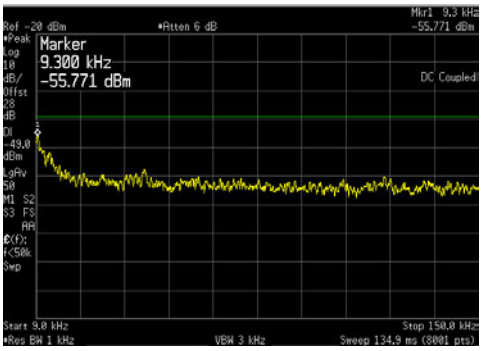
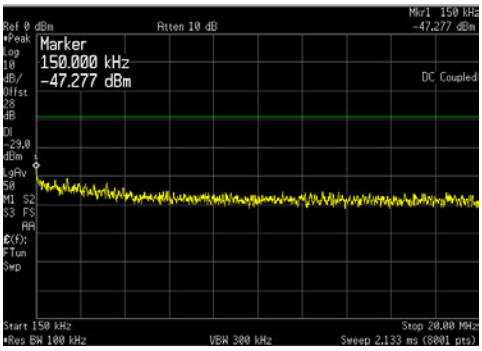
LTE5 Channel Bandwidth _ 64QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

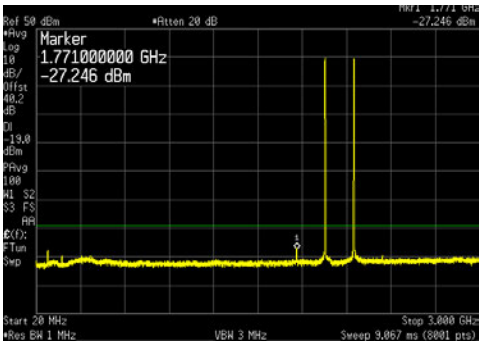
9kHz to 150kHz



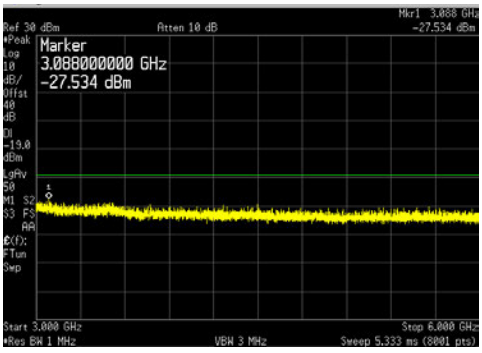
150kHz to 20MHz



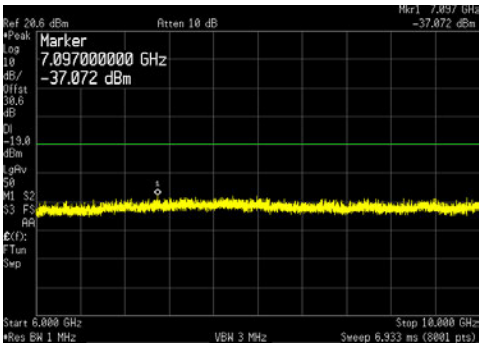
20MHz to 3GHz



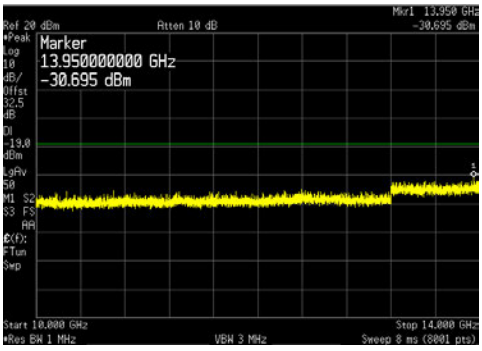
3GHz to 6GHz



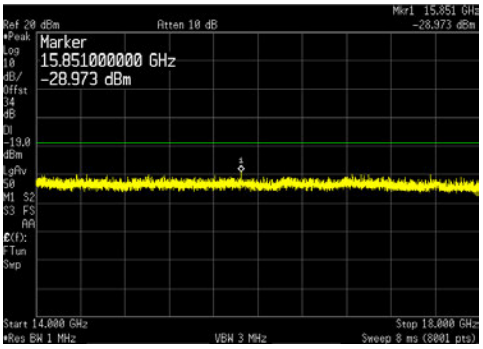
6GHz to 10GHz



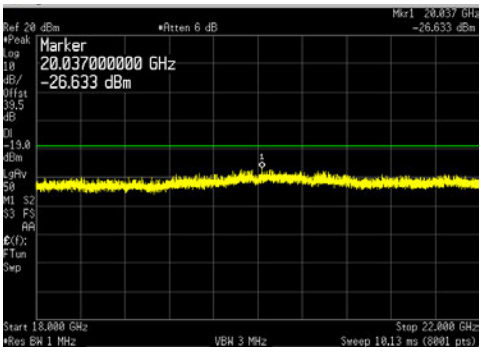
10GHz to 14GHz



14GHz to 18GHz

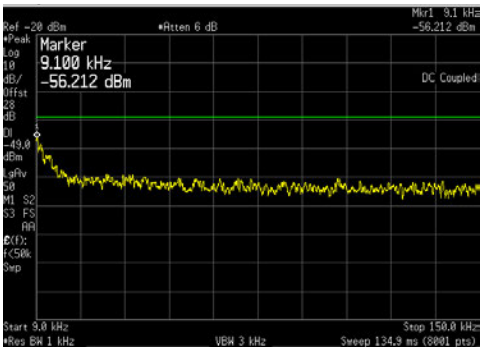


18GHz to 22GHz

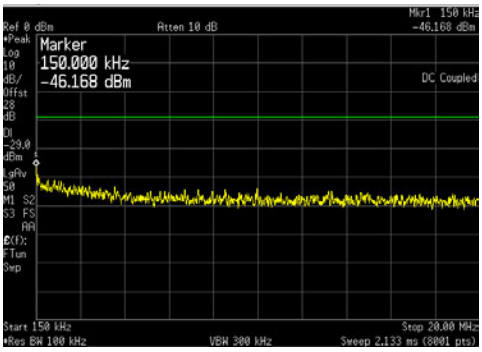


LTE5 Channel Bandwidth _ 256QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

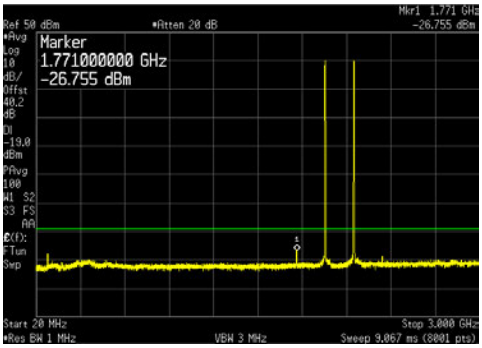
9kHz to 150kHz



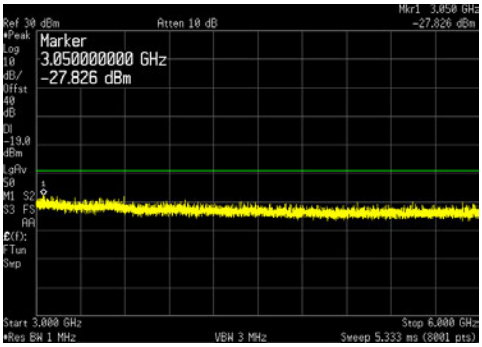
150kHz to 20MHz



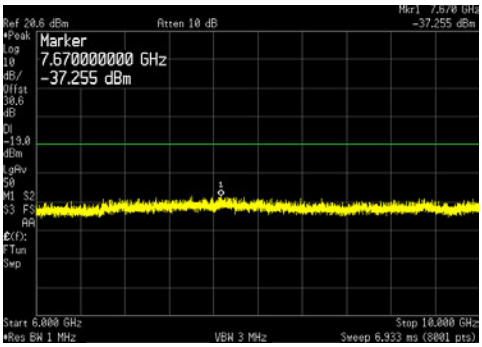
20MHz to 3GHz



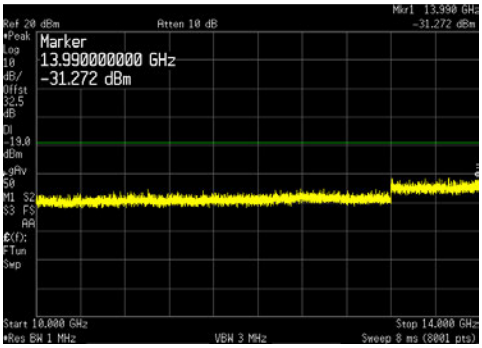
3GHz to 6GHz



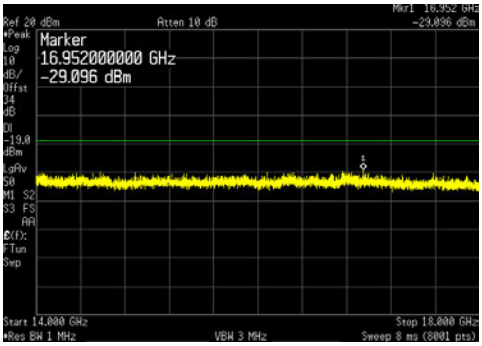
6GHz to 10GHz



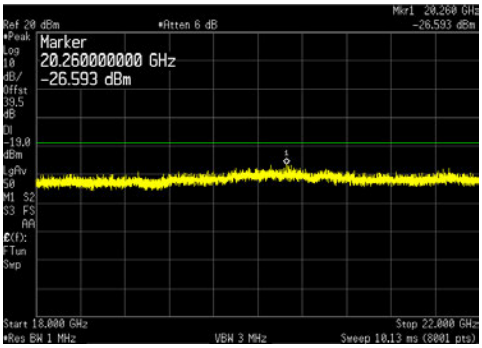
10GHz to 14GHz



14GHz to 18GHz

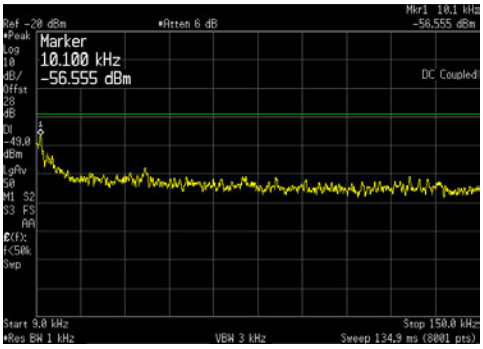


18GHz to 22GHz

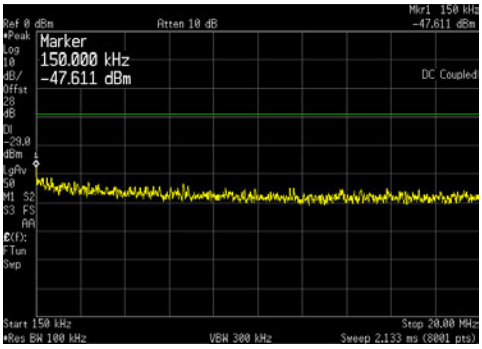


LTE10 Channel Bandwidth _ QPSK _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

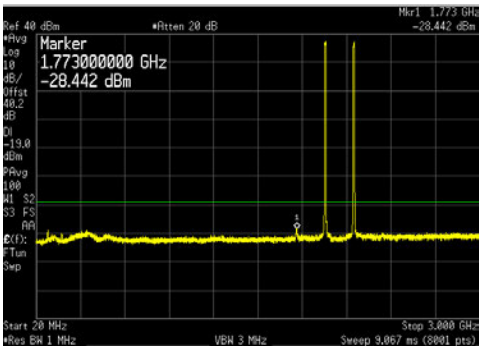
9kHz to 150kHz



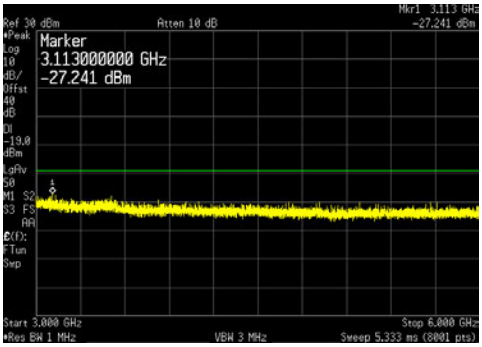
150kHz to 20MHz



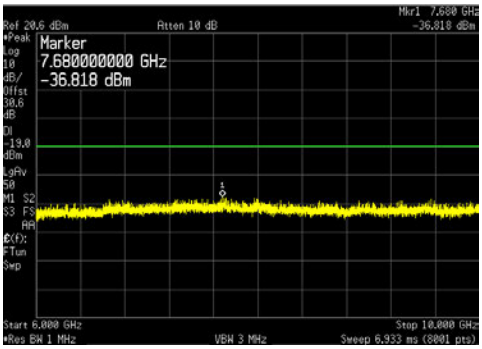
20MHz to 3GHz



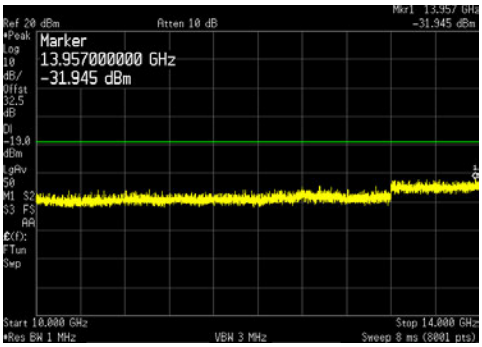
3GHz to 6GHz



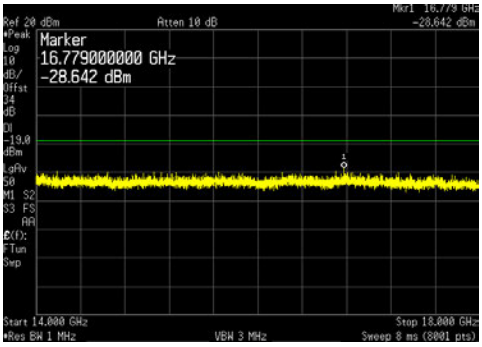
6GHz to 10GHz



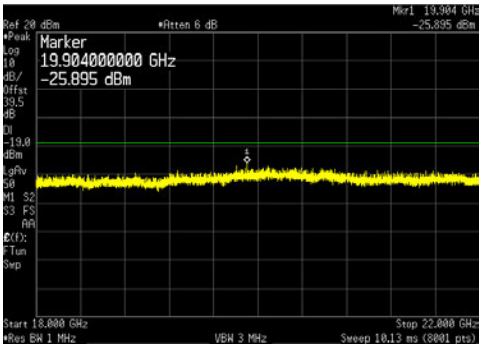
10GHz to 14GHz



14GHz to 18GHz

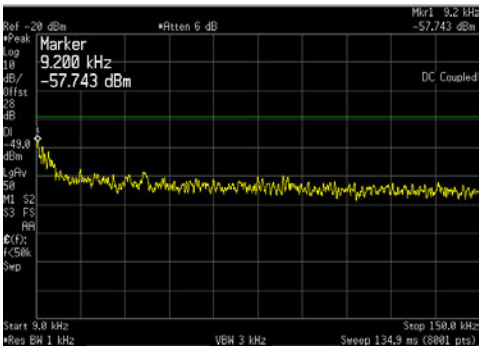


18GHz to 22GHz

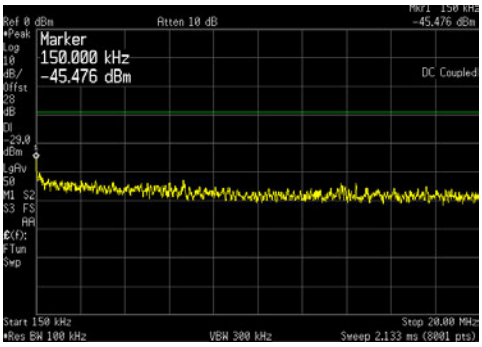


LTE10 Channel Bandwidth _ 16QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

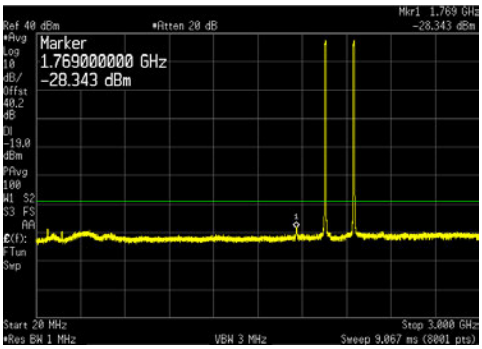
9kHz to 150kHz



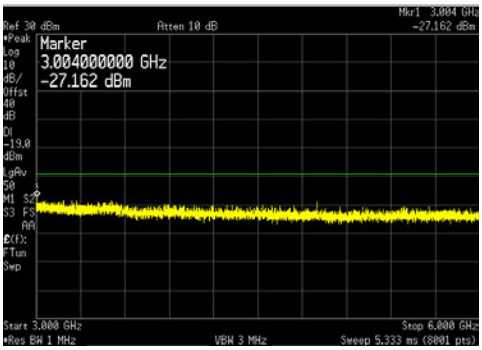
150kHz to 20MHz



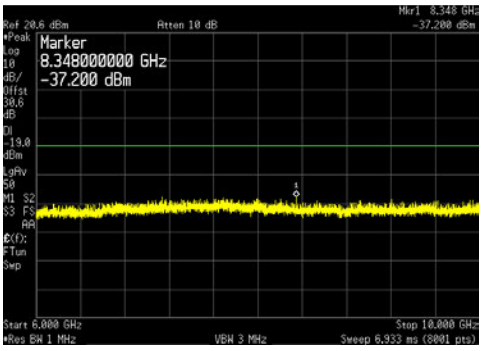
20MHz to 3GHz



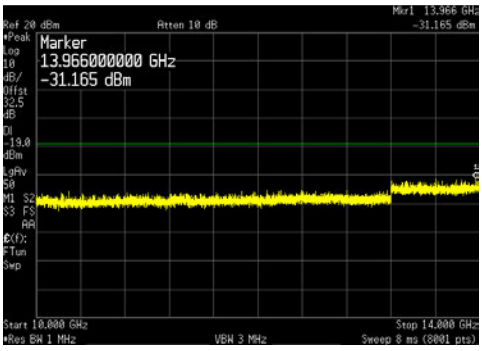
3GHz to 6GHz



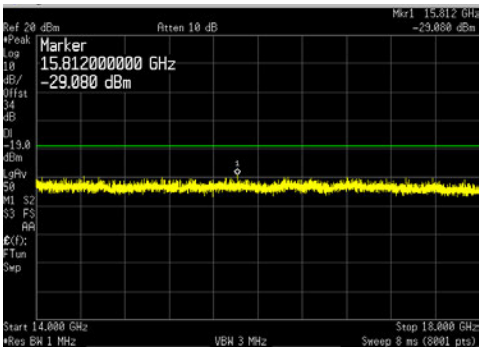
6GHz to 10GHz



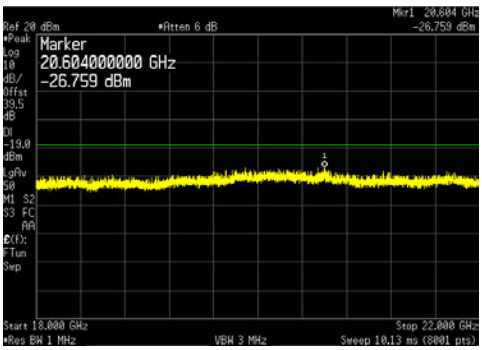
10GHz to 14GHz



14GHz to 18GHz

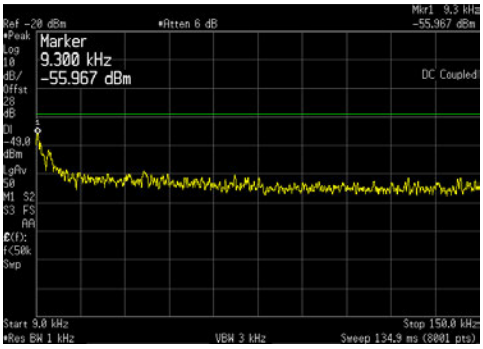


18GHz to 22GHz

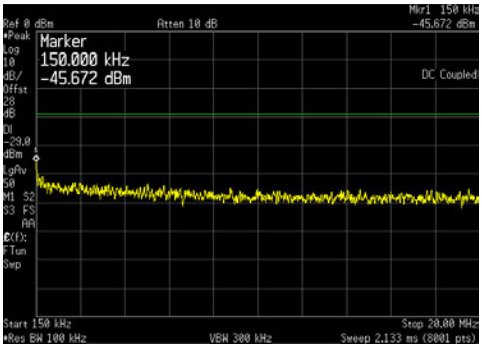


LTE10 Channel Bandwidth _ 64QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

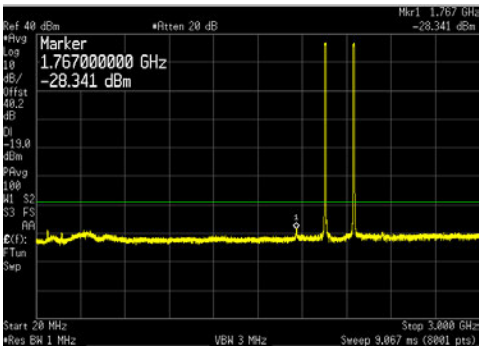
9kHz to 150kHz



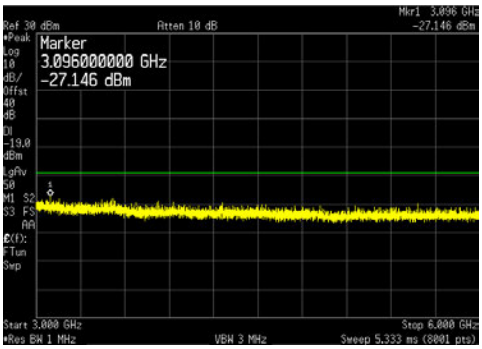
150kHz to 20MHz



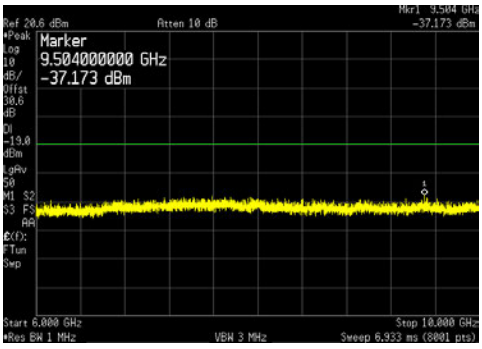
20MHz to 3GHz



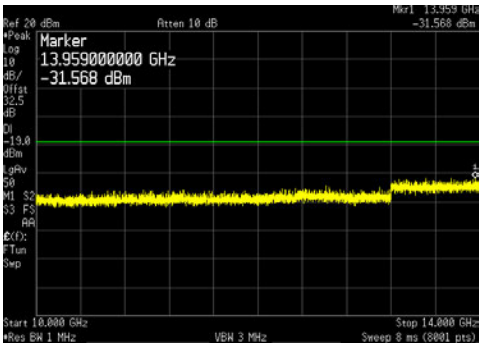
3GHz to 6GHz



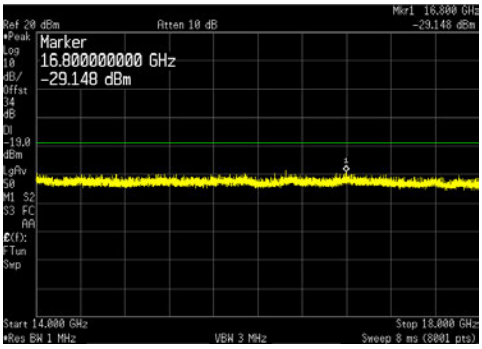
6GHz to 10GHz



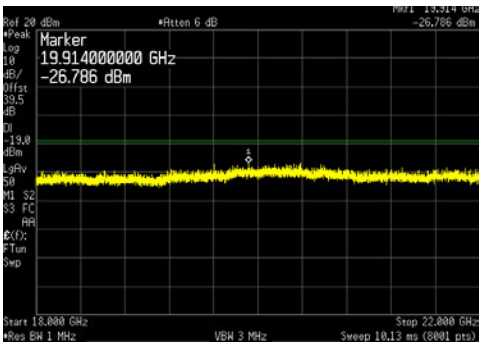
10GHz to 14GHz



14GHz to 18GHz

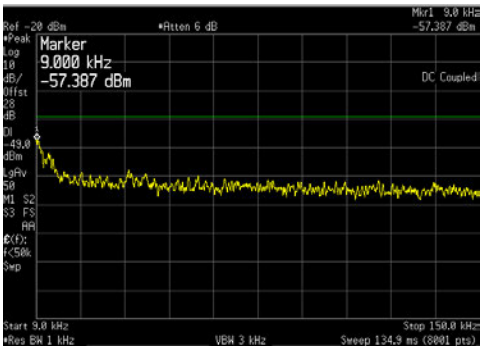


18GHz to 22GHz

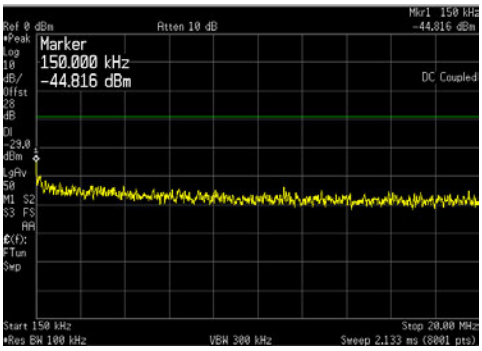


LTE10 Channel Bandwidth _ 256QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

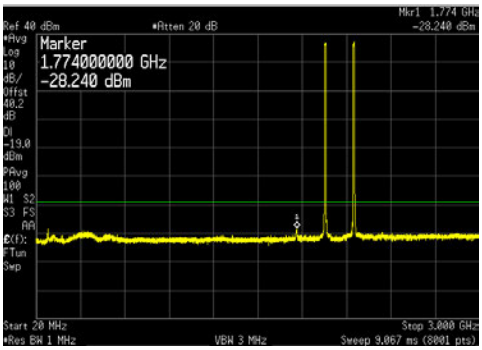
9kHz to 150kHz



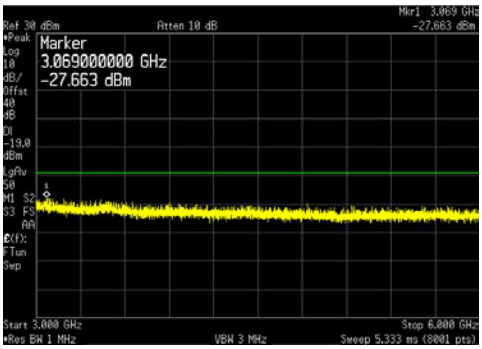
150kHz to 20MHz



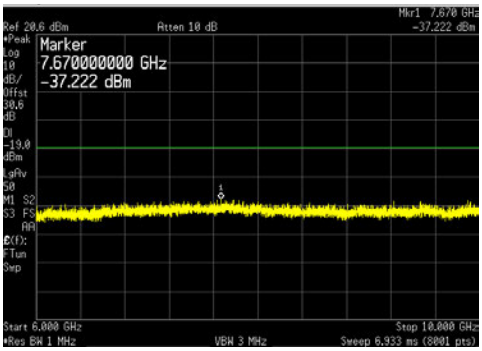
20MHz to 3GHz



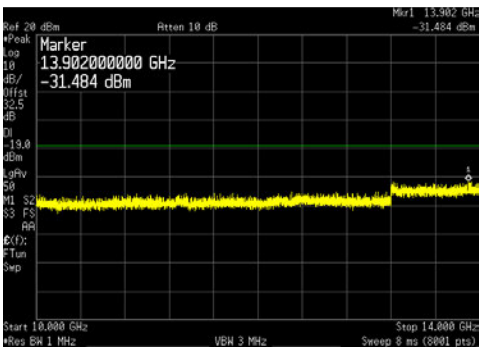
3GHz to 6GHz



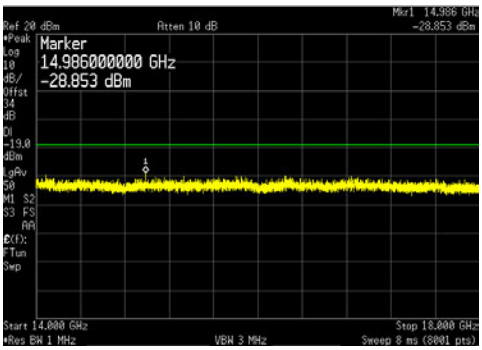
6GHz to 10GHz



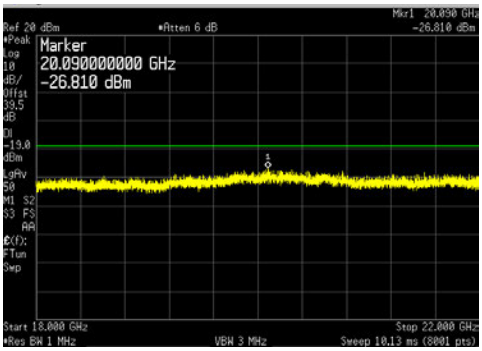
10GHz to 14GHz



14GHz to 18GHz

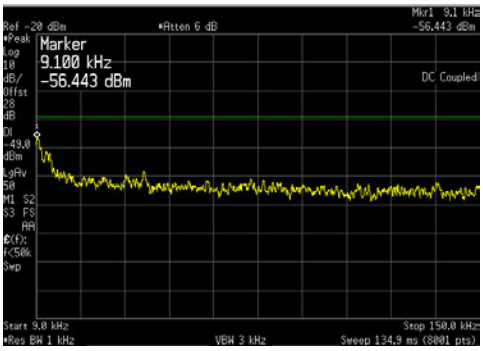


18GHz to 22GHz

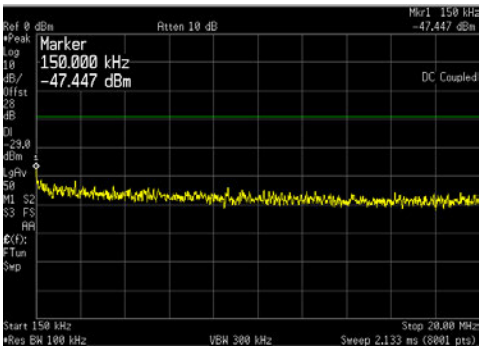


LTE15 Channel Bandwidth _ QPSK _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

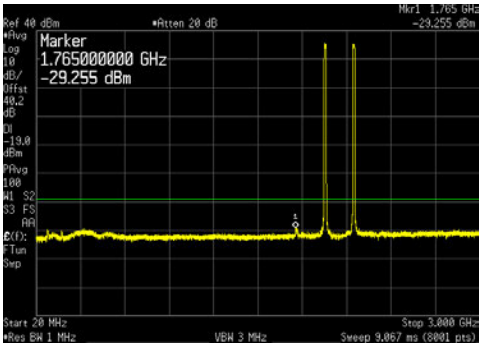
9kHz to 150kHz



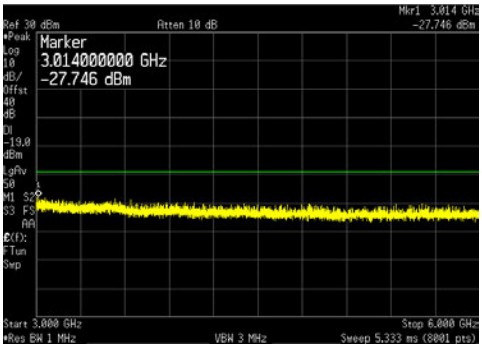
150kHz to 20MHz



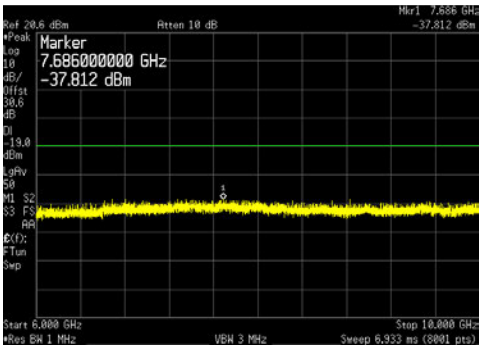
20MHz to 3GHz



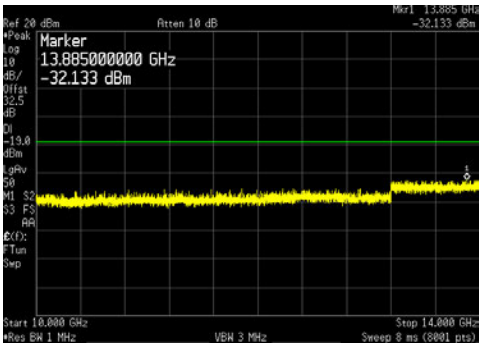
3GHz to 6GHz



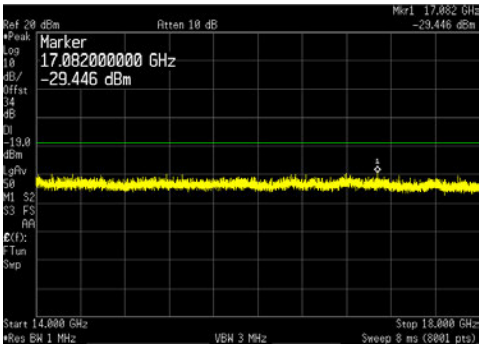
6GHz to 10GHz



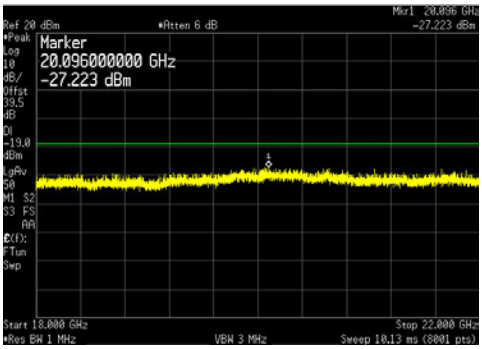
10GHz to 14GHz



14GHz to 18GHz

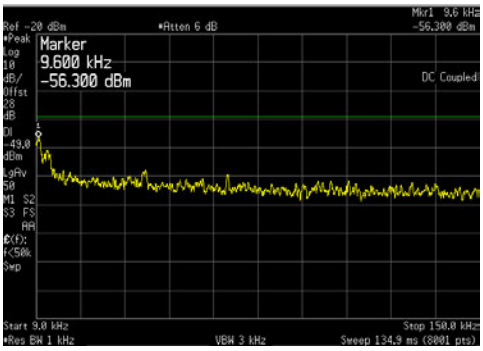


18GHz to 22GHz

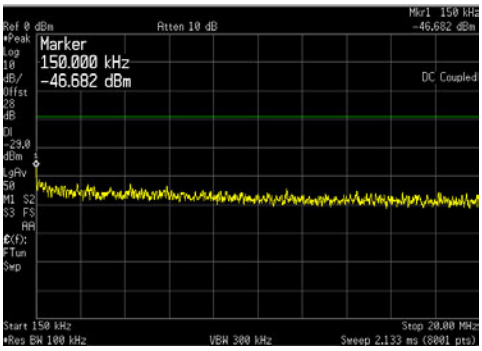


LTE15 Channel Bandwidth _ 16QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

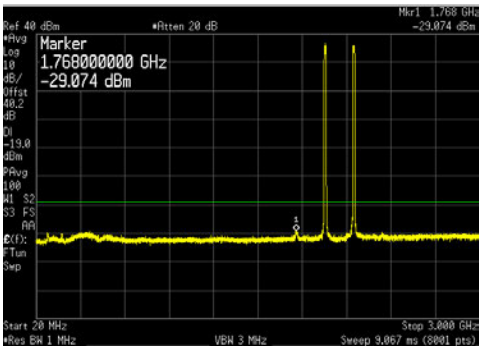
9kHz to 150kHz



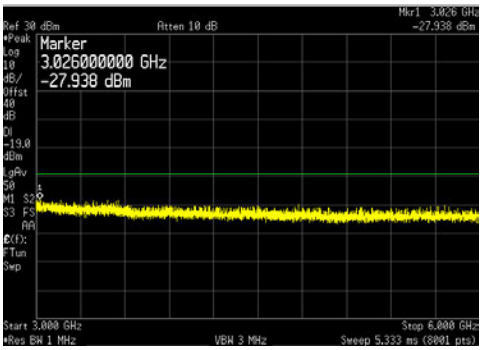
150kHz to 20MHz



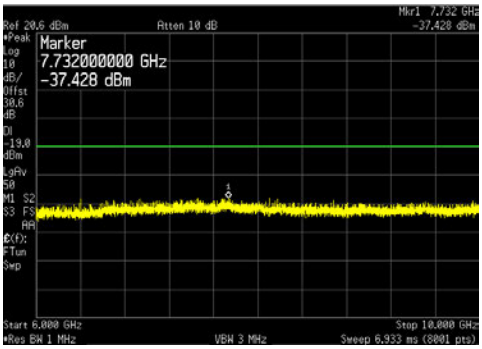
20MHz to 3GHz



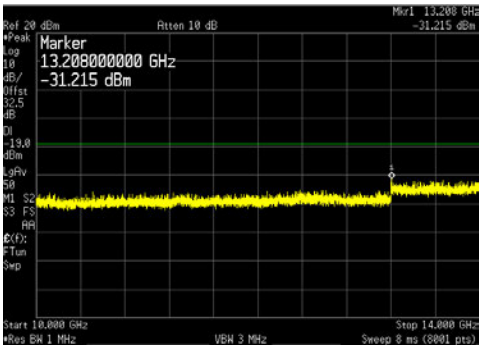
3GHz to 6GHz



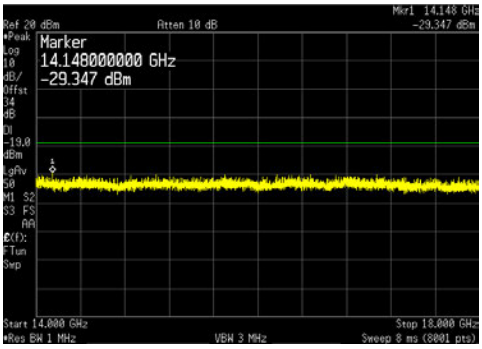
6GHz to 10GHz



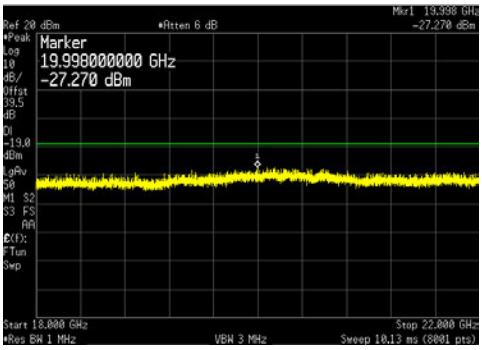
10GHz to 14GHz



14GHz to 18GHz

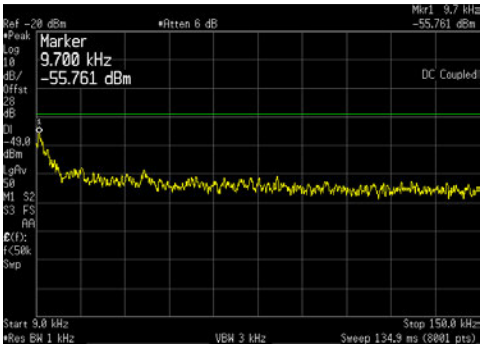


18GHz to 22GHz

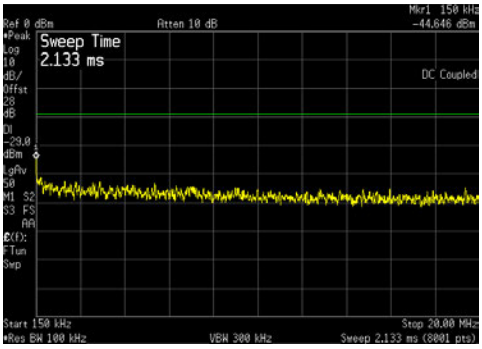


LTE15 Channel Bandwidth _ 64QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

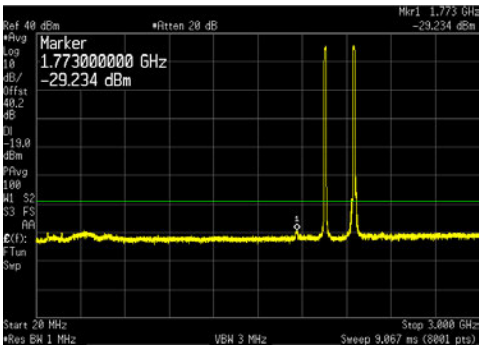
9kHz to 150kHz



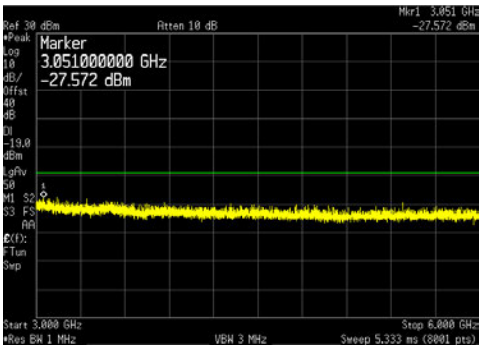
150kHz to 20MHz



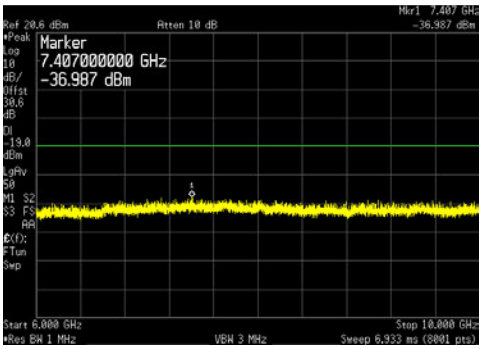
20MHz to 3GHz



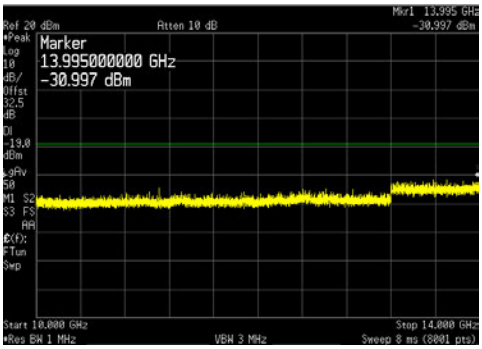
3GHz to 6GHz



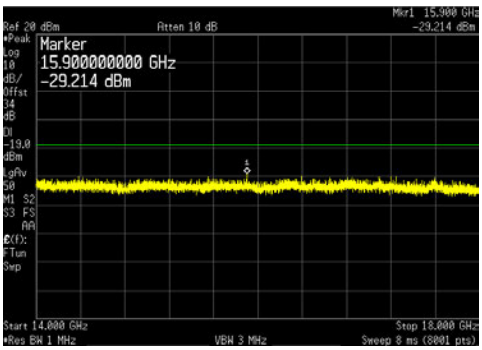
6GHz to 10GHz



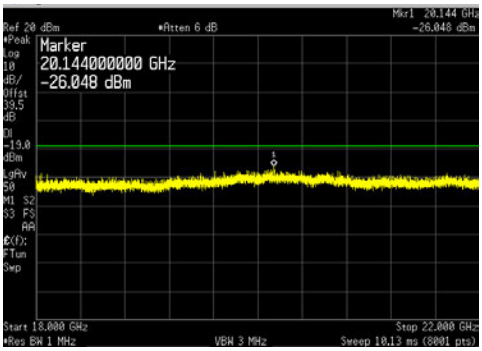
10GHz to 14GHz



14GHz to 18GHz

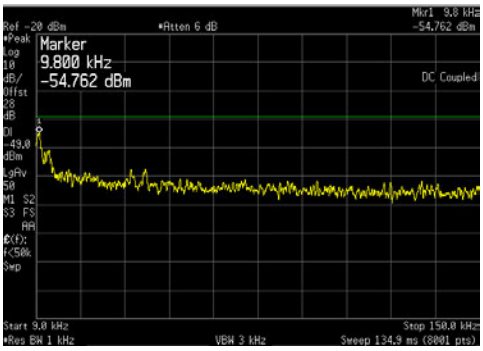


18GHz to 22GHz

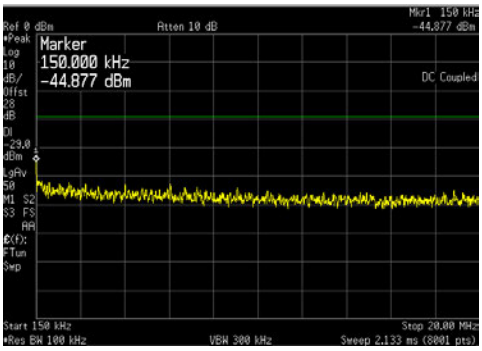


LTE15 Channel Bandwidth _ 256QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

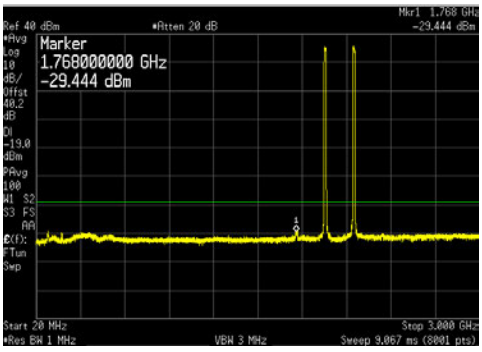
9kHz to 150kHz



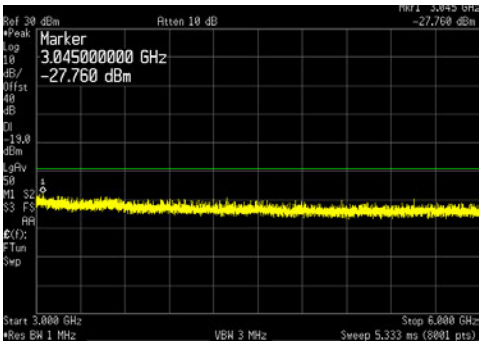
150kHz to 20MHz



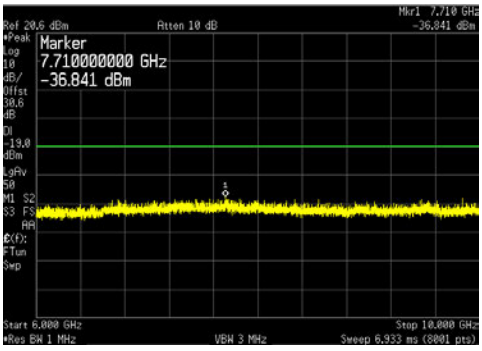
20MHz to 3GHz



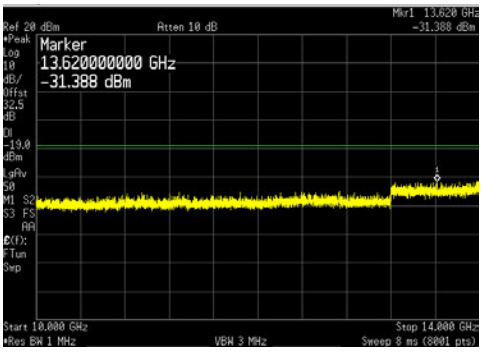
3GHz to 6GHz



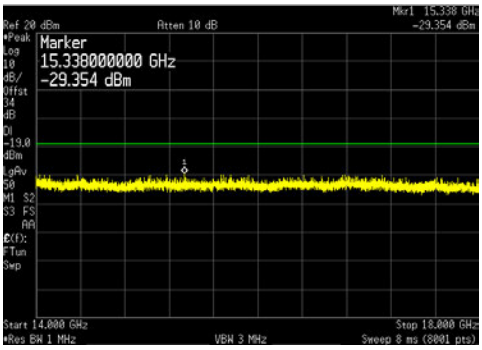
6GHz to 10GHz



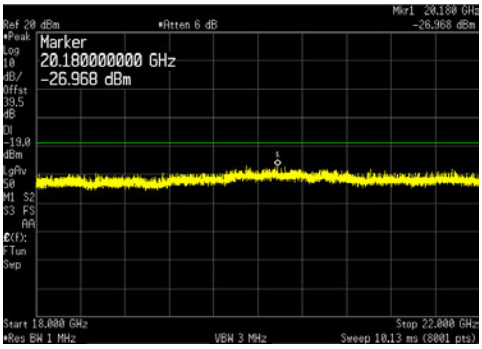
10GHz to 14GHz



14GHz to 18GHz

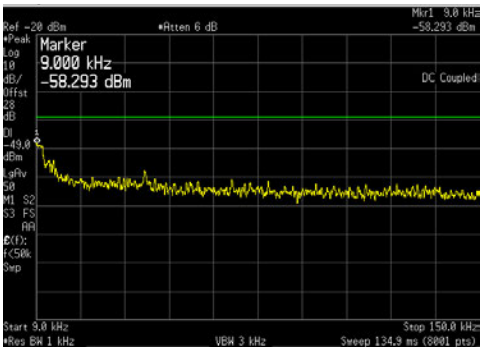


18GHz to 22GHz

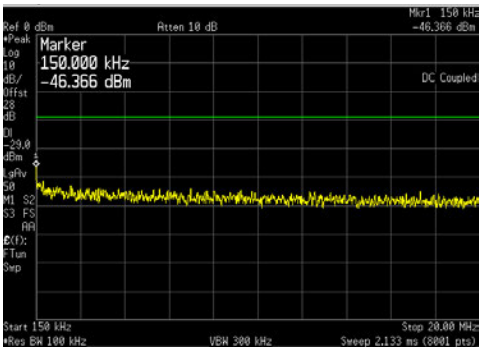


LTE20 Channel Bandwidth _ QPSK _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

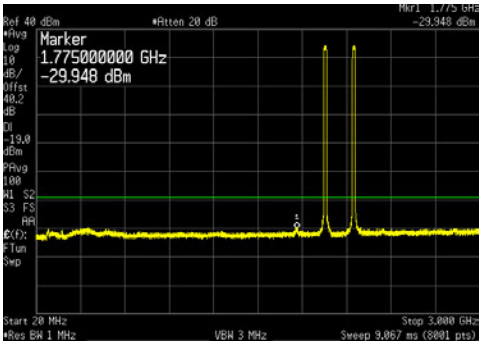
9kHz to 150kHz



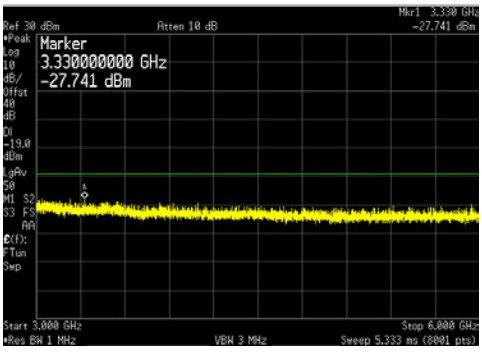
150kHz to 20MHz



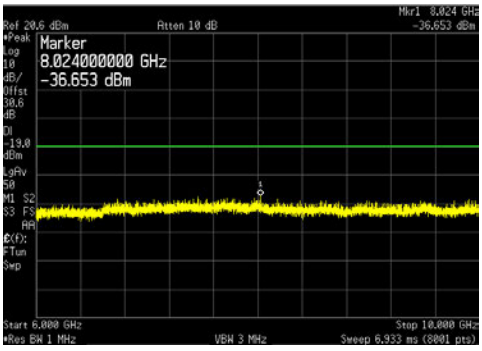
20MHz to 3GHz



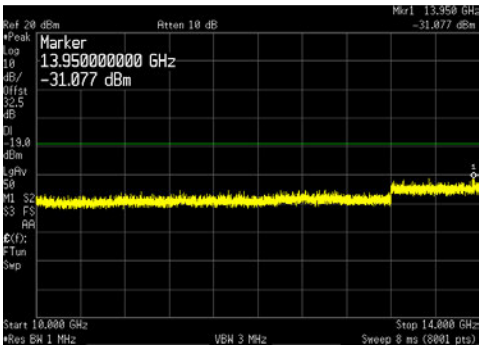
3GHz to 6GHz



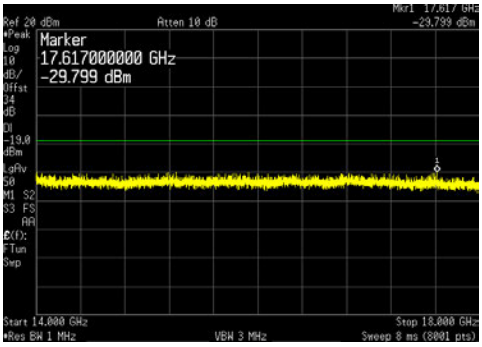
6GHz to 10GHz



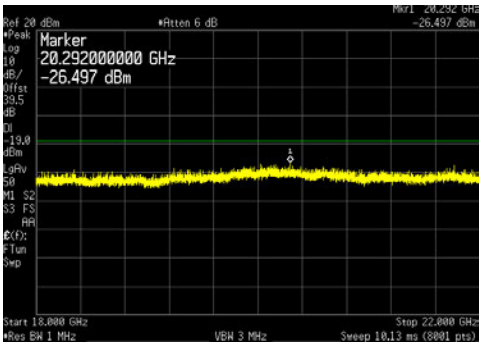
10GHz to 14GHz



14GHz to 18GHz

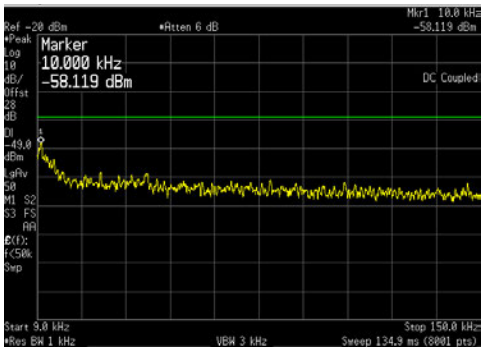


18GHz to 22GHz

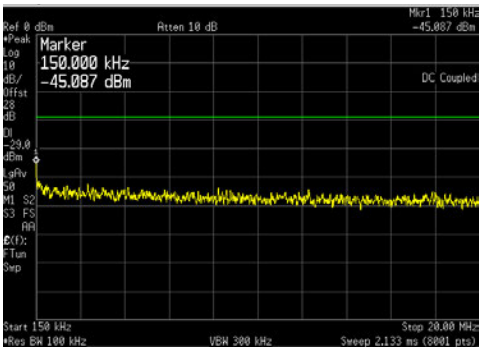


LTE20 Channel Bandwidth _ 16QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

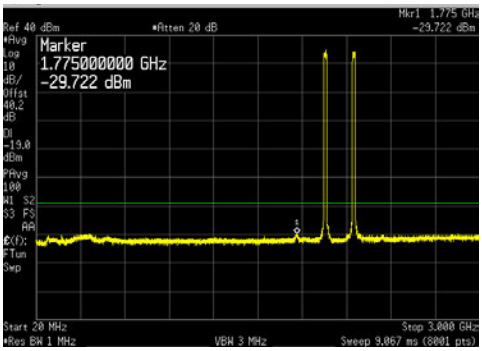
9kHz to 150kHz



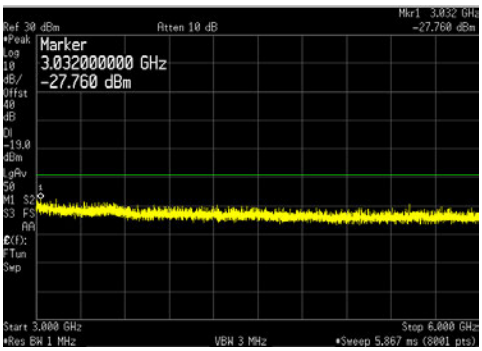
150kHz to 20MHz



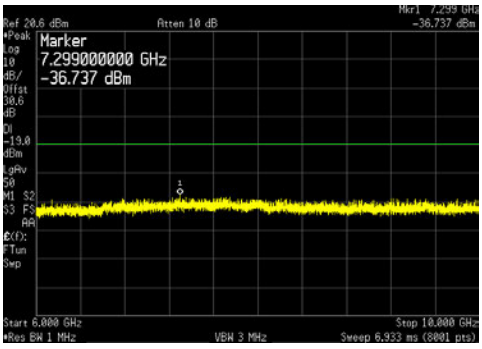
20MHz to 3GHz



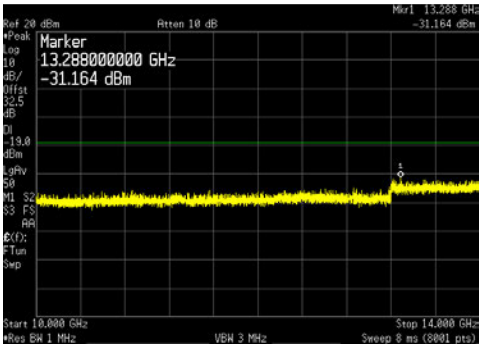
3GHz to 6GHz



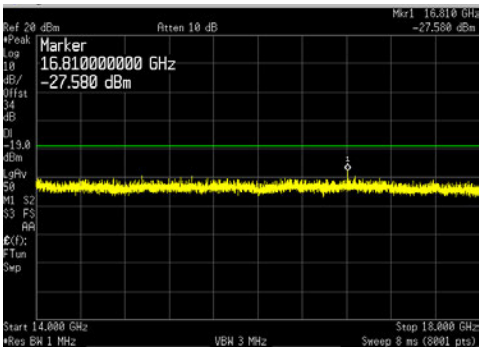
6GHz to 10GHz



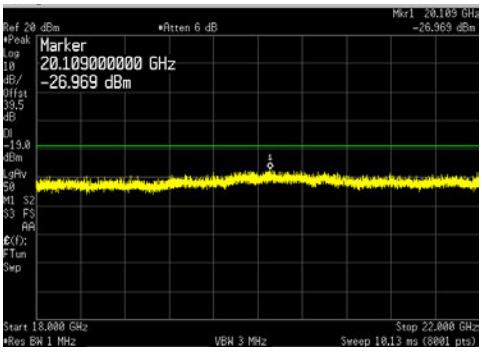
10GHz to 14GHz



14GHz to 18GHz

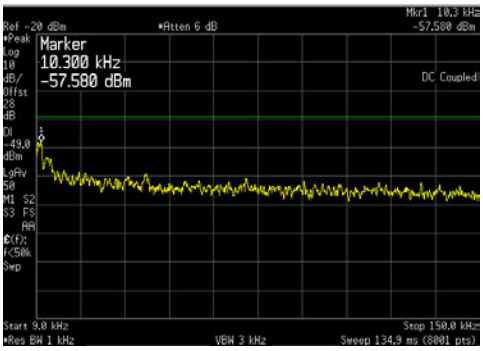


18GHz to 22GHz

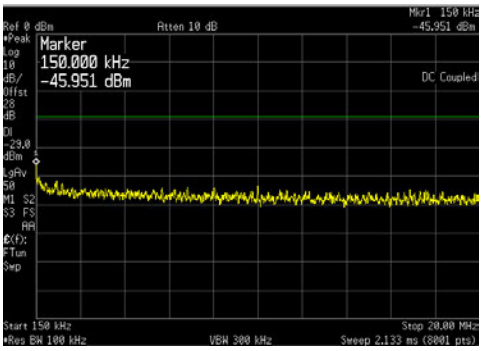


LTE20 Channel Bandwidth _ 64QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

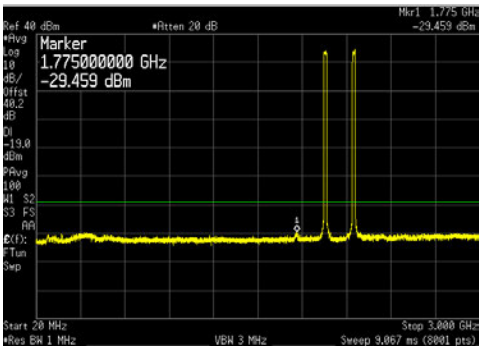
9kHz to 150kHz



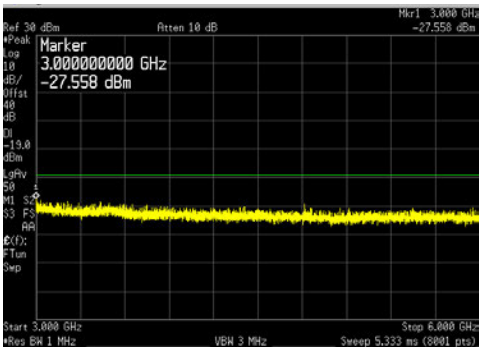
150kHz to 20MHz



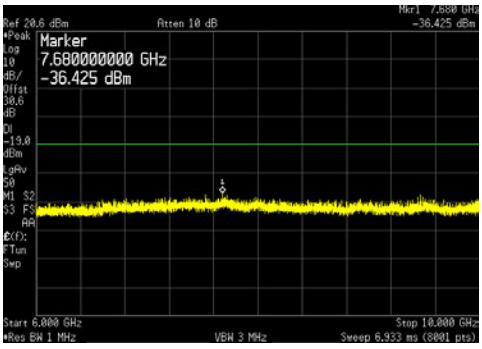
20MHz to 3GHz



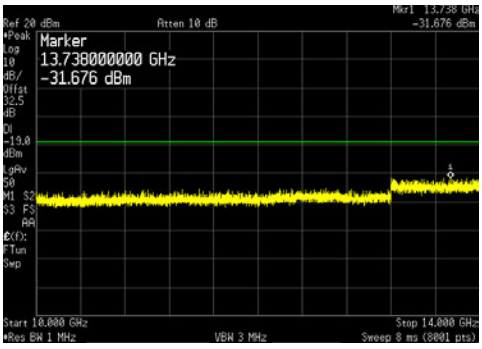
3GHz to 6GHz



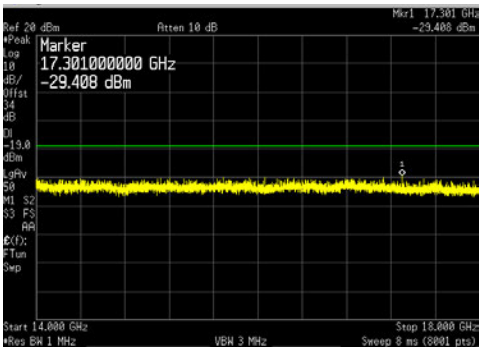
6GHz to 10GHz



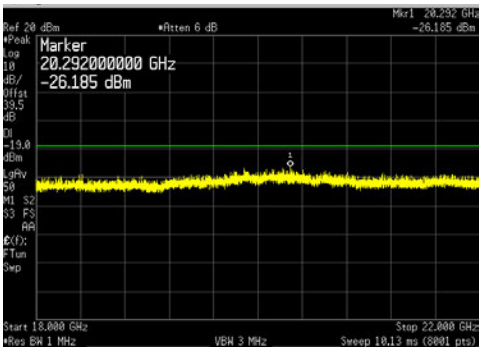
10GHz to 14GHz



14GHz to 18GHz

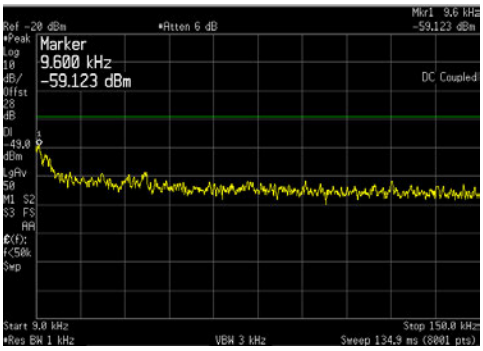


18GHz to 22GHz

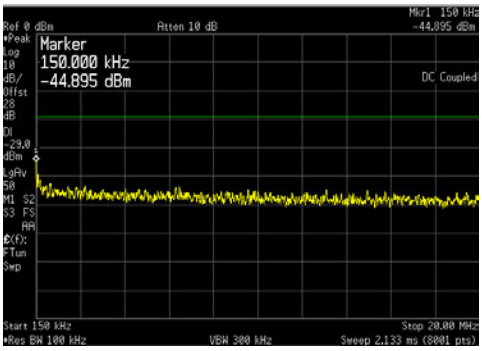


LTE20 Channel Bandwidth _ 256QAM _ Middle Channels (1962.5MHz and 2155MHz) Simultaneously:

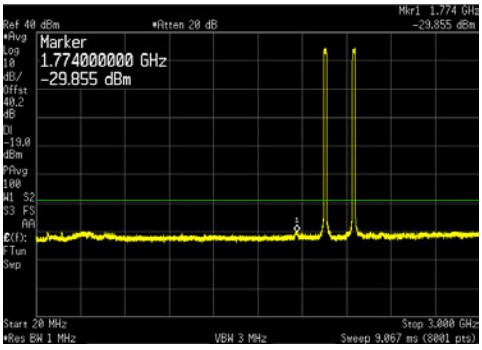
9kHz to 150kHz



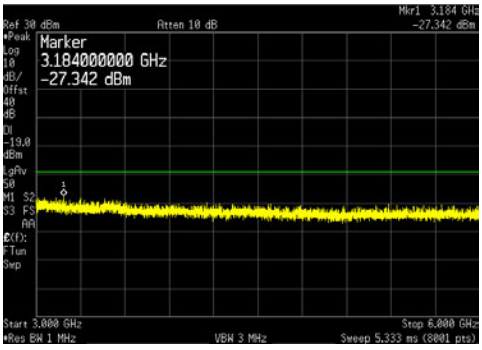
150kHz to 20MHz



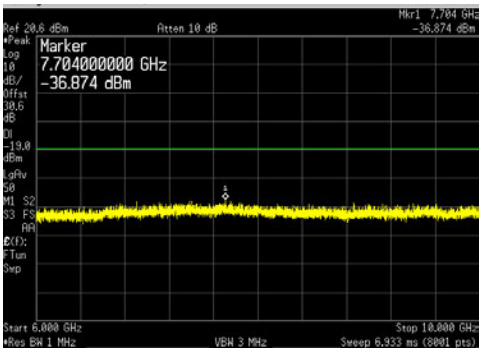
20MHz to 3GHz



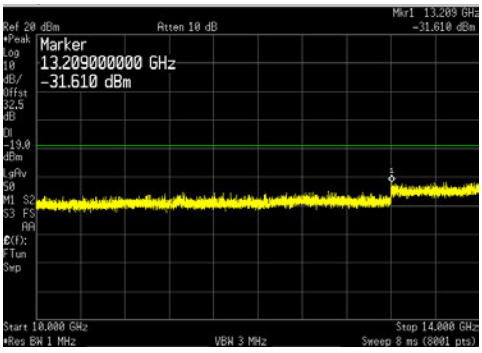
3GHz to 6GHz



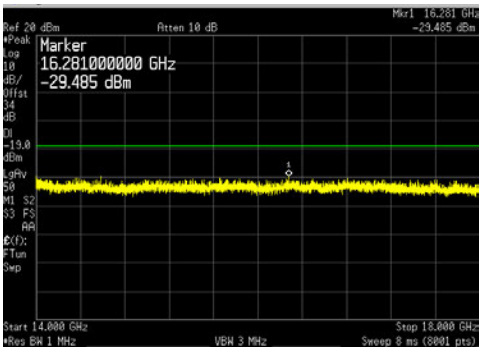
6GHz to 10GHz



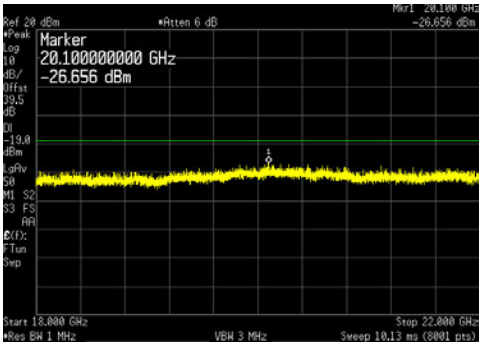
10GHz to 14GHz



14GHz to 18GHz

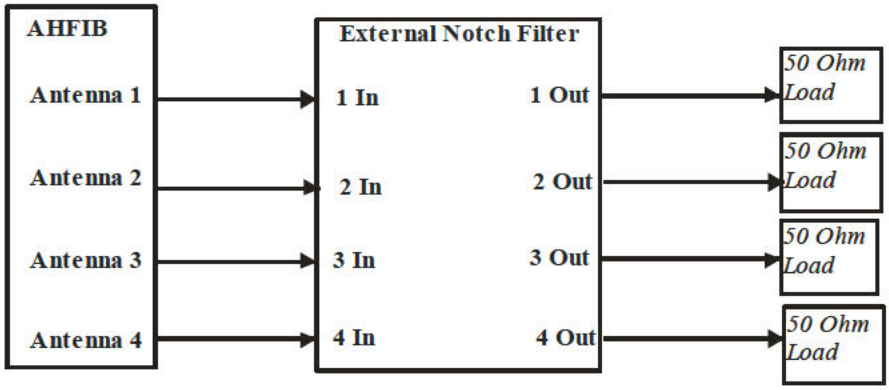


18GHz to 22GHz



Transmitter Radiated Spurious Emissions

During radiated emission testing all antenna ports of the base station were terminated with 50ohm termination blocks via the external RF notch filter as shown in the diagram below.



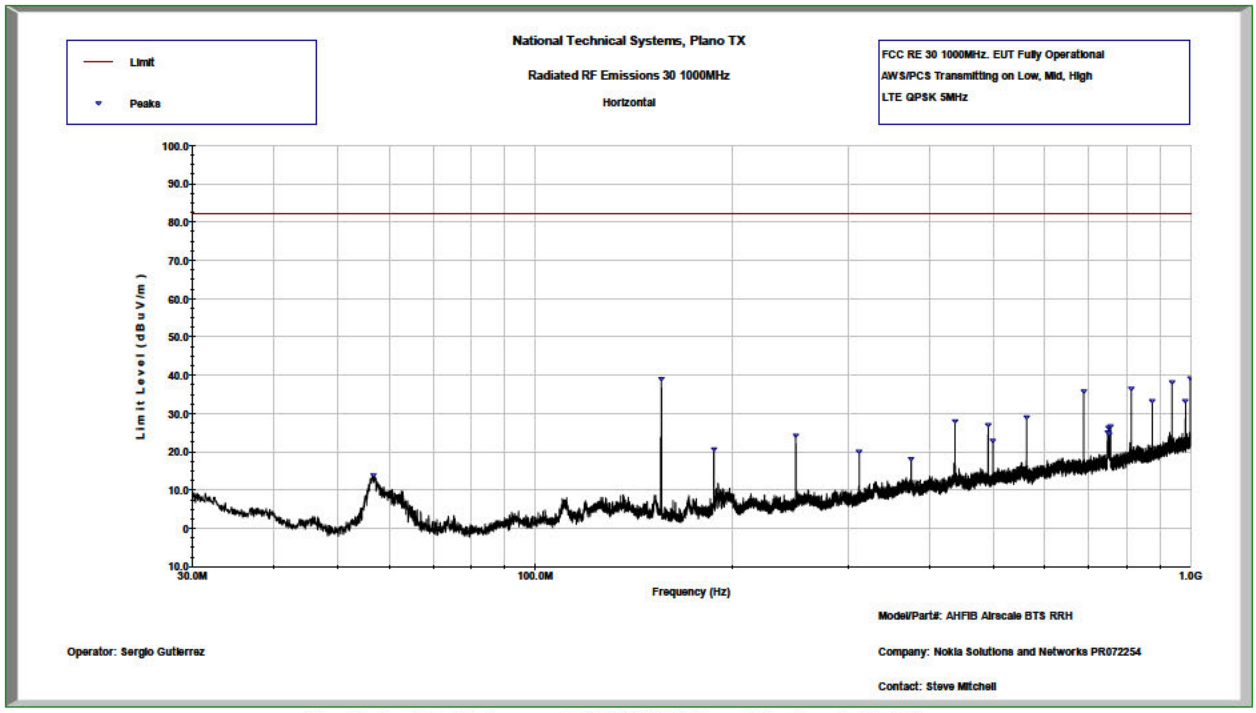
Based on antenna port conducted spurious emissions tests results, preliminary scans for radiated spurious emissions were performed in 30MHz – 22GHz frequency range. One radiated emission test configuration (with the external notch filter and cooling fan) was used to prove compliance for both the AWS and PCS frequency bands. The 3GPP Band 25 and the 3GPP Band 66 transmitters were enabled simultaneously at maximum power using QPSK modulation on all four ports for this test. The test includes channel bandwidth with the highest spectral density (LTE5) for both frequency bands. The bottom, middle and top frequency channels for each band were enabled. The carrier configuration for the radiated emission testing is provided below. Final maximized peak radiated emissions were measured in these modes.

Frequency Band	Antenna Port	RF Bandwidth	EARFCN	Transmit Frequency
PCS	1	5 MHz	8065 (Bottom Channel)	1932.5 MHz
PCS	2	5 MHz	8365 (Middle Channel)	1962.5 MHz
PCS	3	5 MHz	8365 (Middle Channel)	1962.5 MHz
PCS	4	5 MHz	8665 (Top Channel)	1992.5 MHz
AWS	1	5 MHz	66461 (Bottom Channel)	2112.5 MHz
AWS	2	5 MHz	66886 (Middle Channel)	2155.0 MHz
AWS	3	5 MHz	66886 (Middle Channel)	2155.0 MHz
AWS	4	5 MHz	67261 (Top Channel with NF)	2192.5 MHz

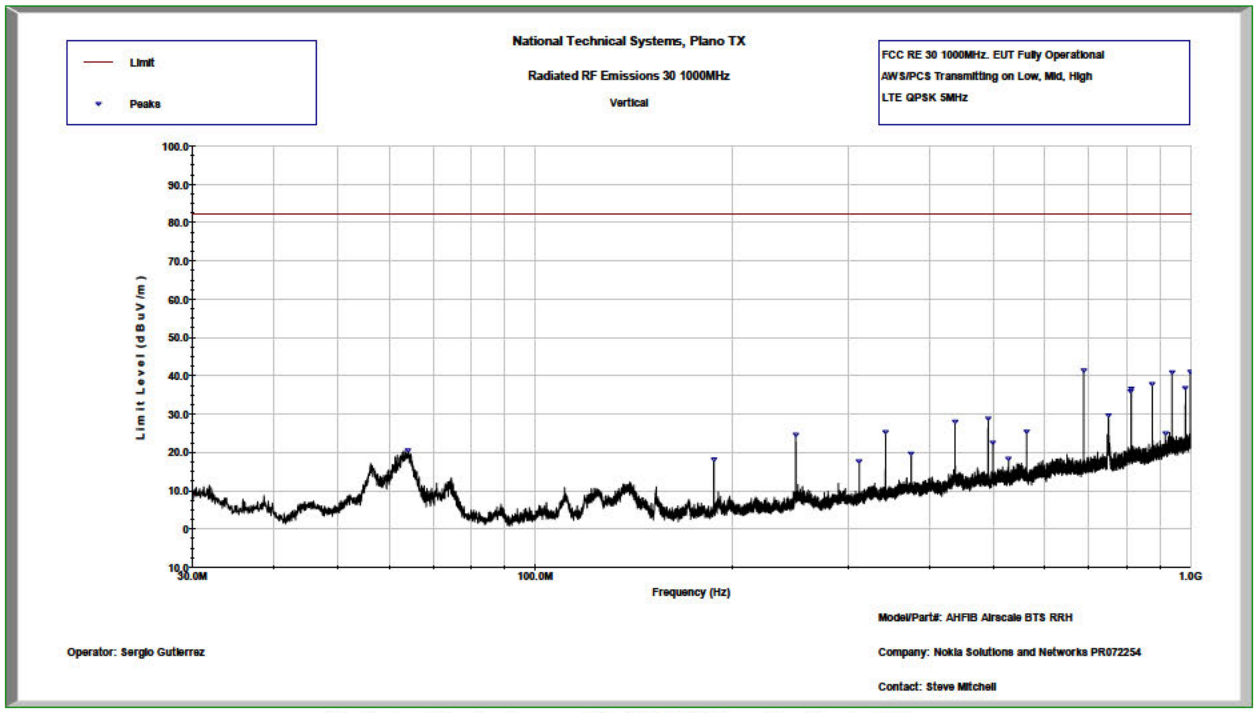
RE Data

Frequency	Peaks Raw	Polarity	Antenna	Pre Amp	Cableloss	Peaks	Limit	Margin	Tower	Turntable
MHz	dBuV/m	V/H	dB	dB	dB	dBuV/m	dBuV/m	dB	cm	Degrees
4224.86	52.876	V	32.083	-31.948	4.353	57.364	82.2	-24.836	99.9	0
18719.8	71.154	V	44.715	-46.421	-3.921	65.527	91.7	-26.173	100	0.9
18587.78	71.064	H	44.82	-46.676	-3.938	65.27	91.7	-26.43	100	287.9
20198.87	51.965	H	44.61	-28.043	-3.777	64.755	91.7	-26.945	100	360.1
8943.59	40.741	V	37.817	-31.636	8.031	54.953	82.2	-27.247	97.9	0.8
18723.7	69.681	V	44.717	-46.405	-3.92	64.073	91.7	-27.627	100	154.1
20170.7	52.21	V	44.616	-29.111	-3.779	63.936	91.7	-27.764	100	-0.1
17942.45	39.116	H	46.3	-28.872	6.852	63.396	91.7	-28.304	199.1	0
18730.28	68.787	V	44.72	-46.379	-3.919	63.209	91.7	-28.491	100	-0.1
17932.4	37.823	V	46.257	-28.863	6.851	62.068	91.7	-29.632	199.1	0
9991.16	36.687	H	38.29	-30.88	8.465	52.562	82.2	-29.638	200	360
8797.91	37.996	H	37.764	-31.219	7.496	52.037	82.2	-30.163	99.9	360
9656.96	38.638	V	37.861	-32.07	7.116	51.545	82.2	-30.655	97	0
18502.27	66.38	V	44.821	-46.505	-3.95	60.746	91.7	-30.954	100	167
4224.71	46.421	H	32.083	-31.948	4.352	50.908	82.2	-31.292	128.9	293.8
5898.4	41.568	V	34.161	-31.827	6.465	50.367	82.2	-31.833	98.8	159.1
14232.45	39.974	V	41.877	-29.315	6.115	58.651	91.7	-33.049	199.9	0
18893.09	63.371	H	44.855	-45.728	-3.896	58.602	91.7	-33.098	100	211.8
7269.82	37.072	H	36.41	-31.5	6.609	48.591	82.2	-33.609	100.2	360
14250.72	38.826	H	41.867	-29.27	6.133	57.556	91.7	-34.144	199.1	0
18724.41	63.074	H	44.717	-46.402	-3.92	57.469	91.7	-34.231	100	360.2
18745.88	62.745	V	44.726	-46.316	-3.917	57.238	91.7	-34.462	100	132.9
3931.97	42.381	V	32.58	-32.199	4.966	47.728	82.2	-34.472	100.2	0
17054.37	38.145	V	41.848	-29.507	6.685	57.171	91.7	-34.529	199.1	-0.1
2949.07	47.045	V	29.587	-33.732	4.173	47.073	82.2	-35.127	100.1	0
18889.83	61.256	H	44.851	-45.741	-3.897	56.469	91.7	-35.231	100	360
2948.93	46.512	H	29.586	-33.733	4.173	46.538	82.2	-35.662	148.1	49.2
13255.31	37.31	V	41.342	-28.284	5.662	56.03	91.7	-35.67	200.1	0.9
14966.04	38.694	H	39.989	-29.199	6.172	55.656	91.7	-36.044	199.1	0
14847.71	38.619	V	40.413	-29.778	6.109	55.363	91.7	-36.337	199.1	0

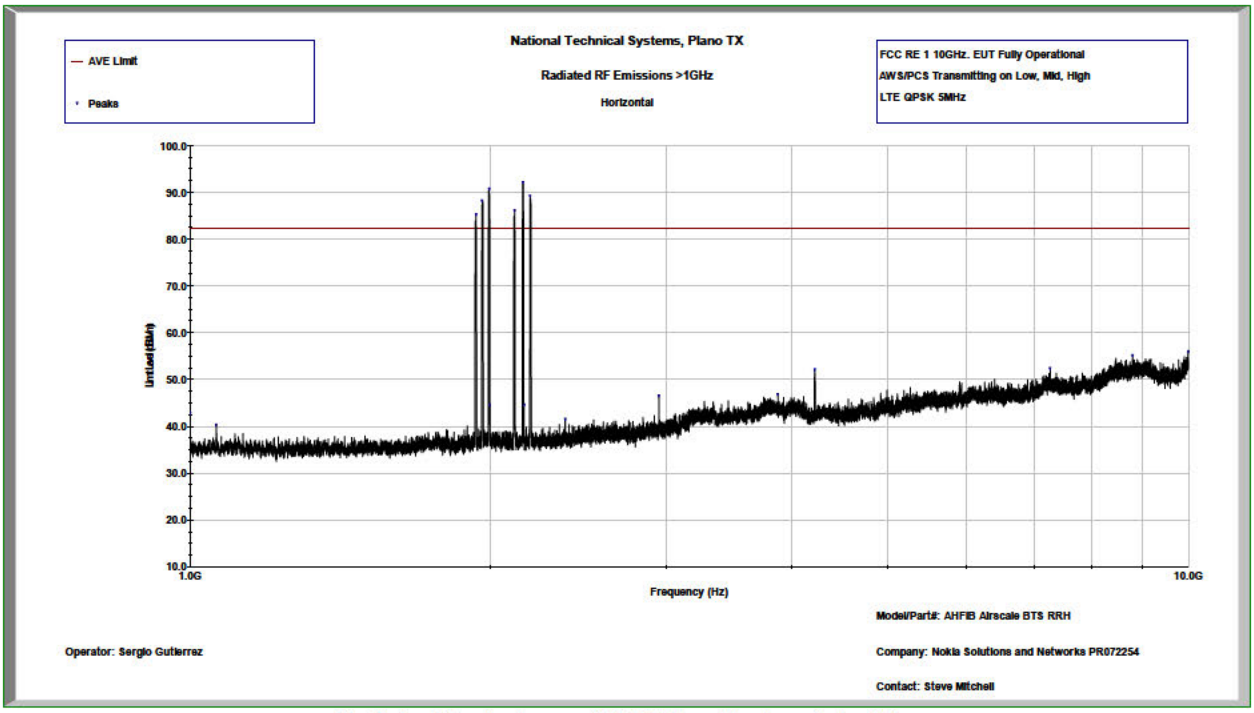
A three meter measurement distance was used for radiated emission less than 10GHz. A one meter measurement distance was used for radiated emission greater than 10GHz. The highest radiated emissions detected were more than 20dB below the three meter limit of 82.2dBuV/m and the one meter limit of 91.7dBuV/m (equivalent to -13dBm EIRP). Since all maximized measurements were more than 20dB below these levels, substitution measurements were not performed. TILE software was used for all preliminary scans and plots that are included on the following pages.



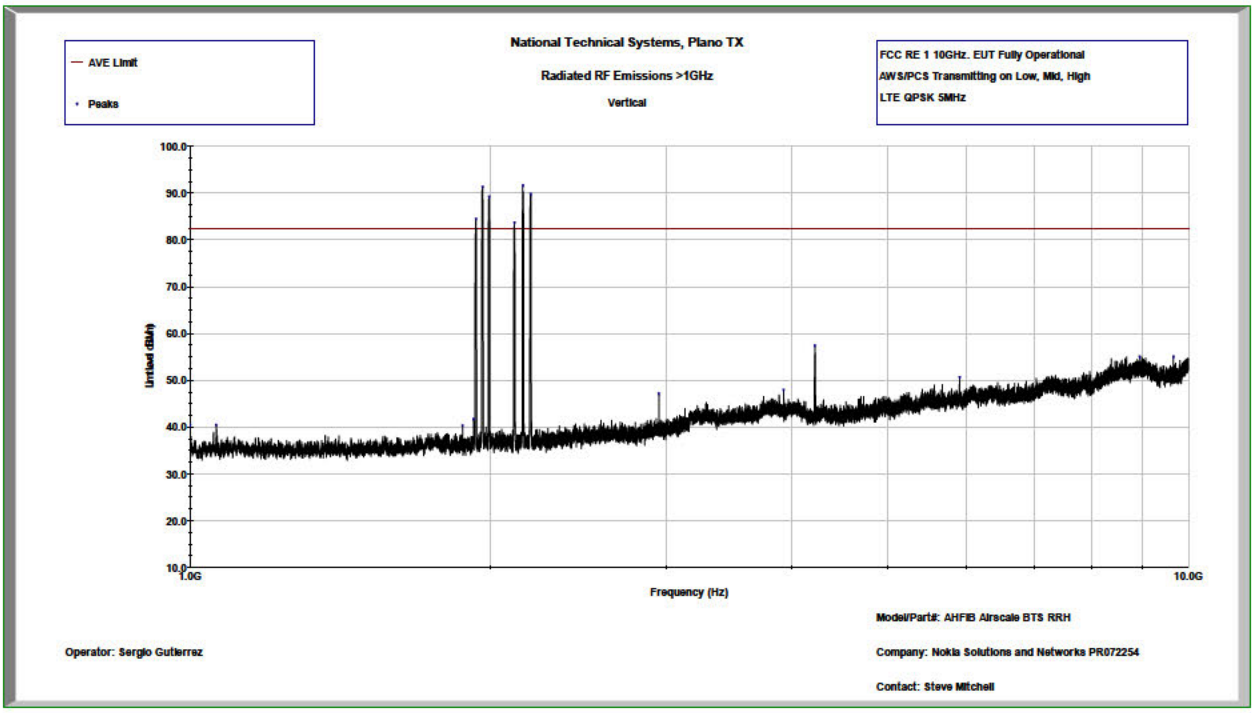
Radiated Emissions – 30-1000MHz – Horizontal at 3m



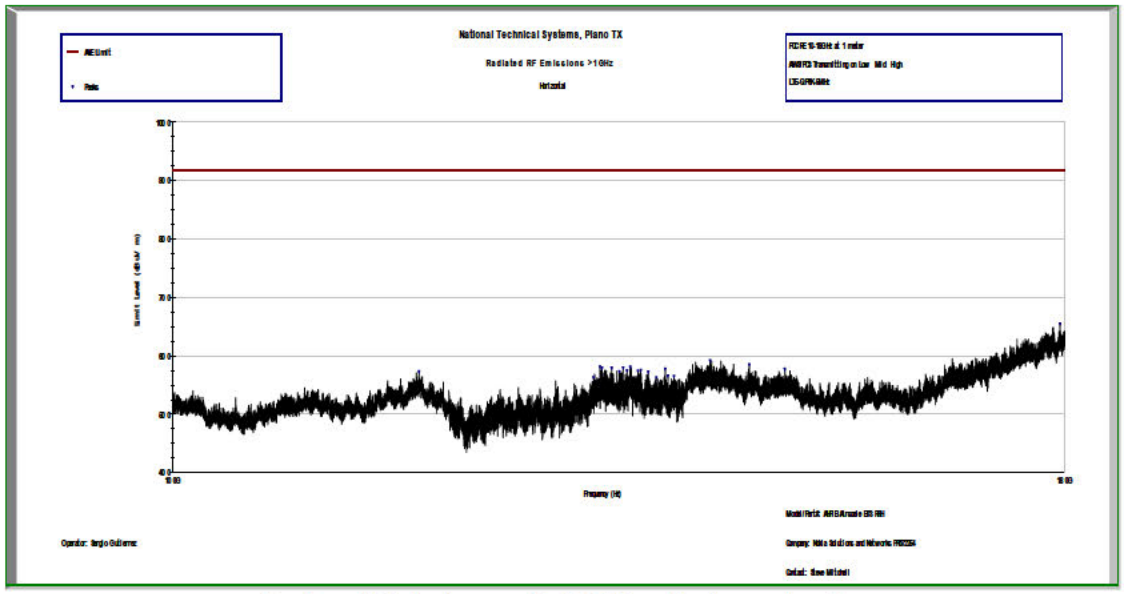
Radiated Emissions – 30-1000MHz – Vertical at 3m



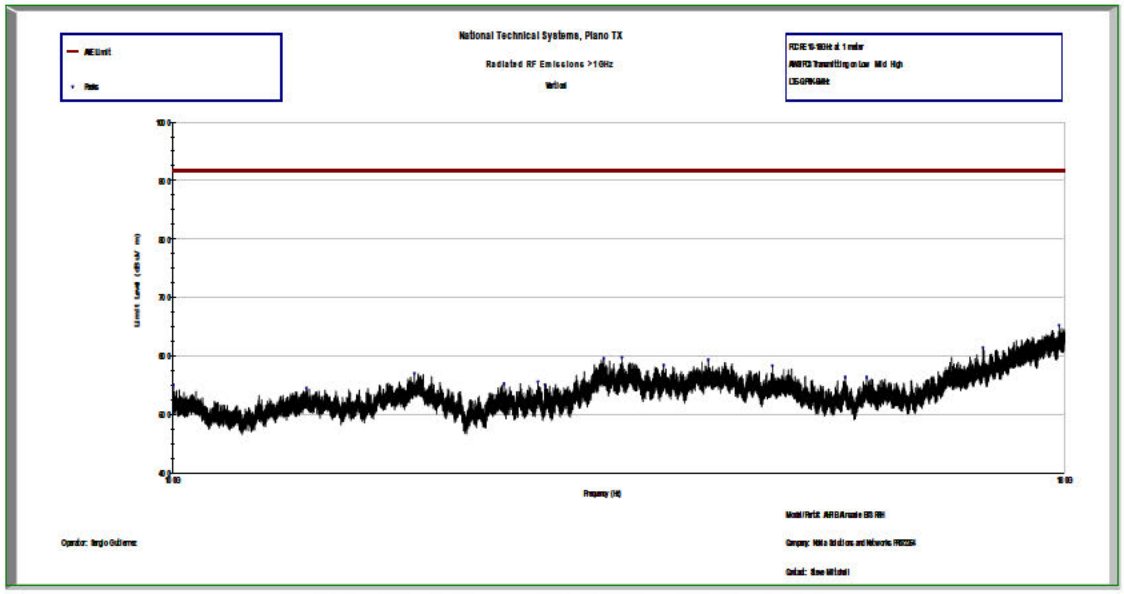
Radiated Emissions – 1-10GHz – Horizontal at 3m



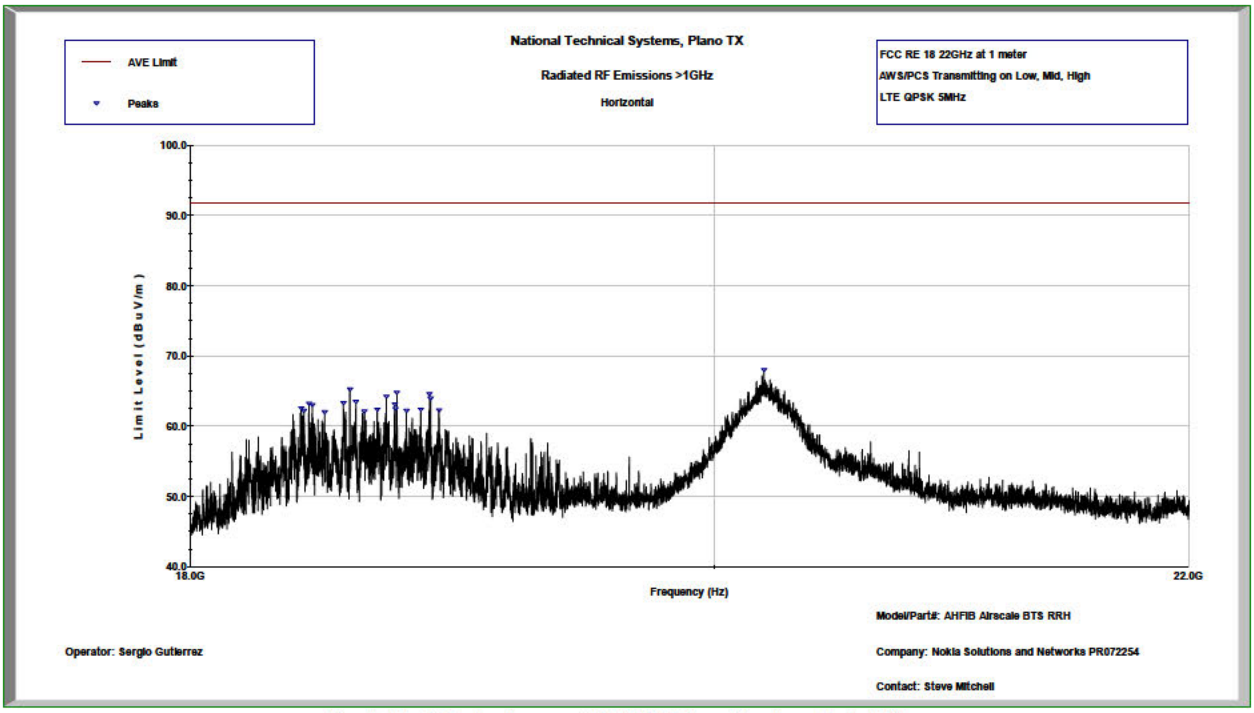
Radiated Emissions – 1-10GHz – Vertical at 3m



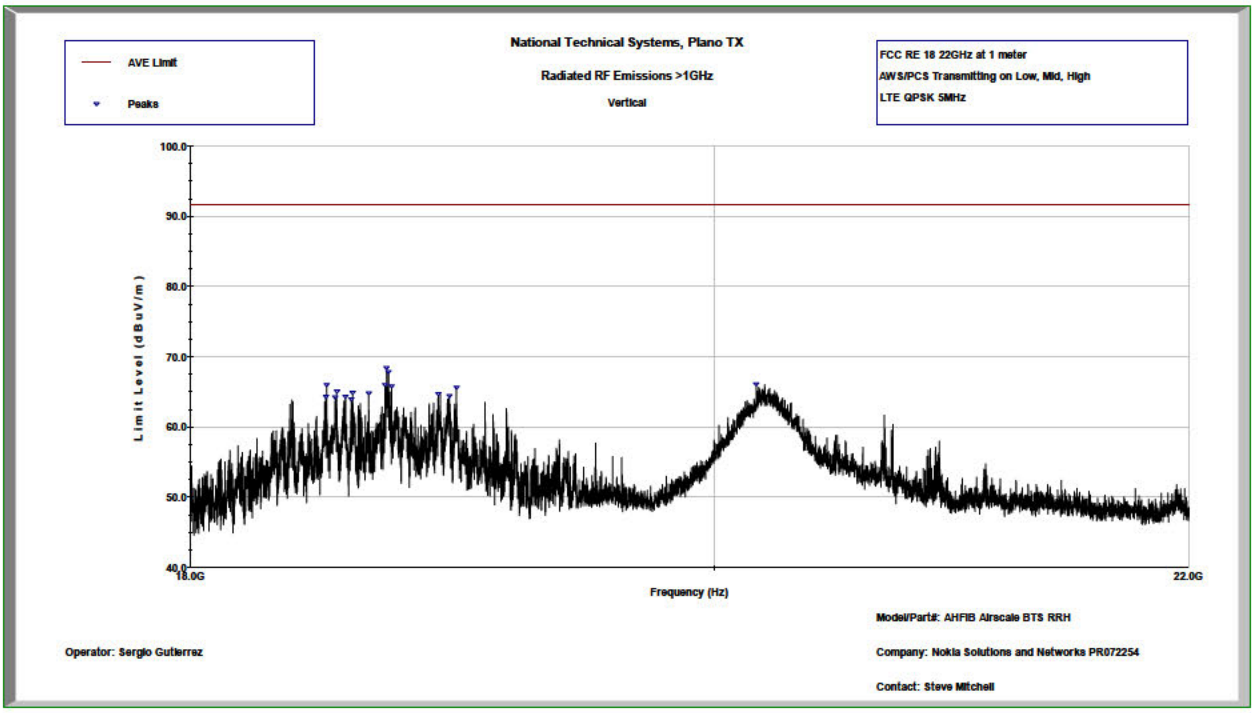
Radiated Emissions – 10-18GHz – Horizontal at 1m



Radiated Emissions – 10-18GHz – Vertical at 1m



Radiated Emissions – 18-22GHz – Horizontal at 1m



Radiated Emissions – 18-22GHz - Vertical at 1m

Frequency Stability/Accuracy

Carrier frequency stability at extreme temperatures and voltages, frequency error was measured as follows:

(1) Transmitting in 5MHz-QPSK-LTE mode at center channel (1962.5MHz) on port 2.
(2) The EUT temperature was stabilized at each temperature step (for a minimum of 30 minutes) prior to frequency accuracy measurement.

Nominal operating voltage of the product is declared as 48VDC.

Frequency error results are listed below for extreme voltages and temperatures.

Extreme Voltages:

Percentage of Rated Supply	DC Voltage (VDC)	Frequency Error (Hz) at 20°C
85%	40.8	0.029
100%	48.0	0.042
115%	55.2	0.104

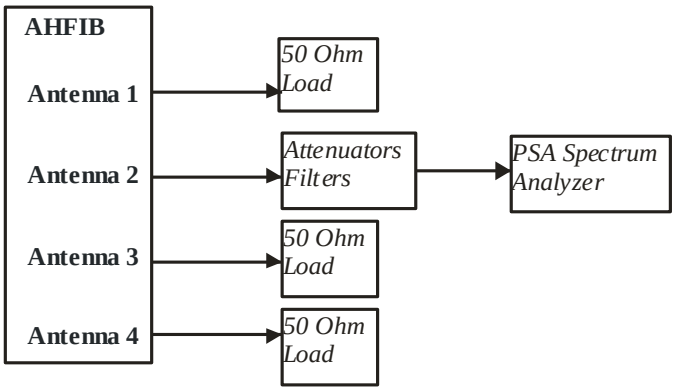
Extreme Temperatures:

Temperature	Frequency Error (Hz) at 48VDC
-30 °C	2.731
-20 °C	3.146
-10 °C	**3.274**
0 °C	2.782
10 °C	2.387
20 °C	0.042
30 °C	0.088
40 °C	0.121
50 °C	0.126

Based on the results above, highest recorded frequency error (3.274Hz or 0.0017ppm) ensures that the transmitted signal remains in its authorized frequency block at extreme voltages and temperatures. The results above are deemed sufficient to demonstrate carrier frequency stability for all other channel bandwidth modes and modulations since all carriers are controlled by the same frequency stabilization circuitry that was subjected to the extreme conditions under this test.

APPENDIX B: ANTENNA PORT TEST DATA FOR THE AWS BAND W/O NOTCH FILTER

All conducted RF measurements for this test effort in this section were made at AHFIB antenna ports for the AWS band measurements. Antenna port RF conducted measurements in this section were made without the external notch filter. The test setup used is provided below.



Test Setup Used for Conducted RF Measurements on AHFIB without External Notch Filter

RF Output Power

RF output power has been measured in both Peak and RMS Average terms for each AWS transmit chain at the middle channel for 256QAM modulation and LTE5 bandwidth. Peak to average power ratio (PAPR) has been calculated as described in Section 5.7.2 of KDB971168 D01 v02r02 and all results are presented in tabular form below.

Antenna	LTE Bandwidth	LTE - 256QAM		
		Peak (dBm)	Average (dBm)	PAPR (dB)
Port 1 Middle Channel	5M	53.59	45.67	7.92
Port 2 Middle Channel	5M	53.65	45.77	7.88
Port 3 Middle Channel	5M	53.65	45.78	7.87
Port 4 Middle Channel	5M	53.69	45.80	7.89

The variation in RMS output power levels between the antenna ports is 0.13 dB per data sample provided above. Pre-compliance testing (and testing of similar EUTs) shows that the output power variation between antenna ports is small (the output ports are essentially electrically identical).

Pre-compliance testing has shown that the output power variation between modulation types is small. Antenna port 2 power output measurements for the LTE5 bandwidth for all modulation types on the middle (center) channel are provided below.

	Modulation Type							
	QPSK		16QAM		64QAM		256QAM	
	Peak (dBm)	Ave (dBm)	Peak (dBm)	Ave (dBm)	Peak (dBm)	Ave (dBm)	Peak (dBm)	Ave (dBm)
Antenna Port 2 Middle Channel LTE5	53.64	45.77	53.60	45.83	53.70	45.80	53.70	45.78

The output power variation between modulation types is small in this measurement snapshot (and from past efforts on similar hardware as well). The variation of average power output versus modulation type is 0.06dB for the data snapshot provided. The variation of peak power output versus modulation type is 0.10dB for the data snapshot provided. All power measurements in this report (except the sample test noted above) were performed with the EUT operating with 256QAM modulation.

Based on the AWS band results above and the PCS band power output, Port 2 had the highest combined RMS average power (for the AWS + PCS band) and therefore it was selected for all the remaining antenna port tests.
Subsequently output power levels on bottom, middle, and top channels in all 4 LTE channel bandwidths and 256QAM modulation type were tested only at Port 2 and the results presented below. The highest measured values are highlighted.

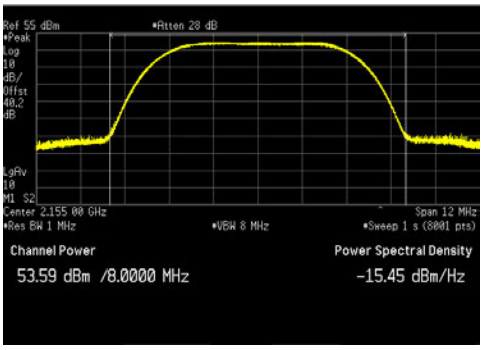
Antenna LTE Channel	LTE Bandwidth	LTE - 256QAM		
		Peak (dBm)	Average (dBm)	PAPR (dB)
Port 2 Bottom Channel	5M	53.63	45.75	7.88
	10M	53.92	45.85	8.07
	15M	**53.96**	**45.91**	8.05
	20M	53.91	45.85	8.06
Port 2 Middle Channel	5M	53.65	45.77	7.88
	10M	53.84	45.82	8.02
	15M	53.84	45.84	8.00
	20M	53.91	45.78	**8.13**
Port 2 Top Channel	5M	53.68	45.78	7.90
	10M	53.84	45.84	8.00
	15M	53.87	45.85	8.02
	20M	53.92	45.90	8.02

The data provided in the table shows (and testing of similar EUTs) that the output RMS power variation between channel bandwidths at the center frequency channel is small (0.07dB).

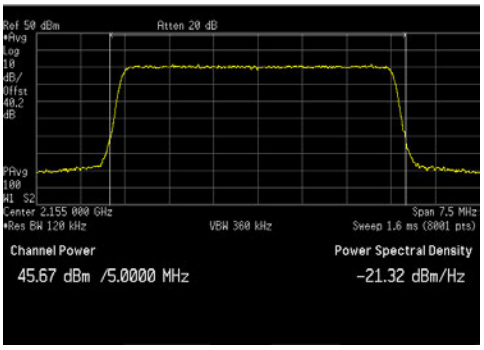
All measurement results are provided in the following pages. The total measurement RF path loss of the test setup (attenuator and test cables) was 40.2 dB and is accounted for by the spectrum analyzer reference level offset.

LTE5 Channel Power Plots at Middle Channel and 256QAM Modulation:

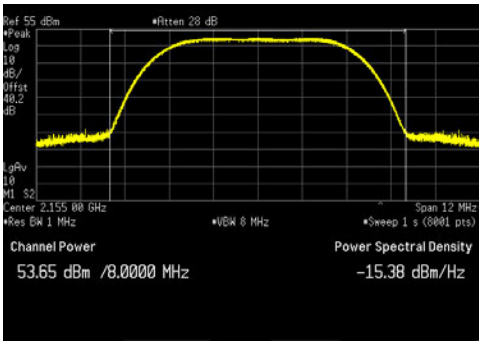
Port 1 - LTE5_ Middle Channel_Peak



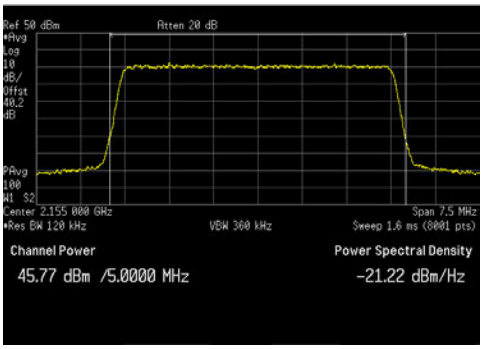
Port 1 - LTE5_ Middle Channel_Average



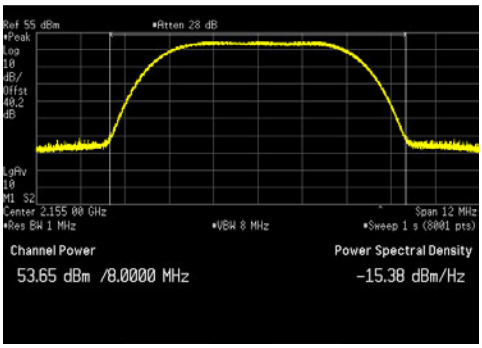
Port 2 - LTE5_Middle Channel_Peak



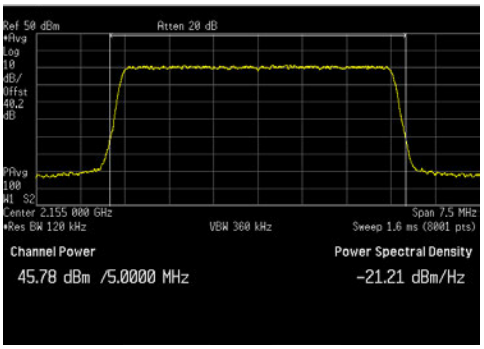
Port 2 - LTE5_Middle Channel_Average



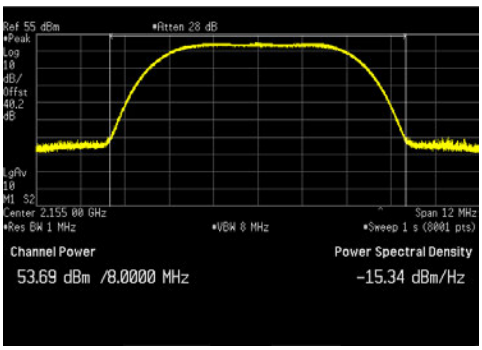
Port 3 - LTE5_ Middle Channel_Peak



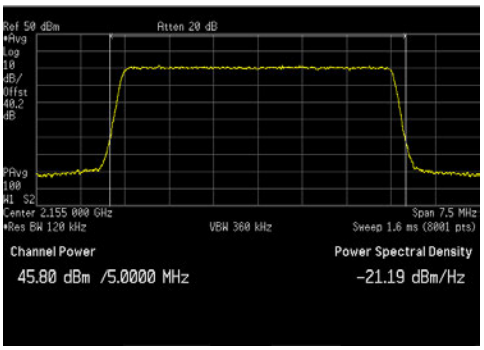
Port 3 - LTE5_ Middle Channel_Average



Port 4 - LTE5_ Middle Channel_Peak

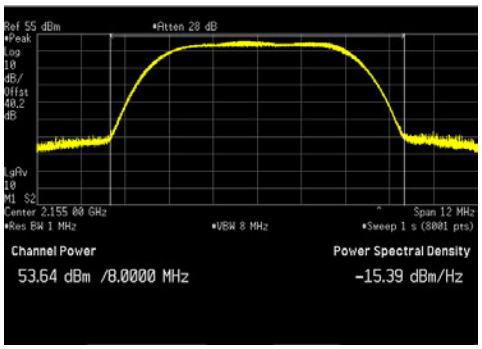


Port 4 - LTE5_ Middle Channel_Average

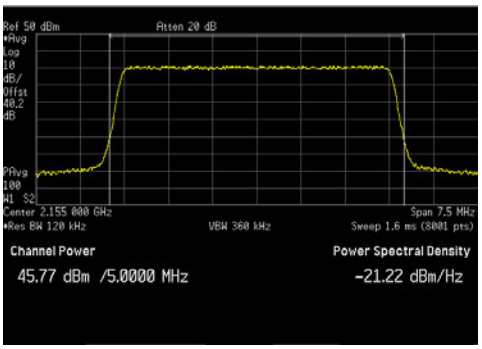


LTE5 Channel Power Plots for Antenna Port 2 at Middle Channel and all Modulation Types:

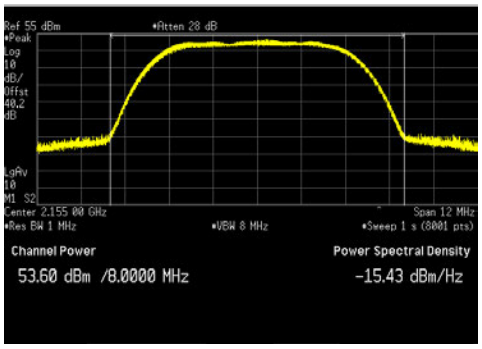
LTE5_ Middle Channel_QPSK_Peak



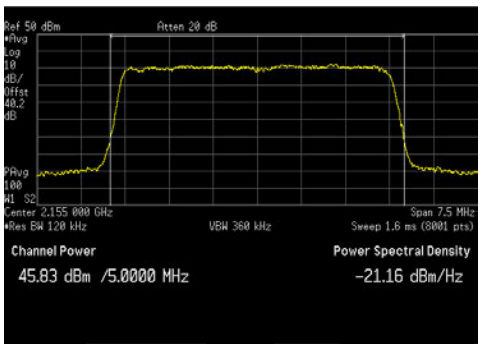
Port 1 - LTE5_ Middle Channel_QPSK_Average



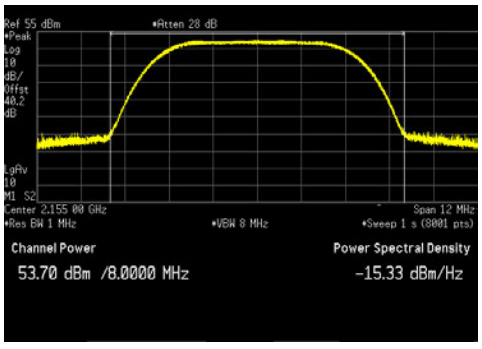
LTE5_Middle Channel_16QAM_Peak



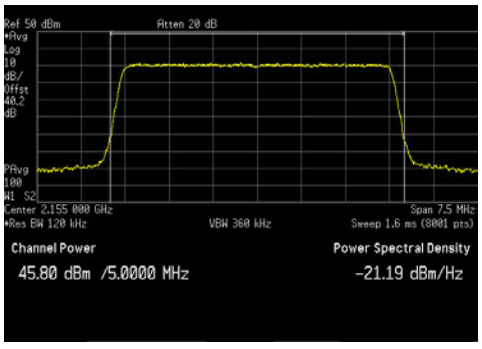
LTE5_Middle Channel_16QAM_Average



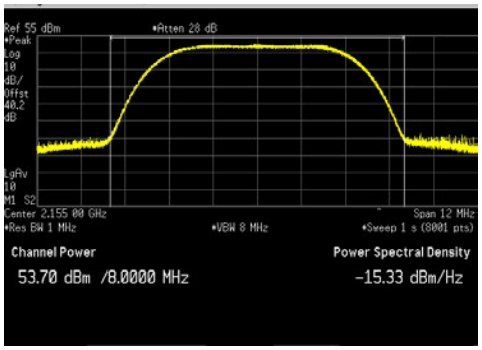
LTE5_ Middle Channel_64QAM_Peak



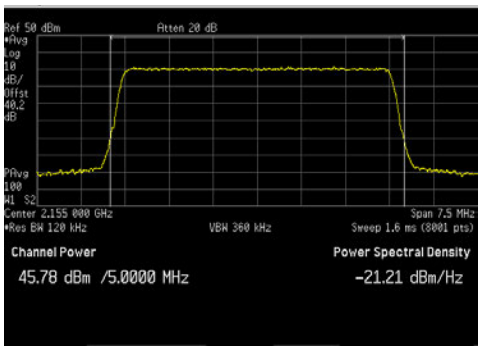
LTE5_ Middle Channel_64QAM_Average



LTE5_ Middle Channel_256QAM_Peak

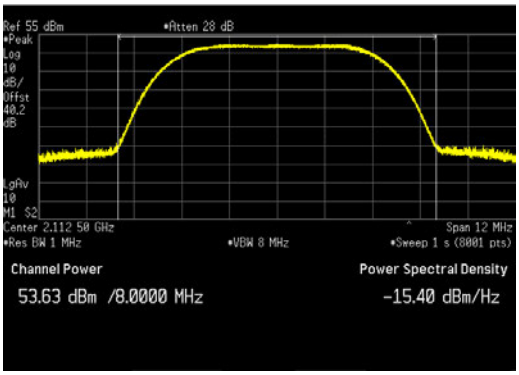


LTE5_ Middle Channel_256QAM_Average

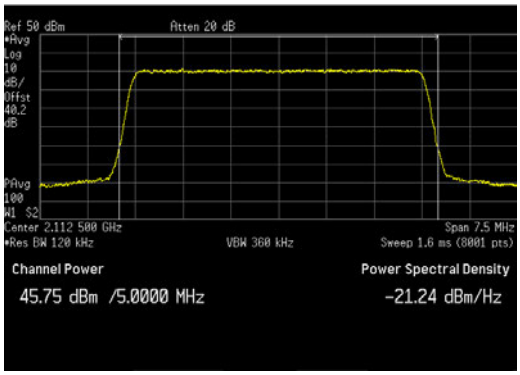


LTE5 Channel Power Plots for Antenna Port 2 and 256QAM Modulation:

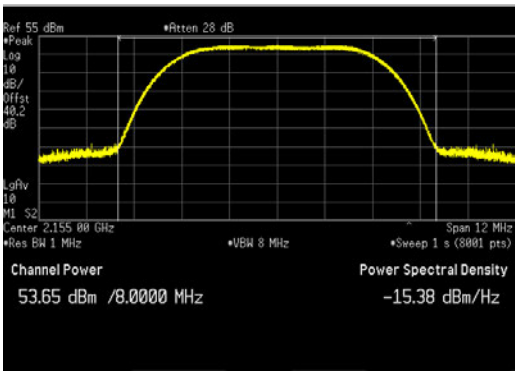
LTE5_Bottom Channel_Peak



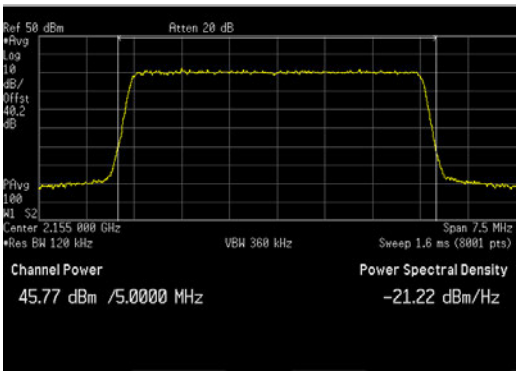
LTE5_Bottom Channel_Average



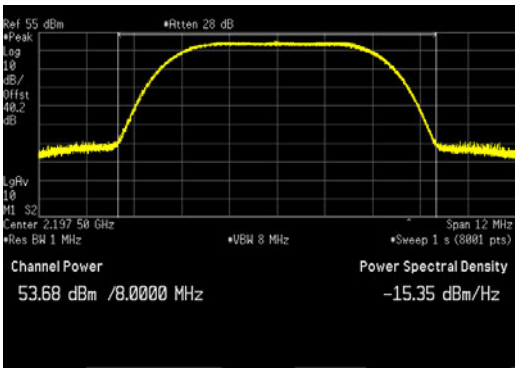
LTE5_Middle Channel_Peak



LTE5_Middle Channel_Average



LTE5_Top Channel_Peak



LTE5_Top Channel_Average