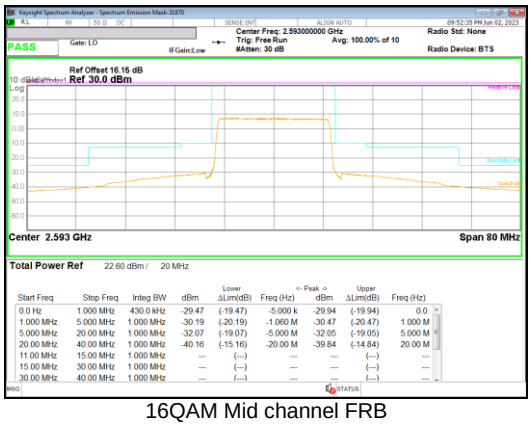
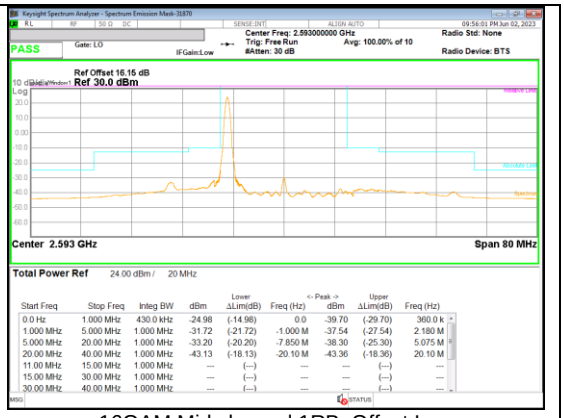
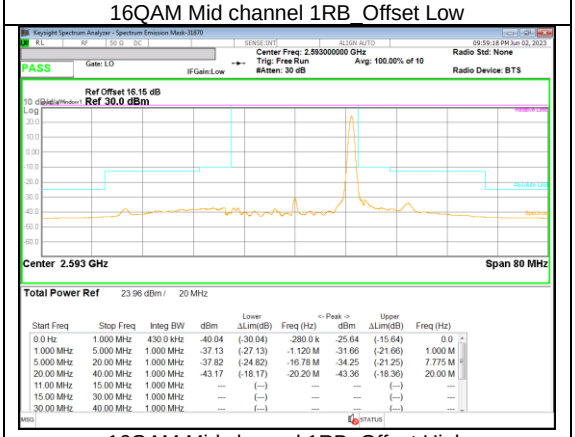
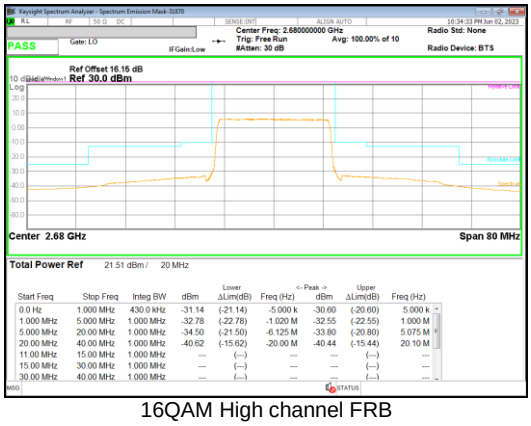
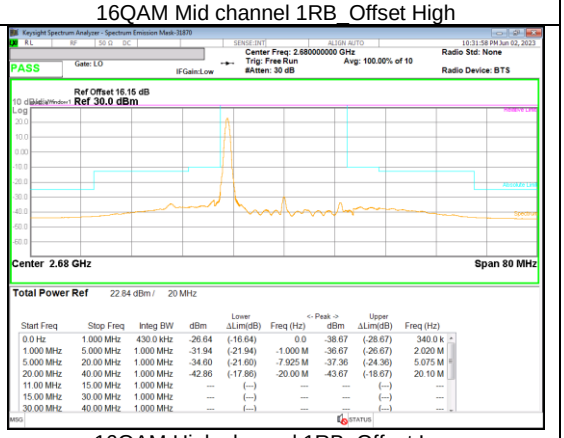
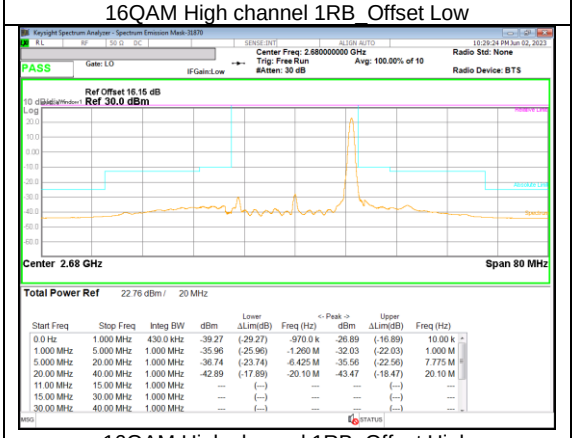
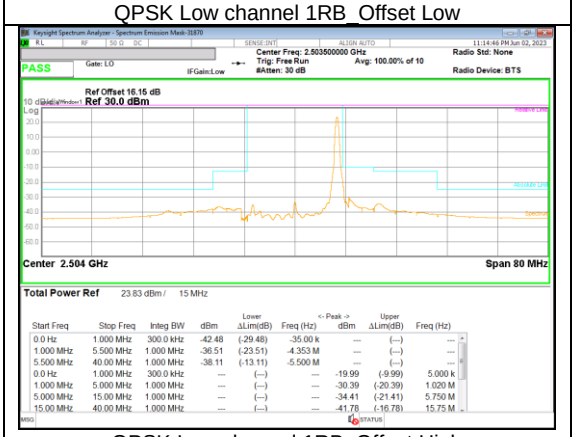
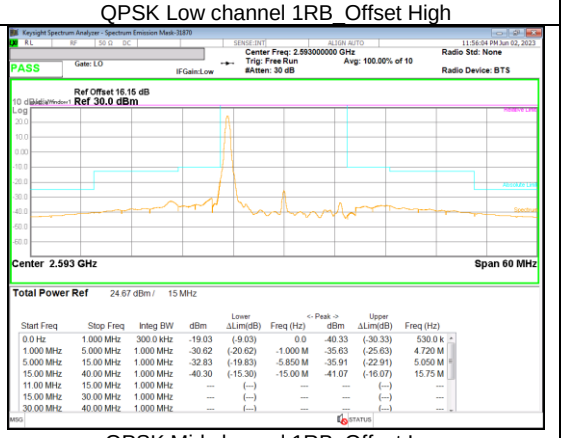
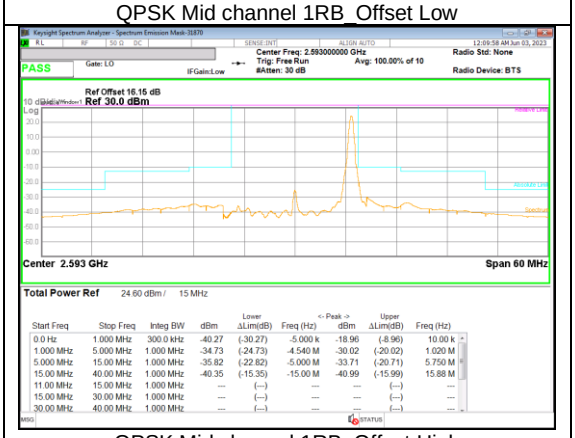
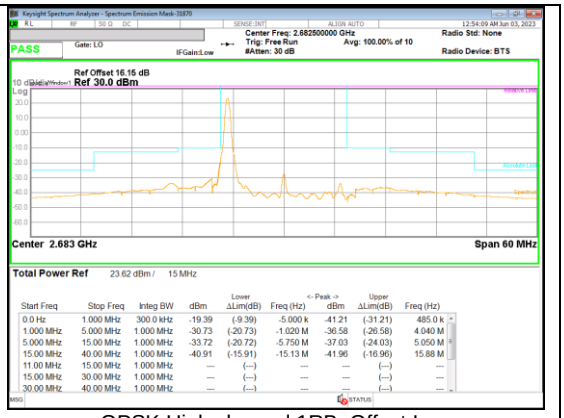
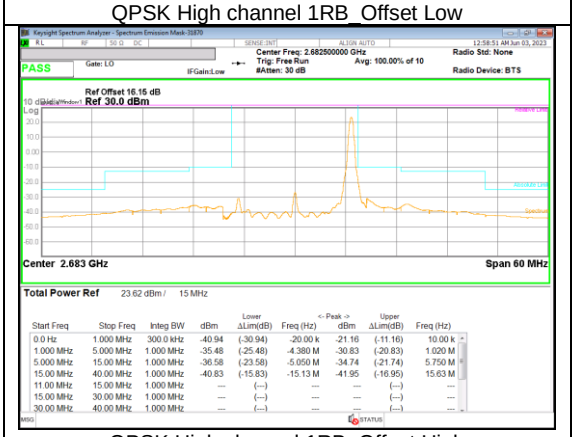
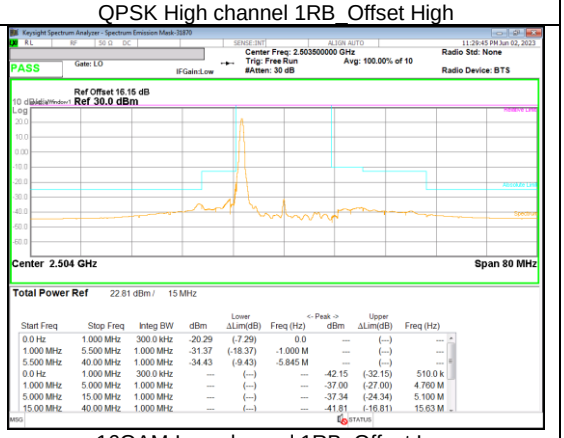
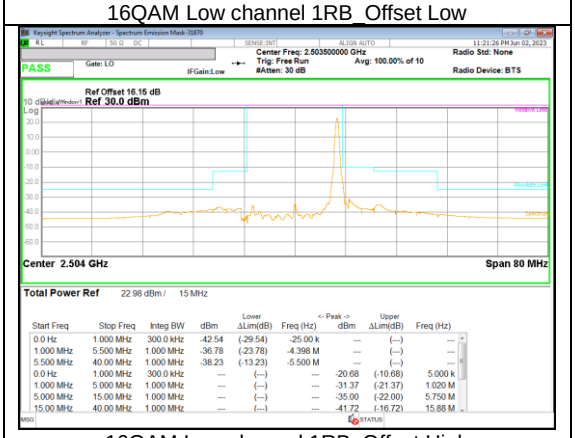
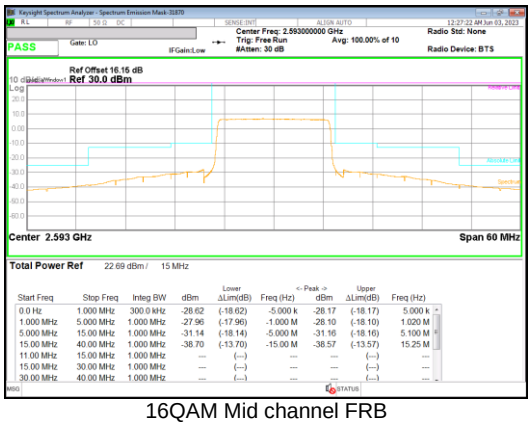
20MHz 16QAM	 16QAM Mid channel FRB	 16QAM Mid channel 1RB_Offset Low
		 16QAM Mid channel 1RB_Offset High
	 16QAM High channel FRB	 16QAM High channel 1RB_Offset Low
		 16QAM High channel 1RB_Offset High

15MHz QPSK	 QPSK Low channel FRB	 QPSK Low channel 1RB_Offset Low
		 QPSK Low channel 1RB_Offset High
	 QPSK Mid channel FRB	 QPSK Mid channel 1RB_Offset Low
		 QPSK Mid channel 1RB_Offset High

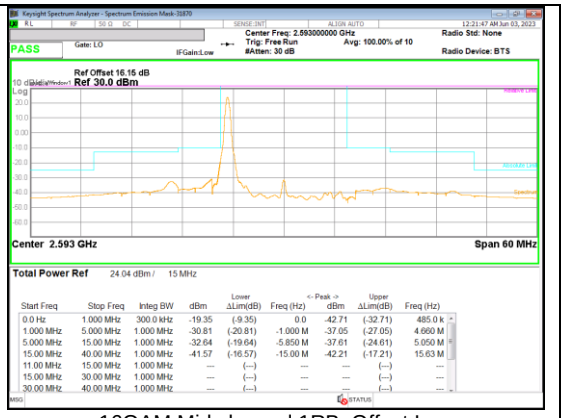
15MHz QPSK	 QPSK High channel FRB	 QPSK High channel 1RB_Offset Low  QPSK High channel 1RB_Offset High
15MHz 16QAM	 16QAM Low channel FRB	 16QAM Low channel 1RB_Offset Low  16QAM Low channel 1RB_Offset High

15MHz

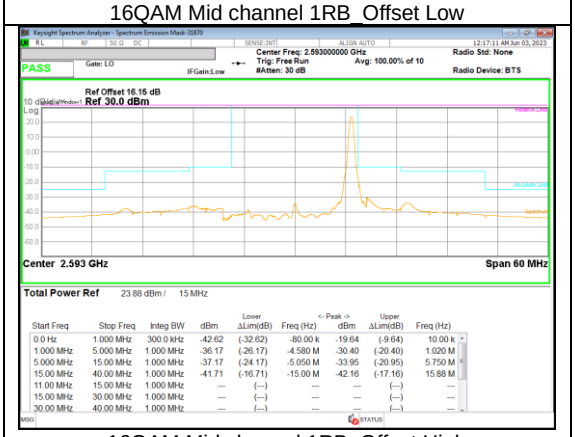
16QAM



16QAM Mid channel FRB

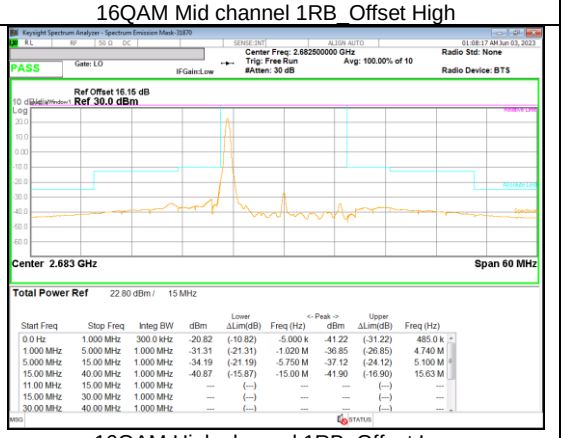


16QAM Mid channel 1RB_Offset Low

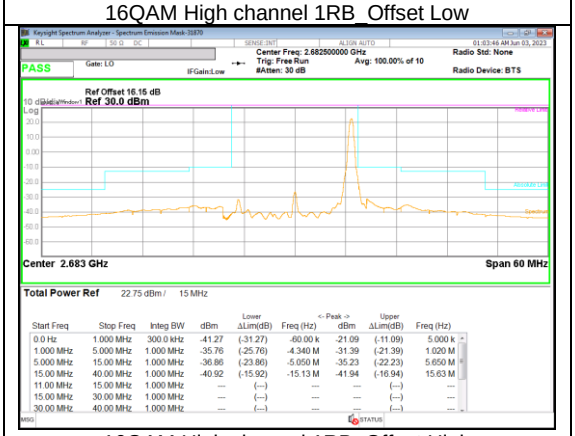


16QAM Mid channel 1RB_Offset High

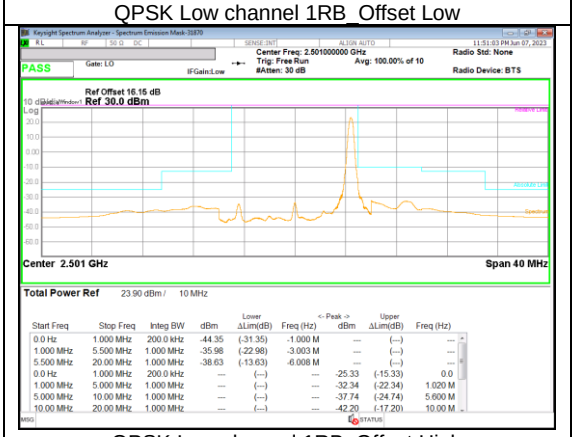
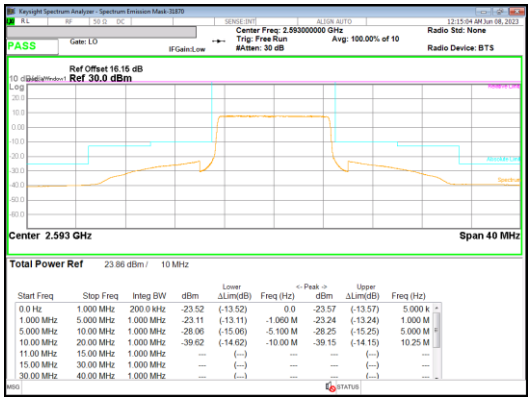
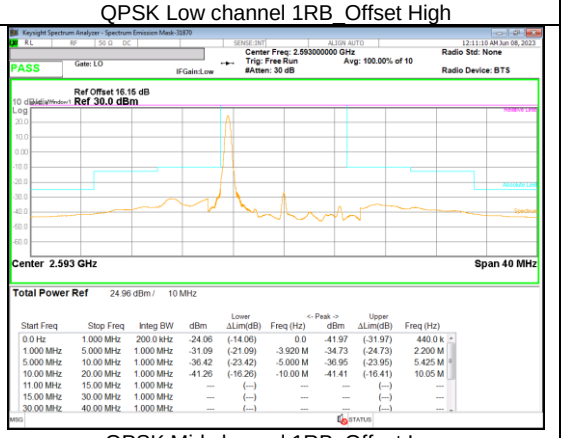
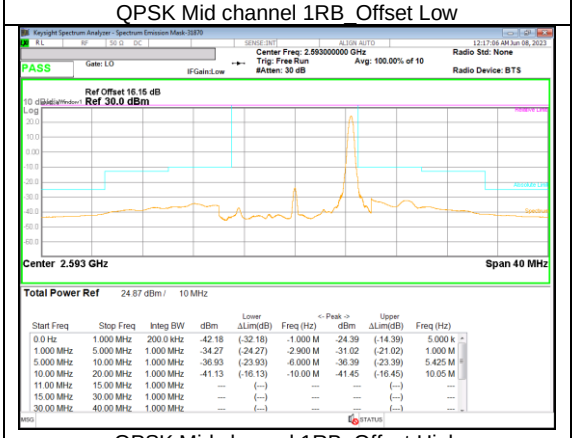
16QAM High channel FRB



16QAM High channel 1RB_Offset Low



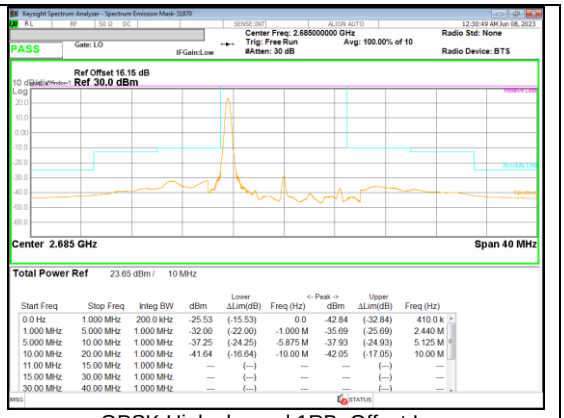
16QAM High channel 1RB_Offset High

10MHz QPSK	 QPSK Low channel FRB	 QPSK Low channel 1RB_Offset Low
		 QPSK Low channel 1RB_Offset High
	 QPSK Mid channel FRB	 QPSK Mid channel 1RB_Offset Low
		 QPSK Mid channel 1RB_Offset High

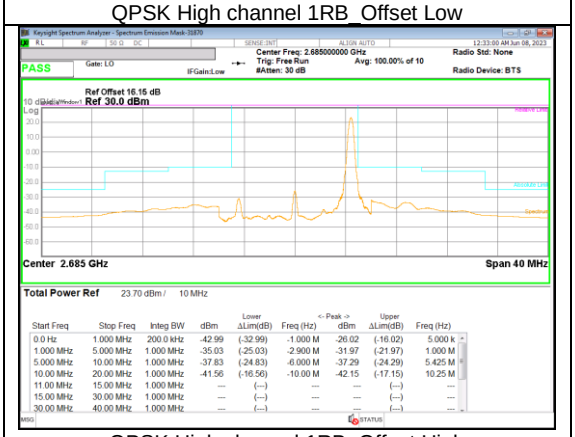
10MHz

QPSK

QPSK High channel FRB



QPSK High channel 1RB_Offset Low

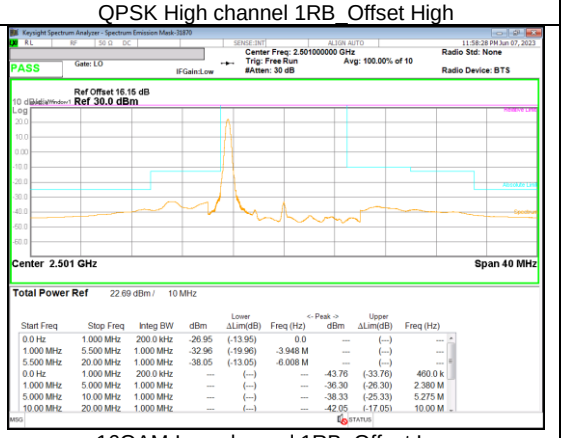


QPSK High channel 1RB_Offset High

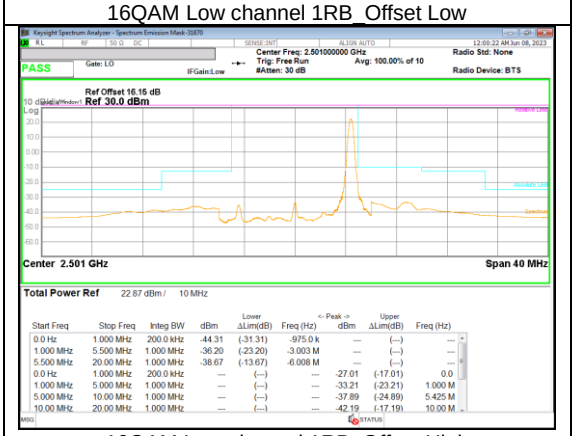
10MHz

16QAM

16QAM Low channel FRB



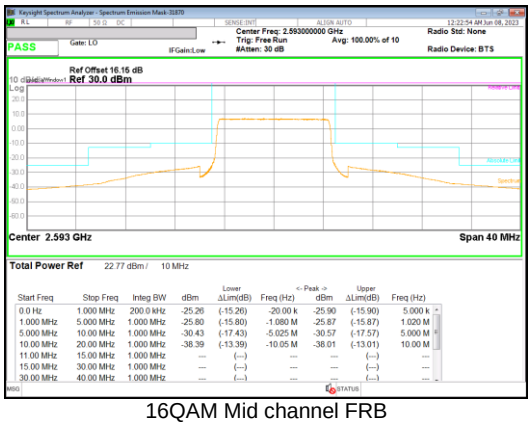
16QAM Low channel 1RB_Offset Low



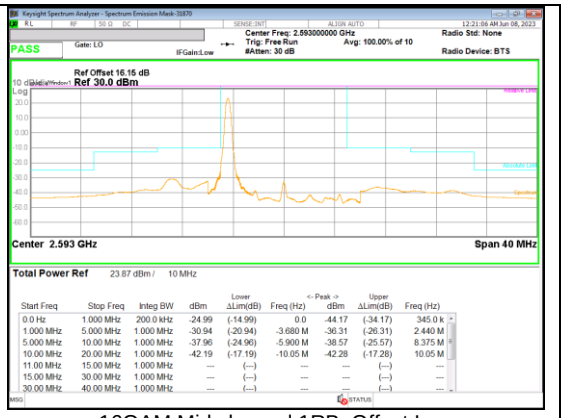
16QAM Low channel 1RB_Offset High

10MHz

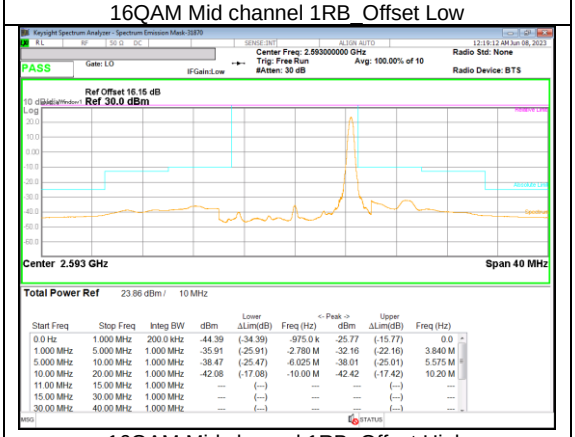
16QAM



16QAM Mid channel FRB

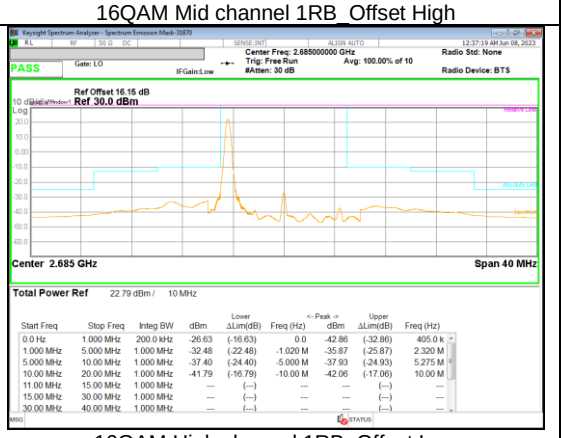


16QAM Mid channel 1RB_Offset Low

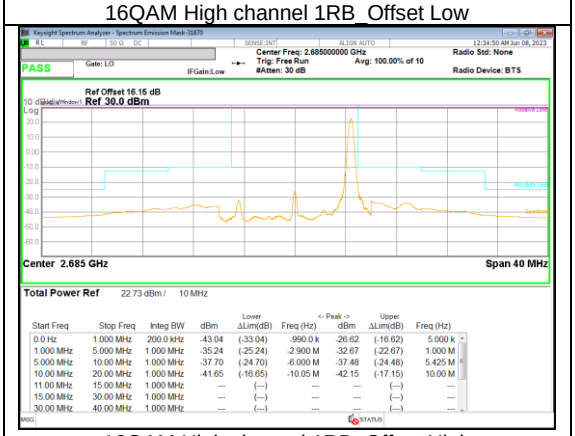


16QAM Mid channel 1RB_Offset High

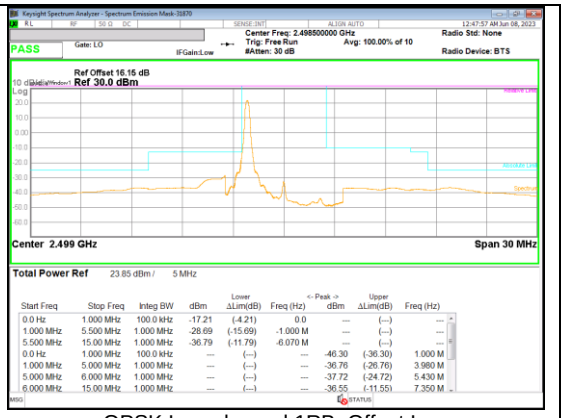
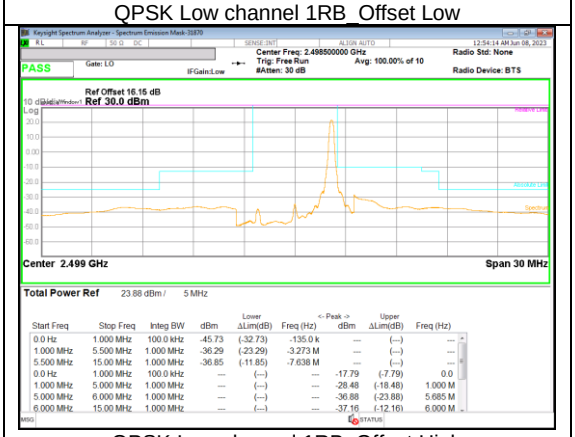
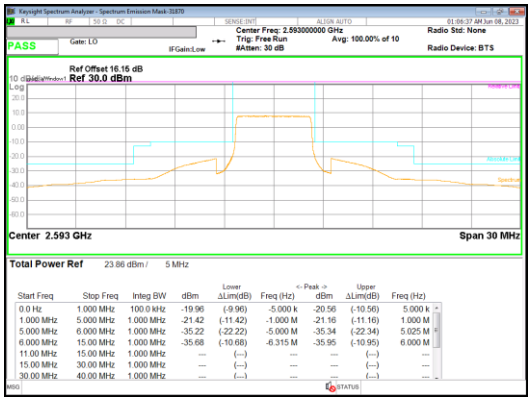
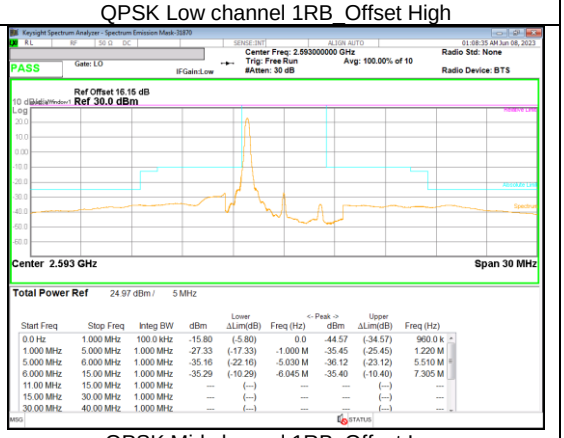
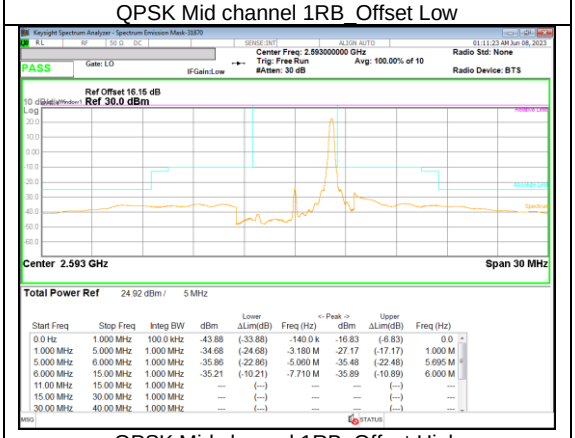
16QAM High channel FRB

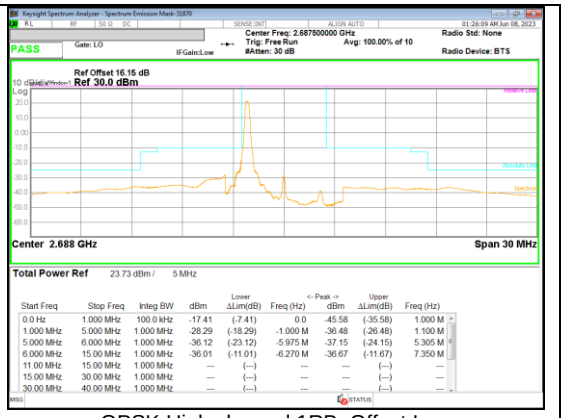
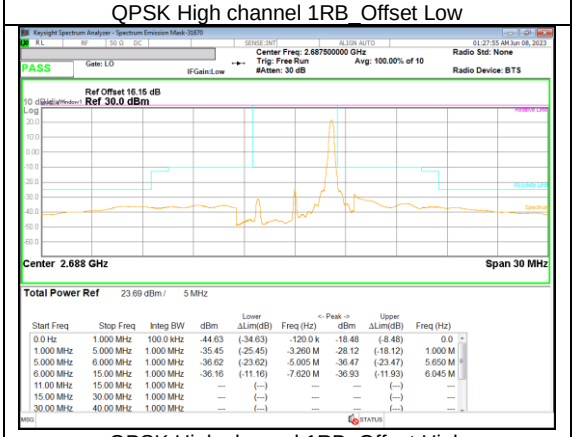
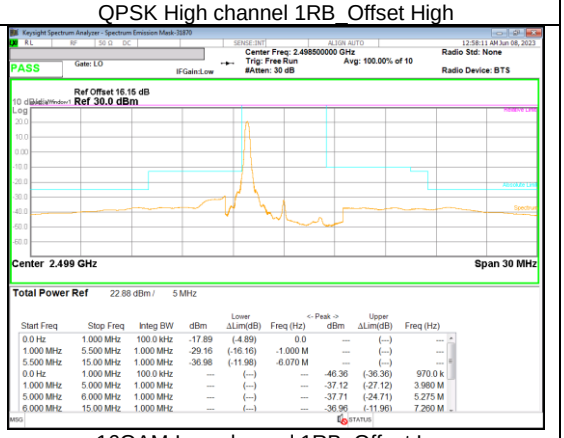
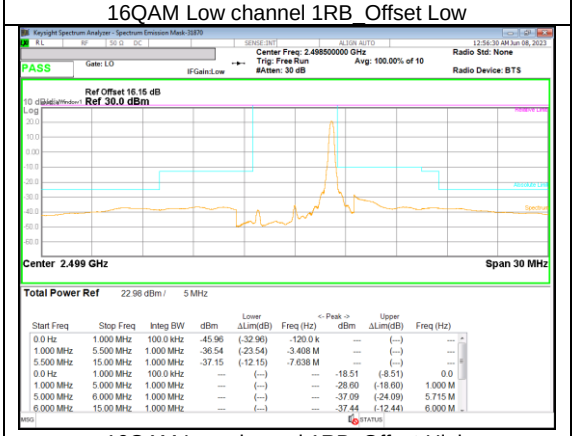


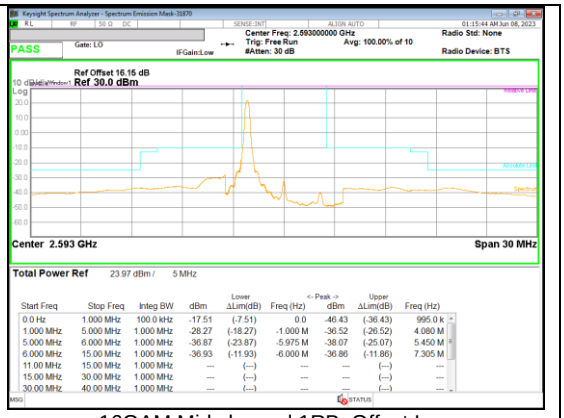
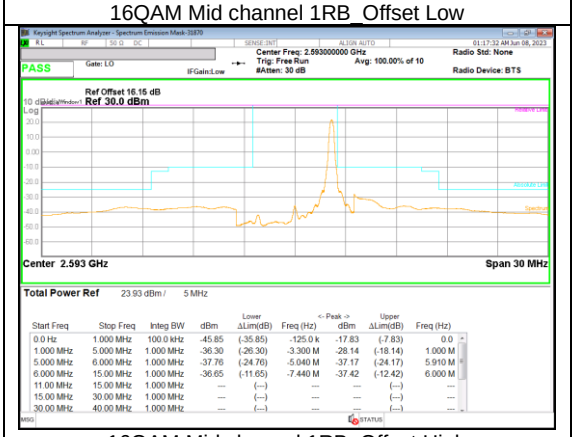
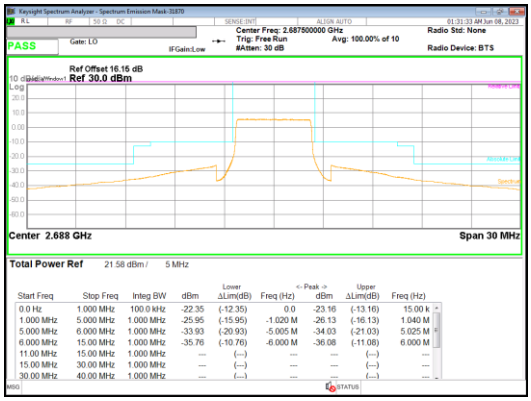
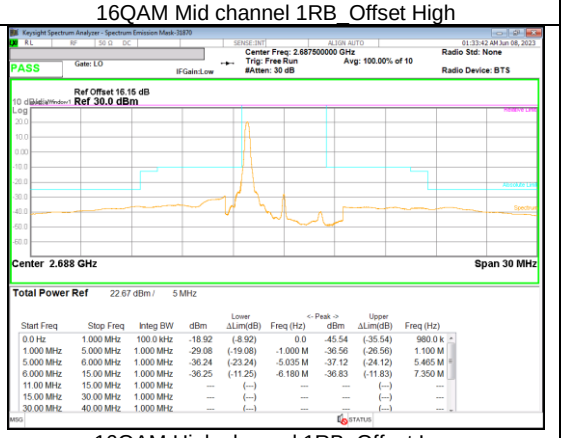
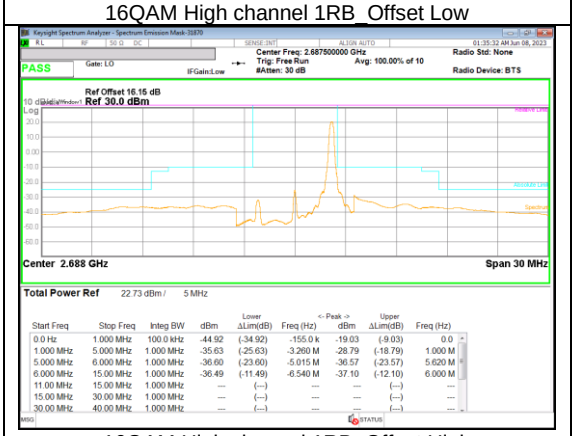
16QAM High channel 1RB_Offset Low



16QAM High channel 1RB_Offset High

5MHz QPSK	 QPSK Low channel FRB	 QPSK Low channel 1RB_Offset Low
		 QPSK Low channel 1RB_Offset High
	 QPSK Mid channel FRB	 QPSK Mid channel 1RB_Offset Low
		 QPSK Mid channel 1RB_Offset High

5MHz QPSK	 QPSK High channel FRB	 QPSK High channel 1RB_Offset Low
		 QPSK High channel 1RB_Offset High
5MHz 16QAM	 16QAM Low channel FRB	 16QAM Low channel 1RB_Offset Low
		 16QAM Low channel 1RB_Offset High

5MHz 16QAM	 16QAM Mid channel FRB	 16QAM Mid channel 1RB_Offset Low
		 16QAM Mid channel 1RB_Offset High
	 16QAM High channel FRB	 16QAM High channel 1RB_Offset Low
		 16QAM High channel 1RB_Offset High

8.5. CONDUCTED SPURIOUS EMISSIONS

RULE PART(S)

FCC: §27.53

LIMITS

Part 27.53:
(c)(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB.

(h) The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}$ (P) dB.

(m) (4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_27(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01
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.

a) Set the RBW = 100 kHz for emission below 1 GHz and 1 MHz for emissions above 1 GHz
(Tests were performed 1MHz [Worst case], to sweep 1 time for all frequency range)
b) Set VBW ≥ 3 × RBW;
c) Set span ≥ 1.5 times the OBW;
d) Sweep time = auto couple;
e) Detector = rms;
f) Ensure that the number of measurement points = Max (40001);
g) Trace Mode = average(WCDMA, LTE FDD, 5G NR FDD),
Max hold(LTE TDD, 5G NR TDD);

NOTE1

5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All Modes of operation were investigated and the worst case configuration results are reported in this section.

NOTE2

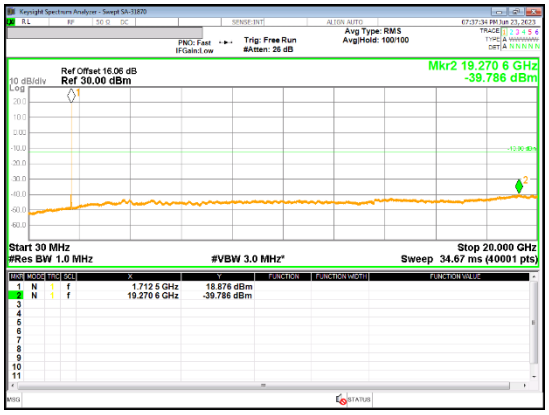
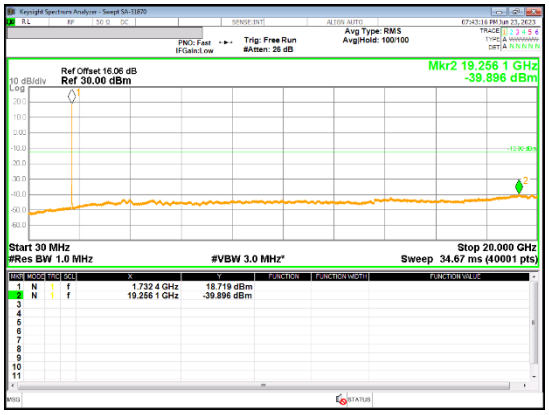
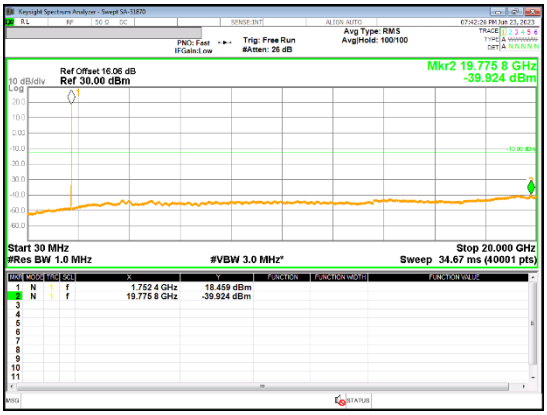
Please refer to section 5.4 for bandwidth and RB setting about LTE, 5G NR bands.

RESULTS

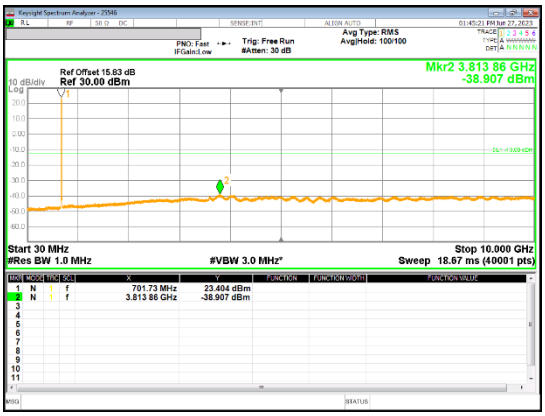
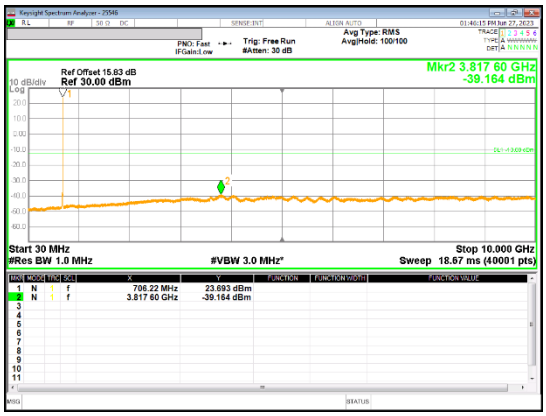
See the following pages.

8.5.1. OUT OF BAND EMISSIONS RESULT

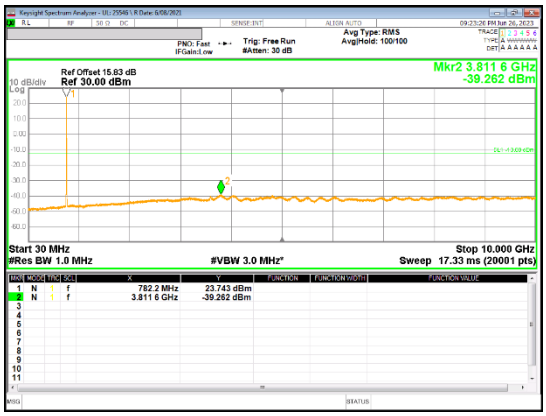
WCDMA Band 4

REL99	 Low channel	 Mid channel
	 High channel	

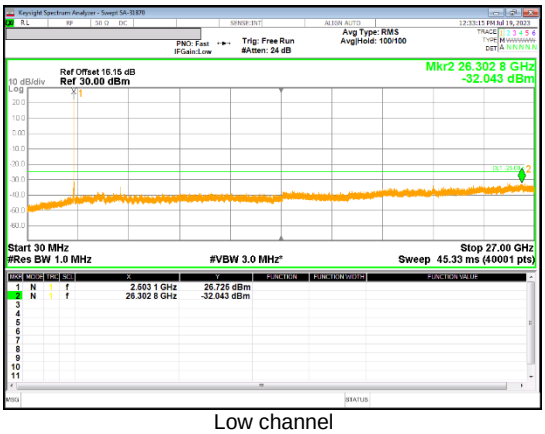
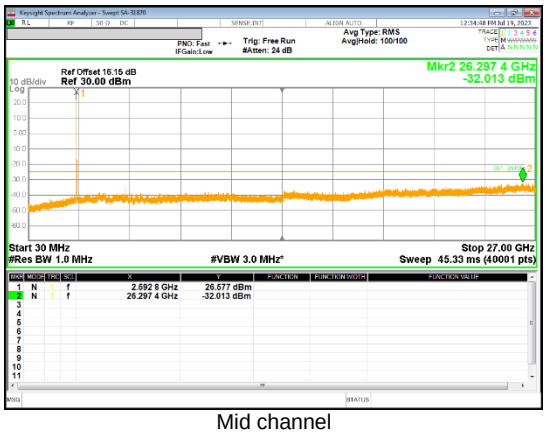
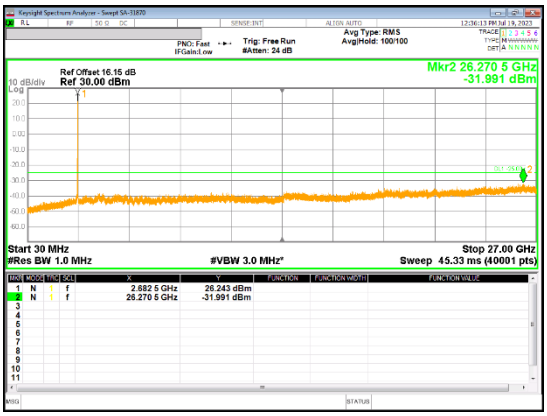
LTE Band 12

3 MHz QPSK	 Low channel	 Mid channel
	 High channel	

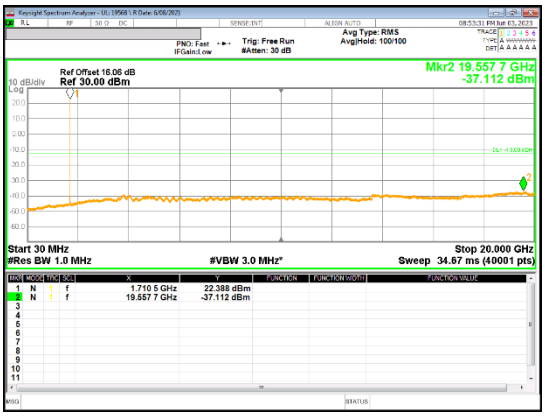
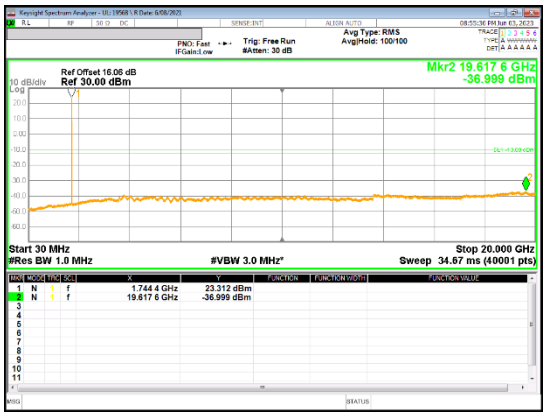
LTE Band 13

5 MHz QPSK	 Low channel	 Mid channel
	 High channel	

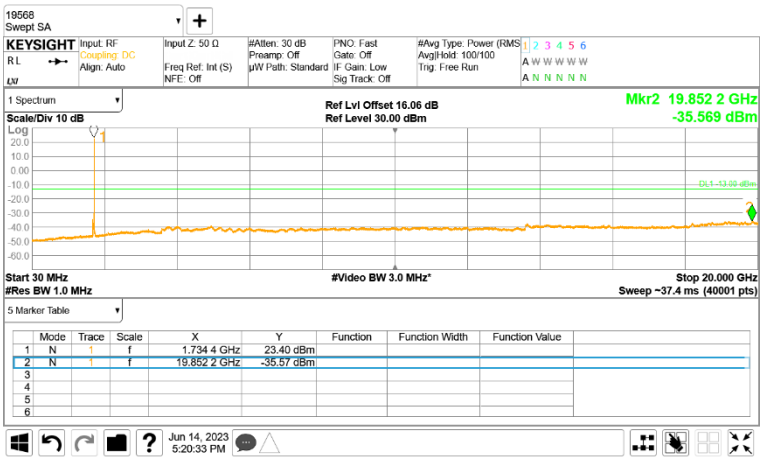
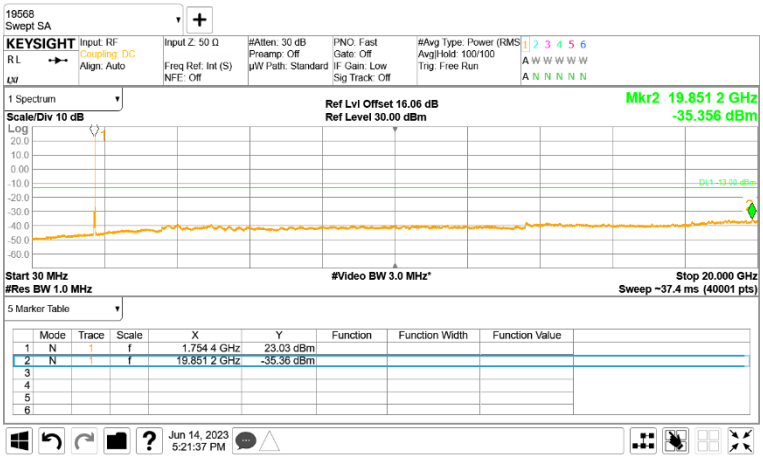
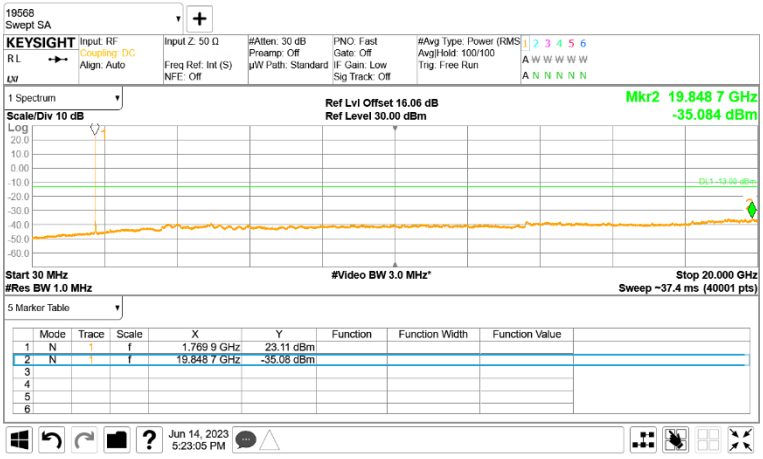
LTE Band 41

15 MHz QPSK	 Low channel	 Mid channel
	 High channel	

LTE Band 66

1.4 MHz QPSK	 Low channel	 Mid channel
	 High channel	

NR Band n66

10 MHz QPSK	 DFT-s_OFDM_Low channel
	 DFT-s_OFDM_Mid channel
	 DFT-s_OFDM_High channel

8.6. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §27.54

LIMITS

§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 v03r01

RESULTS

See the following pages.

NOTE

Test were performed each lowest or highest frequency on the modulation condition of more wide bandwidth.(Please refer to section 9.1.1 OBW results)

8.6.1. FREQUENCY STABILITY RESULTS

WCDMA Band 4 (Lowest Frequency: REL99 / Highest Frequency: HSDPA)

Test Date	2023-06-27
Test Engineer	47989

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	1710.3157	1754.6944		
Extreme (50C)		1710.3157	1754.6944	9.6	0.006
Extreme (40C)		1710.3157	1754.6944	5.4	0.003
Extreme (30C)		1710.3157	1754.6944	7.1	0.004
Extreme (10C)		1710.3157	1754.6944	6.2	0.004
Extreme (0C)		1710.3157	1754.6944	7.3	0.004
Extreme (-10C)		1710.3157	1754.6944	7.9	0.005
Extreme (-20C)		1710.3157	1754.6944	8.2	0.005
Extreme (-30C)		1710.3157	1754.6944	10.0	0.006
20C	15%	1710.3157	1754.6944	5.2	0.003
	-15%	1710.3157	1754.6944	5.0	0.003
	End Point	1710.3157	1754.6944	5.5	0.003

LTE Band 12 (Lowest Frequency: 16QAM / Highest Frequency: QPSK)

Test Date	2023-06-30
Test Engineer	47989

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	699.1545	715.8458		
Extreme (50C)		699.1545	715.8458	4.2	0.006
Extreme (40C)		699.1545	715.8458	4.4	0.006
Extreme (30C)		699.1545	715.8458	3.9	0.005
Extreme (10C)		699.1545	715.8458	3.8	0.005
Extreme (0C)		699.1545	715.8458	3.4	0.005
Extreme (-10C)		699.1545	715.8458	4.8	0.007
Extreme (-20C)		699.1545	715.8458	3.6	0.005
Extreme (-30C)		699.1545	715.8458	3.7	0.005
20C	15%	699.1545	715.8458	5.1	0.007
	-15%	699.1545	715.8458	7.6	0.011
	End Point	699.1545	715.8458	6.0	0.008

LTE Band 13 (Lowest Frequency: 16QAM / Highest Frequency: 16QAM)

Test Date	2023-07-04
Test Engineer	47989

Limit		777	787	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	777.2518	786.7495		
Extreme (50C)		777.2518	786.7495	3.4	0.004
Extreme (40C)		777.2518	786.7495	3.9	0.005
Extreme (30C)		777.2518	786.7495	3.3	0.004
Extreme (10C)		777.2518	786.7495	3.8	0.005
Extreme (0C)		777.2518	786.7495	4.0	0.005
Extreme (-10C)		777.2518	786.7495	4.5	0.006
Extreme (-20C)		777.2518	786.7495	2.6	0.003
Extreme (-30C)		777.2518	786.7495	3.7	0.005
20C	15%	777.2518	786.7495	3.9	0.005
	-15%	777.2518	786.7495	3.6	0.005
	End Point	777.2518	786.7495	3.7	0.005

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

Test Date	2023-07-06
Test Engineer	47989

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	2496.2499	2689.7500		
Extreme (50C)		2496.2499	2689.7500	16.6	0.006
Extreme (40C)		2496.2499	2689.7500	16.2	0.006
Extreme (30C)		2496.2499	2689.7500	16.8	0.006
Extreme (10C)		2496.2499	2689.7500	15.5	0.006
Extreme (0C)		2496.2499	2689.7500	15.1	0.006
Extreme (-10C)		2496.2499	2689.7500	18.2	0.007
Extreme (-20C)		2496.2499	2689.7500	19.2	0.007
Extreme (-30C)		2496.2499	2689.7500	19.3	0.007
20C	15%	2496.2499	2689.7500	12.5	0.005
	-15%	2496.2499	2689.7500	13.1	0.005
	End Point	2496.2499	2689.7500	11.9	0.005

LTE Band 66 (Lowest Frequency: 16QAM / Highest Frequency: 16QAM)

Test Date	2023-07-07
Test Engineer	47989

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	1710.1555	1779.8439		
Extreme (50C)		1710.1555	1779.8439	9.9	0.006
Extreme (40C)		1710.1555	1779.8439	10.2	0.006
Extreme (30C)		1710.1555	1779.8439	10.2	0.006
Extreme (10C)		1710.1555	1779.8439	6.7	0.004
Extreme (0C)		1710.1555	1779.8439	10.8	0.006
Extreme (-10C)		1710.1555	1779.8439	6.1	0.003
Extreme (-20C)		1710.1555	1779.8439	8.5	0.005
Extreme (-30C)		1710.1555	1779.8439	10.0	0.006
20C	15%	1710.1555	1779.8439	7.1	0.004
	-15%	1710.1555	1779.8439	5.7	0.003
	End Point	1710.1555	1779.8439	7.1	0.004

5G NR Band n66 (Lowest Frequency: QPSK / Highest Frequency: QPSK)

Test Date	2023-07-11
Test Engineer	47989

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	1709.8005	1779.7611		
Extreme (50C)		1709.8005	1779.7611	2.5	0.001
Extreme (40C)		1709.8005	1779.7611	5.5	0.003
Extreme (30C)		1709.8005	1779.7611	6.5	0.004
Extreme (10C)		1709.8005	1779.7611	4.3	0.002
Extreme (0C)		1709.8005	1779.7611	7.7	0.004
Extreme (-10C)		1709.8005	1779.7611	5.3	0.003
Extreme (-20C)		1709.8005	1779.7611	2.2	0.001
Extreme (-30C)		1709.8005	1779.7611	2.5	0.001
20C	15%	1709.8005	1779.7611	3.6	0.002
	-15%	1709.8005	1779.7611	4.7	0.003
	End Point	1709.8005	1779.7611	2.7	0.002

9. RADIATED RESULTS

9.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §27.50

LIMITS

27.50:

(b)(10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

(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) The following power limits shall apply in the BRS and EBS:

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

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 or 1 second;
e) Detector = rms;
f) Ensure that the number of measurement points ≥ span/RBW;
g) Trace Mode = max hold(WCDMA), average(LTE, 5G NR);

TEST RESULTS

See the following pages.

9.1.1. ERP/EIRP Results

WCDMA

Band	Mode	f (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Limit (dBm)	Delta (dB)
Band 4	REL99	1712.40	22.26	H	4.31	9.51	27.46	557.19	30.00	-2.54
		1732.60	22.10	H	4.33	9.60	27.37	545.76	30.00	-2.63
		1752.60	21.35	H	4.36	9.68	26.68	465.59	30.00	-3.32
	HSDPA	1712.40	21.46	H	4.31	9.51	26.66	463.45	30.00	-3.34
		1732.60	20.98	H	4.33	9.60	26.25	421.70	30.00	-3.75
		1752.60	20.49	H	4.36	9.68	25.82	381.94	30.00	-4.18

LTE Band 12

BW (MHz)	Modulation	f (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	ERP (mW)	Limit (dBm)	Delta (dB)	RB
10	QPSK	704.00	23.91	V	2.79	-1.34	19.78	95.06	34.77	-14.99	1/0
		707.50	23.98	V	2.79	-1.34	19.85	96.61	34.77	-14.92	1/0
		711.00	24.66	V	2.80	-1.33	20.53	112.98	34.77	-14.24	1/0
	16-QAM	704.00	22.60	V	2.79	-1.34	18.47	70.31	34.77	-16.30	1/0
		707.50	22.89	V	2.79	-1.34	18.76	75.16	34.77	-16.01	1/0
		711.00	23.45	V	2.80	-1.33	19.32	85.51	34.77	-15.45	1/0
5	QPSK	701.50	23.91	V	2.78	-1.35	19.78	95.06	34.77	-14.99	1/12
		707.50	24.55	V	2.79	-1.34	20.42	110.15	34.77	-14.35	1/0
		713.50	24.83	V	2.81	-1.32	20.71	117.76	34.77	-14.06	1/0
	16-QAM	701.50	22.85	V	2.78	-1.35	18.72	74.47	34.77	-16.05	1/0
		707.50	23.22	V	2.79	-1.34	19.09	81.10	34.77	-15.68	1/0
		713.50	23.75	V	2.81	-1.32	19.63	91.83	34.77	-15.14	1/0
3	QPSK	700.50	23.99	V	2.78	-1.35	19.86	96.83	34.77	-14.91	1/14
		707.50	24.49	V	2.79	-1.34	20.36	108.64	34.77	-14.41	1/0
		714.50	24.94	V	2.81	-1.32	20.81	120.50	34.77	-13.96	1/14
	16-QAM	700.50	22.69	V	2.78	-1.35	18.56	71.78	34.77	-16.21	1/0
		707.50	23.30	V	2.79	-1.34	19.17	82.60	34.77	-15.60	1/0
		714.50	23.99	V	2.81	-1.32	19.86	96.83	34.77	-14.91	1/0
1.4	QPSK	699.70	23.84	V	2.78	-1.35	19.71	93.54	34.77	-15.06	1/0
		707.50	24.00	V	2.79	-1.34	19.87	97.05	34.77	-14.90	1/0
		715.30	24.43	V	2.81	-1.32	20.30	107.15	34.77	-14.47	1/3
	16-QAM	699.70	22.67	V	2.78	-1.35	18.54	71.45	34.77	-16.23	1/3
		707.50	22.82	V	2.79	-1.34	18.69	73.96	34.77	-16.08	1/3
		715.30	23.18	V	2.81	-1.32	19.05	80.35	34.77	-15.72	1/3

LTE Band 13

BW (MHz)	Modulation	f (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	ERP (mW)	Limit (dBm)	Delta (dB)	RB
10	QPSK	782.00	27.95	V	2.93	-1.19	23.83	241.55	34.77	-10.94	1/0
	16-QAM	782.00	27.10	V	2.93	-1.19	22.98	198.61	34.77	-11.79	1/25
5	QPSK	779.50	27.93	V	2.93	-1.19	23.81	240.44	34.77	-10.96	1/12
		782.00	28.09	V	2.93	-1.19	23.97	249.46	34.77	-10.80	1/12
		784.50	28.59	V	2.94	-1.18	24.47	279.90	34.77	-10.30	1/24
	16-QAM	779.50	26.77	V	2.93	-1.19	22.65	184.08	34.77	-12.12	1/0
		782.00	26.86	V	2.93	-1.19	22.74	187.93	34.77	-12.03	1/0
		784.50	27.47	V	2.94	-1.18	23.35	216.27	34.77	-11.42	1/0

LTE Band 41

BW (MHz)	Modulation	f (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Limit (dBm)	Delta (dB)	RB
20	QPSK	2506.00	17.75	H	5.25	9.99	22.49	177.42	33.00	-10.51	1/99
		2593.00	20.00	H	5.34	9.91	24.58	287.08	33.00	-8.42	1/0
		2680.00	17.91	H	5.43	9.87	22.35	171.79	33.00	-10.65	1/99
	16-QAM	2506.00	16.90	H	5.25	9.99	21.64	145.88	33.00	-11.36	1/0
		2593.00	20.22	H	5.34	9.91	24.80	302.00	33.00	-8.20	1/99
		2680.00	17.13	H	5.43	9.87	21.57	143.55	33.00	-11.43	1/99
15	QPSK	2503.50	18.09	H	5.24	9.99	22.84	192.31	33.00	-10.16	1/37
		2593.00	21.33	H	5.34	9.91	25.91	389.94	33.00	-7.09	1/37
		2682.50	17.79	H	5.43	9.87	22.24	167.49	33.00	-10.76	1/74
	16-QAM	2503.50	17.18	H	5.24	9.99	21.93	155.96	33.00	-11.07	1/74
		2593.00	20.63	H	5.34	9.91	25.21	331.89	33.00	-7.79	1/74
		2682.50	16.90	H	5.43	9.87	21.35	136.46	33.00	-11.65	1/74
10	QPSK	2501.00	17.50	H	5.24	10.00	22.25	167.88	33.00	-10.75	1/49
		2593.00	21.37	H	5.34	9.91	25.95	393.55	33.00	-7.05	1/0
		2685.00	17.69	H	5.43	9.87	22.13	163.31	33.00	-10.87	1/49
	16-QAM	2501.00	16.43	H	5.24	10.00	21.18	131.22	33.00	-11.82	1/25
		2593.00	20.56	H	5.34	9.91	25.14	326.59	33.00	-7.86	1/25
		2685.00	16.72	H	5.43	9.87	21.16	130.62	33.00	-11.84	1/25
5	QPSK	2498.50	17.65	H	5.23	10.00	22.42	174.58	33.00	-10.58	1/12
		2593.00	21.25	H	5.34	9.91	25.83	382.82	33.00	-7.17	1/12
		2687.50	18.04	H	5.44	9.87	22.47	176.60	33.00	-10.53	1/12
	16-QAM	2498.50	17.00	H	5.23	10.00	21.77	150.31	33.00	-11.23	1/24
		2593.00	20.31	H	5.34	9.91	24.89	308.32	33.00	-8.11	1/12
		2687.50	17.23	H	5.44	9.87	21.66	146.55	33.00	-11.34	1/12

LTE Band 66

BW (MHz)	Modulation	f (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Limit (dBm)	Delta (dB)	RB
20	QPSK	1720.00	21.20	H	4.32	9.55	26.43	439.54	30.00	-3.57	1/99
		1745.00	20.72	H	4.35	9.66	26.03	400.87	30.00	-3.97	1/99
		1770.00	19.32	H	4.38	9.68	24.62	289.73	30.00	-5.38	1/49
	16-QAM	1720.00	20.61	H	4.32	9.55	25.84	383.71	30.00	-4.16	1/99
		1745.00	20.19	H	4.35	9.66	25.50	354.81	30.00	-4.50	1/49
		1770.00	18.93	H	4.38	9.68	24.23	264.85	30.00	-5.77	1/49
15	QPSK	1717.50	21.09	H	4.31	9.53	26.31	427.56	30.00	-3.69	1/74
		1745.00	21.46	H	4.35	9.66	26.77	475.34	30.00	-3.23	1/37
		1772.50	19.21	H	4.38	9.68	24.51	282.49	30.00	-5.49	1/37
	16-QAM	1717.50	20.50	H	4.31	9.53	25.72	373.25	30.00	-4.28	1/74
		1745.00	20.98	H	4.35	9.66	26.29	425.60	30.00	-3.71	1/37
		1772.50	18.79	H	4.38	9.68	24.09	256.45	30.00	-5.91	1/37
10	QPSK	1715.00	21.47	H	4.31	9.52	26.68	465.59	30.00	-3.32	1/49
		1745.00	21.46	H	4.35	9.66	26.77	475.34	30.00	-3.23	1/25
		1775.00	19.61	H	4.38	9.68	24.91	309.74	30.00	-5.09	1/49
	16-QAM	1715.00	20.91	H	4.31	9.52	26.12	409.26	30.00	-3.88	1/49
		1745.00	21.00	H	4.35	9.66	26.31	427.56	30.00	-3.69	1/25
		1775.00	19.06	H	4.38	9.68	24.36	272.90	30.00	-5.64	1/0
5	QPSK	1712.50	21.35	H	4.31	9.51	26.55	451.86	30.00	-3.45	1/12
		1745.00	21.75	H	4.35	9.66	27.06	508.16	30.00	-2.94	1/24
		1777.50	19.61	H	4.39	9.68	24.90	309.03	30.00	-5.10	1/12
	16-QAM	1712.50	21.11	H	4.31	9.51	26.31	427.56	30.00	-3.69	1/0
		1745.00	21.06	H	4.35	9.66	26.37	433.51	30.00	-3.63	1/0
		1777.50	19.17	H	4.39	9.68	24.46	279.25	30.00	-5.54	1/12
3	QPSK	1711.50	21.06	H	4.31	9.51	26.26	422.67	30.00	-3.74	1/14
		1745.00	21.92	H	4.35	9.66	27.23	528.45	30.00	-2.77	1/8
		1778.50	19.98	H	4.39	9.68	25.27	336.51	30.00	-4.73	1/8
	16-QAM	1711.50	20.64	H	4.31	9.51	25.84	383.71	30.00	-4.16	1/14
		1745.00	21.23	H	4.35	9.66	26.54	450.82	30.00	-3.46	1/14
		1778.50	19.31	H	4.39	9.68	24.60	288.40	30.00	-5.40	1/8
1.4	QPSK	1710.70	20.68	H	4.31	9.50	25.88	387.26	30.00	-4.12	1/5
		1745.00	22.11	H	4.35	9.66	27.42	552.08	30.00	-2.58	1/3
		1779.30	20.08	H	4.39	9.68	25.37	344.35	30.00	-4.63	1/5
	16-QAM	1710.70	20.89	H	4.31	9.50	26.09	406.44	30.00	-3.91	1/5
		1745.00	21.56	H	4.35	9.66	26.87	486.41	30.00	-3.13	1/3
		1779.30	19.19	H	4.39	9.68	24.48	280.54	30.00	-5.52	1/3

5G NR n66

BW (MHz)	Modulation	f (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Limit (dBm)	Delta (dB)	RB
20	QPSK	1720.00	21.23	H	4.32	9.55	26.46	442.59	30.00	-3.54	1/104
		1745.00	20.15	H	4.35	9.66	25.46	351.56	30.00	-4.54	1/104
		1770.00	19.97	H	4.38	9.68	25.27	336.51	30.00	-4.73	1/104
	16-QAM	1720.00	20.29	H	4.32	9.55	25.52	356.45	30.00	-4.48	1/104
		1745.00	18.67	H	4.35	9.66	23.98	250.03	30.00	-6.02	1/104
		1770.00	18.53	H	4.38	9.68	23.83	241.55	30.00	-6.17	1/104
15	QPSK	1717.50	19.92	H	4.31	9.53	25.14	326.59	30.00	-4.86	1/40
		1745.00	20.05	H	4.35	9.66	25.36	343.56	30.00	-4.64	1/77
		1772.50	18.30	H	4.38	9.68	23.60	229.09	30.00	-6.40	1/77
	16-QAM	1717.50	19.28	H	4.31	9.53	24.50	281.84	30.00	-5.50	1/40
		1745.00	19.63	H	4.35	9.66	24.94	311.89	30.00	-5.06	1/77
		1772.50	17.76	H	4.38	9.68	23.06	202.30	30.00	-6.94	1/77
10	QPSK	1715.00	21.26	H	4.31	9.52	26.47	443.61	30.00	-3.53	1/26
		1745.00	21.32	H	4.35	9.66	26.63	460.26	30.00	-3.37	1/50
		1775.00	20.22	H	4.38	9.68	25.52	356.45	30.00	-4.48	1/26
	16-QAM	1715.00	20.17	H	4.31	9.52	25.38	345.14	30.00	-4.62	1/26
		1745.00	20.27	H	4.35	9.66	25.58	361.41	30.00	-4.42	1/50
		1775.00	19.70	H	4.38	9.68	25.00	316.23	30.00	-5.00	1/26
5	QPSK	1712.50	21.30	H	4.31	9.51	26.50	446.68	30.00	-3.50	1/13
		1745.00	20.88	H	4.35	9.66	26.19	415.91	30.00	-3.81	1/23
		1777.50	19.41	H	4.39	9.68	24.70	295.12	30.00	-5.30	1/1
	16-QAM	1712.50	20.59	H	4.31	9.51	25.79	379.31	30.00	-4.21	1/13
		1745.00	20.07	H	4.35	9.66	25.38	345.14	30.00	-4.62	1/23
		1777.50	18.66	H	4.39	9.68	23.95	248.31	30.00	-6.05	1/1

9.2. RADIATIED SPURIOUS EMISSION

RULE PART(S)

FCC: §2.1053, §27. 53

LIMIT

Part 27.53:
(c)(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

(f) For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB.

(h) The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 $\log_{10}$ (P) dB.

(m) (4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.12; ESU40 setting reference to 971168 D01 v03r01

For peak power measurement with a ESU40:

a) Set the RBW = 100 kHz for emission below 1 GHz and 1 MHz for emissions above 1 GHz
b) Set VBW ≥ 3 × RBW;
c) Set span ≥ 1.5 times the OBW;
d) Sweep time = auto couple;
e) Detector = rms;
f) Ensure that the number of measurement points ≥ span/RBW;
g) Trace Mode = average(WCDMA, LTE FDD, 5G NR FDD), Maxhold(LTE TDD);

NOTE1

5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All Modes of operation were investigated and the worst case configuration results are reported in this section.

NOTE2

Please refer to section 5.4 for bandwidth and RB setting about LTE, 5G NR bands.

RESULTS

See the following pages.

9.2.1. SPURIOUS RADIATION PLOTS

WCDMA Band 4

REL99

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company:	Samsung
Project #:	4790841155
Date:	2023-06-23
Test Engineer:	24542
Configuration:	EUT / AC Aapter, X-Posiiton
Location:	Chamber 2
Mode:	Rel99 Band 4 Harmonics
Test Votage:	AC 120 V, 60 Hz

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1712.4MHz									
3424.80	-8.9	V	3.0	42.1	1.0	-50.0	-13.0	-37.0	
5137.20	-8.9	V	3.0	42.8	1.0	-50.7	-13.0	-37.7	
6849.60	-5.9	V	3.0	42.7	1.0	-47.6	-13.0	-34.6	
3424.80	-9.1	H	3.0	42.1	1.0	-50.2	-13.0	-37.2	
5137.20	-8.8	H	3.0	42.8	1.0	-50.6	-13.0	-37.6	
6849.60	-5.9	H	3.0	42.7	1.0	-47.6	-13.0	-34.6	
Mid Ch, 1732.6MHz									
3465.20	-8.8	V	3.0	42.1	1.0	-49.8	-13.0	-36.8	
5197.80	-8.7	V	3.0	42.8	1.0	-50.5	-13.0	-37.5	
6930.40	-5.8	V	3.0	42.7	1.0	-47.5	-13.0	-34.5	
3465.20	-9.0	H	3.0	42.1	1.0	-50.1	-13.0	-37.1	
5197.80	-8.6	H	3.0	42.8	1.0	-50.4	-13.0	-37.4	
6930.40	-6.0	H	3.0	42.7	1.0	-47.7	-13.0	-34.7	
High Ch, 1752.6MHz									
3505.20	-8.6	V	3.0	42.1	1.0	-49.6	-13.0	-36.6	
5257.80	-8.7	V	3.0	42.8	1.0	-50.6	-13.0	-37.6	
7010.40	-5.5	V	3.0	42.7	1.0	-47.2	-13.0	-34.2	
3505.20	-8.8	H	3.0	42.1	1.0	-49.9	-13.0	-36.9	
5257.80	-5.5	H	3.0	42.8	1.0	-47.4	-13.0	-34.4	
7010.40	-5.7	H	3.0	42.7	1.0	-47.3	-13.0	-34.3	

LTE Band 12

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company:	Samsung
Project #:	4790841155
Date:	2023-06-23
Test Engineer:	19568
Configuration:	EUT / AC Adapter, Y-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 12 Harmonics, 3MHz Bandwidth
Test Votage:	AC 120 V, 60 Hz

3 MHz

QPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 700.5MHz									
1401.00	-16.3	V	3.0	40.7	1.0	-56.0	-13.0	-43.0	
2101.50	-13.3	V	3.0	40.8	1.0	-53.1	-13.0	-40.1	
2802.00	-11.4	V	3.0	41.8	1.0	-52.2	-13.0	-39.2	
1401.00	-17.3	H	3.0	40.7	1.0	-57.0	-13.0	-44.0	
2101.50	-13.3	H	3.0	40.8	1.0	-53.1	-13.0	-40.1	
2802.00	-11.7	H	3.0	41.8	1.0	-52.4	-13.0	-39.4	
Mid Ch, 707.5MHz									
1415.00	-16.3	V	3.0	40.7	1.0	-56.1	-13.0	-43.1	
2122.50	-13.3	V	3.0	40.8	1.0	-53.1	-13.0	-40.1	
2830.00	-11.5	V	3.0	41.8	1.0	-52.3	-13.0	-39.3	
1415.00	-17.3	H	3.0	40.7	1.0	-57.1	-13.0	-44.1	
2122.50	-13.3	H	3.0	40.8	1.0	-53.1	-13.0	-40.1	
2830.00	-11.5	H	3.0	41.8	1.0	-52.3	-13.0	-39.3	
High Ch, 714.5MHz									
1429.00	-16.2	V	3.0	40.7	1.0	-55.9	-13.0	-42.9	
2143.50	-13.4	V	3.0	40.8	1.0	-53.2	-13.0	-40.2	
2858.00	-11.4	V	3.0	41.8	1.0	-52.3	-13.0	-39.3	
1429.00	-16.9	H	3.0	40.7	1.0	-56.6	-13.0	-43.6	
2143.50	-13.4	H	3.0	40.8	1.0	-53.2	-13.0	-40.2	
2858.00	-11.4	H	3.0	41.8	1.0	-52.2	-13.0	-39.2	

LTE Band 13

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company:	Samsung
Project #:	4790841155
Date:	2023-06-02
Test Engineer:	24542
Configuration:	EUT / AC Adapter, X-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 13 Harmonics, 5MHz Bandwidth
Test Votage:	AC 120 V, 60 Hz

5 MHz

QPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 779.5MHz									
1559.00	-17.1	V	3.0	46.3	1.0	-62.4	-40.0	-22.4	
2338.50	-12.1	V	3.0	46.8	1.0	-57.9	-13.0	-44.9	
3118.00	-10.1	V	3.0	46.9	1.0	-56.0	-13.0	-43.0	
1559.00	-20.6	H	3.0	46.3	1.0	-65.9	-40.0	-25.9	
2338.50	-12.4	H	3.0	46.8	1.0	-58.3	-13.0	-45.3	
3118.00	-10.1	H	3.0	46.9	1.0	-56.0	-13.0	-43.0	
Mid Ch, 782MHz									
1564.00	-17.8	V	3.0	46.4	1.0	-63.2	-40.0	-23.2	
2346.00	-11.9	V	3.0	46.8	1.0	-57.7	-13.0	-44.7	
3128.00	-10.0	V	3.0	46.9	1.0	-55.9	-13.0	-42.9	
1564.00	-20.3	H	3.0	46.4	1.0	-65.7	-40.0	-25.7	
2346.00	-12.3	H	3.0	46.8	1.0	-58.2	-13.0	-45.2	
3128.00	-10.0	H	3.0	46.9	1.0	-55.9	-13.0	-42.9	
High Ch, 784.5MHz									
1569.00	-15.9	V	3.0	46.4	1.0	-61.3	-40.0	-21.3	
2353.50	-12.0	V	3.0	46.8	1.0	-57.8	-13.0	-44.8	
3138.00	-10.0	V	3.0	46.9	1.0	-55.8	-13.0	-42.8	
1569.00	-19.9	H	3.0	46.4	1.0	-65.2	-40.0	-25.2	
2353.50	-12.5	H	3.0	46.8	1.0	-58.3	-13.0	-45.3	
3138.00	-10.0	H	3.0	46.9	1.0	-55.8	-13.0	-42.8	

LTE Band 41

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company:	Samsung
Project #:	4790841155
Date:	2023-06-21
Test Engineer:	24542
Configuration:	EUT / AC Adapter, Z-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 41 Harmonics, 10MHz Bandwidth
Test Votage:	AC 120 V, 60 Hz

10 MHz

QPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 2501MHz									
5002.00	-2.6	V	3.0	46.2	1.0	-47.9	-25.0	-22.9	
7503.00	3.4	V	3.0	45.5	1.0	-41.2	-25.0	-16.2	
10004.00	-10.1	V	3.0	45.6	1.0	-54.7	-25.0	-29.7	
5002.00	0.6	H	3.0	46.2	1.0	-44.6	-25.0	-19.6	
7503.00	3.0	H	3.0	45.5	1.0	-41.6	-25.0	-16.6	
10004.00	-10.1	H	3.0	45.6	1.0	-54.6	-25.0	-29.6	
Mid Ch, 2593MHz									
5186.00	-4.5	V	3.0	46.1	1.0	-49.6	-25.0	-24.6	
7779.00	4.1	V	3.0	45.6	1.0	-40.5	-25.0	-15.5	
10372.00	-8.3	V	3.0	45.9	1.0	-53.2	-25.0	-28.2	
5186.00	-1.3	H	3.0	46.1	1.0	-46.4	-25.0	-21.4	
7779.00	5.3	H	3.0	45.6	1.0	-39.3	-25.0	-14.3	
10372.00	-9.0	H	3.0	45.9	1.0	-53.9	-25.0	-28.9	
High Ch, 2685MHz									
5370.00	-8.4	V	3.0	45.9	1.0	-53.3	-25.0	-28.3	
8055.00	4.7	V	3.0	45.6	1.0	-39.9	-25.0	-14.9	
10740.00	-9.3	V	3.0	46.2	1.0	-54.5	-25.0	-29.5	
5370.00	-10.7	H	3.0	45.9	1.0	-55.6	-25.0	-30.6	
8055.00	-0.1	H	3.0	45.6	1.0	-44.7	-25.0	-19.7	
10740.00	-9.2	H	3.0	46.2	1.0	-54.4	-25.0	-29.4	

LTE Band 66

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company:	Samsung
Project #:	4790841155
Date:	2023-06-23
Test Engineer:	19568
Configuration:	EUT / AC Adapter, Z-Position
Location:	Chamber 2
Mode:	LTE_QPSK Band 66 Harmonics, 1.4MHz Bandwidth
Test Votage:	AC 120 V, 60 Hz

1.4 MHz

QPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1710.7MHz									
3421.40	-8.8	V	3.0	42.1	1.0	-49.9	-13.0	-36.9	
5132.10	-8.8	V	3.0	42.8	1.0	-50.6	-13.0	-37.6	
6842.80	-5.3	V	3.0	42.7	1.0	-47.0	-13.0	-34.0	
3421.40	-9.0	H	3.0	42.1	1.0	-50.0	-13.0	-37.0	
5132.10	-8.7	H	3.0	42.8	1.0	-50.5	-13.0	-37.5	
6842.80	-4.7	H	3.0	42.7	1.0	-46.4	-13.0	-33.4	
Mid Ch, 1745MHz									
3490.00	-8.7	V	3.0	42.1	1.0	-49.8	-13.0	-36.8	
5235.00	-8.6	V	3.0	42.8	1.0	-50.5	-13.0	-37.5	
6980.00	-3.8	V	3.0	42.7	1.0	-45.5	-13.0	-32.5	
3490.00	-9.0	H	3.0	42.1	1.0	-50.0	-13.0	-37.0	
5235.00	-8.6	H	3.0	42.8	1.0	-50.4	-13.0	-37.4	
6980.00	-2.4	H	3.0	42.7	1.0	-44.1	-13.0	-31.1	
High Ch, 1779.3MHz									
3558.60	-7.5	V	3.0	42.1	1.0	-48.6	-13.0	-35.6	
5337.90	-8.0	V	3.0	42.8	1.0	-49.8	-13.0	-36.8	
7117.20	-3.0	V	3.0	42.6	1.0	-44.7	-13.0	-31.7	
3558.60	-7.7	H	3.0	42.1	1.0	-48.8	-13.0	-35.8	
5337.90	-8.1	H	3.0	42.8	1.0	-49.9	-13.0	-36.9	
7117.20	-0.9	H	3.0	42.6	1.0	-42.5	-13.0	-29.5	

NR Band n66

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company:	Samsung
Project #:	4790841155
Date:	2023-06-22
Test Engineer:	24542
Configuration:	EUT / AC Adapter, Z-Position
Location:	Chamber 2
Mode:	5G NR_QPSK NR n66 Harmonics, 10MHz Bandwidth
Test Votage:	AC 120 V, 60 Hz

10 MHz

DFT-OFDM

QPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1715MHz									
3430.00	-8.9	V	3.0	42.1	1.0	-50.0	-13.0	-37.0	
5145.00	-5.9	V	3.0	42.8	1.0	-47.7	-13.0	-34.7	
6860.00	-5.0	V	3.0	42.7	1.0	-46.7	-13.0	-33.7	
8575.00	-4.7	V	3.0	41.9	1.0	-45.6	-13.0	-32.6	
10290.00	-1.5	V	3.0	41.0	1.0	-41.5	-13.0	-28.5	
3430.00	-9.1	H	3.0	42.1	1.0	-50.2	-13.0	-37.2	
5145.00	-8.8	H	3.0	42.8	1.0	-50.6	-13.0	-37.6	
6860.00	-5.9	H	3.0	42.7	1.0	-47.6	-13.0	-34.6	
8575.00	-4.7	H	3.0	41.9	1.0	-45.6	-13.0	-32.6	
10290.00	-1.3	H	3.0	41.0	1.0	-41.3	-13.0	-28.3	
Mid Ch, 1745MHz									
3490.00	-8.7	V	3.0	42.1	1.0	-49.8	-13.0	-36.8	
5235.00	-8.8	V	3.0	42.8	1.0	-50.6	-13.0	-37.6	
6980.00	-4.9	V	3.0	42.7	1.0	-46.6	-13.0	-33.6	
8725.00	-4.4	V	3.0	41.9	1.0	-45.3	-13.0	-32.3	
10470.00	-1.0	V	3.0	41.1	1.0	-41.0	-13.0	-28.0	
3490.00	-8.9	H	3.0	42.1	1.0	-50.0	-13.0	-37.0	
5235.00	-8.7	H	3.0	42.8	1.0	-50.5	-13.0	-37.5	
6980.00	-4.4	H	3.0	42.7	1.0	-46.1	-13.0	-33.1	
8725.00	-4.3	H	3.0	41.9	1.0	-45.2	-13.0	-32.2	
10470.00	-0.8	H	3.0	41.1	1.0	-40.9	-13.0	-27.9	
High Ch, 1775MHz									
3550.00	-7.5	V	3.0	42.1	1.0	-48.6	-13.0	-35.6	
5325.00	-8.3	V	3.0	42.8	1.0	-50.2	-13.0	-37.2	
7100.00	-4.9	V	3.0	42.6	1.0	-46.5	-13.0	-33.5	
8875.00	-3.9	V	3.0	41.8	1.0	-44.7	-13.0	-31.7	
10650.00	-0.8	V	3.0	41.1	1.0	-40.9	-13.0	-27.9	
3550.00	-7.7	H	3.0	42.1	1.0	-48.8	-13.0	-35.8	
5325.00	-8.2	H	3.0	42.8	1.0	-50.0	-13.0	-37.0	
7100.00	-5.7	H	3.0	42.6	1.0	-47.3	-13.0	-34.3	
8875.00	-3.7	H	3.0	41.8	1.0	-44.6	-13.0	-31.6	
10650.00	-0.6	H	3.0	41.1	1.0	-40.7	-13.0	-27.7	

END OF REPORT