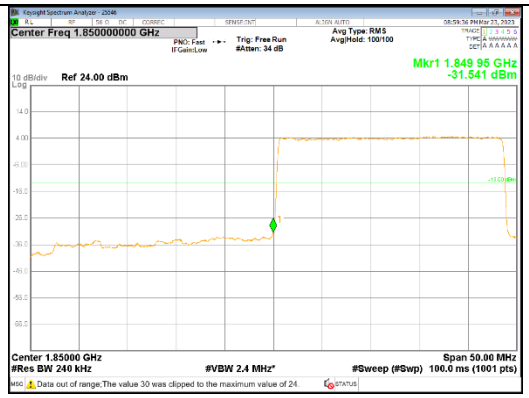
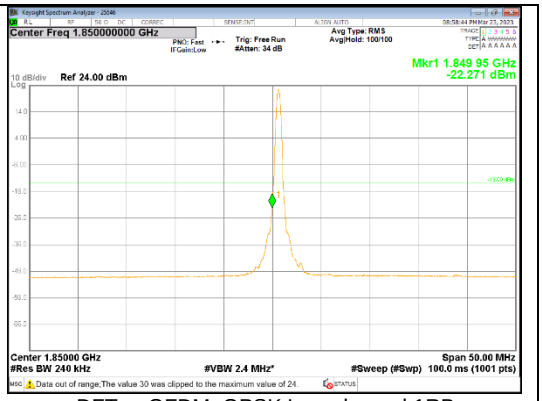
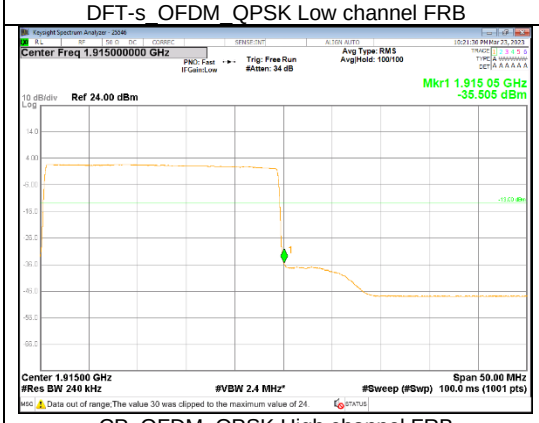
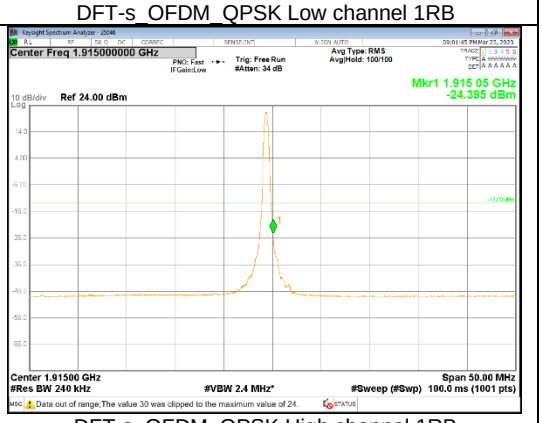
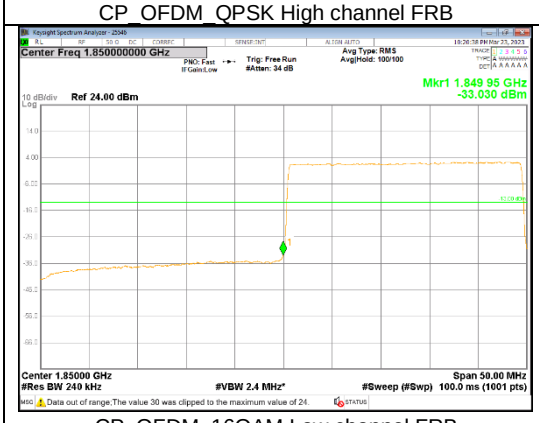
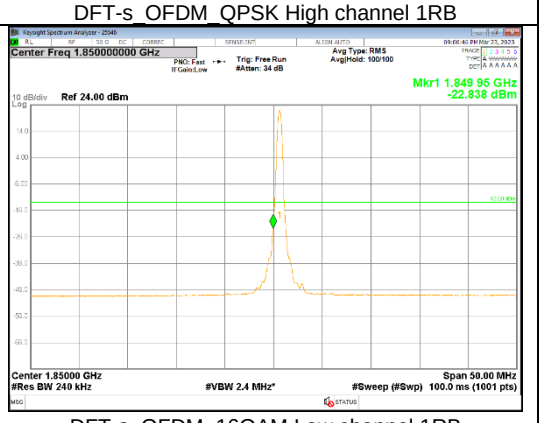
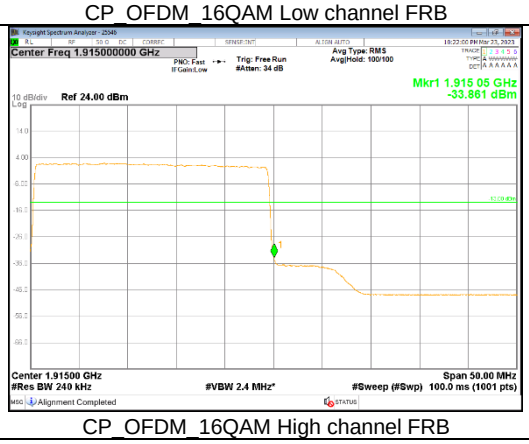
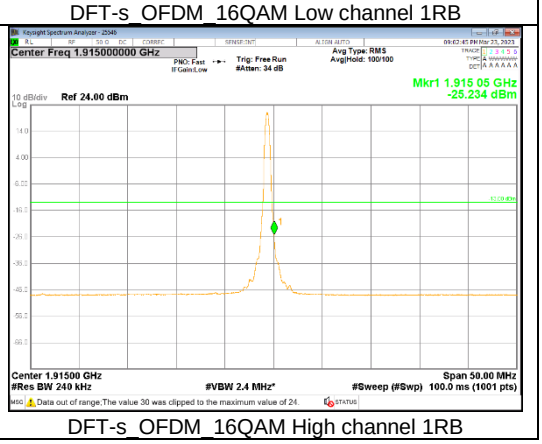
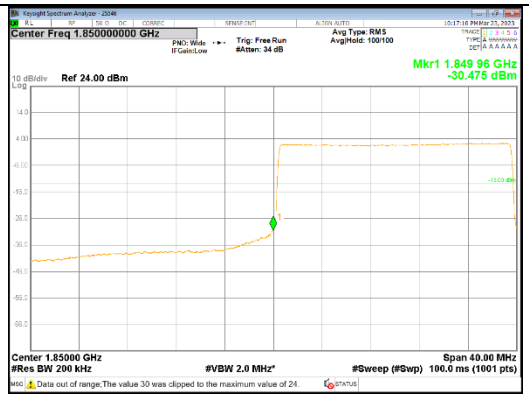
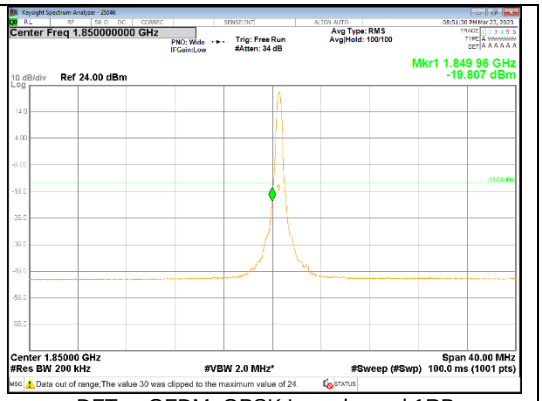
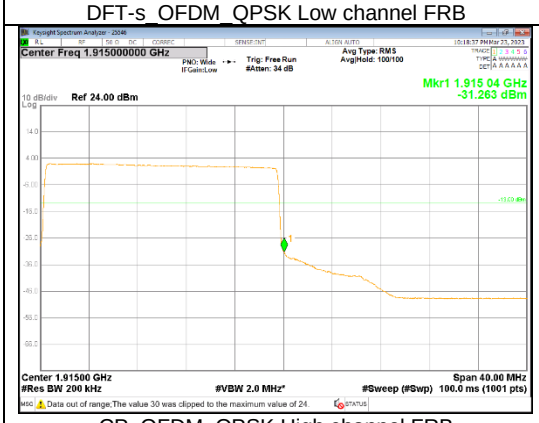
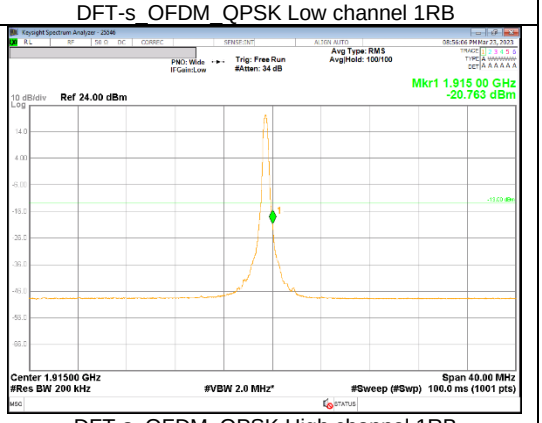
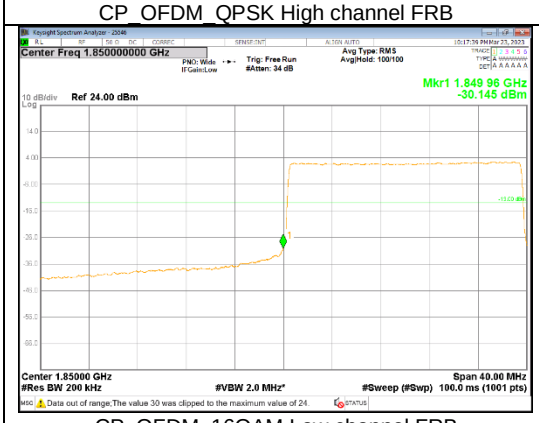
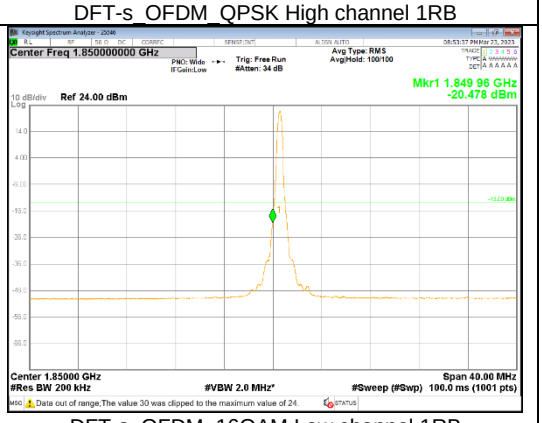
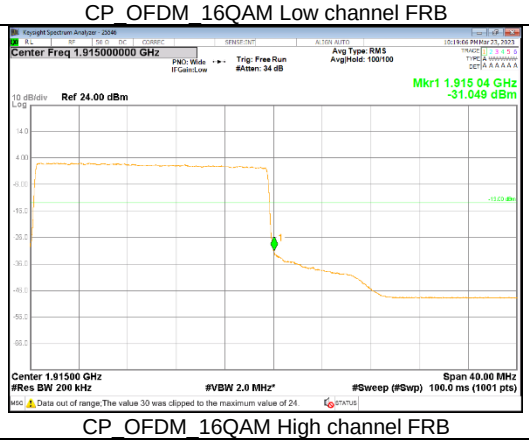
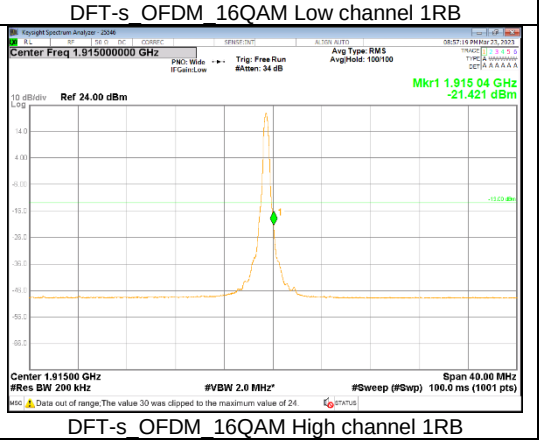
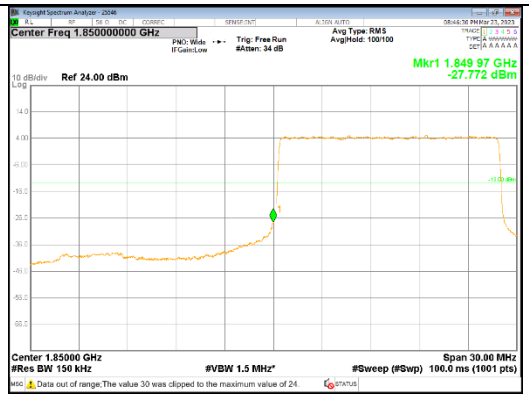
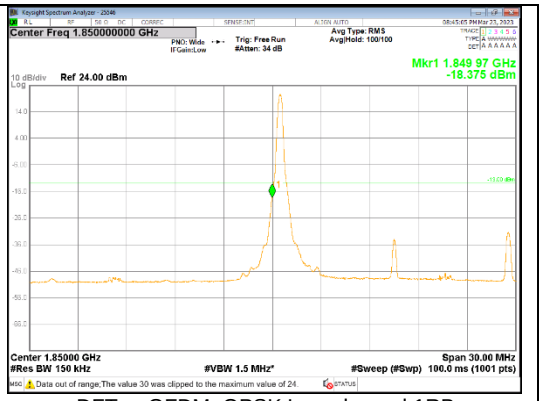
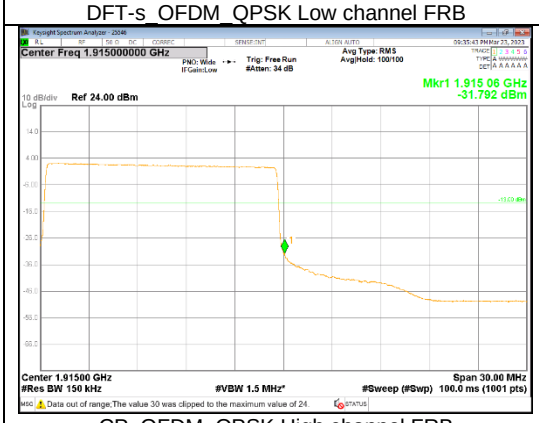
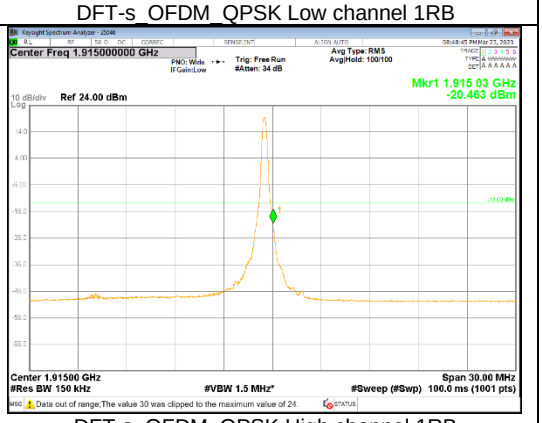
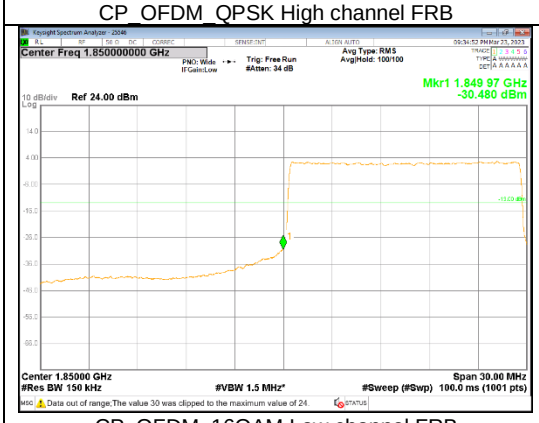
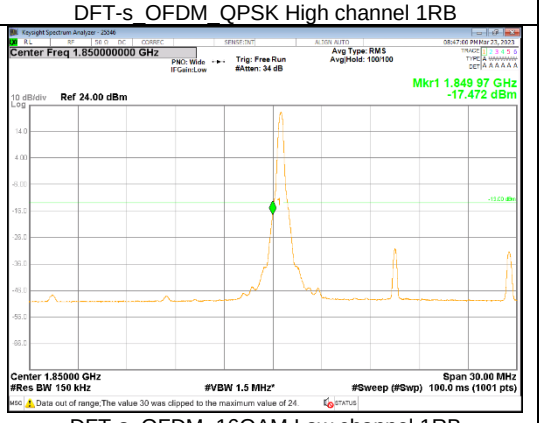
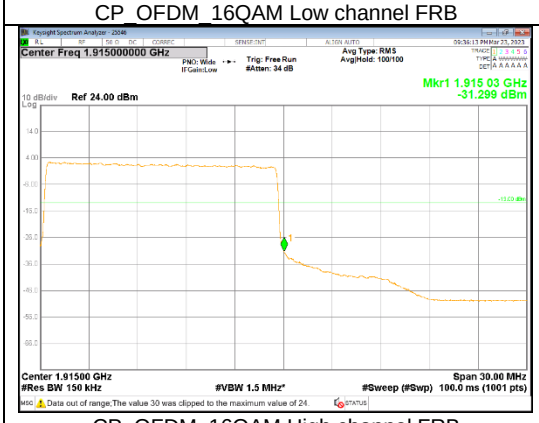
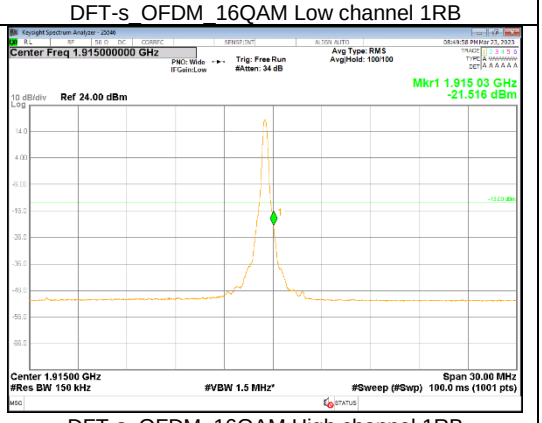
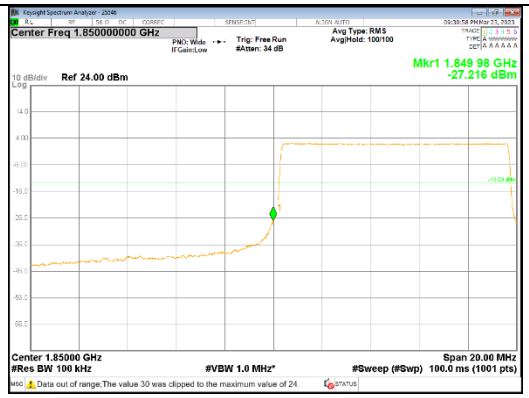
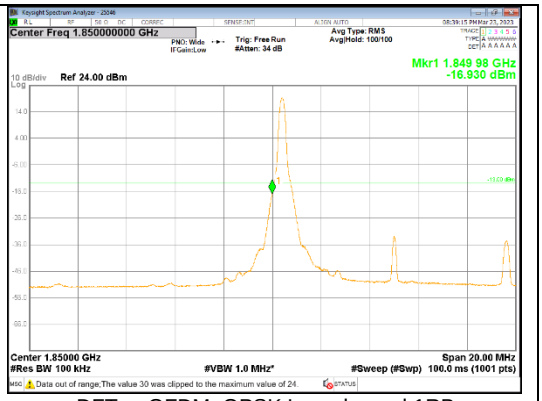
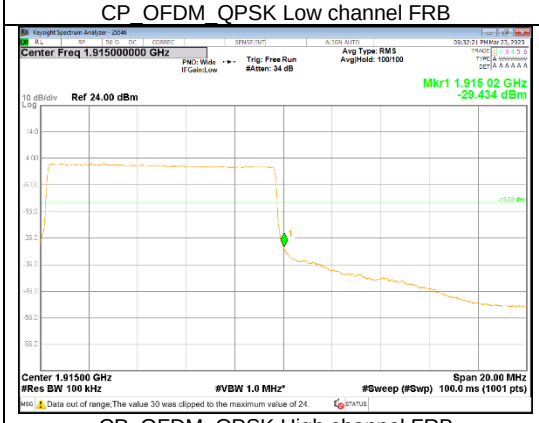
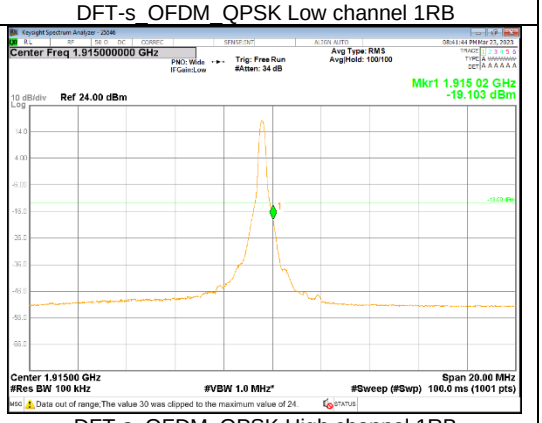
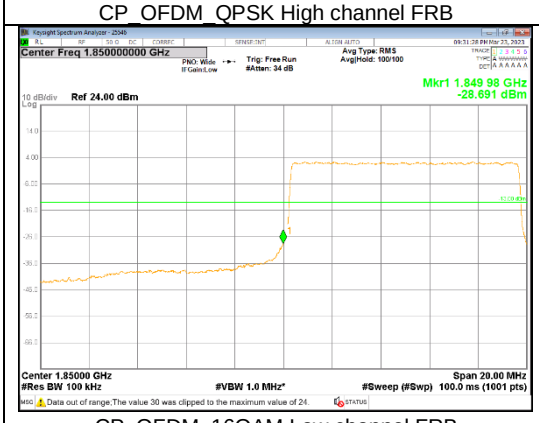
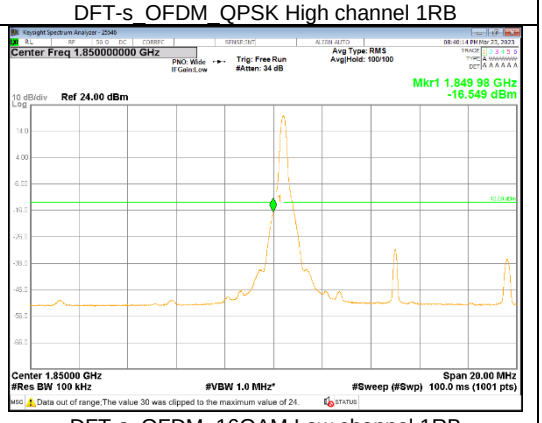
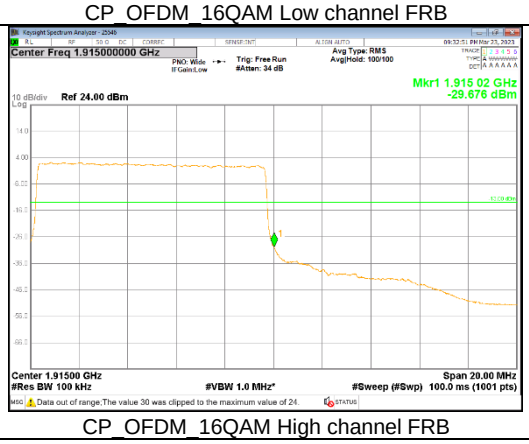
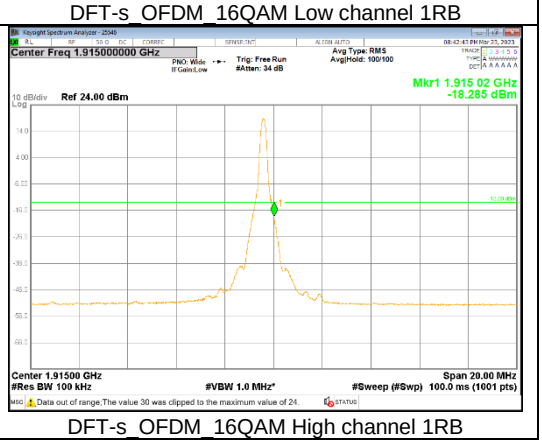
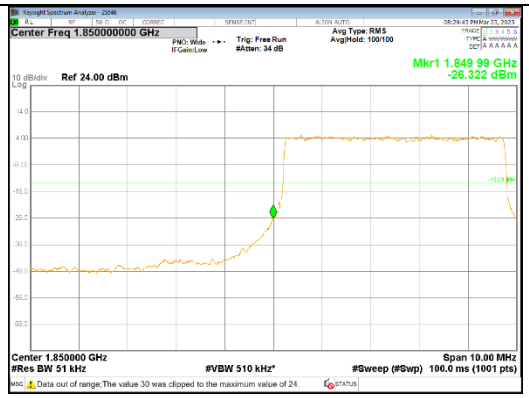
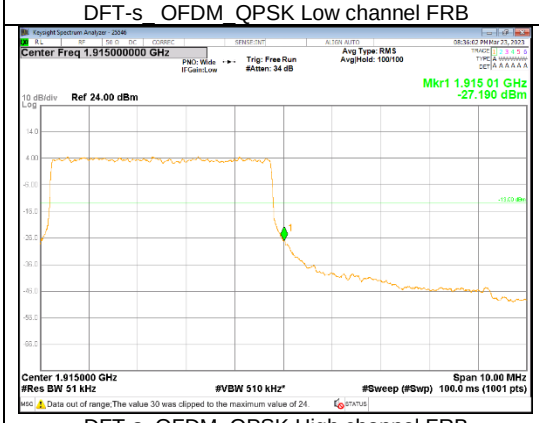
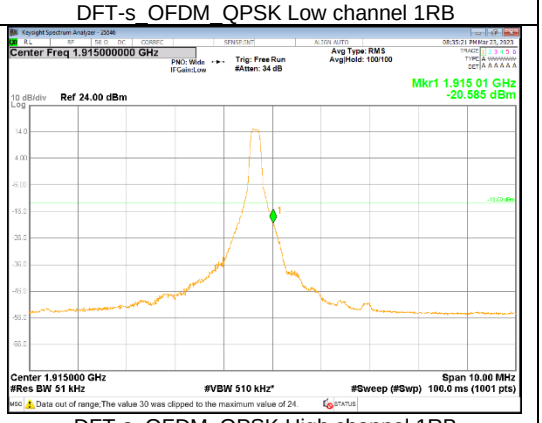
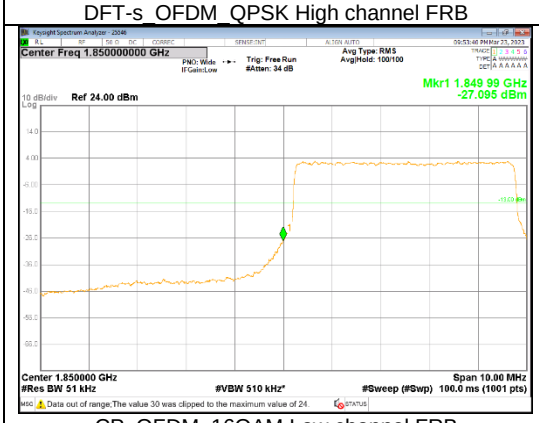
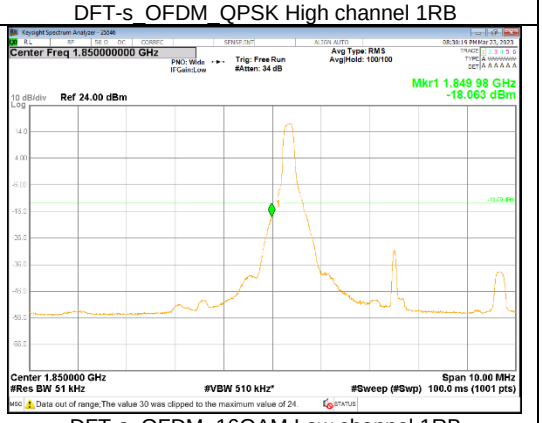
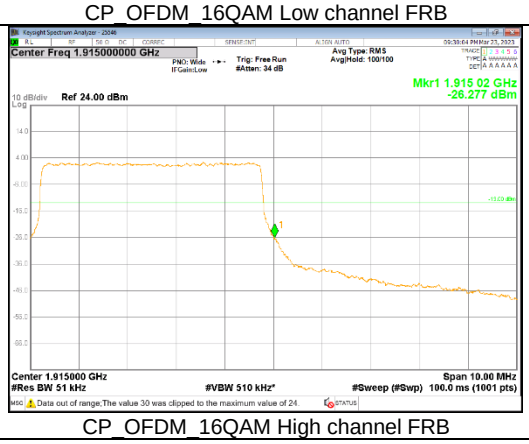
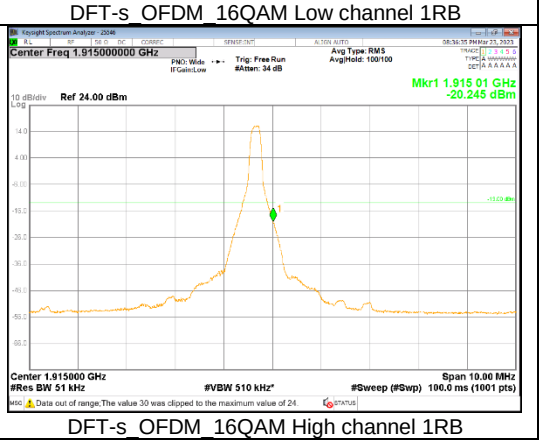
25MHz	 DFT-s_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 CP_OFDM_QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 CP_OFDM_16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 CP_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

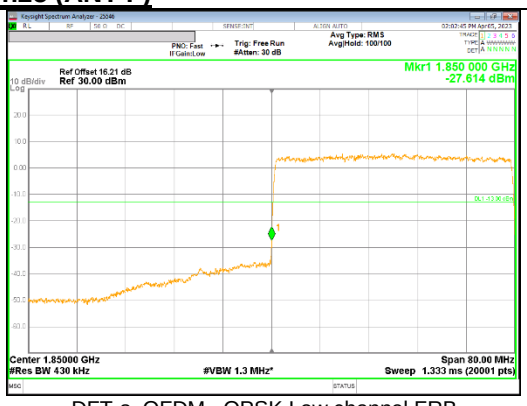
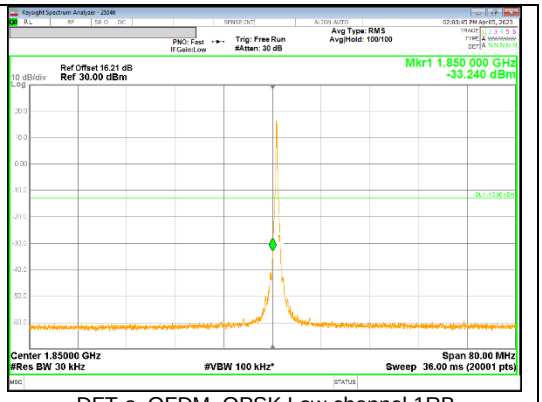
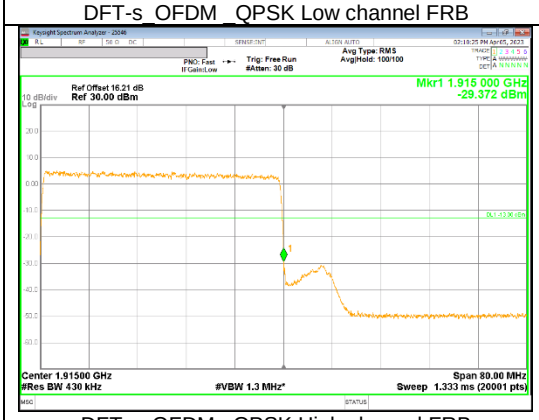
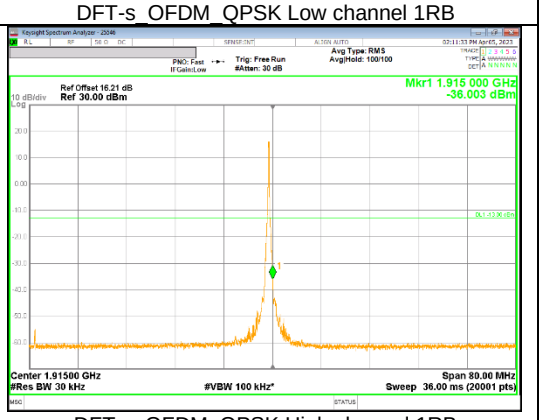
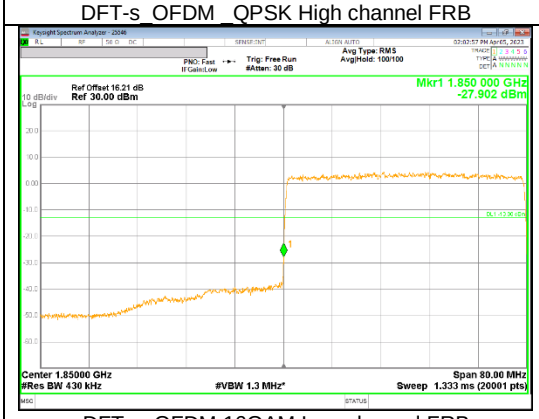
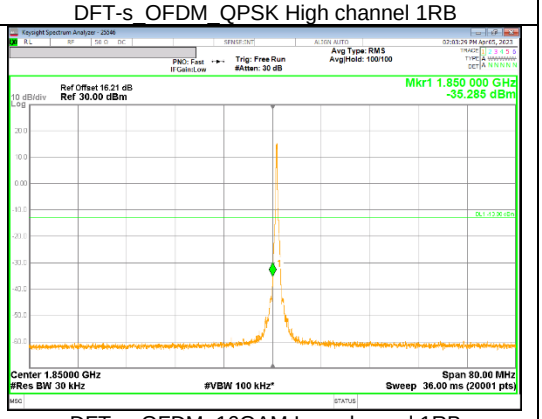
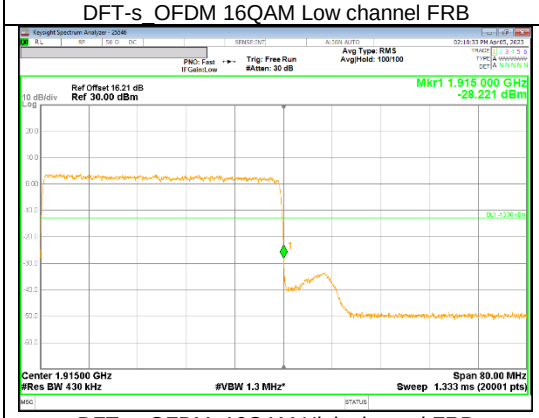
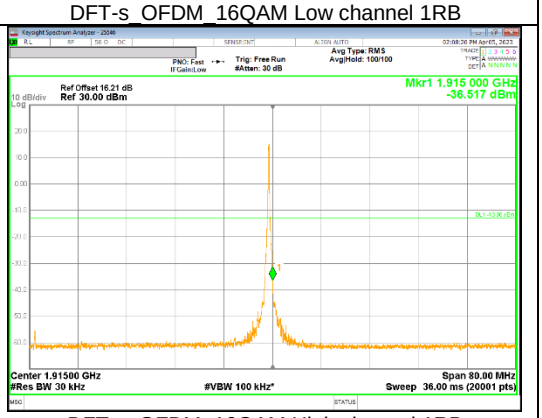
20MHz	 DFT-s_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 CP_OFDM_QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 CP_OFDM_16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 CP_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

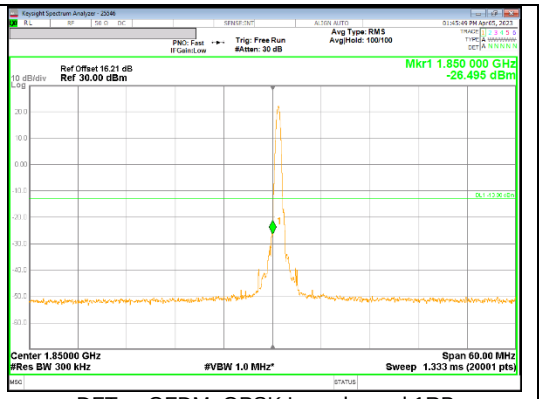
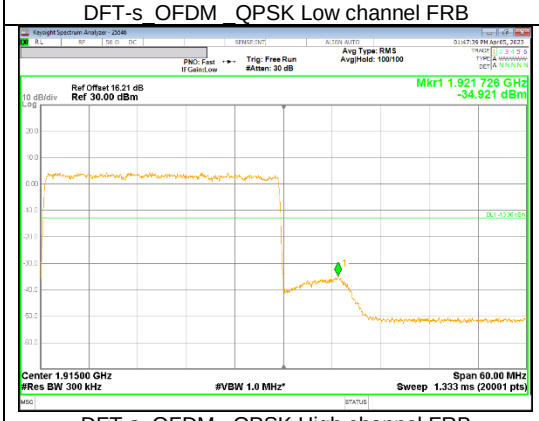
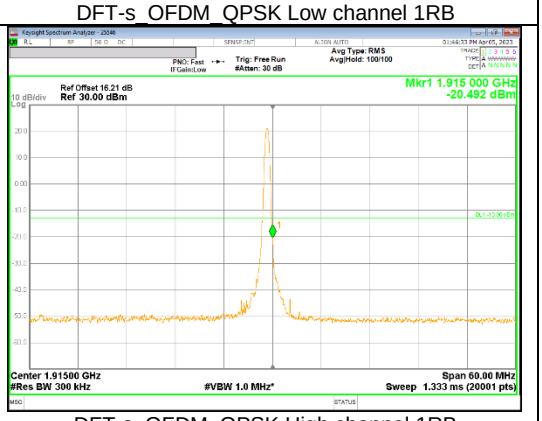
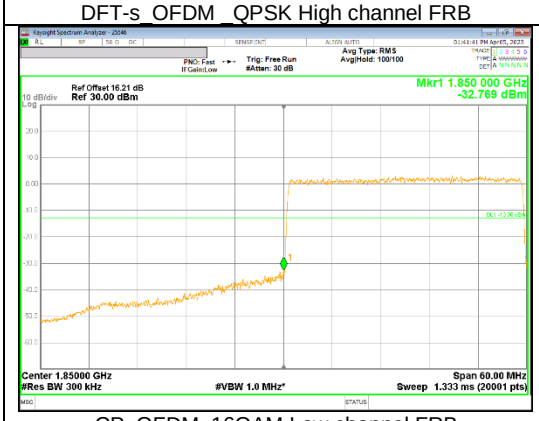
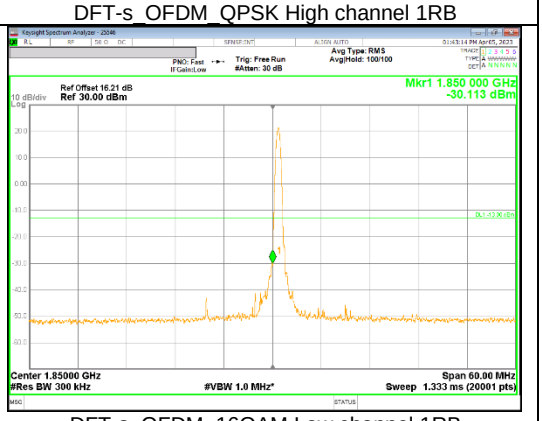
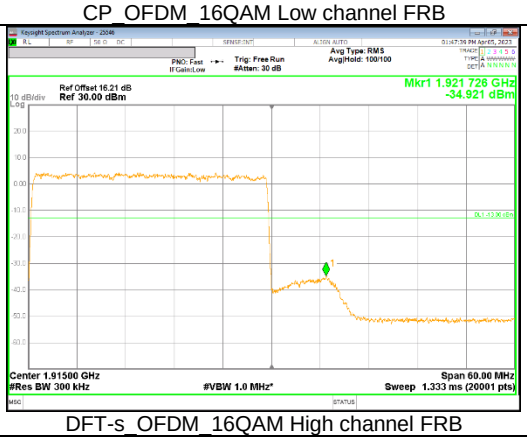
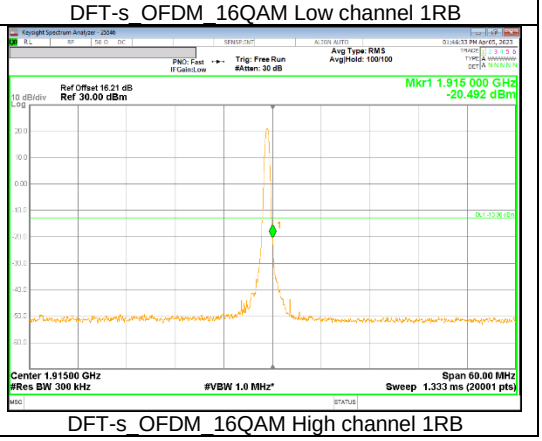
15MHz	 DFT-s_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 CP_OFDM_QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 CP_OFDM_16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 CP_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

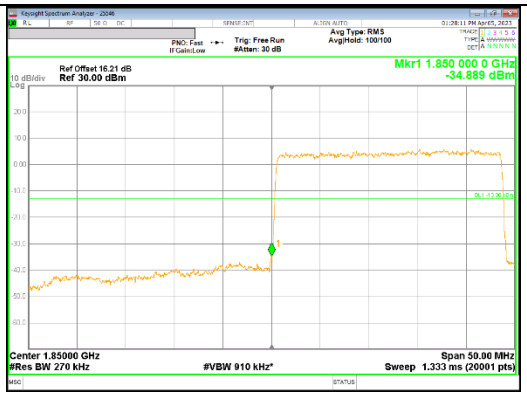
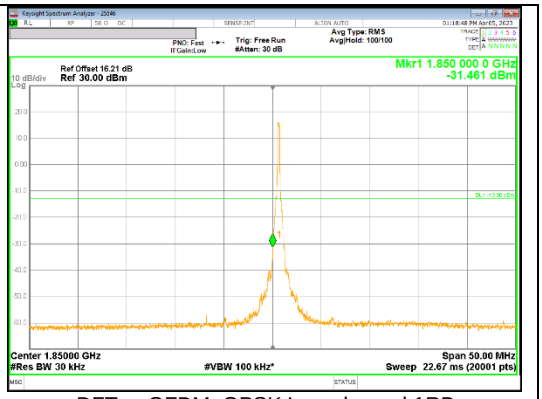
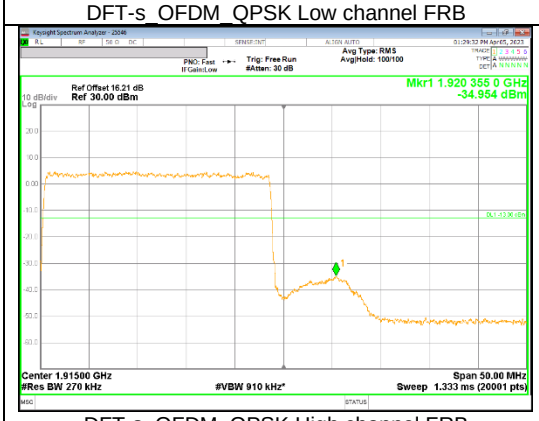
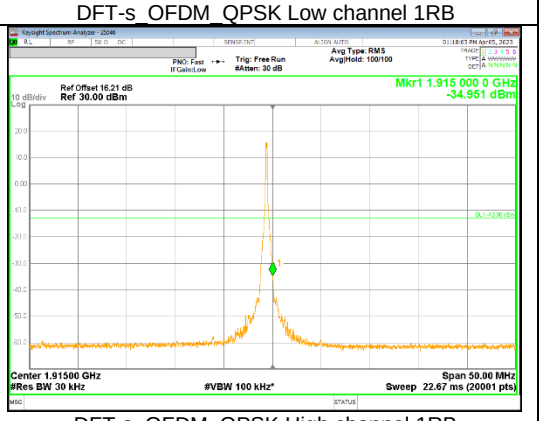
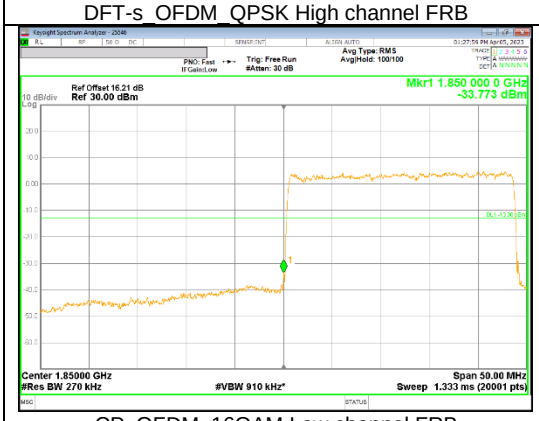
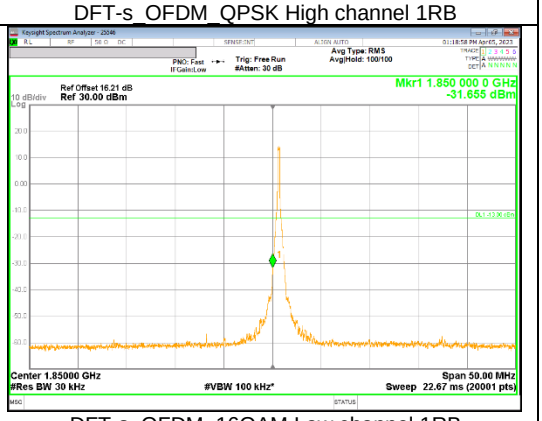
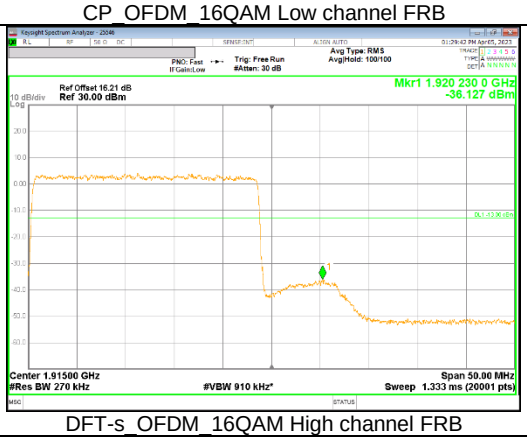
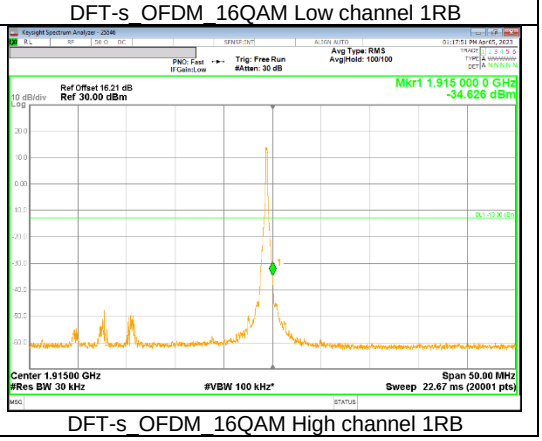
10MHz	 CP_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 CP_OFDM_QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 CP_OFDM_16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 CP_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

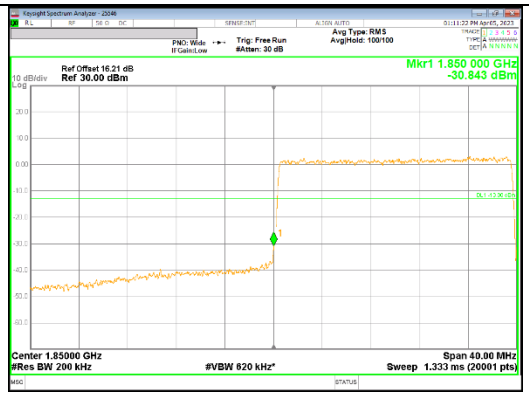
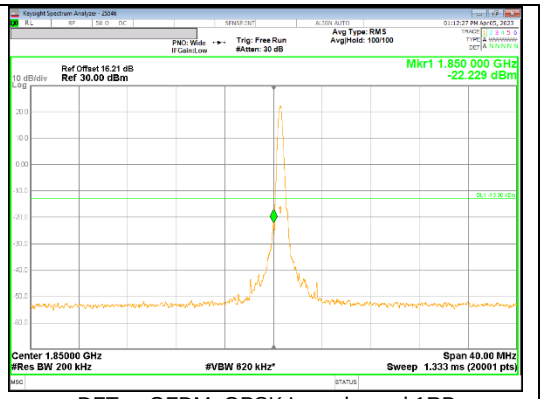
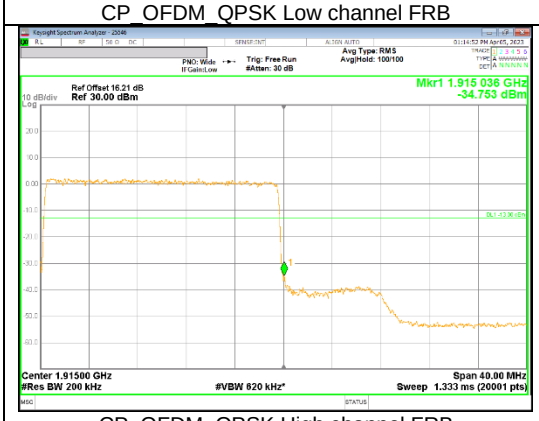
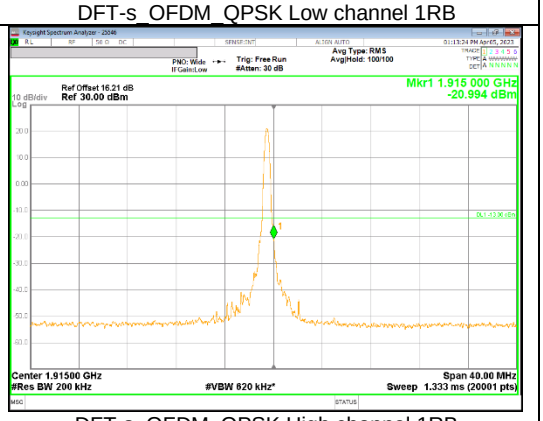
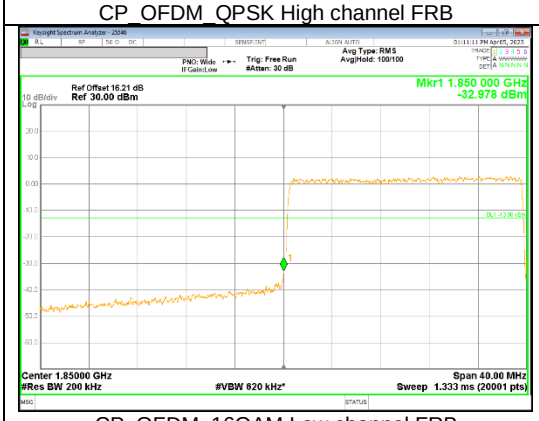
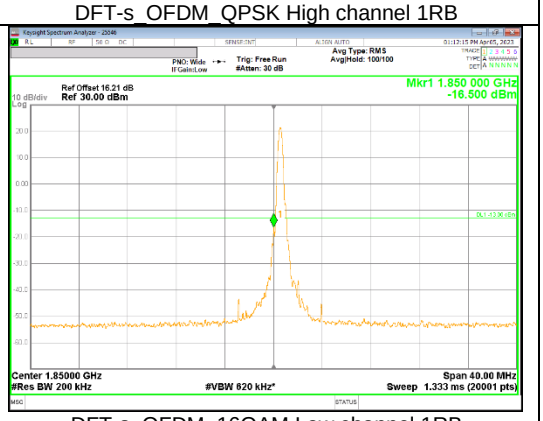
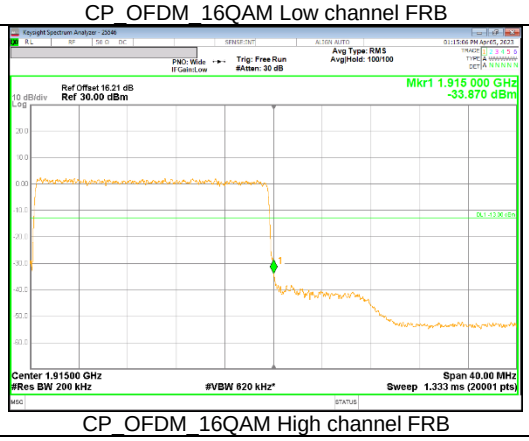
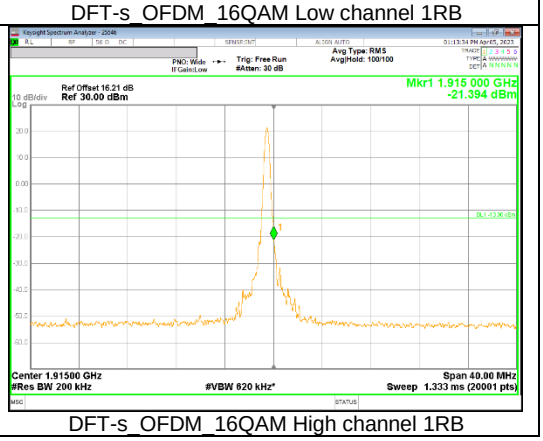
5MHz	 DFT-s_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 DFT-s_OFDM_QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 CP_OFDM_16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 CP_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

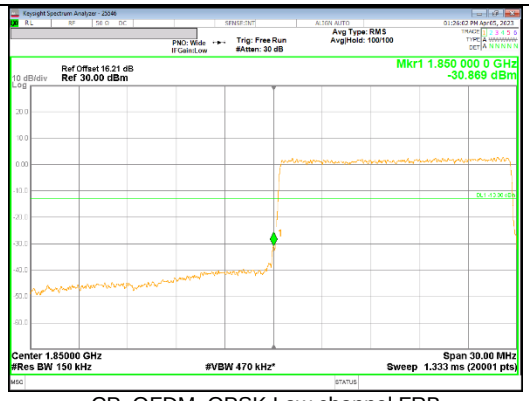
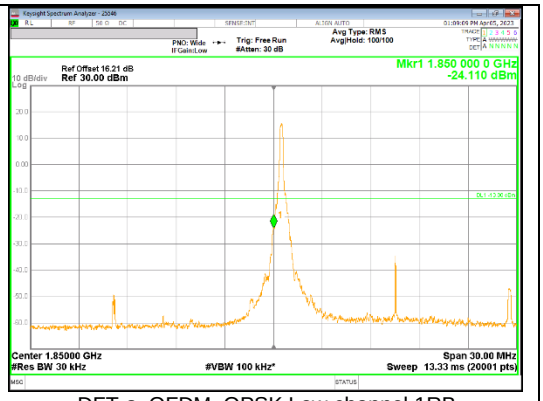
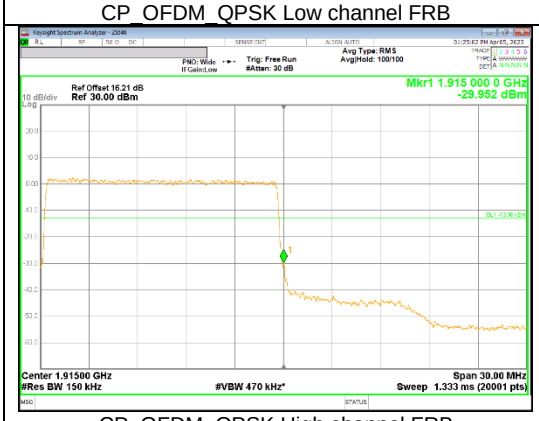
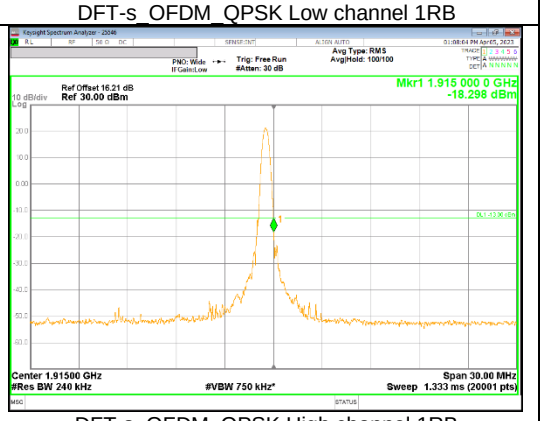
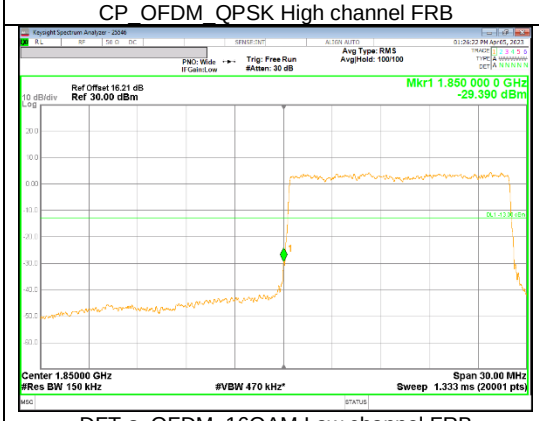
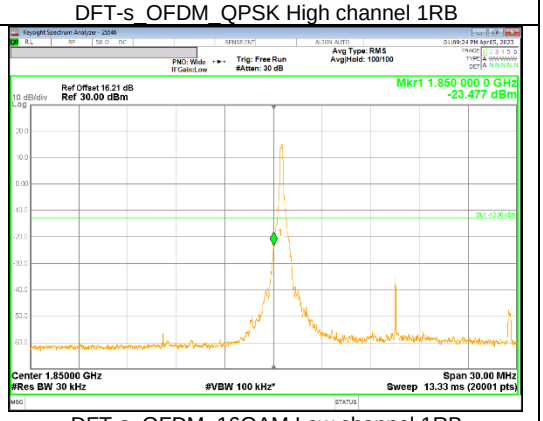
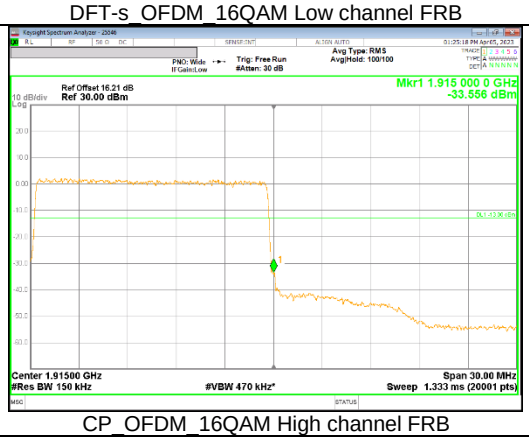
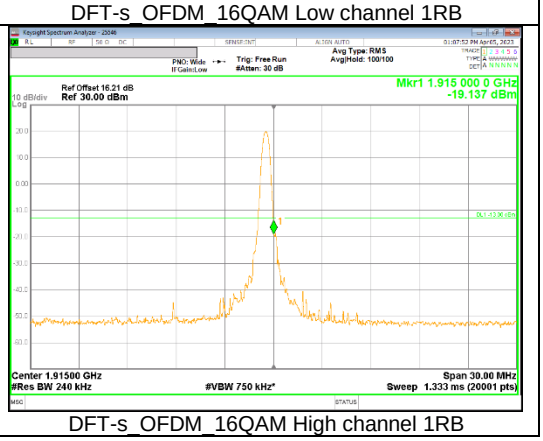
NR Band n25 (ANT F)

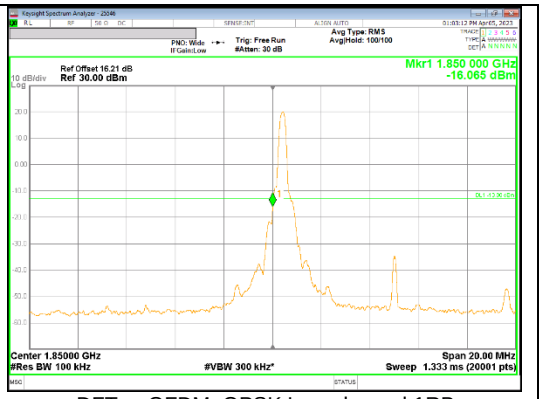
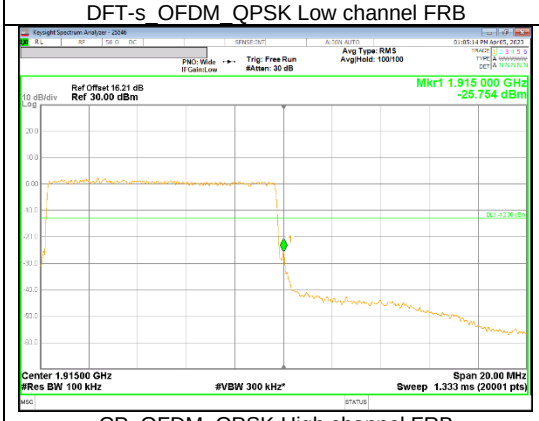
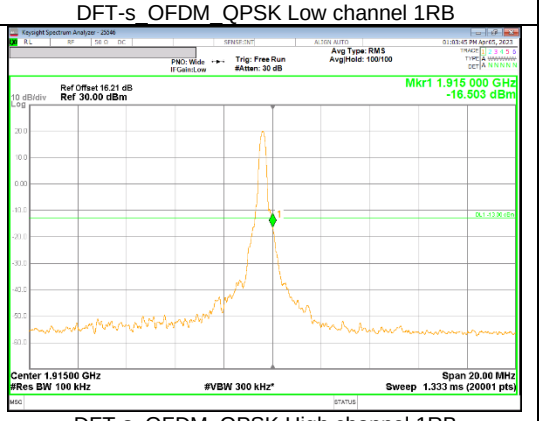
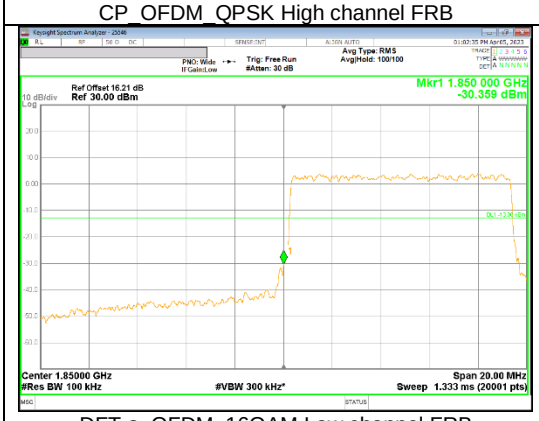
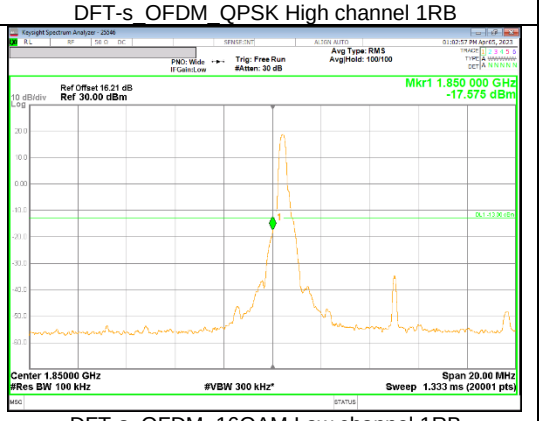
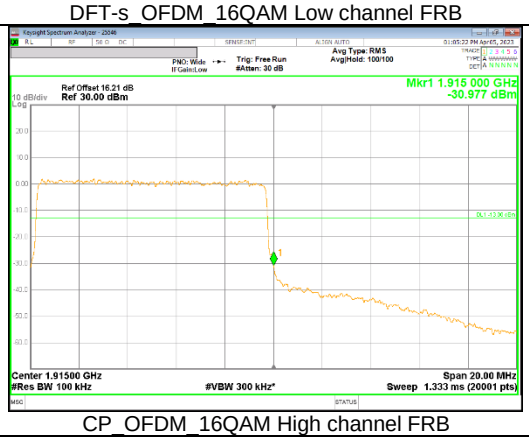
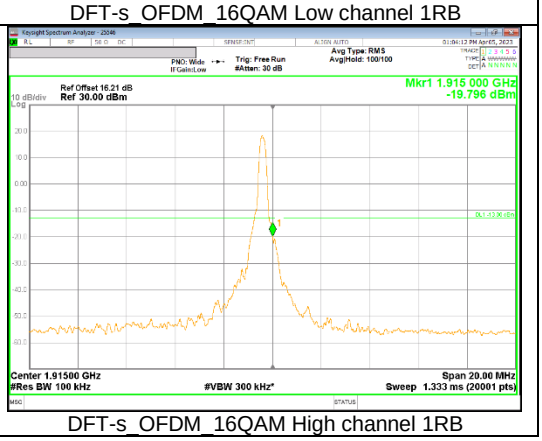
40MHz	 DFT-s_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 DFT-s_OFDM_QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 DFT-s_OFDM 16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 DFT-s_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

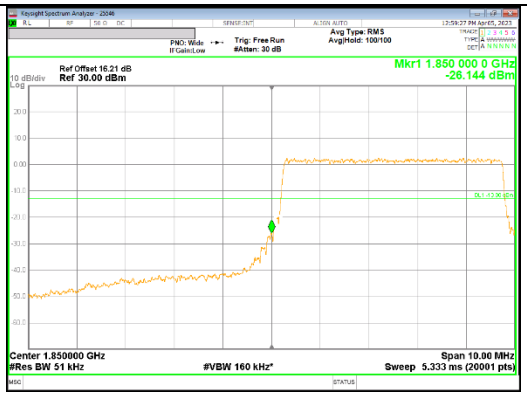
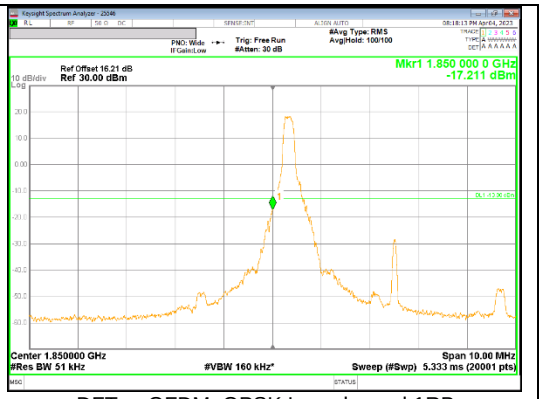
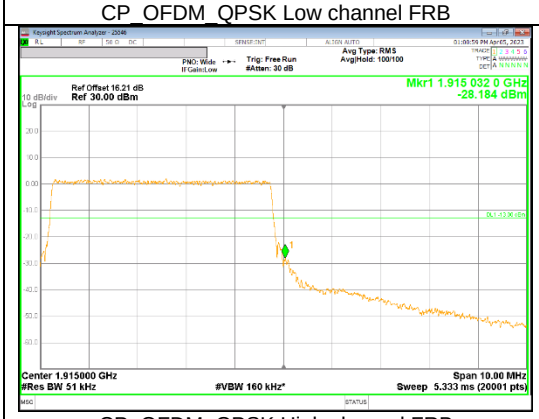
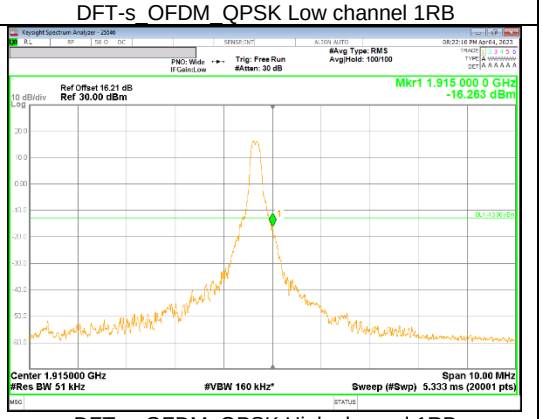
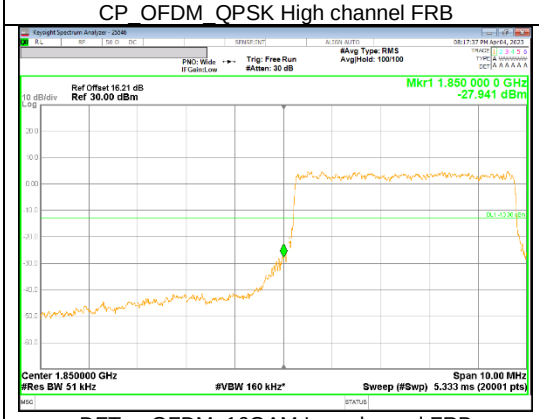
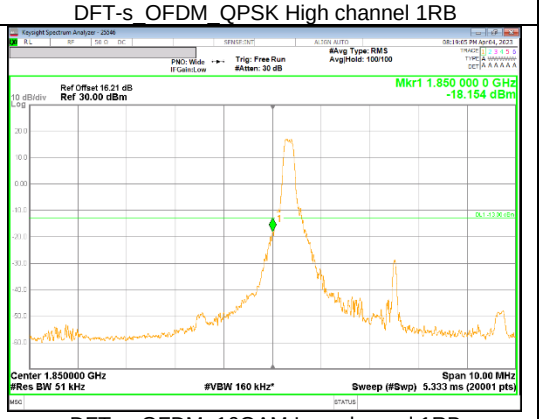
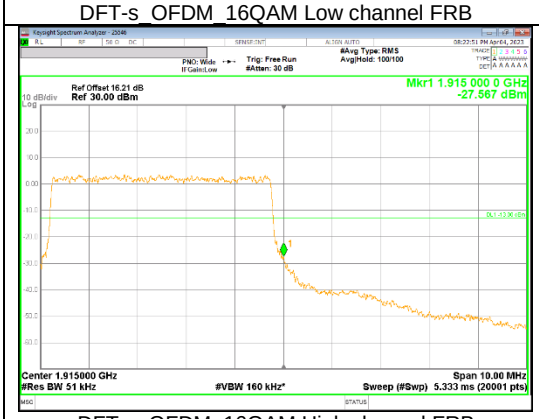
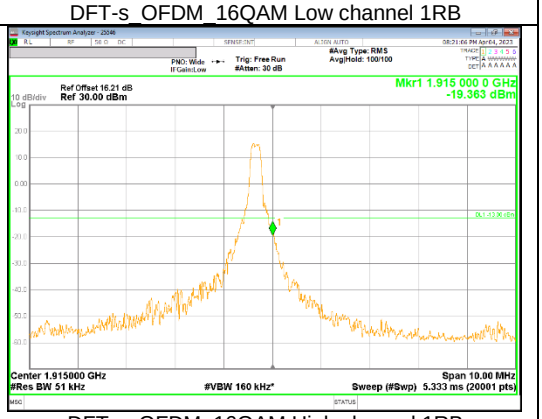
30MHz	 DFT-s_OFDM _QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 DFT-s_OFDM _QPSK High channel FRB	 DFT-s_OFDM_QPSK High channel 1RB
	 CP_OFDM_16QAM Low channel FRB	 DFT-s_OFDM_16QAM Low channel 1RB
	 DFT-s_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

25MHz	 DFT-s_OFDM_QPSK Low channel FRB	 DFT-s_OFDM_QPSK Low channel 1RB
	 DFT-s_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
	 DFT-s_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

20MHz	 CP_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

15MHz	 CP_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
	 CP_OFDM_16QAM High channel FRB	 DFT-s_OFDM_16QAM High channel 1RB

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
	 DFT-s_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	 CP_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.

8.5.1. OUT OF BAND EMISSIONS RESULT

GSM 1900

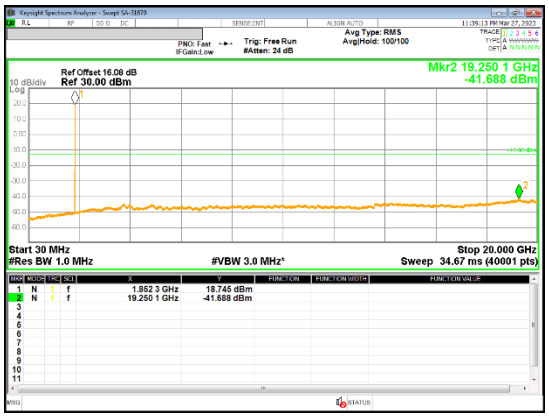
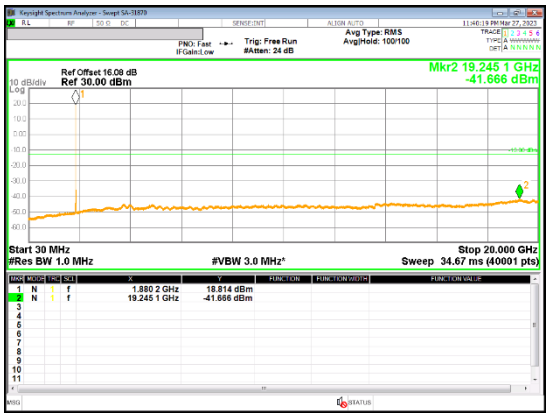
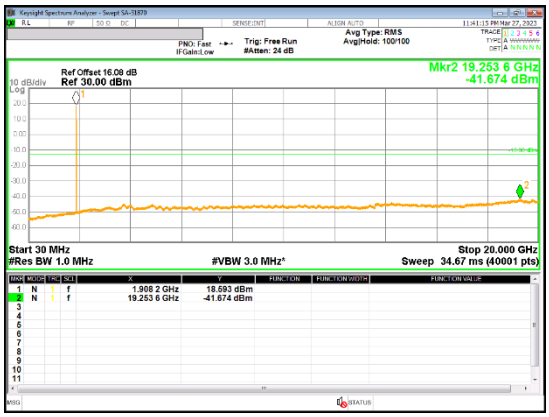
GPRS

Low channel

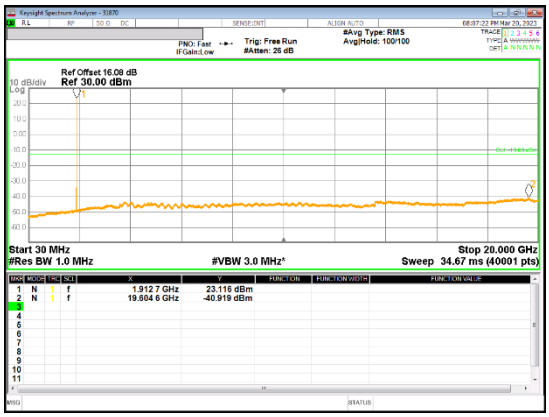
Mid channel

High channel

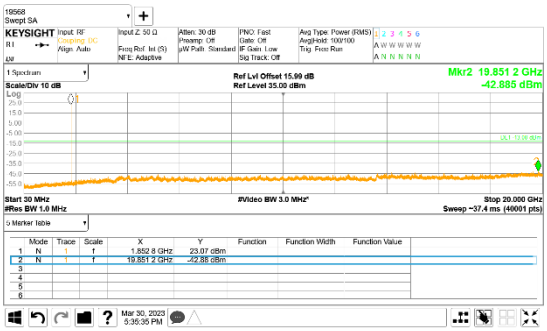
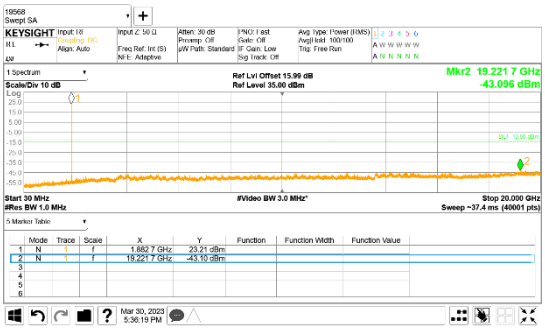
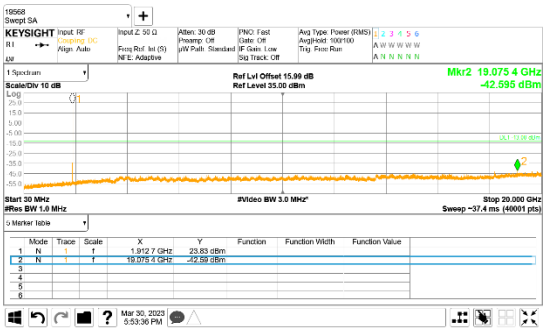
WCDMA Band 2

REL99	 Low channel	 Mid channel
	 High channel	

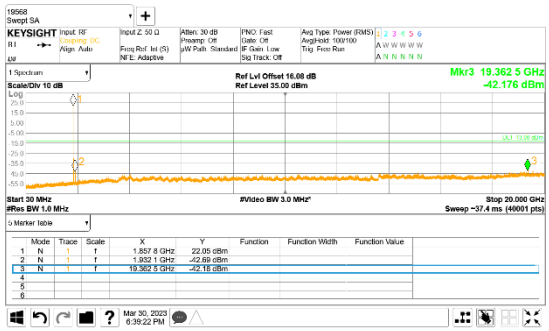
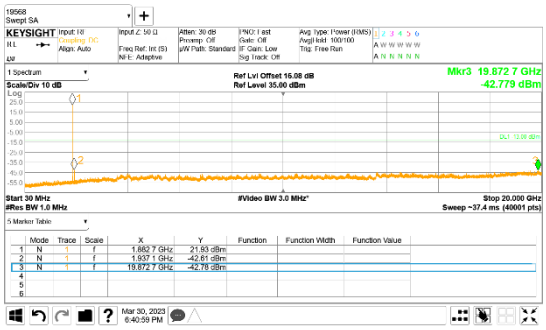
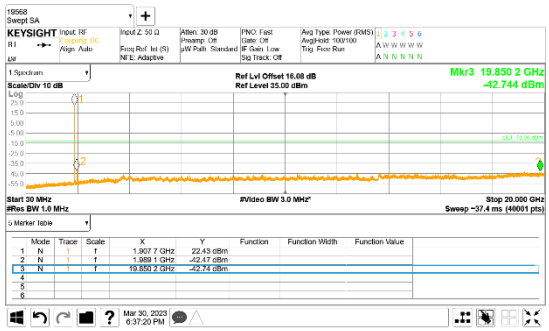
LTE Band 25 (ANT B)

5 MHz QPSK	 Low channel	 Mid channel
	 High channel	

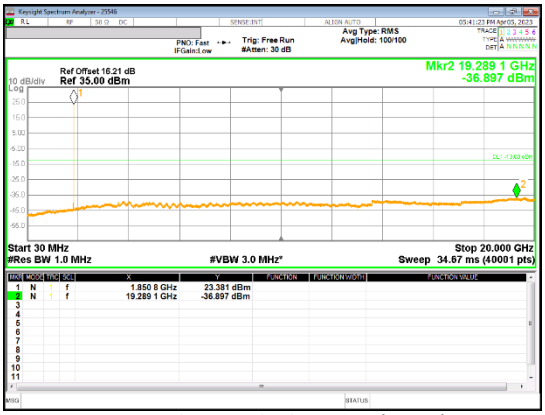
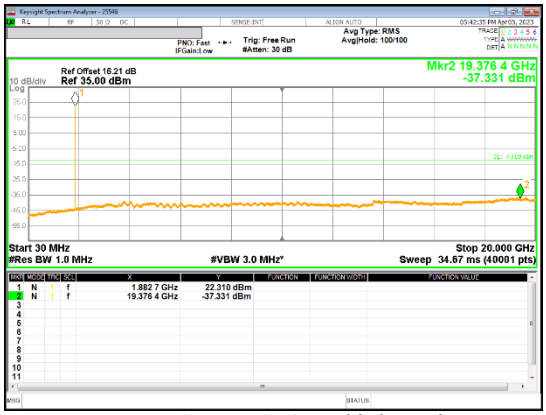
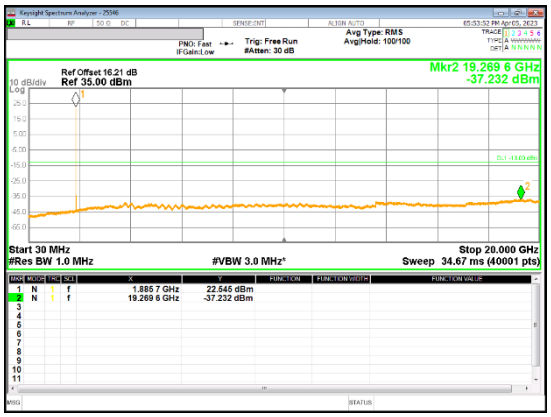
LTE Band 25 (ANT F)

5 MHz QPSK	 Low channel	 Mid channel
	 High channel	

NR Band n25 (ANT B)

15MHz QPSK	 DFT-s_OFDM _QPSK_Low channel	 DFT-s_OFDM _QPSK_Mid channel
	 DFT-s_OFDM _QPSK_High channel	

NR Band n25 (ANT F)

30MHz 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.

8.6.1. FREQUENCY STABILITY RESULTS

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

Test Date	2023-03-14
Test Engineer	19568

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	1850.0778	1909.9211		
Extreme (50C)		1850.0778	1909.9212	10.4	0.006
Extreme (40C)		1850.0778	1909.9212	14.4	0.008
Extreme (30C)		1850.0778	1909.9212	10.4	0.006
Extreme (10C)		1850.0778	1909.9212	16.6	0.009
Extreme (0C)		1850.0778	1909.9212	18.6	0.010
Extreme (-10C)		1850.0778	1909.9212	6.5	0.003
Extreme (-20C)		1850.0778	1909.9212	8.4	0.004
Extreme (-30C)		1850.0778	1909.9212	9.6	0.005
20C	15%	1850.0778	1909.9212	37.9	0.020
	-15%	1850.0778	1909.9212	32.2	0.017
	End Point	1850.0778	1909.9212	33.8	0.018

WCDMA Band 2 (Lowest Frequency: HSDPA / Highest Frequency: Rel99)

Test Date	2023-03-17
Test Engineer	19568

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	1850.3218	1909.6757		
Extreme (50C)		1850.3218	1909.6757	22.3	0.012
Extreme (40C)		1850.3218	1909.6757	30.8	0.016
Extreme (30C)		1850.3218	1909.6757	19.4	0.010
Extreme (10C)		1850.3218	1909.6757	21.3	0.011
Extreme (0C)		1850.3218	1909.6757	23.1	0.012
Extreme (-10C)		1850.3218	1909.6757	22.2	0.012
Extreme (-20C)		1850.3218	1909.6757	18.1	0.010
Extreme (-30C)		1850.3218	1909.6757	16.3	0.009
20C	15%	1850.3218	1909.6757	6.8	0.004
	-15%	1850.3218	1909.6757	7.2	0.004
	End Point	1850.3218	1909.6757	8.8	0.005

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

Test Date	2023-03-27
Test Engineer	19568

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	1850.1513	1914.8465		
Extreme (50C)		1850.1513	1914.8465	20.4	0.011
Extreme (40C)		1850.1513	1914.8465	22.5	0.012
Extreme (30C)		1850.1513	1914.8465	24.8	0.013
Extreme (10C)		1850.1513	1914.8465	17.3	0.009
Extreme (0C)		1850.1513	1914.8465	15.2	0.008
Extreme (-10C)		1850.1513	1914.8465	17.7	0.009
Extreme (-20C)		1850.1513	1914.8465	20.6	0.011
Extreme (-30C)		1850.1513	1914.8465	22.3	0.012
20C	15%	1850.1513	1914.8465	5.3	0.003
	-15%	1850.1513	1914.8465	6.1	0.003
	End Point	1850.1513	1914.8465	5.7	0.003

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

Test Date	2023-04-14
Test Engineer	19568

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	1850.2595	1914.7452		
Extreme (50C)		1850.2595	1914.7452	19.3	0.010
Extreme (40C)		1850.2595	1914.7452	21.4	0.011
Extreme (30C)		1850.2595	1914.7452	23.7	0.013
Extreme (10C)		1850.2595	1914.7452	16.2	0.009
Extreme (0C)		1850.2595	1914.7452	14.0	0.007
Extreme (-10C)		1850.2595	1914.7452	16.6	0.009
Extreme (-20C)		1850.2595	1914.7452	19.5	0.010
Extreme (-30C)		1850.2595	1914.7452	21.2	0.011
20C	15%	1850.2595	1914.7452	7.4	0.004
	-15%	1850.2595	1914.7452	7.0	0.004
	End Point	1850.2595	1914.7452	7.0	0.004

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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.

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9.1.1. EIRP Results

GSM

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)
GSM 1900	GPRS	1850.20	22.18	H	4.48	9.52	27.22	527.23	33.00	-5.78
		1880.00	22.58	H	4.52	9.29	27.35	543.25	33.00	-5.65
		1909.80	23.54	H	4.55	9.00	27.98	628.06	33.00	-5.02
	EGPRS	1850.20	19.14	H	4.48	9.52	24.18	261.82	33.00	-8.82
		1880.00	19.46	H	4.52	9.29	24.23	264.85	33.00	-8.77
		1909.80	20.39	H	4.55	9.00	24.83	304.09	33.00	-8.17

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 2	REL99	1852.40	17.23	H	4.49	9.51	22.25	167.88	33.00	-10.75
		1880.00	17.99	H	4.52	9.29	22.76	188.80	33.00	-10.24
		1907.60	17.86	H	4.55	9.03	22.34	171.40	33.00	-10.66
	HSDPA	1852.40	16.23	H	4.49	9.51	21.25	133.35	33.00	-11.75
		1880.00	17.15	H	4.52	9.29	21.92	155.60	33.00	-11.08
		1907.60	16.90	H	4.55	9.03	21.38	137.40	33.00	-11.62

LTE Band 25 (ANT B)

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
1.4	QPSK	1850.70	16.76	H	4.48	9.52	21.79	151.11	33.00	-11.21	1/0
		1882.50	17.80	H	4.52	9.27	22.55	179.98	33.00	-10.45	1/0
		1914.30	17.82	H	4.56	8.94	22.20	165.86	33.00	-10.80	1/3
	16-QAM	1850.70	15.96	H	4.48	9.52	20.99	125.69	33.00	-12.01	1/3
		1882.50	16.85	H	4.52	9.27	21.60	144.62	33.00	-11.40	1/3
		1914.30	17.20	H	4.56	8.94	21.58	143.80	33.00	-11.42	1/3
3	QPSK	1851.50	16.63	H	4.49	9.51	21.65	146.22	33.00	-11.35	1/8
		1882.50	17.75	H	4.52	9.27	22.50	177.83	33.00	-10.50	1/8
		1913.50	18.32	H	4.56	8.95	22.71	186.64	33.00	-10.29	1/8
	16-QAM	1851.50	15.80	H	4.49	9.51	20.82	120.78	33.00	-12.18	1/8
		1882.50	16.89	H	4.52	9.27	21.64	145.88	33.00	-11.36	1/8
		1913.50	17.43	H	4.56	8.95	21.82	152.05	33.00	-11.18	1/8
5	QPSK	1852.50	16.29	H	4.49	9.50	21.30	134.90	33.00	-11.70	1/12
		1882.50	17.56	H	4.52	9.27	22.31	170.22	33.00	-10.69	1/12
		1912.50	18.13	H	4.56	8.96	22.53	179.06	33.00	-10.47	1/12
	16-QAM	1852.50	15.46	H	4.49	9.50	20.47	111.43	33.00	-12.53	1/12
		1882.50	17.02	H	4.52	9.27	21.77	150.31	33.00	-11.23	1/12
		1912.50	17.57	H	4.56	8.96	21.97	157.40	33.00	-11.03	1/12
10	QPSK	1855.00	17.39	H	4.49	9.48	22.39	173.38	33.00	-10.61	1/25
		1882.50	17.70	H	4.52	9.27	22.45	175.79	33.00	-10.55	1/25
		1910.00	18.45	H	4.55	8.99	22.90	194.98	33.00	-10.10	1/25
	16-QAM	1855.00	16.80	H	4.49	9.48	21.80	151.36	33.00	-11.20	1/25
		1882.50	16.72	H	4.52	9.27	21.47	140.28	33.00	-11.53	1/25
		1910.00	17.37	H	4.55	8.99	21.82	152.05	33.00	-11.18	1/25
15	QPSK	1857.50	17.27	H	4.49	9.47	22.24	167.49	33.00	-10.76	1/37
		1882.50	17.60	H	4.52	9.27	22.35	171.79	33.00	-10.65	1/0
		1907.50	17.89	H	4.55	9.03	22.37	172.58	33.00	-10.63	1/74
	16-QAM	1857.50	16.20	H	4.49	9.47	21.17	130.92	33.00	-11.83	1/0
		1882.50	16.63	H	4.52	9.27	21.38	137.40	33.00	-11.62	1/0
		1907.50	17.23	H	4.55	9.03	21.71	148.25	33.00	-11.29	1/37
20	QPSK	1860.00	16.80	H	4.49	9.45	21.75	149.62	33.00	-11.25	1/0
		1882.50	17.14	H	4.52	9.27	21.89	154.53	33.00	-11.11	1/49
		1905.00	17.97	H	4.55	9.06	22.48	177.01	33.00	-10.52	1/49
	16-QAM	1860.00	16.46	H	4.49	9.45	21.41	138.36	33.00	-11.59	1/0
		1882.50	16.82	H	4.52	9.27	21.57	143.55	33.00	-11.43	1/0
		1905.00	17.22	H	4.55	9.06	21.73	148.94	33.00	-11.27	1/49

LTE Band 25 (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
5	QPSK	1852.50	17.22	V	4.49	9.50	22.24	167.49	33.00	-10.76	1/12
		1882.50	17.12	V	4.52	9.27	21.87	153.82	33.00	-11.13	1/12
		1912.50	16.50	V	4.56	8.96	20.90	123.03	33.00	-12.10	1/12
	16-QAM	1852.50	16.42	V	4.49	9.50	21.44	139.32	33.00	-11.56	1/12
		1882.50	16.35	V	4.52	9.27	21.10	128.82	33.00	-11.90	1/12
		1912.50	15.71	V	4.56	8.96	20.11	102.57	33.00	-12.89	1/12

5G NR n25 DFT-s_OFDM (ANT B)

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
5	QPSK	1852.50	18.96	H	4.49	9.50	23.98	250.03	33.00	-9.02	1/1
		1882.50	19.25	H	4.52	9.27	23.99	250.61	33.00	-9.01	1/1
		1912.50	18.78	H	4.56	8.96	23.19	208.45	33.00	-9.81	1/1
	16-QAM	1852.50	17.80	H	4.49	9.50	22.82	191.43	33.00	-10.18	1/1
		1882.50	17.99	H	4.52	9.27	22.73	187.50	33.00	-10.27	1/1
		1912.50	17.39	H	4.56	8.96	21.80	151.36	33.00	-11.20	1/1
10	QPSK	1855.00	17.53	H	4.49	9.48	22.52	178.65	33.00	-10.48	1/50
		1882.50	19.33	H	4.52	9.27	24.07	255.27	33.00	-8.93	1/1
		1910.00	19.16	H	4.55	8.99	23.60	229.09	33.00	-9.40	1/1
	16-QAM	1855.00	16.20	H	4.49	9.48	21.19	131.52	33.00	-11.81	1/50
		1882.50	18.11	H	4.52	9.27	22.85	192.75	33.00	-10.15	1/1
		1910.00	18.27	H	4.55	8.99	22.71	186.64	33.00	-10.29	1/1
15	QPSK	1857.50	19.20	H	4.49	9.47	24.17	261.22	33.00	-8.83	1/40
		1882.50	19.02	H	4.52	9.27	23.76	237.68	33.00	-9.24	1/1
		1907.50	20.14	H	4.55	9.03	24.62	289.73	33.00	-8.38	1/1
	16-QAM	1857.50	18.35	H	4.49	9.47	23.32	214.78	33.00	-9.68	1/40
		1882.50	18.02	H	4.52	9.27	22.76	188.80	33.00	-10.24	1/1
		1907.50	19.25	H	4.55	9.03	23.73	236.05	33.00	-9.27	1/1
20	QPSK	1860.00	18.42	H	4.49	9.45	23.37	217.27	33.00	-9.63	1/53
		1882.50	19.55	H	4.52	9.27	24.29	268.53	33.00	-8.71	1/1
		1905.00	19.98	H	4.55	9.06	24.49	281.19	33.00	-8.51	1/53
	16-QAM	1860.00	17.42	H	4.49	9.45	22.37	172.58	33.00	-10.63	1/53
		1882.50	18.59	H	4.52	9.27	23.33	215.28	33.00	-9.67	1/1
		1905.00	19.16	H	4.55	9.06	23.67	232.81	33.00	-9.33	1/53
25	QPSK	1862.50	18.02	H	4.50	9.43	22.95	197.24	33.00	-10.05	1/1
		1882.50	19.11	H	4.52	9.27	23.85	242.66	33.00	-9.15	1/1
		1902.50	19.48	H	4.54	9.10	24.04	253.51	33.00	-8.96	1/1
	16-QAM	1862.50	17.49	H	4.50	9.43	22.42	174.58	33.00	-10.58	1/1
		1882.50	18.85	H	4.52	9.27	23.59	228.56	33.00	-9.41	1/1
		1902.50	19.17	H	4.54	9.10	23.73	236.05	33.00	-9.27	1/1
30	QPSK	1865.00	17.43	H	4.50	9.41	22.33	171.00	33.00	-10.67	1/1
		1882.50	18.31	H	4.52	9.27	23.05	201.84	33.00	-9.95	1/1
		1900.00	17.91	H	4.54	9.13	22.50	177.83	33.00	-10.50	1/1
	16-QAM	1865.00	16.42	H	4.50	9.41	21.32	135.52	33.00	-11.68	1/1
		1882.50	17.41	H	4.52	9.27	22.15	164.06	33.00	-10.85	1/1
		1900.00	17.09	H	4.54	9.13	21.68	147.23	33.00	-11.32	1/1
40	QPSK	1870.00	17.77	H	4.51	9.37	22.63	183.23	33.00	-10.37	1/1
		1882.50	17.40	H	4.52	9.27	22.14	163.68	33.00	-10.86	1/1
		1895.00	18.28	H	4.54	9.17	22.91	195.43	33.00	-10.09	1/1
	16-QAM	1870.00	16.89	H	4.51	9.37	21.75	149.62	33.00	-11.25	1/1
		1882.50	16.71	H	4.52	9.27	21.45	139.64	33.00	-11.55	1/1
		1895.00	17.33	H	4.54	9.17	21.96	157.04	33.00	-11.04	1/1

5G NR n25 DFT-s_OFDM (ANT F)

30	QPSK	1865.00	17.42	H	4.50	9.24	22.16	164.35	33.00	-10.84	1/1
		1882.50	17.20	H	4.52	9.12	21.80	151.22	33.00	-11.20	1/80
		1900.00	17.80	H	4.54	9.00	22.26	168.10	33.00	-10.74	1/1
	16-QAM	1865.00	16.53	H	4.50	9.24	21.27	133.89	33.00	-11.73	1/1
		1882.50	16.12	H	4.52	9.12	20.72	117.93	33.00	-12.28	1/80
		1900.00	16.90	H	4.54	9.00	21.36	136.64	33.00	-11.64	1/1

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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)
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9.2.1. SPURIOUS RADIATION PLOTS

GSM1900

GPRS

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

Company:	Samsung
Project #:	4790748041
Date:	2023-05-12
Test Engineer:	26087
Configuration:	EUT / AC Adapter, X-Position, HF
Location:	Chamber 1
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	-6.6	V	3.0	46.0	1.0	-51.6	-13.0	-38.6	
5550.60	-3.3	V	3.0	45.8	1.0	-48.1	-13.0	-35.1	
7400.80	-0.5	V	3.0	45.5	1.0	-45.1	-13.0	-32.1	
3700.40	-4.3	H	3.0	46.0	1.0	-49.3	-13.0	-36.3	
5550.60	-3.9	H	3.0	45.8	1.0	-48.7	-13.0	-35.7	
7400.80	-2.6	H	3.0	45.5	1.0	-47.1	-13.0	-34.1	
Mid Ch, 1880MHz									
3760.00	-5.6	V	3.0	46.0	1.0	-50.6	-13.0	-37.6	
5640.00	-1.5	V	3.0	45.7	1.0	-46.2	-13.0	-33.2	
7520.00	0.7	V	3.0	45.5	1.0	-43.9	-13.0	-30.9	
3760.00	-2.3	H	3.0	46.0	1.0	-47.2	-13.0	-34.2	
5640.00	-1.6	H	3.0	45.7	1.0	-46.3	-13.0	-33.3	
7520.00	-0.6	H	3.0	45.5	1.0	-45.2	-13.0	-32.2	
High Ch, 1909.8MHz									
3819.60	-4.6	V	3.0	45.9	1.0	-49.5	-13.0	-36.5	
5729.40	-1.2	V	3.0	45.6	1.0	-45.8	-13.0	-32.8	
7639.20	0.3	V	3.0	45.6	1.0	-44.2	-13.0	-31.2	
3819.60	-0.4	H	3.0	45.9	1.0	-45.3	-13.0	-32.3	
5729.40	-1.6	H	3.0	45.6	1.0	-46.2	-13.0	-33.2	
7639.20	-1.3	H	3.0	45.6	1.0	-45.9	-13.0	-32.9	

WCDMA Band 2

REL99

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

Company:	Samsung
Project #:	4790748041
Date:	2023-05-17
Test Engineer:	26087
Configuration:	EUT / AC Adapter, X-Position, Open
Location:	Chamber 1
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	-9.5	V	3.0	46.0	1.0	-54.6	-13.0	-41.6	
5557.20	-6.9	V	3.0	45.8	1.0	-51.7	-13.0	-38.7	
7409.60	-3.8	V	3.0	45.5	1.0	-48.4	-13.0	-35.4	
3704.80	-8.7	H	3.0	46.0	1.0	-53.8	-13.0	-40.8	
5557.20	-6.5	H	3.0	45.8	1.0	-51.3	-13.0	-38.3	
7409.60	-4.1	H	3.0	45.5	1.0	-48.6	-13.0	-35.6	
Mid Ch, 1880MHz									
3760.00	-9.6	V	3.0	46.0	1.0	-54.6	-13.0	-41.6	
5640.00	-6.6	V	3.0	45.7	1.0	-51.3	-13.0	-38.3	
7520.00	-3.9	V	3.0	45.5	1.0	-48.4	-13.0	-35.4	
3760.00	-8.3	H	3.0	46.0	1.0	-53.3	-13.0	-40.3	
5640.00	-6.5	H	3.0	45.7	1.0	-51.2	-13.0	-38.2	
7520.00	-4.1	H	3.0	45.5	1.0	-48.6	-13.0	-35.6	
High Ch, 1907.6MHz									
3815.20	-9.3	V	3.0	45.9	1.0	-54.2	-13.0	-41.2	
5722.80	-6.7	V	3.0	45.6	1.0	-51.3	-13.0	-38.3	
7630.40	-3.5	V	3.0	45.6	1.0	-48.0	-13.0	-35.0	
3815.20	-8.9	H	3.0	45.9	1.0	-53.8	-13.0	-40.8	
5722.80	-6.5	H	3.0	45.6	1.0	-51.2	-13.0	-38.2	
7630.40	-3.6	H	3.0	45.6	1.0	-48.2	-13.0	-35.2	

LTE Band 25

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

Company: Samsung
Project #: 4790748041
Date: 2023-04-27
Test Engineer: 25770
Configuration: EUT / AC Adapter, Y-Position, Open
Location: Chamber 2
Mode: LTE_QPSK Band 25 Harmonics, 10MHz Bandwidth
Test Votage: AC 120 V, 60 Hz

10 MHz
QPSK
ANT B

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1855MHz									
3710.00	-10.9	V	3.0	42.1	1.0	-51.9	-13.0	-38.9	
5565.00	-7.9	V	3.0	42.9	1.0	-49.8	-13.0	-36.8	
7420.00	-5.8	V	3.0	42.5	1.0	-47.3	-13.0	-34.3	
3710.00	-11.0	H	3.0	42.1	1.0	-52.1	-13.0	-39.1	
5565.00	-7.9	H	3.0	42.9	1.0	-49.8	-13.0	-36.8	
7420.00	-5.5	H	3.0	42.5	1.0	-47.0	-13.0	-34.0	
Mid Ch, 1882.5MHz									
3765.00	-10.4	V	3.0	42.1	1.0	-51.5	-13.0	-38.5	
5647.50	-7.4	V	3.0	42.9	1.0	-49.3	-13.0	-36.3	
7530.00	-5.8	V	3.0	42.4	1.0	-47.2	-13.0	-34.2	
3765.00	-10.9	H	3.0	42.1	1.0	-52.0	-13.0	-39.0	
5647.50	-7.6	H	3.0	42.9	1.0	-49.5	-13.0	-36.5	
7530.00	-5.5	H	3.0	42.4	1.0	-47.0	-13.0	-34.0	
High Ch, 1910MHz									
3820.00	-10.6	V	3.0	42.1	1.0	-51.7	-13.0	-38.7	
5730.00	-7.6	V	3.0	42.9	1.0	-49.5	-13.0	-36.5	
7640.00	-5.7	V	3.0	42.4	1.0	-47.1	-13.0	-34.1	
3820.00	-10.8	H	3.0	42.1	1.0	-51.9	-13.0	-38.9	
5730.00	-7.7	H	3.0	42.9	1.0	-49.6	-13.0	-36.6	
7640.00	-5.5	H	3.0	42.4	1.0	-46.9	-13.0	-33.9	

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

Company: Samsung
Project #: 4790748041
Date: 2023-04-27
Test Engineer: 25770
Configuration: EUT / AC Adapter, Z-Position, FF
Location: Chamber 2
Mode: LTE_QPSK Band 25 Harmonics, 5MHz Bandwidth
Test Votage: AC 120 V, 60 Hz

5 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, 1852.5MHz									
3705.00	-11.0	V	3.0	42.1	1.0	-52.1	-13.0	-39.1	
5557.50	-6.9	V	3.0	42.9	1.0	-48.8	-13.0	-35.8	
7410.00	-5.8	V	3.0	42.5	1.0	-47.3	-13.0	-34.3	
3705.00	-11.2	H	3.0	42.1	1.0	-52.2	-13.0	-39.2	
5557.50	-6.8	H	3.0	42.9	1.0	-48.7	-13.0	-35.7	
7410.00	-5.7	H	3.0	42.5	1.0	-47.2	-13.0	-34.2	
Mid Ch, 1882.5MHz									
3765.00	-10.8	V	3.0	42.1	1.0	-51.9	-13.0	-38.9	
5647.50	-4.9	V	3.0	42.9	1.0	-46.8	-13.0	-33.8	
7530.00	-5.9	V	3.0	42.4	1.0	-47.3	-13.0	-34.3	
3765.00	-11.0	H	3.0	42.1	1.0	-52.1	-13.0	-39.1	
5647.50	-3.8	H	3.0	42.9	1.0	-45.7	-13.0	-32.7	
7530.00	-5.8	H	3.0	42.4	1.0	-47.3	-13.0	-34.3	
High Ch, 1912.5MHz									
3825.00	-10.7	V	3.0	42.1	1.0	-51.8	-13.0	-38.8	
5737.50	-2.6	V	3.0	42.9	1.0	-44.6	-13.0	-31.6	
7650.00	-5.8	V	3.0	42.4	1.0	-47.2	-13.0	-34.2	
3825.00	-10.9	H	3.0	42.1	1.0	-51.9	-13.0	-38.9	
5737.50	0.7	H	3.0	42.9	1.0	-41.2	-13.0	-28.2	
7650.00	-5.7	H	3.0	42.4	1.0	-47.1	-13.0	-34.1	

NR Band n25

15 MHz

DFT-s_OFDM

QPSK

ANT B

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

Company: Samsung
Project #: 4790748041
Date: 2023-05-11
Test Engineer: 26087
Configuration: EUT / AC Adapter, X-Position, HF
Location: Chamber 1
Mode: 5G NR_QPSK NR n25 Harmonics, 15MHz 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, 1857.5MHz									
3715.00	-9.7	V	3.0	46.0	1.0	-54.7	-13.0	-41.7	
5572.50	-6.0	V	3.0	45.7	1.0	-50.8	-13.0	-37.8	
7430.00	-3.1	V	3.0	45.5	1.0	-47.7	-13.0	-34.7	
3715.00	-8.7	H	3.0	46.0	1.0	-53.8	-13.0	-40.8	
5572.50	-4.4	H	3.0	45.7	1.0	-49.1	-13.0	-36.1	
7430.00	-3.6	H	3.0	45.5	1.0	-48.2	-13.0	-35.2	
Mid Ch, 1882.5MHz									
3765.00	-8.5	V	3.0	46.0	1.0	-53.4	-13.0	-40.4	
5647.50	-5.1	V	3.0	45.7	1.0	-49.8	-13.0	-36.8	
7530.00	-3.1	V	3.0	45.5	1.0	-47.6	-13.0	-34.6	
3765.00	-7.2	H	3.0	46.0	1.0	-52.2	-13.0	-39.2	
5647.50	-4.0	H	3.0	45.7	1.0	-48.7	-13.0	-35.7	
7530.00	-3.7	H	3.0	45.5	1.0	-48.2	-13.0	-35.2	
High Ch, 1907.5MHz									
3815.00	-8.8	V	3.0	45.9	1.0	-53.7	-13.0	-40.7	
5722.50	-5.9	V	3.0	45.6	1.0	-50.6	-13.0	-37.6	
7630.00	-2.8	V	3.0	45.6	1.0	-47.4	-13.0	-34.4	
3815.00	-8.2	H	3.0	45.9	1.0	-53.1	-13.0	-40.1	
5722.50	-6.1	H	3.0	45.6	1.0	-50.7	-13.0	-37.7	
7630.00	-3.2	H	3.0	45.6	1.0	-47.8	-13.0	-34.8	

30 MHz

DFT-s_OFDM

QPSK

ANT F

Tx Hopping

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

Company: Samsung
Project #: 4790748041
Date: 2023-05-25
Test Engineer: 19568
Configuration: EUT / AC Adapter, Z-Position, FF
Location: Chamber 2
Mode: 5G NR_QPSK NR n25 Harmonics, 30MHz 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, 1865MHz									
3730.00	-11.6	V	3.0	42.1	1.0	-52.7	-13.0	-39.7	
5595.00	-6.9	V	3.0	42.9	1.0	-48.8	-13.0	-35.8	
7460.00	-5.0	V	3.0	42.5	1.0	-46.4	-13.0	-33.4	
3730.00	-9.5	H	3.0	42.1	1.0	-50.6	-13.0	-37.6	
5595.00	-6.6	H	3.0	42.9	1.0	-48.5	-13.0	-35.5	
7460.00	-4.9	H	3.0	42.5	1.0	-46.3	-13.0	-33.3	
Mid Ch, 1882.5MHz									
3765.00	-9.5	V	3.0	42.1	1.0	-50.5	-13.0	-37.5	
5647.50	-6.2	V	3.0	42.9	1.0	-48.1	-13.0	-35.1	
7530.00	-5.2	V	3.0	42.4	1.0	-46.6	-13.0	-33.6	
3765.00	-9.2	H	3.0	42.1	1.0	-50.3	-13.0	-37.3	
5647.50	-6.8	H	3.0	42.9	1.0	-48.7	-13.0	-35.7	
7530.00	-5.1	H	3.0	42.4	1.0	-46.5	-13.0	-33.5	
High Ch, 1900MHz									
3800.00	-11.5	V	3.0	42.1	1.0	-52.6	-13.0	-39.6	
5700.00	-5.8	V	3.0	42.9	1.0	-47.8	-13.0	-34.8	
7600.00	-5.7	V	3.0	42.4	1.0	-47.1	-13.0	-34.1	
3800.00	-9.1	H	3.0	42.1	1.0	-50.1	-13.0	-37.1	
5700.00	-2.8	H	3.0	42.9	1.0	-44.8	-13.0	-31.8	
7600.00	-4.8	H	3.0	42.4	1.0	-46.2	-13.0	-33.2	

END OF REPORT