

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

1.5 ppm is for base and fixed station. 2.5 ppm is for mobile station.

4.3.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

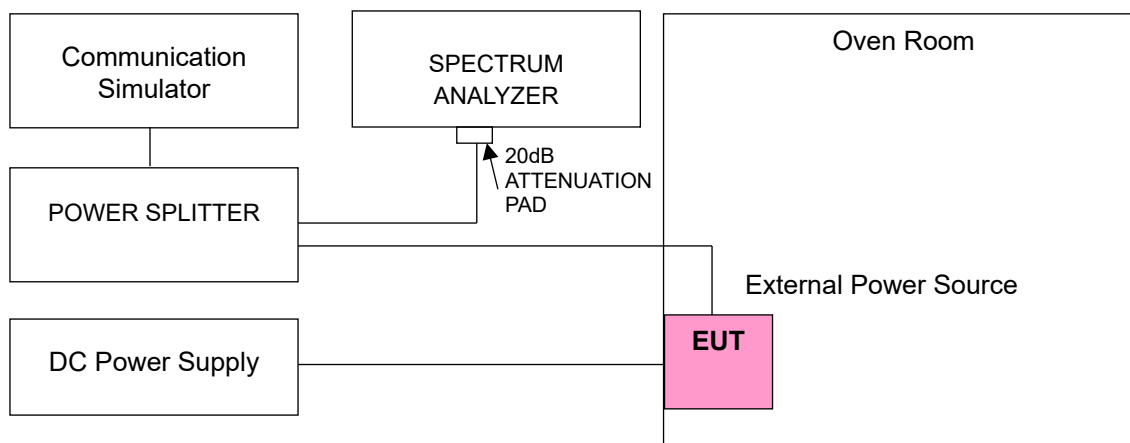
Note: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
UXM 5G Wireless Test Platform Keysight	E7515B	MY58300759	Apr. 18, 2020	Apr. 17, 2021
Temperature & Humidity Chamber TERCHY	HRM-120RF	931022	Dec. 24, 2020	Dec. 23, 2021
Digital Multimeter Fluke	87-III	70360742	Jun. 23, 2020	Jun. 22, 2021
DC Power Supply Topward	6306A	727263	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.3.4 Test Setup



4.3.5 Test Results

Frequency Error vs. Voltage

Voltage (Volts)	n5			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.40	826.500002	0.002	846.500003	0.004
3.85	826.499999	-0.001	846.500004	0.005
3.40	826.499998	-0.002	846.499999	-0.001

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	n5			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	826.499999	-0.001	846.499998	-0.002
-20	826.499996	-0.005	846.499999	-0.001
-10	826.500002	0.002	846.499998	-0.002
0	826.499998	-0.002	846.499997	-0.004
10	826.499996	-0.005	846.499997	-0.004
20	826.500003	0.004	846.499999	-0.001
30	826.499998	-0.002	846.500004	0.005
40	826.499996	-0.005	846.499996	-0.005
50	826.499997	-0.004	846.500003	0.004

Frequency Error vs. Voltage

Voltage (Volts)	n5			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.40	829.000004	0.005	843.999997	-0.004
3.85	828.999998	-0.002	843.999998	-0.002
3.40	828.999998	-0.002	843.999997	-0.004

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	n5			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	828.999996	-0.005	843.999996	-0.005
-20	828.999998	-0.002	844.000004	0.005
-10	828.999997	-0.004	844.000004	0.005
0	829.000004	0.005	843.999997	-0.004
10	829.000001	0.001	843.999997	-0.004
20	828.999998	-0.002	843.999996	-0.005
30	829.000002	0.002	844.000001	0.001
40	828.999998	-0.002	844.000001	0.001
50	829.000004	0.005	844.000001	0.001

Frequency Error vs. Voltage

Voltage (Volts)	n5			
	Channel Bandwidth 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.40	831.499996	-0.005	841.499999	-0.001
3.85	831.499999	-0.001	841.499998	-0.002
3.40	831.500002	0.002	841.499998	-0.002

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	n5			
	Channel Bandwidth 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	831.499999	-0.001	841.500003	0.004
-20	831.499998	-0.002	841.499998	-0.002
-10	831.499997	-0.004	841.499996	-0.005
0	831.500001	0.001	841.500004	0.005
10	831.499999	-0.001	841.500002	0.002
20	831.499999	-0.001	841.499996	-0.005
30	831.500003	0.004	841.500004	0.005
40	831.499996	-0.005	841.499998	-0.002
50	831.499997	-0.004	841.499997	-0.004

Frequency Error vs. Voltage

Voltage (Volts)	n5			
	Channel Bandwidth 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.40	834.000002	0.002	838.999999	-0.001
3.85	833.999997	-0.004	839.000001	0.001
3.40	833.999999	-0.001	838.999998	-0.002

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	n5			
	Channel Bandwidth 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	834.000001	0.001	838.999996	-0.005
-20	833.999996	-0.005	839.000003	0.004
-10	833.999996	-0.005	839.000002	0.002
0	833.999998	-0.002	839.000002	0.002
10	833.999997	-0.004	839.000003	0.004
20	834.000004	0.005	839.000004	0.005
30	834.000004	0.005	839.000002	0.002
40	834.000003	0.004	838.999997	-0.004
50	834.000001	0.001	838.999999	-0.001

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1850.700003	0.001621	1909.300000	0.001886
3.40	1850.700003	0.001405	1909.300004	0.001886
4.40	1850.700002	0.001081	1909.300002	0.000943

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1850.700004	0.001999	1909.300002	0.000838
-20	1850.700002	0.001027	1909.300001	0.000629
-10	1850.700001	0.000540	1909.300002	0.000943
0	1850.700002	0.000919	1909.300003	0.001624
10	1850.699998	-0.000919	1909.299998	-0.001205
20	1850.699998	-0.001351	1909.299998	-0.001205
30	1850.699998	-0.001027	1909.299999	-0.000629
40	1850.699997	-0.001567	1909.299999	-0.000576
50	1850.699997	-0.001675	1909.299999	-0.000786

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth 3MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1851.500002	0.000864	1908.500003	0.001782
3.40	1851.500001	0.000540	1908.500004	0.001991
4.40	1851.500004	0.001998	1908.500003	0.001415

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 3MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1851.500004	0.002106	1908.500003	0.001729
-20	1851.500003	0.001620	1908.500004	0.001939
-10	1851.500001	0.000648	1908.500004	0.001886
0	1851.500002	0.000972	1908.500003	0.001729
10	1851.499998	-0.001188	1908.499998	-0.001310
20	1851.499998	-0.001242	1908.499999	-0.000734
30	1851.499996	-0.002160	1908.499997	-0.001782
40	1851.499996	-0.001944	1908.499999	-0.000576
50	1851.499997	-0.001566	1908.499998	-0.001048

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1852.500002	0.001134	1907.500003	0.001415
3.40	1852.500004	0.001997	1907.500002	0.001153
4.40	1852.500003	0.001457	1907.500002	0.001258

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1852.500001	0.000756	1907.500003	0.001363
-20	1852.500003	0.001673	1907.500002	0.001258
-10	1852.500002	0.001296	1907.500004	0.002045
0	1852.500001	0.000756	1907.500002	0.001206
10	1852.499997	-0.001727	1907.499998	-0.000839
20	1852.499996	-0.002159	1907.499999	-0.000682
30	1852.499997	-0.001835	1907.499997	-0.001835
40	1852.499997	-0.001511	1907.499999	-0.000577
50	1852.499997	-0.001835	1907.499996	-0.002045

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1855.000002	0.000863	1905.000002	0.000787
3.40	1855.000002	0.000916	1905.000002	0.000787
4.40	1855.000002	0.000863	1905.000003	0.001470

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1855.000002	0.001132	1905.000002	0.001102
-20	1855.000002	0.001294	1905.000002	0.001155
-10	1855.000002	0.000916	1905.000002	0.001207
0	1855.000003	0.001348	1905.000004	0.001837
10	1854.999996	-0.001995	1904.999996	-0.002100
20	1854.999998	-0.000970	1904.999999	-0.000735
30	1854.999999	-0.000539	1904.999996	-0.001995
40	1854.999997	-0.001617	1904.999996	-0.001942
50	1854.999998	-0.001294	1904.999997	-0.001627

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1857.500003	0.001777	1902.500003	0.001577
3.40	1857.500002	0.001292	1902.500004	0.002050
4.40	1857.500003	0.001723	1902.500003	0.001524

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1857.500002	0.001023	1902.500004	0.001840
-20	1857.500003	0.001507	1902.500004	0.001945
-10	1857.500003	0.001615	1902.500002	0.000999
0	1857.500001	0.000538	1902.500003	0.001577
10	1857.499997	-0.001561	1902.499996	-0.002050
20	1857.499996	-0.002153	1902.499996	-0.002050
30	1857.499998	-0.000861	1902.499996	-0.002102
40	1857.499999	-0.000538	1902.499998	-0.000894
50	1857.499997	-0.001777	1902.499997	-0.001524

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 2			
	Channel Bandwidth 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1860.000002	0.000914	1900.000004	0.001895
3.40	1860.000003	0.001505	1900.000004	0.002105
4.40	1860.000002	0.001129	1900.000002	0.001211

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 2			
	Channel Bandwidth 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1860.000003	0.001613	1900.000002	0.000895
-20	1860.000003	0.001720	1900.000003	0.001684
-10	1860.000004	0.001989	1900.000004	0.002105
0	1860.000002	0.001022	1900.000002	0.000789
10	1859.999998	-0.001075	1899.999997	-0.001842
20	1859.999997	-0.001452	1899.999997	-0.001632
30	1859.999998	-0.000914	1899.999998	-0.001000
40	1859.999999	-0.000645	1899.999997	-0.001789
50	1859.999998	-0.001022	1899.999998	-0.000842

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 66			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1710.700001	0.000818	1779.300004	0.002023
3.40	1710.700003	0.001520	1779.300002	0.001180
4.40	1710.700002	0.000935	1779.300002	0.000899

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 66			
	Channel Bandwidth 1.4 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1710.700002	0.001286	1779.300002	0.001349
-20	1710.700004	0.002104	1779.300002	0.001068
-10	1710.700002	0.000994	1779.300003	0.001405
0	1710.700002	0.000877	1779.300004	0.001967
10	1710.699999	-0.000701	1779.299999	-0.000674
20	1710.699999	-0.000818	1779.299999	-0.000731
30	1710.699998	-0.001461	1779.299998	-0.001012
40	1710.699998	-0.001461	1779.299997	-0.001461
50	1710.699998	-0.001344	1779.299996	-0.002136

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 66			
	Channel Bandwidth 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1711.500004	0.002337	1778.500002	0.000843
3.40	1711.500002	0.001110	1778.500004	0.002024
4.40	1711.500004	0.002337	1778.500003	0.001518

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 66			
	Channel Bandwidth 3 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1711.500003	0.001578	1778.500004	0.002249
-20	1711.500002	0.001402	1778.500004	0.002249
-10	1711.500004	0.002162	1778.500002	0.001125
0	1711.500002	0.001402	1778.500004	0.002193
10	1711.499996	-0.002103	1778.499997	-0.001743
20	1711.499997	-0.002045	1778.499998	-0.000900
30	1711.499997	-0.001987	1778.499997	-0.001968
40	1711.499998	-0.001052	1778.499999	-0.000562
50	1711.499999	-0.000584	1778.499997	-0.001855

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 66			
	Channel Bandwidth 5MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1712.500003	0.001577	1777.500004	0.002082
3.40	1712.500002	0.001285	1777.500004	0.002025
4.40	1712.500004	0.002219	1777.500003	0.001519

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 66			
	Channel Bandwidth 5MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1712.500003	0.001577	1777.500002	0.001125
-20	1712.500004	0.002102	1777.500003	0.001857
-10	1712.500003	0.001869	1777.500002	0.001294
0	1712.500002	0.001401	1777.500002	0.000900
10	1712.499996	-0.002277	1777.499998	-0.000900
20	1712.499997	-0.001869	1777.499999	-0.000788
30	1712.499999	-0.000642	1777.499997	-0.001688
40	1712.499997	-0.001927	1777.499997	-0.001463
50	1712.499998	-0.000993	1777.499998	-0.001181

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 66			
	Channel Bandwidth 10MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1715.000003	0.001574	1775.000002	0.001183
3.40	1715.000002	0.000933	1775.000003	0.001803
4.40	1715.000003	0.001983	1775.000002	0.000845

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 66			
	Channel Bandwidth 10MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1715.000004	0.002041	1775.000003	0.001915
-20	1715.000002	0.000875	1775.000001	0.000676
-10	1715.000003	0.001574	1775.000004	0.001972
0	1715.000003	0.001691	1775.000003	0.001408
10	1714.999997	-0.001924	1774.999998	-0.001352
20	1714.999998	-0.001399	1774.999997	-0.001634
30	1714.999998	-0.001283	1774.999999	-0.000676
40	1714.999999	-0.000816	1774.999996	-0.002254
50	1714.999998	-0.001108	1774.999997	-0.001859

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 66			
	Channel Bandwidth 15MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1717.500002	0.001164	1772.500002	0.001072
3.40	1717.500001	0.000582	1772.500002	0.000846
4.40	1717.500002	0.000990	1772.500002	0.001128

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 66			
	Channel Bandwidth 15MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1717.500004	0.002038	1772.500003	0.001580
-20	1717.500002	0.001048	1772.500003	0.001862
-10	1717.500003	0.001456	1772.500003	0.001805
0	1717.500004	0.002271	1772.500003	0.001523
10	1717.499996	-0.002154	1772.499999	-0.000621
20	1717.499998	-0.001164	1772.499999	-0.000564
30	1717.499998	-0.001164	1772.499997	-0.001975
40	1717.499996	-0.002213	1772.499999	-0.000790
50	1717.499999	-0.000582	1772.499999	-0.000790

Frequency Error vs. Voltage

Voltage (Volts)	LTE Band 66			
	Channel Bandwidth 20MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.85	1720.000002	0.000988	1770.000002	0.001186
3.40	1720.000002	0.001221	1770.000002	0.000847
4.40	1720.000002	0.001395	1770.000001	0.000791

Note: The applicant defined the normal working voltage is from 3.40Vdc to 4.40Vdc.

Frequency Error vs. Temperature

Temp. (°C)	LTE Band 66			
	Channel Bandwidth 20MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	1720.000002	0.000930	1770.000002	0.000847
-20	1720.000003	0.001860	1770.000002	0.001186
-10	1720.000004	0.002035	1770.000003	0.001751
0	1720.000003	0.001512	1770.000002	0.001186
10	1719.999999	-0.000640	1769.999998	-0.001186
20	1719.999997	-0.001744	1769.999999	-0.000847
30	1719.999999	-0.000814	1769.999998	-0.001186
40	1719.999997	-0.001512	1769.999997	-0.001864
50	1719.999996	-0.002151	1769.999997	-0.001864

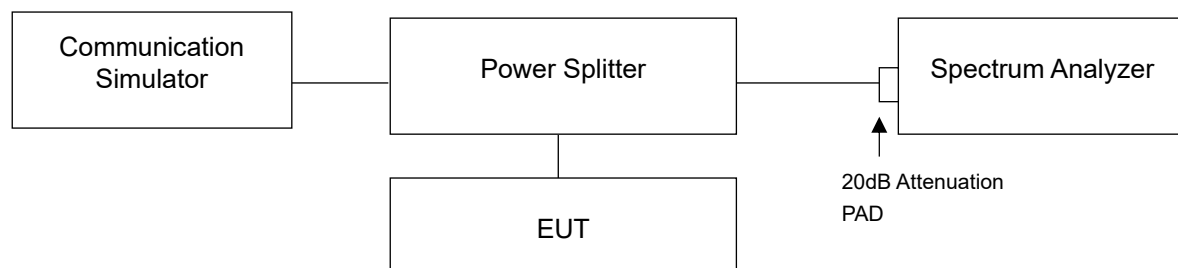
4.4 Occupied Bandwidth Measurement

4.4.1 Test Procedure

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Measurement method, please refer to section 5.4.4 of ANSI C63.26. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

For the 26dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

4.4.2 Test Setup



4.4.3 Test Result

Occupied Bandwidth

n5, Channel Bandwidth 5MHz						
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
165300	826.5	4.47	4.47	4.47	4.47	4.47
167300	836.5	4.46	4.47	4.47	4.47	4.47
169300	846.5	4.47	4.47	4.46	4.47	4.47
n5, Channel Bandwidth 10MHz						
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
165800	829.0	9.18	9.29	9.26	9.26	9.28
167300	836.5	9.17	9.28	9.28	9.26	9.28
168800	844.0	9.21	9.29	9.28	9.26	9.29
n5, Channel Bandwidth 15MHz						
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
166300	831.5	13.99	14.11	14.10	14.11	14.11
167300	836.5	13.99	14.11	14.10	14.11	14.11
168300	841.5	14.01	14.11	14.10	14.11	14.11
n5, Channel Bandwidth 20MHz						
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
166800	834.0	18.67	18.89	18.89	18.89	18.89
167300	836.5	18.73	18.89	18.89	18.89	18.90
167800	839.0	18.72	18.89	18.89	18.89	18.89

Spectrum Plot of Worst Value

5MHz / 64QAM



10MHz / QPSK



15MHz / 64QAM



20MHz / 256QAM

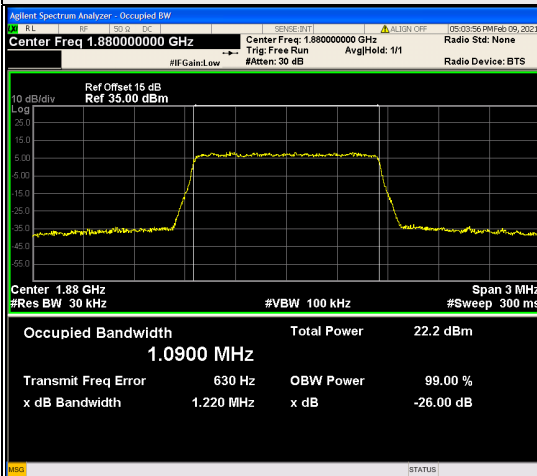


LTE Band 2, Channel Bandwidth 1.4MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18607	1850.7	1.09	1.09	1.09	1.09
18900	1880.0	1.09	1.09	1.09	1.09
19193	1909.3	1.09	1.09	1.09	1.09
LTE Band 2, Channel Bandwidth 3MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18615	1851.5	2.70	2.69	2.70	2.70
18900	1880.0	2.70	2.69	2.69	2.70
19185	1908.5	2.70	2.70	2.70	2.70
LTE Band 2, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18625	1852.5	4.49	4.49	4.50	4.49
18900	1880.0	4.49	4.49	4.49	4.49
19175	1907.5	4.49	4.49	4.50	4.48
LTE Band 2, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18650	1855.0	8.95	8.95	8.95	8.95
18900	1880.0	8.96	8.96	8.96	8.96
19150	1905.0	8.95	8.96	8.96	8.96
LTE Band 2, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18675	1857.5	13.45	13.44	13.43	13.44
18900	1880.0	13.46	13.45	13.44	13.45
19125	1902.5	13.45	13.44	13.43	13.44

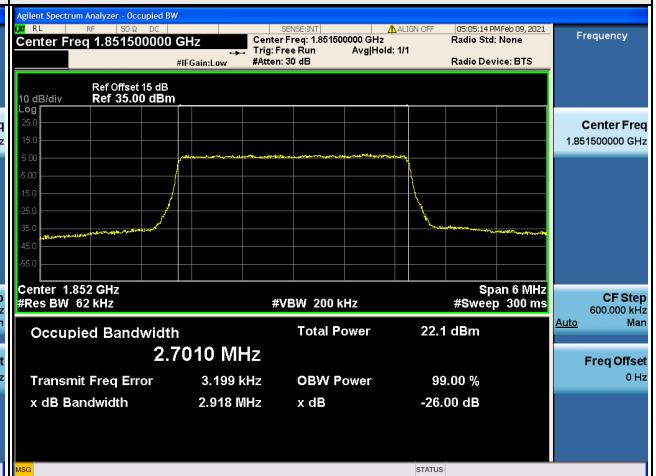
LTE Band 2, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18700	1860.0	17.90	17.92	17.92	17.92
18900	1880.0	17.91	17.94	17.93	17.93
19100	1900.0	17.90	17.93	17.90	17.91

Spectrum Plot of Worst Value

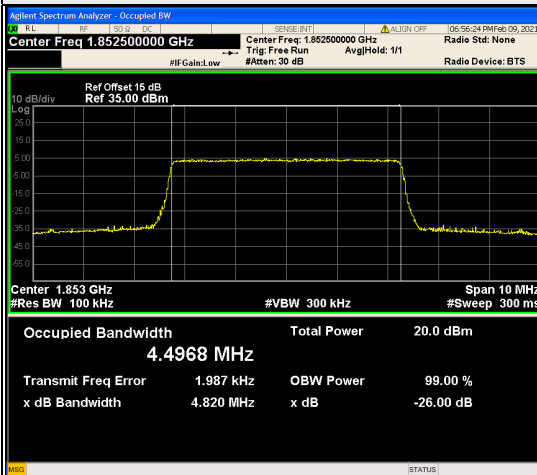
1.4MHz / 16QAM



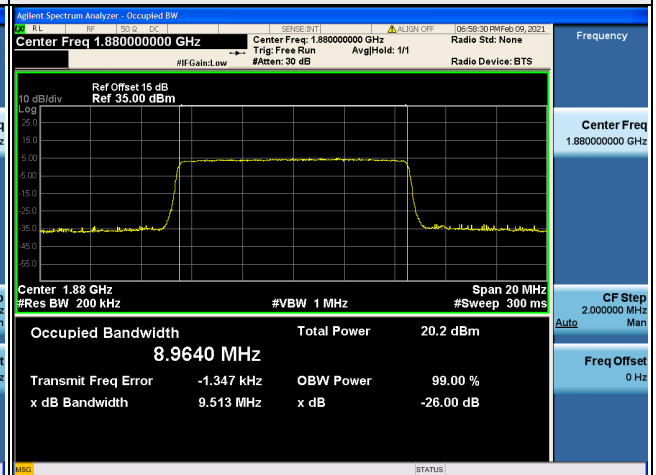
3MHz / QPSK



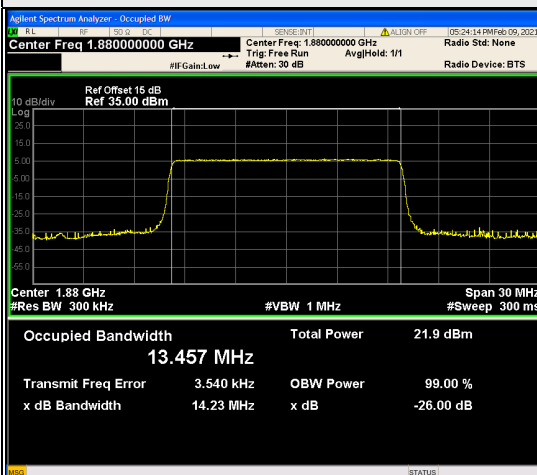
5MHz / 64QAM



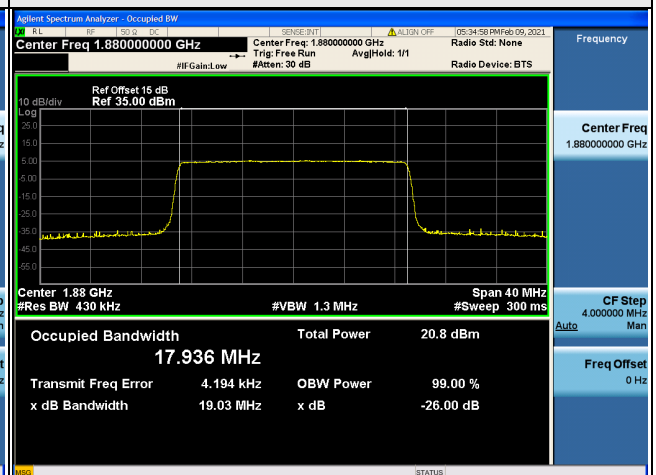
10MHz / 64QAM



15MHz / QPSK



20MHz / 16QAM

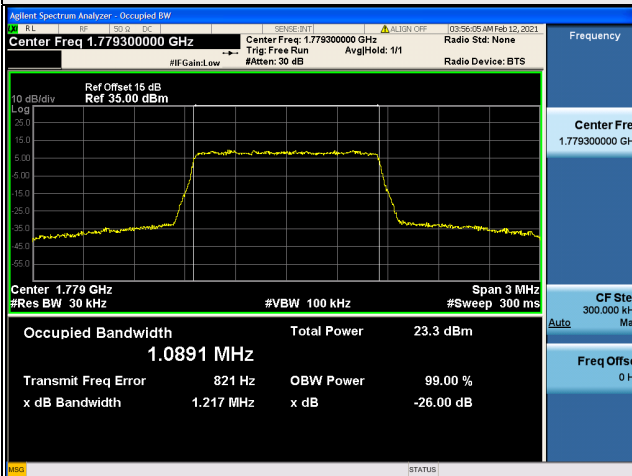


LTE Band 66, Channel Bandwidth 1.4MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
131979	1710.7	1.09	1.09	1.09	1.08
132322	1745.0	1.09	1.09	1.09	1.09
132665	1779.3	1.09	1.09	1.09	1.09
LTE Band 66, Channel Bandwidth 3MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
131987	1711.5	2.70	2.70	2.70	2.70
132322	1745.0	2.70	2.70	2.70	2.70
132657	1778.5	2.70	2.69	2.70	2.70
LTE Band 66, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
131997	1712.5	4.49	4.49	4.50	4.49
132322	1745.0	4.49	4.49	4.49	4.48
132647	1777.5	4.49	4.49	4.49	4.48
LTE Band 66, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
132022	1715.0	8.96	8.96	8.96	8.95
132322	1745.0	8.95	8.95	8.96	8.95
132622	1775.0	8.95	8.95	8.96	8.95
LTE Band 66, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
132047	1717.5	13.45	13.44	13.43	13.46
132322	1745.0	13.45	13.45	13.44	13.45
132597	1772.5	13.46	13.45	13.44	13.45

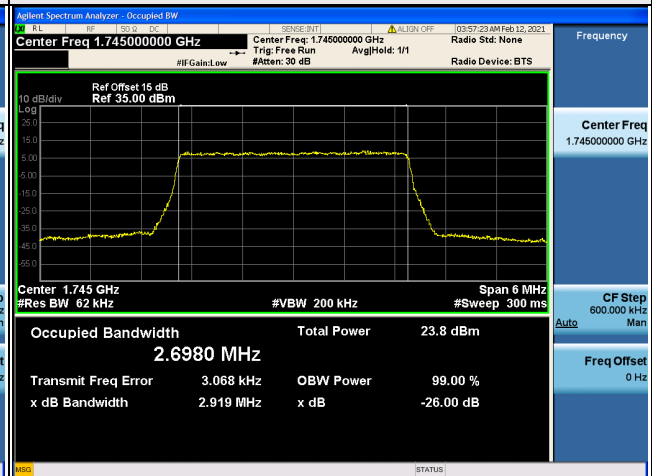
LTE Band 66, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
132072	1720.0	17.89	17.91	17.91	17.91
132322	1745.0	17.92	17.94	17.93	17.94
132572	1770.0	17.94	17.96	17.96	17.96

Spectrum Plot of Worst Value

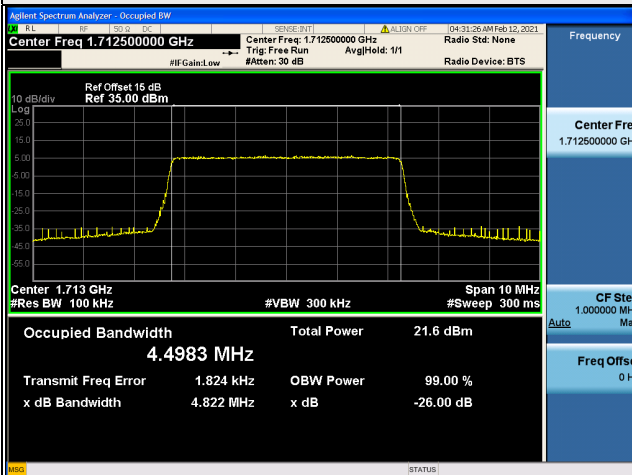
1.4MHz / 16QAM



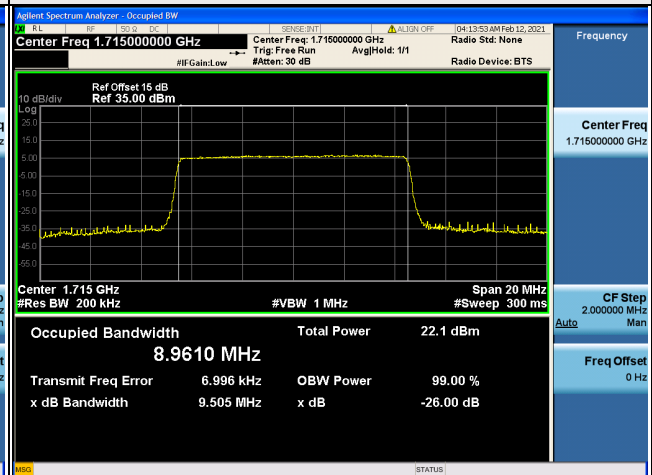
3MHz / QPSK



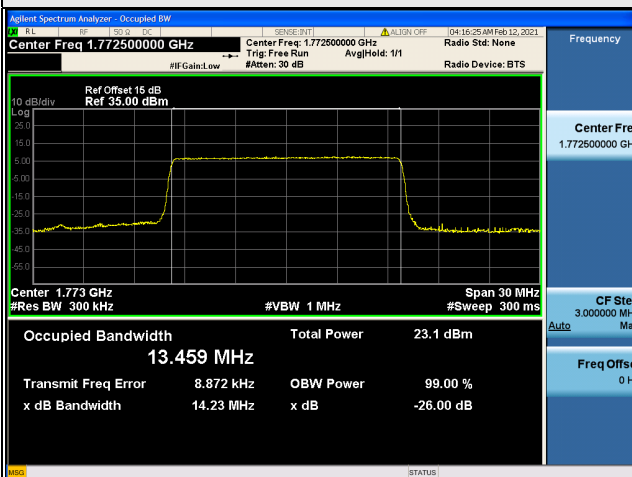
5MHz / 64QAM



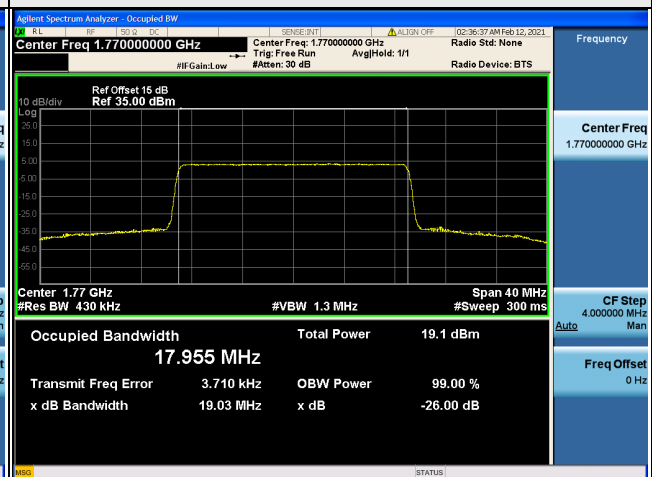
10MHz / 16QAM



15MHz / QPSK



20MHz / 256QAM



26dB Bandwidth

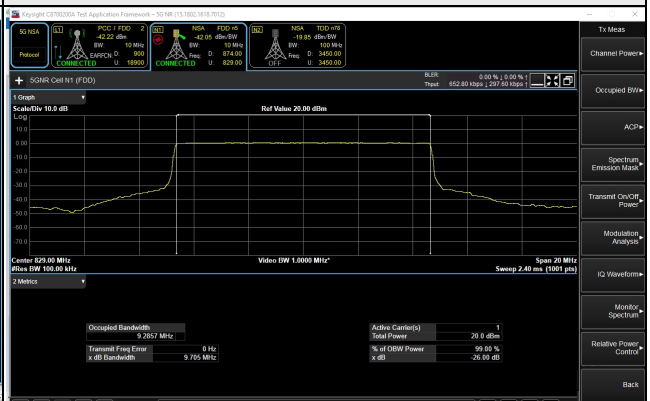
n5, Channel Bandwidth 5MHz						
Channel	Frequency (MHz)	26dB Bandwidth (MHz)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
165300	826.5	4.72	4.73	4.75	4.75	4.71
167300	836.5	4.73	4.73	4.73	4.75	4.69
169300	846.5	4.73	4.75	4.73	4.75	4.70
n5, Channel Bandwidth 10MHz						
Channel	Frequency (MHz)	26dB Bandwidth (MHz)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
165800	829.0	9.26	9.71	9.63	9.64	9.64
167300	836.5	9.26	9.66	9.62	9.63	9.63
168800	844.0	9.31	9.67	9.61	9.62	9.63
n5, Channel Bandwidth 15MHz						
Channel	Frequency (MHz)	26dB Bandwidth (MHz)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
166300	831.5	13.88	14.62	14.61	14.61	14.58
167300	836.5	13.88	14.62	14.60	14.60	14.59
168300	841.5	13.87	14.61	14.60	14.62	14.59
n5, Channel Bandwidth 20MHz						
Channel	Frequency (MHz)	26dB Bandwidth (MHz)				
		$\pi/2$ BPSK	QPSK	16QAM	64QAM	256QAM
166800	834.0	18.46	19.56	19.57	19.55	19.54
167300	836.5	18.47	19.56	19.57	19.55	19.55
167800	839.0	18.46	19.56	19.55	19.54	19.54

Spectrum Plot of Worst Value

5MHz / 64QAM



10MHz / QPSK



15MHz / QPSK



20MHz / 16QAM

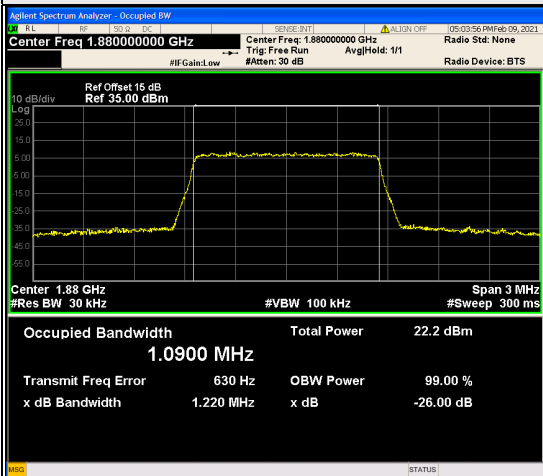


LTE Band 2, Channel Bandwidth 1.4MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18607	1850.7	1.22	1.22	1.22	1.21
18900	1880.0	1.21	1.22	1.21	1.21
19193	1909.3	1.21	1.21	1.22	1.21
LTE Band 2, Channel Bandwidth 3MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18615	1851.5	2.92	2.93	2.91	2.93
18900	1880.0	2.91	2.92	2.90	2.92
19185	1908.5	2.92	2.92	2.90	2.91
LTE Band 2, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18625	1852.5	4.78	4.80	4.82	4.80
18900	1880.0	4.80	4.80	4.82	4.81
19175	1907.5	4.79	4.80	4.83	4.80
LTE Band 2, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18650	1855.0	9.49	9.50	9.51	9.49
18900	1880.0	9.51	9.50	9.51	9.50
19150	1905.0	9.49	9.50	9.51	9.50
LTE Band 2, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18675	1857.5	14.25	14.25	14.23	14.22
18900	1880.0	14.23	14.25	14.24	14.24
19125	1902.5	14.25	14.23	14.23	14.23

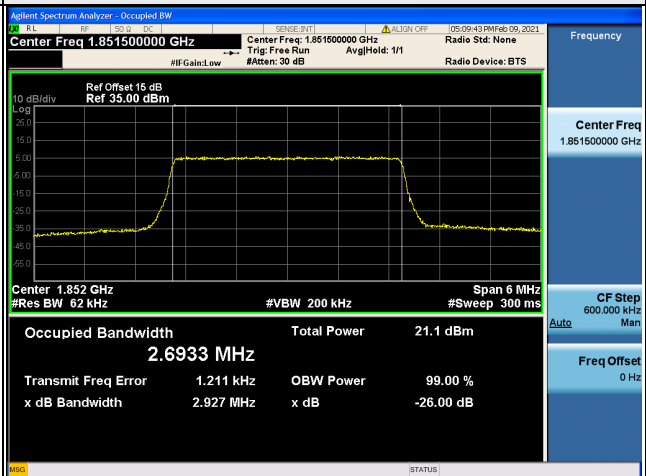
LTE Band 2, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
18700	1860.0	19.01	19.00	19.01	19.00
18900	1880.0	19.02	19.03	19.02	19.01
19100	1900.0	19.01	19.02	19.00	19.01

Spectrum Plot of Worst Value

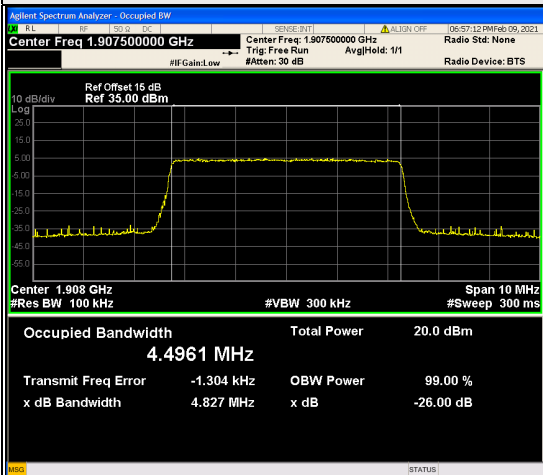
1.4MHz / 16QAM



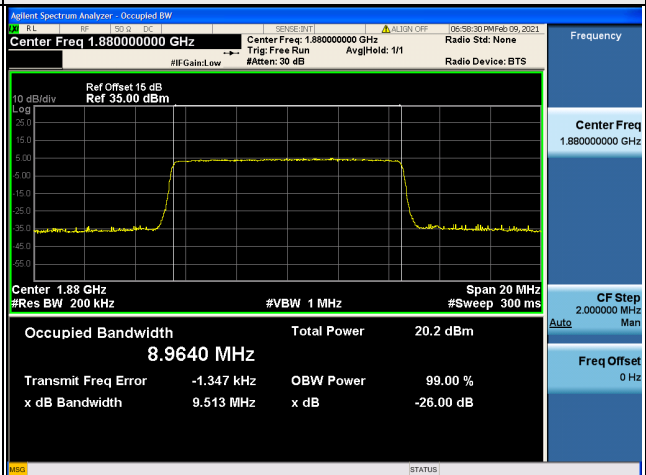
3MHz / 16QAM



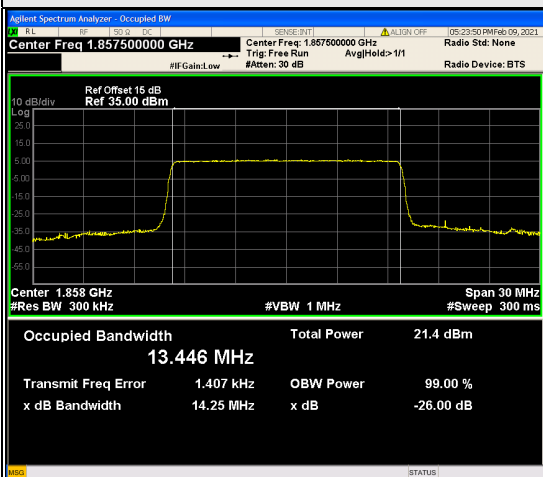
5MHz / 64QAM



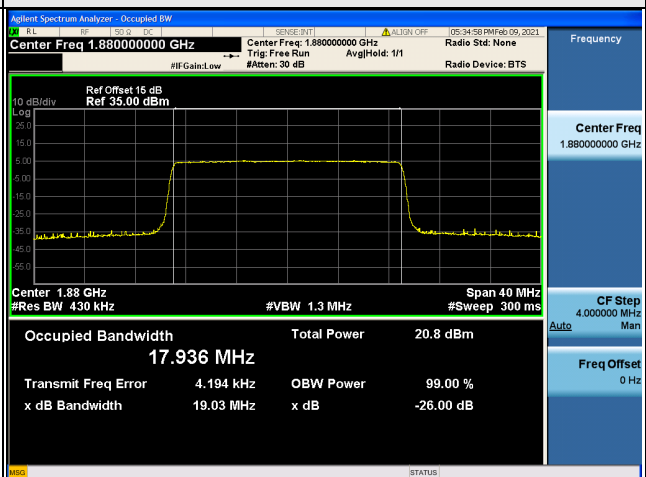
10MHz / 64QAM



15MHz / QPSK



20MHz / 16QAM

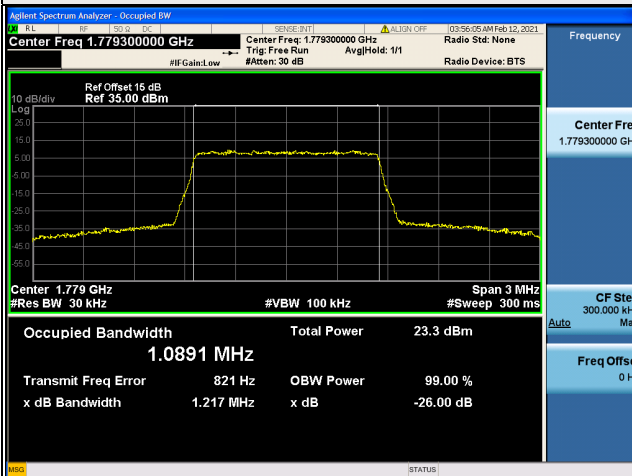


LTE Band 66, Channel Bandwidth 1.4MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
131979	1710.7	1.21	1.21	1.21	1.18
132322	1745.0	1.21	1.21	1.22	1.21
132665	1779.3	1.21	1.22	1.21	1.21
LTE Band 66, Channel Bandwidth 3MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
131987	1711.5	2.92	2.93	2.90	2.91
132322	1745.0	2.92	2.93	2.90	2.91
132657	1778.5	2.91	2.91	2.90	2.91
LTE Band 66, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
131997	1712.5	4.80	4.79	4.82	4.78
132322	1745.0	4.80	4.79	4.83	4.81
132647	1777.5	4.81	4.79	4.83	4.80
LTE Band 66, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
132022	1715.0	9.49	9.51	9.50	9.50
132322	1745.0	9.50	9.50	9.50	9.50
132622	1775.0	9.49	9.50	9.48	9.49
LTE Band 66, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
132047	1717.5	14.23	14.23	14.23	14.22
132322	1745.0	14.26	14.24	14.24	14.23
132597	1772.5	14.23	14.25	14.23	14.22

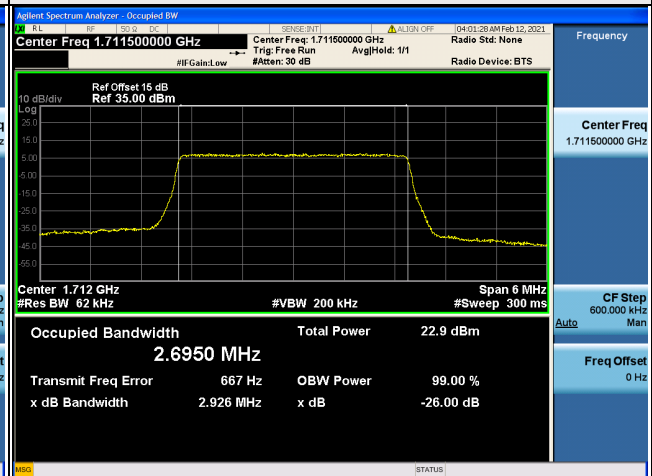
LTE Band 66, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
132072	1720.0	19.00	18.99	19.00	18.98
132322	1745.0	18.99	19.02	19.01	19.01
132572	1770.0	19.05	19.03	19.03	19.03

Spectrum Plot of Worst Value

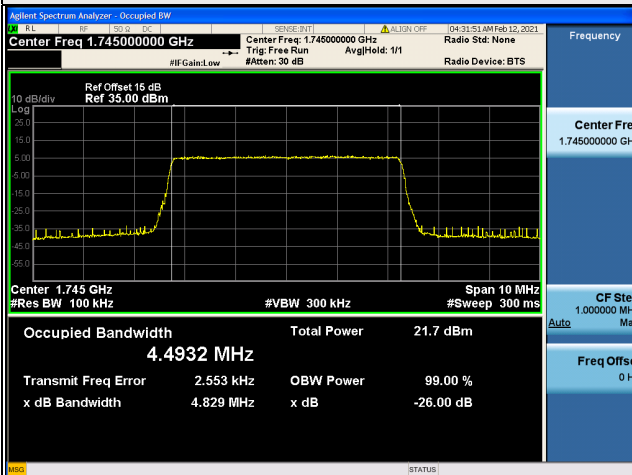
1.4MHz / 16QAM



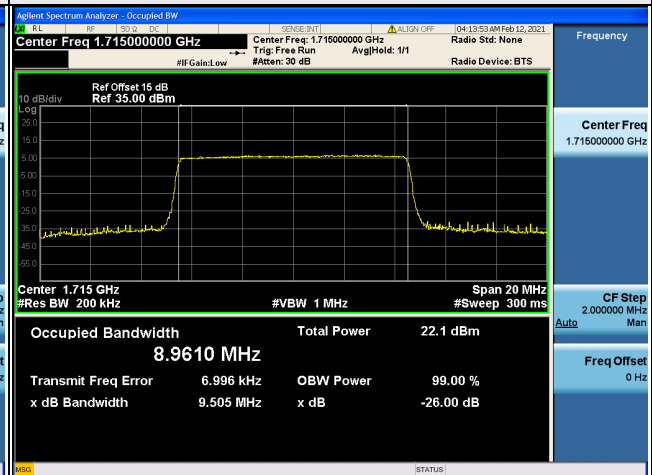
3MHz / 16QAM



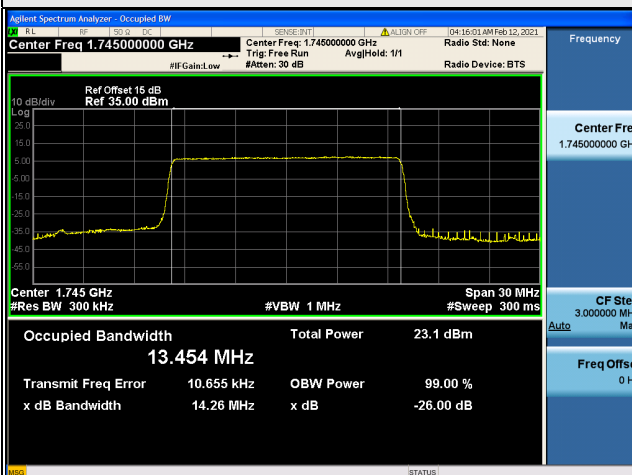
5MHz / 64QAM



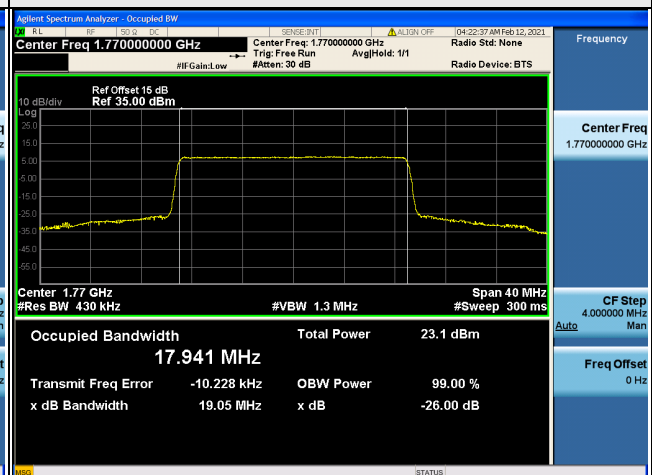
10MHz / 16QAM



15MHz / QPSK



20MHz / QPSK



4.5 Band Edge Measurement

4.5.1 Limits of Band Edge Measurement

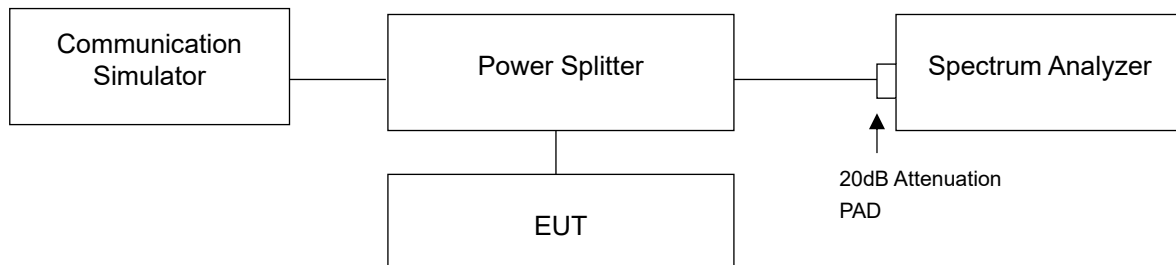
For n5, LTE Band 2:

Power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

For LTE Band 66:

According to FCC 27.53(h) for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log(P)$ dB.

4.5.2 Test Setup



4.5.3 Test Procedures

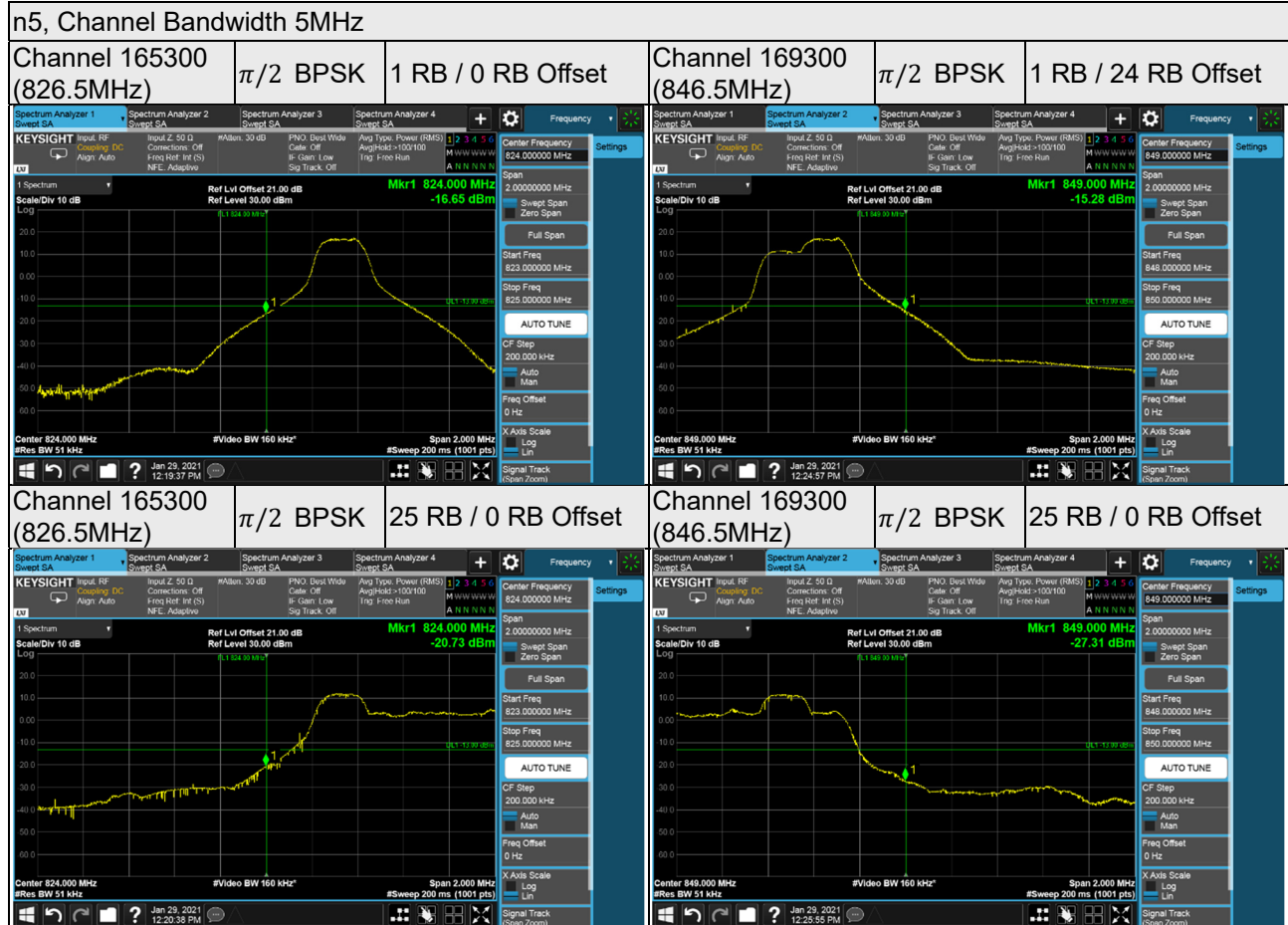
For 5G NR Band:

- a. The center frequency of spectrum is the band edge frequency and span is 2MHz. RB of the spectrum is 51kHz and VB of the spectrum is 160kHz (Channel Bandwidth 5MHz).
- b. The center frequency of spectrum is the band edge frequency and span is 2MHz. RB of the spectrum is 100kHz and VB of the spectrum is 300kHz (Channel Bandwidth 10MHz).
- c. The center frequency of spectrum is the band edge frequency and span is 2MHz. RB of the spectrum is 150kHz and VB of the spectrum is 470kHz (Channel Bandwidth 15MHz).
- d. The center frequency of spectrum is the band edge frequency and span is 2MHz. RB of the spectrum is 200kHz and VB of the spectrum is 620kHz (Channel Bandwidth 20MHz).
- e. Record the max trace plot into the test report.

For LTE Band:

- a. All measurements were done at low and high operational frequency range.
- b. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 15kHz and VB of the spectrum is 51kHz (Channel Bandwidth 1.4MHz).
- c. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 30kHz and VB of the spectrum is 100kHz (Channel Bandwidth 3MHz).
- d. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 51kHz and VB of the spectrum is 160kHz (Channel Bandwidth 5MHz).
- e. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 100kHz and VB of the spectrum is 300kHz (Channel Bandwidth 10MHz).
- f. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 150kHz and VB of the spectrum is 470kHz (Channel Bandwidth 15MHz).
- g. The center frequency of spectrum is the band edge frequency and span is 1MHz. RB of the spectrum is 200kHz and VB of the spectrum is 1MHz (Channel Bandwidth 20MHz).
- h. Record the max trace plot into the test report.

4.5.4 Test Results



n5, Channel Bandwidth 10MHz

Channel 165800
(829.0MHz)

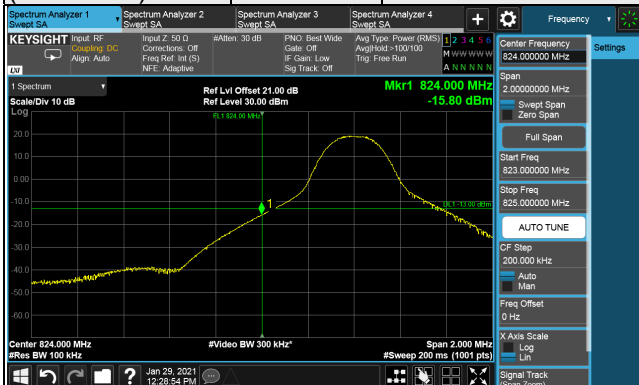
$\pi/2$ BPSK

1 RB / 1 RB Offset

Channel 168800
(844.0MHz)

$\pi/2$ BPSK

1 RB / 50 RB Offset



Channel 165800
(829.0MHz)

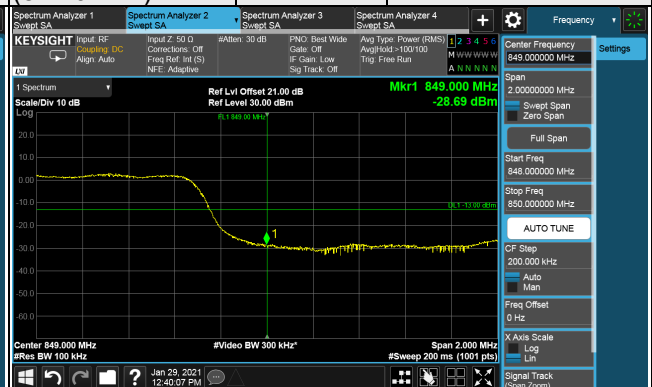
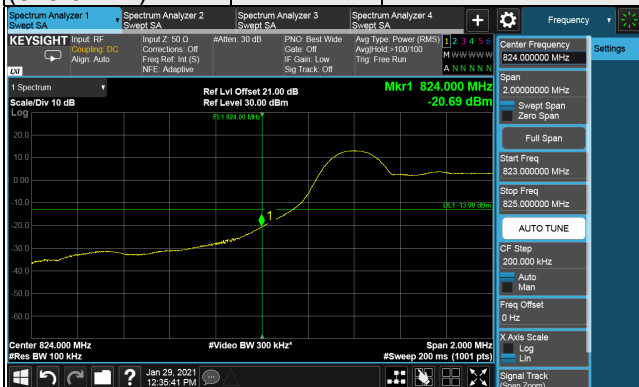
$\pi/2$ BPSK

50 RB / 0 RB Offset

Channel 168800
(844.0MHz)

$\pi/2$ BPSK

50 RB / 0 RB Offset



n5, Channel Bandwidth 15MHz

Channel 166300
(831.5MHz)

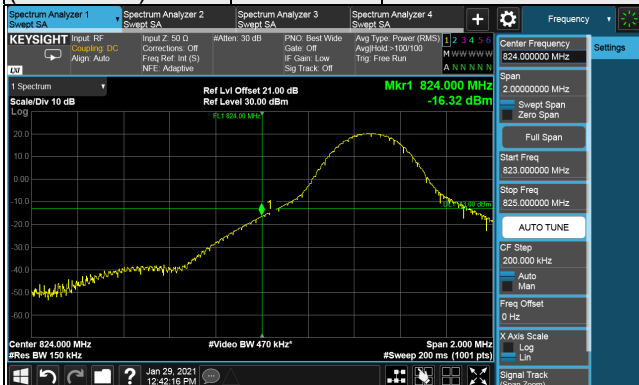
$\pi/2$ BPSK

1 RB / 1 RB Offset

Channel 168300
(841.5MHz)

$\pi/2$ BPSK

1 RB / 77 RB Offset



Channel 166300
(831.5MHz)

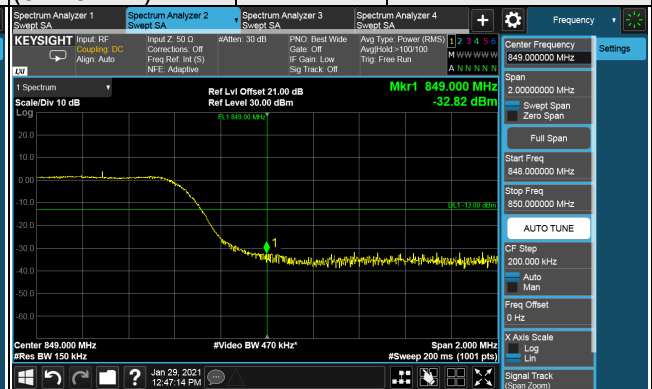
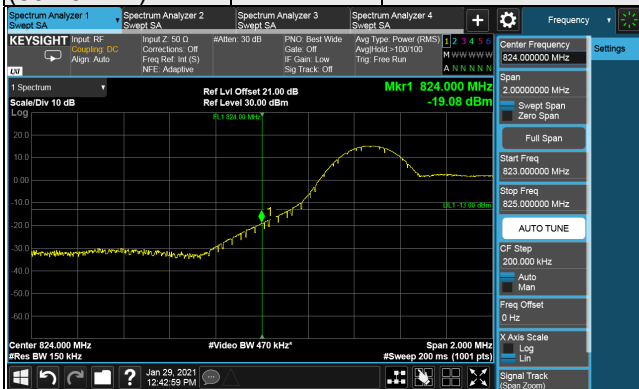
$\pi/2$ BPSK

75 RB / 0 RB Offset

Channel 168300
(841.5MHz)

$\pi/2$ BPSK

75 RB / 0 RB Offset



n5, Channel Bandwidth 20MHz

Channel 166800
(834.0MHz)

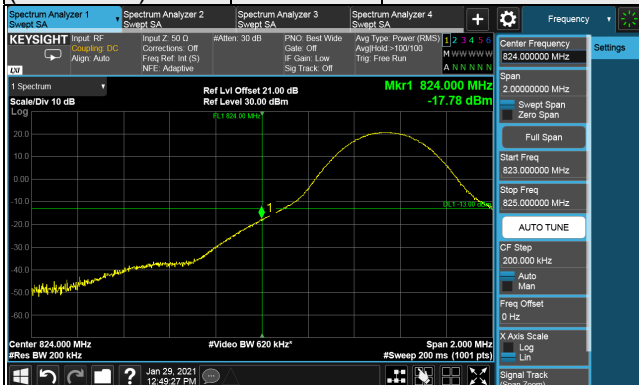
$\pi/2$ BPSK

1 RB / 1 RB Offset

Channel 167800
(839.0MHz)

$\pi/2$ BPSK

1 RB / 104 RB Offset



Channel 166800
(834.0MHz)

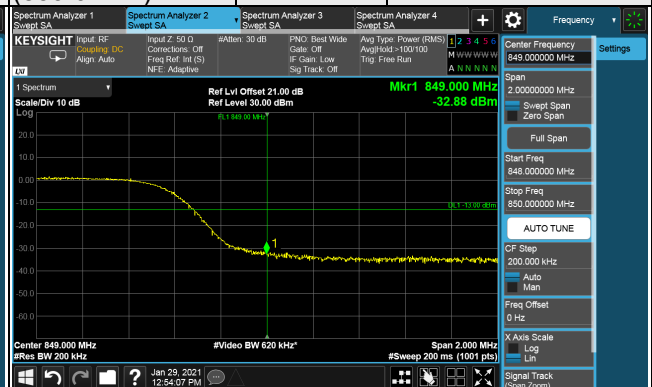
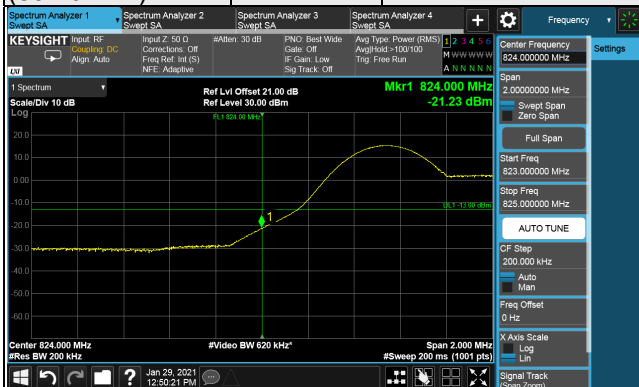
$\pi/2$ BPSK

100 RB / 0 RB Offset

Channel 167800
(839.0MHz)

$\pi/2$ BPSK

100 RB / 0 RB Offset



LTE Band 2, Channel Bandwidth 1.4MHz

Channel 18607
(1850.70MHz)

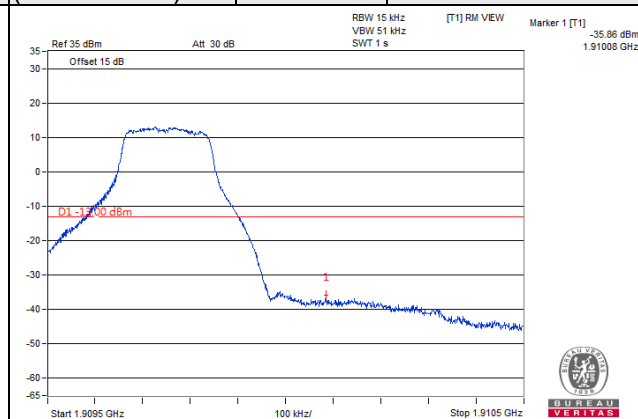
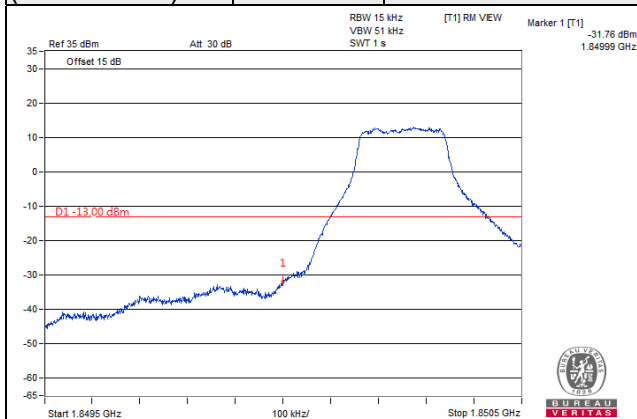
QPSK

1 RB / 0 RB Offset

Channel 19193
(1909.30MHz)

QPSK

1 RB / 5 RB Offset



Channel 18607
(1850.70MHz)

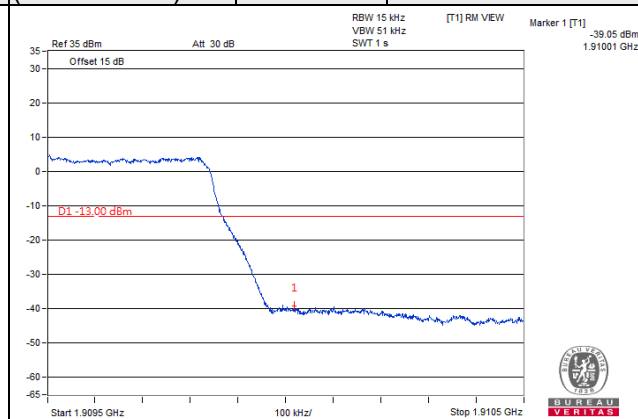
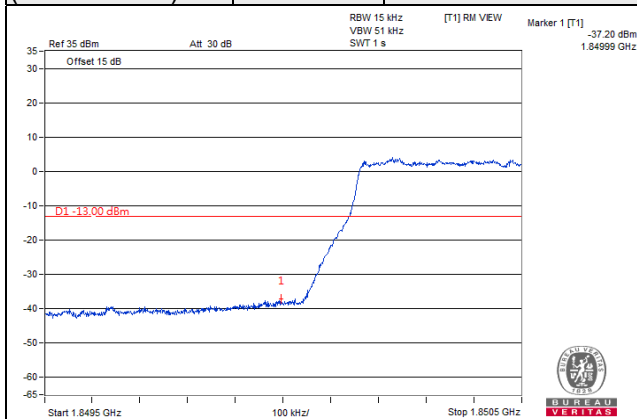
QPSK

6 RB / 0 RB Offset

Channel 19193
(1909.30MHz)

QPSK

6 RB / 0 RB Offset



LTE Band 2, Channel Bandwidth 3MHz

Channel 18615
(1851.50MHz)

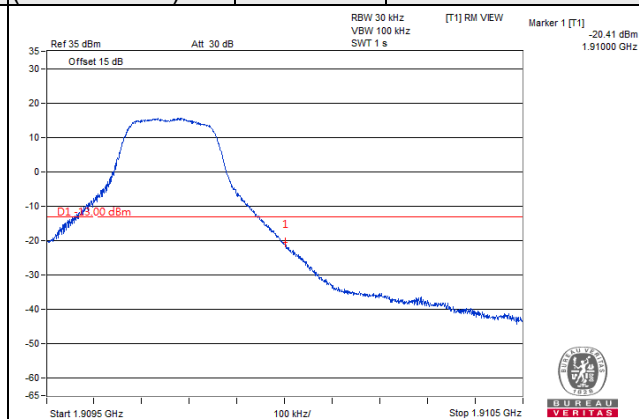
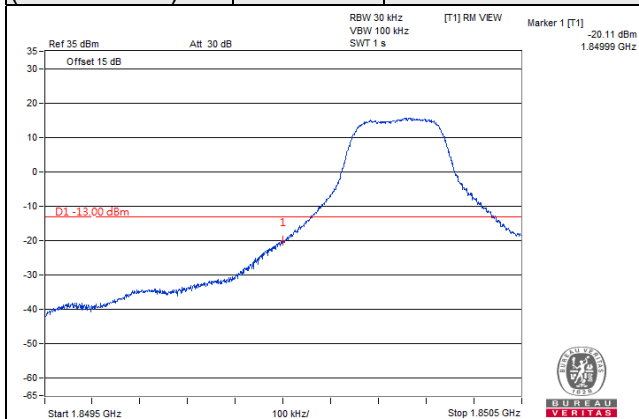
QPSK

1 RB / 0 RB Offset

Channel 19185
(1908.50MHz)

QPSK

1 RB / 14 RB Offset



Channel 18615
(1851.50MHz)

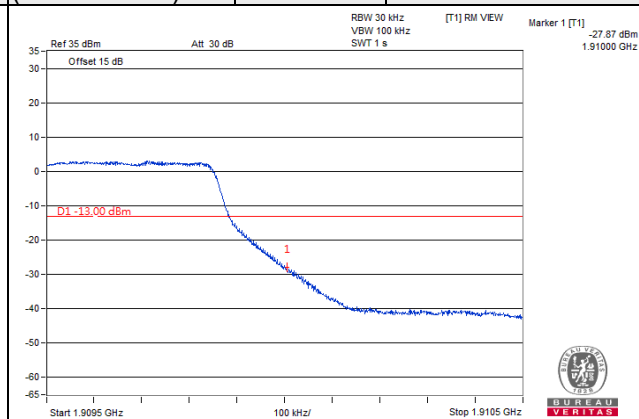
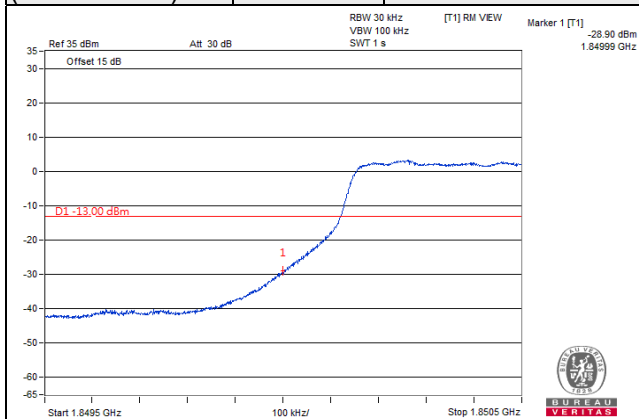
QPSK

15 RB / 0 RB Offset

Channel 19185
(1908.50MHz)

QPSK

15 RB / 0 RB Offset



LTE Band 2, Channel Bandwidth 5MHz

Channel 18625
(1852.50MHz)

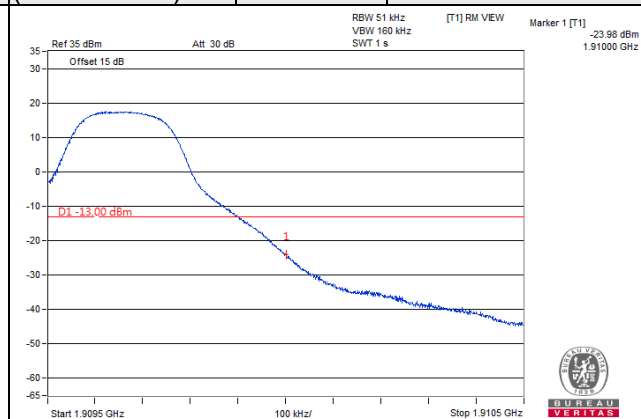
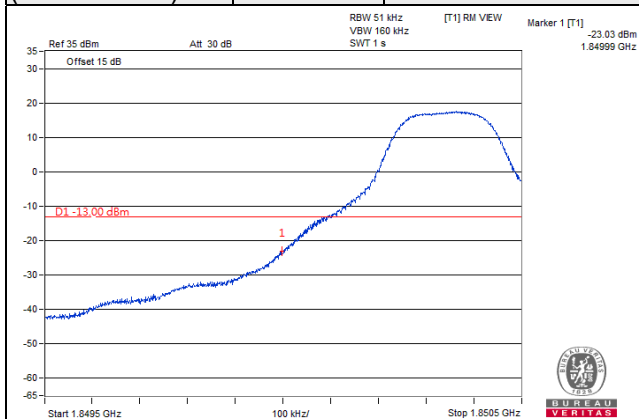
QPSK

1 RB / 0 RB Offset

Channel 19175
(1907.50MHz)

QPSK

1 RB / 24 RB Offset



Channel 18625
(1852.50MHz)

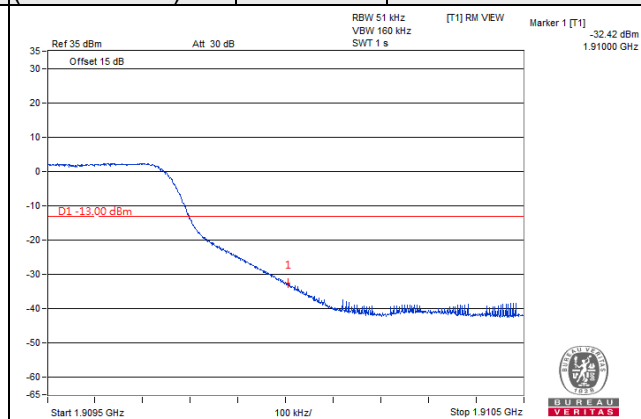
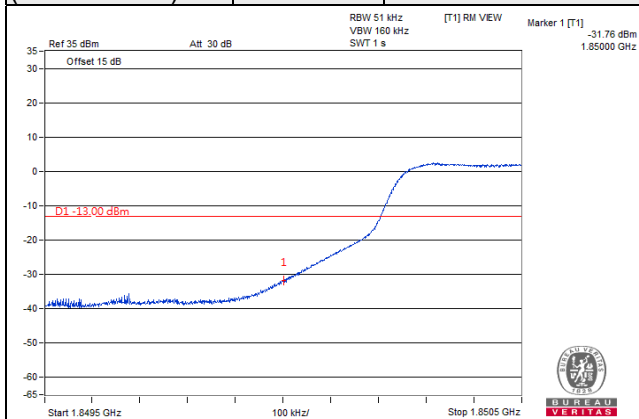
QPSK

25 RB / 0 RB Offset

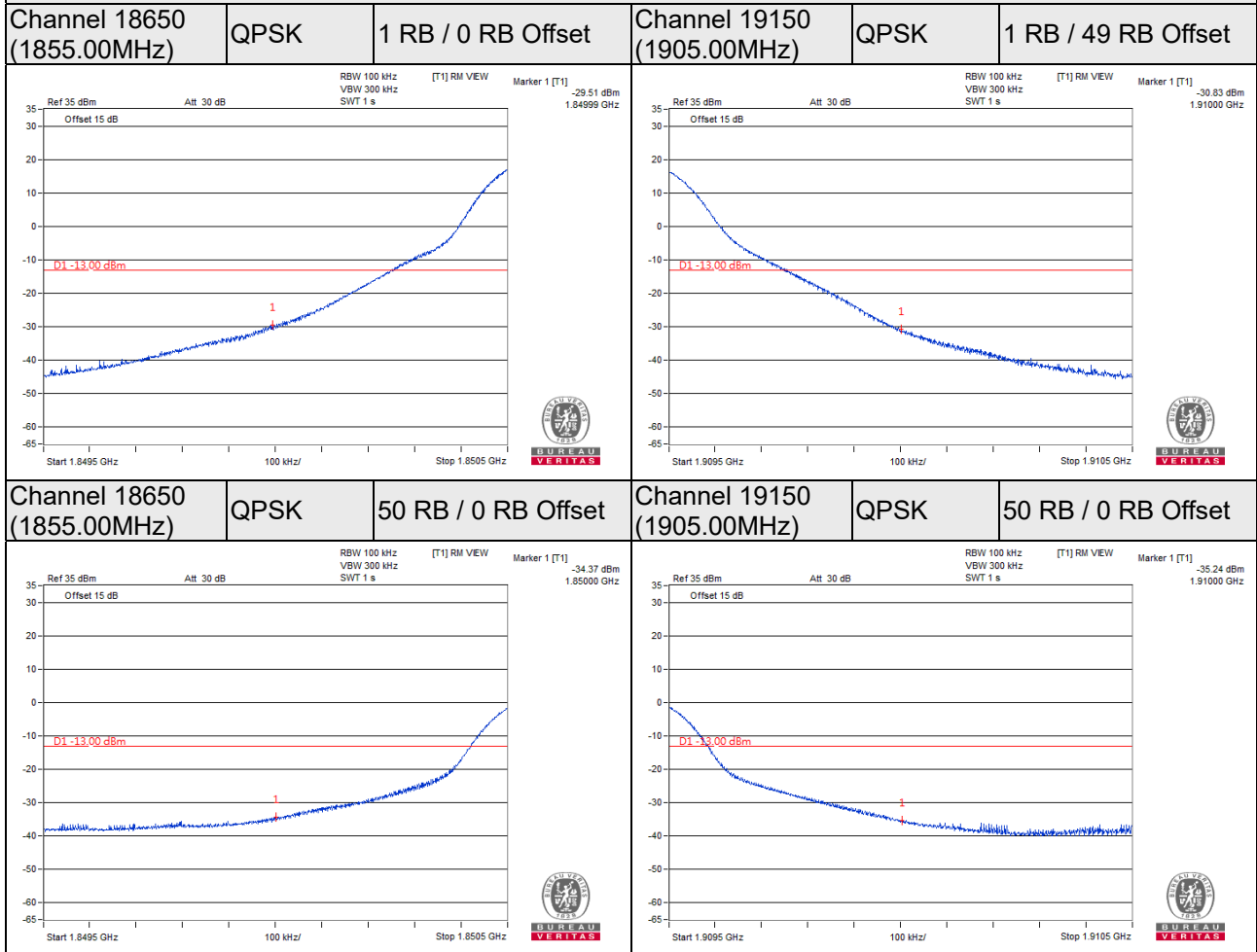
Channel 19175
(1907.50MHz)

QPSK

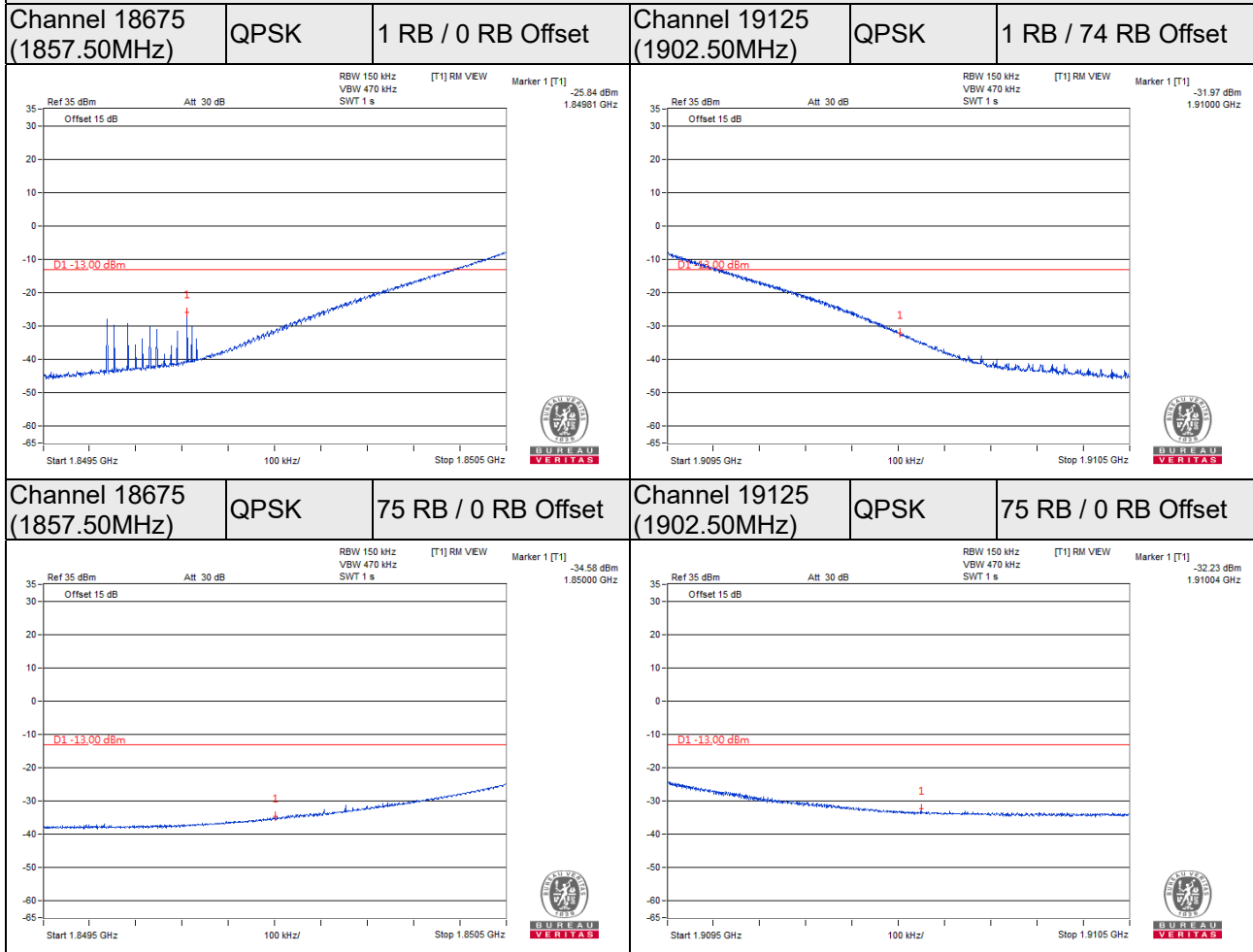
25 RB / 0 RB Offset



LTE Band 2, Channel Bandwidth 10MHz



LTE Band 2, Channel Bandwidth 15MHz



LTE Band 2, Channel Bandwidth 20MHz

Channel 18700
(1860.00MHz)

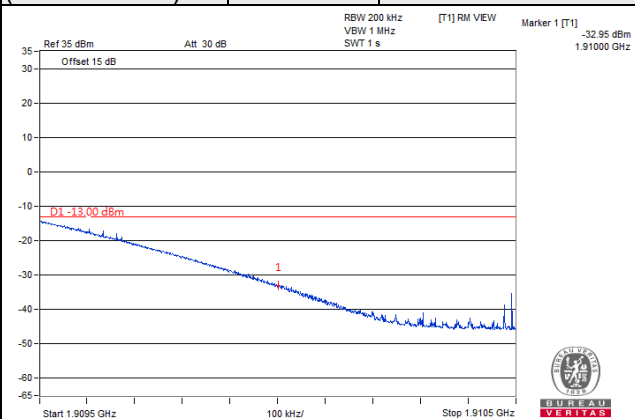
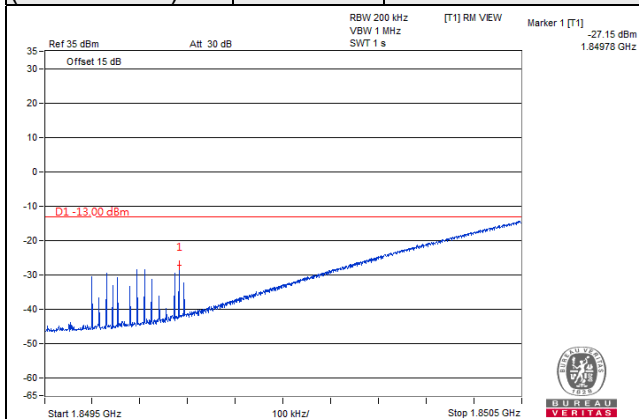
QPSK

1 RB / 0 RB Offset

Channel 19100
(1900.00 MHz)

QPSK

1 RB / 99 RB Offset



Channel 18700
(1860.00MHz)

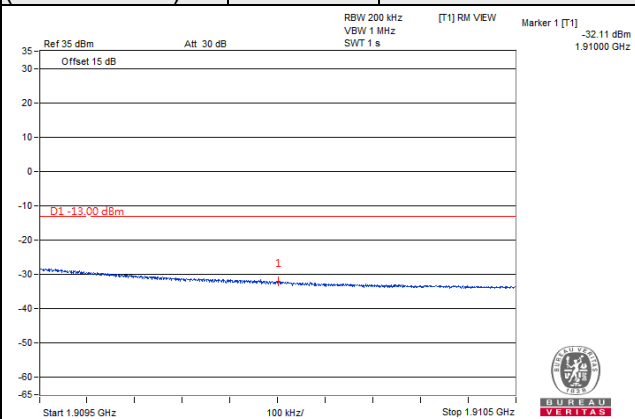
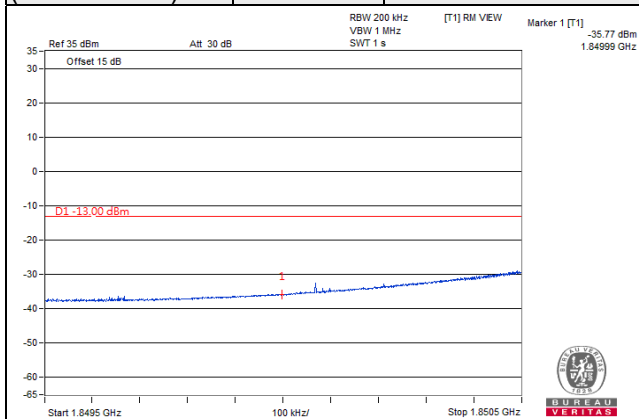
QPSK

100 RB / 0 RB Offset

Channel 19100
(1900.00 MHz)

QPSK

100 RB / 0 RB Offset



LTE Band 66, Channel Bandwidth 1.4MHz

Channel 131979
(1710.7MHz)

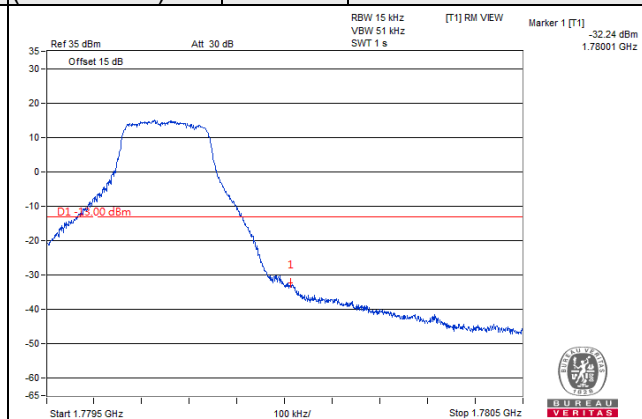
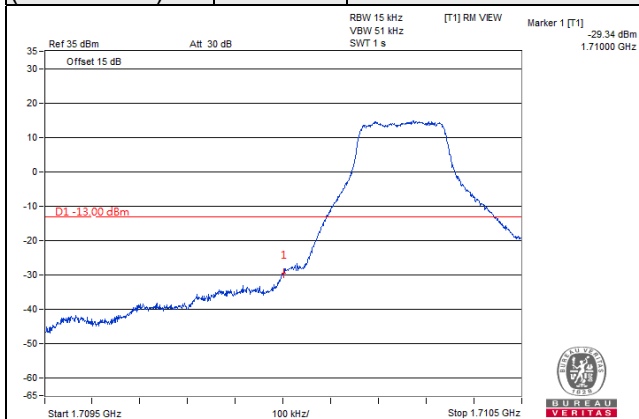
QPSK

1 RB / 0 RB Offset

Channel 132665
(1779.3MHz)

QPSK

1 RB / 5 RB Offset



Channel 131979
(1710.7MHz)

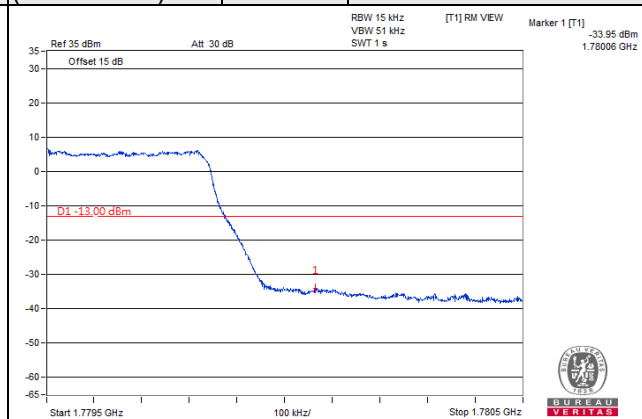
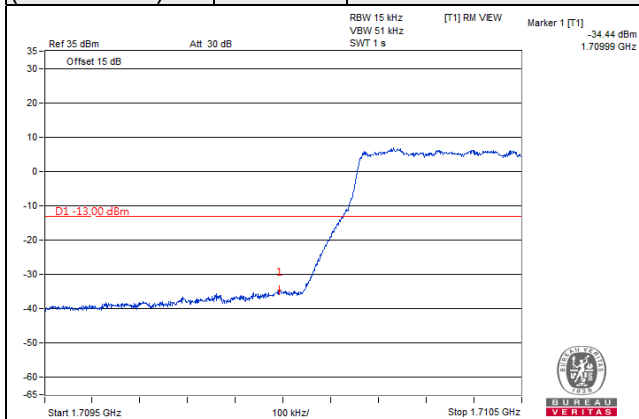
QPSK

6 RB / 0 RB Offset

Channel 132665
(1779.3MHz)

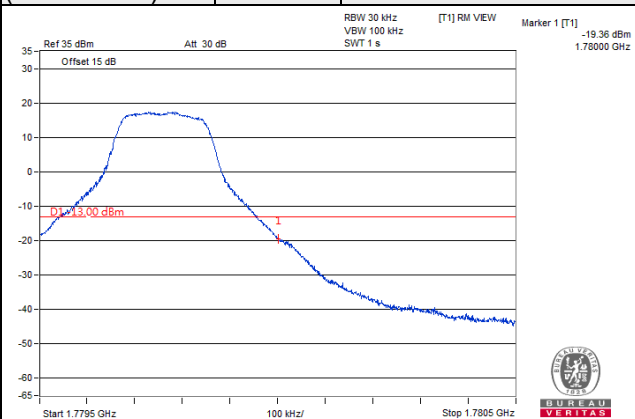
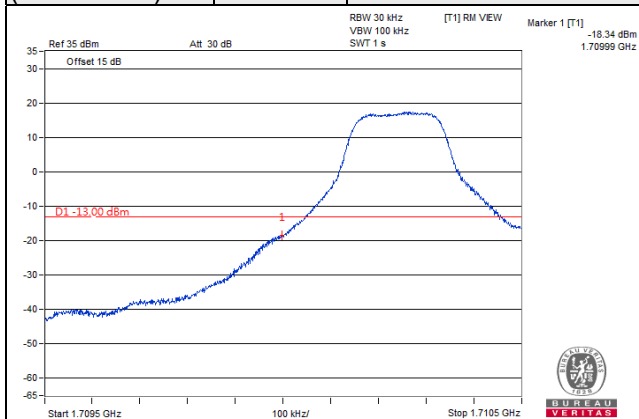
QPSK

6 RB / 0 RB Offset

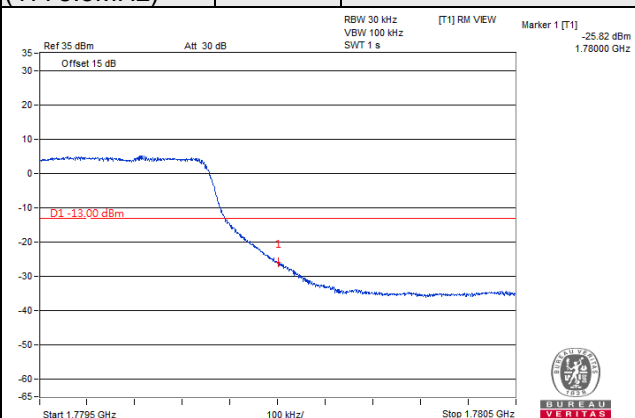
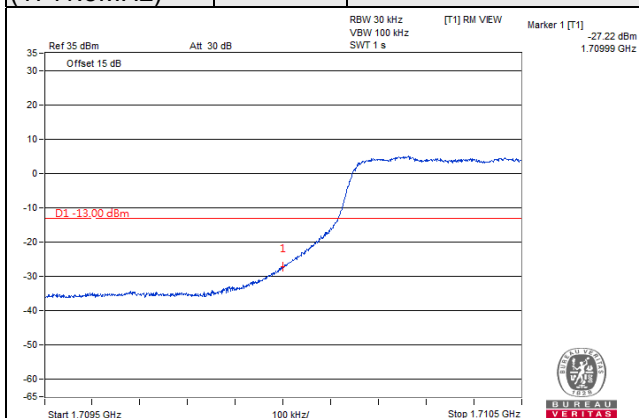


LTE Band 66, Channel Bandwidth 3MHz

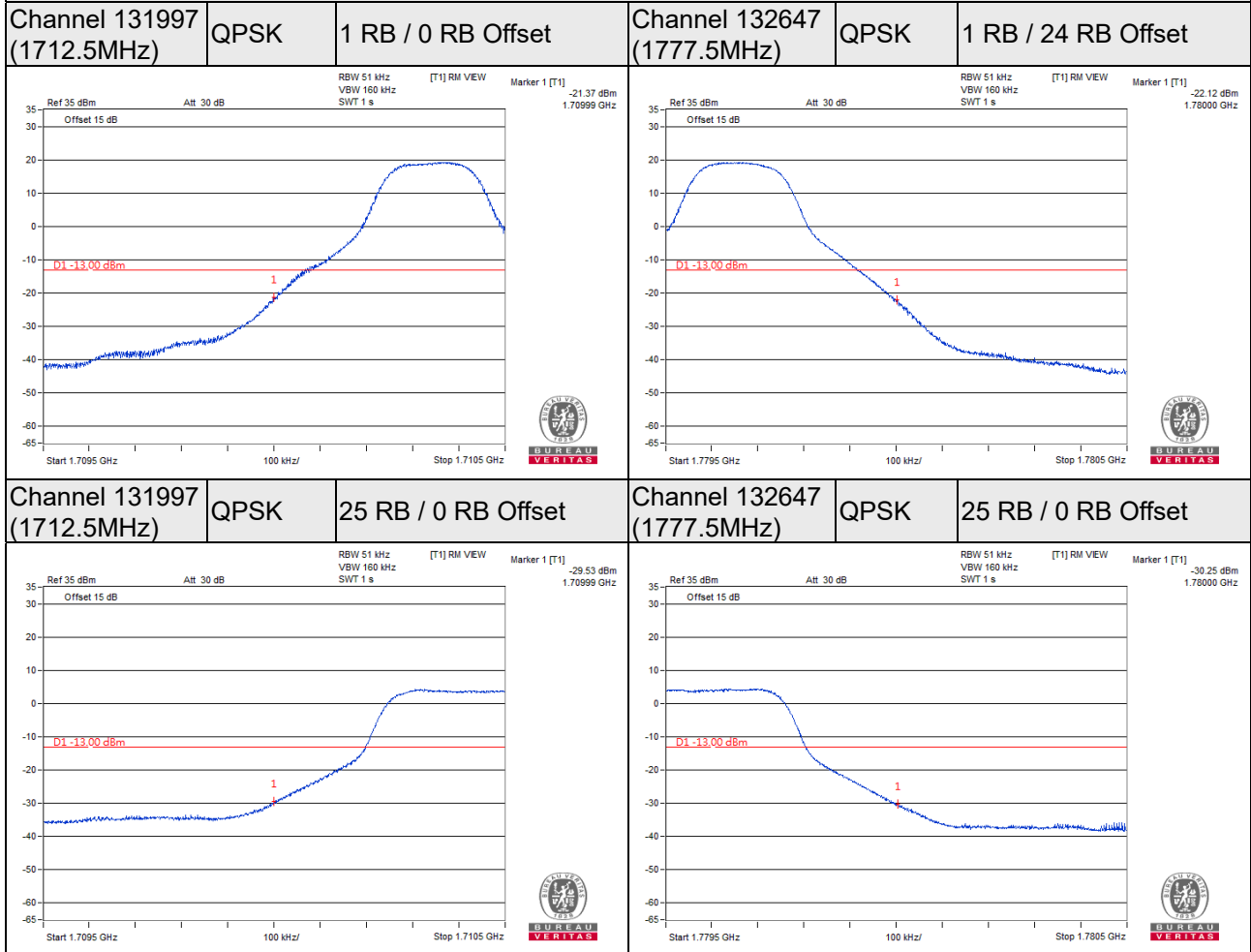
Channel 131987 (1711.5MHz)	QPSK	1 RB / 0 RB Offset	Channel 132657 (1778.5MHz)	QPSK	1 RB / 14 RB Offset
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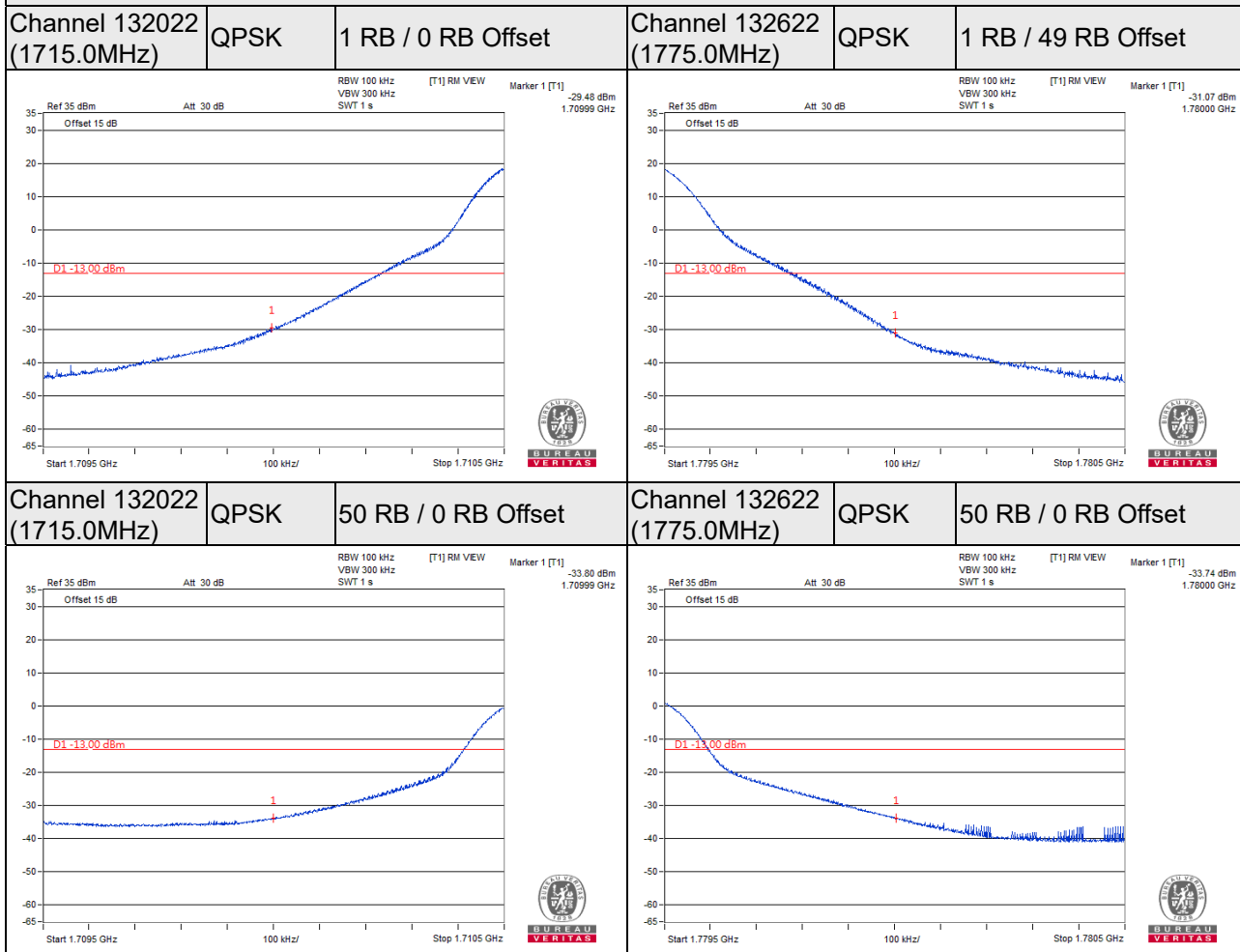
Channel 131987 (1711.5MHz)	QPSK	15 RB / 0 RB Offset	Channel 132657 (1778.5MHz)	QPSK	15 RB / 0 RB Offset
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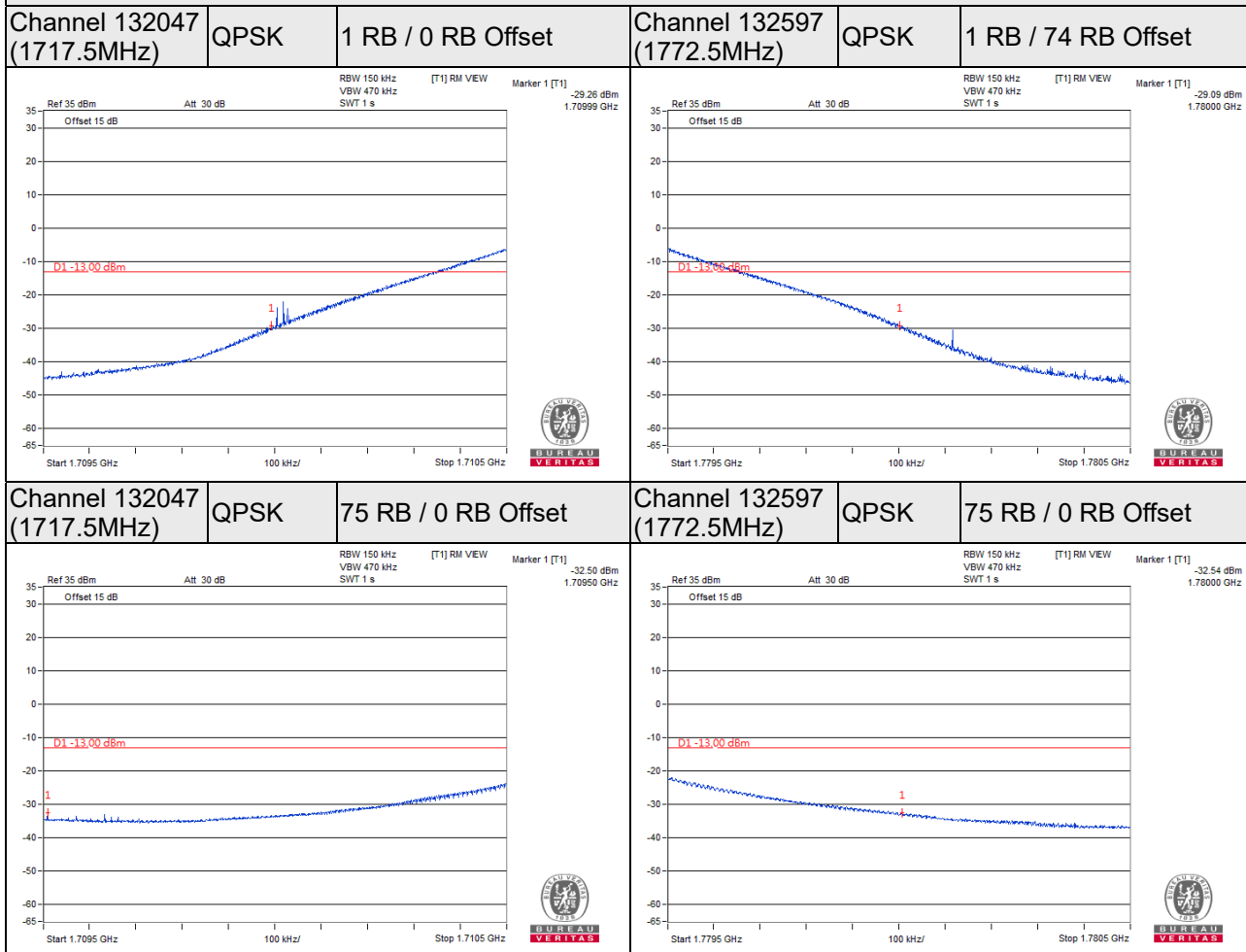
LTE Band 66, Channel Bandwidth 5MHz



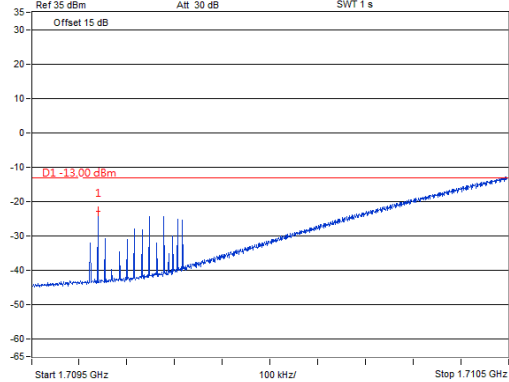
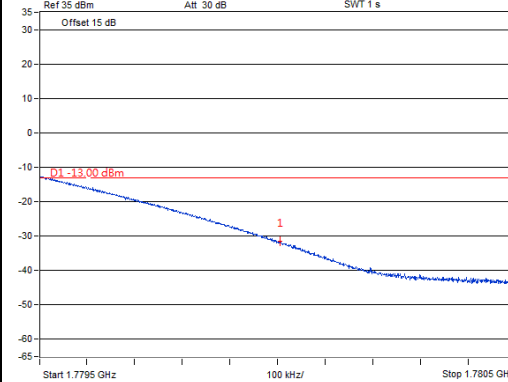
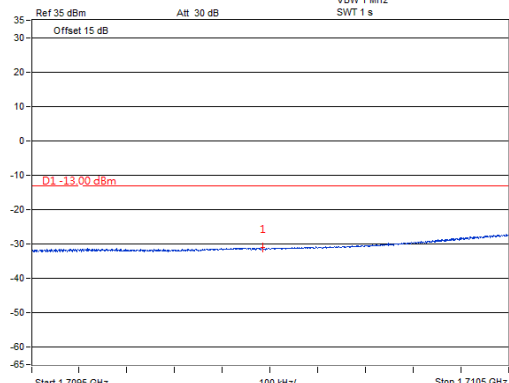
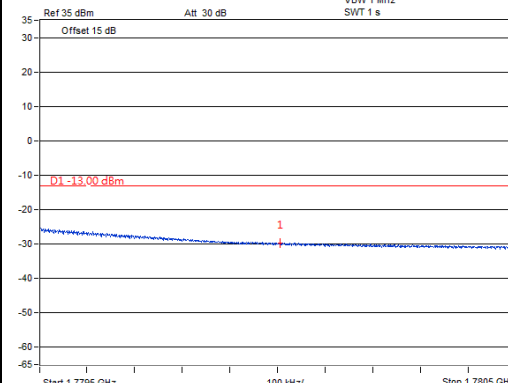
LTE Band 66, Channel Bandwidth 10MHz



LTE Band 66, Channel Bandwidth 15MHz



LTE Band 66, Channel Bandwidth 20MHz

Channel 132072 (1720.0MHz)	QPSK	1 RB / 0 RB Offset	Channel 132572 (1770.0MHz)	QPSK	1 RB / 99 RB Offset
Ref 35 dBm Att 30 dB RBW 200 kHz [T1] RM VIEW Marker 1 [T1] -22.86 dBm 1.70963 GHz  Start 1.7095 GHz 100 kHz/ Stop 1.7105 GHz			Ref 35 dBm Att 30 dB RBW 200 kHz [T1] RM VIEW Marker 1 [T1] -31.61 dBm 1.78000 GHz  Start 1.7795 GHz 100 kHz/ Stop 1.7805 GHz		
Channel 132072 (1720.0MHz)	QPSK	100 RB / 0 RB Offset	Channel 132572 (1770.0MHz)	QPSK	100 RB / 0 RB Offset
Ref 35 dBm Att 30 dB RBW 200 kHz [T1] RM VIEW Marker 1 [T1] -31.05 dBm 1.70998 GHz  Start 1.7095 GHz 100 kHz/ Stop 1.7105 GHz			Ref 35 dBm Att 30 dB RBW 200 kHz [T1] RM VIEW Marker 1 [T1] -29.66 dBm 1.78000 GHz  Start 1.7795 GHz 100 kHz/ Stop 1.7805 GHz		