

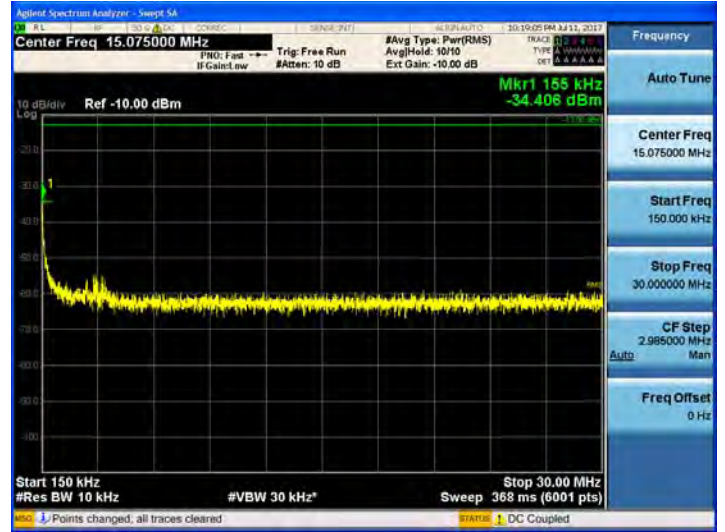
UHF(APCO_406.1 ~ 430 MHz) UL

[Uplink_Low]

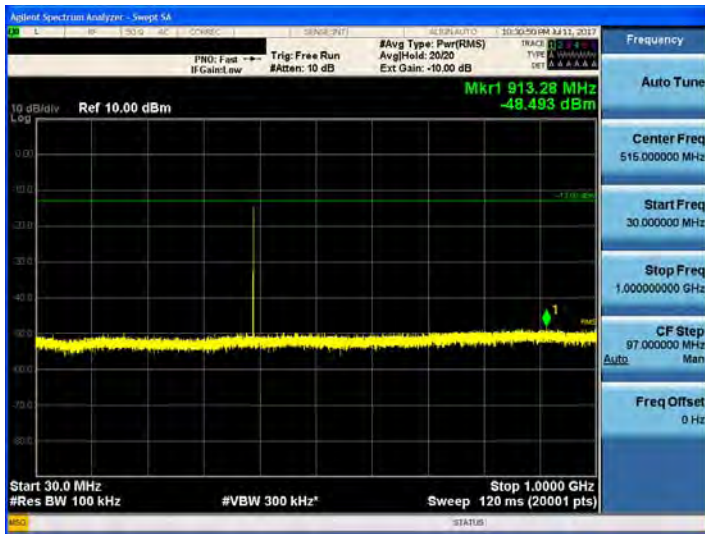
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

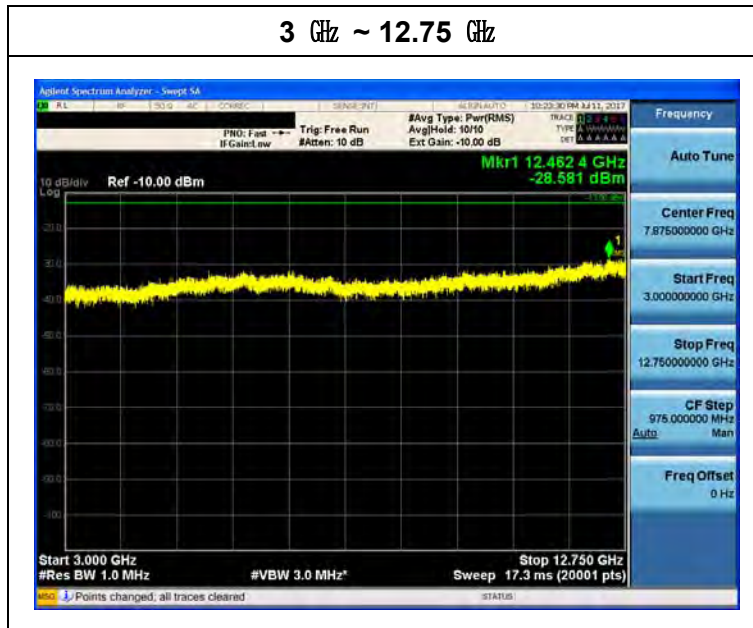


30 MHz ~ 1 GHz



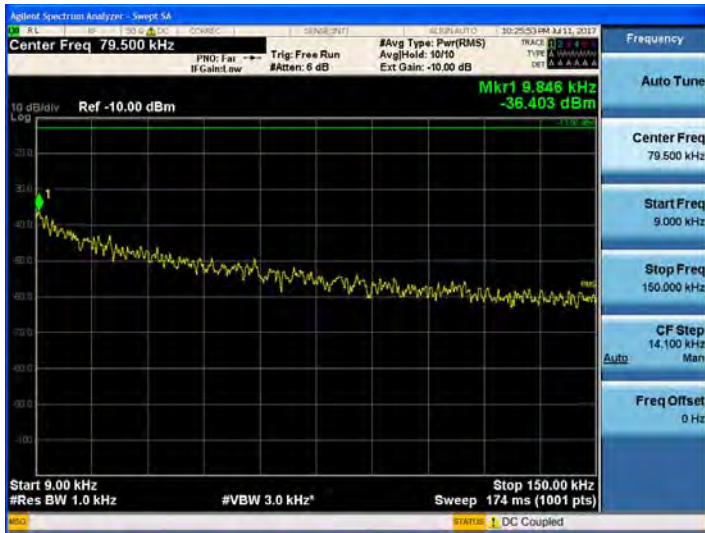
1 GHz ~ 3 GHz



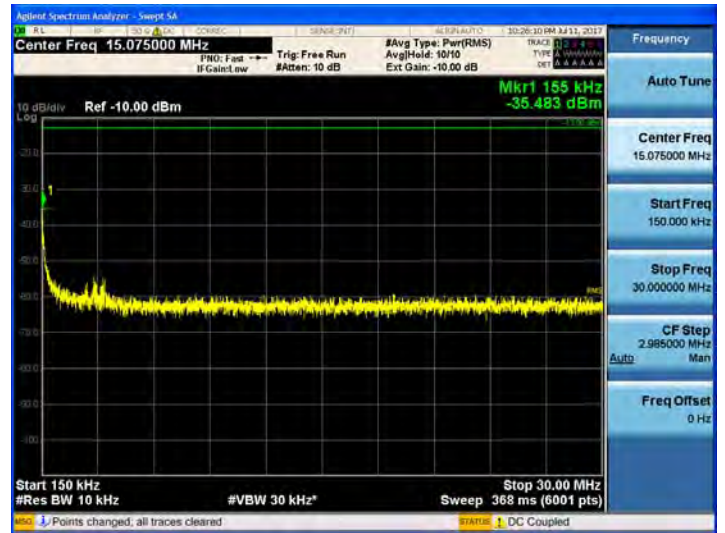


[Uplink_High]

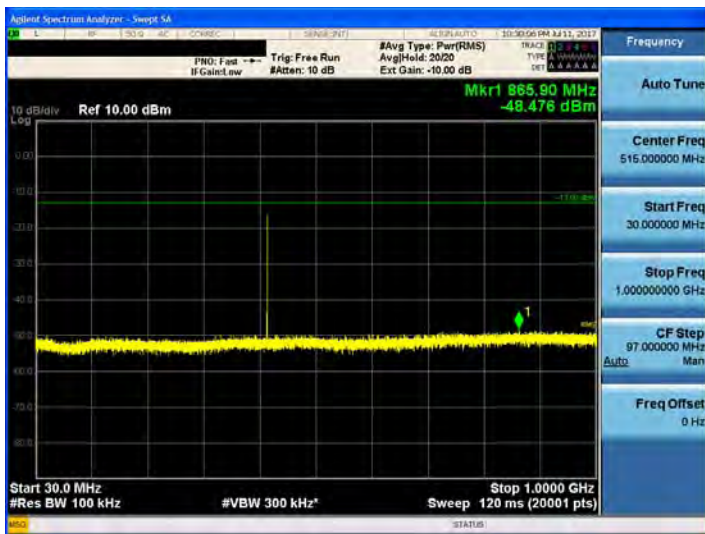
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

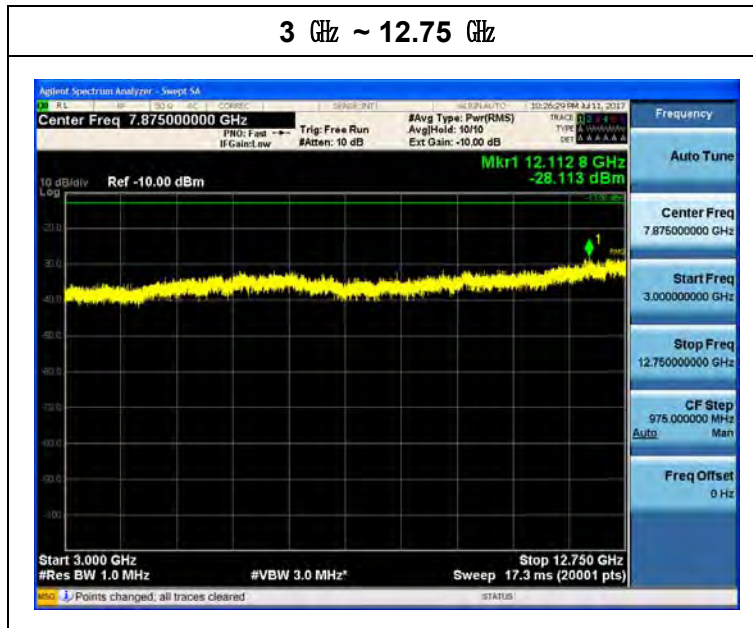


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz





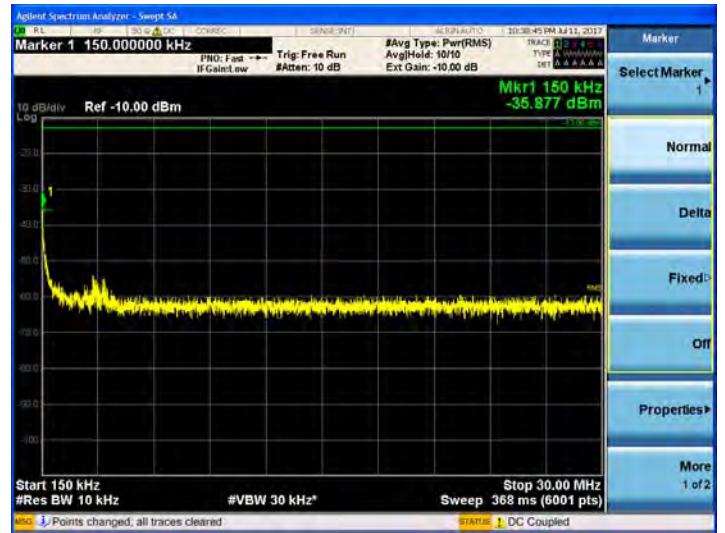
UHF(APCO_450 ~ 470 MHz) UL

[Uplink_Low]

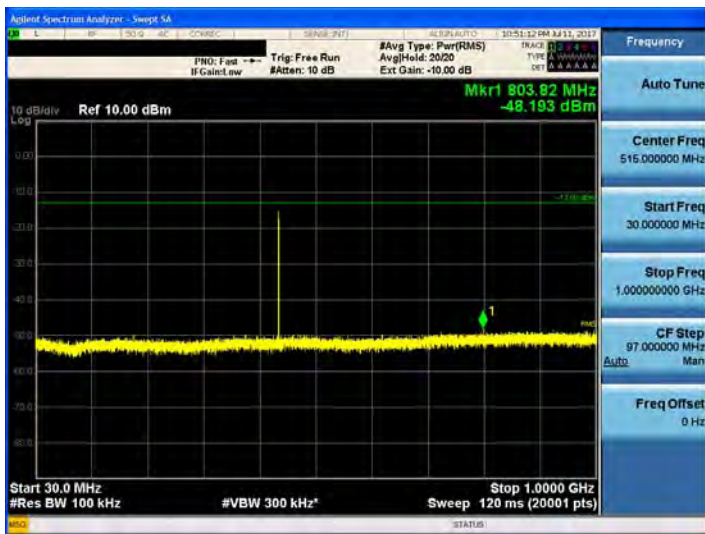
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz



30 MHz ~ 1 GHz



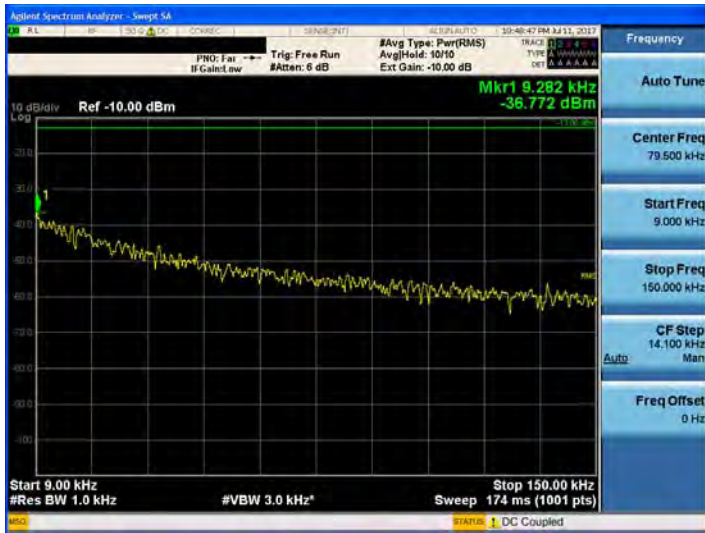
1 GHz ~ 3 GHz



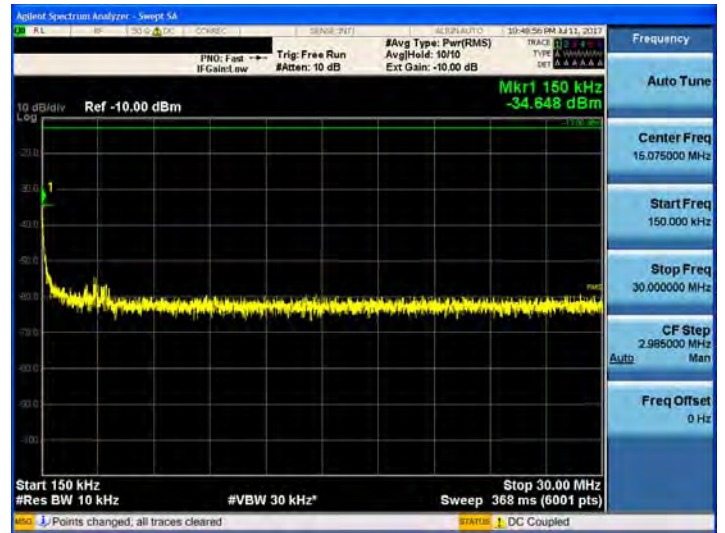


[Uplink_High]

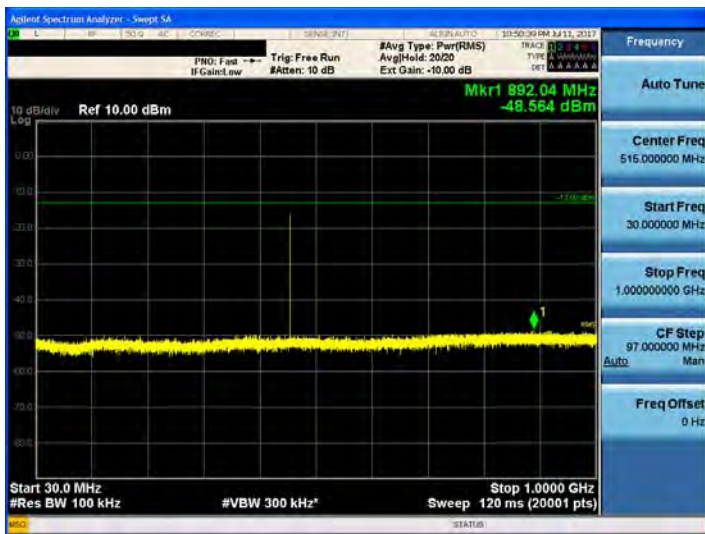
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

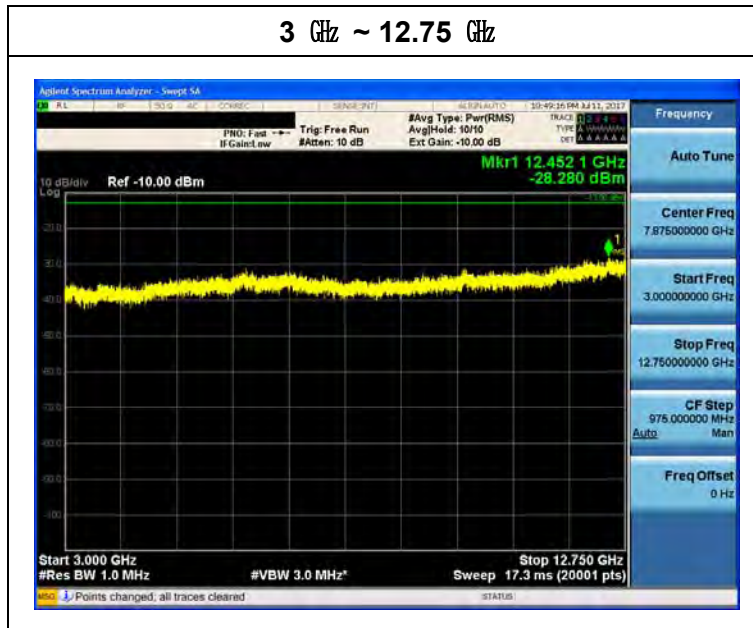


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz





UHF(TETRA_450 ~ 470 MHz) UL

[Uplink_Low]

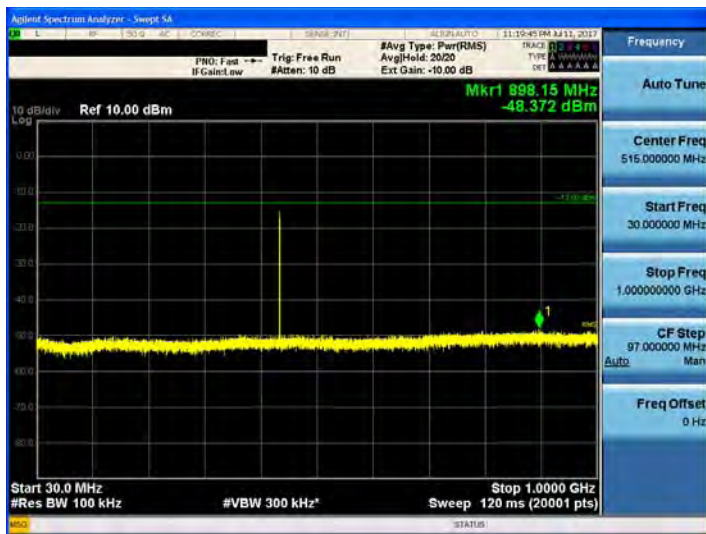
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

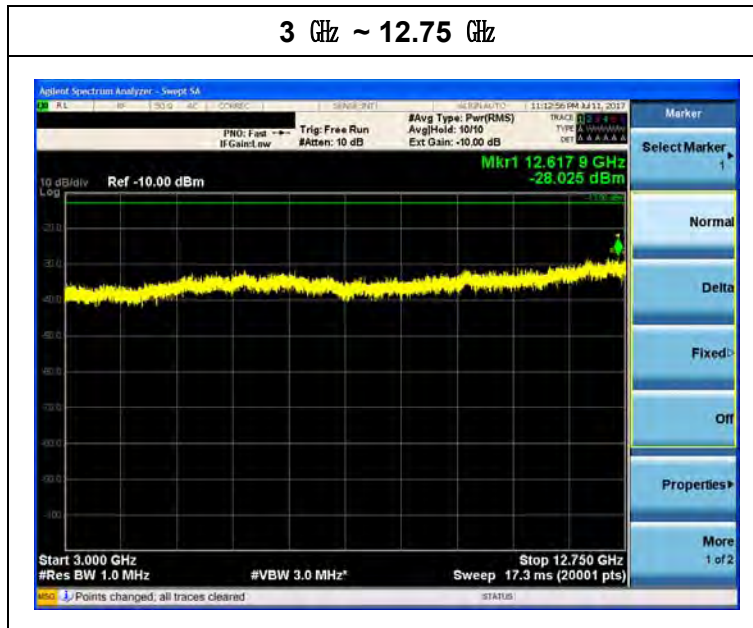


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



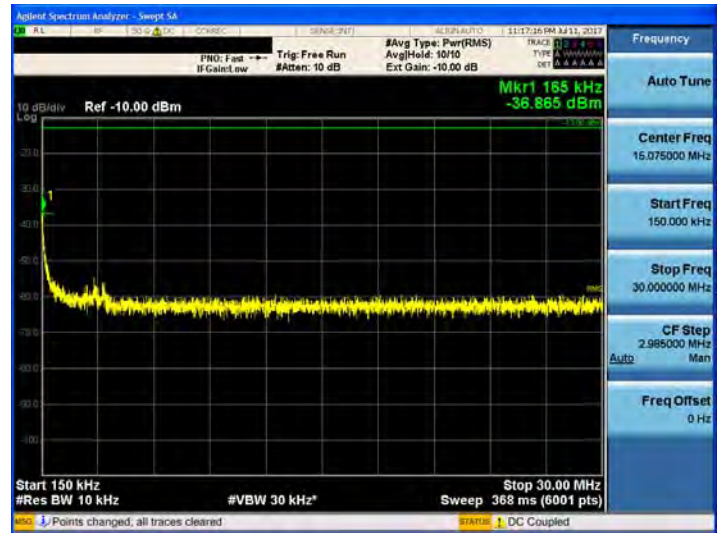


[Uplink_High]

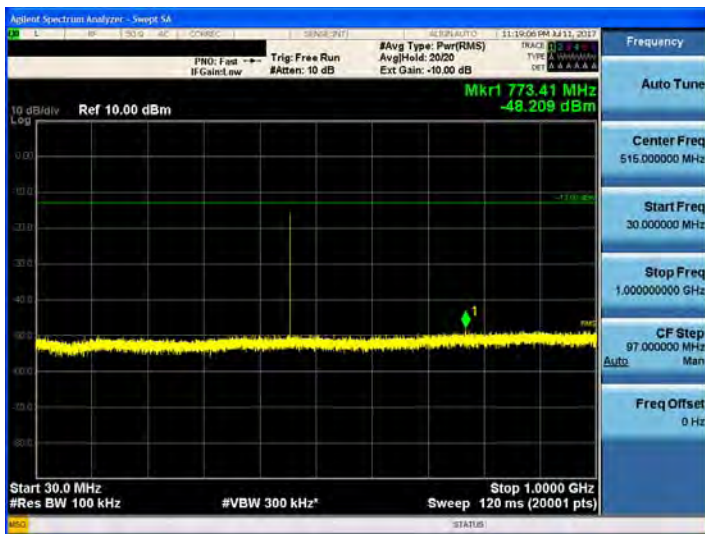
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

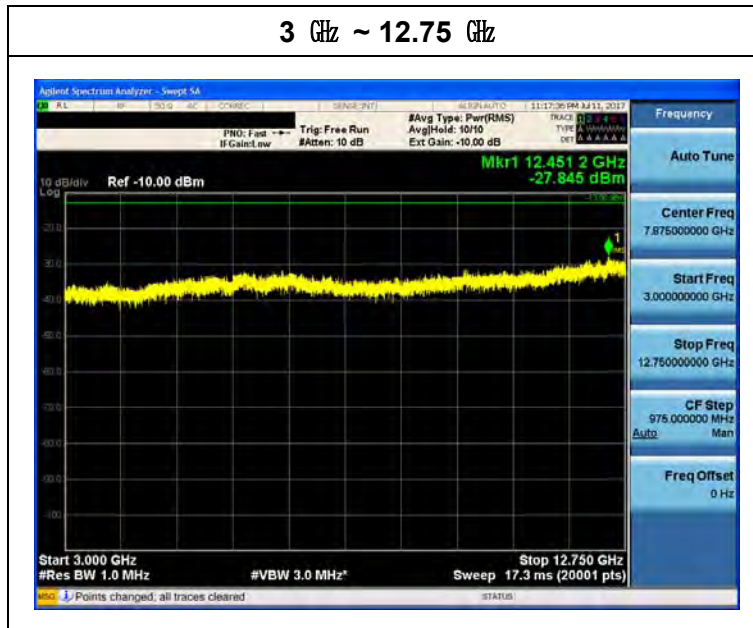


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz





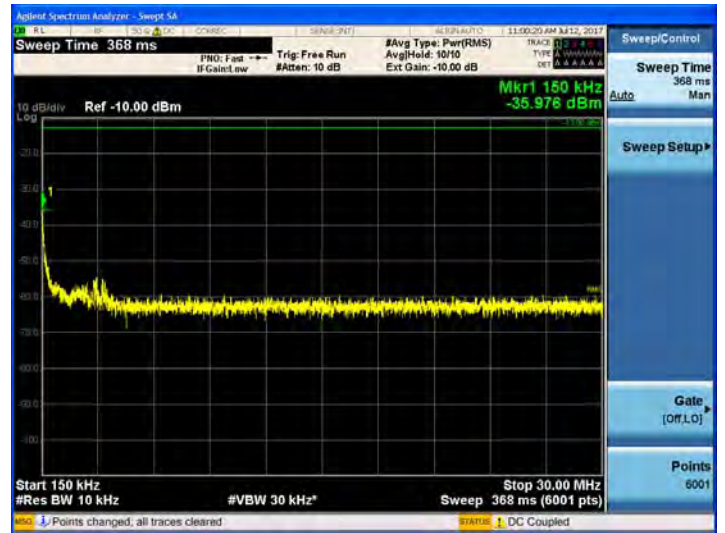
UHF(TETRA_470 ~ 512 MHz) UL

[Uplink_Low]

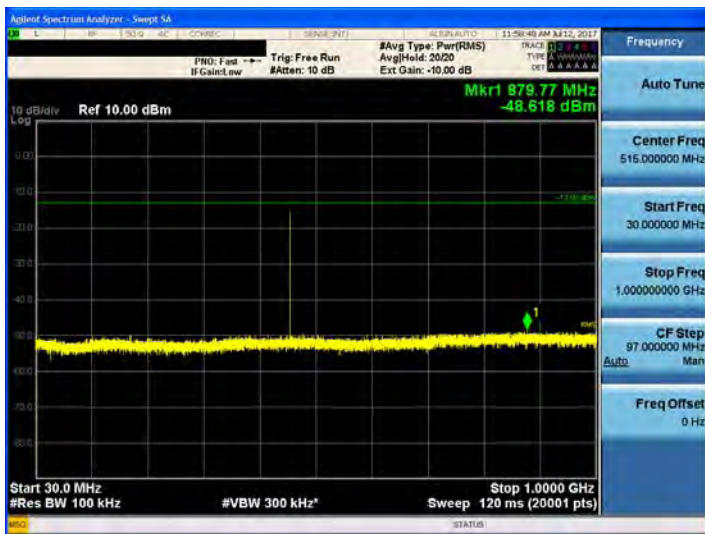
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

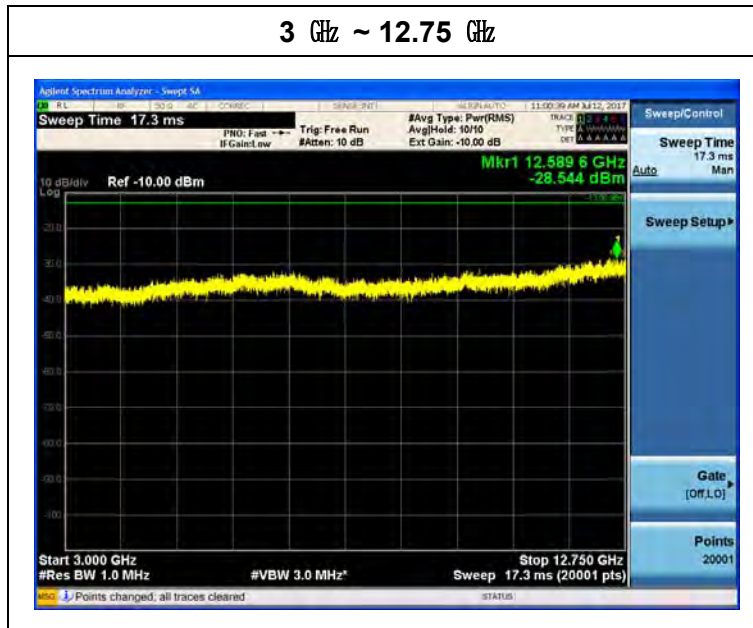


30 MHz ~ 1 GHz



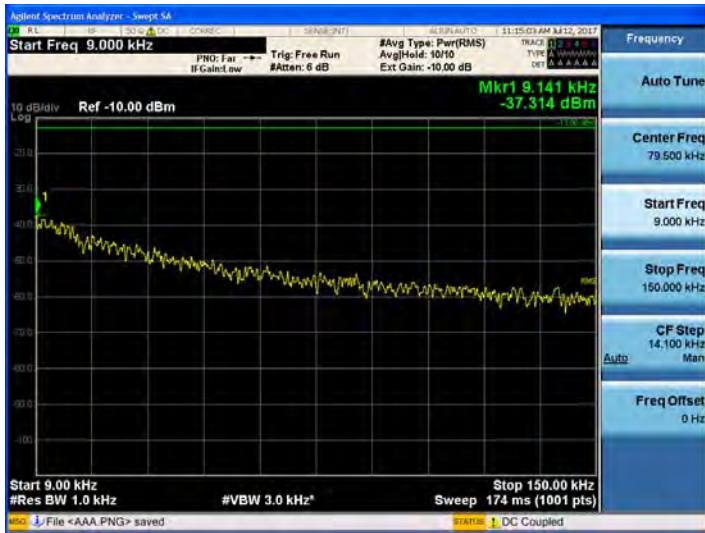
1 GHz ~ 3 GHz



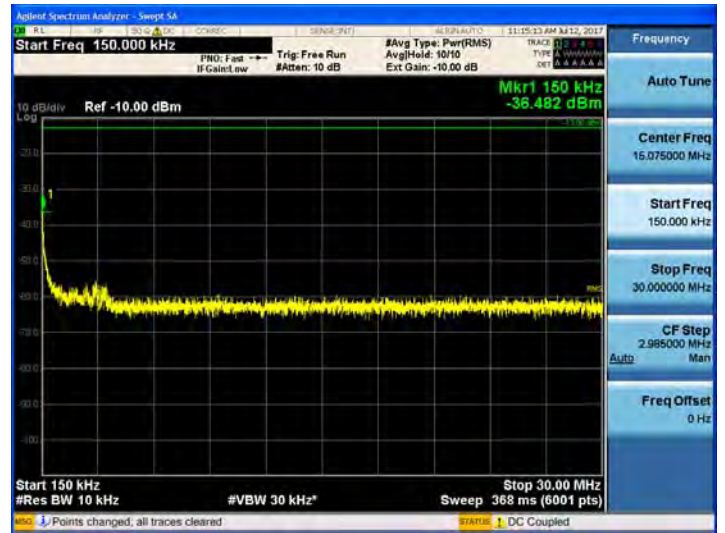


[Uplink_Middle]

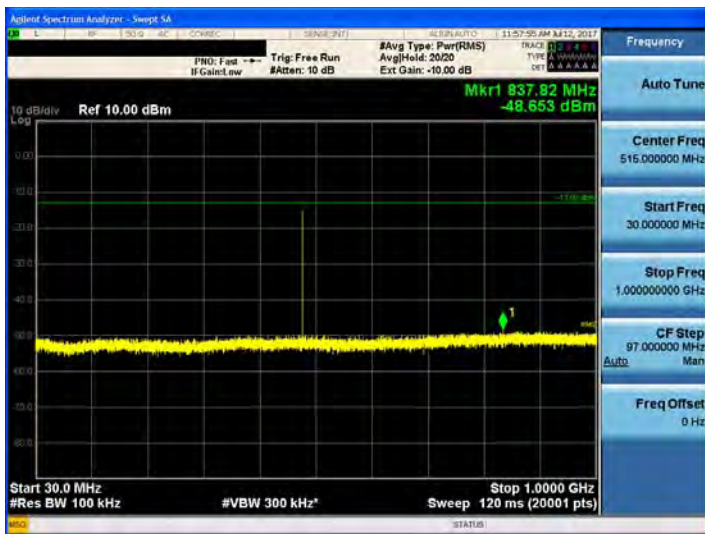
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

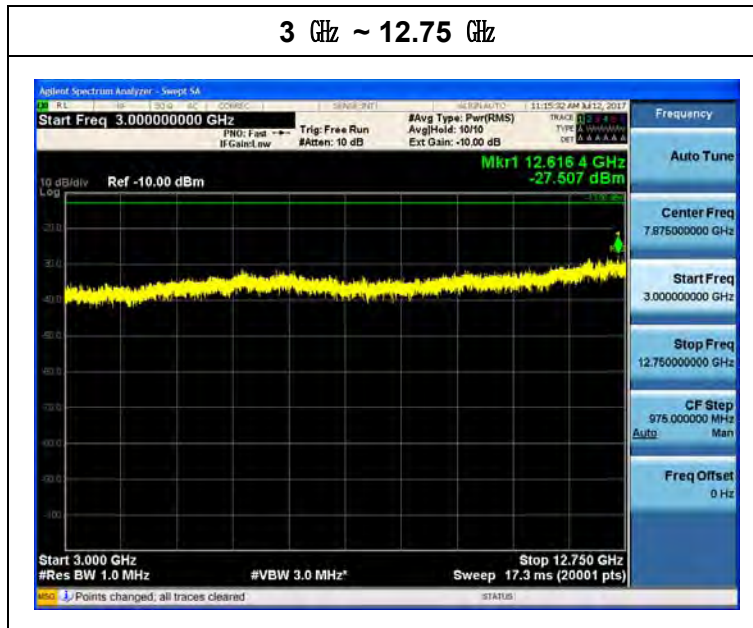


30 MHz ~ 1 GHz



1 GHz ~ 3 GHz



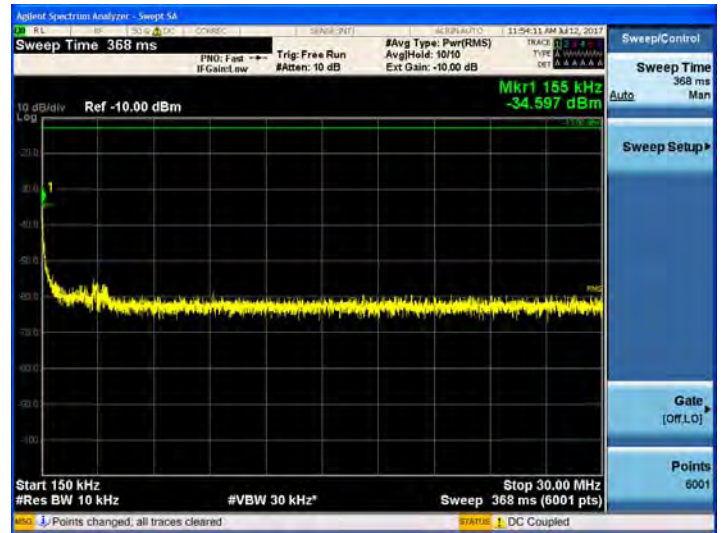


[Uplink_High]

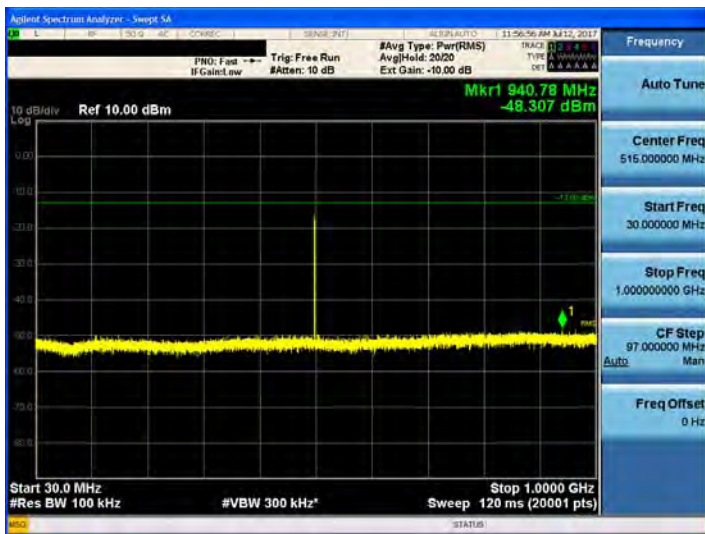
9 kHz ~ 150 kHz



150 kHz ~ 30 MHz

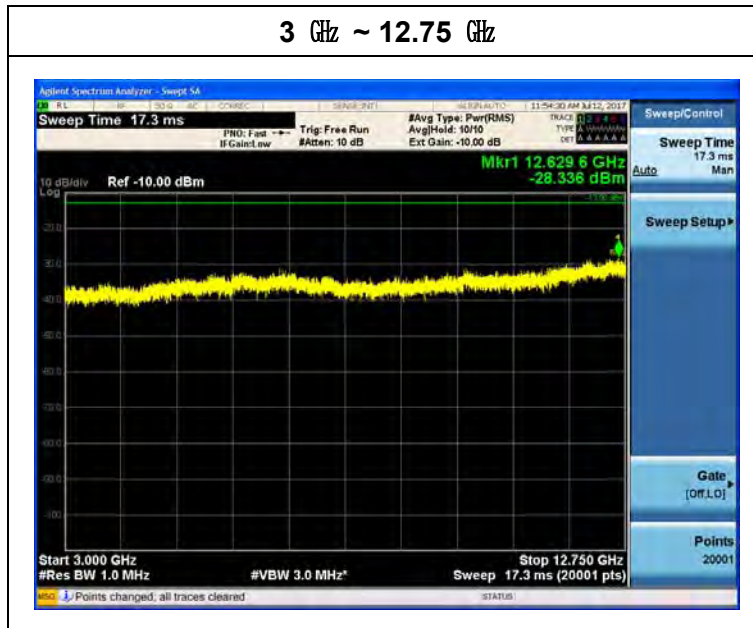


30 MHz ~ 1 GHz



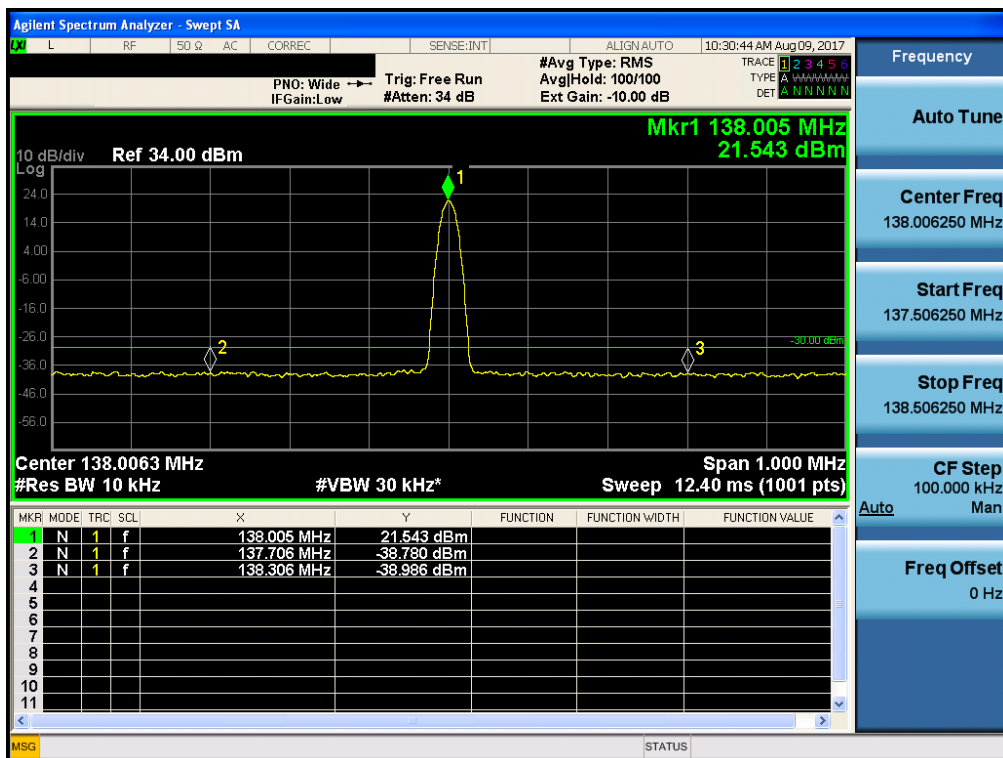
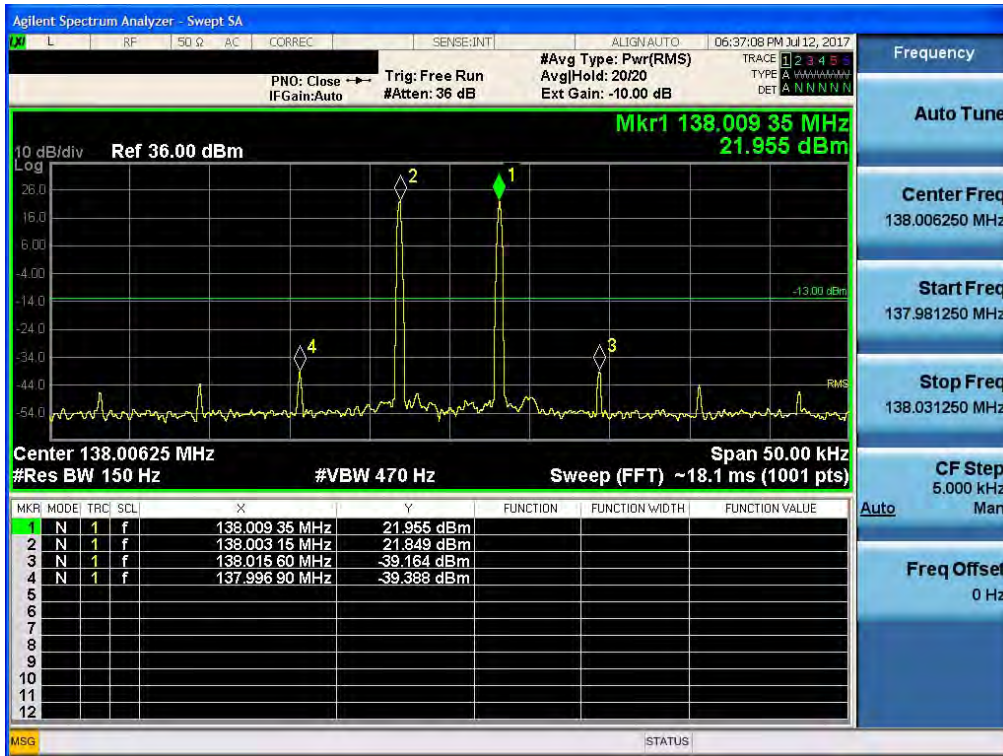
1 GHz ~ 3 GHz





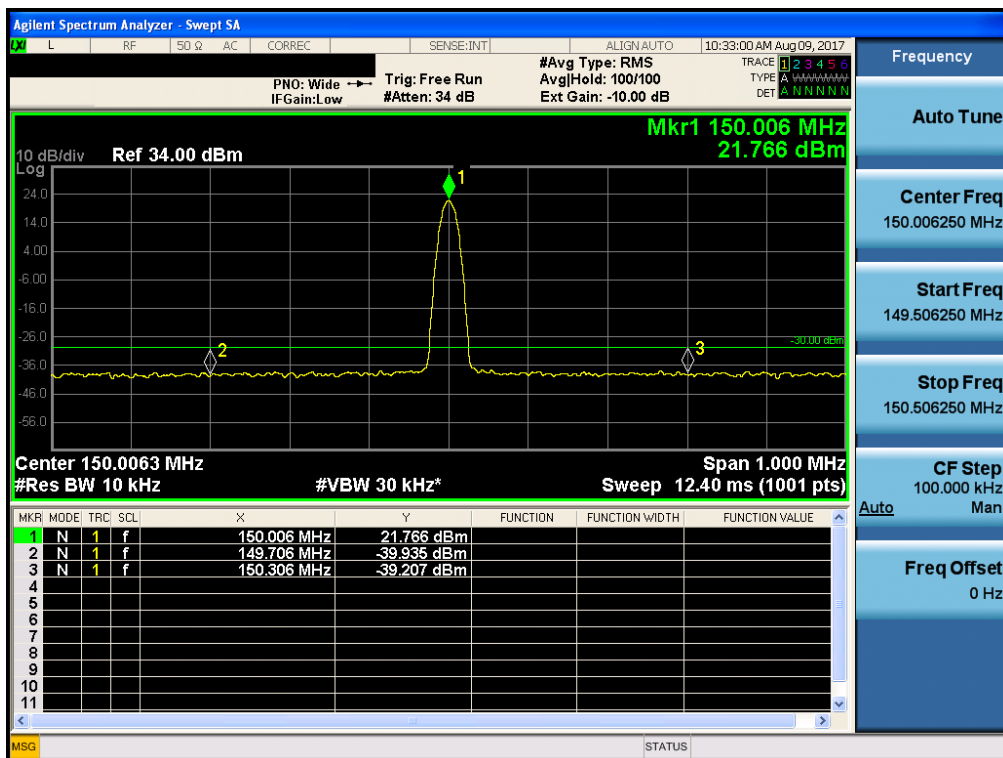
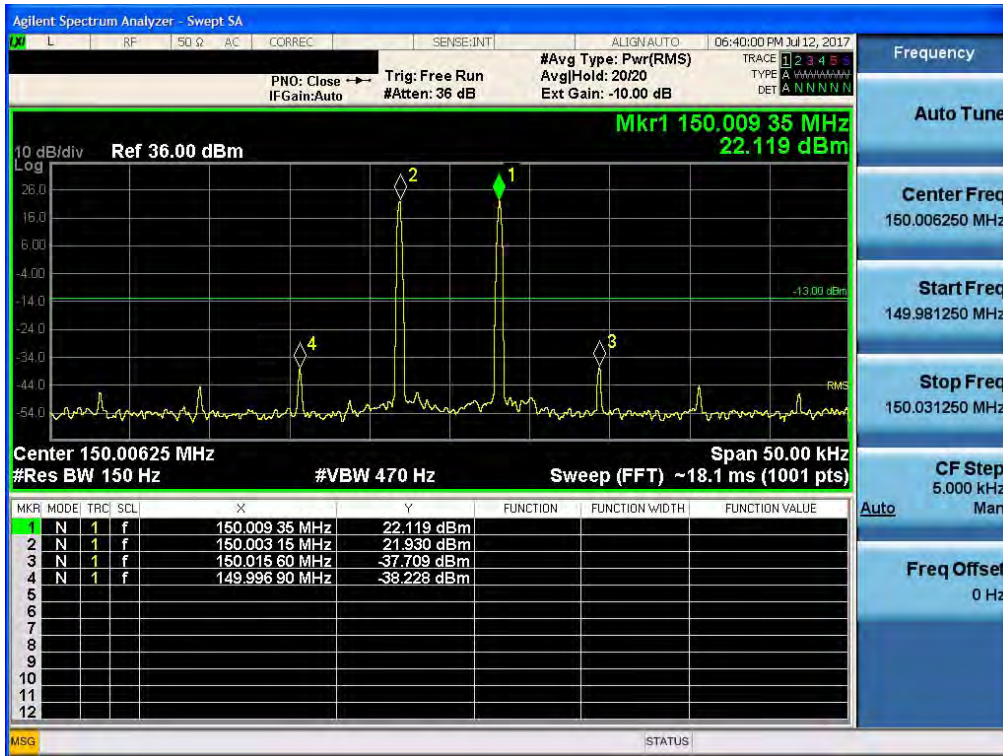
Intermodulation Spurious Emissions VHF(APCO25_138 MHz) DL

[Downlink - Low]

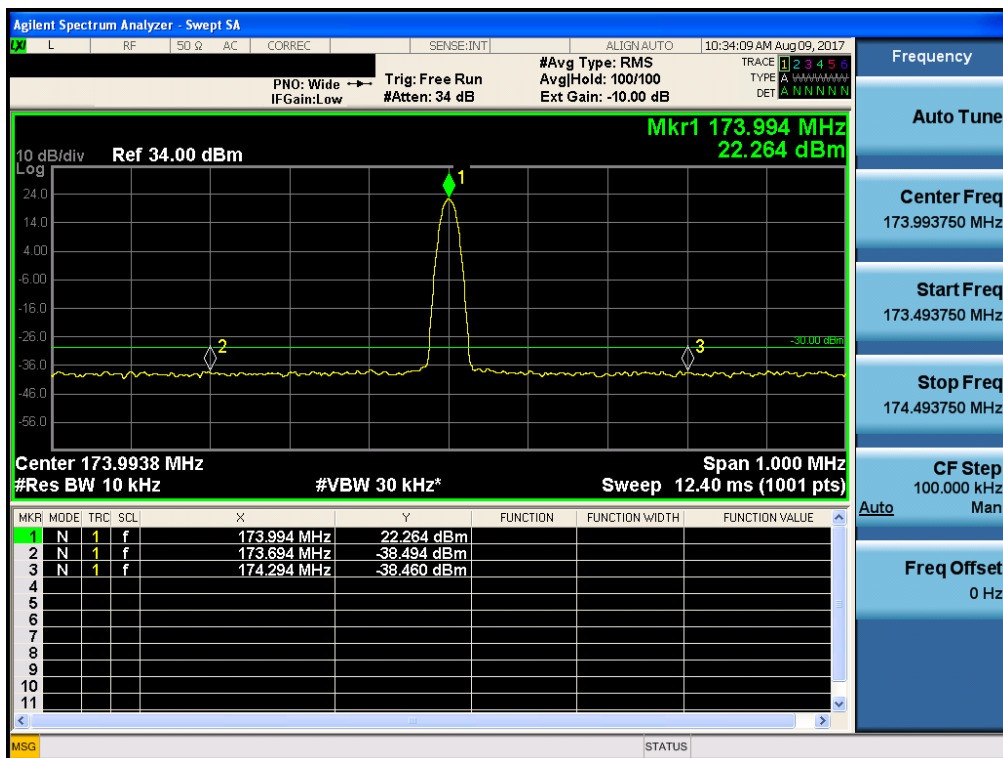
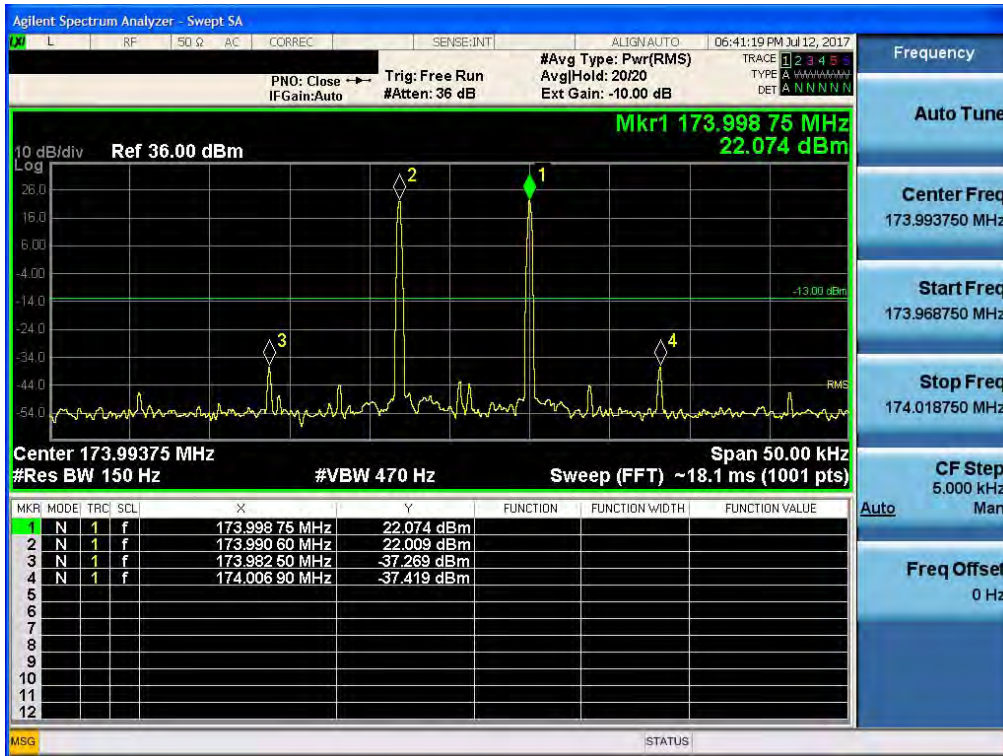


VHF(APCO25_150 ~ 174 MHz) DL

[Downlink - Low]

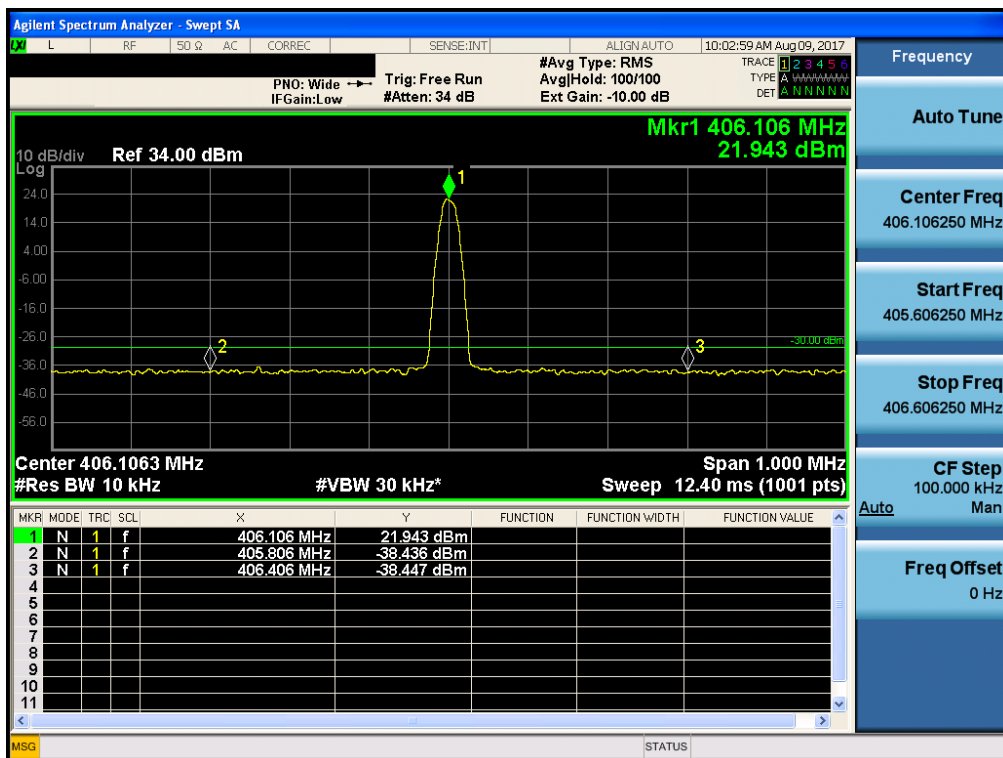
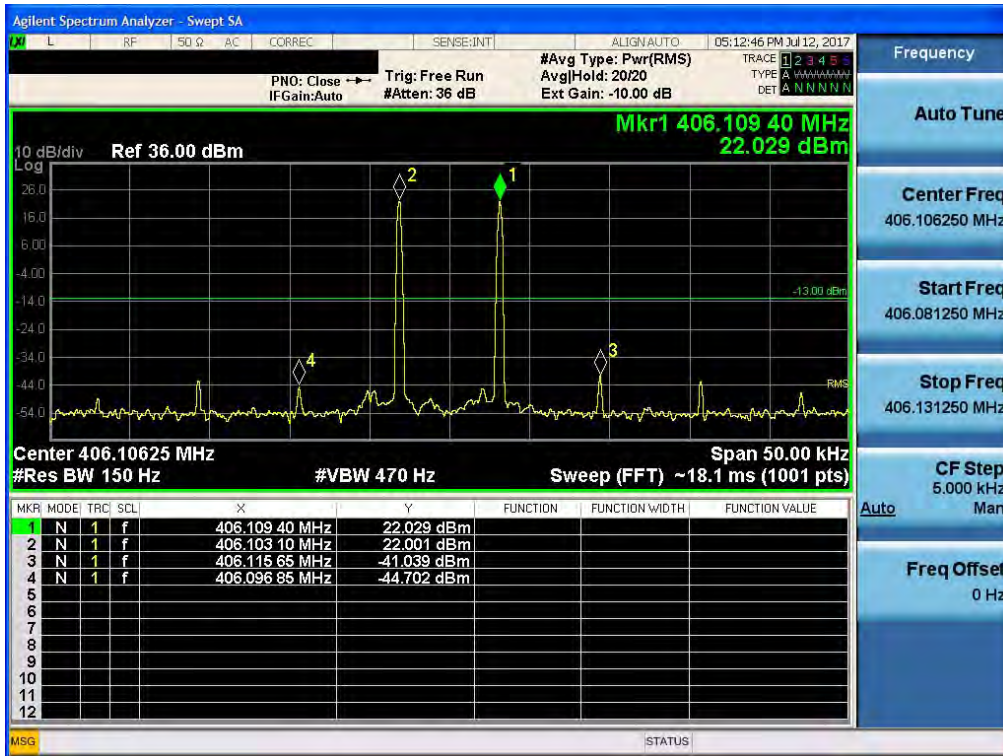


[Downlink - High]

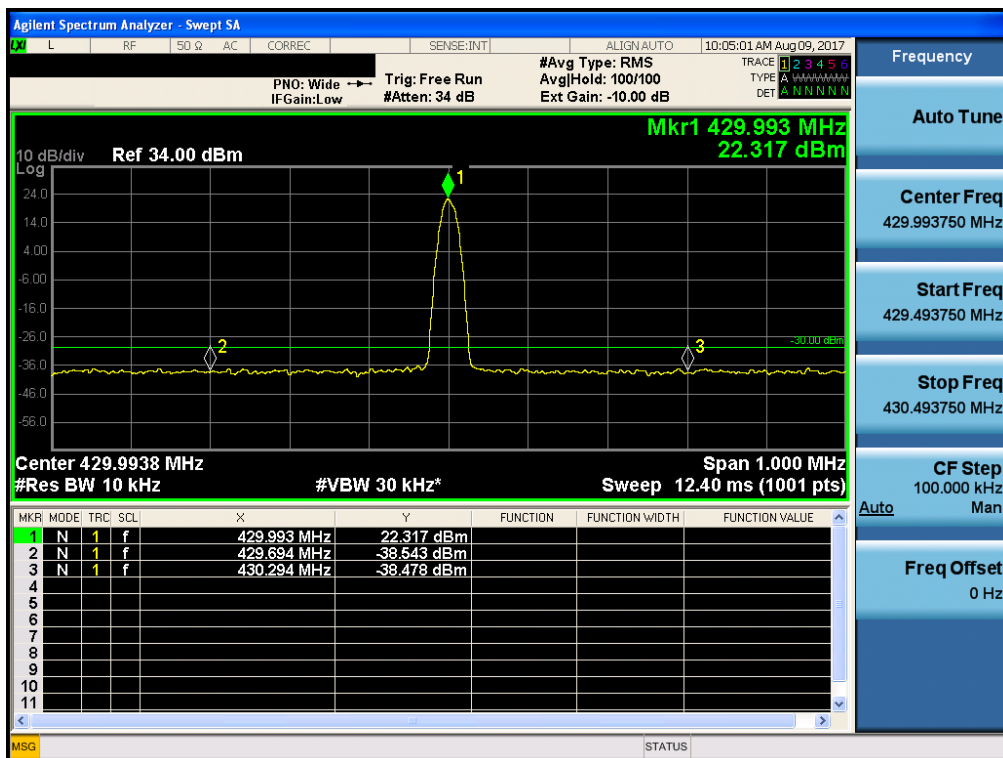
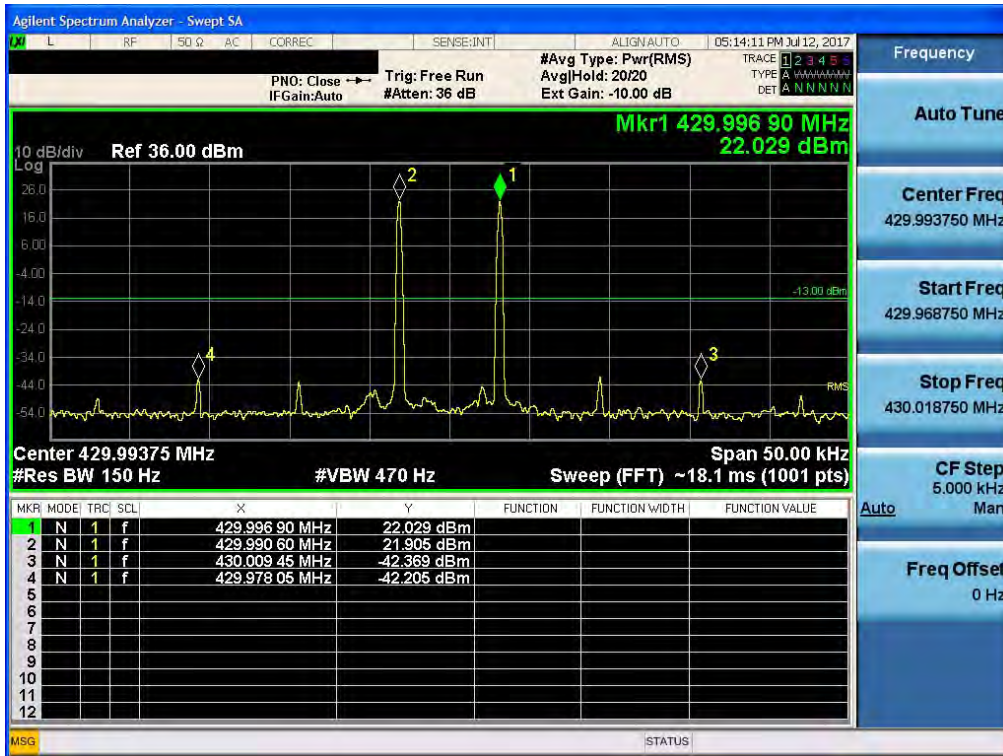


UHF(APCO_406.1 ~ 430 MHz) DL

[Downlink - Low]

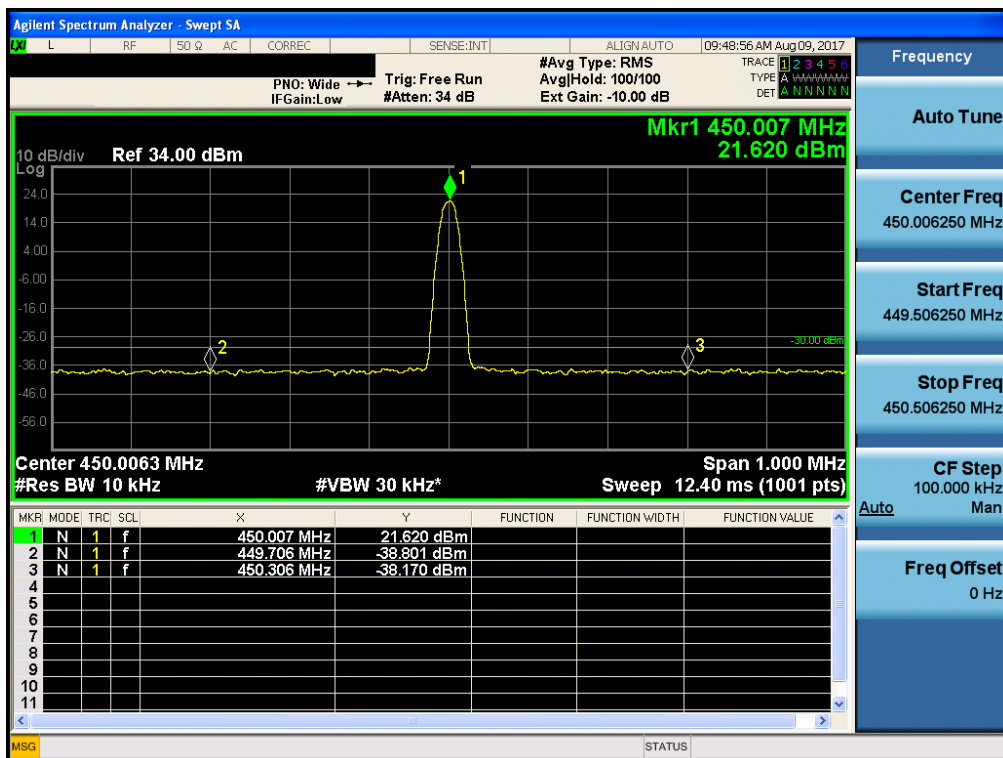
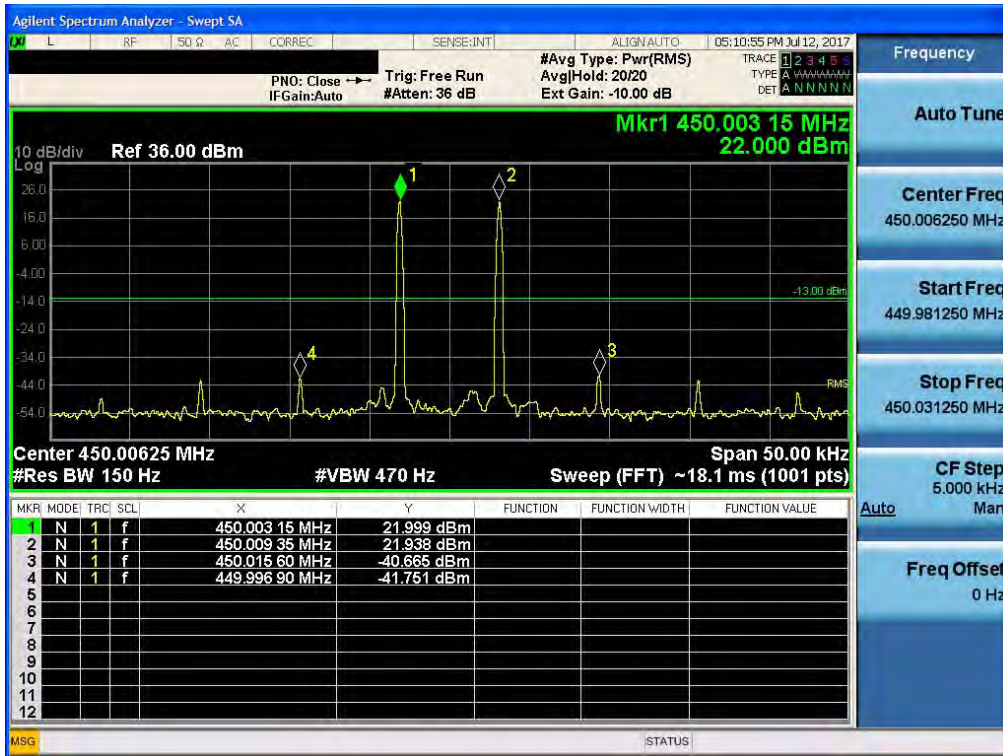


[Downlink - High]

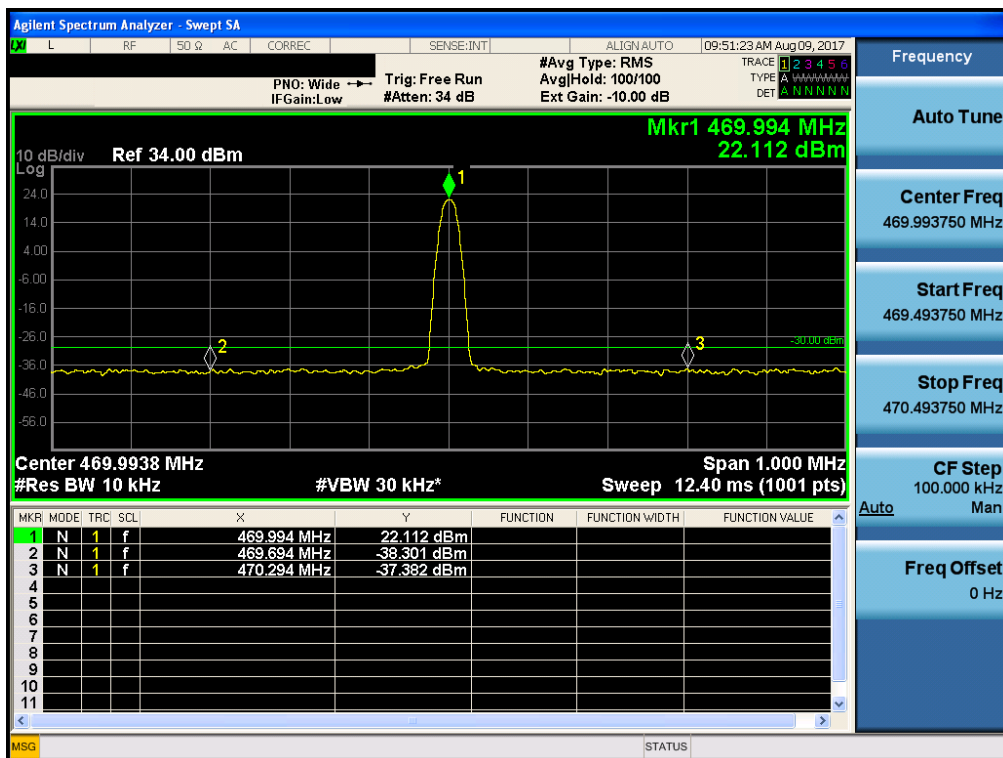
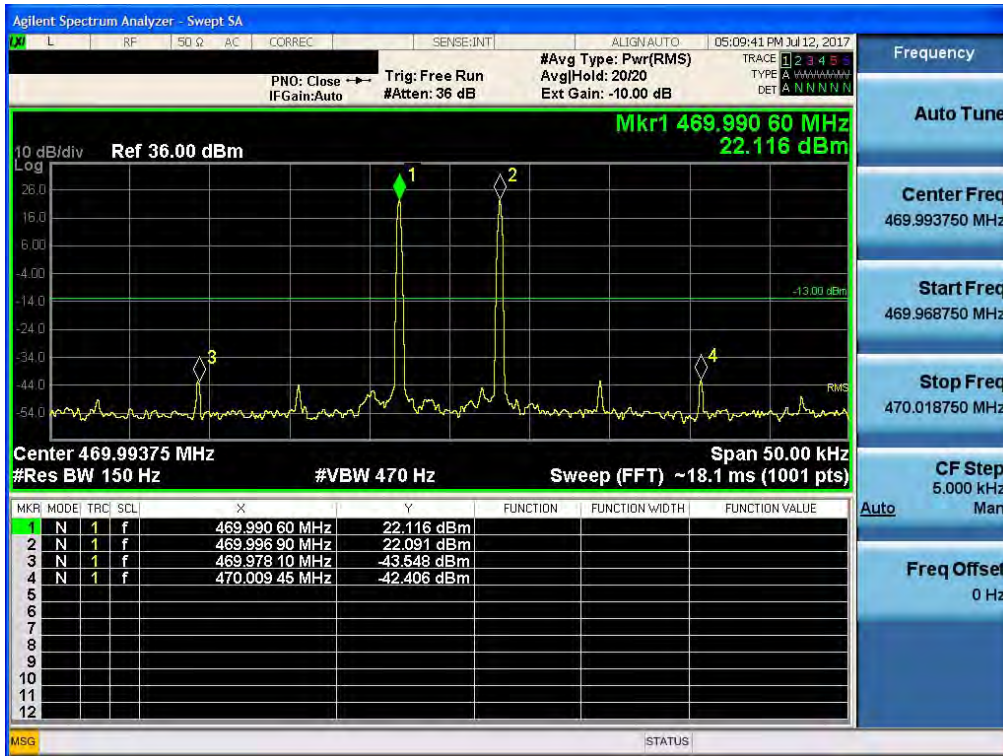


UHF(APCO_450 ~ 470 MHz) DL

[Downlink - Low]

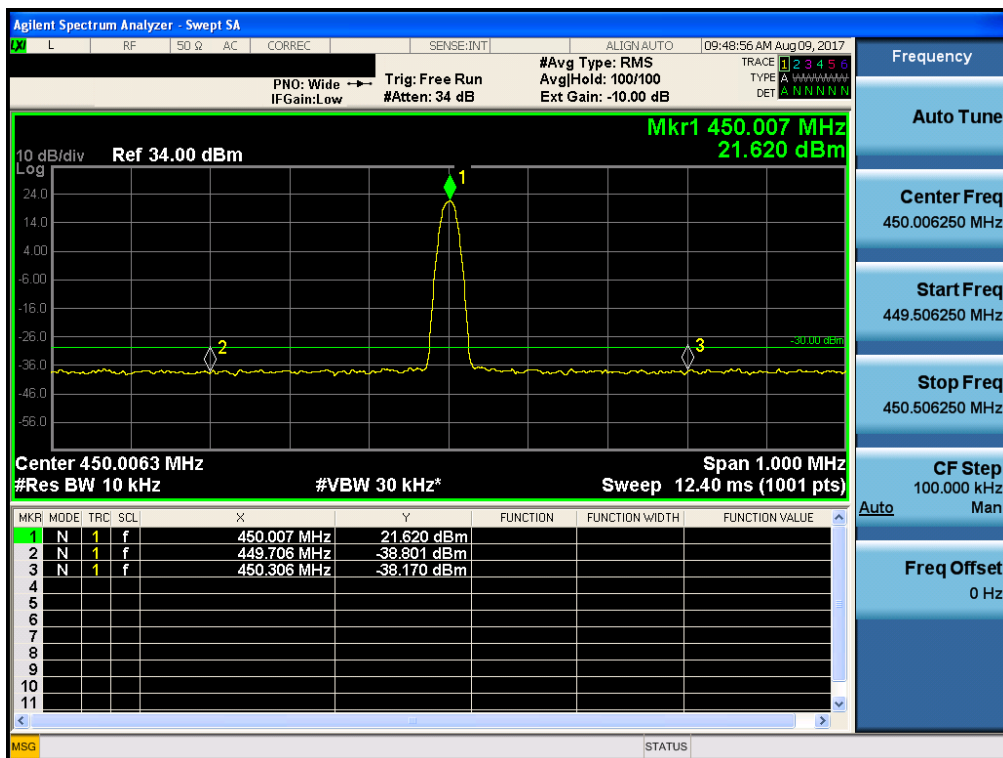
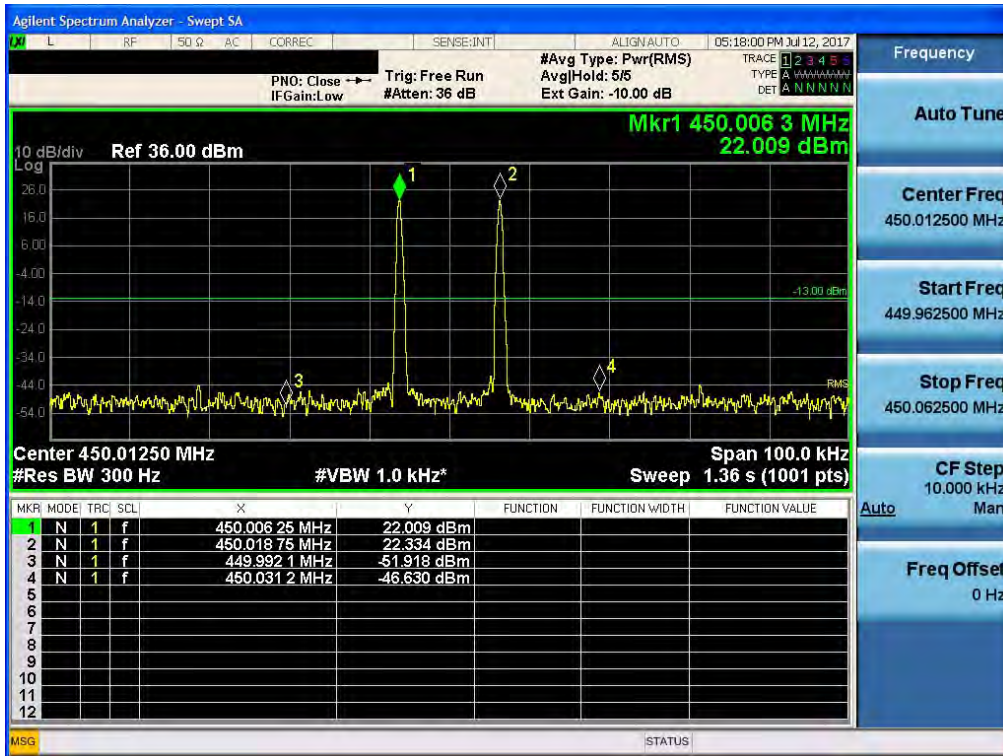


[Downlink - High]

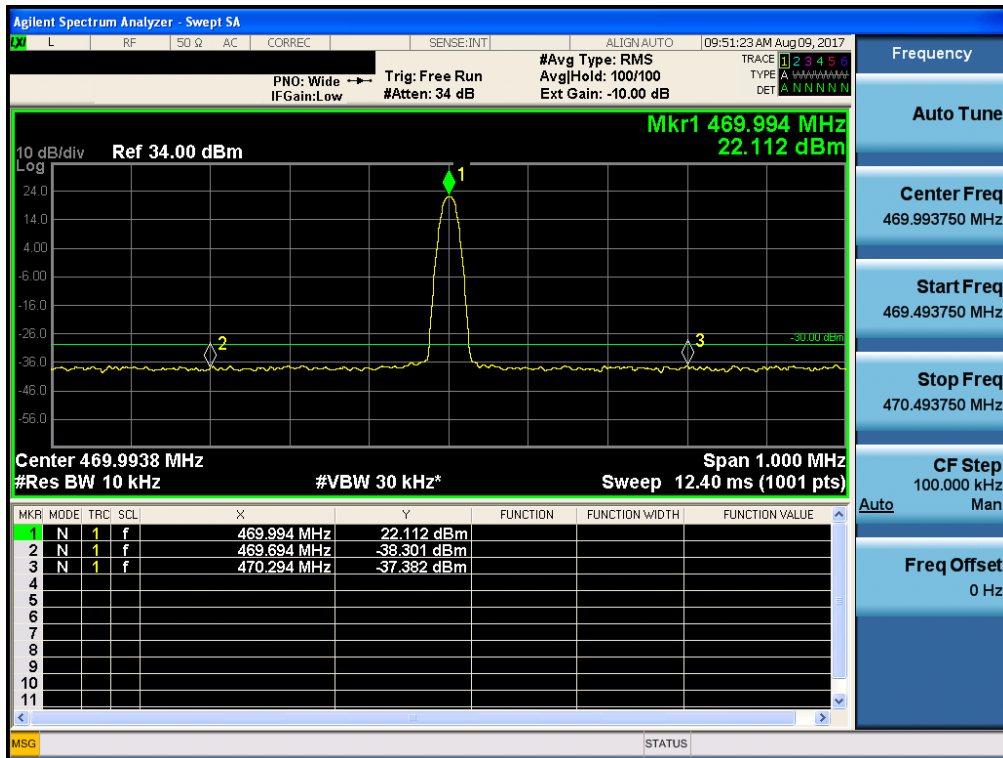
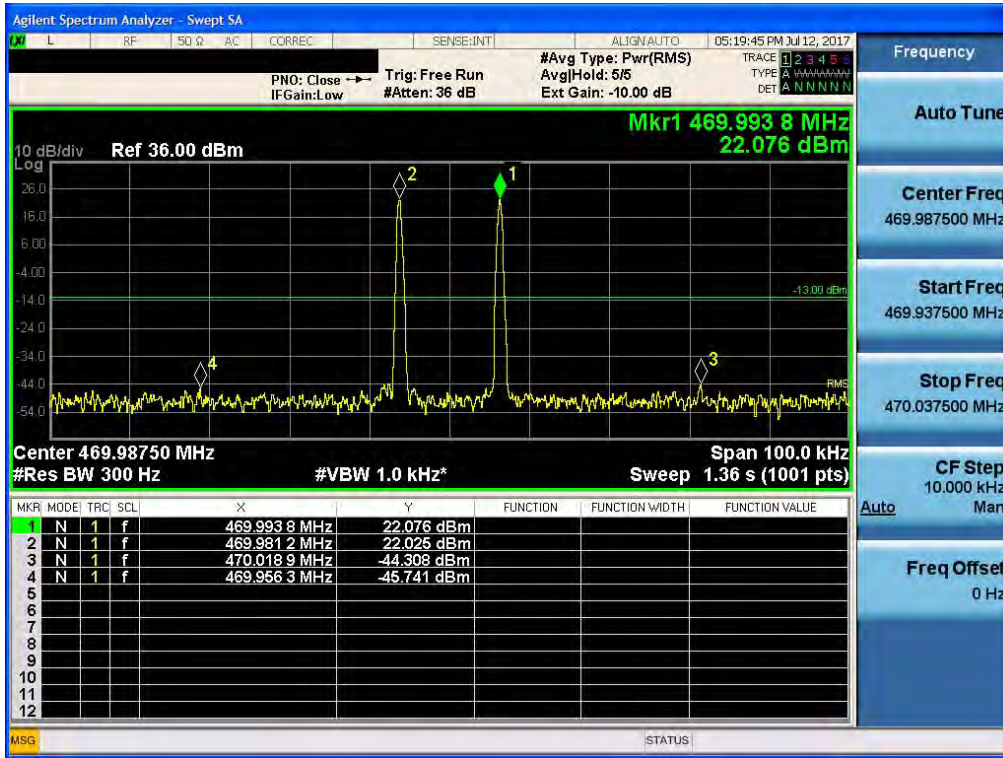


UHF(TETRA_450 ~ 470 MHz) DL

[Downlink - Low]

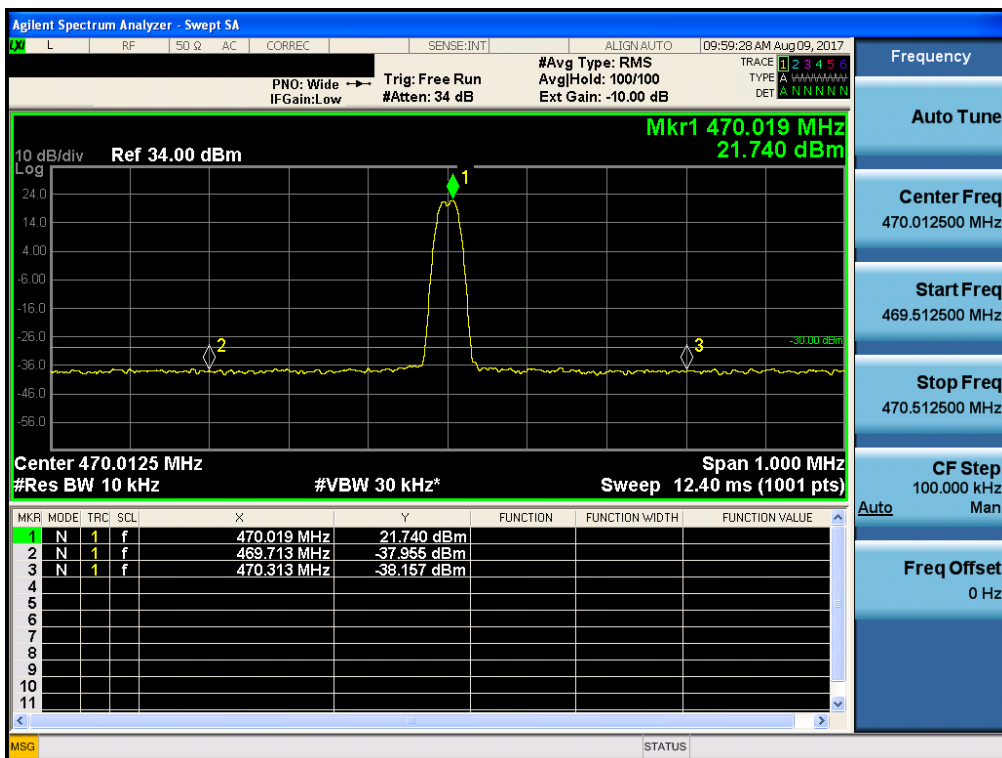
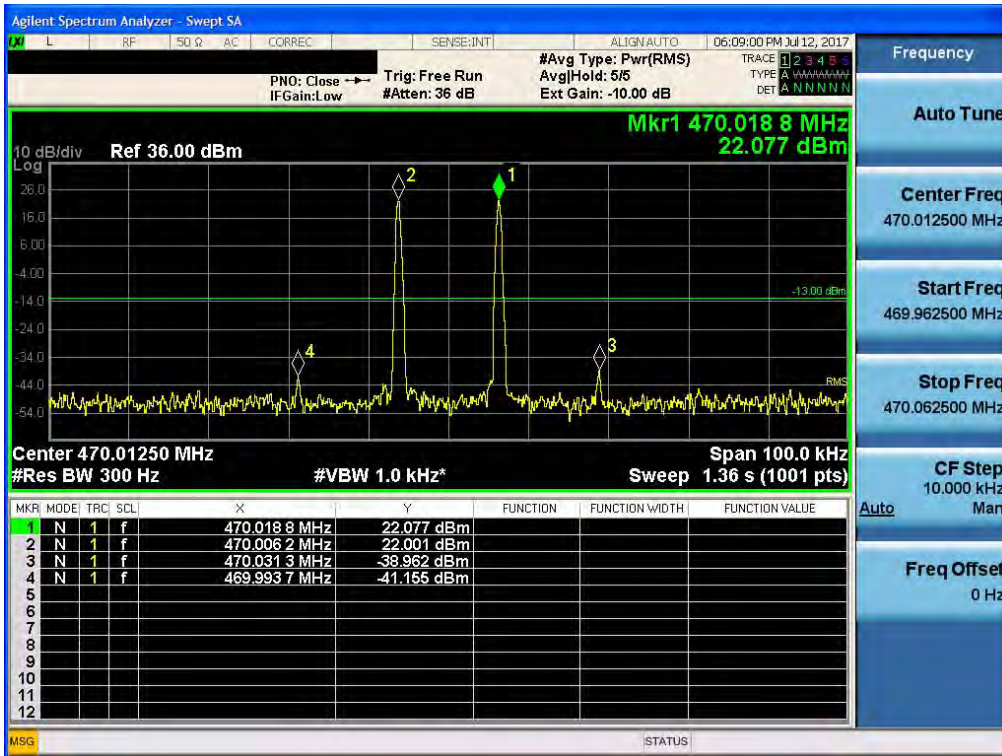


[Downlink - High]

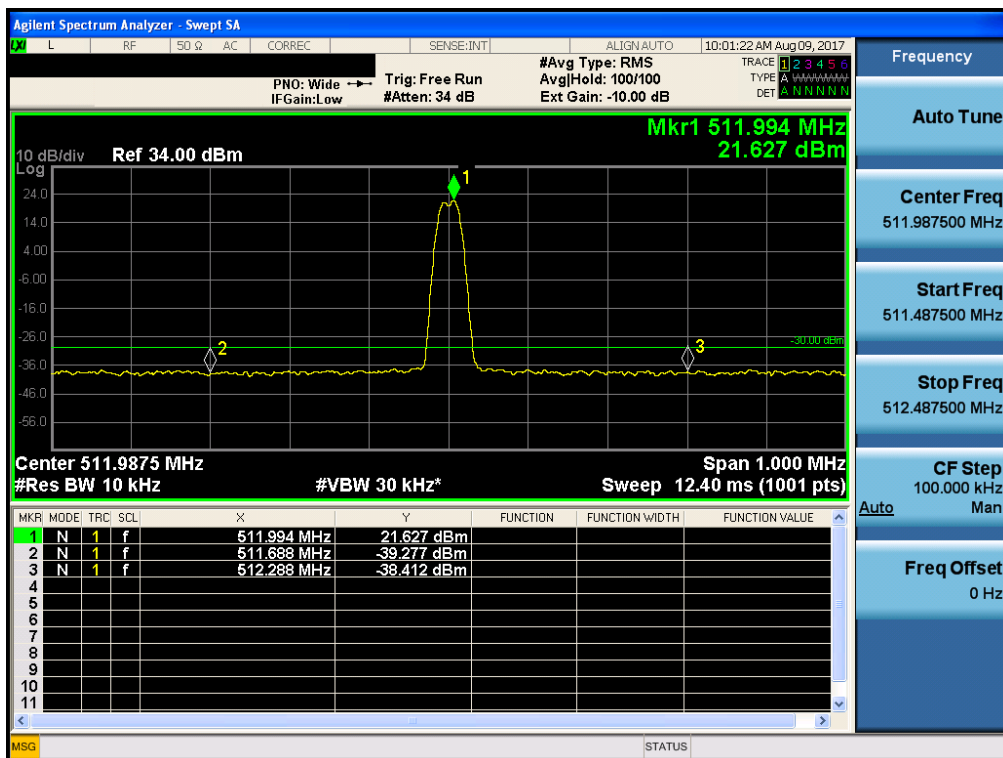
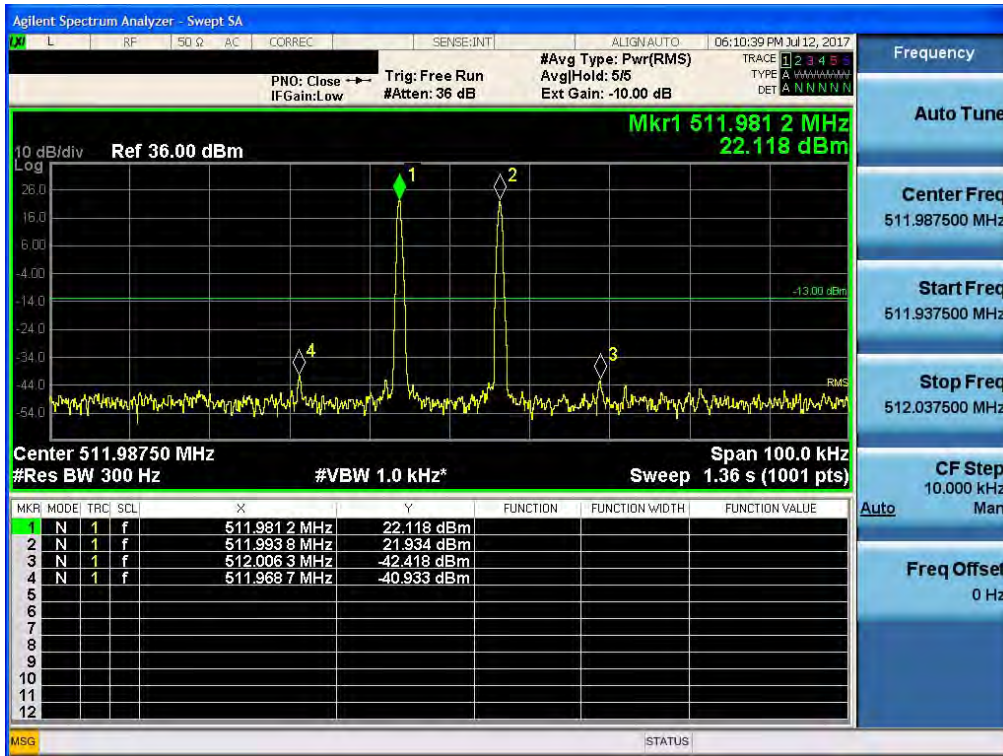


UHF(TETRA_470 ~ 512 MHz) DL

[Downlink - Low]

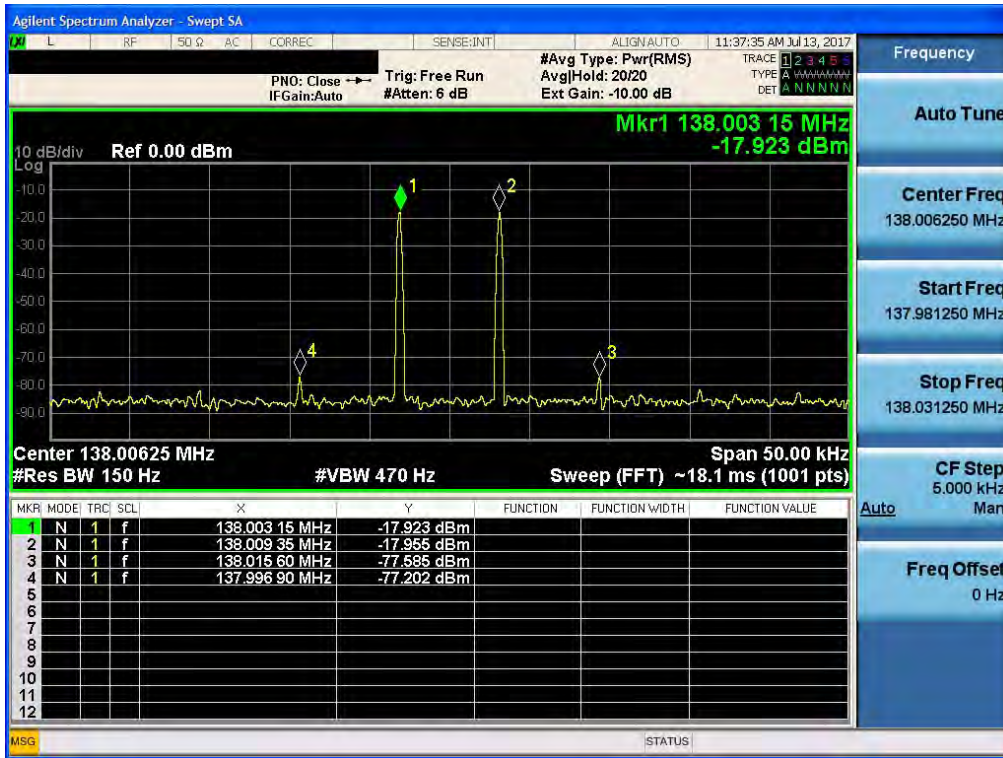


[Downlink - High]



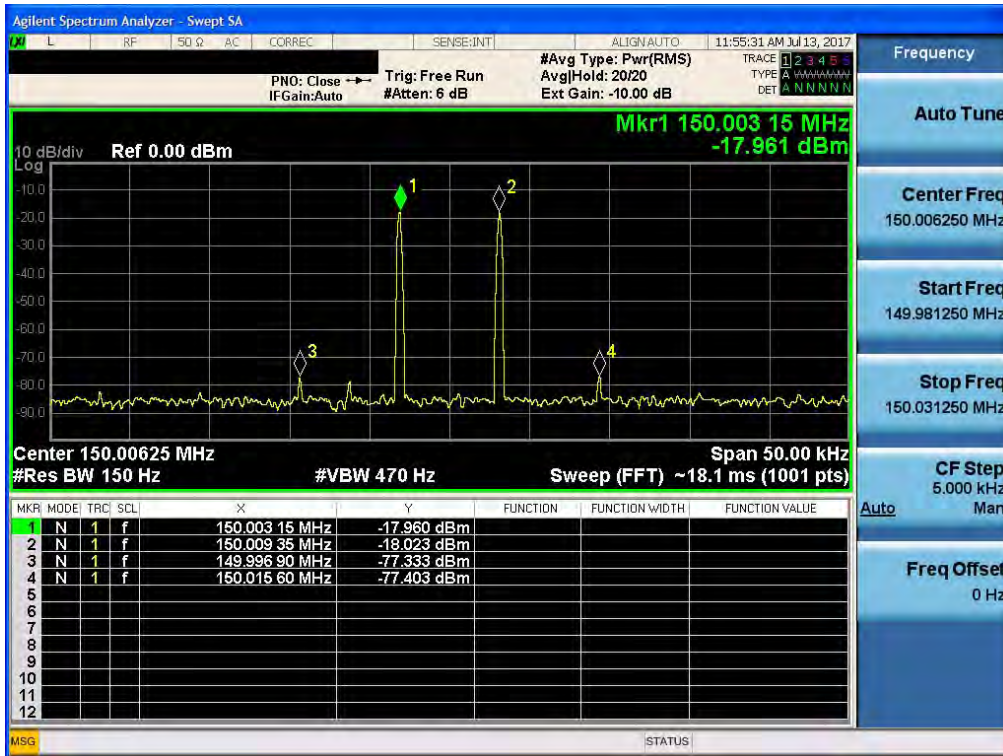
VHF(APCO25_138 MHz) UL

[Uplink - Low]

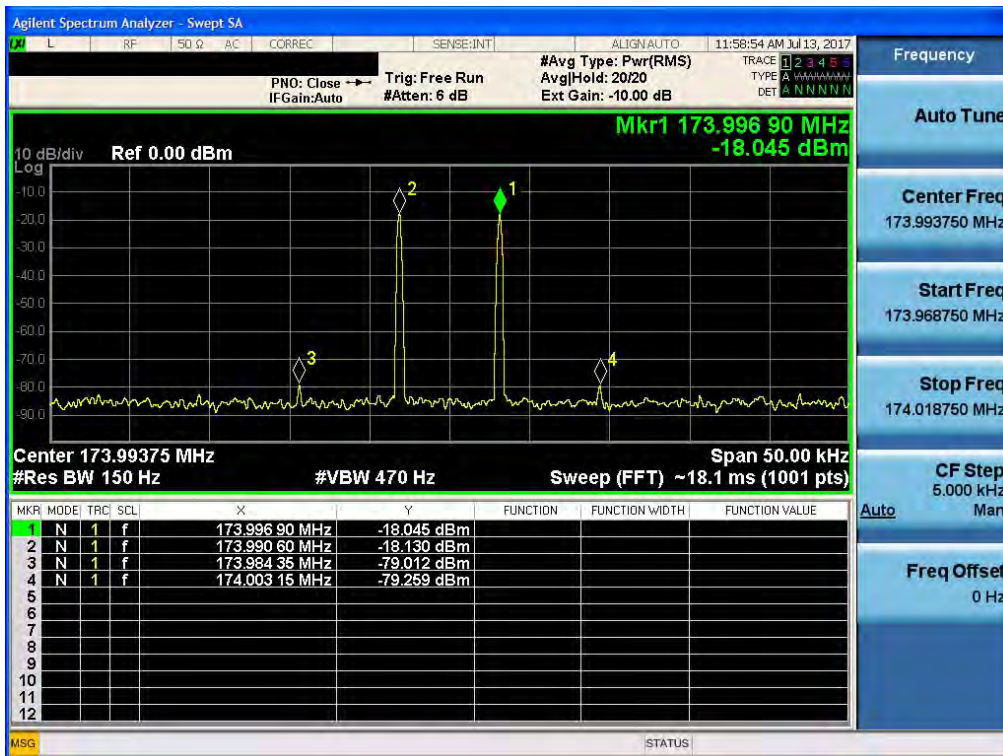


VHF(APCO25_150 ~ 174 MHz) UL

[Uplink - Low]

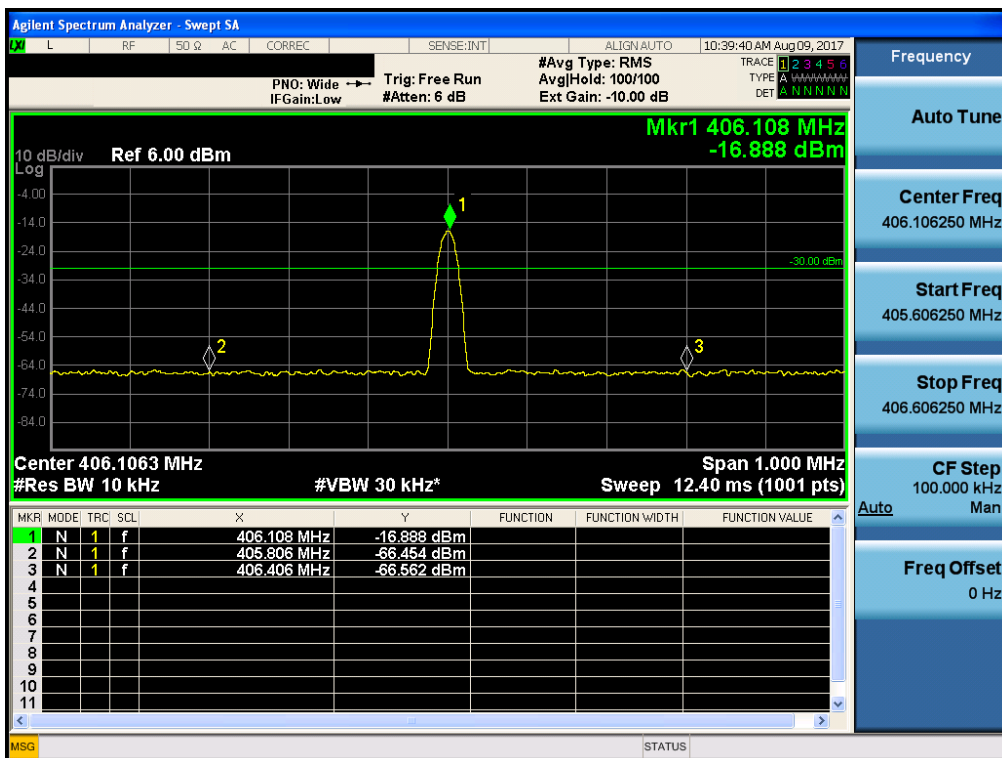
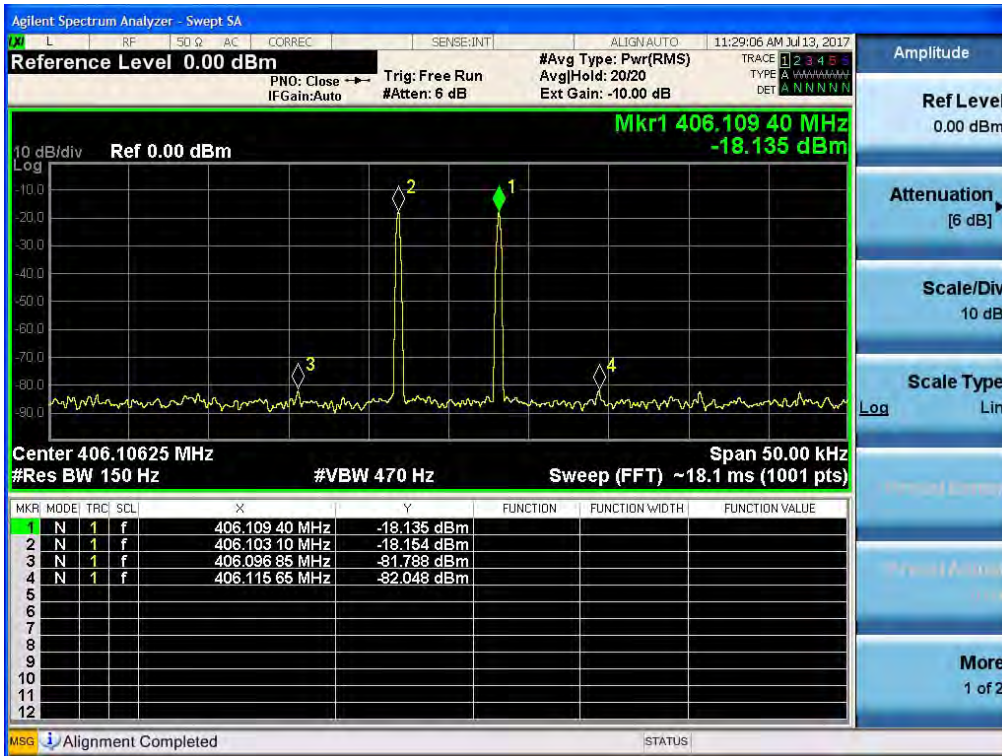


[Uplink - High]

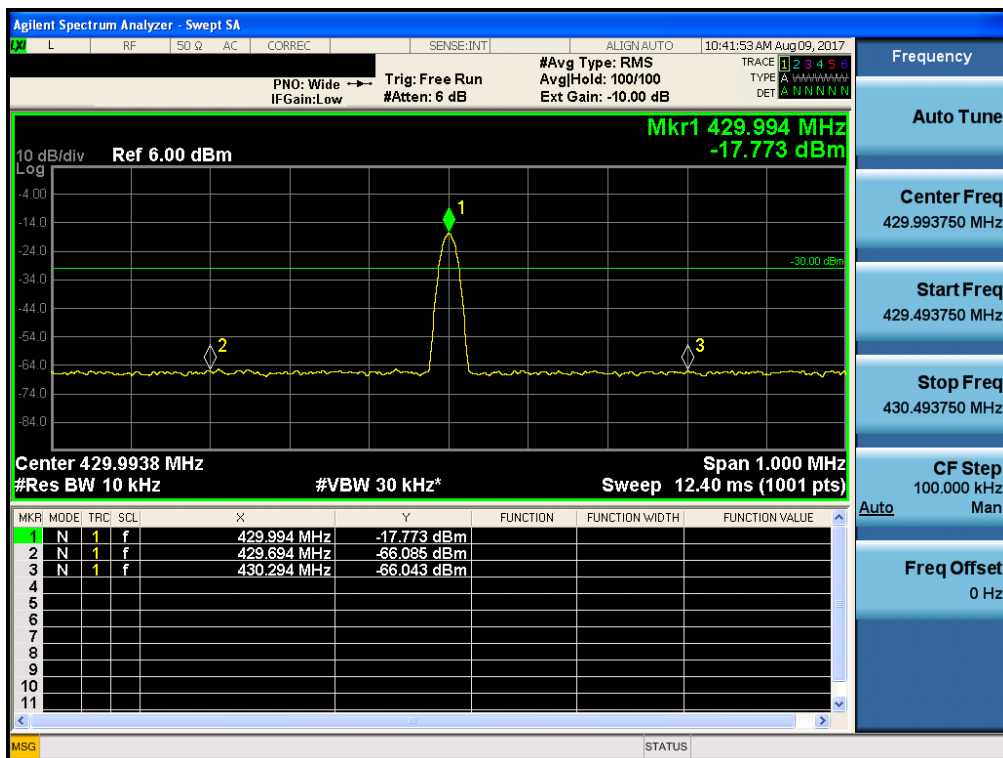
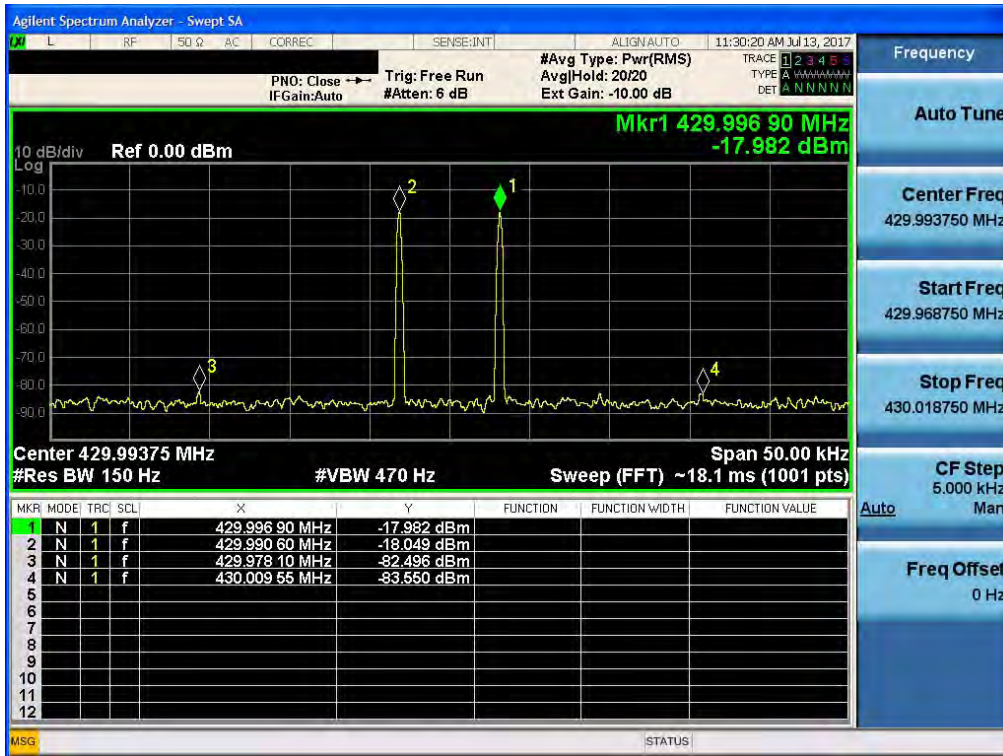


UHF(APCO_406.1 ~ 430 MHz) UL

[Uplink - Low]

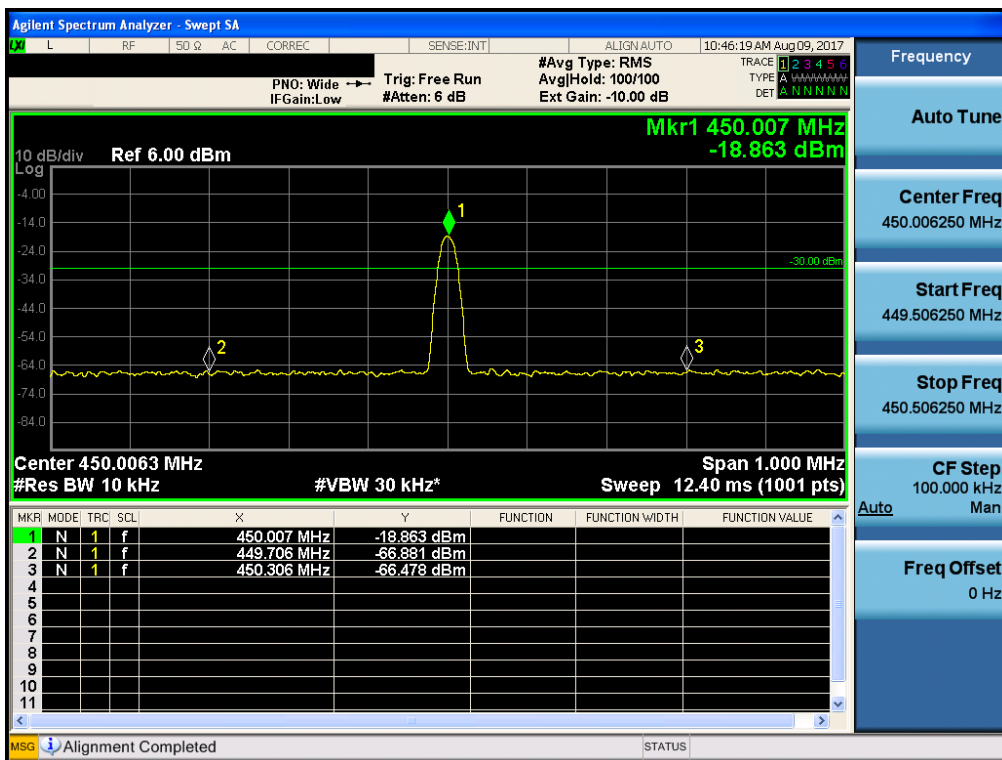
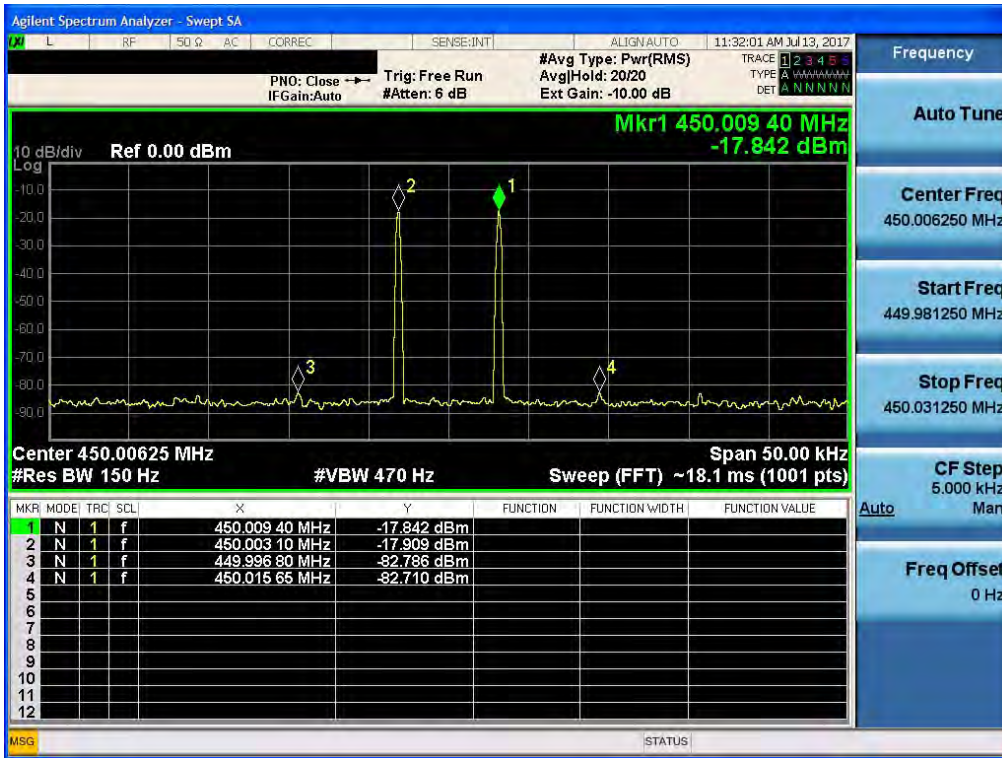


[Uplink - High]

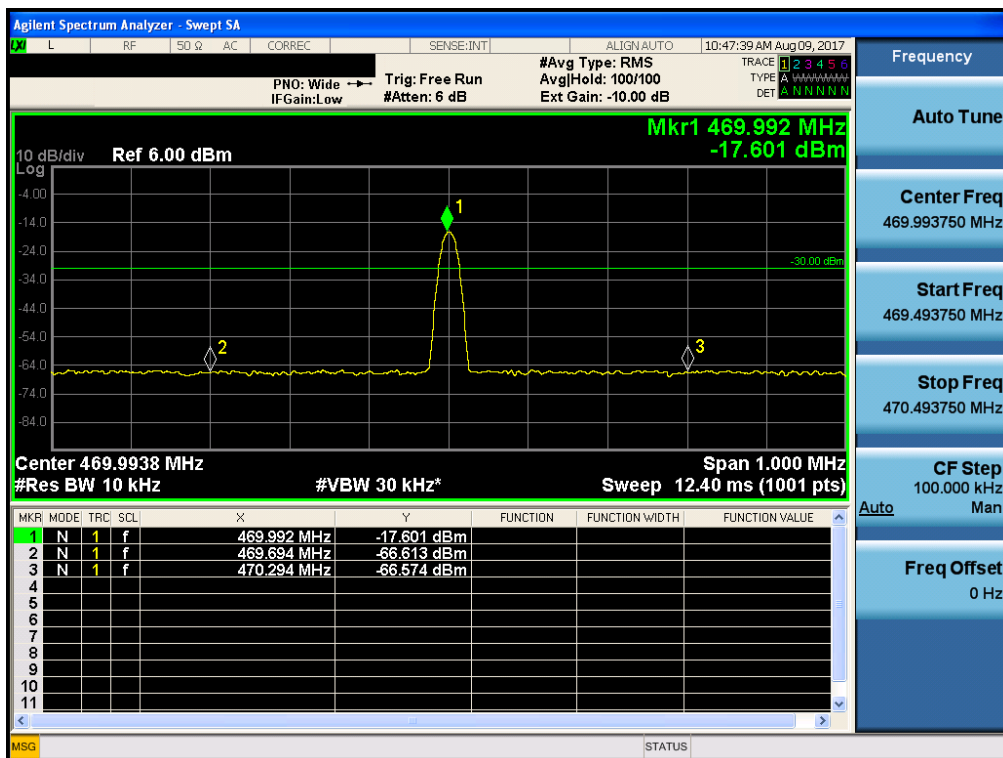
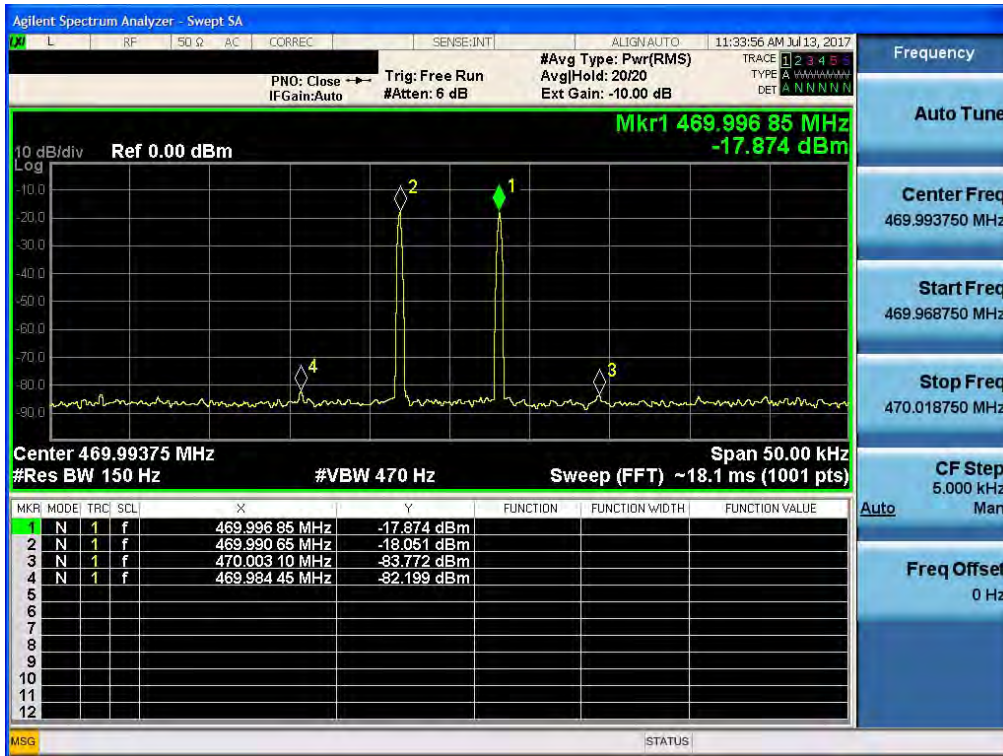


UHF(APCO_450 ~ 470 MHz) UL

[Uplink - Low]

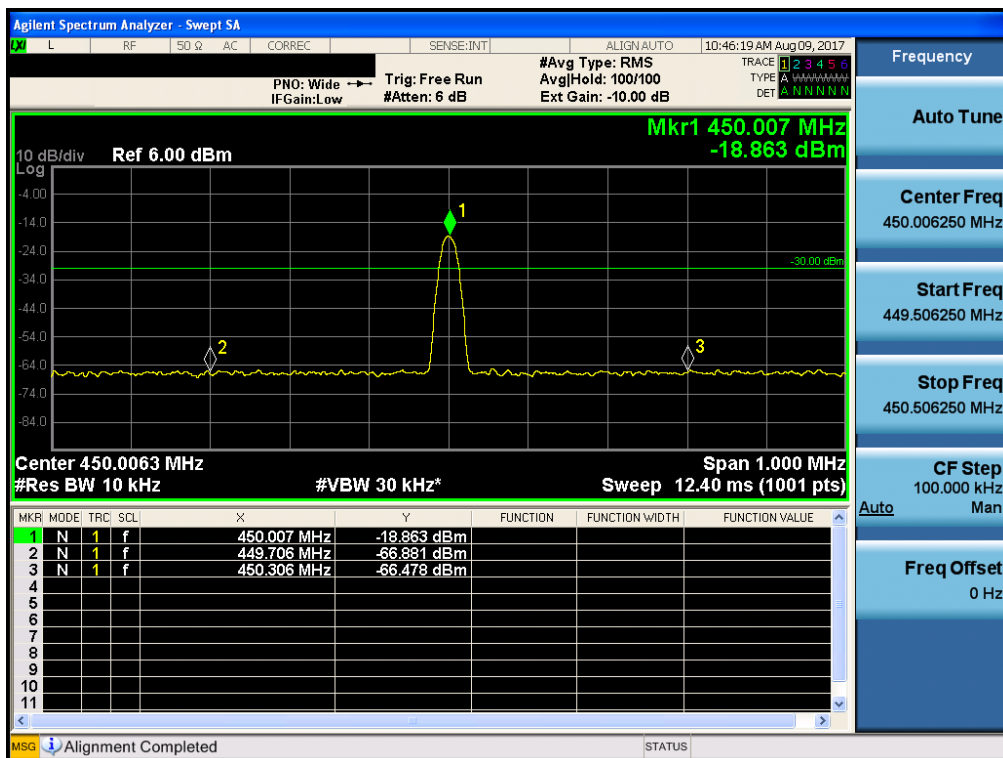
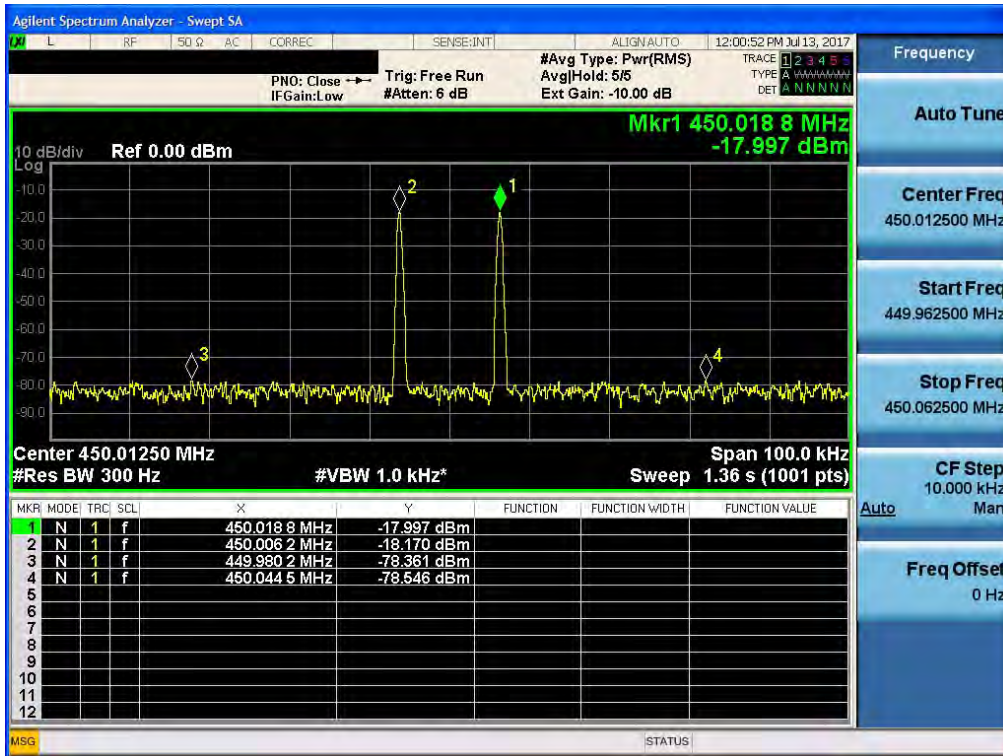


[Uplink - High]



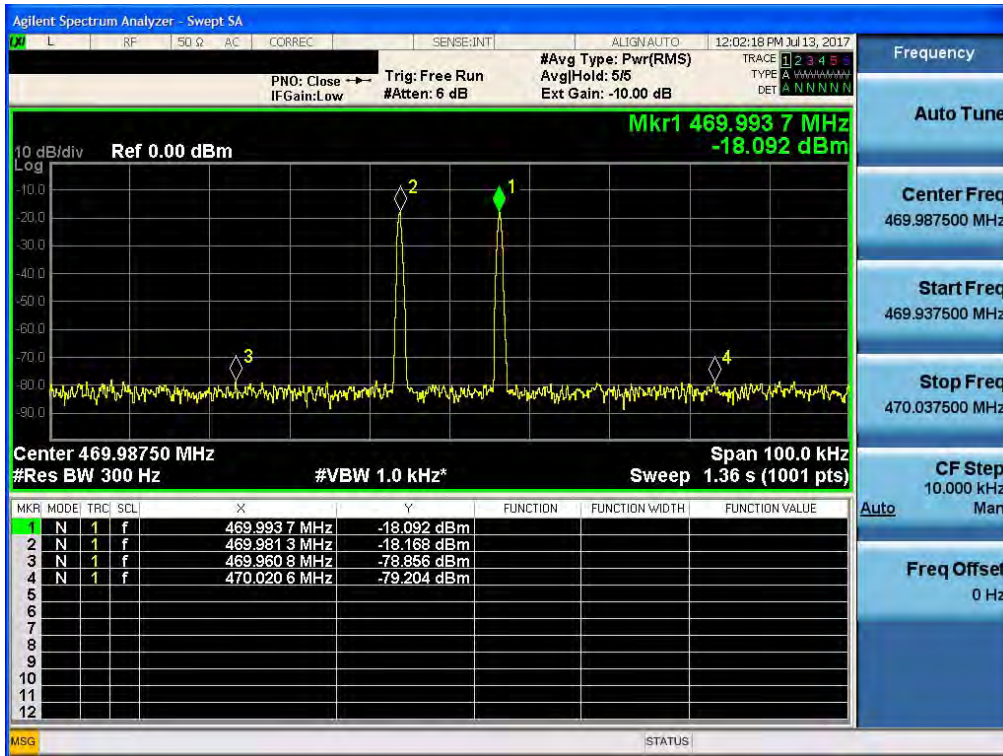
UHF(TETRA_450 ~ 470 MHz) UL

[Uplink - Low]



*Same plot as VHF because of the CW signal.

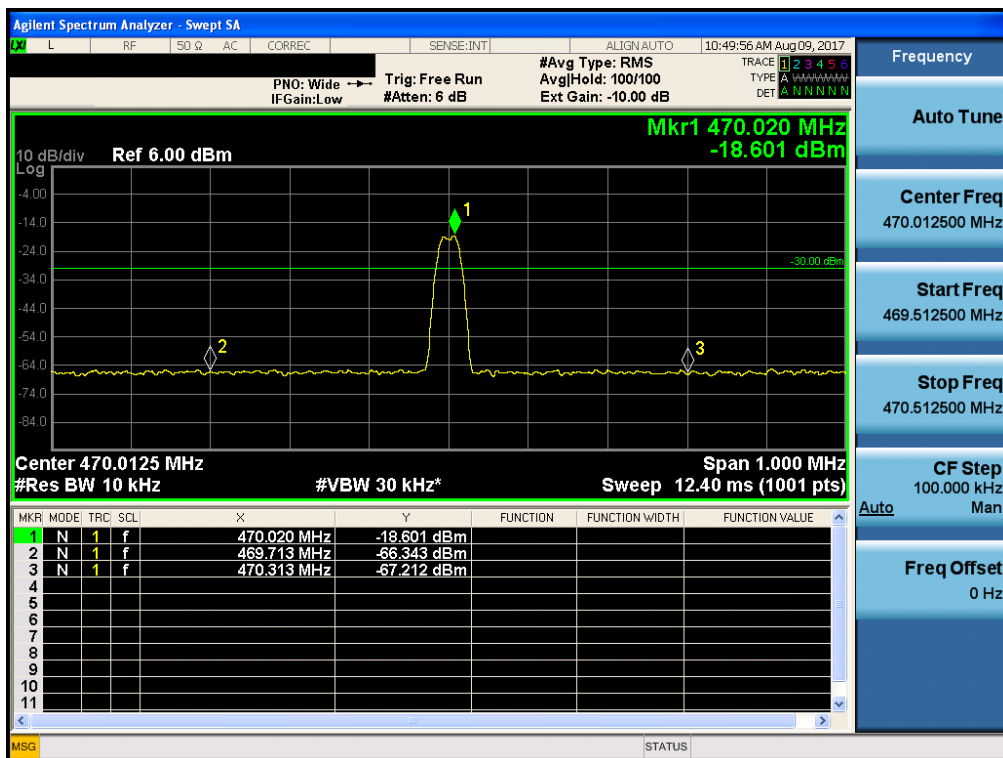
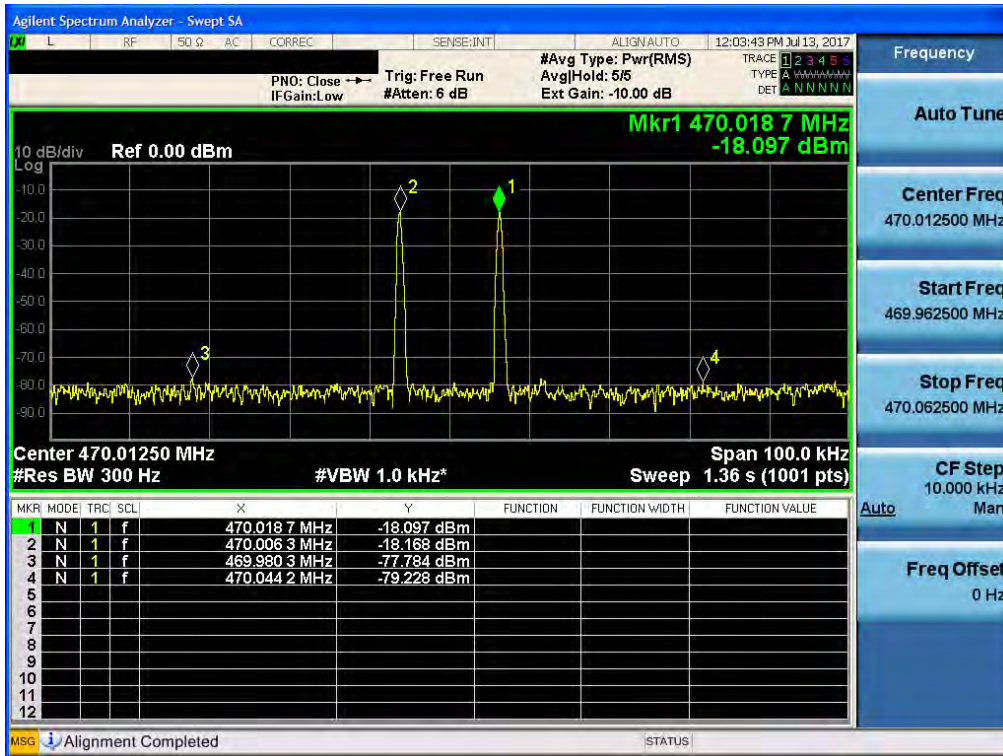
[Uplink - High]



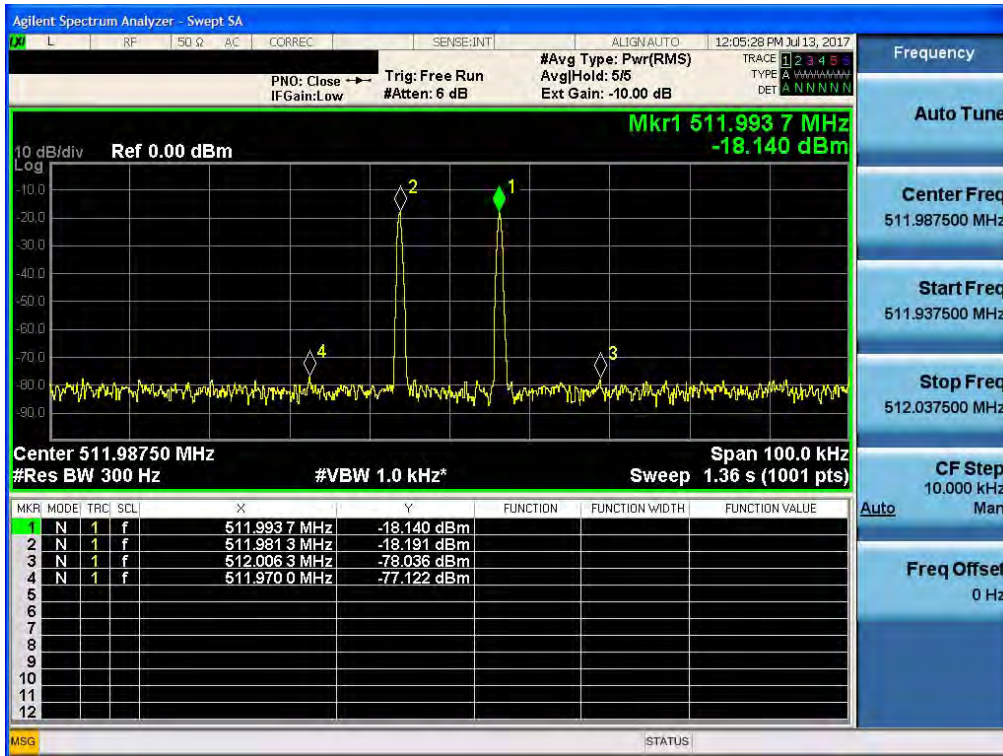
*Same plot as VHF because of the CW signal.

UHF(TETRA_470 ~ 512 MHz) UL

[Uplink - Low]



[Uplink - High]



BAND EDGE

VHF(APCO25_138 MHz) DL

[Downlink - Low]

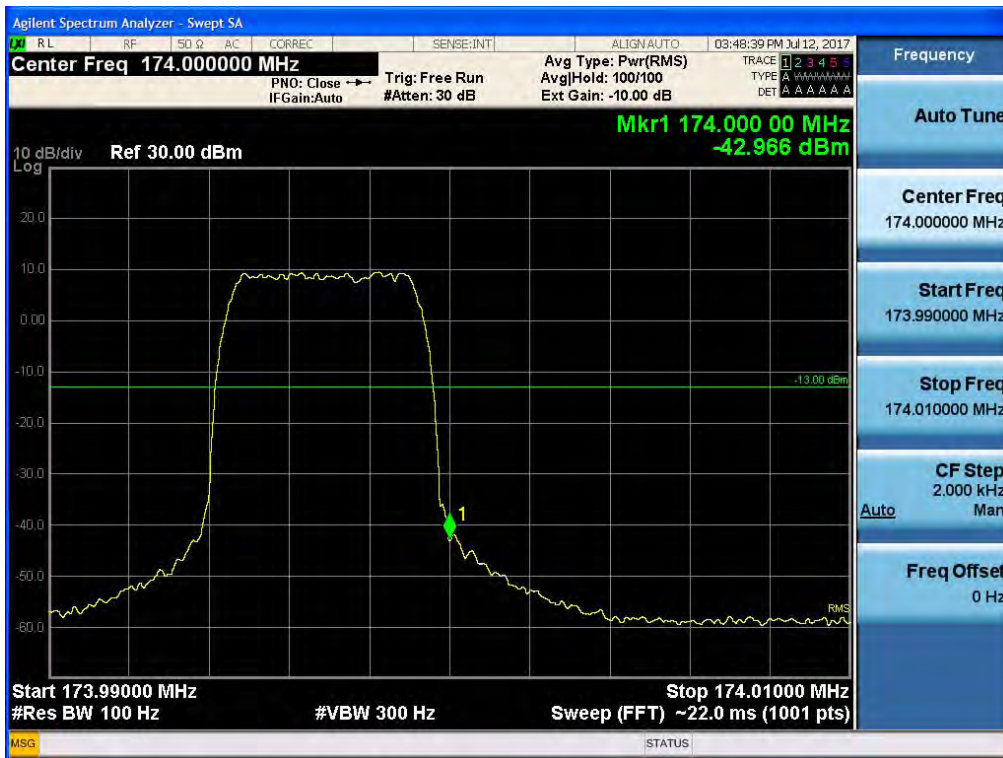


VHF(APCO25_150 ~ 174 MHz) DL

[Downlink - Low]

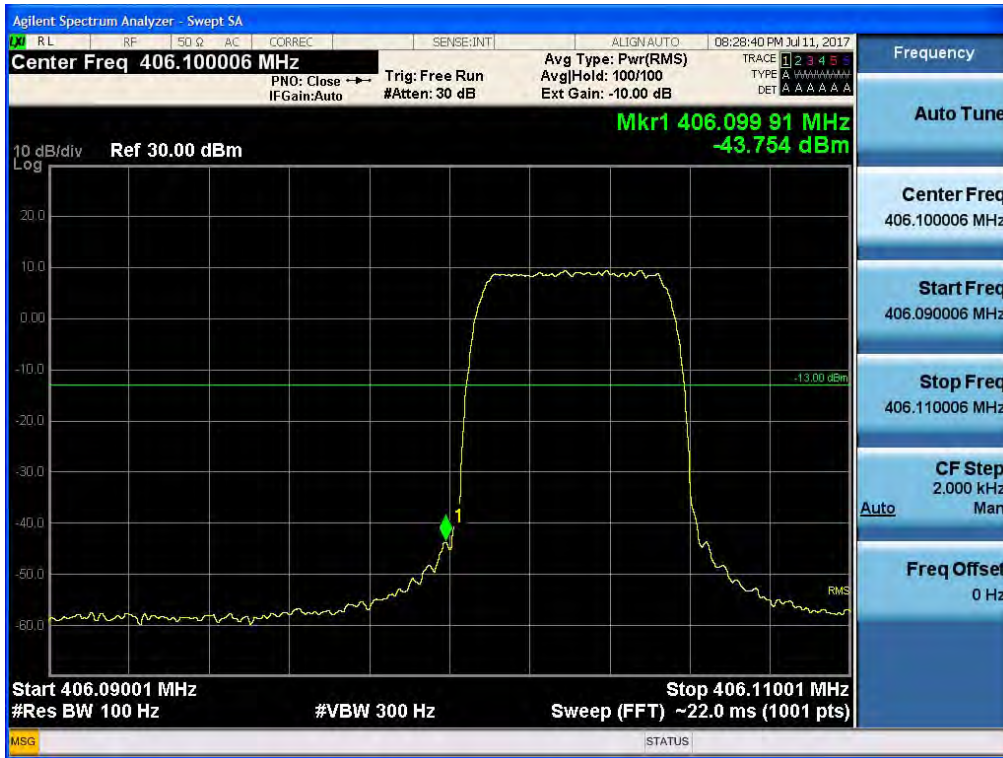


[Downlink - High]

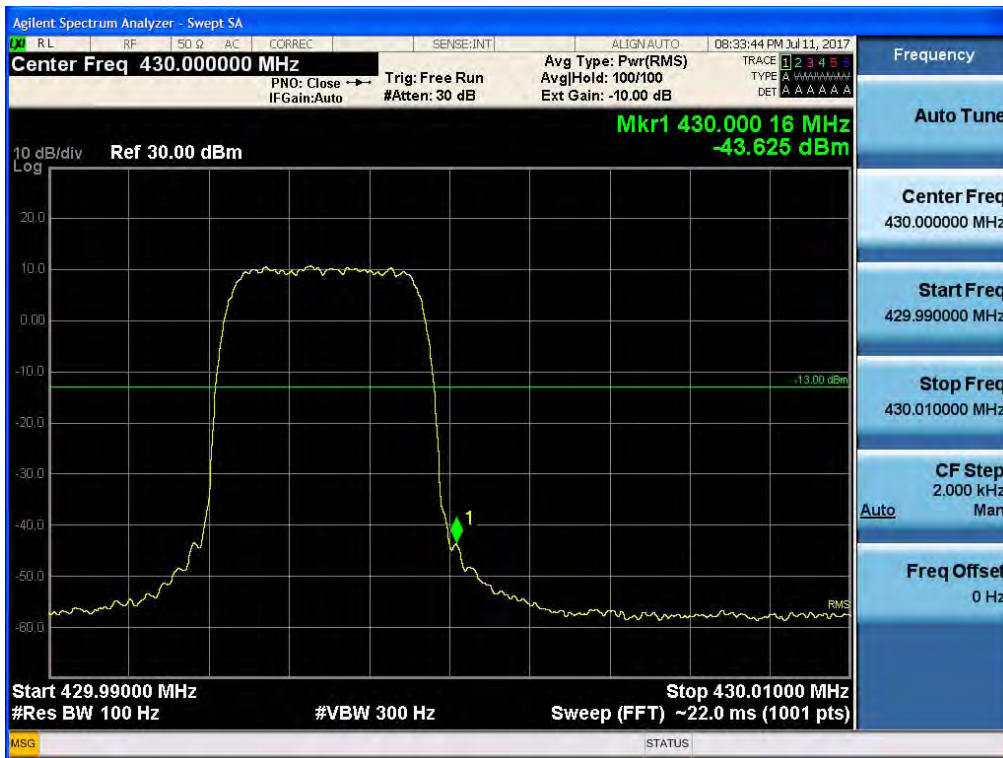


UHF(APCO_406.1 ~ 430 MHz) DL

[Downlink - Low]

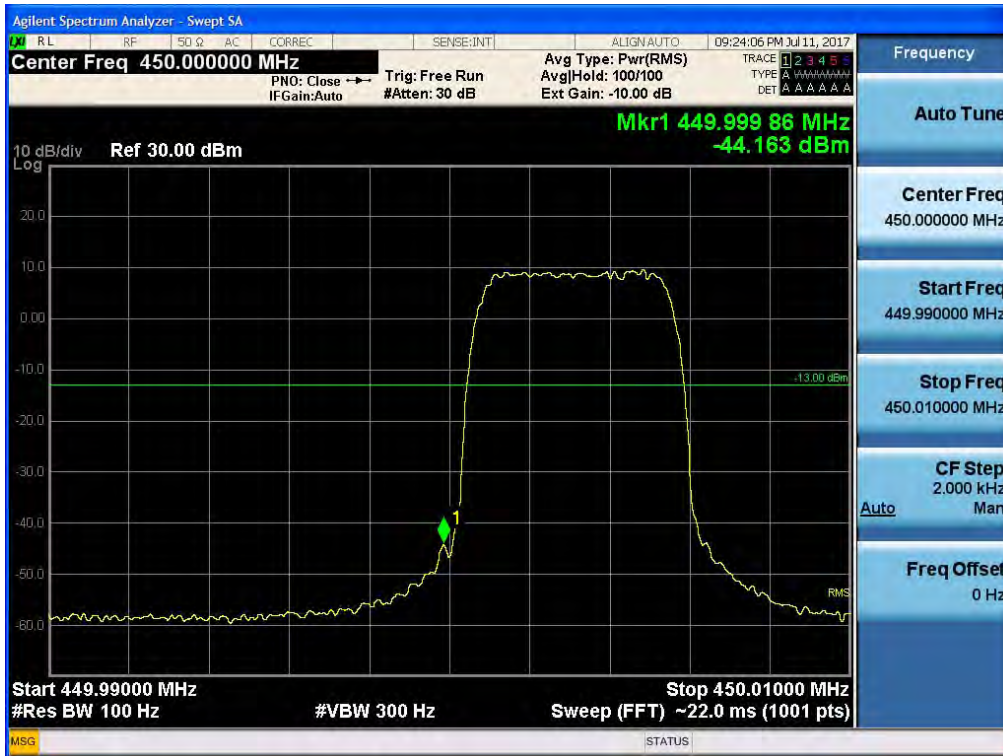


[Downlink - High]

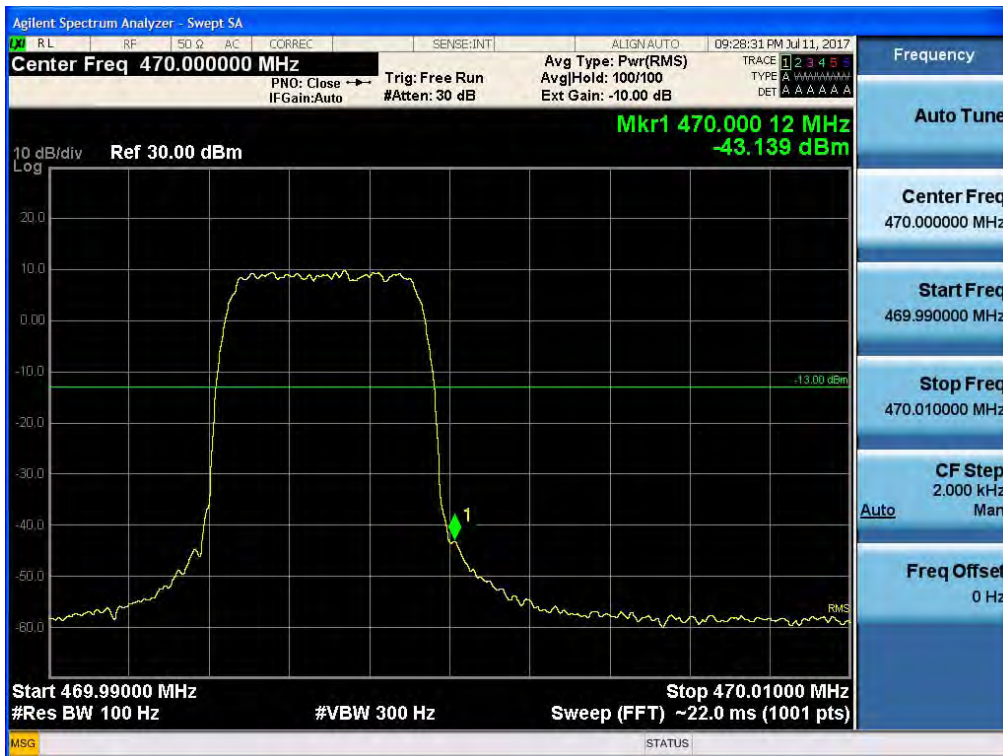


UHF(APCO_450 ~ 470 MHz) DL

[Downlink - Low]

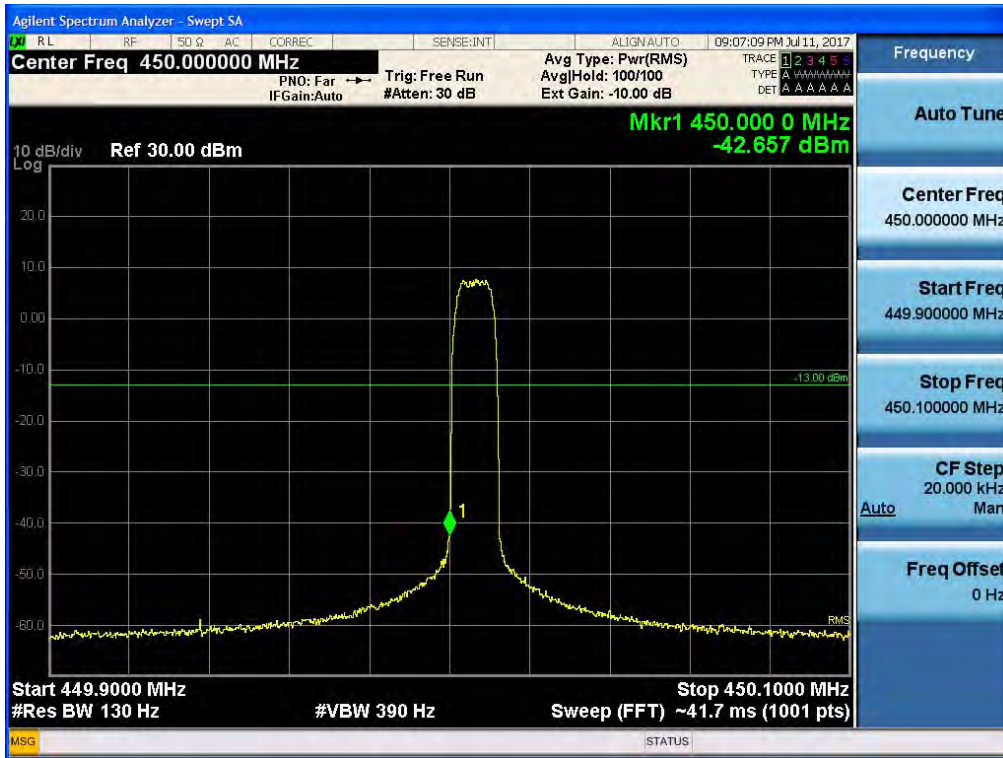


[Downlink - High]

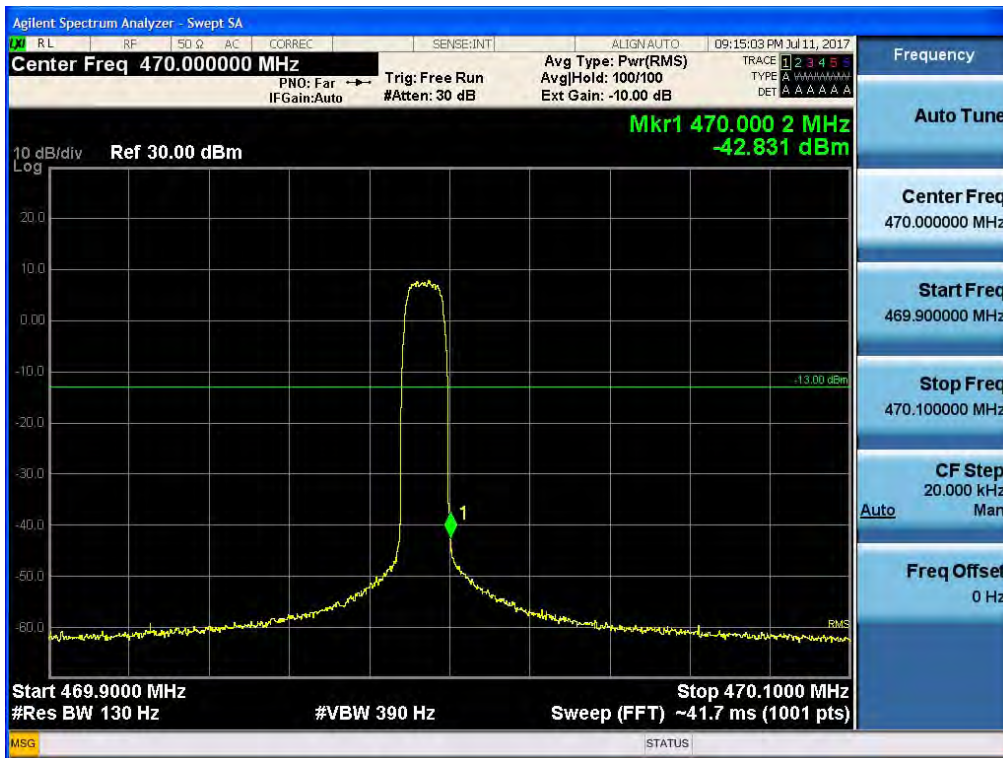


UHF(TETRA_450 ~ 470 MHz) DL

[Downlink - Low]

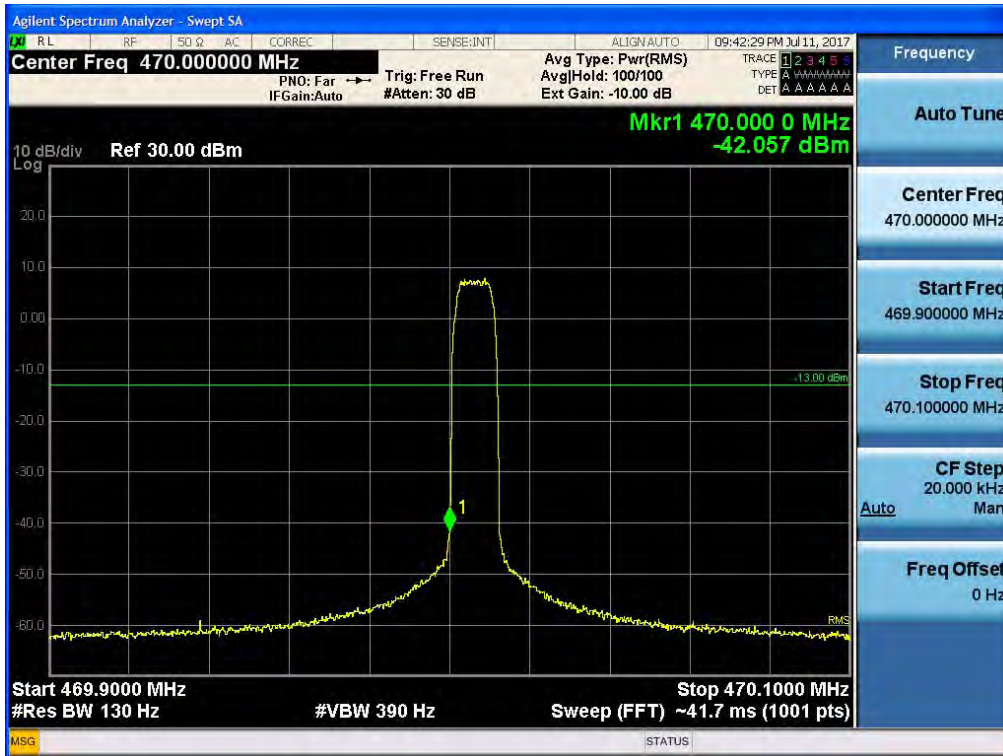


[Downlink - High]

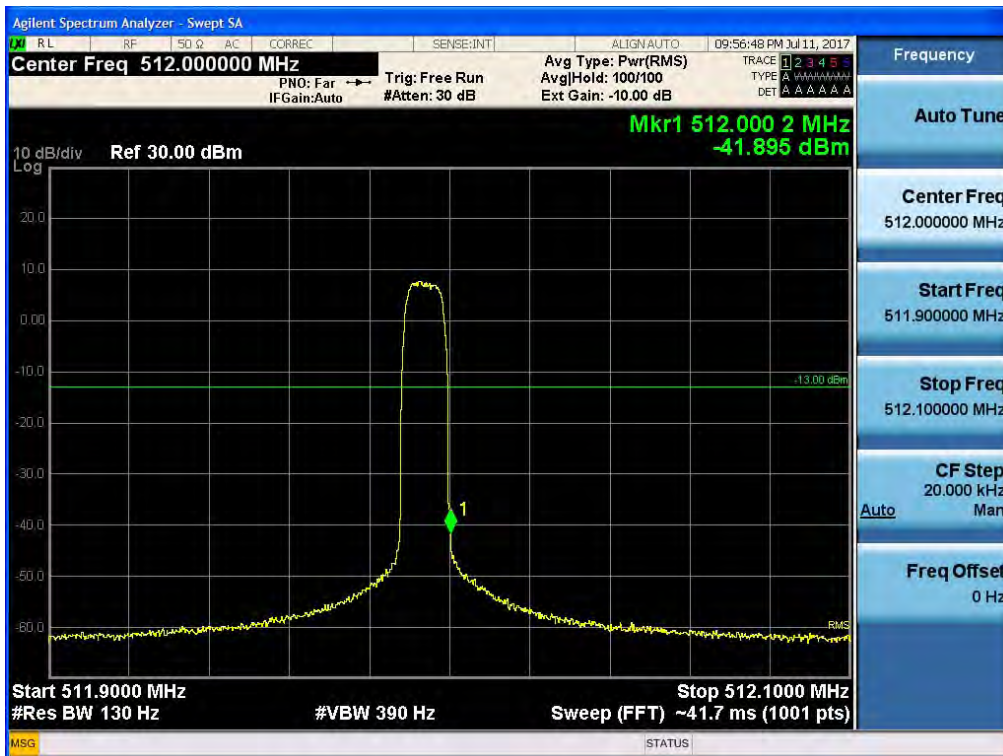


UHF(TETRA_470 ~ 512 MHz) DL

[Downlink - Low]

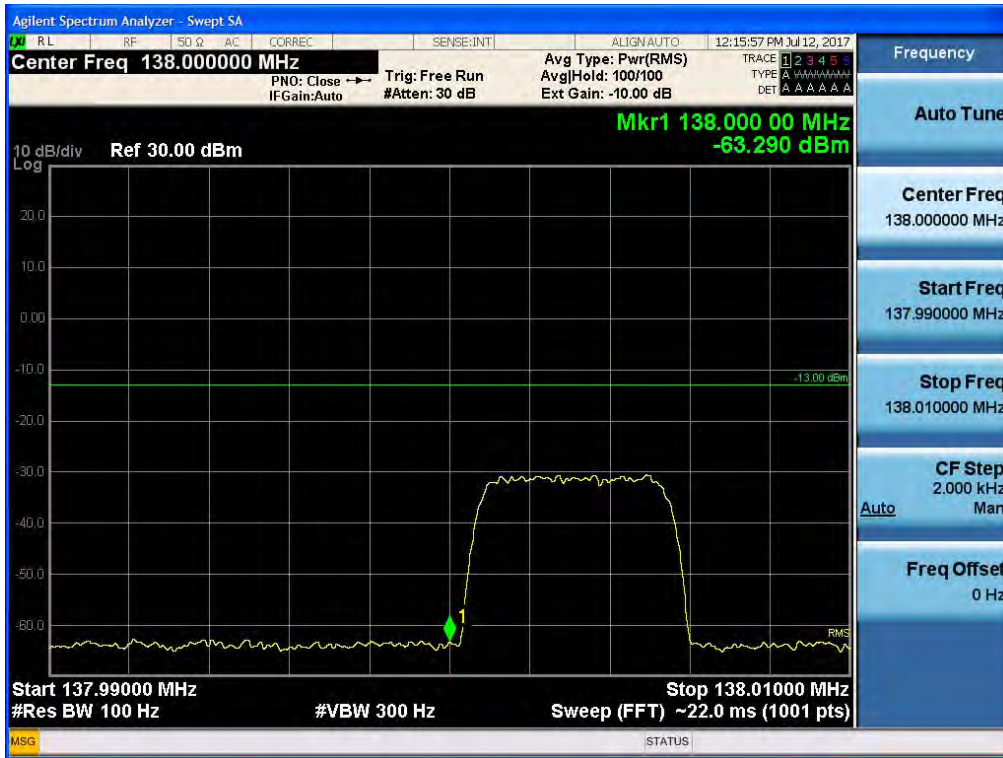


[Downlink - High]



VHF(APCO25_138 MHz) UL

[Uplink - Low]



VHF(APCO25_150 ~ 174 MHz) UL

[Uplink - Low]

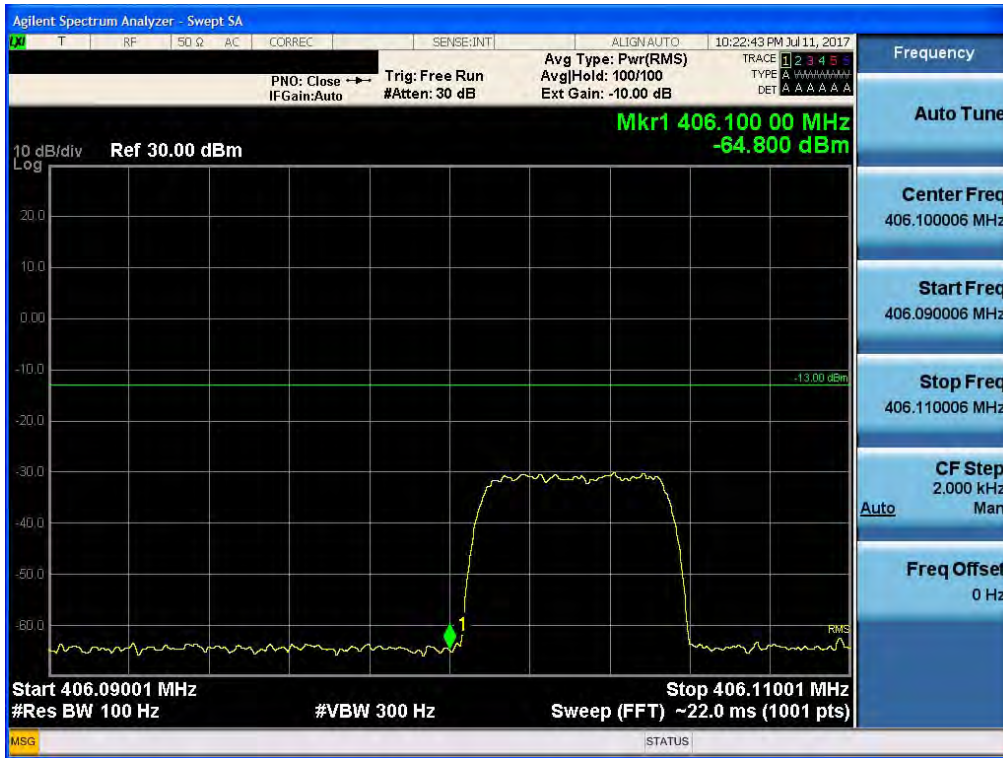


[Uplink - High]

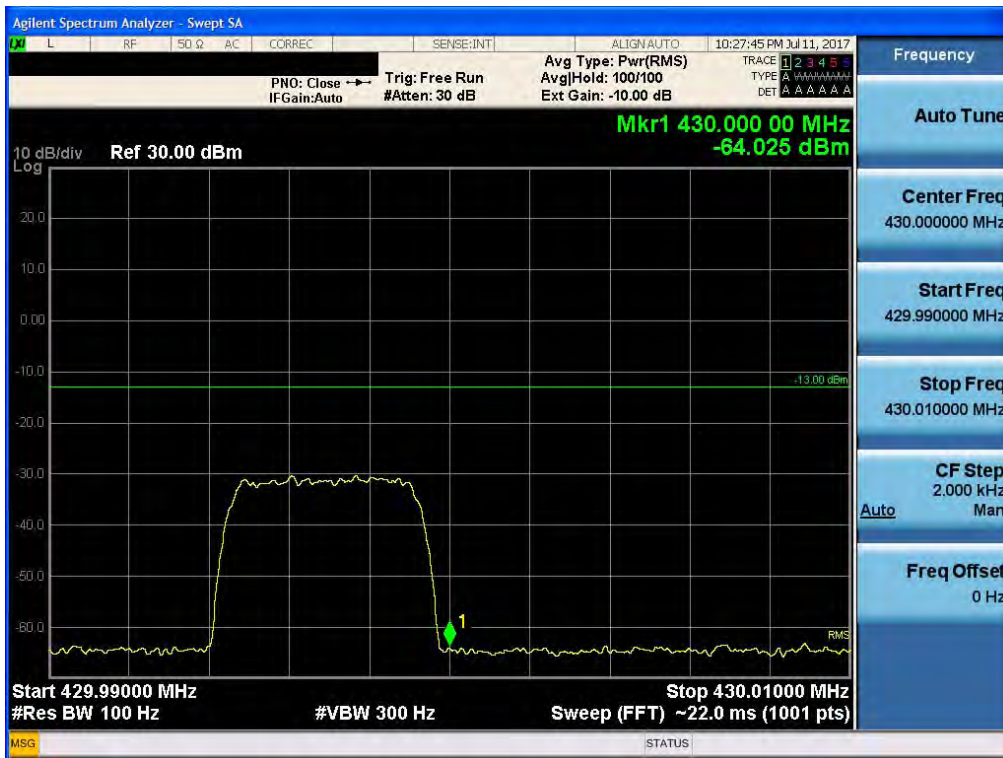


UHF(APCO_406.1 ~ 430 MHz) UL

[Uplink - Low]

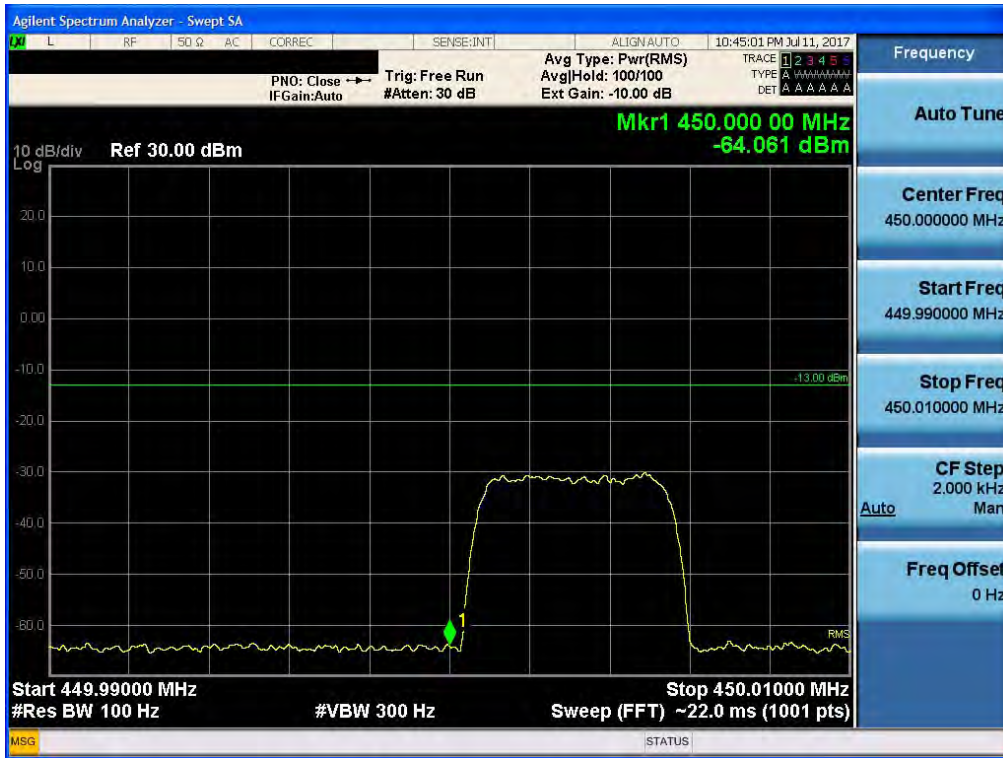


[Uplink - High]



UHF(APCO_450 ~ 470 MHz) UL

[Uplink - Low]

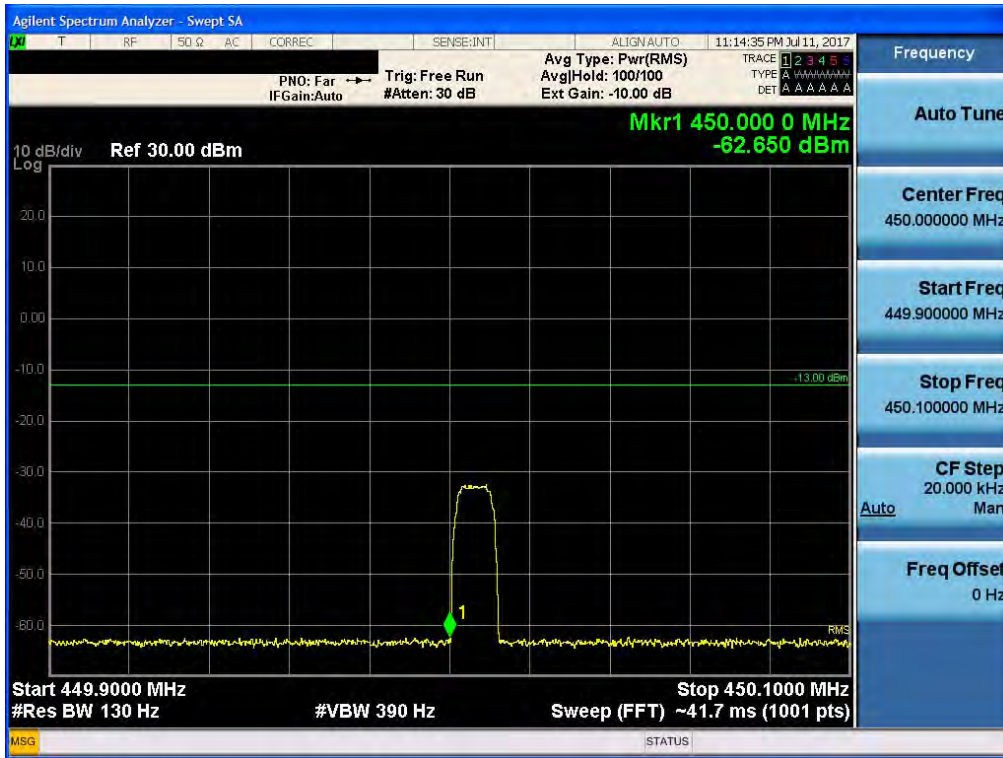


[Uplink - High]

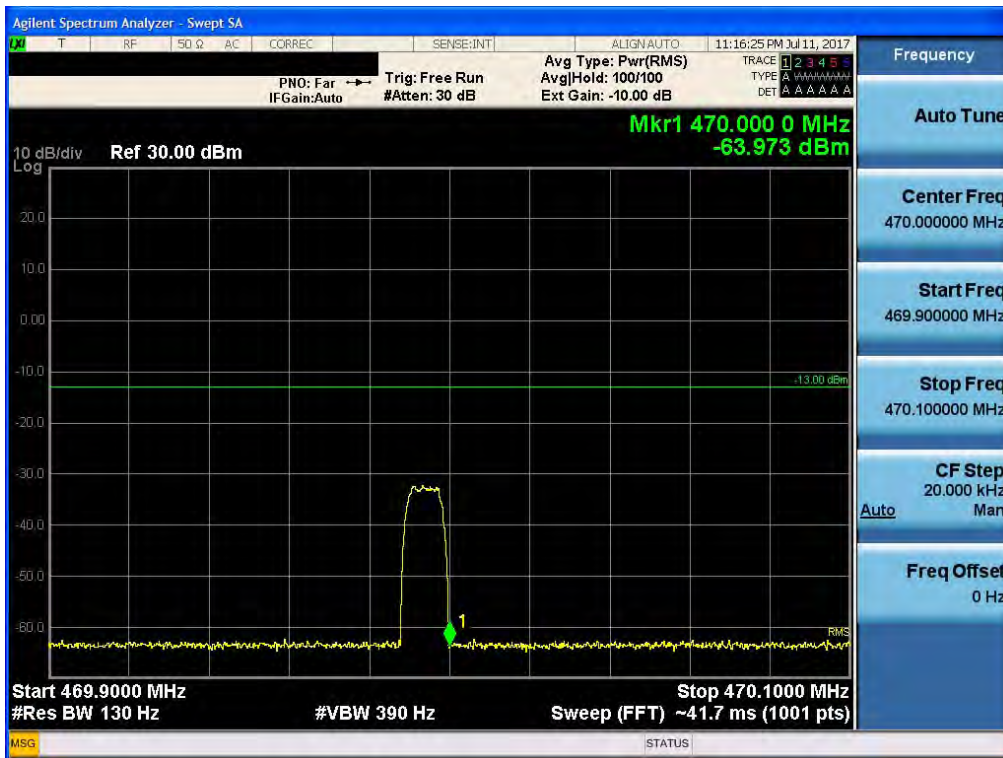


UHF(TETRA_450 ~ 470 MHz) UL

[Uplink - Low]

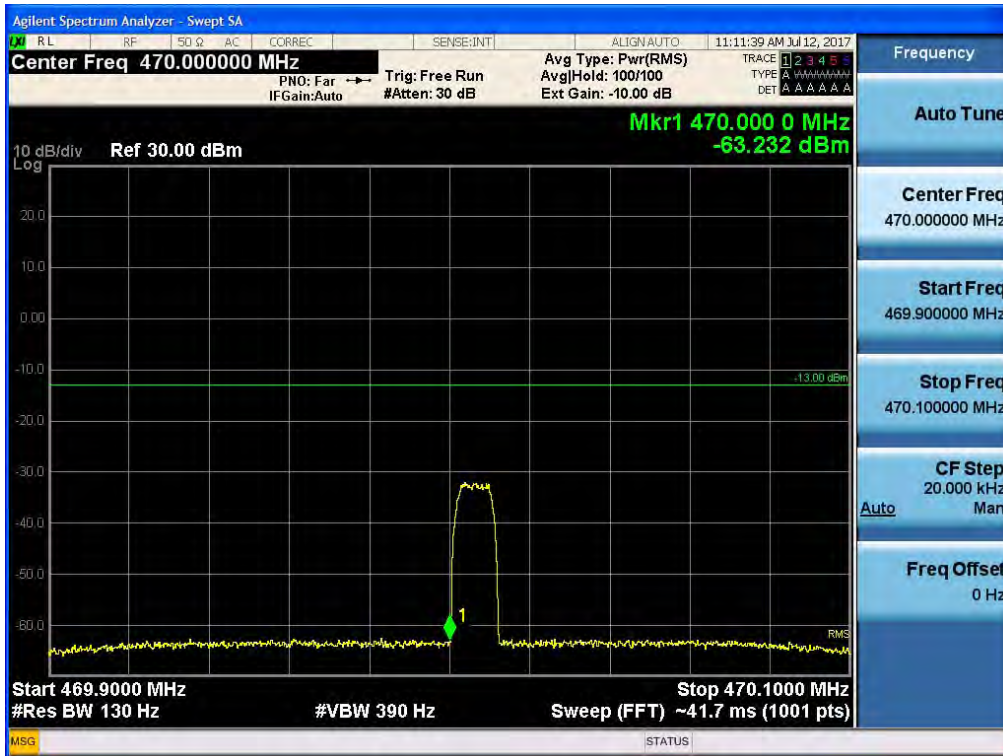


[Uplink - High]

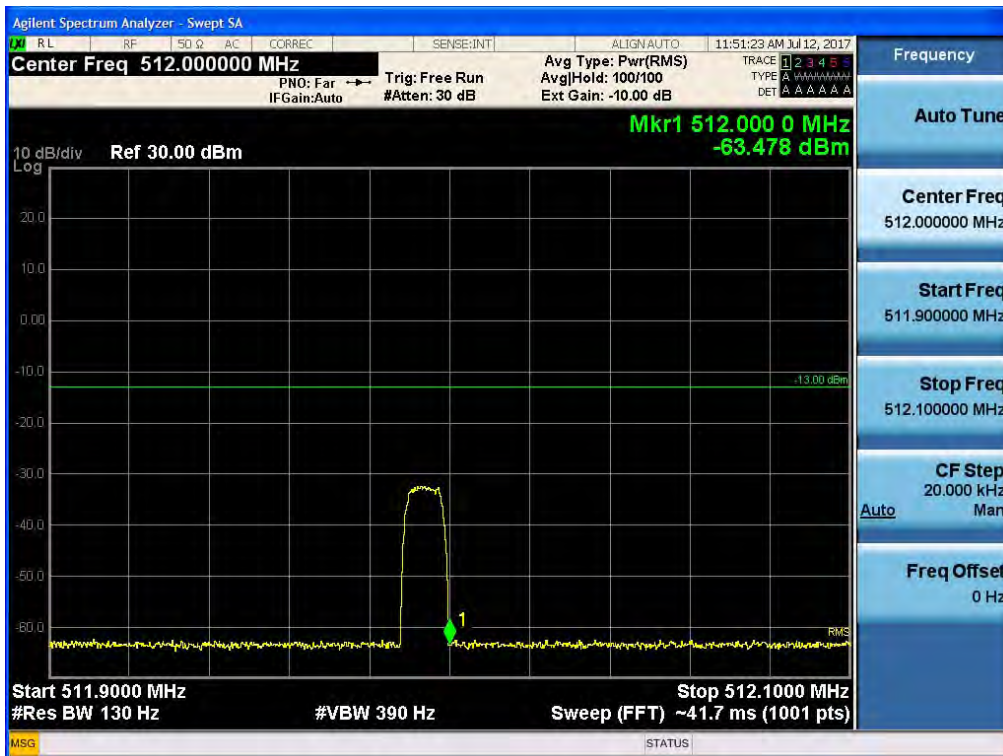


UHF(TETRA_470 ~ 512 MHz) UL

[Uplink - Low]



[Uplink - High]



12. RADIATED SPURIOUS EMISSIONS

Test Requirement(s):

§ 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 ($\mu\text{V}/\text{m}$ 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.

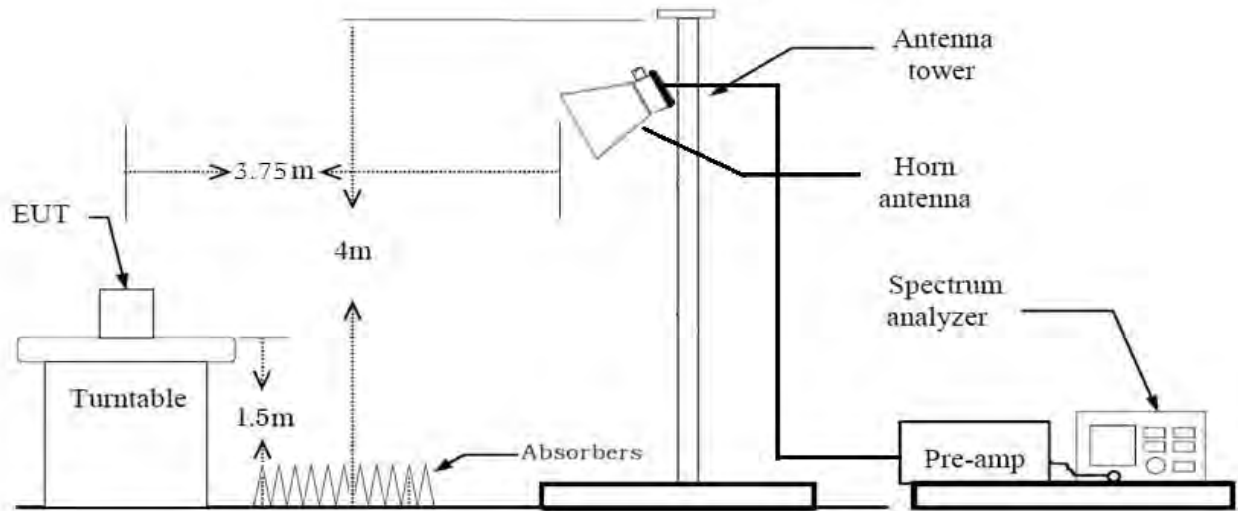
Test Procedures:

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 360 and 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 = $20 \log (\text{test distance} / \text{specific distance})$ (dB)

Test Result:

VHF

[Downlink]

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

* C.L.: Cable Loss / D.F.: Distance Factor (3.75 m)

UHF

[Downlink]

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

* C.L.: Cable Loss / A.G.: Amp Gain / D.F.: Distance Factor (3.75 m)

Notes:

1. Input signal is the CW signal.
2. We have done all kinds of power lines. Test datas were only the worst case.
3. We have done horizontal and vertical polarization in detecting antenna.

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 $\pm 15\%$ of nominal

RSS-131

4. Measurement Methods

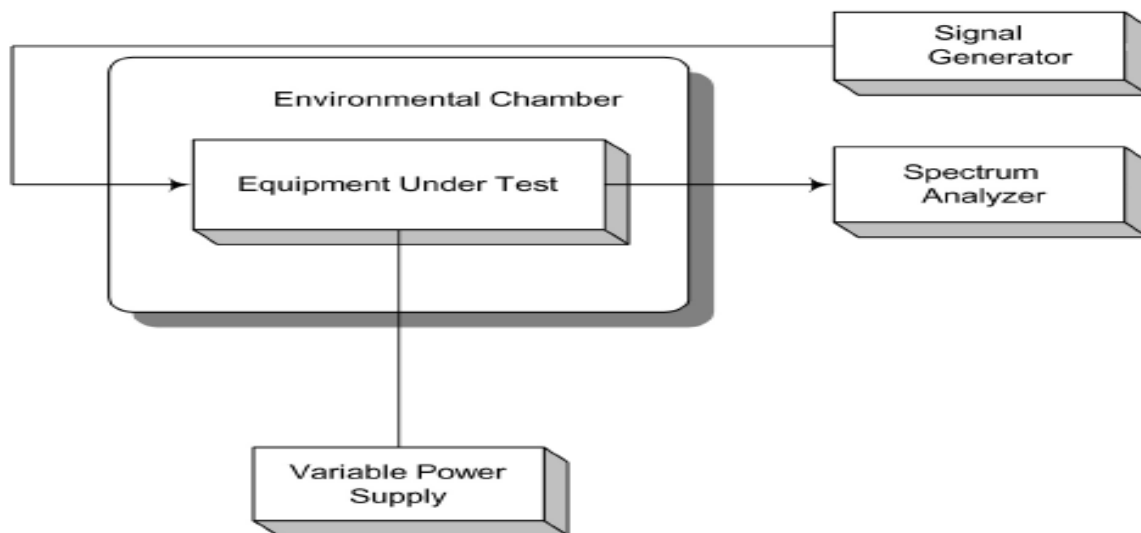
4.5 Frequency Stability of Band Translators

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 $+20^{\circ}\text{C}$ and rated supply voltage.

The following temperature and supply voltage ranges apply:

- a. at 10 degree intervals of temperatures between -30°C and $+50^{\circ}\text{C}$, and at the manufacturer's rated-supply voltage; and
- b. at $+20^{\circ}\text{C}$ temperature and $\pm 15\%$ supply voltage variations.

Test Setup:



* Note: This EUT is supported power supply both of AC and DC. Test results are only attached worst cases.

Frequency Stability and Voltage Test Results

UHF

[Downlink & Uplink]

Reference: 120 Vac at 20°C Freq. = 470.0 MHz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	470 000 000	0.312	0.000	0.00000
	-30	470 000 000	0.216	-0.096	-0.00012
	-20	470 000 000	-0.233	-0.545	-0.00071
	-10	469 999 999	-0.855	-1.167	-0.00151
	0	470 000 000	0.356	0.044	0.00006
	+10	470 000 000	-0.213	-0.525	-0.00068
	+30	470 000 000	0.112	-0.200	-0.00026
	+40	470 000 000	0.364	0.052	0.00007
	+50	470 000 000	-0.216	-0.528	-0.00068
High	+20	470 000 001	0.649	0.337	0.00044
Low	+20	470 000 000	0.423	0.111	0.00014

VHF

[Downlink & Uplink]

Reference: 120 Vac at 20°C Freq. = 162.0 MHz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	162 000 000	-0.213	0.000	0.00000
	-30	162 000 001	0.660	0.873	0.00113
	-20	161 999 999	-0.532	-0.319	-0.00041
	-10	162 000 000	0.364	0.577	0.00075
	0	162 000 001	0.751	0.964	0.00125
	+10	161 999 999	-0.513	-0.300	-0.00039
	+30	162 000 000	0.361	0.574	0.00074
	+40	162 000 000	0.218	0.431	0.00056
	+50	161 999 999	-0.632	-0.419	-0.00054
High	+20	162 000 000	0.451	0.664	0.00086
Low	+20	162 000 001	0.762	0.975	0.00126