

TEST REPORT

FCC Test for PSR-V-9533-N
Certification

APPLICANT
ADRF KOREA, Inc.

REPORT NO.
HCT-RF-2605-FC013

DATE OF ISSUE
May 14, 2026

Tested by
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TEST REPORT

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Applicant**ADRF KOREA, Inc.**

196-16 IYEO-RO BAEKSA-MYEON ICHEON-SI, GYEONGGI-DO, 17316, KOREA

Product Name

BDA

Model Name

PSR-V-9533-N

FCC ID

N52-PSR-V-9533-N

Date of Test

February 25, 2026 ~ May 14, 2026

Location of Test☒ Permanent Testing Lab ☐ On Site Testing

(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

Test Standard Used

CFR 47 Part 2, Part 90

Test Results

PASS

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	May 14, 2026	Initial Release

Notice

Content

Engineering Statement:

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

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked *.

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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1. GENERAL INFORMATION

1.1. APPLICANT INFORMATION

Company Name	ADRF KOREA, Inc.
Company Address	196-16 IYEO-RO BAEKSA-MYEON ICHEON-SI, GYEONGGI-DO, 17316, KOREA

1.2. PRODUCT INFORMATION

EUT Type	BDA		
EUT Serial Number	PSRV9533NXXXXXX		
Power Supply	AC 110~220 Vac		
Frequency Range	Band Name	Uplink / Downlink (MHz)	
	VHF	150.05 ~ 173.4	
Tx Output Power	Band Name	Uplink	Downlink
	VHF	27 dBm	33 dBm
Antenna Gain	Band Name	Uplink	Downlink
	VHF	7 dBd	-1.15 dBd

1.3. TEST INFORMATION

FCC Rule Parts	CFR 47 Part 2, Part 90
Measurement Standards	KDB 935210 D05 v01r04, KDB 971168 D01 v03r01, ANSI C63.26-2015
Test Location	74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea

2. FACILITIES AND ACCREDITATIONS

2.1. FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated February 26, 2026(Registration Number: KR0032).

2.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

3. TEST SPECIFICATIONS

3.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC CFR 47 Part 2, Part 90.

Description	Reference	Results
AGC threshold	KDB 935210 D05 v01r04 4.2	Compliant
Out-of-band rejection	KDB 935210 D05 v01r04 4.3	Compliant
Occupied Bandwidth	§ 2.1049 § 90.209, § 90.219(e)(4)(ii)	Compliant
Input-versus-output signal comparison	§ 90.210, § 90.219(e)(4)(iii)	Compliant
Input/output power and amplifier/booster gain	§ 2.1046, § 90.219(e)(1)	Compliant
Noise figure	§ 90.219(e)(2)	Compliant
Out-of-band/out-of-block emissions and spurious emissions	§ 2.1051, § 90.219(e)(3)	Compliant
Spurious emissions radiated	§ 2.1053	Compliant
Frequency Stability	§ 2.1055 § 90.213	Compliant

Note: The decision rule applies 'simple acceptance'

3.2. ADDITIONAL DESCRIPTIONS ABOUT TEST

- Except for the following cases, EUT was tested under normal operating conditions.
: Out-of-band rejection test requires maximum gain condition without AGC.
- The highest antenna gain among the antennas used was applied for testing.
- The test was generally based on the method of KDB 935210 D05 v01r04 and only followed ANSI C63.26-2015 if there was no test method in KDB standard.
- The EUT was tested using test signals required by the test procedures, configured based on the manufacturer's specifications.

Band Name	Frequency	Tested Signal	
		Uplink	Downlink
VHF	150.05 ~ 173.4	P25 Phase1 (C4FM) P25 Phase2 (H-CPM) FM (12.5kHz, 25kHz) CW	P25 Phase1 (C4FM, CQPSK) P25 Phase2 (H-DQPSK) FM (12.5kHz, 25kHz) CW

- The tests results included actual loss value for attenuator and cable combination as shown in the table below.
- : Input Path

Correction factor table			
Frequency (MHz)	Factor (dB)	Frequency (MHz)	Factor (dB)
50	0.143	250	0.273
100	0.150	300	0.343
150	0.201	350	0.371
200	0.246	400	0.462

: Output Path

Correction factor table			
Frequency (MHz)	Factor (dB)	Frequency (MHz)	Factor (dB)
2	28.964	2 000	30.856
10	29.034	2 100	30.846
30	29.169	2 200	30.939
50	29.246	2 300	31.049
100	29.346	2 400	31.098
200	29.556	2 500	31.171
300	29.747	2 600	31.111
400	29.870	2 700	31.251
500	29.848	2 800	31.253
600	30.042	2 900	31.235
700	30.163	3 000	31.225
800	30.132	4 000	31.733
900	30.217	5 000	32.018
1 000	30.356	6 000	32.350
1 100	30.365	7 000	33.543
1 200	30.530	8 000	34.023
1 300	30.523	9 000	34.324
1 400	30.580	10 000	35.259
1 500	30.625	-	-
1 600	30.780	-	-
1 700	30.676	-	-
1 800	30.604	-	-
1 900	30.673	-	-

3.3. MEASUREMENT UNCERTAINTY

Parameter		Expanded Uncertainty
Radiated Disturbance	9 kHz ~ 30 MHz	4.36 dB
	30 MHz ~ 1 GHz	5.68 dB
	1 GHz ~ 18 GHz	5.75 dB
	18 GHz ~ 40 GHz	5.82 dB

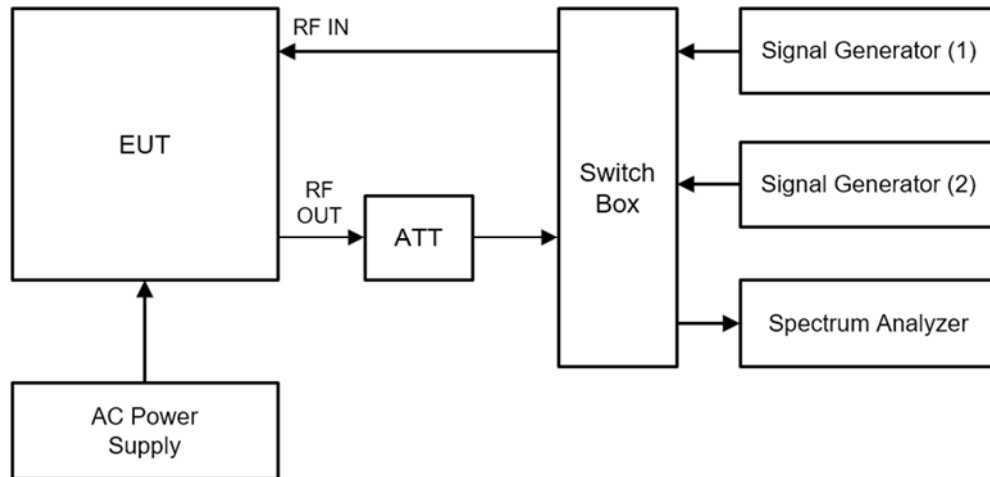
Coverage factor $k=2$, Confidence levels of 95 %

3.4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature	+15 °C to +35 °C
Relative humidity	30 % to 60 %
Air pressure	860 mbar to 1 060 mbar

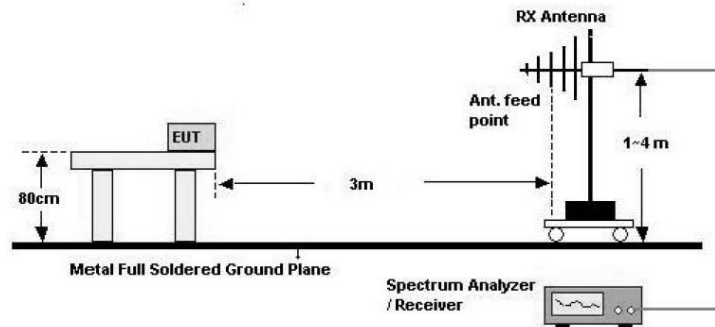
3.5. TEST DIAGRAMS

Conducted Test

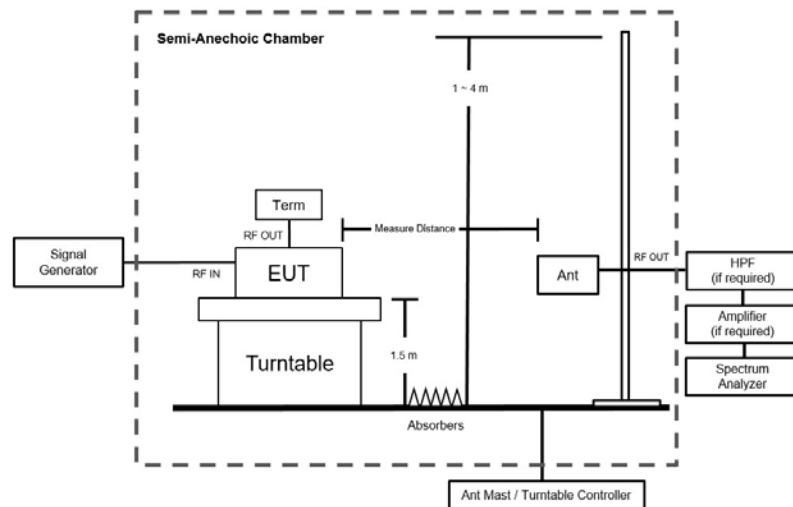


Radiated Test

30 MHz ~ 1 GHz

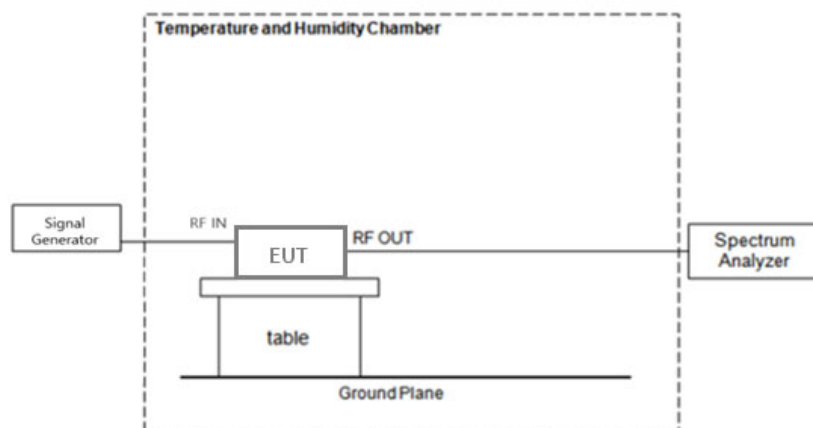


Above 1 GHz



Note: Measure distance for Above 1 GHz is 3 m.

Frequency Stability



4. TEST EQUIPMENTS

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
MXA Signal Analyzer	N9030A	Agilent	MY55410714	12/09/2026	Annual
SPECTRUM ANALYZER	N9020A	Agilent	MY51110068	03/30/2027	Annual
# MXG Vector Signal Generator	N5182A	Agilent	MY47070230	03/12/2027	Annual
SIGNAL GENERATOR	SMBV100B	ROHDE&SCHWARZ	101177	02/11/2027	Annual
30 dB Attenuator	WA93-30-33	Weinschel Associates	0113	11/05/2026	Annual
AC Power Supply	PCR2000MA	KIKUSUI	ZL002530	12/17/2026	Annual
Switch	S46-SV11	KEITHLEY	1088025	N/A	N/A
# 50Ω Termination	908A	H.P.	N/A	N/A	N/A
Temperature and Humidity Chamber	NY-THR18750	NANGYEAL	NY-200912201A	12/16/2026	Annual
Amp & Filter Bank Switch Controller	FBSM-01B	TNM system	TM20090002	N/A	N/A
Controller(Antenna Mast & Turn Table)	CO3000	Innco systems	CO3000/1251/48920320/P	N/A	N/A
Antenna Mast	MA4640	Innco systems	S4AM	08/01/2026	Annual
Turn Table	Turn Table	Ets	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	06/23/2027	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	08/28/2026	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-937	02/07/2027	Biennial
RF Switching System	FBSR-04C (LNA)	TNM system	S4L4	03/04/2027	Annual
RF Switching System	FBSR-04C (Thru)	TNM system	S4L6	03/04/2027	Annual
High Pass Filter	WHKX10-900-1000-15000-40SS	WAINWRIGHT INSTRUMENTS	16	07/10/2026	Annual

Multiple pieces of equipment were used depending on the test configuration; however, only one is listed for simplicity.

Note: All test equipment was within its valid calibration period at the time of testing.

5. TEST RESULT

5.1. AGC THRESHOLD

Test Requirement:

KDB 935210 D05 v01r04

Testing at and above the AGC threshold is required.

Test Procedures:

Measurements were in accordance with the test methods section 4.2 of KDB 935210 D05 v01r04.

Testing at and above the AGC threshold will be required. The AGC threshold shall be determined by applying the procedure of 3.2, but with the signal generator configured to produce a test signal defined in Table 1, a CW input signal, or a digitally modulated signal, consistent with the discussion about signal types in 4.1.

Measurement were in accordance with the test methods in subclause 7.2.3.1 of ANSI C63.26.

- a) Connect a signal generator to the input of the EUT.
- b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation.
- c) The signal generator must be set for CW operation.
- d) While monitoring the output of the EUT, increase the input level until a 1 dB increase in the input signal no longer causes a 1 dB increase in the output signal.
- e) This is the AGC threshold level of the EUT.

Note: Although subclause 7.2.3.1 c) of ANSI C63.26 specifies CW operation, the signal generator was configured to produce a digitally modulated signal in accordance with section 4.2 of KDB 935210 D05 v01r04, consistent with the signal types described in section 4.1.

Test Results:

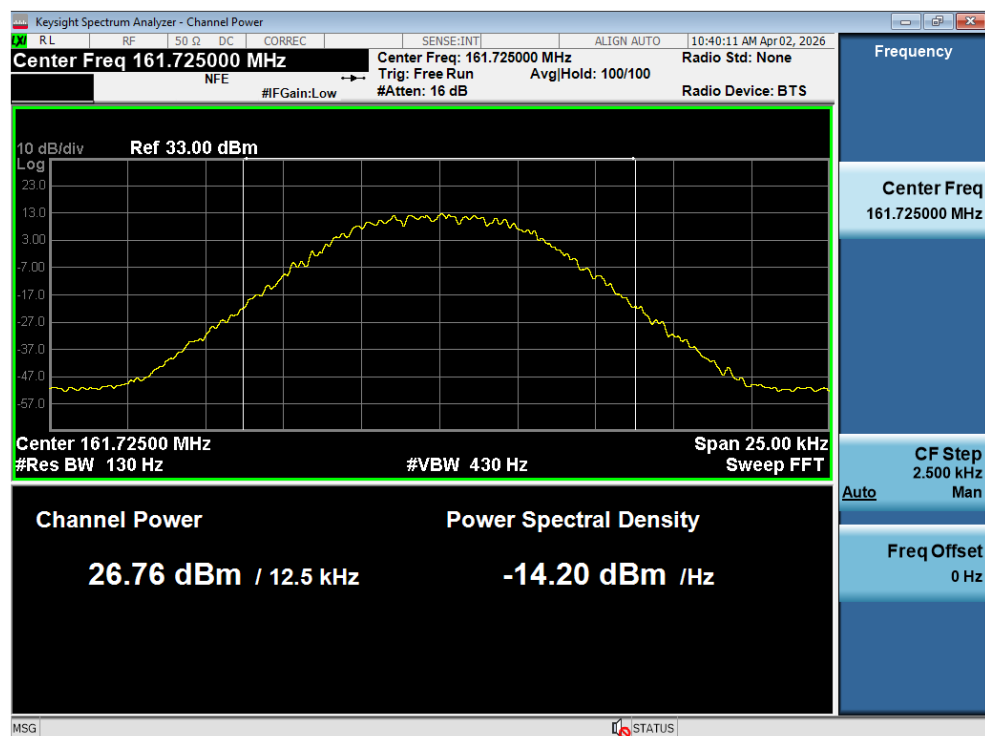
Test Band	Link	Test Signal	Center Frequency (MHz)	AGC Threshold Level (dBm)	Output Level (dBm)
VHF (150.05 ~ 173.4)	Uplink	P25 Phase 1 (C4FM)	161.725	-68	26.88
		P25 Phase 2 (H-CPM)	161.725	-68	26.76
		CW	161.725	-68	26.57
	Downlink	P25 Phase 1 (C4FM)	161.725	-62	32.77
		P25 Phase 1 (CQPSK)	161.725	-62	32.75
		P25 Phase 2 (H-DQPSK)	161.725	-62	33.06
		CW	161.725	-62	32.75

Plot data of AGC Threshold

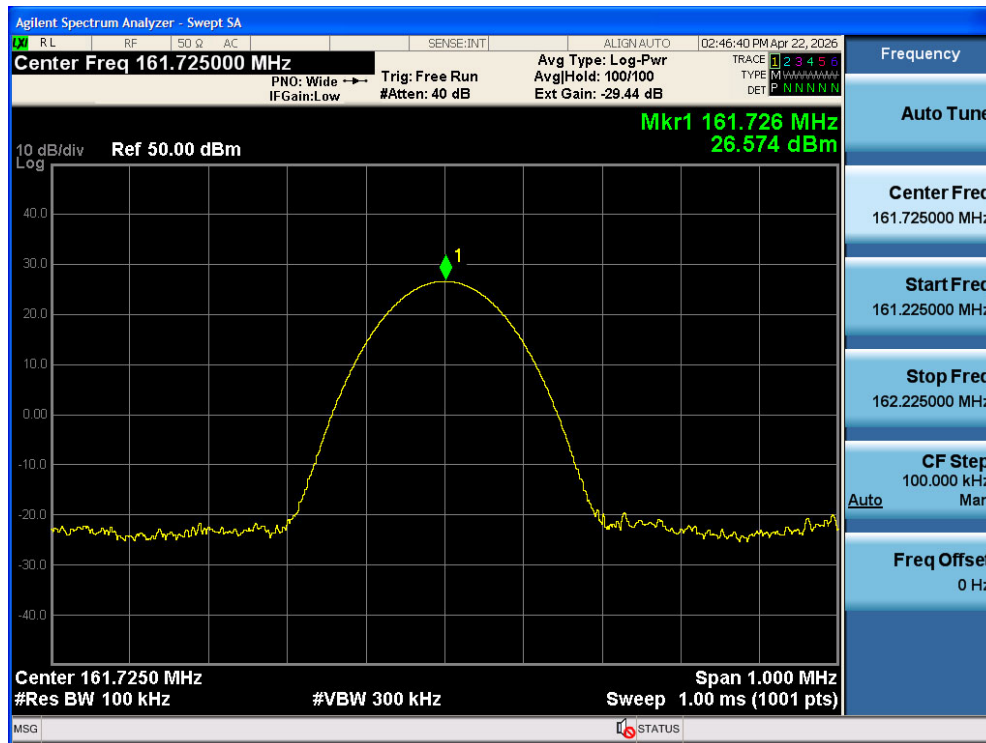
AGC Threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM)



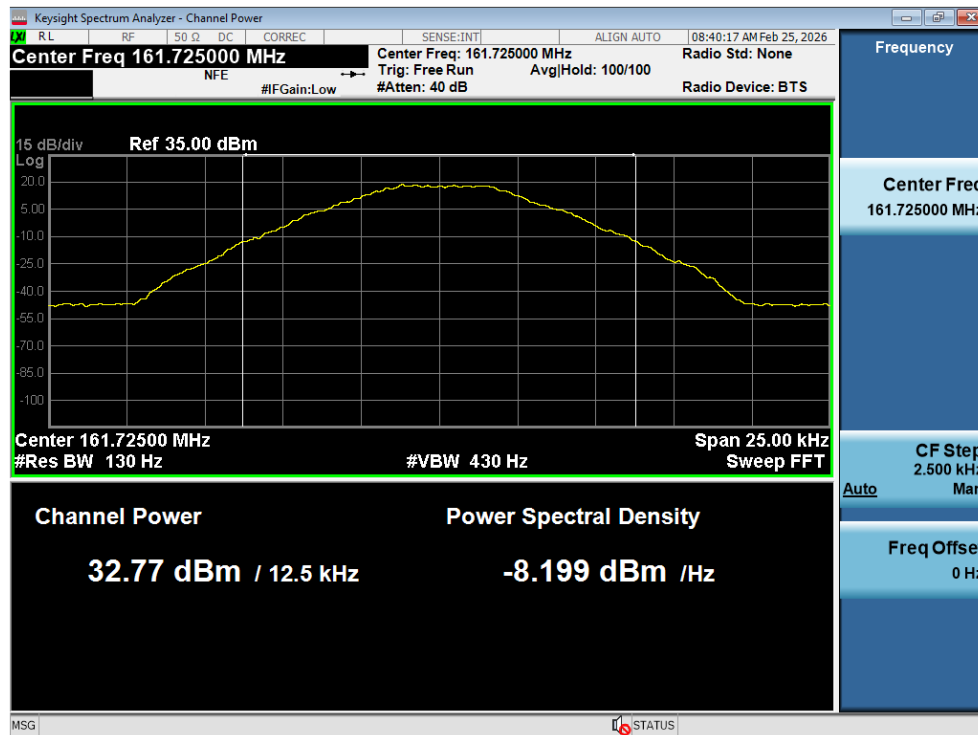
AGC Threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)



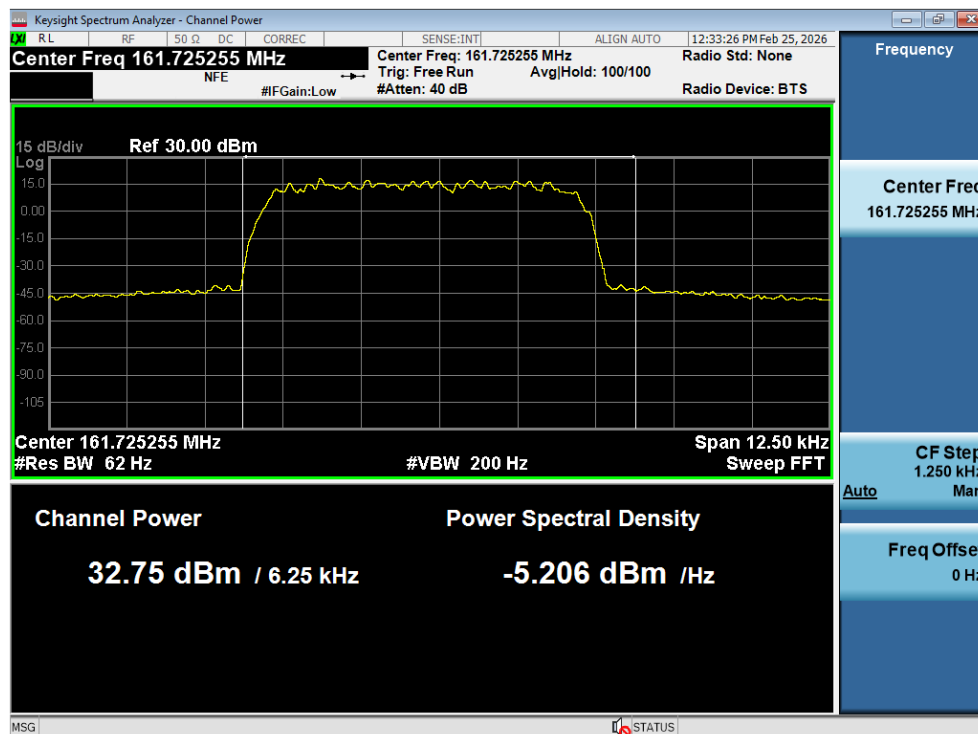
AGC Threshold / VHF (150.05 ~ 173.4) / Uplink / CW



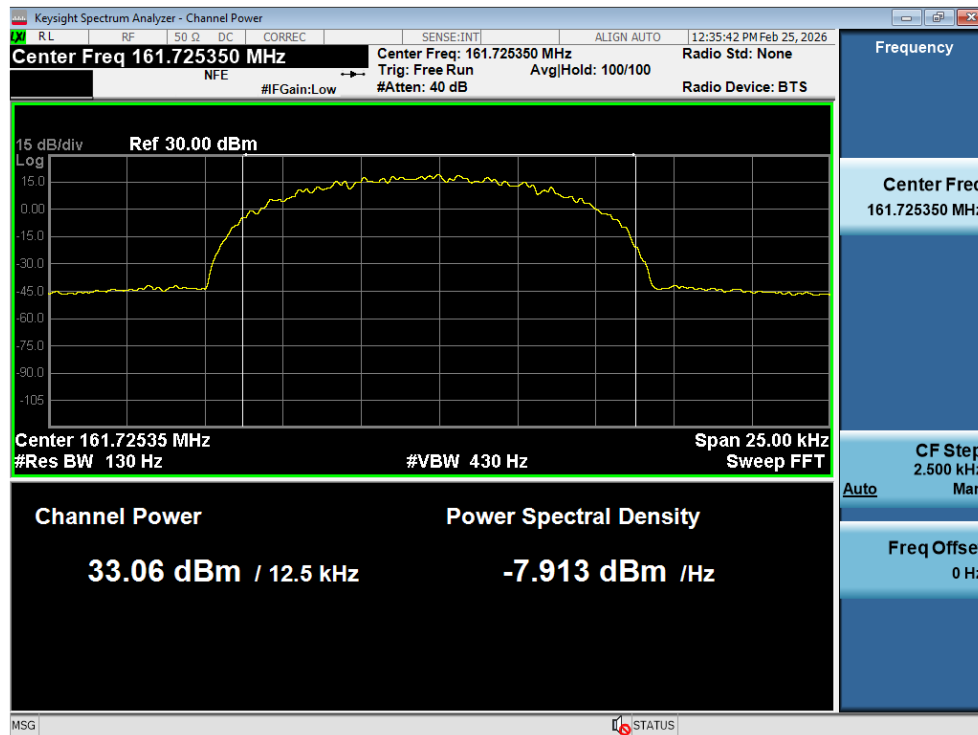
AGC Threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM)



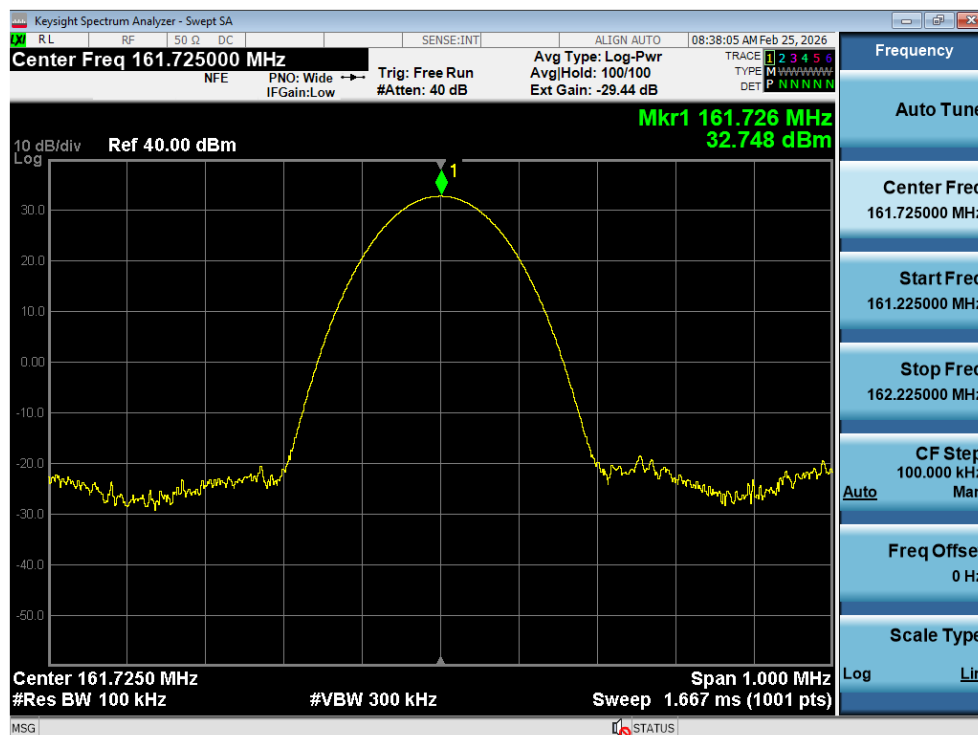
AGC Threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (CQPSK)



AGC Threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 2 (H-DQPSK)



AGC Threshold / VHF (150.05 ~ 173.4) / Downlink / CW



5.2. OUT-OF-BAND REJECTION

Test Requirement:

KDB 935210 D05 v01r04

Out-of-band rejection required.

Test Procedures:

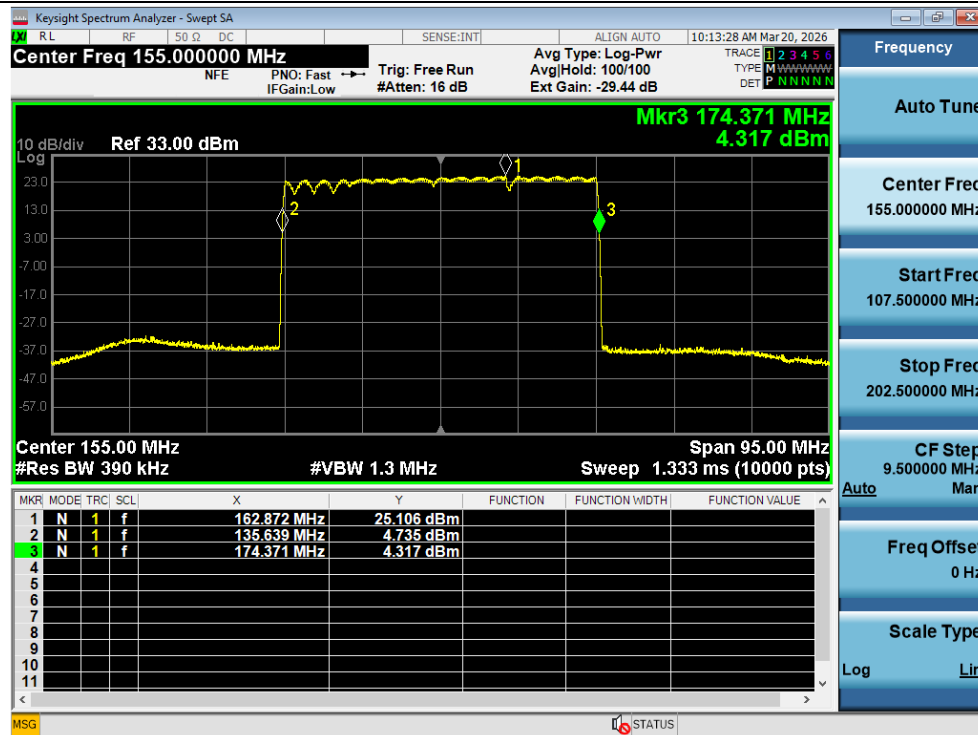
Measurements were in accordance with the test methods section 4.3 of KDB 935210 D05 v01r04.

A signal booster shall reject amplification of other signals outside of its passband. Adjust the internal gain control of the EUT to the maximum gain for which equipment certification is sought.

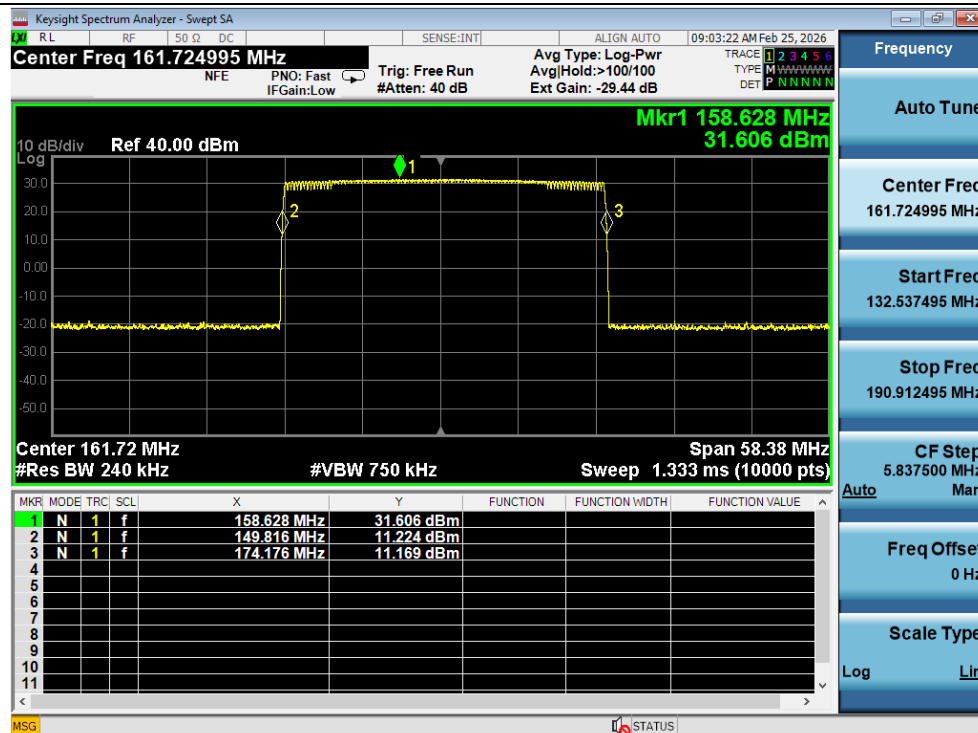
- a) Connect a signal generator to the input of the EUT.
- b) Configure a swept CW signal with the following parameters:
 - 1) Frequency range = ± 250 % of the manufacturer's specified pass band.
 - 2) The CW amplitude shall be 3 dB below the AGC threshold (see 4.2), and shall not activate the AGC threshold 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 f_0 , 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:

VHF (150.05 ~ 173.4 MHz) / Uplink



VHF (150.05 ~ 173.4 MHz) / Downlink



5.3. OCCUPIED BANDWIDTH

Test Requirement:

§ 2.1049 Measurements required: Occupied bandwidth.

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

§ 90.209 Bandwidth limitations.

Table 1 to § 90.209(b)(5) - Standard Channel Spacing/Bandwidth

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
150-174	¹ 7.5	¹³ 20/11.25/6

¹ For stations authorized on or after August 18, 1995.

³ Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of § 90.203(j)(3).

§ 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.
 - (4) A signal booster must be designed such that all signals that it retransmits meet the following requirements:
 - (ii) There is no change in the occupied bandwidth of the retransmitted signals.

Test Procedures:

Measurements were in accordance with the test methods section 5.4.4 of ANSI C63.26-2015.

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of $1.5 \times \text{OBW}$ is sufficient).
- b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times \text{RBW}$.
- c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.
- d) Set the detection mode to peak, and the trace mode to max-hold.
- e) Omit
- f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

Test Results:
Tabular data of Input Occupied Bandwidth

Test Band	Link	Signal	Center Frequency (MHz)	99 % OBW (kHz)	26 dB OBW (kHz)
VHF (150.05 ~ 173.4)	Uplink	P25 Phase 1 (C4FM)	161.725	8.450	11.16
		P25 Phase 2 (H-CPM)	161.725	8.154	10.78
		FM (12.5 kHz)	161.725	11.415	12.99
		FM (25 kHz)	161.725	16.418	18.72
	Downlink	P25 Phase 1 (C4FM)	161.725	8.463	11.07
		P25 Phase 1 (CQPSK)	161.725	4.870	5.41
		P25 Phase 2 (H-DQPSK)	161.725	9.813	12.10
		FM (12.5 kHz)	161.725	11.297	12.96
		FM (25 kHz)	161.725	16.398	18.69

Tabular data of Output Occupied Bandwidth

Test Band	Link	Signal	Center Frequency (MHz)	99 % OBW (kHz)	26 dB OBW (kHz)
VHF (150.05 ~ 173.4)	Uplink	P25 Phase 1 (C4FM)	161.725	8.166	11.20
		P25 Phase 2 (H-CPM)	161.725	8.094	10.78
		FM (12.5 kHz)	161.725	11.372	12.98
		FM (25 kHz)	161.725	16.347	18.65
	Downlink	P25 Phase 1 (C4FM)	161.725	8.270	10.98
		P25 Phase 1 (CQPSK)	161.725	4.864	5.40
		P25 Phase 2 (H-DQPSK)	161.725	9.755	12.04
		FM (12.5 kHz)	161.725	11.270	12.95
		FM (25 kHz)	161.725	16.350	18.66

Tabular data of Input Occupied Bandwidth at 3 dB above the AGC threshold

Test Band	Link	Signal	Center Frequency (MHz)	99 % OBW (kHz)	26 dB OBW (kHz)
VHF (150.05 ~ 173.4)	Uplink	P25 Phase 1 (C4FM)	161.725	8.225	10.98
		P25 Phase 2 (H-CPM)	161.725	8.140	10.81
		FM (12.5 kHz)	161.725	11.400	12.99
		FM (25 kHz)	161.725	16.400	18.70
	Downlink	P25 Phase 1 (C4FM)	161.725	8.346	10.97
		P25 Phase 1 (CQPSK)	161.725	4.867	5.40
		P25 Phase 2 (H-DQPSK)	161.725	9.792	12.06
		FM (12.5 kHz)	161.725	11.297	12.96
		FM (25 kHz)	161.725	16.394	18.69

Tabular data of Output Occupied Bandwidth at 3 dB above the AGC threshold

Test Band	Link	Signal	Center Frequency (MHz)	99 % OBW (kHz)	26 dB OBW (kHz)
VHF (150.05 ~ 173.4)	Uplink	P25 Phase 1 (C4FM)	161.725	8.278	11.02
		P25 Phase 2 (H-CPM)	161.725	8.121	10.78
		FM (12.5 kHz)	161.725	11.371	12.98
		FM (25 kHz)	161.725	16.346	18.66
	Downlink	P25 Phase 1 (C4FM)	161.725	8.316	11.03
		P25 Phase 1 (CQPSK)	161.725	4.867	5.40
		P25 Phase 2 (H-DQPSK)	161.725	9.773	12.04
		FM (12.5 kHz)	161.725	11.270	12.95
		FM (25 kHz)	161.725	16.351	18.66

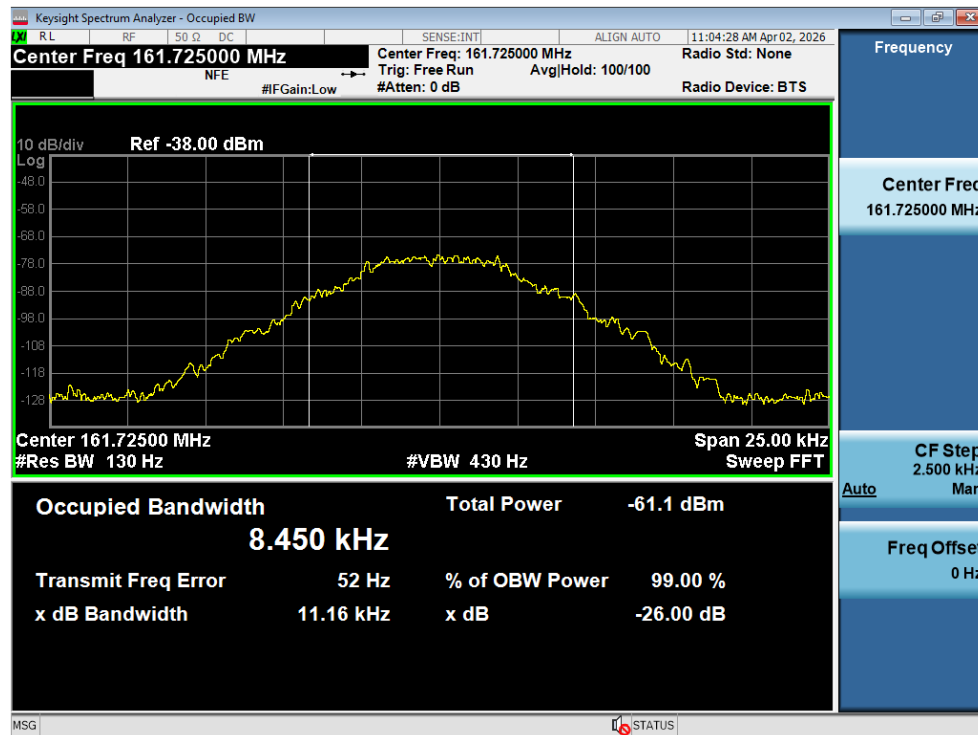
Measured Occupied Bandwidth Comparison

Test Band	Link	Signal	Variant of Input and output Occupied Bandwidth (%)	Variant of Input and Output Occupied Bandwidth at 3 dB above the AGC threshold (%)
VHF (150.05 ~ 173.4)	Uplink	P25 Phase 1 (C4FM)	0.36	0.36
		P25 Phase 2 (H-CPM)	0.00	-0.28
		FM (12.5 kHz)	-0.08	-0.08
		FM (25 kHz)	-0.37	-0.21
	Downlink	P25 Phase 1 (C4FM)	-0.81	0.55
		P25 Phase 1 (CQPSK)	-0.18	-0.06
		P25 Phase 2 (H-DQPSK)	-0.54	-0.12
		FM (12.5 kHz)	-0.08	-0.08
		FM (25 kHz)	-0.17	-0.14

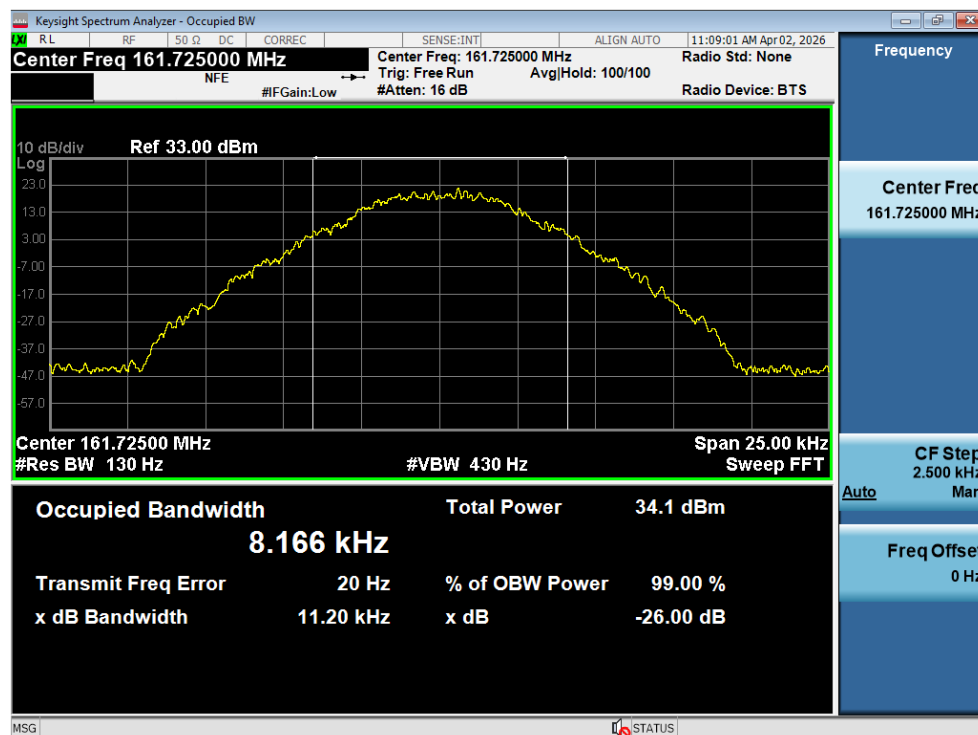
Change in input-output OBW is less than $\pm 5\%$.

Plot data of Occupied Bandwidth

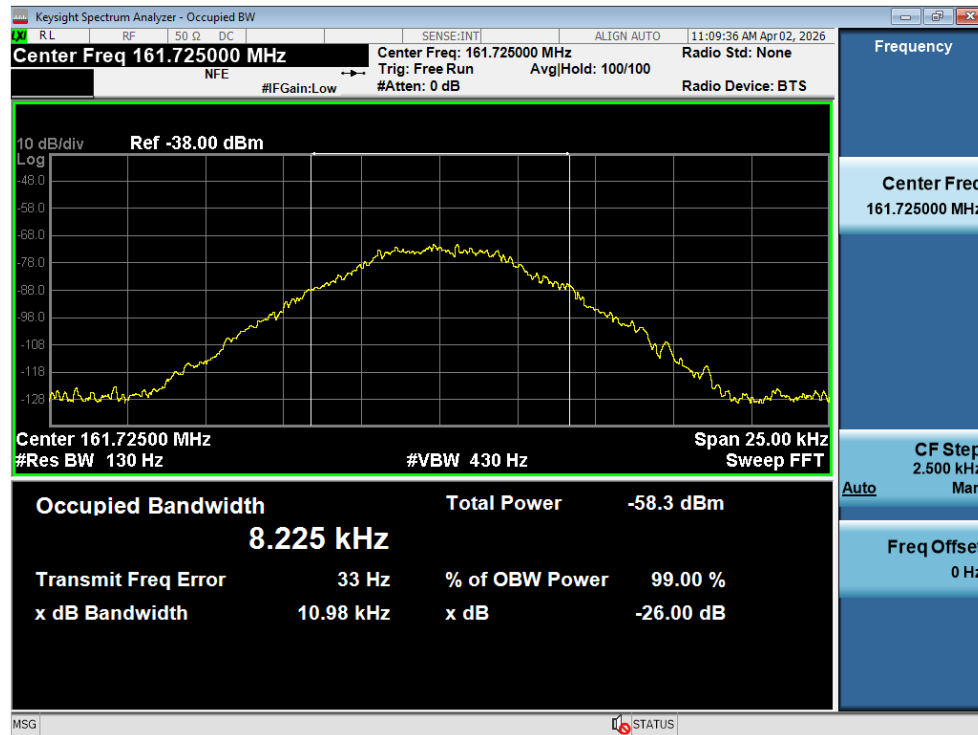
Input / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM)



Output / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM)



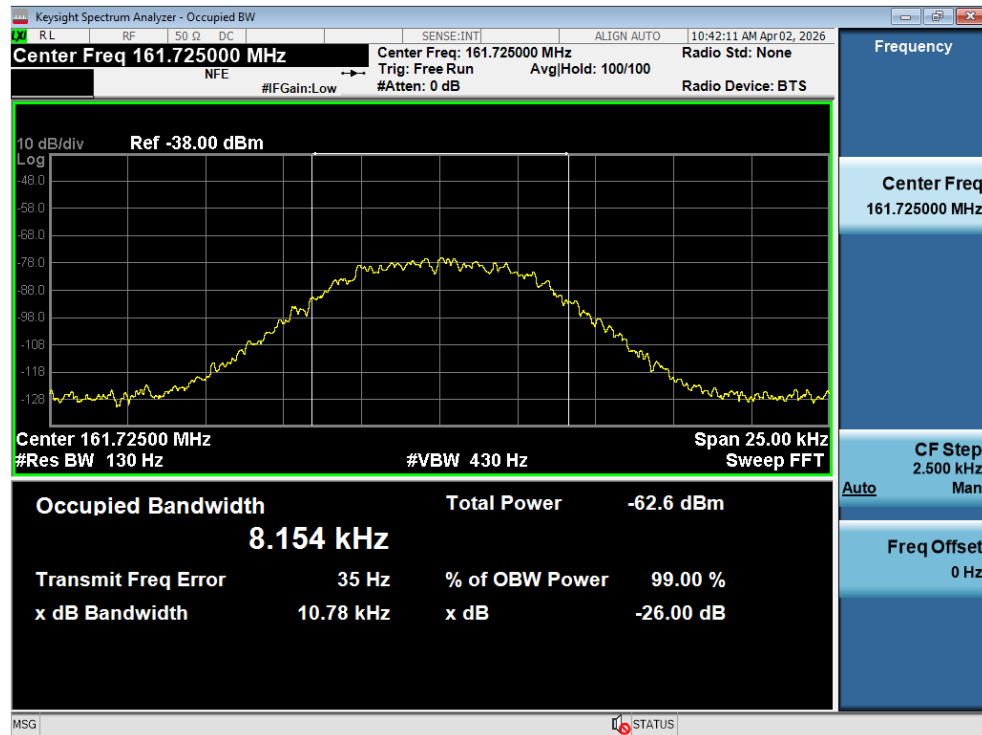
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM)



Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM)



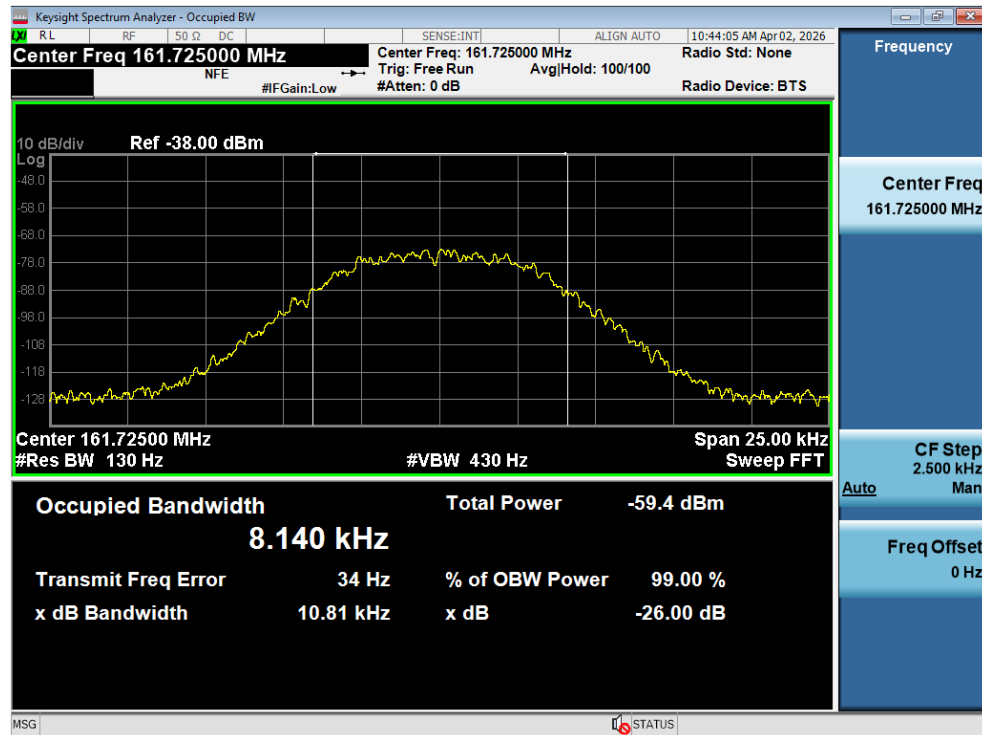
Input / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)



Output / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)



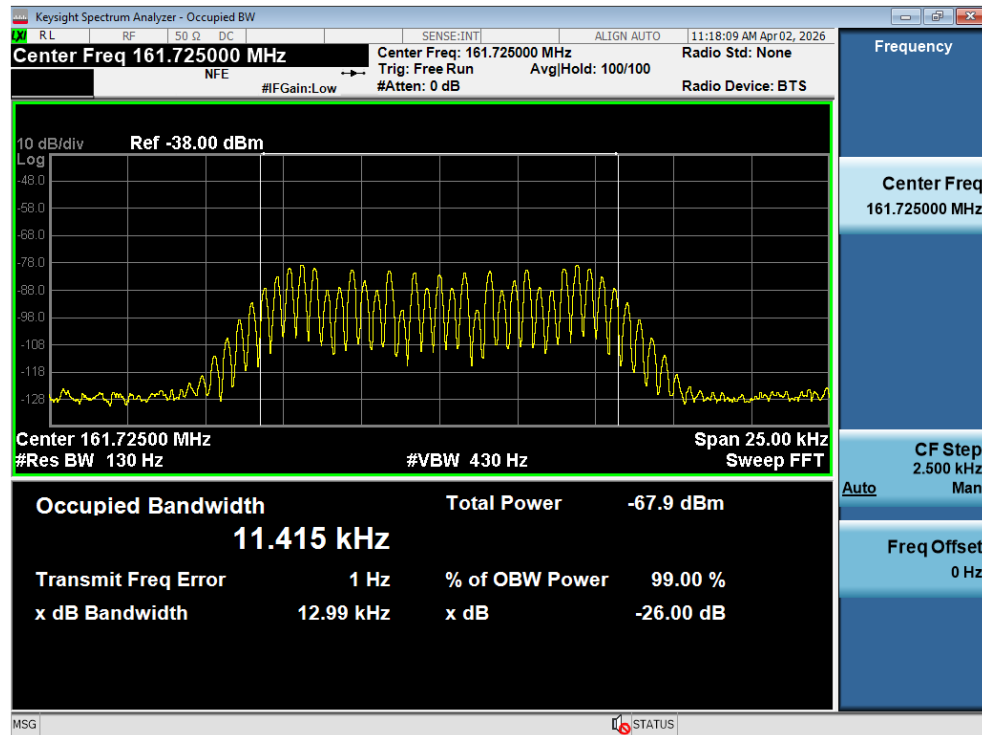
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)



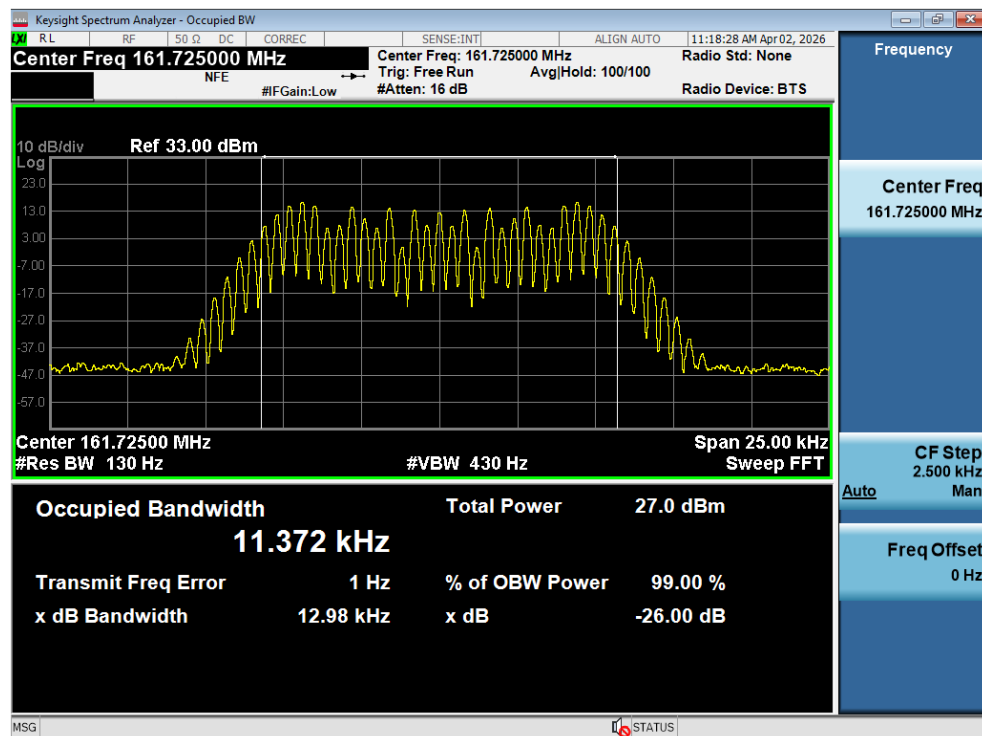
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)



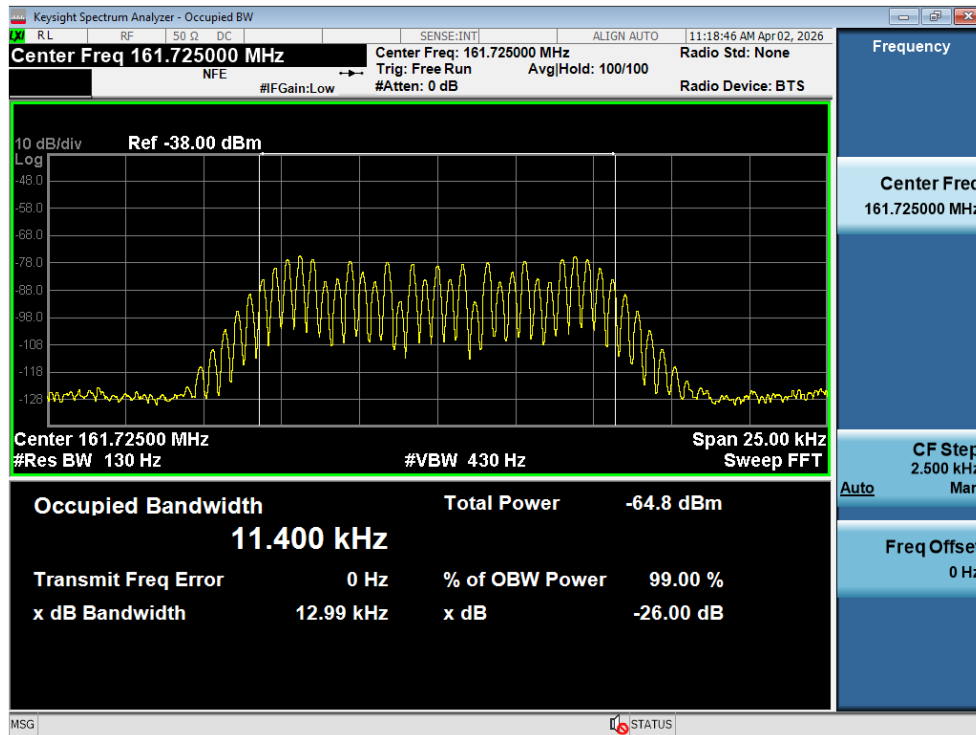
Input / VHF (150.05 ~ 173.4) / Uplink / FM (12.5 kHz)



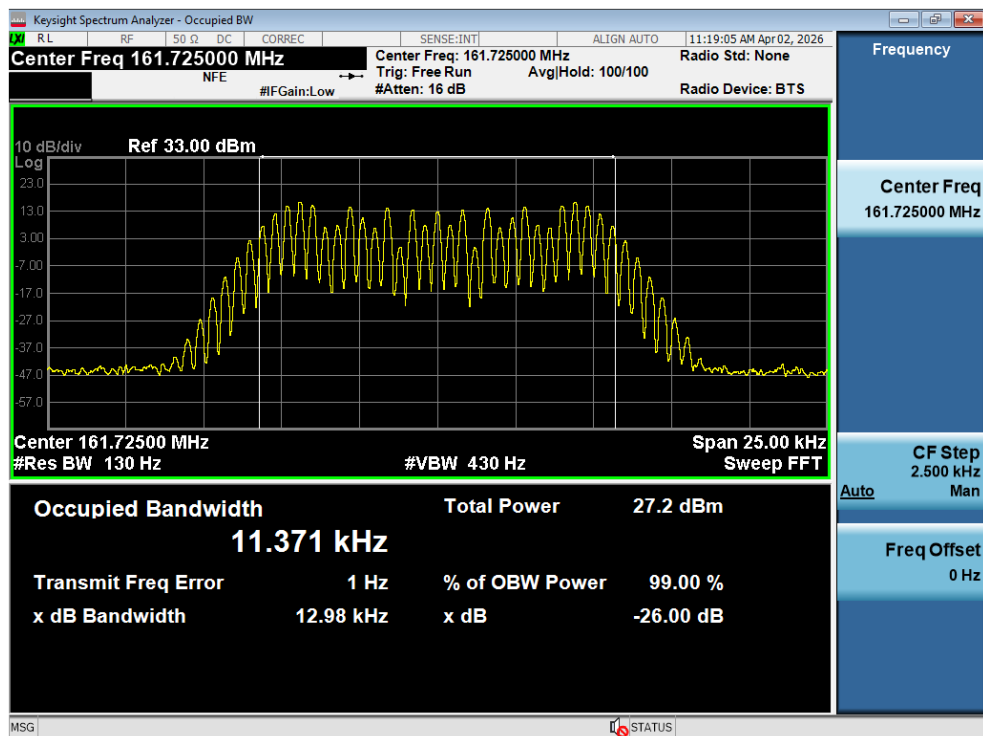
Output / VHF (150.05 ~ 173.4) / Uplink / FM (12.5 kHz)



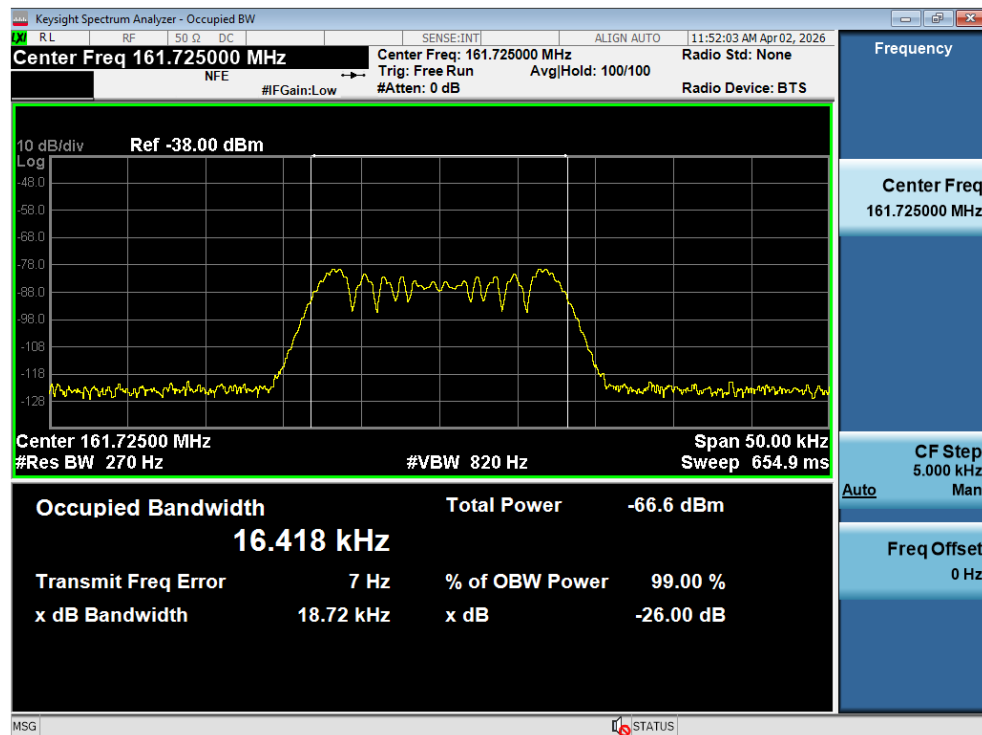
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / FM (12.5 kHz)



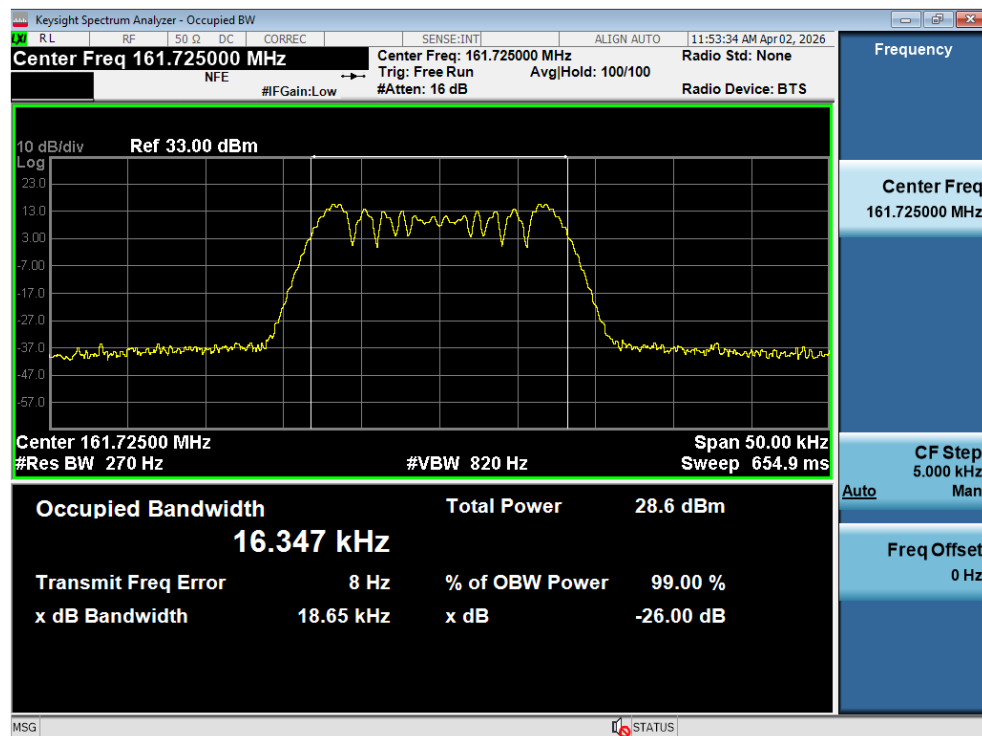
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / FM (12.5 kHz)



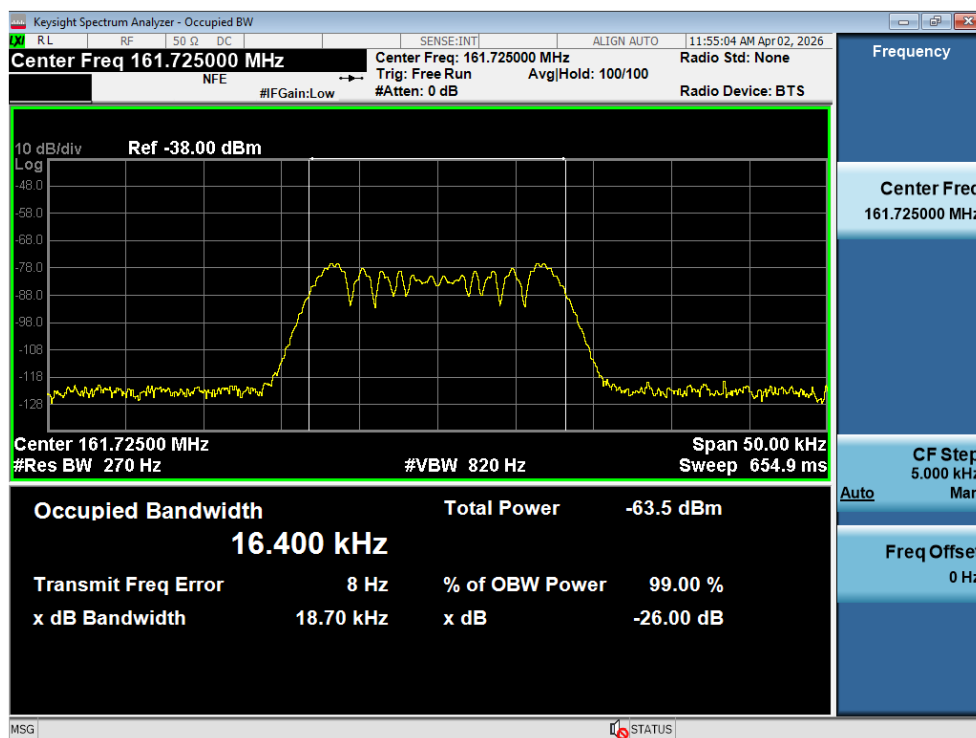
Input / VHF (150.05 ~ 173.4) / Uplink / FM (25 kHz)



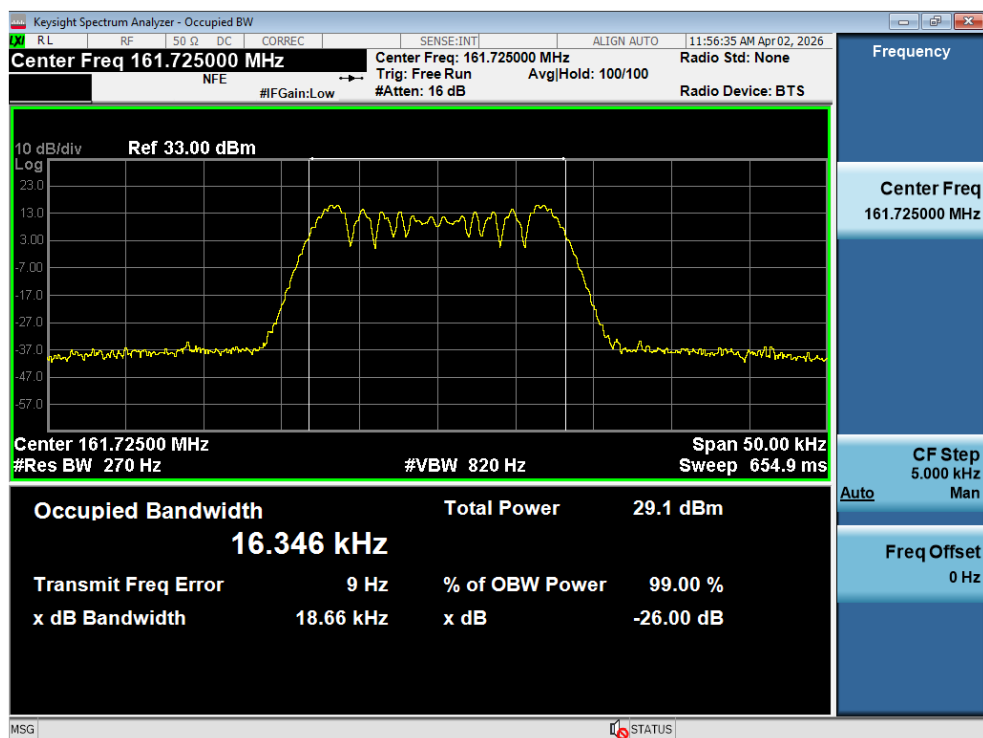
Output / VHF (150.05 ~ 173.4) / Uplink / FM (25 kHz)



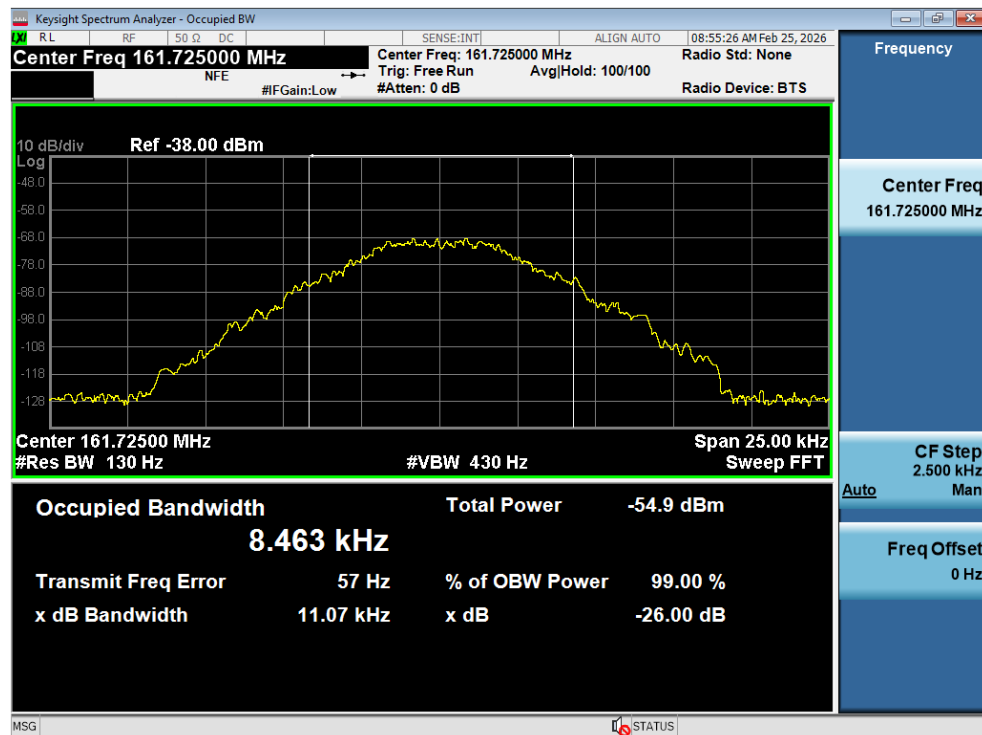
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / FM (25 kHz)



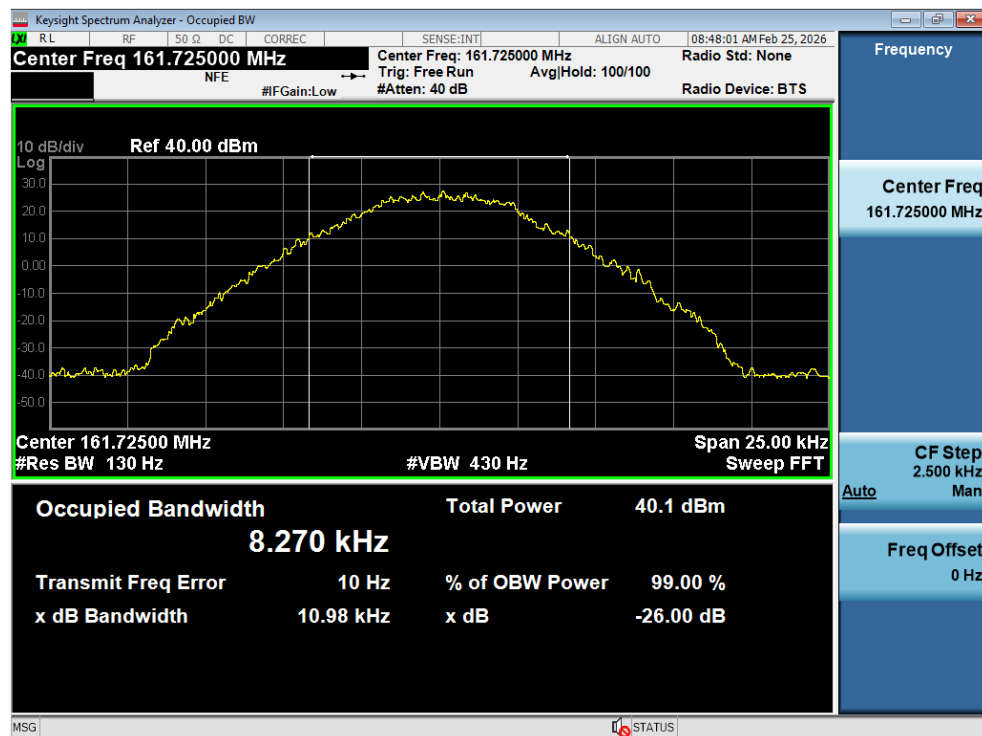
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / FM (25 kHz)



Input / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM)



Output / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM)



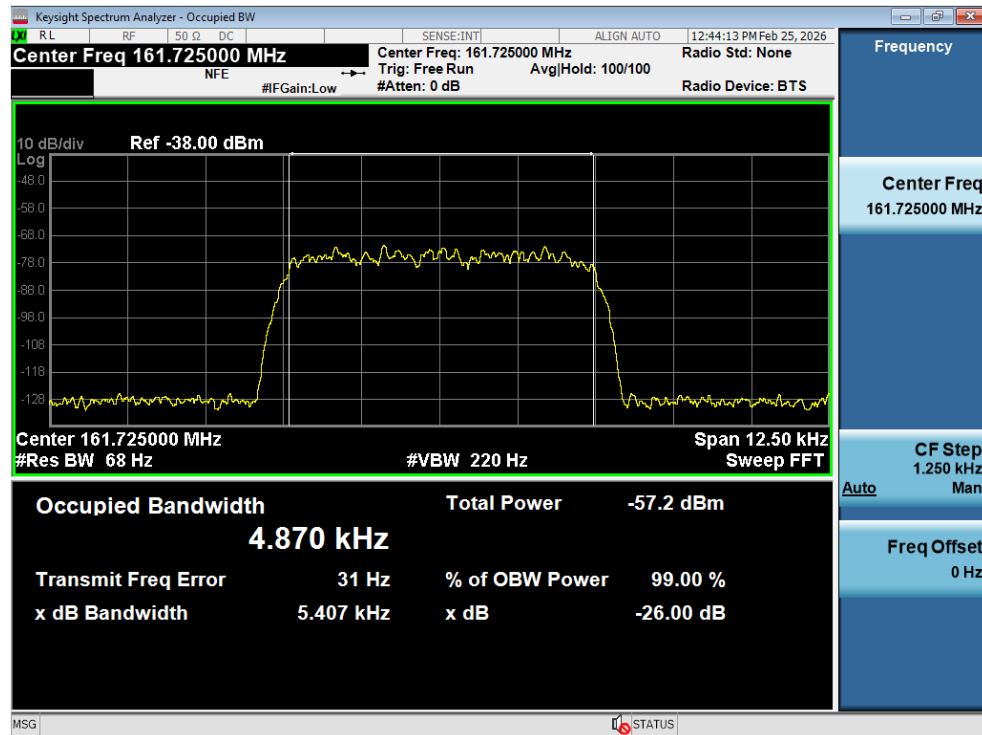
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM)



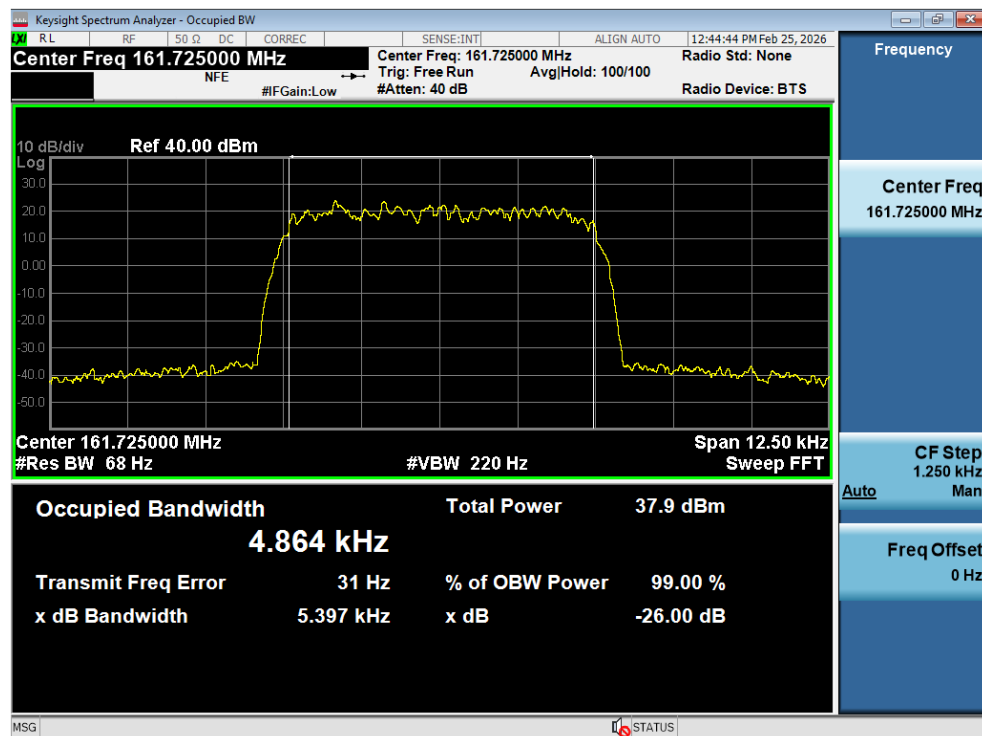
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM)



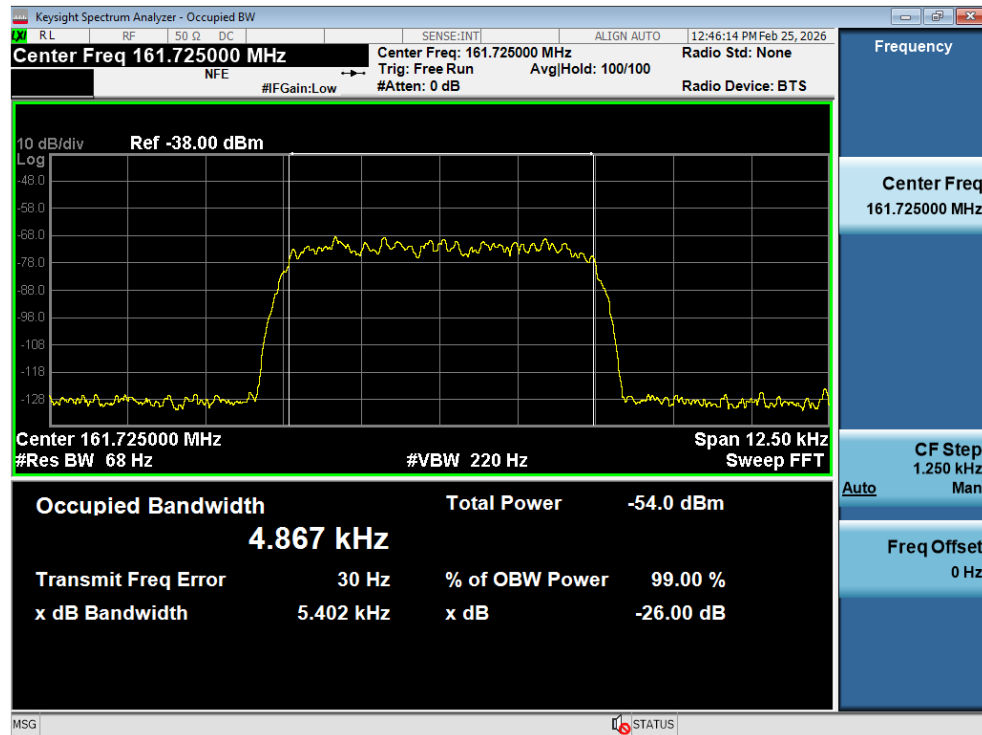
Input / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (CQPSK)



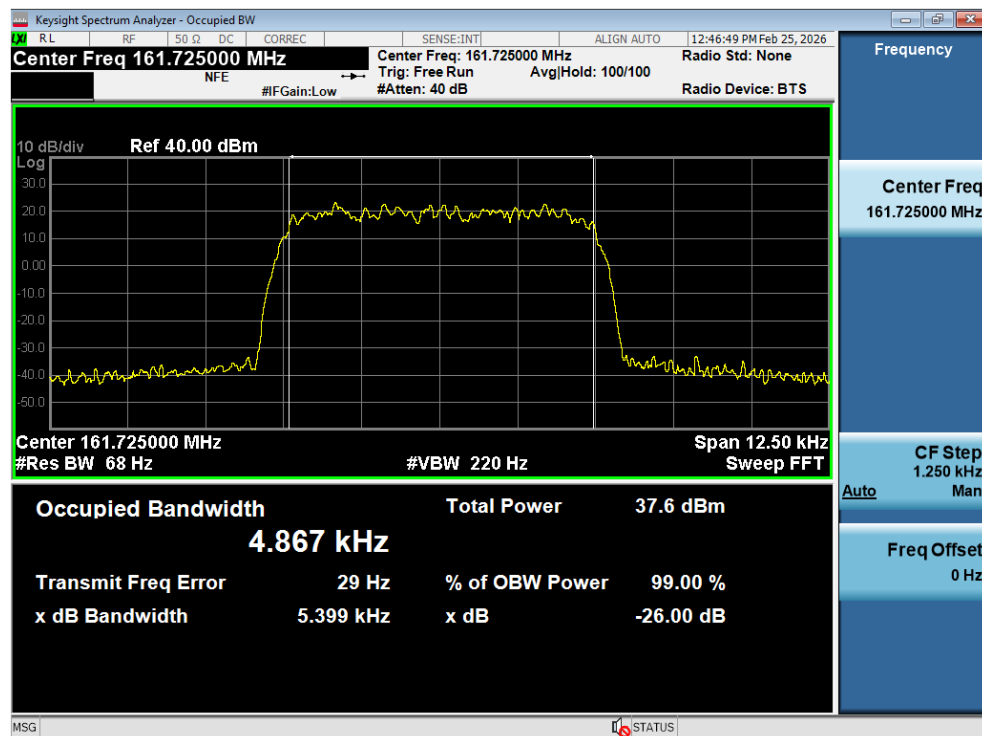
Output / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (CQPSK)



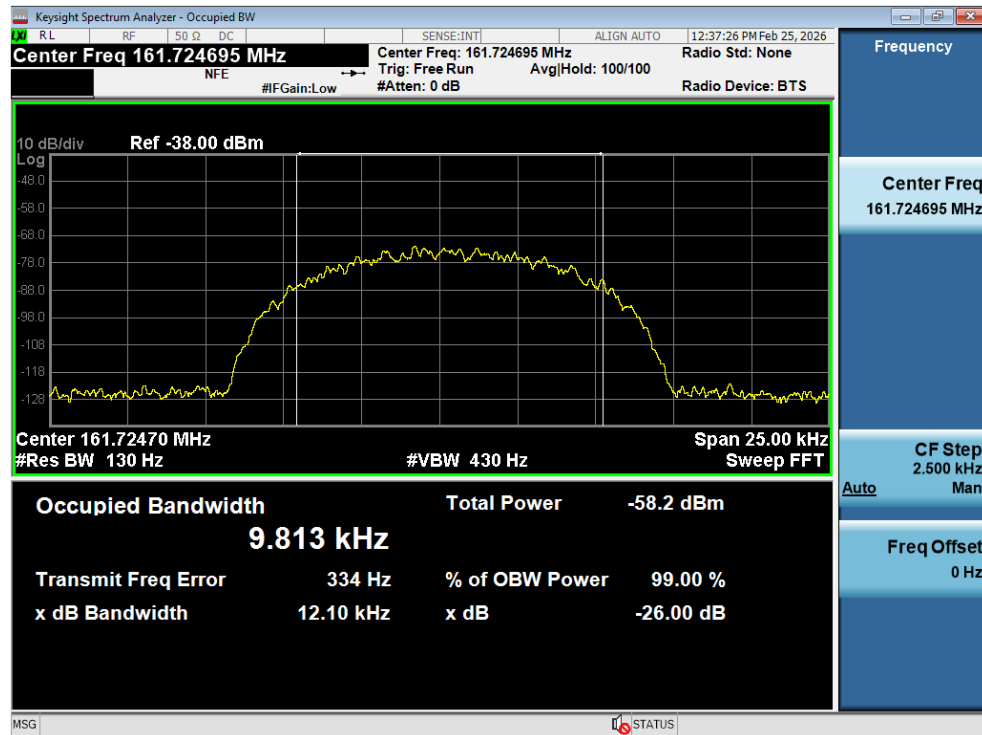
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (CQPSK)



Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (CQPSK)



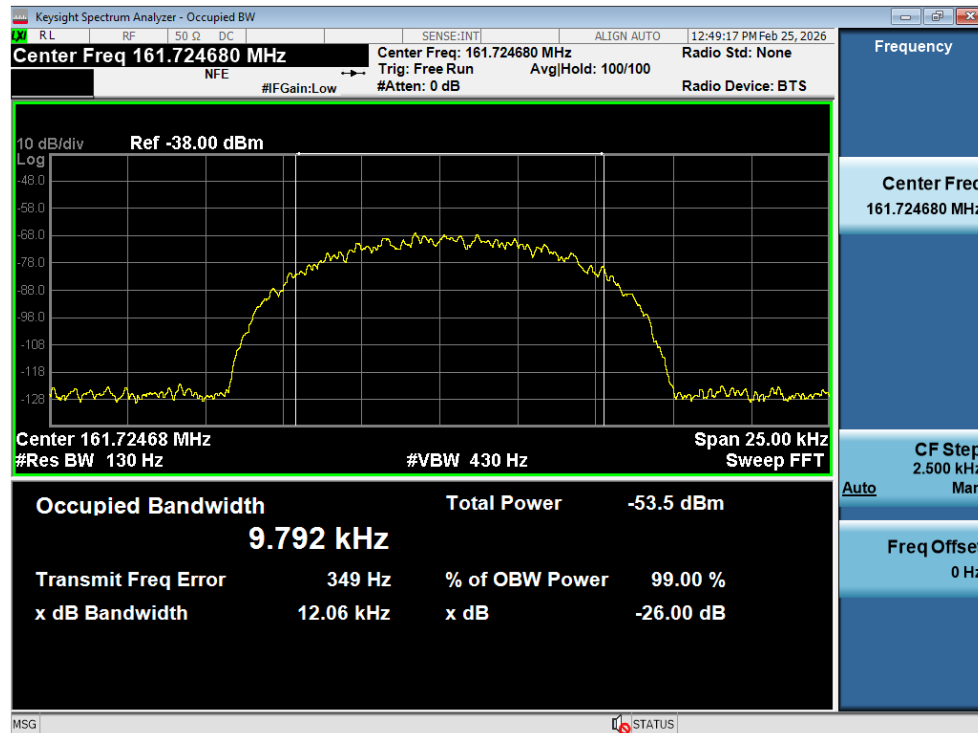
Input / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 2 (H-DQPSK)



Output / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 2 (H-DQPSK)



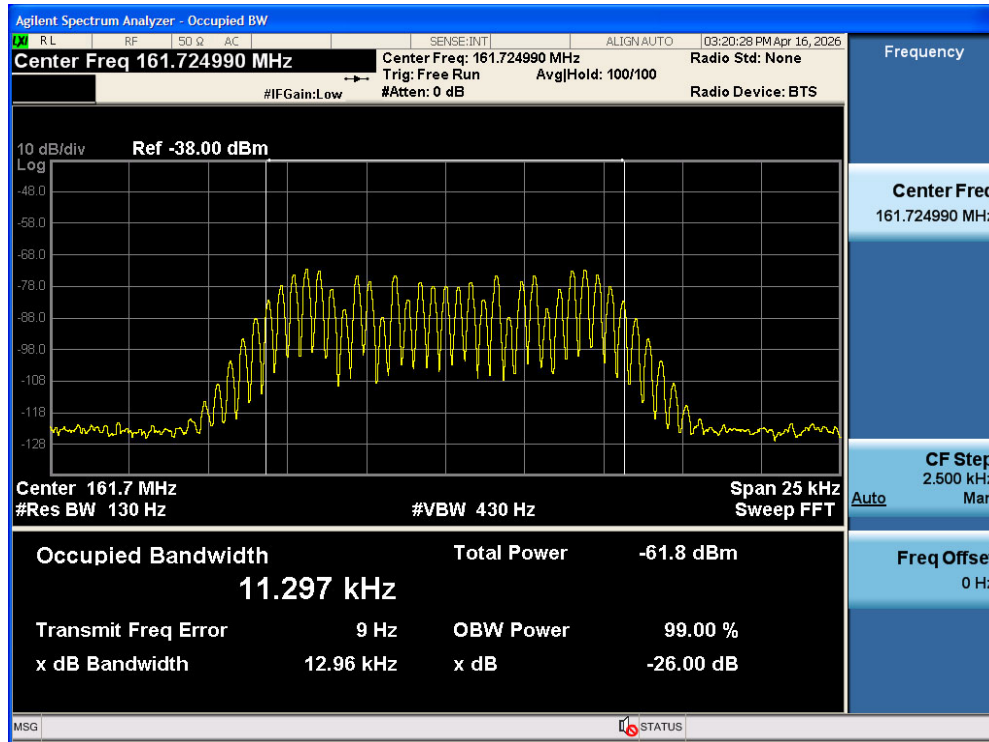
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 2 (H-DQPSK)



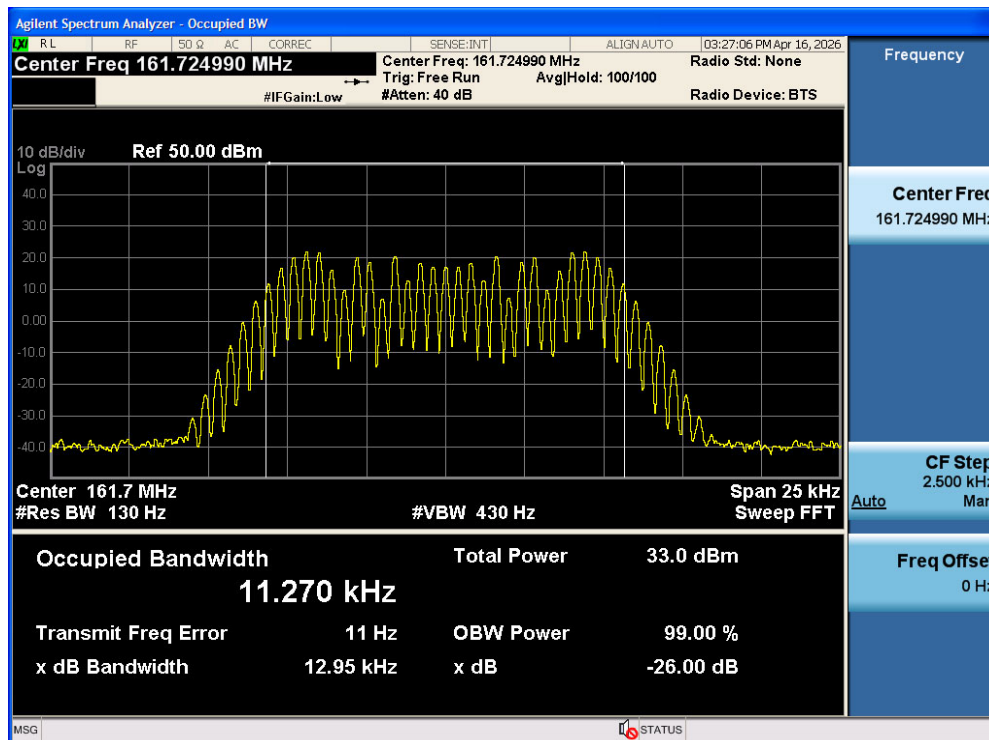
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 2 (H-DQPSK)



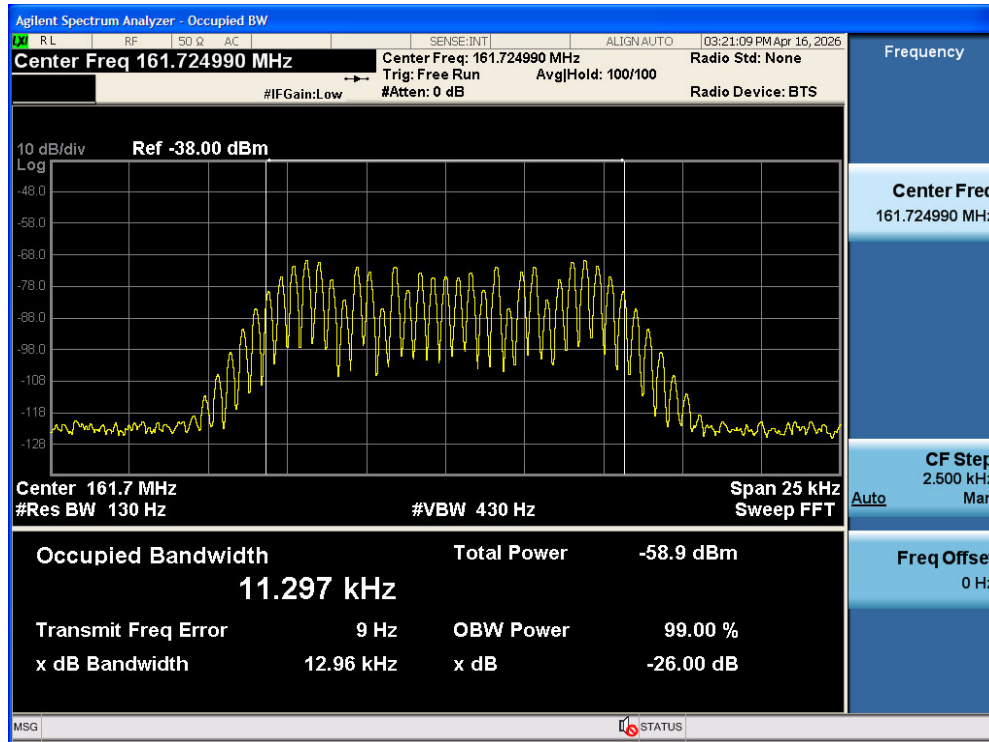
Input / VHF (150.05 ~ 173.4) / Downlink / FM (12.5 kHz)



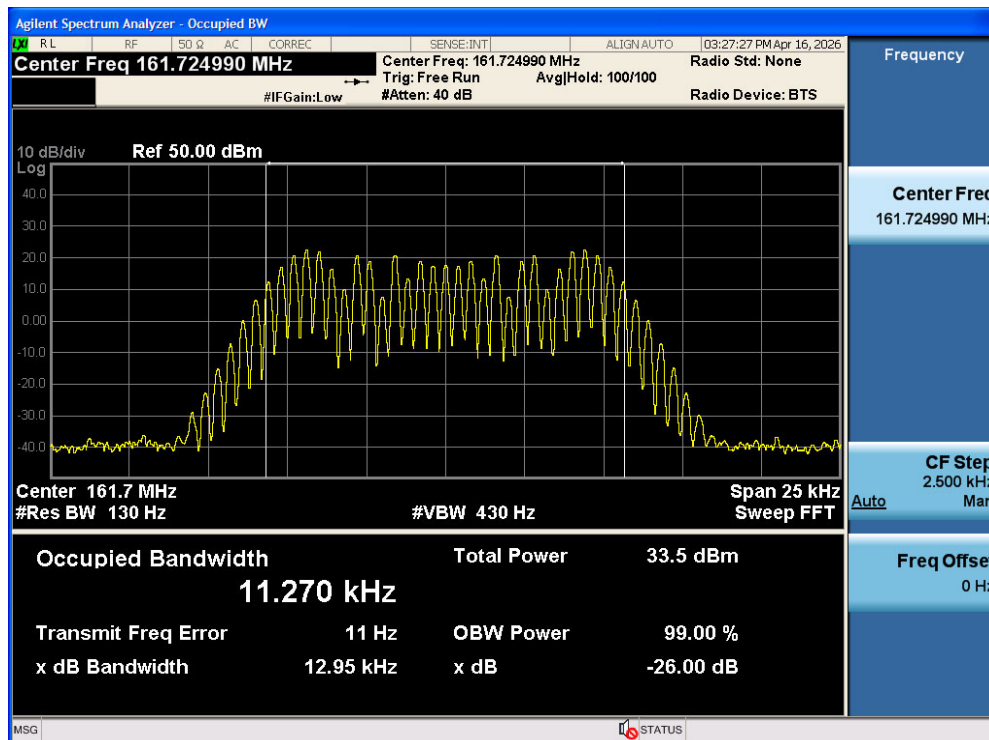
Output / VHF (150.05 ~ 173.4) / Downlink / FM (12.5 kHz)



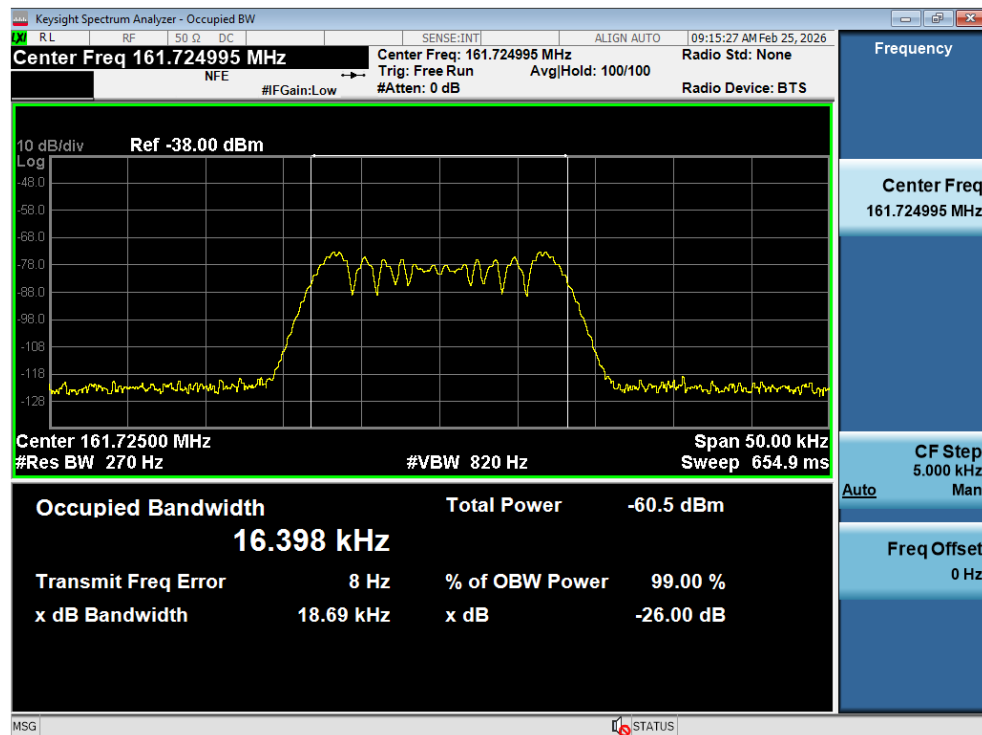
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / FM (12.5 kHz)



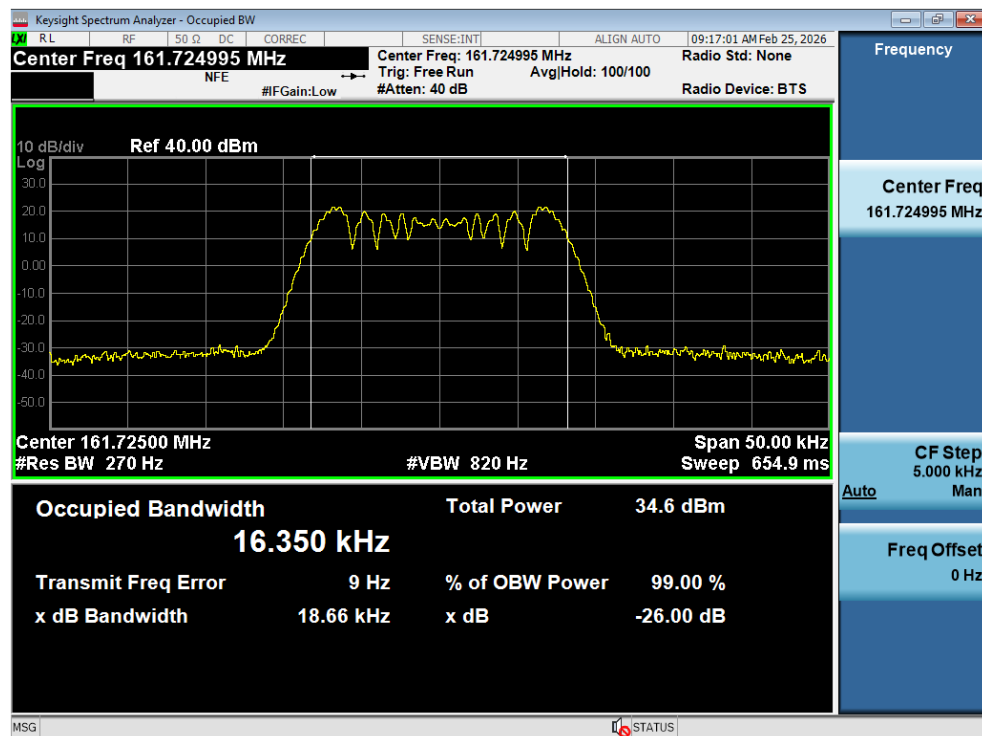
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / FM (12.5 kHz)



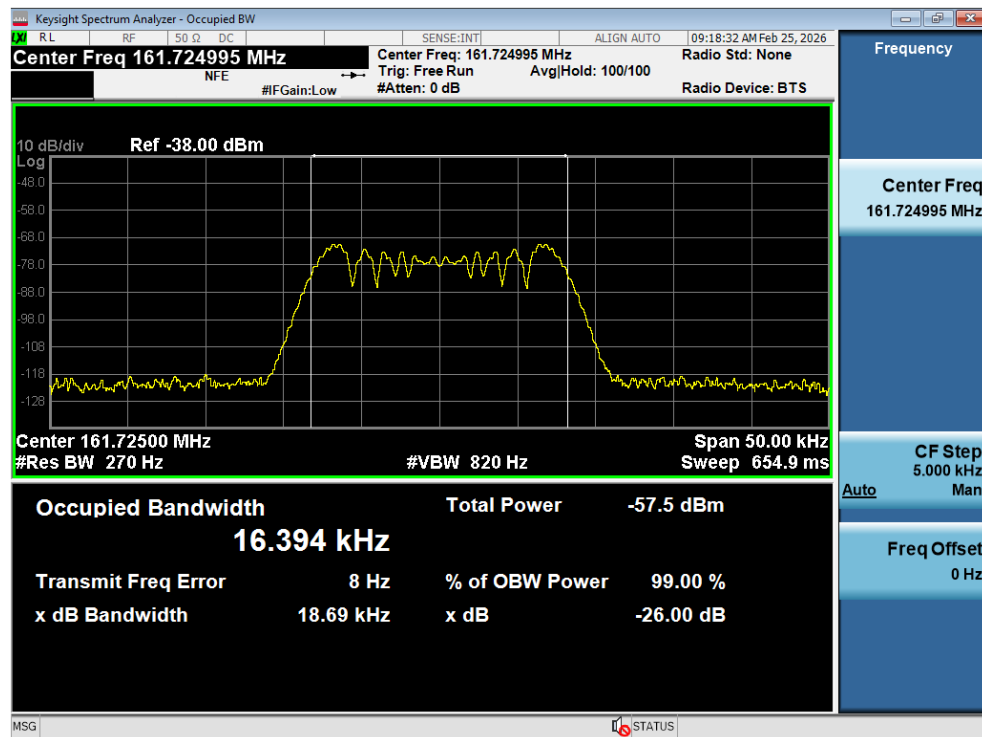
Input / VHF (150.05 ~ 173.4) / Downlink / FM (25 kHz)



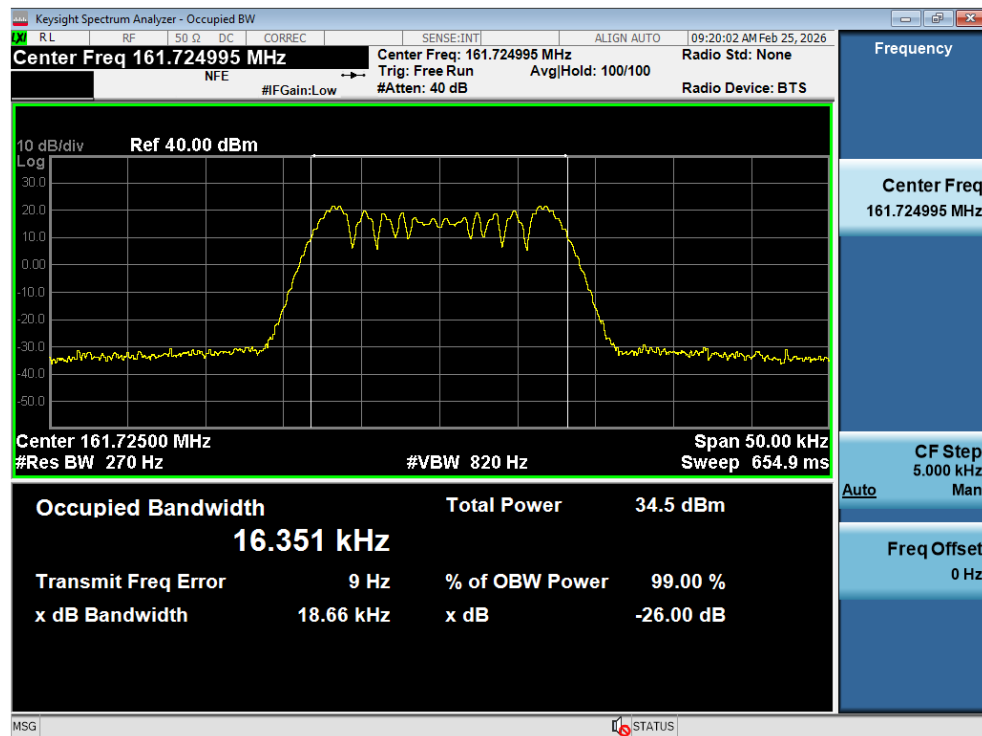
Output / VHF (150.05 ~ 173.4) / Downlink / FM (25 kHz)



Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / FM (25 kHz)



Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / FM (25 kHz)



5.4. INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Requirement:

§ 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
150-174 ²	B, D, or E	C, D or E

² Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask E.

- (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 $29 \log(f_d/11)$ 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.
- (d) **Emission Mask D—12.5 kHz channel bandwidth equipment.** For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
- (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : 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 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
 - (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log(P)$ dB or 70 dB, whichever is the lesser attenuation.
 - (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.
- (e) **Emission Mask E—6.25 kHz or less channel bandwidth equipment.** For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:
- (1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : 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 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3 \text{ kHz})$ or $55 + 10 \log(P)$ or 65 dB, whichever is the lesser attenuation.

- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

§ 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.
 - (4) A signal booster must be designed such that all signals that it retransmits meet the following requirements:
 - (iii) The retransmitted signals continue to meet the unwanted emissions limits of § 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

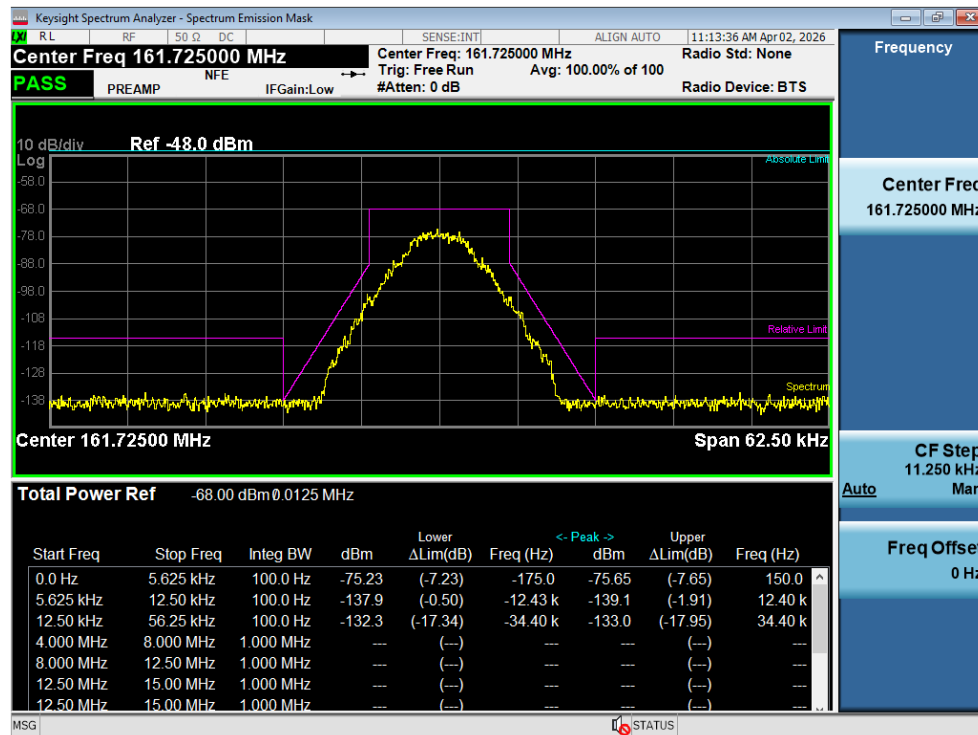
Test Procedures:

Measurements were in accordance with the test methods section 4.4 of KDB 935210 D05 v01r03.

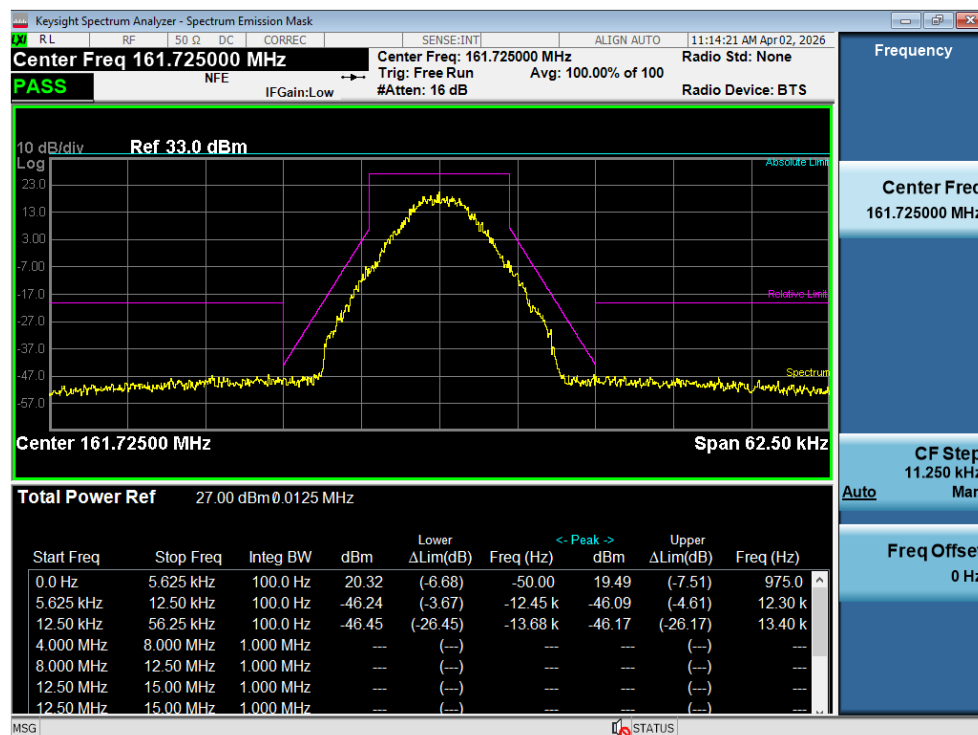
- a) Connect a signal generator to the input of the EUT.
- b) Configure the signal generator to transmit the appropriate test signal associated with the public safety emission designation.
- c) Configure the signal level to be just below the AGC threshold.
- d) Connect a spectrum analyzer to the output 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 RBW shall be 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, i.e., the level at f_0 per Out-of-band rejection test.
- 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.
- 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 [R8] (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 steps d) to n) with the input signal amplitude set 3 dB above the AGC threshold.
- p) Repeat steps b) to o) for all authorized operational bands and emissions types (see applicable regulatory specifications, e.g., Section 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.

Plot data of Emission mask

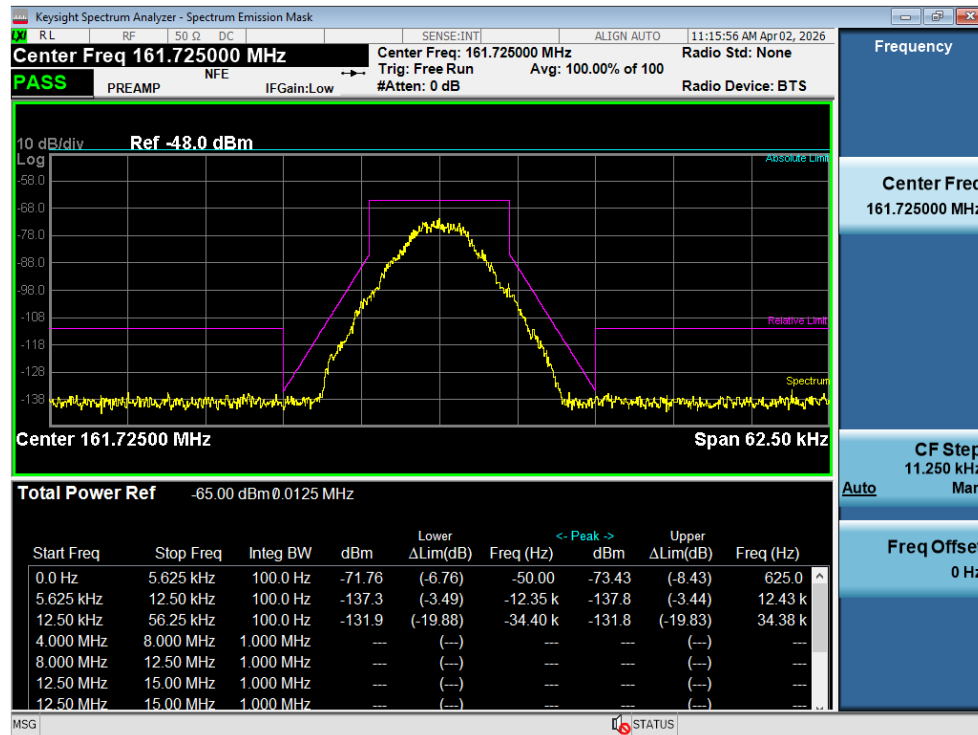
Input / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM) / Mask D



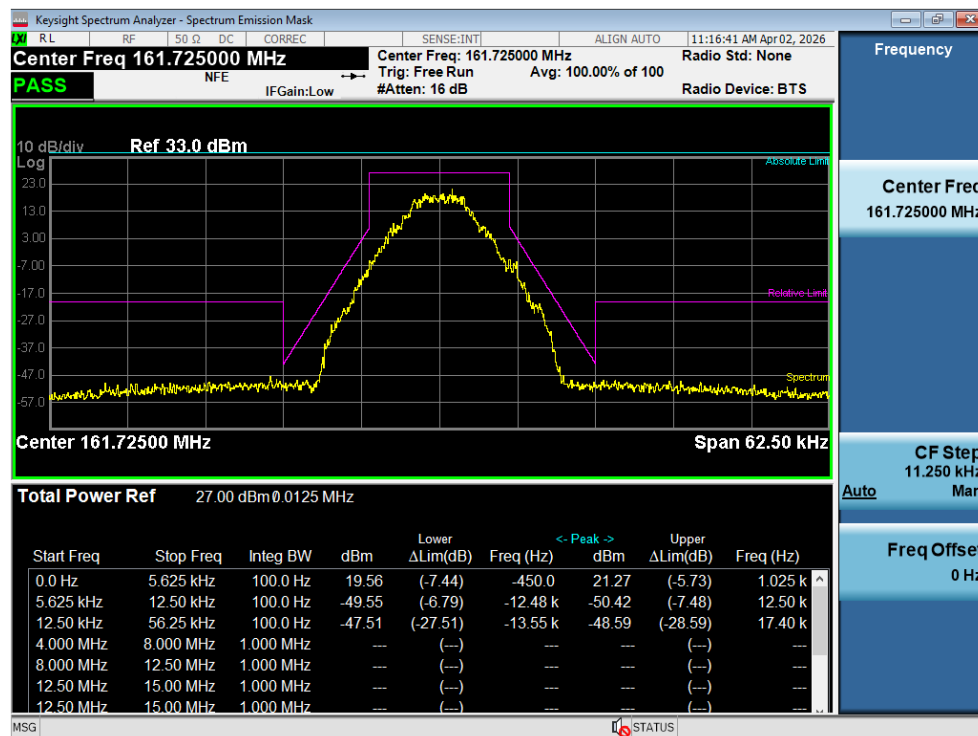
Output / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM) / Mask D



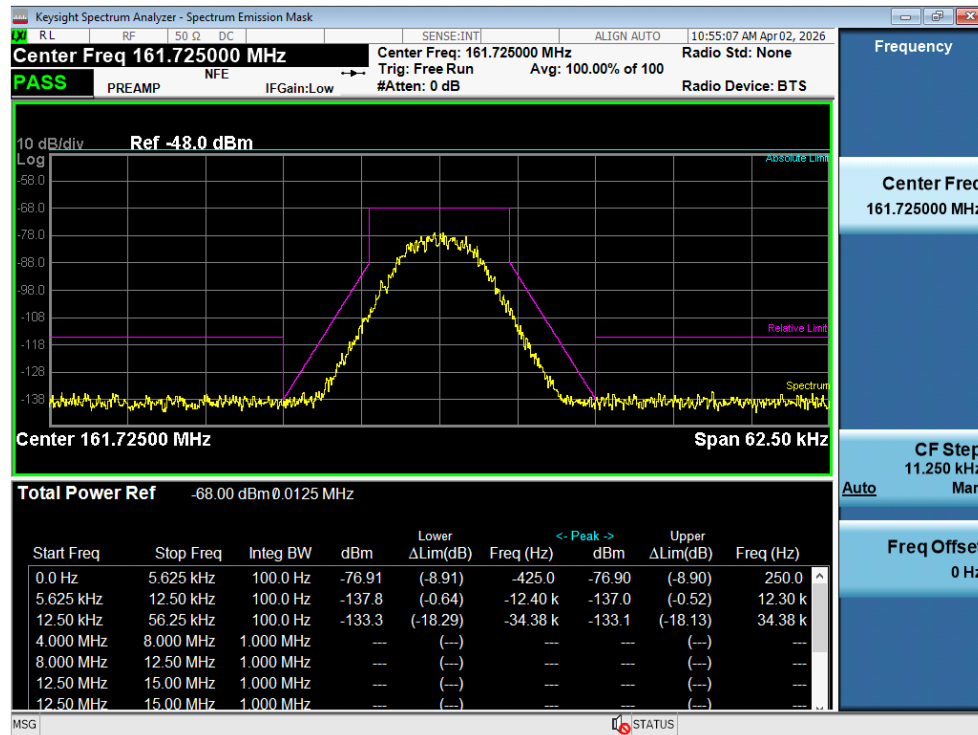
Input @ +3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM) / Mask D



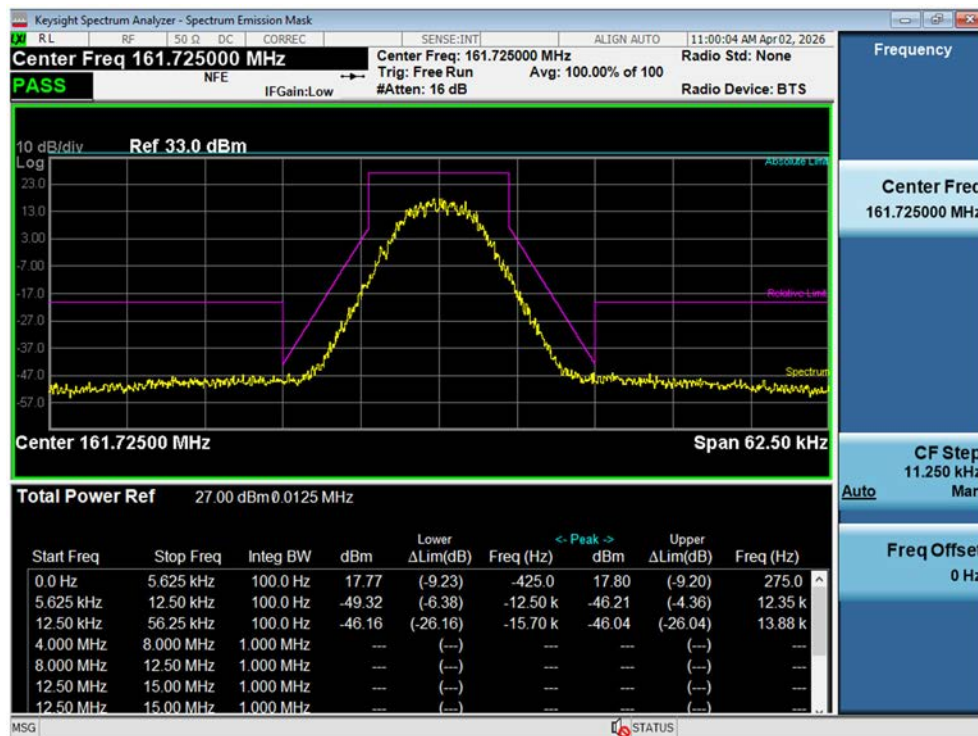
Output @ +3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 1 (C4FM) / Mask D



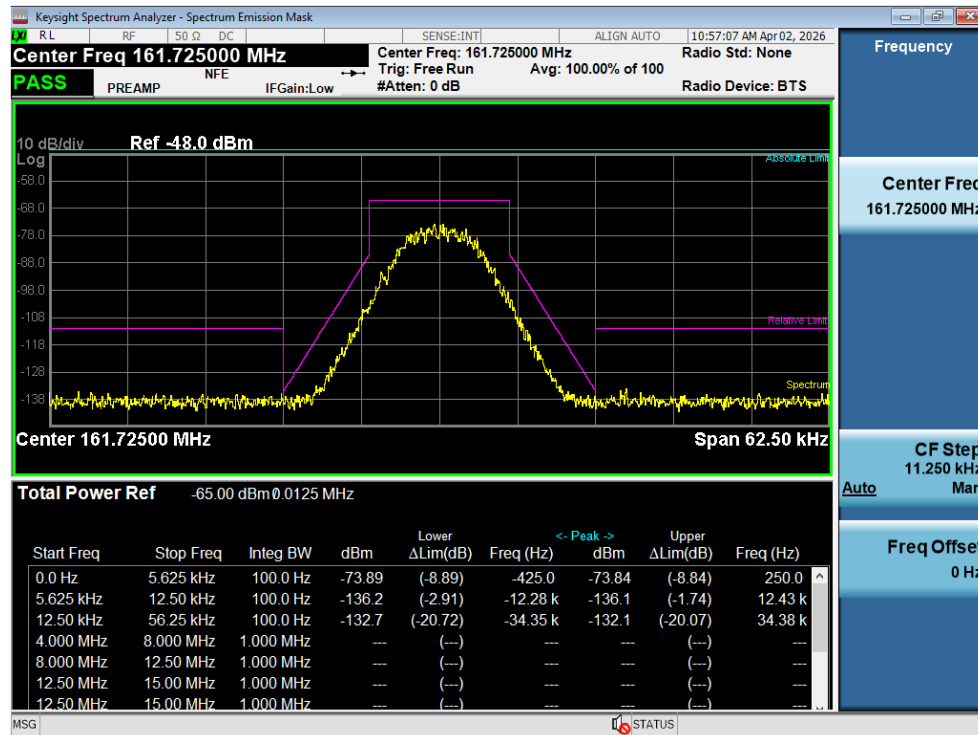
Input / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)/ Mask D



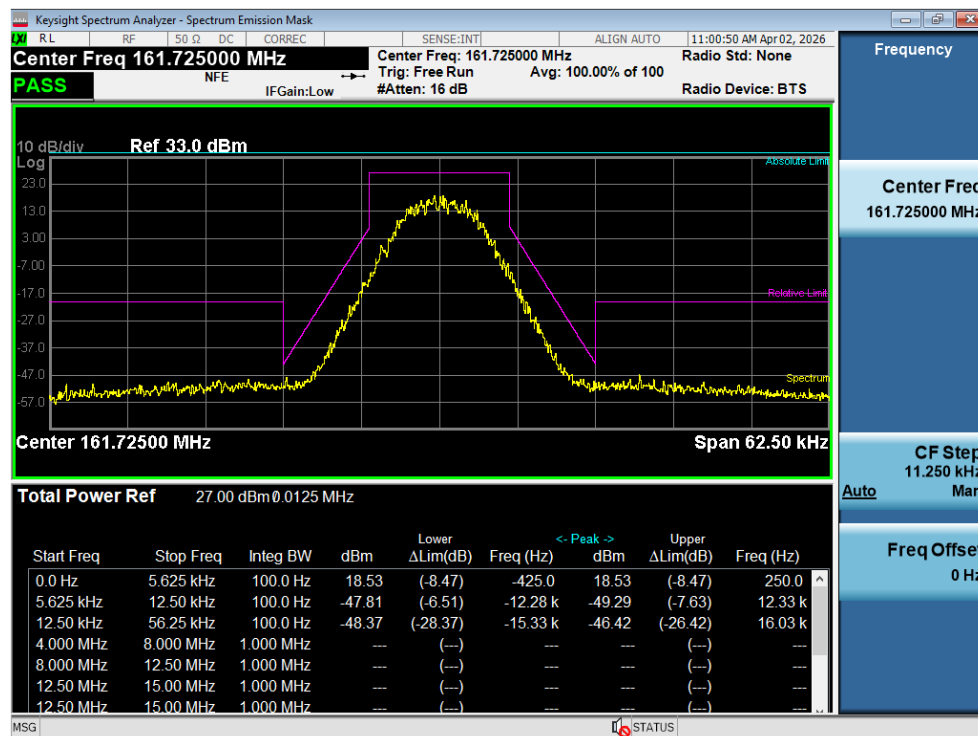
Output / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)/ Mask D



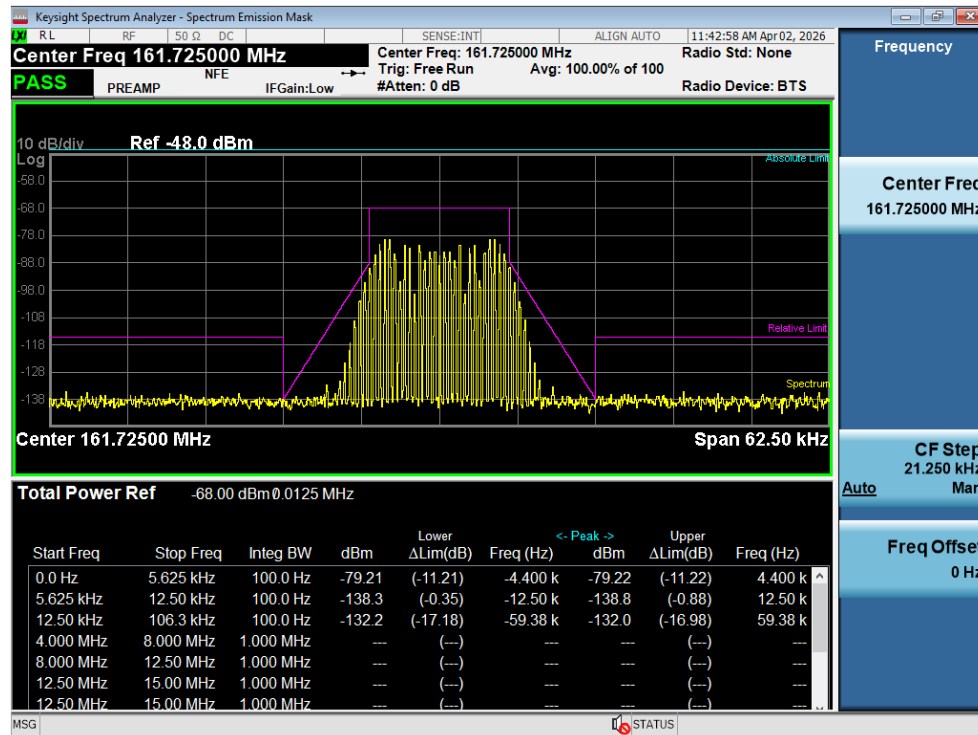
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)/ Mask D



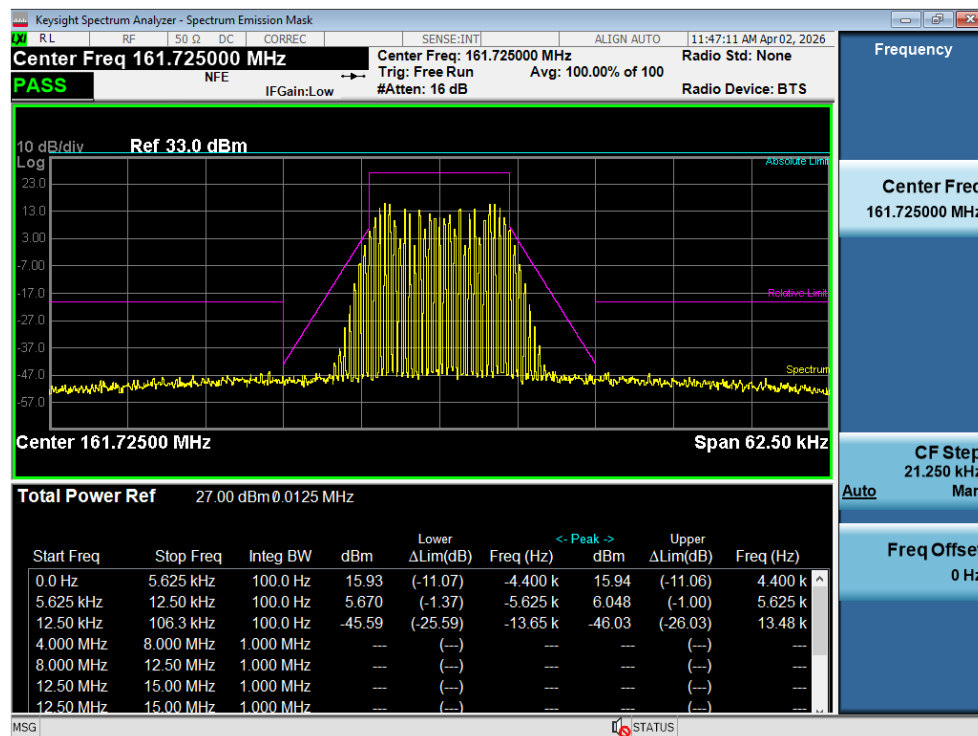
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / P25 Phase 2 (H-CPM)/ Mask D



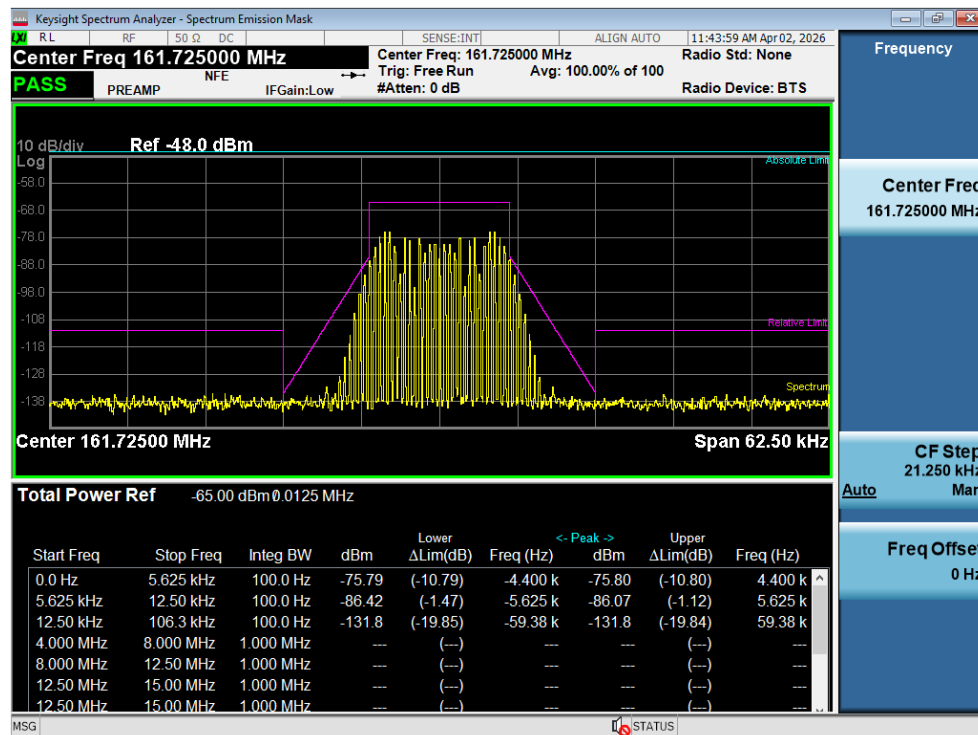
Input / VHF (150.05 ~ 173.4) / Uplink / FM (12.5 kHz) / Mask D



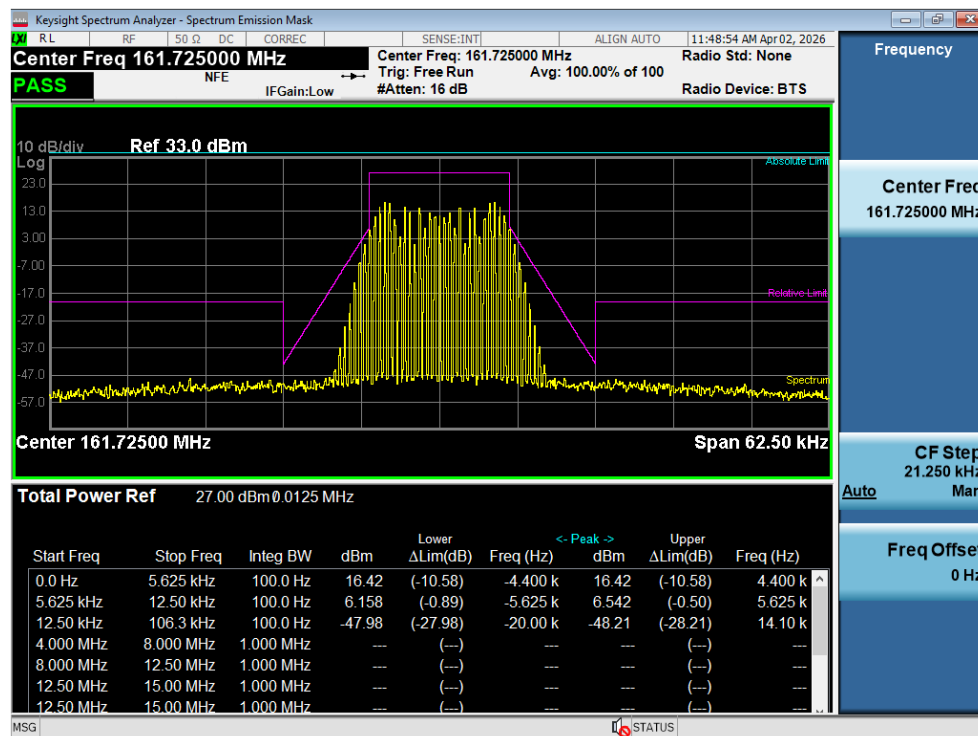
Output / VHF (150.05 ~ 173.4) / Uplink / FM (12.5 kHz) / Mask D



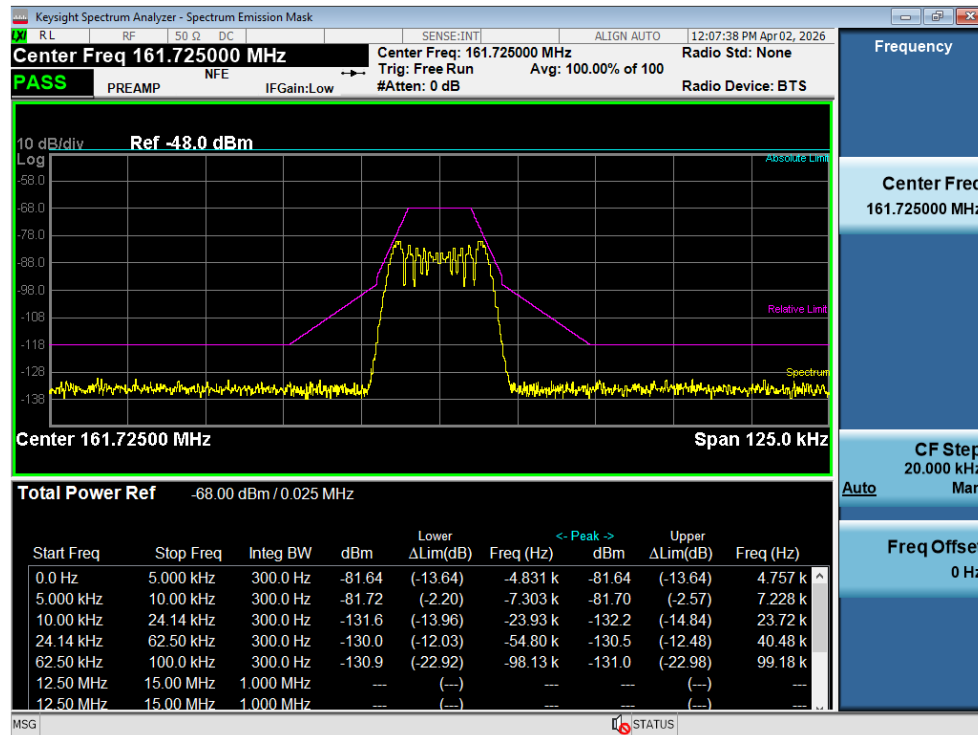
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / FM (12.5 kHz) / Mask D



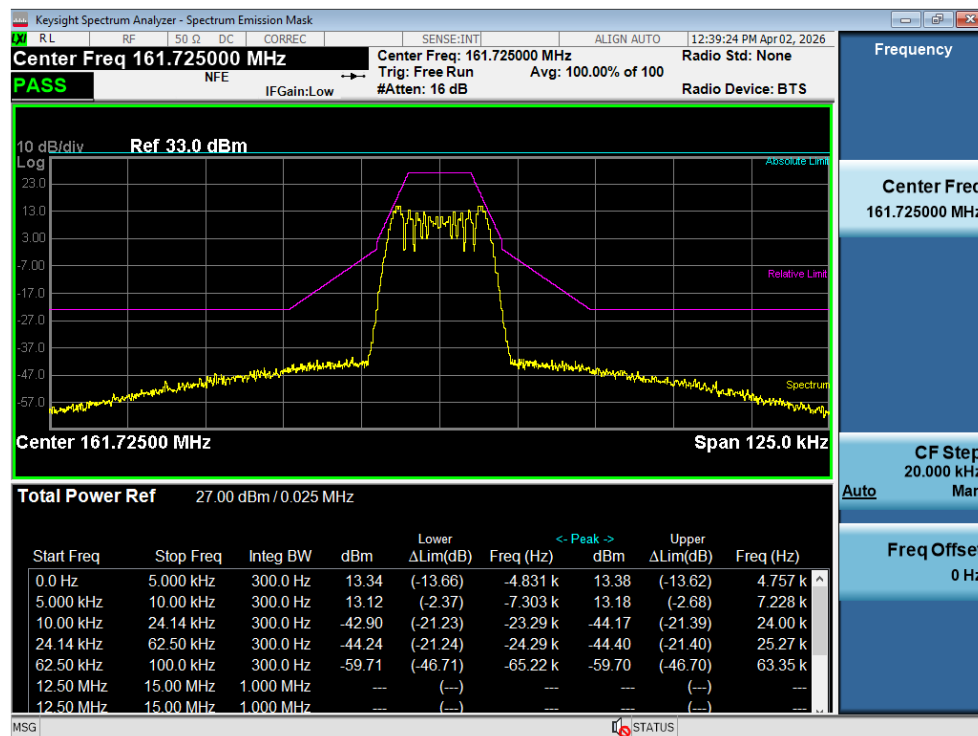
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / FM (12.5 kHz) / Mask D



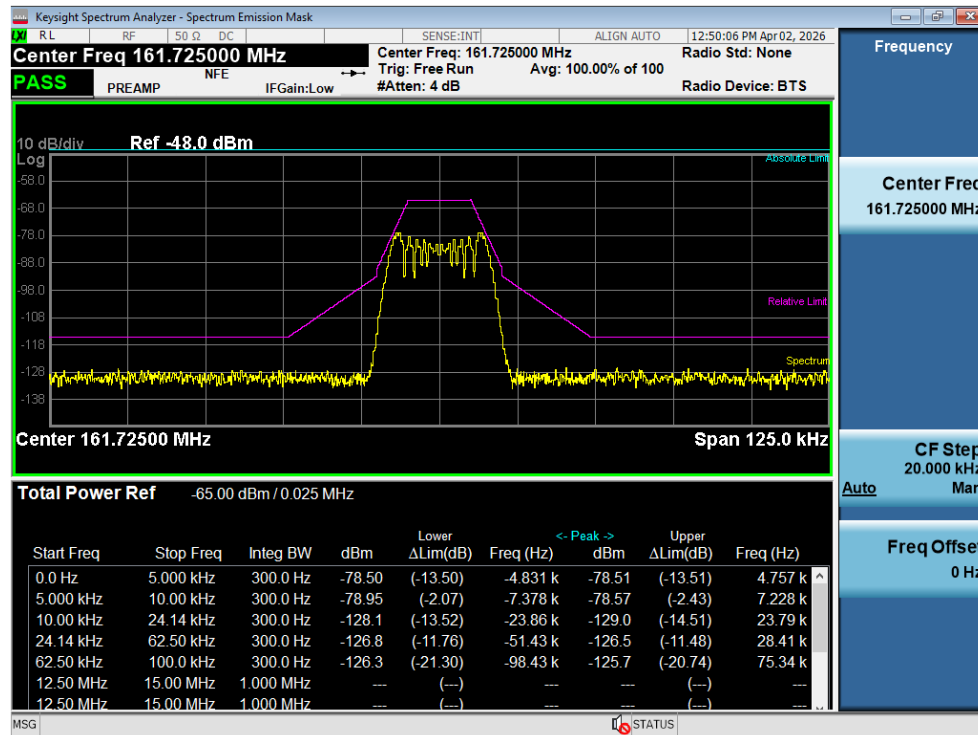
Input / VHF (150.05 ~ 173.4) / Uplink / FM (25 kHz) / Mask C



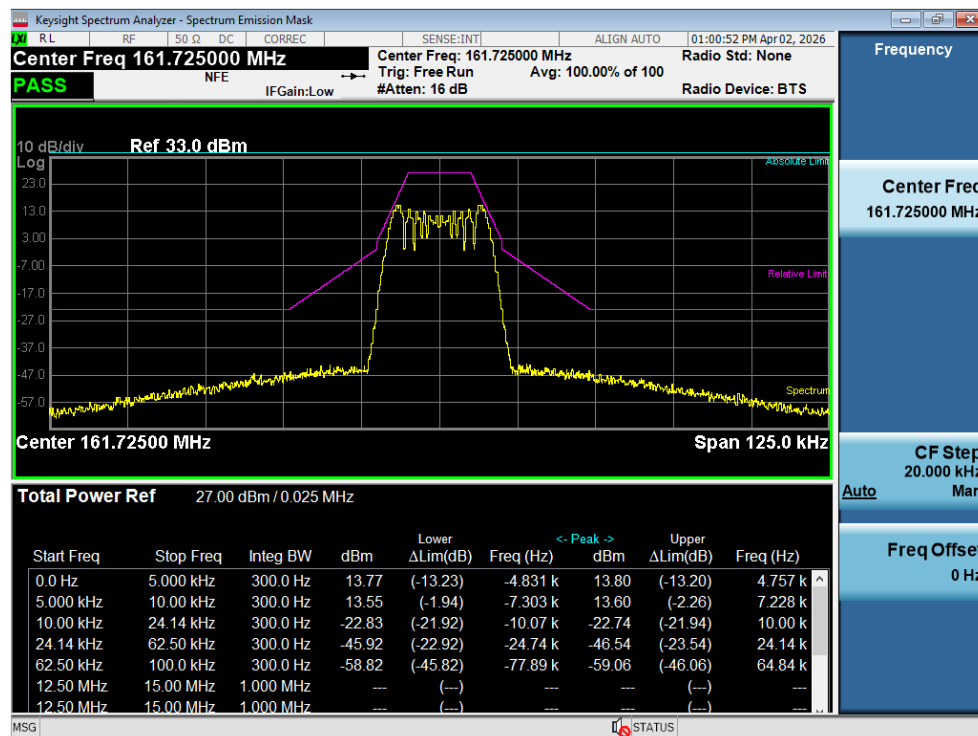
Output / VHF (150.05 ~ 173.4) / Uplink / FM (25 kHz) / Mask C



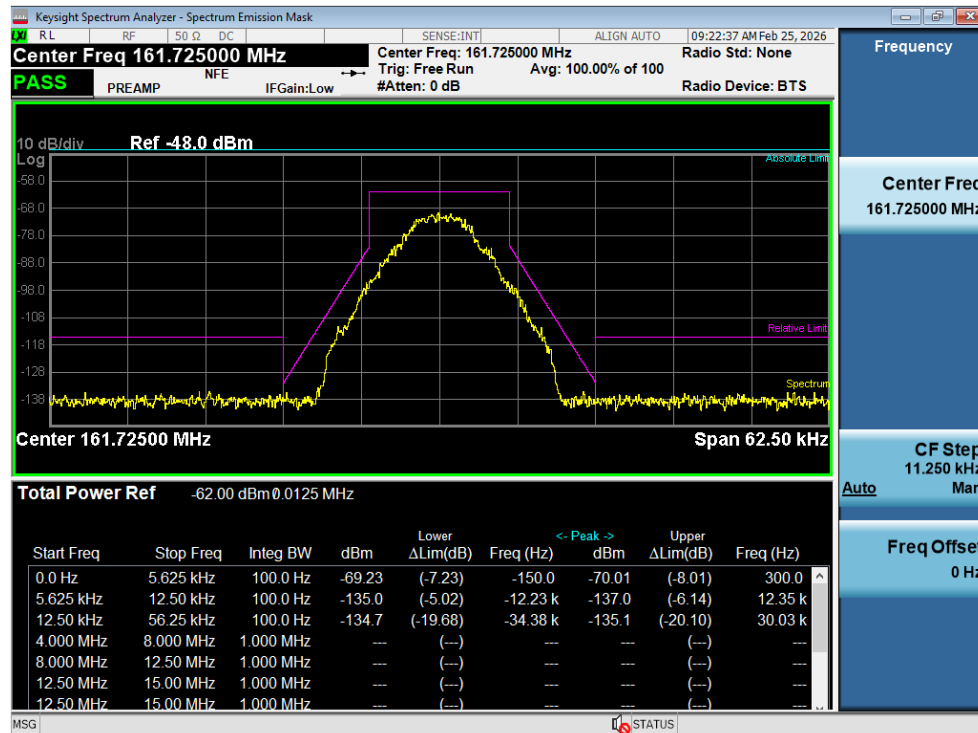
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / FM (25 kHz) / Mask C



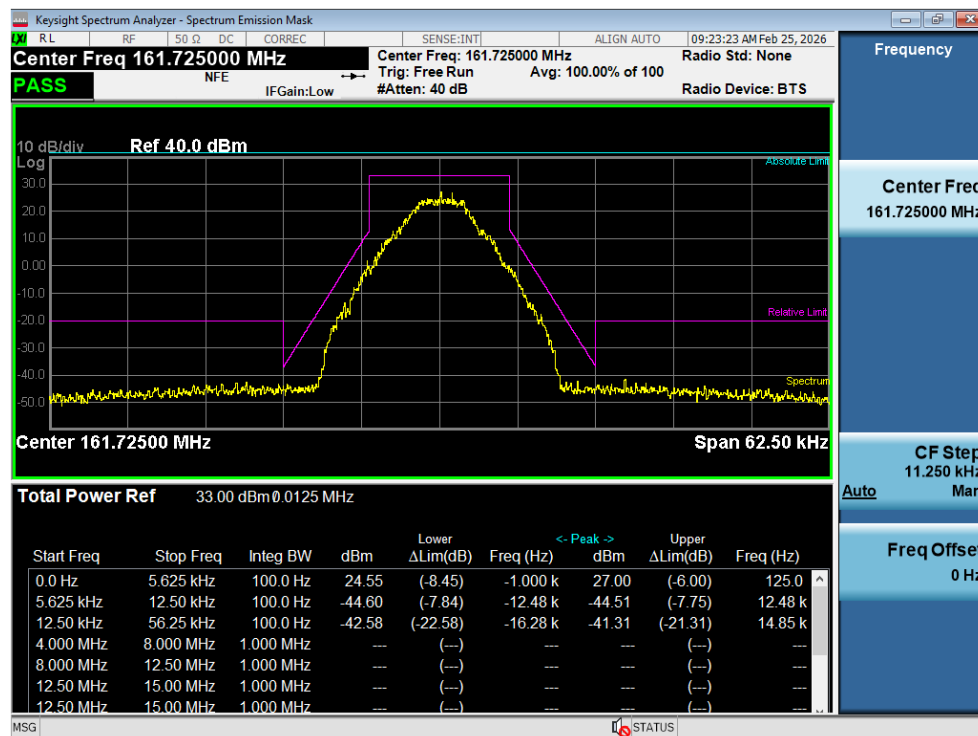
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink / FM (25 kHz) / Mask C



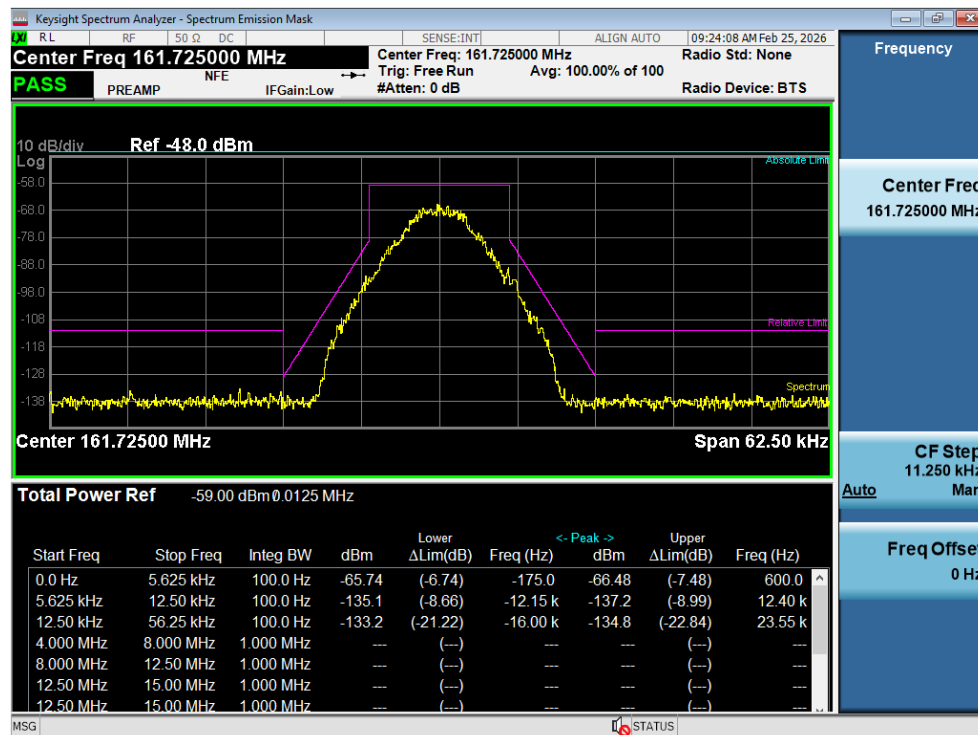
Input / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM) / Mask D



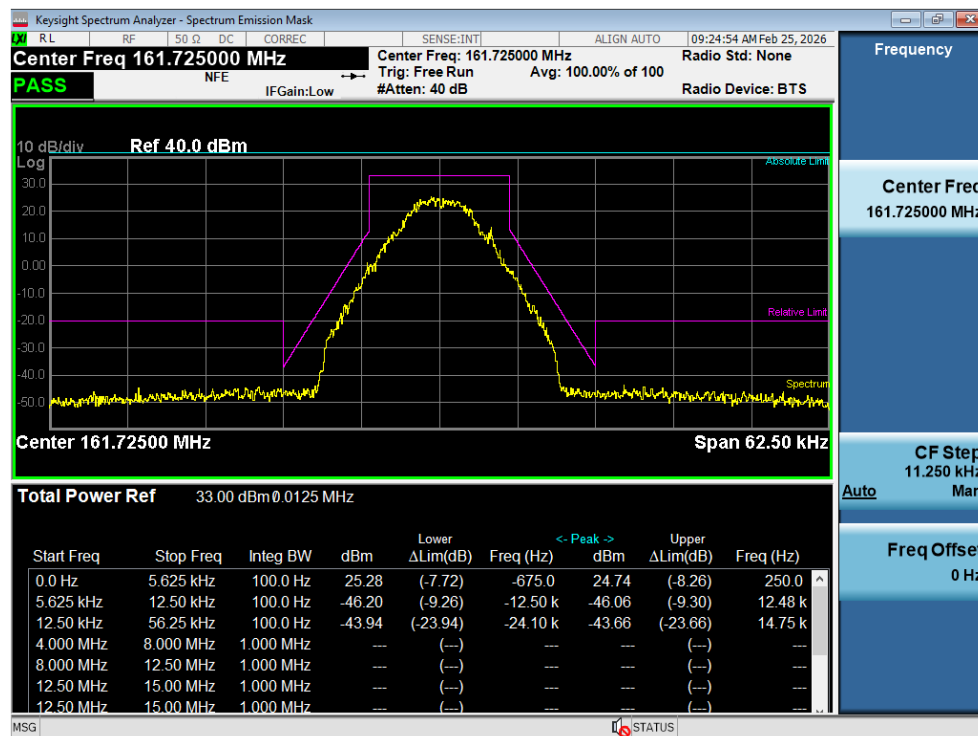
Output / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM) / Mask D



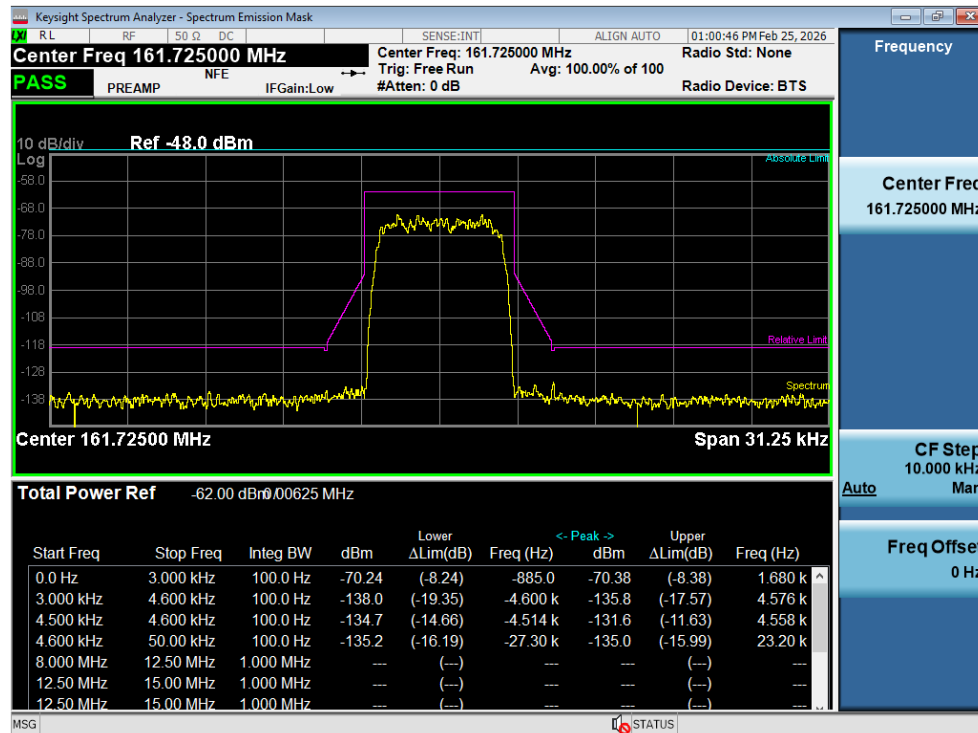
Input @ +3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM) / Mask D



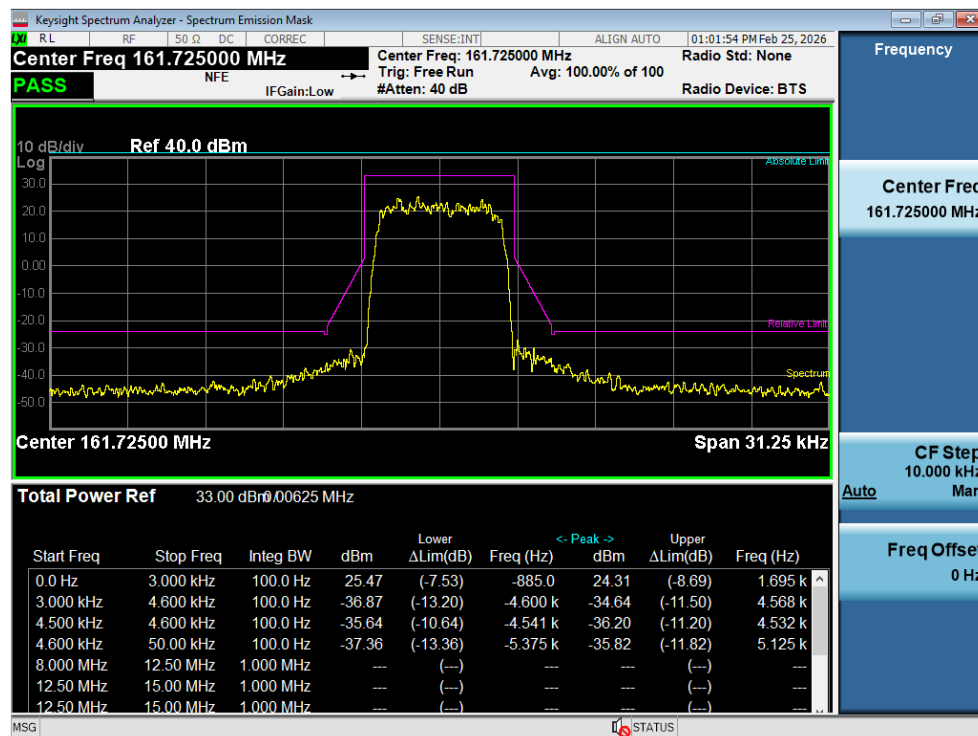
Output @ +3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (C4FM) / Mask D



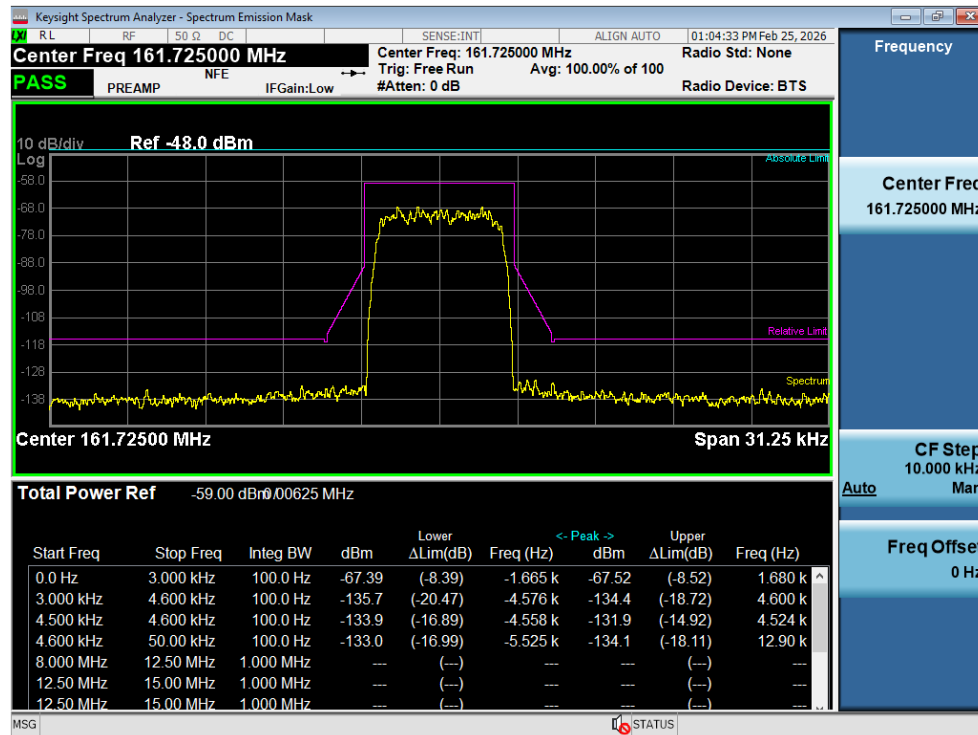
Input / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (CQPSK) / Mask E



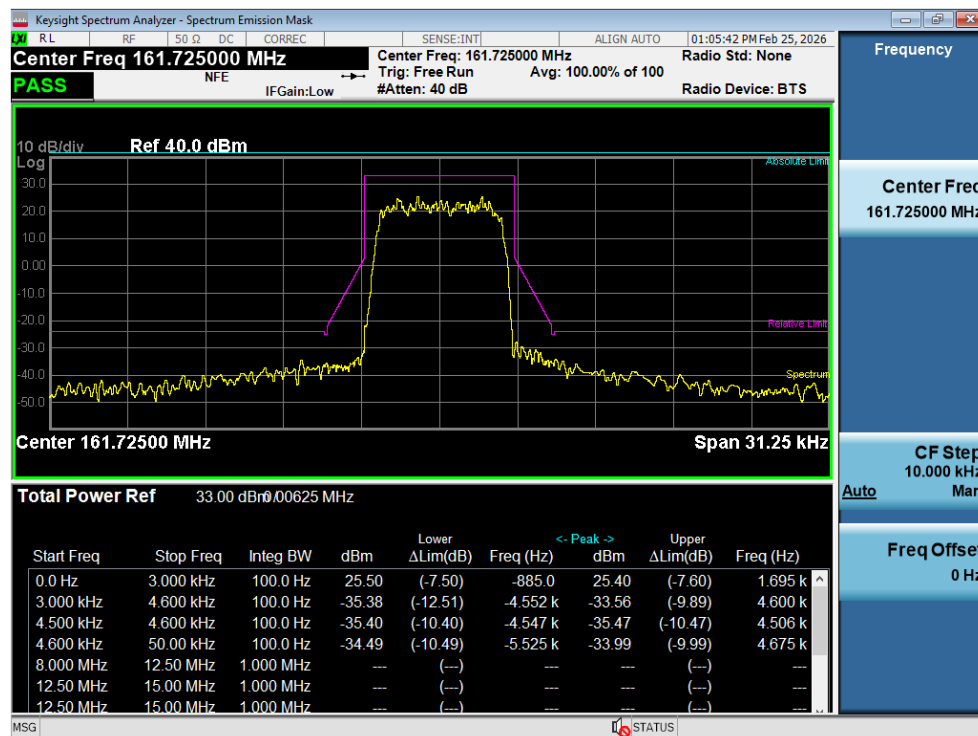
Output / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (CQPSK) / Mask E



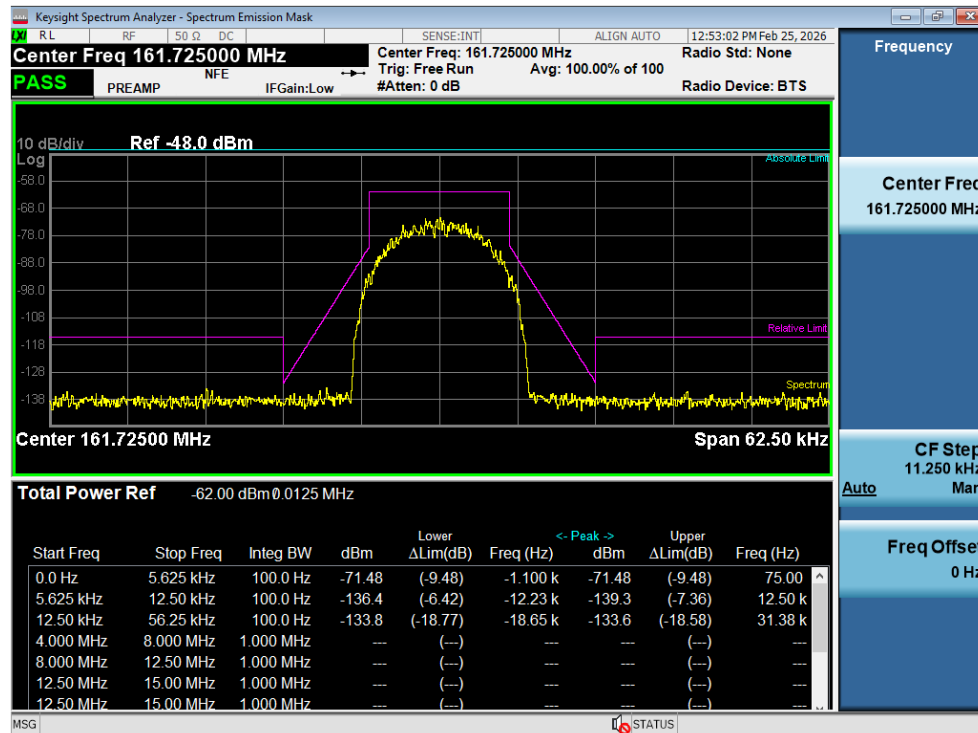
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 1 (CQPSK) / Mask E



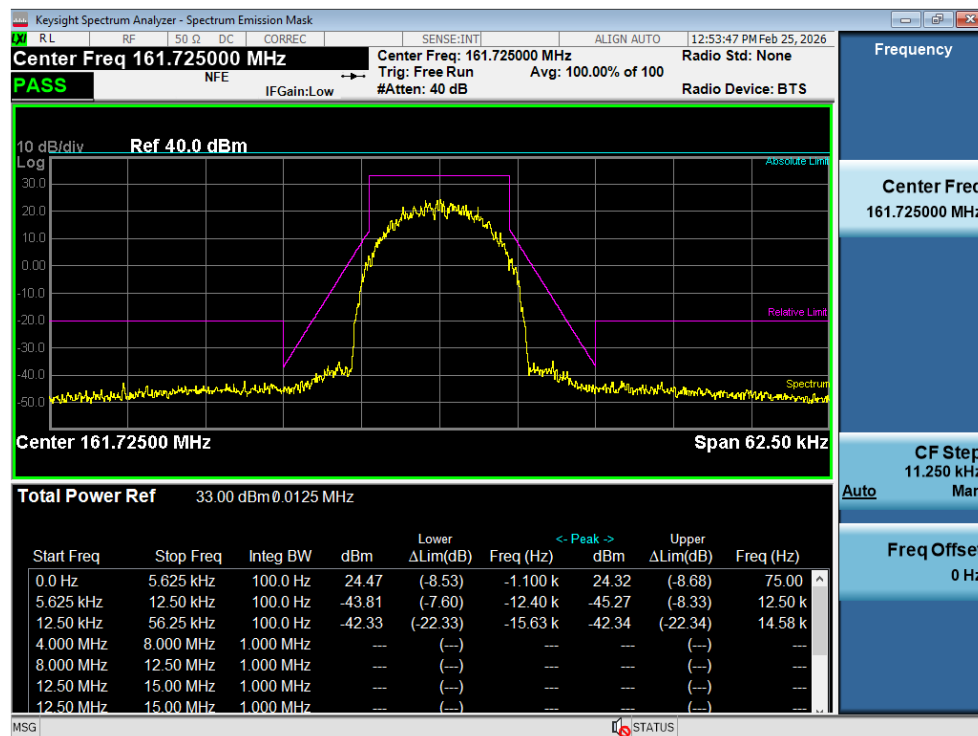
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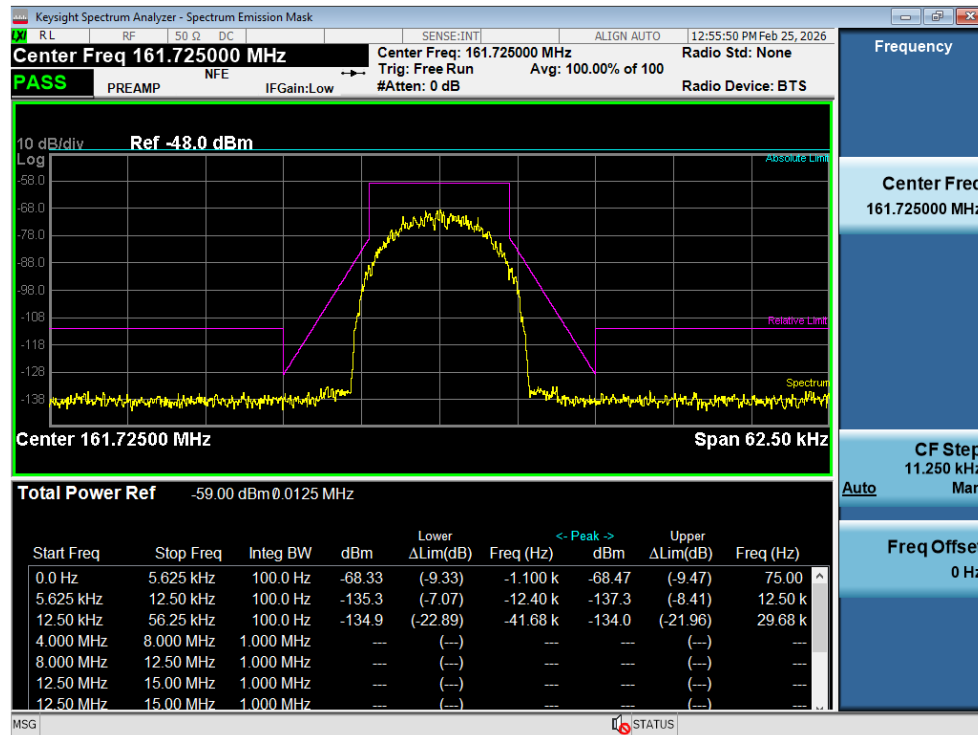
Input / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 2 (H-DQPSK) / Mask D



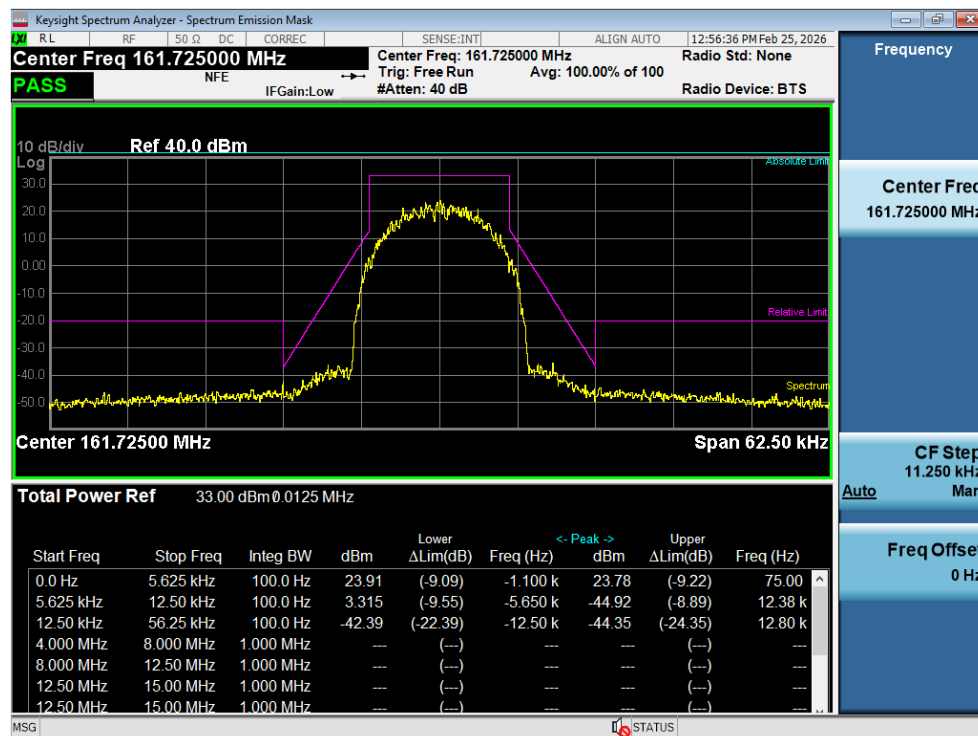
Output / VHF (150.05 ~ 173.4) / Downlink / P25 Phase 2 (H-DQPSK) / Mask D



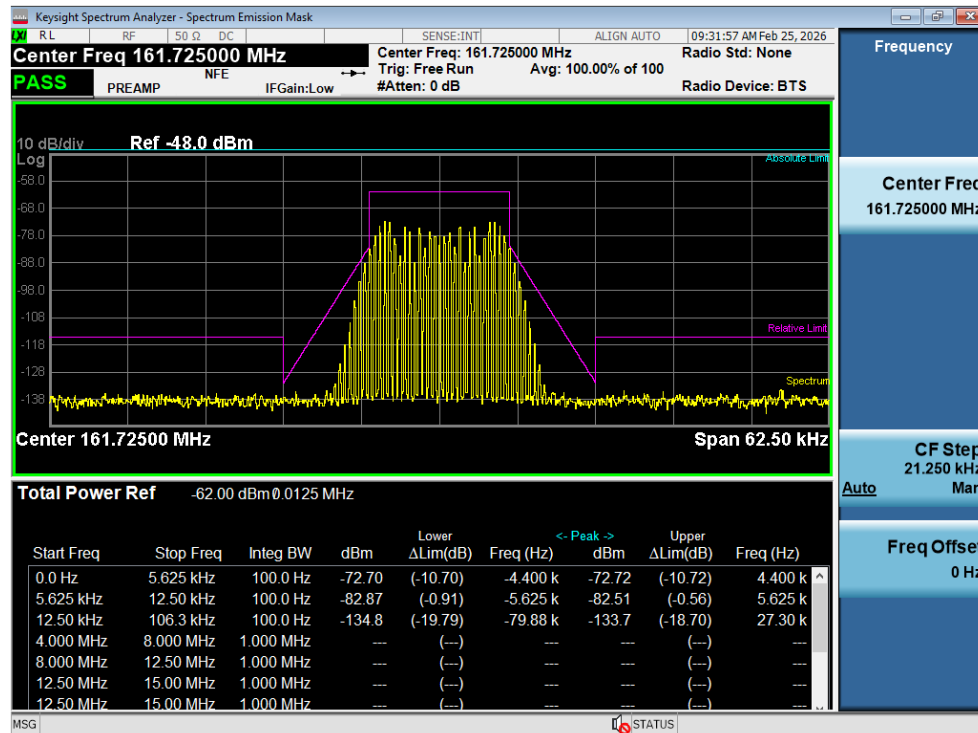
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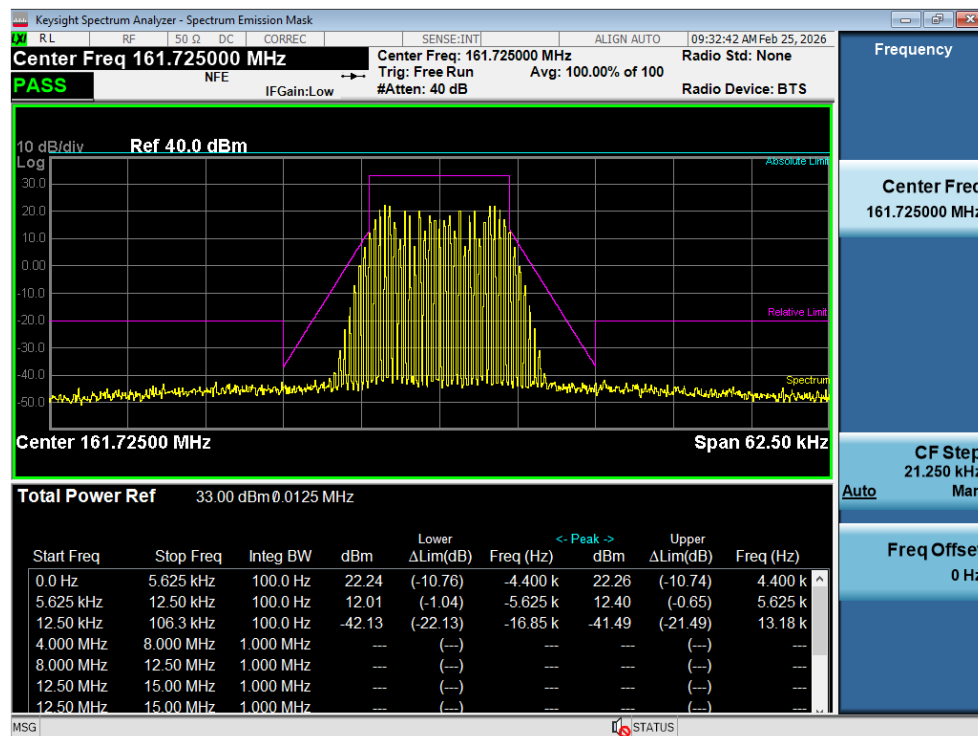
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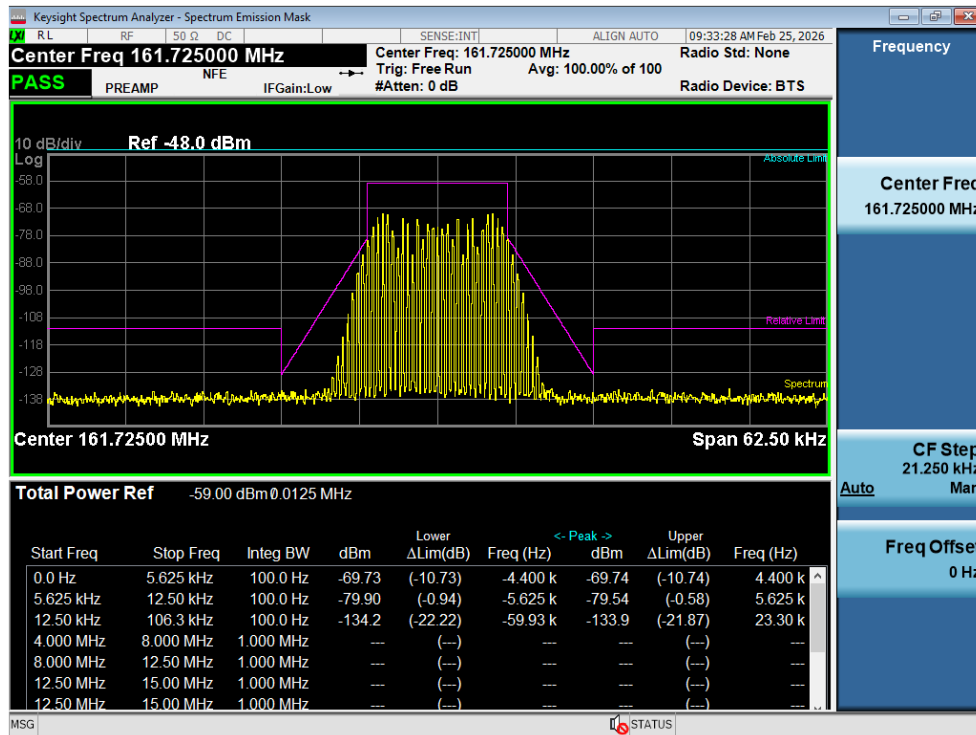
Input / VHF (150.05 ~ 173.4) / Downlink / FM (12.5 kHz) / Mask D



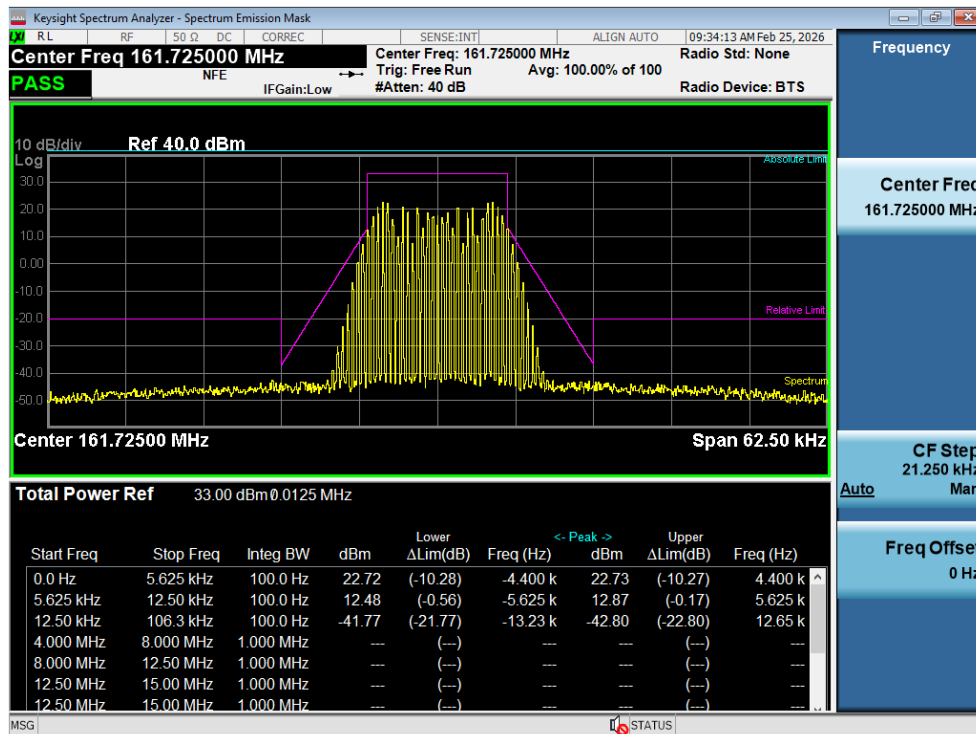
Output / VHF (150.05 ~ 173.4) / Downlink / FM (12.5 kHz) / Mask D



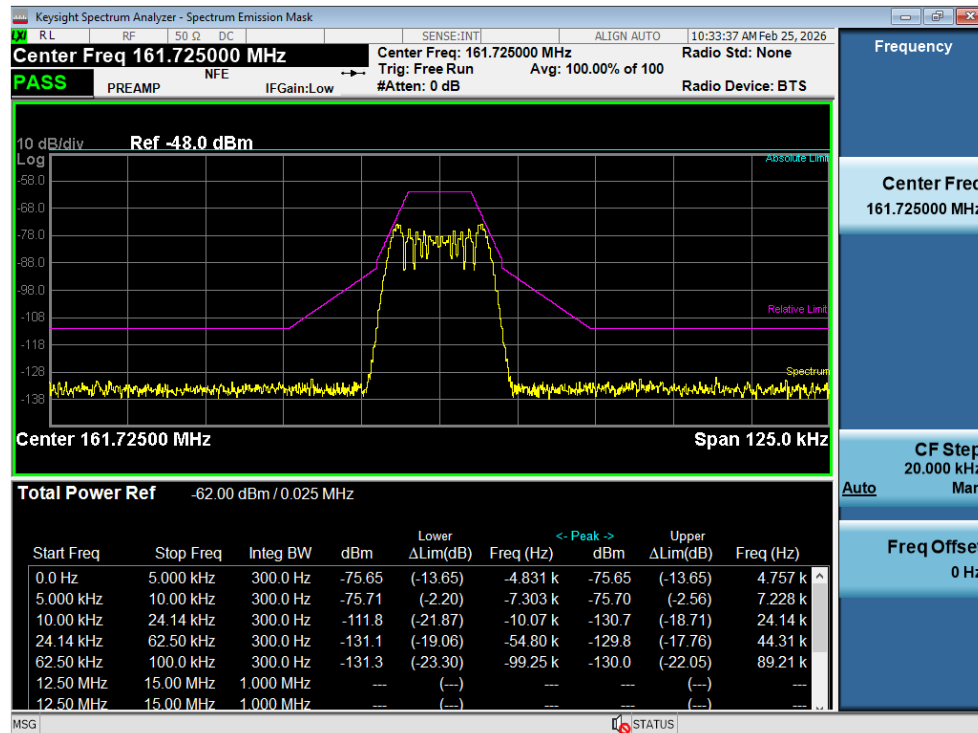
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / FM (12.5 kHz) / Mask D



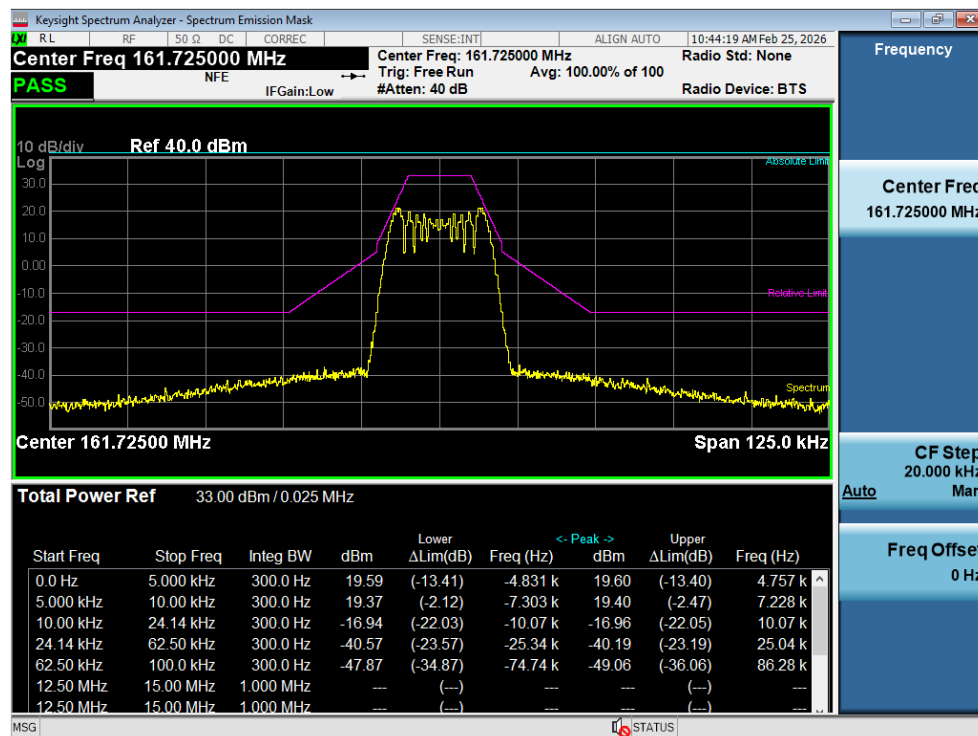
Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / FM (12.5 kHz) / Mask D



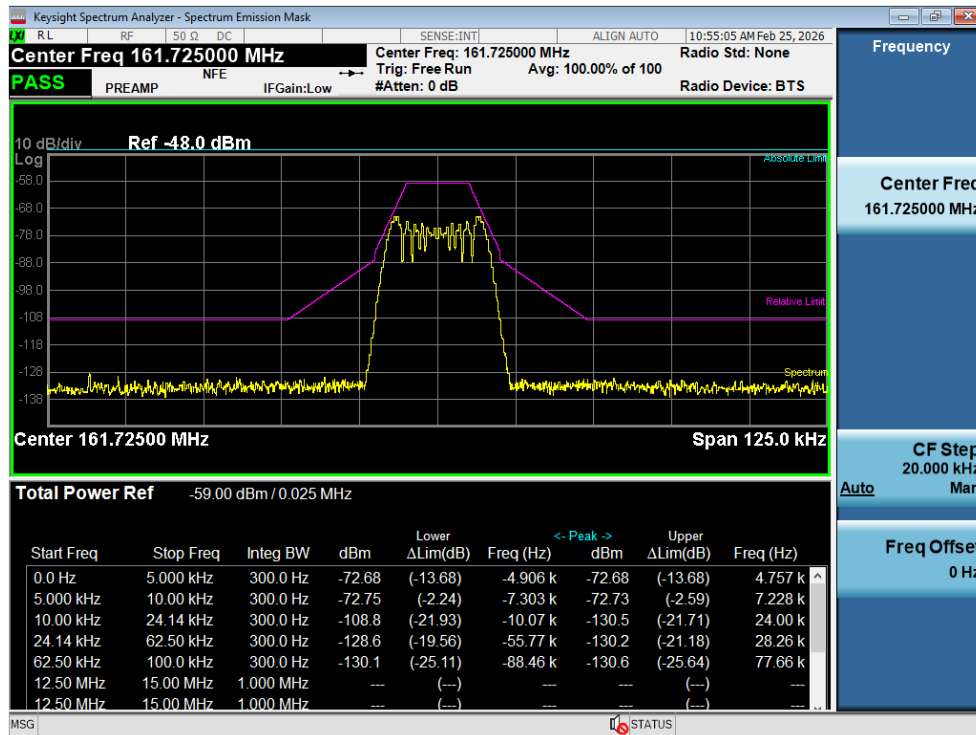
Input / VHF (150.05 ~ 173.4) / Downlink / FM (25 kHz) / Mask C



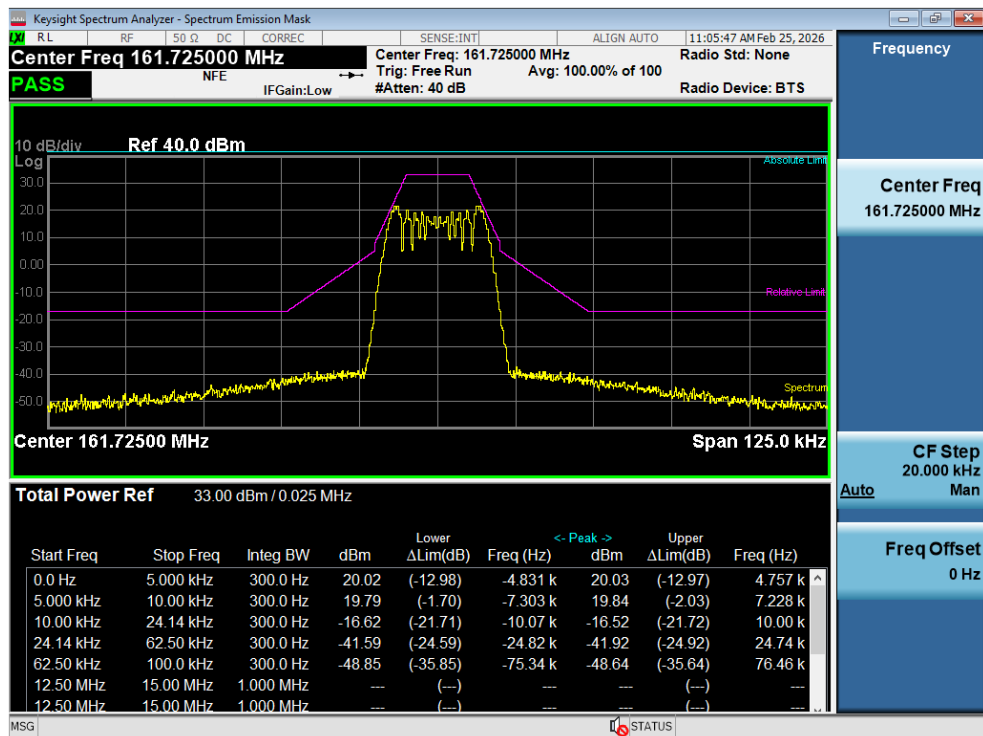
Output / VHF (150.05 ~ 173.4) / Downlink / FM (25 kHz) / Mask C



Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / FM (25 kHz) / Mask C



Output @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Downlink / FM (25 kHz) / 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 Uplink/Downlink ERP is calculated as follows.
 - Uplink ERP = Uplink Output Power + Peak Ant. Gain
 $= 26.93 \text{ dBm} + (-1.15 \text{ dBd}) = 25.78 \text{ dBm}$
 - Downlink ERP = Downlink Output Power + Peak Ant. Gain(dBd)
 $= 33.24 \text{ dBm} + 7 \text{ dBd} = 40.24 \text{ dBm}$

Test Results:
Tabular data of Input / Output Power and Gain

Test Band	Link	Signal	f ₀ Frequency	Input Power	Output Power	Gain	Peak Ant. Gain	E.R.P.#		Limit
			(MHz)	(dBm)		(dB)	(dBd)	(dBm)	(W)	(W)
VHF (150.05 ~ 173.4)	Uplink	CW	162.87	-67.74	26.93	94.66	-1.15	25.78	0.38	5
	Downlink		158.63	-61.87	33.24	95.11	7.00	40.24	10.57	

Gain = Output power - Input power

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

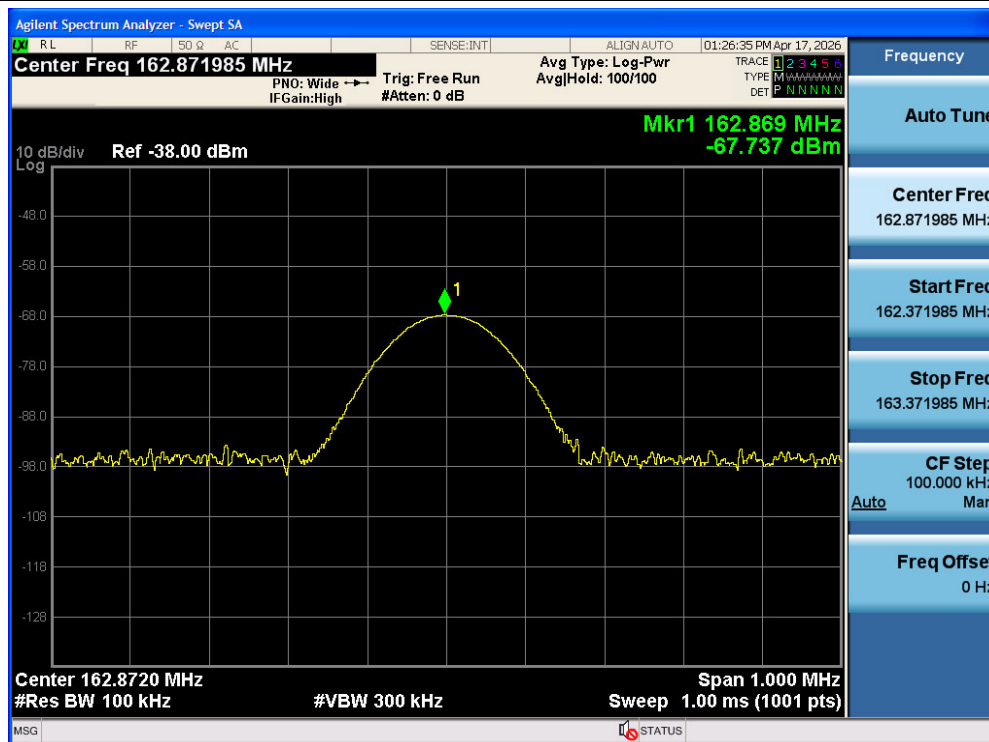
Tabular data of Input / Output Power and Gain at 3 dB above the AGC threshold

Test Band	Link	Signal	f ₀ Frequency	Input Power	Output Power	Peak Ant. Gain	E.R.P.#		Limit
			(MHz)	(dBm)		(dBd)	(dBm)	(W)	(W)
VHF (150.05 ~ 173.4)	Uplink	CW	162.87	-64.79	-1.15	-1.15	25.74	0.37	5
	Downlink		158.63	-59.00	7.00	7.00	40.28	10.67	

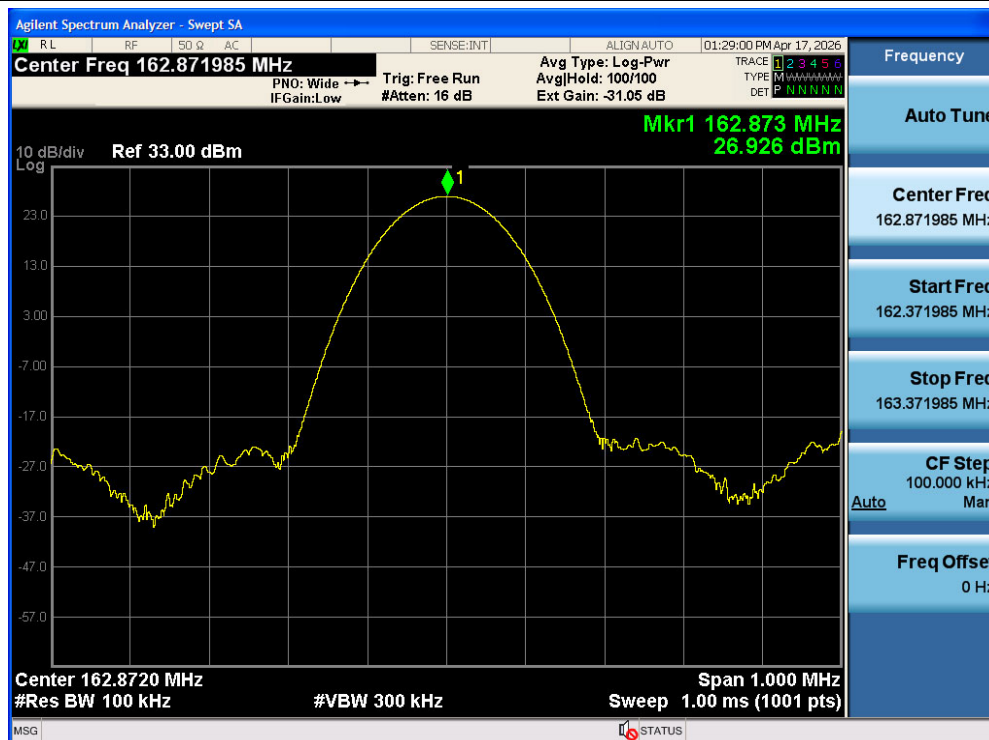
#E.R.P.(dBm) = Output Power(dBm) + Peak Ant. Gain(dBd)

Plot data of Input / Output Power

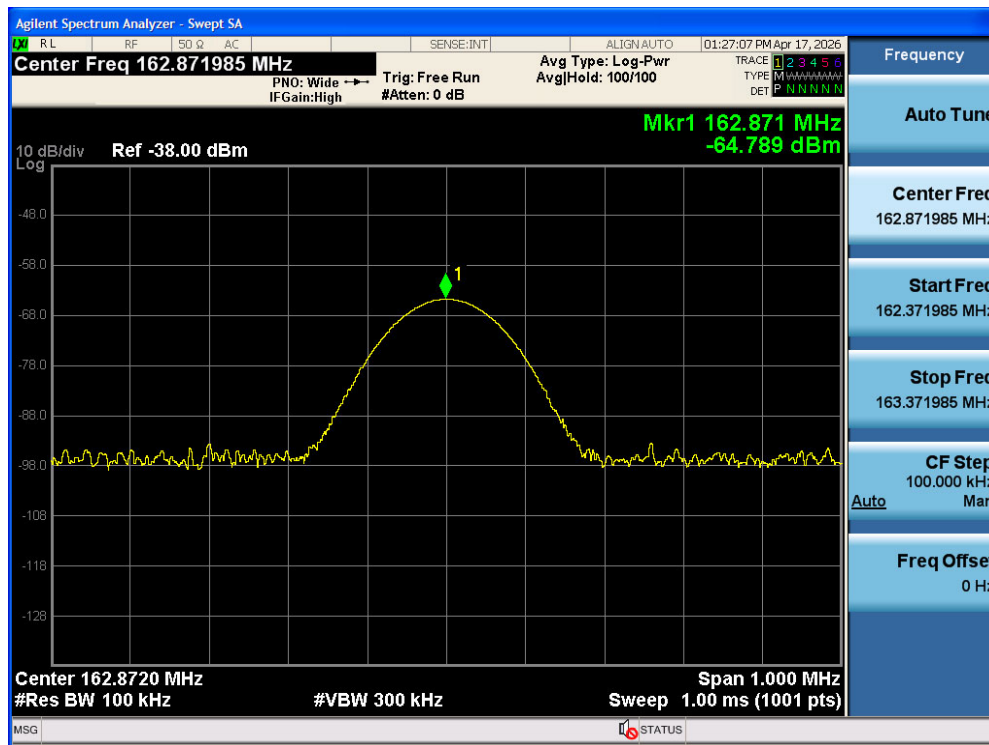
Input / VHF (150.05 ~ 173.4) / Uplink



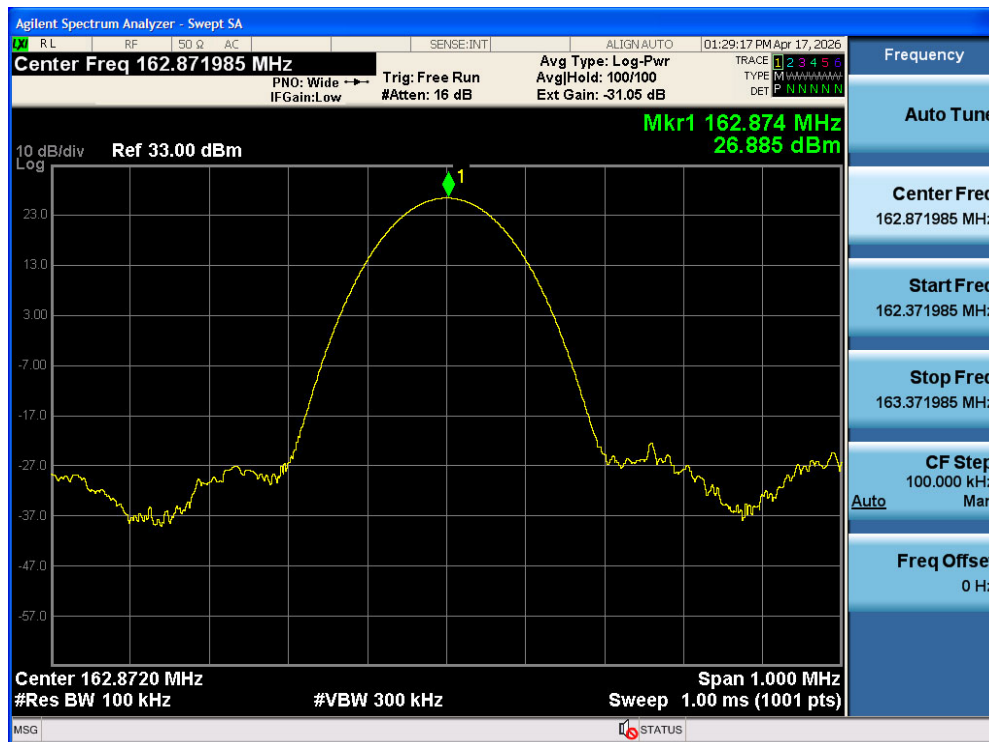
Output/ VHF (150.05 ~ 173.4) / Uplink



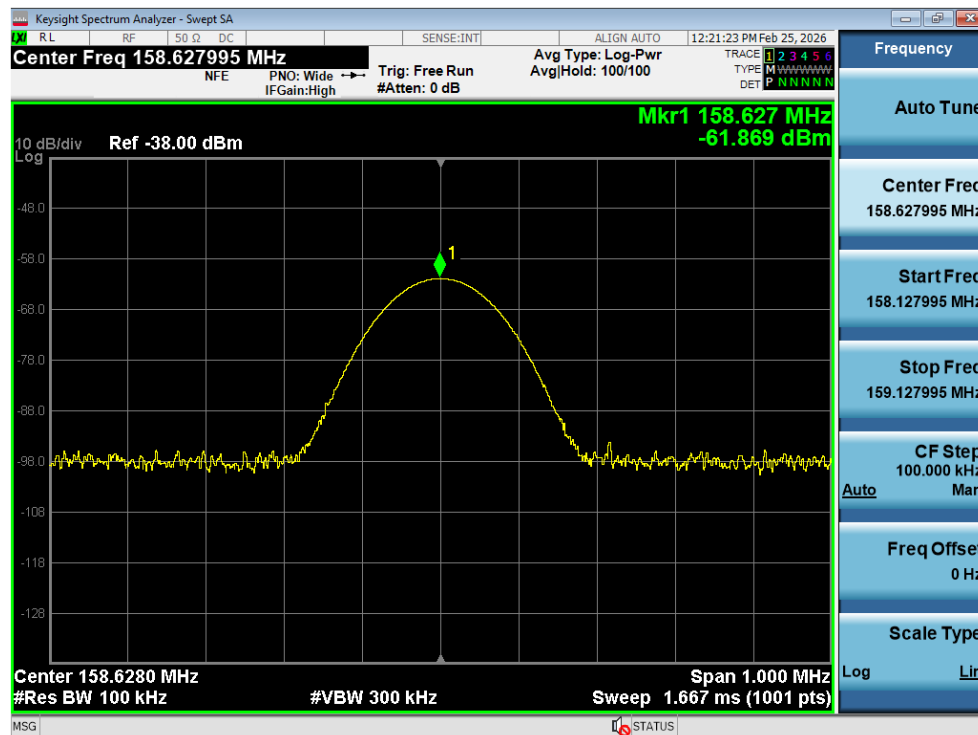
Input @ + 3 dB AGC threshold / VHF (150.05 ~ 173.4) / Uplink



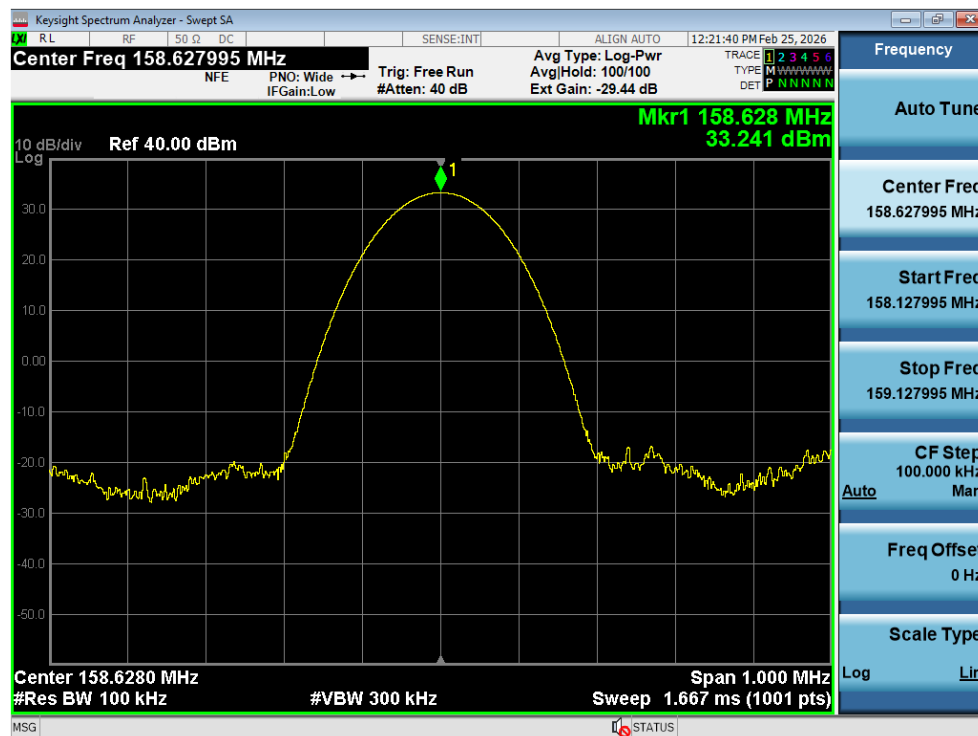
Output @ + 3 dB AGC threshold/ VHF (150.05 ~ 173.4) / Uplink



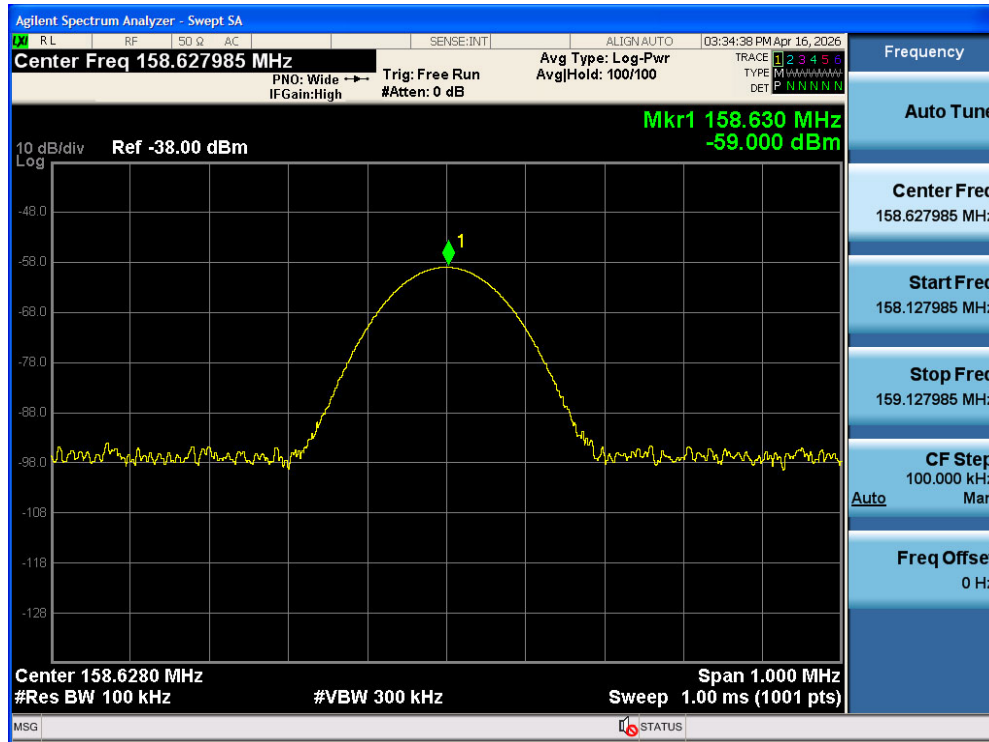
Input / VHF (150.05 ~ 173.4) / Downlink



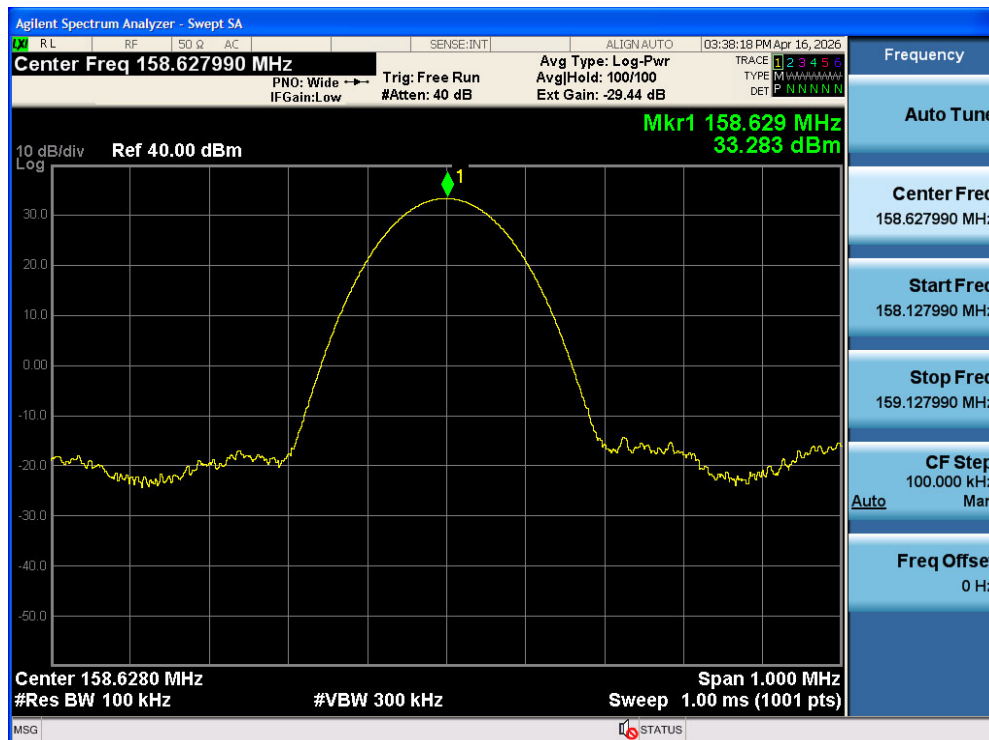
Output/ VHF (150.05 ~ 173.4) / Downlink



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



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



5.6. NOISE FIGURE

Test Requirements:

§ 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) The noise figure of a signal booster must not exceed 9 dB in either direction.

Test Procedures:

Measurements were in accordance with Agilent Application Note 57-1, 'The Direct Noise Measurement Method'.

The output power of the device is measured with an input termination at a temperature of approximately 290K. If the gain of the device and noise bandwidth of the measurement system is known, the noise factor can be determined.

F_{sys} = System Noise Factor

N_o = Output Noise Power

k = Boltzmann's Constant

T_0 = Standard Noise Temperature (290K)

B = Noise Bandwidth

G = Gain

' kT_0B ' calculation result for 1 MHz noise bandwidth is -114 dBm/MHz.

'Gain' value can be obtained from the test performed previously.

For measure the 'output noise power', perform the following procedure.

- a) Remove a signal generator from the input port of EUT then terminate it.
- b) Turn off the AGC function in EUT.
- c) Connect a spectrum analyzer to output port of EUT.
- d) Set the RBW 1 MHz. and set the VBW to $\geq 3 \times RBW$.
- e) Measure the maximum output noise power for EUT pass band.

After the measurement, calculate the noise figure according to the following formular.

$$\text{Noise Figure} = \text{Noise Output Power} - kT_0B - \text{Gain}$$

Test Results:

Test Band	Link	Input Power (dBm)	Output Power (dBm)	Gain (dB)	kT ₀ B (dBm/MHz)	Measured Value (dBm)	Noise Figure (dB)
VHF (150.05 ~ 173.4)	Uplink	-67.74	26.93	94.66	-114	-19.01	0.33
	Downlink	-61.87	33.24	95.11	-114	-18.69	0.20