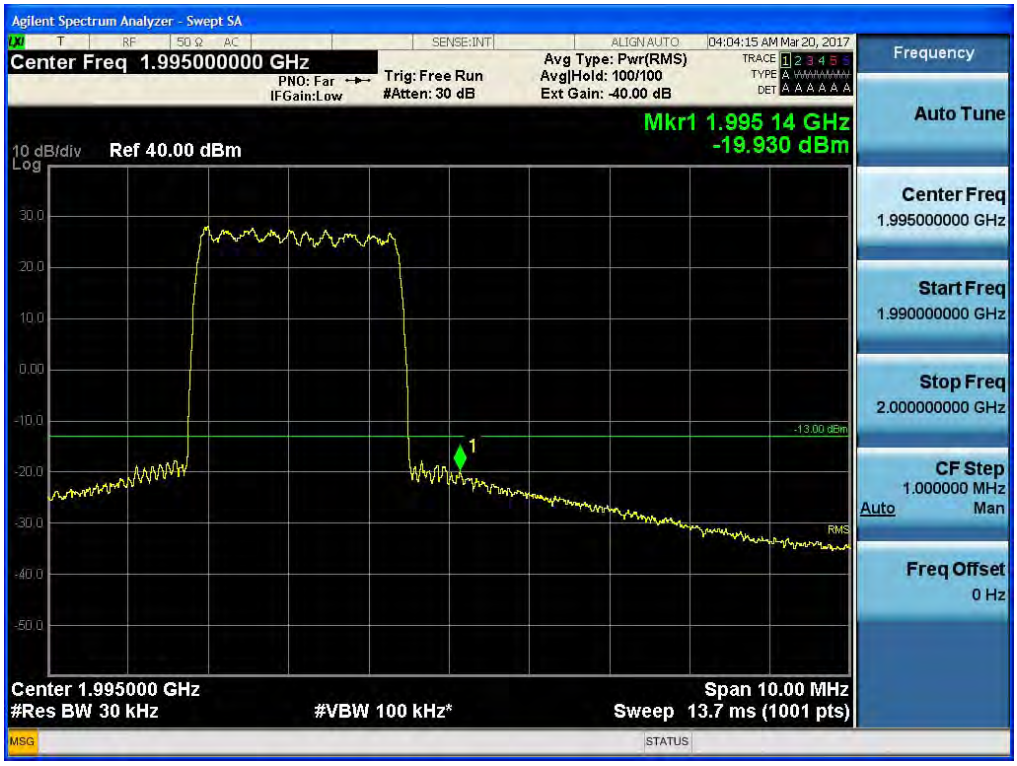
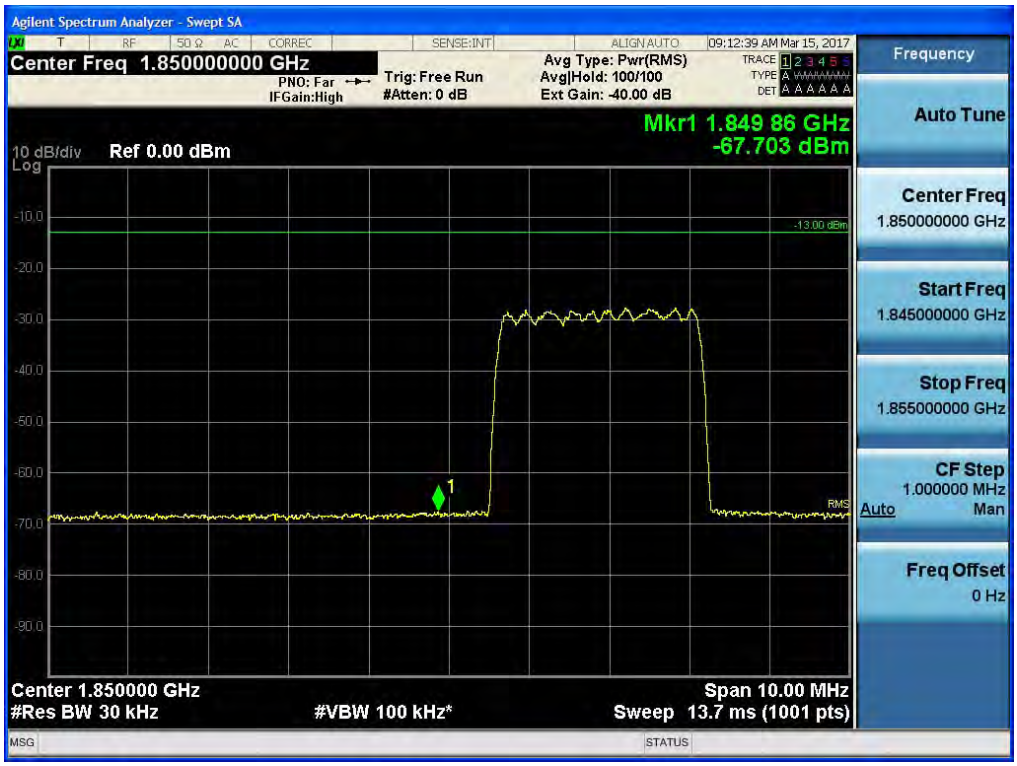
Intermodulation Spurious Emissions for PCS 1900_CDMA

[Downlink Low]

[Downlink High]



[Uplink Low]



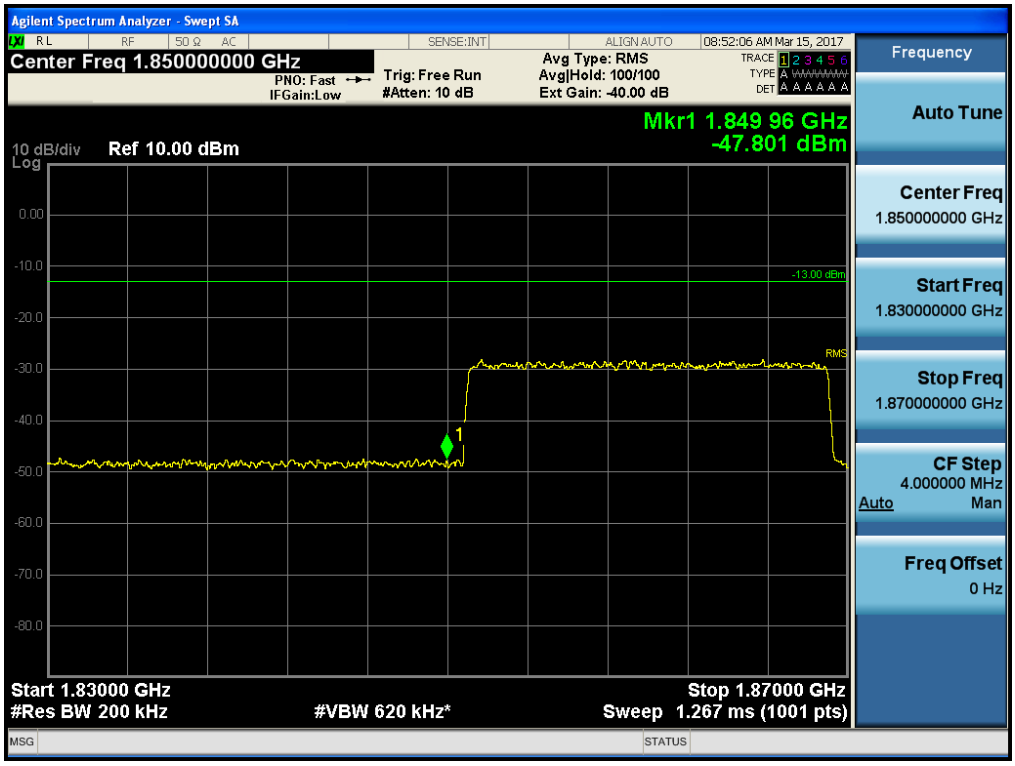
[Uplink High]

Single channel Enhancer Band Edge for PCS 1900_LTE 20 MHz

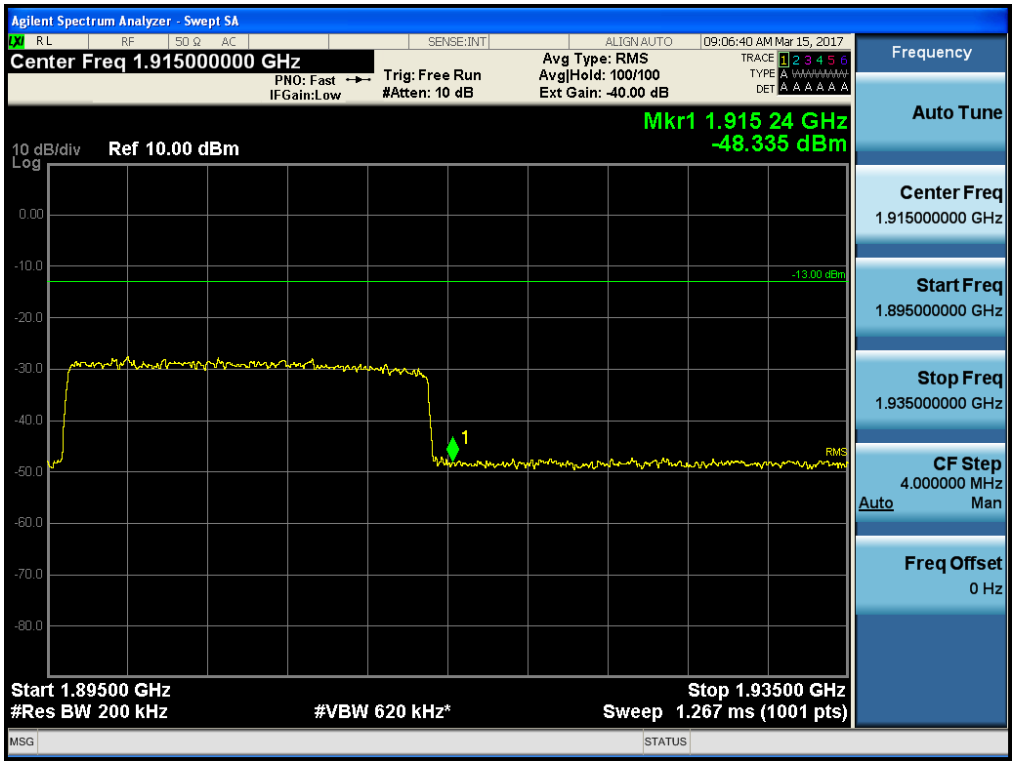
[Downlink Low]

[Downlink High]

[Uplink Low]

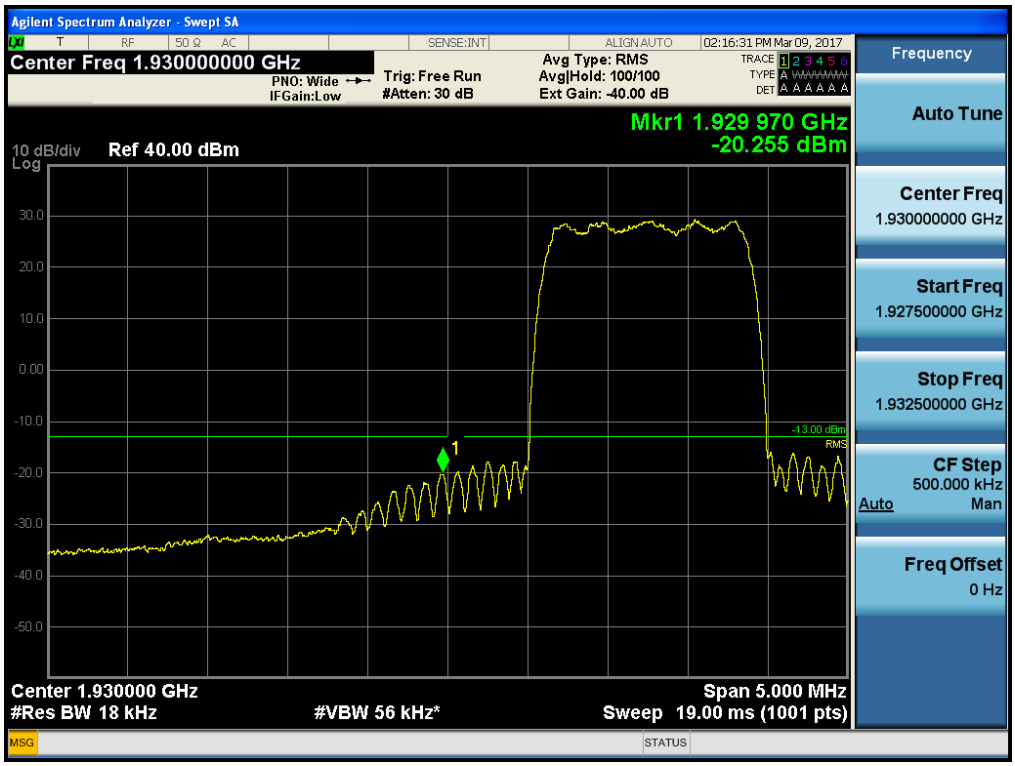


[Uplink High]



Single channel Enhancer Band Edge for PCS 1900_CDMA

[Downlink Low]



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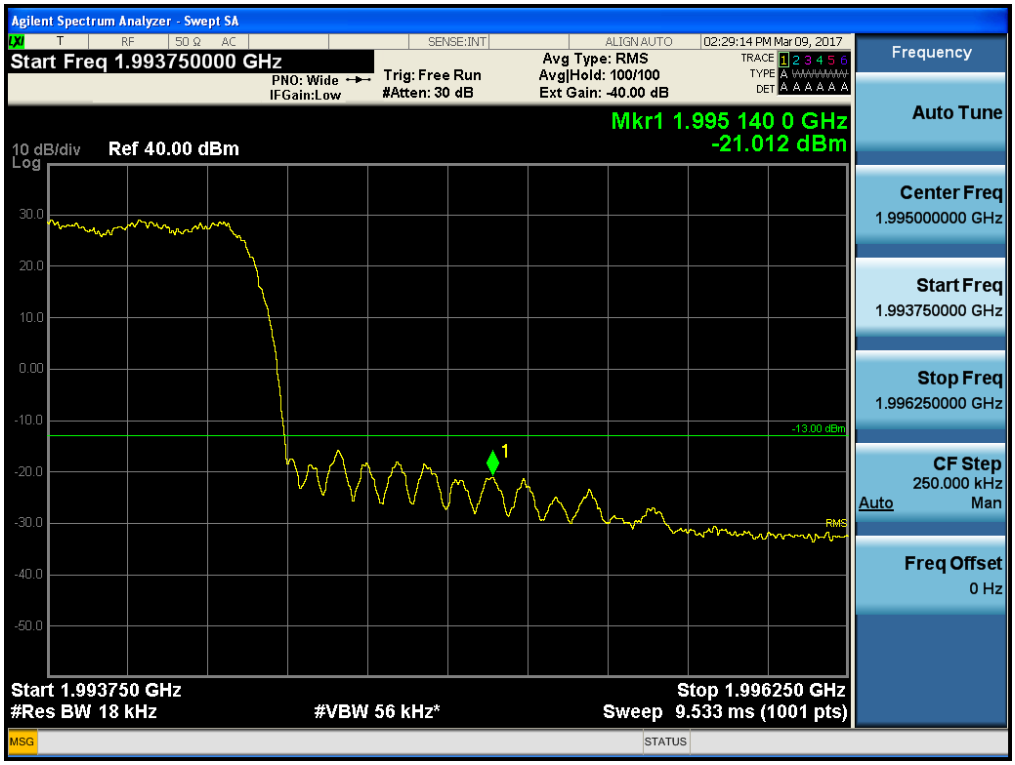

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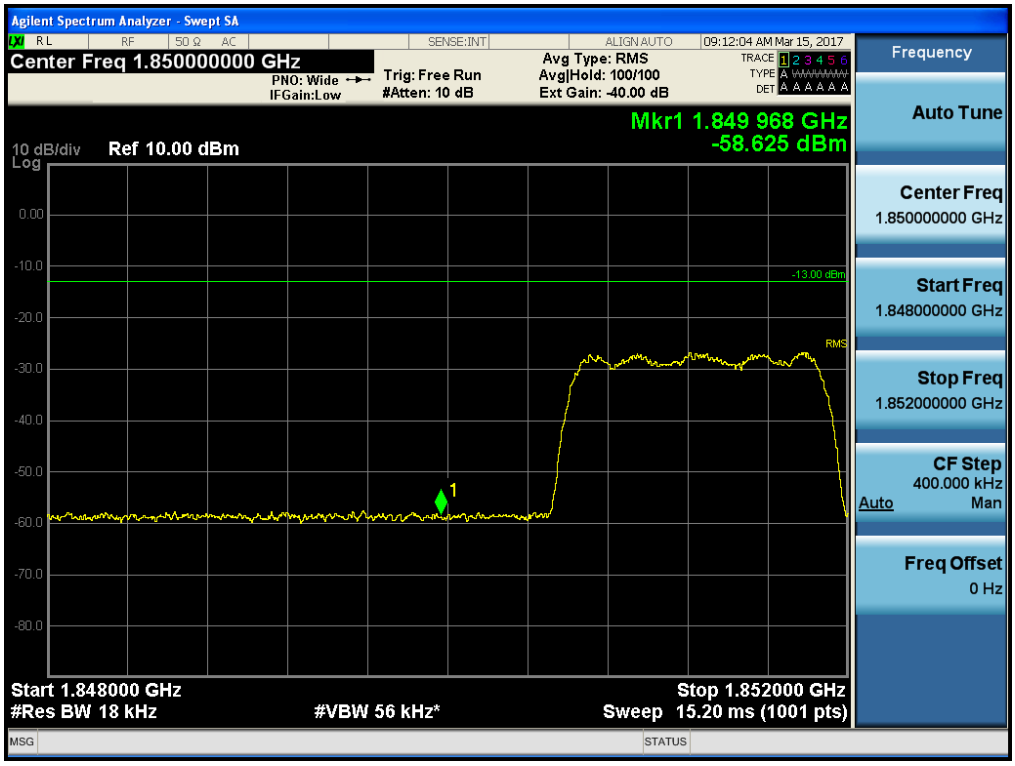

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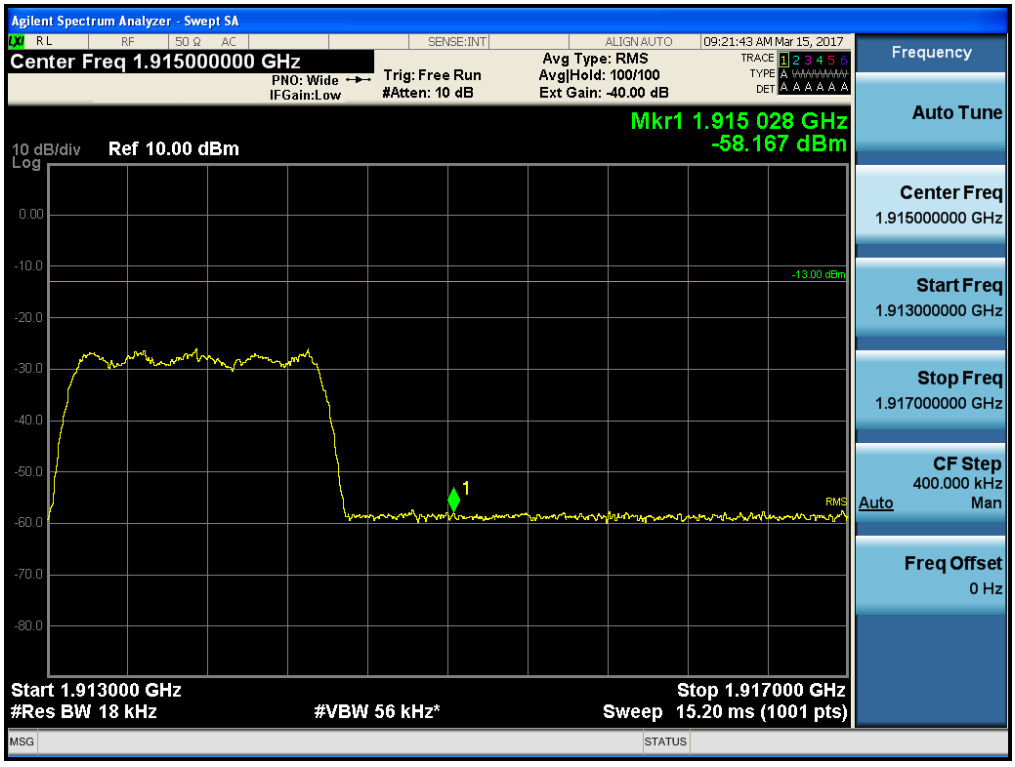
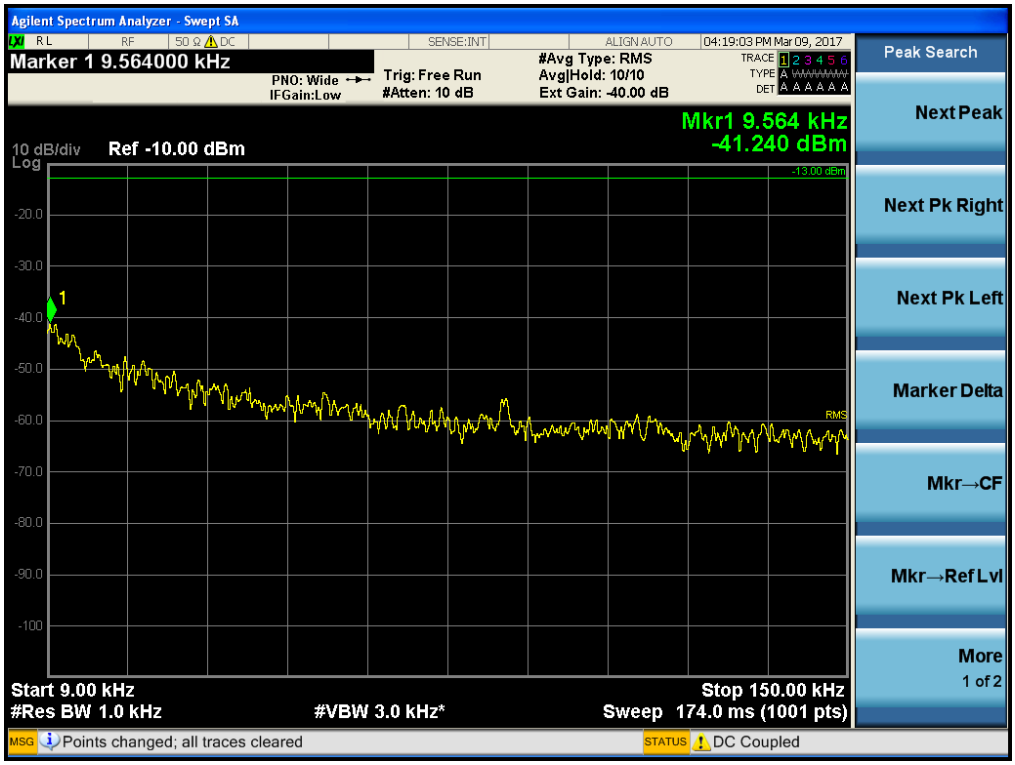


Plots of Spurious Emission for AWS 2100_LTE 20 MHz

Conducted Spurious Emissions (9 kHz – 150 kHz)

[Downlink Low]



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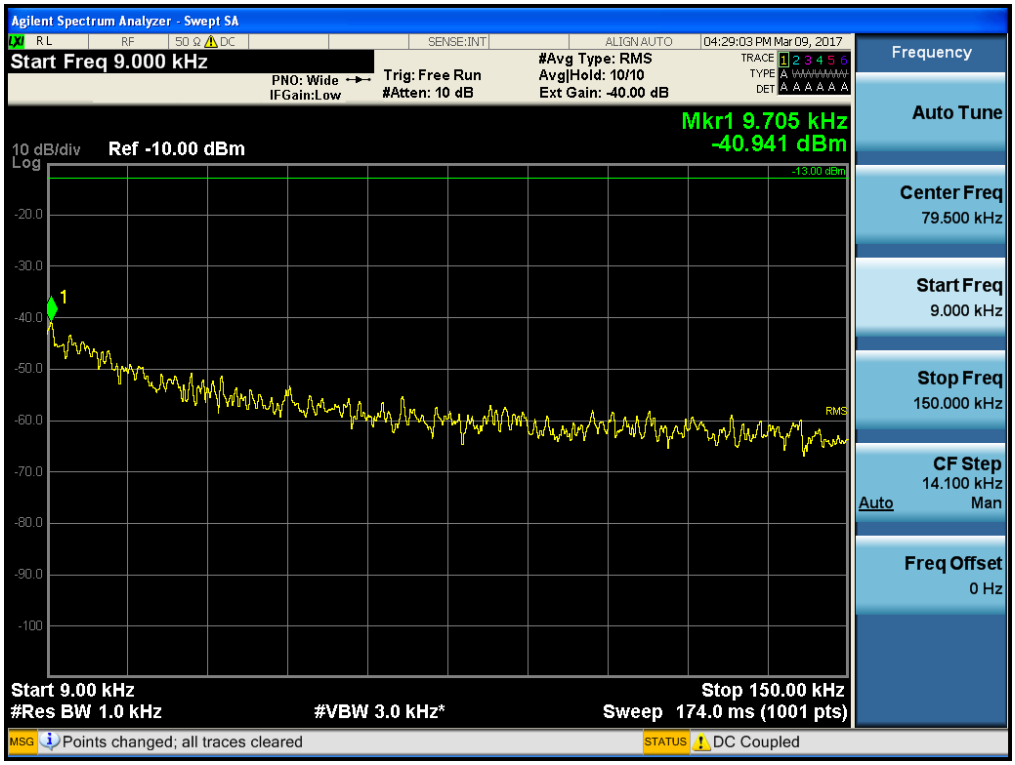

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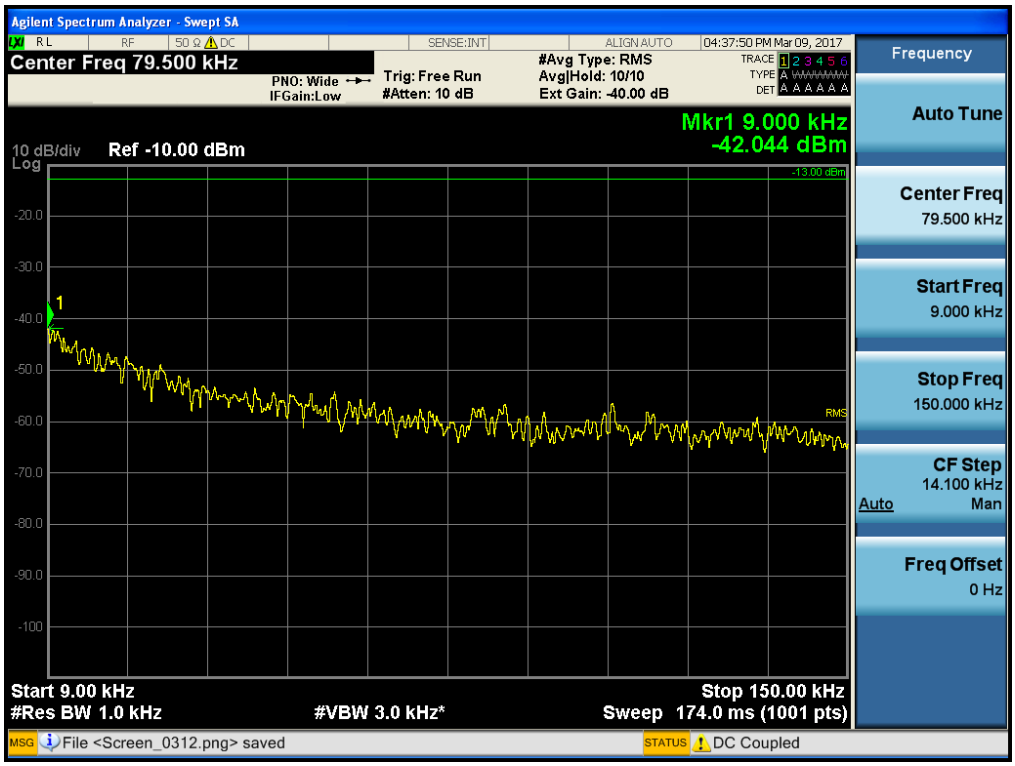
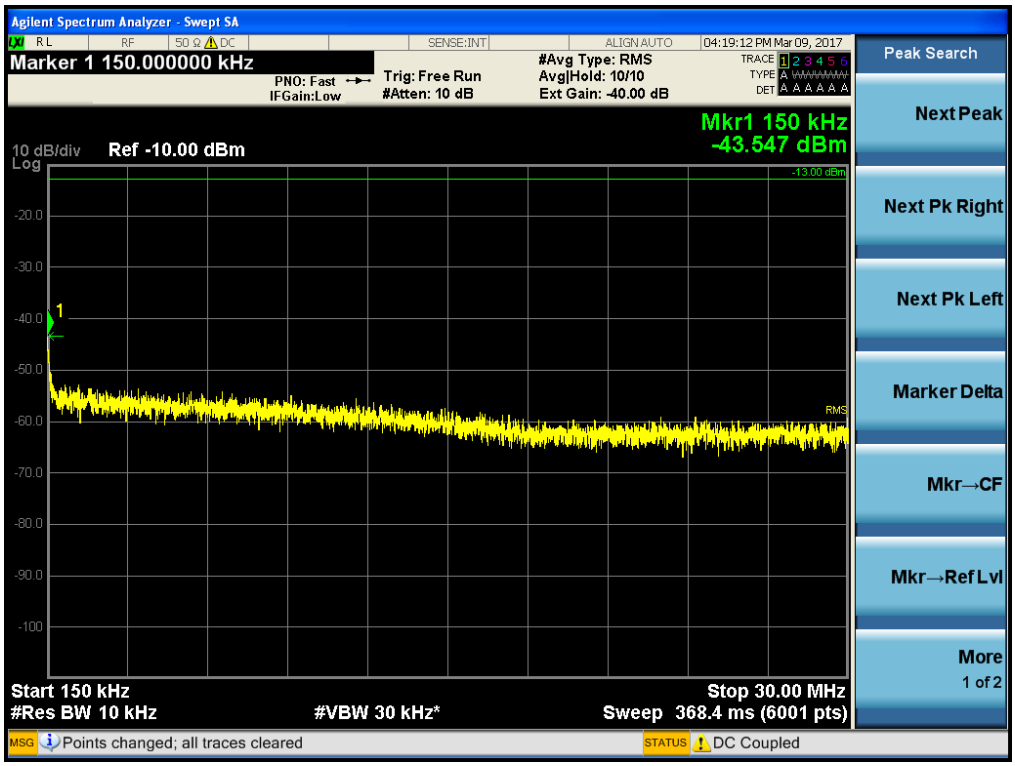


Conducted Spurious Emissions (150 kHz – 30 MHz)

[Downlink Low]



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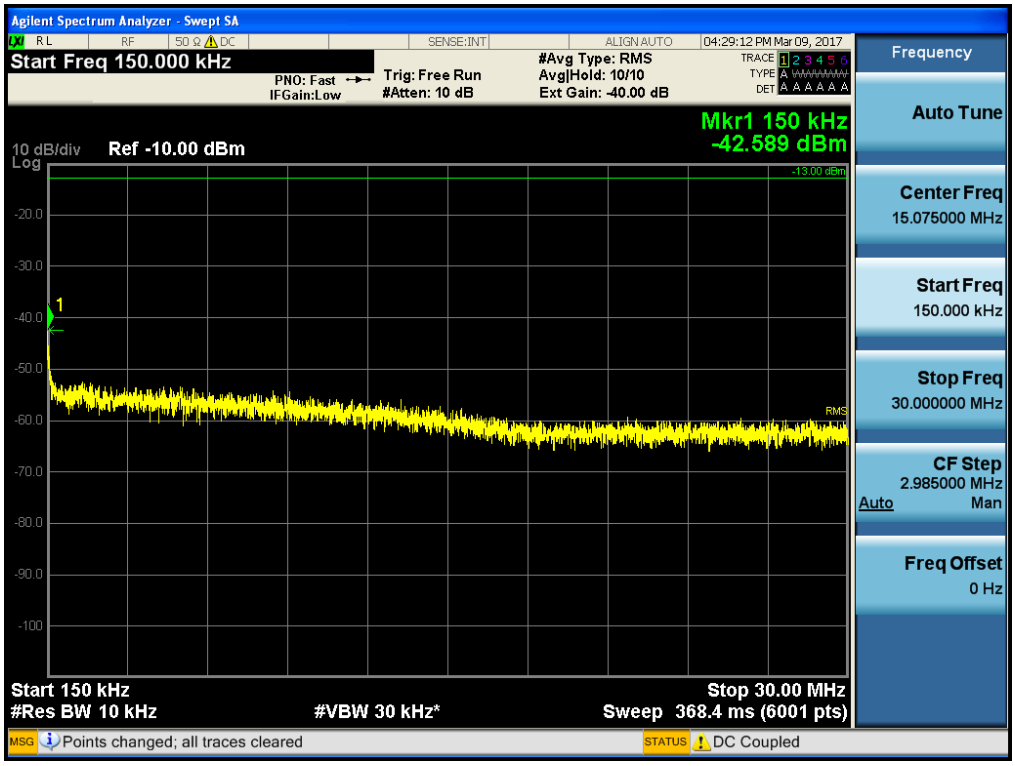

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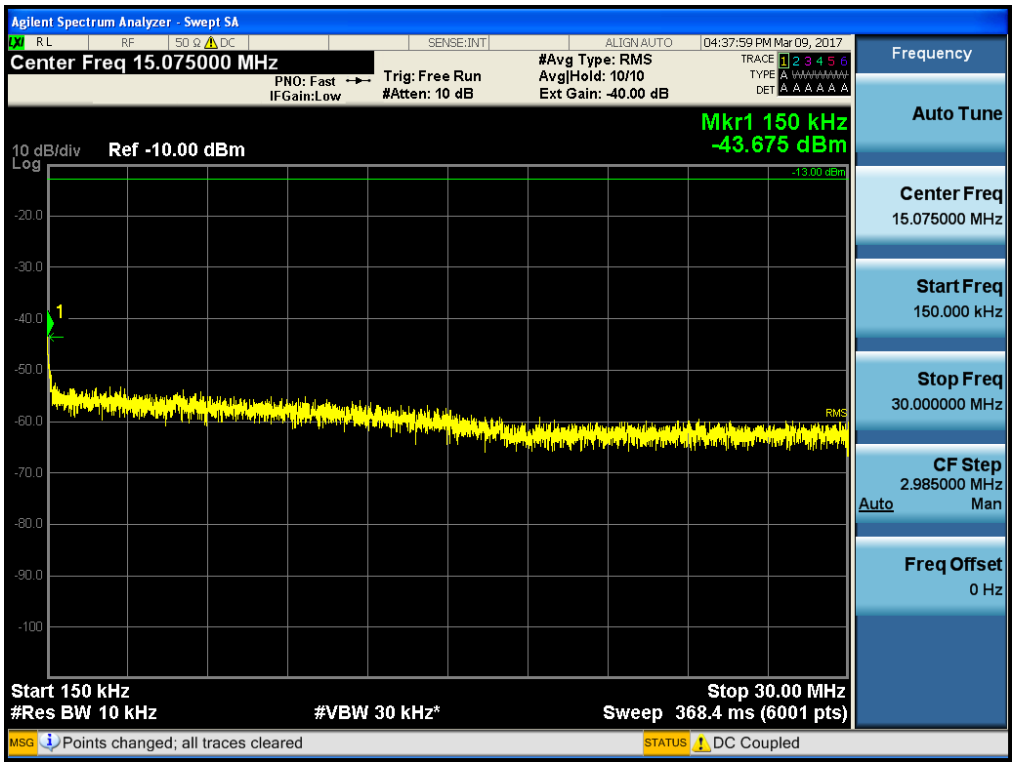
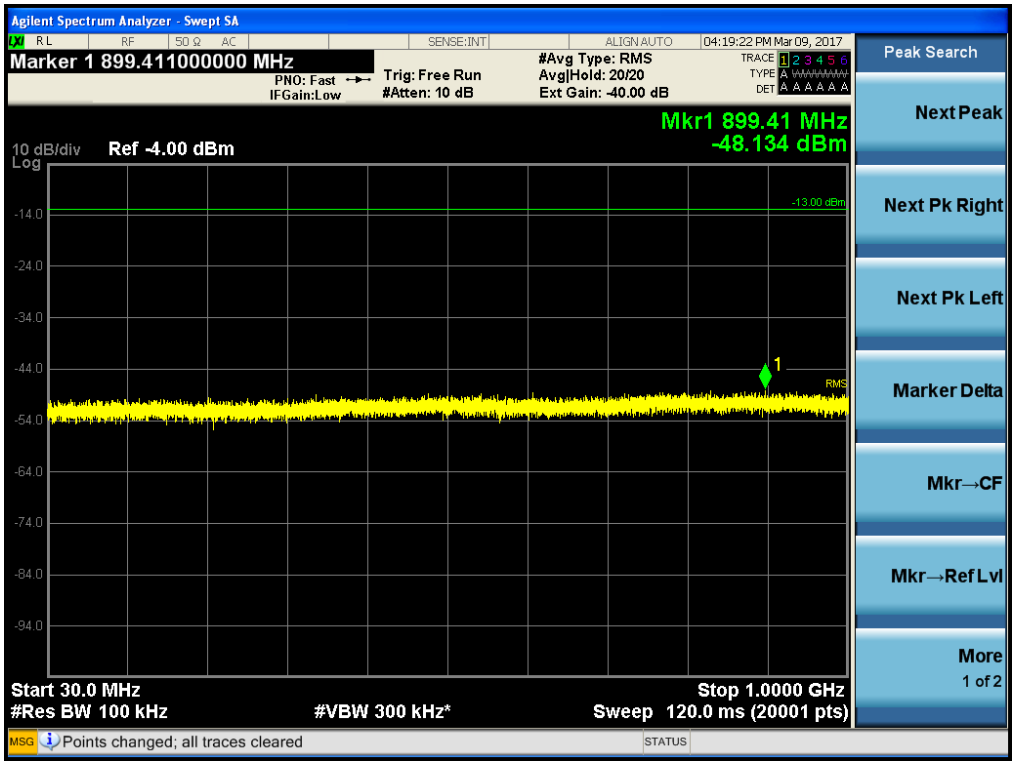
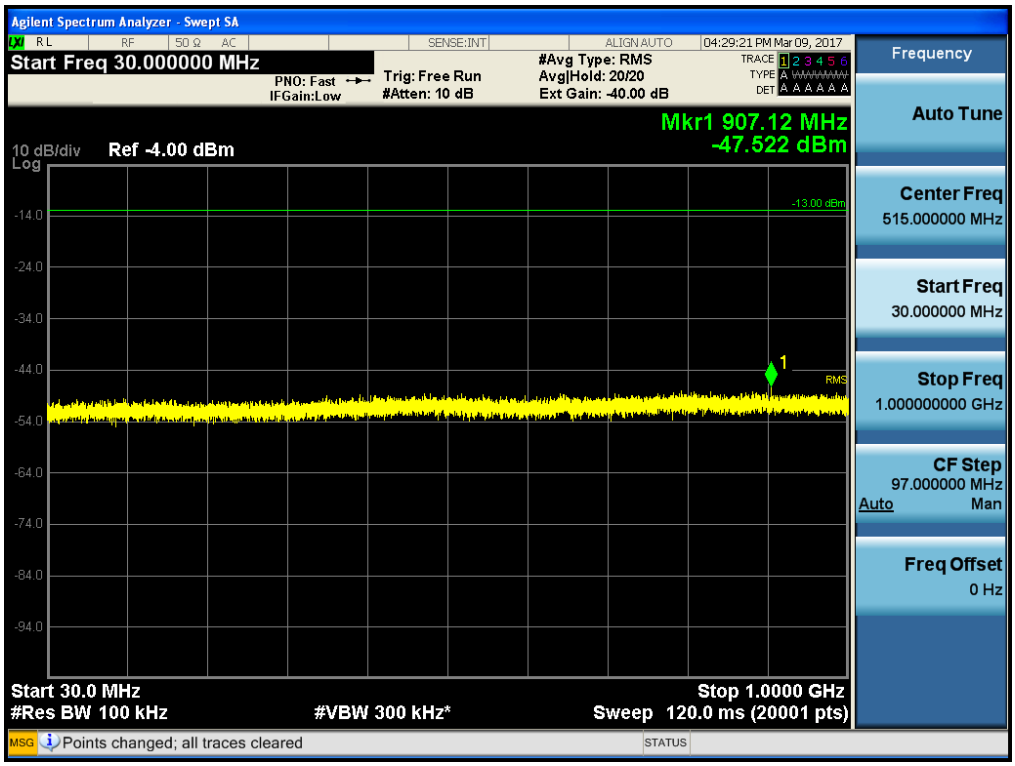


Conducted Spurious Emissions (30 MHz – 1 GHz)

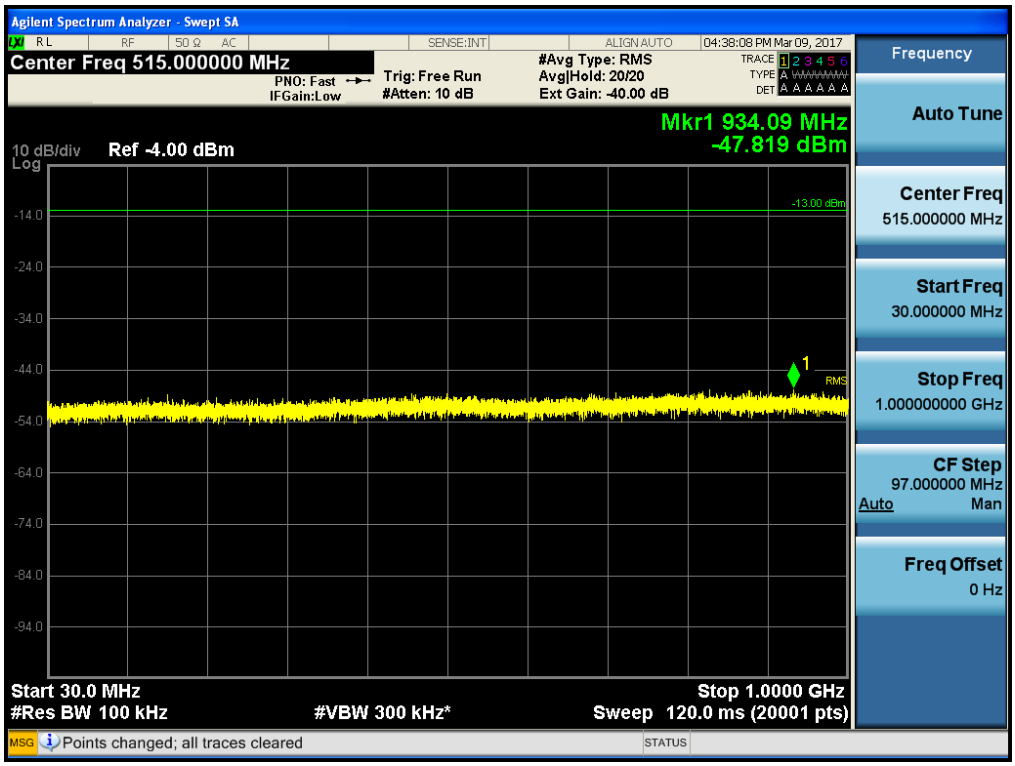
[Downlink Low]



[Downlink Middle]

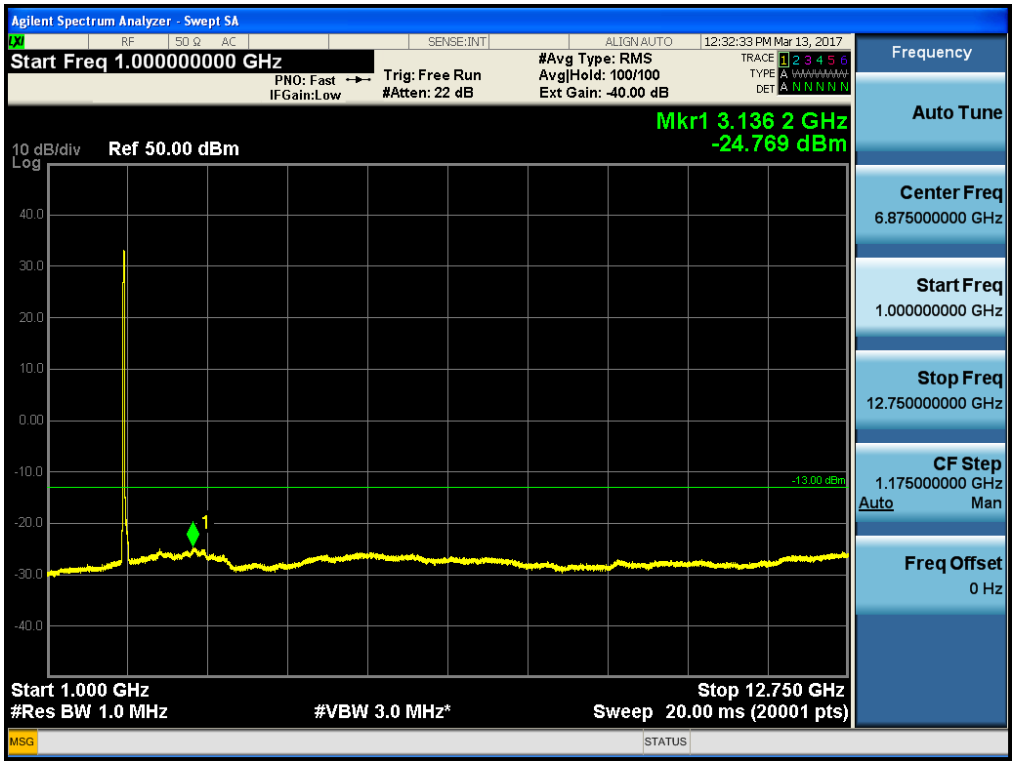


[Downlink High]



Conducted Spurious Emissions (1 GHz – 12.75 GHz)

[Downlink Low]



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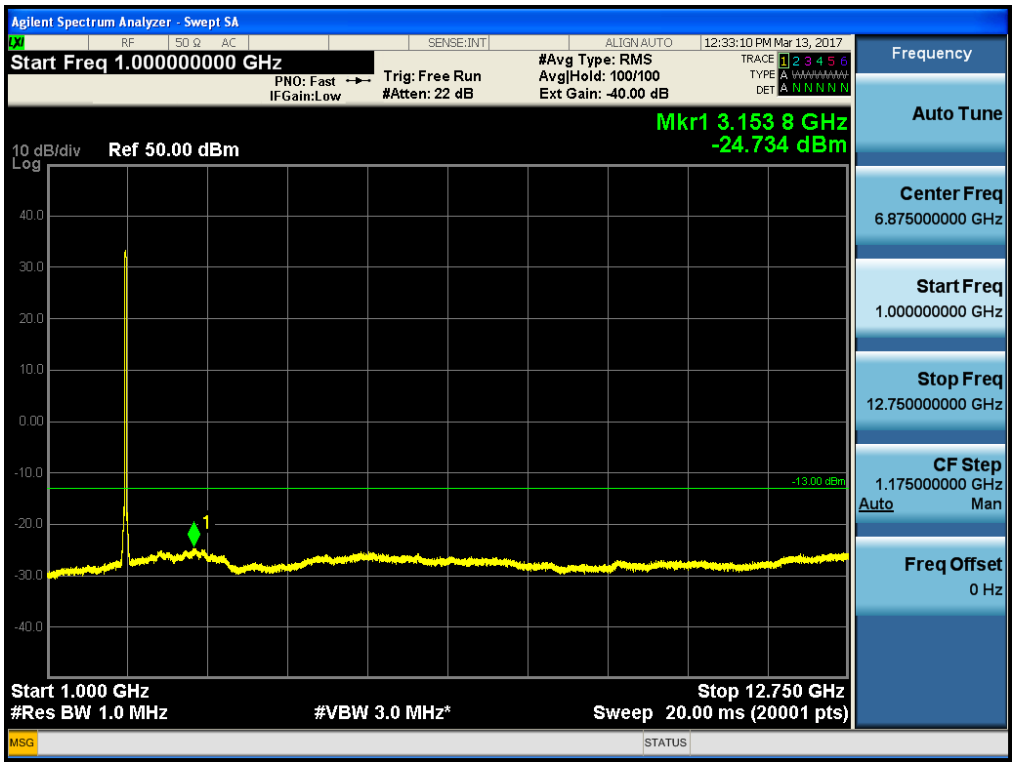
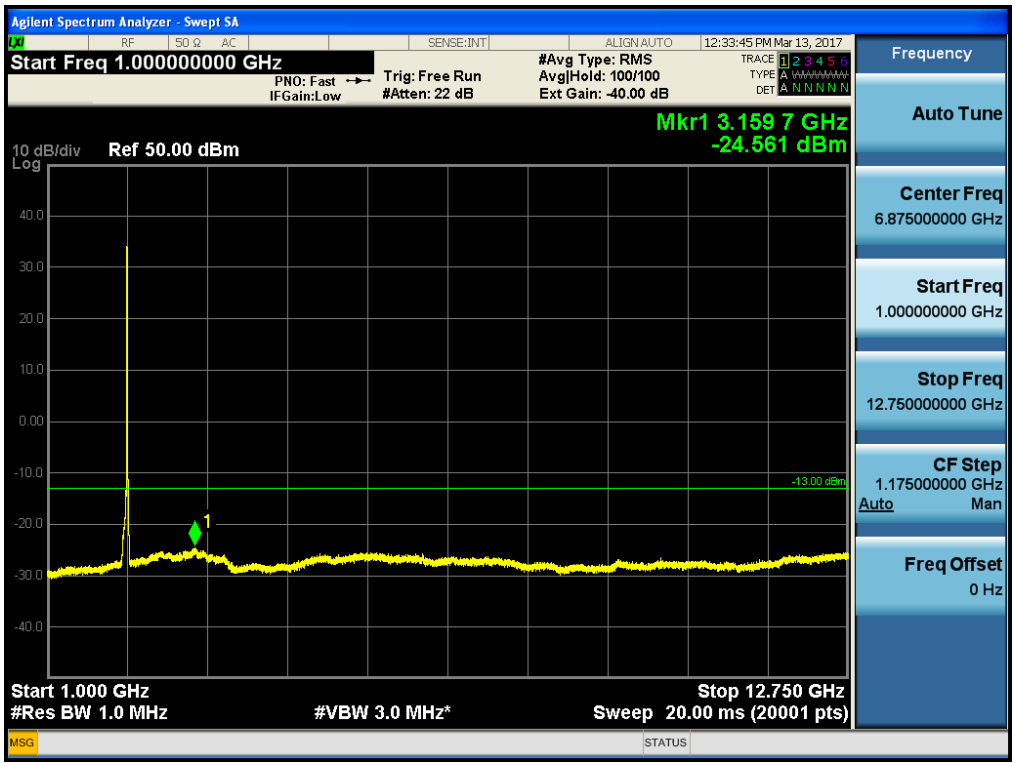


[Downlink High]



Conducted Spurious Emissions (12.75 GHz – 26.5 GHz)

[Downlink Low]

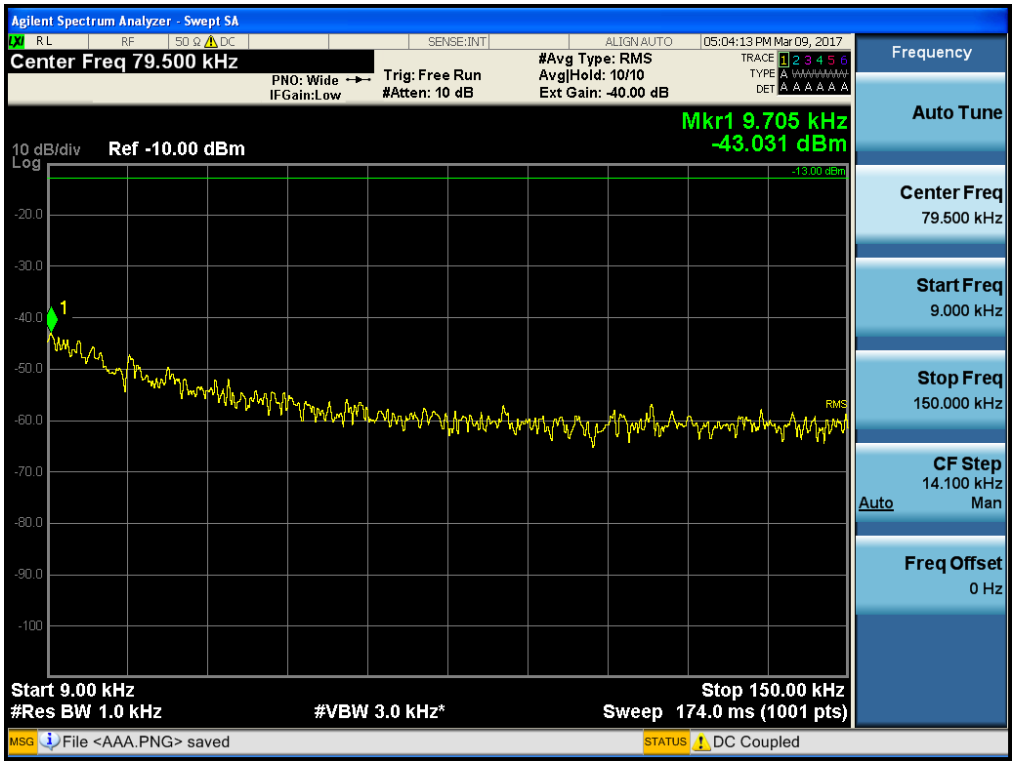
[Downlink Middle]

[Downlink High]

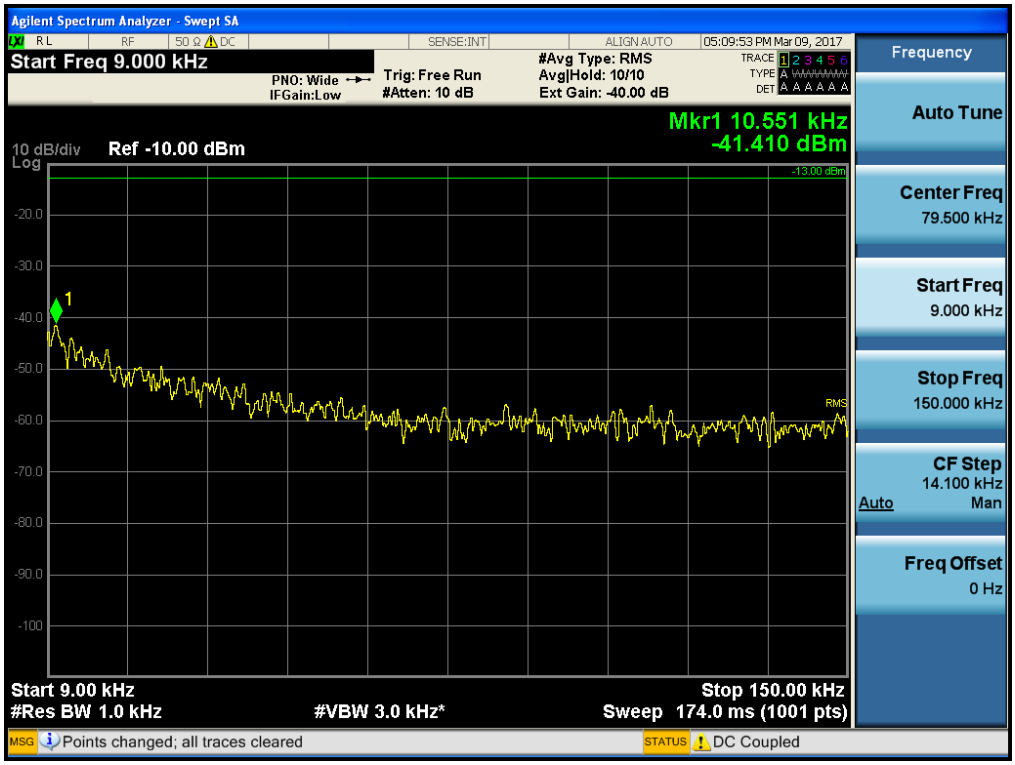
Plots of Spurious Emission for AWS 2100_CDMA

Conducted Spurious Emissions (9 kHz – 150 kHz)

[Downlink Low]



[Downlink Middle]



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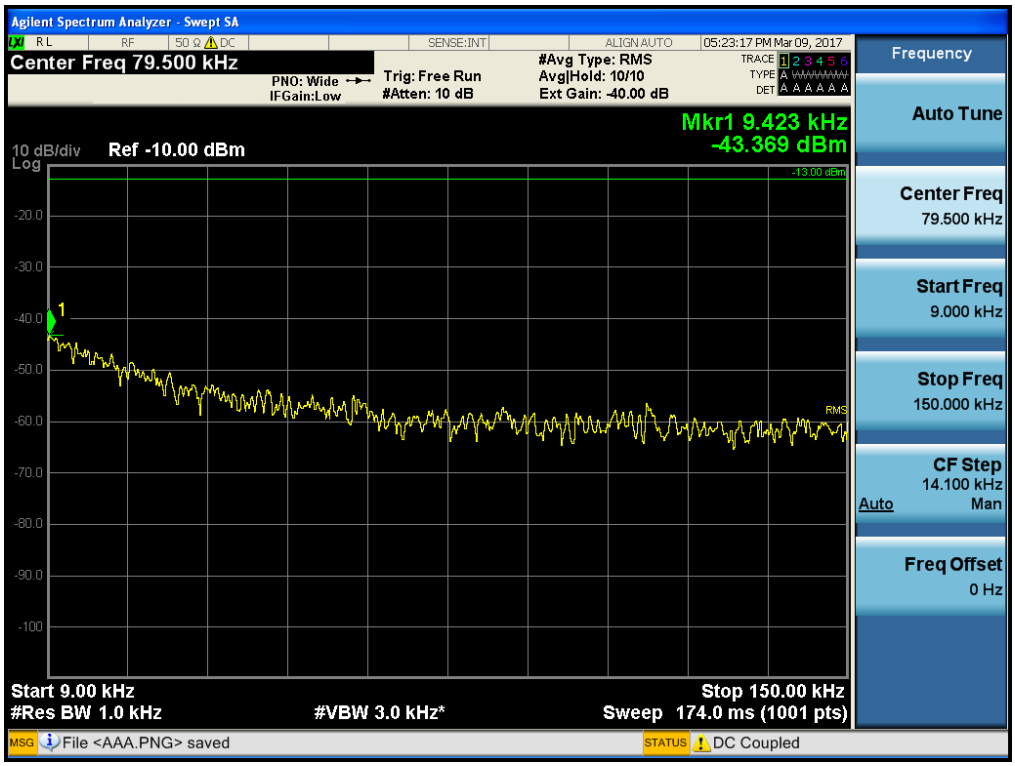
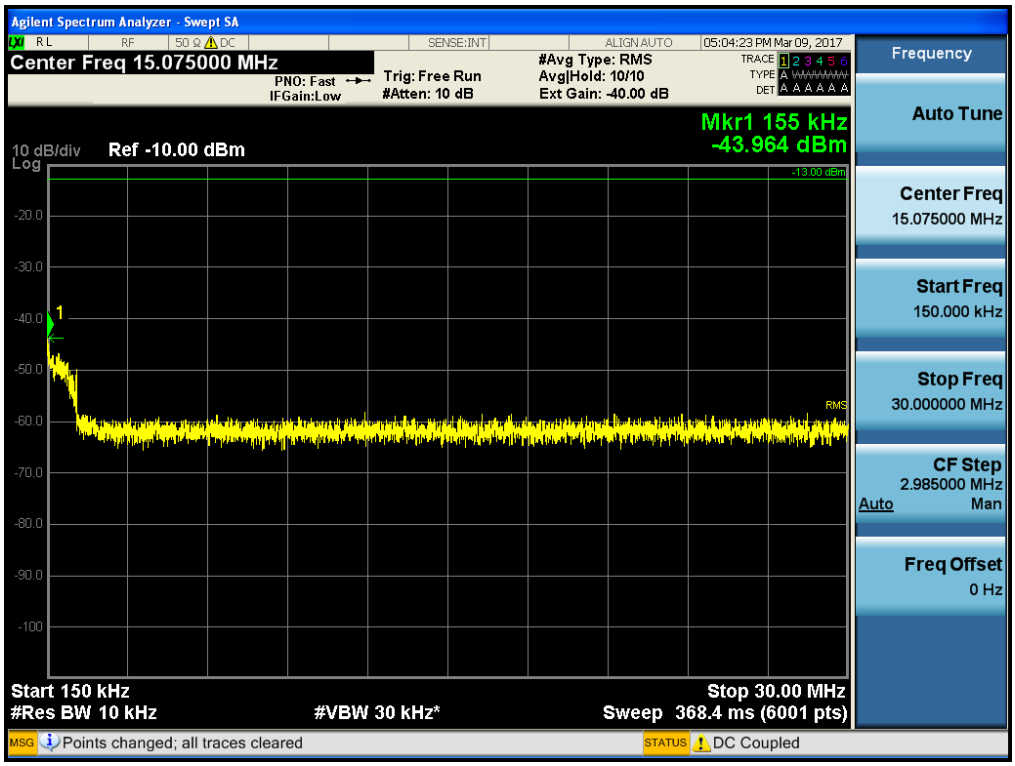


Conducted Spurious Emissions (150 kHz – 30 MHz)

[Downlink Low]



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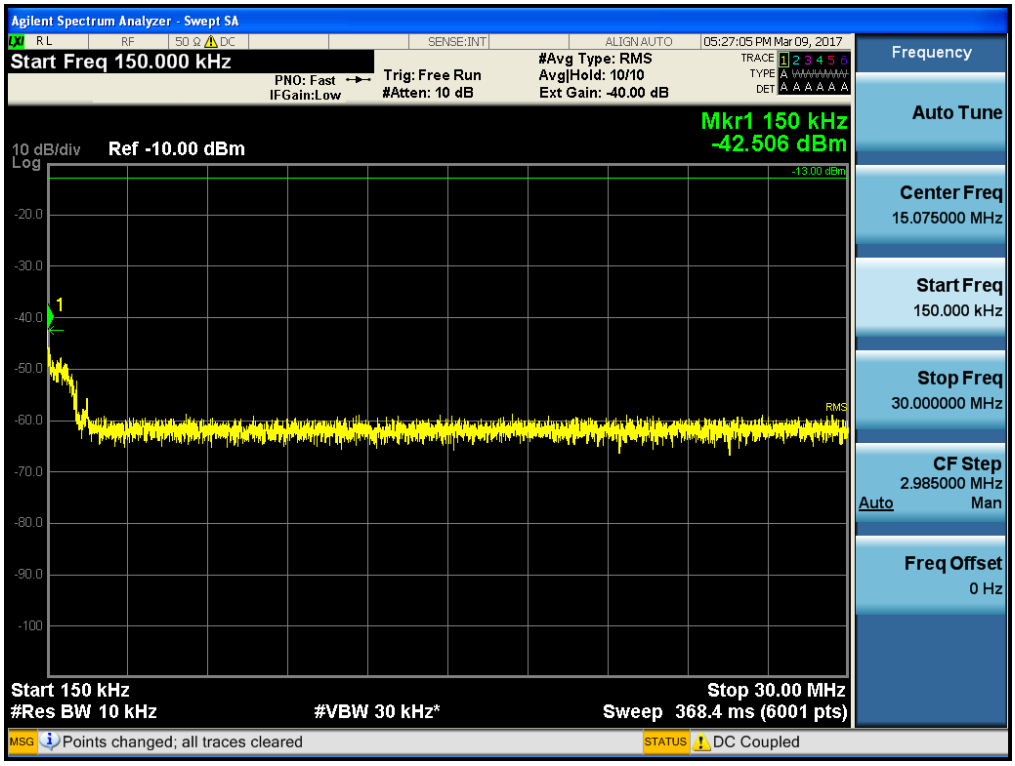

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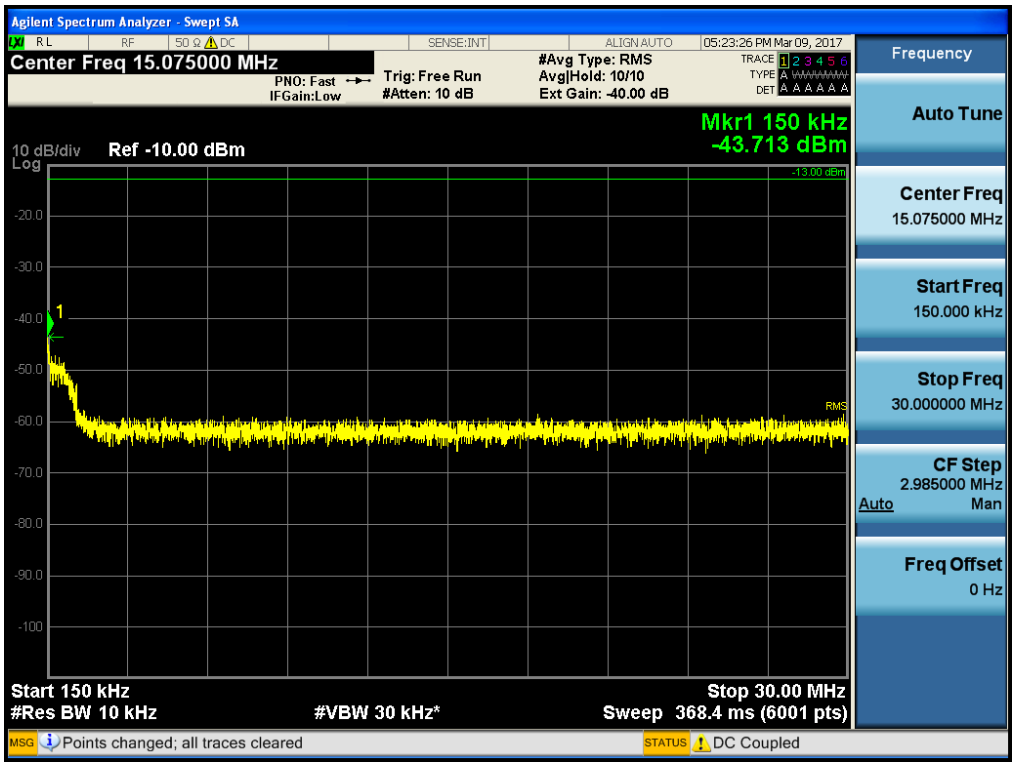
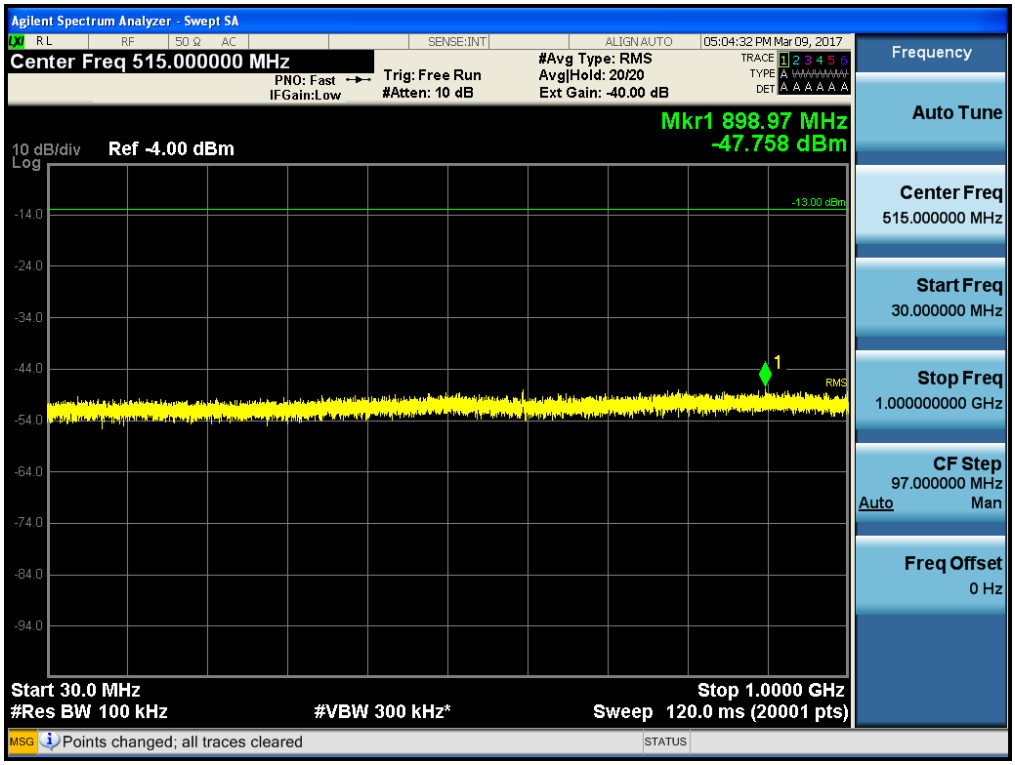
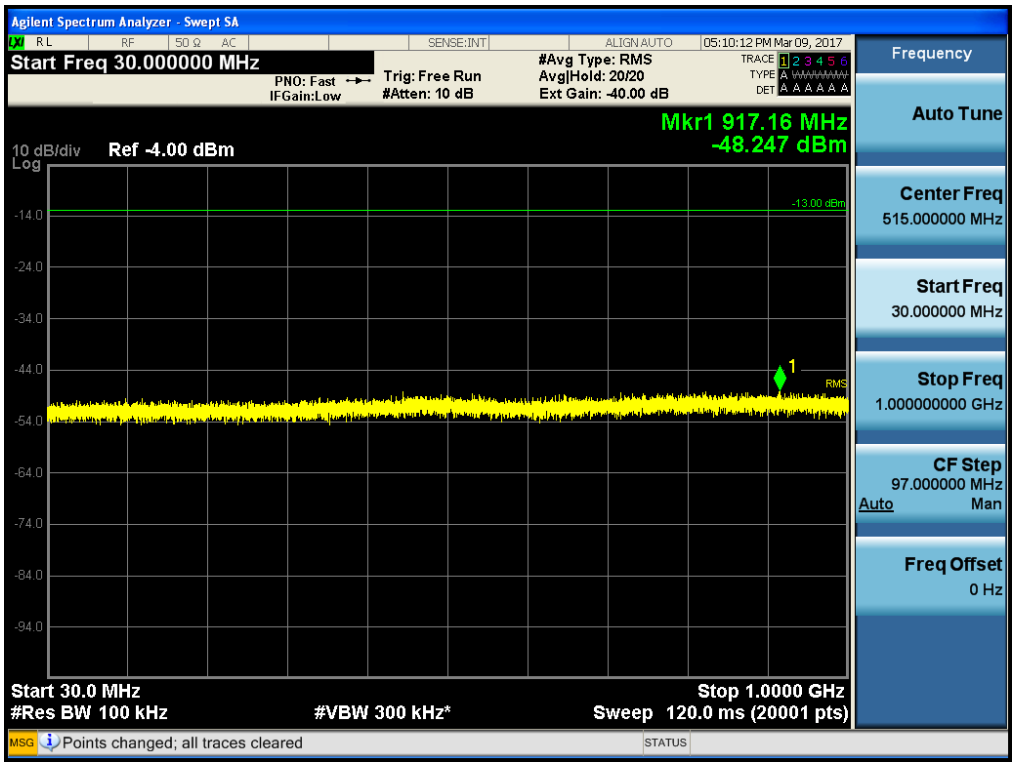


Conducted Spurious Emissions (30 MHz – 1 GHz)

[Downlink Low]



[Downlink Middle]



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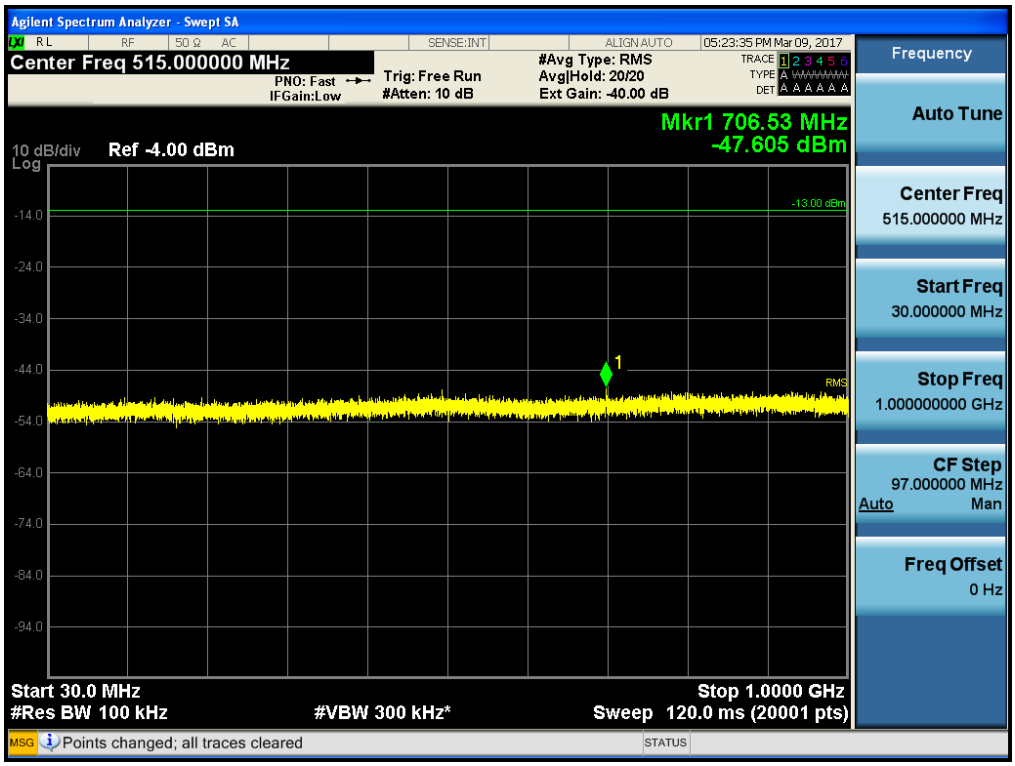
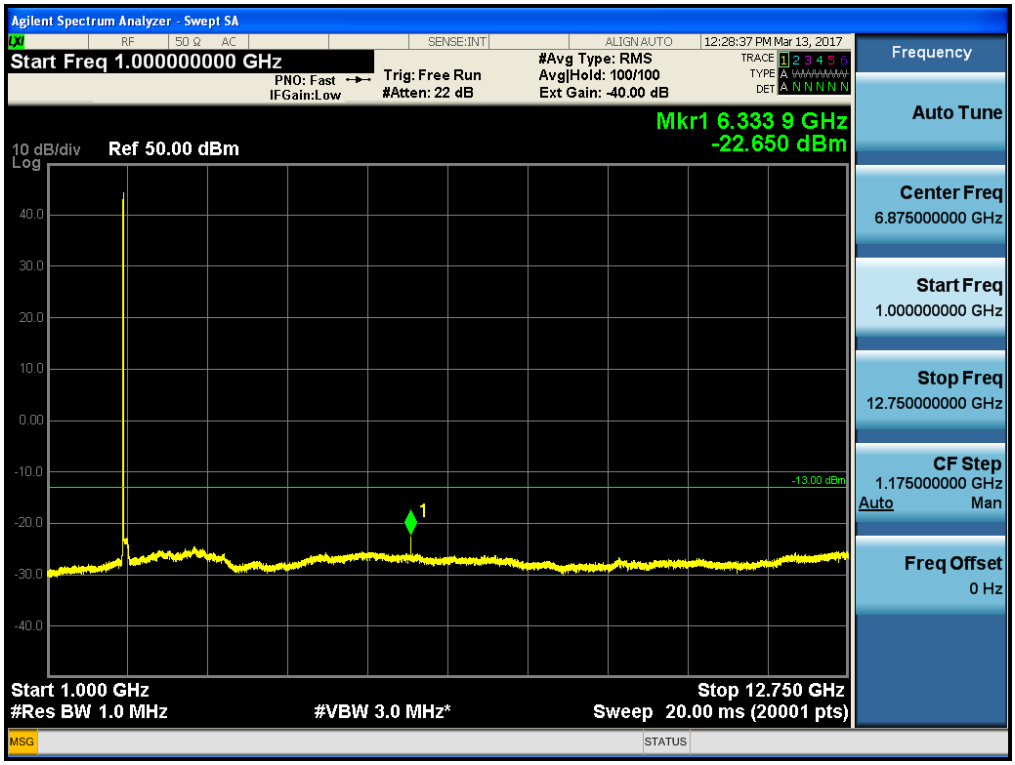


Conducted Spurious Emissions (1 GHz – 12.75 GHz)

[Downlink Low]



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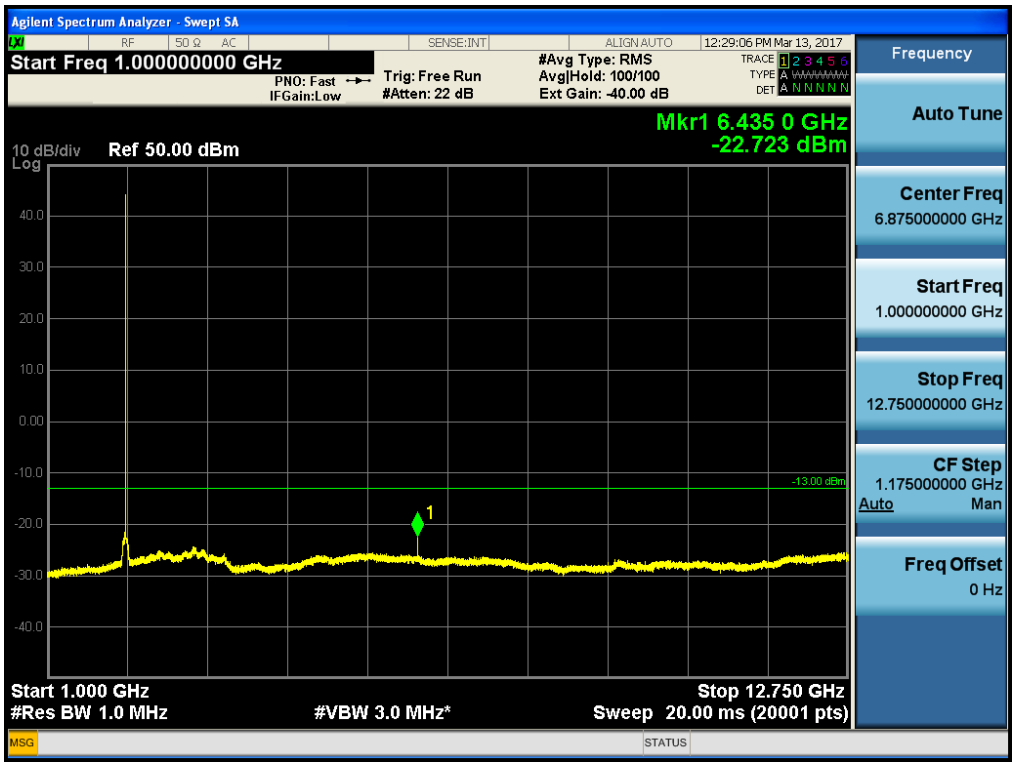

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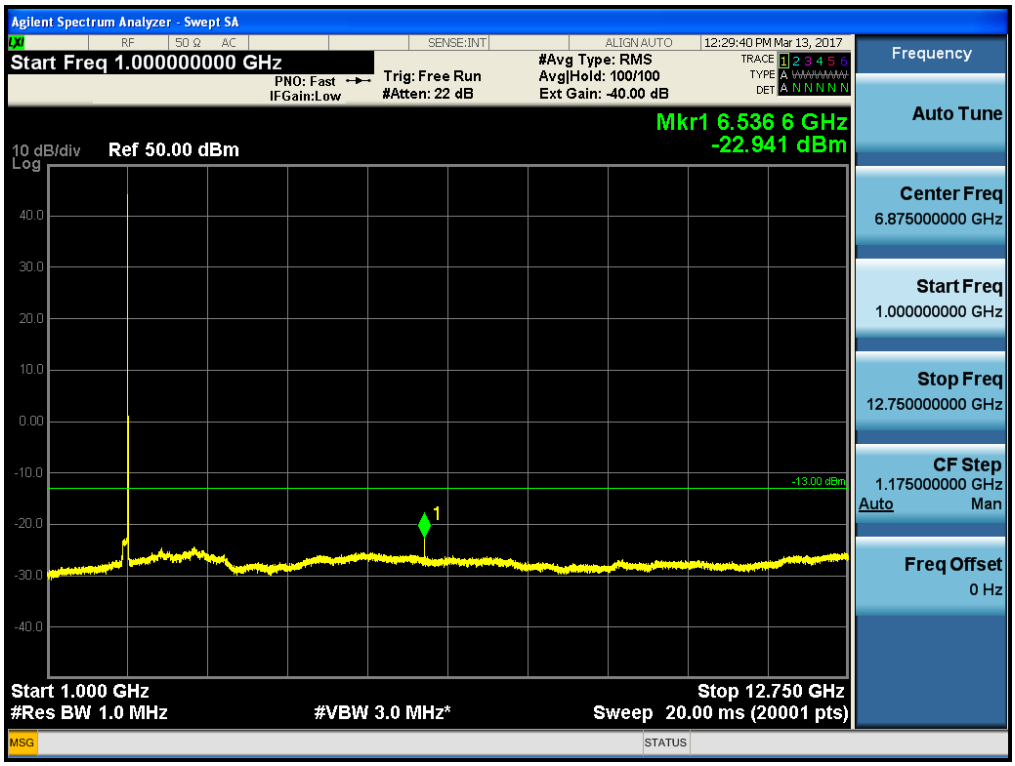


Conducted Spurious Emissions (12.75 GHz – 26.5 GHz)

[Downlink Low]

[Downlink Middle]

[Downlink High]

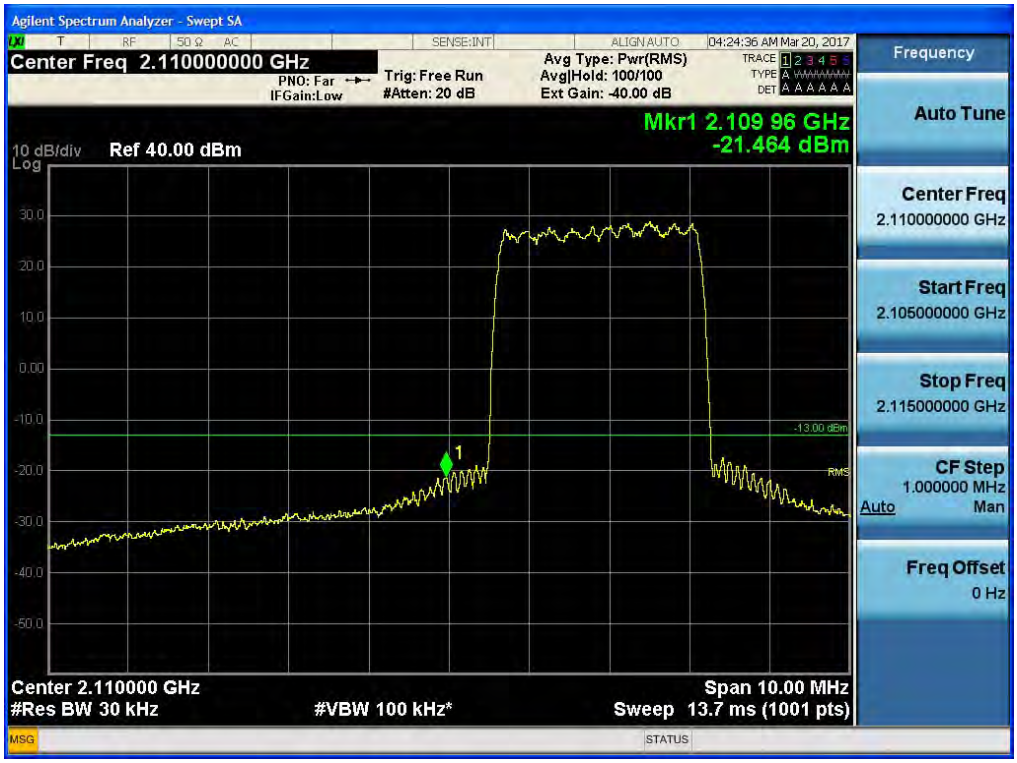
Intermodulation Spurious Emissions for AWS 2100_LTE 20 MHz

[Downlink Low]

[Downlink High]

Intermodulation Spurious Emissions for AWS 2100_CDMA

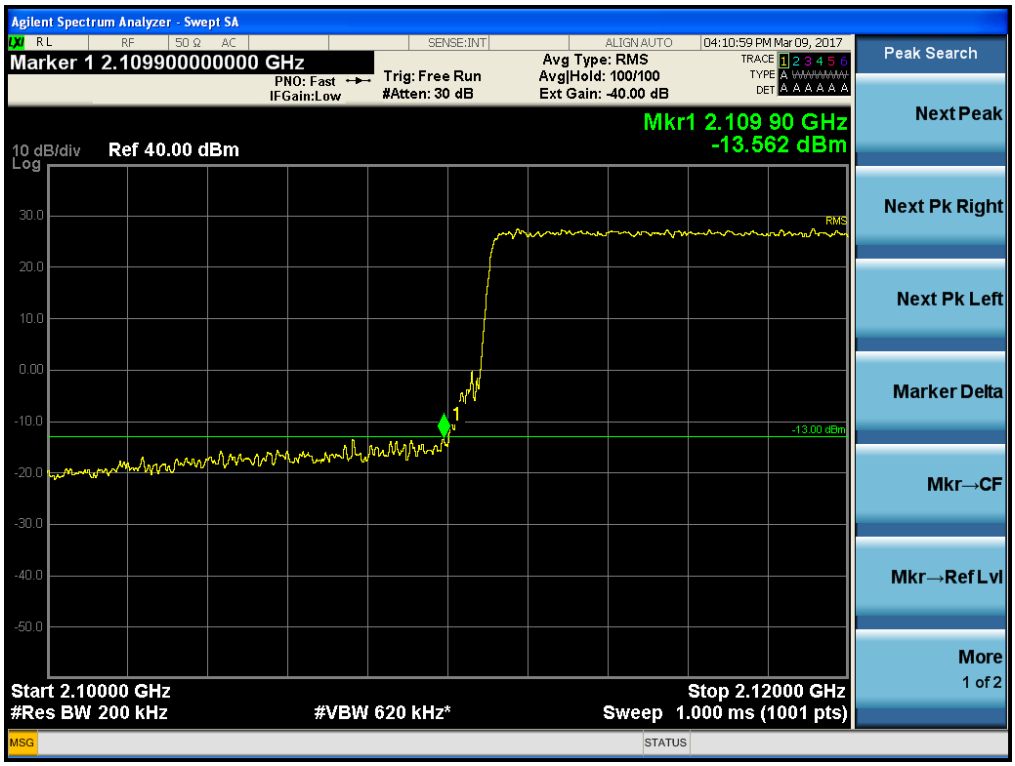
[Downlink Low]



[Downlink High]

Single channel Enhancer Band Edge for AWS 2100_LTE 20 MHz

[Downlink Low]



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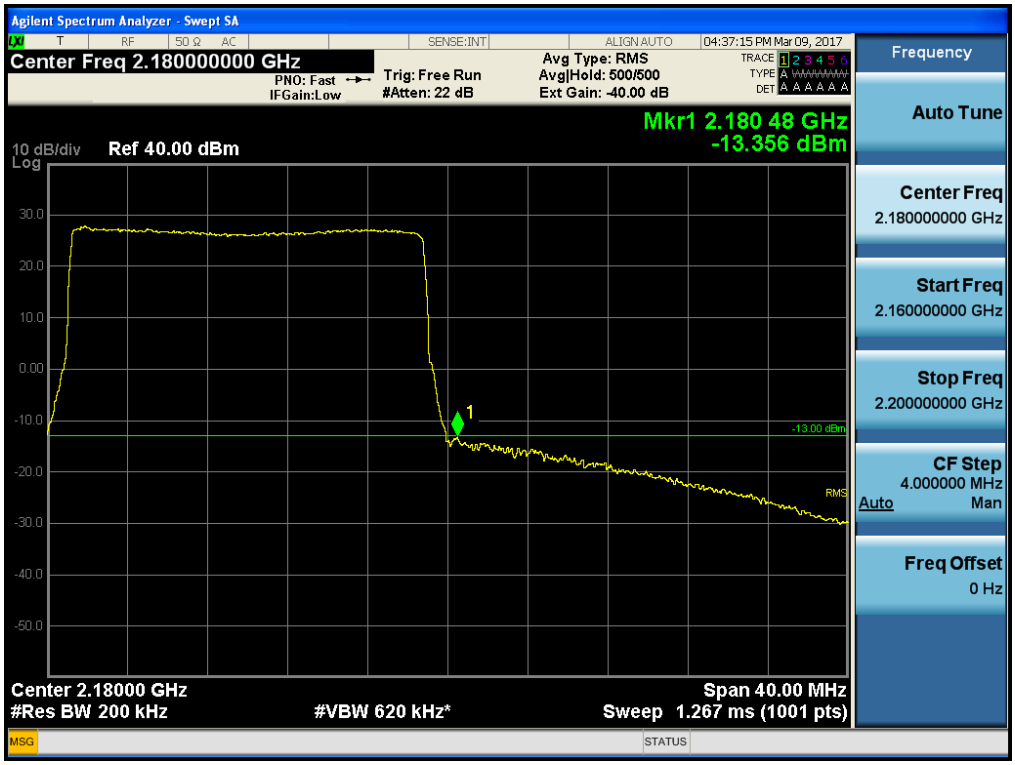
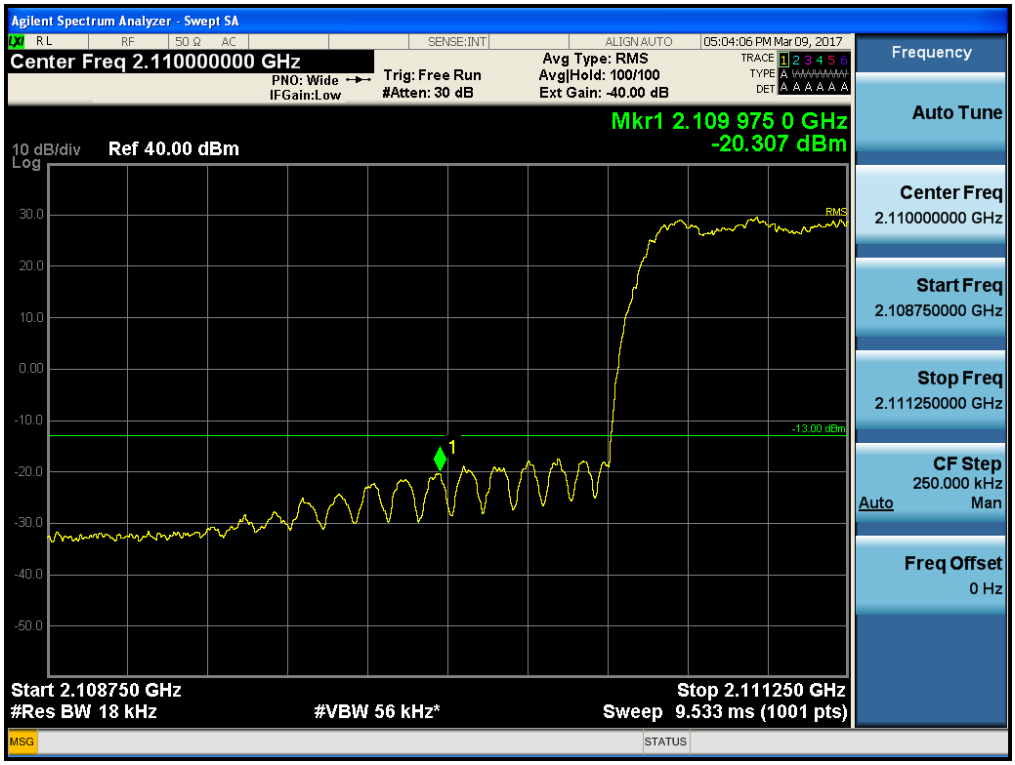


Single channel Enhancer Band Edge for AWS 2100_CDMA

[Downlink Low]



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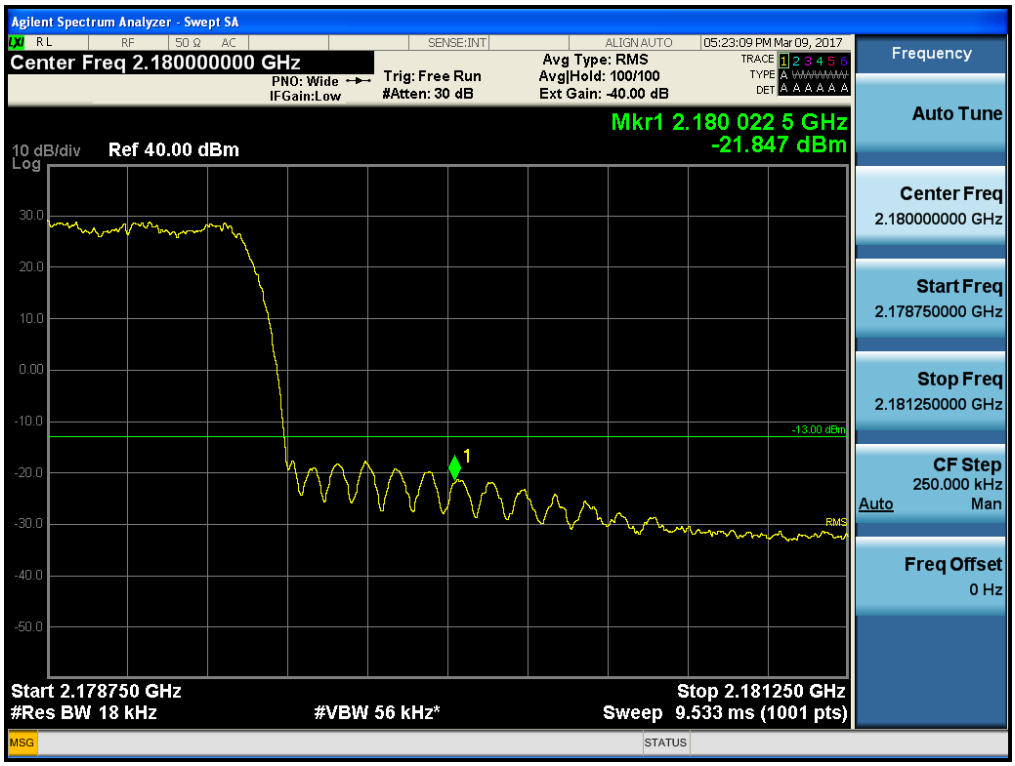


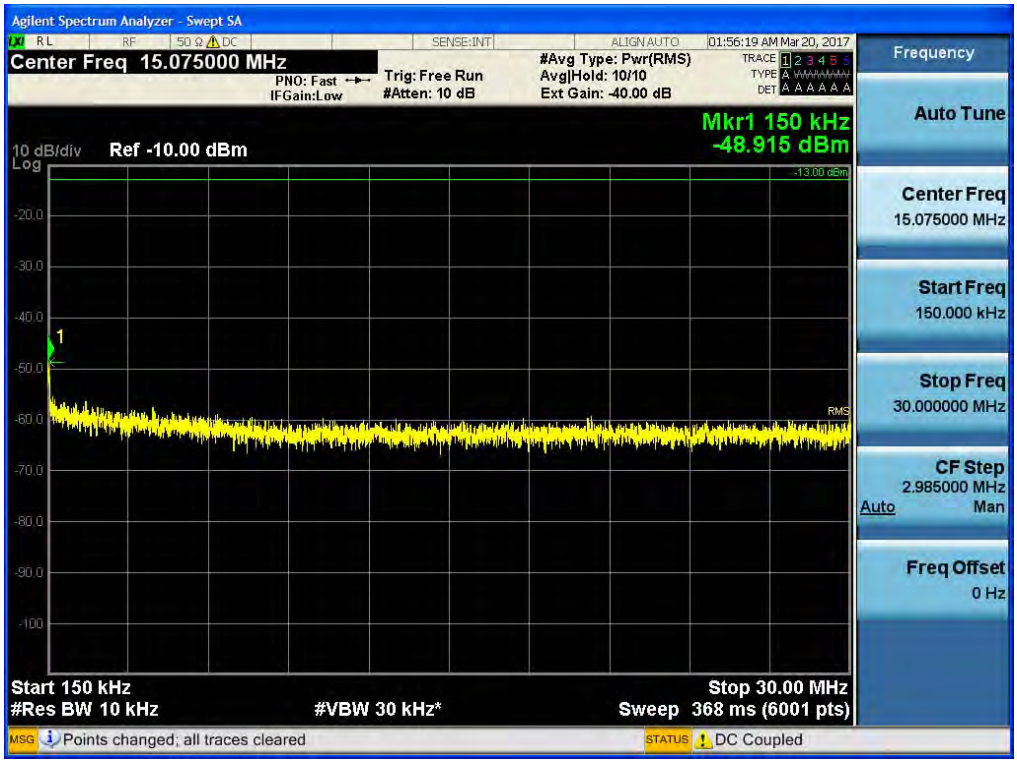
Plots of Spurious Emission for 2300_WCS BAND LTE 10 MHz

Conducted Spurious Emissions (9 kHz – 150 kHz)

[Downlink Middle]

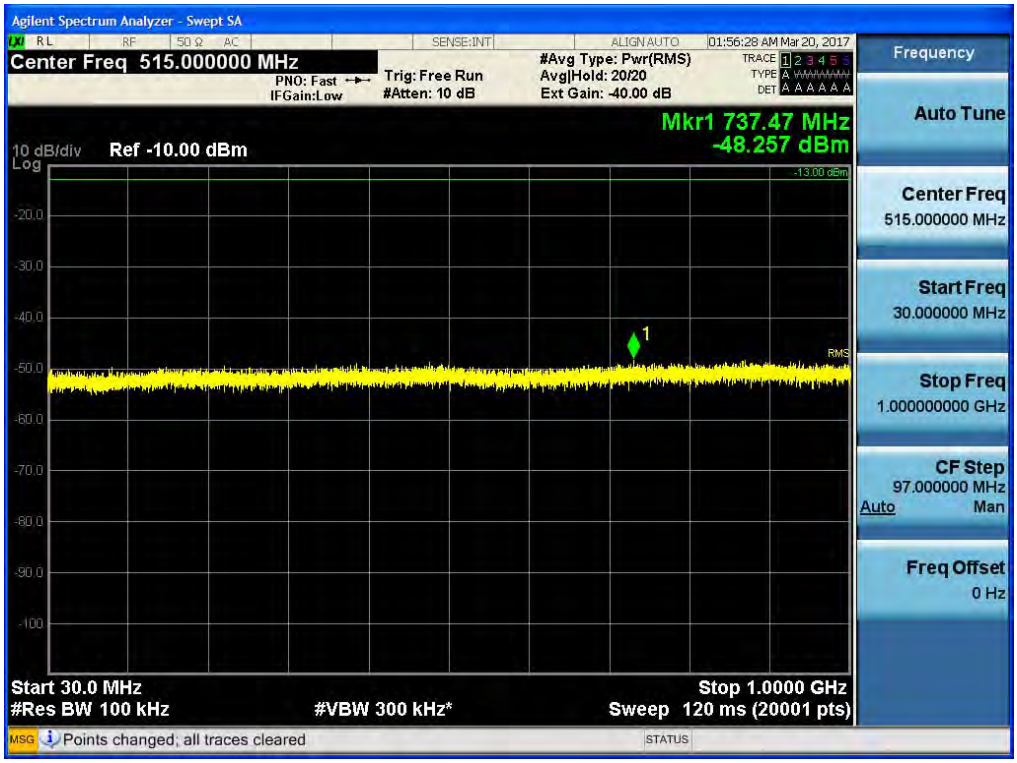
Conducted Spurious Emissions (150 kHz – 30 MHz)

[Downlink Middle]



Conducted Spurious Emissions (30 MHz – 1 GHz)

[Downlink Middle]



Conducted Spurious Emissions (1 GHz – 26.5 GHz)

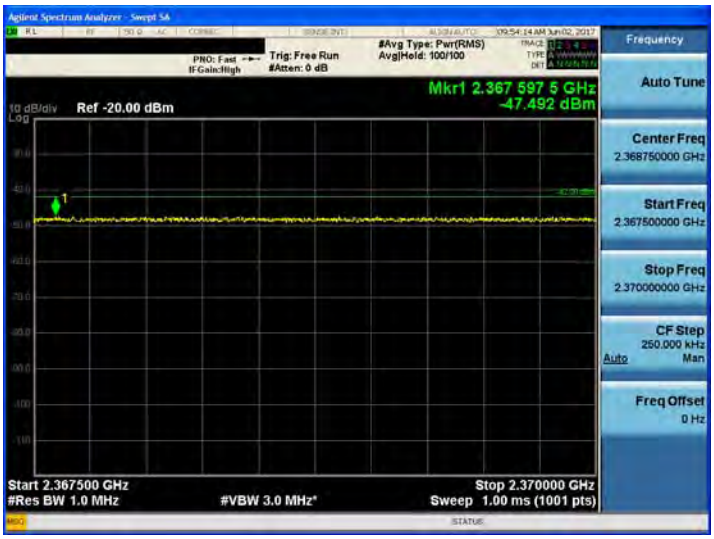
[Downlink Middle]

1000 ㎒ ~ 12750 ㎒

12750 ㎒ ~ 26500 ㎒

2200 ㎒ ~ 2285 ㎒	2285 ㎒ ~ 2287.5 ㎒
	
2287.5 ㎒ ~ 2300 ㎒	**2300 ㎒ ~ 2305 ㎒**
	

2305 ㎒ ~ 2320 ㎒	2320 ㎒ ~ 2345 ㎒
	
2345 ㎒ ~ 2350 ㎒	**2360 ㎒ ~ 2362.5 ㎒**
	

2362.5 ㎒ ~ 2365 ㎒	2365 ㎒ ~ 2367.5 ㎒
	
2367.5 ㎒ ~ 2370 ㎒	**2370 ㎒ ~ 2395 ㎒**
	

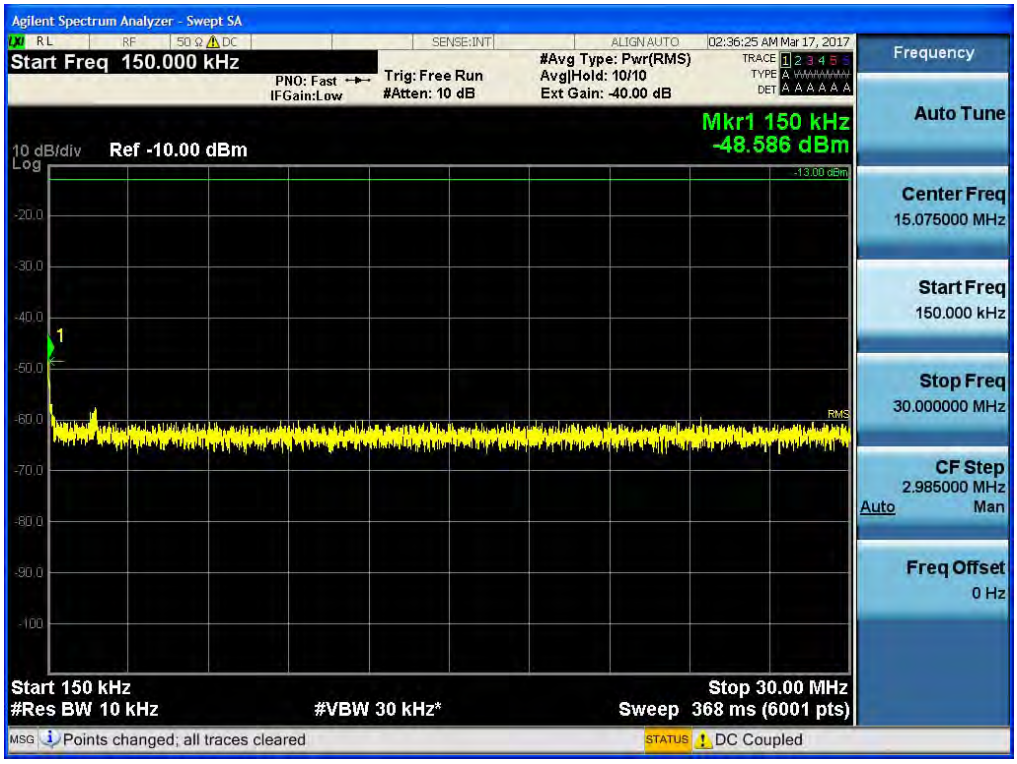
Plots of Spurious Emission for 2300_WCS BAND LTE 10 MHz

Conducted Spurious Emissions (9 kHz – 150 kHz)

[Uplink Middle]

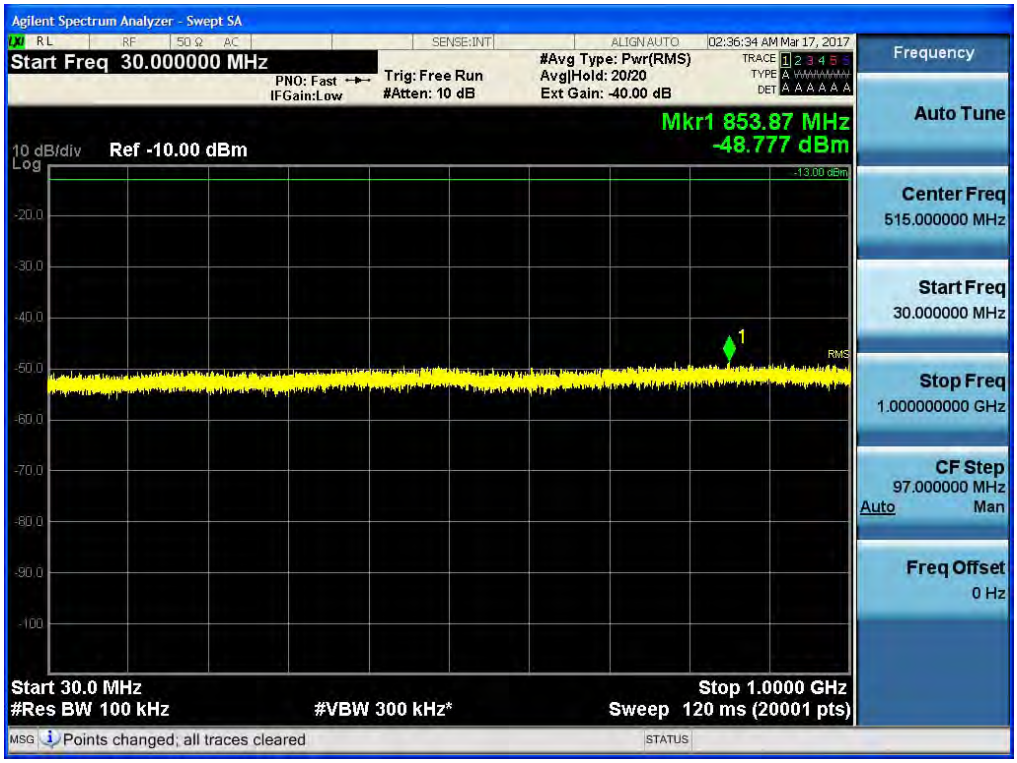
Conducted Spurious Emissions (150 kHz – 30 MHz)

[Uplink Middle]



Conducted Spurious Emissions (30 MHz – 1 GHz)

[Uplink Middle]



Conducted Spurious Emissions (1 GHz – 26.5 GHz)

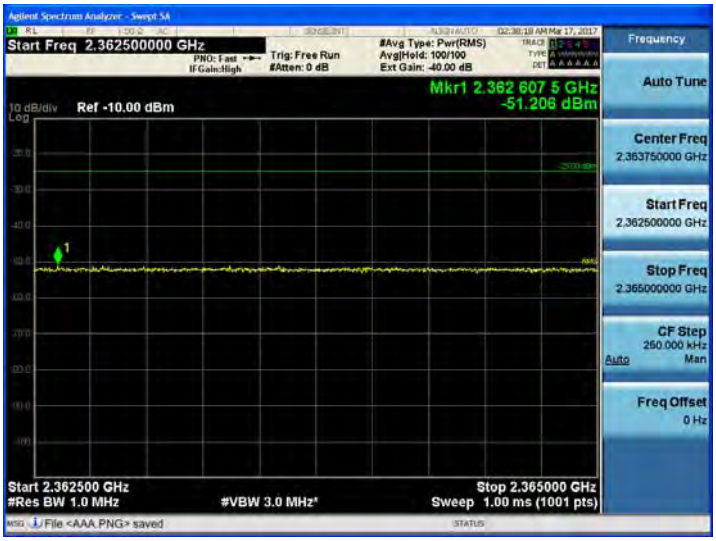
[Uplink Middle]

1000 ㎒ ~ 12750 ㎒

12750 ㎒ ~ 26500 ㎒

2200 ㎒ ~ 2285 ㎒	2285 ㎒ ~ 2287.5 ㎒
	
2287.5 ㎒ ~ 2300 ㎒	**2300 ㎒ ~ 2305 ㎒**
	

2305 ㎒ ~ 2320 ㎒	2320 ㎒ ~ 2345 ㎒
	
2345 ㎒ ~ 2350 ㎒	**2360 ㎒ ~ 2362.5 ㎒**
	

2362.5 ㎒ ~ 2365 ㎒	2365 ㎒ ~ 2367.5 ㎒
	
2367.5 ㎒ ~ 2370 ㎒	**2370 ㎒ ~ 2395 ㎒**
	

Single channel Enhancer Band Edge_2300_WCS BAND LTE 10 MHz

[Downlink Low]

[Downlink High]

[Uplink Low]

[Uplink High]

Intermodulation Spurious Emissions for FCC_2300_WCS BAND LTE 10 MHz

* This EUT's frequency range is 2350 ~ 2360 MHz. It's wide for this measurement, so except the test that band.

Plots of Spurious Emission for BRS BAND LTE 20 MHz

Conducted Spurious Emissions (9 kHz – 150 kHz)

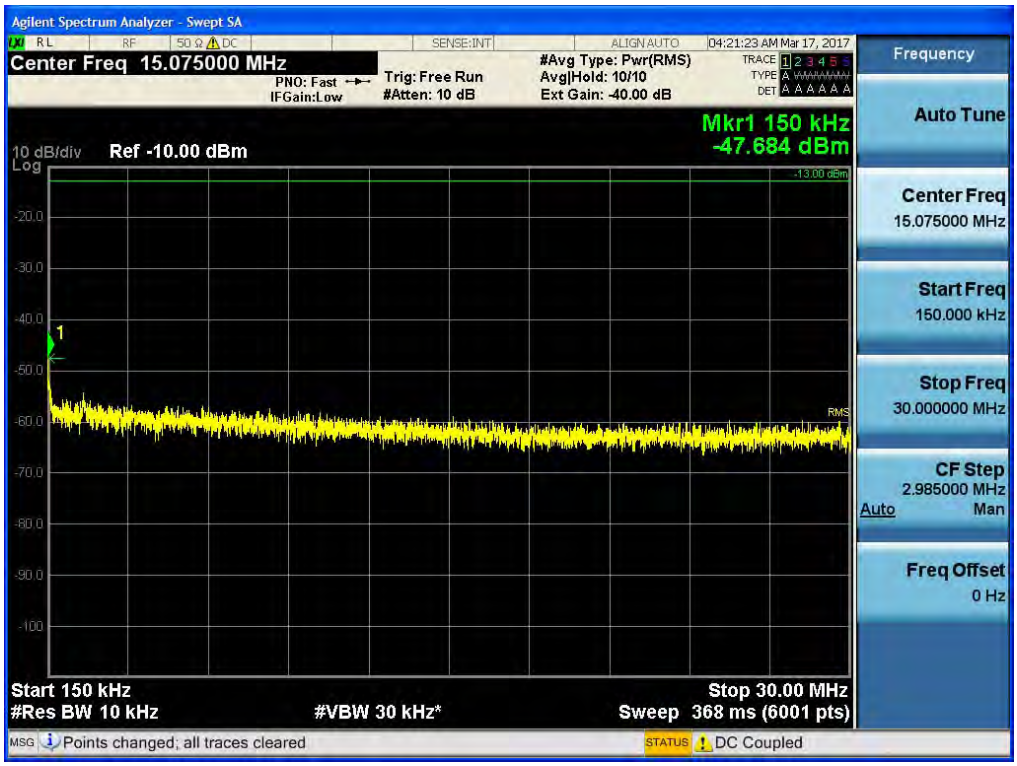
[Downlink Low]

[Downlink Middle]

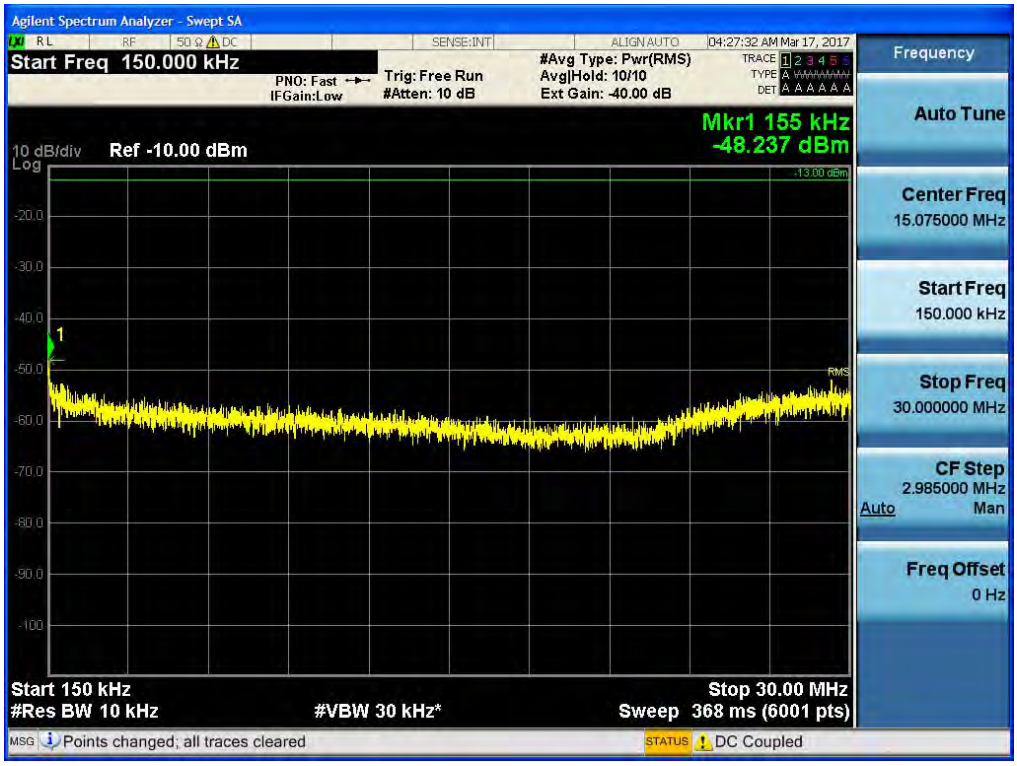
[Downlink High]

Conducted Spurious Emissions (150 kHz – 30 MHz)

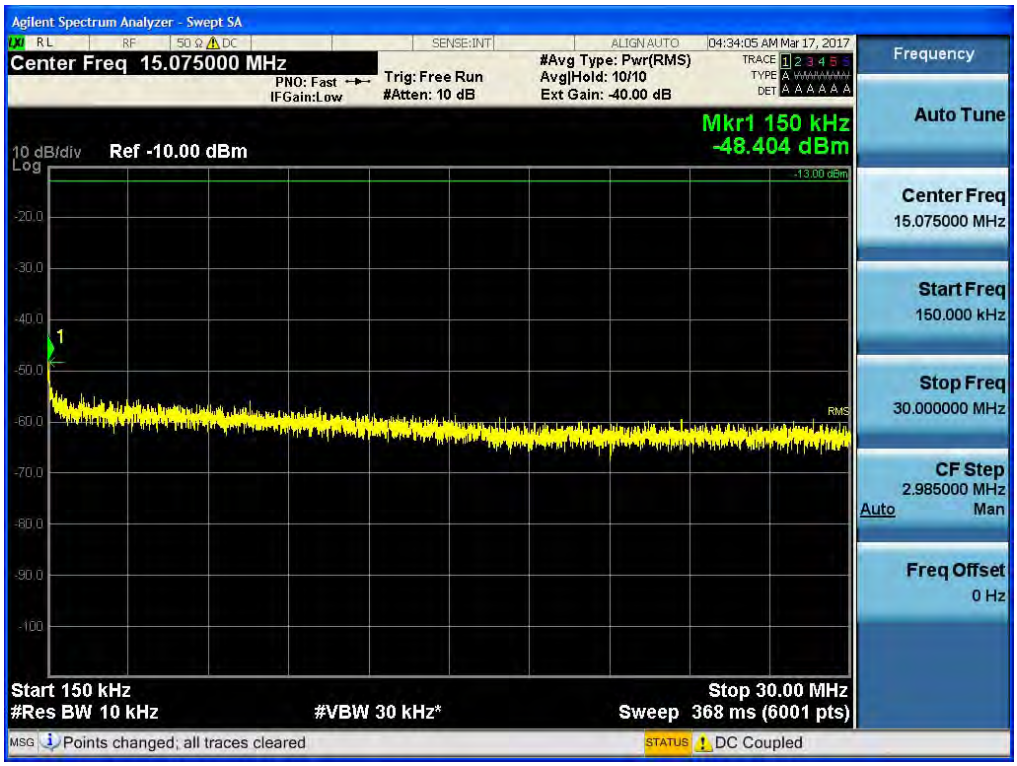
[Downlink Low]



[Downlink Middle]

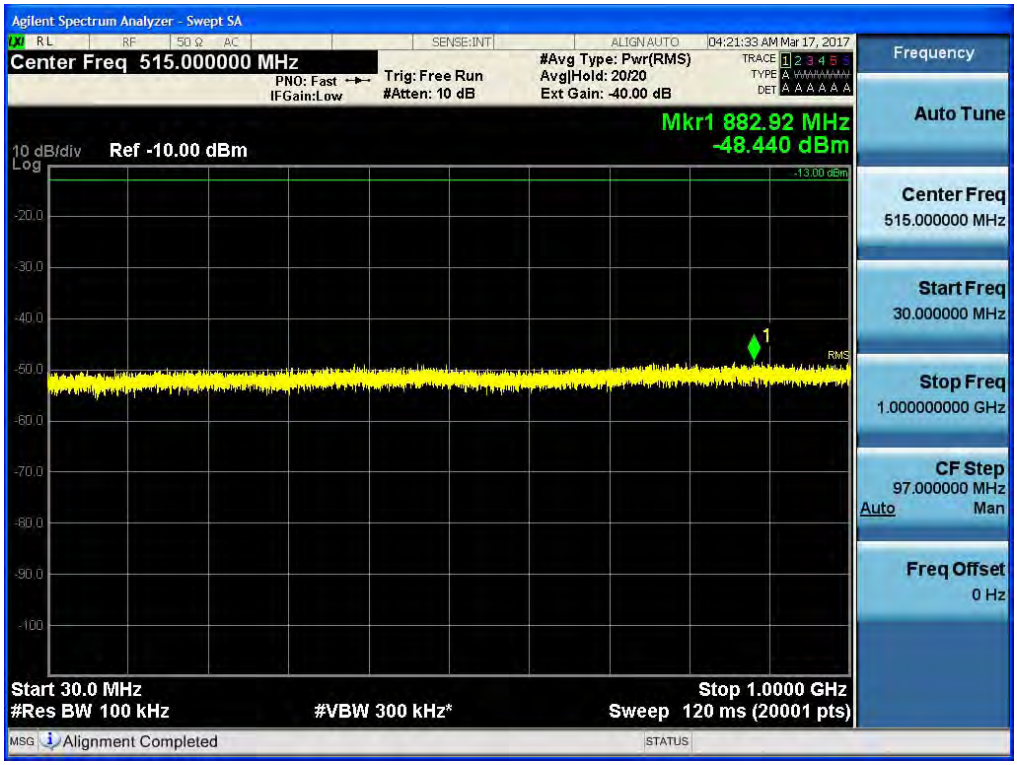


[Downlink High]



Conducted Spurious Emissions (30 MHz – 1 GHz)

[Downlink Low]



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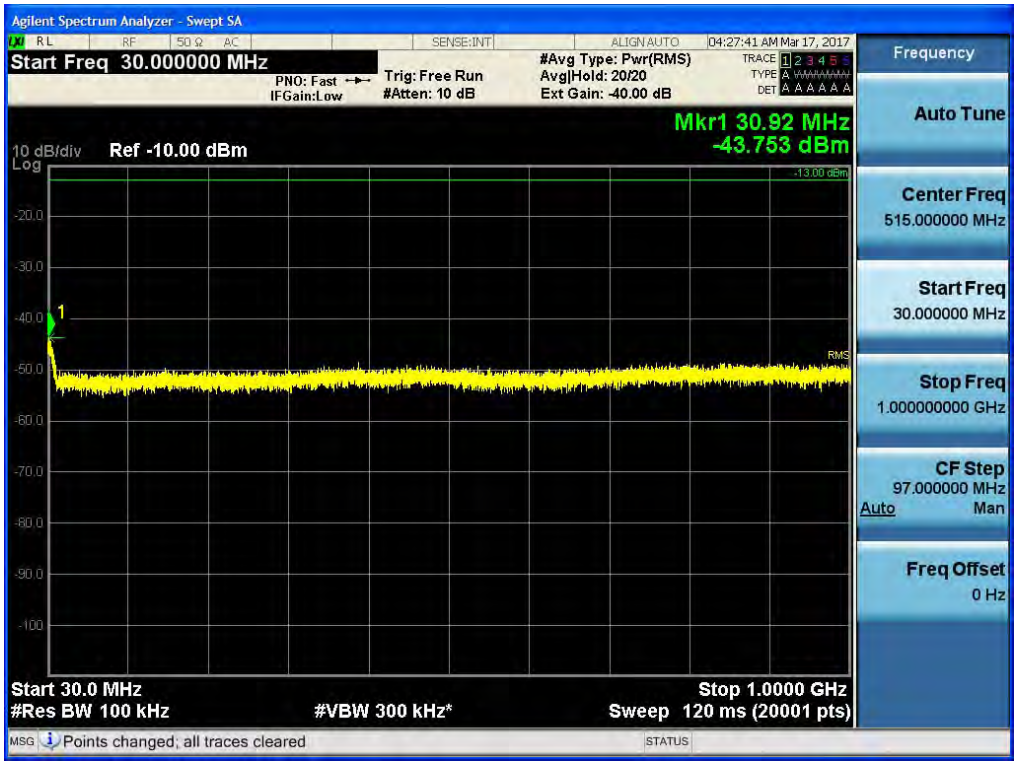

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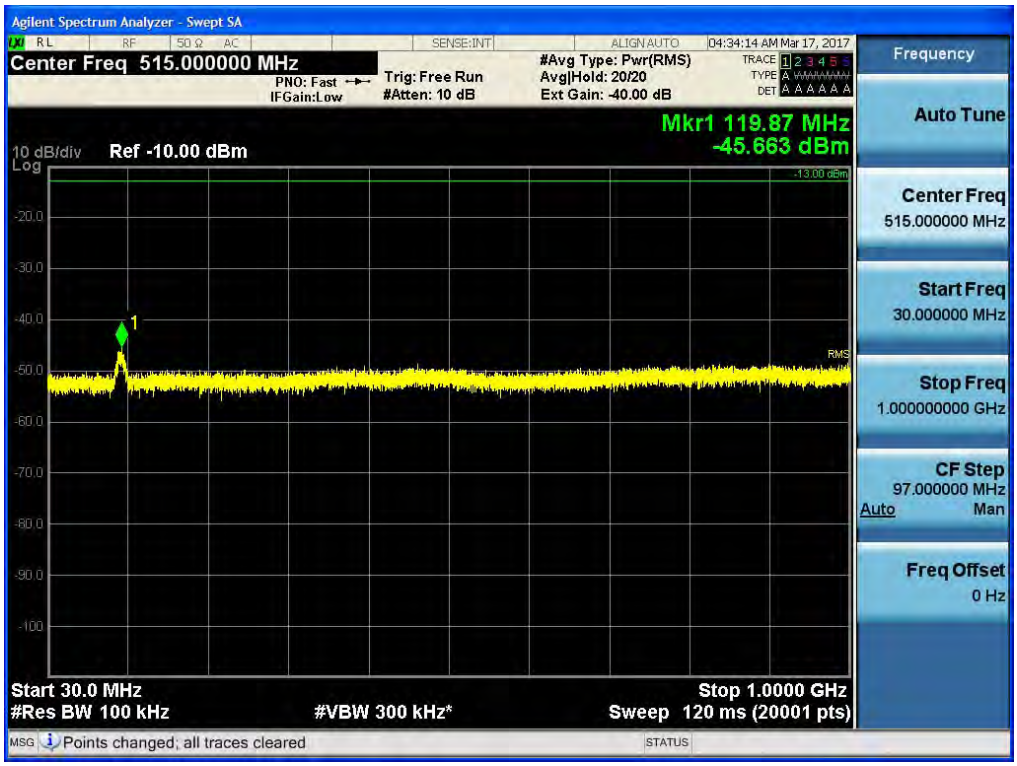
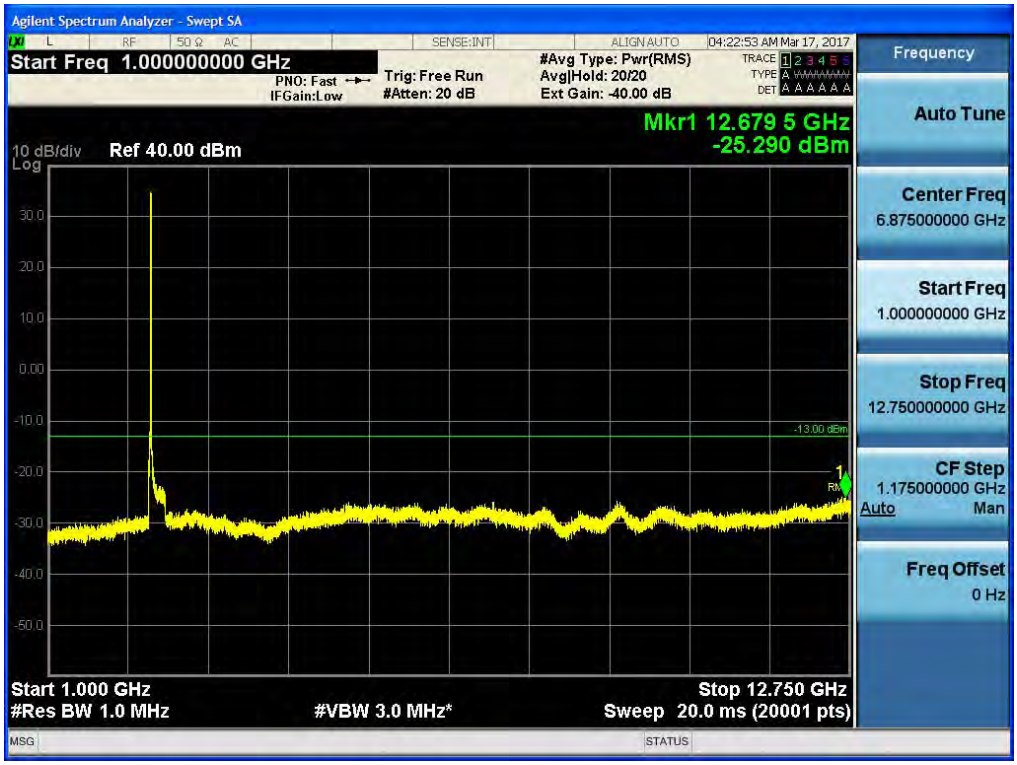
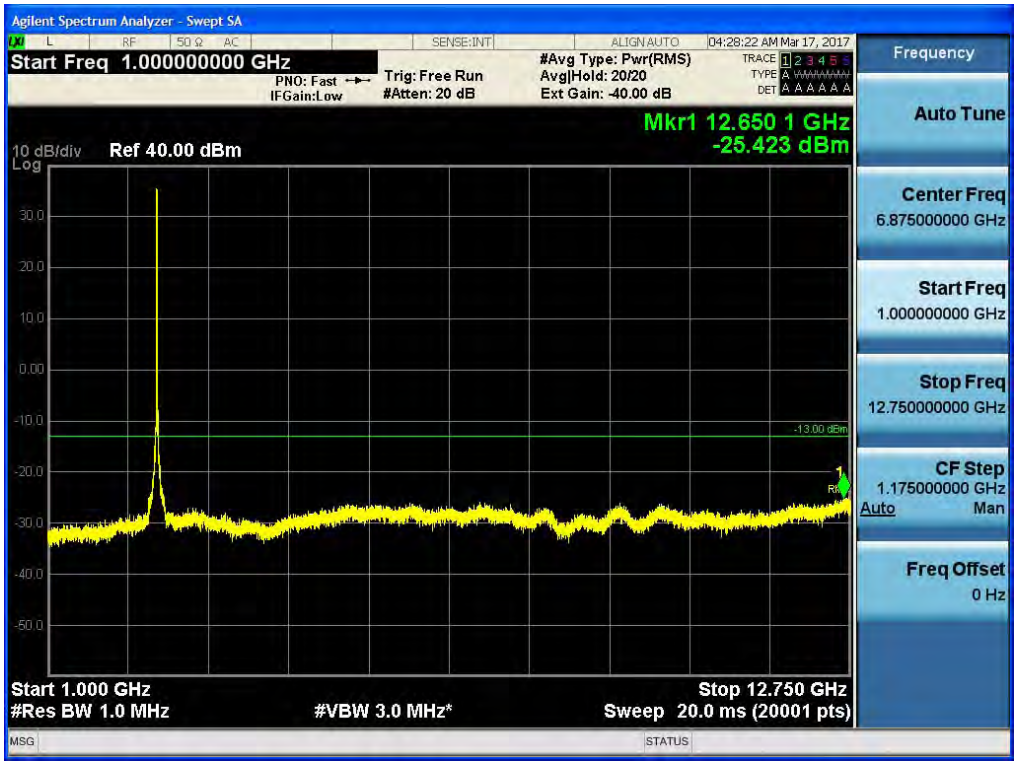


Conducted Spurious Emissions (1 GHz – 12.75 GHz)

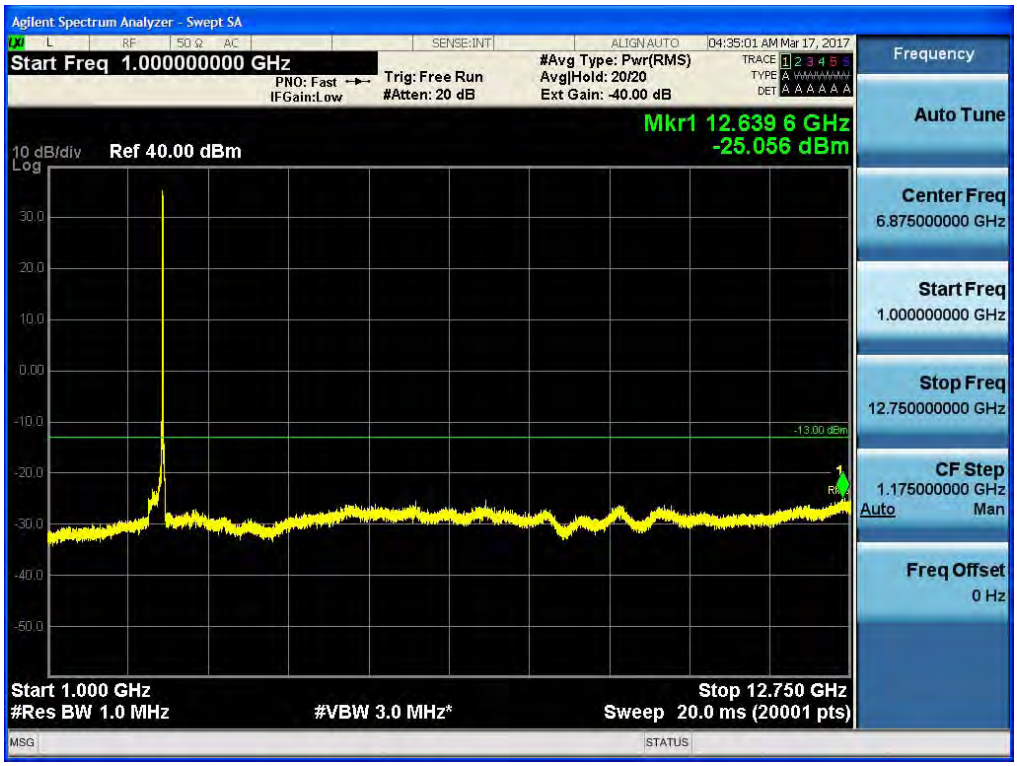
[Downlink Low]



[Downlink Middle]



[Downlink High]



Conducted Spurious Emissions (12.75 GHz – 26.5 GHz)

[Downlink Low]

[Downlink Middle]

[Downlink High]

Plots of Spurious Emission for BRS BAND LTE 20 MHz

Conducted Spurious Emissions (9 kHz – 150 kHz)

[Uplink Low]

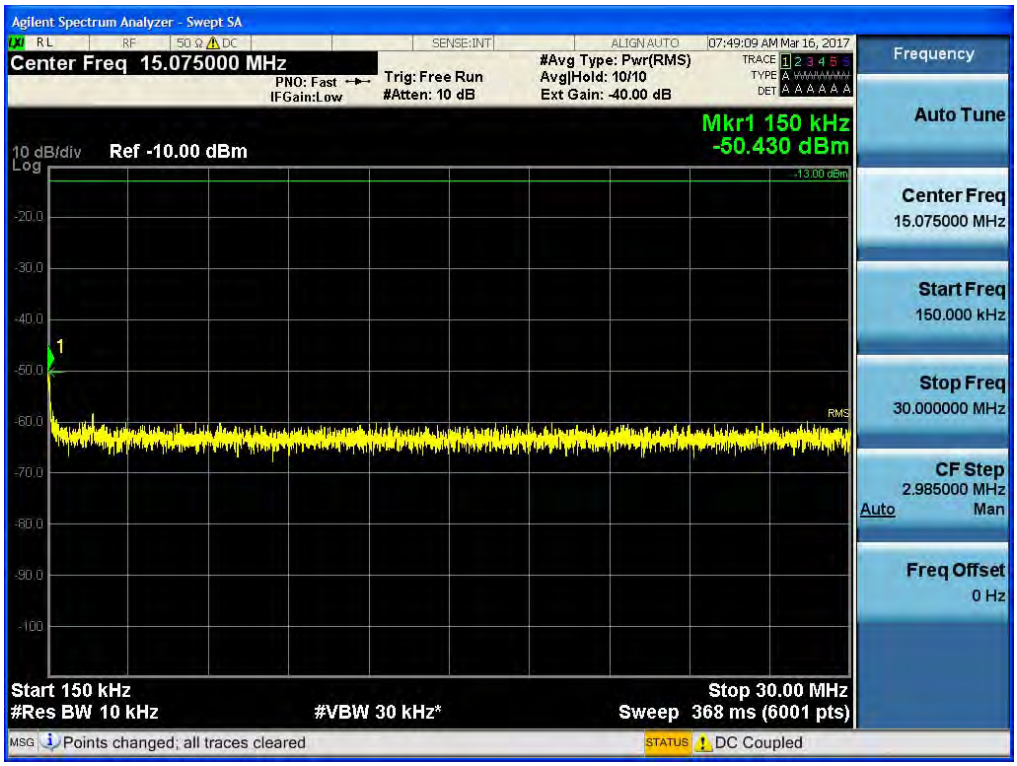
[Uplink Middle]

[Uplink High]

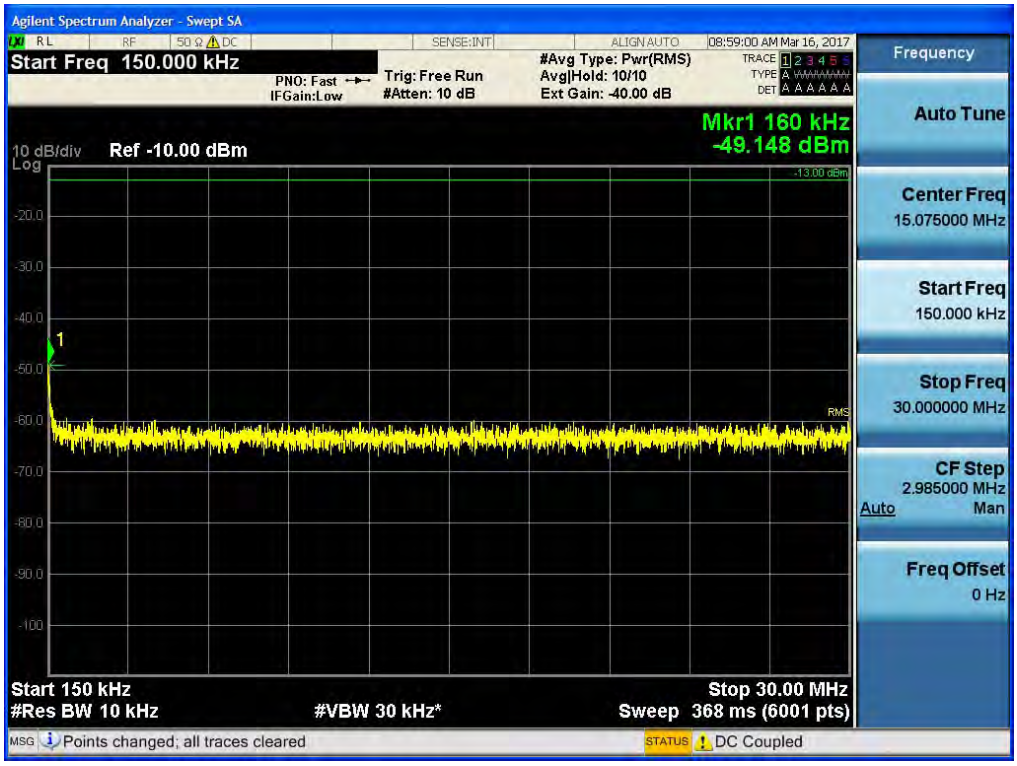

Agilent Spectrum Analyzer - Swept SA
Center Freq 79.500 kHz
PNO: Far
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: Pwr(RMS)
Avg|Hold: 10/10
Ext Gain: -40.00 dB
09:02:35 AM Mar 16, 2017
Mkr1 9.846 kHz
-46.556 dBm
10 dB/div
Log
Ref -10.00 dBm
-13.00 dBm
RMS
Start 9.00 kHz
#Res BW 1.0 kHz
#VBW 3.0 kHz*
Stop 150.00 kHz
Sweep 174 ms (1001 pts)
File <AAA.PNG> saved
DC Coupled
Frequency
Auto Tune
Center Freq
79.500 kHz
Start Freq
9.000 kHz
Stop Freq
150.000 kHz
CF Step
14.100 kHz
Auto
Man
Freq Offset
0 Hz

Conducted Spurious Emissions (150 kHz – 30 MHz)

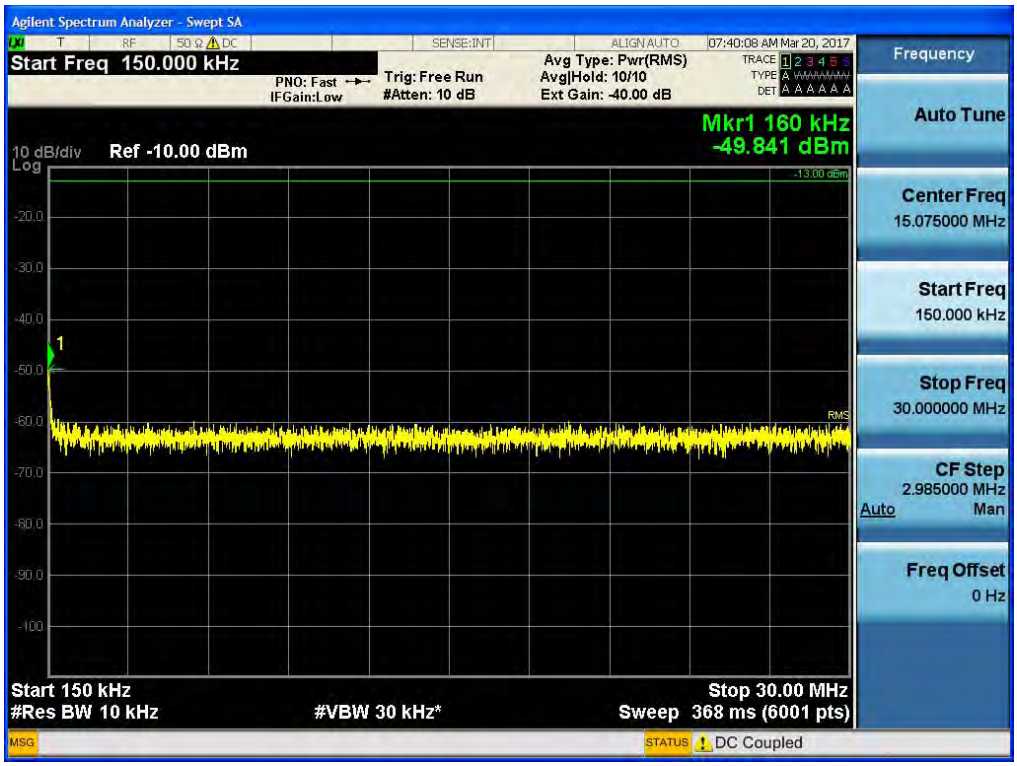
[Uplink Low]



[Uplink Middle]

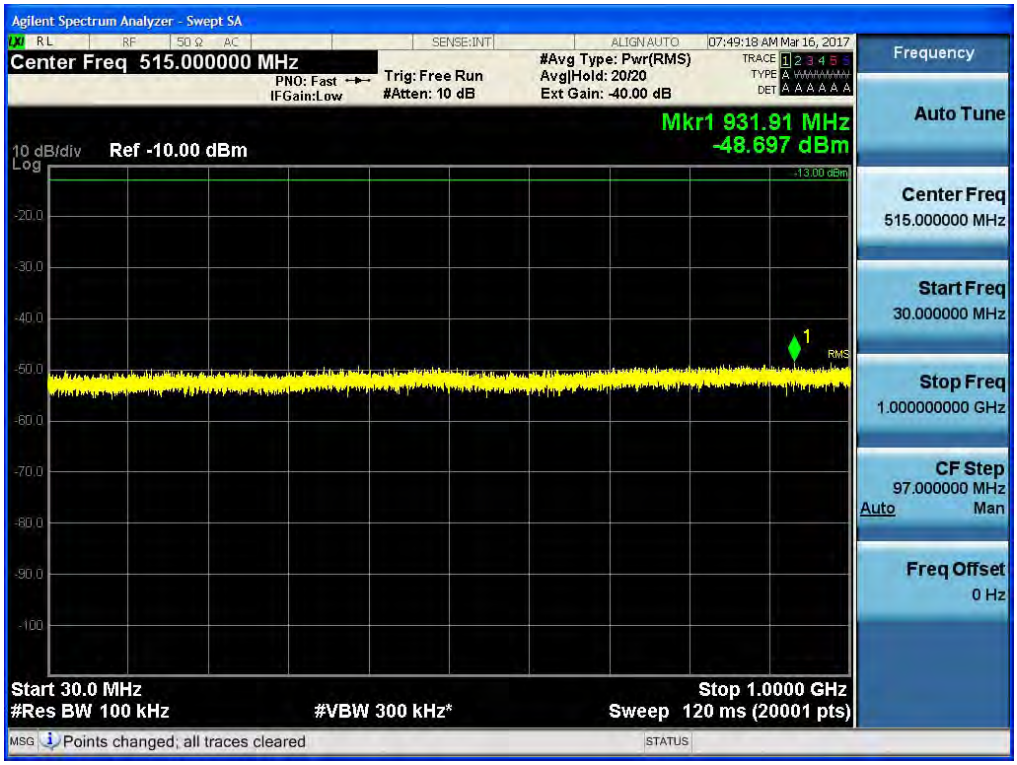


[Uplink High]

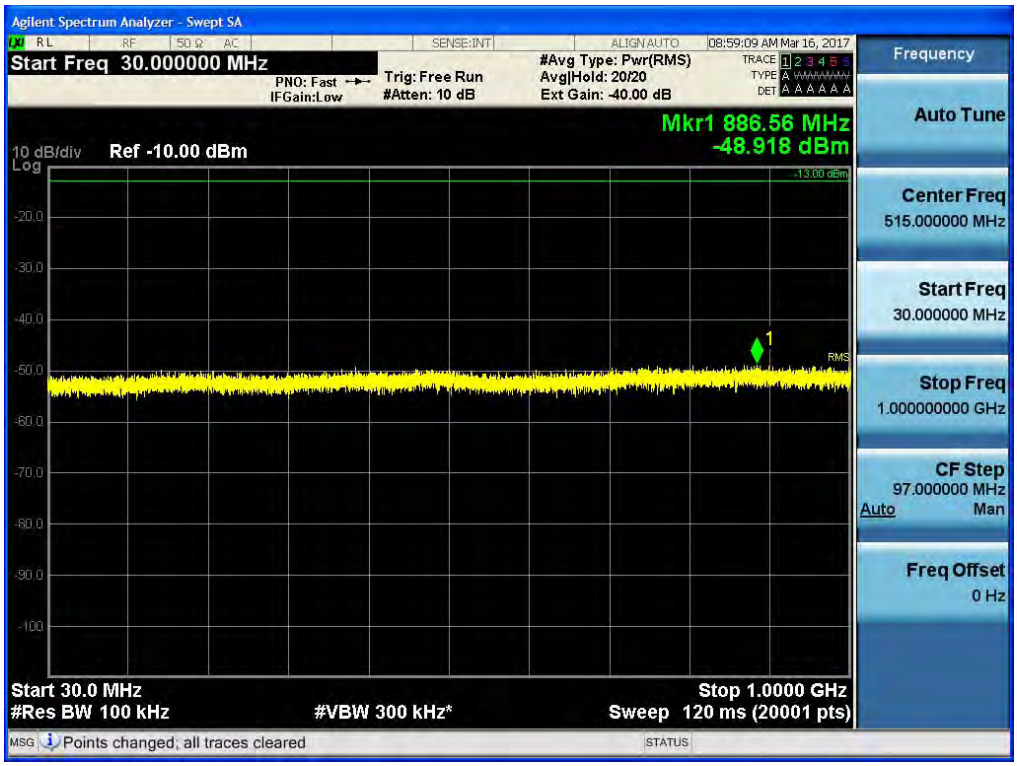

Agilent Spectrum Analyzer - Swept SA
Start Freq 150.000 kHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Pwr(RMS)
Avg|Hold: 10/10
Ext Gain: -40.00 dB
07:40:08 AM Mar 20, 2017
Mkr1 160 kHz
-49.841 dBm
10 dB/div
Log
Ref -10.00 dBm
-13.00 dBm
RMS
Start 150 kHz
#Res BW 10 kHz
#VBW 30 kHz*
Stop 30.00 MHz
Sweep 368 ms (6001 pts)
DC Coupled
Frequency
Auto Tune
Center Freq
15.075000 MHz
Start Freq
150.000 kHz
Stop Freq
30.000000 MHz
CF Step
2.985000 MHz
Auto
Man
Freq Offset
0 Hz

Conducted Spurious Emissions (30 MHz – 1 GHz)

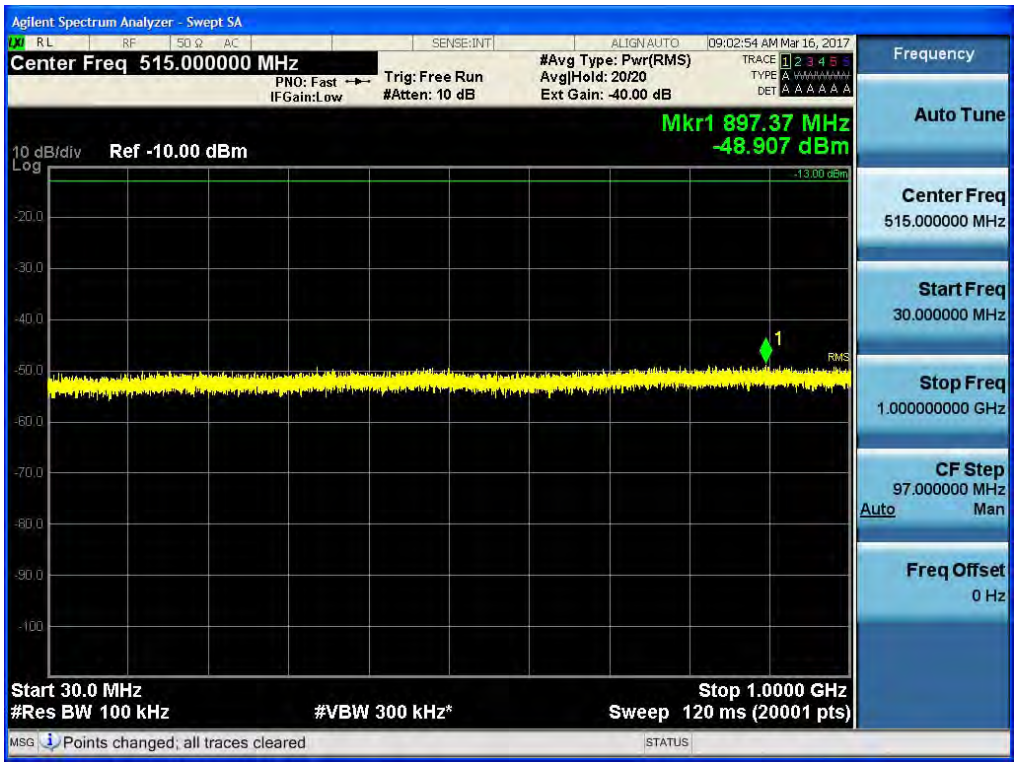
[Uplink Low]



[Uplink Middle]



[Uplink High]


Agilent Spectrum Analyzer - Swept SA
Center Freq 515.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: Pwr(RMS)
Avg|Hold: 20/20
Ext Gain: -40.00 dB
09:02:54 AM Mar 16, 2017
Mkr1 897.37 MHz
-48.907 dBm
10 dB/div
Log
Ref -10.00 dBm
-13.00 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz*
Stop 1.0000 GHz
Sweep 120 ms (20001 pts)
Points changed; all traces cleared
Frequency
Auto Tune
Center Freq
515.000000 MHz
Start Freq
30.000000 MHz
Stop Freq
1.000000000 GHz
CF Step
97.000000 MHz
Auto
Man
Freq Offset
0 Hz

Conducted Spurious Emissions (1 GHz – 12.75 GHz)

[Uplink Low]

[Uplink Middle]

[Uplink High]


Agilent Spectrum Analyzer - Swept SA
Start Freq 1.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: Pwr(RMS)
Avg|Hold: 20/20
Ext Gain: -40.00 dB
09:03:25 AM Mar 16, 2017
Mkr1 12.619 0 GHz
-35.418 dBm
10 dB/div
Log
Ref 10.00 dBm
-13.00 dBm
Start 1.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 12.750 GHz
Sweep 20.0 ms (20001 pts)
Frequency
Auto Tune
Center Freq
6.875000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
12.750000000 GHz
CF Step
1.175000000 GHz
Auto
Man
Freq Offset
0 Hz

Conducted Spurious Emissions (12.75 GHz – 26.5 GHz)

[Uplink Low]

[Uplink Middle]

[Uplink High]


Agilent Spectrum Analyzer - Swept SA
Start Freq 12.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: Pwr(RMS)
Avg|Hold: 20/20
Ext Gain: -40.00 dB
09:04:05 AM Mar 16, 2017
Mkr1 25.592 8 GHz
-25.750 dBm
10 dB/div
Log
Ref 10.00 dBm
-13.00 dBm
Start 12.750 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 26.500 GHz
Sweep 34.7 ms (40001 pts)
Frequency
Auto Tune
Center Freq
19.625000000 GHz
Start Freq
12.750000000 GHz
Stop Freq
26.500000000 GHz
CF Step
1.375000000 GHz
Auto
Man
Freq Offset
0 Hz

Intermodulation Spurious Emissions for FCC_BRS BAND LTE 20 MHz

[Downlink Low]

[Downlink High]

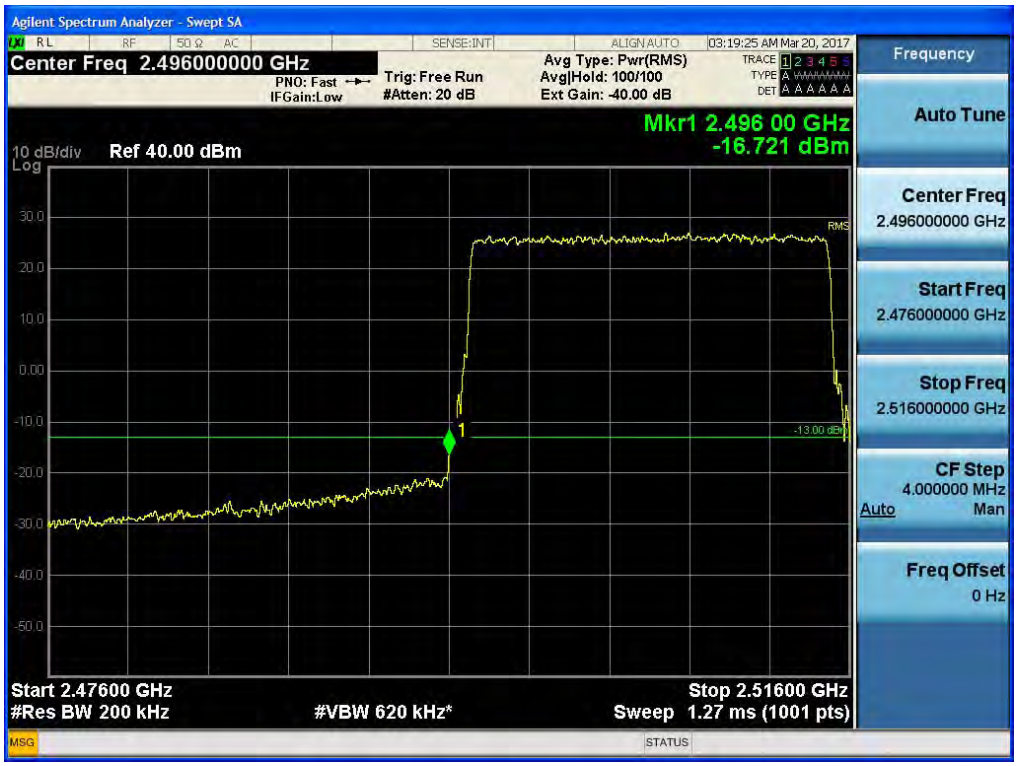
Intermodulation Spurious Emissions for FCC_BRS BAND LTE 20 MHz

[Uplink Low]

[Uplink High]

Single channel Enhancer Band Edge_BRS BAND LTE 20 MHz

[Downlink Low]



[Downlink High]

Single channel Enhancer Band Edge_BRS BAND LTE 20 MHz

[Uplink Low]

[Uplink High]

11. RADIATED SPURIOUS EMISSIONS

FCC Rules

Test Requirements:

§ 2.1053 Measurements required: Field strength of spurious radiation.

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

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

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

IC Rules

Test Requirements:

RSS-Gen

7. Receiver Limits

7.1 Receiver Emission Limits

7.1.2 Receiver Radiated Limits

Radiated emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals. The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or

carrier frequency), or 30 MHz, whichever is higher, to at least 5x the highest tunable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.

Spurious emissions from receivers shall not exceed the radiated limits shown in Table 2 below:

Table 2 – Receiver Radiated Limits	
Frequency (MHz)	**Field Strength (μv/m at 3 metres)***
30-88	100
88-216	150
216-960	200
Above 960	500

Footnote *

Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 6.5.

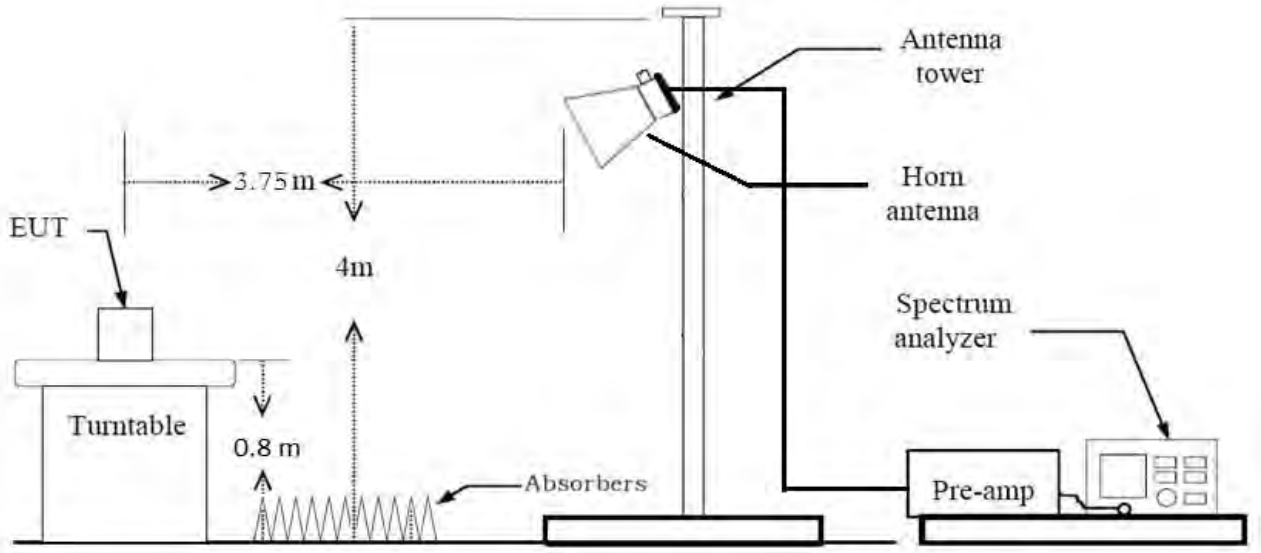
Test Procedures:

As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of ANSI/TIA-603-C-2004 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber.

The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360and the receiving antenna scanned from 1-3m in order to capture the maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried. out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10th or 40GHz, whichever was the lesser, were investigated.

Radiated Spurious Emissions Test Setup



Note :

1. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
2. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)

Receiver Spurious Emissions Test Result:

ISED Rule(s):	**RSS-GEN**
Test Requirements:	**Blow the table**
Operating conditions:	**Under normal test conditions**
Method of testing:	**Radiated**
S/A. Settings:	**F < 1 GHz: RBW: 120 kHz, VBW: 300 kHz (Quasi Peak)** **F > 1 GHz: RBW: 1 MHz, VBW: 1 MHz (Peak)**
Mode of operation:	**Receive**

Frequency (MHz)	Field Strength (microvolts/m at 3 meters)
30 – 88	100
88 - 216	150
216 – 960	200
Above 960	500

Operation Mode: Receive:

30 MHz ~ 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμN	dB /m	dB	(H/V)	dBμN/m	dBμN/m	dB
No critical peaks found							

Above 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμN	dB /m	dB	(H/V)	dBμN/m	dBμN/m	dB
No critical peaks found							

Radiated Spurious Emissions Test Result:

Test results are only attached worst cases.

[Downlink] – LTE 700 Band

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	D.F. [dB]	Pol.	Result [dBm]
Low 773 MHz	1,466.00	74.80	-20.40	25.542	2.080	45.96	1.96	H	-36.780
Mid 742 MHz	1,484.00	79.57	-15.63	25.488	1.964	46.01	1.96	H	-32.226
High 751 MHz	1,502.00	79.29	-15.91	25.437	2.084	46.13	1.96	H	-32.555

* C.L.: Cable Loss / A.G.: Ant. Gain / D.F.: Distance Factor (3.75 m)

[Uplink] – LTE 700 Band

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

Notes:

1. Test datas were only the worst case.
2. We have done horizontal and vertical polarization in detecting antenna.

[Downlink] – 800 MHz

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	D.F. [dB]	Pol.	Result [dBm]
Low 870.25 MHz	1,740.50	76.07	-19.13	25.206	2.205	46.26	1.96	V	-36.020
	2,610.75	59.96	-35.24	27.549	3.040	45.90	1.96	H	-48.589
	3,481.00	73.98	-21.22	28.755	3.568	45.03	1.96	V	-31.971
	4,351.25	64.58	-30.62	30.345	4.611	44.57	1.96	V	-38.272
Mid 881.50 MHz	1,763.00	88.21	-6.99	25.207	2.217	46.18	1.96	H	-23.783
	2,644.50	63.17	-32.03	27.610	3.035	45.65	1.96	V	-45.073
	3,526.00	73.68	-21.52	29.011	3.944	45.05	1.96	V	-31.659
	4,407.50	60.54	-34.66	30.531	4.125	44.34	1.96	H	-42.382
	5,289.00	55.56	-39.64	31.344	4.455	44.00	1.96	H	-45.877
High 892.75 MHz	1,785.50	81.78	-13.42	25.243	2.339	46.47	1.96	H	-30.347
	2,678.25	-	-	-	-	-	-	-	-
	3,571.00	73.03	-22.17	29.177	4.689	45.82	1.96	H	-32.166
	4,463.75	71.35	-23.85	30.626	4.275	44.49	1.96	H	-31.478

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

[Uplink] – 800 MHz

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

Notes:

1. Test datas were only the worst case.
2. We have done horizontal and vertical polarization in detecting antenna.

[Downlink] – PCS 1900

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
Low	3,862.50	87.73	-7.47	29.633	4.088	44.57	0.210	1.96	H	-16.145
1931.25 MHz	5,793.75	77.70	-17.50	32.041	5.134	44.07	0.004	1.96	H	-22.427
Mid	3,925.00	85.89	-9.31	29.725	3.955	44.99	-0.190	1.96	V	-18.845
1962.50 MHz	5,887.50	75.86	-19.34	32.258	5.400	44.14	0.110	1.96	V	-23.755
High	3,987.50	73.09	-22.11	29.750	4.083	44.76	0.035	1.96	V	-31.043
1993.75 MHz	5,981.25	81.47	-13.73	32.346	5.471	44.11	0.279	1.96	H	-17.780

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

[Uplink] – PCS 1900

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

Notes:

1. Test datas were only the worst case.

2. We have done horizontal and vertical polarization in detecting antenna.

[Downlink] – AWS 2100

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
Low 2111.25 MHz	4,222.50	61.48	-33.72	30.090	4.153	44.91	-0.82	1.96	V	-43.245
	6,333.75	77.65	-17.55	33.320	5.391	44.67	0.43	1.96	H	-21.123
	10,556.25	60.98	-34.22	40.115	7.018	43.38	0.26	1.96	V	-28.244
Mid 2145.00 MHz	4,290.00	61.30	-33.90	30.280	3.530	44.56	-0.17	1.96	V	-42.860
	6,435.00	74.16	-21.04	33.589	5.975	45.04	0.34	1.96	V	-24.216
	10,725.00	68.51	-26.69	40.155	7.365	43.20	0.62	1.96	H	-19.795
High 2178.75 MHz	4,357.50	58.75	-36.45	30.367	4.618	44.61	-0.36	1.96	H	-44.471
	6,536.25	70.03	-25.17	34.106	5.325	45.14	0.28	1.96	H	-28.637
	10,893.75	61.03	-34.17	40.789	8.674	43.15	0.54	1.96	V	-25.361

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

Notes:

1. Test datas were only the worst case.

2. We have done horizontal and vertical polarization in detecting antenna.

[Downlink] – WCS 2300

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
Mid.	4,710.00	55.87	-39.33	31.080	4.580	44.66	-0.24	1.96	V	-46.610
2355 MHz	9,420.00	62.59	-32.61	38.900	7.090	43.72	0.44	1.96	H	-27.940

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

[Uplink] – WCS 2300

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

Notes:

1. Test datas were only the worst case.
2. We have done horizontal and vertical polarizaion in detecting antenna.

[Downlink] – BRS Band

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

[Uplink] – BRS Band

Ch.	Freq.(MHz)	Measured Level [dBuV/m]	Measured Power [dBm]	Ant. Factor [dB/m]	C.L [dB]	A.G. [dB]	H.P.F.. [dB]	D.F. [dB]	Pol.	Result [dBm]
No Critical Peaks Found										

* C.L.: Cable Loss / A.G.: Ant. Gain / H.P.F.: High Pass Filter / D.F.: Distance Factor (3.75 m)

12. FREQUENCY STABILITY OVER TEMPERATURE AND VOLTAGE VARIATIONS

FCC Rules

Test Requirements:

§ 2.1055 Measurements required: Frequency stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

§ 22.355 Frequency tolerance.

Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

Table C-1—Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Base, fixed (ppm)	Mobile >3 watts (ppm)	Mobile ≤3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	n/a	n/a
929 to 960	1.5	n/a	n/a
2110 to 2220	10.0	n/a	n/a

§ 24.235 Frequency stability.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

§ 27.54 Frequency stability.

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

§90.213 Frequency stability.

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

Minimum Frequency Stability

[Parts per million (ppm)]

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

(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

IC Rules

Test Requirements:

RSS-130

4. Transmitter and Receiver Standard Specifications

4.3 Transmitter Frequency Stability

The transmitter frequency stability limit shall be determined as follows:

(a) The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;

(b) Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of 43 + 10 $\log_{10}$ p (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as f_L and f_H respectively.

The applicant shall ensure frequency stability by showing that f_L minus the frequency offset and f_H plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

RSS-131

5. Equipment standard specifications for zone enhancers working with equipment certified in RSSs listed in section 1 except RSS-119

5.2 Industrial Zone Enhancers

5.2.4 Frequency stability

Industrial Zone Enhancers shall comply with the frequency stability given in the RSS that applies to the equipment with which the zone enhancer is to be used. In cases where the frequency stability limit is not given in the applicable RSS, the equipment shall comply with a frequency stability of ± 1.5 ppm.

For zone enhancers with no input signal processing capability, the frequency stability measurement in this section is not required.

RSS-119

5. Transmitter and Receiver Specifications

5.3 Transmitter Frequency Stability

The carrier frequency shall not depart from the reference frequency in excess of the values given in Table 1. For transmitters that have an output power of less than 120 mW, the frequency stability shall comply with the limits listed in Table 1 or, alternatively, with the conditions in Section 5.10.

For fixed and base station equipment, in lieu of meeting the frequency stability limit specified in Table 1, the test report can show that the frequency stability is met by demonstrating that the unwanted emission limits, related to the equipment's nominal carrier frequency measured under

normal operation, are met when the equipment is tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

Table 1 — Transmitter Frequency Stability

Frequency Band (MHz)	Channel Bandwidth (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			Output Power >2 W	Output Power ≤2 W
27.41-28 and 29.7-50	20	20	20	50
72-76	20	5	20	50
138-174	30	5	5	5
	15	2.5	5	5
	7.5	1	2	5
217-218 and 219-220	12.5	1	5	5
220-222	5	0.1	1.5	1.5
406.1-430 and 450-470	25	0.5	1	1
	25	2.5	5	5
	12.5	1.5	2.5	2.5
	6.25	0.5	1	1
768-776 and 798-806	25	0.1	0.4	0.4
	12.5			
	6.25			
	50	1	1.25	1.25
806-821/851-866 and 821-824/866- 869	25	0.1	0.1	0.1
	25	1.5	2.5	2.5
	12.5	1	1.5	1.5
	6.25	0.1	0.4	0.4
896-901/935-940	12.5	0.1	1.5	1.5
929-930/931-932	25	1.5	N/A	N/A
928-929/952-953 and 932-932.5/941- 941.5	25	1.5	N/A	N/A
	12.5	1	3 (for remote station)	N/A
932.5-935/941.5-944	25	2.5	N/A	N/A
	12.5	2.5	N/A	N/A

RSS-132

5. Transmitter Standard Specifications

5.3 Frequency Stability

The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth stays within each of the sub-bands (see Section 5.1) when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS-139

6. Transmitter and Receiver Standard Specifications

6.3 Frequency Stability

The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS-195

5. Transmitter and Receiver Standard Specifications

5.4 Frequency Stability

The applicant shall ensure frequency stability by showing that the occupied bandwidth is maintained within the range of the operating frequency blocks when testing under the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

RSS-199

4. Transmitter and receiver standard specifications

4.3 Transmitter Frequency Stability

The transmitter frequency stability limit shall be determined as follows:

a. the frequency offset shall be measured according to the procedure described in RSS-Gen and recorded
b. using a resolution bandwidth equal to that permitted within the 1 MHz band immediately outside the channel edge, as found in section 4.5, reference points will be selected at the unwanted emission limits, which comply with the attenuation specified in section 4.5 for the type of device under test, on the emission mask of the lowest and highest channels. The frequency at these points shall be recorded as f_L and f_H respectively

The applicant shall ensure compliance with frequency stability requirements by showing that

f_L minus the frequency offset and f_H plus the frequency offset is within the frequency range in which the equipment is designed to operate.

Test Procedures:

As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Spectrum Analyzer.

The EUT was placed in the Environmental Chamber.

A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.

The frequency drift was investigated for every 10 °C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30 to 50 °C.

Voltage supplied to EUT is 110 Vac reference temperature was done at 20°C.

The voltage was varied by ± 15 % of nominal

RSS-Gen

6. Technical Requirements

6.11 Transmitter Frequency Stability

In circumstances when the transmitter frequency stability is not stated in the applicable RSS or reference measurement method, the following applies:

- Frequency stability is a measure of frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage. Unless specified otherwise in an RSS applicable to the device, the reference temperature for radio transmitters is +20°C (+68°F);
- A hand-held device that is only capable of operating using internal batteries shall be tested at the battery's nominal voltage, and again at the battery's operating end-point voltage, which must be specified by the equipment manufacturer. For this test, either a battery or an external power supply can be used; and
- The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determiningcircuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environmental test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement. The following temperatures and supply voltage ranges apply, unless specified otherwise in the applicable RSS:

(a) at the temperatures of −30°C (−22°F), +20°C (+68°F) and +50°C (+122°F), and at the

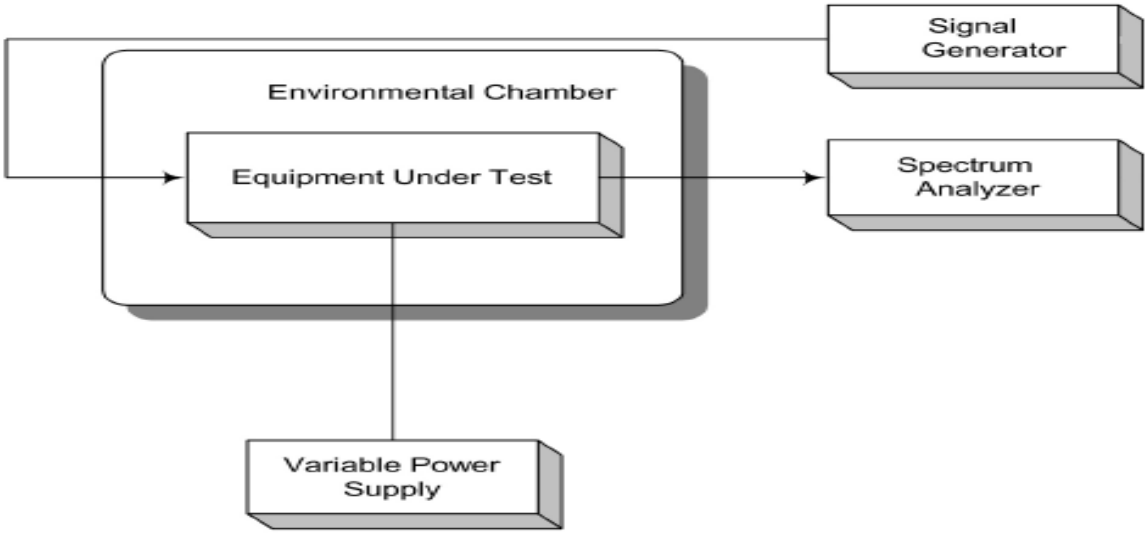
manufacturer's rated supply voltage; and

(b) at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage.

If the frequency stability limits are only met within a temperature range that is smaller than the −30°C to +50°C range specified in (a), the frequency stability requirement will be deemed to be met if the transmitter is automatically prevented from operating outside this smaller temperature range and if the published operating characteristics for the equipment are revised to reflect this restricted temperature range.

In addition, if an unmodulated carrier is not available, the measurement method shall be described in the test report.

Test Setup:



* Note: This EUT is supported power supply both of AC and DC. Test results are only attached worst cases.

Test Results:

Frequency Stability and Voltage Test Results

[Downlink] – 700 LTE

Reference: 120 Vac at 20°C **Freq.** = 742.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	742 000 000	0.048	0.000	0.00000
	-30	741 999 998	-2.113	-2.161	-0.00083
	-20	742 000 001	1.371	1.323	0.00051
	-10	742 000 002	2.221	2.173	0.00084
	0	742 000 000	0.384	0.336	0.00013
	+10	741 999 999	-1.131	-1.179	-0.00045
	+30	742 000 000	0.146	0.098	0.00004
	+40	742 000 003	3.021	2.973	0.00115
	+50	742 000 000	0.173	0.125	0.00005
High	+20	741 999 998	-1.742	-1.790	-0.00069
Low	+20	742 000 000	0.244	0.196	0.00008

[Uplink_Lower] – 700 LTE

Reference: 120 Vac at 20°C **Freq.** = 707.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	707 000 001	1.003	0.000	0.00000
	-30	706 999 999	-0.508	-1.511	-0.00058
	-20	706 999 998	-2.233	-3.236	-0.00125
	-10	707 000 001	1.345	0.342	0.00013
	0	707 000 001	0.937	-0.066	-0.00003
	+10	707 000 001	1.433	0.430	0.00017
	+30	706 999 999	-1.440	-2.443	-0.00094
	+40	707 000 002	2.383	1.380	0.00053
	+50	707 000 000	0.381	-0.622	-0.00024
High	+20	707 000 001	1.433	0.430	0.00017
Low	+20	707 000 001	0.857	-0.146	-0.00006

[Uplink_Upper] – 700 LTE

Reference: 120 Vac at 20°C **Freq.** = 782.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	782 000 003	2.589	0.000	0.00000
	-30	782 000 003	3.334	0.745	0.00029
	-20	782 000 002	1.918	-0.671	-0.00026
	-10	781 999 997	-3.032	-5.621	-0.00217
	0	781 999 997	-2.834	-5.423	-0.00209
	+10	781 999 998	-1.919	-4.508	-0.00174
	+30	782 000 001	1.335	-1.254	-0.00048
	+40	782 000 000	0.308	-2.281	-0.00088
	+50	782 000 001	0.542	-2.047	-0.00079
High	+20	782 000 002	1.937	-0.652	-0.00025
Low	+20	782 000 002	2.483	-0.106	-0.00004

[Downlink] – 800 MHz

Reference: 120 Vac at 20°C **Freq.** = 869.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	869 000 001	0.814	0.000	0.00000
	-30	868 999 999	-1.439	-2.253	-0.00087
	-20	869 000 001	1.234	0.420	0.00016
	-10	869 000 000	-0.195	-1.009	-0.00039
	0	869 000 000	0.077	-0.737	-0.00028
	+10	869 000 001	0.564	-0.250	-0.00010
	+30	869 000 001	1.448	0.634	0.00024
	+40	869 000 001	0.531	-0.283	-0.00011
	+50	869 000 000	0.179	-0.635	-0.00024
High	+20	869 000 001	0.549	-0.265	-0.00010
Low	+20	869 000 001	0.882	0.068	0.00003

[Uplink] – 800 MHz

Reference: 120 Vac at 20°C **Freq.** = 824.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	824 000 000	0.117	0.000	0.00000
	-30	824 000 002	2.316	2.199	0.00085
	-20	823 999 999	-1.393	-1.510	-0.00058
	-10	824 000 002	1.749	1.632	0.00063
	0	824 000 001	1.495	1.378	0.00053
	+10	824 000 000	-0.397	-0.514	-0.00020
	+30	823 999 999	-0.990	-1.107	-0.00043
	+40	824 000 001	0.653	0.536	0.00021
	+50	823 999 998	-2.010	-2.127	-0.00082
High	+20	824 000 000	-0.207	-0.324	-0.00012
Low	+20	824 000 001	0.542	0.425	0.00016

[Downlink] – PCS 1900

Reference: 120 Vac at 20°C **Freq.** = 1962.5 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	1962 500 000	0.376	0.000	0.00000
	-30	1962 499 998	-2.317	-2.693	-0.00104
	-20	1962 500 001	1.125	0.749	0.00029
	-10	1962 500 001	0.986	0.610	0.00024
	0	1962 499 999	-0.583	-0.959	-0.00037
	+10	1962 500 001	1.299	0.923	0.00036
	+30	1962 499 999	-1.336	-1.712	-0.00066
	+40	1962 500 001	1.053	0.677	0.00026
	+50	1962 500 003	2.551	2.175	0.00084
High	+20	1962 500 001	0.822	0.446	0.00017
Low	+20	1962 500 001	1.048	0.672	0.00026

[Uplink] – PCS 1900

Reference: 120 Vac at 20°C **Freq.** = 1882.5 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	1882 500 000	-0.037	0.000	0.00000
	-30	1882 500 001	0.694	0.731	0.00028
	-20	1882 499 999	-1.279	-1.242	-0.00048
	-10	1882 499 999	-0.898	-0.861	-0.00033
	0	1882 500 002	2.245	2.282	0.00088
	+10	1882 500 003	3.385	3.422	0.00132
	+30	1882 500 002	1.606	1.643	0.00063
	+40	1882 499 997	-2.535	-2.498	-0.00096
	+50	1882 499 998	-1.609	-1.572	-0.00061
High	+20	1882 499 999	-0.822	-0.785	-0.00030
Low	+20	1882 499 999	-0.549	-0.512	-0.00020

[Downlink] – AWS 2100

Reference: 120 Vac at 20°C **Freq.** = 2145.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2145 000 002	2.371	0.000	0.00000
	-30	2144 999 999	-0.910	-3.281	-0.00127
	-20	2145 000 002	2.485	0.114	0.00004
	-10	2145 000 003	3.291	0.920	0.00035
	0	2145 000 002	2.224	-0.147	-0.00006
	+10	2145 000 001	1.078	-1.293	-0.00050
	+30	2145 000 001	0.993	-1.378	-0.00053
	+40	2144 999 997	-3.183	-5.554	-0.00214
	+50	2145 000 002	1.865	-0.506	-0.00020
High	+20	2145 000 002	1.993	-0.378	-0.00015
Low	+20	2145 000 003	2.644	0.273	0.00011

[Downlink] – WCS 2300

Reference: 120 Vac at 20°C **Freq.** = 2355.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2355 000 000	0.456	0.000	0.00000
	-30	2355 000 001	0.914	0.458	0.00019
	-20	2355 000 000	-0.383	-0.839	-0.00036
	-10	2354 999 999	-1.117	-1.573	-0.00067
	0	2355 000 000	0.122	-0.334	-0.00014
	+10	2355 000 000	0.218	-0.238	-0.00010
	+30	2355 000 001	0.656	0.200	0.00008
	+40	2355 000 000	-0.483	-0.939	-0.00040
	+50	2354 999 999	-0.598	-1.054	-0.00045
High	+20	2355 000 001	0.591	0.135	0.00006
Low	+20	2355 000 000	0.338	-0.118	-0.00005

[Uplink] – WCS 2300

Reference: 120 Vac at 20°C **Freq.** = 2310.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2310 000 000	0.456	0.000	0.00000
	-30	2310 000 001	0.914	0.458	0.00020
	-20	2310 000 000	-0.383	-0.839	-0.00036
	-10	2309 999 999	-1.117	-1.573	-0.00068
	0	2310 000 000	0.122	-0.334	-0.00014
	+10	2310 000 000	0.218	-0.238	-0.00010
	+30	2310 000 001	0.656	0.200	0.00009
	+40	2310 000 000	-0.483	-0.939	-0.00041
	+50	2309 999 999	-0.598	-1.054	-0.00046
High	+20	2310 000 001	0.591	0.135	0.00006
Low	+20	2310 000 000	0.338	-0.118	-0.00005

[Downlink / Uplink] – BRS 2600

Reference: 120 Vac at 20°C **Freq.** = 2593.0 MHz

Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (Hz)	ppm
100%	+20(Ref)	2593 000 000	0.472	0.000	0.00000
	-30	2592 999 998	-1.623	-2.095	-0.00081
	-20	2592 999 998	-2.145	-2.617	-0.00101
	-10	2593 000 000	-0.031	-0.503	-0.00019
	0	2593 000 003	3.019	2.547	0.00098
	+10	2593 000 003	2.530	2.058	0.00079
	+30	2593 000 000	0.177	-0.295	-0.00011
	+40	2592 999 999	-0.517	-0.989	-0.00038
	+50	2593 000 002	1.568	1.096	0.00042
High	+20	2593 000 000	0.181	-0.291	-0.00011
Low	+20	2593 000 001	0.638	0.166	0.00006