Spectrum Emission Mask

Governing Doc	FCC Part 90.210 (i)	Room Temperature (°C)	24
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October 27, 2017	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Sophie Piao/Jeremy Lee	Date	Jan 04, 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
40dB Attenuator	Aeroflex Winschel	58-40-43	n/p	CVP	CVP

Note) CVP = Calibration Verification Performed internally, n/p = not provided.

Frequency Range:	☒ Center Channel
Detector:	☒ Peak
RBW/VBW:	☒100 Hz
Type of Facility:	☒ Testbench
Distance:	☒ direct connect
Arrangement of EUT:	☐ Table-top only ☐ Floor-standing only ☒ Rack Mounted

Signal of all types of modulation is contained within the emission mask.

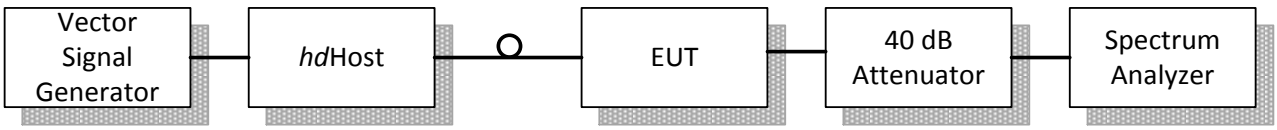
Compliant ☒ Non-Compliant ☐ Not Applicable ☐

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 2 times of the channel BW. The emission was measured with RBW 100 Hz.

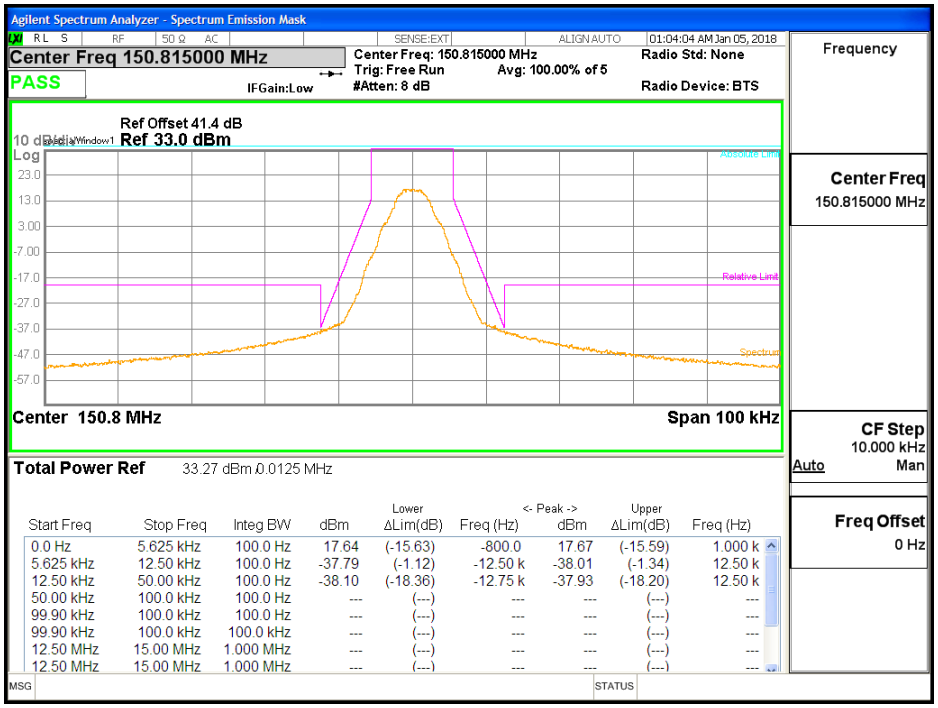
The EUT was set to **Operation Mode #1 with configuration Mode #1.**



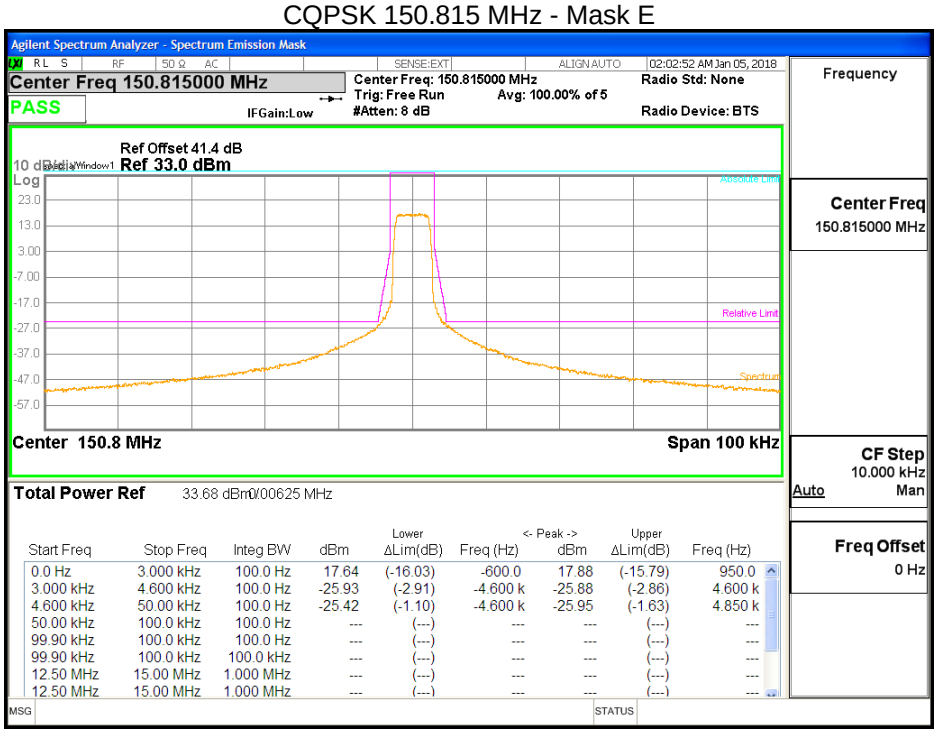
Results

At Input Power 0.5 dB below AGC threshold

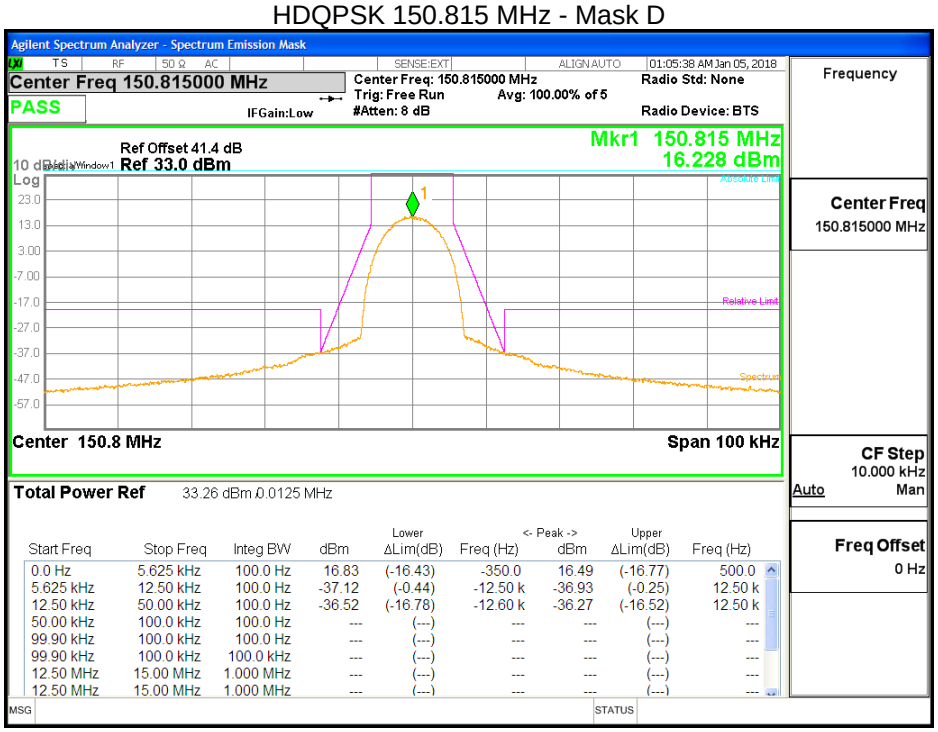
C4FM 150.815 MHz – Mask D



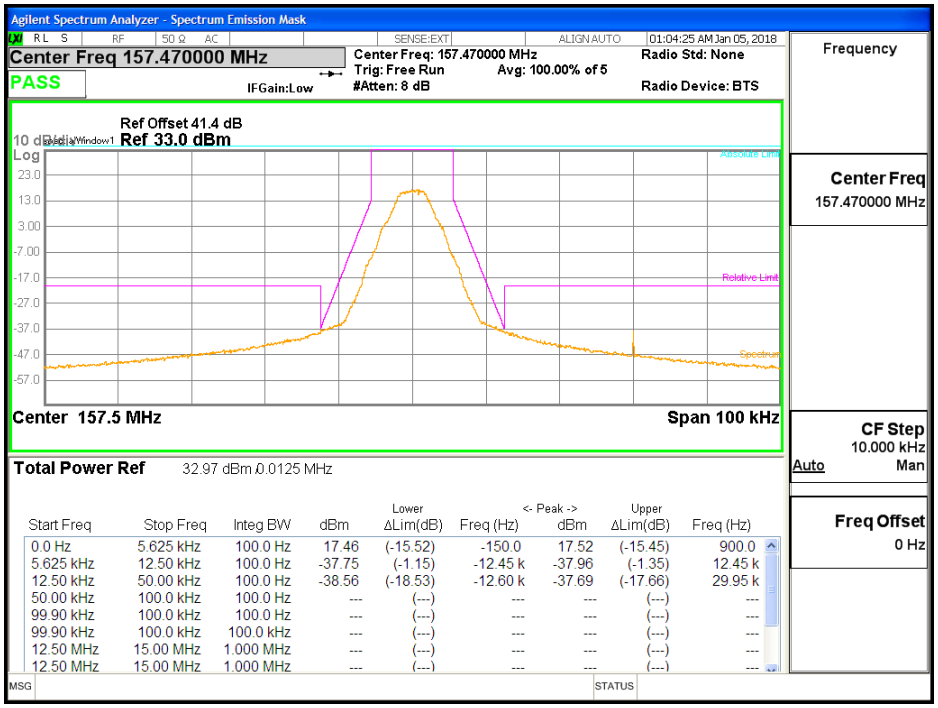
CQPSK 150.815 MHz - Mask E



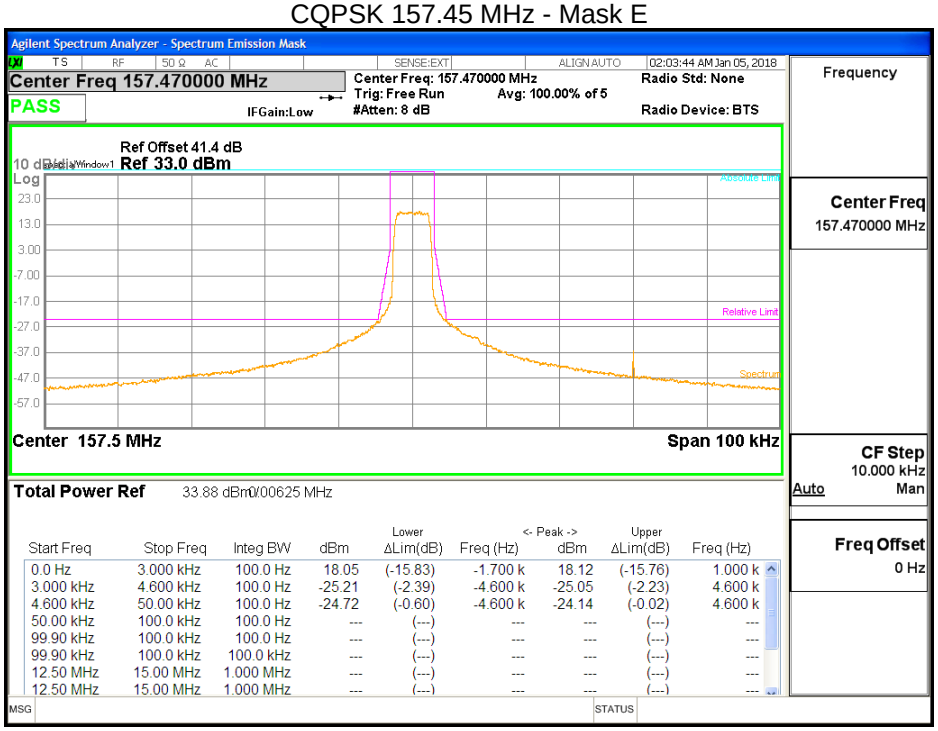
HDQPSK 150.815 MHz - Mask D



C4FM 157.45MHz - Mask D

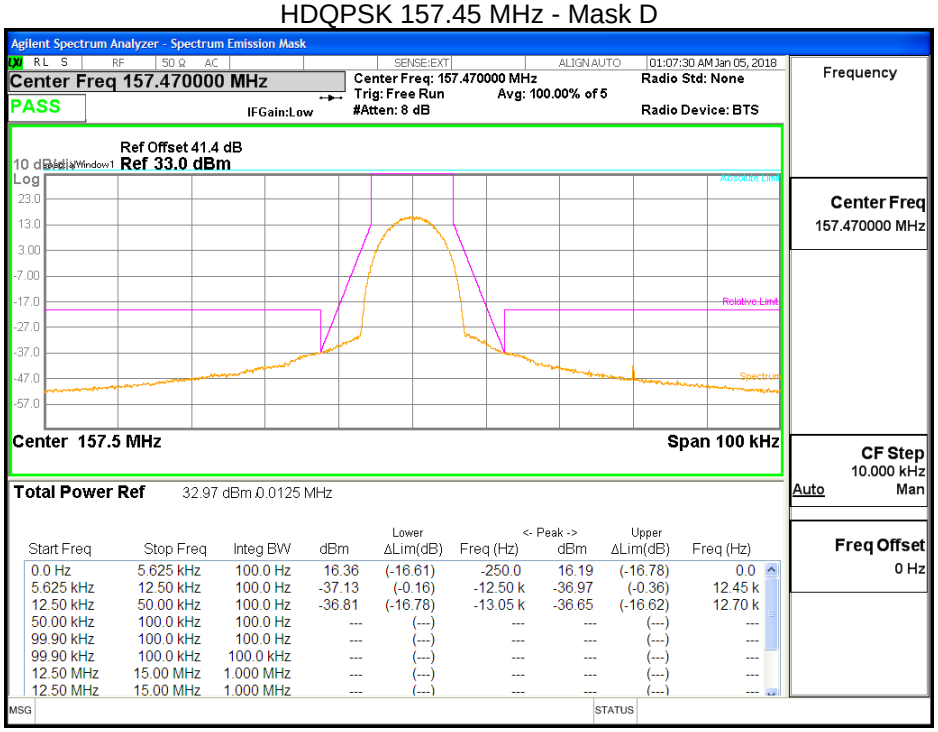


CQPSK 157.45 MHz - Mask E



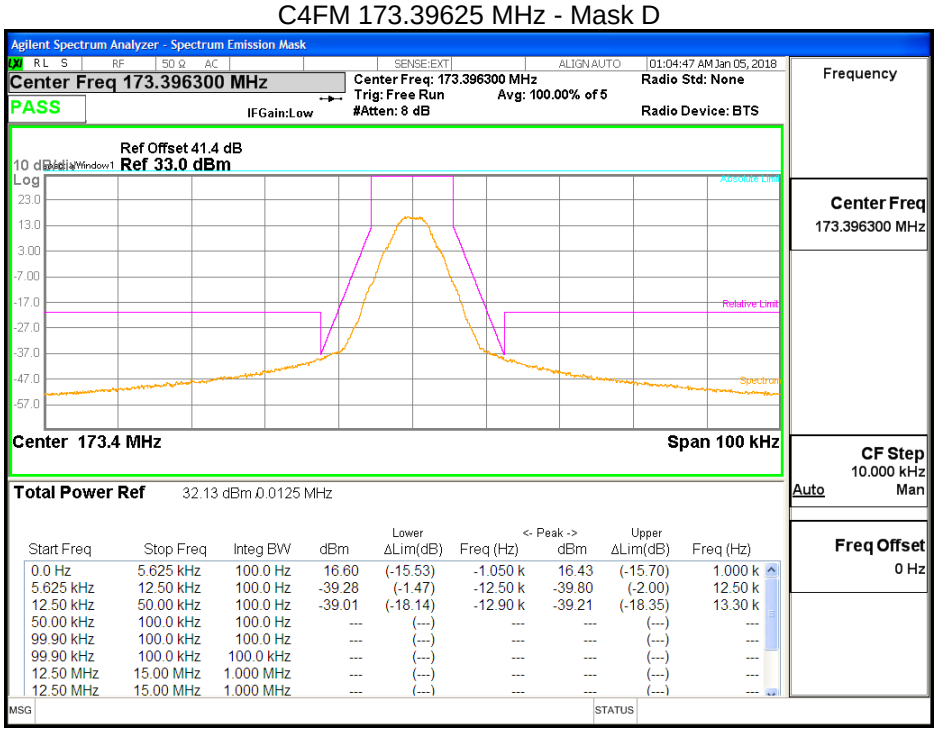
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	3.000 kHz	100.0 Hz	18.05	(-15.83)	-1.700 k	18.12	(-15.76)	1.000 k
3.000 kHz	4.600 kHz	100.0 Hz	-25.21	(-2.39)	-4.600 k	-25.05	(-2.23)	4.600 k
4.600 kHz	50.00 kHz	100.0 Hz	-24.72	(-0.60)	-4.600 k	-24.14	(-0.02)	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 157.45 MHz - Mask D

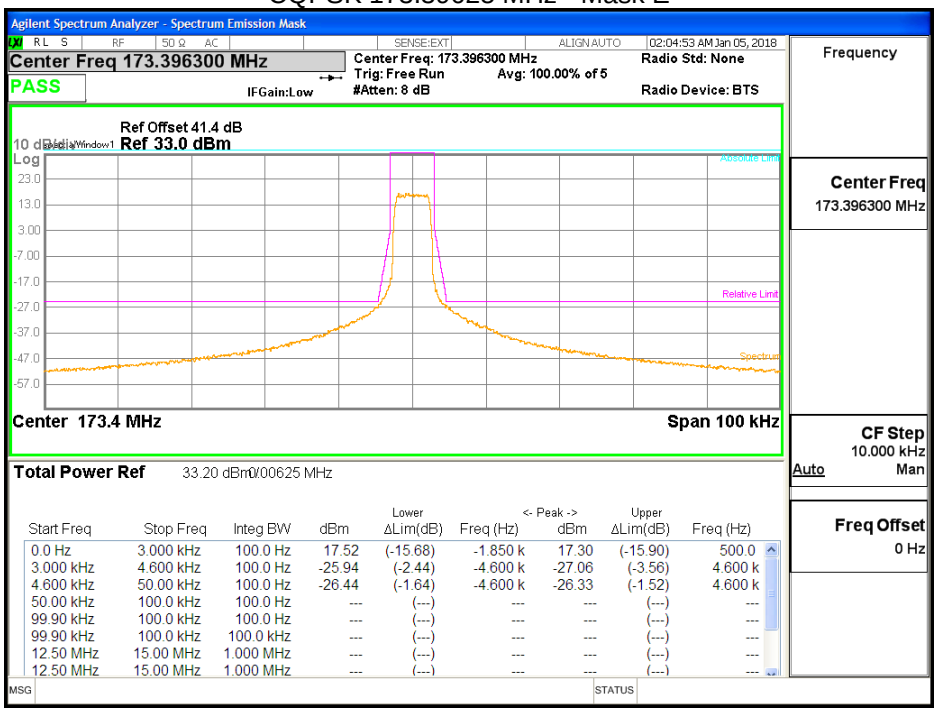


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	16.36	(-16.61)	-250.0	16.19	(-16.78)	0.0
5.625 kHz	12.50 kHz	100.0 Hz	-37.13	(-0.16)	-12.50 k	-36.97	(-0.36)	12.45 k
12.50 kHz	50.00 kHz	100.0 Hz	-36.81	(-16.78)	-13.05 k	-36.65	(-16.62)	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	---	(---)	---	---	(---)	---

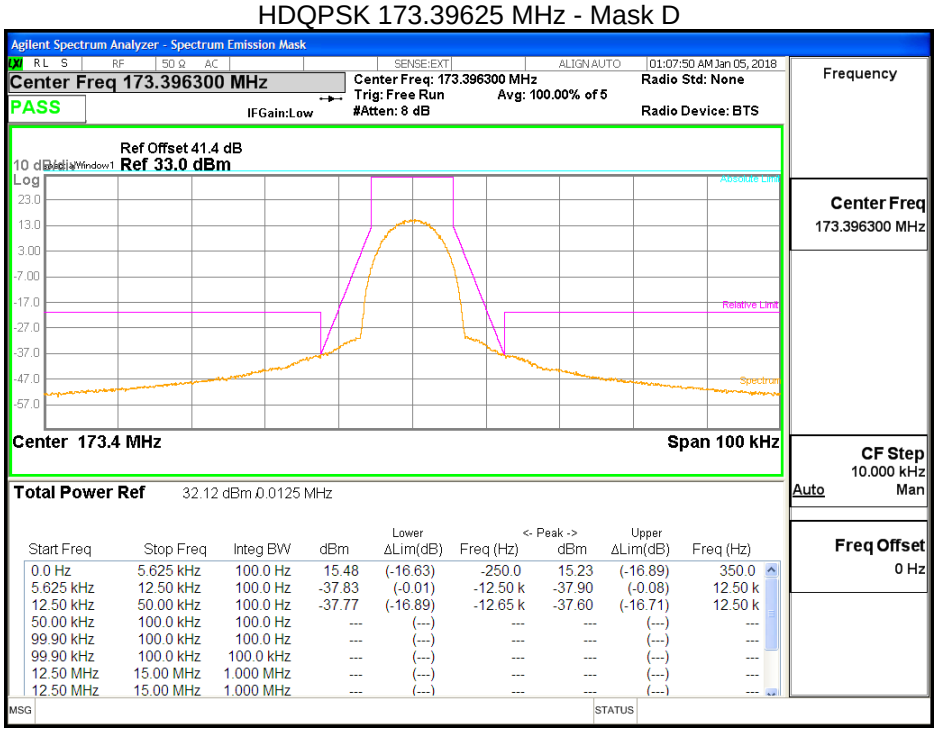
C4FM 173.39625 MHz - Mask D



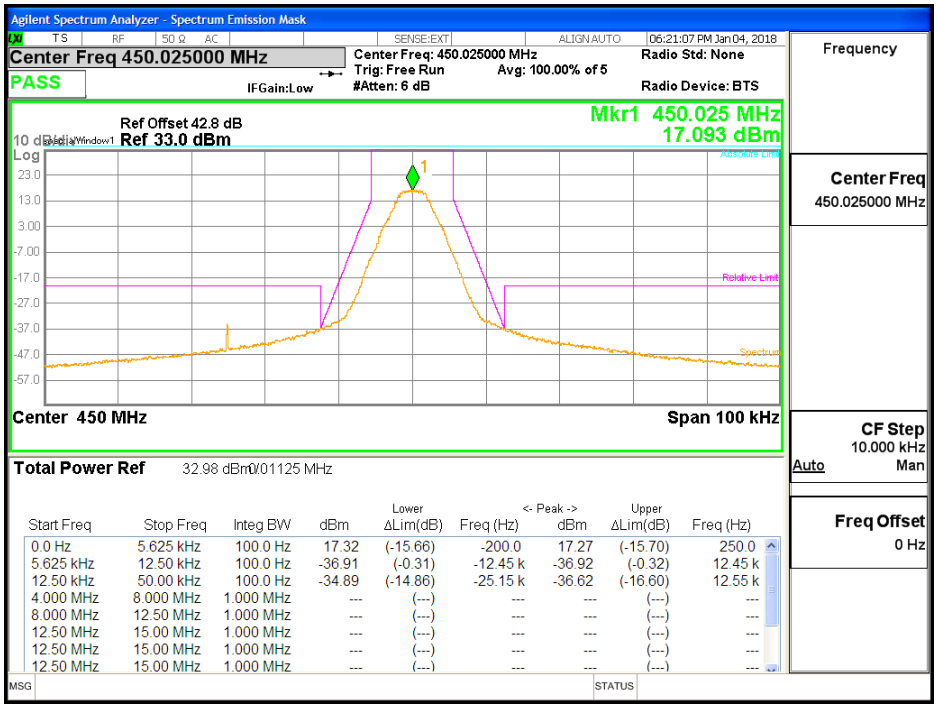
CQPSK 173.39625 MHz - Mask E



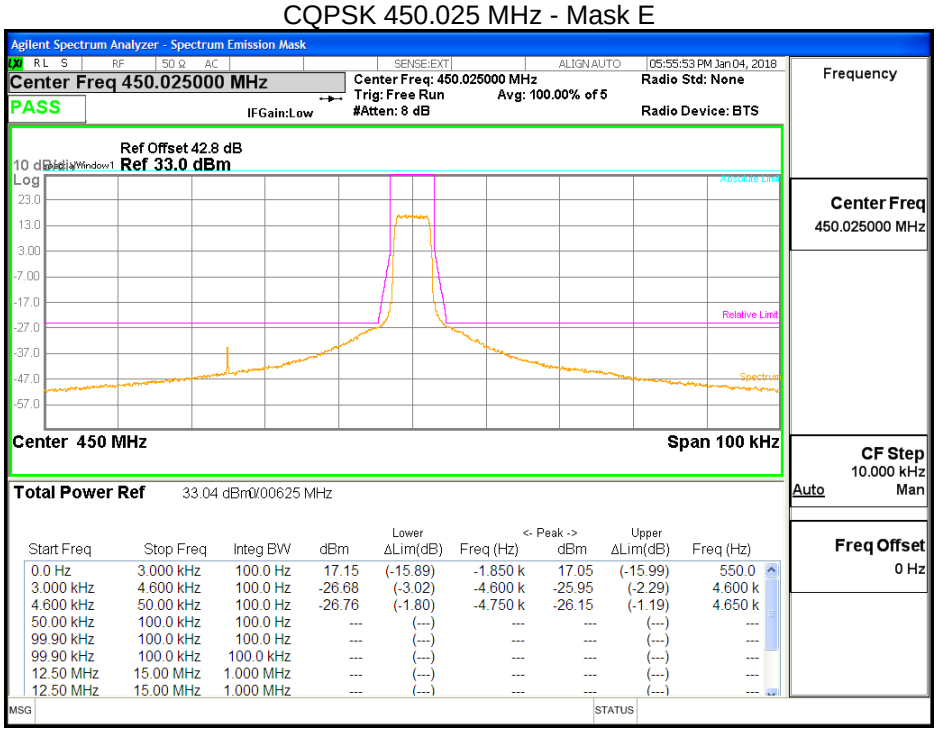
HDQPSK 173.39625 MHz - Mask D



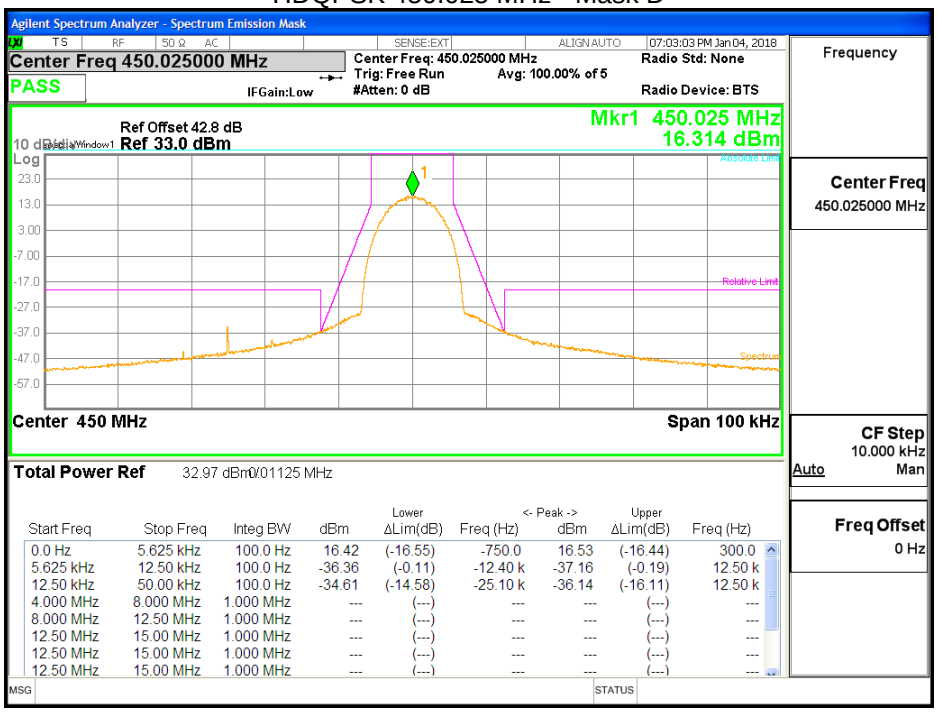
C4FM 450.025 MHz - Mask D



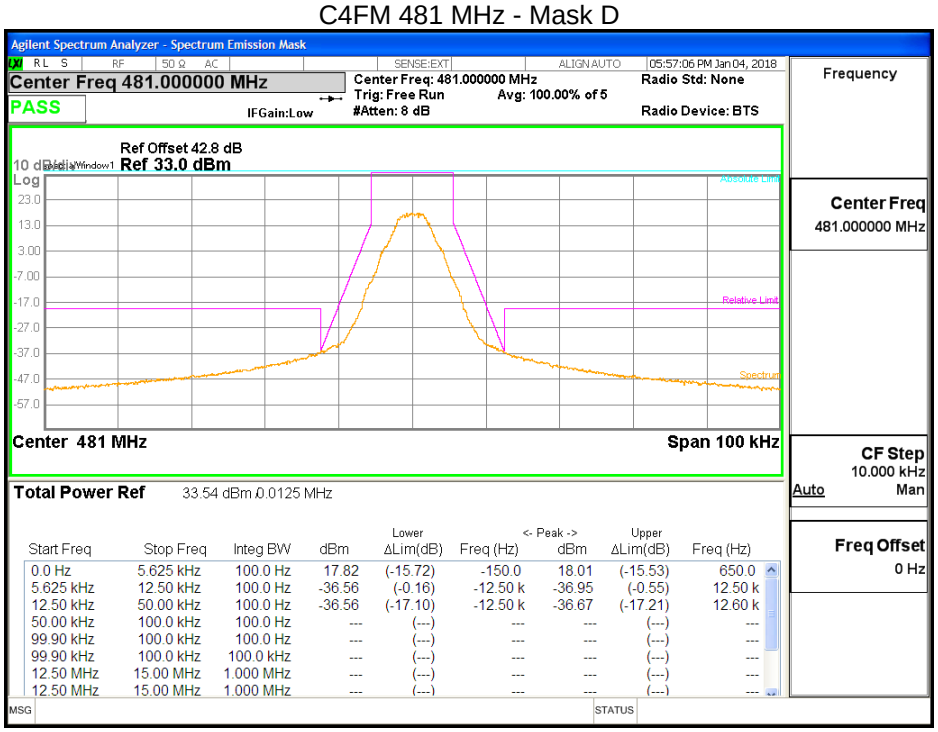
CQPSK 450.025 MHz - Mask E



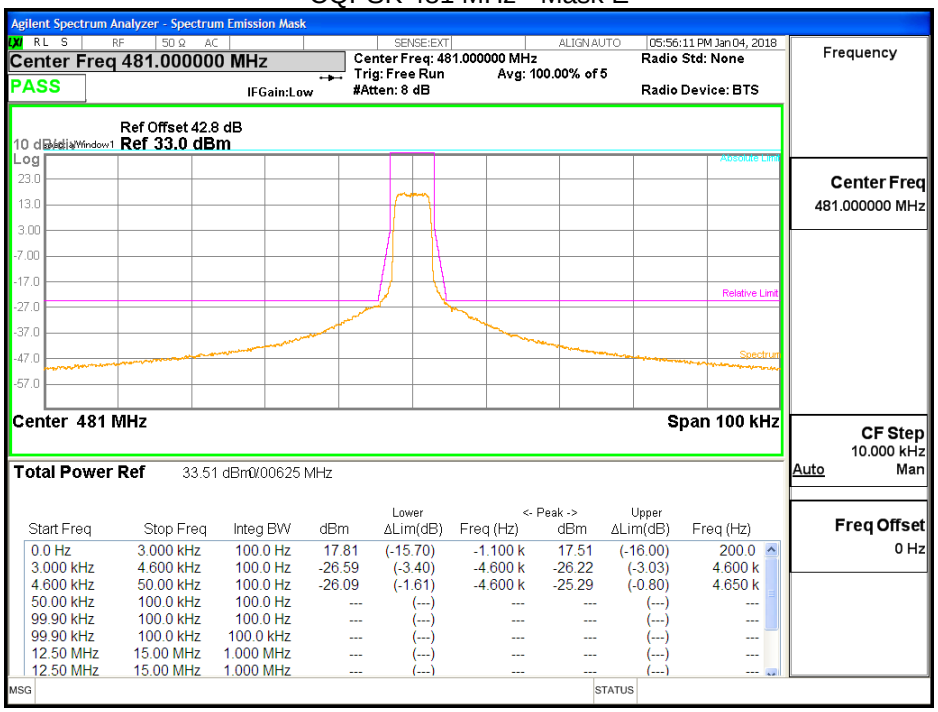
HDQPSK 450.025 MHz - Mask D



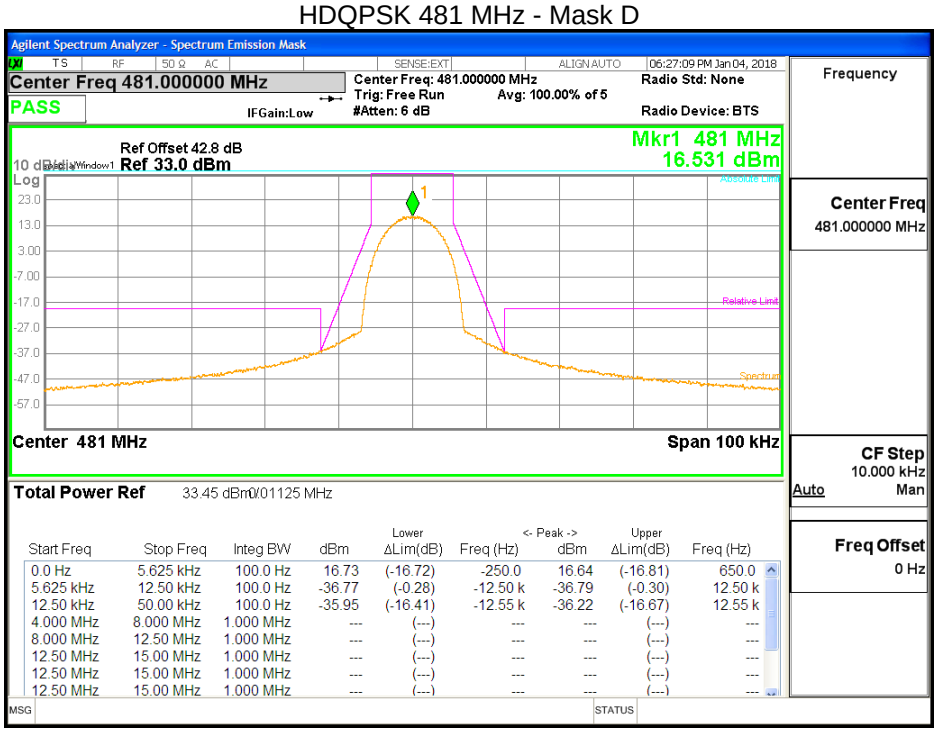
C4FM 481 MHz - Mask D



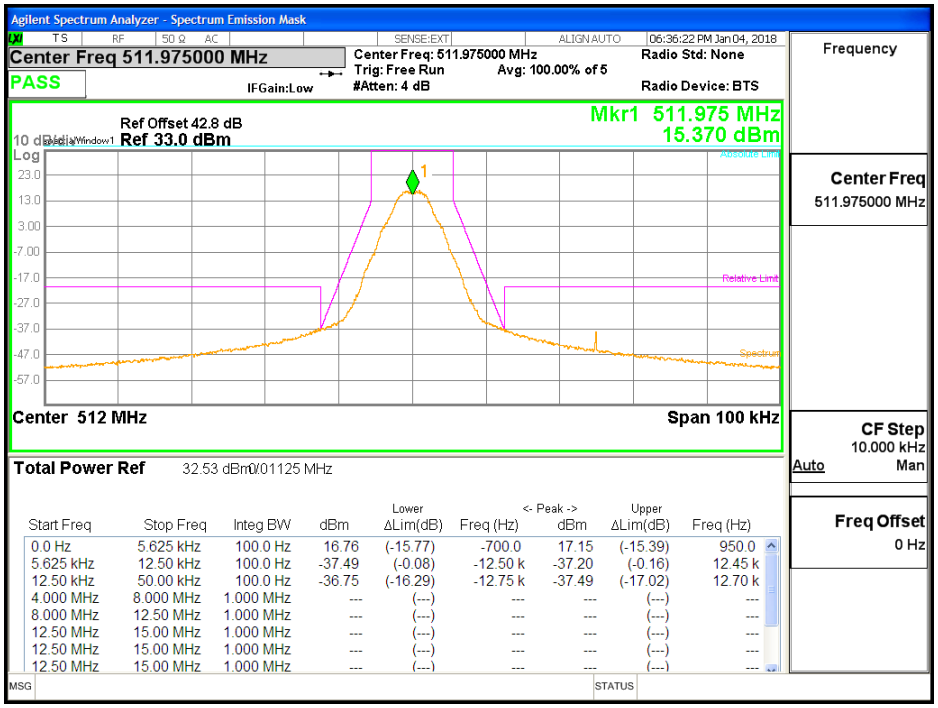
CQPSK 481 MHz - Mask E



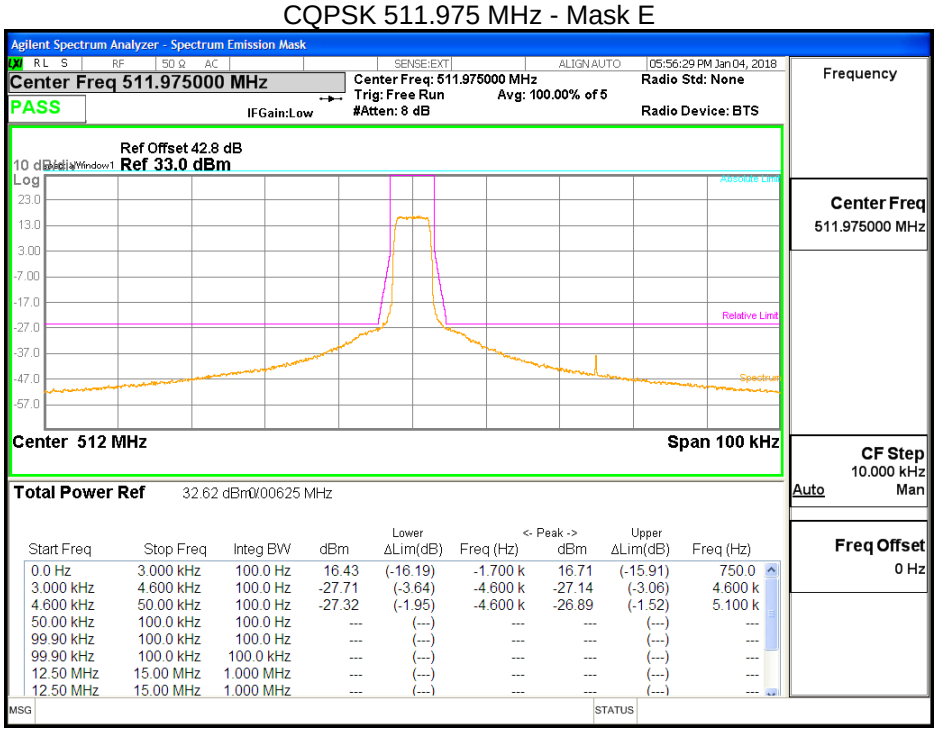
HDQPSK 481 MHz - Mask D



C4FM 511.975 MHz - Mask D

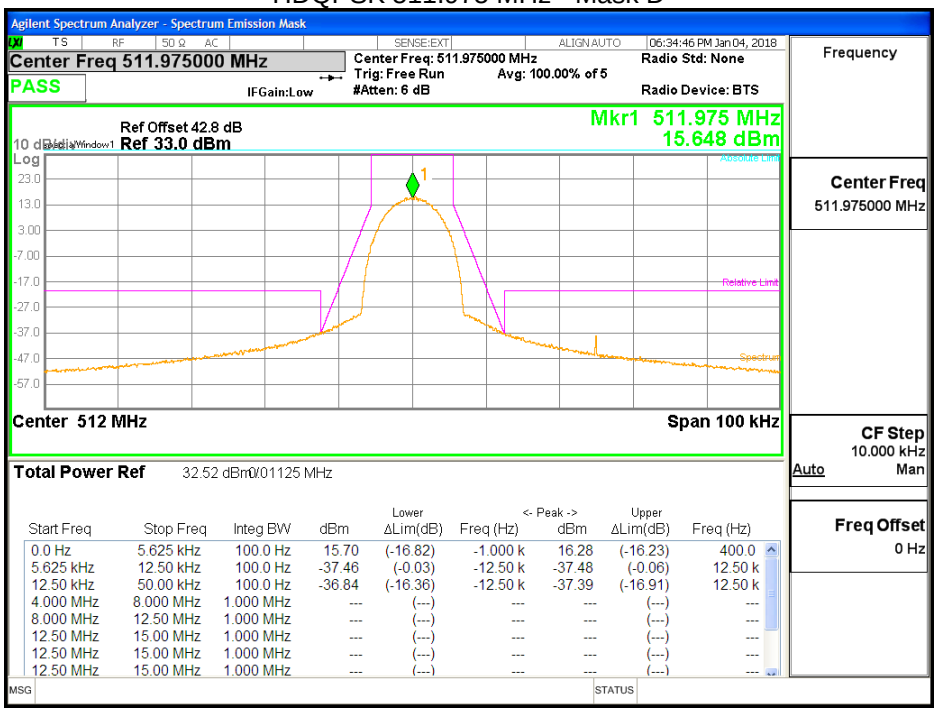


CQPSK 511.975 MHz - Mask E



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	16.43	(-16.19)	-1.700 k	16.71	(-15.91)	750.0
3.000 kHz	4.600 kHz	100.0 Hz	-27.71	(-3.64)	-4.600 k	-27.14	(-3.06)	4.600 k
4.600 kHz	50.00 kHz	100.0 Hz	-27.32	(-1.95)	-4.600 k	-26.89	(-1.52)	5.100 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	---	(---)	---	---	(---)	---

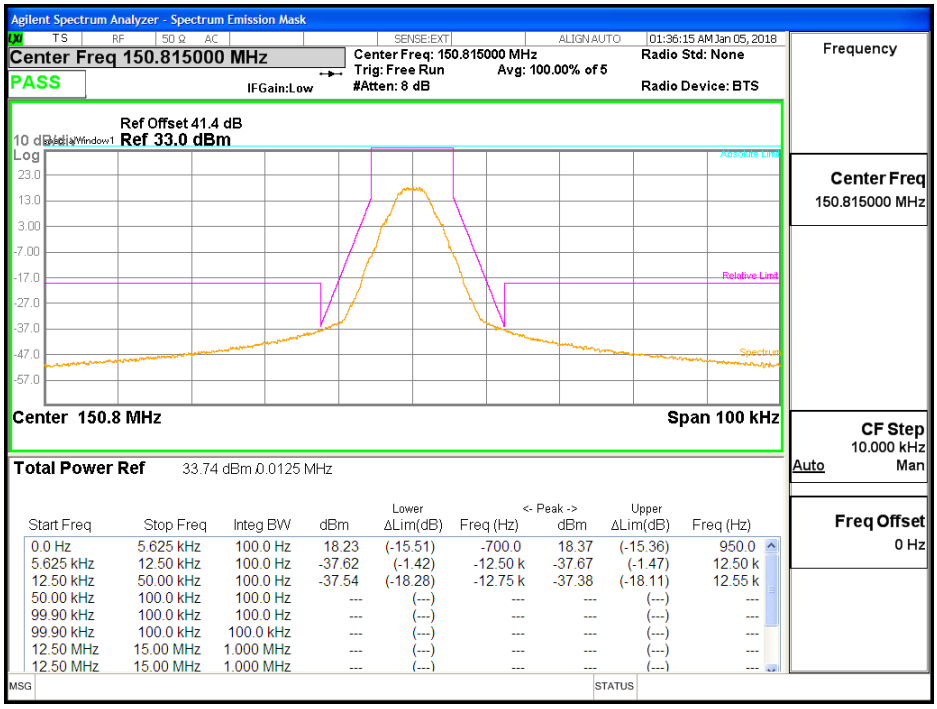
HDQPSK 511.975 MHz - Mask D



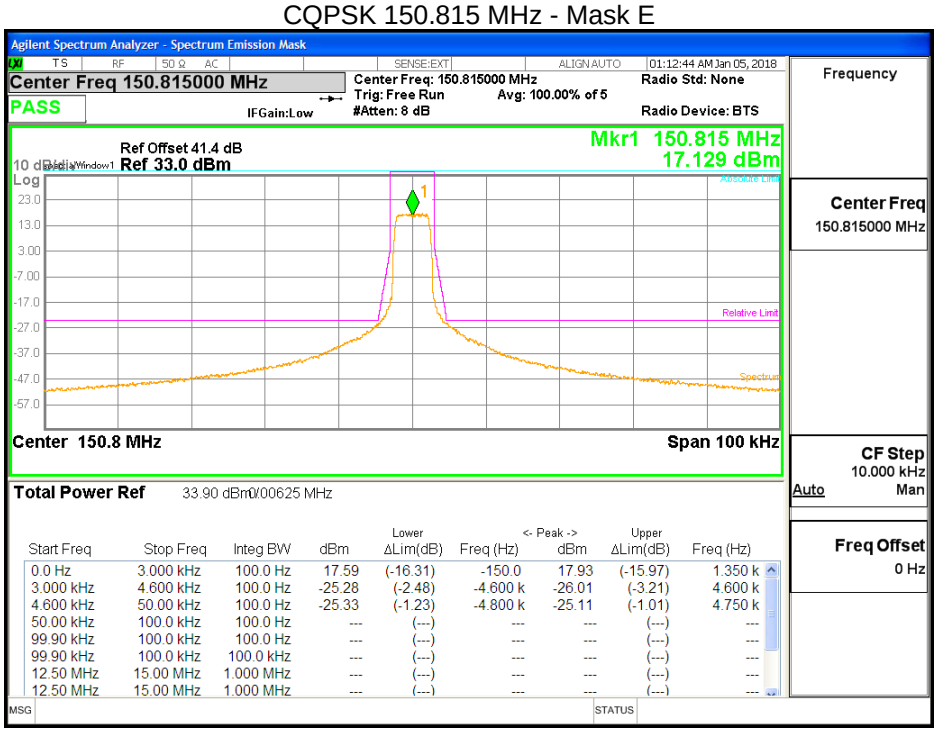
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	15.70	(-16.82)	-1.000 k	16.28	(-16.23)	400.0
5.625 kHz	12.50 kHz	100.0 Hz	-37.46	(-0.03)	-12.50 k	-37.48	(-0.06)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-36.84	(-16.36)	-12.50 k	-37.39	(-16.91)	12.50 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

At Input Power 3 dB above AGC threshold

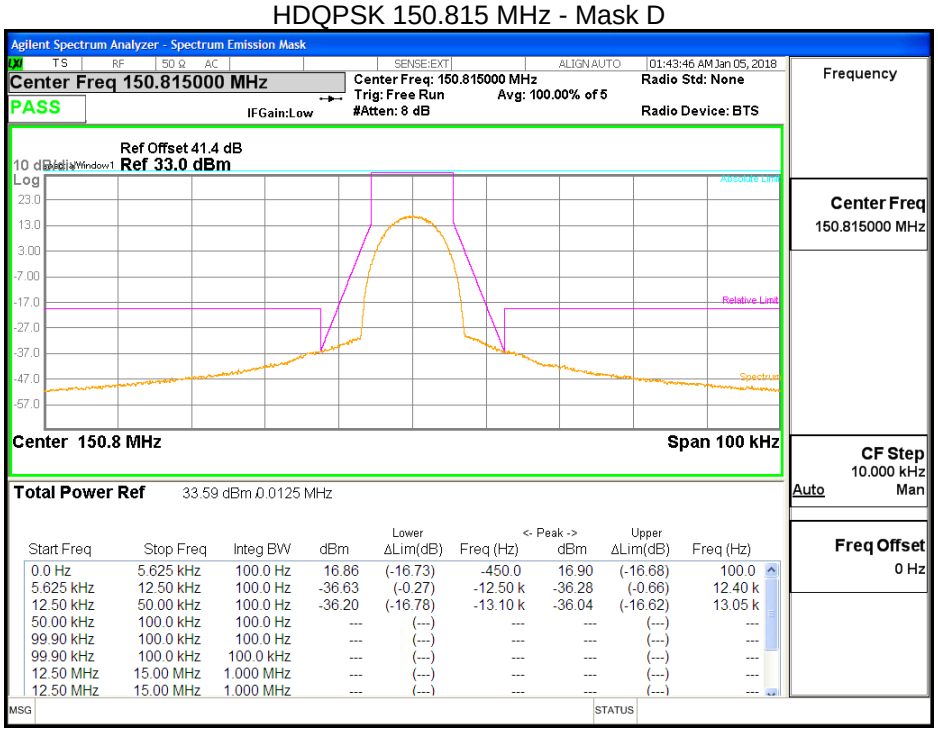
C4FM 150.815 MHz - Mask D



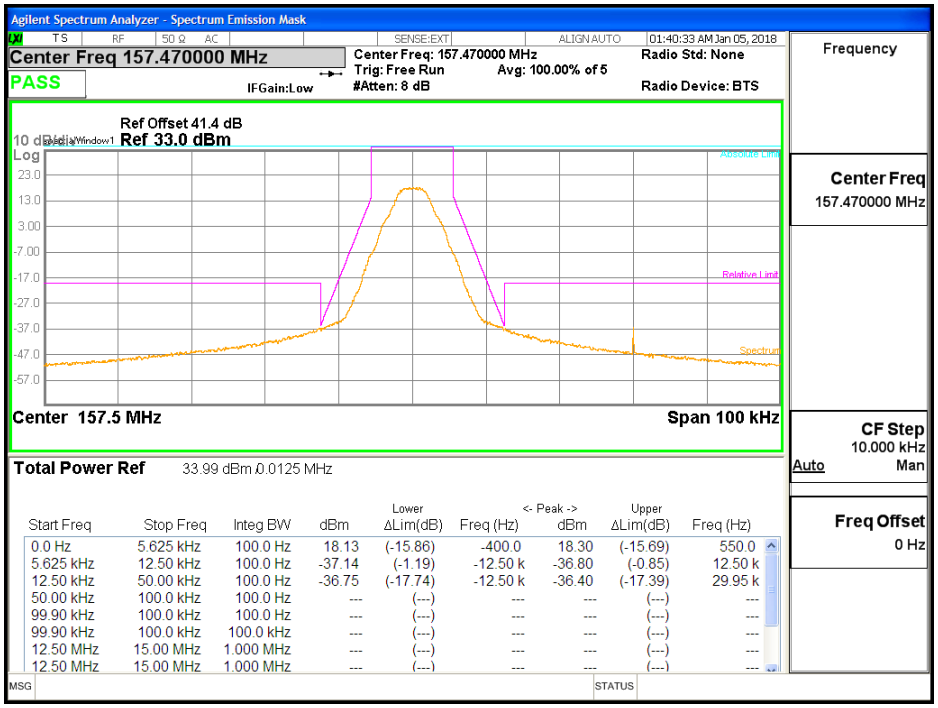
CQPSK 150.815 MHz - Mask E



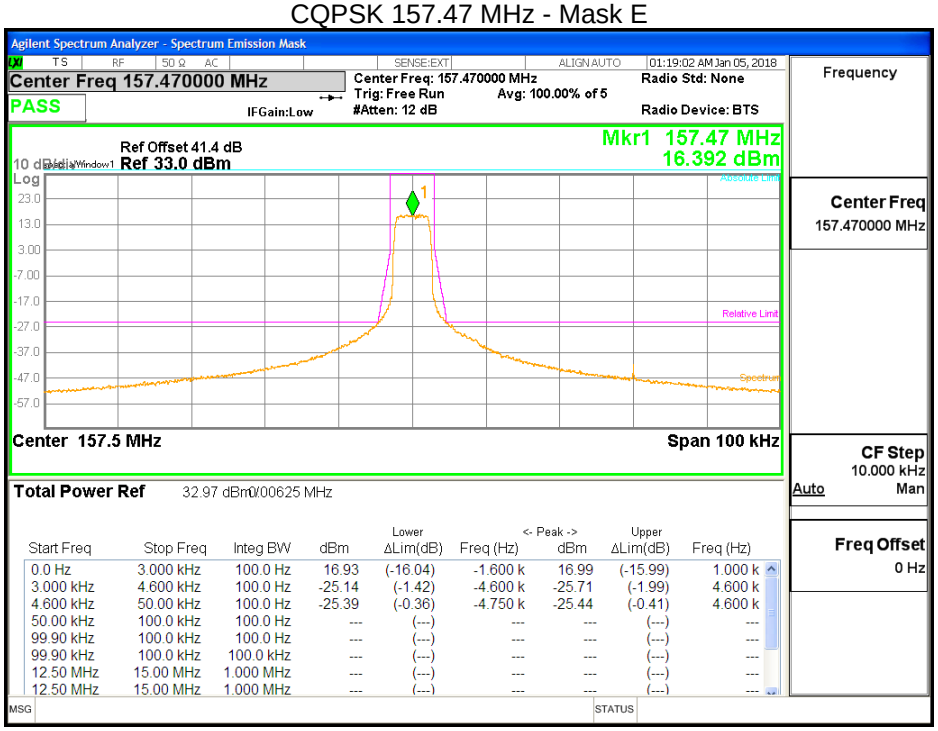
HDQPSK 150.815 MHz - Mask D



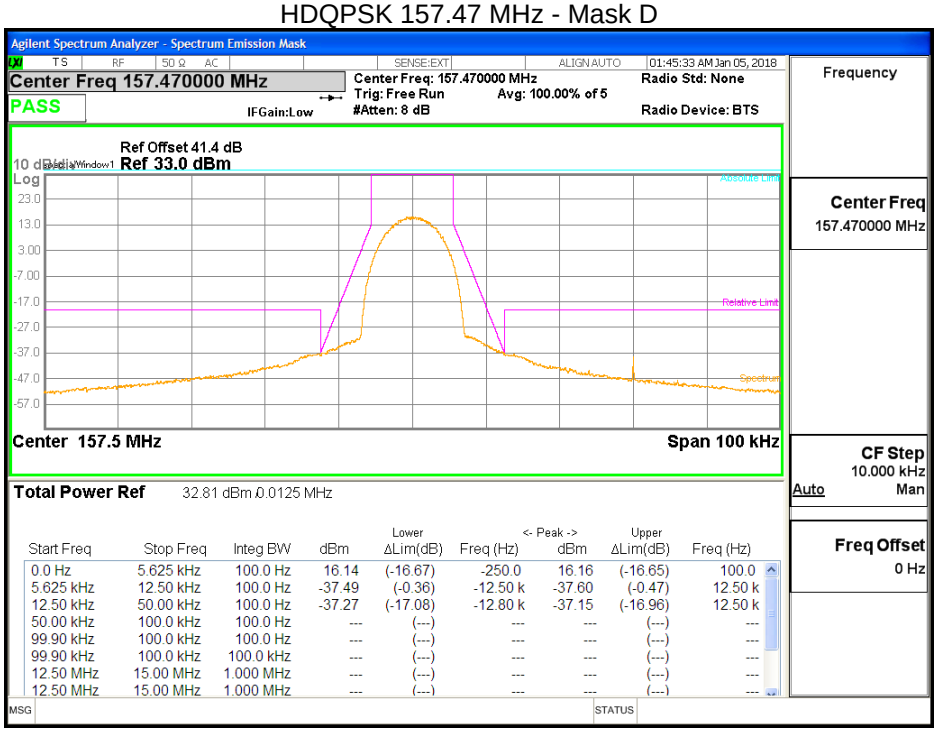
C4FM 157.47 MHz - Mask D



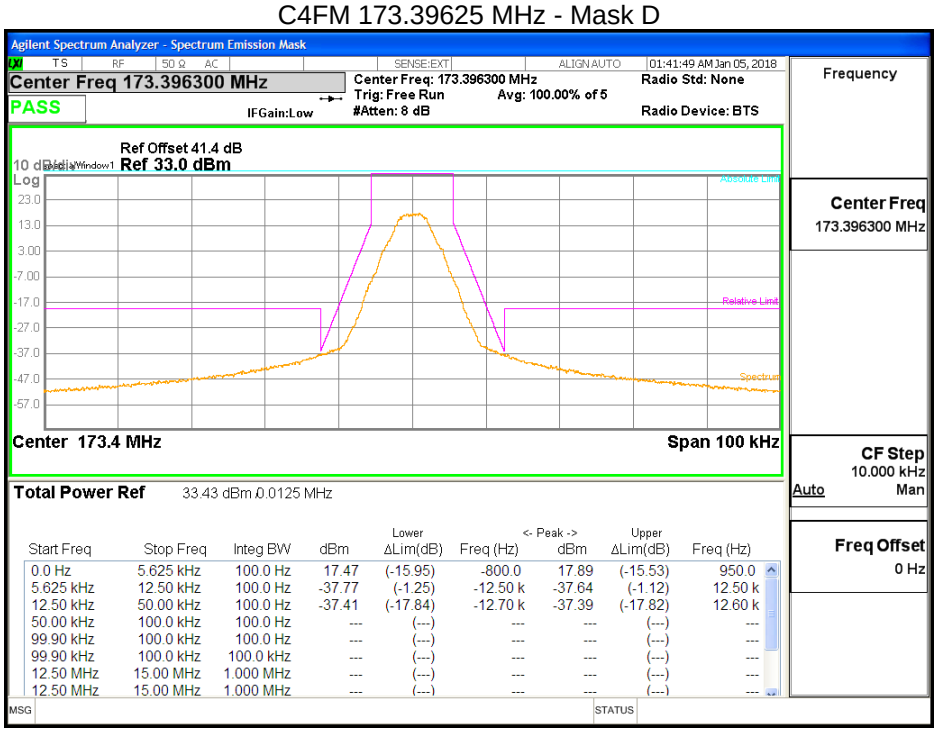
CQPSK 157.47 MHz - Mask E



HDQPSK 157.47 MHz - Mask D

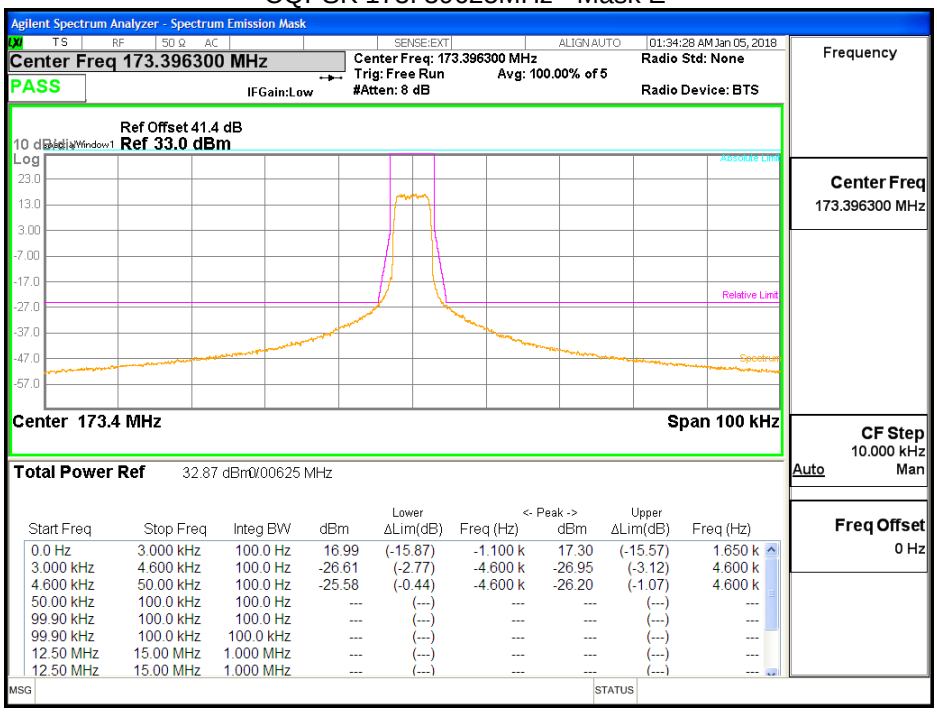


C4FM 173.39625 MHz - Mask D



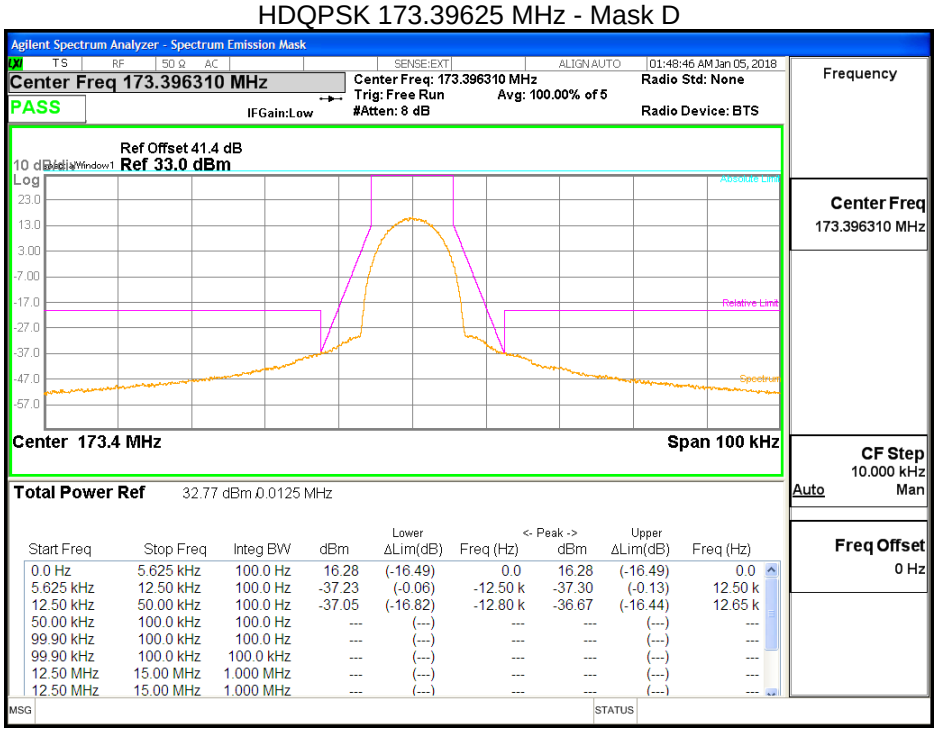
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	17.47	(-15.95)	-800.0	17.89	(-15.53)	950.0
5.625 kHz	12.50 kHz	100.0 Hz	-37.77	(-1.25)	-12.50 k	-37.64	(-1.12)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-37.41	(-17.84)	-12.70 k	-37.39	(-17.82)	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 173. 39625MHz - Mask E

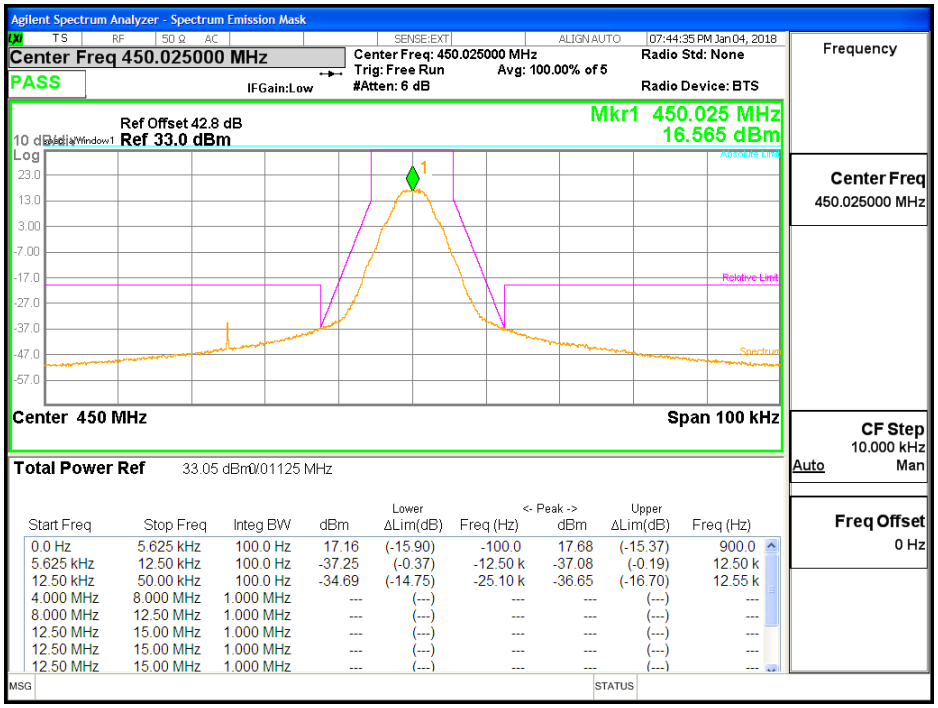


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	3.000 kHz	100.0 Hz	16.99	(-15.87)	-1.100 k	17.30	(-15.57)	1.650 k
3.000 kHz	4.600 kHz	100.0 Hz	-26.61	(-2.77)	-4.600 k	-26.95	(-3.12)	4.600 k
4.600 kHz	50.00 kHz	100.0 Hz	-25.58	(-0.44)	-4.600 k	-26.20	(-1.07)	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	---	(---)	---	---	(---)	---

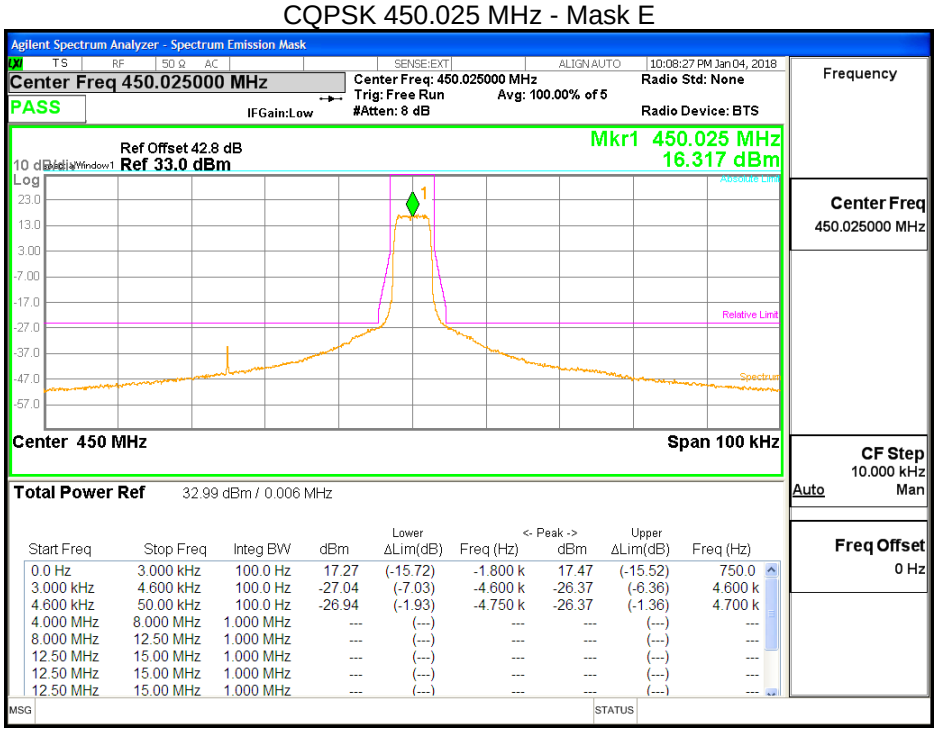
HDQPSK 173.39625 MHz - Mask D



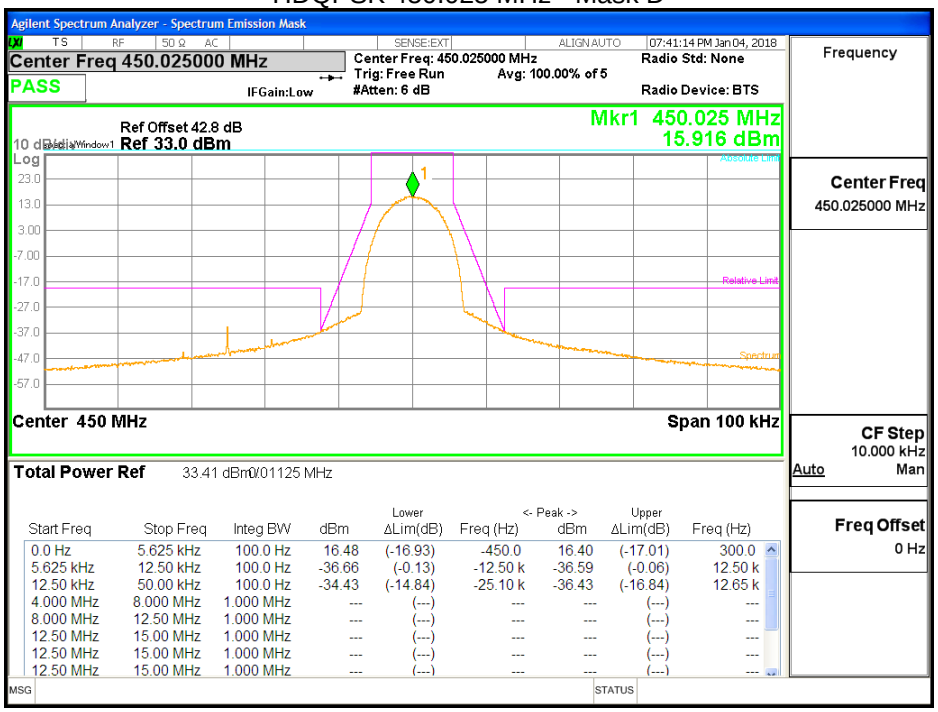
C4FM 450.025 MHz - Mask D



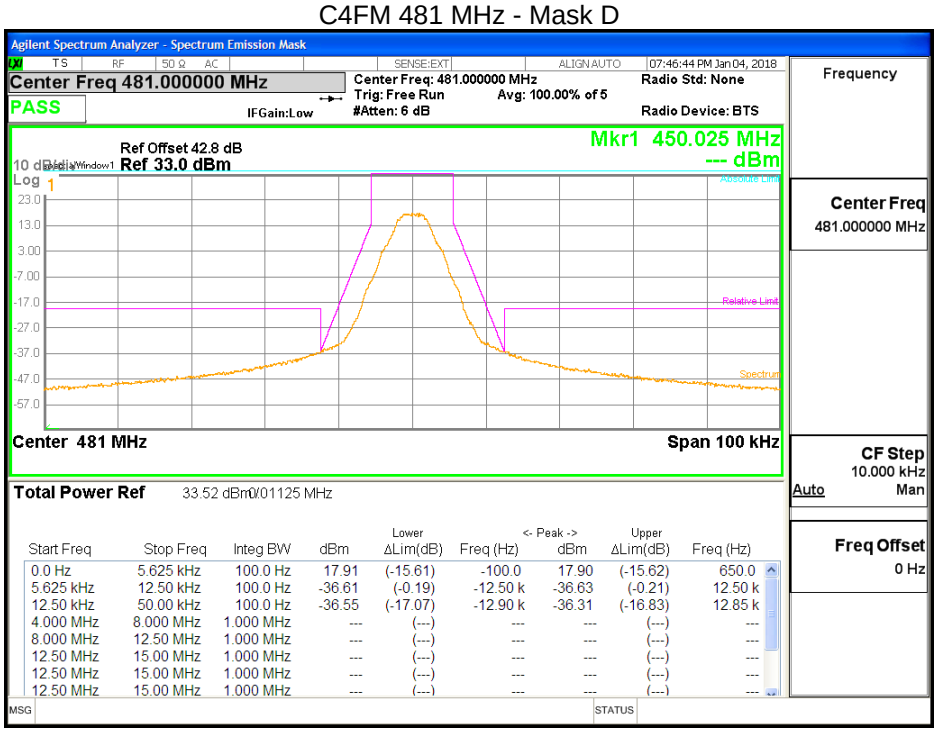
CQPSK 450.025 MHz - Mask E



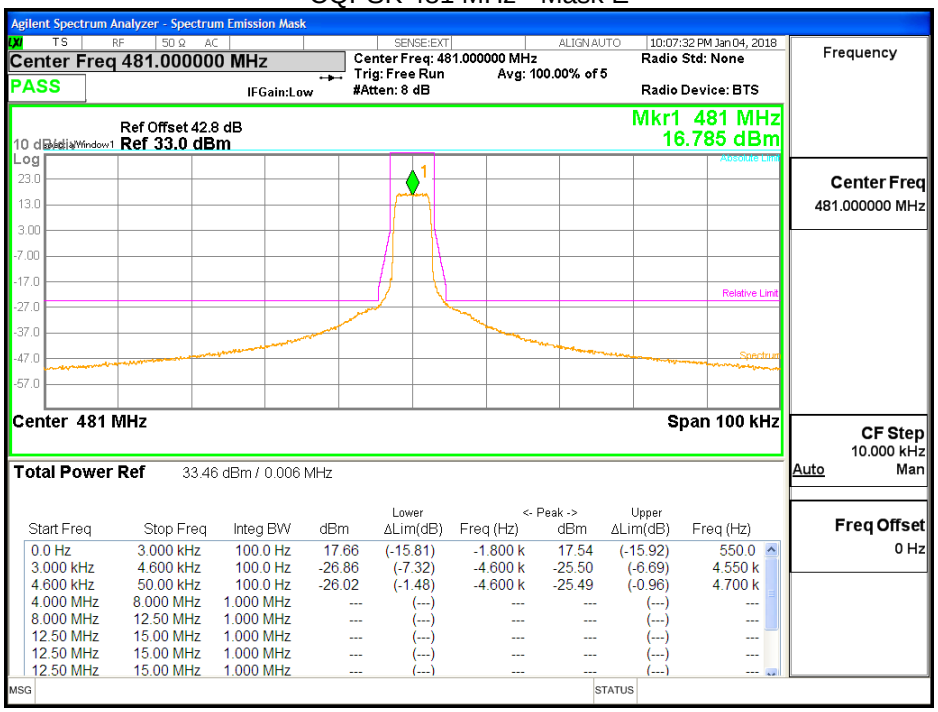
HDQPSK 450.025 MHz - Mask D



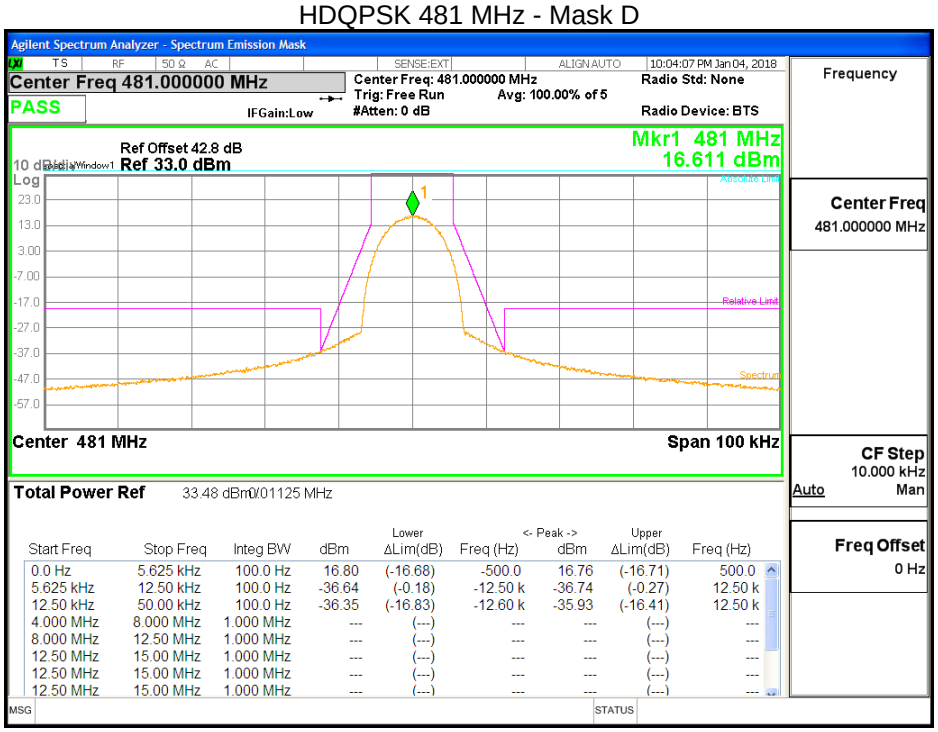
C4FM 481 MHz - Mask D



CQPSK 481 MHz - Mask E

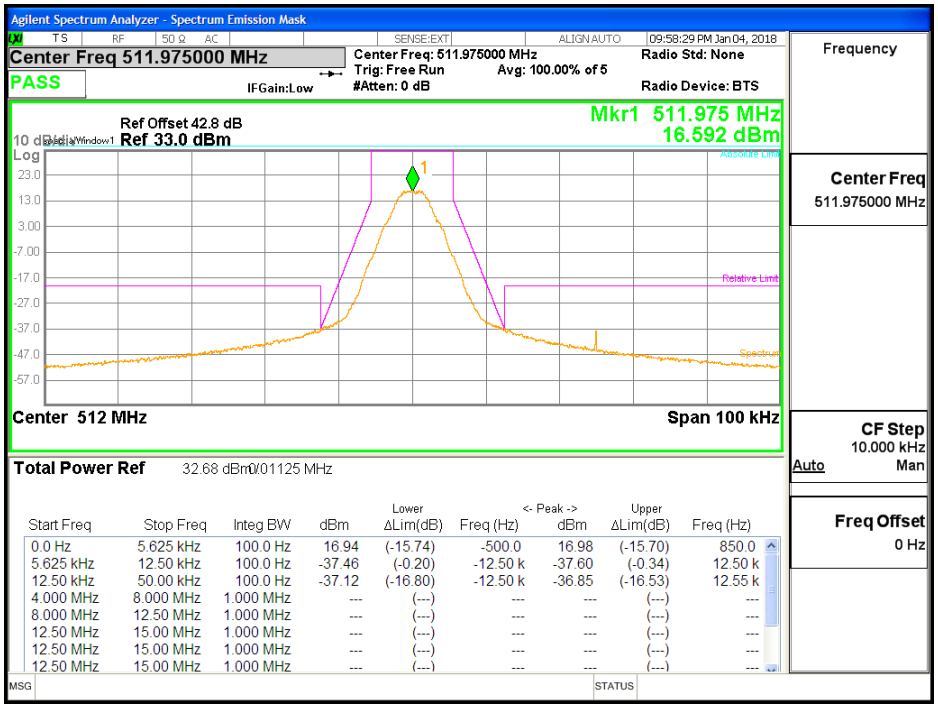


HDQPSK 481 MHz - Mask D



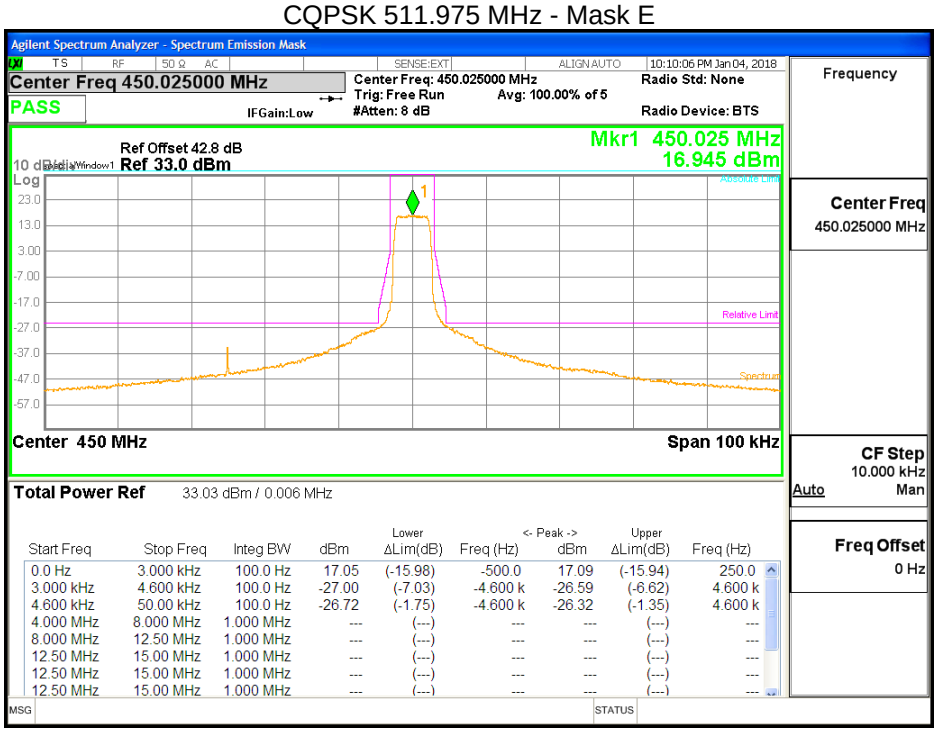
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	16.80	(-16.68)	-500.0	16.76	(-16.71)	500.0
5.625 kHz	12.50 kHz	100.0 Hz	-36.64	(-0.18)	-12.50 k	-36.74	(-0.27)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-36.35	(-16.83)	-12.60 k	-35.93	(-16.41)	12.50 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

C4FM 511.975 MHz - Mask D



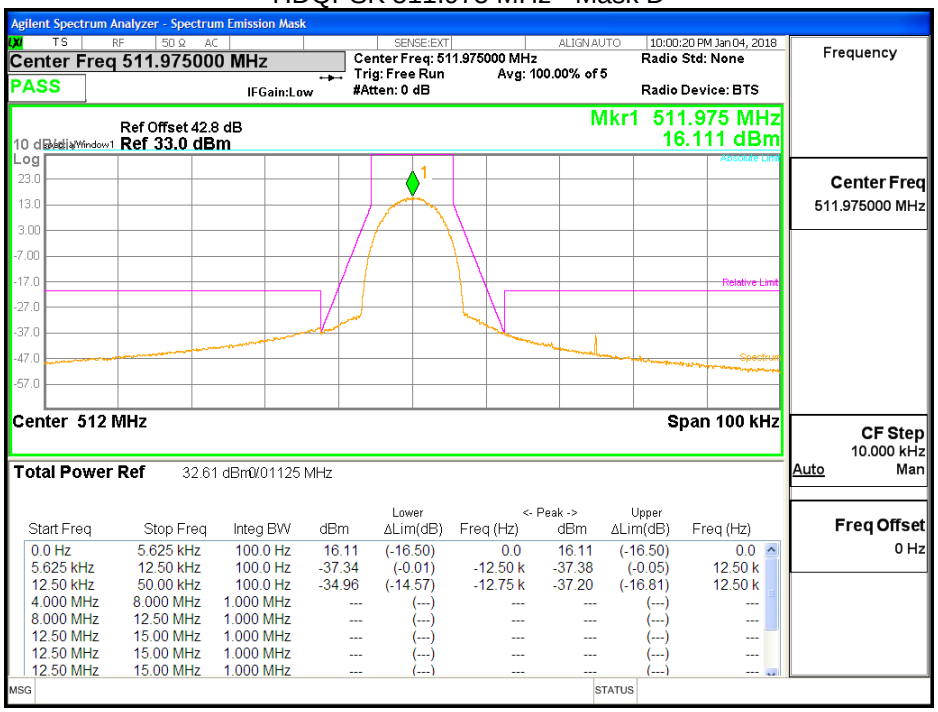
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	5.625 kHz	100.0 Hz	16.94	(-15.74)	-500.0	16.98	(-15.70)	850.0
5.625 kHz	12.50 kHz	100.0 Hz	-37.46	(-0.20)	-12.50 k	-37.60	(-0.34)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-37.12	(-16.80)	-12.50 k	-36.85	(-16.53)	12.55 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

CQPSK 511.975 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	17.05	(-15.98)	-500.0	17.09	(-15.94)	250.0
3.000 kHz	4.600 kHz	100.0 Hz	-27.00	(-7.03)	-4.600 k	-26.59	(-6.62)	4.600 k
4.600 kHz	50.00 kHz	100.0 Hz	-26.72	(-1.75)	-4.600 k	-26.32	(-1.35)	4.600 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

HDQPSK 511.975 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	16.11	(-16.50)	0.0	16.11	(-16.50)	0.0
5.625 kHz	12.50 kHz	100.0 Hz	-37.34	(-0.01)	-12.50 k	-37.38	(-0.05)	12.50 k
12.50 kHz	50.00 kHz	100.0 Hz	-34.96	(-14.57)	-12.75 k	-37.20	(-16.81)	12.50 k
4.000 MHz	8.000 MHz	1.000 MHz	---	(---)	---	---	(---)	---
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Frequency Stability

The hdHost and hd30 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 RSS-131 Sec 6.1	Room Temperature (°C)	24
Test Procedure	ANSI/TIA-603- E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October, 2017 RSS-131 Sec 4.2	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Sophie Piao/Jeremy Lee	Date	Jan 04, 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
40dB Attenuator	Aeroflex Winschel	58-40-43	n/p	CVP	CVP

Note) CVP = Calibration Verification Performed internally, n/p = not provided.

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

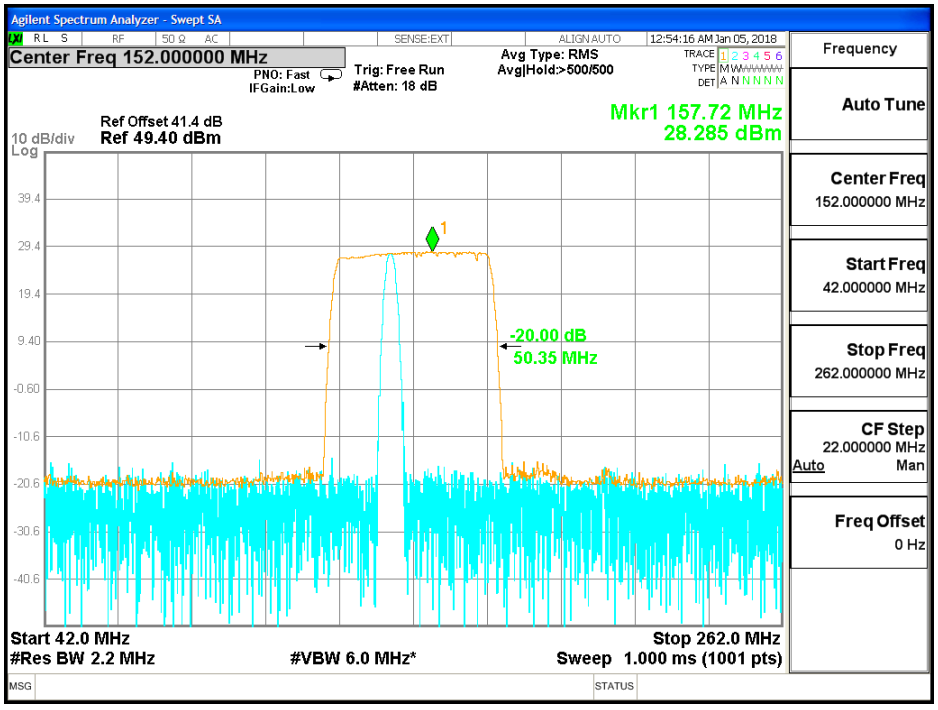
Compliant ☒ Non-Compliant ☐ Not Applicable ☐

Test setup

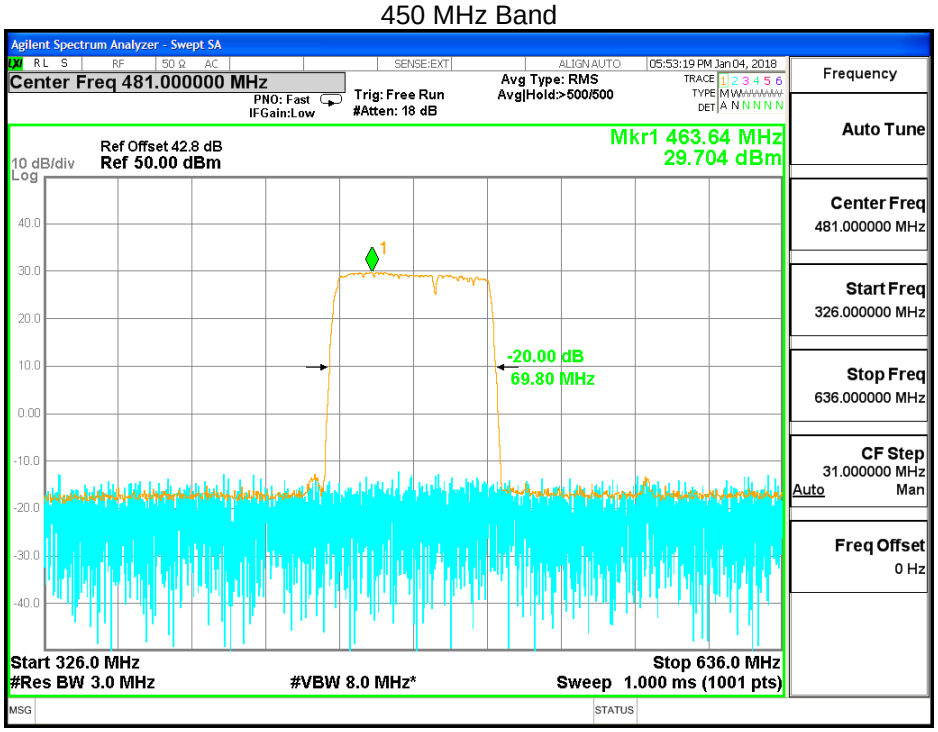
Description of test set-up:
The procedure used was ANSI/TIA-603-E-2016 and FCC KDB 935210 D05 Indus Booster Basic Meas v01r02. The signal booster was set to maximum gain. A swept CW signal was set to the range of ±250 % of the product pass band. The CW ampltitude was set to 3 dB below the AGC threshold 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

150 MHz Band



450 MHz 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	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Sophie Piao/Jeremy Lee	Date	Jan 04, 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
40dB Attenuator	Aeroflex Winschel	58-40-43	n/p	CVP	CVP

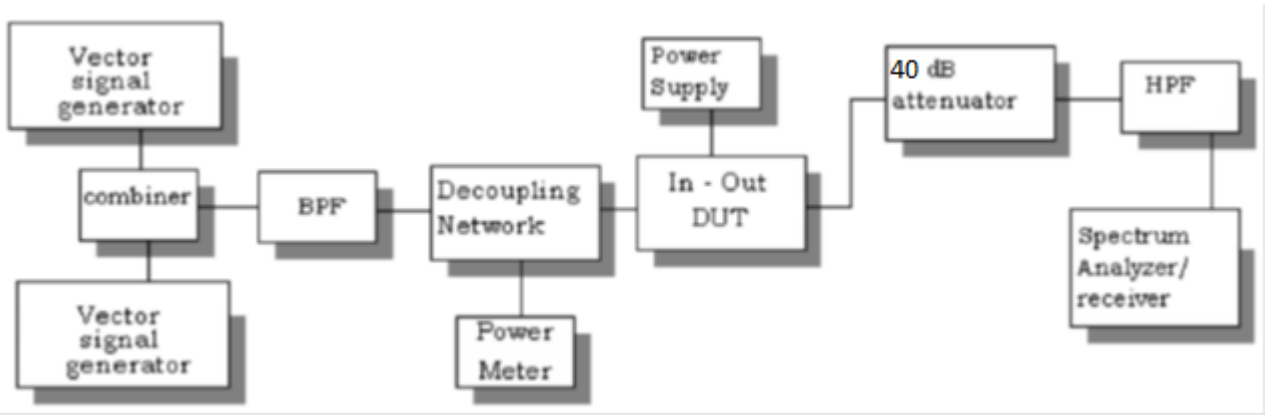
Note) CVP = Calibration Verification Performed internally, n/p = not provided.

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

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

Compliant ☒ Non-Compliant ☐ Not Applicable ☐

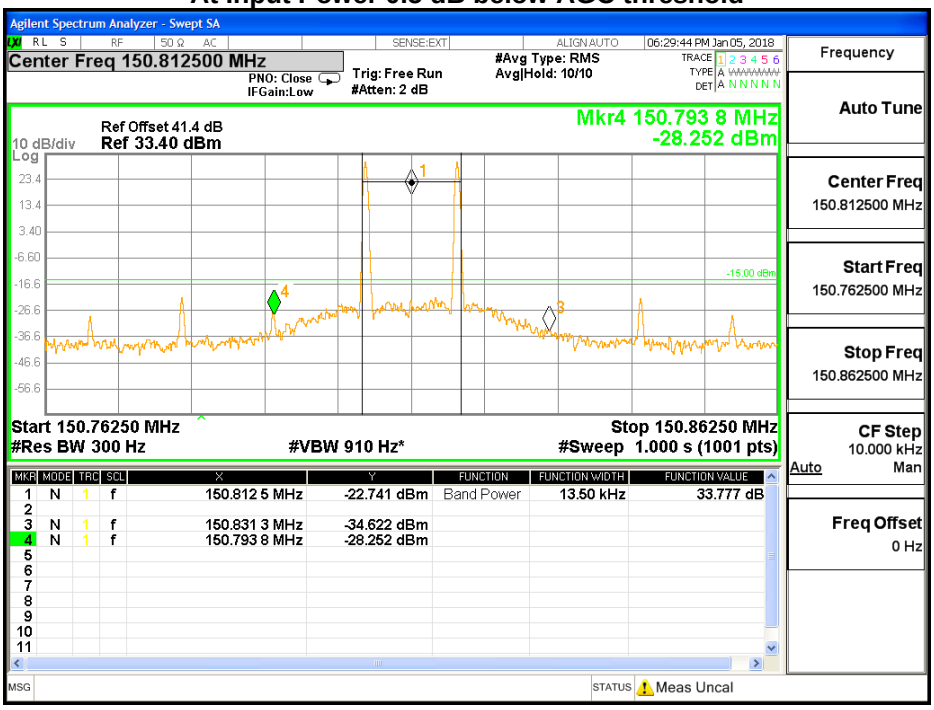
Test setup

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 in 150 MHz band and 450 MHz band. 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.**


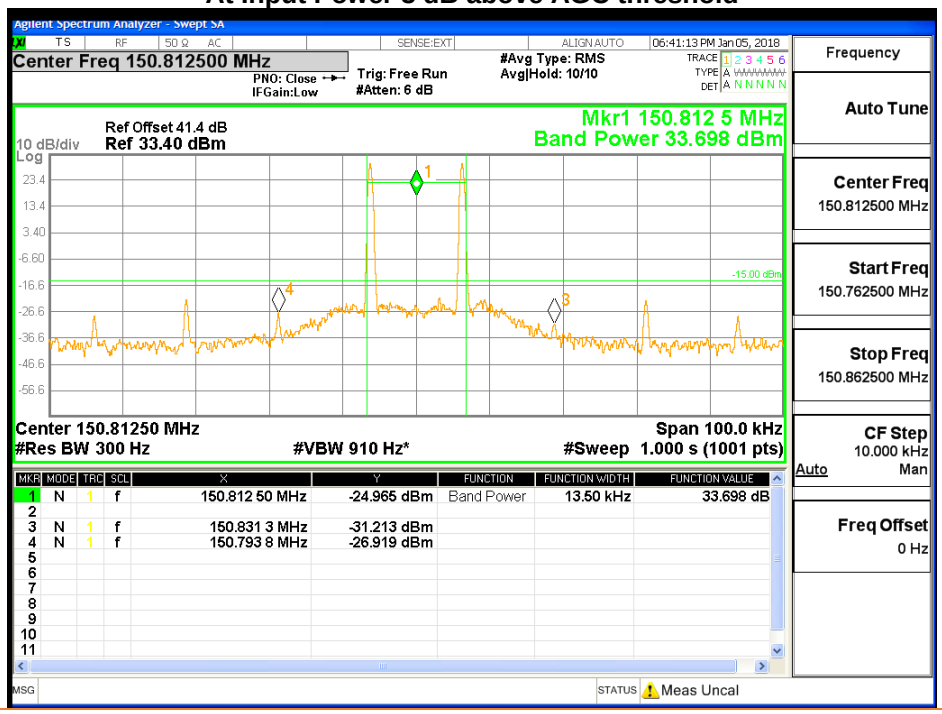
Results

On the maximum gain channel 150.8125 MHz:

At Input Power 0.5 dB below AGC threshold

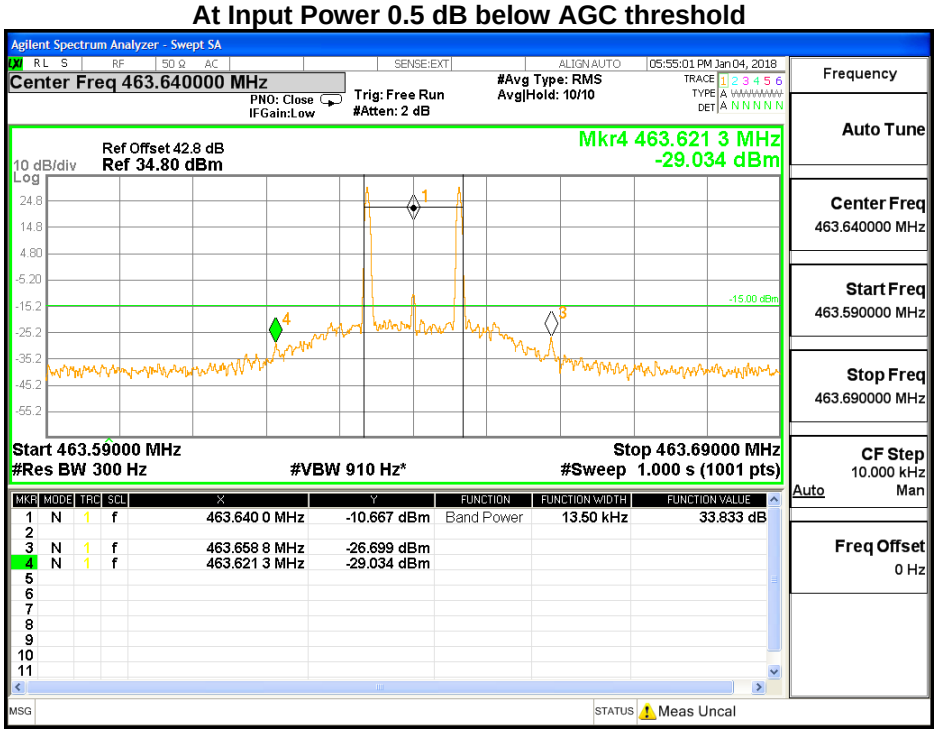


At Input Power 3 dB above AGC threshold

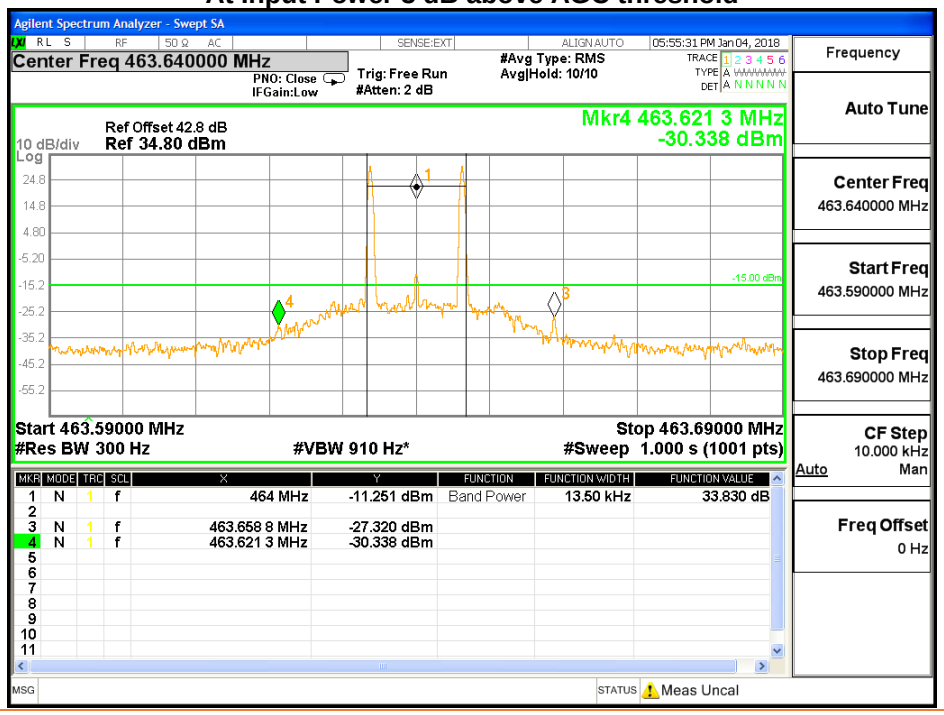


On the maximum gain channel 463.64 MHz:

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)	24
Test Procedure	ANSI/TIA-603-E-2016; FCC KDB 935210 D05 Indus Booster Basic Meas v01r02: October 27, 2017	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Sophie Piao/Jeremy Lee	Date	Jan 04, 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
40dB Attenuator	Aeroflex Winschel	58-40-43	n/p	CVP	CVP

Note) CVP = Calibration Verification Performed internally, n/p = not provided.

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

Maximum booster gain is 44 dB.

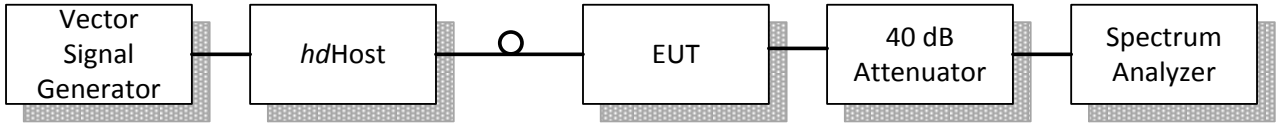
Compliant ☒ Non-Compliant ☐ Not Applicable ☐

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

	150 band	450 band
DL Gain	43.9 dB	44 dB

Noise Figure

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 27, 2017	Relative Humidity (%)	33.9
Test Location	Burnaby	Barometric Pressure (kPa)	101.3
Test Engineer	Sophie Piao/Jeremy Lee	Date	Jan 04, 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

Note) CNR = Calibration not required when used with other calibrated equipment.

Frequency Range:	☒ 100 MHz centered at the center frequency 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.

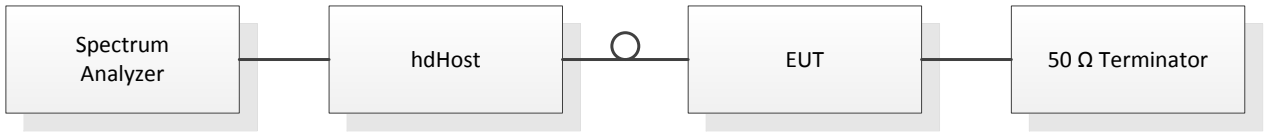
The noise figure is then calculated by NF = NP – Gain + KTB Noise; where

NP is in band noise power per Herz,

Gain is in band booster gain, which is 55 dB in UL.

KTB Noise is 174dB/Hz at room temperature.

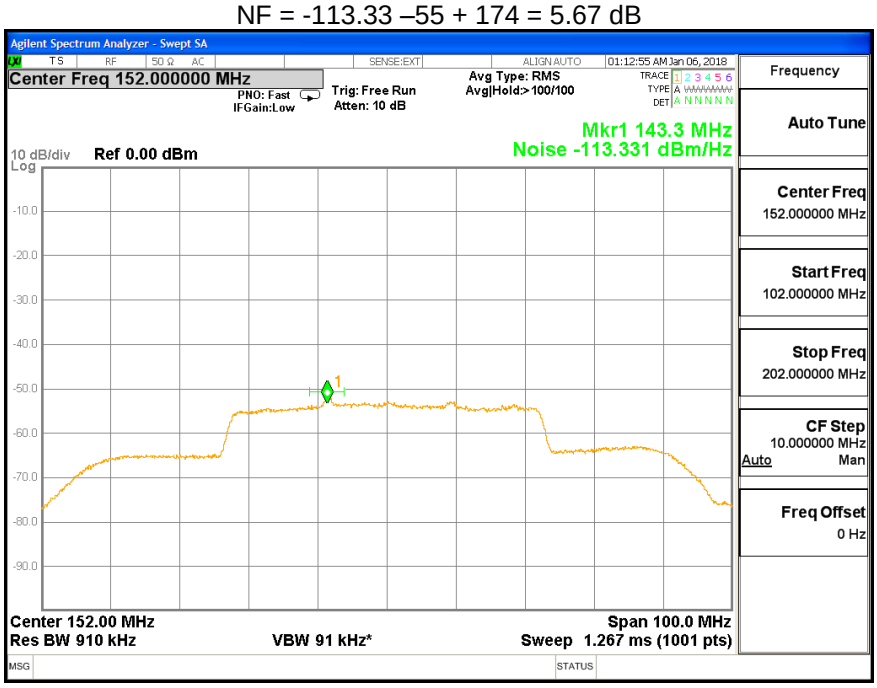
The EUT was set to **Operation Mode #1 with configuration Mode #1.**



Results

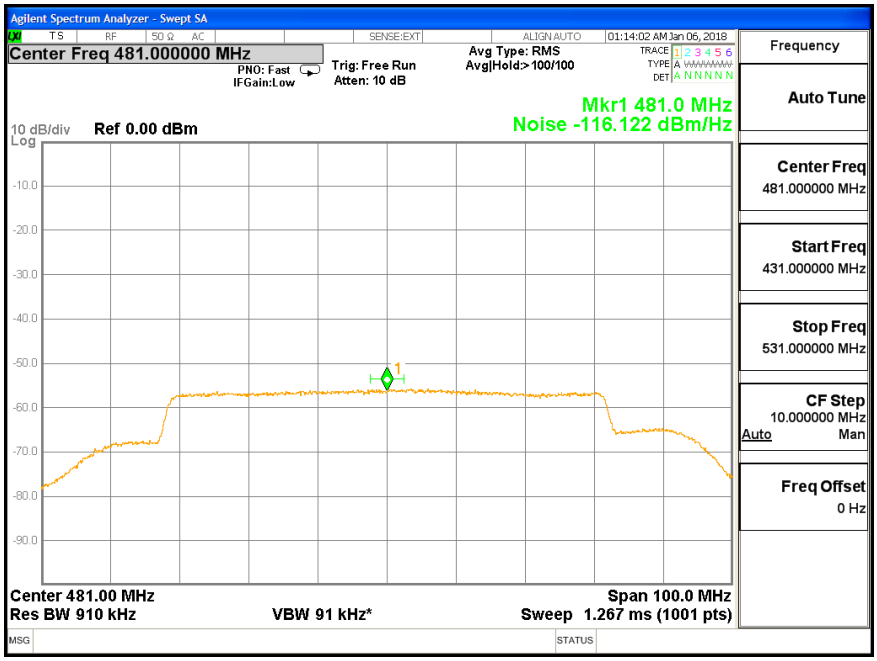
150MHz band

NF = -113.33 –55 + 174 = 5.67 dB



450MHz band

NF = -115.12 -55 + 174 = 3.88 dB



Radiated Emissions - Enclosure

Governing Doc	FCC Part 2.1053, FCC Part 90.210 & FCC Part 90.219	Room Temperature (°C)	23.5
Test Procedure	ANSI TIA-603-D	Relative Humidity (%)	46.0
Test Location	Richmond	Barometric Pressure (kPa)	100.9
Test Engineer	David Johanson	Date	22 Nov. 2017
EUT Voltage	☒ DC	☐ 120VAC @ 60Hz	

Test Equipment Used	Manufacturer	Model	Identifier	Calibration date	Calibration
Spectrum Analyzer	KeySight	N9038A	702	18-Apr-2017	18-Apr-2018
Broadband Antenna	Sunol	JB1	371	29-Mar-2016	29-Mar-2018
Loop Antenna	ComPower	AL-130	241	11-Nov-2017	11-Nov-2019
Horn Antenna	A.H Systems	SAS-571	227C	22-Sep-2016	22-Sep-2018
RF Preamplifier	Agilent	8449B	273	NCR	NCR
EMC Shielded Enclosure	USC	USC-26	374	NCR[1]	NCR[1]

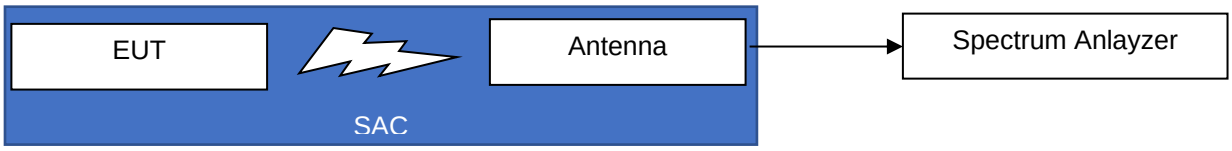
Note1) NCR = No Calibration Required, but NSA was done at 2016.

Frequency Range:	☒ 9kHz-30MHz	☒ 30-1000MHz	☒ 1-5GHz
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

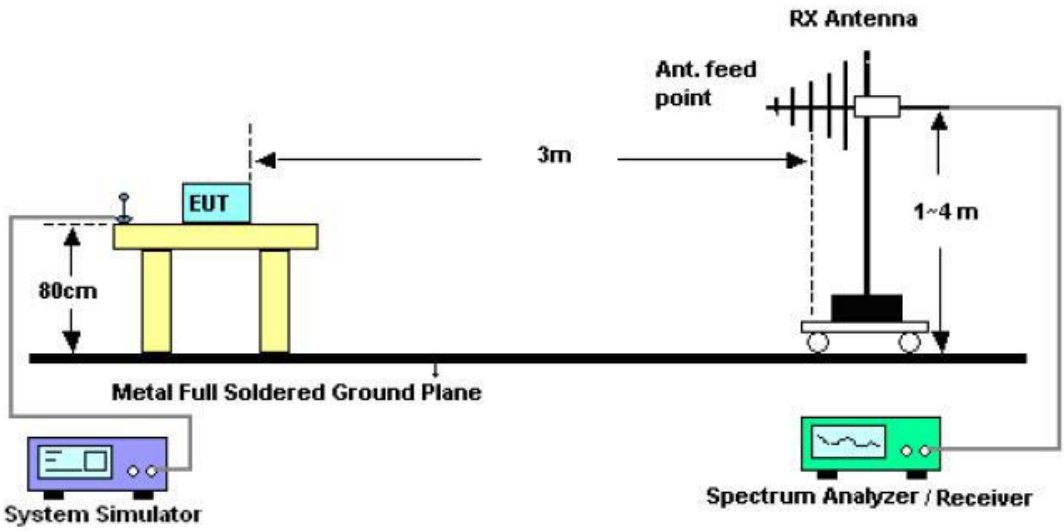
Compliant ☒ Non-Compliant ☐ Not Applicable ☐

Test setup

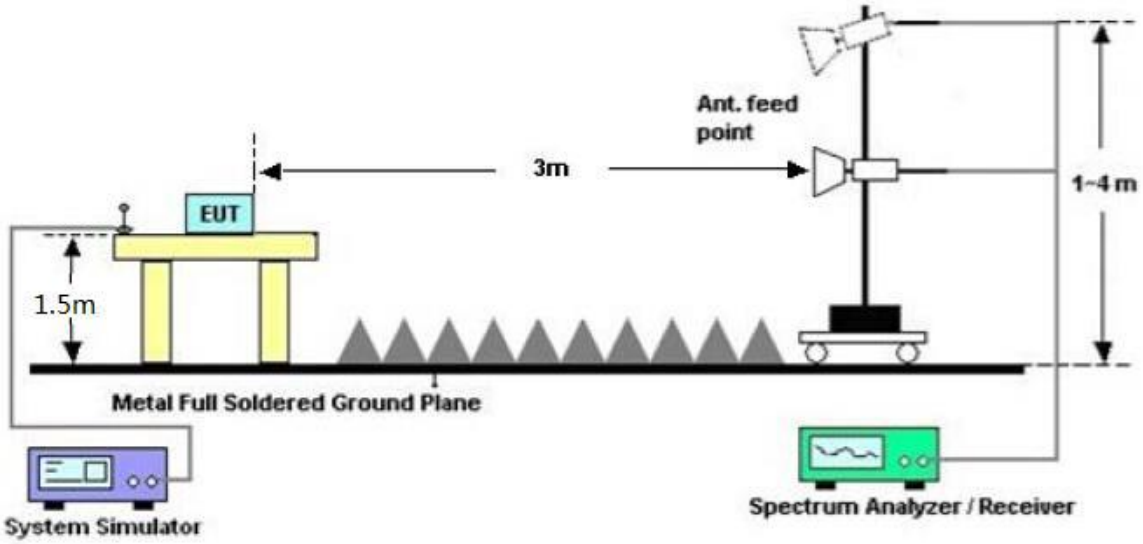
Description of test set-up:
The EUT was placed on a nonconducting platform (i.e., an “EUT support table”), of nominal size 1 m by 1.5 m, whose top surface is nominally 80 cm above the reference ground plane. The EUT was set up on 3 meters away from the EUT. The EUT was set continually on its Radio, 1W Max., which was downlinked from tHOST. 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 18GHz, 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

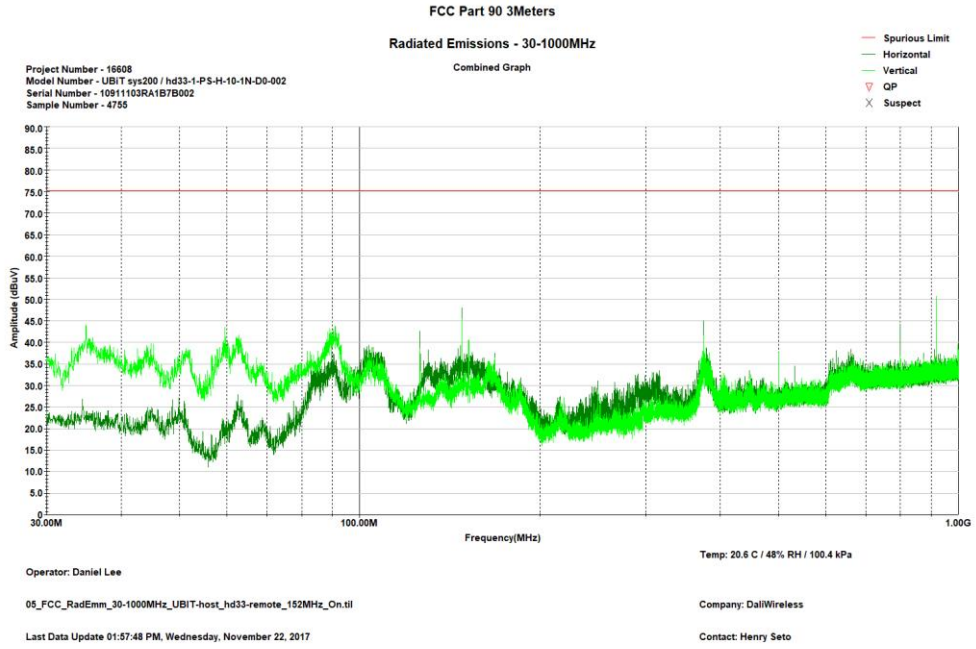
The output of EUT was set to 1 Watt(+30dBm), the PASS level of Spurious is: 43 + 10log(P) = 43 + 10log(1) = 43dB attenuation = -13dBm Since of radiated measurement was performed at 3 meters, the limit line was converted to dBuV/m using the formulas ad outlined in KDB 971168: -13 dBm ERP = 84.38 dBuV/m 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

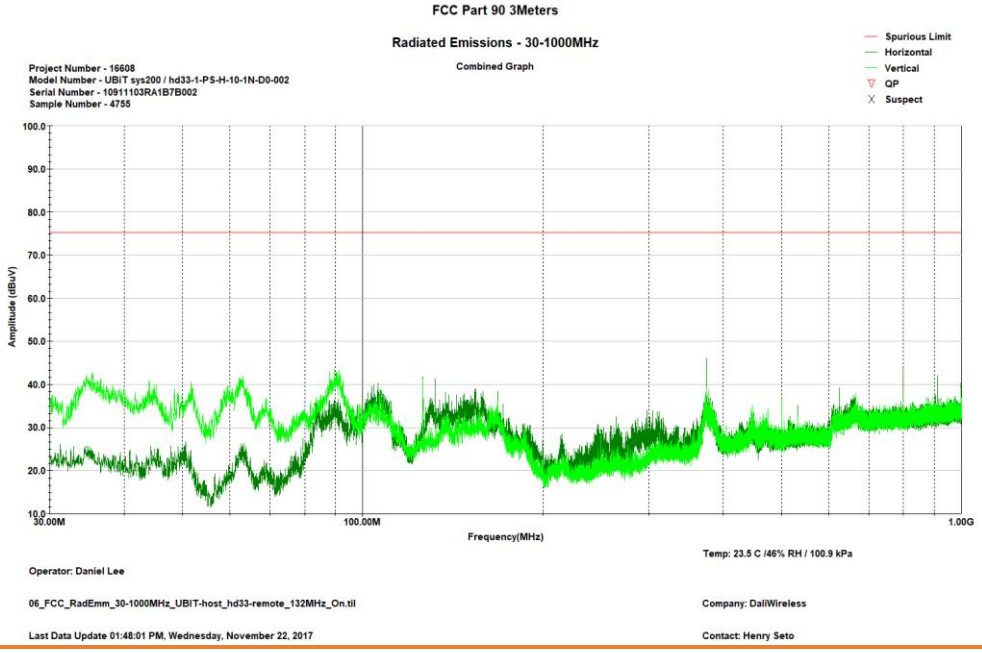
Spectrum was scanned manually from 30kHz to 30MHz. No automated plot is available for this frequency range. No spurious emissions from the product were detectable

Graphical Representation for Emission - Radiated 30MHz to 1GHz

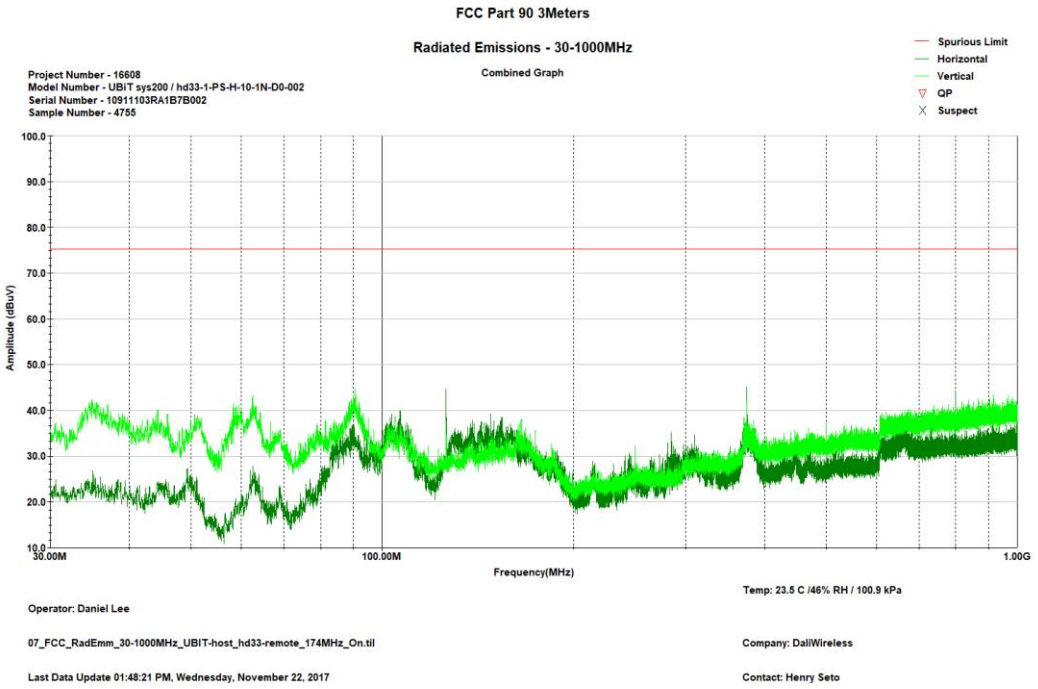
- Transmitter On, 152MHz



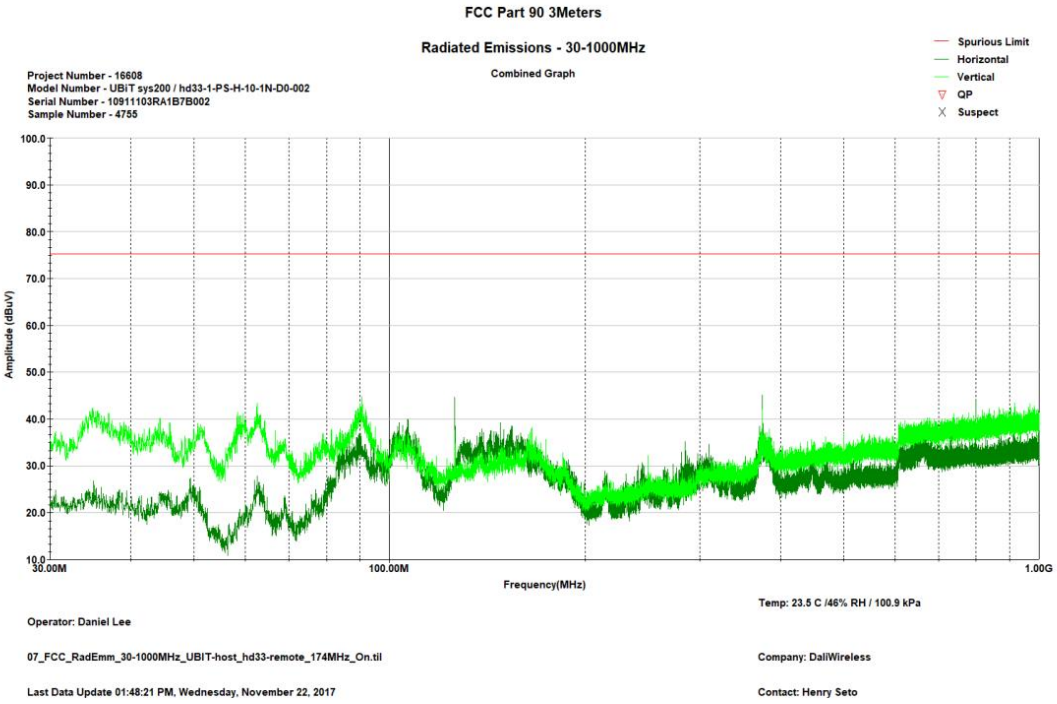
- Transmitter On, 132MHz (low channel of 152MHz Band)



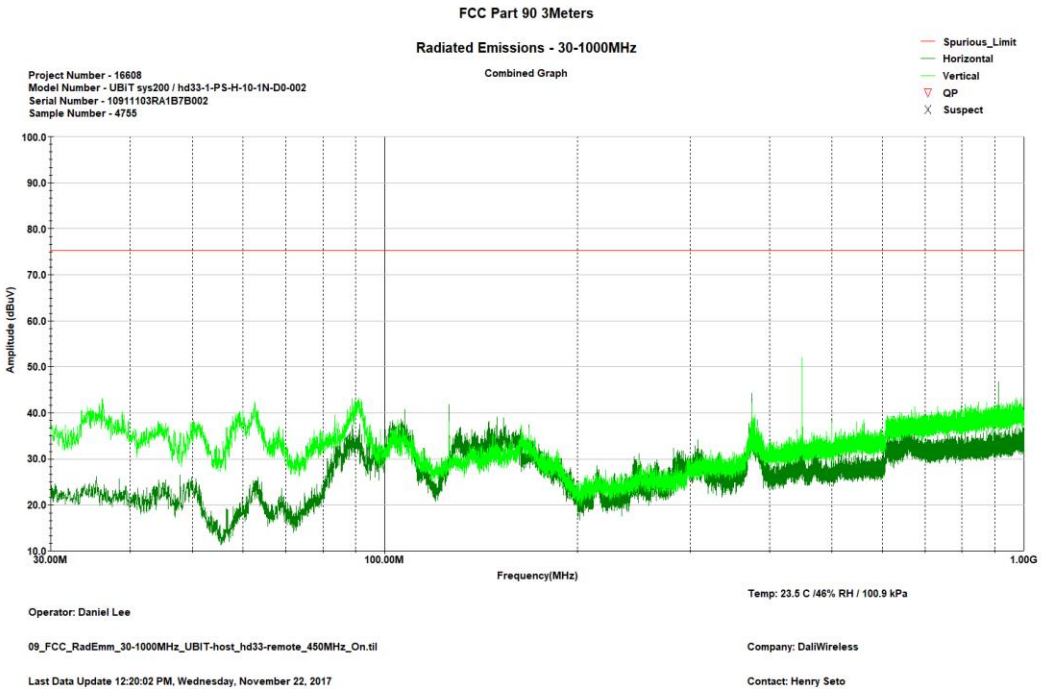
- Transmitter On, 174MHz (High channel of 152MHz Band)



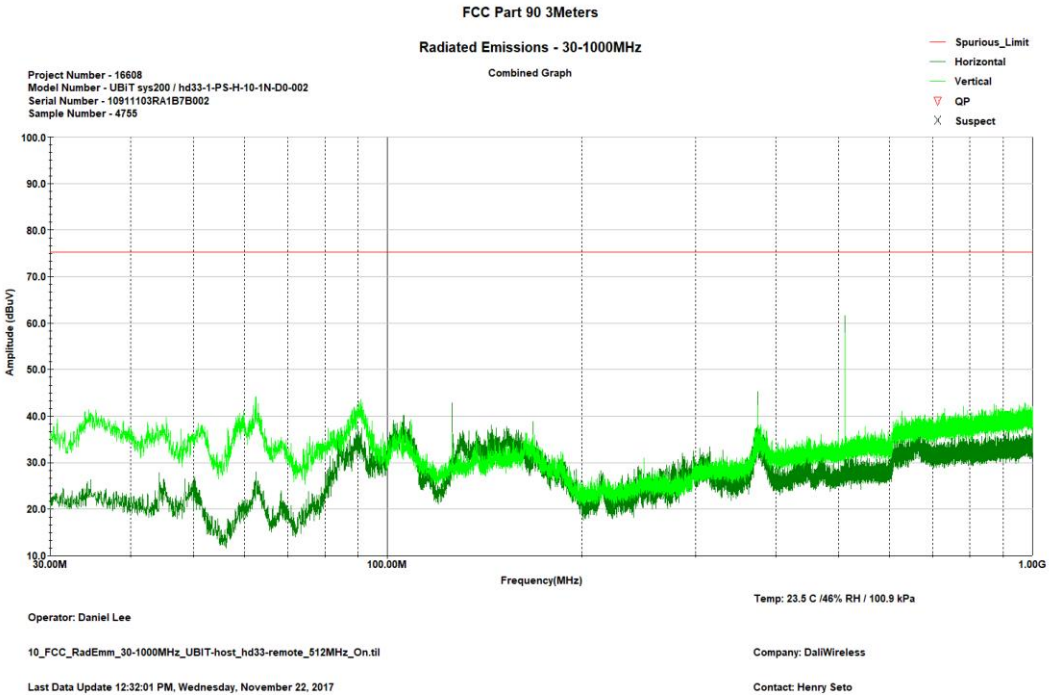
- Transmitter On, 481MHz



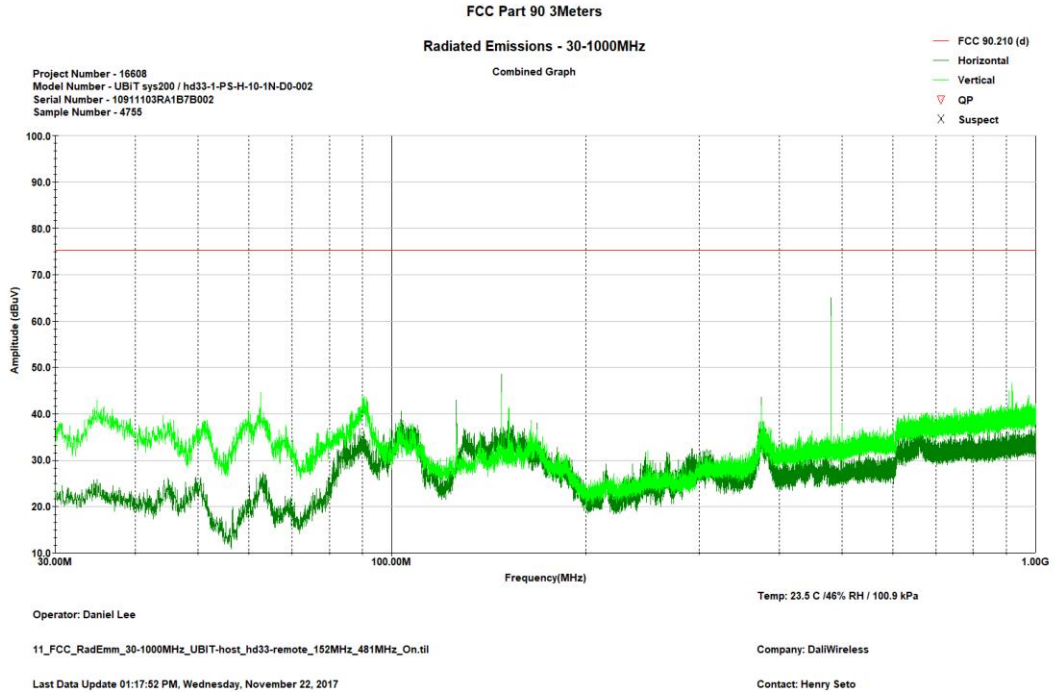
- Transmitter On, 450MHz (Low channel of 481MHz Band)



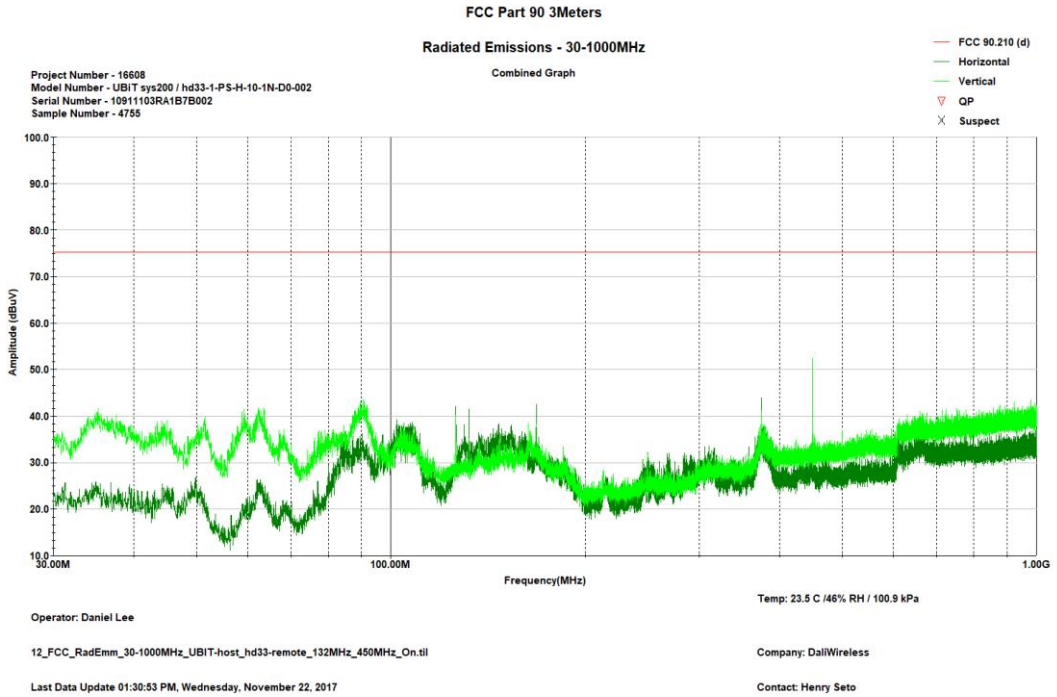
- Transmitter On, 512MHz (High channel of 481MHz Band)



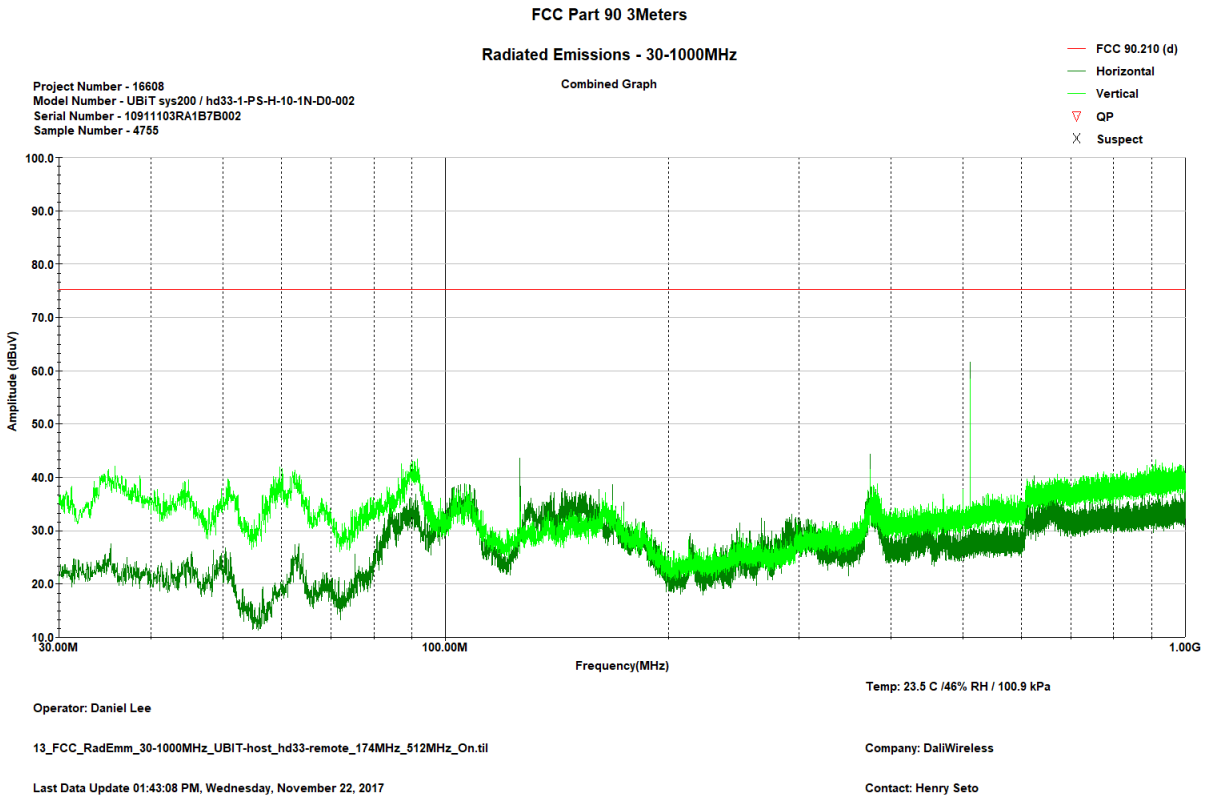
- Both channel is on, 152MHz and 481MHz



- Both channel is on, 132MHz and 450MHz

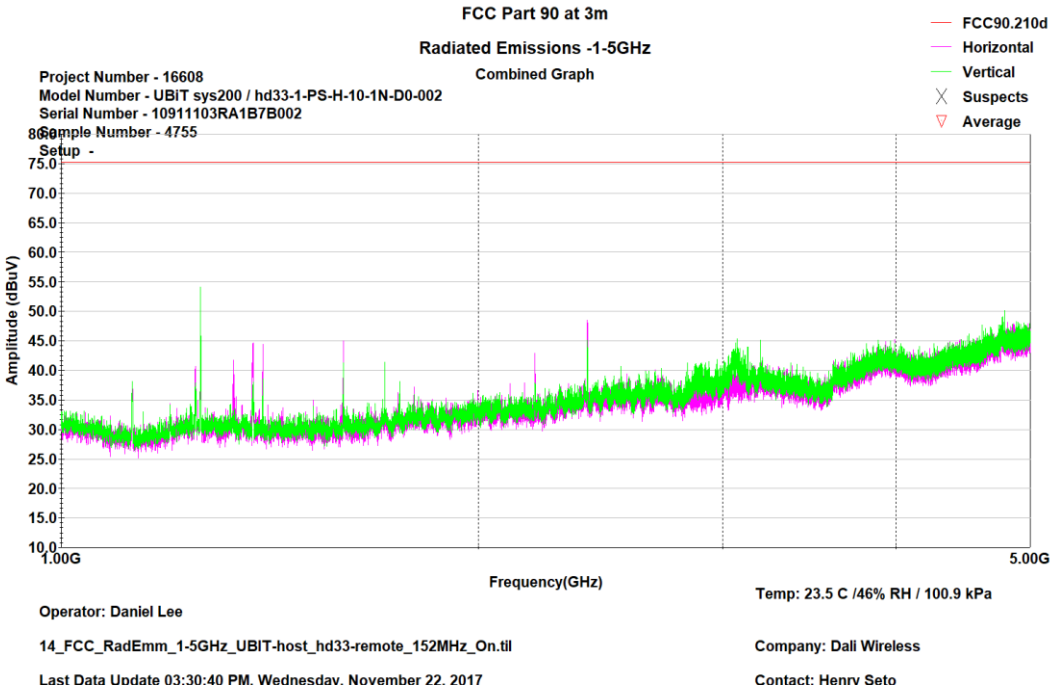


- Both channel is on, 174MHz and 512MHz

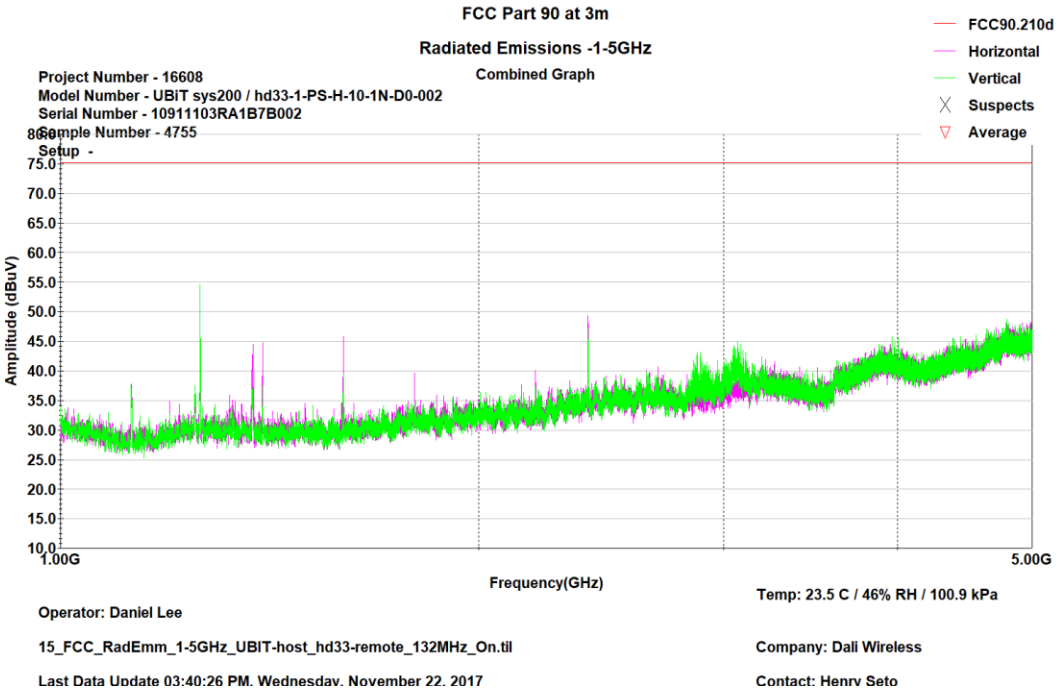


Graphical Representation for Emission - Radiated 1 to 5GHz

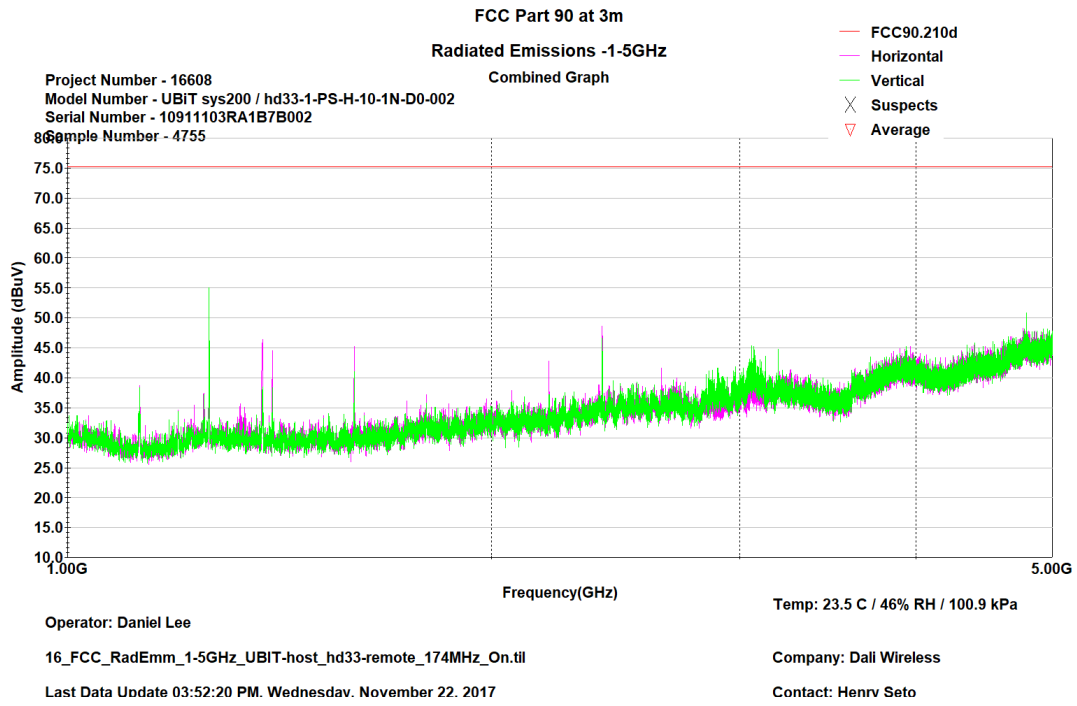
- Transmitter On, 152MHz



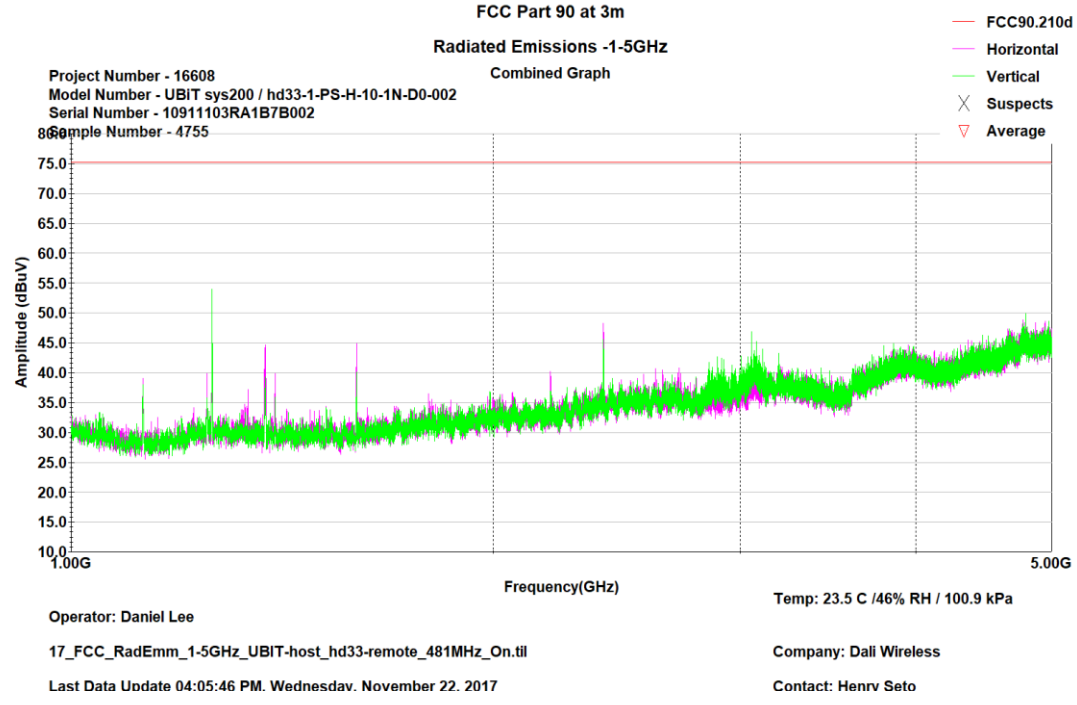
- Transmitter On, 132MHz (low channel of 152MHz Band)



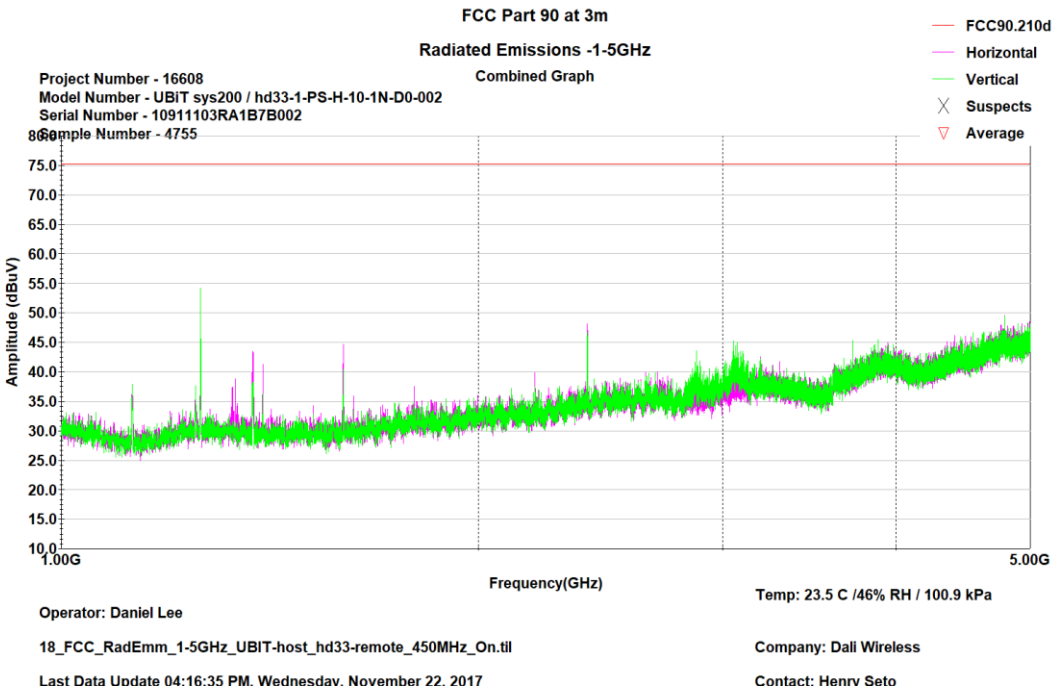
- Transmitter On, 174MHz (High channel of 152MHz Band)



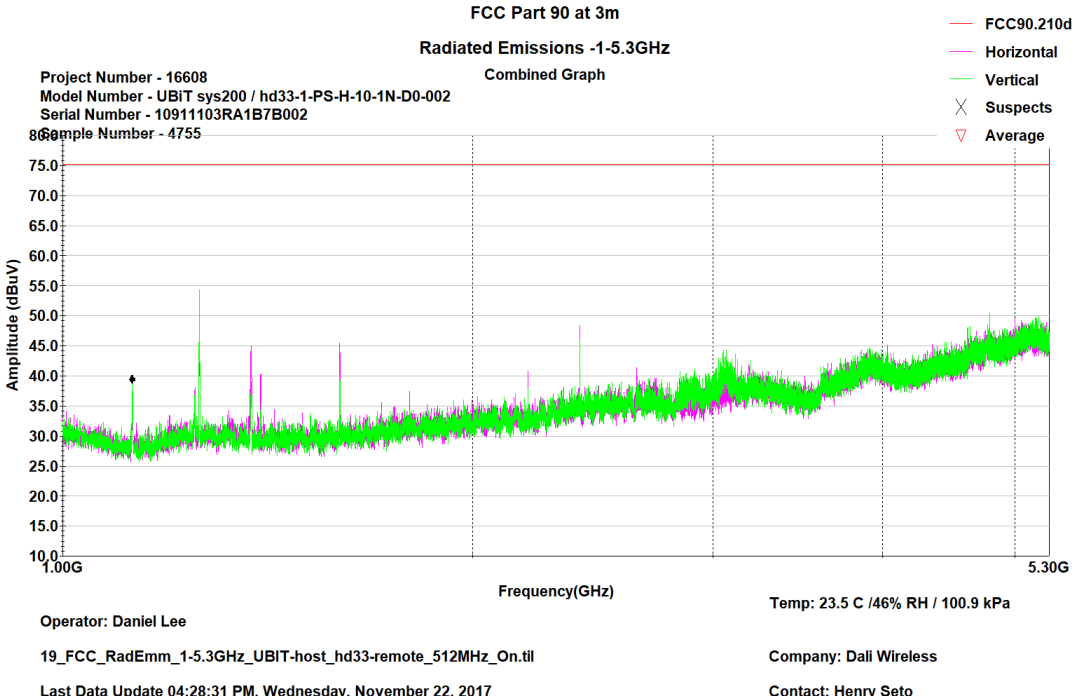
- Transmitter On, 481MHz



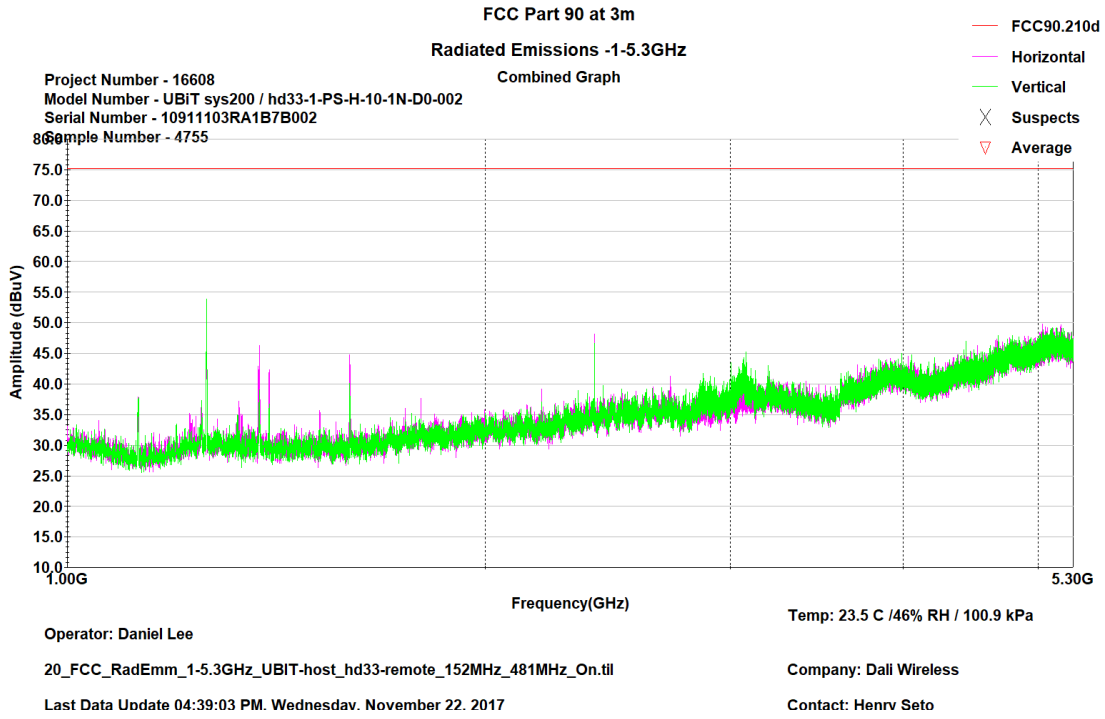
- Transmitter On, 450MHz (Low channel of 481MHz Band)



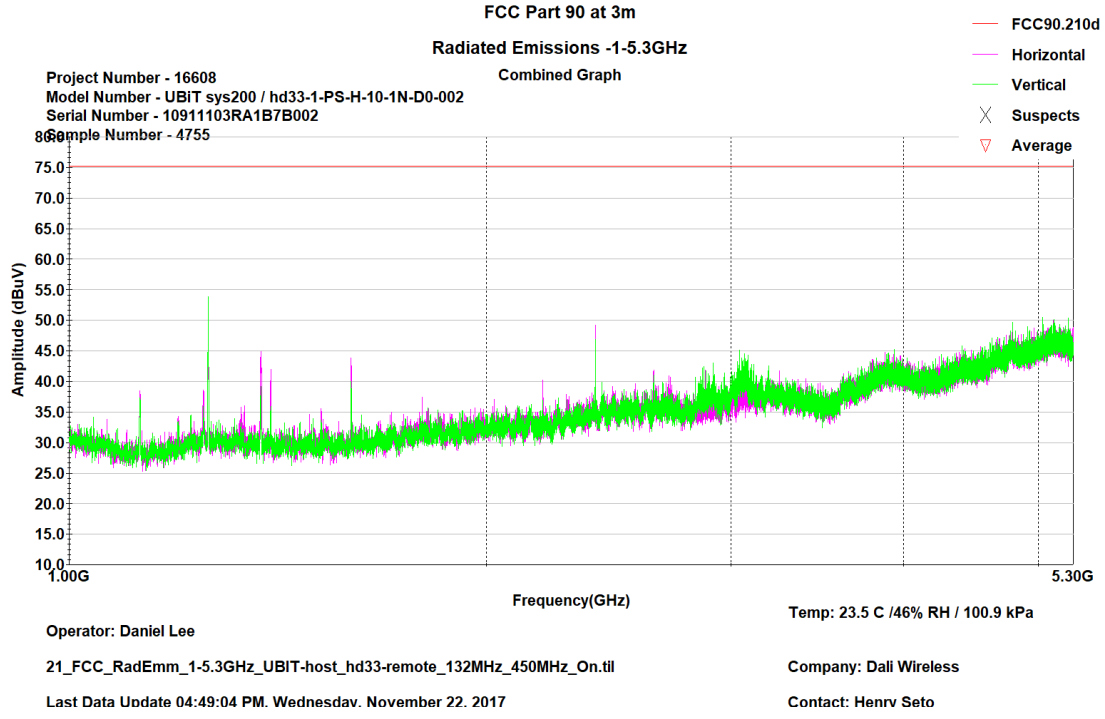
- Transmitter On, 512MHz (High channel of 481MHz Band)



- Both channel is on, 152MHz and 481MHz



- Both channel is on, 132MHz and 450MHz



- Both channel is on, 174MHz and 512MHz

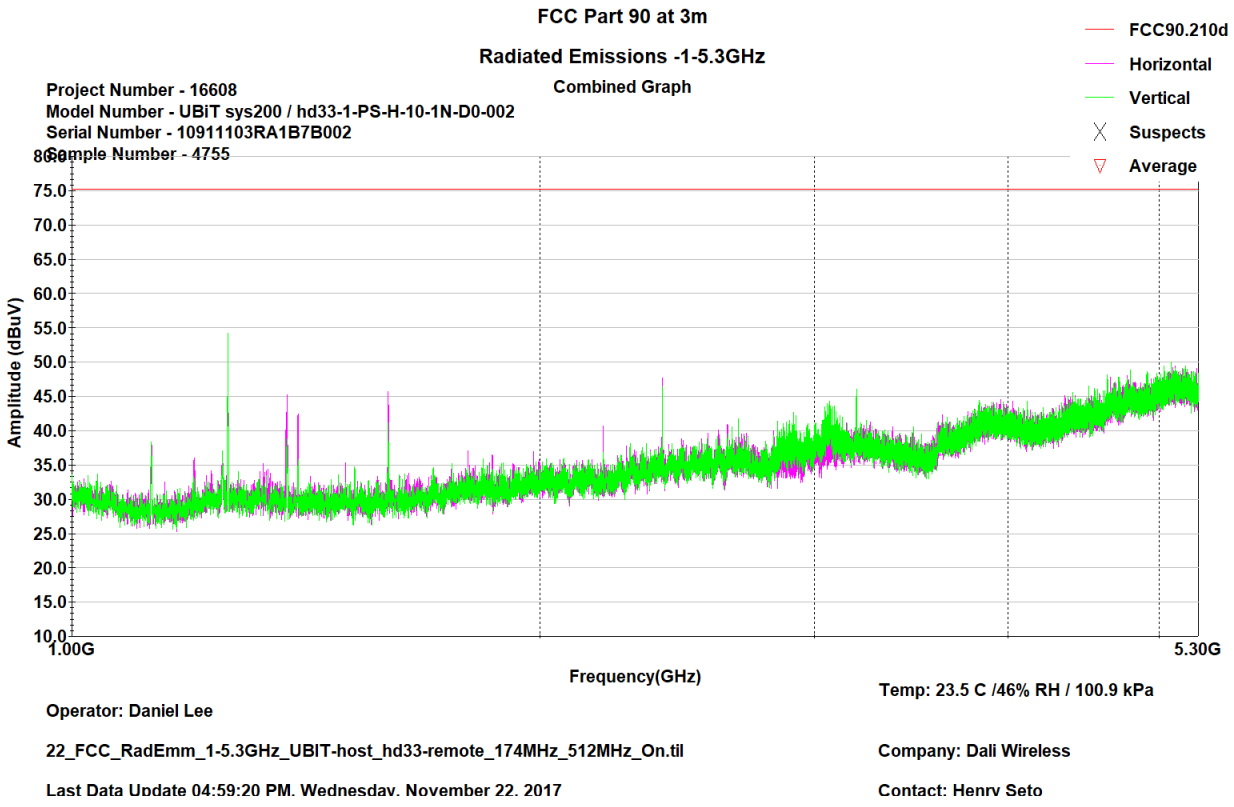


Table Representation for Emission - Radiated 30MHz to 18GHz

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.

APPENDIX A: ISO 17025:2005 Accreditation Certificate

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Labtest Certification, Inc.
3128, 20800 Westminster HWY
Richmond B.C. V6V 2W3

has been assessed by ANAB
and meets the requirements of international standard

ISO/IEC 17025:2005

while demonstrating technical competence in the field of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of tests to which this accreditation applies.

AT-2033
Certificate Number

ANAB Approval

Certificate Valid: 08/07/2017-03/04/2018
Version No. 004 Issued: 08/07/2017

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

ANSI-ASQ National Accreditation Board

ANAB

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Labtest Certification, Inc.
3128, 20800 Westminster HWY
Richmond, B.C. V6V 2W3
Kavinder Dhillon Ruben Ugarte Phone: 604-247-0444
kdhillon@labtestcert.com ruben.Ugarte@labtestcert.com
www.labtestcert.com

TESTING

Valid to: **March 4, 2018** Certificate Number: **AT-2033**

Testing performed in support of FCC DoC and Certification approval procedures

Type of Device Examples	Scope of Accreditation	Supporting FCC Guidance	Comments
Unintentional Radiators (FCC Part 15, Subpart B)	• ANSI C63.4-2014		
Industrial, Scientific, and Medical Equipment (FCC Part 18) • Consumer ISM equipment	• FCC MP-5, (February 1986)		
Intentional Radiators (FCC Part 15 Subpart C)	• ANSI C63.10-2013		
UPCS (FCC Part 15, Subpart D) •Unlicensed Personal Communication Systems devices	• ANSI C63.17-2013		
U-NII without DFS Intentional Radiators (FCC Part 15, Subpart E) •Unlicensed National Information Infrastructure Devices (U-NII without DFS)	• ANSI C63.10-2013	KDB Publication 789033	
U-NII with DFS Intentional Radiators (FCC Part 15 Subpart E) • Unlicensed National Information Infrastructure U-NII) Devices with Dynamic Frequency Selection (DFS)	• FCC KDB Publication 905462 D02 UNII DFS Compliance Procedures New Rules v01 (April 8, 2016)		
UWB Intentional Radiators (FCC Part 15, Subpart F) •Ultra-wideband Operation	• ANSI C63.10-2013		
BPL Intentional Radiators (FCC Part 15, Subpart G) •Access Broadband Over Power Line (Access BPL)	• ANSI C63.10-2013		
White Space Device Intentional Radiators (FCC Part 15, Subpart H) •White Space Devices	• ANSI C63.10-2013		

ANSI-ASQ National Accreditation Board

Testing performed in support of FCC DoC and Certification approval procedures

Type of Device Examples	Scope of Accreditation	Supporting FCC Guidance	Comments
Commercial Mobile Services (FCC Licensed Radio Service Equipment) •Part 22 (cellular) •Part 24 •Part 25 (non-microwave) •Part 27	• ANSI/TIA-603-D • TIA-102.CAAA-D	KDB Publication 971168	
General Mobile Radio Services (FCC Licensed Radio Service Equipment) •Part 22 (non-cellular) •Part 90 (non-microwave) •Part 95 •Part 97 •Part 101 (non-microwave)	• ANSI/TIA-603-D • TIA-102.CAAA-D		Microwave Frequencies, as used in this part, refers to frequencies of 890 MHz and above.
Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment) •Part 96	• ANSI/TIA-603-D • TIA-102.CAAA-D	KDB Publication 971168	
Maritime and Aviation Radio Services (FCC Licensed Radio Service Equipment) •Part 80 •Part 87	• ANSI/TIA-603-D		
Microwave and Millimeter Bands Radio Services (FCC Licensed Radio Service Equipment) •Part 25 •Part 74 •Part 90 (90Y, 90Z, DSRC) •Part 101	• ANSI/TIA-603-D • TIA-102.CAAA-D		
Broadcast Radio Services (FCC Licensed Radio Service Equipment) •Part 73 •Part 74 (non-microwave)	• ANSI/TIA-603-D • TIA-102.CAAA-D		
RF Exposure •Devices subject to SAR requirements	• IEEE Std 1528™-2013	KDB Publication 865664 KDB Publication 447498	
Hearing Aid Compatibility (Part 20) •HAC for Commercial mobile services	• ANSI C63.19-2007; or • ANSI C63.19-2011		

ANSI-ASQ National Accreditation Board

Testing performed in support of FCC DoC and Certification approval procedures

Type of Device Examples	Scope of Accreditation	Supporting FCC Guidance	Comments
Signal Boosters (Part 20) •Wideband Consumer signal boosters •Provider-specific signal boosters •Industrial signal boosters	• FCC KDB Publication 935210 D03 Signal Booster Measurements v04(February 12,2016) • FCC KDB Publication 935210 D04 Provider Specific Booster Measurements v02 (February 12,2016) • FCC KDB Publication 935210 D05 Indus Booster Basic Meas v01r01 (February 12,2016)		

Electromagnetic Compatibility (EMC)

Test Method	Test Specification(s)	Range	Comments
Unintentional Radiators	ANSI C63.4-2003 ANSI C63.4-2009		
Radiated and Conducted Emissions	ANSI C63.4:2014; FCC OST/MP-05 (1986); ICES-001(2006); ICES-002(2013); ICES-003(2016); ICES-005(2009); CISPR 16-1-1(2015); CISPR 16-1-2(2014); CISPR 16-1-3(2006); CISPR 16-2-1(2014); CISPR 16-2-2(2010); CISPR 16-2-3(2014); CISPR 16-2-5(2008); CISPR 16-4-2(2014); EN 55016-1-1(2010); EN 55016-1-2(2014); EN 55016-1-3(2006); EN 55016-1-4(2010); EN 55016-2-1(2014); EN 55016-2-2(2011); EN 55016-2-3(2014); EN 55016-4-2(2014); CISPR 11(2012); EN 55011(2013); AS/NZS CISPR 11(2013); KN 11 (RRA Announce 2015-110, Dec, 03, 2015); VCCI V-3 (up to 6 GHz); VCCI V-5; CNS 13438	9 kHz to 40 GHz	

END OF REPORT