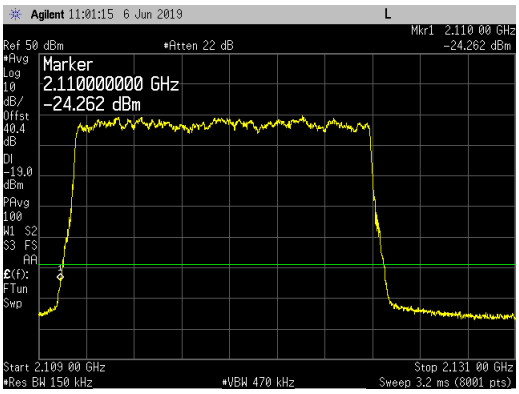
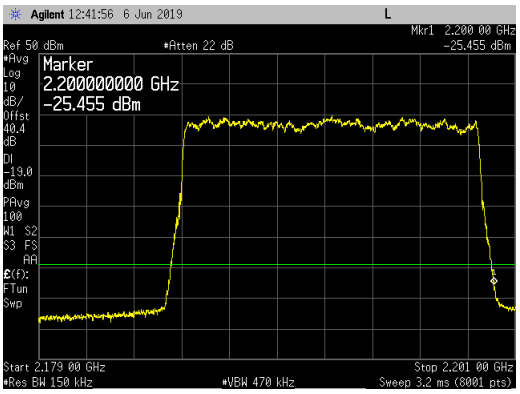
Single Carrier LTE15 Band Edge Plots for Antenna Port 3 and 16QAM Modulation:

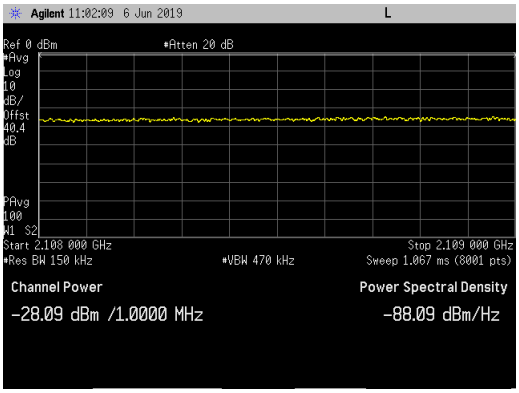
Bottom Channel_ LBE_ 2109 to 2131MHz



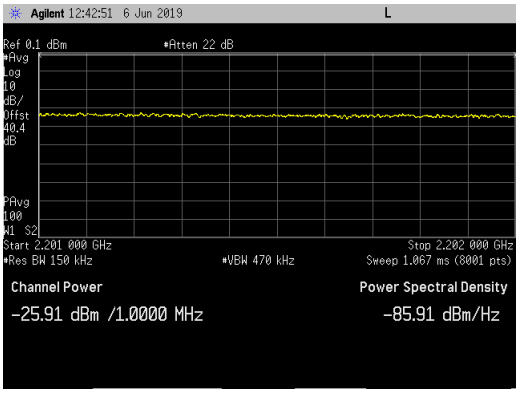
Top Channel_ UBE_ 2179 to 2201MHz



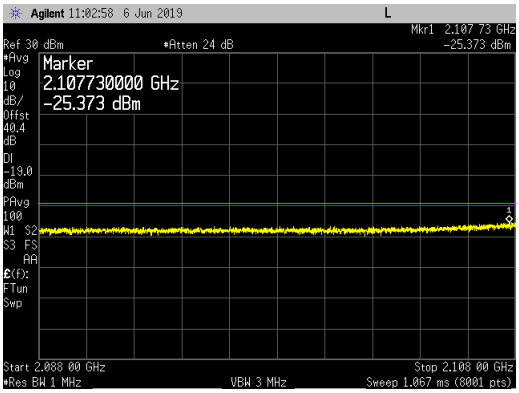
Bottom Channel_ LBE_ 2108 to 2109MHz



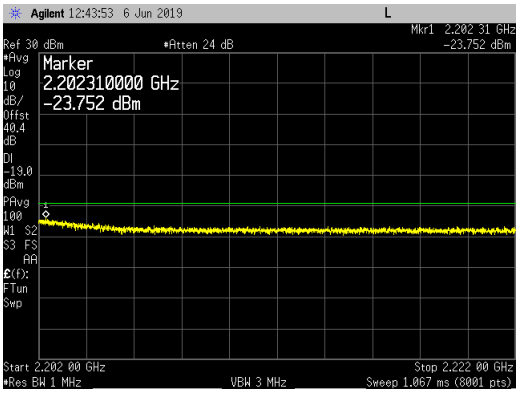
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

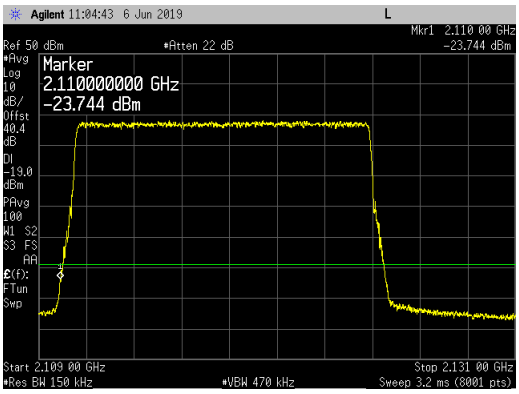


Top Channel_ UBE_ 2202 to 2222MHz

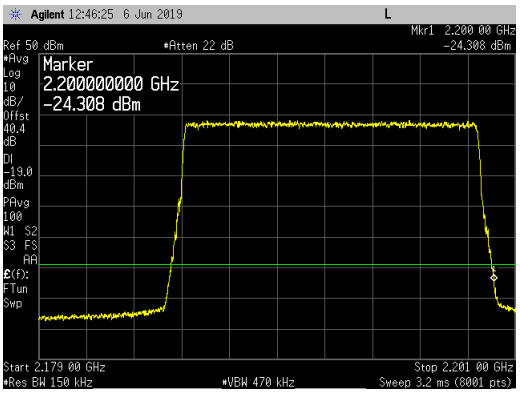


Single Carrier LTE15 Band Edge Plots for Antenna Port 3 and 64QAM Modulation:

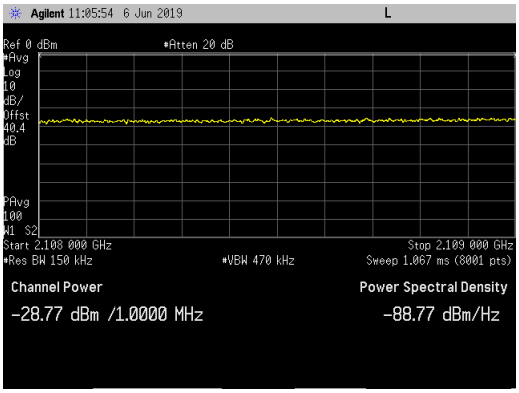
Bottom Channel_ LBE_ 2109 to 2131MHz



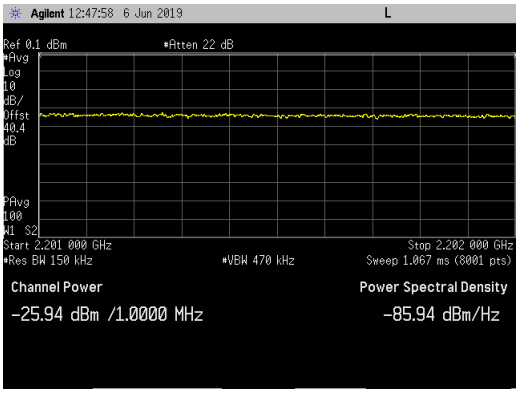
Top Channel_ UBE_ 2179 to 2201MHz



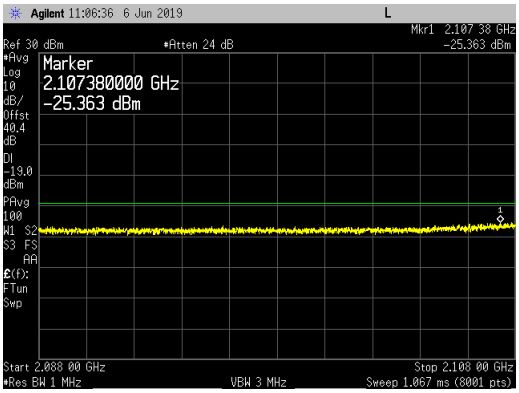
Bottom Channel_ LBE_ 2108 to 2109MHz



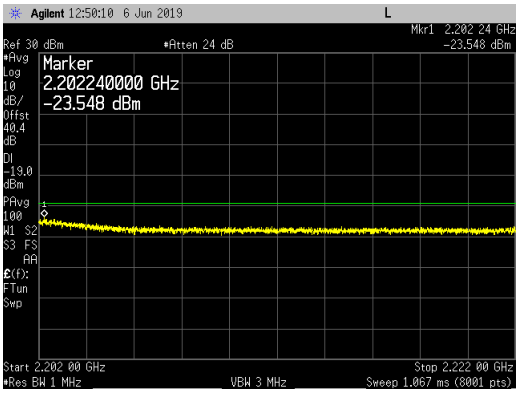
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

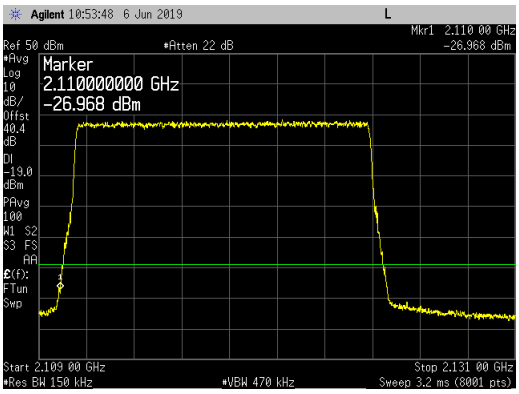


Top Channel_ UBE_ 2202 to 2222MHz

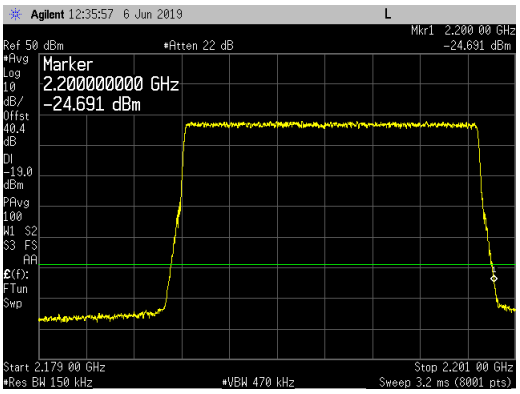


Single Carrier LTE15 Band Edge Plots for Antenna Port 3 and 256QAM Modulation:

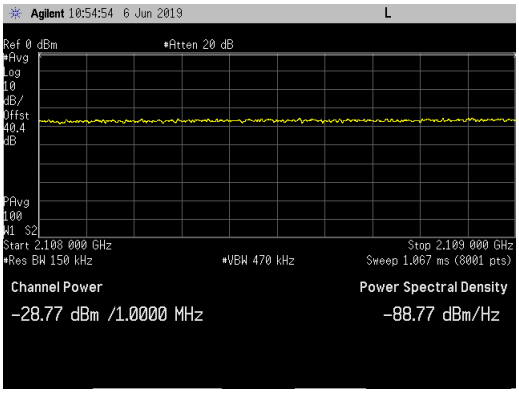
Bottom Channel_ LBE_ 2109 to 2131MHz



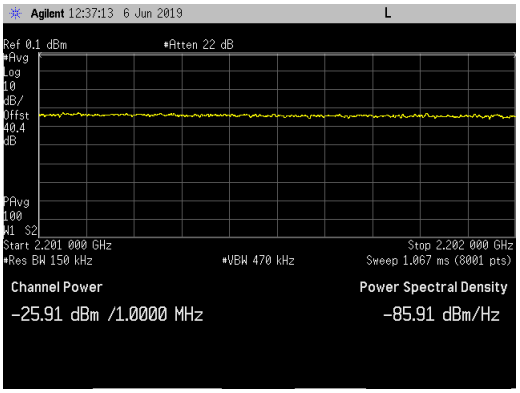
Top Channel_ UBE_ 2179 to 2201MHz



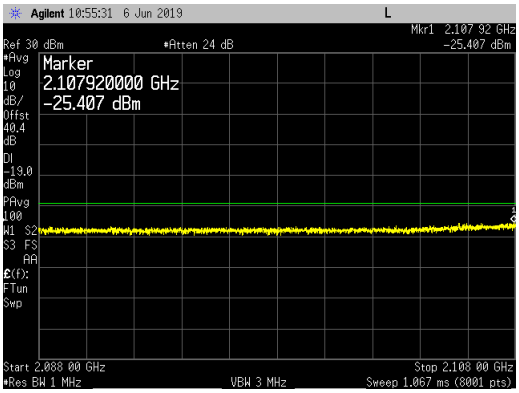
Bottom Channel_ LBE_ 2108 to 2109MHz



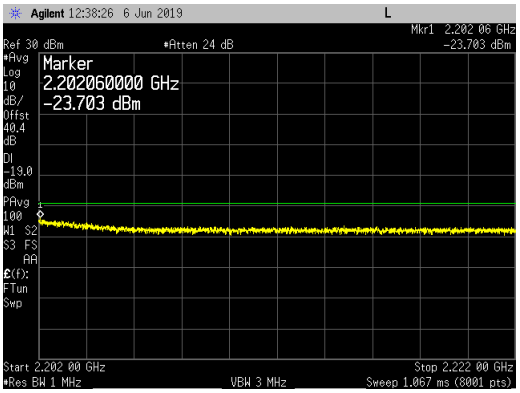
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

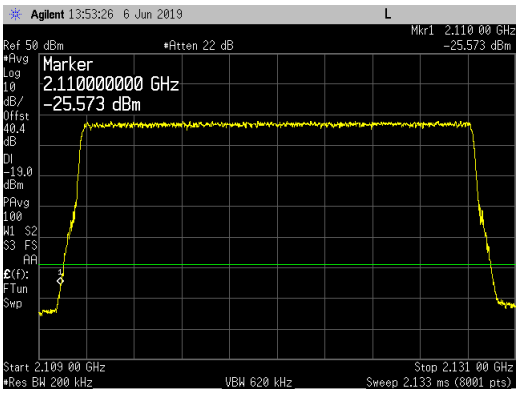


Top Channel_ UBE_ 2202 to 2222MHz

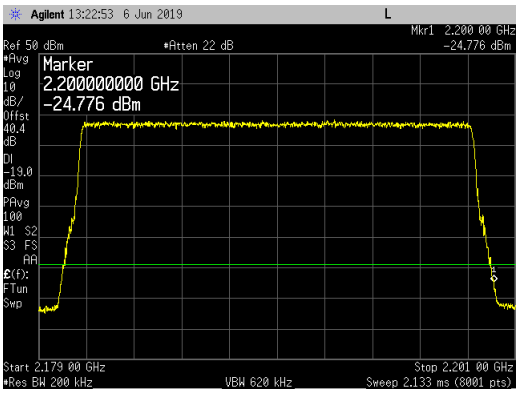


Single Carrier LTE20 Band Edge Plots for Antenna Port 3 and QPSK Modulation:

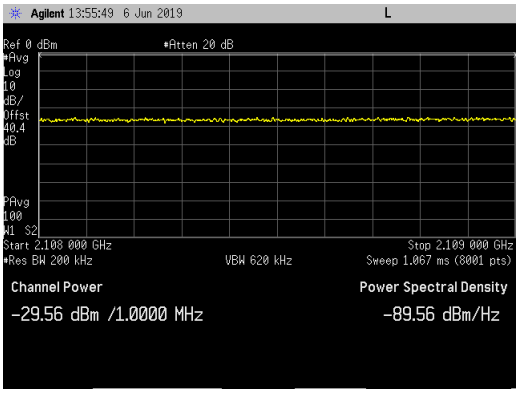
Bottom Channel_ LBE_ 2109 to 2131MHz



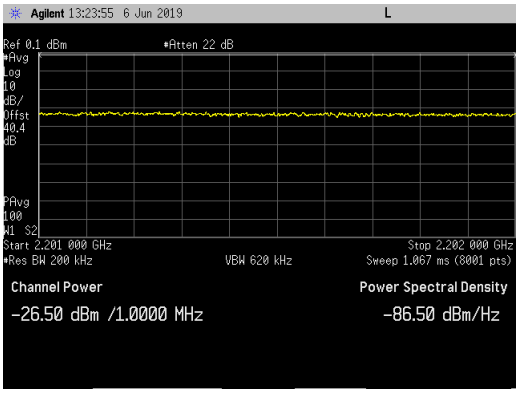
Top Channel_ UBE_ 2179 to 2201MHz



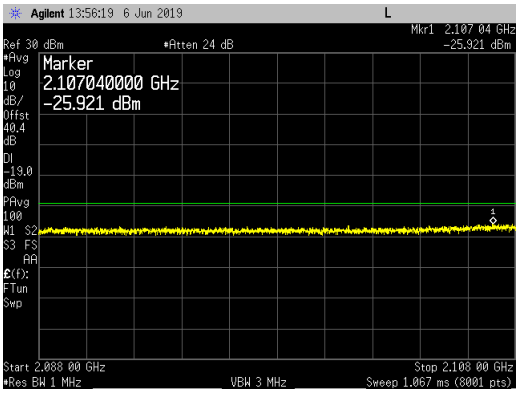
Bottom Channel_ LBE_ 2108 to 2109MHz



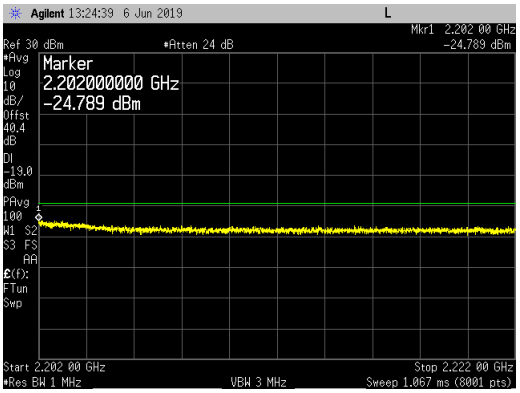
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

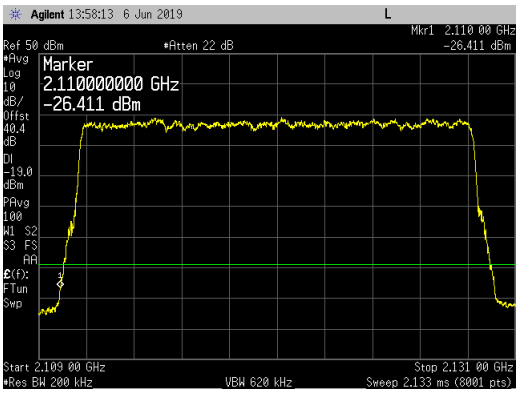


Top Channel_ UBE_ 2202 to 2222MHz

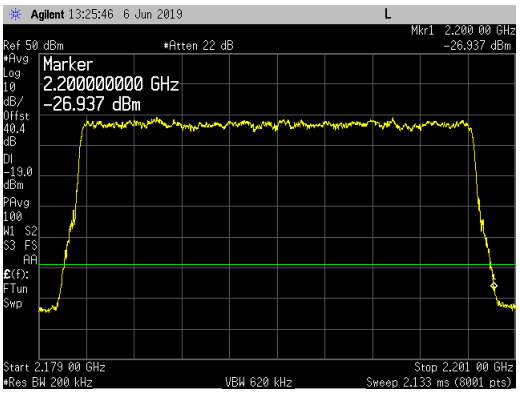


Single Carrier LTE20 Band Edge Plots for Antenna Port 3 and 16QAM Modulation:

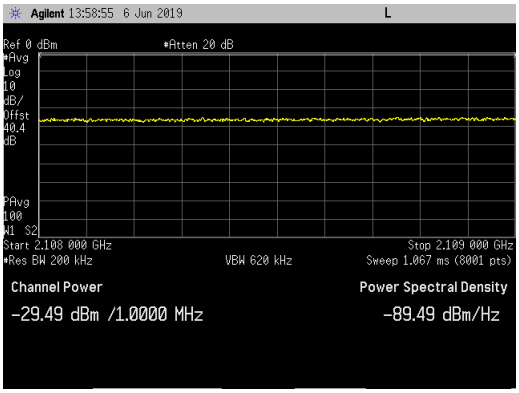
Bottom Channel_ LBE_ 2109 to 2131MHz



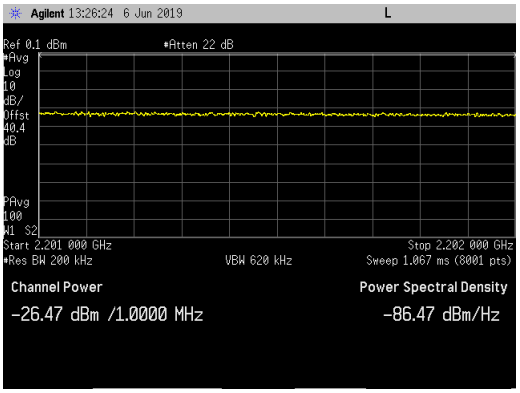
Top Channel_ UBE_ 2179 to 2201MHz



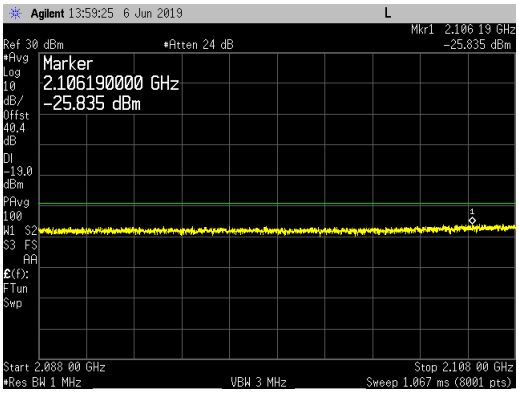
Bottom Channel_ LBE_ 2108 to 2109MHz



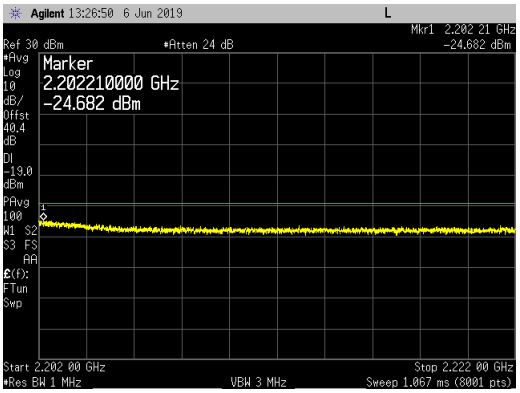
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

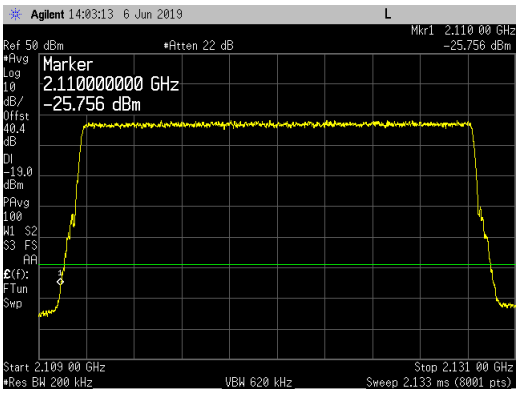


Top Channel_ UBE_ 2202 to 2222MHz

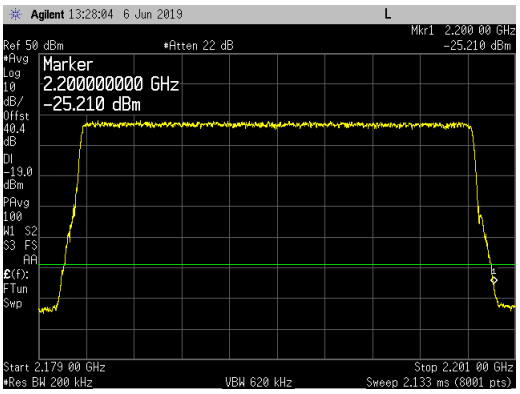


Single Carrier LTE20 Band Edge Plots for Antenna Port 3 and 64QAM Modulation:

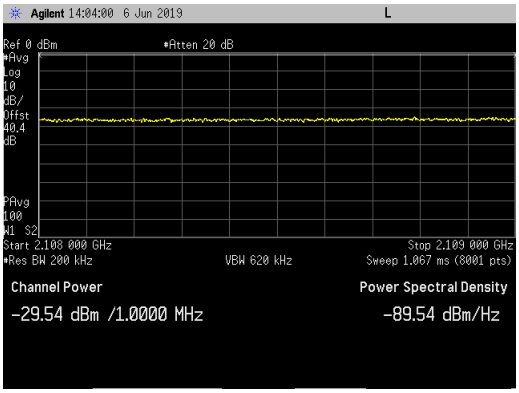
Bottom Channel_ LBE_ 2109 to 2131MHz



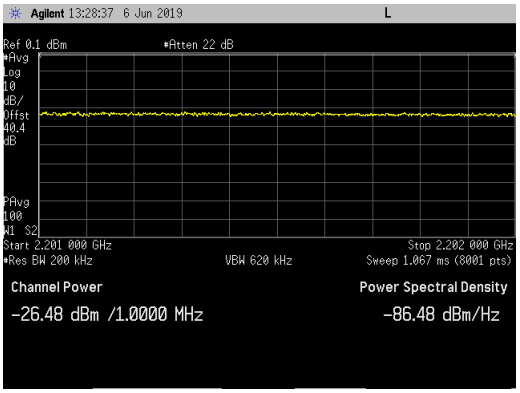
Top Channel_ UBE_ 2179 to 2201MHz



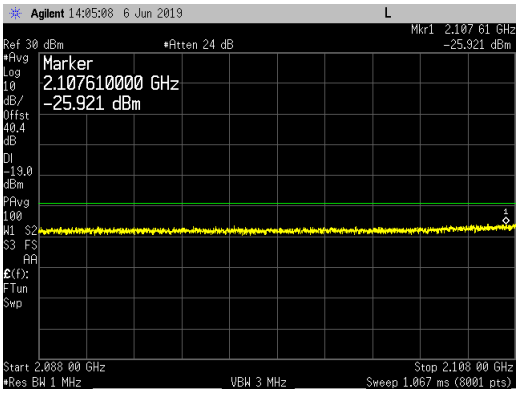
Bottom Channel_ LBE_ 2108 to 2109MHz



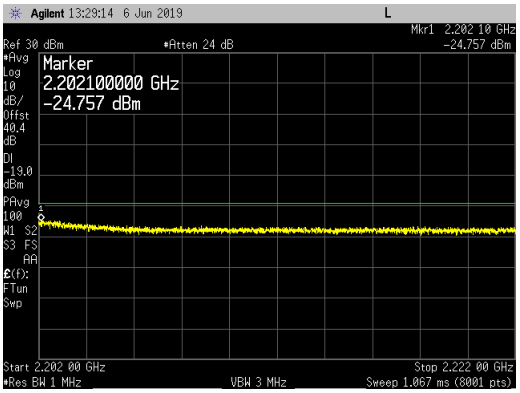
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

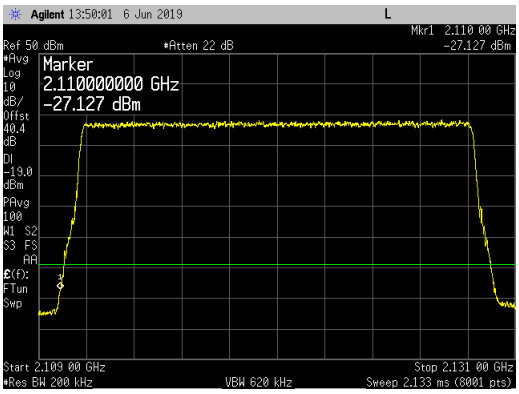


Top Channel_ UBE_ 2202 to 2222MHz

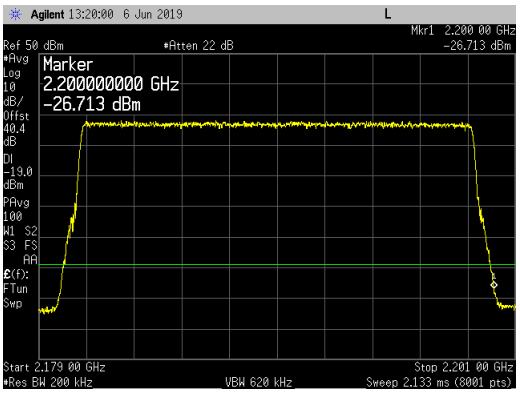


Single Carrier LTE20 Band Edge Plots for Antenna Port 3 and 256QAM Modulation:

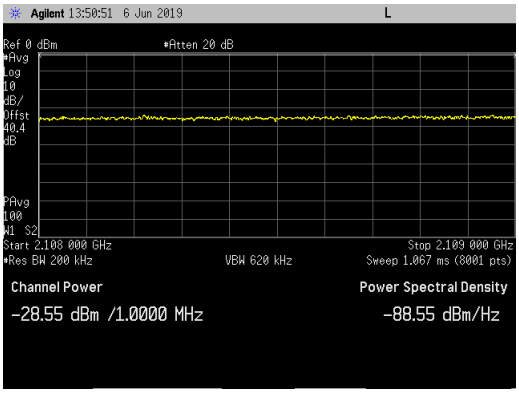
Bottom Channel_ LBE_ 2109 to 2131MHz



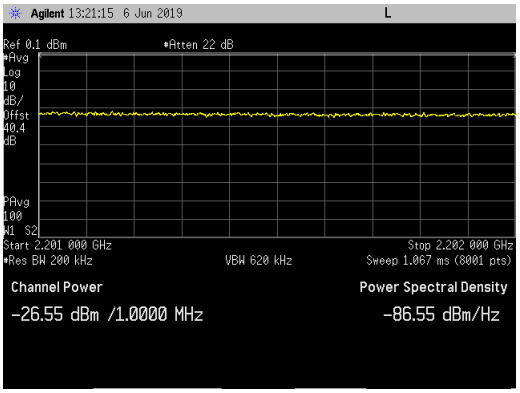
Top Channel_ UBE_ 2179 to 2201MHz



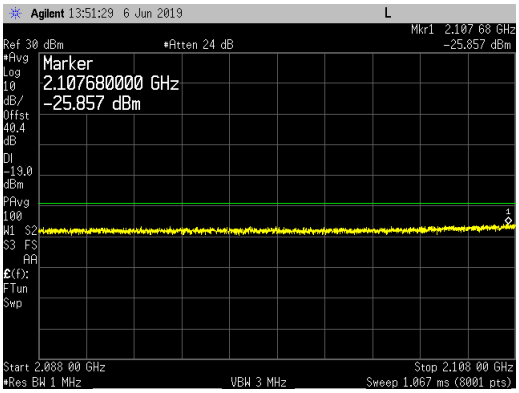
Bottom Channel_ LBE_ 2108 to 2109MHz



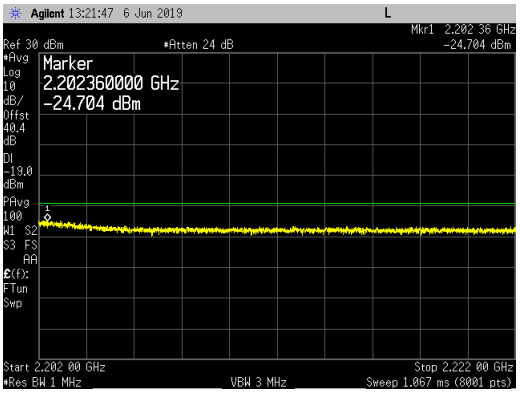
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

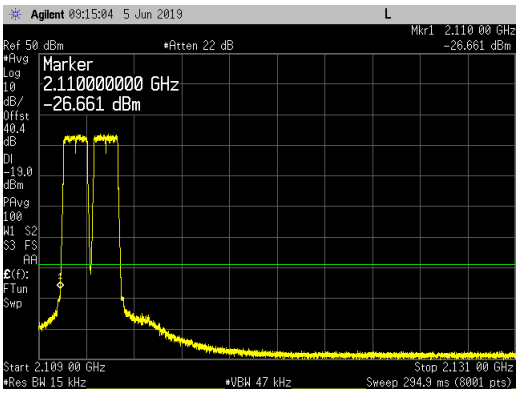


Top Channel_ UBE_ 2202 to 2222MHz

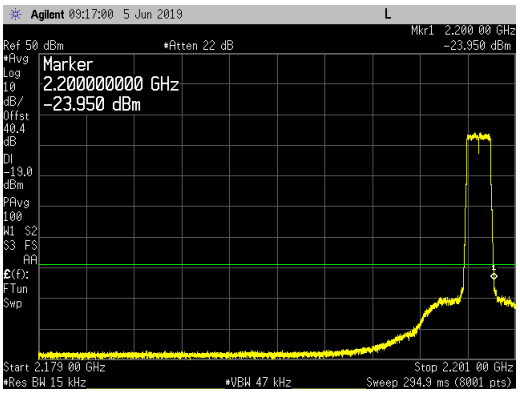


AWS Band Multicarrier LTE1.4 Band Edge Plots for Antenna Port 3 and QPSK Modulation:

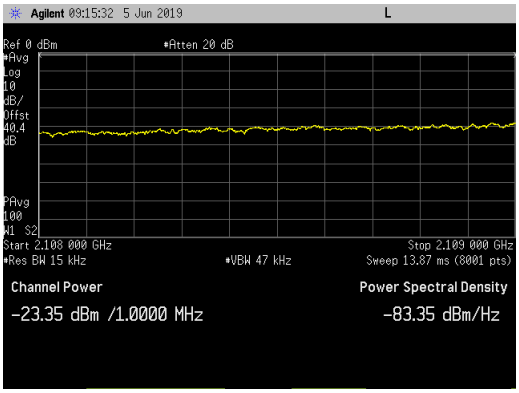
Bottom Channel_ LBE_ 2109 to 2131MHz



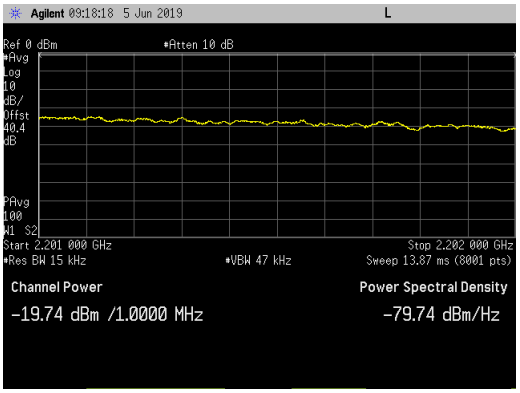
Top Channel_ UBE_ 2179 to 2201MHz



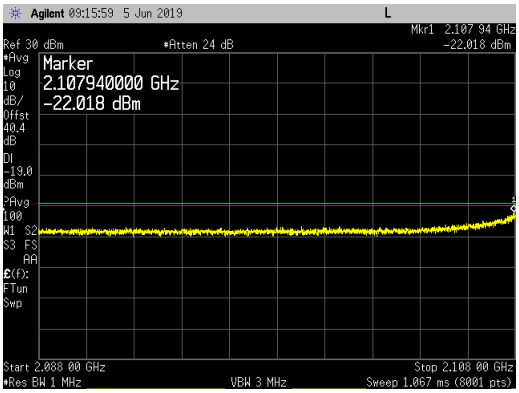
Bottom Channel_ LBE_ 2108 to 2109MHz



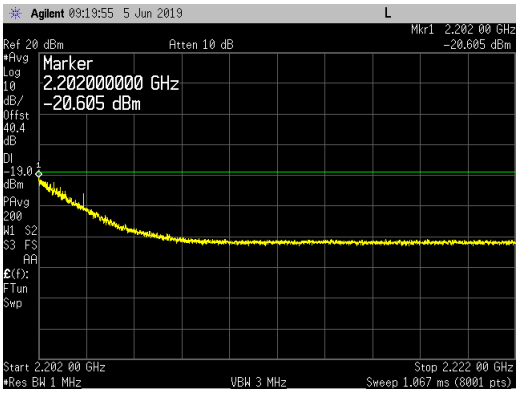
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

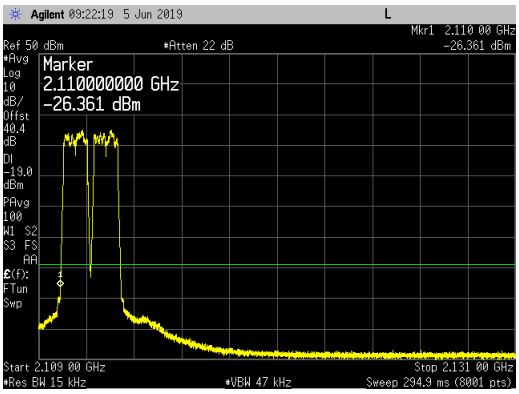


Top Channel_ UBE_ 2202 to 2222MHz

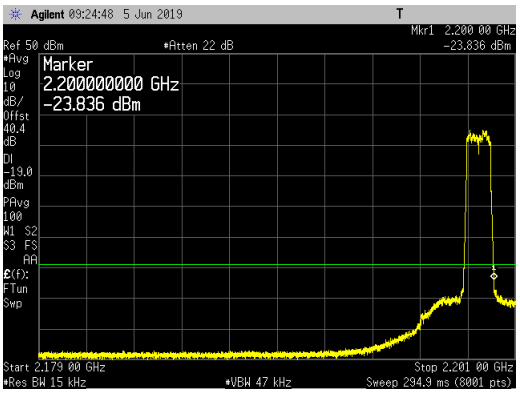


AWS Band Multicarrier LTE1.4 Band Edge Plots for Antenna Port 3 and 16QAM Modulation:

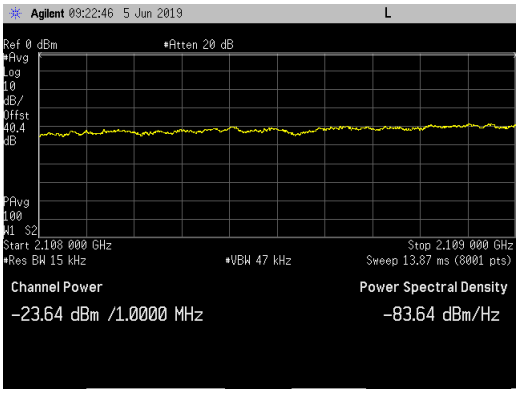
Bottom Channel_ LBE_ 2109 to 2131MHz



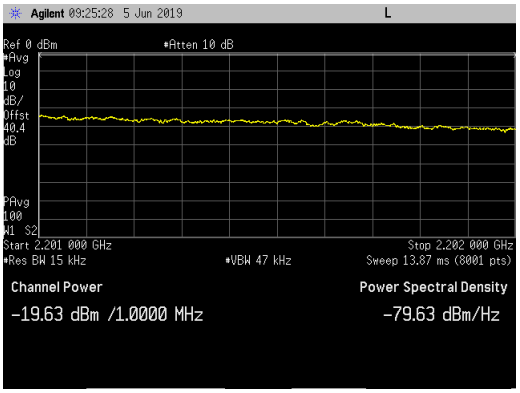
Top Channel_ UBE_ 2179 to 2201MHz



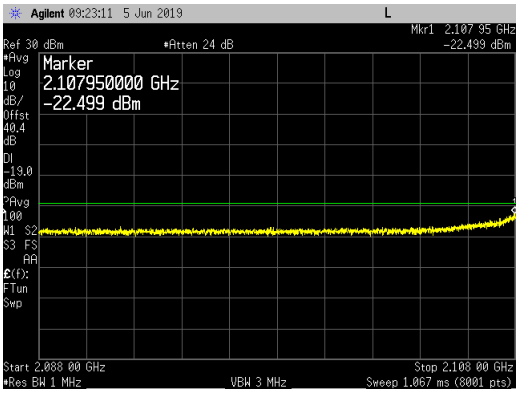
Bottom Channel_ LBE_ 2108 to 2109MHz



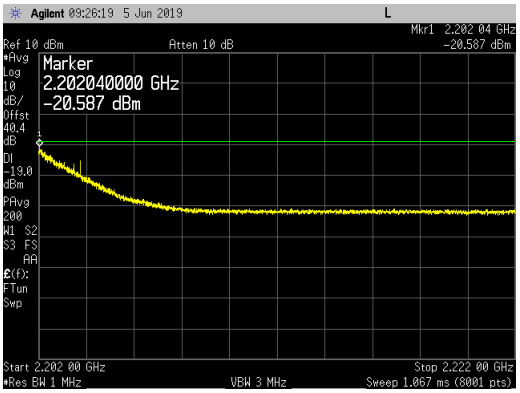
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

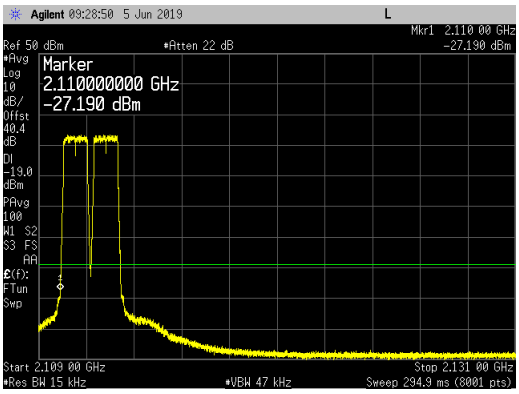


Top Channel_ UBE_ 2202 to 2222MHz

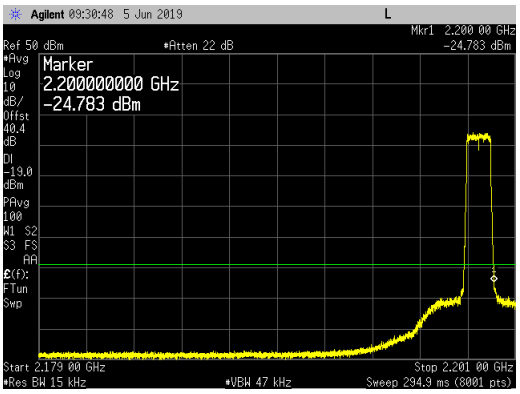


AWS Band Multicarrier LTE1.4 Band Edge Plots for Antenna Port 3 and 64QAM Modulation:

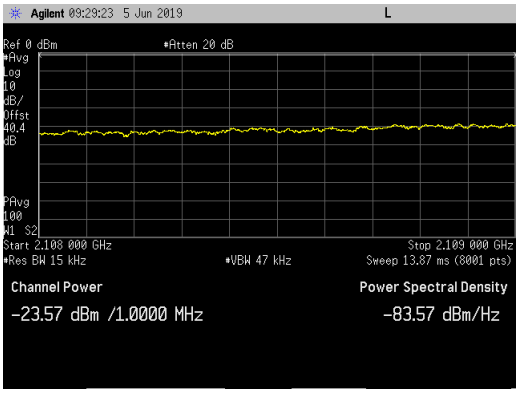
Bottom Channel_ LBE_ 2109 to 2131MHz



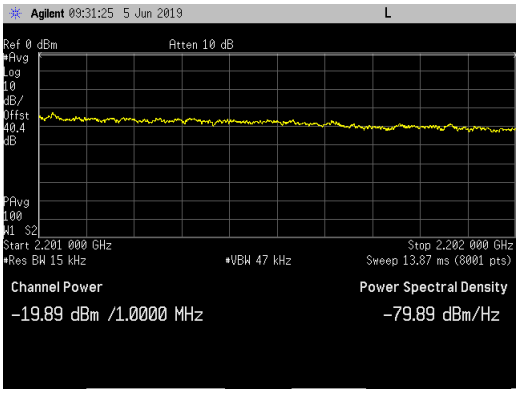
Top Channel_ UBE_ 2179 to 2201MHz



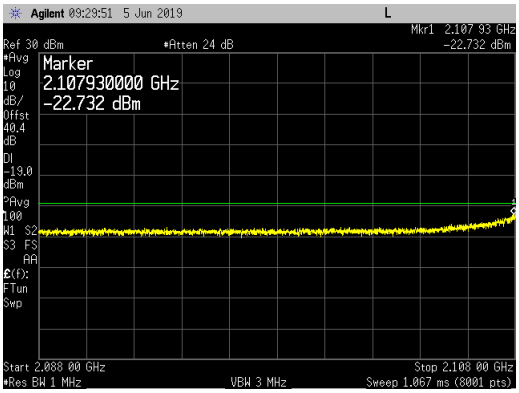
Bottom Channel_ LBE_ 2108 to 2109MHz



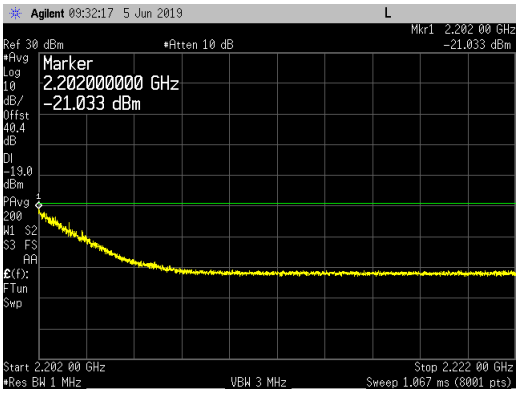
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz

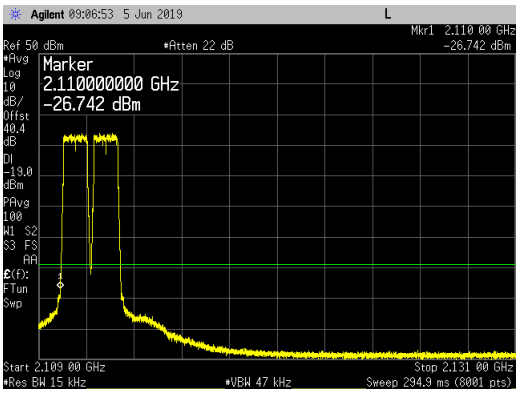


Top Channel_ UBE_ 2202 to 2222MHz

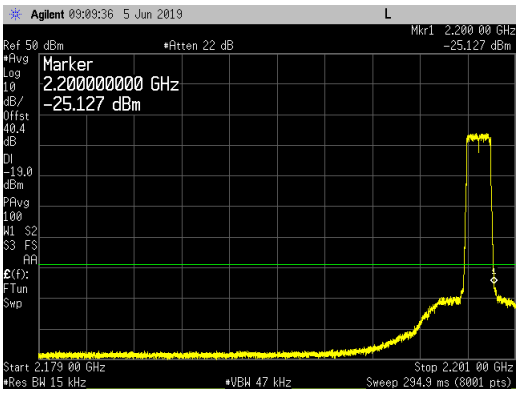


AWS Band Multicarrier LTE1.4 Band Edge Plots for Antenna Port 3 and 256QAM Modulation:

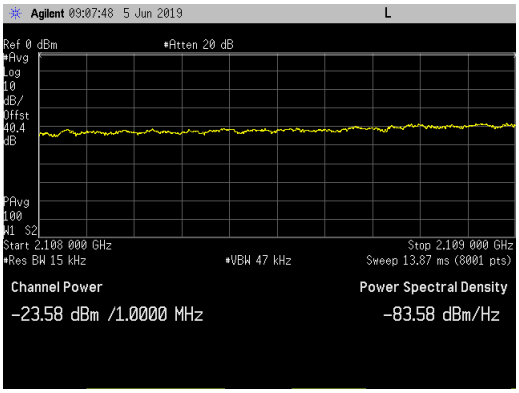
Bottom Channel_ LBE_ 2109 to 2131MHz



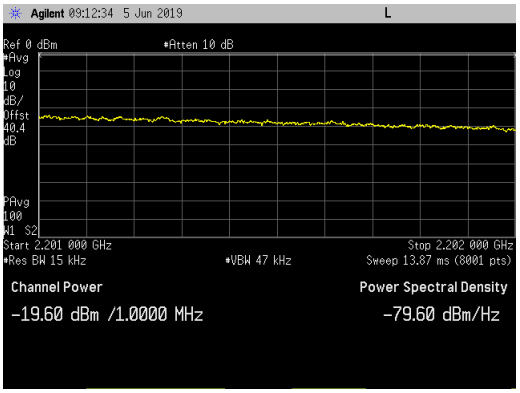
Top Channel_ UBE_ 2179 to 2201MHz



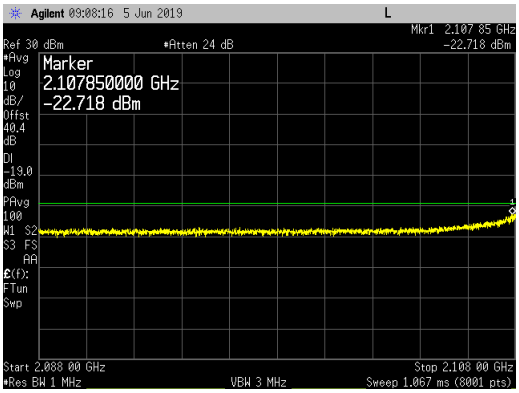
Bottom Channel_ LBE_ 2108 to 2109MHz



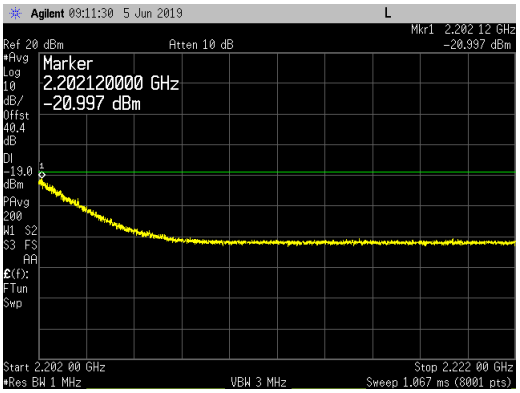
Top Channel_ UBE_ 2201 to 2202MHz



Bottom Channel_ LBE_ 2088 to 2108MHz



Top Channel_ UBE_ 2202 to 2222MHz



Transmitter Antenna Port Conducted Emissions

Transmitter conducted emission measurements were made at RRH antenna port 3. Measurements were performed over the 9kHz to 22GHz frequency range.

Single Carrier Test Cases

The single carrier test case was performed with the RRH operating on the PCS middle channel (1962.5MHz) and AWS middle channel (2155.0MHz) simultaneously with all LTE modulation types (QPSK, 16QAM, 64QAM and 256QAM) for all LTE bandwidths (1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz). The same modulation type was used for both PCS and AWS carriers.

Multicarrier Test Cases

PCS Multicarrier Multiband Test Case

In the PCS band _Three LTE5 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (EARFCN 8065: 1932.5 & EARFCN 8115: 1937.5MHz) and a third carrier with maximum spacing between the other two carrier frequencies (EARFCN 8665: 1992.5MHz) at the upper band edge. In the AWS band _ Single LTE1.4 carrier at the middle channel (EARFCN 66866: 2155MHz). The smallest channel bandwidth was selected to maximize carrier power spectral density. The LTE5 PCS carrier bandwidth was chosen because it was the smallest LTE bandwidth that covers the entire PCS frequency range. The carriers were operated at maximum power (~26W/PCS carrier and 40W/AWS carrier) with at total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carrier). The same modulation type was used for both PCS and AWS carriers.

AWS Multicarrier Multiband Test Case

In the AWS band: Three LTE1.4 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (EARFCN 66443: 2110.7 & EARFCN 66457: 2112.1MHz) and a third carrier with maximum spacing between the other two carrier frequencies (EARFCN 67329: 2199.3MHz) at the upper band edge. In the PCS band: Single LTE1.4 carrier at the middle channel (EARFCN 8365: 1962.5MHz). The smallest channel bandwidth was selected to maximize carrier power spectral density. The carriers were operated at maximum power (80W/PCS carrier and ~13W/AWS carrier) with at total port power of 120 watts (80W for PCS band carrier + 40W for AWS band carriers). The same modulation type was used for both PCS and AWS carriers.

Multicarrier Multiband Test Case

Three LTE1.4 carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the PCS band lower band edge (EARFCN 8047: 1930.7 & EARFCN 8061: 1932.1MHz) and a third carrier with maximum spacing between the other two carrier frequencies (EARFCN 67329: 2199.3MHz) at the AWS band upper band edge. The smallest channel bandwidth was selected to maximize carrier power spectral density. The carriers were operated at maximum power (40W/PCS carrier and 40W/AWS carrier) with at total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carrier). The same modulation type was used for both PCS and AWS carriers.

The test configuration parameters are provided below:

PCS Band Transmission Parameters			AWS Band Transmission Parameters		
Carrier Frequency	**Channel Bandwidth**	**Carrier Power**	**Carrier Frequency**	**Channel Bandwidth**	**Carrier Power**
1962.5MHz (Mid Ch)	LTE1.4 – LTE20	80 Watts	2154.0MHz (Mid Ch)	LTE1.4 – LTE20	40 Watts
1932.5, 1937.5 & 1992.5MHz (BC, BC+1, and TC)	LTE5	26+26+26 Watts	2154.0MHz (Mid Ch)	LTE1.4	40 Watts
1932.5 & 1937.5MHz (BC and BC+1)	LTE1.4	40 + 40 Watts	2199.3MHz (Top Ch)	LTE1.4	40 Watts
1962.5MHz (Mid Ch)	LTE1.4	80 Watts	2110.7, 2112.1 & 2199.3MHz (BC, BC+1, and TC)	LTE1.4	13+13+13 Watts

The power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm as specified in section 24.238(a), 27.53(h)(1), RSS 133 6.5(i) and RSS 139 6.6. 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 transmitter. The required measurement parameters include a 1MHz 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 max hold over 50 sweeps (except for the 20MHz to 3GHz frequency range). Measurements for the 20MHz to 3GHz 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 –49dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -49dBm = -19dBm -10log(1MHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to –39dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -39dBm = -19dBm -10log(1MHz/10kHz)]. The required limit of -19dBm with a RBW of $\geq$ 1MHz 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	8.7dB
150kHz to 20MHz	10kHz	30kHz	8001	Peak	Auto	50 Sweeps	8.7dB
20MHz to 3GHz	1MHz	3MHz	8001	Average	Auto	Note (2)	40.4dB
3GHz to 6GHz	1MHz	3MHz	8001	Peak	Auto	50 Sweeps	40.2dB
6GHz to 18GHz	2MHz	6MHz	8192	Peak	Auto	50 Sweeps	33.1dB
18GHz to 22GHz	1MHz	3MHz	8001	Peak	Auto	50 Sweeps	41.3dB
1900 to 2200MHz	1MHz	3MHz	8001	Average	Auto	Note (2)	40.4dB

Note 1: The total measurement RF path loss of the test setup (attenuators, test cables and filters) 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 low pass filter was used to reduce measurement instrumentation noise floor for the frequency ranges less than 20MHz. A high pass filter was used to reduce measurement instrumentation noise floor for the frequency ranges above 6GHz. The total measurement RF path loss of the test setup (attenuators, low pass filter, 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

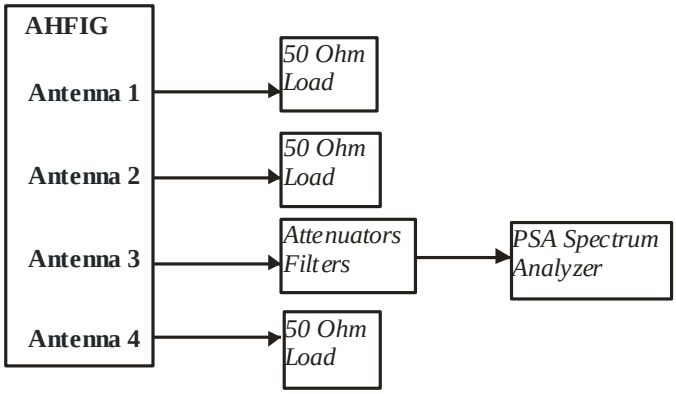
Radiated emission measurement results are in Appendix A.

Frequency Stability/Accuracy

Frequency Stability/Accuracy measurement results are in Appendix A.

APPENDIX C: ANTENNA PORT WCDMA TEST DATA FOR THE PCS BAND

All conducted RF measurements in this section were made at AHFIG antenna port 3. Based on the RF power measurement results shown in Appendix A & B, Port 3 had the highest LTE RMS average power for the PCS and AWS bands (represents the worst case) and therefore it was selected for all the remaining antenna port tests. All testing in this section was performed with WCDMA modulation types. The WCDMA modulation types are setup according to 3GPP TS 25.141 UTRA Test Models (TM) as follows TM 1: QPSK, TM 5: 16QAM and TM 6: 64QAM. The test setup used is provided below.



Test Setup Used for AHFIG Conducted RF Measurements

RF Output Power

RF output power has been measured in both Peak and RMS Average terms at AHFIG Antenna Port 3 at the bottom, middle and top PCS frequency channels for WCDMA modulation types (QPSK, 16QAM, 64QAM). RMS Average power was measured as described in section 5.2 of KDB 971168 D01v03r01 and ANSI C63.26-2015 sections 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 values are highlighted.

Single Carrier Operation on Antenna port 3			
Modulation	**Frequency _ Channel**	**PAPR (dB)**	**Average (dBm)**
QPSK	**1932.4MHz _ Bottom Channel**	7.25	48.73
	1960.0MHz _ Middle Channel	7.25	48.80
	1987.6MHz _ Top Channel	7.25	**48.82**
16QAM	**1932.4MHz _ Bottom Channel**	7.30	48.69
	1960.0MHz _ Middle Channel	**7.35**	48.75
	1987.6MHz _ Top Channel	7.31	48.79
64QAM	**1932.4MHz _ Bottom Channel**	7.34	48.66
	1960.0MHz _ Middle Channel	7.31	48.81
	1987.6MHz _ Top Channel	7.34	48.70

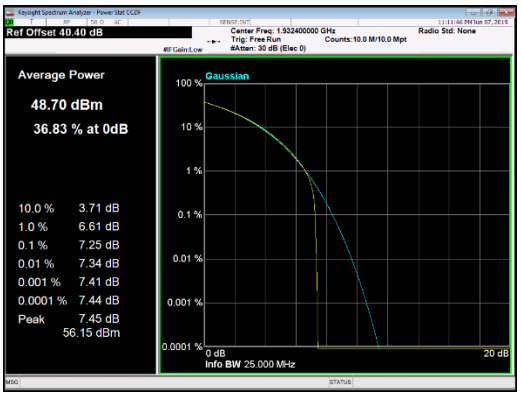
RF output power has been measured in RMS Average terms for each PCS multicarrier test configuration to verify/document the power levels. All results are presented in tabular form below.

Measured RMS Average Carrier Power Level for the Multicarrier Configurations at Antenna Port 3				
Modulation Type	**PCS Multicarrier WCDMA**		**Multiband Multicarrier WCDMA**	
	Bottom Carriers 1932.4 & 1937.4MHz	**Top Carrier 1987.6MHz**	**Bottom Carriers 1932.4 & 1937.4MHz**	**Top Carrier 2167.6MHz**
QPSK	46.65 dBm (46.2 Watts)	44.30 dBm (26.9 Watts)	48.93 dBm (78.2 Watts)	46.01 dBm (39.9 Watts)
	Total Carrier Power in PCS Band is 73.1 Watts or 48.64 dBm		Total Carrier Power in the PCS and AWS Band is 118.1 Watts or 50.72 dBm	
16QAM	46.65 dBm (46.2 Watts)	44.24 dBm (26.5 Watts)	48.86 dBm (76.9 Watts)	46.00 dBm (39.8 Watts)
	Total Carrier Power in PCS Band is 72.7 Watts or 48.62 dBm		Total Carrier Power in the PCS and AWS Band is 116.7 Watts or 50.67 dBm	
64QAM	46.75 dBm (47.3 Watts)	44.25 dBm (26.6 Watts)	48.71 dBm (74.3 Watts)	45.85 dBm (38.5 Watts)
	Total Carrier Power in PCS Band is 73.9 Watts or 48.69 dBm		Total Carrier Power in the PCS and AWS Band is 112.8 Watts or 50.52 dBm	

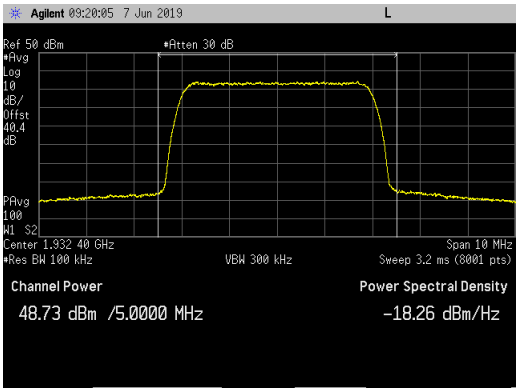
All measurement results are provided in the following pages. The total measurement RF path loss of the test setup (attenuator and test cables) was 40.4 dB and is accounted for by the spectrum analyzer reference level offset.

WCDMA Channel Power Plots for Antenna Port 3 and QPSK Modulation:

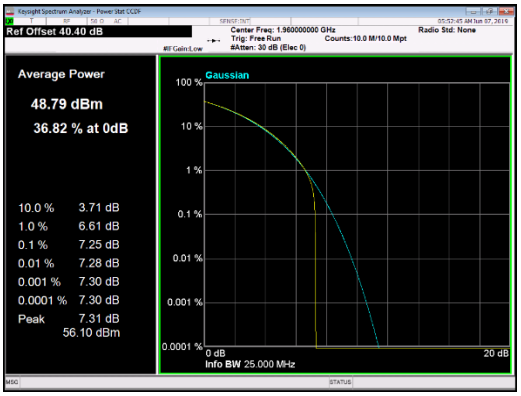
Bottom Channel_ CCDF



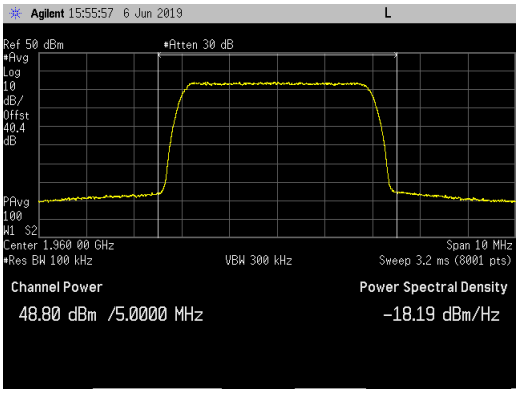
Bottom Channel_ Average



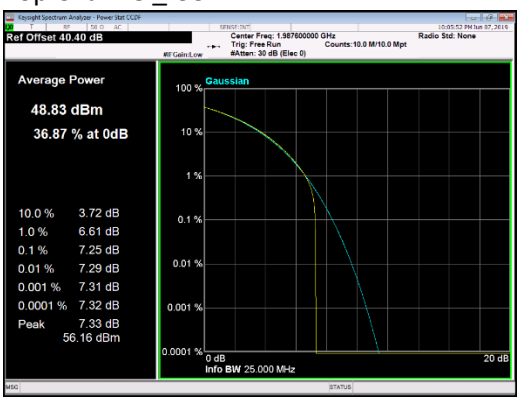
Middle Channel_ CCDF



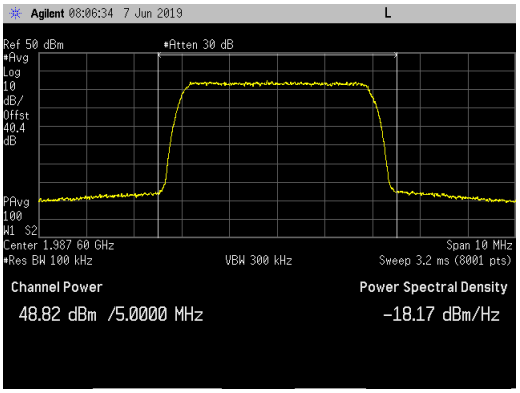
Middle Channel_ Average



Top Channel_ CCDF

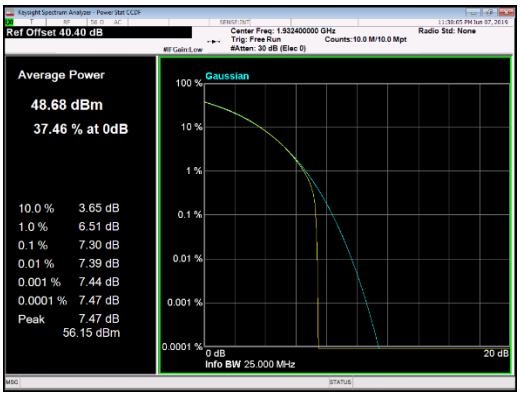


Top Channel_ Average

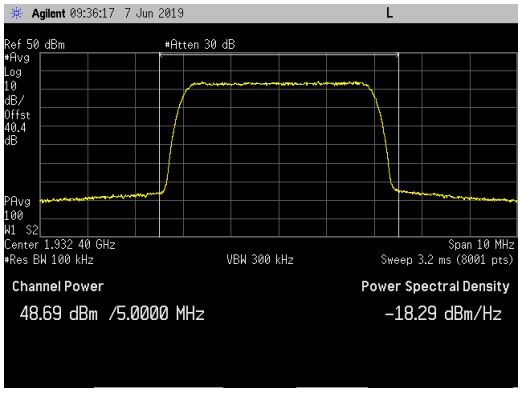


WCDMA Channel Power Plots for Antenna Port 3 and 16QAM Modulation:

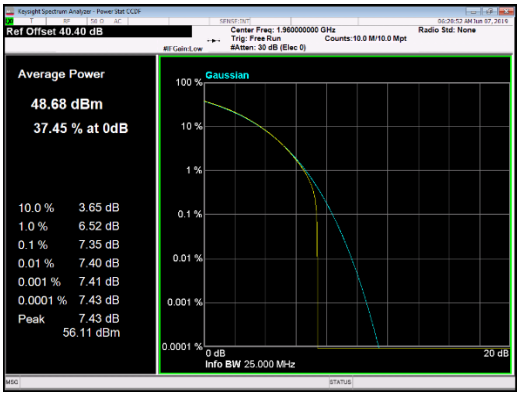
Bottom Channel_ CCDF



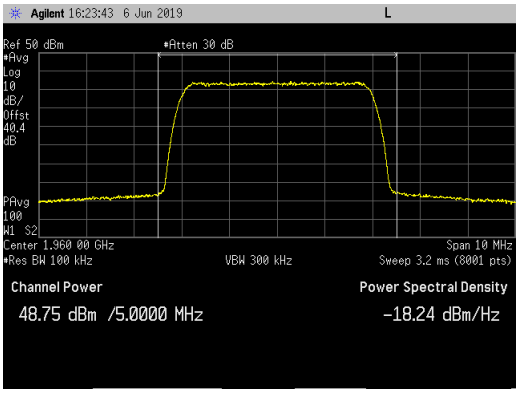
Bottom Channel_ Average



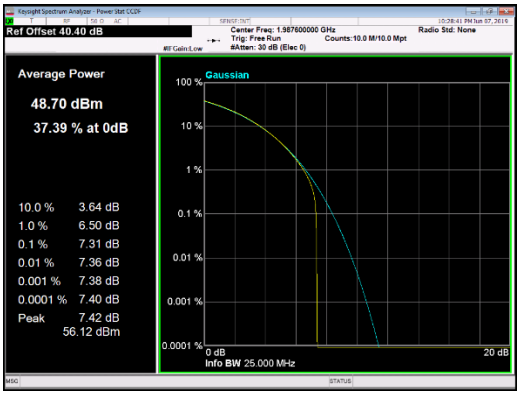
Middle Channel_ CCDF



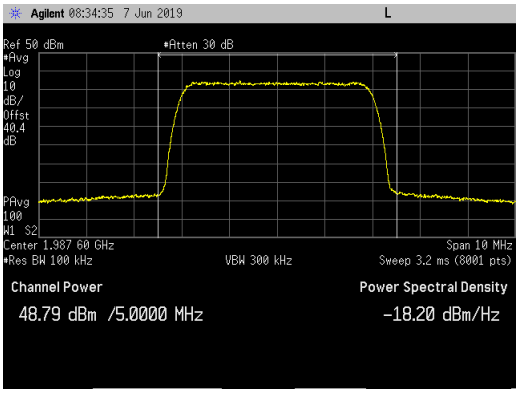
Middle Channel_ Average



Top Channel_ CCDF

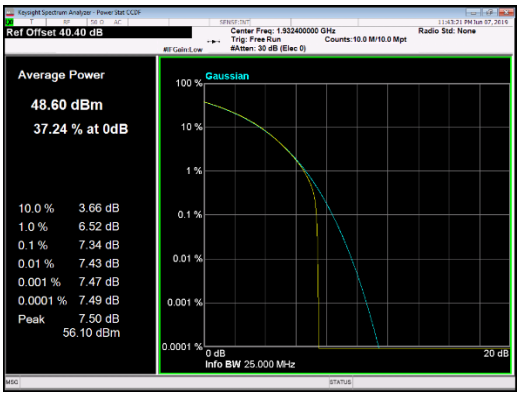


Top Channel_ Average

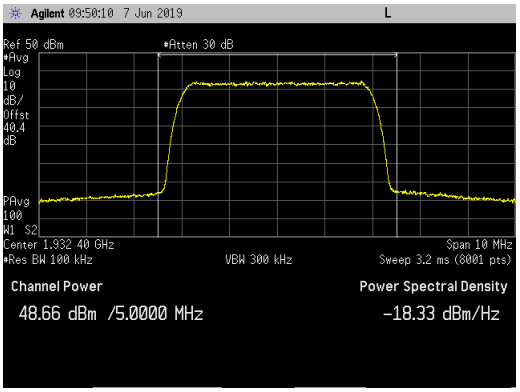


WCDMA Channel Power Plots for Antenna Port 3 and 64QAM Modulation:

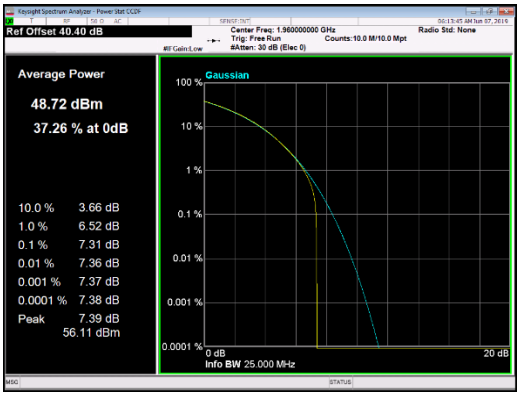
Bottom Channel_ CCDF



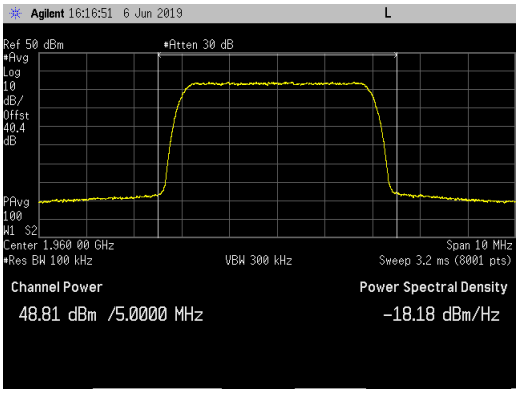
Bottom Channel_ Average



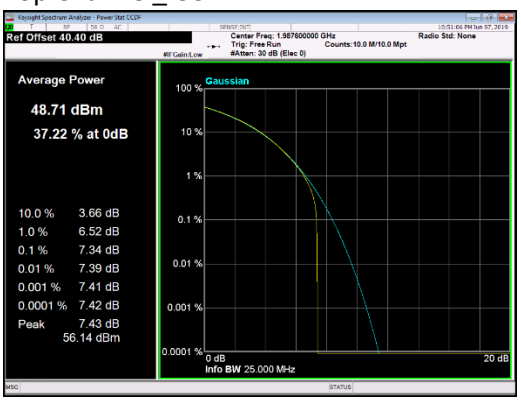
Middle Channel_ CCDF



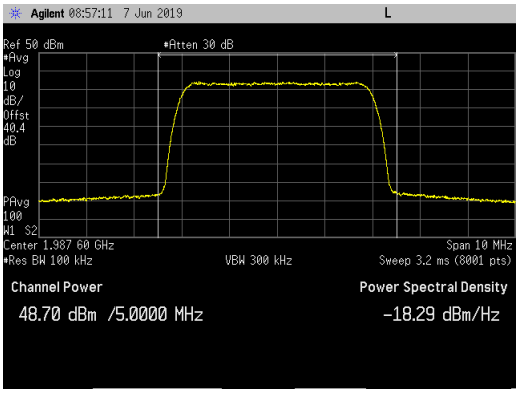
Middle Channel_ Average



Top Channel_ CCDF

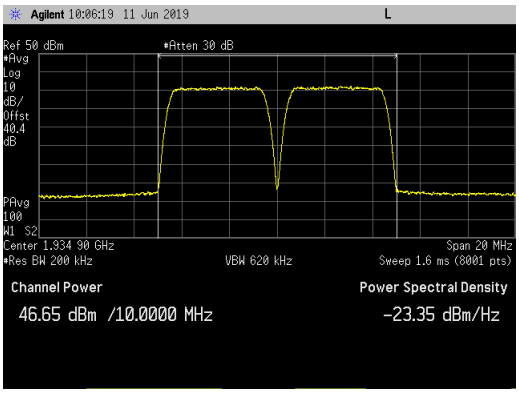


Top Channel_ Average

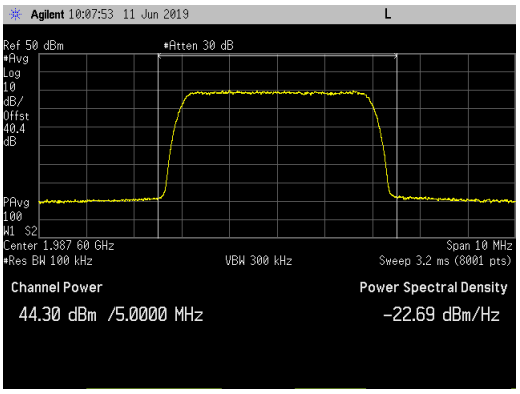


PCS Multicarrier (Carriers at 1932.4, 1937.4 & 1987.6MHz) Channel Power Plots for Antenna Port 3:

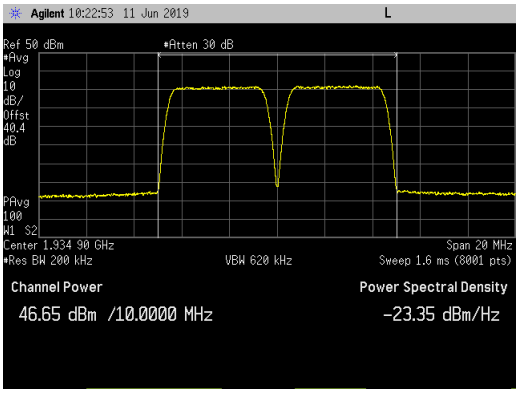
QPSK_ 1932.4 & 1937.4MHz_ Average Power



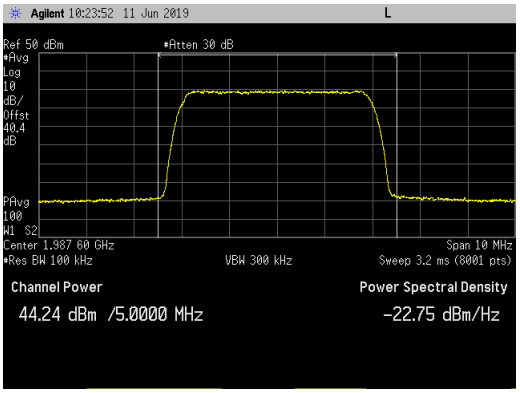
QPSK_ 1987.6MHz_ Average Power



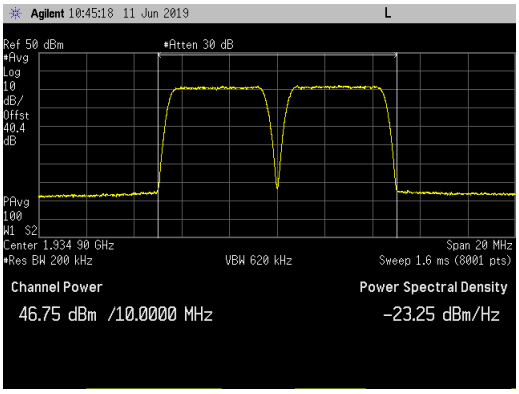
16QAM_ 1932.4 & 1937.4MHz_ Average Power



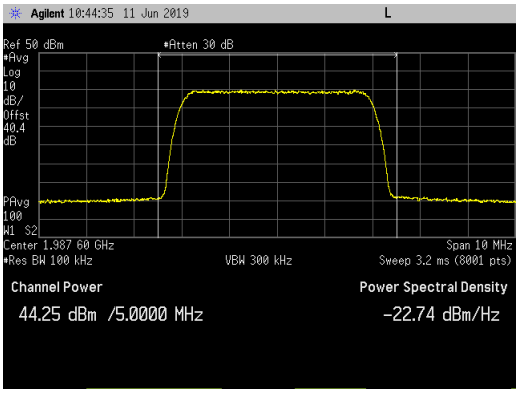
16QAM_ 1987.6MHz_ Average Power



64QAM_ 1932.4 & 1937.4MHz_ Average Power

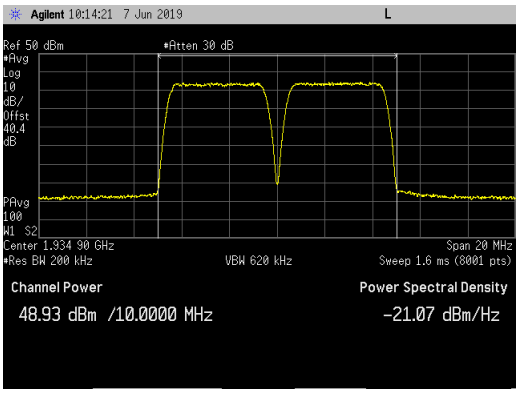


64QAM_ 1987.6MHz_ Average Power

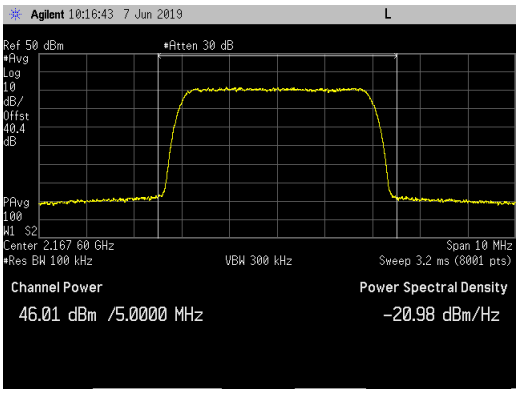


Multiband Multicarrier (Carriers at 1932.4, 1937.4 & 2167.6MHz) Channel Power Plots for Antenna Port 3:

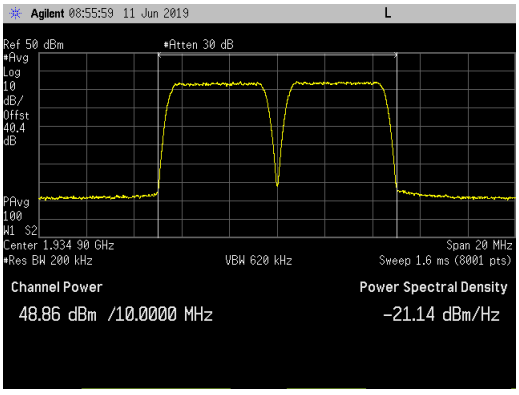
QPSK_ 1932.4 & 1937.4MHz_ Average Power



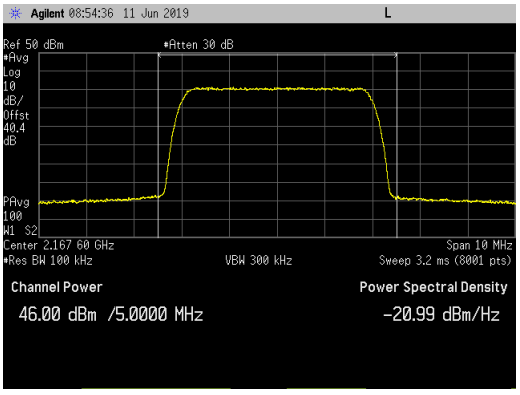
QPSK_ 2167.6MHz_ Average Power



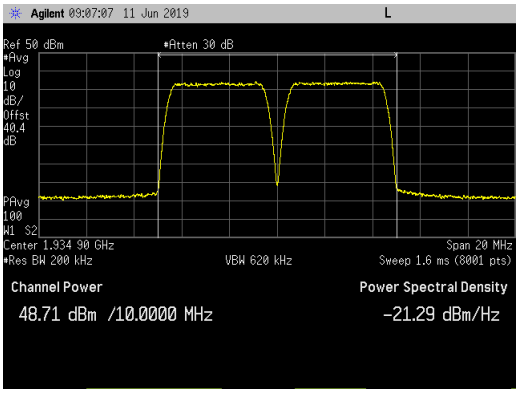
16QAM_ 1932.4 & 1937.4MHz_ Average Power



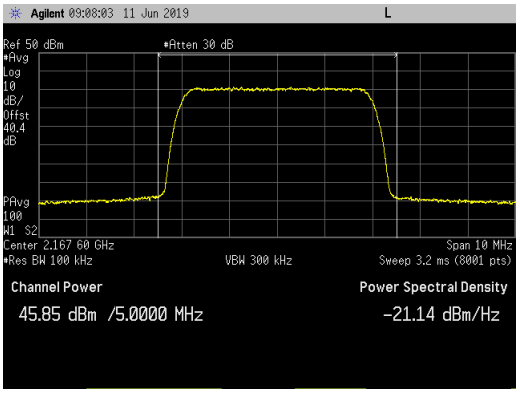
16QAM_ 2167.6MHz_ Average Power



64QAM_ 1932.4 & 1937.4MHz_ Average Power



64QAM_ 2167.6MHz_ Average Power



Emission Bandwidth (26 dB down and 99%)

Emission bandwidth measurements were made at antenna port 3 on the bottom, middle and top PCS channels. The AHFIG was operated at maximum RF output power for WCDMA modulation types (QPSK, 16QAM, 64QAM).

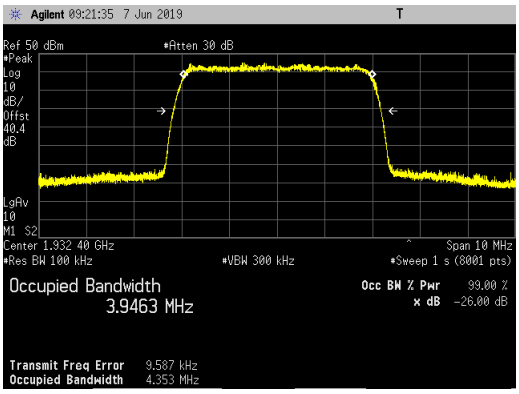
The 26dB emission bandwidth was measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth was measured in accordance with section 6.7 of RSS-Gen Issue 5. For both measurements, an occupied bandwidth built-in function in the spectrum analyzer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

Modulation	Frequency _ Channel	Emission Bandwidth (MHz)	
		26dB	99%
QPSK	1932.4MHz _ Bottom Channel	4.353	3.9463
	1960.0MHz _ Middle Channel	4.364	**3.9497**
	1987.6MHz _ Top Channel	4.359	3.9474
16QAM	1932.4MHz _ Bottom Channel	4.353	3.9423
	1960.0MHz _ Middle Channel	**4.388**	3.9466
	1987.6MHz _ Top Channel	4.359	3.9425
64QAM	1932.4MHz _ Bottom Channel	4.359	3.9375
	1960.0MHz _ Middle Channel	4.363	3.9348
	1987.6MHz _ Top Channel	4.362	3.9367

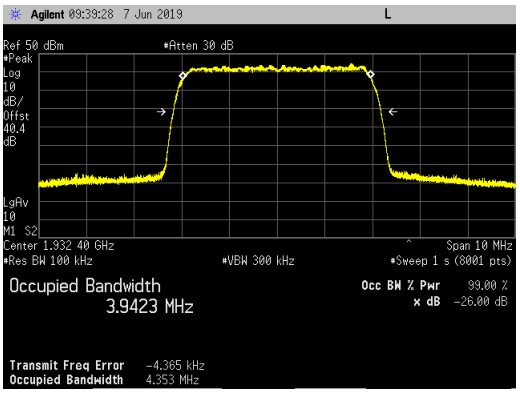
Emission bandwidth measurement data are provided in the following pages.

WCDMA Emission Bandwidth Plots at AHFIG Antenna Port 3

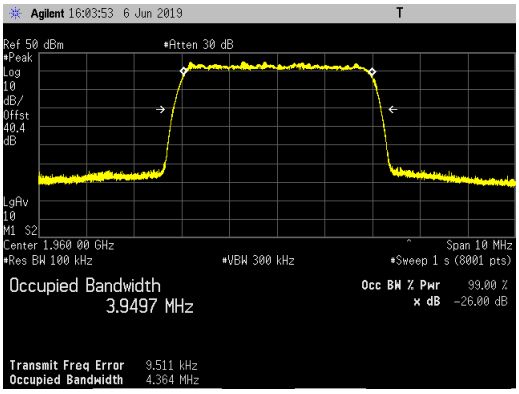
Bottom Channel_ QPSK Modulation



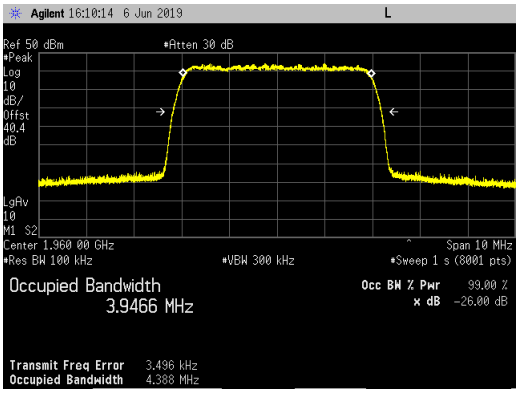
Bottom Channel_ 16QAM Modulation



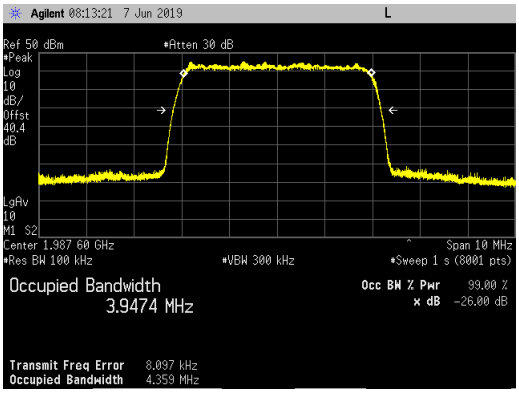
Middle Channel_ QPSK Modulation



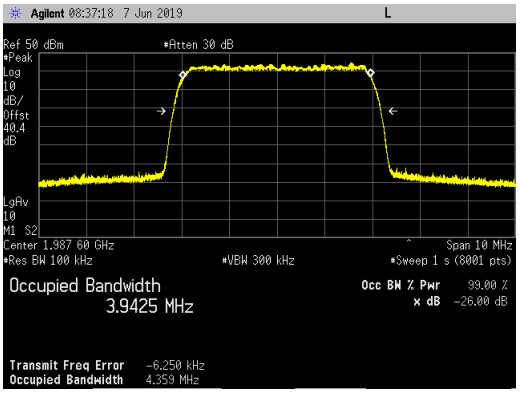
Middle Channel_ 16QAM Modulation



Top Channel_ QPSK Modulation

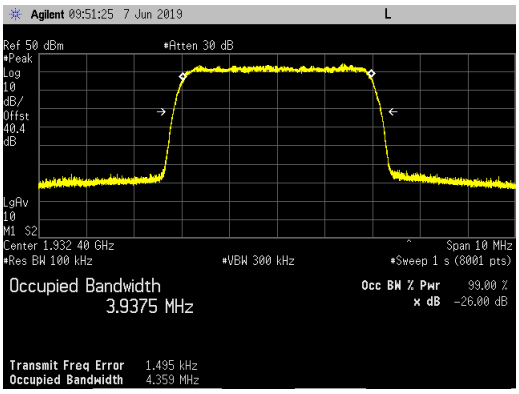


Top Channel_ 16QAM Modulation

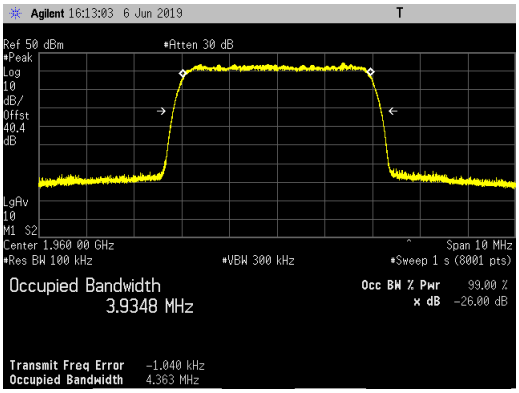


WCDMA Emission Bandwidth Plots at AHFIG Antenna Port 3

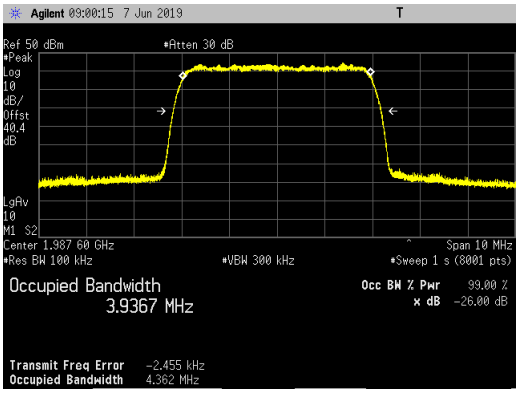
Bottom Channel_ 64QAM Modulation



Middle Channel_ 64QAM Modulation



Top Channel_ 64QAM Modulation



Antenna Port Conducted Band Edge

Conducted band edge measurements were made at RRH antenna port 3.

Single Carrier Test Cases

The RRH was operated at the PCS band edge frequencies with all WCDMA modulation types (QPSK, 16QAM and 64QAM) at maximum power (80 watts/port and 80 watts/carrier).

PCS Multicarrier Multiband Test Case

In the PCS band: Three carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (UARFCN 9662: 1932.4 & UARFCN 9687: 1937.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 9938: 1987.6MHz) at the upper band edge. In the AWS band: Single WCDMA carrier at the middle channel (UARFCN 3250: 2140MHz). The carriers were operated at maximum power (~26W/PCS carrier and 40W/AWS carrier) with at total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carrier). The same modulation type was used for both PCS and AWS carriers.

Multiband Multicarrier Test Case

Three WCDMA carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the PCS band lower band edge (UARFCN 9662: 1932.4 & UARFCN 9687: 1937.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 3388: 2167.6MHz) at the AWS band upper band edge. The carriers were operated at maximum power (40W/PCS carrier and 40W/AWS carrier) with at total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carrier). The same modulation type was used for both PCS and AWS carriers.

The power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm as specified in section 24.238(a) and RSS 133 6.5(i). The limit is adjusted to -16dBm [-13dBm -10 log (2)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 2 port MIMO transmitter.

Measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces. In the 1MHz bands outside and adjacent to the frequency block, a resolution bandwidth of $\geq$1% of the measured emission bandwidth (51kHz) per 24.238(b) and RSS 133 6.5(i) was used. In the 1 to 2MHz frequency range outside the band edge (i.e.: 1928 to 1929MHz and 1991 to 1992MHz bands) the RBW was set to 1% of the measured emission bandwidth (51kHz) and the power integrated over 1MHz. In the 2MHz to 22MHz frequency range outside the band edge (i.e.: 1908 to 1928MHz and 1992 to 2012MHz bands) a 1MHz RBW and 3MHz VBW was used.

The results are summarized in the following table. The highest (worst case) emissions from the measurement data are provided.

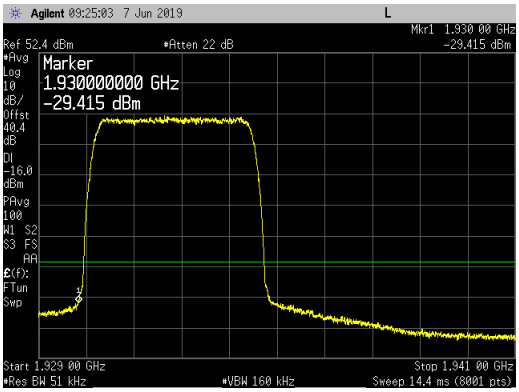
Test Cases	QPSK		16QAM		64QAM	
	LBE	UBE	LBE	UBE	LBE	UBE
PCS Single Carrier at Band Edge Frequency	-19.274	-21.033	-19.493	-20.955	-20.350	-20.015
PCS Multicarrier at 1932.4, 1937.4 & 1987.6MHz	-19.276	-20.221	-19.770	-20.339	-19.318	-20.789
Multiband Multicarrier at 1932.4, 1937.4 & 2167.6MHz	-22.783	-21.600	-22.209	-22.934	-22.328	-22.609

The total measurement RF path loss of the test setup (attenuator and test cables) was 40.4 dB and is accounted for by the spectrum analyzer reference level offset. The display line on the plots reflects the required limit. Conducted band edge measurements are provided in the following pages.

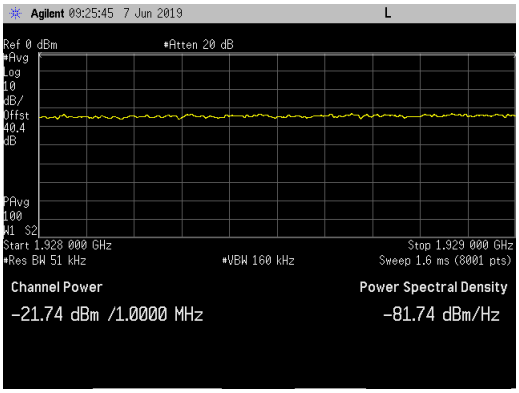
Single Carrier with QPSK Modulation at Maximum Power -Lower and Upper Band Edge Plots:

WCDMA Carrier at BC (1932.4MHz)

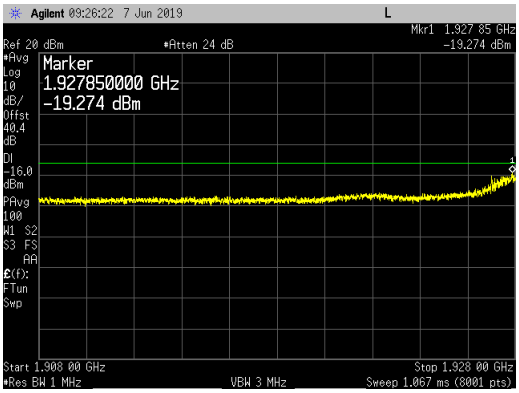
Port 3_LBE_1929 to 1941MHz



Port 3_LBE_1928 to 1929MHz

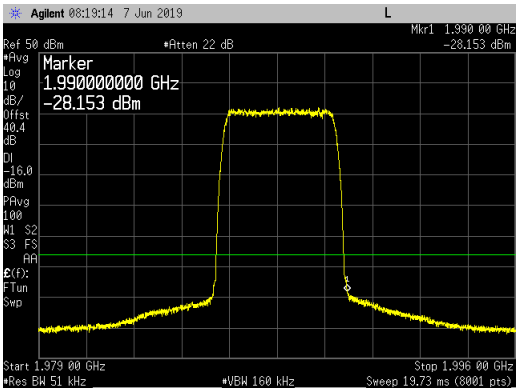


Port 3_LBE_1908 to 1928MHz

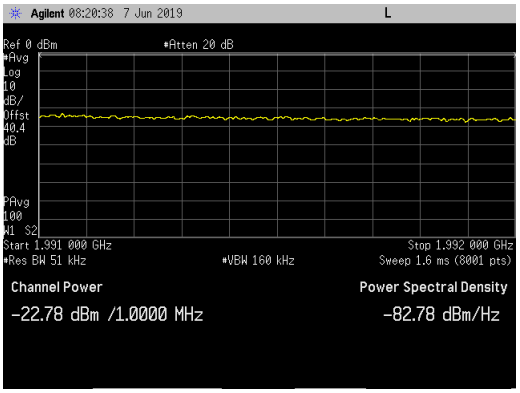


WCDMA Carrier at TC (1987.6MHz)

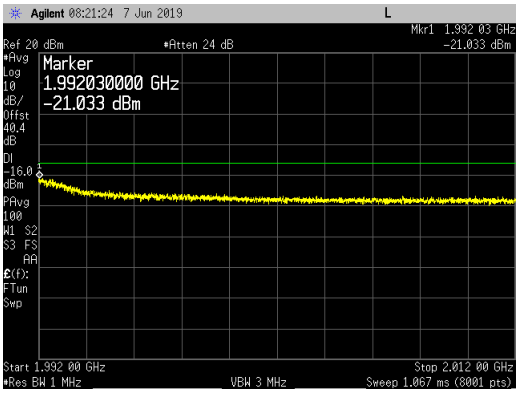
Port 3_UBE_1979 to 1991MHz



Port 3_UBE_1991 to 1992MHz



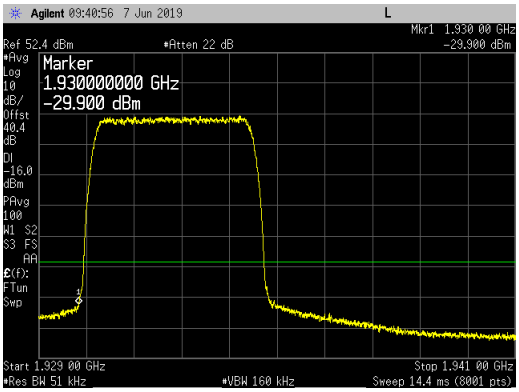
Port 3_UBE_1992 to 2012MHz



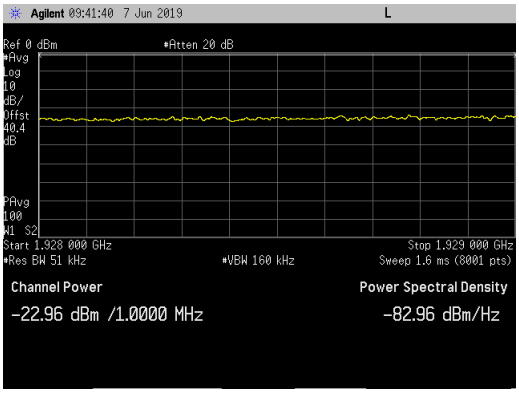
Single Carrier with 16QAM Modulation at Maximum Power -Lower and Upper Band Edge Plots:

WCDMA Carrier at BC (1932.4MHz)

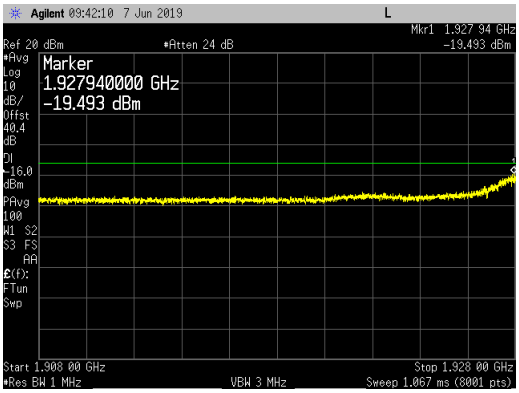
Port 3_LBE_1929 to 1941MHz



Port 3_LBE_1928 to 1929MHz

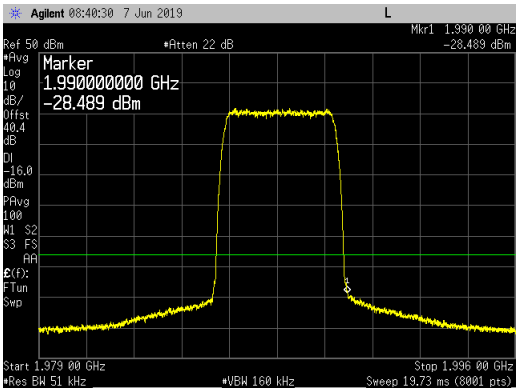


Port 3_LBE_1908 to 1928MHz

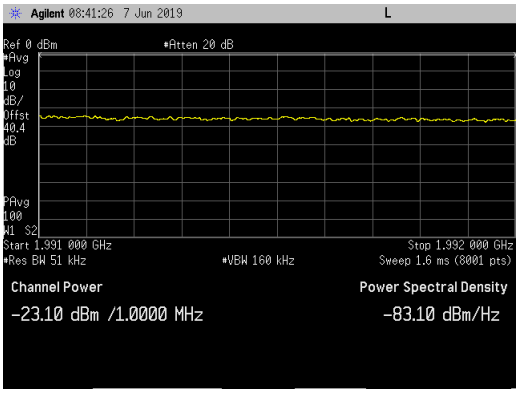


WCDMA Carrier at TC (1987.6MHz)

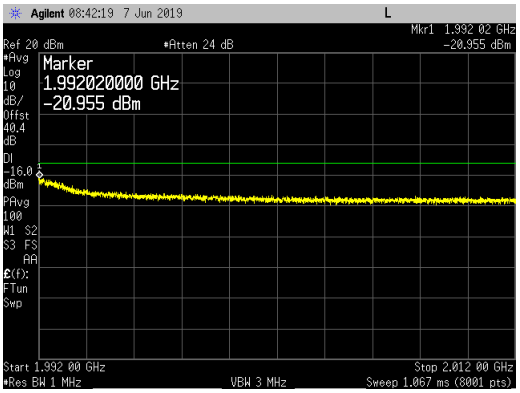
Port 3_UBE_1979 to 1991MHz



Port 3_UBE_1991 to 1992MHz



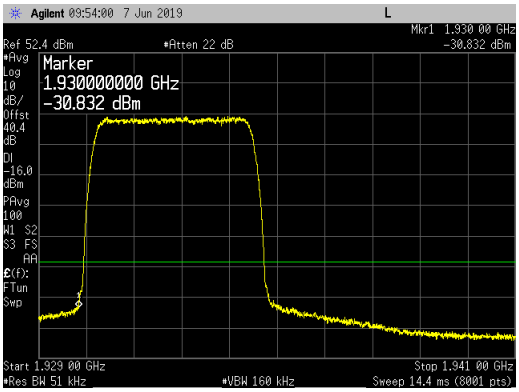
Port 3_UBE_1992 to 2012MHz



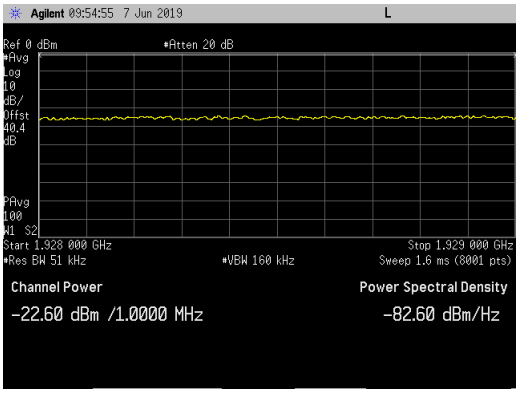
Single Carrier with 64QAM Modulation at Maximum Power -Lower and Upper Band Edge Plots:

WCDMA Carrier at BC (1932.4MHz)

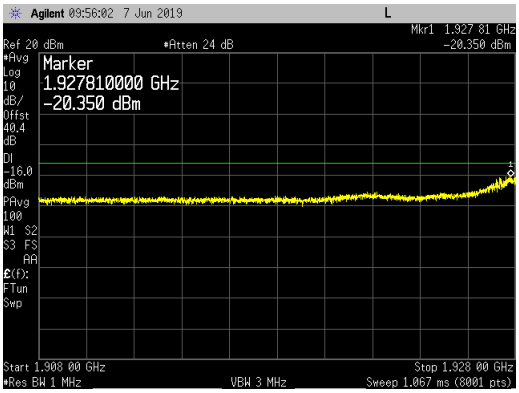
Port 3_LBE_1929 to 1941MHz



Port 3_LBE_1928 to 1929MHz

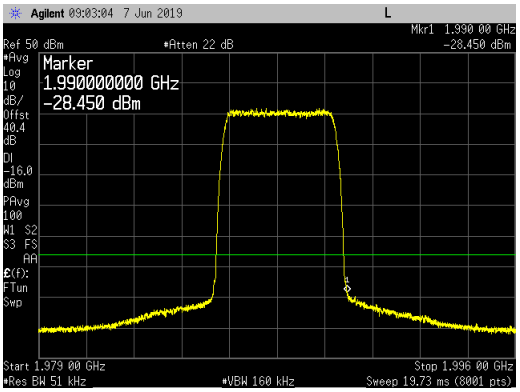


Port 3_LBE_1908 to 1928MHz

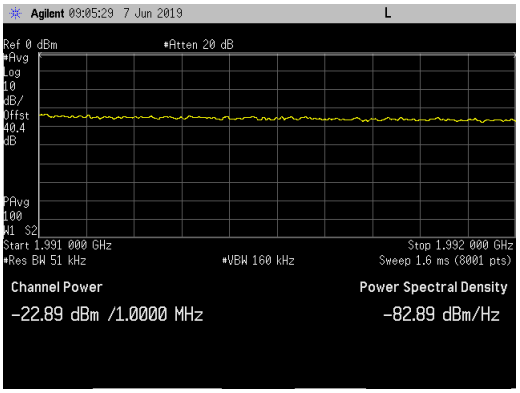


WCDMA Carrier at TC (1987.6MHz)

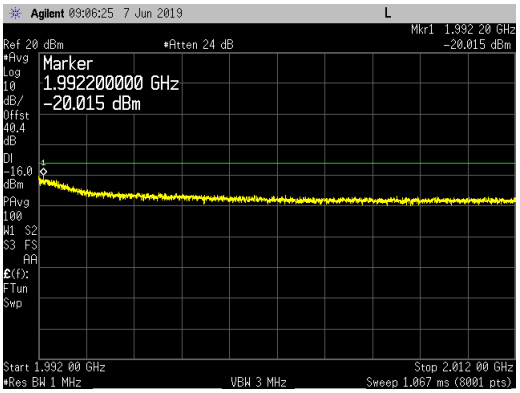
Port 3_UBE_1979 to 1991MHz



Port 3_UBE_1991 to 1992MHz



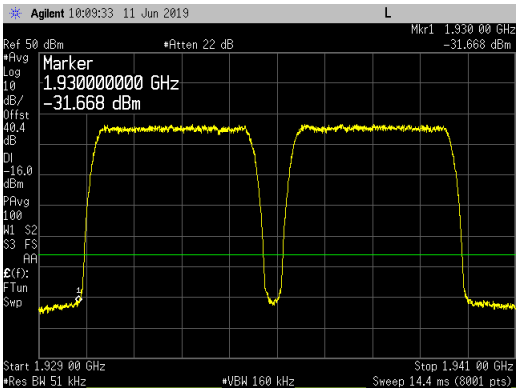
Port 3_UBE_1992 to 2012MHz



PCS Band Multicarrier with QPSK Modulation at Max Power at Bottom Chs and at Top Ch -LBE & UBE Plots:

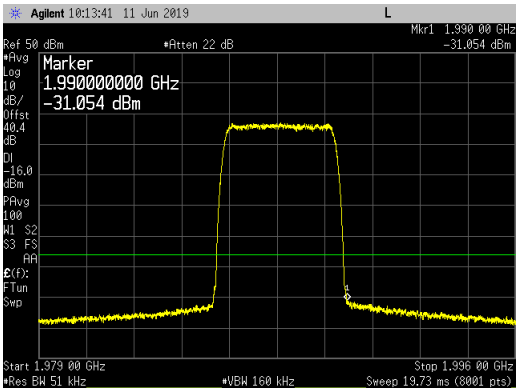
WCDMA Carriers at 1932.4, 1937.4 & 1987.6MHz

Port 3_LBE_1929 to 1941MHz

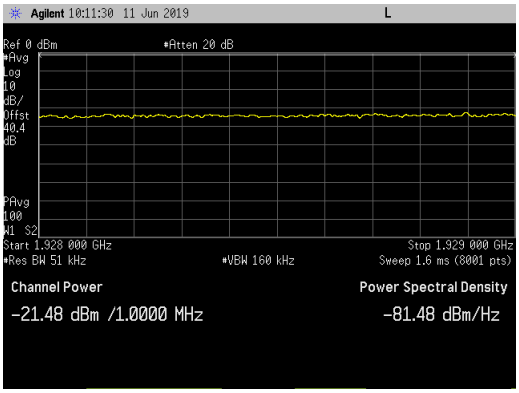


WCDMA Carriers at 1932.4, 1937.4 & 1987.6MHz

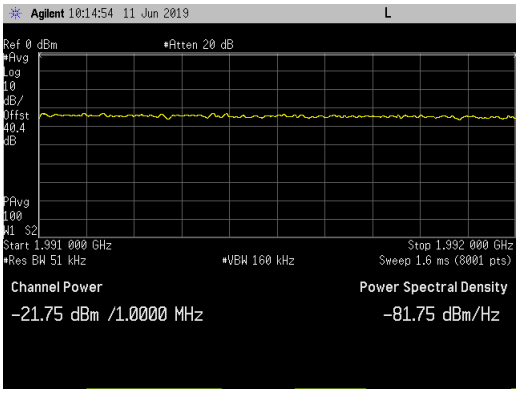
Port 3_UBE_1979 to 1991MHz



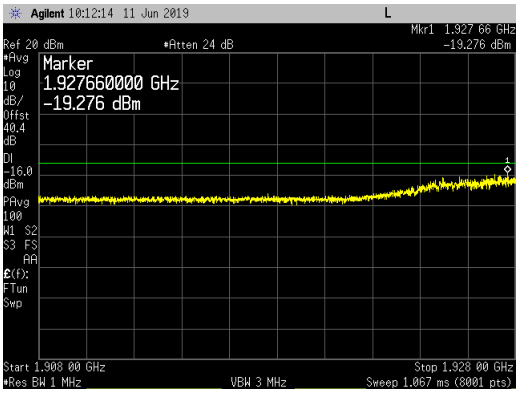
Port 3_LBE_1928 to 1929MHz



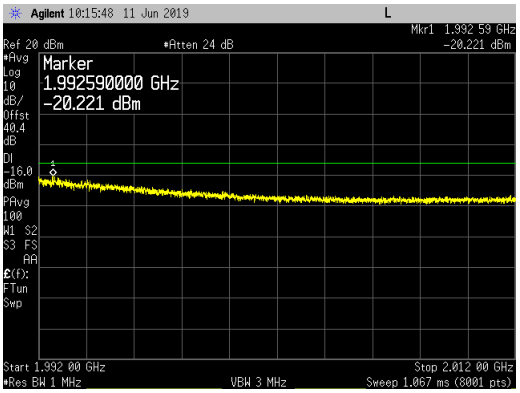
Port 3_UBE_1991 to 1992MHz



Port 3_LBE_1908 to 1928MHz



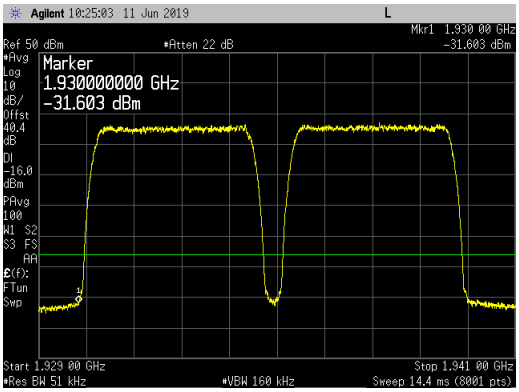
Port 3_UBE_1992 to 2012MHz



PCS Band Multicarrier with 16QAM Modulation at Max Power at Bottom Chs and at Top Ch -LBE & UBE Plots:

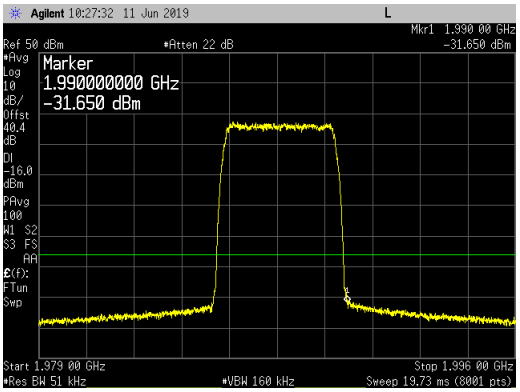
WCDMA Carriers at 1932.4, 1937.4 & 1987.6MHz

Port 3_LBE_1929 to 1941MHz

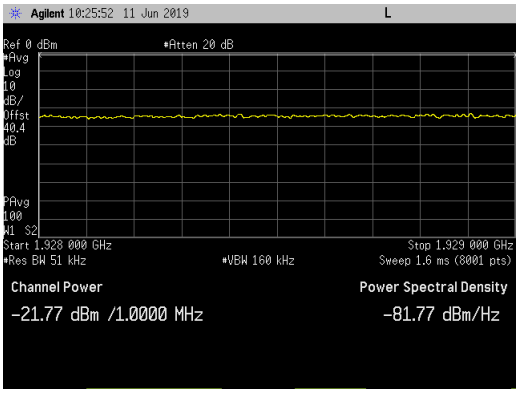


WCDMA Carriers at 1932.4, 1937.4 & 1987.6MHz

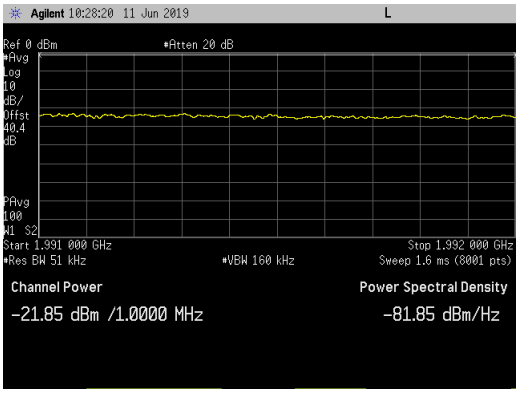
Port 3_UBE_1979 to 1991MHz



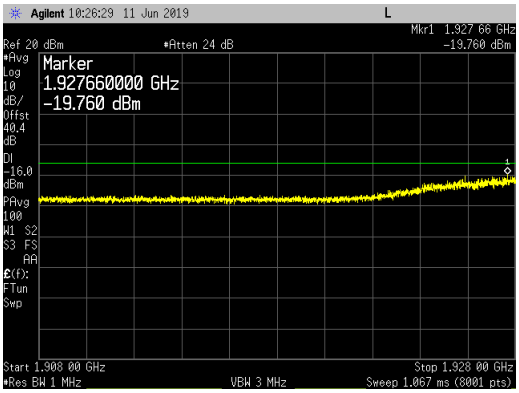
Port 3_LBE_1928 to 1929MHz



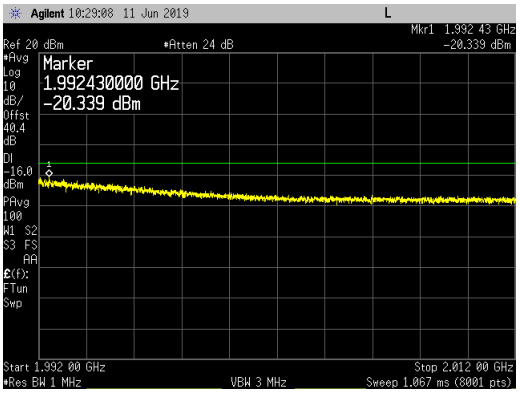
Port 3_UBE_1991 to 1992MHz



Port 3_LBE_1908 to 1928MHz



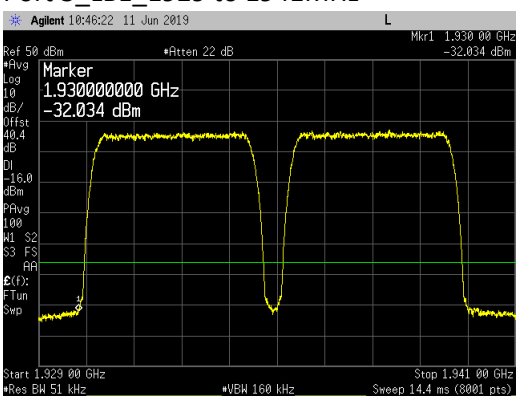
Port 3_UBE_1992 to 2012MHz



PCS Band Multicarrier with 64QAM Modulation at Max Power at Bottom Chs and at Top Ch -LBE & UBE Plots:

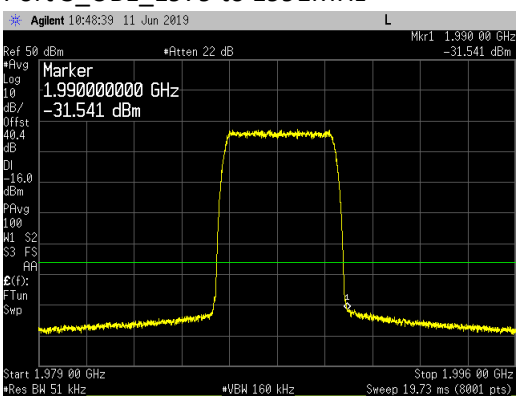
WCDMA Carriers at 1932.4, 1937.4 & 1987.6MHz

Port 3_LBE_1929 to 1941MHz

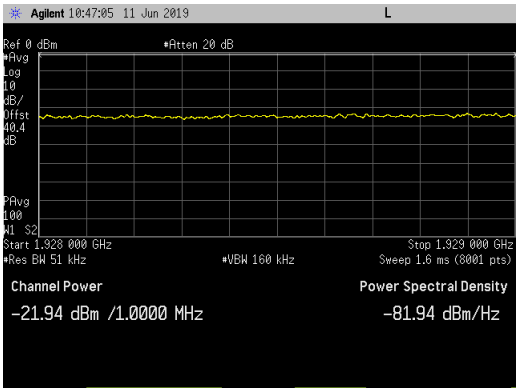


WCDMA Carriers at 1932.4, 1937.4 & 1987.6MHz

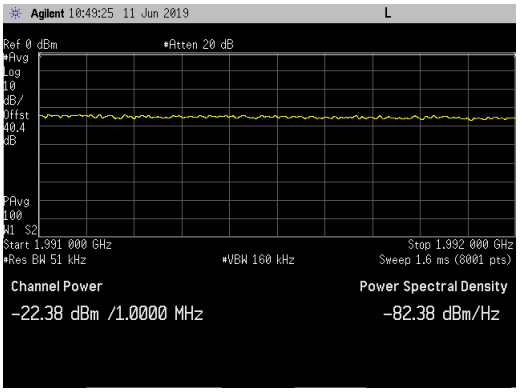
Port 3_UBE_1979 to 1991MHz



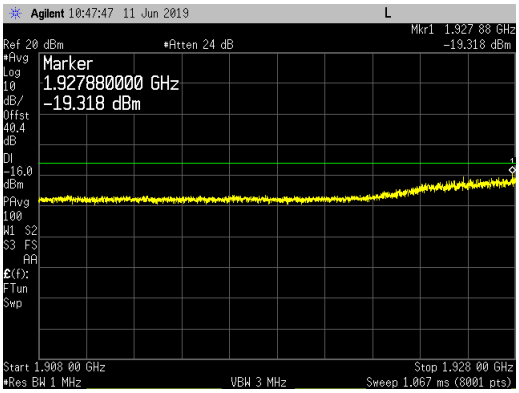
Port 3_LBE_1928 to 1929MHz



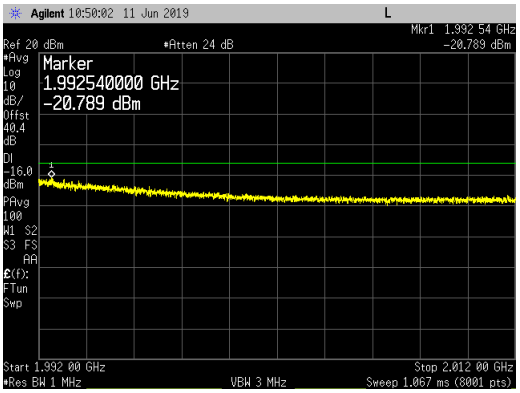
Port 3_UBE_1991 to 1992MHz



Port 3_LBE_1908 to 1928MHz



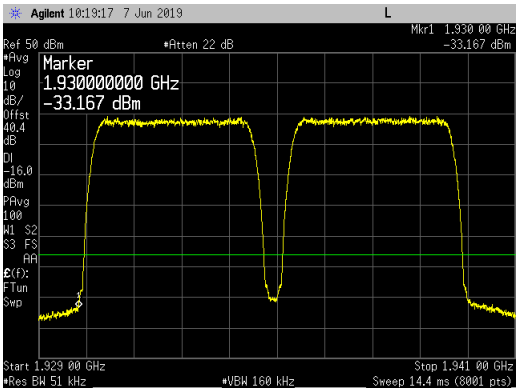
Port 3_UBE_1992 to 2012MHz



Multiband Multicarrier with QPSK Modulation at Max Power at Bottom Chs and at Top Ch -LBE & UBE Plots:

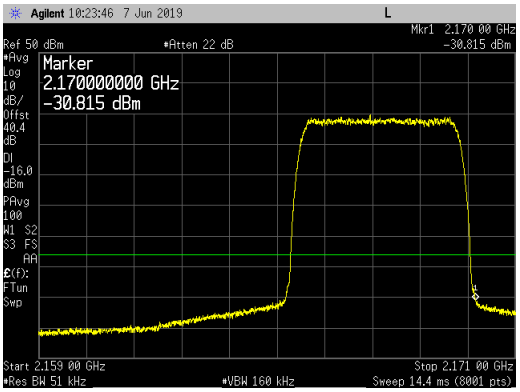
WCDMA Carriers at 1932.4, 1937.4 & 2167.6MHz

Port 3_PCS LBE_1929 to 1941MHz

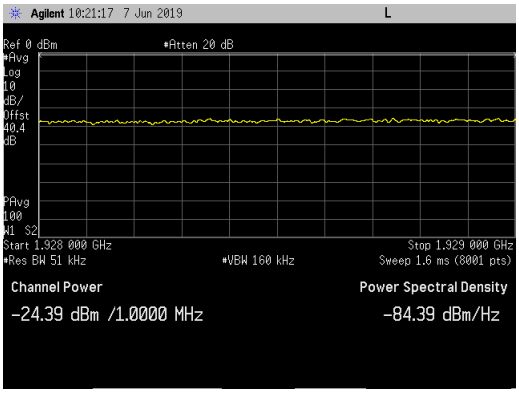


WCDMA Carriers at 1932.4, 1937.4 & 2167.6MHz

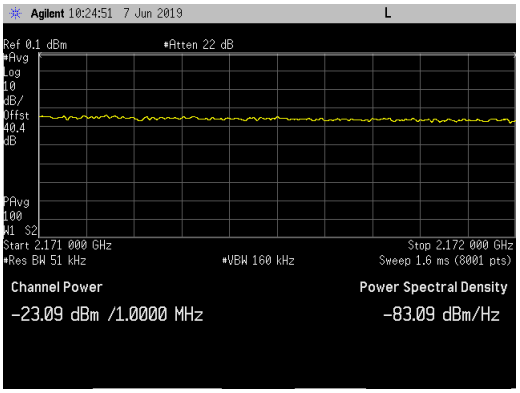
Port 3_AWS UBE_2159 to 2171MHz



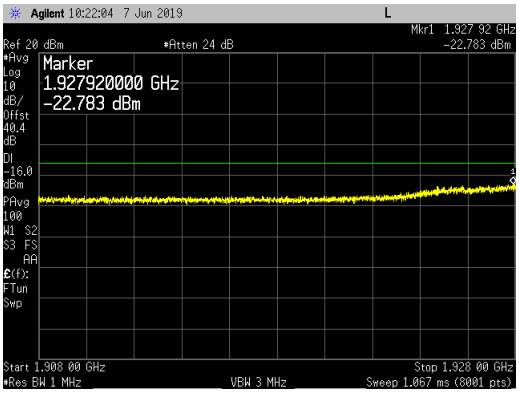
Port 3_PCS LBE_1928 to 1929MHz



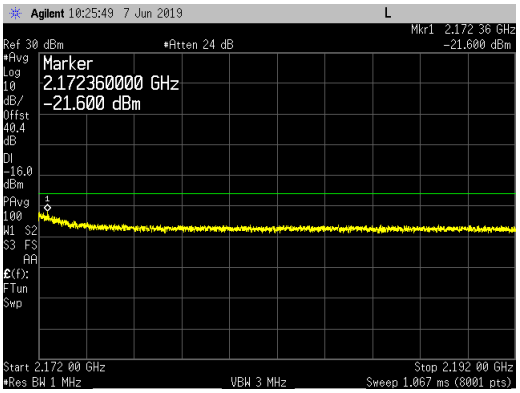
Port 3_AWS UBE_2171 to 2172MHz



Port 3_PCS LBE_1908 to 1928MHz



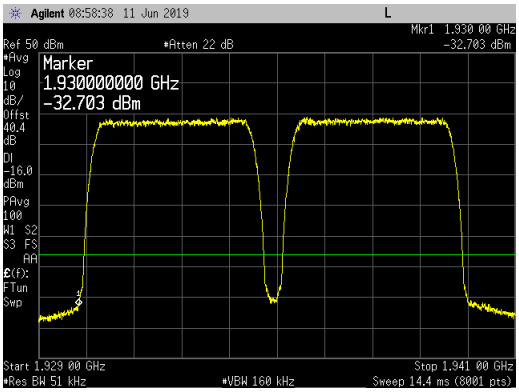
Port 3_AWS UBE_2172 to 2192MHz



Multiband Multicarrier with 16QAM Modulation at Max Power at Bottom Chs and at Top Ch -LBE & UBE Plots:

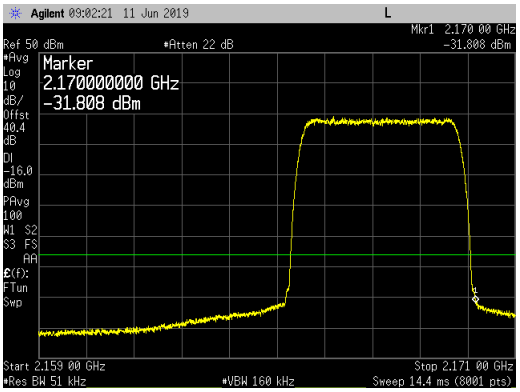
WCDMA Carriers at 1932.4, 1937.4 & 2167.6MHz

Port 3_PCS LBE_1929 to 1941MHz

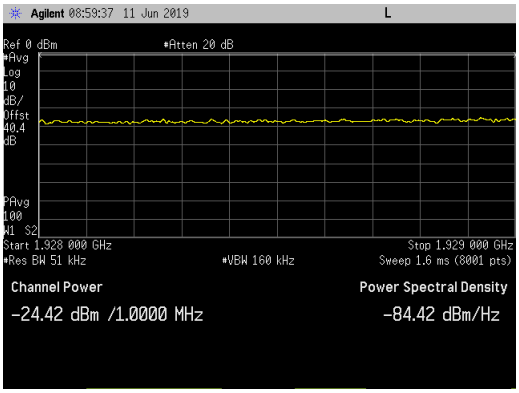


WCDMA Carriers at 1932.4, 1937.4 & 2167.6MHz

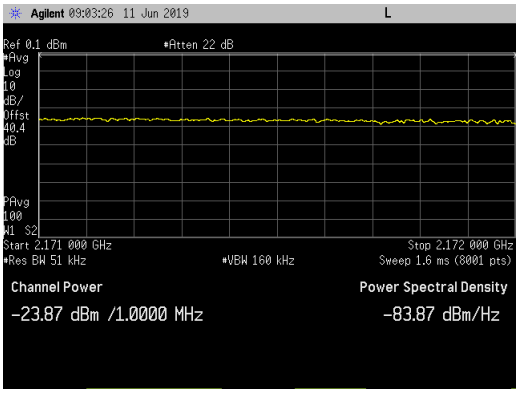
Port 3_AWS UBE_2159 to 2171MHz



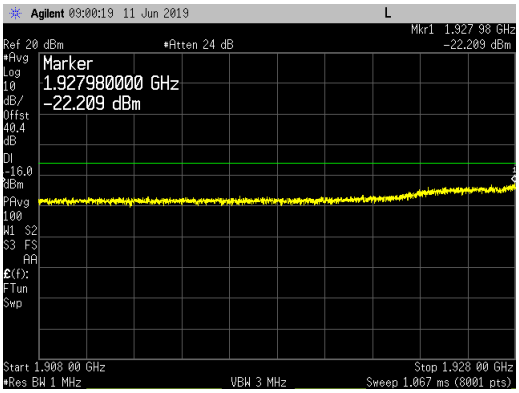
Port 3_PCS LBE_1928 to 1929MHz



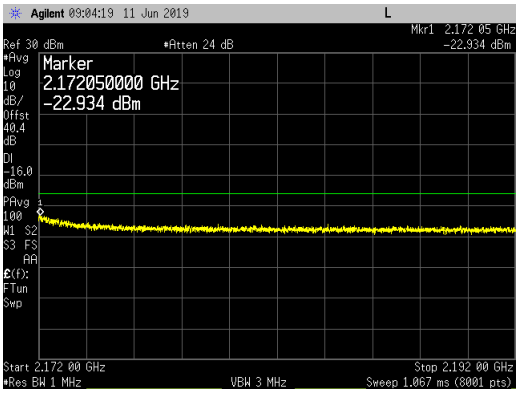
Port 3_AWS UBE_2171 to 2172MHz



Port 3_PCS LBE_1908 to 1928MHz



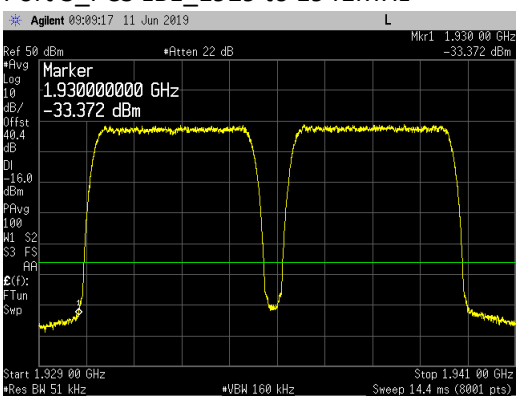
Port 3_AWS UBE_2172 to 2192MHz



Multiband Multicarrier with 64QAM Modulation at Max Power at Bottom Chs and at Top Ch -LBE & UBE Plots:

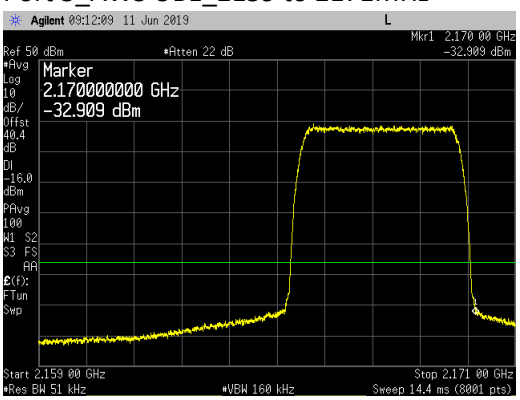
WCDMA Carriers at 1932.4, 1937.4 & 2167.6MHz

Port 3_PCS LBE_1929 to 1941MHz

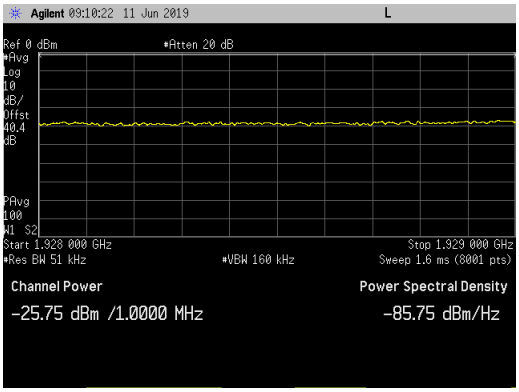


WCDMA Carriers at 1932.4, 1937.4 & 2167.6MHz

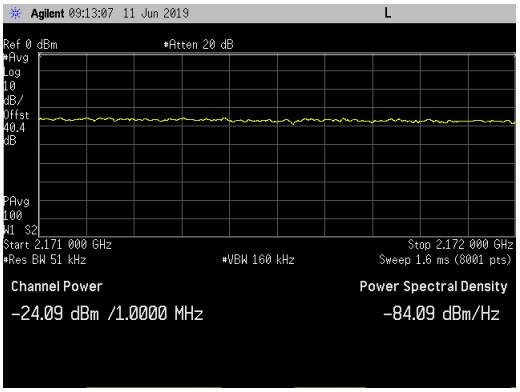
Port 3_AWS UBE_2159 to 2171MHz



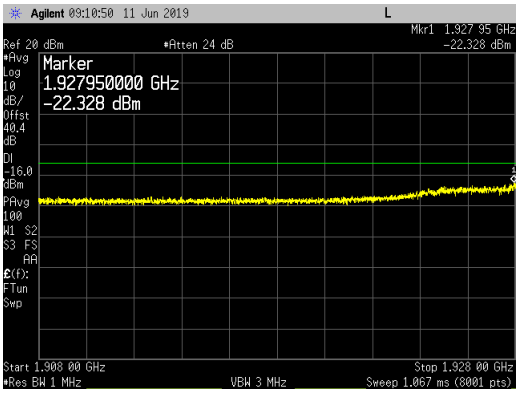
Port 3_PCS LBE_1928 to 1929MHz



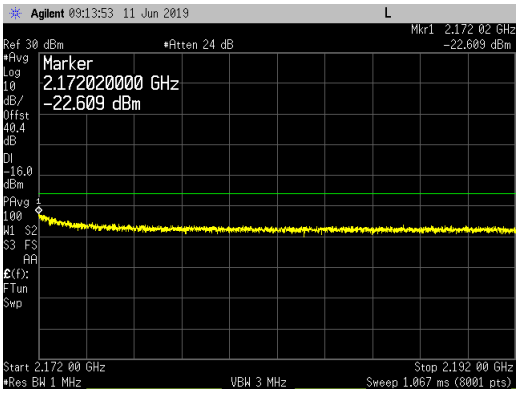
Port 3_AWS UBE_2171 to 2172MHz



Port 3_PCS LBE_1908 to 1928MHz



Port 3_AWS UBE_2172 to 2192MHz



Transmitter Antenna Port Conducted Emissions

Transmitter conducted emission measurements were made at RRH antenna port 3. Measurements were performed over the 9kHz to 22GHz frequency range.

Single Carrier Test Cases

The single carrier test case was performed with the RRH operating on the PCS middle channel (1960.0MHz) and AWS middle channel (2140.0MHz) simultaneously with all WCDMA modulation types (QPSK, 16QAM and 64QAM) at maximum power. The same modulation type was used for both PCS and AWS carriers.

PCS Multicarrier Multiband Test Case

In the PCS band: Three carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (UARFCN 9662: 1932.4 & UARFCN 9687: 1937.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 9938: 1987.6MHz) at the upper band edge. In the AWS band: Single WCDMA carrier at the middle channel (UARFCN 3250: 2140MHz). The carriers were operated at maximum power (~26W/PCS carrier and 40W/AWS carrier) with at total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carrier). The same modulation type was used for both PCS and AWS carriers.

AWS Multicarrier Multiband Test Case

In the AWS band: Three carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (UARFCN 3112: 2112.4 & UARFCN 3137: 2117.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 3388: 2167.6MHz) at the upper band edge. In the PCS band: Single WCDMA carrier at the middle channel (UARFCN 9800: 1960.0MHz). The carriers were operated at maximum power (80W/PCS carrier and ~13W/AWS carrier) with at total port power of 120 watts (80W for PCS band carrier + 40W for AWS band carriers). The same modulation type was used for both PCS and AWS carriers.

Multicarrier Multiband Test Case

Three carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the PCS band lower band edge (UARFCN 9662: 1932.4 & UARFCN 9687: 1937.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 3388: 2167.6MHz) at the AWS band upper band edge. The carriers were operated at maximum power (40W/PCS carrier and 40W/AWS carrier) with at total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carrier). The same modulation type was used for both PCS and AWS carriers.

The test configuration parameters are provided below:

PCS Band Transmission Parameters			AWS Band Transmission Parameters		
Carrier Frequency	**Channel Bandwidth**	**Carrier Power**	**Carrier Frequency**	**Channel Bandwidth**	**Carrier Power**
1960.0MHz (Mid Ch)	WCDMA 5M	80 Watts	2140.0MHz (Mid Ch)	WCDMA 5M	40 Watts
1932.4, 1937.4 & 1987.6MHz (BC, BC+1, and TC)	WCDMA 5M	26+26+26 Watts	2140.0MHz (Mid Ch)	WCDMA 5M	40 Watts
1932.4 & 1937.4MHz (BC and BC+1)	WCDMA 5M	40 + 40 Watts	2167.6MHz (Top Ch)	WCDMA 5M	40 Watts
1960.0MHz (Mid Ch)	WCDMA 5M	80 Watts	2112.4, 2117.4 & 2167.6MHz (BC, BC+1, and TC)	WCDMA 5M	13+13+13 Watts

The power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm as specified in section 24.238(a), 27.53(h)(1), RSS 133 6.5(i) and RSS 139 6.6. The limit of -16dBm was used in the certification testing. The limit is adjusted to -16dBm [-13dBm -10 log (2)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 2 port MIMO transmitter. The required measurement parameters include a 1MHz 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 max hold over 50 sweeps (except for the 20MHz to 3GHz frequency range). Measurements for the 20MHz to 3GHz frequency range was 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 –46dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -46dBm = -16dBm -10log(1000kHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to –36dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -36dBm = -16dBm -10log(1000kHz/10kHz)]. The required limit of -16dBm with a RBW of $\geq$1MHz was used for all other frequency ranges. The spectrum analyzer settings that were used for this test are summarized in the following table.

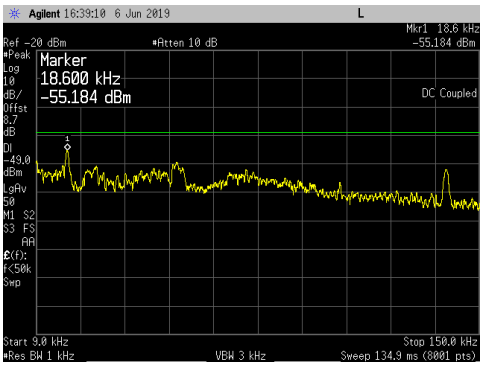
Frequency Range	RBW	VBW	Number of Data Points	Detector	Sweep Time	Max Hold over	Offset Note (1)
9kHz to 150kHz	1kHz	3kHz	8001	Peak	Auto	50 Sweeps	8.7dB
150kHz to 20MHz	10kHz	30kHz	8001	Peak	Auto	50 Sweeps	8.7dB
20MHz to 3GHz	1MHz	3MHz	8001	Average	Auto	Note (2)	40.4dB
3GHz to 6GHz	1MHz	3MHz	8001	Peak	Auto	50 Sweeps	40.2dB
6GHz to 18GHz	2MHz	6MHz	8192	Peak	Auto	50 Sweeps	33.1dB
18GHz to 22GHz	1MHz	3MHz	8001	Peak	Auto	50 Sweeps	41.3dB
1900 to 2200MHz	1MHz	3MHz	8001	Average	Auto	Note (2)	40.4dB

Note 1: The total measurement RF path loss of the test setup (attenuators, test cables and filters) 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.

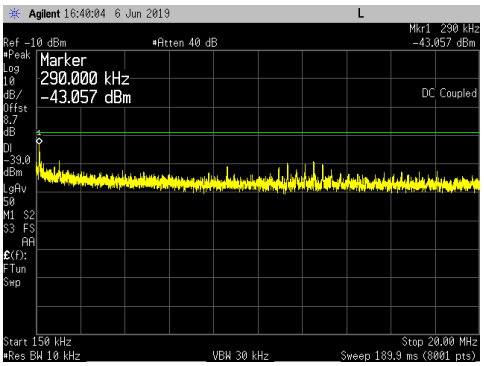
A low pass filter was used to reduce the measurement instrumentation noise floor for the frequency ranges below 20MHz. A high pass filter was used to reduce the measurement instrumentation noise floor for the frequency range above 6GHz. The total measurement RF path loss of the test setup (attenuators, low pass filter, 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 (please note that the display line on the single carrier plots are mistakenly 3dB lower than required). Conducted spurious emission plots/measurements are provided in the following pages.

Single PCS & AWS Carriers_ QPSK _ Middle Channels (1960.0MHz & 2140.0MHz) Simultaneously:

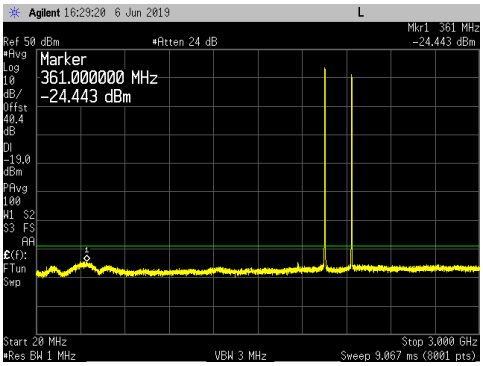
9kHz to 150kHz



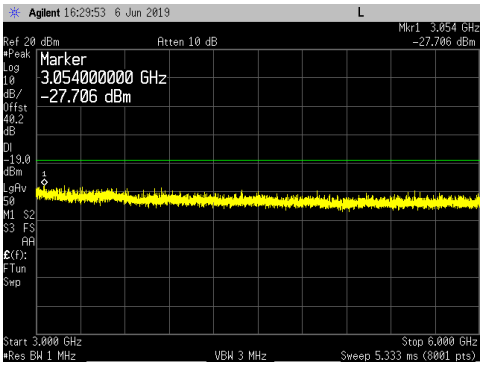
150kHz to 20MHz



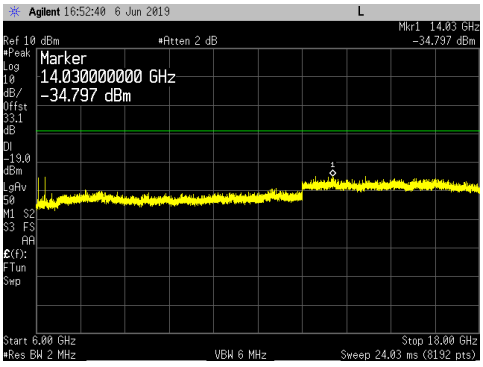
20MHz to 3GHz



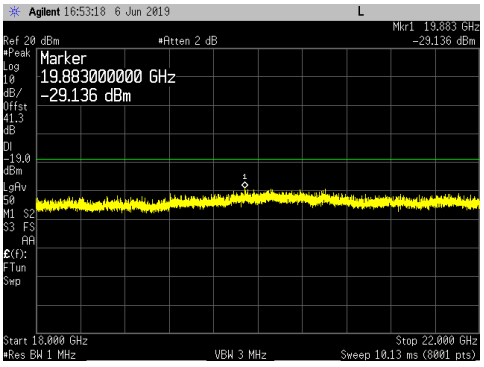
3GHz to 6GHz



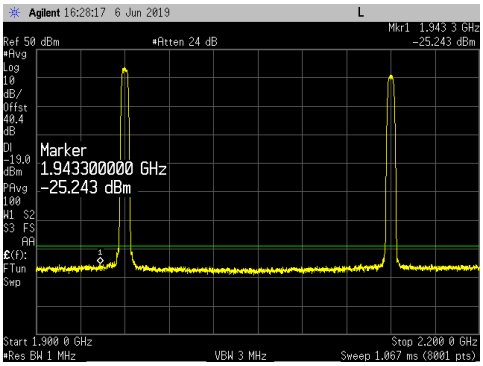
6GHz to 18GHz



18GHz to 22GHz

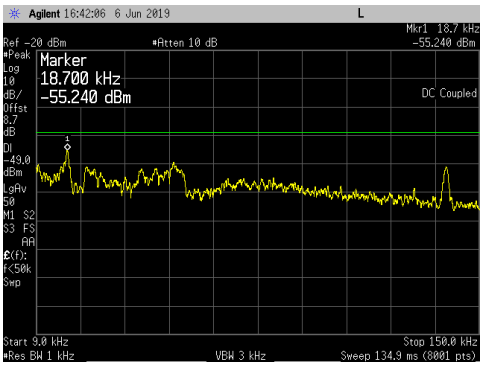


1900MHz to 2200MHz

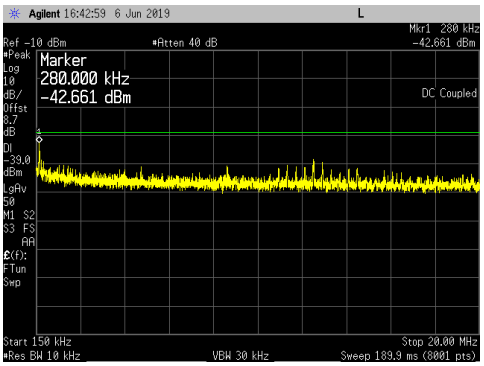


Single PCS & AWS Carriers_ 16QAM _ Middle Channels (1960.0MHz & 2140.0MHz) Simultaneously:

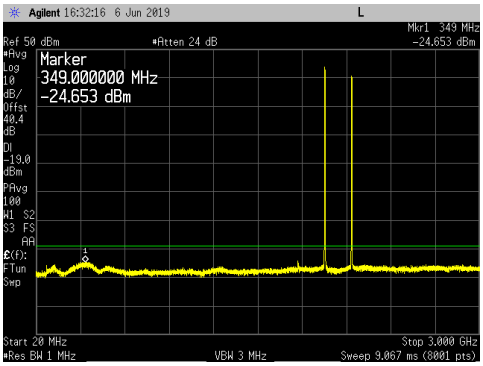
9kHz to 150kHz



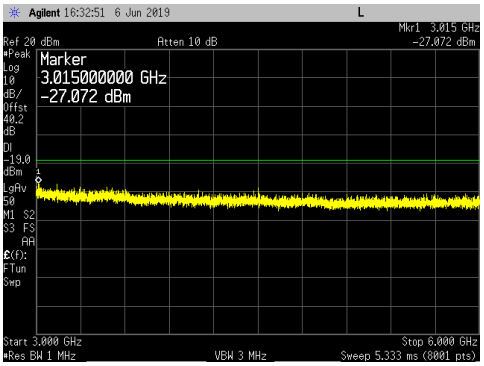
150kHz to 20MHz



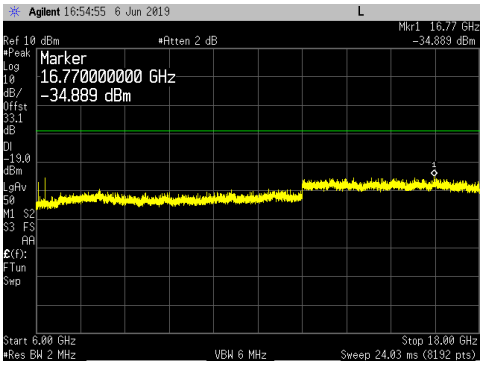
20MHz to 3GHz



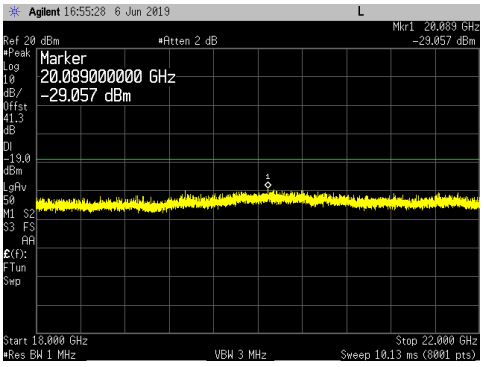
3GHz to 6GHz



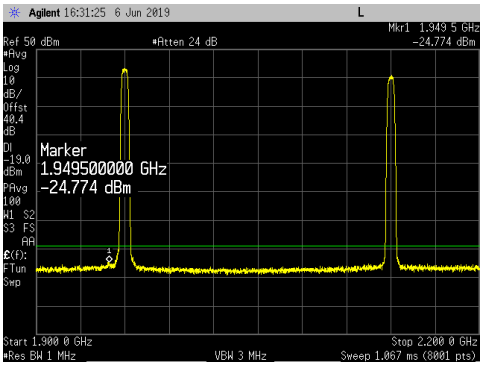
6GHz to 18GHz



18GHz to 22GHz

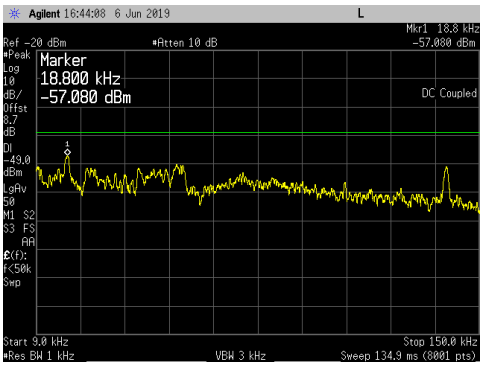


1900MHz to 2200MHz

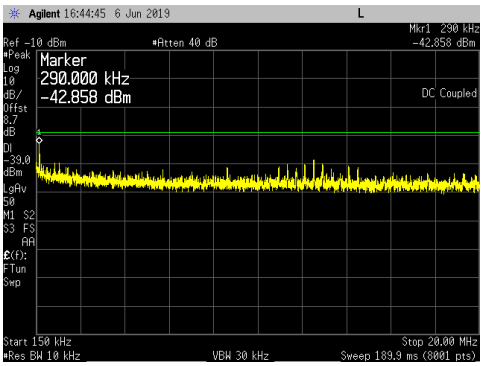


Single PCS & AWS Carriers_ 64QAM _ Middle Channels (1960.0MHz & 2140.0MHz) Simultaneously:

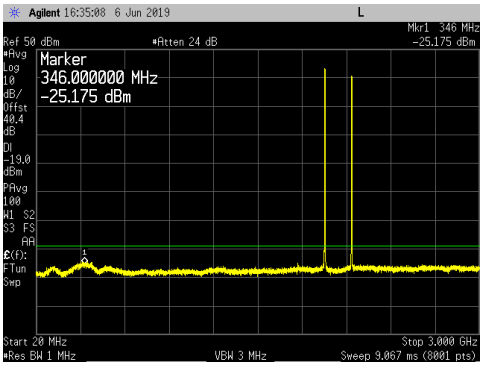
9kHz to 150kHz



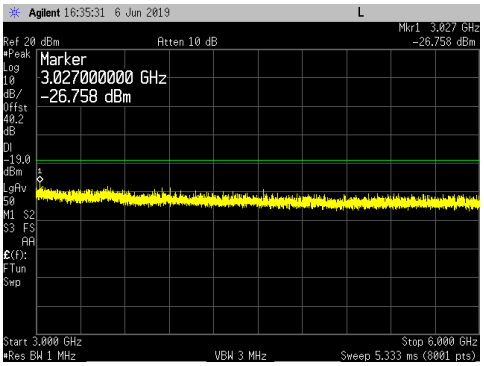
150kHz to 20MHz



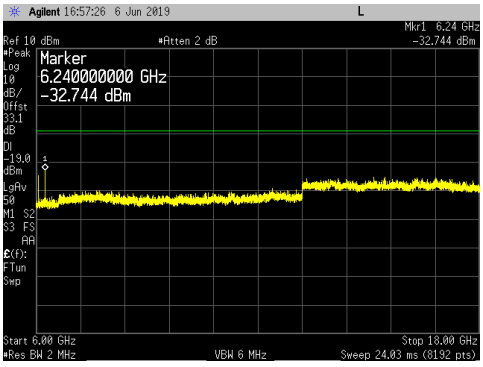
20MHz to 3GHz



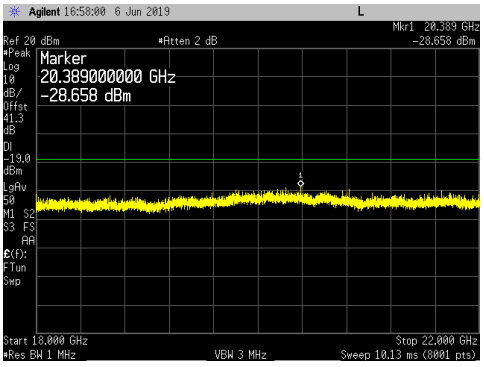
3GHz to 6GHz



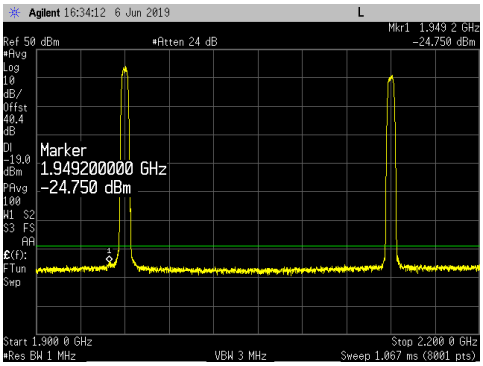
6GHz to 18GHz



18GHz to 22GHz

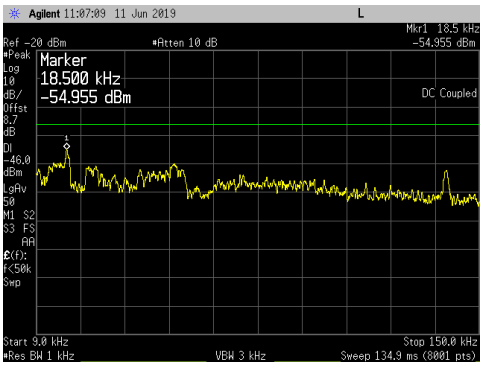


1900MHz to 2200MHz

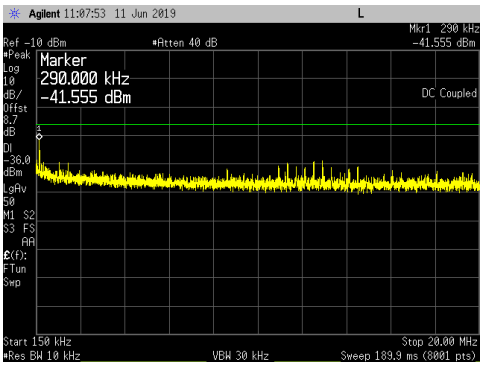


Three PCS (BCs & TC) Carriers & One AWS Carrier (MC)_ QPSK _ 1932.4, 1937.4, 1987.6 & 2140.0MHz:

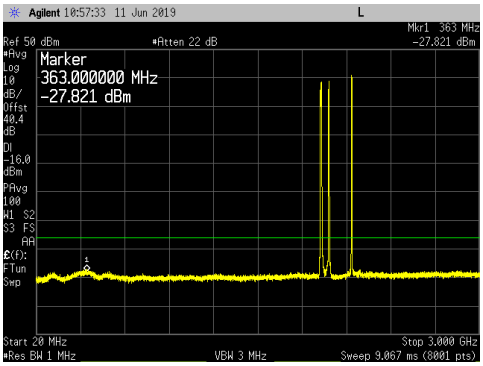
9kHz to 150kHz



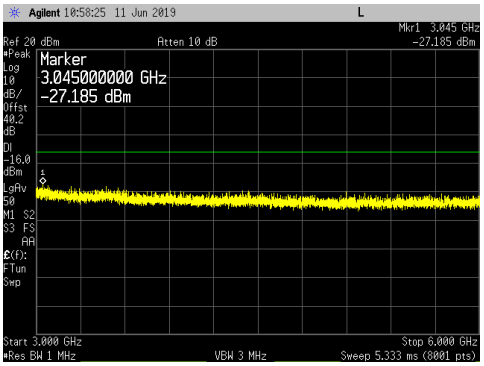
150kHz to 20MHz



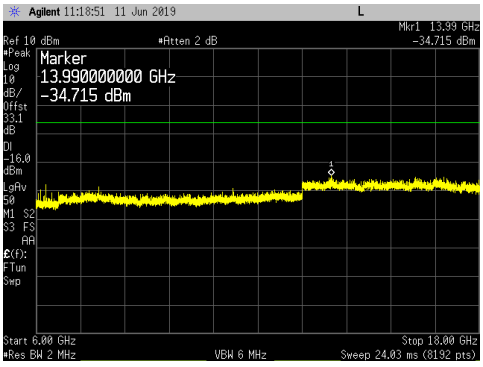
20MHz to 3GHz



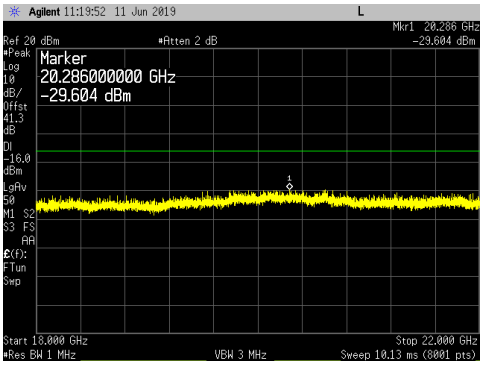
3GHz to 6GHz



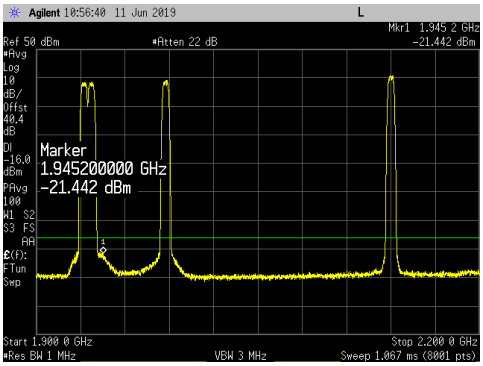
6GHz to 18GHz



18GHz to 22GHz

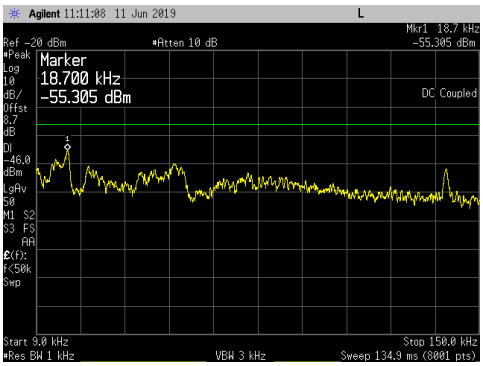


1900MHz to 2200MHz

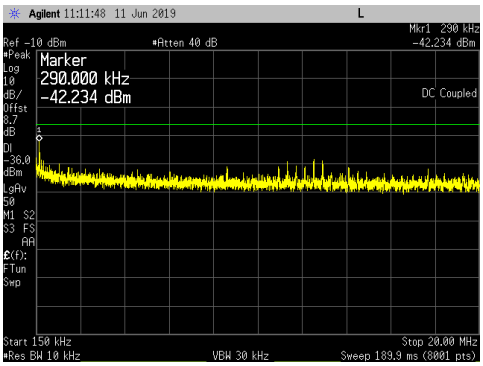


Three PCS (BCs & TC) Carriers & One AWS Carrier (MC)_16QAM_ 1932.4, 1937.4, 1987.6 & 2140.0MHz:

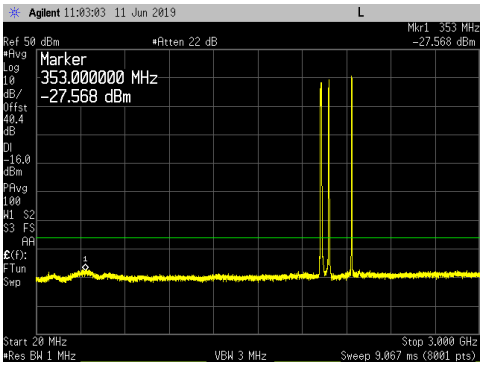
9kHz to 150kHz



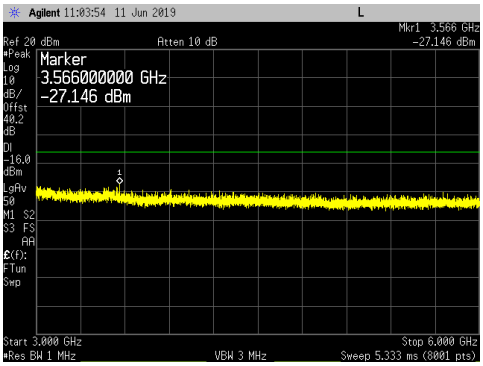
150kHz to 20MHz



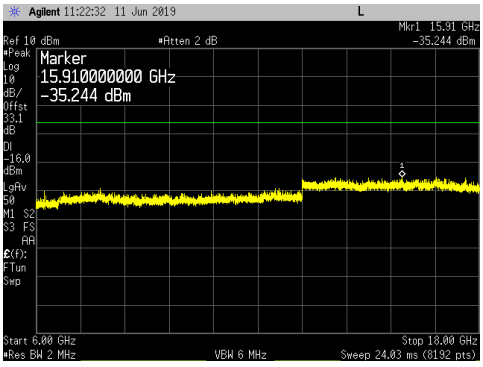
20MHz to 3GHz



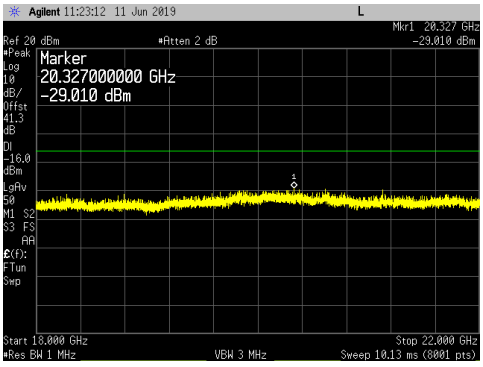
3GHz to 6GHz



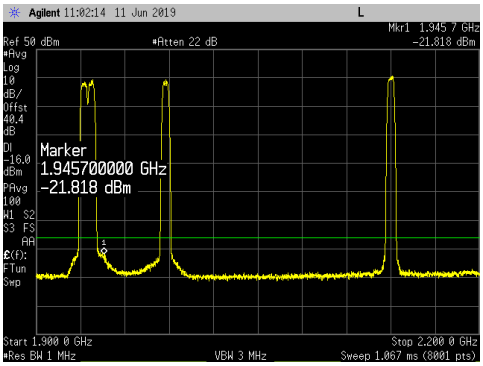
6GHz to 18GHz



18GHz to 22GHz

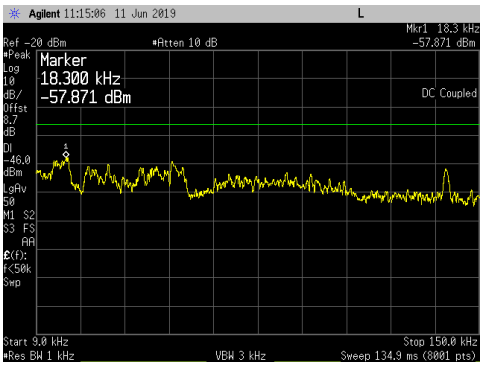


1900MHz to 2200MHz

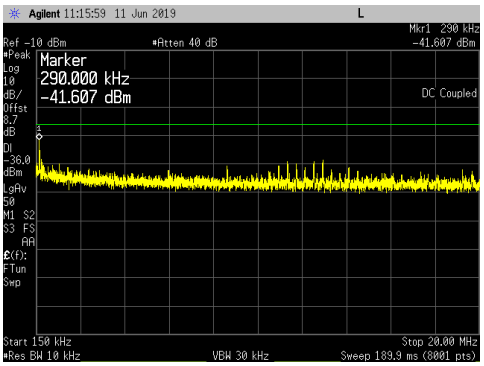


Three PCS (BCs & TC) Carriers & One AWS Carrier (MC)_64QAM_ 1932.4, 1937.4, 1987.6 & 2140.0MHz:

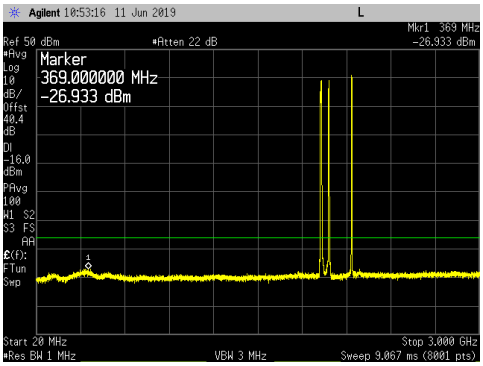
9kHz to 150kHz



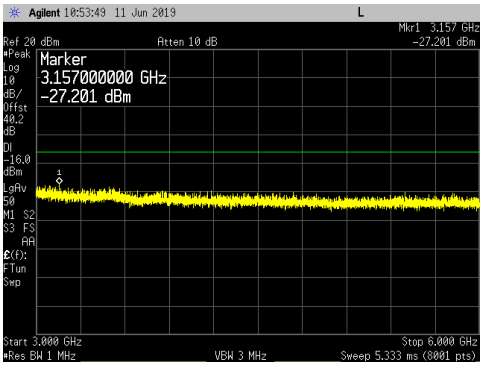
150kHz to 20MHz



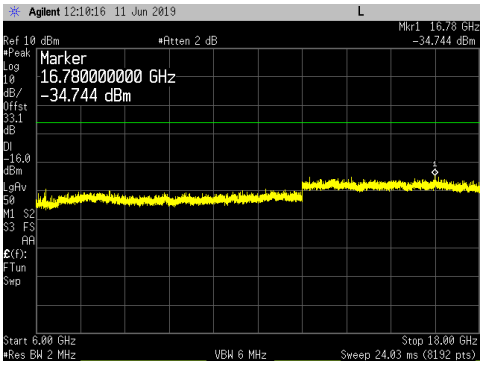
20MHz to 3GHz



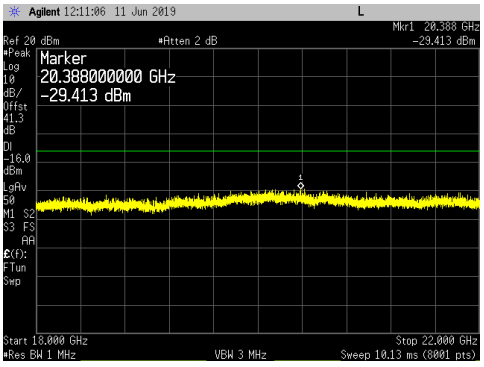
3GHz to 6GHz



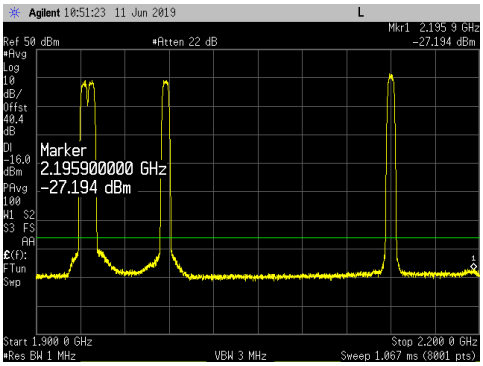
6GHz to 18GHz



18GHz to 22GHz

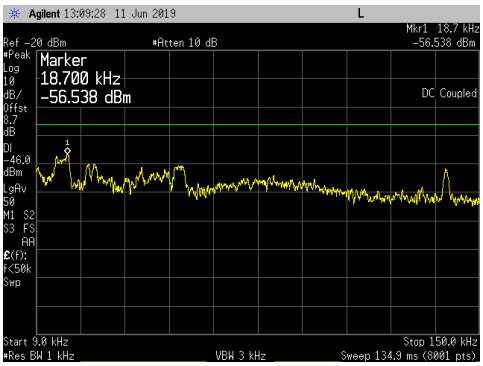


1900MHz to 2200MHz

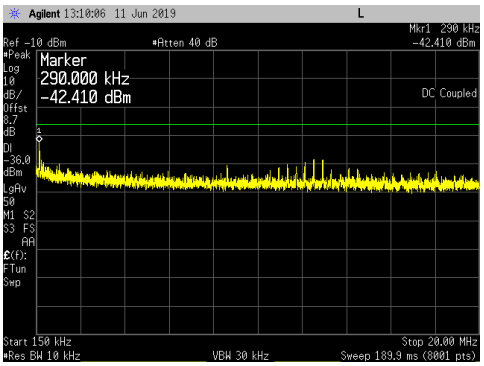


Three AWS (BCs & TC) Carriers & One PCS Carrier (MC)_QPSK _ 2112.4, 2117.4, 2167.6 & 1960.0MHz:

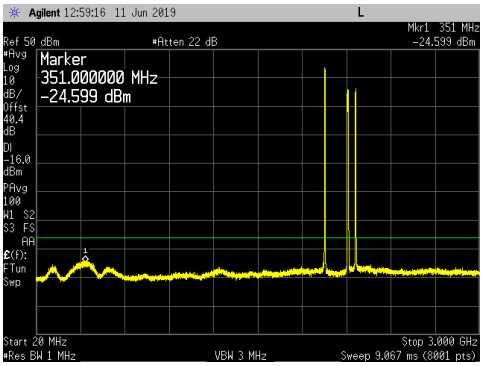
9kHz to 150kHz



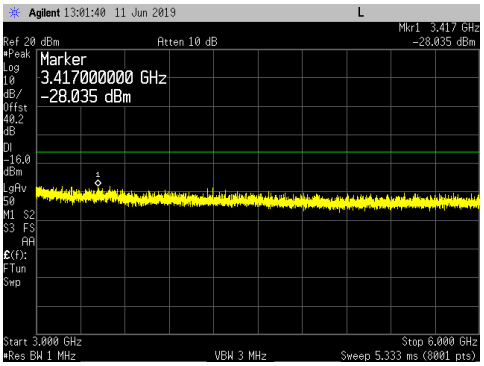
150kHz to 20MHz



20MHz to 3GHz

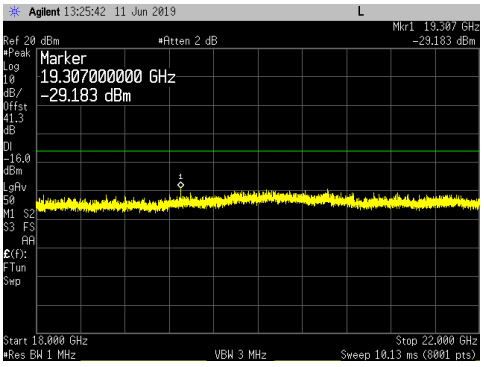


3GHz to 6GHz

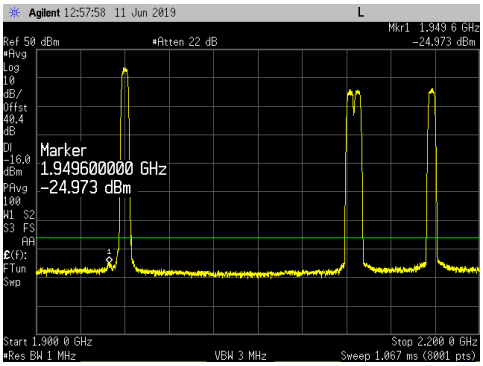


6GHz to 18GHz

18GHz to 22GHz

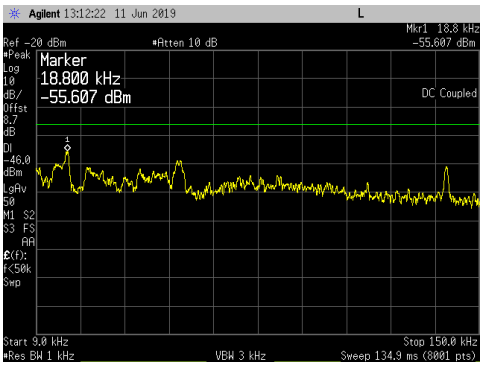


1900MHz to 2200MHz

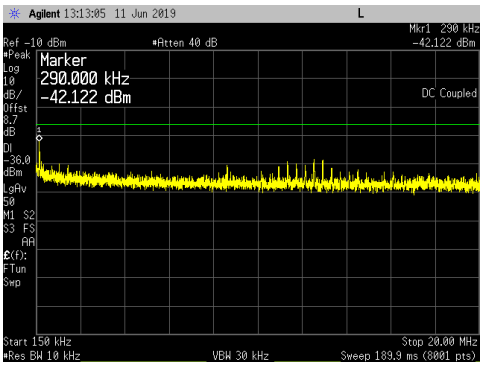


Three AWS (BCs & TC) Carriers & One PCS Carrier (MC)_16QAM_ 2112.4, 2117.4, 2167.6 & 1960.0MHz:

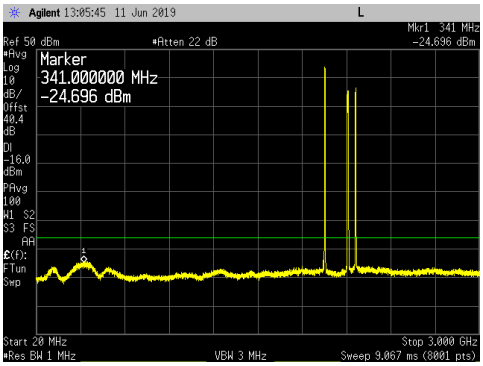
9kHz to 150kHz



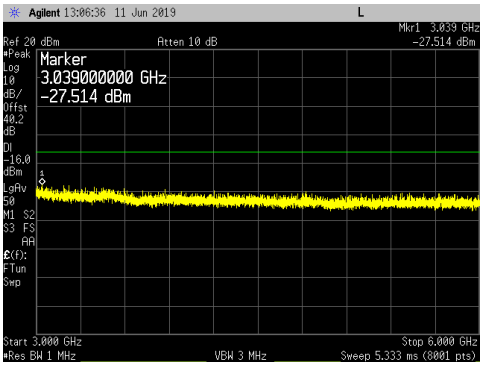
150kHz to 20MHz



20MHz to 3GHz

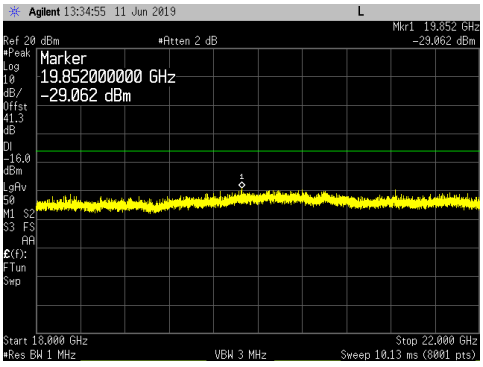


3GHz to 6GHz

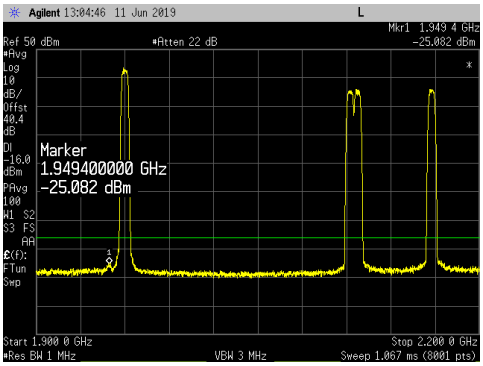


6GHz to 18GHz

18GHz to 22GHz

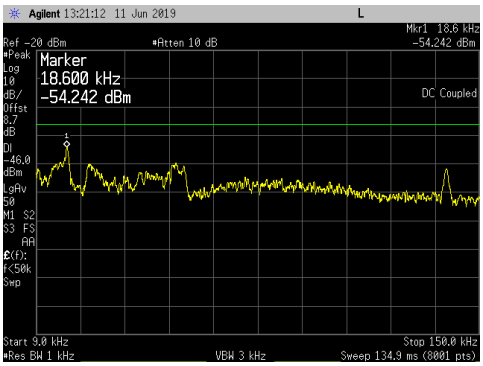


1900MHz to 2200MHz

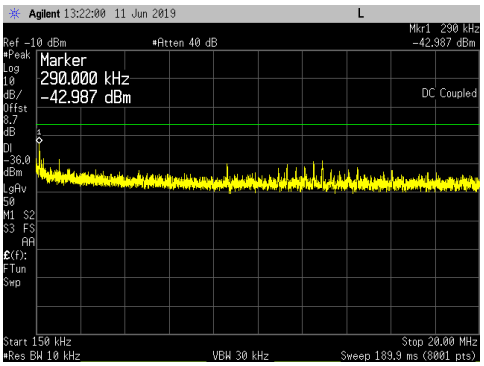


Three AWS (BCs & TC) Carriers & One PCS Carrier (MC)_64QAM_ 2112.4, 2117.4, 2167.6 & 1960.0MHz:

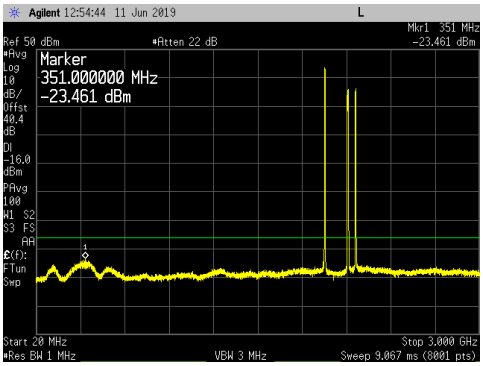
9kHz to 150kHz



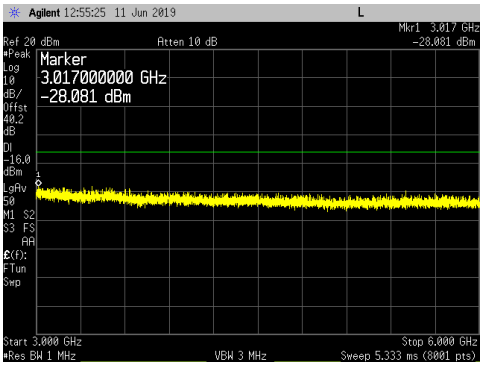
150kHz to 20MHz



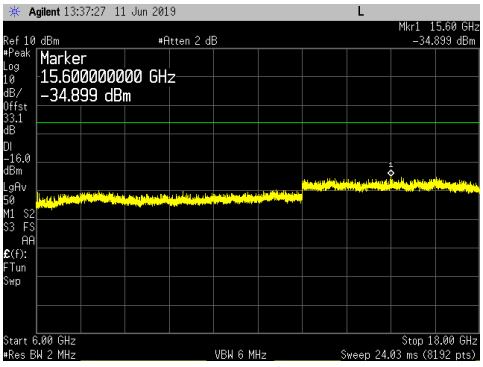
20MHz to 3GHz



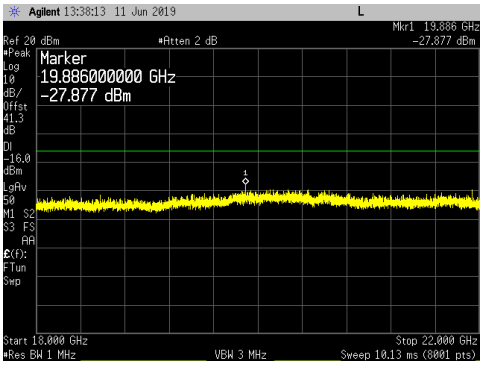
3GHz to 6GHz



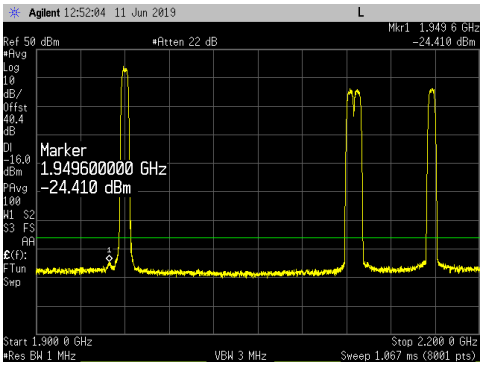
6GHz to 18GHz



18GHz to 22GHz

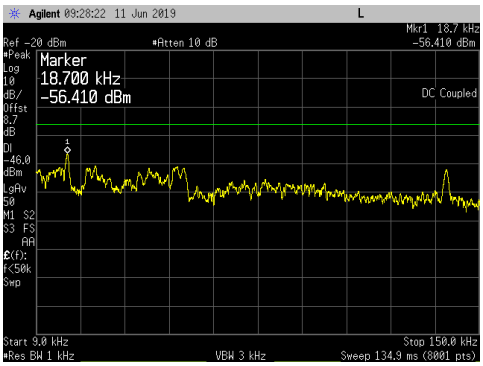


1900MHz to 2200MHz

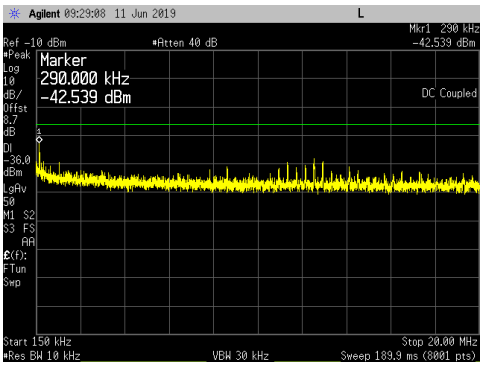


Multicarrier Multiband WCDMA _ QPSK_ (1932.4, 1937.4 & 2167.4MHz):

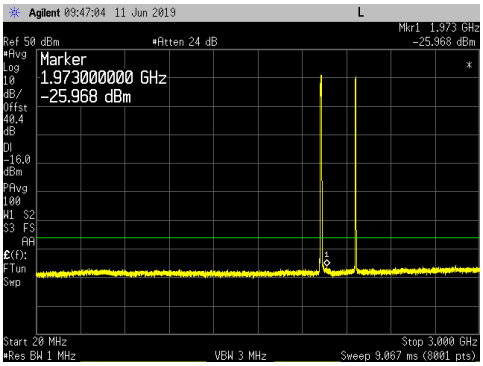
9kHz to 150kHz



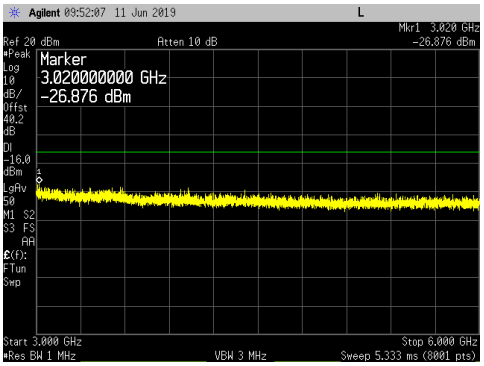
150kHz to 20MHz



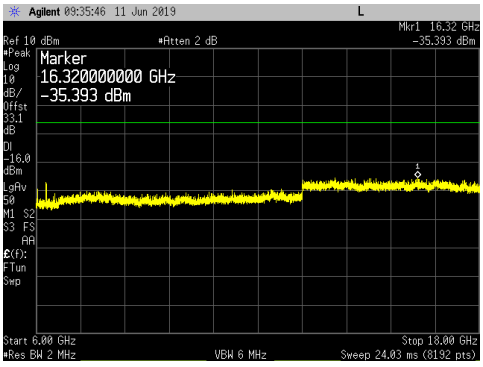
20MHz to 3GHz



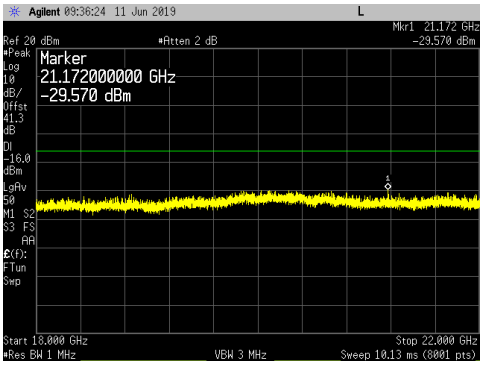
3GHz to 6GHz



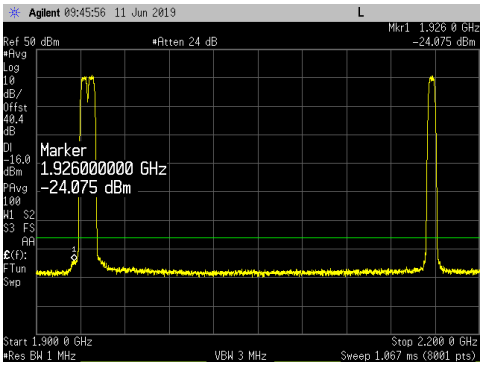
6GHz to 18GHz



18GHz to 22GHz

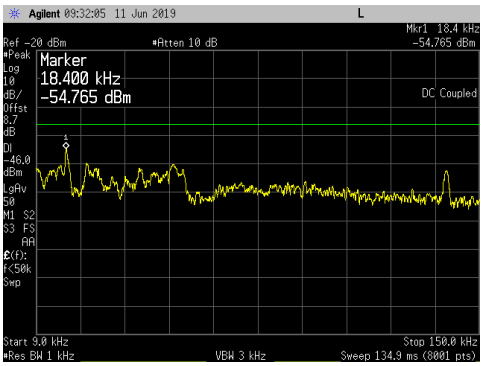


1900MHz to 2200MHz

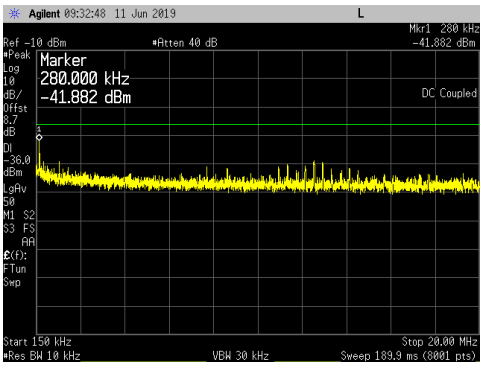


Multicarrier Multiband WCDMA _ 16QAM_ (1932.4, 1937.4 & 2167.4MHz):

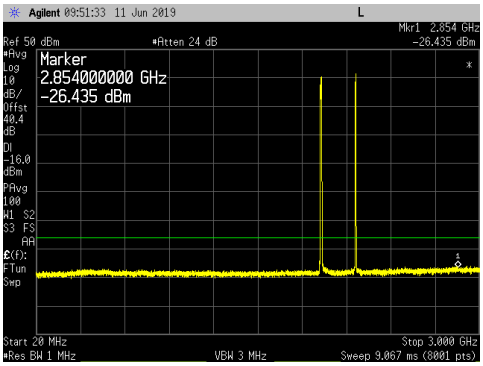
9kHz to 150kHz



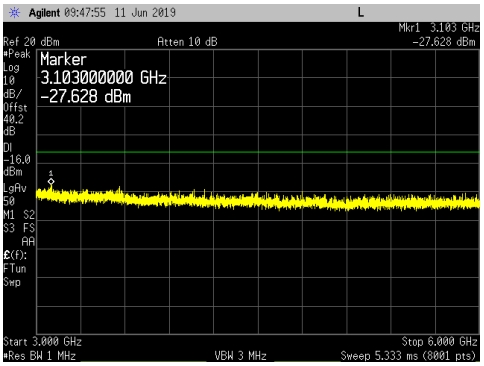
150kHz to 20MHz



20MHz to 3GHz

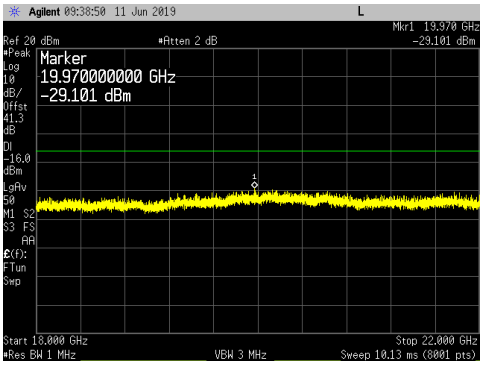


3GHz to 6GHz

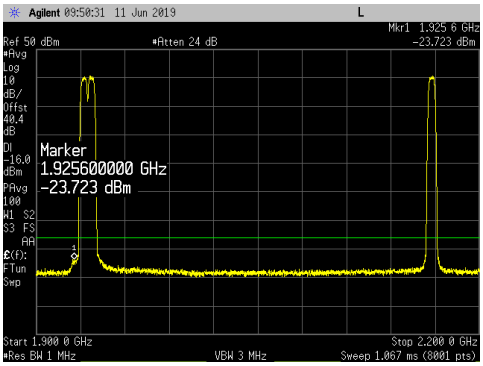


6GHz to 18GHz

18GHz to 22GHz

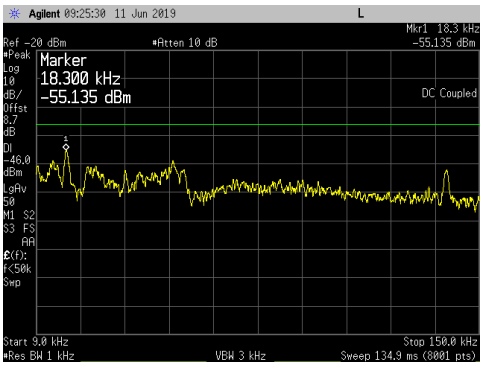


1900MHz to 2200MHz

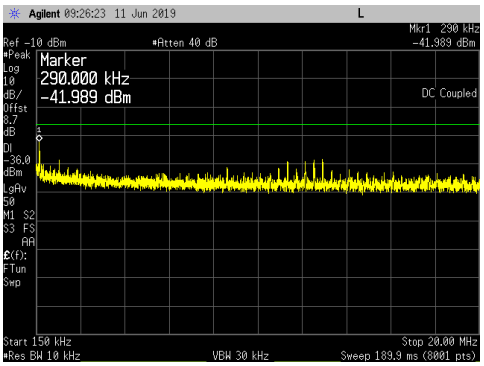


Multicarrier Multiband WCDMA _ 64QAM_ (1932.4, 1937.4 & 2167.4MHz):

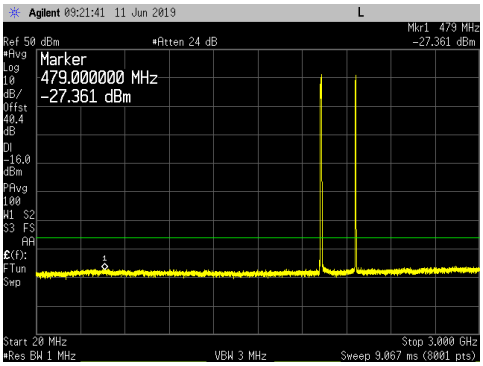
9kHz to 150kHz



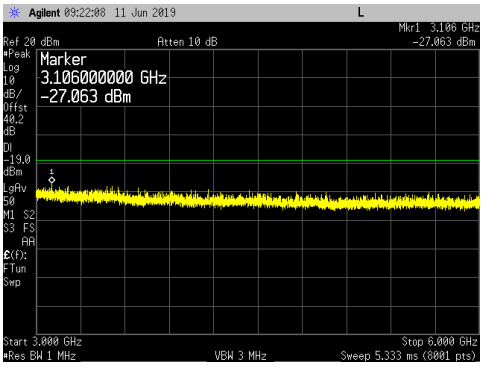
150kHz to 20MHz



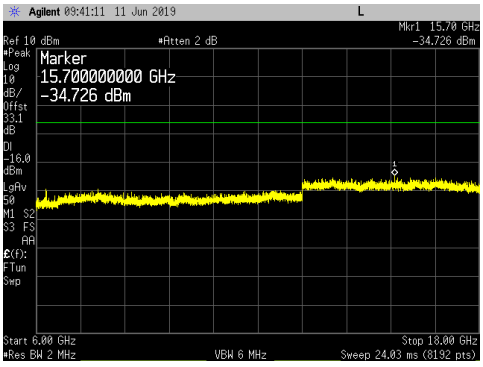
20MHz to 3GHz



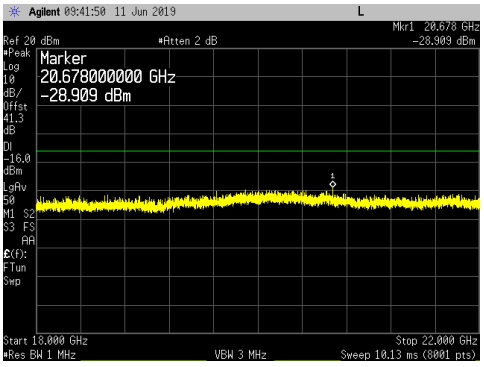
3GHz to 6GHz



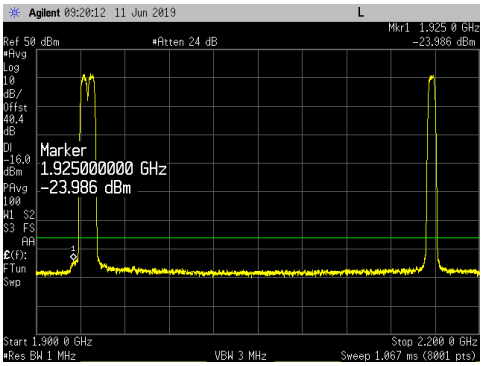
6GHz to 18GHz



18GHz to 22GHz



1900MHz to 2200MHz



Transmitter Radiated Spurious Emissions

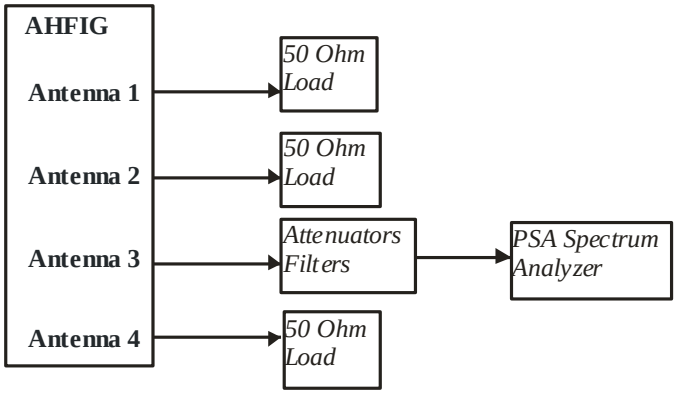
Radiated emission measurement results are in Appendix A.

Frequency Stability/Accuracy

Frequency Stability/Accuracy measurement results are in Appendix A.

APPENDIX D: ANTENNA PORT WCDMA TEST DATA FOR THE AWS BAND

All conducted RF measurements in this section were made at AHFIG antenna port 3. Based on the RF power measurement results shown in Appendix A & B, Port 3 had the highest LTE RMS average power for the PCS and AWS bands (represents the worst case) and therefore it was selected for all the remaining antenna port tests. All testing in this section was performed with WCDMA modulation types. The WCDMA modulation types are setup according to 3GPP TS 25.141 UTRA Test Models (TM) as follows TM 1: QPSK, TM 5: 16QAM and TM 6: 64QAM. The test setup used is provided below.



Test Setup Used for AHFIG Conducted RF Measurements

RF Output Power

RF output power has been measured in both Peak and RMS Average terms at AHFIG Antenna Port 3 at the bottom, middle and top AWS frequency channels for WCDMA modulation types (QPSK, 16QAM, 64QAM). RMS Average power was measured as described in section 5.2 of KDB 971168 D01v03r01 and ANSI C63.26-2015 sections 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 values are highlighted.

Single Carrier Operation			
Modulation	**Frequency _ Channel**	**PAPR (dB)**	**Average (dBm)**
QPSK	**2112.4MHz _ Bottom Channel**	7.28	45.87
	2140.0MHz _ Middle Channel	7.28	45.97
	2167.6MHz _ Top Channel	7.27	**46.06**
16QAM	**2112.4MHz _ Bottom Channel**	**7.37**	45.77
	2140.0MHz _ Middle Channel	7.29	46.03
	2167.6MHz _ Top Channel	7.34	45.90
64QAM	**2112.4MHz _ Bottom Channel**	7.32	45.81
	2140.0MHz _ Middle Channel	7.34	45.98
	2167.6MHz _ Top Channel	7.31	45.89

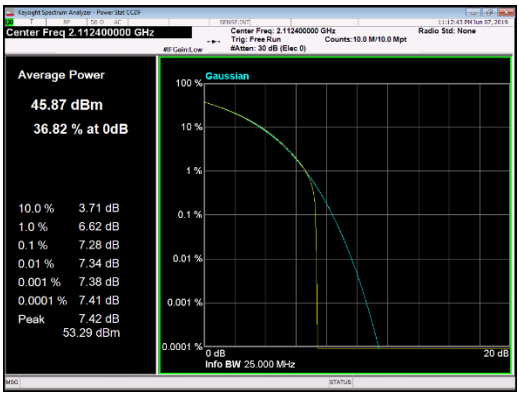
RF output power has been measured in RMS Average terms for each AWS multicarrier test configuration to verify/document the power levels. All results are presented in tabular form below.

<table>
<tr><th colspan="5">Measured RMS Average Carrier Power Level for the Multicarrier Configurations at Antenna Port 3</th></tr>
<tr><th rowspan="2">Modulation Type</th><th colspan="2">AWS Multicarrier WCDMA</th><th colspan="2">Multiband Multicarrier WCDMA</th></tr>
<tr><th>Bottom Carriers
2112.4 & 2117.4MHz</th><th>Top Carrier
2167.6MHz</th><th>Bottom Carriers
1932.4 & 1937.4MHz</th><th>Top Carrier
2167.6MHz</th></tr>
<tr><td rowspan="2">QPSK</td><td>43.38 dBm
(21.8 Watts)</td><td>41.47 dBm
(14.0 Watts)</td><td rowspan="6" colspan="2">See Appendix A for data and test results for this test case.</td></tr>
<tr><td colspan="2">Total Carrier Power in AWS Band is 35.8 Watts or 45.54 dBm</td></tr>
<tr><td rowspan="2">16QAM</td><td>43.94 dBm
(24.8 Watts)</td><td>41.46 dBm
(14.0 Watts)</td></tr>
<tr><td colspan="2">Total Carrier Power in AWS Band is 38.8 Watts or 45.89 dBm</td></tr>
<tr><td rowspan="2">64QAM</td><td>43.86 dBm
(24.3 Watts)</td><td>41.50 dBm
(14.1 Watts)</td></tr>
<tr><td colspan="2">Total Carrier Power in AWS Band is 38.4 Watts or 45.84 dBm</td></tr>
</table>

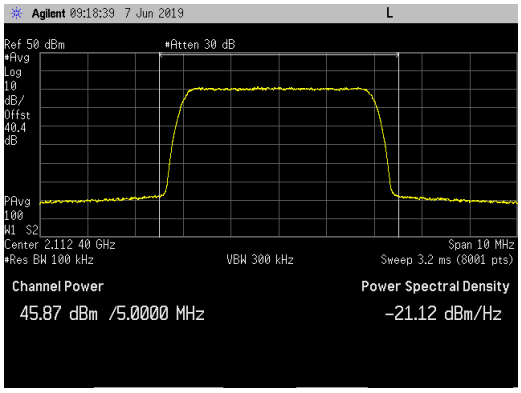
All measurement results are provided in the following pages. The total measurement RF path loss of the test setup (attenuator and test cables) was 40.4 dB and is accounted for by the spectrum analyzer reference level offset.

WCDMA Channel Power Plots for Antenna Port 3 and QPSK Modulation:

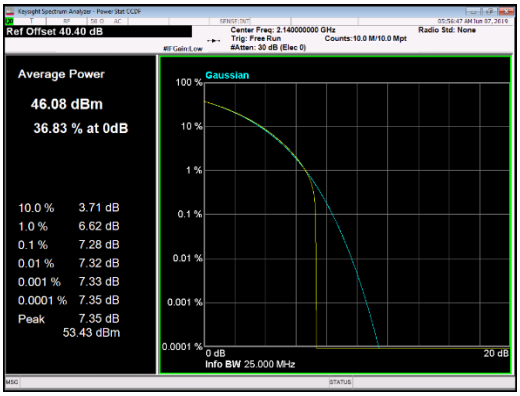
Bottom Channel_ CCDF



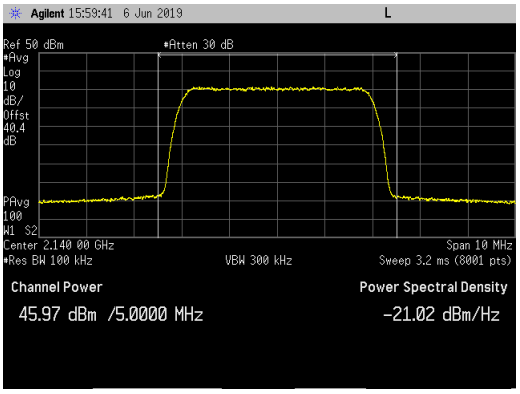
Bottom Channel_ Average



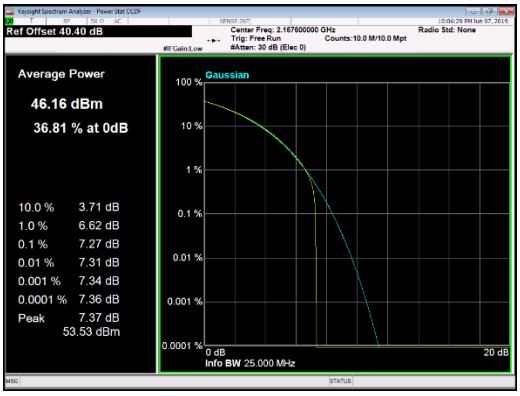
Middle Channel_ CCDF



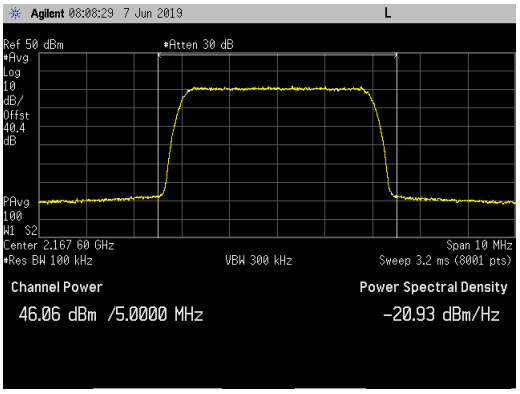
Middle Channel_ Average



Top Channel_ CCDF

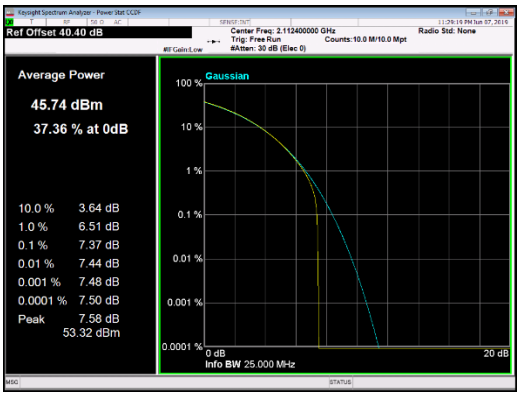


Top Channel_ Average

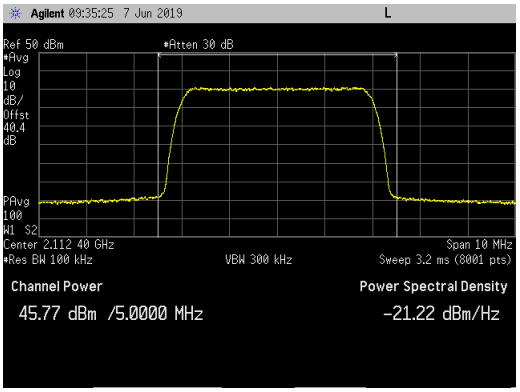


WCDMA Channel Power Plots for Antenna Port 3 and 16QAM Modulation:

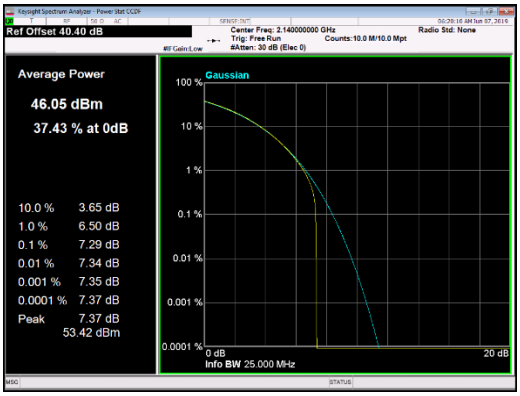
Bottom Channel_ CCDF



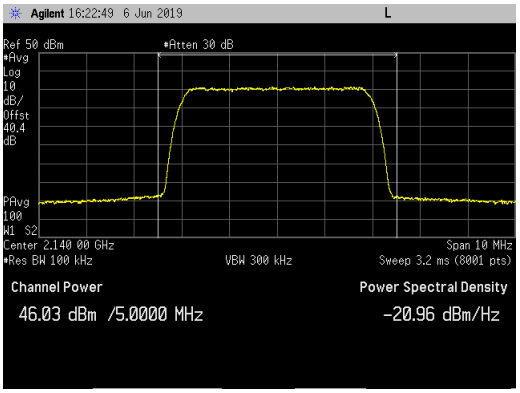
Bottom Channel_ Average



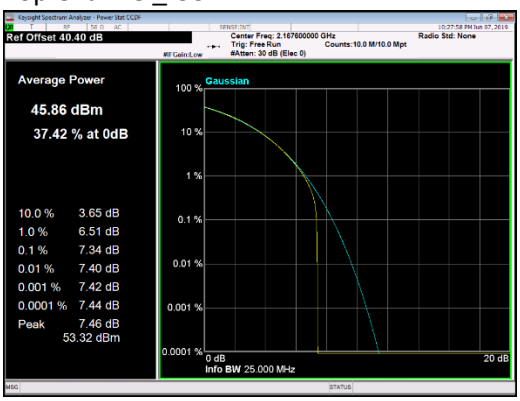
Middle Channel_ CCDF



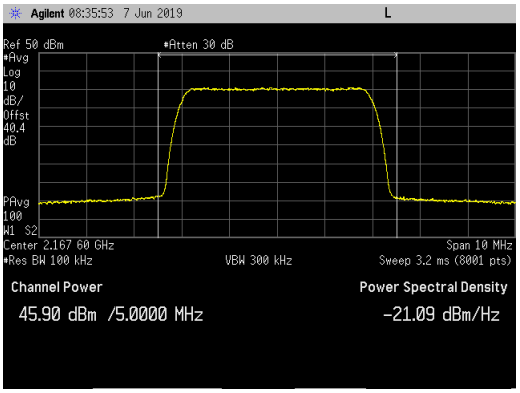
Middle Channel_ Average



Top Channel_ CCDF

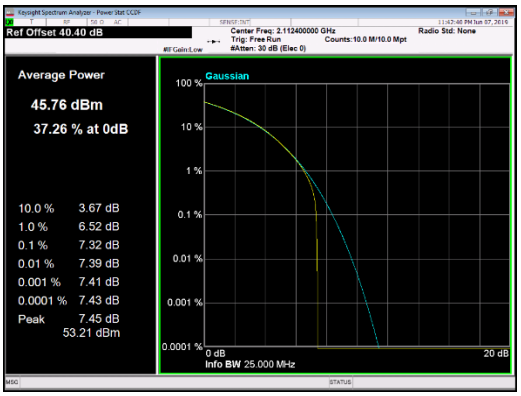


Top Channel_ Average

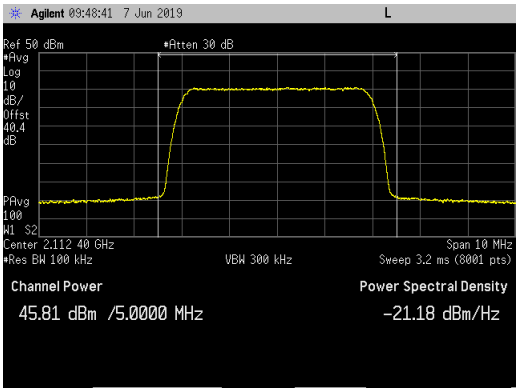


WCDMA Channel Power Plots for Antenna Port 3 and 64QAM Modulation:

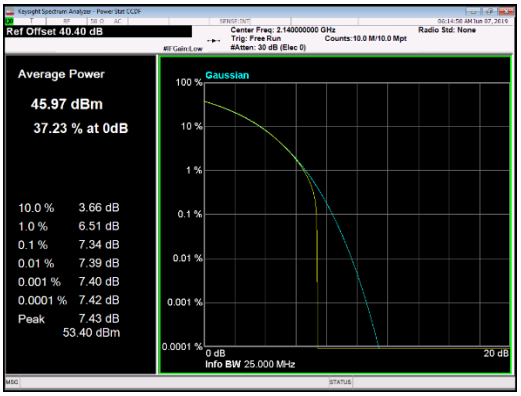
Bottom Channel_ CCDF



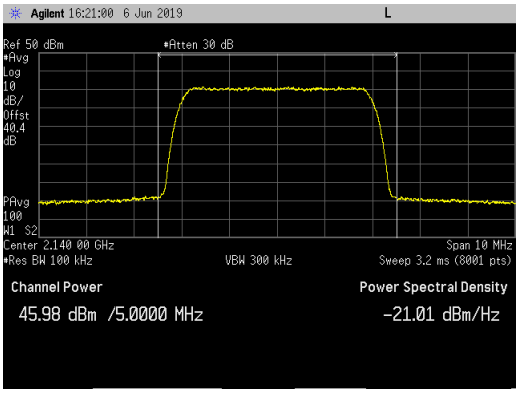
Bottom Channel_ Average



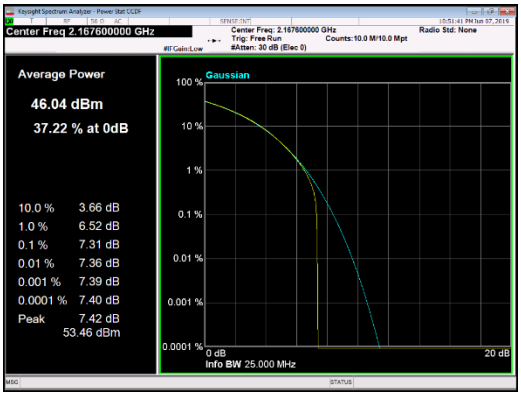
Middle Channel_ CCDF



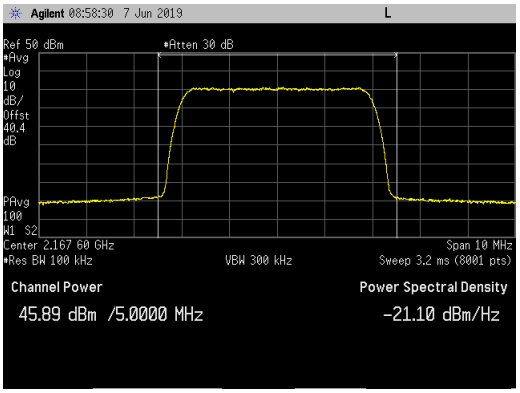
Middle Channel_ Average



Top Channel_ CCDF

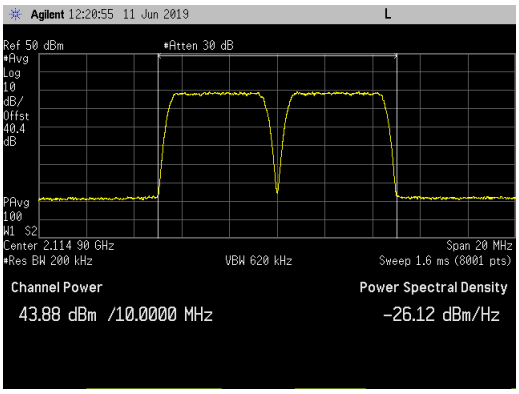


Top Channel_ Average

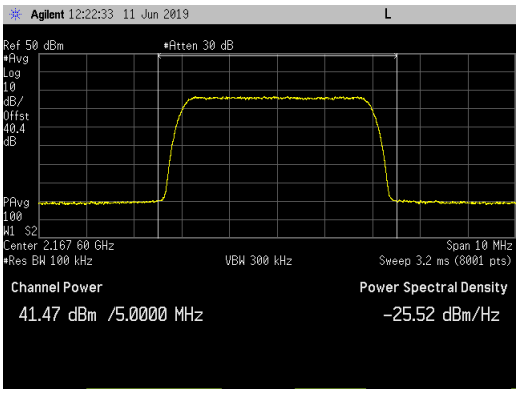


AWS Multicarrier (Carriers at 2112.4, 2117.4 & 2167.6MHz) Channel Power Plots for Antenna Port 3:

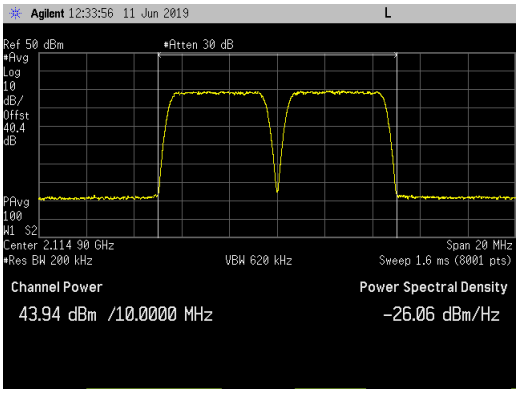
QPSK_ 2112.4 & 2117.4MHz_ Average Power



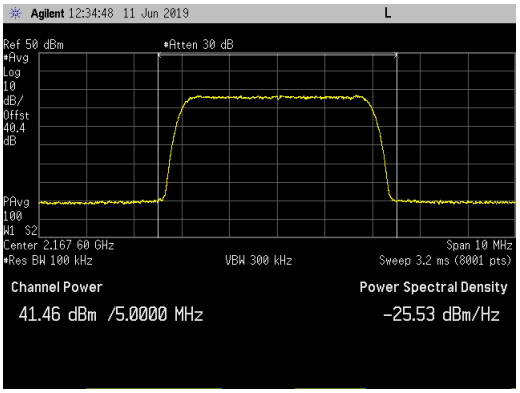
QPSK_ 2167.6MHz _ Average Power



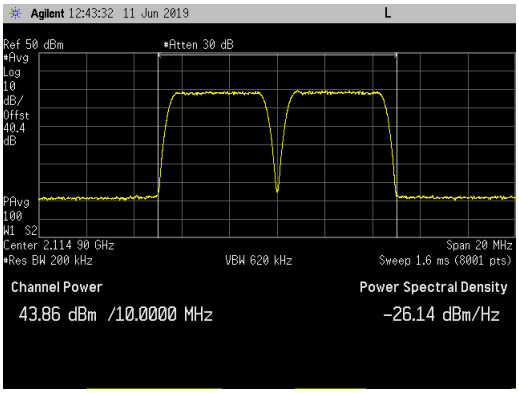
16QAM_ 2112.4 & 2117.4MHz_ Average Power



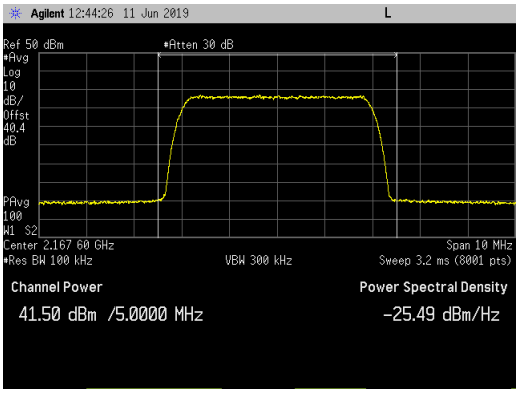
16QAM_ 2167.6MHz _ Average Power



64QAM_ 2112.4 & 2117.4MHz_ Average Power



64QAM_ 2167.6MHz _ Average Power



Emission Bandwidth (26 dB down and 99%)

Emission bandwidth measurements were made at antenna port 3 on the bottom, middle and top AWS channels. The AHFIG was operated at maximum RF output power for WCDMA modulation types (QPSK, 16QAM, 64QAM).

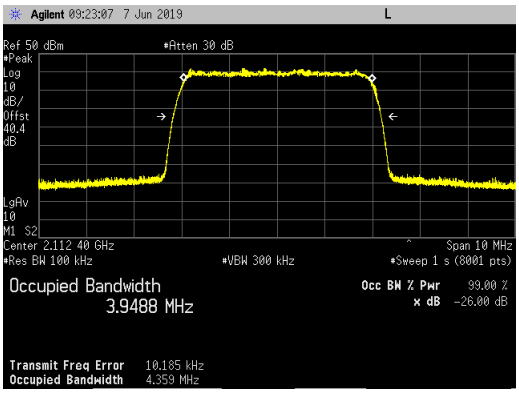
The 26dB emission bandwidth was measured in accordance with section 4 of FCC KDB 971168 D01v03r01 and ANSI C63.26 section 5.4. The 99% occupied bandwidth was measured in accordance with section 6.7 of RSS-Gen Issue 5. For both measurements, an occupied bandwidth built-in function in the spectrum analyzer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

Modulation	Frequency _ Channel	Emission Bandwidth (MHz)	
		26dB	99%
QPSK	**2112.4MHz _ Bottom Channel**	4.359	3.9488
	2140.0MHz _ Middle Channel	4.362	**3.9494**
	2167.6MHz _ Top Channel	4.362	3.9485
16QAM	**2112.4MHz _ Bottom Channel**	4.352	3.9425
	2140.0MHz _ Middle Channel	4.355	3.9442
	2167.6MHz _ Top Channel	4.358	3.9440
64QAM	**2112.4MHz _ Bottom Channel**	4.360	3.9365
	2140.0MHz _ Middle Channel	**4.365**	3.9366
	2167.6MHz _ Top Channel	4.363	3.9375

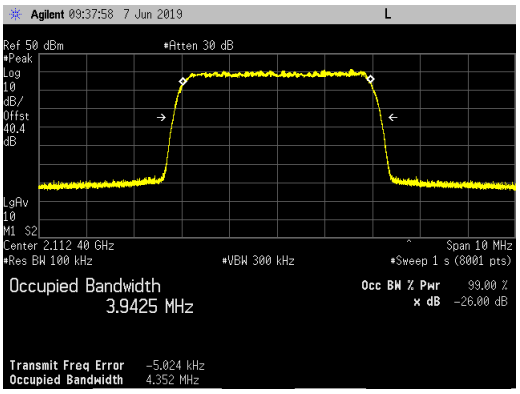
Emission bandwidth measurement data are provided in the following pages.

WCDMA Emission Bandwidth Plots at AHFIG Antenna Port 3

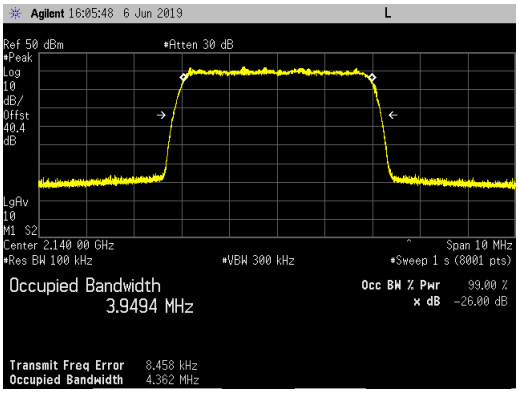
Bottom Channel_2112.4MHz_QPSK Modulation



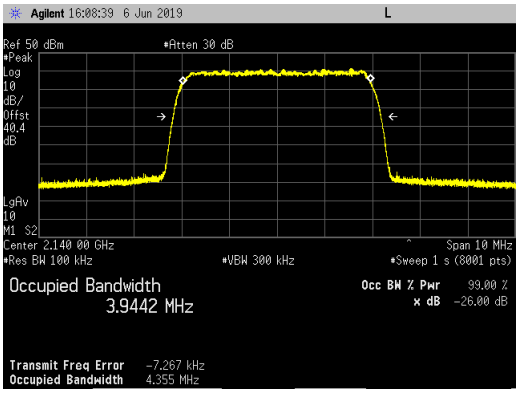
Bottom Channel_2112.4MHz_16QAM Modulation



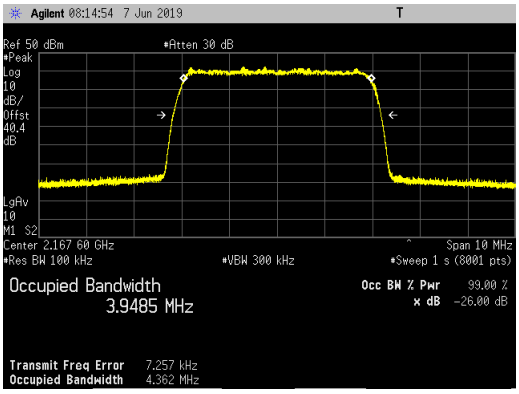
Middle Channel_2140.0MHz_QPSK Modulation



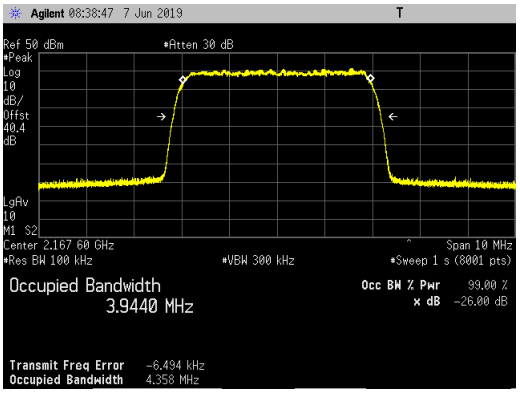
Middle Channel_2140.0MHz_16QAM Modulation



Top Channel_2167.6MHz_QPSK Modulation

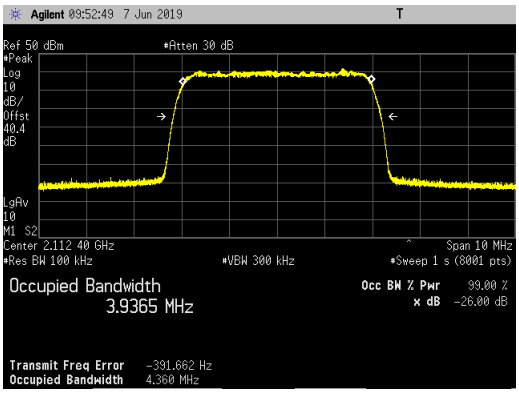


Top Channel_2167.6MHz_16QAM Modulation

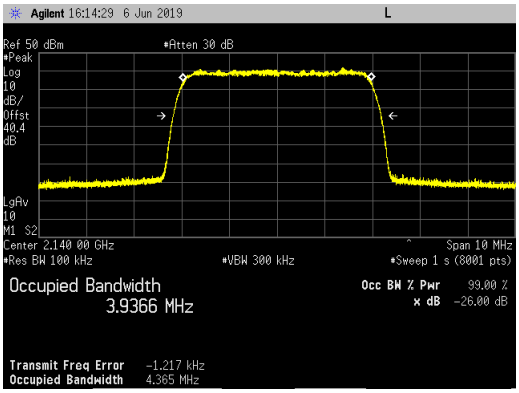


WCDMA Emission Bandwidth Plots at AHFIG Antenna Port 3

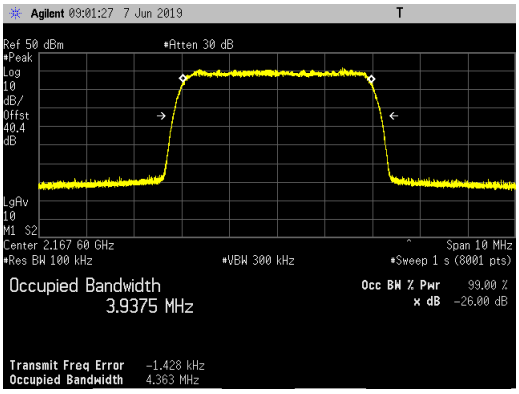
Bottom Channel_2112.4MHz_64QAM Modulation



Middle Channel_2140.0MHz_64QAM Modulation



Top Channel_2167.6MHz_64QAM Modulation



Antenna Port Conducted Band Edge

Conducted band edge measurements were made at RRH antenna port 3.

Single Carrier Test Cases

The RRH was operated at the AWS band edge frequencies with all WCDMA modulation types (QPSK, 16QAM and 64QAM) at maximum power (40 watts/port and 40 watts/carrier).

AWS Multicarrier Multiband Test Case

In the AWS band: Three carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the lower band edge (UARFCN 3112: 2112.4 & UARFCN 3137: 2117.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 3388: 2167.6MHz) at the upper band edge. In the PCS band: Single WCDMA carrier at the middle channel (UARFCN 9800: 1960.0MHz). The carriers were operated at maximum power (80W/PCS carrier and ~13W/AWS carrier) with at total port power of 120 watts (80W for PCS band carrier + 40W for AWS band carriers). The same modulation type was used for both PCS and AWS carriers.

Multiband Multicarrier Test Case

Three WCDMA carriers (based upon KDB 971168 D03v01) using two carriers (with minimum spacing between carrier frequencies) at the PCS band lower band edge (UARFCN 9662: 1932.4 & UARFCN 9687: 1937.4MHz) and a third carrier with maximum spacing between the other two carrier frequencies (UARFCN 3388: 2167.6MHz) at the AWS band upper band edge. The carriers were operated at maximum power (40W/PCS carrier and 40W/AWS carrier) with at total port power of 120 watts (80W for PCS band carriers + 40W for AWS band carrier). The same modulation type was used for both PCS and AWS carriers. This test case is documented in Appendix C.

The power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm as specified in section 27.53(h)(1) and RSS 139 6.6. The limit is adjusted to -16dBm [-13dBm -10 log (2)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 2 port MIMO transmitter.

Measurements were performed with the spectrum analyzer in the RMS average mode over 100 traces. In the 1MHz bands outside and adjacent to the frequency block, a resolution bandwidth of 1% of the measured emission bandwidth (51kHz) per 27.53(h)(1) and RSS 139 6.6 was used. In the 1 to 2MHz frequency range outside the band edge (i.e.: 2108 to 2109MHz and 2171 to 2172MHz bands) the RBW was set to 1% of the measured emission bandwidth (51kHz) and the power integrated over 1MHz. In the 2MHz to 22MHz frequency range outside the band edge (i.e.: 2088 to 2108MHz and 2172 to 2192MHz bands) a 1MHz RBW and 3MHz VBW was used.