Spectrum Emission Mask

Governing Doc	FCC Part 90.210 (j) (h) (d) and (e)	Room Temperature (°C)	30.5
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October 27, 2017	Relative Humidity (%)	34.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Jeremy Lee	Date	Jun 20, 2018
EUT Voltage	☒ DC	☐ 120VAC @ 60Hz	

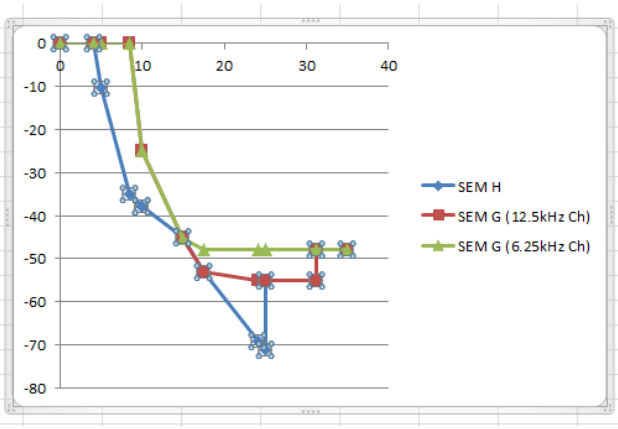
Test Equipment Used	Manufacturer	Model	Serial Number	Calibration	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	08/04/17	08/04/18
Spectrum Analyzer	Keysight	N9010A	MY50520285	08/07/17	08/07/18

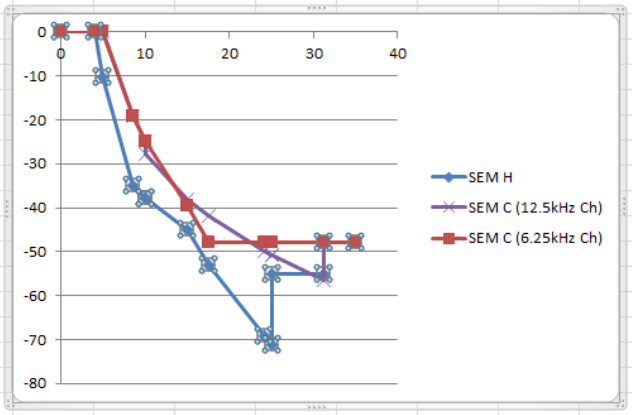
Frequency Range:	☒ 935 MHz – 940 MHz; 851 MHz – 861 MHz; 769 MHz – 775 MHz; 450 MHz – 512 MHz
Detector:	☒ Peak
RBW/VBW:	☒100 Hz
Type of Facility:	☒ Testbench
Distance:	☒ direct connect
Arrangement of EUT:	☐ Table-top only ☐ Floor-standing only ☒ Rack Mounted

Based on FCC Part90.210, transmitters without audio low pass filter used in frequency band
935 - 940 MHz must comply to emission mask J;
851 - 854 MHz must comply to emission mask H;
854 - 861 MHz must comply to emission mask G;
769 - 775 MHz (all other bands) must comply to emission mask C;
450 - 512 MHz operates with 6.25kHz channel must comply to emission mask E;
450 - 512 MHz operates with 12.5kHz channel must comply to emission mask D.

For simplicity of the test, noting that SEM H is more strigent than SEM G and SEM C, SEM H is applied to limit check on channels operate in frequency bands 854 - 861 MHz and 769 - 775 MHz in this test report.

SEM diagram show SEM H is more strigent than SEM G and SEM C:

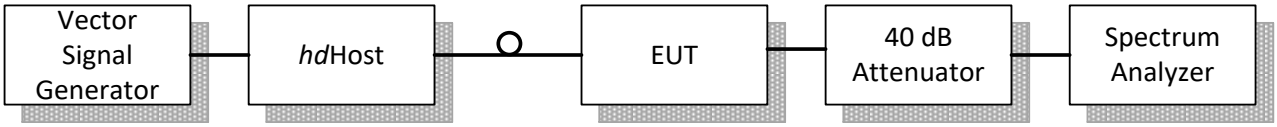




Compliant ☒ Non-Compliant ☐ Not Applicable ☐

Test setup

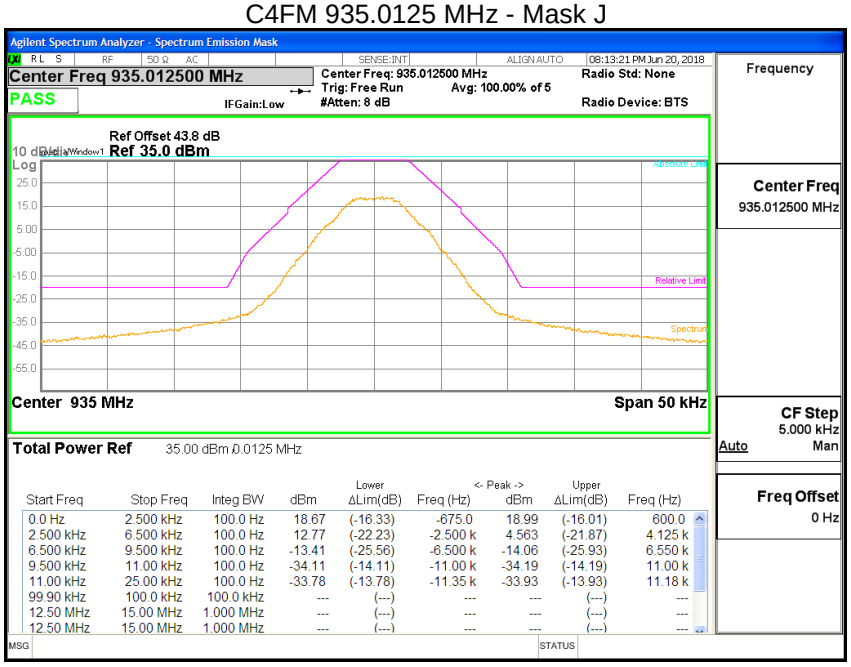
Description of test set-up:
Spectrum Emission Mask is measured by connecting a Spectrum Analyzer to the RF output connector. The input power was adjusted to produce maximum output power on the antenna port. The reference level was measured with integrated BW of the designated channel BW. The emission was measured with RBW 100 Hz. The EUT was set to **Operation Mode #1 with configuration Mode #1.**



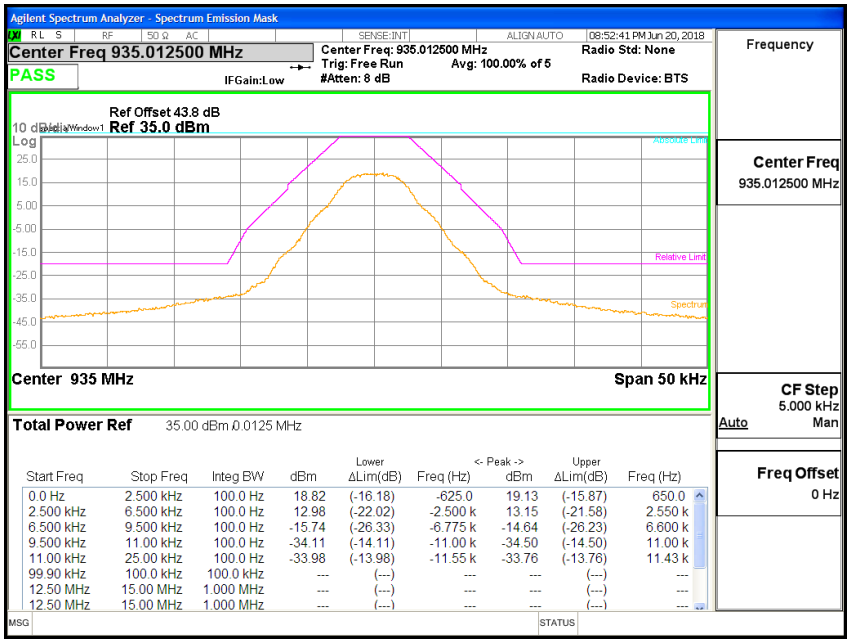
Results

At Input Power 0.5 dB below AGC threshold

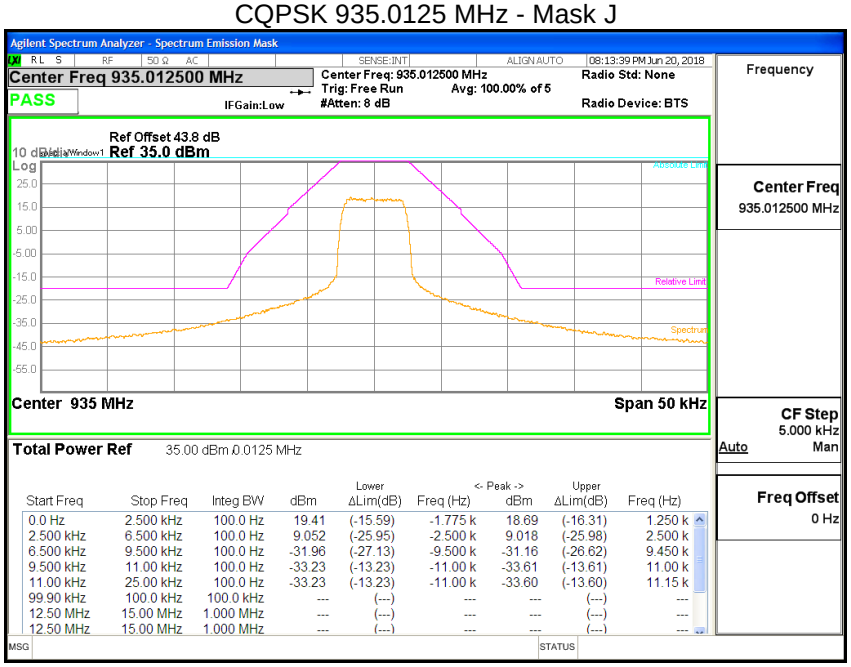
C4FM 935.0125 MHz - Mask J



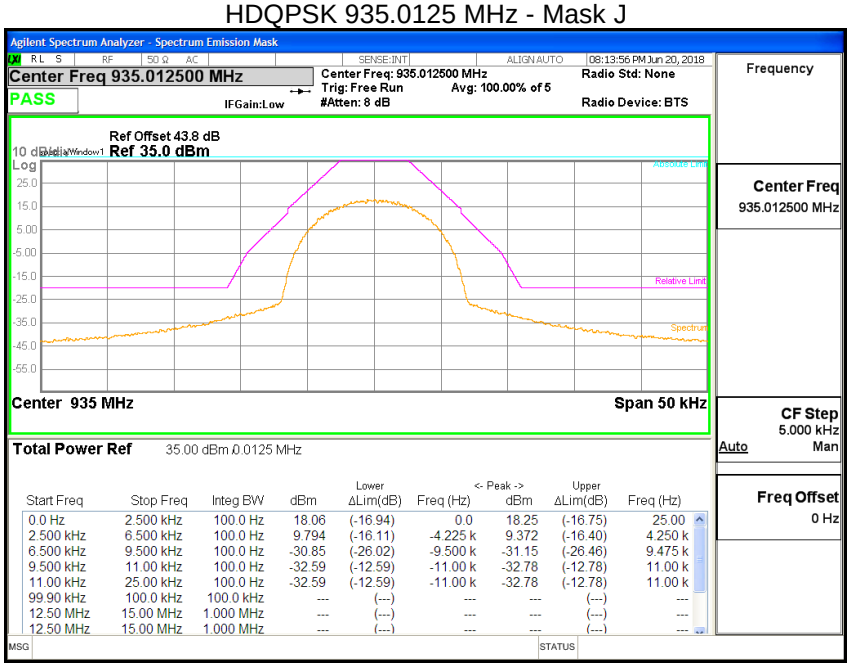
4FSK 935.0125 MHz - Mask J



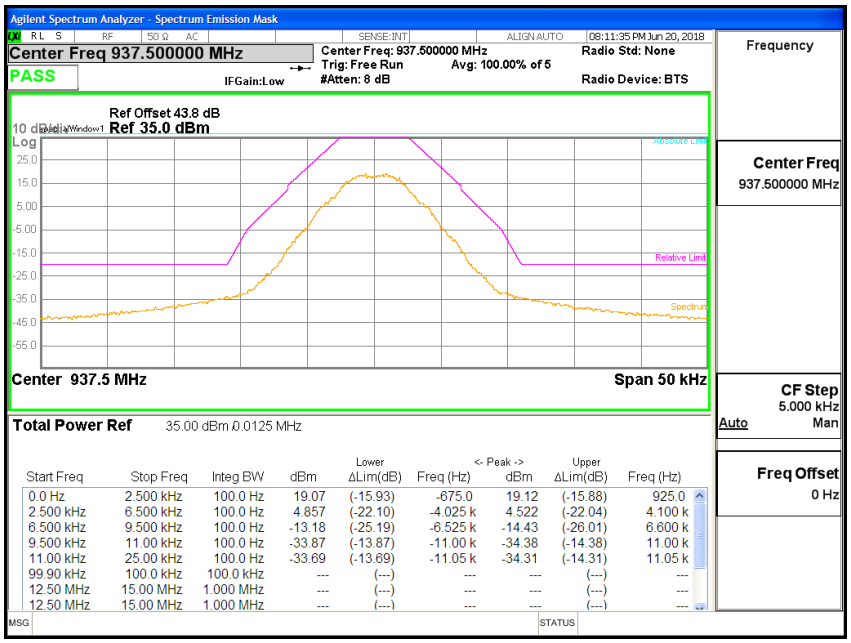
CQPSK 935.0125 MHz - Mask J



HDQPSK 935.0125 MHz - Mask J

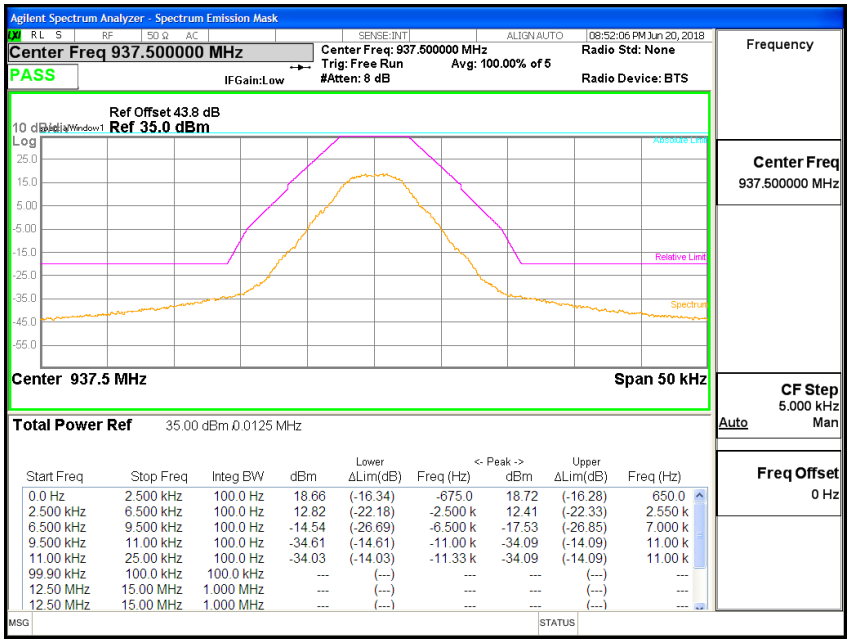


C4FM 937.5 MHz - Mask J



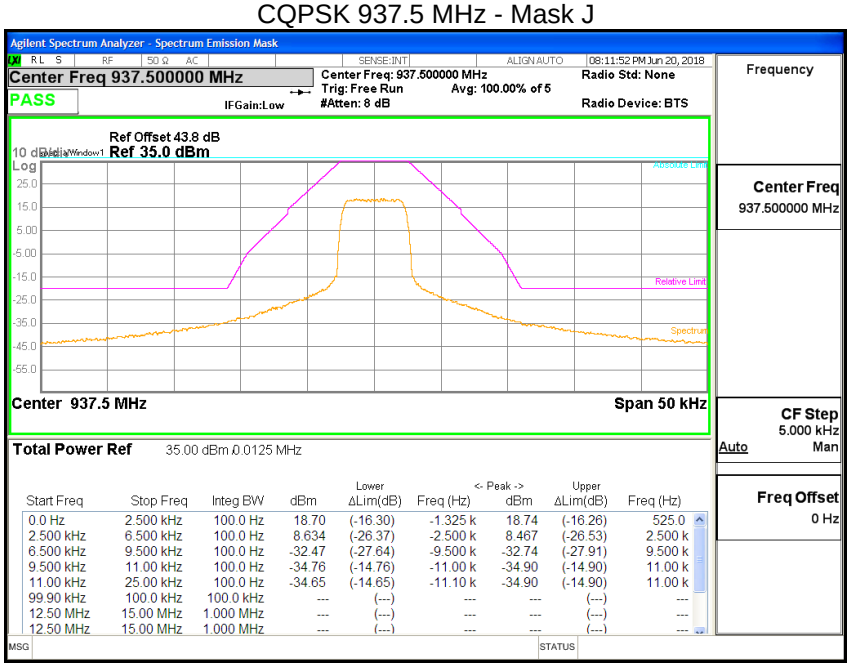
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	19.07	(-15.93)	-675.0	19.12	(-15.88)	925.0
2.500 kHz	6.500 kHz	100.0 Hz	4.857	(-22.10)	-4.025 k	4.522	(-22.04)	4.100 k
6.500 kHz	9.500 kHz	100.0 Hz	-13.18	(-25.19)	-6.525 k	-14.43	(-26.01)	6.600 k
9.500 kHz	11.00 kHz	100.0 Hz	-33.87	(-13.87)	-11.00 k	-34.38	(-14.38)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-33.69	(-13.69)	-11.05 k	-34.31	(-14.31)	11.05 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

4FSK 937.5 MHz - Mask J

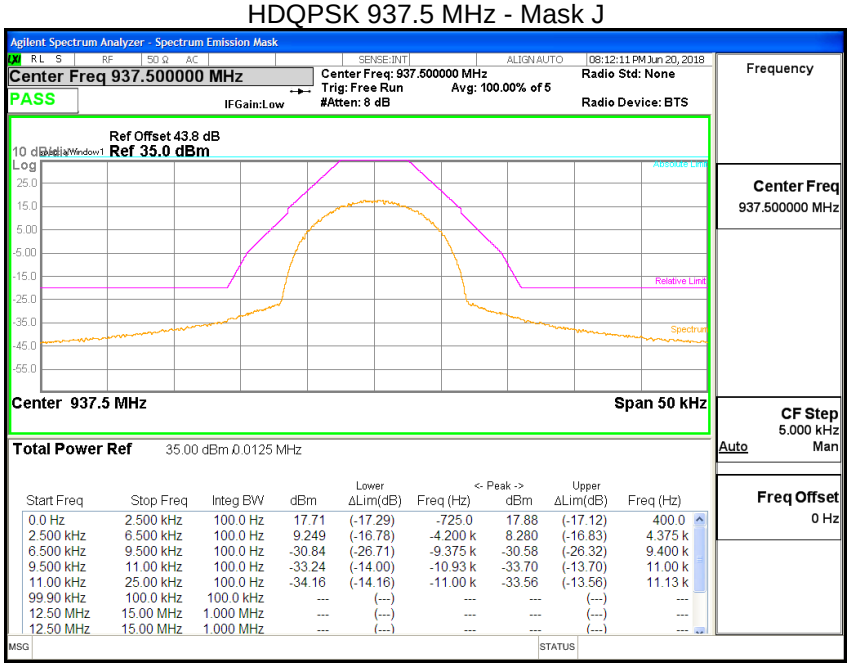


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	18.66	(-16.34)	-675.0	18.72	(-16.28)	650.0
2.500 kHz	6.500 kHz	100.0 Hz	12.82	(-22.18)	-2.500 k	12.41	(-22.33)	2.550 k
6.500 kHz	9.500 kHz	100.0 Hz	-14.54	(-26.69)	-6.500 k	-17.53	(-26.85)	7.000 k
9.500 kHz	11.00 kHz	100.0 Hz	-34.61	(-14.61)	-11.00 k	-34.09	(-14.09)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-34.03	(-14.03)	-11.33 k	-34.09	(-14.09)	11.00 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

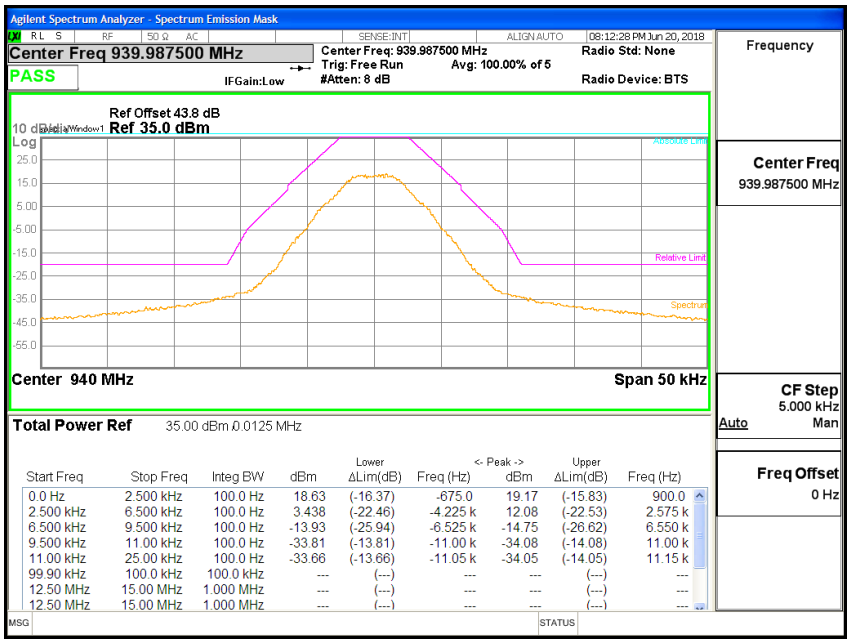
CQPSK 937.5 MHz - Mask J



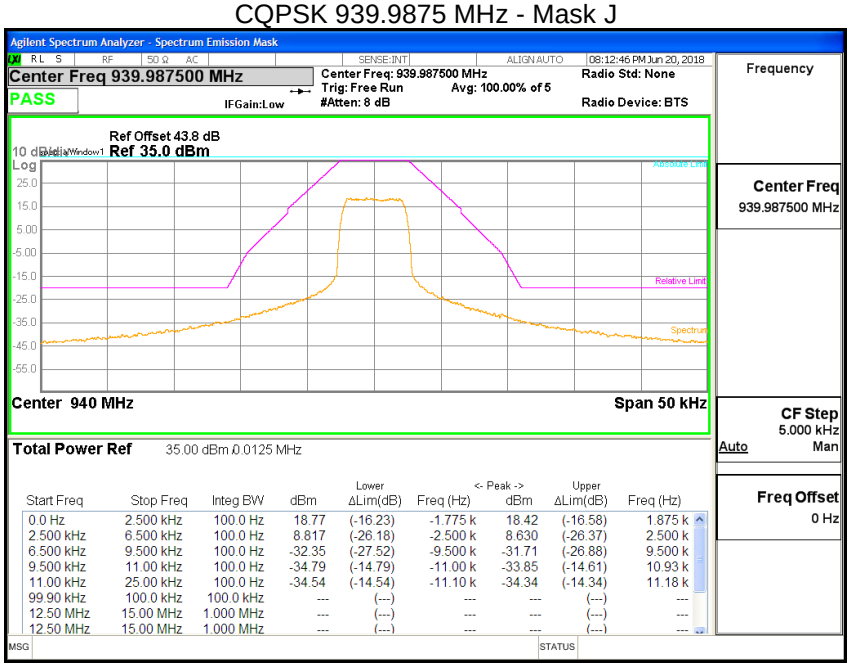
HDQPSK 937.5 MHz - Mask J



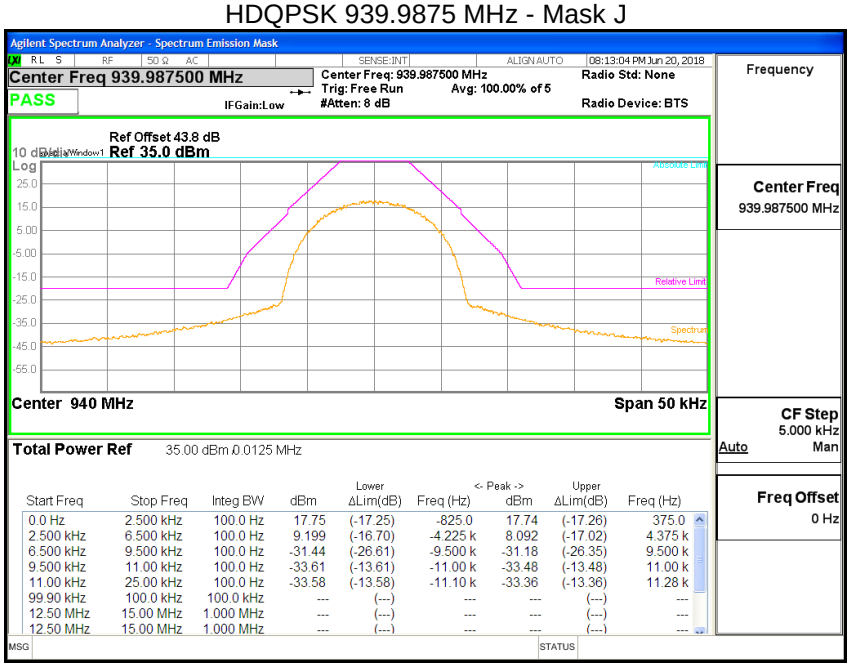
C4FM 939.9875 MHz - Mask J



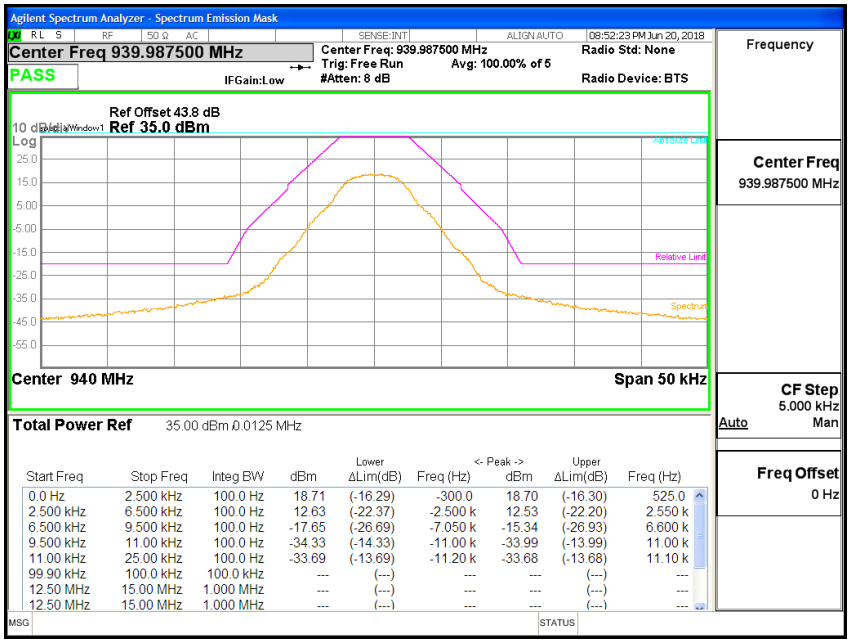
CQPSK 939.9875 MHz - Mask J



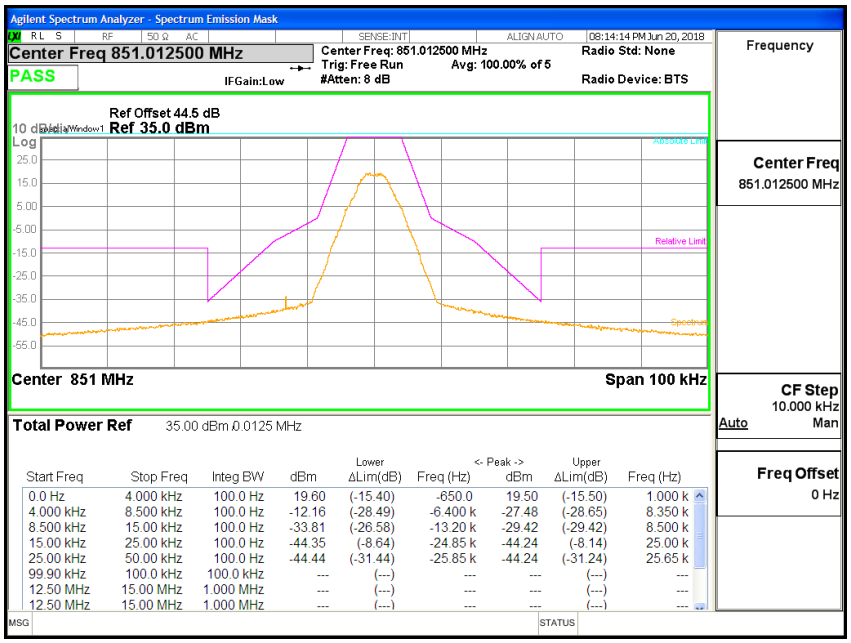
HDQPSK 939.9875 MHz - Mask J



4FSK 939.9875 MHz – Mask J

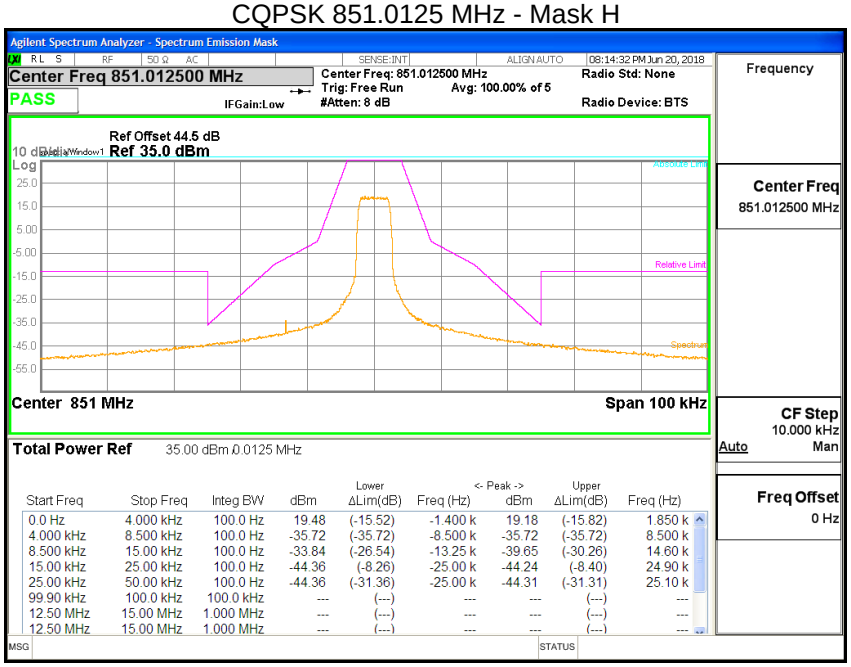


C4FM 851.0125 MHz – Mask H



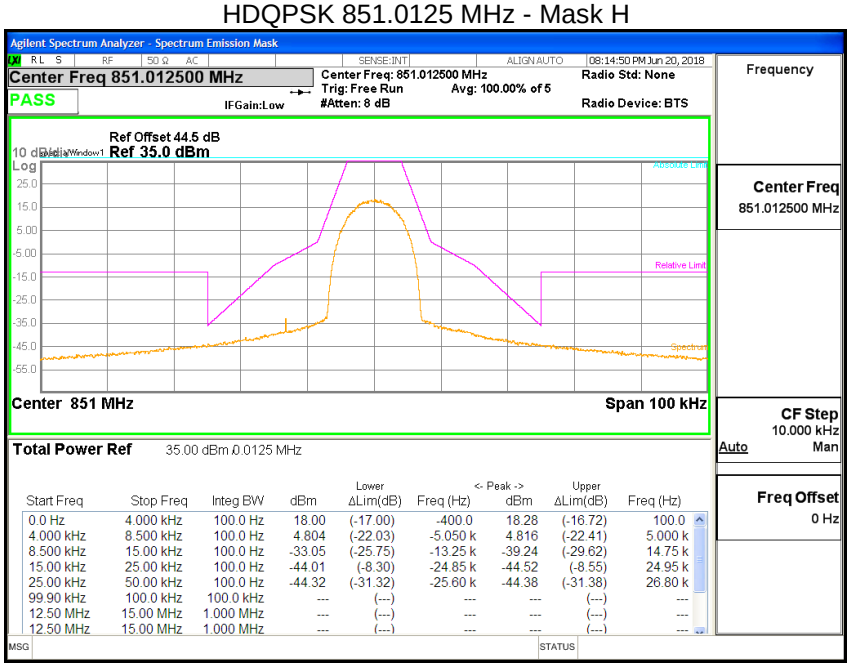
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.60	(-15.40)	-650.0	19.50	(-15.50)	1.000 k
4.000 kHz	8.500 kHz	100.0 Hz	-12.16	(-28.49)	-6.400 k	-27.48	(-28.65)	8.350 k
8.500 kHz	15.00 kHz	100.0 Hz	-33.81	(-26.58)	-13.20 k	-29.42	(-29.42)	8.500 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.35	(-8.64)	-24.85 k	-44.24	(-8.14)	25.00 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.44	(-31.44)	-25.85 k	-44.24	(-31.24)	25.65 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

CQPSK 851.0125 MHz - Mask H



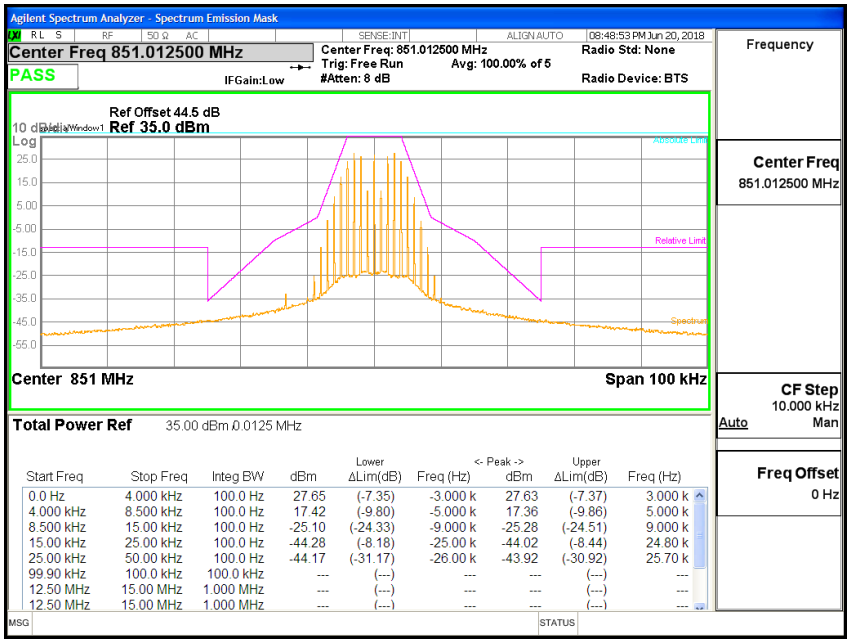
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.48	(-15.52)	-1.400 k	19.18	(-15.82)	1.850 k
4.000 kHz	8.500 kHz	100.0 Hz	-35.72	(-35.72)	-8.500 k	-35.72	(-35.72)	8.500 k
8.500 kHz	15.00 kHz	100.0 Hz	-33.84	(-26.54)	-13.25 k	-39.65	(-30.26)	14.60 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.36	(-8.26)	-25.00 k	-44.24	(-8.40)	24.90 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.36	(-31.36)	-25.00 k	-44.31	(-31.31)	25.10 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

HDQPSK 851.0125 MHz - Mask H



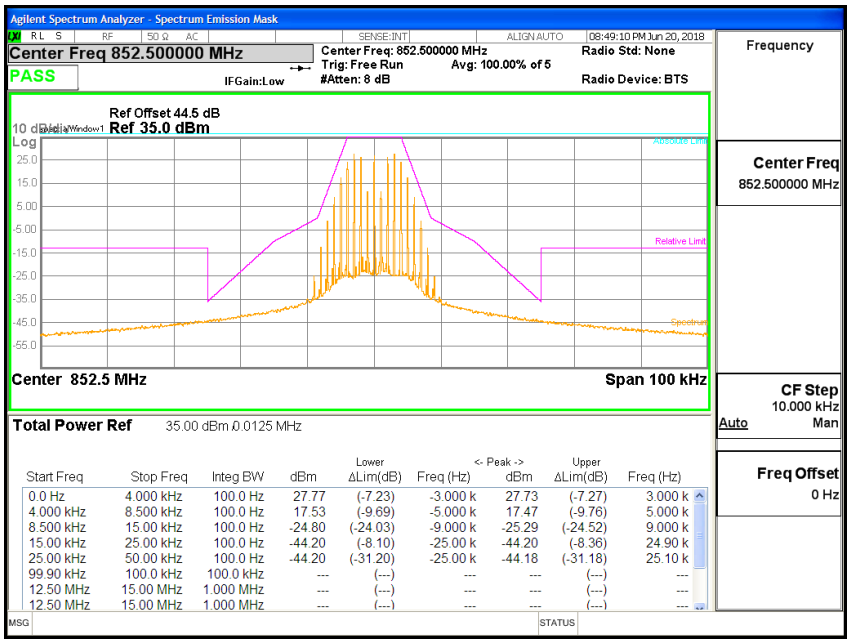
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	18.00	(-17.00)	-400.0	18.28	(-16.72)	100.0
4.000 kHz	8.500 kHz	100.0 Hz	4.804	(-22.03)	-5.050 k	4.816	(-22.41)	5.000 k
8.500 kHz	15.00 kHz	100.0 Hz	-33.05	(-25.75)	-13.25 k	-39.24	(-29.62)	14.75 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.01	(-8.30)	-24.85 k	-44.52	(-8.55)	24.95 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.32	(-31.32)	-25.60 k	-44.38	(-31.38)	26.80 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

FM 851.0125 MHz - Mask H

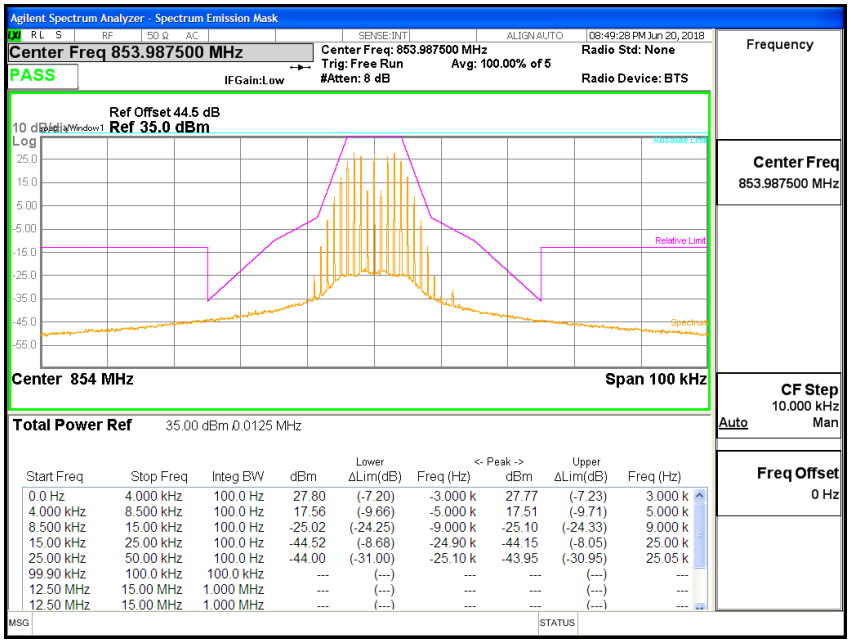


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	27.65	(-7.35)	-3.000 k	27.63	(-7.37)	3.000 k
4.000 kHz	8.500 kHz	100.0 Hz	17.42	(-9.80)	-5.000 k	17.36	(-9.86)	5.000 k
8.500 kHz	15.00 kHz	100.0 Hz	-25.10	(-24.33)	-9.000 k	-25.28	(-24.51)	9.000 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.28	(-8.18)	-25.00 k	-44.02	(-8.44)	24.80 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.17	(-31.17)	-26.00 k	-43.92	(-30.92)	25.70 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

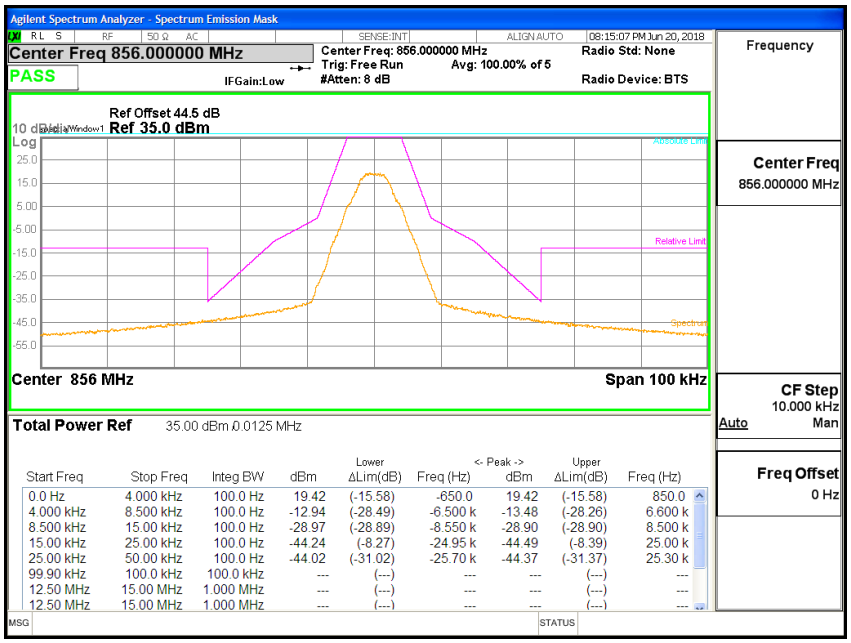
FM 852.5 MHz – Mask H



FM 853.9875 MHz – Mask H

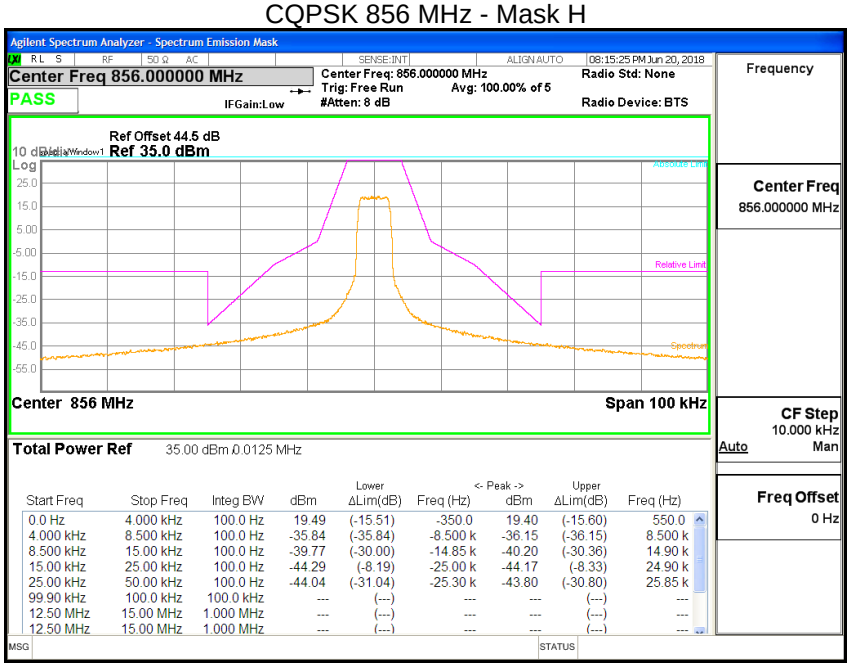


C4FM 856 MHz – Mask H



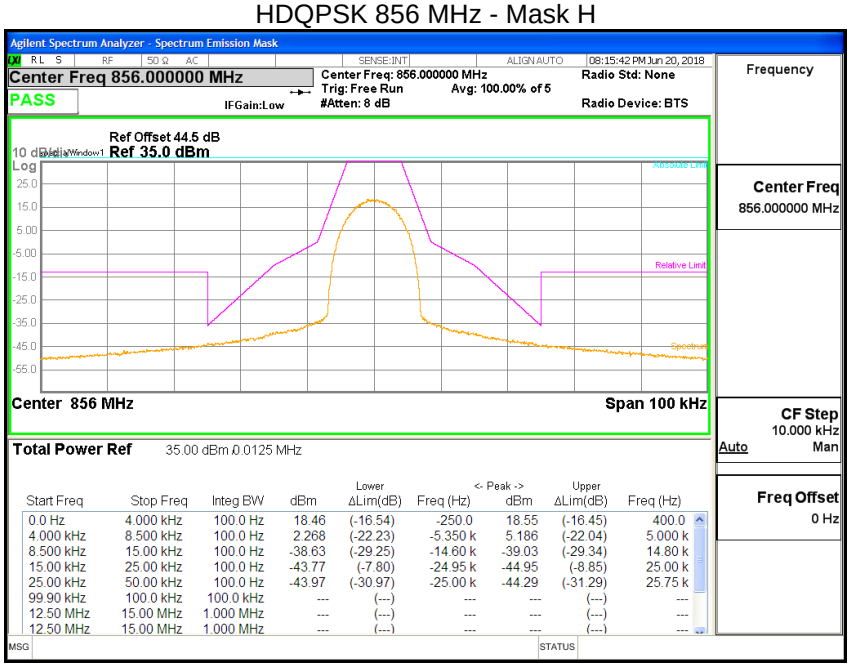
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.42	(-15.58)	-650.0	19.42	(-15.58)	850.0
4.000 kHz	8.500 kHz	100.0 Hz	-12.94	(-28.49)	-6.500 k	-13.48	(-28.26)	6.600 k
8.500 kHz	15.00 kHz	100.0 Hz	-28.97	(-28.89)	-8.550 k	-28.90	(-28.90)	8.500 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.24	(-8.27)	-24.95 k	-44.49	(-8.39)	25.00 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.02	(-31.02)	-25.70 k	-44.37	(-31.37)	25.30 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

CQPSK 856 MHz - Mask H

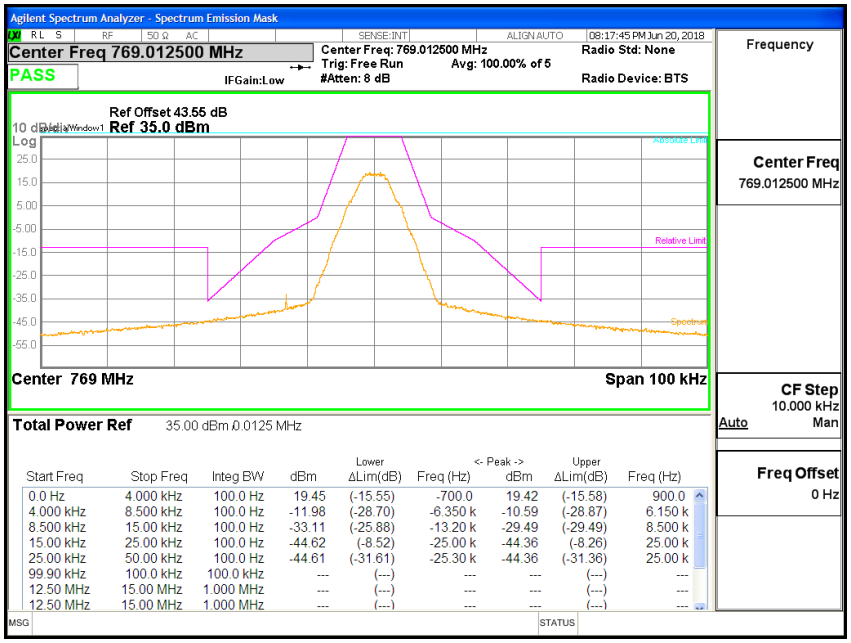


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.49	(-15.51)	-350.0	19.40	(-15.60)	550.0
4.000 kHz	8.500 kHz	100.0 Hz	-35.84	(-35.84)	-8.500 k	-36.15	(-36.15)	8.500 k
8.500 kHz	15.00 kHz	100.0 Hz	-39.77	(-30.00)	-14.85 k	-40.20	(-30.36)	14.90 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.29	(-8.19)	-25.00 k	-44.17	(-8.33)	24.90 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.04	(-31.04)	-25.30 k	-43.80	(-30.80)	25.85 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

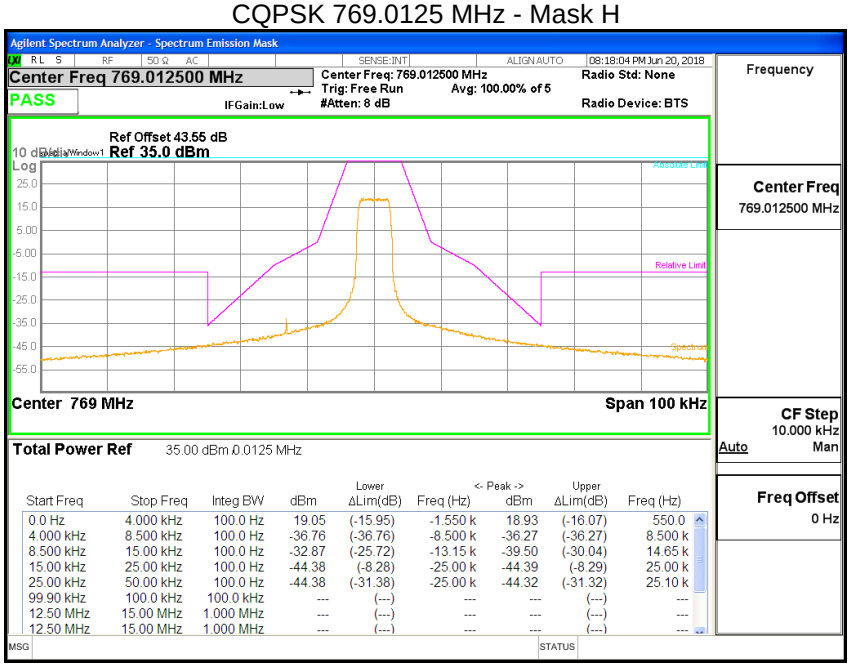
HDQPSK 856 MHz - Mask H



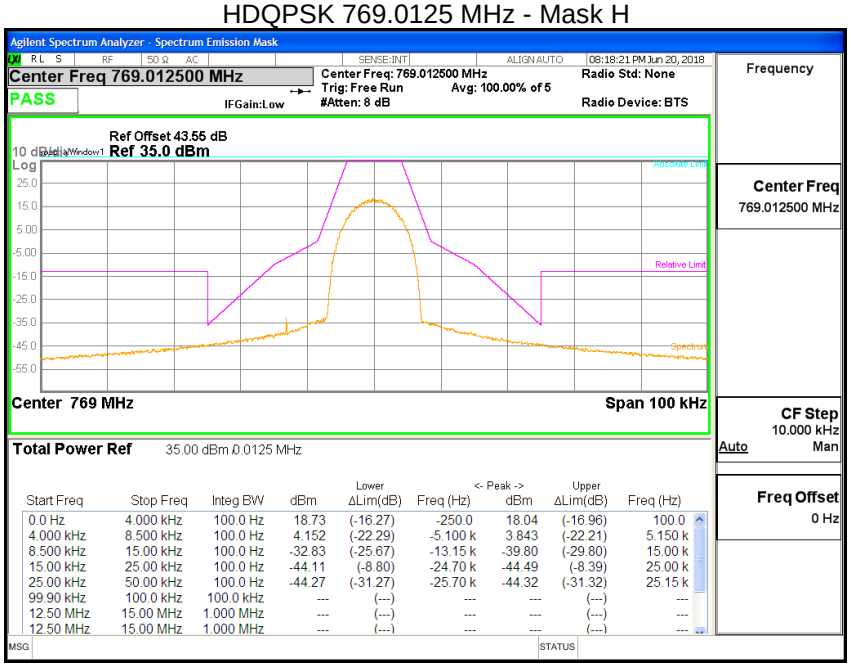
C4FM 769.0125 MHz - Mask H



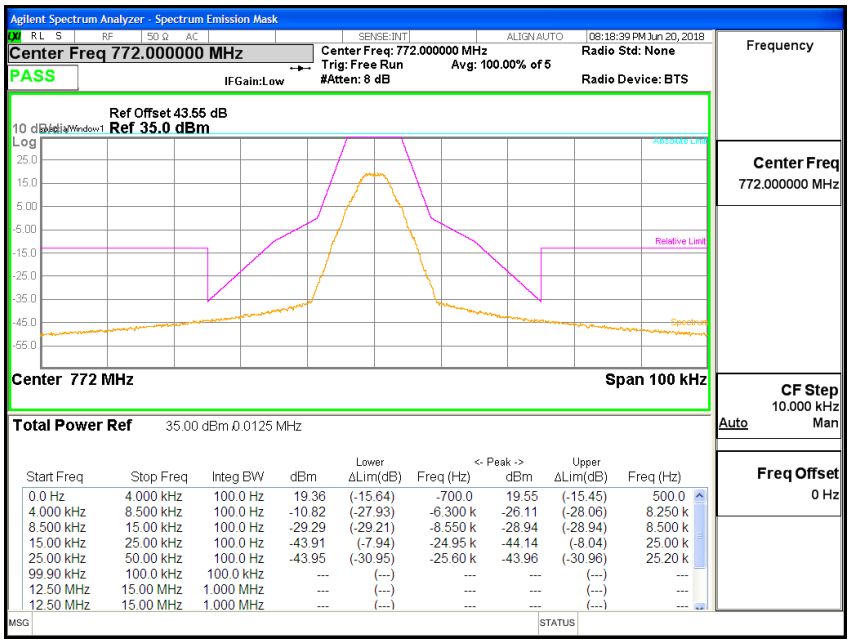
CQPSK 769.0125 MHz - Mask H



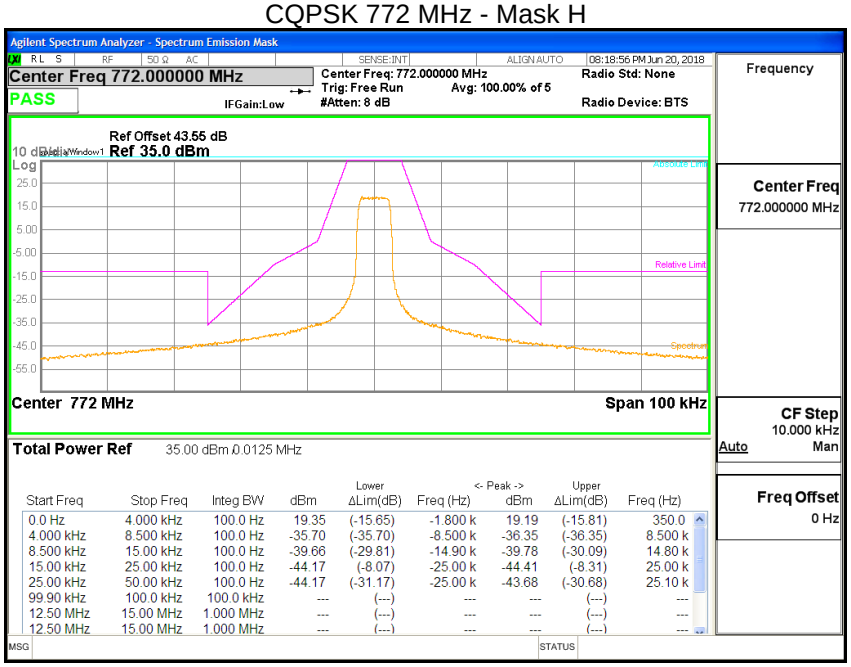
HDQPSK 769.0125 MHz - Mask H



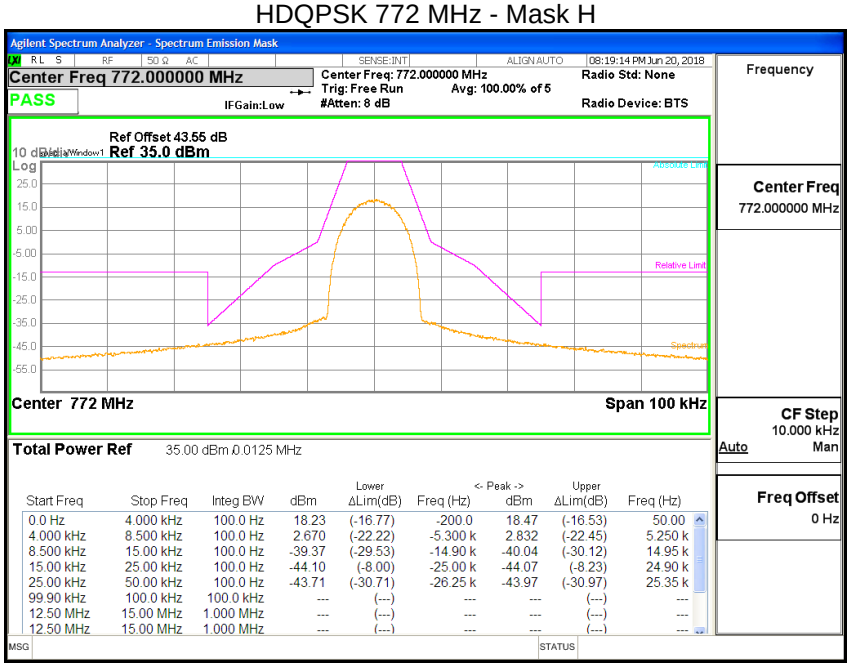
C4FM 772 MHz - Mask H



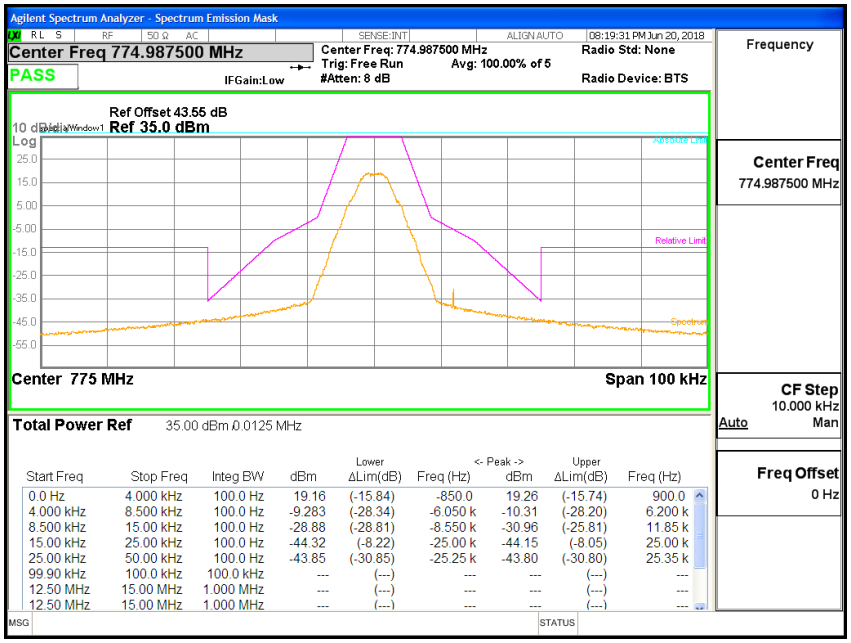
CQPSK 772 MHz - Mask H



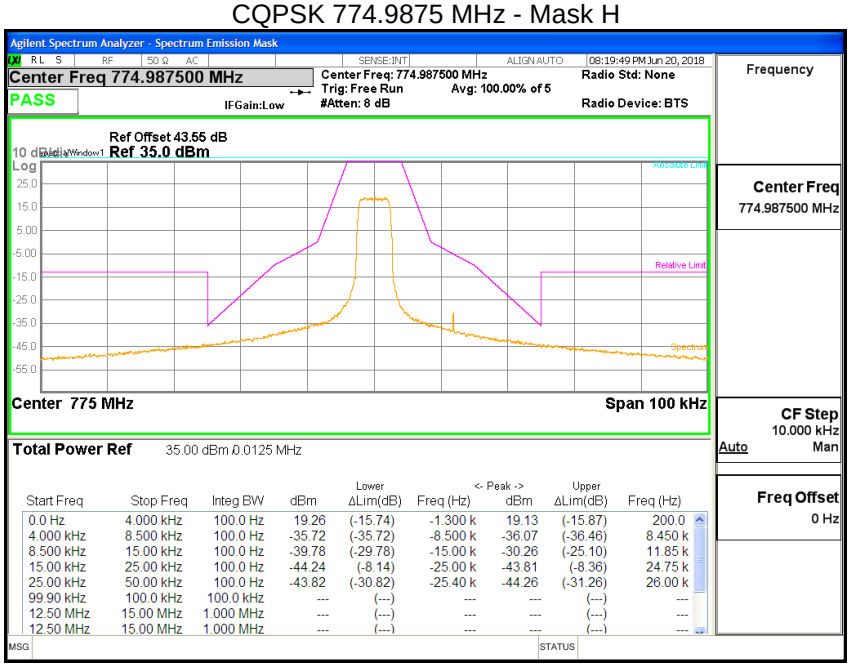
HDQPSK 772 MHz - Mask H



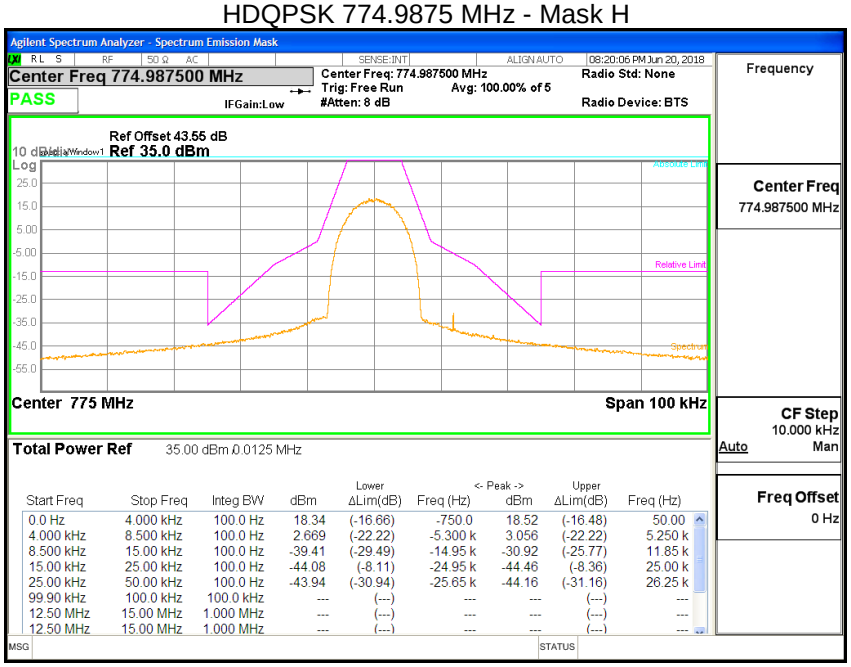
C4FM 774.9875 MHz - Mask H



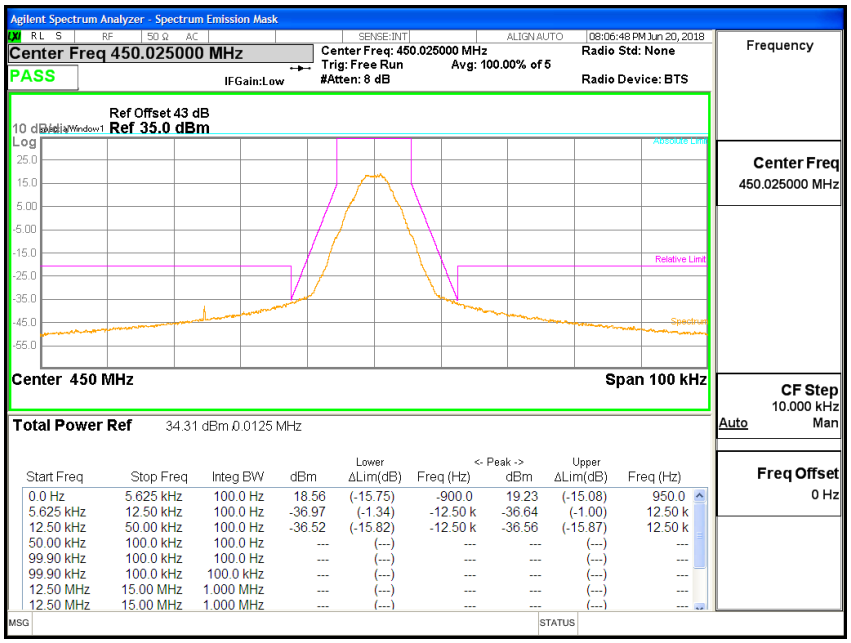
CQPSK 774.9875 MHz - Mask H



HDQPSK 774.9875 MHz - Mask H

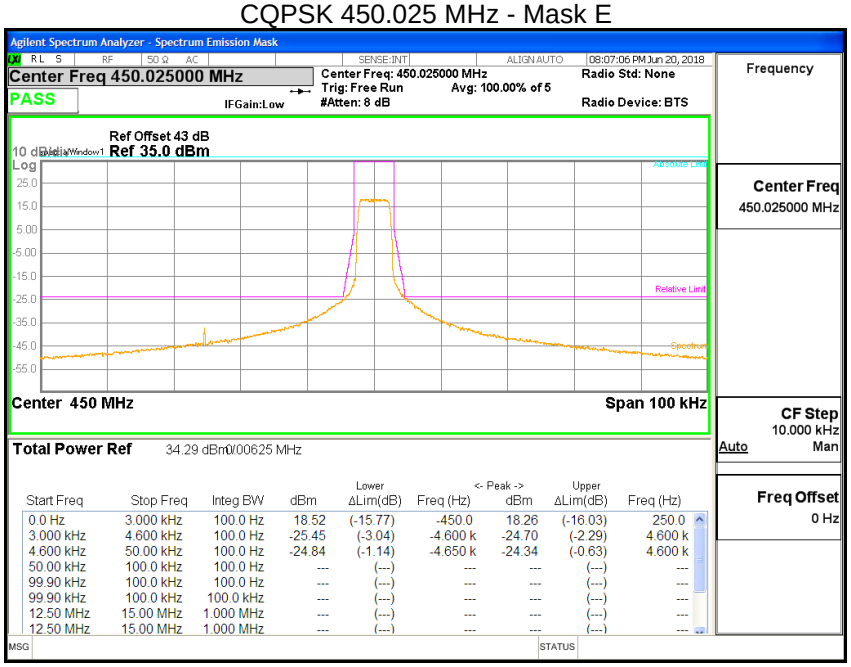


C4FM 450.025 MHz - Mask D



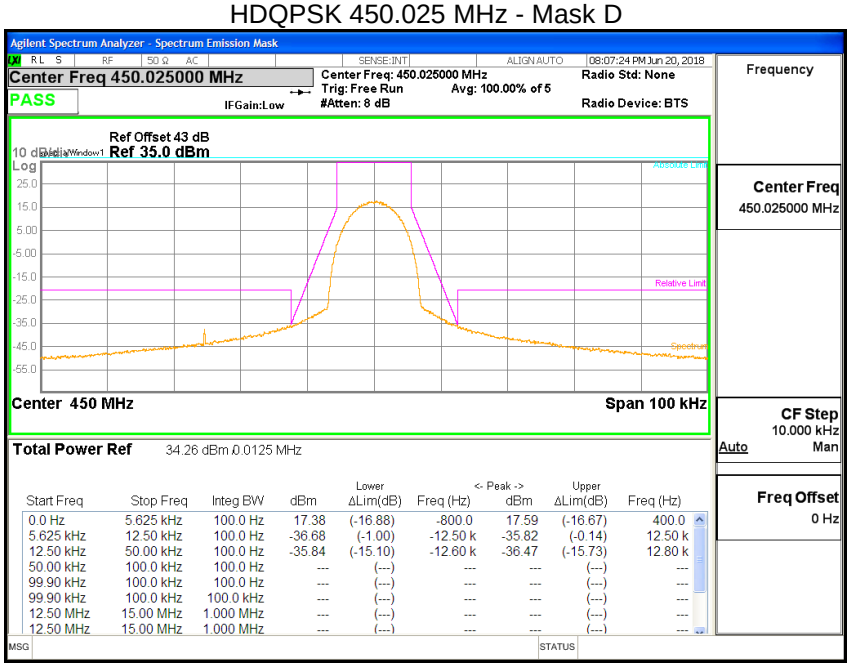
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	18.56	(-15.75)	-900.0	19.23	(-15.08)	950.0
5.625 kHz	12.50 kHz	100.0 Hz	-36.97	(-1.34)	-12.50 k	-36.64	(-1.00)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-36.52	(-15.82)	-12.50 k	-36.56	(-15.87)	12.50 k
50.00 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

CQPSK 450.025 MHz - Mask E



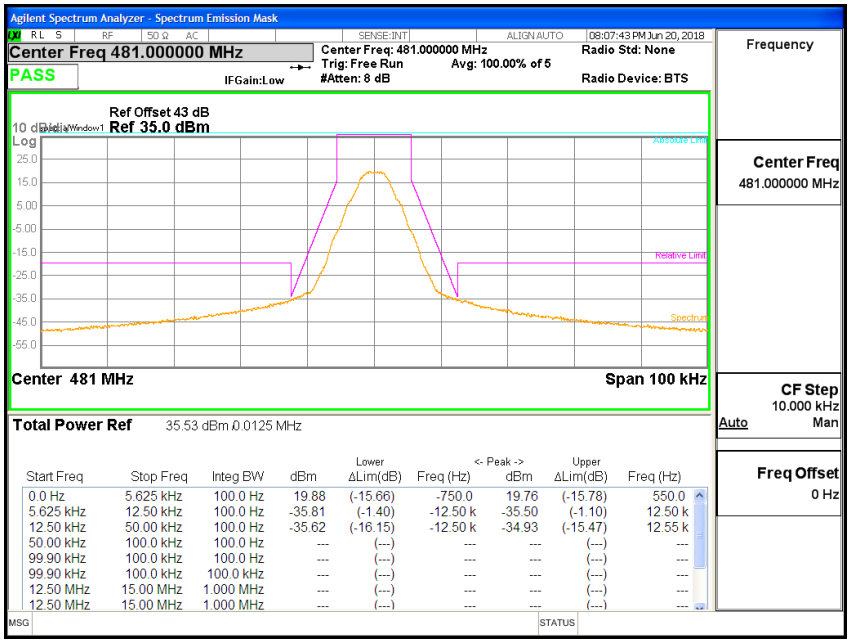
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	3.000 kHz	100.0 Hz	18.52	(-15.77)	-450.0	18.26	(-16.03)	250.0
3.000 kHz	4.600 kHz	100.0 Hz	-25.45	(-3.04)	-4.600 k	-24.70	(-2.29)	4.600 k
4.600 kHz	50.00 kHz	100.0 Hz	-24.84	(-1.14)	-4.650 k	-24.34	(-0.63)	4.600 k
50.00 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

HDQPSK 450.025 MHz - Mask D



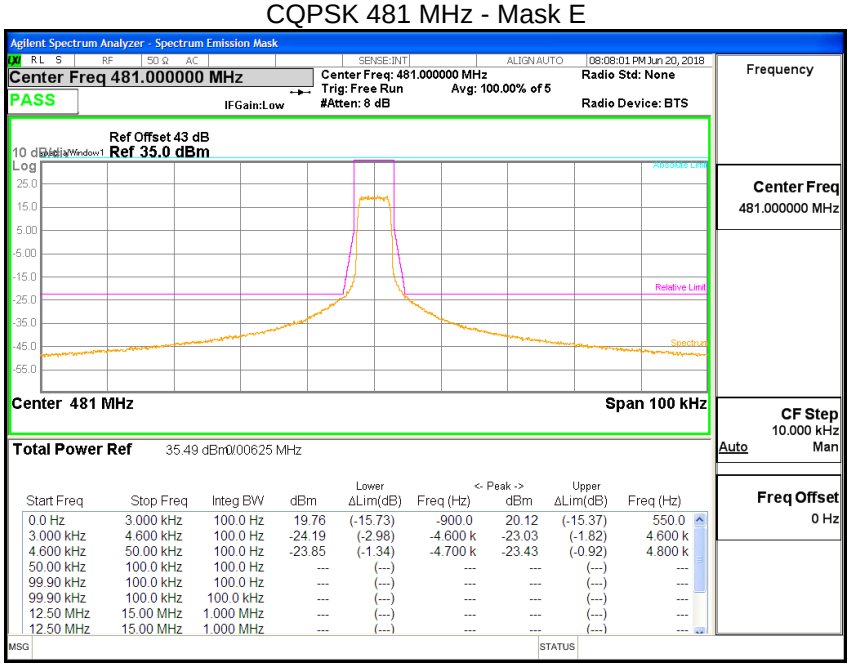
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	17.38	(-16.88)	-800.0	17.59	(-16.67)	400.0
5.625 kHz	12.50 kHz	100.0 Hz	-36.68	(-1.00)	-12.50 k	-35.82	(-0.14)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-35.84	(-15.10)	-12.60 k	-36.47	(-15.73)	12.80 k
50.00 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

C4FM 481 MHz - Mask D

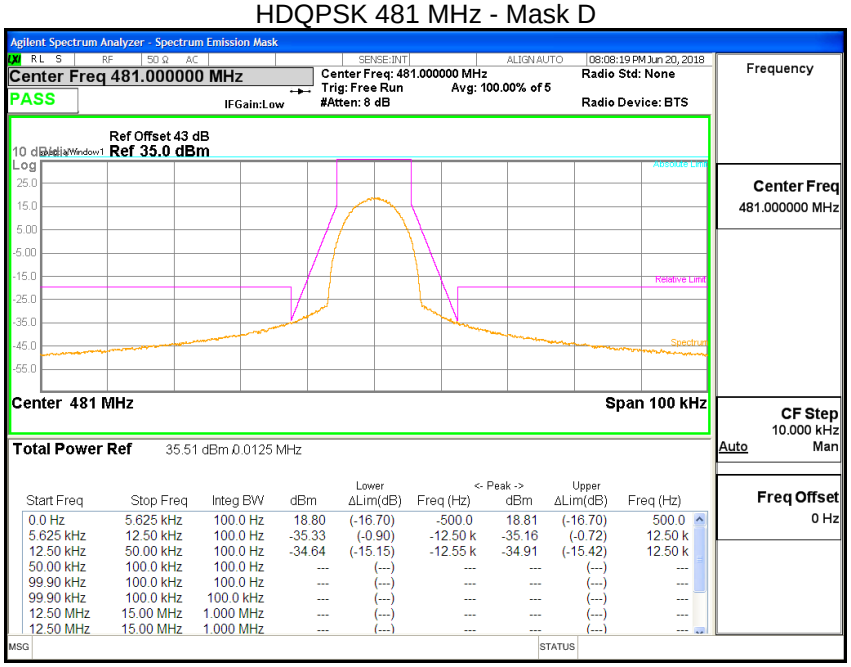


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	19.88	(-15.66)	-750.0	19.76	(-15.78)	550.0
5.625 kHz	12.50 kHz	100.0 Hz	-35.81	(-1.40)	-12.50 k	-35.50	(-1.10)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-35.62	(-16.15)	-12.50 k	-34.93	(-15.47)	12.55 k
50.00 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

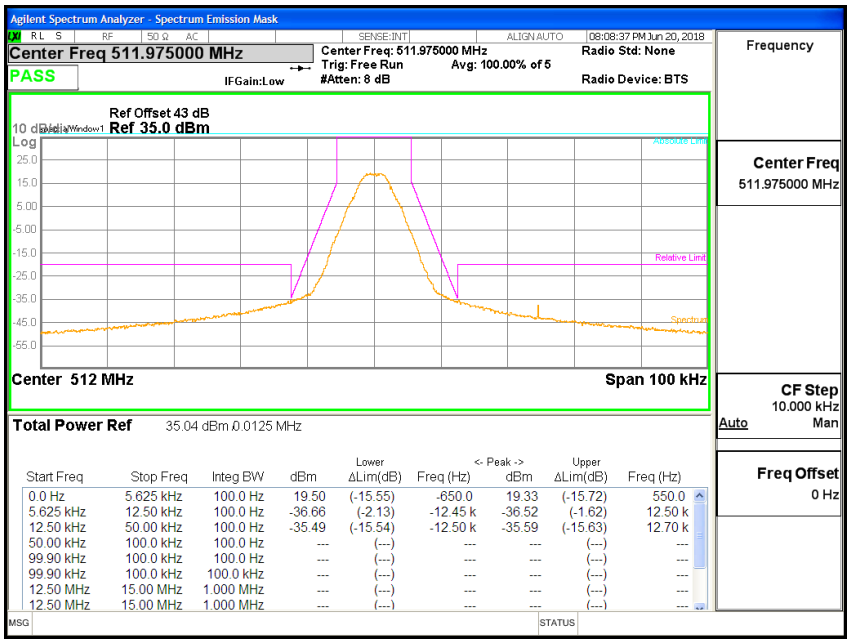
CQPSK 481 MHz - Mask E



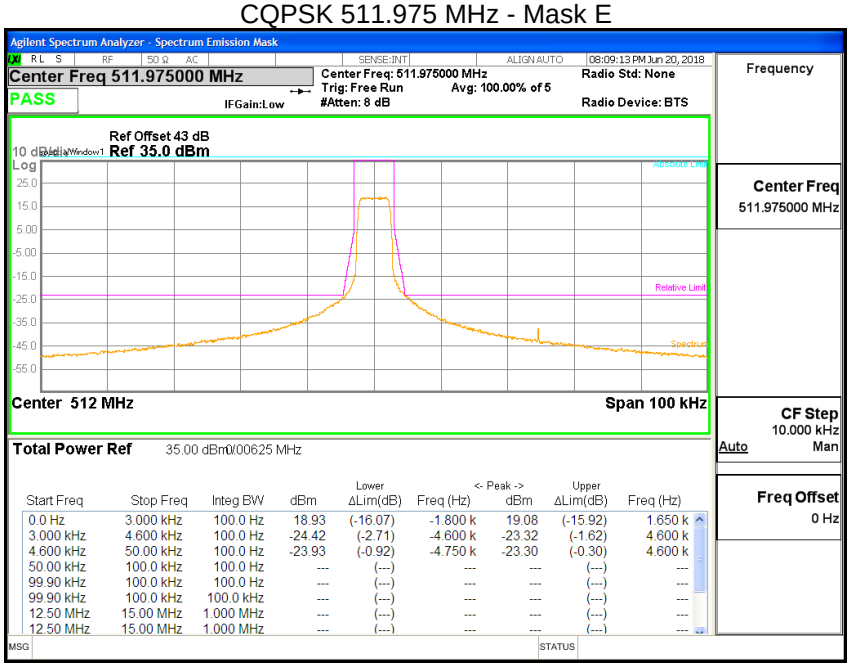
HDQPSK 481 MHz - Mask D



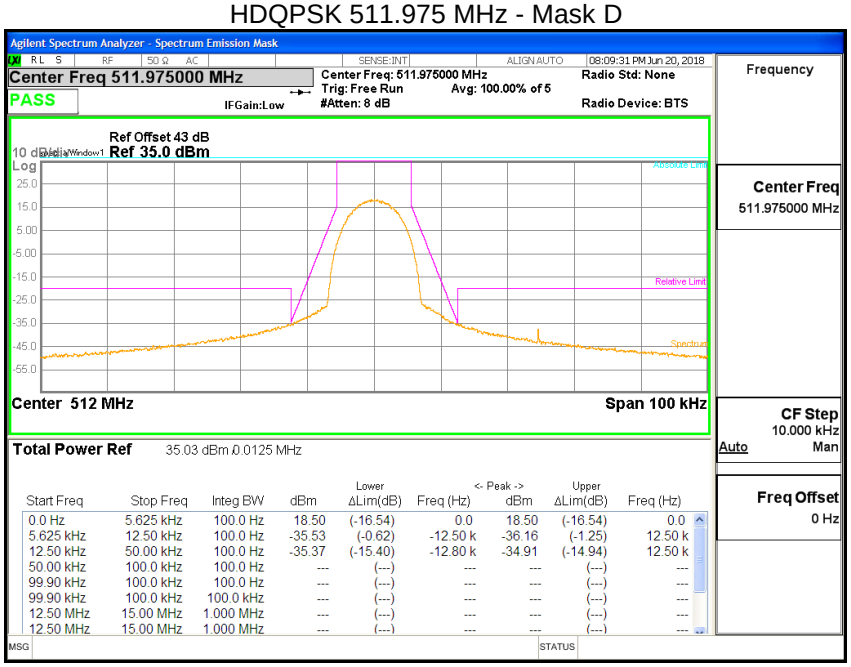
C4FM 511.975 MHz - Mask D



CQPSK 511.975 MHz - Mask E

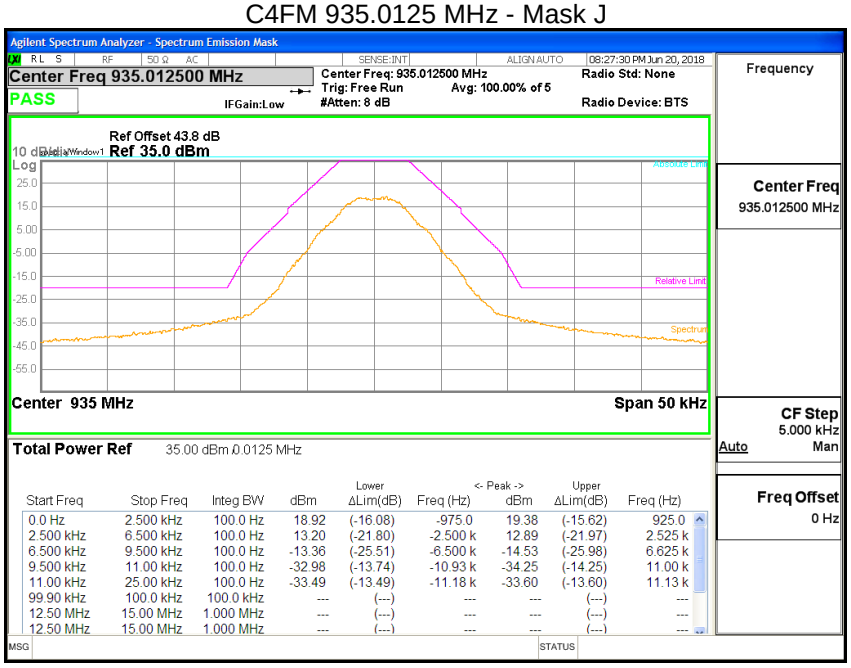


HDQPSK 511.975 MHz - Mask D

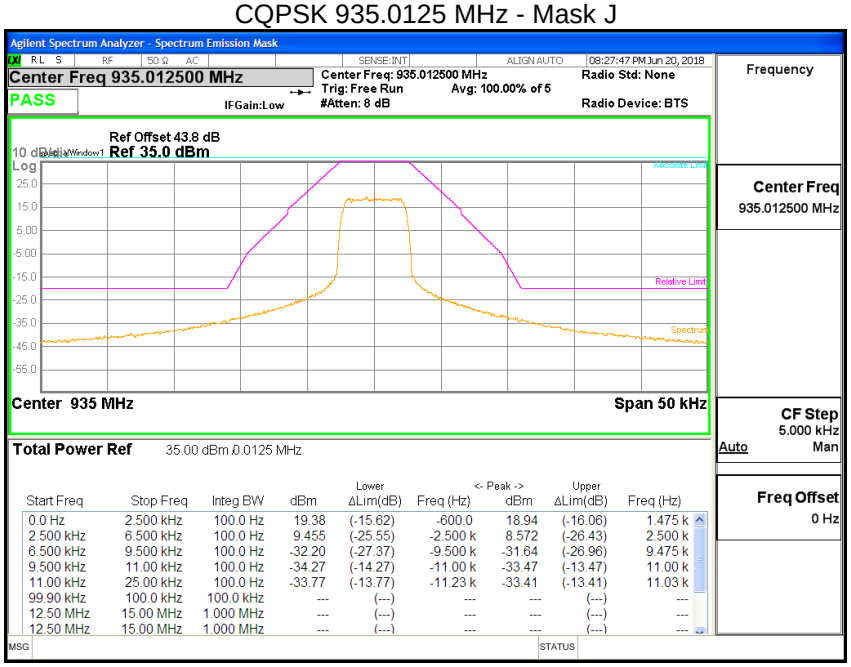


At Input Power 3 dB above AGC threshold

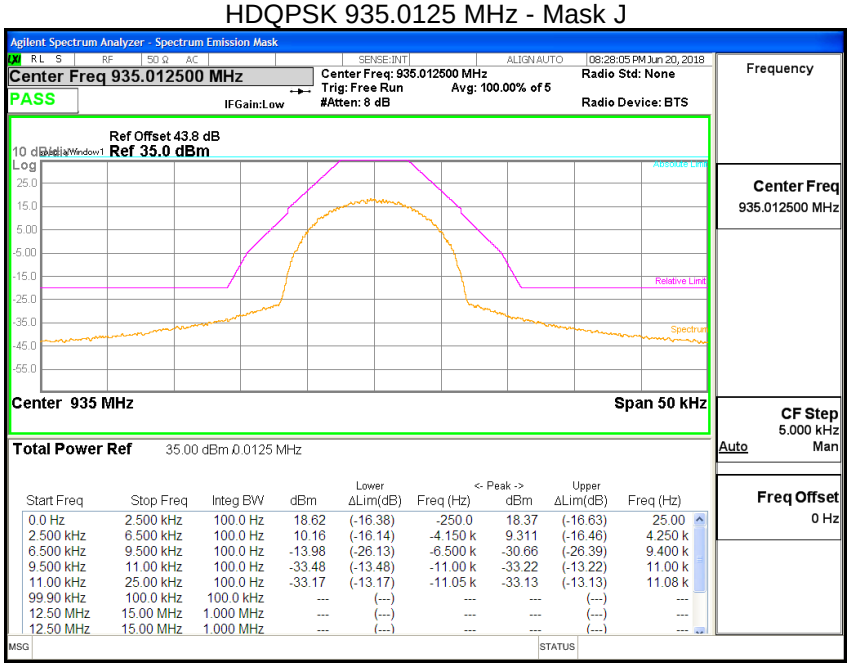
C4FM 935.0125 MHz - Mask J



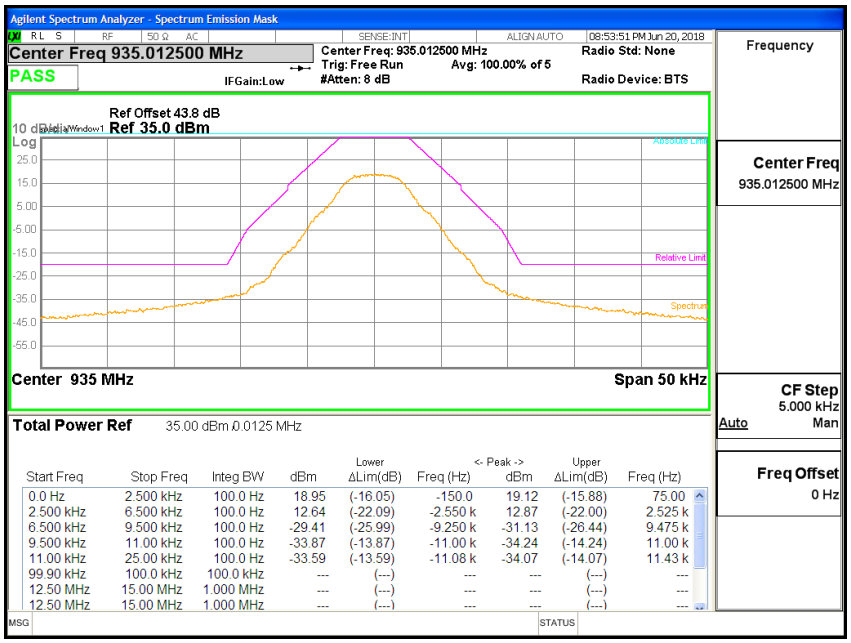
CQPSK 935.0125 MHz - Mask J



HDQPSK 935.0125 MHz - Mask J

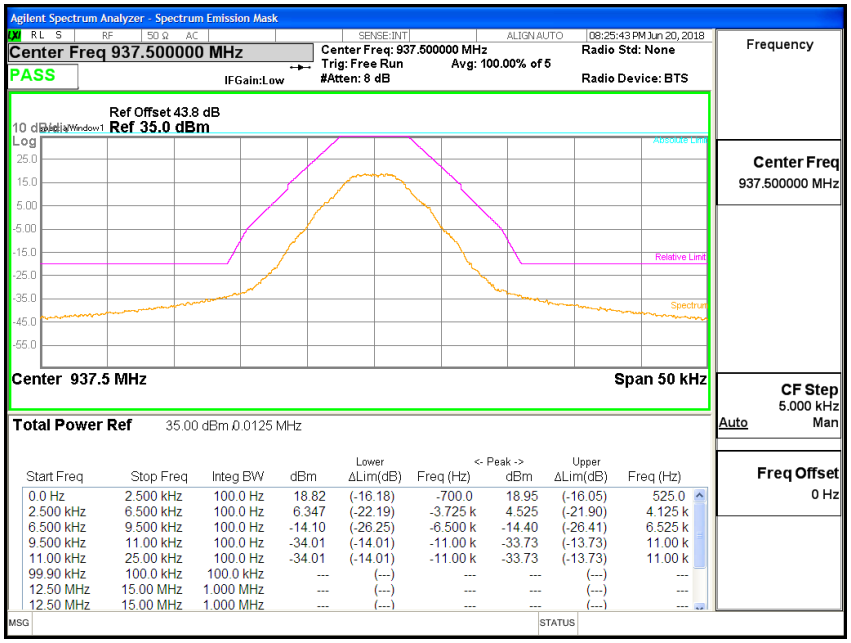


4FSK 935.0125 MHz - Mask J



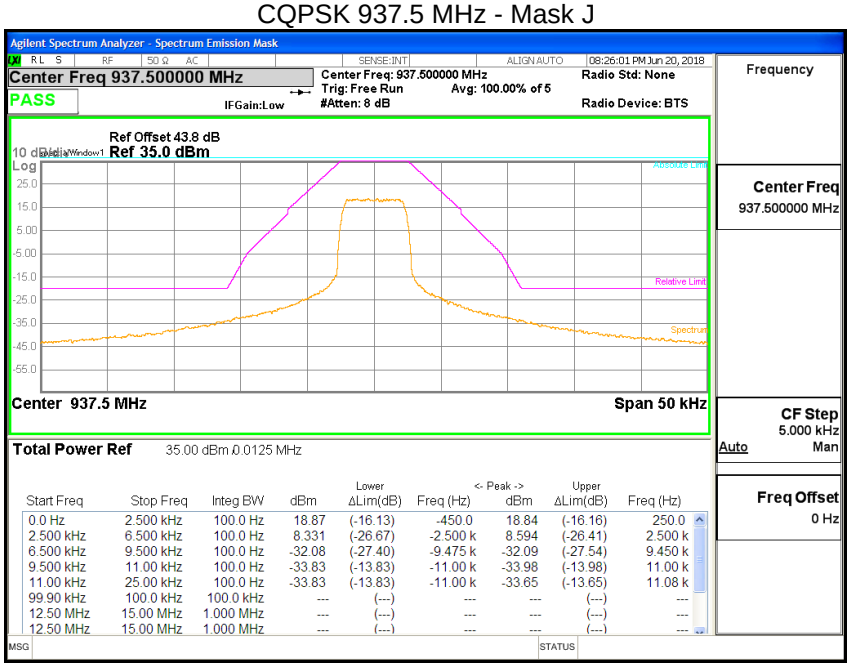
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	18.95	(-16.05)	-150.0	19.12	(-15.88)	75.00
2.500 kHz	6.500 kHz	100.0 Hz	12.64	(-22.09)	-2.550 k	12.87	(-22.00)	2.525 k
6.500 kHz	9.500 kHz	100.0 Hz	-29.41	(-25.99)	-9.250 k	-31.13	(-26.44)	9.475 k
9.500 kHz	11.00 kHz	100.0 Hz	-33.87	(-13.87)	-11.00 k	-34.24	(-14.24)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-33.59	(-13.59)	-11.08 k	-34.07	(-14.07)	11.43 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

C4FM 937.5 MHz - Mask J



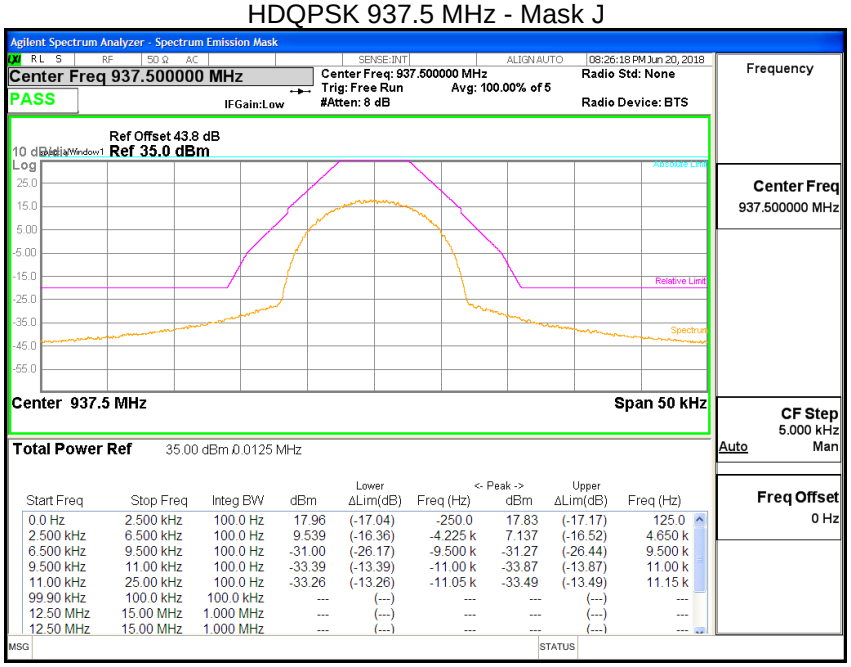
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	18.82	(-16.18)	-700.0	18.95	(-16.05)	525.0
2.500 kHz	6.500 kHz	100.0 Hz	6.347	(-22.19)	-3.725 k	4.525	(-21.90)	4.125 k
6.500 kHz	9.500 kHz	100.0 Hz	-14.10	(-26.25)	-6.500 k	-14.40	(-26.41)	6.525 k
9.500 kHz	11.00 kHz	100.0 Hz	-34.01	(-14.01)	-11.00 k	-33.73	(-13.73)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-34.01	(-14.01)	-11.00 k	-33.73	(-13.73)	11.00 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

CQPSK 937.5 MHz - Mask J



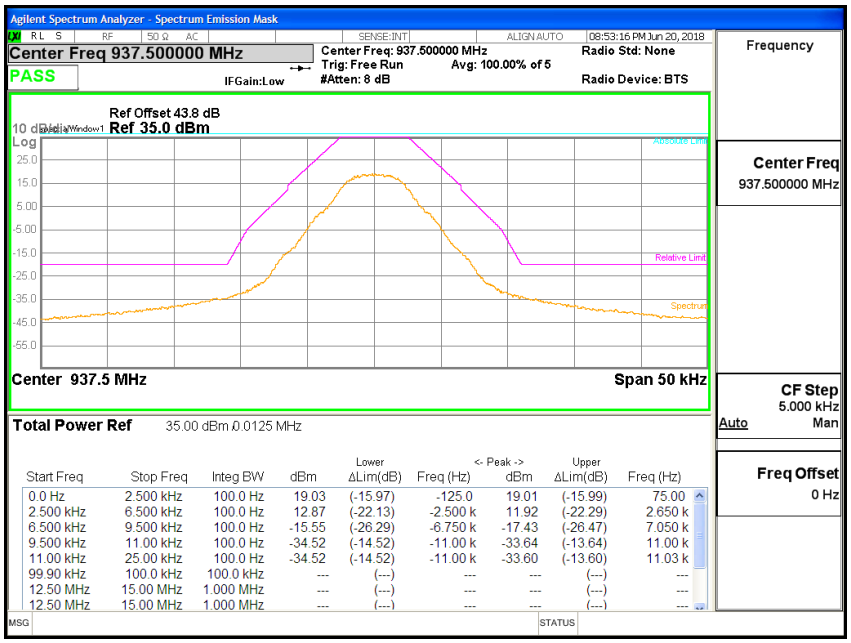
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	18.87	(-16.13)	-450.0	18.84	(-16.16)	250.0
2.500 kHz	6.500 kHz	100.0 Hz	8.331	(-26.67)	-2.500 k	8.594	(-26.41)	2.500 k
6.500 kHz	9.500 kHz	100.0 Hz	-32.08	(-27.40)	-9.475 k	-32.09	(-27.54)	9.450 k
9.500 kHz	11.00 kHz	100.0 Hz	-33.83	(-13.83)	-11.00 k	-33.98	(-13.98)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-33.83	(-13.83)	-11.00 k	-33.65	(-13.65)	11.08 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

HDQPSK 937.5 MHz - Mask J



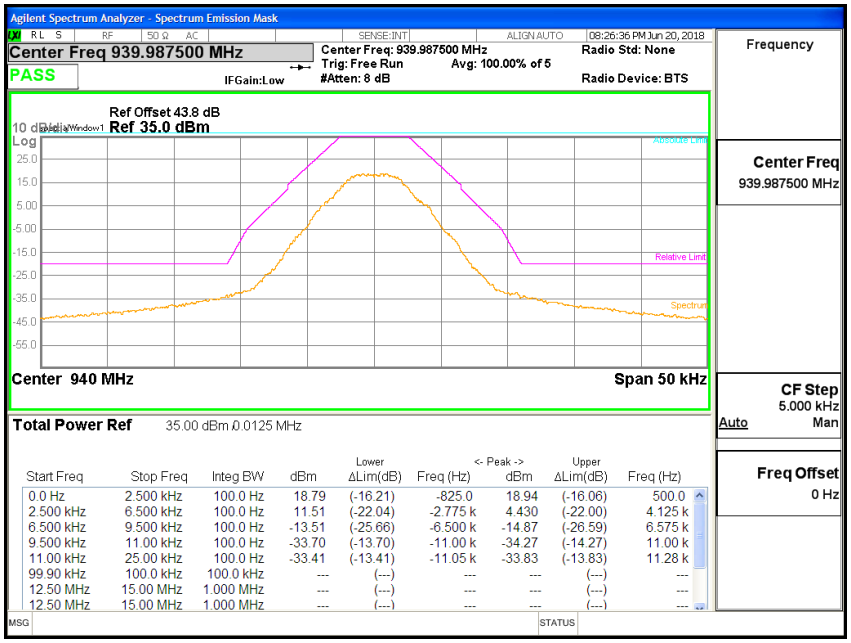
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	17.96	(-17.04)	-250.0	17.83	(-17.17)	125.0
2.500 kHz	6.500 kHz	100.0 Hz	9.539	(-16.36)	-4.225 k	7.137	(-16.52)	4.650 k
6.500 kHz	9.500 kHz	100.0 Hz	-31.00	(-26.17)	-9.500 k	-31.27	(-26.44)	9.500 k
9.500 kHz	11.00 kHz	100.0 Hz	-33.39	(-13.39)	-11.00 k	-33.87	(-13.87)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-33.26	(-13.26)	-11.05 k	-33.49	(-13.49)	11.15 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

4FSK 937.5 MHz - Mask J



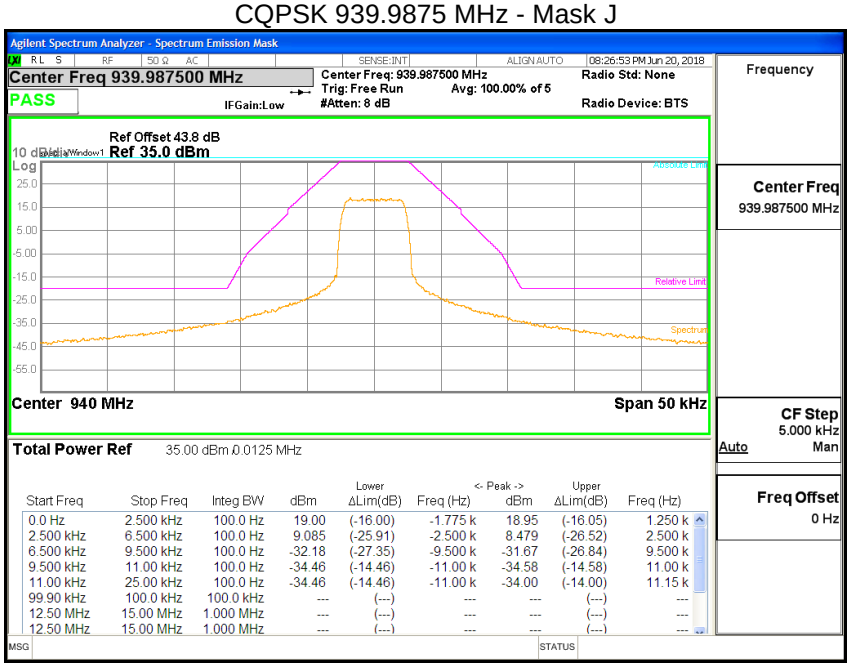
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	19.03	(-15.97)	-125.0	19.01	(-15.99)	75.00
2.500 kHz	6.500 kHz	100.0 Hz	12.87	(-22.13)	-2.500 k	11.92	(-22.29)	2.650 k
6.500 kHz	9.500 kHz	100.0 Hz	-15.55	(-26.29)	-6.750 k	-17.43	(-26.47)	7.050 k
9.500 kHz	11.00 kHz	100.0 Hz	-34.52	(-14.52)	-11.00 k	-33.64	(-13.64)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-34.52	(-14.52)	-11.00 k	-33.60	(-13.60)	11.03 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

C4FM 939.9875 MHz - Mask J

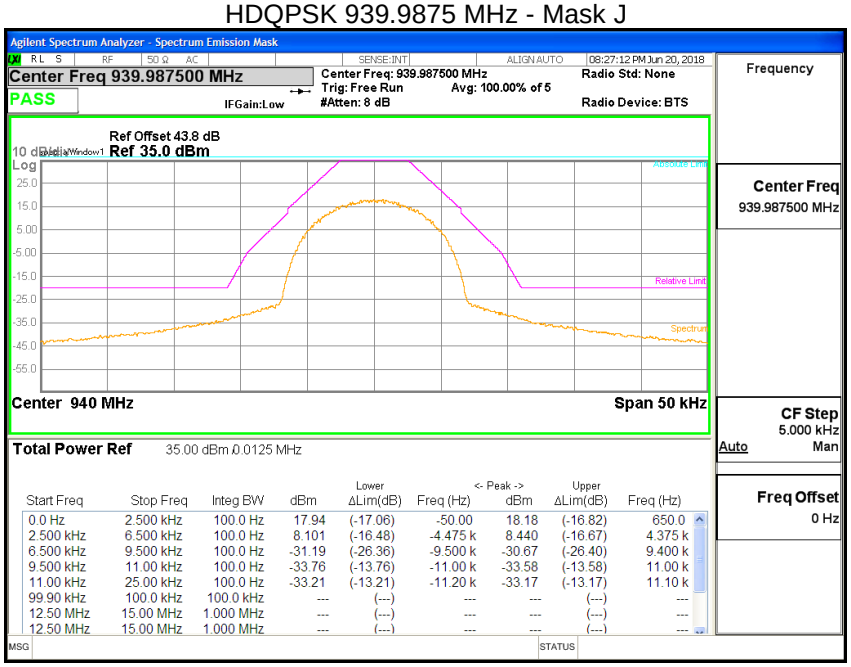


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	18.79	(-16.21)	-825.0	18.94	(-16.06)	500.0
2.500 kHz	6.500 kHz	100.0 Hz	11.51	(-22.04)	-2.775 k	4.430	(-22.00)	4.125 k
6.500 kHz	9.500 kHz	100.0 Hz	-13.51	(-25.66)	-6.500 k	-14.87	(-26.59)	6.575 k
9.500 kHz	11.00 kHz	100.0 Hz	-33.70	(-13.70)	-11.00 k	-34.27	(-14.27)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-33.41	(-13.41)	-11.05 k	-33.83	(-13.83)	11.28 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

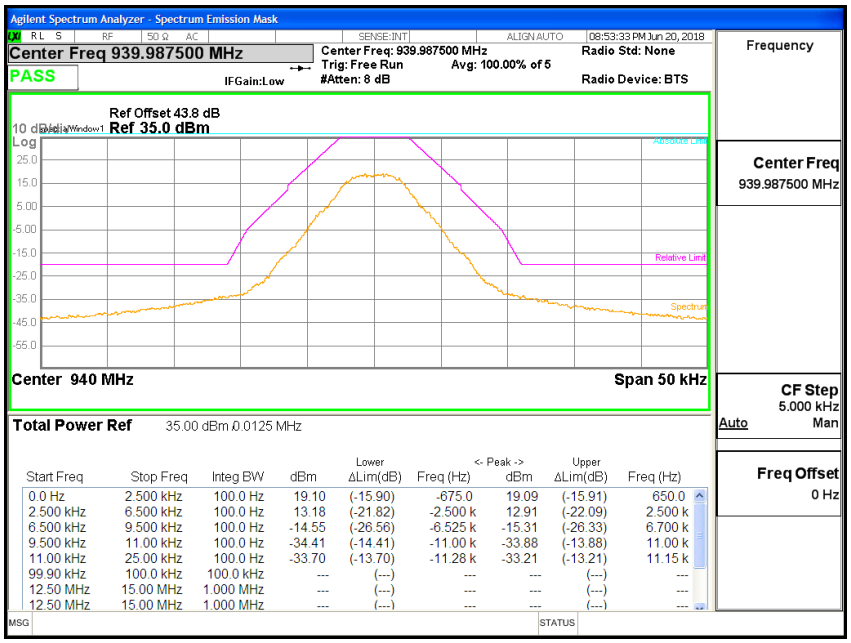
CQPSK 939.9875 MHz - Mask J



HDQPSK 939.9875 MHz - Mask J

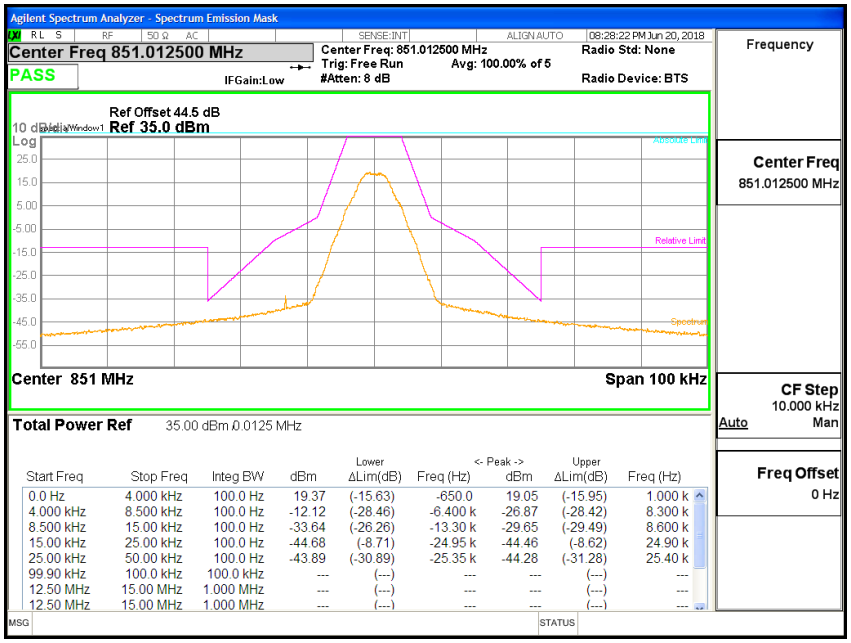


4FSK 939.9875 MHz – Mask J



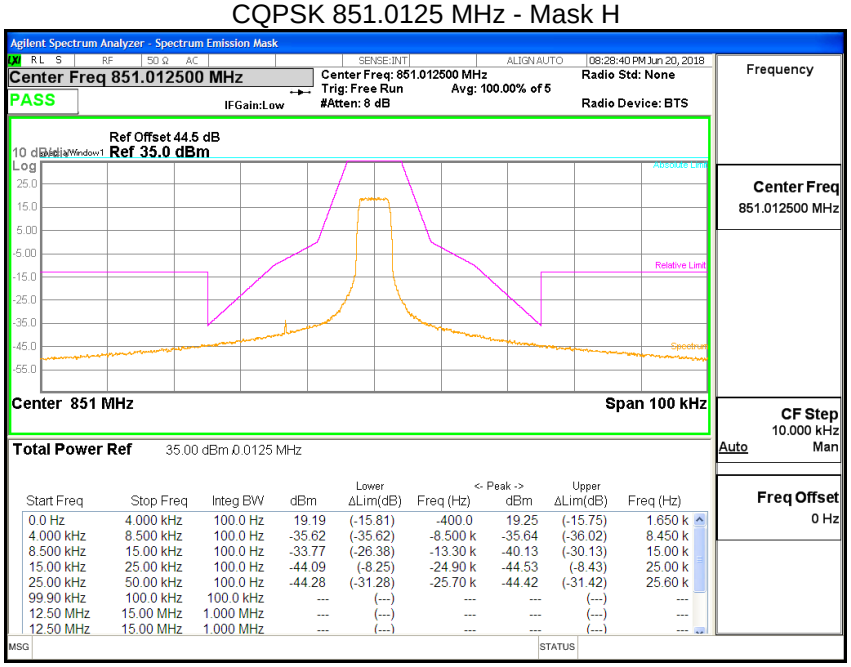
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	<- Peak -> Freq (Hz)	dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	2.500 kHz	100.0 Hz	19.10	(-15.90)	-675.0	19.09	(-15.91)	650.0
2.500 kHz	6.500 kHz	100.0 Hz	13.18	(-21.82)	-2.500 k	12.91	(-22.09)	2.500 k
6.500 kHz	9.500 kHz	100.0 Hz	-14.55	(-26.56)	-6.525 k	-15.31	(-26.33)	6.700 k
9.500 kHz	11.00 kHz	100.0 Hz	-34.41	(-14.41)	-11.00 k	-33.88	(-13.88)	11.00 k
11.00 kHz	25.00 kHz	100.0 Hz	-33.70	(-13.70)	-11.28 k	-33.21	(-13.21)	11.15 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

C4FM 851.0125 MHz - Mask H

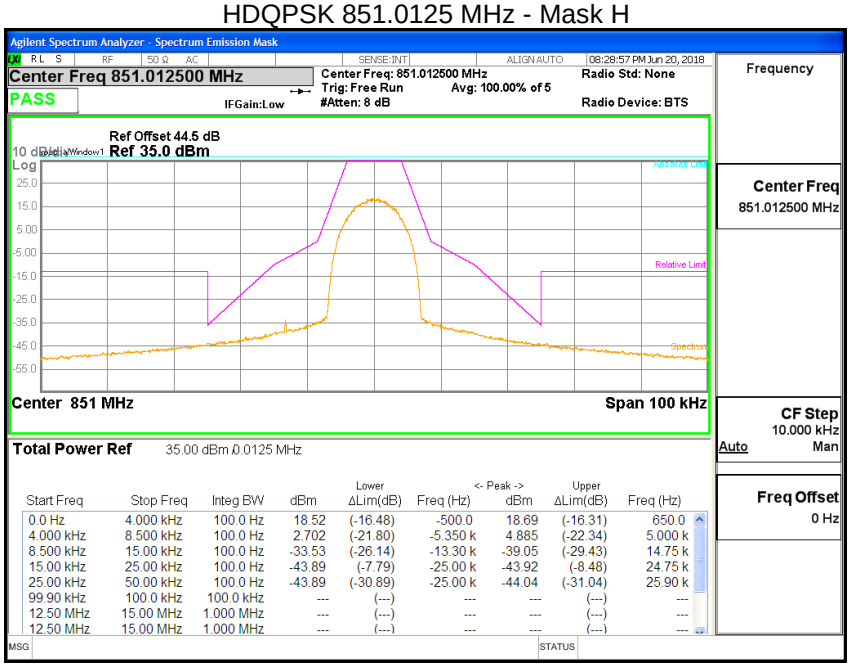


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	<- Peak -> Freq (Hz)	dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.37	(-15.63)	-650.0	19.05	(-15.95)	1.000 k
4.000 kHz	8.500 kHz	100.0 Hz	-12.12	(-28.46)	-6.400 k	-26.87	(-28.42)	8.300 k
8.500 kHz	15.00 kHz	100.0 Hz	-33.64	(-26.26)	-13.30 k	-29.65	(-29.49)	8.600 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.68	(-8.71)	-24.95 k	-44.46	(-8.62)	24.90 k
25.00 kHz	50.00 kHz	100.0 Hz	-43.89	(-30.89)	-25.35 k	-44.28	(-31.28)	25.40 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

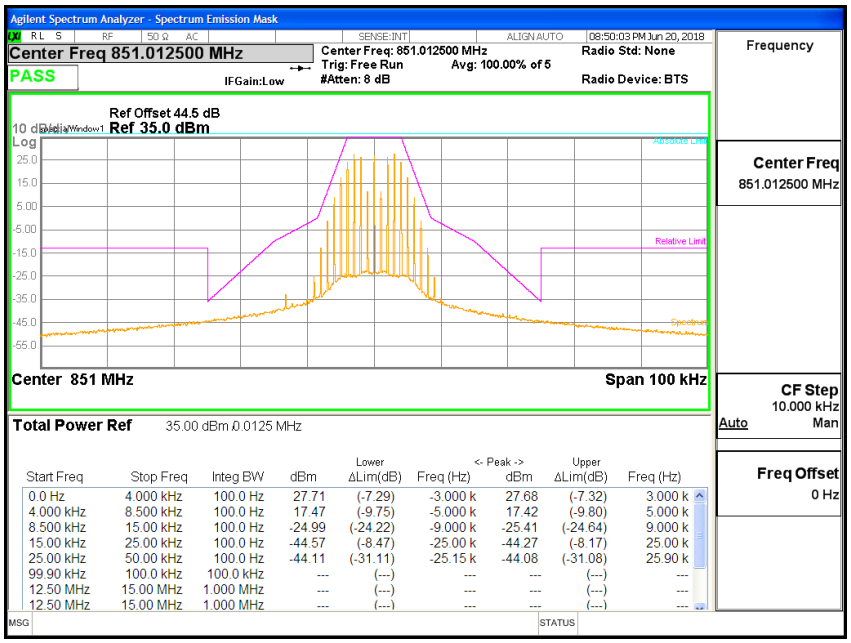
CQPSK 851.0125 MHz - Mask H



HDQPSK 851.0125 MHz - Mask H

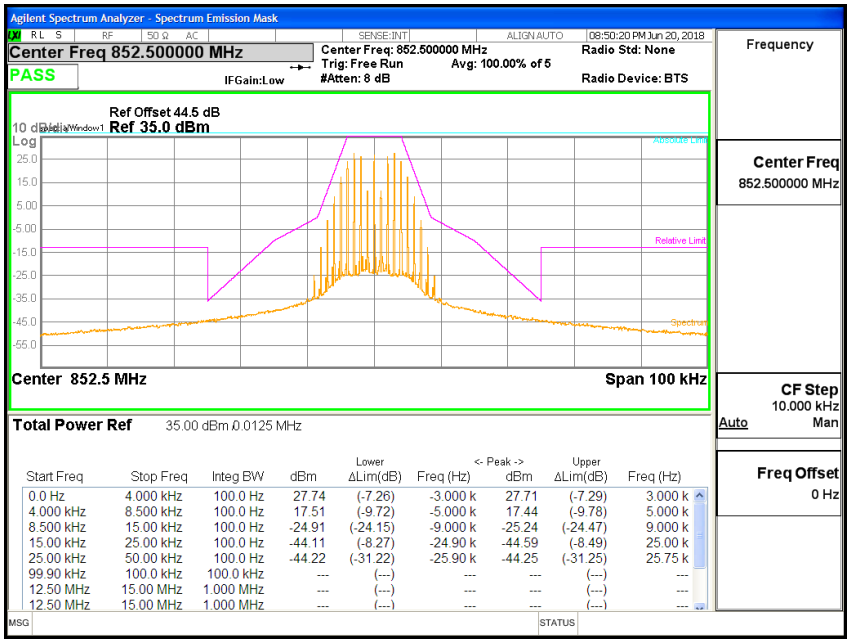


FM 851.0125 MHz - Mask H



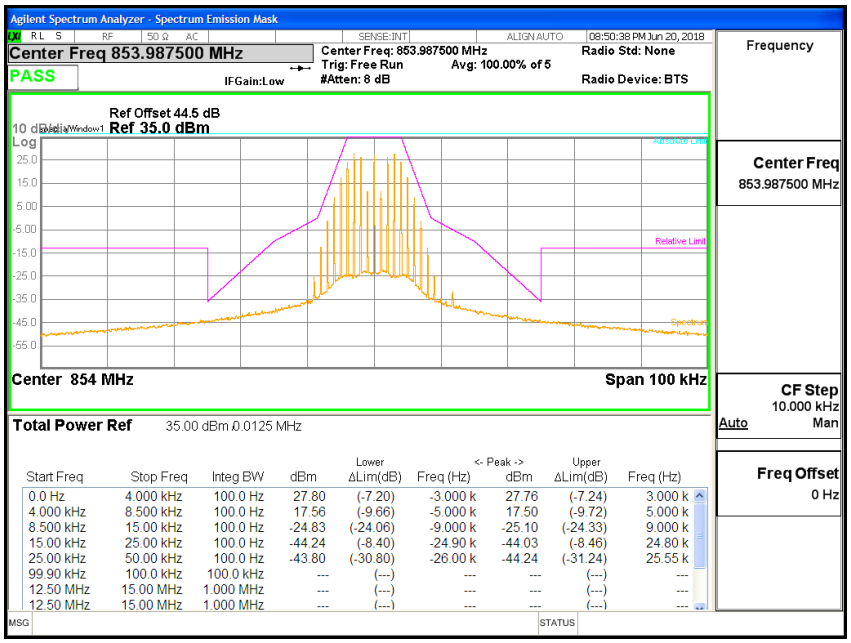
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	27.71	(-7.29)	-3.000 k	27.68	(-7.32)	3.000 k
4.000 kHz	8.500 kHz	100.0 Hz	17.47	(-9.75)	-5.000 k	17.42	(-9.80)	5.000 k
8.500 kHz	15.00 kHz	100.0 Hz	-24.99	(-24.22)	-9.000 k	-25.41	(-24.64)	9.000 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.57	(-8.47)	-25.00 k	-44.27	(-8.17)	25.00 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.11	(-31.11)	-25.15 k	-44.08	(-31.08)	25.90 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

FM 852.5 MHz - Mask H

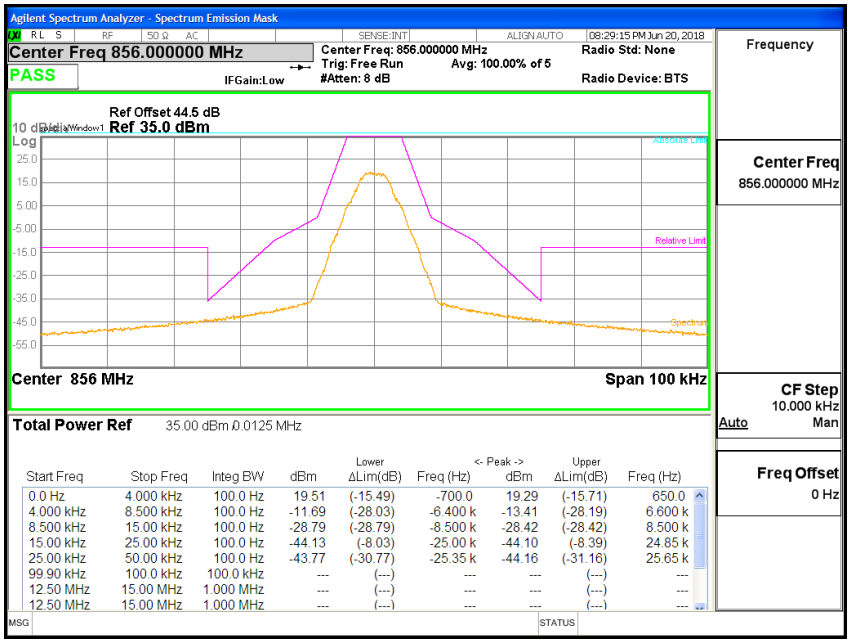


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	27.74	(-7.26)	-3.000 k	27.71	(-7.29)	3.000 k
4.000 kHz	8.500 kHz	100.0 Hz	17.51	(-9.72)	-5.000 k	17.44	(-9.78)	5.000 k
8.500 kHz	15.00 kHz	100.0 Hz	-24.91	(-24.15)	-9.000 k	-25.24	(-24.47)	9.000 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.11	(-8.27)	-24.90 k	-44.59	(-8.49)	25.00 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.22	(-31.22)	-25.90 k	-44.25	(-31.25)	25.75 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

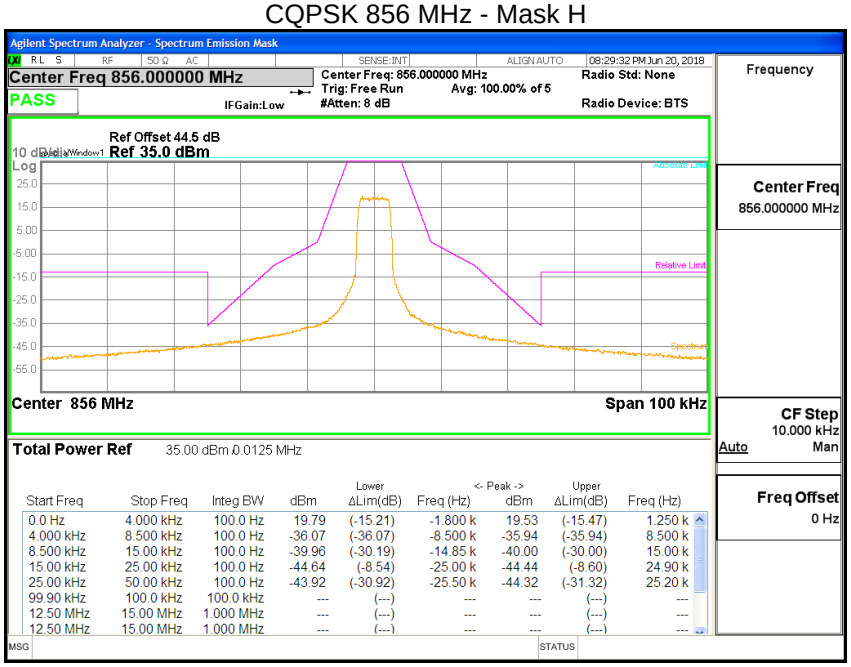
FM 853.9875 MHz - Mask H



C4FM 856 MHz - Mask H

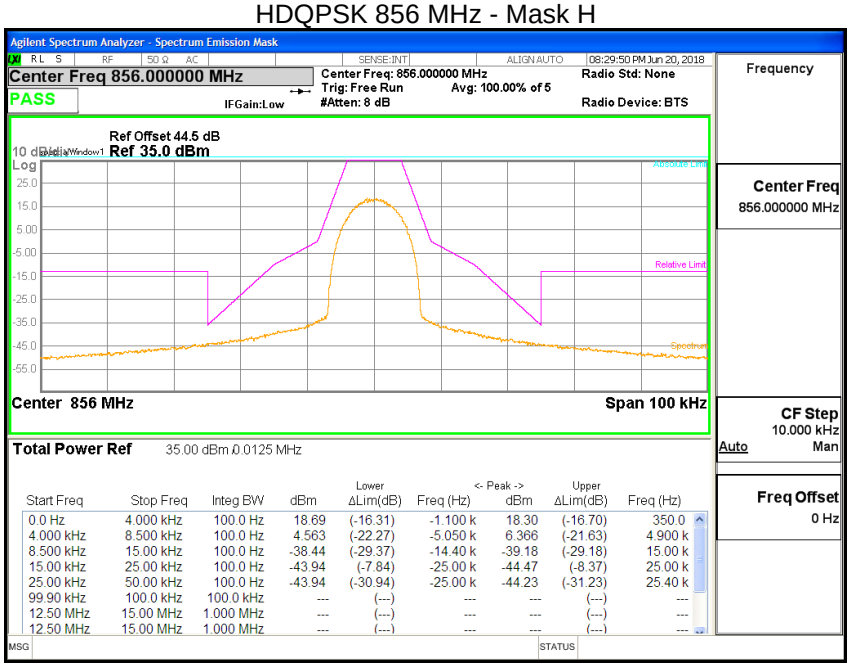


CQPSK 856 MHz - Mask H



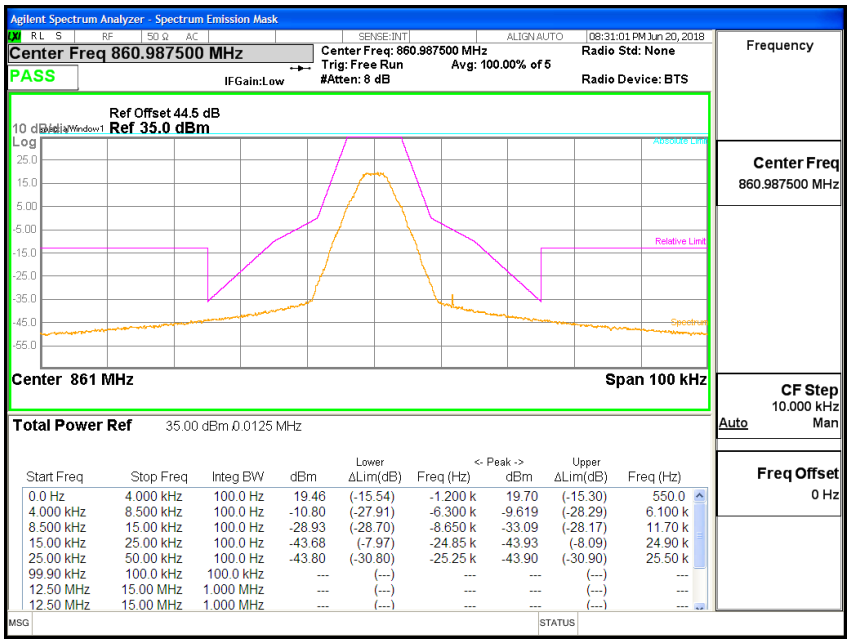
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.79	(-15.21)	-1.800 k	19.53	(-15.47)	1.250 k
4.000 kHz	8.500 kHz	100.0 Hz	-36.07	(-36.07)	-8.500 k	-35.94	(-35.94)	8.500 k
8.500 kHz	15.00 kHz	100.0 Hz	-39.96	(-30.19)	-14.85 k	-40.00	(-30.00)	15.00 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.64	(-8.54)	-25.00 k	-44.44	(-8.60)	24.90 k
25.00 kHz	50.00 kHz	100.0 Hz	-43.92	(-30.92)	-25.50 k	-44.32	(-31.32)	25.20 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

HDQPSK 856 MHz - Mask H

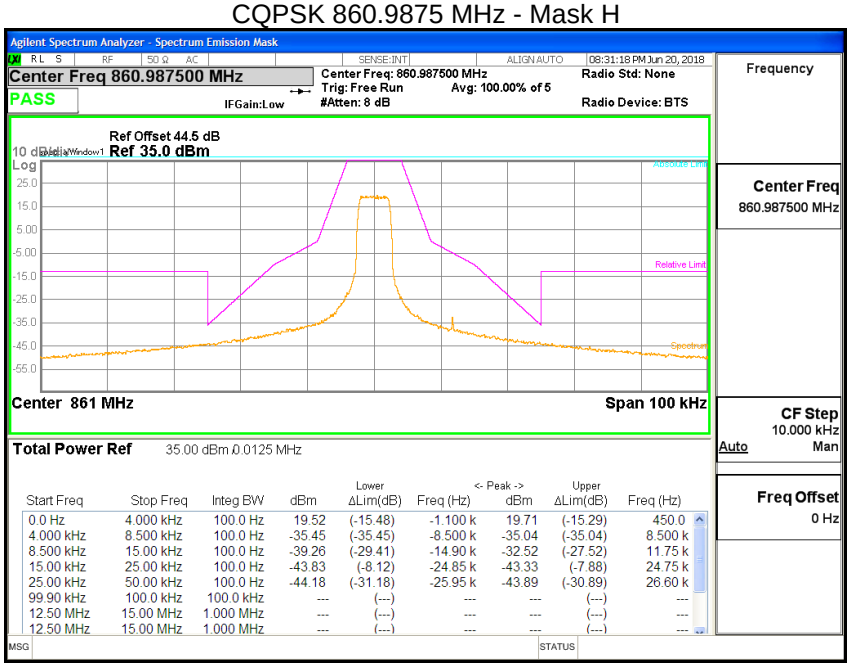


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	18.69	(-16.31)	-1.100 k	18.30	(-16.70)	350.0
4.000 kHz	8.500 kHz	100.0 Hz	4.563	(-22.27)	-5.050 k	6.366	(-21.63)	4.900 k
8.500 kHz	15.00 kHz	100.0 Hz	-38.44	(-29.37)	-14.40 k	-39.18	(-29.18)	15.00 k
15.00 kHz	25.00 kHz	100.0 Hz	-43.94	(-7.84)	-25.00 k	-44.47	(-8.37)	25.00 k
25.00 kHz	50.00 kHz	100.0 Hz	-43.94	(-30.94)	-25.00 k	-44.23	(-31.23)	25.40 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

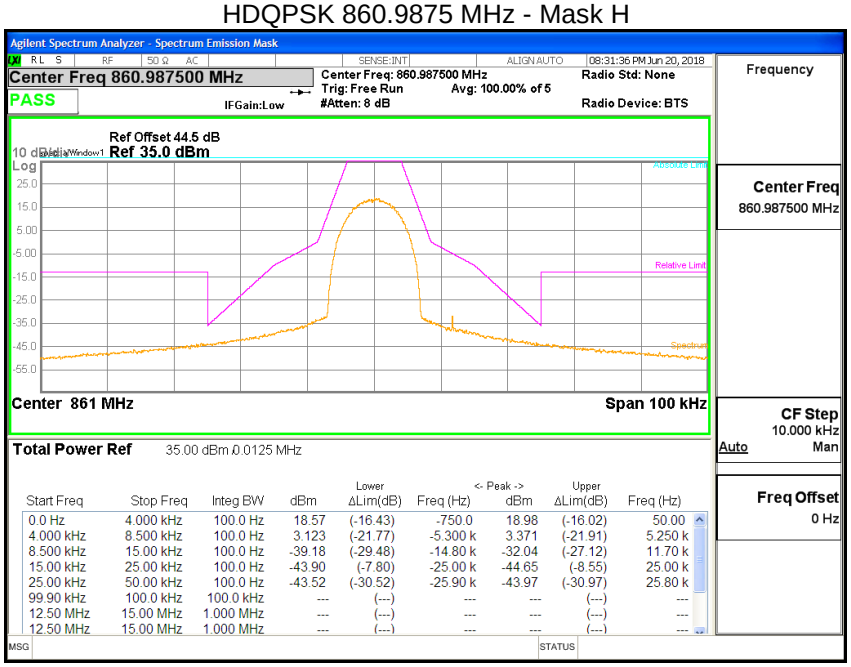
C4FM 860.9875 MHz - Mask H



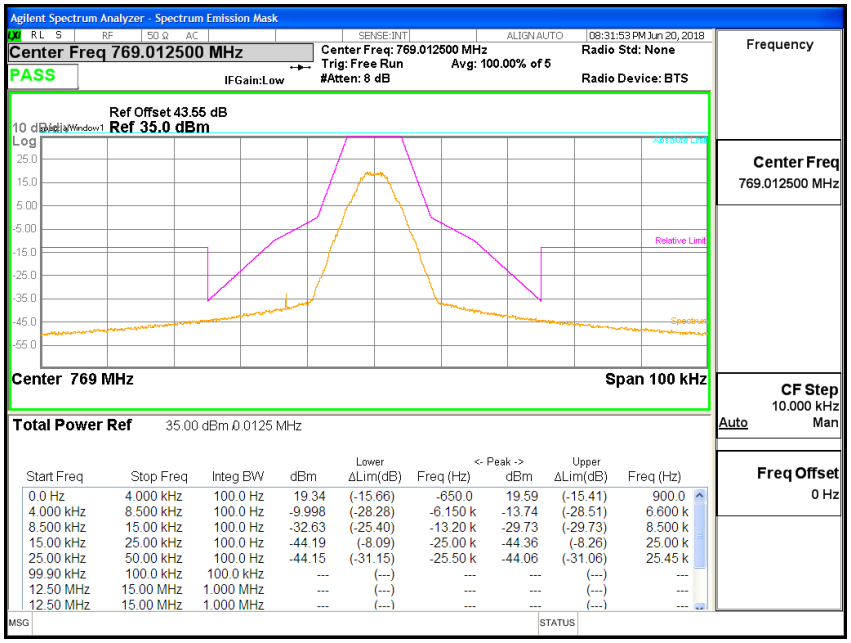
CQPSK 860.9875 MHz - Mask H



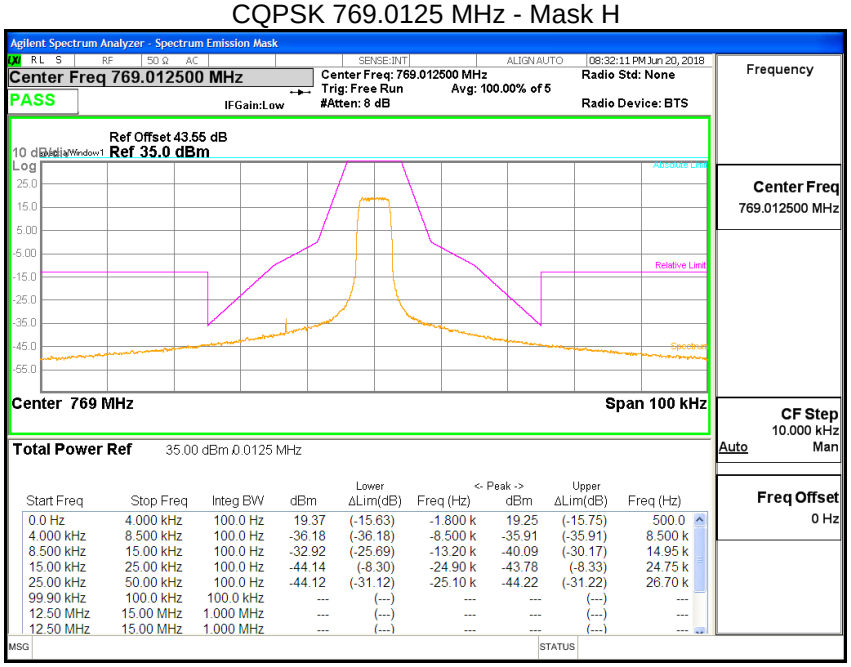
HDQPSK 860.9875 MHz - Mask H



C4FM 769.0125 MHz - Mask H

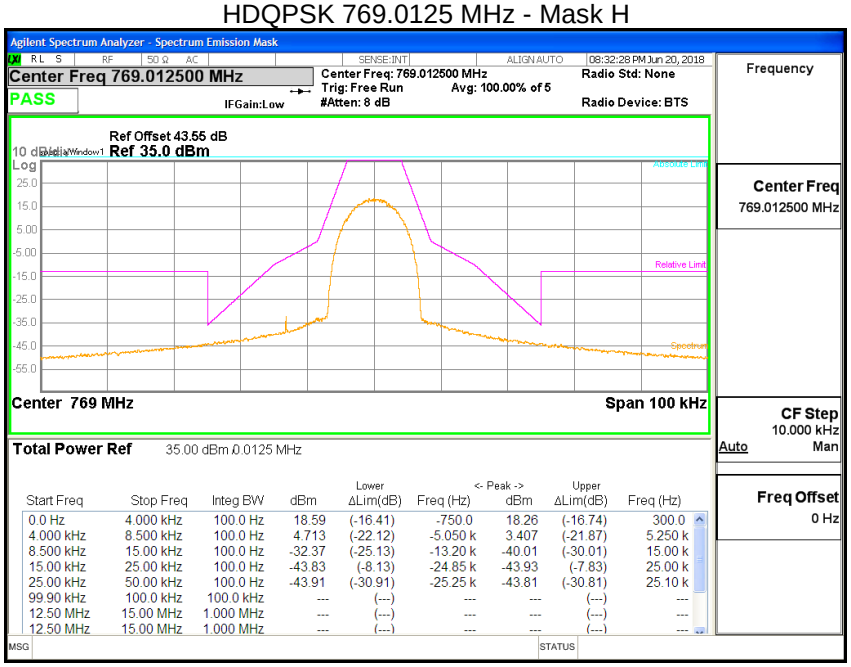


CQPSK 769.0125 MHz - Mask H



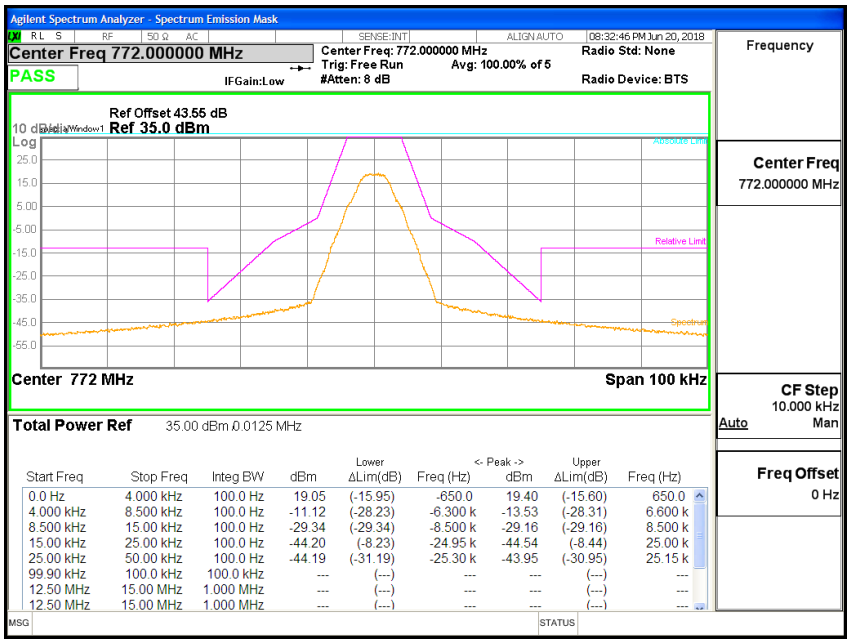
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	<- Peak -> Freq (Hz)	dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.37	(-15.63)	-1.800 k	19.25	(-15.75)	500.0
4.000 kHz	8.500 kHz	100.0 Hz	-36.18	(-36.18)	-8.500 k	-35.91	(-35.91)	8.500 k
8.500 kHz	15.00 kHz	100.0 Hz	-32.92	(-25.69)	-13.20 k	-40.09	(-30.17)	14.95 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.14	(-8.30)	-24.90 k	-43.78	(-8.33)	24.75 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.12	(-31.12)	-25.10 k	-44.22	(-31.22)	26.70 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

HDQPSK 769.0125 MHz - Mask H



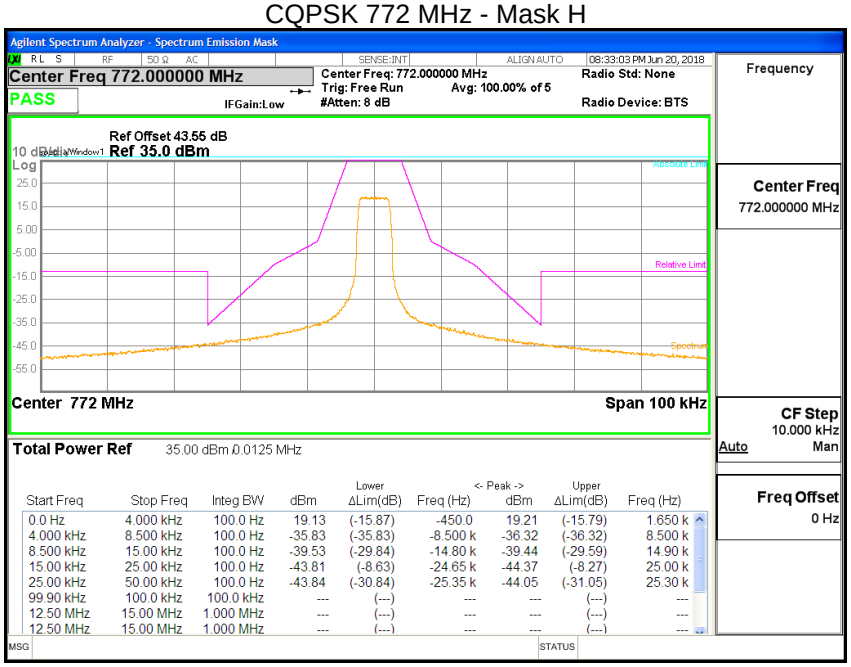
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	<- Peak -> Freq (Hz)	dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	18.59	(-16.41)	-750.0	18.26	(-16.74)	300.0
4.000 kHz	8.500 kHz	100.0 Hz	4.713	(-22.12)	-5.050 k	3.407	(-21.87)	5.250 k
8.500 kHz	15.00 kHz	100.0 Hz	-32.37	(-25.13)	-13.20 k	-40.01	(-30.01)	15.00 k
15.00 kHz	25.00 kHz	100.0 Hz	-43.83	(-8.13)	-24.85 k	-43.93	(-7.83)	25.00 k
25.00 kHz	50.00 kHz	100.0 Hz	-43.91	(-30.91)	-25.25 k	-43.81	(-30.81)	25.10 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

C4FM 772 MHz - Mask H



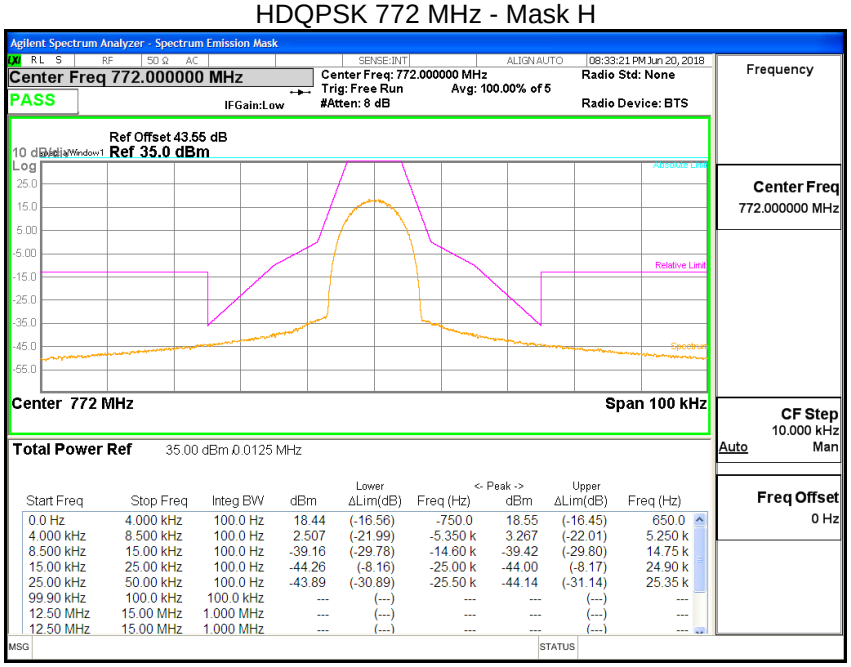
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.05	(-15.95)	-650.0	19.40	(-15.60)	650.0
4.000 kHz	8.500 kHz	100.0 Hz	-11.12	(-28.23)	-6.300 k	-13.53	(-28.31)	6.600 k
8.500 kHz	15.00 kHz	100.0 Hz	-29.34	(-29.34)	-8.500 k	-29.16	(-29.16)	8.500 k
15.00 kHz	25.00 kHz	100.0 Hz	-44.20	(-8.23)	-24.95 k	-44.54	(-8.44)	25.00 k
25.00 kHz	50.00 kHz	100.0 Hz	-44.19	(-31.19)	-25.30 k	-43.95	(-30.95)	25.15 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

CQPSK 772 MHz - Mask H

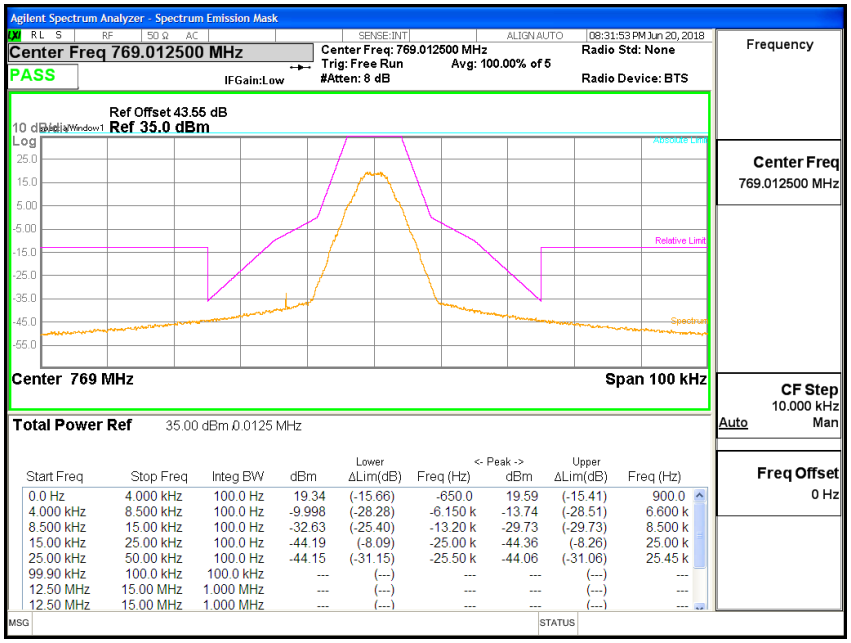


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	4.000 kHz	100.0 Hz	19.13	(-15.87)	-450.0	19.21	(-15.79)	1.650 k
4.000 kHz	8.500 kHz	100.0 Hz	-35.83	(-35.83)	-8.500 k	-36.32	(-36.32)	8.500 k
8.500 kHz	15.00 kHz	100.0 Hz	-39.53	(-29.84)	-14.80 k	-39.44	(-29.59)	14.90 k
15.00 kHz	25.00 kHz	100.0 Hz	-43.81	(-8.63)	-24.65 k	-44.37	(-8.27)	25.00 k
25.00 kHz	50.00 kHz	100.0 Hz	-43.84	(-30.84)	-25.35 k	-44.05	(-31.05)	25.30 k
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

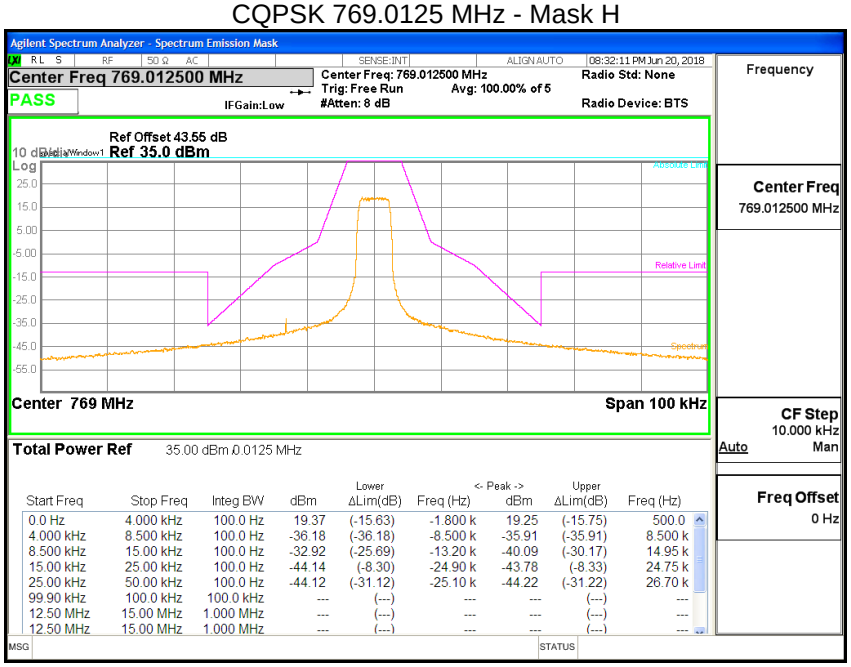
HDQPSK 772 MHz - Mask H



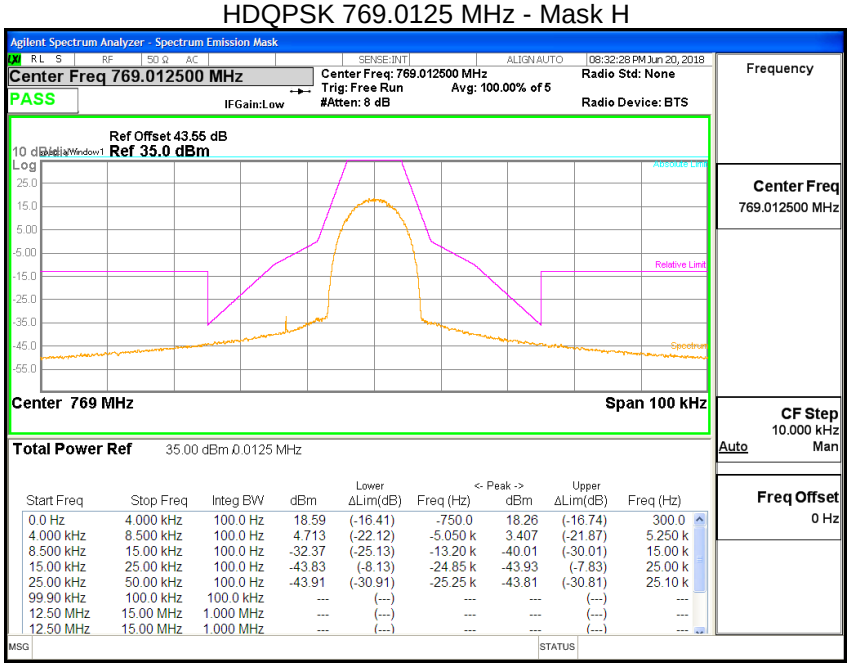
C4FM 769.0125 MHz - Mask H



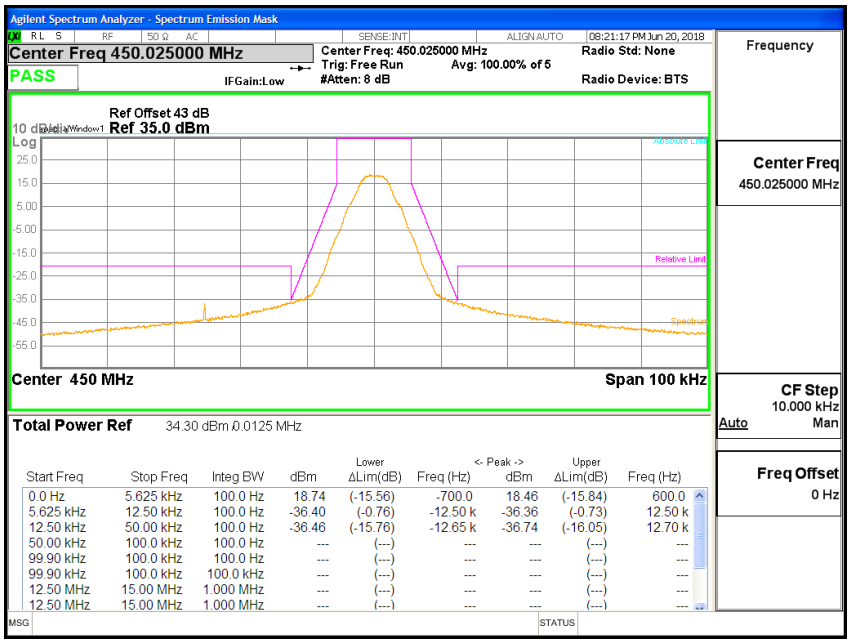
CQPSK 769.0125 MHz - Mask H



HDQPSK 769.0125 MHz - Mask H

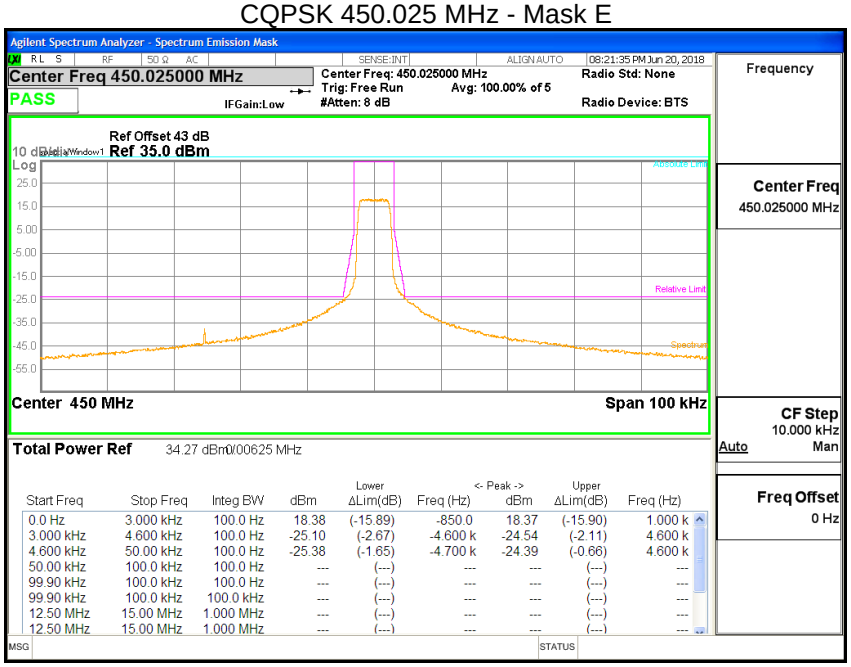


C4FM 450.025 MHz - Mask D



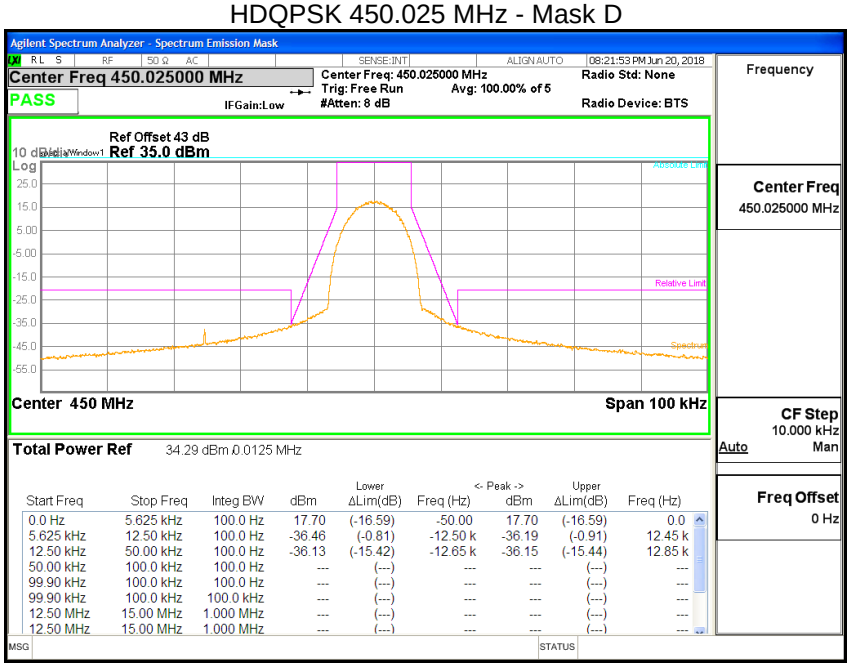
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	18.74	(-15.56)	-700.0	18.46	(-15.84)	600.0
5.625 kHz	12.50 kHz	100.0 Hz	-36.40	(-0.76)	-12.50 k	-36.36	(-0.73)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-36.46	(-15.76)	-12.65 k	-36.74	(-16.05)	12.70 k
50.00 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

CQPSK 450.025 MHz - Mask E



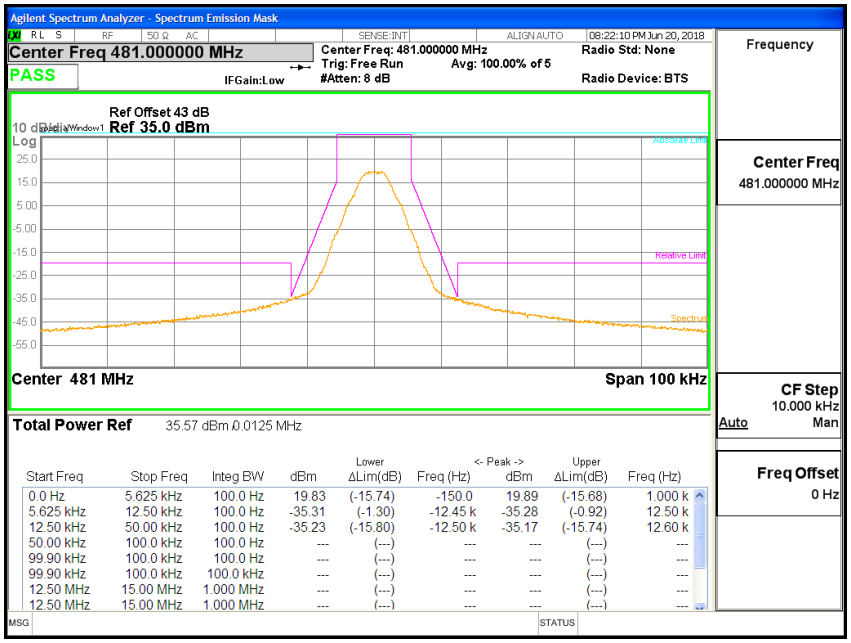
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	3.000 kHz	100.0 Hz	18.38	(-15.89)	-850.0	18.37	(-15.90)	1.000 k
3.000 kHz	4.600 kHz	100.0 Hz	-25.10	(-2.67)	-4.600 k	-24.54	(-2.11)	4.600 k
4.600 kHz	50.00 kHz	100.0 Hz	-25.38	(-1.65)	-4.700 k	-24.39	(-0.66)	4.600 k
50.00 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

HDQPSK 450.025 MHz - Mask D



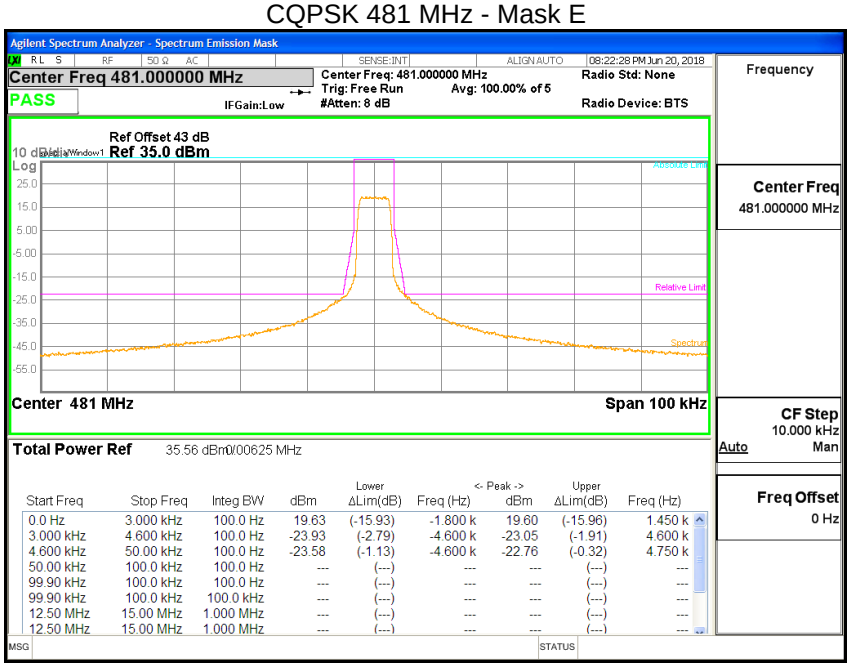
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	17.70	(-16.59)	-50.00	17.70	(-16.59)	0.0
5.625 kHz	12.50 kHz	100.0 Hz	-36.46	(-0.81)	-12.50 k	-36.19	(-0.91)	12.45 k
12.50 kHz	50.00 kHz	100.0 Hz	-36.13	(-15.42)	-12.65 k	-36.15	(-15.44)	12.85 k
50.00 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

C4FM 481 MHz - Mask D

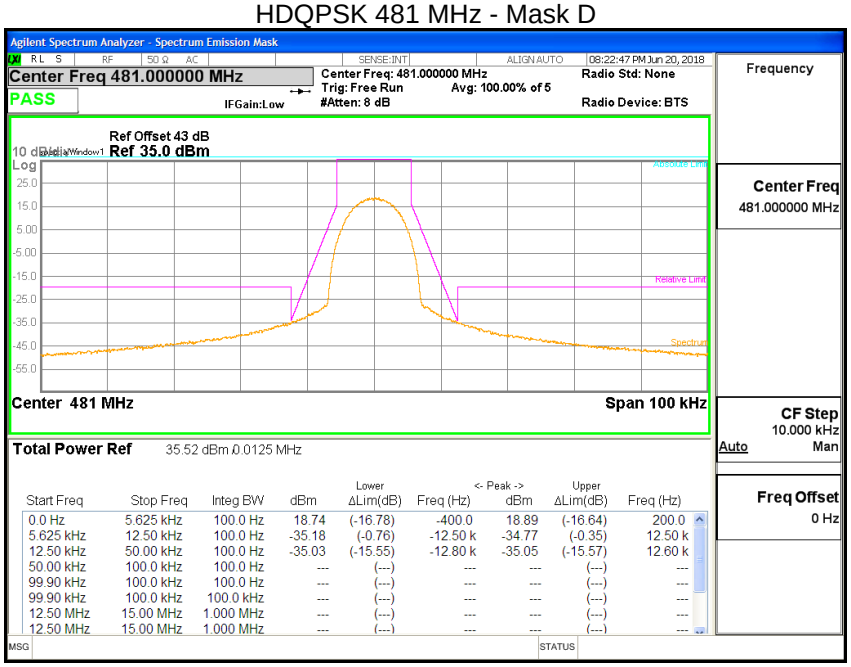


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	19.83	(-15.74)	-150.0	19.89	(-15.68)	1.000 k
5.625 kHz	12.50 kHz	100.0 Hz	-35.31	(-1.30)	-12.45 k	-35.28	(-0.92)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-35.23	(-15.80)	-12.50 k	-35.17	(-15.74)	12.60 k
50.00 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 Hz	---	(---)	---	---	(---)	---
99.90 kHz	100.0 kHz	100.0 kHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

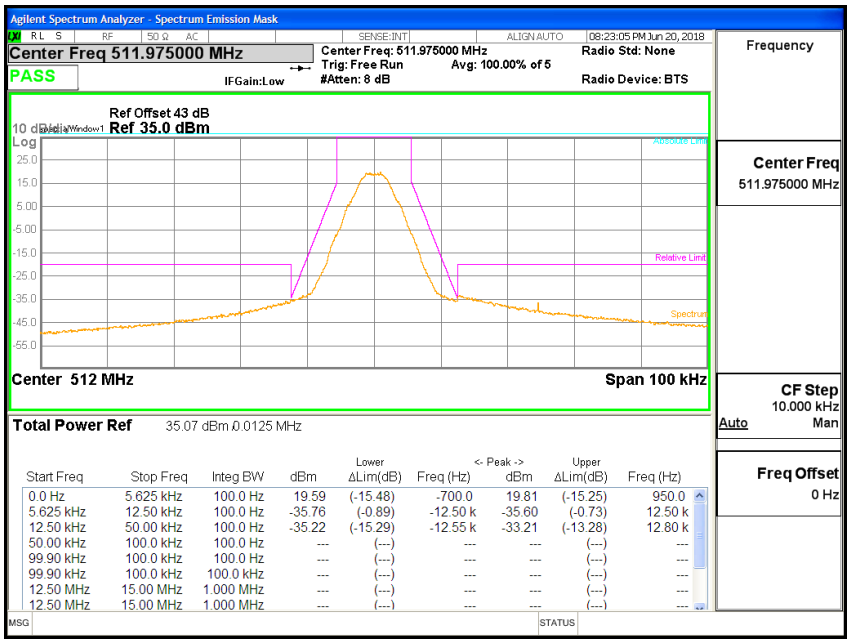
CQPSK 481 MHz - Mask E



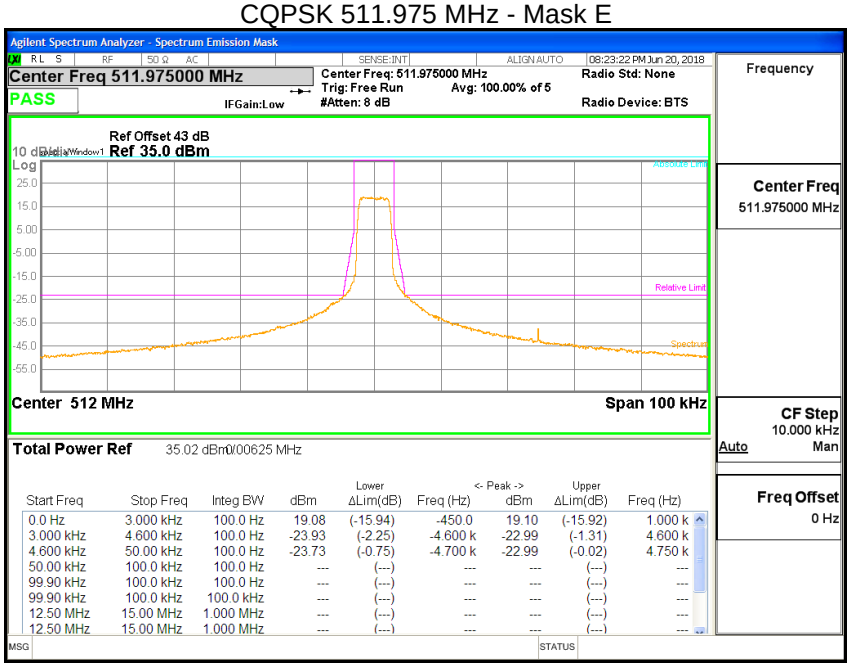
HDQPSK 481 MHz - Mask D



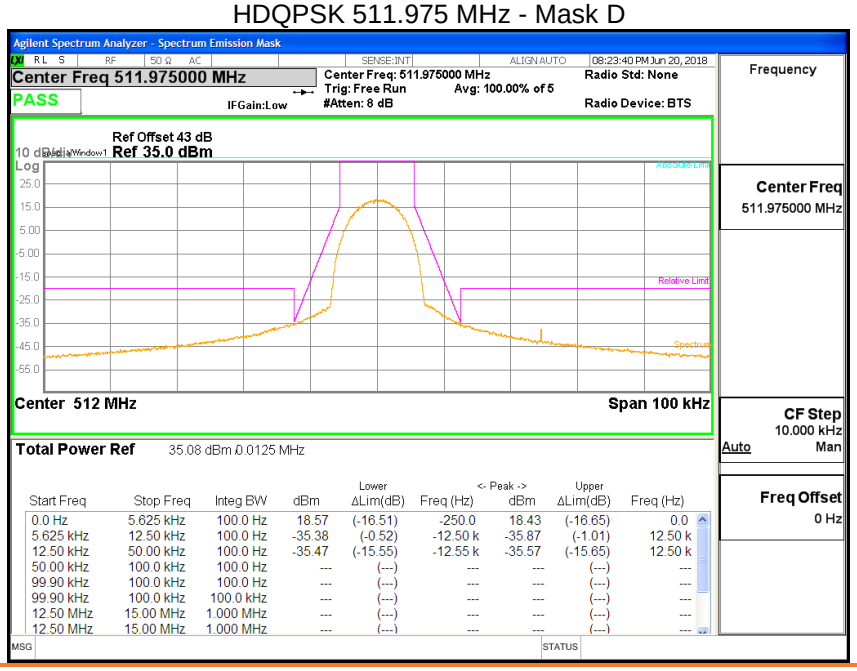
C4FM 511.975 MHz - Mask D



CQPSK 511.975 MHz - Mask E



HDQPSK 511.975 MHz - Mask D



Frequency Stability

The hdHost and hd33 are sychronized to the same reference clock. Therefore there is no frequency error after down and up frequency conversion are performed.

The frequency stability check is not applicable to the EUT.

Passband Gain and Bandwidth & Out of Band Rejection

Governing Doc	FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October, 2017	Room Temperature (°C)	30.5
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October, 2017	Relative Humidity (%)	34.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Jeremy Lee	Date	Jun 20, 2018
EUT Voltage	☒ DC	☐ 120VAC @ 60Hz	

Test Equipment Used	Manufacturer	Model	Serial Number	Calibration	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	08/04/17	08/04/18
Spectrum Analyzer	Keysight	N9010A	MY50520285	08/07/17	08/07/18

Frequency Range:	☒ Product Passband ± 250%
Detector:	☒ Peak
RBW/VBW:	☒0.1% of 5 times of passband bandwidth
Type of Facility:	☒ Tabletop
Distance:	☒ Direct

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

Test setup

Description of test set-up:

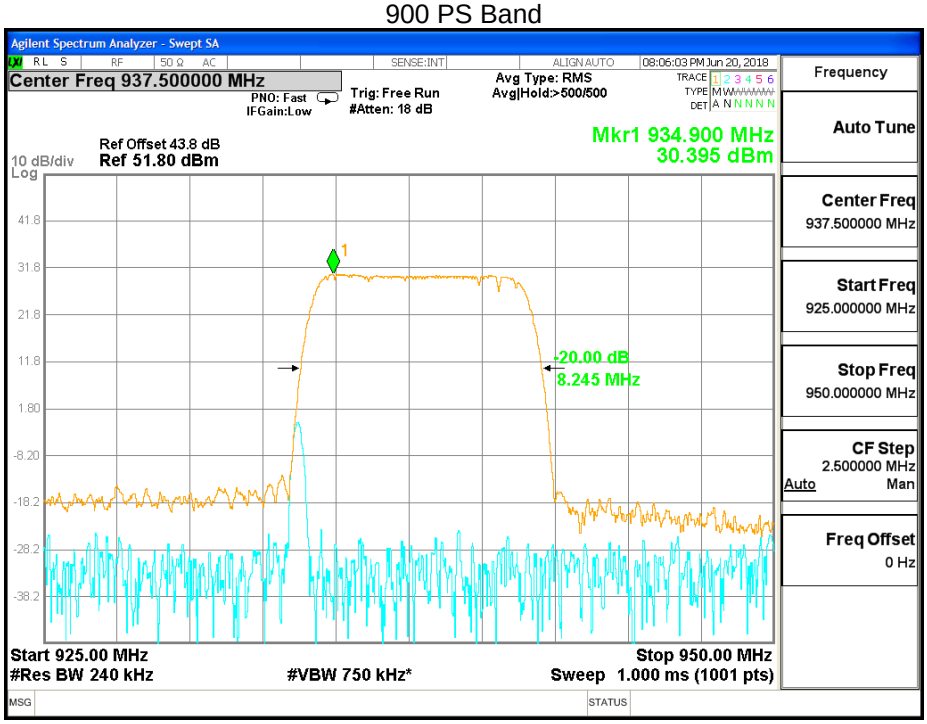
The procedure used was ANSI/TIA-603-E-2016 and FCC KDB 935210 D05 Indus Booster Basic Meas v01r02. The signal booster was set to maximum gain. A swept CW signal was set to the range of ±250 % of the product pass band. The CW ampltitude was set to 3 dB below the AGC threshold so that the ALC should not activate throughout the test.

After the max-hold sweep trace was completed, a marker was set to the peak amplitude, and a 20dB bandwidth was measured between two additional markers fall 20 dB from the peak.

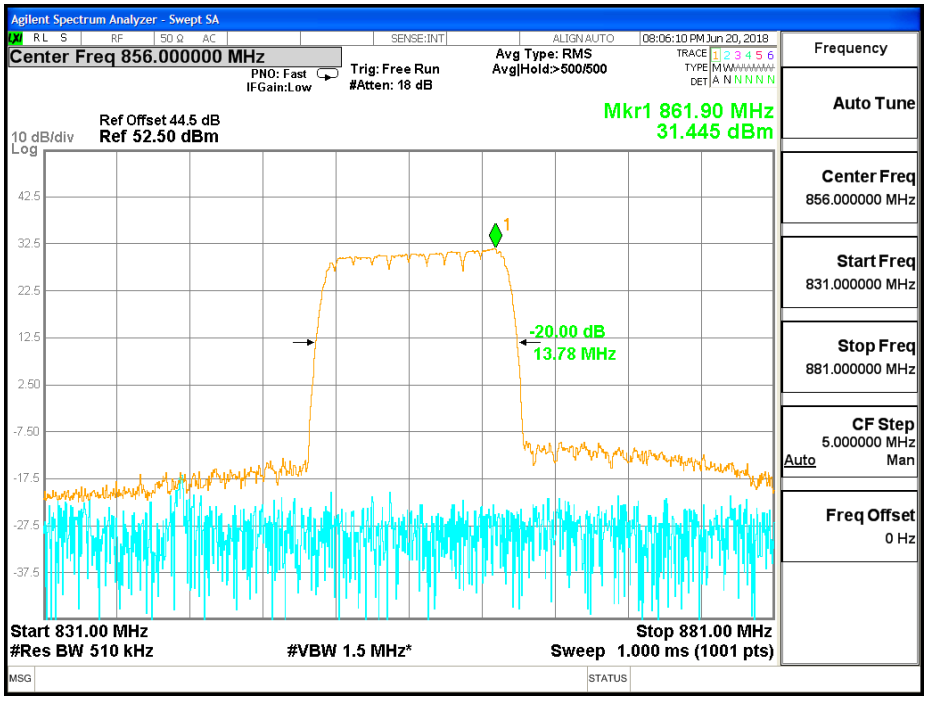
The EUT was set to **Operation Mode #1 with configuration Mode #1.**

Results

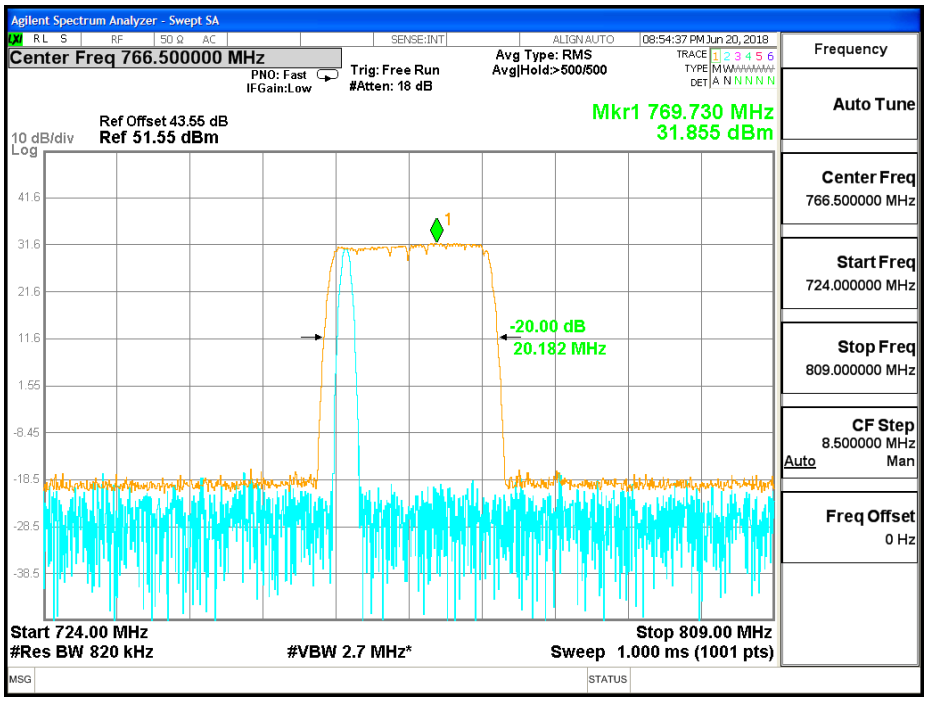
900 PS Band



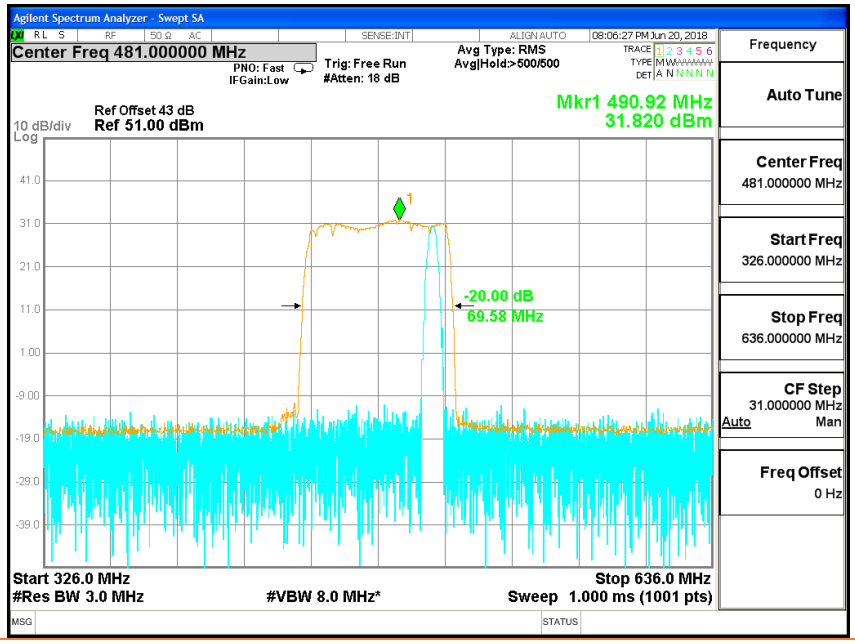
800 PS Band



700 PS Band



450 PS Band



Intermodulation

Governing Doc	FCC Part 90.219	Room Temperature (°C)	24
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October, 2017 Section 4.7.1 and 4.7.2	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	102.6
Test Engineer	Jeremy Lee	Date	Feb 06, 2018
EUT Voltage	☒ DC	☐ 120VAC @ 60Hz	

Test Equipment Used	Manufacturer	Model	Serial Number	Calibration	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	08/04/17	08/04/18
Spectrum Analyzer	Keysight	N9010A	MY50520285	08/07/17	08/07/18

Frequency Range:	☒ Max Gain Frequency ± 50kHz
Detector:	☒ Average
RBW/VBW:	☒100/910Hz
Type of Facility:	☒ Tabletop
Distance:	☒ Direct

On 800 band, 700 band and 450 band: The intermodulation product of 2 tone is below the -13dBm emission limit with input power

- 0.5dBm below AGC threshold and
- 3 dB above AGC threshold

On 900band: The intermodulation product of 2 tone is below the -20dBm ERP emission limit with input power

- 0.5dBm below AGC threshold and
- 3 dB above AGC threshold

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

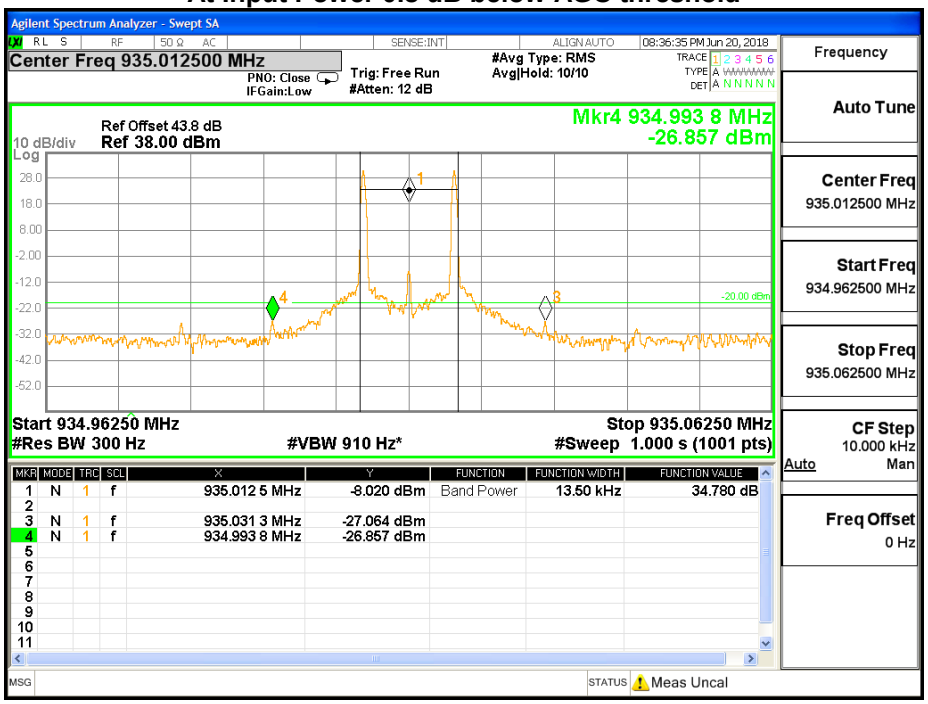
Test setup

Description of test set-up:
The procedure used was ANSI/TIA-603-E-2016. Two tones (CW) method was used. The input power to the amplifier was set at maximum drive level by combining the two tones. The two tones were chosen in such a way (1) the third order intermodulation product frequencies are located within the pass band of the DUT and (2) they produce the worst-case emissions out of band. All signals were modulated. Based on FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: 2017, the two tone was located on either side of the maximum gain frequence in the passing band, and separated with the available spacing, which is 12.5kHz. Measurements were performed with modulated -tone at identical input amplitude which produced integrated maximum rated output power. The EUT was set to **Operation Mode #1 with configuration Mode #1.**

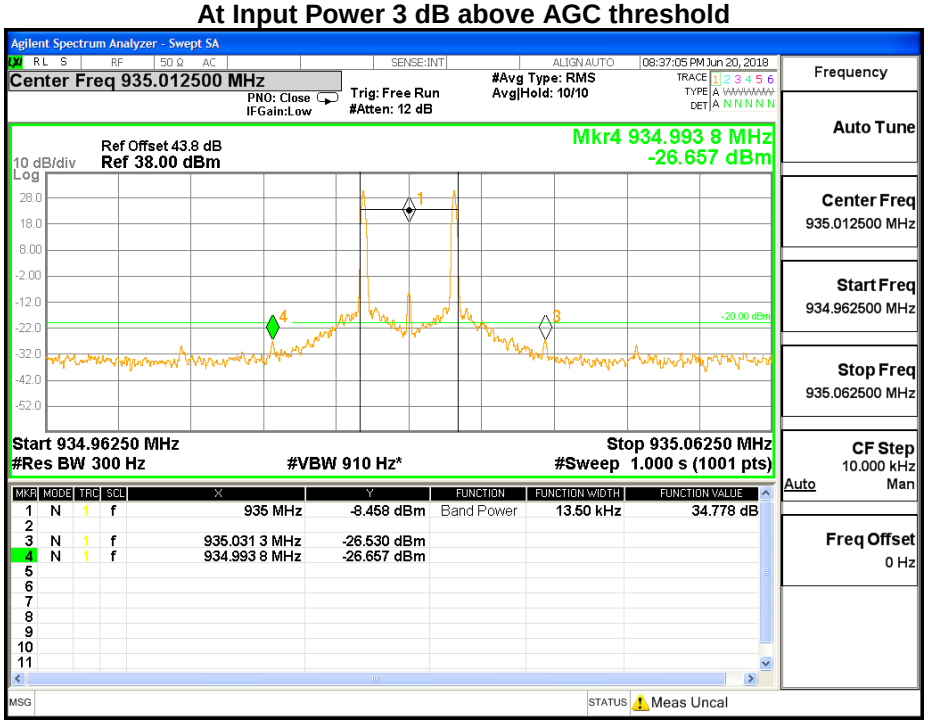

Results Screenshots

On the maximum gain channel 935.0125 MHz:

At Input Power 0.5 dB below AGC threshold

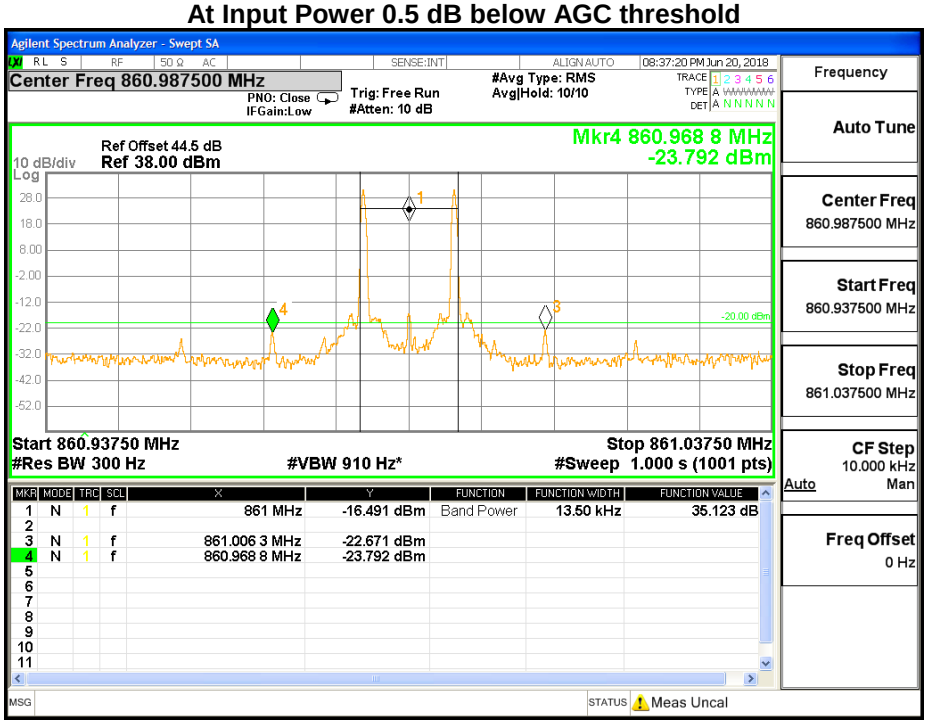


At Input Power 3 dB above AGC threshold

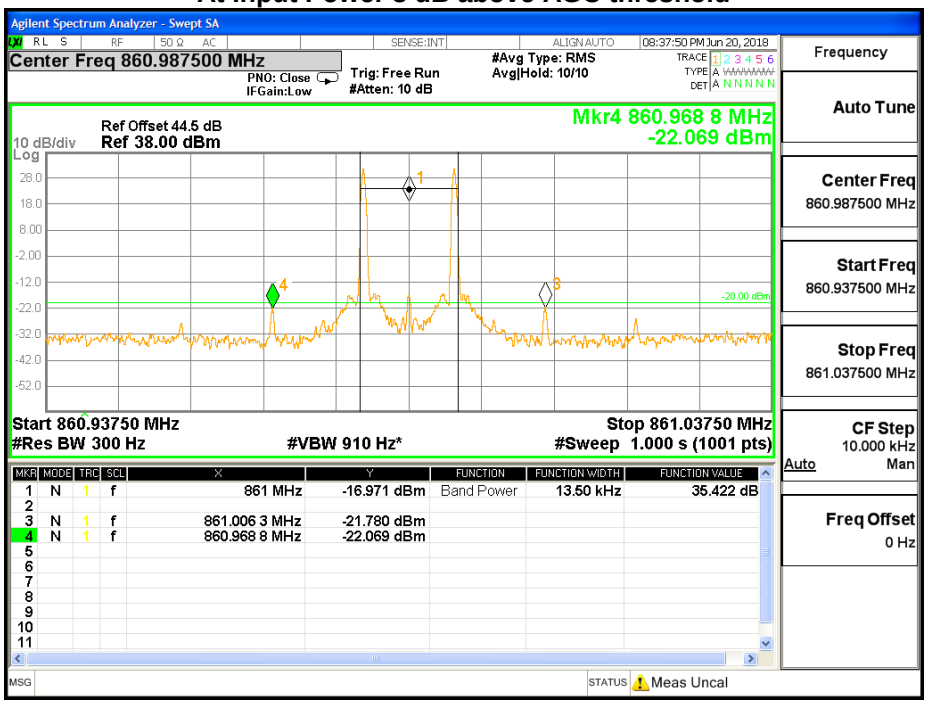


On the maximum gain channel 860.9875 MHz:

At Input Power 0.5 dB below AGC threshold

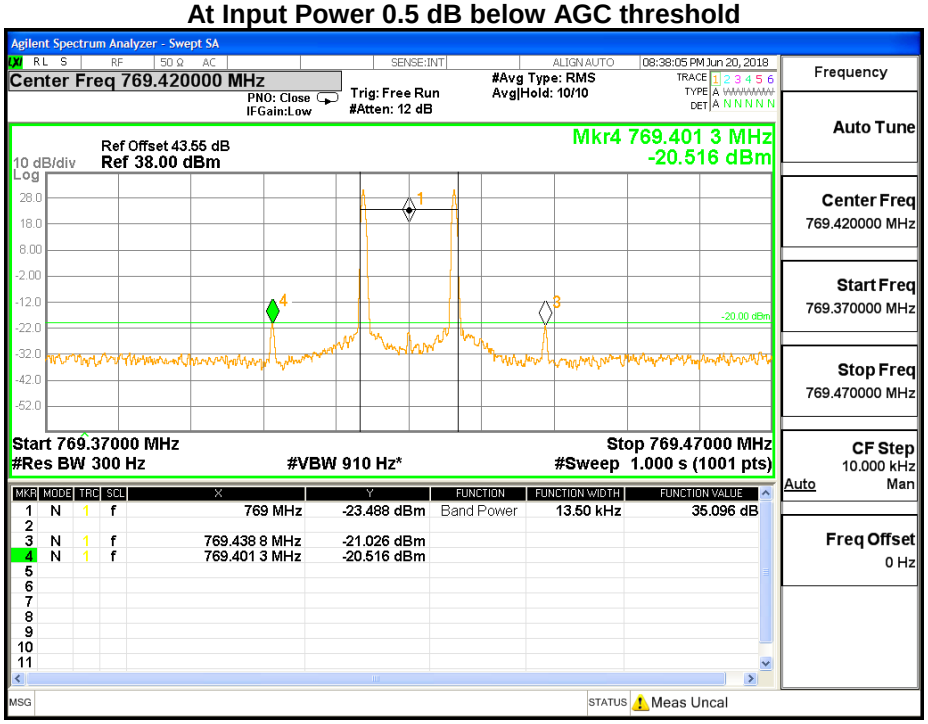


At Input Power 3 dB above AGC threshold

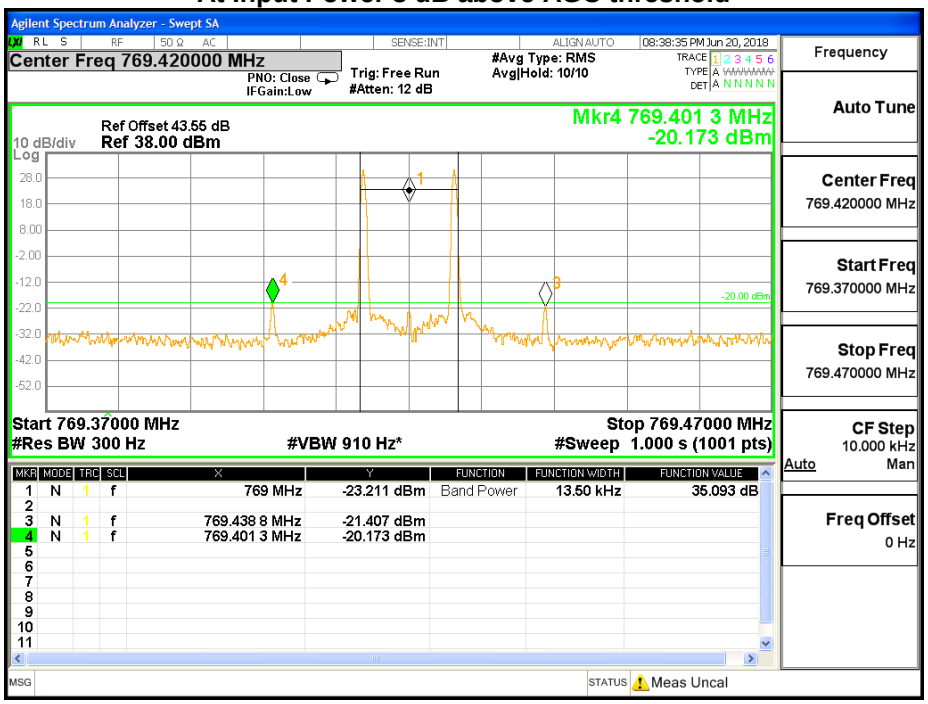


On the maximum gain channel 769.42 MHz:

At Input Power 0.5 dB below AGC threshold

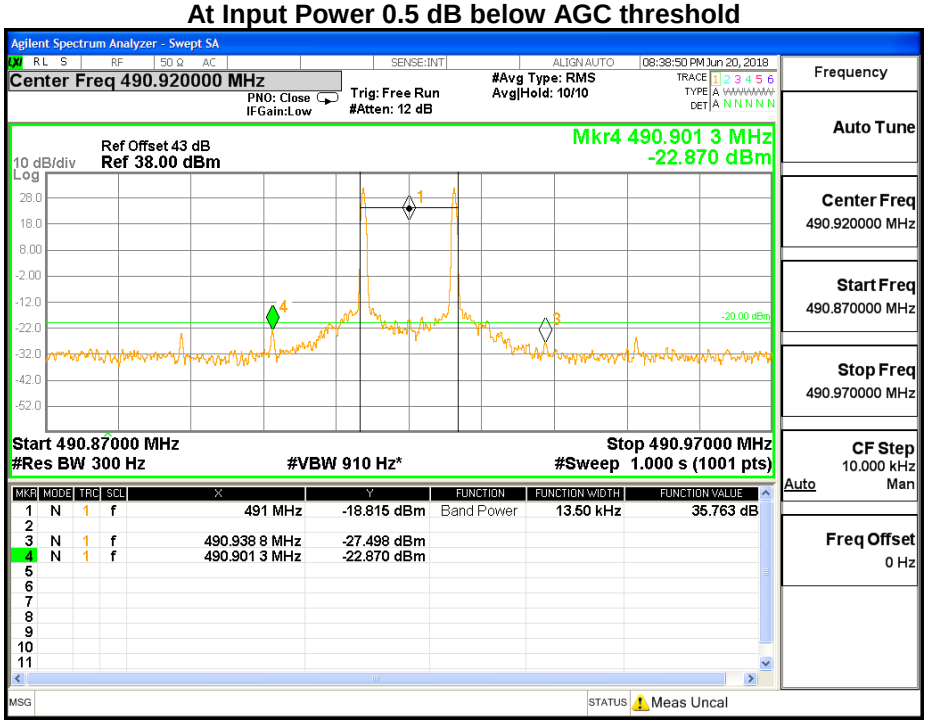


At Input Power 3 dB above AGC threshold

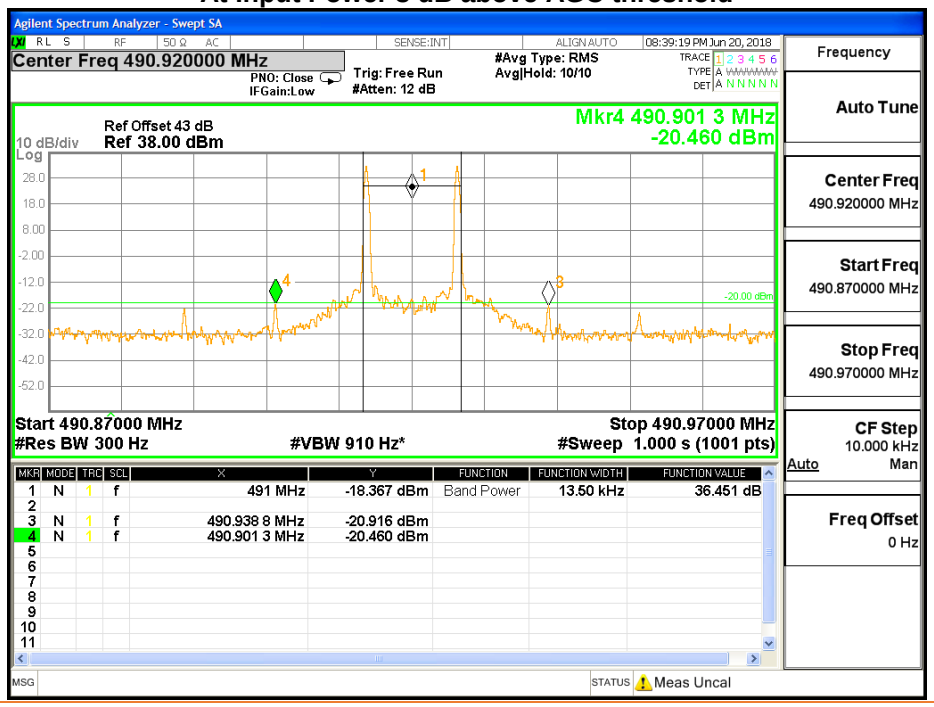


On the maximum gain channel 490.92 MHz:

At Input Power 0.5 dB below AGC threshold



At Input Power 3 dB above AGC threshold



Input/output Power and Amplifier/Booster Gain

Governing Doc	FCC Part 90.219	Room Temperature (°C)	30.5
Test Procedure	ANSI/TIA-603-E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October 27, 2017	Relative Humidity (%)	34.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Jeremy Lee	Date	Jun 20, 2018
EUT Voltage	☒ DC	☐ 120VAC @ 60Hz	

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration due
Signal Generator	Keysight	N5172B	MY53050270	08/04/17	08/04/18
Spectrum Analyzer	Keysight	N9010A	MY50520285	08/07/17	08/07/18

Span:	☒ Max Gain Frequency ± 1500kHz
Detector:	☒ Peak
RBW/VBW:	☒100k Hz/ 300 kHz
Type of Facility:	☒ Tabletop
Distance:	☒ Direct

Maximum booster gain is 43.4 dB.

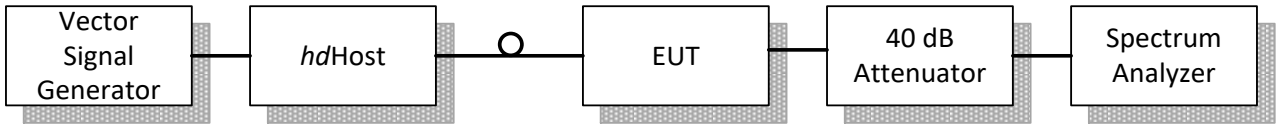
Compliant ☒ Non-Compliant ☐ Not Applicable ☐

Test setup

Description of test set-up:

The procedure used was ANSI/TIA-603-E-2016 and FCC KDB 935210 D05 Indus Booster Basic Meas v01r02:. A CW tone was input at the frequency where the system gain is the maximum in the pass band, with the nominal input power level -10 dBm. The spectrum analyzer was connected to the output RF port via a 50 Ohm 40 dB attenuator. The maximum hold trace and peak detector was used to capture the output power. The output power minus the input power (-10dBm) equals to the booster gain in dB.

The EUT was set to **Operation Mode #1 with configuration Mode #1.**



Results

	900 band	800 band	700 band	450 band
DL Gain	44.8 dB	45.2 dB	45.0 dB	46.3 dB

Noise Figure

Governing Doc	FCC Part 90.219	Room Temperature (°C)	30.5
Test Procedure	ANSI/TIA-603-E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October 27, 2017	Relative Humidity (%)	34.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Jeremy Lee	Date	Jun 20, 2018
EUT Voltage	☒ DC	☐ 120VAC @ 60Hz	

Test Equipment Used	Manufacturer	Model	Serial Number	Calibration	Calibration due
Spectrum Analyzer	Keysight	N9010A	MY50520285	08/07/17	08/07/18

Frequency Range:	☒ 2 times of the passband on each band
Detector:	☒ Average
RBW:	☒910 kHz
Type of Facility:	☒ Tabletop
Distance:	☒ Direct

Noise Figure on each band is less than the 9 dB required.

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

Test setup

Description of test set-up:

Based on FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: 2017, the system maximum gain and the noise density is measured.Measurements were performed within the EUT's passband.

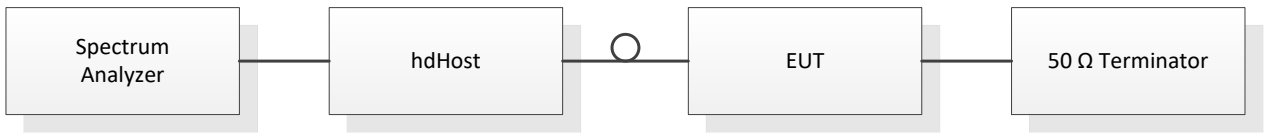
The noise figure is then calculated by NF = NP – Gain + KTB Noise; where

NP is in band noise power per Herz,

Gain is measured at the maximum noise frequence with -55 dBm input signal in UL.

KTB Noise is 174dB/Hz at room temperature.

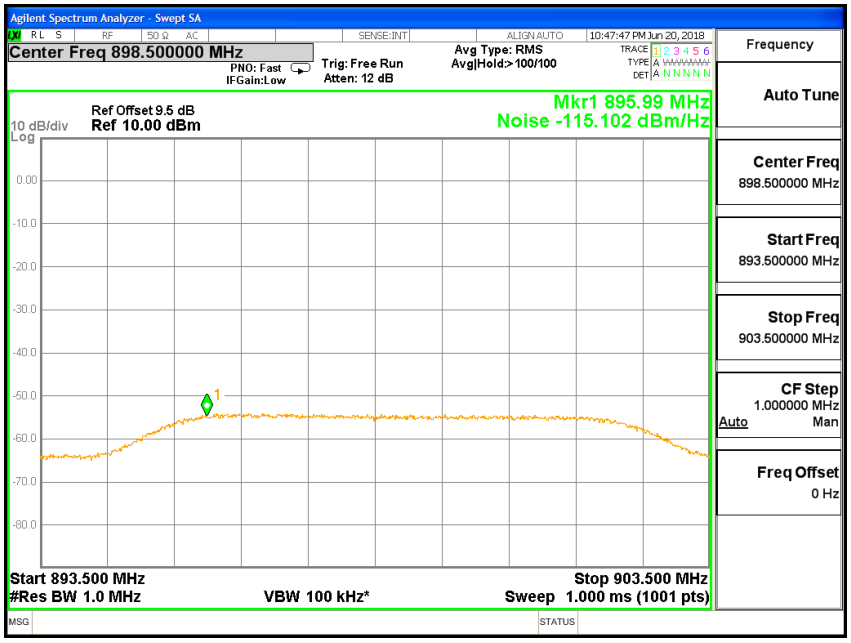
The EUT was set to **Operation Mode #1 with configuration Mode #1.**



Results

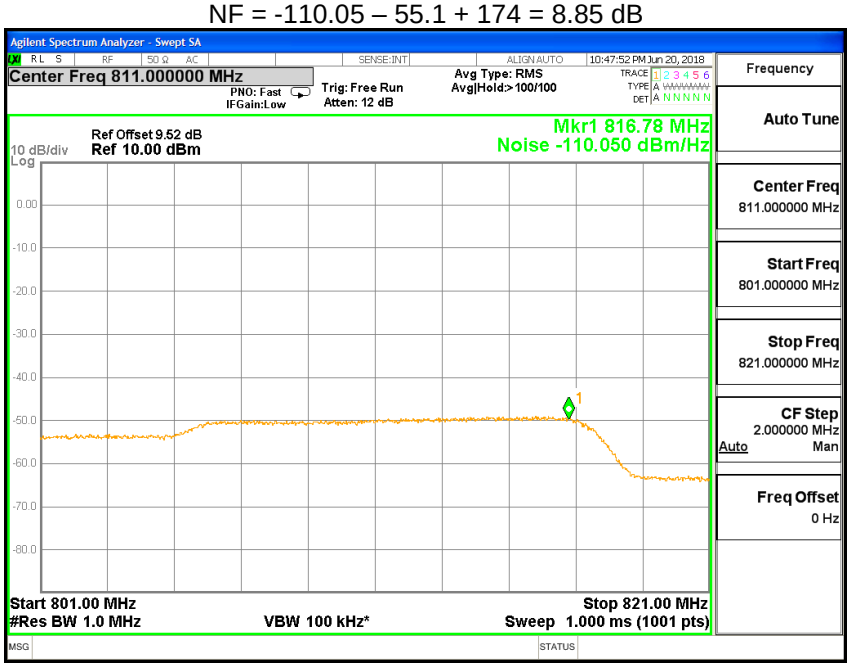
900 MHz band

Gain = 54.5 dB
NF = -115.102 – 54.5 + 174 = 4.398 dB



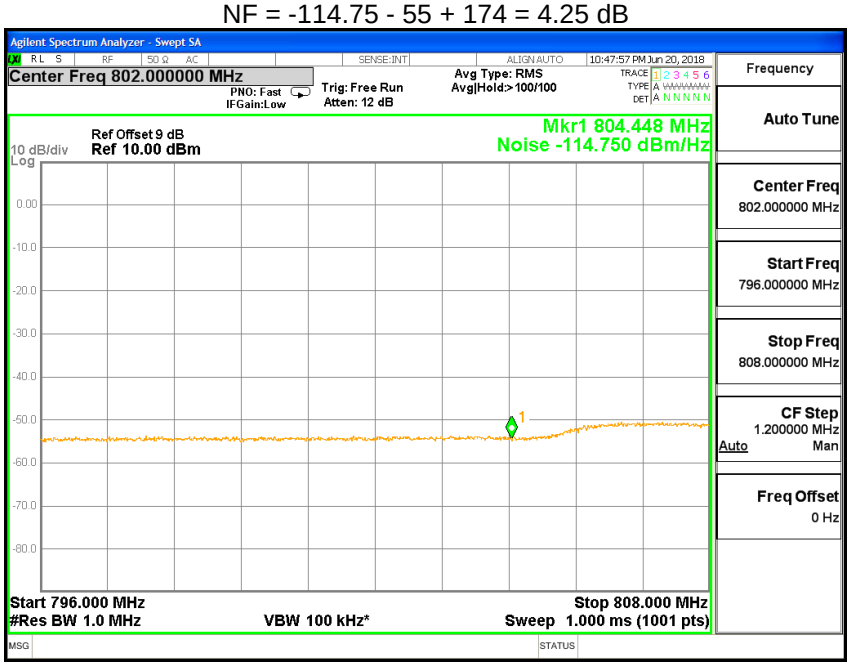
800 Band

Gain = 55.1 dB
NF = -110.05 – 55.1 + 174 = 8.85 dB



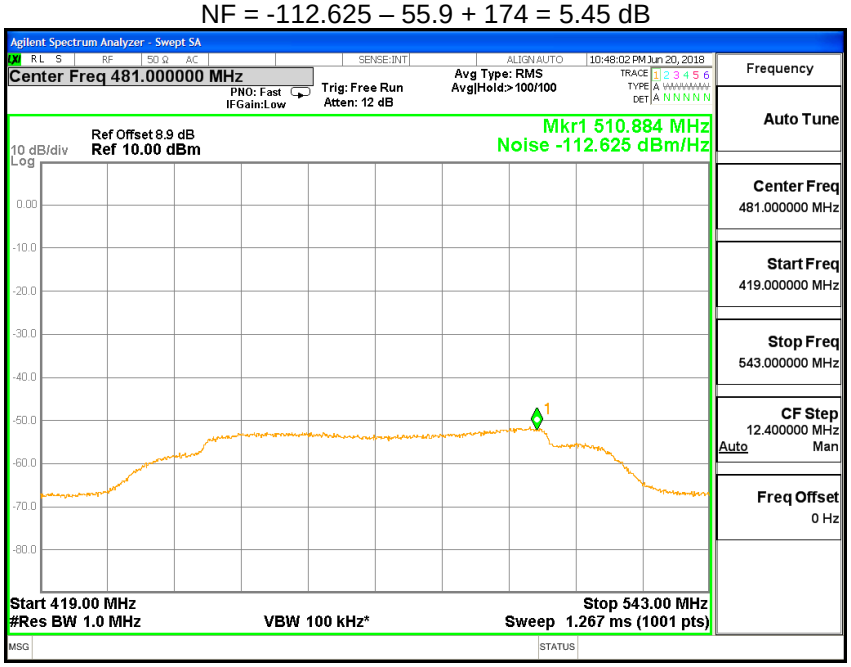
700 MHz band

Gain = 55 dB
NF = -114.75 - 55 + 174 = 4.25 dB



450 MHz Band

Gain = 55.9 dB
NF = -112.625 – 55.9 + 174 = 5.45 dB



Radiated Emissions - Enclosure

Governing Doc	FCC Part 2.1053, FCC Part 90.210 & FCC Part 90.219	Room Temperature (°C)	23.4
Test Procedure	ANSI TIA-603-D	Relative Humidity (%)	42.9
Test Location	Richmond	Barometric Pressure (kPa)	101.5
Test Engineer	Daniel Lee	Date	25 June 2018
EUT Voltage	☒ DC	☐ 120VAC @ 60Hz	

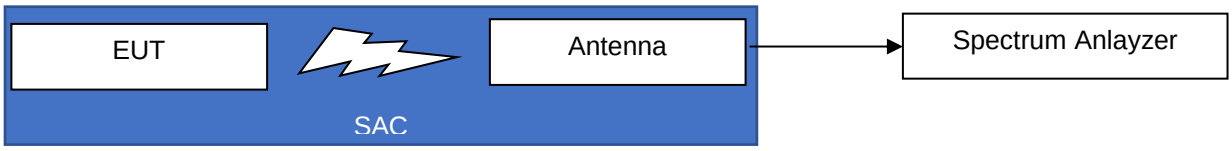
Test Equipment Used	Manufacturer	Model	Identifier	Calibration date	Calibration
Spectrum Analyzer	KeySight	N9038A	702	26-Apr-2018	26-Apr-2019
BiCon Antenna	A.H Systems	SAS-542	227A	07-Feb-2018	07-Feb-2020
LP Antenna	A.H Systems	SAS-510-2	227B	12-Mar-2018	12-Mar-2020
Loop Antenna	ComPower	AL-130	241	08-Nov-2017	08-Nov-2019
Horn Antenna	A.H Systems	SAS-571	227C	22-Sep-2016	22-Sep-2018
RF Preamplifier	Agilent	8449B	273	IHC	IHC
EMC Shielded Enclosure	USC	USC-26	374	IHC	IHC
Broadband Antenna	Sunol	JB1	371	IHC	IHC

Note1) IHC=In House Calibration

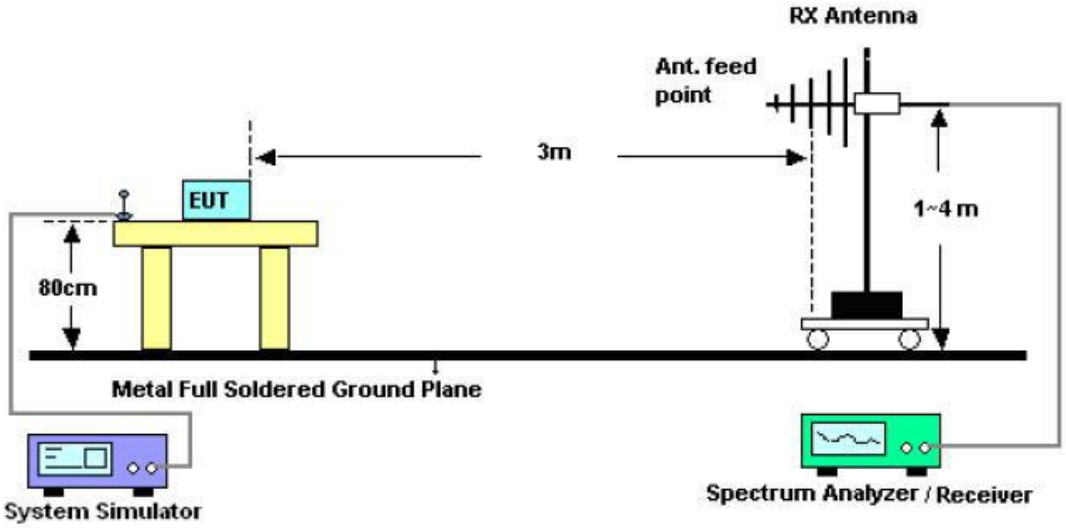
Frequency Range:	☒ 9kHz-30MHz	☒ 30-1000MHz	☒ 1-18GHz
Detector:	☒ Peak (for Prescan)	☒ Quasi-Peak(for Formal))	☒ Average(for Formal)
RBW/VBW:	☒ 9/30kHz	☒ 120/300kHz	☒ 1/3MHz
Type of Facility:	☒ SAC	☐ FSOATS	☐ *in-situ*
Distance:	☒ 3meter	☐ 10meter	☐ 1meter
Arrangement of EUT:	☒ Table-top only	☐ Floor-standing only	☐ Rack Mounted

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

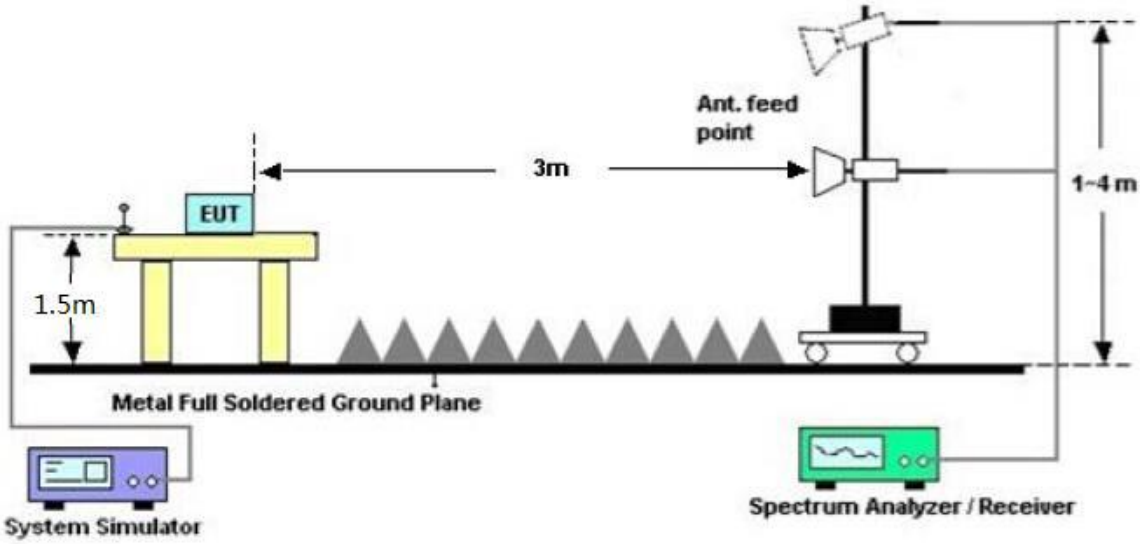
Test setup

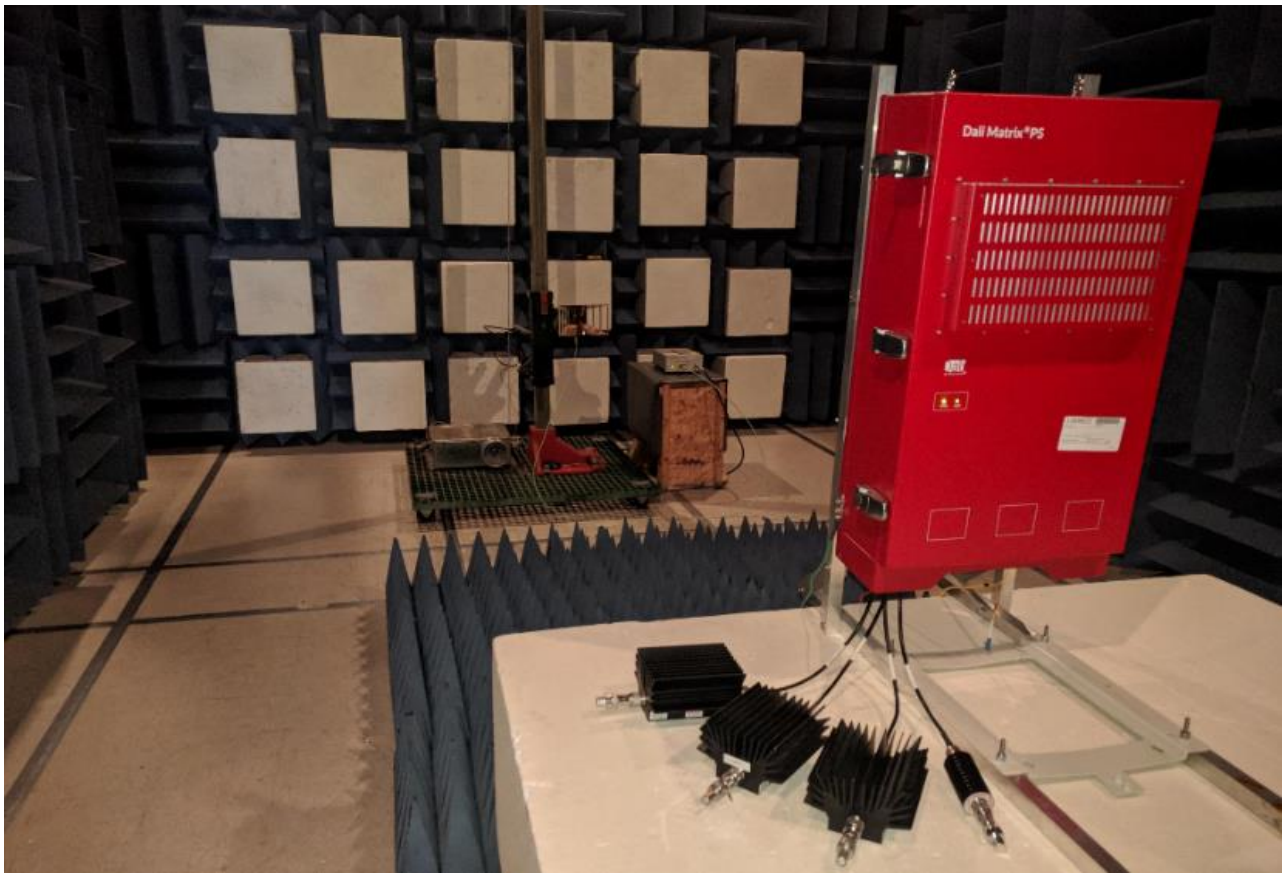
Description of test set-up:
The EUT was placed on a nonconducting platform (i.e., an “EUT support table”), of nominal size 1 m by 1.5 m, whose top surface is nominally 80 cm above the reference ground plane. The EUT was set up on 3 meters away from the EUT. The EUT was set continually on its Radio, 2W Max., which was downlinked from hdHOST. And the output of RF was terminated via 40dB attenuator, for rejecting the high power of carrier. The lowest, middle and highest channels were used for measuring of all radiated spurious emisions . The EUT was set to **Operation Mode #1 with configuration Mode #1.** 

- Radiated Emission 30 to 1,000MHz, with JB-1



- Radiated Emission 1 to 10GHz, with SAS-571





Measurement Procedure

Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT.

Scans were made with an EMC Analyzer, controlled by EMC Test Software, Tile7!, from 30kHz to 18GHz with the receiver in the peak mode. The receiver IF bandwidth was 9kHz,120 kHz or 1MHz as appropriate for the frequency and scan step was about 30kHz. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to produce horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Under 30MHz was only tested at 1meter height and Antenna was changed both polarization, Horizontal and Vertical. Measurements were then made using CISPR quasi peak when the peak readings were within 10dB of the limit line. The numerical results are included herein to demonstrate compliance.

Test Result

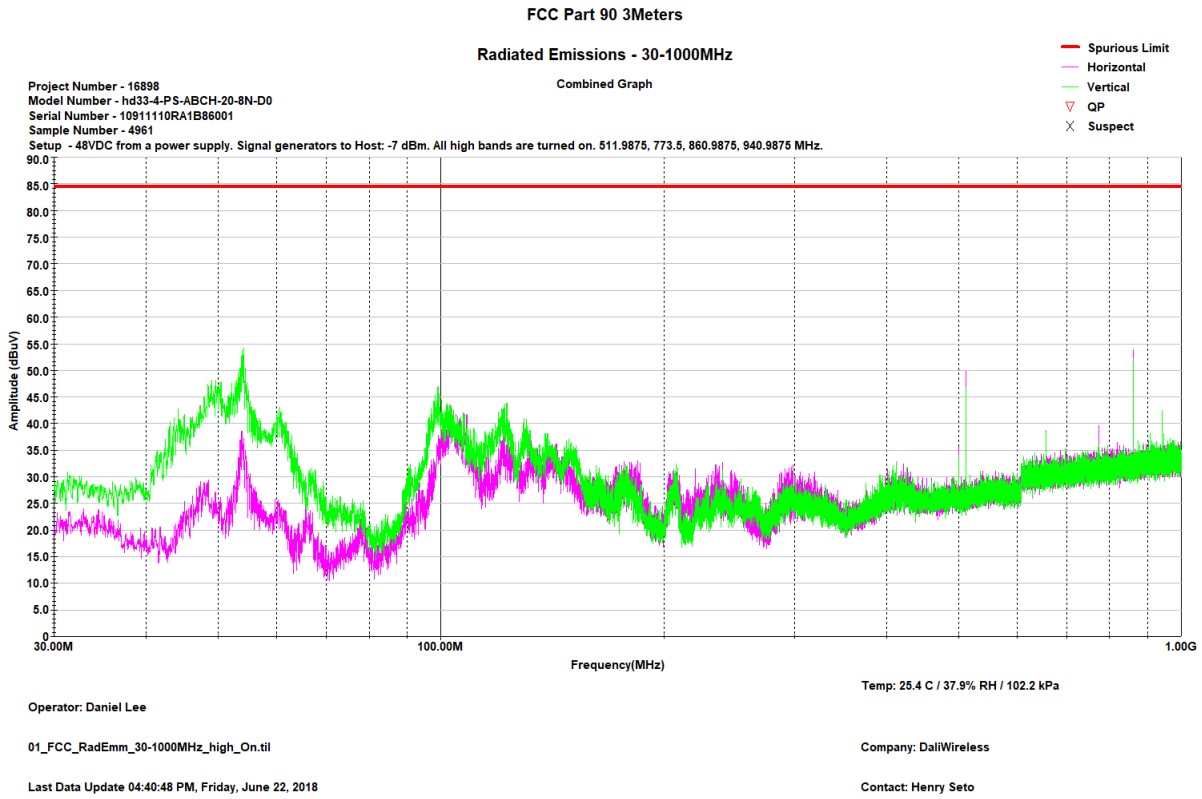
The output of EUT was set to 3.16 Watt(+35dBm), the PASS level of Spurious is: 43 + 10log(P) = 43 + 10log(3.16) = 48dB attenuation = -13dBm Since of radiated measurement was performed at 3 meters, the limit line was converted to dBuV/m using the formulas ad outlined in KDB 971168: -13 dBm ERP = 84.38 dBuV/m at 3 meters. Spurious Emission level (dBuV/m) = Detected level (dBuV) + Path Loss(dB) + Antenna Factor (dB/m) - Preamplifier's Gain (dB)

Graphical Representation for Emission - Radiated 30kHz to 30MHz

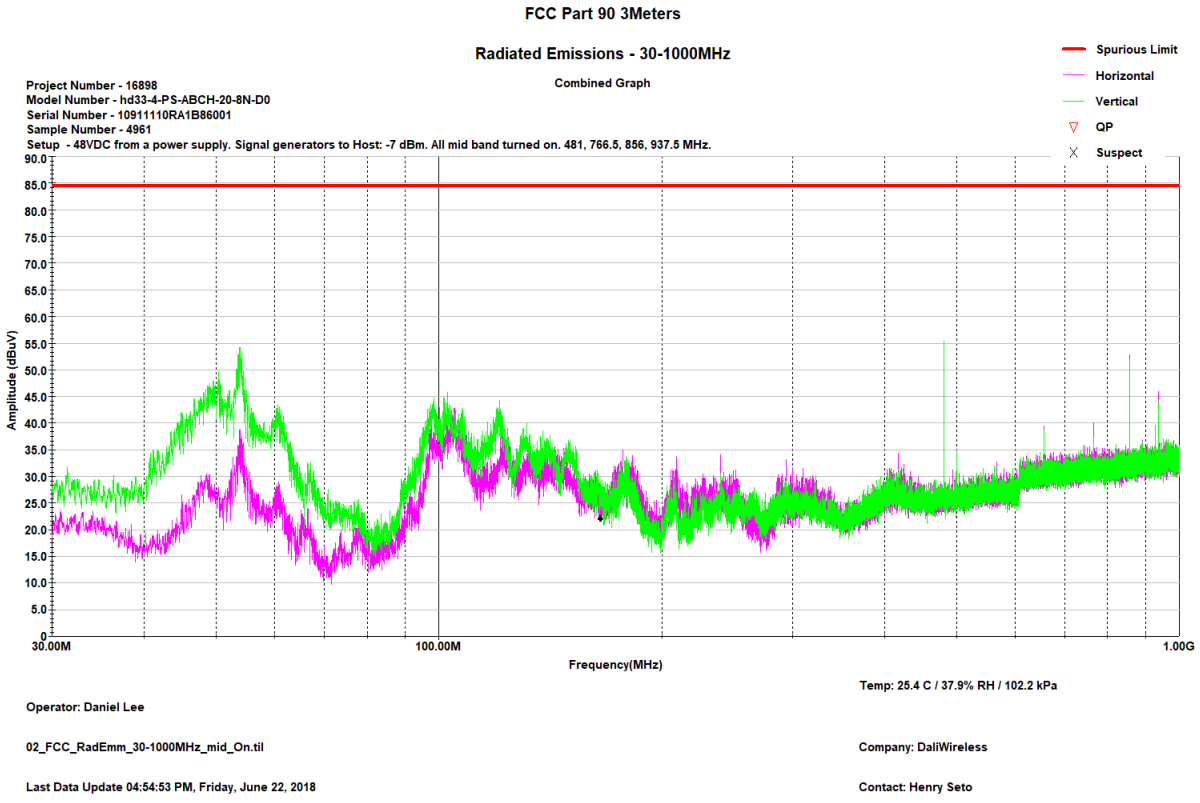
Spectrum was scanned manually from 30kHz to 30MHz. No automated plot is available for this frequency range. No spurious emissions from the product were detectable

Graphical Representation for Emission - Radiated 30MHz to 1GHz

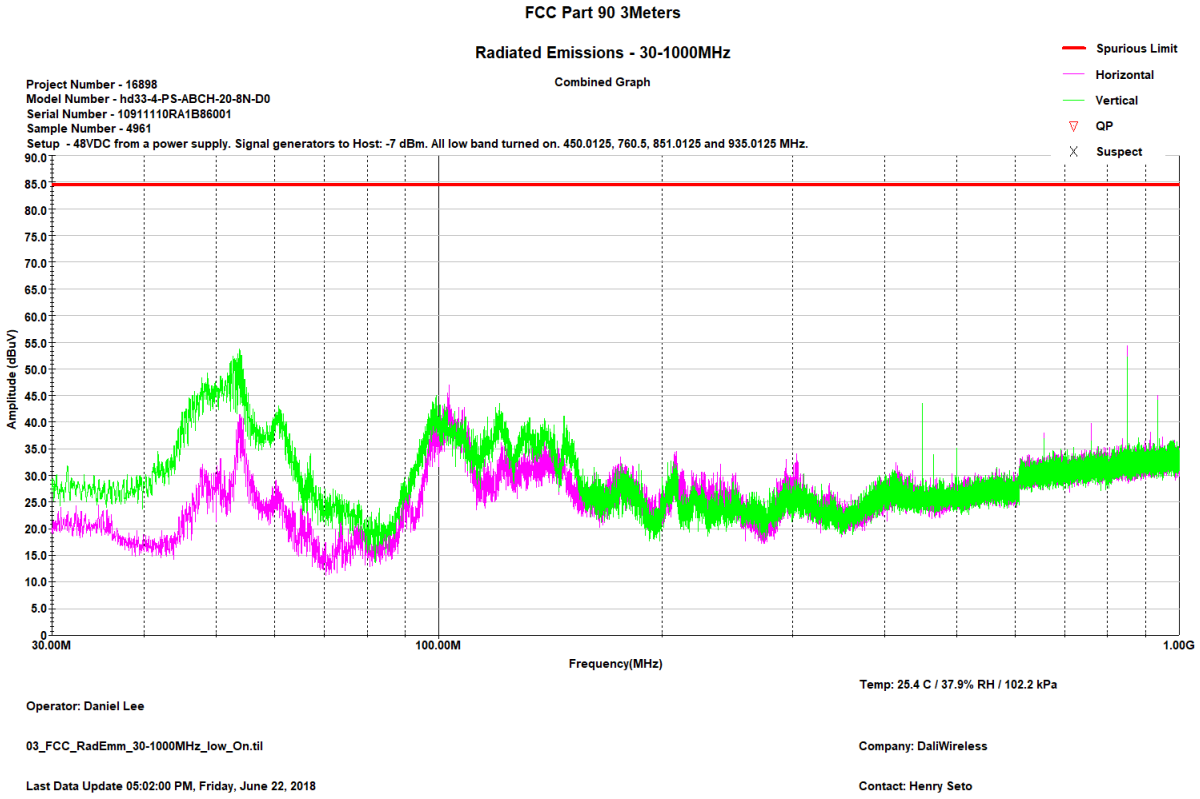
- All high bands turned on. 511.9875, 773.5, 860.9875 and 940.9875MHz. Terminated.



- All mid bands turned on. 481, 766.5, 856 and 937.5MHz. Terminated.

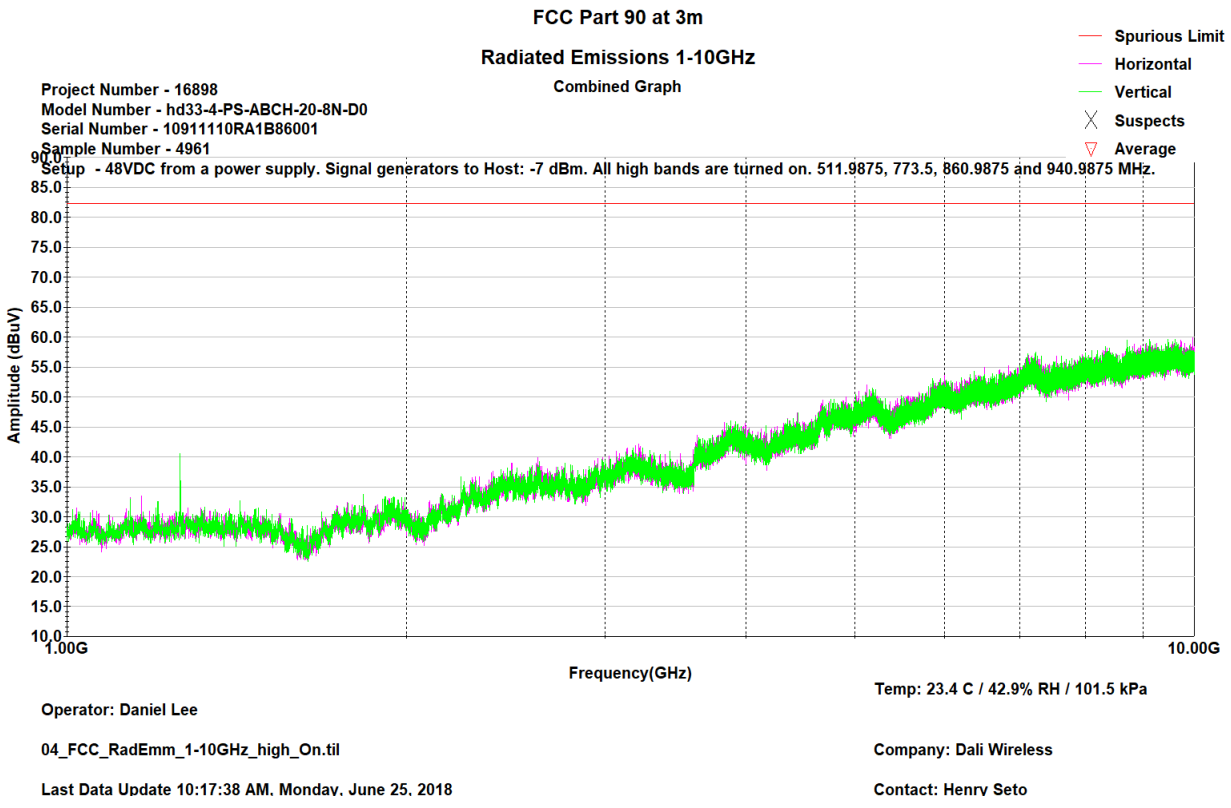


- All low bands turned on. 450.0125, 760.5, 851.0125 and 935.0125MHz. Terminated.

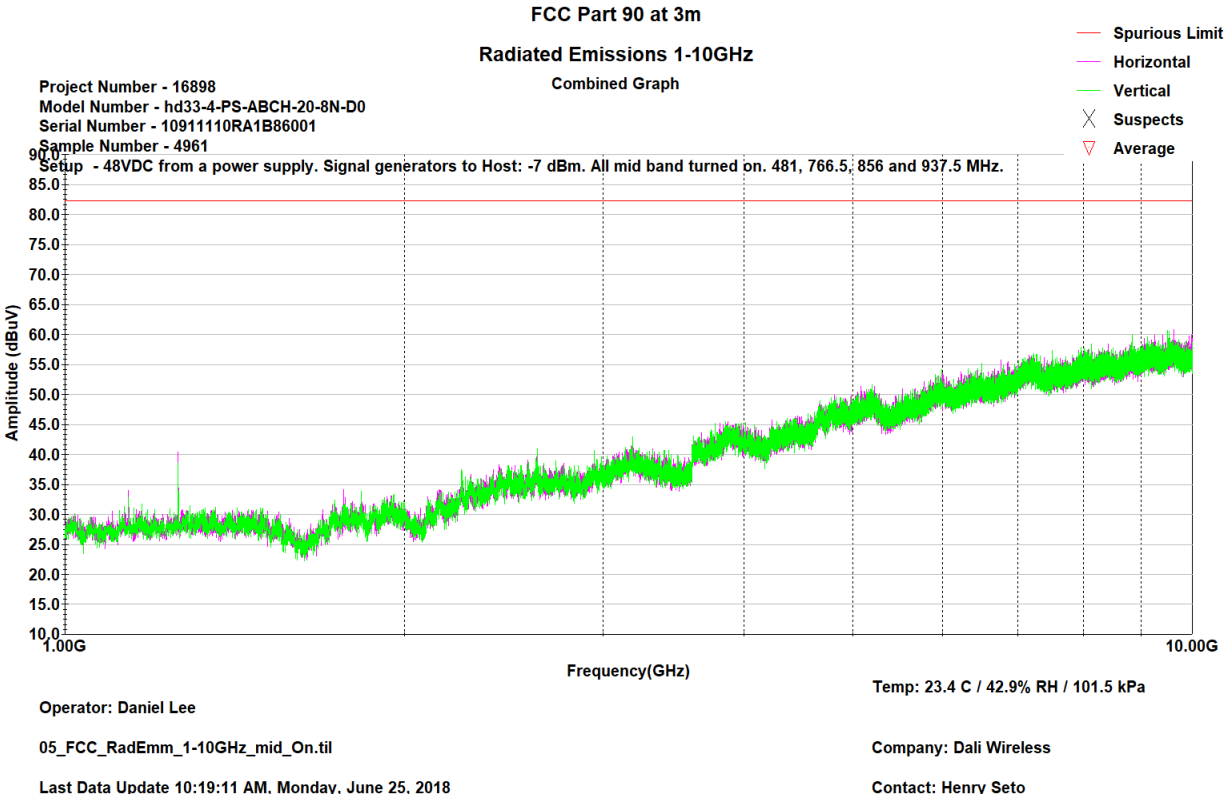


Graphical Representation for Emission - Radiated 1 to 18GHz

- All high bands turned on. 511.9875, 773.5, 860.9875 and 940.9875MHz. Terminated.



- All mid bands turned on. 481, 766.5, 856 and 937.5MHz. Terminated.



- All low bands turned on. 450.0125, 760.5, 851.0125 and 935.0125MHz. Terminated.

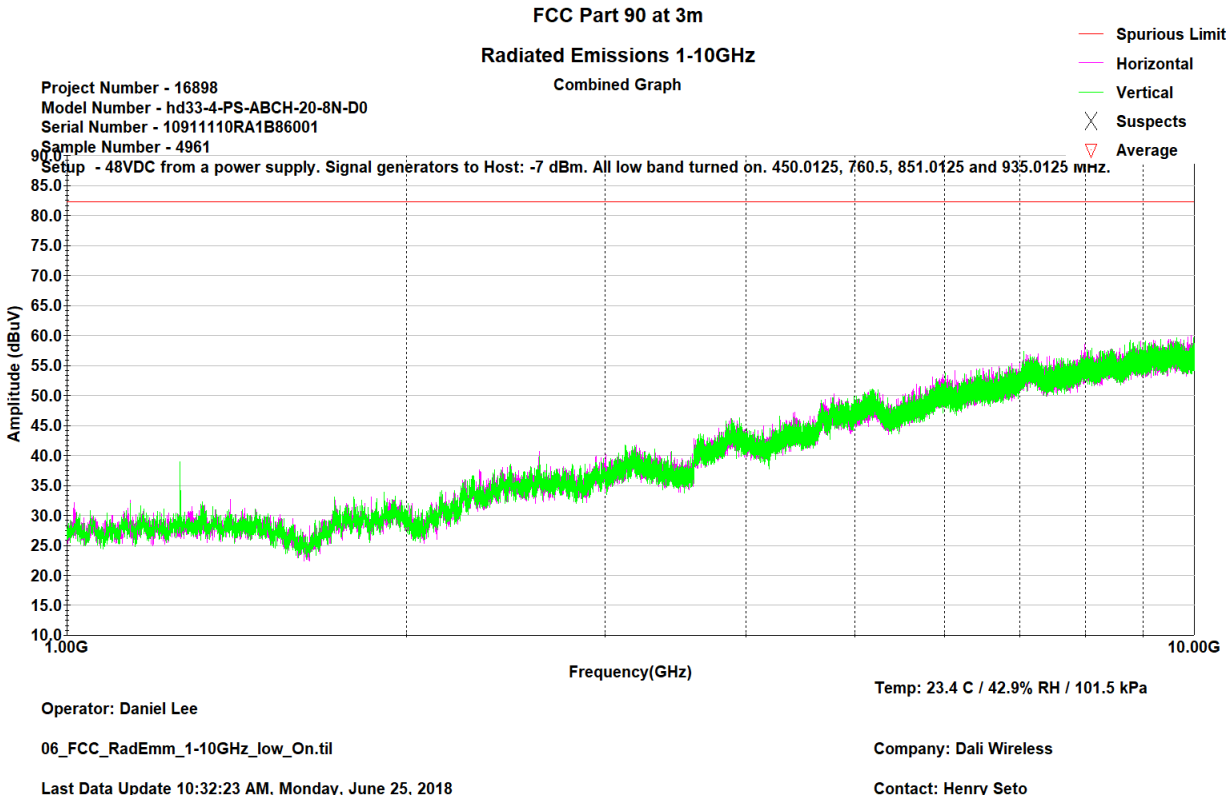


Table Representation for Emission - Radiated 30MHz to 18GHz

No Emissions were measured. All emissions detected, other than the fundamental, were related to the Digital Mode circuitry. No Transmitter Spurious Emissions were detectable and are greater than 20dB below the limit line.

END OF REPORT