CERTIFICATION TEST REPORT

Report Number. : 4790381906-E1V2

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-S906B/DS
FCC ID	:	A3LSMS906B
EUT Description	:	GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax NFC, WPT and UWB.
Test Standard	:	FCC CFR47 PART 27 SUBPART L

Date Of Issue:
2022-08-18

Prepared by:
UL Korea, Ltd.
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Suwon Test Site: UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
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IAS ACCREDITED Testing Laboratory TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2022-08-11	Initial issue	Yeonhee Lim
V2	2022-08-18	Updated to address TCB's question	Yeonhee Lim

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_27(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

TABLE OF CONTENTS

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_27(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax NFC, WPT and UWB.
MODEL NUMBER:	SM-S906B
SERIAL NUMBER:	R3CRA0PLQPZ (CONDUCTED); R3CRA0PKN1K (RADIATED);
DATE TESTED:	2022-08-05 ~ 2022-08-11;

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 27L	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

Seokhwan Hong
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Yeonhee Lim
Suwon Lab Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 27.
3. ANSI TIA-603-E, 2016
4. ANSI C63.26, 2015
5. KDB 971168 D01 Power Meas License Digital Systems v03r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☐ Chamber 1(3m semi-anechoic chamber)
☒ Chamber 2(3m semi-anechoic chamber)
☐ Chamber 3(3m semi-anechoic chamber)
☒ Chamber 4(3m Full-anechoic chamber)
☐ Chamber 5(3m Full-anechoic chamber)

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.02 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.05 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.78 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.58 dB

Uncertainty figures are valid to a confidence level of 95%.

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax and NFC. This test report addresses the WWAN operational mode.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average radiated EIRP output powers as follows:

NR Band n66

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
					Measured Pwr (dBm)			MPR	Tune-up Limit
					344000	349000	354000		
					1720 MHz	1745 MHz	1770 MHz		
20 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.27	24.25	24.13	0.0	25
			1	53	24.20	24.16	24.01	0.0	25
			1	104	24.21	24.10	23.93	0.0	25
			50	0	24.35	24.34	24.14	0.5	24.5
			50	28	24.25	24.22	24.09	0.0	25
			50	56	24.24	24.17	24.11	0.5	24.5
			100	0	24.30	24.22	24.03	0.5	24.5
		QPSK	1	1	24.32	24.31	24.15	0.0	25
			1	53	24.20	24.20	23.83	0.0	25
			1	104	24.20	24.18	23.78	0.0	25
			50	0	22.26	22.29	22.18	1.0	24
			50	28	24.29	24.25	23.90	0.0	25
			50	56	22.17	22.07	22.17	1.0	24
			100	0	22.29	22.15	22.09	1.0	24
		16QAM	1	1	22.40	22.43	22.26	1.0	24
			1	53	22.25	22.34	22.12	1.0	24
			1	104	22.23	22.33	22.03	1.0	24
		64QAM	1	1	20.72	20.56	20.68	2.5	22.5
		256QAM	1	1	18.92	18.79	18.72	4.5	20.5
	CP-OFDM	QPSK	1	1	21.81	21.68	21.60	1.5	23.5

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					343500	349000	354500		
					1717.5 MHz	1745 MHz	1772.5 MHz		
15 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.39	24.26	24.12	0.0	25
			1	40	24.40	24.22	24.12	0.0	25
			1	77	24.24	24.17	23.99	0.0	25
			36	0	24.41	24.31	24.10	0.5	24.5
			36	22	24.43	24.31	24.11	0.0	25
			36	43	24.36	24.24	24.16	0.5	24.5
			75	0	24.43	24.29	24.13	0.5	24.5
		QPSK	1	1	24.39	24.19	24.16	0.0	25
			1	40	24.40	24.28	24.13	0.0	25
			1	77	24.23	24.15	24.02	0.0	25
			36	0	22.38	22.25	22.21	1.0	24
			36	22	24.41	24.26	24.14	0.0	25
			36	43	22.42	22.13	22.20	1.0	24
			75	0	22.45	22.20	22.23	1.0	24
		16QAM	1	1	22.31	22.40	22.34	1.0	24
		64QAM	1	1	20.94	20.91	20.76	2.5	22.5
		256QAM	1	1	19.01	18.84	18.78	4.5	20.5
	CP-OFDM	QPSK	1	1	21.95	21.80	21.70	1.5	23.5

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					343000	349000	355000		
					1715 MHz	1745 MHz	1775 MHz		
10 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.46	24.33	24.11	0.0	25
			1	26	24.41	24.21	24.13	0.0	25
			1	50	24.40	24.18	24.07	0.0	25
			25	0	24.44	24.32	24.09	0.5	24.5
			25	14	24.47	24.28	24.13	0.0	25
			25	27	24.44	24.22	24.14	0.5	24.5
			50	0	24.44	24.27	24.16	0.5	24.5
		QPSK	1	1	24.43	24.35	24.10	0.0	25
			1	26	24.43	24.30	24.14	0.0	25
			1	50	24.38	24.21	24.06	0.0	25
			25	0	22.50	22.34	22.17	1.0	24
			25	14	24.42	24.27	24.13	0.0	25
			25	27	22.42	22.22	22.14	1.0	24
			50	0	22.47	22.30	22.21	1.0	24
		16QAM	1	1	22.50	22.45	22.33	1.0	24
		64QAM	1	1	21.00	20.86	20.70	2.5	22.5
		256QAM	1	1	19.11	18.89	18.84	4.5	20.5
	CP-OFDM	QPSK	1	1	21.96	22.07	21.87	1.5	23.5

BW (MHz)	Modulation	Mode	RB Allocation	RB offset	Measured Pwr (dBm)			MPR	Tune-up Limit
					342500	349000	355500		
					1712.5 MHz	1745 MHz	1777.5 MHz		
5 MHz	DFT-s-OFDM	π/2 BPSK	1	1	24.41	24.24	24.15	0.0	25
			1	13	24.44	24.25	24.18	0.0	25
			1	23	24.43	24.13	24.07	0.0	25
			12	0	24.40	24.30	24.12	0.5	24.5
			12	7	24.43	24.28	24.13	0.0	25
			12	13	24.45	24.26	24.12	0.5	24.5
			25	0	24.39	24.27	24.19	0.5	24.5
		QPSK	1	1	24.40	24.25	24.17	0.0	25
			1	13	24.44	24.25	24.15	0.0	25
			1	23	24.42	24.16	24.09	0.0	25
			12	0	22.41	22.25	22.25	1.0	24
			12	7	24.42	24.28	24.19	0.0	25
			12	13	22.36	22.27	22.10	1.0	24
			25	0	22.40	22.36	22.30	1.0	24
		16QAM	1	1	22.35	22.32	22.22	1.0	24
		64QAM	1	1	21.03	20.84	20.82	2.5	22.5
		256QAM	1	1	19.10	18.77	18.72	4.5	20.5
	CP-OFDM	QPSK	1	1	22.05	21.82	21.67	1.5	23.5

NR Band n66

FCC Part 27								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n66	1720 - 1770	20	DFT-s OFDM	π/2 BPSK	24.35	272.30	24.28	267.92
				QPSK	24.32	270.49		
				16QAM	22.43	174.98	23.37	217.27
				64QAM	20.72	118.03		
				256QAM	18.92	77.98		
			CP-OFDM	QPSK	21.81	151.71		
	1717.5 - 1772.5	15	DFT-s OFDM	π/2 BPSK	24.43	277.46	23.63	230.67
				QPSK	24.41	276.19		
				16QAM	22.40	173.78	22.08	161.44
				64QAM	20.94	124.17		
				256QAM	19.01	79.62		
			CP-OFDM	QPSK	21.95	156.68		
	1715 - 1775	10	DFT-s OFDM	π/2 BPSK	**24.47**	**280.01**	**24.42**	**276.69**
				QPSK	24.43	277.52		
				16QAM	22.50	177.83	23.45	221.31
				64QAM	21.00	125.89		
				256QAM	19.11	81.47		
			CP-OFDM	QPSK	22.07	161.06		
	1712.5 - 1777.5	5	DFT-s OFDM	π/2 BPSK	24.45	278.70	24.11	257.64
				QPSK	24.44	278.16		
				16QAM	22.35	171.79	23.11	204.65
				64QAM	21.03	126.77		
				256QAM	19.10	81.28		
			CP-OFDM	QPSK	22.05	160.32		

5.3. WORST-CASE ORIENTATION

For all 5G NR Band n66, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on π/2 BPSK, QPSK, 16QAM, 64QAM and 256QAM modulations. It was found that π/2 BPSK and 16QAM results were worst case.

However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest conducted power in π/2 BPSK

Both 'Main ANT' and 'Sub ANT' were tested and the worst case of either 'Main ANT' or 'Sub ANT' is reported.

NR Band n66 (Sub Antenna)
Sub Antenna of NR Band n66 (Frequency range: 1710-1780 MHz) is covered by Main Antenna of NR Band n66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, lower maximum tune-up limit and same channel bandwidth.

Highest power setting for each bands				
NR Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
66 (Main ANT)	1715.0	10	1	1
	1745.0		1	1
	1775.0		1	26
66 (Sub ANT)	1712.5	5	1	13
	1745.0		1	13
	1777.5		1	13

For LTE anchor, the band with highest output power was chosen among the possible combinations with NR Bands.

NR Band	LTE Band
66	2, 5, 12, **13**

The fundamental and radiated spurious emission were investigated in three orthogonal orientations X, Y and Z, it was determined that below orientation was worst-case orientation for each band.

Band	EIRP			RSE		
	X	Y	Z	X	Y	Z
NR n66 (Main ANT)	O	-	-	O	-	-
NR n66 (Sub ANT)	-	O	-	-	O	-

Note : For EIRP testing, the EUT didn't attached with travel adapter. But radiated spurious testing, the EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacture**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA800	R37R38J49R8SE3	N/A
Data Cable	SAMSUNG	EP-DN980	GH39-02111ABBE	N/A

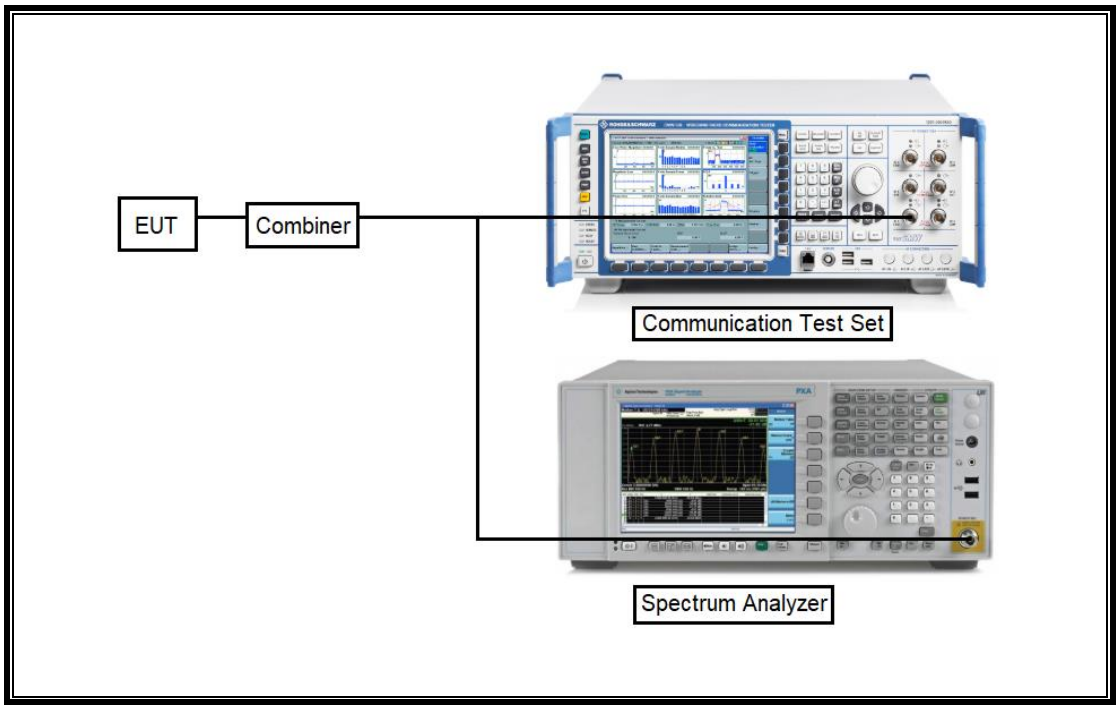
I/O CABLE

I/O Cable List						
Cable No.	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0 m	N/A

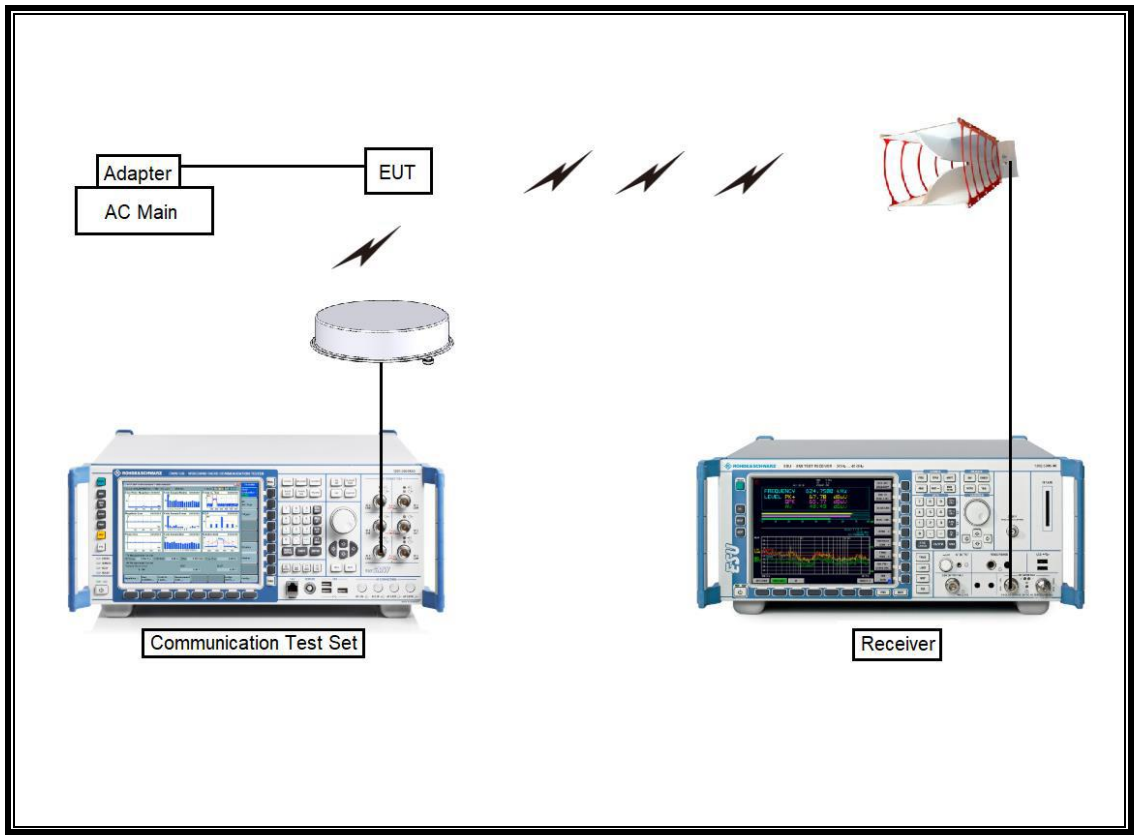
TEST SETUP

The EUT is continuously communicated with the call box during the tests.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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5.5. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a internal antenna for the supported bands with a maximum peak gain as follow:

Frequency (MHz)	Peak Gain (dBi)
NR Band n66 1710 ~ 1780 MHz	-2.0

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	2023-02-08
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2023-10-13
Preamplifier	ETS	3116C-PA	00168841	2023-08-04
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2022-08-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2022-08-13
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2022-08-13
Antenna, Horn, 18 GHz	ETS	3115	00161451	2022-08-15
Antenna, Horn, 18 GHz	ETS	3117	00168717	2022-08-15
Communications Test Set	R&S	CMW500	169796	2023-01-07
DC Power Supply	Agilent / HP	E3640A	MY54226395	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	341282	2023-08-02
Preamplifier, 1000 MHz	Sonoma	310N	351741	2023-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	2023-08-02
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029168	2023-08-01
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2023-08-01
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2023-08-03
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2022-08-01
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2023-08-02
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2023-07-29
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2023-08-01
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2023-08-01
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2023-08-01
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2023-08-01
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2023-08-02
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2023-08-01
Attenuator	PASTERNACK	PE7087-10	A009	2023-08-03
Attenuator	PASTERNACK	PE7087-10	A001	2023-08-03
Attenuator	PASTERNACK	PE7087-10	A008	2023-08-03
Attenuator	PASTERNACK	PE7004-10	2	2023-08-01
Attenuator	PASTERNACK	PE7395-10	A011	2023-08-03
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2023-10-06
Temperature Chamber	ESPEC	SH-642	93001109	2023-08-01
Power Splitter	MINI-CIRCUITS	WA1534	UL003	2023-01-11
Power Splitter	MINI-CIRCUITS	WA1534	UL004	2023-01-11
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY58120110	2023-01-07

UL Software			
Description	**Manufacturer**	**Model**	**Version**
Antenna port test software	UL	CLT	Ver 3.4
Radiated software	UL	UL EMC	Ver 9.5
Antenna port test software (5G NR FR1)	UL	UL iM	Ver 1.06

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass
27.53(h)	Band Edge / Conducted Spurious Emission	-13dBm		Pass
2.1046	Conducted output power	N/A		Pass
27.54	Frequency Stability	2.5PPM		Pass
27.50(d)(4)	Equivalent Isotropic Radiated Power	30dBm	Radiated	Pass
27.53(h)	Radiated Spurious Emission	-13dBm		Pass

8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to E7515B Test set configured to operate at maximum power. The PAR were measured on the Spectrum Analyzer.

Test Spec

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

NOTE

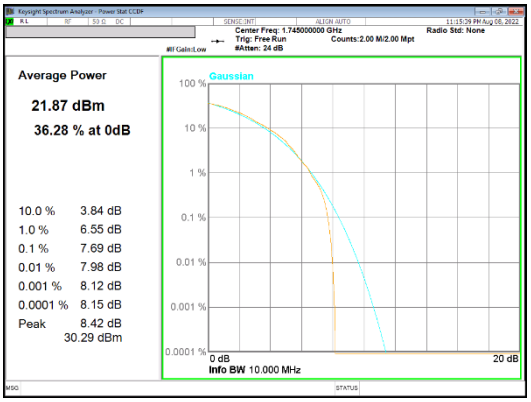
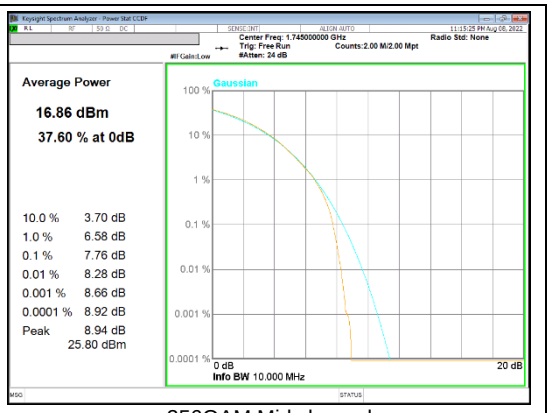
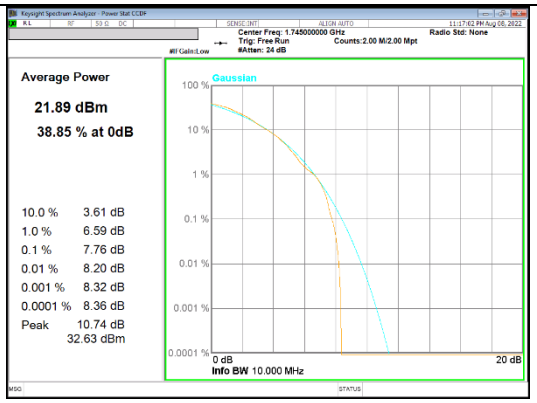
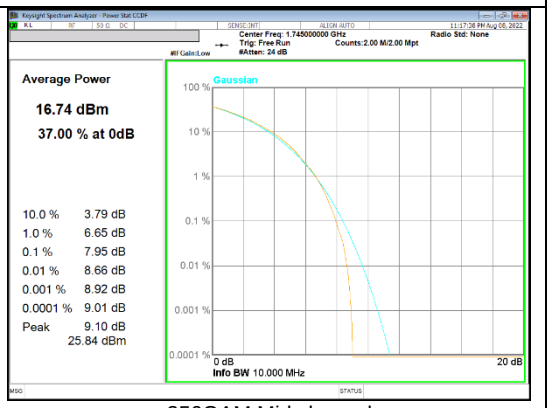
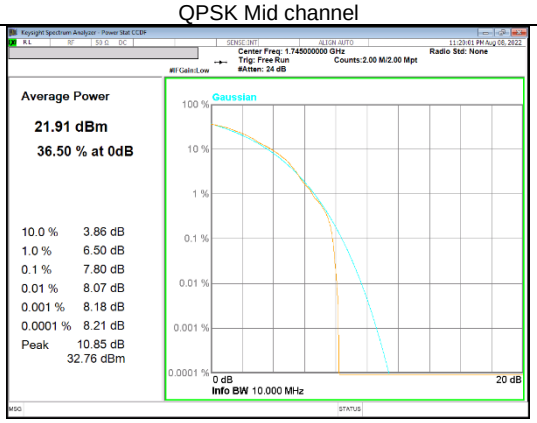
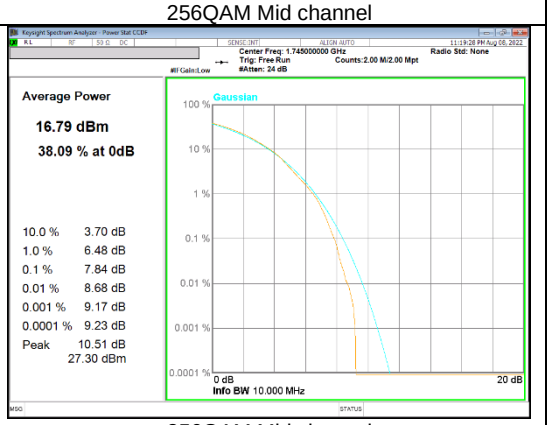
5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

See the following pages.

8.1. CONDUCTED PEAK TO AVERAGE RESULT

NR Band n66 CP-OFDM

20 MHz	 QPSK Mid channel	 256QAM Mid channel
15 MHz	 QPSK Mid channel	 256QAM Mid channel
10 MHz	 QPSK Mid channel	 256QAM Mid channel

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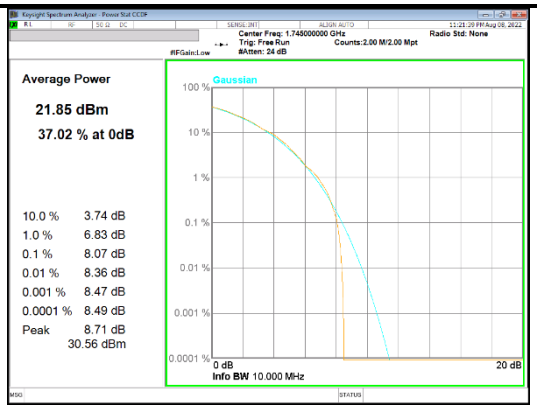
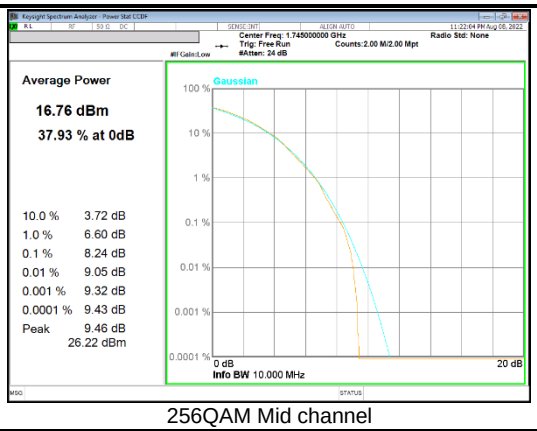
5 MHz	 QPSK Mid channel	 256QAM Mid channel

9. LIMITS AND CONDUCTED RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at middle channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v03r01)

- NR Band n66 CP-OFDM

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR n66	20M	QPSK	1745.0	18.969	21.04
		16QAM		18.931	20.75
	15M	QPSK		14.128	15.32
		16QAM		14.132	15.21
	10M	QPSK		9.320	10.36
		16QAM		9.345	10.41
	5M	QPSK		4.490	5.466
		16QAM		4.483	5.289

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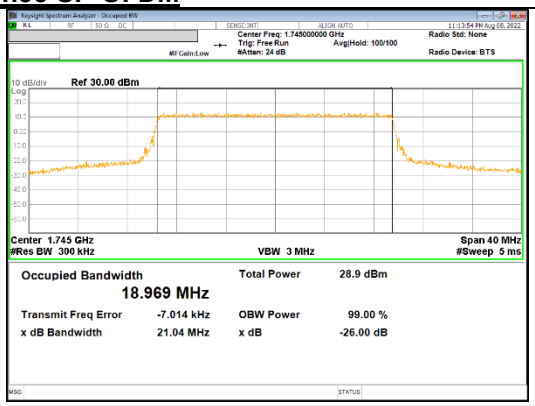
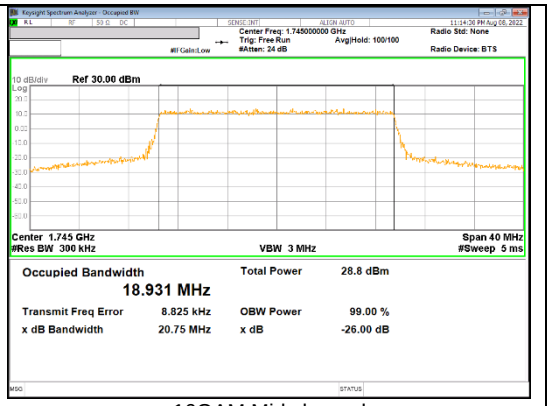
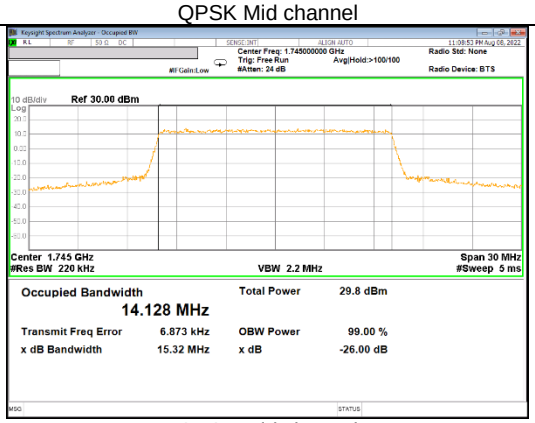
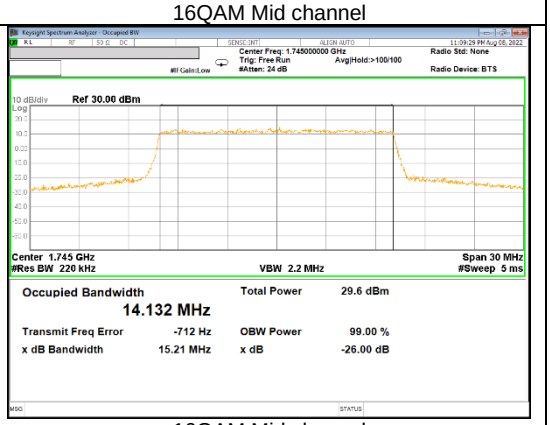
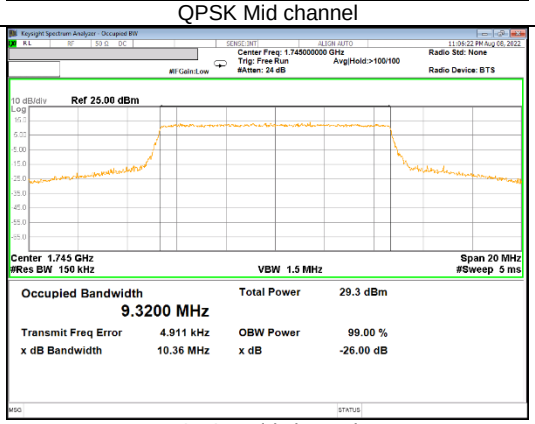
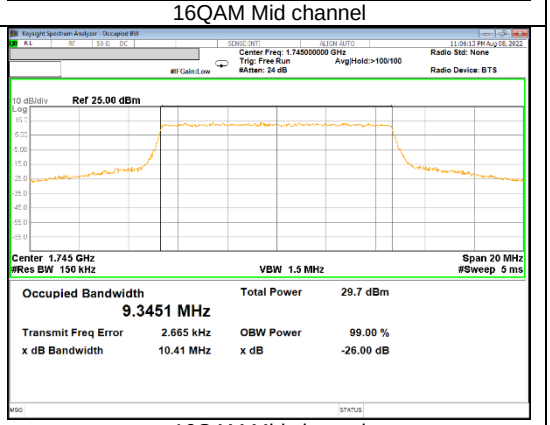
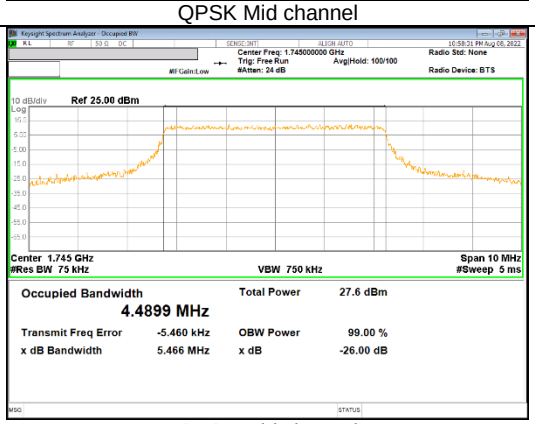
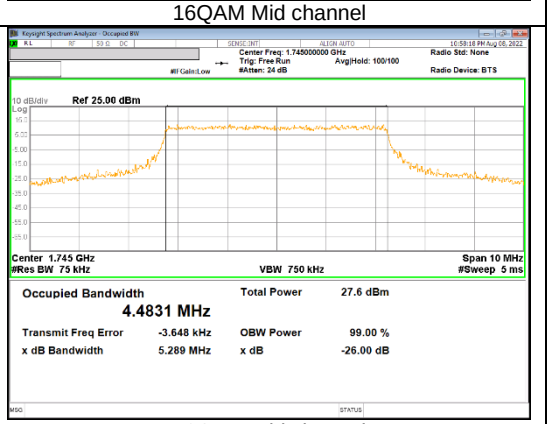
9.1.1. OCCUPIED BANDWIDTH RESULTS

NR Band n66 CP-OFDM

20MHz	 QPSK Mid channel	 16QAM Mid channel
15MHz	 QPSK Mid channel	 16QAM Mid channel
10MHz	 QPSK Mid channel	 16QAM Mid channel
5MHz	 QPSK Mid channel	 16QAM Mid channel

9.2. BAND EDGE EMISSIONS

RULE PART

FCC: §27. 53

LIMITS

Part 27.53
(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.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01
The transmitter output was connected to E7515B Test Set configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

a) Set the RBW = 1 ~ 1.5 % of OBW(Typically limited to a minimum RBW of 1% of the OBW)

b) Set VBW ≥ 3 × RBW;

c) Set span ≥ 1.5 times the OBW;

d) Sweep time = Auto;

e) Detector = RMS;

f) Ensure that the number of measurement points ≥ 2*Span/RBW;

g) Trace mode = Average (100);

NOTE1

Note that the spurious emissions outside of the channel include narrowband signals. These signals are all below the -13dBm limits. Although the measurement bandwidth is less than the reference bandwidth of 1MHz no addental correction is applied as ANSI C63.26 section 4.2.3 only requires the correction to be applied when the OBW of the emission being measured is wider than the measurement bandwidth (Where the OBW of the signal under measurement is less than the RBW of the measuring instrument, no bandwidth correction or integration will be required.) Plots for low and high channels show the level of the emission measured with the reduced bandwidth and the level of the same emission measured using the integration method over the 1MHz reference bandwidth are very close, indicating the emissions are narrowband.

NOTE2

For Band-Edge extended:

CH BW (MHz)	RB Used (kHz)	CF for emissions more than 100kHz	CF for emissions more than 1MHz
5	51	+2.9 dB	+12.9 dB
10	100	N/A	+10.0 dB
15	150	N/A	+8.2 dB
20	200	N/A	+7.0 dB

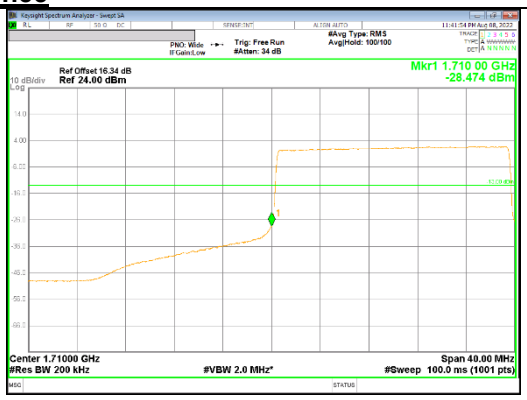
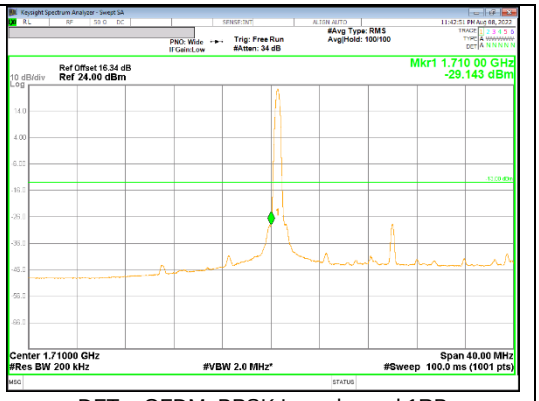
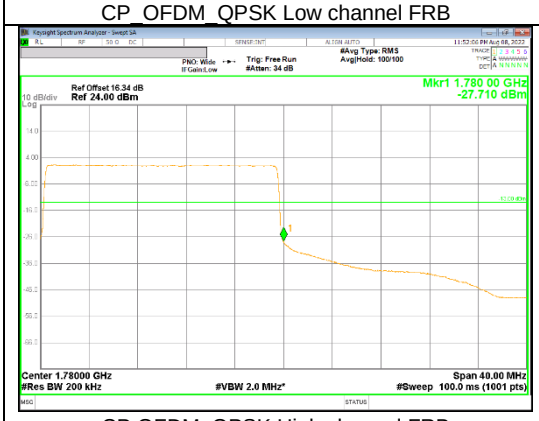
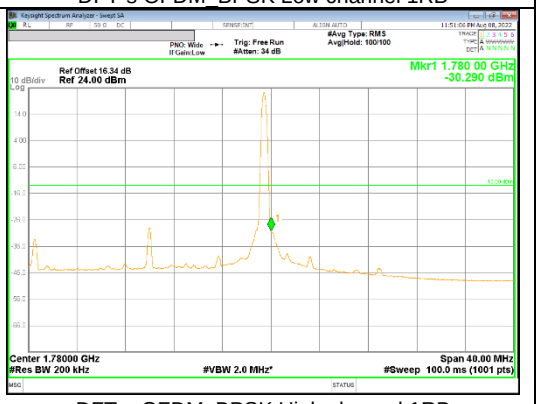
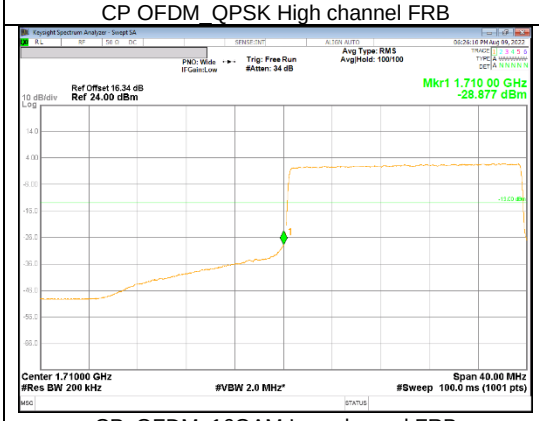
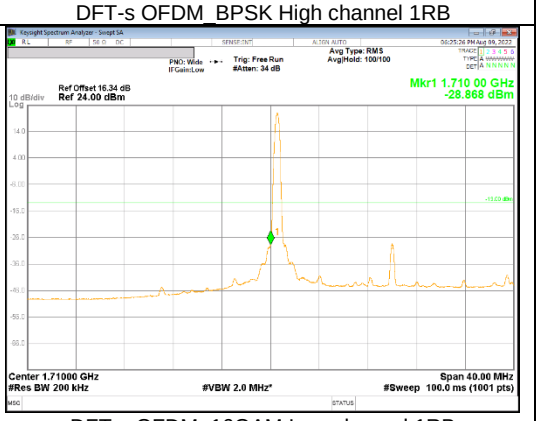
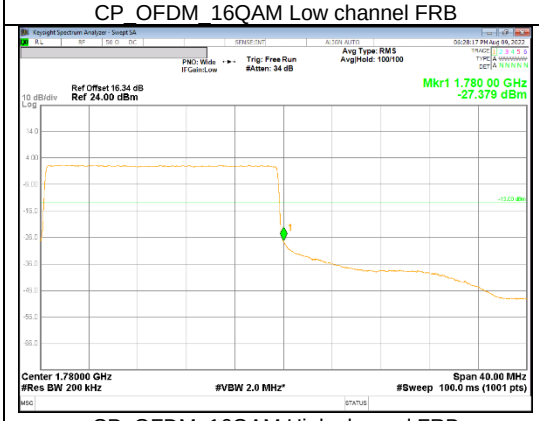
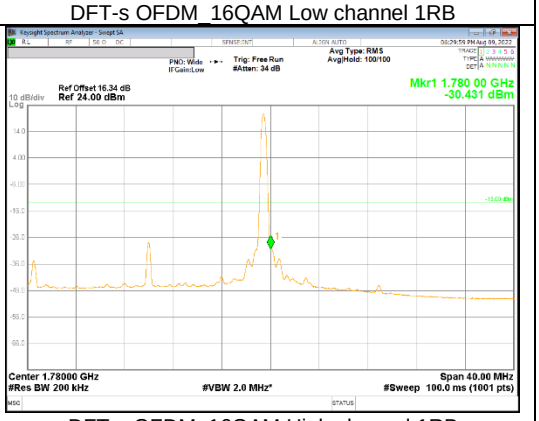
For the band edge value measured in [RB Used], even if [CF for emissions reference bandwidth 100kHz/1MHz] is applied, it is below -13dBm.

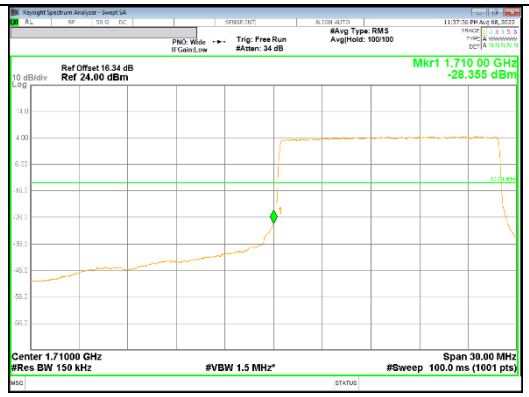
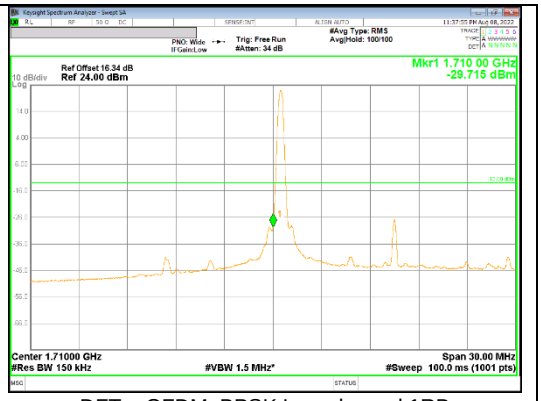
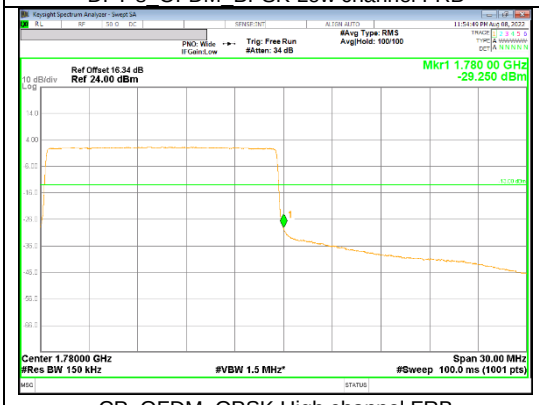
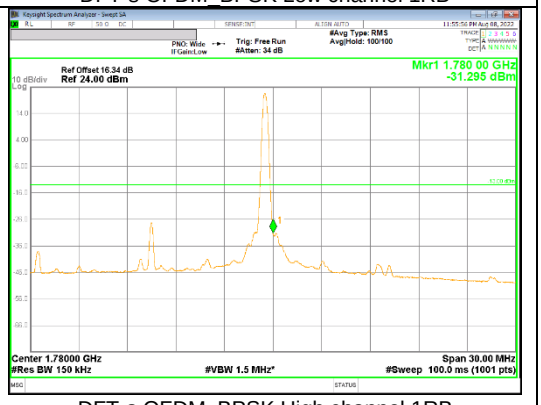
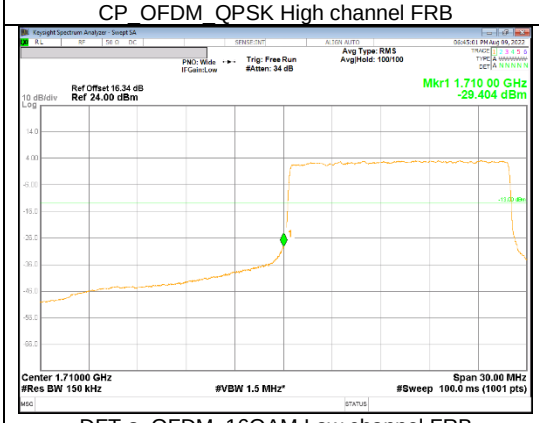
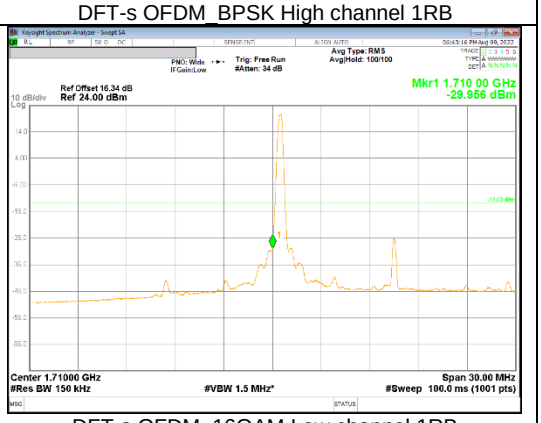
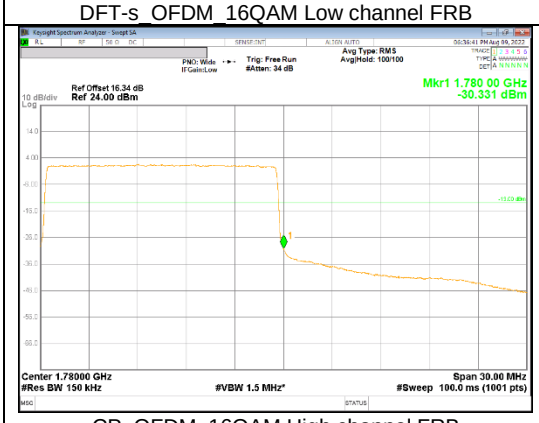
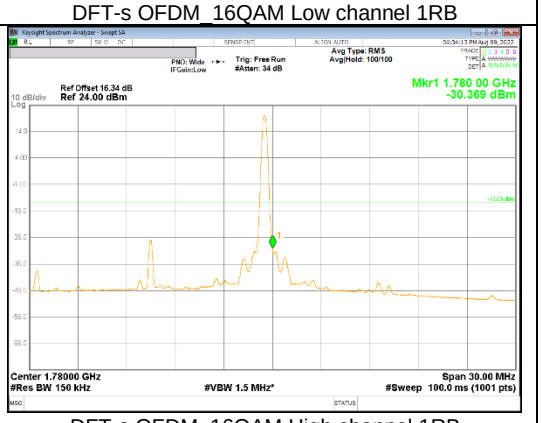
NOTE3

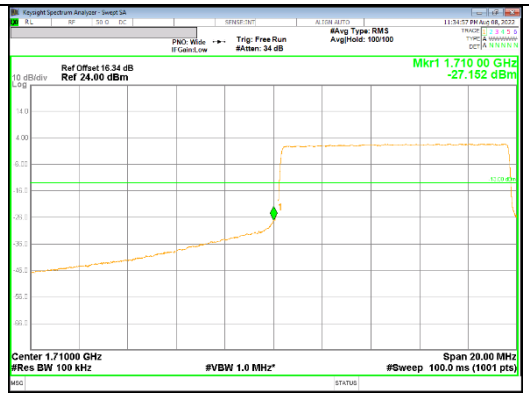
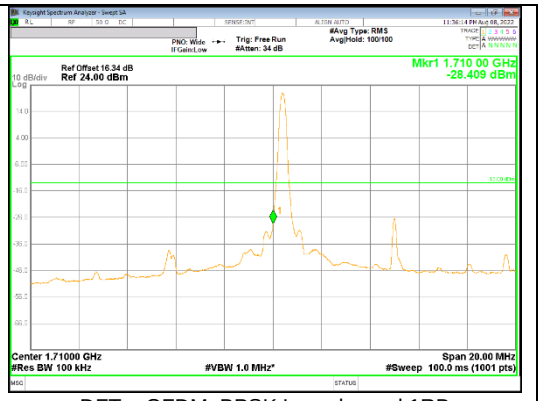
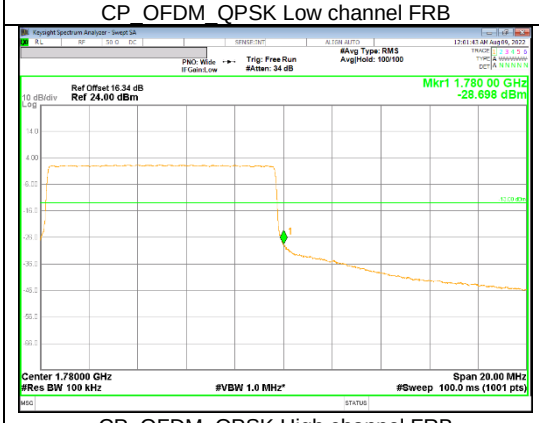
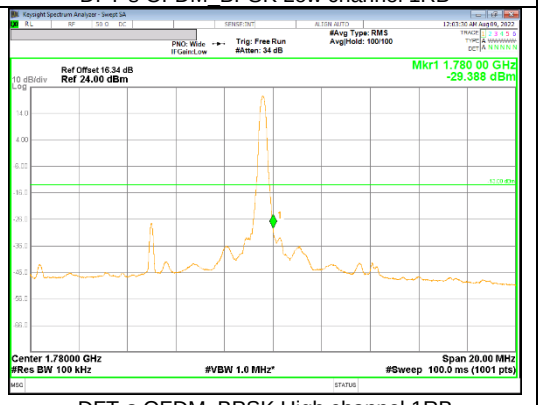
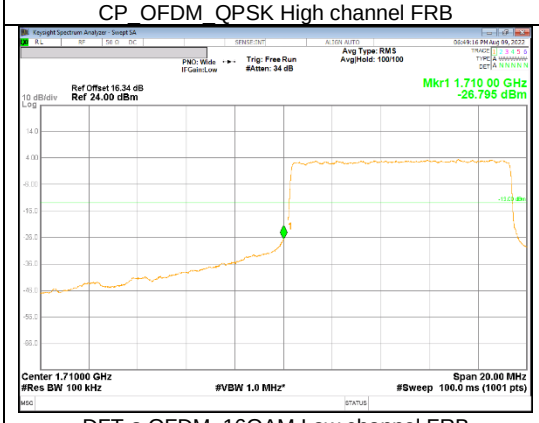
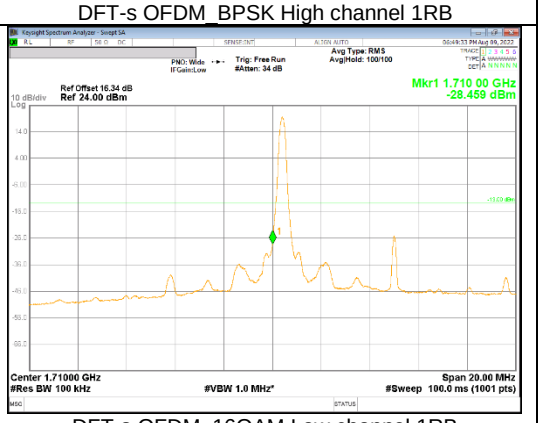
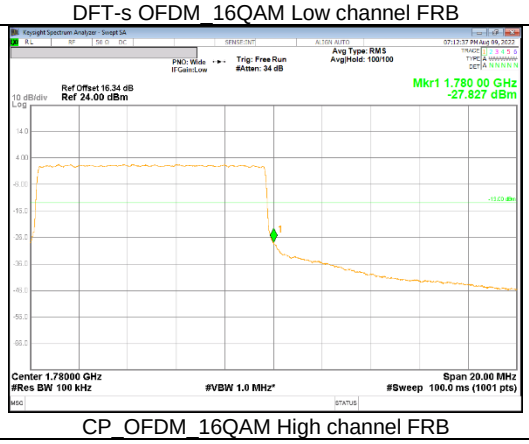
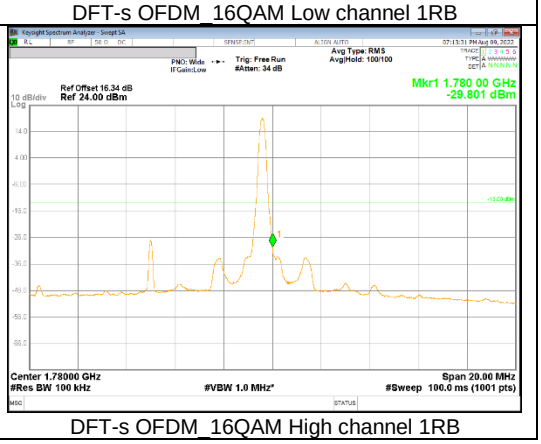
5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

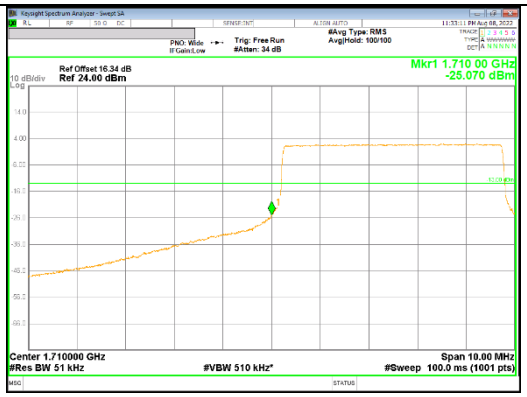
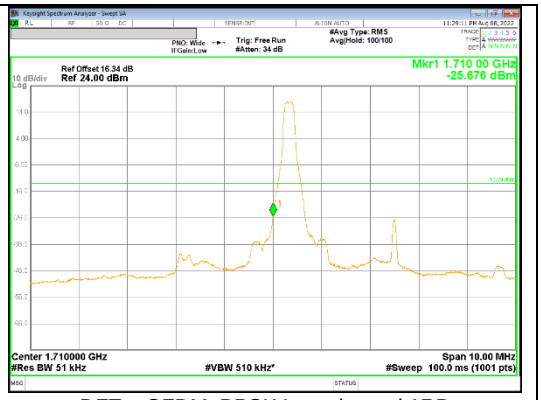
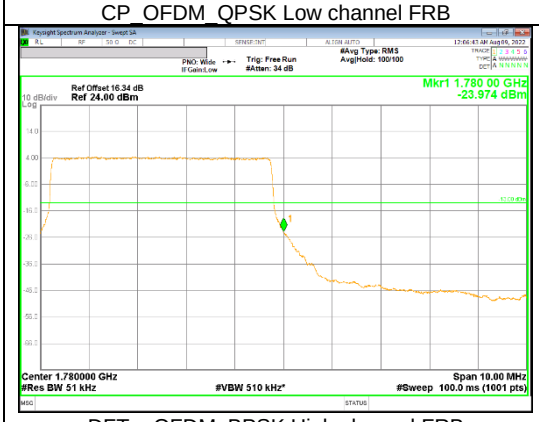
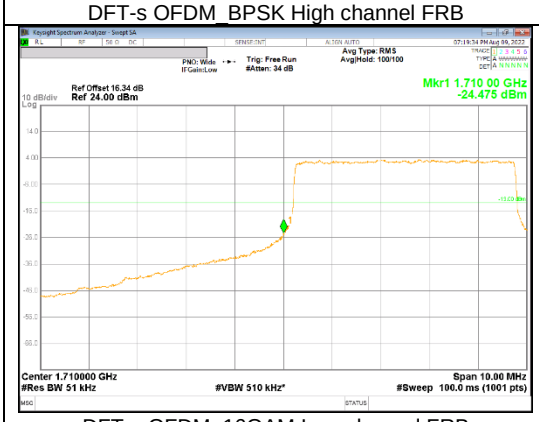
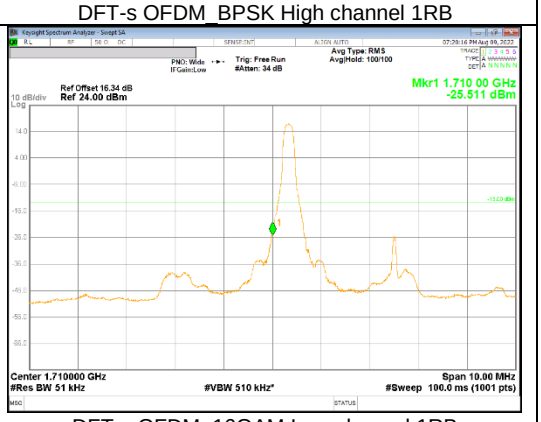
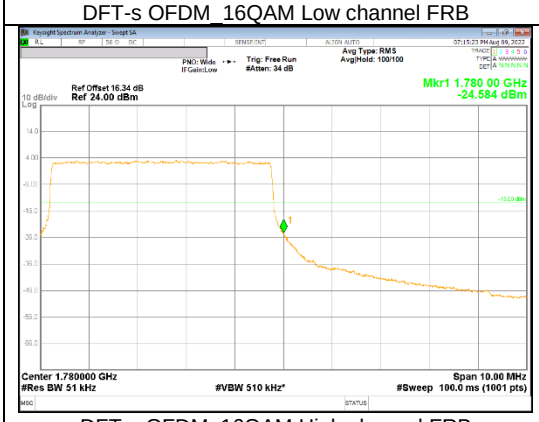
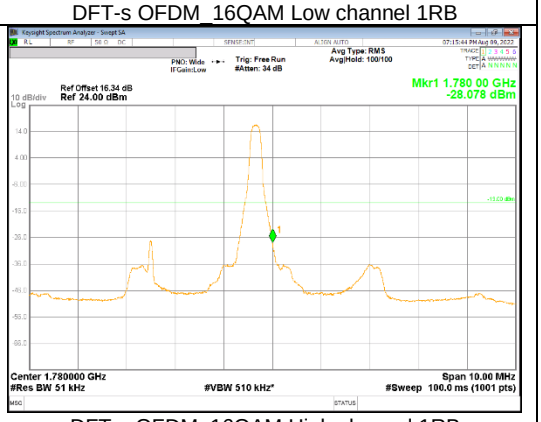
9.2.1. BAND EDGE RESULT

NR Band n66

20MHz	 CP_OFDM_QPSK Low channel FRB	 DFT-s OFDM_BPSK Low channel 1RB
	 CP OFDM_QPSK High channel FRB	 DFT-s OFDM_BPSK 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_BPSK Low channel FRB	 DFT-s OFDM_BPSK Low channel 1RB
	 CP_OFDM_QPSK High channel FRB	 DFT-s OFDM_BPSK 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	 CP_OFDM_QPSK Low channel FRB	 DFT-s OFDM_BPSK Low channel 1RB
	 CP_OFDM_QPSK High channel FRB	 DFT-s OFDM_BPSK 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_BPSK Low channel 1RB
	 DFT-s OFDM_BPSK High channel FRB	 DFT-s OFDM_BPSK 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

9.3. OUT OF BAND EMISSIONS

RULE PART

FCC: §27.53

LIMITS

Part 27.53:
(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.

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 = 1MHz for emissions above 1GHz (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;

RESULTS

See the following pages.

NOTE1

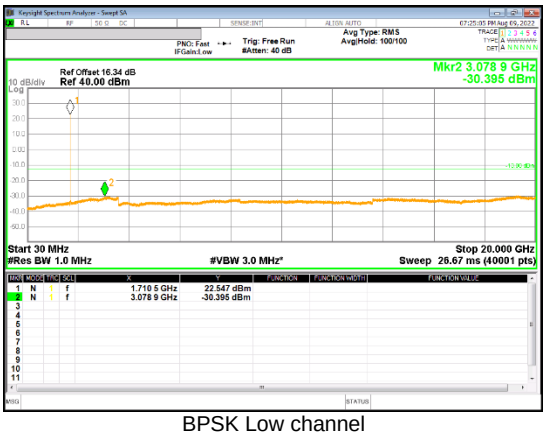
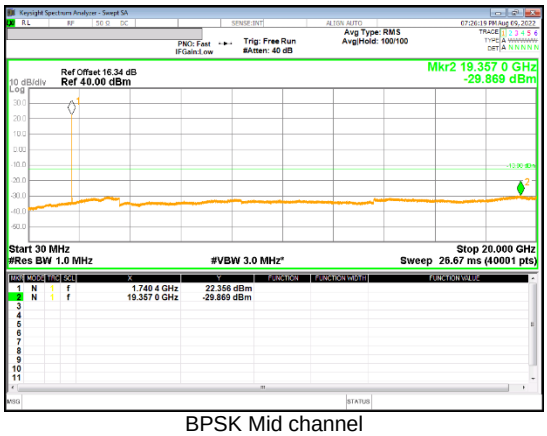
5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (π/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

NOTE2

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

9.3.1. OUT OF BAND EMISSIONS RESULT

NR Band n66

10 MHz	 BPSK Low channel	 BPSK Mid channel
	 BPSK High channel	

9.4. FREQUENCY STABILITY

RULE PART

FCC: §27.54

LIMITS

Part 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

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)

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

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	1710.2421	1779.7565		
Extreme (50C)		1710.2421	1779.7565	19.3	0.011
Extreme (40C)		1710.2421	1779.7565	16.4	0.009
Extreme (30C)		1710.2421	1779.7565	21.3	0.012
Extreme (10C)		1710.2421	1779.7565	20.5	0.012
Extreme (0C)		1710.2421	1779.7565	21.4	0.012
Extreme (-10C)		1710.2421	1779.7565	22.1	0.013
Extreme (-20C)		1710.2421	1779.7565	18.8	0.011
Extreme (-30C)		1710.2421	1779.7565	24.6	0.014
20C	15%	1710.2421	1779.7565	16.0	0.009
	-15%	1710.2421	1779.7565	16.9	0.010
	End Point	1710.2421	1779.7565	22.3	0.013

9.5. RADIATED POWER (EIRP)

RULE PART

FCC: §27.50

LIMITS

Part 27.50

(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.

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

TEST PROCEDURE

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

For radiated output power measurement with a ESU40:

a) Set the RBW ≥ OBW;
b) Set VBW ≥ 3 × RBW;
c) Set span ≥ 2 x RBW;
d) Sweep time = auto couple or 1 second;
e) Detector = rms;
f) Ensure that the number of measurement points ≥ span/RBW;
g) Trace mode = average;

RESULTS

See the following pages.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_27(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

9.5.1. EIRP Results

5G NR n66(Main Ant)

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	BPSK	1712.50	18.97	H	4.44	9.57	24.11	257.64	30.00	-5.89	1/13
		1745.00	18.43	H	4.47	9.68	23.63	230.65	30.00	-6.37	1/13
		1777.50	17.01	H	4.52	9.70	22.19	165.60	30.00	-7.81	1/13
	16-QAM	1712.50	17.97	H	4.44	9.57	23.11	204.65	30.00	-6.89	1/13
		1745.00	17.73	H	4.47	9.68	22.93	196.32	30.00	-7.07	1/13
		1777.50	16.07	H	4.52	9.70	21.25	133.37	30.00	-8.75	1/13
10	BPSK	1715.00	19.27	H	4.40	9.60	24.42	276.69	30.00	-5.58	1/1
		1745.00	18.66	H	4.50	9.70	23.86	243.22	30.00	-6.14	1/1
		1775.00	17.25	H	4.50	9.70	22.44	175.39	30.00	-7.56	1/26
	16-QAM	1715.00	18.30	H	4.40	9.60	23.45	221.31	30.00	-6.55	1/1
		1745.00	17.83	H	4.50	9.70	23.03	200.91	30.00	-6.97	1/1
		1775.00	16.47	H	4.50	9.70	21.66	146.55	30.00	-8.34	1/26
15	BPSK	1717.50	18.48	H	4.40	9.60	23.63	230.67	30.00	-6.37	1/40
		1745.00	18.29	H	4.50	9.70	23.49	223.36	30.00	-6.51	1/1
		1772.50	17.64	H	4.50	9.70	22.83	191.87	30.00	-7.17	1/40
	16-QAM	1717.50	16.46	H	4.40	9.60	21.61	144.88	30.00	-8.39	1/40
		1745.00	15.55	H	4.50	9.70	20.75	118.85	30.00	-9.25	1/1
		1772.50	16.89	H	4.50	9.70	22.08	161.44	30.00	-7.92	1/40
20	BPSK	1720.00	19.12	H	4.40	9.60	24.28	267.92	30.00	-5.72	1/1
		1745.00	18.24	H	4.50	9.70	23.44	220.80	30.00	-6.56	1/1
		1770.00	17.70	H	4.50	9.70	22.89	194.54	30.00	-7.11	1/1
	16-QAM	1720.00	18.21	H	4.40	9.60	23.37	217.27	30.00	-6.63	1/1
		1745.00	17.35	H	4.50	9.70	22.55	179.89	30.00	-7.45	1/1
		1770.00	16.59	H	4.50	9.70	21.78	150.66	30.00	-8.22	1/1

5G NR n66(Sub Ant)

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	BPSK	1712.50	18.89	V	4.44	9.57	24.03	252.93	30.00	-5.97	1/13
		1745.00	18.12	V	4.47	9.68	23.32	214.78	30.00	-6.68	1/13
		1777.50	17.30	V	4.52	9.70	22.48	177.01	30.00	-7.52	1/13
	16-QAM	1712.50	17.99	V	4.44	9.57	23.13	205.59	30.00	-6.87	1/13
		1745.00	17.26	V	4.47	9.68	22.46	176.20	30.00	-7.54	1/13
		1777.50	16.63	V	4.52	9.70	21.81	151.71	30.00	-8.19	1/13
10	BPSK										
	16-QAM										
15	BPSK										
	16-QAM										
20	BPSK										
	16-QAM										

9.6. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART

FCC:§27. 53

LIMIT

(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.

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 1GHz and 1MHz for emissions above 1GHz
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;

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 5G NR bands.

RESULTS

See the following pages.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_27(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

9.6.1. SPURIOUS RADIATION PLOTS

5G NR n66(Main Ant)

NR n66

10 MHz

BPSK

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

Company: Samsung
Project #: 4790381906
Date: 8/9/2022
Test Engineer: 26087
Configuration: EUT / AC Adapter, X-Position
Location: Chamber 2
Mode: 5G NR_BPSK NR n66 Harmonics, 10MHz 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, 1715MHz									
3430.00	-9.4	V	3.0	42.3	1.0	-50.7	-13.0	-37.7	
5145.00	-9.1	V	3.0	43.1	1.0	-51.1	-13.0	-38.1	
6860.00	-6.6	V	3.0	43.0	1.0	-48.6	-13.0	-35.6	
3430.00	-9.4	H	3.0	42.3	1.0	-50.8	-13.0	-37.8	
5145.00	-8.5	H	3.0	43.1	1.0	-50.5	-13.0	-37.5	
6860.00	-6.5	H	3.0	43.0	1.0	-48.4	-13.0	-35.4	
Mid Ch, 1745MHz									
3490.00	-9.1	V	3.0	42.3	1.0	-50.4	-13.0	-37.4	
5235.00	-8.7	V	3.0	43.1	1.0	-50.8	-13.0	-37.8	
6980.00	-6.6	V	3.0	42.9	1.0	-48.6	-13.0	-35.6	
3490.00	-9.0	H	3.0	42.3	1.0	-50.3	-13.0	-37.3	
5235.00	-8.2	H	3.0	43.1	1.0	-50.2	-13.0	-37.2	
6980.00	-6.5	H	3.0	42.9	1.0	-48.5	-13.0	-35.5	
High Ch, 1775MHz									
3550.00	-8.1	V	3.0	42.3	1.0	-49.4	-13.0	-36.4	
5325.00	-8.6	V	3.0	43.1	1.0	-50.7	-13.0	-37.7	
7100.00	-6.5	V	3.0	42.9	1.0	-48.4	-13.0	-35.4	
3550.00	-8.0	H	3.0	42.3	1.0	-49.3	-13.0	-36.3	
5325.00	-8.0	H	3.0	43.1	1.0	-50.1	-13.0	-37.1	
7100.00	-6.4	H	3.0	42.9	1.0	-48.3	-13.0	-35.3	

NR Band n66(Sub Ant)

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

Company: Samsung
Project #: 4790381906
Date: 8/8/2022
Test Engineer: 26087
Configuration: EUT / AC Adapter, Y-Position
Location: Chamber 2
Mode: 5G NR_BPSK NR n66 Harmonics, 5MHz Bandwidth
Test Votage: AC 120 V, 60 Hz

NR n66
5 MHz
BPSK

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1712.5MHz									
3425.00	-9.4	V	3.0	42.3	1.0	-50.7	-13.0	-37.7	
5137.50	-9.2	V	3.0	43.1	1.0	-51.3	-13.0	-38.3	
6850.00	-6.7	V	3.0	43.0	1.0	-48.6	-13.0	-35.6	
3425.00	-9.4	H	3.0	42.3	1.0	-50.7	-13.0	-37.7	
5137.50	-9.1	H	3.0	43.1	1.0	-51.1	-13.0	-38.1	
6850.00	-6.5	H	3.0	43.0	1.0	-48.5	-13.0	-35.5	
Mid Ch, 1745MHz									
3490.00	-9.1	V	3.0	42.3	1.0	-50.4	-13.0	-37.4	
5235.00	-9.0	V	3.0	43.1	1.0	-51.1	-13.0	-38.1	
6980.00	-6.6	V	3.0	42.9	1.0	-48.5	-13.0	-35.5	
3490.00	-9.1	H	3.0	42.3	1.0	-50.4	-13.0	-37.4	
5235.00	-8.9	H	3.0	43.1	1.0	-51.0	-13.0	-38.0	
6980.00	-6.5	H	3.0	42.9	1.0	-48.4	-13.0	-35.4	
High Ch, 1777.5MHz									
3555.00	-8.0	V	3.0	42.3	1.0	-49.3	-13.0	-36.3	
5332.50	-8.5	V	3.0	43.1	1.0	-50.6	-13.0	-37.6	
7110.00	-6.4	V	3.0	42.9	1.0	-48.3	-13.0	-35.3	
3555.00	-7.8	H	3.0	42.3	1.0	-49.1	-13.0	-36.1	
5332.50	-8.5	H	3.0	43.1	1.0	-50.6	-13.0	-37.6	
7110.00	-6.3	H	3.0	42.9	1.0	-48.2	-13.0	-35.2	

END OF REPORT