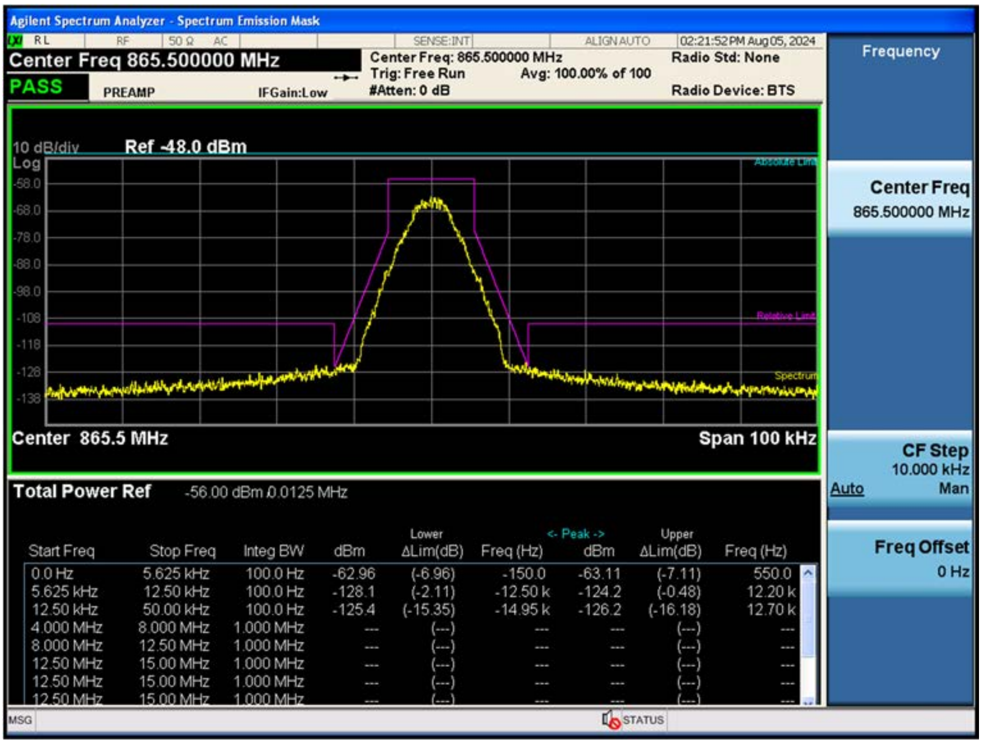
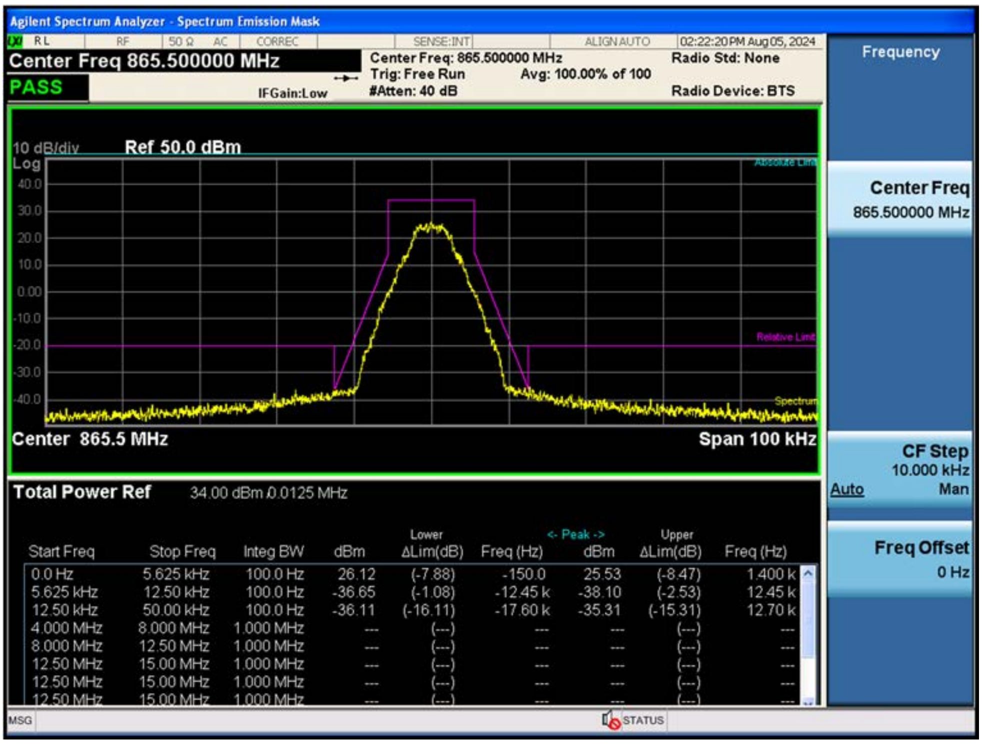
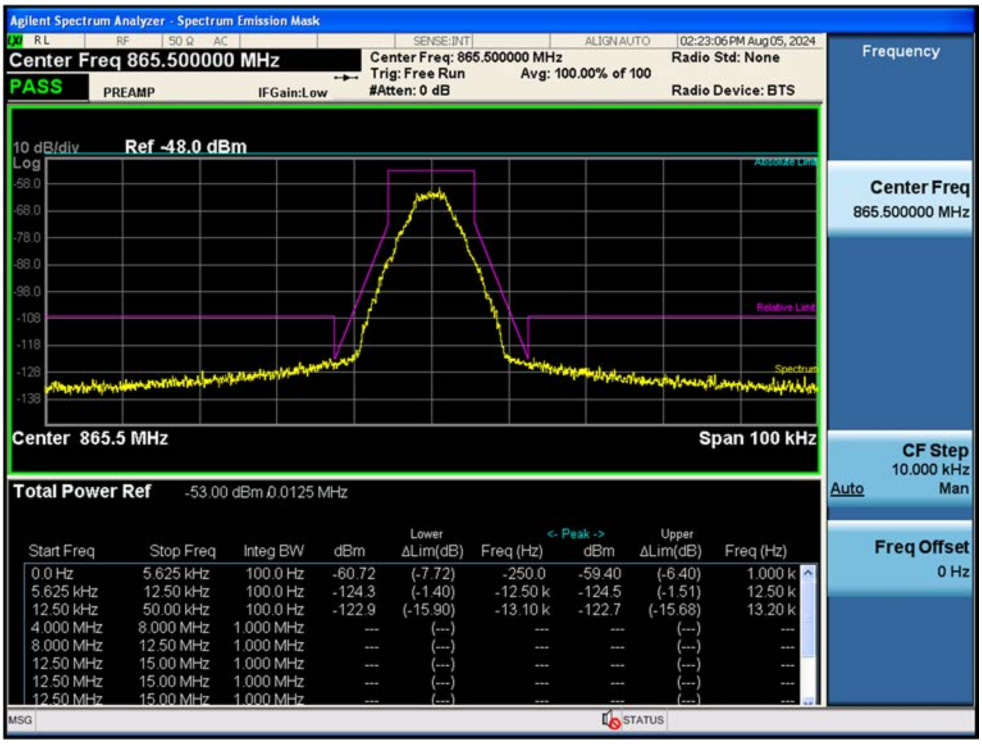
Input / ESMR / 1 Carrier / Downlink / Mask D



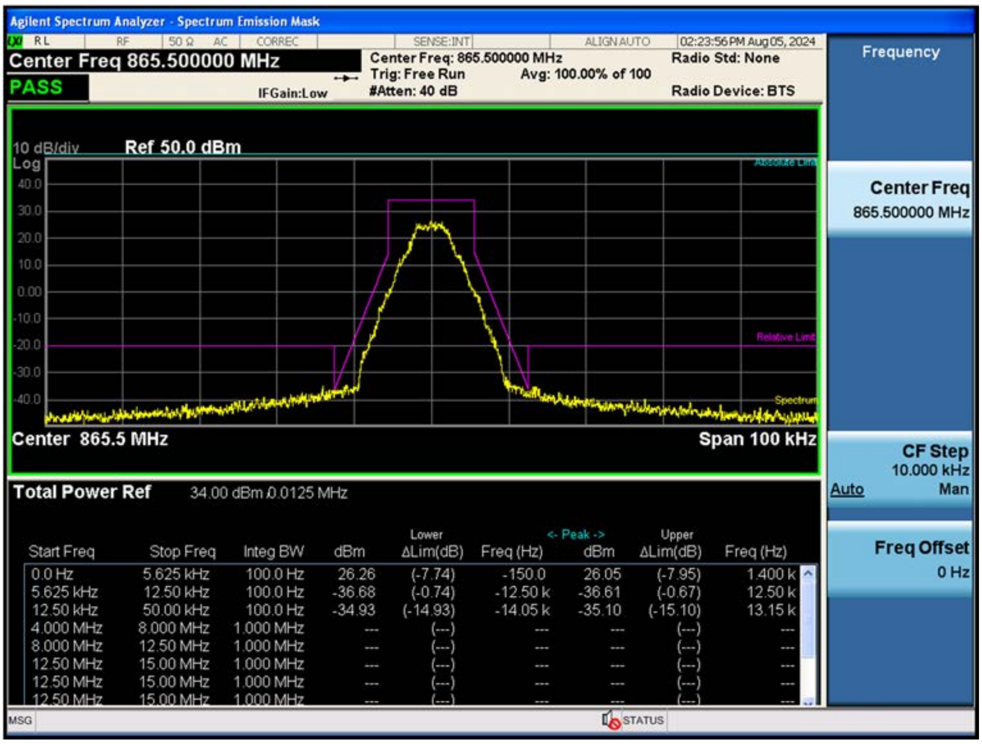
Output / ESMR / 1 Carrier / Downlink / Mask D



3 dB above the AGC threshold Input / ESMR / 1 Carrier / Downlink / Mask D



3 dB above the AGC threshold output / ESMR / 1 Carrier / Downlink / Mask D



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 ≥ 3 × 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:

Gain (dB) = output power (dBm) − input power (dBm).

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

Note:

1. If f_0 that determined from out-of-band rejection test is smaller or greater than difference of test signal's center frequency and operation band block, test is performed at the lowest or the highest frequency that test signals can be passed.
2. The Uplink/Downlink ERP is calculated as follows.
   ex) ERP = Uplink Max Power + Peak Antenna Gain(dBi → dBd)
   = 27.54 dBm + (9.00 dBi – 2.15 dB) = 34.39 dBm

Test Results:

Tabular data of Input / Output Power and Gain

Test Band	Link	Signal	No. of Carriers	f_0 Frequency	Input Power	Output Power	Gain	E.R.P.	
				(MHz)	(dBm)		(dB)	(dBm)	(W)
Public Safety Narrowband	Uplink	P25 Phase 1	1	803.67	-53.13	27.54	80.67	34.39	2.75
	Downlink		1	773.67	-56.00	33.37	89.37	34.72	2.96
NPSPAC	Uplink		1	806.76	-52.24	27.57	79.81	34.42	2.77
	Downlink		1	853.31	-55.63	34.36	89.99	35.71	3.73
B/ILT; SMR	Uplink		1	812.42	-52.27	27.57	79.84	34.42	2.77
	Downlink		1	859.90	-55.82	34.91	90.73	36.26	4.23
ESMR	Uplink		1	817.84	-53.64	27.64	81.28	34.49	2.81
	Downlink		1	862.84	-56.04	33.42	89.46	34.77	3.00

- Peak Antenna Gain: Uplink: 9.0 dBi(6.85 dBd), Downlink: 3.5 dBi(1.35 dBd)

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.

$$F_{sys} = \frac{N_o}{kT_oBG}$$

F_{sys} = System Noise Factor

N_0 = 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 ≥ 3 × RBW.
e) Measure the maximum output noise power for EUT pass band.

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

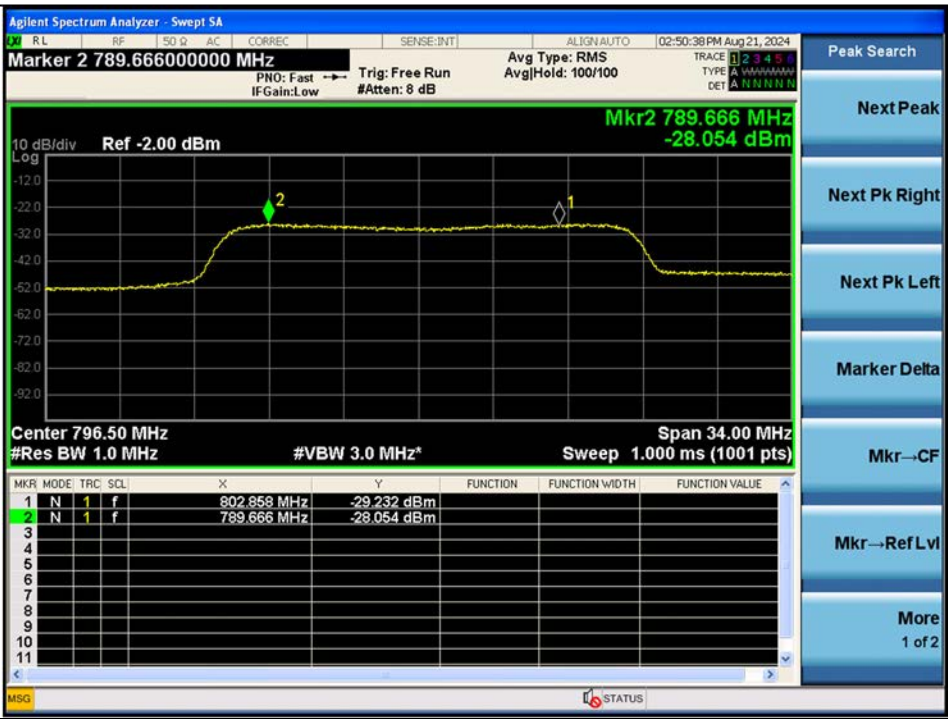
Noise Figure = Noise Output Power - kT0B - Gain

Test Results:

Test Band	Link	Input Power (dBm)	Output Power (dBm)	Gain (dB)	kT_0B (dBm/MHz)	Measured Value (dBm)	Noise Figure (dB)
Public Safety Narrowband	Uplink	-53.13	27.54	80.67	-114	-29.23	4.10
	Downlink	-56.00	33.37	89.37	-114	-18.51	6.12
NPSPAC	Uplink	-52.24	27.57	79.81	-114	-28.22	5.97
	Downlink	-55.63	34.36	89.99	-114	-18.87	5.14
B/ILT; SMR	Uplink	-52.27	27.57	79.84	-114	-28.64	5.52
	Downlink	-55.82	34.91	90.73	-114	-17.84	5.43
ESMR	Uplink	-53.64	27.64	81.28	-114	-28.62	4.10
	Downlink	-56.04	33.42	89.46	-114	-18.36	6.18

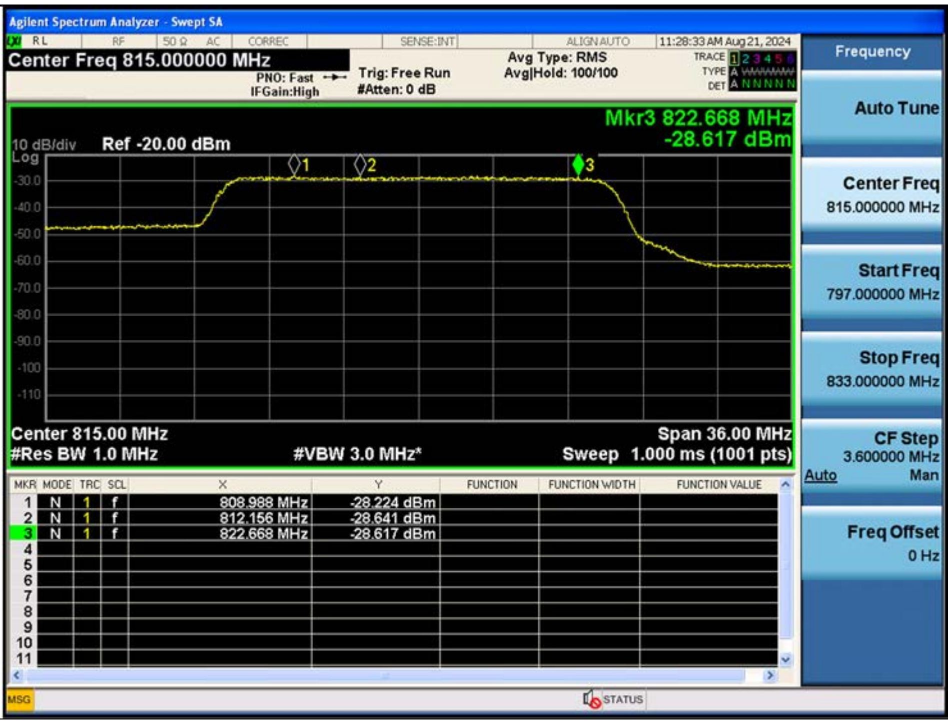
Plot data of Noise Figure

Noise Figure / Public Safety Narrowband / Uplink



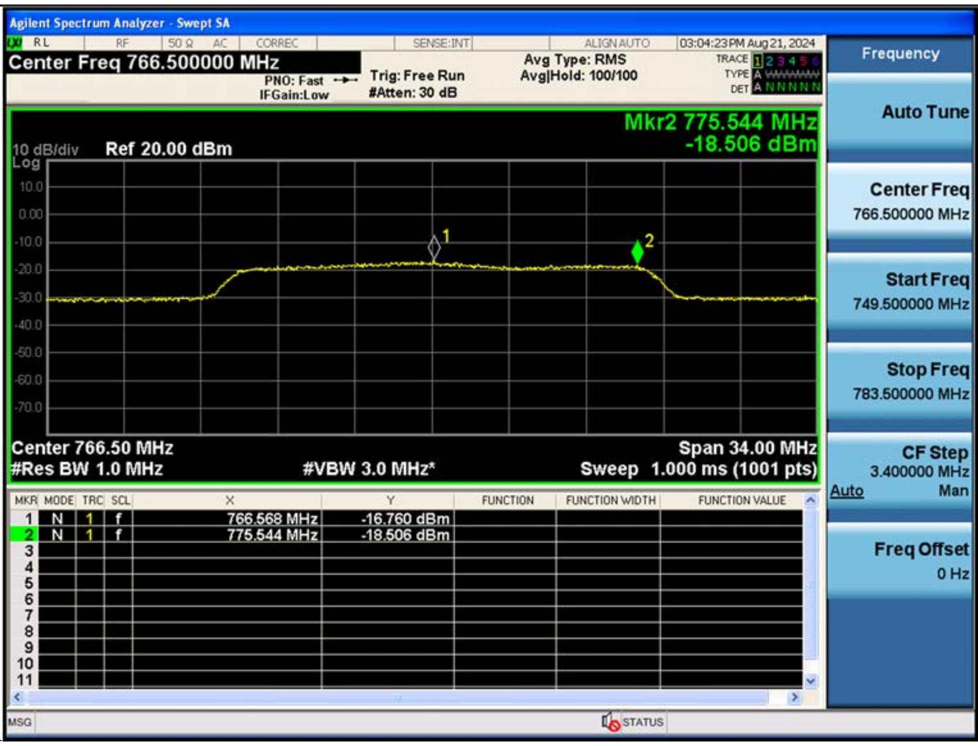
Note: The EUT is amplified over a frequency range of 788 ~ 806 MHz, but this test report uses the results for the frequency range of 799 ~ 805 MHz.

Noise Figure / 800 MHz (806 ~ 809, 809 ~ 816, 817 ~ 824) / Uplink



Note: The EUT is amplified over a frequency range of 806 ~ 824 MHz, but this test report uses the results for the frequency range of 806 ~ 809 MHz, 809 ~ 816 MHz, 817 ~ 824 MHz.

Noise Figure / Public Safety Narrowband / Downlink



Note: The EUT is amplified over a frequency range of 758 ~ 776 MHz, but this test report uses the results for the frequency range of 769 ~ 775 MHz.

Noise Figure / 800 MHz (806 ~ 809, 809 ~ 816, 817 ~ 824) / Downlink

Note: The EUT is amplified over a frequency range of 851 ~ 869 MHz, but this test report uses the results for the frequency range of 851 ~ 854 MHz, 854 ~ 861 MHz, 862 ~ 869 MHz.

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.

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

§ 90.543 Emission limitations.

(f) For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

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.

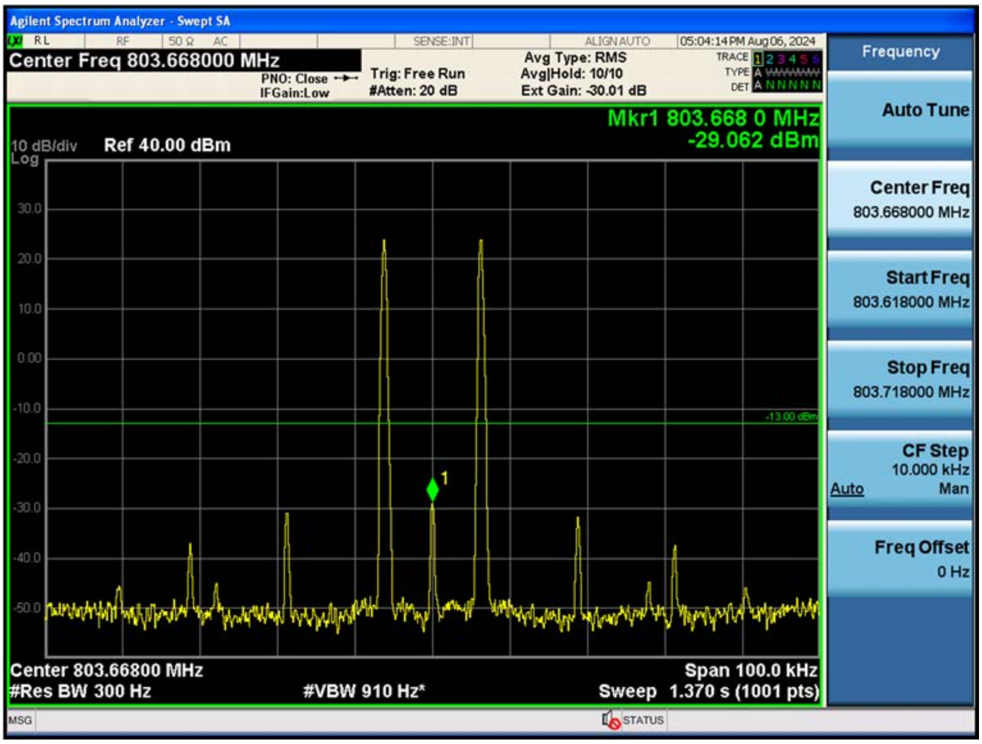
e) Set the span to 100 kHz.
f) Set RBW = 300 Hz with VBW ≥ 3 × RBW.
g) Set the detector to power averaging (rms).
h) Place a marker on highest intermodulation product amplitude.
i) Capture the plot for inclusion in the test report.
j) Repeat steps c) to h) with the composite input power level set to 3 dB above the AGC threshold.
k) Repeat steps b) to i) for all operational bands.

4.7.3 EUT spurious emissions conducted measurements

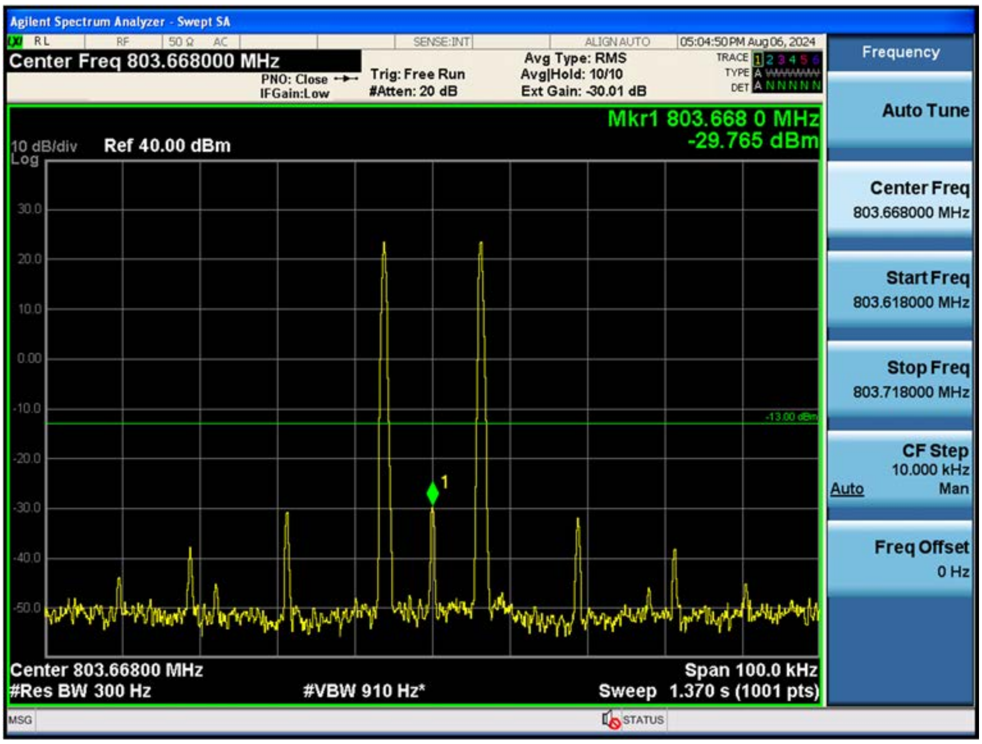
a) Connect a signal generator to the input of the EUT.
b) Configure the signal generator to produce a CW signal.
c) Set the frequency of the CW signal to the center channel of the EUT passband.
d) Set the output power level so that the resultant signal is just below the AGC threshold.
e) Connect a spectrum 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 × 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.

Test Results: Plot data of Out-of-band/out-of-block emissions

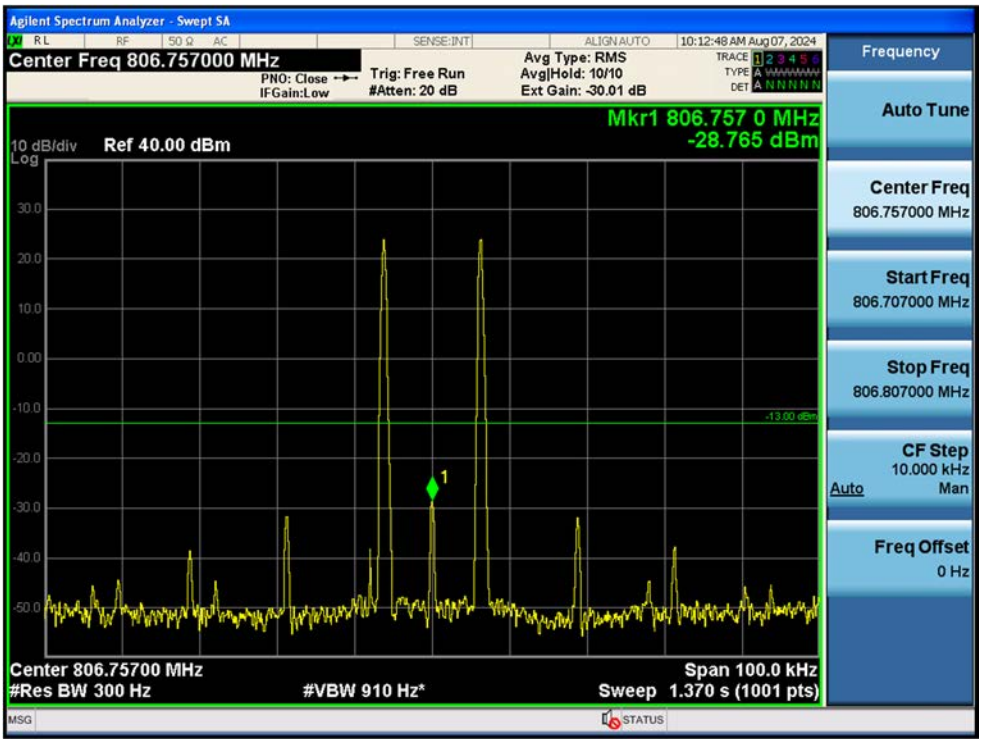
Out-of-band (two adjacent test signals) / Public Safety Narrowband / Uplink



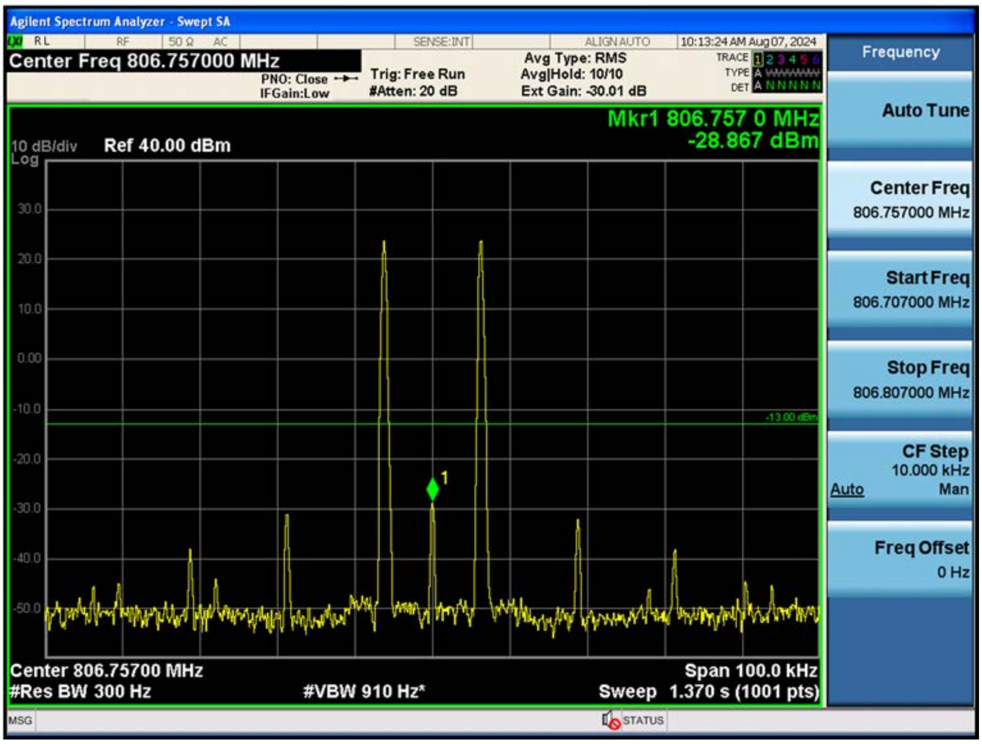
+3 dB above Out-of-band (two adjacent test signals) / Public Safety Narrowband / Uplink



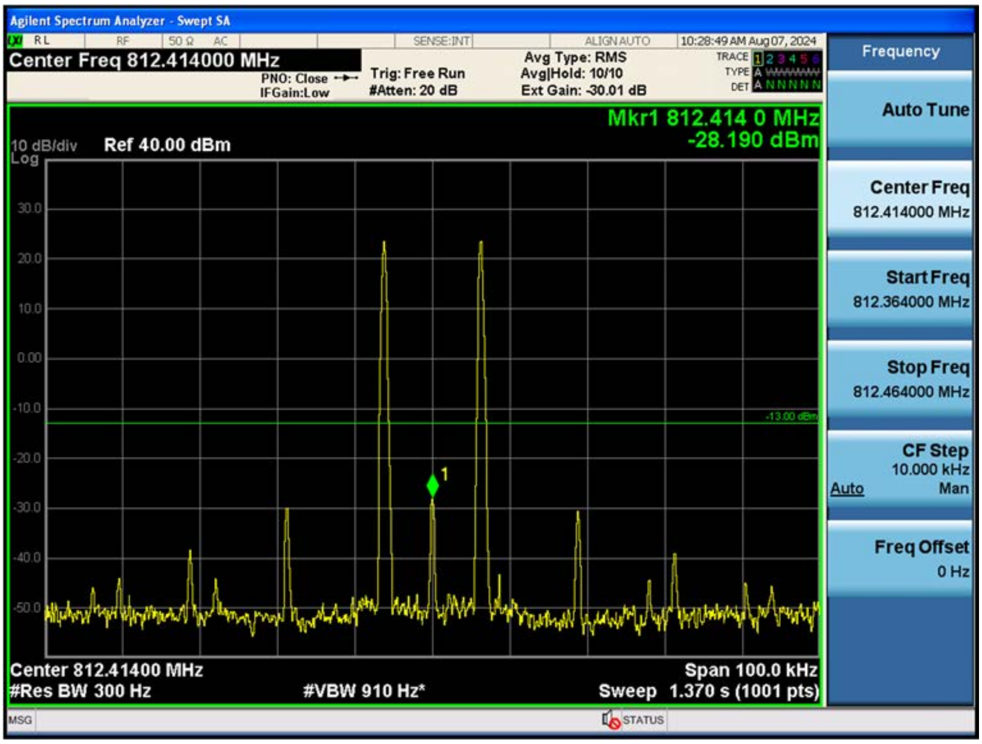
Out-of-band (two adjacent test signals) / NPSPAC / Uplink



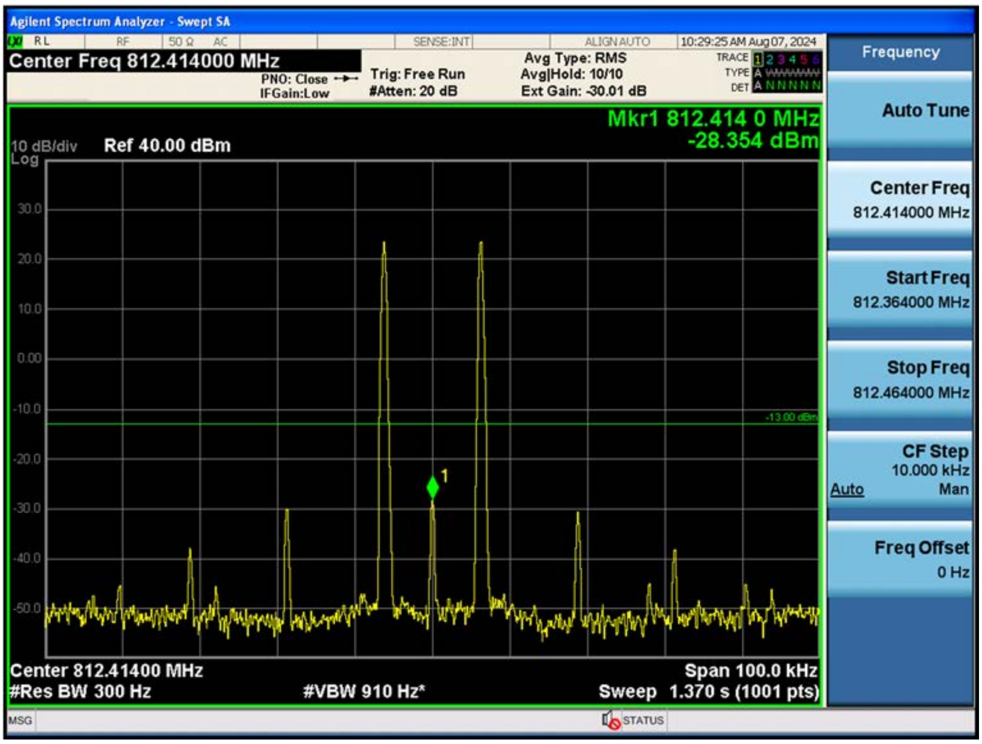
+3 dB above Out-of-band (two adjacent test signals) / NPSPAC / Uplink



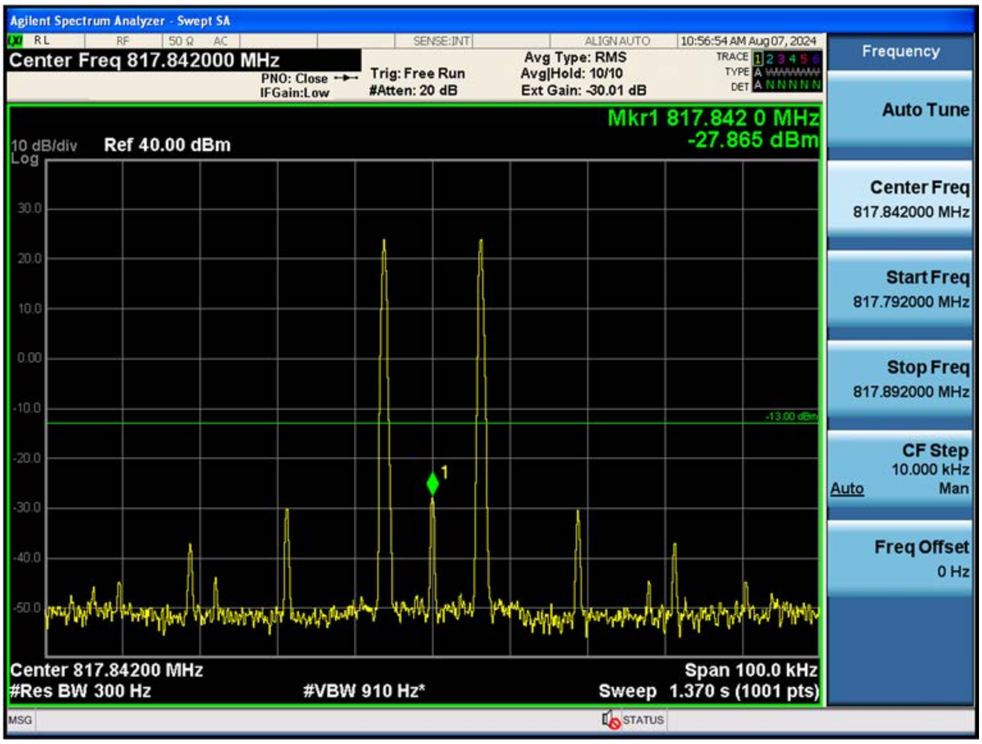
Out-of-band (two adjacent test signals) / B/ILT; SMR / Uplink



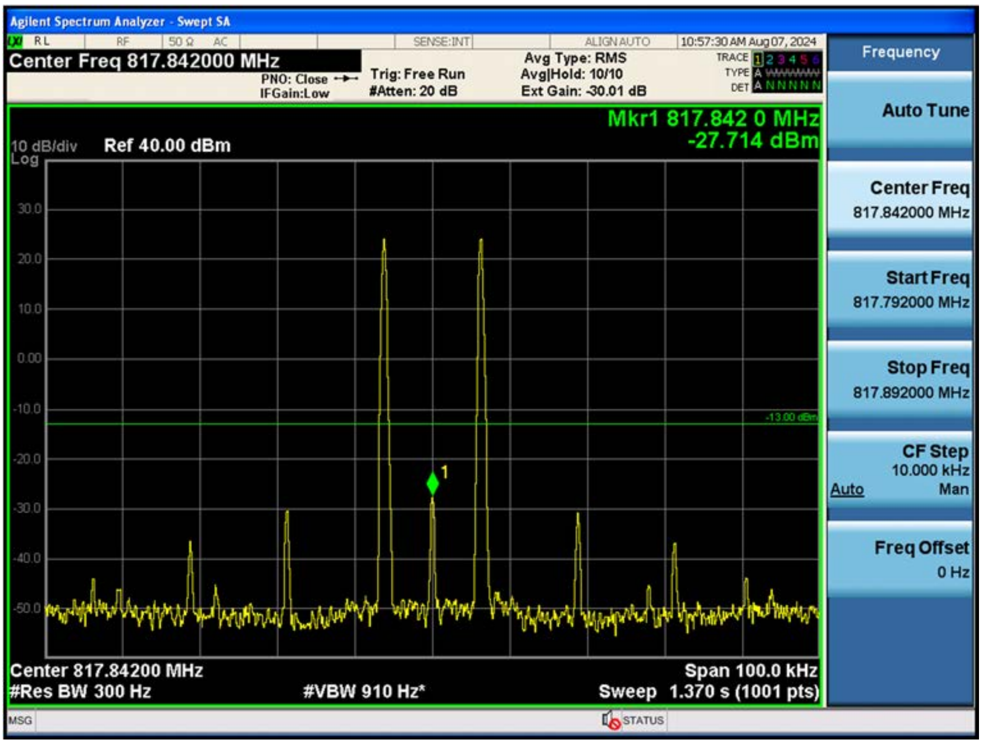
+3 dB above Out-of-band (two adjacent test signals) / B/ILT; SMR / Uplink



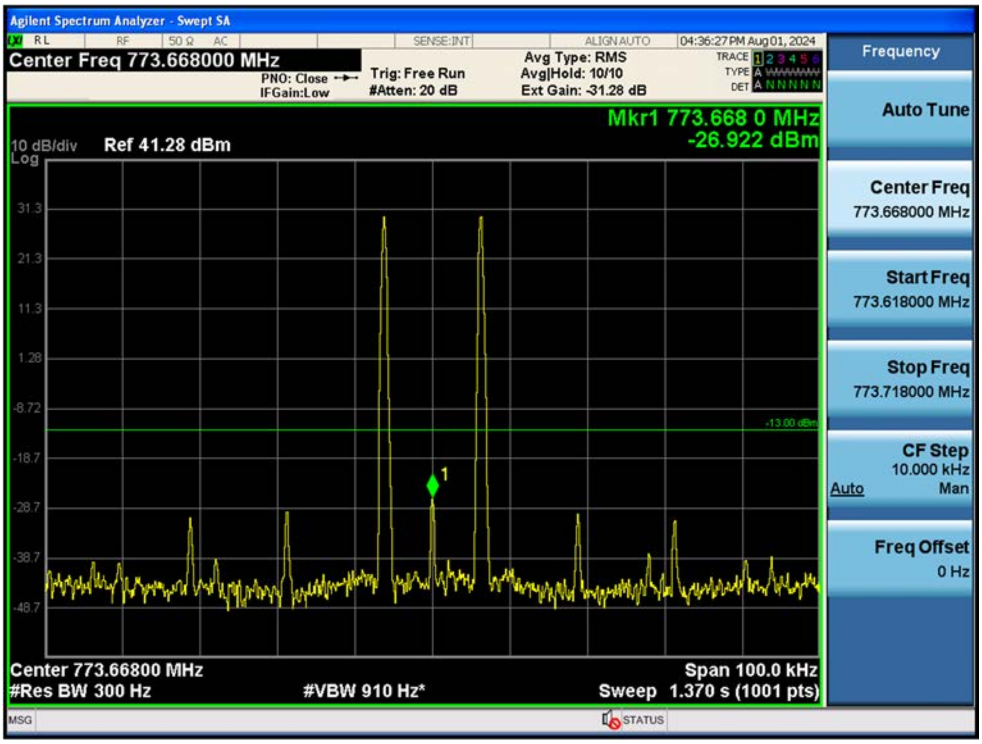
Out-of-band (two adjacent test signals) / ESMR / Uplink



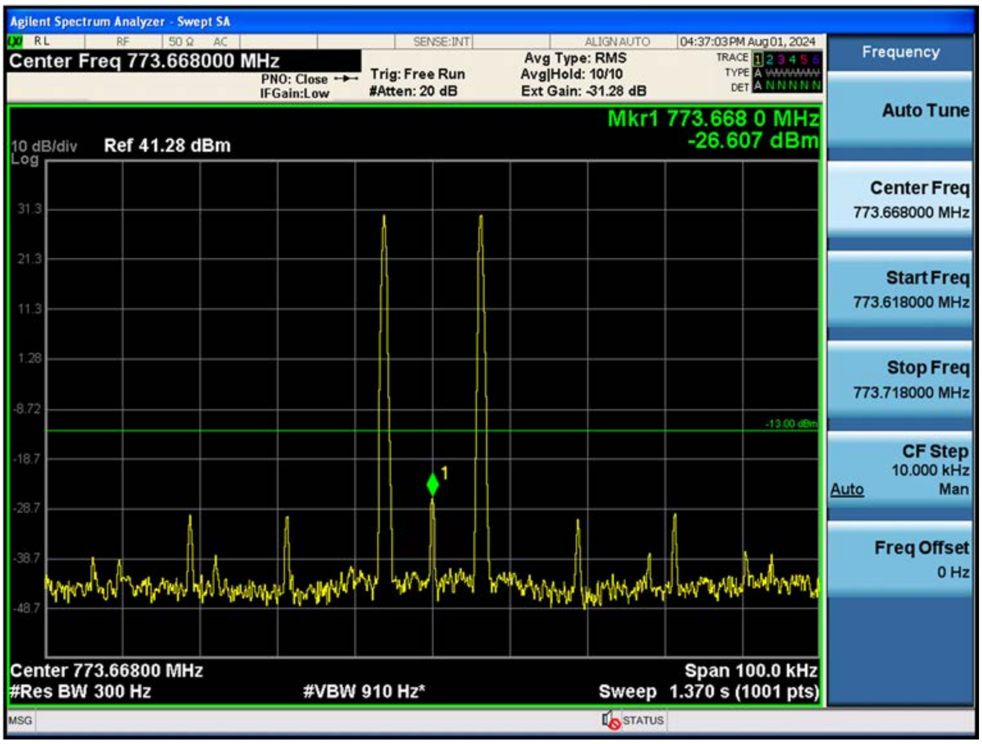
+3 dB above Out-of-band (two adjacent test signals) / ESMR / Uplink



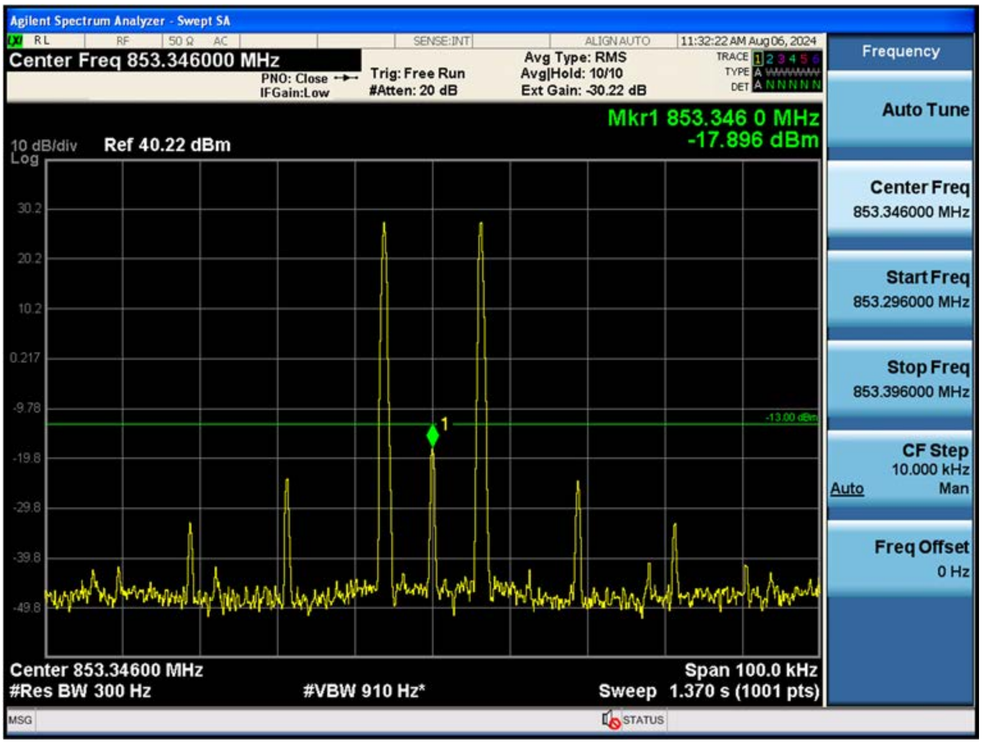
Out-of-band (two adjacent test signals) / Public Safety Narrowband / Downlink



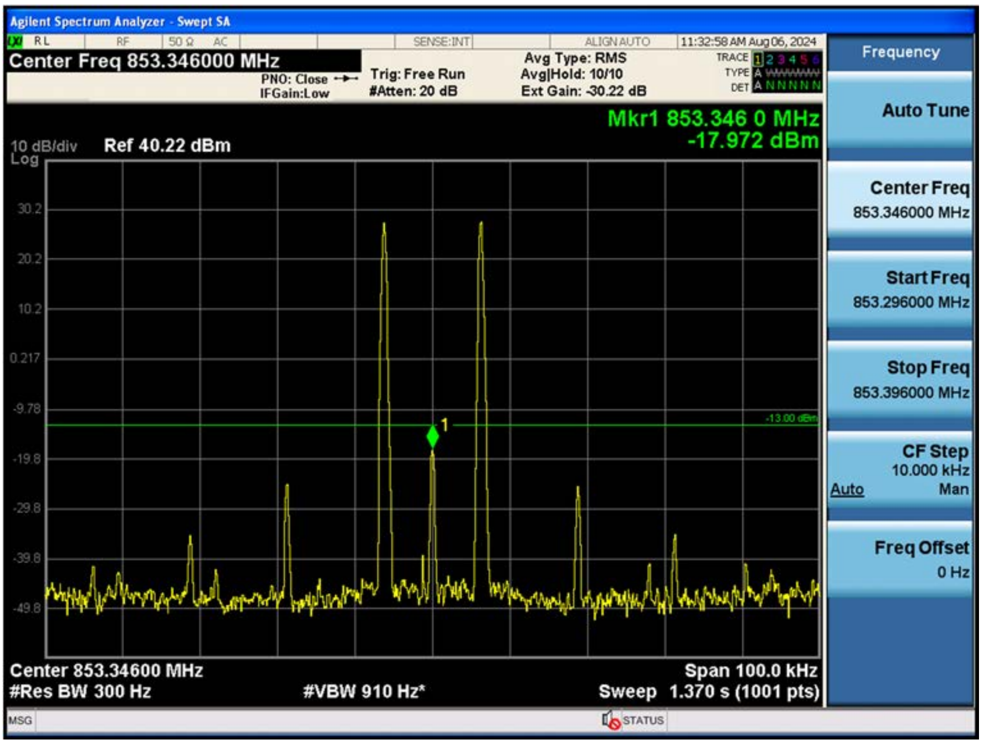
+3 dB above Out-of-band (two adjacent test signals) / Public Safety Narrowband / Downlink



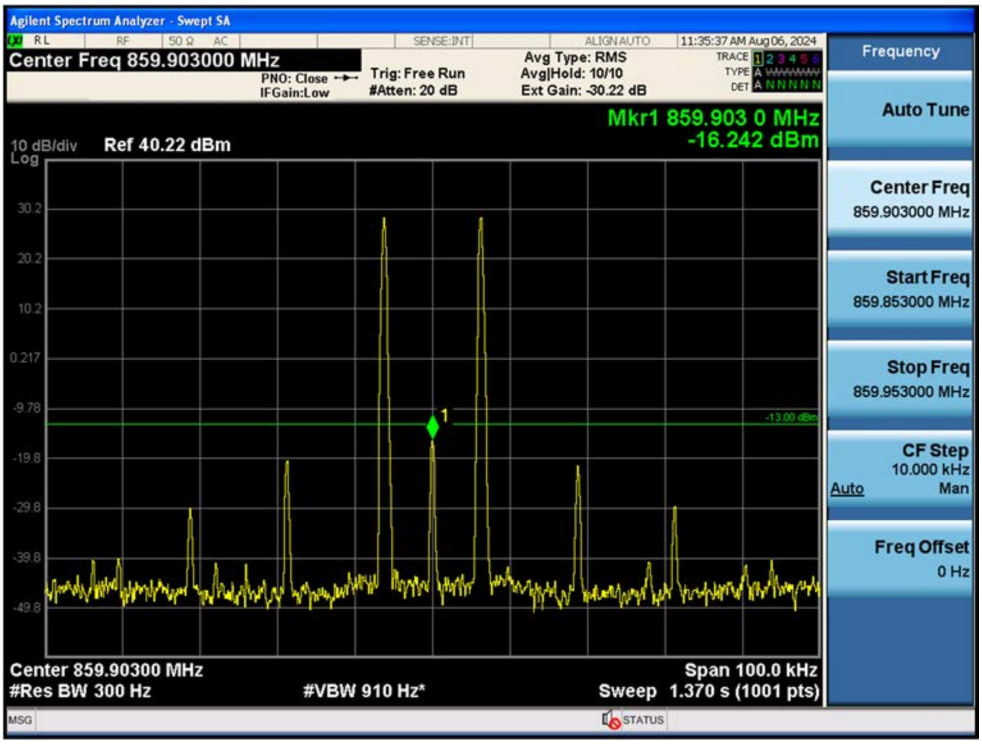
Out-of-band (two adjacent test signals) / NPSPAC / Downlink



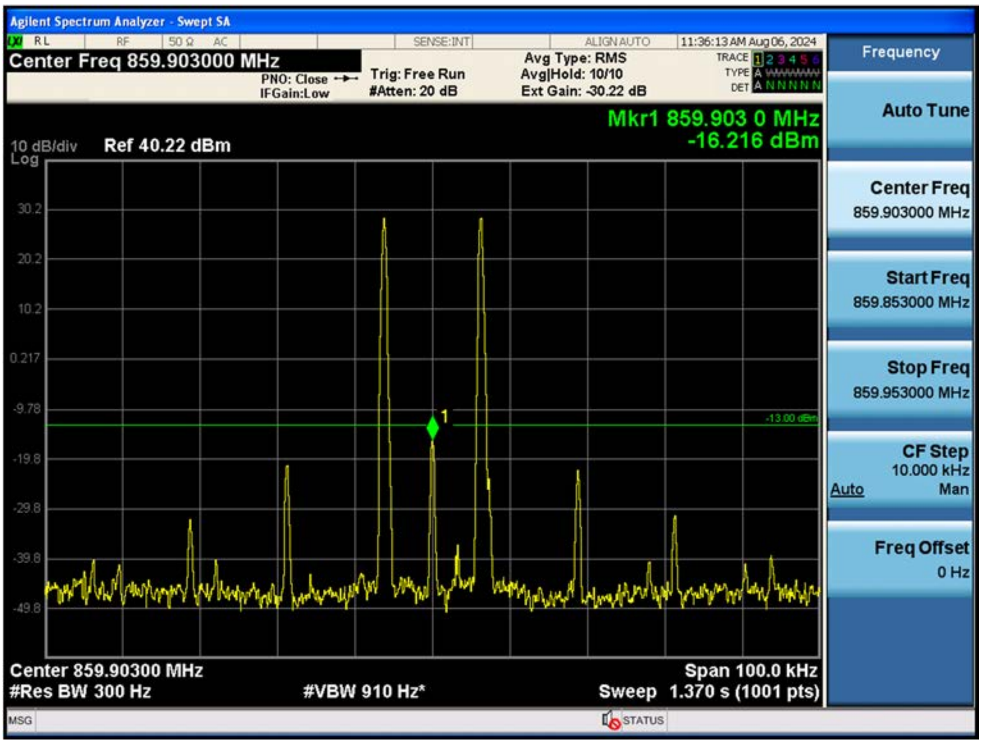
+3 dB above Out-of-band (two adjacent test signals) / NPSPAC / Downlink



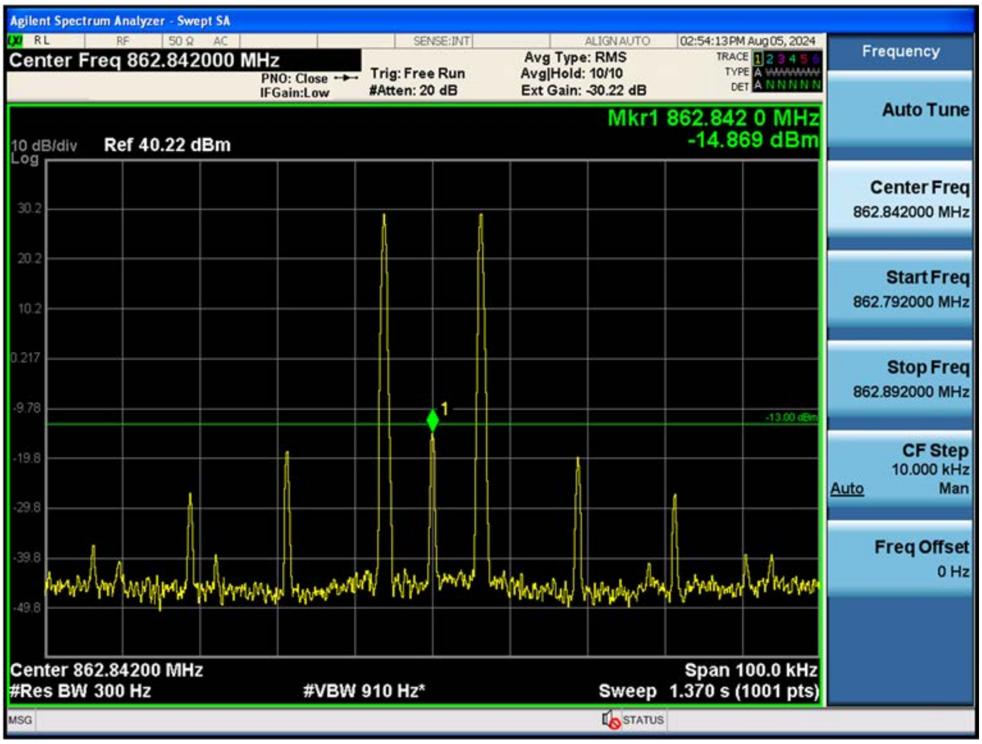
Out-of-band (two adjacent test signals) / B/ILT; SMR / Downlink



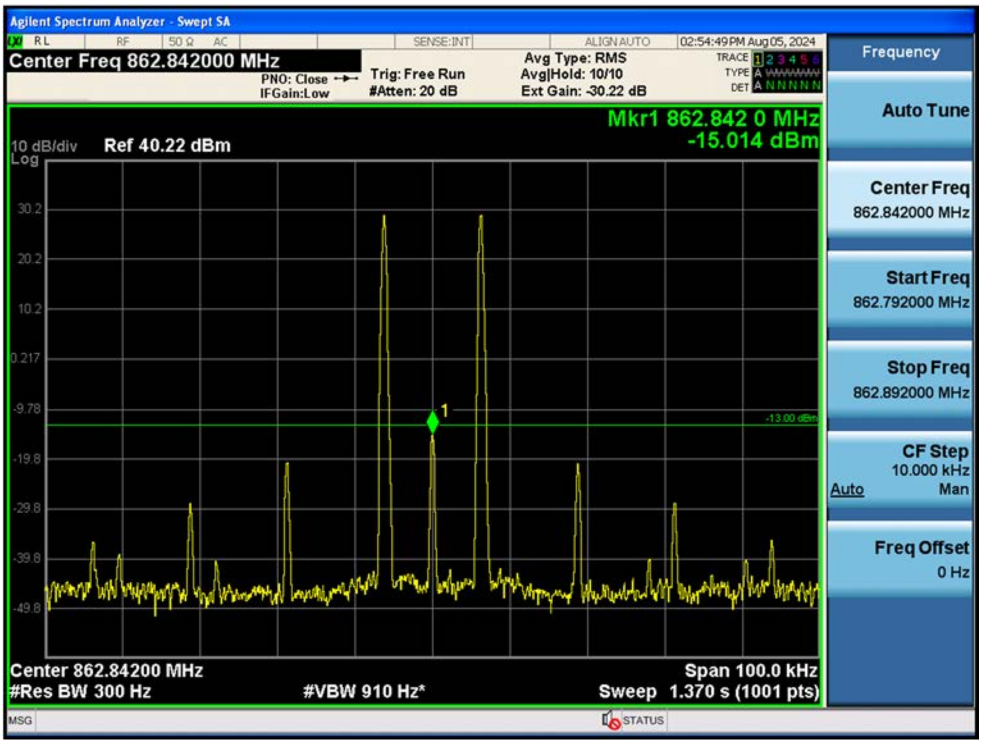
+3 dB above Out-of-band (two adjacent test signals) / B/ILT; SMR / Downlink



Out-of-band (two adjacent test signals) / ESMR / Downlink



+3 dB above Out-of-band (two adjacent test signals) / ESMR / Downlink



Plot data of Spurious Emissions

Spurious / Public Safety Narrowband / Uplink / 1 Carrier

Spurious / NPSPAC / Uplink / 1 Carrier

Spurious / B/ILT; SMR / Uplink / 1 Carrier

Spurious / ESMR / Uplink / 1 Carrier

Spurious / Public Safety Narrowband / Downlink / 1 Carrier

Spurious / NPSPAC / Downlink / 1 Carrier

Spurious / B/ILT; SMR / Downlink / 1 Carrier

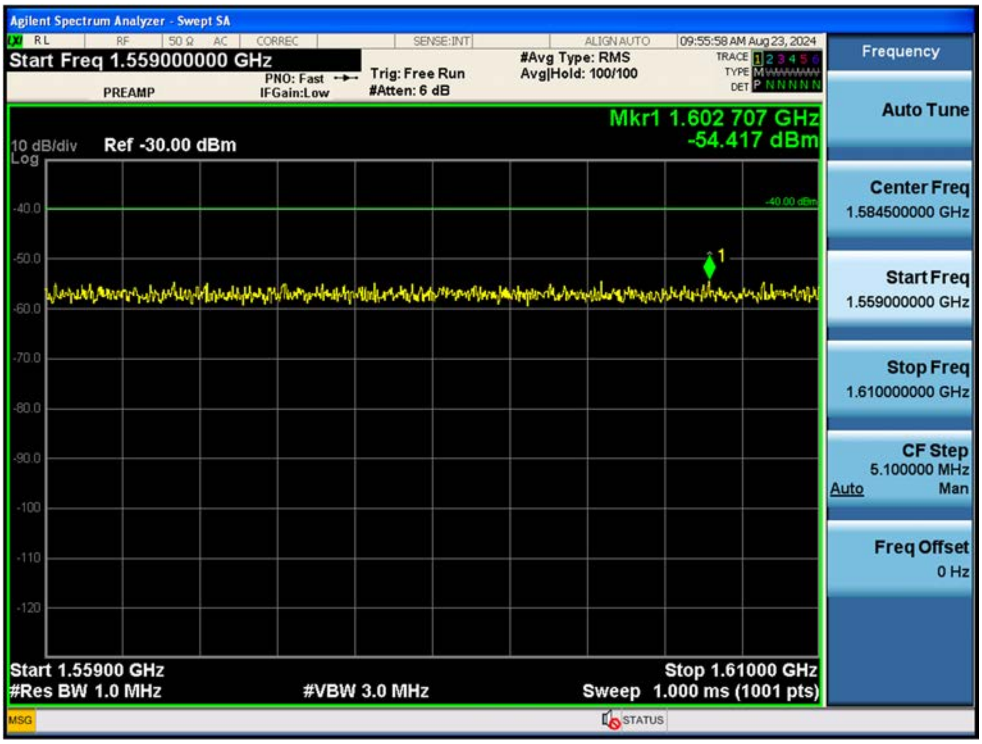
Spurious / ESMR / Downlink / 1 Carrier

Simultaneous / Spurious / Public Safety Narrowband + ESMR / Uplink

Simultaneous / Spurious / Public Safety Narrowband + NPSAC / Downlink

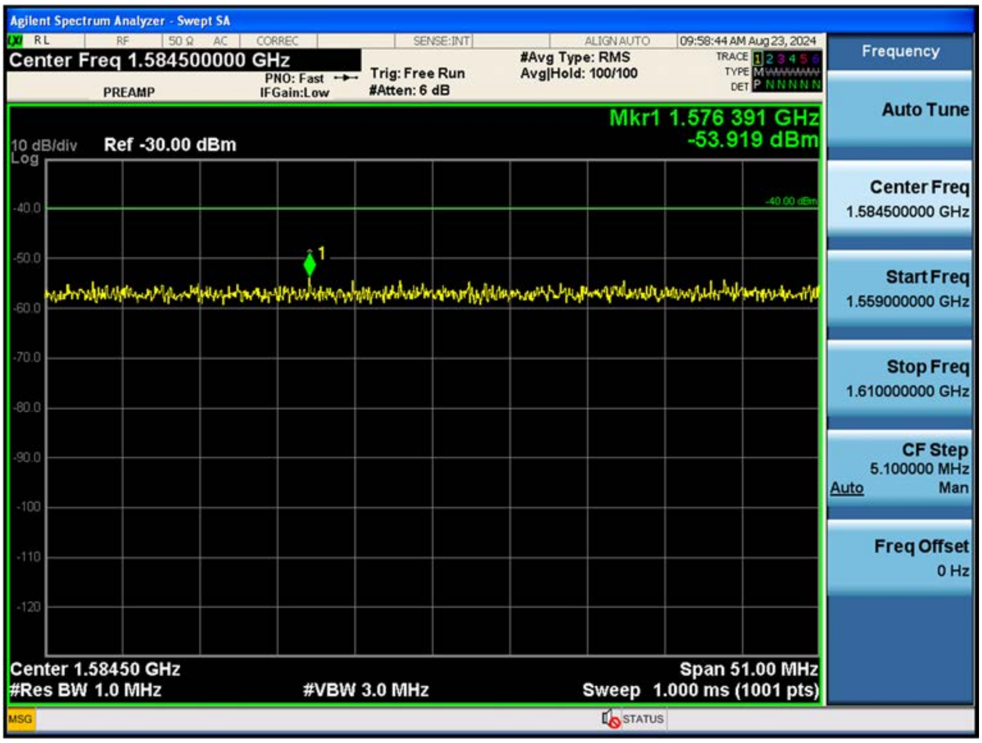
Note: Only the worst case plots for simultaneous spurious emissions.

Spurious / Public Safety Narrowband / Uplink / 1 Carrier / Additional 1559 MHz ~ 1610 MHz



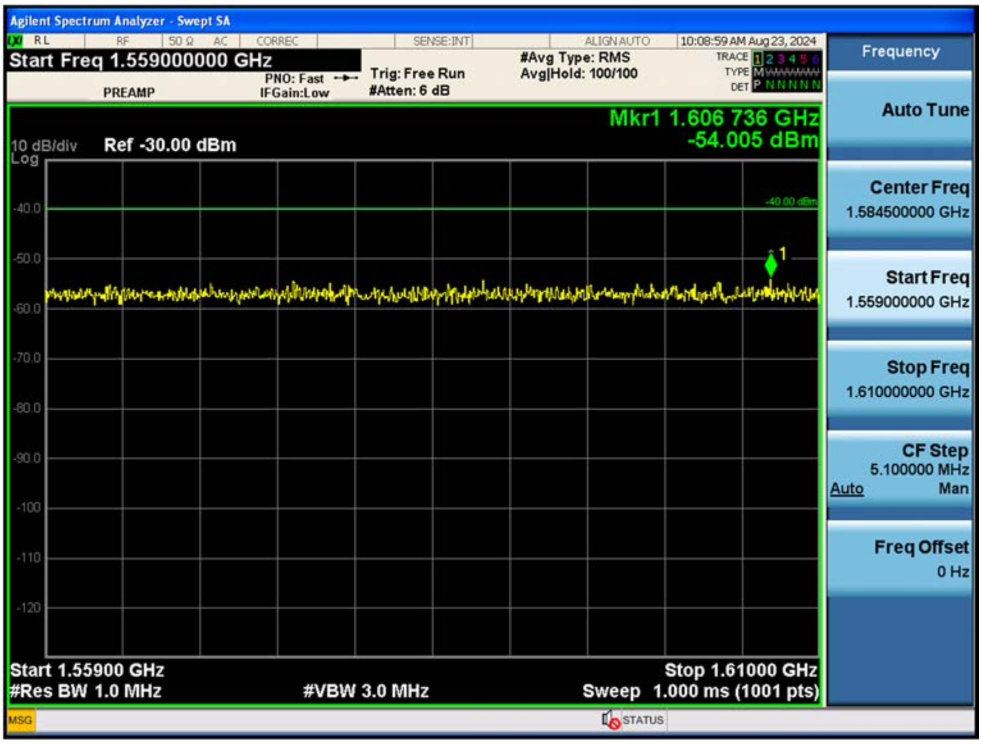
Measured Level + Ant. Gain = -54.417 dBm + 9 dBi = -45.417 dBm(E.I.R.P.) complies with the limit 27.53(f).

Spurious / Public Safety Narrowband / Downlink / 1 Carrier / Additional 1559 MHz ~ 1610 MHz



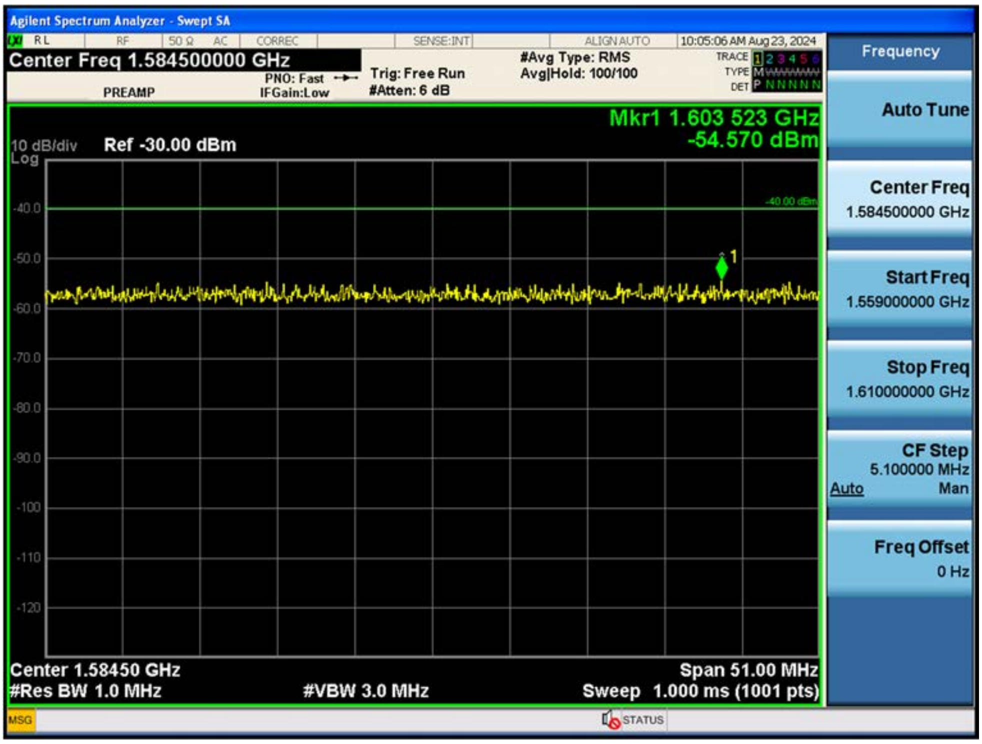
Measured Level + Ant. Gain = -53.919 dBm + 3.5 dBi = -50.419 dBm(E.I.R.P.) complies with the limit 27.53(f).

Simultaneous / Spurious / Public Safety Narrowband + ESMR / Uplink / 1 Carrier / Additional 1559 MHz ~ 1610 MHz



Measured Level + Ant. Gain = -54.005 dBm + 9 dBi = -45.005 dBm(E.I.R.P.) complies with the limit 27.53(f).

Simultaneous / Spurious / Public Safety Narrowband + NPSAC / Downlink / 1 Carrier / Additional 1559 MHz ~ 1610 MHz



Measured Level + Ant. Gain = -54.570 dBm + 3.5 dBi = -51.070 dBm(E.I.R.P.) complies with the limit 27.53(f).

5.8. RADIATED SPURIOUS EMISSIONS

Test Requirements:

§ 2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

Test Procedures:

Because KDB 935210 D05 procedure does not provide this requirement, measurements were in accordance with the test methods section 5.5 of ANSI C63.26-2015

a) Place the EUT in the center of the turntable. The EUT shall be configured to transmit into the standard non-radiating load (for measuring radiated spurious emissions), connected with cables of minimal length unless specified otherwise. If the EUT uses an adjustable antenna, the antenna shall be positioned to the length that produces the worst case emission at the fundamental operating frequency.

b) Each emission under consideration shall be evaluated:

1) Raise and lower the measurement antenna in accordance 5.5.2, as necessary to enable detection of the maximum emission amplitude relative to measurement antenna height.
2) Rotate the EUT through 360° to determine the maximum emission level relative to the axial position.
3) Return the turntable to the azimuth where the highest emission amplitude level was observed.
4) Vary the measurement antenna height again through 1 m to 4 m again to find the height associated with the maximum emission amplitude.
5) Record the measured emission amplitude level and frequency using the appropriate RBW.

c) Repeat step b) for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.

Test Result(Uplink):

Mode	Frequency (MHz)	Measured Level (dBuV)	Ant. Factor (dB/m)	A.G.+C.L.+H.P.F. (dB)	Pol.	Measured Power (dBm)	Result (dBm/m)
No Critical Peaks Found.							

Test Result(Downlink):

Mode	Frequency (MHz)	Measured Level (dBuV)	Ant. Factor (dB/m)	A.G.+C.L.+H.P.F. (dB)	Pol.	Measured Power (dBm)	Result (dBm/m)
No Critical Peaks Found.							

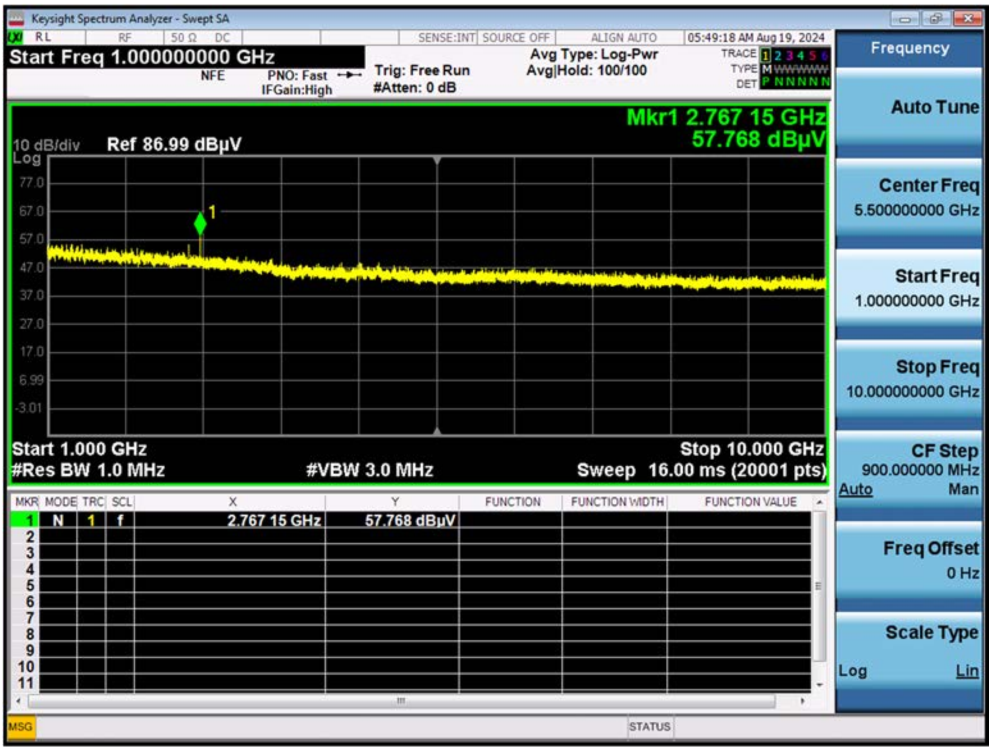
C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter

Note:

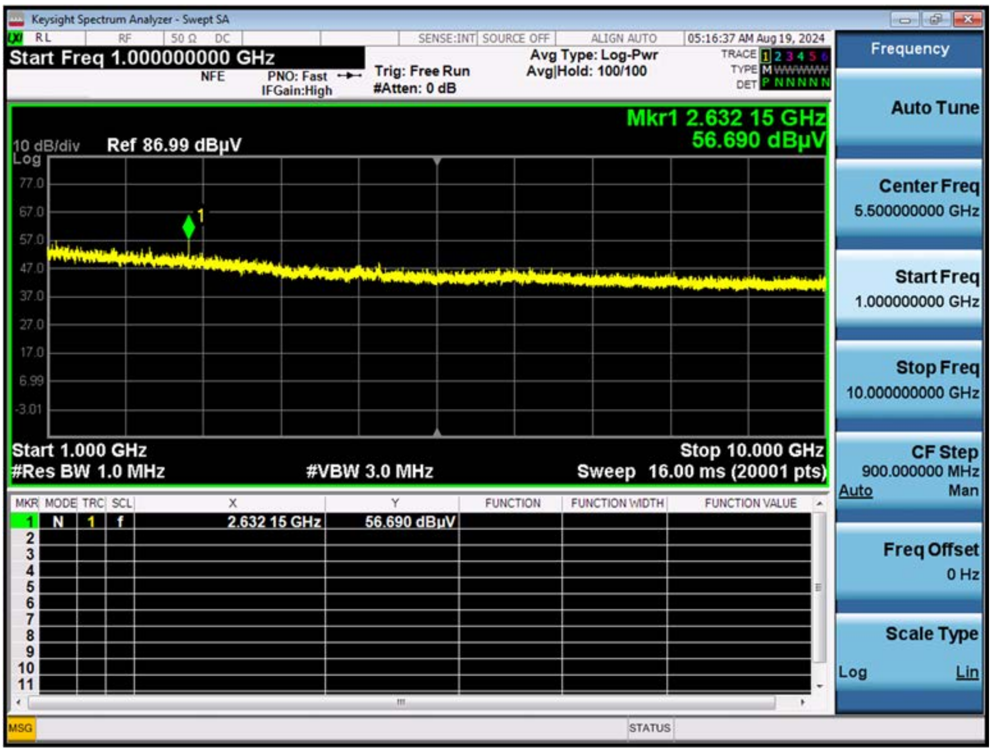
1. We have done horizontal and vertical polarization in detecting antenna.
2. Measure distance = 3 m
3. The amplitude of the spurious domain emission attenuated by more than 20 dB over the permissible value was not recorded according to ANSI C63.26, clause 5.1.1., c).
4. Test data were only the worst case.
5. Among the data of simultaneous and single band emission conditions, the single emission condition is the worst.

Plot data of radiated spurious emissions

Uplink / Public Safety Narrowband / 1 Carrier



Downlink / ESMR / 1 Carrier



Note : Only the worst case plots for Radiated Spurious Emissions.

5.9. FREQUENCY STABILITY

Test Requirements:

§ 90.213 Frequency stability.

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Table 1 to § 90.213(a)—Minimum Frequency Stability
[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	100	100	200
25-50	20	20	50
72-76	5		50
150-174	5	5	50
216-220	1.0		1.0
220-222	0.1	1.5	1.5
421-512	2.5	5	5
806-809	1.0	1.5	1.5
809-824	1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	300	300	300
Above 2450			

Test Procedures:

The measurement is performed in accordance with Section 5.6.3, 5.6.4 and 5.6.5 of ANSI C63.26.

5.6.3 Procedure for frequency stability testing

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer’s published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

a) At 10 °C intervals of temperatures between −30 °C and +50 °C at the manufacturer's rated supply voltage, and
b) At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the −15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.
If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

5.6.4 Frequency stability over variations in temperature

a) Supply the EUT with a nominal 60 Hz ac voltage, dc voltage, or install a new or fully charged battery in the EUT.
b) If possible a dummy load should be connected to the EUT because an antenna near the metallic walls of an environmental test chamber could affect the output frequency of the EUT. If the EUT is equipped with a permanently attached, adjustable-length antenna, the EUT should be placed in the center of the chamber with the antenna adjusted to the shortest length possible.
c) Turn on the EUT, and tune it to the center frequency of the operating band.
d) Couple the transmitter output to the measuring instrument through a suitable attenuator and coaxial cable. If connection to the EUT output is not possible, make the measurement by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away).
   NOTE—An instrument that has an adequate level of accuracy as specified by the procuring or regulatory authority is the recommended measuring instrument.
e) Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Adjust the detector bandwidth and span settings to achieve a resolution capable of accurate frequency measurements over the applicable frequency stability limits.
f) Turn the EUT off, and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.
g) Set the temperature control on the chamber to the Highest temperature specified in the regulatory requirements for the type of device, and allow the oscillator heater and the chamber temperature to stabilize. Unless otherwise instructed by the regulatory authority, this temperature should be 50 °C.
h) While maintaining a constant temperature inside the environmental chamber, turn on the EUT and allow sufficient time for the EUT temperature to stabilize.
i) Measure the frequency.
j) Switch off the EUT, but do not switch off the oscillator heater.

k) Lower the chamber temperature to the next level that is required by the standard and allow the temperature inside the chamber to stabilize. Unless otherwise instructed by the regulators, this temperature step should be 10 °C.

l) Repeat step h) through step k) down to the lowest specified temperature. Unless otherwise instructed by the regulators, this temperature should be −30 °C. When the frequency stability limit is stated as being sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point shall be established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and Highest channel of operation shall be identified as f_L and f_H respectively. The worst-case frequency offset determined in the above methods shall be added or subtracted from the values of f_L and f_H and the resulting frequencies must remain within the band.

m) Omitted

5.6.5 Frequency stability when varying supply voltage

a) Couple the transmitter output to the measuring instrument through a suitable attenuator and coaxial cable. If connection to the EUT output is not possible make the measurement by connecting an antenna to the measuring instrument with a suitable length of coaxial cable and placing the measuring antenna near the EUT (e.g., 15 cm away)

b) Supply the EUT with nominal ac or dc voltage. The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

c) Turn on the EUT, and couple its output to a frequency counter or other frequency-measuring instrument.

d) Tune the EUT to the center frequency of the operating band. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Adjust the detector bandwidth and span settings to achieve a resolution capable of accurate frequency measurements over the applicable frequency stability limits.
NOTE—An instrument that has an adequate level of accuracy as specified by the procuring or regulatory authority is the recommended measuring instrument.

e) Measure the frequency.

f) Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.

g) For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

h) Repeat the frequency measurement.
NOTE—For band-edge compliance, it can be required to make these measurements at the low and High channel of the operating band.

Note: The results of the frequency stability test shown above the frequency deviation measured values are very small and similar trend for each port, so we are attached only the worst case data.

Test Results(Uplink):

Reference: 200 VAC at 20°C **Freq.** = 802,000,000 Hz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100 %	+20(Ref)	802 000 004	4.384	0.000	0.00000
	-30	802 000 006	1.262	-3.122	-0.00389
	-20	802 000 012	7.527	3.143	0.00392
	-10	802 000 010	5.768	1.384	0.00173
	0	802 000 013	8.396	4.012	0.00500
	+10	802 000 008	3.229	-1.155	-0.00144
	+30	802 000 005	0.541	-3.843	-0.00479
	+40	802 000 014	9.759	5.375	0.00670
	+50	802 000 008	3.246	-1.138	-0.00142
115 %	+20	802 000 010	5.917	1.533	0.00191
85 %	+20	802 000 006	1.320	-3.064	-0.00382

Reference: 200 VAC at 20°C **Freq.** = 807,500,000 Hz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100 %	+20(Ref)	807 500 010	9.579	0.000	0.00000
	-30	807 500 011	1.862	-7.717	-0.00956
	-20	807 500 016	6.887	-2.692	-0.00333
	-10	807 500 020	9.928	0.349	0.00043
	0	807 500 014	4.706	-4.873	-0.00603
	+10	807 500 016	6.718	-2.862	-0.00354
	+30	807 500 014	4.501	-5.078	-0.00629
	+40	807 500 011	1.417	-8.162	-0.01011
	+50	807 500 019	9.793	0.214	0.00027
115 %	+20	807 500 015	5.325	-4.254	-0.00527
85 %	+20	807 500 019	9.913	0.334	0.00041

Reference: 200 VAC at 20°C **Freq.** = 812,500,000 Hz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100 %	+20(Ref)	812 500 000	0.490	0.000	0.00000
	-30	812 500 001	0.346	-0.144	-0.00018
	-20	812 500 008	7.118	6.628	0.00816
	-10	812 500 005	4.160	3.670	0.00452
	0	812 500 010	9.648	9.158	0.01127
	+10	812 500 009	8.494	8.004	0.00985
	+30	812 500 003	2.080	1.590	0.00196
	+40	812 500 003	2.629	2.139	0.00263
	+50	812 500 002	1.015	0.525	0.00065
115 %	+20	812 500 004	3.507	3.017	0.00371
85 %	+20	812 500 010	9.339	8.849	0.01089

Reference: 200 VAC at 20°C **Freq.** = 820,500,000 Hz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100 %	+20(Ref)	820 500 010	9.969	0.000	0.00000
	-30	820 500 016	5.551	-4.418	-0.00538
	-20	820 500 017	7.018	-2.951	-0.00360
	-10	820 500 018	8.092	-1.877	-0.00229
	0	820 500 013	2.741	-7.228	-0.00881
	+10	820 500 015	4.729	-5.240	-0.00639
	+30	820 500 016	6.293	-3.676	-0.00448
	+40	820 500 017	7.502	-2.467	-0.00301
	+50	820 500 013	3.382	-6.587	-0.00803
115 %	+20	820 500 018	8.213	-1.756	-0.00214
85 %	+20	820 500 016	6.308	-3.661	-0.00446

Test Results(Downlink):

Reference: 200 VAC at 20°C **Freq.** = 772,000,000 Hz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100 %	+20(Ref)	772 000 001	0.606	0.000	0.00000
	-30	772 000 002	1.891	1.286	0.00167
	-20	772 000 002	1.764	1.158	0.00150
	-10	772 000 010	9.477	8.871	0.01149
	0	772 000 009	8.861	8.255	0.01069
	+10	772 000 007	6.579	5.973	0.00774
	+30	772 000 007	6.800	6.194	0.00802
	+40	772 000 008	6.985	6.380	0.00826
	+50	772 000 008	7.104	6.498	0.00842
115 %	+20	772 000 003	2.292	1.686	0.00218
85 %	+20	772 000 008	7.214	6.608	0.00856

Reference: 200 VAC at 20°C **Freq.** = 852,500,000 Hz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100 %	+20(Ref)	852 500 004	3.737	0.000	0.00000
	-30	852 500 014	9.805	6.067	0.00712
	-20	852 500 008	4.754	1.017	0.00119
	-10	852 500 010	6.185	2.448	0.00287
	0	852 500 007	3.499	-0.239	-0.00028
	+10	852 500 011	7.275	3.538	0.00415
	+30	852 500 011	7.279	3.541	0.00415
	+40	852 500 004	0.049	-3.688	-0.00433
	+50	852 500 006	1.763	-1.974	-0.00232
115 %	+20	852 500 006	2.227	-1.510	-0.00177
85 %	+20	852 500 005	1.051	-2.687	-0.00315

Reference: 200 VAC at 20°C Freq. = 857,500,000 Hz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100 %	+20(Ref)	857 500 007	7.471	0.000	0.00000
	-30	857 500 011	3.927	-3.543	-0.00413
	-20	857 500 008	0.159	-7.312	-0.00853
	-10	857 500 009	1.461	-6.009	-0.00701
	0	857 500 016	8.325	0.855	0.00100
	+10	857 500 016	8.154	0.683	0.00080
	+30	857 500 011	3.360	-4.110	-0.00479
	+40	857 500 015	7.995	0.525	0.00061
	+50	857 500 011	3.786	-3.685	-0.00430
115 %	+20	857 500 012	4.891	-2.580	-0.00301
85 %	+20	857 500 015	7.974	0.503	0.00059

Reference: 200 VAC at 20°C Freq. = 865,500,000 Hz

Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100 %	+20(Ref)	865 500 008	8.043	0.000	0.00000
	-30	865 500 016	7.662	-0.380	-0.00044
	-20	865 500 014	6.173	-1.870	-0.00216
	-10	865 500 009	1.058	-6.985	-0.00807
	0	865 500 009	0.516	-7.527	-0.00870
	+10	865 500 013	5.108	-2.935	-0.00339
	+30	865 500 009	1.133	-6.910	-0.00798
	+40	865 500 015	6.470	-1.573	-0.00182
	+50	865 500 015	6.896	-1.147	-0.00133
115 %	+20	865 500 013	5.056	-2.987	-0.00345
85 %	+20	865 500 017	8.778	0.735	0.00085

6. Annex A_EUT AND TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2409-FC001-P