



FCC RF Test Report

APPLICANT : OnePlus Technology (Shenzhen) Co., Ltd.
EQUIPMENT : Mobile Phone
BRAND NAME : 1+, ONEPLUS
MODEL NAME : CPH2451
FCC ID : 2ABZ2-AA516
STANDARD : 47 CFR Part 2, 27
CLASSIFICATION : PCS Licensed Transmitter Held to Ear (PCE)
TEST DATE(S) : Oct. 31, 2022 ~ Nov. 28, 2022

We, Sporton International Inc. (ShenZhen), would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.26-2015 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (ShenZhen), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia



Sporton International Inc. (ShenZhen)

1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055
People's Republic of China



TABLE OF CONTENTS

REVISION HISTORY	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION	5
1.1 Applicant	5
1.2 Manufacturer	5
1.3 Product Feature of Equipment Under Test	5
1.4 Product Specification of Equipment Under Test	5
1.5 Modification of EUT	6
1.6 Maximum EIRP Power and Emission Designator	7
1.7 Testing Location	9
1.8 Test Software	9
1.9 Applicable Standards	9
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST	10
2.1 Test Mode	10
2.2 Connection Diagram of Test System	12
2.3 Support Unit used in test configuration and system	12
2.4 Measurement Results Explanation Example	12
2.5 Frequency List of Low/Middle/High Channels	13
3 CONDUCTED TEST ITEMS	17
3.1 Measuring Instruments	17
3.2 Test Setup	17
3.3 Test Result of Conducted Test	17
3.4 Conducted Output Power and EIRP	18
3.5 Peak-to-Average Ratio	19
3.6 Occupied Bandwidth	20
3.7 Conducted Band Edge	21
3.8 Conducted Spurious Emission	23
3.9 Frequency Stability	24
4 RADIATED TEST ITEMS	25
4.1 Measuring Instruments	25
4.2 Test Setup	25
4.3 Test Result of Radiated Test	26
4.4 Radiated Spurious Emission	27
5 LIST OF MEASURING EQUIPMENT	28
6 UNCERTAINTY OF EVALUATION	29
APPENDIX A. TEST RESULTS OF CONDUCTED TEST	
APPENDIX B. TEST RESULTS OF RADIATED TEST	
APPENDIX C. TEST SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG2O2001J	Rev. 01	Initial issue of report	Dec. 21, 2022



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.4	§2.1046	Conducted Output Power	Reporting Only	PASS	-
	§27.50(h)(2)	Equivalent Isotropic Radiated Power (5G NR n7, n41, n38)	EIRP < 2Watt		
	§27.50(j)(3)	Equivalent Isotropic Radiated Power (5G NR n77, n78)	EIRP < 1Watt		
3.5	§27.50(j)(4)	Peak-to-Average Ratio	<13 dB	PASS	-
3.6	§2.1049	Occupied Bandwidth	Reporting Only	PASS	-
3.7	§2.1051 §27.53(l)(2)	Conducted Band Edge Measurement (5G NR n77, n78)	< 43+10log ₁₀ (P[Watts])	PASS	-
	§27.53(m)(4)	Conducted Band Edge Measurement (5G NR n7, n41, n38)	§27.53(m)(4)		
3.8	§2.1051 §27.53(l)(2)	Conducted Spurious Emission (5G NR n77, n78)	< 43+10log ₁₀ (P[Watts])	PASS	-
	§2.1051 §27.53(m)(4)	Conducted Spurious Emission (5G NR n7, n41, n38)	< 55+10log ₁₀ (P[Watts])		
3.9	§2.1055 §27.54	Frequency Stability Temperature & Voltage	Within Authorized Band	PASS	-
4.4	§2.1053 §27.53(l)(2)	Radiated Spurious Emission (5G NR n77, n78)	< 43+10log ₁₀ (P[Watts])	PASS	Under limit 10.62 dB at 7762.50 MHz
	§2.1053 §27.53(m)(4)	Radiated Spurious Emission (5G NR n7, n41, n38)	< 55+10log ₁₀ (P[Watts])		

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

OnePlus Technology (Shenzhen) Co., Ltd.

18C02, 18C03, 18C04, and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen, Guangdong, P.R. China.

1.2 Manufacturer

OnePlus Technology (Shenzhen) Co., Ltd.

18C02, 18C03, 18C04, and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen, Guangdong, P.R. China.

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Phone
Brand Name	1+, ONEPLUS
Model Name	CPH2451
FCC ID	2ABZ2-AA516
IMEI Code	Conducted : 864921060035732 Radiation : 864921060027531/864921060027523
HW Version	11
SW Version	OxygenOS 13.0
EUT Stage	Production Unit

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	5G NR n7 : 2500 MHz ~ 2570 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n77: 3700 MHz ~ 3980 MHz 5G NR n78: 3700 MHz ~ 3800 MHz
Rx Frequency	5G NR n7 : 2620 MHz ~ 2690 MHz 5G NR n38: 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n77: 3700 MHz ~ 3980 MHz 5G NR n78: 3700 MHz ~ 3800 MHz
Bandwidth	n7: 5MHz / 10MHz / 15MHz / 20MHz / 25MHz / 30MHz / 40MHz n38: 10MHz / 15MHz / 20MHz / 30MHz n41 : 10MHz / 15MHz / 20MHz / 30MHz / 40MHz / 50MHz / 60MHz / 70MHz / 80MHz / 90MHz / 100MHz n77: 10MHz / 15MHz / 20MHz / 30MHz / 40MHz / 50MHz / 60MHz / 70MHz / 80MHz / 90MHz / 100MHz

	n78: 10MHz / 20MHz / 30MHz / 40MHz / 50MHz / 60MHz / 70MHz / 80MHz / 90MHz / 100MHz
SCS	15kHz for n7 30kHz for n38, n41, n77, n78
Antenna Gain	<Ant. 4> for n7/n38/n41: -3.00 dBi <Ant. 5> for n7/n38/n41: -2.00 dBi <Ant. 6> for n7/n38/n41: -3.00 dBi <Ant. 6> for n77/n78: -2.00 dBi <Ant. 7> for n7/n38: -3.00 dBi <Ant. 7> for n77/n78: -2.00 dBi <Ant. 10> for n77/n78: -2.00 dBi <Ant. 13> for n77/n78: -2.00 dBi
Type of Modulation	CP-OFDM: QPSK / 16QAM / 64QAM / 256QAM DFT-s-OFDM: PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM

Remark:

1. The maximum EIRP is calculated from max output power and max antenna gain, only the maximum EIRP are shown in the report: Ant.5 for n7/n38/n41, Ant.6 for n77/n78, Ant.(5+6) for n41_UL MIMO , and Ant.(6+10) for n77/n78_UL MIMO.
2. All the supported ENDC combinations are verified conducted power, only the ENDC combination with highest power are shown in the report.
3. 5G NR support SA (n7/n38/n41/n77/n78) mode and NSA(n7/n38/n41/n77/n78) mode. According to the maximum power between SA and NSA mode, SA covers NSA mode.
4. 5G NR n41/n77/n78 support UL MIMO mode, the MIMO mode is completely uncorrelated, so the directional gain is selected the maximum gain among all antennas
5. The device supports HPUE mode for 5G NR n41/n77/n78.
6. For n41/n77 MIMO mode, the conducted BE/Spurious are tested at single antenna port and add $10 \cdot \log(N_{ANT})$ according to KDB 662911 D01.
7. The EN-DC mode combination could be referred to the product spec.
8. 5G NR n41 support MIMO Antenna Ant(5+6) / Ant(4+7), only the maximum Ant(5+6) is shown in the report.
9. 5G NR n77/n78 support MIMO Antenna Ant(6+10)/Ant(13+7), only the maximum Ant(6+10) is shown in the report.
10. 5G NR n41/n77/n78 UL_MIMO mode only supports CP-OFDM Modulation.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Maximum EIRP Power and Emission Designator

5G NR n7_Ant.5		PI/2 BPSK / QPSK		16QAM / 64QAM / 256QAM	
BW (MHz)	Frequency Range (MHz)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)
5	2502.5 ~ 2567.5	0.1493	4M49G7D	0.1222	4M50W7D
10	2505.0 ~ 2565.0	0.1503	9M27G7D	0.1227	9M29W7D
15	2507.5 ~ 2562.5	0.1592	14M1G7D	0.1306	14M1W7D
20	2510.0 ~ 2560.0	0.1589	18M9G7D	0.1300	18M9W7D
25	2512.5 ~ 2557.5	0.1607	23M7G7D	0.1276	23M7W7D
30	2515.0 ~ 2555.0	0.1589	28M6G7D	0.1276	28M5W7D
40	2520.0 ~ 2550.0	0.1618	38M5G7D	0.1294	38M6W7D

5G NR n38_Ant.5		PI/2 BPSK / QPSK		16QAM / 64QAM / 256QAM	
BW (MHz)	Frequency Range (MHz)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)
10	2575.0 ~ 2615.0	0.1687	8M62G7D	0.1387	8M60W7D
15	2577.5 ~ 2612.5	0.1746	13M6G7D	0.1439	13M6W7D
20	2580.0 ~ 2610.0	0.1746	18M2G7D	0.1400	18M2W7D
30	2585.0 ~ 2605.0	0.1766	27M8G7D	0.1535	27M9W7D

5G NR n41_Ant.5		PI/2 BPSK / QPSK		16QAM / 64QAM / 256QAM	
BW (MHz)	Frequency Range (MHz)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)
10	2501.01 ~ 2685.00	0.2432	8M62G7D	0.1945	8M60W7D
15	2503.50 ~ 2682.48	0.2483	13M6G7D	0.1995	13M6W7D
20	2506.02 ~ 2679.99	0.2460	18M2G7D	0.1963	18M2W7D
30	2511.00 ~ 2674.98	0.2460	27M8G7D	0.1941	27M9W7D
40	2516.01 ~ 2670.00	0.2477	37M8G7D	0.2000	37M9W7D
50	2521.02 ~ 2664.99	0.2443	47M5G7D	0.1963	47M6W7D
60	2526.00 ~ 2659.98	0.2404	58M0G7D	0.1977	57M9W7D
70	2531.01 ~ 2655.00	0.2355	67M5G7D	0.1928	67M8W7D
80	2536.02 ~ 2649.99	0.2328	77M7G7D	0.1919	77M6W7D
90	2541.00 ~ 2644.98	0.2328	87M6G7D	0.1849	87M8W7D
100	2546.01 ~ 2640.00	0.2500	97M6G7D	0.1914	97M9W7D



5G NR n77_Ant.6		PI/2 BPSK / QPSK		16QAM / 64QAM / 256QAM	
BW (MHz)	Frequency Range (MHz)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)
10	3705.00 ~ 3975.00	0.1803	8M61G7D	0.1435	8M59W7D
15	3707.52 ~ 3972.48	0.2018	13M6G7D	0.1652	13M6W7D
20	3710.01 ~ 3969.99	0.1875	18M2G7D	0.1521	18M2W7D
30	3715.02 ~ 3964.98	0.1871	27M9G7D	0.1567	27M9W7D
40	3720.00 ~ 3960.00	0.1995	37M8G7D	0.1574	37M8W7D
50	3725.01 ~ 3954.99	0.1845	47M5G7D	0.1493	47M6W7D
60	3730.02 ~ 3949.98	0.1820	57M8G7D	0.1479	57M8W7D
70	3735.00 ~ 3945.00	0.1679	67M4G7D	0.1140	67M6W7D
80	3740.01 ~ 3939.99	0.1750	77M5G7D	0.1400	77M6W7D
90	3745.02 ~ 3934.98	0.1730	87M5G7D	0.1390	87M7W7D
100	3750.00 ~ 3930.00	0.2023	97M5G7D	0.1432	97M5W7D

5G NR n78_Ant.6		PI/2 BPSK / QPSK		16QAM / 64QAM / 256QAM	
BW (MHz)	Frequency Range (MHz)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)
10	3705.00 ~ 3795.00	0.1901	8M61G7D	0.1538	8M59W7D
20	3710.01 ~ 3789.99	0.1954	18M2G7D	0.1578	18M2W7D
30	3715.02 ~ 3784.98	0.1982	27M9G7D	0.1637	27M9W7D
40	3720.00 ~ 3780.00	0.1959	37M8G7D	0.1679	37M8W7D
50	3725.01 ~ 3774.99	0.1919	47M5G7D	0.1556	47M6W7D
60	3730.02 ~ 3769.98	0.1862	57M8G7D	0.1510	57M8W7D
70	3735.00 ~ 3765.00	0.1841	67M4G7D	0.1486	67M6W7D
80	3740.01 ~ 3759.99	0.1849	77M5G7D	0.1503	77M6W7D
90	3745.02 ~ 3754.98	0.1854	87M5G7D	0.1503	87M7W7D
100	3750.00	0.1991	97M5G7D	0.1718	97M5W7D

Note:

1. 5G NR n41 overlaps the entire frequency range of 5G NR n38. Therefore, the test results provided in this report covers 5G NR n41 as well as 5G NR n38.
2. 5G NR n77 overlaps the entire frequency range of 5G NR n78. Therefore, the test results provided in this report covers 5G NR n77 as well as 5G NR n78.
3. All modulations have been tested, only the worst test results of PSK & QAM are shown in the report.

1.7 Testing Location

Sporton International Inc. (ShenZhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International Inc. (ShenZhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	TH01-SZ	CN1256	421272

Test Firm	Sporton International Inc. (ShenZhen)		
Test Site Location	101, 1st Floor, Block B, Building 1, No. 2, Tengfeng 4th Road, Fenghuang Community, Fuyong Street, Baoan District, Shenzhen City Guangdong Province China 518103 TEL: +86-755-33202398		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH01-SZ	CN1256	421272

1.8 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH01-SZ	AUDIX	E3	6.2009-8-24

1.9 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 2, 27
- ♦ ANSI C63.26-2015
- ♦ FCC KDB 971168 D01 Power Meas License Digital Systems v03r01
- ♦ FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark:

All test items were verified and recorded according to the standards and without any deviation during the test.



2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items are performed according to KDB 971168 D01 Power Meas License Digital Systems v03r01 with maximum output power.

For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases were recorded in this report.

The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.

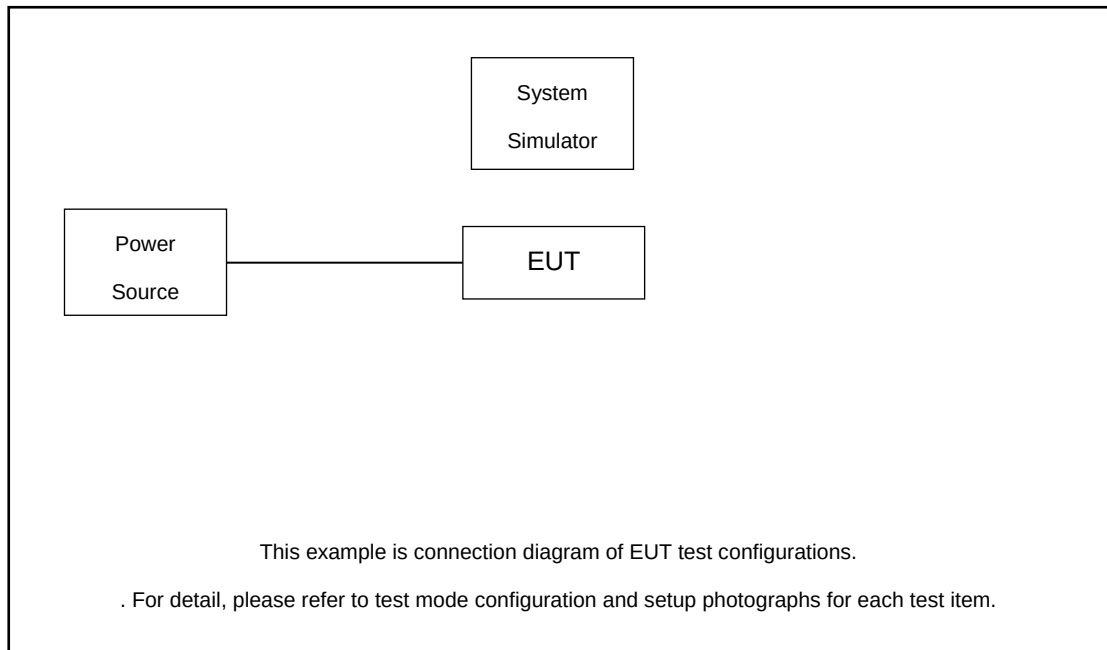
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane

Test Items	5G NR	Bandwidth (MHz)													Modulation					RB #		Test Channel		
		5	10	15	20	25	30	40	50	60	70	80	90	100	PI/2 BPSK	QPSK	16QAM	64QAM	256QAM	1	Full	L	M	H
Max. Output Power	n7	v	v	v	v	v	v	v	-	-	-	-	-	-	v	v	v	v	v	v	v	v	v	v
	n38	-	v	v	v	-	v	-	-	-	-	-	-	-	v	v	v	v	v	v	v	v	v	v
	n41	-	v	v	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	n77	-	v	v	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	n78	-	v	-	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Peak-to- Average Ratio	n7				v				-	-	-	-	-	-	v	v				v	v	v	v	v
	n41	-			v	-	-								v	v				v	v	v	v	v
	n77	-			v	-									v	v				v	v	v	v	v
26dB and 99% Bandwidth	n7	v	v	v	v	v	v	v	-	-	-	-	-	-	v	v	v	v	v		v		v	
	n41	-	v	v	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v		v		v	
	n77	-	v	v	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v		v		v	
Conducted Band Edge	n7	v			v			v	-	-	-	-	-	-	v	v				v	v	v		v
	n41	-	v			-			v					v	v	v				v	v	v		v
	n77	-	v			-			v					v	v	v				v	v	v		v
Conducted Spurious Emission	n7	v			v			v	-	-	-	-	-	-	v	v				v		v	v	v
	n41	-	v			-			v					v	v	v				v		v	v	v
	n77	-	v			-			v					v	v	v				v		v	v	v



Test Items	5G NR	Bandwidth (MHz)													Modulation					RB #		Test Channel		
		5	10	15	20	25	30	40	50	60	70	80	90	100	PI/2 BPSK	QPSK	16QAM	64QAM	256QAM	1	Full	L	M	H
Frequency Stability	n7				v				-	-	-	-	-	-		v					v		v	
	n41	-			v	-	-									v					v		v	
	n77	-			v	-										v					v		v	
E.R.P / E.I.R.P	n7	v	v	v	v	v	v	v	-	-	-	-	-	-	v	v	v	v	v	v	v	v	v	v
	n38	-	v	v	v	-	v	-	-	-	-	-	-	-	v	v	v	v	v	v	v	v	v	v
	n41	-	v	v	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	n77	-	v	v	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
	n78	-	v	-	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Radiated Spurious Emission	n7	Worst Case																				v	v	v
	n38	Worst Case																				v	v	v
	n41	Worst Case																				v	v	v
	n77	Worst Case																				v	v	v
Note	1. The mark “v ” means that this configuration is chosen for testing 2. The mark “-” means that this bandwidth is not supported. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 4. Frequency Stability : Normal Voltage = 7.78V ; Low Voltage =6.60V. ; High Voltage =8.96V																							

2.2 Connection Diagram of Test System



The EUT has been configuration operated in a manner tended to maximize its emission characteristics in a typical application.

2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	DC Power Supply	GW	GPS-3030D	N/A	N/A	Unshielded, 1.8 m
2.	LTE Base Station	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8 m
3.	NR Base Station	Anritsu	MT8000A	N/A	N/A	Unshielded, 1.8 m

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 8.4 dB.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 8.4 \text{ (dB)} \end{aligned}$$

2.5 Frequency List of Low/Middle/High Channels

5G NR n7 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
40	Channel	504000	507000	510000
	Frequency	2520	2535	2550
30	Channel	503000	507000	511000
	Frequency	2515	2535	2555
25	Channel	502500	507000	511500
	Frequency	2512.5	2535	2557.5
20	Channel	502000	507000	512000
	Frequency	2510	2535	2560
15	Channel	501500	507000	512500
	Frequency	2507.5	2535	2562.5
10	Channel	501000	507000	513000
	Frequency	2505	2535	2565
5	Channel	500500	507000	513500
	Frequency	2502.5	2535	2567.5

5G NR n38 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
30	Channel	517000	519000	521000
	Frequency	2585	2595	2605
20	Channel	516000	519000	522000
	Frequency	2580	2595	2610
15	Channel	515500	519000	522500
	Frequency	2577.5	2595	2612.5
10	Channel	515000	519000	523000
	Frequency	2575	2595	2615



5G NR n41 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
100	Channel	509202	518598	528000
	Frequency	2546.01	2592.99	2640
90	Channel	508200	518598	528996
	Frequency	2541	2592.99	2644.98
80	Channel	507204	518598	529998
	Frequency	2536.02	2592.99	2649.99
70	Channel	506202	518598	531000
	Frequency	2531.01	2592.99	2655
60	Channel	505200	518598	531996
	Frequency	2526	2592.99	2659.98
50	Channel	504204	518598	532998
	Frequency	2521.02	2592.99	2664.99
40	Channel	503202	518598	534000
	Frequency	2516.01	2592.99	2670
30	Channel	502200	518598	534996
	Frequency	2511	2592.99	2674.98
20	Channel	501204	518598	535998
	Frequency	2506.02	2592.99	2679.99
15	Channel	500700	518598	536496
	Frequency	2503.5	2592.99	2682.48
10	Channel	500202	518598	537000
	Frequency	2501.01	2592.99	2685



5G n77 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
100	Channel	650000	656000	662000
	Frequency	3750	3840	3930
90	Channel	649668	656000	662332
	Frequency	3745.02	3840	3934.98
80	Channel	649334	656000	662666
	Frequency	3740.01	3840	3939.99
70	Channel	649000	656000	663000
	Frequency	3735	3840	3945
60	Channel	648668	656000	663332
	Frequency	3730.02	3840	3949.98
50	Channel	648334	656000	663666
	Frequency	3725.01	3840	3954.99
40	Channel	648000	656000	664000
	Frequency	3720	3840	3960
30	Channel	647668	656000	664332
	Frequency	3715.02	3840	3964.98
20	Channel	647334	656000	664666
	Frequency	3710.01	3840	3969.99
15	Channel	647168	656000	664832
	Frequency	3707.52	3840	3972.48
10	Channel	647000	656000	665000
	Frequency	3705	3840	3975



5G n78 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
100	Channel	650000		
	Frequency	3750		
90	Channel	649668	650000	650332
	Frequency	3745.02	3750	3754.98
80	Channel	649334	650000	650666
	Frequency	3740.01	3750	3759.99
70	Channel	649000	650000	651000
	Frequency	3735	3750	3765
60	Channel	648668	650000	651332
	Frequency	3730.02	3750	3769.98
50	Channel	648334	650000	651666
	Frequency	3725.01	3750	3774.99
40	Channel	648000	650000	652000
	Frequency	3720	3750	3780
30	Channel	647668	650000	652332
	Frequency	3715.02	3750	3784.98
20	Channel	647334	650000	652666
	Frequency	3710.01	3750	3789.99
10	Channel	647000	650000	653000
	Frequency	3705	3750	3795

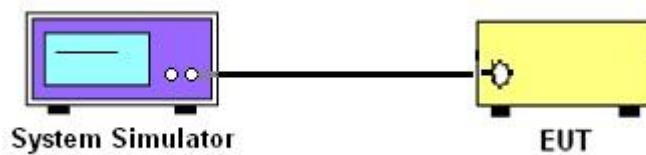
3 Conducted Test Items

3.1 Measuring Instruments

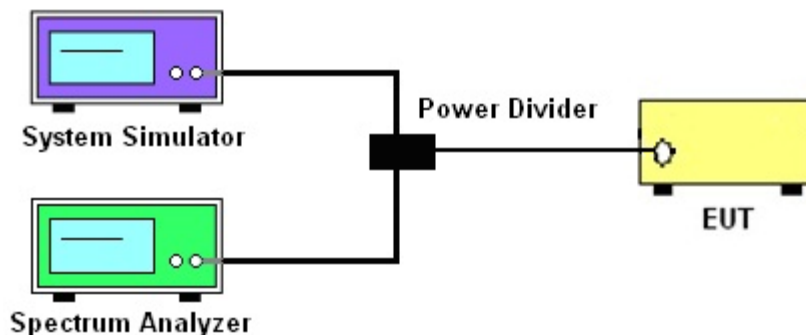
See list of measuring instruments of this test report.

3.2 Test Setup

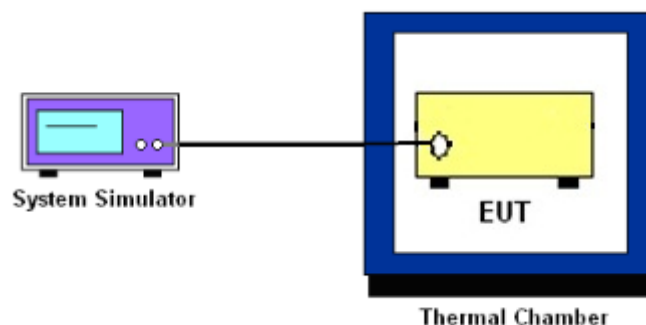
3.2.1 Conducted Output Power



3.2.2 Peak-to-Average Ratio, Occupied Bandwidth ,Conducted Band-Edge and Conducted Spurious Emission



3.2.3 Frequency Stability



3.3 Test Result of Conducted Test

Please refer to Appendix A.

3.4 Conducted Output Power and EIRP

3.4.1 Description of the Conducted Output Power Measurement and EIRP Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The EIRP of mobile transmitters must not exceed 2 Watts for 5G NR n7, n38, n41.

The EIRP of mobile transmitters must not exceed 1 Watts for 5G NR n66, n77, n78.

According to KDB 412172 D01 Power Approach,

$EIRP = P_T + G_T - L_C$, $ERP = EIRP - 2.15$, where

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.4.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.2
2. The transmitter output port was connected to the system simulator.
3. Set EUT at maximum power through the system simulator.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure and record the power level from the system simulator.

3.5 Peak-to-Average Ratio

3.5.1 Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

3.5.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.2.3.4 (CCDF).
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
5. Record the deviation as Peak to Average Ratio.

3.6 Occupied Bandwidth

3.6.1 Description of Occupied Bandwidth Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

3.6.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.4
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
4. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
5. Set the detection mode to peak, and the trace mode to max hold.
6. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.
(this is the reference value)
7. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
8. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
9. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.



3.7 Conducted Band Edge

3.7.1 Description of Conducted Band Edge Measurement

27.53(m)(4)

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

27.53(l)(2)

For mobile operations in the 3700-3980 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 dBm/MHz. Compliance with this paragraph is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be either one percent of the emission bandwidth of the fundamental emission of the transmitter or 350 kHz. In the bands between 1 and 5 MHz removed from the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be 500 kHz.

3.7.2 Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured.
4. Set RBW $\geq$ 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
5. Beyond the 1 MHz band from the band edge, RBW=1MHz was used or a narrower RBW was used (generally limited to no less than 1% of the OBW) and the measured power was integrated over the full required measurement bandwidth.
6. Set spectrum analyzer with RMS detector.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. Checked that all the results comply with the emission limit line.

Example:

The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)

$$= P(W) - [43 + 10\log(P)] \text{ (dB)}$$

$$= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)} = -13\text{dBm}.$$

9. For 5G NR n7/n38/n41, the other 40 dB, and 55 dB have additionally applied same calculation above.
10. When using the integration method, the starting frequency of the integration shall be centered at one-half of the RBW away from the band edge.

3.8 Conducted Spurious Emission

3.8.1 Description of Conducted Spurious Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

For 5G NR n7/n38/n41:

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $55 + 10 \log (P)$ dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

3.8.2 Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
4. The middle channel for the highest RF power within the transmitting frequency was measured.
5. The conducted spurious emission for the whole frequency range was taken.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
7. Set spectrum analyzer with RMS detector.
8. Taking the record of maximum spurious emission.
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
10. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)]$ (dB)
 $= [30 + 10\log(P)]$ (dBm) - $[43 + 10\log(P)]$ (dB)
 $= -13$ dBm.
11. For 5G NR n7/n38/n41
The limit line is derived from $55 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [55 + 10\log(P)]$ (dB)
 $= [30 + 10\log(P)]$ (dBm) - $[55 + 10\log(P)]$ (dB)
 $= -25$ dBm.

3.9 Frequency Stability

3.9.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

3.9.2 Test Procedures for Temperature Variation

1. The testing follows ANSI C63.26 section 5.6.4
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
4. With power OFF, the temperature was raised in 10°C step up to 50°C . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

3.9.3 Test Procedures for Voltage Variation

1. The testing follows ANSI C63.26 section 5.6.5
2. The EUT was placed in a temperature chamber at $20\pm 5^{\circ}\text{C}$ and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.
4. For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.
5. The variation in frequency was measured for the worst case.

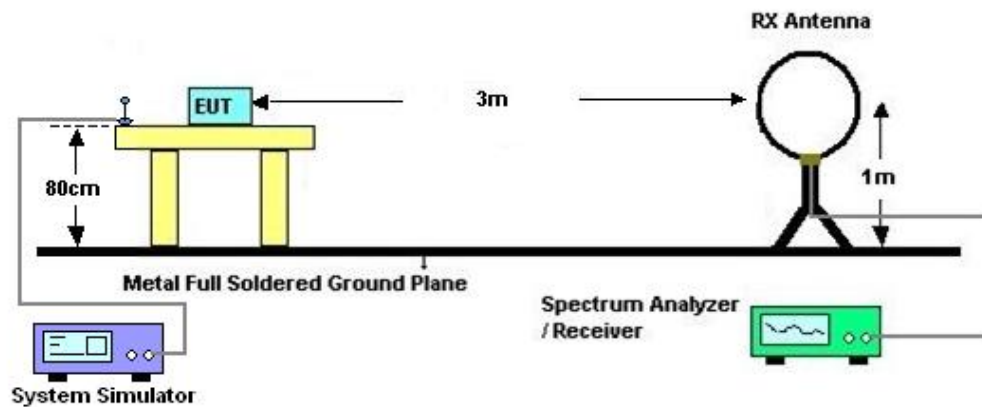
4 Radiated Test Items

4.1 Measuring Instruments

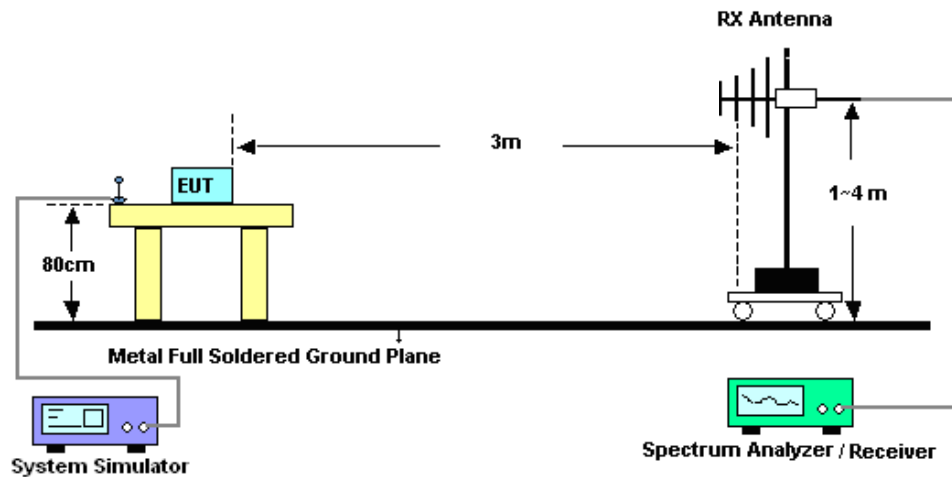
See list of measuring instruments of this test report.

4.2 Test Setup

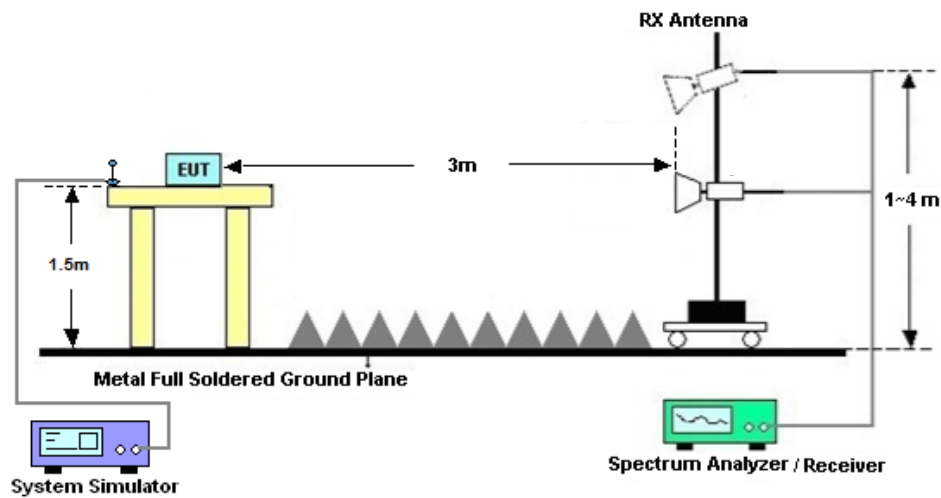
4.2.1 For radiated test below 30MHz



4.2.2 For radiated test from 30MHz to 1GHz



4.2.3 For radiated test above 1GHz



4.3 Test Result of Radiated Test

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

Please refer to Appendix B.

4.4 Radiated Spurious Emission

4.4.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI C63.26. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

For 5G NR n7/n38/n41

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $55 + 10 \log (P)$ dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.4.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.5
2. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
6. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
7. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
8. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
9. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
10. $EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$
11. $ERP \text{ (dBm)} = EIRP - 2.15$
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$
 $= -13\text{dBm}.$

13. For 5G NR n7/n38/n41:

The limit line is derived from $55 + 10\log(P)$ dB below the transmitter power P(Watts)The limit line is derived from $55 + 10\log(P)$ dB below the transmitter power P(Watts)



5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 07, 2022	Oct. 31, 2022~ Nov. 28, 2022	Apr. 08, 2023	Conducted (TH01-SZ)
DC Power Supply	TTI	PL330P	290070	Max 32V , 3A	Oct. 17, 2022	Oct. 31, 2022~ Nov. 28, 2022	Oct. 16, 2023	Conducted (TH01-SZ)
Power Divider	TOJOIN	PS-2SM-04 265	60.06.020.007 7	0.4GHz~26.5GHz	Dec. 25, 2021	Oct. 31, 2022~ Nov. 28, 2022	Dec. 24, 2022	Conducted (TH01-SZ)
Thermal Chamber	Ten Billion Hongzhangroup	LP-150U	H2014081803	-40~+150°C	Jul. 07, 2022	Oct. 31, 2022~ Nov. 28, 2022	Jul. 06, 2023	Conducted (TH01-SZ)
EMI Test Receiver&SA	Agilent	N9038A	MY52260185	20Hz~26.5GHz	Dec. 27, 2021	Nov. 07, 2022	Dec. 26, 2022	Radiation (03CH01-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Jul. 07, 2022	Nov. 07, 2022	Jul. 06, 2023	Radiation (03CH01-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jul. 28, 2022	Nov. 07, 2022	Jul. 27, 2024	Radiation (03CH01-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz~2GHz	Sep. 28, 2021	Nov. 07, 2022	Sep. 27, 2023	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Jul. 07, 2022	Nov. 07, 2022	Jul. 06, 2023	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Apr. 10, 2022	Nov. 07, 2022	Apr. 09, 2023	Radiation (03CH01-SZ)
LF Amplifier	Burgeon	BPA-530	102209	0.01~3000Mhz	Apr. 06, 2022	Nov. 07, 2022	Apr. 05, 2023	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-00 101800-30-1 0P-R	1943528	1GHz~18GHz	Oct. 19, 2022	Nov. 07, 2022	Oct. 18, 2023	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270105	0.5GHz~26.5Ghz	Oct. 19, 2022	Nov. 07, 2022	Oct. 18, 2023	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	TTA1840-35 -HG	1871923	18GHz~40GHz	Jul. 06, 2022	Nov. 07, 2022	Jul. 05, 2023	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Nov. 07, 2022	NCR	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Nov. 07, 2022	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Nov. 07, 2022	NCR	Radiation (03CH01-SZ)

NCR: No Calibration Required

6 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.26-2015. All the measurement uncertainty value were shown with a coverage $K=2$ to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	± 1.34 dB
Conducted Emissions	± 1.34 dB
Occupied Channel Bandwidth	± 0.12 %

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.48dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	3.53dB
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.02dB
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----- THE END -----



Appendix A. Test Results of Conducted Test

Test Engineer :	Jung Kuo	Temperature :	22~23°C
		Relative Humidity :	40~42%

FR1 N7 (ANT5)

Transmitter Conducted Output Power and EIRP, ($G_T - L_C$)=-2dBi

NR Band	SCS (kHz)	Bandwidth (MHz)	Arfcn	Freq (MHz)	Modulation	RB	Conducted Power (dBm)	EIRP (dBm)	EIRP (W)
7	15	5	500500	2502.5	DFT-s-OFDM QPSK	1@1	23.74	21.74	0.1493
7	15	5	500500	2502.5	DFT-s-OFDM 16 QAM	1@1	22.87	20.87	0.1222
7	15	5	507000	2535.0	DFT-s-OFDM QPSK	1@1	23.65	21.65	0.1462
7	15	5	507000	2535.0	DFT-s-OFDM 16 QAM	1@1	22.81	20.81	0.1205
7	15	5	513500	2567.5	DFT-s-OFDM QPSK	1@1	23.71	21.71	0.1483
7	15	5	513500	2567.5	DFT-s-OFDM 16 QAM	1@1	22.86	20.86	0.1219
7	15	10	501000	2505.0	DFT-s-OFDM QPSK	1@1	23.77	21.77	0.1503
7	15	10	501000	2505.0	DFT-s-OFDM 16 QAM	1@1	22.89	20.89	0.1227
7	15	10	507000	2535.0	DFT-s-OFDM QPSK	1@1	23.61	21.61	0.1449
7	15	10	507000	2535.0	DFT-s-OFDM 16 QAM	1@1	22.79	20.79	0.1199
7	15	10	513000	2565.0	DFT-s-OFDM QPSK	1@1	23.64	21.64	0.1459
7	15	10	513000	2565.0	DFT-s-OFDM 16 QAM	1@1	22.82	20.82	0.1208
7	15	15	501500	2507.5	DFT-s-OFDM QPSK	1@1	24.02	22.02	0.1592
7	15	15	501500	2507.5	DFT-s-OFDM 16 QAM	1@1	23.16	21.16	0.1306
7	15	15	507000	2535.0	DFT-s-OFDM QPSK	1@1	23.85	21.85	0.1531
7	15	15	507000	2535.0	DFT-s-OFDM 16 QAM	1@1	22.98	20.98	0.1253
7	15	15	512500	2562.5	DFT-s-OFDM QPSK	1@1	23.77	21.77	0.1503
7	15	15	512500	2562.5	DFT-s-OFDM 16 QAM	1@1	22.91	20.91	0.1233
7	15	20	502000	2510.0	DFT-s-OFDM QPSK	1@1	24.01	22.01	0.1589
7	15	20	502000	2510.0	DFT-s-OFDM 16 QAM	1@1	23.14	21.14	0.1300
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	1@1	23.82	21.82	0.1521
7	15	20	507000	2535.0	DFT-s-OFDM 16 QAM	1@1	22.98	20.98	0.1253
7	15	20	512000	2560.0	DFT-s-OFDM QPSK	1@1	23.81	21.81	0.1517
7	15	20	512000	2560.0	DFT-s-OFDM 16 QAM	1@1	22.93	20.93	0.1239
7	15	25	502500	2512.5	DFT-s-OFDM QPSK	1@1	24.06	22.06	0.1607
7	15	25	502500	2512.5	DFT-s-OFDM 16 QAM	1@1	23.06	21.06	0.1276
7	15	25	507000	2535.0	DFT-s-OFDM QPSK	1@1	23.84	21.84	0.1528
7	15	25	507000	2535.0	DFT-s-OFDM	1@1	22.97	20.97	0.1250

16 QAM									
7	15	25	511500	2557.5	DFT-s-OFDM QPSK	1@1	23.79	21.79	0.1510
7	15	25	511500	2557.5	DFT-s-OFDM 16 QAM	1@1	22.9	20.9	0.1230
7	15	30	503000	2515.0	DFT-s-OFDM QPSK	1@1	24.01	22.01	0.1589
7	15	30	503000	2515.0	DFT-s-OFDM 16 QAM	1@1	23.04	21.04	0.1271
7	15	30	507000	2535.0	DFT-s-OFDM QPSK	1@1	23.92	21.92	0.1556
7	15	30	507000	2535.0	DFT-s-OFDM 16 QAM	1@1	22.96	20.96	0.1247
7	15	30	511000	2555.0	DFT-s-OFDM QPSK	1@1	23.91	21.91	0.1552
7	15	30	511000	2555.0	DFT-s-OFDM 16 QAM	1@1	23.06	21.06	0.1276
7	15	40	504000	2520.0	DFT-s-OFDM PI/2 BPSK	108@54	23.47	21.47	0.1403
7	15	40	504000	2520.0	DFT-s-OFDM PI/2 BPSK	1@1	23.46	21.46	0.1400
7	15	40	504000	2520.0	DFT-s-OFDM PI/2 BPSK	1@214	23.48	21.48	0.1406
7	15	40	504000	2520.0	DFT-s-OFDM QPSK	108@54	23.93	21.93	0.1560
7	15	40	504000	2520.0	DFT-s-OFDM QPSK	1@1	24.09	22.09	0.1618
7	15	40	504000	2520.0	DFT-s-OFDM QPSK	1@214	23.98	21.98	0.1578
7	15	40	504000	2520.0	DFT-s-OFDM 16 QAM	108@54	23.01	21.01	0.1262
7	15	40	504000	2520.0	DFT-s-OFDM 16 QAM	1@1	23.06	21.06	0.1276
7	15	40	504000	2520.0	DFT-s-OFDM 16 QAM	1@214	23.1	21.1	0.1288
7	15	40	504000	2520.0	DFT-s-OFDM 64 QAM	108@54	21.49	19.49	0.0889
7	15	40	504000	2520.0	DFT-s-OFDM 64 QAM	1@1	21.64	19.64	0.0920
7	15	40	504000	2520.0	DFT-s-OFDM 64 QAM	1@214	21.54	19.54	0.0899
7	15	40	504000	2520.0	DFT-s-OFDM 256 QAM	108@54	19.44	17.44	0.0555
7	15	40	504000	2520.0	DFT-s-OFDM 256 QAM	1@1	19.28	17.28	0.0535
7	15	40	504000	2520.0	DFT-s-OFDM 256 QAM	1@214	19.26	17.26	0.0532
7	15	40	504000	2520.0	CP-OFDM QPSK	108@54	22.44	20.44	0.1107
7	15	40	504000	2520.0	CP-OFDM QPSK	1@1	22.65	20.65	0.1161
7	15	40	504000	2520.0	CP-OFDM QPSK	1@214	22.59	20.59	0.1146
7	15	40	507000	2535.0	DFT-s-OFDM PI/2 BPSK	108@54	23.38	21.38	0.1374
7	15	40	507000	2535.0	DFT-s-OFDM PI/2 BPSK	1@1	23.42	21.42	0.1387
7	15	40	507000	2535.0	DFT-s-OFDM PI/2 BPSK	1@214	23.41	21.41	0.1384
7	15	40	507000	2535.0	DFT-s-OFDM QPSK	108@54	23.91	21.91	0.1552
7	15	40	507000	2535.0	DFT-s-OFDM QPSK	1@1	23.99	21.99	0.1581
7	15	40	507000	2535.0	DFT-s-OFDM QPSK	1@214	23.9	21.9	0.1549
7	15	40	507000	2535.0	DFT-s-OFDM 16 QAM	108@54	22.95	20.95	0.1245

7	15	40	507000	2535.0	DFT-s-OFDM 16 QAM	1@1	23.09	21.09	0.1285
7	15	40	507000	2535.0	DFT-s-OFDM 16 QAM	1@214	23.07	21.07	0.1279
7	15	40	507000	2535.0	DFT-s-OFDM 64 QAM	108@54	21.39	19.39	0.0869
7	15	40	507000	2535.0	DFT-s-OFDM 64 QAM	1@1	21.53	19.53	0.0897
7	15	40	507000	2535.0	DFT-s-OFDM 64 QAM	1@214	21.59	19.59	0.0910
7	15	40	507000	2535.0	DFT-s-OFDM 256 QAM	108@54	19.12	17.12	0.0515
7	15	40	507000	2535.0	DFT-s-OFDM 256 QAM	1@1	19.25	17.25	0.0531
7	15	40	507000	2535.0	DFT-s-OFDM 256 QAM	1@214	19.3	17.3	0.0537
7	15	40	507000	2535.0	CP-OFDM QPSK	108@54	22.45	20.45	0.1109
7	15	40	507000	2535.0	CP-OFDM QPSK	1@1	22.66	20.66	0.1164
7	15	40	507000	2535.0	CP-OFDM QPSK	1@214	22.44	20.44	0.1107
7	15	40	510000	2550.0	DFT-s-OFDM PI/2 BPSK	108@54	23.42	21.42	0.1387
7	15	40	510000	2550.0	DFT-s-OFDM PI/2 BPSK	1@1	23.34	21.34	0.1361
7	15	40	510000	2550.0	DFT-s-OFDM PI/2 BPSK	1@214	23.46	21.46	0.1400
7	15	40	510000	2550.0	DFT-s-OFDM QPSK	108@54	23.97	21.97	0.1574
7	15	40	510000	2550.0	DFT-s-OFDM QPSK	1@1	23.92	21.92	0.1556
7	15	40	510000	2550.0	DFT-s-OFDM QPSK	1@214	24.04	22.04	0.1600
7	15	40	510000	2550.0	DFT-s-OFDM 16 QAM	108@54	22.96	20.96	0.1247
7	15	40	510000	2550.0	DFT-s-OFDM 16 QAM	1@1	23.03	21.03	0.1268
7	15	40	510000	2550.0	DFT-s-OFDM 16 QAM	1@214	23.12	21.12	0.1294
7	15	40	510000	2550.0	DFT-s-OFDM 64 QAM	108@54	21.45	19.45	0.0881
7	15	40	510000	2550.0	DFT-s-OFDM 64 QAM	1@1	21.46	19.46	0.0883
7	15	40	510000	2550.0	DFT-s-OFDM 64 QAM	1@214	21.65	19.65	0.0923
7	15	40	510000	2550.0	DFT-s-OFDM 256 QAM	108@54	19.42	17.42	0.0552
7	15	40	510000	2550.0	DFT-s-OFDM 256 QAM	1@1	19.22	17.22	0.0527
7	15	40	510000	2550.0	DFT-s-OFDM 256 QAM	1@214	19.43	17.43	0.0553
7	15	40	510000	2550.0	CP-OFDM QPSK	108@54	22.44	20.44	0.1107
7	15	40	510000	2550.0	CP-OFDM QPSK	1@1	22.48	20.48	0.1117
7	15	40	510000	2550.0	CP-OFDM QPSK	1@214	22.65	20.65	0.1161

Frequency Stability

NR Band	SCS (kHz)	Bandwidth (MHz)	Arfcn	Freq (MHz)	Modulation	RB	Deviation (ppm)	Verdict	Environment
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0000	PASS	NV
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0015	PASS	LV
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0012	PASS	HV
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0003	PASS	-30°C
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0002	PASS	-20°C
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0007	PASS	-10°C
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0002	PASS	0°C
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0005	PASS	10°C
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0000	PASS	20°C
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0009	PASS	30°C
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0000	PASS	40°C
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	0.0010	PASS	50°C

Peak to Average Radio

NR Band	SCS (kHz)	Bandwidth (MHz)	Arfcn	Freq (MHz)	Modulation	RB	Result (dB)	Limit (dB)	Verdict
7	15	20	502000	2510.0	DFT-s-OFDM PI/2 BPSK	100@0	4.55	13	PASS
7	15	20	502000	2510.0	DFT-s-OFDM PI/2 BPSK	1@0	4.86	13	PASS
7	15	20	502000	2510.0	DFT-s-OFDM QPSK	100@0	5.72	13	PASS
7	15	20	502000	2510.0	DFT-s-OFDM QPSK	1@0	5.58	13	PASS
7	15	20	507000	2535.0	DFT-s-OFDM PI/2 BPSK	100@0	4.69	13	PASS
7	15	20	507000	2535.0	DFT-s-OFDM PI/2 BPSK	1@0	4.61	13	PASS
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	5.79	13	PASS
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	1@0	5.35	13	PASS
7	15	20	512000	2560.0	DFT-s-OFDM PI/2 BPSK	100@0	4.71	13	PASS
7	15	20	512000	2560.0	DFT-s-OFDM PI/2 BPSK	1@0	4.73	13	PASS
7	15	20	512000	2560.0	DFT-s-OFDM QPSK	100@0	5.82	13	PASS
7	15	20	512000	2560.0	DFT-s-OFDM QPSK	1@0	5.33	13	PASS

N7(20M)_DFT-s-OFDM_PI_2-BPSK Outer Full Low CH



N7(20M)_DFT-s-OFDM_PI_2-BPSK Edge 1RB Left Low CH



N7(20M)_DFT-s-OFDM QPSK Outer Full Low CH



N7(20M)_DFT-s-OFDM QPSK Edge 1RB Left Low CH



N7(20M)_DFT-s-OFDM_PI_2-BPSK Outer Full Mid CH



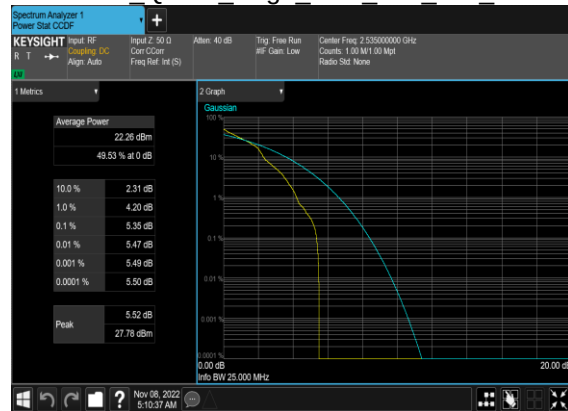
N7(20M)_DFT-s-OFDM_PI_2-BPSK Edge 1RB Left Mid CH



N7(20M)_DFT-s-
OFDM QPSK Outer Full Mid CH



N7(20M)_DFT-s-
OFDM QPSK Edge 1RB Left Mid CH



N7(20M)_DFT-s-OFDM_PI_2-
BPSK Outer Full High CH



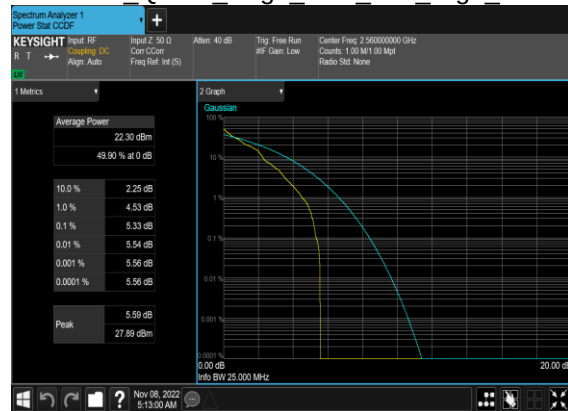
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BPSK Edge 1RB Left High CH



N7(20M)_DFT-s-
OFDM QPSK Outer Full High CH



N7(20M)_DFT-s-
OFDM QPSK Edge 1RB Left High CH

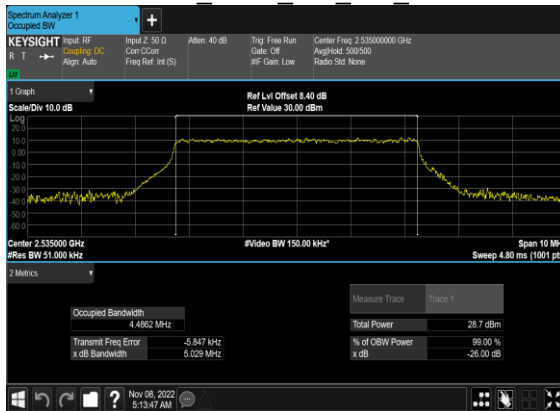


Occupied Bandwidth

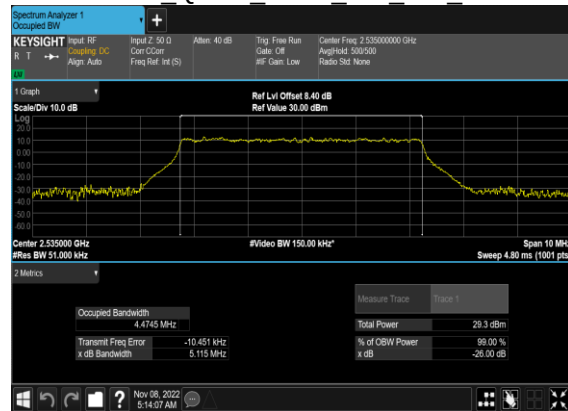
NR Band	SCS (kHz)	Bandwidth (MHz)	Arfcn	Freq (MHz)	Modulation	RB	OBW (MHz)	26dB OBW (MHz)
7	15	5	507000	2535.0	DFT-s-OFDM PI/2 BPSK	25@0	4.4862	5.029
7	15	5	507000	2535.0	DFT-s-OFDM QPSK	25@0	4.4745	5.115
7	15	5	507000	2535.0	CP-OFDM QPSK	25@0	4.4785	5.025
7	15	5	507000	2535.0	CP-OFDM 16 QAM	25@0	4.5011	5.194
7	15	5	507000	2535.0	CP-OFDM 64 QAM	25@0	4.468	4.997
7	15	5	507000	2535.0	CP-OFDM 256 QAM	25@0	4.48	4.906
7	15	10	507000	2535.0	DFT-s-OFDM PI/2 BPSK	50@0	8.8988	9.57
7	15	10	507000	2535.0	DFT-s-OFDM QPSK	50@0	8.9278	9.72
7	15	10	507000	2535.0	CP-OFDM QPSK	52@0	9.2748	10.05
7	15	10	507000	2535.0	CP-OFDM 16 QAM	52@0	9.2867	10.0
7	15	10	507000	2535.0	CP-OFDM 64 QAM	52@0	9.2782	10.04
7	15	10	507000	2535.0	CP-OFDM 256 QAM	52@0	9.2828	10.04
7	15	15	507000	2535.0	DFT-s-OFDM PI/2 BPSK	75@0	13.392	14.38
7	15	15	507000	2535.0	DFT-s-OFDM QPSK	75@0	13.419	14.29
7	15	15	507000	2535.0	CP-OFDM QPSK	79@0	14.103	14.99
7	15	15	507000	2535.0	CP-OFDM 16 QAM	79@0	14.089	14.96
7	15	15	507000	2535.0	CP-OFDM 64 QAM	79@0	14.119	14.93
7	15	15	507000	2535.0	CP-OFDM 256 QAM	79@0	14.084	15.03
7	15	20	507000	2535.0	DFT-s-OFDM PI/2 BPSK	100@0	17.906	18.85
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	100@0	17.857	18.85
7	15	20	507000	2535.0	CP-OFDM QPSK	106@0	18.904	19.92
7	15	20	507000	2535.0	CP-OFDM 16 QAM	106@0	18.913	19.92
7	15	20	507000	2535.0	CP-OFDM 64 QAM	106@0	18.905	19.82
7	15	20	507000	2535.0	CP-OFDM 256 QAM	106@0	18.918	19.88
7	15	25	507000	2535.0	DFT-s-OFDM PI/2 BPSK	128@0	22.836	24.0
7	15	25	507000	2535.0	DFT-s-OFDM QPSK	128@0	22.86	23.92
7	15	25	507000	2535.0	CP-OFDM QPSK	133@0	23.722	24.82
7	15	25	507000	2535.0	CP-OFDM 16 QAM	133@0	23.718	24.9
7	15	25	507000	2535.0	CP-OFDM 64 QAM	133@0	23.708	24.89
7	15	25	507000	2535.0	CP-OFDM 256 QAM	133@0	23.71	24.82
7	15	30	507000	2535.0	DFT-s-OFDM PI/2 BPSK	160@0	28.551	29.73
7	15	30	507000	2535.0	DFT-s-OFDM	160@0	28.494	29.7

QPSK								
7	15	30	507000	2535.0	CP-OFDM QPSK	160@0	28.539	29.78
7	15	30	507000	2535.0	CP-OFDM 16 QAM	160@0	28.516	29.75
7	15	30	507000	2535.0	CP-OFDM 64 QAM	160@0	28.536	29.68
7	15	30	507000	2535.0	CP-OFDM 256 QAM	160@0	28.524	29.71
7	15	40	507000	2535.0	DFT-s-OFDM PI/2 BPSK	216@0	38.498	40.02
7	15	40	507000	2535.0	DFT-s-OFDM QPSK	216@0	38.52	40.05
7	15	40	507000	2535.0	CP-OFDM QPSK	216@0	38.458	39.98
7	15	40	507000	2535.0	CP-OFDM 16 QAM	216@0	38.554	40.13
7	15	40	507000	2535.0	CP-OFDM 64 QAM	216@0	38.581	40.01
7	15	40	507000	2535.0	CP-OFDM 256 QAM	216@0	38.536	39.95

N7(5M)_DFT-s-OFDM_PI_2-
BPSK Outer Full Mid CH



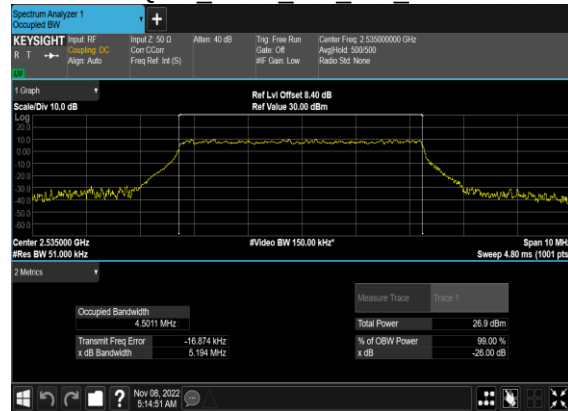
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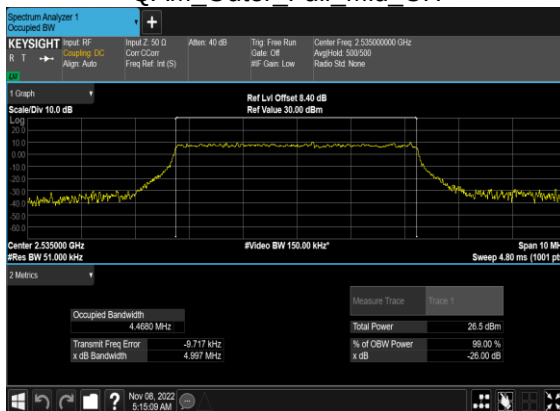
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OFDM QPSK Outer Full Mid CH



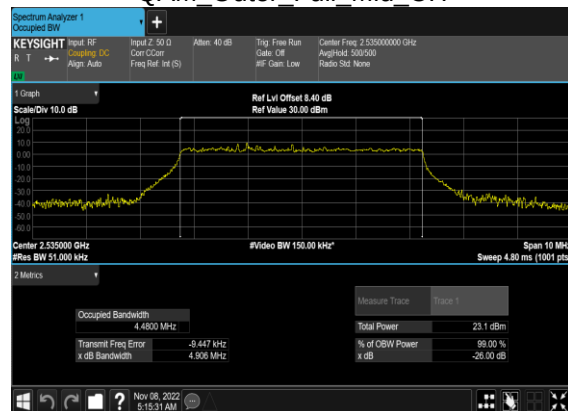
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QAM Outer Full Mid CH



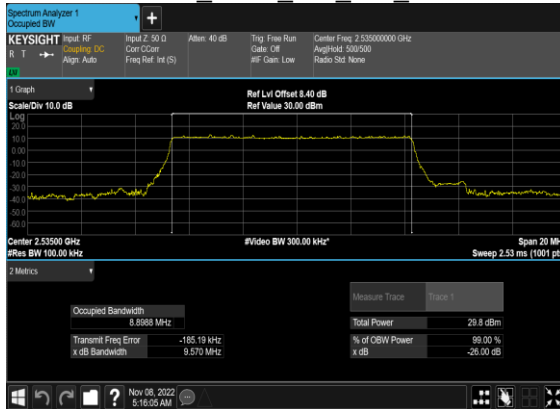
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N7(5M)_CP-OFDM_256
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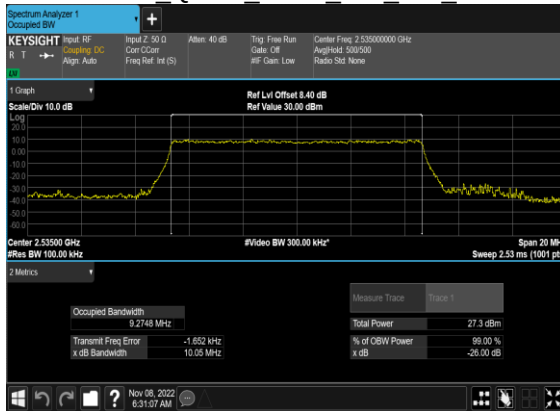
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BPSK Outer Full Mid CH



N7(10M)_DFT-s-
OFDM QPSK Outer Full Mid CH



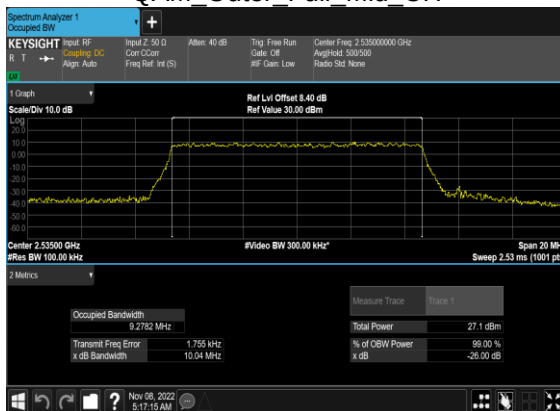
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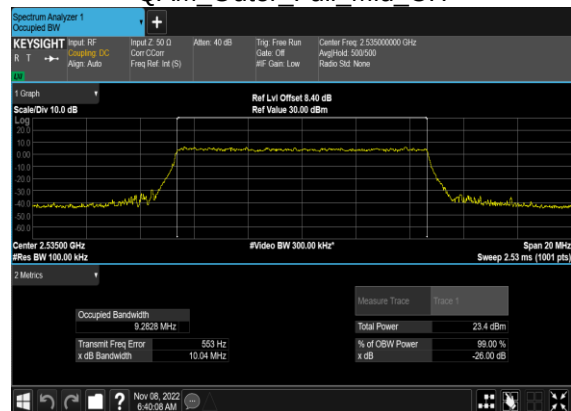
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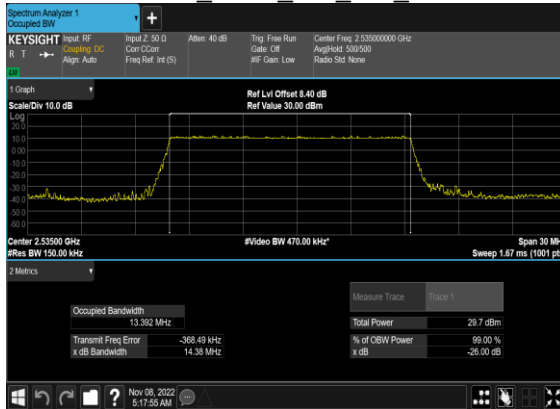
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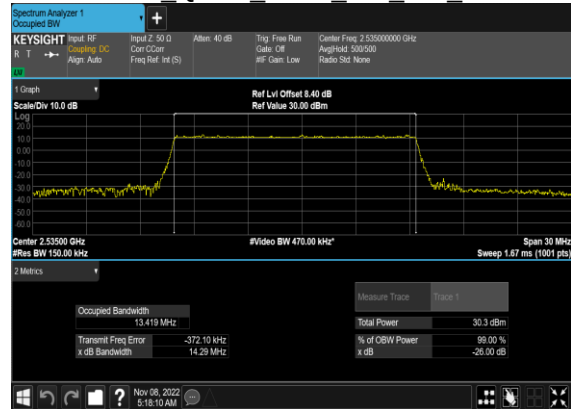
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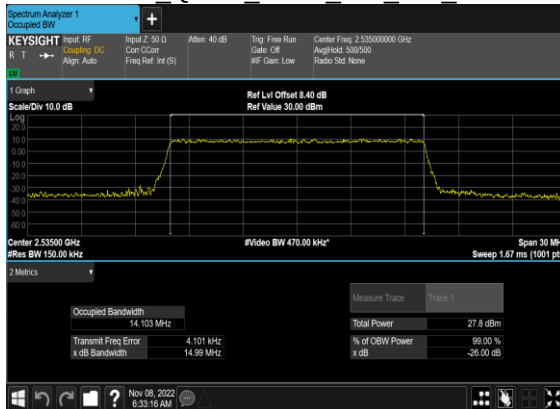
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BPSK Outer Full Mid CH



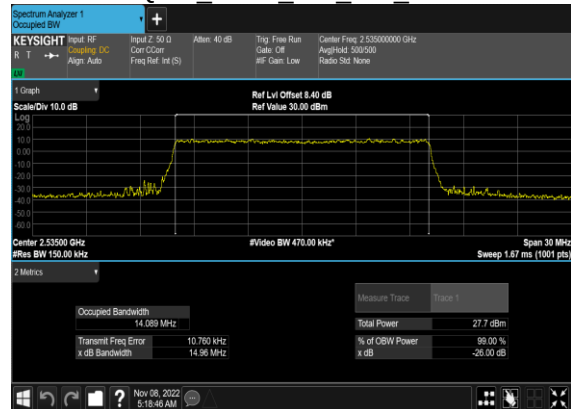
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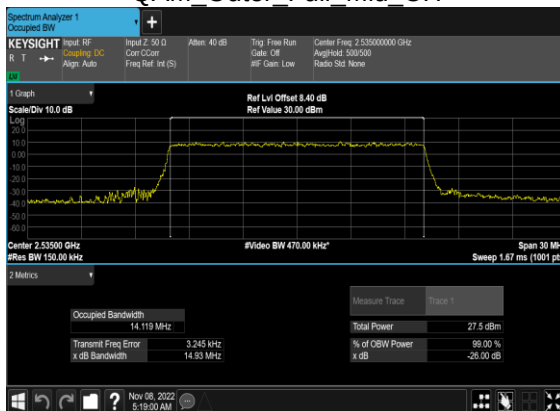
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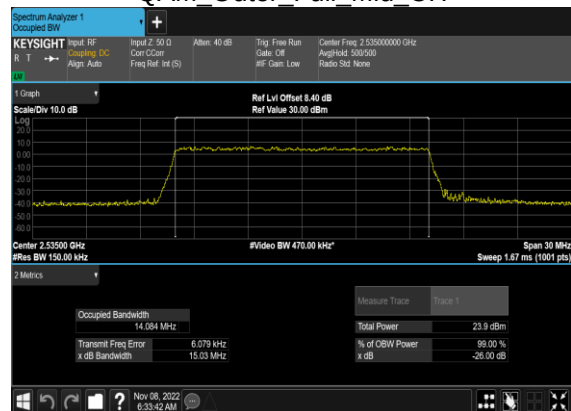
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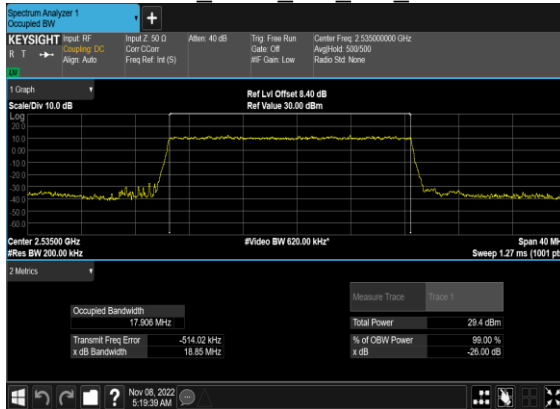
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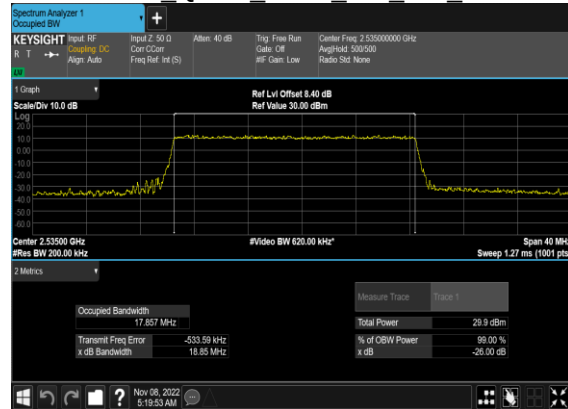
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QAM Outer Full Mid CH



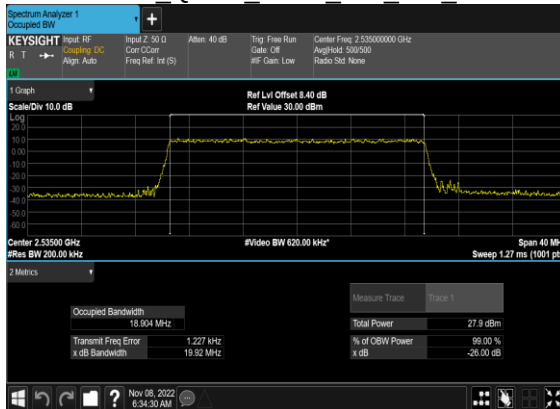
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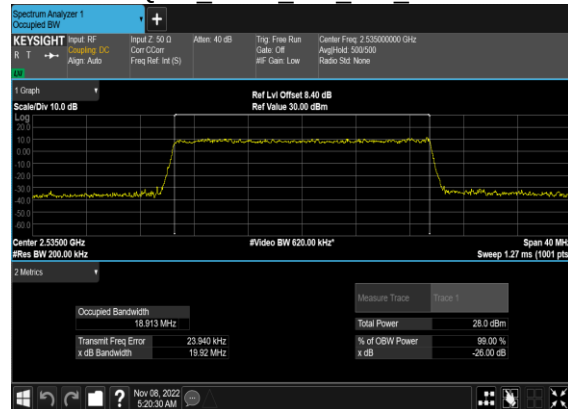
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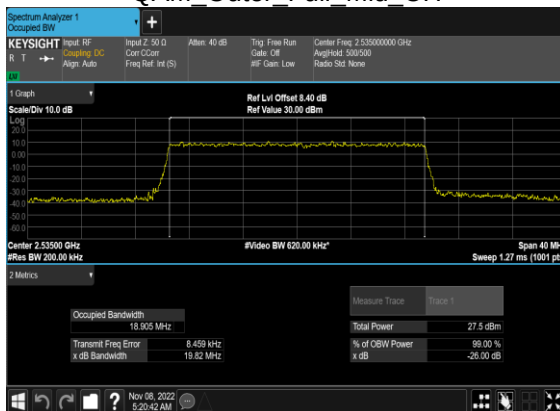
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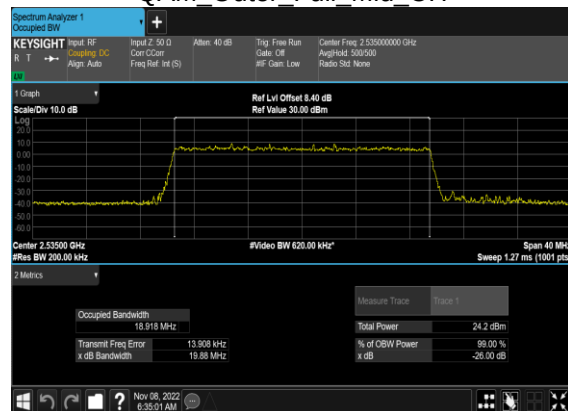
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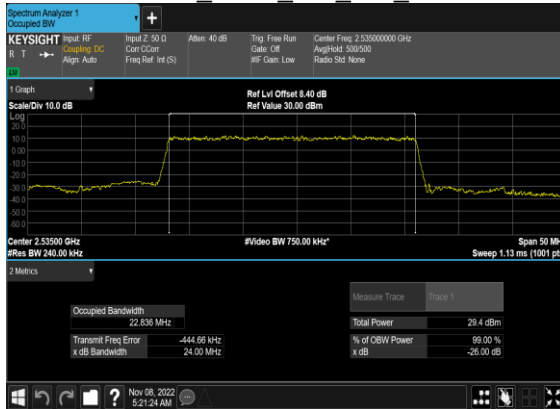
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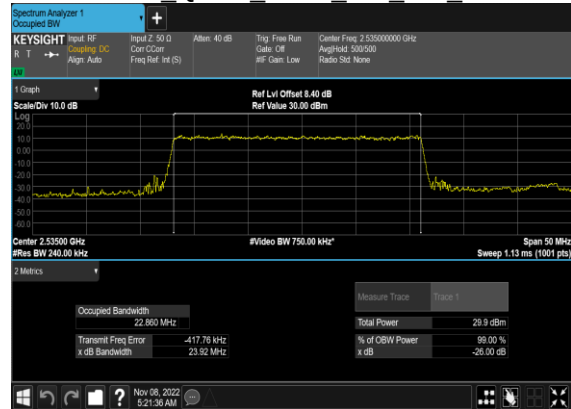
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QAM Outer Full Mid CH



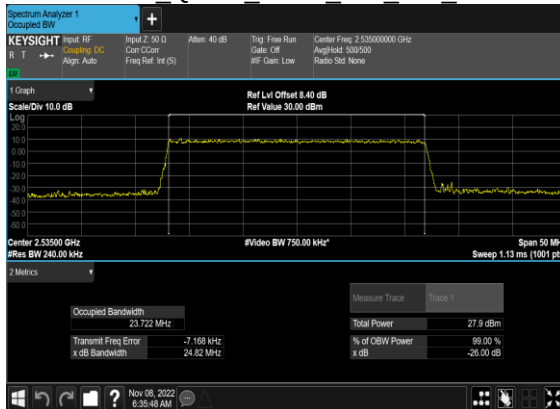
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BPSK Outer Full Mid CH



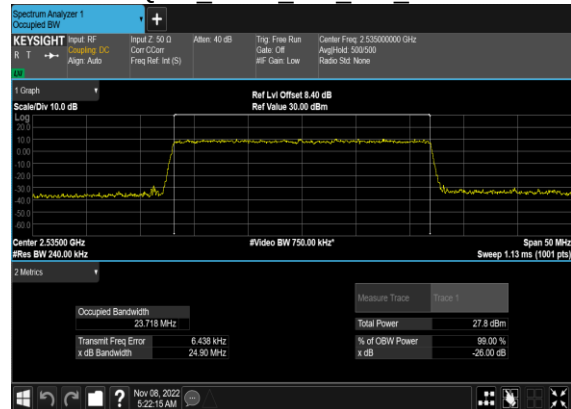
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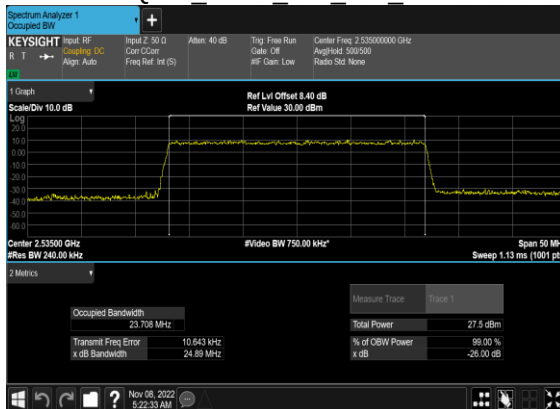
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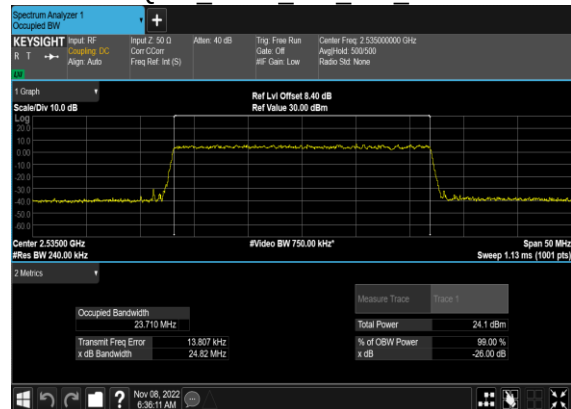
N7(25M)_CP-OFDM_16
QAM Outer Full Mid CH



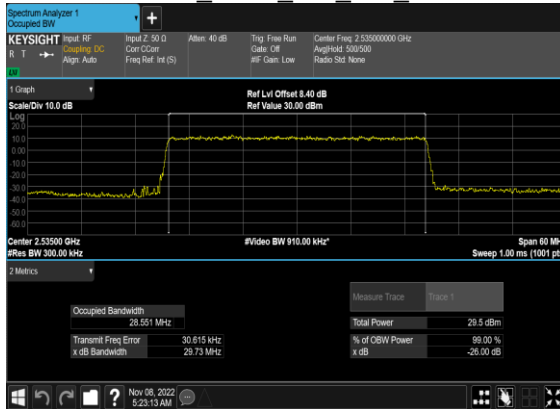
N7(25M)_CP-OFDM_64
QAM Outer Full Mid CH



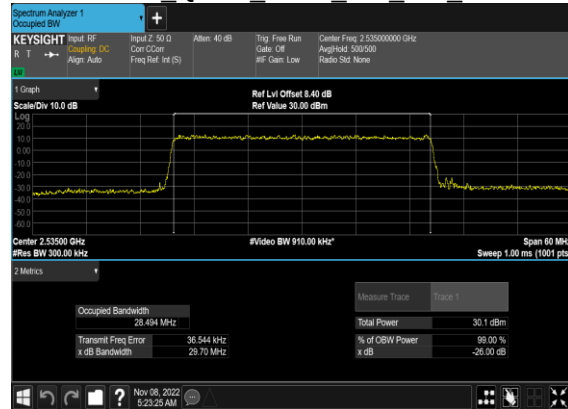
N7(25M)_CP-OFDM_256
QAM Outer Full Mid CH



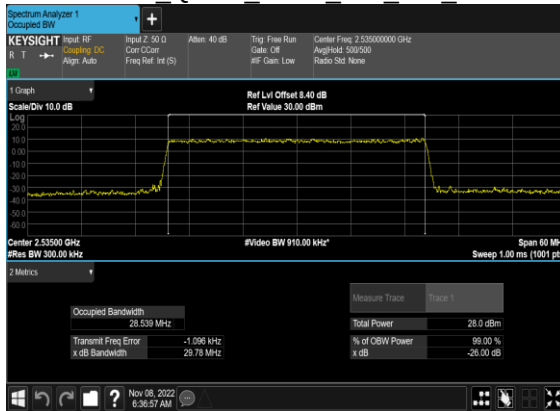
N7(30M)_DFT-s-OFDM_PI_2-
BPSK Outer Full Mid CH



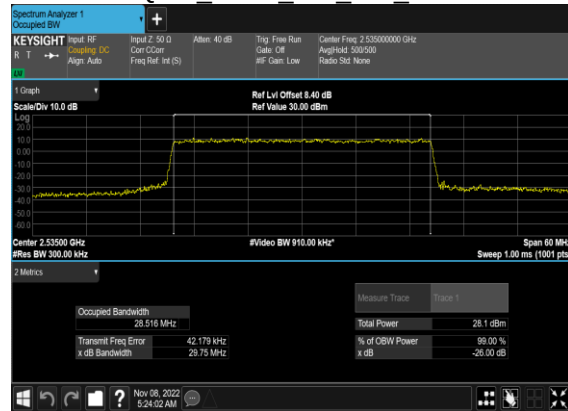
N7(30M)_DFT-s-
OFDM QPSK Outer Full Mid CH



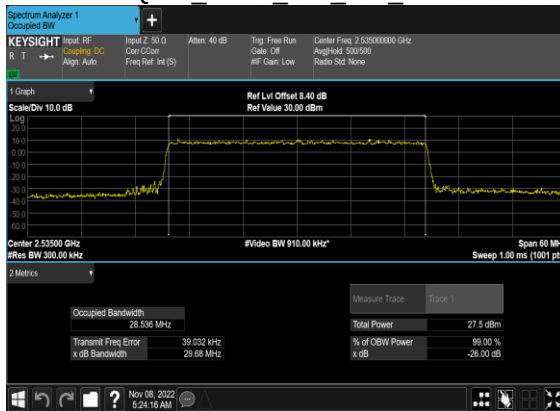
N7(30M)_CP-
OFDM QPSK Outer Full Mid CH



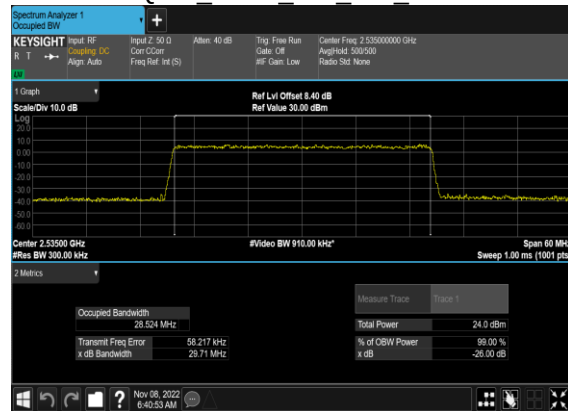
N7(30M)_CP-OFDM_16
QAM Outer Full Mid CH



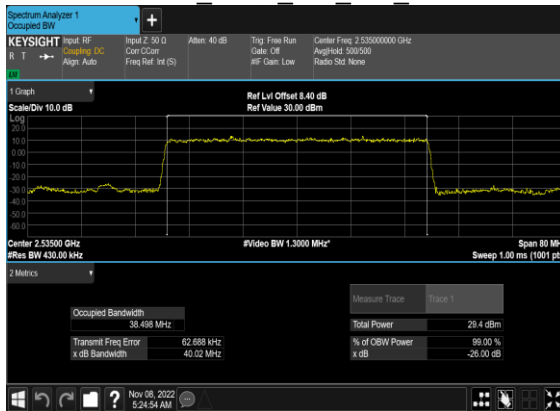
N7(30M)_CP-OFDM_64
QAM Outer Full Mid CH



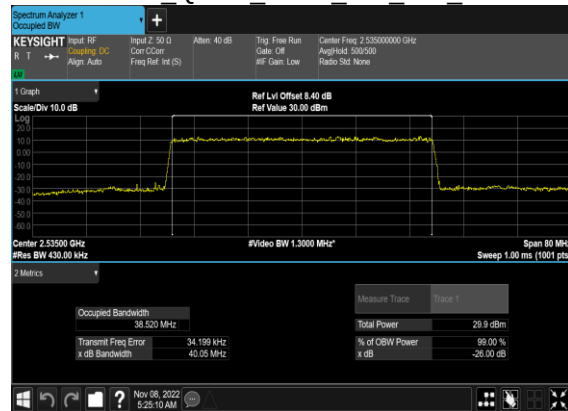
N7(30M)_CP-OFDM_256
QAM Outer Full Mid CH



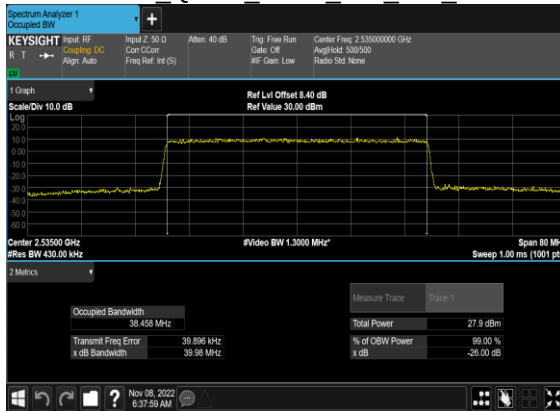
N7(40M)_DFT-s-OFDM_PI_2-
BPSK Outer Full Mid CH



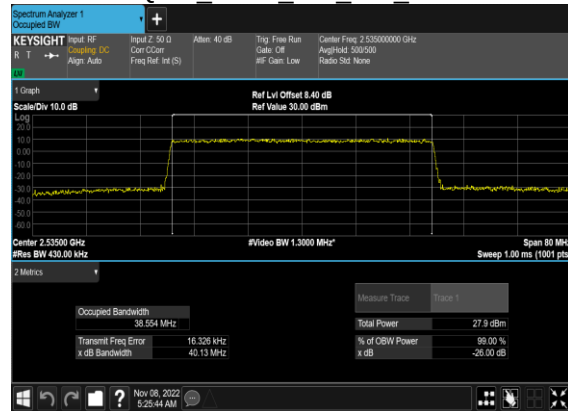
N7(40M)_DFT-s-
OFDM QPSK Outer Full Mid CH



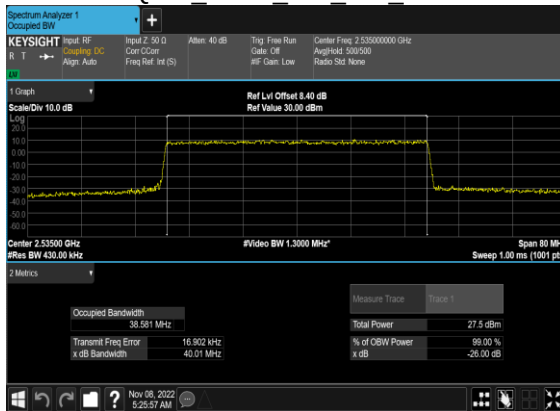
N7(40M)_CP-
OFDM QPSK Outer Full Mid CH



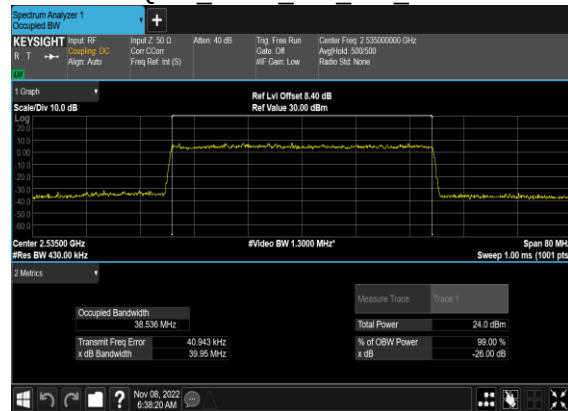
N7(40M)_CP-OFDM_16
QAM Outer Full Mid CH



N7(40M)_CP-OFDM_64
QAM Outer Full Mid CH



N7(40M)_CP-OFDM_256
QAM Outer Full Mid CH



Conducted Spurious Emissions

NR Band	SCS (kHz)	Bandwidth (MHz)	Arfcn	Freq (MHz)	Modulation	RB	Result	Verdict
7	15	5	500500	2502.5	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	5	500500	2502.5	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	5	500500	2502.5	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	5	500500	2502.5	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	5	500500	2502.5	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	5	500500	2502.5	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	5	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	5	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	5	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	5	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	5	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	5	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	5	513500	2567.5	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	5	513500	2567.5	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	5	513500	2567.5	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	5	513500	2567.5	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	5	513500	2567.5	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	5	513500	2567.5	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	20	502000	2510.0	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	20	502000	2510.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	20	502000	2510.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	20	502000	2510.0	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	20	502000	2510.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	20	502000	2510.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	20	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	20	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	20	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	20	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	20	512000	2560.0	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	20	512000	2560.0	DFT-s-OFDM BPSK	1@0	see graph	PASS

7	15	20	512000	2560.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	20	512000	2560.0	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	20	512000	2560.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	20	512000	2560.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	40	504000	2520.0	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	40	504000	2520.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	40	504000	2520.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	40	504000	2520.0	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	40	504000	2520.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	40	504000	2520.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	40	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	40	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	40	507000	2535.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	40	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	40	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	40	507000	2535.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	40	510000	2550.0	DFT-s-OFDM BPSK	1@0	see graph	---
7	15	40	510000	2550.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	40	510000	2550.0	DFT-s-OFDM BPSK	1@0	see graph	PASS
7	15	40	510000	2550.0	DFT-s-OFDM QPSK	1@0	see graph	---
7	15	40	510000	2550.0	DFT-s-OFDM QPSK	1@0	see graph	PASS
7	15	40	510000	2550.0	DFT-s-OFDM QPSK	1@0	see graph	PASS

N7(5M)_DFT-s-OFDM BPSK Edge 1RB Left Low CH



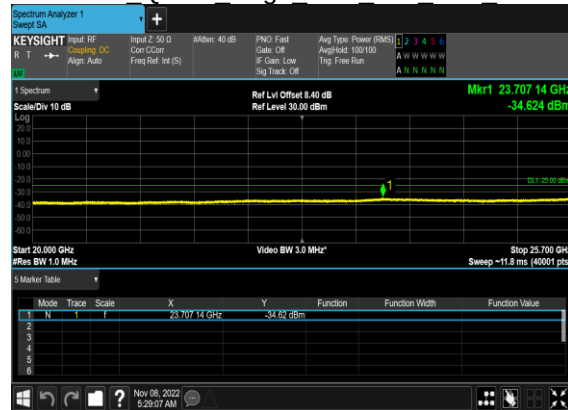
N7(5M)_DFT-s-OFDM BPSK Edge 1RB Left Low CH



N7(5M)_DFT-s-OFDM QPSK Edge 1RB Left Low CH



N7(5M)_DFT-s-OFDM QPSK Edge 1RB Left Low CH



N7(5M)_DFT-s-OFDM BPSK Edge 1RB Left Mid CH



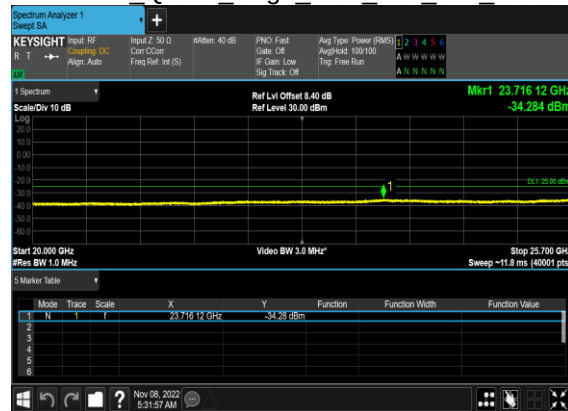
N7(5M)_DFT-s-OFDM BPSK Edge 1RB Left Mid CH



N7(5M)_DFT-s-
OFDM QPSK Edge 1RB Left Mid CH



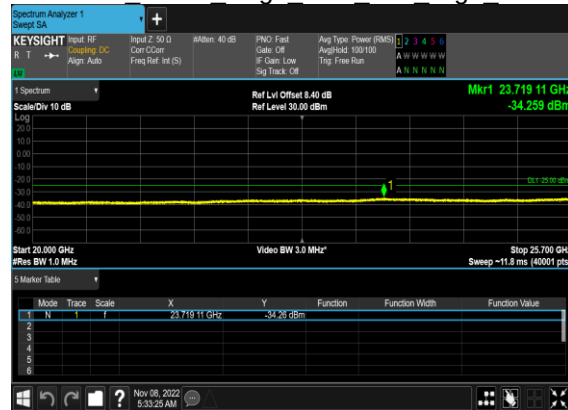
N7(5M)_DFT-s-
OFDM QPSK Edge 1RB Left Mid CH



N7(5M)_DFT-s-
OFDM BPSK Edge 1RB Left High CH



N7(5M)_DFT-s-
OFDM BPSK Edge 1RB Left High CH



N7(5M)_DFT-s-
OFDM QPSK Edge 1RB Left High CH



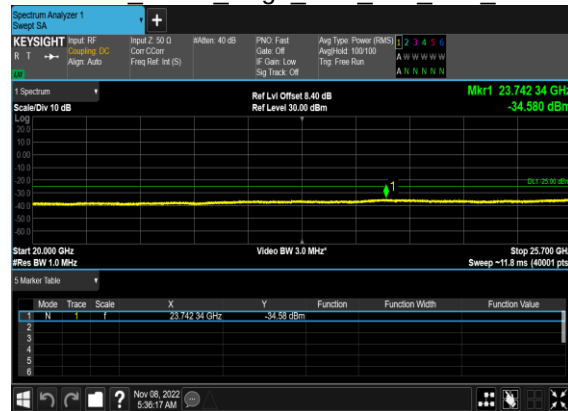
N7(5M)_DFT-s-
OFDM QPSK Edge 1RB Left High CH



N7(20M)_DFT-s-OFDM BPSK Edge 1RB Left Low CH



N7(20M)_DFT-s-OFDM BPSK Edge 1RB Left Low CH



N7(20M)_DFT-s-OFDM QPSK Edge 1RB Left Low CH



N7(20M)_DFT-s-OFDM QPSK Edge 1RB Left Low CH



N7(20M)_DFT-s-OFDM BPSK Edge 1RB Left Mid CH



N7(20M)_DFT-s-OFDM BPSK Edge 1RB Left Mid CH



N7(20M)_DFT-s-
OFDM QPSK Edge 1RB Left Mid CH



N7(20M)_DFT-s-
OFDM QPSK Edge 1RB Left Mid CH



N7(20M)_DFT-s-
OFDM BPSK Edge 1RB Left High CH



N7(20M)_DFT-s-
OFDM BPSK Edge 1RB Left High CH



N7(20M)_DFT-s-
OFDM QPSK Edge 1RB Left High CH



N7(20M)_DFT-s-
OFDM QPSK Edge 1RB Left High CH



N7(40M)_DFT-s-
OFDM BPSK Edge 1RB Left Low CH



N7(40M)_DFT-s-
OFDM BPSK Edge 1RB Left Low CH



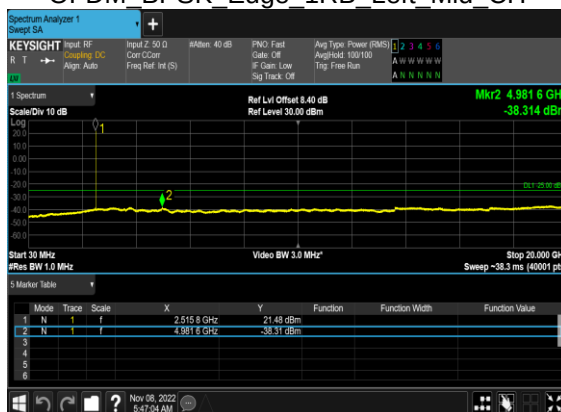
N7(40M)_DFT-s-
OFDM QPSK Edge 1RB Left Low CH



N7(40M)_DFT-s-
OFDM QPSK Edge 1RB Left Low CH



N7(40M)_DFT-s-
OFDM BPSK Edge 1RB Left Mid CH



N7(40M)_DFT-s-
OFDM BPSK Edge 1RB Left Mid CH

