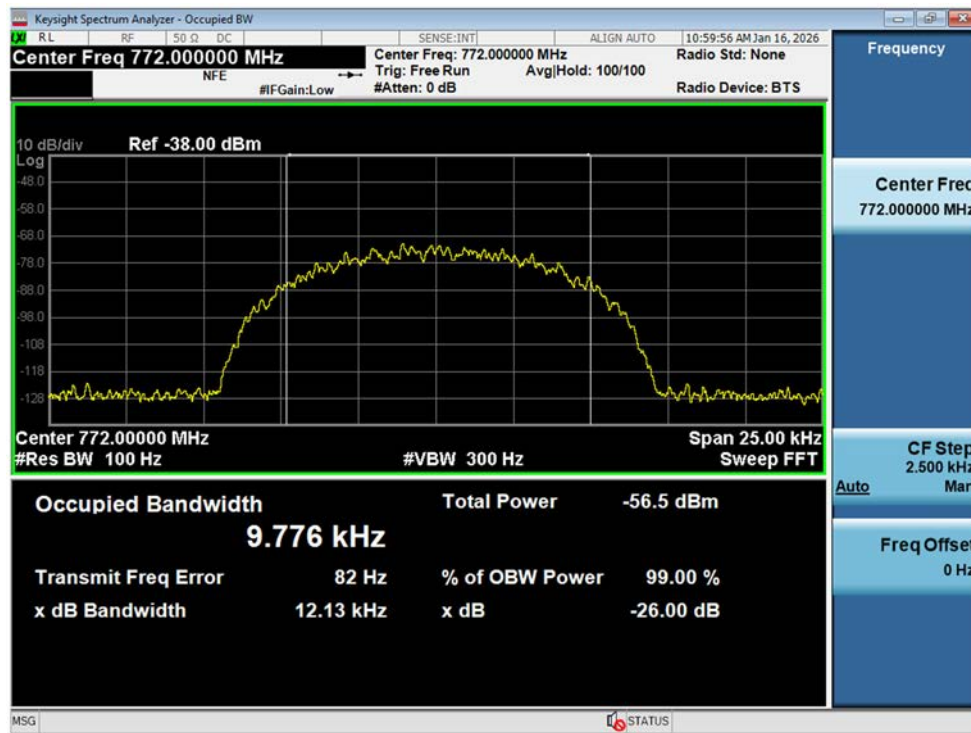


Input / Public Safety Narrowband / Downlink / P25 Phase 2 (H-DQPSK)



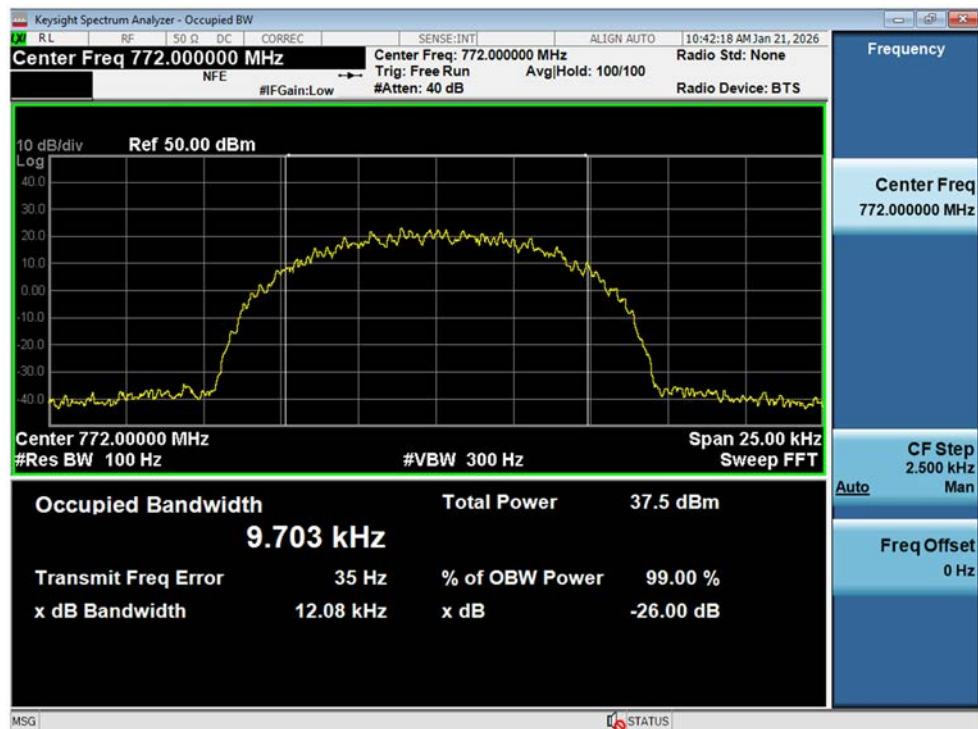
Output / Public Safety Narrowband / Downlink / P25 Phase 2 (H-DQPSK)



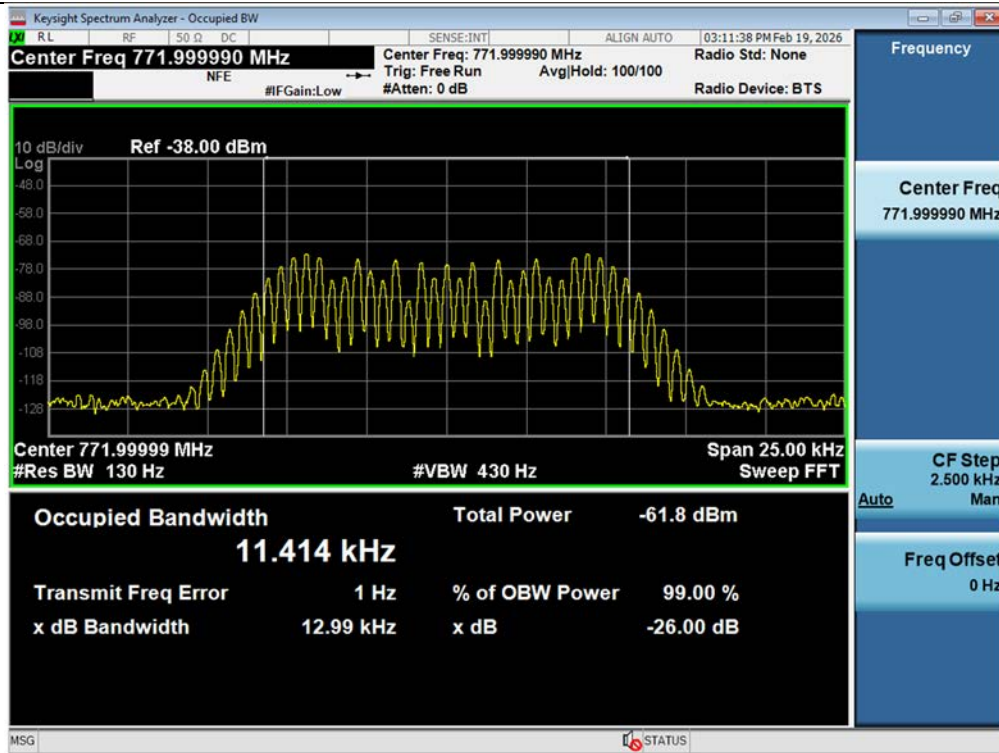
3 dB above the AGC threshold Input / Public Safety Narrowband / Downlink / P25 Phase 2 (H-DQPSK)



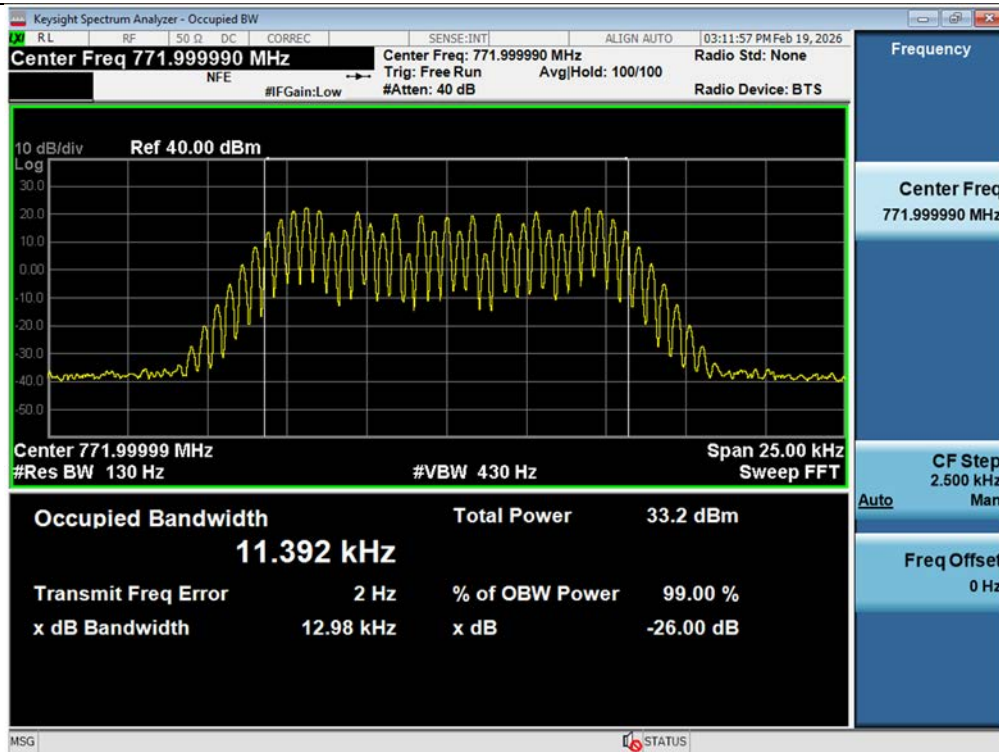
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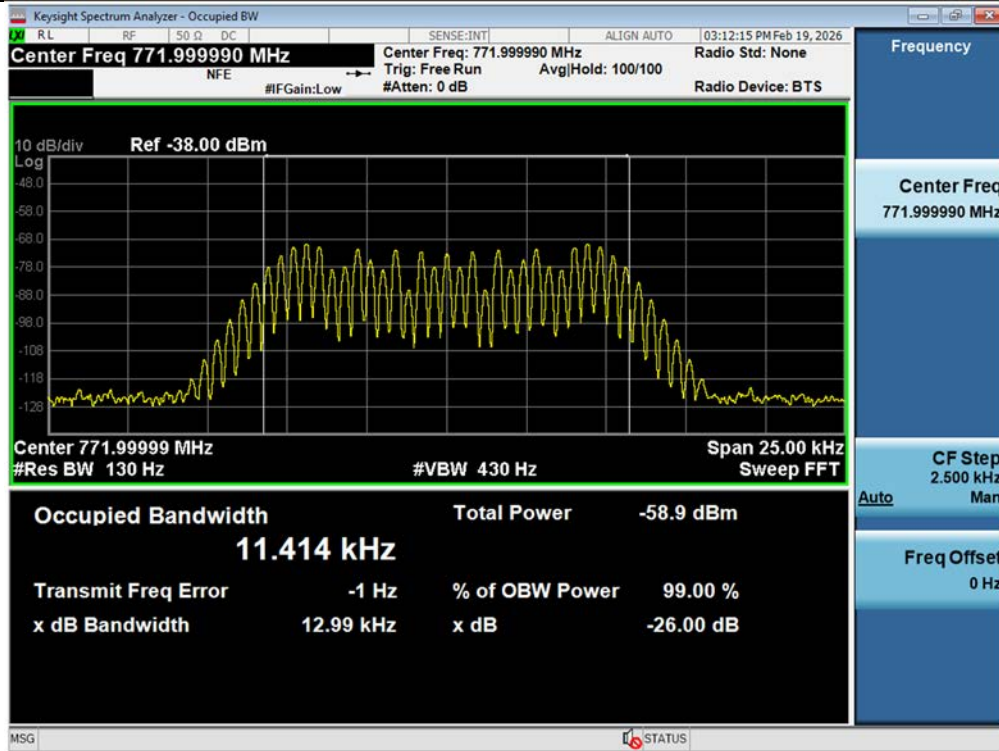
Input / Public Safety Narrowband / Downlink / FM (12.5 kHz)



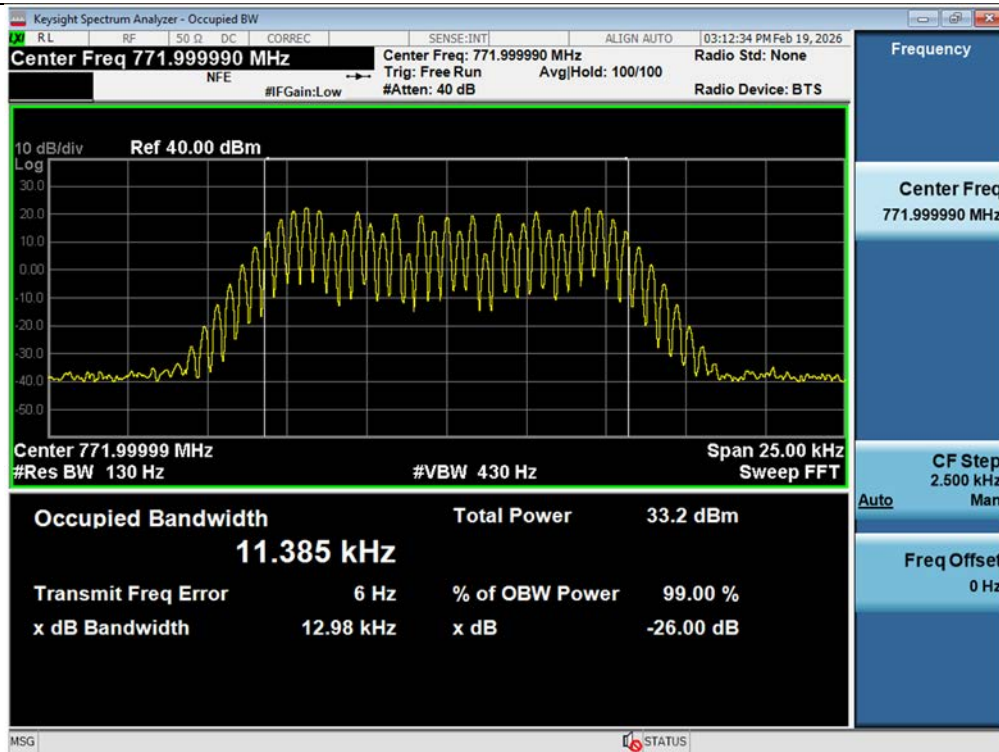
Output / Public Safety Narrowband / Downlink / FM (12.5 kHz)



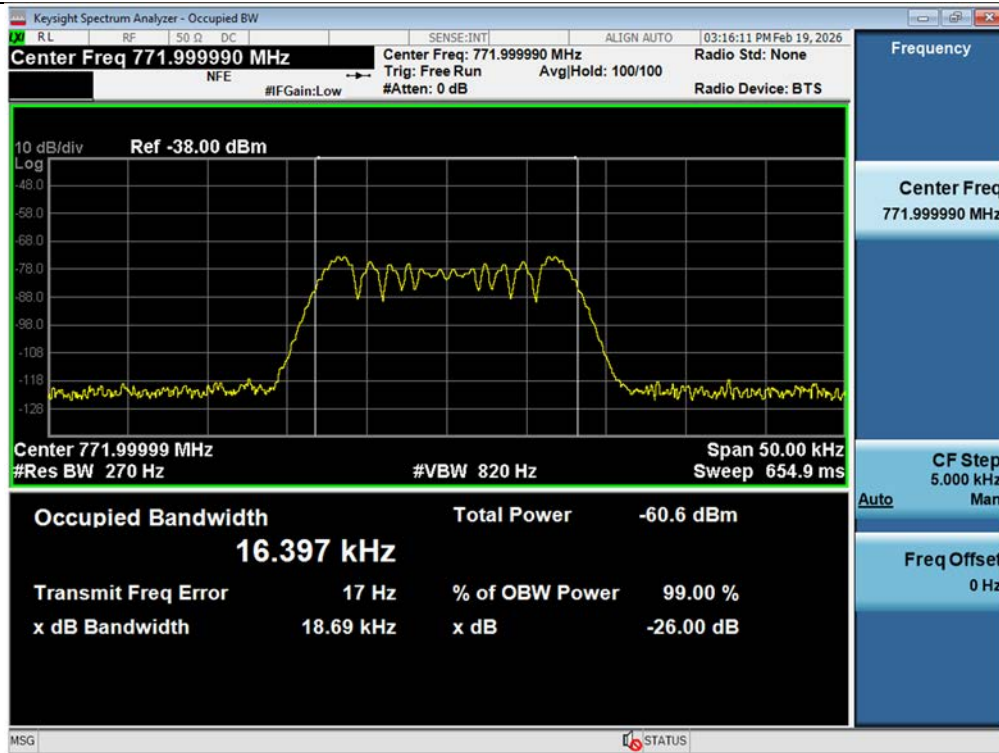
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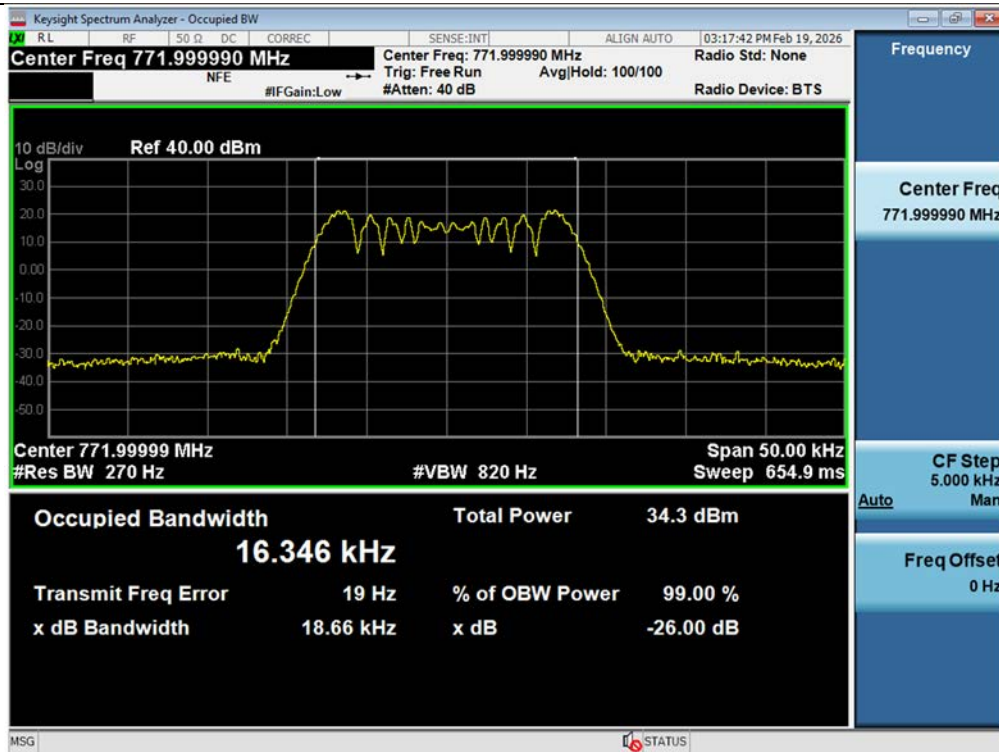
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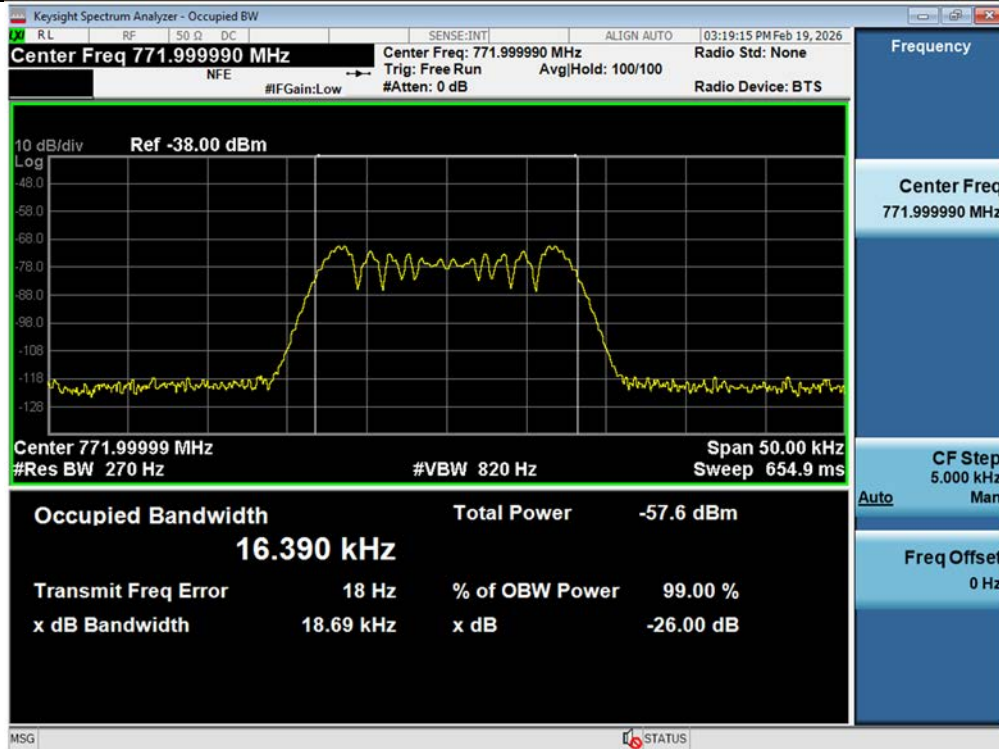
Input / Public Safety Narrowband / Downlink / FM (25 kHz)



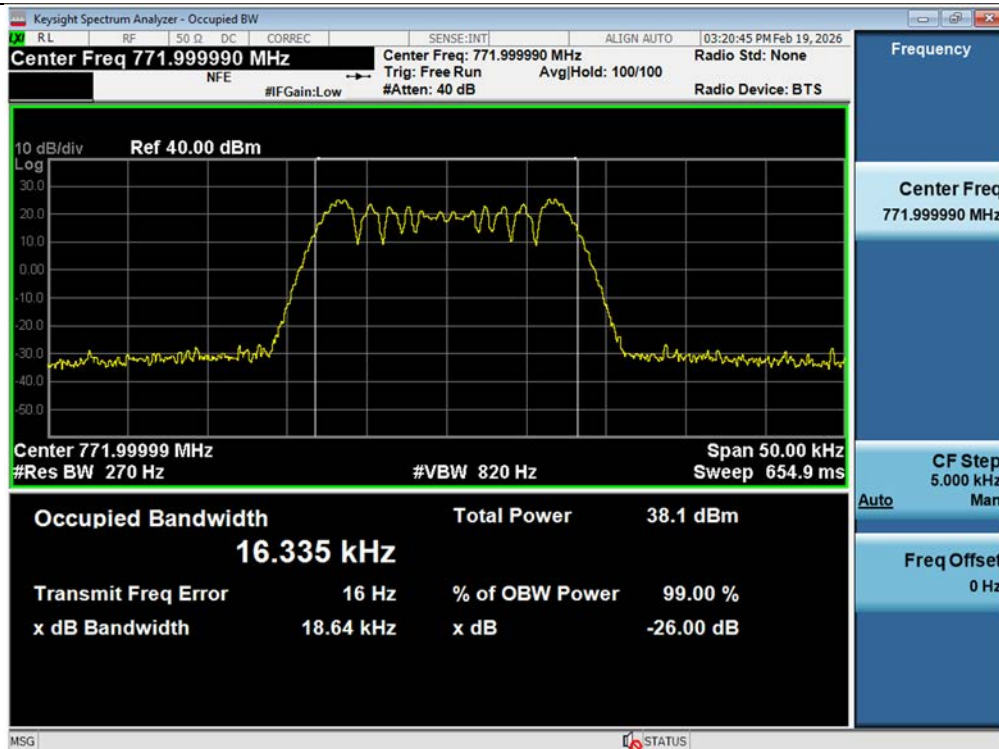
Output / Public Safety Narrowband / Downlink / FM (25 kHz)



3 dB above the AGC threshold Input / Public Safety Narrowband / Downlink / FM (25 kHz)



3 dB above the AGC threshold output / Public Safety Narrowband / Downlink / FM (25 kHz)



Input / NPSPAC / Downlink / P25 Phase 1 (C4FM)



Output / NPSPAC / Downlink / P25 Phase 1 (C4FM)



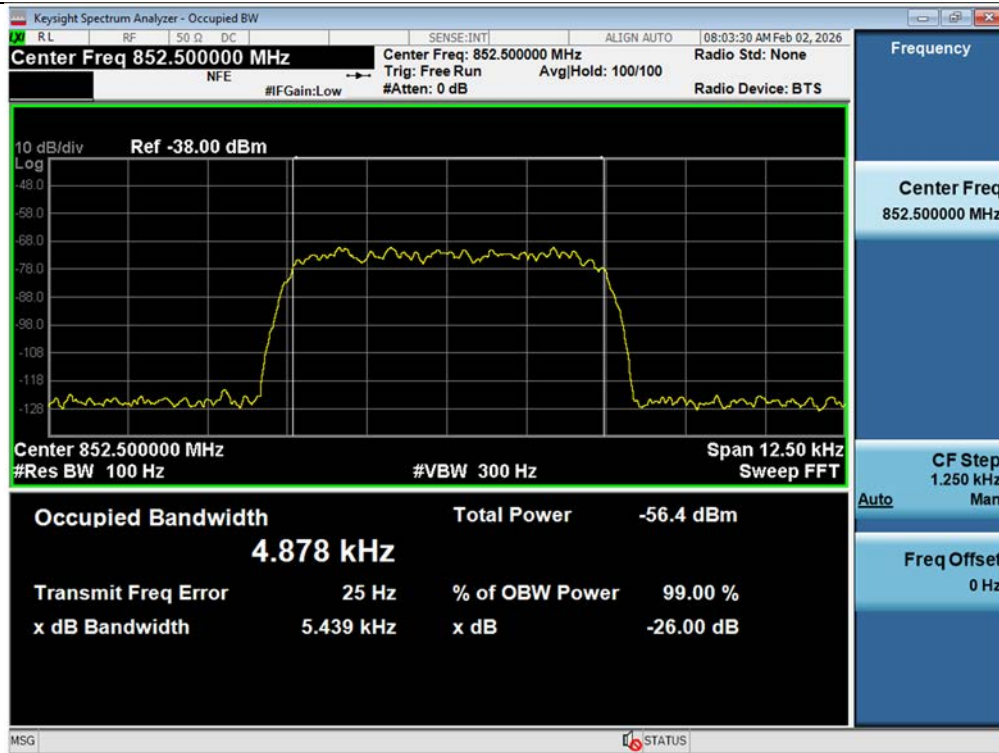
3 dB above the AGC threshold Input / NPSPAC / Downlink / P25 Phase 1 (C4FM)



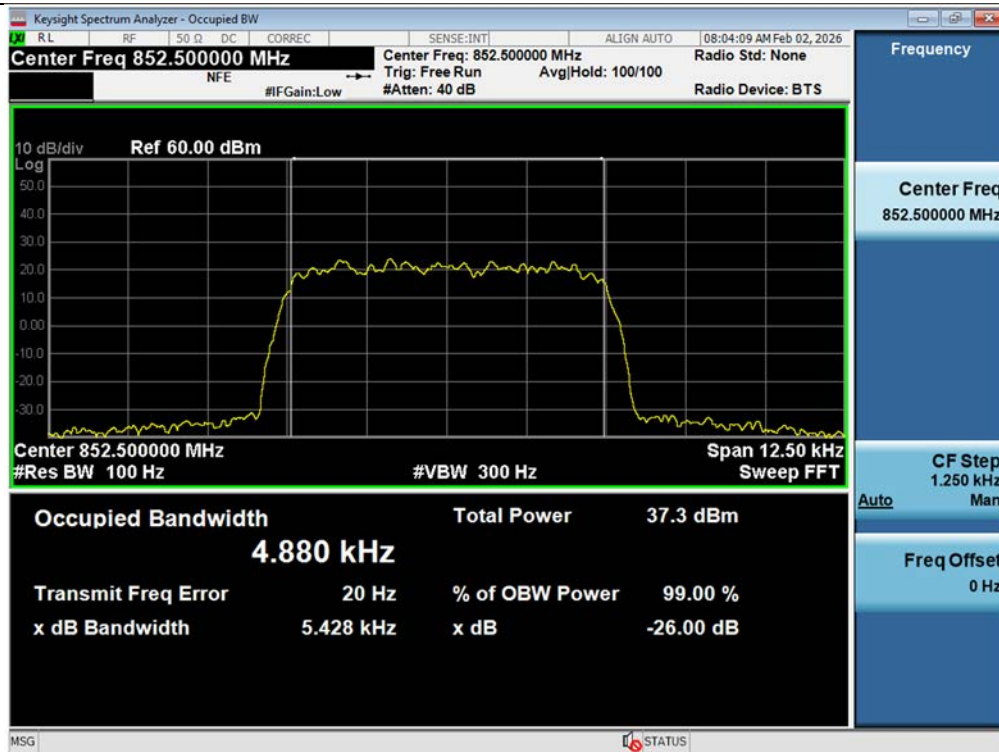
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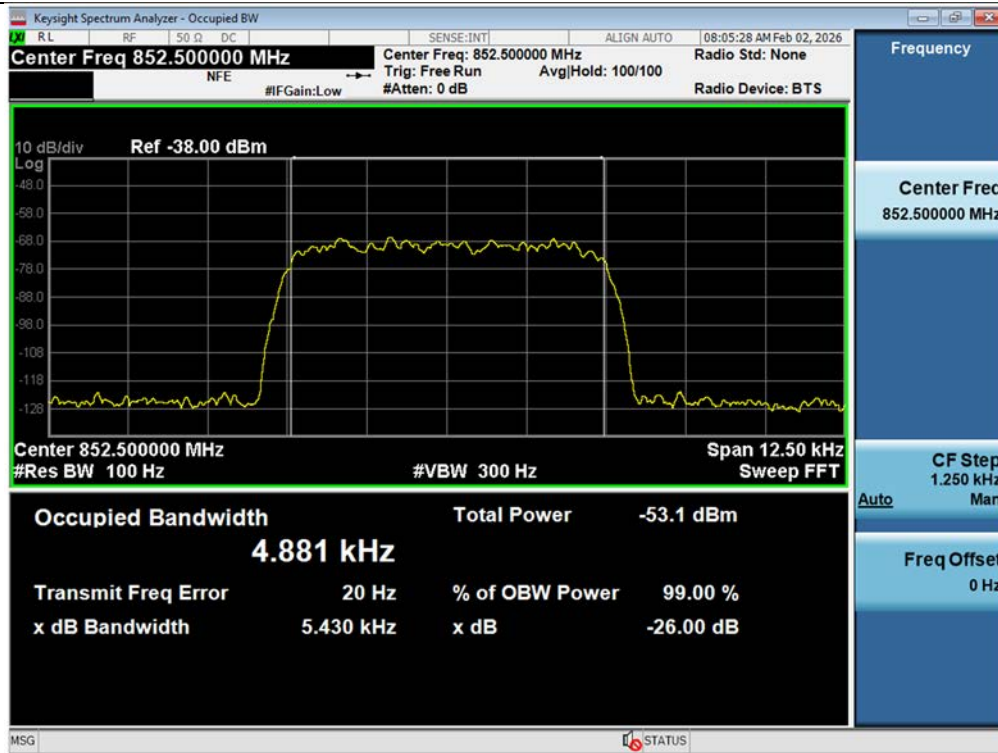
Input / NPSPAC / Downlink / P25 Phase 1 (CQPSK)



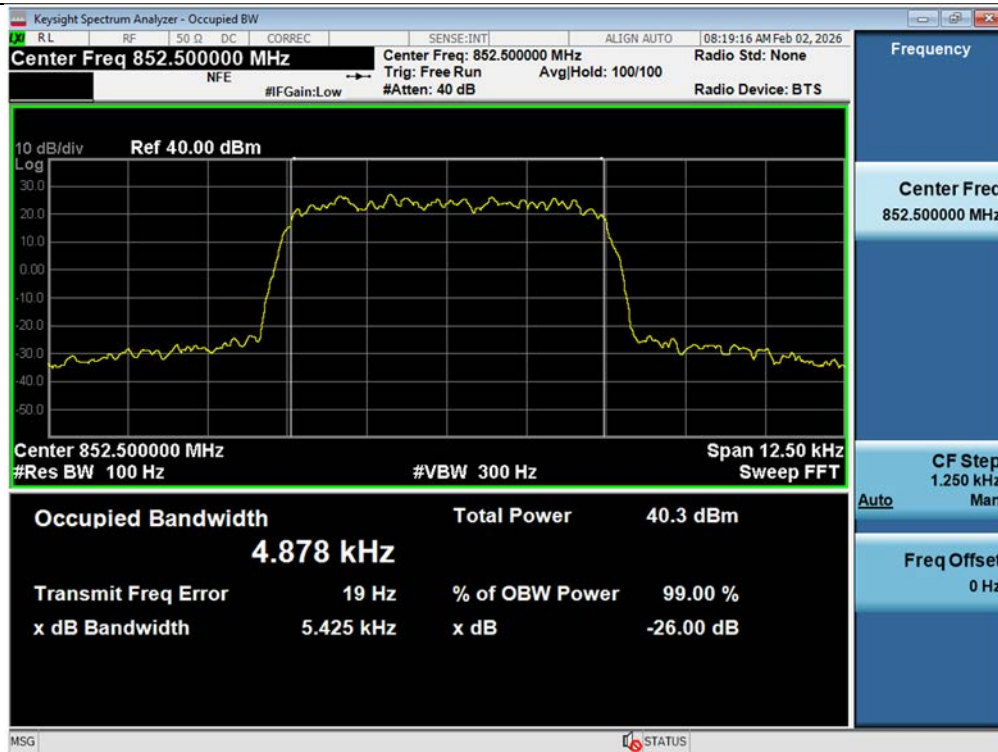
Output / NPSPAC / Downlink / P25 Phase 1 (CQPSK)



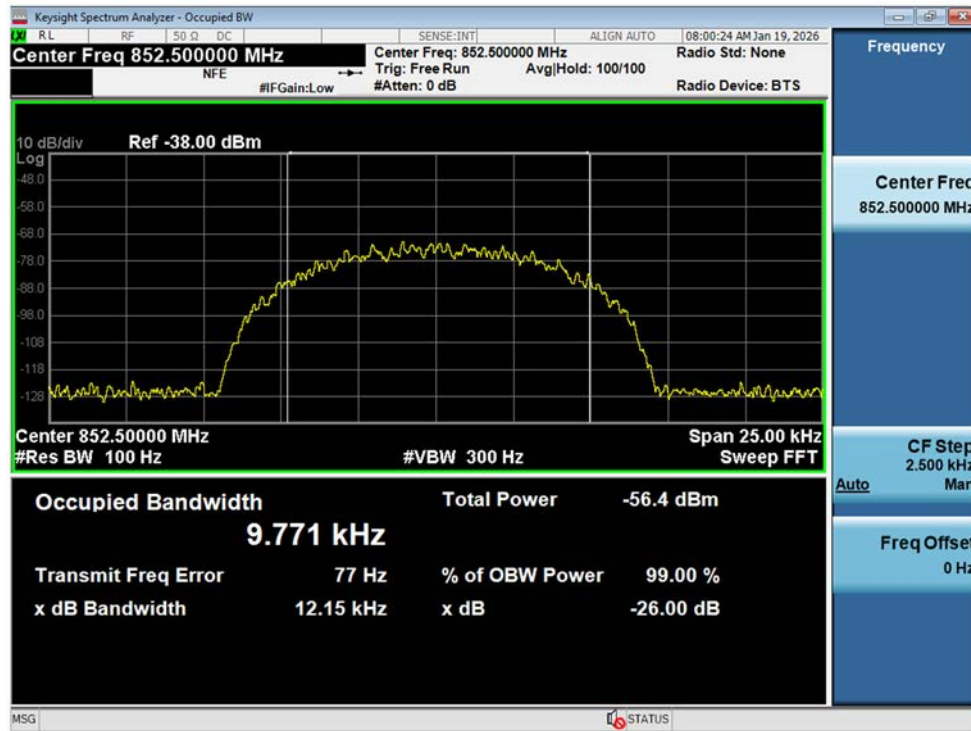
3 dB above the AGC threshold Input / NPSPAC / Downlink / P25 Phase 1 (CQPSK)



3 dB above the AGC threshold output / NPSPAC / Downlink / P25 Phase 1 (CQPSK)



Input / NPSPAC / Downlink / P25 Phase 2 (H-DQPSK)



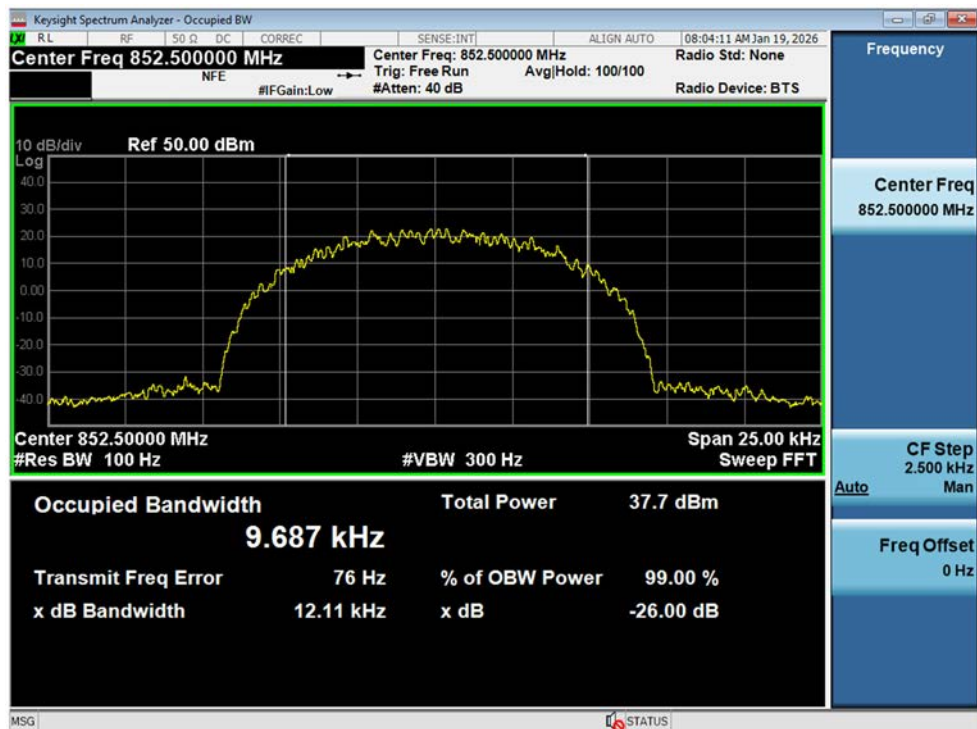
Output / NPSPAC / Downlink / P25 Phase 2 (H-DQPSK)



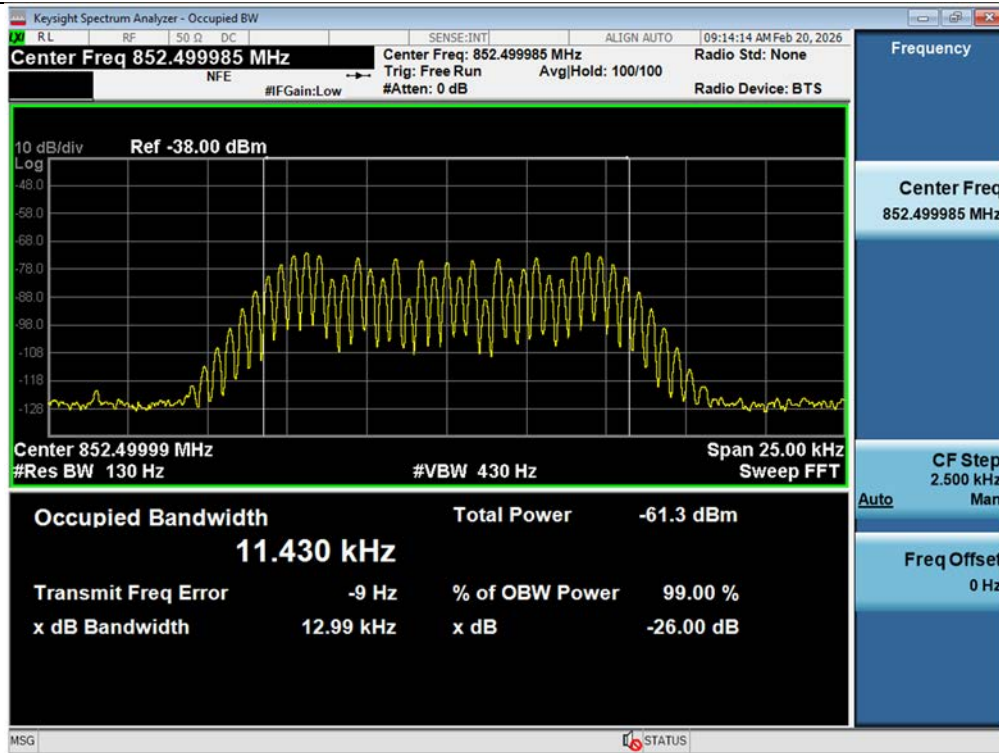
3 dB above the AGC threshold Input / NPSPAC / Downlink / P25 Phase 2 (H-DQPSK)



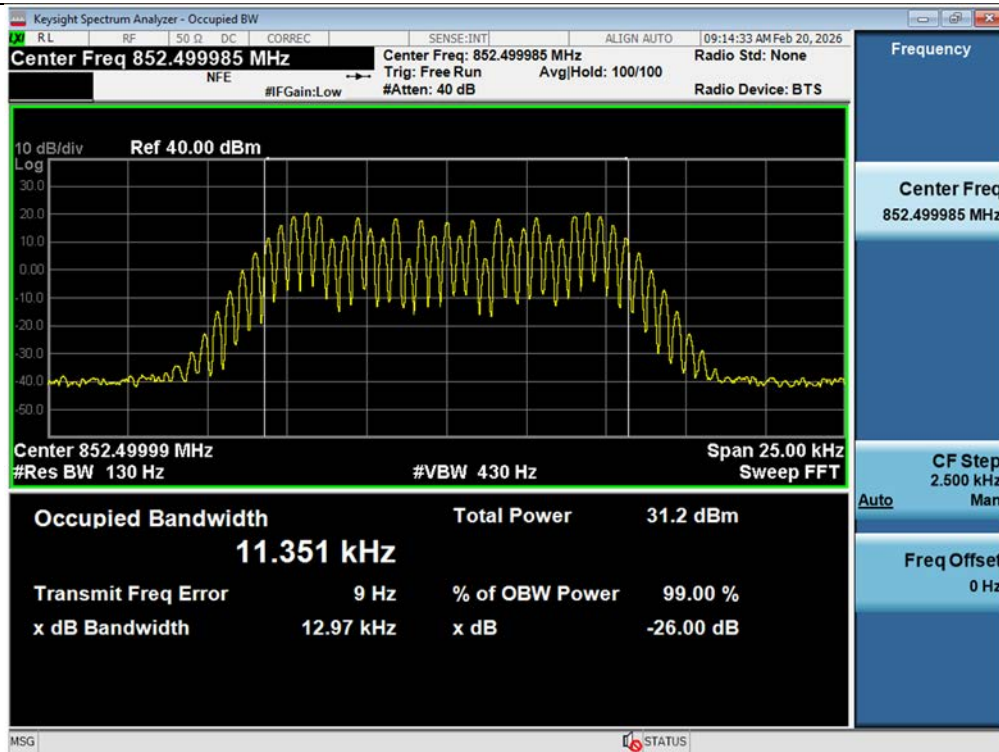
3 dB above the AGC threshold output / NPSPAC / Downlink / P25 Phase 2 (H-DQPSK)



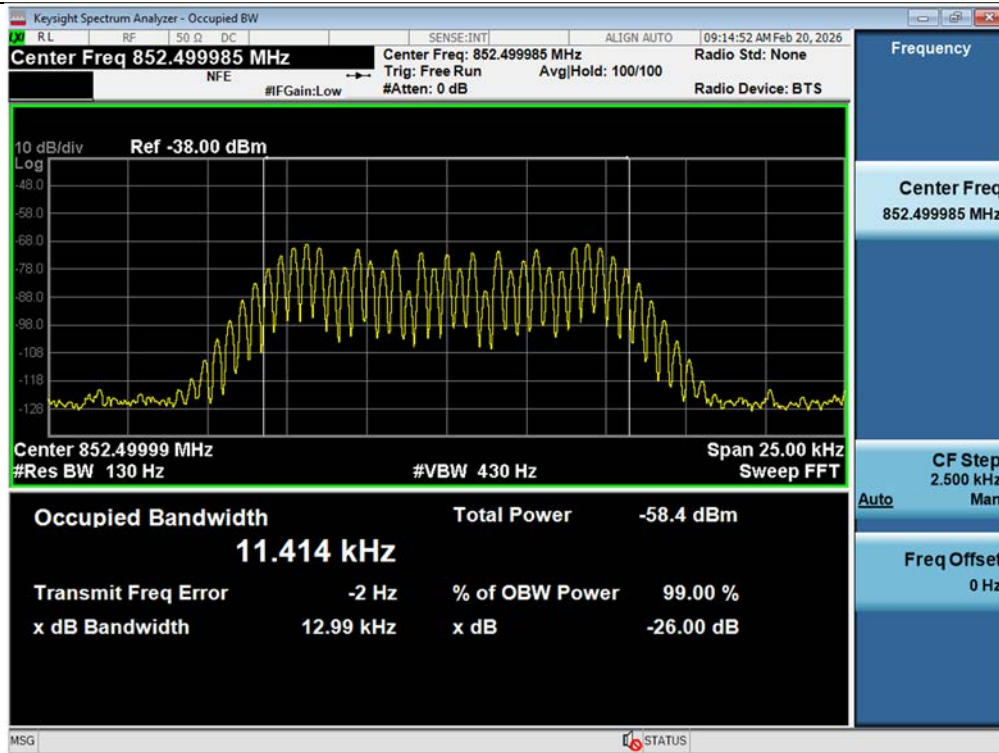
Input / NPSPAC / Downlink / FM (12.5 kHz)



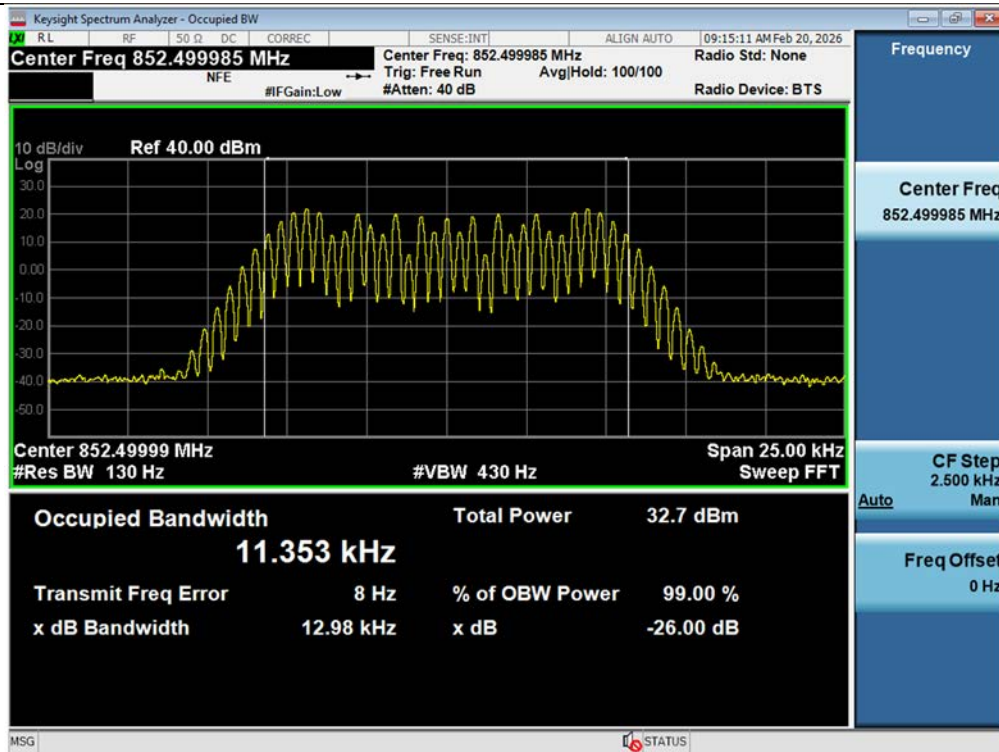
Output / NPSPAC / Downlink / FM (12.5 kHz)



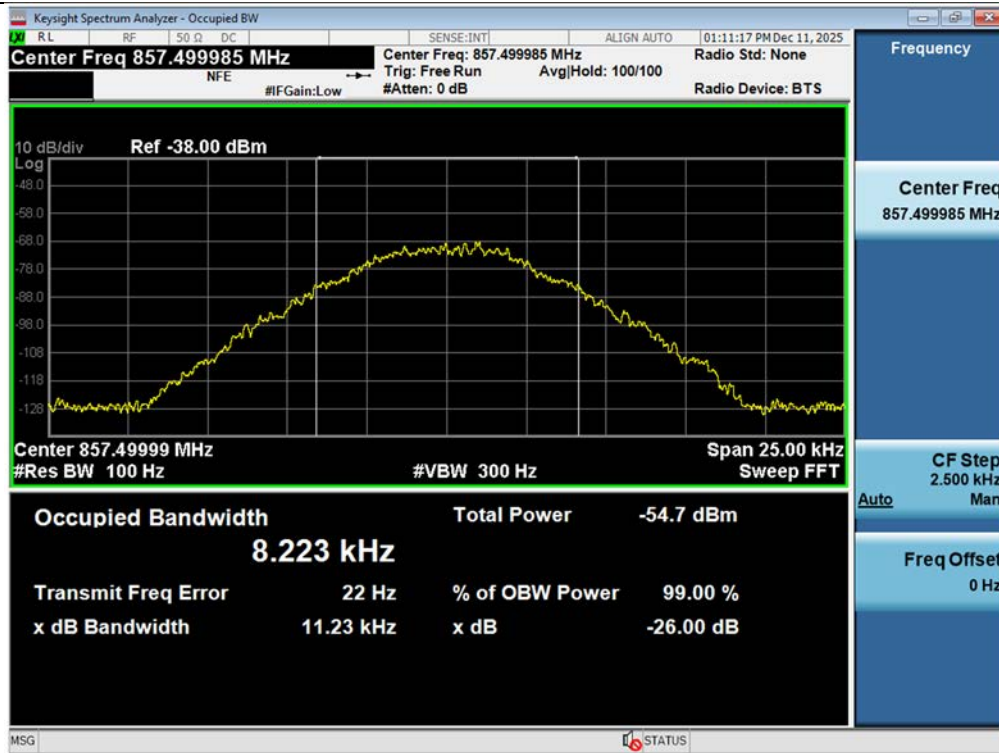
3 dB above the AGC threshold Input / NPSPAC / Downlink / FM (12.5 kHz)



3 dB above the AGC threshold output / NPSPAC / Downlink / FM (12.5 kHz)



Input / B/ILT; SMR / Downlink / P25 Phase 1 (C4FM)



Output / B/ILT; SMR / Downlink / P25 Phase 1 (C4FM)



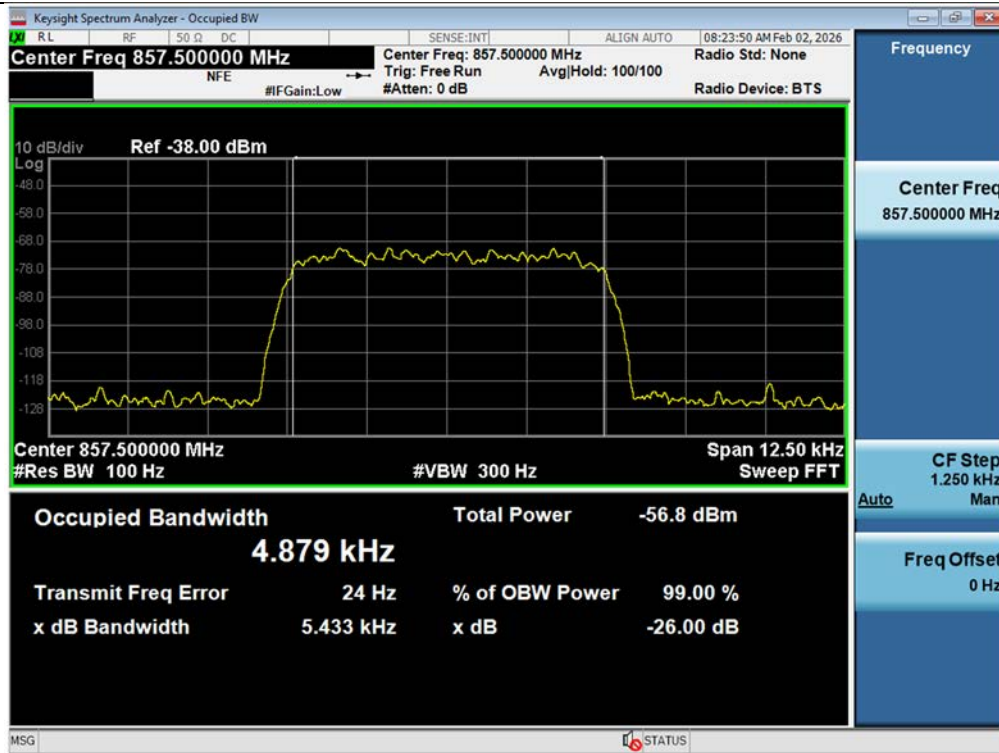
3 dB above the AGC threshold Input / B/ILT; SMR / Downlink / P25 Phase 1 (C4FM)



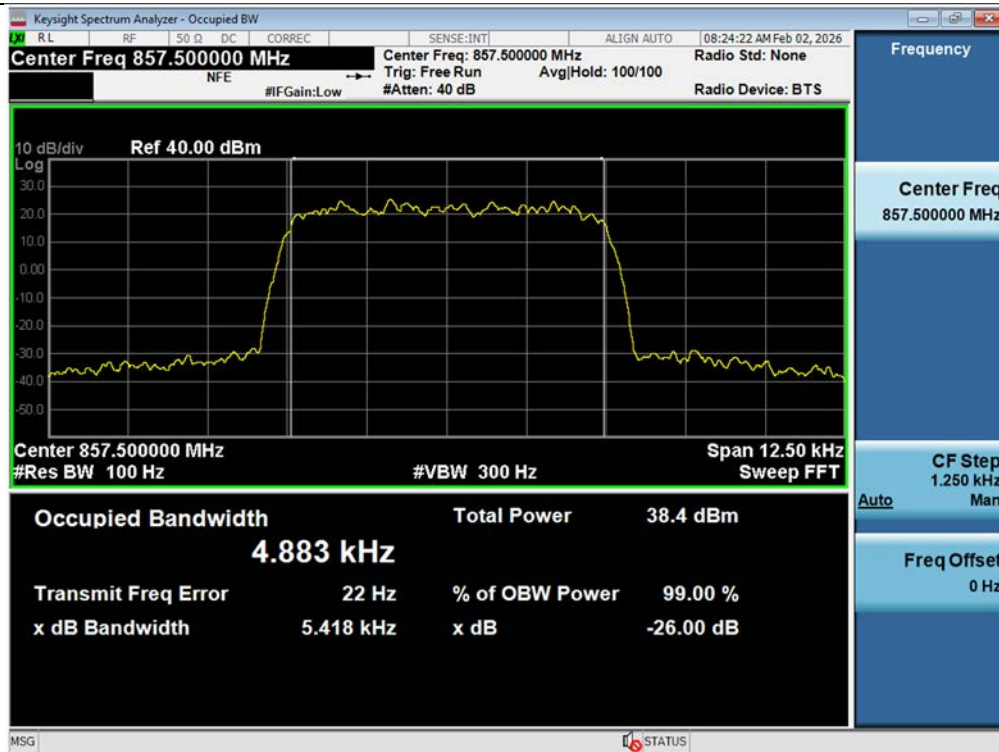
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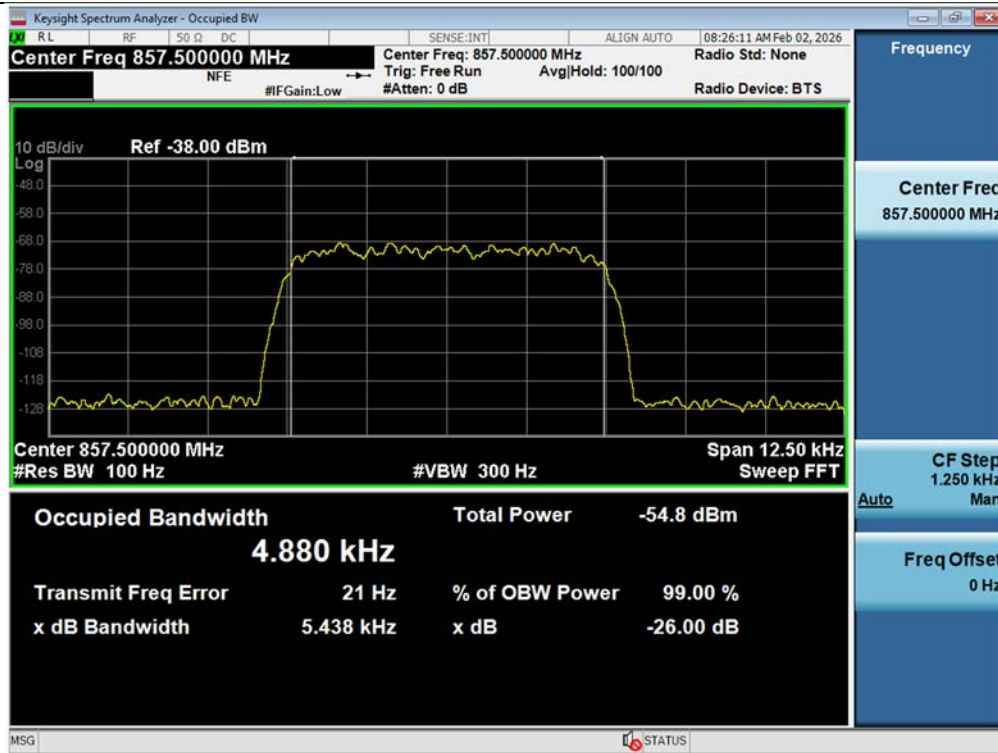
Input / B/ILT; SMR / Downlink / P25 Phase 1 (CQPSK)



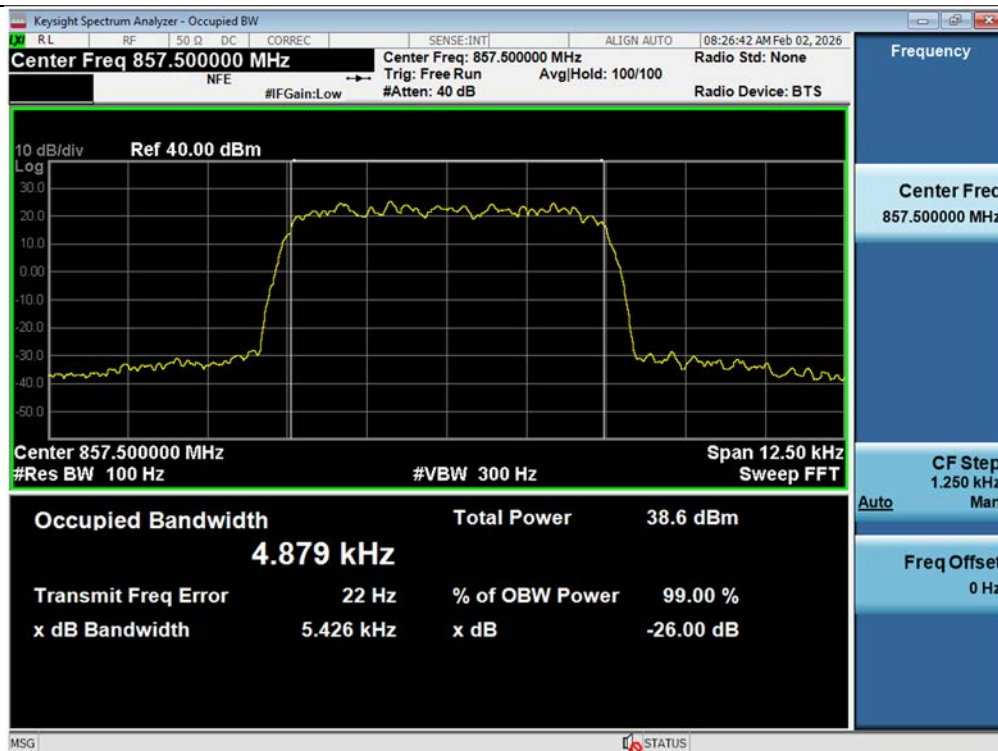
Output / B/ILT; SMR / Downlink / P25 Phase 1 (CQPSK)



3 dB above the AGC threshold Input / B/ILT; SMR / Downlink / P25 Phase 1 (CQPSK)



3 dB above the AGC threshold output / B/ILT; SMR / Downlink / P25 Phase 1 (CQPSK)



Input / B/ILT; SMR / Downlink / P25 Phase 2 (H-DQPSK)



Output / B/ILT; SMR / Downlink / P25 Phase 2 (H-DQPSK)



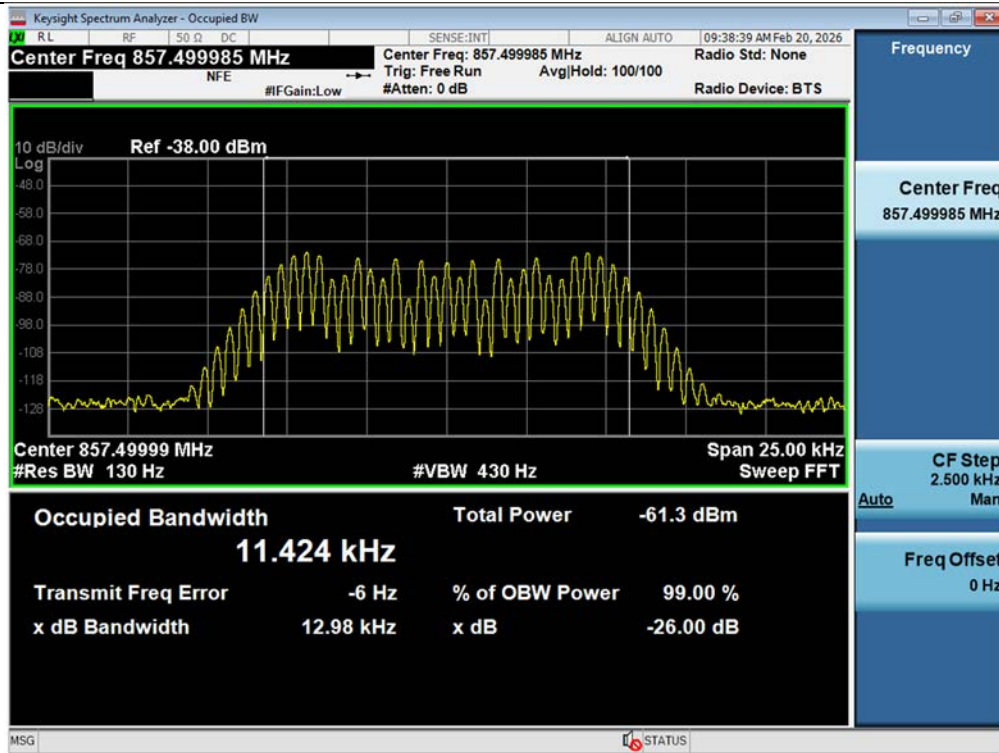
3 dB above the AGC threshold Input / B/ILT; SMR / Downlink / P25 Phase 2 (H-DQPSK)



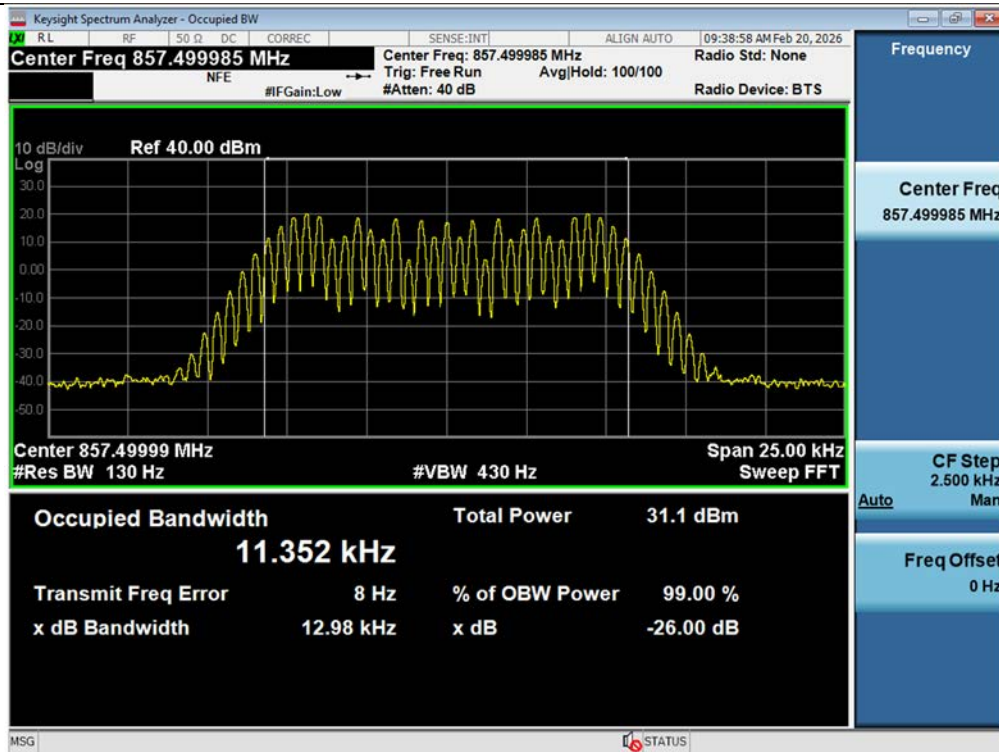
3 dB above the AGC threshold output / B/ILT; SMR / Downlink / P25 Phase 2 (H-DQPSK)



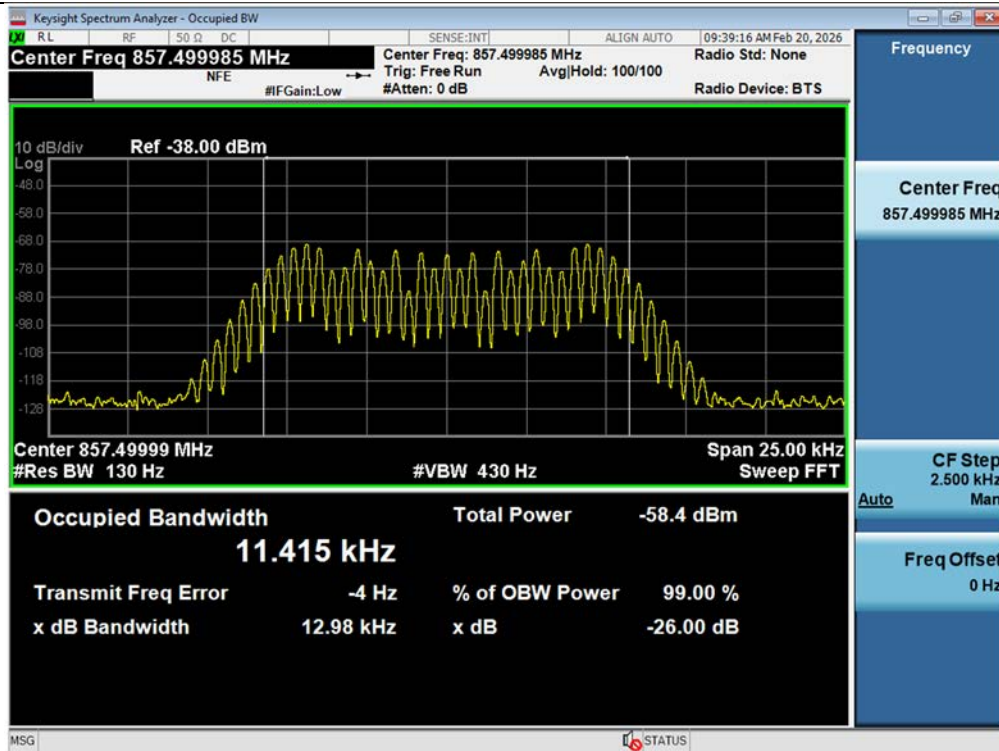
Input / B/ILT; SMR / Downlink / FM (12.5 kHz)



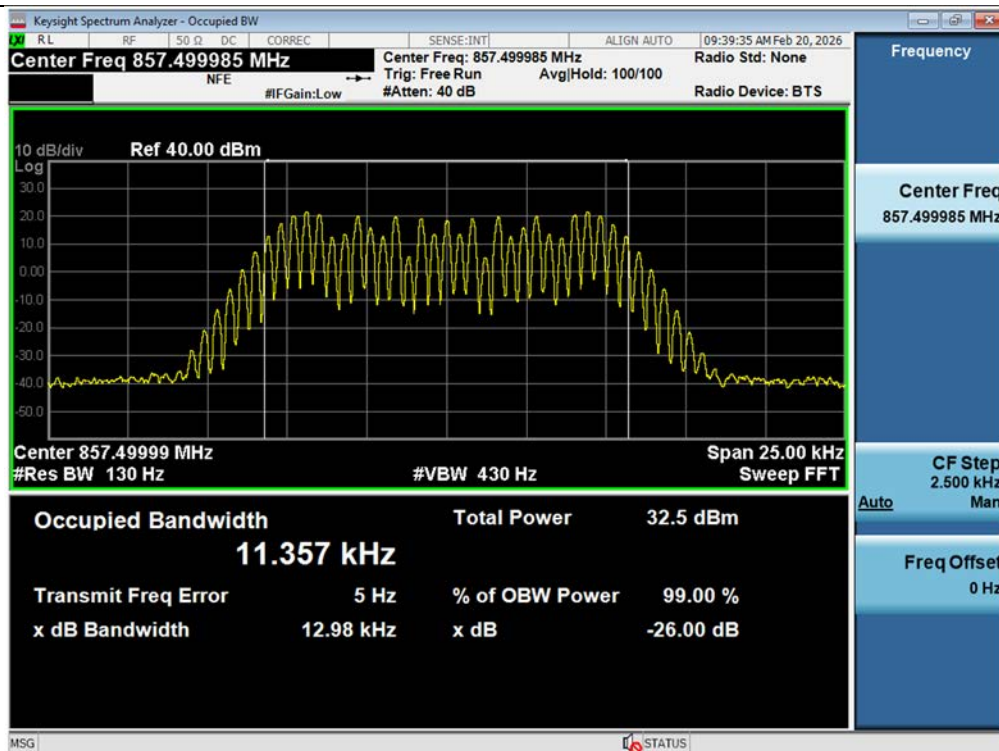
Output / B/ILT; SMR / Downlink / FM (12.5 kHz)



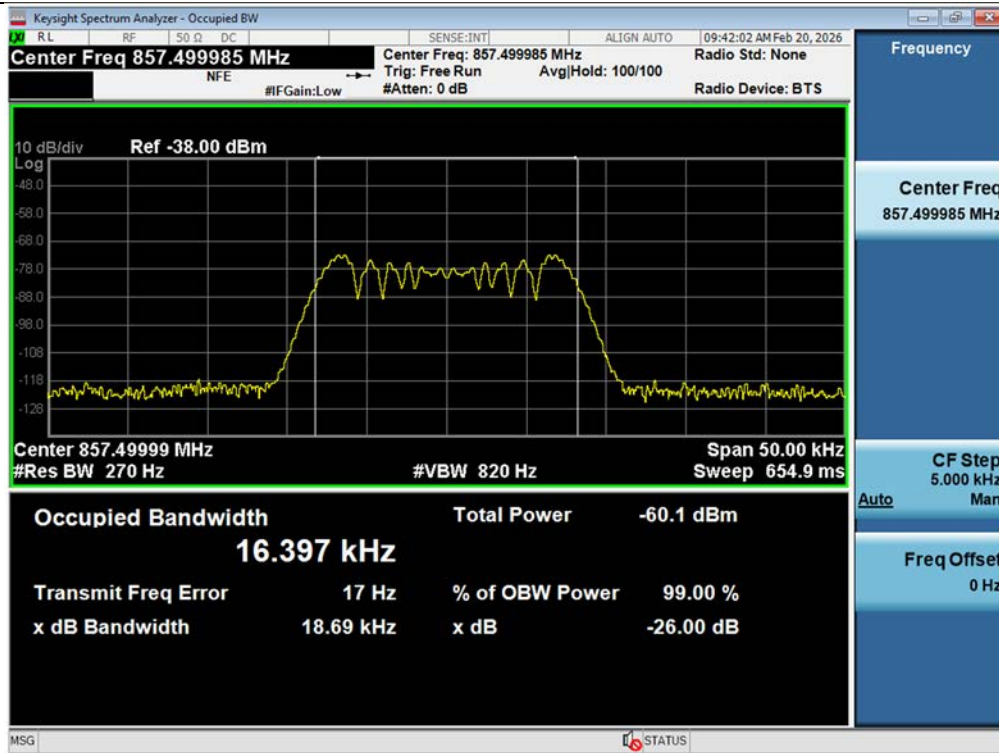
3 dB above the AGC threshold Input / B/ILT; SMR / Downlink / FM (12.5 kHz)



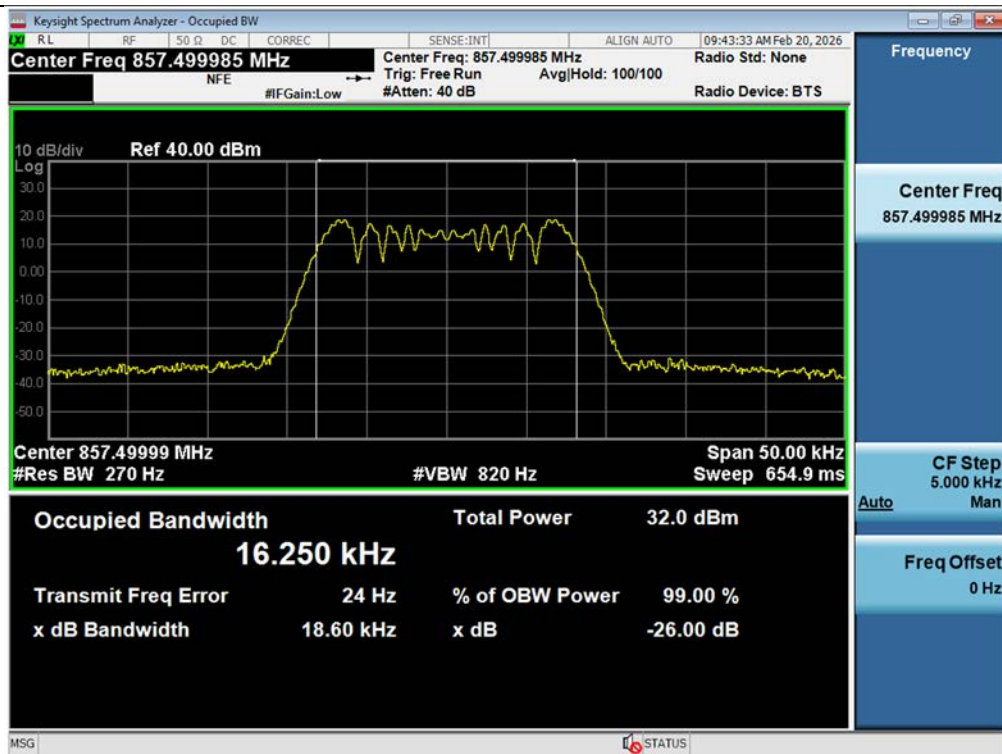
3 dB above the AGC threshold output / B/ILT; SMR / Downlink / FM (12.5 kHz)



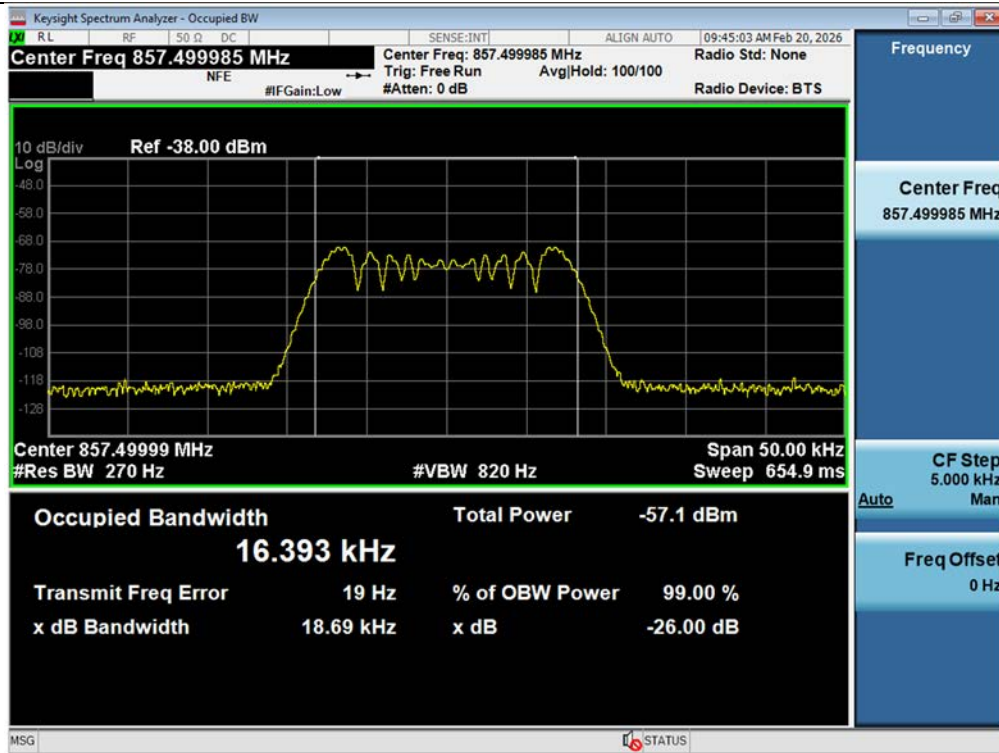
Input / B/ILT; SMR / Downlink / FM (25 kHz)



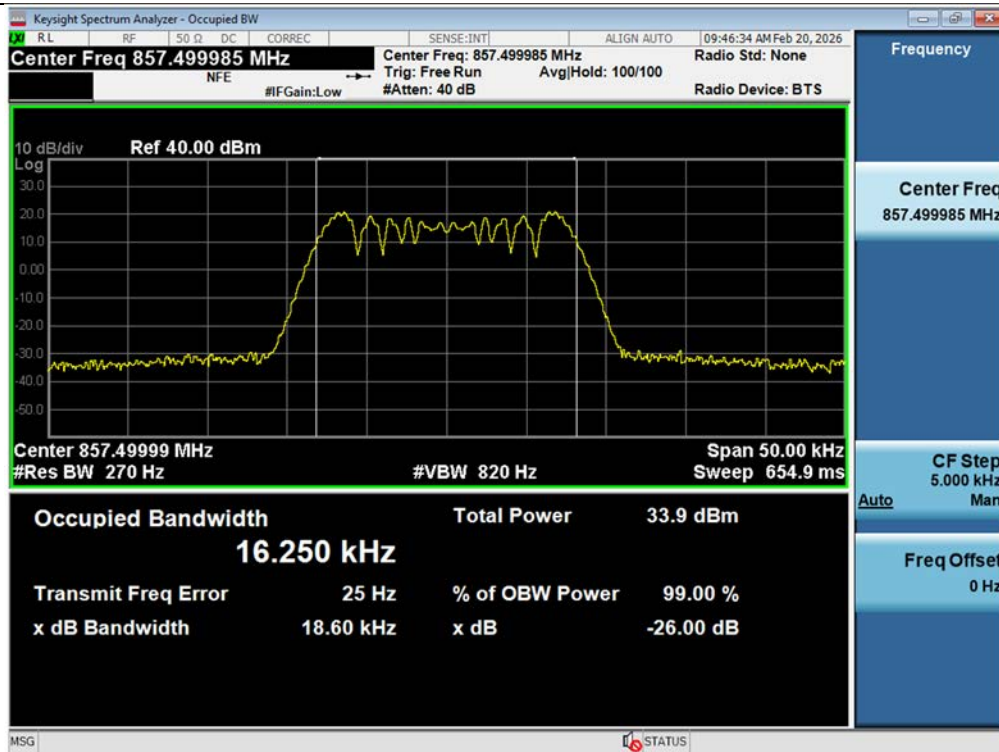
Output / B/ILT; SMR / Downlink / FM (25 kHz)



3 dB above the AGC threshold Input / B/ILT; SMR / Downlink / FM (25 kHz)



3 dB above the AGC threshold output / B/ILT; SMR / Downlink / FM (25 kHz)



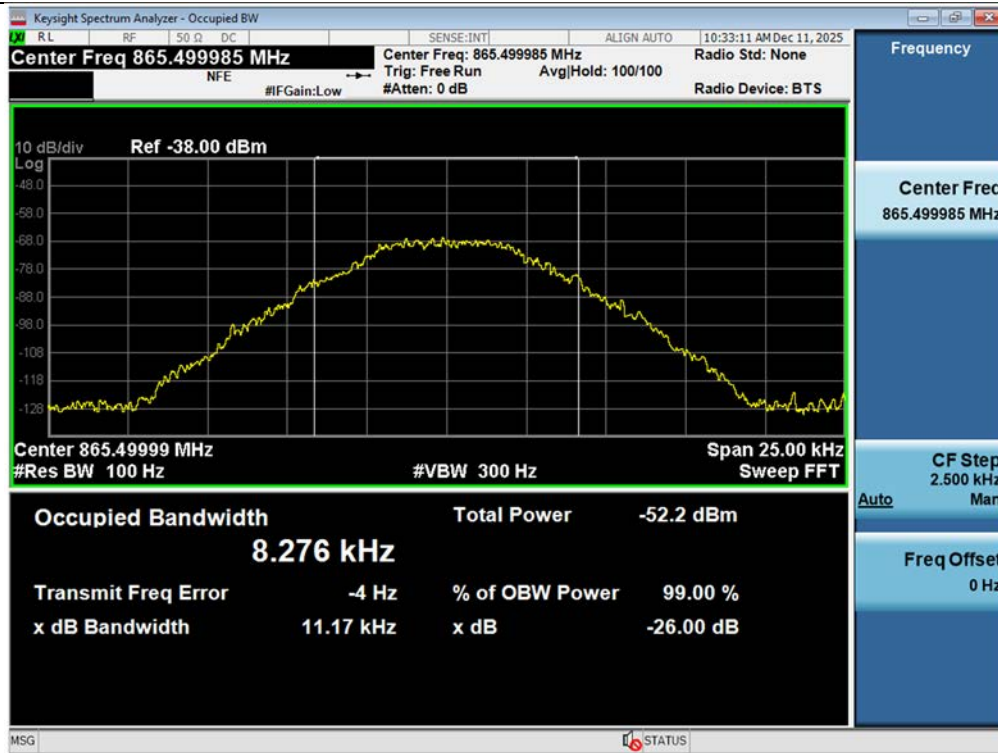
Input / ESMR / Downlink / P25 Phase 1 (C4FM)



Output / ESMR / Downlink / P25 Phase 1 (C4FM)



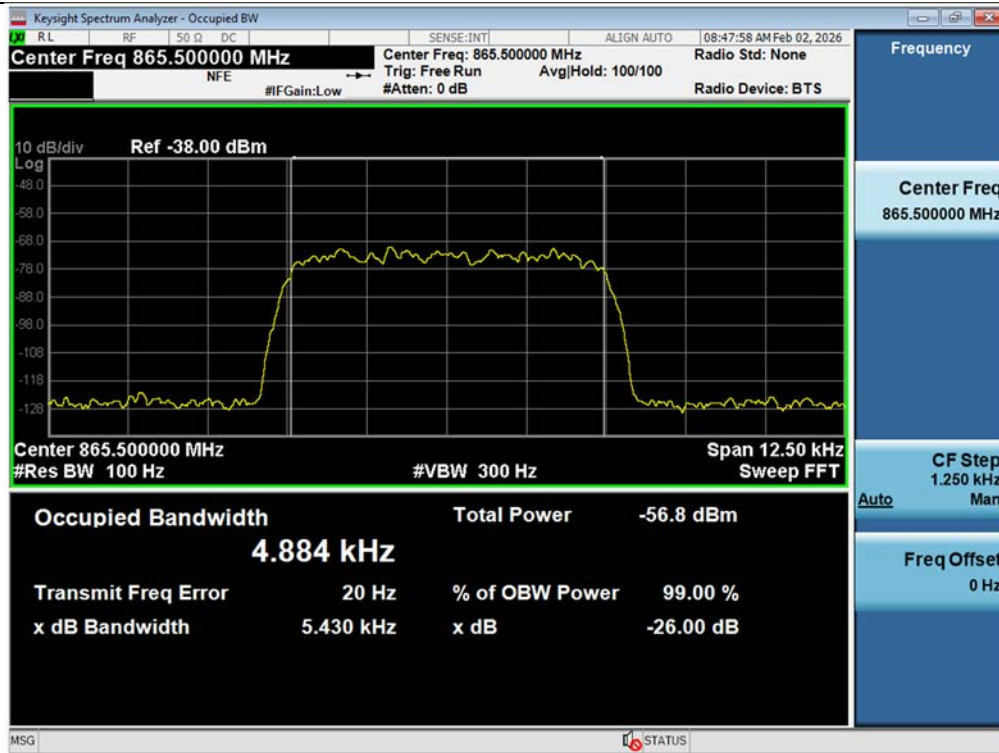
3 dB above the AGC threshold Input / ESMR / Downlink / P25 Phase 1 (C4FM)



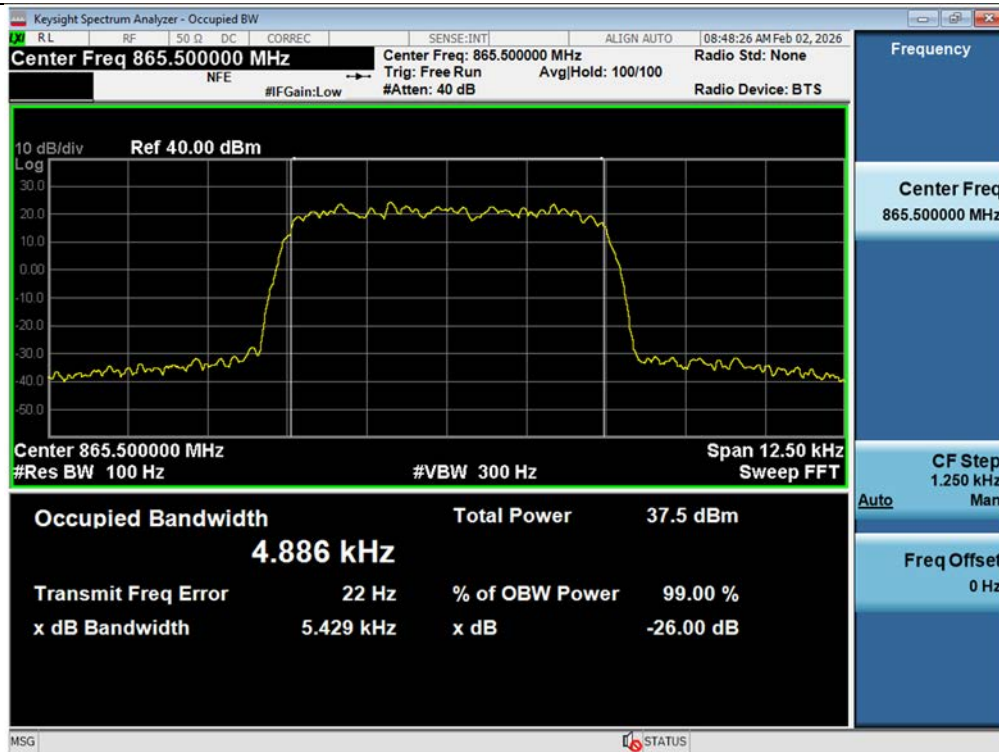
3 dB above the AGC threshold output / ESMR / Downlink / P25 Phase 1 (C4FM)



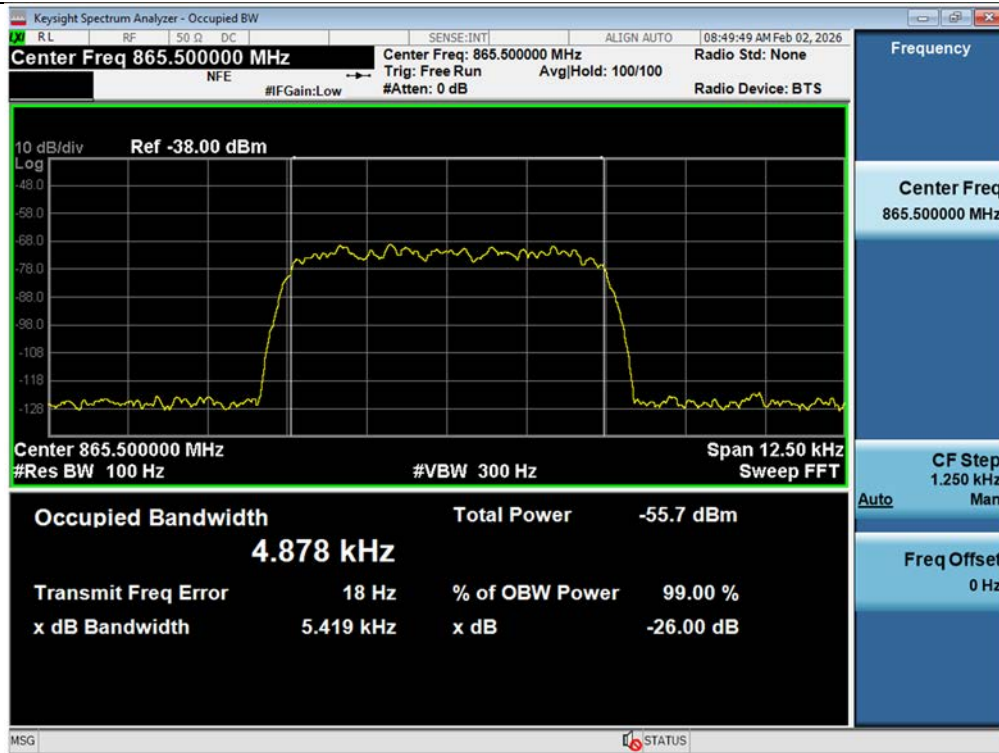
Input / ESMR / Downlink / P25 Phase 1 (CQPSK)



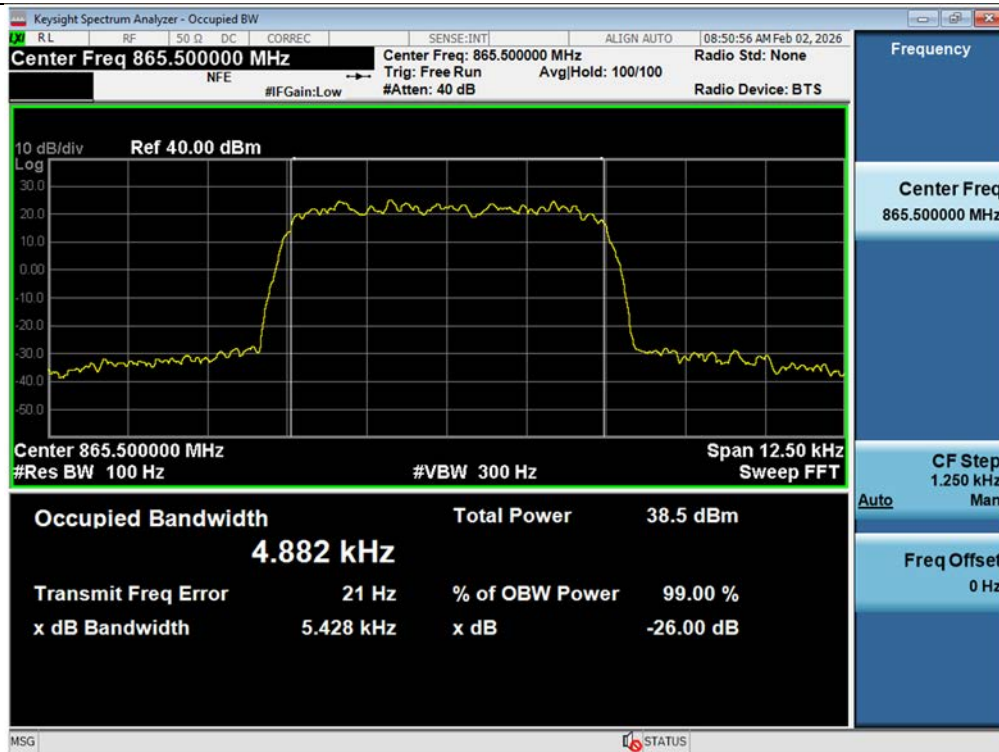
Output / ESMR / Downlink / P25 Phase 1 (CQPSK)



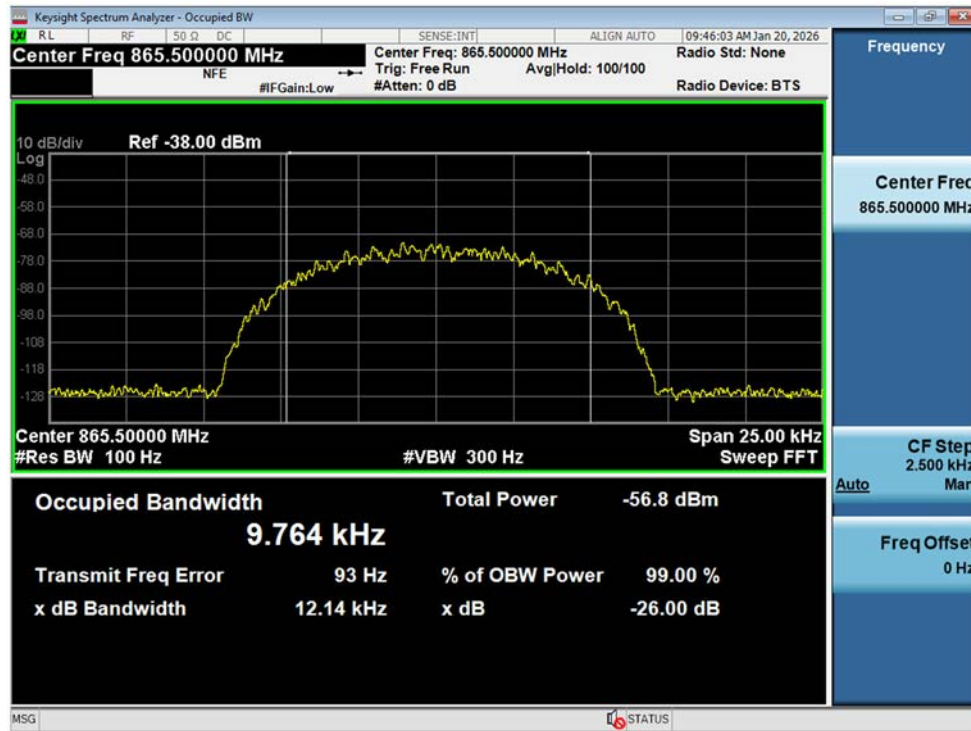
3 dB above the AGC threshold Input / ESMR / Downlink / P25 Phase 1 (CQPSK)



3 dB above the AGC threshold output / ESMR / Downlink / P25 Phase 1 (CQPSK)



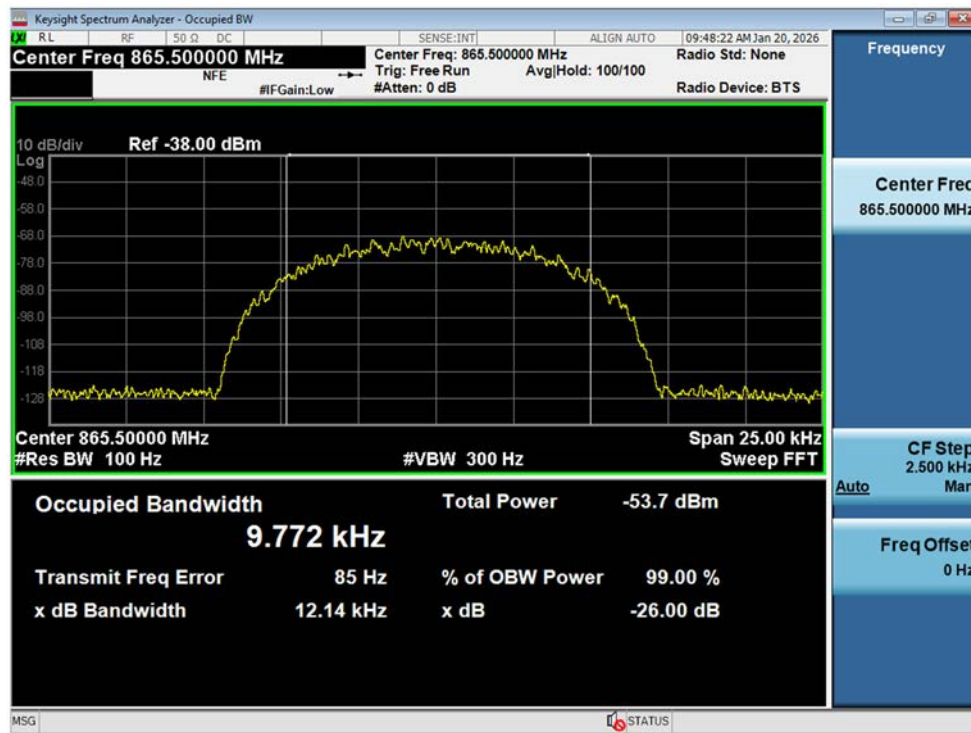
Input / ESMR / Downlink / P25 Phase 2 (H-DQPSK)



Output / ESMR / Downlink / P25 Phase 2 (H-DQPSK)



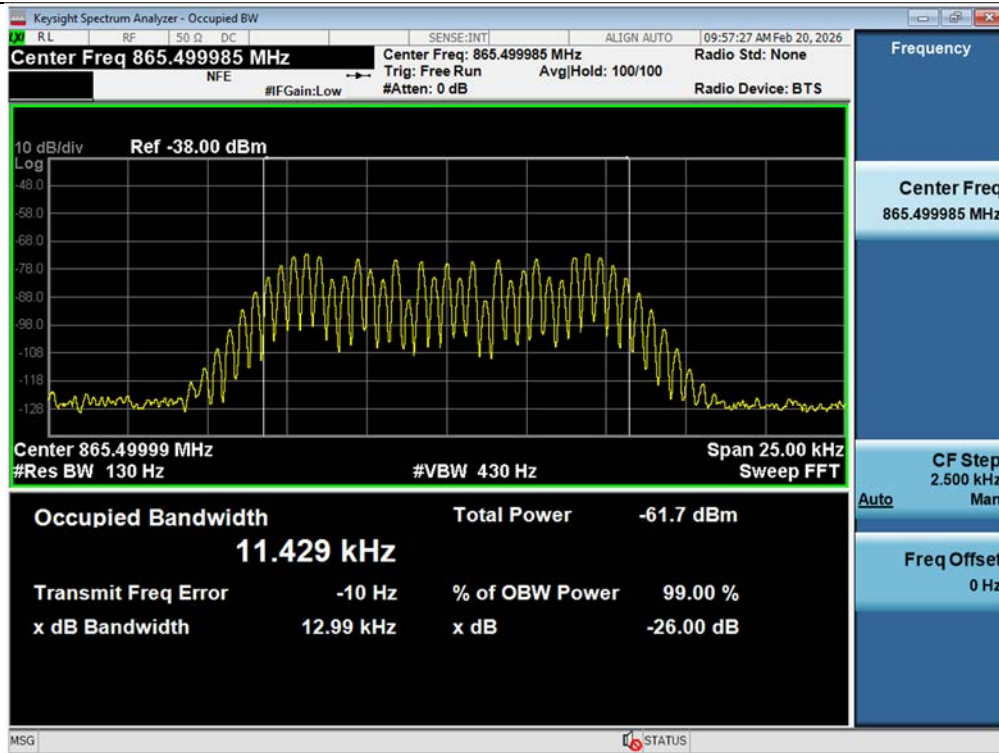
3 dB above the AGC threshold Input / ESMR / Downlink / P25 Phase 2 (H-DQPSK)



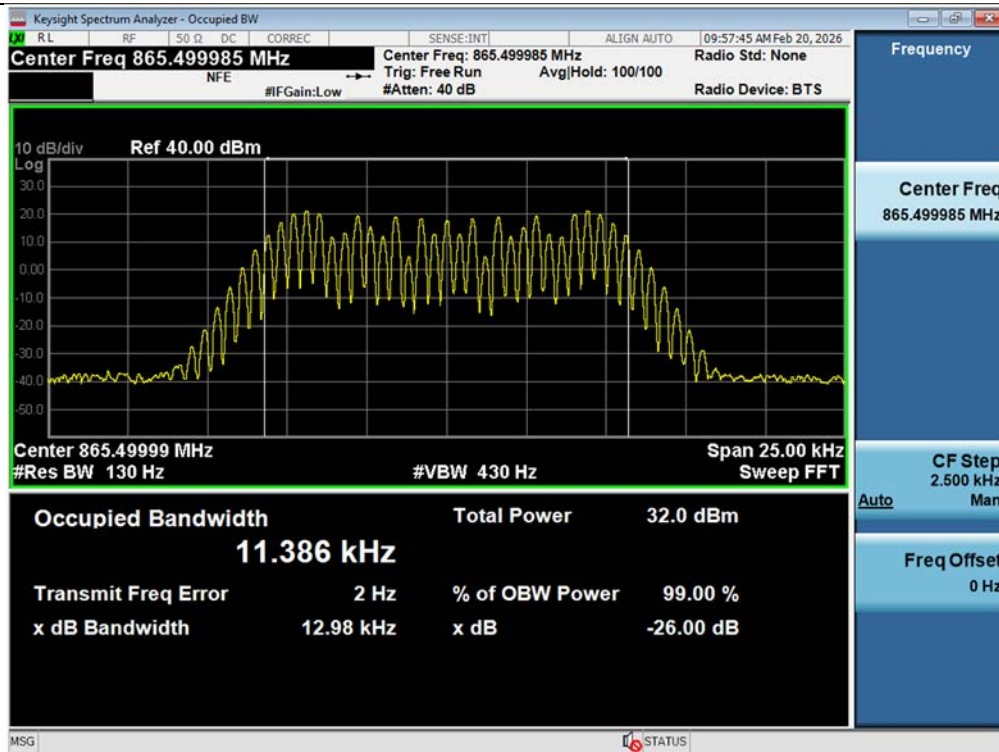
3 dB above the AGC threshold output / ESMR / Downlink / P25 Phase 2 (H-DQPSK)



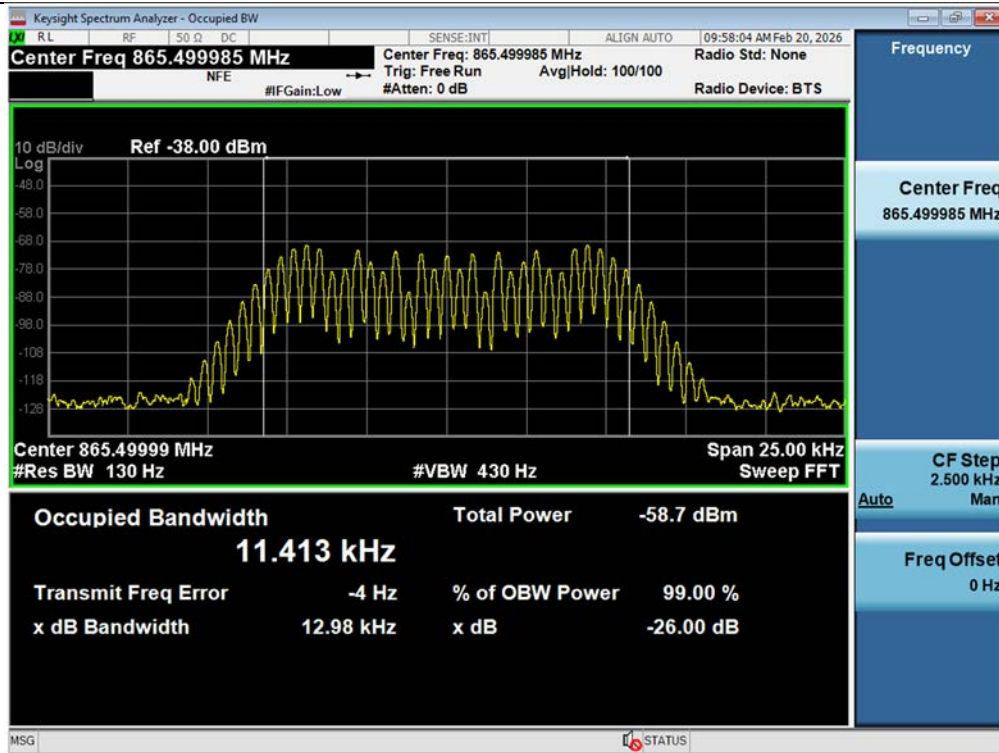
Input / ESMR / Downlink / FM (12.5 kHz)



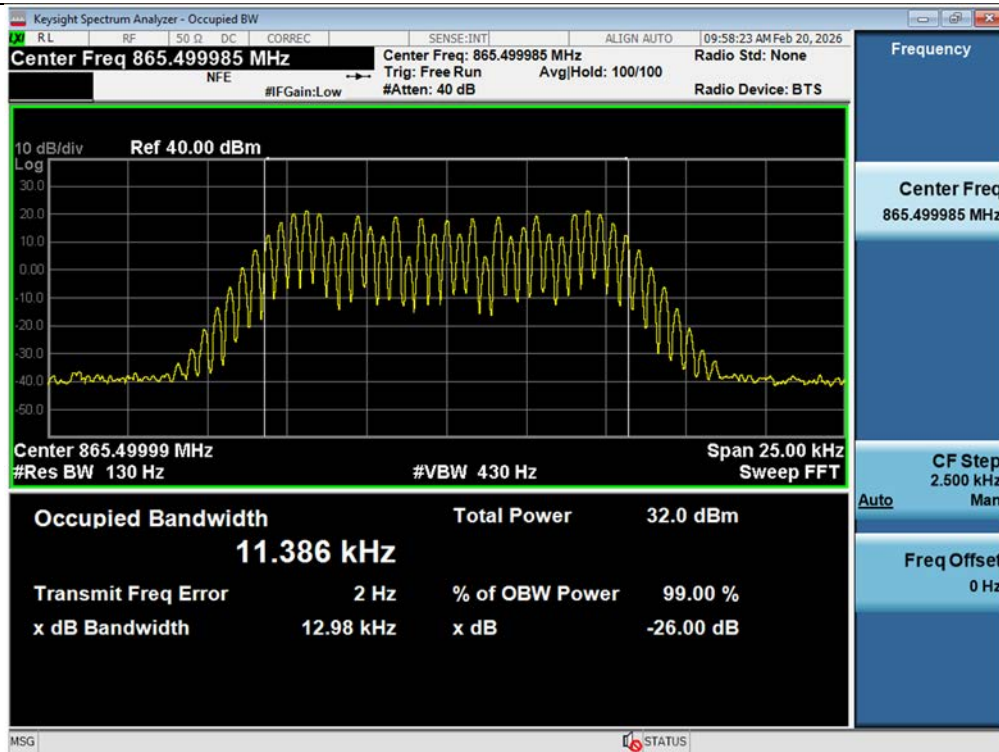
Output / ESMR / Downlink / FM (12.5 kHz)



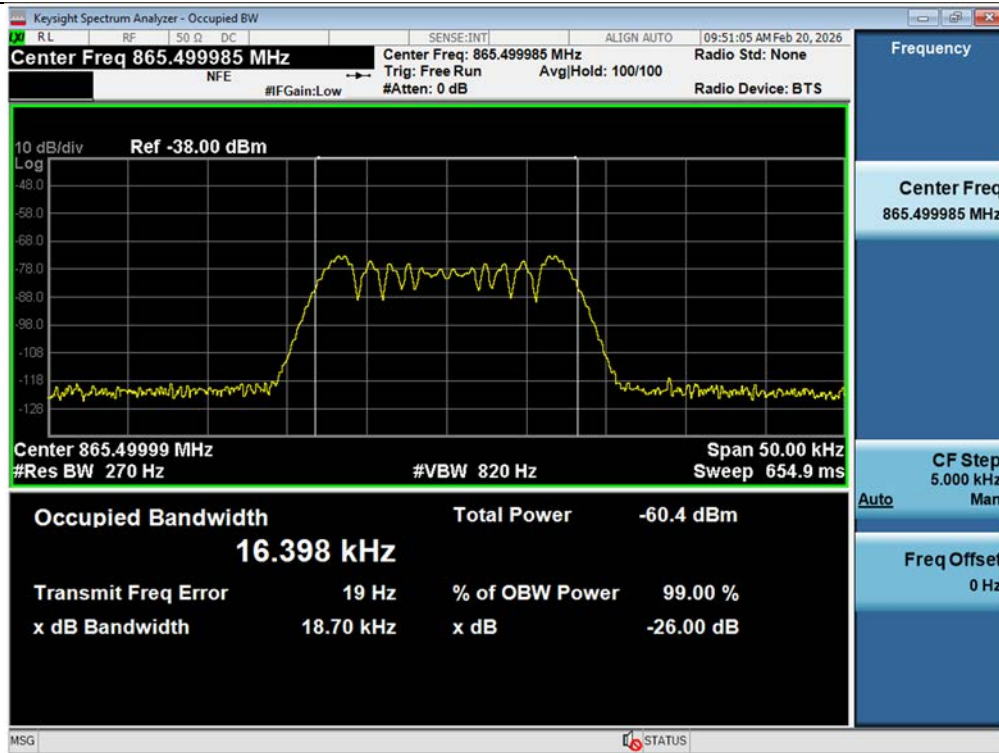
3 dB above the AGC threshold Input / ESMR / Downlink / FM (12.5 kHz)



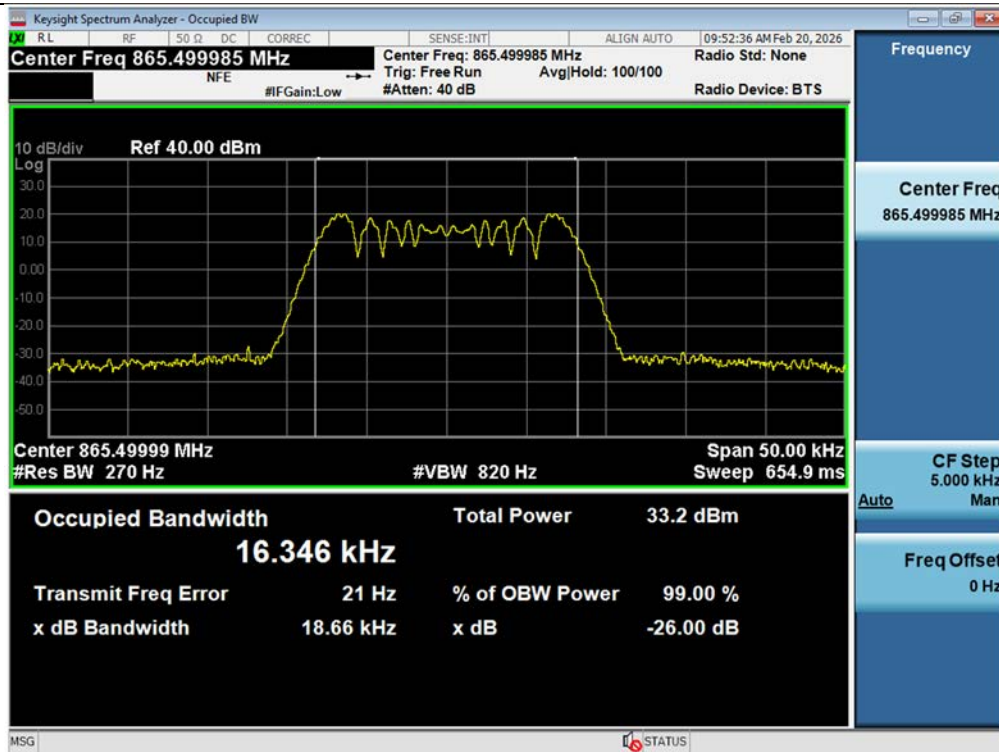
3 dB above the AGC threshold output / ESMR / Downlink / FM (12.5 kHz)



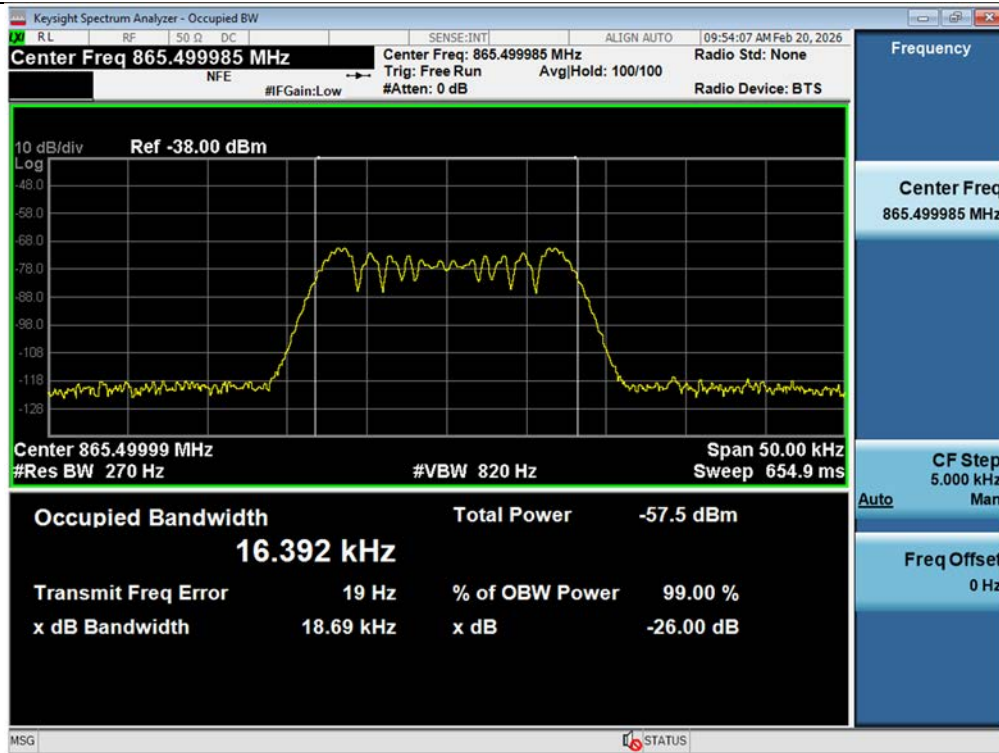
Input / ESMR / Downlink / FM (25 kHz)



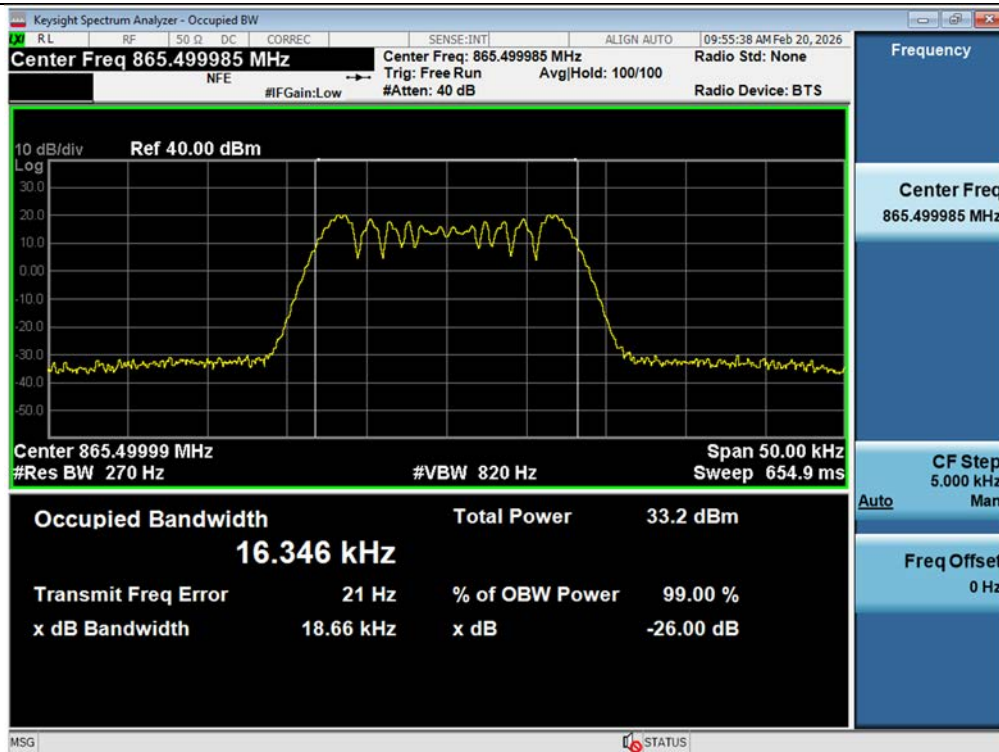
Output / ESMR / Downlink / FM (25 kHz)



3 dB above the AGC threshold Input / ESMR / Downlink / FM (25 kHz)



3 dB above the AGC threshold output / ESMR / 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.

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

[#] Equipment designed to operate on 25 kilohertz bandwidth channels must meet the requirements of either Emission Mask B or G, whichever is applicable, while equipment designed to operate on 12.5 kilohertz bandwidth channels must meet the requirements of Emission Mask D. Equipment designed to operate on 25 kilohertz bandwidth channels may alternatively meet the Adjacent Channel Power limits of § 90.221.

- (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.
- (g) Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least $116 \log(f_d/6.1)$ dB, or $50 + 10 \log(P)$ dB, or 70 dB, whichever is the lesser attenuation;
 - (2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log(P)$ dB.

- (h) Emission Mask H. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of 4 kHz or less: Zero dB.
 - (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 4 kHz, but no more than 8.5 kHz: At least $107 \log (f_d/4)$ dB;
 - (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 8.5 kHz, but no more than 15 kHz: At least $40.5 \log (f_d/1.16)$ dB;
 - (4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 15 kHz, but no more than 25 kHz: At least $116 \log (f_d/6.1)$ dB;
 - (5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least $43 + 10 \log (P)$ dB.

§ 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).

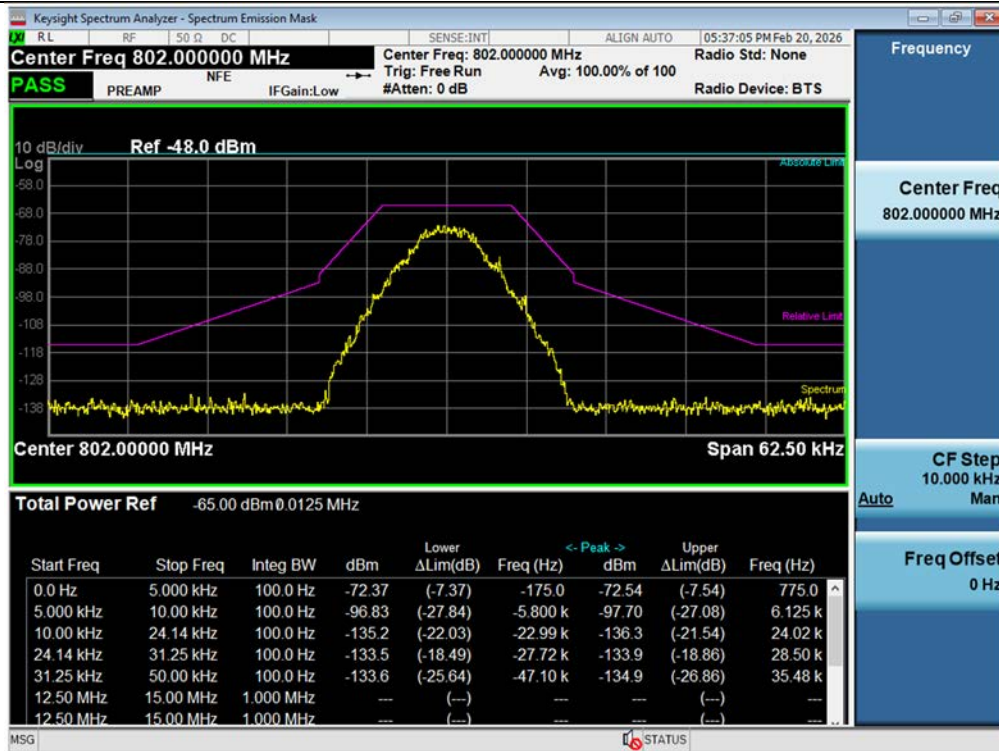
Test Procedures:

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

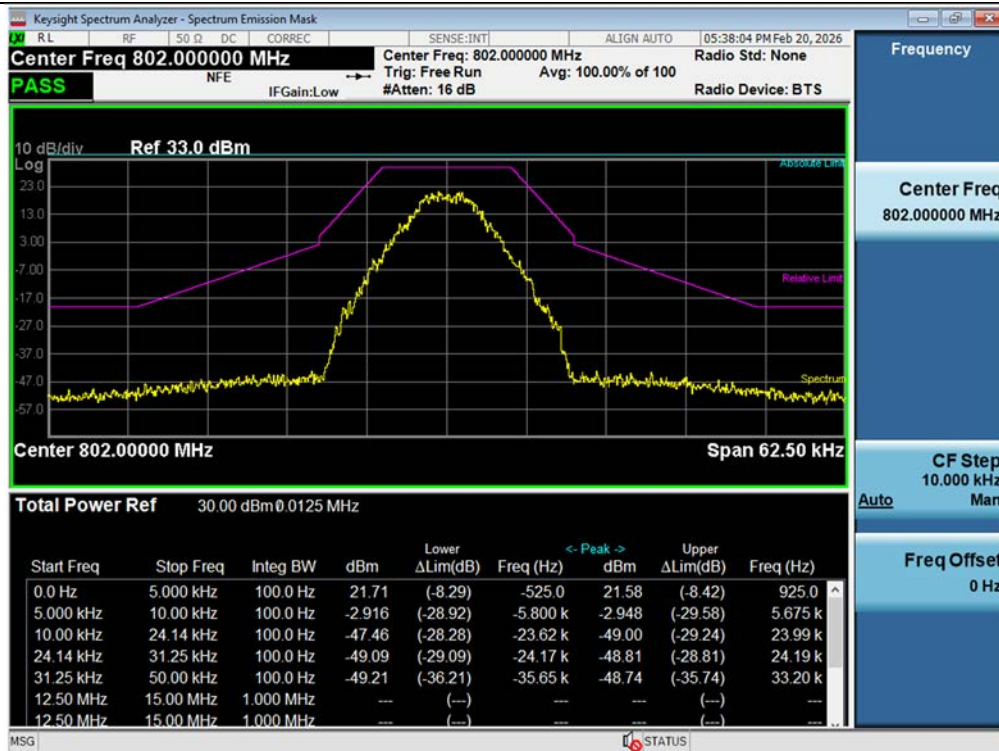
- a) Connect a signal generator to the input of the EUT.
- b) Configure the signal generator to transmit the appropriate test signal associated with the public safety emission designation.
- c) Configure the signal level to be just below the AGC threshold.
- d) Connect a spectrum analyzer to the output 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

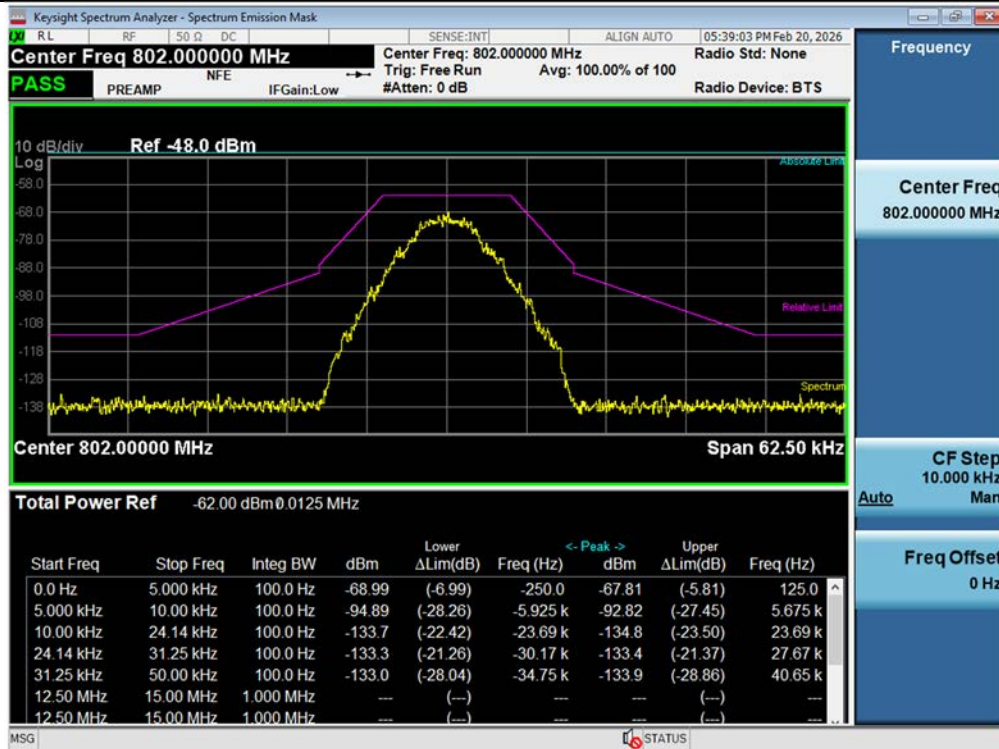
Input / Public Safety Narrowband / Uplink / P25 Phase 1 (C4FM) / Mask C



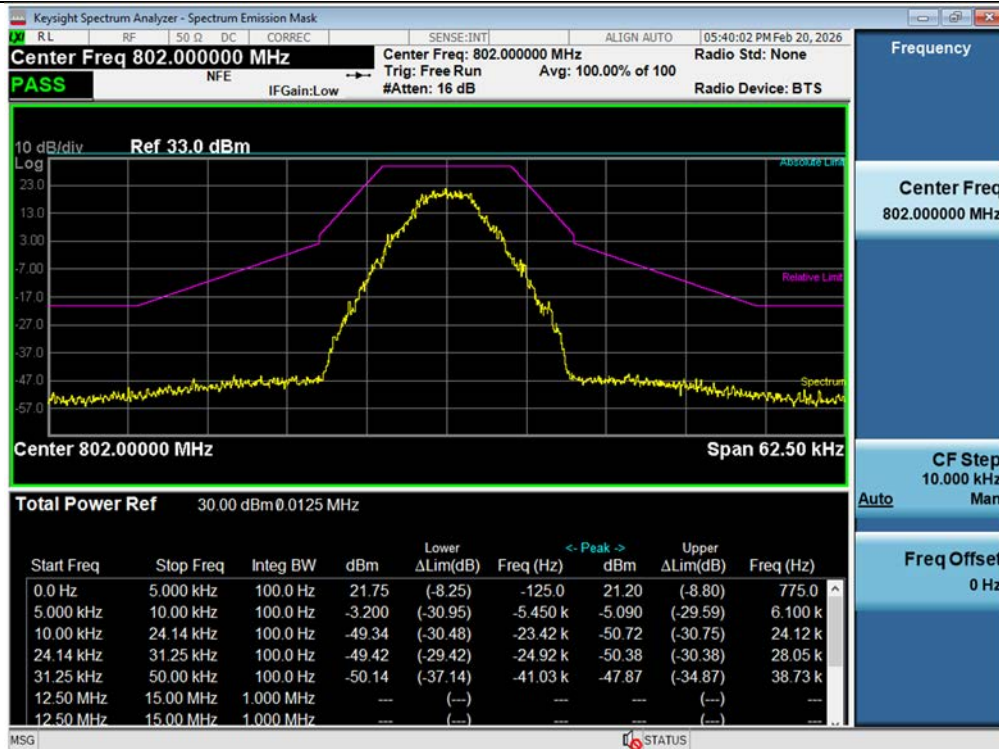
Output / Public Safety Narrowband / Uplink / P25 Phase 1 (C4FM) / Mask C



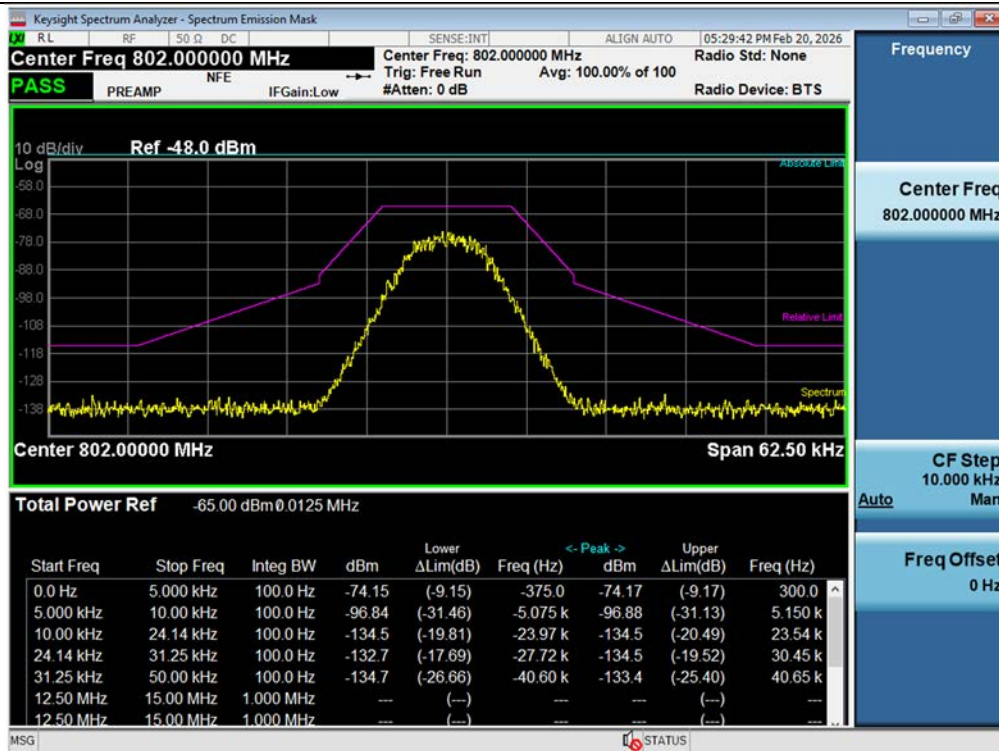
3 dB above the AGC threshold Input / Public Safety Narrowband / Uplink / P25 Phase 1 (C4FM) / Mask C



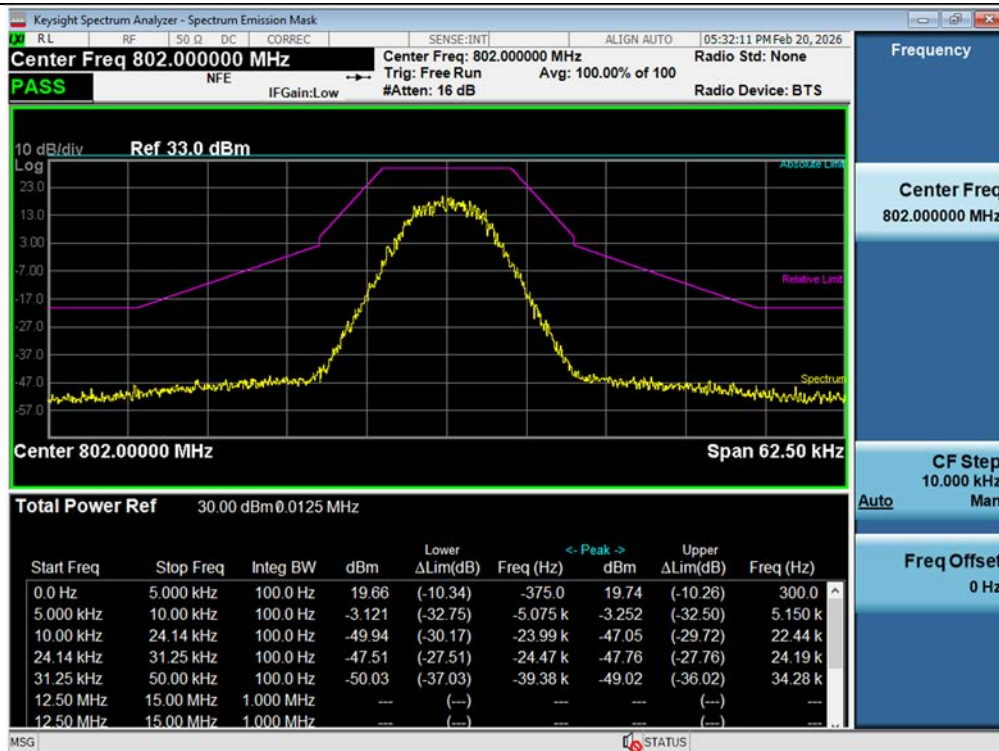
3 dB above the AGC threshold output / Public Safety Narrowband / Uplink / P25 Phase 1 (C4FM) / Mask C



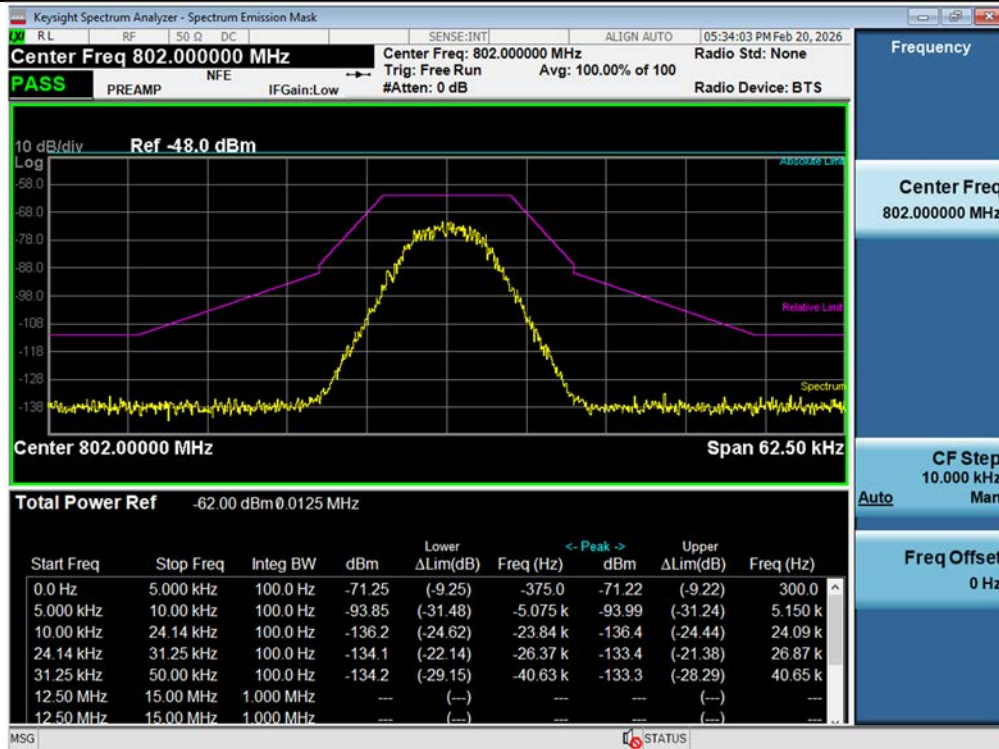
Input / Public Safety Narrowband / Uplink / P25 Phase 2 (H-CPM)/ Mask C



Output / Public Safety Narrowband / Uplink / P25 Phase 2 (H-CPM)/ Mask C



3 dB above the AGC threshold Input / Public Safety Narrowband / Uplink / P25 Phase 2 (H-CPM)/ Mask C



3 dB above the AGC threshold output / Public Safety Narrowband / Uplink / P25 Phase 2 (H-CPM)/ Mask C

