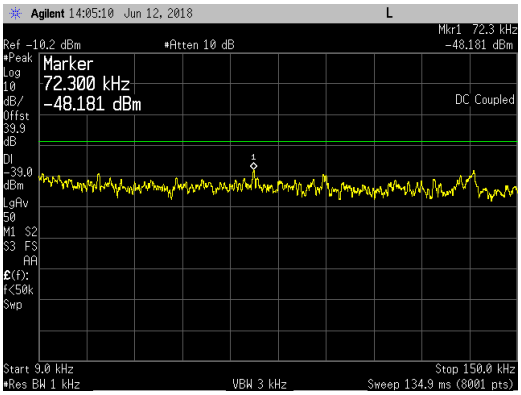
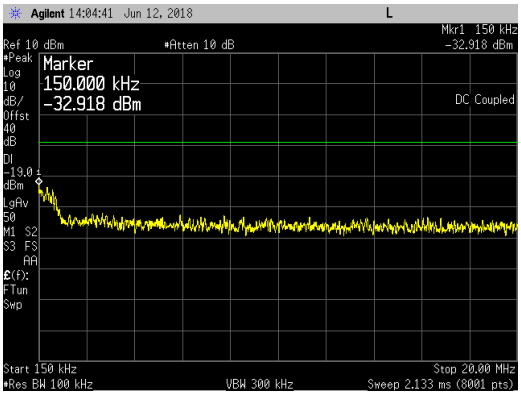
Band 5 LTE1.4 Ch BW _ 16QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

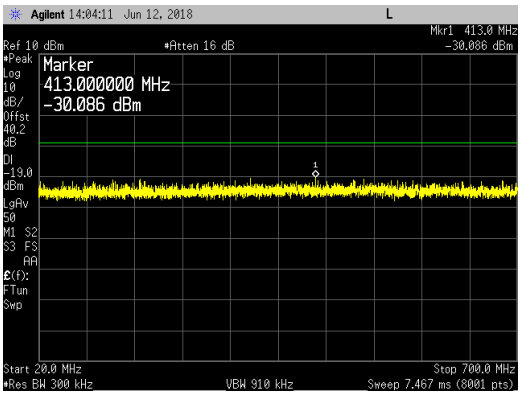
9kHz to 150kHz



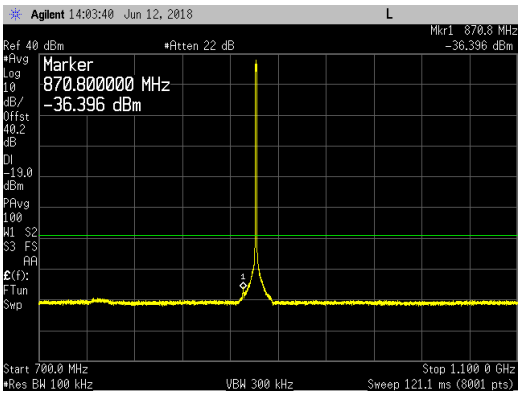
150kHz to 20MHz



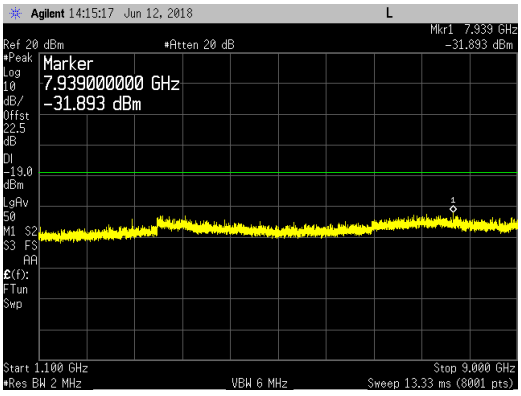
20MHz to 700MHz



700MHz to 1.1GHz

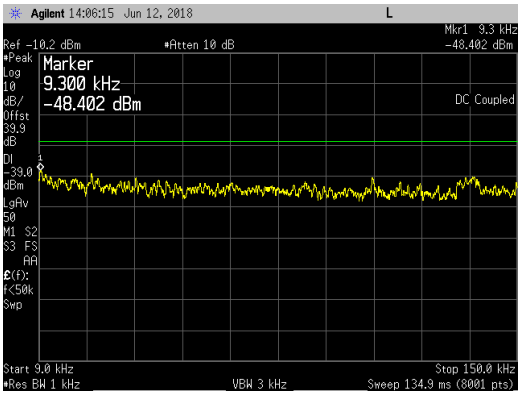


1.1GHz to 9GHz

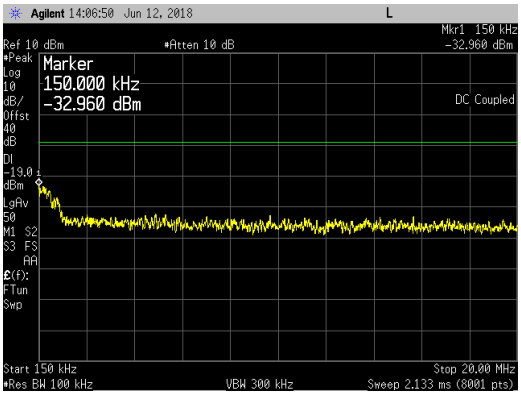


Band 5 LTE1.4 Ch BW _ 64QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

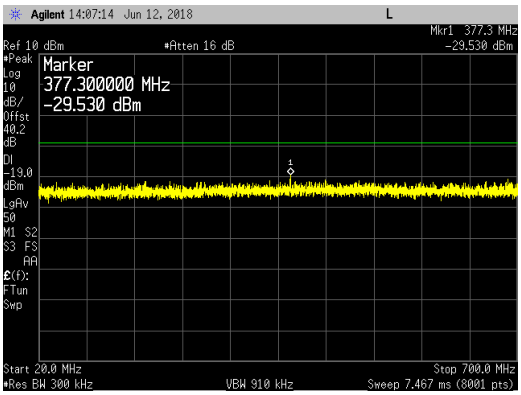
9kHz to 150kHz



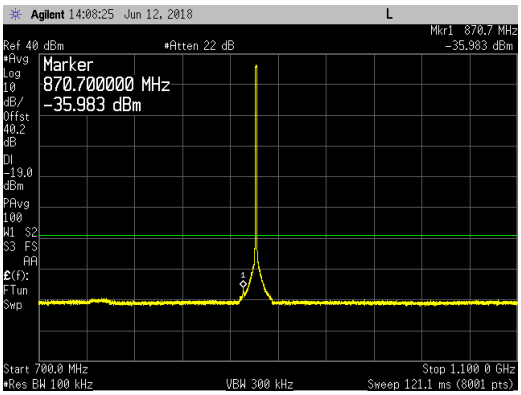
150kHz to 20MHz



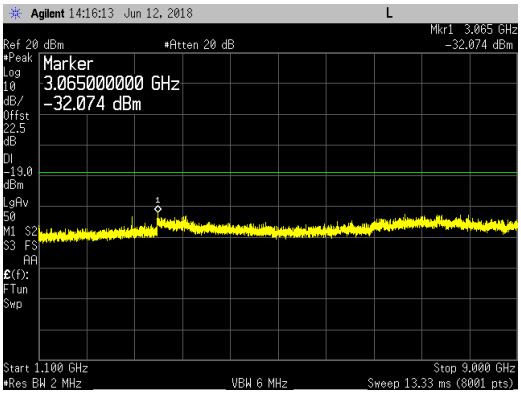
20MHz to 700MHz



700MHz to 1.1GHz

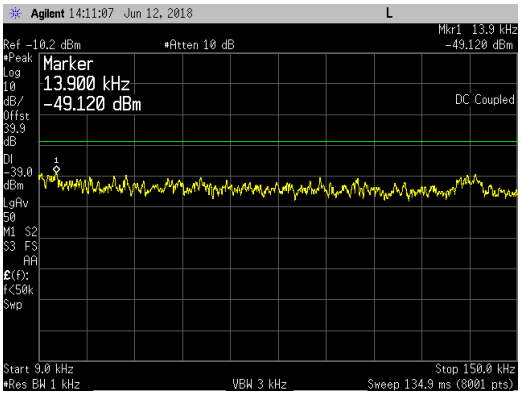


1.1GHz to 9GHz

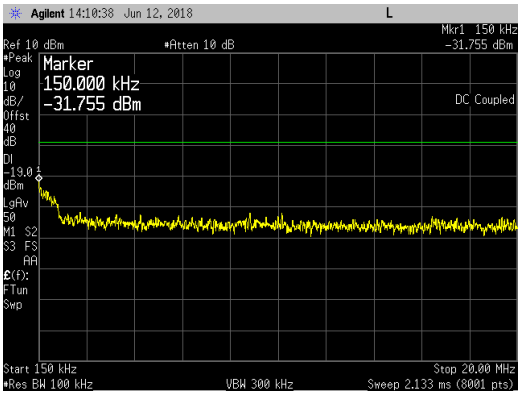


Band 5 LTE1.4 Ch BW _ 256QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

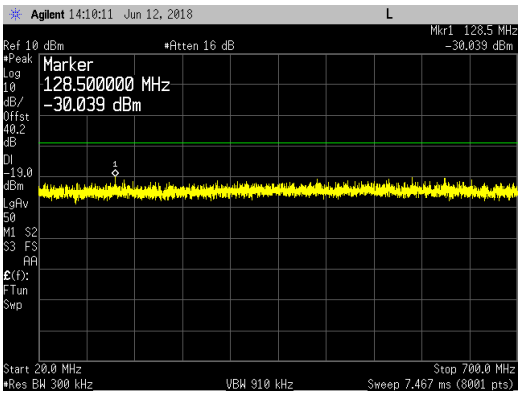
9kHz to 150kHz



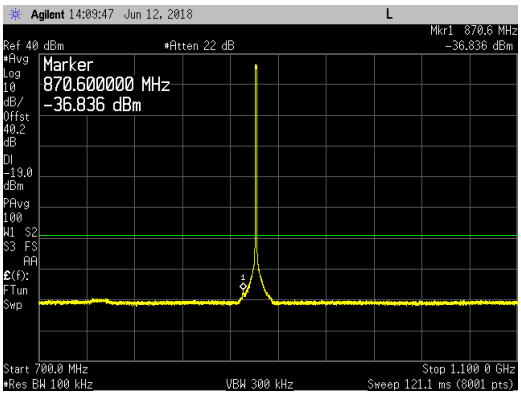
150kHz to 20MHz



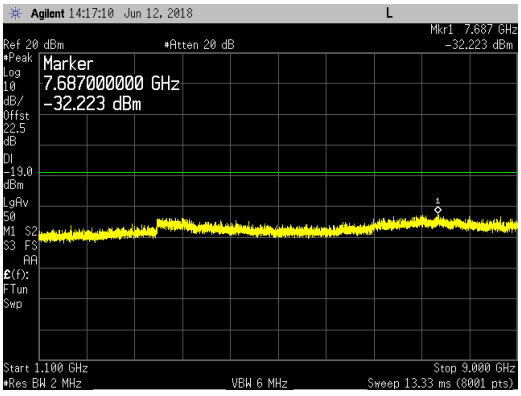
20MHz to 700MHz



700MHz to 1.1GHz

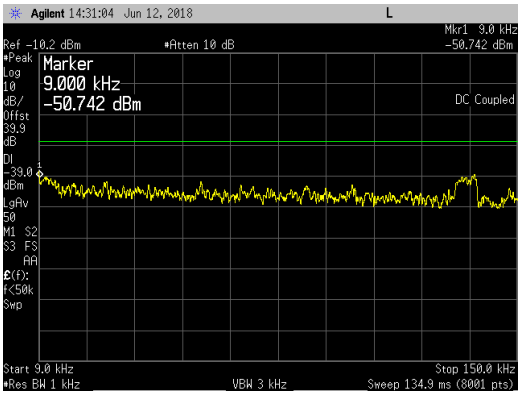


1.1GHz to 9GHz

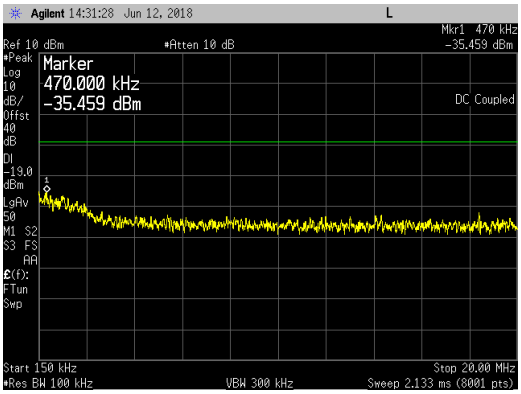


Band 5 LTE3 Ch BW _ QPSK _ Middle Channel (881.5MHz) at 40 watts/carrier:

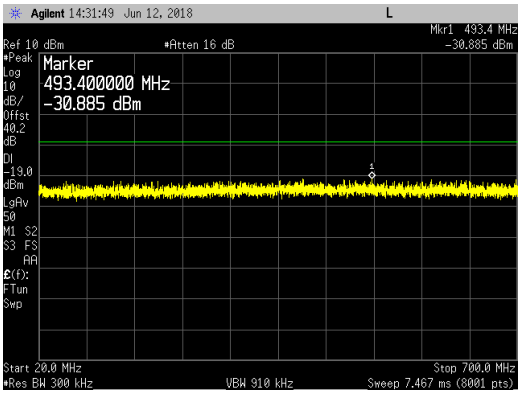
9kHz to 150kHz



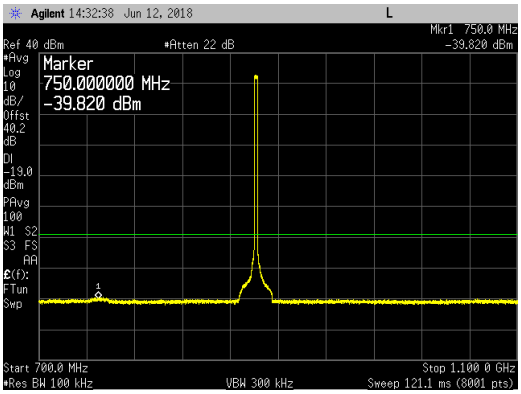
150kHz to 20MHz



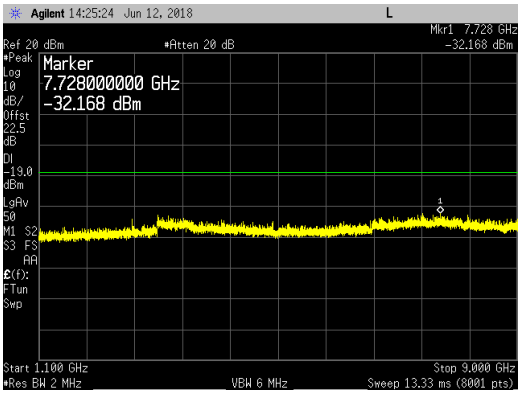
20MHz to 700MHz



700MHz to 1.1GHz

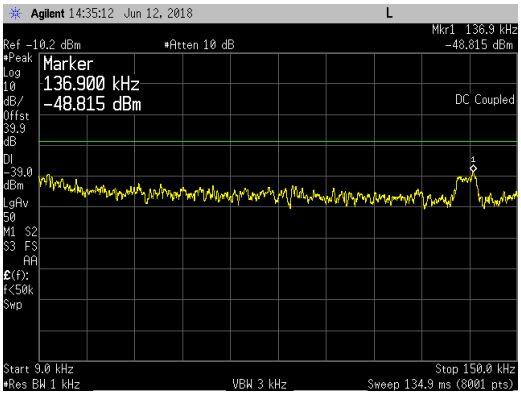


1.1GHz to 9GHz

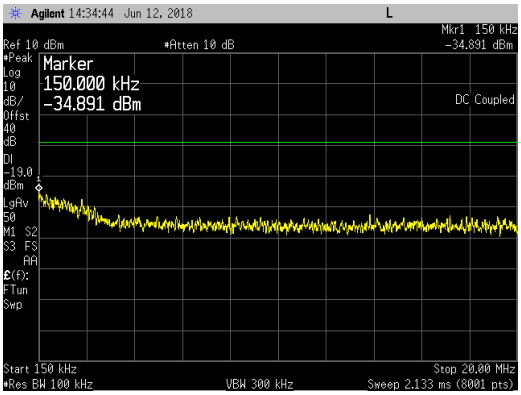


Band 5 LTE3 Ch BW _ 16QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

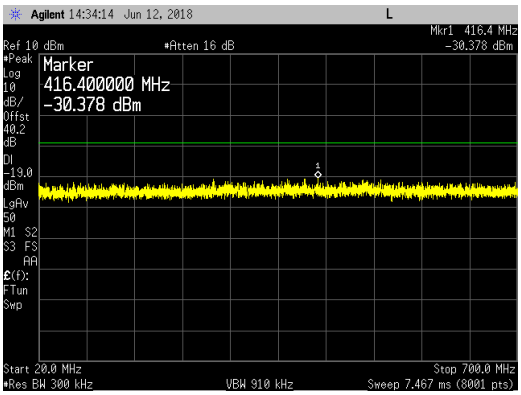
9kHz to 150kHz



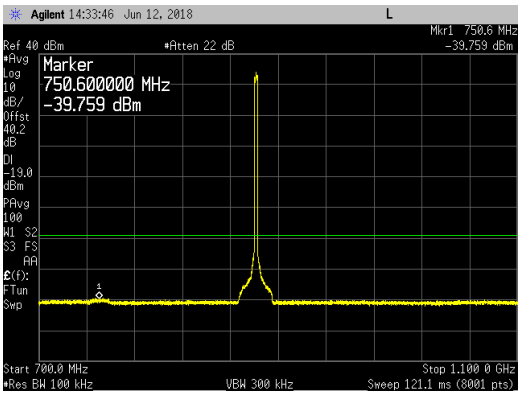
150kHz to 20MHz



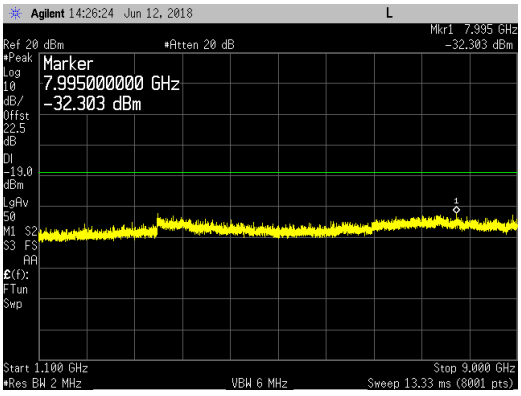
20MHz to 700MHz



700MHz to 1.1GHz

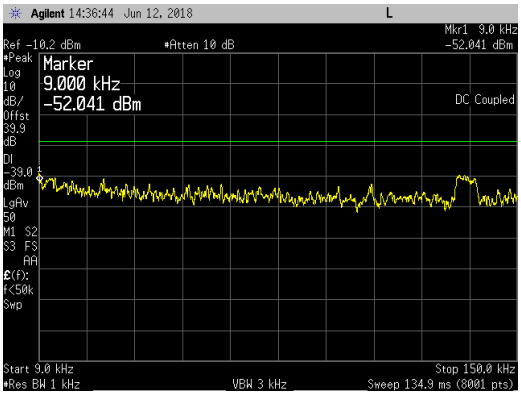


1.1GHz to 9GHz

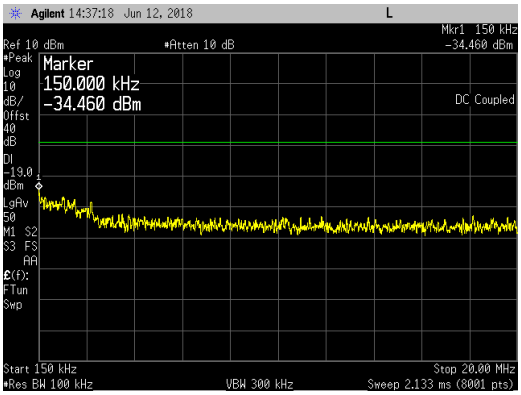


Band 5 LTE3 Ch BW _ 64QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

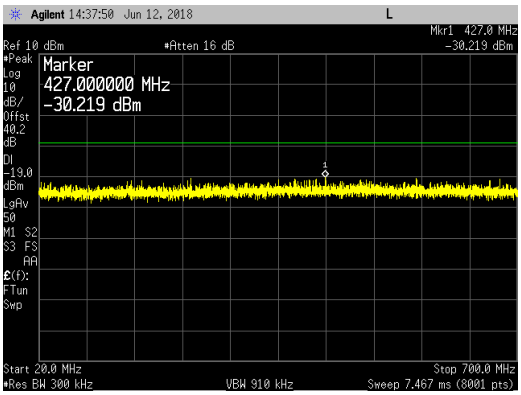
9kHz to 150kHz



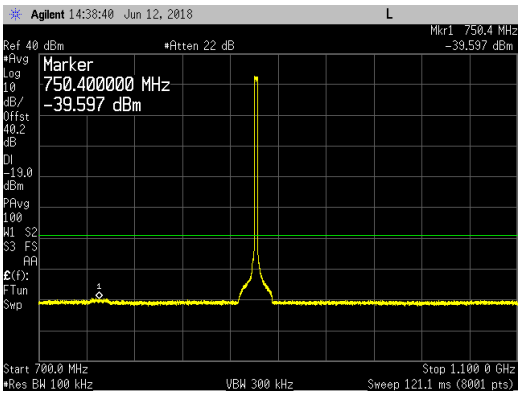
150kHz to 20MHz



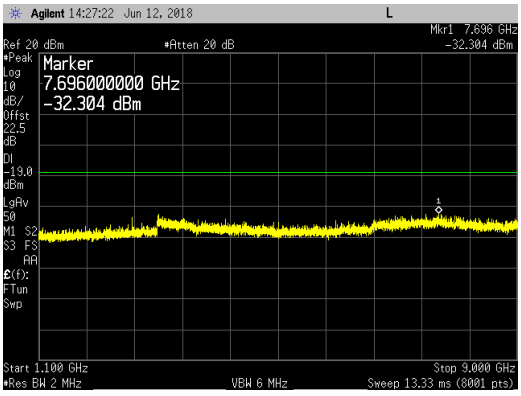
20MHz to 700MHz



700MHz to 1.1GHz

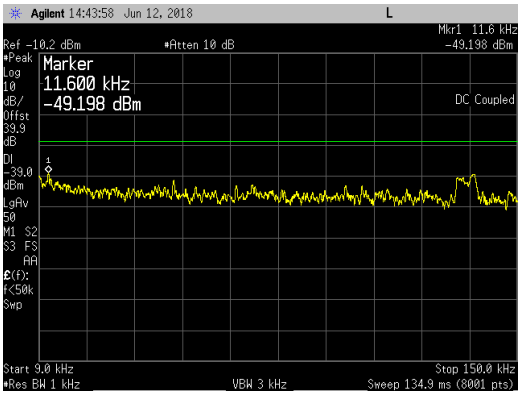


1.1GHz to 9GHz

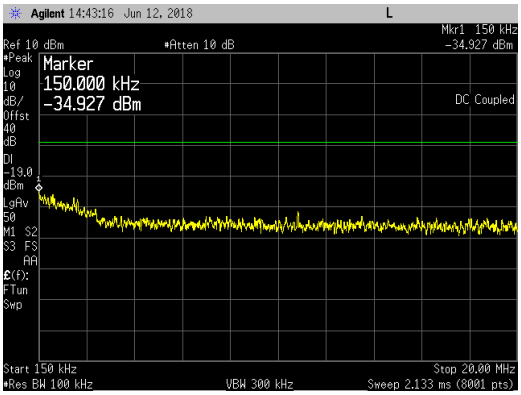


Band 5 LTE3 Ch BW _ 256QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

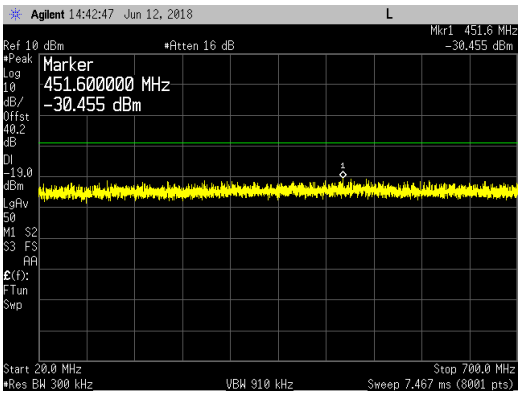
9kHz to 150kHz



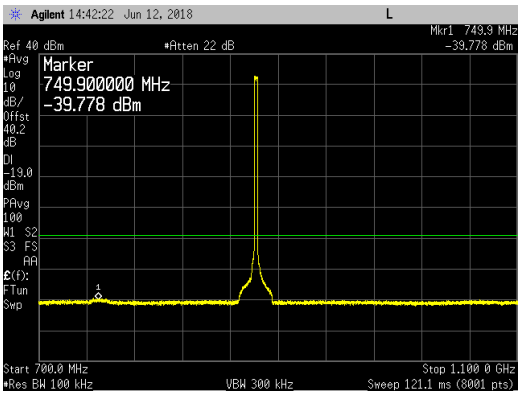
150kHz to 20MHz



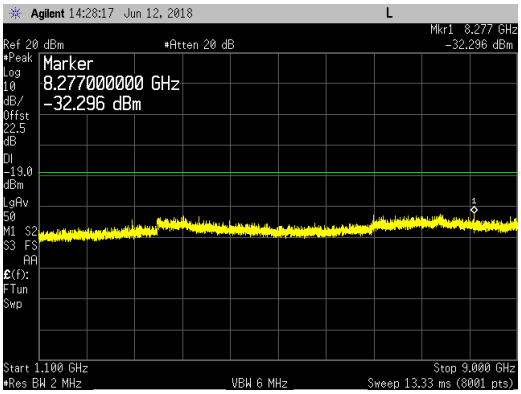
20MHz to 700MHz



700MHz to 1.1GHz

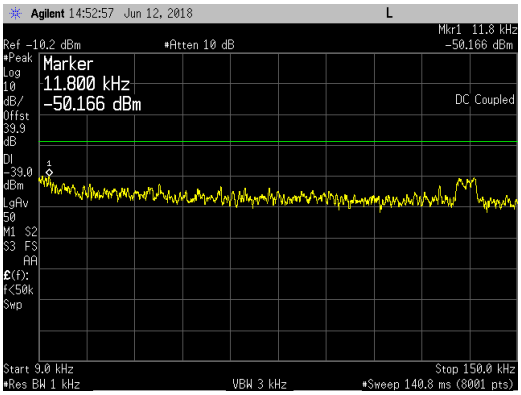


1.1GHz to 9GHz

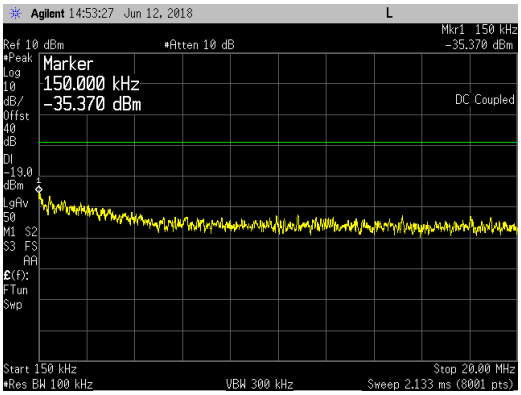


Band 5 LTE5 Ch BW _ QPSK _ Middle Channel (881.5MHz) at 40 watts/carrier:

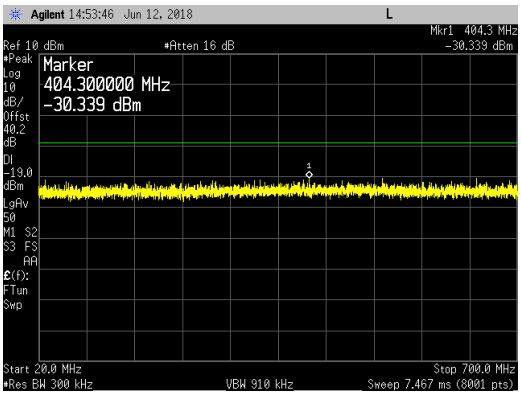
9kHz to 150kHz



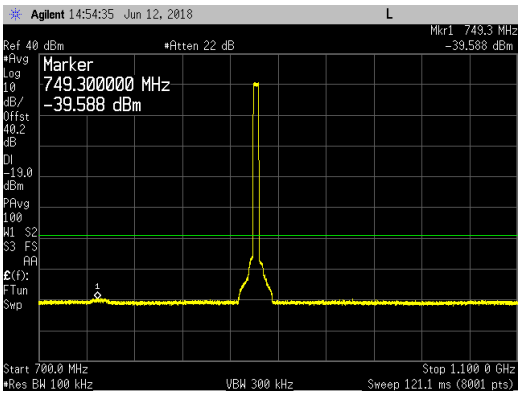
150kHz to 20MHz



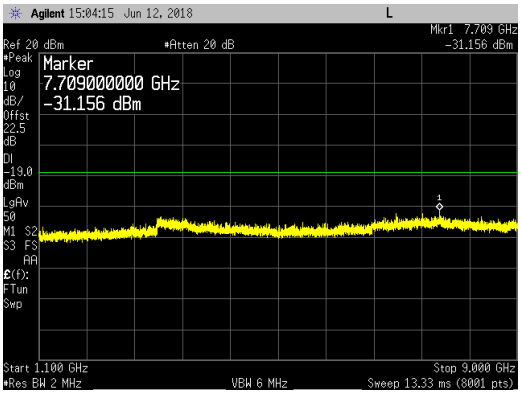
20MHz to 700MHz



700MHz to 1.1GHz

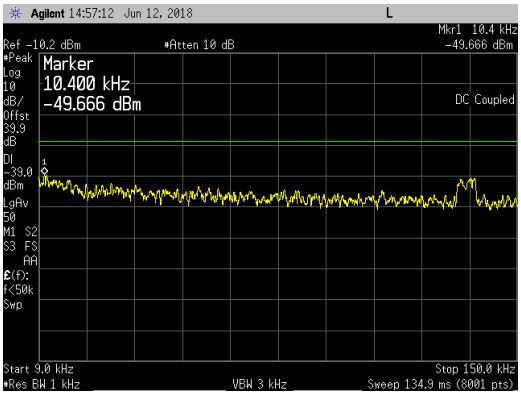


1.1GHz to 9GHz

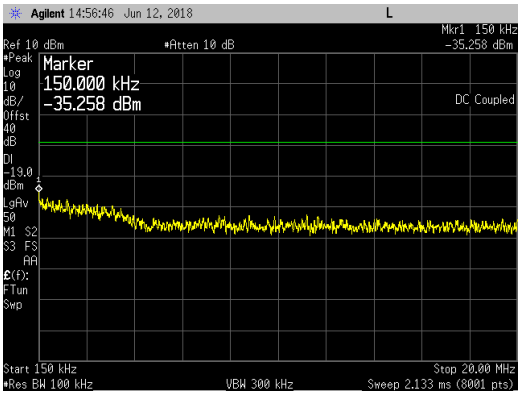


Band 5 LTE5 Ch BW _ 16QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

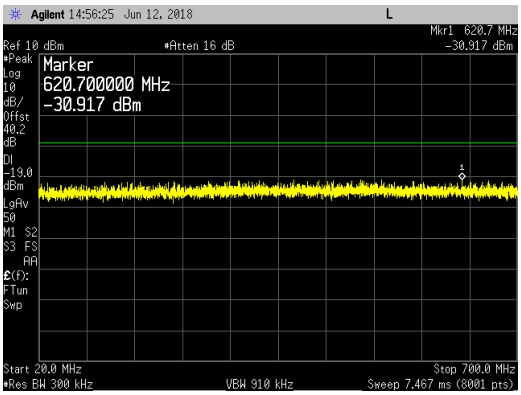
9kHz to 150kHz



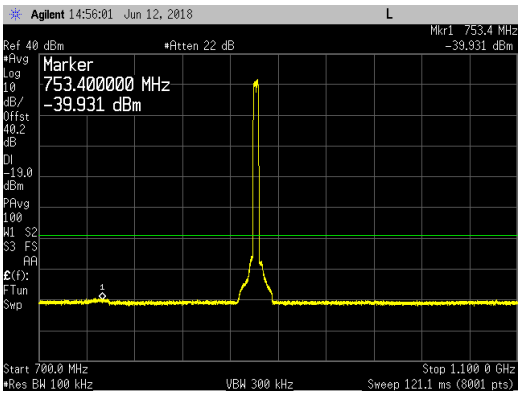
150kHz to 20MHz



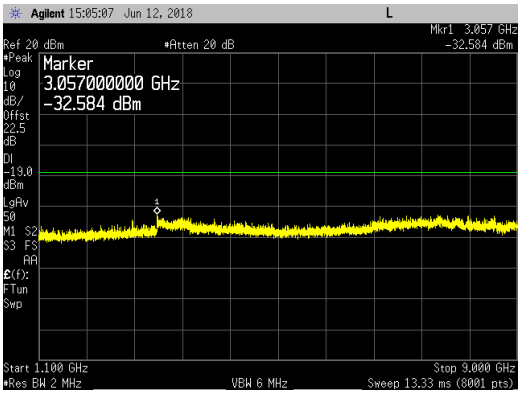
20MHz to 700MHz



700MHz to 1.1GHz

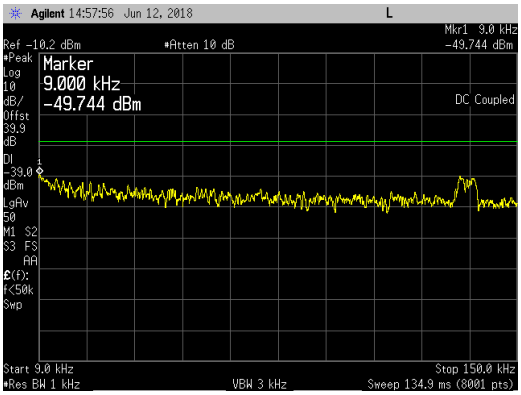


1.1GHz to 9GHz

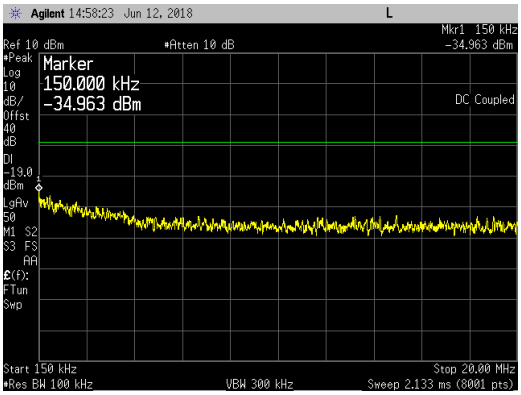


Band 5 LTE5 Ch BW _ 64QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

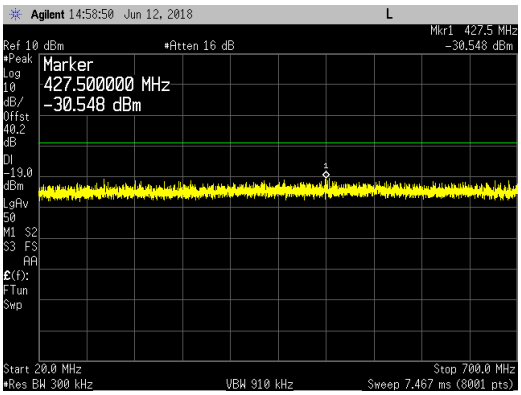
9kHz to 150kHz



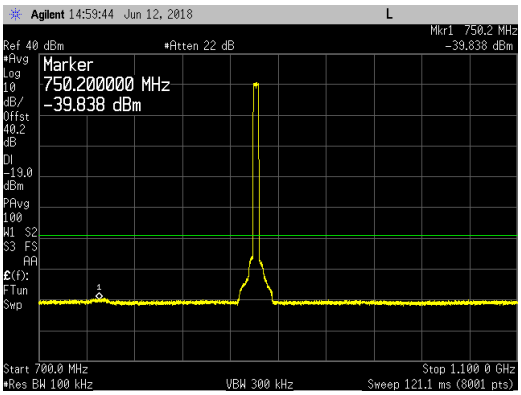
150kHz to 20MHz



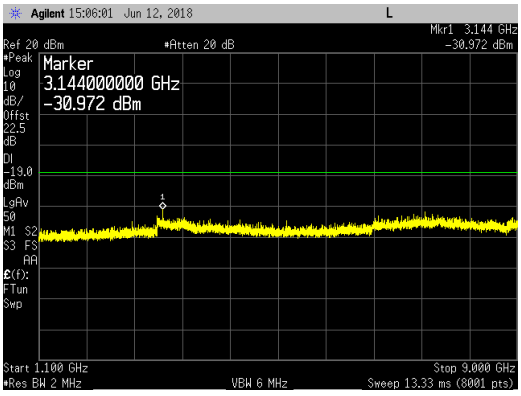
20MHz to 700MHz



700MHz to 1.1GHz

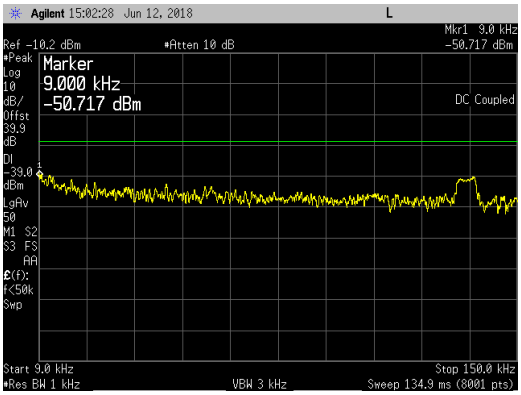


1.1GHz to 9GHz

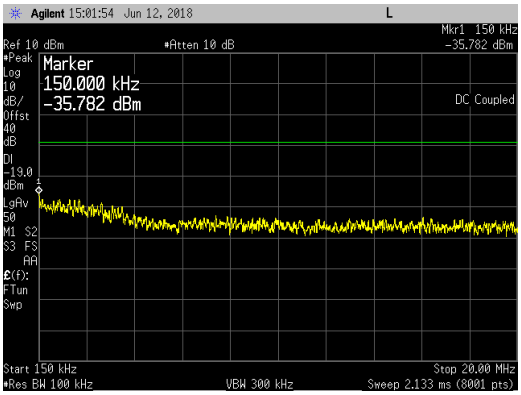


Band 5 LTE5 Ch BW _ 256QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

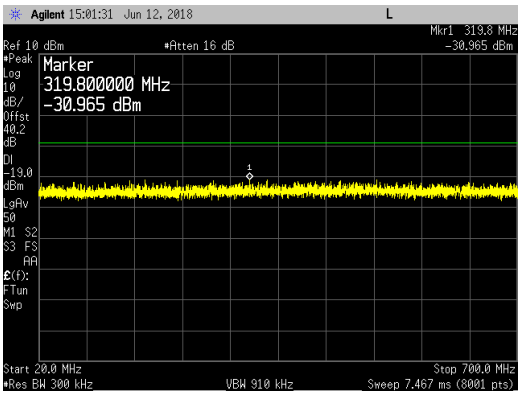
9kHz to 150kHz



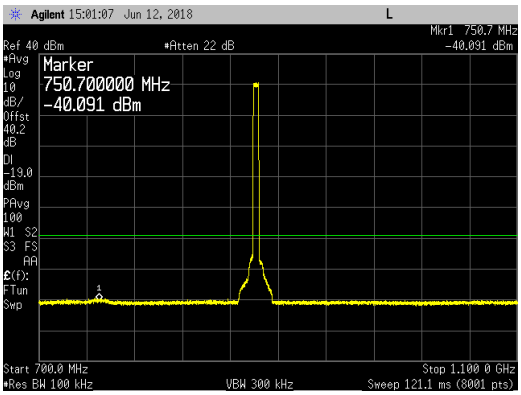
150kHz to 20MHz



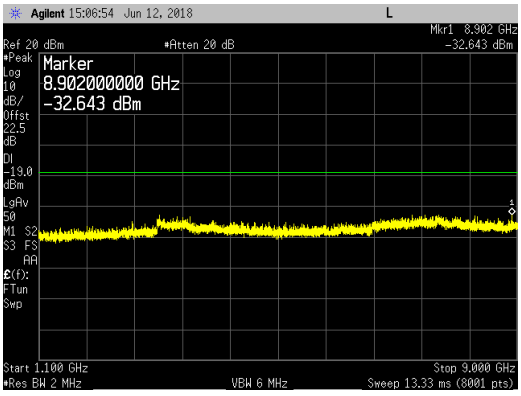
20MHz to 700MHz



700MHz to 1.1GHz

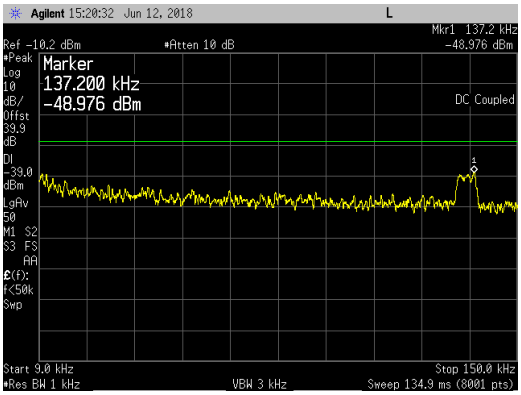


1.1GHz to 9GHz

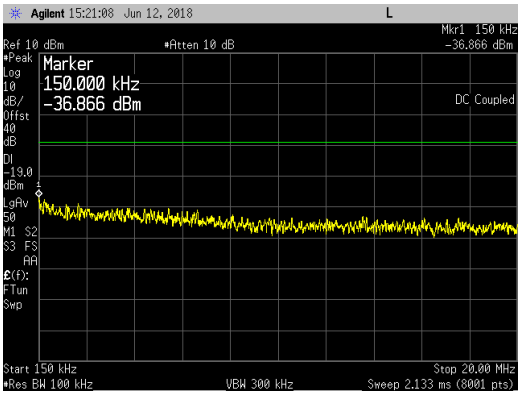


Band 5 LTE10 Ch BW _ QPSK _ Middle Channel (881.5MHz) at 40 watts/carrier:

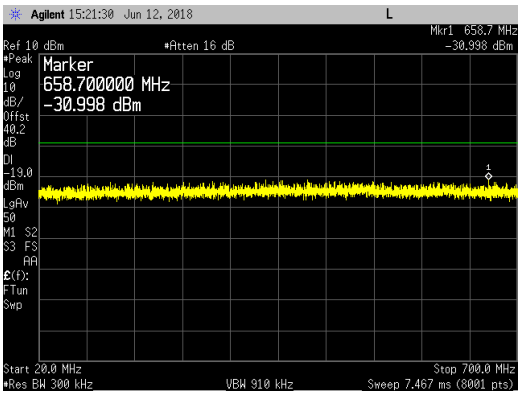
9kHz to 150kHz



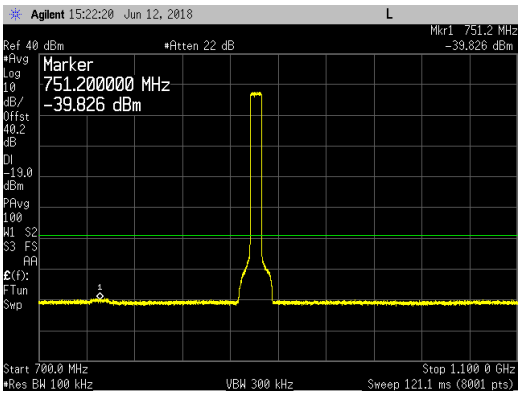
150kHz to 20MHz



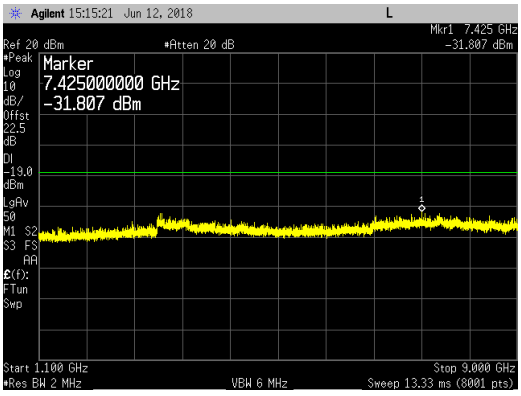
20MHz to 700MHz



700MHz to 1.1GHz

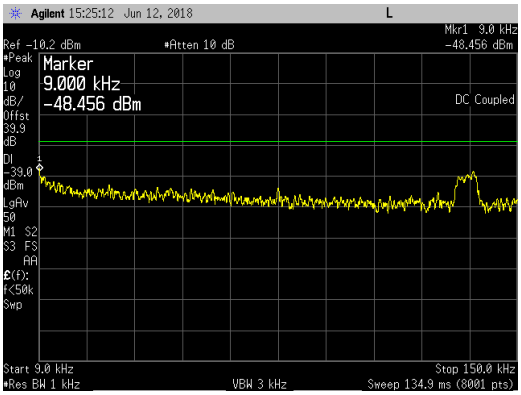


1.1GHz to 9GHz

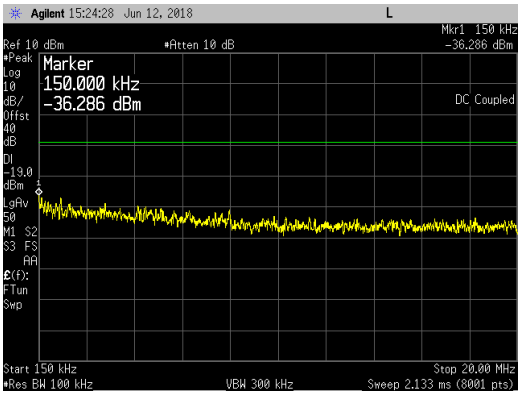


Band 5 LTE10 Ch BW _ 16QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

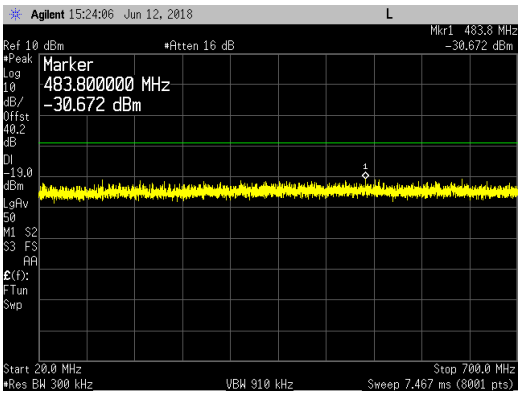
9kHz to 150kHz



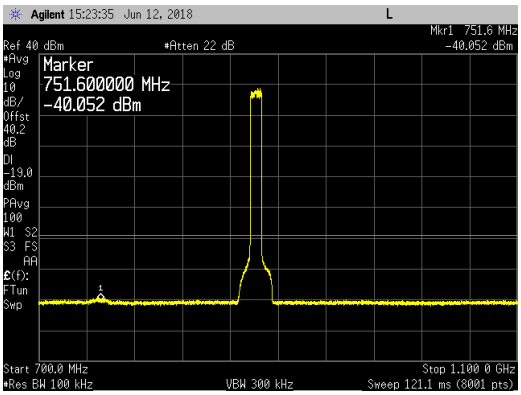
150kHz to 20MHz



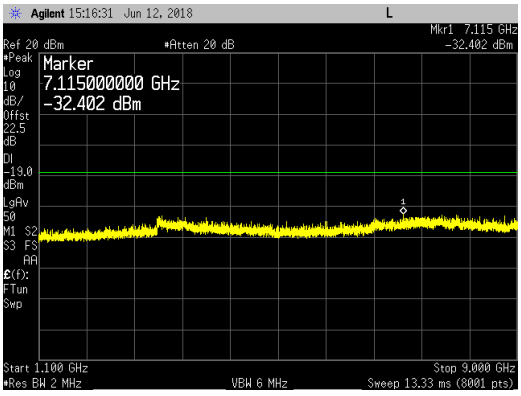
20MHz to 700MHz



700MHz to 1.1GHz

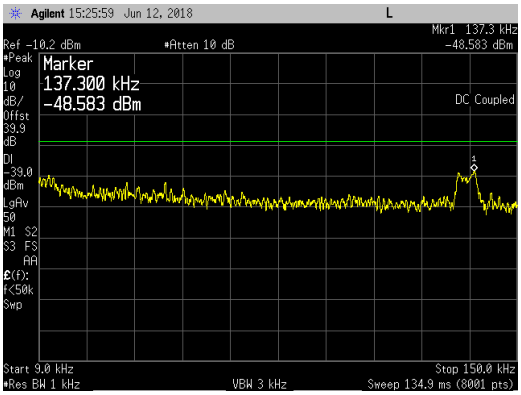


1.1GHz to 9GHz

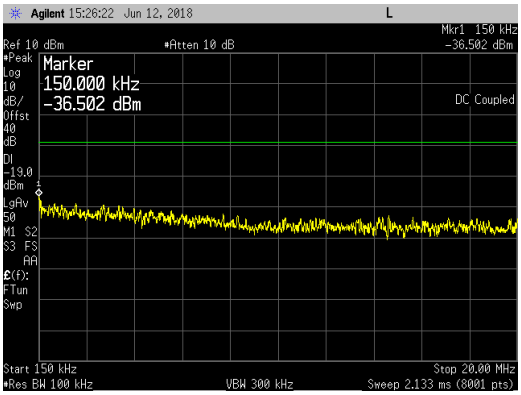


Band 5 LTE10 Ch BW _ 64QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

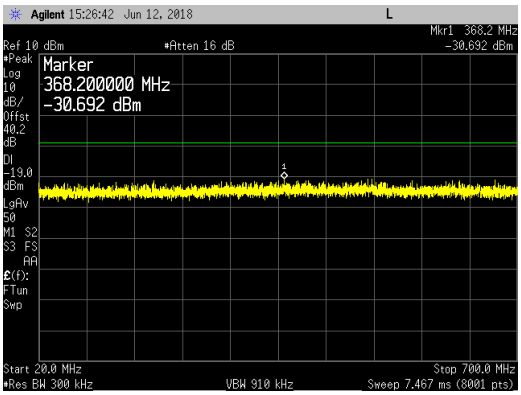
9kHz to 150kHz



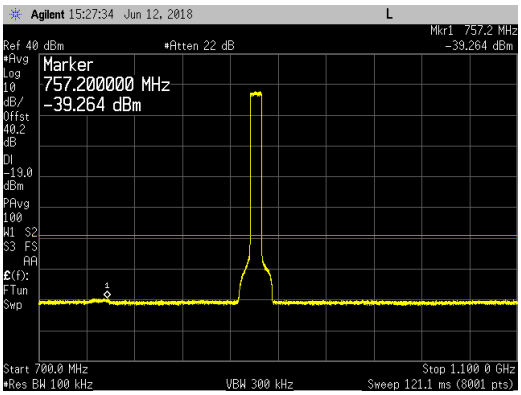
150kHz to 20MHz



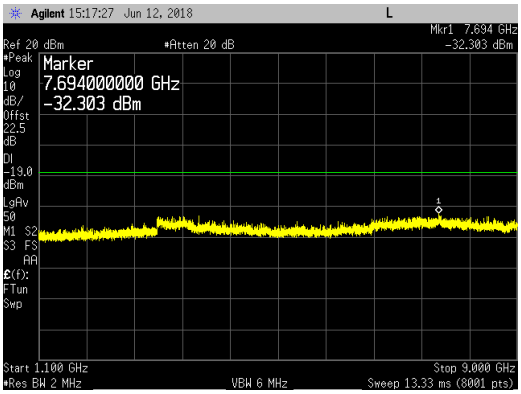
20MHz to 700MHz



700MHz to 1.1GHz

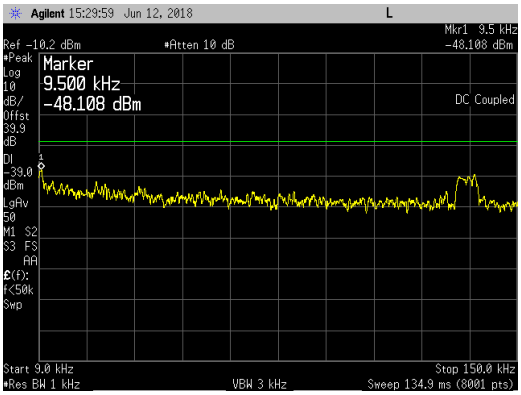


1.1GHz to 9GHz

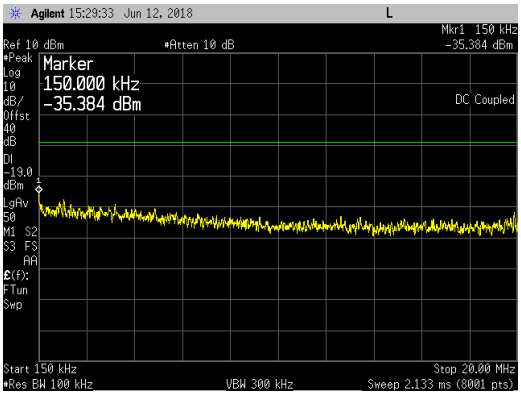


Band 5 LTE10 Ch BW _ 256QAM _ Middle Channel (881.5MHz) at 40 watts/carrier:

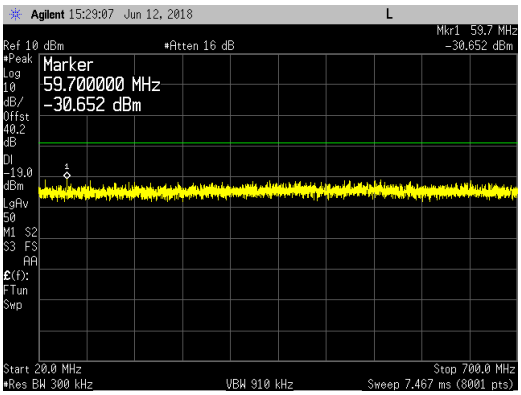
9kHz to 150kHz



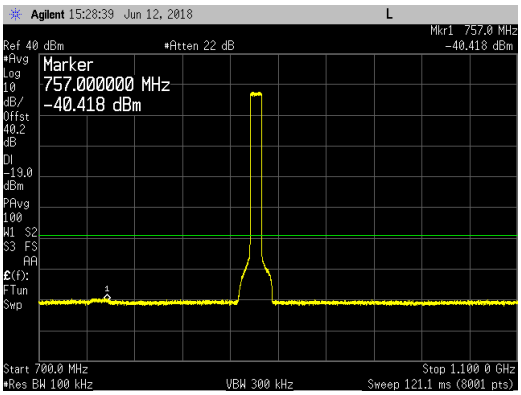
150kHz to 20MHz



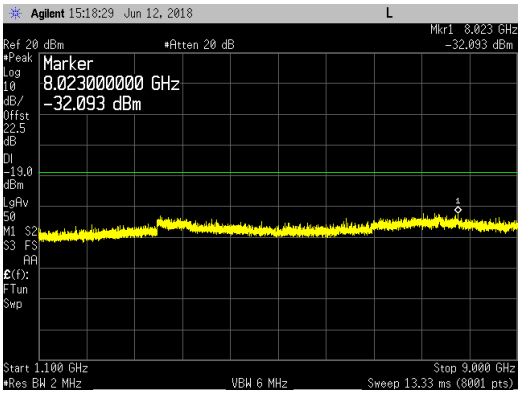
20MHz to 700MHz



700MHz to 1.1GHz

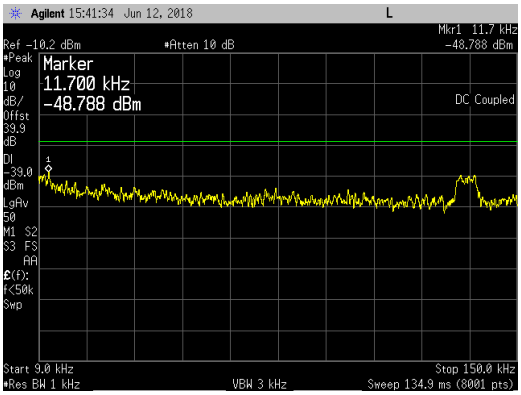


1.1GHz to 9GHz

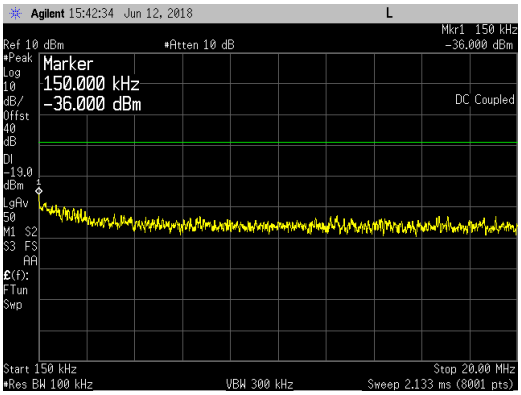


Band 5 LTE1.4 Ch BW _ QPSK _ BC, BC+1, & TC (869.7, 871.1, & 893.3MHz) at 13 watts/carrier:

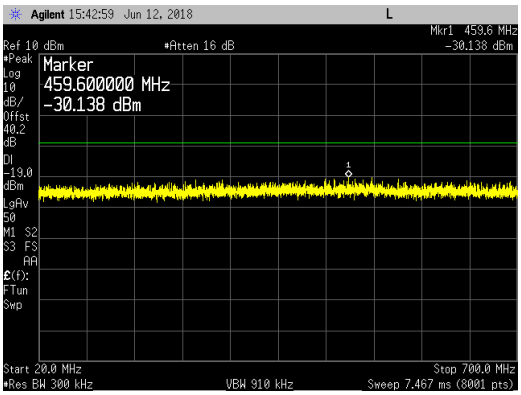
9kHz to 150kHz



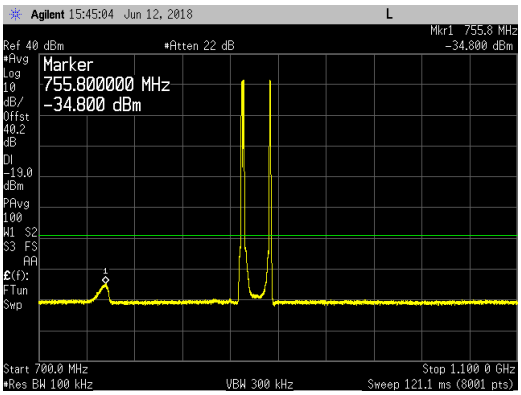
150kHz to 20MHz



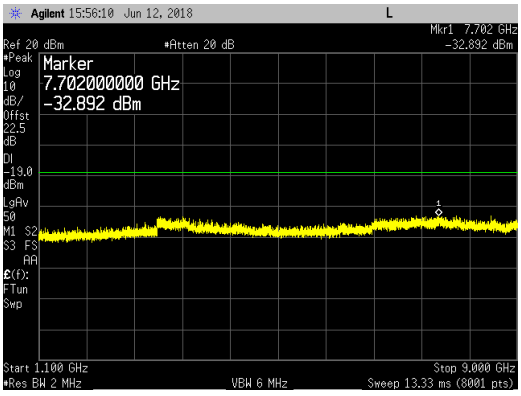
20MHz to 700MHz



700MHz to 1.1GHz

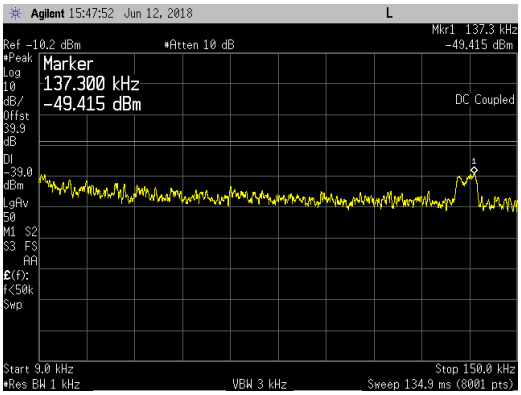


1.1GHz to 9GHz

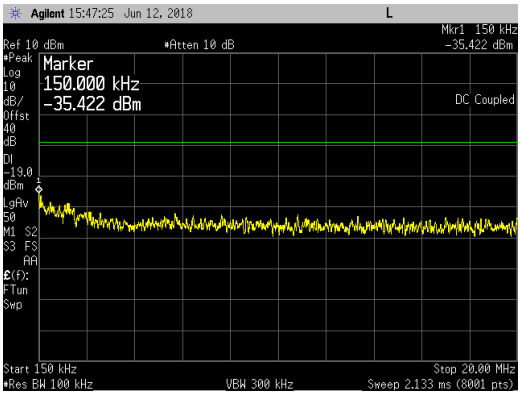


Band 5 LTE1.4 Ch BW _ 16QAM _ BC, BC+1, & TC (869.7, 871.1, & 893.3MHz) at 13 watts/carrier:

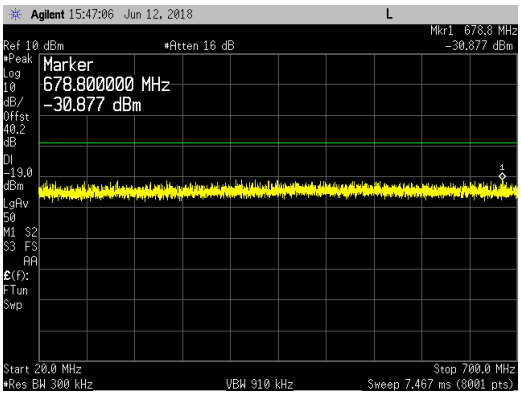
9kHz to 150kHz



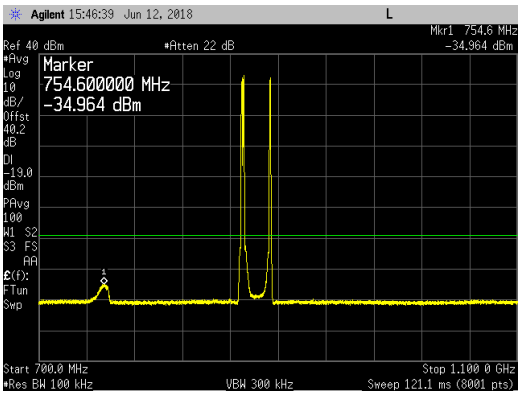
150kHz to 20MHz



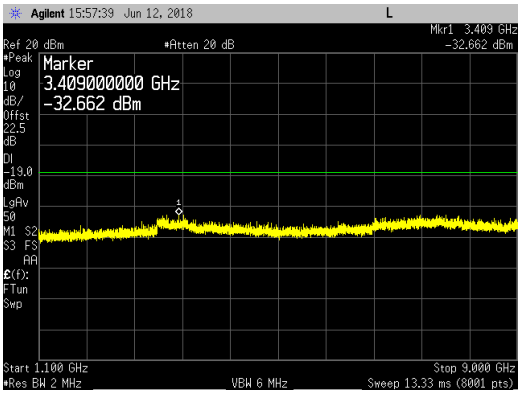
20MHz to 700MHz



700MHz to 1.1GHz

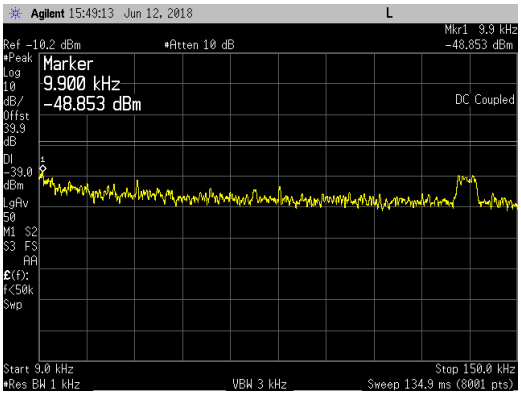


1.1GHz to 9GHz

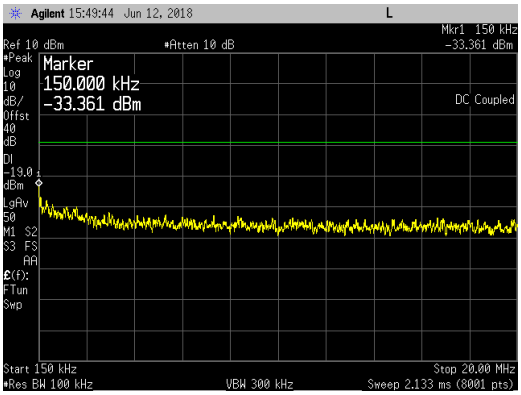


Band 5 LTE1.4 Ch BW _ 64QAM _ BC, BC+1, & TC (869.7, 871.1, & 893.3MHz) at 13 watts/carrier:

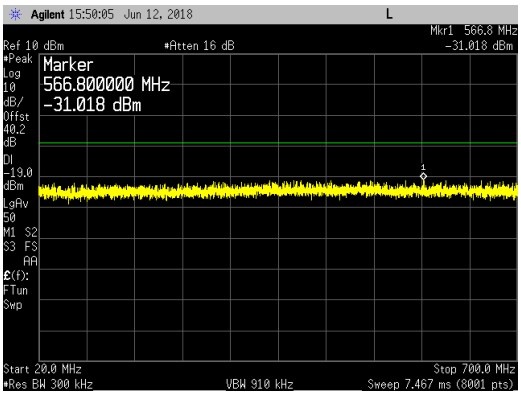
9kHz to 150kHz



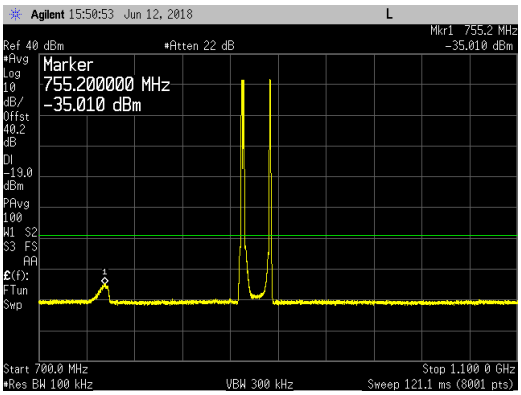
150kHz to 20MHz



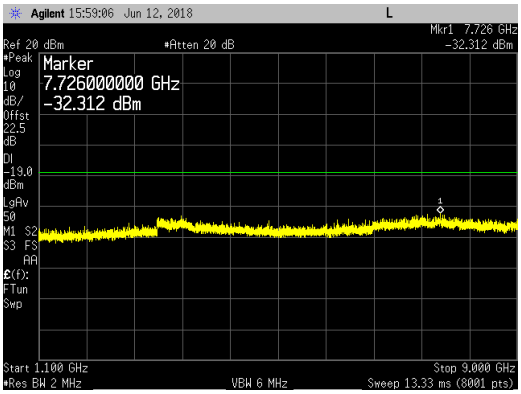
20MHz to 700MHz



700MHz to 1.1GHz

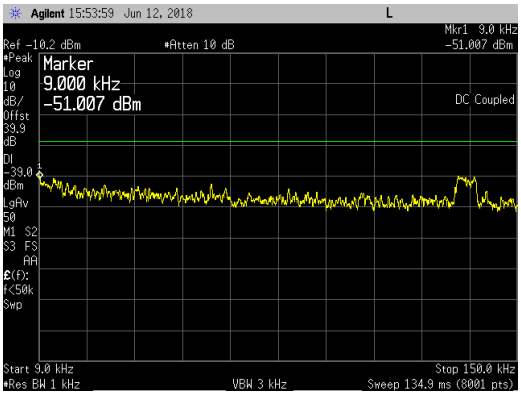


1.1GHz to 9GHz

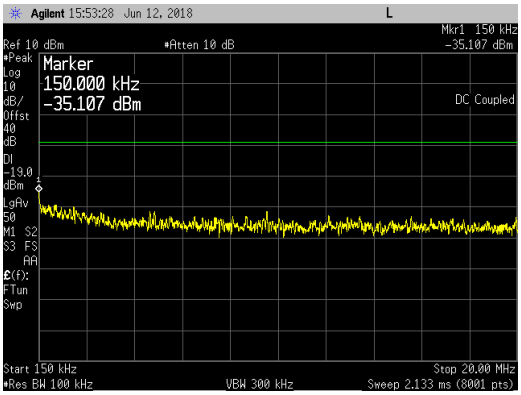


Band 5 LTE1.4 Ch BW _ 256QAM _ BC, BC+1, & TC (869.7, 871.1, & 893.3MHz) at 13 watts/carrier:

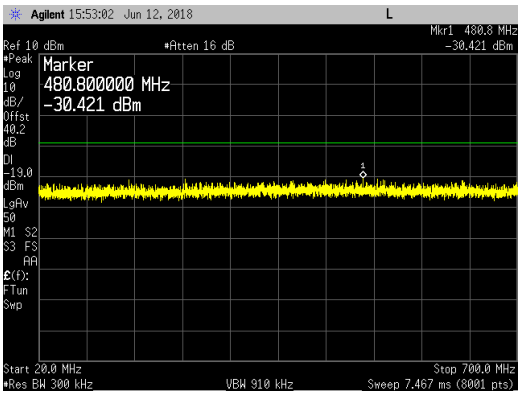
9kHz to 150kHz



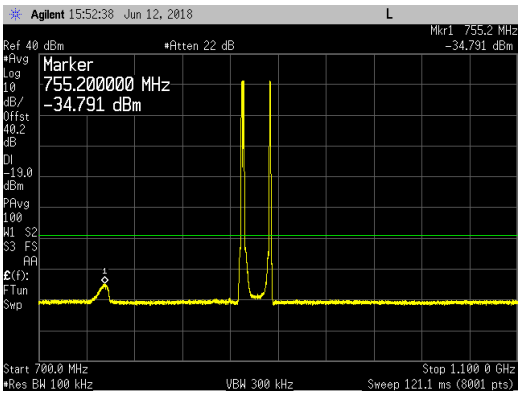
150kHz to 20MHz



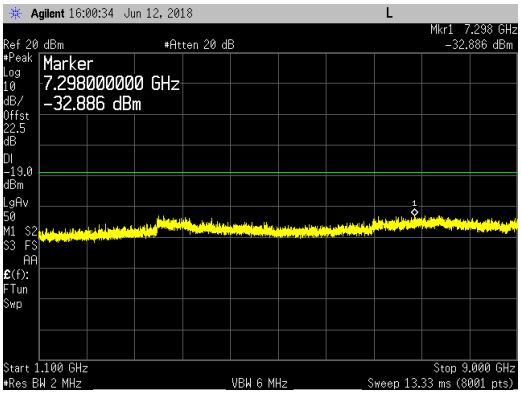
20MHz to 700MHz



700MHz to 1.1GHz

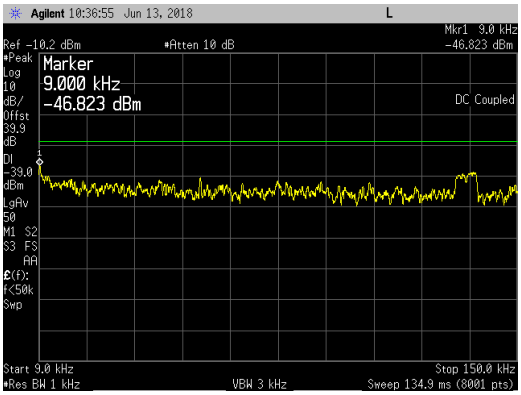


1.1GHz to 9GHz

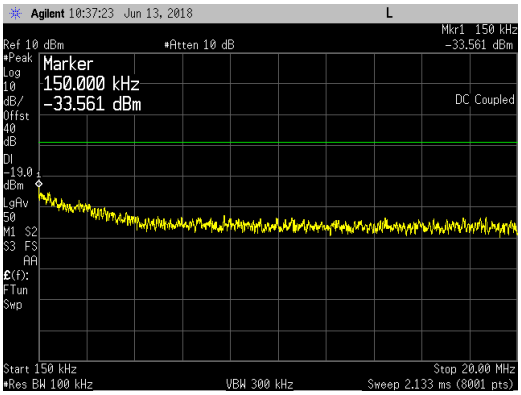


LTE1.4 & LTE5 Ch BWs _ QPSK _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

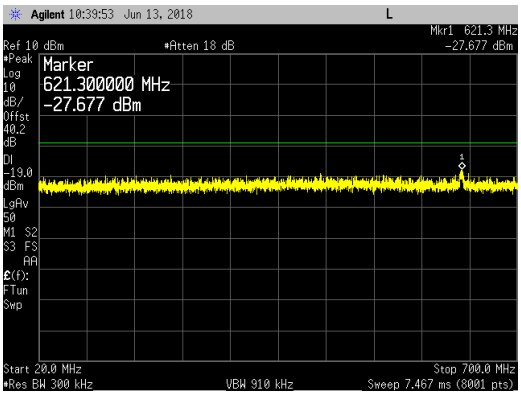
9kHz to 150kHz



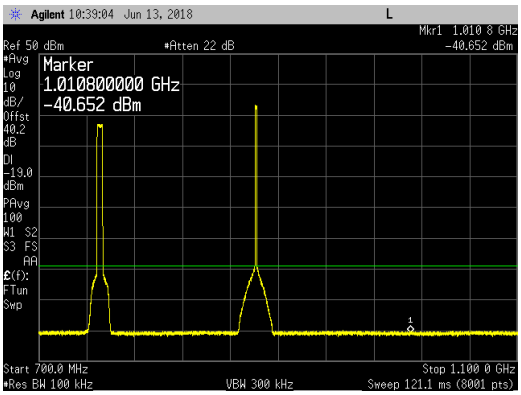
150kHz to 20MHz



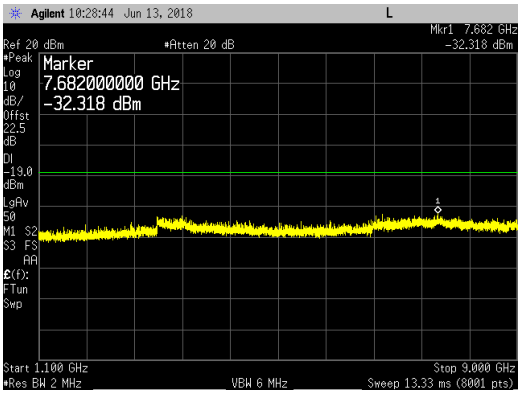
20MHz to 700MHz



700MHz to 1.1GHz

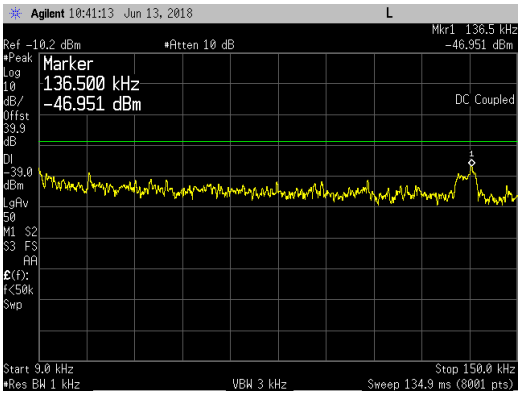


1.1GHz to 9GHz

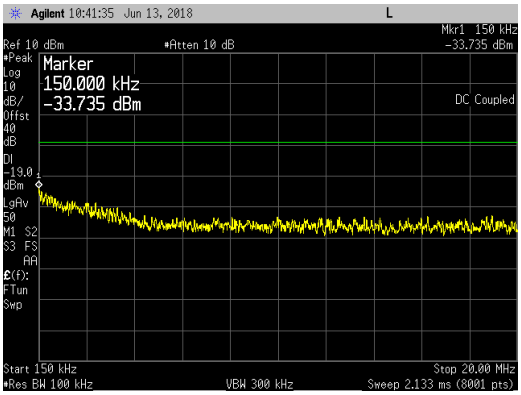


LTE1.4 & LTE5 Ch BWs _ 16QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

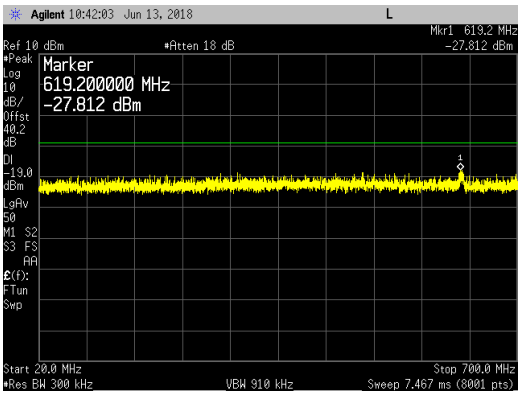
9kHz to 150kHz



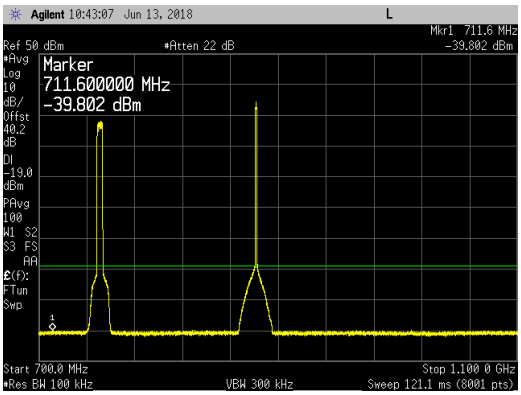
150kHz to 20MHz



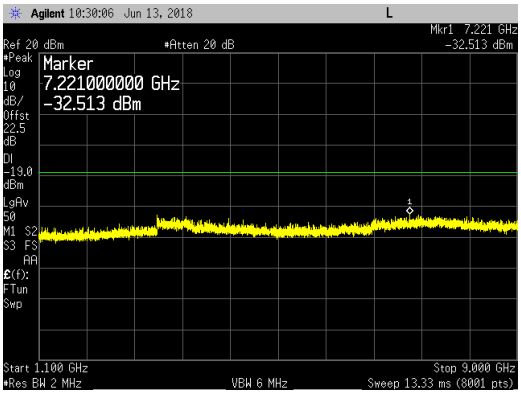
20MHz to 700MHz



700MHz to 1.1GHz

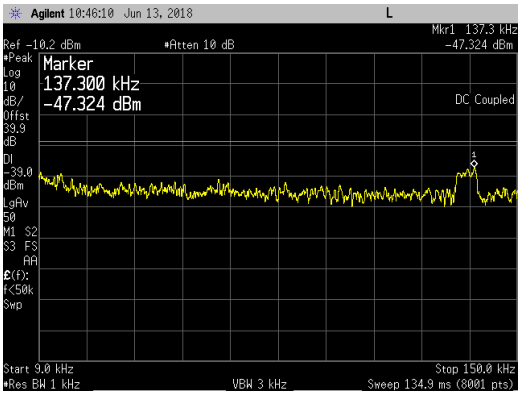


1.1GHz to 9GHz

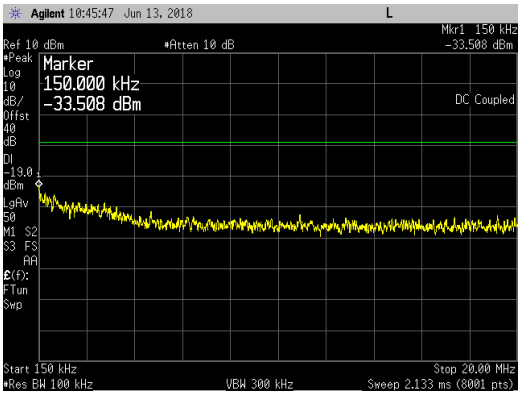


LTE1.4 & LTE5 Ch BWs _ 64QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

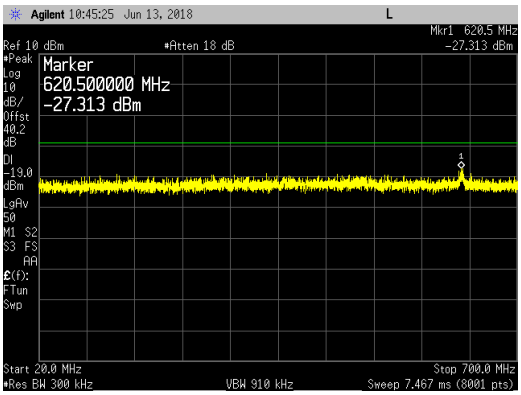
9kHz to 150kHz



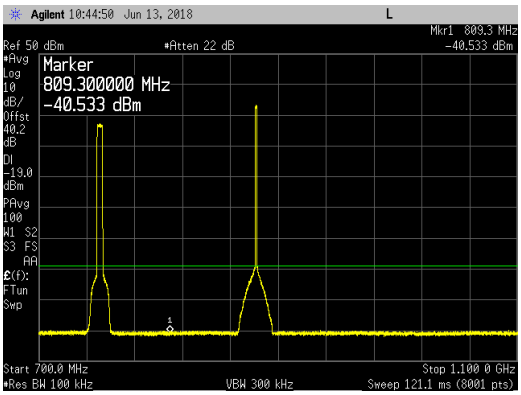
150kHz to 20MHz



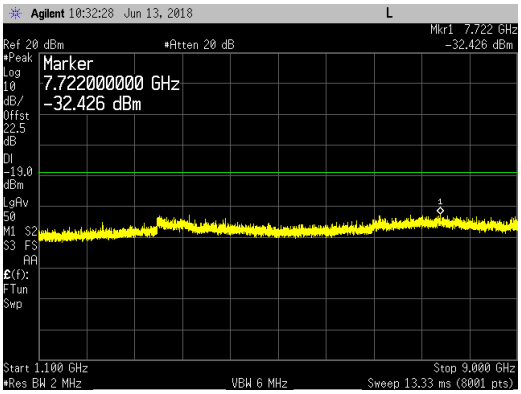
20MHz to 700MHz



700MHz to 1.1GHz

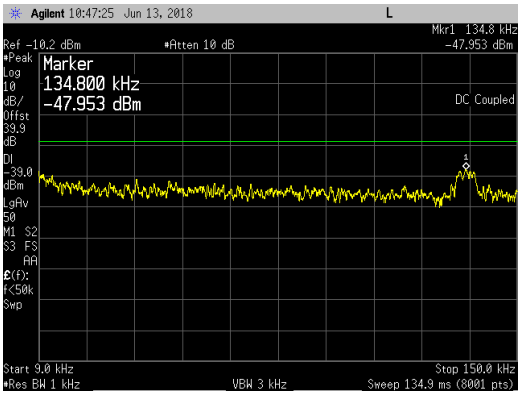


1.1GHz to 9GHz

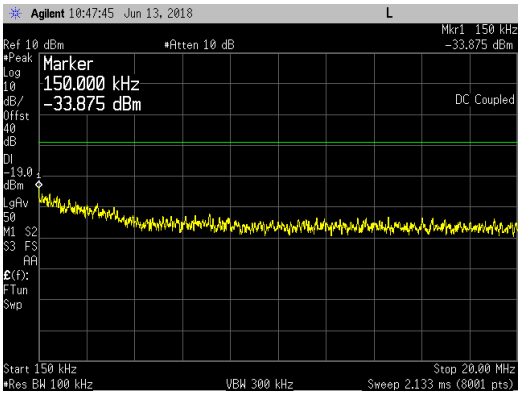


LTE1.4 & LTE5 Ch BWs _ 256QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

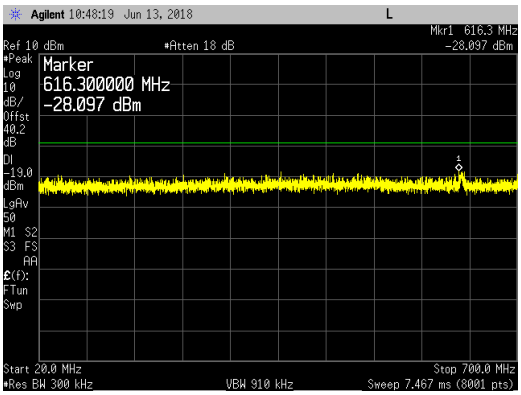
9kHz to 150kHz



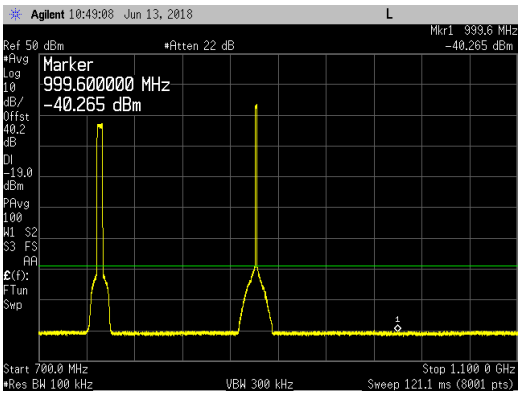
150kHz to 20MHz



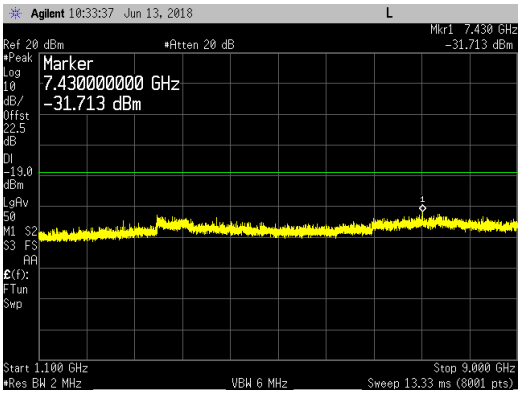
20MHz to 700MHz



700MHz to 1.1GHz

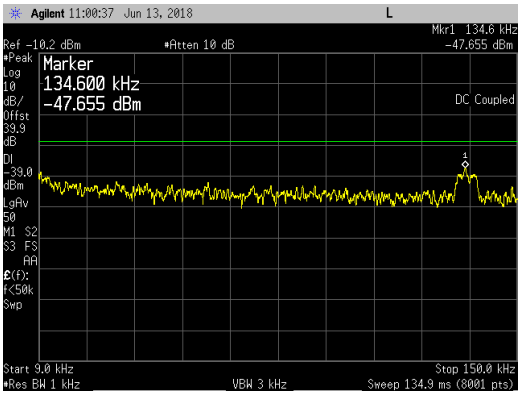


1.1GHz to 9GHz

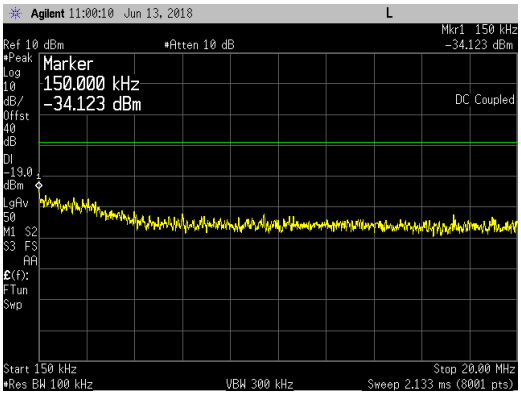


LTE3 & LTE5 Ch BWs _ QPSK _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

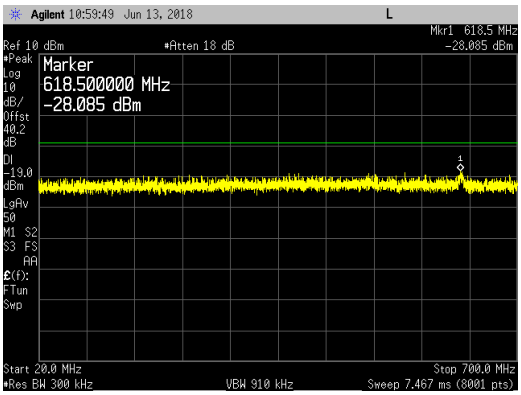
9kHz to 150kHz



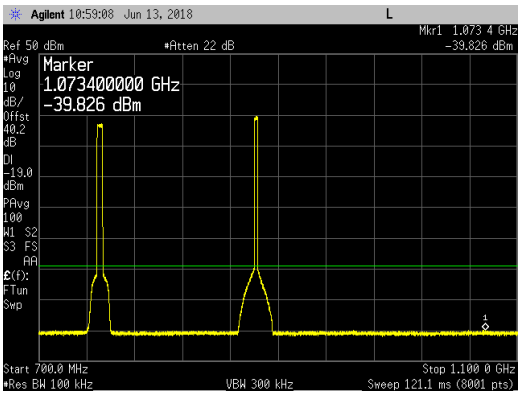
150kHz to 20MHz



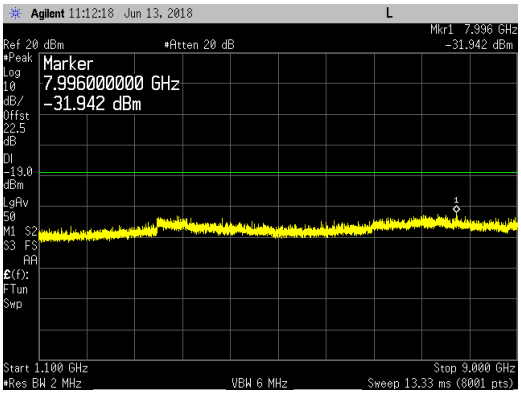
20MHz to 700MHz



700MHz to 1.1GHz

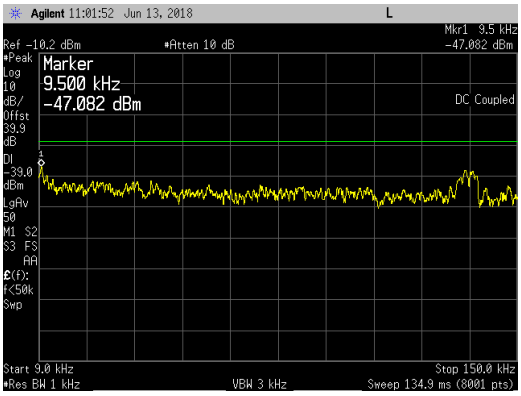


1.1GHz to 9GHz

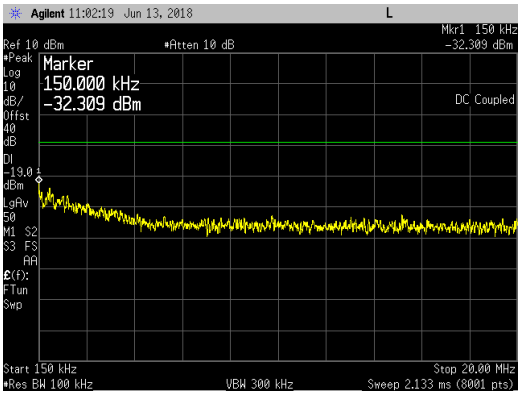


LTE3 & LTE5 Ch BWs _ 16QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

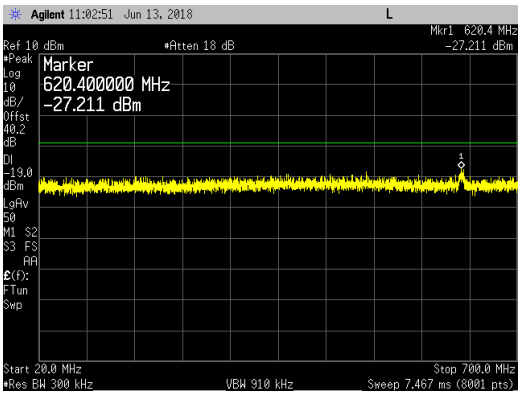
9kHz to 150kHz



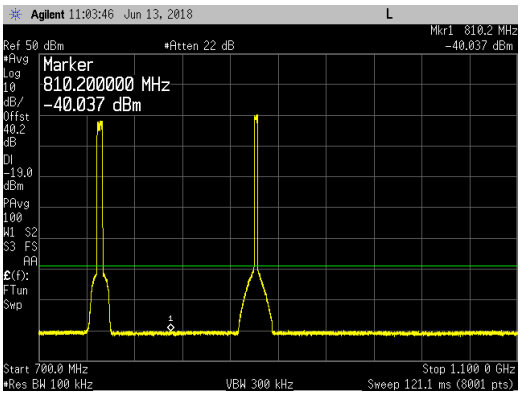
150kHz to 20MHz



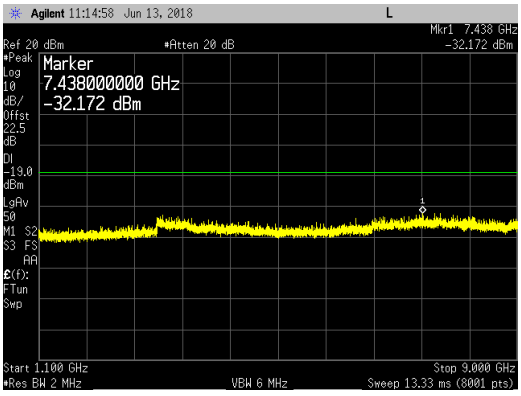
20MHz to 700MHz



700MHz to 1.1GHz

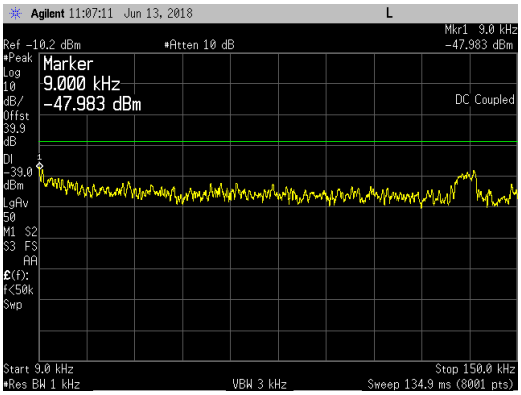


1.1GHz to 9GHz

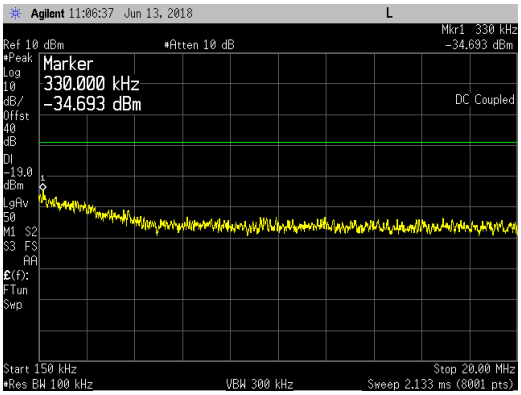


LTE3 & LTE5 Ch BWs _ 64QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

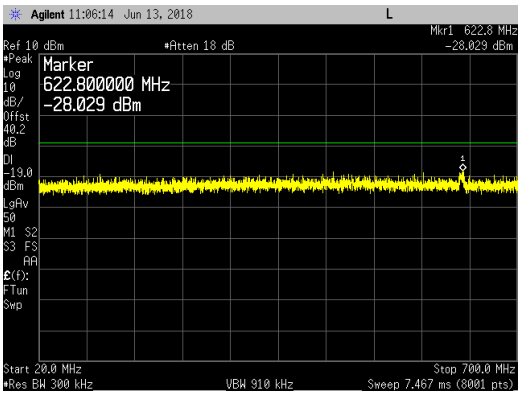
9kHz to 150kHz



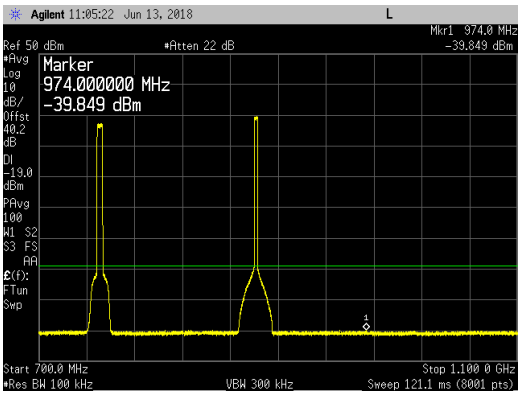
150kHz to 20MHz



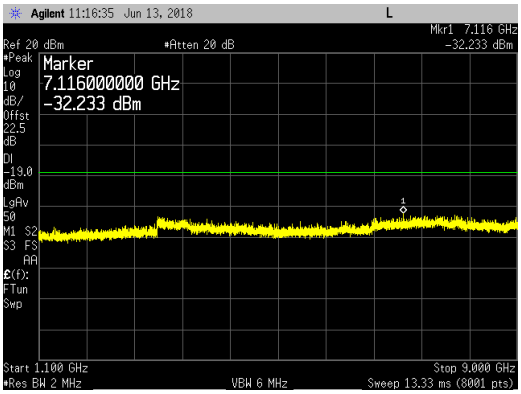
20MHz to 700MHz



700MHz to 1.1GHz

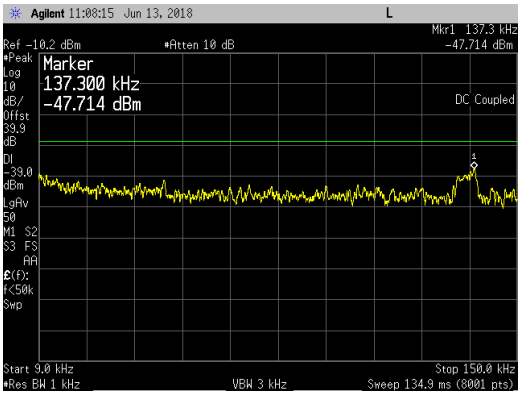


1.1GHz to 9GHz

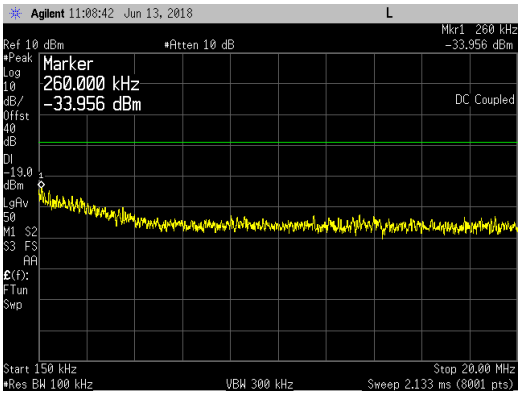


LTE3 & LTE5 Ch BWs _ 256QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

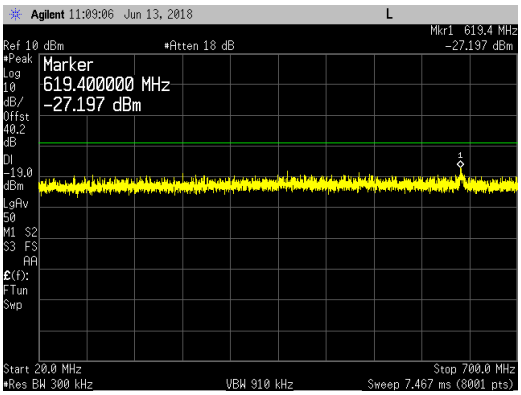
9kHz to 150kHz



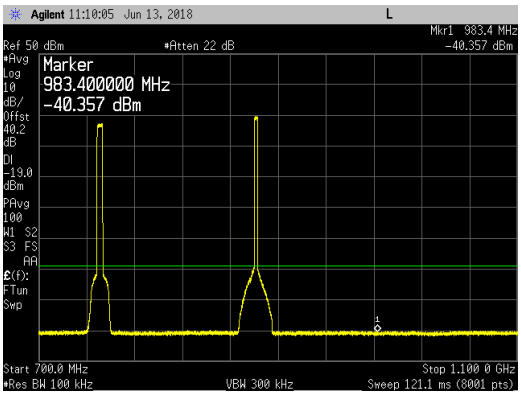
150kHz to 20MHz



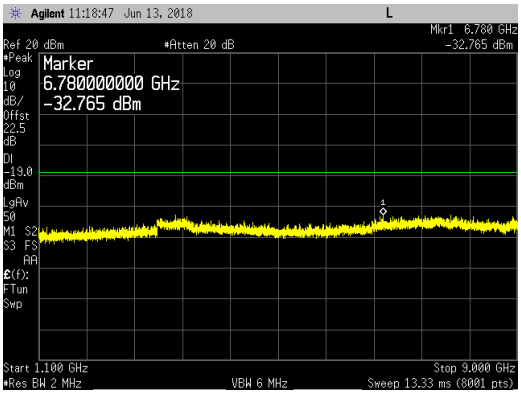
20MHz to 700MHz



700MHz to 1.1GHz

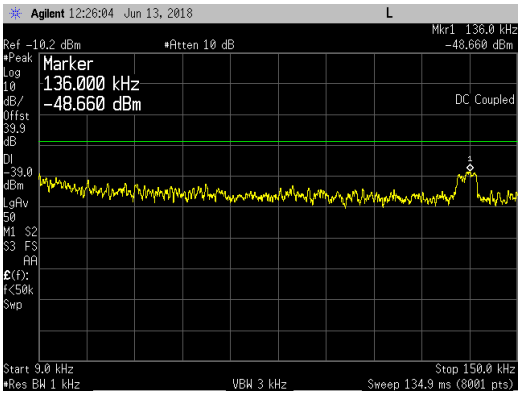


1.1GHz to 9GHz

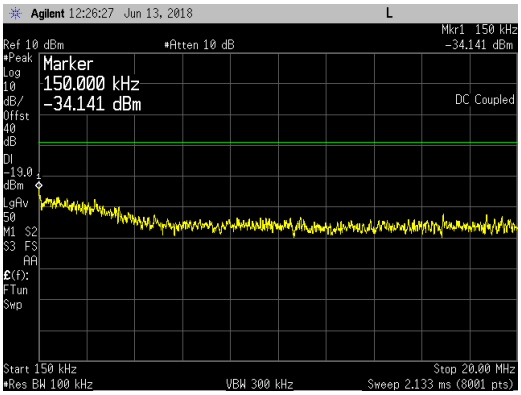


LTE5 & LTE5 Ch BWs _ QPSK _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

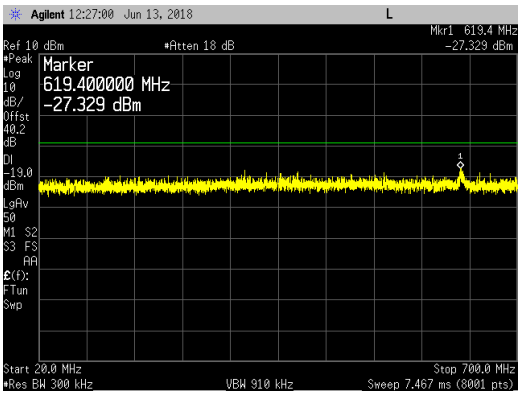
9kHz to 150kHz



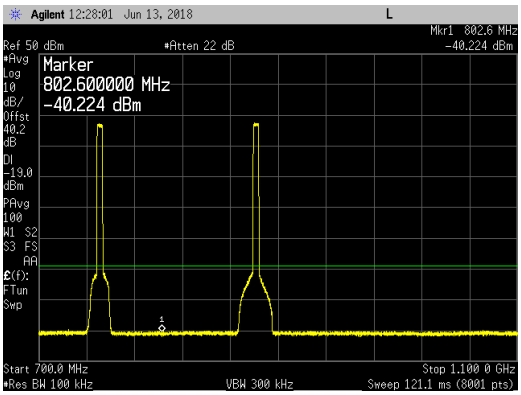
150kHz to 20MHz



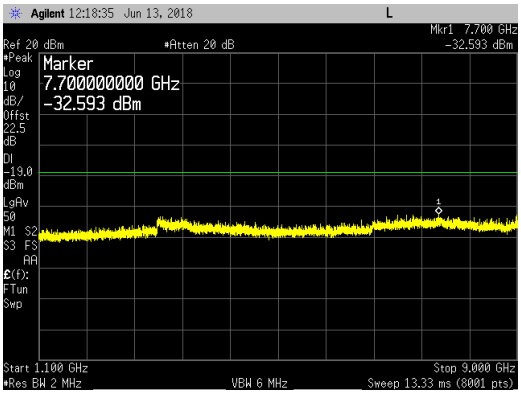
20MHz to 700MHz



700MHz to 1.1GHz

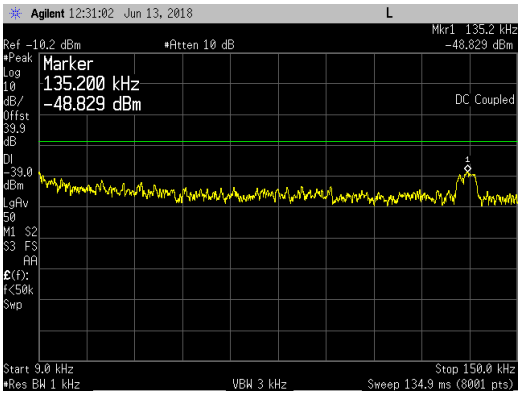


1.1GHz to 9GHz

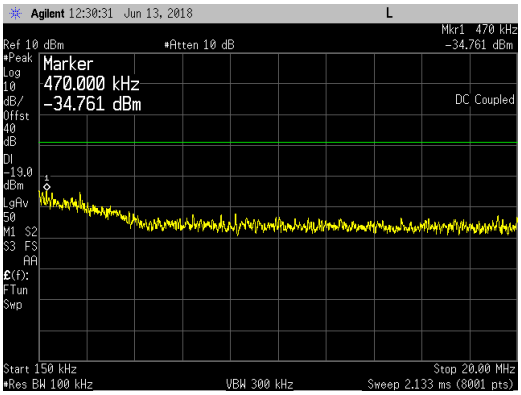


LTE5 & LTE5 Ch BWs _ 16QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

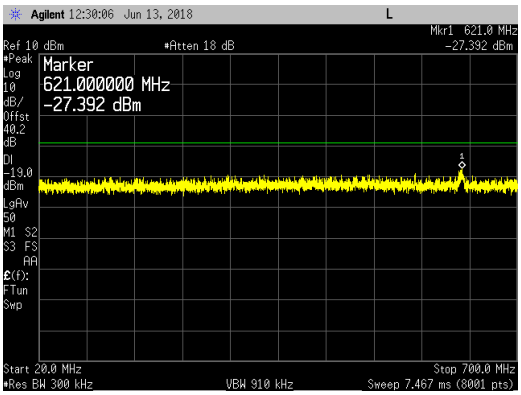
9kHz to 150kHz



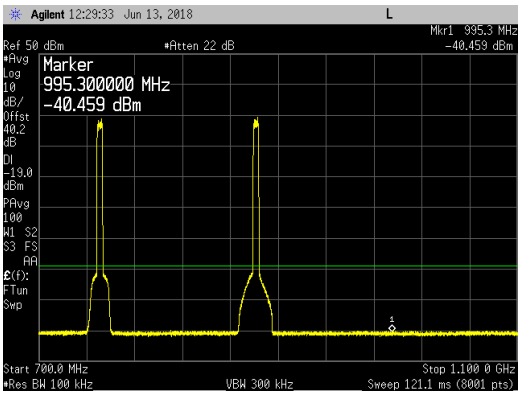
150kHz to 20MHz



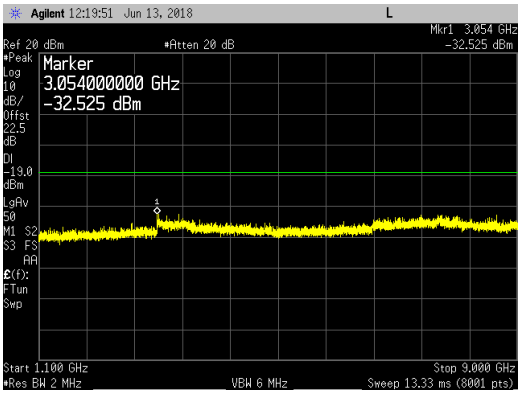
20MHz to 700MHz



700MHz to 1.1GHz

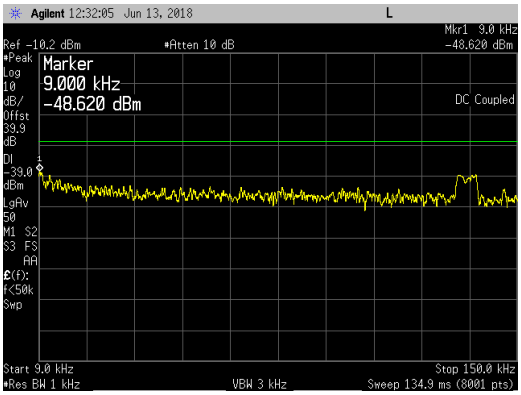


1.1GHz to 9GHz

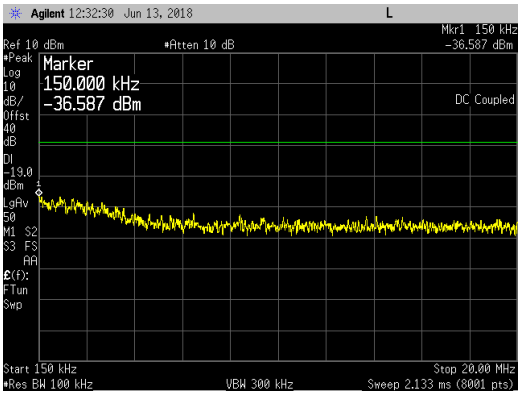


LTE5 & LTE5 Ch BWs _ 64QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

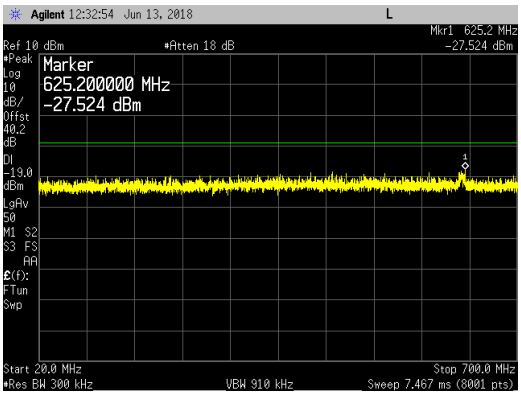
9kHz to 150kHz



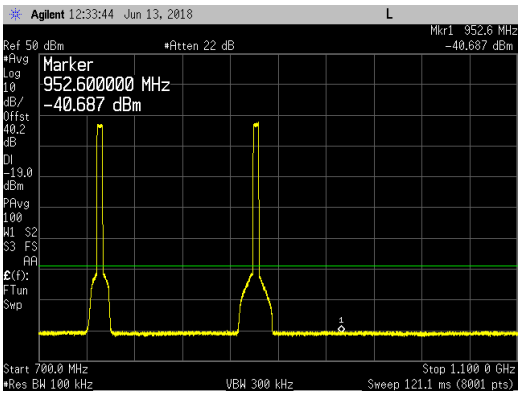
150kHz to 20MHz



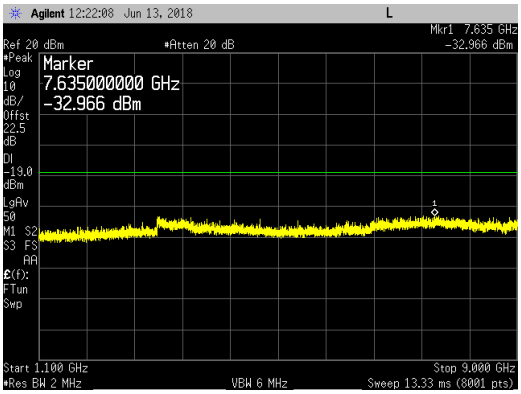
20MHz to 700MHz



700MHz to 1.1GHz

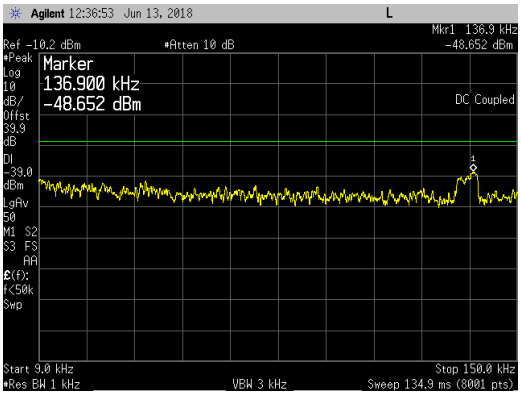


1.1GHz to 9GHz

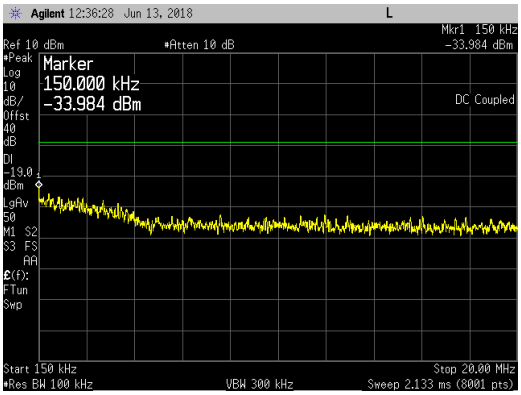


LTE5 & LTE5 Ch BWs _ 256QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

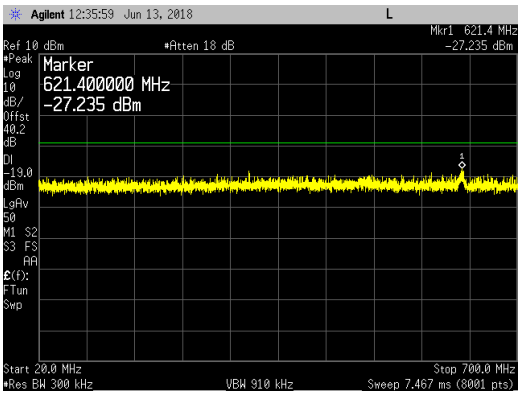
9kHz to 150kHz



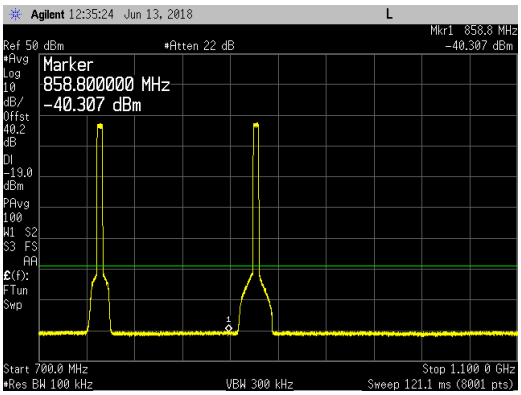
150kHz to 20MHz



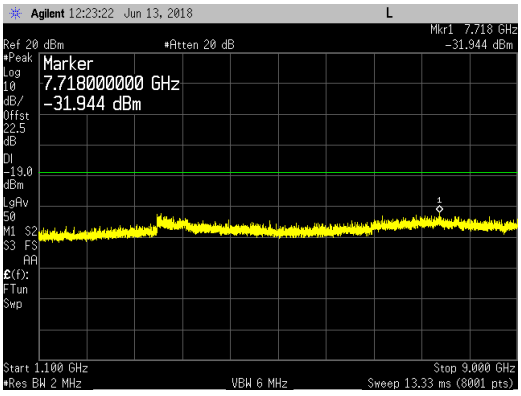
20MHz to 700MHz



700MHz to 1.1GHz

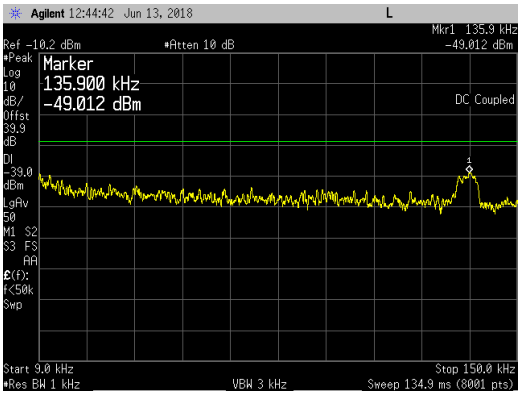


1.1GHz to 9GHz

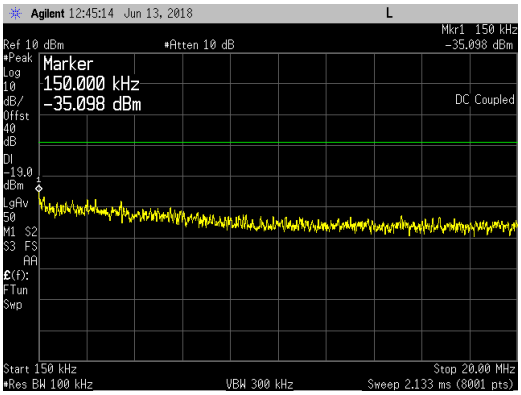


LTE10 & LTE10 Ch BWs _ QPSK _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

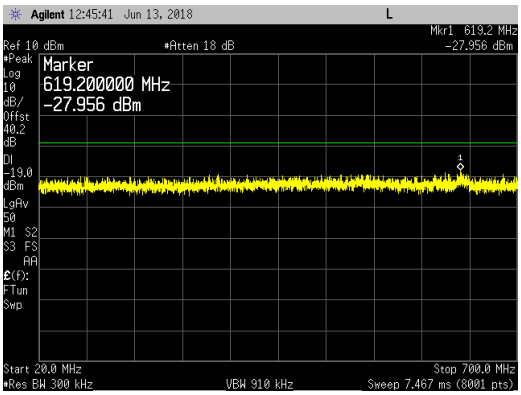
9kHz to 150kHz



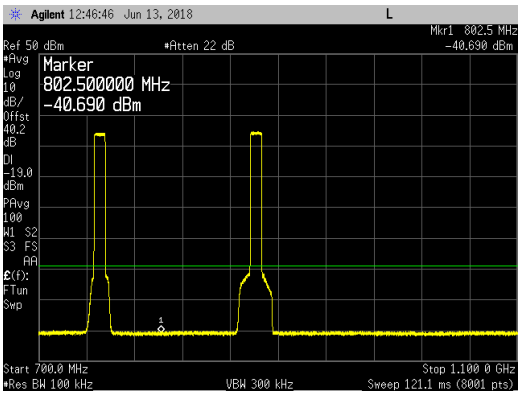
150kHz to 20MHz



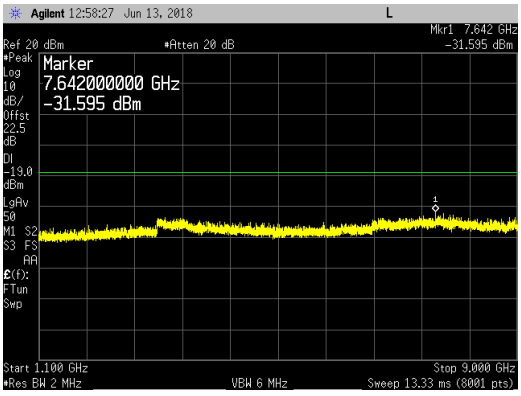
20MHz to 700MHz



700MHz to 1.1GHz

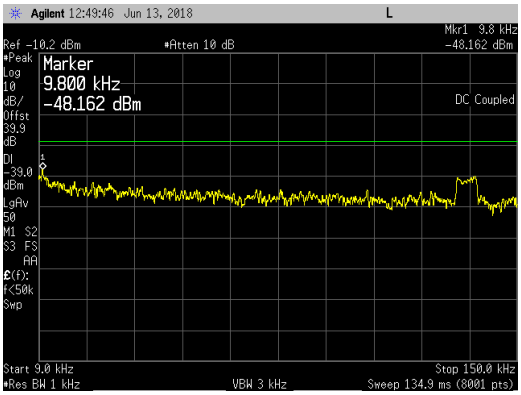


1.1GHz to 9GHz

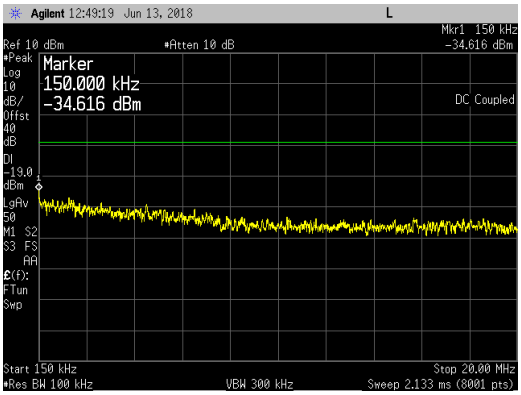


LTE10 & LTE10 Ch BWs _ 16QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

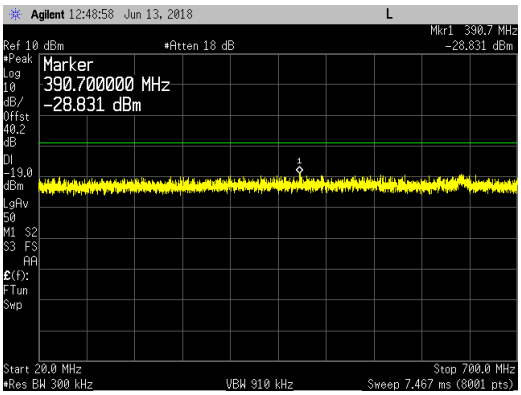
9kHz to 150kHz



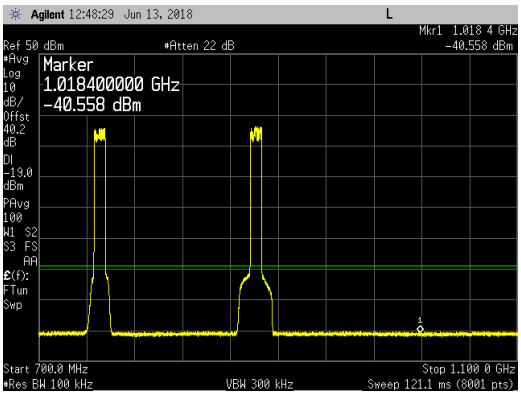
150kHz to 20MHz



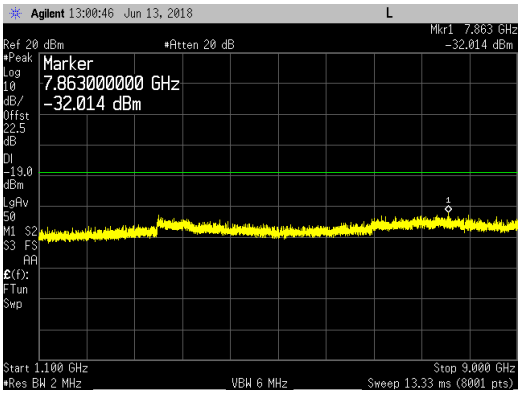
20MHz to 700MHz



700MHz to 1.1GHz

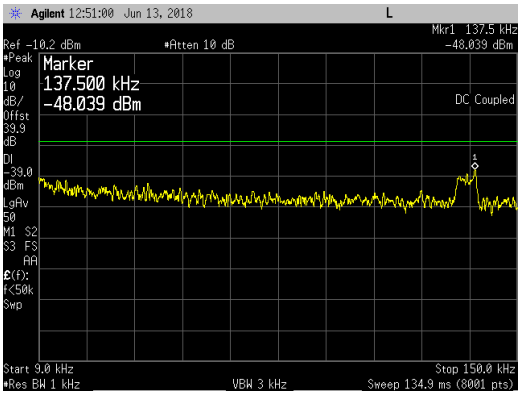


1.1GHz to 9GHz

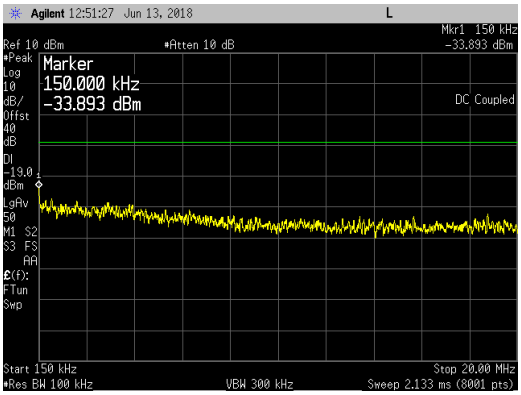


LTE10 & LTE10 Ch BWs _ 64QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

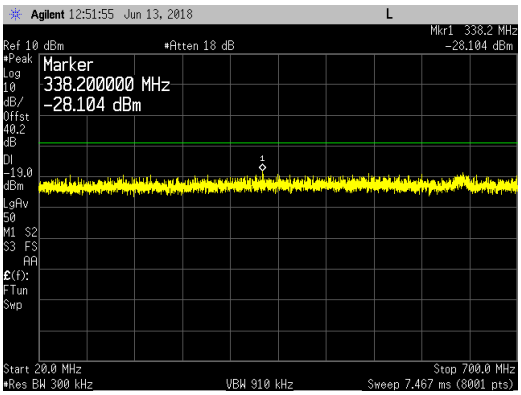
9kHz to 150kHz



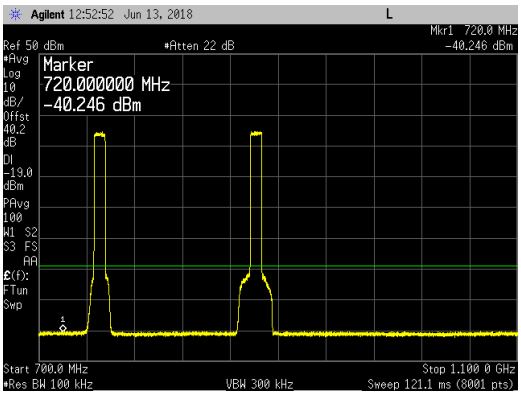
150kHz to 20MHz



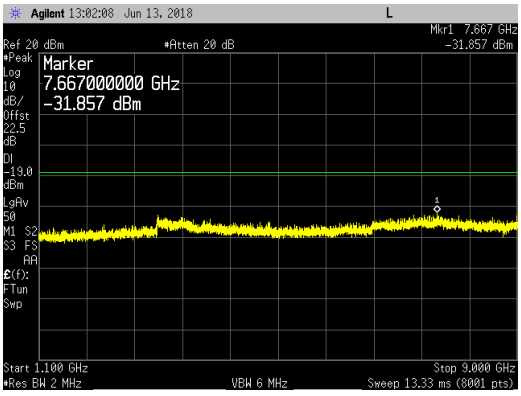
20MHz to 700MHz



700MHz to 1.1GHz

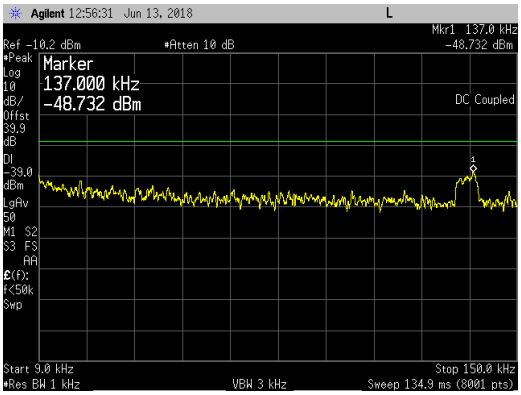


1.1GHz to 9GHz

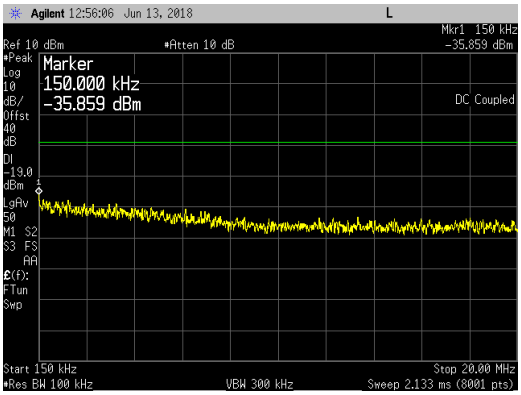


LTE10 & LTE10 Ch BWs _ 256QAM _ Middle Channels (751MHz and 881.5MHz) at 20 watts/carrier:

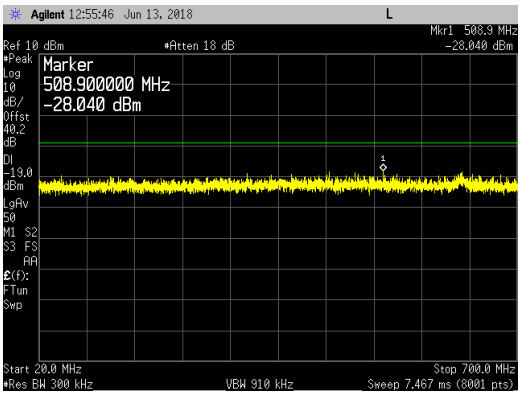
9kHz to 150kHz



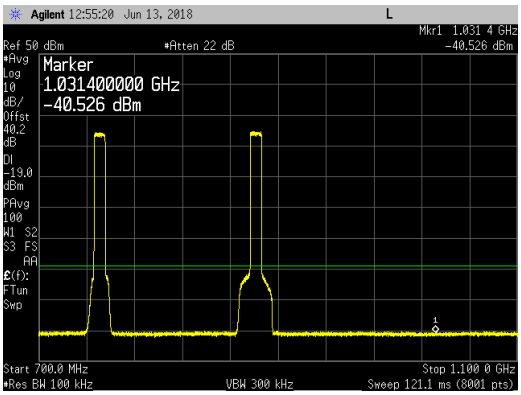
150kHz to 20MHz



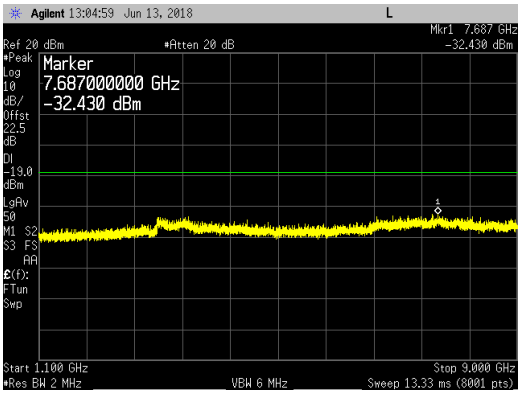
20MHz to 700MHz



700MHz to 1.1GHz

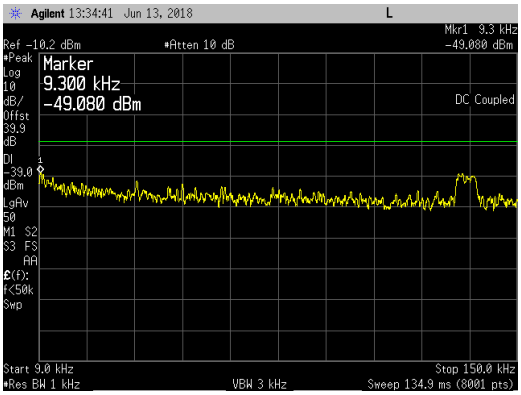


1.1GHz to 9GHz

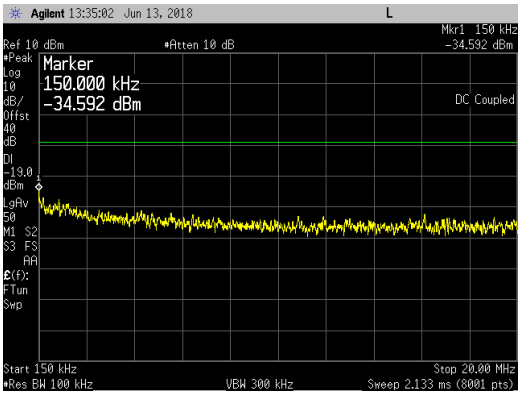


LTE1.4 & LTE10 Ch BWs _ QPSK _ TC-1, TC, & MC (892.9, 893.3 & 751MHz) at 13 watts/carrier:

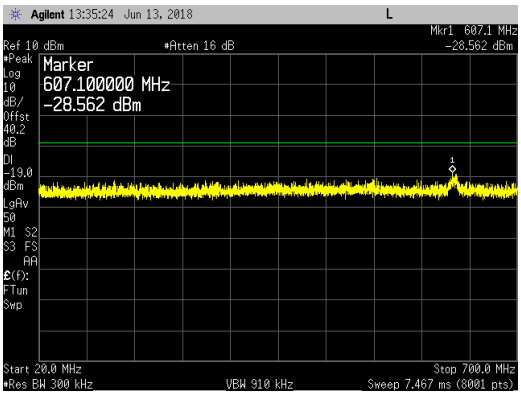
9kHz to 150kHz



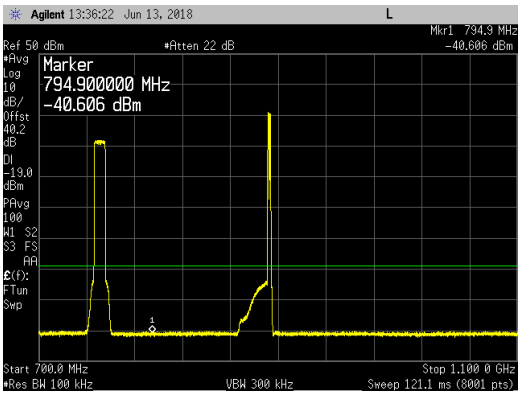
150kHz to 20MHz



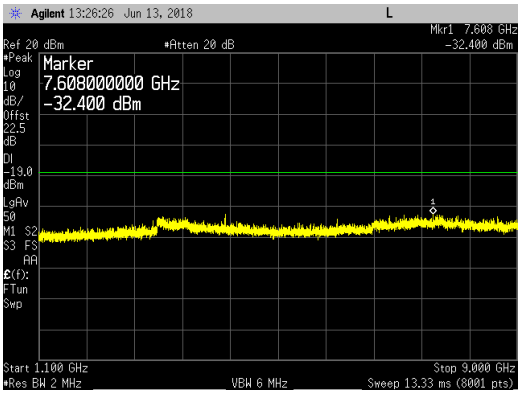
20MHz to 700MHz



700MHz to 1.1GHz

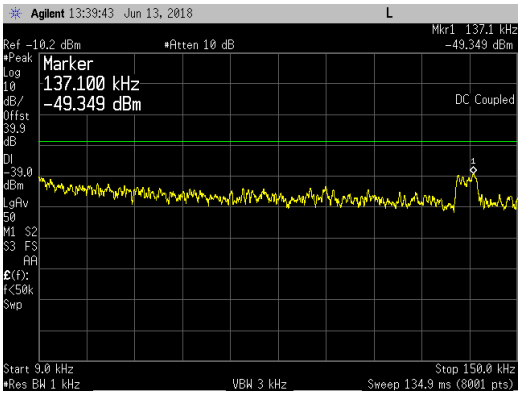


1.1GHz to 9GHz

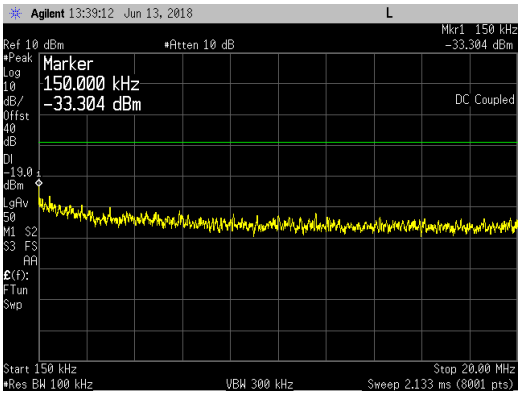


LTE1.4 & LTE10 Ch BWs _ 16QAM _ TC-1, TC, & MC (892.9, 893.3 & 751MHz) at 13 watts/carrier:

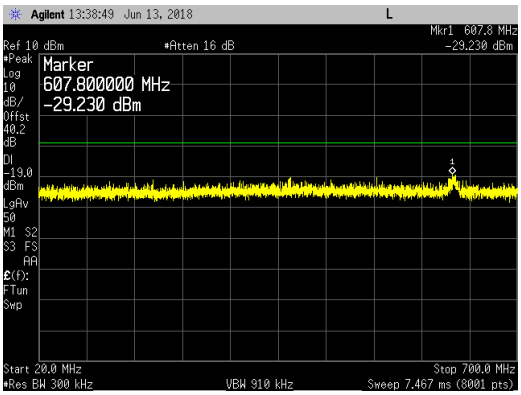
9kHz to 150kHz



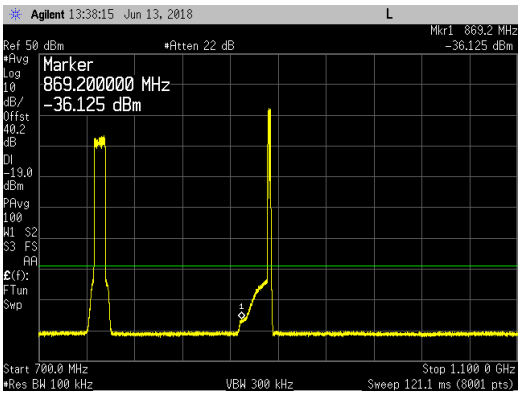
150kHz to 20MHz



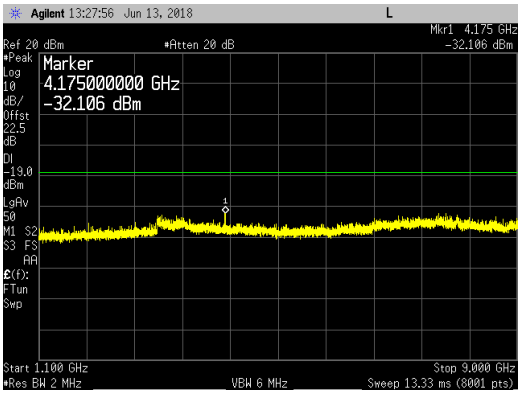
20MHz to 700MHz



700MHz to 1.1GHz

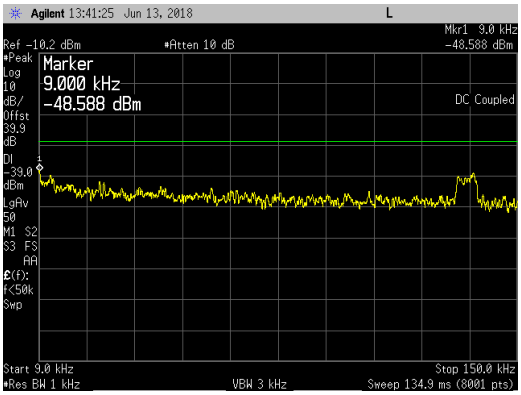


1.1GHz to 9GHz

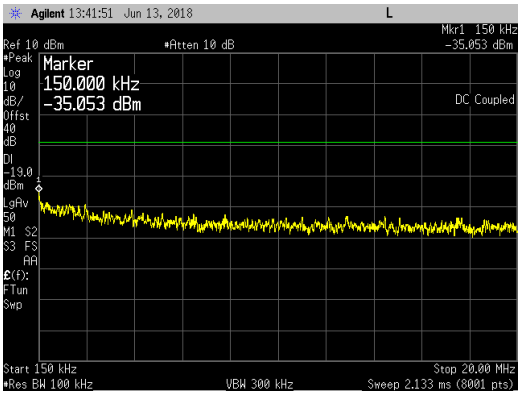


LTE1.4 & LTE10 Ch BWs _ 64QAM _ TC-1, TC, & MC (892.9, 893.3 & 751MHz) at 13 watts/carrier:

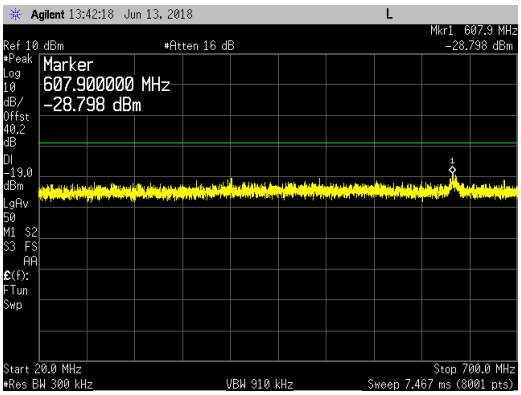
9kHz to 150kHz



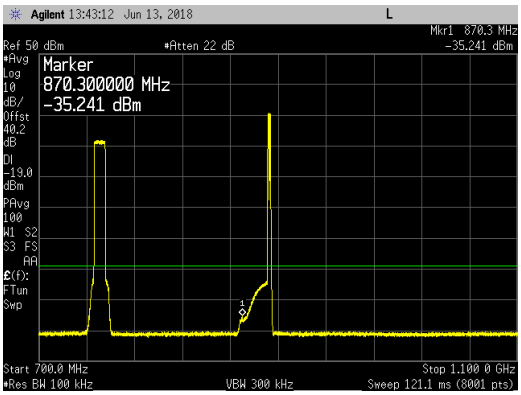
150kHz to 20MHz



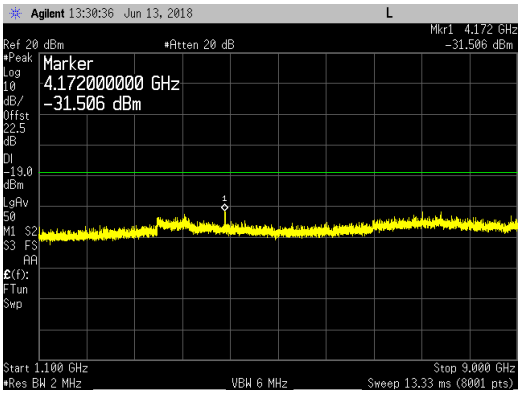
20MHz to 700MHz



700MHz to 1.1GHz

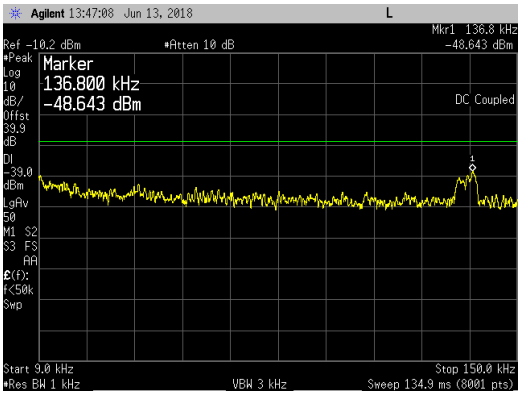


1.1GHz to 9GHz

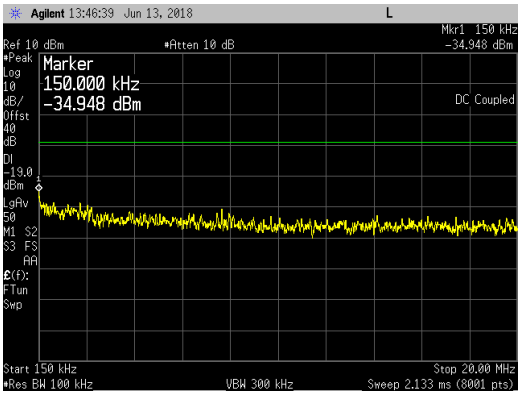


LTE1.4 & LTE10 Ch BWs _ 256QAM _ TC-1, TC, & MC (892.9, 893.3 & 751MHz) at 13 watts/carrier:

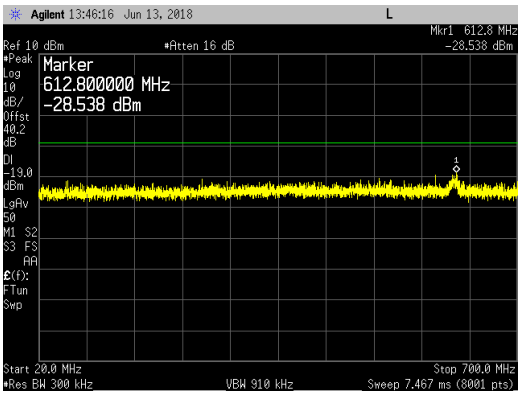
9kHz to 150kHz



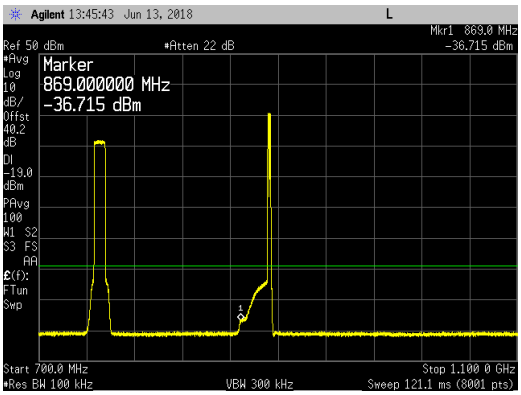
150kHz to 20MHz



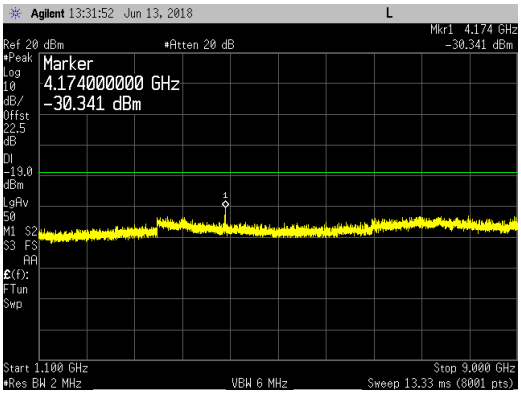
20MHz to 700MHz



700MHz to 1.1GHz

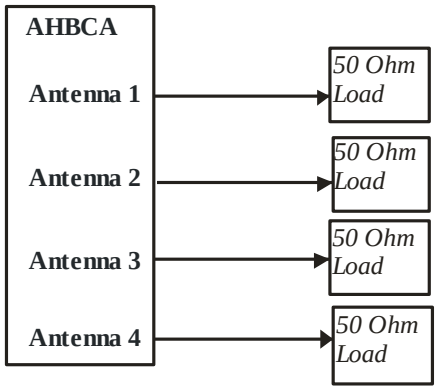


1.1GHz to 9GHz



Transmitter Radiated Spurious Emissions

During radiated emission testing all antenna ports of the base station were terminated with 50ohm termination blocks 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 – 9GHz frequency range.

Two radiated emission test configurations (with the RRH fan assembly) are needed to prove compliance for the 3GPP Band 5 transmitters. The first test is with the 3GPP Band 5 carriers operating at 40W/carrier (3GPP Band 13 carriers are not enabled). The second test is with the 3GPP Band 5 and the 3GPP Band 13 carriers enabled simultaneously (20 watts per carrier and 40 watts per port) on all four ports.

The bottom, middle and top frequency channels for each band were enabled. The AHBCA band 13 configured for LTE10 may operate only on the middle channel since the operational bandwidth is 10MHz wide (The band 13 carrier covers the entire downlink band). The carrier configurations for the radiated emission testing are provided below. Final maximized radiated emissions were measured in these modes.

Frequency Band	Antenna Port	RF Bandwidth	EARFCN	Transmit Frequency	Carrier Power
Band 5	1	1.4 MHz	2407 (Bottom Channel)	869.7 MHz	40 Watts
Band 5	2	1.4 MHz	2525 (Middle Channel)	881.5 MHz	40 Watts
Band 5	3	1.4 MHz	2525 (Middle Channel)	881.5 MHz	40 Watts
Band 5	4	1.4 MHz	2643 (Top Channel)	893.3 MHz	40 Watts
Band 13	1	10 MHz	5230 (Middle Channel)	751.0 MHz	0 Watts
Band 13	2	10 MHz	5230 (Middle Channel)	751.0 MHz	0 Watts
Band 13	3	10 MHz	5230 (Middle Channel)	751.0 MHz	0 Watts
Band 13	4	10 MHz	5230 (Middle Channel)	751.0 MHz	0 Watts

Band 5 Carriers at Maximum Power (40W/carrier) and Band 13 Carriers not Enabled

Frequency Band	Antenna Port	RF Bandwidth	EARFCN	Transmit Frequency	Carrier Power
Band 5	1	1.4 MHz	2407 (Bottom Channel)	869.7 MHz	20 Watts
Band 5	2	1.4 MHz	2525 (Middle Channel)	881.5 MHz	20 Watts
Band 5	3	1.4 MHz	2525 (Middle Channel)	881.5 MHz	20 Watts
Band 5	4	1.4 MHz	2643 (Top Channel)	893.3 MHz	20 Watts
Band 13	1	10 MHz	5230 (Middle Channel)	751.0 MHz	20 Watts
Band 13	2	10 MHz	5230 (Middle Channel)	751.0 MHz	20 Watts
Band 13	3	10 MHz	5230 (Middle Channel)	751.0 MHz	20 Watts
Band 13	4	10 MHz	5230 (Middle Channel)	751.0 MHz	20 Watts

Band 5 and Band 13 Carriers Enabled Simultaneously (20W/carrier)

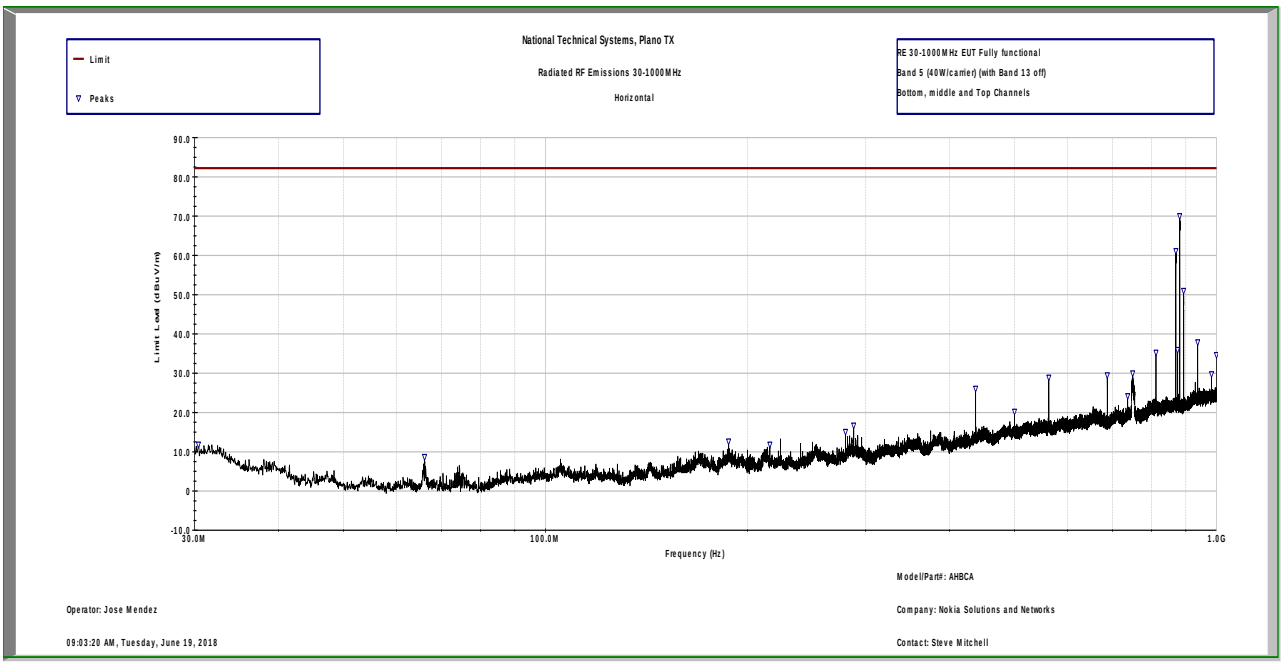
RE Data for Band 5 (40W/carrier) (with Band 13 off)

Frequency	Peaks Raw	Antenna	Pre Amp	Cables	Peaks	Limit	Margin	Tower	Turntable	Polarity
MHz	dBuV/m	dB	dB	dB	dBuV/m	dBuV/m	dB	cm	Degrees	H/V
2949.18	47.324	29.717	-37.32	4.492	44.213	82.2	-37.987	135.1	17.1	V
874.987	47.927	24.2	-36.162	3.364	39.329	82.2	-42.871	111	34.9	V
937.468	44.776	25.7	-36.041	3.895	38.327	82.2	-43.873	161.1	9	V
937.476	44.321	25.7	-36.041	3.895	37.872	82.2	-44.328	300.1	200.9	H
3931.97	37.103	32.676	-36.953	4.967	37.792	82.2	-44.408	200	18	H
5898.32	34.701	34.08	-37.161	5.567	37.186	82.2	-45.014	112	1.1	V
812.491	44.905	24.6	-36.198	2.806	36.112	82.2	-46.088	300	98.1	V
874.979	44.36	24.2	-36.162	3.364	35.762	82.2	-46.438	99.9	329	H
687.489	48.326	21.3	-36.218	2.228	35.636	82.2	-46.564	99.9	1	V
812.492	44.013	24.6	-36.198	2.806	35.221	82.2	-46.979	300	309.9	H
7882.8	30.201	36.573	-38.182	6.063	34.657	82.2	-47.543	99.9	1.1	V
8488.82	26.899	37.276	-38.096	5.051	31.131	82.2	-51.069	200	1	V
7781.88	25.431	36.383	-37.816	6.227	30.225	82.2	-51.975	200.2	254.8	H
4346.7	28.727	32.146	-36.679	5.311	29.506	82.2	-52.694	200	166	H
687.503	42.09	21.3	-36.218	2.228	29.4	82.2	-52.8	106.3	0.9	H
8410.15	24.534	37.18	-38.064	5.327	28.977	82.2	-53.223	200	360	H
562.498	43.214	20.2	-36.5	1.898	28.813	82.2	-53.387	123	112.1	H
929.538	34.968	25.7	-36.069	3.848	28.443	82.2	-53.757	300.1	47.9	V
562.492	42.713	20.2	-36.5	1.898	28.311	82.2	-53.889	100	115	V
9375.84	25.03	37.717	-38.8	3.395	27.342	82.2	-54.858	200.1	360.1	H
437.513	42.742	18.551	-36.876	1.615	26.032	82.2	-56.168	300	27.9	H
4349.59	22.172	32.148	-36.681	5.313	22.952	82.2	-59.248	200	168	V
2609.54	26.16	29.176	-37.455	4.431	22.311	82.2	-59.889	200.1	91	H

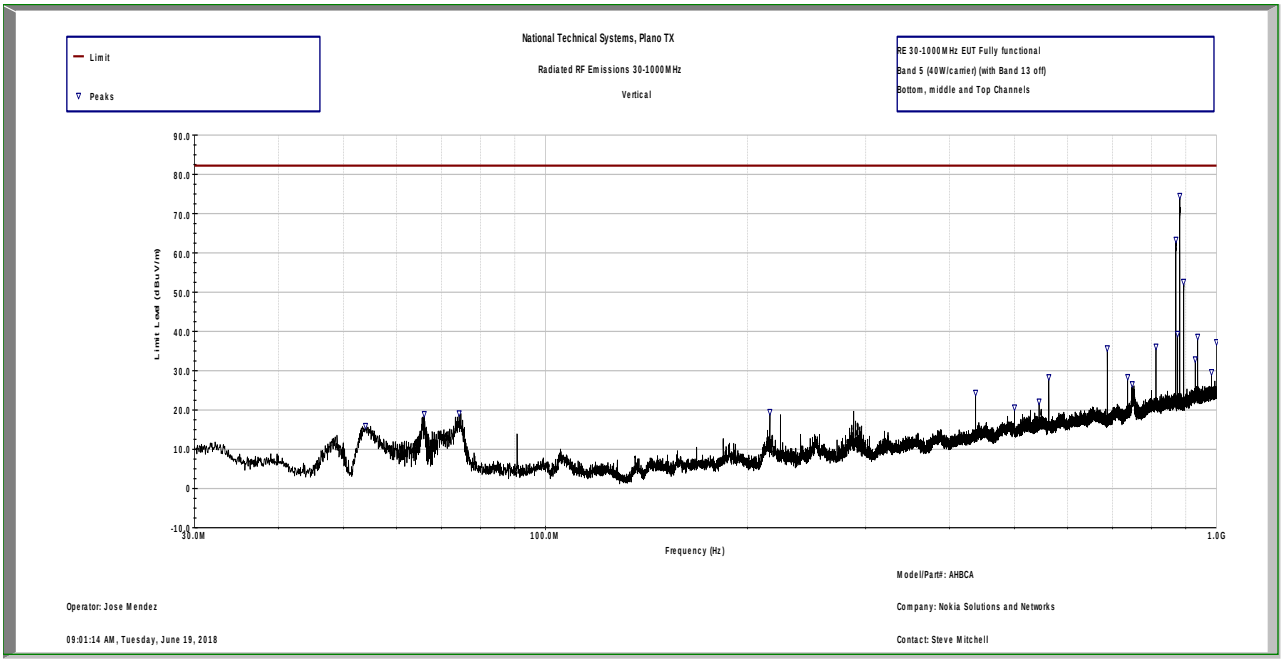
RE Data for Band 5 (20W/carrier) + Band 13 (20W/carrier) simultaneously

Frequency	Peaks Raw	Antenna	Pre Amp	Cables	Peaks	Limit	Margin	Tower	Turntable	Polarity
MHz	dBuV/m	dB	dB	dB	dBuV/m	dBuV/m	dB	cm	Degrees	H/V
929.639	59.587	25.7	-36.069	3.848	53.063	82.2	-29.137	240	72	H
929.641	56.288	25.7	-36.069	3.848	49.764	82.2	-32.436	147.8	91.1	V
2949.110	46.603	29.717	-37.32	4.492	43.492	82.2	-38.708	127.1	16.2	V
940.861	47.77	25.6	-36.028	3.915	41.253	82.2	-40.947	300	1	H
862.784	48.586	24.5	-36.171	3.24	40.154	82.2	-42.046	300	1	H
5898.300	37.411	34.08	-37.161	5.567	39.896	82.2	-42.304	100	-0.1	V
7238.520	30.569	36.011	-37.318	6.596	35.857	82.2	-46.343	200	360	H
812.492	44.535	24.6	-36.198	2.806	35.743	82.2	-46.457	100	175.9	V
687.468	48.051	21.3	-36.218	2.228	35.36	82.2	-46.84	188.9	-0.1	V
2371.800	39.799	28.463	-37.65	4.393	35.005	82.2	-47.195	149.1	0.9	H
812.472	43.529	24.6	-36.198	2.805	34.736	82.2	-47.464	161	109.9	H
8522.440	30.077	37.324	-38.173	4.93	34.159	82.2	-48.041	200.1	360.1	H
7615.420	28.93	36.354	-37.807	6.497	33.974	82.2	-48.226	99.8	0	V
863.321	42.151	24.468	-36.171	3.245	33.692	82.2	-48.508	99.9	1.1	V
2377.560	37.854	28.511	-37.643	4.391	33.113	82.2	-49.087	99.9	304.8	H
2364.710	37.399	28.408	-37.658	4.395	32.543	82.2	-49.657	200.2	178.1	H
7772.520	26.784	36.376	-37.782	6.242	31.62	82.2	-50.58	200	360	H
2374.340	34.571	28.484	-37.647	4.392	29.8	82.2	-52.4	200	228.9	V
8537.160	25.301	37.347	-38.22	4.877	29.305	82.2	-52.895	200.1	0	V
940.988	35.58	25.6	-36.028	3.916	29.065	82.2	-53.135	100	1	V
162.435	56.358	8.944	-37.502	0.943	28.743	82.2	-53.457	99.8	315.9	H
90.983	55.285	7.797	-37.262	0.699	26.519	82.2	-55.681	300	152	V
464.038	35.727	18	-36.832	1.691	18.585	82.2	-63.615	300.1	358.9	H

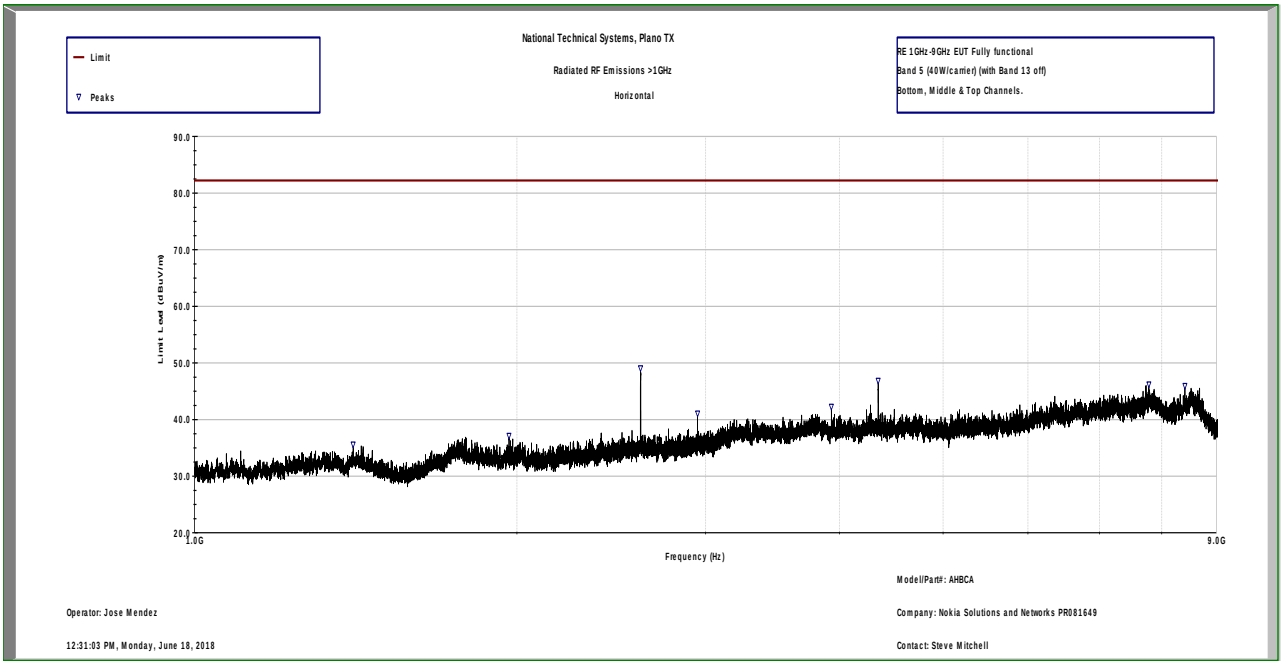
A three-meter measurement distance was used for radiated emission measurements. The highest radiated emissions detected were more than 20dB below the three-meter limit of 82.2dBuV/m (equivalent to -13dBm EIRP). Since all maximized measurements were more than 20dB below these levels, substitution measurements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



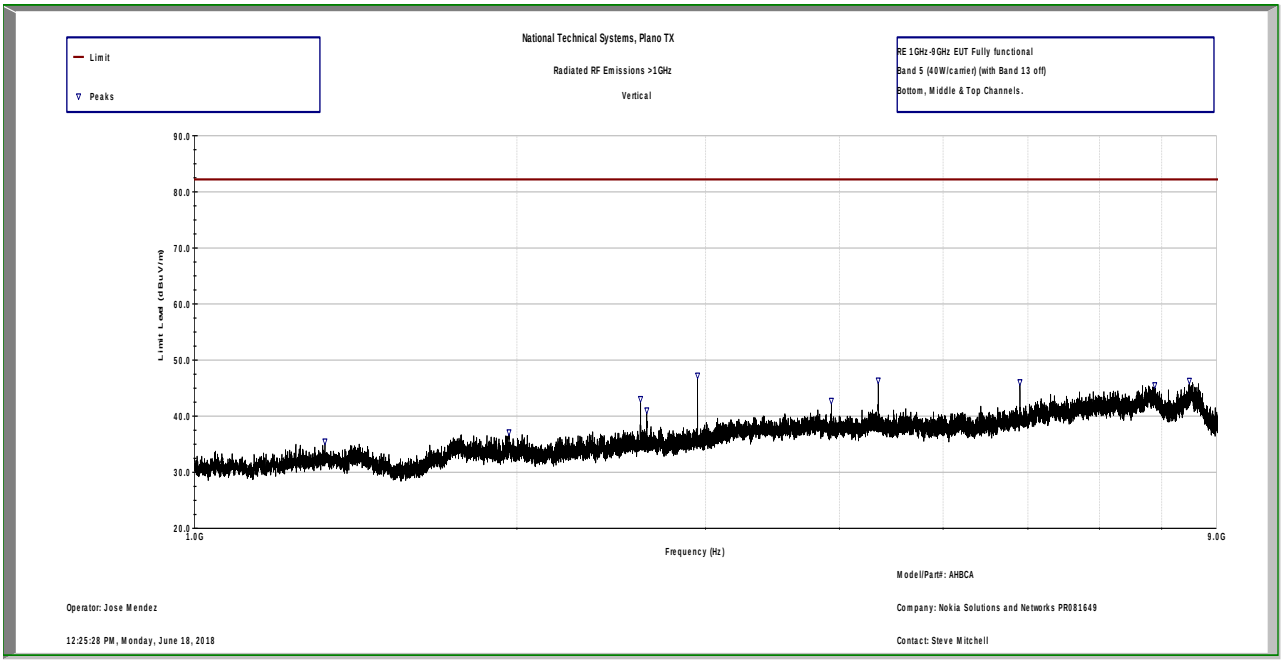
Radiated Spurious Emissions 30-1000 MHz Horizontal – Band 5



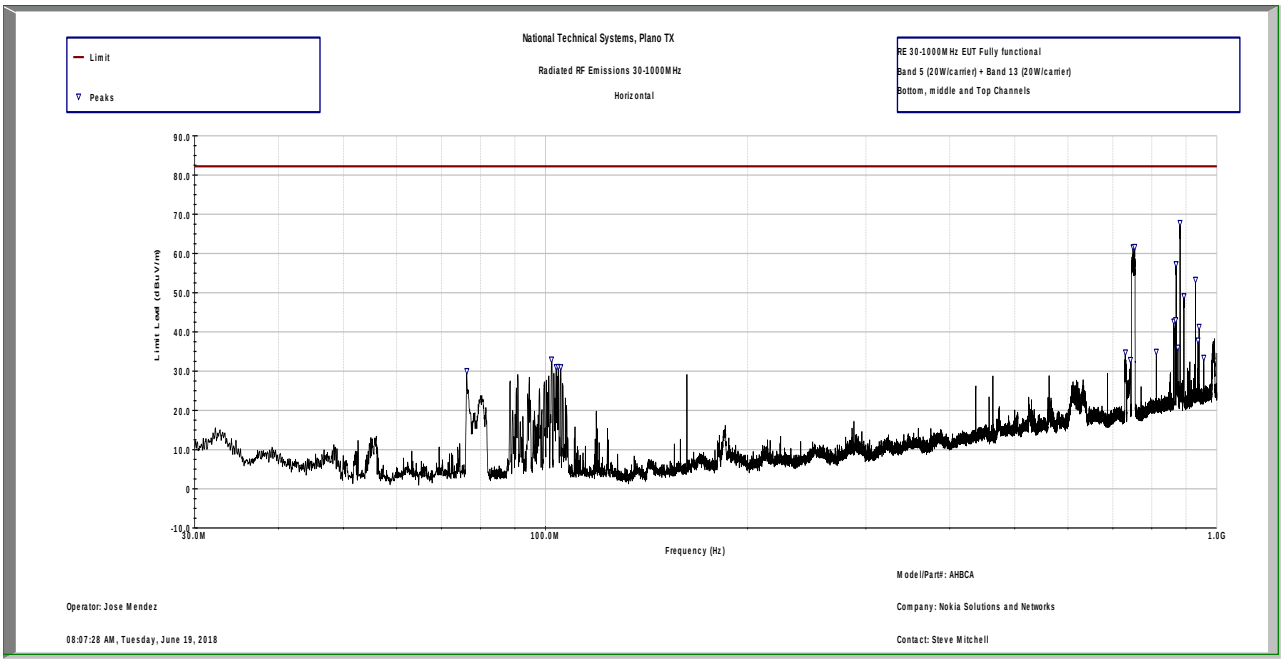
Radiated Spurious Emissions 30-1000 MHz Vertical – Band 5



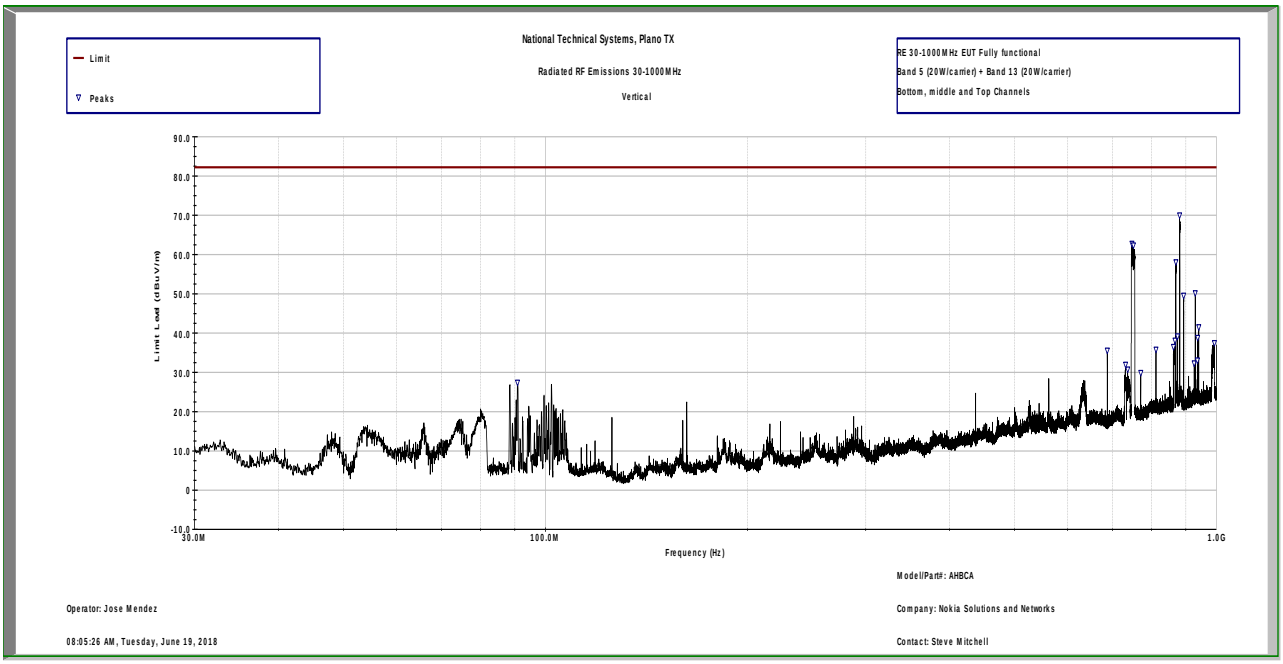
Radiated Spurious Emissions 1-9 GHz Horizontal – Band 5



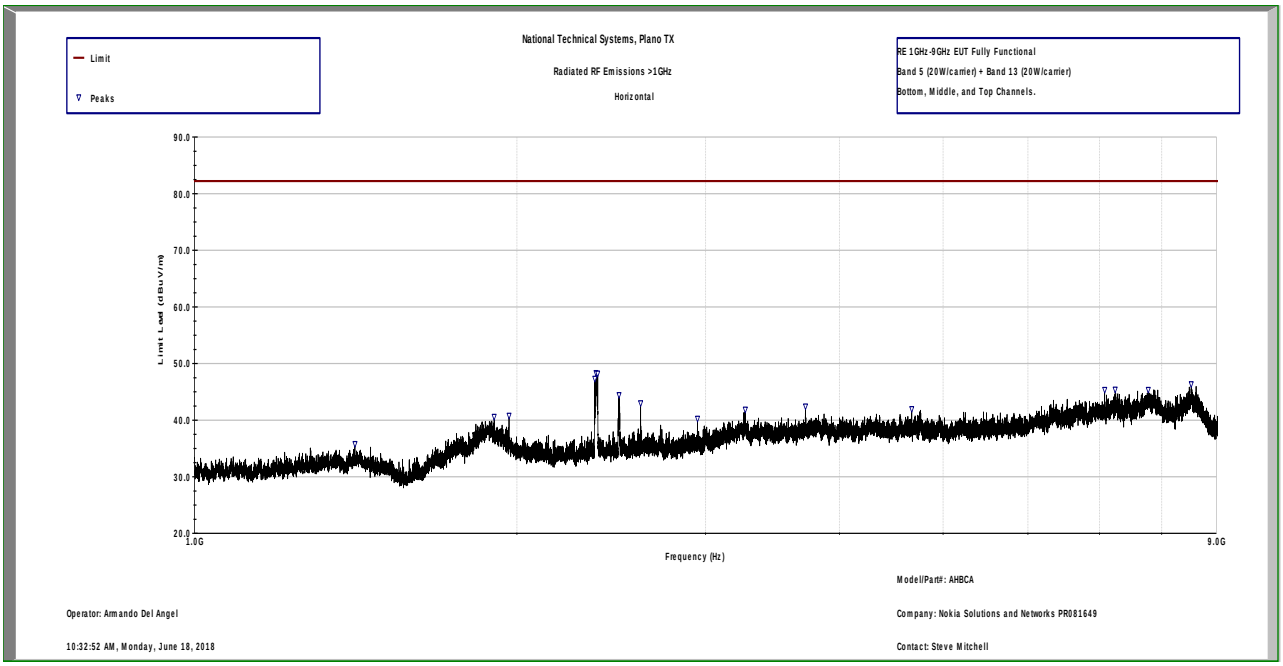
Radiated Spurious Emissions 1-9 GHz Vertical – Band 5



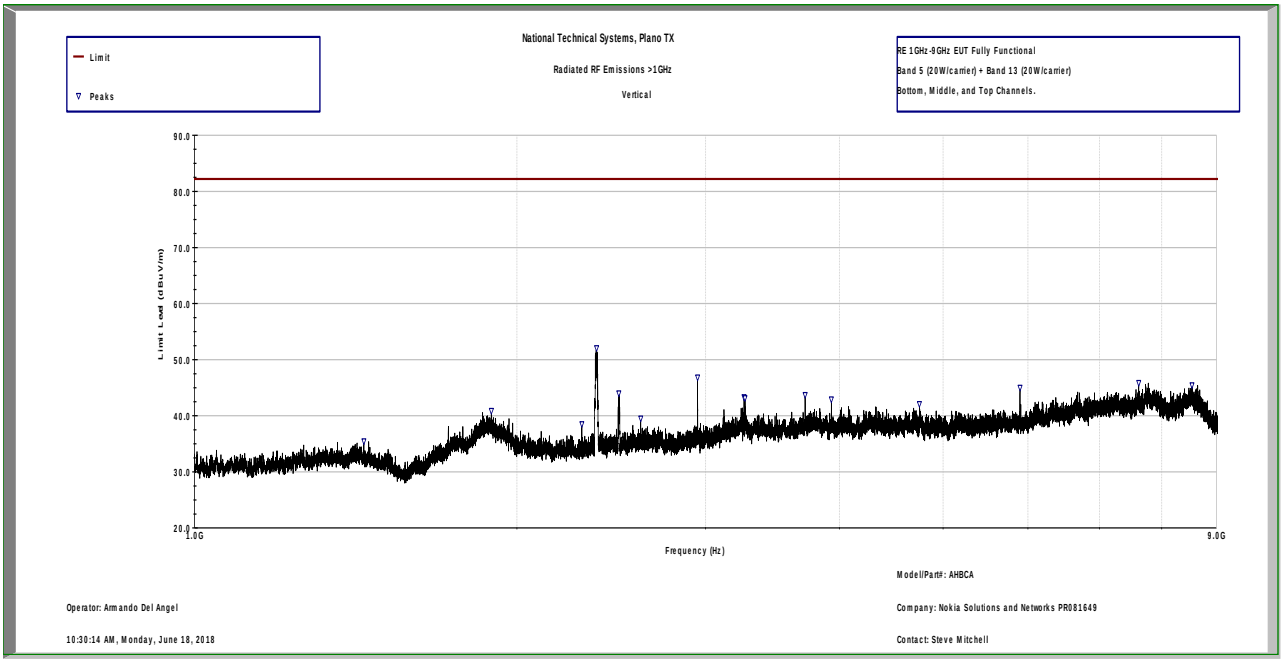
Radiated Spurious Emissions 30-1000 MHz Horizontal - Band 5 & 13 Simultaneously



Radiated Spurious Emissions 30-1000 MHz Vertical - Band 5 & 13 Simultaneously



Radiated Spurious Emissions 1-9 GHz Horizontal – Band 5 & 13 Simultaneously



Radiated Spurious Emissions 1-9 GHz Vertical – Band 5 & 13 Simultaneously

Frequency Stability/Accuracy

Carrier frequency stability of the EUT at extreme temperatures and voltages was measured. The frequency error was measured as follows:

(1) EUT transmitting in 5MHz-QPSK-LTE mode at center channel (881.5MHz) 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)	Maximum Frequency Error (Hz) at 20°C
85%	40.8	0.84
100%	48.0	0.98
115%	55.2	0.94

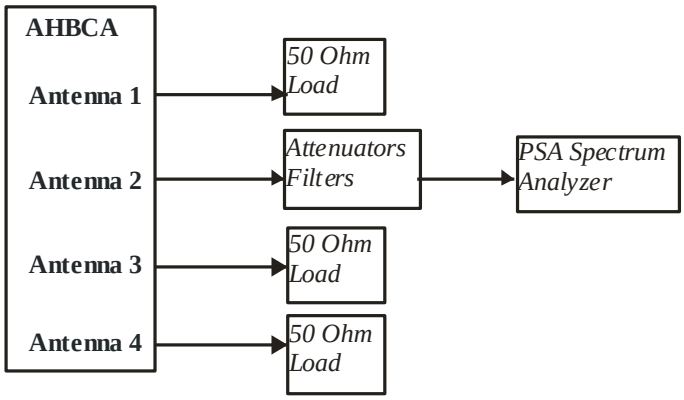
Extreme Temperatures:

Temperature	Maximum Frequency Error (Hz) at 48VDC
-30 °C	**2.80**
-20 °C	1.10
-10 °C	1.07
0 °C	0.88
10 °C	0.76
20 °C	0.98
30 °C	1.14
40 °C	1.21
50 °C	1.01

The highest recorded frequency error is 2.80 Hz or ~0.003 ppm. The deviation limit is defined as ± 1.5 ppm in section FCC 22.355 and RSS 132 5.3. The allowable deviation is ± 1322.3 Hz at the center channel (EARFCN 2525: 881.5 MHz).
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 BAND 13 (746-756MHZ)

All conducted RF measurements for this test effort in this section were made at AHBCA antenna ports for Band 13 measurements. The test setup used is provided below.



Test Setup Used for Conducted RF Measurements on AHBCA

RF Output Power

RF output power has been measured in both Peak and RMS Average terms for each Band 13 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**	53.83	46.04	7.79
Port 2 Middle Channel	**5M**	53.95	46.14	7.81
Port 3 Middle Channel	**5M**	53.77	46.00	7.77
Port 4 Middle Channel	**5M**	53.80	45.99	7.81

The variation in RMS output power levels between the antenna ports is 0.15 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	53.98	46.14	53.90	46.17	53.95	46.14	53.95	46.14

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 0.03dB for the data snapshot provided. The variation of peak power output versus modulation type is 0.08dB 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.