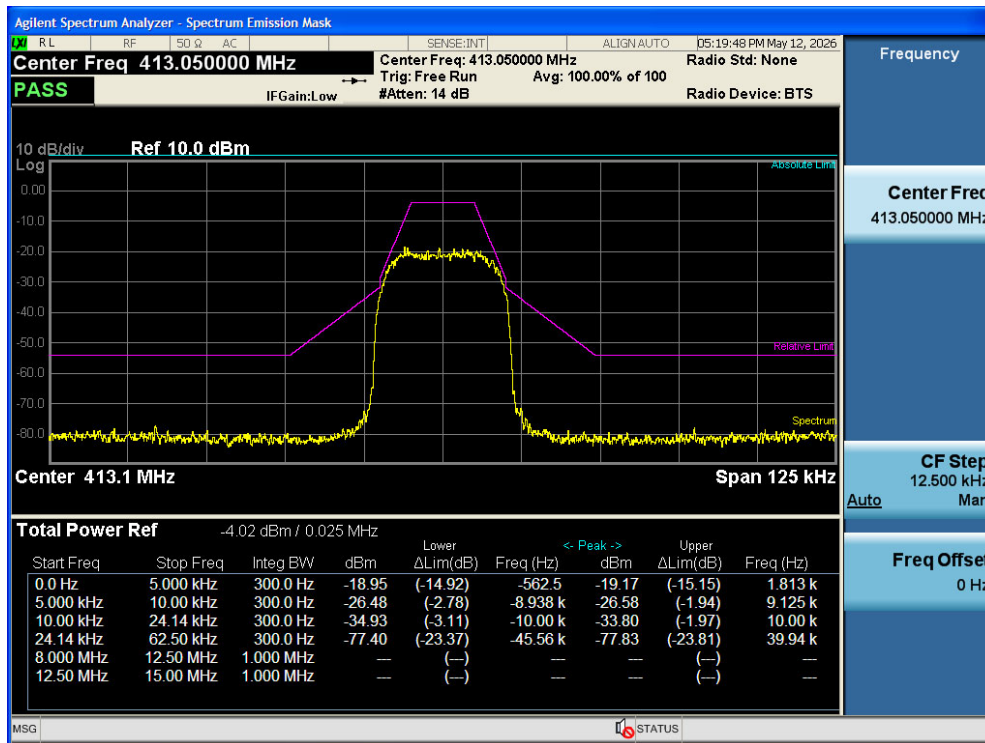
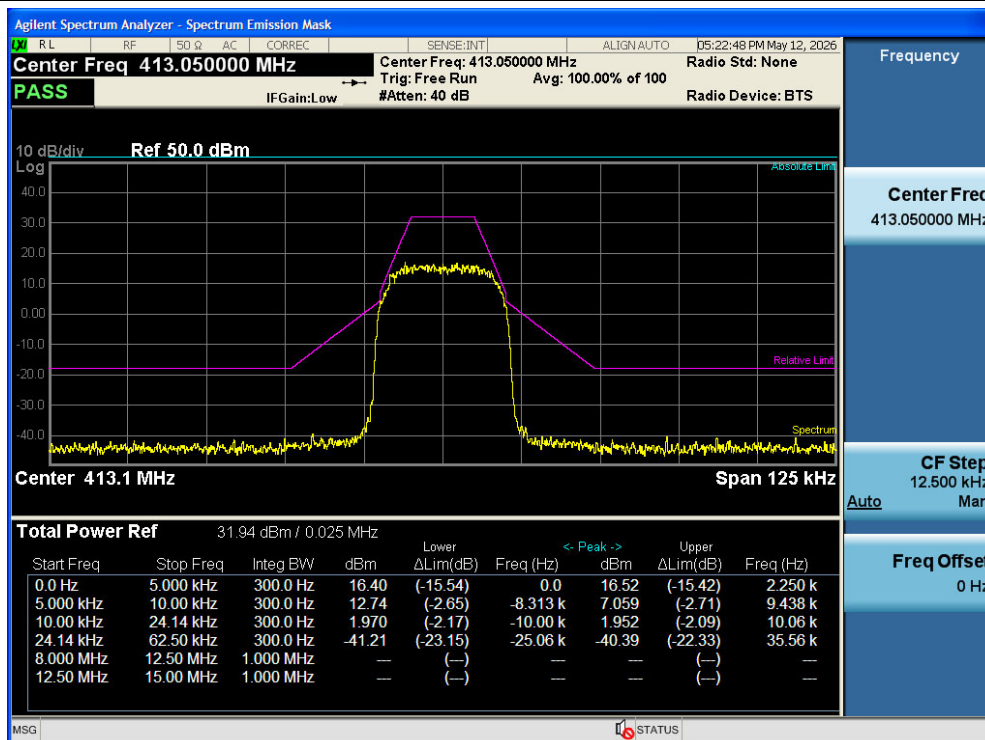


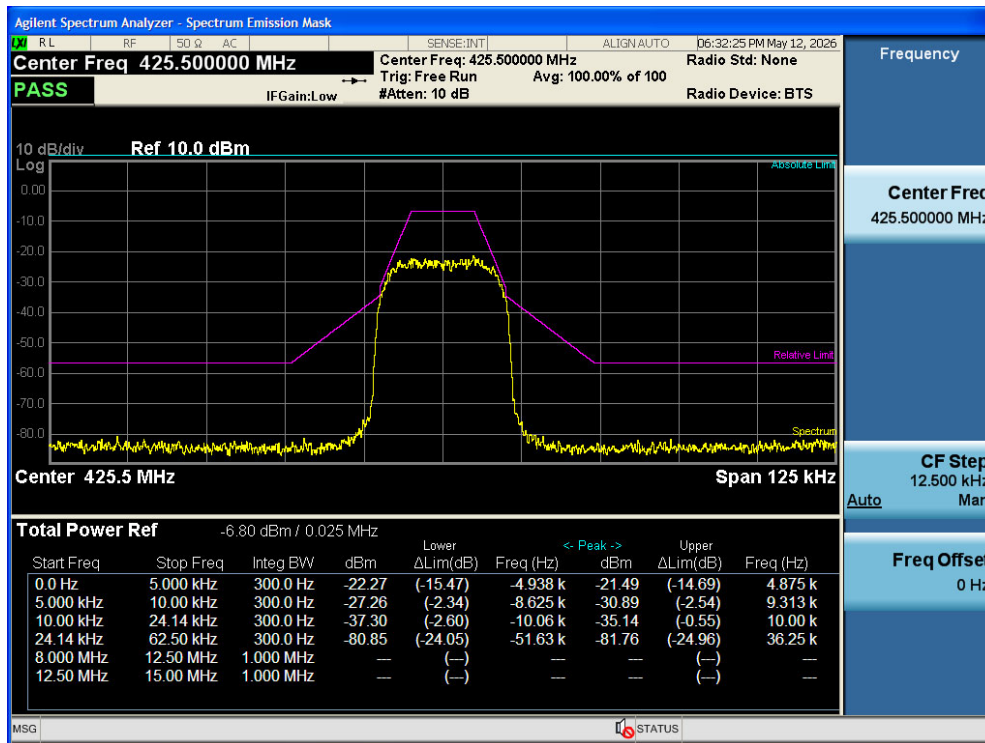
Input @ +3 dB AGC threshold / UHF (406.1 ~ 420) / Downlink / IDEN / Mask C



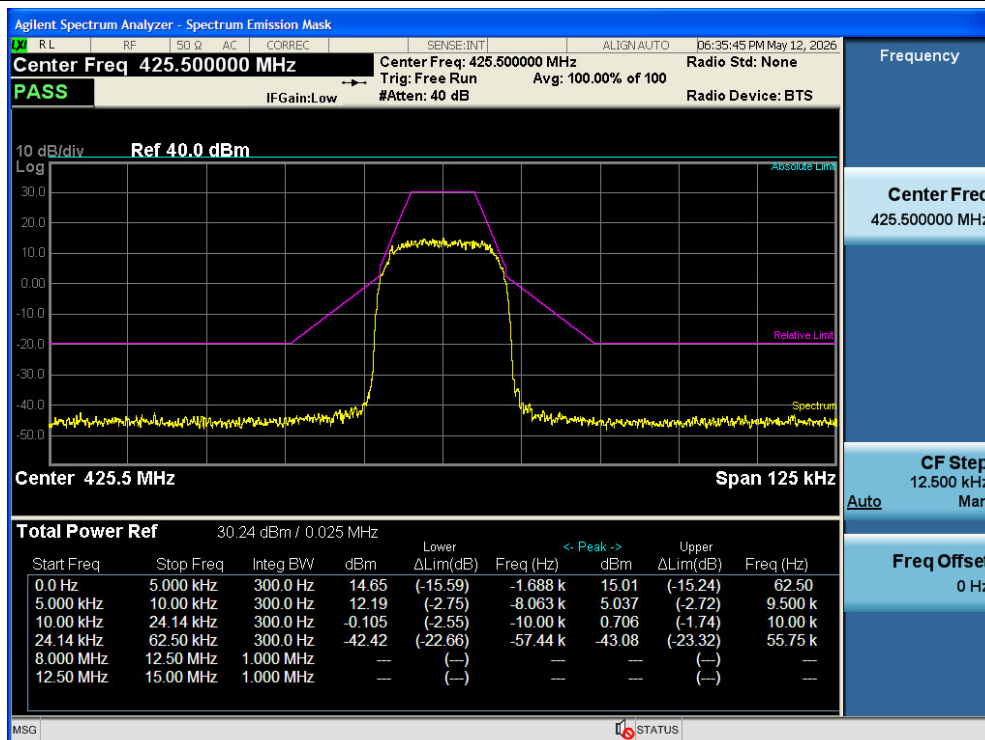
Output @ +3 dB AGC threshold / UHF (406.1 ~ 420) / Downlink / IDEN / Mask C



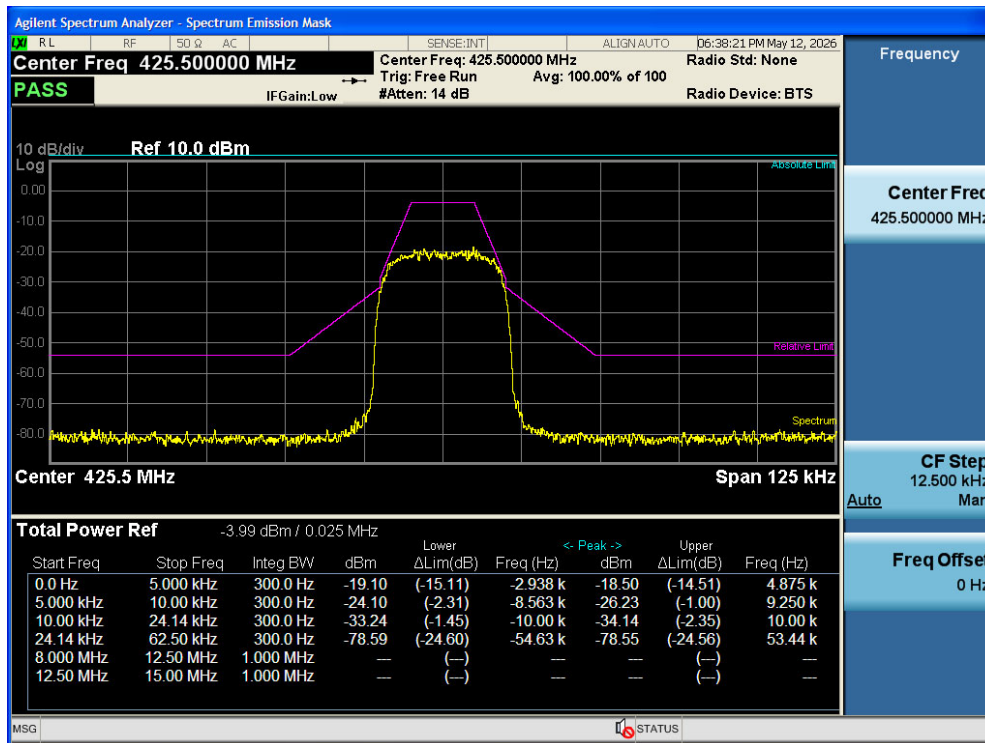
Input / UHF (421 ~ 430) / Downlink / IDEN / Mask C



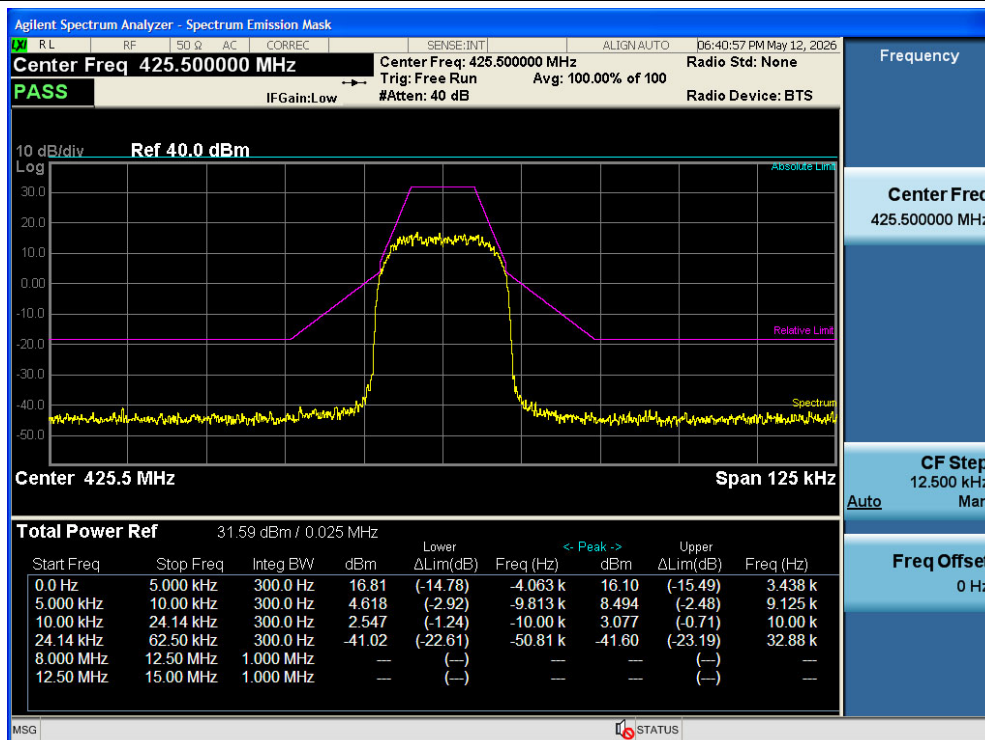
Output / UHF (421 ~ 430) / Downlink / IDEN / Mask C



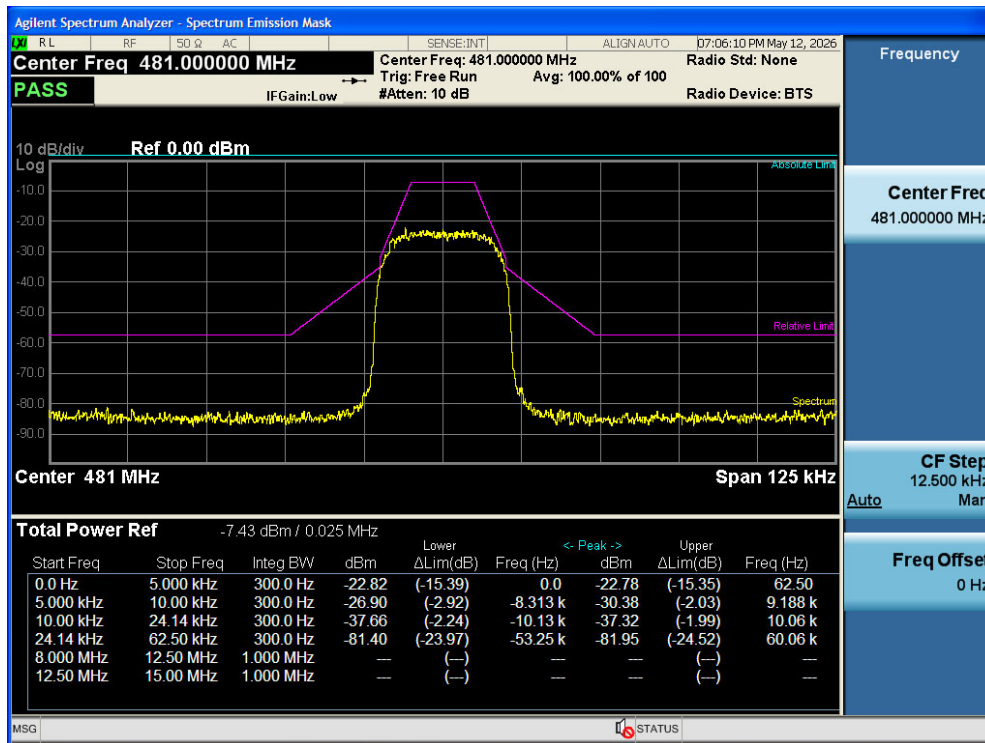
Input @ +3 dB AGC threshold / UHF (421 ~ 430) / Downlink / IDEN / Mask C



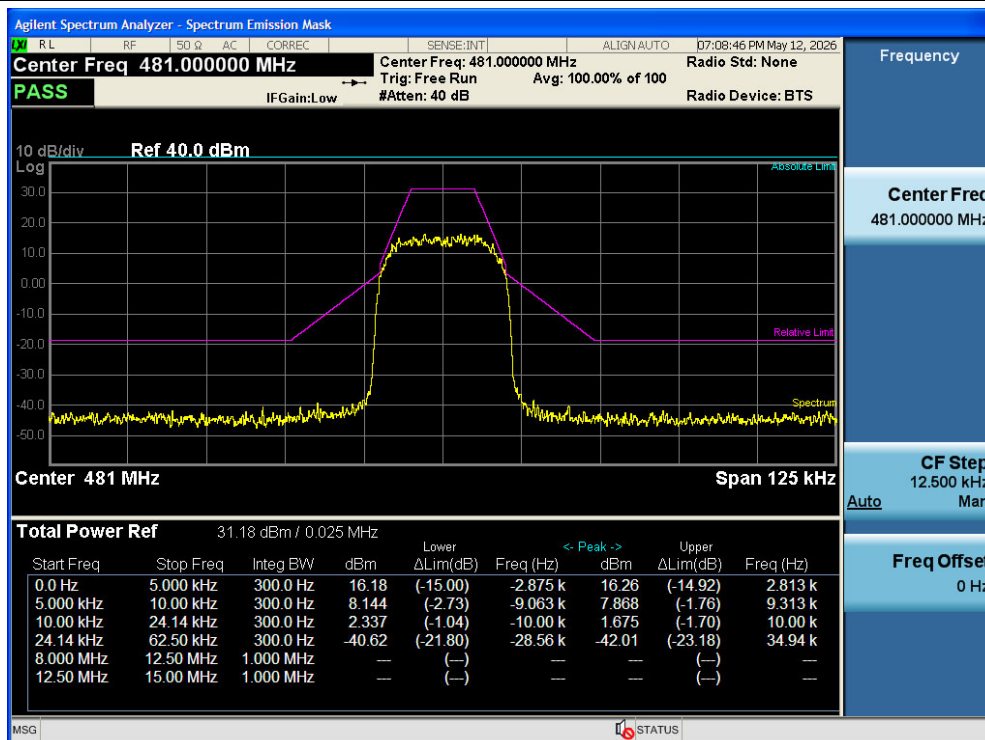
Output @ +3 dB AGC threshold / UHF (421 ~ 430) / Downlink / IDEN / Mask C



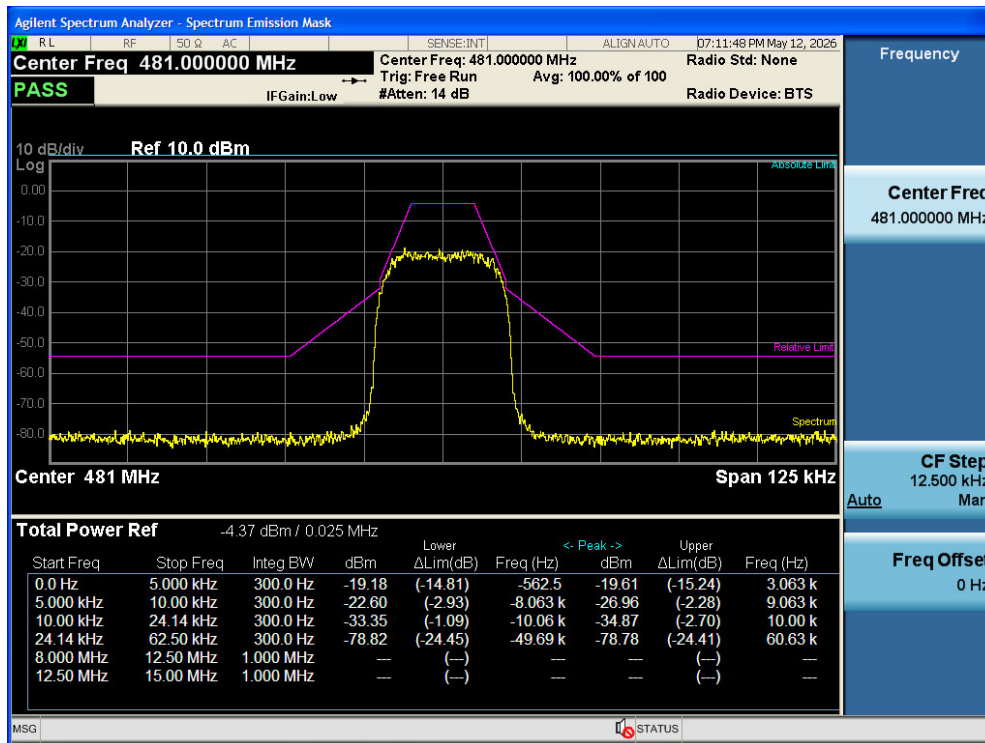
Input / UHF (450 ~ 512) / Downlink / IDEN / Mask C



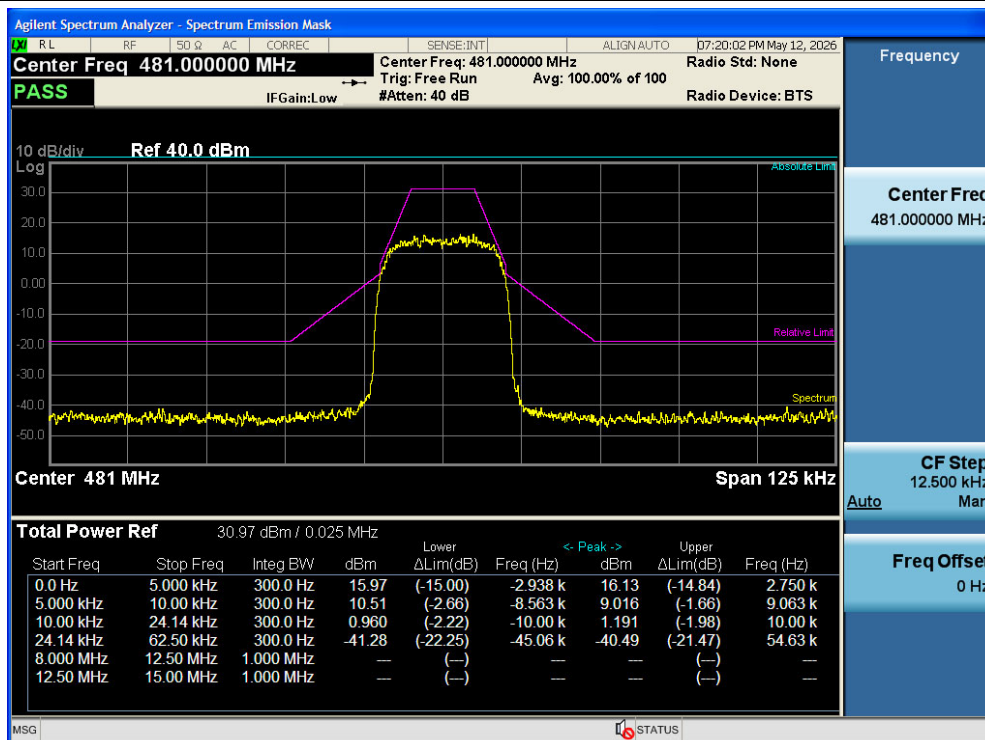
Output / UHF (450 ~ 512) / Downlink / IDEN / Mask C



Input @ +3 dB AGC threshold / UHF (450 ~ 512) / Downlink / IDEN / Mask C



Output @ +3 dB AGC threshold / UHF (450 ~ 512) / Downlink / IDEN / Mask C



5.5. INPUT/OUTPUT POWER AND AMPLIFIER/BOOSTER GAIN

Test Requirement:

§ 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 radiotelephone 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 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.

§ 90.219 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.

Test Procedures:

Measurements were in accordance with the test methods section 4.5 of KDB 935210 D05 v01r04.

4.5.2 Measuring input and output power levels for determining amplifier/booster gain

Apply the same guidance as in 3.5.2 to measure the maximum input and output power levels necessary for computing the mean EUT gain, but with the following modifications:

- a) Configure the signal generator for CW operation, instead of AWGN,
- b) Select the spectrum analyzer positive peak detector, instead of the power averaging (rms) detector,
- c) Activate the max hold function, instead of the trace averaging function,
- d) Use in conjunction with the guidance in 4.5.3.

4.5.3 Power measurement Method 1: using a spectrum or signal analyzer

- a) Set the span to at least 1 MHz.
- b) Set the RBW 100 kHz.
- c) Set the VBW to $\geq 3 \times \text{RBW}$.
- d) Set the detector to PEAK with the trace to MAX HOLD.
- e) Place a marker on the peak of the signal, and record the value as the maximum power.
- f) Repeat step e) but with the EUT in place.
- g) EUT gain may be calculated as described in 4.5.5.

4.5.5 Calculating amplifier, repeater, or industrial booster gain

After the input and output power levels have been measured as described in the preceding subclauses, the gain of the EUT can be determined from:

$$\text{Gain (dB)} = \text{output power (dBm)} - \text{input power (dBm)}.$$

Report the gain for each authorized operating frequency band, and each test signal stimulus.

Note:

1. If the f_0 determined from the out-of-band rejection test is smaller or greater than the difference between the test signal's center frequency and the operating band block, the test is performed at the lowest or highest frequency at which the test signals can pass.
2. The ERP is calculated as follows.
 - Downlink ERP = Downlink Output Power + Peak Antenna Gain + Cable Loss
 $= 23.998 \text{ dBm} + 14.85 \text{ dBd} - 2.87 \text{ dB} = 35.98 \text{ dBm}$

Test Results:

Tabular data of Input / Output Power and Gain

Test Band	Link	Signal	f_0	Input	Output	Gain	Total	E.R.P.#		Limit
			Frequency	Power	Power		Gain#			
			(MHz)	(dBm)		(dB)	(dBd)	(dBm)	(W)	(W)
VHF (150.05 ~ 173.4)	Downlink	CW	158.131	-15.069	23.998	39.067	11.98	35.98	3.96	5
UHF (406.1 ~ 420)			406.860	-14.929	23.766	38.695	11.98	35.75	3.75	
UHF (421 ~ 430)			429.780	-14.956	23.874	38.830	11.98	35.85	3.85	
UHF (450 ~ 512)			469.840	-14.853	23.658	38.511	11.98	35.64	3.66	

Gain(dB) = Output power(dBm) - Input power(dBm)

Total Gain = Peak Antenna Gain + Cable Loss (See page 5)

#E.R.P.(dBm) = Output Power(dBm) + Peak Ant. Gain(dBd)

Tabular data of Input / Output Power at 3 dB above AGC threshold

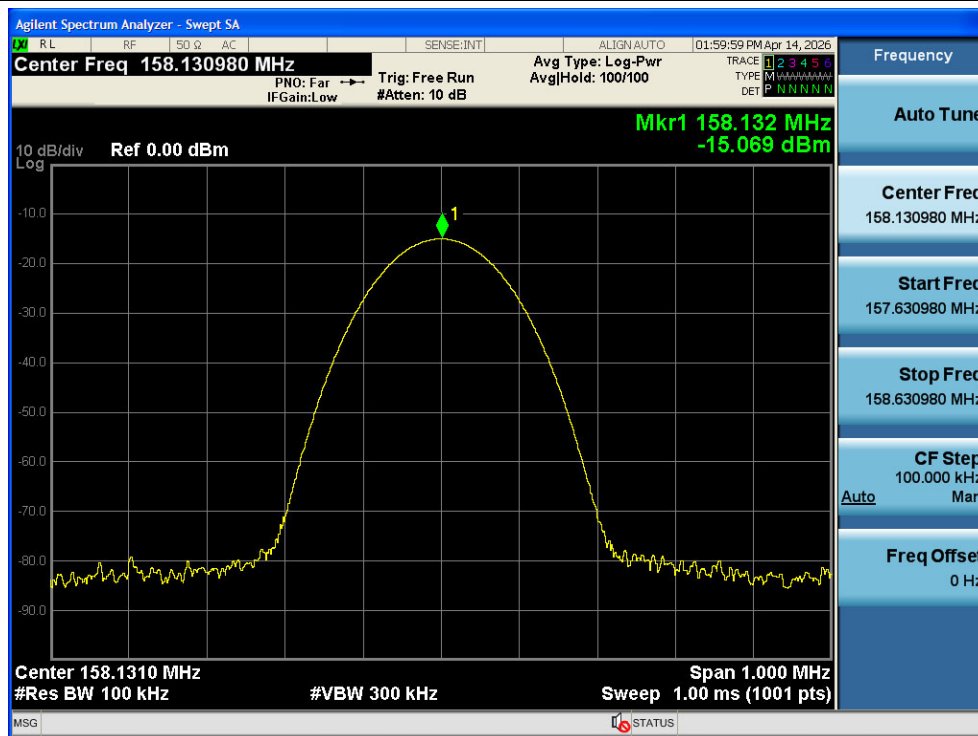
Test Band	Link	Signal	f_0	Input	Output	Total	E.R.P.#		Limit
			Frequency	Power	Power	Gain#			
			(MHz)	(dBm)		(dBd)	(dBm)	(W)	(W)
VHF (150.05 ~ 173.4)	Downlink	CW	158.131	-12.087	23.963	11.98	35.94	3.93	5
UHF (406.1 ~ 420)			406.860	-11.939	23.857	11.98	35.84	3.83	
UHF (421 ~ 430)			429.780	-12.066	23.966	11.98	35.95	3.93	
UHF (450 ~ 512)			469.840	-11.875	23.790	11.98	35.77	3.78	

Total Gain = Peak Antenna Gain + Cable Loss (See page 5)

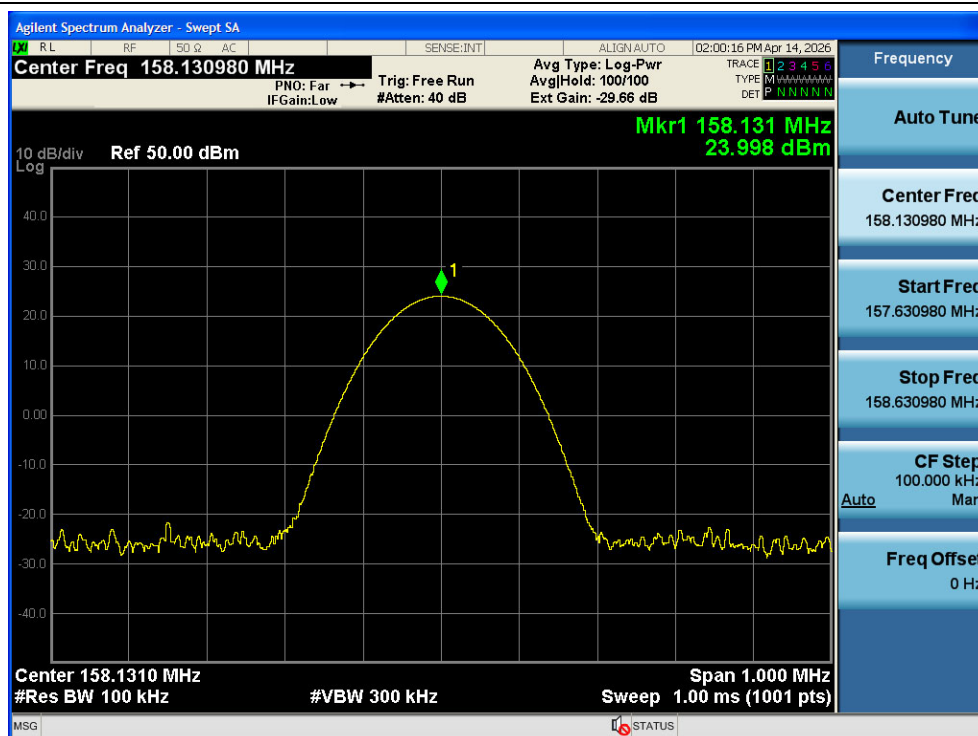
#E.R.P.(dBm) = Output Power(dBm) + Peak Ant. Gain(dBd)

Plot data of Input / Output Power

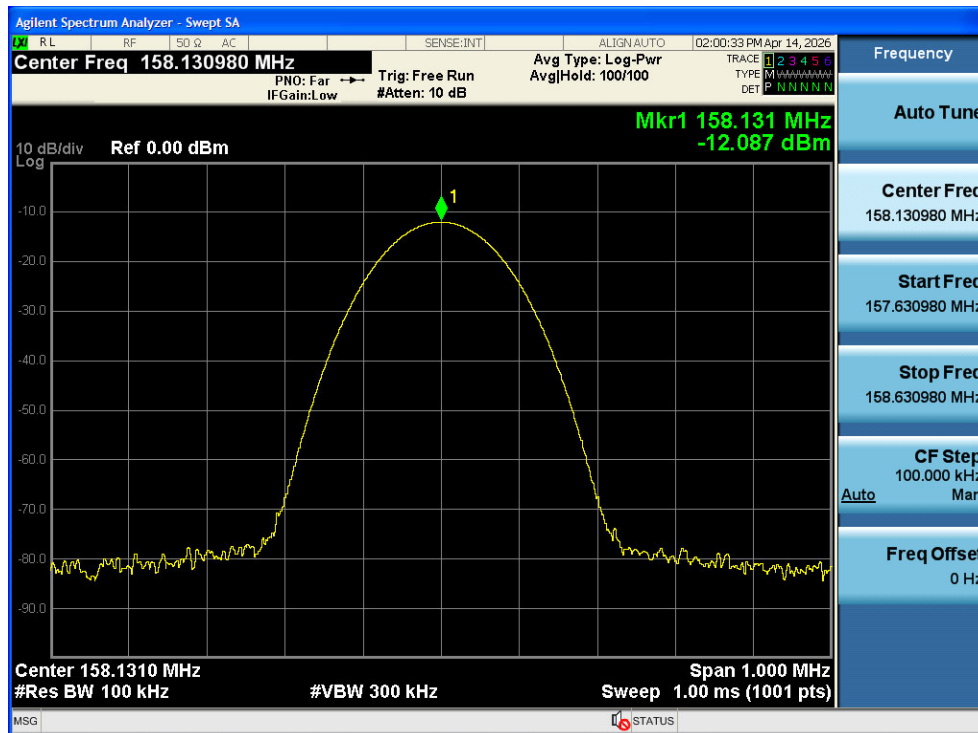
Input Power / VHF (150.05 ~ 173.4) / Downlink / CW



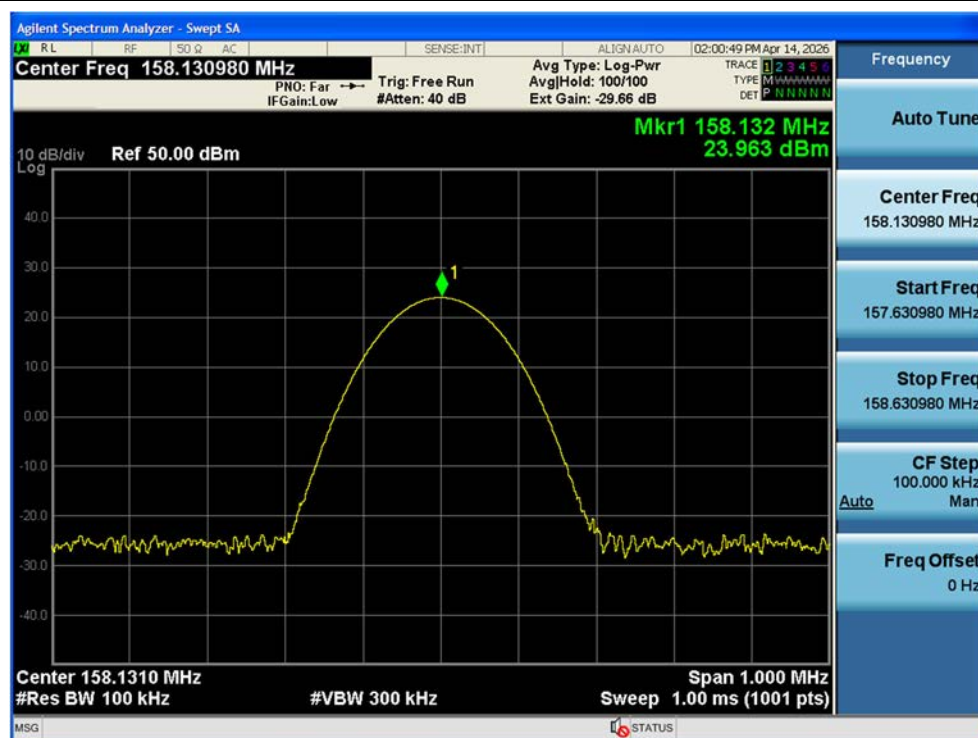
Output Power / VHF (150.05 ~ 173.4) / Downlink / CW



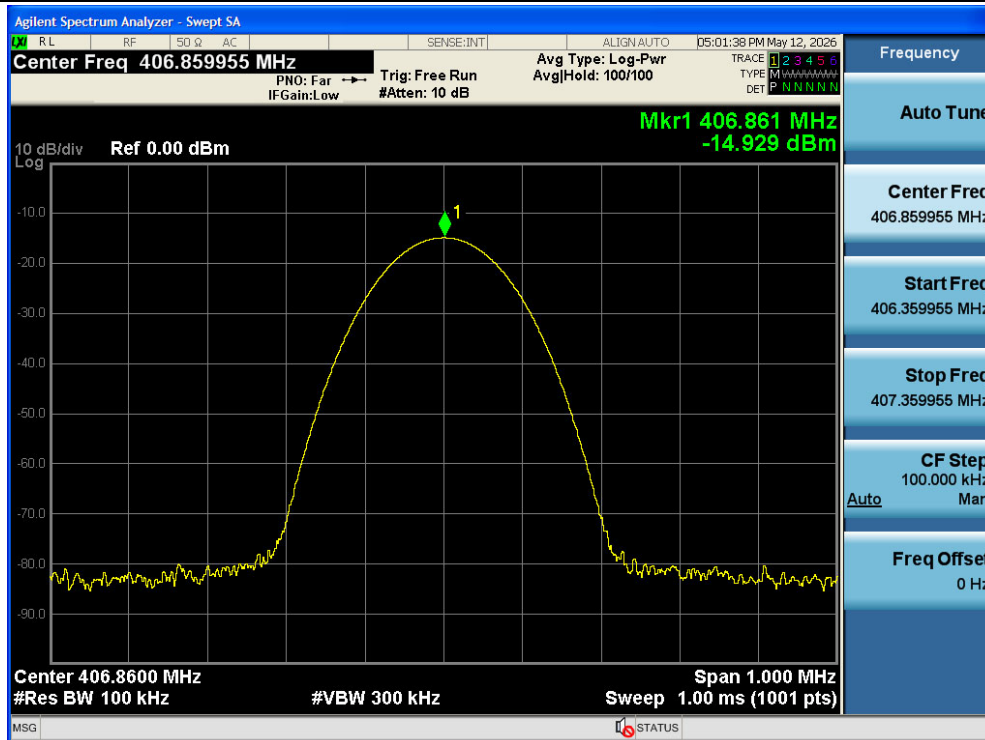
Input Power @ +3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / CW



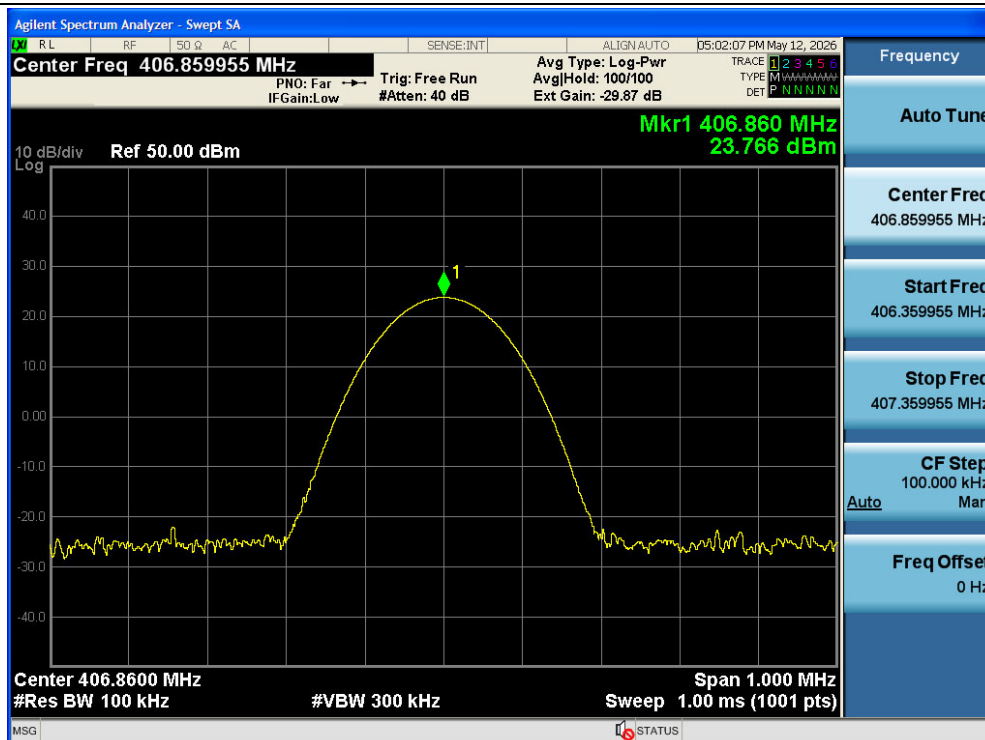
Output Power @ +3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / CW



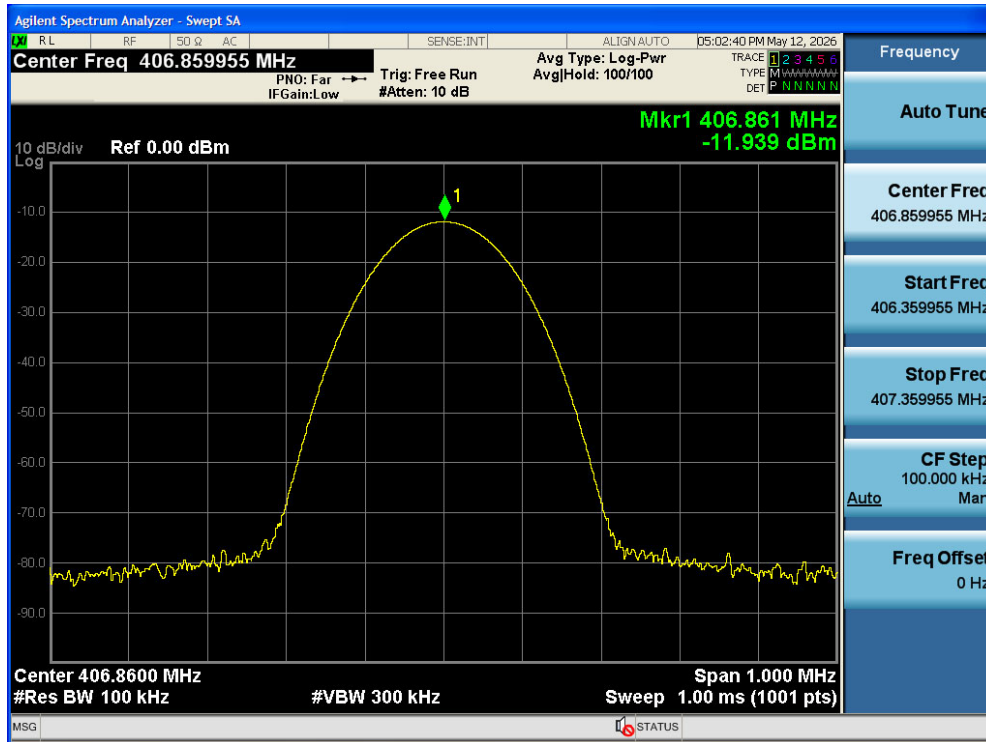
Input Power / UHF (406.1 ~ 420) / Downlink / CW



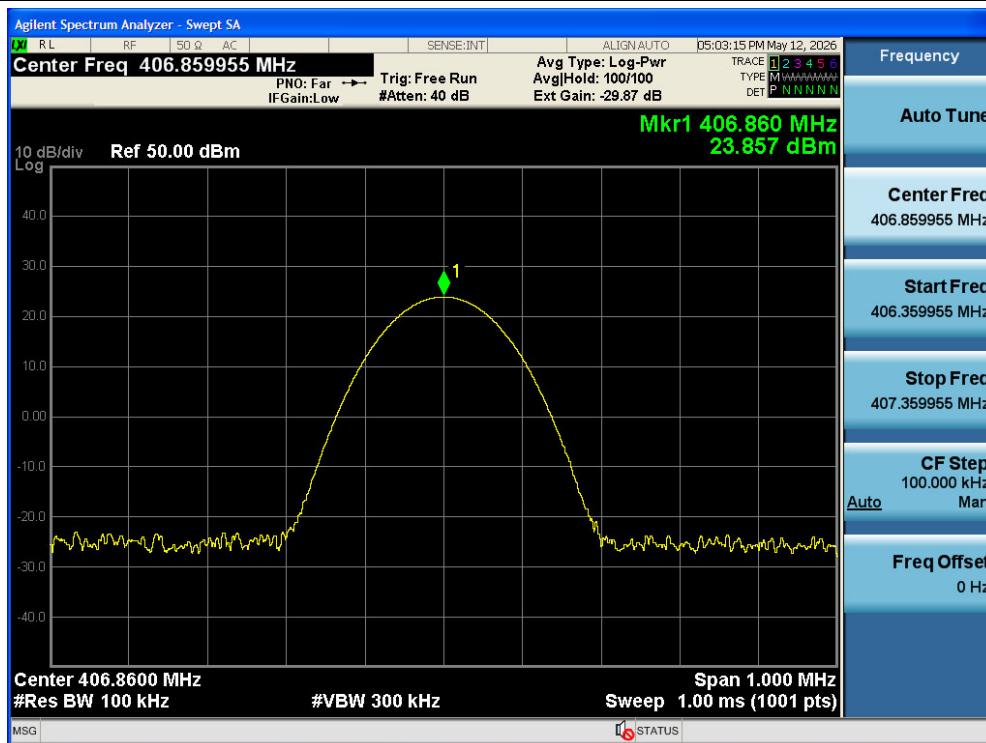
Output Power / UHF (406.1 ~ 420) / Downlink / CW



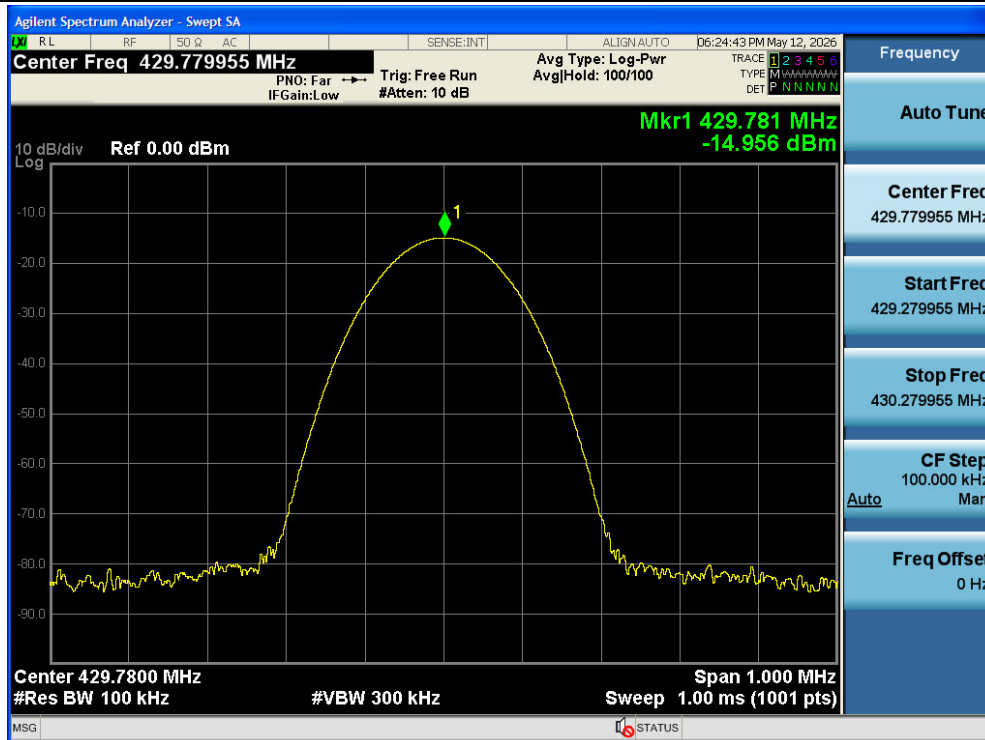
Input Power @ +3 dB AGC threshold / UHF (406.1 ~ 420) / Downlink / CW



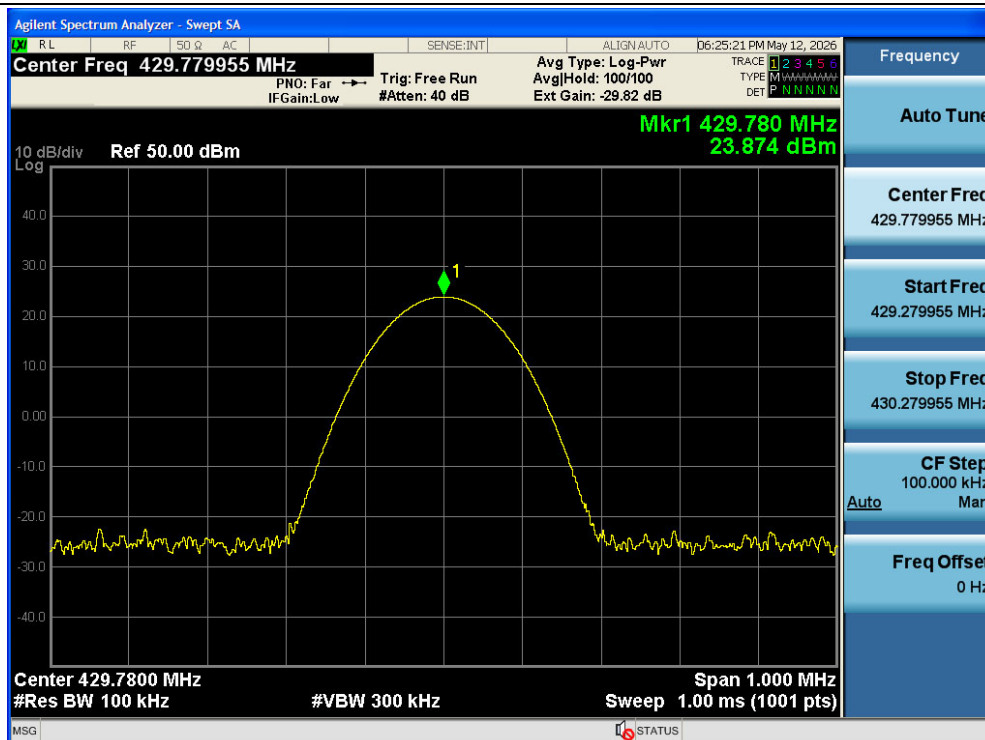
Output Power @ +3 dB AGC threshold / UHF (406.1 ~ 420) / Downlink / CW



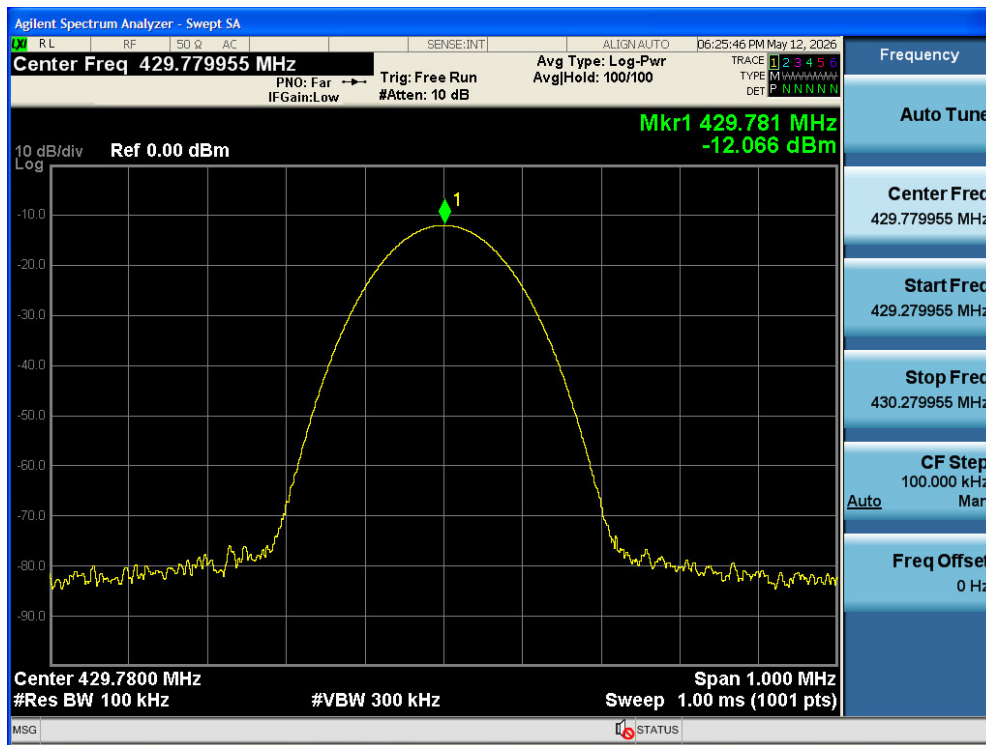
Input Power / UHF (421 ~ 430) / Downlink / CW



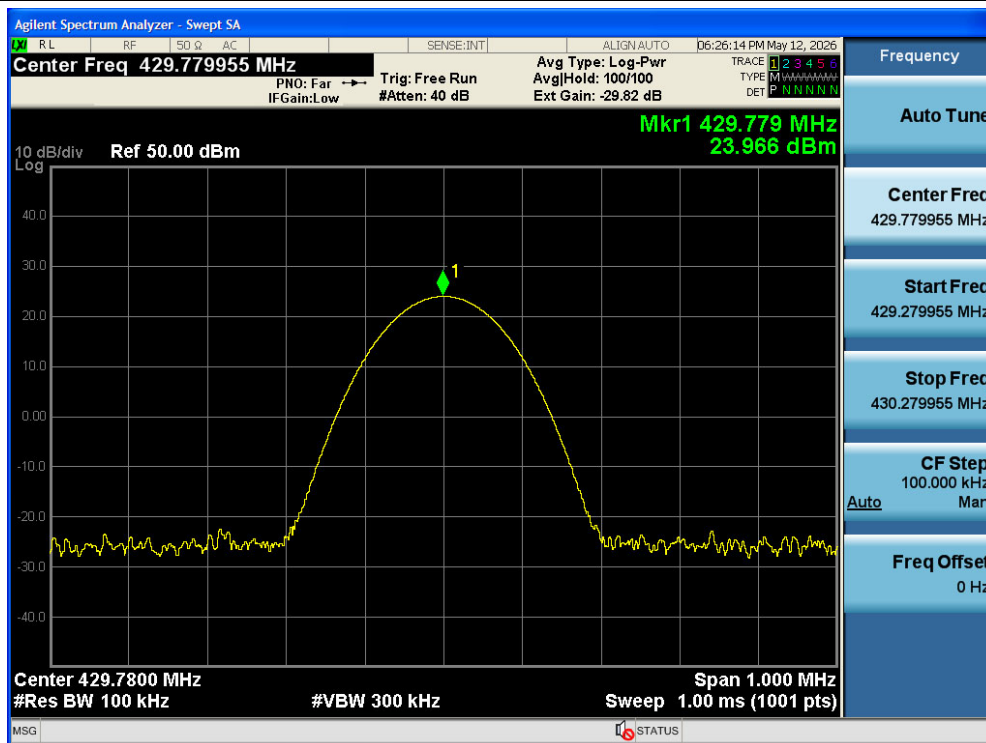
Output Power / UHF (421 ~ 430) / Downlink / CW



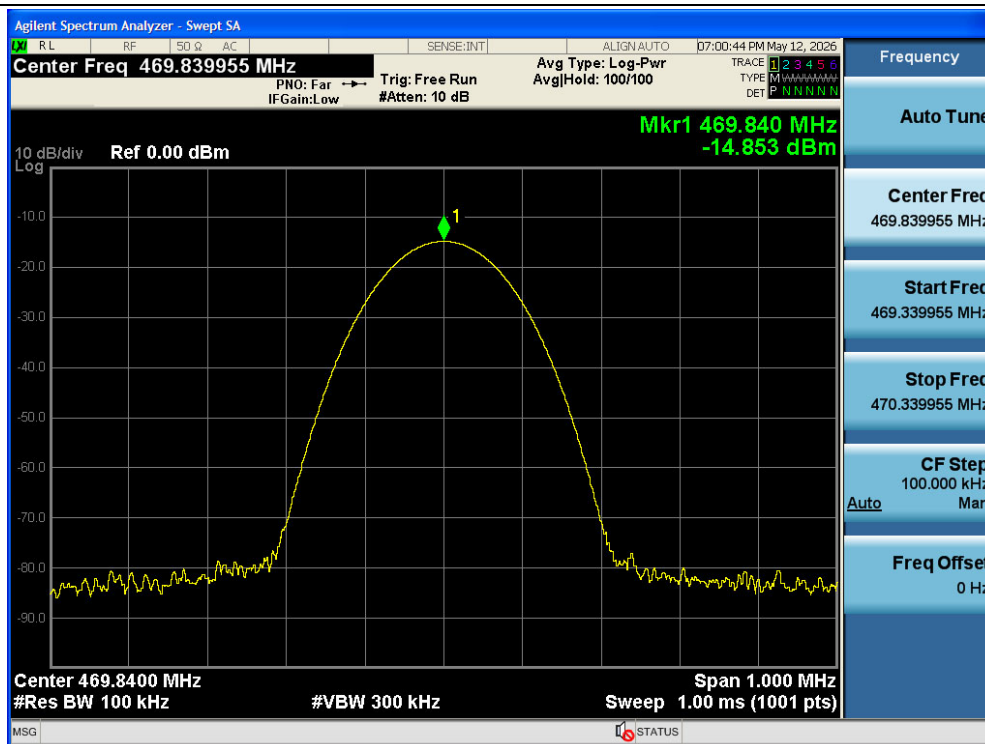
Input Power @ +3 dB AGC threshold / UHF (421 ~ 430) / Downlink / CW



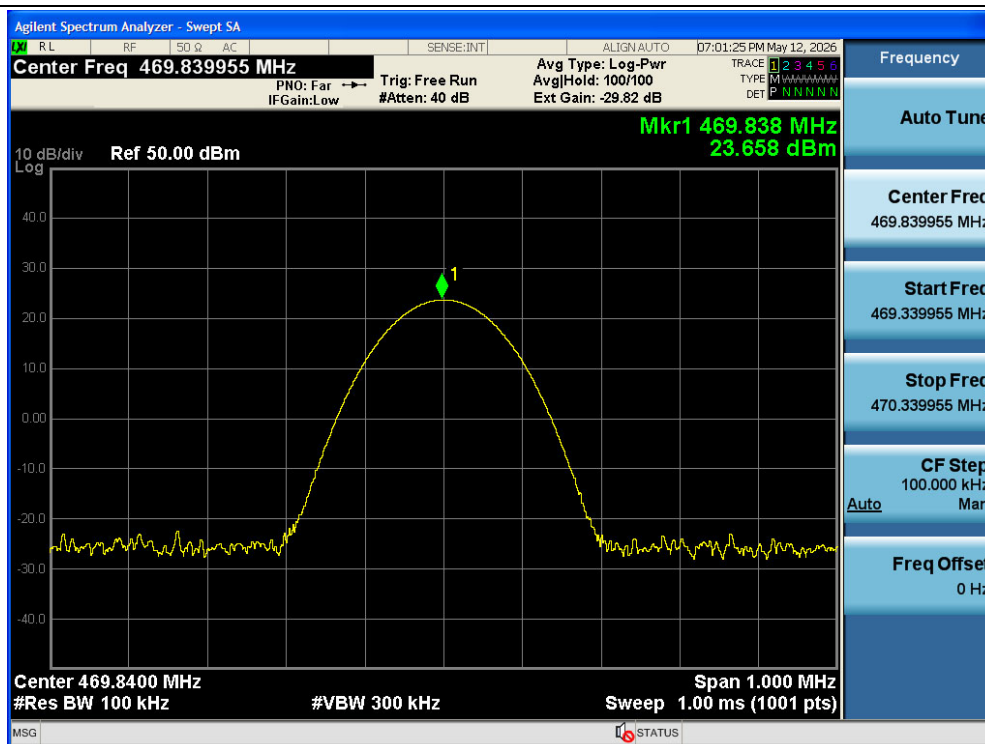
Output Power @ +3 dB AGC threshold / UHF (421 ~ 430) / Downlink / CW



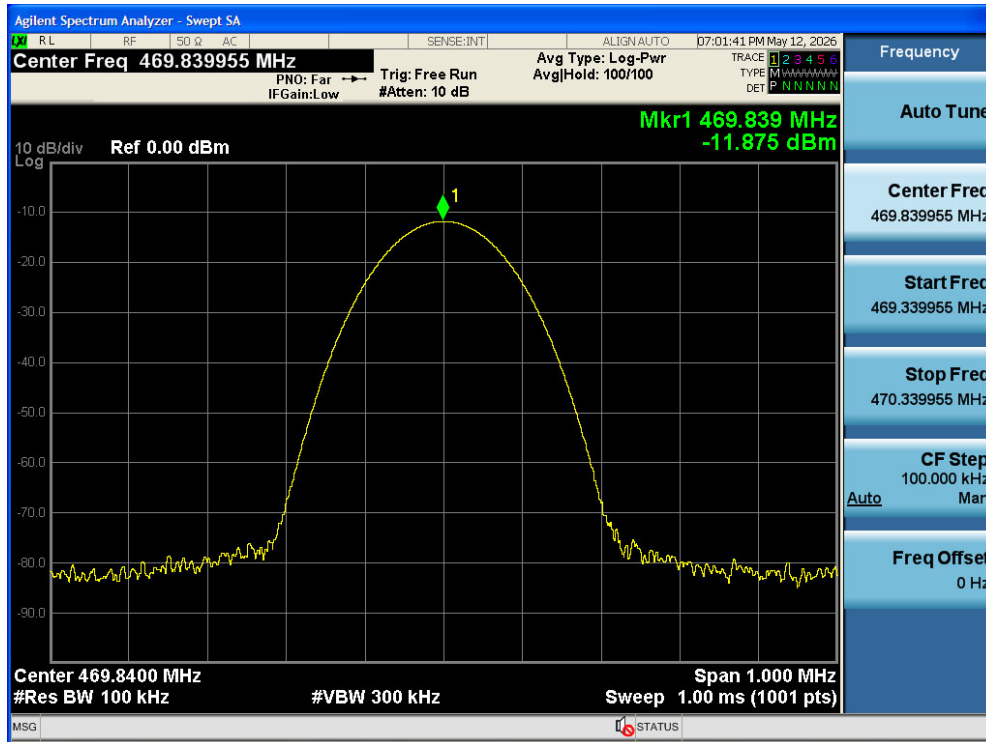
Input Power / UHF (450 ~ 512) / Downlink / CW



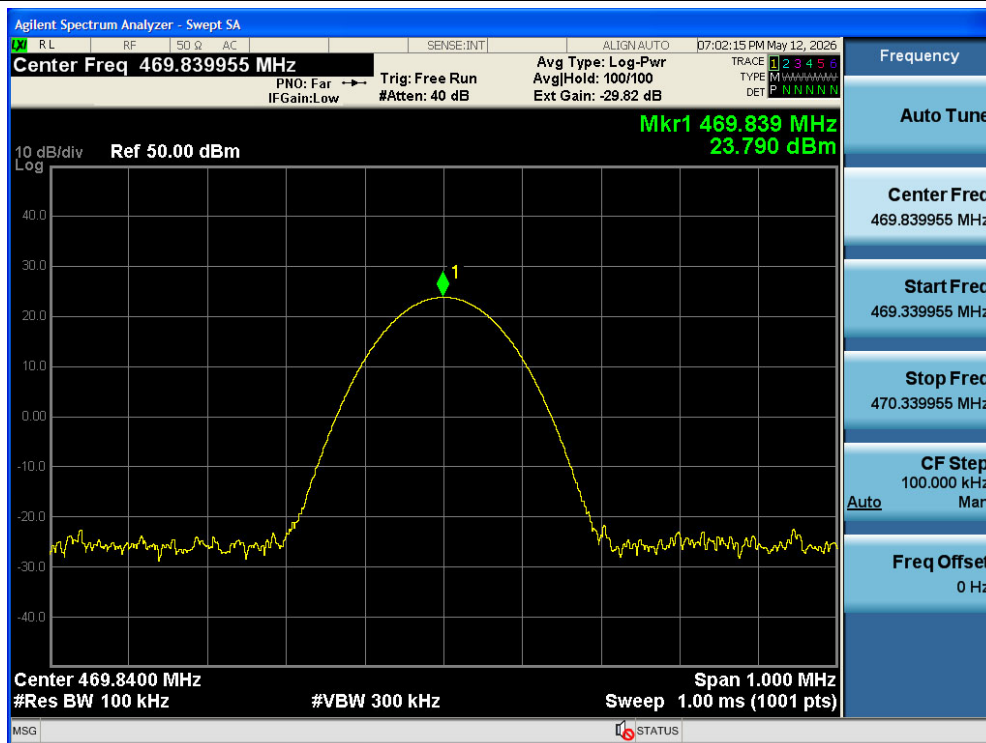
Output Power / UHF (450 ~ 512) / Downlink / CW



Input Power @ +3 dB AGC threshold / UHF (450 ~ 512) / Downlink / CW



Output Power @ +3 dB AGC threshold / UHF (450 ~ 512) / Downlink / CW



5.6. NOISE FIGURE

Test Requirements:

KDB 935210 D02 v04r03

V. PART 90 SIGNAL BOOSTER SPECIFIC REQUIREMENTS

- (j) Other provisions for Part 90 boosters in specific bands and/or for specific conditions
 - (5) For the remote unit of a conventional fiber-connected host/remote DAS booster system, it is acceptable to submit compliance information and test data consistent with Section 90.219(d)(6)(ii) (i.e., ERP of noise ≤ -43 dBm in 10 kHz RBW) for the downlink path only, in place of Section 90.219(e)(2) noise figure test data (i.e., NF ≤ 9 dB for both UL and DL). Test reports must provide explicit details about the instrumentation and test procedure used for Section 90.219(d)(6)(ii) testing.

§ 90.219 Use of signal boosters.

- (d) **Deployment rules.** Deployment of signal boosters must be carried out in accordance with the rules in this paragraph.
 - (6) Good engineering practice must be used in regard to the radiation of intermodulation products and noise, such that interference to licensed communications systems is avoided. In the event of harmful interference caused by any given deployment, the FCC may require additional attenuation or filtering of the emissions and/or noise from signal boosters or signal booster systems, as necessary to eliminate the interference.
 - (ii) In general, the ERP of noise within the passband should not exceed -43 dBm in 10 kHz measurement bandwidth.

Test Results:

Test Band	Link	Measured Value (dBm/10 kHz)	Total Gain [#] (dBd)	E.R.P. (dBm/10 kHz)	Limit (dBm/10 kHz)
VHF (150.05 ~ 173.4)	Downlink	-60.100	11.98	-48.120	-43
UHF (406.1 ~ 420)		-60.203	11.98	-48.223	
UHF (421 ~ 430)		-60.249	11.98	-48.269	
UHF (450 ~ 512)		-59.527	11.98	-47.547	

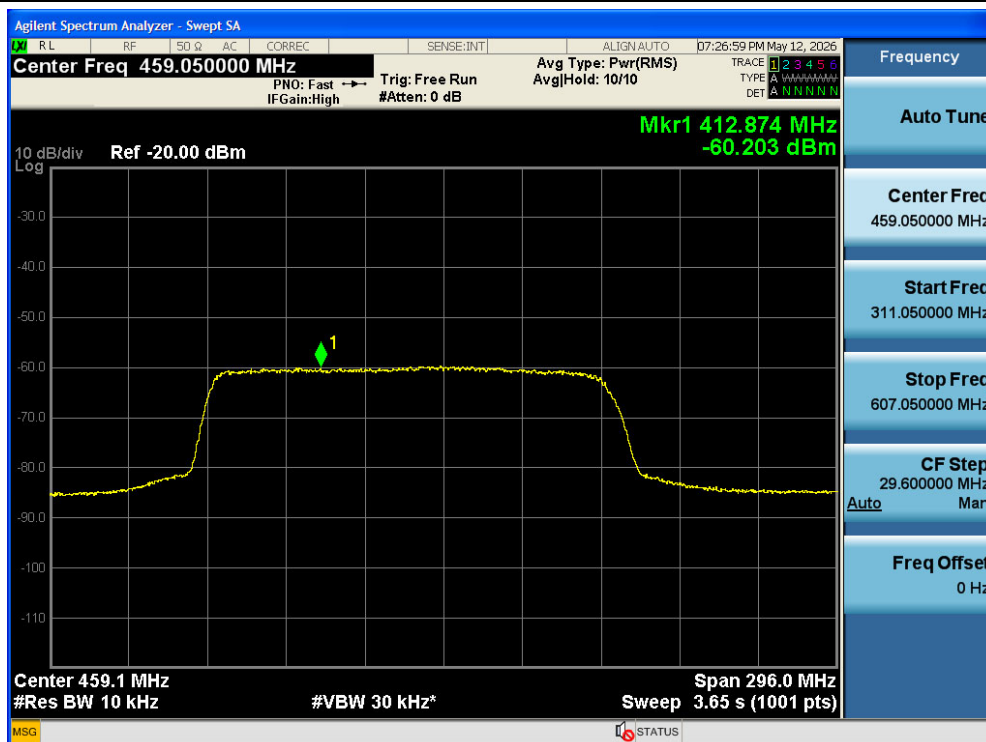
[#] Total Gain = Peak Antenna Gain + Cable Loss (See page 5)

Plot data of Noise

ERP of noise within the passband / VHF (150.05 ~ 173.4)/ Downlink



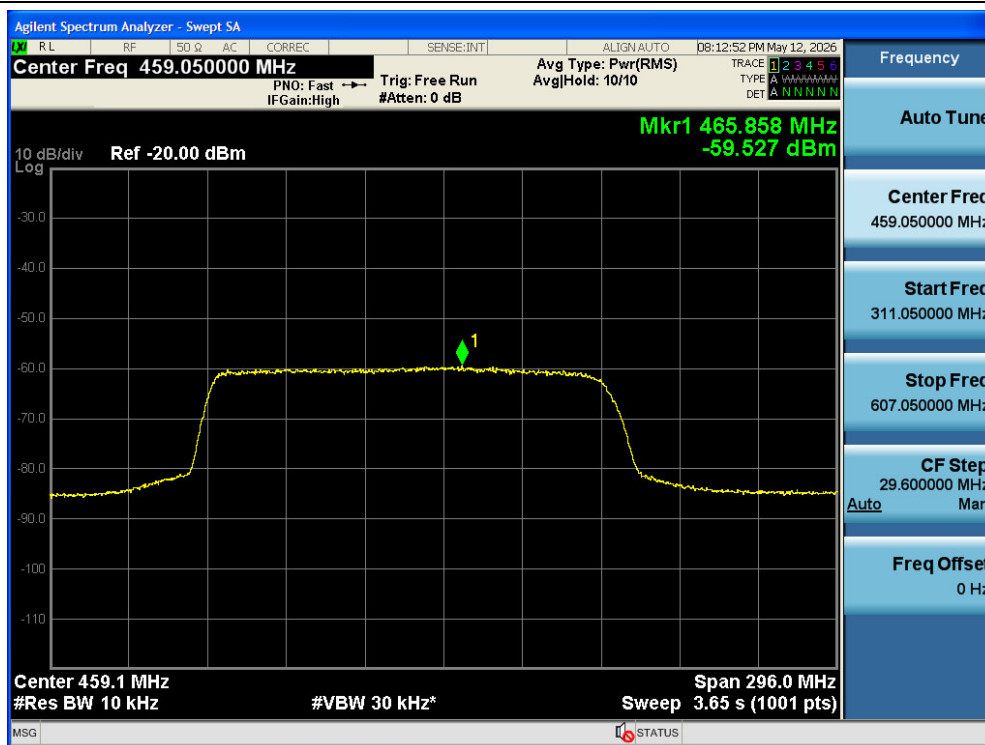
ERP of noise within the passband / UHF (406.1 ~ 420)/ Downlink



ERP of noise within the passband / UHF (421 ~ 430)/ Downlink



ERP of noise within the passband / UHF (450 ~ 512)/ Downlink



5.7. OUT-OF-BAND/OUT-OF-BLOCK EMISSIONS AND SPURIOUS EMISSIONS

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

Test Procedures:

Measurements were in accordance with the test methods section 4.7 of KDB 935210 D05 v01r04.

Spurious emissions shall be measured using a single test signal sequentially tuned to frequencies within each authorized frequency band of operation.

Intermodulation products shall be measured using two CW signals with all available channel spacing with the center between these channels being equal to the center frequency f_0 as determined from Out-of-band rejection test.

4.7.2 Out-of-band/out-of-block emissions conducted measurements

- a) Connect a signal generator to the input of the EUT.
- b) 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-signal test.
- c) Configure the two signal generators to produce CW on frequencies spaced consistent with f_0 , with amplitude levels set to just below the AGC threshold.
- d) Connect a spectrum analyzer to the EUT output.
- e) Set the span to 100 kHz.
- f) Set RBW = 300 Hz with VBW $\geq 3 \times$ RBW.
- g) Set the detector to power averaging (rms).
- h) Place a marker on highest intermodulation product amplitude.
- i) Capture the plot for inclusion in the test report.
- j) Repeat steps c) to h) with the composite input power level set to 3 dB above the AGC threshold.
- k) Repeat steps b) to i) for all operational bands.

4.7.3 EUT spurious emissions conducted measurements

- 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 EUT passband.
- d) Set the output power level so that the resultant signal is just below the AGC threshold.
- e) Connect a spectrum analyzer to the output of the EUT, using appropriate attenuation as necessary.
- f) Set the RBW = 100 kHz. (i.e., for 30 MHz to 1 GHz PLMRS and/or PSRS booster devices)
- g) Set the VBW = $3 \times$ RBW.
- h) Set the Sweep time = auto-couple.
- i) Set the detector to PEAK.
- j) Set the spectrum analyzer start frequency to 30 MHz (or the lowest radio frequency signal generated in the EUT, without going below 9 kHz if the EUT has additional internal clock frequencies), and the stop frequency to 10 times the highest allowable frequency of the EUT passband.
- k) Select MAX HOLD, and use the marker peak function to find the highest emission(s) outside the passband. (This could be either at a frequency lesser or greater than the passband frequencies.)
- l) Capture a plot for inclusion in the test report.
- m) Repeat steps c) to l) for each authorized frequency band/block of operation.