

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 96
47 CFR FCC Part 2

Report No.: RFBICM-WTW-P22110528-10

FCC ID: S9E-125500

Product: Rugged Handheld Computer

Brand: 

Model No.: 125500

Received Date: 2022/12/7

Test Date: 2022/12/23 ~ 2023/3/15

Issued Date: 2023/10/27

Applicant: Trimble Inc.

Address: 5475 Kellenburger Road, Dayton, Ohio, 45424

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

Test Location (1): No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN

FCC Registration / 788550 / TW0003

Designation Number:

Test Location (2): No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

FCC Registration / 281270 / TW0032

Designation Number:

Approved by:



Date:

2023/10/27

Jeremy Lin / Project Engineer

This test report consists of 134 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The test results in the report only apply to the tested sample. The test results in this report are traceable to the national or international standards.

Prepared by : Gina Liu / Specialist



This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

Table of Contents

Release Control Record	4
1 Certificate.....	5
2 Summary of Test Results	6
2.1 Measurement Uncertainty	6
2.2 Supplementary Information	6
3 General Information	7
3.1 General Description of EUT	7
3.2 Antenna Description of EUT	8
3.3 Test Mode Applicability and Tested Channel Detail.....	9
3.4 Test Program Used and Operation Descriptions	12
3.5 Connection Diagram of EUT and Peripheral Devices	12
3.6 Configuration of Peripheral Devices and Cable Connections	12
4 Test Instruments	13
4.1 Maximum EIRP	13
4.2 Modulation Characteristics	13
4.3 Peak to Average Ratio	13
4.4 Bandwidth	13
4.5 Conducted Spurious Emissions	13
4.6 Radiated Spurious Emissions below 1GHz	14
4.7 Radiated Spurious Emissions above 1GHz	15
4.8 Frequency Stability	16
5 Limits of Test Items.....	17
5.1 Maximum EIRP	17
5.2 Modulation Characteristics	17
5.3 Peak to Average Ratio	17
5.4 Bandwidth	17
5.5 Conducted Spurious Emissions	17
5.6 Radiated Spurious Emissions below 1GHz	17
5.7 Radiated Spurious Emissions above 1GHz	18
5.8 Frequency Stability	18
6 Test Arrangements	19
6.1 Maximum EIRP	19
6.1.1 Test Setup	19
6.1.2 Test Procedure	19
6.2 Modulation Characteristics	20
6.2.1 Test Setup	20
6.2.2 Test Procedure	20
6.3 Peak to Average Ratio	20
6.3.1 Test Setup	20
6.3.2 Test Procedure	20
6.4 Bandwidth	21
6.4.1 Test Setup	21
6.4.2 Test Procedure	21
6.5 Conducted Spurious Emissions	23
6.5.1 Test Setup	23
6.5.2 Test Procedure	23
6.6 Radiated Spurious Emissions below 1GHz	24
6.6.1 Test Setup	24
6.6.2 Test Procedure	24
6.7 Radiated Spurious Emissions above 1GHz	25
6.7.1 Test Setup	25
6.7.2 Test Procedure	25
6.8 Frequency Stability	26
6.8.1 Test Setup	26

6.8.2	Test Procedure	26
7	Test Results of Test Item	27
7.1	Maximum EIRP	27
7.1.1	NR n77 SCS 30 kHz	27
7.1.2	NR n78 SCS 30 kHz	31
7.2	Modulation Characteristics	37
7.2.1	NR n77 SCS 30 kHz	37
7.2.2	NR n78 SCS 30 kHz	38
7.3	Peak to Average Ratio	39
7.3.1	NR n77 SCS 30 kHz	39
7.3.2	NR n78 SCS 30 kHz	42
7.4	Bandwidth	47
7.4.1	NR n77 SCS 30 kHz	47
7.4.2	NR n78 SCS 30 kHz	50
7.5	Conducted Spurious Emissions	55
7.5.1	NR n77 SCS 30 kHz	55
7.5.2	NR n78 SCS 30 kHz	73
7.6	Radiated Spurious Emissions below 1GHz	103
7.6.1	NR n77 SCS 30 kHz	103
7.6.2	NR n78 SCS 30 kHz	105
7.7	Radiated Spurious Emissions above 1GHz	107
7.7.1	NR n77 SCS 30 kHz	107
7.7.2	NR n78 SCS 30 kHz	116
7.8	Frequency Stability	125
7.8.1	NR n77 SCS 30 kHz	125
7.8.2	NR n78 SCS 30 kHz	128
8	Pictures of Test Arrangements	133
9	Information of the Testing Laboratories	134

Release Control Record

Issue No.	Description	Date Issued
RFBICM-WTW-P22110528-9	Original release.	2023/10/27

1 Certificate

Product: Rugged Handheld Computer

Brand: 

Test Model: 125500

Sample Status: Engineering sample

Applicant: Trimble Inc.

Test Date: 2022/12/23 ~ 2023/3/15

Standard: 47 CFR FCC Part 96
47 CFR FCC Part 2

Measurement procedure: ANSI/TIA/EIA-603-E 2016
ANSI C63.26-2015

KDB 971168 D01 Power Meas License Digital Systems v03r01
KDB 940660 D01 Part 96 CBRS Eqpt v03

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2 Summary of Test Results

47 CFR FCC Part 96 & Part 2			
Standard / Clause	Test Item	Result	Remark
FCC 47 CFR Part 2.1046 FCC 47 CFR Part 96.41(b)	Maximum EIRP	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1047	Modulation Characteristics	Pass	Meet the requirement of limit.
FCC 47 CFR Part 96.41(g)	Peak to Average Ratio	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1049	Bandwidth	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1051 FCC 47 CFR Part 96.41(e)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
FCC 47 CFR Part 2.1053 FCC 47 CFR Part 96.41(e)	Radiated Spurious Emissions below 1GHz	Pass	Minimum passing margin is -13.15 dB at 41.64 MHz
FCC 47 CFR Part 2.1053 FCC 47 CFR Part 96.41(e)	Radiated Spurious Emissions above 1GHz	Pass	Minimum passing margin is -0.69 dB at 7172.04 MHz
FCC 47 CFR Part 2.1055	Frequency Stability	Pass	Meet the requirement of limit.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Specification	Expanded Uncertainty (k=2) (±)
Radiated Spurious Emissions below 1GHz	9 kHz ~ 30 MHz	3.00 dB
	30 MHz ~ 1 GHz	2.93 dB
Radiated Spurious Emissions above 1GHz	1 GHz ~ 18 GHz	1.76 dB
	18 GHz ~ 40 GHz	1.77 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Rugged Handheld Computer
Brand	
Test Model	125500
Status of EUT	Engineering sample
Power Supply Rating	Refer to note

Note:

1. The EUT supports the following ENDC configuration.

5GNR	FCC 5G FR1			ENDC
	Band	SCS	Bandwidth (MHz)	
	n77	30kHz	20/40/50	Band 2/5/7/12/41
	n78	30kHz	20/30/40/50/60	Band 2/7/12/38/41

* This EUT support SA mode and NSA mode, after verification, SA mode was the worst case and chosen for final test.

2. EUT Overview

Band / Bandwidth	TX Frequency Range (MHz)	Max. EIRP Power				
		BPSK	QPSK	16QAM	64QAM	256QAM
n77 (Channel Bandwidth 20MHz)	3585.00-3665.13	147.911mW (21.70dBm/10MHz)	147.571mW (21.69dBm/10MHz)	117.220mW (20.69dBm/10MHz)	82.224mW (19.15dBm/10MHz)	51.404mW (17.11dBm/10MHz)
n77 (Channel Bandwidth 40MHz)	3595.02-3665.11	145.881mW (21.64dBm/10MHz)	147.571mW (21.69dBm/10MHz)	116.413mW (20.66dBm/10MHz)	82.035mW (19.14dBm/10MHz)	51.880mW (17.15dBm/10MHz)
n77 (Channel Bandwidth 50MHz)	3600.00-3650.13	147.911mW (21.70dBm/10MHz)	157.036mW (21.96dBm/10MHz)	115.345mW (20.62dBm/10MHz)	82.985mW (19.19dBm/10MHz)	52.240mW (17.18dBm/10MHz)
n78 (Channel Bandwidth 20MHz)	3586.02-3652.98	145.546mW (21.63dBm/10MHz)	147.231mW (21.68dBm/10MHz)	117.490mW (20.70dBm/10MHz)	83.176mW (19.20dBm/10MHz)	52.360mW (17.19dBm/10MHz)
n78 (Channel Bandwidth 30MHz)	3591.00-3648.00	145.881mW (21.64dBm/10MHz)	154.882mW (21.90dBm/10MHz)	115.878mW (20.64dBm/10MHz)	82.035mW (19.14dBm/10MHz)	50.466mW (17.03dBm/10MHz)
n78 (Channel Bandwidth 40MHz)	3596.01-3642.99	146.893mW (21.67dBm/10MHz)	147.231mW (21.68dBm/10MHz)	115.878mW (20.64dBm/10MHz)	81.283mW (19.10dBm/10MHz)	52.360mW (17.19dBm/10MHz)
n78 (Channel Bandwidth 50MHz)	3601.02-3673.98	143.880mW (21.58dBm/10MHz)	145.881mW (21.64dBm/10MHz)	114.815mW (20.60dBm/10MHz)	82.794mW (19.18dBm/10MHz)	51.642mW (17.13dBm/10MHz)
n78 (Channel Bandwidth 60MHz)	3606.00-3633.00	147.231mW (21.68dBm/10MHz)	155.955mW (21.93dBm/10MHz)	117.490mW (20.70dBm/10MHz)	82.604mW (19.17dBm/10MHz)	50.699mW (17.05dBm/10MHz)

Band / Bandwidth	TX Frequency Range (MHz)	Emission Designator				
		BPSK	QPSK	16QAM	64QAM	256QAM
n77 (Channel Bandwidth 20MHz)	3585.00-3665.13	18M0G7D	18M2G7D	18M2D7W	18M2D7W	18M2D7W
n77 (Channel Bandwidth 40MHz)	3595.02-3665.11	37M5G7D	37M8G7D	37M8D7W	37M8D7W	37M8D7W
n77 (Channel Bandwidth 50MHz)	3600.00-3650.13	47M1G7D	47M5G7D	47M5D7W	47M5D7W	47M5D7W
n78 (Channel Bandwidth 20MHz)	3586.02-3652.98	18M0G7D	18M2G7D	18M2D7W	18M2D7W	18M2D7W
n78 (Channel Bandwidth 30MHz)	3591.00-3648.00	27M6G7D	27M9G7D	27M9D7W	27M9D7W	27M9D7W
n78 (Channel Bandwidth 40MHz)	3596.01-3642.99	37M5G7D	37M8G7D	37M8D7W	37M8D7W	37M8D7W
n78 (Channel Bandwidth 50MHz)	3601.02-3673.98	47M1G7D	47M5G7D	47M5D7W	47M5D7W	47M5D7W
n78 (Channel Bandwidth 60MHz)	3606.00-3633.00	57M9G7D	57M9G7D	57M9D7W	57M9D7W	57M9D7W

3. The EUT uses following accessories.

Battery		
Brand	Model	Specification
N/A	1400-900069G	Manufacturer : LIFUN TECHNOLOGY CO.,LTD. Power Rating : 3.85 Vdc 4950mAh
USB Cable		
Brand	Model	Specification
Trimble	121920	Signal Line : 2 meters, shielded cable. w/o ferrite core

4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Antenna Type		LDS		
Antenna Connector		shrapel		
Item	Antenna No.	Band		Gain (dBi)
5G NR	ANT0	TX+RX	Band 2	0.3
			Band 5	-2.2
			Band 41	0.04
			Band 71	-2.45
	ANT1	TX+RX	Band 77	-1.14
			Band 78	-1.14
	ANT4	RX	-	-
	ANT5	RX	-	-
	ANT6	RX	-	-

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

* 5G NR N77/78 uses ANT1+ANT4+ANT5+ANT6

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	EUT can be used in the following ways: X-axis/ Y-axis/ Z-axis. Pre-scan these ways and find the worst case as a representative test condition.
Worst Case:	X-axis/ Y-axis/ Z-axis Worst Condition: Y-axis

For NR n77_SCS 30kHz

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
EIRP	639000 (3585.00 MHz)	20 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641670 (3625.05 MHz)			Half RB
	644342 (3665.13 MHz)			Full RB
	639668 (3595.02 MHz)	40 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641670 (3625.05 MHz)			Half RB
	643674 (3655.11 MHz)			Full RB
Modulation Characteristics	640000 (3600.00 MHz)	50 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641670 (3625.05 MHz)			Half RB
	644342 (3665.13 MHz)			Full RB
Frequency Stability	641670 (3625.05 MHz)	50 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	Full RB
	639000 (3585.00 MHz)	20 MHz	QPSK	Full RB
	644342 (3665.13 MHz)			Full RB
	639668 (3595.02 MHz)	40 MHz	QPSK	Full RB
	643674 (3655.11 MHz)			Full RB
	640000 (3600.00 MHz)			Full RB
Occupied Bandwidth	644342 (3665.13 MHz)	50 MHz	QPSK	Full RB
	639000 (3585.00 MHz)			Full RB
	641670 (3625.05 MHz)			Full RB
	639668 (3595.02 MHz)	40 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641670 (3625.05 MHz)			Half RB
	643674 (3655.11 MHz)			Full RB
Peak to Average Ratio	640000 (3600.00 MHz)	50 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641670 (3625.05 MHz)			Half RB
	644342 (3665.13 MHz)			Full RB
	639000 (3585.00 MHz)	20 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641670 (3625.05 MHz)			1 RB
	644342 (3665.13 MHz)			1 RB
Conducted Emission	639668 (3595.02 MHz)	40 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641670 (3625.05 MHz)			Full RB
	643674 (3655.11 MHz)			Full RB
	640000 (3600.00 MHz)	50 MHz	QPSK	1 RB
	641670 (3625.05 MHz)			Full RB
	644342 (3665.13 MHz)			Full RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
RE Below 1GHz	641670 (3625.05 MHz)	50 MHz	QPSK	1 RB
RE Above 1GHz	639000 (3585.00 MHz)	20 MHz	QPSK	1 RB
	641670 (3625.05 MHz)			
	644342 (3665.13 MHz)			
	639668 (3595.02 MHz)	40 MHz	QPSK	1 RB
	641670 (3625.05 MHz)			
	643674 (3655.11 MHz)			
	640000 (3600.00 MHz)	50 MHz	QPSK	1 RB
	641670 (3625.05 MHz)			
	644342 (3665.13 MHz)			

For NR n78_SCS 30kHz

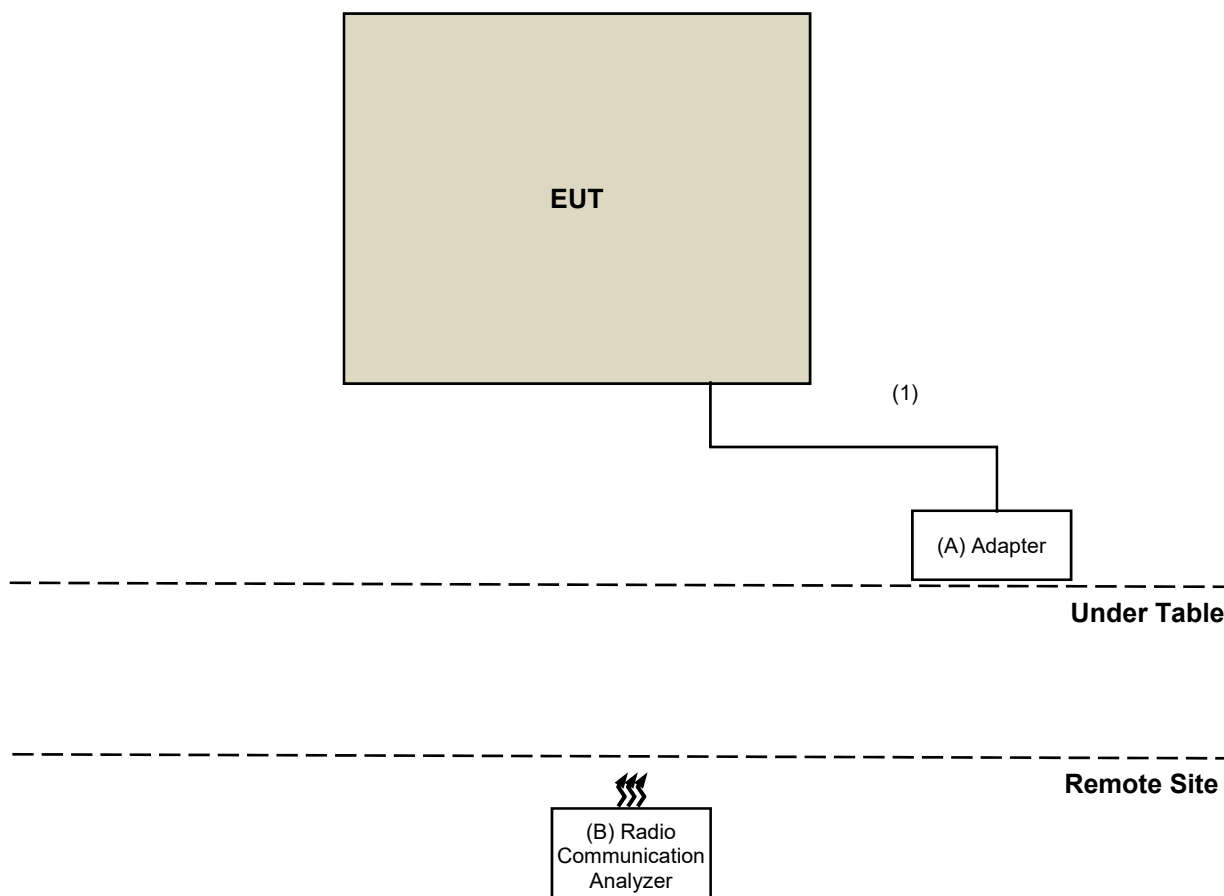
Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
EIRP	639068 (3586.02 MHz)	20 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641300 (3619.50 MHz)			Half RB
	643532 (3652.98 MHz)			Full RB
	639400 (3591.00 MHz)	30 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641300 (3619.50 MHz)			Half RB
	643200 (3648.00 MHz)			Full RB
	639734 (3596.01 MHz)	40 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641300 (3619.50 MHz)			Half RB
	642866 (3642.99 MHz)			Full RB
	640068 (3601.02 MHz)	50 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641300 (3619.50 MHz)			Half RB
	642532 (3637.98 MHz)			Full RB
	640400 (3606.00 MHz)	60 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	641300 (3619.50 MHz)			Half RB
	642200 (3633.00 MHz)			Full RB
Modulation Characteristics	641300 (3619.50 MHz)	60 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	Full RB
Frequency Stability	639068 (3586.02 MHz)	20 MHz	QPSK	Full RB
	643532 (3652.98 MHz)			
	639400 (3591.00 MHz)	30 MHz	QPSK	Full RB
	643200 (3648.00 MHz)			
	639734 (3596.01 MHz)	40 MHz	QPSK	Full RB
	642866 (3642.99 MHz)			
	640068 (3601.02 MHz)	50 MHz	QPSK	Full RB
	642532 (3637.98 MHz)			
	640400 (3606.00 MHz)	60 MHz	QPSK	Full RB
	642200 (3633.00 MHz)			
Occupied Bandwidth	639068 (3586.02 MHz)	20 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	Full RB
	641300 (3619.50 MHz)			
	643532 (3652.98 MHz)			
	639400 (3591.00 MHz)	30 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	Full RB
	641300 (3619.50 MHz)			
	643200 (3648.00 MHz)			

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Occupied Bandwidth	639734 (3596.01 MHz) 641300 (3619.50 MHz) 642866 (3642.99 MHz)	40 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	Full RB
	640068 (3601.02 MHz) 641300 (3619.50 MHz) 642532 (3637.98 MHz)	50 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	Full RB
	640400 (3606.00 MHz) 641300 (3619.50 MHz) 642200 (3633.00 MHz)	60 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	Full RB
Peak to Average Ratio	639068 (3586.02 MHz) 641300 (3619.50 MHz) 643532 (3652.98 MHz)	20 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	639400 (3591.00 MHz) 641300 (3619.50 MHz) 643200 (3648.00 MHz)	30 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	639734 (3596.01 MHz) 641300 (3619.50 MHz) 642866 (3642.99 MHz)	40 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	640068 (3601.02 MHz) 641300 (3619.50 MHz) 642532 (3637.98 MHz)	50 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
	640400 (3606.00 MHz) 641300 (3619.50 MHz) 642200 (3633.00 MHz)	60 MHz	BPSK / QPSK / 16QAM / 64QAM / 256QAM	1 RB
Conducted Emission	639068 (3586.02 MHz) 641300 (3619.50 MHz) 643532 (3652.98 MHz)	20 MHz	QPSK	1 RB Full RB
	639400 (3591.00 MHz) 641300 (3619.50 MHz) 643200 (3648.00 MHz)	30 MHz	QPSK	1 RB Full RB
	639734 (3596.01 MHz) 641300 (3619.50 MHz) 642866 (3642.99 MHz)	40 MHz	QPSK	1 RB Full RB
	640068 (3601.02 MHz) 641300 (3619.50 MHz) 642532 (3637.98 MHz)	50 MHz	QPSK	1 RB Full RB
	640400 (3606.00 MHz) 641300 (3619.50 MHz) 642200 (3633.00 MHz)	60 MHz	QPSK	1 RB Full RB
RE Below 1GHz	639068 (3586.02 MHz)	20 MHz	QPSK	1 RB
RE Above 1GHz	639068 (3586.02 MHz) 641300 (3619.50 MHz) 643532 (3652.98 MHz)	20 MHz	QPSK	1 RB Full RB
	639734 (3596.01 MHz) 641300 (3619.50 MHz) 642866 (3642.99 MHz)	40 MHz	QPSK	1 RB Full RB
	640400 (3606.00 MHz) 641300 (3619.50 MHz) 642200 (3633.00 MHz)	60 MHz	QPSK	1 RB Full RB

3.4 Test Program Used and Operation Descriptions

There is no need to controlling software during the test, and the EUT can be paired with the 5G Wireless Test Platforms to test the connection when it is powered on.

3.5 Connection Diagram of EUT and Peripheral Devices



3.6 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Adapter	FULLPOWER	TYPE-C45IC	N/A	N/A	Supplied by applicant
B	Radio Communication Analyzer	Anritsu	MT8821C	6201462755	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	Type-C Cable	1	2	Yes	0	Supplied by applicant

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 Maximum EIRP

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
N9030B - PXA Signal Analyzer KEYSIGHT	N9030B	MY57140938	2022/3/15	2023/3/14
5G Wireless Test Platforms Keysight	E7515B	MY60102114	2022/5/20	2023/5/19
Software BV	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2022/12/23 ~ 2023/3/7

4.2 Modulation Characteristics

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
N9030B - PXA Signal Analyzer KEYSIGHT	N9030B	MY57140938	2022/3/15	2023/3/14
5G Wireless Test Platforms Keysight	E7515B	MY60102114	2022/5/20	2023/5/19
Software BV	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2022/12/23 ~ 2023/3/7

4.3 Peak to Average Ratio

Refer to section 4.2 to get information of the instruments.

4.4 Bandwidth

Refer to section 4.2 to get information of the instruments.

4.5 Conducted Spurious Emissions

Refer to section 4.2 to get information of the instruments.

4.6 Radiated Spurious Emissions below 1GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
Bi-log Broadband Antenna Schwarzbeck	VULB9168	9168-1213	2022/10/20	2023/10/19
Loop Antenna EMCI	EM-6879	269	2022/9/19	2023/9/18
Loop Antenna TESEQ	HLA 6121	45745	2022/7/27	2023/7/26
Pre-amplifier EMCI	EMC001340	980201	2022/9/23	2023/9/22
Pre_Amplifier EMCI	EMC330N	980782	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	5D-NM-BM	140903+140902	2022/1/15	2023/1/14
	EMCCFD400-NM-NM-500	201233	2022/1/17	2023/1/16
	EMCCFD400-NM-NM-3000	201235	2022/1/17	2023/1/16
	EMCCFD400-NM-NM-9000	201236	2022/1/17	2023/1/16
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Spectrum Analyzer R&S	FSW43	101866	2022/1/14	2023/1/13
Test Receiver R&S	ESR3+	102782	2022/12/12	2023/12/11
Turn Table Max-Full	MF-7802BS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208674	N/A	N/A
5G Wireless Test Platforms Keysight	E7515B	MY60102114	2022/5/20	2023/5/19

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2023/1/6

4.7 Radiated Spurious Emissions above 1GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
Horn Antenna RFSPIN	DRH18-E	210103A18E	2022/11/13	2023/11/12
Horn Antenna Schwarzbeck	BBHA 9170	9170-1049	2022/11/13	2023/11/12
Pre_Amplifier EMCI	EMC118A45SE	980808	2022/12/29	2023/12/28
	EMC184045SE	980788	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	EMC101G-KM-KM-2000	201254	2022/1/17	2023/1/16
	EMC101G-KM-KM-3000	201257	2022/1/17	2023/1/16
	EMC101G-KM-KM-5000	201260	2022/1/17	2023/1/16
	EMC104-SM-SM-1000	210102	2022/1/17	2023/1/16
	EMC104-SM-SM-3000	201231	2022/1/17	2023/1/16
	EMC104-SM-SM-9000	201243	2022/1/17	2023/1/16
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Spectrum Analyzer R&S	FSW43	101866	2022/1/14	2023/1/13
Test Receiver R&S	ESR3+	102782	2022/12/12	2023/12/11
Turn Table Max-Full	MF-7802BS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208674	N/A	N/A
5G Wireless Test Platforms Keysight	E7515B	MY60102114	2022/5/20	2023/5/19

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2023/1/5

4.8 Frequency Stability

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
3-channel DC power supply JIN YIH Technology	ODP3033	ODP30332128138	N/A	N/A
Digital Multimeter Fluke	87-III	70360742	2022/6/23	2023/6/22
Software BV	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A
Spectrum Analyzer R&S	FSV40	100980	2022/4/20	2023/4/19
Temperature & Humidity Chamber TERCHY	HRM-120RF	931022	2022/12/27	2023/12/26
5G Wireless Test Platforms Keysight	E7515B	MY60102114	2022/5/20	2023/5/19

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2023/3/15

5 Limits of Test Items

5.1 Maximum EIRP

Device		Maximum EIRP (dBm/10 MHz)
☒	End User Device	23
☐	Category A CBSD	30
☐	Category B CBSD	47

5.2 Modulation Characteristics

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

5.3 Peak to Average Ratio

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.

5.4 Bandwidth

According to FCC 47 CFR part 2.1049, the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.

5.5 Conducted Spurious Emissions

Power of any emissions outside the Fundamental	Limit
Within 0-10MHz above the Assigned Channel	-13 dBm/MHz
Within 0-10MHz below the Assigned Channel	
Greater than 10MHz above the Assigned Channel	-25 dBm/MHz
Greater than 10MHz below the Assigned Channel	
Power of any emission below 3530MHz	-40 dBm/MHz
Power of any emission above 3720MHz	

5.6 Radiated Spurious Emissions below 1GHz

Power of any emissions outside the Fundamental	Limit
Within 0-10MHz above the Assigned Channel	-13 dBm/MHz
Within 0-10MHz below the Assigned Channel	
Greater than 10MHz above the Assigned Channel	-25 dBm/MHz
Greater than 10MHz below the Assigned Channel	
Power of any emission below 3530MHz	-40 dBm/MHz
Power of any emission above 3720MHz	

5.7 Radiated Spurious Emissions above 1GHz

Power of any emissions outside the Fundamental	Limit
Within 0-10MHz above the Assigned Channel	-13 dBm/MHz
Within 0-10MHz below the Assigned Channel	
Greater than 10MHz above the Assigned Channel	-25 dBm/MHz
Greater than 10MHz below the Assigned Channel	
Power of any emission below 3530MHz	-40 dBm/MHz
Power of any emission above 3720MHz	

5.8 Frequency Stability

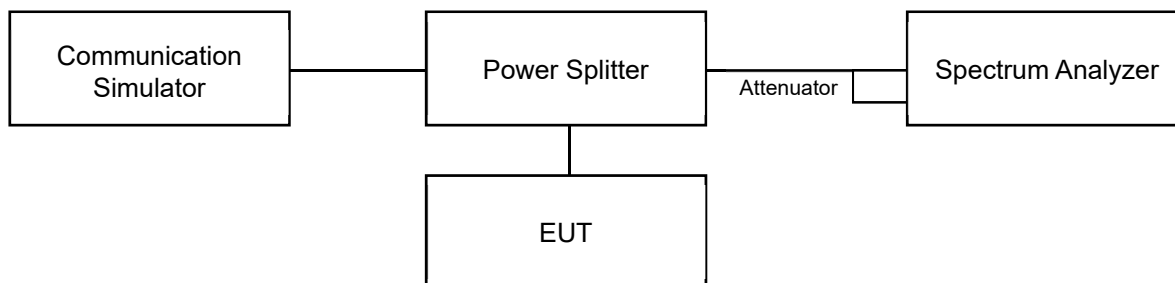
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation (authorized frequency block).

6 Test Arrangements

6.1 Maximum EIRP

6.1.1 Test Setup

Conducted Power Measurement:



6.1.2 Test Procedure

Conducted Power Measurement:

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology. The power measurement was performed on emulator and power value was measured from power function on emulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Measurement method refers to ANSI C63.26 section 5.2.4.4.

- Set span to $2 \times$ to $3 \times$ the OBW.
- Set RBW = 1% to 5% of the OBW.
- Set VBW $\geq 3 \times$ RBW.
- Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
- Set Sweep time = auto-couple.
- Detector = power averaging (rms).
- Set sweep trigger to "free run."
- Trace average at least 100 traces in power averaging (rms) mode.
- Compute power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function with band/channel limits set equal to the OBW band edges.
- If Duty cycle < 98%, Add $10 \log (1/\text{duty cycle})$ to the measured power level to compute the average power during continuous transmission.
- For per 10MHz method, channel power integrating bandwidth 10MHz is used for bandwidth 20M and 40M. For full power method, channel power integrating bandwidth 20MHz is used for bandwidth 20M, integrating bandwidth 40MHz is used for bandwidth 40M.

Maximum EIRP / ERP

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

$$\text{EIRP} = P_{\text{Meas}} + G_T$$

$$\text{ERP} = P_{\text{Meas}} + G_T - 2.15$$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively

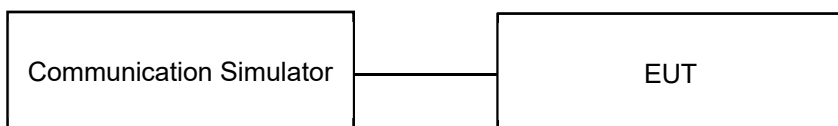
(expressed in the same units as P_{Meas} , e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

6.2 Modulation Characteristics

6.2.1 Test Setup

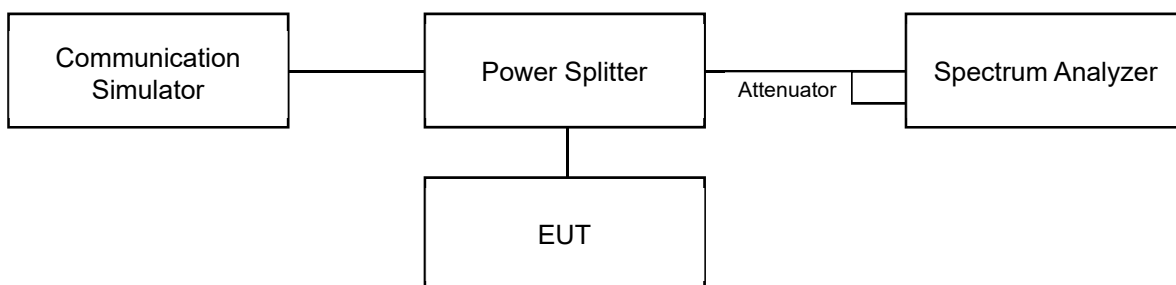


6.2.2 Test Procedure

Connect the EUT to Communication Simulator via the antenna connector, the frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

6.3 Peak to Average Ratio

6.3.1 Test Setup

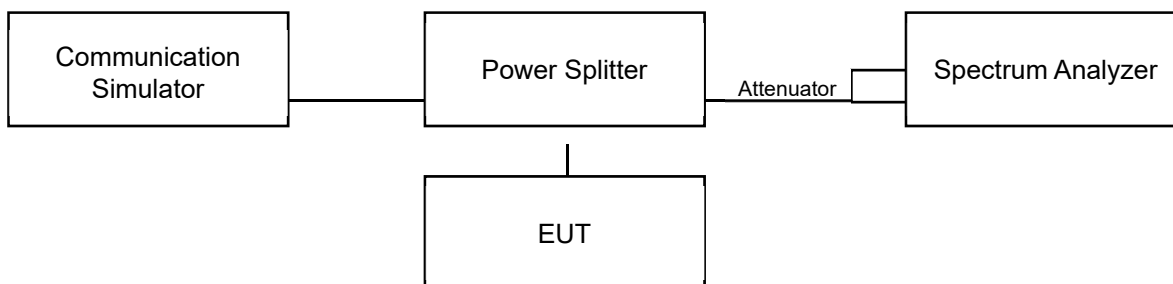


6.3.2 Test Procedure

- Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

6.4 Bandwidth

6.4.1 Test Setup



6.4.2 Test Procedure

For the 26 dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

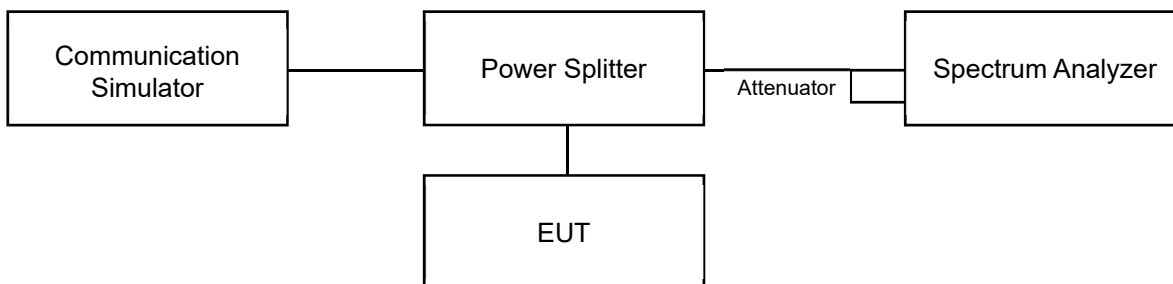
- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
- Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- Determine the following reference values: 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).
- Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- 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 amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.
- The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.

- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b. The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
- c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d. The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- e. Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- f. Determine the reference value by either of the following:
 - g. 1) 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).
 - h. 2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.
- i. Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- j. If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).
- k. 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 amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers. The spectral envelope can cross the “-X dB amplitude” at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the “-X dB amplitude.”
- l. The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

6.5 Conducted Spurious Emissions

6.5.1 Test Setup



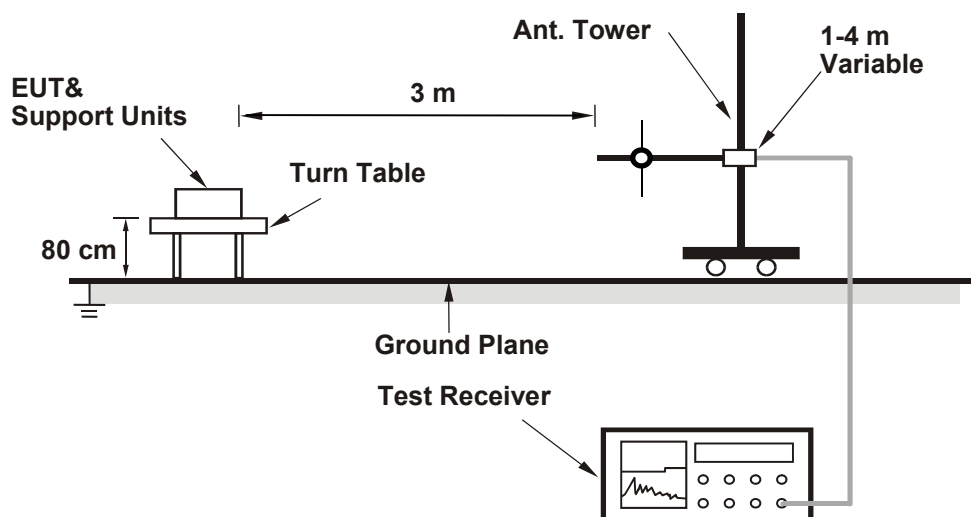
6.5.2 Test Procedure

- Measurement refer to ANSI C63.26 section 5.7.
- All measurements were done at 3 channels: low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. 20 dB attenuation pad is connected with spectrum.
- The fundamental frequency above 1 GHz, the spectrum set RBW = 1 MHz, VBW = 3 MHz, Detector = Average.
- The fundamental frequency below 1 GHz, the spectrum set RBW $\geq$ 100 kHz, VBW $\geq$ 3 x RBW, Detector = Average.
- Measuring frequency band edge, narrow RBW (no less than 1% of the OBW) is used for conducted emission measurement.

6.6 Radiated Spurious Emissions below 1GHz

6.6.1 Test Setup

For radiated emission 30 MHz to 1 GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.6.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

- In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- Following C63.26 section 5.5 and 5.2.7
- $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
- $ERP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8 - 2.15$; where D is the measurement distance (in the far field region) in m.

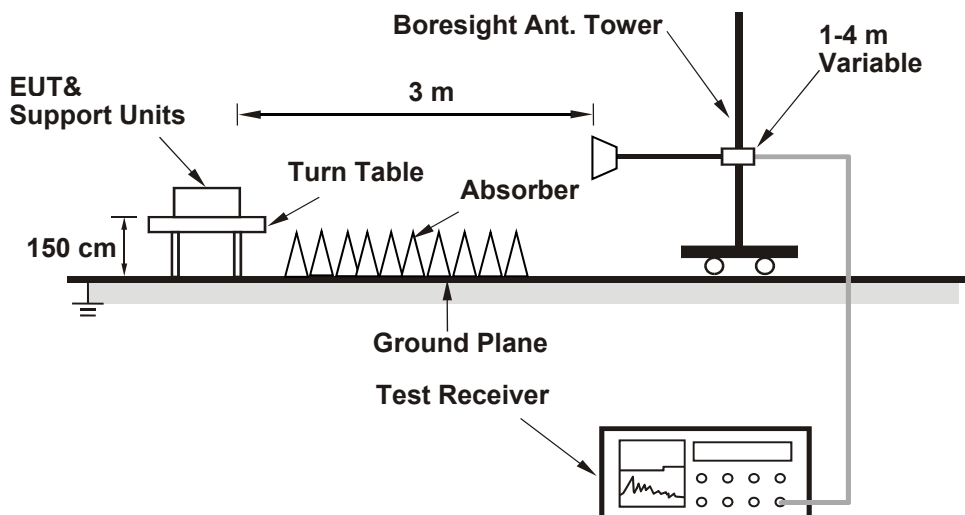
Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz.
- The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

6.7 Radiated Spurious Emissions above 1GHz

6.7.1 Test Setup

For radiated emission above 1 GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.7.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

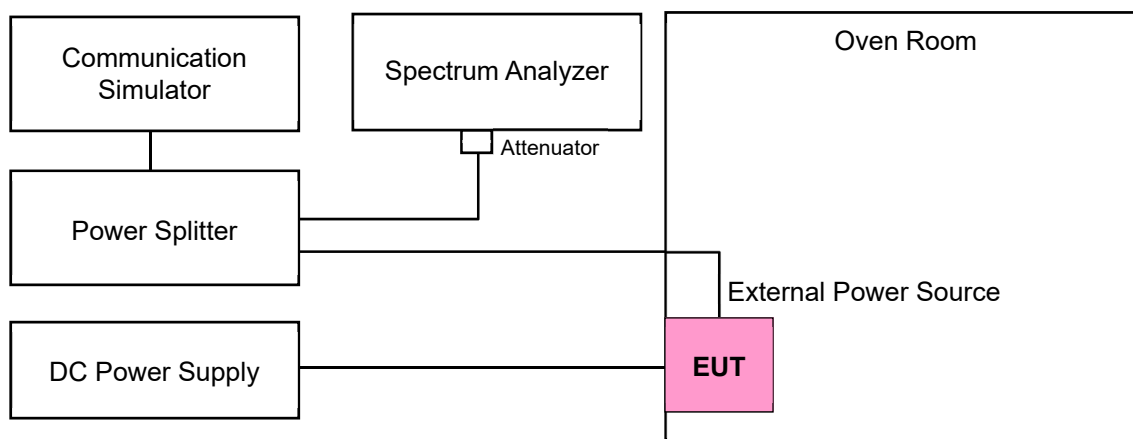
- In the semi-anechoic chamber, EUT placed on the 1.5 m height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- Following C63.26 section 5.5 and 5.2.7
- $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
- $ERP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8 - 2.15$; where D is the measurement distance (in the far field region) in m.

Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz.

6.8 Frequency Stability

6.8.1 Test Setup



6.8.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Note: The frequency error was recorded frequency error from the communication simulator.

7 Test Results of Test Item

7.1 Maximum EIRP

Input Power:	3.85 Vdc	Environmental Conditions:	22°C, 73% RH	Tested By:	Willy Cheng
--------------	----------	---------------------------	--------------	------------	-------------

7.1.1 NR n77 SCS 30 kHz

Conducted Output Power (dBm)

NR Band 77						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		640000	641670	643342
		Frequency (MHz)		3600	3625.05	3650.13
50M	DFT-S PI/2 BPSK	1	1	21.69	21.61	21.70
50M	DFT-S QPSK	1	1	21.50	21.96	21.54
		1	67	21.61	21.66	21.67
		1	131	21.57	21.61	21.54
		64	0	20.53	20.55	20.70
		64	35	21.50	21.87	21.55
		64	69	20.55	20.55	20.53
		128	0	20.64	20.94	20.68
50M	DFT-S 16QAM	1	1	20.62	20.57	20.50
50M	DFT-S 64QAM	1	1	19.19	19.11	19.17
50M	DFT-S 256QAM	1	1	17.07	17.05	17.18
50M	CP QPSK	1	1	20.18	20.14	20.12
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		639668	641670	643674
		Frequency (MHz)		3595.02	3625.05	3655.11
40M	DFT-S PI/2 BPSK	1	1	21.64	21.52	21.58
40M	DFT-S QPSK	1	1	21.59	21.59	21.61
		1	53	21.67	21.65	21.51
		1	104	21.69	21.60	21.59
		50	0	20.59	20.68	20.61
		50	28	21.66	21.68	21.64
		50	56	20.60	20.52	20.51
		100	0	20.65	20.62	20.50
40M	DFT-S 16QAM	1	1	20.57	20.65	20.66
40M	DFT-S 64QAM	1	1	19.06	19.14	19.07
40M	DFT-S 256QAM	1	1	17.11	17.15	17.14
40M	CP QPSK	1	1	20.02	20.06	20.00

NR Band 77						
BW	MCS Index	Channel		639000	641670	644342
		Frequency (MHz)		3585	3625.05	3665.13
20M	DFT-S PI/2 BPSK	1	1	21.60	21.66	21.70
20M	DFT-S QPSK	1	1	21.55	21.51	21.56
		1	26	21.69	21.68	21.64
		1	49	21.62	21.62	21.53
		25	0	20.63	20.64	20.50
		25	13	21.63	21.69	21.59
		25	26	20.59	20.55	20.56
		50	0	20.52	20.69	20.50
20M	DFT-S 16QAM	1	1	20.69	20.63	20.67
20M	DFT-S 64QAM	1	1	19.08	19.13	19.15
20M	DFT-S 256QAM	1	1	17.00	17.11	17.05
20M	CP QPSK	1	1	20.01	20.18	20.14

Maximum EIRP (dBm)

NR Band 77						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		640000	641670	643342
		Frequency (MHz)		3600	3625.05	3650.13
50M	DFT-S PI/2 BPSK	1	1	20.55	20.47	20.56
50M	DFT-S QPSK	1	1	20.36	20.82	20.40
		1	67	20.47	20.52	20.53
		1	131	20.43	20.47	20.40
		64	0	19.39	19.41	19.56
		64	35	20.36	20.73	20.41
		64	69	19.41	19.41	19.39
		128	0	19.50	19.80	19.54
50M	DFT-S 16QAM	1	1	19.48	19.43	19.36
50M	DFT-S 64QAM	1	1	18.05	17.97	18.03
50M	DFT-S 256QAM	1	1	15.93	15.91	16.04
50M	CP QPSK	1	1	19.04	19.00	18.98
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		639668	641670	643674
		Frequency (MHz)		3595.02	3625.05	3655.11
40M	DFT-S PI/2 BPSK	1	1	20.50	20.38	20.44
40M	DFT-S QPSK	1	1	20.45	20.45	20.47
		1	53	20.53	20.51	20.37
		1	104	20.55	20.46	20.45
		50	0	19.45	19.54	19.47
		50	28	20.52	20.54	20.50
		50	56	19.46	19.38	19.37
		100	0	19.51	19.48	19.36
40M	DFT-S 16QAM	1	1	19.43	19.51	19.52
40M	DFT-S 64QAM	1	1	17.92	18.00	17.93
40M	DFT-S 256QAM	1	1	15.97	16.01	16.00
40M	CP QPSK	1	1	18.88	18.92	18.86

*EIRP (dBm) = Conducted Output Power (dBm/10MHz) + Antenna Gain (dBi).

NR Band 77						
BW	MCS Index	Channel		639000	641670	644342
		Frequency (MHz)		3585	3625.05	3665.13
20M	DFT-S PI/2 BPSK	1	1	20.46	20.52	20.56
20M	DFT-S QPSK	1	1	20.41	20.37	20.42
		1	26	20.55	20.54	20.50
		1	49	20.48	20.48	20.39
		25	0	19.49	19.50	19.36
		25	13	20.49	20.55	20.45
		25	26	19.45	19.41	19.42
		50	0	19.38	19.55	19.36
20M	DFT-S 16QAM	1	1	19.55	19.49	19.53
20M	DFT-S 64QAM	1	1	17.94	17.99	18.01
20M	DFT-S 256QAM	1	1	15.86	15.97	15.91
20M	CP QPSK	1	1	18.87	19.04	19.00

*EIRP (dBm) = Conducted Output Power (dBm/10MHz) + Antenna Gain (dBi).

7.1.2 NR n78 SCS 30 kHz

Conducted Output Power (dBm)

NR Band 78						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		640400	641300	642200
		Frequency (MHz)		3606	3619.5	3633
60M	DFT-S PI/2 BPSK	1	1	21.62	21.68	21.51
60M	DFT-S QPSK	1	1	21.61	21.93	21.64
		1	81	21.64	21.62	21.56
		1	160	21.58	21.51	21.61
		81	0	20.60	20.59	20.62
		81	41	21.68	21.82	21.66
		81	81	20.66	20.58	20.56
		162	0	20.64	20.85	20.58
60M	DFT-S 16QAM	1	1	20.70	20.55	20.61
60M	DFT-S 64QAM	1	1	19.15	19.17	19.00
60M	DFT-S 256QAM	1	1	17.05	17.00	17.05
60M	CP QPSK	1	1	20.09	20.00	20.12
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		640068	641300	642532
		Frequency (MHz)		3601.02	3619.5	3637.98
50M	DFT-S PI/2 BPSK	1	1	21.58	21.50	21.56
50M	DFT-S QPSK	1	1	21.55	21.53	21.62
		1	67	21.55	21.56	21.54
		1	131	21.53	21.57	21.64
		64	0	20.66	20.50	20.60
		64	35	21.50	21.52	21.64
		64	69	20.54	20.51	20.67
		128	0	20.65	20.67	20.56
50M	DFT-S 16QAM	1	1	20.52	20.53	20.60
50M	DFT-S 64QAM	1	1	19.16	19.18	19.16
50M	DFT-S 256QAM	1	1	17.01	17.13	17.00
50M	CP QPSK	1	1	20.00	20.11	20.19

NR Band 78						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		639734	641300	642866
		Frequency (MHz)		3596.01	3619.5	3642.99
40M	DFT-S PI/2 BPSK	1	1	21.67	21.51	21.53
40M	DFT-S QPSK	1	1	21.56	21.66	21.61
		1	53	21.65	21.58	21.52
		1	104	21.58	21.63	21.54
		50	0	20.56	20.51	20.65
		50	28	21.63	21.68	21.63
		50	56	20.60	20.67	20.59
		100	0	20.58	20.53	20.62
40M	DFT-S 16QAM	1	1	20.59	20.54	20.64
40M	DFT-S 64QAM	1	1	19.10	19.02	19.05
40M	DFT-S 256QAM	1	1	17.19	17.05	17.08
40M	CP QPSK	1	1	20.00	20.09	20.16
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		637168	643166	646166
		Frequency (MHz)		3557.52	3647.49	3692.49
30M	DFT-S PI/2 BPSK	1	1	21.52	21.64	21.46
30M	DFT-S QPSK	1	1	21.58	21.9	21.59
		1	53	21.63	21.6	21.53
		1	104	21.53	21.51	21.53
		50	0	20.59	20.51	20.52
		50	28	21.63	21.73	21.66
		50	56	20.63	20.58	20.56
		100	0	20.57	20.82	20.58
30M	DFT-S 16QAM	1	1	20.64	20.49	20.56
30M	DFT-S 64QAM	1	1	19.14	19.14	18.9
30M	DFT-S 256QAM	1	1	17	16.91	17.03
30M	CP QPSK	1	1	19.99	19.96	20.02

NR Band 78						
BW	MCS Index	Channel		639068	641300	643532
		Frequency (MHz)		3586.02	3619.5	3652.98
20M	DFT-S PI/2 BPSK	1	1	21.63	21.59	21.52
20M	DFT-S QPSK	1	1	21.67	21.53	21.60
		1	26	21.53	21.68	21.65
		1	49	21.67	21.67	21.55
		25	0	20.59	20.54	20.50
		25	13	21.53	21.62	21.50
		25	26	20.50	20.50	20.58
		50	0	20.56	20.70	20.58
20M	DFT-S 16QAM	1	1	20.70	20.65	20.65
20M	DFT-S 64QAM	1	1	19.11	19.20	19.14
20M	DFT-S 256QAM	1	1	17.11	17.19	17.03
20M	CP QPSK	1	1	20.16	20.16	20.08

Maximum EIRP (dBm)

NR Band 78						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		640400	641300	642200
		Frequency (MHz)		3606	3619.5	3633
60M	DFT-S PI/2 BPSK	1	1	20.48	20.54	20.37
60M	DFT-S QPSK	1	1	20.47	20.79	20.50
		1	81	20.50	20.48	20.42
		1	160	20.44	20.37	20.47
		81	0	19.46	19.45	19.48
		81	41	20.54	20.68	20.52
		81	81	19.52	19.44	19.42
		162	0	19.50	19.71	19.44
60M	DFT-S 16QAM	1	1	19.56	19.41	19.47
60M	DFT-S 64QAM	1	1	18.01	18.03	17.86
60M	DFT-S 256QAM	1	1	15.91	15.86	15.91
60M	CP QPSK	1	1	18.95	18.86	18.98
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		640068	641300	642532
		Frequency (MHz)		3601.02	3619.5	3637.98
50M	DFT-S PI/2 BPSK	1	1	20.44	20.36	20.42
50M	DFT-S QPSK	1	1	20.41	20.39	20.48
		1	67	20.41	20.42	20.40
		1	131	20.39	20.43	20.50
		64	0	19.52	19.36	19.46
		64	35	20.36	20.38	20.50
		64	69	19.40	19.37	19.53
		128	0	19.51	19.53	19.42
50M	DFT-S 16QAM	1	1	19.38	19.39	19.46
50M	DFT-S 64QAM	1	1	18.02	18.04	18.02
50M	DFT-S 256QAM	1	1	15.87	15.99	15.86
50M	CP QPSK	1	1	18.86	18.97	19.05

*EIRP (dBm) = Conducted Output Power (dBm/10MHz) + Antenna Gain (dBi).

NR Band 78						
BW	MCS Index	RB Size	RB Offset	Low	Mid	High
		Channel		639734	641300	642866
		Frequency (MHz)		3596.01	3619.5	3642.99
40M	DFT-S PI/2 BPSK	1	1	20.53	20.37	20.39
40M	DFT-S QPSK	1	1	20.42	20.52	20.47
		1	53	20.51	20.44	20.38
		1	104	20.44	20.49	20.40
		50	0	19.42	19.37	19.51
		50	28	20.49	20.54	20.49
		50	56	19.46	19.53	19.45
		100	0	19.44	19.39	19.48
40M	DFT-S 16QAM	1	1	19.45	19.40	19.50
40M	DFT-S 64QAM	1	1	17.96	17.88	17.91
40M	DFT-S 256QAM	1	1	16.05	15.91	15.94
40M	CP QPSK	1	1	18.86	18.95	19.02
BW	MCS Index	Channel		637168	643166	646166
		Frequency (MHz)		3557.52	3647.49	3692.49
30M	DFT-S PI/2 BPSK	1	1	20.38	20.50	20.32
30M	DFT-S QPSK	1	1	20.44	20.76	20.45
		1	26	20.49	20.46	20.39
		1	49	20.39	20.37	20.39
		25	0	19.45	19.37	19.38
		25	13	20.49	20.59	20.52
		25	26	19.49	19.44	19.42
		50	0	19.43	19.68	19.44
30M	DFT-S 16QAM	1	1	19.50	19.35	19.42
30M	DFT-S 64QAM	1	1	18.00	18.00	17.76
30M	DFT-S 256QAM	1	1	15.86	15.77	15.89
30M	CP QPSK	1	1	18.85	18.82	18.88

*EIRP (dBm) = Conducted Output Power (dBm/10MHz) + Antenna Gain (dBi).

NR Band 78						
BW	MCS Index	Channel		639068	641300	643532
		Frequency (MHz)		3586.02	3619.5	3652.98
20M	DFT-S PI/2 BPSK	1	1	20.49	20.45	20.38
20M	DFT-S QPSK	1	1	20.53	20.39	20.46
		1	26	20.39	20.54	20.51
		1	49	20.53	20.53	20.41
		25	0	19.45	19.40	19.36
		25	13	20.39	20.48	20.36
		25	26	19.36	19.36	19.44
		50	0	19.42	19.56	19.44
20M	DFT-S 16QAM	1	1	19.56	19.51	19.51
20M	DFT-S 64QAM	1	1	17.97	18.06	18.00
20M	DFT-S 256QAM	1	1	15.97	16.05	15.89
20M	CP QPSK	1	1	19.02	19.02	18.94

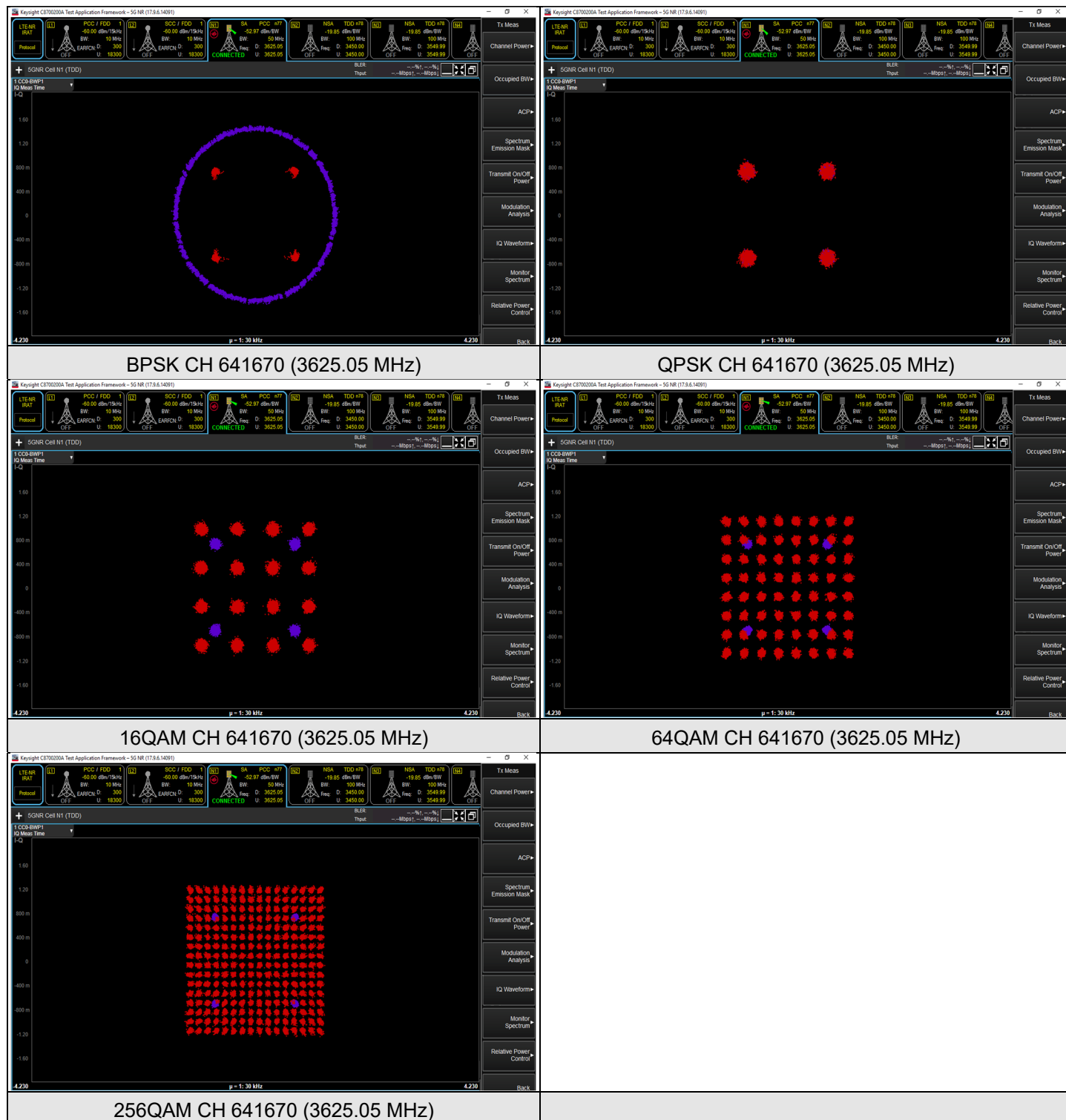
*EIRP (dBm) = Conducted Output Power (dBm/10MHz) + Antenna Gain (dBi).

7.2 Modulation Characteristics

Input Power:	3.85 Vdc	Environmental Conditions:	25°C, 66% RH	Tested By:	Noah Chang
--------------	----------	---------------------------	--------------	------------	------------

7.2.1 NR n77 SCS 30 kHz

NR n77 SCS 30 kHz, Channel Bandwidth: 50 MHz



7.3 Peak to Average Ratio

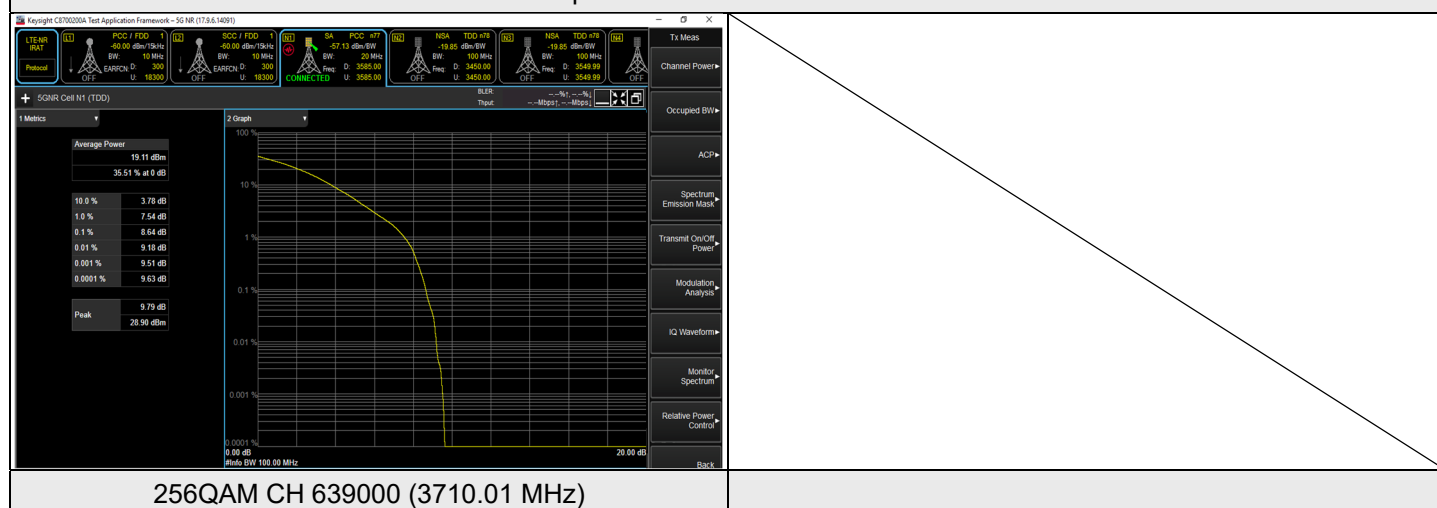
Input Power:	3.85 Vdc	Environmental Conditions:	25°C, 66% RH	Tested By:	Noah Chang
--------------	----------	---------------------------	--------------	------------	------------

7.3.1 NR n77 SCS 30 kHz

NR n77 SCS 30 kHz, Channel Bandwidth: 20 MHz

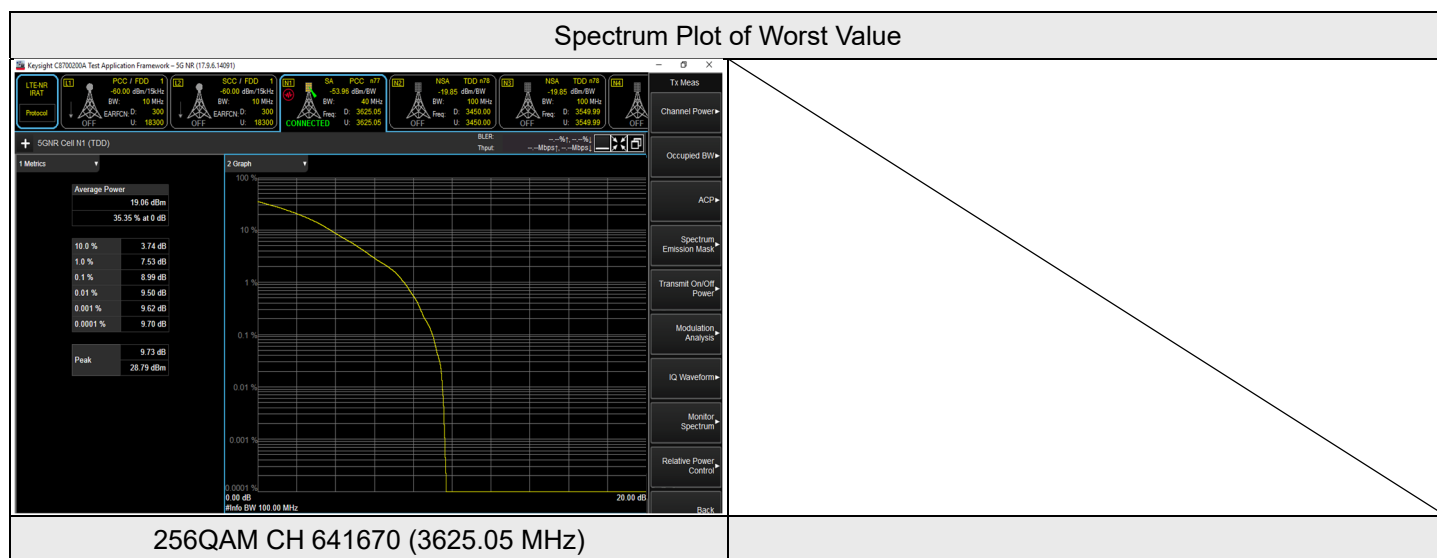
NR n77 SCS 30 kHz (3575~3675.13 MHz) 20M					
Modulation	RB Size	RB Offset	Peak To Average Ratio (dB)		
			CH 639000	CH 641670	CH 644342
			3710.01 MHz	3840 MHz	3969.99 MHz
BPSK	1	50	4.87	4.68	4.63
	1	0	4.99	4.71	4.72
	50	0	4.97	4.67	4.6
QPSK	1	50	7.44	7.6	7.55
	1	0	7.52	7.64	7.63
	51	0	7.46	7.55	7.56
16QAM	1	50	7.7	7.71	7.78
	1	0	7.8	7.73	7.9
	51	0	7.72	7.72	7.81
64QAM	1	50	7.57	7.55	7.58
	1	0	7.61	7.66	7.67
	51	0	7.58	7.61	7.65
256QAM	1	50	8.52	8.5	8.44
	1	0	8.64	8.56	8.48
	51	0	8.56	8.43	8.45

Spectrum Plot of Worst Value



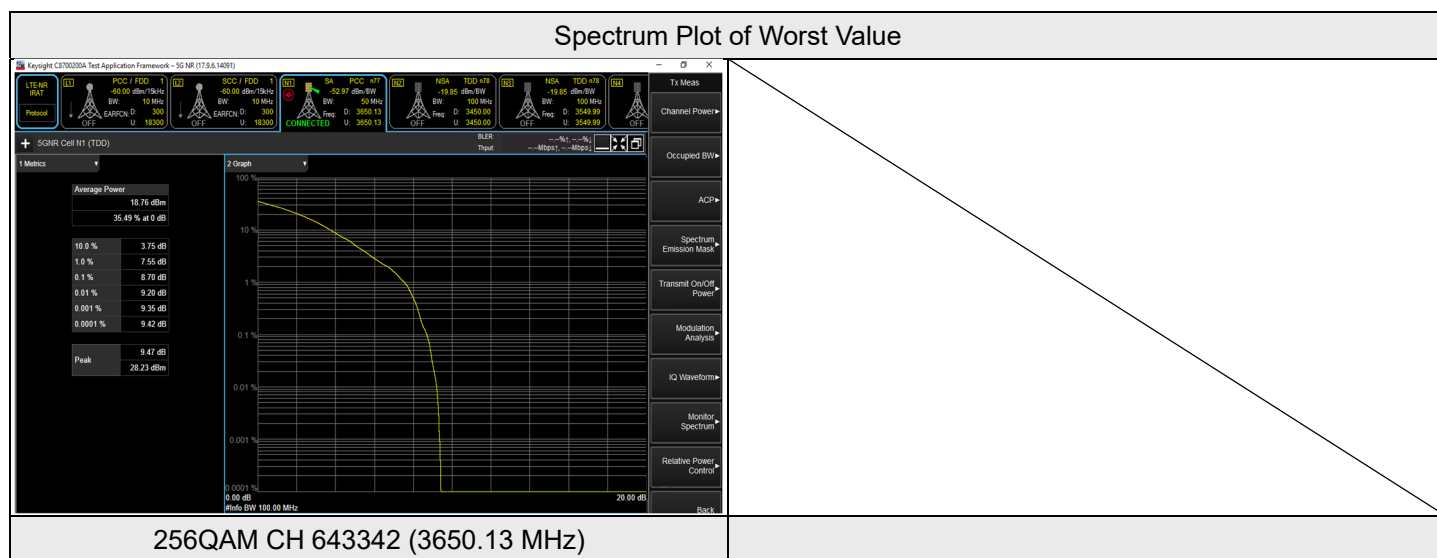
NR n77 SCS 30 kHz, Channel Bandwidth: 40 MHz

NR n77 SCS 30 kHz (3575~3675.13 MHz) 40M					
Modulation	RB Size	RB Offset	Peak To Average Ratio (dB)		
			CH 639668	CH 641670	CH 643674
			3595.02 MHz	3625.05 MHz	3655.11 MHz
BPSK	1	105	4.18	4.28	4.45
	1	0	4.19	4.29	4.54
	100	0	4.16	4.21	4.43
QPSK	1	105	7.93	7.42	7.8
	1	0	7.94	7.52	7.88
	106	0	7.88	7.39	7.78
16QAM	1	105	8.34	7.45	8
	1	0	8.36	7.54	8.07
	106	0	8.31	7.45	8.03
64QAM	1	105	7.3	7.26	7.65
	1	0	7.35	7.37	7.73
	106	0	7.23	7.32	7.67
256QAM	1	105	8.61	8.92	8.88
	1	0	8.71	8.99	8.92
	106	0	8.63	8.98	8.84



NR n77 SCS 30 kHz, Channel Bandwidth: 50 MHz

NR n77 SCS 30 kHz (3575~3675.13 MHz) 50M					
Modulation	RB Size	RB Offset	Peak To Average Ratio (dB)		
			CH 640000	CH 641670	CH 643342
			3600 MHz	3625.05 MHz	3650.13 MHz
BPSK	1	132	4.46	4.4	4.45
	1	0	4.5	4.52	4.5
	128	0	4.41	4.42	4.43
QPSK	1	132	7.66	7.52	7.9
	1	0	7.76	7.65	7.95
	133	0	7.7	7.54	7.88
16QAM	1	132	8.05	7.78	8
	1	0	8.12	7.84	8.03
	133	0	8.06	7.8	7.93
64QAM	1	132	7.62	7.49	7.5
	1	0	7.68	7.6	7.63
	133	0	7.65	7.57	7.61
256QAM	1	132	8.62	8.53	8.61
	1	0	8.66	8.56	8.7
	133	0	8.65	8.51	8.66

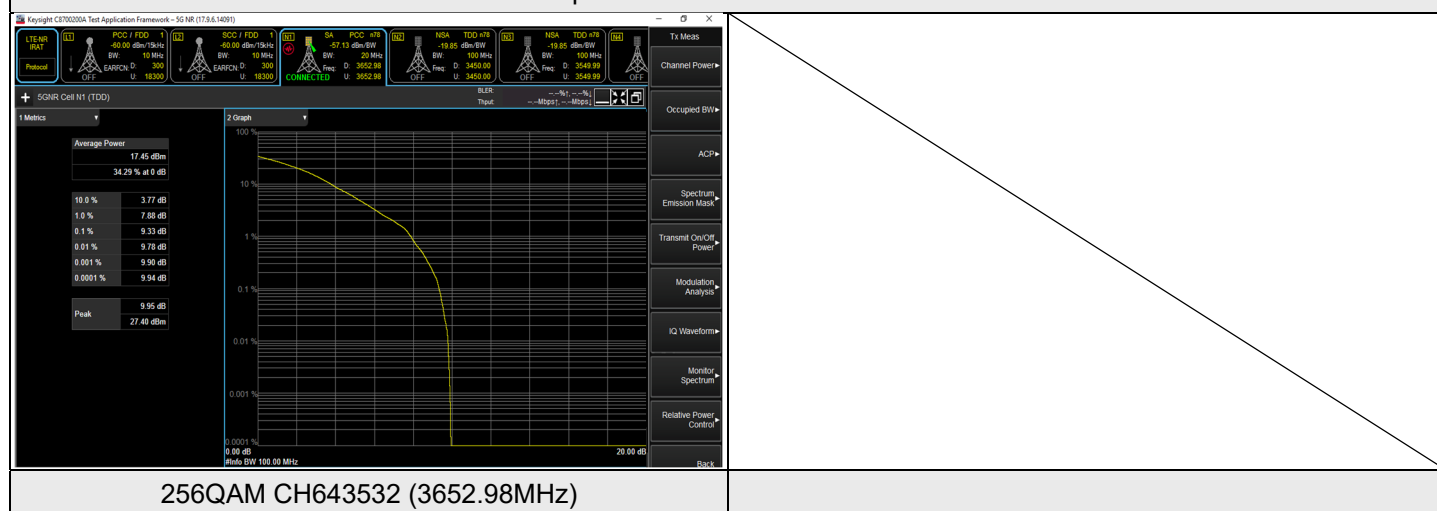


7.3.2 NR n78 SCS 30 kHz

NR n78 SCS 30 kHz, Channel Bandwidth: 20 MHz

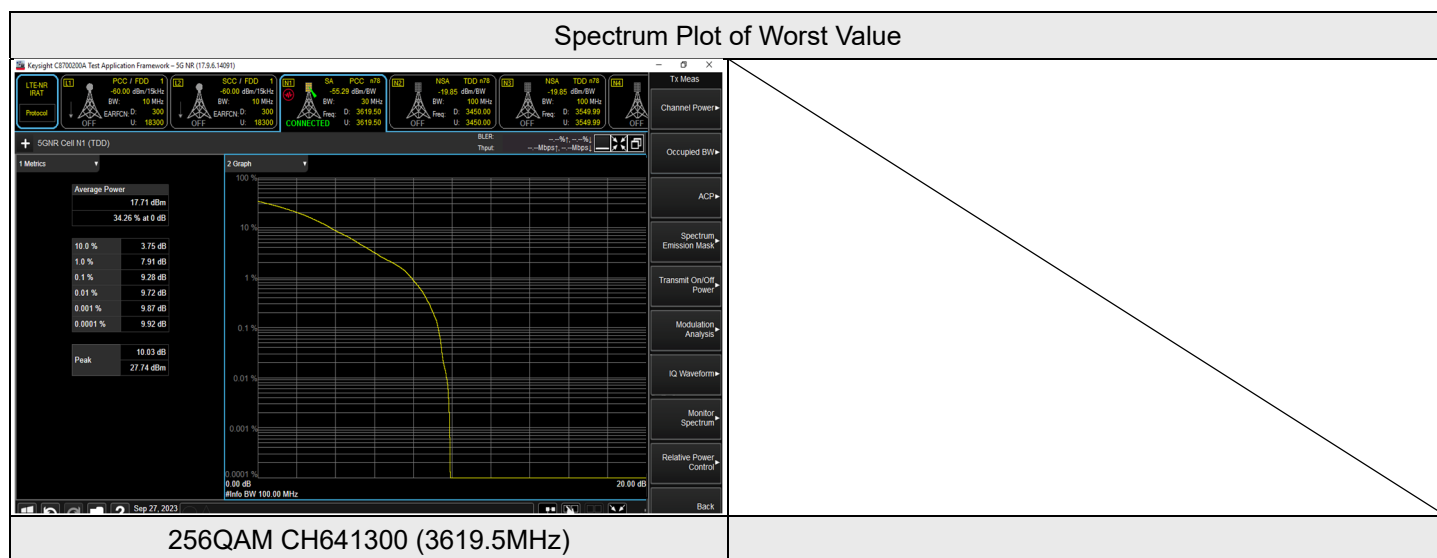
NR n78 SCS 30 kHz 20M (3576~3663MHz)					
Modulation	RB Size	RB Offset	Peak To Average Ratio (dB)		
			CH 639068	CH 641300	CH 643532
			3586.02 MHz	3619.5 MHz	3652.98 MHz
BPSK	1	50	4.92	4.96	4.18
	1	0	5.04	5.04	4.3
	50	0	4.99	5.01	4.23
QPSK	1	50	7.62	7.94	7.66
	1	0	7.68	8.01	7.79
	51	0	7.65	7.89	7.72
16QAM	1	50	7.88	7.78	7.8
	1	0	7.91	7.9	7.91
	51	0	7.86	7.87	7.85
64QAM	1	50	7.61	7.65	7.91
	1	0	7.73	7.76	7.95
	51	0	7.62	7.62	7.83
256QAM	1	50	9.14	9.02	9.27
	1	0	9.22	9.15	9.33
	51	0	9.19	9.08	9.3

Spectrum Plot of Worst Value



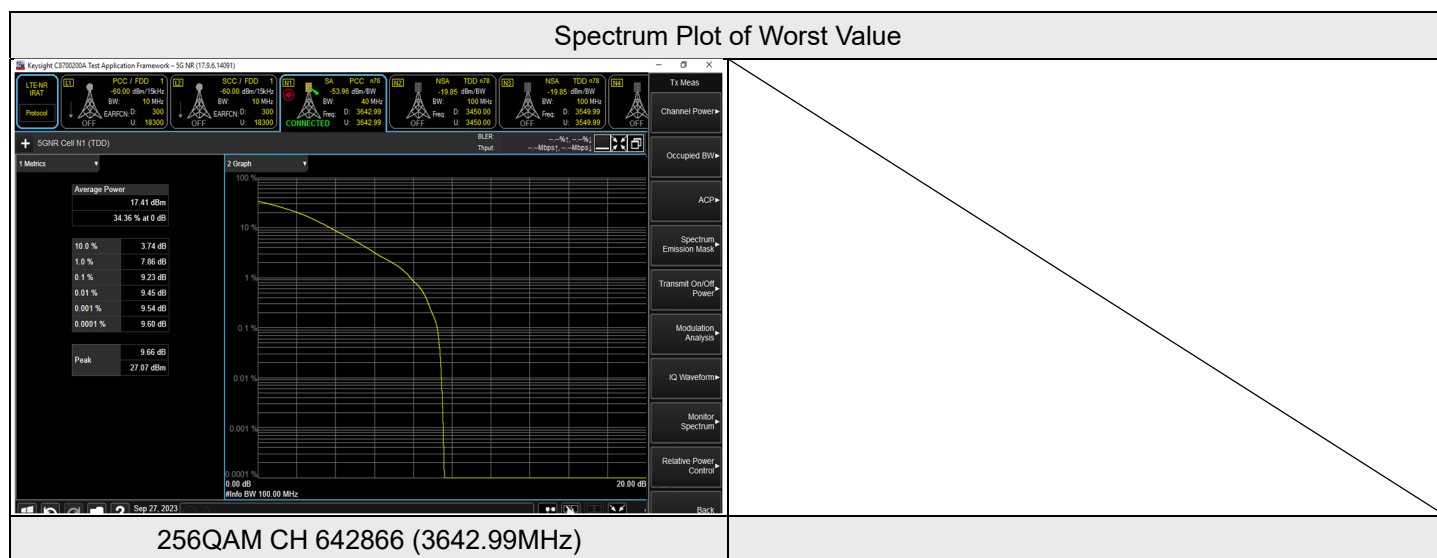
NR n78 SCS 30 kHz, Channel Bandwidth: 30 MHz

NR n78 SCS 30 kHz 30M (3576~3663MHz)					
Modulation	RB Size	RB Offset	Peak To Average Ratio (dB)		
			CH 639400	CH 641300	CH 643200
			3591 MHz	3619.5 MHz	3648MHz
BPSK	1	77	4.96	4.87	4.19
	1	0	5.06	4.96	4.32
	75	0	4.93	4.9	4.29
QPSK	1	77	7.71	7.61	7.8
	1	0	7.82	7.64	7.93
	78	0	7.77	7.61	7.87
16QAM	1	77	7.79	7.6	7.99
	1	0	7.89	7.71	8.06
	78	0	7.77	7.69	7.93
64QAM	1	77	7.78	7.58	7.67
	1	0	7.85	7.72	7.8
	78	0	7.74	7.63	7.76
256QAM	1	77	9.15	9.15	9.1
	1	0	9.25	9.28	9.17
	78	0	9.16	9.21	9.07



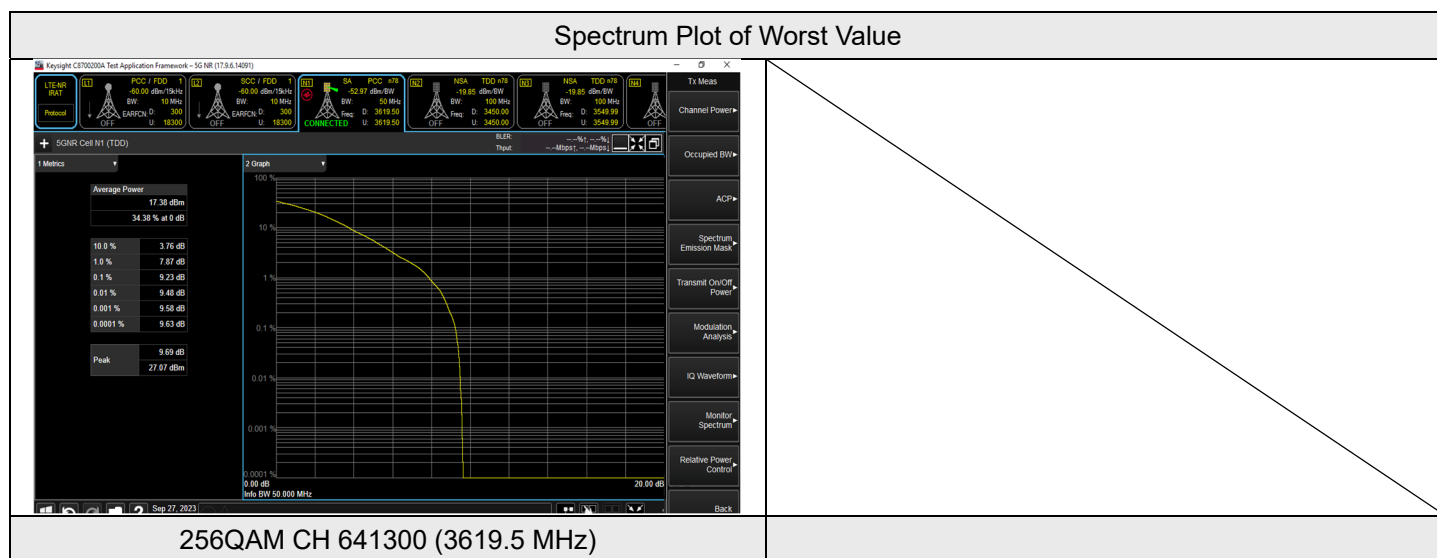
NR n78 SCS 30 kHz, Channel Bandwidth: 40 MHz

NR n78CS 30 kHz 40M(3576~3663MHz)					
Modulation	RB Size	RB Offset	Peak To Average Ratio (dB)		
			CH 639734	CH 641300	CH 642866
			3596.01MHz	3619.5MHz	3642.99MHz
BPSK	1	105	4.18	4.88	4.96
	1	0	4.2	5	5.02
	100	0	4.09	4.98	4.98
QPSK	1	105	7.9	7.71	8.33
	1	0	8.01	7.77	8.41
	106	0	7.98	7.69	8.39
16QAM	1	105	8.14	7.68	8.62
	1	0	8.24	7.78	8.63
	106	0	8.16	7.66	8.52
64QAM	1	105	7.39	7.72	8.23
	1	0	7.49	7.73	8.27
	106	0	7.42	7.66	8.14
256QAM	1	105	9.08	9.03	9.11
	1	0	9.14	9.12	9.23
	106	0	9.03	9.07	9.1



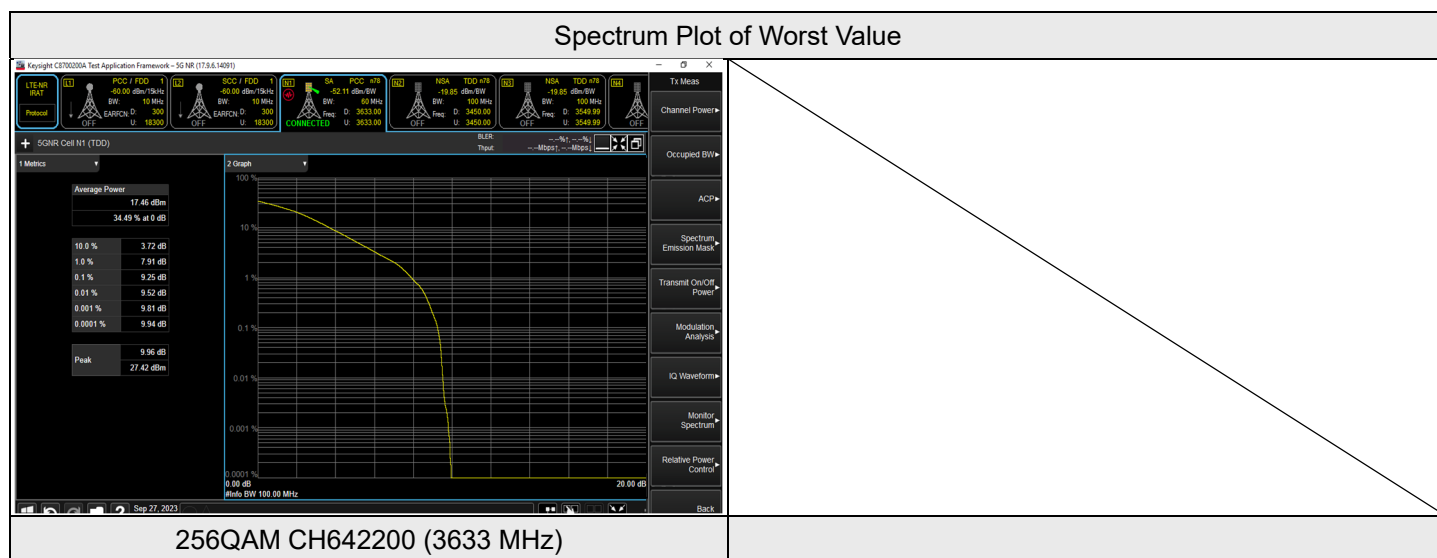
NR n78 SCS 30 kHz, Channel Bandwidth: 50 MHz

NR n78CS 30 kHz 50M(3576~3663MHz)					
Modulation	RB Size	RB Offset	Peak To Average Ratio (dB)		
			CH 640068	CH 641300	CH 642532
			3601.02 MHz	3619.5 MHz	3637.98 MHz
BPSK	1	132	4.49	4.58	4.01
	1	0	4.62	4.69	4.09
	128	0	4.53	4.6	4.01
QPSK	1	132	7.55	7.98	7.57
	1	0	7.64	8.11	7.7
	133	0	7.6	8.04	7.66
16QAM	1	132	8.04	8.32	7.99
	1	0	8.12	8.33	8.02
	133	0	8.05	8.28	7.97
64QAM	1	132	7.9	7.82	7.85
	1	0	7.91	7.91	7.89
	133	0	7.83	7.86	7.76
256QAM	1	132	9.17	9.13	9.04
	1	0	9.2	9.23	9.07
	133	0	9.08	9.12	9.06



NR n78 SCS 30 kHz, Channel Bandwidth: 60 MHz

NR n78CS 30 kHz 60M(3576~3663MHz)					
Modulation	RB Size	RB Offset	Peak To Average Ratio (dB)		
			CH 640400	CH 641300	CH 642200
			3606 MHz	3619.5 MHz	3633 MHz
BPSK	1	161	4.8	4.8	4.93
	1	0	4.88	4.83	5.05
	162	0	4.82	4.77	5.01
QPSK	1	161	7.81	7.74	7.48
	1	0	7.9	7.79	7.6
	162	0	7.81	7.67	7.53
16QAM	1	161	7.82	7.86	7.9
	1	0	7.86	7.94	7.98
	162	0	7.74	7.92	7.85
64QAM	1	161	7.64	7.74	7.89
	1	0	7.74	7.76	7.91
	162	0	7.71	7.65	7.89
256QAM	1	161	9.1	9.08	9.17
	1	0	9.17	9.11	9.25
	162	0	9.15	9.03	9.2



7.4 Bandwidth

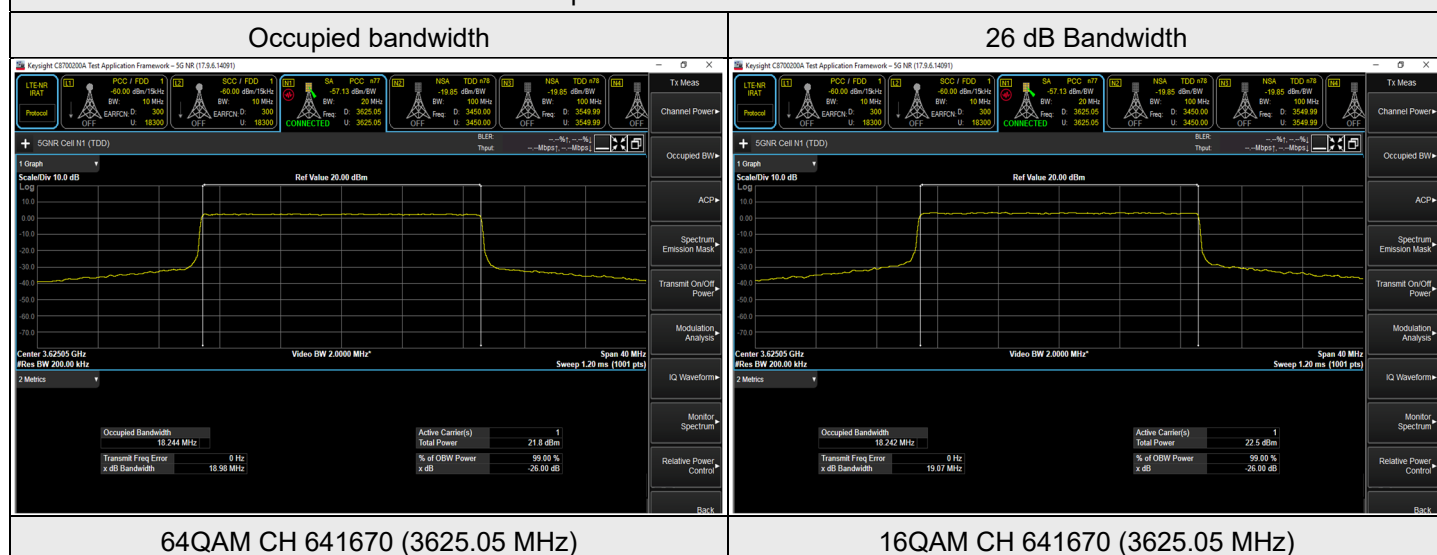
Input Power:	3.85 Vdc	Environmental Conditions:	25°C, 66% RH	Tested By:	Noah Chang
--------------	----------	---------------------------	--------------	------------	------------

7.4.1 NR n77 SCS 30 kHz

NR n77 SCS 30 kHz, Channel Bandwidth: 20 MHz

NR n77 SCS 30 kHz (3550-3700 MHz) 20M				
Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
BPSK	639000	3585	18.022	18.59
BPSK	641670	3625.05	18.024	18.60
BPSK	644342	3665.13	18.039	18.60
QPSK	639000	3585	18.196	18.93
QPSK	641670	3625.05	18.196	19.05
QPSK	644342	3665.13	18.194	19.03
16QAM	639000	3585	18.240	19.06
16QAM	641670	3625.05	18.242	19.07
16QAM	644342	3665.13	18.240	19.01
64QAM	639000	3585	18.242	19.00
64QAM	641670	3625.05	18.244	18.98
64QAM	644342	3665.13	18.195	18.93
256QAM	639000	3585	18.240	18.98
256QAM	641670	3625.05	18.199	18.96
256QAM	644342	3665.13	18.199	18.96

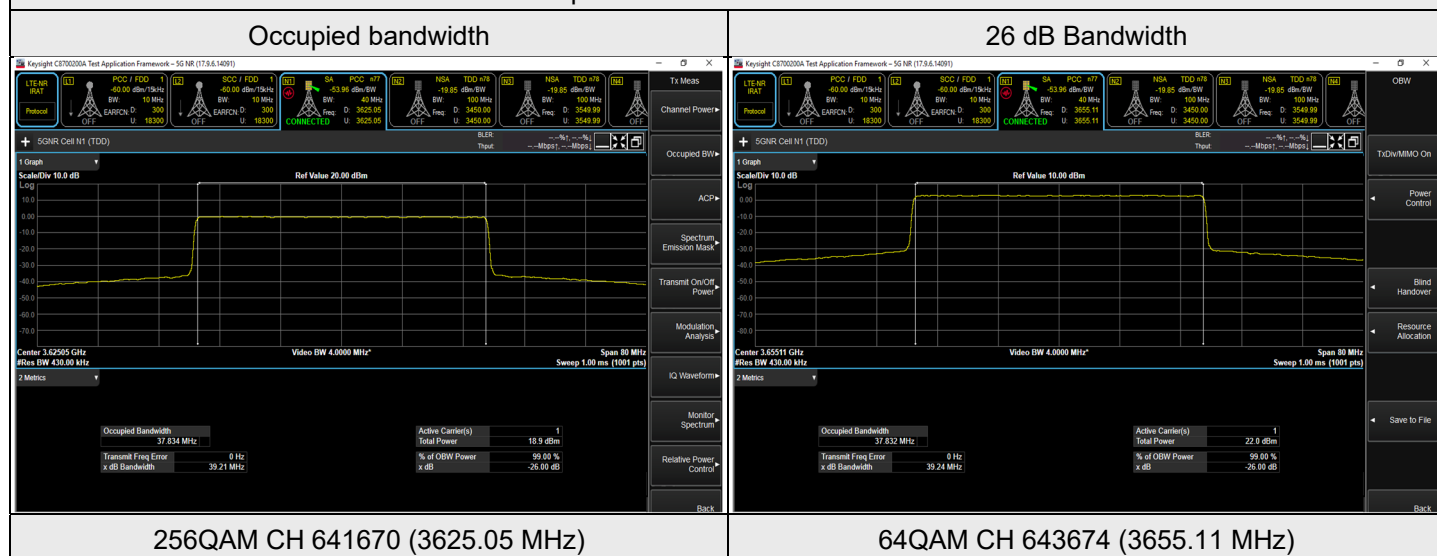
Spectrum Plot of Worst Value



NR n77 SCS 30 kHz, Channel Bandwidth: 40 MHz

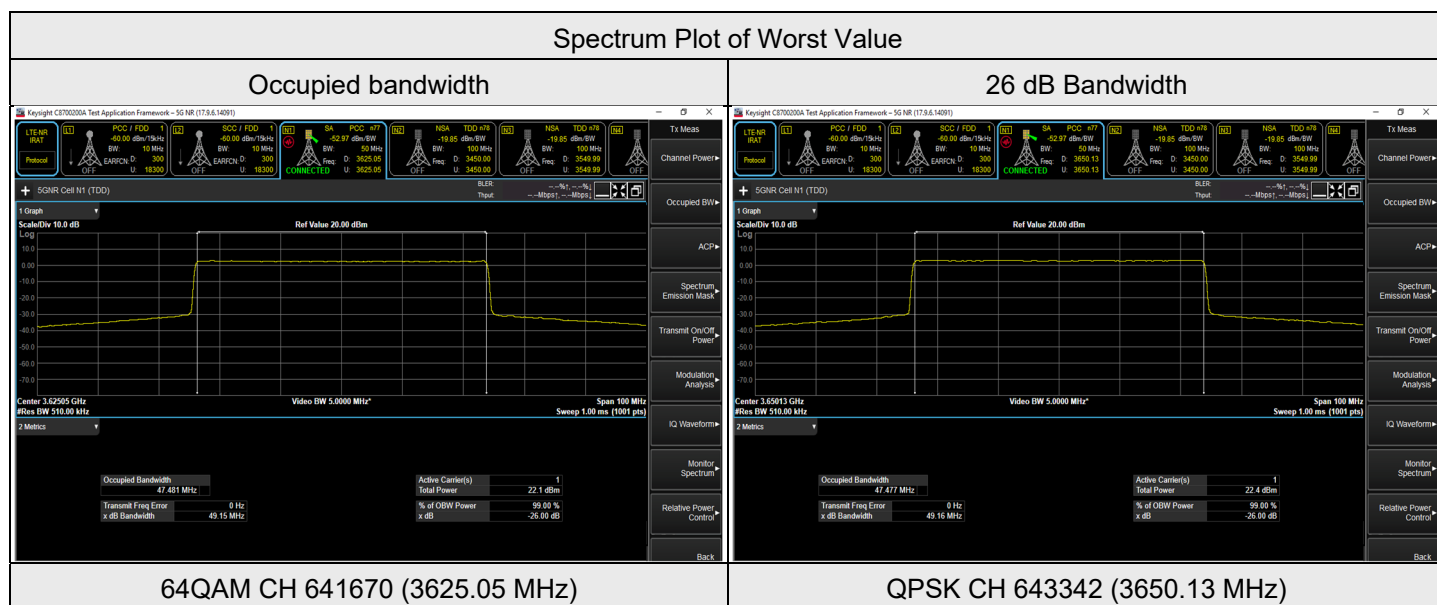
NR n77 SCS 30 kHz (3550-3700 MHz) 40M				
Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
BPSK	639668	3595.02	37.495	37.05
BPSK	641670	3625.05	37.501	37.05
BPSK	643674	3655.11	37.491	37.04
QPSK	639668	3595.02	37.828	39.23
QPSK	641670	3625.05	37.832	39.23
QPSK	643674	3655.11	37.833	39.23
16QAM	639668	3595.02	37.821	39.19
16QAM	641670	3625.05	37.822	39.21
16QAM	643674	3655.11	37.826	39.22
64QAM	639668	3595.02	37.828	39.24
64QAM	641670	3625.05	37.831	39.22
64QAM	643674	3655.11	37.832	39.24
256QAM	639668	3595.02	37.833	39.21
256QAM	641670	3625.05	37.834	39.21
256QAM	643674	3655.11	37.829	39.20

Spectrum Plot of Worst Value



NR n77 SCS 30 kHz, Channel Bandwidth: 50 MHz

NR n77 SCS 30 kHz (3550-3700 MHz) 50M				
Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
BPSK	640000	3600	47.046	47.31
BPSK	641670	3625.05	47.056	47.31
BPSK	643342	3650.13	47.035	47.30
QPSK	640000	3600	47.469	49.13
QPSK	641670	3625.05	47.474	49.14
QPSK	643342	3650.13	47.477	49.16
16QAM	640000	3600	47.466	49.13
16QAM	641670	3625.05	47.474	49.13
16QAM	643342	3650.13	47.473	49.15
64QAM	640000	3600	47.467	49.14
64QAM	641670	3625.05	47.481	49.15
64QAM	643342	3650.13	47.469	49.13
256QAM	640000	3600	47.475	49.13
256QAM	641670	3625.05	47.480	49.13
256QAM	643342	3650.13	47.475	49.13

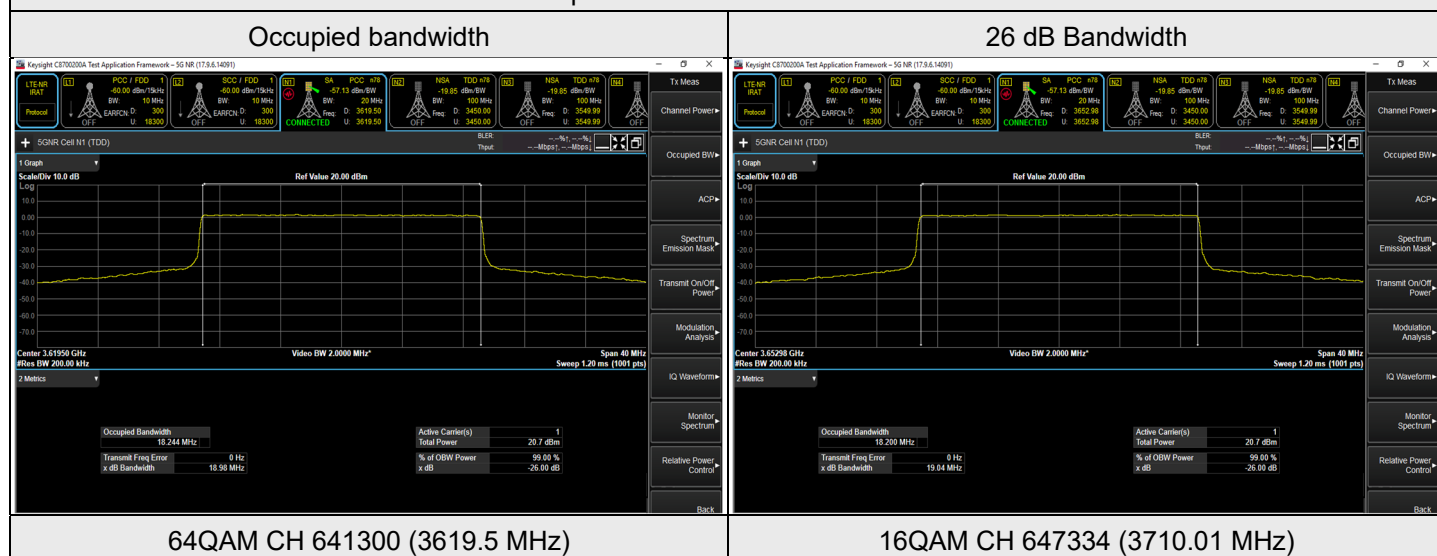


7.4.2 NR n78 SCS 30 kHz

NR n78 SCS 30 kHz, Channel Bandwidth: 20 MHz

NR n78 SCS 30 kHz (3550-3700 MHz) 20M				
Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
BPSK	639068	3586.02	18.029	18.62
BPSK	641300	3619.5	18.031	18.62
BPSK	643532	3652.98	18.025	18.61
QPSK	639068	3586.02	18.197	18.98
QPSK	641300	3619.5	18.195	19
QPSK	643532	3652.98	18.197	18.96
16QAM	639068	3586.02	18.199	19.01
16QAM	641300	3619.5	18.200	19.01
16QAM	643532	3652.98	18.200	19.04
64QAM	639068	3586.02	18.197	18.98
64QAM	641300	3619.5	18.244	18.98
64QAM	643532	3652.98	18.199	18.97
256QAM	639068	3586.02	18.200	18.96
256QAM	641300	3619.5	18.199	18.95
256QAM	643532	3652.98	18.199	18.97

Spectrum Plot of Worst Value



NR n78 SCS 30 kHz, Channel Bandwidth: 30 MHz

NR n78 SCS 30 kHz (3550-3700 MHz) 30M				
Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
BPSK	639400	3591	27.615	27.79
BPSK	641300	3619.5	27.640	27.80
BPSK	643200	3648	27.628	27.81
QPSK	639400	3591	27.867	28.86
QPSK	641300	3619.5	27.866	28.89
QPSK	643200	3648	27.816	28.79
16QAM	639400	3591	27.870	28.90
16QAM	641300	3619.5	27.866	28.89
16QAM	643200	3648	27.826	28.79
64QAM	639400	3591	27.871	28.91
64QAM	641300	3619.5	27.869	28.88
64QAM	643200	3648	27.803	28.79
256QAM	639400	3591	27.867	28.87
256QAM	641300	3619.5	27.866	28.85
256QAM	643200	3648	27.833	28.78

Spectrum Plot of Worst Value

