

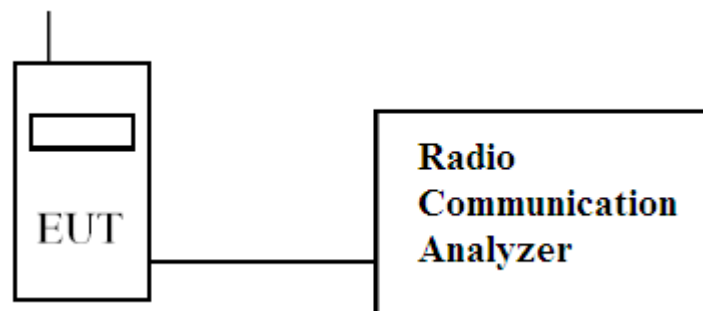
6. Spurious Emission

6.1. Test Specification

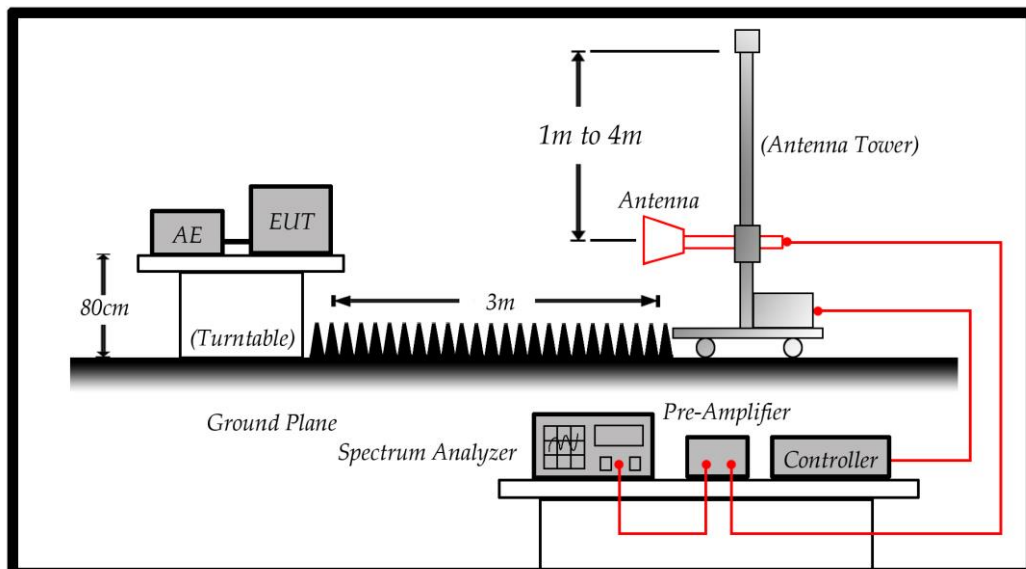
According to Part 2.1051, 2.1053, 24.238

6.2. Test Setup

6.2.1 Spurious emissions at antenna terminals.



6.2.2 Field strength of spurious radiation.



6.3. Limits

Limit	<-13dBm
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$43 + 10\log(P)$ down on the carrier where P is the power in Watts.

6.4. Test Procedure

In accordance with Part 2.1051, 2.1053, 24.238, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 30MHz to 20GHz. The EUT was set to transmit on full power. The EUT was tested on Low, middle and High channels for both power levels. The resolution and video bandwidth was set to 1MHz/3MHz in accordance with Part 2.1051, 2.1053, 24.238. The spectrum analyzer detector was set to Max Hold. In addition, measurements were made up to the 10th harmonic of the fundamental. The device was then replaced with a substitution antenna, which input signal was adjusted until the received level matched that of the previously detected emission.

- (1) The EUT is tested with maximum rated TX power via the Base Station simulator.
- (2) The EUT is tested in three orthogonal planes, The worst case was showing in this report.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

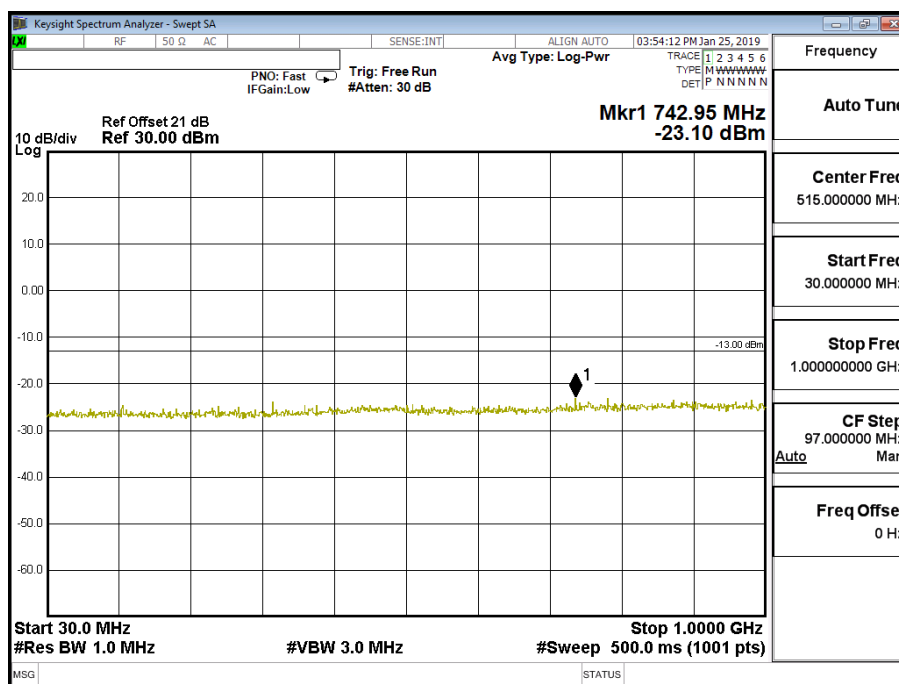
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to TIA/EIA 603-E on radiated measurement.

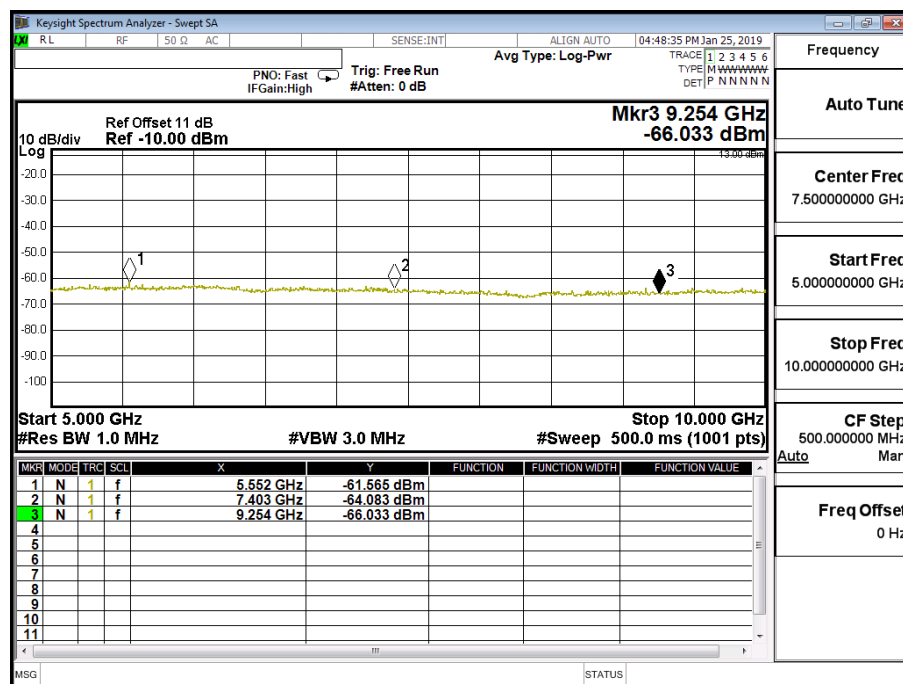
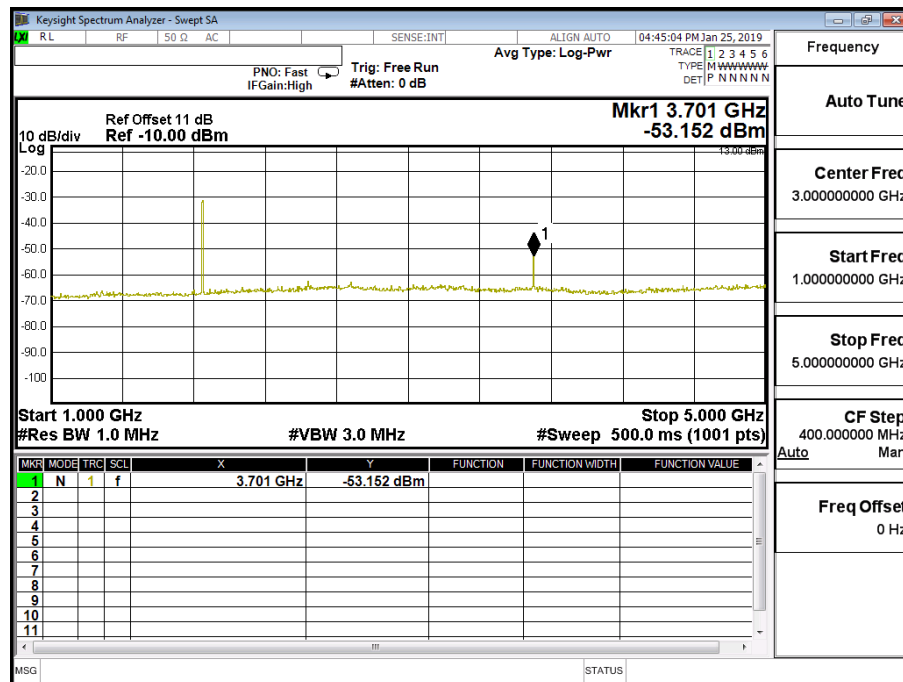
6.5. Test Result of Spurious Emission

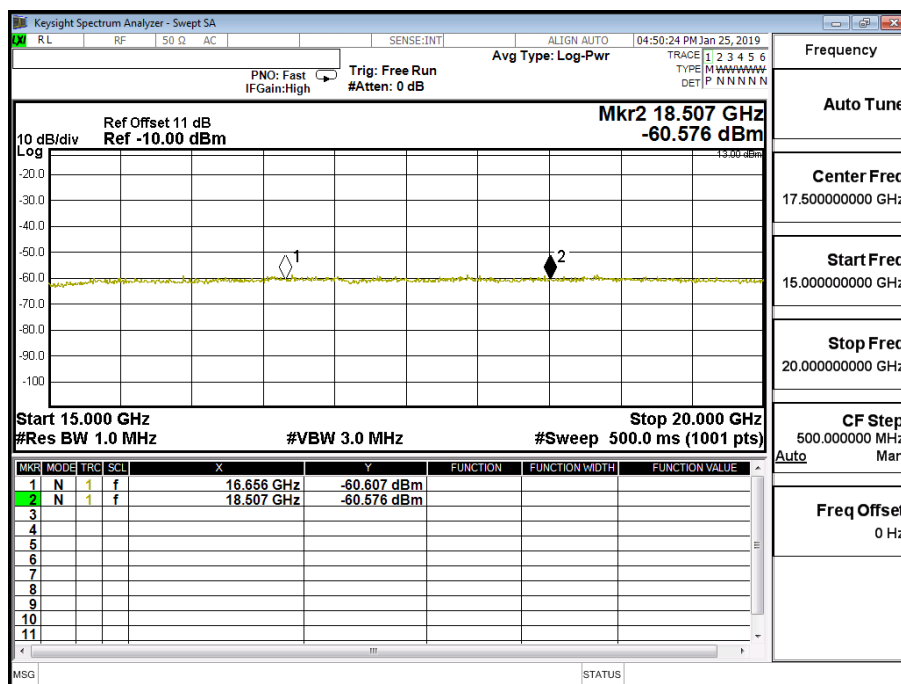
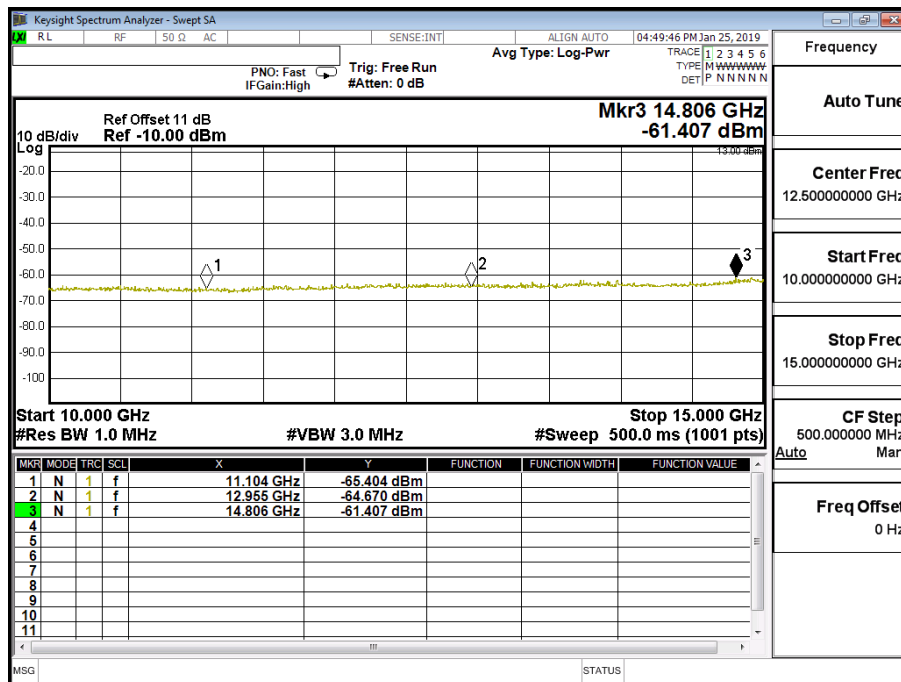
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Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (1.4M)	Test Range	30MHz~20GHz

LTE-Band 2 (1.4M) QPSK(1,0) CH18607(1850.7 MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3701	-53.152	1.10	-52.052	-13
5552	-61.565	1.23	-60.335	-13
7403	-64.083	1.59	-62.493	-13
9254	-66.033	1.89	-64.143	-13
11104	-65.404	2.07	-63.334	-13
12955	-64.670	2.26	-62.410	-13
14806	-61.407	2.64	-58.767	-13
16656	-60.607	3.50	-57.107	-13
18507	-60.576	3.70	-56.876	-13



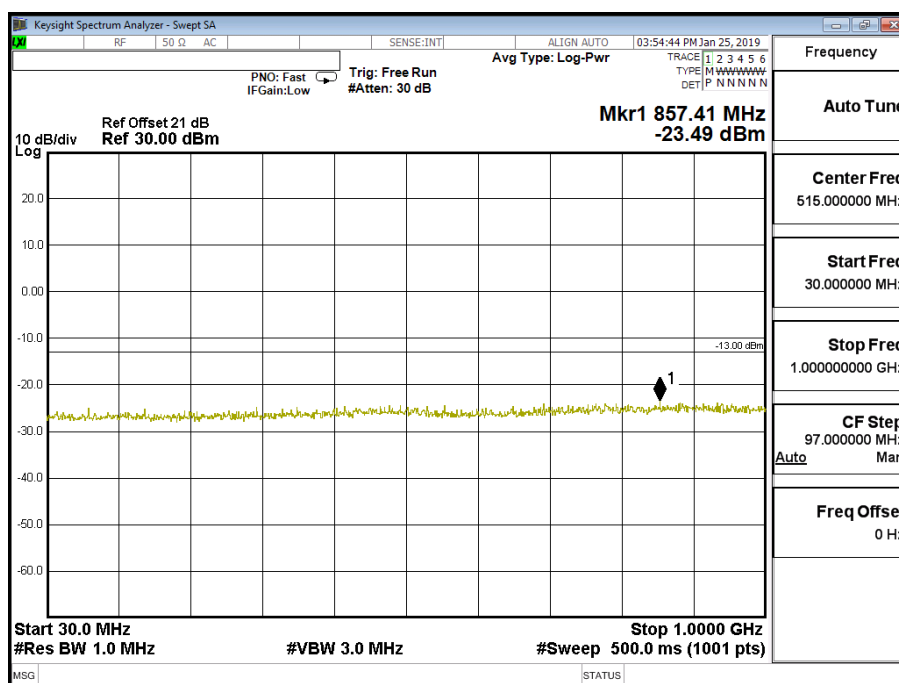


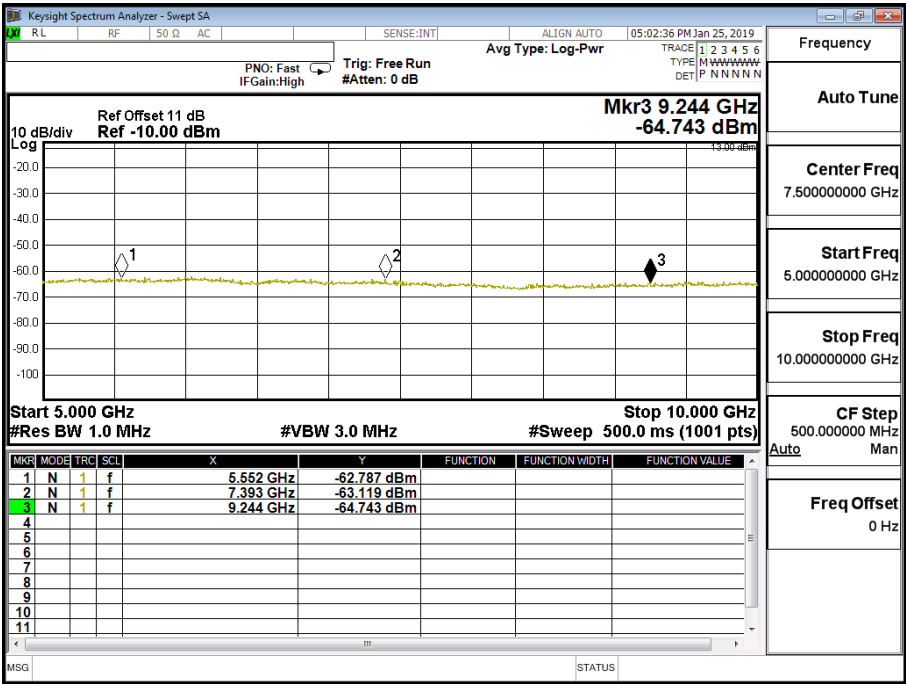
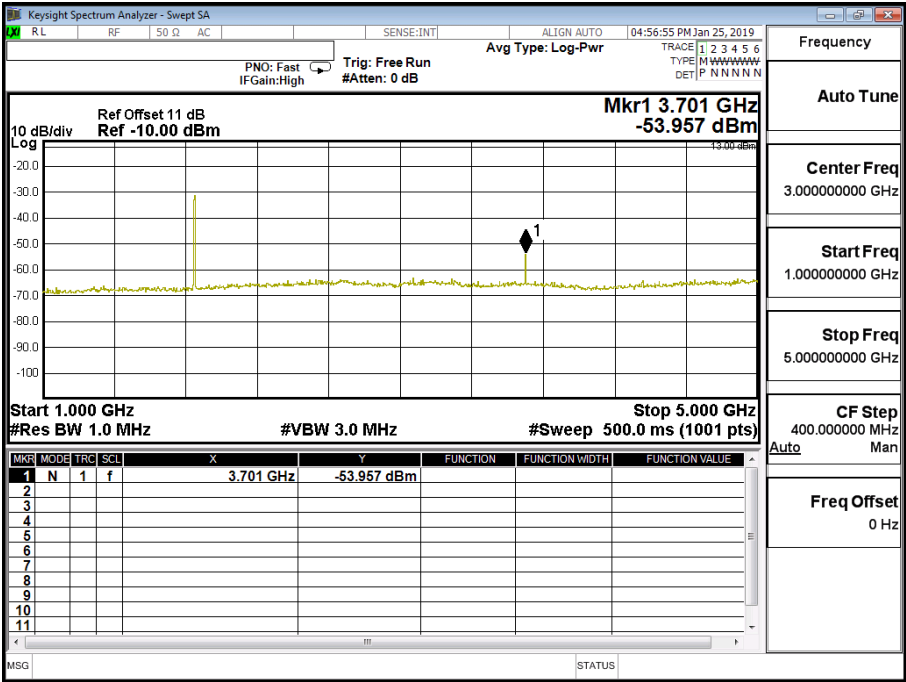


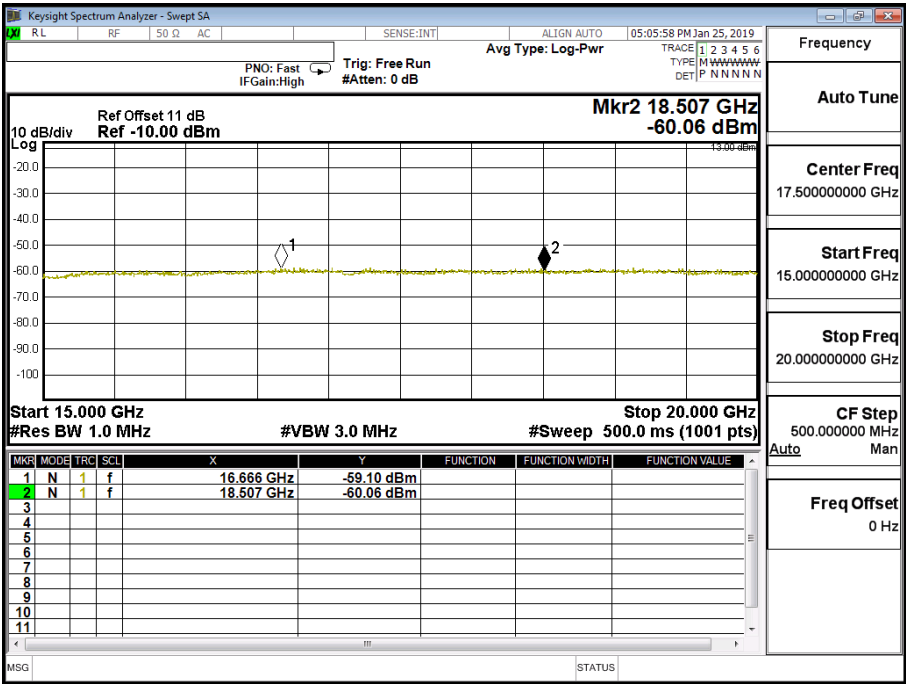
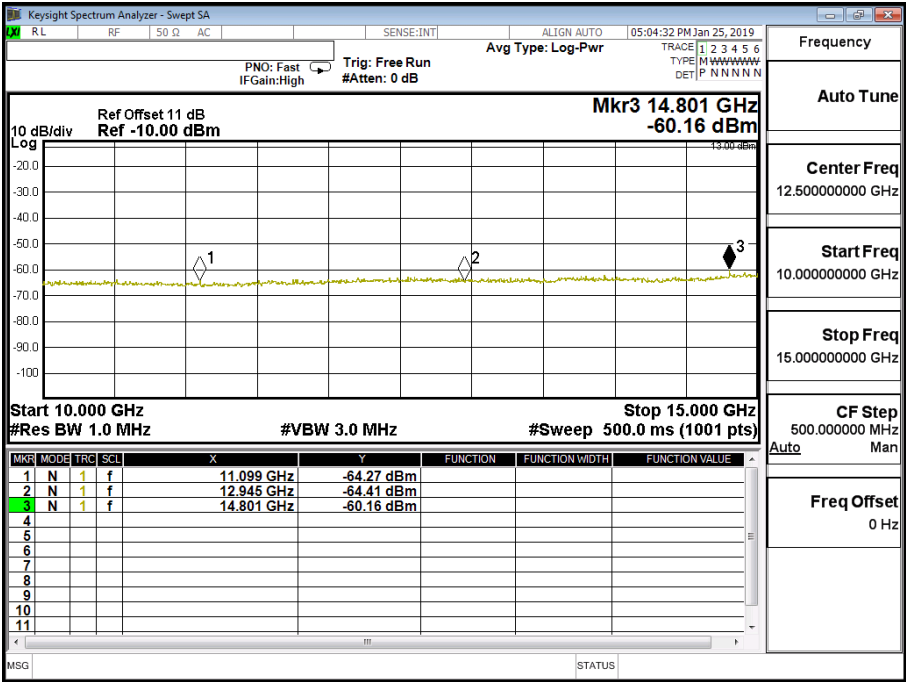
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (1.4M)	Test Range	30MHz~20GHz

LTE-Band 2 (1.4M) 16QAM(1,0) CH18607(1850.7MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3701	-53.957	1.10	-52.857	-13
5552	-62.787	1.23	-61.557	-13
7393	-63.119	1.59	-61.529	-13
9244	-64.743	1.89	-62.853	-13
11099	-64.270	2.07	-62.200	-13
12945	-64.410	2.26	-62.150	-13
14801	-60.160	2.64	-57.520	-13
16666	-59.100	3.50	-55.600	-13
18507	-60.060	3.70	-56.360	-13



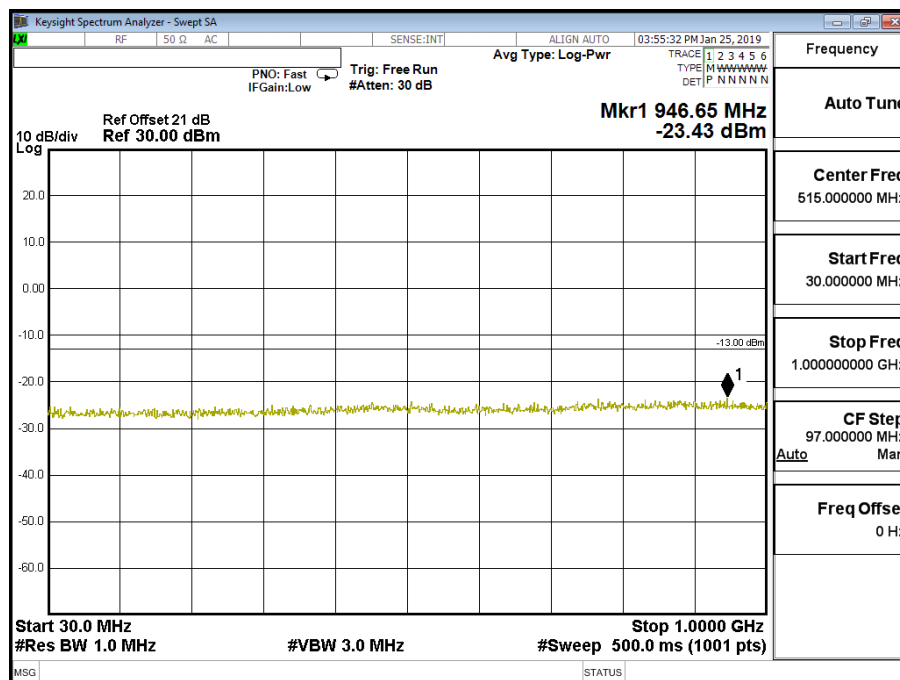


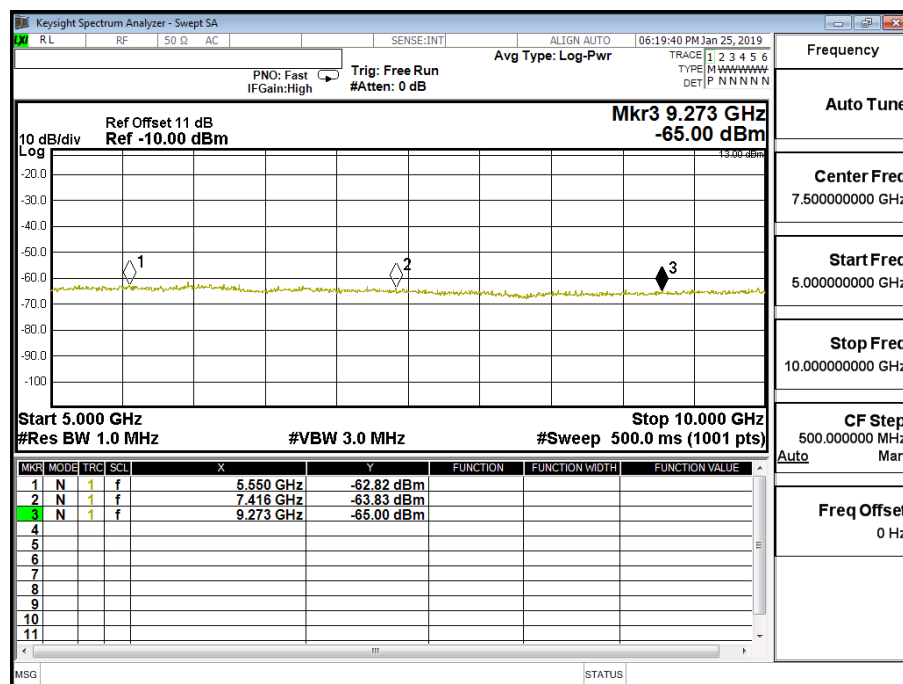
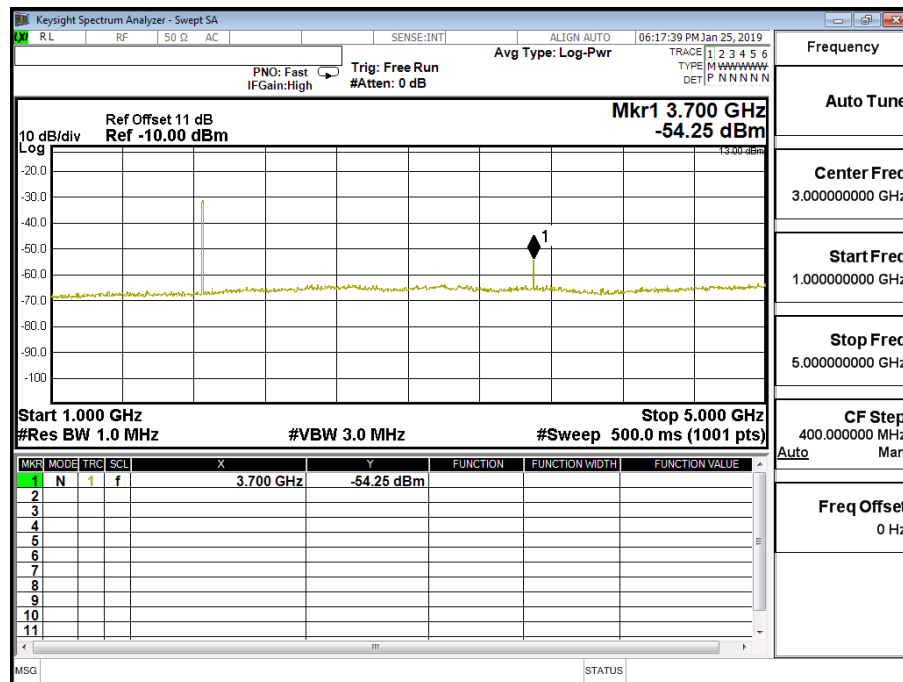


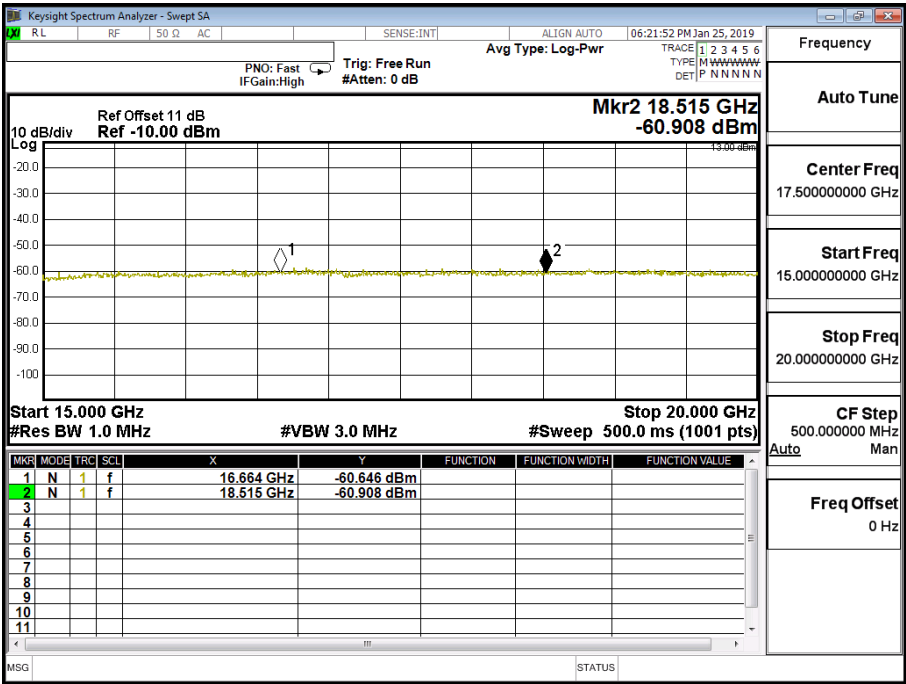
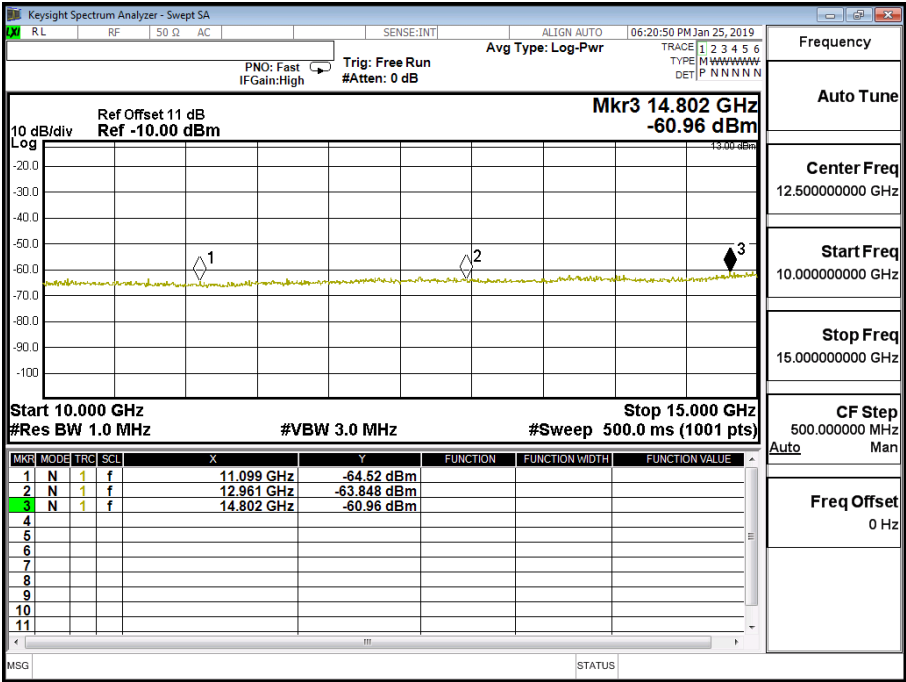
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (3M)	Test Range	30MHz~20GHz

LTE-Band 2 (3M) QPSK(1,7) CH18615 (1851.5MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3700	-54.250	1.10	-53.150	-13
5550	-62.820	1.23	-61.590	-13
7416	-63.830	1.59	-62.240	-13
9273	-65.000	1.89	-63.110	-13
11099	-64.520	2.07	-62.450	-13
12961	-63.848	2.26	-61.588	-13
14802	-60.960	2.64	-58.320	-13
16664	-60.646	3.50	-57.146	-13
18515	-60.908	3.70	-57.208	-13



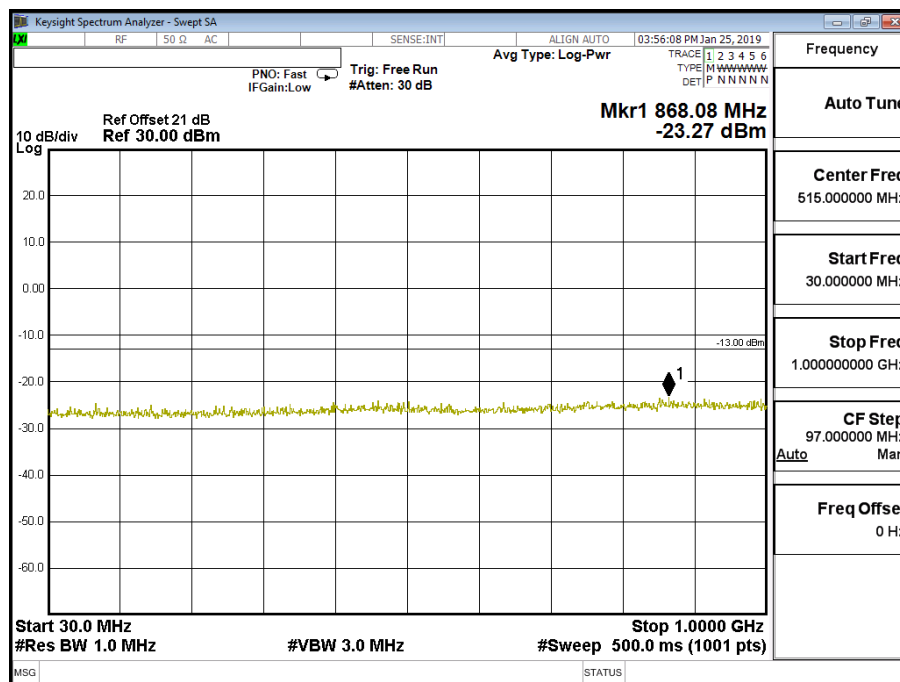


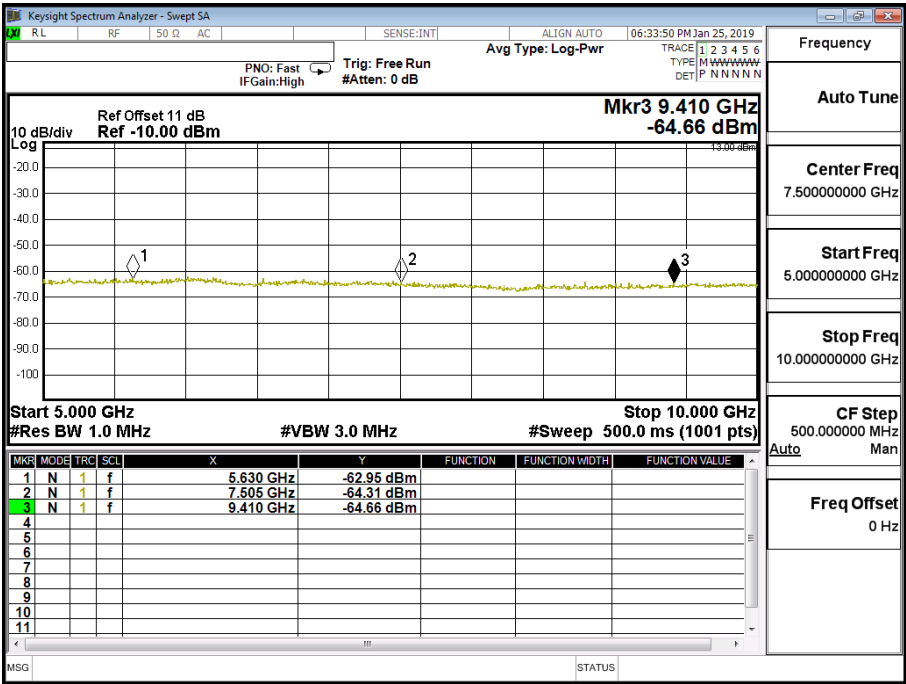
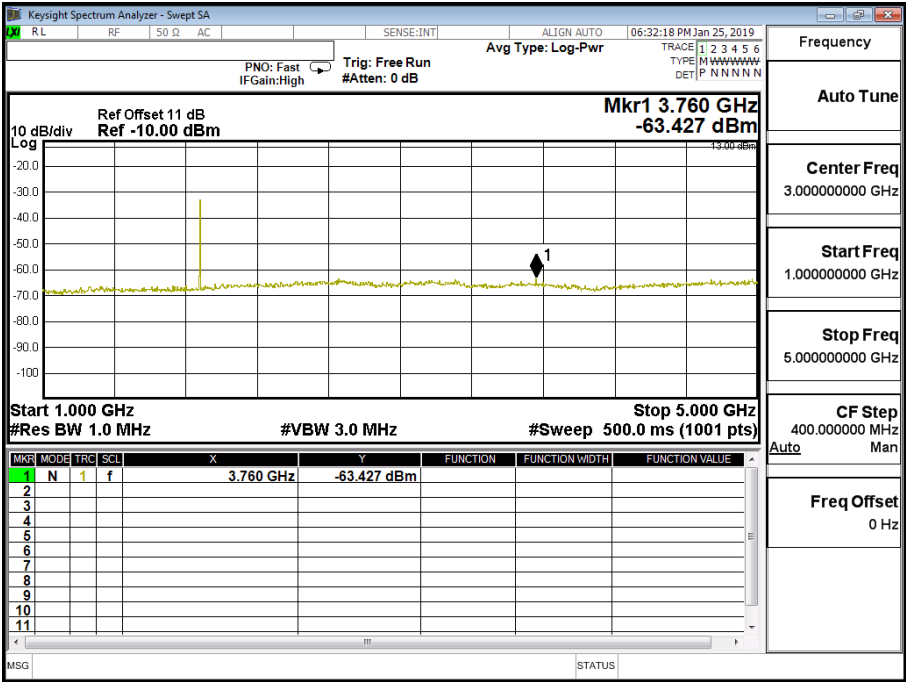


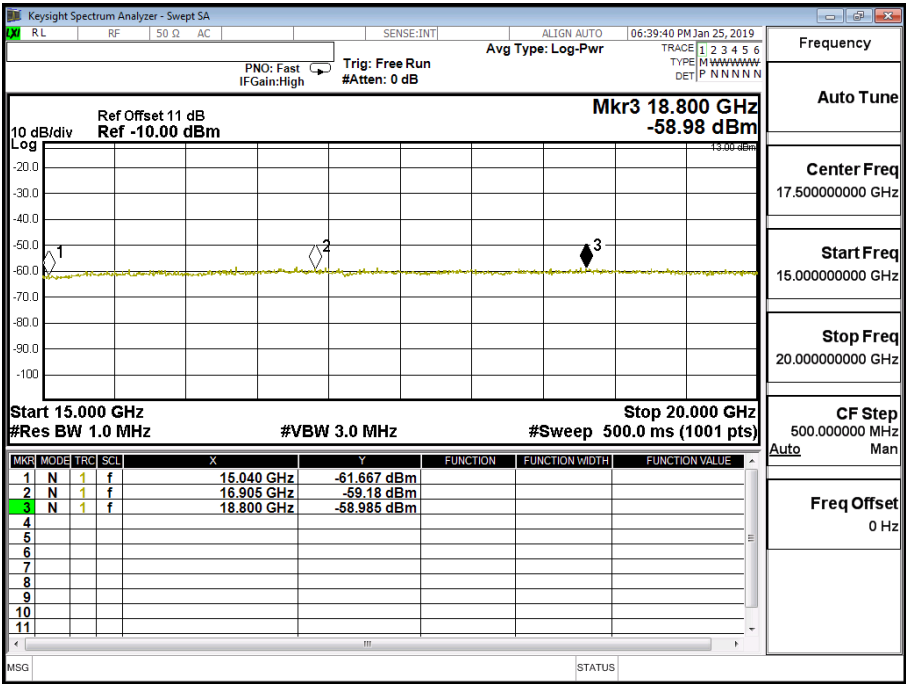
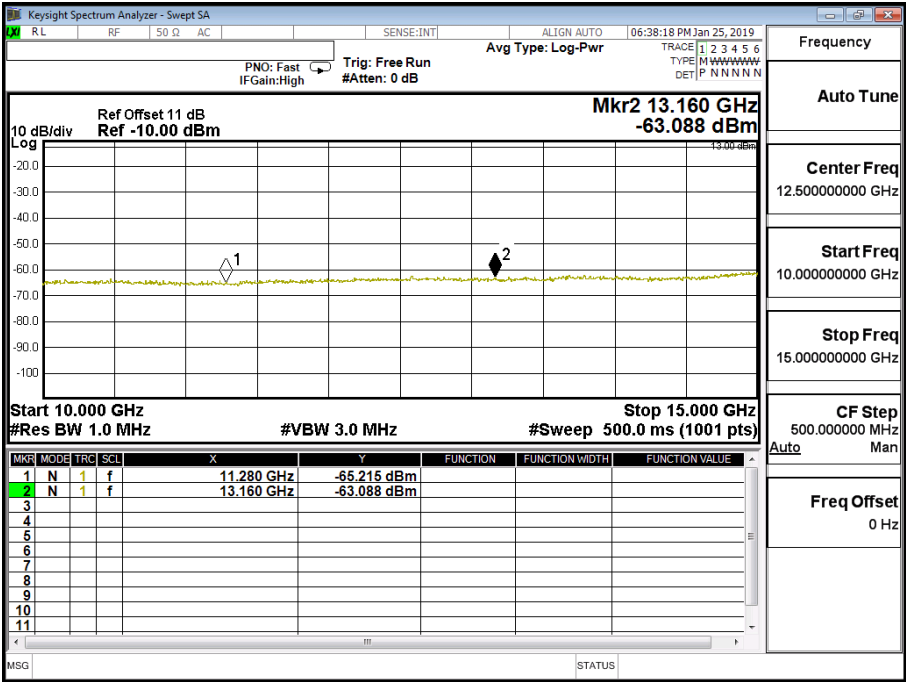
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (3M)	Test Range	30MHz~20GHz

LTE-Band 2 (3M) 16QAM(1,7) CH18900 (1880MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3760	-63.427	1.10	-62.327	-13
5630	-62.950	1.23	-61.720	-13
7505	-64.310	1.59	-62.720	-13
9410	-64.660	1.89	-62.770	-13
11280	-65.215	2.07	-63.145	-13
13160	-63.088	2.26	-60.828	-13
15040	-61.667	2.64	-59.027	-13
16905	-59.180	3.50	-55.680	-13
18800	-58.985	3.70	-55.285	-13



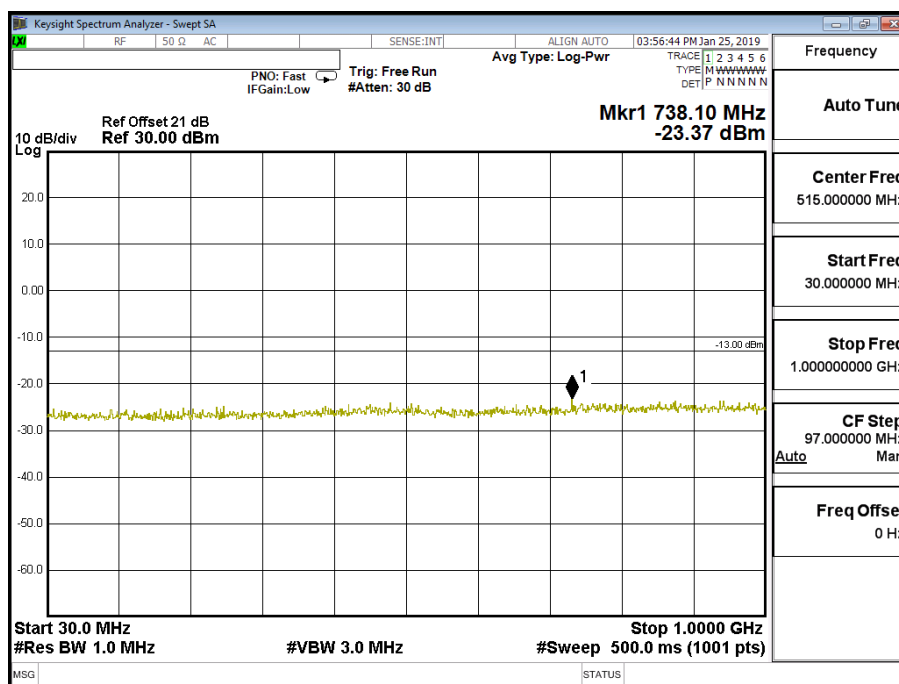


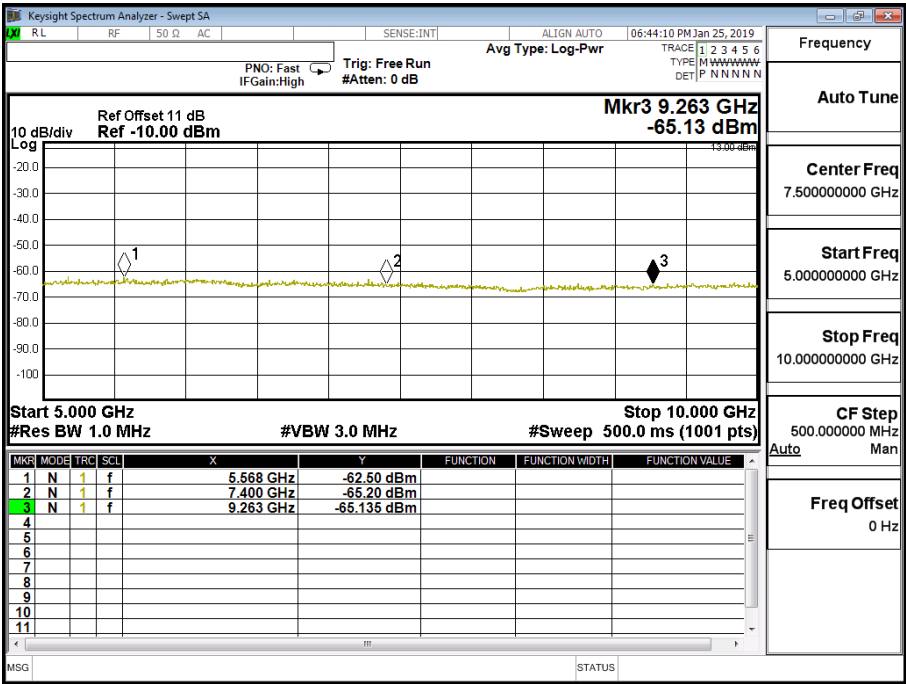
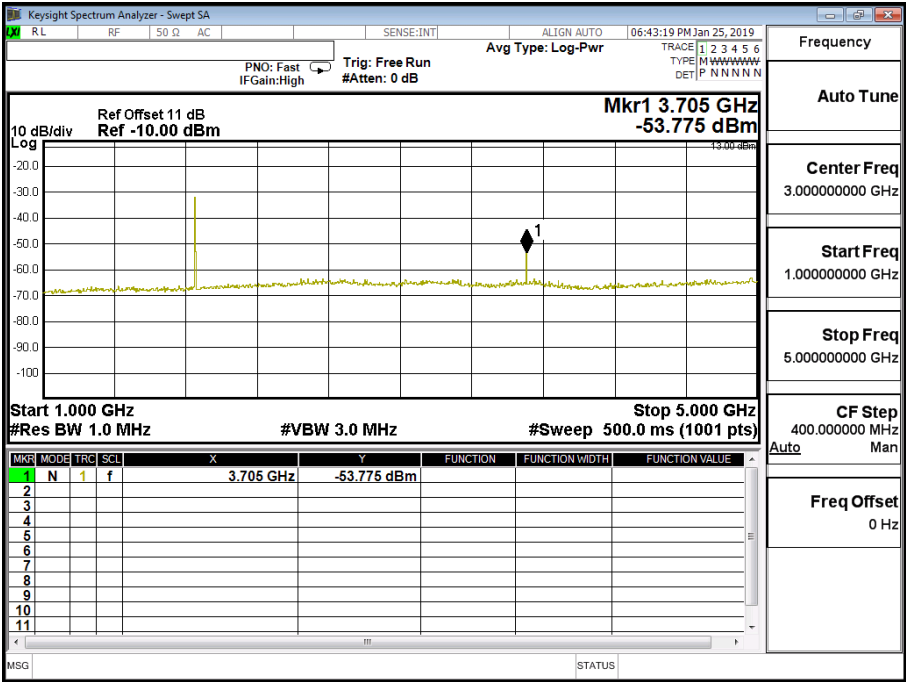


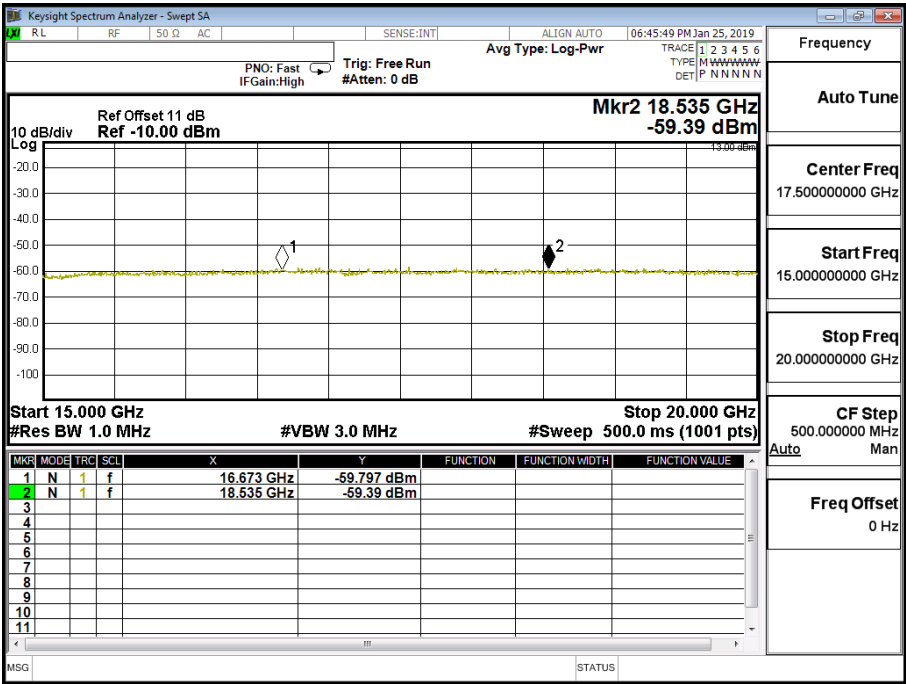
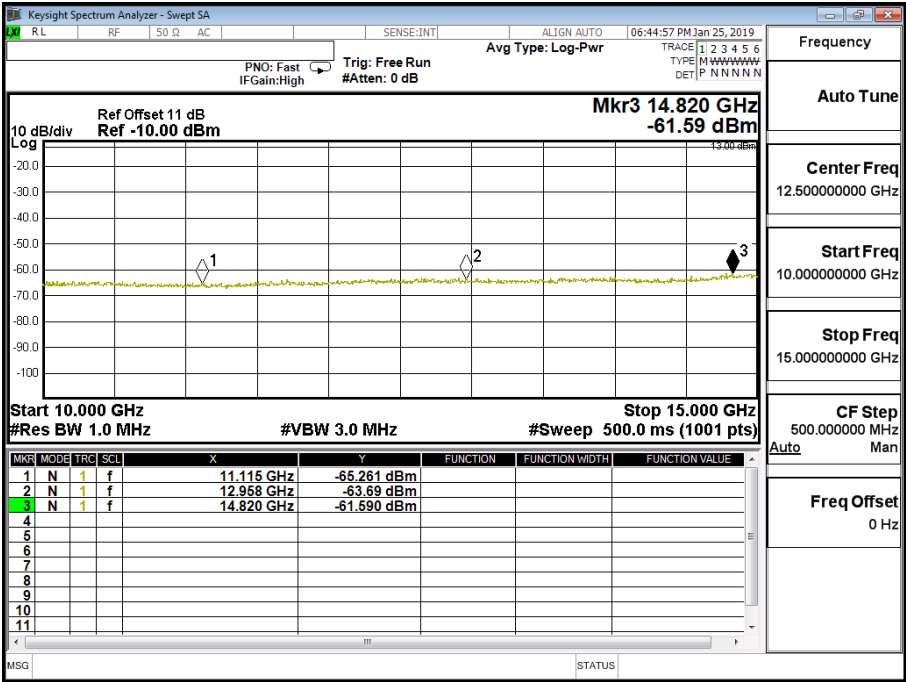
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (5M)	Test Range	30MHz~20GHz

LTE-Band 2 (5M) QPSK(1,12) CH18625 (1852.5MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3705	-53.775	1.10	-52.675	-13
5568	-62.500	1.23	-61.270	-13
7400	-65.200	1.59	-63.610	-13
9263	-65.135	1.89	-63.245	-13
11115	-65.261	2.07	-63.191	-13
12958	-63.690	2.26	-61.430	-13
14820	-61.590	2.64	-58.950	-13
16673	-59.797	3.50	-56.297	-13
18535	-59.390	3.70	-55.690	-13



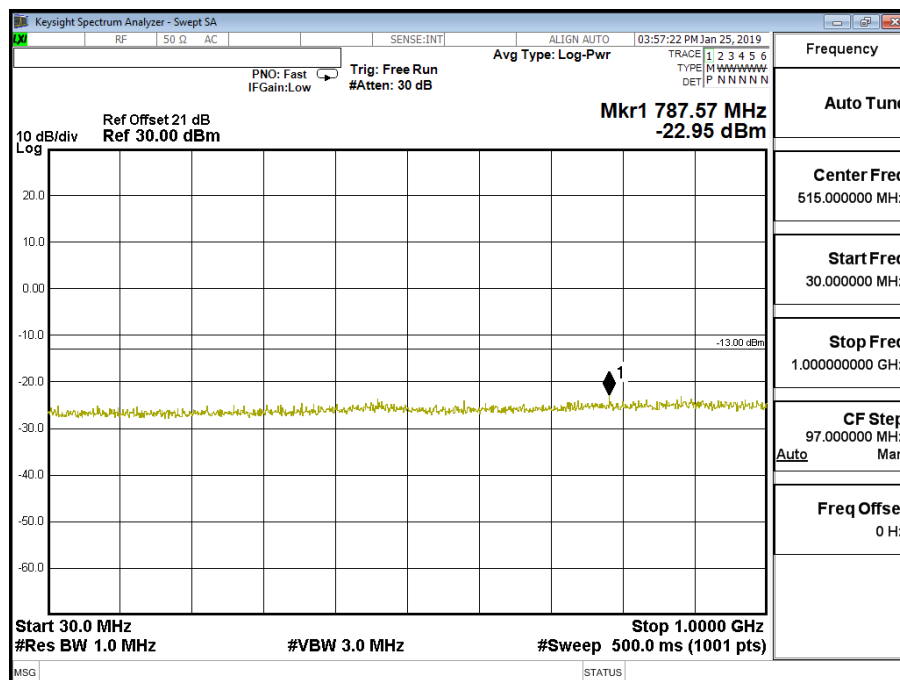


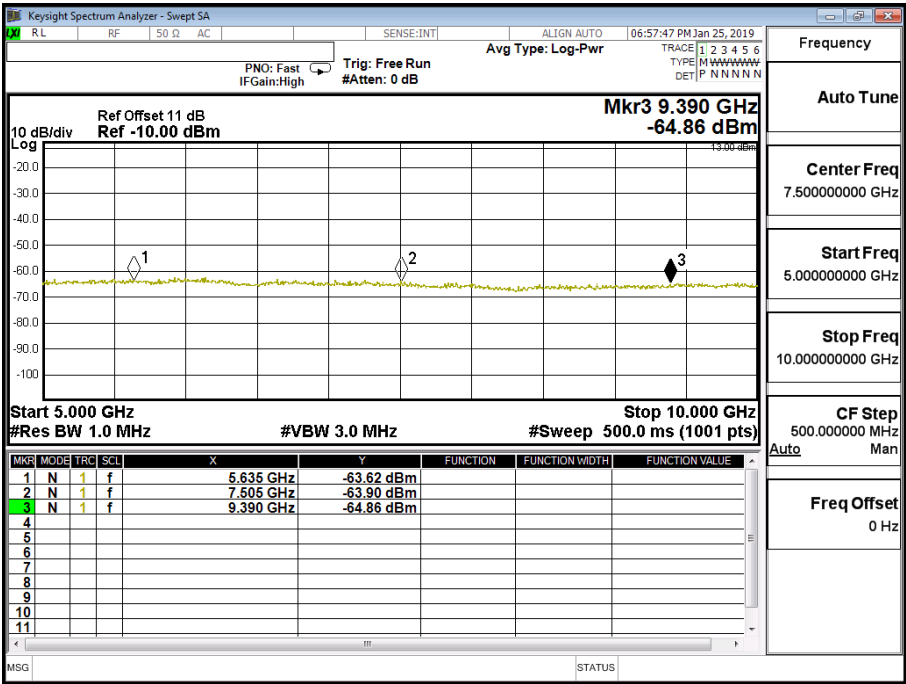
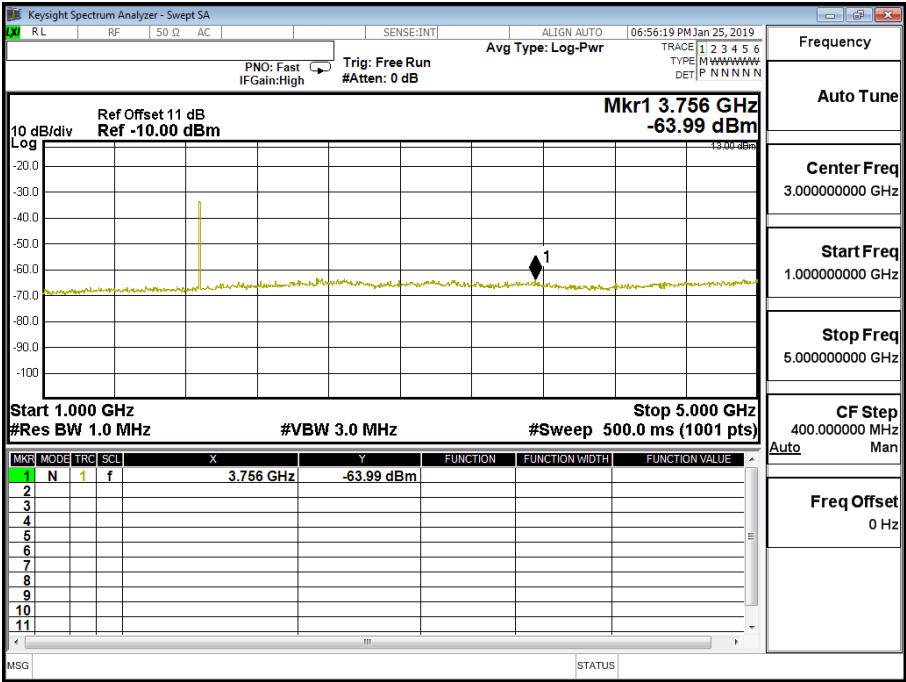


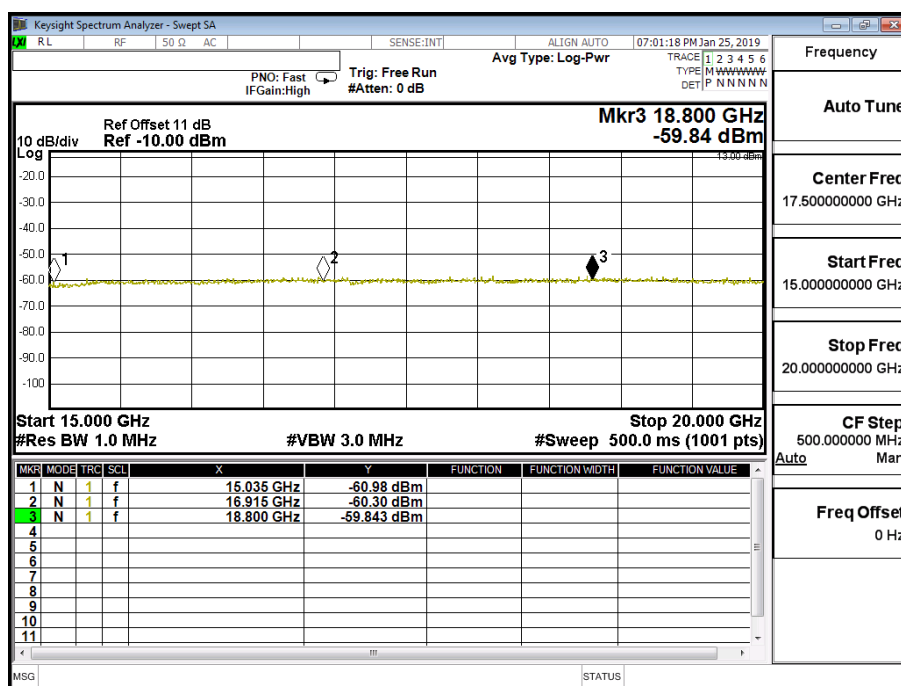
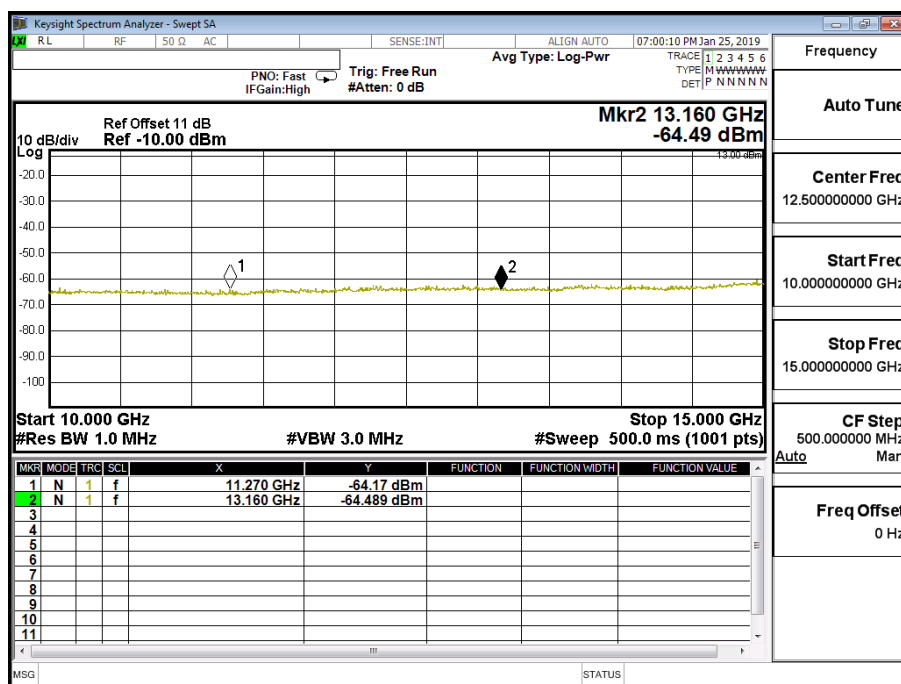
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (5M)	Test Range	30MHz~20GHz

LTE- Band 2 (5M) 16QAM(1,0) CH18900 (1880MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3756	-63.990	1.10	-62.890	-13
5635	-63.620	1.23	-62.390	-13
7505	-63.900	1.59	-62.310	-13
9390	-64.860	1.89	-62.970	-13
11270	-64.170	2.07	-62.100	-13
13160	-64.489	2.26	-62.229	-13
15035	-60.980	2.64	-58.340	-13
16915	-60.300	3.50	-56.800	-13
18800	-59.843	3.70	-56.143	-13



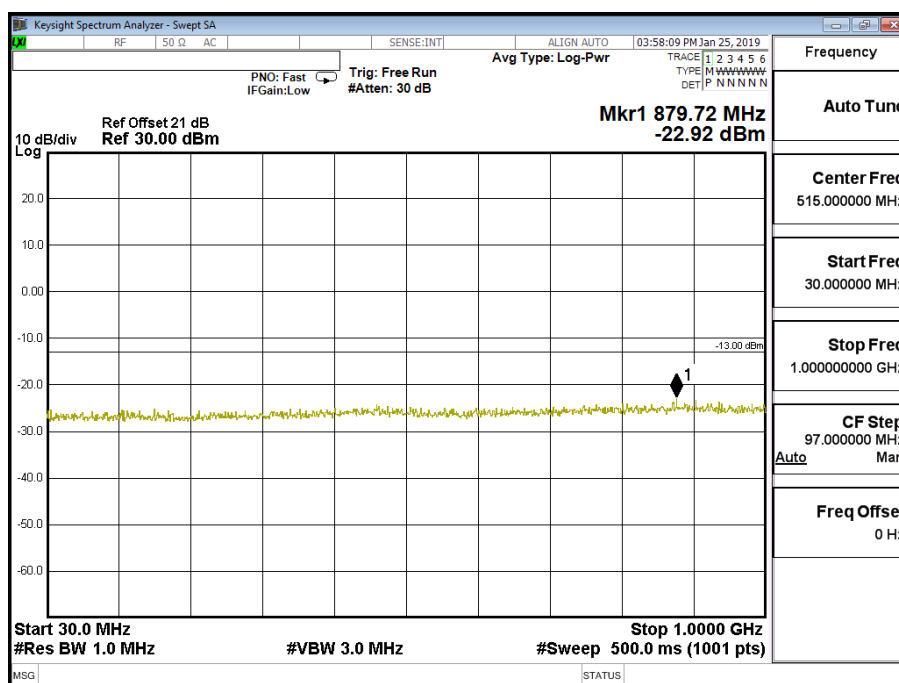


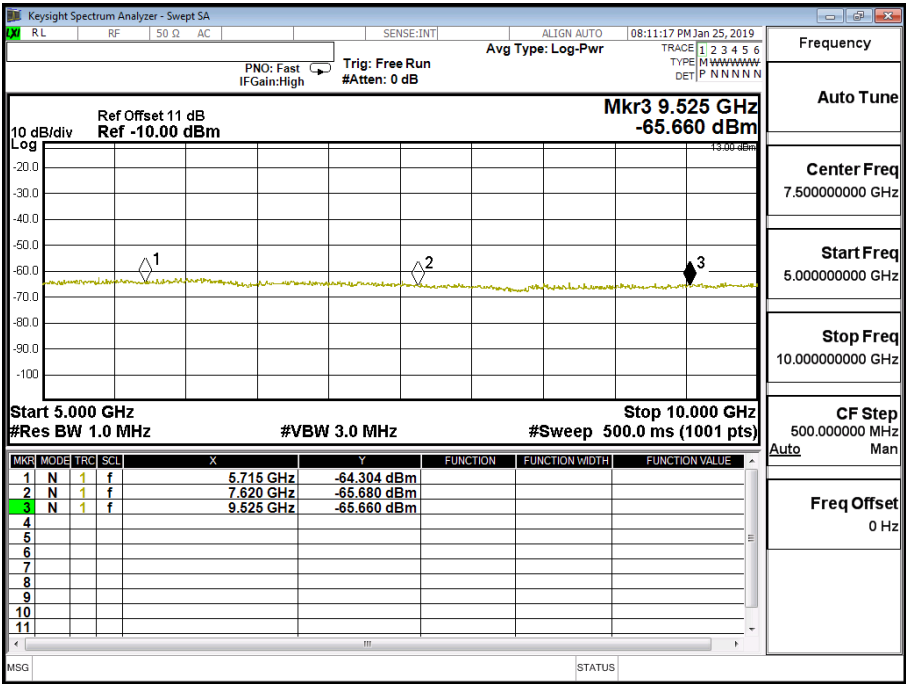
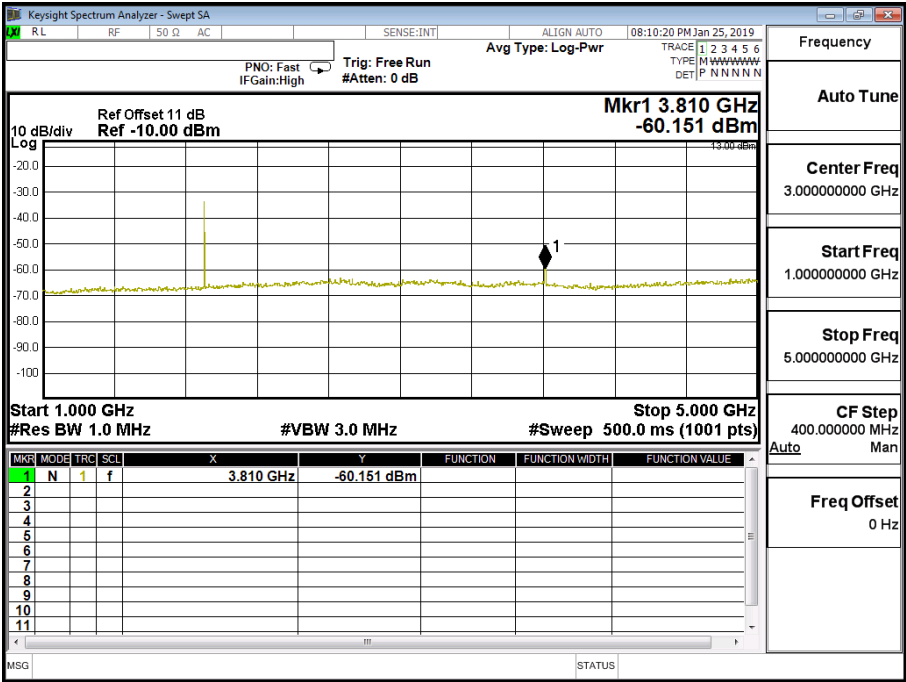


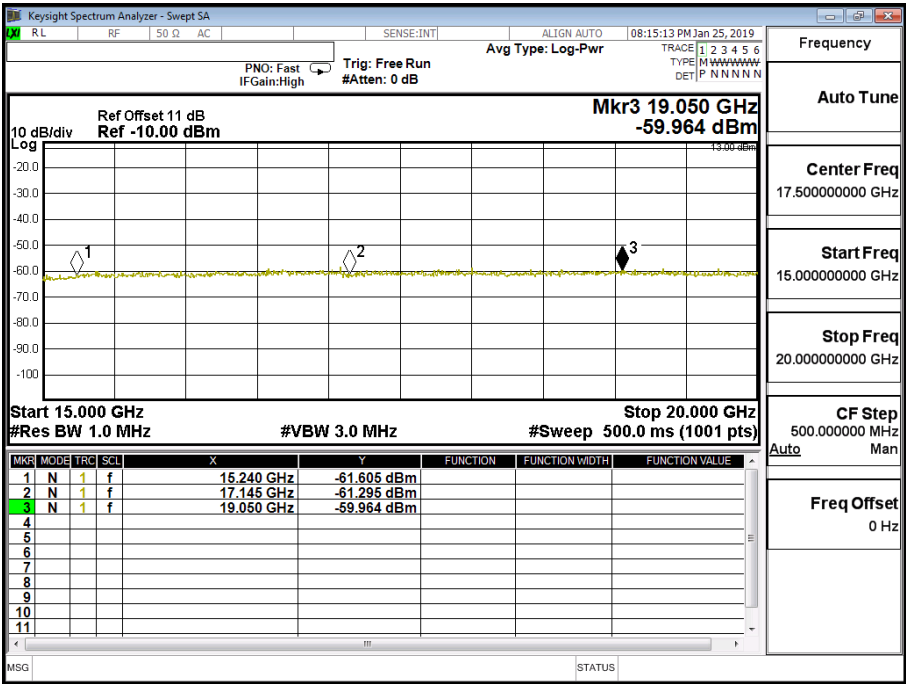
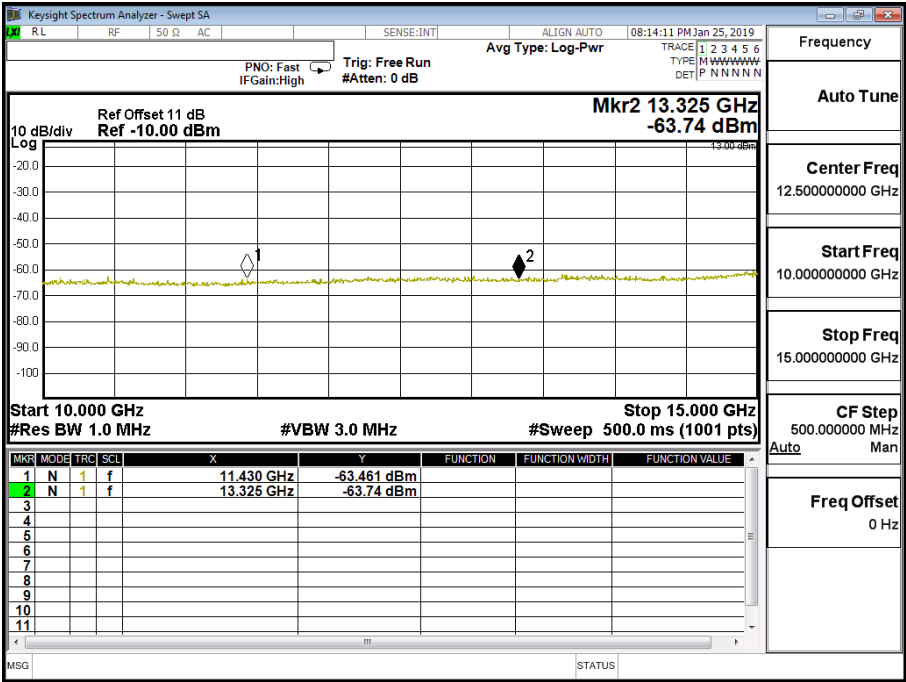
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Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (10M)	Test Range	30MHz~20GHz

LTE- Band 2 (10M) QPSK(1,24) CH19150 (1905MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3810	-60.151	1.10	-59.051	-13
5715	-64.304	1.23	-63.074	-13
7620	-65.680	1.59	-64.090	-13
9525	-65.660	1.89	-63.770	-13
11430	-63.461	2.07	-61.391	-13
13325	-63.740	2.26	-61.480	-13
15240	-61.605	2.64	-58.965	-13
17145	-61.295	3.50	-57.795	-13
19050	-59.964	3.70	-56.264	-13



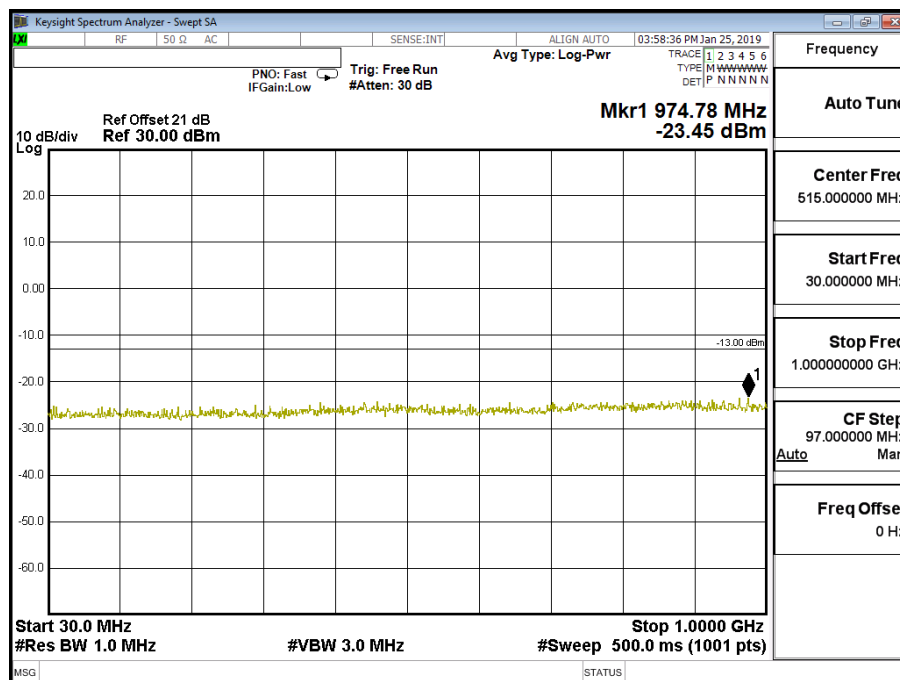


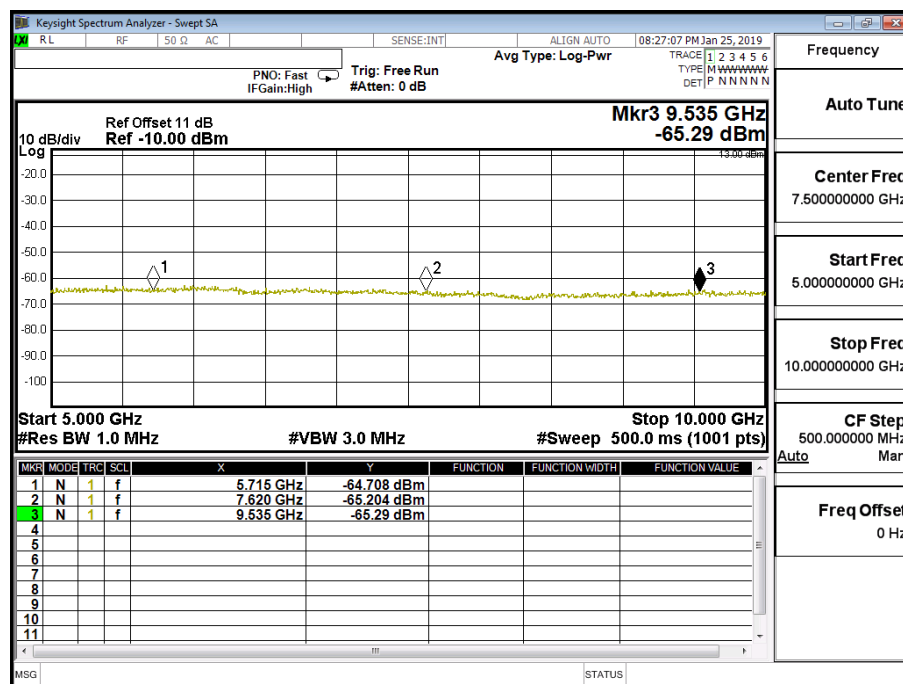
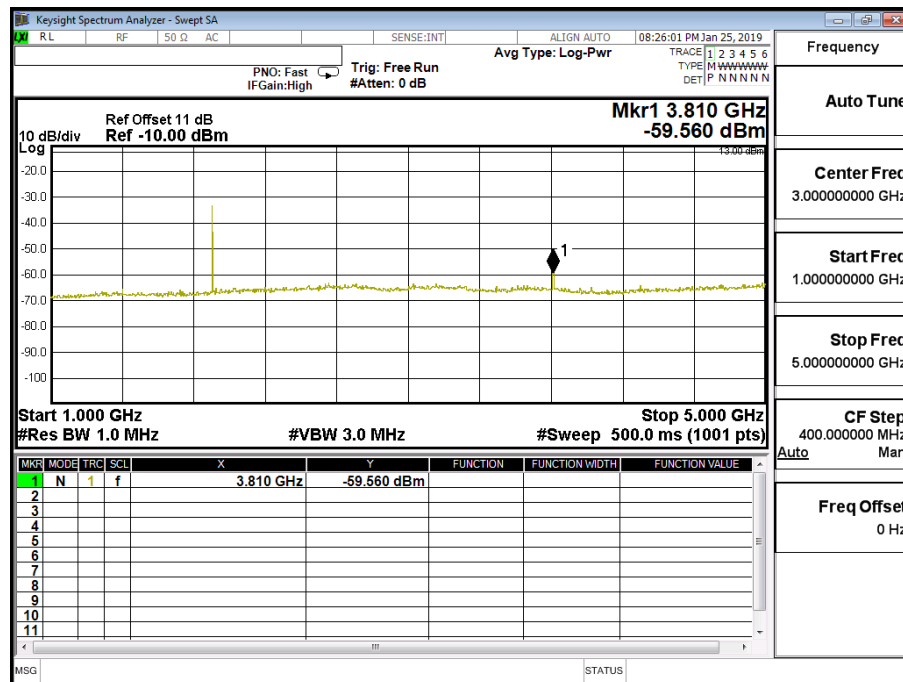


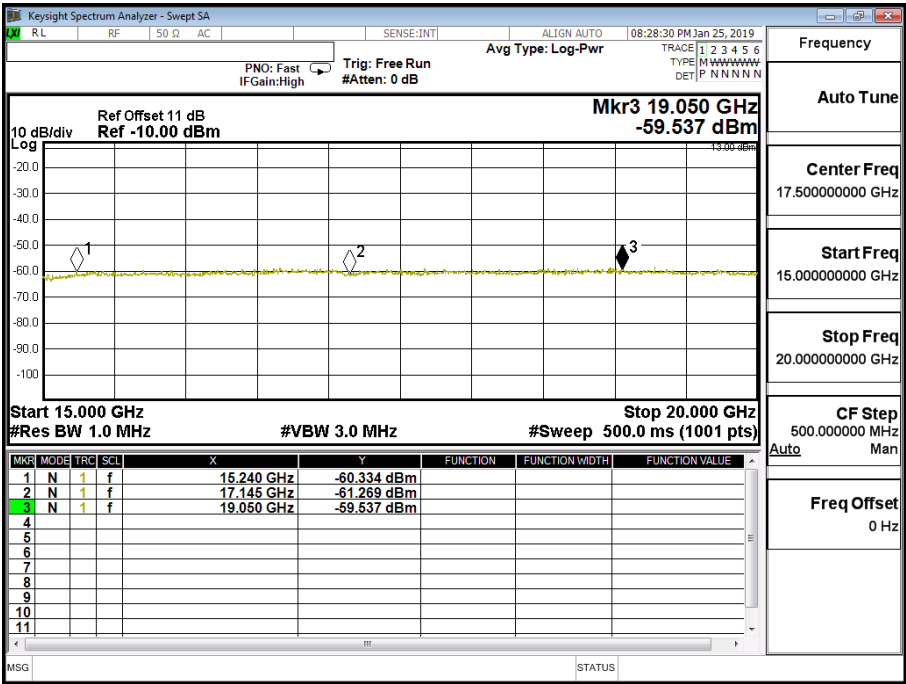
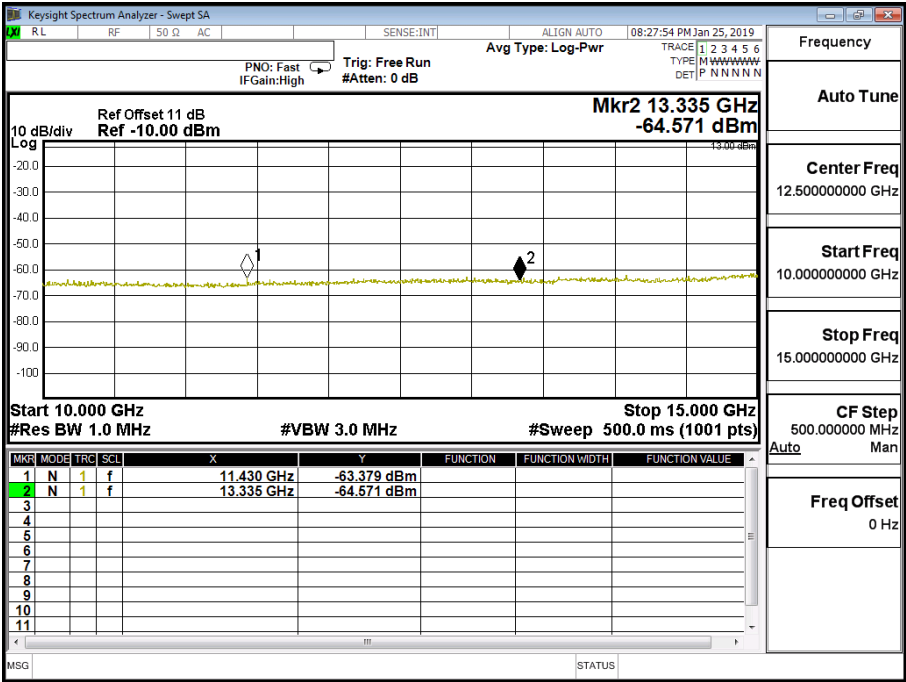
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (10M)	Test Range	30MHz~20GHz

LTE- Band 2 10M 16QAM(1,24) CH19150 (1905MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3810	-59.560	1.10	-58.460	-13
5715	-64.708	1.23	-63.478	-13
7620	-65.204	1.59	-63.614	-13
9535	-65.290	1.89	-63.400	-13
11430	-63.379	2.07	-61.309	-13
13335	-64.571	2.26	-62.311	-13
15240	-60.334	2.64	-57.694	-13
17145	-61.269	3.50	-57.769	-13
19050	-59.537	3.70	-55.837	-13



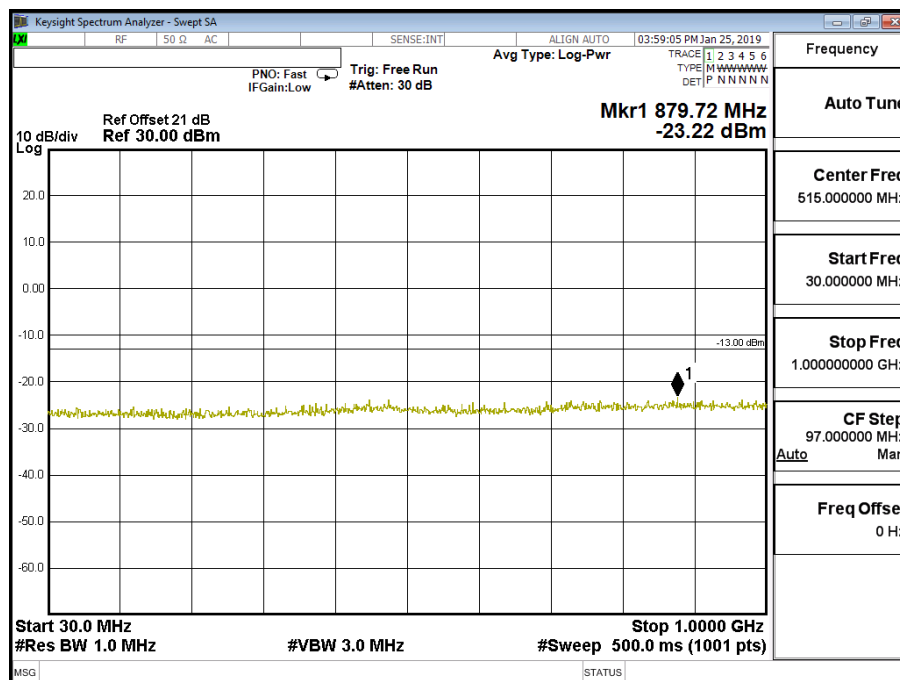


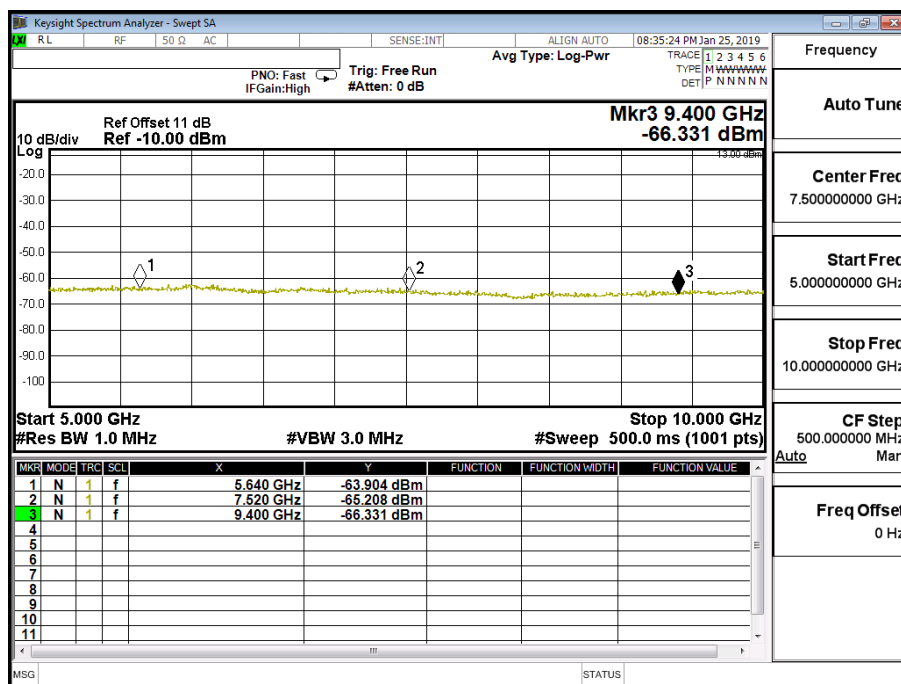
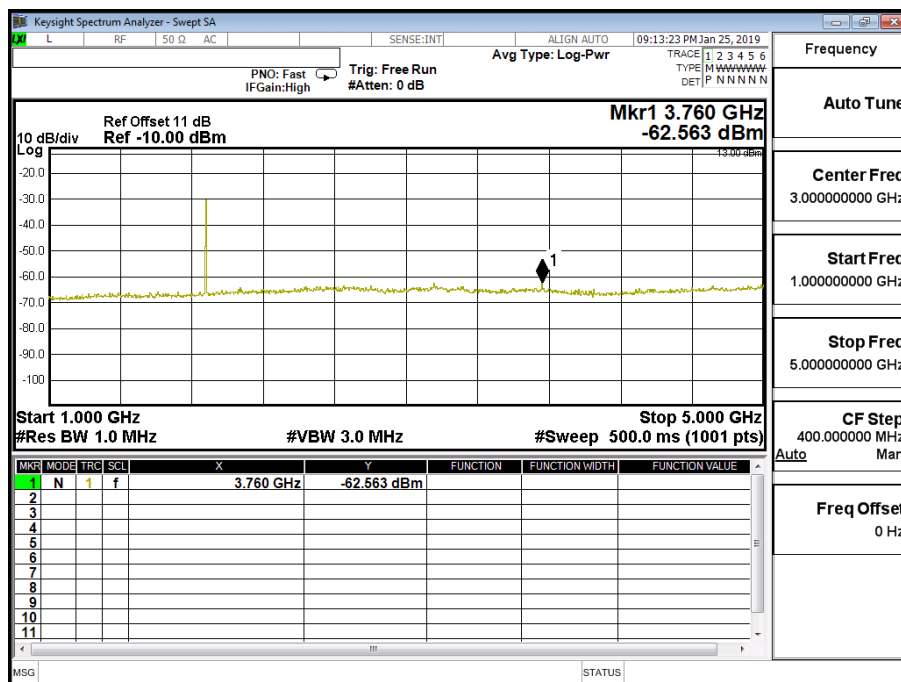


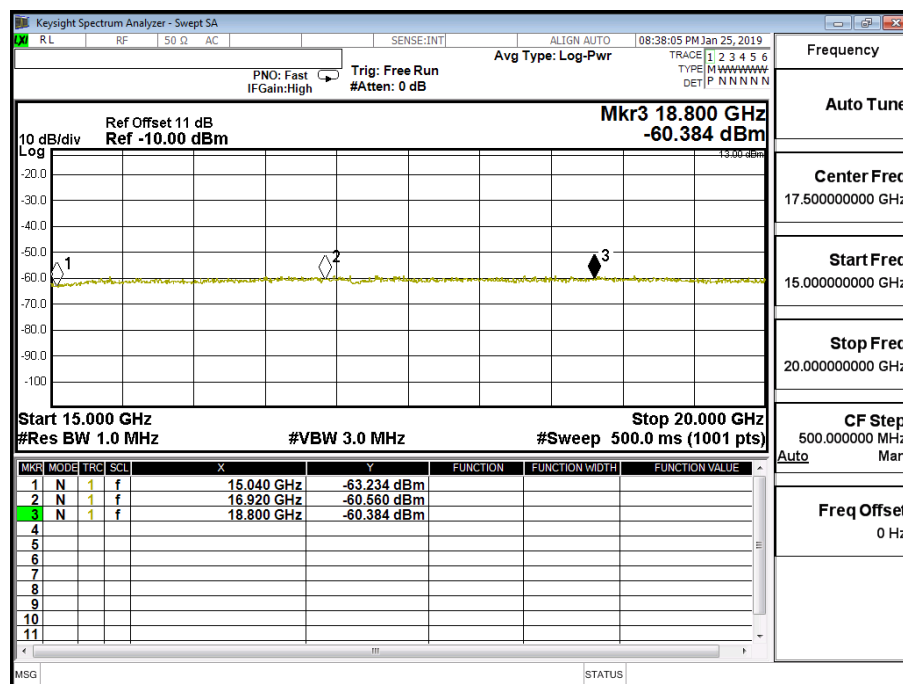
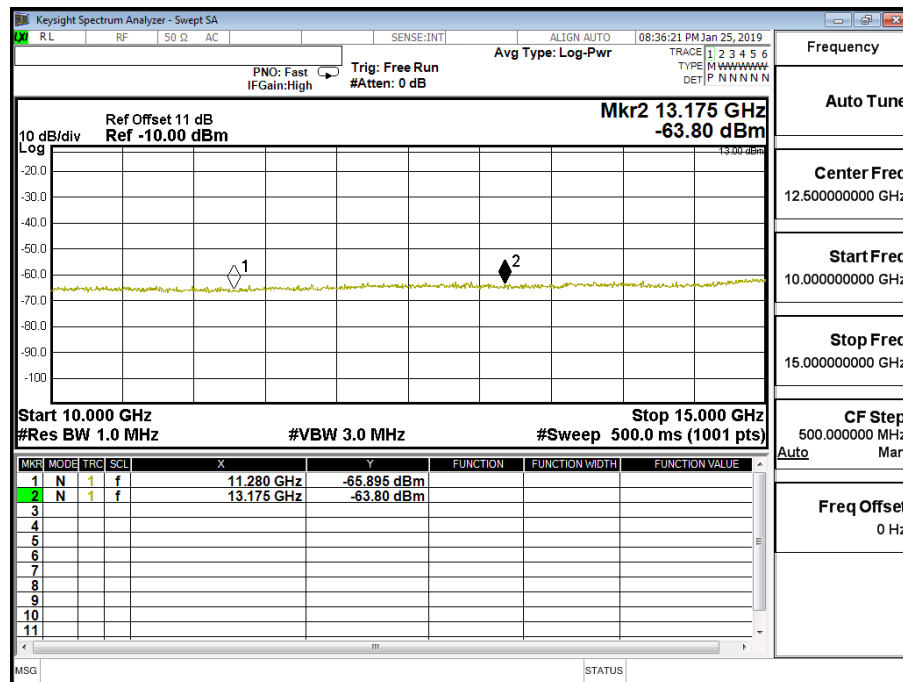
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 15M	Test Range	30MHz~20GHz

LTE-Band 2 15M QPSK(1,37) CH18900 (1880MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3760	-62.563	1.10	-61.463	-13
5640	-63.904	1.23	-62.674	-13
7520	-65.208	1.59	-63.618	-13
9400	-66.331	1.89	-64.441	-13
11280	-65.895	2.07	-63.825	-13
13175	-63.800	2.26	-61.540	-13
15040	-63.234	2.64	-60.594	-13
16920	-60.560	3.50	-57.060	-13
18800	-60.384	3.70	-56.684	-13



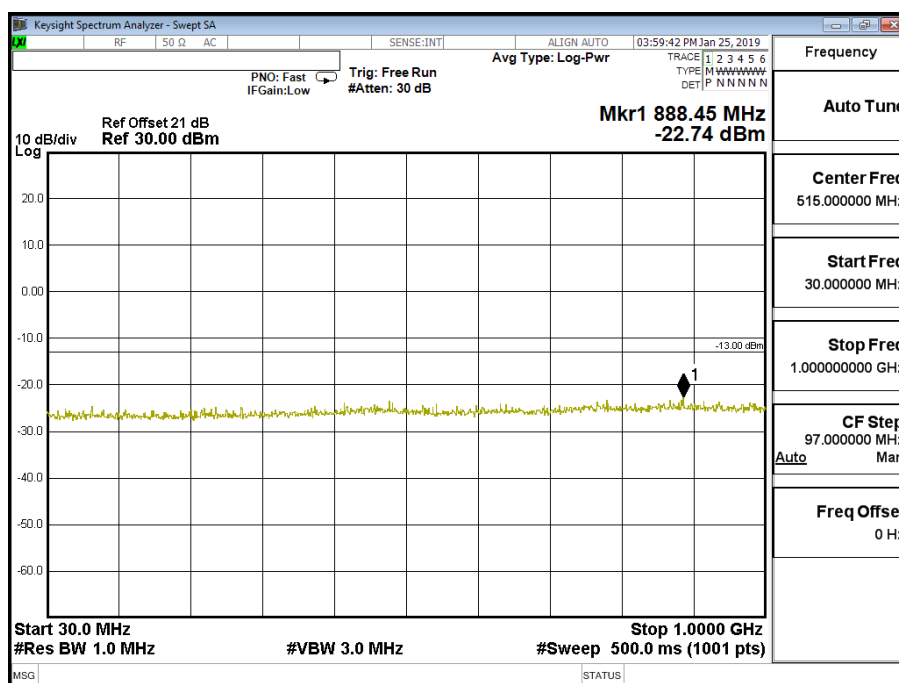


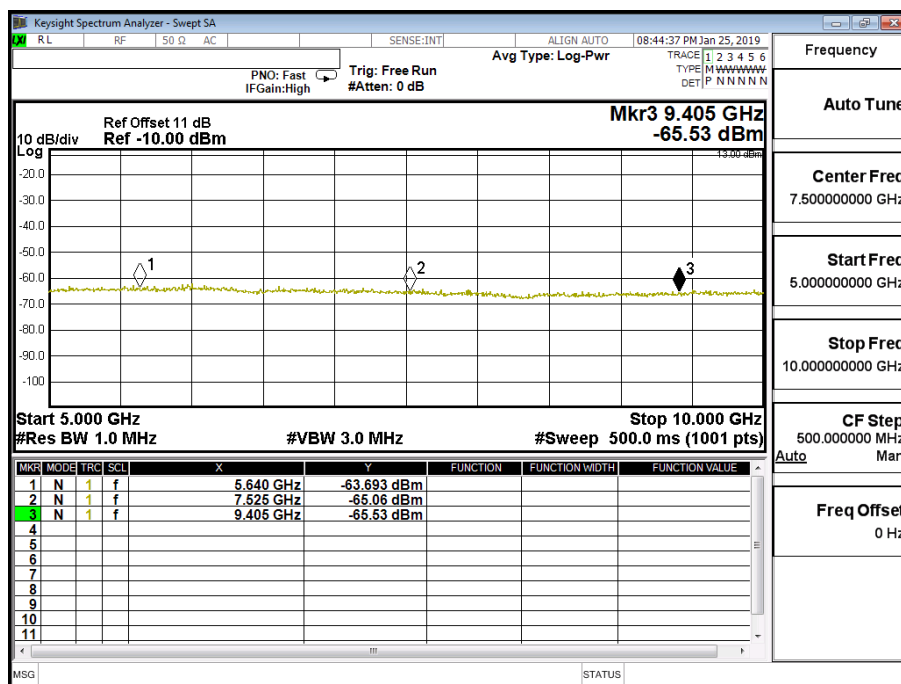
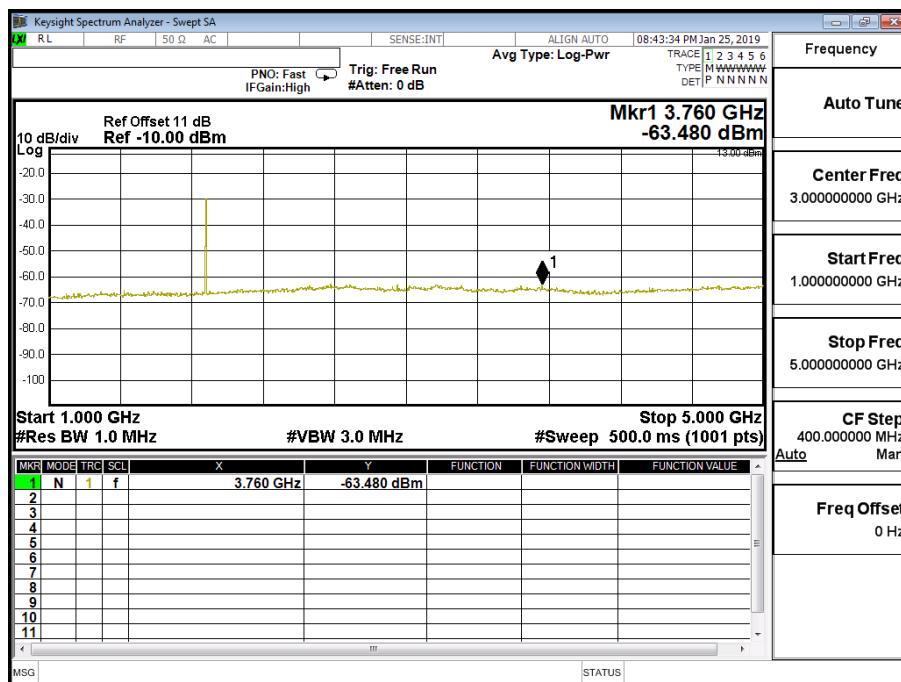


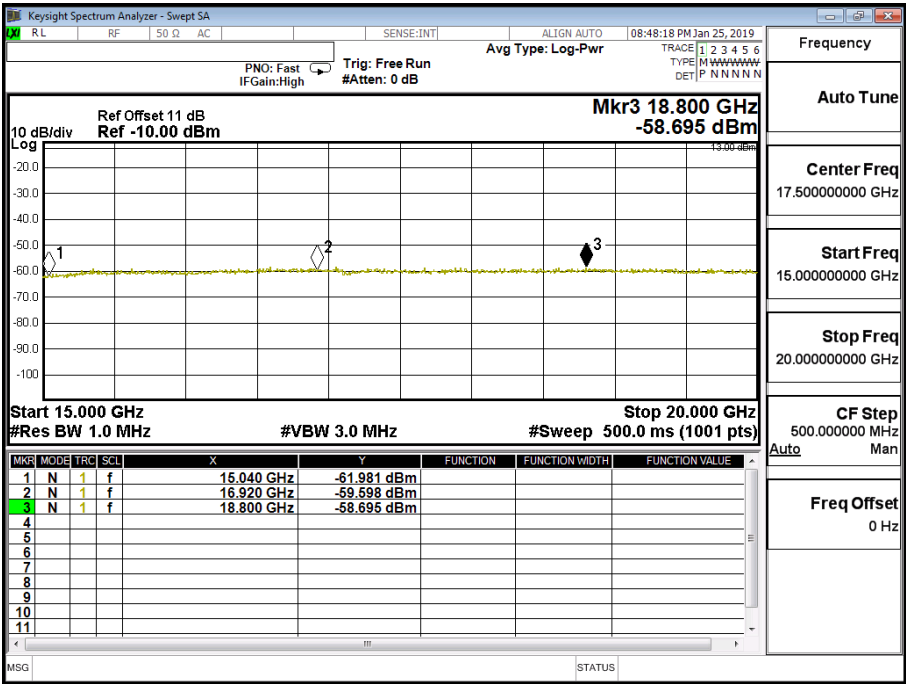
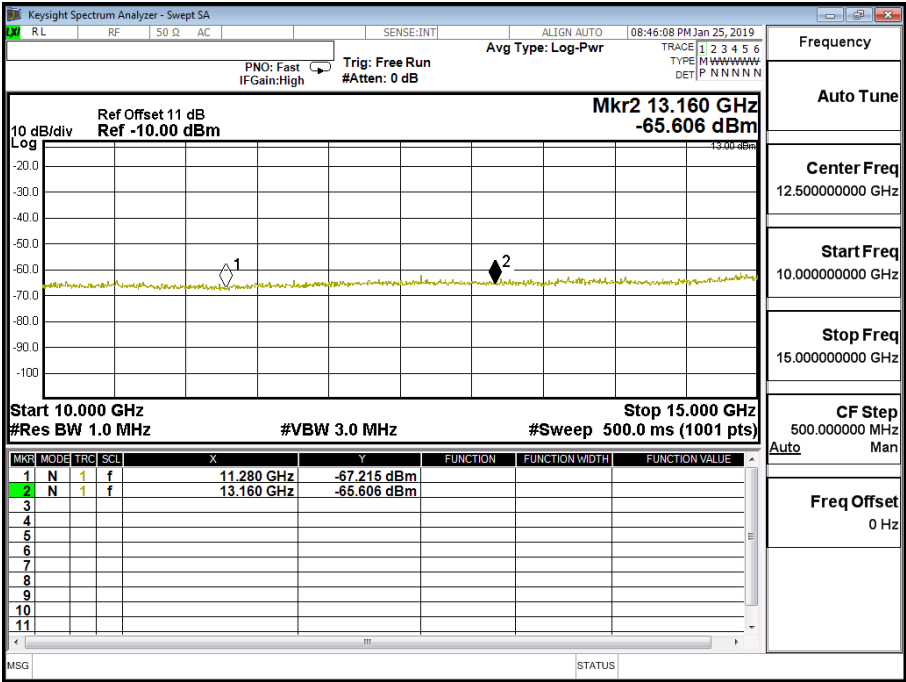
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (15M)	Test Range	30MHz~20GHz

LTE-Band 2 (15M) 16QAM(1,37) CH18900 (1880MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3760	-63.480	1.10	-62.380	-13
5640	-63.693	1.23	-62.463	-13
7525	-65.060	1.59	-63.470	-13
9405	-65.530	1.89	-63.640	-13
11280	-67.215	2.07	-65.145	-13
13160	-65.606	2.26	-63.346	-13
15040	-61.981	2.64	-59.341	-13
16920	-59.598	3.50	-56.098	-13
18800	-58.695	3.70	-54.995	-13



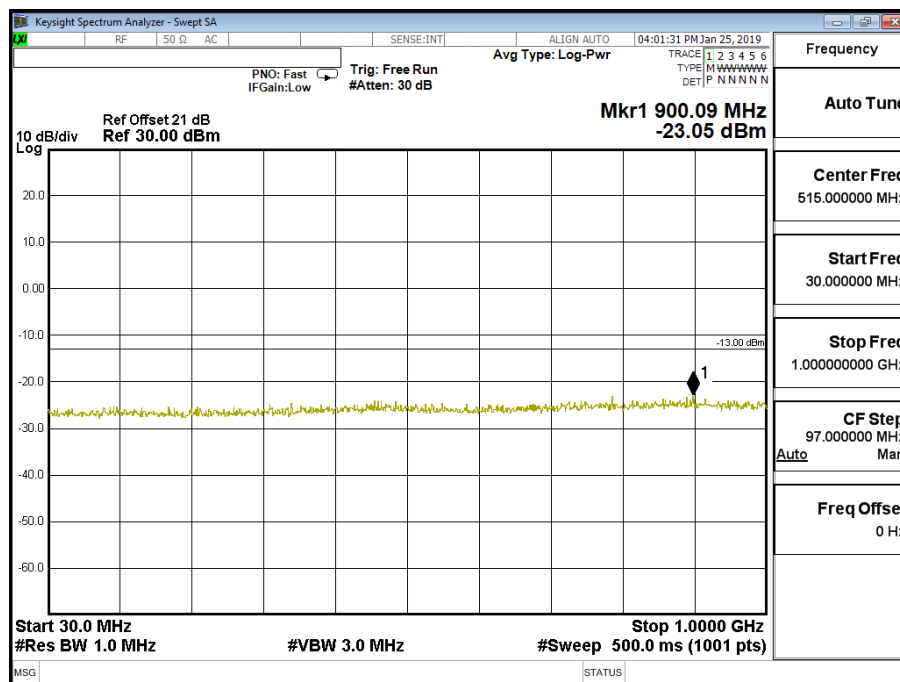


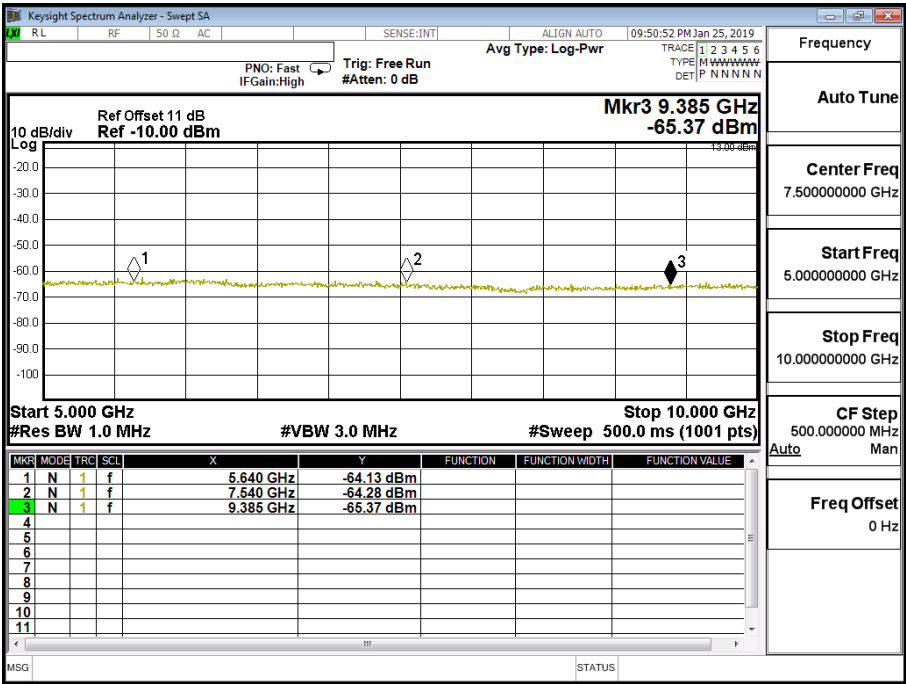
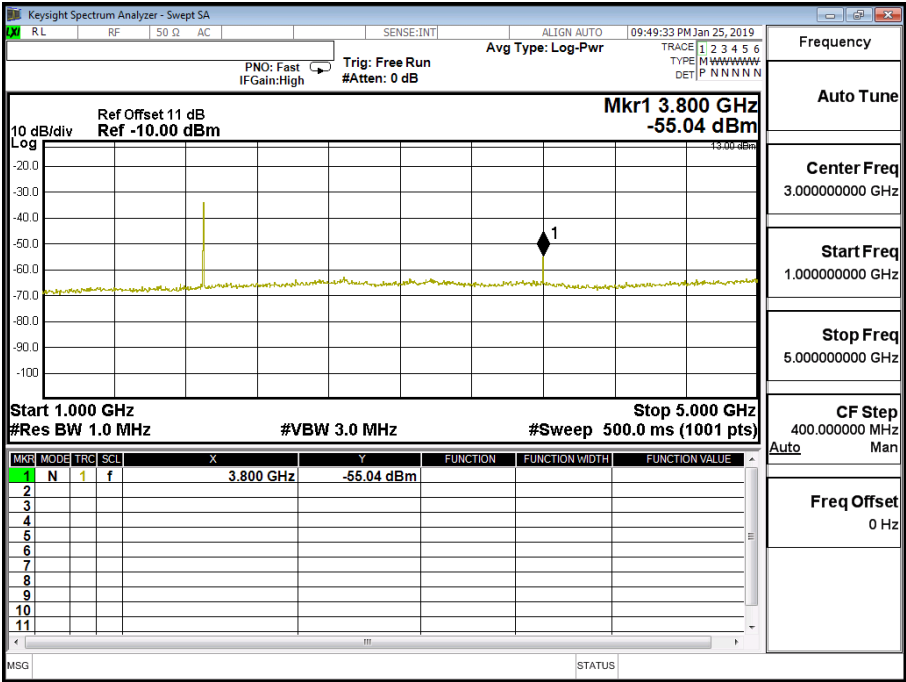


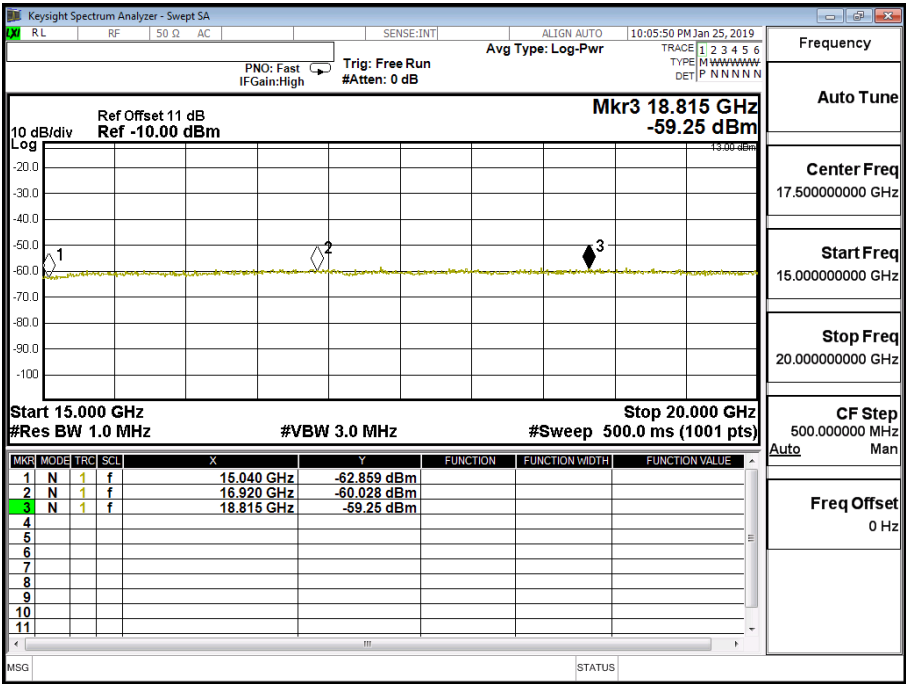
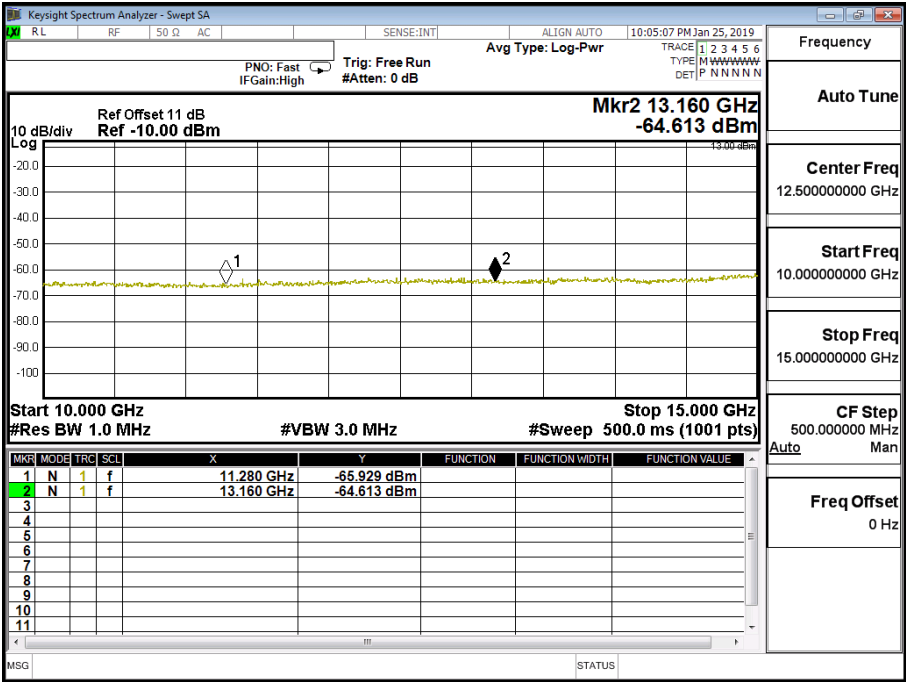
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (20M)	Test Range	30MHz~20GHz

LTE-Band 2 (20M) QPSK(1,49) CH18900 (1880MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3800	-55.040	1.10	-53.940	-13
5640	-64.130	1.23	-62.900	-13
7540	-64.280	1.59	-62.690	-13
9385	-65.370	1.89	-63.480	-13
11280	-65.929	2.07	-63.859	-13
13160	-64.613	2.26	-62.353	-13
15040	-62.859	2.64	-60.219	-13
16920	-60.028	3.50	-56.528	-13
18815	-59.250	3.70	-55.550	-13



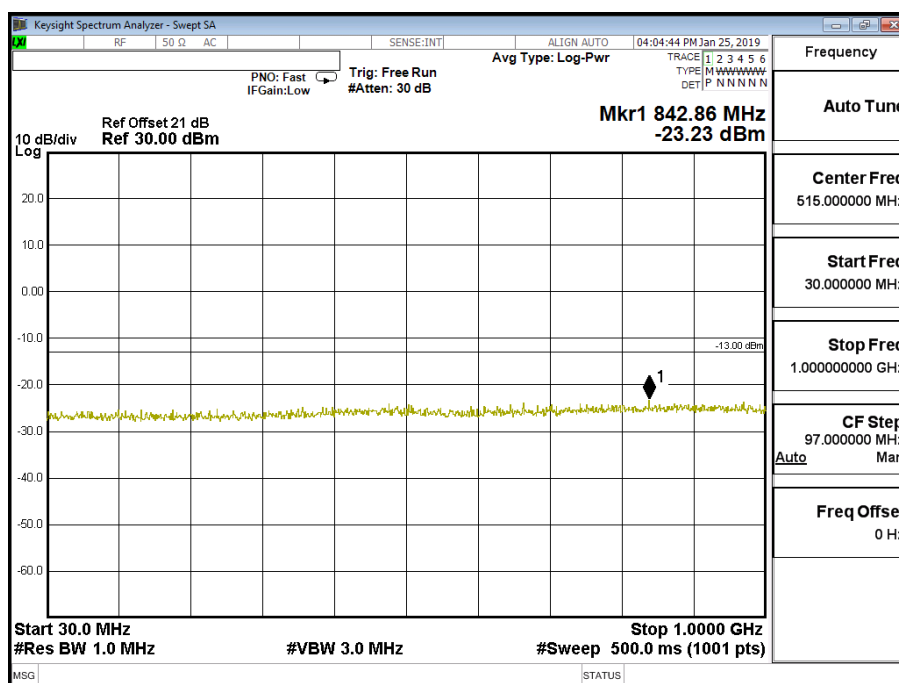


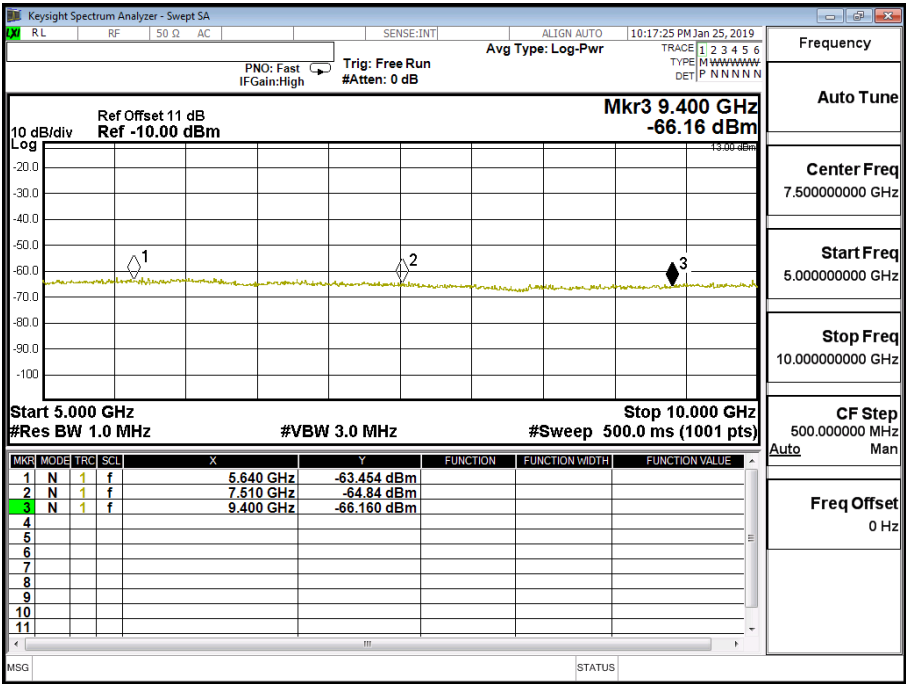
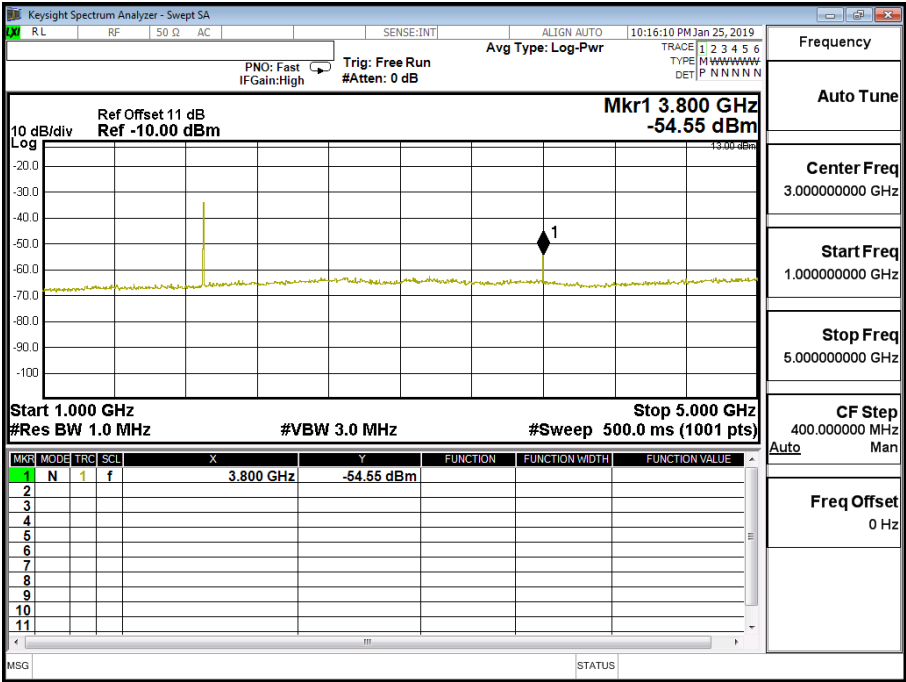


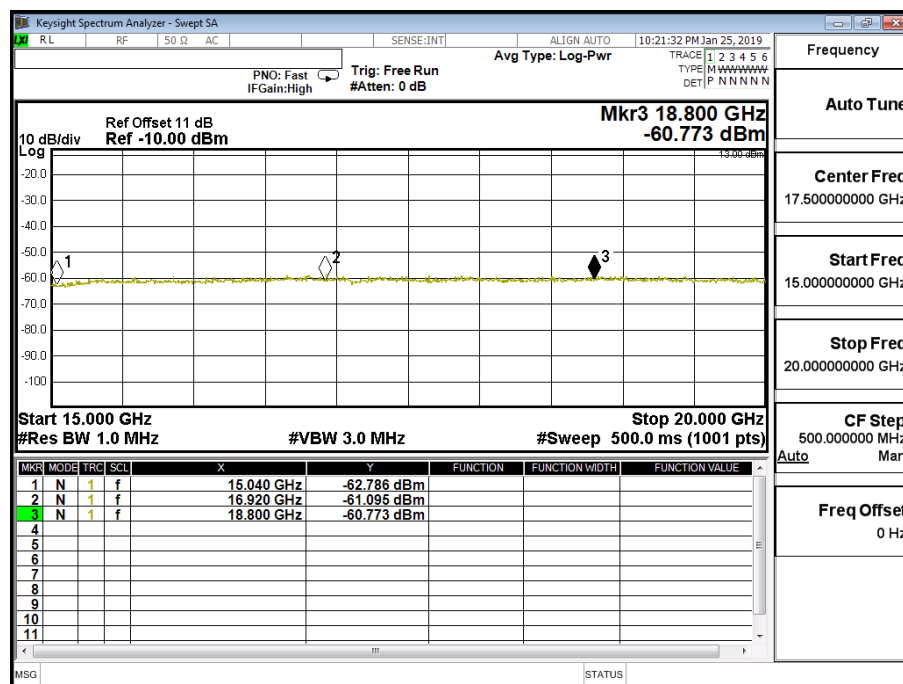
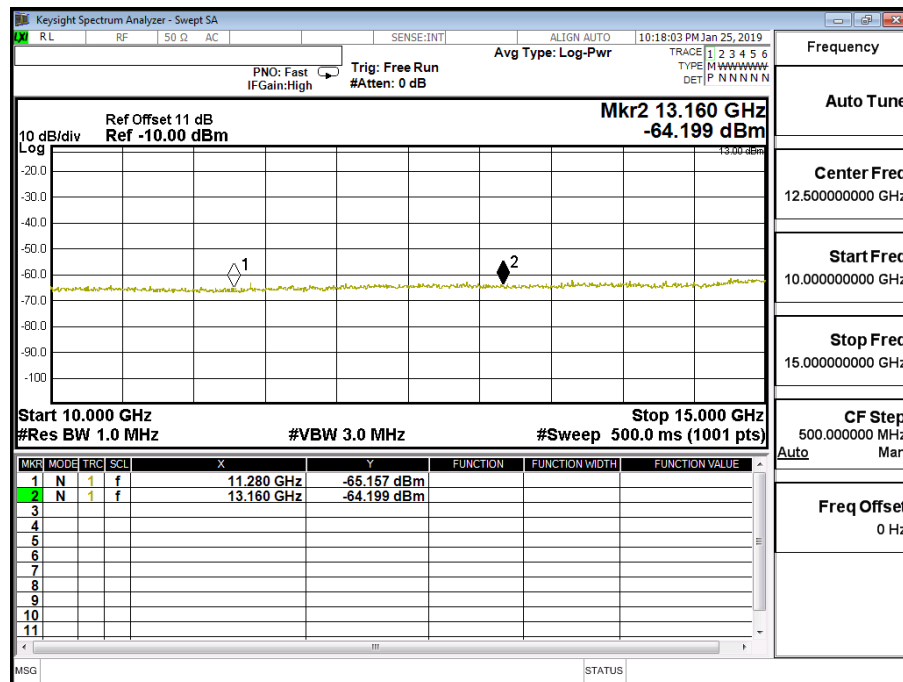
Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Conducted)		
Date of Test	2019/01/25	Test Site	CTR
Test Condition	LTE-Band 2 (20M)	Test Range	30MHz~20GHz

LTE-Band 2 (20M) 16QAM(1,49) CH18900(1880MHz)

Frequency (MHz)	Reading Level (dBm)	Path Loss (dB)	Emission Level (dBm)	Limit (dBm)
3800	-54.550	1.10	-53.450	-13
5640	-63.454	1.23	-62.224	-13
7510	-64.840	1.59	-63.250	-13
9400	-66.160	1.89	-64.270	-13
11280	-65.157	2.07	-63.087	-13
13160	-64.199	2.26	-61.939	-13
15040	-62.786	2.64	-60.146	-13
16920	-61.095	3.50	-57.595	-13
18800	-60.773	3.70	-57.073	-13







Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Radiated) - Multi Band Dipole Antenna (STAF)		
Date of Test	2019/01/29	Test Site	Site3
Test Condition	Band 2 (1.4M) CH18607 (1850.7MHz)	Test Range	9kHz ~20GHz

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	EIRP Value	Limit
(GHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions Band 2 (1.4M) QPSK(1,0)

3701	-57.186	-57.798	2.530	12.600	-47.728	-13
5552	-63.327	-59.943	3.050	13.100	-49.893	-13
7403	-62.903	-48.205	3.650	11.500	-40.355	-13
9254	-61.884	-46.969	3.850	12.000	-38.819	-13
11104	-64.433	-46.884	4.580	12.000	-39.464	-13

Vertical Emissions Band 2 (1.4M) QPSK(1,0)

3701	-56.173	-54.537	2.530	12.600	-44.467	-13
5552	-63.041	-58.997	3.050	13.100	-48.947	-13
7403	-62.708	-47.678	3.650	11.500	-39.828	-13
9254	-62.634	-47.160	3.850	12.000	-39.010	-13
11104	-63.615	-45.864	4.580	12.000	-38.444	-13

Note:

1. Receiver setting (Peak Detector) : RBW:1MHz; VBW:3MHz
2. EIRP Value = Signal Generator Level + Antenna Gain - Cable Loss
3. Spurious emissions past 12 GHz are not shown, due to the magnitude of spurious emissions attenuated more than 20 dB below the limit.

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Radiated) - Multi Band Dipole Antenna (STAF)		
Date of Test	2019/01/29	Test Site	Site3
Test Condition	Band 2 (3M) CH18615 (1851.5MHz)	Test Range	9kHz ~20GHz

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	EIRP Value	Limit
(GHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions Band 2 (3M) QPSK(1,7)

3703	-57.834	-58.446	2.530	12.600	-48.376	-13
5555	-63.209	-59.825	3.050	13.100	-49.775	-13
7406	-63.611	-48.957	3.650	11.500	-41.107	-13
9258	-62.706	-47.832	3.850	12.000	-39.682	-13
11109	-64.801	-47.311	4.580	12.000	-39.891	-13

Vertical Emissions Band 2 (3M) QPSK(1,7)

3703	-56.837	-55.202	2.530	12.600	-45.132	-13
5555	-62.087	-58.101	3.050	13.100	-48.051	-13
7406	-62.995	-47.908	3.650	11.500	-40.058	-13
9258	-62.572	-47.097	3.850	12.000	-38.947	-13
11109	-64.220	-46.558	4.580	12.000	-39.138	-13

Note:

1. Receiver setting (Peak Detector) : RBW:1MHz; VBW:3MHz
2. EIRP Value = Signal Generator Level + Antenna Gain - Cable Loss
3. Spurious emissions past 12 GHz are not shown, due to the magnitude of spurious emissions attenuated more than 20 dB below the limit.

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Radiated) - Multi Band Dipole Antenna (STAF)		
Date of Test	2019/01/29	Test Site	Site3
Test Condition	Band 2 (5M) CH18625 (1852.5MHz)	Test Range	9kHz ~20GHz

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	EIRP Value	Limit
(GHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions Band 2 (5M) QPSK(1,12)

3705	-53.719	-54.330	2.530	12.600	-44.260	-13
5558	-62.711	-59.167	3.050	13.100	-49.117	-13
7410	-62.987	-48.445	3.650	11.500	-40.595	-13
9263	-62.078	-46.967	3.850	12.000	-38.817	-13
11115	-64.513	-47.199	4.580	12.000	-39.779	-13

Vertical Emissions Band 2 (5M) QPSK(1,12)

3705	-55.963	-54.328	2.530	12.600	-44.258	-13
5558	-62.055	-58.011	3.050	13.100	-47.961	-13
7410	-63.674	-48.605	3.650	11.500	-40.755	-13
9263	-61.759	-46.393	3.850	12.000	-38.243	-13
11115	-64.045	-46.383	4.580	12.000	-38.963	-13

Note:

1. Receiver setting (Peak Detector) : RBW:3MHz; VBW:3MHz
2. EIRP Value = Signal Generator Level + Antenna Gain - Cable Loss
3. Spurious emissions past 12 GHz are not shown, due to the magnitude of spurious emissions attenuated more than 20 dB below the limit.

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Radiated) - Multi Band Dipole Antenna (STAF)		
Date of Test	2019/01/29	Test Site	Site3
Test Condition	Band 2 (10M) CH19150 (1905MHz)	Test Range	9kHz ~20GHz

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	EIRP Value	Limit
(GHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions Band 2 (10M) QPSK(1,24)

3810	-54.419	-54.771	2.530	12.600	-44.701	-13
5715	-63.229	-61.112	3.050	13.100	-51.062	-13
7620	-63.749	-49.811	3.650	11.500	-41.961	-13
9525	-61.004	-46.273	3.850	12.000	-38.123	-13
11430	-63.732	-45.556	4.580	12.000	-38.136	-13

Vertical Emissions Band 2 (10M) QPSK(1,24)

3810	-54.709	-52.523	2.530	12.600	-42.453	-13
5715	-63.907	-61.626	3.050	13.100	-51.576	-13
7620	-63.011	-48.560	3.650	11.500	-40.710	-13
9525	-61.614	-46.328	3.850	12.000	-38.178	-13
11430	-63.299	-45.239	4.580	12.000	-37.819	-13

Note:

1. Receiver setting (Peak Detector) : RBW:1MHz; VBW:3MHz
2. ERP Value = Signal Generator Level + Antenna Gain - Cable Loss
3. Spurious emissions past 12 GHz are not shown, due to the magnitude of spurious emissions attenuated more than 20 dB below the limit.

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Radiated) - Multi Band Dipole Antenna (STAF)		
Date of Test	2019/01/29	Test Site	Site3
Test Condition	Band 2 (15M) CH18900 (1880MHz)	Test Range	9kHz ~20GHz

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	EIRP Value	Limit
(GHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions Band 2 (15M) QPSK(1,37)

3760	-54.667	-55.015	2.530	12.600	-44.945	-13
5640	-62.792	-60.111	3.050	13.100	-50.061	-13
7520	-63.766	-49.397	3.650	11.500	-41.547	-13
9400	-63.306	-47.988	3.850	12.000	-39.838	-13
11280	-63.847	-47.179	4.580	12.000	-39.759	-13

Vertical Emissions Band 2 (15M) QPSK(1,37)

3760	-53.733	-51.751	2.530	12.600	-41.681	-13
5640	-62.328	-59.178	3.050	13.100	-49.128	-13
7520	-62.388	-47.325	3.650	11.500	-39.475	-13
9400	-62.715	-46.920	3.850	12.000	-38.770	-13
11280	-64.822	-48.168	4.580	12.000	-40.748	-13

Note:

1. Receiver setting (Peak Detector) : RBW:1MHz; VBW:3MHz
2. EIRP Value = Signal Generator Level + Antenna Gain - Cable Loss
3. Spurious emissions past 12 GHz are not shown, due to the magnitude of spurious emissions attenuated more than 20 dB below the limit.

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Spurious Emission (Radiated) - Multi Band Dipole Antenna (STAF)		
Date of Test	2019/01/29	Test Site	Site3
Test Condition	Band 2 (20M) CH18900 (1880MHz)	Test Range	9kHz ~20GHz

Frequency	Reading Level	Signal Generator Level	Cable Loss	Antenna Gain	EIRP Value	Limit
(GHz)	(dBm)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)

Horizontal Emissions Band 2 (20M) QPSK(1,49)

3760	-50.760	-51.108	2.530	12.600	-41.038	-13
5640	-61.864	-59.337	3.050	13.100	-49.287	-13
7520	-64.027	-49.658	3.650	11.500	-41.808	-13
9400	-62.768	-47.430	3.850	12.000	-39.280	-13
11280	-64.506	-48.045	4.580	12.000	-40.625	-13

Vertical Emissions Band 2 (20M) QPSK(1,49)

3760	-50.792	-48.810	2.530	12.600	-38.740	-13
5640	-62.668	-59.009	3.050	13.100	-48.959	-13
7520	-63.371	-48.351	3.650	11.500	-40.501	-13
9400	-61.981	-46.150	3.850	12.000	-38.000	-13
11280	-63.749	-47.101	4.580	12.000	-39.681	-13

Note:

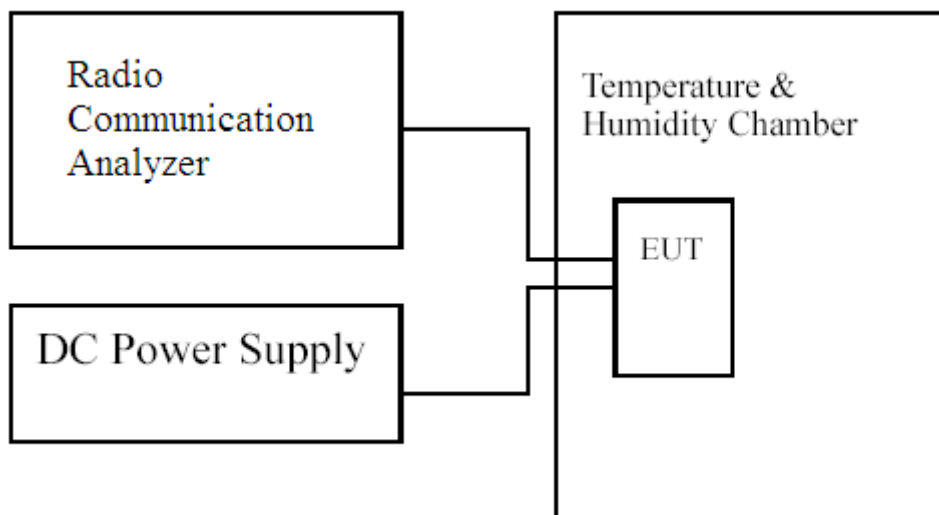
1. Receiver setting (Peak Detector) : RBW:1MHz; VBW:3MHz
2. EIRP Value = Signal Generator Level + Antenna Gain - Cable Loss
3. Spurious emissions past 12 GHz are not shown, due to the magnitude of spurious emissions attenuated more than 20 dB below the limit.

7. Frequency Stability Under Temperature & Voltage Variations

7.1. Test Specification

According to Part 2.1055, 24.235

7.2. Test Setup



7.3. Limits

Limit	<±2.5ppm
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7.4. Test Procedure

The frequency stability of transmitter is measured by:

- Temperature: The temperature is varied from -30 °C to 50 °C in 10 °C increment using a standard temperature & Humidity chamber.
- Primary Supply Voltage: The primary supply voltage is varied 85% to 115% of the nominal value for non hand-carried equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating endpoint which shall be specified by the manufacturer.

The EUT was connected via the base station simulator. Universal Radio Communication Tester, (MT8820C), was used to measure The Frequency Error. The maximum result of measurements was recorded.

7.5. Test Result of Frequency Stability Under Temperature Variations

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (1.4M) CH18900(1880MHz) –QPSK	Test Range	-30°C~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0099	±4.70
-20	1.88	0.0122	±4.70
-10	1.88	-0.0077	±4.70
0	1.88	-0.0069	±4.70
10	1.88	-0.0084	±4.70
20	1.88	-0.0131	±4.70
30	1.88	-0.0107	±4.70
40	1.88	-0.0096	±4.70
50	1.88	-0.0095	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0105	±4.70
120	1.88	-0.0131	±4.70
102	1.88	-0.0098	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (1.4M) CH18900(1880MHz) –16QAM	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0092	±4.70
-20	1.88	-0.0108	±4.70
-10	1.88	0.0078	±4.70
0	1.88	-0.0075	±4.70
10	1.88	0.0067	±4.70
20	1.88	-0.0100	±4.70
30	1.88	-0.0105	±4.70
40	1.88	-0.0085	±4.70
50	1.88	-0.0081	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0105	±4.70
120	1.88	-0.0100	±4.70
102	1.88	-0.0094	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (3M) CH18900(1880MHz) –QPSK	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0076	±4.70
-20	1.88	-0.0096	±4.70
-10	1.88	-0.0109	±4.70
0	1.88	-0.0073	±4.70
10	1.88	-0.0084	±4.70
20	1.88	-0.0100	±4.70
30	1.88	-0.0113	±4.70
40	1.88	-0.0062	±4.70
50	1.88	-0.0104	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0088	±4.70
120	1.88	-0.0100	±4.70
102	1.88	0.0107	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (3M) CH18900(1880MHz) –16QAM	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	0.0070	±4.70
-20	1.88	-0.0107	±4.70
-10	1.88	-0.0098	±4.70
0	1.88	-0.0076	±4.70
10	1.88	-0.0070	±4.70
20	1.88	-0.0083	±4.70
30	1.88	0.0062	±4.70
40	1.88	0.0069	±4.70
50	1.88	0.0089	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0080	±4.70
120	1.88	-0.0083	±4.70
102	1.88	-0.0121	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (5M) CH18900(1880MHz) –QPSK	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0087	±4.70
-20	1.88	-0.0090	±4.70
-10	1.88	-0.0055	±4.70
0	1.88	-0.0078	±4.70
10	1.88	-0.0084	±4.70
20	1.88	-0.0106	±4.70
30	1.88	-0.0093	±4.70
40	1.88	-0.0072	±4.70
50	1.88	-0.0074	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0085	±4.70
120	1.88	-0.0106	±4.70
102	1.88	-0.0115	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (5M) CH18900(1880MHz) –16QAM	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0065	±4.70
-20	1.88	-0.0086	±4.70
-10	1.88	-0.0087	±4.70
0	1.88	-0.0061	±4.70
10	1.88	-0.0083	±4.70
20	1.88	-0.0099	±4.70
30	1.88	-0.0074	±4.70
40	1.88	-0.0087	±4.70
50	1.88	-0.0089	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0120	±4.70
120	1.88	-0.0099	±4.70
102	1.88	-0.0095	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (10M) CH18900(1880MHz) –QPSK	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0077	±4.70
-20	1.88	-0.0074	±4.70
-10	1.88	-0.0064	±4.70
0	1.88	-0.0076	±4.70
10	1.88	-0.0064	±4.70
20	1.88	-0.0085	±4.70
30	1.88	-0.0074	±4.70
40	1.88	-0.0084	±4.70
50	1.88	-0.0090	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0093	±4.70
120	1.88	-0.0085	±4.70
102	1.88	-0.0069	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (10M) CH18900(1880MHz) -16QAM	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0080	±4.70
-20	1.88	-0.0082	±4.70
-10	1.88	-0.0073	±4.70
0	1.88	-0.0066	±4.70
10	1.88	-0.0077	±4.70
20	1.88	-0.0081	±4.70
30	1.88	-0.0087	±4.70
40	1.88	-0.0059	±4.70
50	1.88	-0.0084	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0085	±4.70
120	1.88	-0.0081	±4.70
102	1.88	-0.0104	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (15M) CH18900(1880MHz) –QPSK	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0078	±4.70
-20	1.88	-0.0090	±4.70
-10	1.88	0.0077	±4.70
0	1.88	-0.0074	±4.70
10	1.88	0.0078	±4.70
20	1.88	-0.0082	±4.70
30	1.88	-0.0104	±4.70
40	1.88	-0.0091	±4.70
50	1.88	-0.0078	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0104	±4.70
120	1.88	-0.0082	±4.70
102	1.88	-0.0086	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (15M) CH18900(1880MHz) -16QAM	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	-0.0084	±4.70
-20	1.88	-0.0102	±4.70
-10	1.88	-0.0079	±4.70
0	1.88	-0.0097	±4.70
10	1.88	-0.0104	±4.70
20	1.88	-0.0103	±4.70
30	1.88	-0.0095	±4.70
40	1.88	-0.0095	±4.70
50	1.88	-0.0092	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0087	±4.70
120	1.88	-0.0103	±4.70
102	1.88	-0.0085	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (20M) CH18900(1880MHz) –QPSK	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	0.0072	±4.70
-20	1.88	0.0059	±4.70
-10	1.88	0.0066	±4.70
0	1.88	-0.0069	±4.70
10	1.88	-0.0060	±4.70
20	1.88	-0.0077	±4.70
30	1.88	-0.0073	±4.70
40	1.88	-0.0082	±4.70
50	1.88	-0.0077	±4.70

Voltage Variations

AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0077	±4.70
120	1.88	-0.0077	±4.70
102	1.88	-0.0101	±4.70

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Frequency Stability Under Temperature Variations & Voltage Variations		
Date of Test	2019/01/30	Test Site	CTR
Test Condition	Band 2 (20M) CH18900(1880MHz) -16QAM	Test Range	-30°C ~+50°C

Frequency Stability Under Temperature Variations

Temperature Interval(°C)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
-30	1.88	0.0100	±4.70
-20	1.88	-0.0076	±4.70
-10	1.88	-0.0086	±4.70
0	1.88	-0.0064	±4.70
10	1.88	-0.0094	±4.70
20	1.88	0.0078	±4.70
30	1.88	-0.0064	±4.70
40	1.88	-0.0088	±4.70
50	1.88	-0.0103	±4.70

Voltage Variations

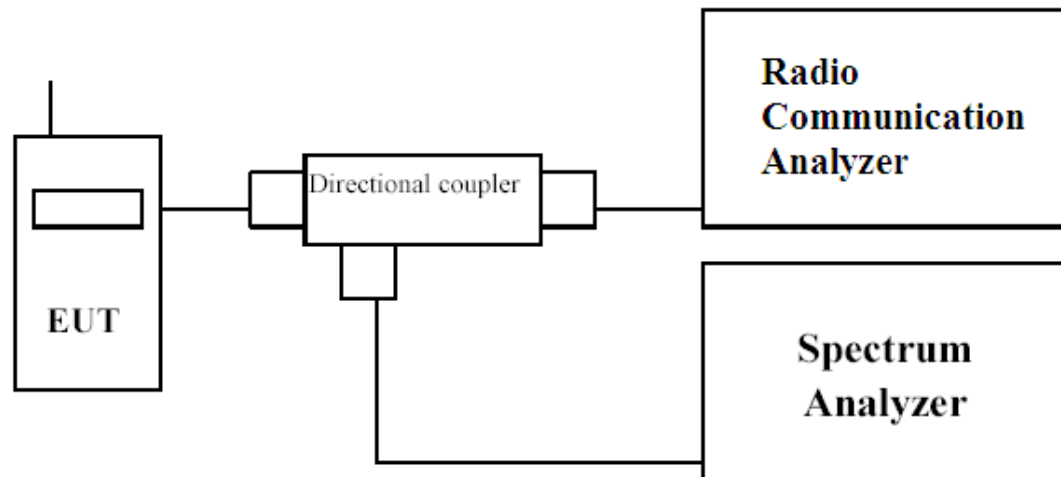
AC Voltage (V)	Test Frequency (GHz)	Deviation (kHz)	Limit (kHz)
138	1.88	-0.0063	±4.70
120	1.88	0.0078	±4.70
102	1.88	-0.0071	±4.70

8. Peak to Average Ratio

8.1 Test Specification

According to Part 24.232 (a)

8.2 Test Setup



8.3 Limits

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure.

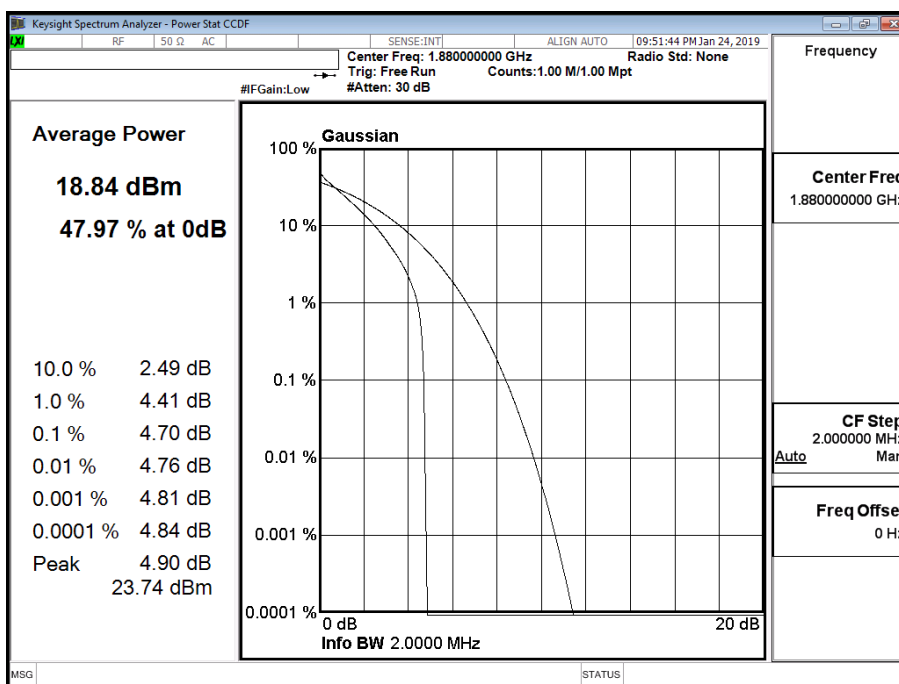
8.4 Test Procedure

- a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
- b) Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
- c) Set the number of counts to a value that stabilizes the measured CCDF curve;
- d) Set the measurement interval as follows:
 - 1) for continuous transmissions, set to 1 ms,
 - 2) for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
- e) Record the maximum PAPR level associated with a probability of 0.1%.

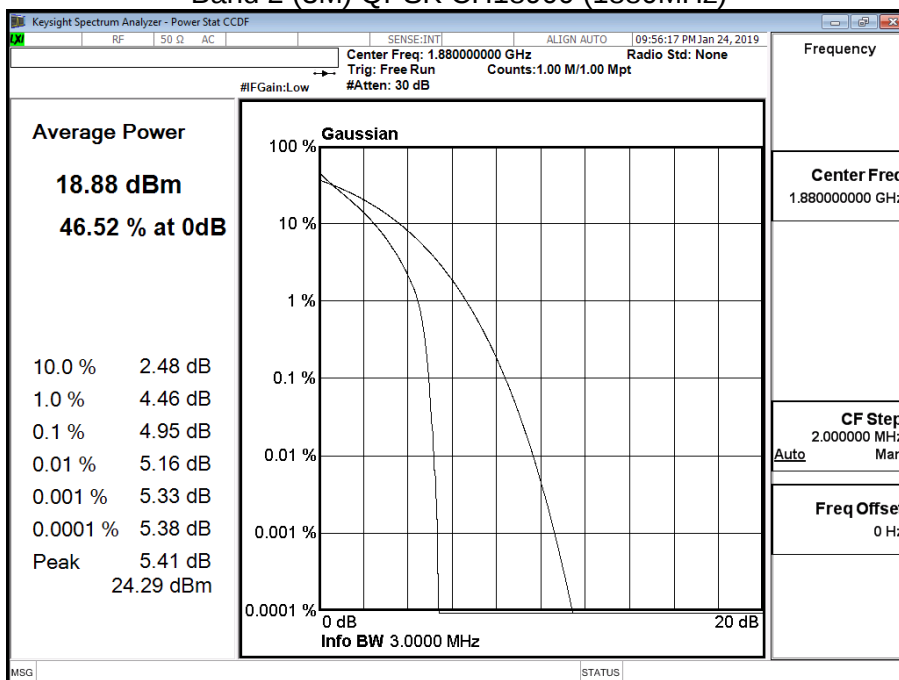
8.5 Test Result of Spurious Emission

Product	4G/LTE Multi-Service 11ac Broadband Router, 4G/LTE Wireless-AC VoIP Broadband Router, 4G/LTE Wireless-AC Broadband Router		
Test Mode	Peak to Average Ratio		
Date of Test	2019/01/24	Test Site	CTR
Test Condition	LTE-Band 2		

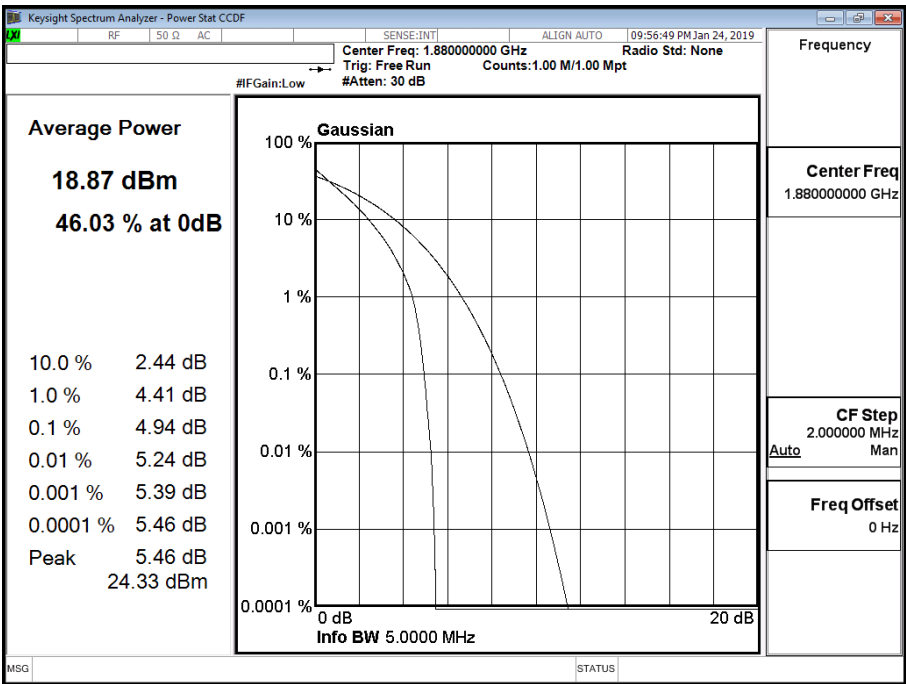
Band 2 (1.4M) QPSK CH18900 (1880MHz)



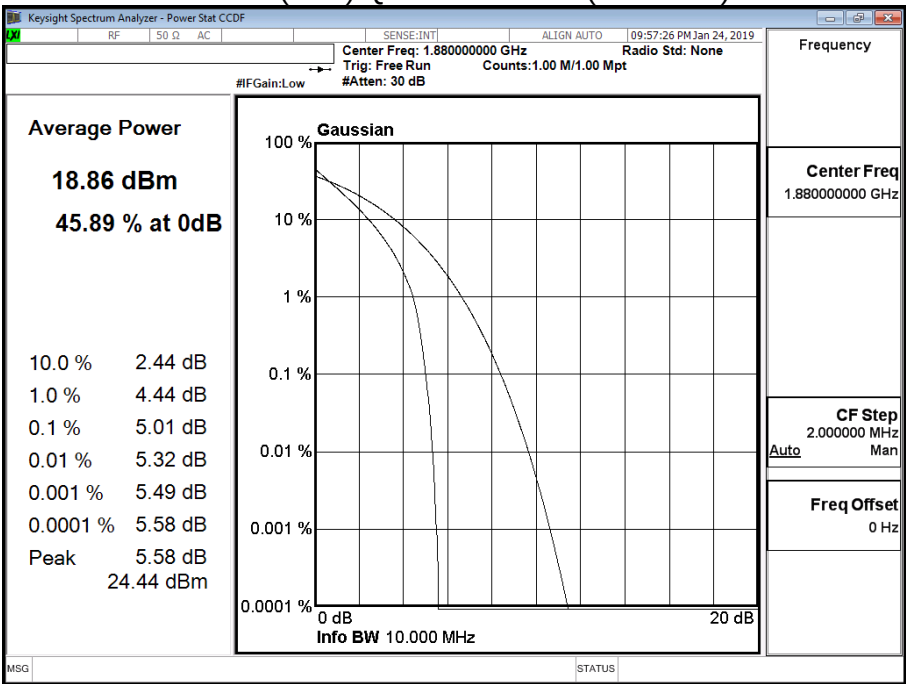
Band 2 (3M) QPSK CH18900 (1880MHz)



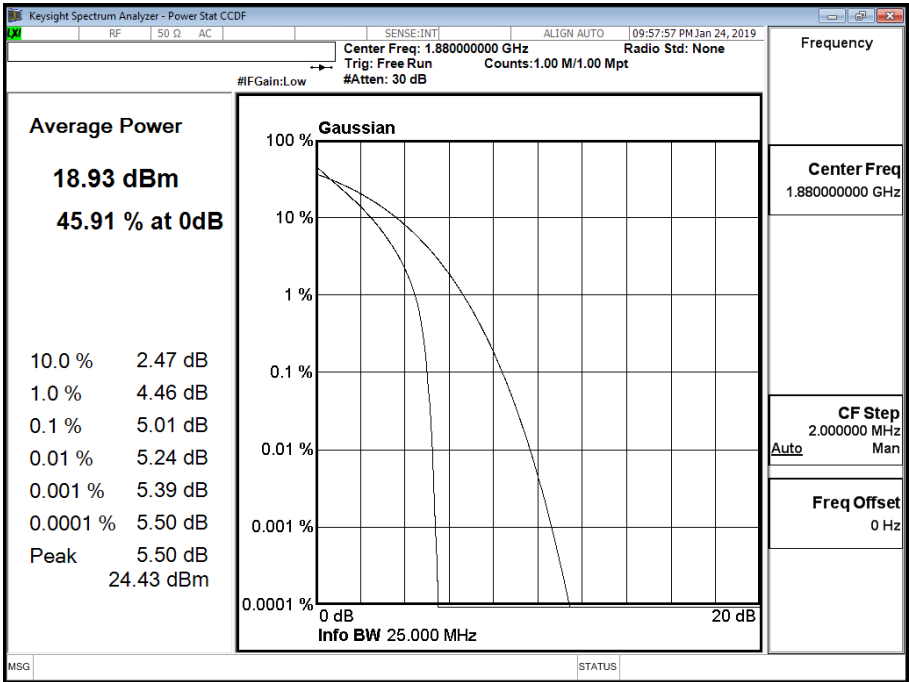
Band 2 (5M) QPSK CH18900 (1880MHz)



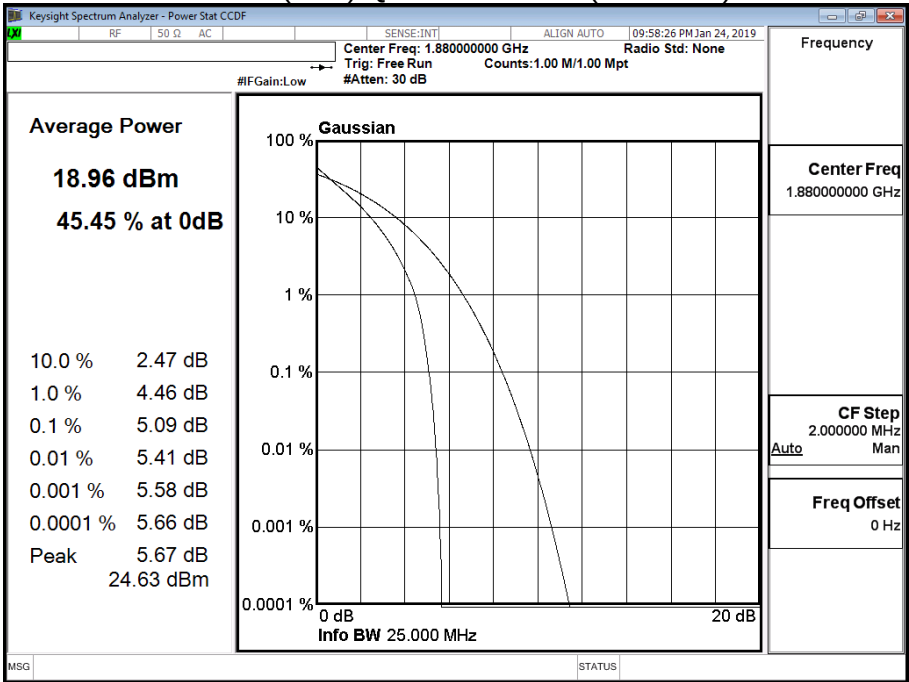
Band 2 (10M) QPSK CH18900 (1880MHz)



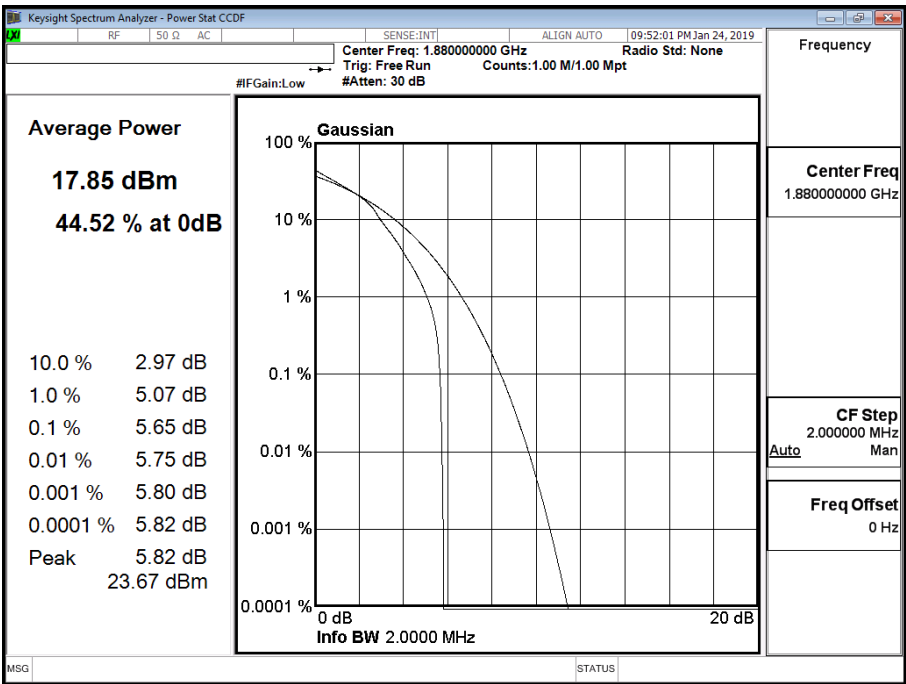
Band 2 (15M) QPSK CH18900 (1880MHz)



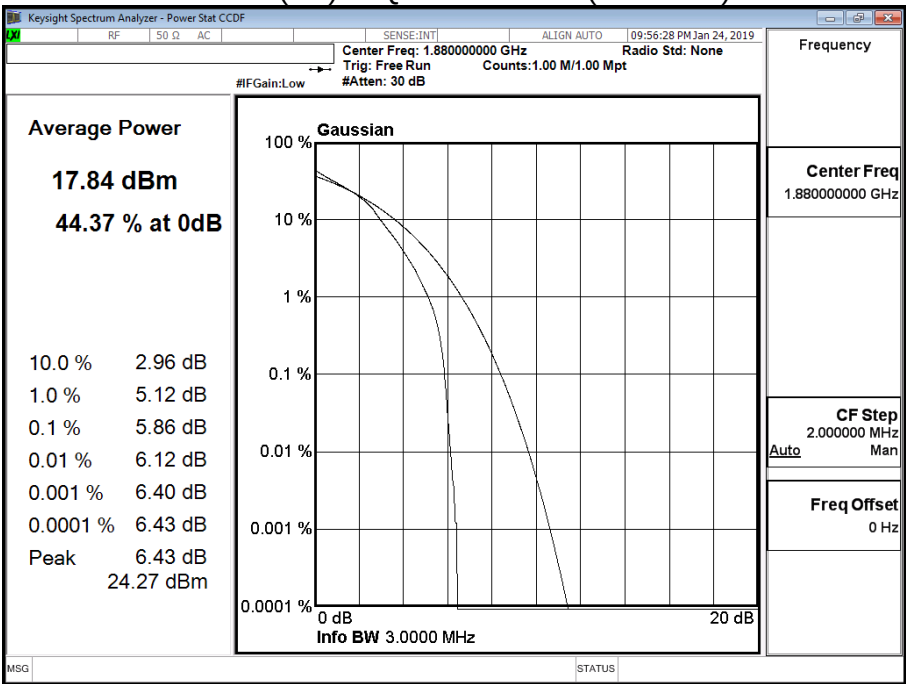
Band 2 (20M) QPSK CH18900 (1880MHz)



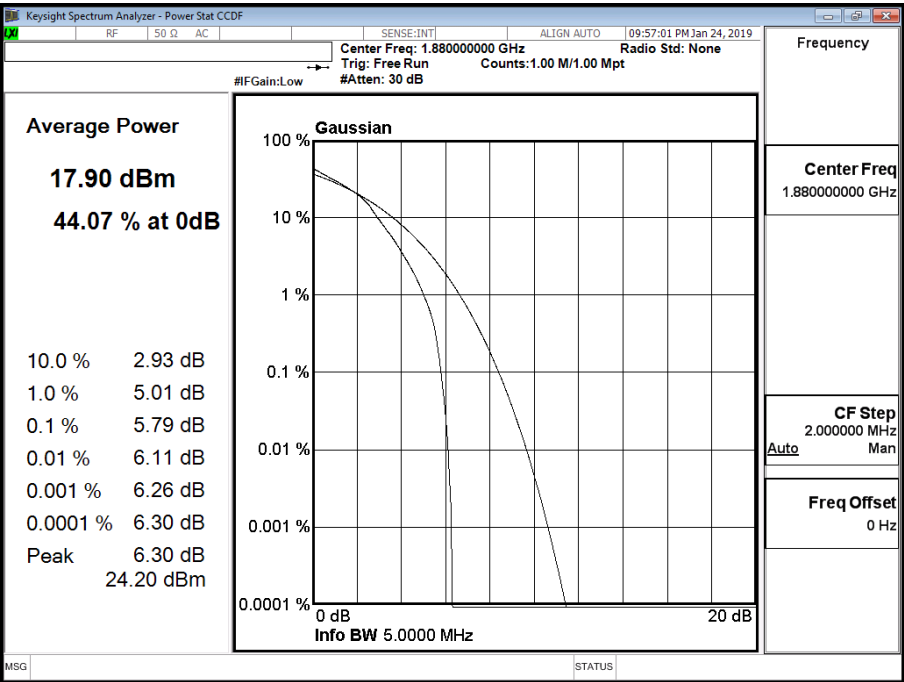
Band 2 (1.4M) 16QAM CH18900 (1880MHz)



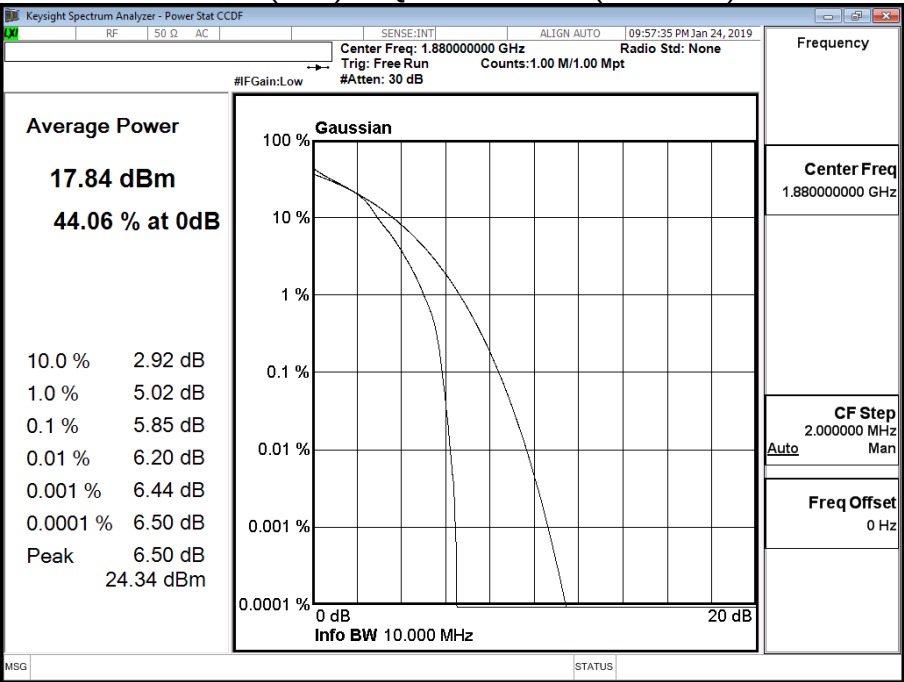
Band 2 (3M) 16QAM CH18900 (1880MHz)



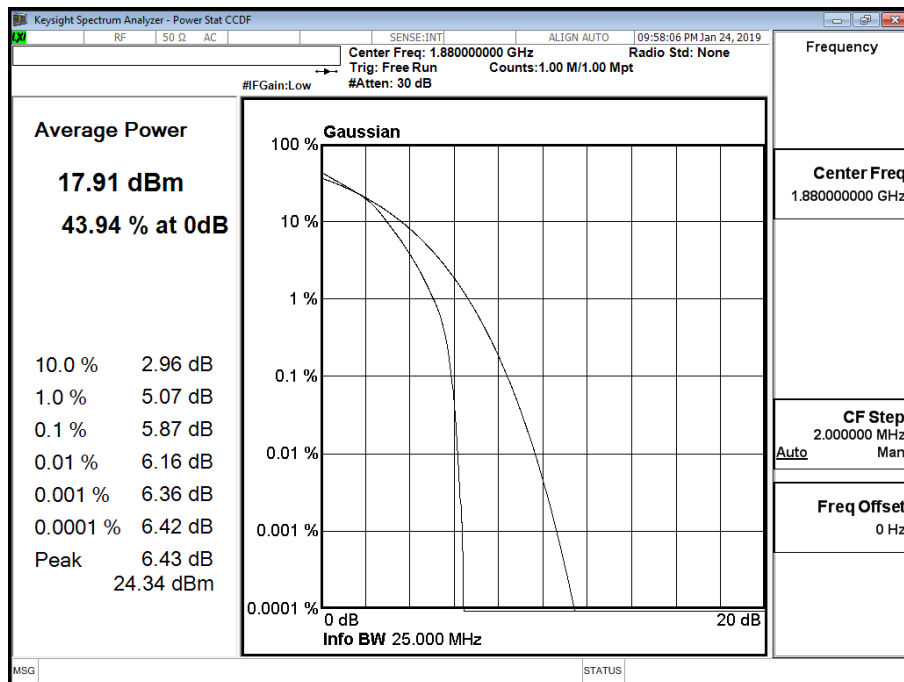
Band 2 (5M) 16QAM CH18900 (1880MHz)



Band 2 (10M) 16QAM CH18900 (1880MHz)



Band 2 (15M) 16QAM CH18900 (1880MHz)



Band 2 (20M) 16QAM CH18900 (1880MHz)

