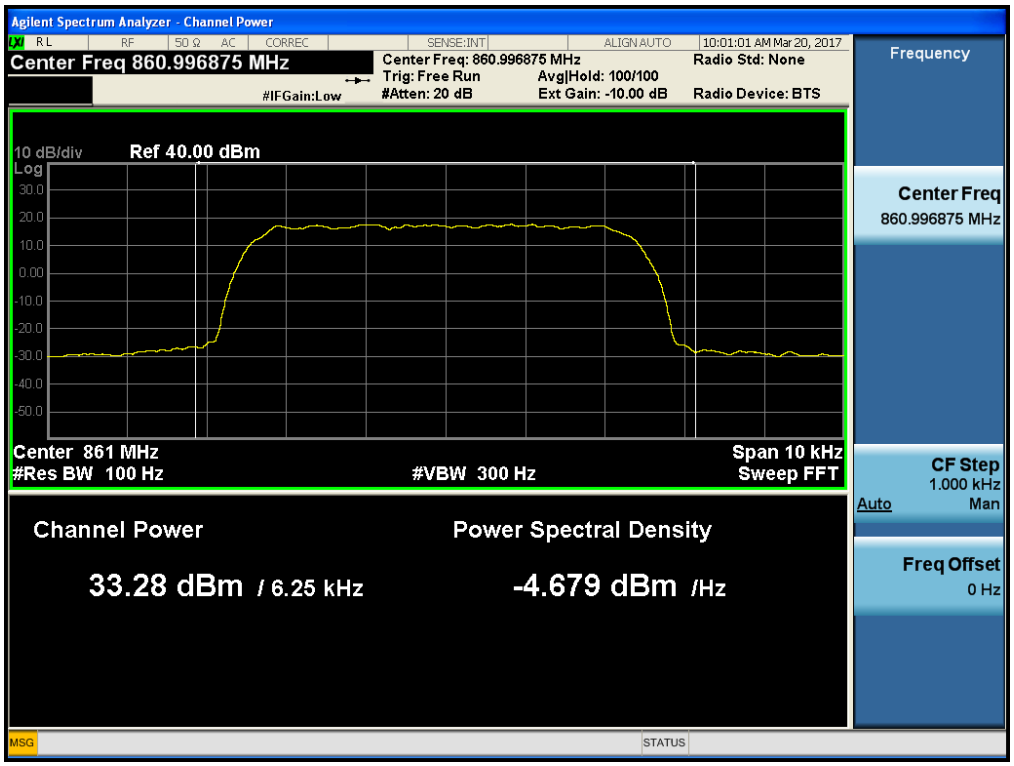
[AGC threshold Downlink - Low]



[AGC threshold Downlink - Middle]

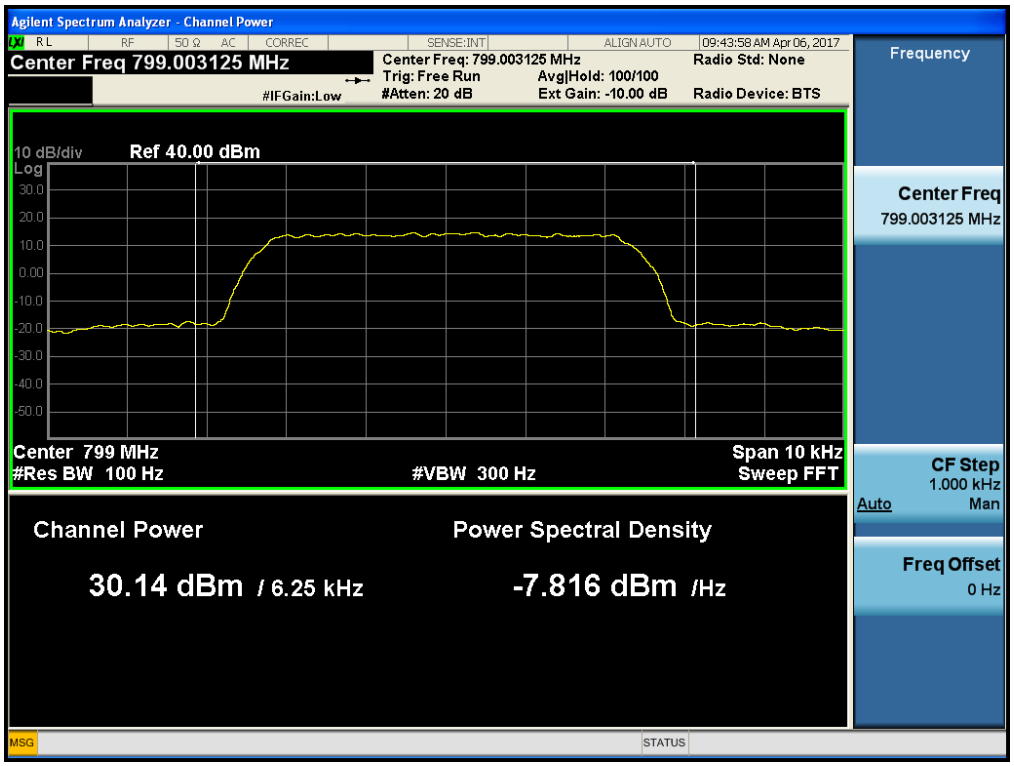


[AGC threshold Downlink - High]



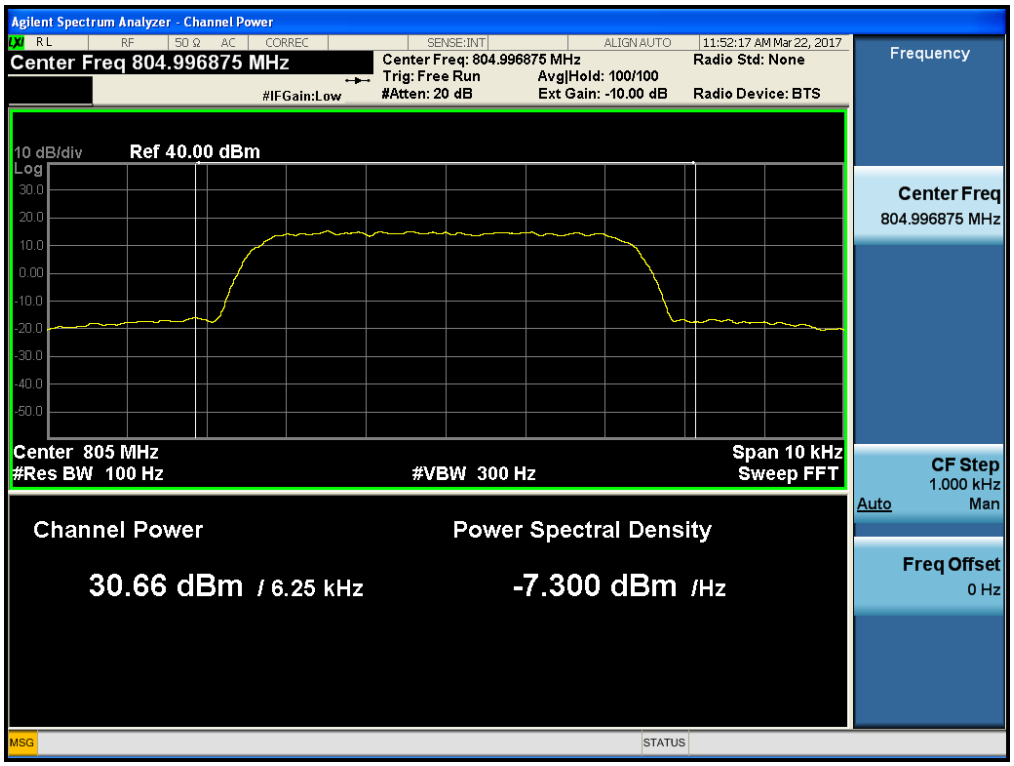
700 APCO 25(6.25 kHz)_UL

[AGC threshold Uplink - Low]



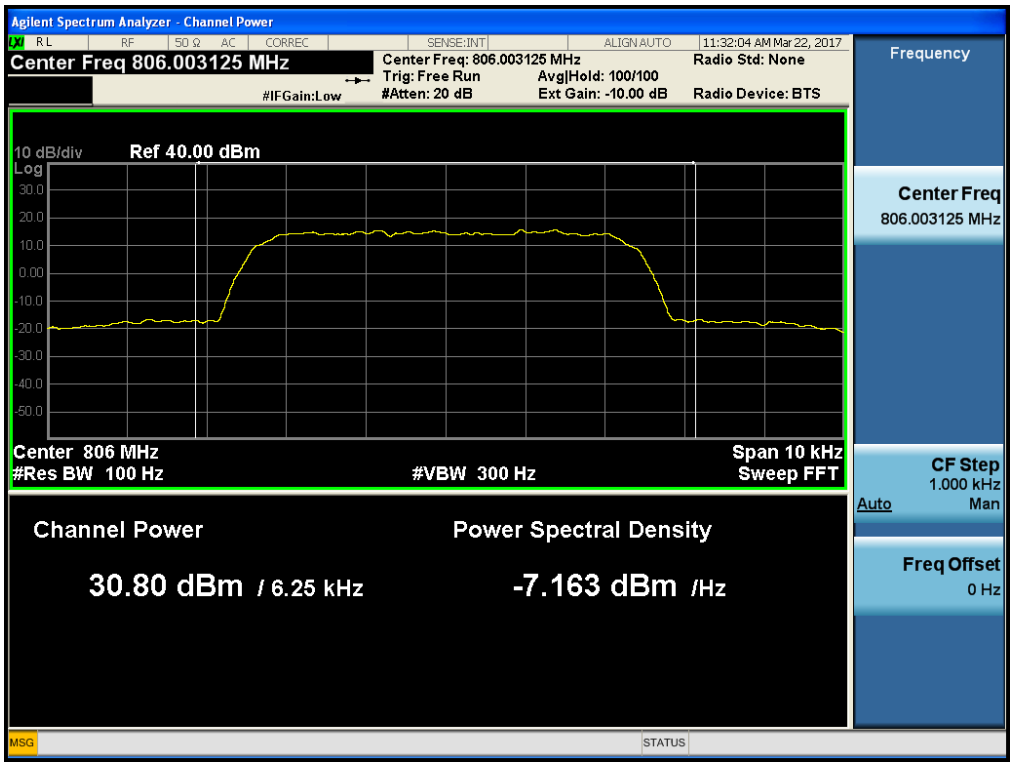
[AGC threshold Uplink - Middle]

[AGC threshold Uplink - High]

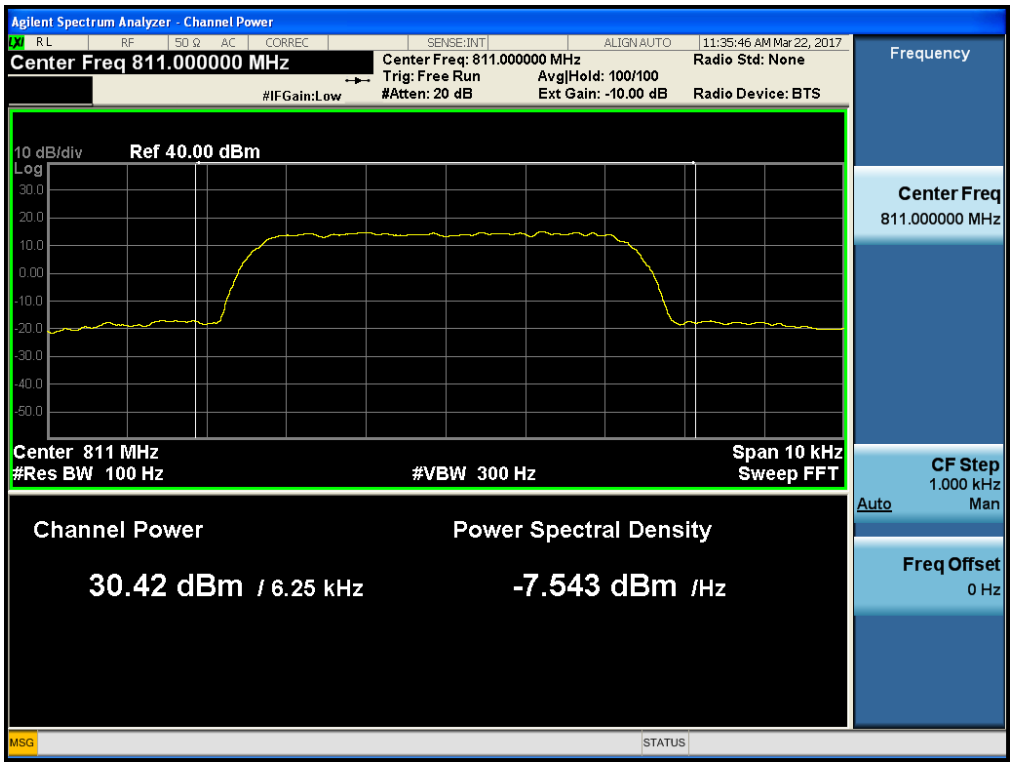


800 APCO 25(6.25 kHz)_UL

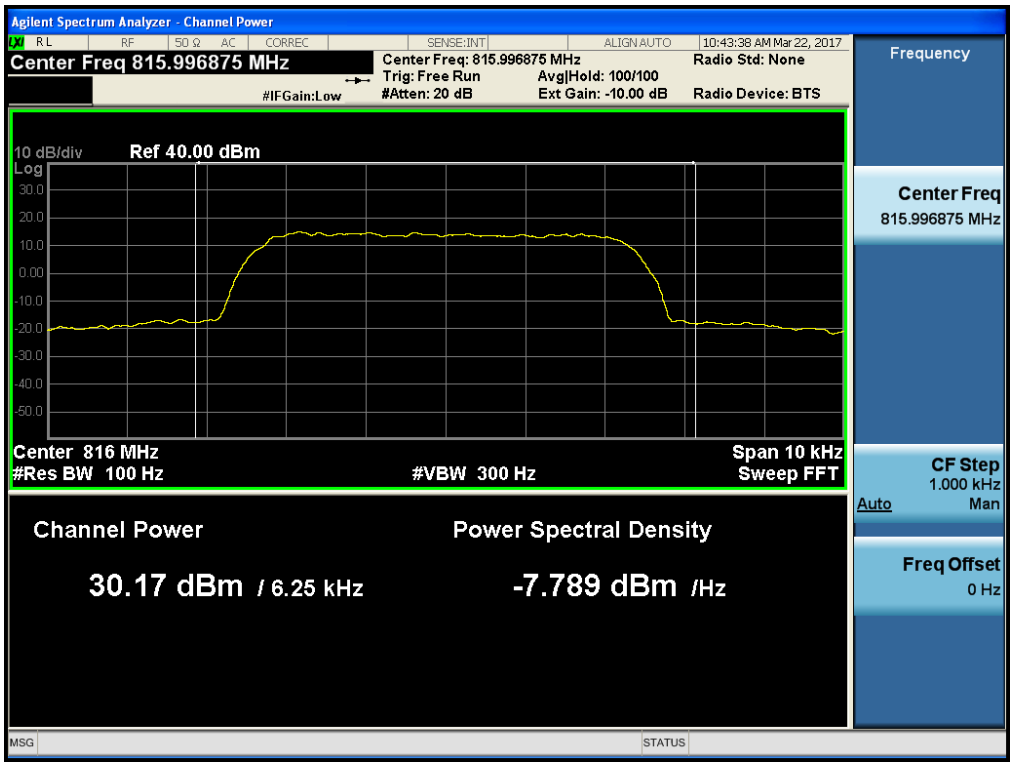
[AGC threshold Uplink - Low]



[AGC threshold Uplink - Middle]



[AGC threshold Uplink - High]



7. OCCUPIED BANDWIDTH

FCC Rules

Test Requirements:

§ 2.1049 Measurements required: Occupied bandwidth:

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to
0.5 percent of the total mean power radiated by a given emission shall be measured
under the specified conditions of § 2.1049 (a) through (i) as applicable.

IC Rules

Test Requirements:

RSS-Gen

6 Technical Requirements

6.6 Occupied Bandwidth

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99 % emission bandwidth, as calculated or measured.

Test Procedures:

Measurements were in accordance with the test methods section 3.4 of KDB 935210 D05 v01r01 and section 4.2 of KDB 971168 D01 v02r02.

Test is 99% OBW measured and used.

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

b) Configure the signal generator to transmit the AWGN signal.

c) Configure the signal amplitude to be just below the AGC threshold level (see 3.2), but not more than 0.5 dB below.

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

e) Set the spectrum analyzer center frequency to the center frequency of the operational band under test. The span range of the spectrum analyzer shall be between 2 times to 5 times the OBW.

f) The nominal resolution bandwidth (RBW) shall be in the range of 1% to 5 % of the anticipated OBW, and the VBW shall be ≥ 3 × RBW.

g) Set the reference level of the instrument as required to preclude the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than [10 log (OBW / RBW)] below the reference level.

NOTE—Steps f) and g) may require iteration to enable adjustments within the specified tolerances.

h) The noise floor of the spectrum analyzer at the selected RBW shall be at least 36 dB below

the reference level.

i) Set spectrum analyzer detection function to positive peak.

j) Set the trace mode to max hold.

k) Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.

l) Repeat steps e) to k) with the input signal connected directly to the spectrum analyzer (i.e., input signal measurement).

m) Compare the spectral plot of the input signal (determined from step l) to the output signal (determined from step k) to affirm that they are similar (in passband and rolloff characteristic features and relative spectral locations), and include plot(s) and descriptions in test report.

n) Repeat for all frequency bands authorized for use by the EUT.

Test Results:

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
PS 700	-62	-65	95	95
PS 800	-62	-65	95	95

[Downlink Output]

	Channel	Frequency (MHz)	OBW (kHz)
700 APCO 25 (6.25 kHz) AGC threshold	Low	769.003125	4.839
	Middle	772.000000	4.850
	High	774.996875	4.803
800 APCO 25 (6.25 kHz) AGC threshold	Low	851.003125	4.842
	Middle	856.000000	4.834
	High	860.996875	4.791

[Downlink Input]

	Channel	Frequency (MHz)	OBW (kHz)
700 APCO 25 (6.25 kHz) AGC threshold	Low	769.003125	4.828
	Middle	772.000000	4.813
	High	774.996875	4.844
800 APCO 25 (6.25 kHz) AGC threshold	Low	851.003125	4.846
	Middle	856.000000	4.843
	High	860.996875	4.836

[Uplink Output]

	Channel	Frequency (MHz)	OBW (kHz)
700 APCO 25 (6.25 kHz) AGC threshold	Low	799.003125	4.825
	Middle	802.000000	4.852
	High	804.996875	4.864
800 APCO 25 (6.25 kHz) AGC threshold	Low	806.003125	4.845
	Middle	811.000000	4.856
	High	815.996875	4.815

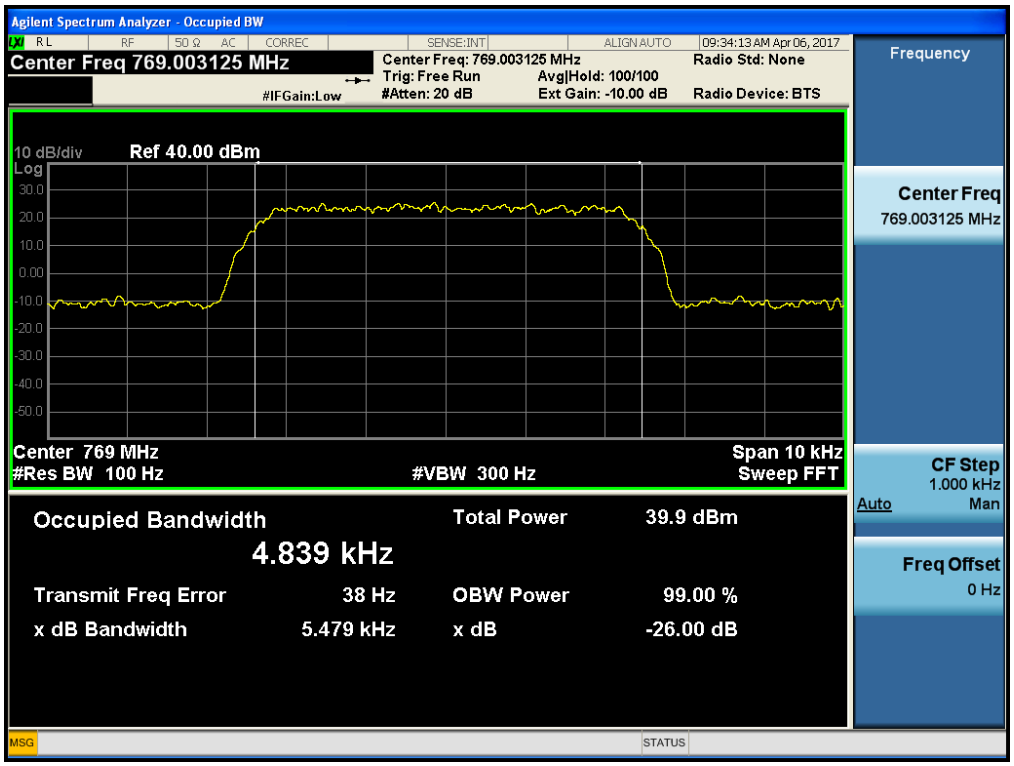
[Uplink Input]

	Channel	Frequency (MHz)	OBW (kHz)
700 APCO 25 (6.25 kHz) AGC threshold	Low	799.003125	4.844
	Middle	802.000000	4.835
	High	804.996875	4.834
800 APCO 25 (6.25 kHz) AGC threshold	Low	806.003125	4.844
	Middle	811.000000	4.855
	High	815.996875	4.845

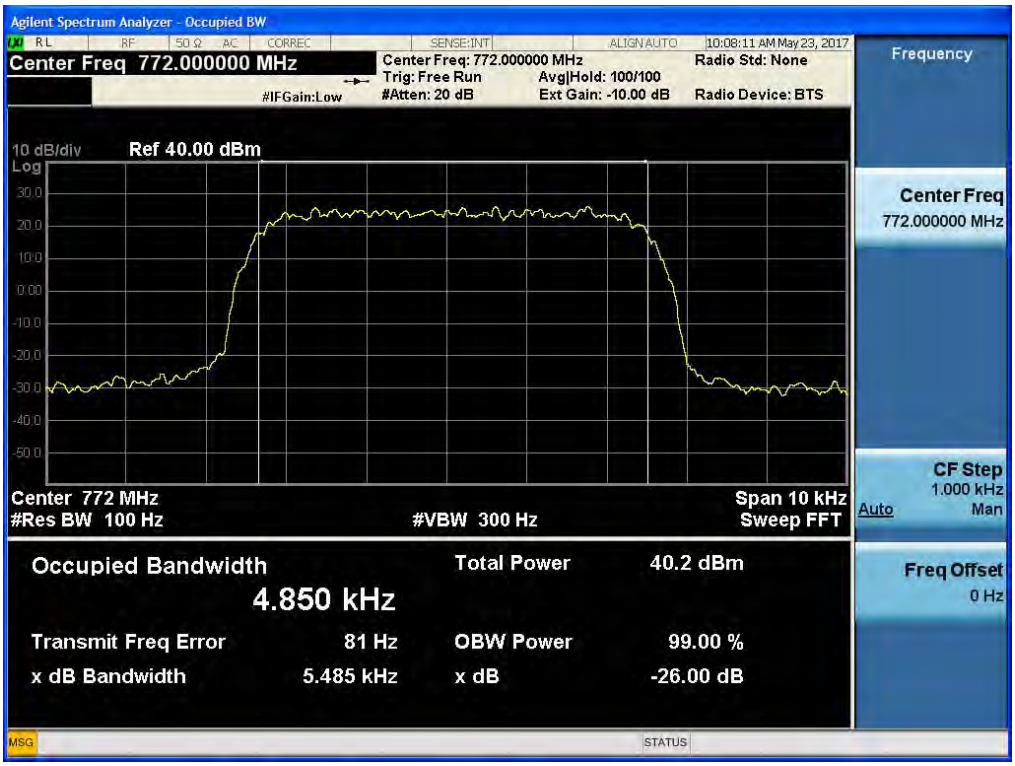
Plots of Occupied Bandwidth

700 APCO 25(6.25 kHz)_DL_Output

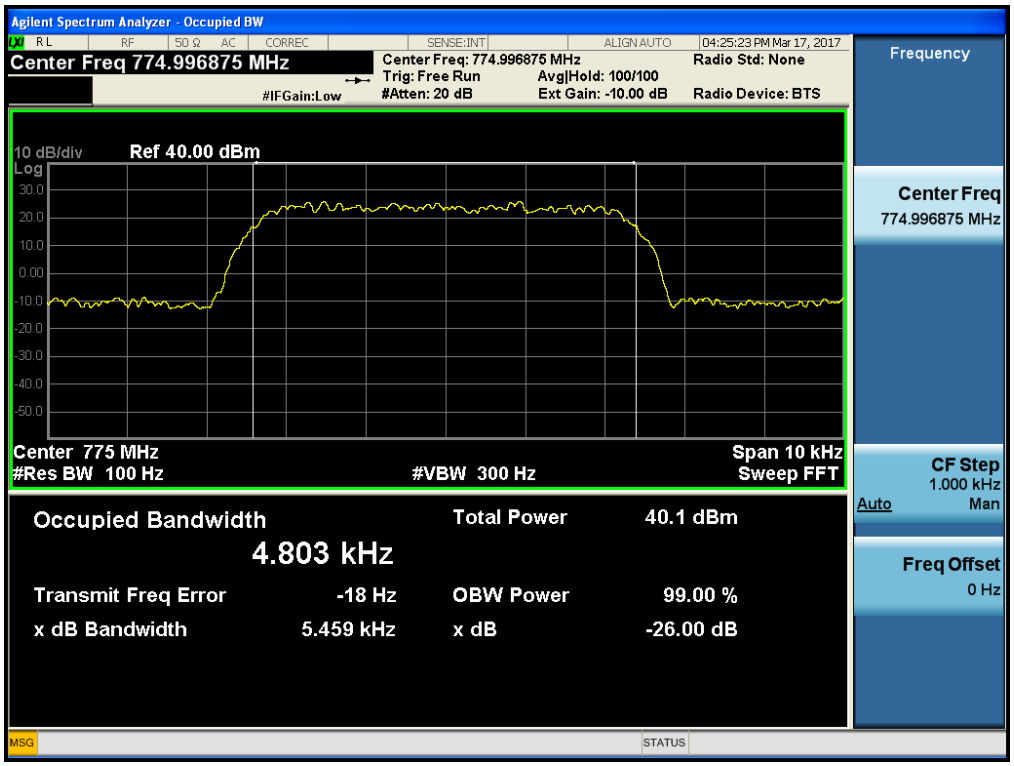
[AGC threshold Downlink – Low]



[AGC threshold Downlink - Middle]

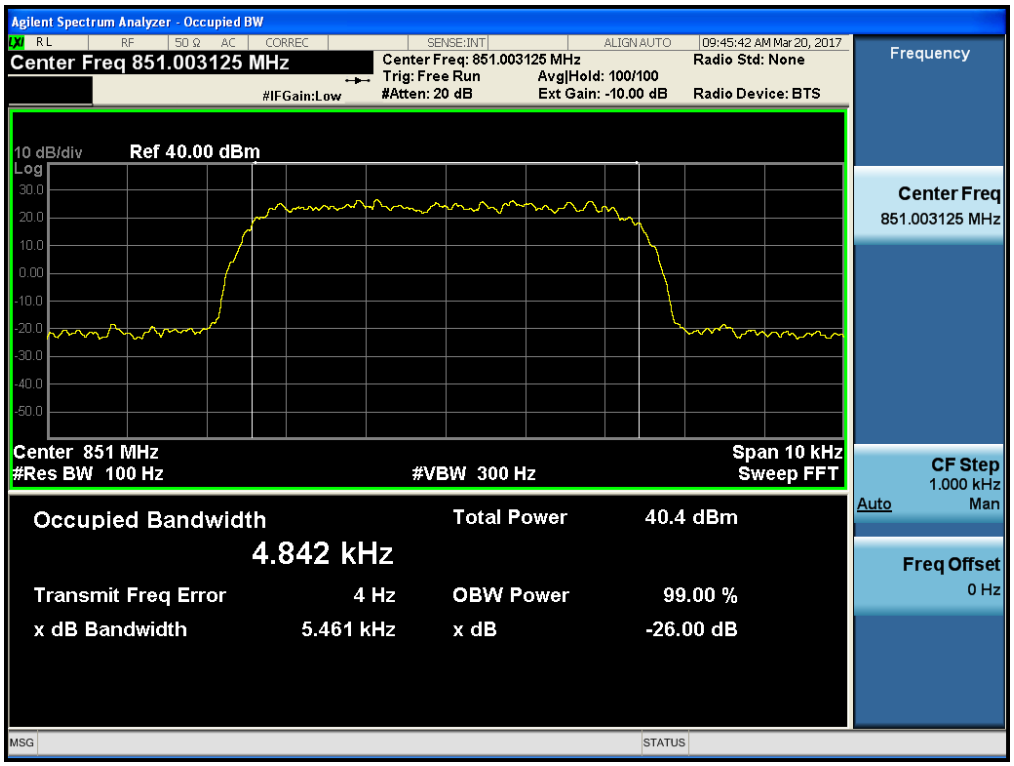


[AGC threshold Downlink - High]

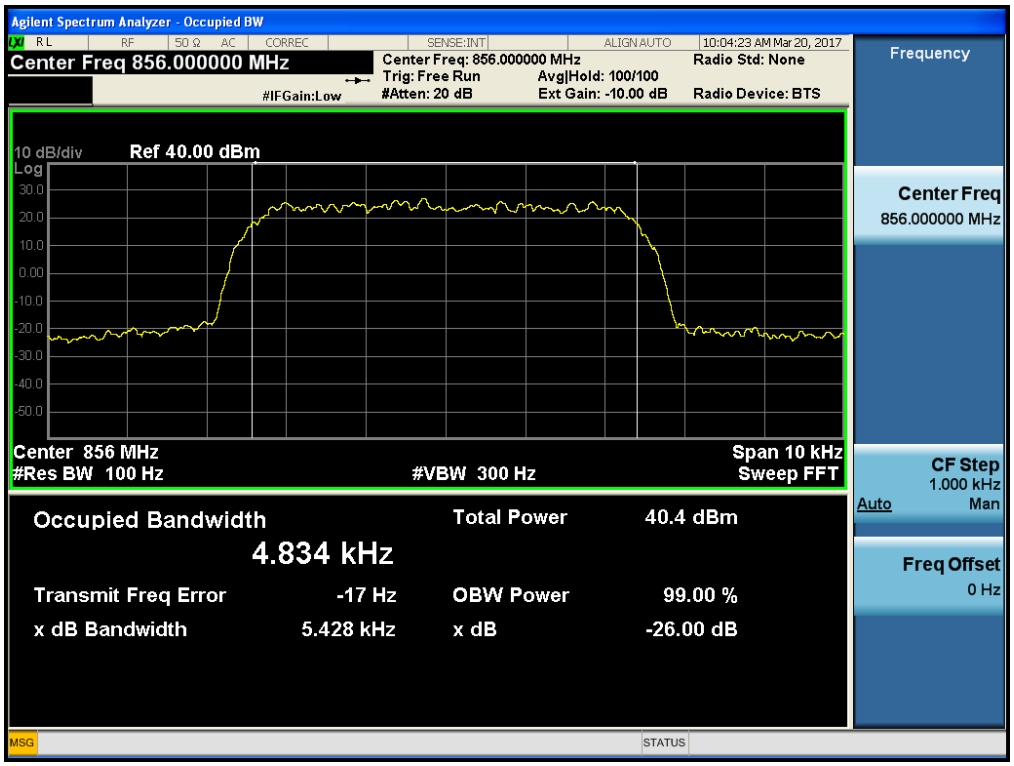


800 APCO 25(6.25 kHz)_DL_Output

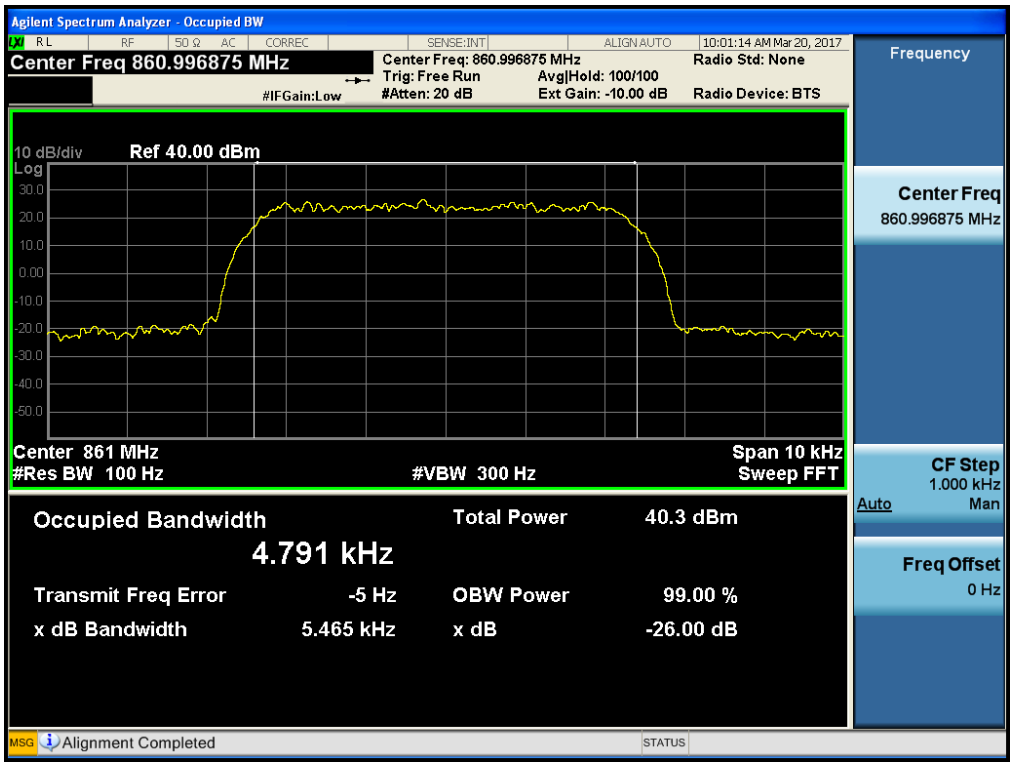
[AGC threshold Downlink – Low]



[AGC threshold Downlink - Middle]

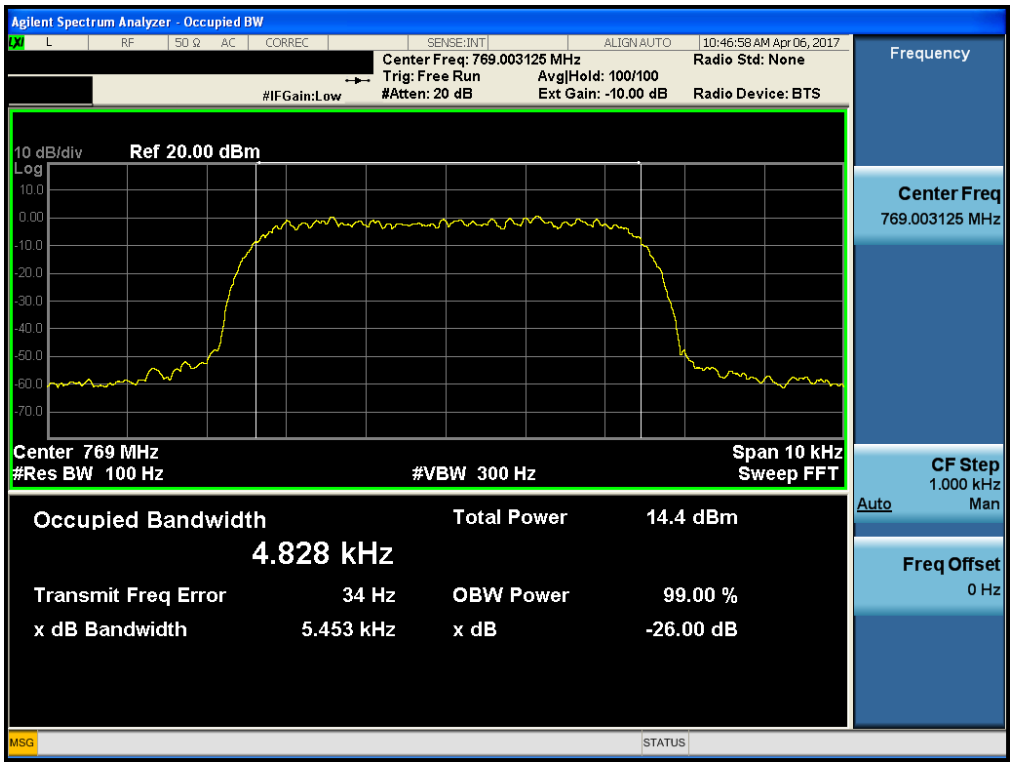


[AGC threshold Downlink - High]



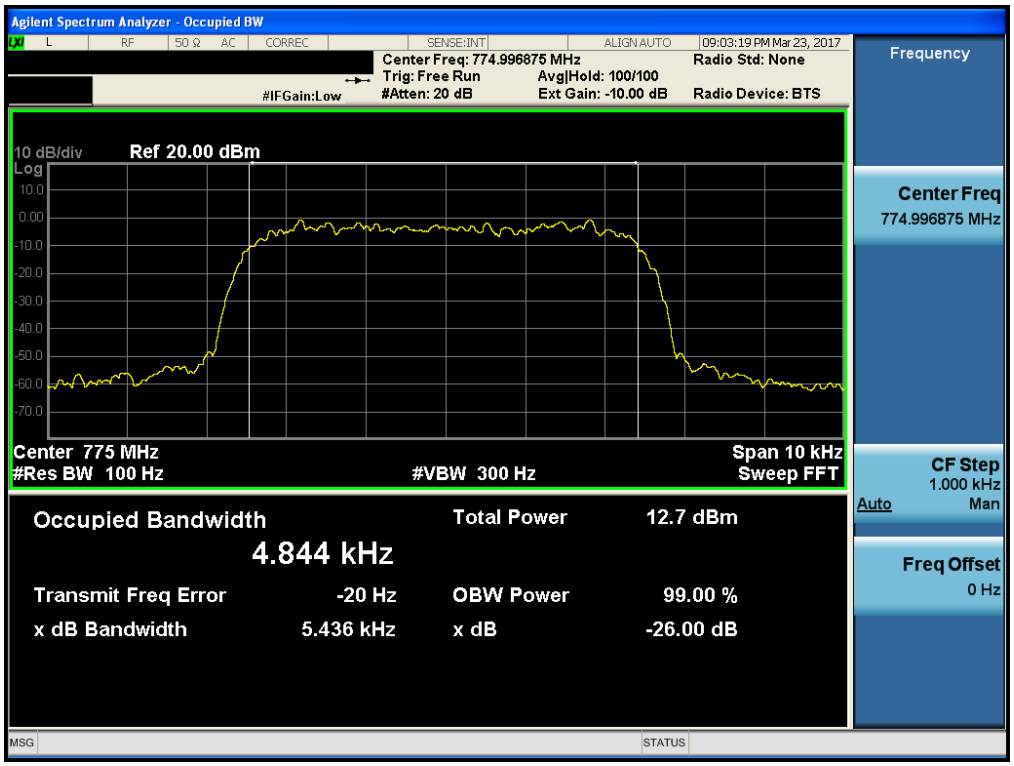
700 APCO 25(6.25 kHz)_DL_Input

[AGC threshold Downlink – Low]



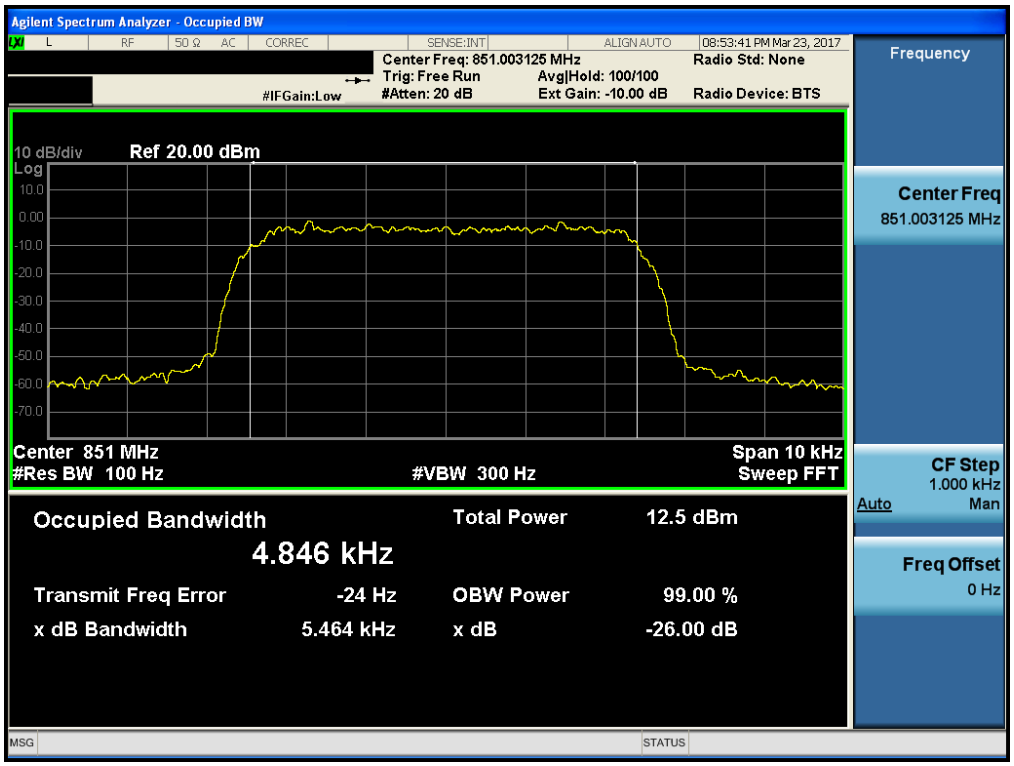
[AGC threshold Downlink - Middle]

[AGC threshold Downlink - High]



800 LTE(6.25 kHz)_DL_Input

[AGC threshold Downlink – Low]

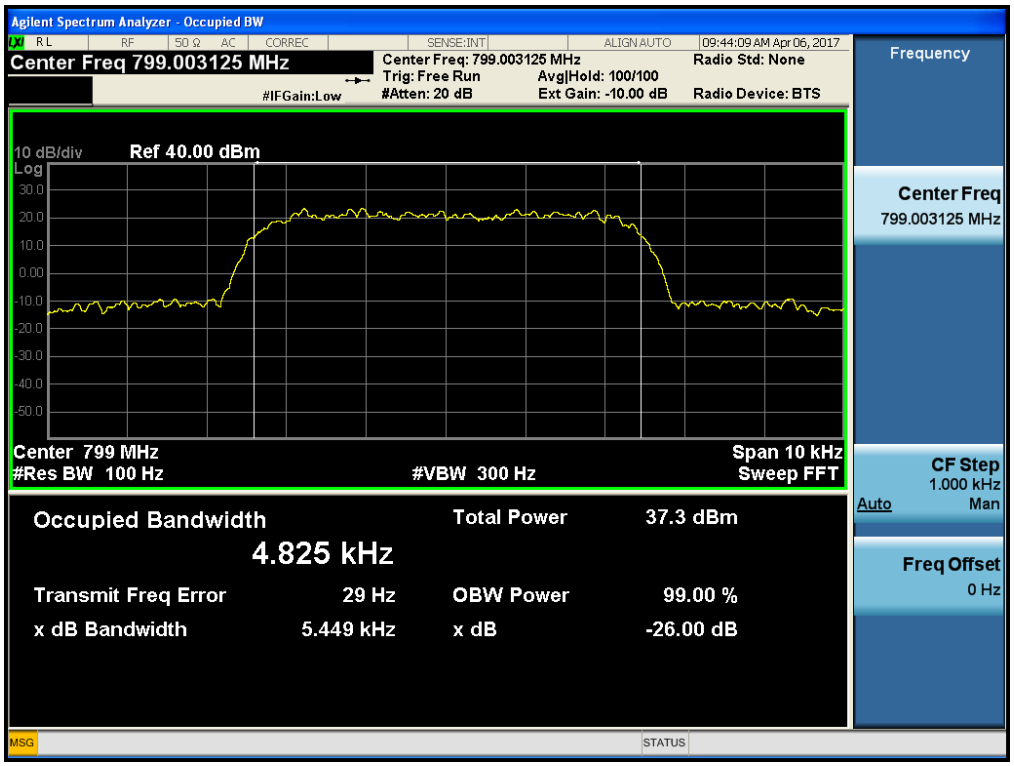


[AGC threshold Downlink - Middle]

[AGC threshold Downlink - High]

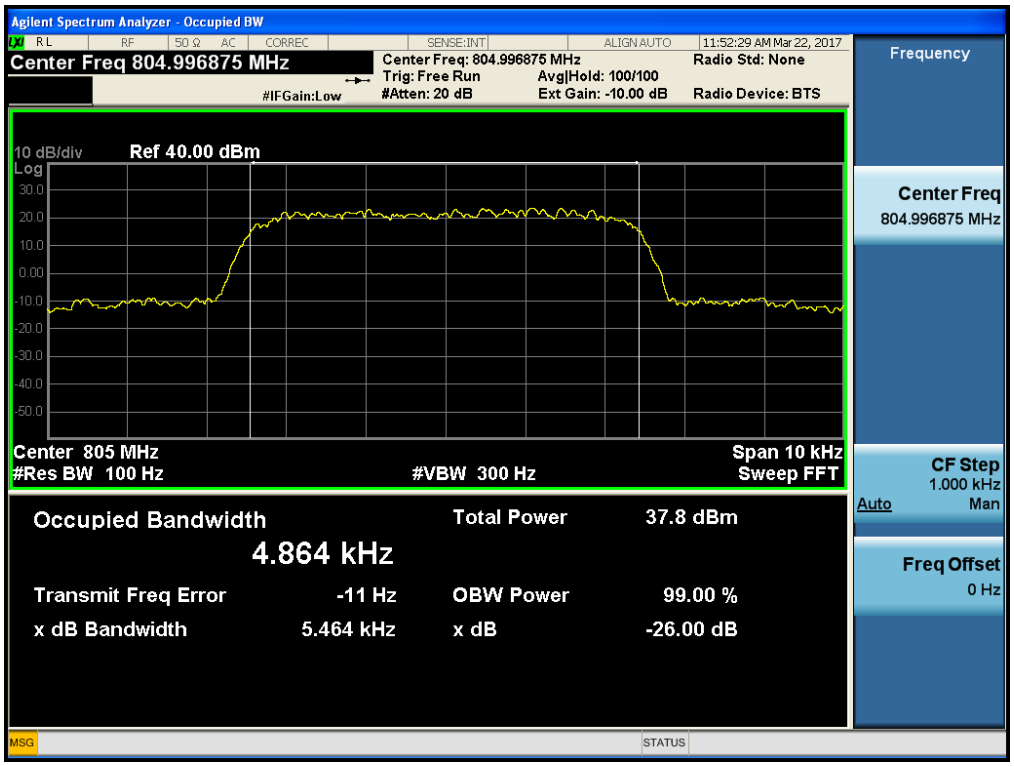
700 APCO 25(6.25 kHz)_UL_Output

[AGC threshold Uplink – Low]



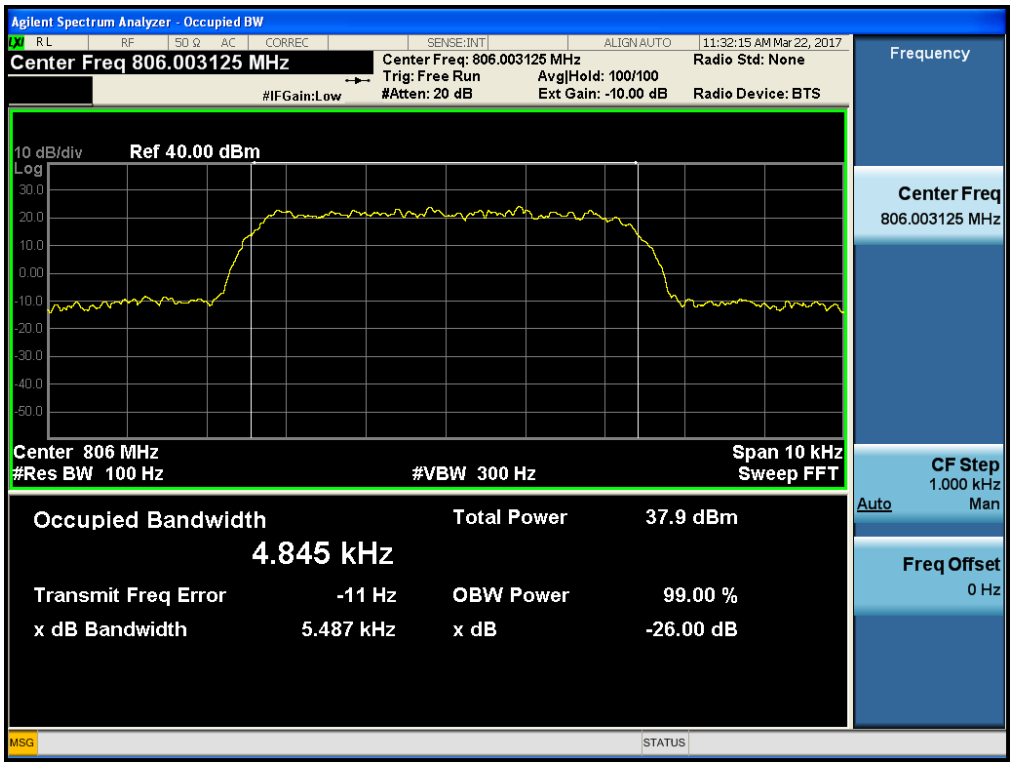
[AGC threshold Uplink - Middle]

[AGC threshold Uplink - High]

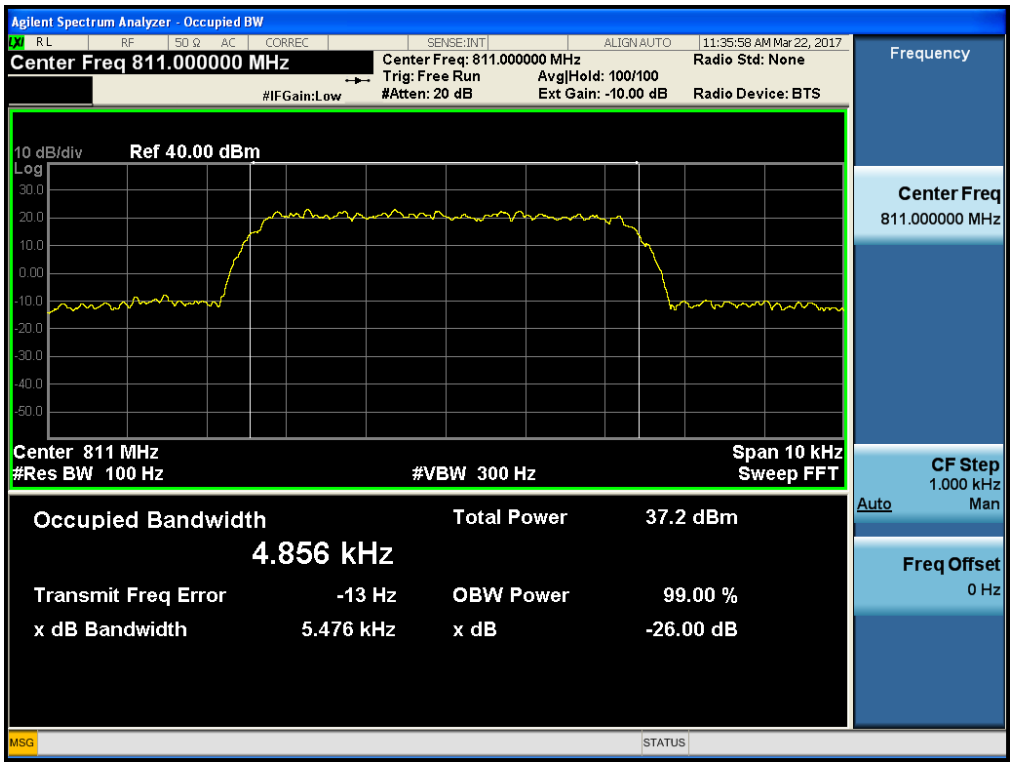


800 APCO 25(6.25 kHz)_UL_Output

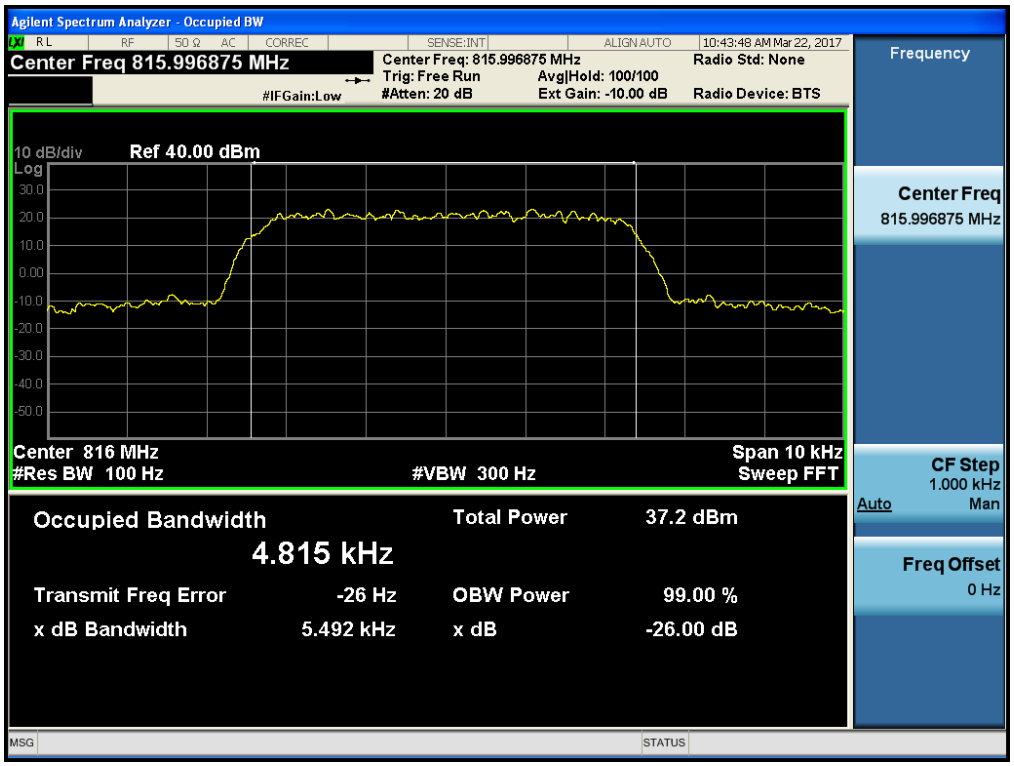
[AGC threshold Uplink – Low]



[AGC threshold Uplink - Middle]

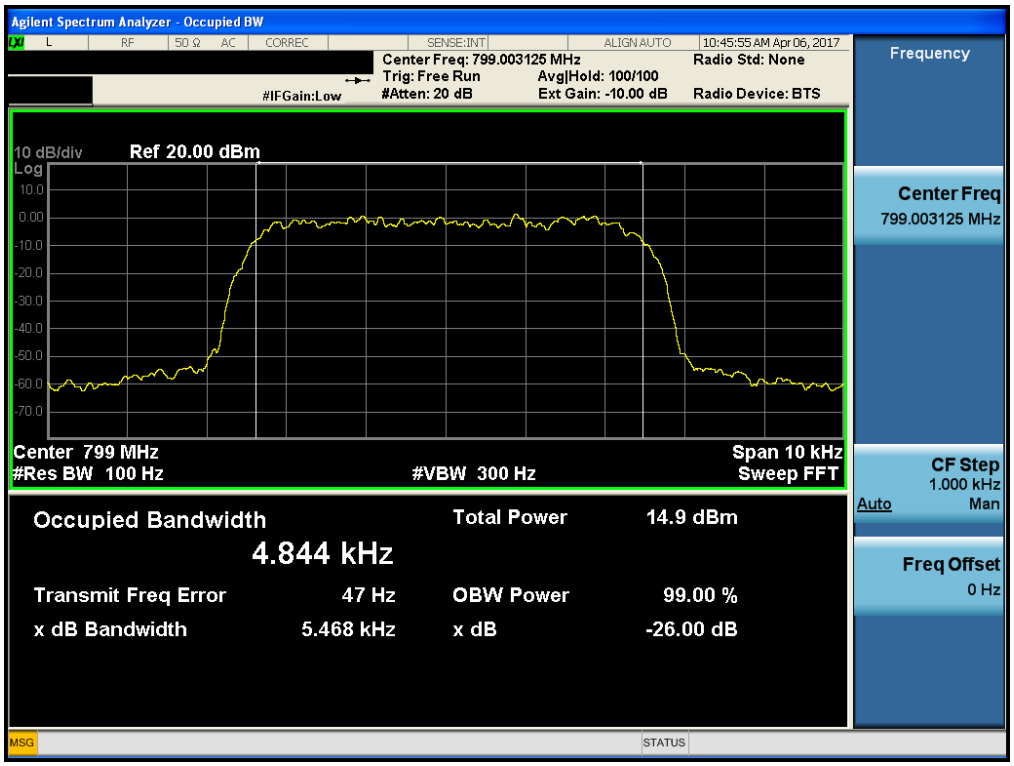


[AGC threshold Uplink - High]



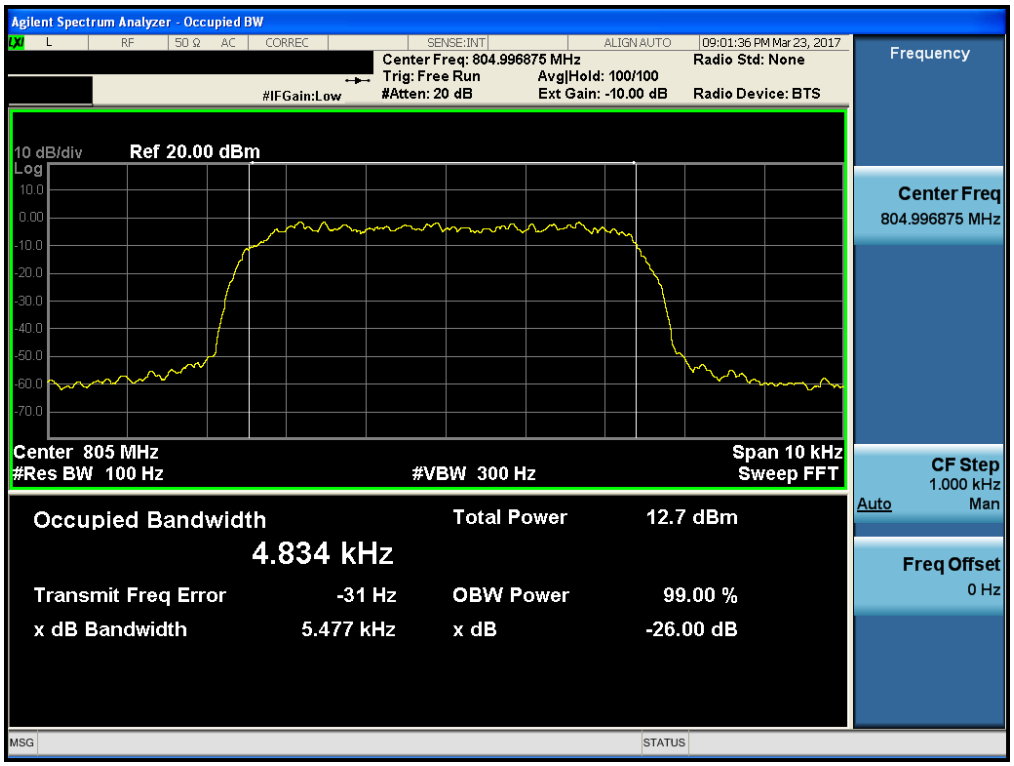
700 APCO 25(6.25 kHz)_UL_Input

[AGC threshold Uplink – Low]



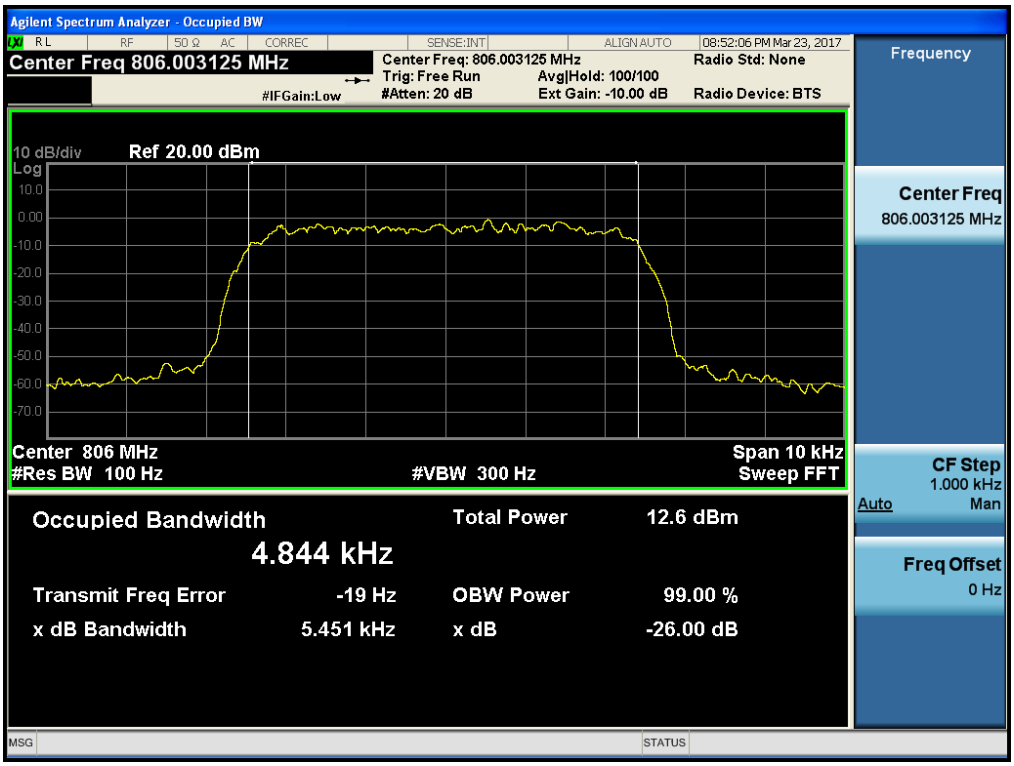
[AGC threshold Uplink - Middle]

[AGC threshold Uplink - High]



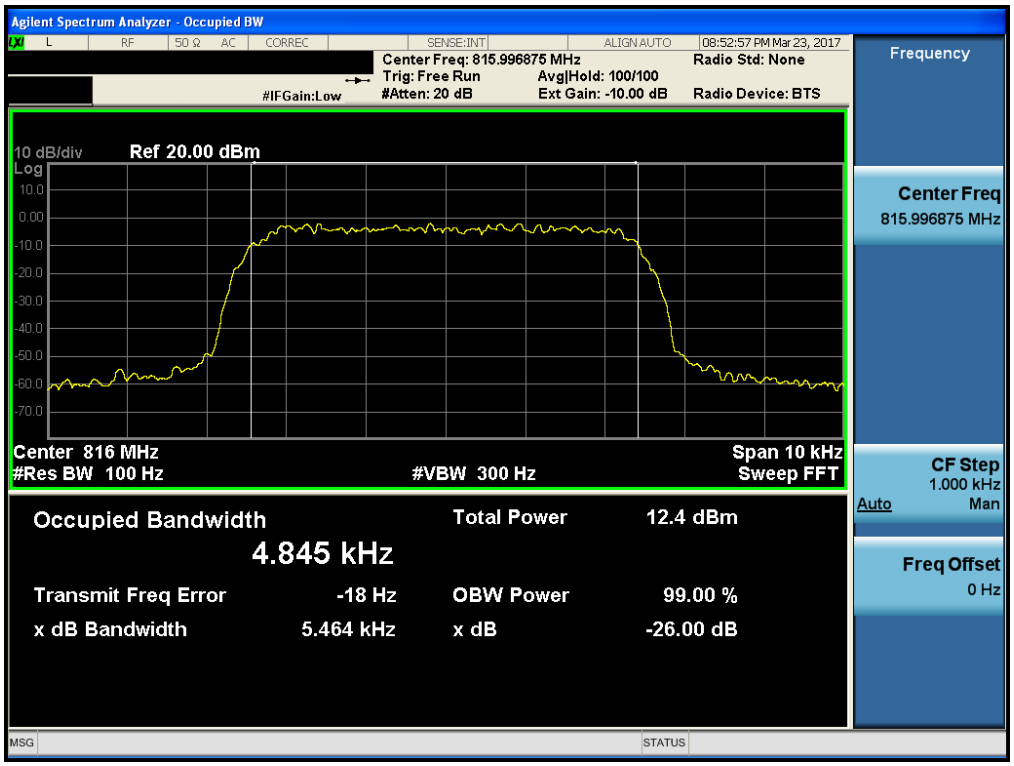
800 APCO 25(6.25 kHz)_UL_Input

[AGC threshold Uplink – Low]



[AGC threshold Uplink - Middle]

[AGC threshold Uplink - High]



8. OUT OF BAND REJECTION

FCC/IC Rules

Test Requirements:

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:

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
PS 700	-62	-65	95	95
PS 800	-62	-65	95	95

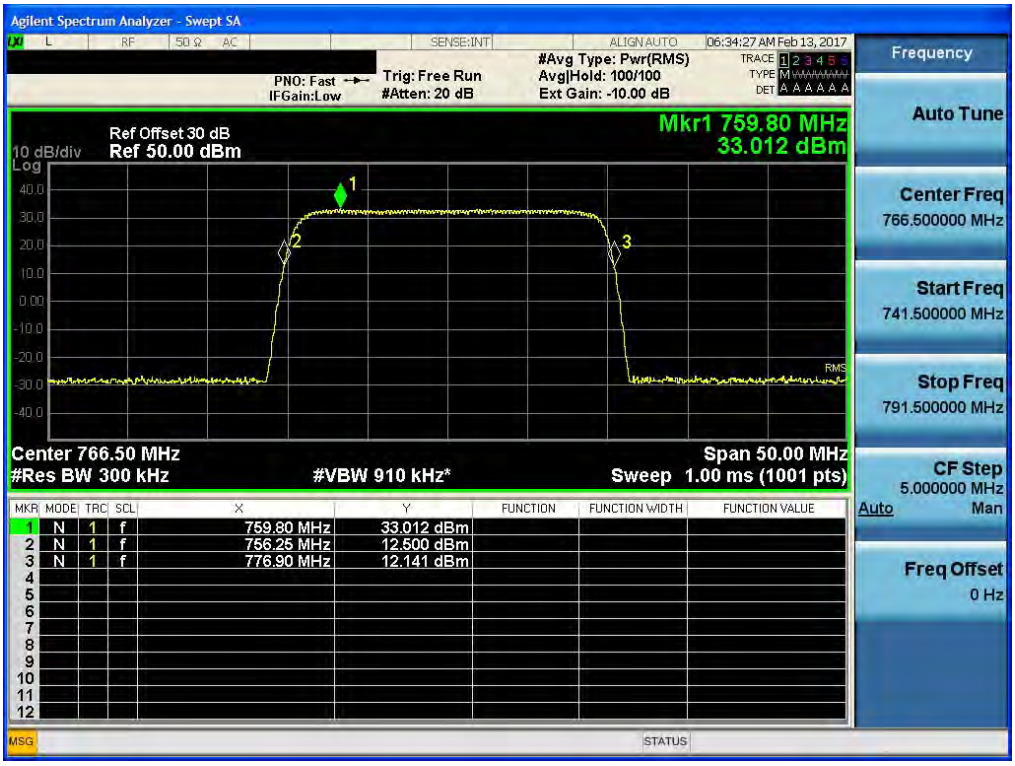
PS 700

[Downlink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
756.25 ~ 776.90	33.012	95.012

Plots of Out of Band Rejection

[FirstNet + PS 700 Downlink]



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

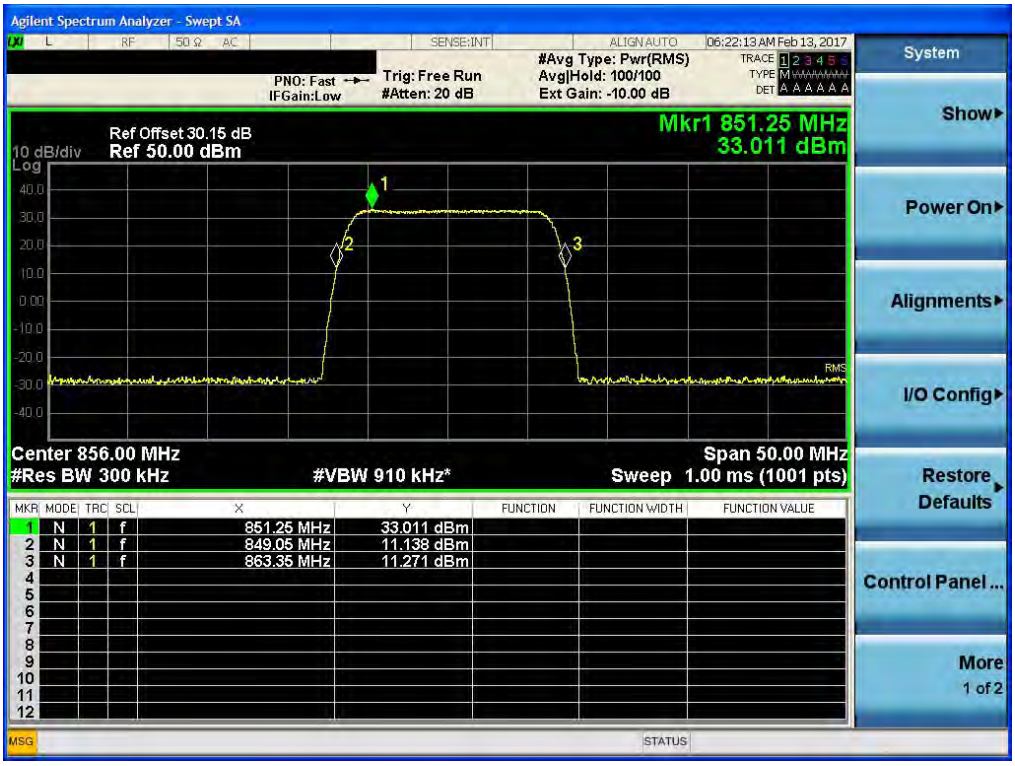
PS 800

[Downlink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
849.05 ~ 863.35	33.011	95.011

Plots of Out of Band Rejection

[PS 800 Downlink]



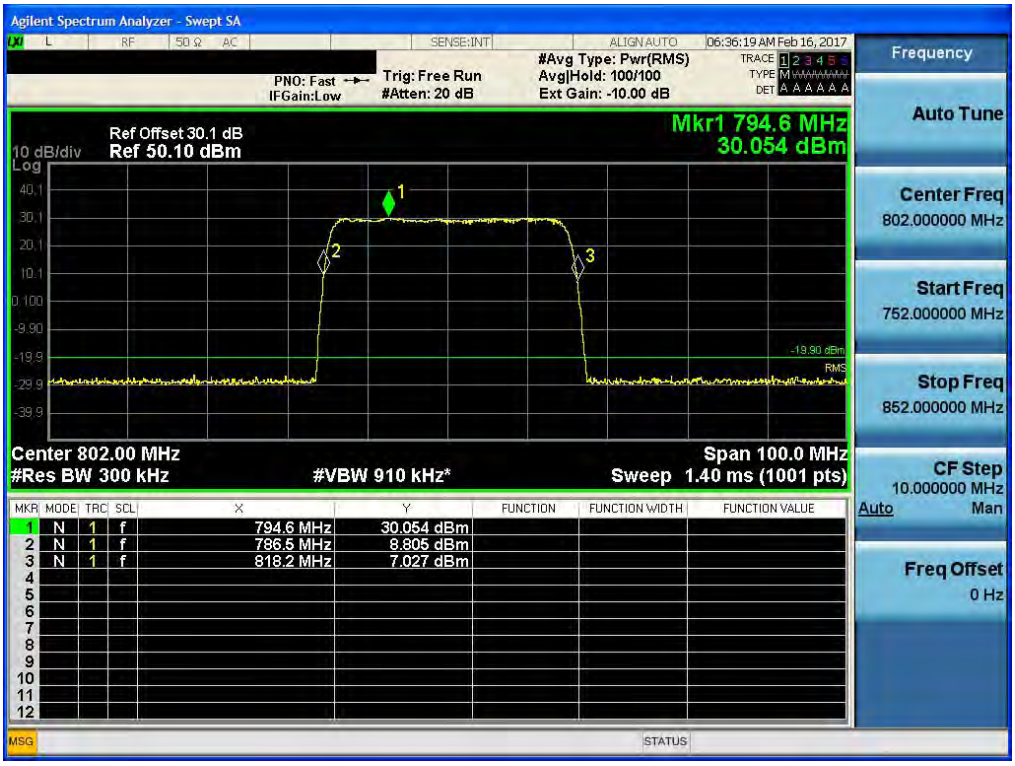
PS 700 + PS 800

[Uplink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
786.50 ~ 818.20	30.054	95.054

Plots of Out of Band Rejection

[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.

IC Rules

Test Requirements:

RSS-131

6. Equipment standard specifications for zone enhancers working with equipment certified under RSS-119

6.4 Noise

The noise figure of a zone enhancer shall 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:

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

PS 700

Downlink : Noise Figure = - 34.081 – 95 + 114 = -15.081 dB

Uplink: Noise Figure = - 34.746 – 95 + 114 = - 15.746 dB

PS 800

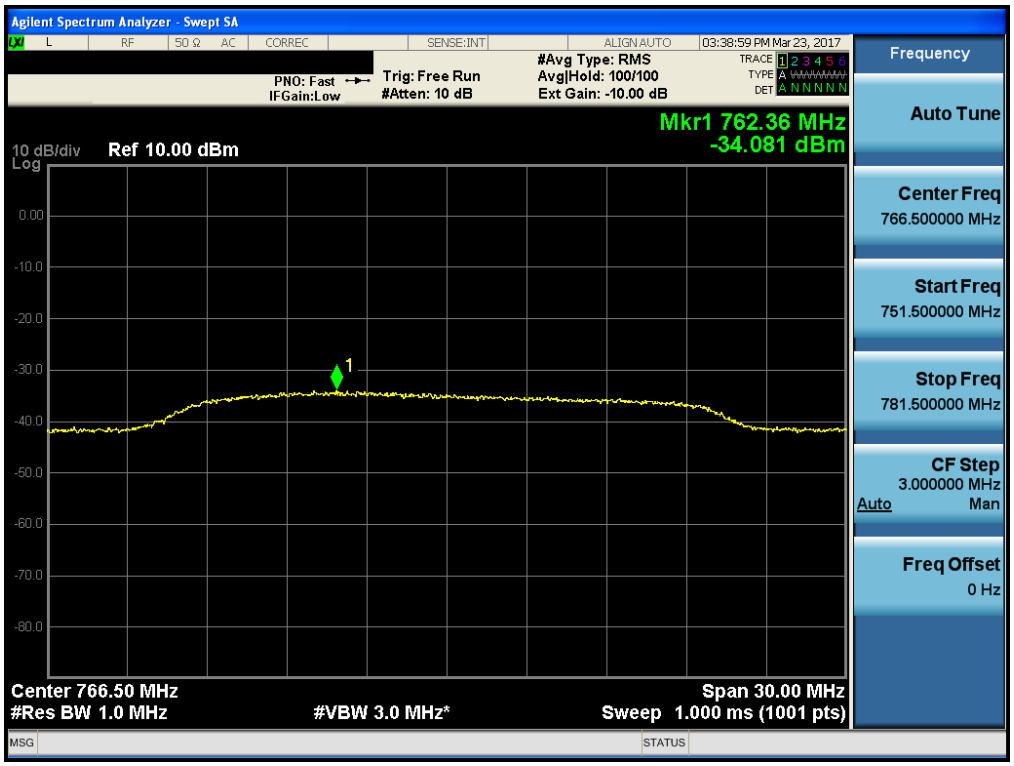
Downlink : Noise Figure = - 36.685 – 95 + 114 = -17.685 dB

Uplink: Noise Figure = - 35.224 – 95 + 114 = - 16.224 dB

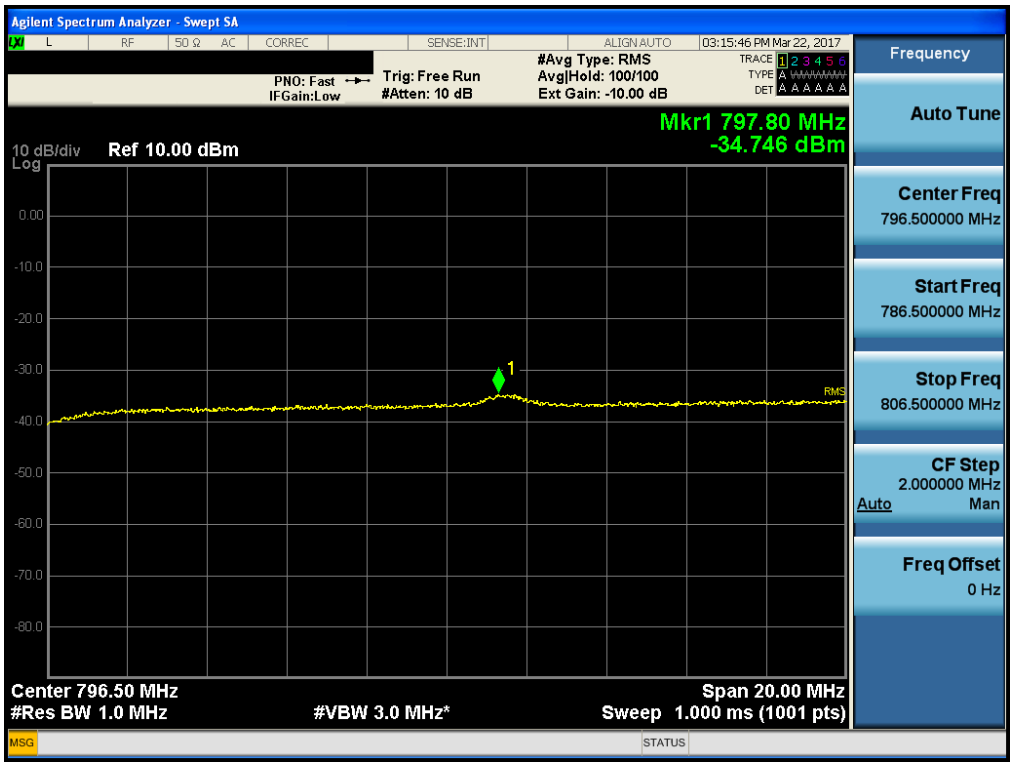
Plots of Noise power

PS 700

[Downlink]

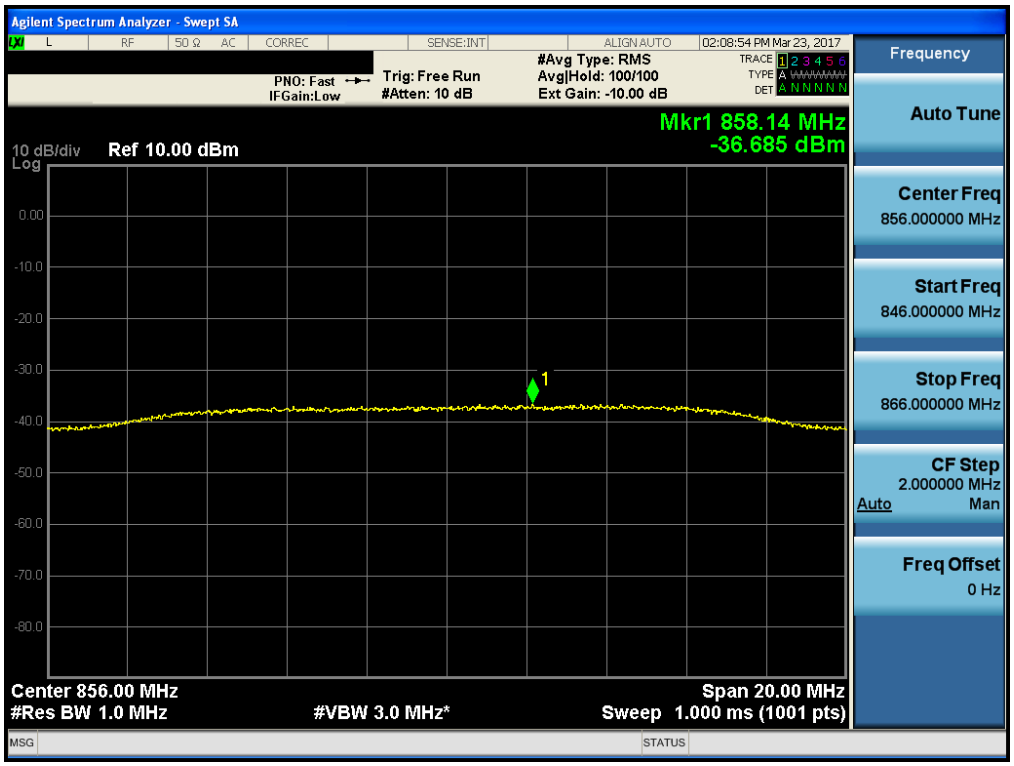


[Uplink]

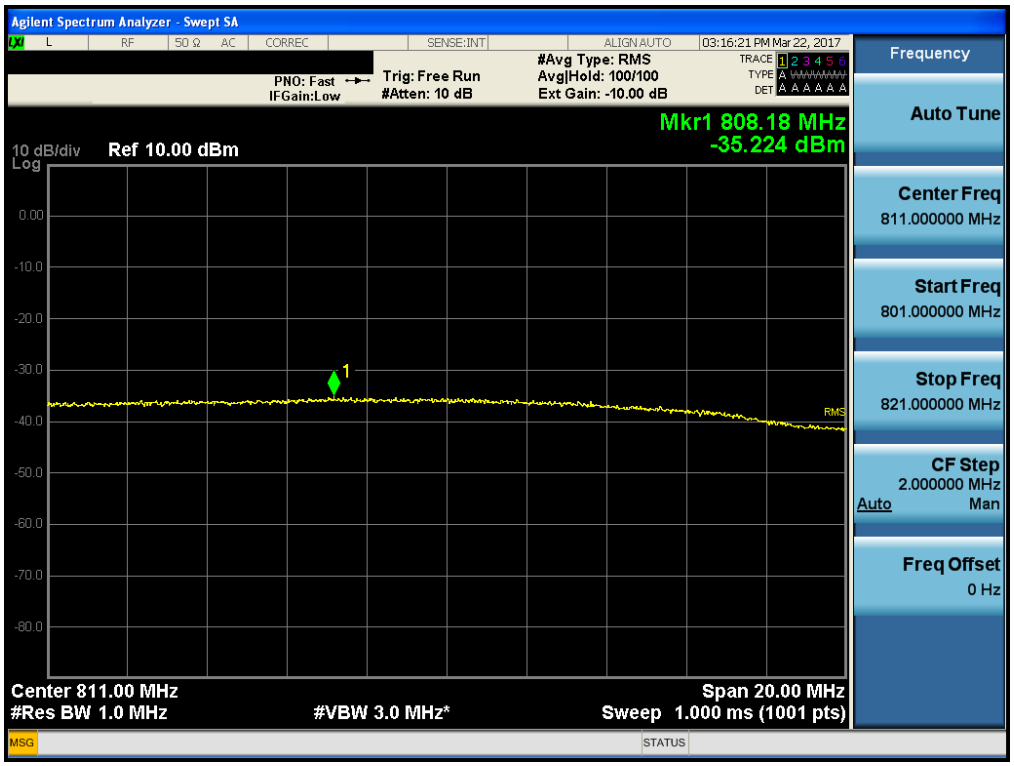


PS 800

[Downlink]



[Uplink]



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[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	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^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 (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.

IC Rules

Test Requirements:

RSS-119

5. Transmitter and Receiver Specifications

5.5 Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks

For the purpose of this document, channel bandwidth is the channel width in which the equipment is designed to operate.

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in Table 3 for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licences.

The channel bandwidths, authorized bandwidths and spectrum masks are given in Table 3 for equipment having an output power greater than 120 mW. For equipment with an output power that does not exceed 120 mW, Section 5.10 applies.

Table 3 — Channel Bandwidths, Authorized Bandwidths and Spectrum Masks

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment With Audio Filter	Spectrum Masks for Equipment Without Audio Filter
27.41-28 and 29.7-50	N/A	20	20	B	C
72-76	N/A	20	20	B	C
138-144, 148-149.9 and 150.05-174	SRSP-500	30	20	B	C
		15	11.25	D	D
		7.5	6	E	E
217-218 and 219-220	N/A	12.5	11.25	D or I	D or J
220-222	SRSP-512	5	4	F	F
406.1-430 and 450-470	SRSP-501	25	20 22	B Y	C (G) Y
		12.5	11.25	D	D
		6.25	6	E	E
768-776 and 798-806	SRSP-511	6.25 12.5	Footnote2	See Section 5.8.9	See Section 5.8.9

		25 50			
806-821/851-866 and 821-824/866-869	SRSP- 502	25	20 22	B Y	G Y
		12.5	11.25	D	D
		6.25	6	E	E
896-901/935-940	SRSP-506	12.5	13.6	I	J (G)
929-930 and 931-932	SRSP-504 (for paging)	25	20	B	G
928-929/952-953 and 932-932.5/941-941.5	SRSP-505	25	20	B	G
		12.5	11.25	D	D
932.5-935/941.5-944	SRSP- 507	25	20	B	G
		12.5	11.25	D	D

Footnote2 : Provided that the ACP requirements in Section 5.8.9.1 are met, any authorized bandwidth that does not exceed the channel bandwidth can be used.

5.5.4 The bands 768-776 MHz and 798-806 MHz are designated for use by public safety services. See SRSP-511 for channel assignments.

Transmitters using digital modulation shall be capable of having a minimum data rate of 4.8 kbps per 6.25 kHz bandwidth or one voice channel per 12.5 kHz bandwidth.

5.8 Transmitter Unwanted Emissions

The spectrum plots of the unwanted emissions shall comply with the masks specified in Table 3. Descriptions of these permissible emission masks are given in the sections that follow.

The term *displacement frequency*, f_d, used in these sections refers to the difference between the channel frequency and the emission component frequency expressed in kilohertz, and *p* is the transmitter output power in Watts.

5.8.3 Emission Mask D for Transmitters Equipped With or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 7.

Table 7 — Emission Mask D		
Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
$5.625 < f_d \leq 12.5$	$7.27(f_d-2.88)$	Specified in Section 4.2.2

Table 7 — Emission Mask D		
Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
f_d > 12.5	Whichever is the lesser: 70 or 50 + 10 $\log_{10}(p)$	Specified in Section 4.2.2

5.8.4 Emission Mask E for Transmitters Equipped With or Without an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 8.

Table 8 — Emission Mask E		
Displacement Frequency, f_d (kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
3 <f_d ≤ 4.6	Whichever is the lesser: 30 + 16.67(f_d−3) or 55 + 10 $\log_{10}(p)$	Specified in Section 4.2.2
f_d > 4.6	Whichever is the lesser: 57 or 55 + 10 $\log_{10}(p)$	Specified in Section 4.2.2

5.8.6 Emission Mask G for Transmitters not Equipped With an Audio Low-Pass Filter

The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 10.

Table 10 — Emission Mask G		
Displacement Frequency, f_d(kHz)	Minimum Attenuation (dB)	Resolution Bandwidth (Hz)
10 < f_d ≤ 50	Whichever is the lesser: 70 or 116 $\log_{10}(f_d/6.11)$ or 50 + 10 $\log_{10}(p)$	300
f_d > 50	43 + 10 $\log_{10}(p)$	Specified in Section 4.2.1

Test Procedures:

Measurements were in accordance with the test methods section 4.4 of KDB 935210 D05 v01r01.

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 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.

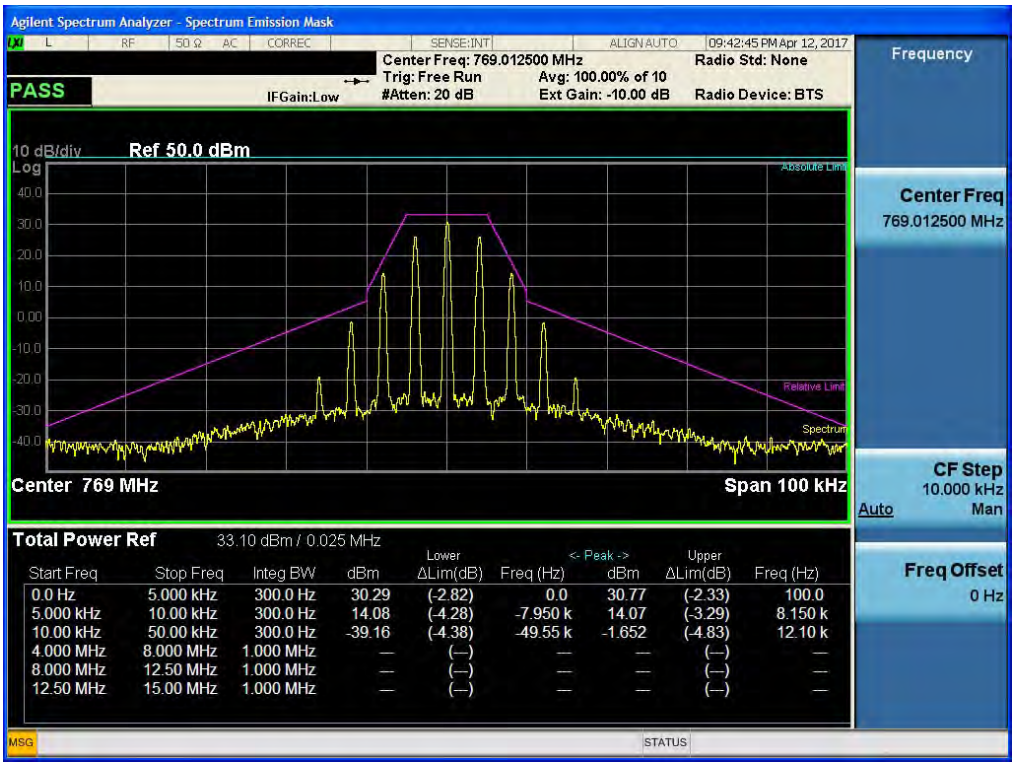
Test Results:

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
PS 700	-62	-65	95	95
PS 800	-62	-65	95	95

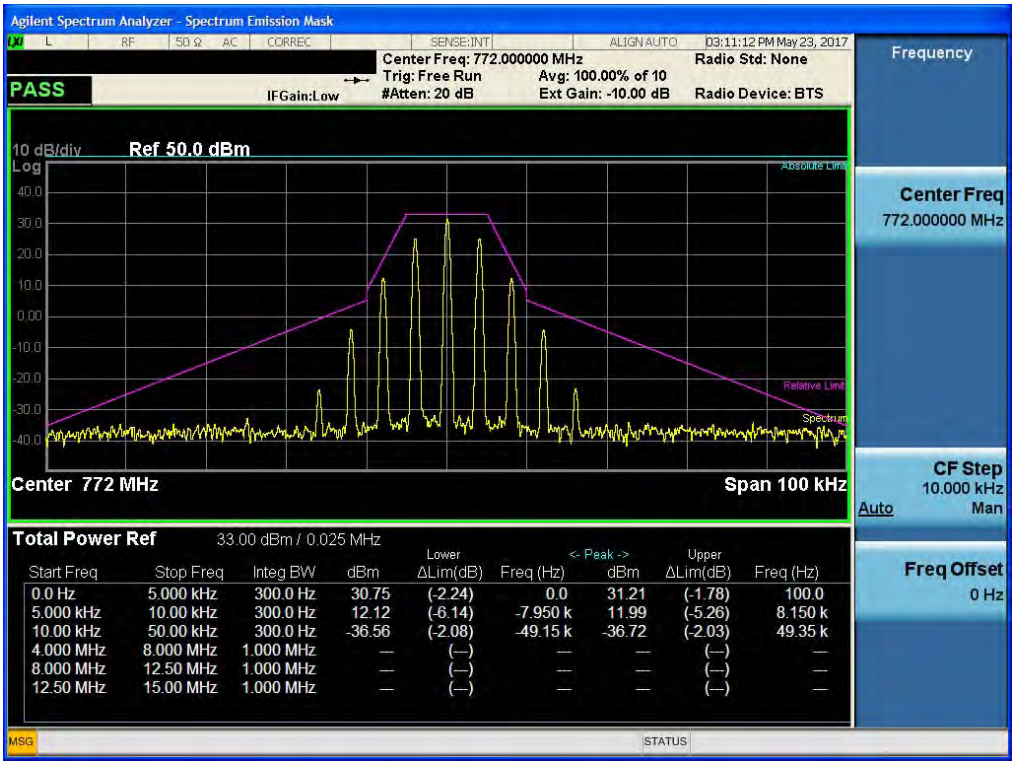
Plots of Emission Mask

700 APCO 25_Downlink

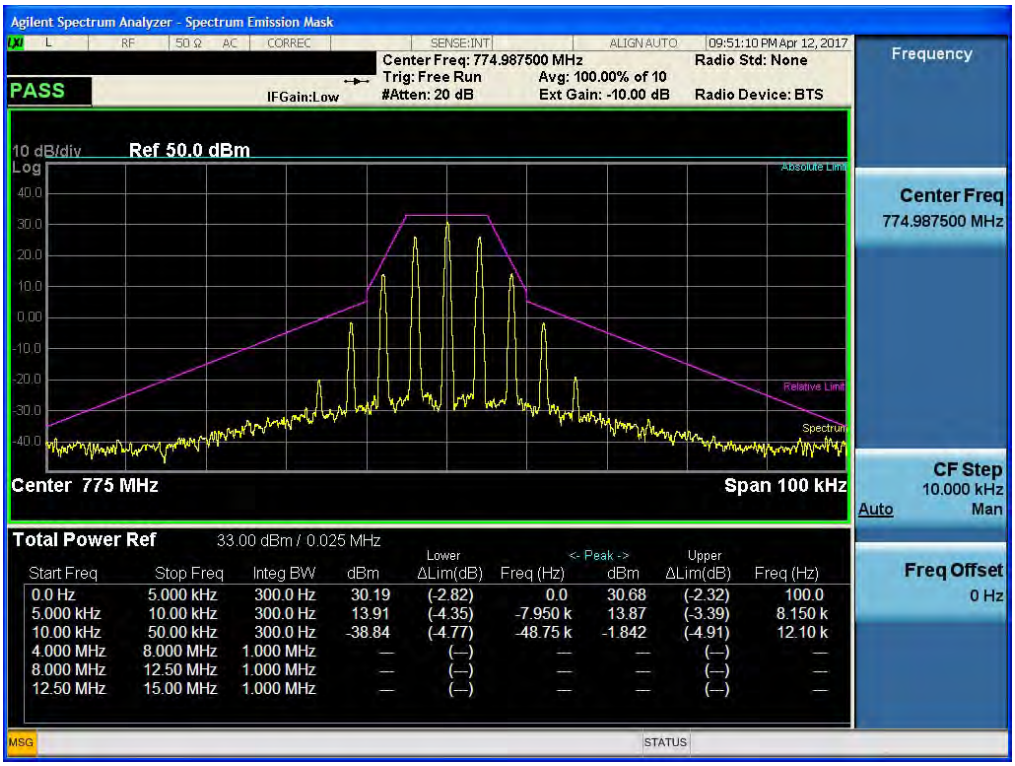
[Downlink Emission Mask C – Low, 25 kHz]



[Downlink Emission Mask C – Middle, 25 kHz]

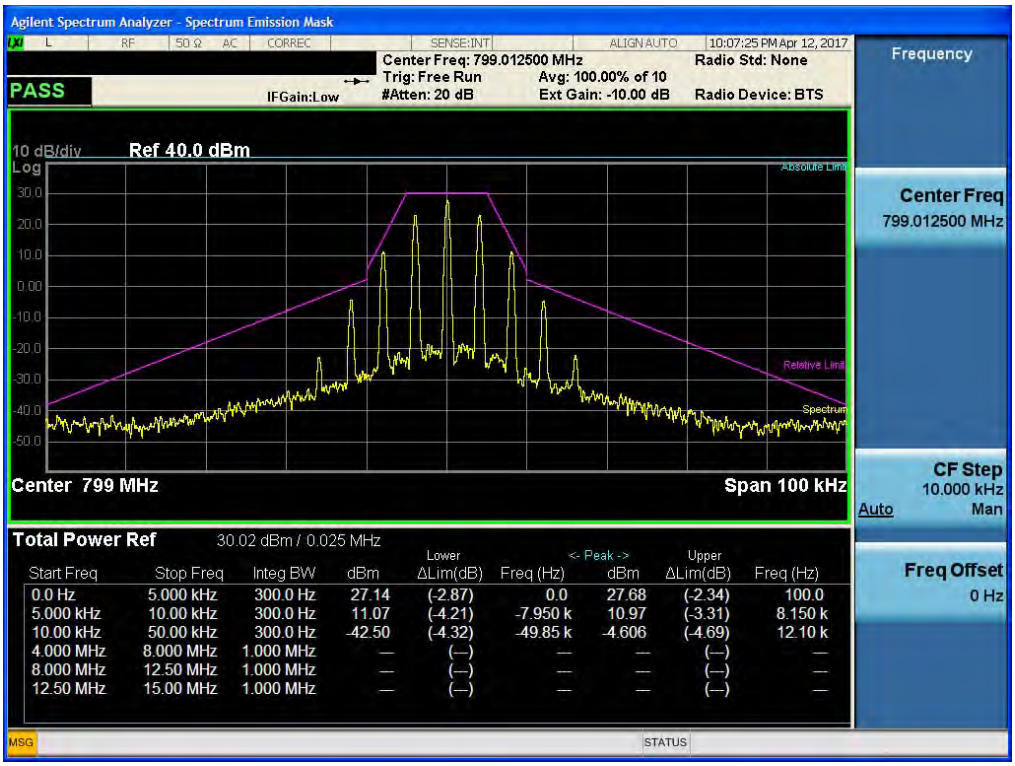


[Downlink Emission Mask C – High, 25 kHz]

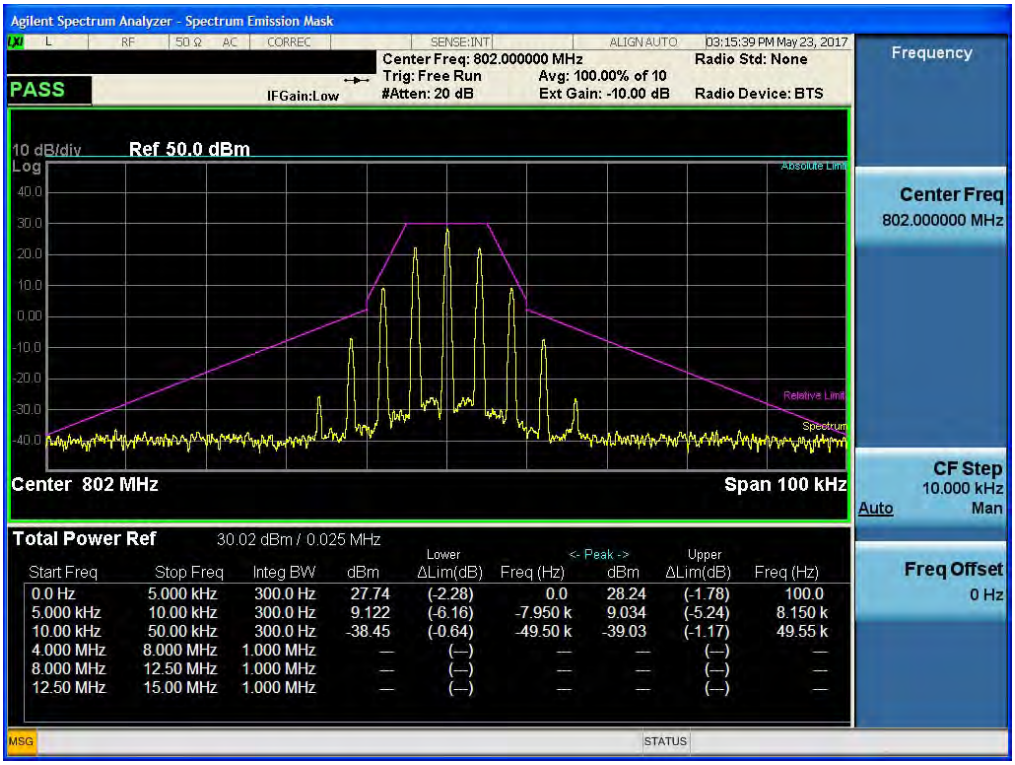


700 APCO 25_Uplink

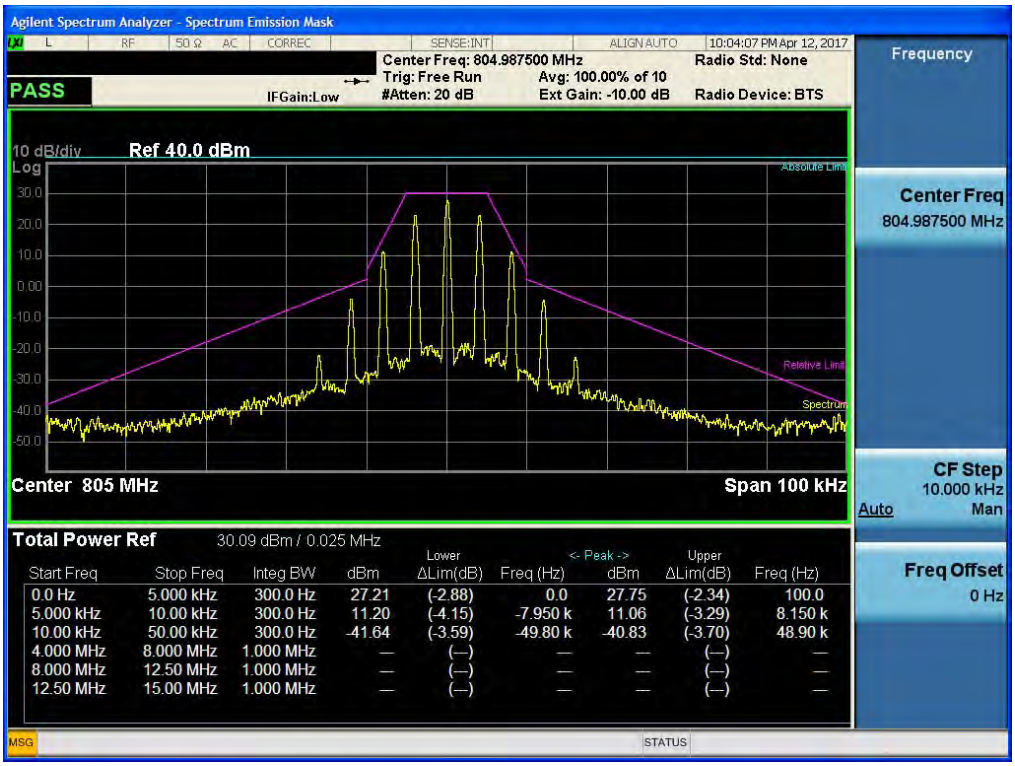
[Uplink Emission Mask C – Low, 25 kHz]



[Uplink Emission Mask C – Middle, 25 kHz]



[Uplink Emission Mask C – High, 25 kHz]

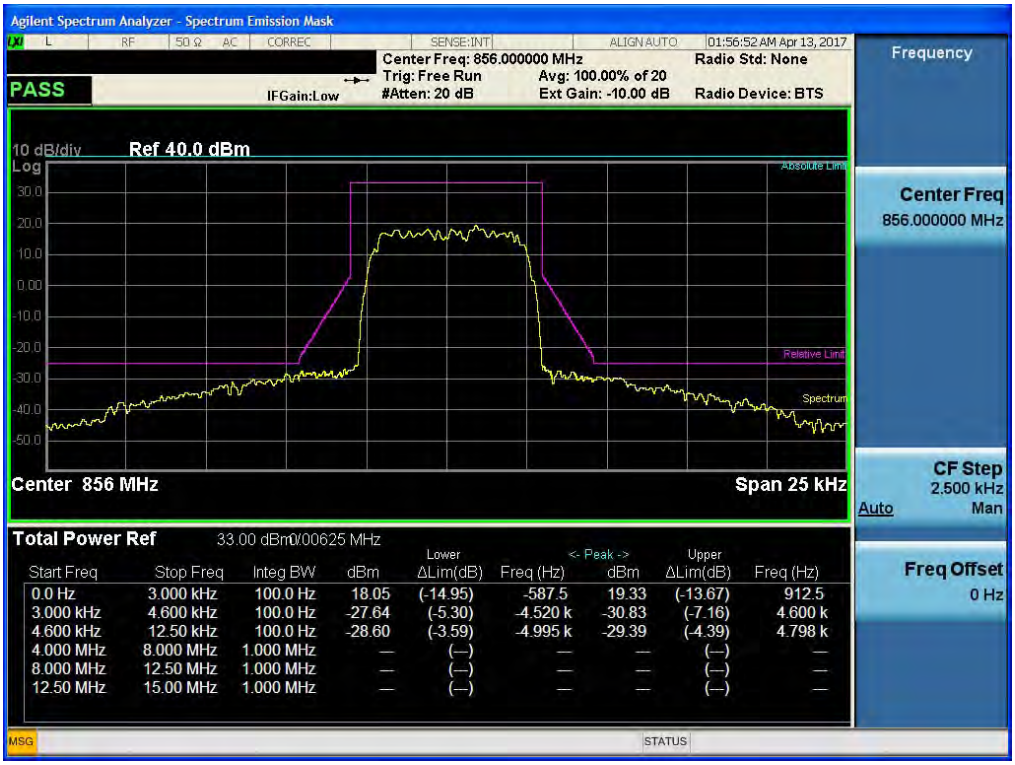


800 APCO 25_Downlink

[Downlink Emission Mask E – Low, 6.25 kHz]

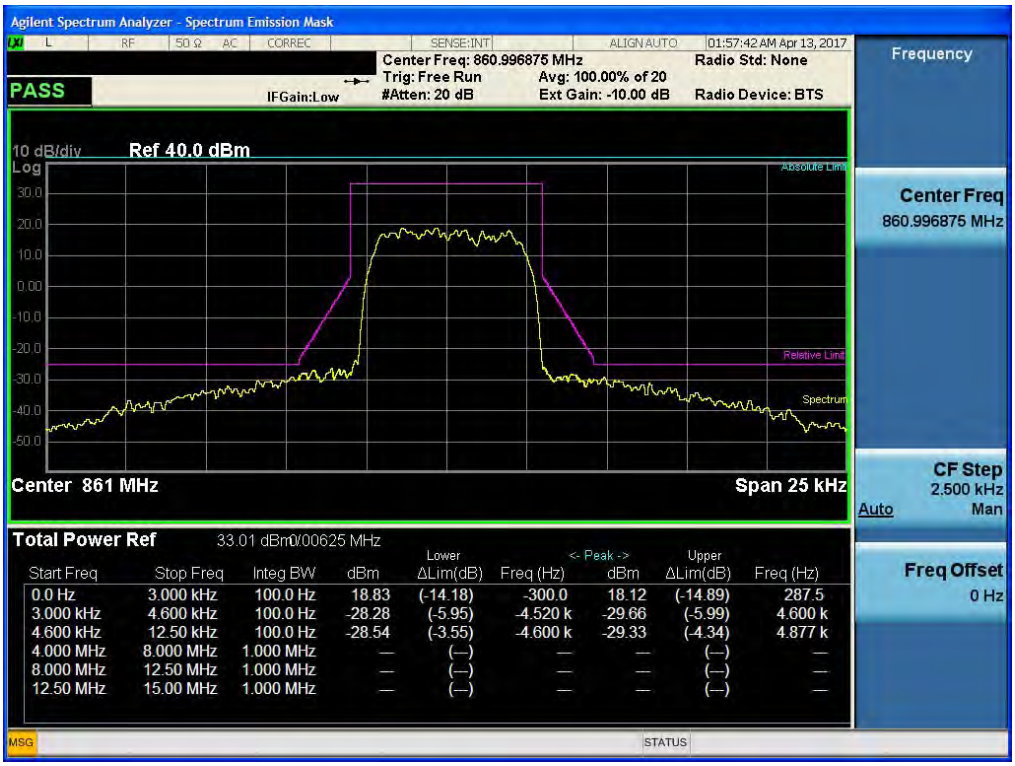
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	3.000 kHz	100.0 Hz	18.42	(-14.54)	-1.250 k	18.19	(-14.77)	562.5
3.000 kHz	4.600 kHz	100.0 Hz	-28.23	(-5.86)	-4.520 k	-29.68	(-6.64)	4.560 k
4.600 kHz	12.50 kHz	100.0 Hz	-29.62	(-4.58)	-4.600 k	-29.16	(-4.13)	4.798 k
4.000 MHz	8.000 MHz	1.000 MHz	—	(---)	—	—	(---)	—
8.000 MHz	12.50 MHz	1.000 MHz	—	(---)	—	—	(---)	—
12.50 MHz	15.00 MHz	1.000 MHz	—	(---)	—	—	(---)	—

[Downlink Emission Mask E – Middle, 6.25 kHz]

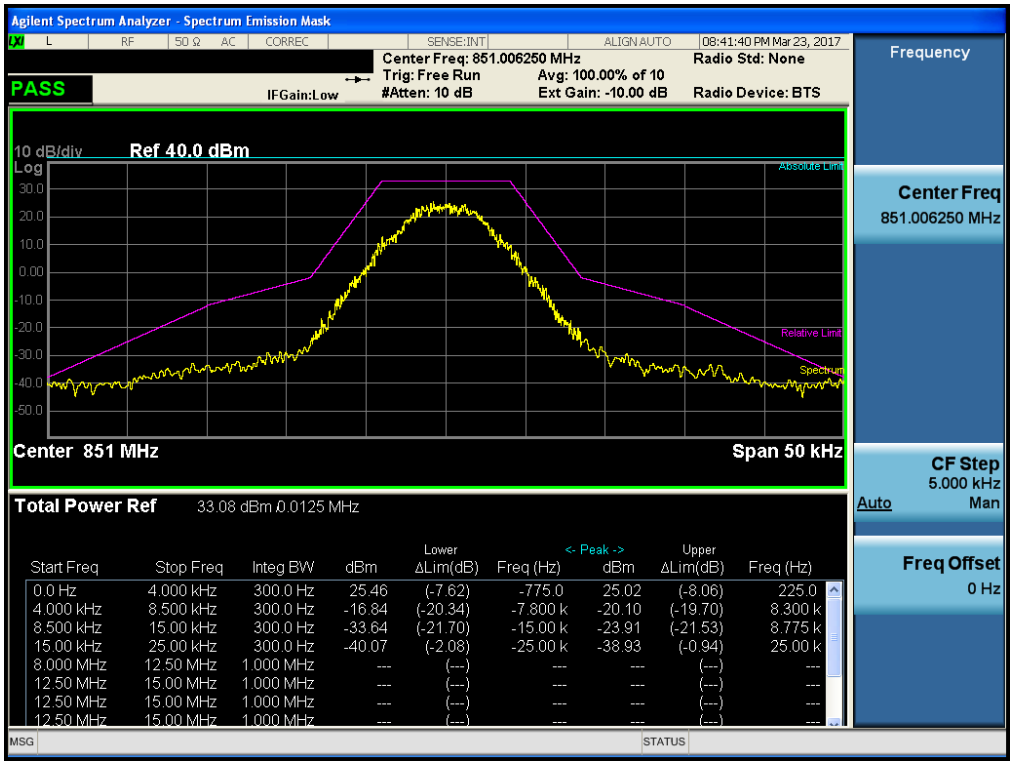


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	3.000 kHz	100.0 Hz	18.05	(-14.95)	-587.5	19.33	(-13.67)	912.5
3.000 kHz	4.600 kHz	100.0 Hz	-27.64	(-5.30)	-4.520 k	-30.83	(-7.16)	4.600 k
4.600 kHz	12.50 kHz	100.0 Hz	-28.60	(-3.59)	-4.995 k	-29.39	(-4.39)	4.798 k
4.000 MHz	8.000 MHz	1.000 MHz	—	(---)	—	—	(---)	—
8.000 MHz	12.50 MHz	1.000 MHz	—	(---)	—	—	(---)	—
12.50 MHz	15.00 MHz	1.000 MHz	—	(---)	—	—	(---)	—

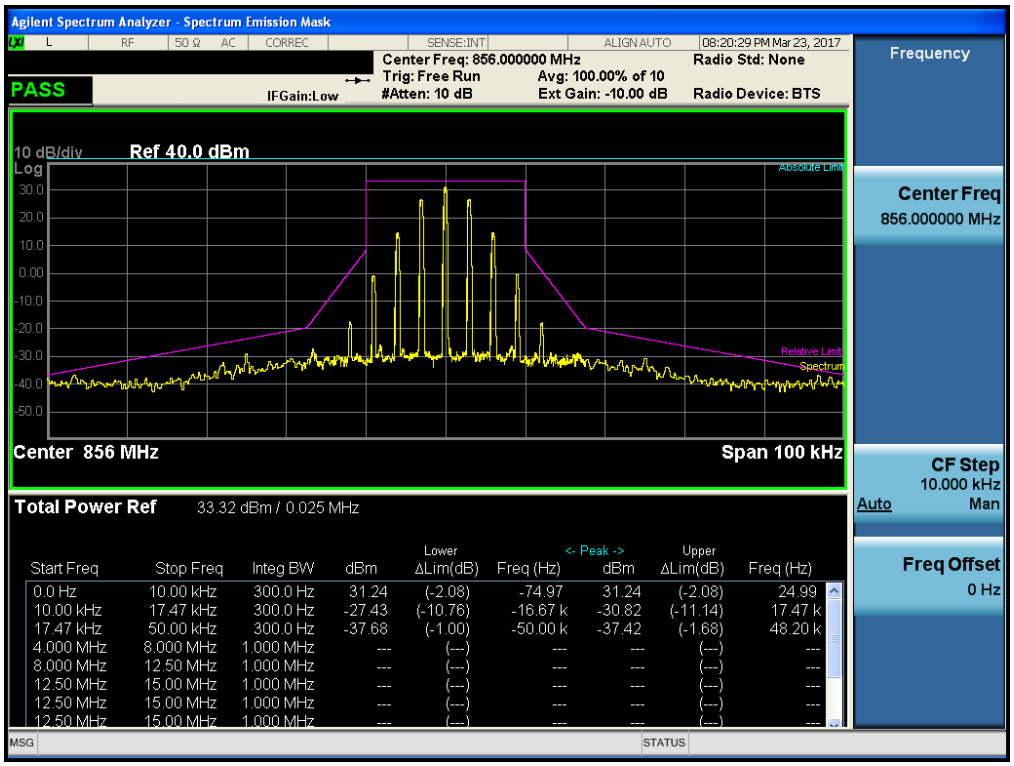
[Downlink Emission Mask E – High, 6.25 kHz]



[Downlink Emission Mask H – Low, 12.5 kHz]

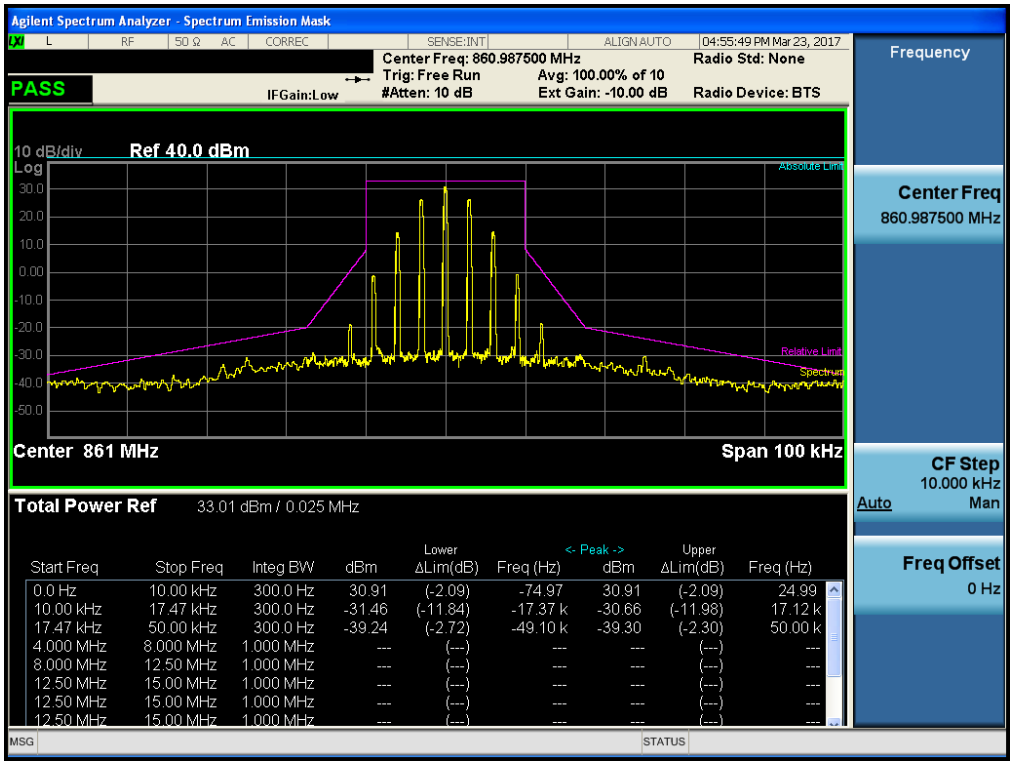


[Downlink Emission Mask G – Middle, 25 kHz]



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	10.00 kHz	300.0 Hz	31.24	(-2.08)	-74.97	31.24	(-2.08)	24.99
10.00 kHz	17.47 kHz	300.0 Hz	-27.43	(-10.76)	-16.67 k	-30.82	(-11.14)	17.47 k
17.47 kHz	50.00 kHz	300.0 Hz	-37.68	(-1.00)	-50.00 k	-37.42	(-1.68)	48.20 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

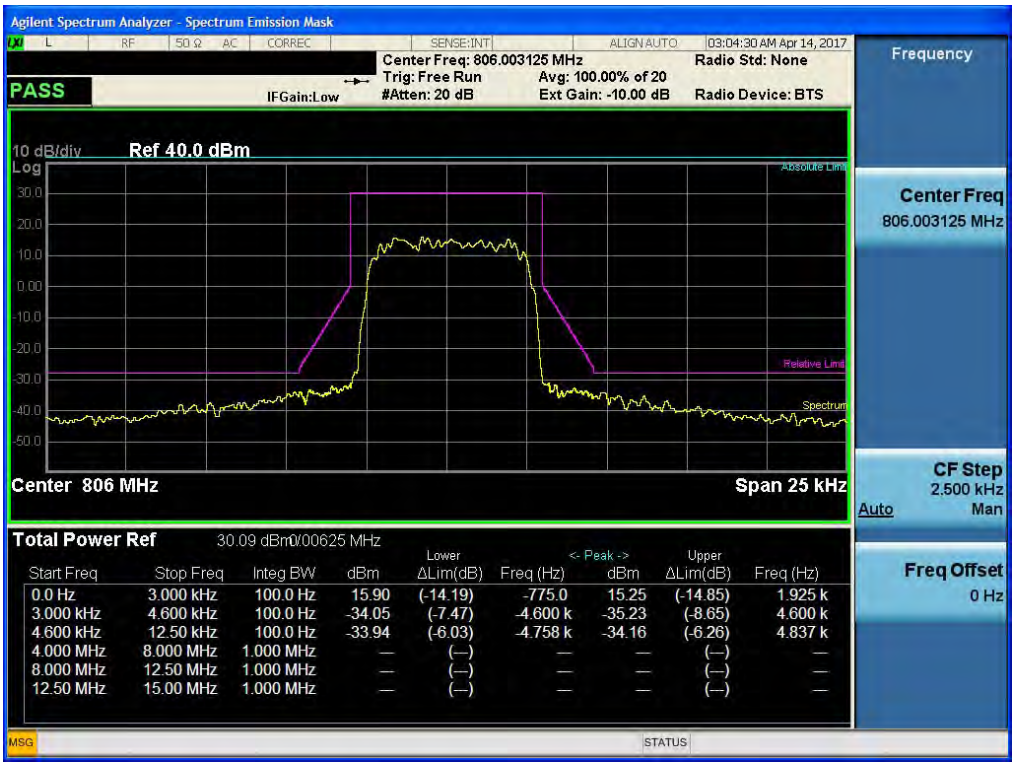
[Downlink Emission Mask G – High, 25 kHz]



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	10.00 kHz	300.0 Hz	30.91	(-2.09)	-74.97	30.91	(-2.09)	24.99
10.00 kHz	17.47 kHz	300.0 Hz	-31.46	(-11.84)	-17.37 k	-30.66	(-11.98)	17.12 k
17.47 kHz	50.00 kHz	300.0 Hz	-39.24	(-2.72)	-49.10 k	-39.30	(-2.30)	50.00 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

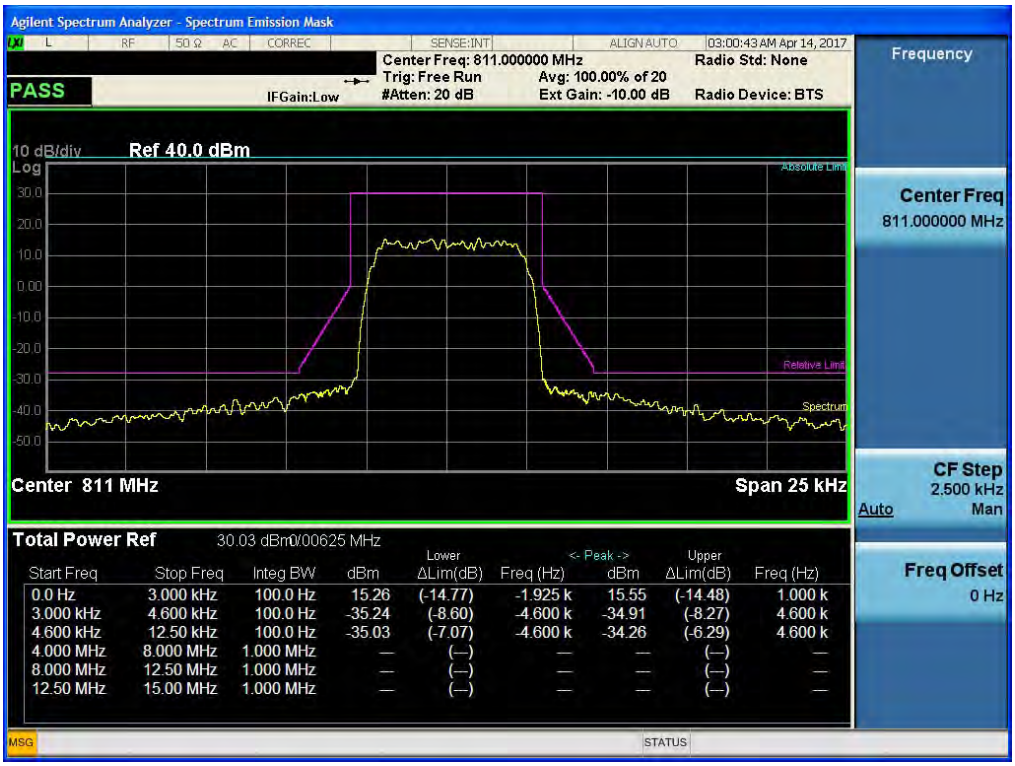
800 APCO 25_Uplink

[Uplink Emission Mask E – Low, 6.25 kHz]



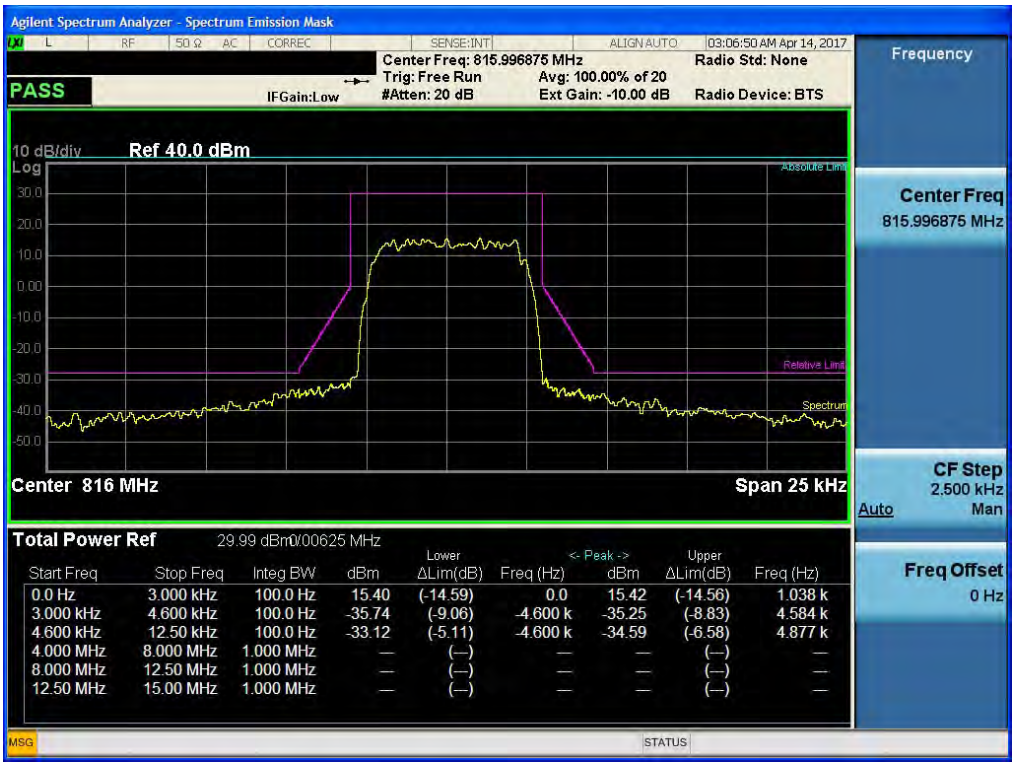
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	3.000 kHz	100.0 Hz	15.90	(-14.19)	-775.0	15.25	(-14.85)	1.925 k
3.000 kHz	4.600 kHz	100.0 Hz	-34.05	(-7.47)	-4.600 k	-35.23	(-8.65)	4.600 k
4.600 kHz	12.50 kHz	100.0 Hz	-33.94	(-6.03)	-4.758 k	-34.16	(-6.26)	4.837 k
4.000 MHz	8.000 MHz	1.000 MHz	—	(---)	—	—	(---)	—
8.000 MHz	12.50 MHz	1.000 MHz	—	(---)	—	—	(---)	—
12.50 MHz	15.00 MHz	1.000 MHz	—	(---)	—	—	(---)	—

[Uplink Emission Mask E – Middle, 6.25 kHz]

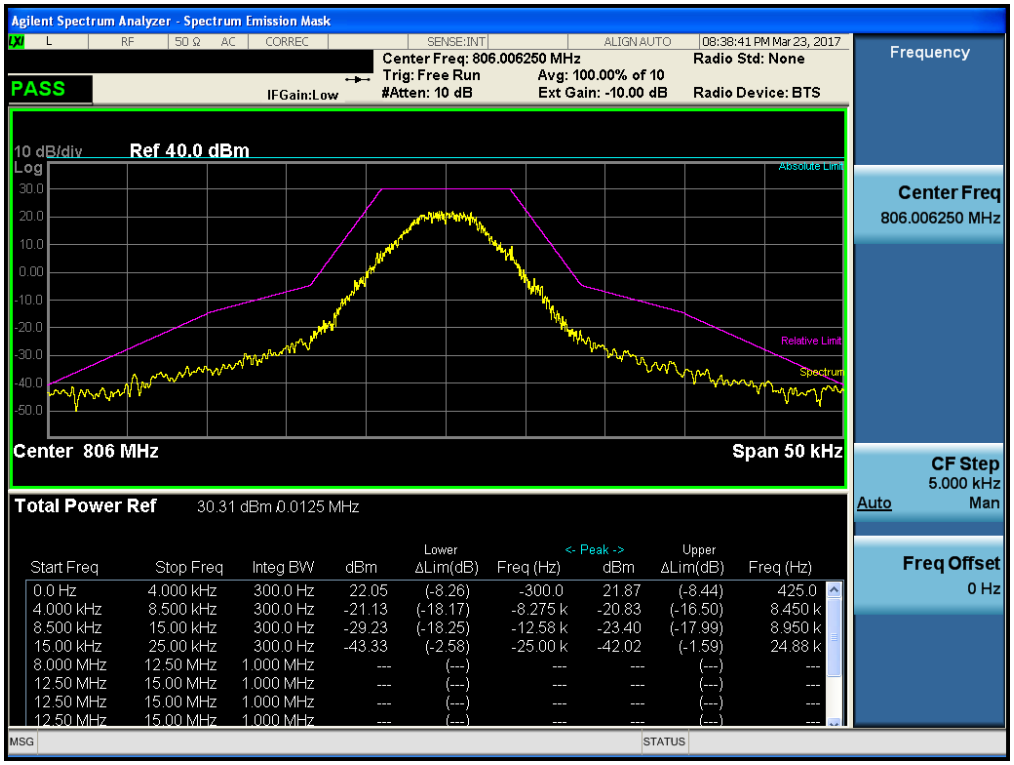


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	3.000 kHz	100.0 Hz	15.26	(-14.77)	-1.925 k	15.55	(-14.48)	1.000 k
3.000 kHz	4.600 kHz	100.0 Hz	-35.24	(-8.60)	-4.600 k	-34.91	(-8.27)	4.600 k
4.600 kHz	12.50 kHz	100.0 Hz	-35.03	(-7.07)	-4.600 k	-34.26	(-6.29)	4.600 k
4.000 MHz	8.000 MHz	1.000 MHz	—	(---)	—	—	(---)	—
8.000 MHz	12.50 MHz	1.000 MHz	—	(---)	—	—	(---)	—
12.50 MHz	15.00 MHz	1.000 MHz	—	(---)	—	—	(---)	—

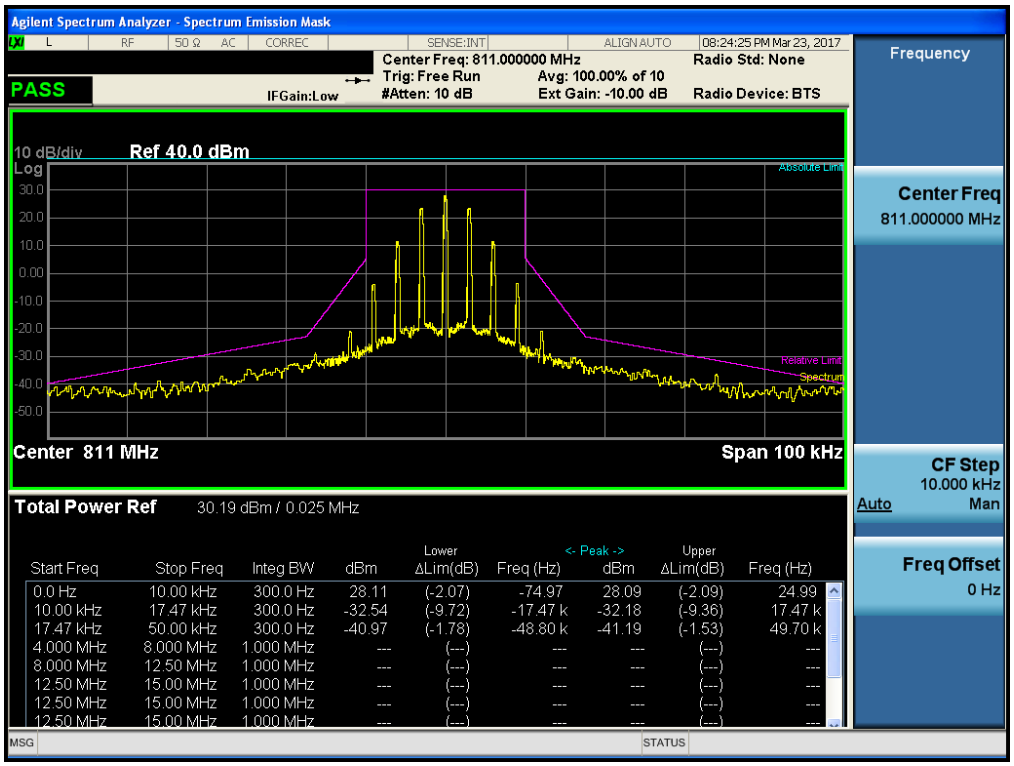
[Uplink Emission Mask E – High, 6.25 kHz]



[Uplink Emission Mask H – Low, 12.5 kHz]

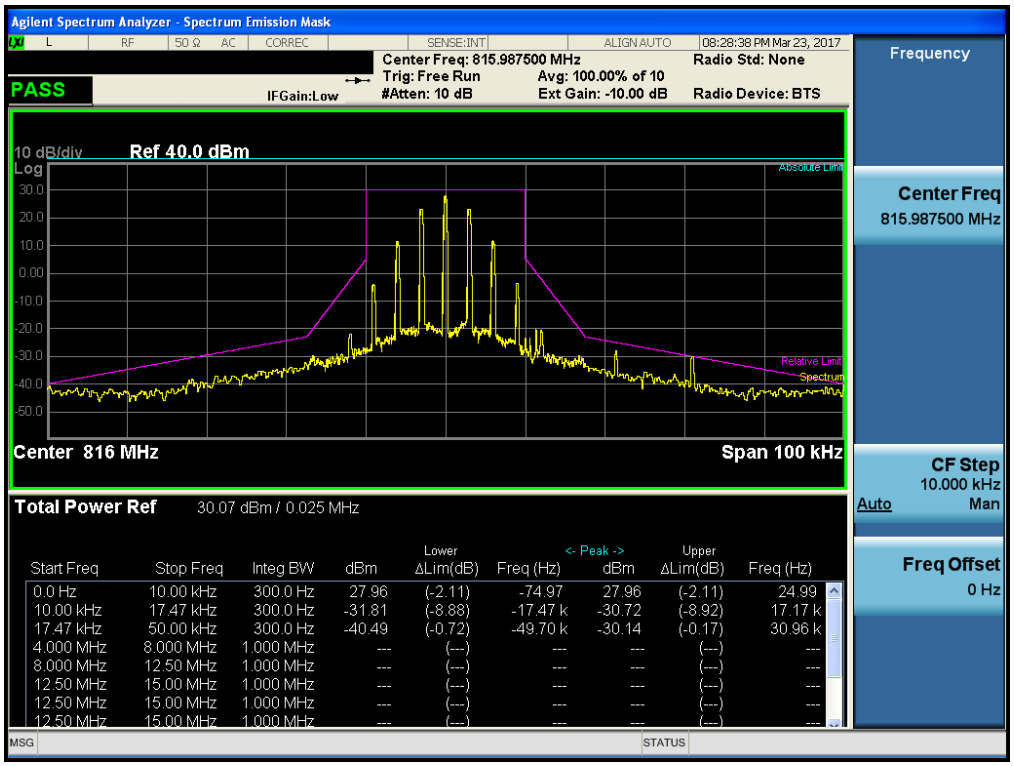


[Uplink Emission Mask G – Middle, 25 kHz]



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	Peak dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	10.00 kHz	300.0 Hz	28.11	(-2.07)	-74.97	28.09	(-2.09)	24.99
10.00 kHz	17.47 kHz	300.0 Hz	-32.54	(-9.72)	-17.47 k	-32.18	(-9.36)	17.47 k
17.47 kHz	50.00 kHz	300.0 Hz	-40.97	(-1.78)	-48.80 k	-41.19	(-1.53)	49.70 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

[Uplink Emission Mask G – High, 25 kHz]



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	Peak dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	10.00 kHz	300.0 Hz	27.96	(-2.11)	-74.97	27.96	(-2.11)	24.99
10.00 kHz	17.47 kHz	300.0 Hz	-31.81	(-8.88)	-17.47 k	-30.72	(-8.92)	17.17 k
17.47 kHz	50.00 kHz	300.0 Hz	-40.49	(-0.72)	-49.70 k	-30.14	(-0.17)	30.96 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

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 booters.

(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

12.5 kHz Mobile Transmitter ACP Requirements

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)
9.375	6.25	−40
15.625	6.25	−60
21.875	6.25	−60
37.50	25.00	−60
62.50	25.00	−65
87.50	25.00	−65
150.00	100	−65
250.00	100	−65
350.00	100	−65
>400 to 12 MHz	30 (s)	−75
12 MHz to paired receive band	30 (s)	−75
In the paired receive band	30 (s)	−100

25 kHz Mobile Transmitter ACP Requirements

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)
15.625	6.25	−40
21.875	6.25	−60
37.50	25	−60

62.50	25	−65
87.50	25	−65
150.00	100	−65
250.00	100	−65
350.00	100	−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

[1]Although 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.

12.5 kHz Base Transmitter ACP Requirements

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)

9.375	6.25	−40
15.625	6.25	−60
21.875	6.25	−60
37.5	25	−60
62.5	25	−65
87.5	25	−65
150	100	−65
250	100	−65
350.00	100	−65
>400 kHz to 12 MHz	30 (s)	−80
12 MHz to paired receive band	30 (s)	−80
In the paired receive band	30 (s)	[1]-85

[1]Although 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.

25 kHz Base Transmitter ACP Requirements

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)
15.625	6.25	−40
21.875	6.25	−60
37.5	25	−60
62.5	25	−65
87.5	25	−65
150	100	−65
250	100	−65
350	100.00	−65
>400 kHz to 12 MHz	30 (s)	−80
12 MHz to paired receive band	30 (s)	−80
In the paired receive band	30 (s)	[1]-85

[1]Although 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 mesurement 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 substracting 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 substracting 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 + 10log (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	100
250			
350			
400 < fd ≤ 12 MHz	−75	−80	30(s)
12 MHz < fd ≤paired receive band			
In the paired receive band	−100	−85	

Table 14 — ACP Requirements for 12.5 kHz Bandwidth Transmitters			
Displacement Frequency, fd (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
9.375	−40	−40	6.25
15.625	−60	−60	
21.875			
37.5	−60	−60	25
62.5	−65	−65	25

87.5			
150	−65	−65	100
250			
350			
400 < fd ≤ 12 MHz	−75	−80	30(s)
12 MHz > fd ≤ paired receive band			
In the paired receive band	−100	−85	

Table 15 — ACP Requirements for 25 kHz Bandwidth Transmitters

Displacement Frequency, fd (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
15.625	−40	−40	6.25
21.875	−60	−60	6.25
37.5	−60	−60	25
62.5	−65	−65	25
87.5			25
150	−65	−65	100
250			
350			
400 ≤ fd ≤ 12 MHz	−75	−80	30(s)
12 MHz ≤ fd ≤ paired receive band			
In the paired receive band	−100	−85	

Table 16 — ACP Requirements for 50 kHz Bandwidth Transmitters

Displacement Frequency, fd (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
50	−40	−40	50

100	−50	−50	
150			
200			
250			
300		−55	
350			
400		−60	
450			
500			
550			
600 ≤ fd < 1000	−60	−65	30(s)
1000 ≤ fd < 2000	−65	−70	
2000 ≤ fd < 9000	−70	−75	
9000 ≤ fd ≤ 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 v01r01.

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 × 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 ≥ 3 × 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 ≥ (2 × span/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 ≥ (2 × span/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 (f0) 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 f0 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 ≥ 3 × 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 × 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 × 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.

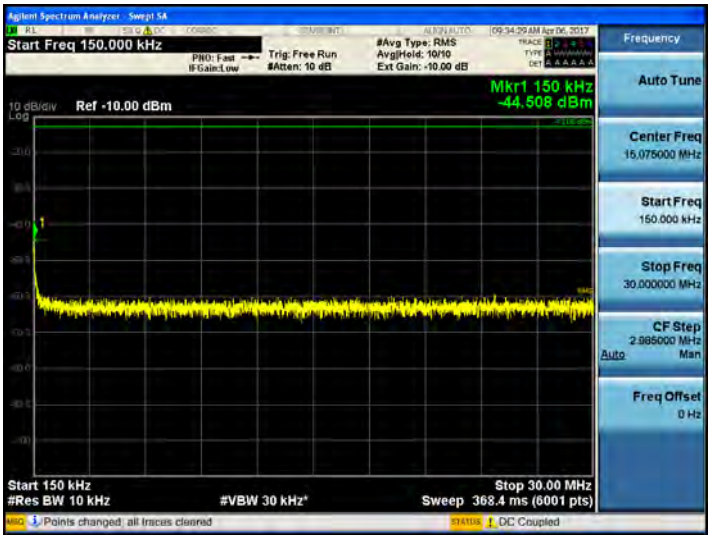
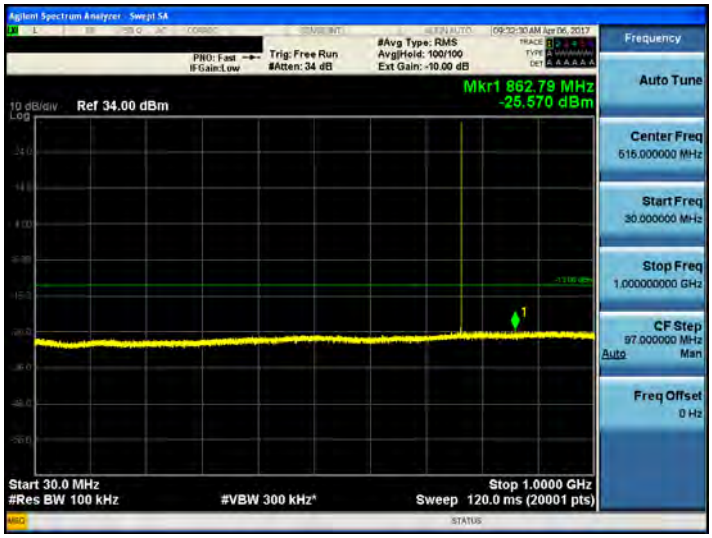
m) Repeat steps c) to l) for each authorized frequency band/block of operation.

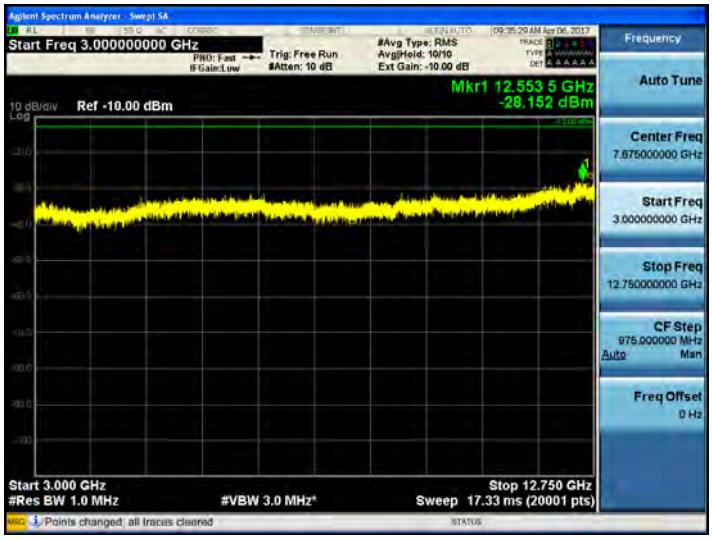
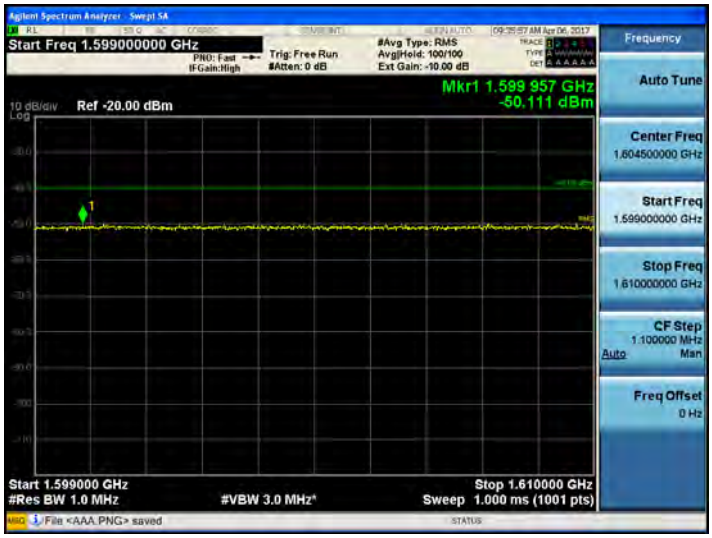
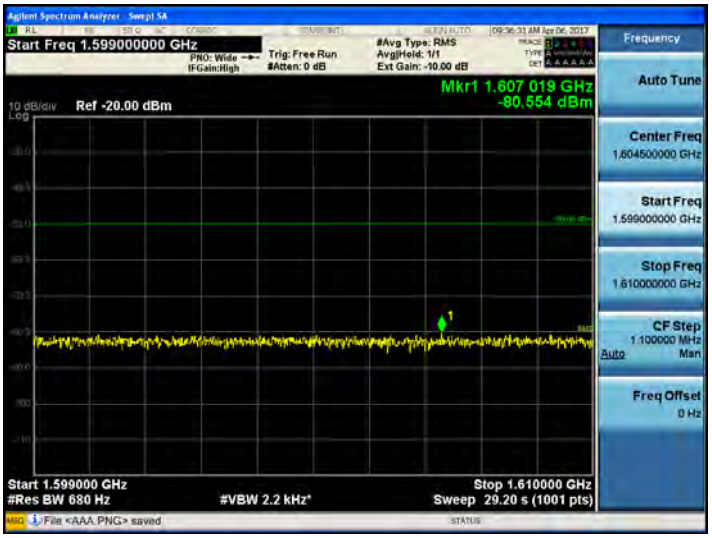
Notes: In 9 KHz-150 KHz and 150 KHz-30 MHz bands, RBW was reduced to 1% and 10% of the reference bandwidth for measuring unwanted emission level(typically, 100KHz if the authorized frequency band is below 1GHz) and power was integrated. (1% = +20 dB, 10% = +10 dB)

Single channel Enhancer Plots of Spurious Emission

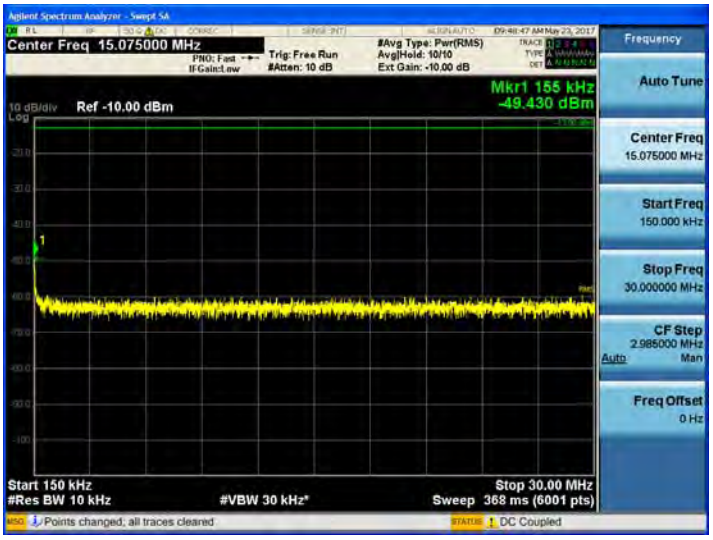
700 APCO 25(6.25 kHz)_DL

[Downlink_Low]

9 ㎑ ~ 150 ㎑	150 ㎑ ~ 30 ㎒
	
30 ㎒ ~ 1 ㎓	**1 ㎓ ~ 3 ㎓**
	

3 GHz ~ 12.75 GHz	
	
1599 MHz ~ 1610 MHz (1)	**1599 MHz ~ 1610 MHz (2)**
	

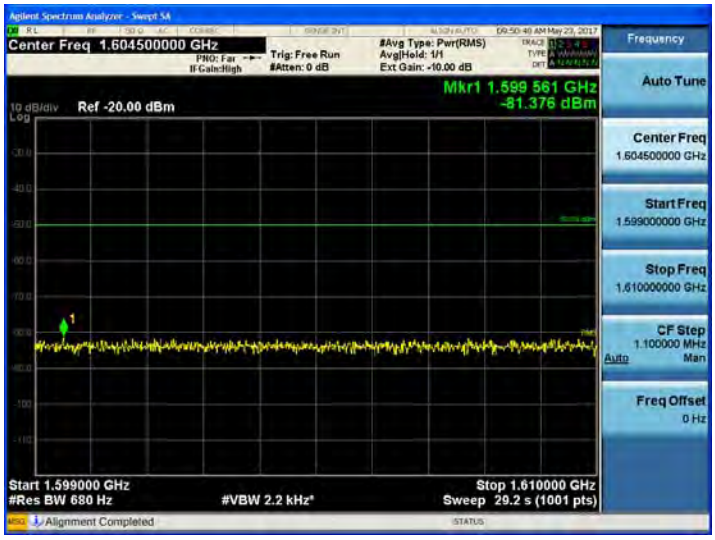
[Downlink_Middle]

9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 1 GHz	**1 GHz ~ 3 GHz**

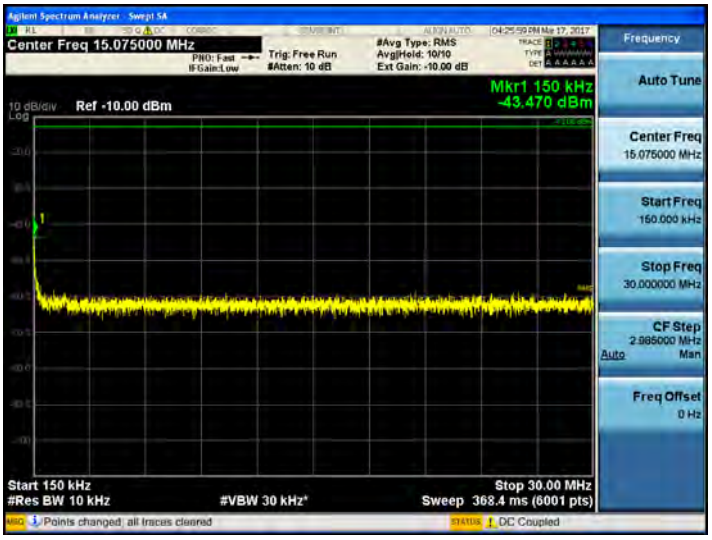
3 GHz ~ 12.75 GHz

1599 MHz ~ 1610 MHz (1)

1599 MHz ~ 1610 MHz (2)



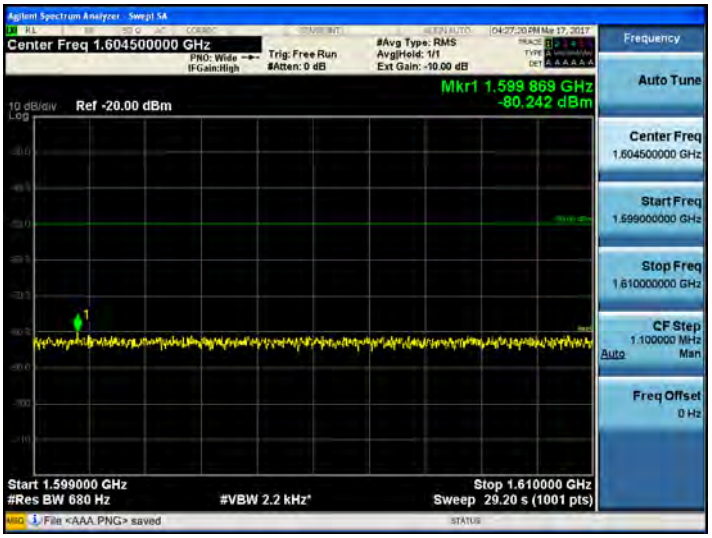
[Downlink_High]

9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 1 GHz	**1 GHz ~ 3 GHz**

3 GHz ~ 12.75 GHz

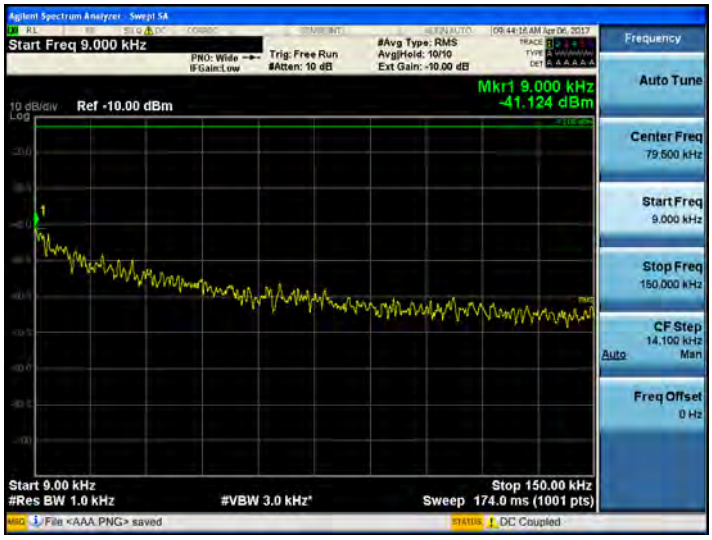
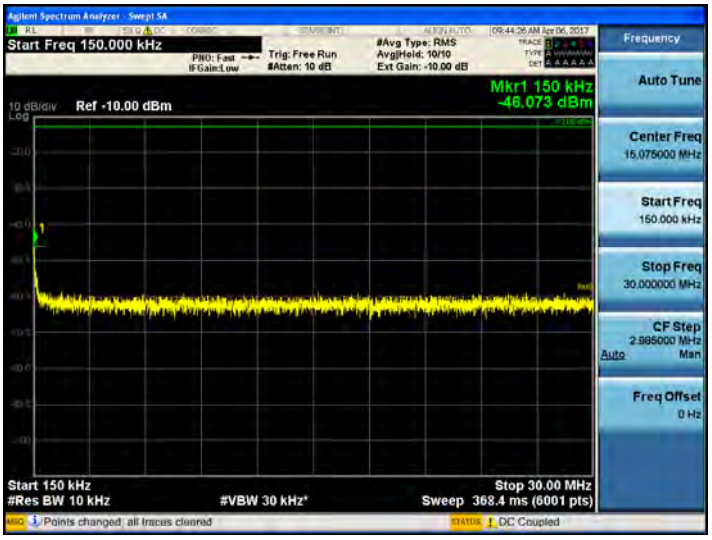
1599 MHz ~ 1610 MHz (1)

1599 MHz ~ 1610 MHz (2)

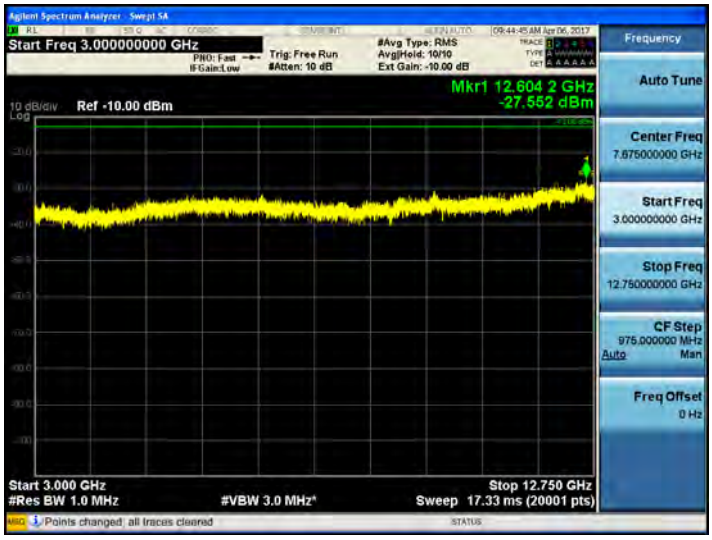


700 APCO 25(6.25 kHz)_UL

[Uplink_Low]

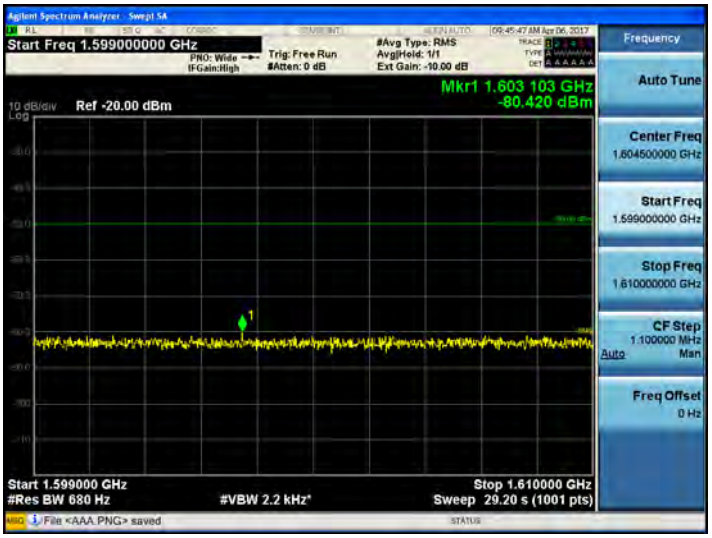
9 ㎑ ~ 150 ㎑	150 ㎑ ~ 30 ㎒
	
30 ㎒ ~ 1 ㎓	**1 ㎓ ~ 3 ㎓**

3 GHz ~ 12.75 GHz

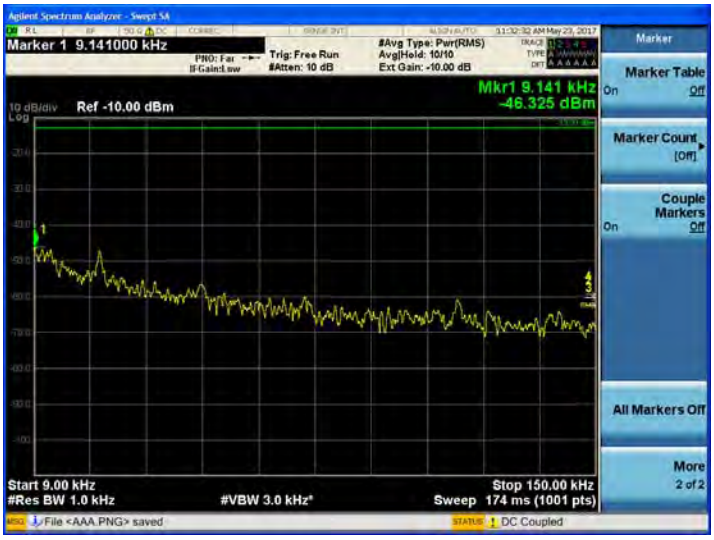
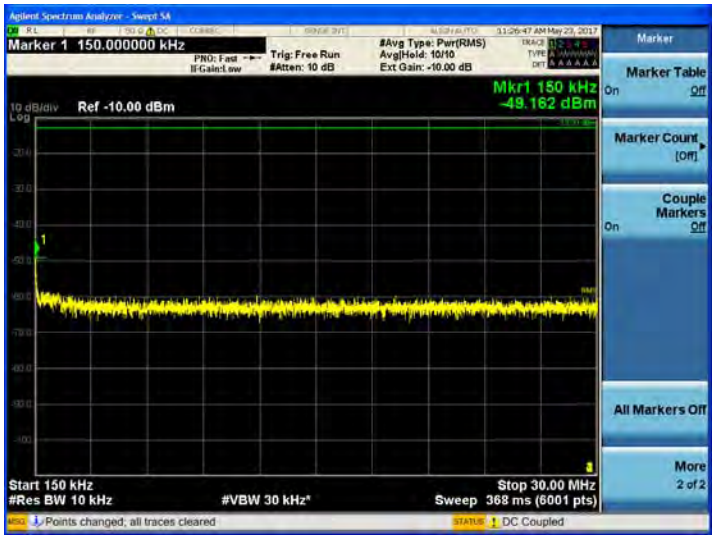


1599 MHz ~ 1610 MHz (1)

1599 MHz ~ 1610 MHz (2)



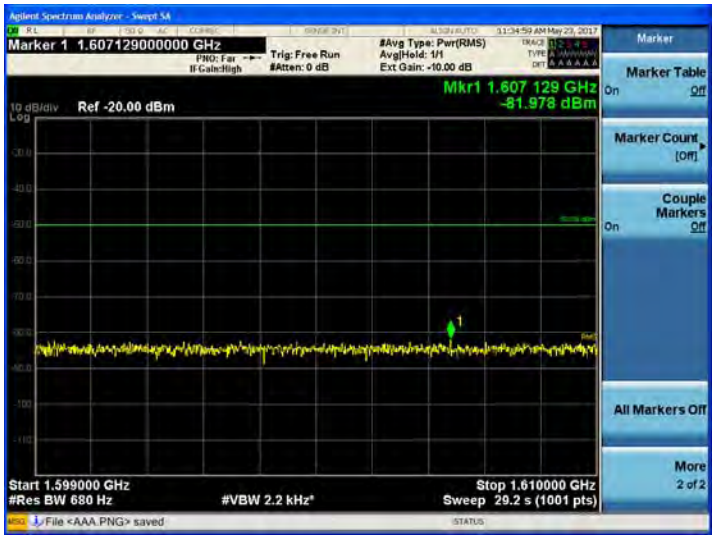
[Uplink_Middle]

9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 1 GHz	**1 GHz ~ 3 GHz**

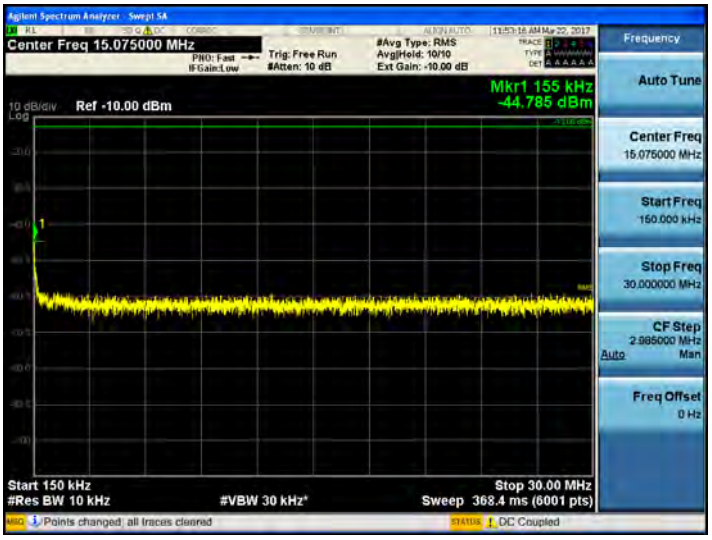
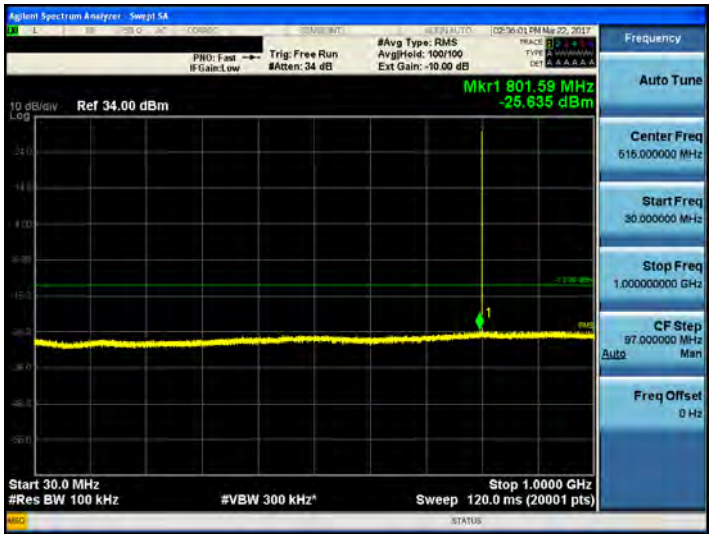
3 GHz ~ 12.75 GHz

1599 MHz ~ 1610 MHz (1)

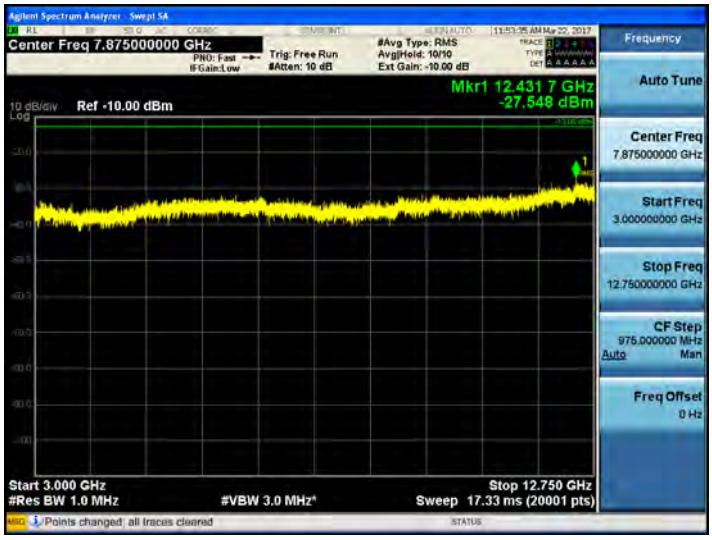
1599 MHz ~ 1610 MHz (2)



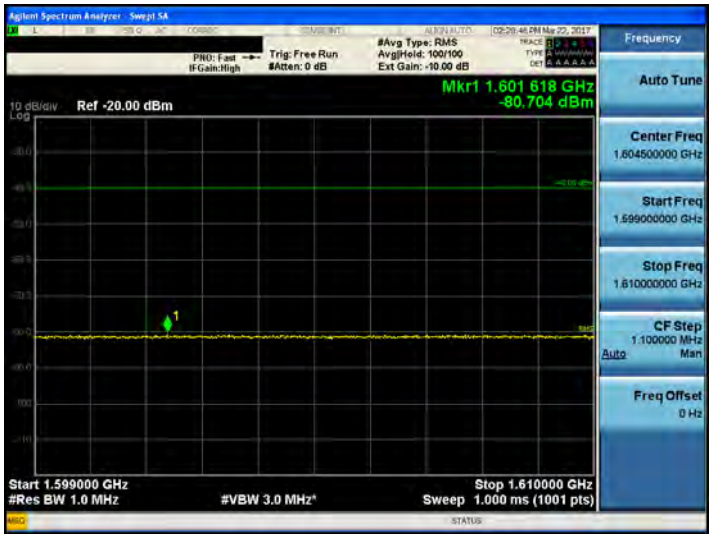
[Uplink_High]

9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 1 GHz	**1 GHz ~ 3 GHz**
	

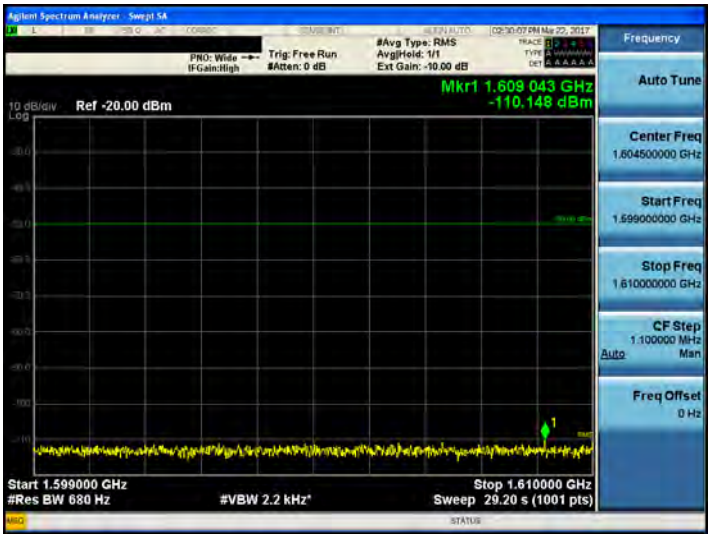
3 GHz ~ 12.75 GHz



1599 MHz ~ 1610 MHz (1)

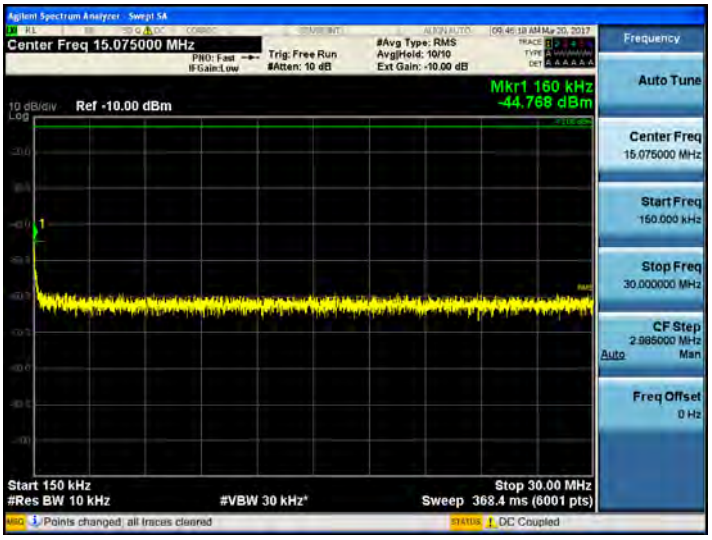


1599 MHz ~ 1610 MHz (2)

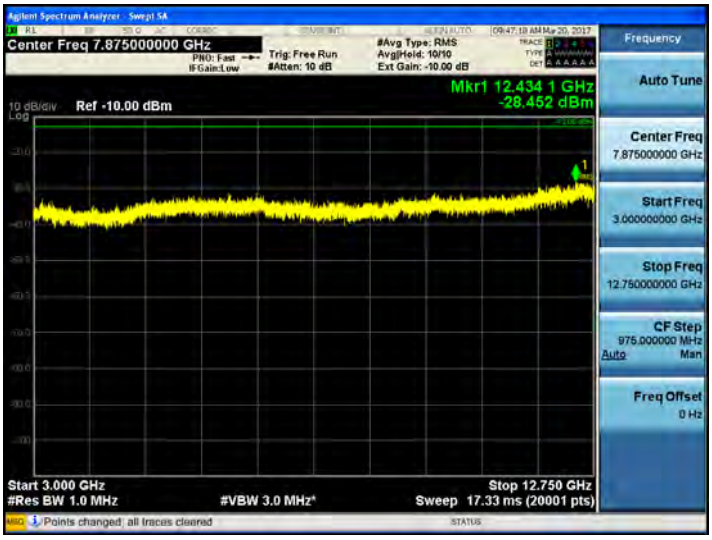


800 APCO 25(6.25 kHz)_DL

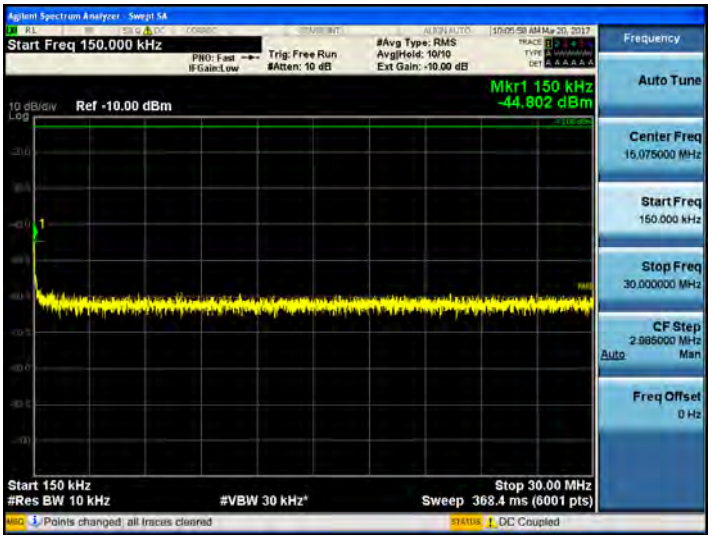
[Downlink_Low]

9 ㎑ ~ 150 ㎑	150 ㎑ ~ 30 ㎒
	
30 ㎒ ~ 1 ㎓	**1 ㎓ ~ 3 ㎓**

3 ㎓ ~ 12.75 ㎓

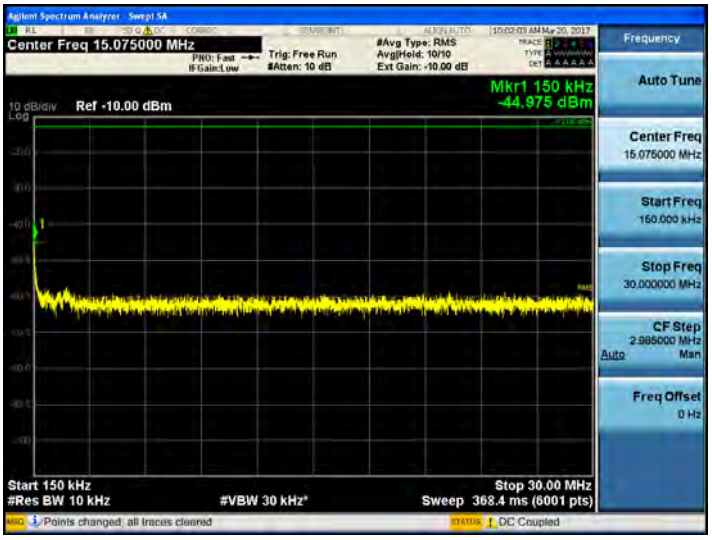
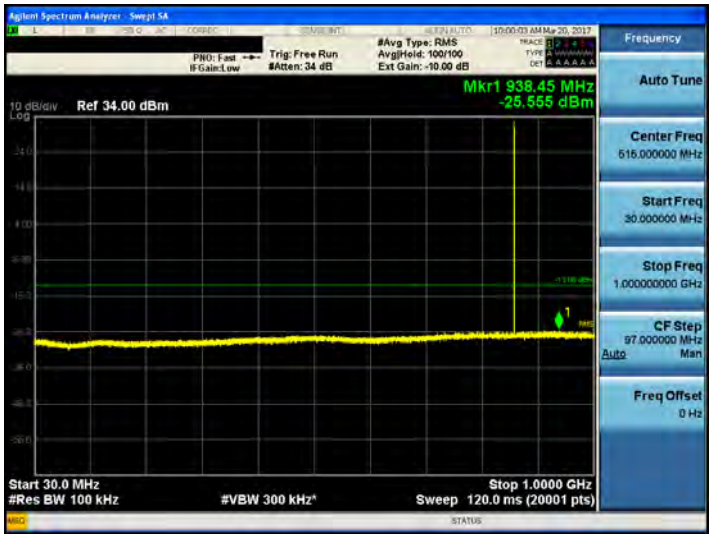

Agilent Spectrum Analyzer - Swept SA
Center Freq 7.875000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: RMS
Avg|Hold: 10/10
Ext Gain: -10.00 dB
Mkr1 12.434 1 GHz
-28.452 dBm
10 dB/div
Log
Ref -10.00 dBm
Frequency
Auto Tune
Center Freq
7.875000000 GHz
Start Freq
3.000000000 GHz
Stop Freq
12.750000000 GHz
CF Step
975.000000 MHz
Auto
Man
Freq Offset
0 Hz
Start 3.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 12.750 GHz
Sweep 17.33 ms (20001 pts)
Points changed; all traces cleared

[Downlink_Middle]

9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 1 GHz	**1 GHz ~ 3 GHz**

3 GHz ~ 12.75 GHz

[Downlink_High]

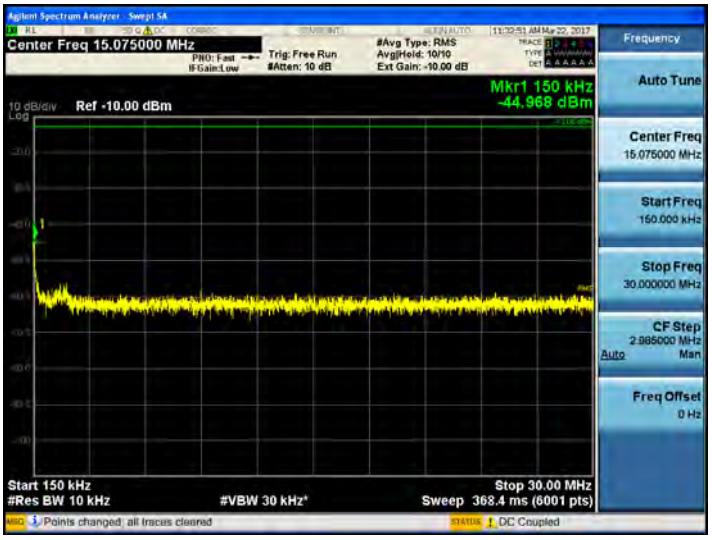
9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 1 GHz	**1 GHz ~ 3 GHz**
	

3 ㎓ ~ 12.75 ㎓

Agilent Spectrum Analyzer - Swept SA
Center Freq 7.875000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: RMS
Avg|Hold: 10/10
Ext Gain: -10.00 dB
Mkr1 12.577 9 GHz
-27.779 dBm
10 dB/div
Ref -10.00 dBm
Log
Start 3.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 12.750 GHz
Sweep 17.33 ms (20001 pts)
Points changed; all traces cleared
Frequency
Auto Tune
Center Freq
7.875000000 GHz
Start Freq
3.000000000 GHz
Stop Freq
12.750000000 GHz
CF Step
975.000000 MHz
Auto
Man
Freq Offset
0 Hz

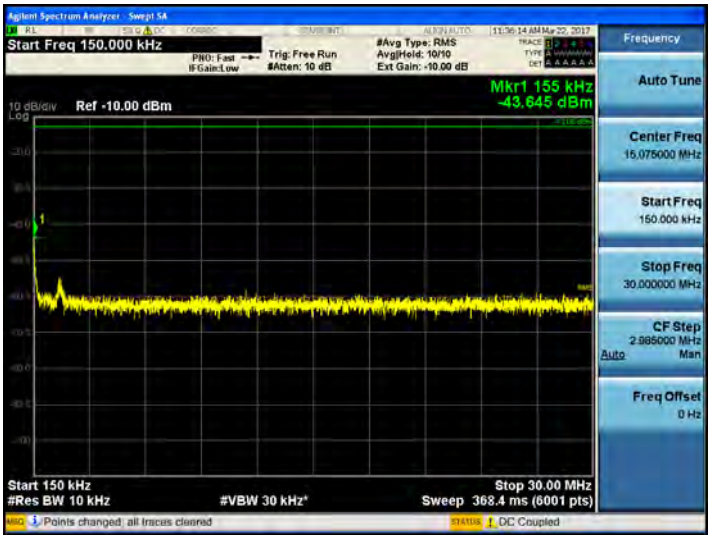
800 APCO 25(6.25 kHz)_UL

[Uplink_Low]

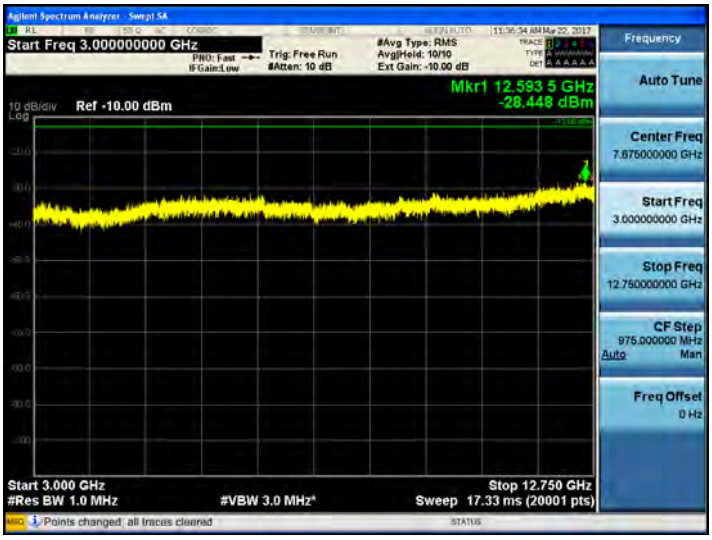
9 ㎑ ~ 150 ㎑	150 ㎑ ~ 30 ㎒
	
30 ㎒ ~ 1 ㎓	**1 ㎓ ~ 3 ㎓**

3 GHz ~ 12.75 GHz

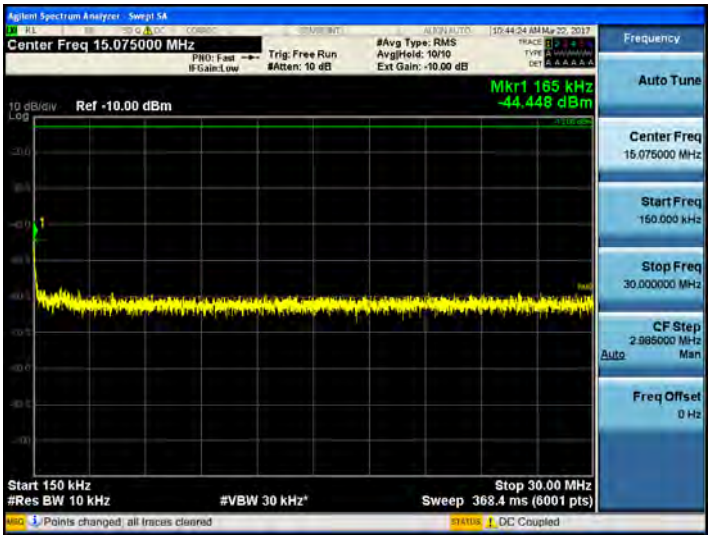
[Uplink_Middle]

9 ㎑ ~ 150 ㎑	150 ㎑ ~ 30 ㎒
	
30 ㎒ ~ 1 ㎓	**1 ㎓ ~ 3 ㎓**

3 GHz ~ 12.75 GHz



[Uplink_High]

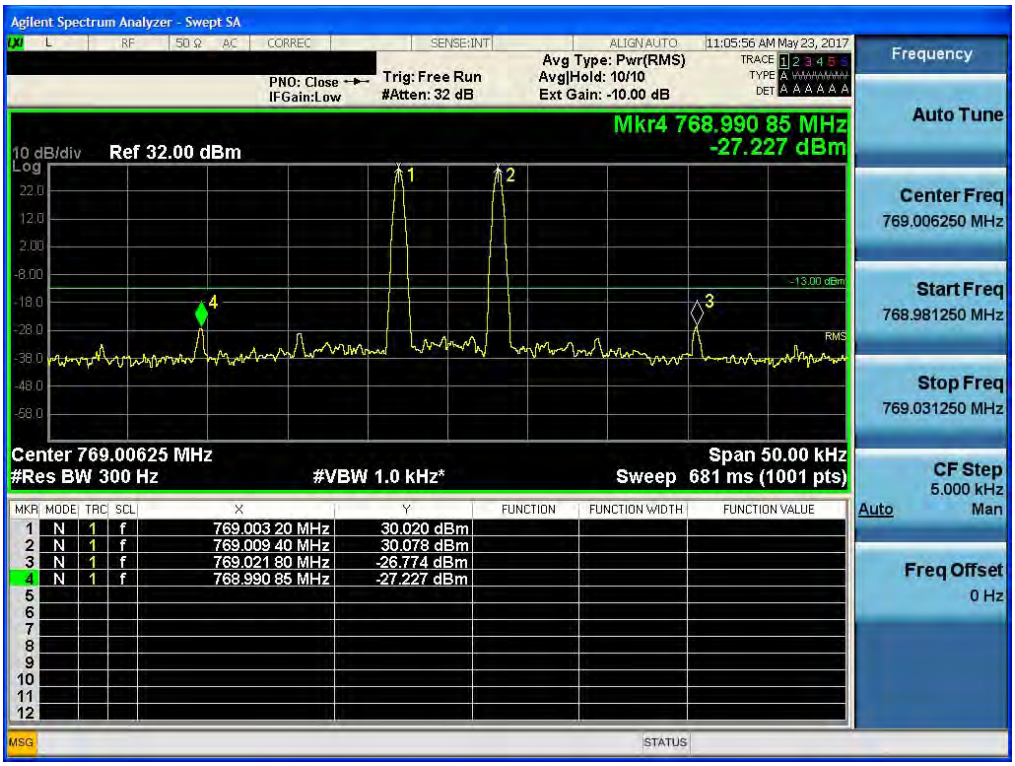
9 kHz ~ 150 kHz	150 kHz ~ 30 MHz
	
30 MHz ~ 1 GHz	**1 GHz ~ 3 GHz**

3 GHz ~ 12.75 GHz

Intermodulation Spurious Emissions

700 APCO 25(6.25 kHz)_DL

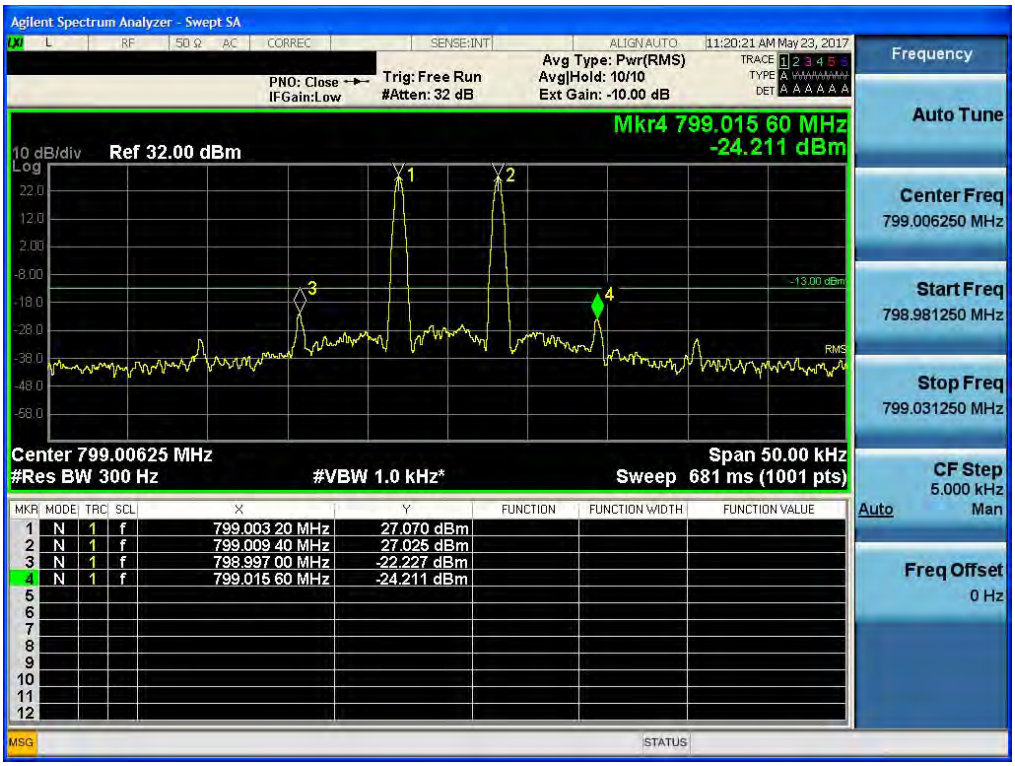
[Downlink - Low]



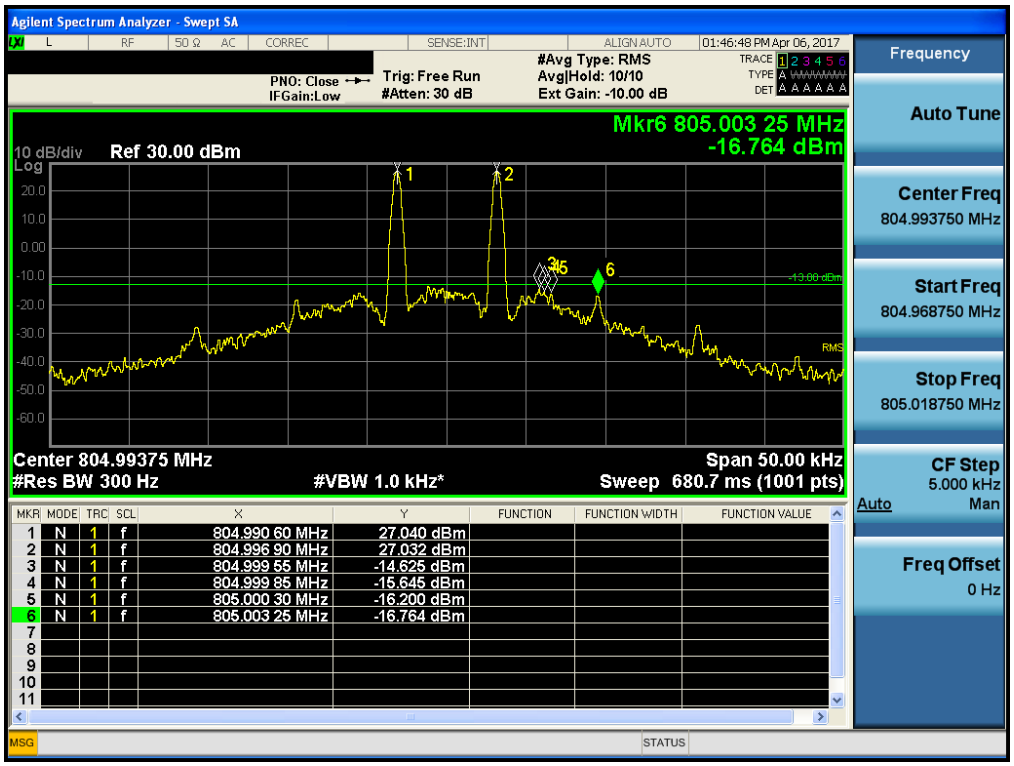
[Downlink - High]

700 APCO 25(6.25 kHz)_UL

[Uplink - Low]

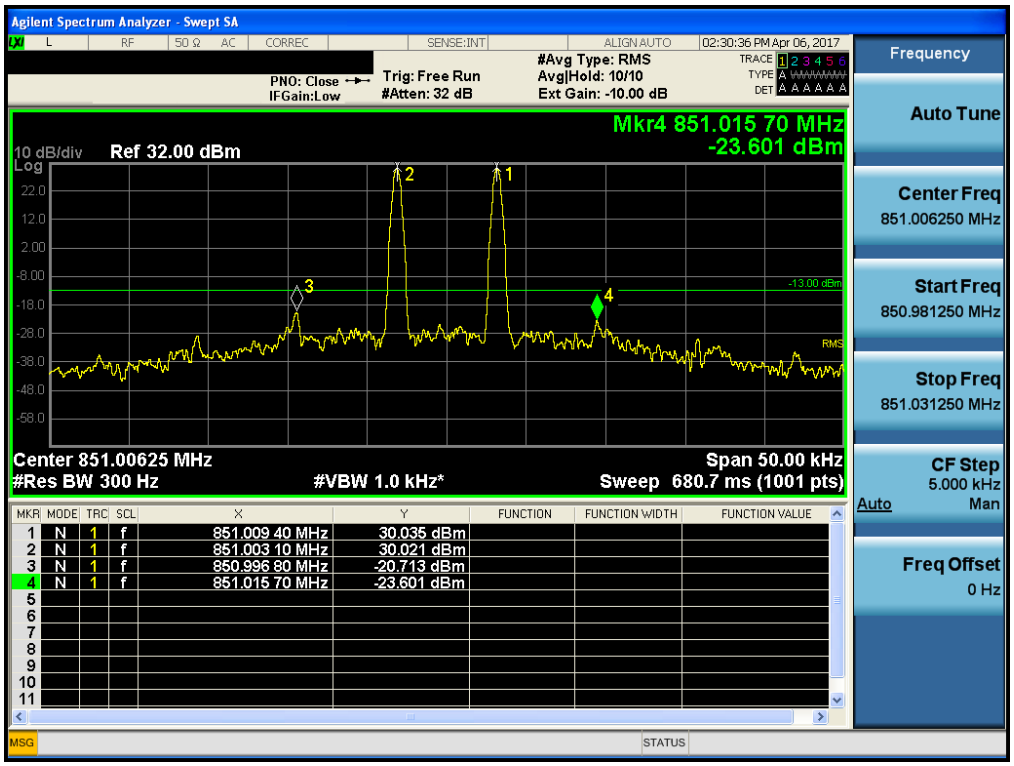


[Uplink - High]

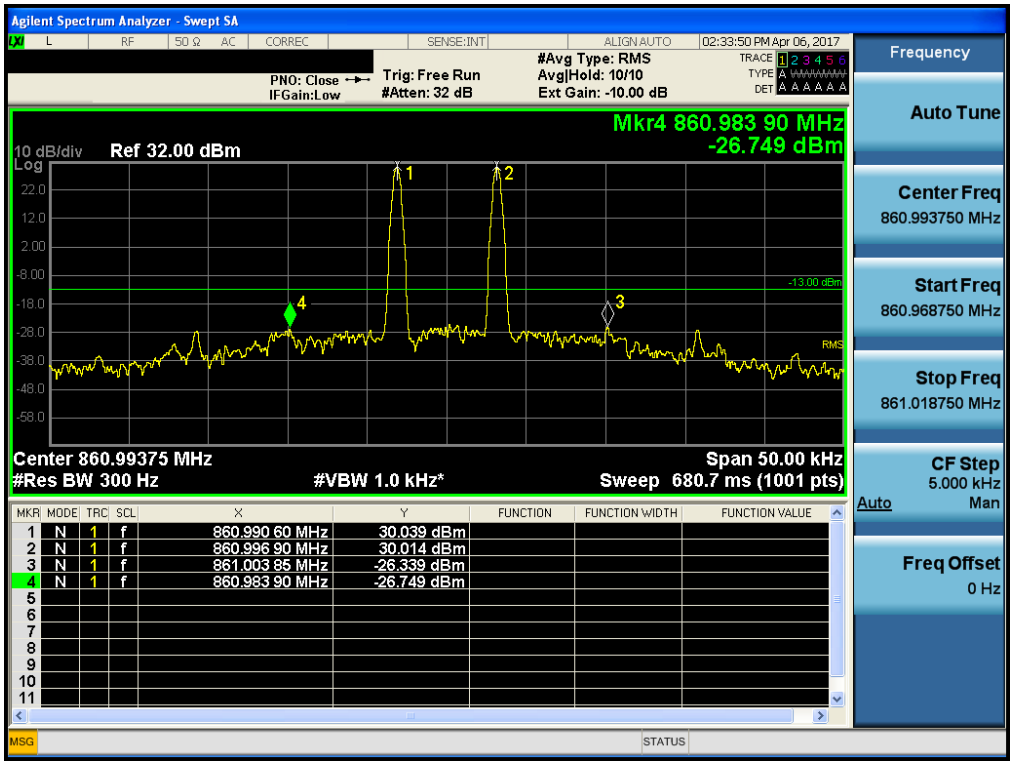


800 APCO 25(6.25 kHz)_DL

[Downlink - Low]

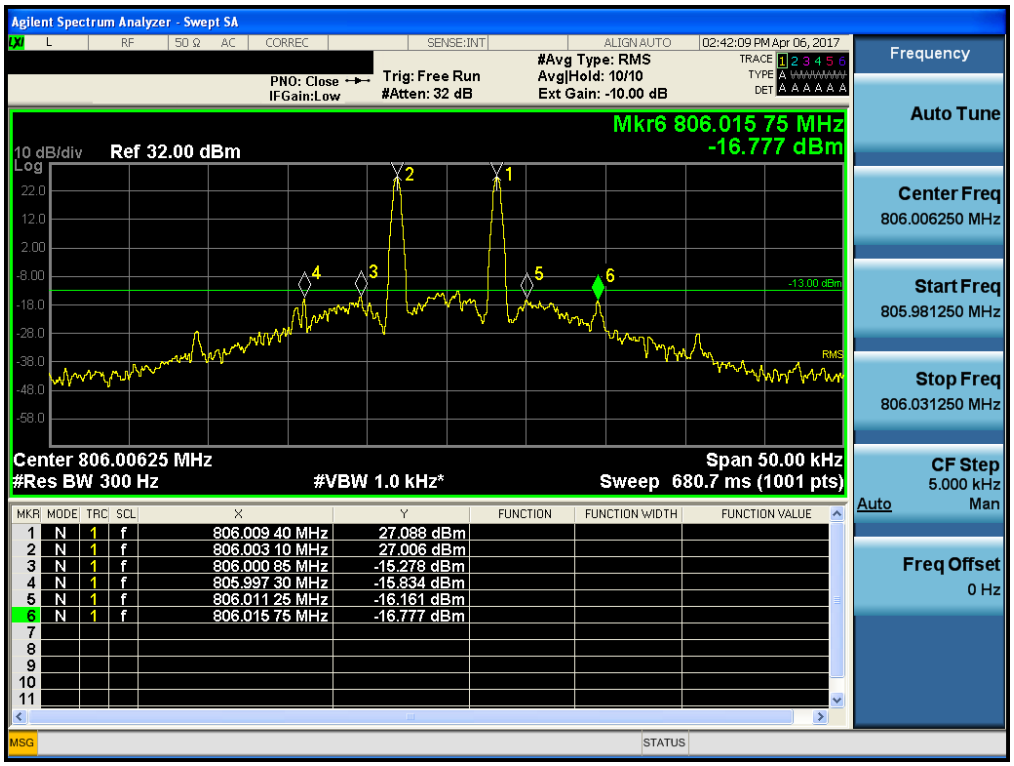


[Downlink - High]

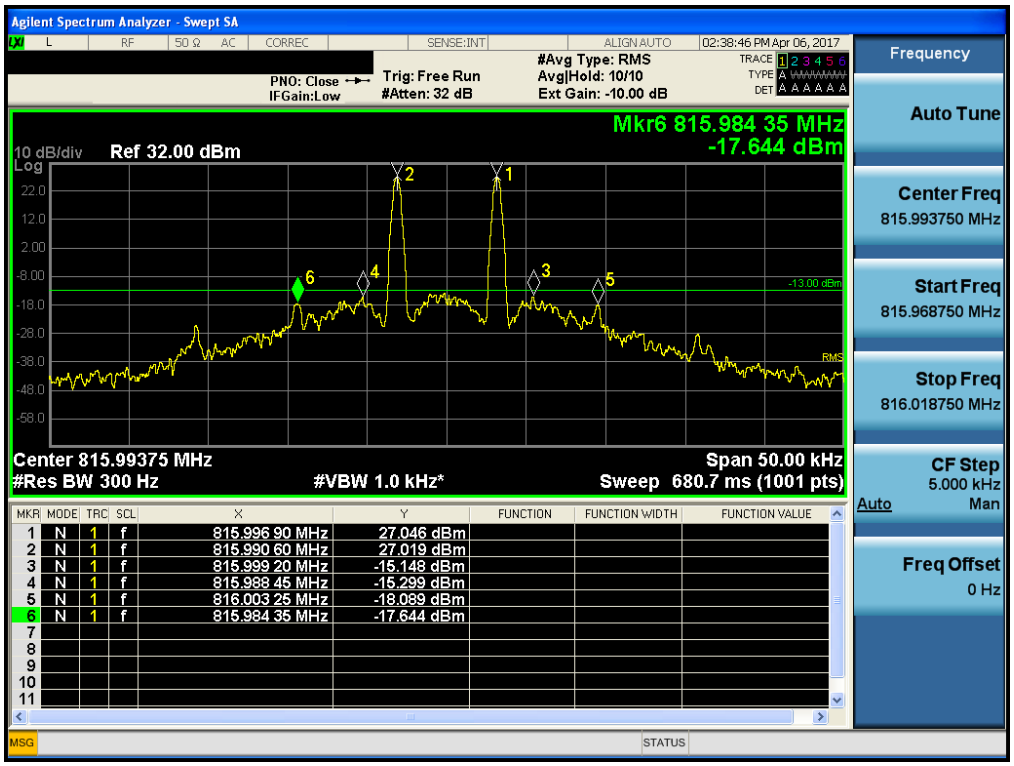


800 APCO 25(6.25 kHz)_UL

[Uplink - Low]



[Uplink - High]



BAND EDGE

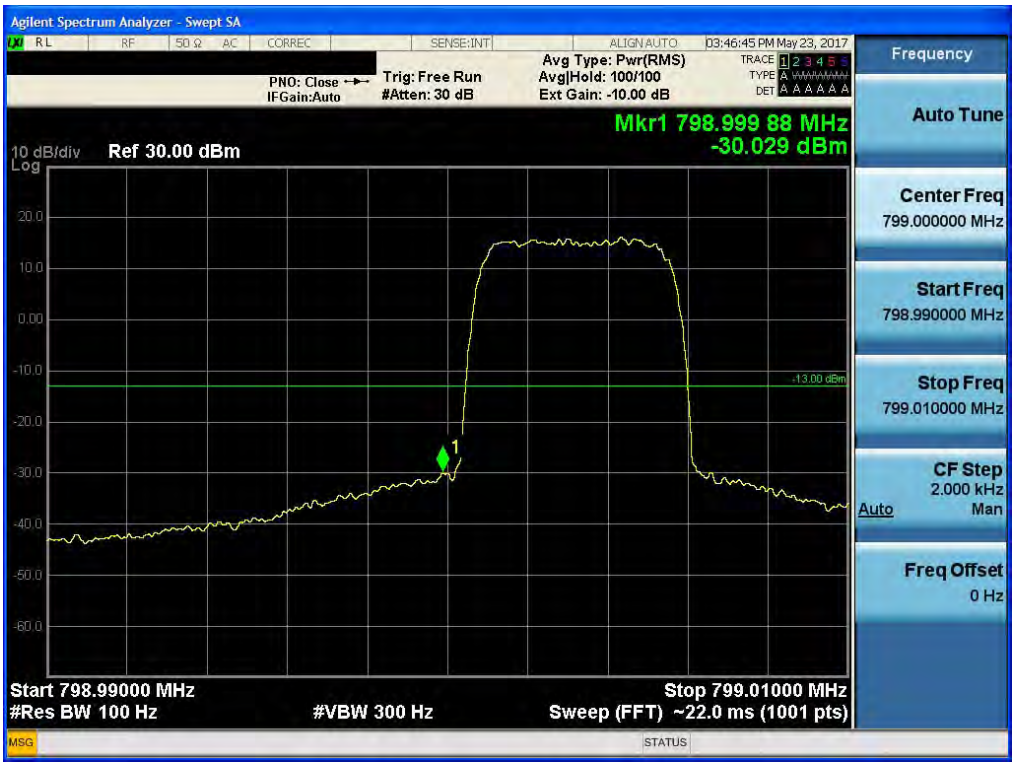
700 APCO 25(6.25 kHz)_DL

[Downlink - Low]

[Downlink - High]

700 APCO 25(6.25 kHz)_UL

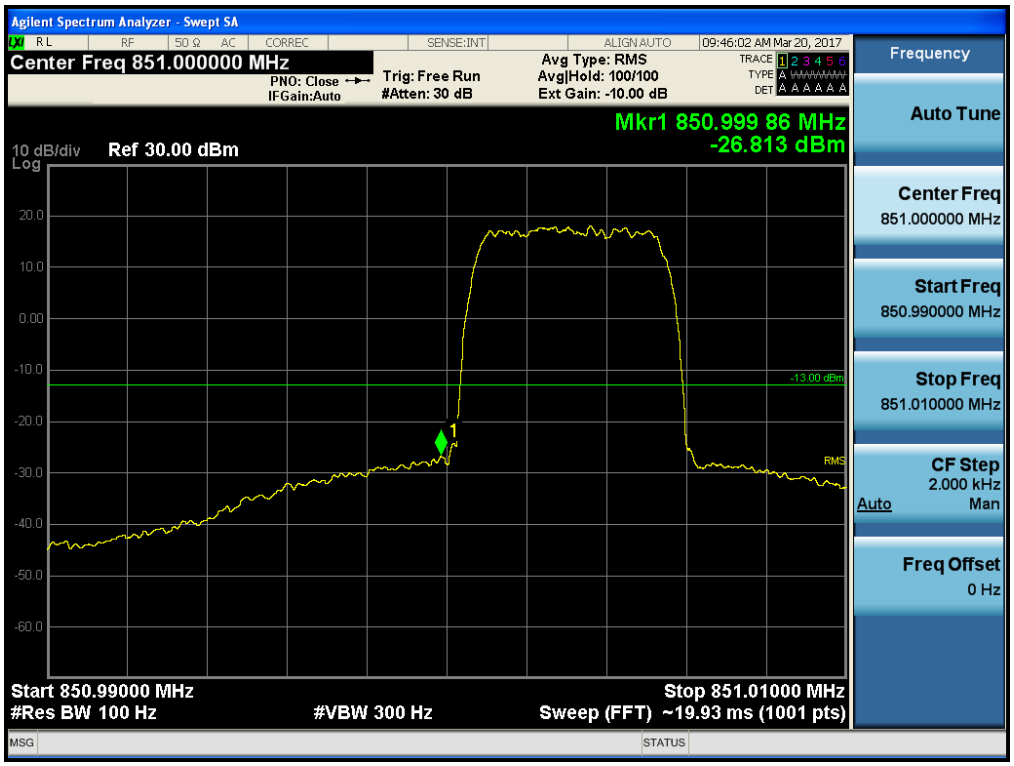
[Uplink - Low]



[Uplink - High]

800 APCO 25(6.25 kHz)_DL

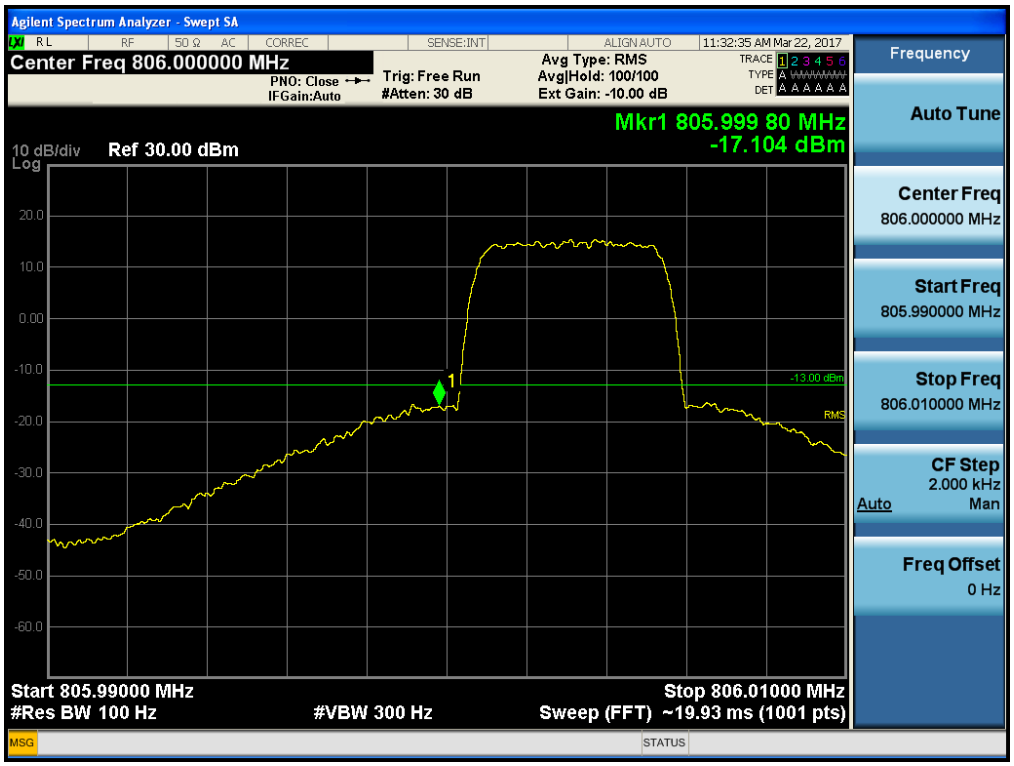
[Downlink - Low]



[Downlink - High]

800 APCO 25(6.25 kHz)_UL

[Uplink - Low]

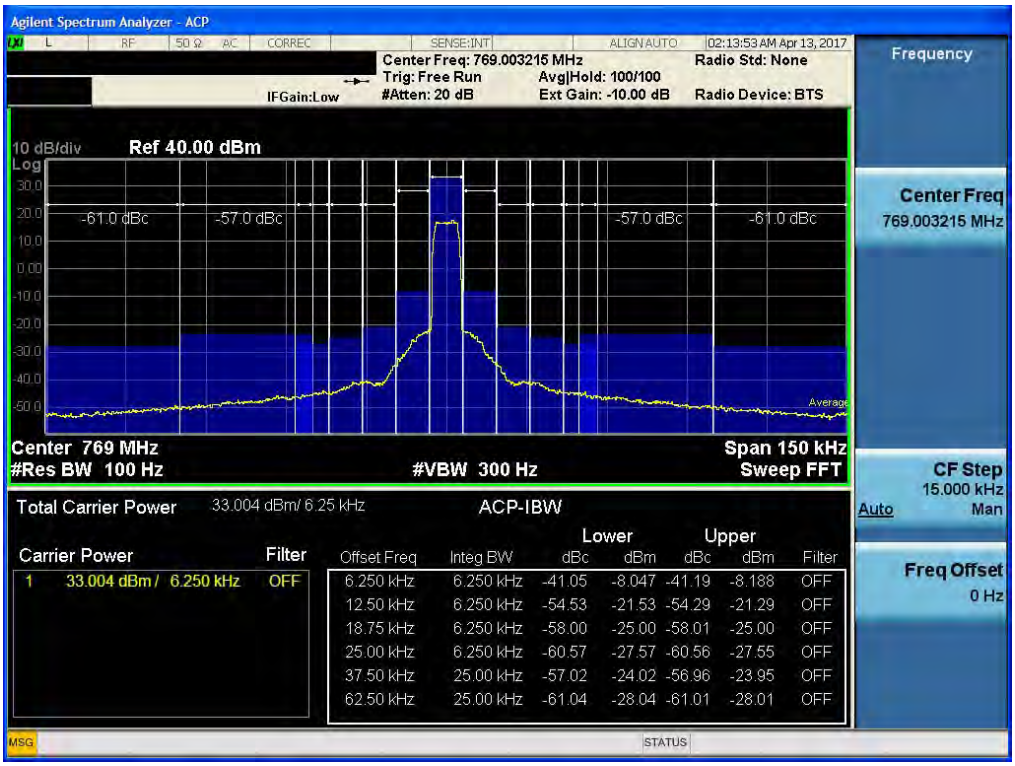


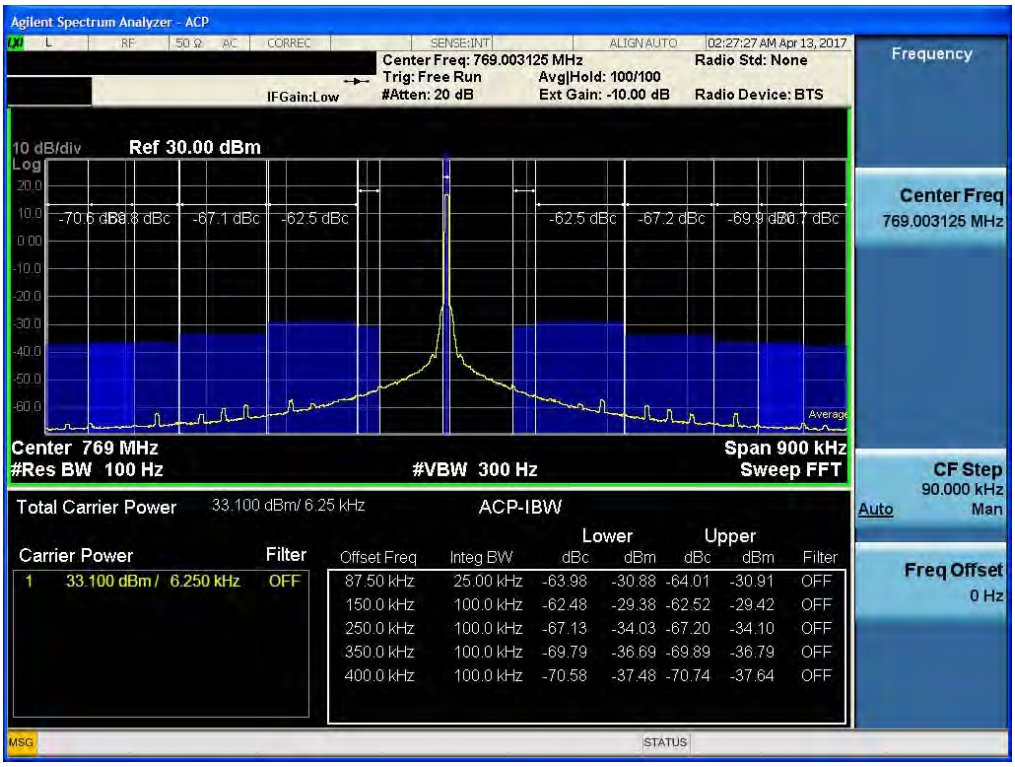
[Uplink - High]

ACP

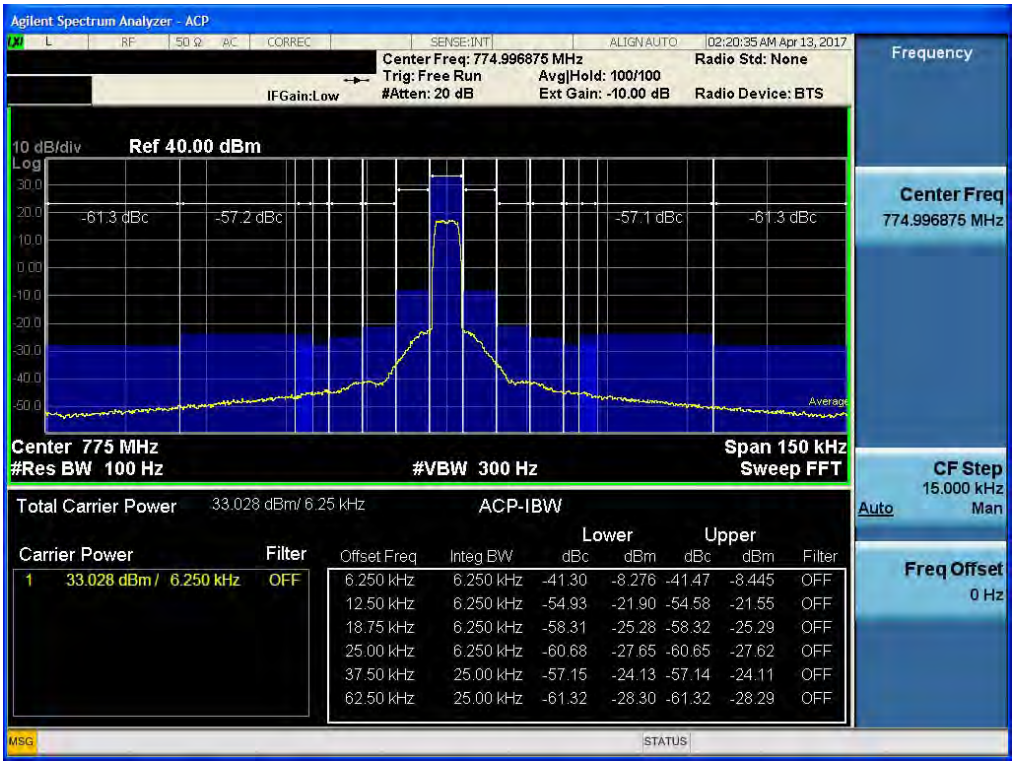
700 APCO 25(6.25 kHz)_DL

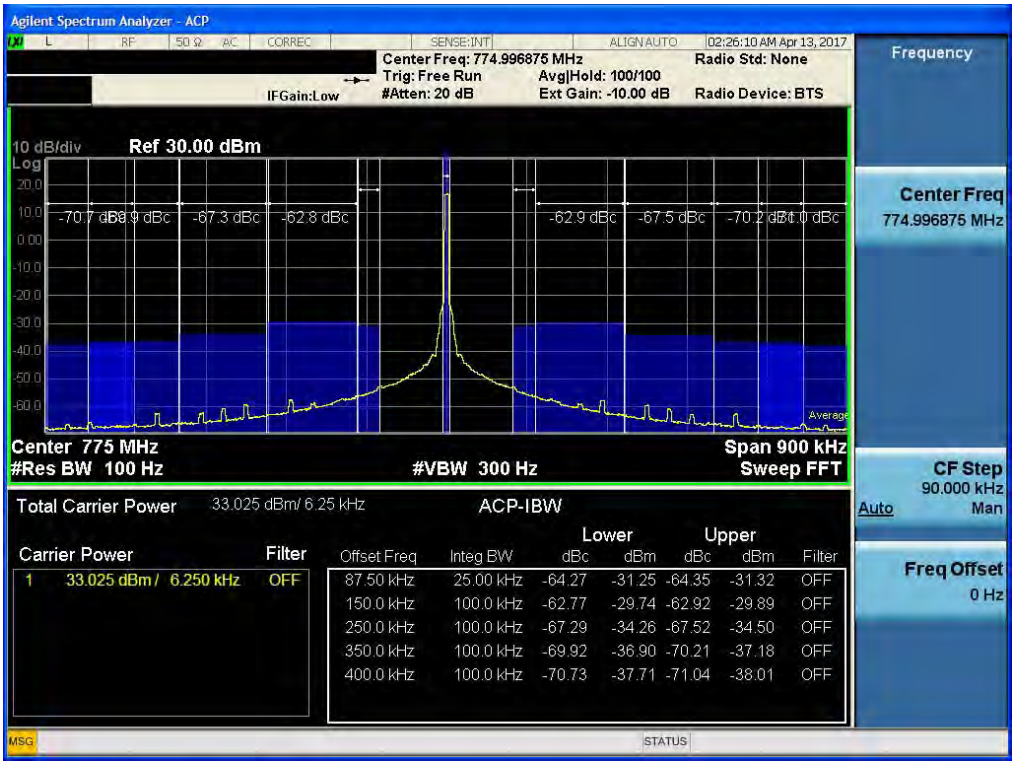
[Low]





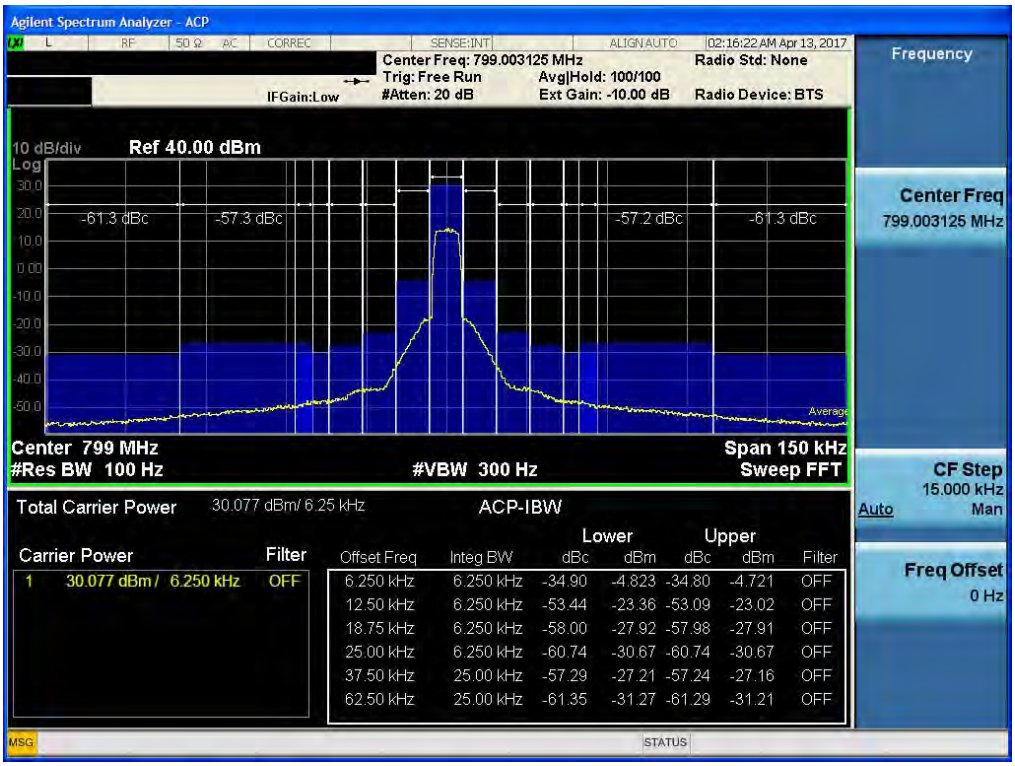
[High]

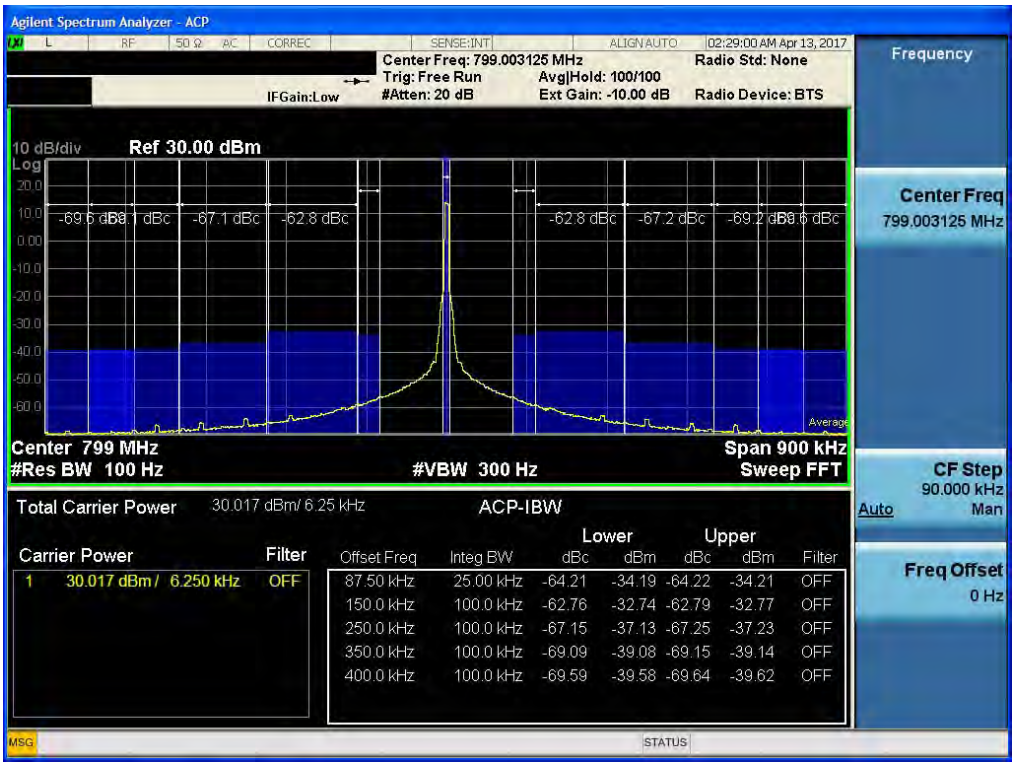

Agilent Spectrum Analyzer - ACP
02:20:35 AM Apr 13, 2017
Center Freq: 774.996875 MHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 20 dB
Ext Gain: -10.00 dB
Radio Std: None
Radio Device: BTS
IFGain:Low
10 dB/div
Ref 40.00 dBm
-61.3 dBc
-57.2 dBc
-57.1 dBc
-61.3 dBc
Center 775 MHz
#Res BW 100 Hz
#VBW 300 Hz
Span 150 kHz
Sweep FFT
Total Carrier Power 33.028 dBm/ 6.25 kHz
ACP-IBW
Carrier Power
Filter
1 33.028 dBm / 6.250 kHz OFF
Offset Freq Integ BW Lower dBc dBm Upper dBc dBm Filter
6.250 kHz 6.250 kHz -41.30 -8.276 -41.47 -8.445 OFF
12.50 kHz 6.250 kHz -54.93 -21.90 -54.58 -21.55 OFF
18.75 kHz 6.250 kHz -58.31 -25.28 -58.32 -25.29 OFF
25.00 kHz 6.250 kHz -60.68 -27.65 -60.65 -27.62 OFF
37.50 kHz 25.00 kHz -57.15 -24.13 -57.14 -24.11 OFF
62.50 kHz 25.00 kHz -61.32 -28.30 -61.32 -28.29 OFF
Frequency
Center Freq
774.996875 MHz
CF Step
15.000 kHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - ACP
02:26:10 AM Apr 13, 2017
Center Freq: 774.996875 MHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 20 dB
Ext Gain: -10.00 dB
Radio Std: None
Radio Device: BTS
IFGain:Low
10 dB/div
Ref 30.00 dBm
-70.7 dBc
-68.9 dBc
-67.3 dBc
-62.8 dBc
-62.9 dBc
-67.5 dBc
-70.2 dBc
-70.0 dBc
Center 775 MHz
#Res BW 100 Hz
#VBW 300 Hz
Span 900 kHz
Sweep FFT
Total Carrier Power 33.025 dBm/ 6.25 kHz
ACP-IBW
Carrier Power
Filter
1 33.025 dBm / 6.250 kHz OFF
Offset Freq Integ BW Lower dBc dBm Upper dBc dBm Filter
87.50 kHz 25.00 kHz -64.27 -31.25 -64.35 -31.32 OFF
150.0 kHz 100.0 kHz -62.77 -29.74 -62.92 -29.89 OFF
250.0 kHz 100.0 kHz -67.29 -34.26 -67.52 -34.50 OFF
350.0 kHz 100.0 kHz -69.92 -36.90 -70.21 -37.18 OFF
400.0 kHz 100.0 kHz -70.73 -37.71 -71.04 -38.01 OFF
Frequency
Center Freq
774.996875 MHz
CF Step
90.000 kHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS

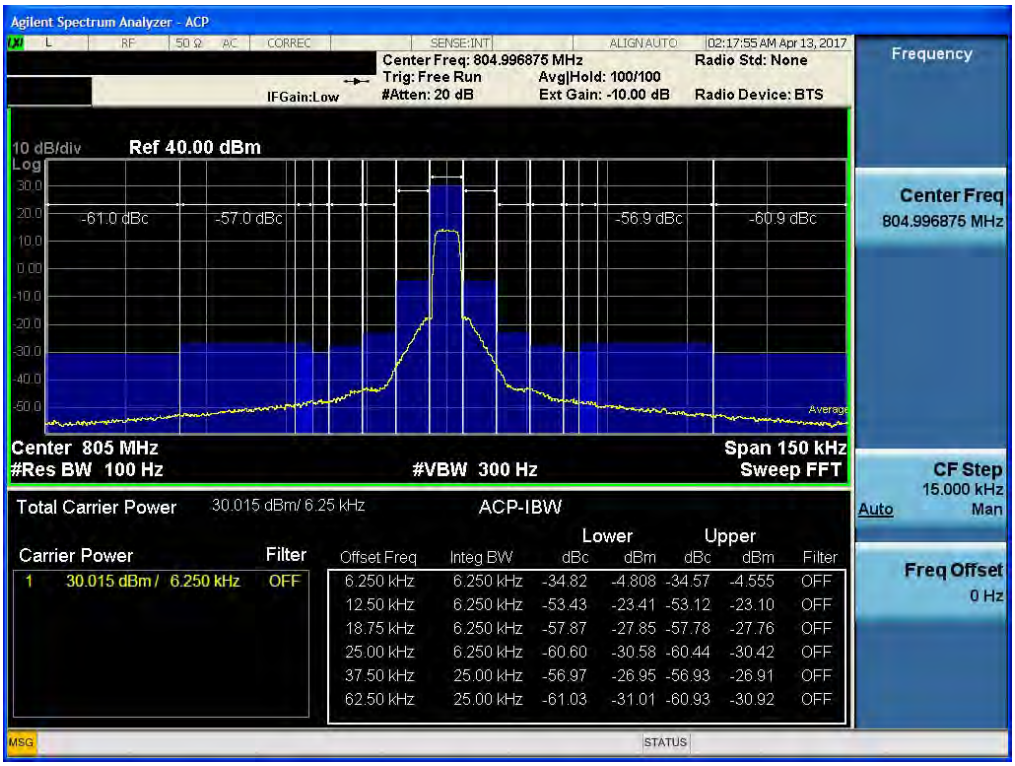
700 APCO 25(6.25 kHz)_UL

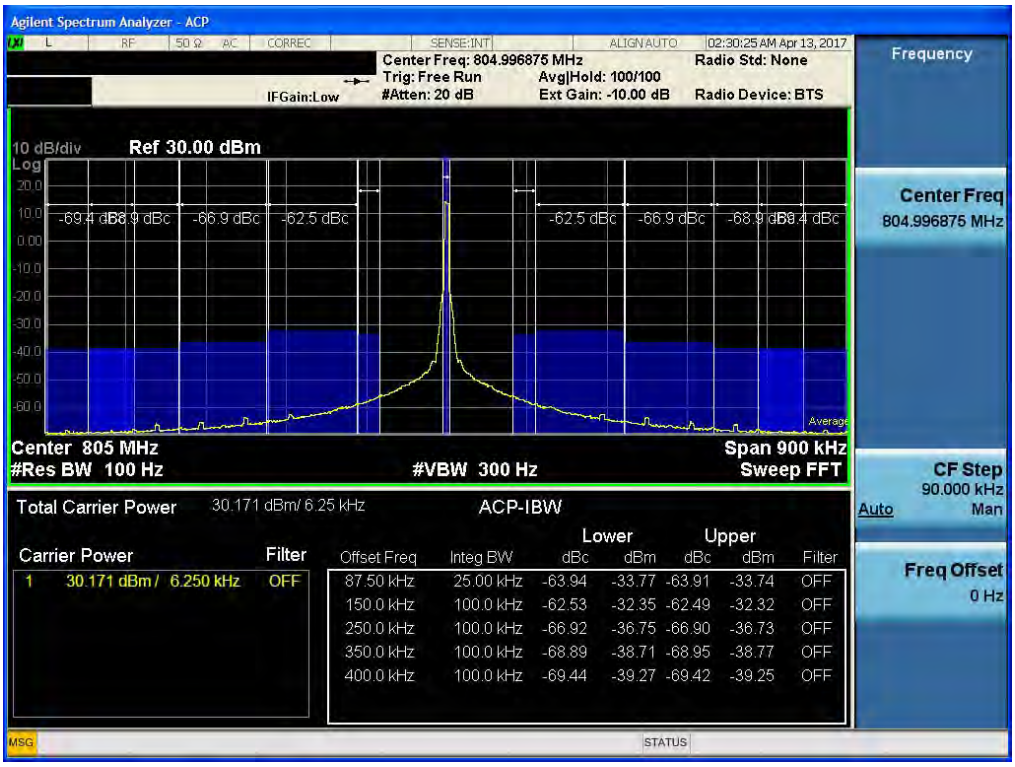
[Low]





[High]


Agilent Spectrum Analyzer - ACP
02:17:55 AM Apr 13, 2017
Center Freq: 804.996875 MHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 20 dB
Ext Gain: -10.00 dB
Radio Std: None
Radio Device: BTS
IFGain:Low
10 dB/div
Ref 40.00 dBm
-61.0 dBc
-57.0 dBc
-56.9 dBc
-60.9 dBc
Center 805 MHz
#Res BW 100 Hz
#VBW 300 Hz
Span 150 kHz
Sweep FFT
Total Carrier Power 30.015 dBm/ 6.25 kHz
ACP-IBW
Carrier Power
Filter
1 30.015 dBm / 6.250 kHz OFF
Offset Freq Integ BW Lower dBc Lower dBm Upper dBc Upper dBm Filter
6.250 kHz 6.250 kHz -34.82 -4.808 -34.57 -4.555 OFF
12.50 kHz 6.250 kHz -53.43 -23.41 -53.12 -23.10 OFF
18.75 kHz 6.250 kHz -57.87 -27.85 -57.78 -27.76 OFF
25.00 kHz 6.250 kHz -60.60 -30.58 -60.44 -30.42 OFF
37.50 kHz 25.00 kHz -56.97 -26.95 -56.93 -26.91 OFF
62.50 kHz 25.00 kHz -61.03 -31.01 -60.93 -30.92 OFF
Frequency
Center Freq
804.996875 MHz
CF Step
15.000 kHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - ACP
02:30:25 AM Apr 13, 2017
Center Freq: 804.996875 MHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 20 dB
Ext Gain: -10.00 dB
Radio Std: None
Radio Device: BTS
IFGain:Low
10 dB/div
Ref 30.00 dBm
-69.4 dBc
-66.9 dBc
-62.5 dBc
-62.5 dBc
-66.9 dBc
-68.9 dBc
Center 805 MHz
#Res BW 100 Hz
#VBW 300 Hz
Span 900 kHz
Sweep FFT
Total Carrier Power 30.171 dBm/ 6.25 kHz
ACP-IBW
Carrier Power
Filter
1 30.171 dBm / 6.250 kHz OFF
Offset Freq Integ BW Lower dBc Lower dBm Upper dBc Upper dBm Filter
87.50 kHz 25.00 kHz -63.94 -33.77 -63.91 -33.74 OFF
150.0 kHz 100.0 kHz -62.53 -32.35 -62.49 -32.32 OFF
250.0 kHz 100.0 kHz -66.92 -36.75 -66.90 -36.73 OFF
350.0 kHz 100.0 kHz -68.89 -38.71 -68.95 -38.77 OFF
400.0 kHz 100.0 kHz -69.44 -39.27 -69.42 -39.25 OFF
Frequency
Center Freq
804.996875 MHz
CF Step
90.000 kHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS

12. RADIATED SPURIOUS EMISSIONS

FCC Rules

Test Requirements:

§ 2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

IC Rules

Test Requirements:

RSS-Gen

7. Receiver Limits

7.1 Receiver Emission Limits

7.1.2 Receiver Radiated Limits

Radiated emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals. The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least 5x the highest tunable or local

oscillator frequency, whichever is higher, without exceeding 40 GHz.

Spurious emissions from receivers shall not exceed the radiated limits shown in Table 2 below:

Table 2 – Receiver Radiated Limits	
Frequency (MHz)	**Field Strength (µv/m at 3 metres)***
30-88	100
88-216	150
216-960	200
Above 960	500

Footnote *

Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 6.5.

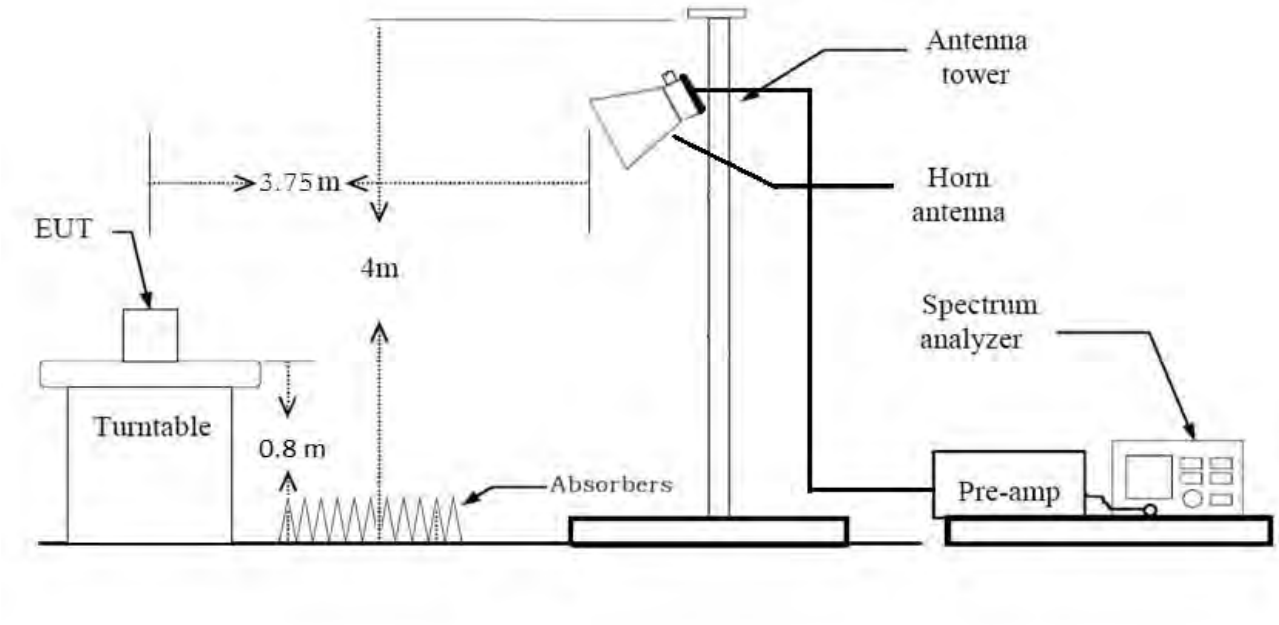
Test Procedures:

As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of ANSI/TIA-603-C-2004 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber.

The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360and the receiving antenna scanned from 1-3m in order to capture the maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried. out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

Radiated Spurious Emissions Test Setup



Note :

1. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
2. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)

Receiver Spurious Emissions Test Result:

ISED Rule(s):	**RSS-GEN**
Test Requirements:	**Blow the table**
Operating conditions:	**Under normal test conditions**
Method of testing:	**Radiated**
S/A. Settings:	**F < 1 GHz: RBW: 120 kHz, VBW: 300 kHz (Quasi Peak)** **F > 1 GHz: RBW: 1 MHz, VBW: 1 MHz (Peak)**
Mode of operation:	**Receive**

Frequency (MHz)	Field Strength (microvolts/m at 3 meters)
30 – 88	100
88 - 216	150
216 – 960	200
Above 960	500

Operation Mode: Receive:

30 MHz ~ 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV	dB /m	dB	(H/V)	dBμV/m	dBμV/m	dB
No critical peaks found							

Above 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV	dB /m	dB	(H/V)	dBμV/m	dBμV/m	dB
No critical peaks found							

Radiated Spurious Emissions Test Result:

PS 700

[Downlink]

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

[Uplink]

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

PS 800

[Downlink]

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

[Uplink]

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

13. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

FCC Rules

Test Requirements:

§ 2.1055 Measurements required: Frequency stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

§ 90.213 Frequency stability.

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Minimum Frequency Stability [Parts per million (ppm)]

Frequency range (MHz)	**Fixed and base stations**	**Mobile stations**	
		Over 2 watts output	**2 watts or less output**
Below 25	100	100	200
25-50	20	20	50
72-76	5		50
150-174	5	5	[4]50
216-220	1.0		1.0
220-222[12]	0.1	1.5	1.5
421-512	2.5	5	5
806-809	1.0	1.5	1.5
809-824	1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928[13]	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	300	300	300
Above 2450			

(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

§ 90.539 Frequency stability.

Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the frequency stability requirements in this section.

(a) Mobile, portable and control transmitters must normally use automatic frequency control (AFC) to lock on to the base station signal.

(b) The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better.

(c) The frequency stability of mobile, portable, and control transmitters operating in the narrowband segment must be 400 parts per billion or better when AFC is locked to the base station. When AFC is not locked to the base station, the frequency stability must be at least 1.0 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2 channel aggregate), and 2.5 ppm for 25 kHz (4 channel aggregate).

(d) The frequency stability of base transmitters operating in the wideband segment must be 1 part per million or better.

(e) The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

IC Rules

Test Requirements:

RSS-119

5. Transmitter and Receiver Specifications

5.3 Transmitter Frequency Stability

The carrier frequency shall not depart from the reference frequency in excess of the values given in Table 1. For transmitters that have an output power of less than 120 mW, the frequency stability shall comply with the limits listed in Table 1 or, alternatively, with the conditions in Section 5.10.

For fixed and base station equipment, in lieu of meeting the frequency stability limit specified in Table 1, the test report can show that the frequency stability is met by demonstrating that the unwanted emission limits, related to the equipment's nominal carrier frequency measured under normal operation, are met when the equipment is tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

Table 1 — Transmitter Frequency Stability				
Frequency Band (MHz)	**Channel Bandwidth (kHz)**	**Frequency Stability (ppm)**		
		Base/Fixed	**Mobile Station**	
			Output	**Output**

			Power >2 W	Power ≤2 W
27.41-28 and 29.7-50	20	20	20	50
72-76	20	5	20	50
138-174	30	5	5	5
	15	2.5	5	5
	7.5	1	2	5
217-218 and 219-220	12.5	1	5	5
220-222	5	0.1	1.5	1.5
406.1-430 and 450-470	25	0.5	1	1
	25	2.5	5	5
	12.5	1.5	2.5	2.5
	6.25	0.5	1	1
768-776 and 798-806	25	0.1	0.4	0.4
	12.5			
	6.25			
	50	1	1.25	1.25
806-821/851-866 and 821-824/866- 869	25	0.1	0.1	0.1
	25	1.5	2.5	2.5
	12.5	1	1.5	1.5
	6.25	0.1	0.4	0.4
896-901/935-940	12.5	0.1	1.5	1.5
929-930/931-932	25	1.5	N/A	N/A
928-929/952-953 and 932-932.5/941- 941.5	25	1.5	N/A	N/A
	12.5	1	3 (for remote station)	N/A
932.5-935/941.5-944	25	2.5	N/A	N/A
	12.5	2.5	N/A	N/A

Test Procedures:

As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Spectrum Analyzer.

The EUT was placed in the Environmental Chamber.

A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.

The frequency drift was investigated for every 10 °C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50 °C.

Voltage supplied to EUT is 110 Vac reference temperature was done at 20°C.

The voltage was varied by ± 15 % of nominal

RSS-131

4. Measurement Methods

4.5 Frequency Stability of Band Translators

In addition, the local oscillator frequency stability of the band translator shall be reported. Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20°C and rated supply voltage. The following temperature and supply voltage ranges apply:

a. at 10 degree intervals of temperatures between -30°C and +50°C, and at the manufacturer'srated-supply voltage; and
b. at +20°C temperature and ± 15% supply voltage variations.

Frequency Stability and Voltage Test Results

PS 700

[Downlink]

Reference: 120 Vac at 20°C **Freq.** = 772.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	771 999 998	-1.618	0.000	0.00000
	-30	771 999 998	-2.413	-0.795	-0.00031
	-20	772 000 000	0.163	1.781	0.00069
	-10	772 000 002	1.846	3.464	0.00134
	0	772 000 001	0.697	2.315	0.00089
	+10	771 999 998	-1.933	-0.315	-0.00012
	+30	772 000 001	0.678	2.296	0.00089
	+40	772 000 000	-0.375	1.243	0.00048
	+50	771 999 999	-0.819	0.799	0.00031
High	+20	772 000 001	1.195	2.813	0.00108
Low	+20	772 000 001	1.294	2.912	0.00112

[Uplink]

Reference: 120 Vac at 20°C **Freq.** = 802.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	802 000 000	0.030	0.000	0.00000
	-30	802 000 000	-0.436	-0.466	-0.00018
	-20	802 000 000	0.217	0.187	0.00007
	-10	801 999 998	-1.639	-1.669	-0.00064
	0	802 000 002	1.522	1.492	0.00058
	+10	802 000 002	2.387	2.357	0.00091
	+30	802 000 001	0.965	0.935	0.00036
	+40	801 999 998	-1.724	-1.754	-0.00068
	+50	801 999 999	-0.933	-0.963	-0.00037
High	+20	802 000 001	0.852	0.822	0.00032
Low	+20	802 000 001	0.645	0.615	0.00024

PS 800

[Downlink]

Reference: 110 Vac at 20°C **Freq.** = 856.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	856 000 000	0.247	0.000	0.00000
	-30	856 000 000	0.338	0.091	0.00004
	-20	856 000 000	-0.047	-0.294	-0.00011
	-10	856 000 000	-0.172	-0.419	-0.00016
	0	856 000 000	0.112	-0.135	-0.00005
	+10	856 000 000	-0.067	-0.314	-0.00012
	+30	856 000 000	0.109	-0.138	-0.00005
	+40	856 000 000	-0.170	-0.417	-0.00016
	+50	856 000 000	0.064	-0.183	-0.00007
High	+20	856 000 000	0.266	0.019	0.00001
Low	+20	856 000 000	-0.301	-0.548	-0.00021

[Uplink]

Reference: 110 Vac at 20°C **Freq.** = 811.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	811 000 000	-0.032	0.000	0.00000
	-30	811 000 000	0.241	0.273	0.00011
	-20	811 000 000	0.066	0.098	0.00004
	-10	811 000 000	0.428	0.460	0.00018
	0	811 000 000	0.007	0.039	0.00002
	+10	811 000 000	0.133	0.165	0.00006
	+30	811 000 000	0.068	0.100	0.00004
	+40	811 000 000	-0.148	-0.116	-0.00004
	+50	811 000 000	0.164	0.196	0.00008
High	+20	811 000 000	-0.104	-0.072	-0.00003
Low	+20	811 000 000	-0.022	0.010	0.00000