FCC Test Report
(5GNR n78)

Report No.:	RFBHQC-WTW-P21123448
FCC ID:	2AQ68RPQN7800
Test Model:	RPQN-7800E, RPQN-7800I
Received Date:	Dec. 28, 2021
Test Date:	Dec. 23 ~ Dec. 28, 2021
Issued Date:	Feb. 09, 2022
Applicant:	Hon Lin Technology Co., Ltd.
Address:	11F, No. 32, Jihu Rd., Neihu Dist., Taipei City 114, Taiwan R.O.C.
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 / Designation Number:	788550 / TW0003
Test Location (2):	No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
FCC Registration / Designation Number:	281270 / TW0032

Testing Laboratory
2021

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBHQC-WTW-P21123448	Original release	Feb. 09, 2022

1 Certificate of Conformity

Product:	5G NR indoor O-RU S4 RPQN-7800
Brand:	Foxconn
Test Model:	RPQN-7800E, RPQN-7800I
Sample Status:	Mass Production
Applicant:	Hon Lin Technology Co., Ltd.
Test Date:	Dec. 23 ~ Dec. 28, 2021
Standards:	FCC Part 27, Subpart C, Q

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.

Prepared by : Celine Chou , **Date:** Feb. 09, 2022

Celine Chou / Senior Specialist

Approved by : Jeremy Lin , **Date:** Feb. 09, 2022

Jeremy Lin / Project Engineer

2 Summary of Test Results

For 5GNR n78:

Applied Standard: FCC Part 27 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 27.50 (k)	Equivalent Radiated Power	Pass	Meet the requirement of limit.
2.1047	Modulation Characteristics	Pass	Meet the requirement
----	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1055 27.54	Frequency Stability Stay with the authorized bands of operation	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
2.1051 27.53(n)	Band Edge / Out of Band Emissions Measurements	Pass	Meet the requirement of limit.
2.1051 27.53(n)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 27.53(n)	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -2.47dB at 53.90MHz.

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	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.00 dB
	30MHz ~ 200MHz	2.91 dB
	200MHz ~1000MHz	2.93 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	1.76 dB
	18GHz ~ 40GHz	1.77 dB

2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Rohde & Schwarz	N9038A	MY55420137	Apr. 09, 2021	Apr. 08, 2022
Spectrum Analyzer KEYSIGHT	N9020B	MY60110440	Dec. 09, 2021	Dec. 08, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-1213	Oct. 27, 2021	Oct. 26, 2022
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-563	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	9170-995	Nov. 14, 2021	Nov. 13, 2022
Preamplifier EMCI	EMC330N	980782	Jan. 12, 2021	Jan. 11, 2022
Preamplifier EMCI	EMC118A45SE	980808	Jan. 12, 2021	Jan. 11, 2022
Preamplifier EMCI	EMC184045SE	980788	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMC104-SM-SM-(9000+2000+1000)	201243+ 201231+ 210102	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMCCFD400-NM-NM-(9000+300+500)	201236+ 201235+ 201233	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201260+201257+201254	Jan. 12, 2021	Jan. 11, 2022
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
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/ MY55190007/MY55210005	Jul. 12, 2021	Jul. 11, 2022
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Standard Temperature And Humidity Chamber GIANT FORCE	GTH-120-40-CP-AR	MAA1306-019	Sep. 10, 2021	Sep. 09, 2022
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
True RMS Clamp Meter Fluke	325	31130711WS	Jun. 02, 2021	Jun. 01, 2022
DC power supply Keysight	U8002A	MY56330015	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in WM Chamber 8.

3 General Information

3.1 General Description of EUT

Product	5G NR indoor O-RU S4 RPQN-7800				
Brand	Foxconn				
Test Model	RPQN-7800E, RPQN-7800I				
Sample Status	Mass Production				
Power Supply Rating	12 Vdc (Adapter)				
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM				
Operating Band	n78 (3450-3550MHz)				
Operating Frequency	n78 (Channel Bandwidth 100MHz)	3500.01MHz			
Max. EIRP Power		QPSK	16QAM	64QAM	256QAM
	n78 (Channel Bandwidth 100MHz)	20.33dBm/MHz (0.11W/MHz)	20.27dBm/MHz (0.11W/MHz)	20.17dBm/MHz (0.10W/MHz)	20.12dBm/MHz (0.10W/MHz)
Emission Designator		QPSK	16QAM	64QAM	256QAM
	n78 (Channel Bandwidth 100MHz)	92M9G7D	93M9D7W	94M3D7W	94M2D7W
Antenna Type	Refer to Note as below				
Antenna Connector	Refer to Note as below				
Accessory Device	Refer to Note as below				
Cable Supplied	Refer to Note as below				

Note:

1. All models are listed as below.

Brand	Model	Difference
Foxconn	RPQN-7800E	With external antenna
	RPQN-7800I	With internal antenna

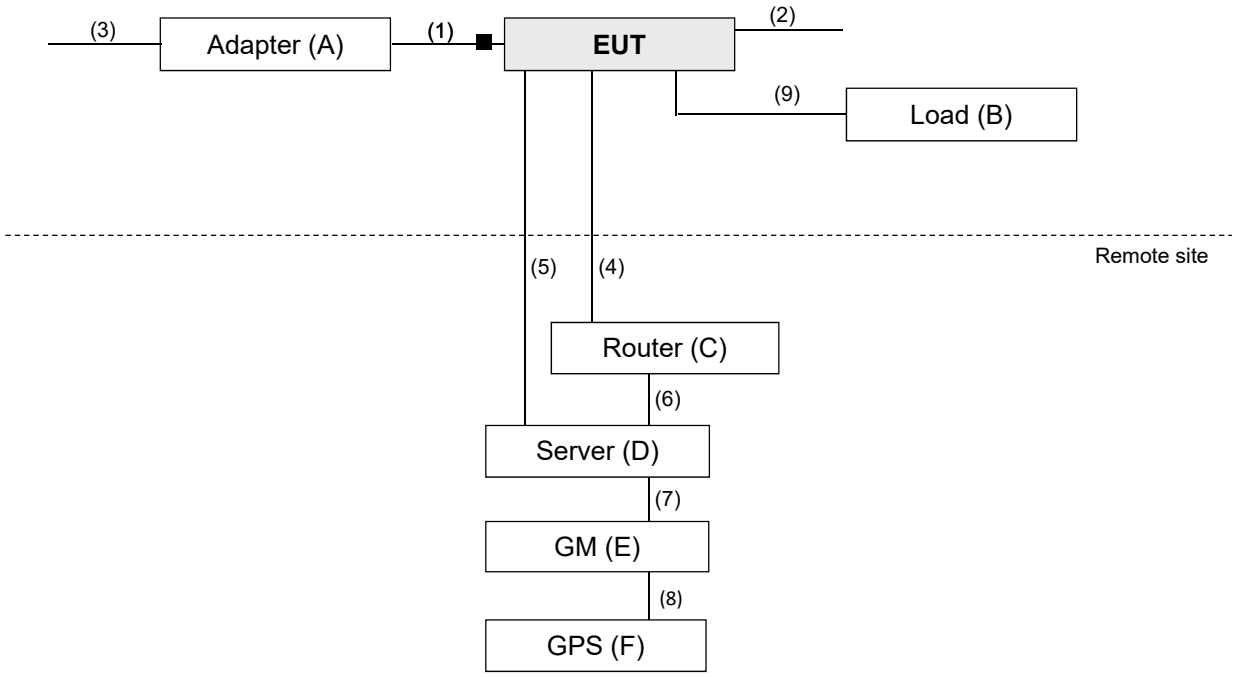
2. The EUT uses following adapter.

Brand	Model	Specification
DVE	DSA-60PFE-12 1 120500	AC Input: 100-240Vac, 50/60Hz, 2.0A DC Output: 12Vdc, 5A DC Output Cable: 1.2 m with 1 core

3. The following antennas were provided to the EUT.

Antenna No.	Brand	Model	Antenna Net Gain (dBi)	Antenna Type	Connector Type
1. External	Whayu	C107-511850-A	5.12	Dipole	SMA
2. Internal	Grand Tek	103EG00000030	4.60	PIFA	i-pex(MHF)

3.2 Configuration of System under Test



3.2.1 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Adapter	LITEON	PA-1050-39	NA	NA	Accessory
B.	Load	NA	NA	NA	NA	-
C.	Router	Netgear	R7000P	4TJ1737FA0811	NA	-
D.	Server	NA	NA	NA	NA	Provided by client.
E.	GM	NA	NA	NA	NA	Provided by client.
F.	GPS	NA	NA	NA	NA	Provided by client.

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items C-D acted as a communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC cable	1	1.2	N	1	Accessory
2.	Micro USB cable	1	1.0	Y	0	-
3.	AC cable	1	1.8	N	0	Provided by client.
4.	RJ45 Cable	1	6.0	N	0	Provided by client.
5.	Fiber cable	1	6.0	N	0	Provided by client.
6.	RJ45 Cable	1	1.0	N	0	-
7.	RJ45 Cable	1	1.0	N	0	-
8.	BNC cable	1	15.0	N	0	Provided by client.
9.	RJ45 Cable	1	1.5	N	0	Provided by client.

Note: The core(s) is(are) originally attached to the cable(s).

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned as the table below. Following channel(s) was (were) selected for the final test as listed below:

Band	Radiated Emission
5GNR n78	X-plane (RPQN-7800I)
	Y-plane (RPQN-7800E)

For radiated emission test and EIRP, the EUT has been tested under following test modes. For other tests, test mode B was with the maximum gain for final tests.

Test Mode	EUT Model
A	RPQN-7800I
B	RPQN-7800E

5GNR n78

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
A, B	EIRP	633334	633334 (3500.01MHz)	100MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB
B	Modulation Characteristics	633334	633334 (3500.01MHz)	100MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB
B	Frequency Stability	633334	633334 (3500.01MHz)	100MHz	QPSK	Full RB
B	Emission Bandwidth	633334	633334 (3500.01MHz)	100MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB
B	Band Edge	633334	633334 (3500.01MHz)	100MHz	QPSK	Full RB
B	Peak to Average Ratio	633334	633334 (3500.01MHz)	100MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB
B	Conducted Emission	633334	633334 (3500.01MHz)	100MHz	QPSK	Full RB
A, B	Radiated Emission Below 1GHz	633334	633334 (3500.01MHz)	100MHz	QPSK	Full RB
A, B	Radiated Emission Above 1GHz	633334	633334 (3500.01MHz)	100MHz	QPSK	Full RB

Note: Only output power, modulation characteristics, occupied bandwidth and Peak to average ratio items had been tested under QPSK, 16QAM, 64QAM and 256QAM modes, the other test items were performed under worst mode according to the maximum output power.

Test Condition:

Test Item	Environmental Conditions	Input Power (system)	Tested By
EIRP	25deg. C, 63%RH	120Vac, 60Hz	James Yang
Modulation characteristics	25deg. C, 63%RH	120Vac, 60Hz	James Yang
Frequency Stability	25deg. C, 63%RH	120Vac, 60Hz	James Yang
Occupied Bandwidth	25deg. C, 63%RH	120Vac, 60Hz	James Yang
Band Edge	25deg. C, 63%RH	120Vac, 60Hz	James Yang
Peak To Average Ratio	25deg. C, 63%RH	120Vac, 60Hz	James Yang
Conducted Emission	25deg. C, 63%RH	120Vac, 60Hz	James Yang
Radiated Emission	20deg. C, 66%RH	120Vac, 60Hz	Randy Wu

3.4 EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency

3.5 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and References:

Test Standard:

FCC 47 CFR Part 2

FCC 47 CFR Part 27

ANSI/TIA/EIA-603-E 2016

ANSI 63.26-2015

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 971168 D02 Misc Rev Approv License Devices v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Output Power Measurement

4.1.1 Limits of Output Power Measurement

The power of each fixed or base station transmitting in the 3450-3550 MHz band and situated in any geographic location other than that described in paragraph (k)(1) of this section is limited to an EIRP of 1640 Watts/MHz. This limit applies to the aggregate power of all antenna elements in any given sector of a base station.

4.1.2 Test Procedures

Conducted Power Measurement:

The EUT was set up for the maximum power with 5GNR link data modulation and link up with Spectrum Analyzer. Set the EUT to transmit under one channel and record the power level shown on Spectrum Analyzer.

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:

$EIRP = P_{Meas} + G_T$

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

where

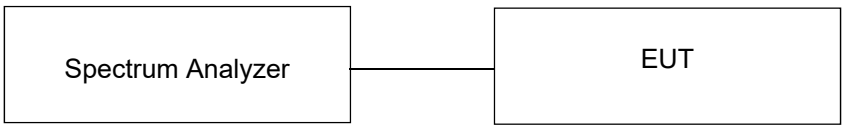
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

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)

4.1.3 Test Setup

Conducted Power Measurement:



4.1.4 Test Results

Conducted Output Power (dBm)

Test Mode A - 5GNR n78:

Channel Number	Freq. (MHz)	QPSK									Pass / Fail
		Conducted Average Power					Directional gain (dBi)	EIRP (dBm /MHz)	EIRP (W/MHz)	Limit (W/MHz)	
		Unit	Ant.0	Ant.1	Ant.2	Ant.3	Total				
633334	3500.01	dBm/MHz	3.20	3.10	3.12	3.23	9.19	10.62	19.81	0.10	1640.00	Pass
		dBm/100MHz	24.20	24.10	24.12	24.23	30.18	10.62	40.80	12.03	-	

Channel Number	Freq. (MHz)	16QAM									Pass / Fail
		Conducted Average Power					Directional gain (dBi)	EIRP (dBm /MHz)	EIRP (W/MHz)	Limit (W/MHz)	
		Unit	Ant.0	Ant.1	Ant.2	Ant.3	Total				
633334	3500.01	dBm/MHz	3.16	3.07	3.05	3.16	9.13	10.62	19.75	0.09	1640.00	Pass
		dBm/100MHz	24.16	24.07	24.05	24.16	30.13	10.62	40.75	11.89	-	

Channel Number	Freq. (MHz)	64QAM									Pass / Fail
		Conducted Average Power					Directional gain (dBi)	EIRP (dBm /MHz)	EIRP (W/MHz)	Limit (W/MHz)	
		Unit	Ant.0	Ant.1	Ant.2	Ant.3	Total				
633334	3500.01	dBm/MHz	3.06	2.88	3.02	3.08	9.03	10.62	19.65	0.09	1640.00	Pass
		dBm/100MHz	24.06	23.88	24.02	24.08	30.03	10.62	40.65	11.62	-	

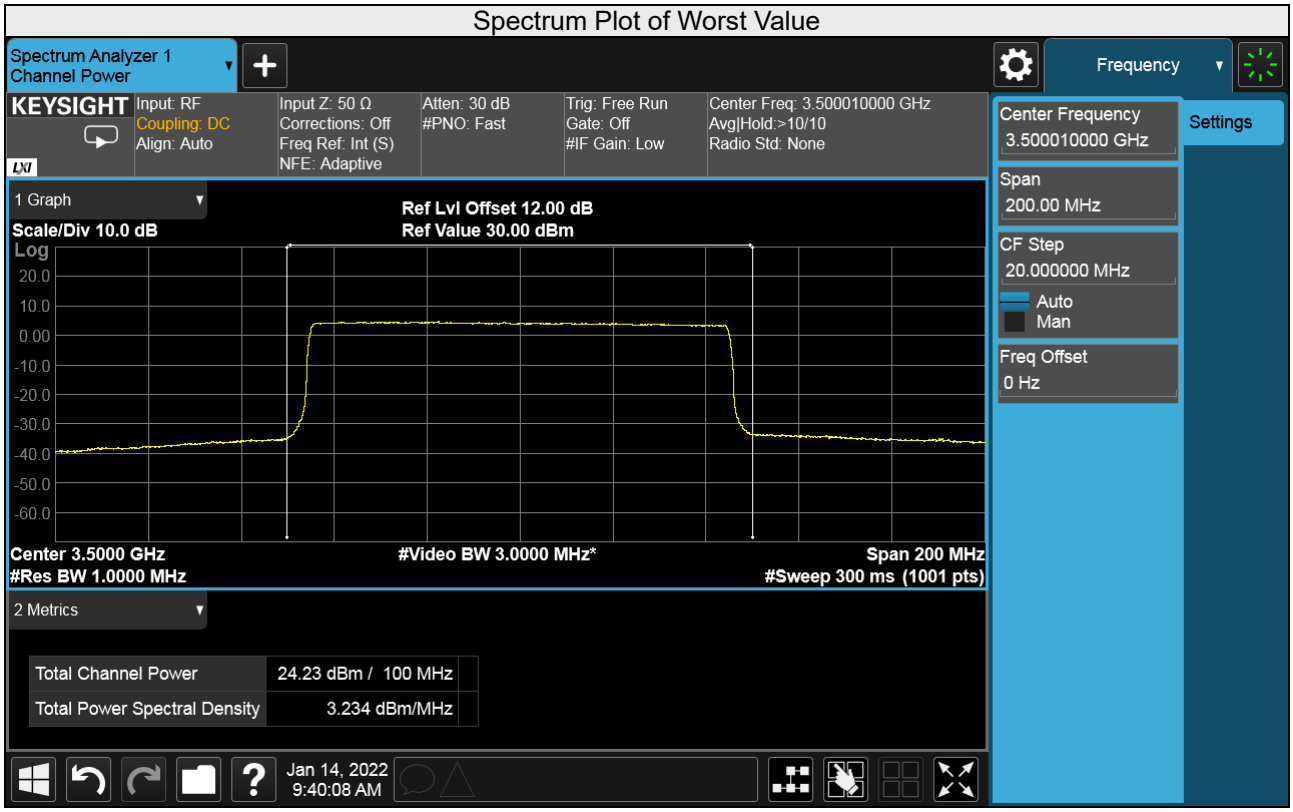
Channel Number	Freq. (MHz)	256QAM									Pass / Fail
		Conducted Average Power					Directional gain (dBi)	EIRP (dBm /MHz)	EIRP (W/MHz)	Limit (W/MHz)	
		Unit	Ant.0	Ant.1	Ant.2	Ant.3	Total				
633334	3500.01	dBm/MHz	3.07	2.84	2.92	3.01	8.98	10.62	19.60	0.09	1640.00	Pass
		dBm/100MHz	24.07	23.84	23.92	24.01	29.98	10.62	40.60	11.49	-	

*Directional Gain = 4.60dBi + Array Gain (6.02) = 10.62dBi

*EIRP = Conducted + Directional gain (10.62dBi)

*The antenna gain was declared by client.

Spectrum Plot of Worst Value



Test Mode B - 5GNR n78:

Channel Number	Freq. (MHz)	QPSK										Pass / Fail
		Conducted Average Power						Directional gain (dBi)	EIRP (dBm /MHz)	EIRP (W/MHz)	Limit (W/MHz)	
		Unit	Ant.0	Ant.1	Ant.2	Ant.3	Total					
633334	3500.01	dBm/MHz	3.20	3.10	3.12	3.23	9.19	11.14	20.33	0.11	1640.00	Pass
		dBm/100MHz	24.20	24.10	24.12	24.23	30.18	11.14	41.32	13.56	-	

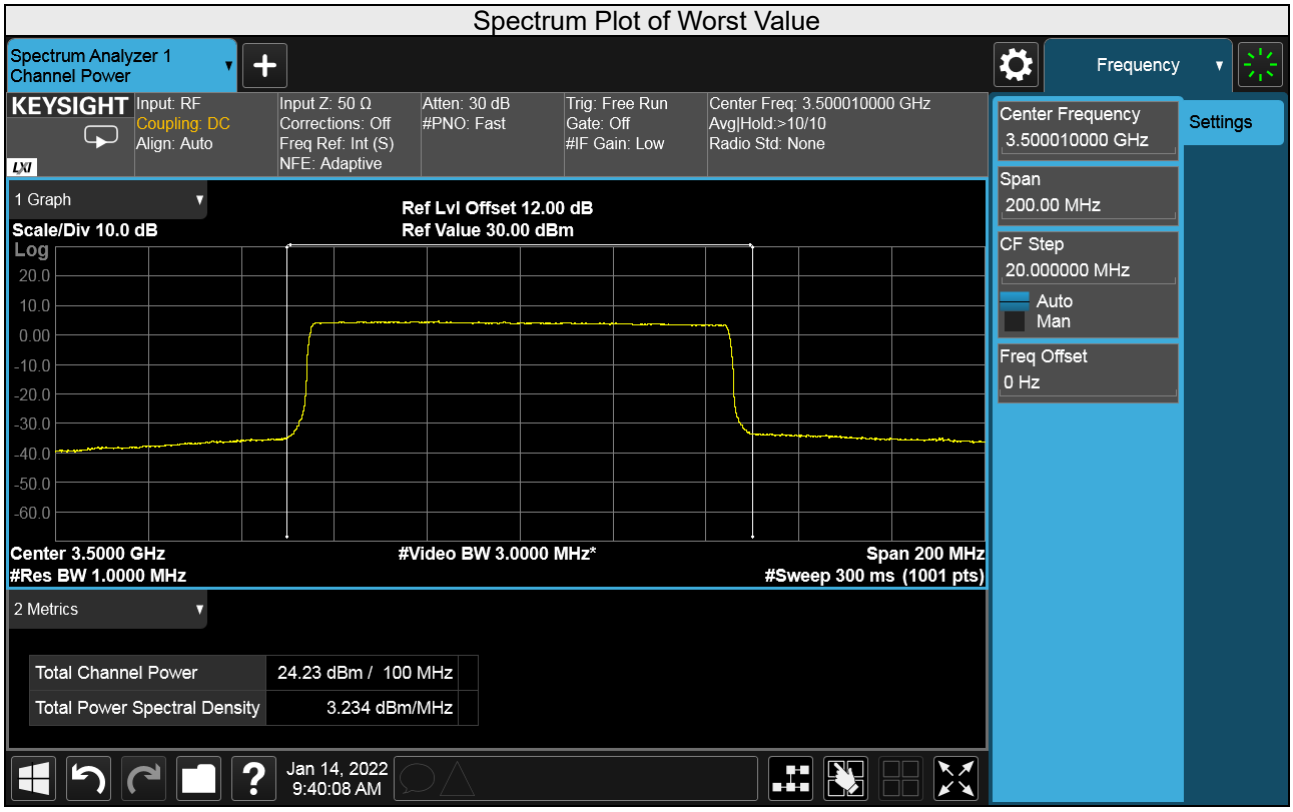
Channel Number	Freq. (MHz)	16QAM										Pass / Fail
		Conducted Average Power						Directional gain (dBi)	EIRP (dBm /MHz)	EIRP (W/MHz)	Limit (W/MHz)	
		Unit	Ant.0	Ant.1	Ant.2	Ant.3	Total					
633334	3500.01	dBm/MHz	3.16	3.07	3.05	3.16	9.13	11.14	20.27	0.11	1640.00	Pass
		dBm/100MHz	24.16	24.07	24.05	24.16	30.13	11.14	41.27	13.40	-	

Channel Number	Freq. (MHz)	64QAM										Pass / Fail
		Conducted Average Power						Directional gain (dBi)	EIRP (dBm /MHz)	EIRP (W/MHz)	Limit (W/MHz)	
		Unit	Ant.0	Ant.1	Ant.2	Ant.3	Total					
633334	3500.01	dBm/MHz	3.06	2.88	3.02	3.08	9.03	11.14	20.17	0.10	1640.00	Pass
		dBm/100MHz	24.06	23.88	24.02	24.08	30.03	11.14	41.17	13.10	-	

Channel Number	Freq. (MHz)	64QAM										Pass / Fail
		Conducted Average Power						Directional gain (dBi)	EIRP (dBm /MHz)	EIRP (W/MHz)	Limit (W/MHz)	
		Unit	Ant.0	Ant.1	Ant.2	Ant.3	Total					
633334	3500.01	dBm/MHz	3.07	2.84	2.92	3.01	8.98	11.14	20.12	0.10	1640.00	Pass
		dBm/100MHz	24.07	23.84	23.92	24.01	29.98	11.14	41.12	12.95	-	

*Directional Gain = 5.12dBi + Array Gain (6.02) = 11.14dBi
*EIRP = Conducted + Directional gain (11.14dBi)
*The antenna gain was declared by client.

Spectrum Plot of Worst Value



4.2 Modulation Characteristics Measurement

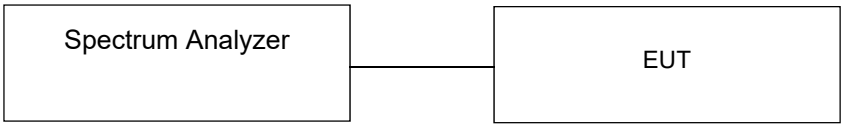
4.2.1 Limits of Modulation Characteristics

N/A

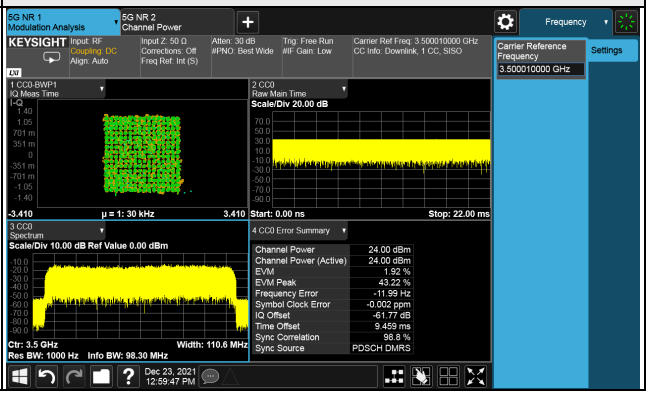
4.2.2 Test Procedure

Connect the EUT to Spectrum Analyzer 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.

4.2.3 Test Setup



4.2.4 Test Results

5GNR n78	
Spectrum Plot of Measurement Value	
Channel: 633334 / Frequency (MHz): 3500.01MHz	
QPSK	16QAM
	
64QAM	256QAM
	

4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

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

According to the FCC part 2.1055 shall be tested the frequency stability. The rule is defined that" The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block." The test extreme voltage is according to the 2.1055(d)(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment and the extreme temperature rule is comply with specification of EUT -30℃ ~ 50℃.

4.3.2 Test Procedure

a. 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.
b. 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.
c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ±0.5 ℃ 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.

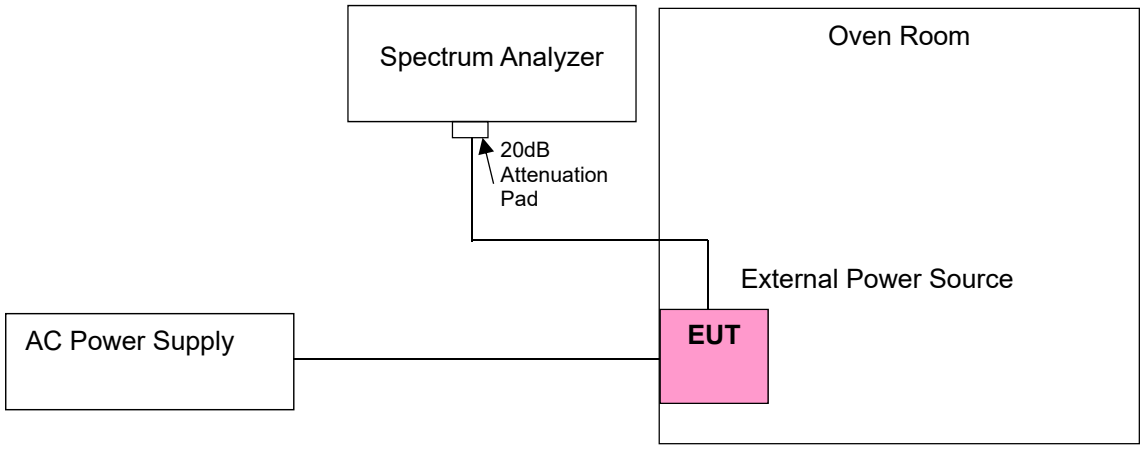
Note: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140938	Mar. 09, 2021	Mar. 08, 2022
Standard Temperature And Humidity Chamber GIANT FORCE	GTH-120-40-CP-AR	MAA1306-019	Sep. 10, 2021	Sep. 09, 2022
Digital Multimeter Fluke	87-III	70360742	Jun. 24, 2021	Jun. 23, 2022
AC Power Supply Extech	CFW-105	E000603	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.3.4 Test Setup



4.3.5 Test Results

Frequency Error vs. Voltage

Voltage (Vac)	5GNR n78			
	Channel Bandwidth 100 MHz			
	Ant. TX 0		Ant. TX 1	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120.00	3500.010027	0.008	3500.010040	0.011
102.00	3500.010010	0.003	3500.010025	0.007
138.00	3500.010014	0.004	3500.010032	0.009

Note: The applicant defined the normal working voltage is from 102Vac to 138Vac.

Frequency Error vs. Temperature

Temp. (℃)	5GNR n78			
	Channel Bandwidth 100 MHz			
	Ant. TX 0		Ant. TX 1	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3500.010010	0.003	3500.010012	0.003
-20	3500.010024	0.007	3500.010035	0.010
-10	3500.010038	0.011	3500.010029	0.008
0	3500.010024	0.007	3500.010039	0.011
10	3500.010026	0.007	3500.010013	0.004
20	3500.009975	-0.007	3500.009980	-0.006
30	3500.009989	-0.003	3500.009987	-0.004
40	3500.009978	-0.006	3500.009964	-0.010
50	3500.009962	-0.011	3500.009964	-0.010

Frequency Error vs. Voltage

Voltage (Vac)	5GNR n78			
	Channel Bandwidth 100 MHz			
	Ant. TX 2		Ant. TX 3	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
120.00	3500.010034	0.010	3500.010030	0.009
102.00	3500.010011	0.003	3500.010027	0.008
138.00	3500.010032	0.009	3500.010012	0.003

Note: The applicant defined the normal working voltage is from 102Vac to 138Vac.

Frequency Error vs. Temperature

Temp. (℃)	5GNR n78			
	Channel Bandwidth 100 MHz			
	Ant. TX 2		Ant. TX 3	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3500.010035	0.010	3500.010036	0.010
-20	3500.010036	0.010	3500.010010	0.003
-10	3500.010030	0.009	3500.010030	0.009
0	3500.010039	0.011	3500.010018	0.005
10	3500.010025	0.007	3500.010026	0.007
20	3500.009960	-0.011	3500.009989	-0.003
30	3500.009979	-0.006	3500.009964	-0.010
40	3500.009986	-0.004	3500.009989	-0.003
50	3500.009966	-0.010	3500.009963	-0.011

4.4 Emission Bandwidth Measurement

4.4.1 Test Procedure

According to FCC 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.

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

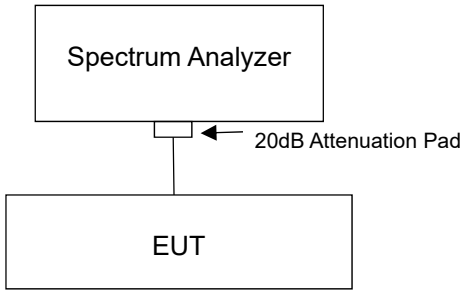
4.4.2 Test Procedure

For the 26dBc 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 ≥ 3 × 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.

4.4.3 Test Setup



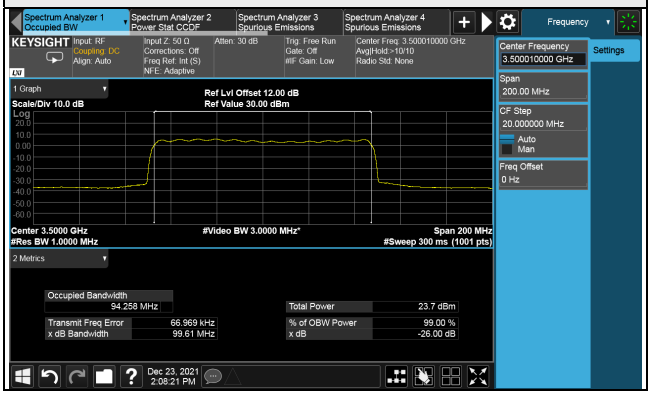
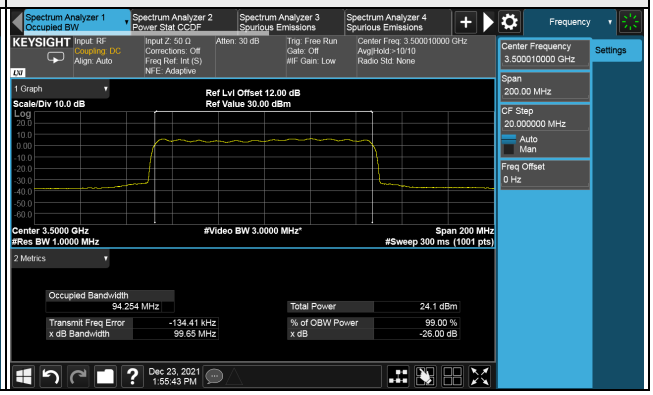
4.4.4 Test Result

Occupied Bandwidth

Channel Number	Freq. (MHz)	99% Occupied Bandwidth (MHz)															
		Ant. TX0				Ant. TX1				Ant. TX2				Ant. TX3			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
633334	3500.01	92.92	93.87	94.25	94.24	92.80	93.86	94.25	94.22	92.91	93.86	94.24	94.22	92.91	93.83	94.26	94.24

26dB Bandwidth

Channel Number	Freq. (MHz)	26dB Bandwidth (MHz)															
		Ant. TX0				Ant. TX1				Ant. TX2				Ant. TX3			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
633334	3500.01	99.51	99.55	99.65	99.61	99.48	99.55	99.63	99.62	99.51	99.55	99.61	99.61	99.51	99.54	99.61	99.61

Spectrum Plot of Worst Value	
99% Occupied Bandwidth	26dB Bandwidth
Ant. TX3 / 64QAM	Ant. TX0 / 64QAM
	

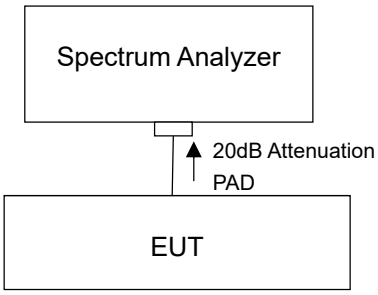
4.5 Channel Edge / Out-of-Band Emission Measurement

4.5.1 Limits of Channel Edge / Out-of-Band Emission Measurement

For base station operations in the 3450-3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz. Compliance with the provisions of this paragraph (n)(1) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed, but limited to a maximum of 200 kHz. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Notwithstanding the channel edge requirement of −13 dBm per megahertz, for base station operations in the 3450-3550 MHz band, the conducted power of any emission below 3440 MHz or above 3560 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3430 MHz or above 3570 MHz shall not exceed −40 dBm/MHz.

Note: This device can be impelement MIMO function, so the limit of spurious emissions needs to be reduced by 10log(NumbersAnt) according to FCC KDB 662911 D01 guidance.

4.5.2 Test Setup



4.5.3 Test Procedures

a. The EUT was set up for the rated peak power. The power was measured with Spectrum Analyzer. All measurements were done at one channel.
b. Measurement refer to ANSI C63.26 section 5.7.2 and FCC Part 27 section 27.53.
c. Record the max trace plot into the test report.

4.5.4 Test Results

Out-of-Band Emission

Ant. TX 0

5GNR n78, Channel Bandwidth 100MHz
Channel 633334 (3500.01MHz)

Ant. TX 1

5GNR n78, Channel Bandwidth 100MHz
Channel 633334 (3500.01MHz)

Ant. TX 2

5GNR n78, Channel Bandwidth 100MHz
Channel 633334 (3500.01MHz)

Ant. TX 3

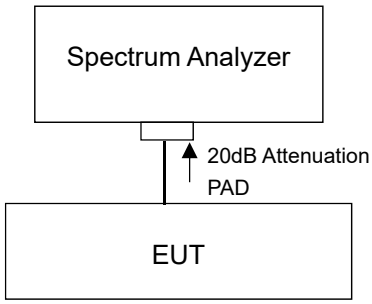
5GNR n78, Channel Bandwidth 100MHz
Channel 633334 (3500.01MHz)

4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

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

4.6.2 Test Setup



4.6.3 Test Procedures

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

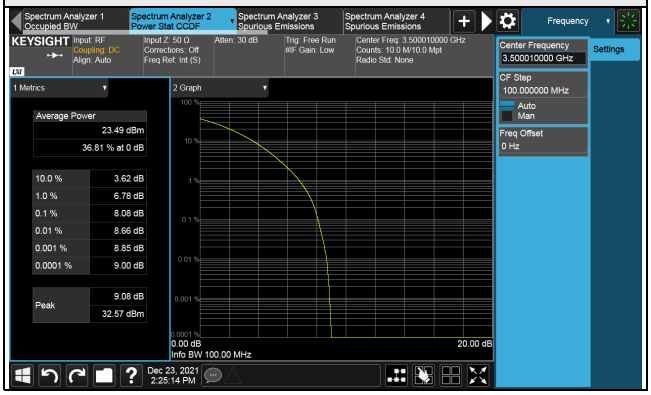
4.6.4 Test Results

5GNR n78:

Channel Number	Freq. (MHz)	Peak To Average Ratio (dB)															
		Ant. TX0				Ant. TX1				Ant. TX2				Ant. TX3			
		QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM	QPSK	16QAM	64QAM	256QAM
633334	3500.01	8.05	8.05	7.93	7.87	8.03	8.08	8.00	8.05	8.04	8.08	8.07	7.99	8.02	7.86	7.81	7.89

Spectrum Plot of Worst Value

Ant. TX1 / 16QAM



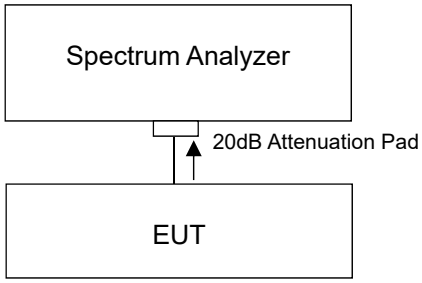
4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

According to FCC 27.53(n),
For base station operations in the 3450-3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz.
For base station operations in the 3450-3550 MHz band, the conducted power of any emission below 3440 MHz or above 3560 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3430 MHz or above 3570 MHz shall not exceed −40 dBm/MHz.

Note: This device can be impelement MIMO function, so the limit of spurious emissions needs to be reduced by 10log(NumbersAnt) according to FCC KDB 662911 D01 guidance.

4.7.2 Test Setup



4.7.3 Test Procedure (For Unwanted Emission 9kHz ~ 3420 MHz & 3570MHz ~ 40GHz)

a. Measuring frequency range is from 9 kHz up to 40GHz, whichever is lower. 20dB attenuation pad is connected with spectrum.
b. The spectrum set RBW = 1MHz, VBW = 3MHz.
c. Measurement refer to ANSI C63.26 section 5.7.3.

Limit:

Frequency Range	Limit (dBm)
9kHz ~ 3420MHz	-46.02
3570MHz ~ 40GHz	-46.02

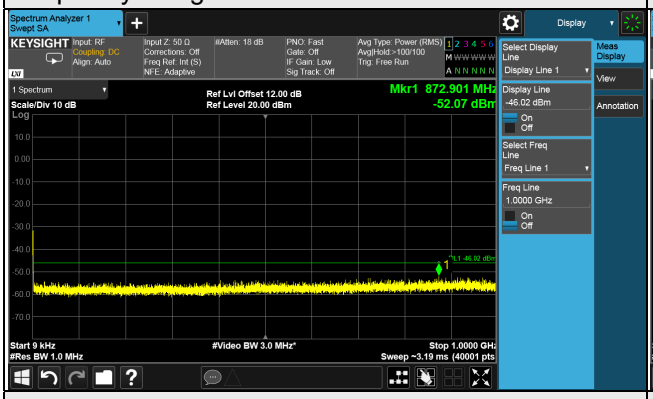
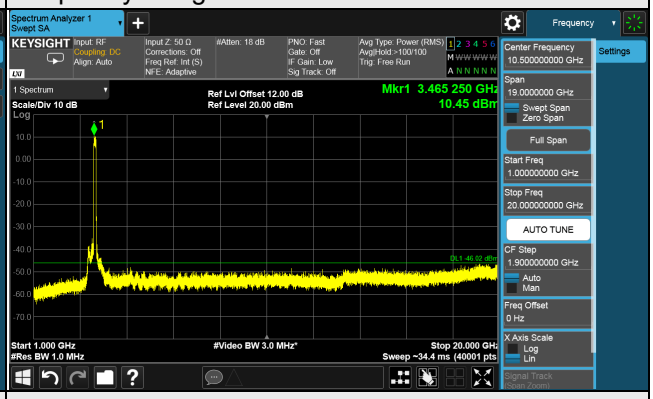
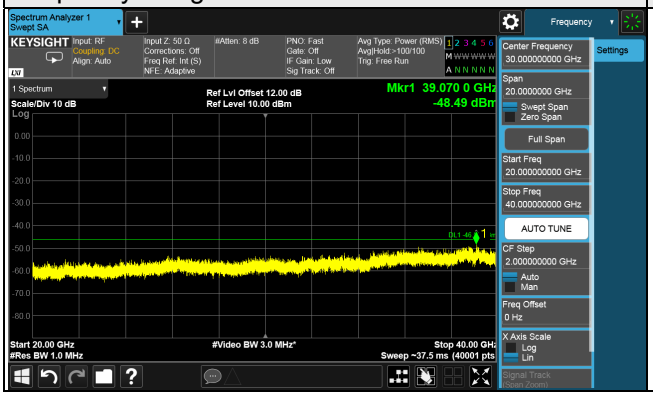
Note: Out-of-Frequency Band Unwanted Emission Limit = -40 - 10log($Numbers_{Ant}$) = -40 – 10log(4) = -46.02 dBm

Frequency Range	Limit (dBm)
3420 ~ 3570MHz	Note

Note: Test result please refer to chapter 4.5.

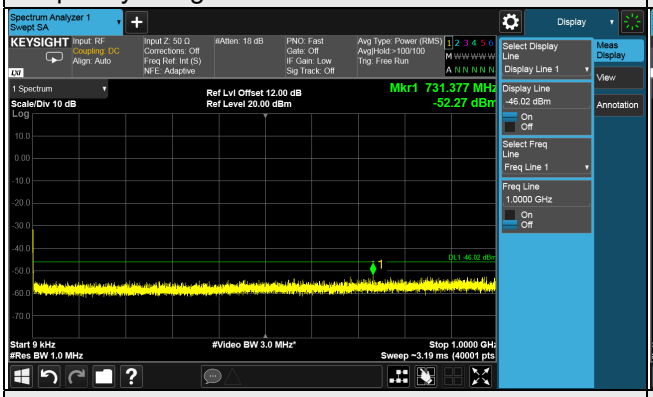
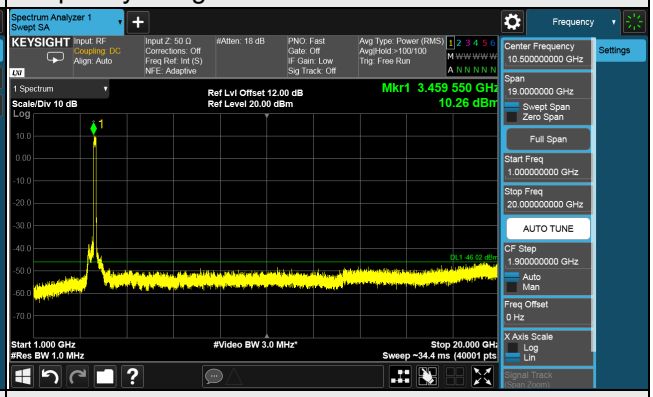
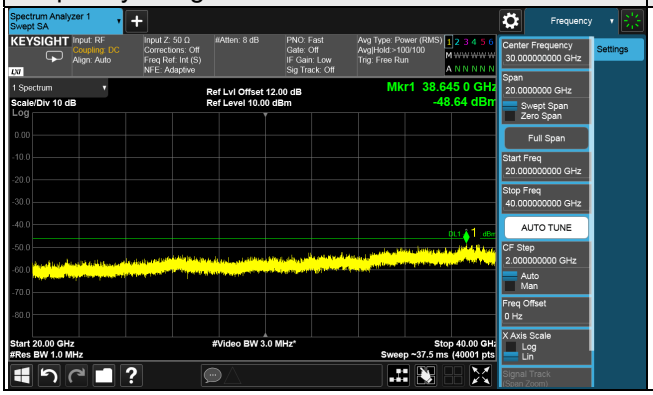
4.7.4 Test Results

Ant. TX 0

5GNR n78, Channel Bandwidth 100MHz	
Channel 633334 (3500.01MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	
Frequency Range : 20GHz ~ 40GHz	
	

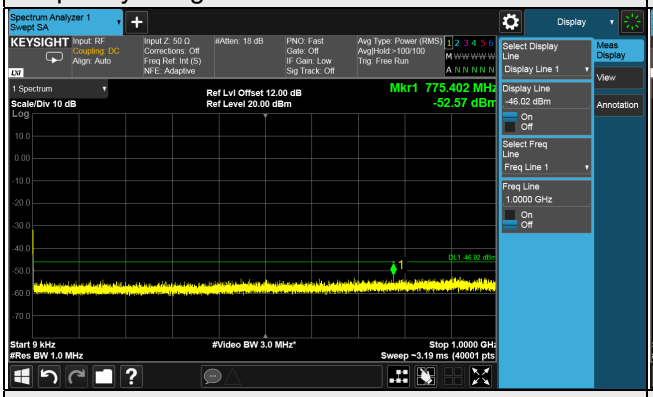
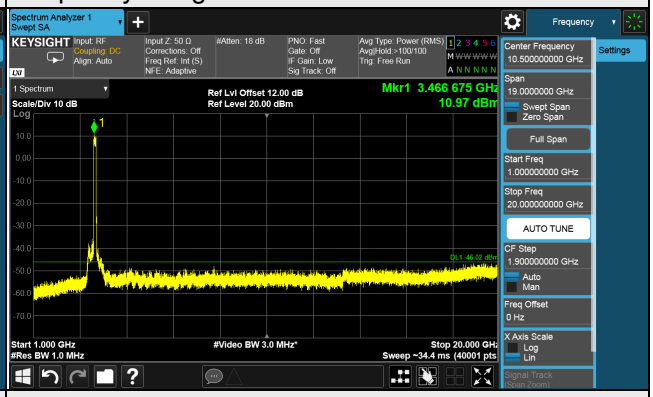
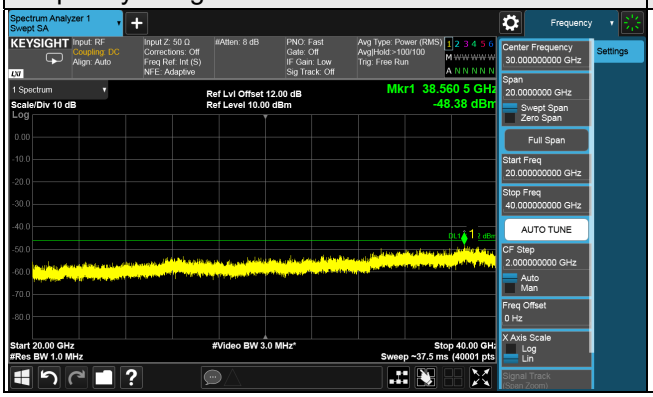
*The 9 kHz tone is from the spectrum analyzer.

Ant. TX 1

5GNR n78, Channel Bandwidth 100MHz	
Channel 633334 (3500.01MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	
Frequency Range : 20GHz ~ 40GHz	
	

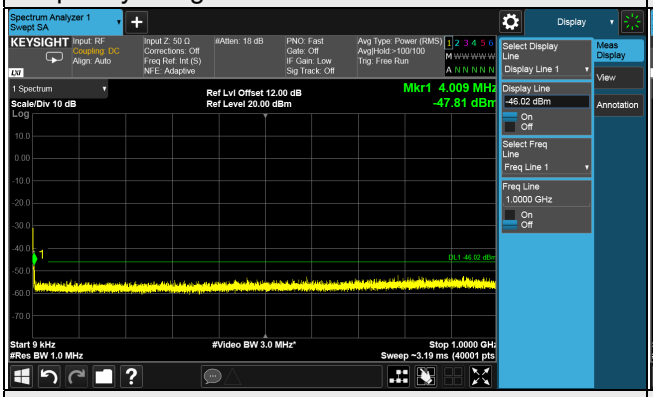
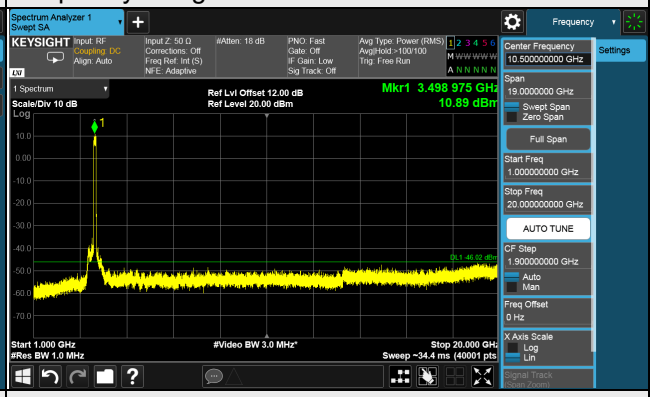
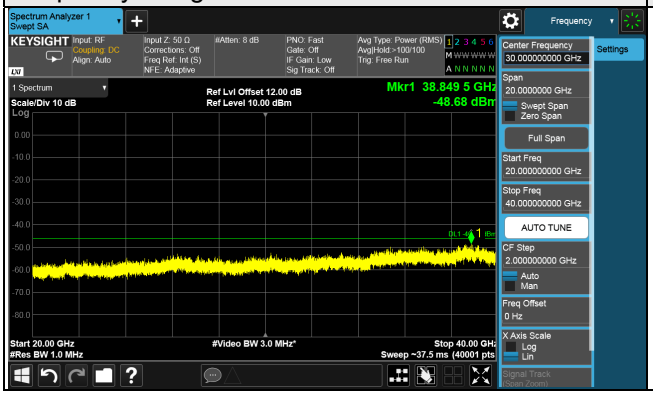
*The 9 kHz tone is from the spectrum analyzer.

Ant. TX 2

5GNR n78, Channel Bandwidth 100MHz	
Channel 633334 (3500.01MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	
Frequency Range : 20GHz ~ 40GHz	
	

*The 9 kHz tone is from the spectrum analyzer.

Ant. TX 3

5GNR n78, Channel Bandwidth 100MHz	
Channel 633334 (3500.01MHz)	
Frequency Range : 9kHz ~ 1GHz	Frequency Range : 1GHz ~ 20GHz
	
Frequency Range : 20GHz ~ 40GHz	
	

*The 9 kHz tone is from the spectrum analyzer.

4.8 Radiated Emission Measurement

4.8.1 Limits of Radiated Emission Measurement

According to FCC 27.53(n), For base station operations in the 3450-3550 MHz band, the conducted power of emissions below 3430 MHz or above 3570 MHz shall not exceed −40 dBm/MHz.

4.8.2 Test Procedure

a. In the semi-anechoic chamber, EUT placed on the 0.8m(below or equal 1GHz) and/or 1.5m(above 1GHz) 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 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
b. 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.
c. 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.
d. Following C63.26 section 5.5 and 5.2.7
   EIRP (dBm) = E (dBμV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m.
   ERP (dBm) = E (dBμV/m) + 20log(D) - 104.8 - 2.15; where D is the measurement distance (in the far field region) in m.

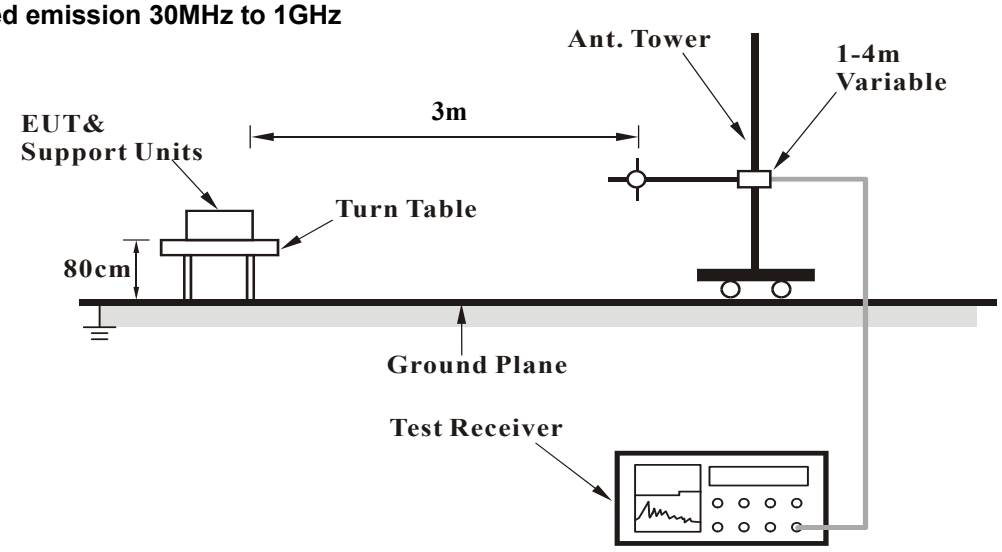
Note:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.
2. The emission levels were against the limit of frequency range 9 kHz ~ 30 MHz:
   The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

4.8.3 Deviation from Test Standard

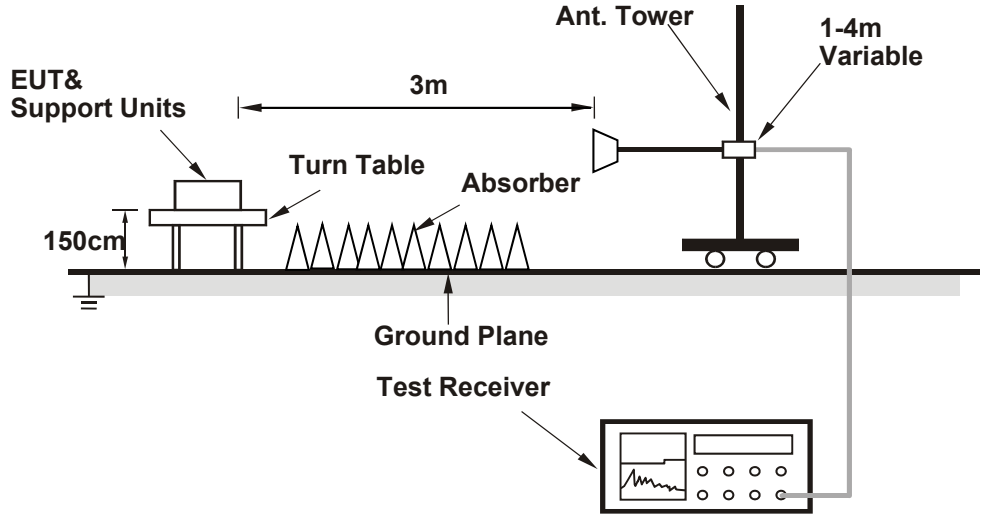
No deviation.

4.8.4 Test Setup

For radiated emission 30MHz to 1GHz



For radiated emission above 1GHz



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

4.8.5 Test Results

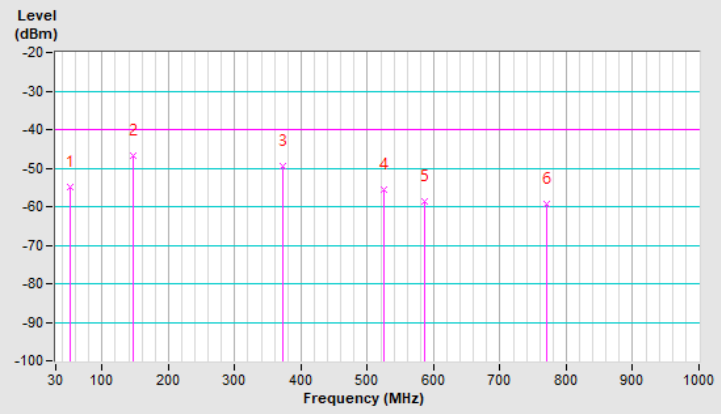
Below 1GHz
5GNR n78, Channel Bandwidth 100MHz

Mode	TX channel 633334 (3500.01MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	20deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Randy Wu	Test Mode	A

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	51.09	-54.97	-40.00	-14.97	2.00 H	238	58.76	-113.73
2	146.68	-46.80	-40.00	-6.80	1.01 H	114	66.51	-113.31
3	371.61	-49.62	-40.00	-9.62	2.00 H	174	61.46	-111.08
4	524.84	-55.71	-40.00	-15.71	1.51 H	126	51.88	-107.59
5	586.70	-58.54	-40.00	-18.54	1.51 H	51	47.49	-106.03
6	769.45	-59.30	-40.00	-19.30	1.01 H	9	43.69	-102.99

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

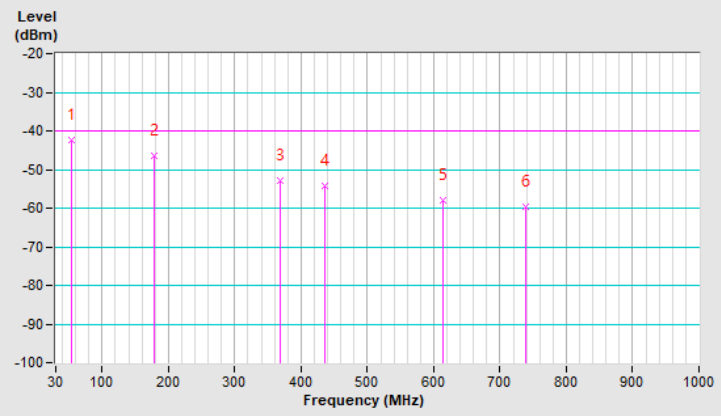


Mode	TX channel 633334 (3500.01MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	20deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Randy Wu	Test Mode	A

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	**53.90**	**-42.47**	**-40.00**	**-2.47**	**1.49 V**	**18**	**71.49**	**-113.96**
2	177.61	-46.31	-40.00	-6.31	1.00 V	283	68.25	-114.56
3	368.80	-52.82	-40.00	-12.82	1.49 V	261	58.35	-111.17
4	436.28	-54.33	-40.00	-14.33	1.99 V	2	54.87	-109.20
5	614.81	-57.88	-40.00	-17.88	1.00 V	262	47.40	-105.28
6	738.52	-59.79	-40.00	-19.79	1.49 V	120	43.88	-103.67

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

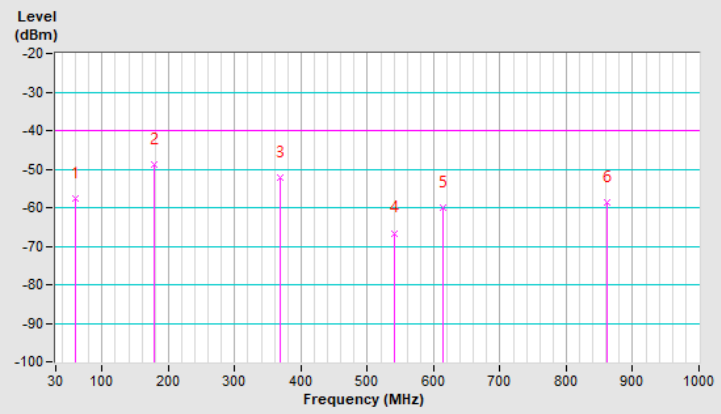


Mode	TX channel 633334 (3500.01MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	20deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Randy Wu	Test Mode	B

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	59.52	-57.78	-40.00	-17.78	1.51 H	292	56.61	-114.39
2	177.61	-48.88	-40.00	-8.88	1.01 H	246	65.68	-114.56
3	368.80	-52.23	-40.00	-12.23	1.01 H	119	58.94	-111.17
4	541.71	-66.61	-40.00	-26.61	1.01 H	100	40.83	-107.44
5	614.81	-59.89	-40.00	-19.89	1.51 H	141	45.39	-105.28
6	862.23	-58.74	-40.00	-18.74	1.51 H	157	43.38	-102.12

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

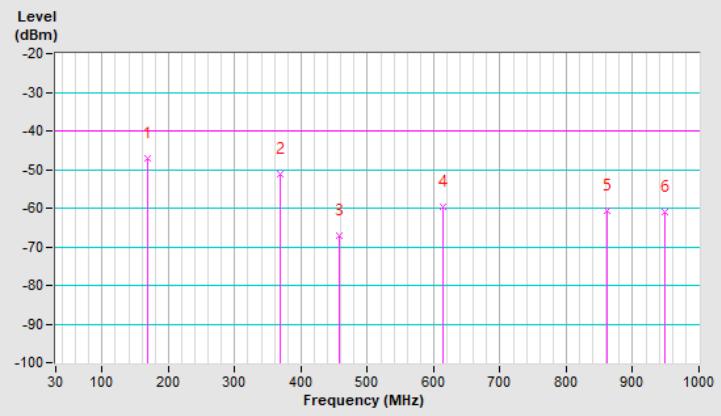


Mode	TX channel 633334 (3500.01MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	20deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Randy Wu	Test Mode	B

Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	169.17	-47.16	-40.00	-7.16	1.00 V	163	66.55	-113.71
2	368.80	-51.32	-40.00	-11.32	1.49 V	308	59.85	-111.17
3	457.36	-67.25	-40.00	-27.25	1.49 V	268	41.36	-108.61
4	614.81	-59.76	-40.00	-19.76	1.49 V	98	45.52	-105.28
5	860.83	-60.57	-40.00	-20.57	1.00 V	330	41.54	-102.11
6	949.39	-61.12	-40.00	-21.12	1.99 V	2	39.81	-100.93

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.



Above 1GHz

5GNR n78, Channel Bandwidth 100MHz

Mode	TX channel 633334 (3500.01MHz)	Frequency Range	1GHz ~ 40GHz
Environmental Conditions	20deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Randy Wu	Test Mode	A

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7000.02	-50.38	-40.00	-10.38	1.01 H	340	38.06	-88.44
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7000.02	-47.89	-40.00	-7.89	2.65 V	45	40.55	-88.44

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

Mode	TX channel 633334 (3500.01MHz)	Frequency Range	1GHz ~ 40GHz
Environmental Conditions	20deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Randy Wu	Test Mode	B

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7000.02	-44.99	-40.00	-4.99	1.53 H	357	43.45	-88.44
Antenna Polarity & Test Distance : Vertical at 3m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7000.02	-51.39	-40.00	-11.39	1.38 V	12	37.05	-88.44

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

--- END ---