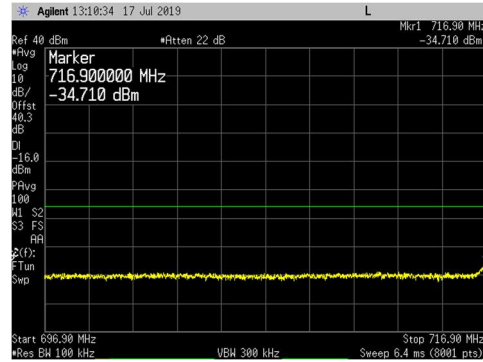
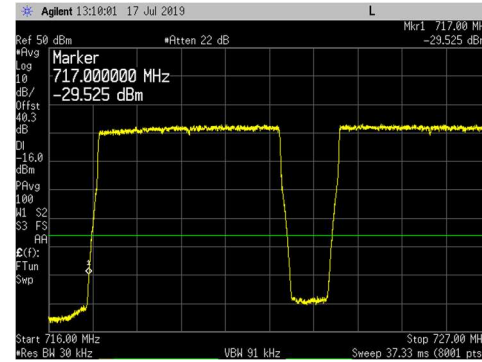


Band 29 Multicarrier LTE5 Lower Band Edge Plots for Antenna Port 2:

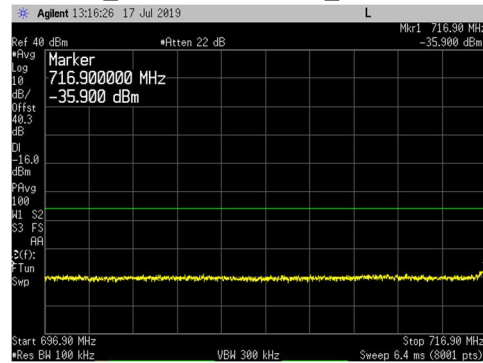
QPSK_ Bottom Channel _696.9MHz to 716.9MHz



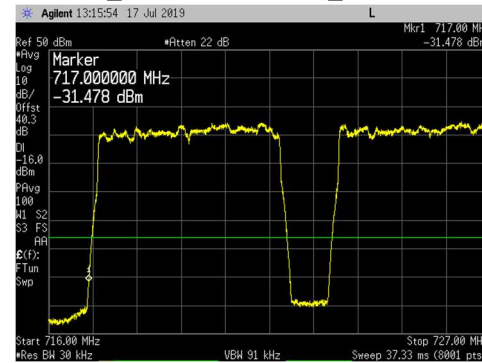
QPSK_ Bottom Channel _716MHz to 727MHz



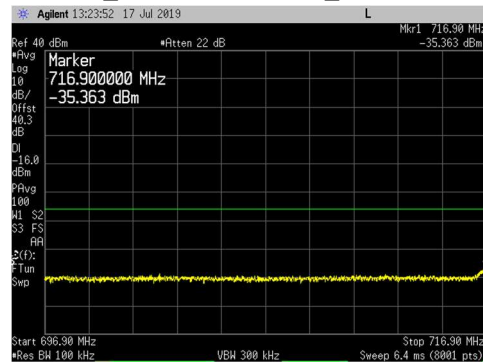
16QAM_ Bottom Channel _696.9MHz to 716.9MHz



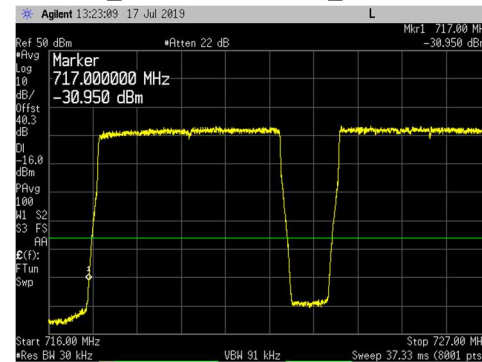
16QAM_ Bottom Channel _716MHz to 727MHz



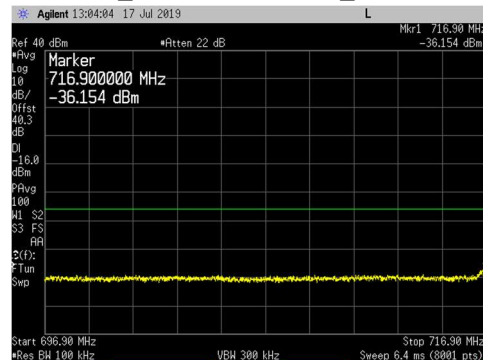
64QAM_ Bottom Channel _696.9MHz to 716.9MHz



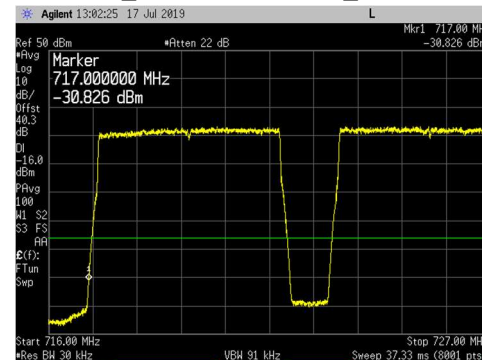
64QAM_ Bottom Channel _716MHz to 727MHz



256QAM_ Bottom Channel _696.9MHz to 716.9MHz

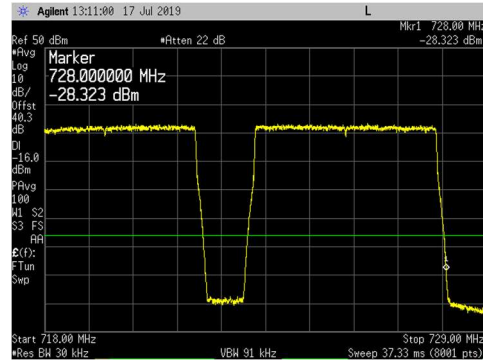


256QAM_ Bottom Channel _716MHz to 727MHz

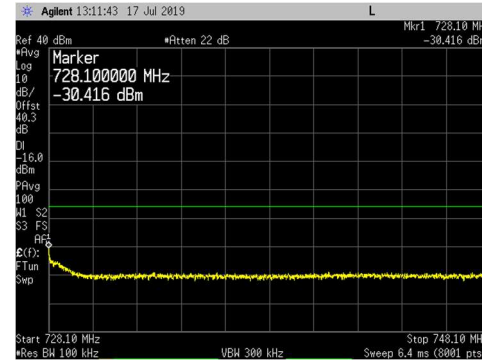


Band 29 Multicarrier LTE5 Upper Band Edge Plots for Antenna Port 2:

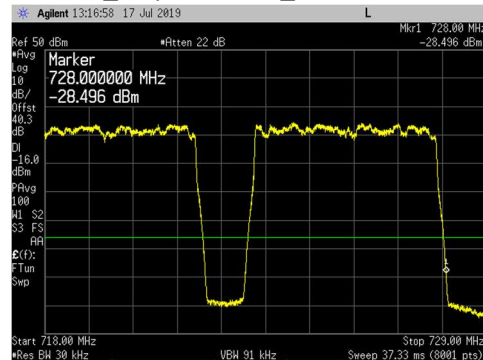
QPSK_Top Channel _718MHz to 729MHz



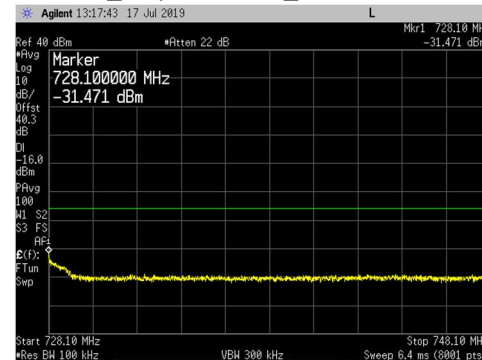
QPSK_Top Channel _728.1MHz to 748.1MHz



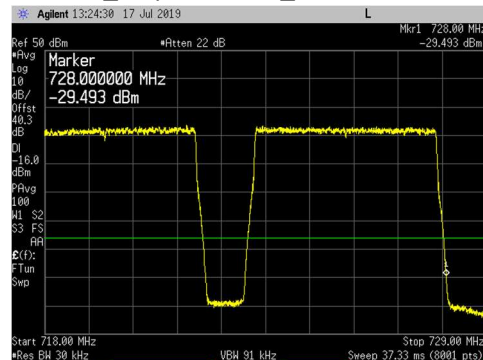
16QAM_Top Channel _718MHz to 729MHz



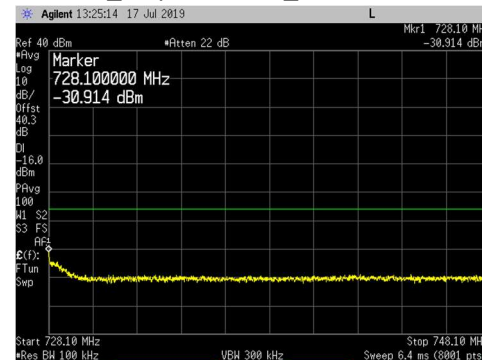
16QAM_Top Channel _728.1MHz to 748.1MHz



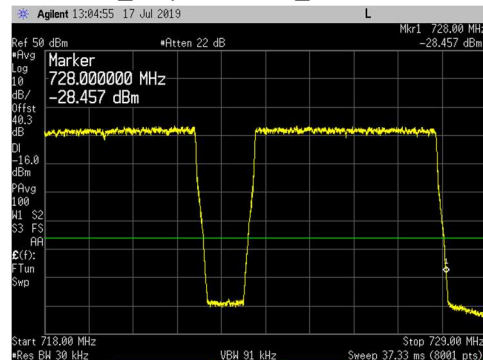
64QAM_Top Channel _718MHz to 729MHz



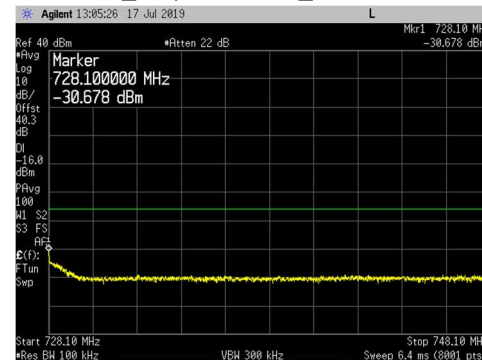
64QAM_Top Channel _728.1MHz to 748.1MHz



256QAM_Top Channel _718MHz to 729MHz



256QAM_Top Channel _728.1MHz to 748.1MHz



Transmitter Antenna Port Conducted Emissions

Transmitter conducted emission measurements were made at RRH antenna port 2. Measurements were performed over the 9kHz to 9GHz frequency range.

Single Carrier Test Cases

The RRH was operated on the Band 5 middle channel (881.5MHz) and Band 29 middle channel (722.5MHz) simultaneously with all LTE modulation types (QPSK, 16QAM, 64QAM and 256QAM) for all available LTE bandwidths (Band 5: 1.4MHz, 3MHz, 5MHz and 10MHz; Band 29: 5MHz and 10MHz). The same LTE bandwidth was used for both frequency bands when available. If the same LTE bandwidth for both bands were not available, then the smallest LTE bandwidth was used. The Band 5 and Band 29 carriers were enabled at maximum power (80 watts/port and 40 watts/carrier).

Multicarrier Multiband Test Case

In Band 5_Three LTE1.4 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (EARFCN 2407: 869.7 MHz and EARFCN 2421: 871.1 MHz) and a third carrier with maximum spacing between the other two carrier frequencies (EARFCN 2643: 893.3 MHz) at the upper band edge. In Band 29_Two LTE5 carriers with maximum spacing at the lower and upper band edges (EARFCN 9685: 719.5 & EARFCN 9745: 725.5MHz. Three carrier operation is not available because it exceeds the Band 29 downlink bandwidth. The smallest channel bandwidth was selected to maximize carrier power spectral density. The carriers were operated at maximum power (~13W/Band 5 carrier and ~20W/Band 29 carrier) with at total port power of 80 watts (40W for Band 5 carriers + 40W for Band 29 carriers). The same modulation type was used for both Band 5 and Band 29 carriers.

The test configuration parameters are provided below:

Band 5 Transmission Parameters			Band 29 Transmission Parameters		
Carrier Frequency	Channel Bandwidth	Carrier Power	Carrier Frequency	Channel Bandwidth	Carrier Power
881.5MHz (Mid Ch)	LTE1.4 – LTE10	40 Watts	722.5MHz (Mid Ch)	LTE5 & LTE 10	40 Watts
869.7, 871.1 & 893.3MHz (BC, BC+1, and TC)	LTE1.4	13+13+13 Watts	719.5 & 725.5MHz (BC & TC)	LTE5	20 + 20 Watts

The limit of -19dBm was used in the certification testing. The limit is adjusted to -19dBm [-13dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO Band 5 transmitter. The required measurement parameters include a 100kHz bandwidth with power measured in average value (since transmitter power was measured in average value).

Measurements were performed with a spectrum analyzer using a peak detector with maximum hold over 50 sweeps (except for the 700MHz to 1100MHz frequency range). The measurements for the 700MHz to 1.1GHz frequency range were performed with the spectrum analyzer in the RMS average mode over 100 traces.

The limit for the 9kHz to 150kHz frequency range was adjusted to -39dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 100kHz [i.e.: -39dBm = -19dBm -10log(100kHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -29dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 100kHz [i.e.: -29dBm = -19dBm -10log(100kHz/10kHz)]. The required limit of -19dBm with a RBW of ≥ 100 kHz was used for all other frequency ranges. The spectrum analyzer settings that were used for this test are summarized in the following table.

Frequency Range	RBW	VBW	Number of Data Points	Detector	Sweep Time	Max Hold over	Offset Note 1
9kHz to 150kHz	1kHz	3kHz	8001	Peak	Auto	50 Sweeps	40.0dB
150kHz to 20MHz	10kHz	30kHz	8001	Peak	Auto	50 Sweeps	39.9dB
20MHz to 700MHz	200kHz	600kHz	8001	Peak	Auto	50 Sweeps	40.3dB
700MHz to 1.1GHz	100kHz	300kHz	8192	Average	Auto	Note 2	40.3dB
1.1GHz to 9GHz	2MHz	6MHz	8192	Peak	Auto	50 Sweeps	25.0dB
Note 1: The total measurement RF path loss of the test setup (attenuators, filters and test cables) is accounted for by the spectrum analyzer reference level offset.							
Note 2: Max Hold not used and instead measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces.							

A high pass filter was used to reduce measurement instrumentation noise floor for the frequency ranges above 1100MHz. The total measurement RF path loss of the test setup (attenuators, high pass filter and test cables) as shown in the table is accounted for by the spectrum analyzer reference level offset. The display line on the plots reflects the required limit.

Conducted spurious emission plots/measurements are provided in Appendix A.



Transmitter Radiated Spurious Emissions

Radiated emission measurement results are in Appendix A.

Frequency Stability/Accuracy

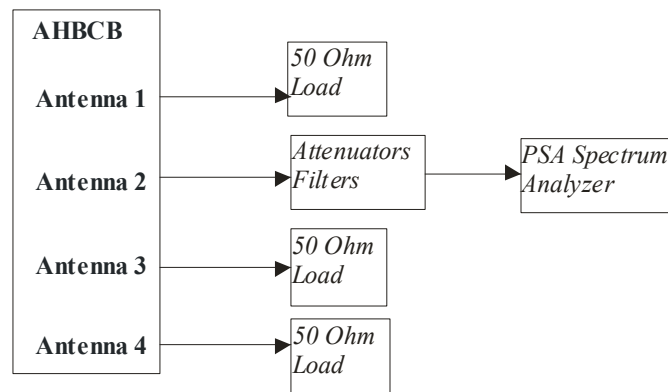
Frequency Stability/Accuracy measurement results are in Appendix A.

APPENDIX C: ANTENNA PORT 5G NR TEST DATA FOR BAND 5 (869-894MHZ)

All conducted RF measurements in this section were made at AHBCB antenna port 2. Based on the RF power measurement results shown in Appendix A & B, Port 2 has the highest LTE RMS average power for Band 5 (869 to 894MHz) and Band 29 (717 to 728MHz). Therefore, antenna port 2 represents worst case and was selected for the remaining antenna port conducted emission tests.

All testing in this section was performed with 5G NR modulation types on Band n5 (869 to 894MHz). The 5G NR carrier bandwidths of 5MHz and 10MHz with QPSK, 16QAM, 64QAM and 256QAM modulation types were measured. The 5G NR carriers/modulation types for this testing are based upon 3GPP TS 38.141-1 Test Models and are NR-FR1-TM 1.1 (QPSK modulation type), NR-FR1-TM 3.2 (16QAM modulation type), NR-FR1-TM 3.1 (64QAM modulation type), and NR-FR1-TM 3.1a (256QAM modulation type).

The test setup used is provided below.



Test Setup Used for Conducted RF Measurements on AHBCB

RF Output Power

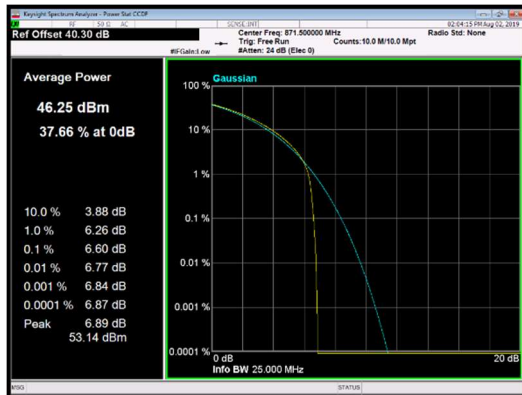
The AHBCB was operated at maximum RF output power. RF output power has been measured in RMS Average terms at the AHBCB Antenna Port 2 transmit chain [5G NR Band n5 (869 to 894MHz)] at the bottom, middle and top frequency channels for all 5G NR modulation types (QPSK, 16QAM, 64QAM and 256QAM) and channel bandwidths (5 and 10MHz) as described in section 5.2 of KDB 971168 D01v03r01 and ANSI C63.26-2015 section 5.2.4.4. The peak to average power ratio (PAPR) has been measured using the signal analyzer complementary cumulative distribution function (CCDF) for a probability of 0.1% as described in section 5.7.2 of KDB971168 D01v03r01 and ANSI C63.26-2015 section 5.2.3.4. All results are presented in tabular form below. The highest measured values are highlighted.

5G NR Channel BW	Modulation	Frequency _ Channel	PAPR (dB)	Ave (dBm)
5MHz	QPSK	871.5MHz _ Bottom Channel	6.60	46.38
		881.5MHz _ Middle Channel	6.54	46.51
		891.5MHz _ Top Channel	6.71	46.19
	16QAM	871.5MHz _ Bottom Channel	6.64	46.26
		881.5MHz _ Middle Channel	6.54	46.28
		891.5MHz _ Top Channel	6.63	46.45
	64QAM	871.5MHz _ Bottom Channel	6.60	46.38
		881.5MHz _ Middle Channel	6.50	46.36
		891.5MHz _ Top Channel	6.74	46.31
	256QAM	871.5MHz _ Bottom Channel	6.62	46.45
		881.5MHz _ Middle Channel	6.56	46.44
		891.5MHz _ Top Channel	6.69	46.38
10MHz	QPSK	874.0MHz _ Bottom Channel	6.70	46.49
		881.5MHz _ Middle Channel	6.41	46.61
		889.0MHz _ Top Channel	6.86	46.62
	16QAM	874.0MHz _ Bottom Channel	6.64	46.66
		881.5MHz _ Middle Channel	6.38	46.68
		889.0MHz _ Top Channel	6.80	46.52
	64QAM	874.0MHz _ Bottom Channel	6.74	46.55
		881.5MHz _ Middle Channel	6.35	46.58
		889.0MHz _ Top Channel	6.79	46.59
	256QAM	874.0MHz _ Bottom Channel	6.69	46.57
		881.5MHz _ Middle Channel	6.34	46.58
		889.0MHz _ Top Channel	6.73	46.64

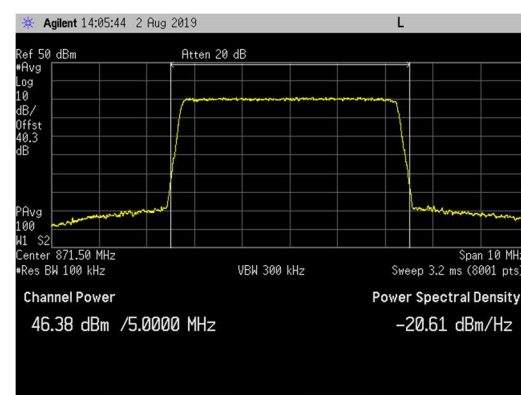
The total measurement RF path loss of the test setup (attenuator and test cables) was 40.3 dB and is accounted for by the spectrum analyzer reference level offset. All measurement results are provided in the following pages.

5G NR 5MHz Channel Power Plots for QPSK Modulation at Antenna Port 2:

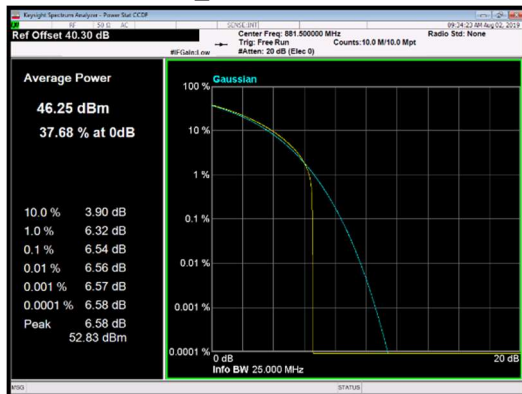
Bottom Channel_ CCDF



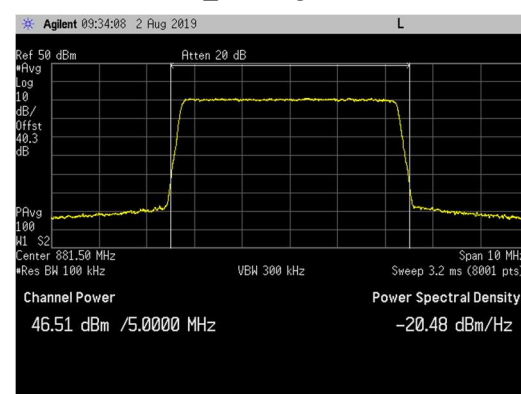
Bottom Channel_ Average



Middle Channel_ CCDF



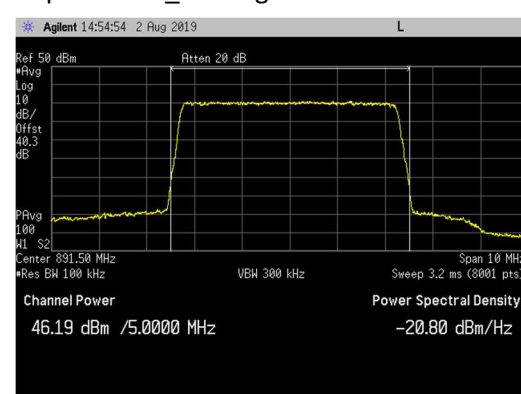
Middle Channel_ Average



Top Channel_ CCDF

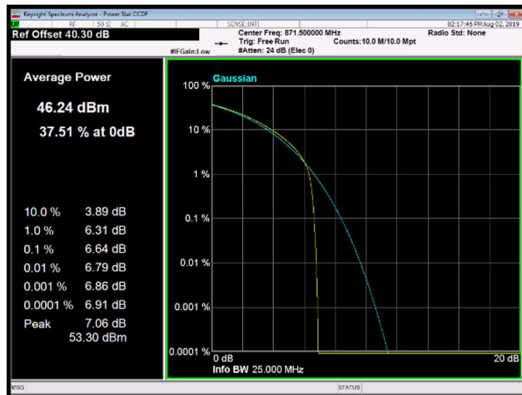


Top Channel_ Average

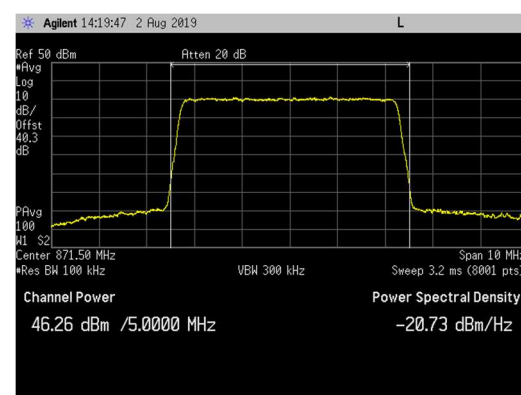


5G NR 5MHz Channel Power Plots for 16QAM Modulation at Antenna Port 2:

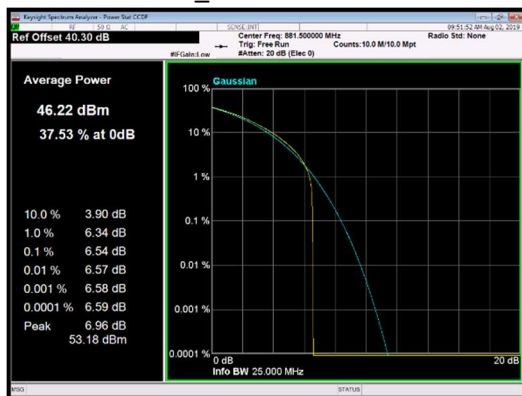
Bottom Channel_ CCDF



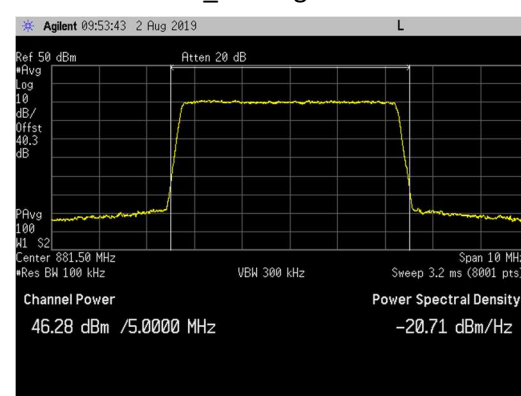
Bottom Channel_ Average



Middle Channel_ CCDF



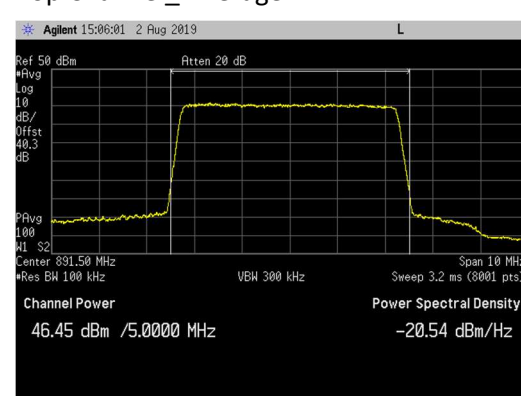
Middle Channel_ Average



Top Channel_ CCDF

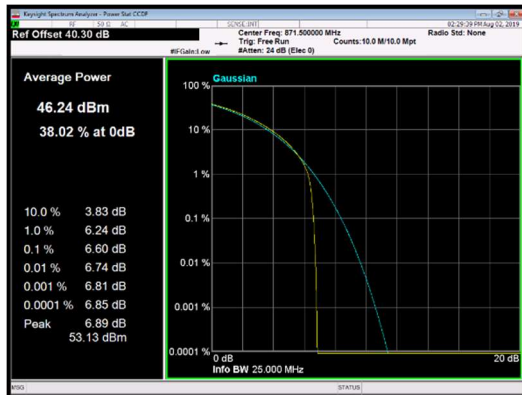


Top Channel_ Average

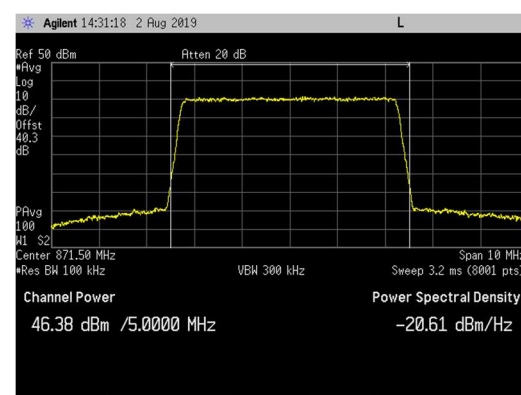


5G NR 5MHz Channel Power Plots for 64QAM Modulation at Antenna Port 2:

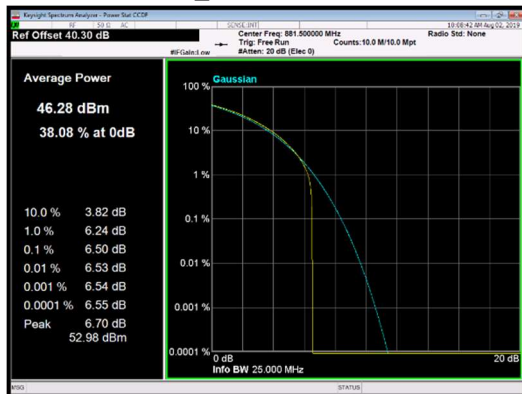
Bottom Channel_ CCDF



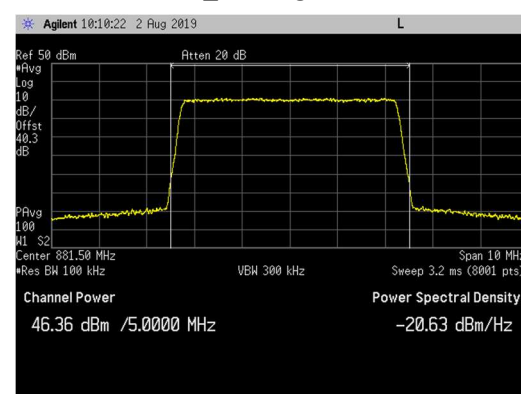
Bottom Channel_ Average



Middle Channel_ CCDF



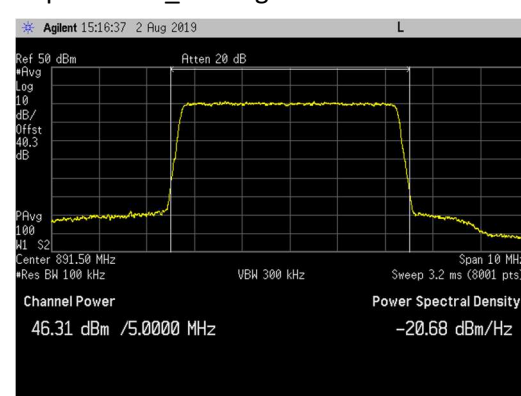
Middle Channel_ Average



Top Channel_ CCDF

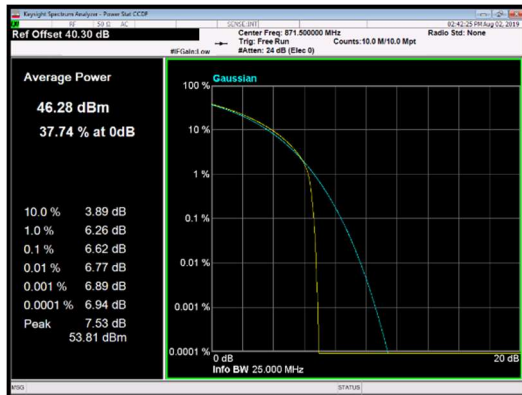


Top Channel_ Average

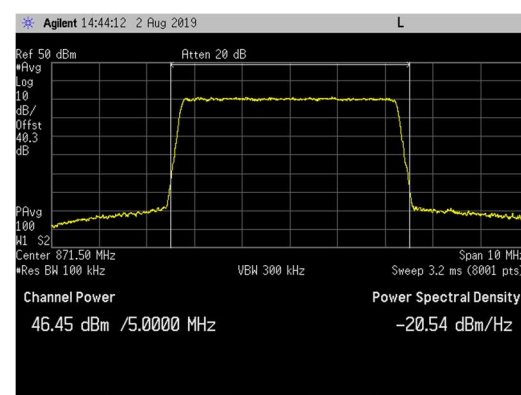


5G NR 5MHz Channel Power Plots for 256QAM Modulation at Antenna Port 2:

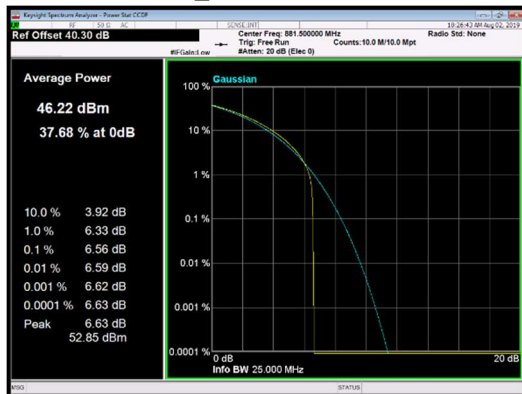
Bottom Channel_ CCDF



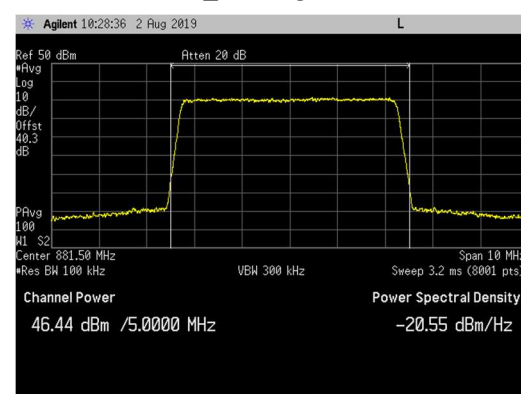
Bottom Channel_ Average



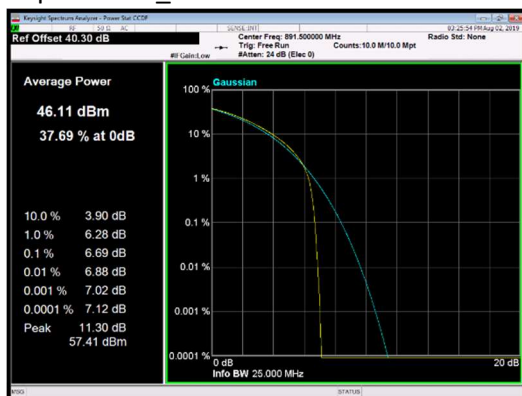
Middle Channel_ CCDF



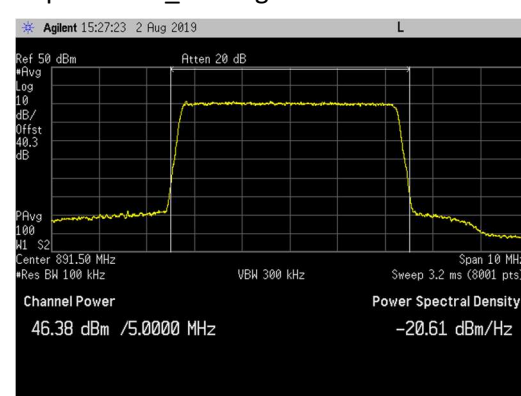
Middle Channel_ Average



Top Channel_ CCDF

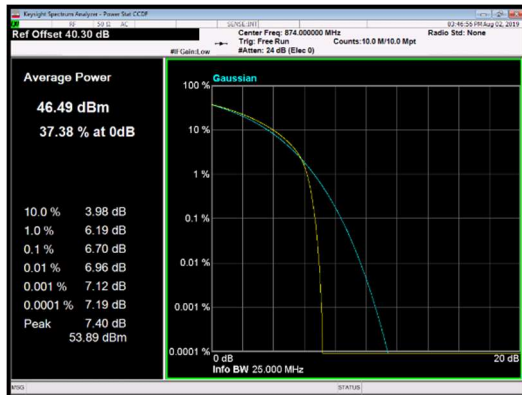


Top Channel_ Average

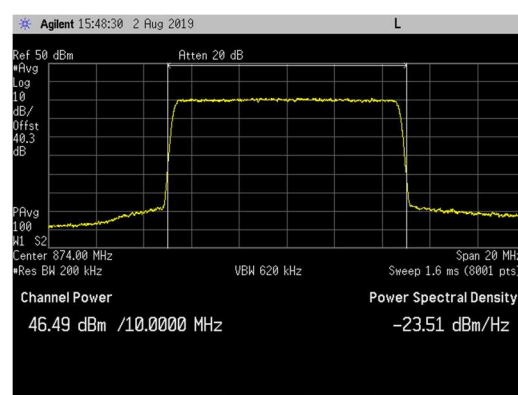


5G NR 10MHz Channel Power Plots for QPSK Modulation at Antenna Port 2:

Bottom Channel_ CCDF



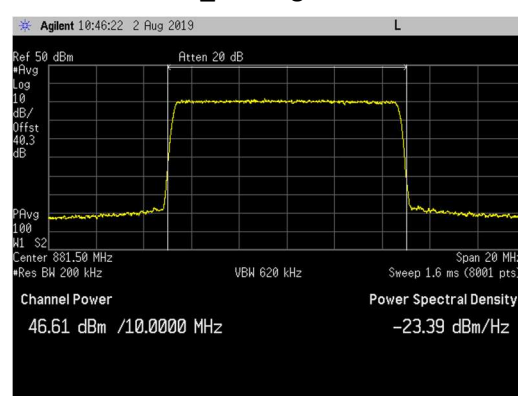
Bottom Channel_ Average



Middle Channel_ CCDF



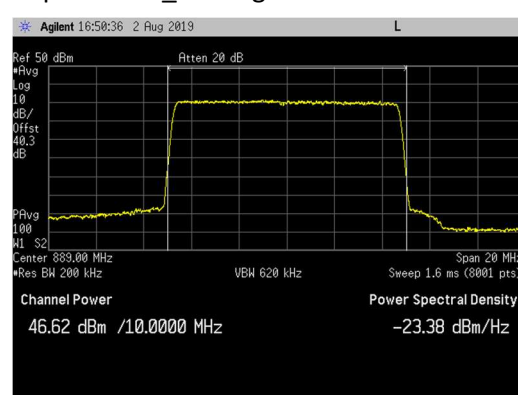
Middle Channel_ Average



Top Channel_ CCDF

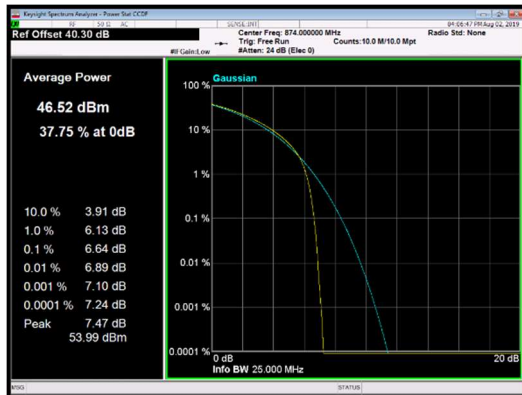


Top Channel_ Average

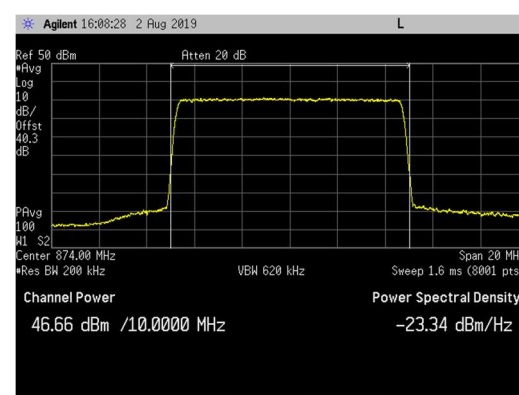


5G NR 10MHz Channel Power Plots for 16QAM Modulation at Antenna Port 2:

Bottom Channel_ CCDF



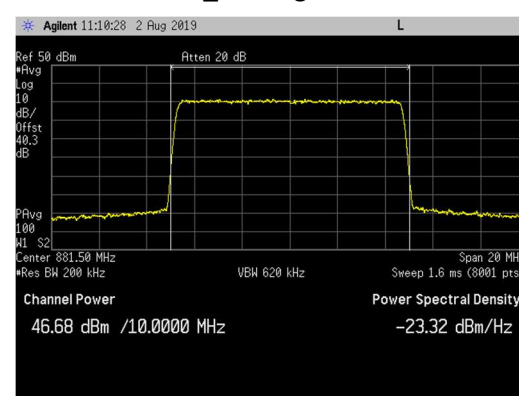
Bottom Channel_ Average



Middle Channel_ CCDF



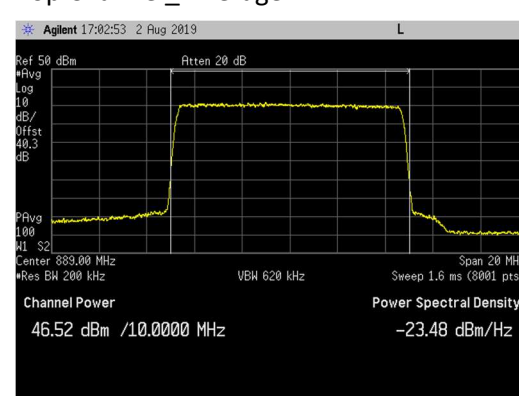
Middle Channel_ Average



Top Channel_ CCDF

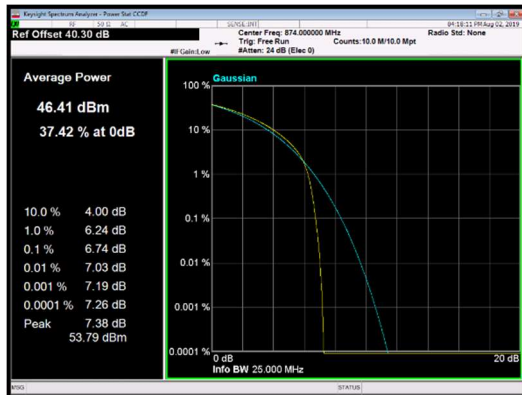


Top Channel_ Average

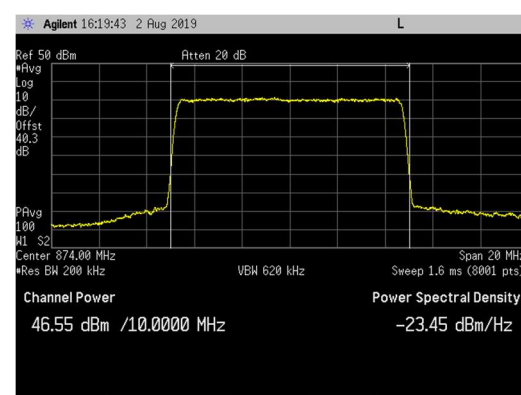


5G NR 10MHz Channel Power Plots for 64QAM Modulation at Antenna Port 2:

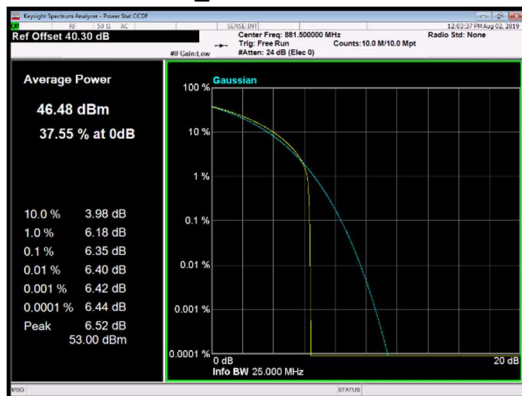
Bottom Channel_ CCDF



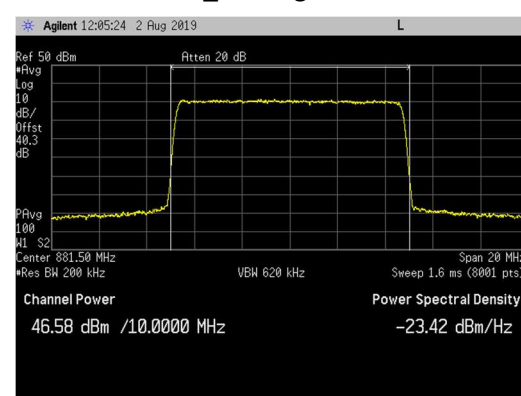
Bottom Channel_ Average



Middle Channel_ CCDF



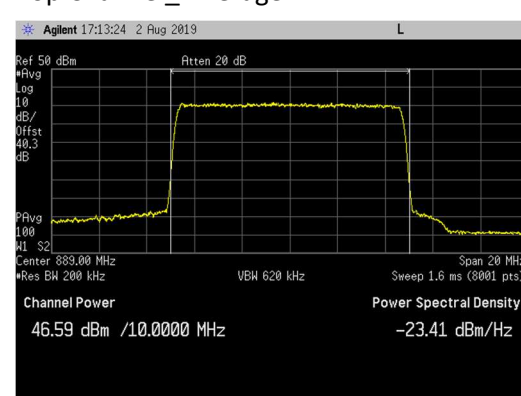
Middle Channel_ Average



Top Channel_ CCDF

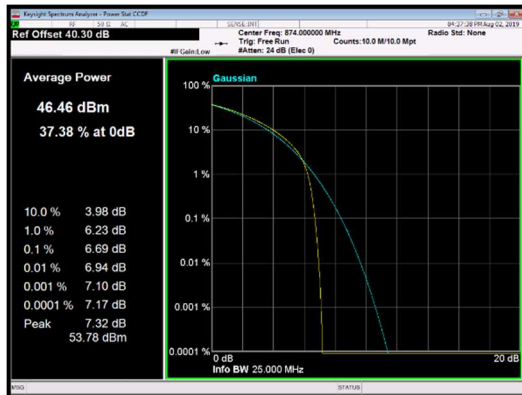


Top Channel_ Average

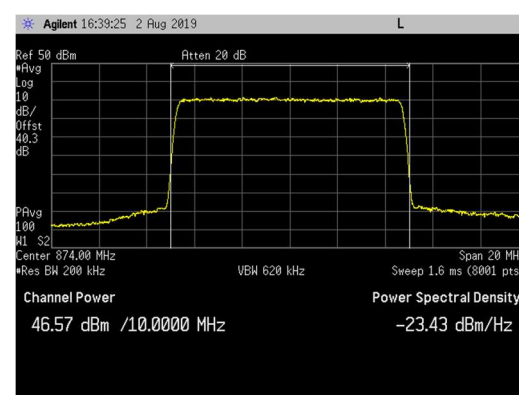


5G NR 10MHz Channel Power Plots for 256QAM Modulation at Antenna Port 2:

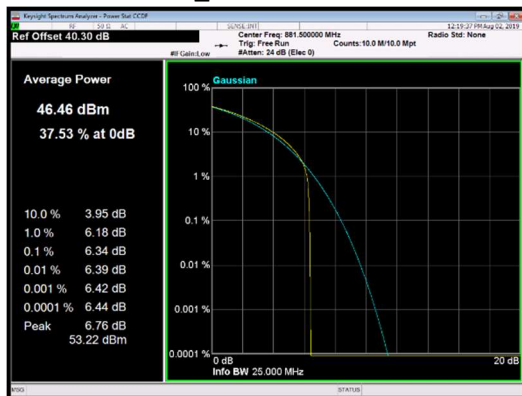
Bottom Channel_ CCDF



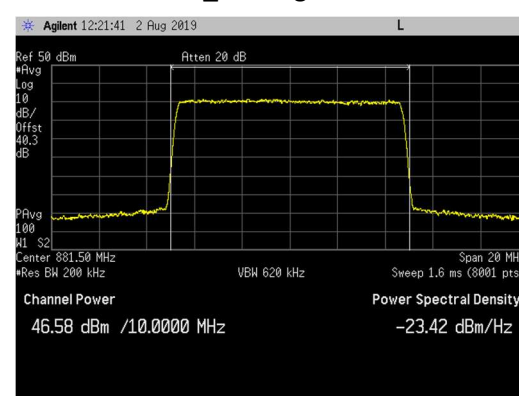
Bottom Channel_ Average



Middle Channel_ CCDF



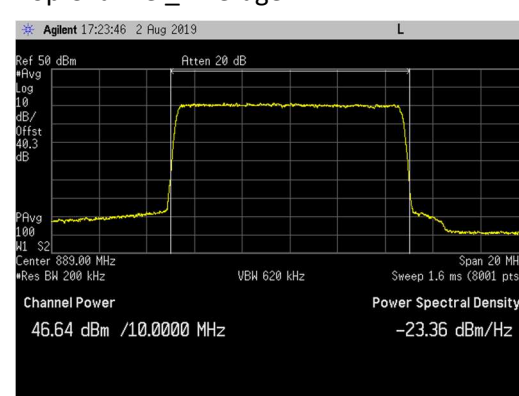
Middle Channel_ Average



Top Channel_ CCDF



Top Channel_ Average



Emission Bandwidth (26 dB down and 99%)

Emission bandwidth measurements were made at antenna port 2 on the middle channel (881.5MHz) with maximum RF output power. All available 5G NR modulations (QPSK, 16QAM, 64QAM and 256QAM) were used. All available 5G NR channel bandwidths (5MHz and 10MHz) were used.

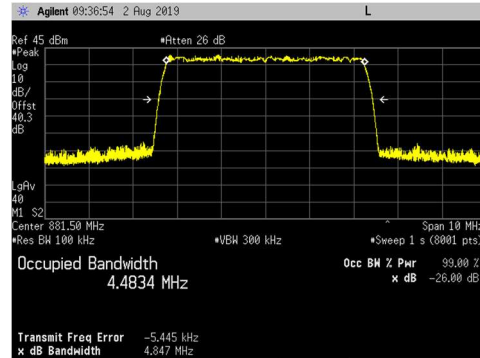
The 26dB emission bandwidth was measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth was measured in accordance with section 6.7 of RSS-Gen Issue 5. For both measurements, an occupied bandwidth built-in function in the spectrum analyzer was used. The results are provided in the following table. The largest emission bandwidths in each channel type are highlighted.

5G NR Channel Bandwidth	5G NR Modulation Type							
	QPSK		16QAM		64QAM		256QAM	
	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)
5 MHz	4.847	4.4834	4.839	4.4742	4.818	4.4840	4.817	4.4784
10 MHz	9.876	9.2927	9.888	9.2963	9.860	9.2773	9.841	9.2987

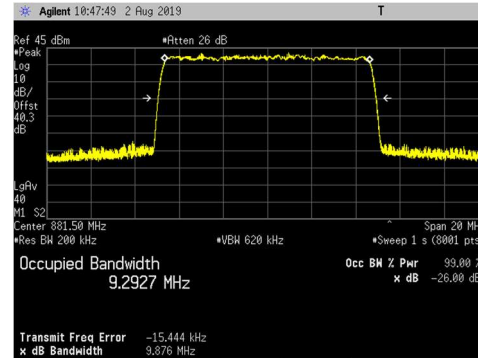
Emission bandwidth measurement data are provided in the following pages.

5G NR Emission Bandwidth Plots on the Middle Channel (881.5MHz) for Antenna Port 2:

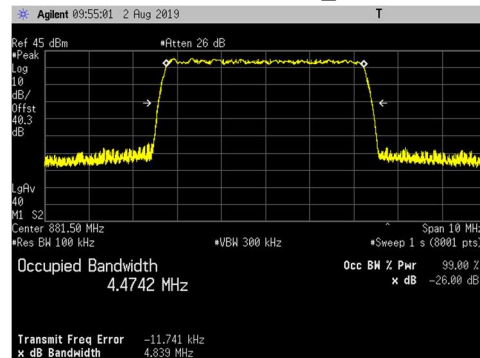
5MHz Channel Bandwidth_ QPSK



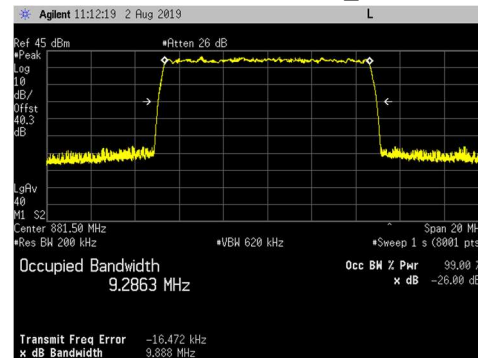
10MHz Channel Bandwidth_ QPSK



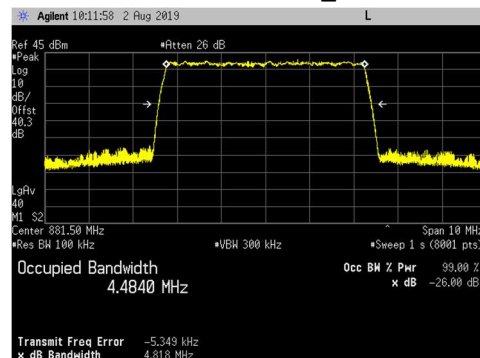
5MHz Channel Bandwidth_ 16QAM



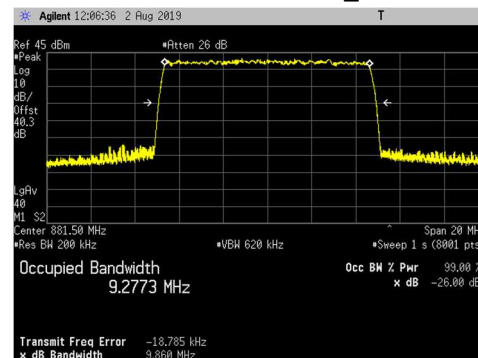
10MHz Channel Bandwidth_ 16QAM



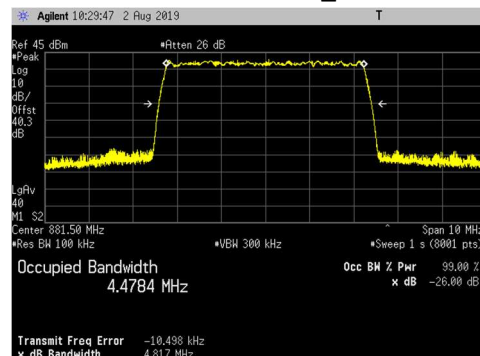
5MHz Channel Bandwidth_ 64QAM



10MHz Channel Bandwidth_ 64QAM



5MHz Channel Bandwidth_ 256QAM



10MHz Channel Bandwidth_ 256QAM

