

TEST REPORT

CERTIFICATE OF CONFORMITY

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

Report No.: RFBCUN-WTW-P23110664-1

FCC ID: H8N60156A

Product: 5G small cell

Brand: ASKEY

Model No.: NR xCell 60156A

Received Date: 2023/11/24

Test Date: 2024/1/24 ~ 2024/5/8

Issued Date: 2024/5/13

Applicant: ASKEY COMPUTER CORP.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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FCC Registration /

Designation Number (1): 788550 / TW0003

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FCC Registration /

Designation Number (2): 281270 / TW0032

Approved by:

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Date:

2024/5/13

Jeremy Lin / Project Engineer

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Prepared by : Pettie Chen / Senior Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBCUN-WTW-P23110664-1	Original release.	2024/5/13

1 Certificate

Product: 5G small cell

Brand: ASKEY

Test Model: NR xCell 60156A

Sample Status: Engineering sample

Applicant: ASKEY COMPUTER CORP.

Test Date: 2024/1/24 ~ 2024/5/8

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

Measurement ANSI/TIA/EIA-603-E 2016

procedure: ANSI C63.26-2015

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 940660 D01 Part 96 CBRS Eqpt v03

KDB 662911 D01 Multiple Transmitter Output v02r01

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 2.1046 FCC 47 CFR Part 96.41(b)	Maximum Power Spectral Density	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 -1.02 dB at 160.95 MHz
FCC 47 CFR Part 2.1053 FCC 47 CFR Part 96.41(e)	Radiated Spurious Emissions above 1GHz	Pass	Minimum passing margin is -1.04 dB at 7380.00 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	5G small cell
Brand	ASKEY
Test Model	NR xCell 60156A
Status of EUT	Engineering sample
Power Supply Rating	100-240 Vac

Note:

1. EUT Overview

Maximum EIRP (dBm/10MHz)

Band / Bandwidth	TX Frequency Range (MHz)	Max. EIRP Power		
		QPSK	64QAM	256QAM
n48 (Channel Bandwidth 20MHz)	3560.01-3690.00	928.966mW (29.68dBm/10MHz)	826.038mW (29.17dBm/10MHz)	820.352mW (29.14dBm/10MHz)
n48 (Channel Bandwidth 30MHz)	3565.02-3684.99	770.903mW (28.87dBm/10MHz)	762.079mW (28.82dBm/10MHz)	744.732mW (28.72dBm/10MHz)
n48 (Channel Bandwidth 40MHz)	3570.00-3679.98	629.506mW (27.99dBm/10MHz)	666.807mW (28.24dBm/10MHz)	545.758mW (27.37dBm/10MHz)

Full Maximum EIRP (dBm/channel bandwidth)

Band / Bandwidth	TX Frequency Range (MHz)	Max. EIRP Power		
		QPSK	64QAM	256QAM
n48 (Channel Bandwidth 20MHz)	3560.01-3690.00	1686.553mW (32.27dBm/20MHz)	1513.561mW (31.80dBm/20MHz)	1499.685mW (31.76dBm/20MHz)
n48 (Channel Bandwidth 30MHz)	3565.02-3684.99	2387.811mW (33.78dBm/30MHz)	2259.436mW (33.54dBm/30MHz)	2208.005mW (33.44dBm/30MHz)
n48 (Channel Bandwidth 40MHz)	3570.00-3679.98	2837.919mW (34.53dBm/40MHz)	2824.880mW (34.51dBm/40MHz)	2500.345mW (33.98dBm/40MHz)

Emission Designator

Band / Bandwidth	TX Frequency Range (MHz)	Emission Designator		
		QPSK	64QAM	256QAM
n48 (Channel Bandwidth 20MHz)	3560.01-3690.00	18M2G7D	18M2D7W	18M2D7W
n48 (Channel Bandwidth 30MHz)	3565.02-3684.99	27M8G7D	27M8D7W	27M8D7W
n48 (Channel Bandwidth 40MHz)	3570.00-3679.98	37M8G7D	37M8D7W	37M8D7W

2. The EUT contains following accessory devices.

AC Adapter	Brand	MEAN WELL
	Model	LRS-100-12
	AC Input	85~264V 12V/8.5A
	DC Output	36V 2.8A 100.8W
	DC Output Cable	2.75m non-shielded cable without core

3. 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.

4. The EUT device does not support 16QAM modulation and only supports Full RB mode.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Antenna Type	Antenna Gain(dBi)			Connector Type
	Frequency (MHz)	Ant 1	Ant 2	
PCB	3300	3.38	5.20	SMA
	3800	3.89	4.63	
	4300	4.18	5.55	
	4400	5.66	5.50	
	4700	3.87	5.57	
	5000	4.66	4.39	

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

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: Z-axis

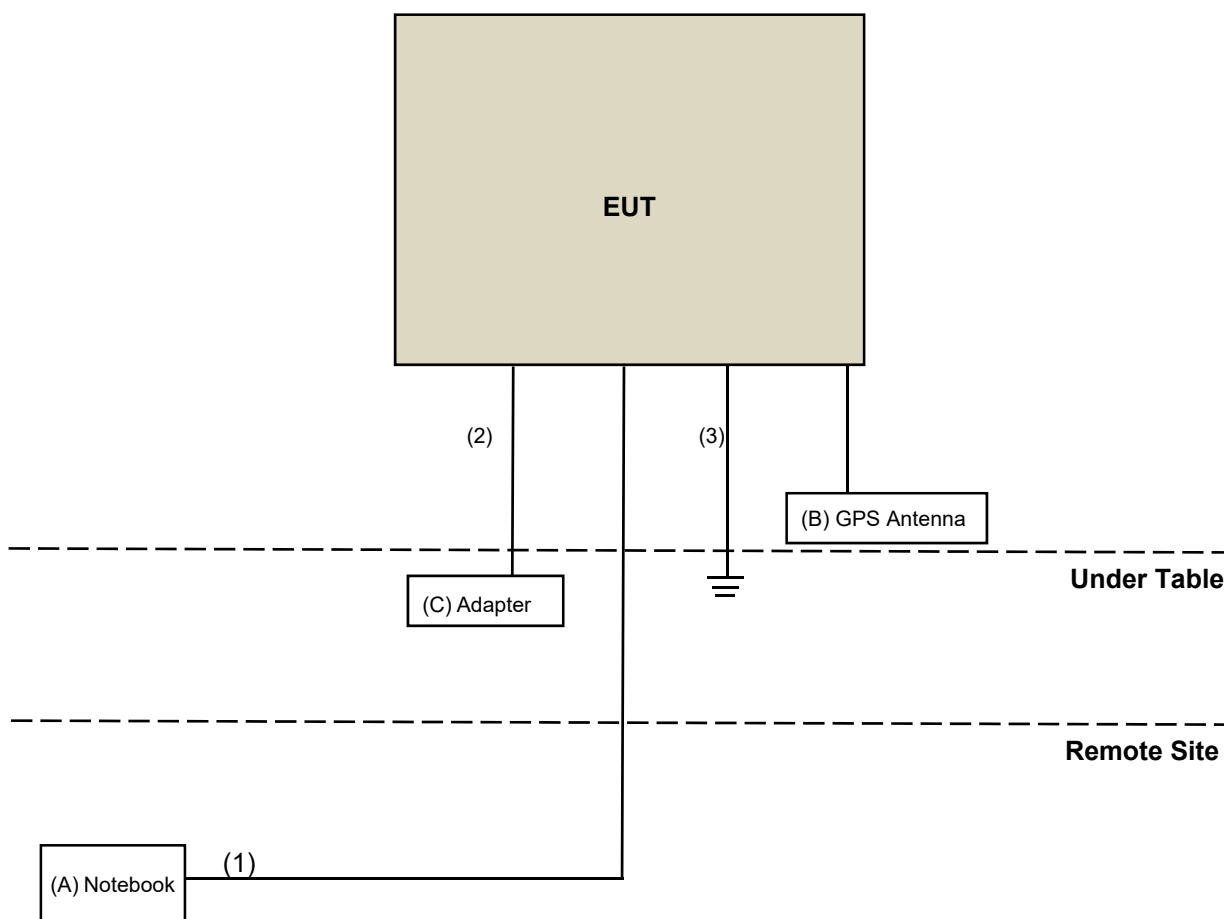
Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
EIRP	637334 (3560.01 MHz) 641666 (3624.99 MHz) 646000 (3690.00 MHz)	20 MHz	QPSK / 64QAM / 256QAM	Full RB
	637668 (3565.02 MHz) 641666 (3624.99 MHz) 645666 (3684.99 MHz)	30 MHz	QPSK / 64QAM / 256QAM	Full RB
	638000 (3570.00 MHz) 641666 (3624.99 MHz) 645332 (3679.98 MHz)	40 MHz	QPSK / 64QAM / 256QAM	Full RB
Modulation Characteristics	641666 (3624.99 MHz)	40 MHz	QPSK / 64QAM / 256QAM	Full RB
Maximum Power Spectral Density	637334 (3560.01 MHz) 641666 (3624.99 MHz) 646000 (3690.00 MHz)	20 MHz	QPSK / 64QAM / 256QAM	Full RB
	637668 (3565.02 MHz) 641666 (3624.99 MHz) 645666 (3684.99 MHz)	30 MHz	QPSK / 64QAM / 256QAM	Full RB
	638000 (3570.00 MHz) 641666 (3624.99 MHz) 645332 (3679.98 MHz)	40 MHz	QPSK / 64QAM / 256QAM	Full RB
Peak to Average Ratio	637334 (3560.01 MHz) 641666 (3624.99 MHz) 646000 (3690.00 MHz)	20 MHz	QPSK / 64QAM / 256QAM	Full RB
	637668 (3565.02 MHz) 641666 (3624.99 MHz) 645666 (3684.99 MHz)	30 MHz	QPSK / 64QAM / 256QAM	Full RB
	638000 (3570.00 MHz) 641666 (3624.99 MHz) 645332 (3679.98 MHz)	40 MHz	QPSK / 64QAM / 256QAM	Full RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Occupied Bandwidth	637334 (3560.01 MHz) 641666 (3624.99 MHz) 646000 (3690.00 MHz)	20 MHz	QPSK / 64QAM / 256QAM	Full RB
	637668 (3565.02 MHz) 641666 (3624.99 MHz) 645666 (3684.99 MHz)	30 MHz	QPSK / 64QAM / 256QAM	Full RB
	638000 (3570.00 MHz) 641666 (3624.99 MHz) 645332 (3679.98 MHz)	40 MHz	QPSK / 64QAM / 256QAM	Full RB
Conducted Emission	637334 (3560.01 MHz) 641666 (3624.99 MHz) 646000 (3690.00 MHz)	20 MHz	QPSK	Full RB
	637668 (3565.02 MHz) 641666 (3624.99 MHz) 645666 (3684.99 MHz)	30 MHz	QPSK	Full RB
	638000 (3570.00 MHz) 641666 (3624.99 MHz) 645332 (3679.98 MHz)	40 MHz	QPSK	Full RB
RE Below 1GHz	646000 (3690.00 MHz)	20 MHz	QPSK	Full RB
RE Above 1GHz	637334 (3560.01 MHz) 641666 (3624.99 MHz) 646000 (3690.00 MHz)	20 MHz	QPSK	Full RB
	638000 (3570.00 MHz) 641666 (3624.99 MHz) 645332 (3679.98 MHz)	40 MHz	QPSK	Full RB
Frequency Stability	637334 (3560.01 MHz) 646000 (3690.00 MHz)	20 MHz	QPSK	Full RB
	637668 (3565.02 MHz) 645666 (3684.99 MHz)	30 MHz	QPSK	Full RB
	638000 (3570.00 MHz) 645332 (3679.98 MHz)	40 MHz	QPSK	Full RB

3.4 Test Program Used and Operation Descriptions

Controlling software (QRCT V4.0.00198.0) during the test and the EUT was set up for the maximum power and link up with Spectrum Analyzer.

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	Notebook	Lenovo	L470	NA	NA	Provided by Lab
B	GPS Antenna	NA	NA	NA	NA	Supplied by applicant
D	Adapter	MEAN WELL	LRS-100-12	NA	NA	Accessory of EUT

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	RJ-45 Cable	1	10	No	0	Provided by Lab
2	AC Cable	1	3	No	0	Supplied by applicant
3	Ground Cable	1	2	No	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
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140488	2023/3/6	2024/3/5
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: 2024/1/24

4.2 Modulation Characteristics

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140488	2023/3/6	2024/3/5
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: 2024/2/20

4.3 Maximum Power Spectral Density

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140488	2024/3/6	2025/3/5
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: 2024/4/3

4.4 Peak to Average Ratio

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140488	2023/3/6	2024/3/5
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: 2024/1/25 ~ 2024/1/26

4.5 Bandwidth

Refer to section 4.4 to get information of the instruments.

4.6 Conducted Spurious Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140488	2023/3/6	2024/3/5
			2024/3/6	2025/3/5
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: 2024/3/21 ~ 2024/5/8

4.7 Radiated Spurious Emissions below 1GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFT-151SS-0.5T	NA	NA	NA
Turn Table Max-Full	MF-7802BS	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208674	NA	NA
EMI Test Receiver R&S	ESR3	102782	2023/12/7	2024/12/6
MXA Signal Analyzer Keysight	N9020B	MY60110513	2023/12/22	2024/12/21
Loop Antenna TESEQ	HLA 6121	45745	2023/8/8	2024/8/7
Loop Antenna Electro-Metrics	EM-6879	269	2023/9/23	2024/9/22
Preamplifier EMCI	EMC001340	980201	2023/9/27	2024/9/26
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-3000	201235	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-9000	201236(with PAD)	2024/1/15	2025/1/14
Preamplifier EMCI	EMC330N	980782	2024/1/15	2025/1/14
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-1213	2023/10/13	2024/10/12
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-500	201233	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-3000	201235	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-9000	201236(with PAD)	2024/1/15	2025/1/14

Notes:

1. The test was performed in HY - 966 chamber 8.
2. Tested Date: 2024/3/12

4.8 Radiated Spurious Emissions above 1GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Horn Antenna RFSPIN	DRH18-E	210103A18E	2023/11/12	2024/11/11
Preamplifier EMCI	EMC118A45SE	980808	2023/12/28	2024/12/27
RF Coaxial Cable EMCI	EMC104-SM-SM-1000	210102	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMC104-SM-SM-3000	201231	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMC104-SM-SM-9000	201243	2024/1/15	2025/1/14
Preamplifier EMCI	EMC184045SE	980788	2024/1/15	2025/1/14
Horn Antenna Schwarzbeck	BBHA 9170	9170-1049	2023/11/12	2024/11/11
RF Coaxial Cable EMCI	EMC101G-KM-KM-5000	201261	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMC101G-KM-KM-3000	201258	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMC101G-KM-KM-2000	201254	2024/1/15	2025/1/14
Boresight antenna tower fixture BV	BAF-02	5	NA	NA

Notes:

1. The test was performed in HY - 966 chamber 8.
2. Tested Date: 2024/3/11

4.9 Frequency Stability

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
AC Power Supply Extech	CFW-105	E000603	N/A	N/A
Digital Multimeter Fluke	87-III	70360742	2023/7/6	2024/7/5
Software BV	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A
Spectrum Analyzer R&S	FSV40	100980	2023/5/3	2024/5/2
Temperature & Humidity Chamber TERCHY	HRM-120RF	931022	2023/12/19	2024/12/18

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/2/21

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 Maximum Power Spectral Density

Device		Maximum PSD (dBm/MHz)
☐	End User Device	n/a
☐	Category A CBSD	20
☒	Category B CBSD	37

5.4 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.

5.5 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.

5.6 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	

5.7 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	

5.8 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	

5.9 Frequency Stability

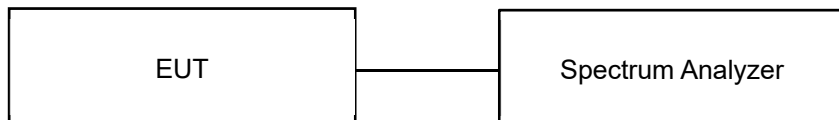
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation (authorized frequency block).

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 test software or key-in commands to set data modulation and maximum power using WWAN technology and link to spectrum analyzer measurements. Set the EUT to transmit under low, middle and high channel and record the power level shown on spectrum analyzer. Power measurements use detector average (rms).

Measurement method refers to ANSI C63.26 section 5.2.4.4.

- a. Set span to $2 \times$ to $3 \times$ the OBW.
- b. Set RBW = 1% to 5% of the OBW.
- c. Set VBW $\geq 3 \times$ RBW.
- d. Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
- e. Set Sweep time = auto-couple.
- f. Detector = power averaging (rms).
- g. Set sweep trigger to "free run."
- h. Trace average at least 100 traces in power averaging (rms) mode.
- i. 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.
- j. If Duty cycle < 98%, Add $10 \log (1/\text{duty cycle})$ to the measured power level to compute the average power during continuous transmission.
- k. For per 10MHz method, channel power integrating bandwidth 10MHz is used for bandwidth 20M, 30M and 40M. For full power method, channel power integrating bandwidth 20MHz is used for bandwidth 20M, integrating bandwidth 30MHz is used for bandwidth 30M, 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

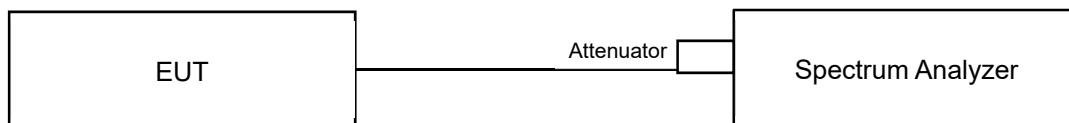
(expressed in the same units as P_{Meas} , e.g., dBm or dBW)

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

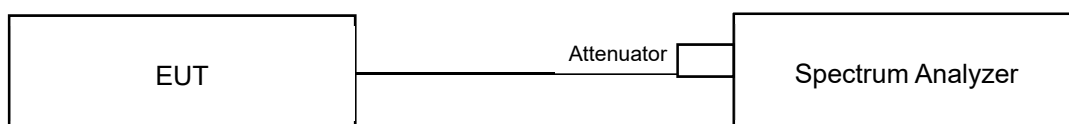


6.2.2 Test Procedure

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 Maximum Power Spectral Density

6.3.1 Test Setup

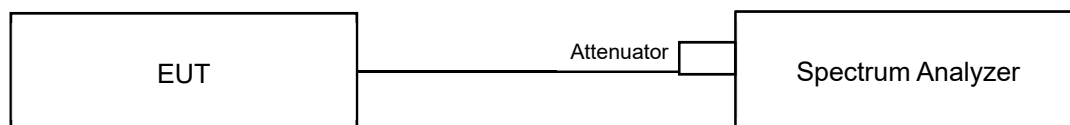


6.3.2 Test Procedure

- a. Connect the transmitter to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
- b. Set instrument center frequency to OBW center frequency.
- c. Set span to $2 \times$ to $3 \times$ the OBW.
- d. Set the RBW to the specified reference bandwidth (often 1 MHz).
- e. Set VBW $\geq 3 \times$ RBW.
- f. Detector = RMS (power averaging).
- g. Ensure that the number of measurement points in the sweep $\geq 2 \times$ span/RBW.
- h. Sweep time = auto couple.
- i. Employ trace averaging (RMS) mode over a minimum of 100 traces.
- j. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).

6.4 Peak to Average Ratio

6.4.1 Test Setup

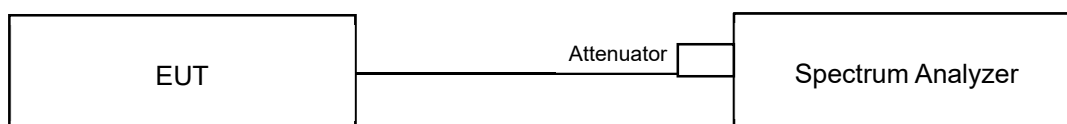


6.4.2 Test Procedure

- 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%.

6.5 Bandwidth

6.5.1 Test Setup



6.5.2 Test Procedure

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

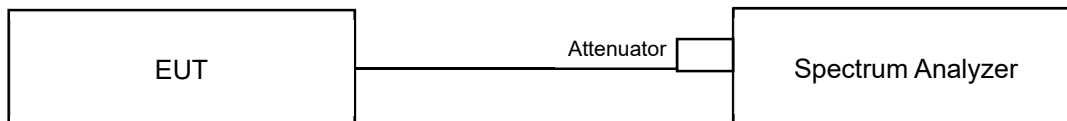
- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b. The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, 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 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).
- g. 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.
- h. 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.
- i. 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).

6.6 Conducted Spurious Emissions

6.6.1 Test Setup



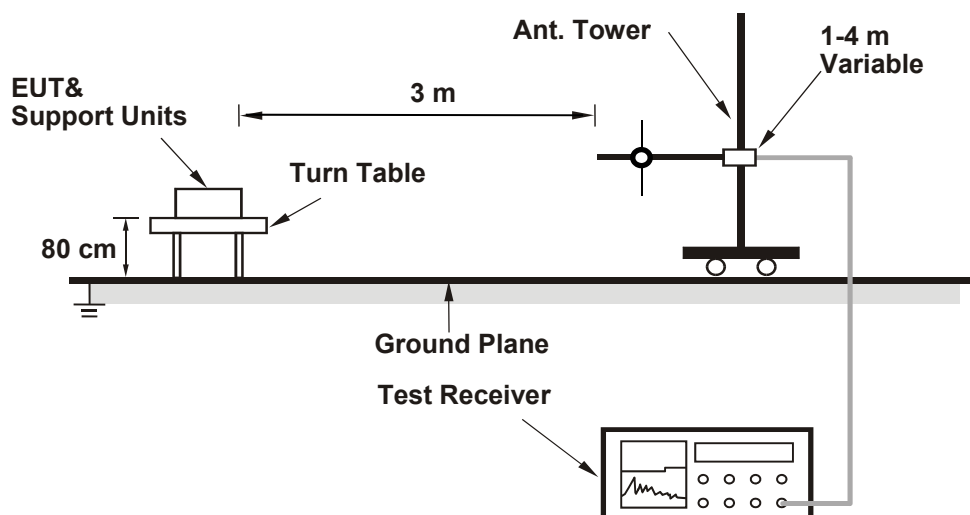
6.6.2 Test Procedure

- 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.
- Ref Lvl offset=12+3.01=15.01, $10\log(\text{Numbers}_{\text{ANT}})=3.01$

6.7 Radiated Spurious Emissions below 1GHz

6.7.1 Test Setup

For radiated emission 30 MHz to 1 GHz



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

6.7.2 Test Procedure

The EUT is configured by test software or key-in commands 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.

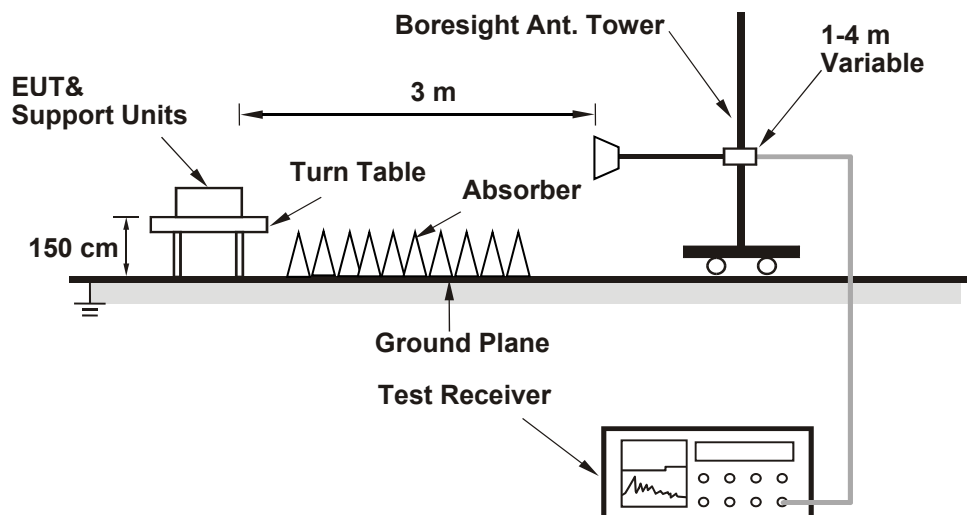
Note:

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

6.8 Radiated Spurious Emissions above 1GHz

6.8.1 Test Setup

For radiated emission above 1 GHz



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

6.8.2 Test Procedure

The EUT is configured by test software or key-in commands to set data modulation and maximum power using WWAN technology.

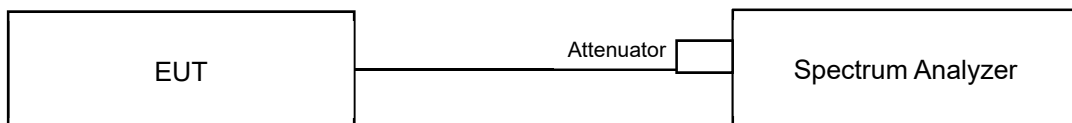
- In the semi-anechoic chamber, EUT placed on the 1.5 m height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. 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. Set detector = average.

6.9 Frequency Stability

6.9.1 Test Setup



6.9.2 Test Procedure

The EUT is configured by test software or key-in commands 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 AC 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:	120 Vac, 60Hz	Environmental Conditions:	22°C, 70% RH	Tested By:	Kevin Kuo
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Per 10M Power

NR Band 48_Per 10M							
Bandwidth	Channel / Frequency	Setting	Modulation	Chain 0	Chain 1	Total (dBm/10MHz)	e.i.r.p. (dBm/10MHz)
20M	CH 637334 3560.01 MHz	210	QPSK	18.17	18.57	21.38	28.96
			64QAM	17.86	18.45	21.18	28.76
			256QAM	17.63	18.27	20.97	28.55
	CH 641666 3624.99 MHz	225	QPSK	19.32	18.84	22.10	29.68
			64QAM	18.60	18.56	21.59	29.17
			256QAM	18.70	18.40	21.56	29.14
	CH 646000 3690 MHz	220	QPSK	18.81	18.38	21.61	29.19
			64QAM	18.27	17.66	20.99	28.57
			256QAM	18.39	17.36	20.92	28.50
30M	CH 637668 3565.02 MHz	235	QPSK	17.96	18.57	21.29	28.87
			64QAM	17.73	18.67	21.24	28.82
			256QAM	18.06	18.19	21.14	28.72
	CH 641666 3624.99 MHz	240	QPSK	18.02	18.26	21.15	28.73
			64QAM	18.07	18.12	21.11	28.69
			256QAM	17.88	17.76	20.83	28.41
	CH 645666 3684.99 MHz	225	QPSK	17.10	16.07	19.63	27.21
			64QAM	16.75	16.18	19.48	27.06
			256QAM	16.20	16.19	19.21	26.79
40M	CH 638000 3570 MHz	240	QPSK	16.79	17.93	20.41	27.99
			64QAM	17.55	17.75	20.66	28.24
			256QAM	16.18	17.30	19.79	27.37
	CH 641666 3624.99 MHz	240	QPSK	17.07	16.91	20.00	27.58
			64QAM	16.44	16.98	19.73	27.31
			256QAM	16.43	16.72	19.59	27.17
	CH 645332 3679.98 MHz	220	QPSK	15.99	14.81	18.45	26.03
			64QAM	14.78	14.99	17.90	25.48
			256QAM	14.76	14.63	17.71	25.29

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

*Directional Gain (dBi) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 10 \log[(10^{3.89/20} + 10^{5.2/20})^2/2] = 7.58 \text{ dBi}$

Full Power

NR Band 48_Full power							
Bandwidth	Channel / Frequency	Setting	Modulation	Chain 0	Chain 1	Total (dBm/20MHz)	e.i.r.p. (dBm/20MHz)
20M	CH 637334 3560.01 MHz	210	QPSK	20.91	21.40	24.17	31.75
			64QAM	20.62	21.18	23.92	31.50
			256QAM	20.57	21.24	23.93	31.51
	CH 641666 3624.99 MHz	225	QPSK	21.84	21.03	24.46	32.04
			64QAM	21.31	21.10	24.22	31.80
			256QAM	21.32	21.02	24.18	31.76
	CH 646000 3690 MHz	220	QPSK	21.83	21.52	24.69	32.27
			64QAM	21.11	20.39	23.78	31.36
			256QAM	21.03	20.02	23.56	31.14

*EIRP (dBm/20MHz) = Conducted Output Power (dBm/20MHz) + Directional Gain (dBi).

*Directional Gain (dBi) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 10 \log[(10^{3.89/20} + 10^{5.2/20})^2/2] = 7.58 \text{ dBi}$

Bandwidth	Channel / Frequency	Setting	Modulation	Chain 0	Chain 1	Total (dBm/30MHz)	e.i.r.p. (dBm/30MHz)
30M	CH 637668 3565.02 MHz	235	QPSK	22.59	23.66	26.17	33.75
			64QAM	22.22	23.57	25.96	33.54
			256QAM	22.64	23.05	25.86	33.44
	CH 641666 3624.99 MHz	240	QPSK	23.17	23.21	26.20	33.78
			64QAM	22.46	22.48	25.48	33.06
			256QAM	22.36	22.28	25.33	32.91
	CH 645666 3684.99 MHz	225	QPSK	21.41	20.84	24.14	31.72
			64QAM	21.17	20.64	23.92	31.50
			256QAM	21.01	20.63	23.83	31.41

*EIRP (dBm/30MHz) = Conducted Output Power (dBm/30MHz) + Directional Gain (dBi).

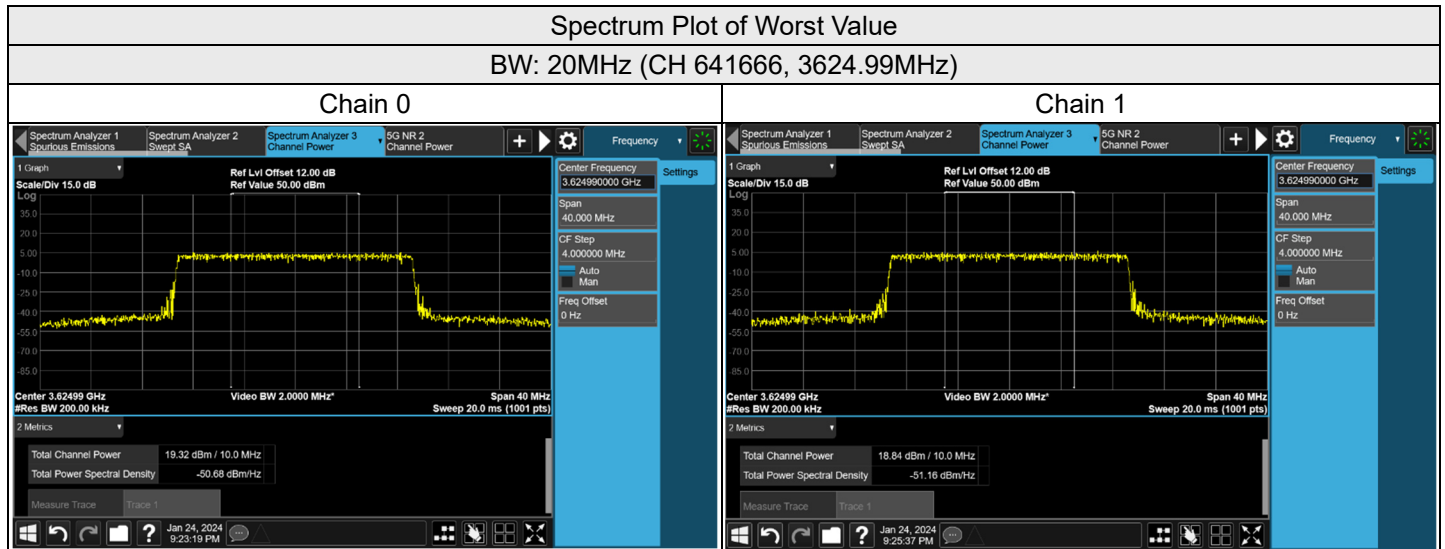
*Directional Gain (dBi) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 10 \log[(10^{3.89/20} + 10^{5.2/20})^2/2] = 7.58 \text{ dBi}$

Bandwidth	Channel / Frequency	Setting	Modulation	Chain 0	Chain 1	Total (dBm/40MHz)	e.i.r.p. (dBm/40MHz)
40M	CH 638000 3570 MHz	240	QPSK	23.37	24.45	26.95	34.53
			64QAM	23.65	24.18	26.93	34.51
			256QAM	22.91	23.83	26.40	33.98
	CH 641666 3624.99 MHz	240	QPSK	23.61	23.44	26.54	34.12
			64QAM	22.47	22.93	25.72	33.30
			256QAM	22.32	22.57	25.46	33.04
	CH 645332 3679.98 MHz	220	QPSK	21.64	20.49	24.11	31.69
			64QAM	20.86	20.89	23.89	31.47
			256QAM	20.65	20.54	23.61	31.19

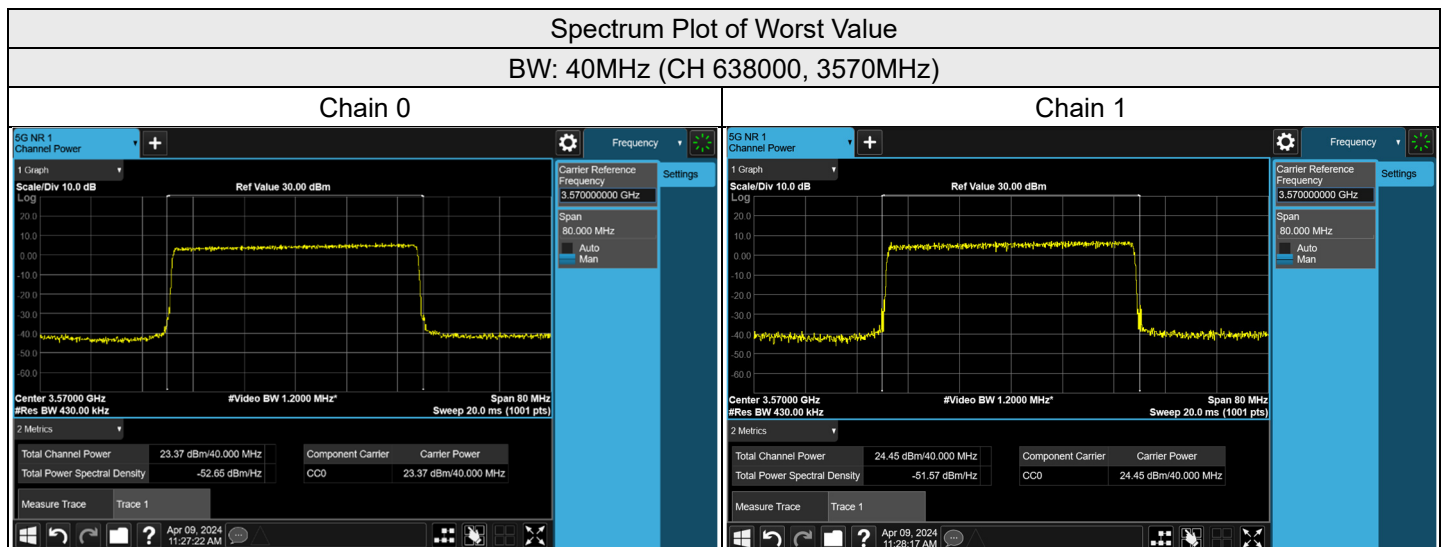
*EIRP (dBm/40MHz) = Conducted Output Power (dBm/40MHz) + Directional Gain (dBi).

*Directional Gain (dBi) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 10 \log[(10^{3.89/20} + 10^{5.2/20})^2/2] = 7.58 \text{ dBi}$

Per 10M Power



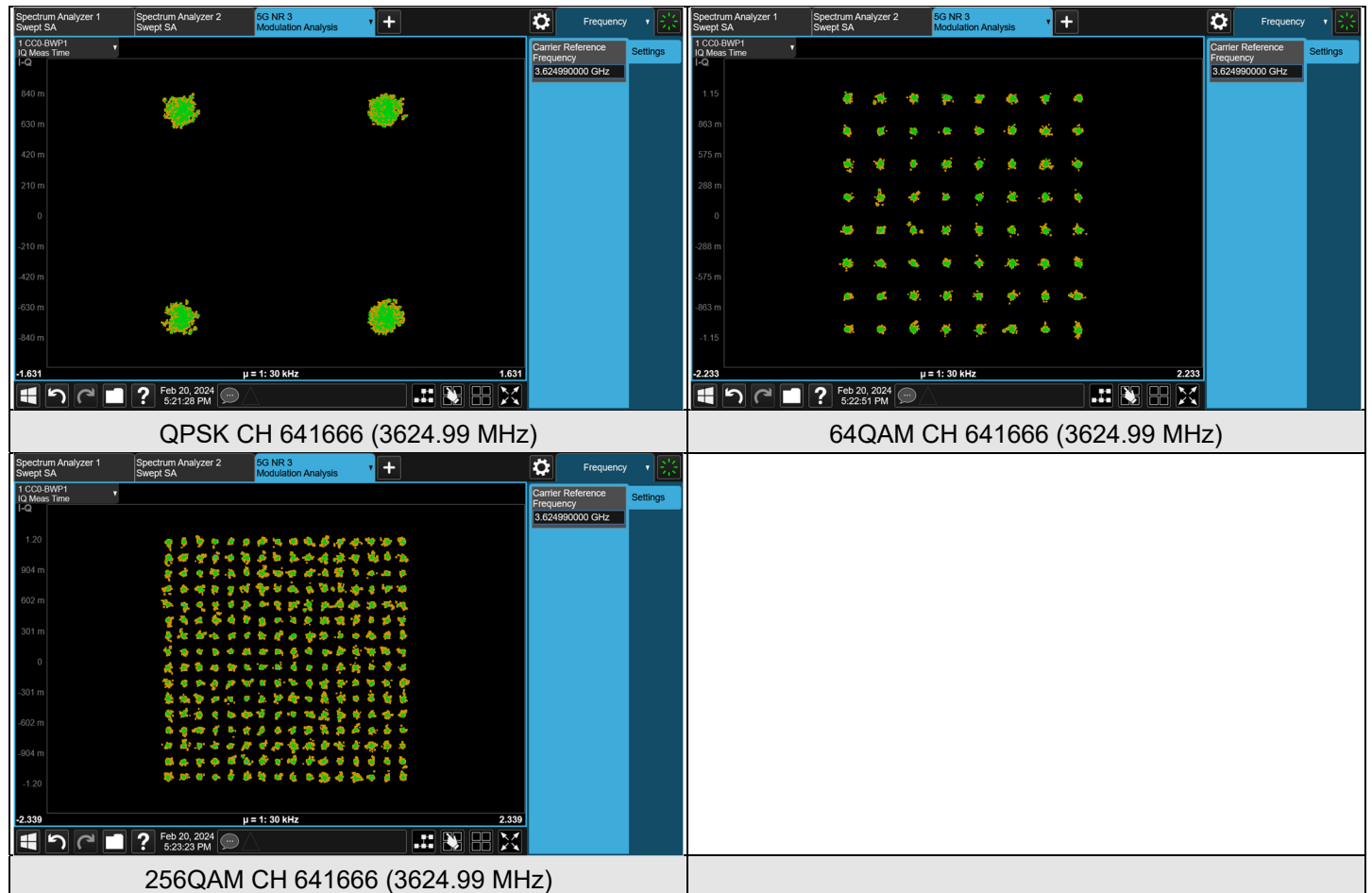
Full Power



7.2 Modulation Characteristics

Input Power:	120 Vac, 60Hz	Environmental Conditions:	22°C, 70% RH	Tested By:	Kevin Kuo
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NR n48 SCS 30 kHz, Channel Bandwidth: 40 MHz



7.3 Maximum Power Spectral Density

Input Power:	120 Vac, 60Hz	Environmental Conditions:	22°C, 70% RH	Tested By:	Kevin Kuo
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Power Spectral Density (dBm/MHz)

NR Band 48							
Bandwidth	Channel / Frequency	Setting	Modulation	Chain 0	Chain 1	Total (dBm/MHz)	e.i.r.p. (dBm/MHz)
20M	CH 637334 3560.01 MHz	210	QPSK	8.70	9.30	12.02	19.60
			64QAM	8.42	9.21	11.84	19.42
			256QAM	8.27	9.04	11.68	19.26
	CH 641666 3624.99 MHz	225	QPSK	9.49	9.10	12.31	19.89
			64QAM	9.27	9.16	12.23	19.81
			256QAM	9.25	9.17	12.22	19.80
	CH 646000 3690 MHz	220	QPSK	9.40	8.93	12.18	19.76
			64QAM	8.82	8.28	11.57	19.15
			256QAM	8.94	8.00	11.51	19.09
30M	CH 637668 3565.02 MHz	235	QPSK	8.49	9.50	12.03	19.61
			64QAM	8.27	9.63	12.01	19.59
			256QAM	8.76	9.10	11.94	19.52
	CH 641666 3624.99 MHz	240	QPSK	8.53	8.95	11.76	19.34
			64QAM	8.58	8.60	11.60	19.18
			256QAM	8.43	8.39	11.42	19.00
	CH 645666 3684.99 MHz	225	QPSK	7.72	6.71	10.25	17.83
			64QAM	7.21	6.64	9.94	17.52
			256QAM	7.06	6.66	9.87	17.45
40M	CH 638000 3570 MHz	240	QPSK	8.02	9.12	11.62	19.20
			64QAM	8.63	8.87	11.76	19.34
			256QAM	7.71	8.52	11.14	18.72
	CH 641666 3624.99 MHz	240	QPSK	7.66	7.53	10.61	18.19
			64QAM	7.29	7.65	10.48	18.06
			256QAM	7.07	7.33	10.21	17.79
	CH 645332 3679.98 MHz	220	QPSK	6.15	5.01	8.63	16.21
			64QAM	5.56	5.61	8.60	16.18
			256QAM	5.36	5.19	8.29	15.87

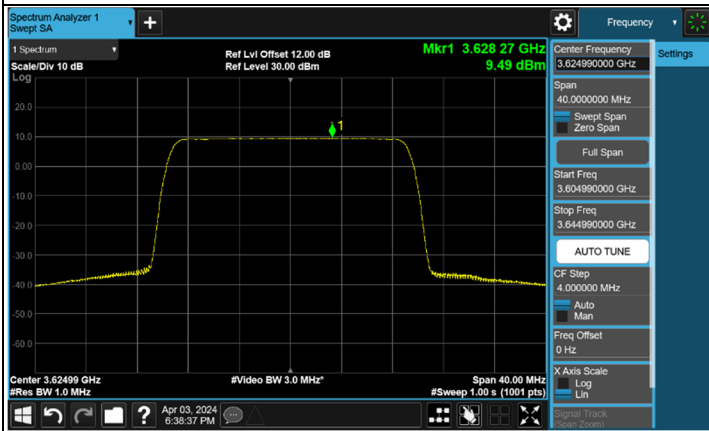
*EIRP (dBm/MHz) = Conducted (dBm/MHz) + Directional Gain (dBi).

*Directional Gain (dBi) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/2] = 10 \log[(10^{3.89/20} + 10^{5.2/20})^2/2] = 7.58 \text{ dBi}$

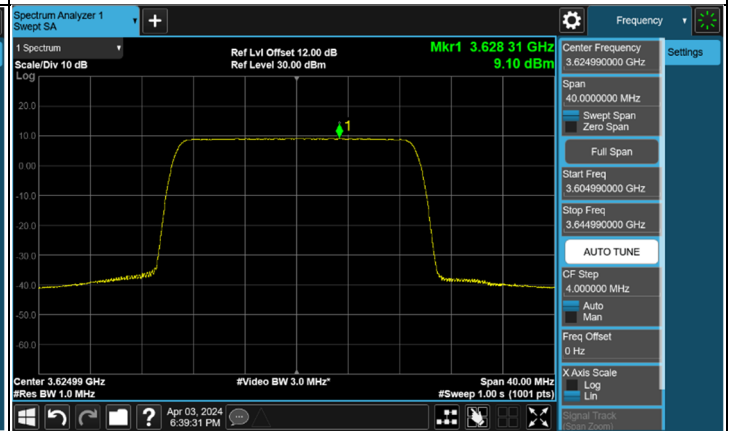
Spectrum Plot of Worst Value

BW: 20MHz (QPSK, CH 641666, 3624.99MHz)

Chain 0



Chain 1

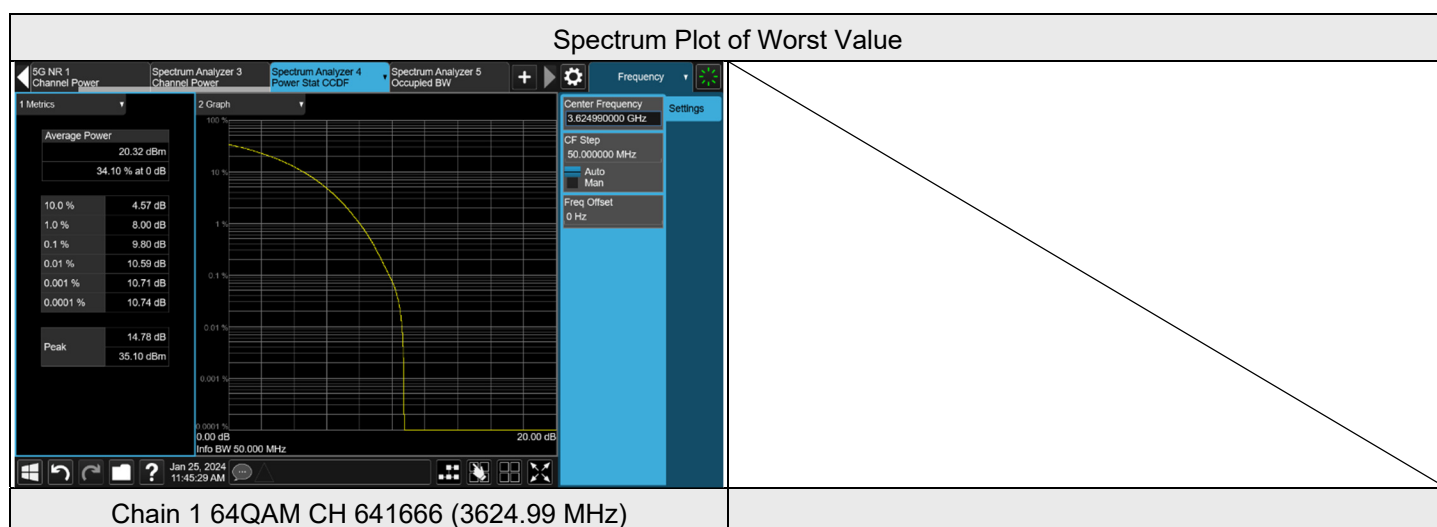


7.4 Peak to Average Ratio

Input Power:	120 Vac, 60Hz	Environmental Conditions:	22°C, 70% RH	Tested By:	Kevin Kuo
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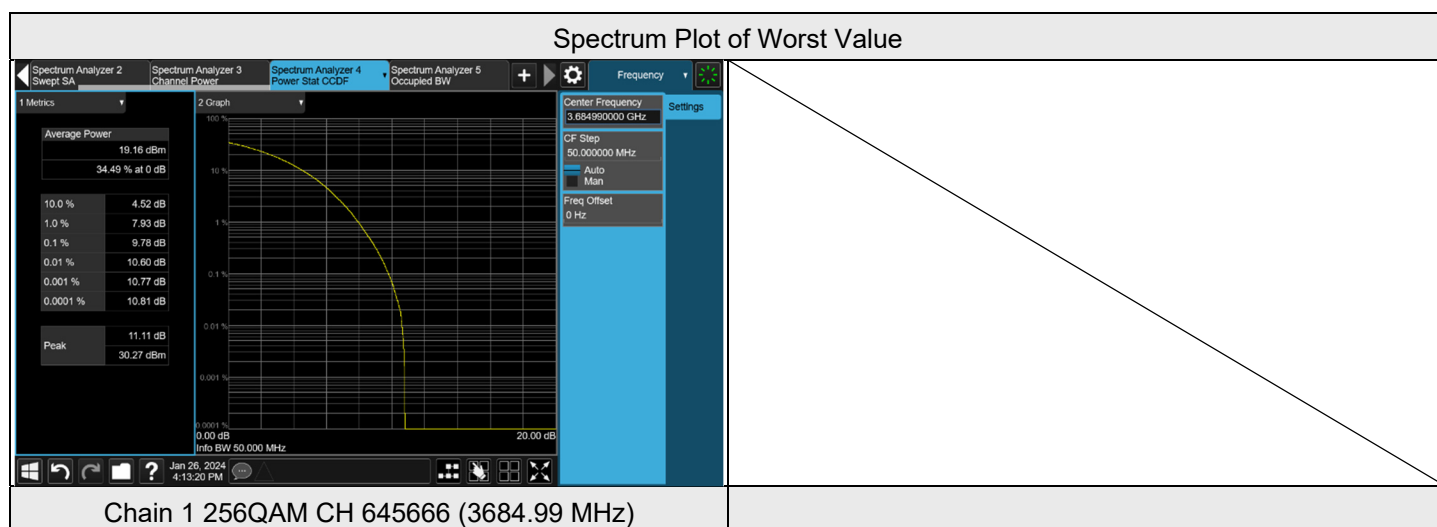
NR n48 SCS 30 kHz, Channel Bandwidth: 20 MHz

Channel	Frequency (MHz)	Peak to Average Ratio (dB)						Limit
		Chain 0			Chain 1			
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM	
637334	3560.01	9.03	9.24	9.46	9.03	9.09	8.71	13.00
641666	3624.99	8.95	8.46	8.80	8.95	9.80	8.84	
646000	3690	9.04	9.45	8.99	9.04	9.75	9.06	



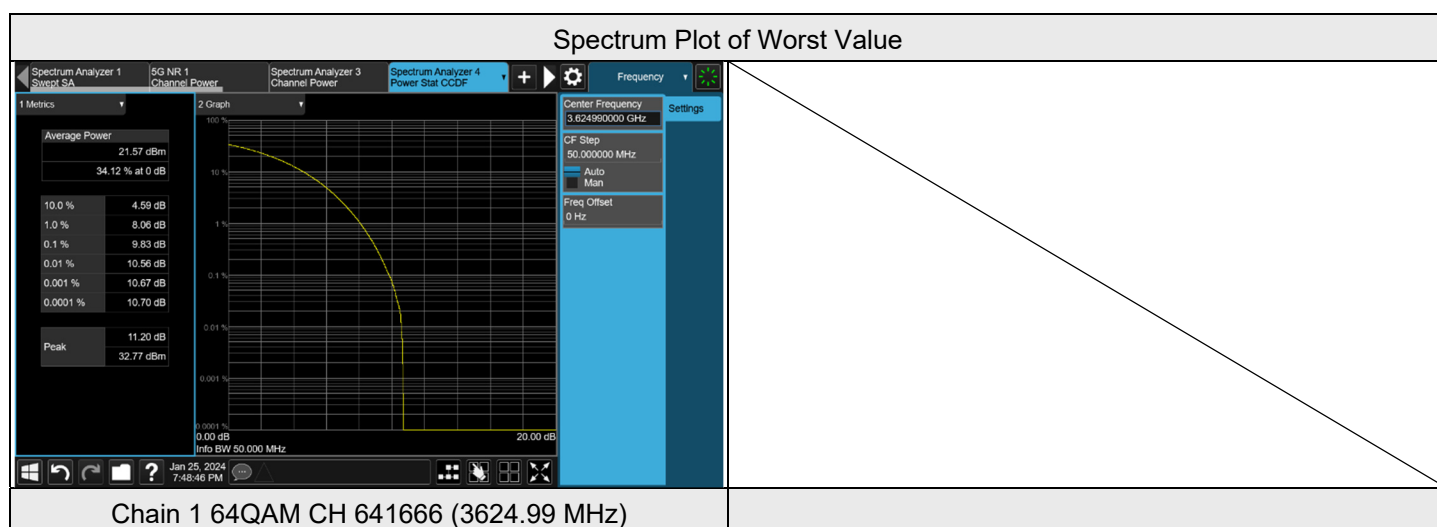
NR n48 SCS 30 kHz, Channel Bandwidth: 30 MHz

Channel	Frequency (MHz)	Peak to Average Ratio (dB)						Limit
		Chain 0			Chain 1			
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM	
637668	3565.02	9.61	9.05	9.44	8.96	8.92	8.82	13.00
641666	3624.99	9.48	8.88	9.53	9.55	9.36	8.64	
645666	3684.99	8.80	8.82	9.53	9.22	9.06	9.78	



NR n48 SCS 30 kHz, Channel Bandwidth: 40 MHz

Channel	Frequency (MHz)	Peak to Average Ratio (dB)						Limit
		Chain 0			Chain 1			
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM	
638000	3570	9.04	9.13	9.22	8.82	8.92	9.68	13.00
641666	3624.99	9.13	9.21	9.69	8.89	9.83	8.67	
645332	3679.98	9.17	9.12	8.95	9.08	9.30	8.90	



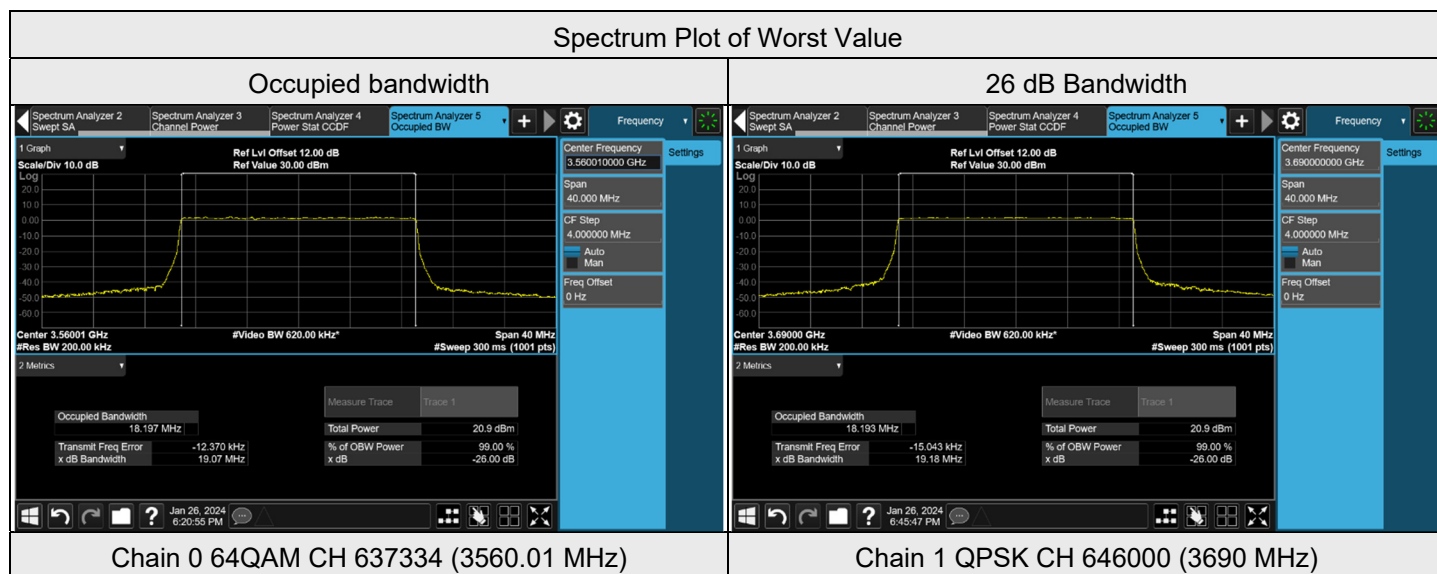
7.5 Bandwidth

Input Power:	120 Vac, 60Hz	Environmental Conditions:	22°C, 70% RH	Tested By:	Kevin Kuo
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NR n48 SCS 30 kHz, Channel Bandwidth: 20 MHz

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)					
		Chain 0			Chain 1		
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM
637334	3560.01	18.189	18.197	18.189	18.191	18.189	18.188
641666	3624.99	18.186	18.193	18.177	18.194	18.182	18.186
646000	3690	18.191	18.192	18.182	18.193	18.183	18.184

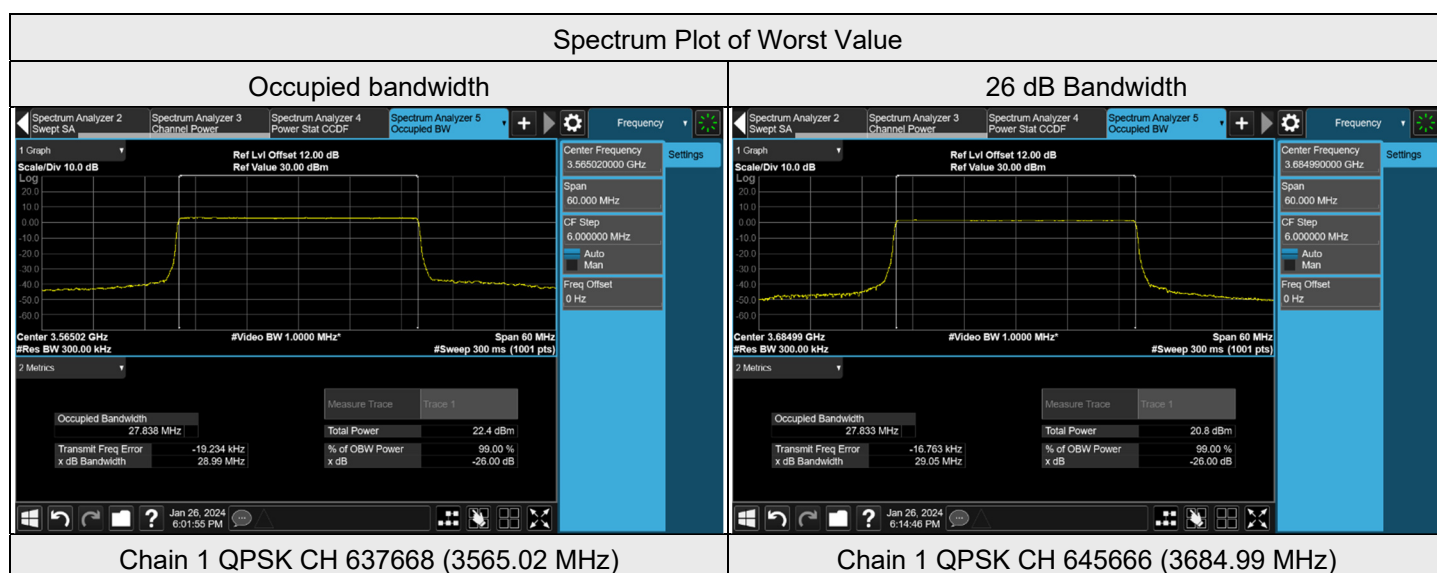
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)					
		Chain 0			Chain 1		
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM
637334	3560.01	19.09	19.07	19.08	19.04	19.15	19.04
641666	3624.99	19.06	19.06	18.98	19.06	19.08	19.00
646000	3690	19.14	19.11	19.07	19.18	19.04	19.04



NR n48 SCS 30 kHz, Channel Bandwidth: 30 MHz

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)					
		Chain 0			Chain 1		
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM
637668	3565.02	27.828	27.816	27.812	27.838	27.828	27.811
641666	3624.99	27.822	27.811	27.813	27.832	27.836	27.806
645666	3684.99	27.825	27.809	27.816	27.833	27.831	27.779

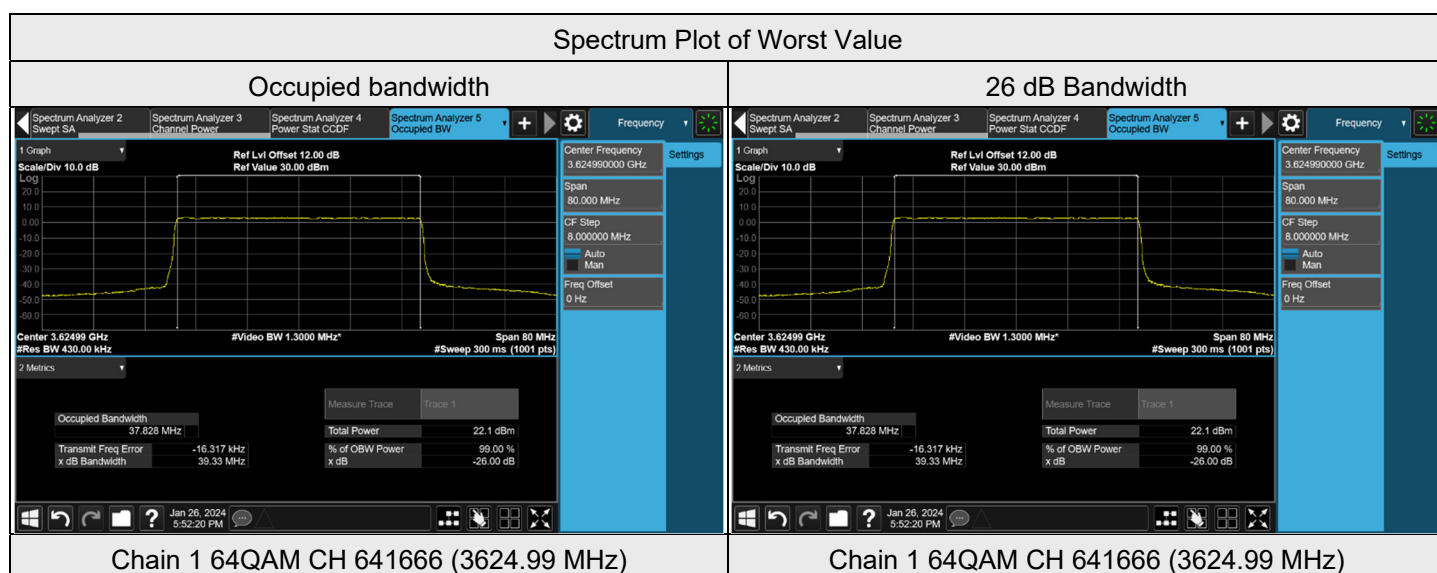
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)					
		Chain 0			Chain 1		
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM
637668	3565.02	28.98	28.90	28.90	28.99	28.99	28.92
641666	3624.99	28.93	28.99	28.89	28.99	28.99	28.89
645666	3684.99	28.92	28.95	28.88	29.05	28.95	28.88



NR n48 SCS 30 kHz, Channel Bandwidth: 40 MHz

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)					
		Chain 0			Chain 1		
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM
638000	3570	37.812	37.818	37.803	37.819	37.813	37.812
641666	3624.99	37.813	37.808	37.809	37.822	37.828	37.802
645332	3679.98	37.817	37.818	37.808	37.826	37.808	37.808

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)					
		Chain 0			Chain 1		
		QPSK	64QAM	256QAM	QPSK	64QAM	256QAM
638000	3570	39.25	39.26	39.24	39.28	39.29	39.25
641666	3624.99	39.26	39.23	39.26	39.27	39.33	39.26
645332	3679.98	39.29	39.29	39.27	39.27	39.24	39.27



7.6 Conducted Spurious Emissions

Input Power:	120 Vac, 60Hz	Environmental Conditions:	22°C, 70% RH	Tested By:	Kevin Kuo
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NR n48 SCS 30 kHz, Channel Bandwidth: 20 MHz

Chain 0

