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FCC REPORT

FCC Class II Permissive Change

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu, Suwon-si,
Gyeonggi-do, 16677, Rep. of Korea

Date of Issue:
May 24, 2018

Location of test lab:
HCT CO., LTD.,
74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-1805-FC031

FCC ID: **A3LRFV01U-D2A**

APPLICANT: **SAMSUNG Electronics Co.,Ltd.**

Model: RFV01U-D2A

EUT Type: RRU(RFV01U)

Frequency Ranges: NB-IoT Band 13: 746 MHz ~ 756 MHz (Tx) / 777 MHz ~ 787 MHz (Rx)

Tx Output Power: 5.5 W x 4 ports (22 W)
8.3 W x 2 ports (16.6 W)

Emission Designator:

Mode	Emission Designator
	QPSK (G7D)
NB-IoT Band 13	212KG7D

Date of Test: May 16, 2018 ~ May 23, 2018

FCC Rule Part(s): CFR 47 Part 2, Part 27

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

Report prepared by : Kyung Soo Kang
Engineer of telecommunication testing center

Approved by : Jong Seok Lee
Manager of telecommunication testing center

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1805-FC031	May 24, 2018	- First Approval Report

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1. GENERAL INFORMATION

1.1. APPLICANT INFORMATION

Company Name	Samsung Electronics Co., Ltd.
Company Address	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

1.2. PRODUCT INFORMATION

EUT Type	RRU(RFV01U)
Power Supply	-48 VDC
Emission Designator	Mode: NB-IoT Band 13 — Emission Designator: QPSK (G7D): 212KG7D
Frequency Range	NB-IoT Band 13: 746 MHz ~ 756 MHz (Tx) / 777 MHz ~ 787 MHz (Rx)
Tx Output Power	5.5 W x 4 ports (22 W) 8.3 W x 2 ports (16.6 W)
Channel Bandwidths	200 kHz
Modulation Type	QPSK
Antenna Specification	Manufacturer does not provide an antenna.

1.3. TEST INFORMATION

FCC Rule Parts	CFR 47 Part 2, Part 27
Measurement standards	ANSI C63.26-2015, KDB 662911 D01 v02r01
Place of Test	HCT CO., LTD. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

2. FACILITIES AND ACCREDITATIONS

2.1. FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4 (Version: 2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661).

2.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.
Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

3. TEST SPECIFICATIONS

3.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 2, Part 27

Description	Reference	Results
RF Output Power	§2.1046, §27.50(b)	Compliant
Occupied Bandwidth	§2.1049	Compliant
Unwanted Conducted Emissions	§2.1051, §27.53(c), (f)	Compliant
Radiated Emissions	§2.1053, §27.53	Compliant
Frequency Stability	§2.1055, §27.54	Compliant

3.2. MODE OF OPERATION DURING THE TEST

The EUT was operated in a manner representative of the typical usage of the equipment.
During all testing, system components were manipulated within the confines of typical usage to maximize each emission.
The device does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports for radiated spurious emission testing.

* The tests results in plots are already including the actual value of loss for the attenuator and cable combination. Please check correction factors below table.

▣ Correction Factor

Frequency (MHz)	Factor (dB)			
	ANT 1	ANT 2	ANT 3	ANT 4
50	28.180	28.062	28.227	28.611
100	28.256	28.157	28.383	28.773
200	28.544	28.376	28.641	29.049
400	28.733	28.609	28.897	29.236
600	28.814	28.705	29.054	29.377
750	28.943	28.833	29.176	29.526
800	29.058	28.922	29.302	29.658
1 000	29.173	28.991	29.417	29.791
2 000	29.767	29.508	30.331	30.614
3 000	30.134	29.803	30.768	31.200
4 000	30.112	29.674	30.910	31.230
5 000	29.962	29.294	30.822	31.123
6 000	30.899	30.100	31.747	32.017
7 000	31.437	30.631	32.554	32.751
8 000	31.501	30.563	32.939	32.986
9 000	32.173	31.186	33.231	33.526
10 000	33.117	31.815	34.006	34.418
11 000	34.408	33.053	34.843	34.992
12 000	33.900	32.597	34.639	35.158
12 750	35.089	33.795	35.585	36.159

3.3. MAXIMUM MEASUREMENTUNCERTAINTY

The value of the measurement uncertainty for the measurement of each parameter.

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

Description	Condition	Uncertainty
RF Output Power	-	± 0.72 dB
Occupied Bandwidth	OBW ≤ 20 MHz	± 52 kHz
Unwanted Conducted Emissions	-	± 1.08 dB
Radiated Emissions	f ≤ 1 GHz f > 1 GHz	± 4.80 dB ± 6.07 dB
Frequency Stability	-	± 1.22 x 10^{-6}

3.4. STANDARDS ENVIRONMENTAL TEST CONDITIONS

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

4. TEST EQUIPMENTS

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Agilent	N9020A / Spectrum Analyzer	09/15/2017	Annual	MY46471250
Weinschel	67-30-33 / Fixed Attenuator	02/21/2018	Annual	BR0530
Weinschel	67-30-33 / Fixed Attenuator	02/08/2018	Annual	BU5347
Weinschel	WA67-30-33 / Fixed Attenuator	09/14/2017	Annual	WA67-30-33-4
Weinschel	WA67-30-33/ Fixed Attenuator	09/14/2017	Annual	WA67-30-33-2
EAGLE	240NFNM / Notch Filter	10/13/2017	Annual	H00564-12
KIKUSUI	PWR800L / DC Power Supply	02/27/2018	Annual	RE001149
KIKUSUI	PWR800L / DC Power Supply	03/21/2018	Annual	RE001154
NANGYEUL CO., LTD.	NY-THR18750 / Temperature and Humidity Chamber	10/21/2017	Annual	NY-2009012201A
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Emco	2090 / Controller	N/A	N/A	060520
Ets	Turn Table	N/A	N/A	N/A
Rohde & Schwarz	Loop Antenna	04/06/2018	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	04/06/2017	Biennial	760
Schwarzbeck	BBHA 9120D / Horn Antenna	06/30/2017	Biennial	9120D-1300
Rohde & Schwarz	FSP / Spectrum Analyzer	09/21/2017	Annual	836650/016
Wainwright Instruments	WHKX10-900-1000-15000-40SS	07/21/2017	Annual	5
CERNEX	CBLU1183540 / Power Amplifier	01/03/2018	Annual	24613

5. RF OUTPUT POWER

FCC Rules

Test Requirements:

§ 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§ 27.50 Power limits and duty cycle.

(b) The following power and antenna height limits apply to transmitters operating in the 746-758 MHz, 775-788 MHz and 805-806 MHz bands:

(4) Fixed and base stations transmitting a signal in the 746-757 MHz and 776-787 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section.

(5) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal in the 746-757 MHz and 776-787 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section.

Test Procedures:

The measurement is performed in accordance with Section 5.2.4.4.1 of ANSI C63.26.

a) Set span to 2 × to 3 × the OBW.

b) Set RBW = 1% to 5% of the OBW.

c) Set VBW ≥ 3 × RBW.

d) Set number of measurement points in sweep ≥ 2 × span / RBW.

e) Sweep time:

1) Set = auto-couple, or

2) Set ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.

f) Detector = power averaging (rms).

g) If the EUT can be configured to transmit continuously, then set the trigger to free run.

h) Omitted

i) Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over multiple symbols, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.

j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Note:

1) The radio frequency load attached to the EUT antenna terminal was 50 Ohm. The lost of the cables the test system is calibrated to correct the reading.
2) The conducted emission level is measured at each antenna port and then summed mathematically to determine the total emission level from the device.
3) Maximum ERP is sufficient level to pass the limit.
4) Sum data is in a tolerance of specification provided from manufacturer.

RF Output power tolerance: ±1 dB (each port)

Maximum output power for one port: 6.92 W (37.40 dBm + 1 dB = 38.40 dBm)

*Maximum output sum power: 6.92 W * 4 = 27.68 W*

Measured sum maximum power: 22.827 W

The measured value is lower than the specification value.

Test Results:

4 Tx / QPSK

Port	Channel	Frequency (MHz)	Measured Output Power	
			(dBm)	(W)
ANT 1	lower	746.20	37.70	5.894
	upper	755.80	37.70	5.894
ANT 2	lower	746.20	37.54	5.675
	upper	755.80	37.59	5.739
ANT 3	lower	746.20	37.61	5.765
	upper	755.80	37.29	5.358
ANT 4	lower	746.20	37.40	5.493
	upper	755.80	37.42	5.521

Sum data of all port

Channel	Frequency (MHz)	Measured Output Power (W)
lower	746.20	22.827
upper	755.80	22.512

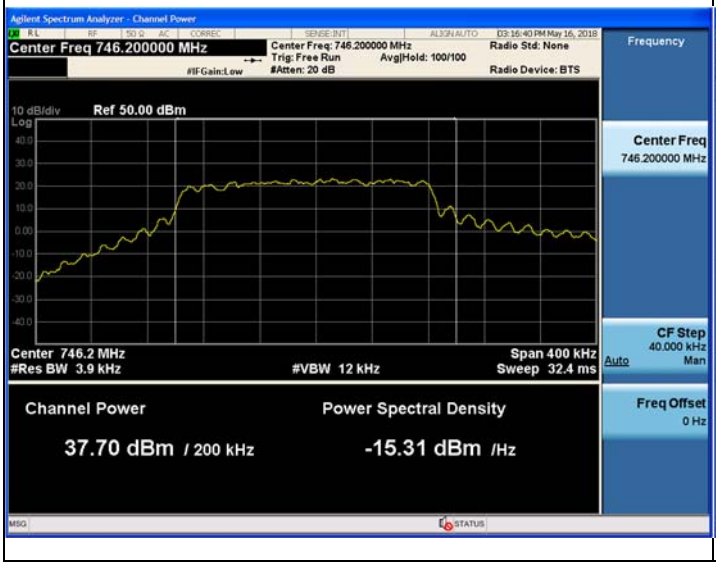
2Tx / QPSK

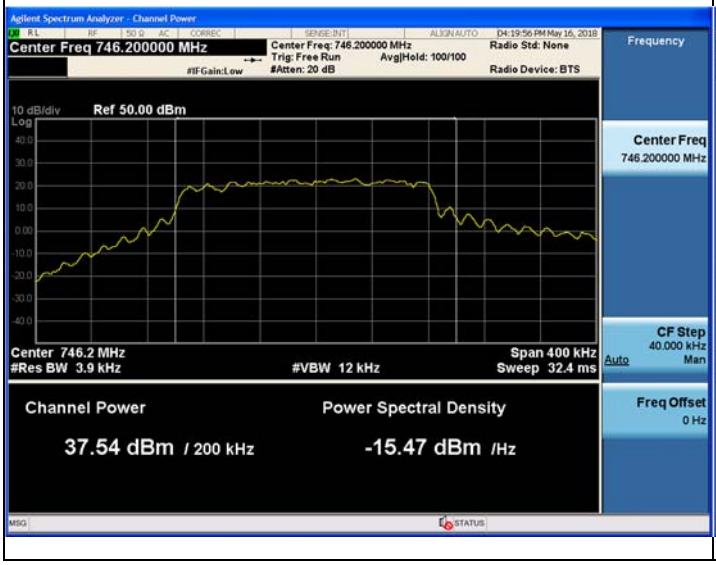
Port	Channel	Frequency (MHz)	Measured Output Power	
			(dBm)	(W)
ANT 1	lower	746.20	39.06	8.059
	upper	755.80	39.15	8.226
ANT 2	lower	746.20	38.93	7.816
	upper	755.80	39.03	7.998

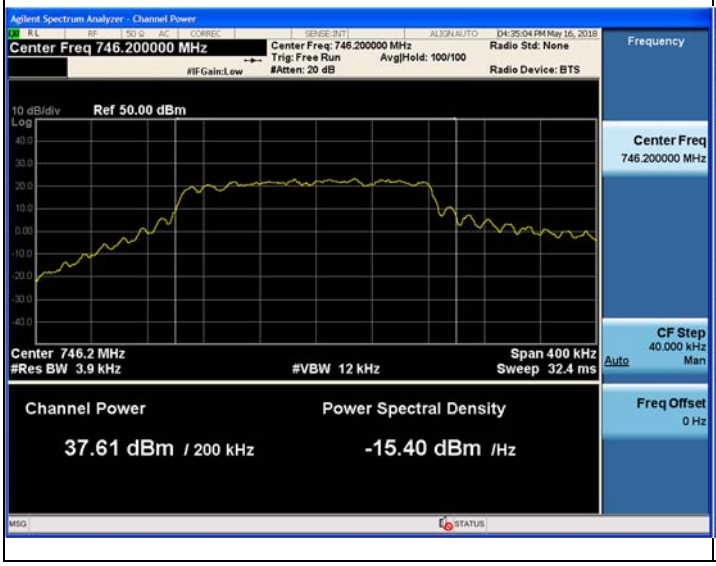
Sum data of all port

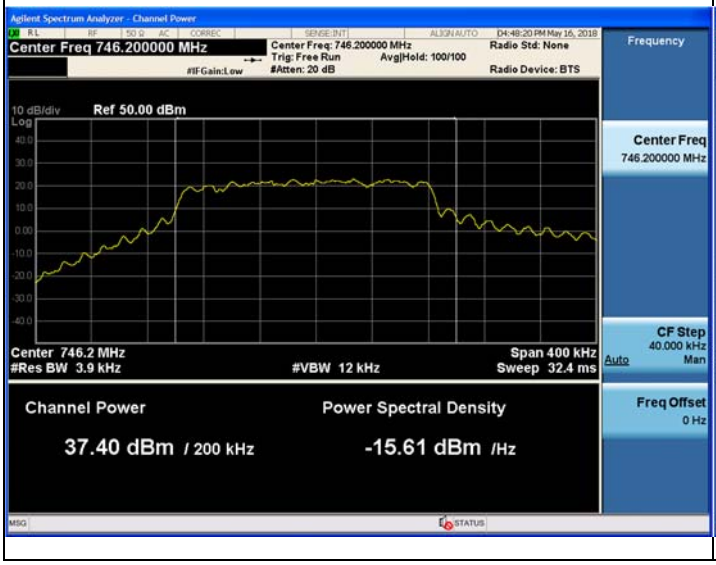
Channel	Frequency (MHz)	Measured Output Power (W)
lower	746.20	15.875
upper	755.80	16.224

Plots of Output Power - 4Tx / QPSK

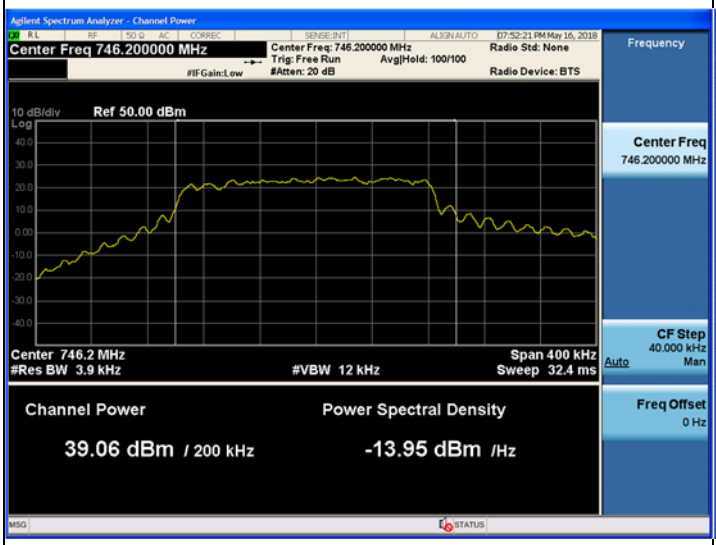
ANT 1	
lower	upper
	

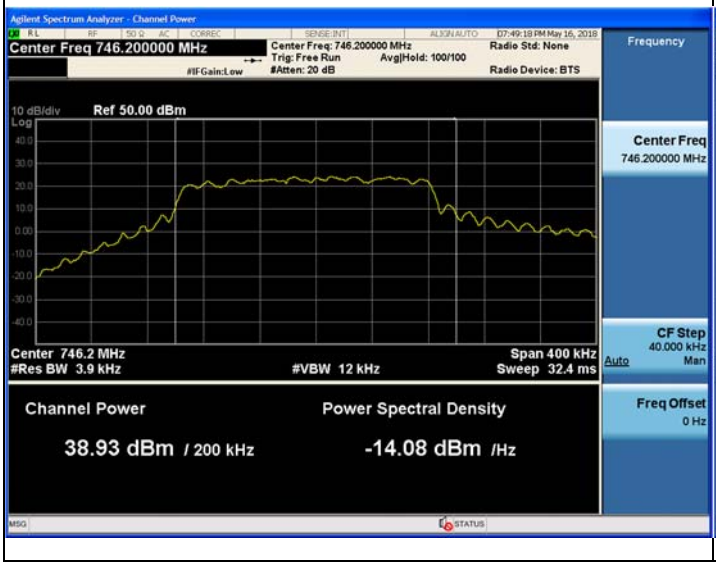
ANT 2	
lower	upper
	

ANT 3	
lower	**upper**
	

ANT 4	
lower	**upper**
	

Plots of Output Power - 2Tx / QPSK

ANT 1	
lower	upper
	

ANT 2	
lower	upper
	

6. OCCUPIED BANDWIDTH

FCC Rules

Test Requirements:

§ 2.1049 Measurements required: Occupied bandwidth.

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

Test Procedures:

The measurement is performed in accordance with Section 5.4.3 and 5.4.4 of ANSI C63.26.

5.4.3 Occupied bandwidth—Relative measurement procedure

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.

b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.

NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.

d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target "−X dB" requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.

e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

f) Determine the reference value by either of the following:

1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).

2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.

g) Determine the "−X dB amplitude" as equal to (Reference Value − X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.

h) If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow

the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).
i) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the "−X dB amplitude" determined in step f). If a marker is below this "−X dB amplitude" value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers. The spectral envelope can cross the "−X dB amplitude" at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the "−X dB amplitude."
j) The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

5.4.4 Occupied bandwidth—Power bandwidth (99%) measurement procedure
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).
b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.

NOTE—Step a), step b), and step c) may require iteration to adjust within the specified tolerances.

d) Set the detection mode to peak, and the trace mode to max-hold.
e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.
f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

Test Results:

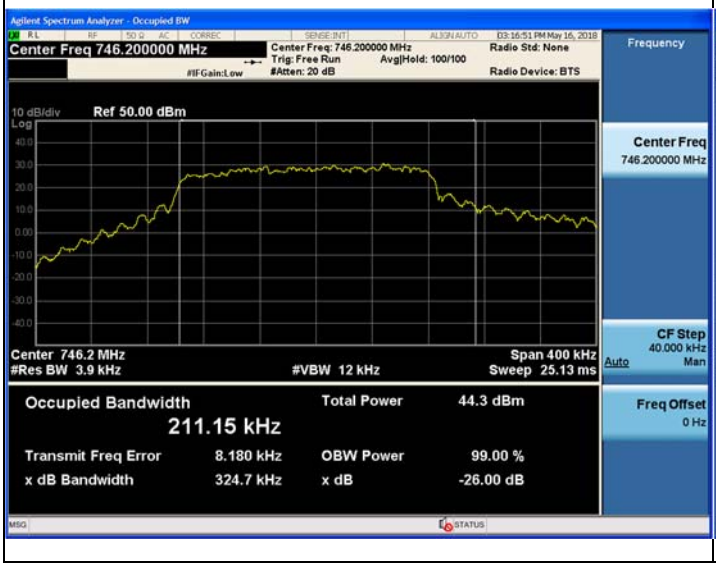
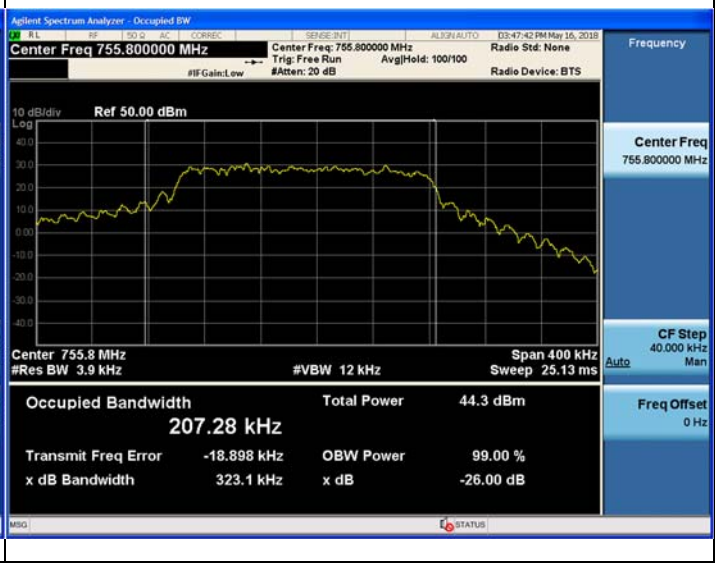
4Tx / QPSK

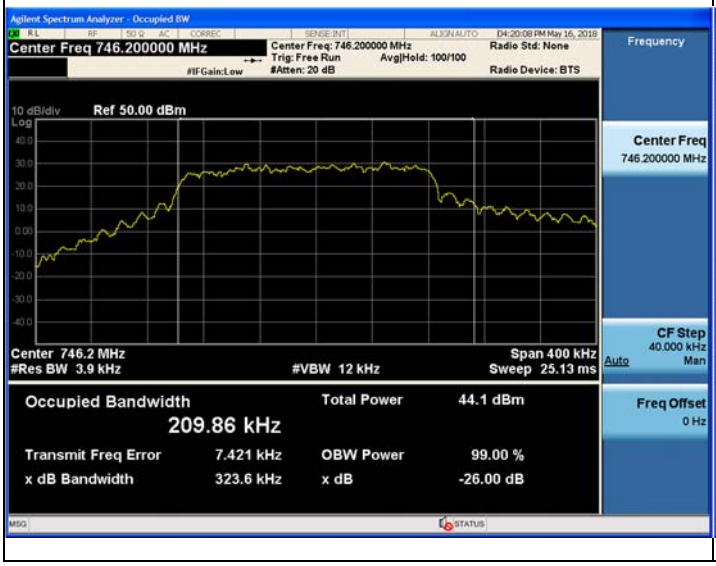
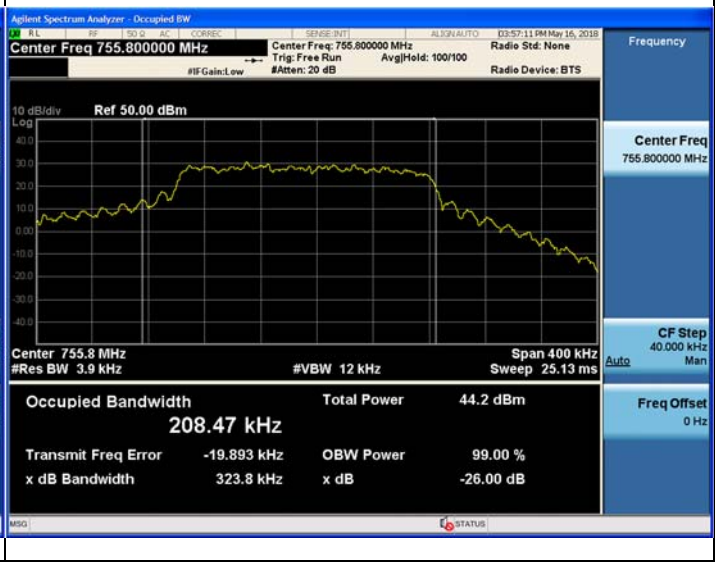
Port	Channel	Frequency (MHz)	Measured Bandwidth (MHz)
ANT 1	lower	746.20	211.15
	upper	755.80	207.28
ANT 2	lower	746.20	209.86
	upper	755.80	208.47
ANT 3	lower	746.20	210.21
	upper	755.80	208.19
ANT 4	lower	746.20	211.79
	upper	755.80	208.39

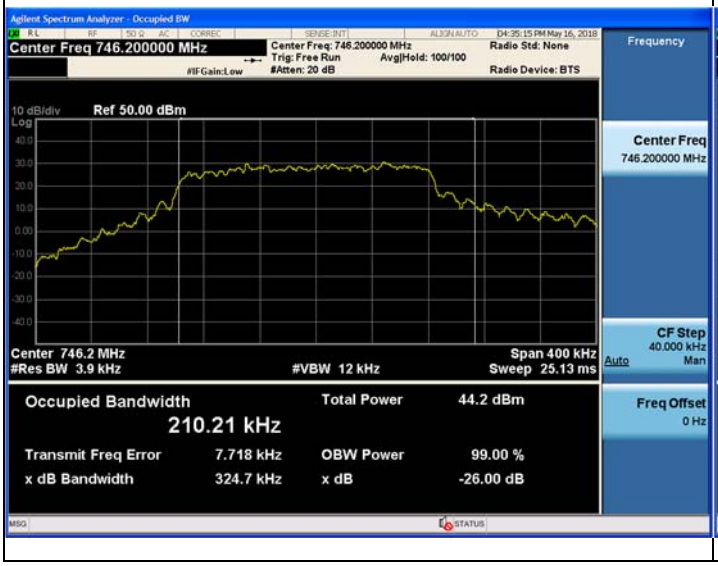
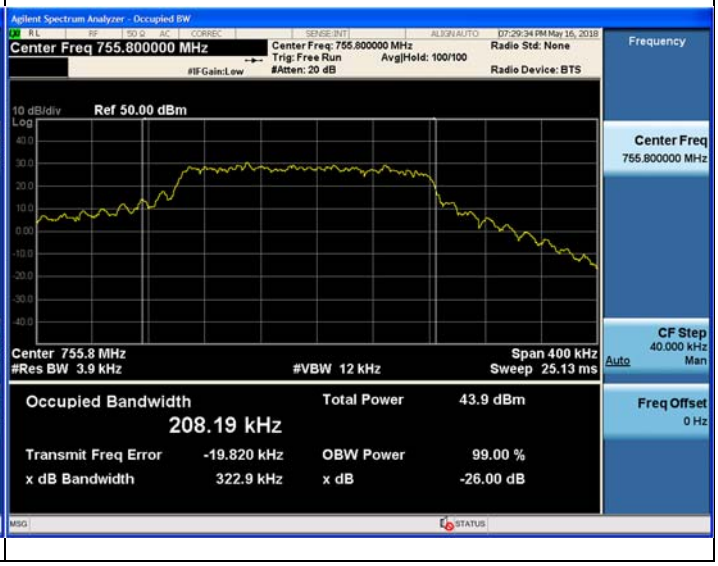
2Tx / QPSK

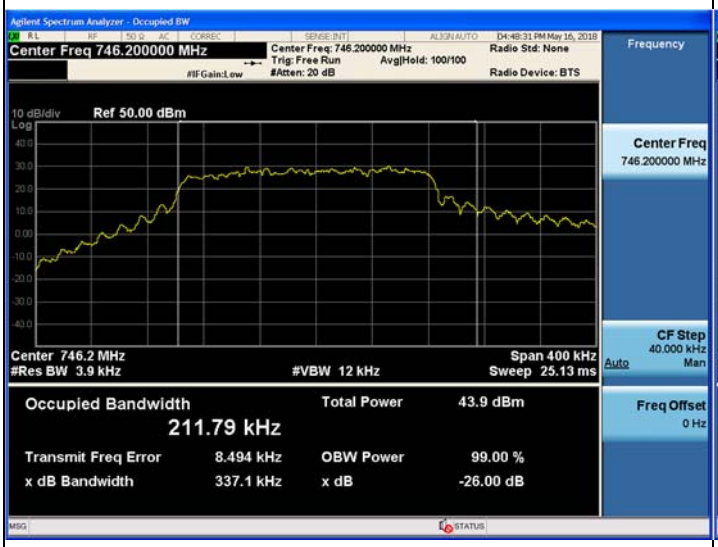
Port	Channel	Frequency (MHz)	Measured Bandwidth (MHz)
ANT 1	lower	746.20	210.56
	upper	755.80	208.29
ANT 2	lower	746.20	212.08
	upper	755.80	207.80

Plots of Occupied Bandwidth - 4Tx / QPSK

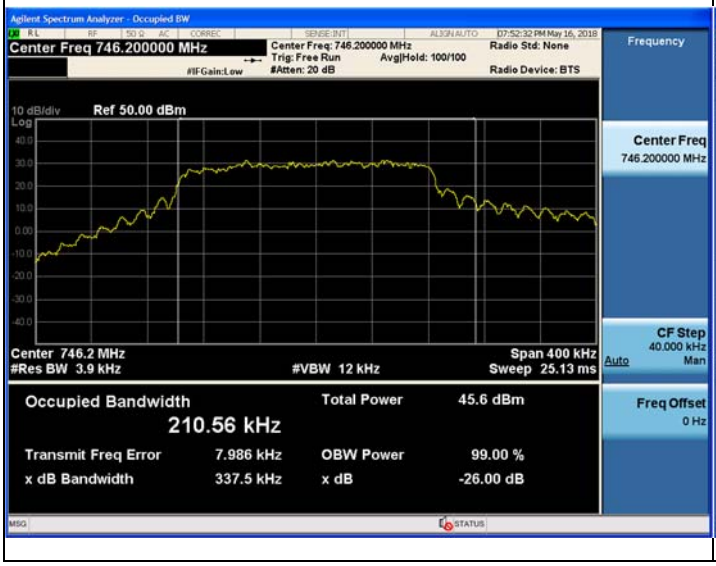
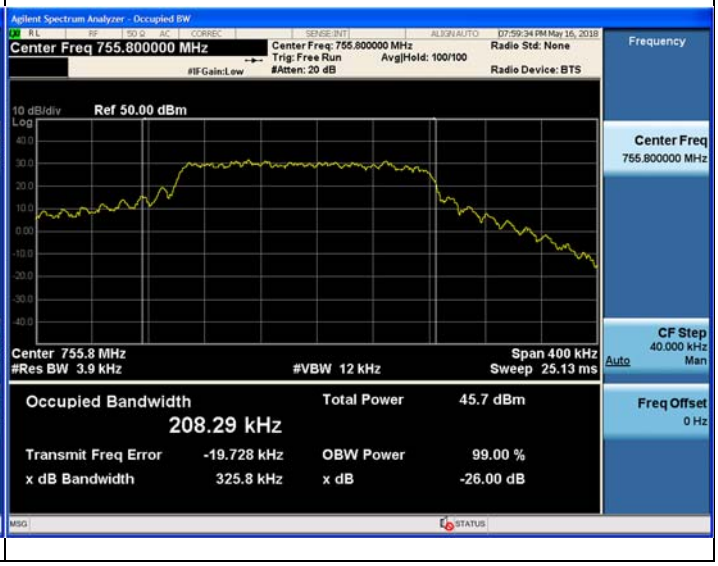
ANT 1	
lower	upper
	

ANT 2	
lower	upper
	

ANT 3	
lower	**upper**
	

ANT 4	
lower	**upper**
	

Plots of Occupied Bandwidth - 2Tx / QPSK

ANT 1	
lower	upper
	

ANT 2	
lower	upper

7. UNWANTED CONDUCTED EMISSIONS

FCC Rules

Test Requirements:

§ 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 27.53 Emission limits.

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(4) Omitted

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Test Procedures:

The measurement is performed in accordance with Section 5.7.3 and 5.7.4 of ANSI C63.26.

5.7.3 Out-of-band unwanted emissions measurements

a) Set the spectrum analyzer center frequency to the block, band, or channel edge frequency.

b) Set the span wide enough to capture the fundamental emission closest to the authorized block or band edge, and to include all modulation products that spill into the immediately adjacent frequency band. In some cases, it may be possible to set the center frequency and span so as to encompass the fundamental emission and the unwanted out-of-band (band-edge) emissions on either side of the authorized block, band, or channel. This can be accomplished with a single (slow) sweep, if adequate overload protection and sufficient dynamic range can be maintained.

c) Set the number of points in sweep ≥ 2 × span / RBW.

d) Sweep time should be auto for peak detection. For rms detection the sweep time should be set as follows:

1) If the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) × (symbol period) (e.g., by a factor of 10 × symbol period × number of points). Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols

2) Omitted

3) Omitted

4) Omitted

e) The test report shall include the plots of the measuring instrument display and the measured data.

f) See Annex I for example emission mask plots.

5.7.4 Spurious unwanted emission measurements

a) Set the spectrum analyzer start frequency to the lowest frequency generated by the EUT, without going below 9 kHz, and the stop frequency to the lower frequency covered by the measurements previously performed in 5.7.3. As an alternative, the stop frequency can be set to the value specified in 5.1.1, depending on the EUT operating range, if the resulting plot can clearly demonstrate compliance for all frequencies not addressed by the out-of-band emissions measurements performed as per 5.7.3.

b) When using an average power (rms) detector, ensure that the number of points in the sweep ≥ 2 × (span / RBW). This may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the spectrum analyzer capabilities. This requirement does not apply to peak-detected power measurements. When average power is specified by the applicable regulation, a peak-detector can be utilized for preliminary measurements to accommodate wider frequency spans. Any emissions found in the preliminary measurement to exceed the applicable limit(s) shall be further examined using a power averaging (rms) detector

with the minimum number of measurement points as defined above.
c) The sweep time should be set to auto-couple for performing peak-detector measurements. For measurements that use a power averaging (rms) detector, the sweep time shall be set as described for out-of-band emissions measurements in item d) of 5.7.3.
d) Identify and measure the highest spurious emission levels in each frequency range. It is not necessary to re-measure the out-of-band emissions as a part of this test. Record the frequencies and amplitudes corresponding to the measured emissions and capture the data plots.
e) Repeat step b) through step d) for the upper spurious emission frequency range if not already captured by a wide span measurement performed as per the alternative provided in step a). The upper frequency for this measurement is defined in 5.1.1 as a function of the EUT operating range.
f) Compare the results with the corresponding limit in the applicable regulation.
g) The test report shall include the data plots of the measuring instrument display and the measured data.

Note:

1) In 9 kHz to 150 kHz and 150 kHz to 30 MHz bands, RBW was reduced to 1% and 10% of the reference bandwidth for measuring unwanted emission level(typically, 100 kHz if the authorized frequency band is below 1 GHz) and power was integrated. (1 % = +20 dB, 10 % = +10 dB)
2) Due to 4Tx operation, -19.02 dBm (-13 dBm – 10*log (4))
   2Tx operation, -16.01 dBm (-13 dBm – 10*log (2)) limit is applied according to KDB 662911D01v02r01.

Test Results:

4Tx / QPSK

Port	Channel	Frequency (MHz)	Measured band edge (dBm)
ANT 1	lower	746.20	-24.358
	upper	755.80	-25.655
ANT 2	lower	746.20	-24.825
	upper	755.80	-26.430
ANT 3	lower	746.20	-24.362
	upper	755.80	-25.498
ANT 4	lower	746.20	-25.470
	upper	755.80	-25.167

2Tx / QPSK

Port	Channel	Frequency (MHz)	Measured band edge (dBm)
ANT 1	lower	746.20	-22.984
	upper	755.80	-24.927
ANT 2	lower	746.20	-22.963
	upper	755.80	-24.086

4Tx / QPSK, emission below 1 GHz

Port	Channel	Frequency (MHz)	Measured emission (dBm)			
			9 kHz ~ 150 kHz	150 kHz ~ 30 MHz	30 MHz ~ 741 MHz	761 MHz ~ 1 GHz
ANT 1	lower	746.20	-26.265	-36.324	-39.528	-40.181
	upper	755.80	-26.946	-36.057	-39.492	-40.663
ANT 2	lower	746.20	-27.6	-37.042	-39.522	-39.404
	upper	755.80	-26.543	-35.807	-39.728	-38.858
ANT 3	lower	746.20	-27.286	-37.564	-39.357	-40.709
	upper	755.80	-24.534	-35.613	-39.505	-40.549
ANT 4	lower	746.20	-27.008	-35.927	-39.742	-40.948
	upper	755.80	-25.872	-36.992	-39.723	-40.683

4Tx / QPSK, emission above 1 GHz

Port	Channel	Frequency (MHz)	Measured emission (dBm)	
			1 GHz ~ 3 GHz	3 GHz ~ 12.75 GHz
ANT 1	lower	746.20	-27.317	-29.402
	upper	755.80	-27.364	-29.260
ANT 2	lower	746.20	-27.347	-29.477
	upper	755.80	-27.277	-29.640
ANT 3	lower	746.20	-27.473	-29.825
	upper	755.80	-27.351	-30.612
ANT 4	lower	746.20	-27.263	-29.201
	upper	755.80	-27.232	-29.107

4Tx / QPSK, additional emission for 700 MHz band

Port	Channel	Frequency (MHz)	Measured emission (dBm)			
			763 MHz ~ 741 MHz	793 MHz ~ 805 MHz	1 559 MHz ~ 1 610 MHz	1 559 MHz ~ 1 610 MHz (700 Hz)
ANT 1	lower	746.20	-63.215	-63.892	-63.111	-94.599
	upper	755.80	-63.646	-63.399	-63.185	-94.438
ANT 2	lower	746.20	-63.656	-63.508	-63.342	-94.792
	upper	755.80	-63.443	-63.461	-62.920	-94.441
ANT 3	lower	746.20	-63.647	-63.566	-63.079	-94.632
	upper	755.80	-63.647	-63.367	-63.096	-94.628
ANT 4	lower	746.20	-63.511	-63.425	-63.018	-94.432
	upper	755.80	-63.743	-63.636	-63.050	-94.750

2Tx / QPSK, emission below 1 GHz

Port	Channel	Frequency (MHz)	Measured emission (dBm)			
			9 kHz ~ 150 kHz	150 kHz ~ 30 MHz	30 MHz ~ 741 MHz	761 MHz ~ 1 GHz
ANT 1	lower	746.20	-23.5	-36.034	-39.353	-40.070
	upper	755.80	-24.181	-36.014	-38.598	-39.428
ANT 2	lower	746.20	-25.612	-36.77	-38.800	-38.727
	upper	755.80	-27.288	-37.176	-39.352	-37.355

2Tx / QPSK, emission above 1 GHz

Port	Channel	Frequency (MHz)	Measured emission (dBm)	
			1 GHz ~ 3 GHz	3 GHz ~ 12.75 GHz
ANT 1	lower	746.20	-27.490	-30.581
	upper	755.80	-27.485	-30.560
ANT 2	lower	746.20	-27.533	-30.492
	upper	755.80	-27.418	-30.713

2Tx / QPSK, additional emission for 700 MHz band

Port	Channel	Frequency (MHz)	Measured emission (dBm)			
			763 MHz ~ 741 MHz	793 MHz ~ 805 MHz	1 559 MHz ~ 1 610 MHz	1 559 MHz ~ 1 610 MHz (700 Hz)
ANT 1	lower	746.20	-63.727	-63.385	-63.070	-94.465
	upper	755.80	-63.819	-63.736	-63.068	-94.620
ANT 2	lower	746.20	-63.724	-63.532	-63.216	-94.426
	upper	755.80	-63.610	-63.205	-63.019	-94.462

Plots of Band edge - 4Tx / QPSK

ANT 1	
Downlink	**Uplink**

ANT 2	
Downlink	**Uplink**

ANT 3	
Downlink	**Uplink**

ANT 4	
Downlink	**Uplink**

Plots of Band edge - 2Tx / QPSK

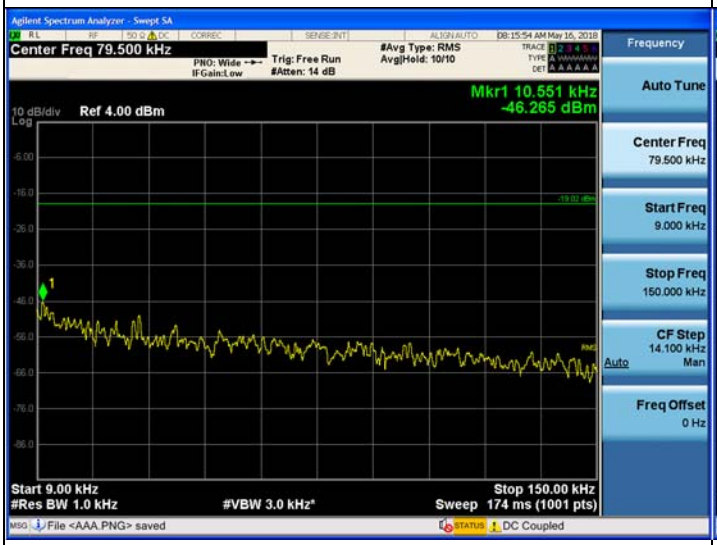
ANT 1	
Downlink	**Uplink**

ANT 2	
Downlink	**Uplink**

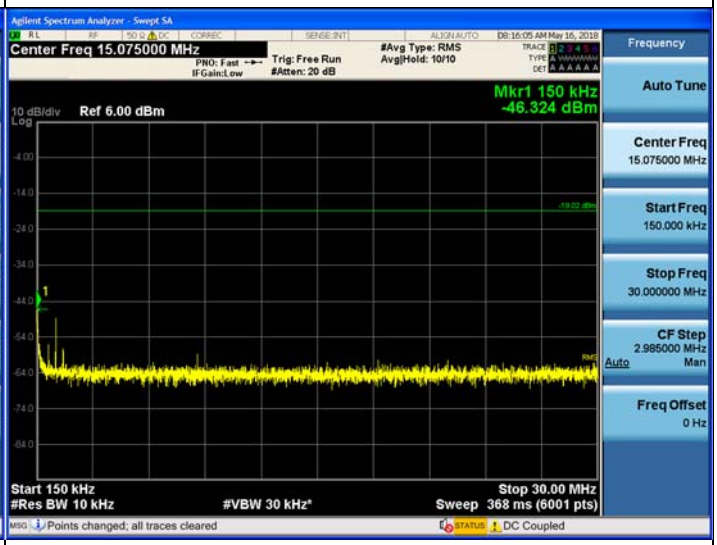
Plots of Unwanted Conducted Emission - 4Tx / QPSK_lower

ANT 1

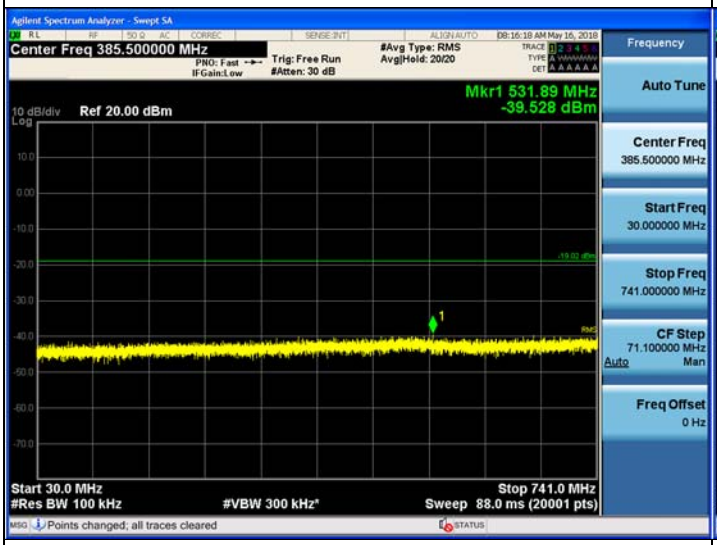
9 kHz ~ 150 kHz



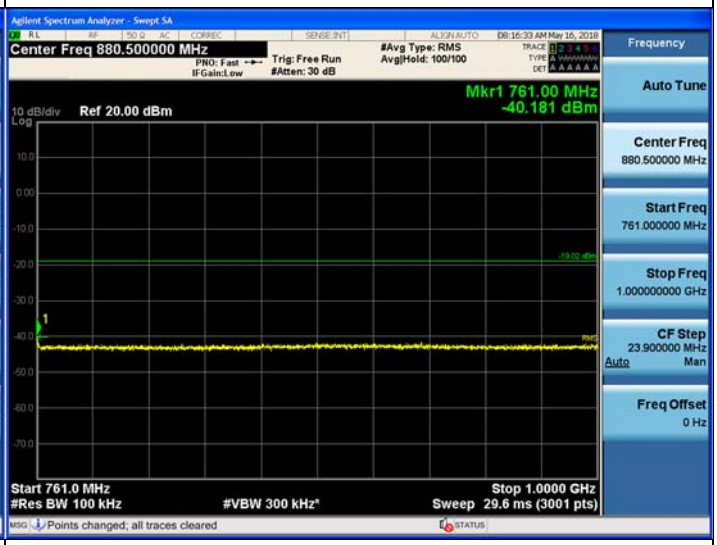
150 kHz ~ 30 MHz



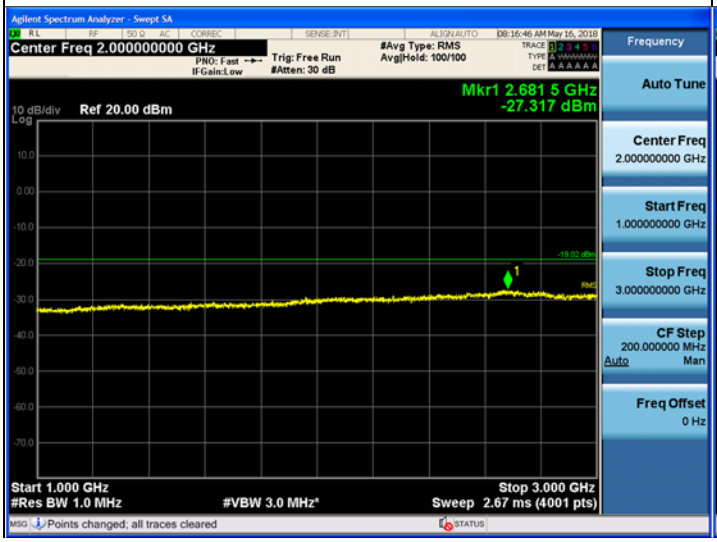
30 MHz ~ 741 MHz



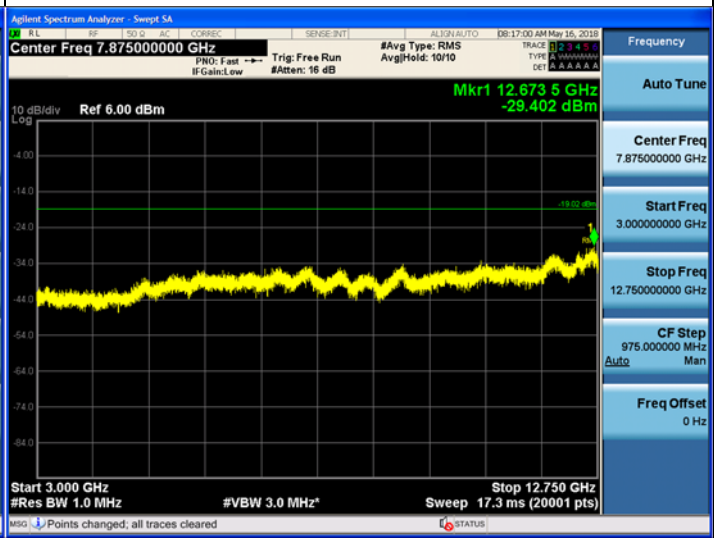
761 MHz ~ 1 GHz



1 GHz ~ 3 GHz

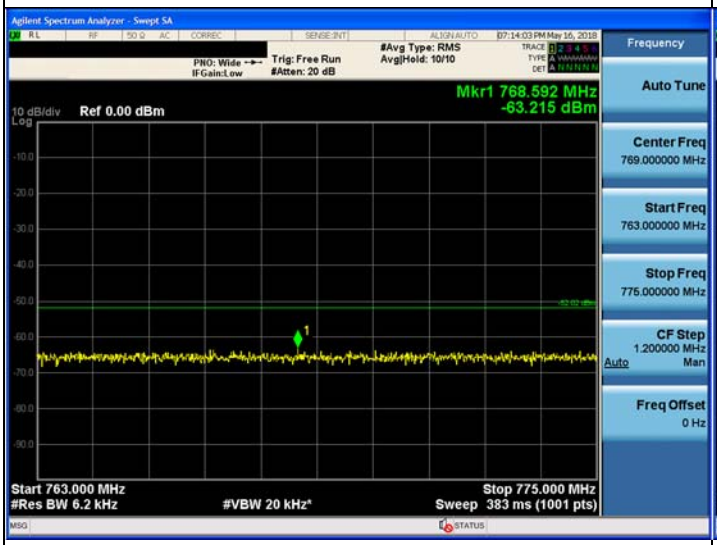


3 GHz ~ 12.75 GHz

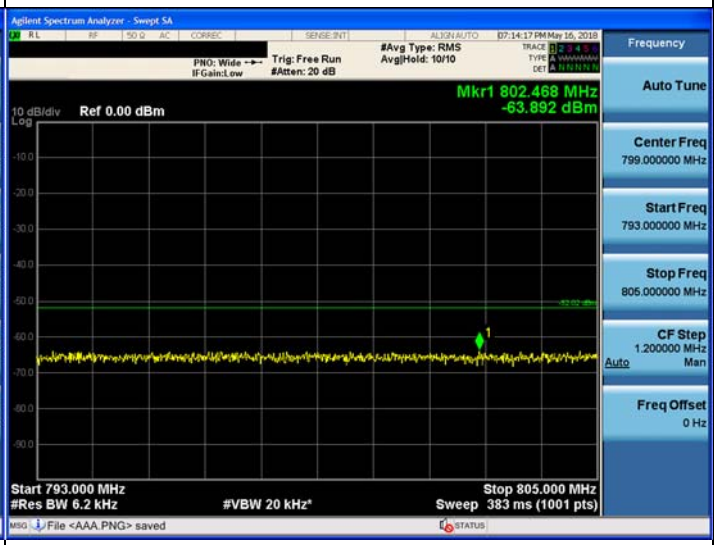


ANT 1

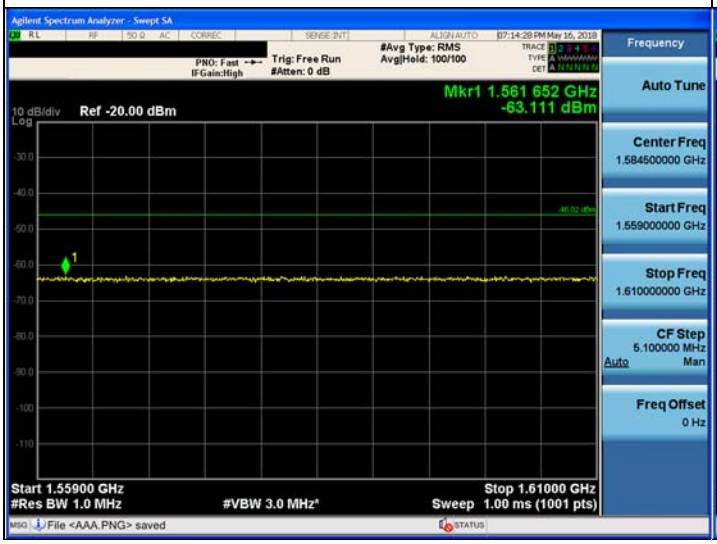
763 MHz ~ 775 MHz



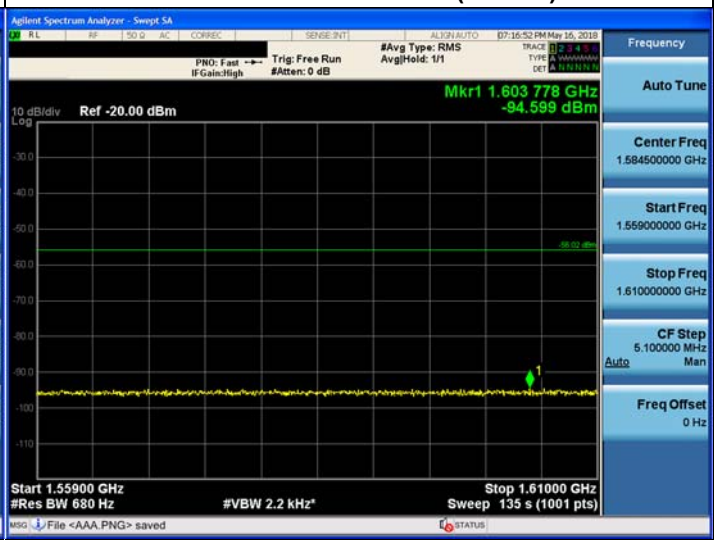
793 MHz ~ 805 MHz



1 559 MHz ~ 1 610 MHz



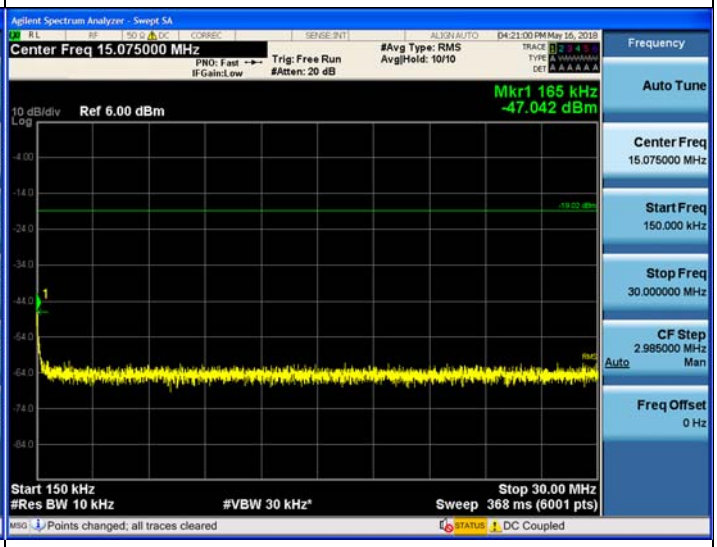
1 559 MHz ~ 1 610 MHz (700 Hz)



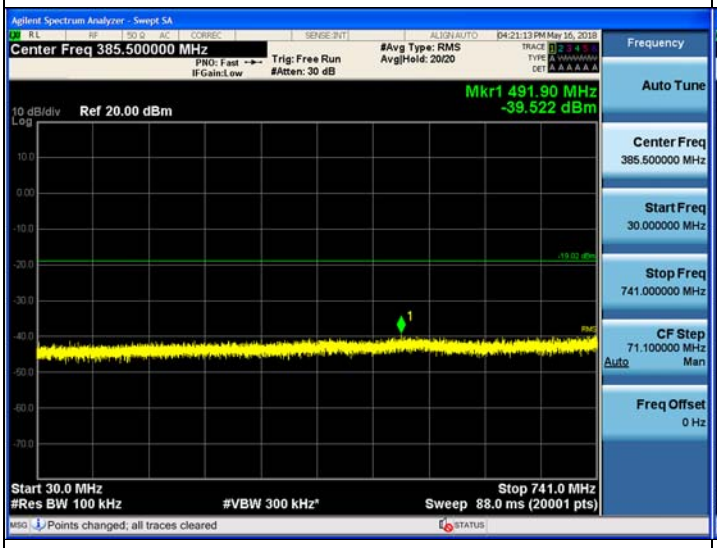
ANT 2

9 kHz ~ 150 kHz

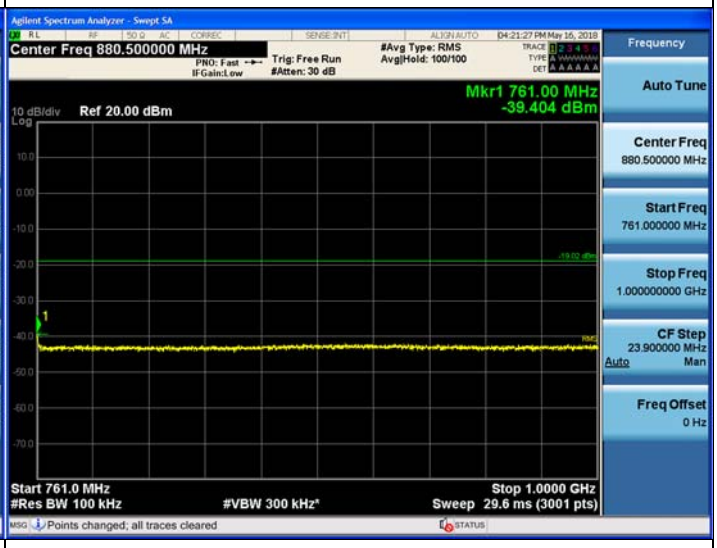
150 kHz ~ 30 MHz



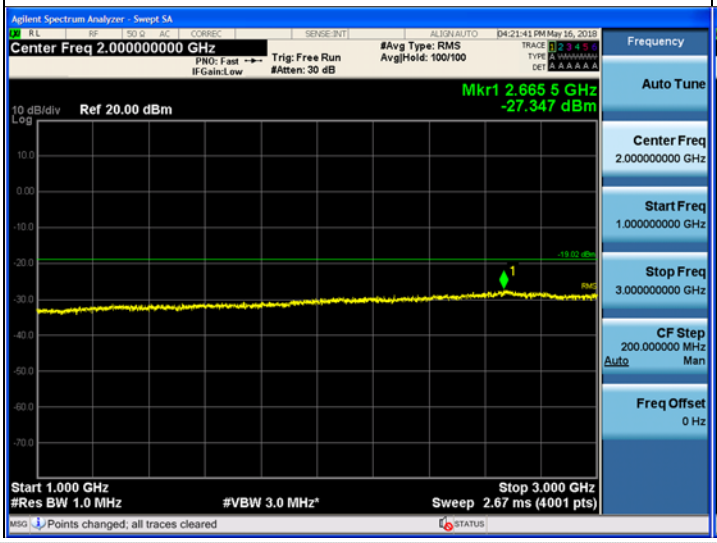
30 MHz ~ 741 MHz



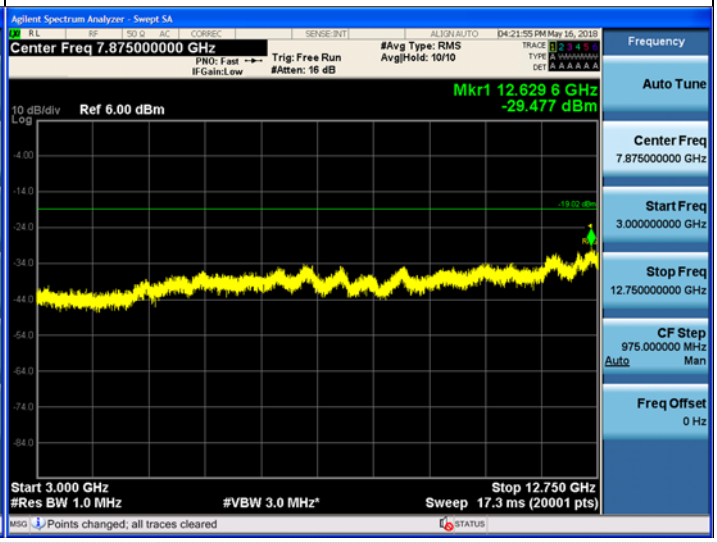
761 MHz ~ 1 GHz



1 GHz ~ 3 GHz

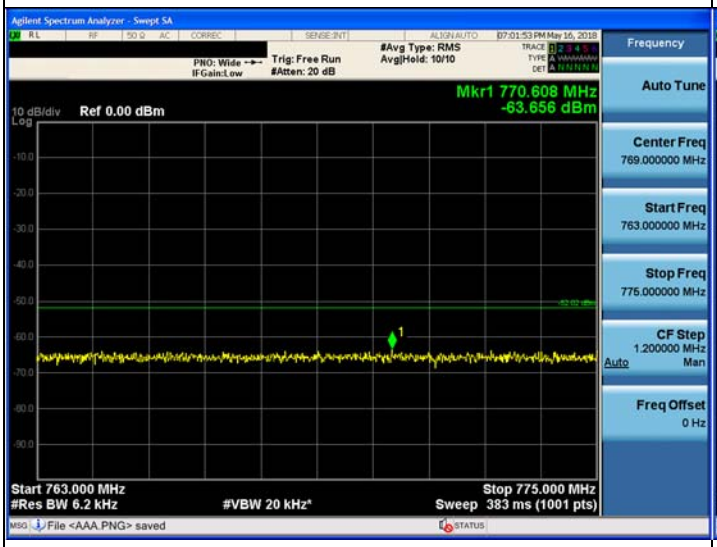


3 GHz ~ 12.75 GHz

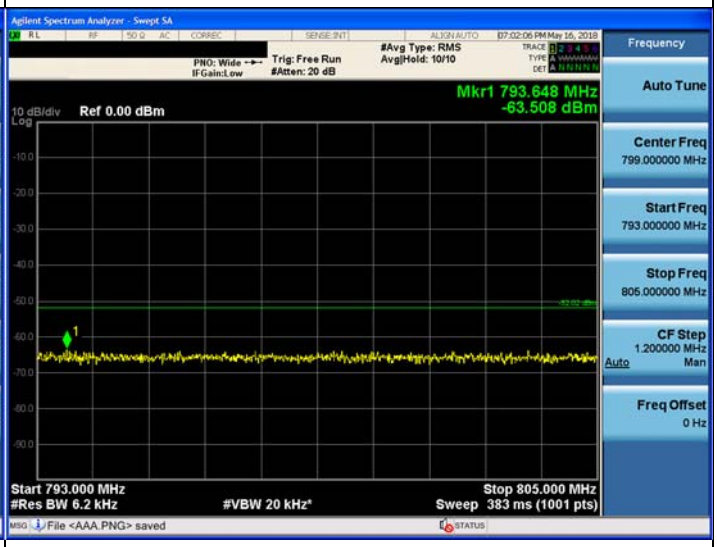


ANT 2

763 MHz ~ 775 MHz

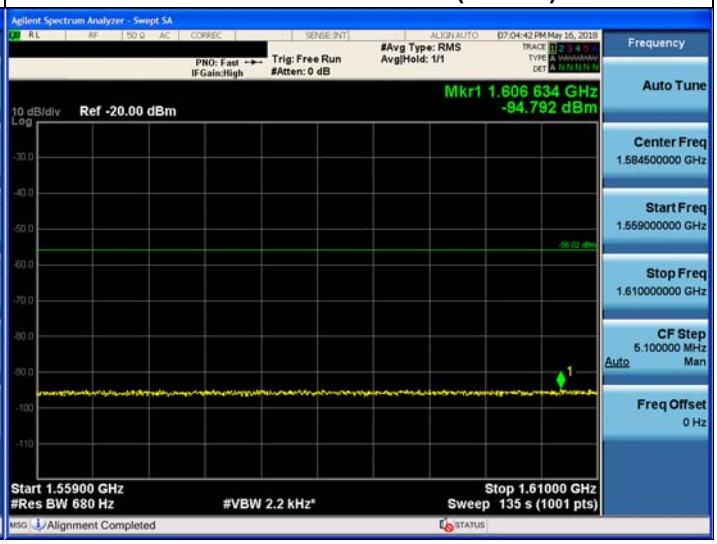


793 MHz ~ 805 MHz



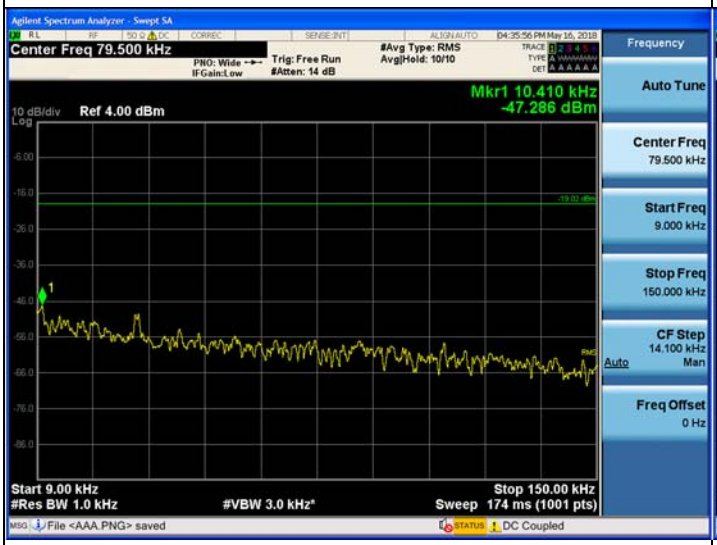
1 559 MHz ~ 1 610 MHz

1 559 MHz ~ 1 610 MHz (700 Hz)

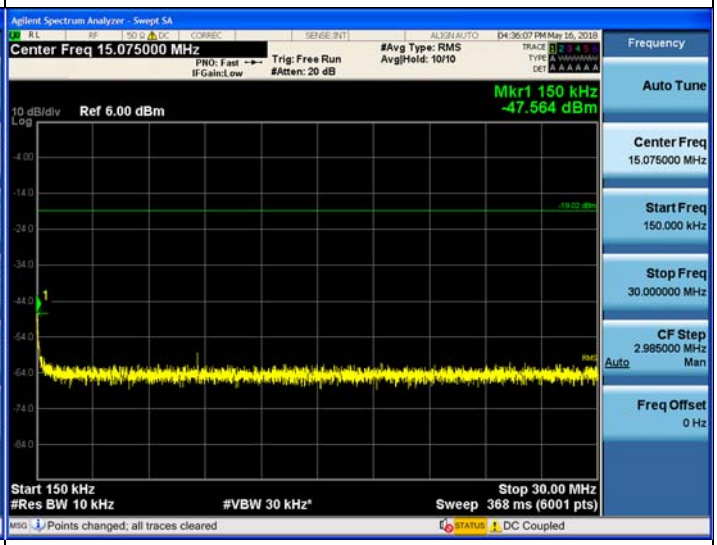


ANT 3

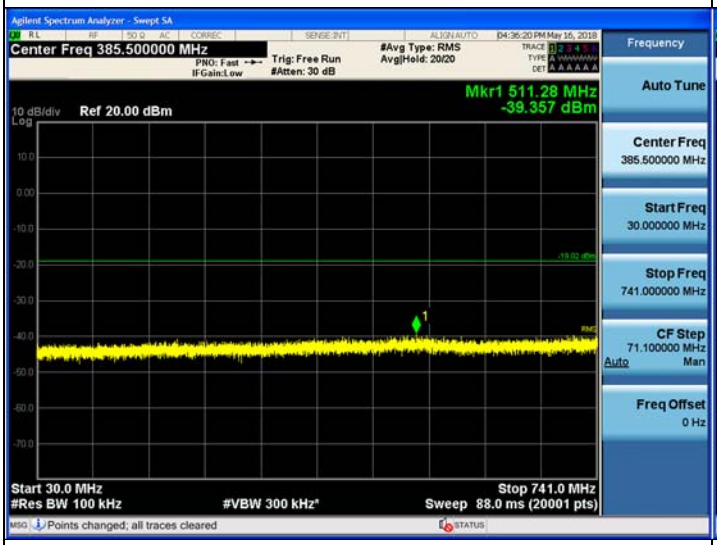
9 kHz ~ 150 kHz



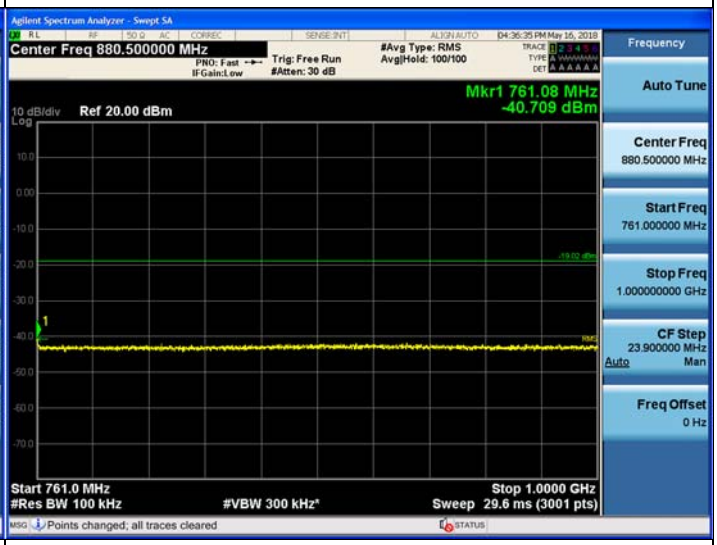
150 kHz ~ 30 MHz



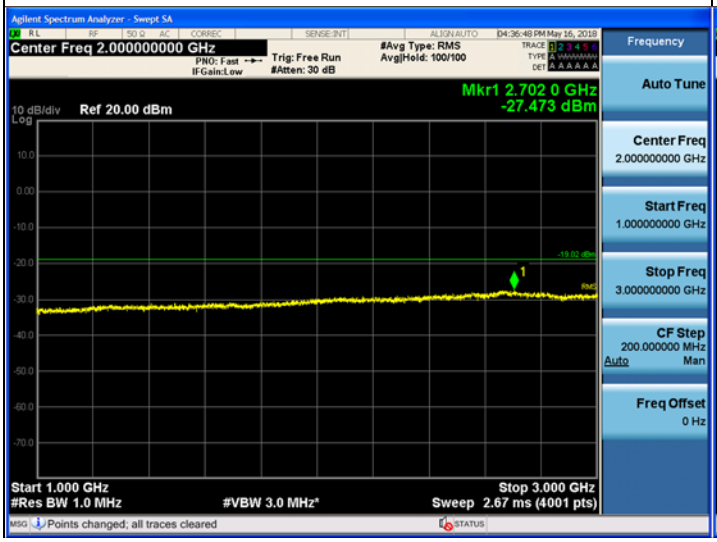
30 MHz ~ 741 MHz



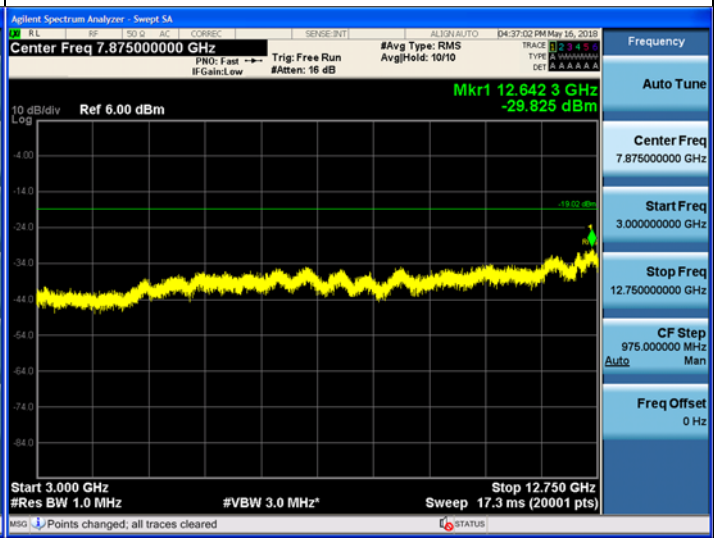
761 MHz ~ 1 GHz

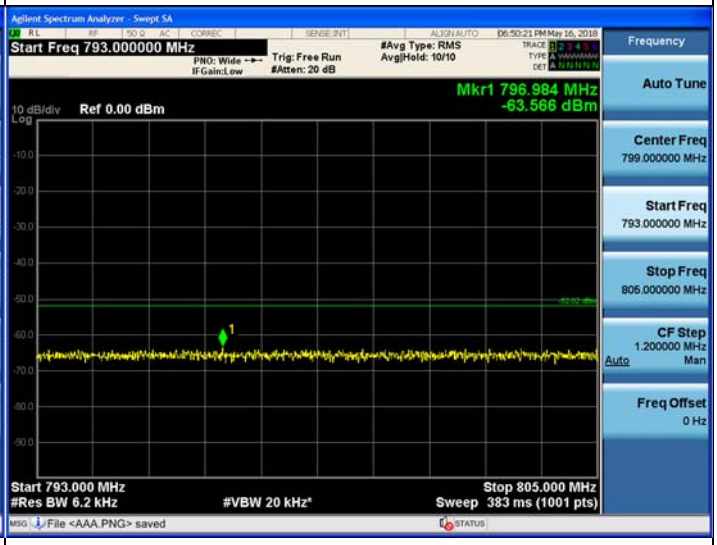
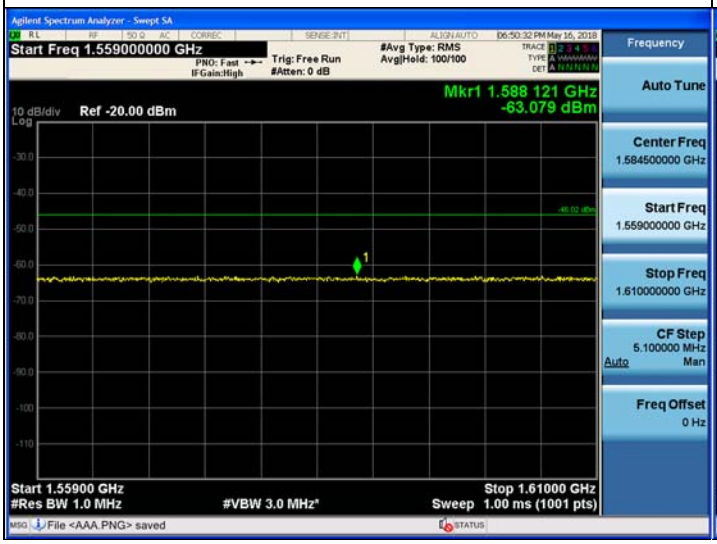


1 GHz ~ 3 GHz



3 GHz ~ 12.75 GHz



ANT 3	
763 MHz ~ 775 MHz	793 MHz ~ 805 MHz
	
1 559 MHz ~ 1 610 MHz	1 559 MHz ~ 1 610 MHz (700 Hz)