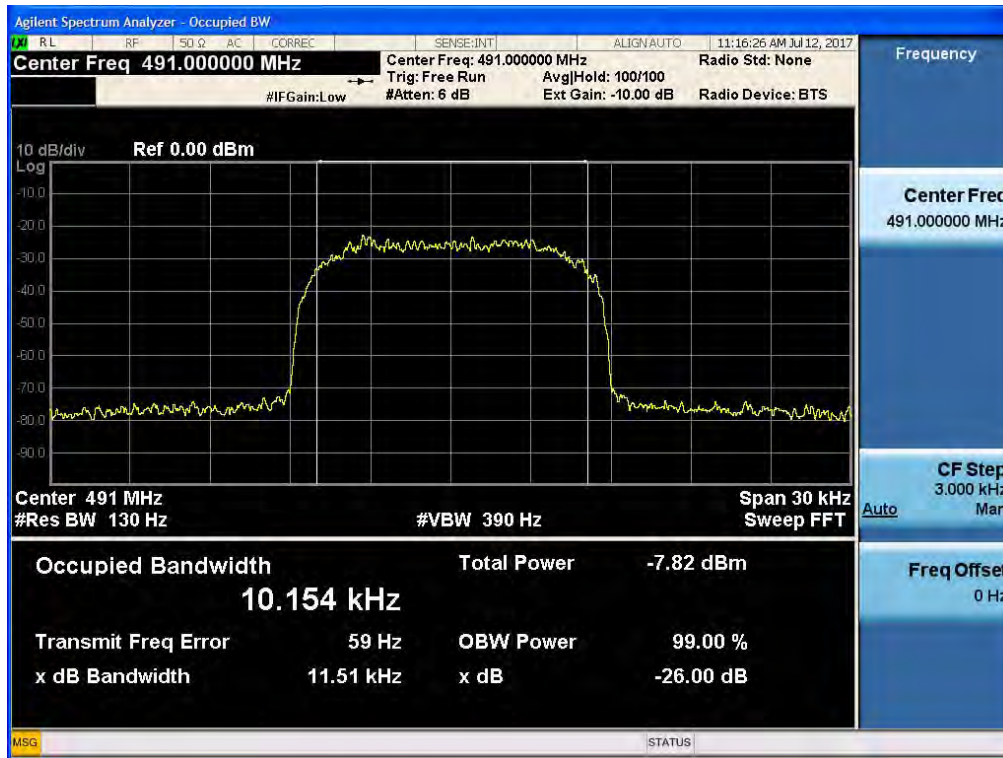


[UHF +3dB above the AGC threshold Uplink - Middle]

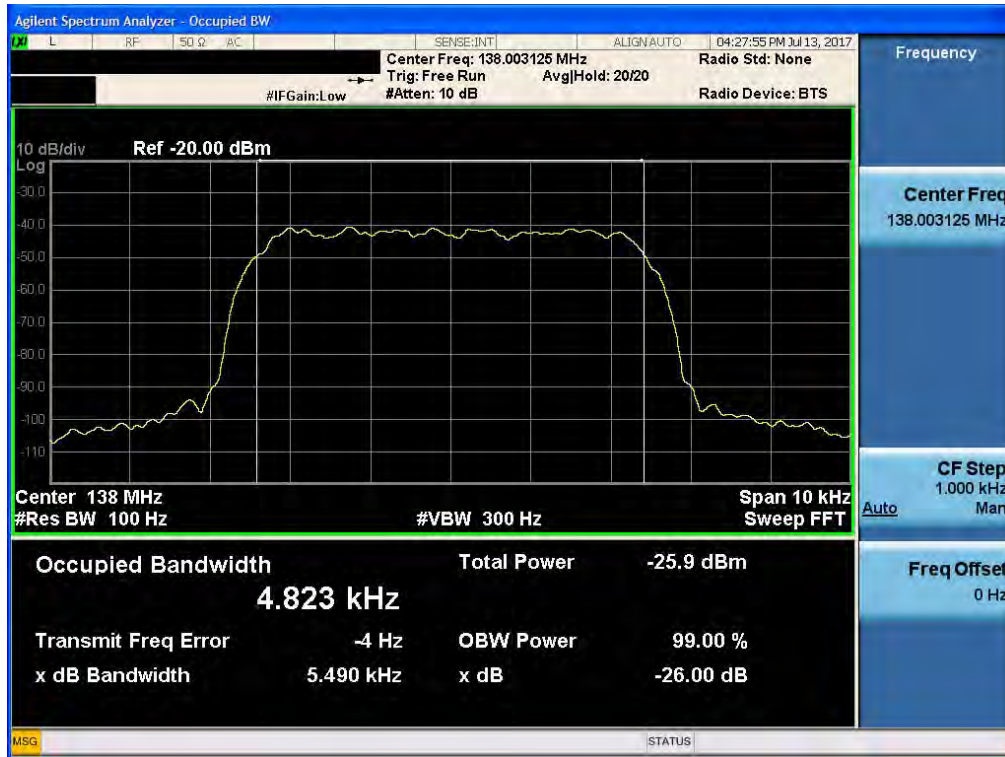


[UHF +3dB above the AGC threshold Uplink - High]



VHF(APCO25_138 MHz) DL_Input

[VHF AGC threshold Downlink - Low]



VHF(APCO25_150 ~ 174 MHz) DL_Input

[VHF AGC threshold Downlink - Low]



[VHF AGC threshold Downlink - Middle]



[VHF AGC threshold Downlink - High]



UHF(APCO_406.1 ~ 430 MHz) DL_Input

[UHF AGC threshold Downlink - Low]



[UHF AGC threshold Downlink - High]



UHF(APCO_450 ~ 470 MHz) DL_Input

[UHF AGC threshold Downlink - Low]

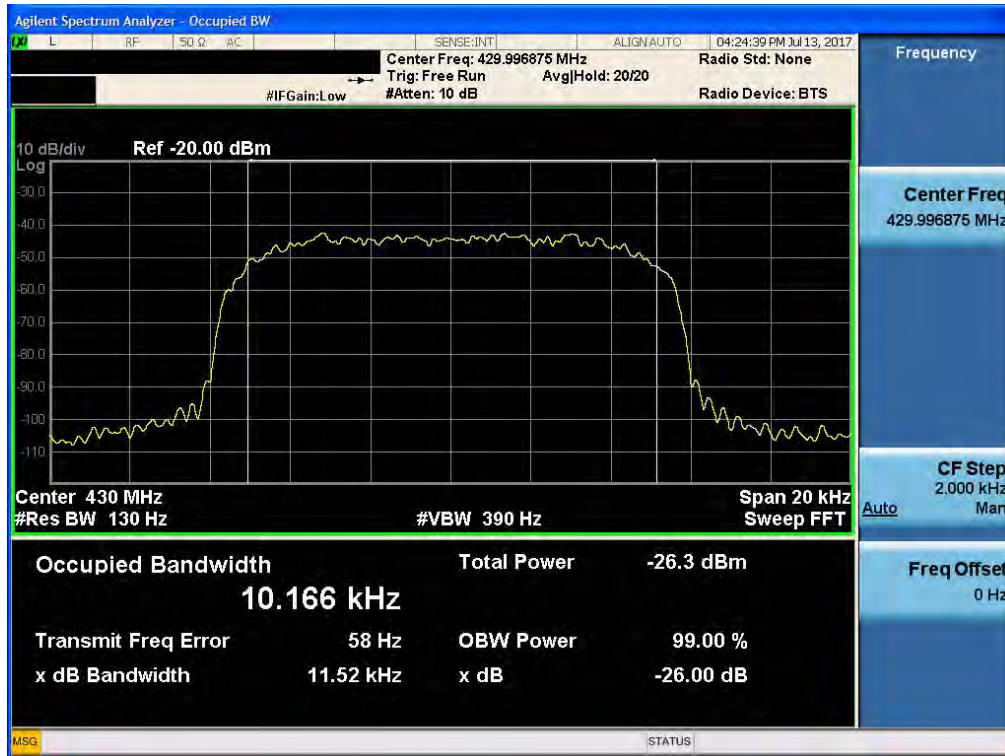


[UHF AGC threshold Downlink - High]



UHF(TETRA_450 ~ 470 MHz) DL_Input

[UHF AGC threshold Downlink - Low]



[UHF AGC threshold Downlink - High]



UHF(TETRA_470 ~ 512 MHz) DL_Input

[UHF AGC threshold Downlink - Low]



[UHF AGC threshold Downlink - Middle]



[UHF AGC threshold Downlink - High]



8. OUT OF BAND REJECTION

FCC/IC Rules

Test Requirement(s):

KDB 935210 D05 v01r01

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

RSS-131

5.2 Industrial Zone Enhancers

5.2.3 Mean output power and zone enhancer gain

The zone enhancer gain shall not exceed the nominal gain by more than 1.0 dB. Outside of the 20 dB bandwidth, the gain shall not exceed the gain at the 20 dB point

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

Adjust the internal gain control of the EUT (if so equipped) to the maximum gain for which equipment certification is sought

- a) Connect a signal generator to the input of the EUT.
- b) Configure a swept CW signal with the following parameters:
 - 1) Frequency range = $\pm 250\%$ of the passband, for each applicable CMRS band (see also KDB Publication 935210 D02 [R7] and KDB Publication 634817 [R5] about selection of frequencies for testing and for grant listings).
 - 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 = approximately 10 ms.
 - 4) Number of points = $\text{SPAN}/(\text{RBW}/2)$.
- c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- d) Set the span of the spectrum analyzer to the same as the frequency range of the signal generator.
- e) Set the resolution bandwidth (RBW) of the spectrum analyzer to be 1 % to 5 % of the EUT passband, and the video bandwidth (VBW) shall be set to $\geq 3 \times \text{RBW}$.
- f) Set the detector to Peak Max-Hold and wait for the spectrum analyzer's spectral display to fill.
- g) Place a marker to the peak of the frequency response and record this frequency as f_0 .
- h) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the -20 dB down amplitude, to determine the 20 dB bandwidth.

- i) Capture the frequency response of the EUT.
- j) Repeat for all frequency bands applicable for use by the EUT.

4.3 Out-of-band rejection

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

- a) Connect a signal generator to the input of the EUT.
- b) Configure a swept CW signal with the following parameters:
 - 1) Frequency range = ± 250 % of the manufacturer's specified pass band.
 - 2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold throughout the test.
 - 3) Dwell time = approximately 10 ms.
 - 4) Frequency step = 50 kHz.
- c) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- d) Set the RBW of the spectrum analyzer to between 1 % and 5 % of the manufacturer's rated passband, and VBW = $3 \times$ RBW.
- e) Set the detector to Peak and the trace to Max-Hold.
- f) After the trace is completely filled, place a marker at the peak amplitude, which is designated as f0, and with two additional markers (use the marker-delta method) at the 20 dB bandwidth (i.e., at the points where the level has fallen by 20 dB).
- g) Capture the frequency response plot for inclusion in the test report.

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

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
VHF	-15	-45	40	30
UHF	-15	-45	40	30

*** This device must be used with a duplexer by the user, and can be used with external filters. This test results were measured without duplexer or external filters. So, the test results were measured to be about ± 250 % of each pass band from the center frequency according to the test procedure.**

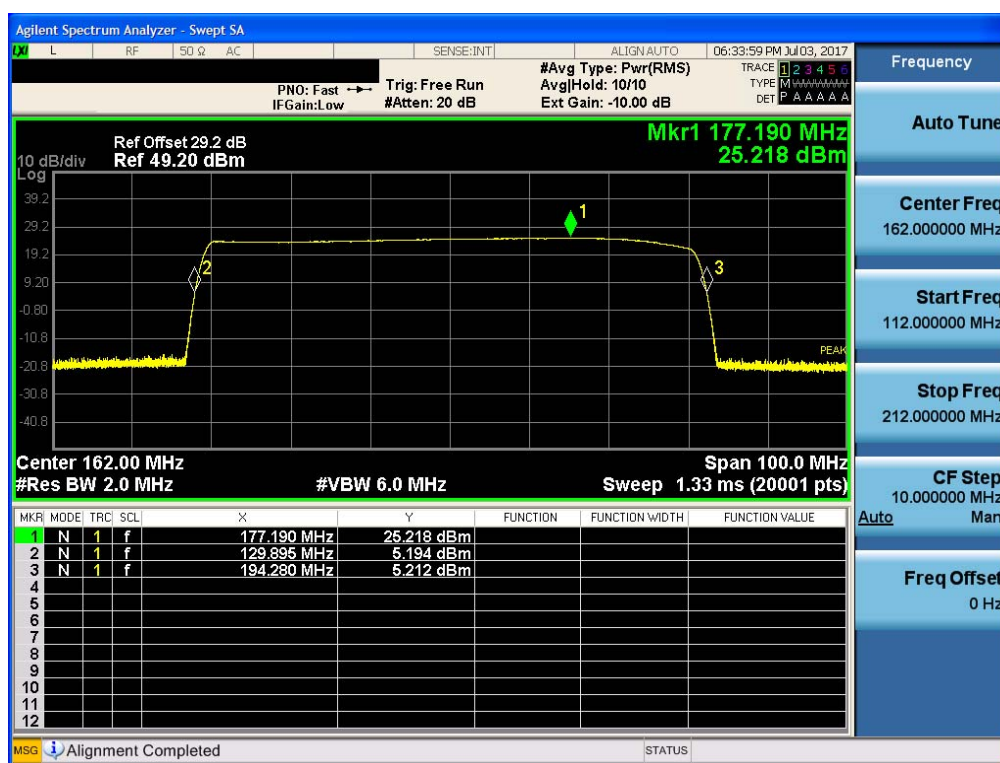
VHF

[Downlink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
129.895 ~ 194.280	25.218	40.218

Plots of Passband Gain and Bandwidth & Out of Band Rejection

[VHF Downlink]



* This device must be used with a duplexer by the user, and can be used with external filters. This test results were measured without duplexer or external filters. So, the test results were measured to be about ± 250 % of each pass band from the center frequency according to the test procedure.

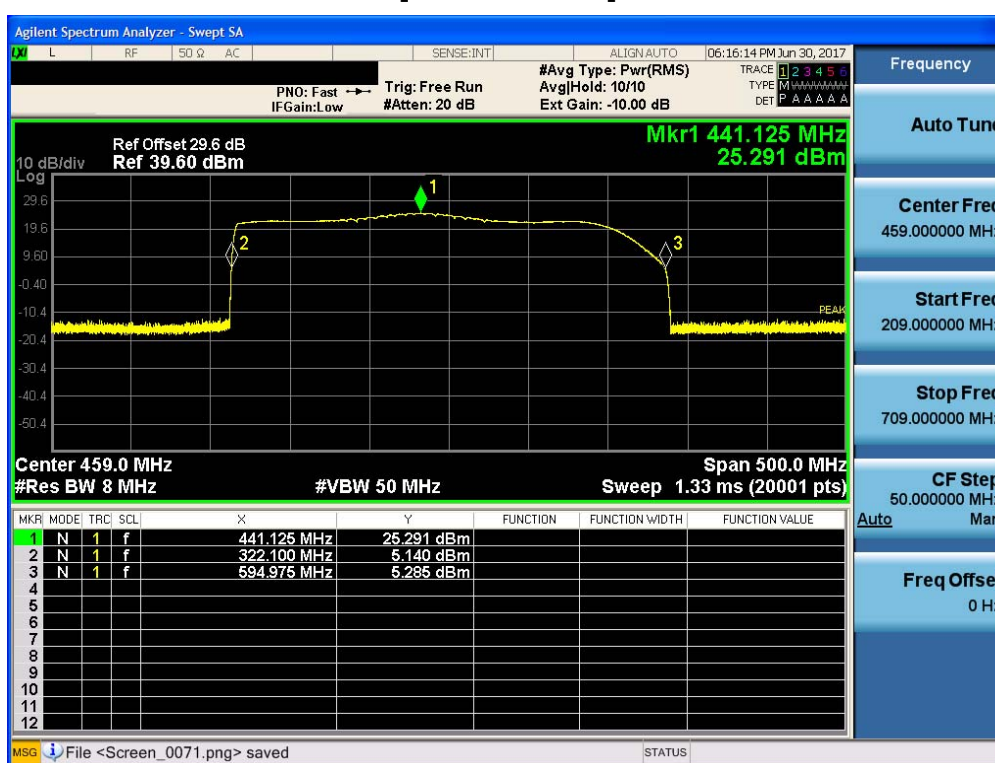
UHF

[Downlink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
322.100 ~ 594.975	25.291	40.291

Plots of Passband Gain and Bandwidth & Out of Band Rejection

[UHF Downlink]



* This device must be used with a duplexer by the user, and can be used with external filters. This test results were measured without duplexer or external filters. So, the test results were measured to be about ± 250 % of each pass band from the center frequency according to the test procedure.

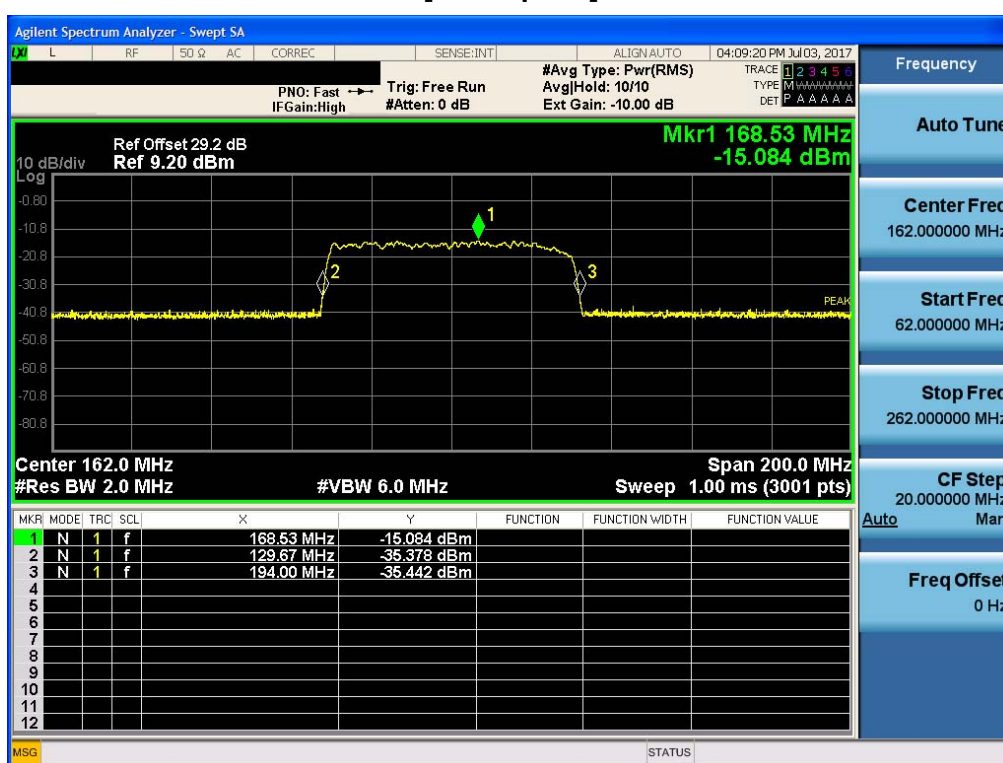
VHF

[Uplink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
129.670 ~ 194.000	-15.084	29.916

Plots of Passband Gain and Bandwidth & Out of Band Rejection

[VHF Uplink]



* This device must be used with a duplexer by the user, and can be used with external filters. This test results were measured without duplexer or external filters. So, the test results were measured to be about $\pm 250\%$ of each pass band from the center frequency according to the test procedure.

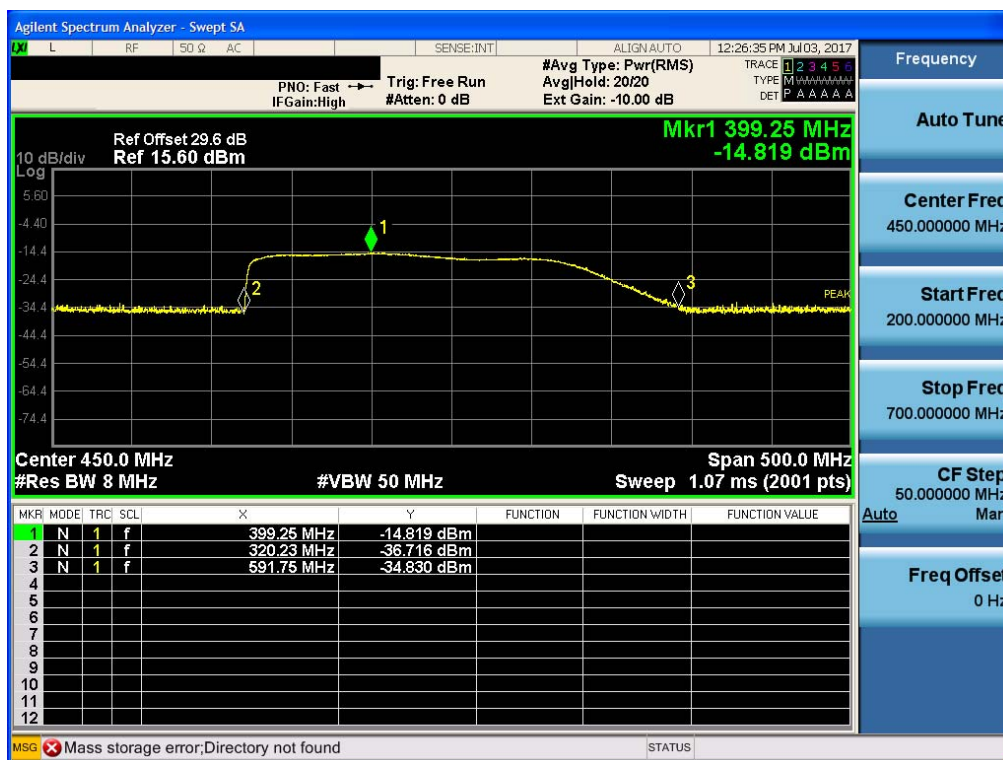
UHF

[Uplink]

20 dB point frequency (MHz)	Output power (dBm)	Gain (dB)
320.230 ~ 591.750	-14.819	30.181

Plots of Passband Gain and Bandwidth & Out of Band Rejection

[UHF Uplink]



* This device must be used with a duplexer by the user, and can be used with external filters. This test results were measured without duplexer or external filters. So, the test results were measured to be about ± 250 % of each pass band from the center frequency according to the test procedure.

9. NOISE FIGURE

FCC Rules

Test Requirement(s):

§ 90.219 Use of signal boosters:

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

IC Rules

Test Requirements:

RSS-131

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

6.4 Noise

The ERP of noise within the passband should not exceed -43 dBm in a 10 kHz measurement bandwidth.

The ERP of noise in spectrum more than 1 MHz outside of the passband should not exceed -70 dBm in a 10 kHz measurement bandwidth.

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= $10\log(1\text{ MHz}/1\text{ Hz})=60$

PNAD=Noise Power Density=-174 dBm/Hz

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

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
VHF	Without input signal		53	38
UHF			53	38

* **Note:** The Maximum Amp Gain values in the above table are only RU gain value except HeadEnd

VHF Band

Downlink : Noise Figure = $-54.523 - 53 + 114 = 6.477\text{ dB}$

Uplink: Noise Figure = $-74.355 - 38 + 114 = 1.645\text{ dB}$

UHF Band

Downlink : Noise Figure = $-53.974 - 53 + 114 = 7.026\text{ dB}$

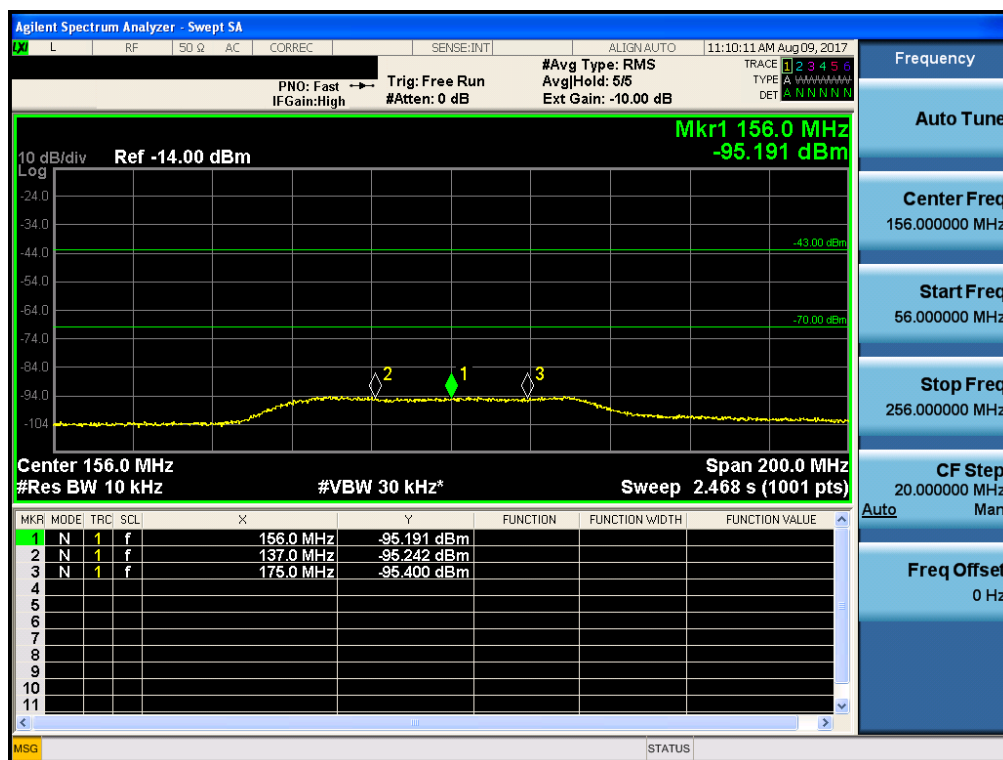
Uplink: Noise Figure = $-75.889 - 38 + 114 = 0.111\text{ dB}$

Plots of Noise power VHF

[Downlink]



[Uplink]



UHF

[Downlink]



[Uplink]



10. EMISSION MASKS

FCC Rules

Test Requirement(s):

§ 90.210 Emission masks:

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

APPLICABLE EMISSION MASKS

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25 ¹	A or B	A or C
25-50	B	C
72-76	B	C
150-174 ²	B, D, or E	C, D or E
150 paging only	B	C
220-222	F	F
421-512 ^{2 5}	B, D, or E	C, D, or E
450 paging only	B	G
806-809/851-854	B	H
809-824/854-869 ^{3 5}	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M
5850-5925 ⁴		
All other bands	B	C

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

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

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

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (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)
$3 < f_d \leq 4.6$	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)
$10 < f_d \leq 50$	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.

- Connect a signal generator to the input of the EUT.
- Configure the signal generator to transmit the appropriate test signal associated with the public safety emission designation (see Table 1).
- Configure the signal level to be just below the AGC threshold (see results from 4.2).

- d) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- e) Set the spectrum analyzer center frequency to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between 2 times to 5 times the EBW (or OBW).
- f) The nominal resolution bandwidth (RBW) shall 300 Hz for 16K0F3E and 100 Hz for all other emissions types.
- g) Set the reference level of the spectrum analyzer to accommodate the maximum input amplitude level.
- h) Set spectrum analyzer detection mode to peak, and trace mode to max hold.
- i) Allow the trace to fully stabilize.
- j) Confirm that the signal is contained within the appropriate emissions mask.
- k) Use the marker function to determine the maximum emission level and record the associated frequency as f0.
- l) Capture the emissions mask plot for inclusion in the test report (output signal spectra).
- m) Measure the EUT input signal power (signal generator output signal) directly from the signal generator using power measurement guidance provided in KDB Publication 971168 (input signal spectra).
- n) Compare the spectral plot of the output signal (determined in step k), to the input signal (determined in step l) to affirm they are similar (in passband and rolloff characteristic features and relative spectral locations).
- o) Repeat the procedure for both test signals with the input signal amplitude set 3 dB above the AGC threshold.
- p) Repeat steps b) to n) for all authorized operational bands and emissions types (see applicable regulatory specifications, e.g., §90.210).
- q) Include all accumulated spectral plots depicting EUT input signal and EUT output signal in the test report and note any observed dissimilarities.

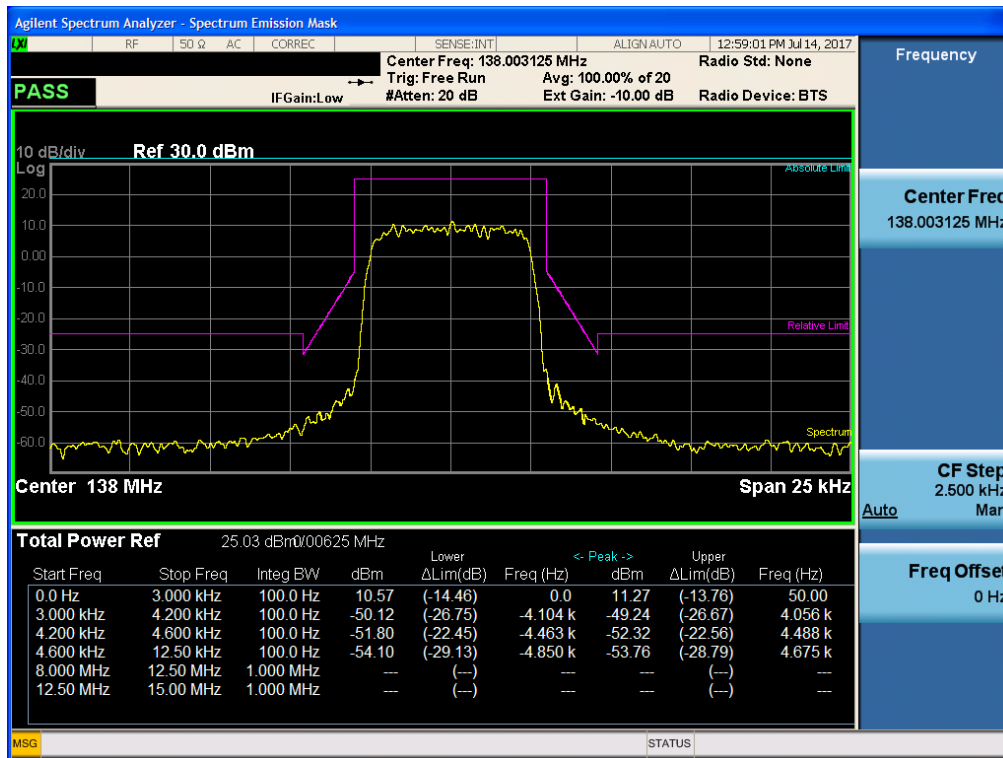
Test Results: The EUT complies with the requirements of this section.

Input Signal	Input Level (dBm)		Maximum Amp Gain	
	DL	UL	DL	UL
VHF	-15	-45	40	30
UHF	-15	-45	40	30

Plots of Emission Mask

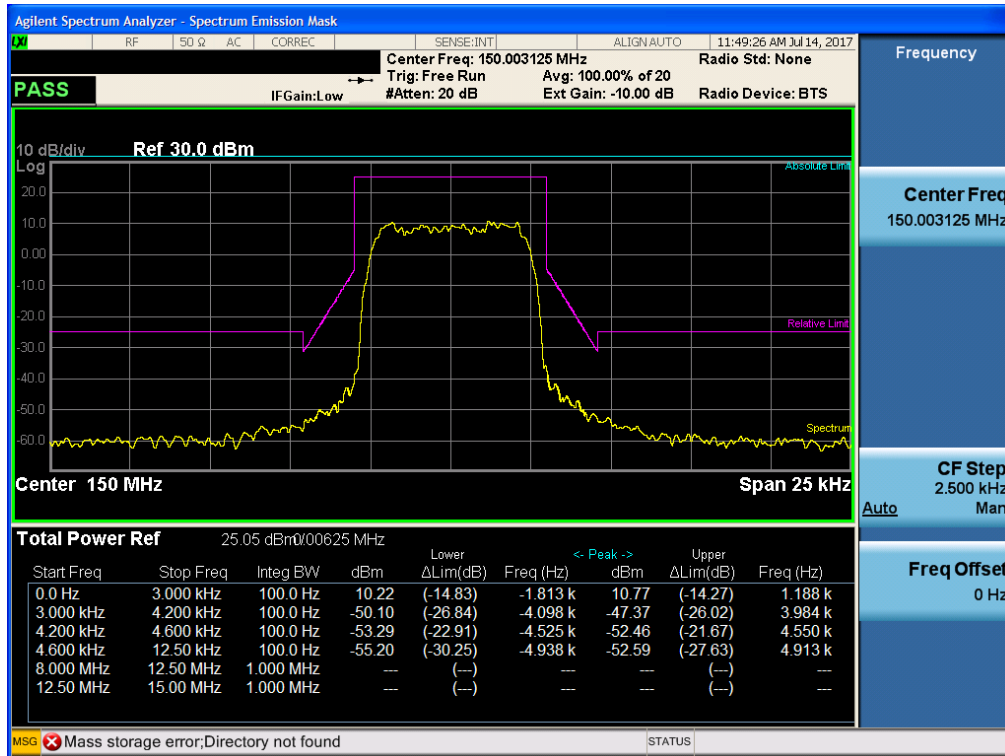
VHF(APCO25_138 MHz) DL

[Downlink Emission Mask E - Low]

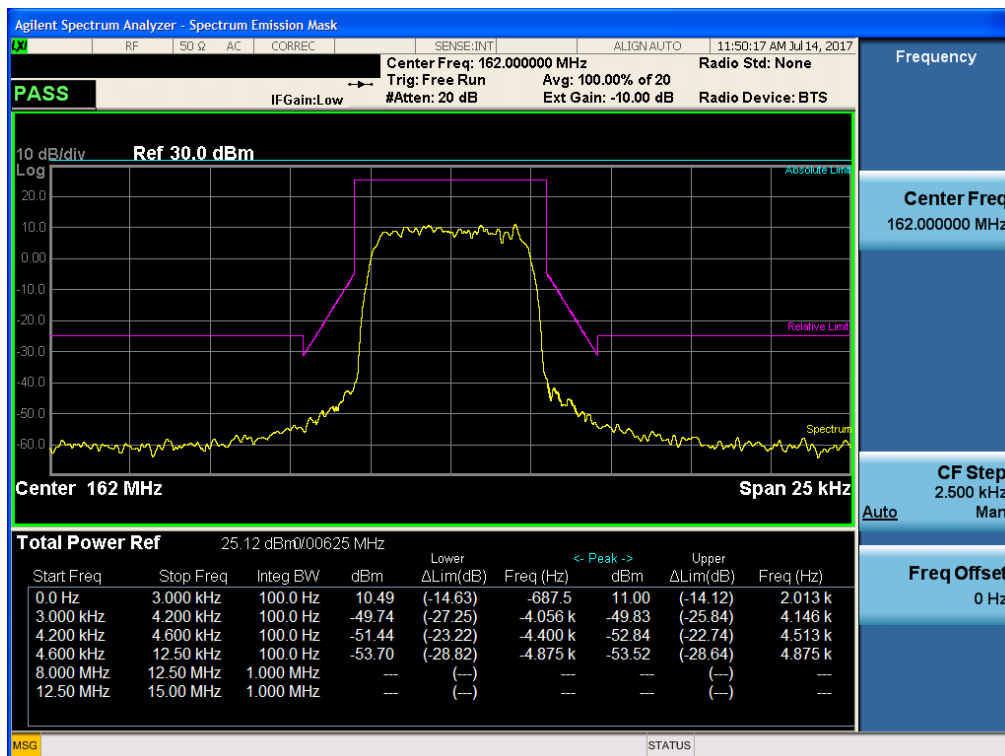


VHF(APCO25_150 ~ 174 MHz) DL

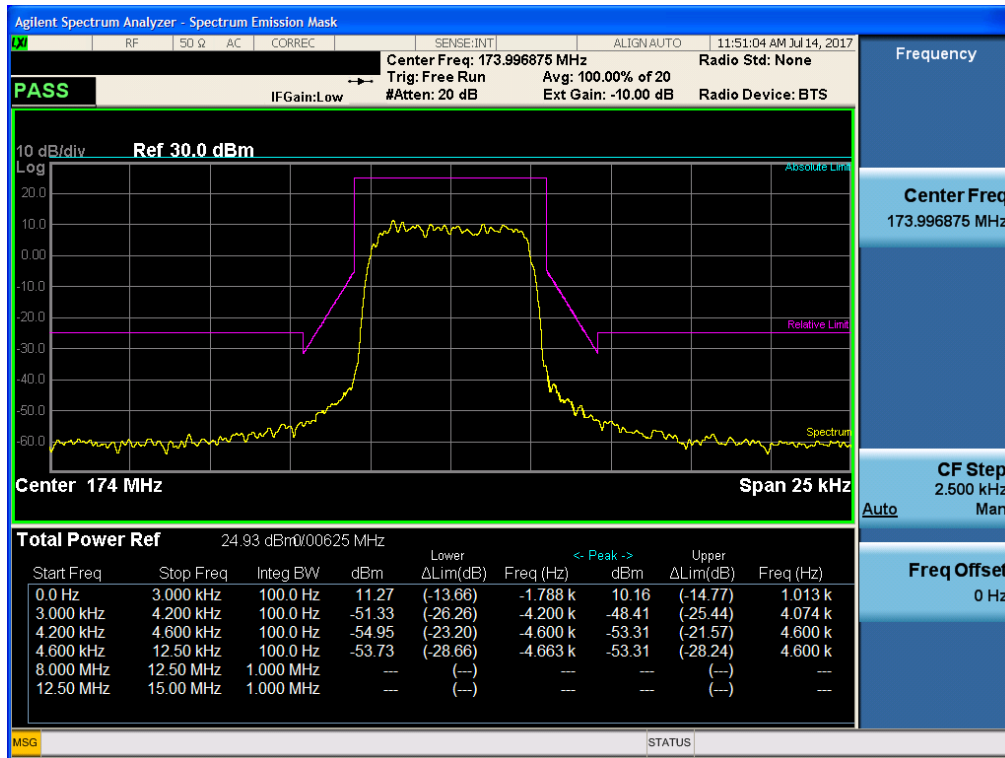
[Downlink Emission Mask E - Low]



[Downlink Emission Mask E - Middle]

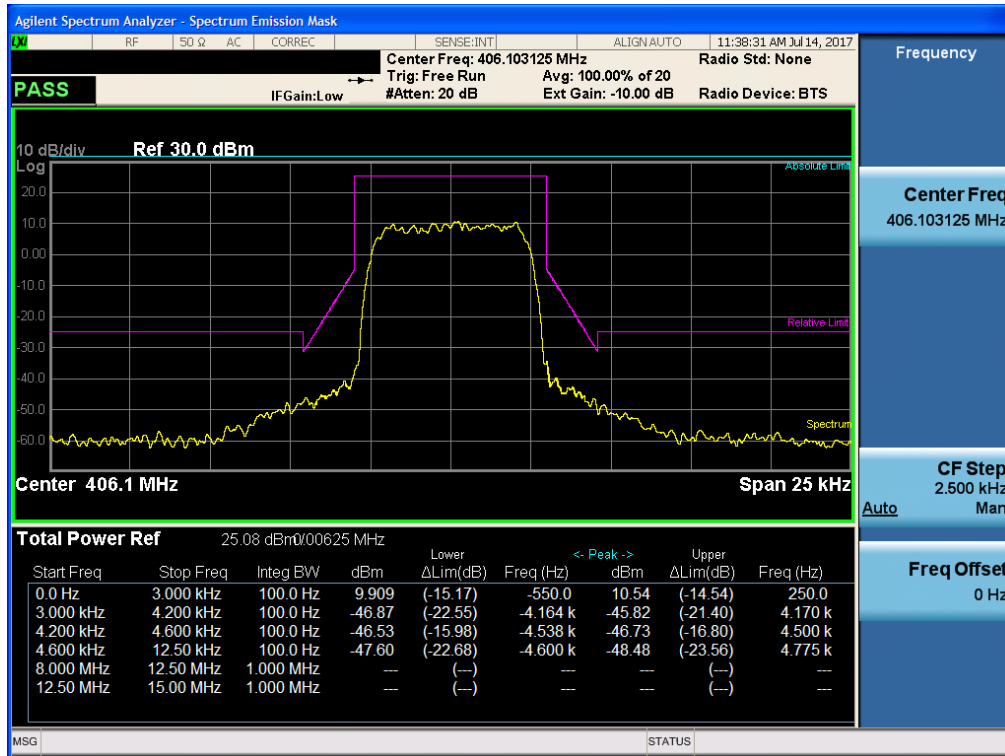


[Downlink Emission Mask E - High]

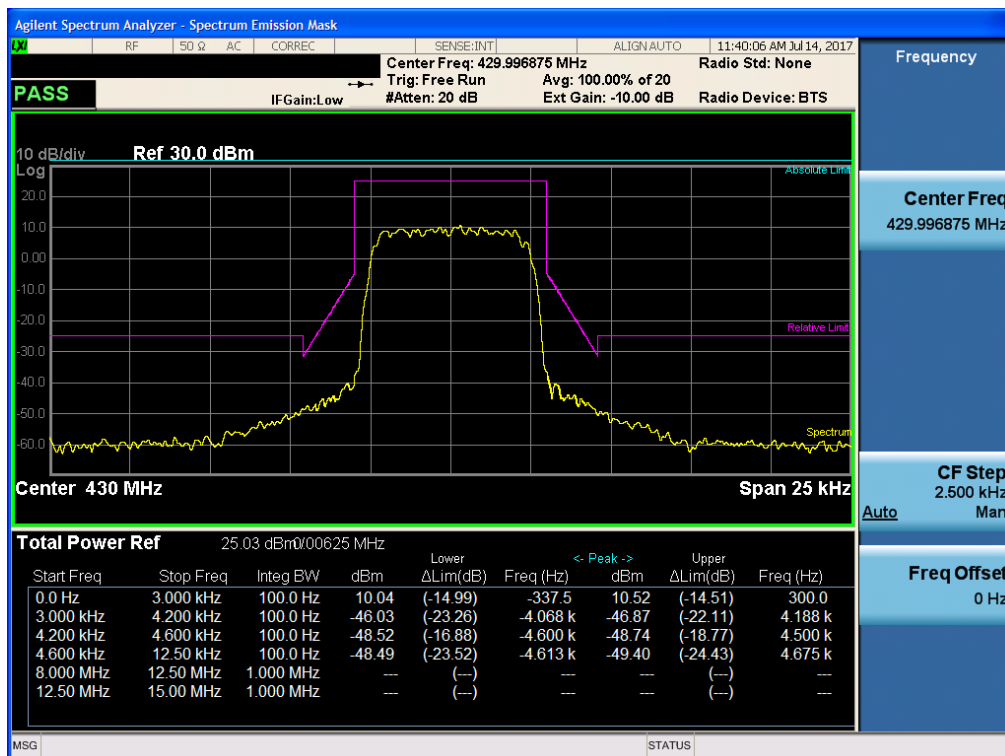


UHF(APCO_406.1 ~ 430 MHz) DL

[Downlink Emission Mask E - Low]

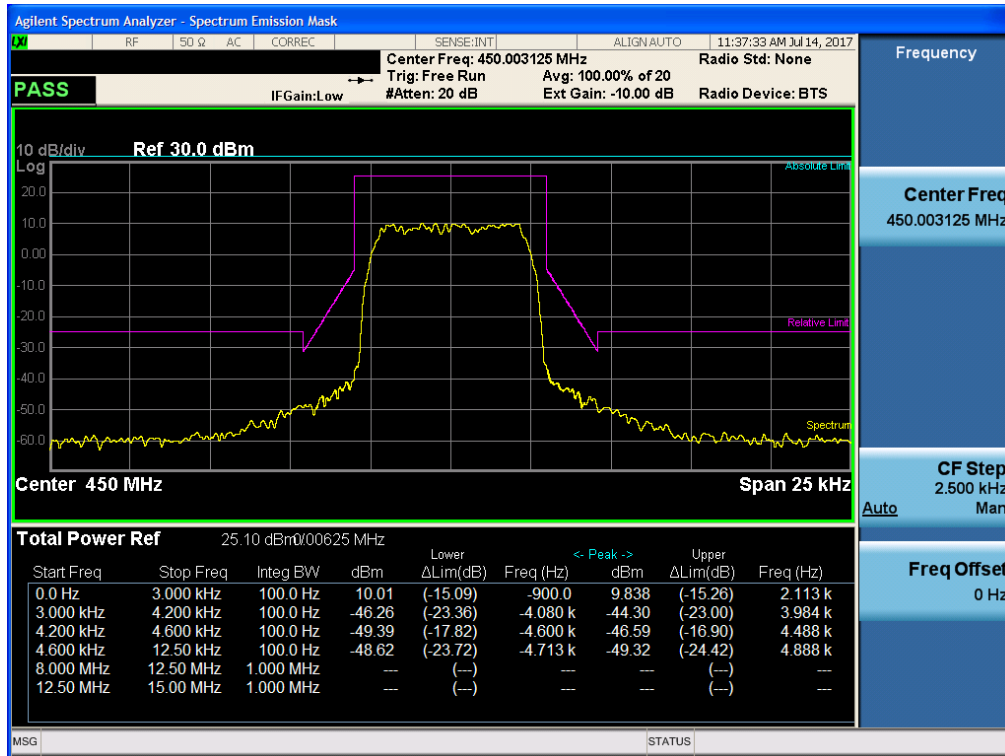


[Downlink Emission Mask E - High]

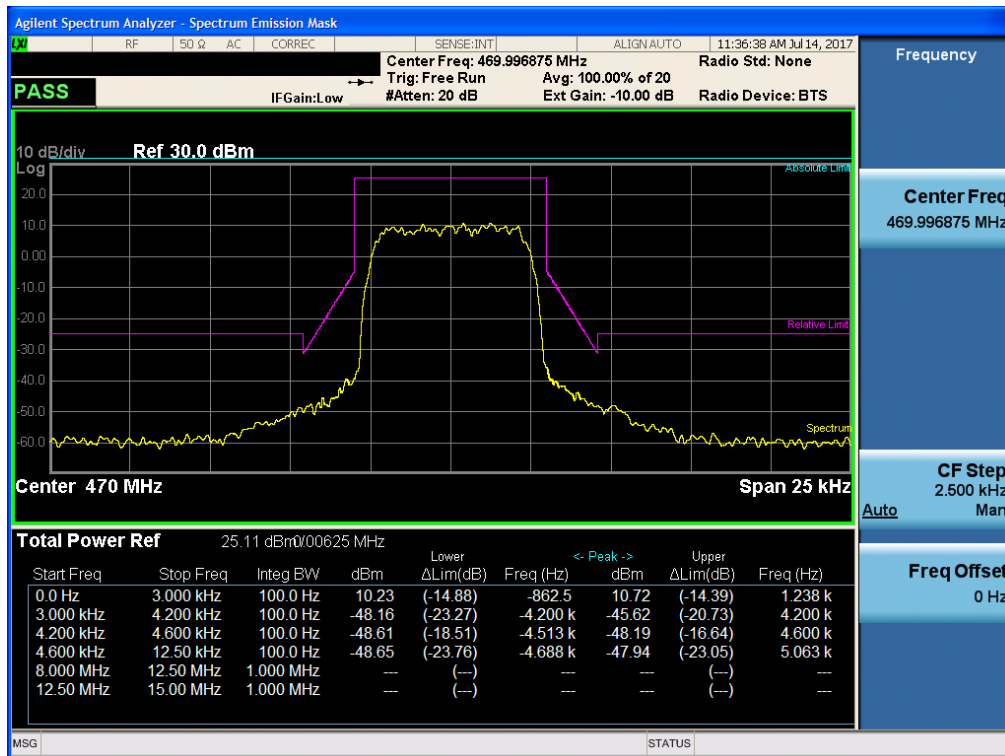


UHF(APCO_450 ~ 470 MHz) DL

[Downlink Emission Mask E - Low]

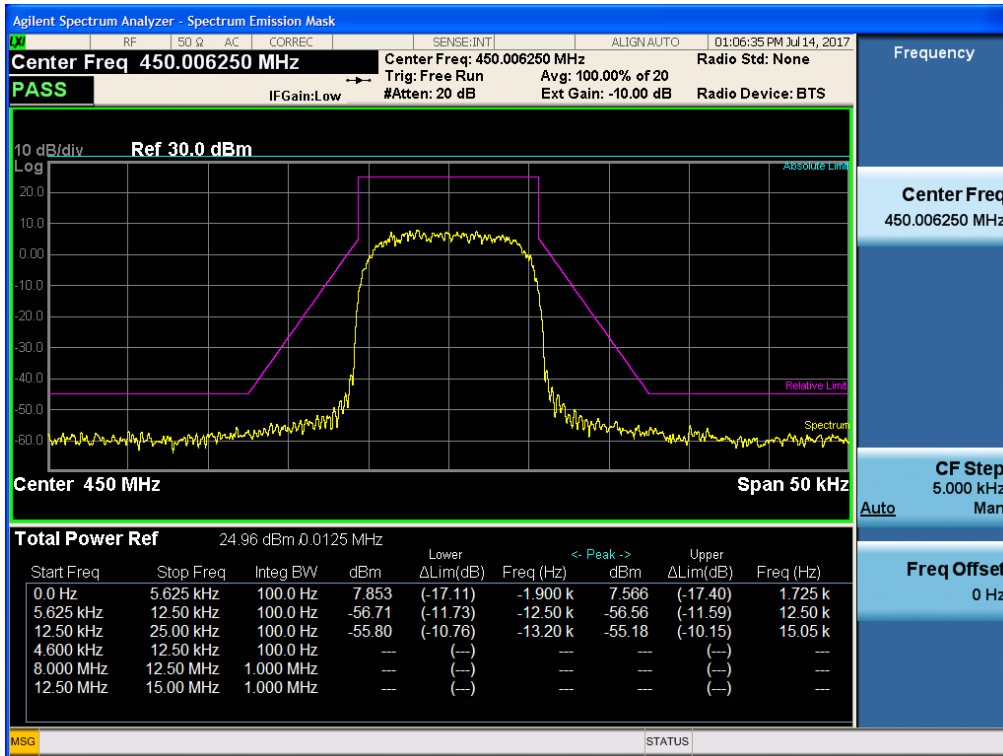


[Downlink Emission Mask E - High]

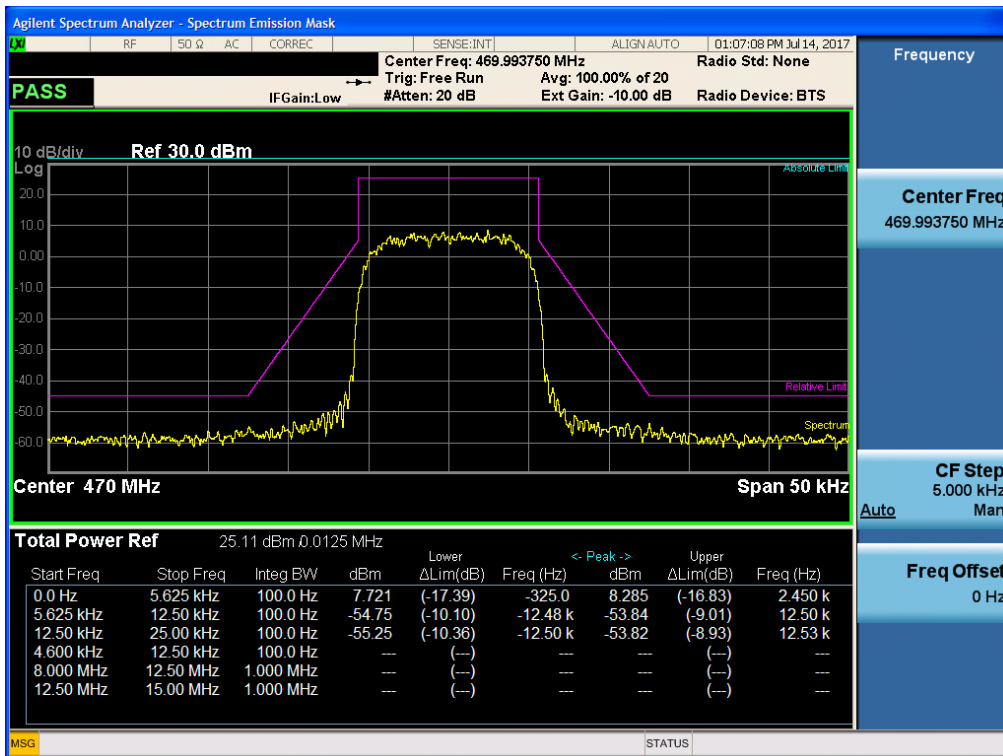


UHF(TETRA_450 ~ 470 MHz) DL

[Downlink Emission Mask D - Low]

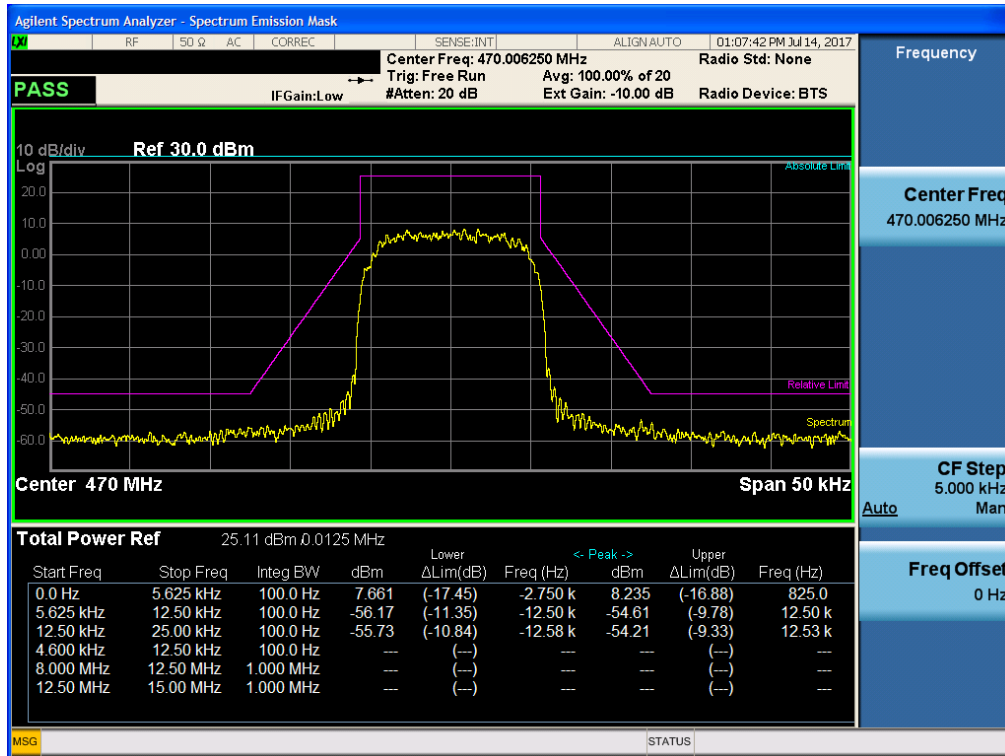


[Downlink Emission Mask D - High]

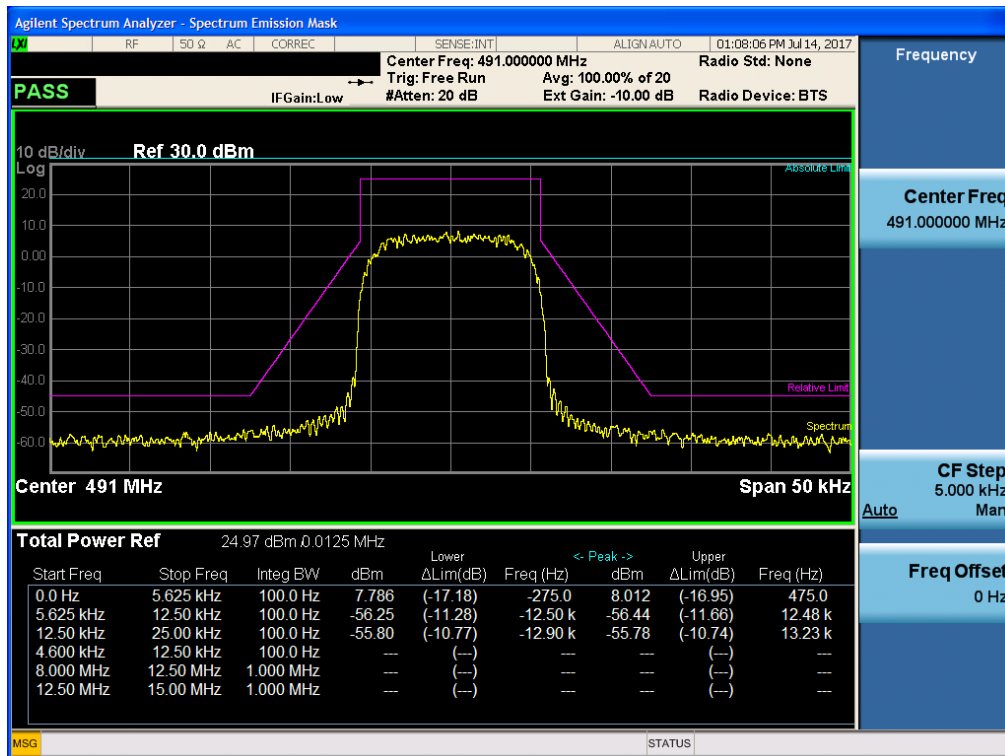


UHF(TETRA_470 ~ 512 MHz) DL

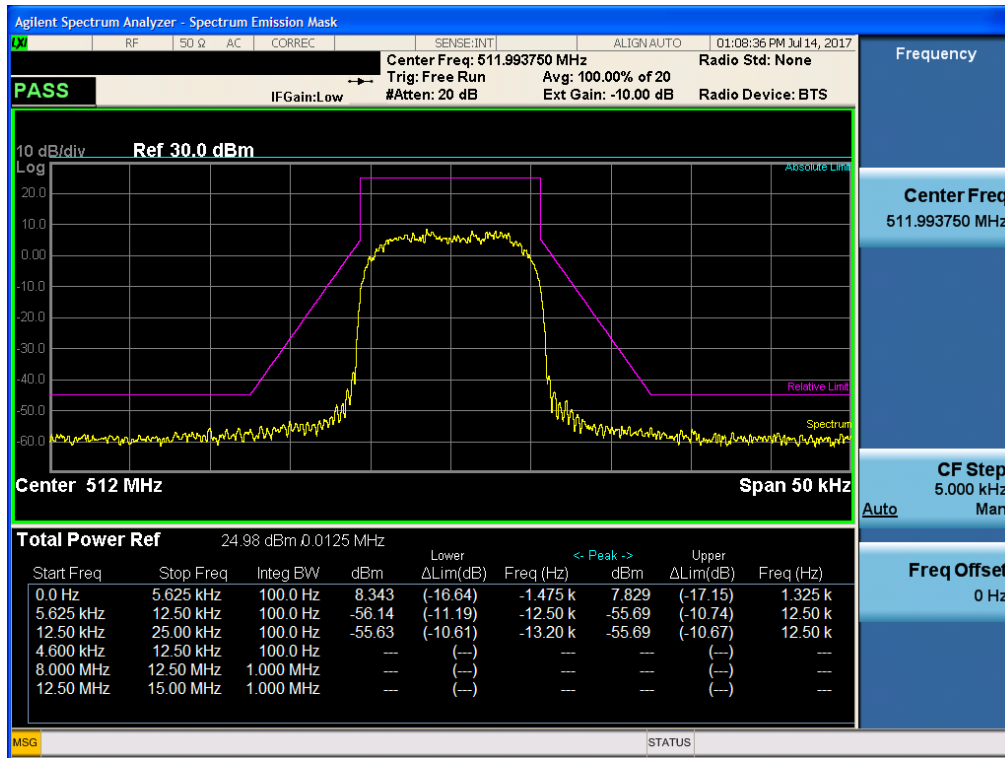
[Downlink Emission Mask D - Low]



[Downlink Emission Mask D - Middle]

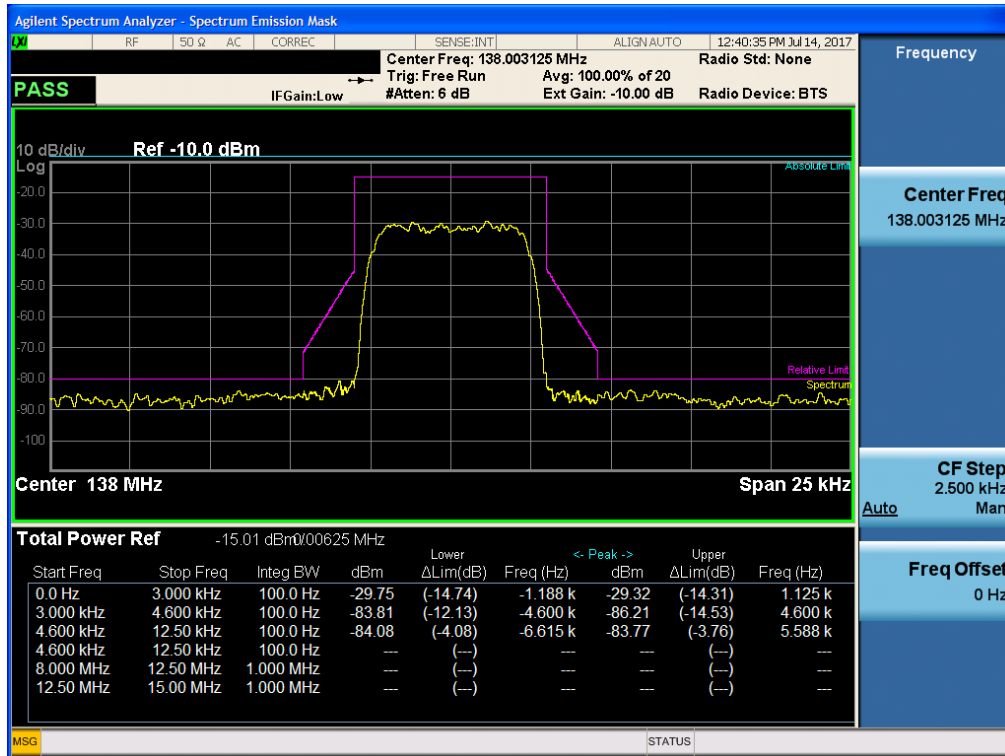


[Downlink Emission Mask D - High]



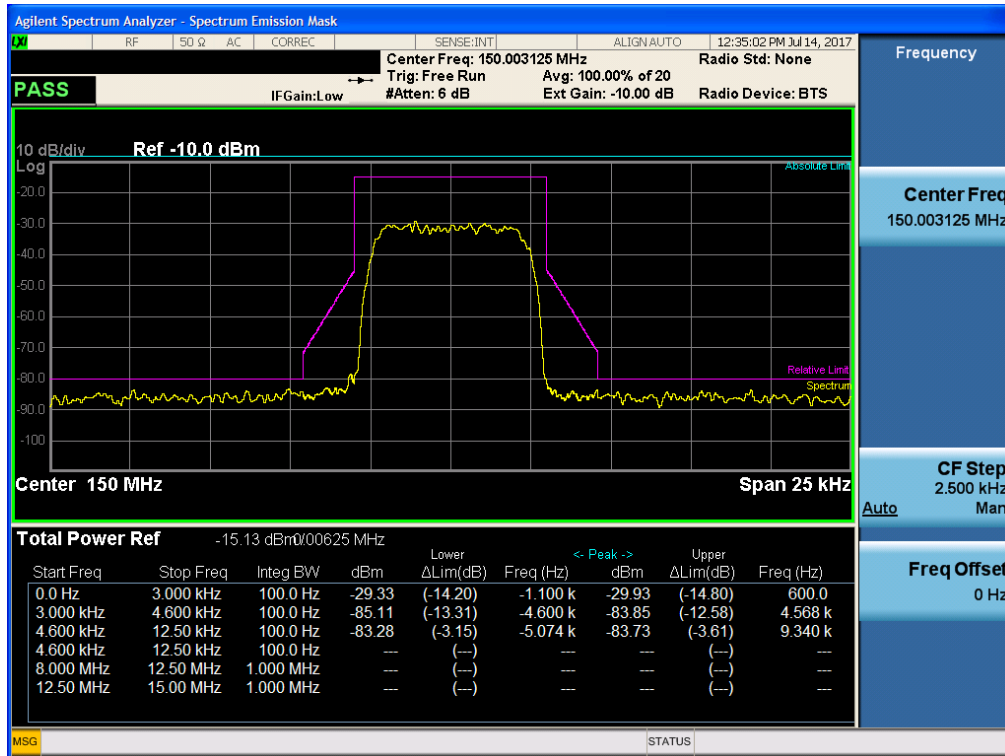
VHF(APCO25_138 MHz) UL

[Downlink Emission Mask E - Low]

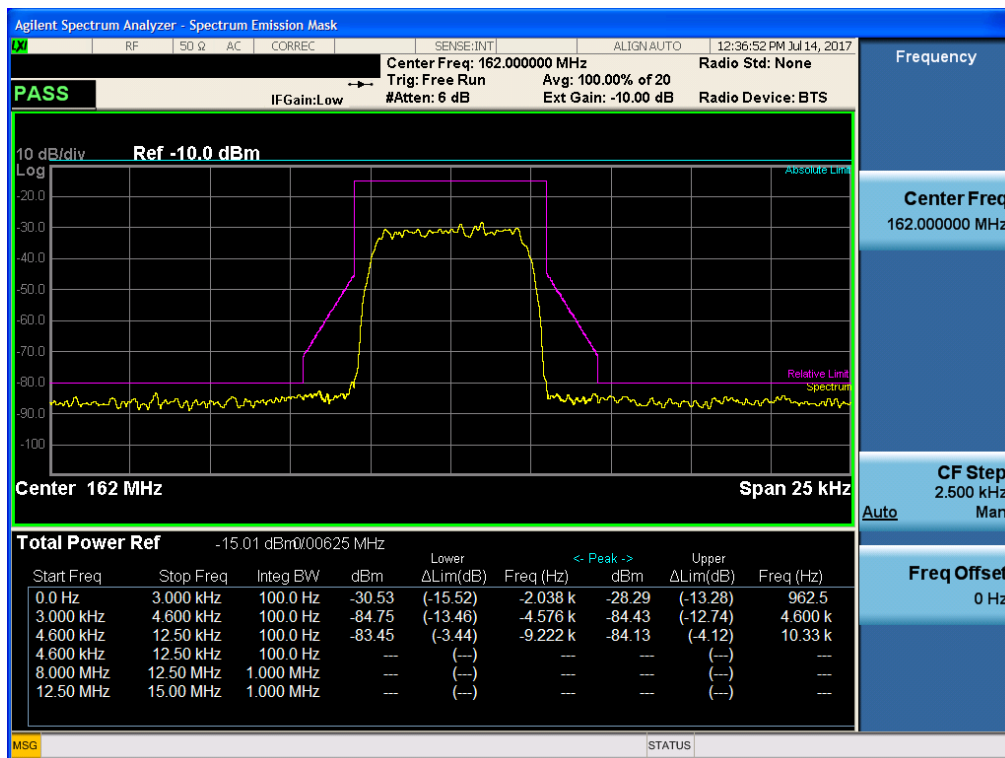


VHF(APCO25_150 ~ 174 MHz) UL

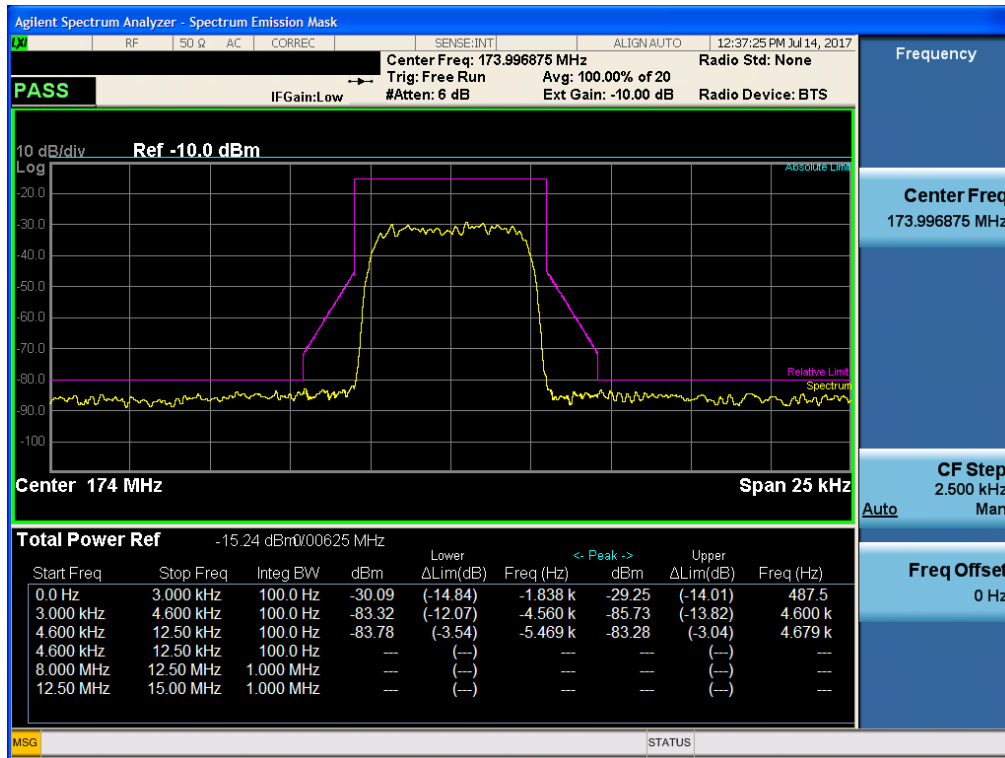
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[Downlink Emission Mask E - Middle]

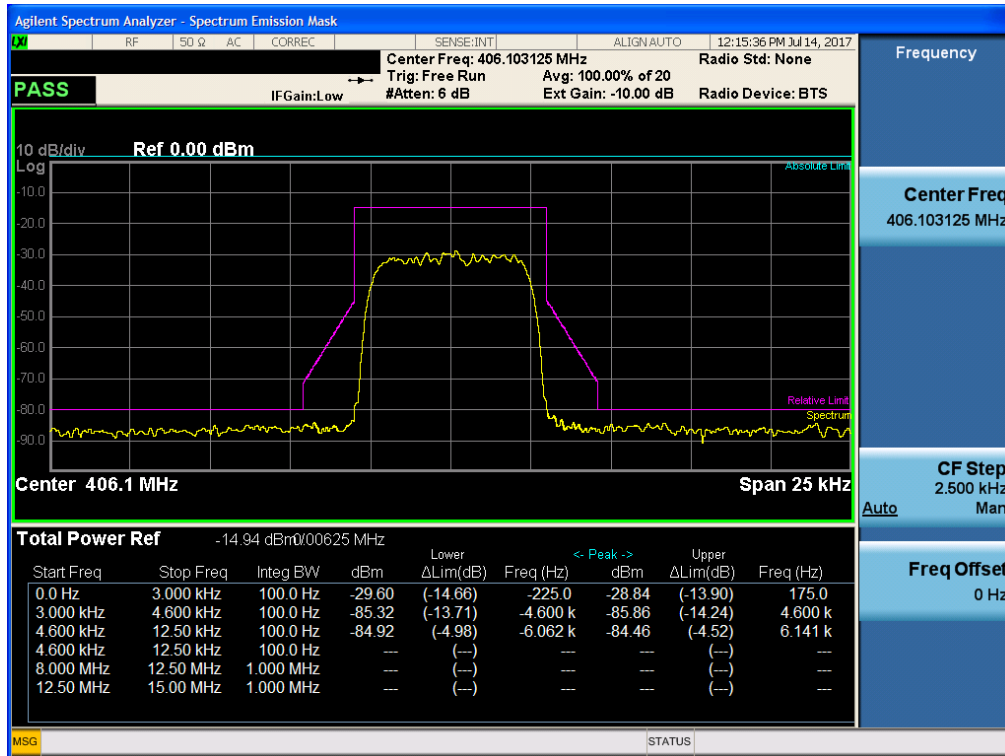


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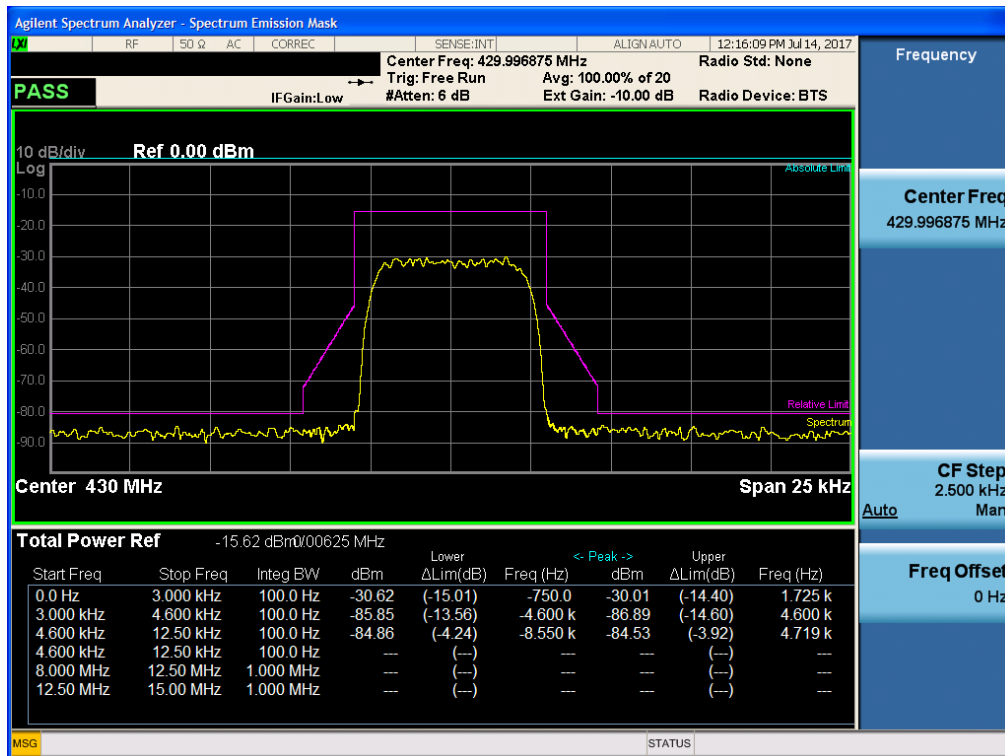


UHF(APCO_406.1 ~ 430 MHz) UL

[Downlink Emission Mask E - Low]

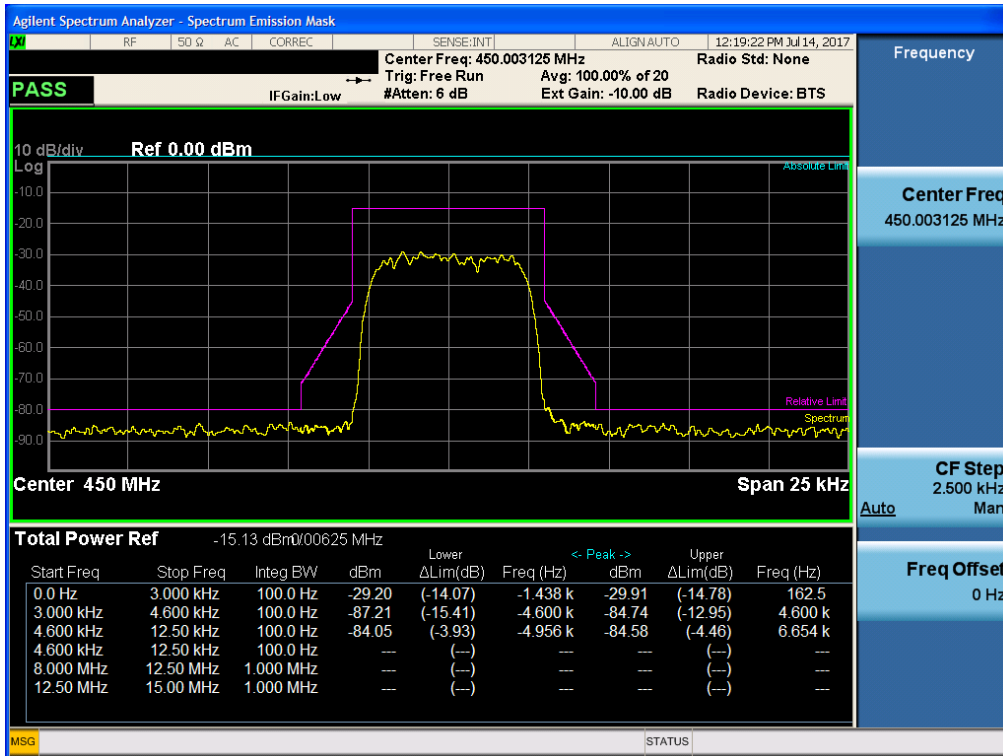


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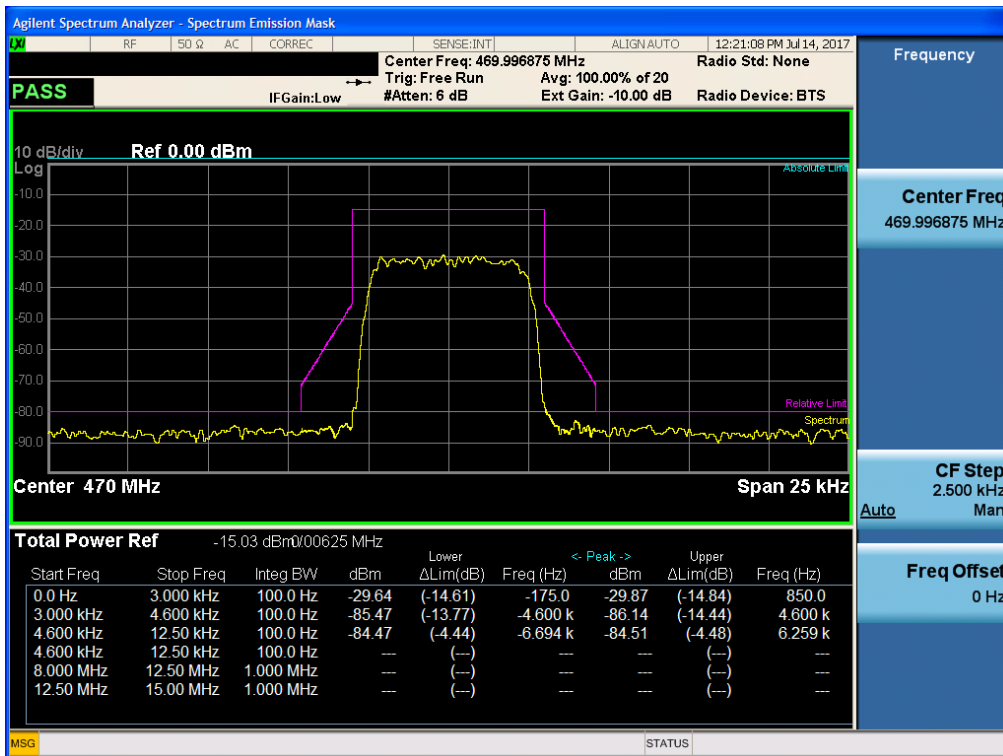


UHF(APCO_450 ~ 470 MHz) UL

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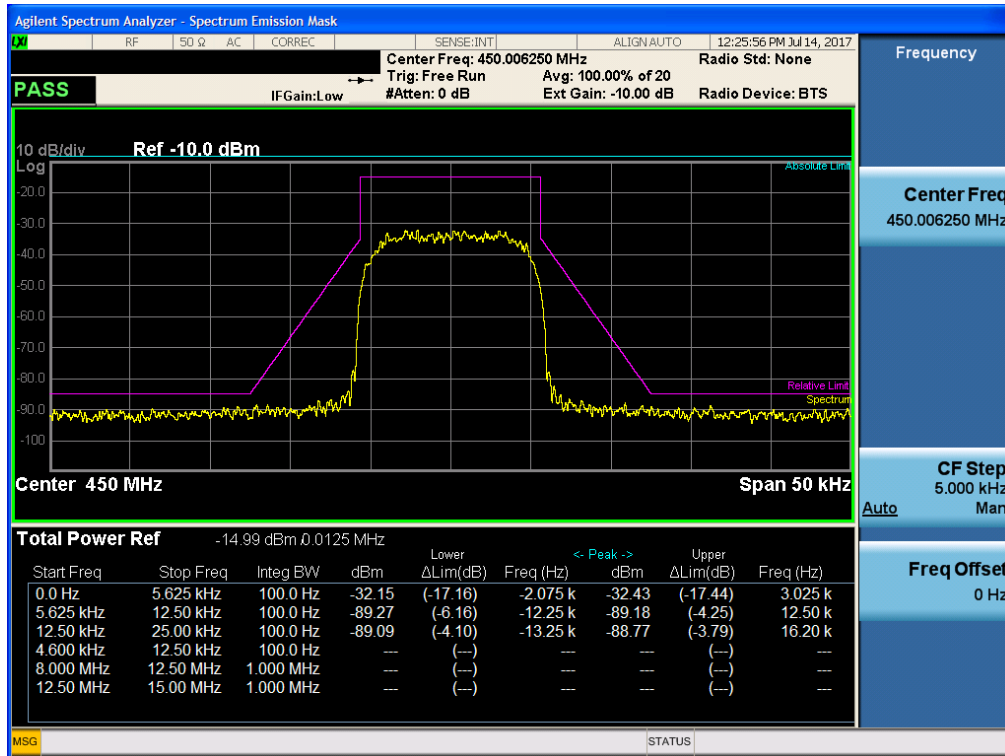


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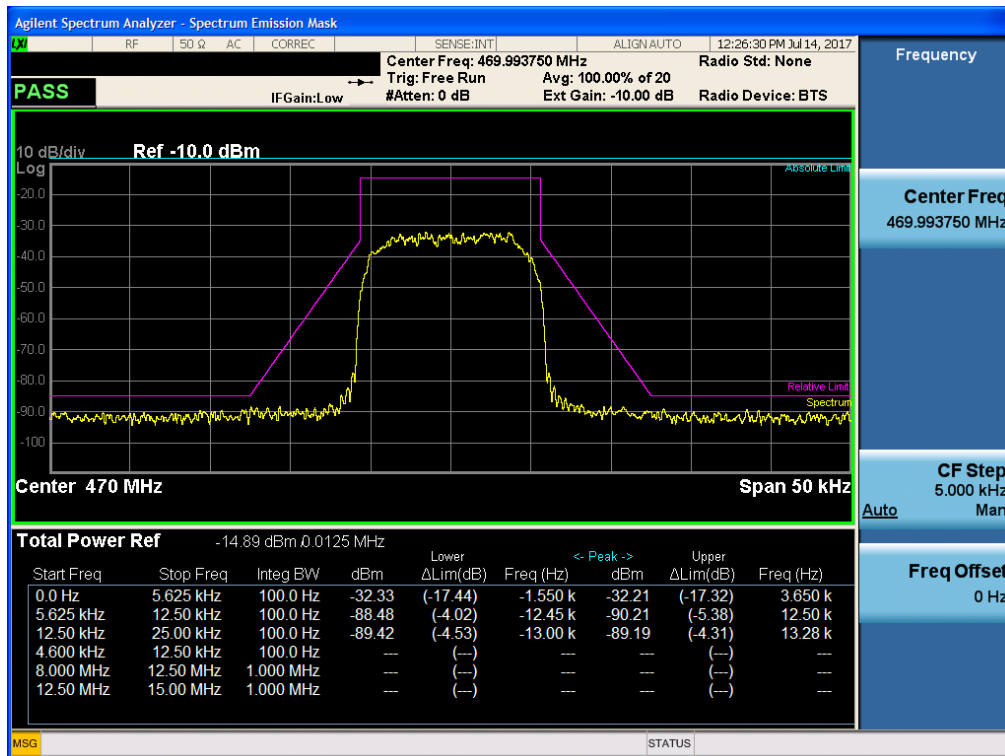


UHF(TETRA_450 ~ 470 MHz) UL

[Downlink Emission Mask D - Low]

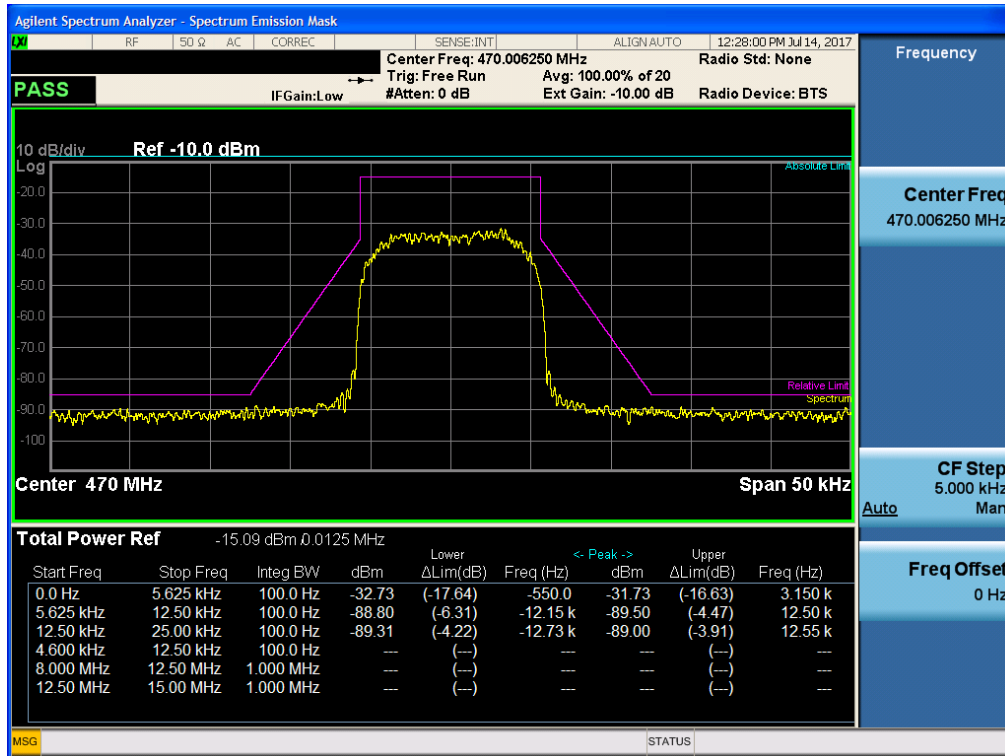


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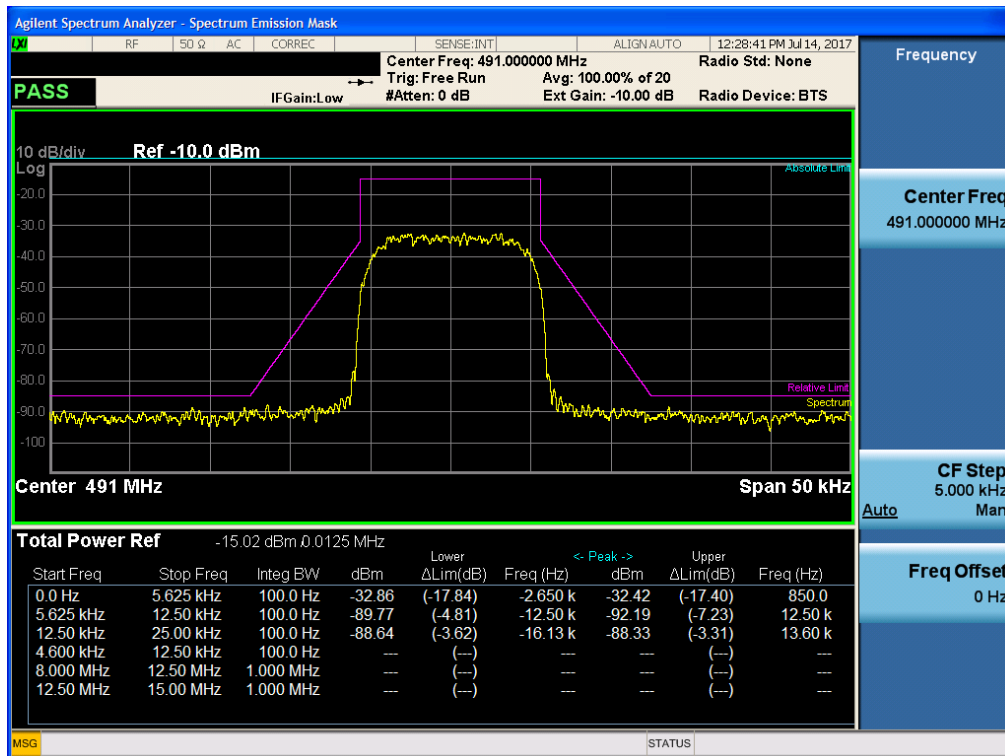


UHF(TETRA_470 ~ 512 MHz) UL

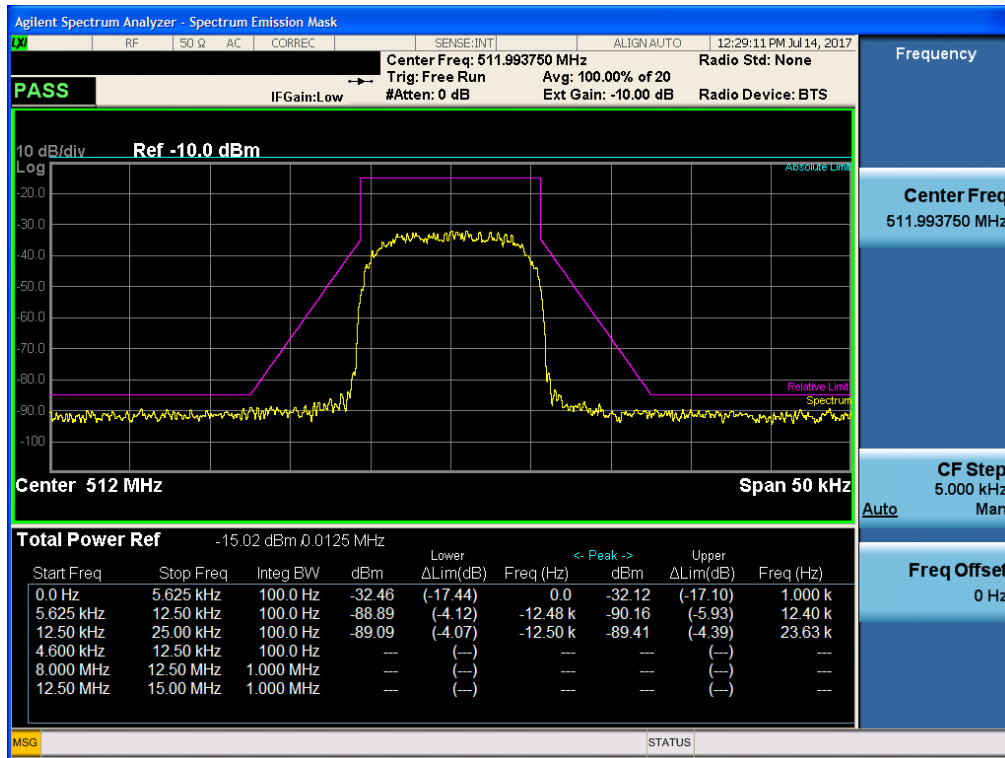
[Downlink Emission Mask D - Low]



[Downlink Emission Mask D - Middle]



[Downlink Emission Mask D - High]



11. SPURIOUS AND HARMONIC EMISSION AT ANTENNA TERMINAL

FCC Rules

Test Requirement(s):

§ 2.1051 Measurements required: Spurious emissions at antenna terminals:

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

§ 90.219 Use of signal boosters.

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

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

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, f_d (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
6.25	-40	-40	6.25

Table 13 — ACP Requirements for 6.25 kHz Bandwidth Transmitters

Displacement Frequency, f_d (kHz)	Maximum Relative ACP (dBc)		Measurement Bandwidth (kHz)
	Mobile Station	Base Station	
12.5	-60	-60	25
18.75			
25	-65	-65	
37.5	-65	-65	25
62.5			
87.5			
150	-65	-65	100
250			
350			
$400 < f_d \leq 12 \text{ MHz}$	-75	-80	30(s)
$12 \text{ MHz} < f_d \leq \text{paired receive band}$			
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			
$600 \leq f_d < 1000$	-60	-65	30(s)
$1000 \leq f_d < 2000$	-65	-70	
$2000 \leq f_d < 9000$	-70	-75	
$9000 \leq f_d \leq \text{paired receive band}$			
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

6.3 Intermodulation

The effective radiated power (ERP) of intermodulation products should not exceed -30 dBm in a 10 kHz measurement bandwidth.

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 = $3 \times \text{RBW}$.

- h) Set the detector to power averaging (rms) detector.

- i) Set the Sweep time = auto-couple.

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

3.6.3. EUT spurious emissions conducted measurement

- a) Connect a signal generator to the input of the EUT.
- b) Set the signal generator to produce the broadband test signal as previously described (e.g., 4.1 MHz OBW AWGN).
- c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.
- d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.
- e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).
- g) Set the VBW $\geq 3 \times$ RBW.
- h) Set the Sweep time = auto-couple.
- i) Set the analyzer start frequency to the lowest radio frequency signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part.

NOTE—The number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$ which may require that the measurement range defined by the start and stop frequencies be

subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

j) Select the power averaging (rms) detector function.

k) Trace average at least 10 traces in power averaging (i.e., rms) mode.

l) Use the peak marker function to identify the highest amplitude level over each measured frequency range. Record the frequency and amplitude and capture a plot for inclusion in the test report.

m) Reset the analyzer start frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the analyzer stop frequency to 10 times the highest frequency of the fundamental emission (see §2.1057). Note that the number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$ which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.

n) Trace average at least 10 traces in power averaging (i.e., rms) mode.

o) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a plot for inclusion in the test report and provide tabular data, if required.

p) Repeat the procedure with the input test signals tuned to a middle band/block frequency/channel and then a high band/block frequency/channel.

q) Repeat entire procedure with the narrowband test signal.

r) Repeat for all authorized frequency bands/blocks used by the EUT.

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

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

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

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

b) Configure the two signal generators to produce CW tones on frequencies spaced at ± 12.5 kHz relative to f_0 with amplitude levels set just below the AGC threshold (see 4.2).

c) Connect a spectrum analyzer to the EUT output.

d) Set the span to 100 kHz.

e) Set the resolution bandwidth to 300 Hz with a video bandwidth $\geq 3 \times \text{RBW}$.

f) Set the detector to power average (rms).

g) Place a marker on highest intermodulation product amplitude.

h) Capture the plot for inclusion in the test report.

i) Repeat the procedure with the composite input power level set to 3 dB above the AGC

threshold.

- j) Repeat steps b) to h) for all operational bands.

4.7.3 EUT spurious emissions conducted measurement

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

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

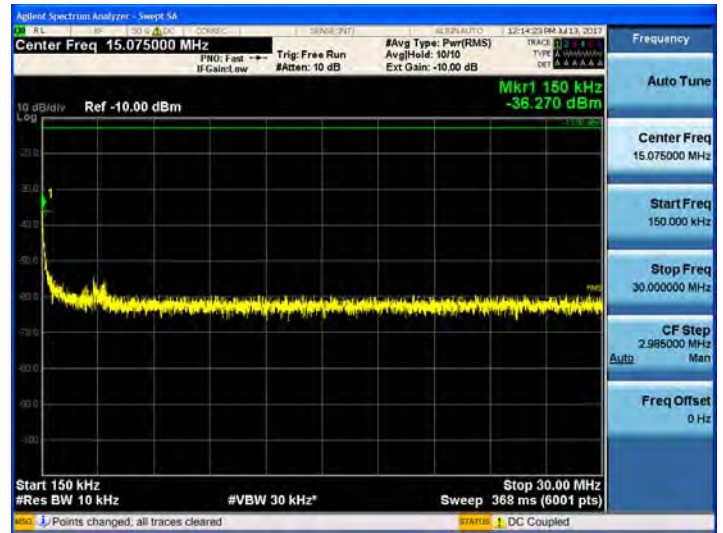
Single channel Enhancer Plots of Spurious Emission VHF(APCO25_138 MHz) DL

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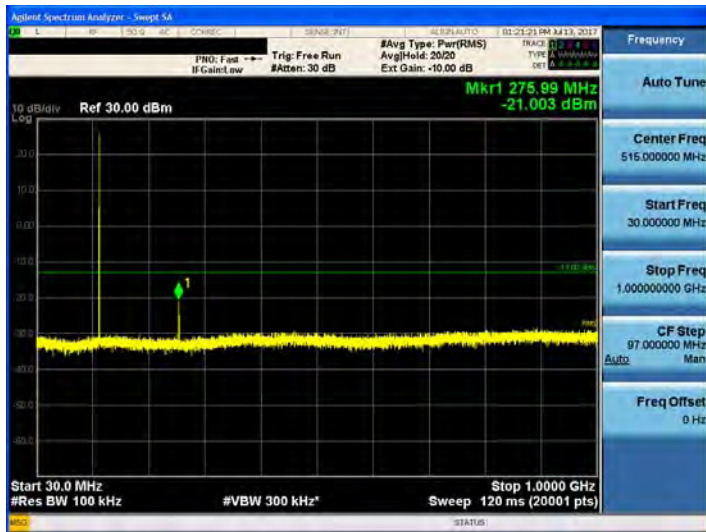
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

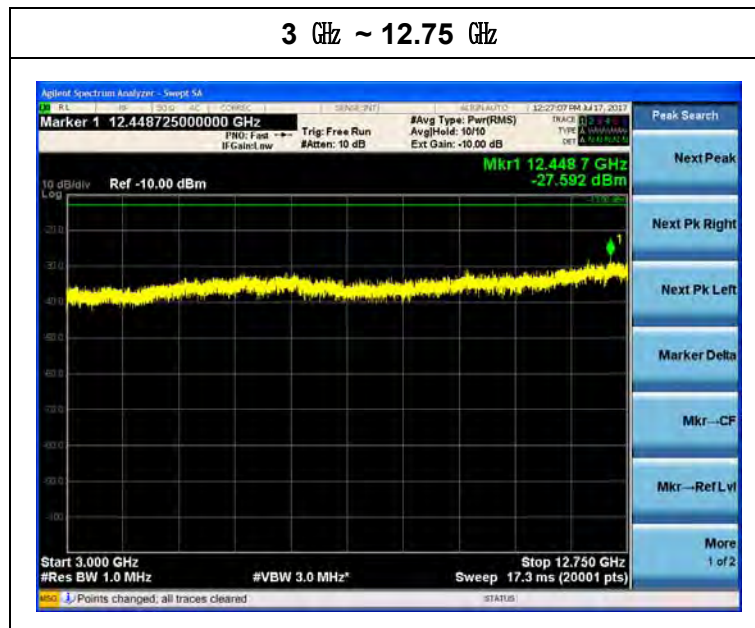


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz





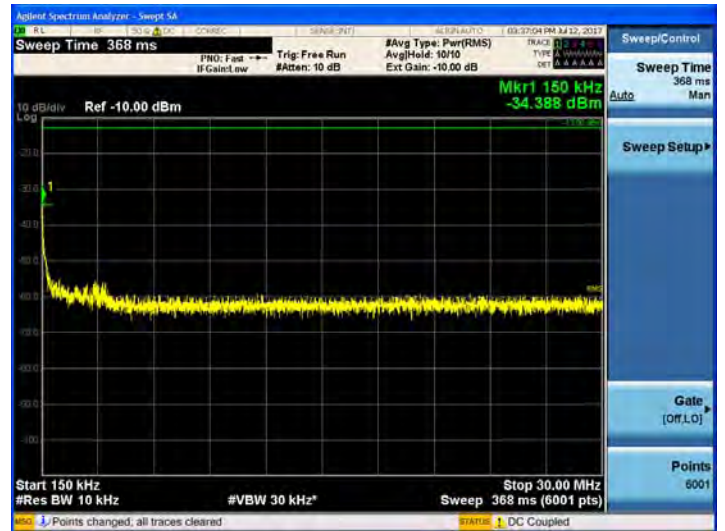
VHF(APCO25_150 ~ 174 MHz) DL

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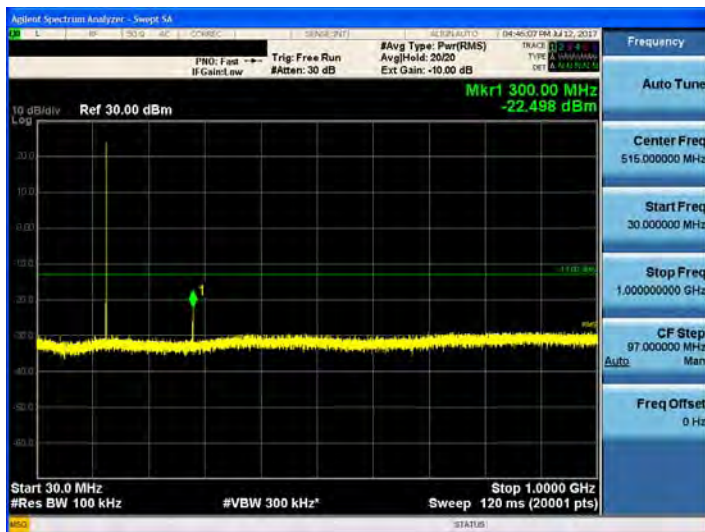
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

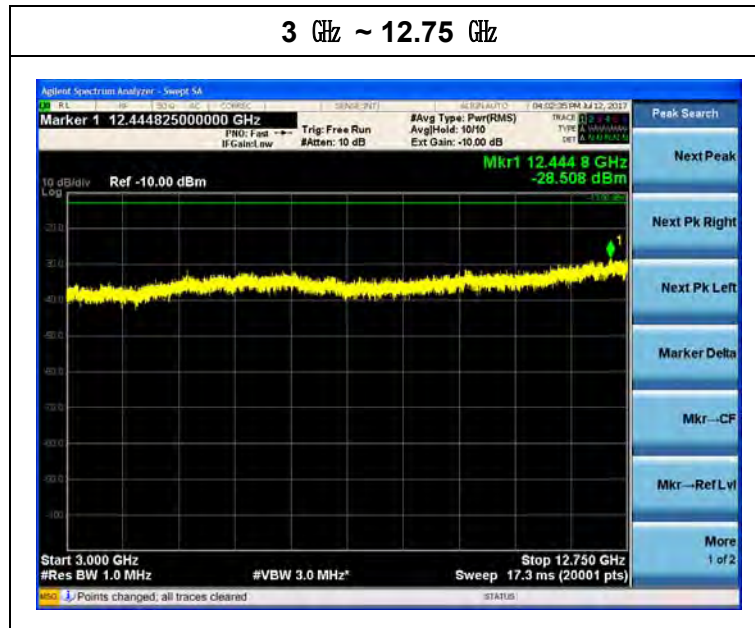


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



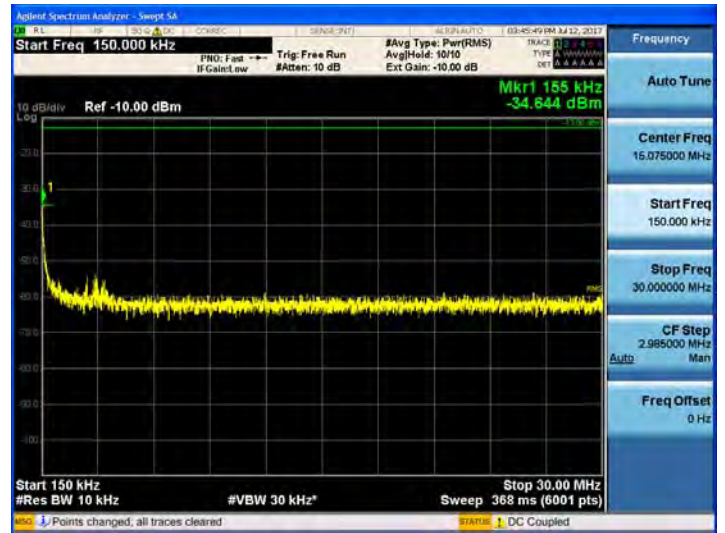


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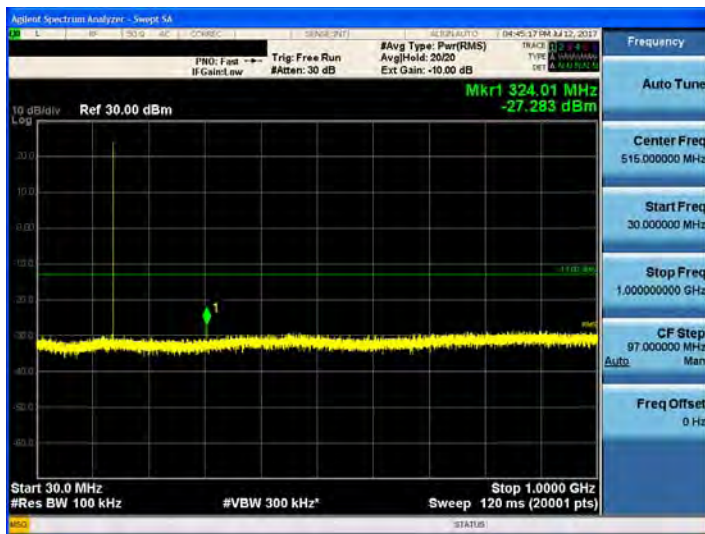
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

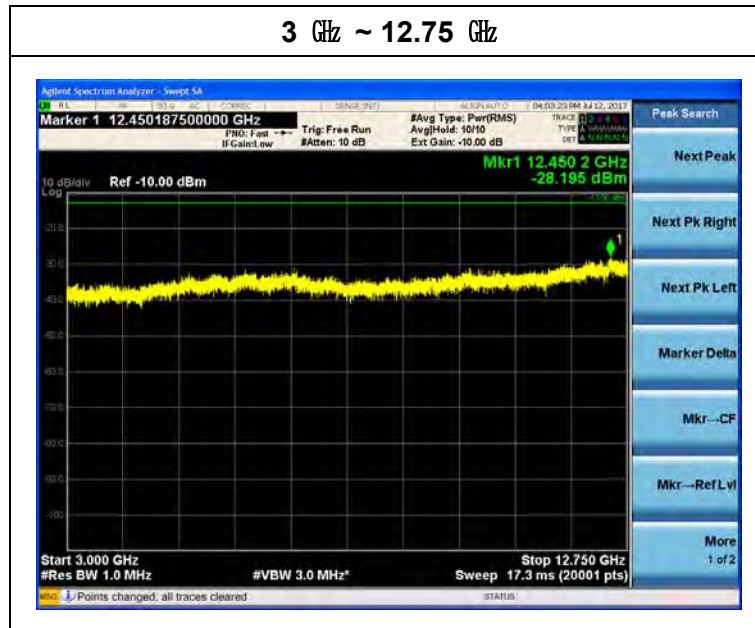


30 MHz ~ 1 GHz



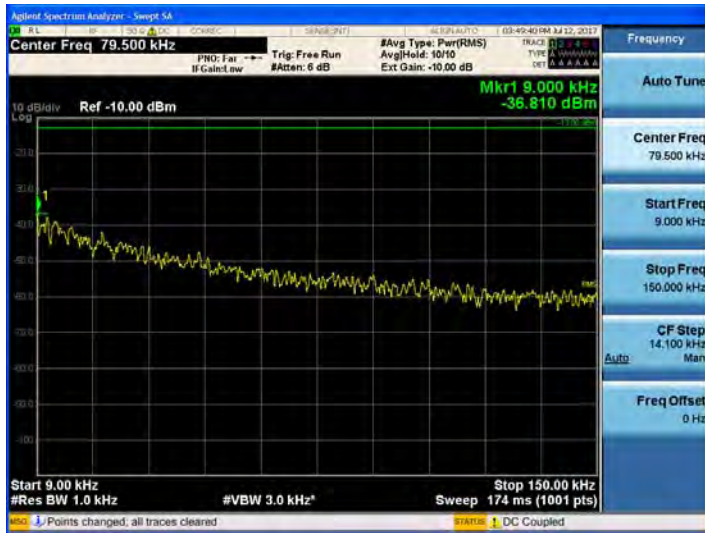
1 GHz ~ 3 GHz



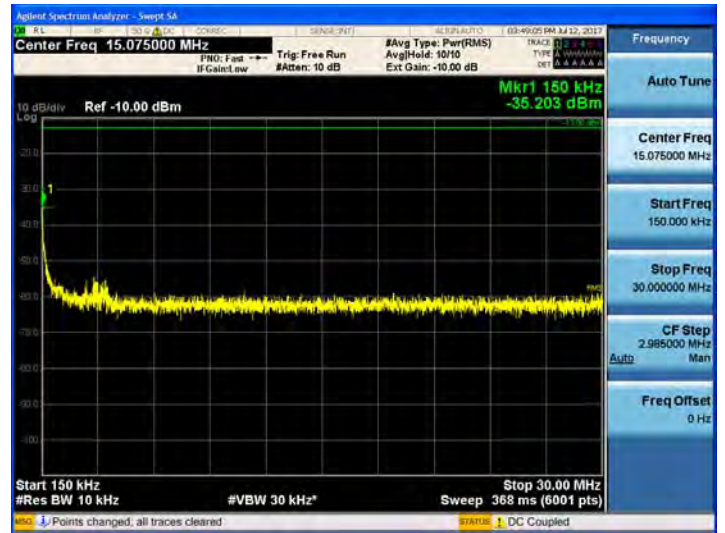


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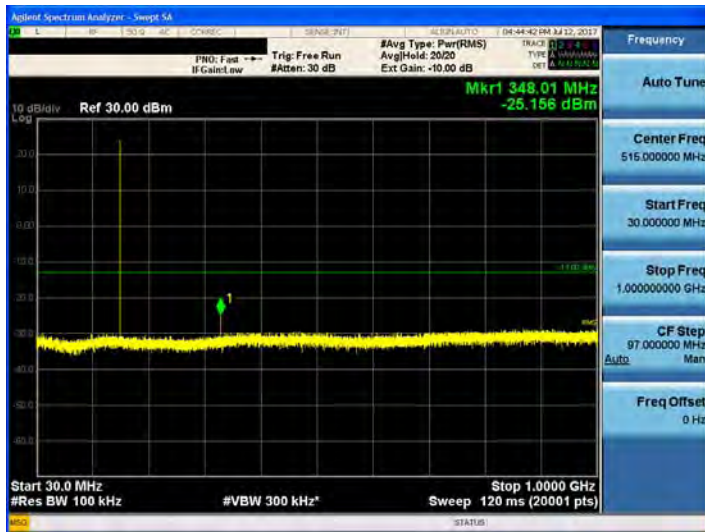
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

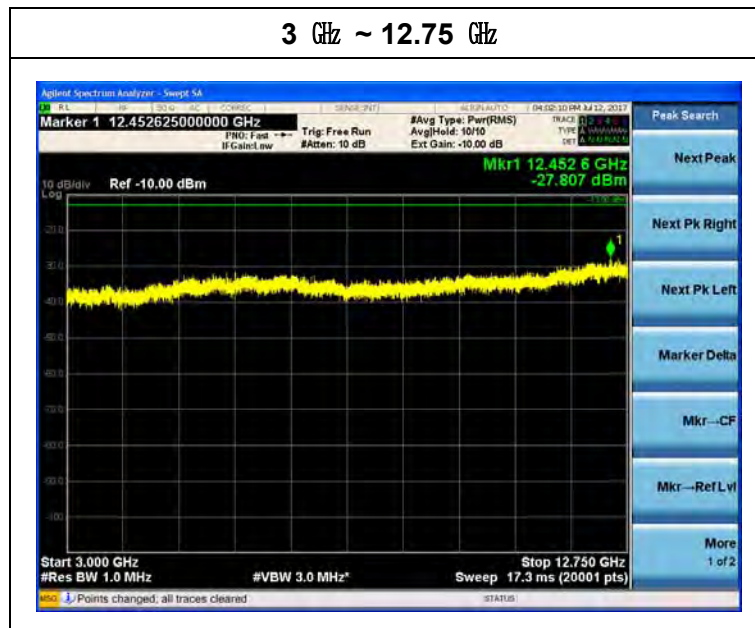


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz





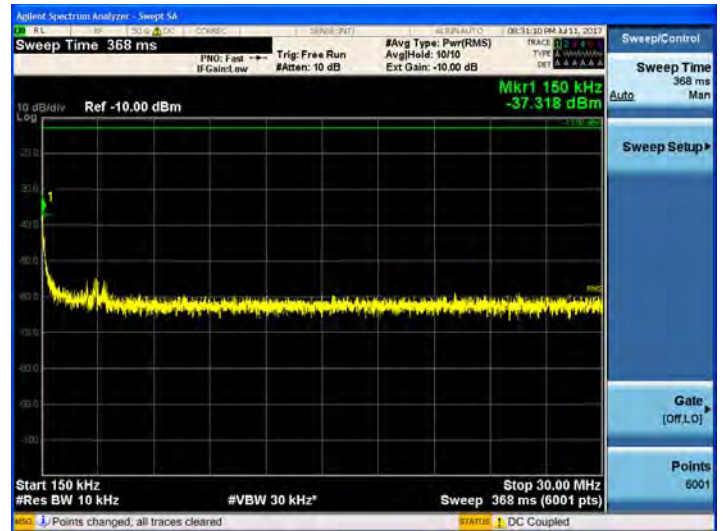
UHF(APCO_406.1 ~ 430 MHz) DL

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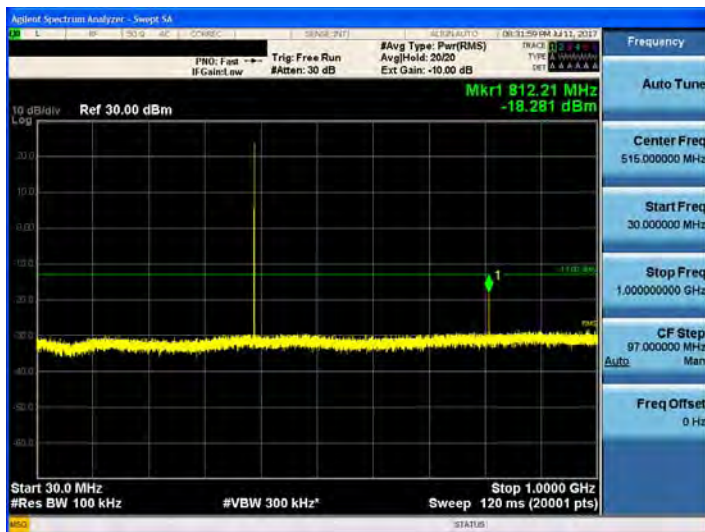
9 kHz ~ 150 kHz



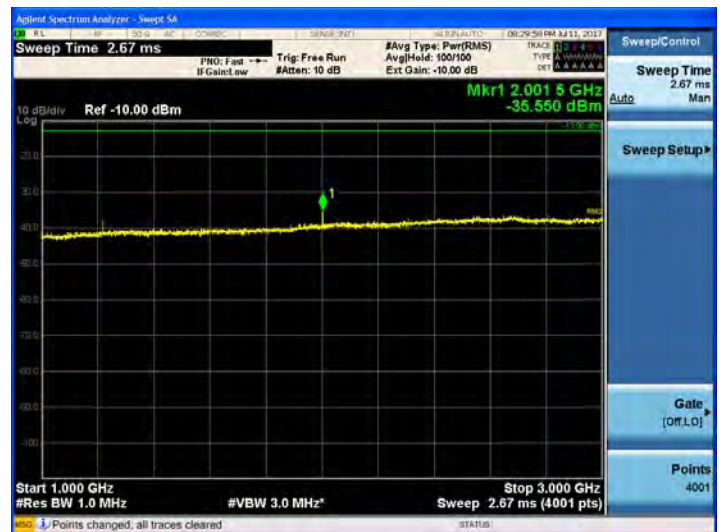
150 kHz ~ 30 MHz

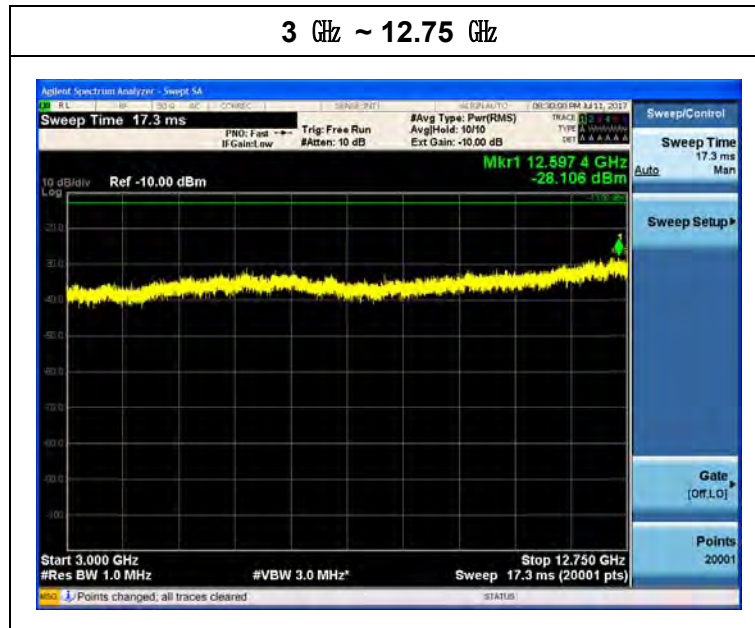


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



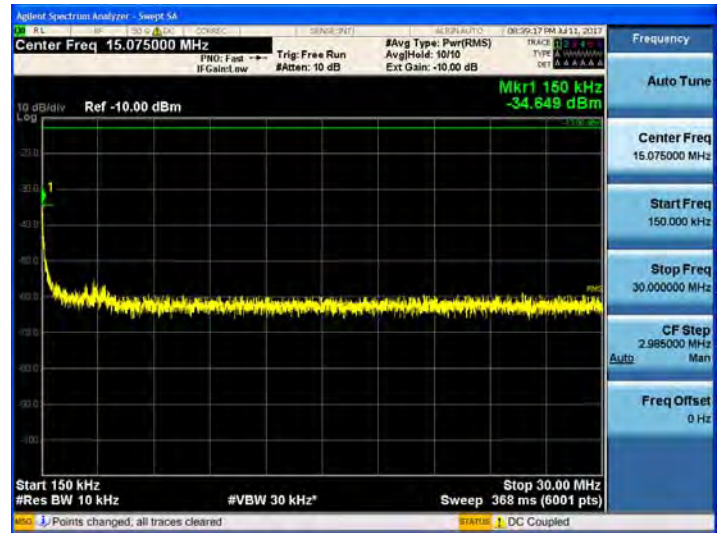


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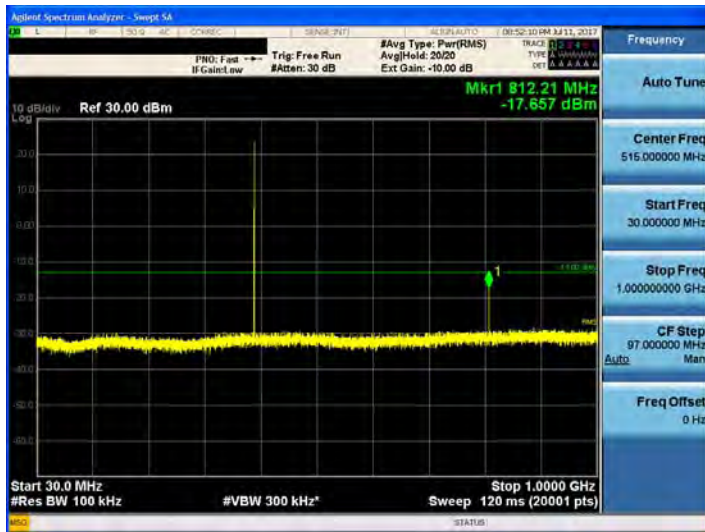
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



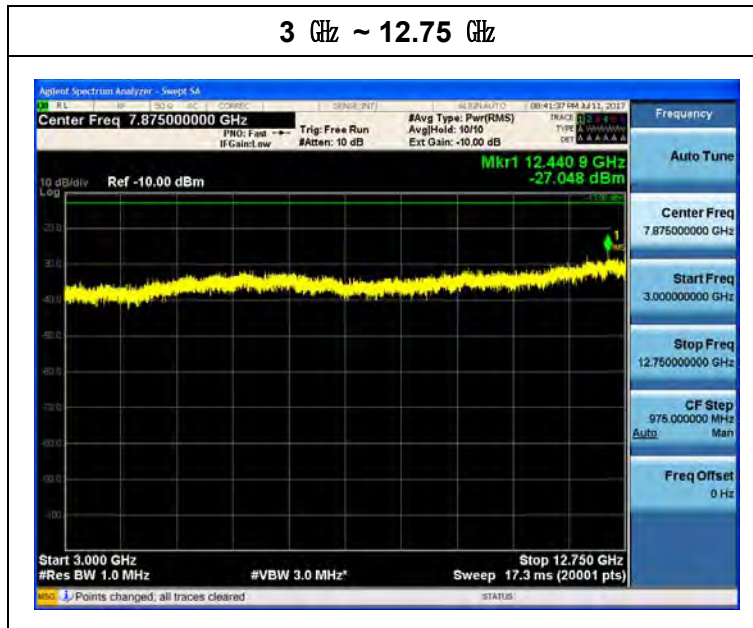
30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



3 GHz ~ 12.75 GHz



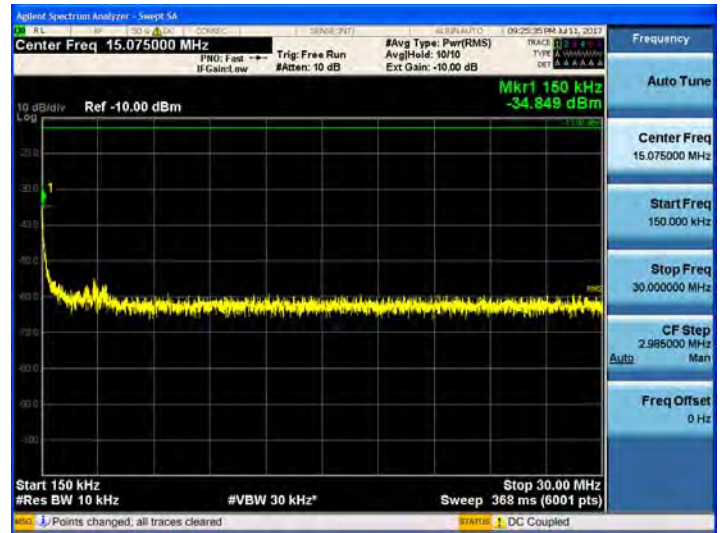
UHF(APCO_450 ~ 470 MHz) DL

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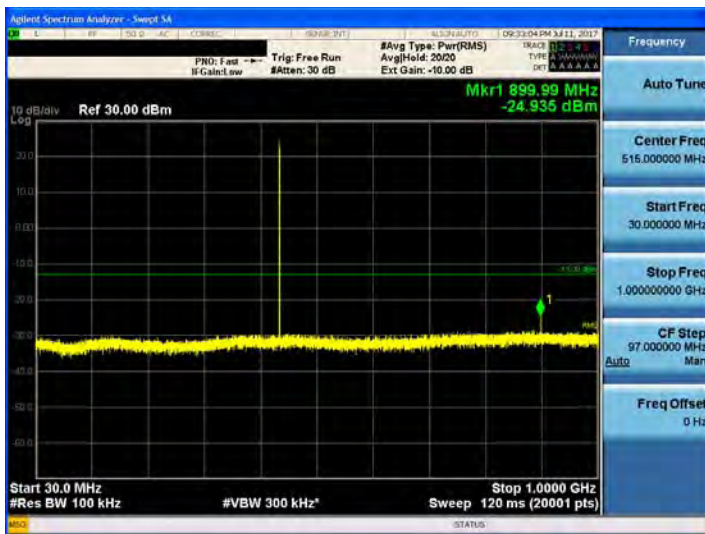
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

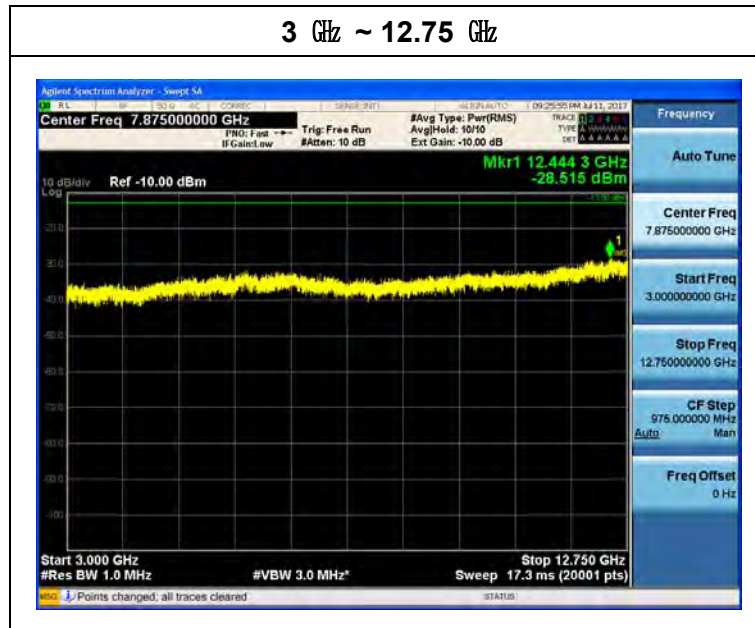


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



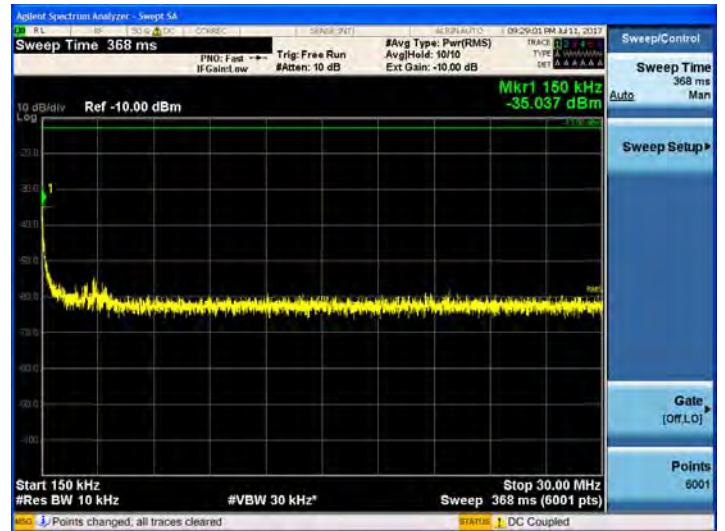


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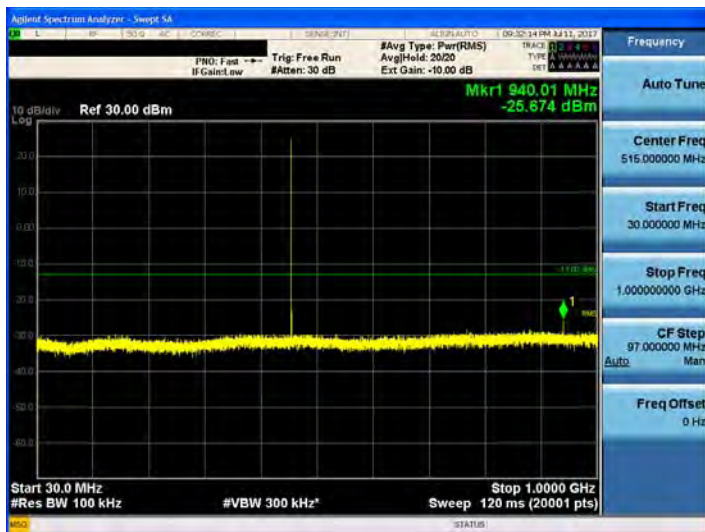
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

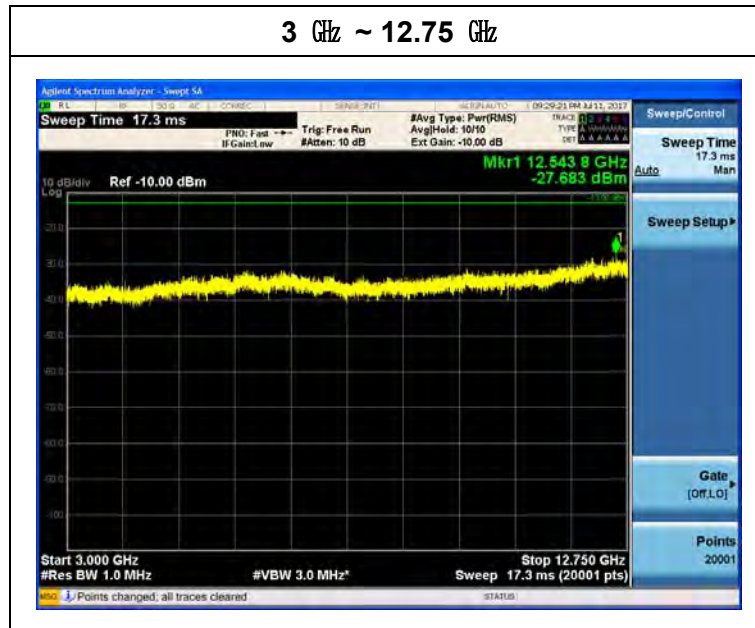


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz





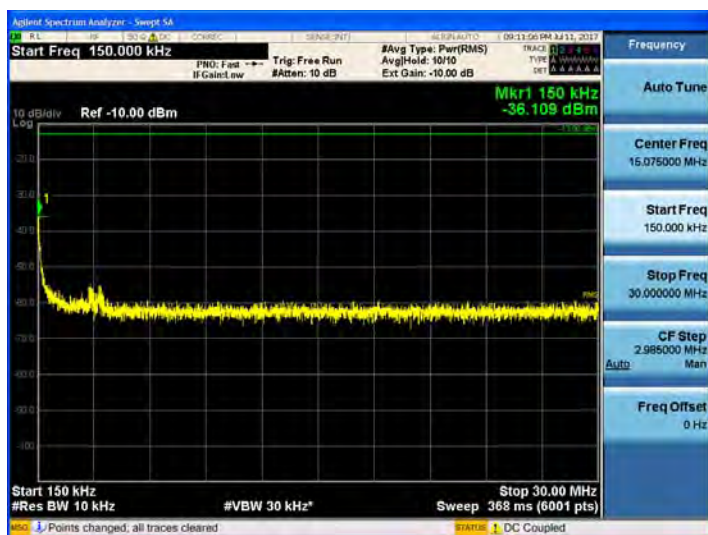
UHF(TETRA_450 ~ 470 MHz) DL

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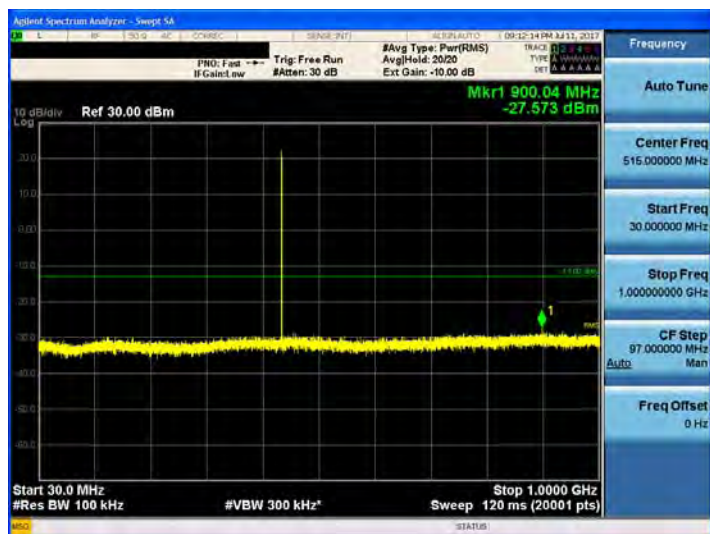
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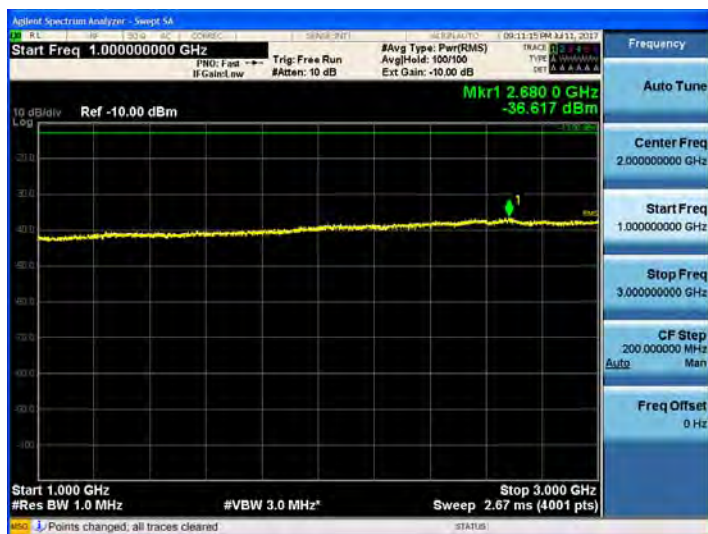
150 kHz ~ 30 MHz

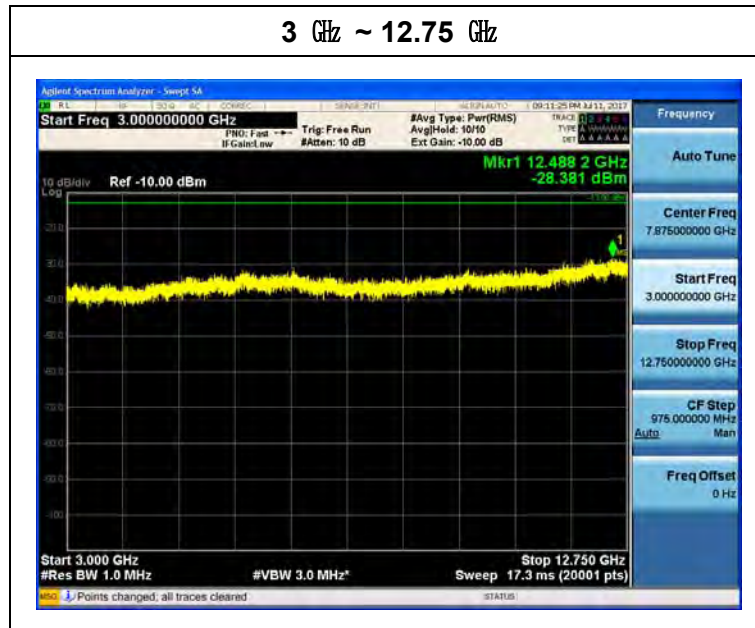


30 MHz ~ 1 GHz



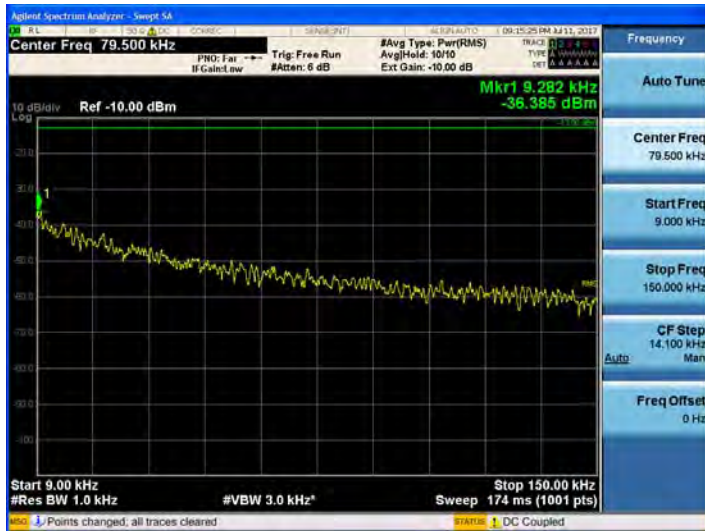
1 GHz ~ 3 GHz





[Downlink_High]

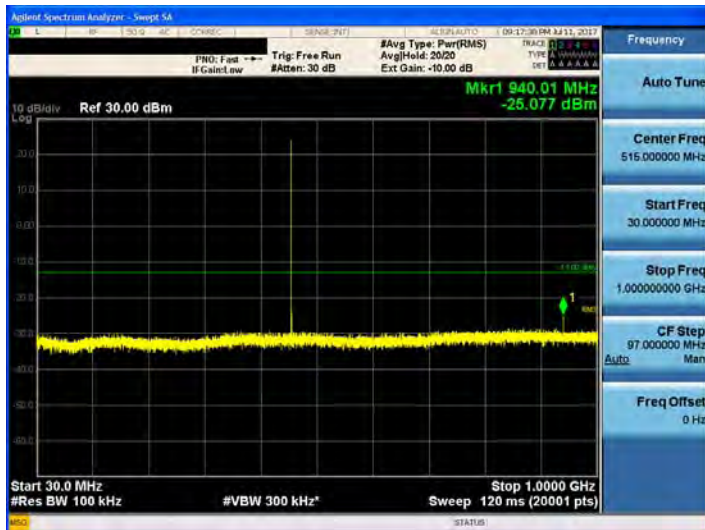
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



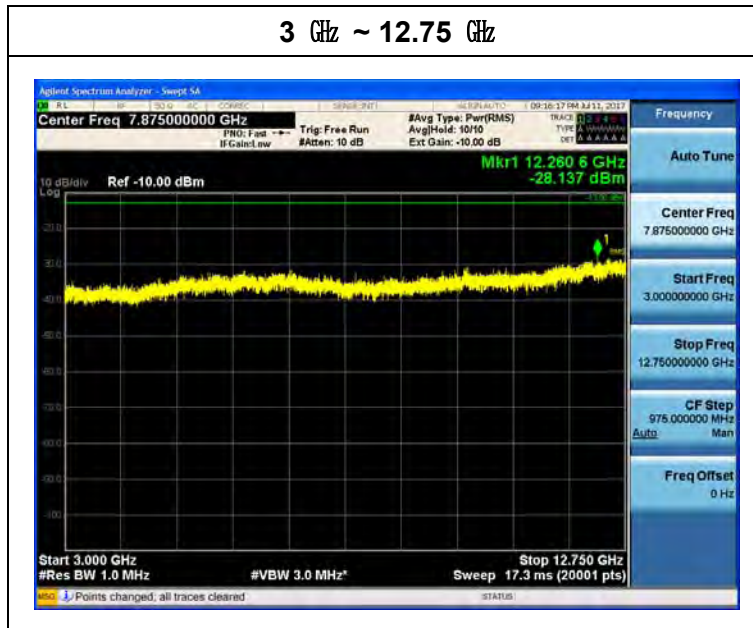
30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



3 GHz ~ 12.75 GHz



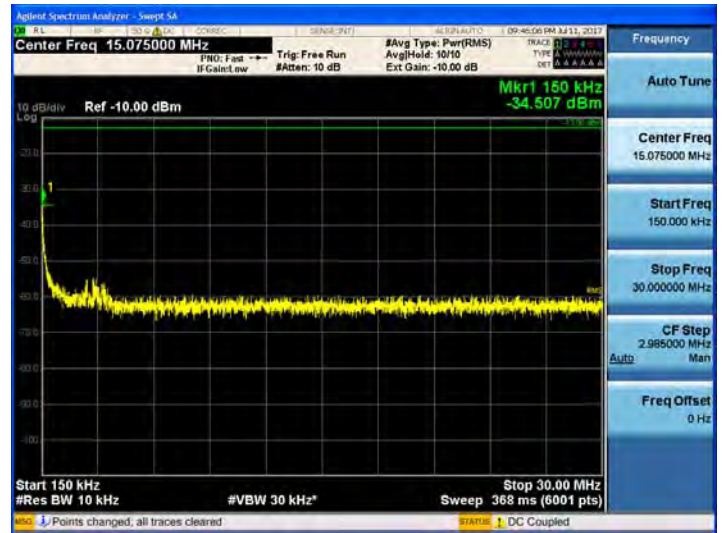
UHF(TETRA_470 ~ 512 MHz) DL

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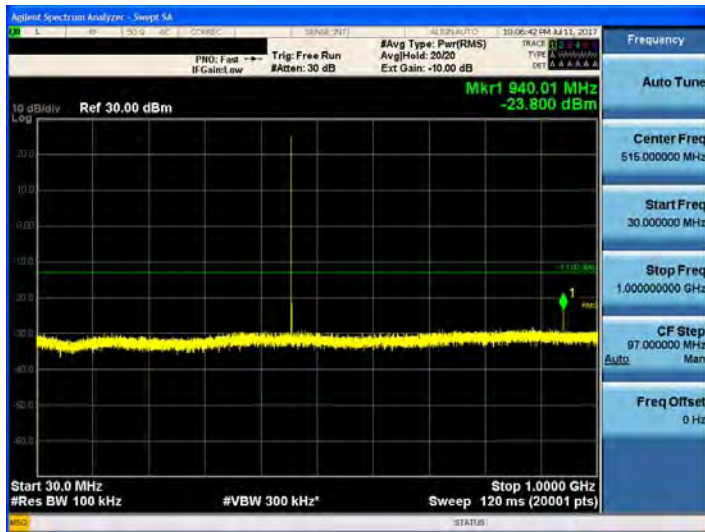
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



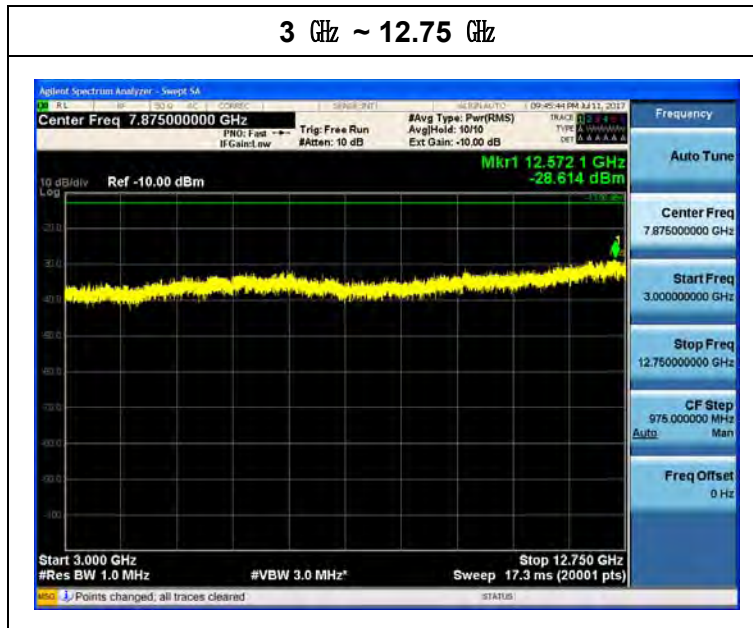
30 MHz ~ 1 GHz



1 GHz ~ 3 GHz

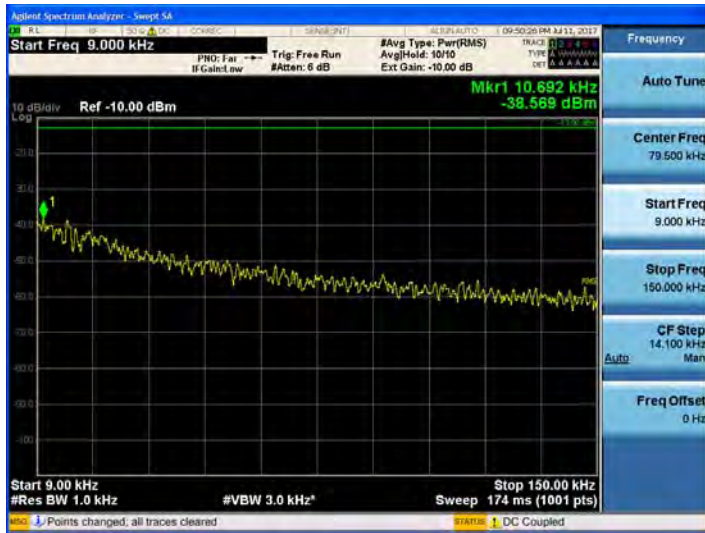


3 GHz ~ 12.75 GHz

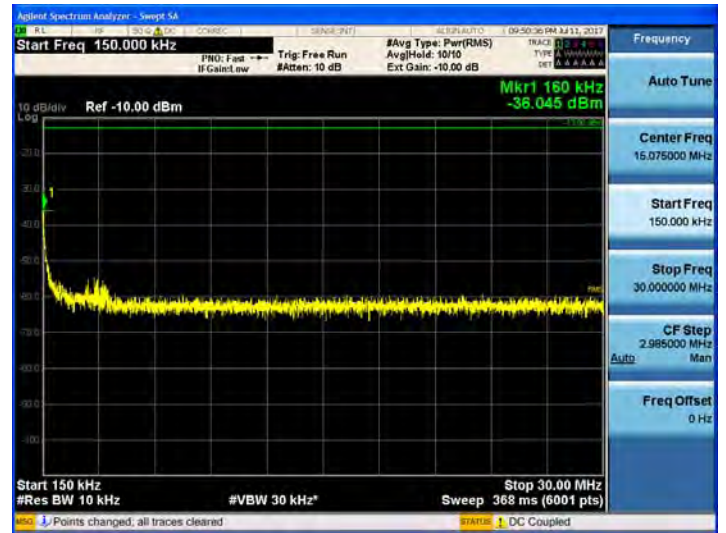


[Downlink_Middle]

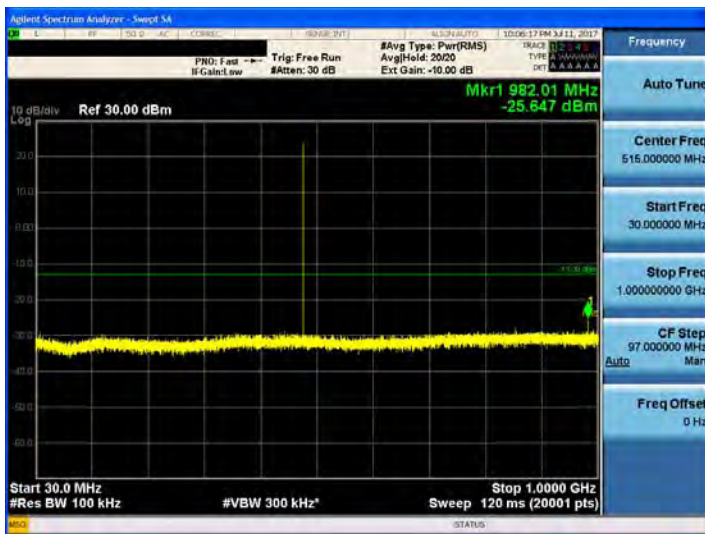
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

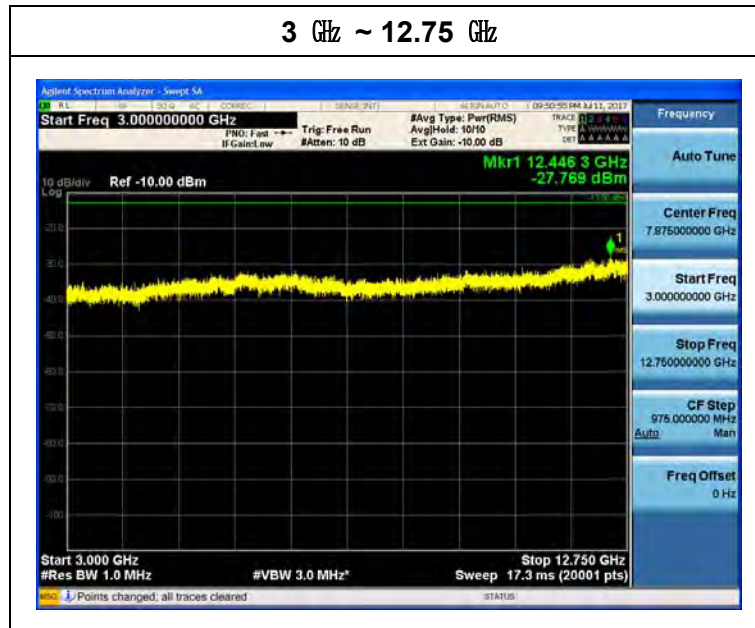


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



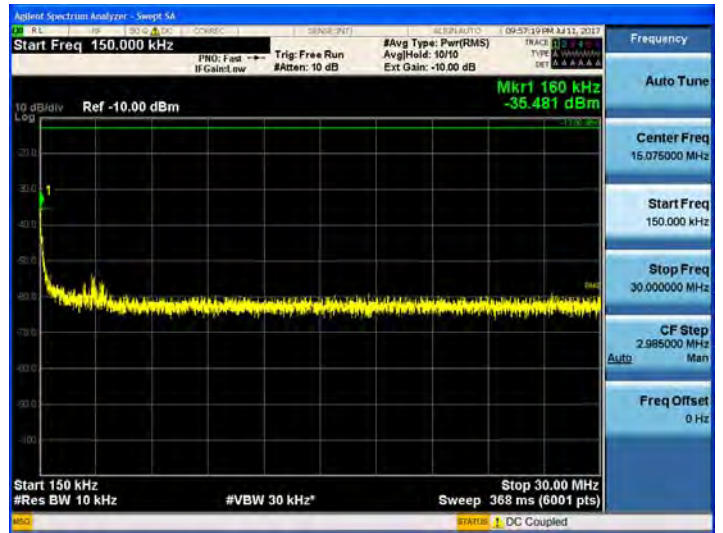


[Downlink_High]

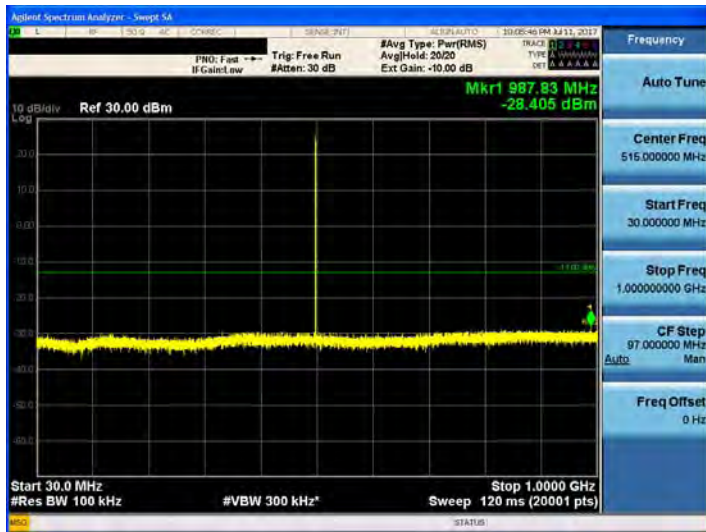
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

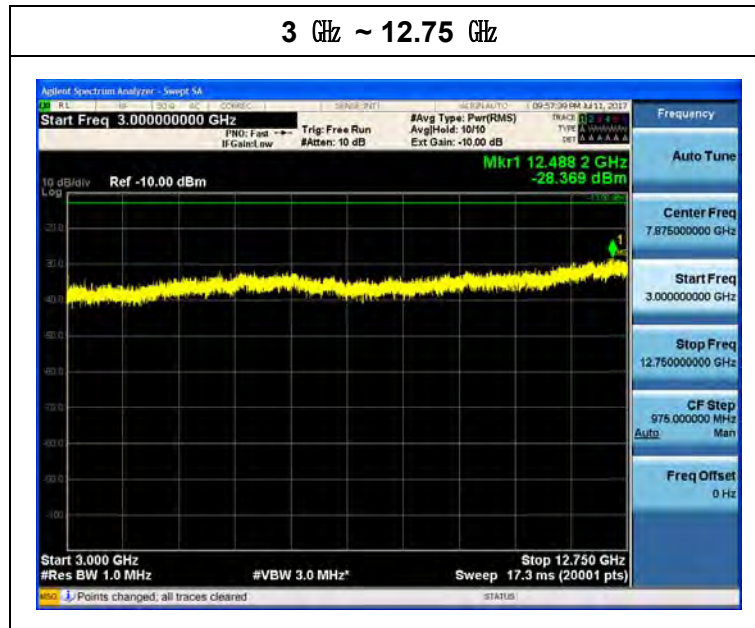


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz





VHF(APCO25_138 MHz) UL

[Uplink_Low]

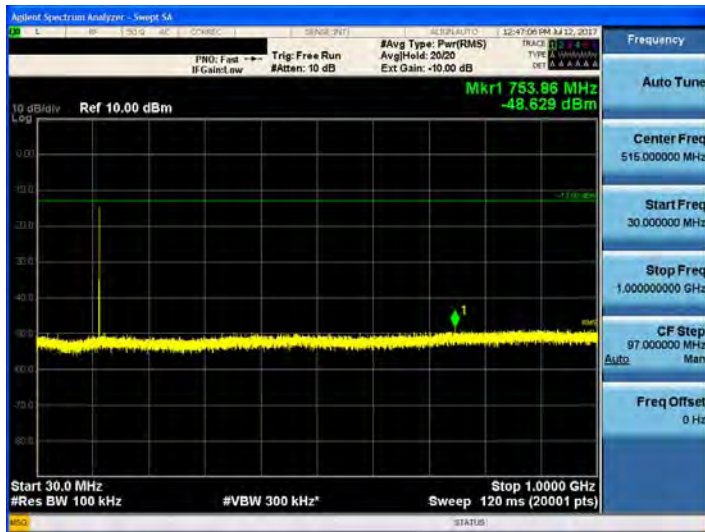
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



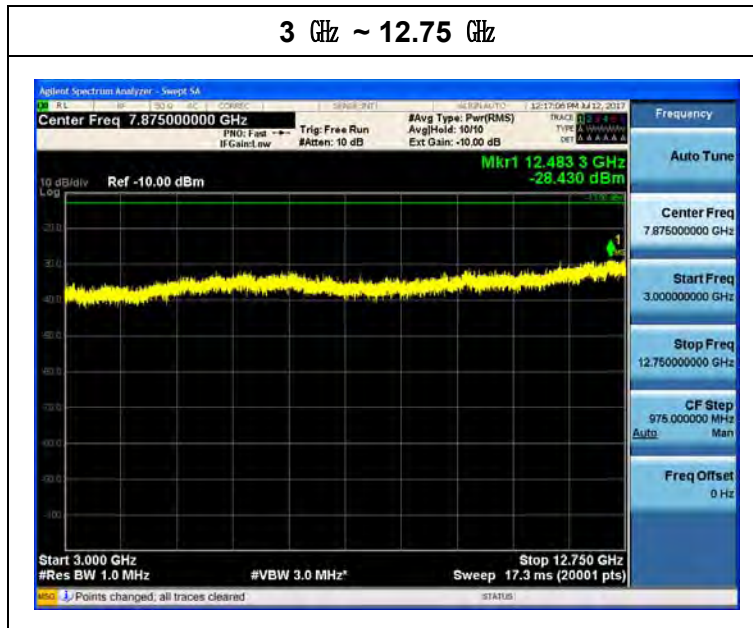
30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



3 GHz ~ 12.75 GHz



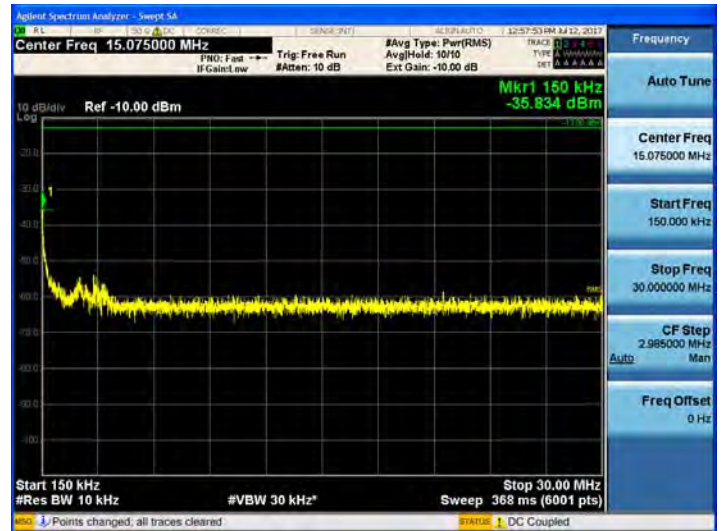
VHF(APCO25_150 ~ 174 MHz) UL

[Uplink_Low]

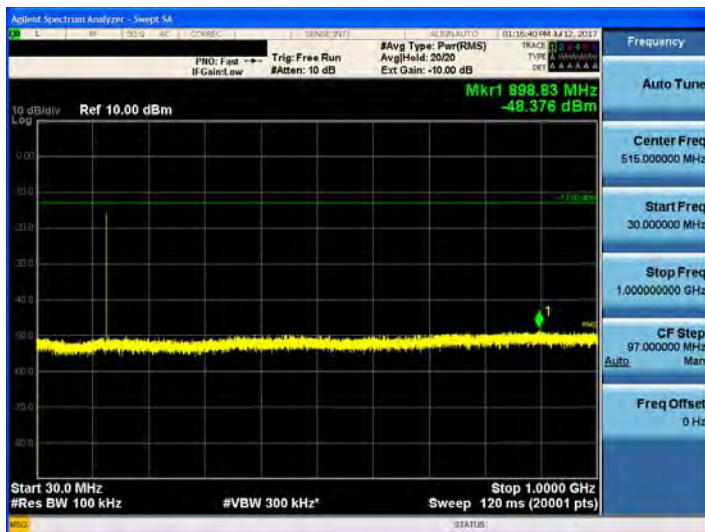
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



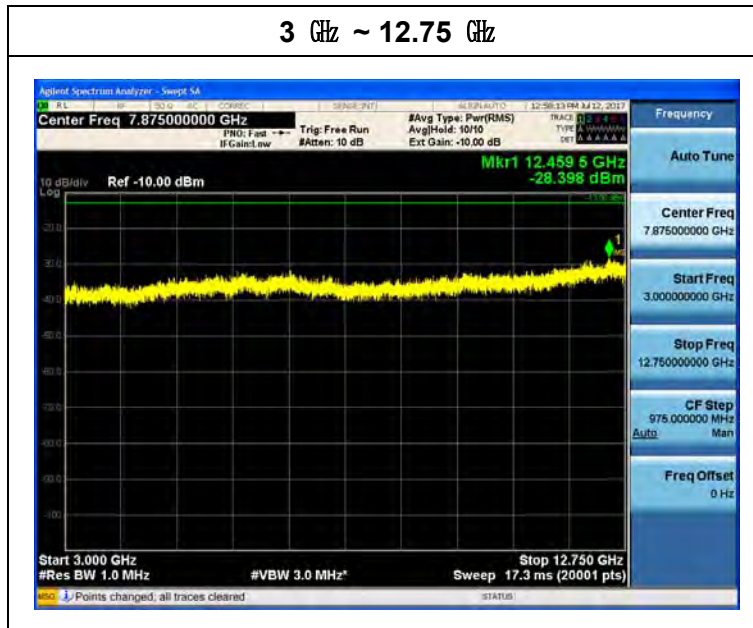
30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



3 GHz ~ 12.75 GHz



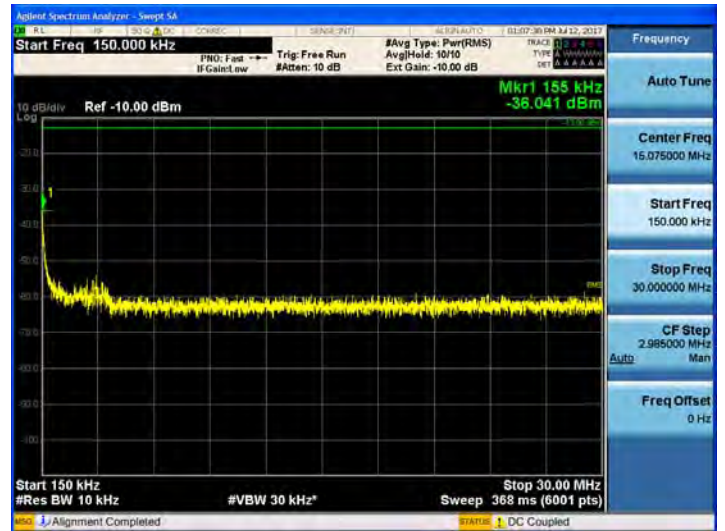
*

[Uplink_Middle]

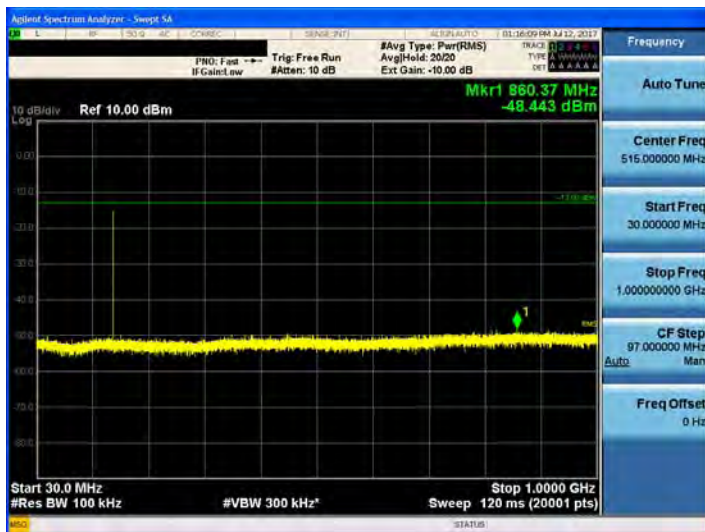
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

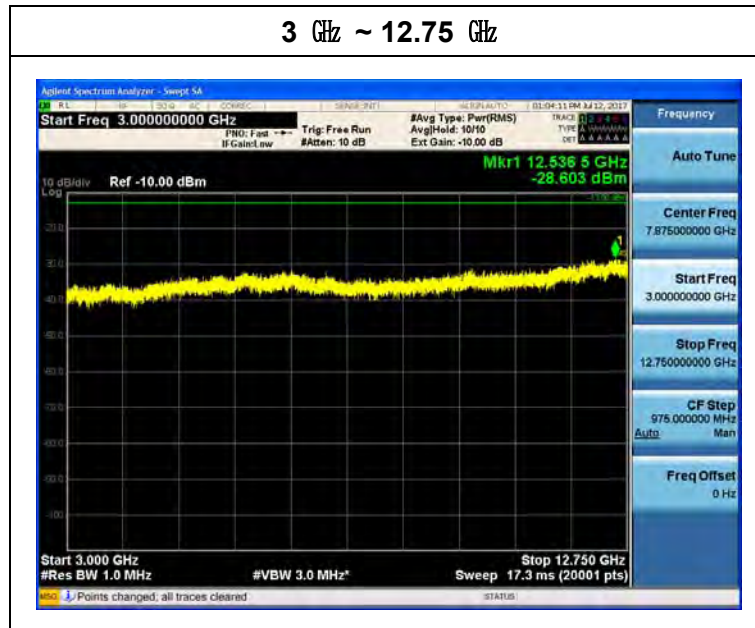


30 MHz ~ 1 GHz



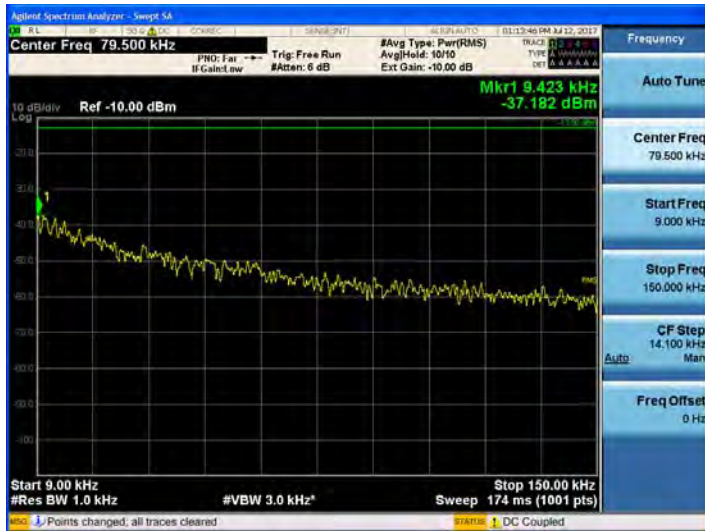
1 GHz ~ 3 GHz



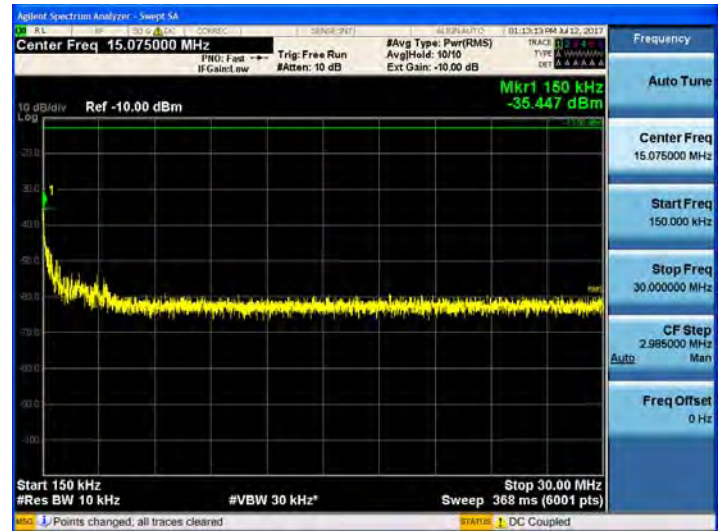


[Uplink_High]

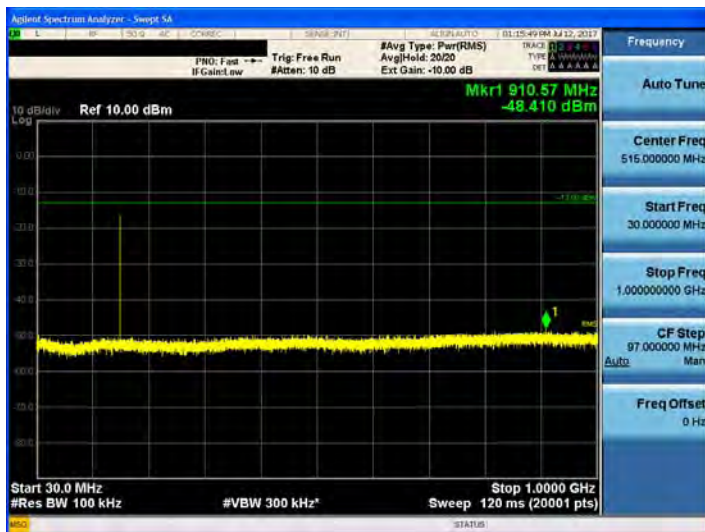
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



3 GHz ~ 12.75 GHz

