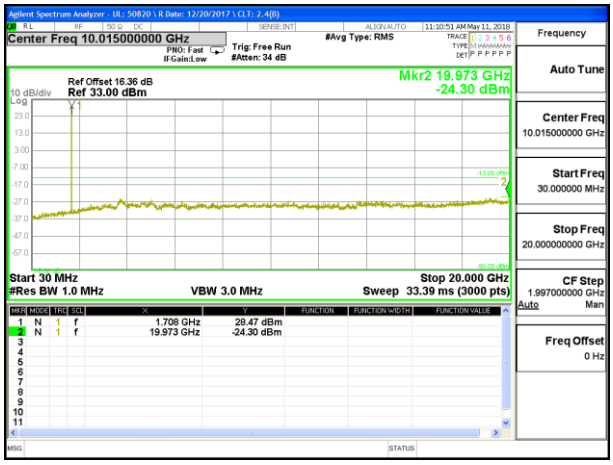
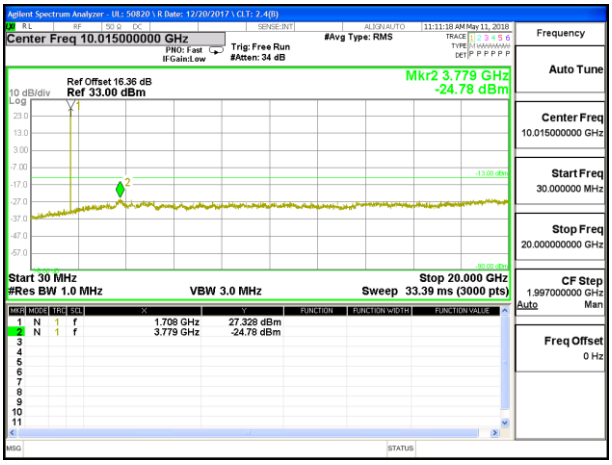
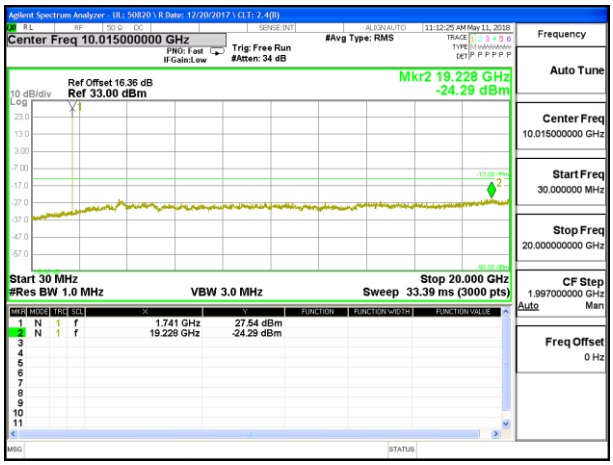


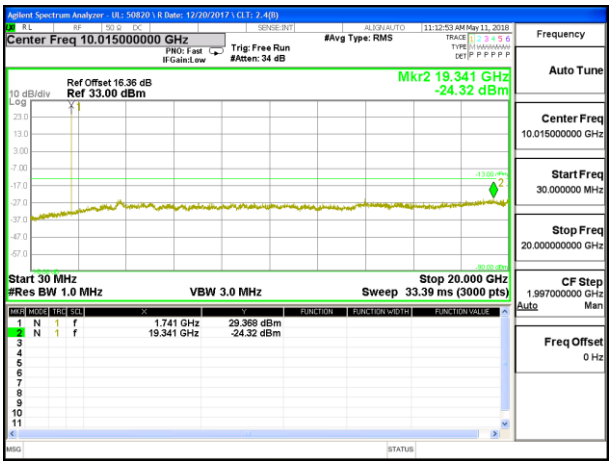
LTE B66 5MHz QPSK Low Channel RB1-0



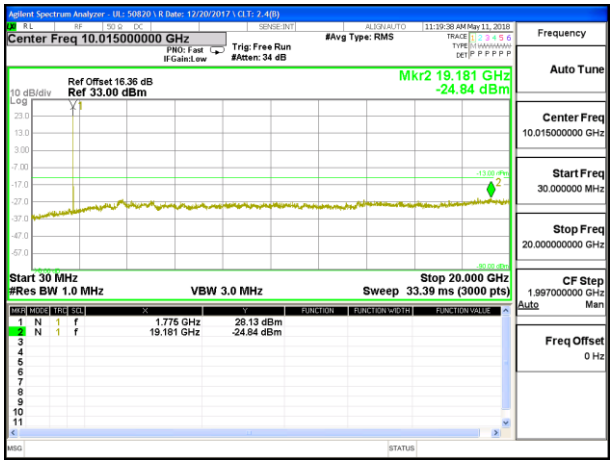
LTE B66 5MHz 16QAM Low Channel RB1-0



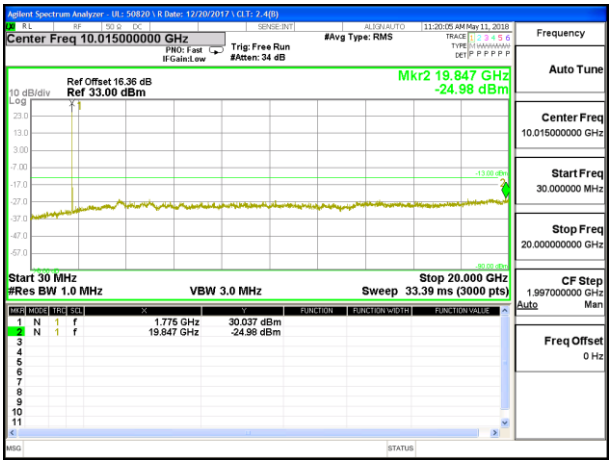
LTE B66 5MHz QPSK Middle Channel RB1-0



LTE B66 5MHz 16QAM Middle Channel RB1-0



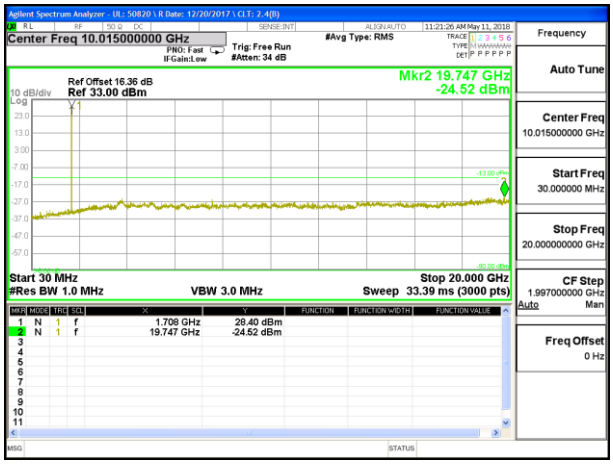
LTE B66 5MHz QPSK High Channel RB1-0



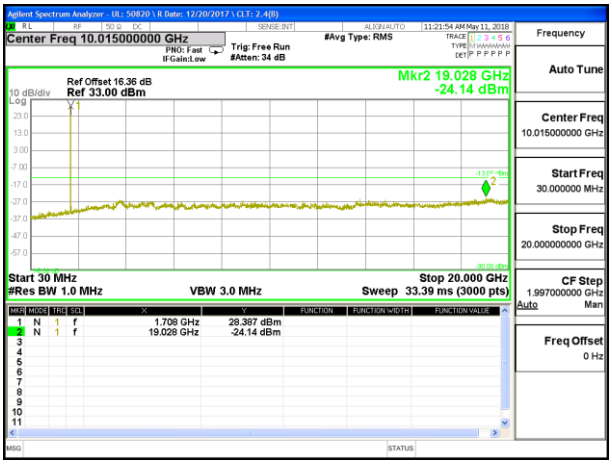
LTE B66 5MHz 16QAM High Channel RB1-0

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

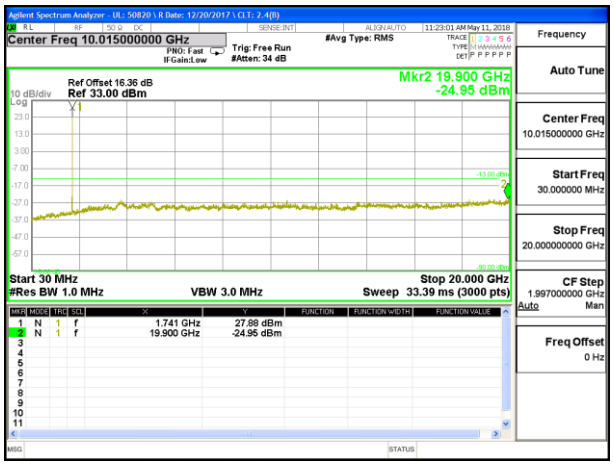
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



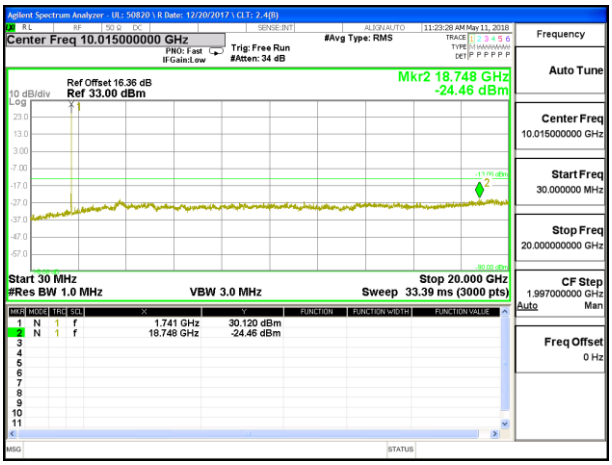
LTE B66 10MHz QPSK Low Channel RB1-0



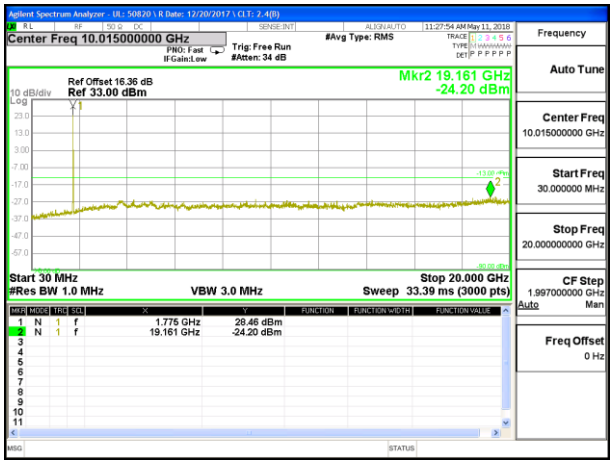
LTE B66 10MHz 16QAM Low Channel RB1-0



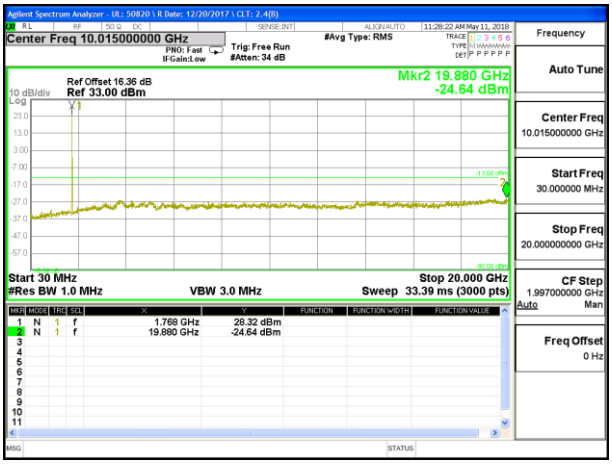
LTE B66 10MHz QPSK Middle Channel RB1-0



LTE B66 10MHz 16QAM Middle Channel RB1-0



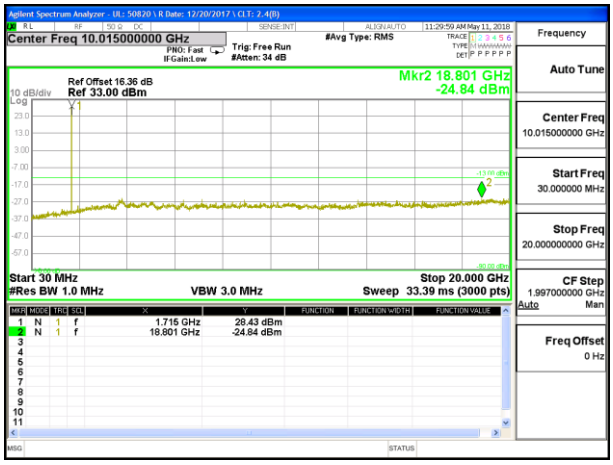
LTE B66 10MHz QPSK High Channel RB1-0



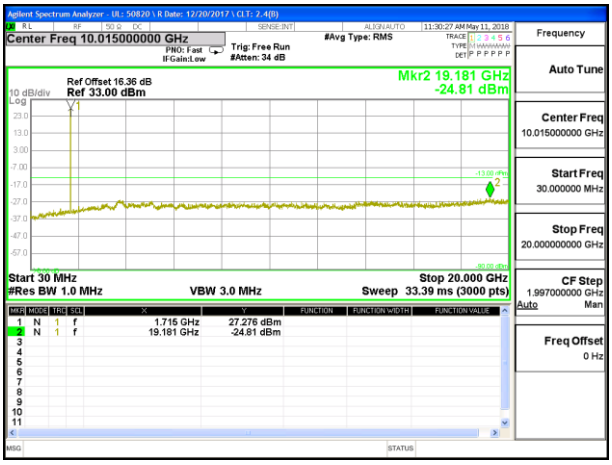
LTE B66 10MHz 16QAM High Channel RB1-0

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

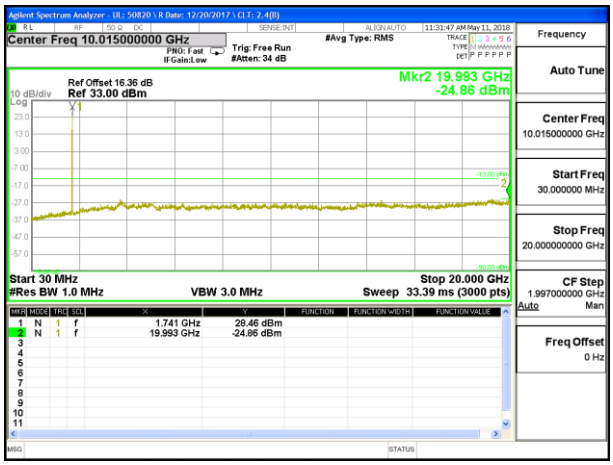
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



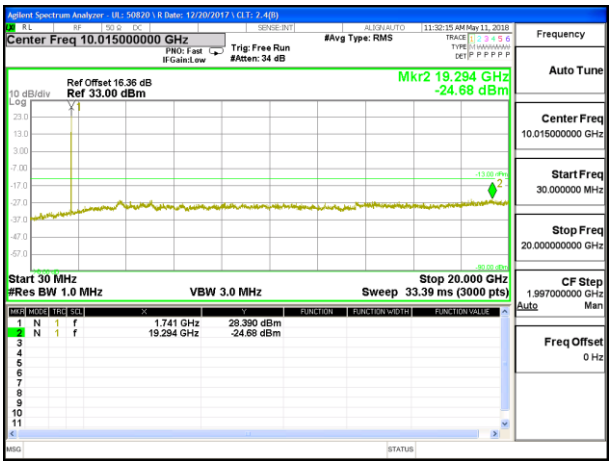
LTE B66 15MHz QPSK Low Channel RB1-0



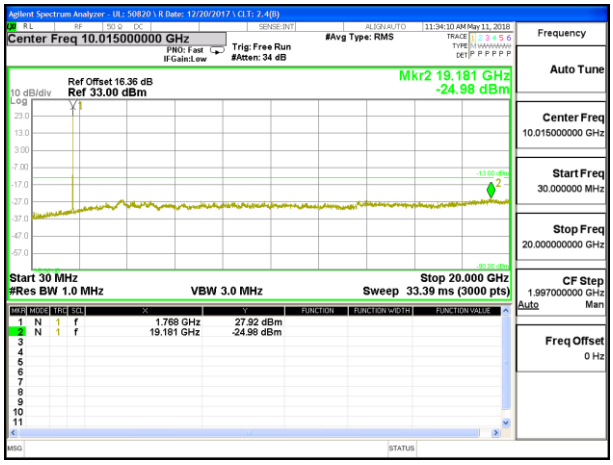
LTE B66 15MHz 16QAM Low Channel RB1-0



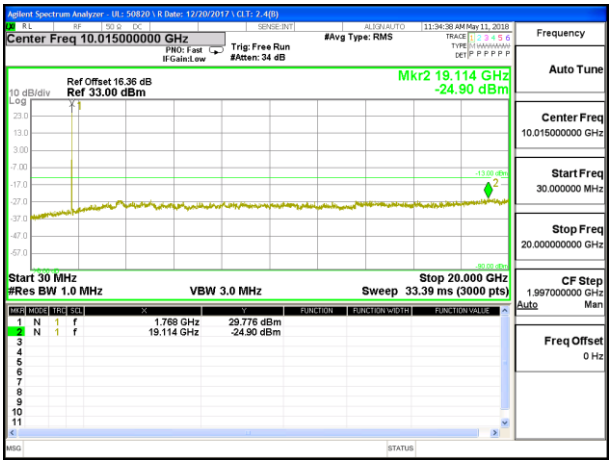
LTE B66 15MHz QPSK Middle Channel RB1-0



LTE B66 15MHz 16QAM Middle Channel RB1-0



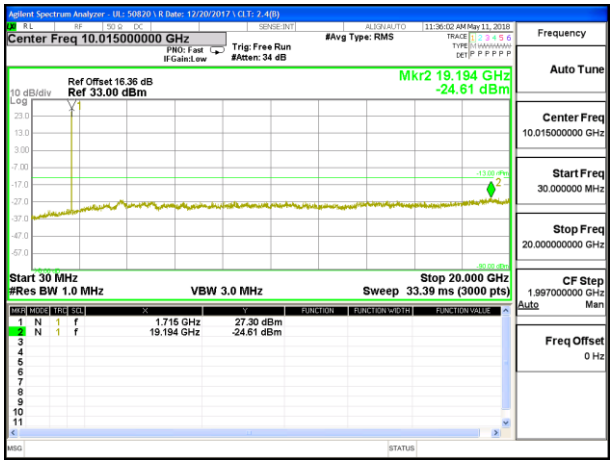
LTE B66 15MHz QPSK High Channel RB1-0



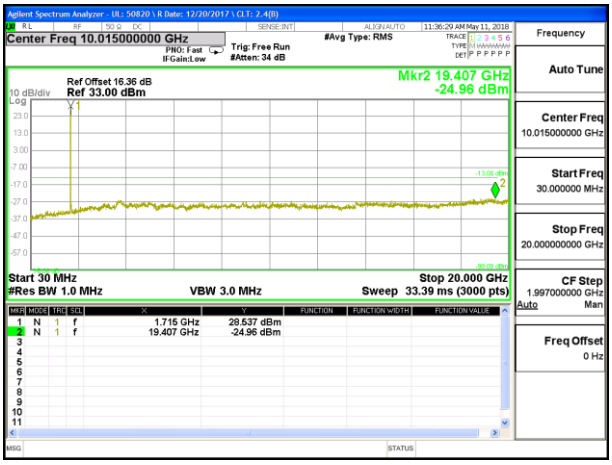
LTE B66 15MHz 16QAM High Channel RB1-0

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

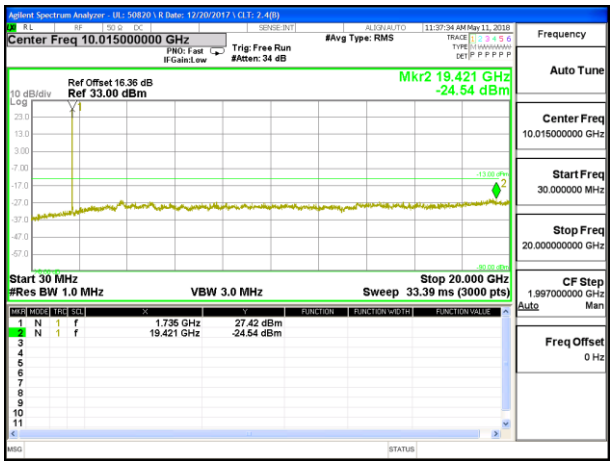
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



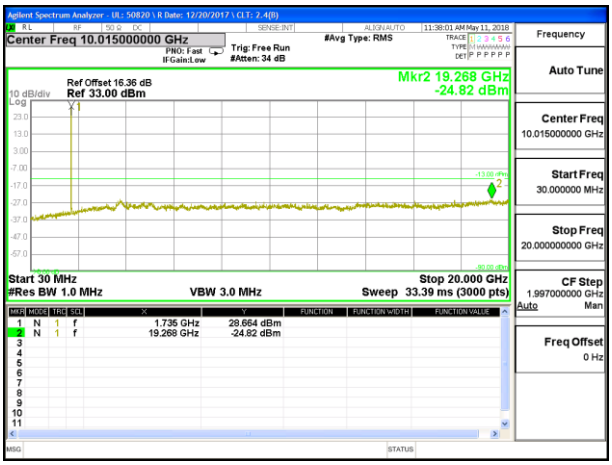
LTE B66 20MHz QPSK Low Channel RB1-0



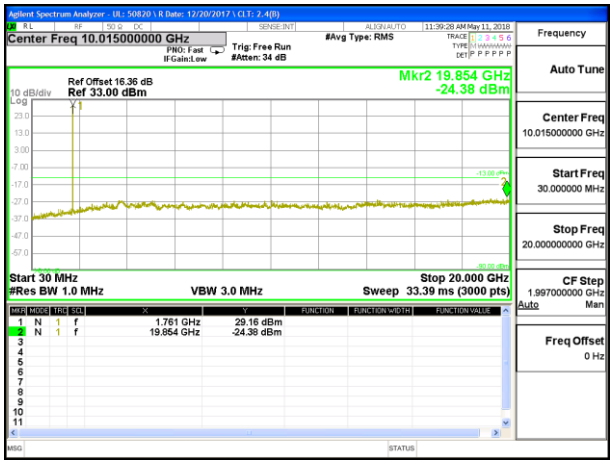
LTE B66 20MHz 16QAM Low Channel RB1-0



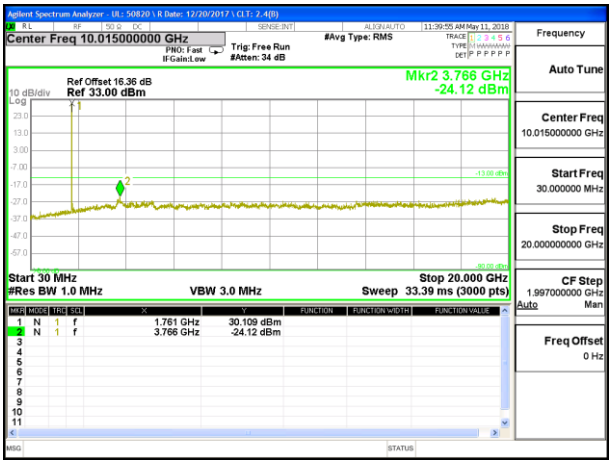
LTE B66 20MHz QPSK Middle Channel RB1-0



LTE B66 20MHz 16QAM Middle Channel RB1-0



LTE B66 20MHz QPSK High Channel RB1-0



LTE B66 20MHz 16QAM High Channel RB1-0

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

FORM NO: CCSUP4031B
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4. FREQUENCY STABILITY

RULE PART(S)

§2.1055, §22.355, §24.235, §27.54, §90.213 and §90.539

LIMITS

FCC: §22.355, §90.213
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

FCC: §90.539
(e) The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 ppm or better when AFC is locked to a base station, and 5 ppm or better when AFC is not locked.

FCC: §24.235 & §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = −30°C to +50°C
- Voltage = (85% - 115%)

  Low voltage, 3.23VDC, Normal, 3.8VDC and High voltage, 4.37VDC.
  End Voltage, 3.2VDC.

Frequency Stability vs Temperature:
The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

Frequency Stability vs Voltage:
The peak frequency error is recorded (worst-case).

MODES TESTED

- LTE Band 2
- LTE Band 5
- LTE Band 7
- LTE Band 12
- LTE Band 13
- LTE Band 14
- LTE Band 17
- LTE Band 25
- LTE Band 26
- LTE Band 30
- LTE Band 41
- LTE Band 66

RESULTS

See the following pages.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4.1. LTE BAND 2

ID:	44410	Date:	2/22/18

QPSK, (20MHz BANDWIDTH)

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.8312	1909.1391		
Extreme (50C)		1850.8312	1909.1391	-18.1	-0.010
Extreme (40C)		1850.8312	1909.1391	27.8	0.015
Extreme (30C)		1850.8312	1909.1391	-19.9	-0.011
Extreme (10C)		1850.8312	1909.1391	-25.1	-0.013
Extreme (0C)		1850.8312	1909.1391	24.0	0.013
Extreme (-10C)		1850.8312	1909.1391	-22.8	-0.012
Extreme (-20C)		1850.8312	1909.1391	-26.7	-0.014
Extreme (-30C)		1850.8312	1909.1391	-25.0	-0.013
20C	15%	1850.8312	1909.1391	-24.4	-0.013
	-15%	1850.8312	1909.1391	26.3	0.014
	End Point	1850.8312	1909.1391	-25.1	-0.013

8.4.2. LTE BAND 5

ID:	44410	Date:	2/22/18

QPSK, (10MHz BANDWIDTH)

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	824.5114	848.8138		
Extreme (50C)		824.5114	848.8138	7.5	0.009
Extreme (40C)		824.5114	848.8138	-20.1	-0.024
Extreme (30C)		824.5114	848.8138	9.3	0.011
Extreme (10C)		824.5114	848.8138	7.2	0.009
Extreme (0C)		824.5114	848.8138	8.4	0.010
Extreme (-10C)		824.5114	848.8138	6.9	0.008
Extreme (-20C)		824.5114	848.8138	8.8	0.011
Extreme (-30C)		824.5114	848.8138	7.0	0.008
20C	15%	824.5114	848.8138	19.0	0.023
	-15%	824.5114	848.8138	20.6	0.025
	End Point	824.5114	848.8138	8.3	0.010

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4.3. LTE BAND 7

ID:	44410	Date:	2/22/18

QPSK, (20MHz BANDWIDTH)

Limit		2500	2570	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	2500.8502	2569.1335		
Extreme (50C)		2500.8502	2569.1335	32.0	0.013
Extreme (40C)		2500.8503	2569.1336	119.4	0.047
Extreme (30C)		2500.8502	2569.1335	36.6	0.014
Extreme (10C)		2500.8502	2569.1335	43.4	0.017
Extreme (0C)		2500.8502	2569.1335	-38.1	-0.015
Extreme (-10C)		2500.8502	2569.1335	-42.4	-0.017
Extreme (-20C)		2500.8502	2569.1335	40.4	0.016
Extreme (-30C)		2500.8502	2569.1335	39.9	0.016
20C	15%	2500.8502	2569.1335	31.6	0.012
	-15%	2500.8502	2569.1335	36.9	0.015
	End Point	2500.8502	2569.1335	41.1	0.016

8.4.4. LTE BAND 12

ID:	44410	Date:	2/22/18

QPSK, (10MHz BANDWIDTH)

Limit		699	716	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	699.7714	715.6476		
Extreme (50C)		699.7714	715.6476	8.7	0.012
Extreme (40C)		699.7714	715.6476	5.8	0.008
Extreme (30C)		699.7714	715.6476	6.6	0.009
Extreme (10C)		699.7714	715.6476	8.7	0.012
Extreme (0C)		699.7714	715.6476	10.4	0.015
Extreme (-10C)		699.7714	715.6476	11.6	0.016
Extreme (-20C)		699.7714	715.6476	11.2	0.016
Extreme (-30C)		699.7714	715.6476	6.3	0.009
20C	15%	699.7714	715.6476	7.8	0.011
	-15%	699.7714	715.6476	8.9	0.013
	End Point	699.7714	715.6476	7.4	0.010

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4.5. LTE BAND 13

ID:	44410	Date:	2/22/18

QPSK, (10MHz BANDWIDTH)

Limit		777	787	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	777.1175	786.8834		
Extreme (50C)		777.1175	786.8834	10.4	0.013
Extreme (40C)		777.1175	786.8834	8.9	0.011
Extreme (30C)		777.1175	786.8834	10.2	0.013
Extreme (10C)		777.1175	786.8834	9.4	0.012
Extreme (0C)		777.1175	786.8834	8.5	0.011
Extreme (-10C)		777.1175	786.8834	11.8	0.015
Extreme (-20C)		777.1175	786.8834	14.6	0.019
Extreme (-30C)		777.1175	786.8834	8.0	0.010
20C	15%	777.1175	786.8834	9.4	0.012
	-15%	777.1175	786.8834	9.6	0.012
	End Point	777.1175	786.8834	10.4	0.013

8.4.6. LTE BAND 14 (FCC)

ID:	44410	Date:	2/22/18

QPSK, (10MHz BANDWIDTH)

Limit		788	798	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	788.1174	797.8832		
Extreme (50C)		788.1174	797.8832	9.4	0.012
Extreme (40C)		788.1174	797.8832	6.6	0.008
Extreme (30C)		788.1174	797.8832	9.3	0.012
Extreme (10C)		788.1174	797.8832	6.9	0.009
Extreme (0C)		788.1174	797.8832	8.2	0.010
Extreme (-10C)		788.1174	797.8832	8.8	0.011
Extreme (-20C)		788.1174	797.8832	9.2	0.012
Extreme (-30C)		788.1174	797.8832	7.5	0.009
20C	15%	788.1174	797.8832	11.4	0.014
	-15%	788.1174	797.8832	12.2	0.015
	End Point	788.1174	797.8832	8.8	0.011

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4.7. LTE BAND 17

ID:	44410	Date:	2/22/18

QPSK, (10MHz BANDWIDTH)

Limit		704	716	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	704.3054	715.6006		
Extreme (50C)		704.3054	715.6006	8.7	0.012
Extreme (40C)		704.3054	715.6006	5.8	0.008
Extreme (30C)		704.3054	715.6006	6.6	0.009
Extreme (10C)		704.3054	715.6006	8.7	0.012
Extreme (0C)		704.3054	715.6006	10.4	0.015
Extreme (-10C)		704.3054	715.6006	11.6	0.016
Extreme (-20C)		704.3054	715.6006	11.2	0.016
Extreme (-30C)		704.3054	715.6006	6.3	0.009
20C	15%	704.3054	715.6006	7.8	0.011
	-15%	704.3054	715.6006	8.9	0.013
	End Point	704.3054	715.6006	7.4	0.010

8.4.8. LTE BAND 25

ID:	44410	Date:	2/22/18

QPSK, (20MHz BANDWIDTH)

Limit		1850	1915	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1850.8202	1914.1904		
Extreme (50C)		1850.8202	1914.1904	-18.1	-0.010
Extreme (40C)		1850.8202	1914.1904	27.8	0.015
Extreme (30C)		1850.8202	1914.1904	-19.9	-0.011
Extreme (10C)		1850.8202	1914.1904	-25.1	-0.013
Extreme (0C)		1850.8202	1914.1904	24.0	0.013
Extreme (-10C)		1850.8202	1914.1904	-22.8	-0.012
Extreme (-20C)		1850.8202	1914.1904	-26.7	-0.014
Extreme (-30C)		1850.8202	1914.1904	-25.0	-0.013
20C	15%	1850.8202	1914.1904	-24.4	-0.013
	-15%	1850.8202	1914.1904	26.3	0.014
	End Point	1850.8202	1914.1904	-25.1	-0.013

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4.9. LTE BAND 26 (FCC PART 90)

ID:	44410	Date:	2/22/18

QPSK, (10MHz BANDWIDTH)

Limit		814	824	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	814.1003	823.8920		
Extreme (50C)		814.1003	823.8920	7.5	0.009
Extreme (40C)		814.1003	823.8920	-20.1	-0.025
Extreme (30C)		814.1003	823.8920	9.3	0.011
Extreme (10C)		814.1003	823.8920	7.2	0.009
Extreme (0C)		814.1003	823.8920	8.4	0.010
Extreme (-10C)		814.1003	823.8920	6.9	0.008
Extreme (-20C)		814.1003	823.8920	8.8	0.011
Extreme (-30C)		814.1003	823.8920	7.0	0.009
20C	15%	814.1003	823.8920	19.0	0.023
	-15%	814.1003	823.8920	20.6	0.025
	End Point	814.1003	823.8920	8.3	0.010

8.4.10. LTE BAND 30

ID:	44410	Date:	2/22/18

QPSK, (10MHz BANDWIDTH)

Limit		2305	2315	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	2305.1174	2314.5837		
Extreme (50C)		2305.1174	2314.5837	-46.8	-0.020
Extreme (40C)		2305.1175	2314.5838	56.7	0.025
Extreme (30C)		2305.1175	2314.5838	53.6	0.023
Extreme (10C)		2305.1174	2314.5837	32.8	0.014
Extreme (0C)		2305.1174	2314.5837	28.6	0.012
Extreme (-10C)		2305.1174	2314.5837	29.2	0.013
Extreme (-20C)		2305.1174	2314.5837	27.3	0.012
Extreme (-30C)		2305.1174	2314.5837	-33.6	-0.015
20C	15%	2305.1174	2314.5837	28.7	0.012
	-15%	2305.1174	2314.5837	22.6	0.010
	End Point	2305.1174	2314.5837	37.6	0.016

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.4.11. LTE BAND 41

ID:	44410	Date:	2/22/18

QPSK, (20MHz BANDWIDTH)

Limit		2496	2690	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	2496.9252	2689.0587		
Extreme (50C)		2496.9252	2689.0587	-29.7	-0.011
Extreme (40C)		2496.9252	2689.0587	21.8	0.008
Extreme (30C)		2496.9252	2689.0587	23.1	0.009
Extreme (10C)		2496.9252	2689.0587	25.6	0.010
Extreme (0C)		2496.9252	2689.0587	30.2	0.012
Extreme (-10C)		2496.9252	2689.0587	33.3	0.013
Extreme (-20C)		2496.9252	2689.0587	34.8	0.013
Extreme (-30C)		2496.9252	2689.0587	35.6	0.014
20C	15%	2496.9252	2689.0587	-25.7	-0.010
	-15%	2496.9252	2689.0587	-22.4	-0.009
	End Point	2496.9252	2689.0587	-26.4	-0.010

8.4.12. LTE BAND 66

ID:	44410	Date:	2/22/18

QPSK, (20MHz BANDWIDTH)

Limit		1710	1780	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm (MHz)	F high @ -13dBm (MHz)		
Temperature	Voltage				
Normal (20C)	Normal	1710.8425	1779.1583		
Extreme (50C)		1710.8426	1779.1584	118.5	0.068
Extreme (40C)		1710.8424	1779.1582	-69.7	-0.040
Extreme (30C)		1710.8426	1779.1584	82.1	0.047
Extreme (10C)		1710.8426	1779.1584	117.9	0.068
Extreme (0C)		1710.8426	1779.1584	65.1	0.037
Extreme (-10C)		1710.8426	1779.1584	60.5	0.035
Extreme (-20C)		1710.8426	1779.1584	55.8	0.032
Extreme (-30C)		1710.8426	1779.1584	61.3	0.035
20C	15%	1710.8425	1779.1583	48.8	0.028
	-15%	1710.8425	1779.1583	49.9	0.029
	End Point	1710.8426	1779.1584	52.9	0.030

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.5. PEAK-TO-AVERAGE POWER RATIO

LIMIT

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

MODES TESTED

- LTE Band 2
- LTE Band 5
- LTE Band 7
- LTE Band 12
- LTE Band 13
- LTE Band 14
- LTE Band 17
- LTE Band 25
- LTE Band 26
- LTE Band 30
- LTE Band 41
- LTE Band 66

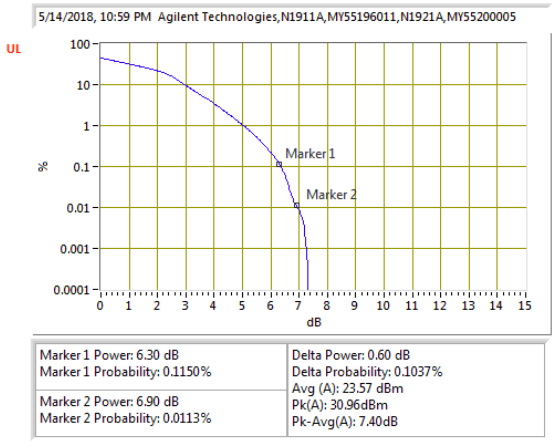
RESULT

Antenna 1 was used to measure as the worst case; full resource block (FRB) for each bandwidth was used to measure as the worst case. The results from all CCDF measurements are passed with 13dB peak-to-average power ratio criteria.

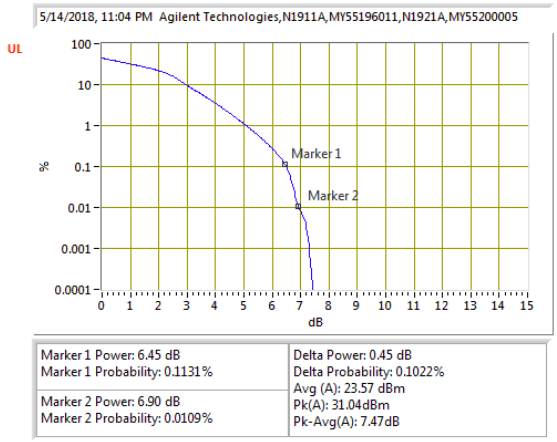
ID:	10643	**Date:**	5/14/18

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

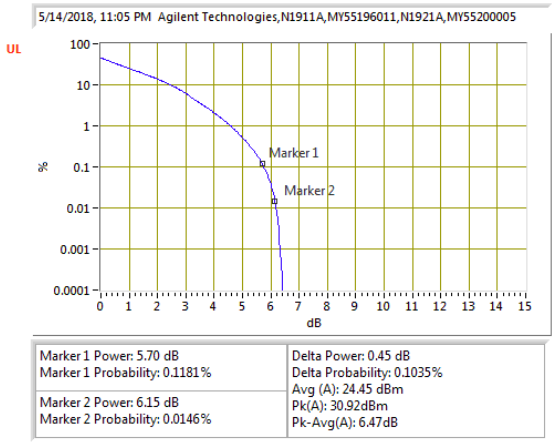
8.5.1. LTE BAND 2



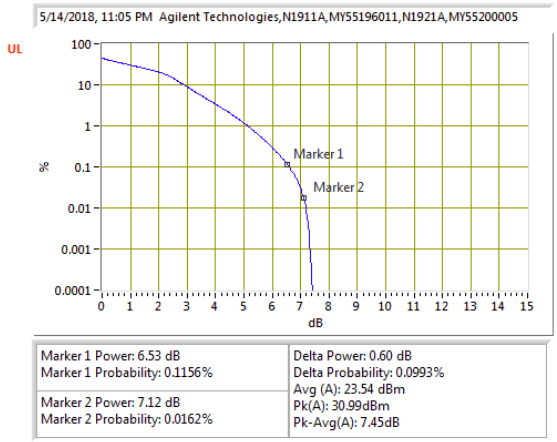
LTE B2 1.4MHz QPSK Middle Channel



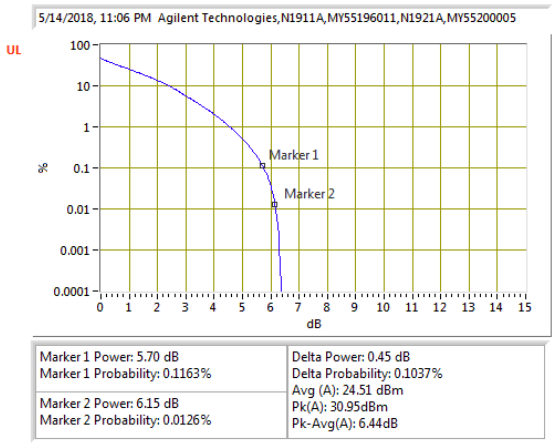
LTE B2 1.4MHz 16QAM Middle Channel



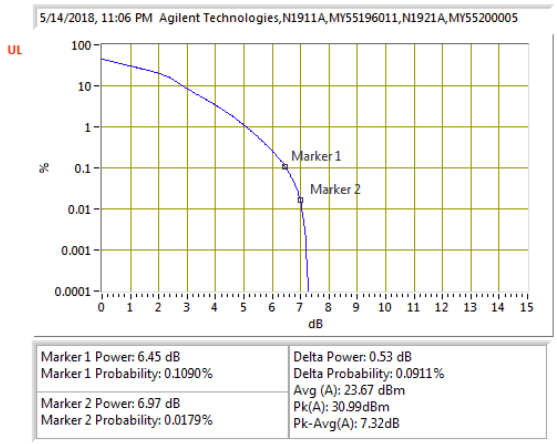
LTE B2 3MHz QPSK Middle Channel



LTE B2 3MHz 16QAM Middle Channel

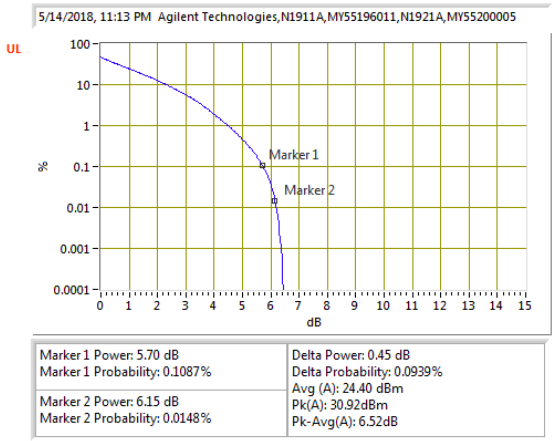


LTE B2 5MHz QPSK Middle Channel

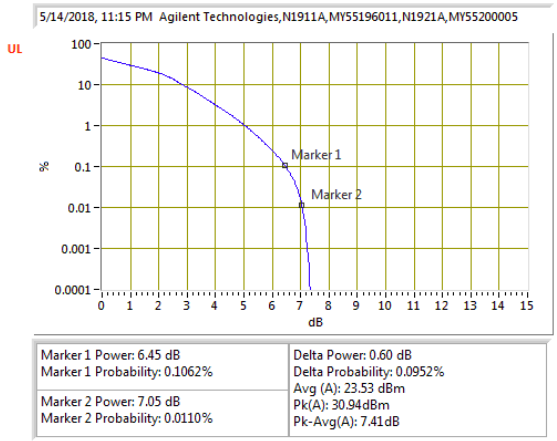


LTE B2 5MHz 16QAM Middle Channel

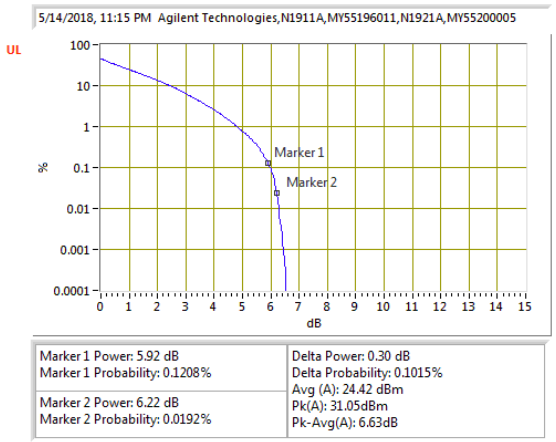
UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



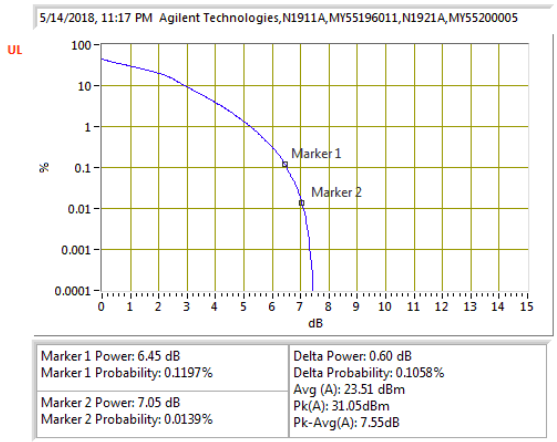
LTE B2 10MHz QPSK Middle Channel



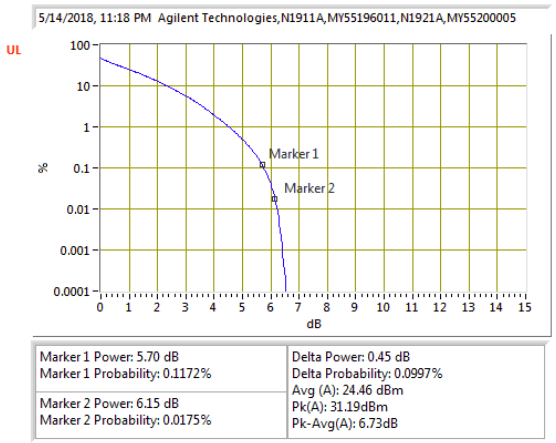
LTE B2 10MHz 16QAM Middle Channel



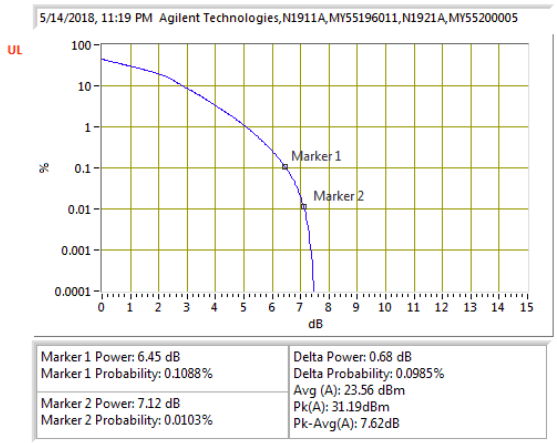
LTE B2 15MHz QPSK Middle Channel



LTE B2 15MHz 16QAM Middle Channel



LTE B2 20MHz QPSK Middle Channel

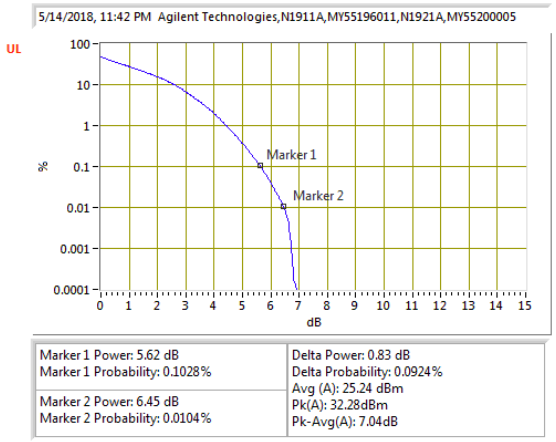


LTE B2 20MHz 16QAM Middle Channel

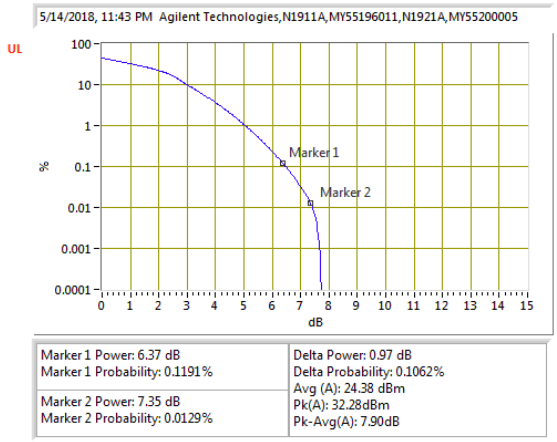
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

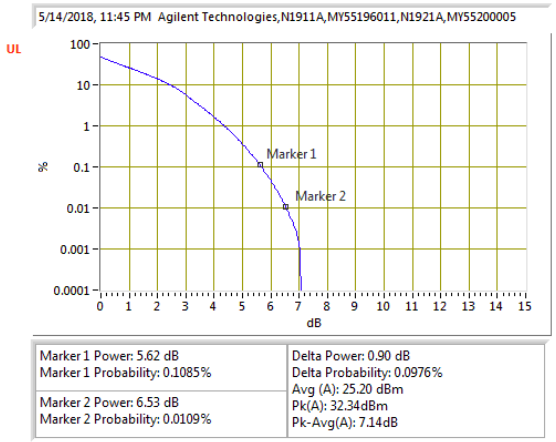
8.5.2. LTE BAND 5



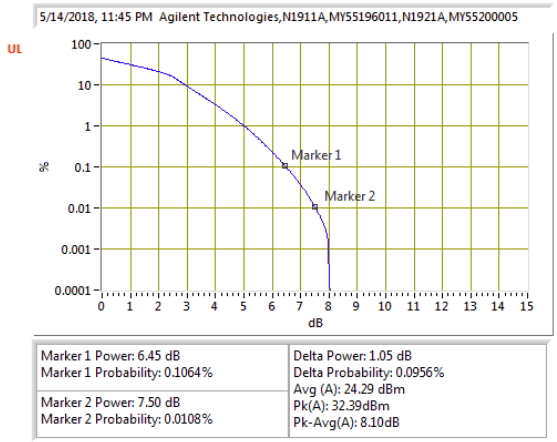
LTE B5 1.4MHz QPSK Middle Channel



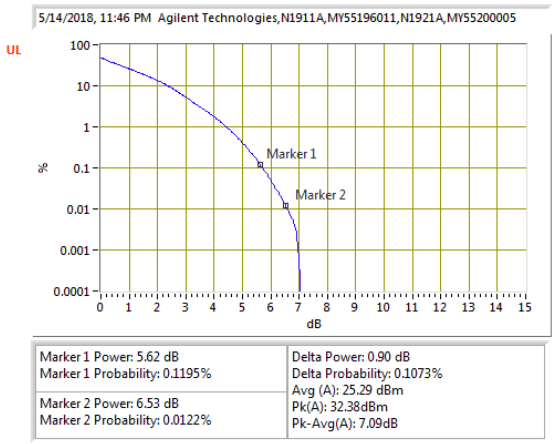
LTE B5 1.4MHz 16QAM Middle Channel



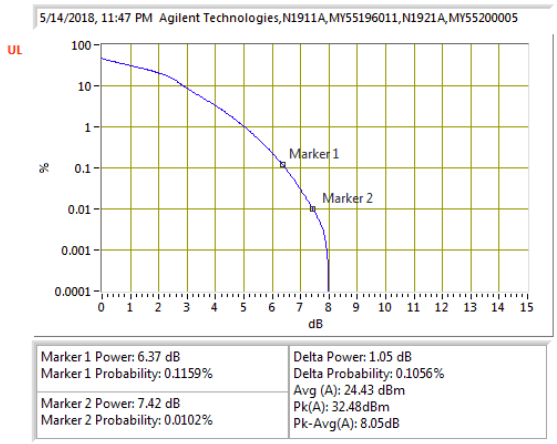
LTE B5 3MHz QPSK Middle Channel



LTE B5 3MHz 16QAM Middle Channel

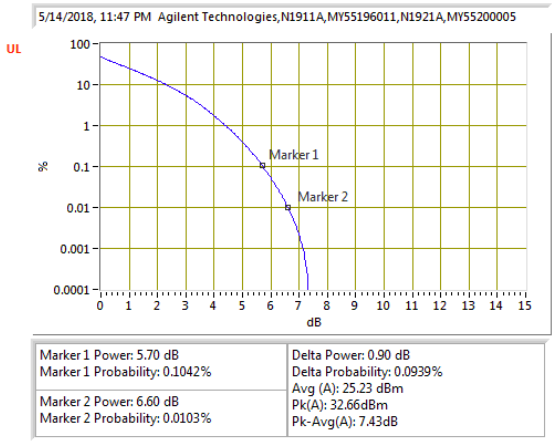


LTE B5 5MHz QPSK Middle Channel

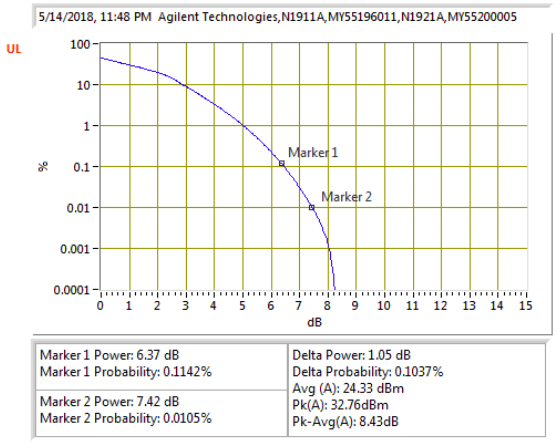


LTE B5 5MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
FORM NO: CCSUP4031B
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



LTE B5 10MHz QPSK Middle Channel

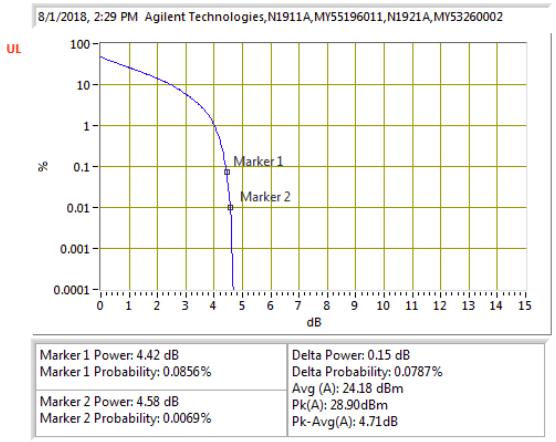


LTE B5 10MHz 16QAM Middle Channel

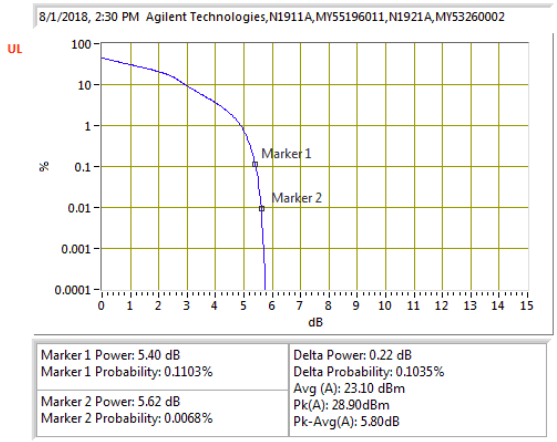
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

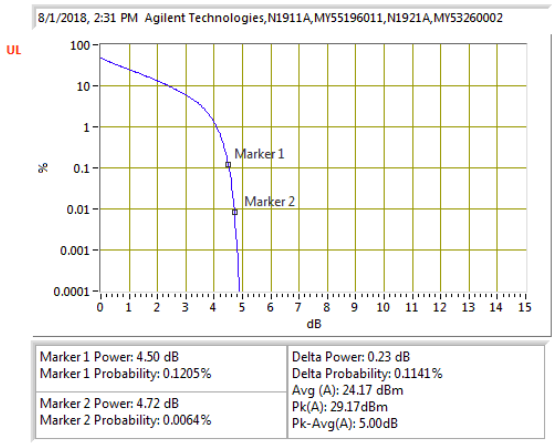
8.5.3. LTE BAND 7



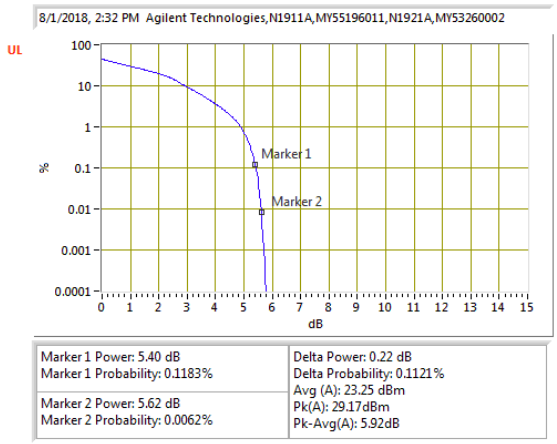
LTE B7 5MHz QPSK Middle Channel



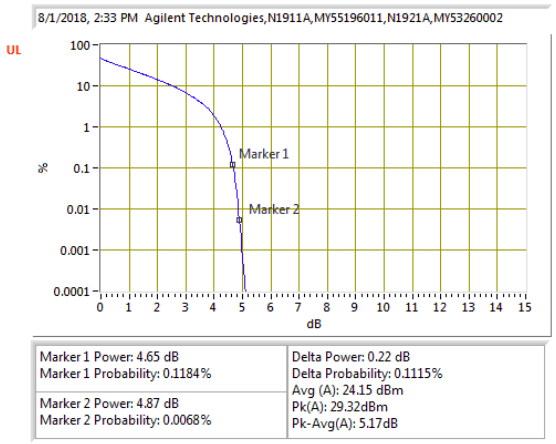
LTE B7 5MHz 16QAM Middle Channel



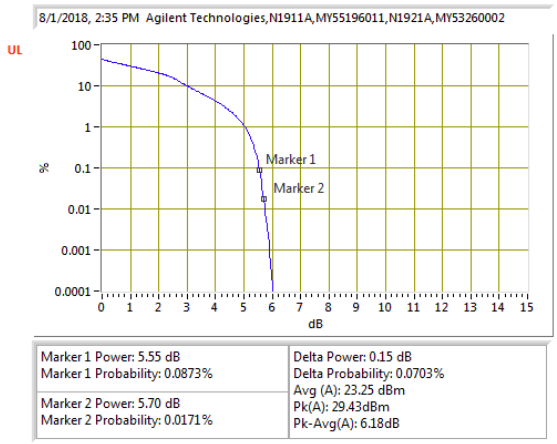
LTE B7 10MHz QPSK Middle Channel



LTE B7 10MHz 16QAM Middle Channel

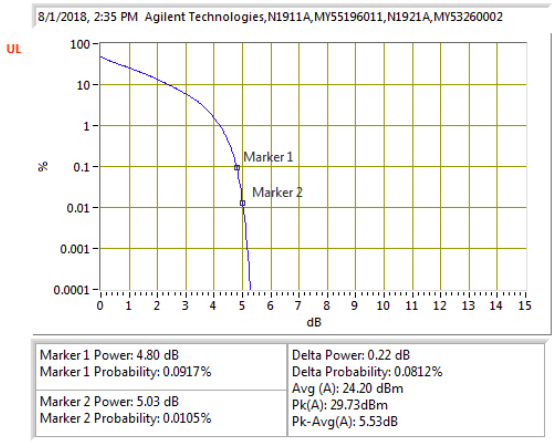


LTE B7 15MHz QPSK Middle Channel

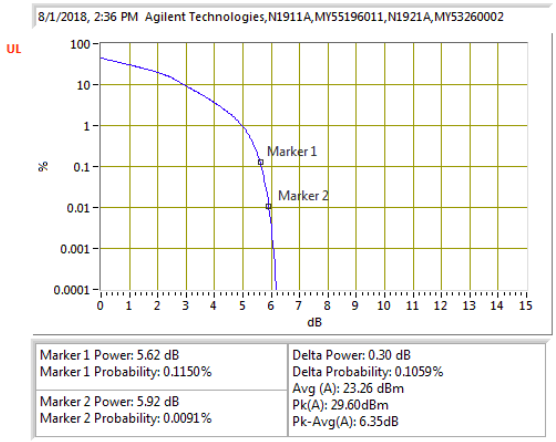


LTE B7 15MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
FORM NO: CCSUP4031B
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



LTE B7 20MHz QPSK Middle Channel

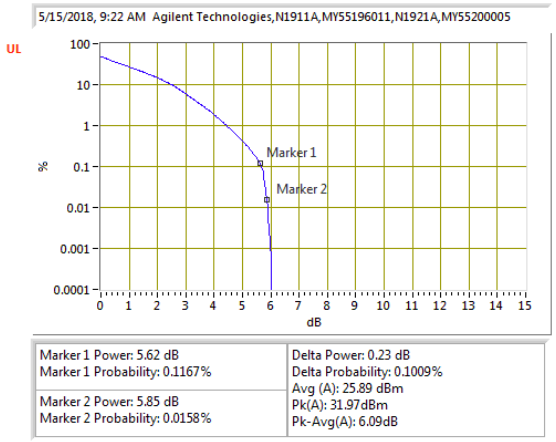


LTE B7 20MHz 16QAM Middle Channel

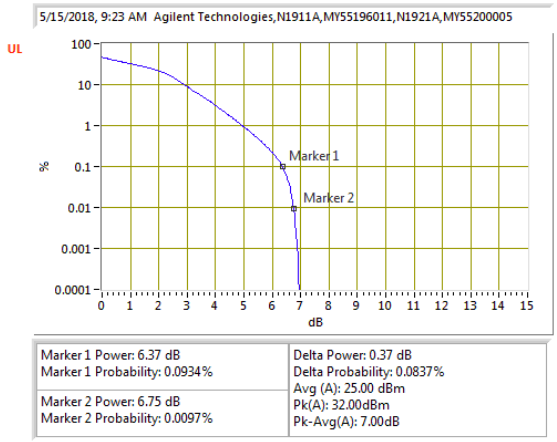
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

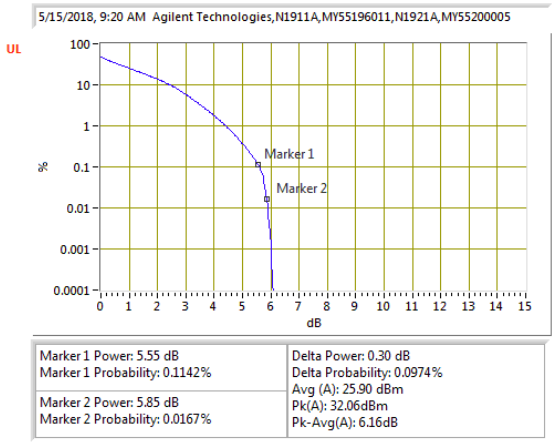
8.5.4. LTE BAND 12



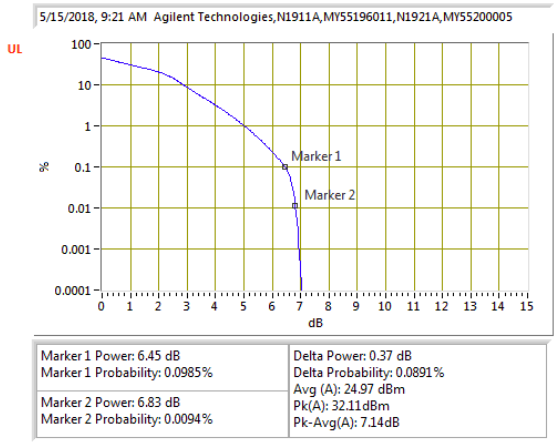
LTE B12 1.4MHz QPSK Middle Channel



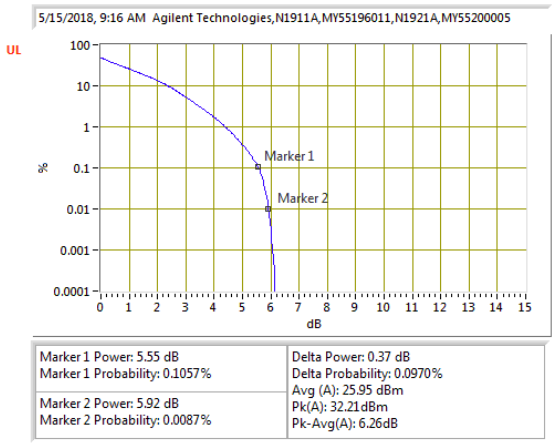
LTE B12 1.4MHz 16QAM Middle Channel



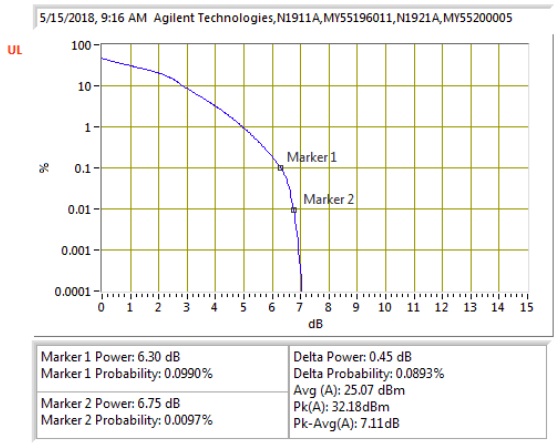
LTE B12 3MHz QPSK Middle Channel



LTE B12 3MHz 16QAM Middle Channel



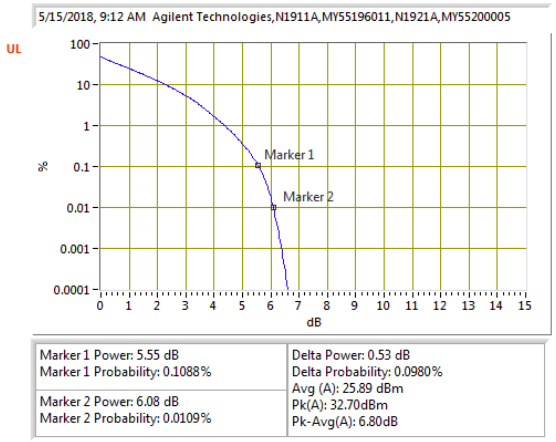
LTE B12 5MHz QPSK Middle Channel



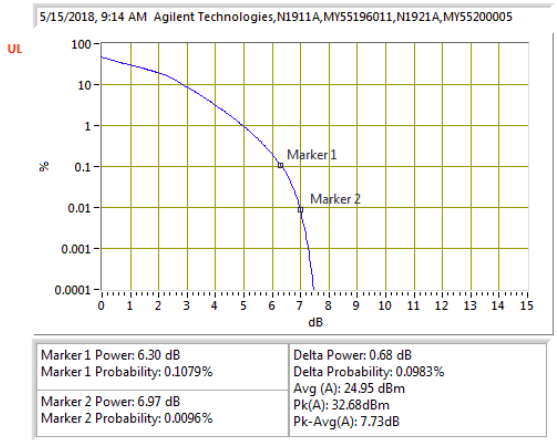
LTE B12 5MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



LTE B12 10MHz QPSK Middle Channel

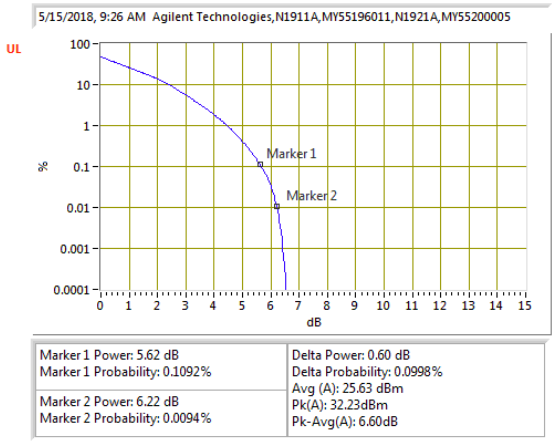


LTE B12 10MHz 16QAM Middle Channel

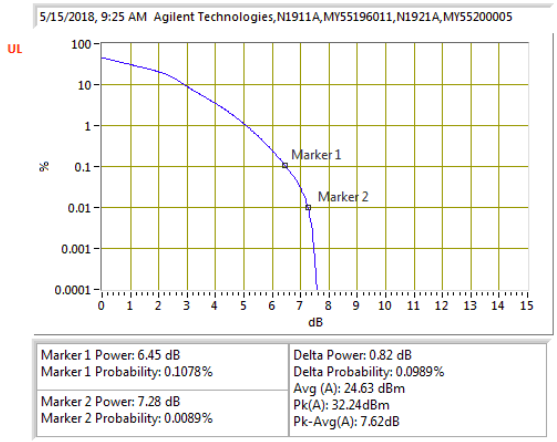
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

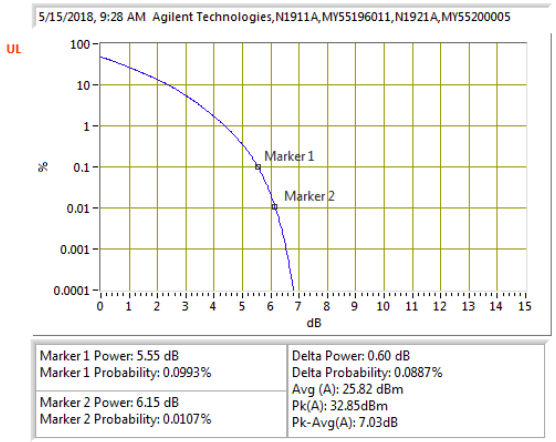
8.5.5. LTE BAND 13



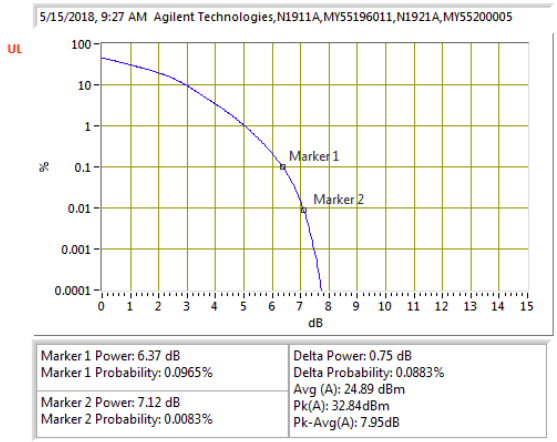
LTE B13 5MHz QPSK Middle Channel



LTE B13 5MHz 16QAM Middle Channel



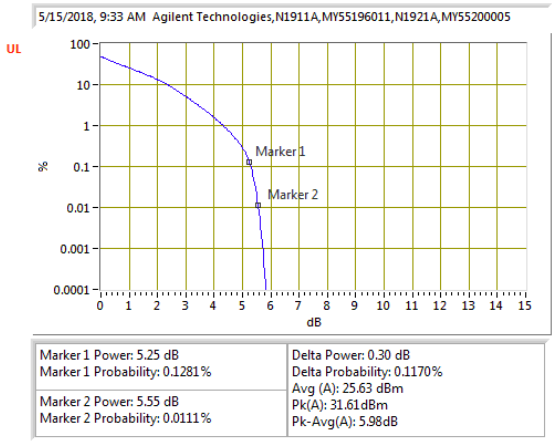
LTE B13 10MHz QPSK Middle Channel



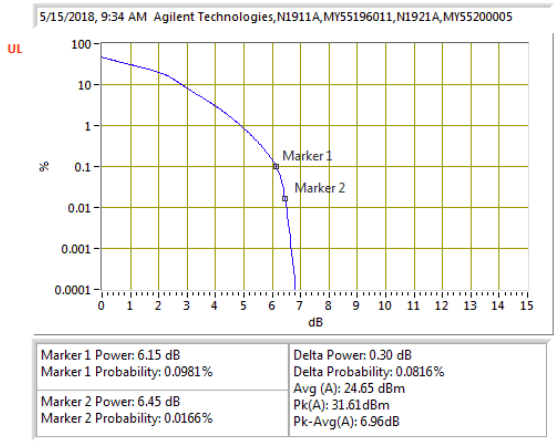
LTE B13 10MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

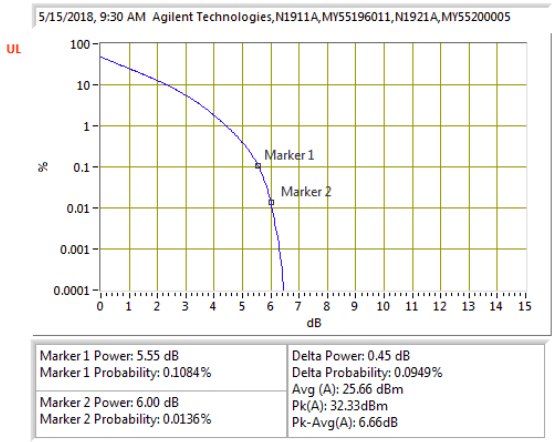
8.5.6. LTE BAND 14



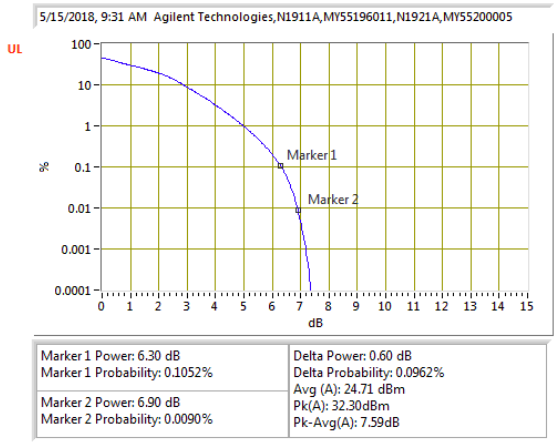
LTE B14 5MHz QPSK Middle Channel



LTE B14 5MHz 16QAM Middle Channel



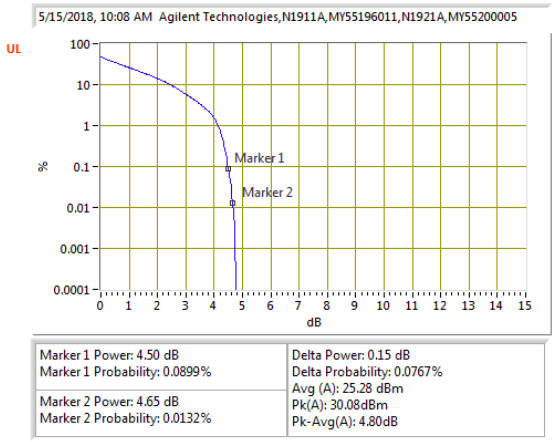
LTE B14 10MHz QPSK Middle Channel



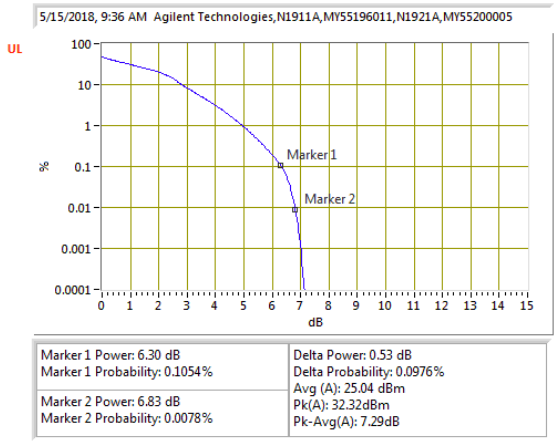
LTE B14 10MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

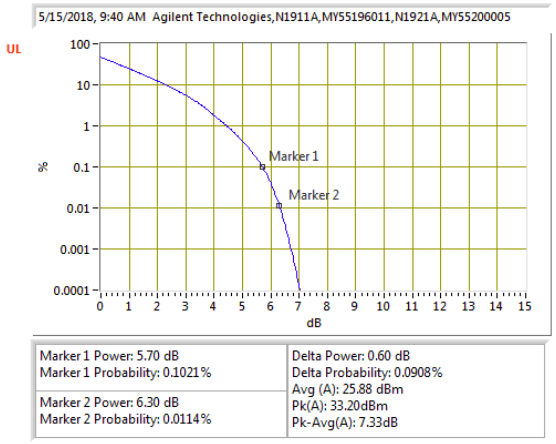
8.5.7. LTE BAND 17



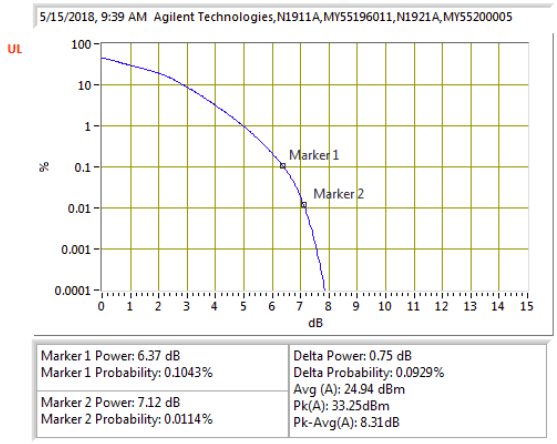
LTE B17 5MHz QPSK Middle Channel



LTE B17 5MHz 16QAM Middle Channel



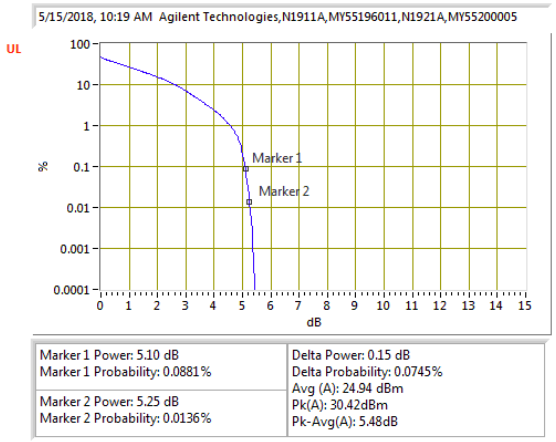
LTE B17 10MHz QPSK Middle Channel



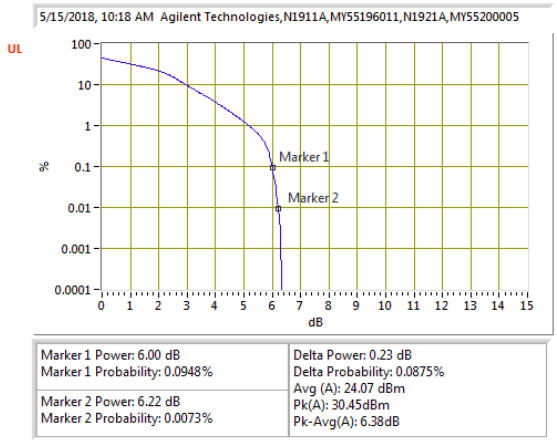
LTE B17 10MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

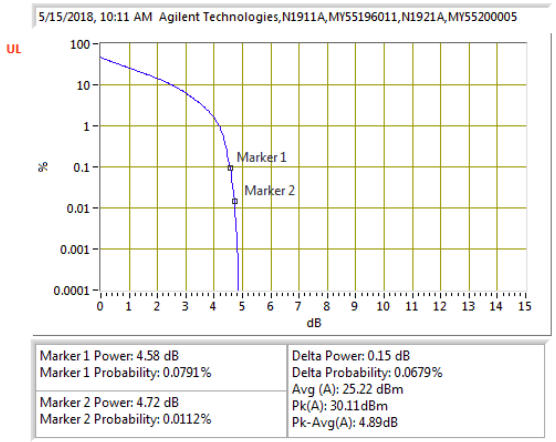
8.5.8. LTE BAND 25



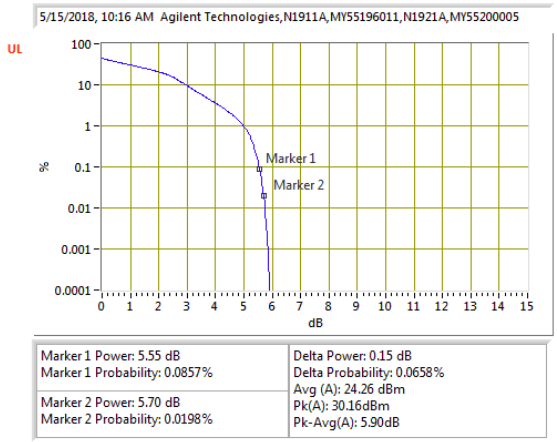
LTE B25 1.4MHz QPSK Middle Channel



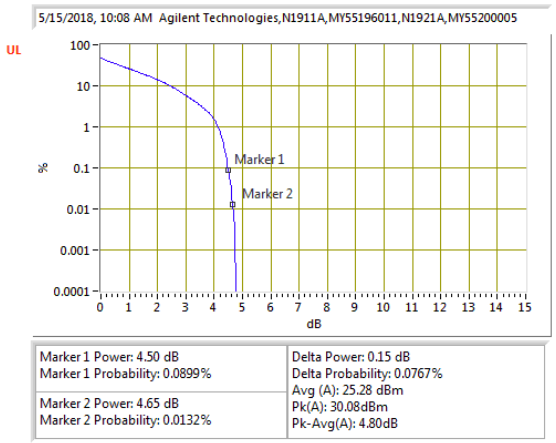
LTE B25 1.4MHz 16QAM Middle Channel



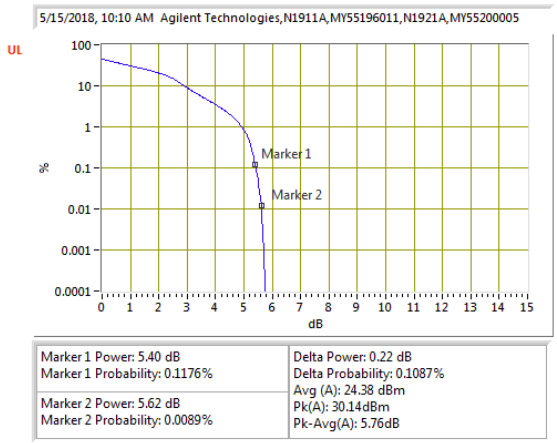
LTE B25 3MHz QPSK Middle Channel



LTE B25 3MHz 16QAM Middle Channel

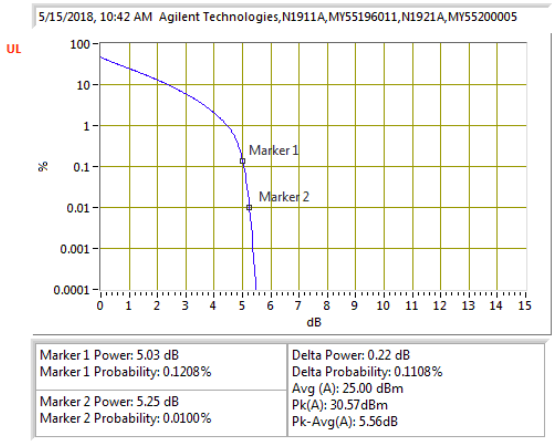


LTE B2 5MHz QPSK Middle Channel

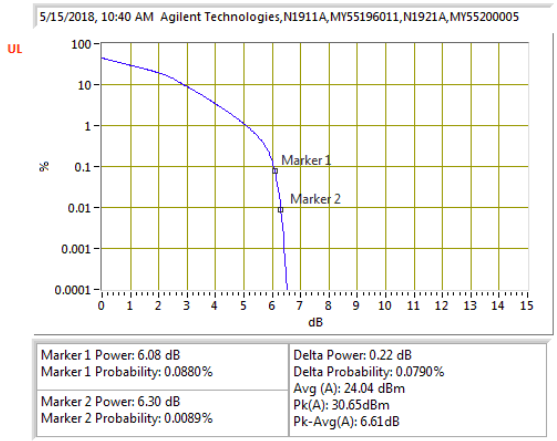


LTE B2 5MHz 16QAM Middle Channel

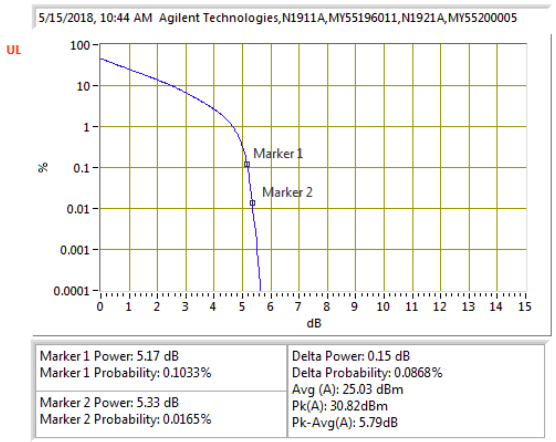
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
FORM NO: CCSUP4031B
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



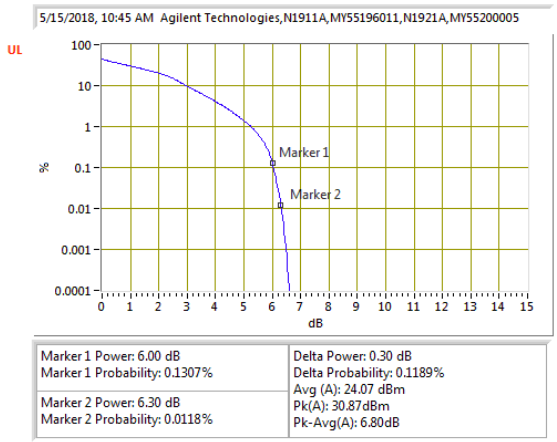
LTE B25 10MHz QPSK Middle Channel



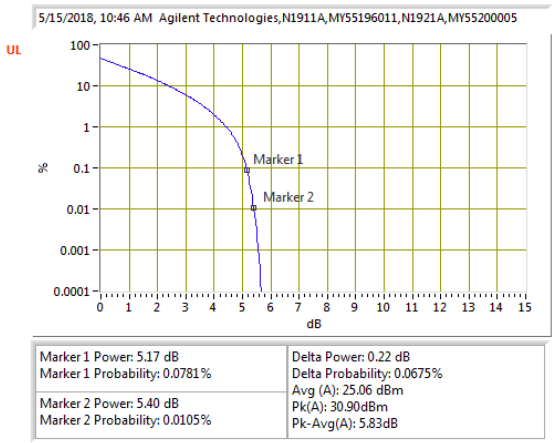
LTE B25 10MHz 16QAM Middle Channel



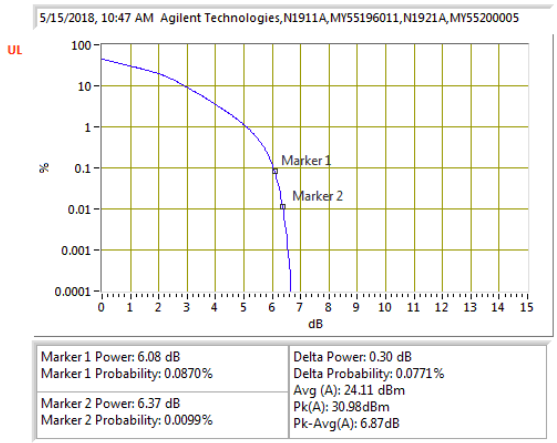
LTE B25 15MHz QPSK Middle Channel



LTE B25 15MHz 16QAM Middle Channel



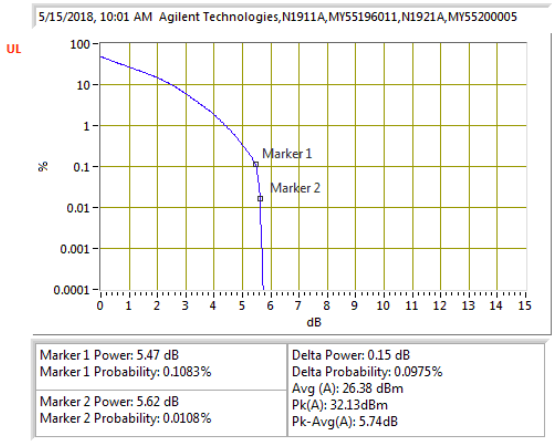
LTE B25 20MHz QPSK Middle Channel



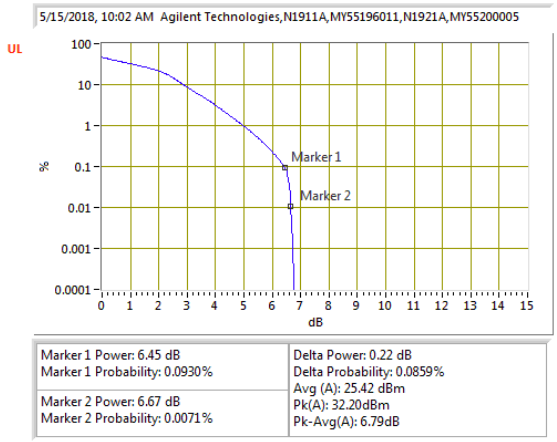
LTE B25 20MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
FORM NO: CCSUP4031B
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

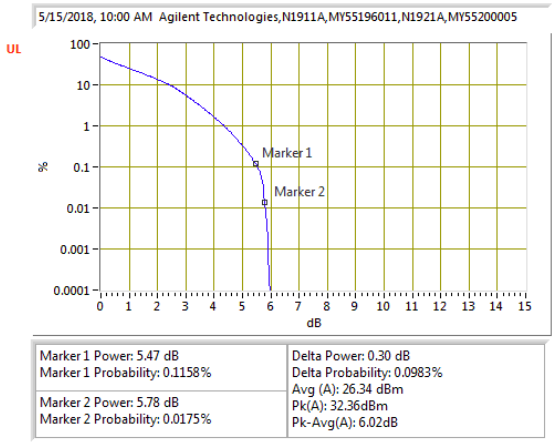
8.5.9. LTE BAND 26 (FCC PART 90S)



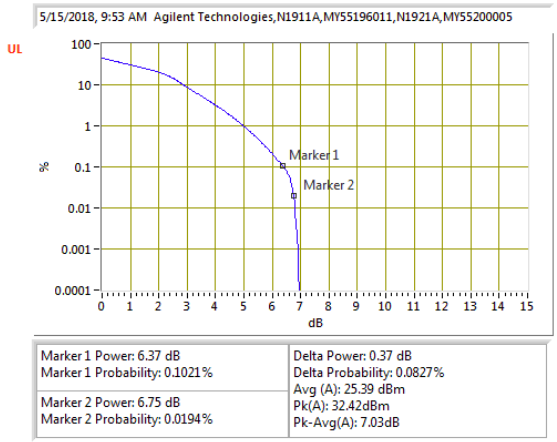
LTE B26 1.4MHz QPSK Middle Channel



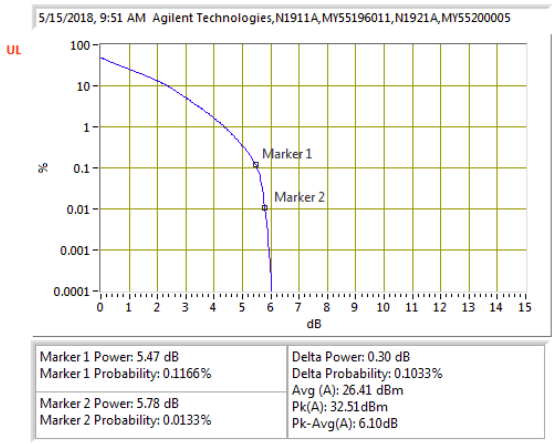
LTE B26 1.4MHz 16QAM Middle Channel



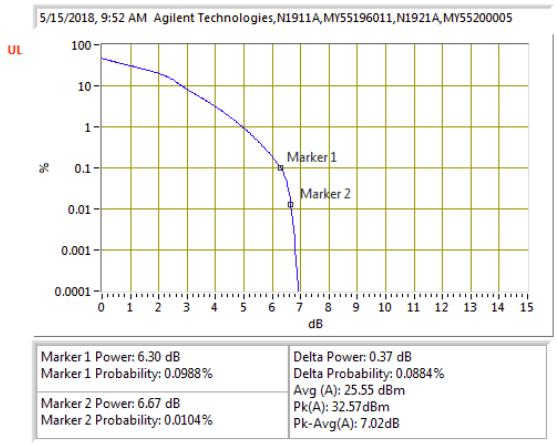
LTE B26 3MHz QPSK Middle Channel



LTE B26 3MHz 16QAM Middle Channel

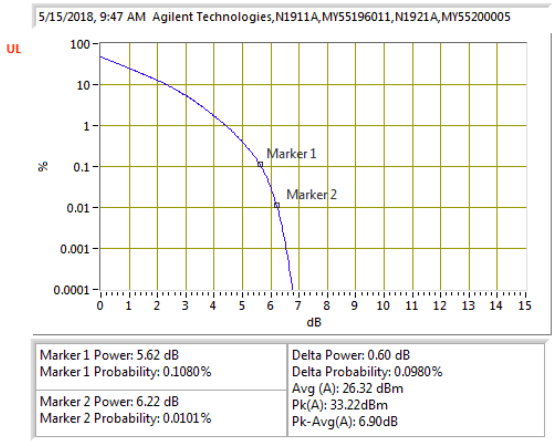


LTE B26 5MHz QPSK Middle Channel

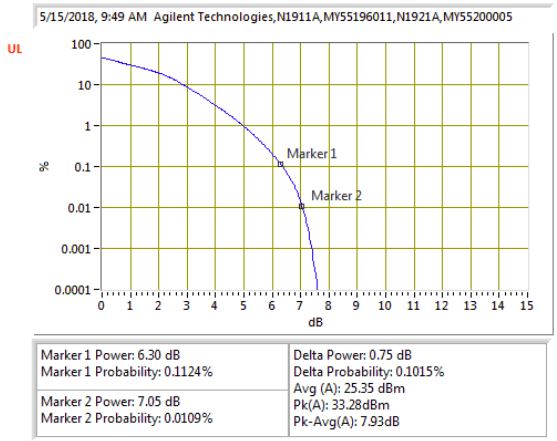


LTE B26 5MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
FORM NO: CCSUP4031B
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



LTE B26 10MHz QPSK Middle Channel

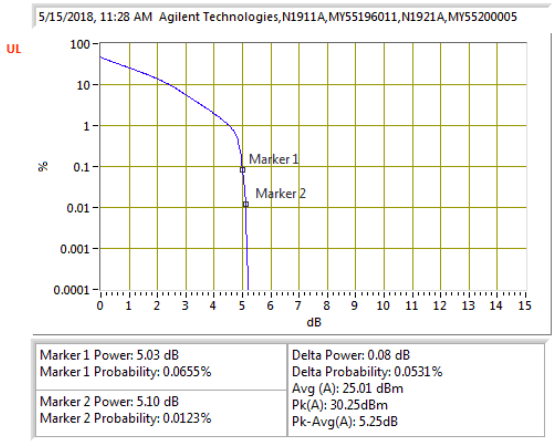


LTE B26 10MHz 16QAM Middle Channel

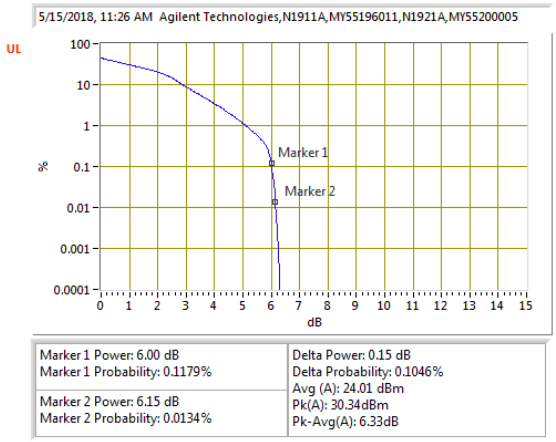
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

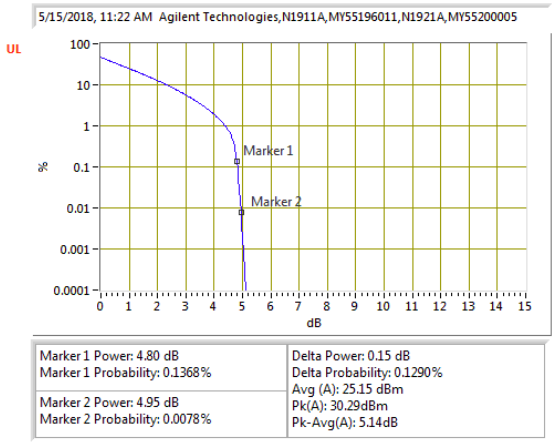
8.5.10. LTE BAND 30



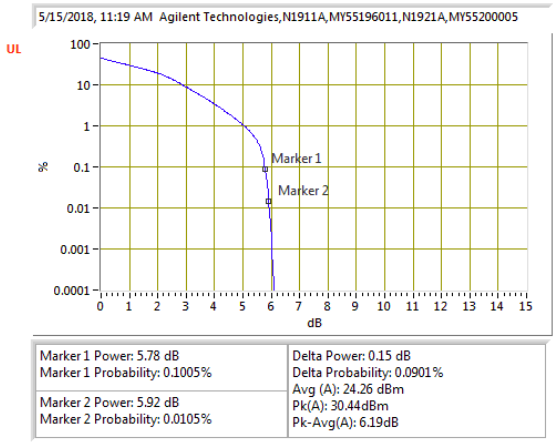
LTE B30 5MHz QPSK Middle Channel



LTE B30 5MHz 16QAM Middle Channel



LTE B30 10MHz QPSK Middle Channel



LTE B30 10MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

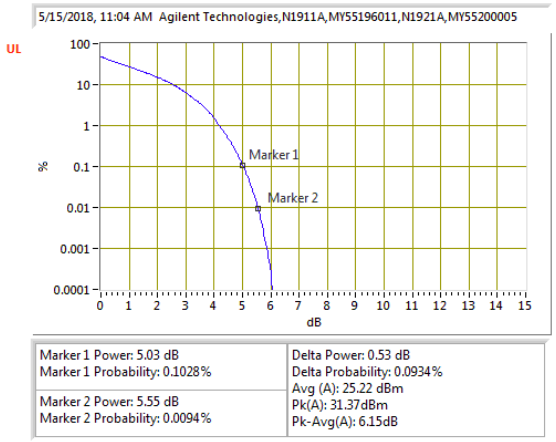
8.5.11. LTE BAND 41

ID:	39004	Date:	5/15/18

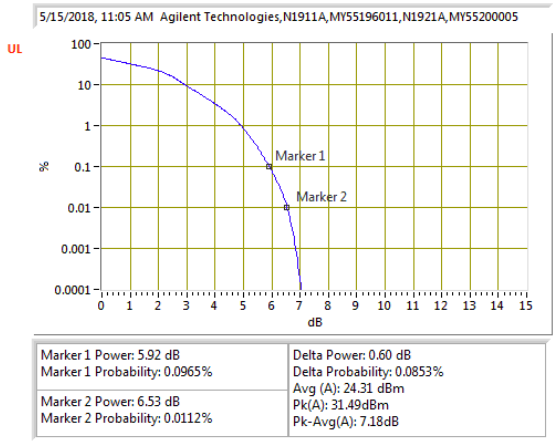
Band	Bandwidth (MHz)	Frequency (MHz)	RB Allocation	RB OffSet	Modulation	Conducted Power (dBm)		Peak-to-Average Power Ratio (dB)
						Peak	Average	
Band 41	5MHz	2593.0	25	0	QPSK	31.06	19.91	4.16
					16QAM	31.29	19.92	4.38
	10MHz		50	0	QPSK	31.11	19.95	4.17
					16QAM	31.24	20.06	4.19
	15MHz		75	0	QPSK	31.28	19.91	4.38
					16QAM	31.29	19.97	4.33
	20MHz		100	0	QPSK	31.13	19.92	4.22
					16QAM	31.36	19.96	4.41
Duty Cycle Correction Factor (dB) =			6.99					
Peak-to-Average Power Ratio= Peak Reading - Average Reading - Duty Cycle Correction Factor								

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

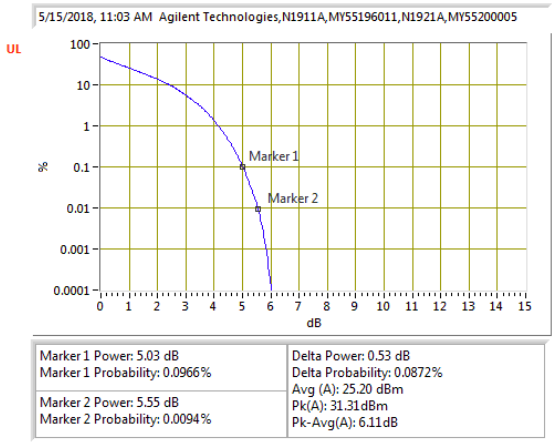
8.5.12. LTE BAND 66



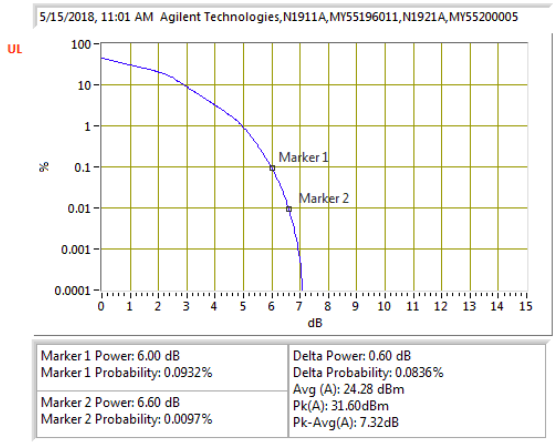
LTE B66 1.4MHz QPSK Middle Channel



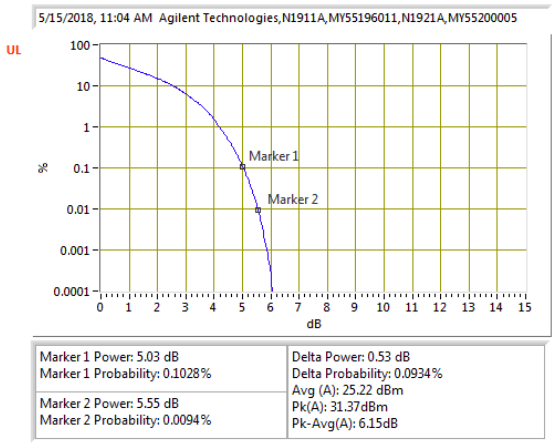
LTE B66 1.4MHz 16QAM Middle Channel



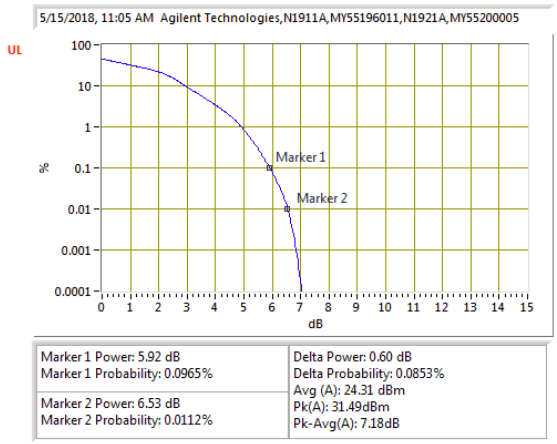
LTE B66 3MHz QPSK Middle Channel



LTE B66 3MHz 16QAM Middle Channel

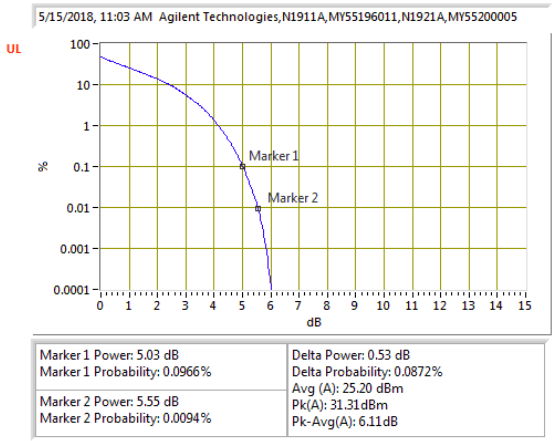


LTE B66 1.4MHz QPSK Middle Channel

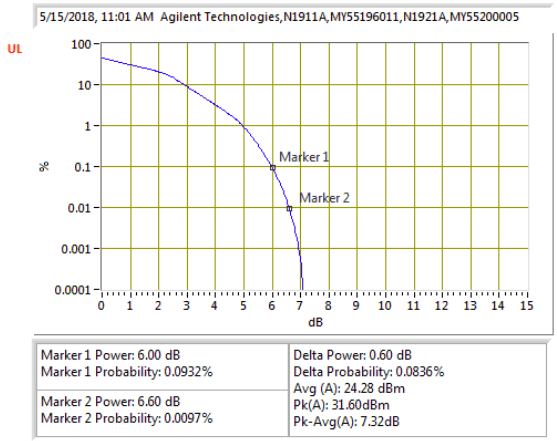


LTE B66 1.4MHz 16QAM Middle Channel

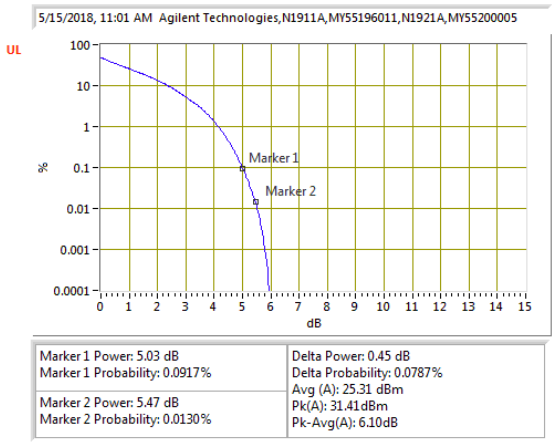
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
FORM NO: CCSUP4031B
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



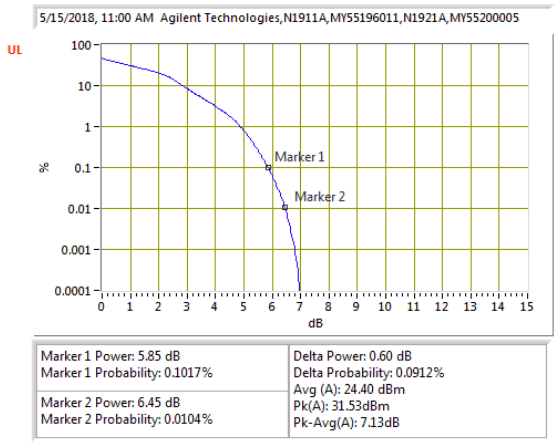
LTE B66 3MHz QPSK Middle Channel



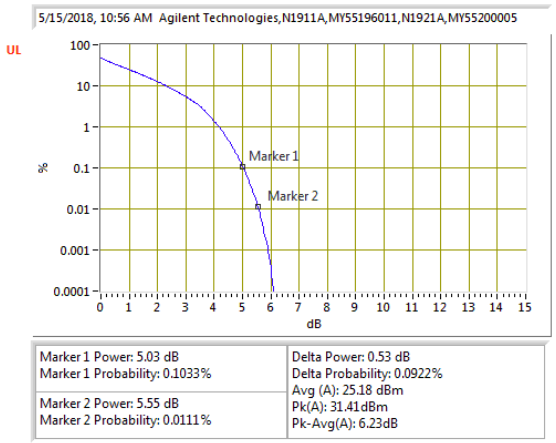
LTE B66 3MHz 16QAM Middle Channel



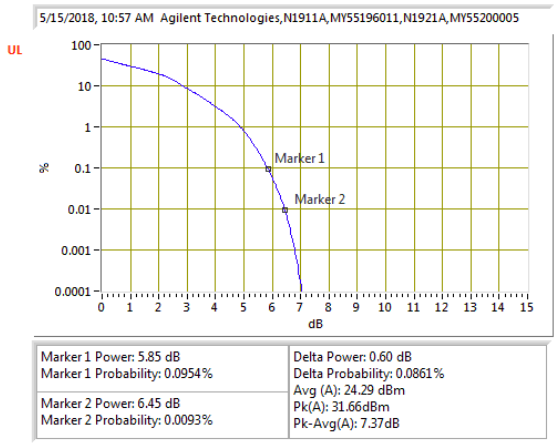
LTE B66 5MHz QPSK Middle Channel



LTE B66 5MHz 16QAM Middle Channel



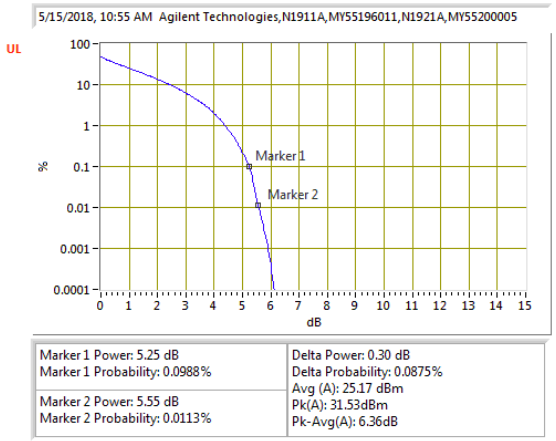
LTE B66 10MHz QPSK Middle Channel



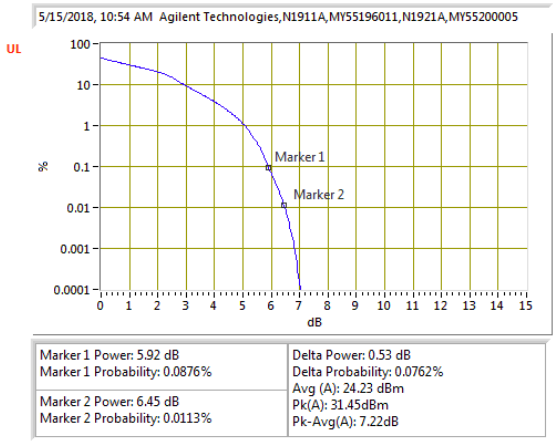
LTE B66 10MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

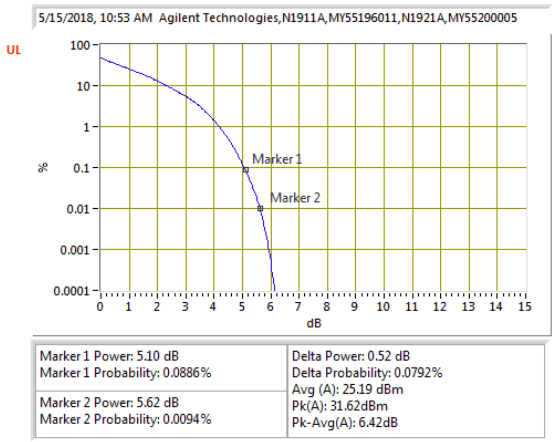
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



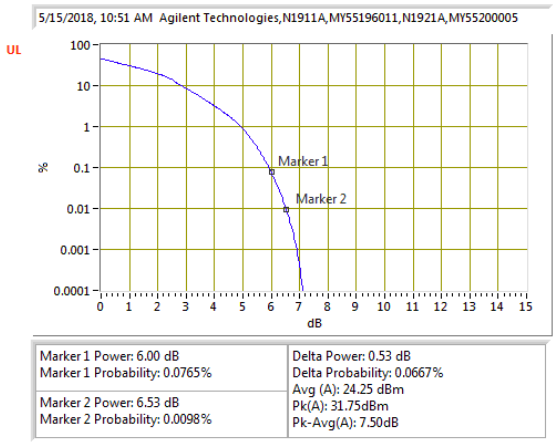
LTE B66 15MHz QPSK Middle Channel



LTE B66 15MHz 16QAM Middle Channel



LTE B66 20MHz QPSK Middle Channel



LTE B66 20MHz 16QAM Middle Channel

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9. RADIATED TEST RESULTS

RULE PART(S)

§2.1053, §22.917, §24.238, §27.53, §90.691 and §90.543

LIMIT

FCC: §22.917(a), §24.238(a), §27.53 (g), (h), §90.691
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

FCC: §27.53 (Band 13)
(c) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.
(f) Emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals. (-70 dBW/MHz = -40dBm/MHz).

FCC: §90.543(Band 14)
(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC: §27.53 (a) (Band 30, Band 40)
For mobile and portable stations operating in the 2305-2315 MHz: by a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365 MHz, and not less than 70 + 10 log (P) dB above 2365 MHz.

FCC: §27.53 (m) (Band 7, 41)
At least 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

TEST PROCEDURE

KDB 971168 D01/D02 v02r01

MODES TESTED

- LTE Band 2
- LTE Band 5
- LTE Band 7
- LTE Band 12
- LTE Band 13
- LTE Band 14
- LTE Band 17
- LTE Band 25
- LTE Band 26
- LTE Band 30
- LTE Band 41
- LTE Band 66

RESULTS

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 1

9.1.1. LTE BAND 2

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/07/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 2, 20MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1860MHz)										
3.72	-64.0	H	3.0	-14.0	38.6	1.0	-51.7	-13.0	-38.7	
5.58	-66.8	H	3.0	-12.7	38.6	1.0	-50.2	-13.0	-37.2	
7.44	-70.6	H	3.0	-12.9	37.8	1.0	-49.7	-13.0	-36.7	
3.72	-64.7	V	3.0	-14.7	38.6	1.0	-52.4	-13.0	-39.4	
5.58	-67.5	V	3.0	-13.7	38.6	1.0	-51.2	-13.0	-38.2	
7.44	-70.3	V	3.0	-12.8	37.8	1.0	-49.6	-13.0	-36.6	
Mid Channel (1880MHz)										
3.76	-64.9	H	3.0	-14.8	38.6	1.0	-52.4	-13.0	-39.4	
5.64	-66.6	H	3.0	-12.3	38.5	1.0	-49.9	-13.0	-36.9	
7.52	-70.7	H	3.0	-12.9	37.7	1.0	-49.6	-13.0	-36.6	
3.76	-64.3	V	3.0	-14.3	38.6	1.0	-51.9	-13.0	-38.9	
5.64	-66.6	V	3.0	-12.6	38.5	1.0	-50.2	-13.0	-37.2	
7.52	-70.1	V	3.0	-12.5	37.7	1.0	-49.3	-13.0	-36.3	
High Channel (1900MHz)										
3.80	-67.0	H	3.0	-16.8	38.6	1.0	-54.4	-13.0	-41.4	
5.70	-67.0	H	3.0	-12.6	38.5	1.0	-50.1	-13.0	-37.1	
7.60	-71.7	H	3.0	-13.8	37.7	1.0	-50.5	-13.0	-37.5	
3.80	-66.3	V	3.0	-16.1	38.6	1.0	-53.8	-13.0	-40.8	
5.70	-66.9	V	3.0	-12.9	38.5	1.0	-50.4	-13.0	-37.4	
7.60	-70.7	V	3.0	-13.0	37.7	1.0	-49.7	-13.0	-36.7	

Rev. 05.21.15

LTE B2 20MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/07/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 2, 20MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1860MHz)										
3.72	-64.8	H	3.0	-14.8	38.6	1.0	-52.5	-13.0	-39.5	
5.58	-66.8	H	3.0	-12.7	38.6	1.0	-50.3	-13.0	-37.3	
7.44	-70.9	H	3.0	-13.1	37.8	1.0	-49.9	-13.0	-36.9	
3.72	-64.8	V	3.0	-14.9	38.6	1.0	-52.5	-13.0	-39.5	
5.58	-66.8	V	3.0	-13.0	38.6	1.0	-50.6	-13.0	-37.6	
7.44	-70.5	V	3.0	-13.0	37.8	1.0	-49.8	-13.0	-36.8	
Mid Channel (1880MHz)										
3.76	-65.3	H	3.0	-15.2	38.6	1.0	-52.8	-13.0	-39.8	
5.64	-67.1	H	3.0	-12.8	38.5	1.0	-50.4	-13.0	-37.4	
7.52	-70.1	H	3.0	-12.3	37.7	1.0	-49.0	-13.0	-36.0	
3.76	-65.6	V	3.0	-15.5	38.6	1.0	-53.2	-13.0	-40.2	
5.64	-67.5	V	3.0	-13.5	38.5	1.0	-51.1	-13.0	-38.1	
7.52	-70.1	V	3.0	-12.5	37.7	1.0	-49.3	-13.0	-36.3	
High Channel (1900MHz)										
3.80	-67.8	H	3.0	-17.6	38.6	1.0	-55.2	-13.0	-42.2	
5.70	-67.3	H	3.0	-12.9	38.5	1.0	-50.5	-13.0	-37.5	
7.60	-71.1	H	3.0	-13.2	37.7	1.0	-49.9	-13.0	-36.9	
3.80	-66.8	V	3.0	-16.6	38.6	1.0	-54.2	-13.0	-41.2	
5.70	-67.6	V	3.0	-13.6	38.5	1.0	-51.1	-13.0	-38.1	
7.60	-70.9	V	3.0	-13.2	37.7	1.0	-49.9	-13.0	-36.9	

Rev. 05.21.15

LTE B2 20MHz 16QAM

9.1.2. LTE BAND 5

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/07/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 5, 10MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (829MHz)										
1.66	-66.2	H	3.0	-23.7	37.8	1.0	-60.6	-13.0	-47.6	
2.49	-68.3	H	3.0	-23.2	38.5	1.0	-60.7	-13.0	-47.7	
3.32	-68.8	H	3.0	-19.8	38.5	1.0	-57.2	-13.0	-44.2	
1.66	-66.8	V	3.0	-24.6	37.8	1.0	-61.4	-13.0	-48.4	
2.49	-67.9	V	3.0	-22.6	38.5	1.0	-60.1	-13.0	-47.1	
3.32	-68.5	V	3.0	-19.7	38.5	1.0	-57.2	-13.0	-44.2	
Mid Channel (836.5MHz)										
1.67	-66.6	H	3.0	-24.1	37.8	1.0	-60.9	-13.0	-47.9	
2.51	-69.7	H	3.0	-24.5	38.6	1.0	-62.1	-13.0	-49.1	
3.35	-66.1	H	3.0	-17.0	38.5	1.0	-54.5	-13.0	-41.5	
1.67	-66.4	V	3.0	-24.2	37.8	1.0	-61.0	-13.0	-48.0	
2.51	-68.7	V	3.0	-23.4	38.6	1.0	-60.9	-13.0	-47.9	
3.35	-67.1	V	3.0	-18.2	38.5	1.0	-55.7	-13.0	-42.7	
High Channel (844MHz)										
1.69	-67.8	H	3.0	-25.2	37.9	1.0	-62.1	-13.0	-49.1	
2.53	-68.2	H	3.0	-22.9	38.6	1.0	-60.4	-13.0	-47.4	
3.38	-67.1	H	3.0	-18.0	38.5	1.0	-55.5	-13.0	-42.5	
1.69	-67.8	V	3.0	-25.4	37.9	1.0	-62.3	-13.0	-49.3	
2.53	-68.5	V	3.0	-23.0	38.6	1.0	-60.6	-13.0	-47.6	
3.38	-68.2	V	3.0	-19.3	38.5	1.0	-56.8	-13.0	-43.8	

Rev. 05.21.15

LTE B5 10MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/07/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 5, 10MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (829MHz)										
1.66	-66.6	H	3.0	-24.1	37.8	1.0	-60.9	-13.0	-47.9	
2.49	-69.3	H	3.0	-24.3	38.5	1.0	-61.8	-13.0	-48.8	
3.32	-68.8	H	3.0	-19.8	38.5	1.0	-57.3	-13.0	-44.3	
1.66	-65.2	V	3.0	-23.0	37.8	1.0	-59.9	-13.0	-46.9	
2.49	-69.5	V	3.0	-24.2	38.5	1.0	-61.7	-13.0	-48.7	
3.32	-69.0	V	3.0	-20.3	38.5	1.0	-57.8	-13.0	-44.8	
Mid Channel (836.5MHz)										
1.67	-66.9	H	3.0	-24.4	37.8	1.0	-61.3	-13.0	-48.3	
2.51	-69.1	H	3.0	-23.9	38.6	1.0	-61.5	-13.0	-48.5	
3.35	-69.0	H	3.0	-19.9	38.5	1.0	-57.4	-13.0	-44.4	
1.67	-66.6	V	3.0	-24.4	37.8	1.0	-61.2	-13.0	-48.2	
2.51	-68.0	V	3.0	-22.6	38.6	1.0	-60.2	-13.0	-47.2	
3.35	-68.5	V	3.0	-19.7	38.5	1.0	-57.2	-13.0	-44.2	
High Channel (844MHz)										
1.69	-64.8	H	3.0	-22.3	37.9	1.0	-59.2	-13.0	-46.2	
2.53	-67.3	H	3.0	-22.0	38.6	1.0	-59.6	-13.0	-46.6	
3.38	-66.8	H	3.0	-17.7	38.5	1.0	-55.2	-13.0	-42.2	
1.69	-65.0	V	3.0	-22.6	37.9	1.0	-59.5	-13.0	-46.5	
2.53	-66.2	V	3.0	-20.7	38.6	1.0	-58.3	-13.0	-45.3	
3.38	-67.1	V	3.0	-18.2	38.5	1.0	-55.7	-13.0	-42.7	

Rev. 05.21.15

LTE B5 10MHz 16QAM

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1.3. LTE BAND 7

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 7, 20MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B7

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (2510MHz)										
5.02	-66.8	H	3.0	-13.9	38.7	1.0	-51.6	-25.0	-26.6	
7.53	-69.9	H	3.0	-12.1	37.7	1.0	-48.8	-25.0	-23.8	
10.04	-72.7	H	3.0	-11.9	36.2	1.0	-47.1	-25.0	-22.1	
5.02	-66.2	V	3.0	-13.5	38.7	1.0	-51.2	-25.0	-26.2	
7.53	-69.3	V	3.0	-11.7	37.7	1.0	-48.5	-25.0	-23.5	
10.04	-73.0	V	3.0	-12.2	36.2	1.0	-47.3	-25.0	-22.3	
Mid Channel (2535MHz)										
5.07	-66.5	H	3.0	-13.5	38.7	1.0	-51.1	-25.0	-26.1	
7.61	-70.6	H	3.0	-12.7	37.7	1.0	-49.4	-25.0	-24.4	
10.14	-72.8	H	3.0	-11.9	36.2	1.0	-47.1	-25.0	-22.1	
5.07	-68.1	V	3.0	-15.4	38.7	1.0	-53.1	-25.0	-28.1	
7.61	-71.4	V	3.0	-13.7	37.7	1.0	-50.3	-25.0	-25.3	
10.14	-72.7	V	3.0	-11.8	36.2	1.0	-47.0	-25.0	-22.0	
High Channel (2560MHz)										
5.12	-66.6	H	3.0	-13.5	38.7	1.0	-51.1	-25.0	-26.1	
7.68	-69.7	H	3.0	-11.7	37.6	1.0	-48.3	-25.0	-23.3	
10.24	-72.6	H	3.0	-11.5	36.3	1.0	-46.8	-25.0	-21.8	
5.12	-67.3	V	3.0	-14.5	38.7	1.0	-52.2	-25.0	-27.2	
7.68	-70.0	V	3.0	-12.2	37.6	1.0	-48.8	-25.0	-23.8	
10.24	-73.5	V	3.0	-12.5	36.3	1.0	-47.8	-25.0	-22.8	

Rev. 05.21.15

LTE B7 20MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 7, 20MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B7

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (2510MHz)										
5.02	-67.8	H	3.0	-14.9	38.7	1.0	-52.6	-25.0	-27.6	
7.53	-70.6	H	3.0	-12.7	37.7	1.0	-49.5	-25.0	-24.5	
10.04	-72.5	H	3.0	-11.6	36.2	1.0	-46.8	-25.0	-21.8	
5.02	-66.6	V	3.0	-14.0	38.7	1.0	-51.7	-25.0	-26.7	
7.53	-68.9	V	3.0	-11.3	37.7	1.0	-48.0	-25.0	-23.0	
10.04	-72.6	V	3.0	-11.8	36.2	1.0	-47.0	-25.0	-22.0	
Mid Channel (2535MHz)										
5.07	-66.7	H	3.0	-13.7	38.7	1.0	-51.3	-25.0	-26.3	
7.61	-70.6	H	3.0	-12.7	37.7	1.0	-49.4	-25.0	-24.4	
10.14	-72.8	H	3.0	-11.9	36.2	1.0	-47.1	-25.0	-22.1	
5.07	-65.9	V	3.0	-13.2	38.7	1.0	-50.8	-25.0	-25.8	
7.61	-69.6	V	3.0	-11.9	37.7	1.0	-48.5	-25.0	-23.5	
10.14	-73.2	V	3.0	-12.3	36.2	1.0	-47.5	-25.0	-22.5	
High Channel (2560MHz)										
5.12	-63.3	H	3.0	-10.2	38.7	1.0	-47.9	-25.0	-22.9	
7.68	-65.1	H	3.0	-7.1	37.6	1.0	-43.7	-25.0	-18.7	
10.24	-67.1	H	3.0	-6.1	36.3	1.0	-41.4	-25.0	-16.4	
5.12	-63.1	V	3.0	-10.3	38.7	1.0	-48.0	-25.0	-23.0	
7.68	-65.5	V	3.0	-7.6	37.6	1.0	-44.3	-25.0	-19.3	
10.24	-66.6	V	3.0	-5.6	36.3	1.0	-40.8	-25.0	-15.8	

Rev. 05.21.15

LTE B7 20MHz 16QAM

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1.4. LTE BAND 12

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 12, 10MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (704MHz)										
1.41	-63.9	H	3.0	-22.3	38.1	1.0	-59.4	-13.0	-46.4	
2.11	-64.9	H	3.0	-21.3	38.0	1.0	-58.3	-13.0	-45.3	
2.82	-64.9	H	3.0	-17.9	38.4	1.0	-55.3	-13.0	-42.3	
1.41	-63.2	V	3.0	-22.2	38.1	1.0	-59.3	-13.0	-46.3	
2.11	-64.6	V	3.0	-20.5	38.0	1.0	-57.5	-13.0	-44.5	
2.82	-64.3	V	3.0	-17.4	38.4	1.0	-54.8	-13.0	-41.8	
Mid Channel (707.5MHz)										
1.42	-58.8	H	3.0	-17.1	38.0	1.0	-54.2	-13.0	-41.2	
2.12	-60.1	H	3.0	-16.5	38.0	1.0	-53.5	-13.0	-40.5	
2.83	-60.2	H	3.0	-13.0	38.4	1.0	-50.4	-13.0	-37.4	
1.42	-59.5	V	3.0	-18.5	38.0	1.0	-55.6	-13.0	-42.6	
2.12	-59.4	V	3.0	-15.3	38.0	1.0	-52.3	-13.0	-39.3	
2.83	-60.3	V	3.0	-13.4	38.4	1.0	-50.8	-13.0	-37.8	
High Channel (711MHz)										
1.42	-63.9	H	3.0	-22.2	38.0	1.0	-59.2	-13.0	-46.2	
2.13	-64.6	H	3.0	-21.0	38.0	1.0	-58.0	-13.0	-45.0	
2.84	-64.9	H	3.0	-17.6	38.4	1.0	-55.1	-13.0	-42.1	
1.42	-64.3	V	3.0	-23.3	38.0	1.0	-60.3	-13.0	-47.3	
2.13	-64.6	V	3.0	-20.4	38.0	1.0	-57.4	-13.0	-44.4	
2.84	-66.1	V	3.0	-19.0	38.4	1.0	-56.5	-13.0	-43.5	

Rev. 05.21.15

LTE B12 10MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 12, 10MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (704MHz)										
1.41	-64.2	H	3.0	-22.5	38.1	1.0	-59.6	-13.0	-46.6	
2.11	-65.2	H	3.0	-21.6	38.0	1.0	-58.6	-13.0	-45.6	
2.82	-65.5	H	3.0	-18.4	38.4	1.0	-55.8	-13.0	-42.8	
1.41	-63.9	V	3.0	-23.0	38.1	1.0	-60.0	-13.0	-47.0	
2.11	-65.5	V	3.0	-21.4	38.0	1.0	-58.4	-13.0	-45.4	
2.82	-65.4	V	3.0	-18.5	38.4	1.0	-56.0	-13.0	-43.0	
Mid Channel (707.5MHz)										
1.42	-64.6	H	3.0	-22.9	38.0	1.0	-60.0	-13.0	-47.0	
2.12	-63.3	H	3.0	-19.7	38.0	1.0	-56.7	-13.0	-43.7	
2.83	-65.7	H	3.0	-18.5	38.4	1.0	-56.0	-13.0	-43.0	
1.42	-63.8	V	3.0	-22.8	38.0	1.0	-59.8	-13.0	-46.8	
2.12	-65.0	V	3.0	-20.8	38.0	1.0	-57.8	-13.0	-44.8	
2.83	-66.9	V	3.0	-19.0	38.4	1.0	-56.4	-13.0	-43.4	
High Channel (711MHz)										
1.42	-63.7	H	3.0	-22.0	38.0	1.0	-59.0	-13.0	-46.0	
2.13	-65.5	H	3.0	-21.8	38.0	1.0	-58.8	-13.0	-45.8	
2.84	-65.1	H	3.0	-17.9	38.4	1.0	-55.3	-13.0	-42.3	
1.42	-63.9	V	3.0	-22.9	38.0	1.0	-59.9	-13.0	-46.9	
2.13	-65.2	V	3.0	-21.0	38.0	1.0	-58.0	-13.0	-45.0	
2.84	-65.5	V	3.0	-18.4	38.4	1.0	-55.9	-13.0	-42.9	

Rev. 05.21.15

LTE B12 10MHz 16QAM

9.1.5. LTE BAND 13

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 13, 10MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B13

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (782MHz)										
1.56	-58.6	H	3.0	-16.3	37.8	1.0	-53.1	-40.0	-13.1	
2.35	-64.6	H	3.0	-20.2	38.1	1.0	-57.4	-13.0	-44.4	
3.13	-65.6	H	3.0	-17.1	38.4	1.0	-54.5	-13.0	-41.5	
1.56	-58.7	V	3.0	-17.0	37.8	1.0	-53.8	-40.0	-13.8	
2.35	-65.8	V	3.0	-21.1	38.1	1.0	-58.3	-13.0	-45.3	
3.13	-65.8	V	3.0	-17.6	38.4	1.0	-55.0	-13.0	-42.0	

Rev. 05.21.15

LTE B13 10MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 13, 10MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B13

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (782MHz)										
1.56	-54.9	H	3.0	-12.6	37.8	1.0	-49.4	-40.0	-9.4	
2.35	-65.6	H	3.0	-21.2	38.1	1.0	-58.3	-13.0	-45.3	
3.13	-63.7	H	3.0	-15.2	38.4	1.0	-52.6	-13.0	-39.6	
1.56	-56.3	V	3.0	-14.6	37.8	1.0	-51.4	-40.0	-11.4	
2.35	-65.1	V	3.0	-20.4	38.1	1.0	-57.5	-13.0	-44.5	
3.13	-65.5	V	3.0	-17.4	38.4	1.0	-54.8	-13.0	-41.8	

Rev. 05.21.15

LTE B13 10MHz 16QAM

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1.6. LTE BAND 14

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 14, 10MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B14

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (793MHz) [BW 10MHz]										
1.59	-58.4	H	3.0	-16.1	37.8	1.0	-53.0	-40.0	-13.0	
2.38	-65.6	H	3.0	-21.0	38.2	1.0	-58.2	-13.0	-45.2	
3.17	-65.7	H	3.0	-17.0	38.4	1.0	-54.5	-13.0	-41.5	
1.59	-58.6	V	3.0	-16.8	37.8	1.0	-53.6	-40.0	-13.6	
2.38	-65.1	V	3.0	-20.4	38.2	1.0	-57.6	-13.0	-44.6	
3.17	-65.7	V	3.0	-17.4	38.4	1.0	-54.8	-13.0	-41.8	

Rev. 05.21.15

LTE B14 10MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 14, 10MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B14

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (793MHz) [BW 10MHz]										
1.59	-58.9	H	3.0	-16.5	37.8	1.0	-53.4	-40.0	-13.4	
2.38	-60.3	H	3.0	-15.7	38.2	1.0	-52.9	-13.0	-39.9	
3.17	-65.5	H	3.0	-16.8	38.4	1.0	-54.3	-13.0	-41.3	
1.59	-56.2	V	3.0	-14.4	37.8	1.0	-51.2	-40.0	-11.2	
2.38	-60.1	V	3.0	-15.4	38.2	1.0	-52.6	-13.0	-39.6	
3.17	-65.2	V	3.0	-16.8	38.4	1.0	-54.3	-13.0	-41.3	

Rev. 05.21.15

LTE B14 10MHz 16QAM

9.1.7. LTE BAND 17

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 4/18/2018
Test Engineer: 12492.0
Configuration: EUT
Mode: LTE Band 17, 10MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber H	3m Chamber H	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (710MHz)										
1.42	-65.8	H	3.0	-26.8	37.4	1.0	-63.2	-13.0	-50.2	
2.13	-63.6	H	3.0	-20.3	37.6	1.0	-56.9	-13.0	-43.9	
2.84	-64.8	H	3.0	-18.3	37.8	1.0	-55.1	-13.0	-42.1	
1.42	-64.0	V	3.0	-24.7	37.4	1.0	-61.1	-13.0	-48.1	
2.13	-63.4	V	3.0	-20.3	37.6	1.0	-56.9	-13.0	-43.9	
2.84	-63.1	V	3.0	-17.6	37.8	1.0	-54.4	-13.0	-41.4	

Rev. 05.21.15

LTE B17 10MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 4/18/2018
Test Engineer: 12492.0
Configuration: EUT
Mode: LTE Band 17, 10MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber H	3m Chamber H	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (710MHz)										
1.42	-64.4	H	3.0	-25.4	37.4	1.0	-61.8	-13.0	-48.8	
2.13	-64.2	H	3.0	-21.0	37.6	1.0	-57.6	-13.0	-44.6	
2.84	-63.5	H	3.0	-17.0	37.8	1.0	-53.8	-13.0	-40.8	
1.42	-64.3	V	3.0	-25.0	37.4	1.0	-61.4	-13.0	-48.4	
2.13	-64.5	V	3.0	-21.4	37.6	1.0	-58.0	-13.0	-45.0	
2.84	-63.0	V	3.0	-17.5	37.8	1.0	-54.3	-13.0	-41.3	

Rev. 05.21.15

LTE B17 10MHz 16QAM

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4031B
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1.8. LTE BAND 25

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/17
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 25, 20MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1860MHz)										
3.72	-67.1	H	3.0	-17.1	38.6	1.0	-54.7	-13.0	-41.7	
5.58	-66.8	H	3.0	-12.7	38.6	1.0	-50.3	-13.0	-37.3	
7.44	-70.9	H	3.0	-13.1	37.8	1.0	-49.9	-13.0	-36.9	
3.72	-66.2	V	3.0	-16.3	38.6	1.0	-53.9	-13.0	-40.9	
5.58	-67.4	V	3.0	-13.6	38.6	1.0	-51.2	-13.0	-38.2	
7.44	-70.8	V	3.0	-13.3	37.8	1.0	-50.1	-13.0	-37.1	
Mid Channel (1882.5MHz)										
3.77	-66.6	H	3.0	-16.5	38.6	1.0	-54.1	-13.0	-41.1	
5.65	-67.3	H	3.0	-13.0	38.5	1.0	-50.5	-13.0	-37.5	
7.53	-70.8	H	3.0	-13.0	37.7	1.0	-49.7	-13.0	-36.7	
3.77	-65.5	V	3.0	-15.4	38.6	1.0	-53.1	-13.0	-40.1	
5.65	-66.7	V	3.0	-12.8	38.5	1.0	-50.3	-13.0	-37.3	
7.53	-70.1	V	3.0	-12.5	37.7	1.0	-49.2	-13.0	-36.2	
High Channel (1905MHz)										
3.81	-65.3	H	3.0	-15.1	38.6	1.0	-52.7	-13.0	-39.7	
5.72	-67.3	H	3.0	-12.9	38.5	1.0	-50.4	-13.0	-37.4	
7.62	-70.1	H	3.0	-12.2	37.7	1.0	-48.8	-13.0	-35.8	
3.81	-64.0	V	3.0	-13.8	38.6	1.0	-51.5	-13.0	-38.5	
5.72	-67.2	V	3.0	-13.1	38.5	1.0	-50.6	-13.0	-37.6	
7.62	-72.2	V	3.0	-14.5	37.7	1.0	-51.1	-13.0	-38.1	

Rev. 05.21.15

LTE B25 20MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 25, 20MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1860MHz)										
3.72	-66.7	H	3.0	-15.7	38.6	1.0	-53.3	-13.0	-40.3	
5.58	-66.0	H	3.0	-11.9	38.6	1.0	-49.5	-13.0	-36.5	
7.44	-70.3	H	3.0	-12.6	37.8	1.0	-49.4	-13.0	-36.4	
3.72	-66.9	V	3.0	-17.0	38.6	1.0	-54.6	-13.0	-41.6	
5.58	-68.3	V	3.0	-14.5	38.6	1.0	-52.1	-13.0	-39.1	
7.44	-71.4	V	3.0	-13.9	37.8	1.0	-50.7	-13.0	-37.7	
Mid Channel (1882.5MHz)										
3.77	-65.4	H	3.0	-15.3	38.6	1.0	-52.9	-13.0	-39.9	
5.65	-67.9	H	3.0	-13.6	38.5	1.0	-51.2	-13.0	-38.2	
7.53	-70.1	H	3.0	-12.3	37.7	1.0	-49.0	-13.0	-36.0	
3.77	-65.2	V	3.0	-15.1	38.6	1.0	-52.8	-13.0	-39.8	
5.65	-67.8	V	3.0	-13.9	38.5	1.0	-51.4	-13.0	-38.4	
7.53	-69.8	V	3.0	-12.1	37.7	1.0	-48.9	-13.0	-35.9	
High Channel (1905MHz)										
3.81	-66.2	H	3.0	-16.0	38.6	1.0	-53.6	-13.0	-40.6	
5.72	-67.6	H	3.0	-13.2	38.5	1.0	-50.8	-13.0	-37.8	
7.62	-71.0	H	3.0	-13.1	37.7	1.0	-49.8	-13.0	-36.8	
3.81	-65.8	V	3.0	-15.6	38.6	1.0	-53.3	-13.0	-40.3	
5.72	-68.7	V	3.0	-14.6	38.5	1.0	-52.2	-13.0	-39.2	
7.62	-71.3	V	3.0	-13.6	37.7	1.0	-50.3	-13.0	-37.3	

Rev. 05.21.15

LTE B25 20MHz 16QAM

9.1.9. LTE BAND 26 (FCC PART 90S)

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 26 (90S), 10MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (819MHz)										
1.64	-64.1	H	3.0	-21.6	37.8	1.0	-58.5	-13.0	-45.5	
2.46	-65.5	H	3.0	-20.6	38.4	1.0	-58.0	-13.0	-45.0	
3.28	-67.2	H	3.0	-18.3	38.5	1.0	-55.8	-13.0	-42.8	
1.64	-64.7	V	3.0	-22.6	37.8	1.0	-59.5	-13.0	-46.5	
2.46	-67.4	V	3.0	-22.3	38.4	1.0	-59.7	-13.0	-46.7	
3.28	-67.2	V	3.0	-18.6	38.5	1.0	-56.1	-13.0	-43.1	

Rev. 05.21.15

LTE B26 10MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 26 (90S), 10MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (819MHz)										
1.64	-65.7	H	3.0	-23.2	37.8	1.0	-60.1	-13.0	-47.1	
2.46	-67.4	H	3.0	-22.5	38.4	1.0	-59.9	-13.0	-46.9	
3.28	-68.1	H	3.0	-19.2	38.5	1.0	-56.7	-13.0	-43.7	
1.64	-65.0	V	3.0	-23.0	37.8	1.0	-59.8	-13.0	-46.8	
2.46	-67.4	V	3.0	-22.3	38.4	1.0	-59.7	-13.0	-46.7	
3.28	-67.1	V	3.0	-18.4	38.5	1.0	-55.9	-13.0	-42.9	

Rev. 05.21.15

LTE B26 10MHz 16QAM

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1.10. LTE BAND 30

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT only
Mode: LTE Band 30, 10MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B30

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (2310MHz)										
4.62	-66.8	H	3.0	-13.0	37.9	1.0	-49.9	-40.0	-9.9	
6.93	-69.3	H	3.0	-10.7	36.6	1.0	-46.2	-40.0	-6.2	
9.24	-71.0	H	3.0	-9.5	34.9	1.0	-43.3	-40.0	-3.3	
4.62	-65.9	V	3.0	-12.2	37.9	1.0	-49.1	-40.0	-9.1	
6.93	-69.0	V	3.0	-9.6	36.6	1.0	-45.0	-40.0	-5.0	
9.24	-71.7	V	3.0	-9.9	34.9	1.0	-43.8	-40.0	-3.8	

Rev. 05.21.15

LTE B30 10MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 30, 10MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B30

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Mid Channel (2310MHz)										
4.62	-67.0	H	3.0	-13.2	37.9	1.0	-50.2	-40.0	-10.2	
6.93	-67.9	H	3.0	-9.3	36.6	1.0	-44.8	-40.0	-4.8	
9.24	-71.9	H	3.0	-10.4	34.9	1.0	-44.2	-40.0	-4.2	
4.62	-66.2	V	3.0	-12.5	37.9	1.0	-49.4	-40.0	-9.4	
6.93	-69.6	V	3.0	-10.1	36.5	1.0	-45.6	-40.0	-5.6	
9.24	-72.6	V	3.0	-10.8	34.9	1.0	-44.7	-40.0	-4.7	

Rev. 05.21.15

LTE B30 10MHz 16QAM

9.1.11. LTE BAND 41

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 41, 20MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B41

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (2506MHz)										
5.01	-64.5	H	3.0	-11.6	38.7	1.0	-49.3	-25.0	-24.3	
7.52	-65.5	H	3.0	-7.7	37.7	1.0	-44.4	-25.0	-19.4	
10.02	-66.3	H	3.0	-5.5	36.1	1.0	-40.6	-25.0	-15.6	
5.01	-65.6	V	3.0	-13.0	38.7	1.0	-50.7	-25.0	-25.7	
7.52	-66.6	V	3.0	-9.0	37.7	1.0	-45.7	-25.0	-20.7	
10.02	-66.8	V	3.0	-6.0	36.1	1.0	-41.2	-25.0	-16.2	
Mid Channel (2593MHz)										
5.19	-63.9	H	3.0	-10.6	38.7	1.0	-48.3	-25.0	-23.3	
7.78	-65.7	H	3.0	-7.6	37.6	1.0	-44.1	-25.0	-19.1	
10.37	-67.7	H	3.0	-6.6	36.4	1.0	-41.9	-25.0	-16.9	
5.19	-63.8	V	3.0	-10.9	38.7	1.0	-48.6	-25.0	-23.6	
7.78	-64.5	V	3.0	-6.5	37.6	1.0	-43.1	-25.0	-18.1	
10.37	-67.2	V	3.0	-6.0	36.4	1.0	-41.3	-25.0	-16.3	
High Channel (2680MHz)										
5.36	-65.7	H	3.0	-12.0	38.6	1.0	-49.6	-25.0	-24.6	
8.04	-65.9	H	3.0	-7.5	37.4	1.0	-43.9	-25.0	-18.9	
10.72	-67.2	H	3.0	-5.8	36.6	1.0	-41.3	-25.0	-16.3	
5.36	-65.8	V	3.0	-12.5	38.6	1.0	-50.2	-25.0	-25.2	
8.04	-66.2	V	3.0	-7.9	37.4	1.0	-44.3	-25.0	-19.3	
10.72	-66.9	V	3.0	-5.4	36.6	1.0	-41.0	-25.0	-16.0	

Rev. 05.21.15

LTE B41 20MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 10649
Configuration: EUT Only
Mode: LTE Band 41, 20MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	LTE B41

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (2506MHz)										
5.01	-66.6	H	3.0	-13.7	38.7	1.0	-51.4	-25.0	-26.4	
7.52	-66.0	H	3.0	-8.2	37.7	1.0	-45.0	-25.0	-20.0	
10.02	-65.4	H	3.0	-4.5	36.1	1.0	-39.7	-25.0	-14.7	
5.01	-65.9	V	3.0	-13.3	38.7	1.0	-51.0	-25.0	-26.0	
7.52	-65.7	V	3.0	-8.0	37.7	1.0	-44.8	-25.0	-19.8	
10.02	-67.0	V	3.0	-6.2	36.1	1.0	-41.4	-25.0	-16.4	
Mid Channel (2593MHz)										
5.19	-63.8	H	3.0	-10.5	38.7	1.0	-48.2	-25.0	-23.2	
7.78	-65.6	H	3.0	-7.5	37.6	1.0	-44.0	-25.0	-19.0	
10.37	-67.0	H	3.0	-5.9	36.4	1.0	-41.2	-25.0	-16.2	
5.19	-63.5	V	3.0	-10.5	38.7	1.0	-48.2	-25.0	-23.2	
7.78	-64.2	V	3.0	-6.3	37.6	1.0	-42.9	-25.0	-17.9	
10.37	-66.4	V	3.0	-5.2	36.4	1.0	-40.6	-25.0	-15.6	
High Channel (2680MHz)										
5.36	-65.1	H	3.0	-11.6	38.6	1.0	-49.1	-25.0	-24.1	
8.04	-65.7	H	3.0	-7.2	37.4	1.0	-43.6	-25.0	-18.6	
10.72	-66.6	H	3.0	-5.2	36.6	1.0	-40.8	-25.0	-15.8	
5.36	-65.8	V	3.0	-12.6	38.6	1.0	-50.1	-25.0	-25.1	
8.04	-66.0	V	3.0	-7.8	37.4	1.0	-44.2	-25.0	-19.2	
10.72	-66.9	V	3.0	-6.3	36.6	1.0	-40.9	-25.0	-15.9	

Rev. 05.21.15

LTE B41 20MHz 16QAM

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.1.12. LTE BAND 66

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/09/18
Test Engineer: 44410
Configuration: EUT only
Mode: LTE Band 66, 20MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1720.0MHz)										
3.44	-66.8	H	3.0	-17.5	38.5	1.0	-55.0	-13.0	-42.0	
5.16	-66.1	H	3.0	-12.9	38.7	1.0	-50.6	-13.0	-37.6	
6.88	-67.9	H	3.0	-11.0	38.1	1.0	-48.1	-13.0	-35.1	
3.44	-67.8	V	3.0	-18.6	38.5	1.0	-56.2	-13.0	-43.2	
5.16	-66.5	V	3.0	-12.6	38.7	1.0	-50.3	-13.0	-37.3	
6.88	-68.2	V	3.0	-11.5	38.1	1.0	-48.6	-13.0	-35.6	
Mid Channel (1745.0MHz)										
3.49	-67.6	H	3.0	-18.1	38.5	1.0	-55.7	-13.0	-42.7	
5.16	-66.3	H	3.0	-13.1	38.7	1.0	-50.8	-13.0	-37.8	
6.98	-68.9	H	3.0	-11.8	38.1	1.0	-48.9	-13.0	-35.9	
3.49	-67.3	V	3.0	-18.0	38.5	1.0	-55.5	-13.0	-42.5	
5.16	-65.6	V	3.0	-12.7	38.7	1.0	-50.4	-13.0	-37.4	
6.98	-68.7	V	3.0	-11.8	38.1	1.0	-48.9	-13.0	-35.9	
High Channel (1770.0MHz)										
3.54	-67.5	H	3.0	-17.9	38.6	1.0	-55.5	-13.0	-42.5	
5.31	-68.1	H	3.0	-14.6	38.6	1.0	-52.2	-13.0	-39.2	
7.08	-69.4	H	3.0	-12.1	38.0	1.0	-49.1	-13.0	-36.1	
3.54	-67.3	V	3.0	-17.9	38.6	1.0	-55.4	-13.0	-42.4	
5.31	-67.4	V	3.0	-14.2	38.6	1.0	-51.8	-13.0	-38.8	
7.08	-68.0	V	3.0	-10.9	38.0	1.0	-47.9	-13.0	-34.9	

Rev. 02.24.17

LTE B66 20MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/09/18
Test Engineer: 44410
Configuration: EUT only
Mode: LTE Band 66, 20MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber	Pre-amplifer	Filter	Limit
3m Chamber E	3m Chamber E	Filter	EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1720.0MHz)										
3.44	-67.5	H	3.0	-18.2	38.5	1.0	-55.7	-13.0	-42.7	
5.16	-66.5	H	3.0	-13.3	38.7	1.0	-51.0	-13.0	-38.0	
6.88	-67.4	H	3.0	-10.4	38.1	1.0	-47.6	-13.0	-34.6	
3.44	-68.1	V	3.0	-19.0	38.5	1.0	-56.5	-13.0	-43.5	
5.16	-66.6	V	3.0	-13.8	38.7	1.0	-51.4	-13.0	-38.4	
6.88	-67.7	V	3.0	-11.1	38.1	1.0	-48.2	-13.0	-35.2	
Mid Channel (1745.0MHz)										
3.49	-68.2	H	3.0	-18.7	38.5	1.0	-56.3	-13.0	-43.3	
5.16	-67.2	H	3.0	-14.0	38.7	1.0	-51.7	-13.0	-38.7	
6.98	-70.3	H	3.0	-13.1	38.1	1.0	-50.2	-13.0	-37.2	
3.49	-67.1	V	3.0	-17.8	38.5	1.0	-55.4	-13.0	-42.4	
5.16	-66.7	V	3.0	-13.9	38.7	1.0	-51.5	-13.0	-38.5	
6.98	-69.3	V	3.0	-12.4	38.1	1.0	-49.5	-13.0	-36.5	
High Channel (1770.0MHz)										
3.54	-66.5	H	3.0	-16.9	38.6	1.0	-54.5	-13.0	-41.5	
5.31	-68.0	H	3.0	-14.5	38.6	1.0	-52.2	-13.0	-39.2	
7.08	-68.9	H	3.0	-11.6	38.0	1.0	-48.6	-13.0	-35.6	
3.54	-67.2	V	3.0	-17.8	38.6	1.0	-55.3	-13.0	-42.3	
5.31	-68.0	V	3.0	-14.8	38.6	1.0	-52.5	-13.0	-39.5	
7.08	-69.1	V	3.0	-12.1	38.0	1.0	-49.1	-13.0	-36.1	

Rev. 02.24.17

LTE B66 20MHz 16QAM

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9.2. FIELD STRENGTH OF SPURIOUS RADIATION, ANT 2

9.2.1. LTE BAND 2

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/17
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 2, 20MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber: 3m Chamber E | Pre-amplifer: 3m Chamber E | Filter: Filter | Limit: EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1860MHz)										
3.72	-66.0	H	3.0	-16.0	38.6	1.0	-53.6	-13.0	-40.6	
5.58	-68.0	H	3.0	-13.9	38.6	1.0	-51.5	-13.0	-38.5	
7.44	-70.7	H	3.0	-13.0	37.8	1.0	-49.8	-13.0	-36.8	
3.72	-65.7	V	3.0	-15.8	38.6	1.0	-53.4	-13.0	-40.4	
5.58	-68.1	V	3.0	-14.3	38.6	1.0	-51.8	-13.0	-38.8	
7.44	-71.1	V	3.0	-13.6	37.8	1.0	-50.4	-13.0	-37.4	
Mid Channel (1880MHz)										
3.76	-66.1	H	3.0	-15.9	38.6	1.0	-53.6	-13.0	-40.6	
5.64	-67.3	H	3.0	-13.0	38.5	1.0	-50.5	-13.0	-37.5	
7.52	-70.1	H	3.0	-12.3	37.7	1.0	-49.0	-13.0	-36.0	
3.76	-65.6	V	3.0	-15.5	38.6	1.0	-53.2	-13.0	-40.2	
5.64	-66.7	V	3.0	-12.8	38.5	1.0	-50.3	-13.0	-37.3	
7.52	-69.7	V	3.0	-12.1	37.7	1.0	-48.9	-13.0	-35.9	
High Channel (1900MHz)										
3.80	-66.1	H	3.0	-15.9	38.6	1.0	-53.5	-13.0	-40.5	
5.70	-68.6	H	3.0	-14.2	38.5	1.0	-51.8	-13.0	-38.8	
7.60	-69.9	H	3.0	-12.0	37.7	1.0	-48.7	-13.0	-35.7	
3.80	-65.1	V	3.0	-14.9	38.6	1.0	-52.6	-13.0	-39.6	
5.70	-67.4	V	3.0	-13.3	38.5	1.0	-50.8	-13.0	-37.8	
7.60	-69.5	V	3.0	-11.8	37.7	1.0	-48.5	-13.0	-35.5	

Rev. 05.21.15

LTE B2 20MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/08/18
Test Engineer: 52275
Configuration: EUT
Mode: LTE Band 2, 20MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber: 3m Chamber E | Pre-amplifer: 3m Chamber E | Filter: Filter | Limit: EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (1860MHz)										
3.72	-64.5	H	3.0	-14.5	38.6	1.0	-52.1	-13.0	-39.1	
5.58	-67.6	H	3.0	-13.5	38.6	1.0	-51.1	-13.0	-38.1	
7.44	-70.5	H	3.0	-12.8	37.8	1.0	-49.6	-13.0	-36.6	
3.72	-64.7	V	3.0	-14.7	38.6	1.0	-52.4	-13.0	-39.4	
5.58	-66.1	V	3.0	-12.3	38.6	1.0	-49.9	-13.0	-36.9	
7.44	-70.7	V	3.0	-13.2	37.8	1.0	-50.0	-13.0	-37.0	
Mid Channel (1880MHz)										
3.76	-66.0	H	3.0	-15.8	38.6	1.0	-53.5	-13.0	-40.5	
5.64	-67.7	H	3.0	-13.4	38.6	1.0	-51.0	-13.0	-38.0	
7.52	-70.1	H	3.0	-12.3	37.7	1.0	-49.0	-13.0	-36.0	
3.76	-66.5	V	3.0	-16.5	38.6	1.0	-54.1	-13.0	-41.1	
5.64	-67.0	V	3.0	-13.1	38.5	1.0	-50.6	-13.0	-37.6	
7.52	-70.5	V	3.0	-12.9	37.7	1.0	-49.6	-13.0	-36.6	
High Channel (1900MHz)										
3.80	-66.9	H	3.0	-16.6	38.6	1.0	-54.3	-13.0	-41.3	
5.70	-67.7	H	3.0	-13.3	38.5	1.0	-50.9	-13.0	-37.9	
7.60	-70.7	H	3.0	-12.8	37.7	1.0	-49.5	-13.0	-36.5	
3.80	-66.3	V	3.0	-16.1	38.6	1.0	-53.7	-13.0	-40.7	
5.70	-67.5	V	3.0	-13.4	38.5	1.0	-50.9	-13.0	-37.9	
7.60	-71.0	V	3.0	-13.3	37.7	1.0	-50.0	-13.0	-37.0	

Rev. 05.21.15

LTE B2 20MHz 16QAM

9.2.2. LTE BAND 5

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/09/18
Test Engineer: 44410
Configuration: EUT only
Mode: LTE Band 5, 10MHz QPSK

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber: 3m Chamber E | Pre-amplifer: 3m Chamber E | Filter: Filter | Limit: EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (829MHz)										
1.66	-57.6	H	3.0	-15.1	37.8	1.0	-52.0	-13.0	-39.0	
2.49	-62.5	H	3.0	-17.4	38.5	1.0	-54.9	-13.0	-41.9	
3.32	-68.7	H	3.0	-19.7	38.5	1.0	-57.2	-13.0	-44.2	
1.66	-55.6	V	3.0	-13.5	37.8	1.0	-50.3	-13.0	-37.3	
2.49	-67.6	V	3.0	-22.3	38.5	1.0	-59.8	-13.0	-46.8	
3.32	-67.3	V	3.0	-18.5	38.5	1.0	-56.0	-13.0	-43.0	
Mid Channel (836.5MHz)										
1.67	-58.8	H	3.0	-16.3	37.8	1.0	-53.2	-13.0	-40.2	
2.51	-66.6	H	3.0	-21.4	38.6	1.0	-59.0	-13.0	-46.0	
3.35	-67.0	H	3.0	-17.9	38.5	1.0	-55.4	-13.0	-42.4	
1.67	-55.7	V	3.0	-13.4	37.8	1.0	-50.2	-13.0	-37.2	
2.51	-62.9	V	3.0	-17.6	38.6	1.0	-55.1	-13.0	-42.1	
3.35	-68.0	V	3.0	-19.1	38.5	1.0	-56.6	-13.0	-43.6	
High Channel (844MHz)										
1.69	-59.2	H	3.0	-16.7	37.9	1.0	-53.6	-13.0	-40.6	
2.53	-60.1	H	3.0	-14.8	38.6	1.0	-52.3	-13.0	-39.3	
3.38	-67.1	H	3.0	-18.0	38.5	1.0	-55.5	-13.0	-42.5	
1.69	-54.9	V	3.0	-12.6	37.9	1.0	-49.4	-13.0	-36.4	
2.53	-62.4	V	3.0	-16.9	38.6	1.0	-54.5	-13.0	-41.5	
3.38	-67.6	V	3.0	-18.7	38.5	1.0	-56.2	-13.0	-43.2	

Rev. 05.21.15

LTE B5 10MHz QPSK

High Frequency Substitution Measurement
UL Fremont Radiated Chamber

Company:
Project #:
Date: 04/09/18
Test Engineer: 44410
Configuration: EUT only
Mode: LTE Band 5, 10MHz 16QAM

Test Equipment:
Substitution: Horn T59 Substitution, and 8ft SMA Cable

Chamber: 3m Chamber E | Pre-amplifer: 3m Chamber E | Filter: Filter | Limit: EIRP

Frequency (GHz)	SA reading (dBm)	Ant. Pol. (H/V)	Distance	EIRP @ TX Ant End (dBm)	Preamp	Attenuator	EIRP	Limit	Delta	Notes
Low Channel (829MHz)										
1.66	-55.8	H	3.0	-13.3	37.8	1.0	-50.1	-13.0	-37.1	
2.49	-62.5	H	3.0	-17.4	38.5	1.0	-54.9	-13.0	-41.9	
3.32	-67.1	H	3.0	-18.1	38.5	1.0	-55.6	-13.0	-42.6	
1.66	-57.8	V	3.0	-15.6	37.8	1.0	-52.5	-13.0	-39.5	
2.49	-63.3	V	3.0	-18.0	38.5	1.0	-55.5	-13.0	-42.5	
3.32	-66.5	V	3.0	-17.8	38.5	1.0	-55.3	-13.0	-42.3	
Mid Channel (836.5MHz)										
1.67	-58.8	H	3.0	-16.3	37.8	1.0	-53.1	-13.0	-40.1	
2.51	-67.2	H	3.0	-22.0	38.6	1.0	-59.6	-13.0	-46.6	
3.35	-67.1	H	3.0	-18.0	38.5	1.0	-55.5	-13.0	-42.5	
1.67	-52.6	V	3.0	-10.4	37.8	1.0	-47.2	-13.0	-34.2	
2.51	-67.1	V	3.0	-21.7	38.6	1.0	-59.3	-13.0	-46.3	
3.35	-67.0	V	3.0	-18.2	38.5	1.0	-55.7	-13.0	-42.7	
High Channel (844MHz)										
1.69	-59.7	H	3.0	-17.1	37.9	1.0	-54.0	-13.0	-41.0	
2.53	-59.6	H	3.0	-14.2	38.6	1.0	-51.8	-13.0	-38.8	
3.38	-68.0	H	3.0	-18.9	38.5	1.0	-56.4	-13.0	-43.4	
1.69	-53.0	V	3.0	-10.7	37.9	1.0	-47.5	-13.0	-34.5	
2.53	-62.5	V	3.0	-17.0	38.6	1.0	-54.5	-13.0	-41.5	
3.38	-67.8	V	3.0	-18.9	38.5	1.0	-56.4	-13.0	-43.4	

Rev. 05.21.15

LTE B5 10MHz 16QAM

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.