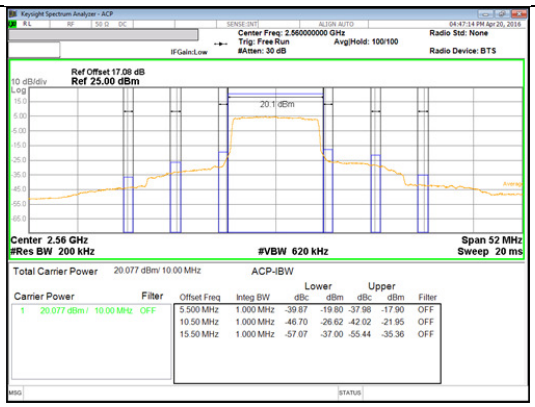
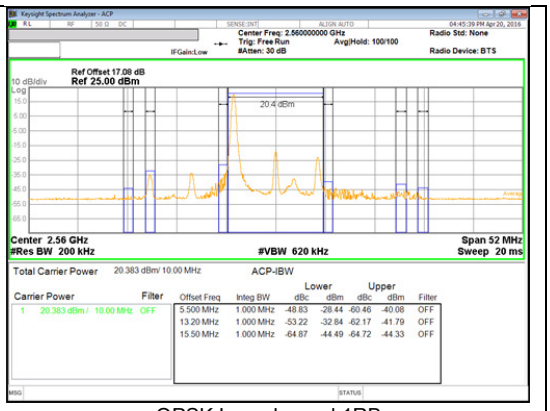
Band 41

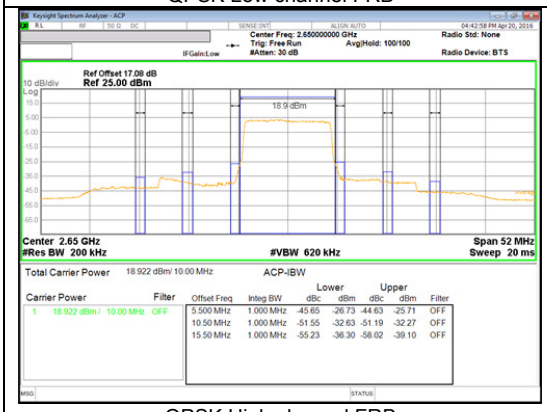
10MHz



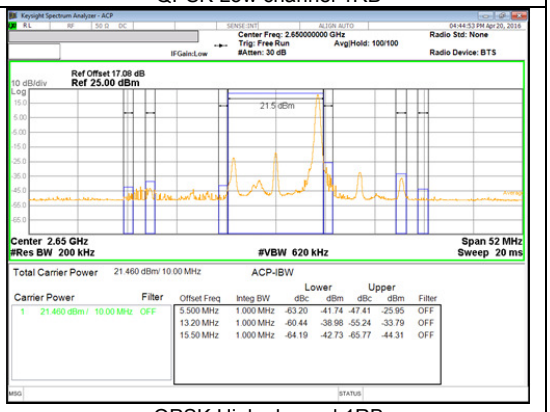
QPSK Low channel FRB



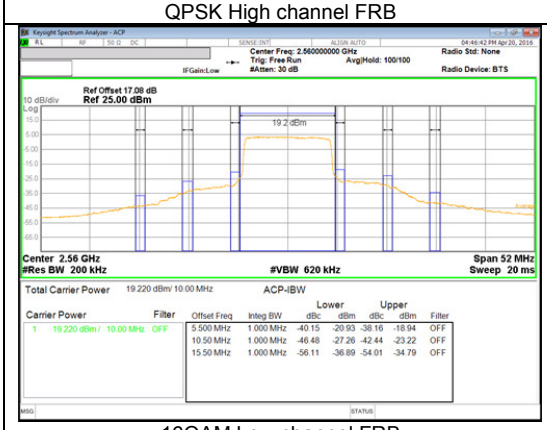
QPSK Low channel 1RB



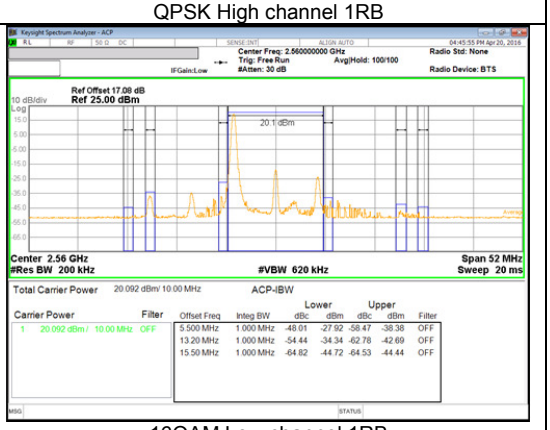
QPSK High channel FRB



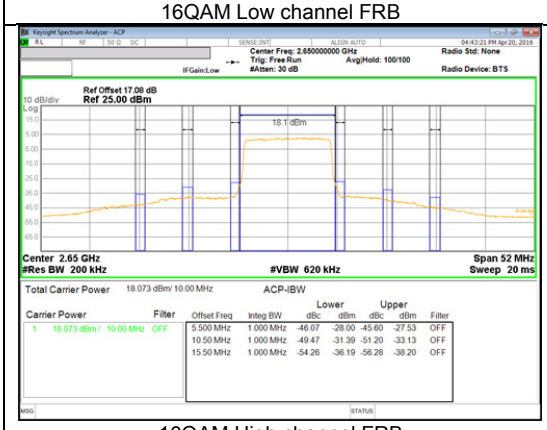
QPSK High channel 1RB



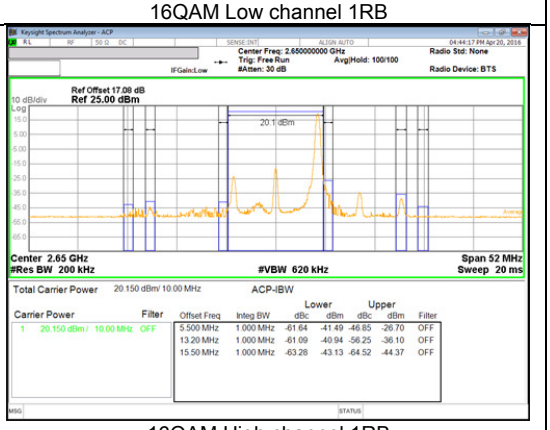
16QAM Low channel FRB



16QAM Low channel 1RB



16QAM High channel FRB



16QAM High channel 1RB

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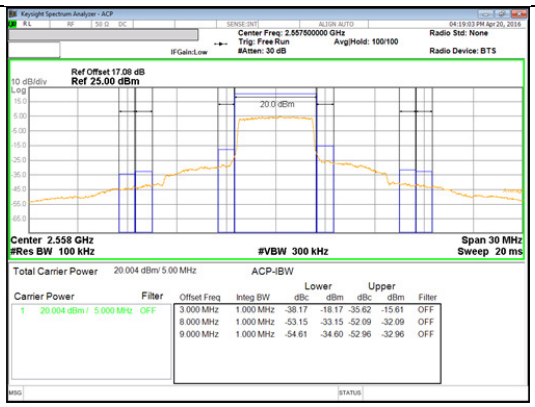
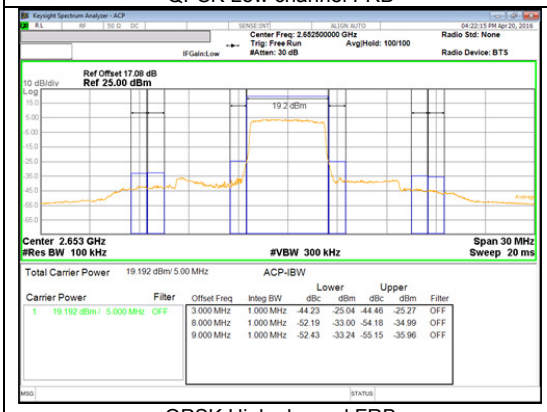
Band 41

5MHz

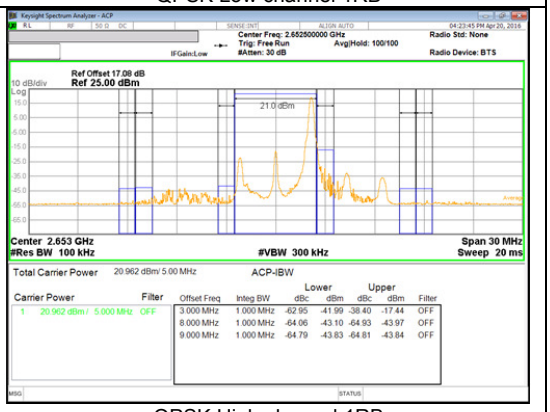


QPSK Low channel FRB

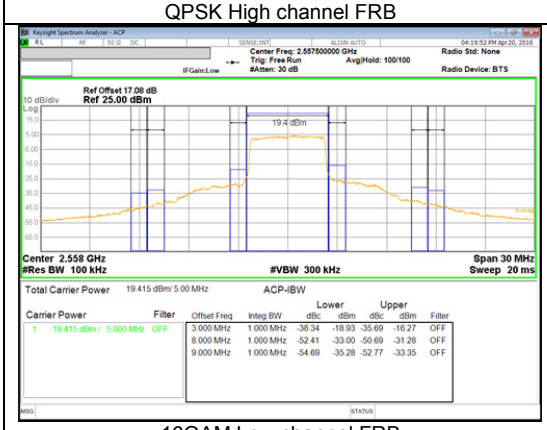
QPSK Low channel 1RB



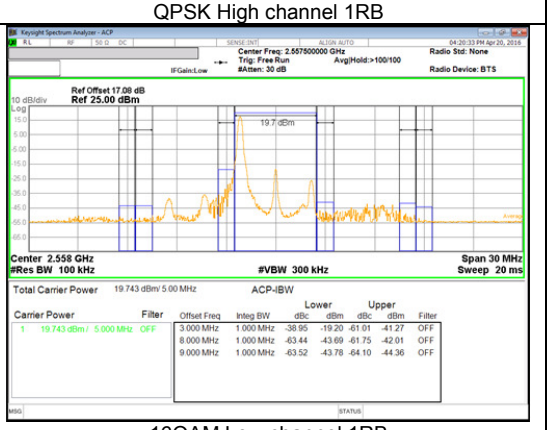
QPSK High channel FRB



QPSK High channel 1RB

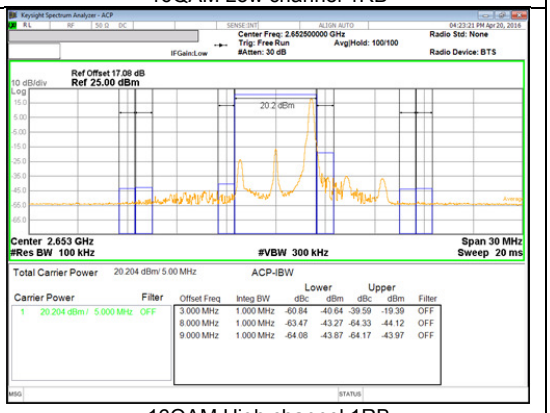


16QAM Low channel FRB



16QAM Low channel 1RB

16QAM High channel FRB



16QAM High channel 1RB

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10.3 OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238 and §27. 53

LIMITS

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.

Part 27: (m)(4) For mobile station, the attenuation factor shall be not less than 43 + 10 log (P) dB at the channel edge and (55 + 10 log (P)dB) at the 5.5 MHz from the channel edges.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v02r02
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

RESULTS

10.3.1. OUT OF BAND EMISSIONS RESULT

GSM

Band	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
GSM850	GPRS	824.2	-23.25	-13.00
		836.6	-23.31	
		848.8	-23.40	
	EGPRS	824.2	-23.04	
		836.6	-23.28	
		848.8	-23.22	
GSM1900	GPRS	1850.2	-22.90	
		1880.0	-22.48	
		1909.8	-22.58	
	EGPRS	1850.2	-22.59	
		1880.0	-22.12	
		1909.8	-22.76	

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WCDMA

Band	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
Band 5	REL99	826.4	-32.81	-13.00
		836.6	-32.81	
		846.6	-32.29	
	HSDPA	826.4	-32.90	
		836.6	-32.92	
		846.6	-33.44	
Band 2	REL99	1852.4	-32.74	
		1880.0	-32.56	
		1907.6	-32.24	
	HSDPA	1852.4	-32.53	
		1880.0	-32.89	
		1907.6	-31.80	

CDMA

Band	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
BC0	1xRTT	1013	-33.084	-13.00
		384	-32.842	
		777	-32.493	
	EVDO Rel.0	1013	-32.412	
		384	-32.608	
		777	-31.952	

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LTE 41

Bandwidth	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
20 MHz	QPSK	2565.0	-31.34	-25.00
		2605.0	-31.23	
		2645.0	-30.73	
	16QAM	2565.0	-31.94	
		2605.0	-31.54	
		2645.0	-31.36	
15 MHz	QPSK	2562.5	-31.88	
		2605.0	-31.53	
		2647.5	-31.75	
	16QAM	2562.5	-31.23	
		2605.0	-31.73	
		2647.5	-31.49	
10 MHz	QPSK	2560.0	-31.73	
		2605.0	-31.62	
		2650.0	-32.26	
	16QAM	2560.0	-31.94	
		2605.0	-31.82	
		2650.0	-31.34	
5 MHz	QPSK	2557.5	-32.01	
		2605.0	-31.29	
		2652.5	-31.41	
	16QAM	2557.5	-31.57	
		2605.0	-30.99	
		2652.5	-31.63	

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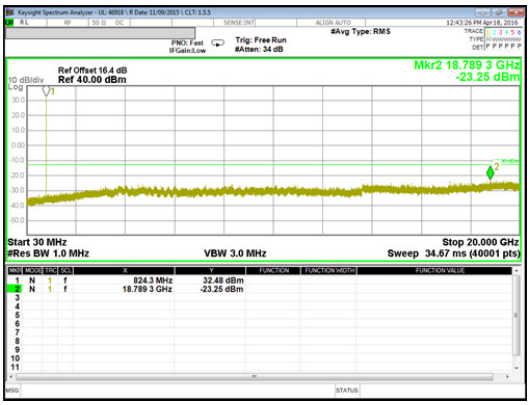
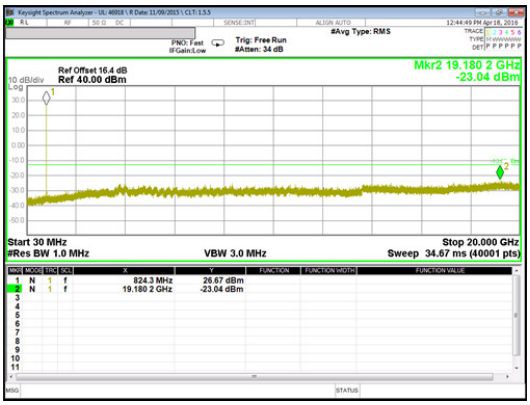
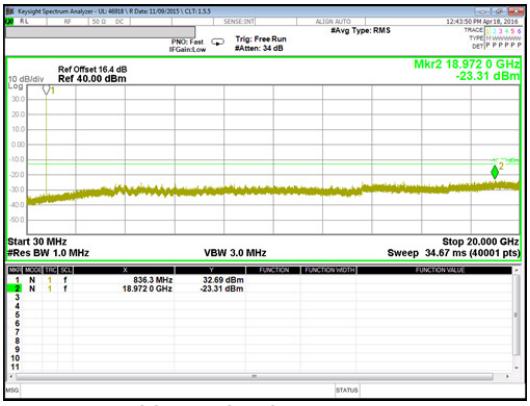
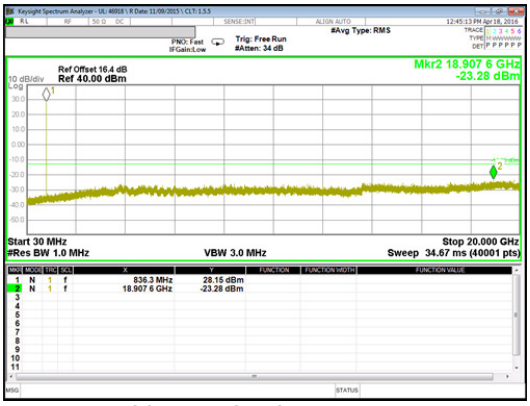
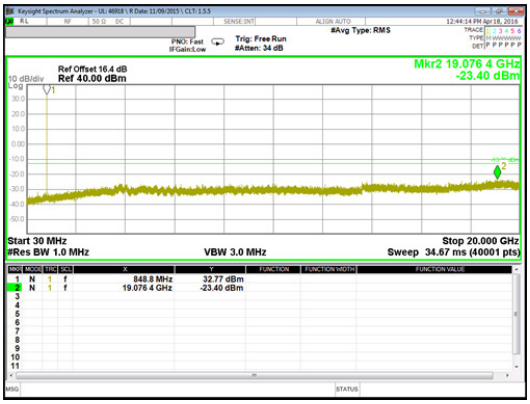
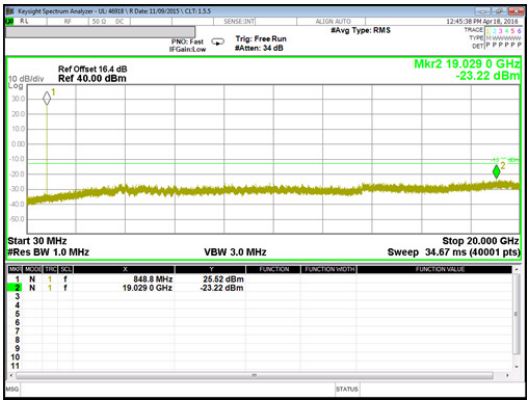
10.3.2. OUT OF BAND EMISSIONS PLOTS

GSM 850

GSM 850	 GSM850 GPRS Low channel	 GSM850 EGPRS Low channel
	 GSM850 GPRS Mid channel	 GSM850 EGPRS Mid channel
	 GSM850 GPRS High channel	 GSM850 EGPRS High channel

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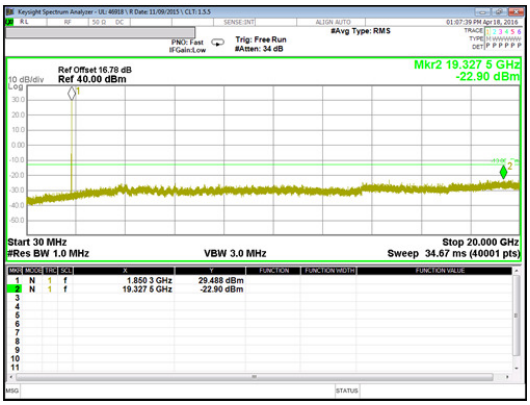
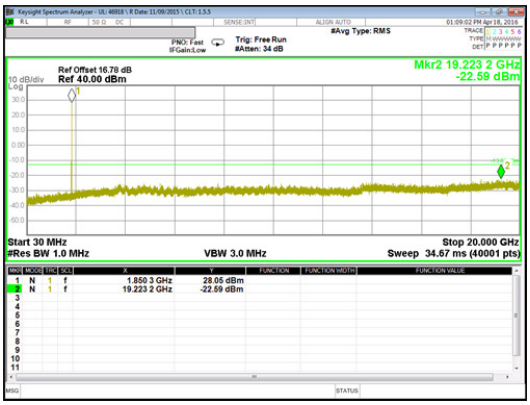
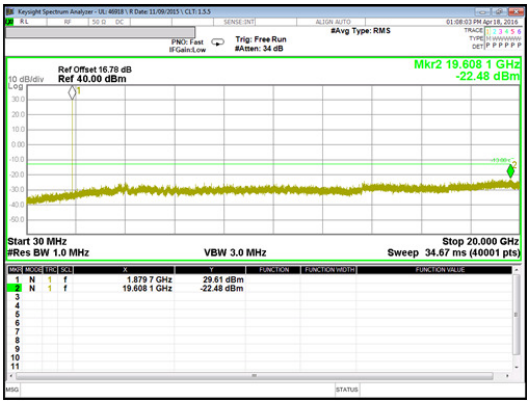
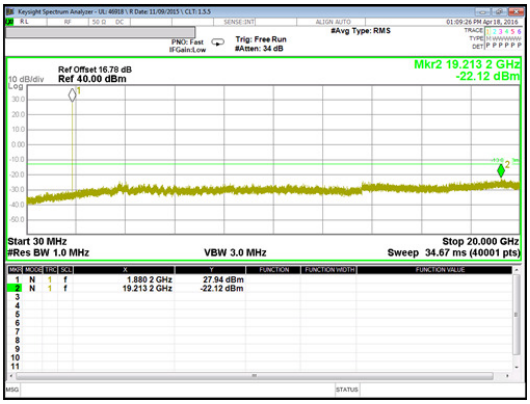
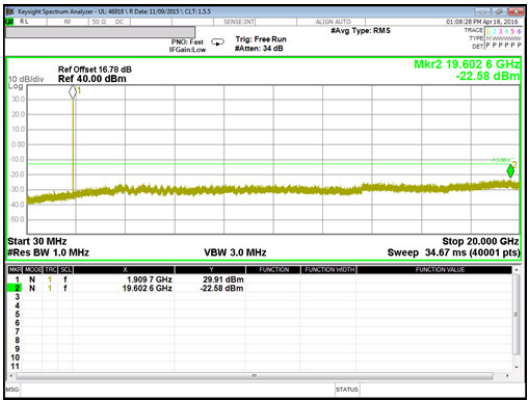
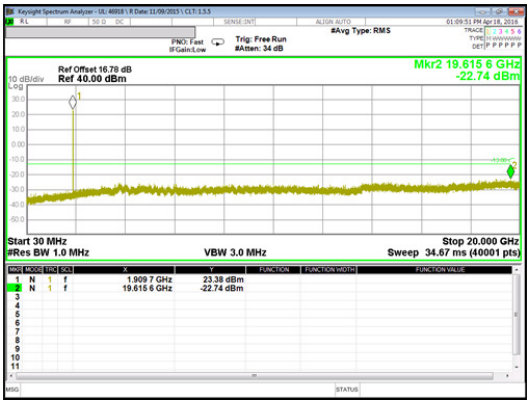
GSM 1900

GSM 1900	 GSM1900 GPRS Low channel	 GSM1900 EGPRS Low channel
	 GSM1900 GPRS Mid channel	 GSM1900 EGPRS Mid channel
	 GSM1900 GPRS High channel	 GSM1900 EGPRS High channel

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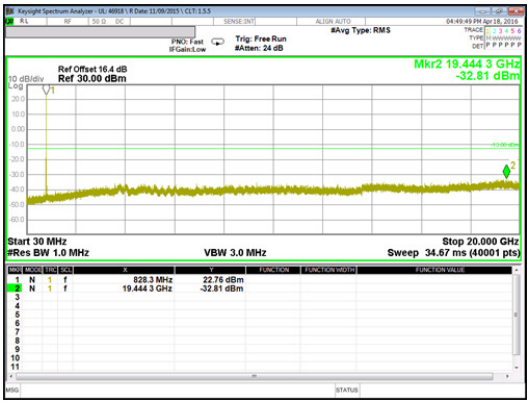
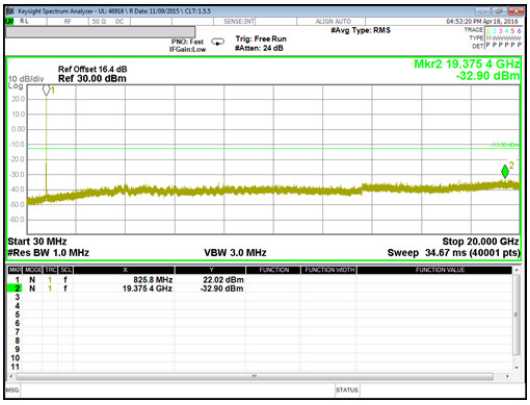
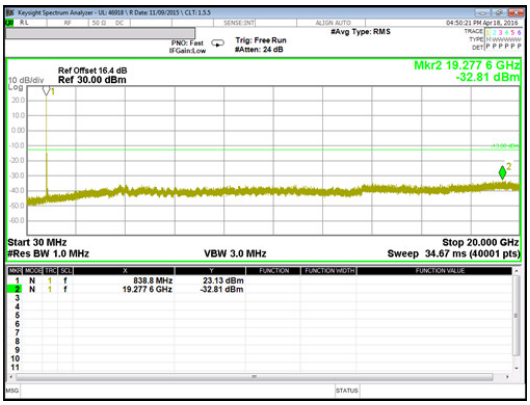
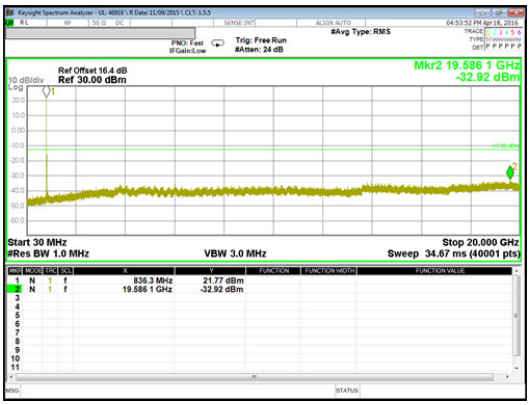
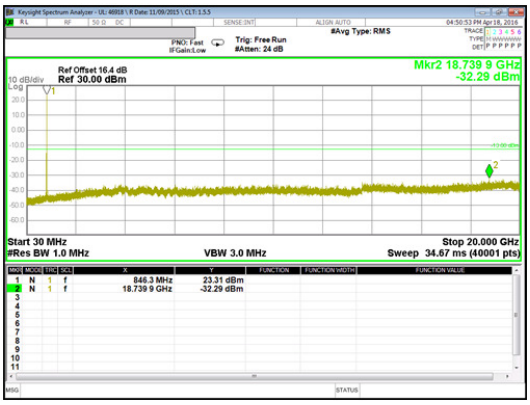
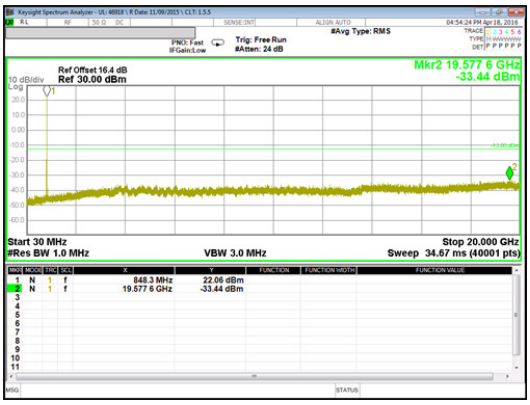
WCDMA Band 5

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

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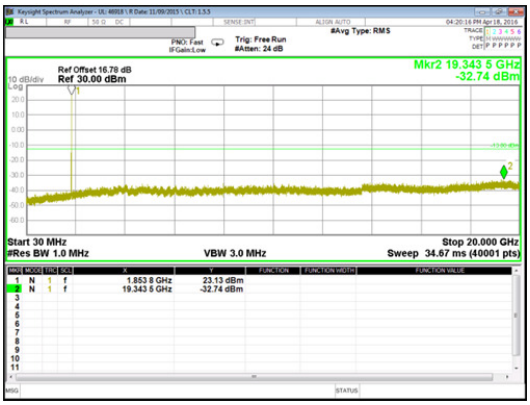
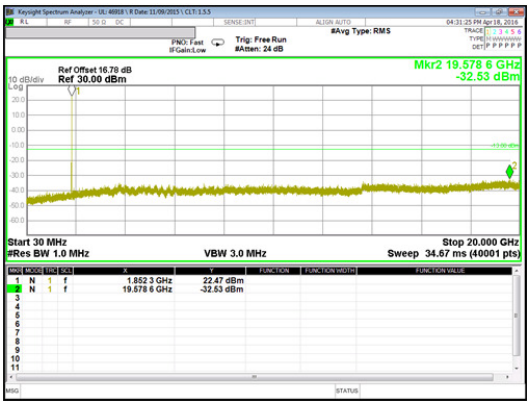
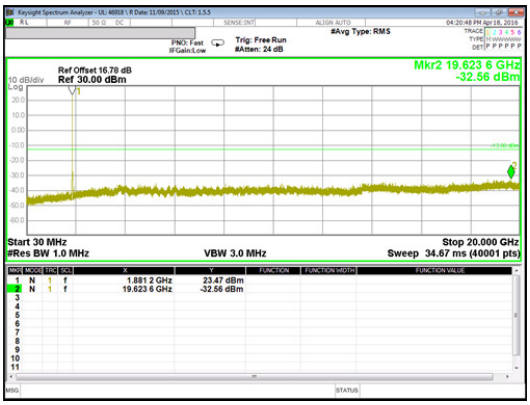
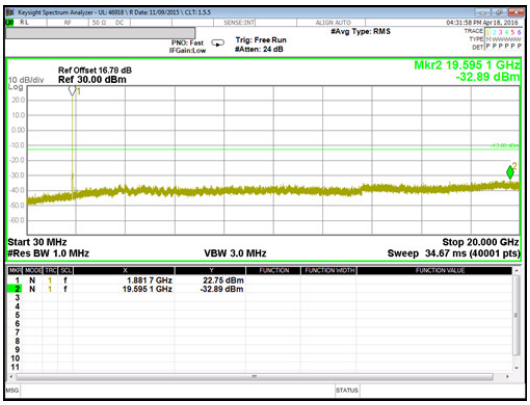
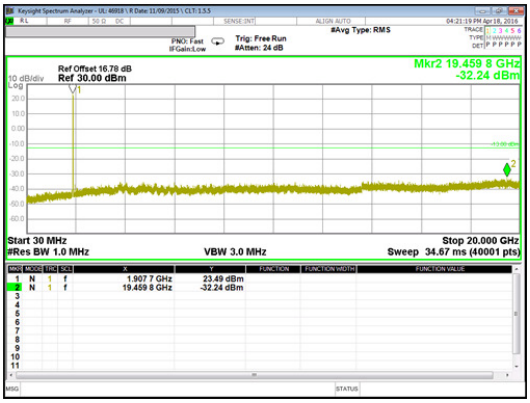
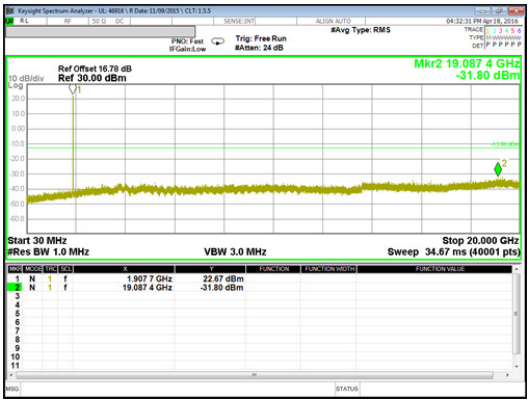
WCDMA Band 2

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

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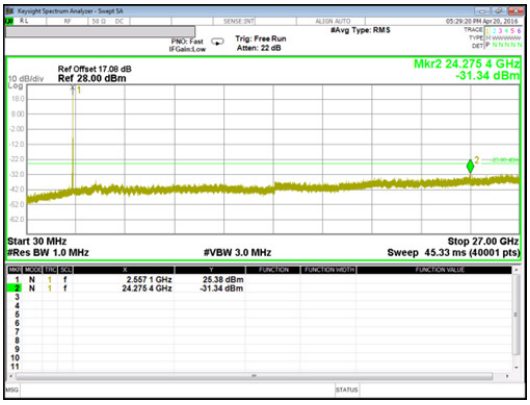
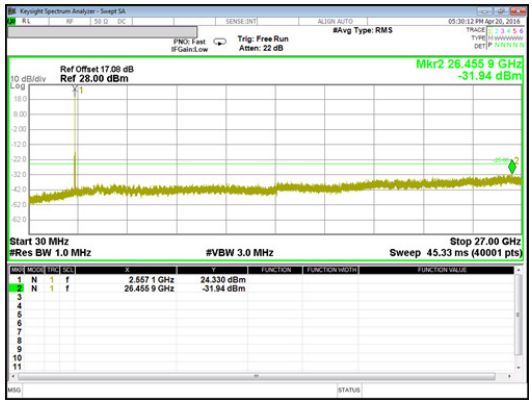
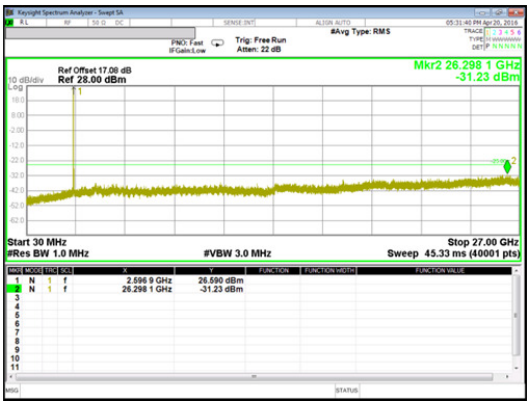
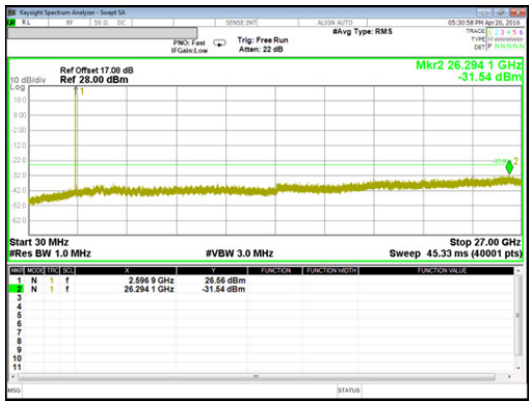
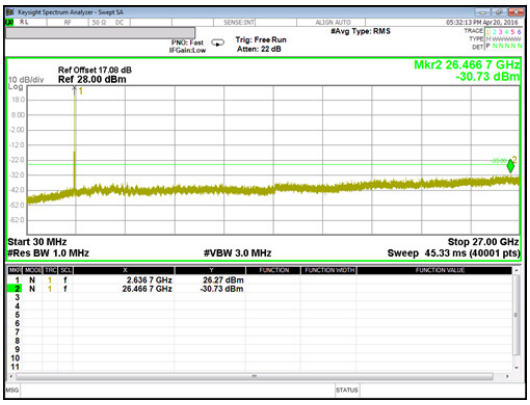
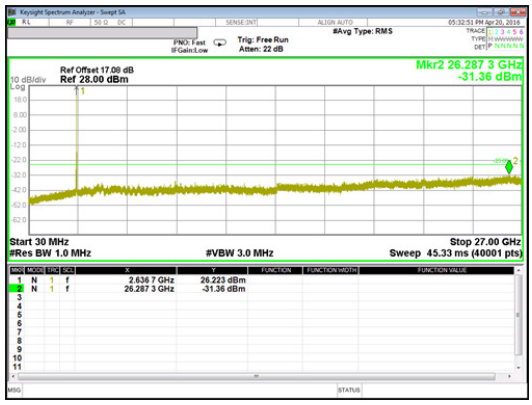
LTE Band 41

Band 41 20MHz	 QPSK Low channel	 16QAM Low channel
	 QPSK Mid channel	 16QAM Mid channel
	 QPSK High channel	 16QAM High channel

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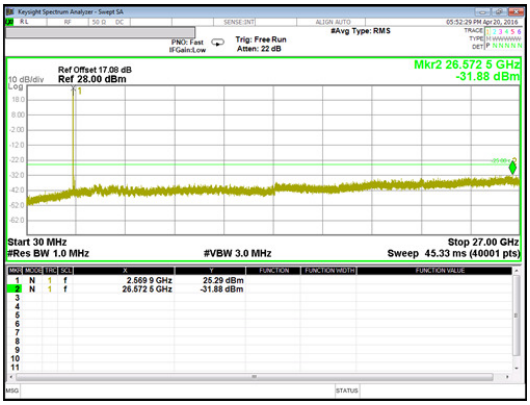
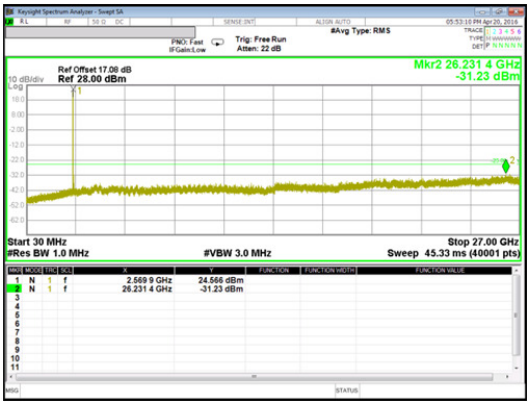
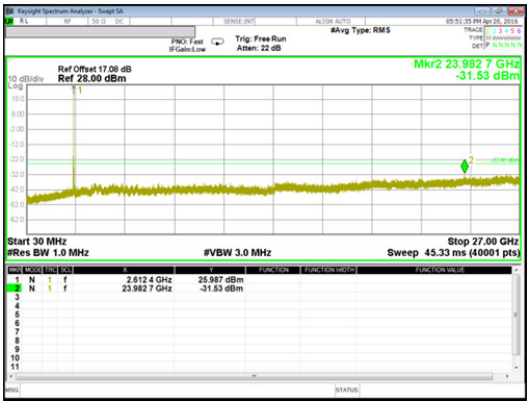
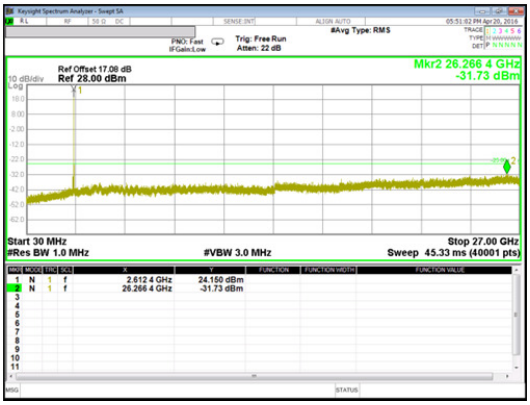
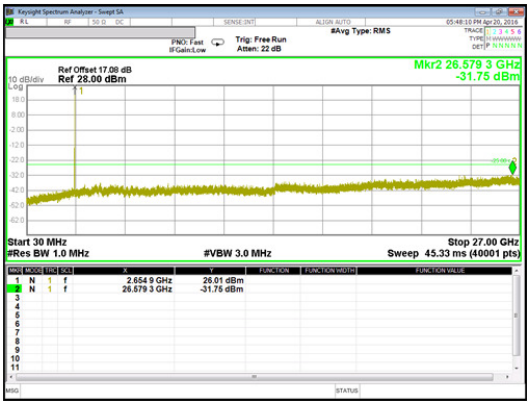
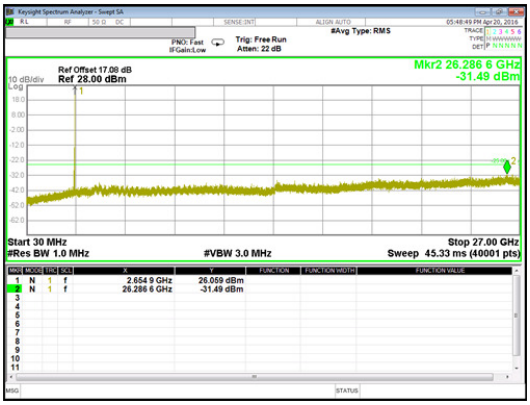
Band 41 15MHz	 QPSK Low channel	 16QAM Low channel
	 QPSK Mid channel	 16QAM Mid channel
	 QPSK High channel	 16QAM High channel

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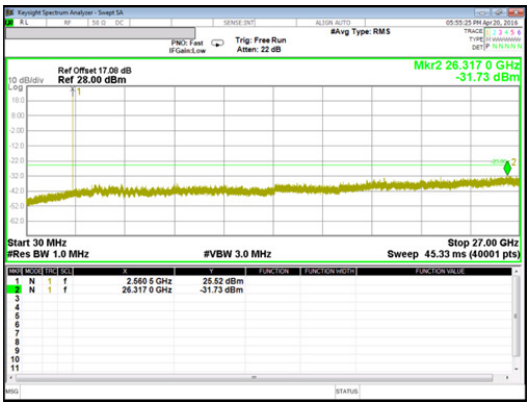
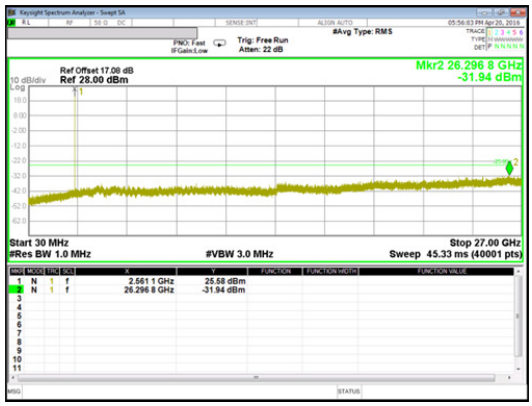
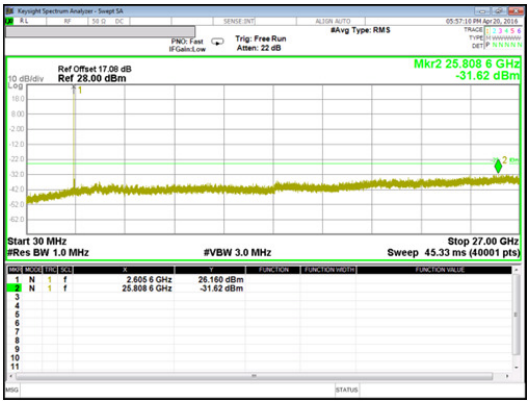
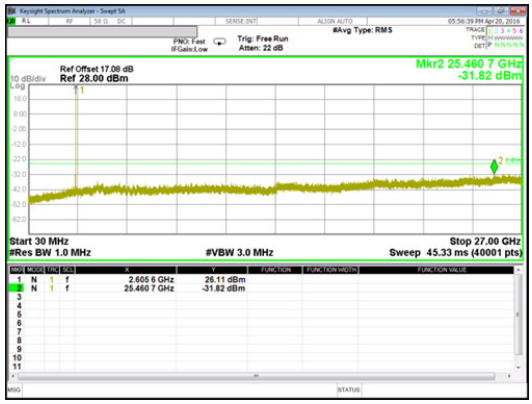
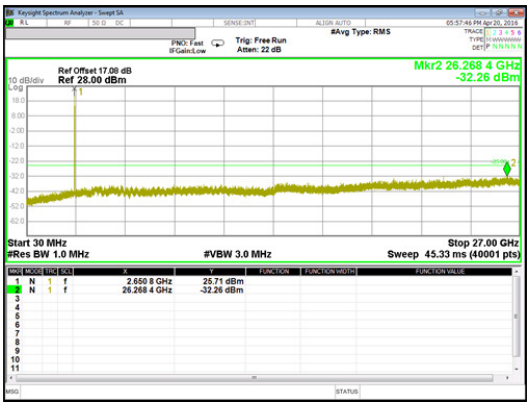
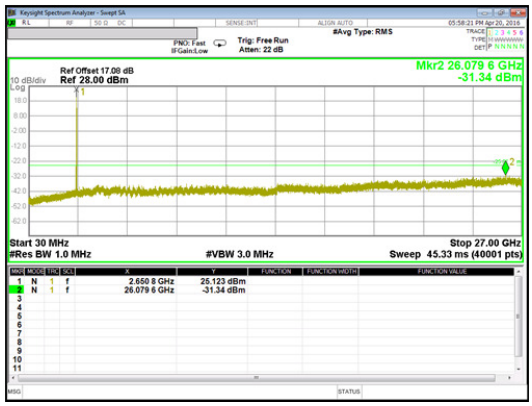
Band 41 10MHz	 QPSK Low channel	 16QAM Low channel
	 QPSK Mid channel	 16QAM Mid channel
	 QPSK High channel	 16QAM High channel

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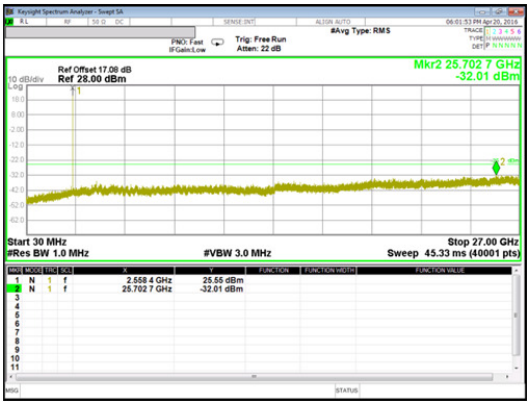
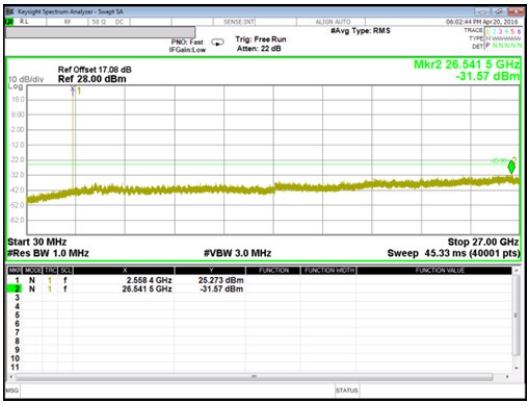
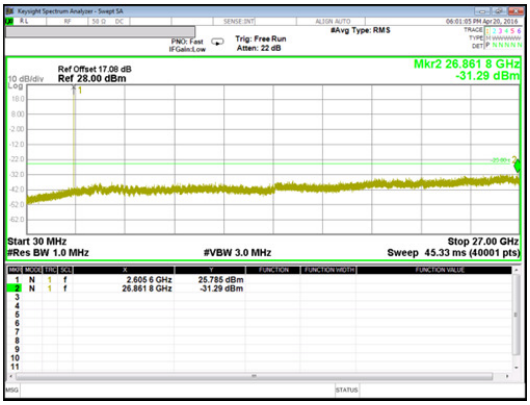
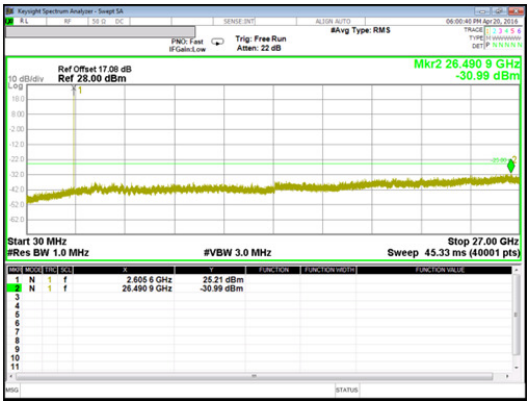
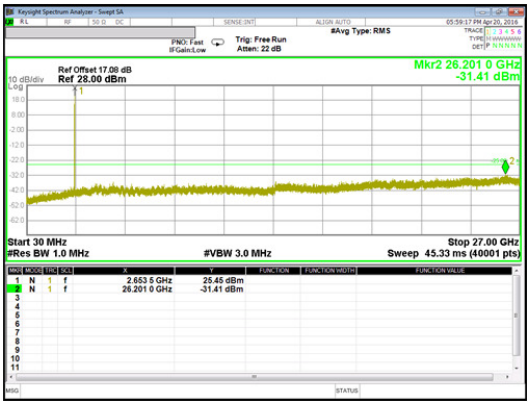
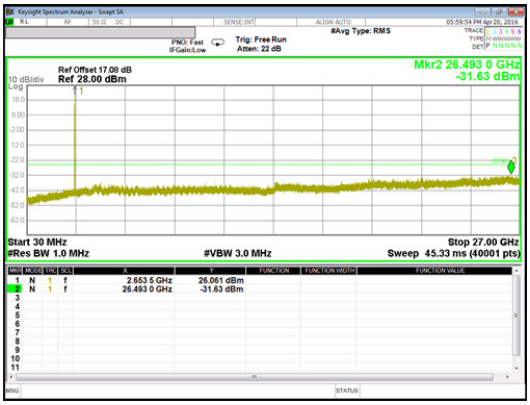
Band 41 5MHz	 QPSK Low channel	 16QAM Low channel
	 QPSK Mid channel	 16QAM Mid channel
	 QPSK High channel	 16QAM High channel

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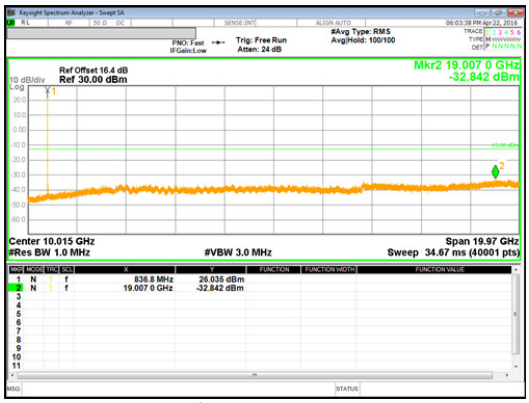
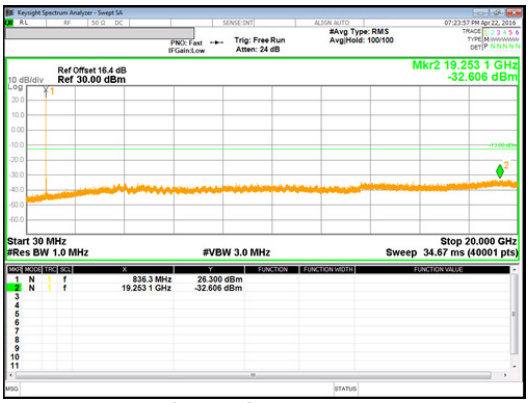
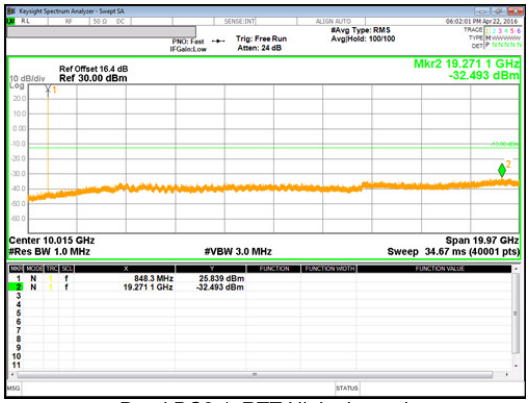
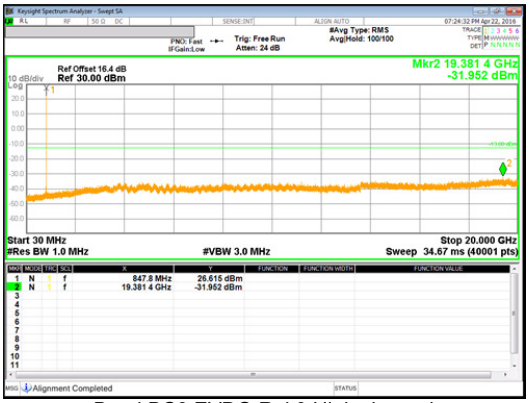
CDMA

BC0	 Band BC0 1xRTT Low channel	 Band BC0 EVDO Rel.0 Low channel
	 Band BC0 1xRTT Mid channel	 Band BC0 EVDO Rel.0 Mid channel
	 Band BC0 1xRTT High channel	 Band BC0 EVDO Rel.0 High channel

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10.4. FREQUENCY STABILITY

RULE PART(S)

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

LIMITS

§22.355 - 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.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v02r02

RESULTS

See the following pages.

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10.4.1. FREQUENCY STABILITY RESULTS

GSM 850, Channel 190, Frequency 836.6 MHz

Reference Frequency: GSM850 Mid Channel 836.6 MHz @ 20ºC Limit: ± 2.5 ppm = 2091.500 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse (MHz)	Delta (ppm)	Limit (ppm)
3.85	50	836.60002473	-0.004	2.5
3.85	40	836.60002255	-0.001	2.5
3.85	30	836.60003099	-0.011	2.5
3.85	***20***	***836.60002150***	***0***	***2.5***
3.85	10	836.60003263	-0.013	2.5
3.85	0	836.60003375	-0.015	2.5
3.85	-10	836.60003149	-0.012	2.5
3.85	-20	836.60002892	-0.009	2.5
3.85	-30	836.60002808	-0.008	2.5

Reference Frequency: GSM850 Mid Channel 836.6 MHz @ 20ºC Limit: ± 2.5 ppm = 2091.500 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse (MHz)	Delta (ppm)	Limit (ppm)
3.85	***20***	***836.60002150***	***0***	***2.5***
4.20	20	836.60001811	0.004	2.5
3.40	20	836.60002642	-0.006	2.5

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BC0 1xRTT , Channel 384, Frequency 836.52 MHz

Reference Frequency: CDMA Mid Channel 836.52 MHz @ 20ºC Limit: ± 2.5 ppm = 2091.500 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.85	50	836.52002153	-0.004	2.5
3.85	40	836.52002674	-0.011	2.5
3.85	30	836.52003029	-0.015	2.5
3.85	***20***	***836.52001789***	***0***	***2.5***
3.85	10	836.52002666	-0.010	2.5
3.85	0	836.52003124	-0.016	2.5
3.85	-10	836.52002137	-0.004	2.5
3.85	-20	836.52001864	-0.001	2.5
3.85	-30	836.52002353	-0.007	2.5

Reference Frequency: CDMA Mid Channel 836.52 MHz @ 20ºC Limit: ± 2.5 ppm = 2091.500 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.85	***20***	***836.52001789***	***0***	***2.5***
4.20	20	836.52001647	0.002	2.5
3.40	20	836.52001584	0.002	2.5

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WCDMA Band 5, Channel 4183, Frequency 836.6 MHz

Reference Frequency: WCDMA B5 Mid Channel 836.6 MHz @ 20ºC Limit: ± 2.5 ppm = 2091.500 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.85	50	836.60003320	-0.002	2.5
3.85	40	836.60002678	0.006	2.5
3.85	30	836.60001889	0.015	2.5
3.85	***20***	***836.60003169***	***0***	***2.5***
3.85	10	836.60001354	0.022	2.5
3.85	0	836.60002357	0.010	2.5
3.85	-10	836.60002951	0.003	2.5
3.85	-20	836.60003180	0.000	2.5
3.85	-30	836.60002615	0.007	2.5

Reference Frequency: WCDMA B5 Mid Channel 836.6 MHz @ 20ºC Limit: ± 2.5 ppm = 2091.500 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.85	***20***	***836.60003169***	***0***	***2.5***
4.20	20	836.60001647	0.018	2.5
3.40	20	836.60001586	0.019	2.5

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GSM 1900, Channel 661, Frequency 1880.0 MHz

Reference Frequency: GSM1900 Mid Channel 1880 MHz @ 20ºC Limit: ± 2.5 ppm = 4700.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
3.85	50	1880.00002443	0.004	2.5
3.85	40	1880.00002621	0.003	2.5
3.85	30	1880.00003542	-0.001	2.5
3.85	***20***	**1880.00003279**	***0***	***2.5***
3.85	10	1880.00002139	0.006	2.5
3.85	0	1880.00002401	0.005	2.5
3.85	-10	1880.00002291	0.005	2.5
3.85	-20	1880.00002459	0.004	2.5
3.85	-30	1880.00003063	0.001	2.5

Reference Frequency: GSM1900 Mid Channel 1880 MHz @ 20ºC Limit: ± 2.5 ppm = 4700.000 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
3.85	***20***	**1880.00003279**	***0***	***2.5***
4.20	20	1880.00002772	0.003	2.5
3.40	20	1880.00003273	0.000	2.5

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WCDMA Band 2, Channel 9400, Frequency 1880.0 MHz

Reference Frequency: WCDMA B2 Mid Channel 1880 MHz @ 20ºC Limit: ± 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.85	50	1880.00001646	0.001	2.5
3.85	40	1880.00001512	0.002	2.5
3.85	30	1880.00002537	-0.004	2.5
3.85	***20***	**1880.00001815**	***0***	***2.5***
3.85	10	1880.00001237	0.003	2.5
3.85	0	1880.00002008	-0.001	2.5
3.85	-10	1880.00001297	0.003	2.5
3.85	-20	1880.00001647	0.001	2.5
3.85	-30	1880.00002036	-0.001	2.5

Reference Frequency: WCDMA B2 Mid Channel 1880 MHz @ 20ºC Limit: ± 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.85	***20***	**1880.00001815**	***0***	***2.5***
4.20	20	1880.00001729	0.000	2.5
3.40	20	1880.00001863	0.000	2.5

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LTE Band 41, Channel 40740, Frequency 2605.0 MHz

Reference Frequency: LTE Band41 Mid Channel 2605 MHz @ 20ºC Limit: ± 2.5 ppm = 6482.500 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
3.85	50	2605.00002535	0.003	2.5
3.85	40	2605.00002466	0.003	2.5
3.85	30	2605.00002585	0.003	2.5
3.85	***20***	**2605.00003242**	***0***	***2.5***
3.85	10	2605.00004396	-0.004	2.5
3.85	0	2605.00003538	-0.001	2.5
3.85	-10	2605.00003440	-0.001	2.5
3.85	-20	2605.00002871	0.001	2.5
3.85	-30	2605.00002446	0.003	2.5

Reference Frequency: LTE Band41 Mid Channel 2605 MHz @ 20ºC Limit: ± 2.5 ppm = 6482.500 Hz				
Power Supply	Environment	Frequency Deviation Measureed with Time Elapse		
(Vdc)	Temperature (*C)	(MHz)	Delta (ppm)	Limit (ppm)
3.85	***20***	**2605.00003242**	***0***	***2.5***
4.20	20	2605.00003062	0.001	2.5
3.40	20	2605.00002573	0.003	2.5

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11. RADIATED TEST RESULTS

11.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

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

LIMITS

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

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.

27.50(h) - (2) Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.(LTE B41)

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 603D Clause 2.2.17; ESU40 setting reference to 971168 D01 v02r02

For average power measurement with a ESU40:

a) Set span to at least 1.5 times the OBW;

b) Set RBW = 1 MHz;

c) Set VBW ≥ 3 x RBW;

d) Set number of points in sweep ≥ 2 × span / RBW;

e) Sweep time = auto-couple;

f) Detector = RMS (power averaging);

g) Use free run trigger If burst duty cycle ≥ 98;

h) Use trigger to capture bursts If burst duty cycle < 98;

i) Trace average at least 100 traces in power averaging (*i.e.*, RMS) mode.

j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function. (RBW/VBW are automatically set for LTE B41)

TEST RESULTS

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11.1.1. ERP/EIRP Results

GSM

Band	Mode	Channel	f [MHz]	ERP / EIRP	
				[dBm]	[mW]
GSM850	GPRS	512	824.2	25.60	363.08
		661	836.6	25.35	342.77
		810	848.8	25.11	324.34
	EGPRS	512	824.2	22.48	177.01
		661	836.6	21.76	149.97
		810	848.8	22.79	190.11
GSM1900	GPRS	512	1850.2	30.44	1106.62
		661	1880.0	30.13	1030.39
		810	1909.8	29.53	897.43
	EGPRS	512	1850.2	26.70	467.74
		661	1880.0	24.58	287.08
		810	1909.8	26.53	449.78

CDMA

Band	Mode	Channel	f [MHz]	ERP / EIRP	
				[dBm]	[mW]
BC0	1xRTT	1013	824.70	21.20	131.83
		384	836.52	20.13	103.04
		777	848.31	20.20	104.71
	EVDO Rel.0	1013	824.70	17.82	60.53
		384	836.52	18.78	75.51
		777	848.31	20.48	111.69

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WCDMA

Band	Mode	Channel	f [MHz]	ERP / EIRP	
				[dBm]	[mW]
Band 5	REL99	4132	826.4	17.62	57.81
		4183	836.6	18.18	65.77
		4233	846.6	18.77	75.34
	HSDPA	4132	826.4	15.01	31.70
		4183	836.6	16.24	42.07
		4233	846.6	18.84	76.56
Band 2	REL99	9262	1852.4	23.38	217.77
		9400	1880.0	22.93	196.34
		9538	1907.6	22.43	174.98
	HSDPA	9262	1852.4	21.99	158.12
		9400	1880.0	21.50	141.25
		9538	1907.6	21.80	151.36

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LTE Band 41

Band	BW [MHz]	Mode	RB/RB Size	f [MHz]	ERP / EIRP	
			Full RB		[dBm]	[mW]
Band 41	20	QPSK	100/0	2565.0	21.20	131.83
			100/0	2605.0	22.46	176.20
			100/0	2645.0	21.14	130.02
		16QAM	100/0	2565.0	20.21	104.95
			100/0	2605.0	21.51	141.58
			100/0	2645.0	20.15	103.51
	15	QPSK	75/0	2562.5	21.03	126.77
			75/0	2605.0	22.85	192.75
			75/0	2647.5	20.95	124.45
		16QAM	75/0	2562.5	20.03	100.69
			75/0	2605.0	22.02	159.22
			75/0	2647.5	20.01	100.23
	10	QPSK	50/0	2560.0	21.10	128.82
			50/0	2605.0	23.26	211.84
			50/0	2650.0	21.42	138.68
		16QAM	50/0	2560.0	20.10	102.33
			50/0	2605.0	22.27	168.66
			50/0	2650.0	20.38	109.14
	5	QPSK	25/0	2557.5	21.71	148.25
			25/0	2605.0	22.70	186.21
			25/0	2652.5	21.65	146.22
		16QAM	25/0	2557.5	20.97	125.03
			25/0	2605.0	21.57	143.55
			25/0	2652.5	20.74	118.58

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11.1.2. ERP/EIRP DATA

GSM 850

GSM

GSM850
GPRS

High Frequency Substitution Measurement
UL Korea, Ltd. Suwon Laboratory Chamber 2

Company: Samsung
Project #: 16K23301
Date: 04-21-16
Test Engineer: Steven Kim
Configuration: EUT ONLY, X Position
Mode: GPRS 850 MHz

Test Equipment:
Receiving: VULB9163-749, and 3m Chamber N-type Cable (Setup this one for testing EUT)
Substitution: Dipole S/N: 00164753, 3m SMA Cable Warehouse.

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
824.20	25.75	V	1.1	-1.6	23.13	38.5	-15.3	
824.20	28.22	H	1.1	-1.6	25.60	38.5	-12.9	
Mid Ch								
836.60	23.72	V	1.1	-1.4	21.23	38.5	-17.2	
836.60	27.84	H	1.1	-1.4	25.35	38.5	-13.1	
High Ch								
848.80	21.50	V	1.1	-1.3	19.14	38.5	-19.3	
848.80	27.47	H	1.1	-1.3	25.11	38.5	-13.3	

Rev. 3.17.11
Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

GSM

GSM850
EGPRS

High Frequency Substitution Measurement
UL Korea, Ltd. Suwon Laboratory Chamber 2

Company: Samsung
Project #: 16K23301
Date: 04-19-16
Test Engineer: Steven Kim
Configuration: EUT ONLY, X Position
Mode: EGPRS 850 MHz

Test Equipment:
Receiving: VULB9163-749, and 3m Chamber N-type Cable (Setup this one for testing EUT)
Substitution: Dipole S/N: 00164753, 3m SMA Cable Warehouse.

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
824.20	19.81	V	1.1	-1.6	17.19	38.5	-21.3	
824.20	25.10	H	1.1	-1.6	22.48	38.5	-16.0	
Mid Ch								
836.60	18.11	V	1.1	-1.4	15.62	38.5	-22.8	
836.60	24.25	H	1.1	-1.4	21.76	38.5	-16.7	
High Ch								
848.80	16.61	V	1.1	-1.3	14.25	38.5	-24.2	
848.80	25.15	H	1.1	-1.3	22.79	38.5	-15.7	

Rev. 3.17.11
Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

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GSM 1900

GSM

GSM1900
GPRS

High Frequency Substitution Measurement
UL Korea, Ltd. Suwon Laboratory Chamber 2

Company: Samsung
Project #: 16K23301
Date: 04-18-16
Test Engineer: Steven Kim
Configuration: EUT ONLY, X Position
Mode: GPRS 1900MHz

Test Equipment:
Receiving: 3117[00168724] and Chamber 1 SMA Cables
Substitution: 3115[00161451] Substitution, 3m SMA Cable Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1850.20	21.2	V	1.60	8.80	28.42	33.0	-4.6	
1850.20	23.2	H	1.60	8.80	30.44	33.0	-2.6	
Mid Ch								
1880.00	19.4	V	1.62	8.62	26.39	33.0	-6.6	
1880.00	23.1	H	1.62	8.62	30.13	33.0	-2.9	
High Ch								
1909.80	20.2	V	1.63	8.44	27.00	33.0	-6.0	
1909.80	22.7	H	1.63	8.44	29.53	33.0	-3.5	

Rev. 3.17.11

GSM

GSM1900
EGPRS

High Frequency Substitution Measurement
UL Korea, Ltd. Suwon Laboratory Chamber 2

Company: Samsung
Project #: 16K23301
Date: 04-18-16
Test Engineer: Steven Kim
Configuration: EUT ONLY, X Position
Mode: EGPRS 1900MHz

Test Equipment:
Receiving: 3117[00168724] and Chamber 1 SMA Cables
Substitution: 3115[00161451] Substitution, 3m SMA Cable Warehouse

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1850.20	16.3	V	1.60	8.80	23.49	33.0	-9.5	
1850.20	19.5	H	1.60	8.80	26.70	33.0	-6.3	
Mid Ch								
1880.00	14.3	V	1.62	8.62	21.25	33.0	-11.7	
1880.00	17.6	H	1.62	8.62	24.58	33.0	-8.4	
High Ch								
1909.80	15.6	V	1.63	8.44	22.41	33.0	-10.6	
1909.80	19.7	H	1.63	8.44	26.53	33.0	-6.5	

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