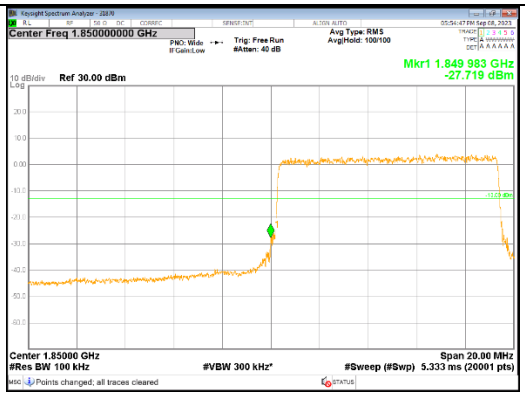
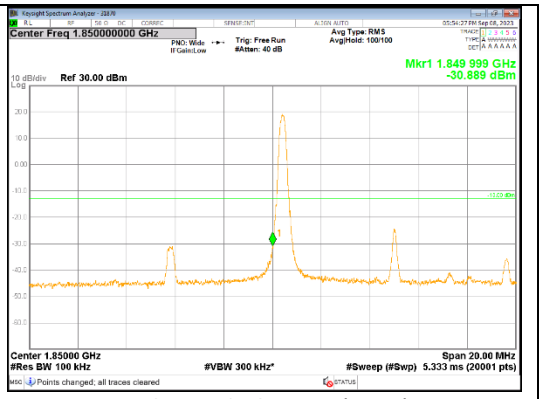
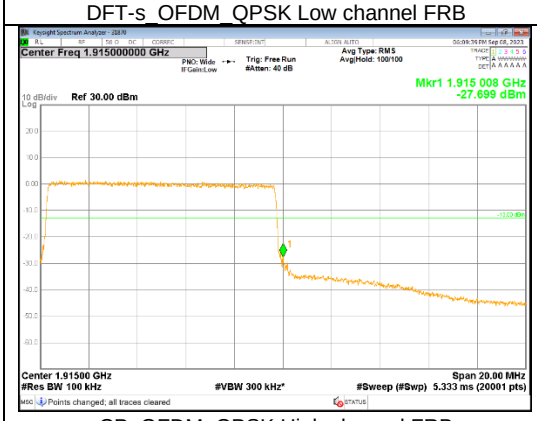
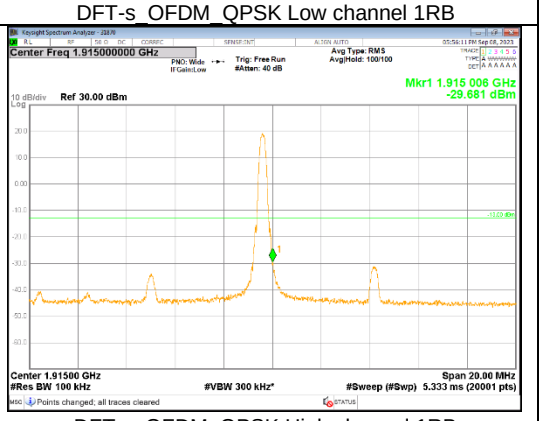
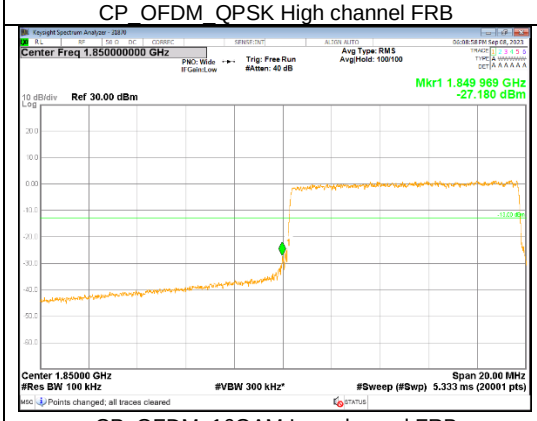
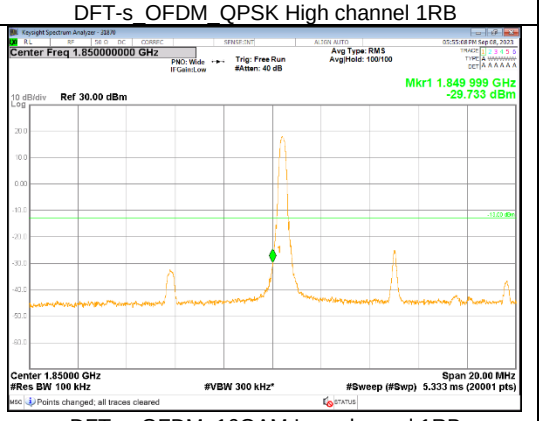
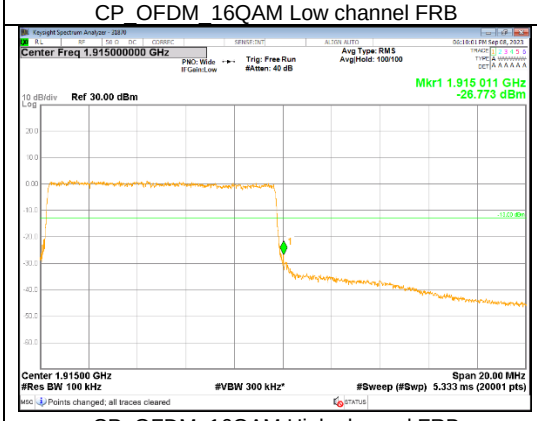
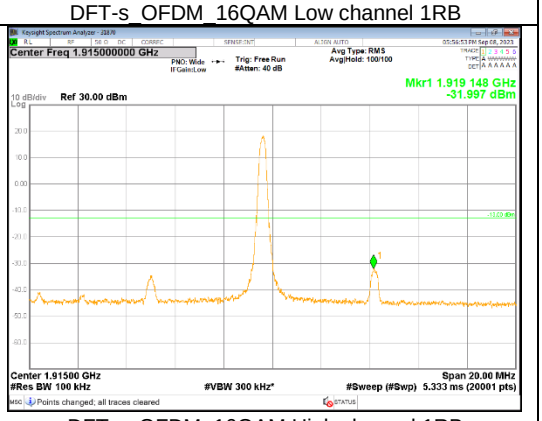
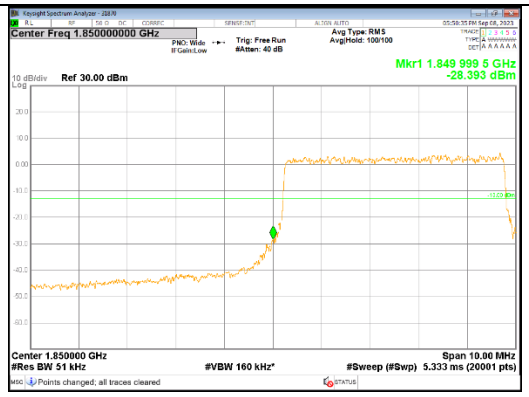
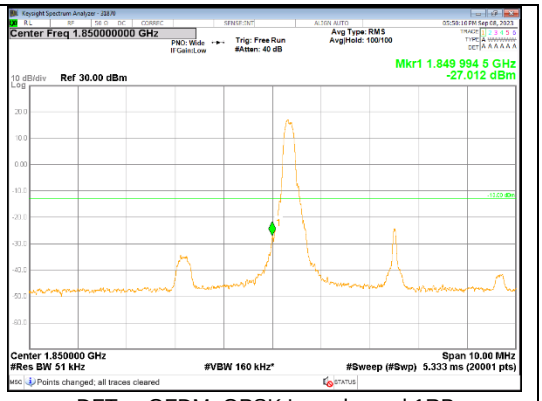
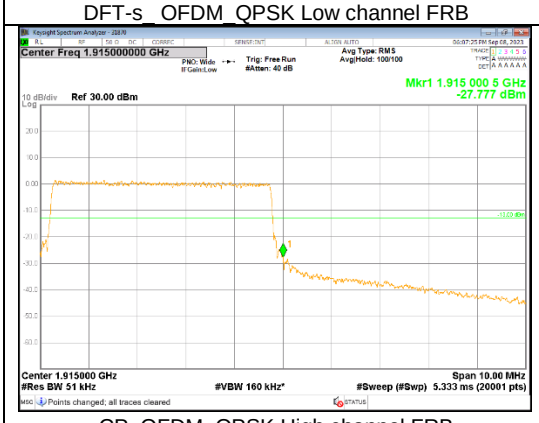
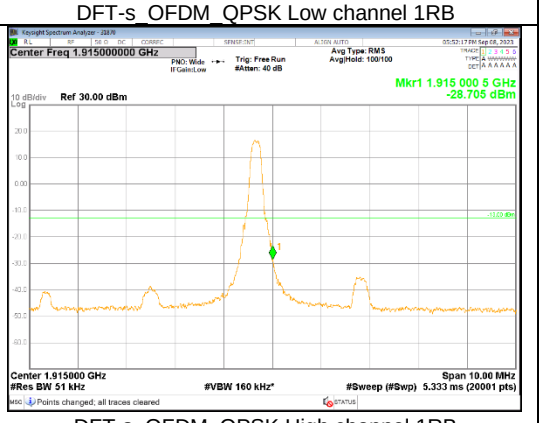
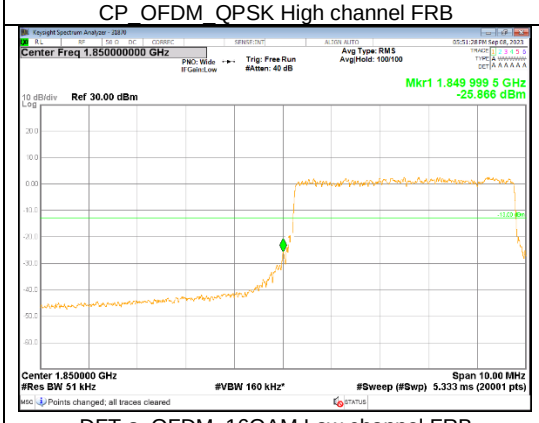
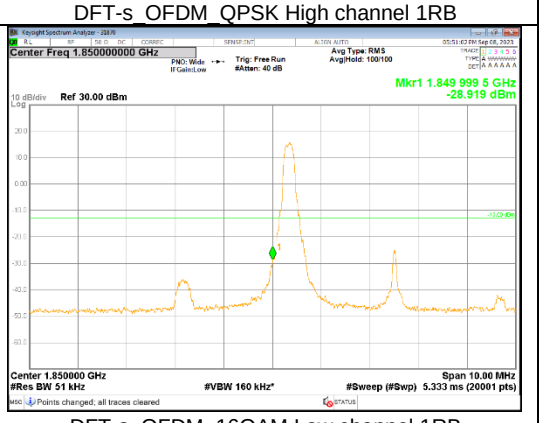
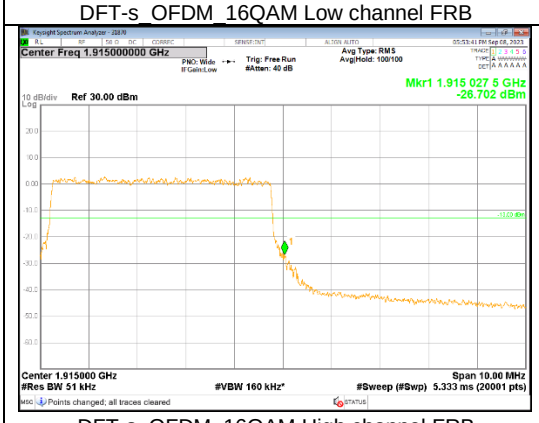
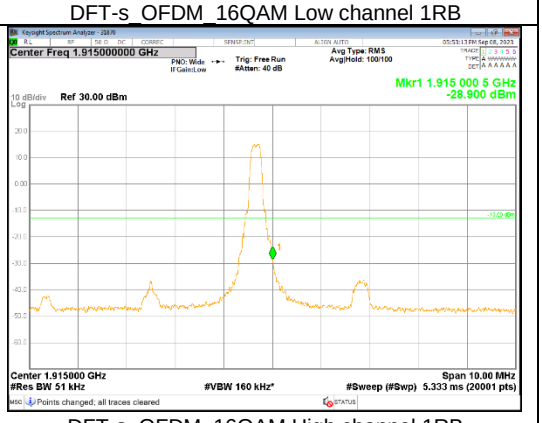
10MHz	 DFT-s_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 CP_OFDM_QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 CP_OFDM_16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 CP_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

5MHz	 DFT-s_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 CP_OFDM_QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 DFT-s_OFDM_16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 DFT-s_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

8.5. CONDUCTED SPURIOUS EMISSIONS

RULE PART(S)

FCC: §2.1051, §24.238

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.

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, 5G NR), Max hold(GSM);

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

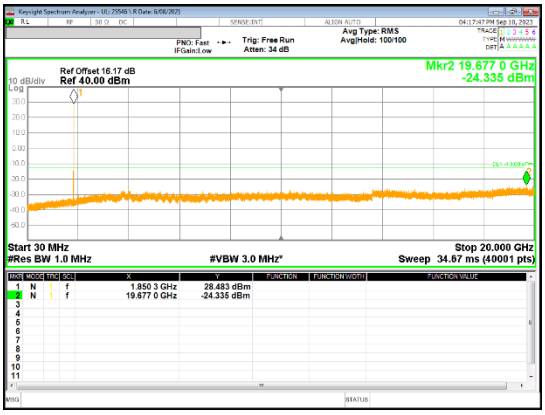
See the following pages.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_24(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

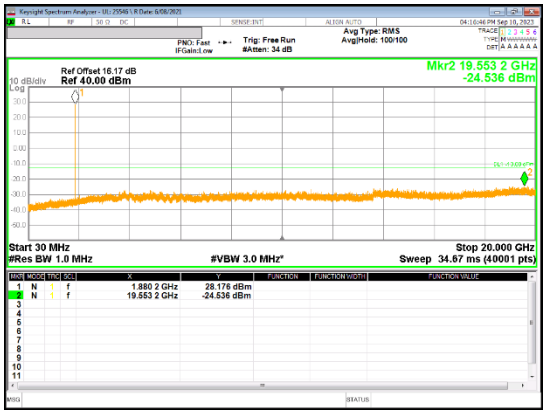
8.5.1. OUT OF BAND EMISSIONS RESULT

GSM 1900

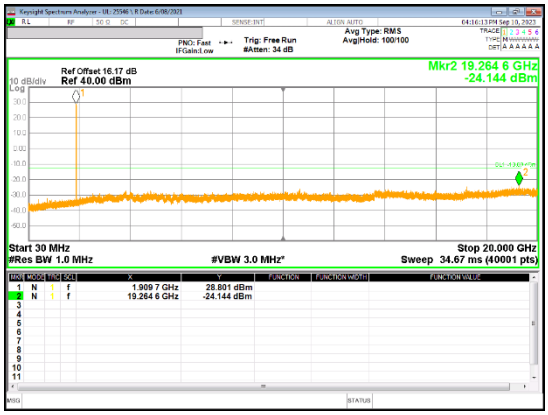
GPRS



Low channel

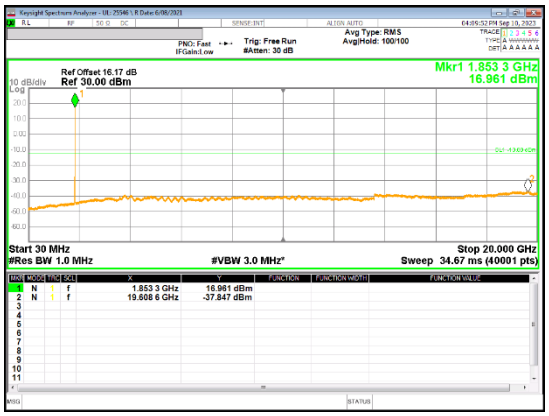
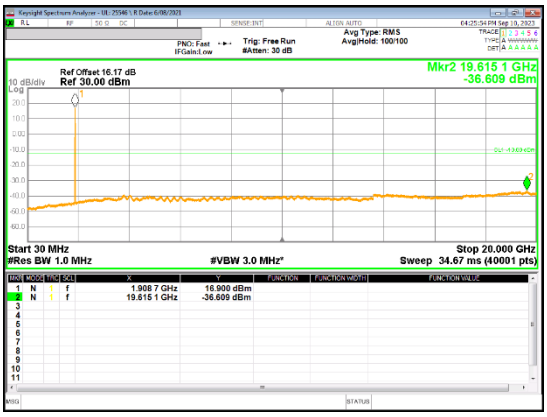


Mid channel

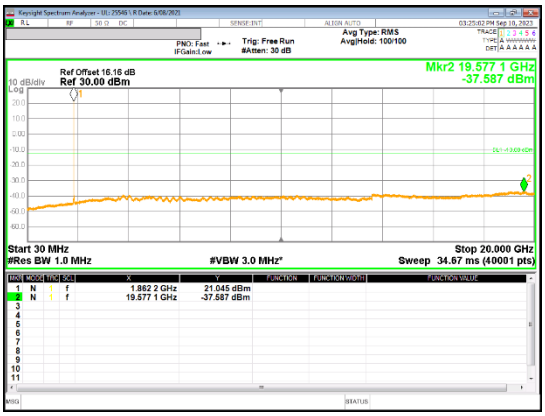
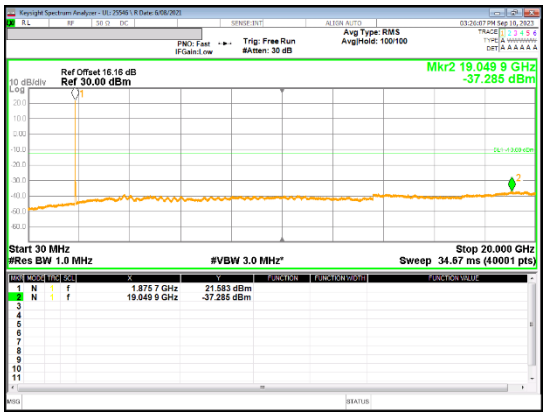
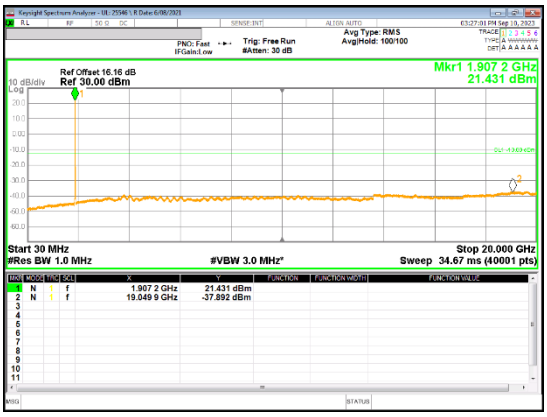


High channel

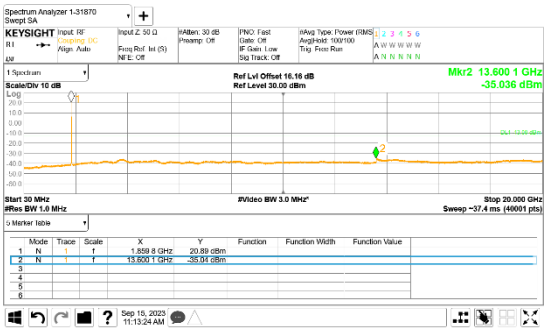
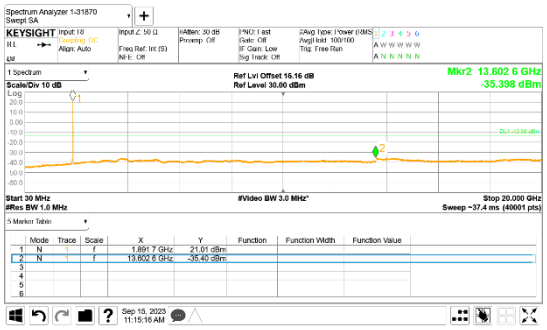
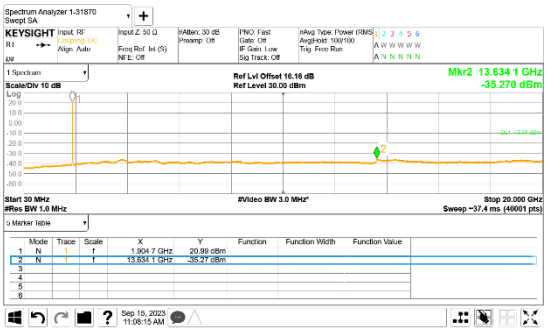
WCDMA Band 2

REL99	 Low channel	 Mid channel
	 High channel	

LTE Band 25

20 MHz QPSK	 Low channel	 Mid channel
	 High channel	

NR Band n25

20MHz QPSK	 DFT-s_OFDM _QPSK_Low channel	 DFT-s_OFDM _QPSK_Mid channel
	 DFT-s_OFDM _QPSK_High channel	

8.6. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §24.235

LIMITS

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

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

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)

RESULTS

See the following pages.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_24(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

8.6.1. FREQUENCY STABILITY RESULTS

GSM 1900, Channel 512/810, Frequency 1850.0/1910.0 MHz
(Lowest Frequency:EGPRS / Highest Frequency: GPRS)

Test Date	2023-09-05
Test Engineer	47989

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	1850.0771	1909.9227		
Extreme (50C)		1850.0771	1909.9227	20.6	0.011
Extreme (40C)		1850.0771	1909.9227	34.4	0.018
Extreme (30C)		1850.0771	1909.9227	25.5	0.014
Extreme (10C)		1850.0771	1909.9227	27.2	0.014
Extreme (0C)		1850.0771	1909.9227	30.9	0.016
Extreme (-10C)		1850.0771	1909.9227	31.3	0.017
Extreme (-20C)		1850.0771	1909.9227	33.3	0.018
Extreme (-30C)		1850.0771	1909.9227	35.4	0.019
20C	15%	1850.0771	1909.9227	39.8	0.021
	-15%	1850.0771	1909.9227	35.6	0.019
	End Point	1850.0771	1909.9227	38.9	0.021

WCDMA Band 2 (Lowest Frequency: HSDPA / Highest Frequency: HSDPA)

Test Date	2023-09-06
Test Engineer	47989

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	1850.3164	1909.6876		
Extreme (50C)		1850.3164	1909.6876	10.1	0.005
Extreme (40C)		1850.3164	1909.6876	6.0	0.003
Extreme (30C)		1850.3164	1909.6876	11.7	0.006
Extreme (10C)		1850.3164	1909.6876	12.2	0.006
Extreme (0C)		1850.3164	1909.6876	10.8	0.006
Extreme (-10C)		1850.3164	1909.6876	12.5	0.007
Extreme (-20C)		1850.3164	1909.6876	8.6	0.005
Extreme (-30C)		1850.3164	1909.6876	11.5	0.006
20C	15%	1850.3164	1909.6876	9.4	0.005
	-15%	1850.3164	1909.6876	13.5	0.007
	End Point	1850.3164	1909.6876	11.6	0.006

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_24(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

LTE Band 25 (Lowest Frequency: QPSK / Highest Frequency: 16QAM)

Test Date	2023-09-18
Test Engineer	47989

Limit		1850	1915	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.1550	1914.8454		
Extreme (50C)		1850.1550	1914.8454	8.1	0.004
Extreme (40C)		1850.1550	1914.8454	12.6	0.007
Extreme (30C)		1850.1550	1914.8454	12.1	0.006
Extreme (10C)		1850.1550	1914.8454	7.5	0.004
Extreme (0C)		1850.1550	1914.8454	8.9	0.005
Extreme (-10C)		1850.1550	1914.8454	11.4	0.006
Extreme (-20C)		1850.1550	1914.8454	10.5	0.006
Extreme (-30C)		1850.1550	1914.8454	11.7	0.006
20C	15%	1850.1550	1914.8454	10.5	0.006
	-15%	1850.1550	1914.8454	13.7	0.007
	End Point	1850.1550	1914.8454	12.9	0.007

5G NR Band n25 (Lowest Frequency: 16QAM / Highest Frequency: QPSK)

Test Date	2023-10-05
Test Engineer	47989

Limit		1850	1915	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.2531	1914.7473		
Extreme (50C)		1850.2531	1914.7473	13.4	0.007
Extreme (40C)		1850.2531	1914.7473	15.7	0.008
Extreme (30C)		1850.2531	1914.7473	19.5	0.010
Extreme (10C)		1850.2531	1914.7473	11.5	0.006
Extreme (0C)		1850.2531	1914.7473	10.5	0.006
Extreme (-10C)		1850.2531	1914.7473	13.6	0.007
Extreme (-20C)		1850.2531	1914.7473	18.7	0.010
Extreme (-30C)		1850.2531	1914.7473	19.3	0.010
20C	15%	1850.2531	1914.7473	20.2	0.011
	-15%	1850.2531	1914.7473	19.4	0.010
	End Point	1850.2531	1914.7473	15.3	0.008

9. RADIATED RESULTS

9.1. RADIATED POWER (EIRP)

RULE PART(S)

FCC: §2.1046, §24.232

LIMITS

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.

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 OBW;
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(GSM, WCDMA), average(LTE, 5G NR);

TEST RESULTS

See the following pages.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_24(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

9.1.1. EIRP Results

GSM (ANT A)

Band	Mode	f (MHz)	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	EIRP (mW)	Limit (dBm)	Delta (dB)
GSM 1900_ANT A	GPRS	1850.20	23.35	H	4.48	9.52	28.39	689.90	33.00	-4.61
		1880.00	24.42	H	4.52	9.29	29.18	828.86	33.00	-3.82
		1909.80	25.47	H	4.55	9.00	29.92	980.85	33.00	-3.08
	EGPRS	1850.20	20.19	H	4.48	9.52	25.23	333.26	33.00	-7.77
		1880.00	21.35	H	4.52	9.29	26.11	408.77	33.00	-6.89
		1909.80	22.47	H	4.55	9.00	26.92	491.59	33.00	-6.08

WCDMA (ANT A)

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 2_ANT A	REL99	1852.40	17.90	H	4.49	9.51	22.91	195.59	33.00	-10.09
		1880.00	18.68	H	4.52	9.29	23.44	221.04	33.00	-9.56
		1907.60	19.54	H	4.55	9.03	24.02	252.53	33.00	-8.98
	HSDPA	1852.40	16.84	H	4.49	9.51	21.85	153.23	33.00	-11.15
		1880.00	17.64	H	4.52	9.29	22.40	173.97	33.00	-10.60
		1907.60	18.49	H	4.55	9.03	22.97	198.30	33.00	-10.03

LTE Band 2 (ANT F)

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	1860.00	14.94	V	4.49	9.45	19.90	97.61	33.00	-13.10	1/49
		1880.00	15.00	V	4.52	9.29	19.77	94.79	33.00	-13.23	1/0
		1900.00	14.97	V	4.54	9.13	19.56	90.35	33.00	-13.44	1/49
	16-QAM	1860.00	14.00	V	4.49	9.45	18.96	78.62	33.00	-14.04	1/49
		1880.00	13.32	V	4.52	9.29	18.09	64.38	33.00	-14.91	1/99
		1900.00	13.97	V	4.54	9.13	18.56	71.77	33.00	-14.44	1/0
15	QPSK	1857.50	15.13	V	4.49	9.47	20.11	102.47	33.00	-12.89	1/0
		1880.00	14.44	V	4.52	9.29	19.21	83.32	33.00	-13.79	1/37
		1902.50	15.00	V	4.54	9.10	19.56	90.32	33.00	-13.44	1/37
	16-QAM	1857.50	13.89	V	4.49	9.47	18.87	77.02	33.00	-14.13	1/37
		1880.00	13.46	V	4.52	9.29	18.23	66.49	33.00	-14.77	1/37
		1902.50	14.41	V	4.54	9.10	18.97	78.84	33.00	-14.03	1/37
10	QPSK	1855.00	14.88	V	4.49	9.48	19.87	97.06	33.00	-13.13	1/25
		1880.00	14.45	V	4.52	9.29	19.22	83.52	33.00	-13.78	1/25
		1905.00	15.18	V	4.55	9.06	19.70	93.34	33.00	-13.30	1/0
	16-QAM	1855.00	13.90	V	4.49	9.48	18.89	77.46	33.00	-14.11	1/25
		1880.00	13.50	V	4.52	9.29	18.27	67.11	33.00	-14.73	1/25
		1905.00	14.56	V	4.55	9.06	19.08	80.92	33.00	-13.92	1/0
5	QPSK	1852.50	14.72	V	4.49	9.50	19.73	94.02	33.00	-13.27	1/12
		1880.00	14.52	V	4.52	9.29	19.29	84.87	33.00	-13.71	1/24
		1907.50	15.20	V	4.55	9.03	19.68	92.80	33.00	-13.32	1/12
	16-QAM	1852.50	14.31	V	4.49	9.50	19.32	85.55	33.00	-13.68	1/12
		1880.00	13.54	V	4.52	9.29	18.31	67.73	33.00	-14.69	1/12
		1907.50	14.46	V	4.55	9.03	18.94	78.26	33.00	-14.06	1/12
3	QPSK	1851.50	14.42	V	4.49	9.51	19.45	88.01	33.00	-13.55	1/14
		1880.00	14.23	V	4.52	9.29	19.00	79.39	33.00	-14.00	1/8
		1908.50	15.25	V	4.55	9.02	19.71	93.57	33.00	-13.29	1/8
	16-QAM	1851.50	13.59	V	4.49	9.51	18.62	72.70	33.00	-14.38	1/8
		1880.00	13.53	V	4.52	9.29	18.30	67.57	33.00	-14.70	1/14
		1908.50	14.18	V	4.55	9.02	18.64	73.14	33.00	-14.36	1/8
1.4	QPSK	1850.70	14.64	V	4.48	9.52	19.67	92.79	33.00	-13.33	1/0
		1880.00	14.47	V	4.52	9.29	19.24	83.90	33.00	-13.76	1/0
		1909.30	15.33	V	4.55	9.00	19.79	95.20	33.00	-13.21	1/0
	16-QAM	1850.70	13.91	V	4.48	9.52	18.94	78.43	33.00	-14.06	1/5
		1880.00	13.75	V	4.52	9.29	18.52	71.08	33.00	-14.48	1/5
		1909.30	14.37	V	4.55	9.00	18.83	76.32	33.00	-14.17	1/3

LTE Band 25 (ANT A)

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	1860.00	17.20	H	4.49	9.27	21.98	157.74	33.00	-11.02	1/0
		1882.50	16.59	H	4.52	9.12	21.19	131.40	33.00	-11.81	1/0
		1905.00	17.29	H	4.55	8.95	21.69	147.48	33.00	-11.31	1/49
	16-QAM	1860.00	16.32	H	4.49	9.27	21.10	128.81	33.00	-11.90	1/0
		1882.50	15.76	H	4.52	9.12	20.36	108.54	33.00	-12.64	1/0
		1905.00	16.16	H	4.55	8.95	20.56	113.69	33.00	-12.44	1/49
15	QPSK	1857.50	16.94	H	4.49	9.29	21.74	149.14	33.00	-11.26	1/0
		1882.50	16.46	H	4.52	9.12	21.06	127.53	33.00	-11.94	1/37
		1907.50	17.44	H	4.55	8.92	21.80	151.47	33.00	-11.20	1/37
	16-QAM	1857.50	15.92	H	4.49	9.29	20.72	117.92	33.00	-12.28	1/37
		1882.50	15.55	H	4.52	9.12	20.15	103.42	33.00	-12.85	1/37
		1907.50	16.28	H	4.55	8.92	20.64	115.96	33.00	-12.36	1/37
10	QPSK	1855.00	16.22	H	4.49	9.30	21.04	127.02	33.00	-11.96	1/25
		1882.50	16.91	H	4.52	9.12	21.51	141.45	33.00	-11.49	1/0
		1910.00	17.76	H	4.55	8.89	22.09	161.97	33.00	-10.91	1/0
	16-QAM	1855.00	16.06	H	4.49	9.30	20.88	122.42	33.00	-12.12	1/0
		1882.50	15.79	H	4.52	9.12	20.39	109.30	33.00	-12.61	1/0
		1910.00	16.73	H	4.55	8.89	21.06	127.77	33.00	-11.94	1/0
5	QPSK	1852.50	16.37	H	4.49	9.32	21.20	131.76	33.00	-11.80	1/12
		1882.50	16.70	H	4.52	9.12	21.30	134.77	33.00	-11.70	1/12
		1912.50	17.90	H	4.56	8.86	22.20	166.13	33.00	-10.80	1/24
	16-QAM	1852.50	15.30	H	4.49	9.32	20.13	102.99	33.00	-12.87	1/12
		1882.50	15.75	H	4.52	9.12	20.35	108.29	33.00	-12.65	1/0
		1912.50	17.12	H	4.56	8.86	21.42	138.82	33.00	-11.58	1/12
3	QPSK	1851.50	16.67	H	4.49	9.33	21.51	141.53	33.00	-11.49	1/14
		1882.50	16.42	H	4.52	9.12	21.02	126.36	33.00	-11.98	1/8
		1913.50	17.96	H	4.56	8.85	22.26	168.09	33.00	-10.74	1/8
	16-QAM	1851.50	15.47	H	4.49	9.33	20.31	107.36	33.00	-12.69	1/8
		1882.50	15.21	H	4.52	9.12	19.81	95.63	33.00	-13.19	1/8
		1913.50	16.97	H	4.56	8.85	21.27	133.83	33.00	-11.73	1/8
1.4	QPSK	1850.70	16.59	H	4.48	9.33	21.44	139.34	33.00	-11.56	1/0
		1882.50	16.70	H	4.52	9.12	21.30	134.77	33.00	-11.70	1/0
		1914.30	17.83	H	4.56	8.84	22.11	162.57	33.00	-10.89	1/3
	16-QAM	1850.70	15.34	H	4.48	9.33	20.19	104.49	33.00	-12.81	1/3
		1882.50	15.42	H	4.52	9.12	20.02	100.37	33.00	-12.98	1/3
		1914.30	16.77	H	4.56	8.84	21.05	127.36	33.00	-11.95	1/3

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_24(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

5G NR n25 DFT-s_OFDM (ANT A)

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	1860.00	16.95	H	4.49	9.45	21.90	154.96	33.00	-11.10	1/53
		1882.50	17.97	H	4.52	9.27	22.71	186.80	33.00	-10.29	1/104
		1905.00	18.65	H	4.55	9.06	23.16	207.15	33.00	-9.84	1/53
	16-QAM	1860.00	15.68	H	4.49	9.45	20.63	115.67	33.00	-12.37	1/53
		1882.50	16.60	H	4.52	9.27	21.34	136.26	33.00	-11.66	1/104
		1905.00	17.70	H	4.55	9.06	22.21	166.45	33.00	-10.79	1/53
15	QPSK	1857.50	17.16	H	4.49	9.47	22.13	163.34	33.00	-10.87	1/1
		1882.50	18.12	H	4.52	9.27	22.86	193.36	33.00	-10.14	1/1
		1907.50	18.55	H	4.55	9.03	23.03	200.70	33.00	-9.97	1/1
	16-QAM	1857.50	16.14	H	4.49	9.47	21.11	129.15	33.00	-11.89	1/1
		1882.50	17.11	H	4.52	9.27	21.85	153.24	33.00	-11.15	1/1
		1907.50	17.40	H	4.55	9.03	21.88	154.01	33.00	-11.12	1/1
10	QPSK	1855.00	16.52	H	4.49	9.48	21.51	141.64	33.00	-11.49	1/26
		1882.50	17.59	H	4.52	9.27	22.33	171.15	33.00	-10.67	1/26
		1910.00	18.57	H	4.55	8.99	23.01	200.19	33.00	-9.99	1/26
	16-QAM	1855.00	15.37	H	4.49	9.48	20.36	108.69	33.00	-12.64	1/26
		1882.50	16.49	H	4.52	9.27	21.23	132.85	33.00	-11.77	1/26
		1910.00	17.37	H	4.55	8.99	21.81	151.86	33.00	-11.19	1/26
5	QPSK	1852.50	16.48	H	4.49	9.50	21.50	141.11	33.00	-11.50	1/23
		1882.50	17.27	H	4.52	9.27	22.01	158.99	33.00	-10.99	1/1
		1912.50	18.78	H	4.56	8.96	23.19	208.29	33.00	-9.81	1/1
	16-QAM	1852.50	15.65	H	4.49	9.50	20.67	116.56	33.00	-12.33	1/23
		1882.50	16.18	H	4.52	9.27	20.92	123.70	33.00	-12.08	1/1
		1912.50	17.86	H	4.56	8.96	22.27	168.53	33.00	-10.73	1/1

5G NR n25 DFT-s_OFDM (ANT F)

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	1860.00	16.34	H	4.49	9.45	21.29	134.66	33.00	-11.71	1/53
		1882.50	15.59	H	4.52	9.27	20.33	107.99	33.00	-12.67	1/53
		1905.00	16.32	H	4.55	9.06	20.83	121.14	33.00	-12.17	1/53
	16-QAM	1860.00	15.33	H	4.49	9.45	20.28	106.71	33.00	-12.72	1/53
		1882.50	14.52	H	4.52	9.27	19.26	84.40	33.00	-13.74	1/53
		1905.00	15.35	H	4.55	9.06	19.86	96.89	33.00	-13.14	1/53
15	QPSK	1857.50	16.24	H	4.49	9.47	21.21	132.24	33.00	99.24	1/77
		1882.50	15.68	H	4.52	9.27	20.43	110.37	33.00	77.37	1/77
		1907.50	16.11	H	4.55	9.03	20.59	114.55	33.00	81.55	1/1
	16-QAM	1857.50	15.30	H	4.49	9.47	20.27	106.51	33.00	73.51	1/77
		1882.50	15.24	H	4.52	9.27	19.99	99.73	33.00	66.73	1/77
		1907.50	15.20	H	4.55	9.03	19.68	92.90	33.00	59.90	1/1
10	QPSK	1855.00	16.20	H	4.49	9.48	21.20	131.68	33.00	98.68	1/26
		1882.50	15.48	H	4.52	9.27	20.23	105.40	33.00	72.40	1/26
		1910.00	16.18	H	4.55	8.99	20.62	115.41	33.00	82.41	1//26
	16-QAM	1855.00	15.20	H	4.49	9.48	20.20	104.59	33.00	71.59	1/26
		1882.50	15.24	H	4.52	9.27	19.99	99.73	33.00	66.73	1/26
		1910.00	15.32	H	4.55	8.99	19.76	94.68	33.00	61.68	1/26
5	QPSK	1852.50	16.14	H	4.49	9.50	21.16	130.49	33.00	97.49	1/1
		1882.50	15.47	H	4.52	9.27	20.22	105.16	33.00	72.16	1/23
		1912.50	16.31	H	4.56	8.96	20.71	117.86	33.00	84.86	1/1
	16-QAM	1852.50	15.19	H	4.49	9.50	20.21	104.85	33.00	71.85	1/1
		1882.50	15.27	H	4.52	9.27	20.02	100.43	33.00	67.43	1/23
		1912.50	15.30	H	4.56	8.96	19.70	93.40	33.00	60.40	1/1

9.2. RADIATIED SPURIOUS EMISSION

RULE PART(S)

FCC: §2.1053, §24.238

LIMIT

24.238(a)
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.

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, 5G NR), Maxhold(GSM);

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.

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_24(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

9.2.1. SPURIOUS RADIATION PLOTS

GSM1900

GPRS

ANT A

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

Company:	Samsung
Project #:	4790976555
Date:	2023-09-06
Test Engineer:	24542
Configuration:	EUT / AC Adapter, Z-Position
Location:	Chamber 2
Mode:	GPRS 1900 MHz 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, 1850.2MHz									
3700.40	-5.9	V	3.0	42.2	1.0	-47.2	-13.0	-34.2	
5550.60	0.3	V	3.0	43.0	1.0	-41.7	-13.0	-28.7	
7400.80	-2.6	V	3.0	42.6	1.0	-44.2	-13.0	-31.2	
3700.40	-5.1	H	3.0	42.2	1.0	-46.3	-13.0	-33.3	
5550.60	0.2	H	3.0	43.0	1.0	-41.8	-13.0	-28.8	
7400.80	-3.5	H	3.0	42.6	1.0	-45.1	-13.0	-32.1	
Mid Ch, 1880MHz									
3760.00	-3.4	V	3.0	42.2	1.0	-44.6	-13.0	-31.6	
5640.00	1.4	V	3.0	43.1	1.0	-40.6	-13.0	-27.6	
7520.00	-2.5	V	3.0	42.6	1.0	-44.0	-13.0	-31.0	
3760.00	-2.9	H	3.0	42.2	1.0	-44.1	-13.0	-31.1	
5640.00	3.2	H	3.0	43.1	1.0	-38.9	-13.0	-25.9	
7520.00	-3.2	H	3.0	42.6	1.0	-44.7	-13.0	-31.7	
High Ch, 1909.8MHz									
3819.60	-3.3	V	3.0	42.2	1.0	-44.5	-13.0	-31.5	
5729.40	2.1	V	3.0	43.1	1.0	-40.0	-13.0	-27.0	
7639.20	-2.7	V	3.0	42.5	1.0	-44.2	-13.0	-31.2	
3819.60	-4.2	H	3.0	42.2	1.0	-45.5	-13.0	-32.5	
5729.40	3.2	H	3.0	43.1	1.0	-38.9	-13.0	-25.9	
7639.20	-3.2	H	3.0	42.5	1.0	-44.7	-13.0	-31.7	

WCDMA Band 2

REL99

ANT A

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

Company: Samsung
Project #: 4790976555
Date: 2023-09-08
Test Engineer: 26087
Configuration: EUT / AC Adpater, X-Position
Location: Chamber 2
Mode: Rel99 Band 2 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, 1852.4MHz									
3704.80	-10.7	V	3.0	42.2	1.0	-51.9	-13.0	-38.9	
5557.20	-7.8	V	3.0	43.0	1.0	-49.8	-13.0	-36.8	
7409.60	-5.4	V	3.0	42.6	1.0	-47.1	-13.0	-34.1	
3704.80	-10.8	H	3.0	42.2	1.0	-52.0	-13.0	-39.0	
5557.20	-8.1	H	3.0	43.0	1.0	-50.1	-13.0	-37.1	
7409.60	-6.0	H	3.0	42.6	1.0	-47.6	-13.0	-34.6	
Mid Ch, 1880MHz									
3760.00	-10.6	V	3.0	42.2	1.0	-51.8	-13.0	-38.8	
5640.00	-7.4	V	3.0	43.1	1.0	-49.5	-13.0	-36.5	
7520.00	-5.4	V	3.0	42.6	1.0	-47.0	-13.0	-34.0	
3760.00	-10.8	H	3.0	42.2	1.0	-52.0	-13.0	-39.0	
5640.00	-7.8	H	3.0	43.1	1.0	-49.9	-13.0	-36.9	
7520.00	-6.0	H	3.0	42.6	1.0	-47.5	-13.0	-34.5	
High Ch, 1907.6MHz									
3815.20	-10.6	V	3.0	42.2	1.0	-51.8	-13.0	-38.8	
5722.80	-7.6	V	3.0	43.1	1.0	-49.6	-13.0	-36.6	
7630.40	-5.2	V	3.0	42.5	1.0	-46.7	-13.0	-33.7	
3815.20	-10.8	H	3.0	42.2	1.0	-52.0	-13.0	-39.0	
5722.80	-8.0	H	3.0	43.1	1.0	-50.1	-13.0	-37.1	
7630.40	-5.9	H	3.0	42.5	1.0	-47.4	-13.0	-34.4	

LTE Band 2

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

Company: Samsung
Project #: 4790976555
Date: 2023-10-17
Test Engineer: 24542
Configuration: EUT, Y-Position
Location: Chamber 1
Mode: LTE_QPSK Band 2 Harmonics, 15MHz Bandwidth
Test Votage: AC 120 V, 60 Hz

15 MHz
QPSK
ANT F

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1857.5MHz									
3715.00	-9.2	V	3.0	44.1	1.0	-52.3	-13.0	-39.3	
5572.50	-6.5	V	3.0	45.0	1.0	-50.5	-13.0	-37.5	
7430.00	-2.9	V	3.0	45.0	1.0	-46.9	-13.0	-33.9	
3715.00	-8.9	H	3.0	44.1	1.0	-52.0	-13.0	-39.0	
5572.50	-6.5	H	3.0	45.0	1.0	-50.4	-13.0	-37.4	
7430.00	-1.6	H	3.0	45.0	1.0	-45.6	-13.0	-32.6	
Mid Ch, 1880MHz									
3760.00	-8.9	V	3.0	44.1	1.0	-52.1	-13.0	-39.1	
5640.00	-6.2	V	3.0	45.0	1.0	-50.2	-13.0	-37.2	
7520.00	-3.1	V	3.0	44.9	1.0	-47.1	-13.0	-34.1	
3760.00	-8.8	H	3.0	44.1	1.0	-51.9	-13.0	-38.9	
5640.00	-6.2	H	3.0	45.0	1.0	-50.2	-13.0	-37.2	
7520.00	-2.4	H	3.0	44.9	1.0	-46.3	-13.0	-33.3	
High Ch, 1902.5MHz									
3805.00	-8.8	V	3.0	44.2	1.0	-52.0	-13.0	-39.0	
5707.50	-6.3	V	3.0	45.0	1.0	-50.3	-13.0	-37.3	
7610.00	-3.0	V	3.0	44.9	1.0	-46.9	-13.0	-33.9	
3805.00	-8.6	H	3.0	44.2	1.0	-51.7	-13.0	-38.7	
5707.50	-6.1	H	3.0	45.0	1.0	-50.1	-13.0	-37.1	
7610.00	-2.3	H	3.0	44.9	1.0	-46.2	-13.0	-33.2	

LTE Band 25

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

Company:	Samsung
Project #:	479097555
Date:	2023-09-06
Test Engineer:	26087
Configuration:	EUT / AC Adapter Z-Position
Location:	Chamber 1
Mode:	LTE_QPSK Band 25 Harmonics, 3MHz Bandwidth
Test Votage:	AC 120 V, 60 Hz

3 MHz

QPSK

ANT A

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1851.5MHz									
3703.00	-9.0	V	3.0	44.1	1.0	-52.1	-13.0	-39.1	
5554.50	-6.1	V	3.0	45.0	1.0	-50.1	-13.0	-37.1	
7406.00	-3.8	V	3.0	45.0	1.0	-47.8	-13.0	-34.8	
3703.00	-8.4	H	3.0	44.1	1.0	-51.5	-13.0	-38.5	
5554.50	-5.2	H	3.0	45.0	1.0	-49.2	-13.0	-36.2	
7406.00	-3.7	H	3.0	45.0	1.0	-47.7	-13.0	-34.7	
Mid Ch, 1882.5MHz									
3765.00	-8.3	V	3.0	44.1	1.0	-51.5	-13.0	-38.5	
5647.50	-5.4	V	3.0	45.0	1.0	-49.4	-13.0	-36.4	
7530.00	-3.7	V	3.0	44.9	1.0	-47.7	-13.0	-34.7	
3765.00	-8.5	H	3.0	44.1	1.0	-51.6	-13.0	-38.6	
5647.50	-4.4	H	3.0	45.0	1.0	-48.4	-13.0	-35.4	
7530.00	-3.8	H	3.0	44.9	1.0	-47.7	-13.0	-34.7	
High Ch, 1913.5MHz									
3827.00	-8.8	V	3.0	44.2	1.0	-51.9	-13.0	-38.9	
5740.50	-5.7	V	3.0	45.0	1.0	-49.7	-13.0	-36.7	
7654.00	-3.4	V	3.0	44.9	1.0	-47.3	-13.0	-34.3	
3827.00	-8.7	H	3.0	44.2	1.0	-51.8	-13.0	-38.8	
5740.50	-4.8	H	3.0	45.0	1.0	-48.8	-13.0	-35.8	
7654.00	-3.3	H	3.0	44.9	1.0	-47.2	-13.0	-34.2	

NR Band n25

5 MHz
DFT-s_OFDM
QPSK
ANT A

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

Company:	Samsung
Project #:	4790976555
Date:	2023-09-11
Test Engineer:	26087
Configuration:	EUT / AC Adapter, X-Position
Location:	Chamber 1
Mode:	5G NR_QPSK NR n25 Harmonics, 5MHz Bandwidth
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, 1852.5MHz									
3705.00	-8.8	V	3.0	44.1	1.0	-51.9	-13.0	-38.9	
5557.50	-5.6	V	3.0	45.0	1.0	-49.6	-13.0	-36.6	
7410.00	-3.8	V	3.0	45.0	1.0	-47.8	-13.0	-34.8	
3705.00	-8.4	H	3.0	44.1	1.0	-51.5	-13.0	-38.5	
5557.50	-3.8	H	3.0	45.0	1.0	-47.7	-13.0	-34.7	
7410.00	-3.7	H	3.0	45.0	1.0	-47.7	-13.0	-34.7	
Mid Ch, 1882.5MHz									
3765.00	-8.8	V	3.0	44.1	1.0	-52.0	-13.0	-39.0	
5647.50	-3.7	V	3.0	45.0	1.0	-47.7	-13.0	-34.7	
7530.00	-3.7	V	3.0	44.9	1.0	-47.7	-13.0	-34.7	
3765.00	-8.4	H	3.0	44.1	1.0	-51.5	-13.0	-38.5	
5647.50	-1.9	H	3.0	45.0	1.0	-45.9	-13.0	-32.9	
7530.00	-3.7	H	3.0	44.9	1.0	-47.6	-13.0	-34.6	
High Ch, 1912.5MHz									
3825.00	-8.8	V	3.0	44.2	1.0	-51.9	-13.0	-38.9	
5737.50	-3.1	V	3.0	45.0	1.0	-47.1	-13.0	-34.1	
7650.00	-3.4	V	3.0	44.9	1.0	-47.3	-13.0	-34.3	
3825.00	-8.2	H	3.0	44.2	1.0	-51.4	-13.0	-38.4	
5737.50	-2.0	H	3.0	45.0	1.0	-46.0	-13.0	-33.0	
7650.00	-3.2	H	3.0	44.9	1.0	-47.1	-13.0	-34.1	

20 MHz
DFT-s_OFDM
QPSK
ANT F

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

Company:	Samsung
Project #:	4790976555
Date:	2023-09-20
Test Engineer:	26087
Configuration:	EUT / AC Adapter, Y-Position
Location:	Chamber 1
Mode:	5G NR_QPSK NR n25 Harmonics, 20MHz Bandwidth
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, 1860MHz									
3720.00	-9.1	V	3.0	44.1	1.0	-52.2	-13.0	-39.2	
5580.00	-2.8	V	3.0	45.0	1.0	-46.8	-13.0	-33.8	
7440.00	-3.8	V	3.0	45.0	1.0	-47.8	-13.0	-34.8	
3720.00	-8.9	H	3.0	44.1	1.0	-52.0	-13.0	-39.0	
5580.00	-0.8	H	3.0	45.0	1.0	-44.7	-13.0	-31.7	
7440.00	-3.6	H	3.0	45.0	1.0	-47.6	-13.0	-34.6	
Mid Ch, 1882.5MHz									
3765.00	-9.0	V	3.0	44.1	1.0	-52.1	-13.0	-39.1	
5647.50	3.0	V	3.0	45.0	1.0	-41.0	-13.0	-28.0	
7530.00	-3.7	V	3.0	44.9	1.0	-47.6	-13.0	-34.6	
3765.00	-8.8	H	3.0	44.1	1.0	-52.0	-13.0	-39.0	
5647.50	3.6	H	3.0	45.0	1.0	-40.4	-13.0	-27.4	
7530.00	-3.6	H	3.0	44.9	1.0	-47.6	-13.0	-34.6	
High Ch, 1905MHz									
3810.00	-9.0	V	3.0	44.2	1.0	-52.2	-13.0	-39.2	
5715.00	-2.4	V	3.0	45.0	1.0	-46.5	-13.0	-33.5	
7620.00	-3.3	V	3.0	44.9	1.0	-47.2	-13.0	-34.2	
3810.00	-8.8	H	3.0	44.2	1.0	-51.9	-13.0	-38.9	
5715.00	-1.4	H	3.0	45.0	1.0	-45.4	-13.0	-32.4	
7620.00	-3.2	H	3.0	44.9	1.0	-47.1	-13.0	-34.1	

END OF REPORT

UL KOREA LTD. Suwon Laboratory FORM ID: FCC_24(05)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433