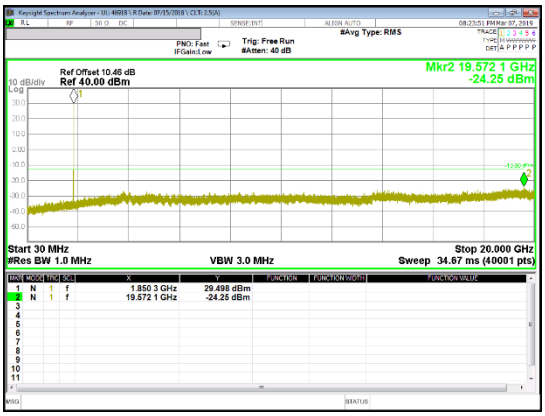
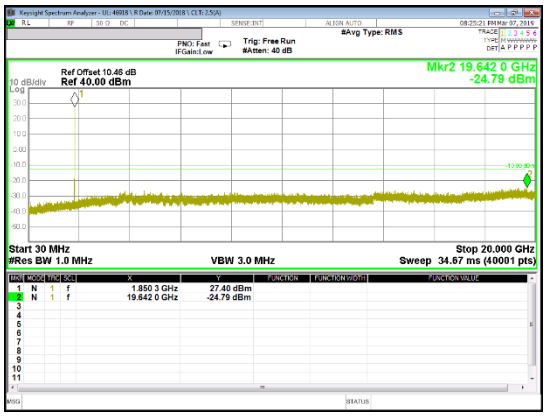
GSM 1900

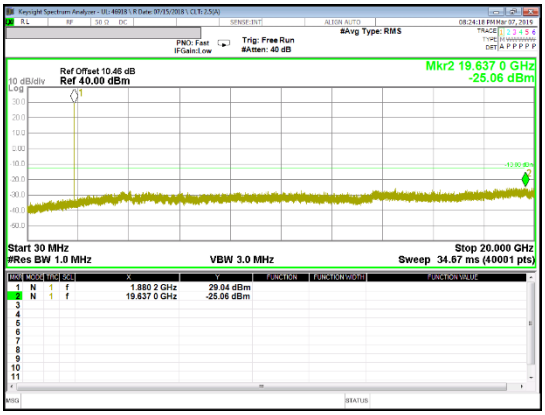
GSM 1900



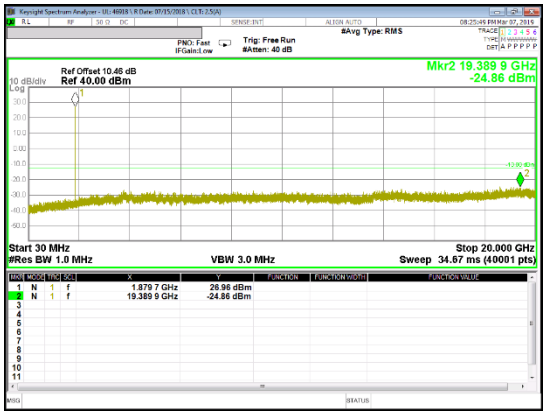
GSM1900 GPRS Low channel



GSM1900 EGPRS Low channel



GSM1900 GPRS Mid channel



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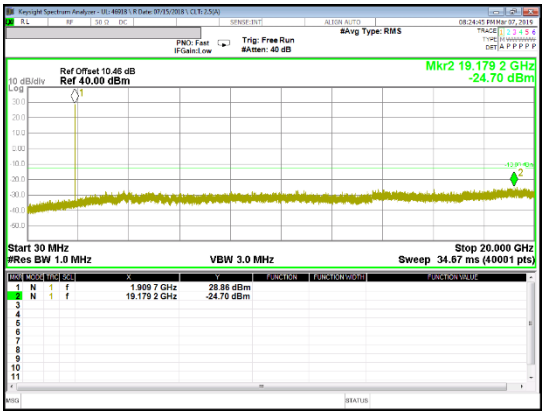
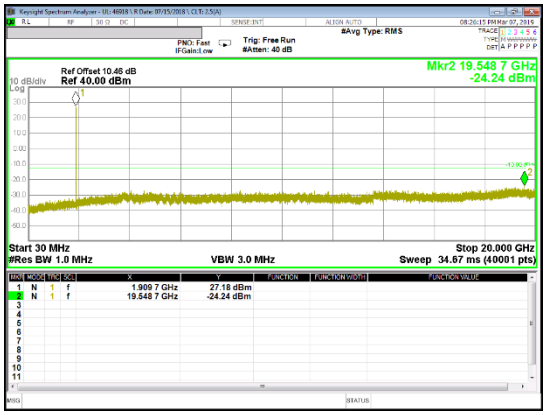
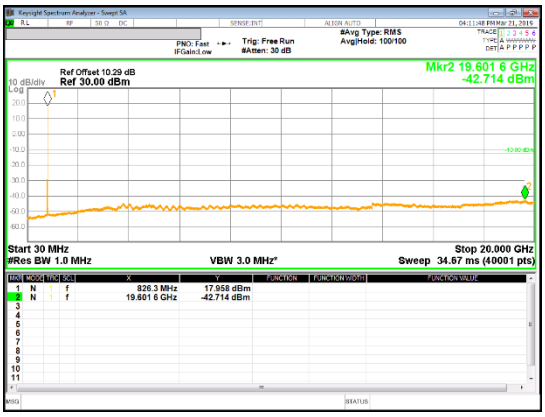
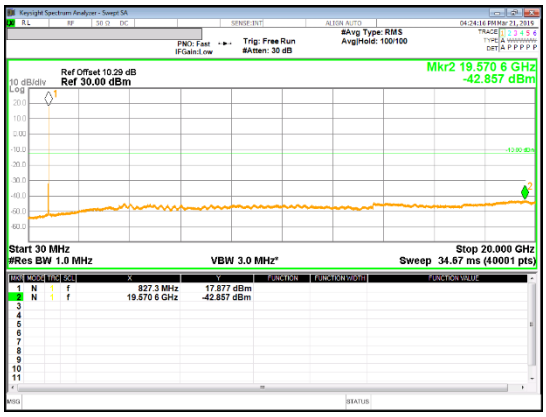
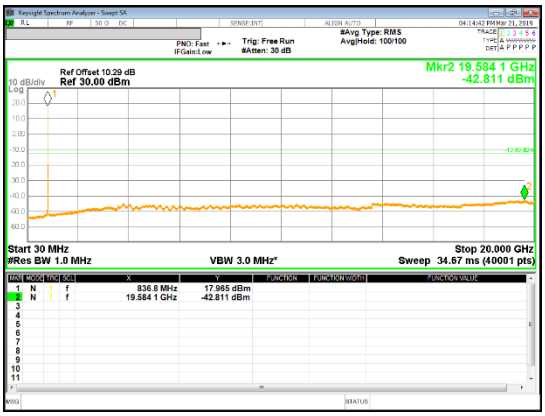
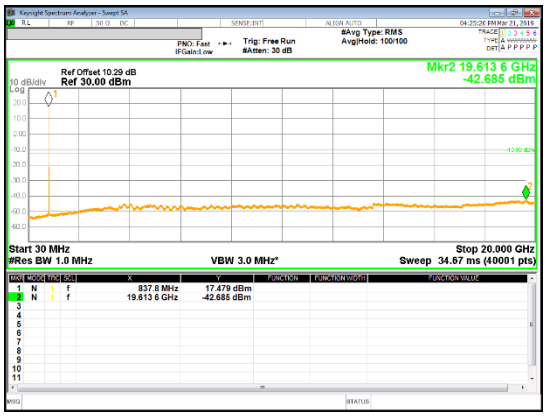
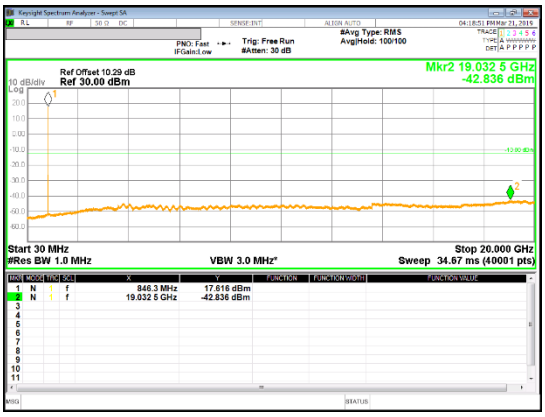
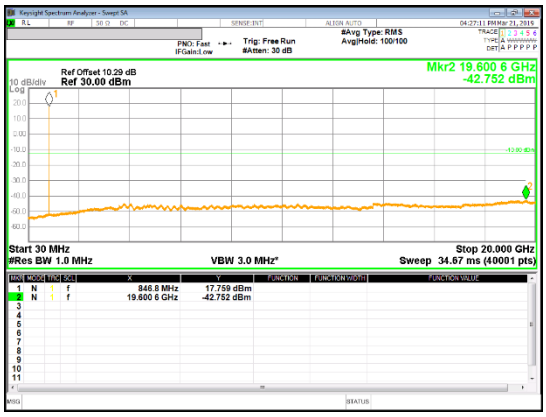


GSM1900 GPRS High channel

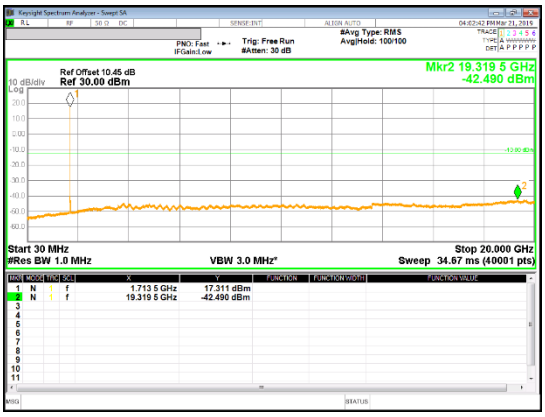
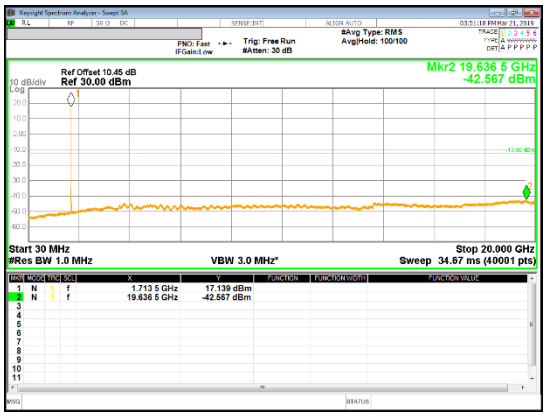
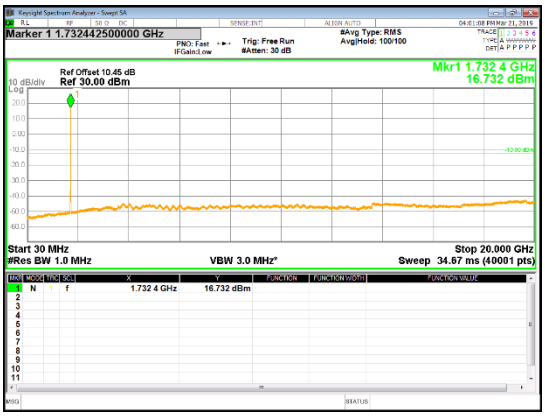
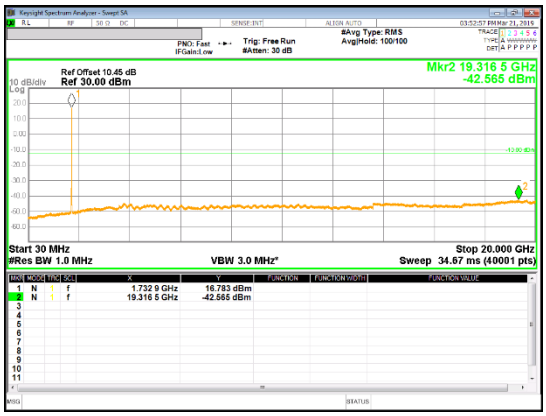
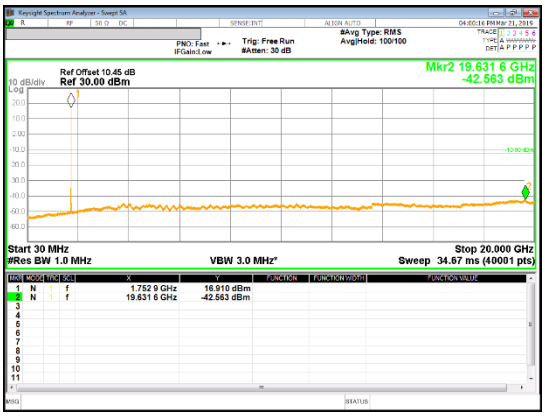
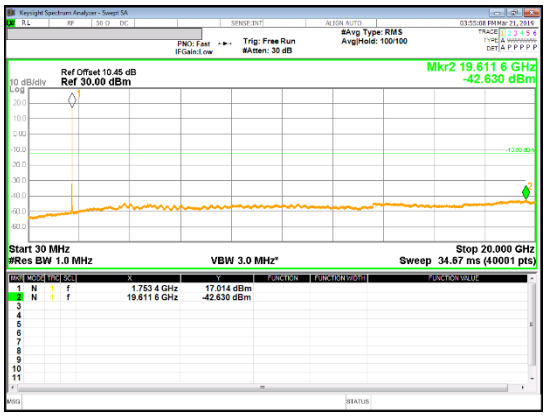


GSM1900 EGPRS High channel

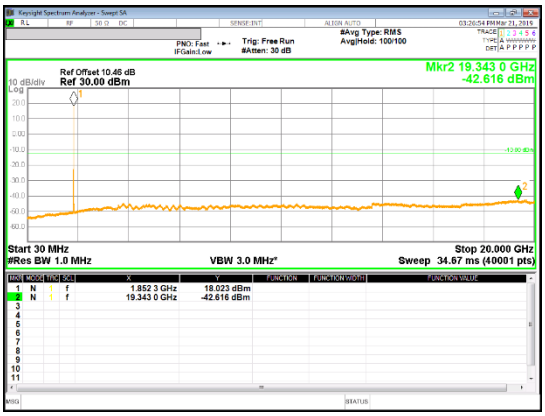
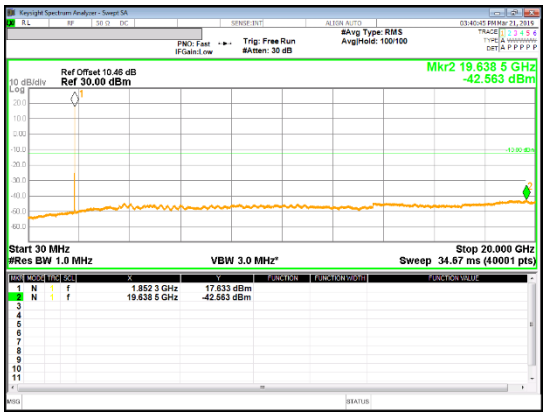
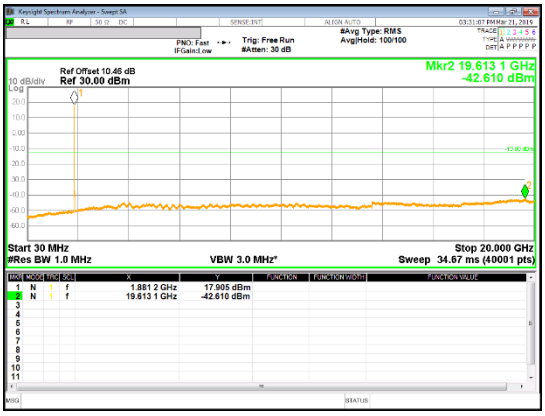
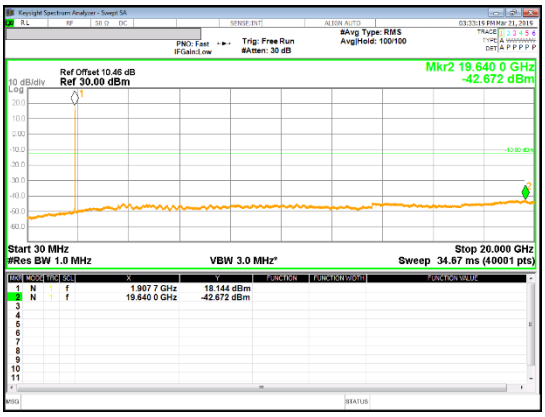
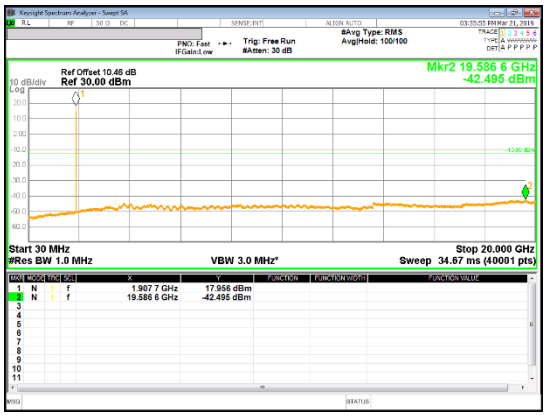
WCDMA Band 5

Band 5	 REL99 Low channel	 HSDPA Low channel
	 REL99 Mid channel	 HSDPA Mid channel
	 REL99 High channel	 HSDPA High channel

WCDMA Band 4

Band 4	 REL99 Low channel	 HSDPA Low channel
	 REL99 Mid channel	 HSDPA Mid channel
	 REL99 High channel	 HSDPA High channel

WCDMA Band 2

Band 2	 REL99 Low channel	 HSDPA Low channel
	 REL99 Mid channel	 HSDPA Mid channel
	 REL99 High channel	 HSDPA High channel

LTE Band 2

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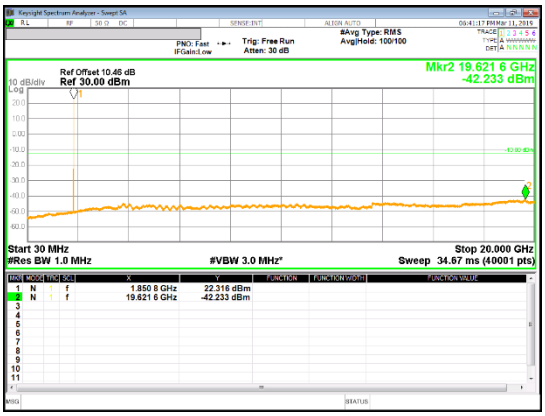
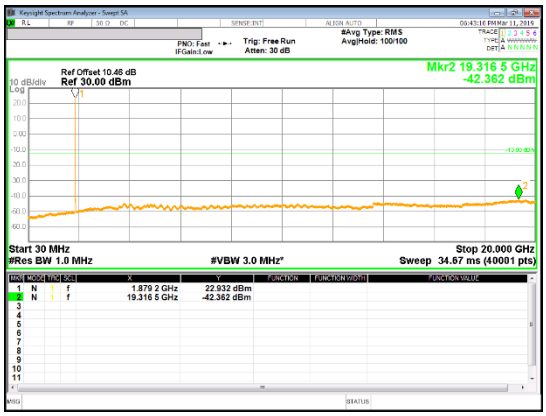
1.4 MHz</td><td> 

QPSK Low channel</td><td> 

QPSK Mid channel</td></tr>
<tr><td colspan="2"> 

QPSK High channel</td></tr>
</table>

LTE Band 5

Band 5 3MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

LTE Band 7

Band 7 10MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

LTE Band 12

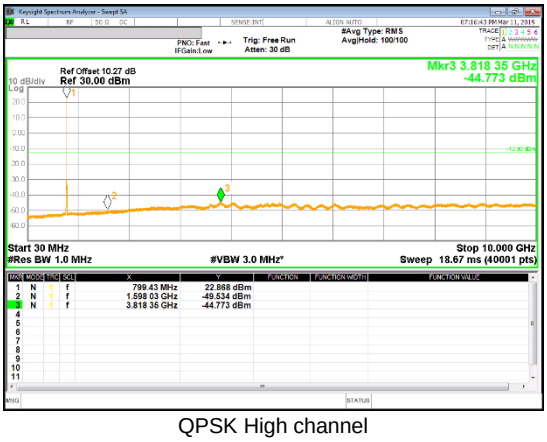
Band 12 1.4MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

LTE Band 14

<table>
<tr><td>Band 14
10MHz</td><td> 

QPSK Mid channel</td></tr>
<tr><td rowspan="2">Band 14
5MHz</td><td> 

QPSK Low channel</td><td> 

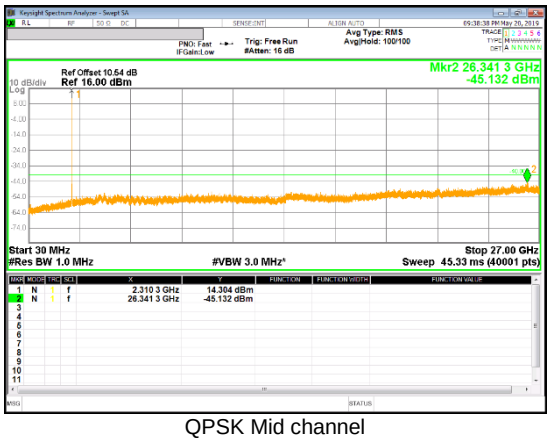
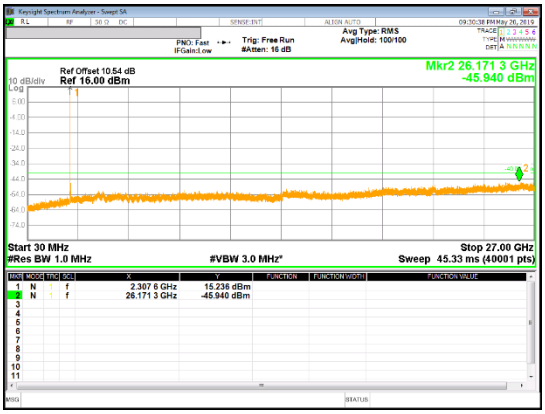
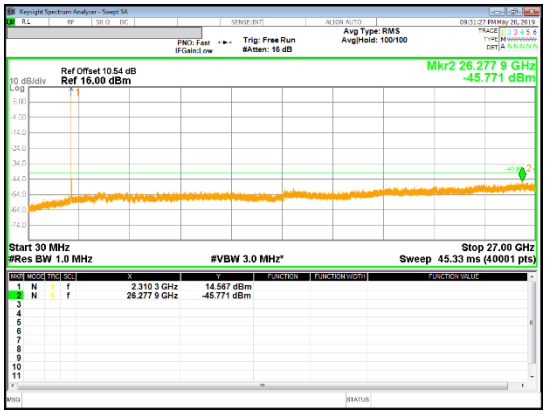
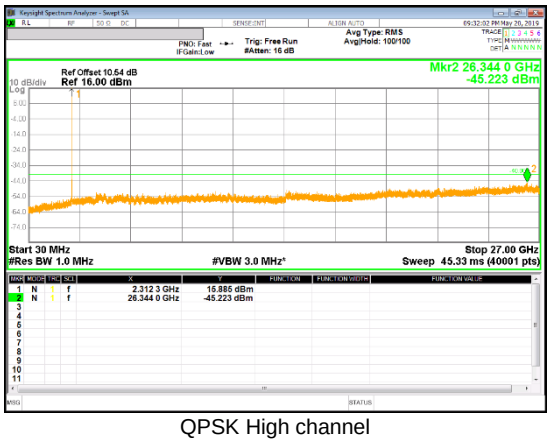
QPSK Mid channel</td></tr>
<tr><td colspan="2"> 

QPSK High channel</td></tr>
</table>

LTE Band 30

Band 30 10MHz	 QPSK Mid channel	
Band 30 5MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

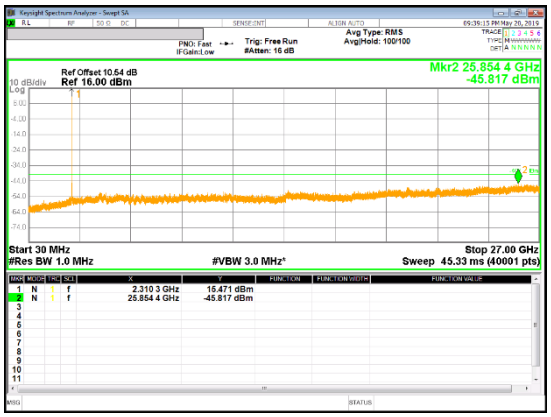
LTE Band 40(Lower Side)

Band 40 10MHz Lower Side QPSK	 QPSK Mid channel	
Band 30 5MHz Lower Side QPSK	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

Band 40
10MHz

Lower
Side

16QAM

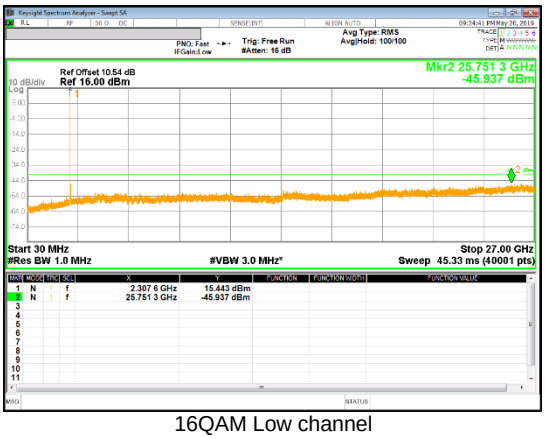


16QAM Mid channel

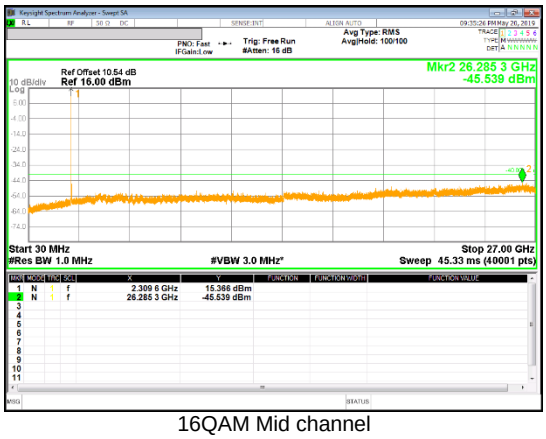
Band 30
5MHz

Lower
Side

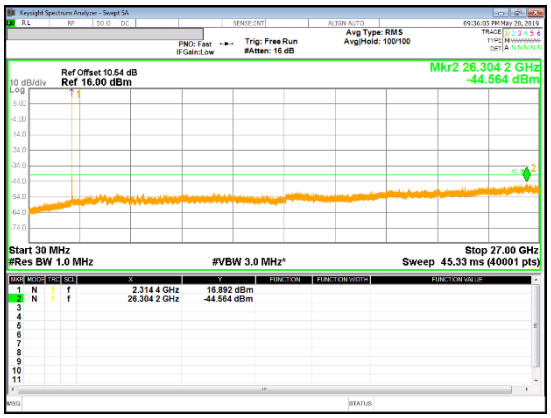
16QAM



16QAM Low channel

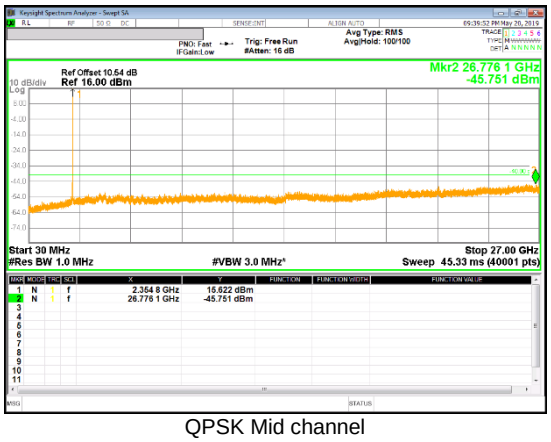
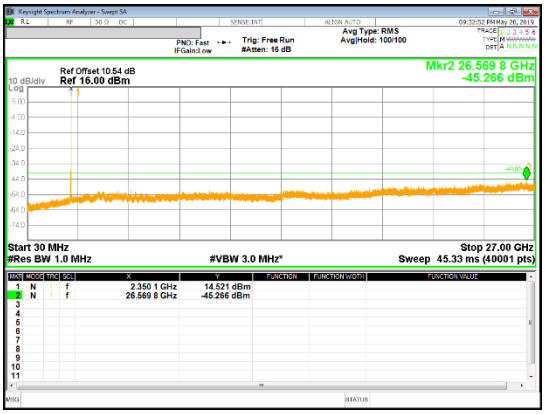
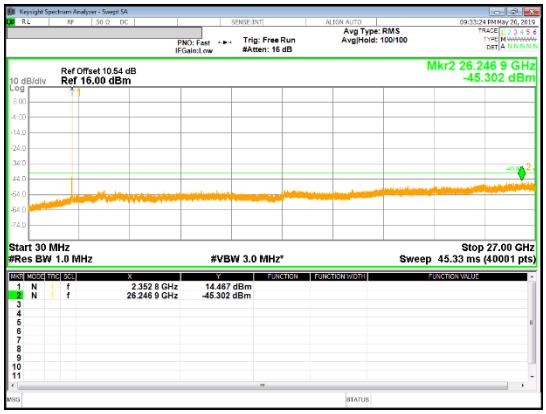
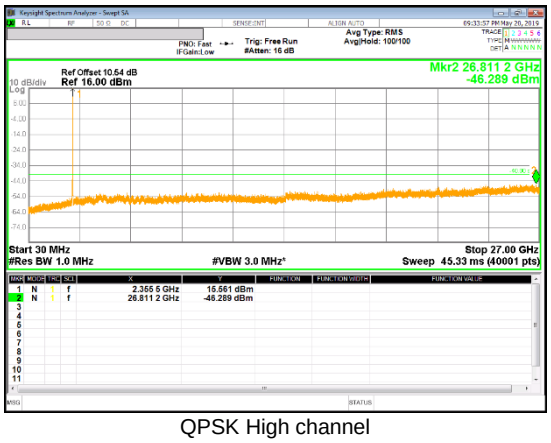


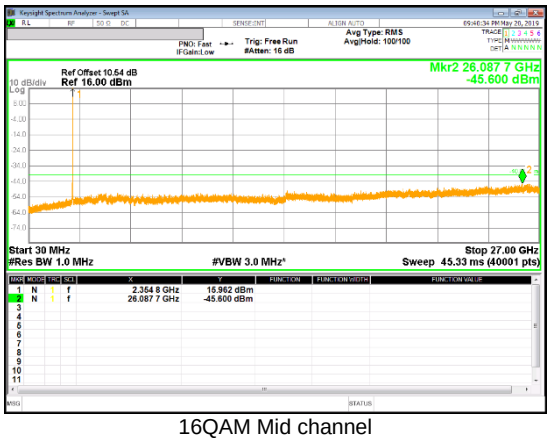
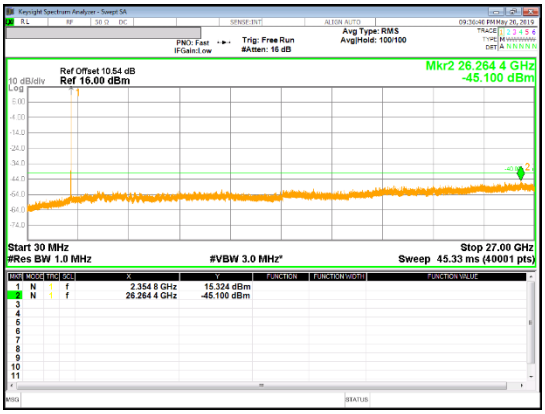
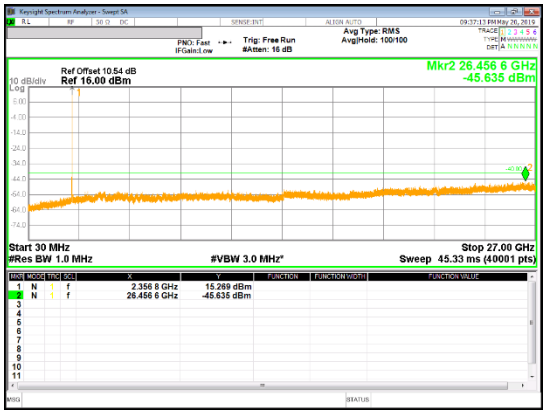
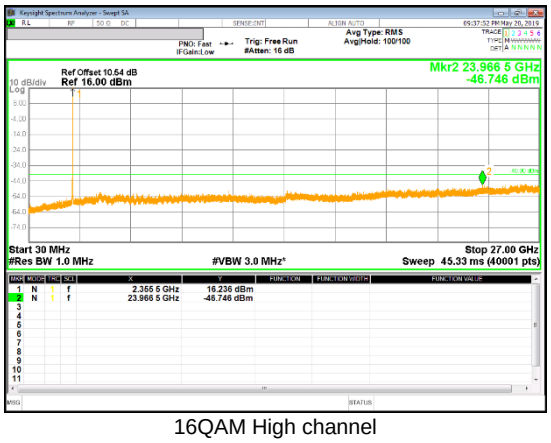
16QAM Mid channel



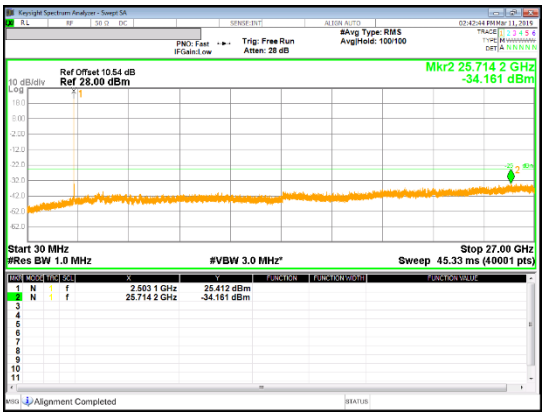
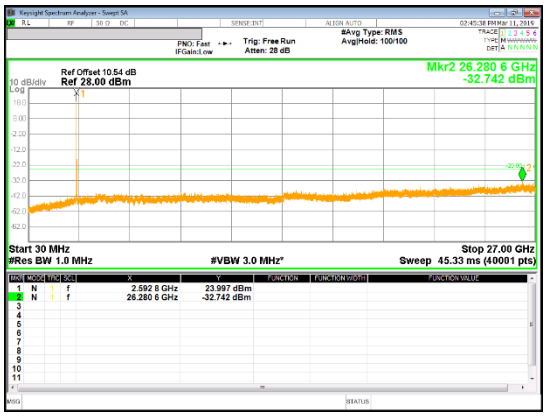
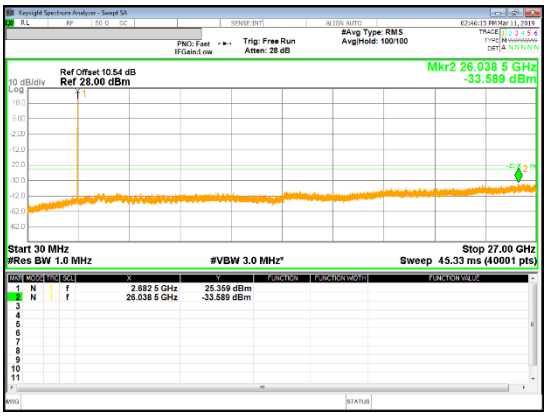
16QAM High channel

LTE Band 40(Upper Side)

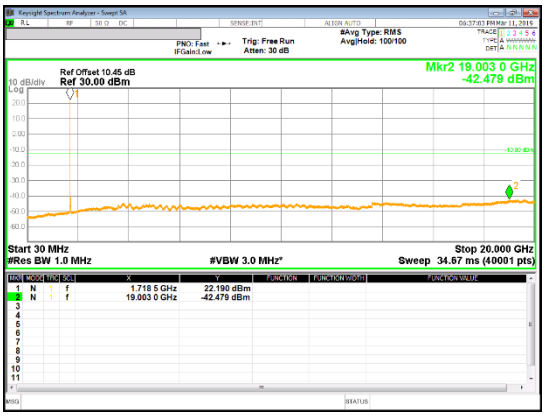
Band 40 10MHz Upper Side QPSK	 QPSK Mid channel	
Band 30 5MHz Upper Side QPSK	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

Band 40 10MHz Upper Side 16QAM	 16QAM Mid channel
Band 30 5MHz Upper Side 16QAM	 16QAM Low channel  16QAM Mid channel  16QAM High channel

LTE Band 41

Band 41 15MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

LTE Band 66

Band 66 15MHz	 QPSK Low channel	 QPSK Mid channel
	 QPSK High channel	

LTE Band 4

LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 38

LTE Band 38 (Frequency range: 2570-2620 MHz) is covered by LTE Band 41 (Frequency range: 2496-2690 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

9.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, §27.54 and §90.539

LIMITS

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

§24.235 - The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

§27.54 - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

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

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

RESULTS

See the following pages.

9.4.1. FREQUENCY STABILITY RESULTS

GSM 850, Channel 128/251, Frequency 824.2/848.8 MHz

Reference Frequency : GSM850 Low Channel 824.2 MHz / High Channel 848.8 MHz @ 20ºC						
Limit: +- 2.5 ppm =	Low Channel	2060.500	Hz	High Channel	2122.000	Hz
Power Supply [Vdc]	Environment Temperature [ºC]	Frequency Deviation Measureed with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.80	50	824.19998230	0.005	848.79998687	-0.006	2.5
3.80	40	824.19998211	0.005	848.79998643	-0.005	2.5
3.80	30	824.19998008	0.008	848.79998226	0.000	2.5
3.80	***20***	***824.19998645***	***0.000***	***848.79998204***	***0.000***	***2.5***
3.80	10	824.19998734	-0.001	848.79998932	-0.009	2.5
3.80	0	824.19998087	0.007	848.79998830	-0.007	2.5
3.80	-10	824.19998783	-0.002	848.79998095	0.001	2.5
3.80	-20	824.19998295	0.004	848.79998727	-0.006	2.5
3.80	-30	824.19998041	0.007	848.79998127	0.001	2.5

Reference Frequency : GSM850 Low Channel 824.2 MHz / High Channel 848.8 MHz @ 20ºC						
Limit: +- 2.5 ppm =	Low Channel	2060.500	Hz	High Channel	2122.000	Hz
Power Supply [Vdc]	Environment Temperature [ºC]	Frequency Deviation Measureed with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.80	***20***	***824.19998645***	***0***	***848.79998204***	***0***	***2.5***
4.30	20	824.19998882	-0.003	848.79998088	0.001	2.5
3.60	20	824.19999070	-0.005	848.79999095	-0.010	2.5

GSM 1900, Channel 512/810, Frequency 1850.0/1910.0 MHz

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.0777	1909.9233		
Extreme (50C)		1850.0776	1909.9233	-29.4	-0.016
Extreme (40C)		1850.0776	1909.9233	-26.5	-0.014
Extreme (30C)		1850.0777	1909.9233	-24.8	-0.013
Extreme (10C)		1850.0777	1909.9233	-20.9	-0.011
Extreme (0C)		1850.0777	1909.9233	-22.8	-0.012
Extreme (-10C)		1850.0777	1909.9233	-22.0	-0.012
Extreme (-20C)		1850.0777	1909.9233	-21.7	-0.012
Extreme (-30C)		1850.0777	1909.9233	-24.9	-0.013
20C	15%	1850.0776	1909.9233	-20.7	-0.011
	-15%	1850.0776	1909.9233	-22.0	-0.012
	End Point	1850.0777	1909.9233	-26.3	-0.014

WCDMA Band 5 (HSDPA)

Reference Frequency : WCDMA Band 5 Low Channel 826.4 MHz / High Channel 846.6 MHz @ 20°C						
Limit: +- 2.5 ppm =	Low Channel	2066.000	Hz	High Channel	2116.500	Hz

Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measureed with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.80	50	826.39998203	-0.002	846.59998748	-0.001	2.5
3.80	40	826.39998935	-0.011	846.59998416	0.003	2.5
3.80	30	826.39998261	-0.003	846.59998040	0.007	2.5
3.80	***20***	***826.39998006***	***0.000***	***846.59998652***	***0.000***	***2.5***
3.80	10	826.39998597	-0.007	846.59999096	-0.005	2.5
3.80	0	826.39999010	-0.012	846.59998025	0.007	2.5
3.80	-10	826.39998526	-0.006	846.59998744	-0.001	2.5
3.80	-20	826.39998594	-0.007	846.59998459	0.002	2.5
3.80	-30	826.39998782	-0.009	846.59998938	-0.003	2.5

Reference Frequency : WCDMA Band 5 Low Channel 826.4 MHz / High Channel 846.6 MHz @ 20°C						
Limit: +- 2.5 ppm =	Low Channel	2066.000	Hz	High Channel	2116.500	Hz

Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measureed with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.80	***20***	***826.39998006***	***0***	***846.59998652***	***0***	***2.5***
4.30	20	826.39998148	-0.002	846.59998565	0.001	2.5
3.60	20	826.39998322	-0.004	846.59998065	0.007	2.5

WCDMA Band 4 (Lowest Frequency: Rel. 99 / Highest Frequency: HSDPA)

Limit		1710	1755	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1712.3979	1752.6021		
Extreme (50C)		1712.3979	1752.6021	-23.6	-0.014
Extreme (40C)		1712.3979	1752.6021	-24.5	-0.014
Extreme (30C)		1712.3979	1752.6021	-20.0	-0.012
Extreme (10C)		1712.3979	1752.6021	-24.5	-0.014
Extreme (0C)		1712.3979	1752.6021	-22.8	-0.013
Extreme (-10C)		1712.3979	1752.6021	-28.7	-0.017
Extreme (-20C)		1712.3979	1752.6021	-24.6	-0.014
Extreme (-30C)		1712.3979	1752.6021	-23.2	-0.013
20C	15%	1712.3979	1752.6021	-27.2	-0.016
	-15%	1712.3979	1752.6021	-20.6	-0.012
	End Point	1712.3979	1752.6021	-23.9	-0.014

WCDMA Band 2 (HSDPA)

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1852.3979	1907.6021		
Extreme (50C)		1852.3979	1907.6021	-25.4	-0.014
Extreme (40C)		1852.3979	1907.6021	-22.7	-0.012
Extreme (30C)		1852.3979	1907.6021	-26.5	-0.014
Extreme (10C)		1852.3979	1907.6021	-27.6	-0.015
Extreme (0C)		1852.3979	1907.6021	-28.9	-0.015
Extreme (-10C)		1852.3979	1907.6021	-23.7	-0.013
Extreme (-20C)		1852.3979	1907.6021	-21.0	-0.011
Extreme (-30C)		1852.3979	1907.6021	-28.9	-0.015
20C	15%	1852.3979	1907.6021	-21.6	-0.012
	-15%	1852.3979	1907.6021	-20.1	-0.011
	End Point	1852.3979	1907.6021	-29.5	-0.016

LTE Band 2 (Lowest Frequency: QPSK / Highest Frequency: 16QAM)

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.6995	1909.3005		
Extreme (50C)		1850.6994	1909.3005	-21.8	-0.012
Extreme (40C)		1850.6994	1909.3005	-25.8	-0.014
Extreme (30C)		1850.6994	1909.3005	-27.3	-0.015
Extreme (10C)		1850.6994	1909.3005	-19.4	-0.010
Extreme (0C)		1850.6994	1909.3005	-26.1	-0.014
Extreme (-10C)		1850.6994	1909.3005	-26.9	-0.014
Extreme (-20C)		1850.6994	1909.3005	-27.9	-0.015
Extreme (-30C)		1850.6994	1909.3005	-28.0	-0.015
20C	15%	1850.6994	1909.3005	-29.3	-0.016
	-15%	1850.6994	1909.3005	-24.8	-0.013
	End Point	1850.6994	1909.3005	-29.5	-0.016

LTE Band 5 (Lowest Frequency: QPSK / Highest Frequency: 16QAM)

Reference Frequency : LTE Band 5 Low Channel 824.7 MHz / High Channel 848.3 MHz @ 20°C						
Limit: +- 2.5 ppm =	Low Channel	2061.750	Hz	High Channel	2120.750	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measureed with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.80	50	824.69998779	0.004	848.29998110	0.003	2.5
3.80	40	824.69998508	0.007	848.29999018	-0.008	2.5
3.80	30	824.69998014	0.013	848.29998412	-0.001	2.5
3.80	***20***	***824.69999076***	***0.000***	***848.29998344***	***0.000***	***2.5***
3.80	10	824.69998232	0.010	848.29998076	0.003	2.5
3.80	0	824.69998727	0.004	848.29998878	-0.006	2.5
3.80	-10	824.69998310	0.009	848.29998323	0.000	2.5
3.80	-20	824.69998943	0.002	848.29998430	-0.001	2.5
3.80	-30	824.69998245	0.010	848.29999045	-0.008	2.5

Reference Frequency : LTE Band 5 Low Channel 824.7 MHz / High Channel 848.3 MHz @ 20°C						
Limit: +- 2.5 ppm =	Low Channel	2061.750	Hz	High Channel	2120.750	Hz
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measureed with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.80	***20***	***824.69999076***	***0***	***848.29998344***	***0***	***2.5***
4.30	20	824.69998318	0.009	848.29998394	-0.001	2.5
3.60	20	824.69998957	0.001	848.29998933	-0.007	2.5

LTE Band 7 (16QAM)

Limit		2500	2570	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	2502.4978	2567.5023		
Extreme (50C)		2502.4977	2567.5022	-31.1	-0.012
Extreme (40C)		2502.4977	2567.5022	-30.6	-0.012
Extreme (30C)		2502.4977	2567.5022	-28.7	-0.011
Extreme (10C)		2502.4977	2567.5022	-33.3	-0.013
Extreme (0C)		2502.4977	2567.5022	-32.7	-0.013
Extreme (-10C)		2502.4977	2567.5022	-26.2	-0.010
Extreme (-20C)		2502.4977	2567.5022	-27.6	-0.011
Extreme (-30C)		2502.4977	2567.5022	-26.1	-0.010
20C	15%	2502.4977	2567.5022	-27.7	-0.011
	-15%	2502.4977	2567.5022	-28.4	-0.011
	End Point	2502.4977	2567.5022	-34.3	-0.014

LTE Band 12 (QPSK)

Limit		699	716	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	699.6995	715.3005		
Extreme (50C)		699.6994	715.3005	-17.7	-0.025
Extreme (40C)		699.6994	715.3005	-11.5	-0.016
Extreme (30C)		699.6994	715.3005	-12.8	-0.018
Extreme (10C)		699.6994	715.3005	-16.9	-0.024
Extreme (0C)		699.6994	715.3005	-14.2	-0.020
Extreme (-10C)		699.6994	715.3005	-19.5	-0.027
Extreme (-20C)		699.6994	715.3005	-14.2	-0.020
Extreme (-30C)		699.6994	715.3005	-19.5	-0.028
20C	15%	699.6994	715.3005	-17.6	-0.025
	-15%	699.6994	715.3005	-10.4	-0.015
	End Point	699.6994	715.3005	-19.0	-0.027

LTE Band 14 (QPSK)

Reference Frequency : LTE Band 14 Low Channel 790.5 MHz / High Channel 795.5 MHz @ 20ºC						
Limit: +- 2.5 ppm =	Low Channel	988.125	Hz	High Channel	994.375	Hz
Power Supply [Vdc]	Environment Temperature [ºC]	Frequency Deviation Measureed with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.80	50	790.49998090	0.016	795.49998607	0.006	1.25
3.80	40	790.49998214	0.013	795.49998507	0.008	1.25
3.80	30	790.49998163	0.015	795.49998807	0.001	1.25
3.80	***20***	***790.49998742***	***0.000***	***795.49998837***	***0.000***	***1.25***
3.80	10	790.49998262	0.012	795.49998988	-0.004	1.25
3.80	0	790.49998705	0.001	795.49998423	0.010	1.25
3.80	-10	790.49998849	-0.003	795.49998026	0.020	1.25
3.80	-20	790.49998415	0.008	795.49998576	0.007	1.25
3.80	-30	790.49998012	0.018	795.49998715	0.003	1.25

Reference Frequency : LTE Band 14 Low Channel 790.5 MHz / High Channel 795.5 MHz @ 20ºC						
Limit: +- 2.5 ppm =	Low Channel	988.125	Hz	High Channel	994.375	Hz
Power Supply [Vdc]	Environment Temperature [ºC]	Frequency Deviation Measureed with Time Elapse				Limit [ppm]
		Low Channel		High Channel		
		[MHz]	Delta [ppm]	[MHz]	Delta [ppm]	
3.80	***20***	***790.49998742***	***0***	***795.49998837***	***0***	***1.25***
4.30	20	790.49998165	0.015	795.49998281	0.014	1.25
3.60	20	790.49998149	0.015	795.49998530	0.008	1.25

LTE Band 30 (Lowest Frequency: 16QAM / Highest Frequency: QPSK)

Limit		2305	2315	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	2307.4978	2312.5023		
Extreme (50C)		2307.4977	2312.5022	-25.8	-0.011
Extreme (40C)		2307.4977	2312.5022	-24.4	-0.011
Extreme (30C)		2307.4977	2312.5022	-31.8	-0.014
Extreme (10C)		2307.4977	2312.5022	-28.5	-0.012
Extreme (0C)		2307.4977	2312.5022	-34.6	-0.015
Extreme (-10C)		2307.4977	2312.5022	-32.8	-0.014
Extreme (-20C)		2307.4977	2312.5022	-28.5	-0.012
Extreme (-30C)		2307.4977	2312.5022	-24.9	-0.011
20C	15%	2307.4977	2312.5022	-24.8	-0.011
	-15%	2307.4977	2312.5022	-26.4	-0.011
	End Point	2307.4977	2312.5022	-27.5	-0.012

LTE Band 40 (Lower side / 16QAM)

Limit		2305	2315	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	2307.4978	2312.5022		
Extreme (50C)		2307.4977	2312.5022	-29.6	-0.013
Extreme (40C)		2307.4977	2312.5022	-27.9	-0.012
Extreme (30C)		2307.4977	2312.5022	-31.7	-0.014
Extreme (10C)		2307.4977	2312.5022	-34.6	-0.015
Extreme (0C)		2307.4977	2312.5022	-31.1	-0.013
Extreme (-10C)		2307.4977	2312.5022	-34.4	-0.015
Extreme (-20C)		2307.4977	2312.5022	-24.1	-0.010
Extreme (-30C)		2307.4977	2312.5022	-35.0	-0.015
20C	15%	2307.4977	2312.5022	-28.4	-0.012
	-15%	2307.4977	2312.5022	-27.2	-0.012
	End Point	2307.4977	2312.5022	-29.3	-0.013

LTE Band 40 (Upper side / 16QAM)

Limit		2350	2360	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	2307.4978	2312.5022		
Extreme (50C)		2307.4977	2312.5022	-32.6	-0.014
Extreme (40C)		2307.4977	2312.5022	-31.9	-0.014
Extreme (30C)		2307.4977	2312.5022	-25.3	-0.011
Extreme (10C)		2307.4977	2312.5022	-34.7	-0.015
Extreme (0C)		2307.4977	2312.5022	-25.2	-0.011
Extreme (-10C)		2307.4977	2312.5022	-24.9	-0.011
Extreme (-20C)		2307.4977	2312.5022	-28.0	-0.012
Extreme (-30C)		2307.4977	2312.5022	-27.7	-0.012
20C	15%	2307.4977	2312.5022	-28.3	-0.012
	-15%	2307.4977	2312.5022	-34.1	-0.014
	End Point	2307.4977	2312.5022	-34.6	-0.015

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LTE Band 41 (Lowest Frequency: 16QAM / Highest Frequency: QPSK)

Limit		2496	2690	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	2498.4978	2687.5022		
Extreme (50C)		2498.4977	2687.5022	-27.9	-0.011
Extreme (40C)		2498.4977	2687.5022	-29.1	-0.011
Extreme (30C)		2498.4977	2687.5022	-31.0	-0.012
Extreme (10C)		2498.4977	2687.5022	-31.2	-0.012
Extreme (0C)		2498.4977	2687.5022	-34.7	-0.013
Extreme (-10C)		2498.4977	2687.5022	-34.5	-0.013
Extreme (-20C)		2498.4977	2687.5022	-27.4	-0.011
Extreme (-30C)		2498.4977	2687.5022	-29.1	-0.011
20C	15%	2498.4977	2687.5022	-33.9	-0.013
	-15%	2498.4977	2687.5022	-31.4	-0.012
	End Point	2498.4977	2687.5022	-29.6	-0.011

LTE Band 66 (16QAM)

Limit		1710	1780	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1710.6995	1779.3005		
Extreme (50C)		1710.6994	1779.3005	-21.1	-0.012
Extreme (40C)		1710.6994	1779.3005	-21.6	-0.012
Extreme (30C)		1710.6994	1779.3005	-27.4	-0.016
Extreme (10C)		1710.6994	1779.3005	-27.2	-0.016
Extreme (0C)		1710.6994	1779.3005	-27.8	-0.016
Extreme (-10C)		1710.6994	1779.3005	-31.5	-0.018
Extreme (-20C)		1710.6994	1779.3005	-25.4	-0.015
Extreme (-30C)		1710.6994	1779.3005	-30.9	-0.018
20C	15%	1710.6994	1779.3005	-24.0	-0.014
	-15%	1710.6994	1779.3005	-22.2	-0.013
	End Point	1710.6994	1779.3005	-30.7	-0.018

LTE Band 4

LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 38

LTE Band 38 (Frequency range: 2570-2620 MHz) is covered by LTE Band 41 (Frequency range: 2496-2690 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

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10. RADIATED TEST RESULTS

10.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913, §24.232, §27.50 and §90.635

LIMITS

Part 22.913(a)(5) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

Part 24.232(c) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

Part 27.50:

(a) The following power limits and related requirements apply to stations transmitting in the 2305-2320 MHz band or the 2345-2360 MHz band.

(c)(10) Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

(d)(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

(h)(2) Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

Part 90.542(a)(7) Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13dB.

TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.17; ESU40 setting reference to 971168 D01 v03r01

For radiated output power measurement with a ESU40:

a) Set the RBW ≥ OBW; b) Set VBW ≥ 3 × RBW; c) Set span ≥ 2 x RBW; d) Sweep time = auto couple; e) Detector = rms; f) Ensure that the number of measurement points ≥ span/RBW; g) Trace mode = max hold(WCDMA), average(LTE);

TEST RESULTS

10.1.1. ERP/EIRP Results

GSM

Band	Mode	Channel	f [MHz]	ERP / EIRP	
				[dBm]	[mW]
GSM850	GPRS	128	824.2	26.17	414.00
		190	836.6	26.61	458.14
		251	848.8	26.77	475.34
	EGPRS	128	824.2	21.74	149.28
		190	836.6	22.79	190.11
		251	848.8	22.59	181.55
GSM1900	GPRS	512	1850.2	28.53	712.85
		661	1880	29.55	901.57
		810	1909.8	29.14	820.35
	EGPRS	512	1850.2	24.99	315.50
		661	1880	26.16	413.05
		810	1909.8	26.18	414.95

WCDMA

Band	Mode	Channel	f [MHz]	ERP / EIRP	
				[dBm]	[mW]
Band 5	REL99	4132	826.4	18.89	77.45
		4183	836.6	**19.16**	**82.41**
		4233	846.6	18.93	78.16
	HSDPA	4132	826.4	17.20	52.48
		4183	836.6	**17.50**	**56.23**
		4233	846.6	17.41	55.08
Band 4	REL99	1312	1712.4	23.49	223.36
		1413	1732.6	**23.64**	**231.21**
		1513	1752.6	23.20	208.93
	HSDPA	1312	1712.4	21.75	149.62
		1413	1732.6	**22.53**	**179.06**
		1513	1752.6	22.12	162.93
Band 2	REL99	9262	1852.4	23.17	207.49
		9400	1880.0	**23.47**	**222.33**
		9538	1907.6	23.36	216.77
	HSDPA	9262	1852.4	**23.32**	**214.78**
		9400	1880.0	**23.32**	**214.78**
		9538	1907.6	23.02	200.45

LTE Band 2

Band	BW [MHz]	Mode	RB Size/ RB Offset	f [MHz]	ERP / EIRP [dBm]	ERP / EIRP [mW]
Band 2	20	QPSK	1 / 49	1860.0	24.59	287.74
			1 / 0	1880.0	25.05	319.89
			1 / 99	1900.0	25.25	334.97
		16QAM	1 / 49	1860.0	23.76	237.68
			1 / 99	1880.0	23.94	247.74
			1 / 99	1900.0	23.90	245.47
	15	QPSK	1 / 37	1857.5	24.86	306.20
			1 / 37	1880.0	25.12	325.09
			1 / 37	1902.5	25.66	368.13
		16QAM	1 / 37	1857.5	24.19	262.42
			1 / 37	1880.0	23.96	248.89
			1 / 37	1902.5	23.85	242.66
	10	QPSK	1 / 25	1855.0	25.49	354.00
			1 / 25	1880.0	25.13	325.84
			1 / 25	1905.0	24.81	302.69
		16QAM	1 / 25	1855.0	**24.82**	303.39
			1 / 25	1880.0	24.06	254.68
			1 / 25	1905.0	23.73	236.05
	5	QPSK	1 / 24	1852.5	25.32	340.41
			1 / 12	1880.0	24.67	293.09
			1 / 12	1907.5	24.89	308.32
		16QAM	1 / 0	1852.5	24.43	277.33
			1 / 24	1880.0	23.54	225.94
			1 / 24	1907.5	23.57	227.51
	3	QPSK	1 / 14	1851.5	**25.89**	**388.15**
			1 / 0	1880.0	25.13	325.84
			1 / 14	1908.5	24.75	298.54
		16QAM	1 / 14	1851.5	24.07	255.27
			1 / 0	1880.0	23.83	241.55
			1 / 14	1908.5	23.51	224.39
	1.4	QPSK	1 / 0	1850.7	25.85	384.59
			1 / 0	1880.0	25.35	342.77
			1 / 0	1909.3	25.42	348.34
		16QAM	1 / 0	1850.7	24.66	292.42
			1 / 0	1880.0	24.13	258.82
			1 / 3	1909.3	24.11	257.63

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LTE Band 5

Band	BW [MHz]	Mode	RB Size/ RB Offset	f [MHz]	ERP / EIRP [dBm]	ERP / EIRP [mW]
Band 5	10	QPSK	1 / 25	829.0	18.46	70.15
			1 / 25	836.5	18.39	69.02
			1 / 25	844.0	**19.49**	**88.92**
		16QAM	1 / 25	829.0	17.36	54.45
			1 / 25	836.5	17.51	56.36
			1 / 49	844.0	**18.39**	**69.02**
	5	QPSK	1 / 12	826.5	18.45	69.98
			1 / 12	836.5	**18.53**	**71.29**
			1 / 24	846.5	17.52	56.49
		16QAM	1 / 0	826.5	17.44	55.46
			1 / 24	836.5	**18.03**	**63.53**
			1 / 24	846.5	16.56	45.29
	3	QPSK	1 / 8	825.5	**18.97**	**78.89**
			1 / 0	836.5	18.92	77.98
			1 / 0	847.5	16.25	42.17
		16QAM	1 / 0	825.5	17.57	57.15
			1 / 0	836.5	**17.75**	**59.57**
			1 / 8	847.5	16.14	41.11
	1.4	QPSK	1 / 0	824.7	18.52	71.12
			1 / 0	836.5	18.68	73.79
			1 / 0	848.3	**19.06**	**80.54**
		16QAM	1 / 3	824.7	17.40	54.95
			1 / 0	836.5	17.52	56.49
			1 / 0	848.3	**18.07**	**64.12**

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LTE Band 7

Band	BW [MHz]	Mode	RB Size/ RB Offset	f [MHz]	ERP / EIRP [dBm]	ERP / EIRP [mW]
Band 7	20	QPSK	1/99	2510.0	**22.94**	**196.79**
			1/49	2535.0	22.12	162.93
			1/49	2560.0	22.82	191.43
		16QAM	1/49	2510.0	**22.12**	**162.93**
			1/99	2535.0	20.84	121.34
			1/49	2560.0	21.84	152.76
	15	QPSK	1/37	2507.5	**23.61**	**229.61**
			1/37	2535.0	20.49	111.94
			1/37	2562.5	22.97	198.15
		16QAM	1/37	2507.5	**22.68**	**185.35**
			1/37	2535.0	19.64	92.04
			1/37	2562.5	21.92	155.60
	10	QPSK	1/25	2505.0	**23.72**	**235.50**
			1/25	2535.0	22.05	160.32
			1/25	2565.0	23.06	202.30
		16QAM	1/25	2505.0	**22.81**	**190.99**
			1/25	2535.0	21.06	127.64
			1/49	2565.0	22.06	160.69
	5	QPSK	1/24	2502.5	**24.00**	**251.19**
			1/12	2535.0	22.16	164.44
			1/24	2567.5	22.93	196.34
		16QAM	1/12	2502.5	**22.90**	**194.98**
			1/12	2535.0	20.94	124.17
			1/24	2567.5	21.89	154.53

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LTE Band 12

Band	BW [MHz]	Mode	RB Size/ RB Offset	f [MHz]	ERP / EIRP [dBm]	ERP / EIRP [mW]
Band 12	10	QPSK	1/25	704.0	16.89	48.87
			1/0	707.5	**17.59**	**57.41**
			1/25	711.0	17.33	54.08
		16QAM	1/25	704.0	15.94	39.26
			1/0	707.5	16.26	42.27
			1/25	711.0	**16.28**	**42.46**
	5	QPSK	1/12	701.5	17.06	50.82
			1/24	707.5	**17.69**	**58.75**
			1/12	713.5	17.24	52.97
		16QAM	1/24	701.5	15.87	38.64
			1/12	707.5	16.65	46.24
			1/12	713.5	**16.70**	**46.77**
	3	QPSK	1/8	700.5	17.06	50.82
			1/0	707.5	**17.53**	**56.62**
			1/0	714.5	17.31	53.83
		16QAM	1/14	700.5	16.34	43.05
			1/0	707.5	16.70	46.77
			1/0	714.5	**17.19**	**52.36**
	1.4	QPSK	1/0	699.7	16.67	46.45
			1/0	707.5	**18.75**	**74.99**
			1/0	715.3	17.75	59.57
		16QAM	1/3	699.7	15.60	36.31
			1/0	707.5	16.08	40.55
			1/3	715.3	**16.40**	**43.65**

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LTE Band 14

Band	BW	Mode	RB size / RB Offset	f [MHz]	ERP / EIRP	
	[MHz]				[dBm]	[mW]
Band 14	10	QPSK	1/49	793.0	20.97	125.03
		16QAM	1/25	793.0	19.56	90.36
	5	QPSK	1/24	790.5	20.44	110.66
			1/12	793.0	20.50	112.20
			1/24	795.5	**20.70**	**117.49**
		16QAM	1/12	790.5	19.50	89.13
			1/12	793.0	19.59	90.99
			1/12	795.5	**19.73**	**93.97**

LTE Band 30

Band	BW [MHz]	Mode	RB Size/ RB Offset	f [MHz]	ERP / EIRP [dBm]	ERP / EIRP [mW]
Band 30	10	QPSK	1/25	2310.0	22.66	184.50
		16QAM	1/25	2310.0	21.43	139.00
	5	QPSK	1/24	2307.5	**22.47**	**176.60**
			1/24	2310.0	22.32	170.61
			1/24	2312.5	21.51	141.58
		16QAM	1/24	2307.5	21.21	132.13
			1/24	2310.0	21.31	135.21
			1/0	2312.5	**22.16**	**164.44**

LTE Band 40

Band	BW [MHz]	Mode	RB size / RB Offset	f [MHz]	ERP / EIRP [dBm]	ERP / EIRP [mW]
Band 40	10	QPSK	1/25	2310.0	**16.06**	**40.36**
			1/25	2355.0	15.39	34.59
		16QAM	1/25	2310.0	**17.39**	**54.83**
			1/25	2355.0	16.96	49.66
	5	QPSK	1/12	2307.5	16.24	42.07
			1/12	2310.0	15.69	37.07
			1/12	2312.5	**17.26**	53.21
			1/0	2352.5	16.36	43.25
			1/0	2355.0	15.98	39.63
			1/0	2357.5	16.82	48.08
		16QAM	1/12	2307.5	**17.42**	**55.21**
			1/12	2310.0	16.54	45.08
			1/24	2312.5	16.81	47.97
			1/24	2352.5	15.94	39.26
			1/24	2355.0	17.31	53.83
			1/0	2357.5	16.17	**41.40**

LTE Band 41

Band	BW [MHz]	Mode	RB Size/ RB Offset	f [MHz]	ERP / EIRP [dBm]	ERP / EIRP [mW]
Band 41	20	QPSK	1/49	2506.0	**21.07**	**127.94**
			1/49	2593.0	20.26	106.17
			1/49	2680.0	17.32	53.95
		16QAM	1/49	2506.0	**20.50**	**112.20**
			1/49	2593.0	18.81	76.03
			1/49	2680.0	15.90	38.90
	15	QPSK	1/37	2503.5	**21.66**	**146.55**
			1/37	2593.0	19.46	88.31
			1/37	2682.5	17.07	50.93
		16QAM	1/37	2503.5	**20.32**	**107.65**
			1/74	2593.0	18.78	75.51
			1/74	2682.5	14.42	27.67
	10	QPSK	1/25	2501.0	**22.00**	**158.49**
			1/25	2593.0	19.41	87.30
			1/25	2685.0	16.93	49.32
		16QAM	1/25	2501.0	**21.38**	**137.40**
			1/25	2593.0	19.15	82.22
			1/25	2685.0	15.73	37.41
	5	QPSK	1/12	2498.5	**22.22**	**166.72**
			1/24	2593.0	20.59	114.55
			1/0	2687.5	17.05	50.70
		16QAM	1/24	2498.5	**21.06**	**127.64**
			1/24	2593.0	18.90	77.62
			1/24	2687.5	14.93	31.12

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LTE Band 66

Band	BW	Mode	RB Size/	f [MHz]	ERP / EIRP	
	[MHz]		RB Offset		[dBm]	[mW]
Band 66	20	QPSK	1/49	1720.0	25.69	370.68
			1/49	1745.0	**26.40**	**436.52**
			1/49	1770.0	25.85	384.59
		16QAM	1/99	1720.0	**24.83**	**304.09**
			1/49	1745.0	**24.83**	**304.09**
			1/49	1770.0	24.46	279.25
	15	QPSK	1/37	1717.5	25.26	335.74
			1/37	1747.5	**26.40**	**436.52**
			1/37	1772.5	25.79	379.31
		16QAM	1/37	1717.5	24.23	264.85
			1/37	1747.5	**25.31**	**339.63**
			1/37	1772.5	24.71	295.80
	10	QPSK	1/25	1715.0	25.22	332.66
			1/25	1745.0	**26.55**	**451.86**
			1/25	1775.0	25.68	369.83
		16QAM	1/25	1715.0	24.27	267.30
			1/25	1745.0	**25.18**	**329.61**
			1/25	1775.0	24.59	287.74
	5	QPSK	1/12	1712.5	25.51	355.63
			1/12	1745.0	**26.25**	**421.70**
			1/12	1777.5	25.16	328.10
		16QAM	1/24	1712.5	**25.70**	**371.54**
			1/12	1745.0	24.94	311.89
			1/24	1777.5	23.87	243.78
	3	QPSK	1/8	1711.5	24.71	295.80
			1/0	1745.0	**26.57**	**453.94**
			1/8	1710.7	25.49	354.00
		16QAM	1/8	1711.5	24.73	297.17
			1/0	1745.0	**25.22**	**332.66**
			1/8	1710.7	24.13	258.82
	1.4	QPSK	1/0	1710.7	25.55	358.92
			1/0	1745.0	**26.58**	**454.99**
			1/3	1779.3	25.27	336.51
		16QAM	1/5	1710.7	24.52	283.14
			1/0	1745.0	**25.39**	**345.94**
			1/0	1779.3	24.23	264.85

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LTE Band 4

LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 38

LTE Band 38 (Frequency range: 2570-2620 MHz) is covered by LTE Band 41 (Frequency range: 2496-2690 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

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10.1.2. ERP/EIRP DATA

GSM850

GSM850

GPRS

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-04
Test Engineer: 45585
Configuration: EUT / Z-Position
Location: Chamber 2
Mode: GPRS 850 MHz Fundamentals

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.20	30.66	V	3.0	-1.5	26.17	38.5	-12.3	
824.20	23.44	H	3.0	-1.5	18.95	38.5	-19.5	
Mid Ch								
836.60	31.07	V	3.0	-1.4	26.61	38.5	-11.9	
836.60	22.85	H	3.0	-1.4	18.39	38.5	-20.1	
High Ch								
848.80	31.21	V	3.1	-1.4	26.77	38.5	-11.7	
848.80	23.78	H	3.1	-1.4	19.34	38.5	-19.2	

GSM850

EGPRS

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-04
Test Engineer: 45585
Configuration: EUT / Z-Position
Location: Chamber 2
Mode: EGPRS 850 MHz Fundamentals

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.20	26.23	V	3.0	-1.5	21.74	38.5	-16.8	
824.20	18.66	H	3.0	-1.5	14.17	38.5	-24.3	
Mid Ch								
836.60	27.25	V	3.0	-1.4	22.79	38.5	-15.7	
836.60	19.17	H	3.0	-1.4	14.71	38.5	-23.8	
High Ch								
848.80	27.03	V	3.1	-1.4	22.59	38.5	-15.9	
848.80	19.98	H	3.1	-1.4	15.54	38.5	-23.0	

GSM1900

GSM1900

GPRS

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	45585
Configuration:	EUT / Y-Position
Location:	Chamber 2
Mode:	GPRS 1900 MHz Fundamentals

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1850.20	23.61	V	4.5	9.4	28.53	33.0	-4.5	
1850.20	17.54	H	4.5	9.4	22.46	33.0	-10.5	
Mid Ch								
1880.00	24.89	V	4.5	9.2	29.55	33.0	-3.5	
1880.00	18.95	H	4.5	9.2	23.62	33.0	-9.4	
High Ch								
1909.80	24.78	V	4.6	8.9	29.14	33.0	-3.9	
1909.80	19.85	H	4.6	8.9	24.21	33.0	-8.8	

GSM1900

EGPRS

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	45585
Configuration:	EUT / Y-Position
Location:	Chamber 2
Mode:	EGPRS 1900 MHz Fundamentals

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1850.20	20.07	V	4.5	9.4	24.99	33.0	-8.0	
1850.20	14.50	H	4.5	9.4	19.42	33.0	-13.6	
Mid Ch								
1880.00	21.50	V	4.5	9.2	26.16	33.0	-6.8	
1880.00	16.69	H	4.5	9.2	21.36	33.0	-11.6	
High Ch								
1909.80	21.82	V	4.6	8.9	26.18	33.0	-6.8	
1909.80	16.97	H	4.6	8.9	21.33	33.0	-11.7	

WCDMA Band 5

WCDMA

Band 5
REL99

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-04
Test Engineer: 45585
Configuration: EUT / Z-Position
Location: Chamber 2
Mode: Rel99 Band 5 Fundamentals

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.40	23.37	V	3.0	-1.5	18.89	38.5	-19.6	
826.40	16.65	H	3.0	-1.5	12.17	38.5	-26.3	
Mid Ch								
836.60	23.62	V	3.0	-1.4	19.16	38.5	-19.3	
836.60	17.40	H	3.0	-1.4	12.94	38.5	-25.6	
High Ch								
846.60	23.37	V	3.1	-1.4	18.93	38.5	-19.6	
846.60	17.45	H	3.1	-1.4	13.01	38.5	-25.5	

WCDMA

Band 5
HSDPA

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-04
Test Engineer: 45585
Configuration: EUT / Z-Position
Location: Chamber 2
Mode: HSDPA Band 5 Fundamentals

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.40	21.68	V	3.0	-1.5	17.20	38.5	-21.3	
826.40	16.09	H	3.0	-1.5	11.61	38.5	-26.9	
Mid Ch								
836.60	21.96	V	3.0	-1.4	17.50	38.5	-21.0	
836.60	16.03	H	3.0	-1.4	11.57	38.5	-26.9	
High Ch								
846.60	21.85	V	3.1	-1.4	17.41	38.5	-21.1	
846.60	15.77	H	3.1	-1.4	11.33	38.5	-27.2	

WCDMA Band 4

WCDMA

Band 4
REL99

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-06
Test Engineer: 47989
Configuration: EUT / X-Position
Location: Chamber 2
Mode: Rel99 Band 4 Fundamentals

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1712.40	10.59	V	4.3	9.3	15.61	30.0	-14.4	
1712.40	18.47	H	4.3	9.3	23.49	30.0	-6.5	
Mid Ch								
1732.60	12.10	V	4.3	9.4	17.16	30.0	-12.8	
1732.60	18.58	H	4.3	9.4	23.64	30.0	-6.4	
High Ch								
1752.60	11.37	V	4.4	9.5	16.48	30.0	-13.5	
1752.60	18.09	H	4.4	9.5	23.20	30.0	-6.8	

WCDMA

Band 4
HSDPA

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-06
Test Engineer: 47989
Configuration: EUT / X-Position
Location: Chamber 2
Mode: HSDPA Band 4 Fundamentals

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1712.40	9.91	V	4.3	9.3	14.93	30.0	-15.1	
1712.40	16.73	H	4.3	9.3	21.75	30.0	-8.3	
Mid Ch								
1732.60	11.37	V	4.3	9.4	16.43	30.0	-13.6	
1732.60	17.47	H	4.3	9.4	22.53	30.0	-7.5	
High Ch								
1752.60	10.66	V	4.4	9.5	15.77	30.0	-14.2	
1752.60	17.01	H	4.4	9.5	22.12	30.0	-7.9	

WCDMA Band 2

WCDMA

Band 2
REL99

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-20
Test Engineer: 47989
Configuration: EUT/ Y-Position
Location: Chamber 1
Mode: Rel99 Band 2 Fundamentals

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1852.40	18.17	V	4.5	9.5	23.17	33.0	-9.8	
1852.40	14.35	H	4.5	9.5	19.35	33.0	-13.7	
Mid Ch								
1880.00	18.69	V	4.5	9.3	23.47	33.0	-9.5	
1880.00	15.04	H	4.5	9.3	19.81	33.0	-13.2	
High Ch								
1907.60	18.85	V	4.6	9.1	23.36	33.0	-9.6	
1907.60	15.99	H	4.6	9.1	20.51	33.0	-12.5	

WCDMA

Band 2
HSDPA

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-20
Test Engineer: 47989
Configuration: EUT/ Y-Position
Location: Chamber 1
Mode: HSDPA Band 2 Fundamentals

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1852.40	18.32	V	4.5	9.5	23.32	33.0	-9.7	
1852.40	14.32	H	4.5	9.5	19.32	33.0	-13.7	
Mid Ch								
1880.00	18.54	V	4.5	9.3	23.32	33.0	-9.7	
1880.00	15.18	H	4.5	9.3	19.95	33.0	-13.0	
High Ch								
1907.60	18.51	V	4.6	9.1	23.02	33.0	-10.0	
1907.60	16.08	H	4.6	9.1	20.60	33.0	-12.4	

LTE Band 2

LTE Band 2 20MHz QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 2 Fundamentals, 20MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1860.00	15.69	V	4.5	9.4	20.63	33.0	-12.4	
1860.00	19.66	H	4.5	9.4	24.59	33.0	-8.4	
Mid Ch								
1880.00	16.99	V	4.5	9.3	21.77	33.0	-11.2	
1880.00	20.28	H	4.5	9.3	25.05	33.0	-7.9	
High Ch								
1900.00	16.40	V	4.6	9.2	21.01	33.0	-12.0	
1900.00	20.63	H	4.6	9.2	25.25	33.0	-7.7	

LTE Band 2 20MHz 16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_16QAM Band 2 Fundamentals, 20MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1860.00	14.66	V	4.5	9.4	19.60	33.0	-13.4	
1860.00	18.83	H	4.5	9.4	23.76	33.0	-9.2	
Mid Ch								
1880.00	15.68	V	4.5	9.3	20.46	33.0	-12.5	
1880.00	19.17	H	4.5	9.3	23.94	33.0	-9.1	
High Ch								
1900.00	14.80	V	4.6	9.2	19.41	33.0	-13.6	
1900.00	19.28	H	4.6	9.2	23.90	33.0	-9.1	

LTE

Band 2

15MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 2 Fundamentals, 15MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1857.50	15.10	V	4.5	9.5	20.05	33.0	-12.9	
1857.50	19.91	H	4.5	9.5	24.86	33.0	-8.1	
Mid Ch								
1880.00	16.88	V	4.5	9.3	21.66	33.0	-11.3	
1880.00	20.35	H	4.5	9.3	25.12	33.0	-7.9	
High Ch								
1902.50	16.50	V	4.6	9.1	21.09	33.0	-11.9	
1902.50	21.08	H	4.6	9.1	25.66	33.0	-7.3	

LTE

Band 2

15MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_16QAM Band 2 Fundamentals, 15MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1857.50	13.78	V	4.5	9.5	18.73	33.0	-14.3	
1857.50	19.24	H	4.5	9.5	24.19	33.0	-8.8	
Mid Ch								
1880.00	15.93	V	4.5	9.3	20.71	33.0	-12.3	
1880.00	19.19	H	4.5	9.3	23.96	33.0	-9.0	
High Ch								
1902.50	15.50	V	4.6	9.1	20.09	33.0	-12.9	
1902.50	19.27	H	4.6	9.1	23.85	33.0	-9.1	

LTE

Band 2

10MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 2 Fundamentals, 10MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1855.00	15.17	V	4.5	9.5	20.14	33.0	-12.9	
1855.00	20.52	H	4.5	9.5	25.49	33.0	-7.5	
Mid Ch								
1880.00	16.65	V	4.5	9.3	21.43	33.0	-11.6	
1880.00	20.36	H	4.5	9.3	25.13	33.0	-7.9	
High Ch								
1905.00	14.05	V	4.6	9.1	18.60	33.0	-14.4	
1905.00	20.26	H	4.6	9.1	24.81	33.0	-8.2	

LTE

Band 2

10MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_16QAM Band 2 Fundamentals, 10MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1855.00	13.71	V	4.5	9.5	18.68	33.0	-14.3	
1855.00	19.85	H	4.5	9.5	24.82	33.0	-8.2	
Mid Ch								
1880.00	15.50	V	4.5	9.3	20.28	33.0	-12.7	
1880.00	19.29	H	4.5	9.3	24.06	33.0	-8.9	
High Ch								
1905.00	12.84	V	4.6	9.1	17.39	33.0	-15.6	
1905.00	19.18	H	4.6	9.1	23.73	33.0	-9.3	

LTE

Band 2

5MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 2 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1852.50	14.99	V	4.5	9.5	19.99	33.0	-13.0	
1852.50	20.32	H	4.5	9.5	25.32	33.0	-7.7	
Mid Ch								
1880.00	16.47	V	4.5	9.3	21.25	33.0	-11.8	
1880.00	19.90	H	4.5	9.3	24.67	33.0	-8.3	
High Ch								
1907.50	14.03	V	4.6	9.1	18.55	33.0	-14.4	
1907.50	20.37	H	4.6	9.1	24.89	33.0	-8.1	

LTE

Band 2

5MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_16QAM Band 2 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1852.50	13.84	V	4.5	9.5	18.84	33.0	-14.2	
1852.50	19.43	H	4.5	9.5	24.43	33.0	-8.6	
Mid Ch								
1880.00	15.53	V	4.5	9.3	20.31	33.0	-12.7	
1880.00	18.77	H	4.5	9.3	23.54	33.0	-9.5	
High Ch								
1907.50	13.02	V	4.6	9.1	17.54	33.0	-15.5	
1907.50	19.05	H	4.6	9.1	23.57	33.0	-9.4	

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LTE

Band 2

3MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 2 Fundamentals, 3MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1851.50	15.03	V	4.5	9.5	20.04	33.0	-13.0	
1851.50	20.89	H	4.5	9.5	25.89	33.0	-7.1	
Mid Ch								
1880.00	16.24	V	4.5	9.3	21.02	33.0	-12.0	
1880.00	20.36	H	4.5	9.3	25.13	33.0	-7.9	
High Ch								
1908.50	14.21	V	4.6	9.1	18.72	33.0	-14.3	
1908.50	20.25	H	4.6	9.1	24.75	33.0	-8.2	

LTE

Band 2

3MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_16QAM Band 2 Fundamentals, 3MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1851.50	14.26	V	4.5	9.5	19.27	33.0	-13.7	
1851.50	19.07	H	4.5	9.5	24.07	33.0	-8.9	
Mid Ch								
1880.00	15.01	V	4.5	9.3	19.79	33.0	-13.2	
1880.00	19.06	H	4.5	9.3	23.83	33.0	-9.2	
High Ch								
1908.50	13.00	V	4.6	9.1	17.51	33.0	-15.5	
1908.50	19.01	H	4.6	9.1	23.51	33.0	-9.5	

LTE

Band 2

1.4MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 2 Fundamentals, 1.4MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1850.70	15.50	V	4.5	9.5	20.51	33.0	-12.5	
1850.70	20.84	H	4.5	9.5	25.85	33.0	-7.2	
Mid Ch								
1880.00	16.81	V	4.5	9.3	21.59	33.0	-11.4	
1880.00	20.58	H	4.5	9.3	25.35	33.0	-7.6	
High Ch								
1909.30	14.46	V	4.6	9.1	18.95	33.0	-14.0	
1909.30	20.93	H	4.6	9.1	25.42	33.0	-7.6	

LTE

Band 2

1.4MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-20
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 1
Mode:	LTE_16QAM Band 2 Fundamentals, 1.4MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168717], and Chamber 1 SMA Cables
Substitution: Horn 3115[00167211], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1850.70	13.75	V	4.5	9.5	18.76	33.0	-14.2	
1850.70	19.65	H	4.5	9.5	24.66	33.0	-8.3	
Mid Ch								
1880.00	15.66	V	4.5	9.3	20.44	33.0	-12.6	
1880.00	19.36	H	4.5	9.3	24.13	33.0	-8.9	
High Ch								
1909.30	13.43	V	4.6	9.1	17.92	33.0	-15.1	
1909.30	19.62	H	4.6	9.1	24.11	33.0	-8.9	

LTE Band 5

LTE Band 5 10MHz QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / Z-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 5 Fundamentals, 10MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
829.00	22.94	V	3.0	-1.5	18.46	38.5	-20.0	
829.00	17.88	H	3.0	-1.5	13.40	38.5	-25.1	
Mid Ch								
836.50	22.85	V	3.0	-1.4	18.39	38.5	-20.1	
836.50	17.44	H	3.0	-1.4	12.97	38.5	-25.5	
High Ch								
844.00	23.94	V	3.1	-1.4	19.49	38.5	-19.0	
844.00	17.07	H	3.1	-1.4	12.62	38.5	-25.9	

LTE Band 5 10MHz 16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / Z-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 5 Fundamentals, 10MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
829.00	21.84	V	3.0	-1.5	17.36	38.5	-21.1	
829.00	16.49	H	3.0	-1.5	12.01	38.5	-26.5	
Mid Ch								
836.50	21.97	V	3.0	-1.4	17.51	38.5	-21.0	
836.50	16.79	H	3.0	-1.4	12.32	38.5	-26.2	
High Ch								
844.00	22.84	V	3.1	-1.4	18.39	38.5	-20.1	
844.00	16.40	H	3.1	-1.4	11.95	38.5	-26.6	

LTE

Band 5

5MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / Z-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 5 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.50	22.94	V	3.0	-1.5	18.45	38.5	-20.0	
826.50	17.33	H	3.0	-1.5	12.85	38.5	-25.7	
Mid Ch								
836.50	22.99	V	3.0	-1.4	18.53	38.5	-20.0	
836.50	17.55	H	3.0	-1.4	13.08	38.5	-25.4	
High Ch								
846.50	21.97	V	3.1	-1.4	17.52	38.5	-21.0	
846.50	17.49	H	3.1	-1.4	13.04	38.5	-25.5	

LTE

Band 5

5MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / Z-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 5 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
826.50	21.93	V	3.0	-1.5	17.44	38.5	-21.1	
826.50	16.16	H	3.0	-1.5	11.68	38.5	-26.8	
Mid Ch								
836.50	22.49	V	3.0	-1.4	18.03	38.5	-20.5	
836.50	17.34	H	3.0	-1.4	12.87	38.5	-25.6	
High Ch								
846.50	21.01	V	3.1	-1.4	16.56	38.5	-21.9	
846.50	16.59	H	3.1	-1.4	12.14	38.5	-26.4	

LTE

Band 5

3MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / Z-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 5 Fundamentals, 3MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
825.50	23.45	V	3.0	-1.5	18.97	38.5	-19.5	
825.50	17.28	H	3.0	-1.5	12.79	38.5	-25.7	
Mid Ch								
836.50	23.38	V	3.0	-1.4	18.92	38.5	-19.6	
836.50	17.57	H	3.0	-1.4	13.10	38.5	-25.4	
High Ch								
847.50	20.69	V	3.1	-1.4	16.25	38.5	-22.2	
847.50	19.21	H	3.1	-1.4	14.77	38.5	-23.7	

LTE

Band 5

3MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / Z-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 5 Fundamentals, 3MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
825.50	22.05	V	3.0	-1.5	17.57	38.5	-20.9	
825.50	16.93	H	3.0	-1.5	12.44	38.5	-26.1	
Mid Ch								
836.50	22.21	V	3.0	-1.4	17.75	38.5	-20.8	
836.50	16.48	H	3.0	-1.4	12.01	38.5	-26.5	
High Ch								
847.50	20.58	V	3.1	-1.4	16.14	38.5	-22.4	
847.50	16.67	H	3.1	-1.4	12.23	38.5	-26.3	

LTE

Band 5

1.4MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / Z-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 5 Fundamentals, 1.4MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.70	23.00	V	3.0	-1.5	18.52	38.5	-20.0	
824.70	17.12	H	3.0	-1.5	12.63	38.5	-25.9	
Mid Ch								
836.50	23.14	V	3.0	-1.4	18.68	38.5	-19.8	
836.50	17.58	H	3.0	-1.4	13.11	38.5	-25.4	
High Ch								
848.30	23.50	V	3.1	-1.4	19.06	38.5	-19.4	
848.30	17.78	H	3.1	-1.4	13.34	38.5	-25.2	

LTE

Band 5

1.4MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / Z-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 5 Fundamentals, 1.4MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
824.70	21.88	V	3.0	-1.5	17.40	38.5	-21.1	
824.70	16.20	H	3.0	-1.5	11.71	38.5	-26.8	
Mid Ch								
836.50	21.98	V	3.0	-1.4	17.52	38.5	-21.0	
836.50	16.48	H	3.0	-1.4	12.01	38.5	-26.5	
High Ch								
848.30	22.51	V	3.1	-1.4	18.07	38.5	-20.4	
848.30	16.47	H	3.1	-1.4	12.03	38.5	-26.5	

LTE Band 7

LTE Band 7 20MHz QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-04
Test Engineer: 45585
Configuration: EUT / Y-Position
Location: Chamber 2
Mode: LTE_QPSK Band 7 Fundamentals, 20MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2510.00	16.18	V	5.3	10.1	21.00	33.0	-12.0	
2510.00	18.12	H	5.3	10.1	22.94	33.0	-10.1	
Mid Ch								
2535.00	15.78	V	5.3	10.0	20.54	33.0	-12.5	
2535.00	17.35	H	5.3	10.0	22.12	33.0	-10.9	
High Ch								
2560.00	16.49	V	5.3	10.0	21.20	33.0	-11.8	
2560.00	18.12	H	5.3	10.0	22.82	33.0	-10.2	

LTE Band 7 20MHz 16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-04
Test Engineer: 45585
Configuration: EUT / Y-Position
Location: Chamber 2
Mode: LTE_16QAM Band 7 Fundamentals, 20MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2510.00	15.84	V	5.3	10.1	20.66	33.0	-12.3	
2510.00	17.30	H	5.3	10.1	22.12	33.0	-10.9	
Mid Ch								
2535.00	14.44	V	5.3	10.0	19.20	33.0	-13.8	
2535.00	16.07	H	5.3	10.0	20.84	33.0	-12.2	
High Ch								
2560.00	15.29	V	5.3	10.0	20.00	33.0	-13.0	
2560.00	17.14	H	5.3	10.0	21.84	33.0	-11.2	

LTE

Band 7

15MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	45585
Configuration:	EUT / Y-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 7 Fundamentals, 15MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2507.50	17.34	V	5.3	10.1	22.17	33.0	-10.8	
2507.50	18.78	H	5.3	10.1	23.61	33.0	-9.4	
Mid Ch								
2535.00	15.73	V	5.3	10.0	20.49	33.0	-12.5	
2535.00	12.26	H	5.3	10.0	17.03	33.0	-16.0	
High Ch								
2562.50	16.50	V	5.3	10.0	21.20	33.0	-11.8	
2562.50	18.26	H	5.3	10.0	22.97	33.0	-10.0	

LTE

Band 7

15MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	45585
Configuration:	EUT / Y-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 7 Fundamentals, 15MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2507.50	16.18	V	5.3	10.1	21.01	33.0	-12.0	
2507.50	17.85	H	5.3	10.1	22.68	33.0	-10.3	
Mid Ch								
2535.00	14.88	V	5.3	10.0	19.64	33.0	-13.4	
2535.00	11.02	H	5.3	10.0	15.79	33.0	-17.2	
High Ch								
2562.50	15.58	V	5.3	10.0	20.28	33.0	-12.7	
2562.50	17.21	H	5.3	10.0	21.92	33.0	-11.1	

LTE

Band 7

10MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	45585
Configuration:	EUT / Y-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 7 Fundamentals, 10MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2505.00	17.26	V	5.2	10.1	22.09	33.0	-10.9	
2505.00	18.89	H	5.2	10.1	23.72	33.0	-9.3	
Mid Ch								
2535.00	15.02	V	5.3	10.0	19.78	33.0	-13.2	
2535.00	17.28	H	5.3	10.0	22.05	33.0	-11.0	
High Ch								
2565.00	16.31	V	5.3	10.0	21.01	33.0	-12.0	
2565.00	18.36	H	5.3	10.0	23.06	33.0	-9.9	

LTE

Band 7

10MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	45585
Configuration:	EUT / Y-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 7 Fundamentals, 10MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2505.00	16.50	V	5.2	10.1	21.33	33.0	-11.7	
2505.00	17.98	H	5.2	10.1	22.81	33.0	-10.2	
Mid Ch								
2535.00	13.60	V	5.3	10.0	18.36	33.0	-14.6	
2535.00	16.29	H	5.3	10.0	21.06	33.0	-11.9	
High Ch								
2565.00	15.25	V	5.3	10.0	19.95	33.0	-13.0	
2565.00	17.36	H	5.3	10.0	22.06	33.0	-10.9	

LTE

Band 7

5MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	45585
Configuration:	EUT / Y-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 7 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2502.50	17.21	V	5.2	10.1	22.05	33.0	-11.0	
2502.50	19.16	H	5.2	10.1	24.00	33.0	-9.0	
Mid Ch								
2535.00	15.15	V	5.3	10.0	19.91	33.0	-13.1	
2535.00	17.39	H	5.3	10.0	22.16	33.0	-10.8	
High Ch								
2567.50	16.35	V	5.3	10.0	21.04	33.0	-12.0	
2567.50	18.24	H	5.3	10.0	22.93	33.0	-10.1	

LTE

Band 7

5MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	45585
Configuration:	EUT / Y-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 7 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00167451], 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
2502.50	15.76	V	5.2	10.1	20.60	33.0	-12.4	
2502.50	18.06	H	5.2	10.1	22.90	33.0	-10.1	
Mid Ch								
2535.00	14.04	V	5.3	10.0	18.80	33.0	-14.2	
2535.00	16.17	H	5.3	10.0	20.94	33.0	-12.1	
High Ch								
2567.50	15.03	V	5.3	10.0	19.72	33.0	-13.3	
2567.50	17.20	H	5.3	10.0	21.89	33.0	-11.1	

LTE Band 12

LTE Band 12 10MHz QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-04
Test Engineer: 47989
Configuration: EUT / X-Position
Location: Chamber 2
Mode: LTE_QPSK Band 12 Fundamentals, 10MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
704.00	14.05	V	2.8	-1.6	9.67	34.8	-25.1	
704.00	21.28	H	2.8	-1.6	16.89	34.8	-17.9	
Mid Ch								
707.50	14.20	V	2.8	-1.6	9.82	34.8	-25.0	
707.50	21.97	H	2.8	-1.6	17.59	34.8	-17.2	
High Ch								
711.00	14.27	V	2.8	-1.6	9.87	34.8	-24.9	
711.00	21.73	H	2.8	-1.6	17.33	34.8	-17.5	

LTE Band 12 10MHz 16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: Samsung
Project #: 4788768228
Date: 2019-03-04
Test Engineer: 47989
Configuration: EUT / X-Position
Location: Chamber 2
Mode: LTE_16QAM Band 12 Fundamentals, 10MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
704.00	12.86	V	2.8	-1.6	8.48	34.8	-26.3	
704.00	20.33	H	2.8	-1.6	15.94	34.8	-18.9	
Mid Ch								
707.50	13.12	V	2.8	-1.6	8.74	34.8	-26.1	
707.50	20.64	H	2.8	-1.6	16.26	34.8	-18.5	
High Ch								
711.00	13.75	V	2.8	-1.6	9.35	34.8	-25.4	
711.00	20.68	H	2.8	-1.6	16.28	34.8	-18.5	

LTE

Band 12

5MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 12 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
701.50	14.27	V	2.8	-1.6	9.89	34.8	-24.9	
701.50	21.44	H	2.8	-1.6	17.06	34.8	-17.7	
Mid Ch								
707.50	14.39	V	2.8	-1.6	10.01	34.8	-24.8	
707.50	22.07	H	2.8	-1.6	17.69	34.8	-17.1	
High Ch								
713.50	14.79	V	2.8	-1.6	10.39	34.8	-24.4	
713.50	21.63	H	2.8	-1.6	17.24	34.8	-17.6	

LTE

Band 12

5MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 12 Fundamentals, 5MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
701.50	13.44	V	2.8	-1.6	9.06	34.8	-25.7	
701.50	20.25	H	2.8	-1.6	15.87	34.8	-18.9	
Mid Ch								
707.50	13.68	V	2.8	-1.6	9.30	34.8	-25.5	
707.50	21.03	H	2.8	-1.6	16.65	34.8	-18.2	
High Ch								
713.50	13.71	V	2.8	-1.6	9.31	34.8	-25.5	
713.50	21.09	H	2.8	-1.6	16.70	34.8	-18.1	

LTE

Band 12

3MHz

QPSK

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 12 Fundamentals, 3MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
700.50	14.06	V	2.8	-1.6	9.68	34.8	-25.1	
700.50	21.44	H	2.8	-1.6	17.06	34.8	-17.7	
Mid Ch								
707.50	14.50	V	2.8	-1.6	10.12	34.8	-24.7	
707.50	21.91	H	2.8	-1.6	17.53	34.8	-17.3	
High Ch								
714.50	14.85	V	2.8	-1.6	10.45	34.8	-24.3	
714.50	21.71	H	2.8	-1.6	17.31	34.8	-17.5	

LTE

Band 12

3MHz

16QAM

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company:	Samsung
Project #:	4788768228
Date:	2019-03-04
Test Engineer:	47989
Configuration:	EUT / X-Position
Location:	Chamber 2
Mode:	LTE_16QAM Band 12 Fundamentals, 3MHz Bandwidth

Test Equpment:
Receiving: VULB9163-749, and Chamber 2 SMA Cables
Substitution: Dipole 3121_DB4, 8.5m SMA-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
700.50	12.67	V	2.8	-1.6	8.29	34.8	-26.5	
700.50	20.72	H	2.8	-1.6	16.34	34.8	-18.5	
Mid Ch								
707.50	13.43	V	2.8	-1.6	9.05	34.8	-25.8	
707.50	21.08	H	2.8	-1.6	16.70	34.8	-18.1	
High Ch								
714.50	14.15	V	2.8	-1.6	9.75	34.8	-25.0	
714.50	21.59	H	2.8	-1.6	17.19	34.8	-17.6	