

## FCC Test Report (Part 22\_C2PC (Class II Permissive Change))

**Report No.:** RF180905C04D

**FCC ID:** 2AD8UAHCE01

**Test Model:** AHCE

**Received Date:** Feb. 26, 2020

**Test Date:** Mar. 08 ~ Mar. 09, 2020

**Issued Date:** Mar. 19, 2020

**Applicant:** Nokia Solutions and Networks, OY

**Address:** 2000 W. Lucent Lane, Naperville, IL 60563, USA

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

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Taiwan

**FCC Registration /  
Designation Number:** 788550 / TW0003



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### Release Control Record

Issue No.	Description	Date Issued
RF180905C04D	Original release	Mar. 19, 2020

## 1 Certificate of Conformity

**Product:** AirScale Micro Remote Radio Head  
**Brand:** Nokia  
**Test Model:** AHCE  
**Sample Status:** Mass product  
**Applicant:** Nokia Solutions and Networks, OY  
**Test Date:** Mar. 08 ~ Mar. 09, 2020  
**Standards:** FCC Part 22, Subpart H

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 :**                     *Polly Chen*                     , **Date:**                     Mar. 19, 2020                      
Polly Chen / Specialist

**Approved by :**                     *Bruce Chen*                     , **Date:**                     Mar. 19, 2020                      
Bruce Chen / Senior Project Engineer

## 2 Summary of Test Results

Applied Standard: FCC Part 22 & Part 2			
FCC Clause	Test Item	Result	Remarks
2.1046 22.913 (a)	Effective radiated power	Pass	Meet the requirement of limit.
2.1047	Modulation characteristics	Pass	Meet the requirement
22.913 (d)	Peak To Average Ratio	Pass	Meet the requirement of limit.
2.1055 22.355	Frequency Stability	Pass	Meet the requirement of limit.
2.1049	Occupied Bandwidth	Pass	Meet the requirement of limit.
22.917	Band Edge Measurements	Pass	Meet the requirement of limit.
2.1051 22.917	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
2.1053 22.917	Radiated Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -16.8dB at 133.79MHz.

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) ( $\pm$ )
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.59 dB
	200MHz ~ 1000MHz	3.60 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

## 2.2 Test Site and Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 15, 2019	Apr. 14, 2020
Spectrum Analyzer KEYSIGHT	N9030B	MY57140953	Jun. 28, 2019	Jun. 27, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 07, 2019	Nov. 06, 2020
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 24, 2019	Nov. 23, 2020
Loop Antenna TESEQ	HLA 6121	45745	Jul. 01, 2019	Jun. 30, 2020
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Jul. 11, 2019	Jul. 10, 2020
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 18, 2020	Feb. 17, 2021
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM- SM8000	CABLE-CH9-02 (248780+171006)	Jan. 18, 2020	Jan. 17, 2021
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Jul. 11, 2019	Jul. 10, 2020
RF signal cable Woken	8D-FB	Cable-CH9-01	Jul. 30, 2019	Jul. 29, 2020
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
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
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 03, 2019	Jun. 02, 2020
JFW 20dB attenuation	50HF-020-SMA	NA	NA	NA
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 03, 2019	Jun. 02, 2020
True RMS Clamp Meter Fluke	325	31130711WS	May 21, 2019	May 20, 2020

- 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 HwaYa Chamber 9.

### 3 General Information

#### 3.1 General Description of EUT

Product	AirScale Micro Remote Radio Head				
Brand	Nokia				
Test Model	AHCE				
Sample Status	Mass product				
Power Supply Rating	I/P: 100-240Vac, 50/60Hz, 3A MAX O/P: -54Vdc, 3A MAX				
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM				
Operating Frequency	n5 (Channel Bandwidth 5MHz)	871.5~891.5MHz			
	n5 (Channel Bandwidth 10MHz)	874.0~889.0MHz			
	n5 (Channel Bandwidth 15MHz)	876.5~886.5MHz			
	n5 (Channel Bandwidth 20MHz)	879.0~884.0MHz			
Max. ERP Power		QPSK	16QAM	64QAM	256QAM
	n5 (Channel Bandwidth 5MHz)	75509.223 mW (48.78dBm)	74644.876 mW (48.73dBm)	74301.914 mW (48.71dBm)	73113.908 mW (48.64dBm)
	n5 (Channel Bandwidth 10MHz)	76383.578 mW (48.83dBm)	74989.421 mW (48.75dBm)	74473.197 mW (48.72dBm)	74301.914 mW (48.71dBm)
	n5 (Channel Bandwidth 15MHz)	75509.223 mW (48.78dBm)	74816.950 mW (48.74dBm)	74816.950 mW (48.74dBm)	74816.950 mW (48.74dBm)
	n5 (Channel Bandwidth 20MHz)	76207.901 mW (48.82dBm)	75509.223 mW (48.78dBm)	74989.421 mW (48.75dBm)	75509.223 mW (48.78dBm)
Emission Designator		QPSK	16QAM	64QAM	256QAM
	n5 (Channel Bandwidth 5MHz)	4M48G7D	4M48D7W	4M48D7W	4M48D7W
	n5 (Channel Bandwidth 10MHz)	9M31G7D	9M31D7W	9M31D7W	9M31D7W
	n5 (Channel Bandwidth 15MHz)	14M1G7D	14M1D7W	14M1D7W	14M1D7W
	n5 (Channel Bandwidth 20MHz)	19M0G7D	19M0D7W	19M0D7W	19M0D7W
Antenna Gain	8dBi				
S/N	474036A.102				
HW Version	A102				
SW Version	5G19B				
Accessory Device	Refer to Note as below				
Cable Supplied	NA				



Note:

1. This report is prepared for FCC class II permissive change. This is a supplementary report of Report No.: RF180905C04C. The differences between them are as below information:

- ◆ Added 5G NR n5 Band (Bandwidth: 5MHz, 10MHz, 15MHz, 20MHz)
- ◆ An representative Nokia antenna, AABA 8dBi antenna, is referred to comply with the EIRP limits.

For above changes, only 5G NR n5 Band (Bandwidth: 5MHz, 10MHz, 15MHz, 20MHz) mode test results has to be performed.

2. The EUT contains following accessory devices.

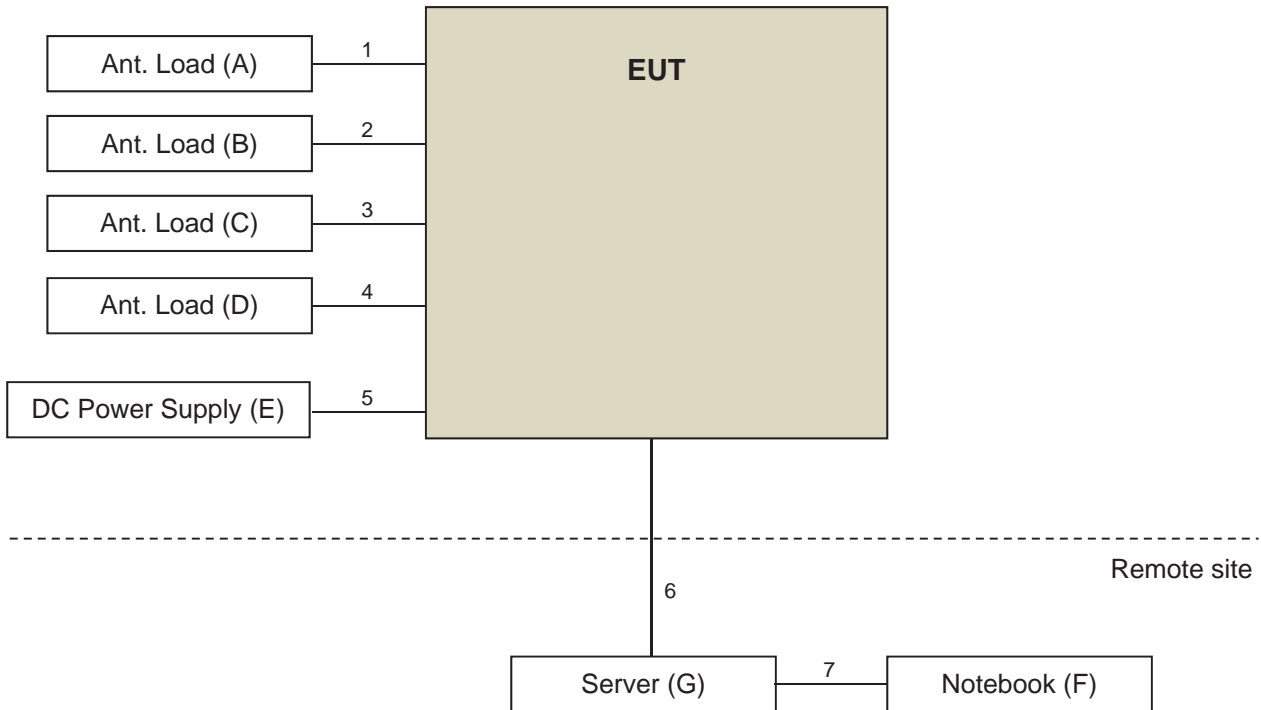
AC PSU (Optional)	
Brand	Nokia
Model	APAB
Sales Item	474130A.102
S/N	U7174800066
Remark	SUPLET/S818A160-220S54W
Input Power	100-240Vac, 50-60Hz, 3A MAX
Output Power	-54Vdc, 3A MAX

3. This device operate with Multiple Antennas Using Multiple-input, Multiple-output (MIMO) Technology for uncorrelated Transmission.

Modulation Mode	TX Function
QPSK, 16QAM, 64QAM, 256QAM	1TX
QPSK, 16QAM, 64QAM, 256QAM	2TX
QPSK, 16QAM, 64QAM, 256QAM	3TX
QPSK, 16QAM, 64QAM, 256QAM	4TX

4. The antenna gain for reference only, the test was done with 50ohm terminator on antenna port.

### 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.	Ant. Load	NA	NA	NA	NA	Provided by manufacturer
B.	Ant. Load	NA	NA	NA	NA	Provided by manufacturer
C.	Ant. Load	NA	NA	NA	NA	Provided by manufacturer
D.	Ant. Load	NA	NA	NA	NA	Provided by manufacturer
E.	DC Power Supply	MEAN WELL	RSP-500-48	EB8B336856	NA	-
F.	Notebook	DELL	E5420	BPQ8MQ1	FCC DoC Approved	-
G.	Server	NA	NA	NA	NA	Provided by manufacturer

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item E, F, G acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Ant. Cable	1	1	Y	0	-
2.	Ant. Cable	1	1	Y	0	-
3.	Ant. Cable	1	1	Y	0	-
4.	Ant. Cable	1	1	Y	0	-
5.	DC Cable	1	1	Y	0	-
6.	Fiber Cable	1	5	N	0	-
7.	RJ45 Cable	1	1	N	0	-

### 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 on X-plane. Following channel(s) was (were) selected for the final test as listed below:

n5

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
-	ERP	174300 to 178300	174300(871.5MHz), 176300(881.5MHz), 178300(891.5MHz)	5MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		174800 to 177800	174800(874.0MHz), 176300(881.5MHz), 177800(889.0MHz)	10MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		175300 to 177300	175300(876.5MHz), 176300(881.5MHz), 177300(886.5MHz)	15MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		175800 to 176800	175800(879.0MHz), 176300(881.5MHz), 176800(884.0MHz)	20MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
-	Modulation characteristics	175800 to 176800	176300(881.5MHz)	20MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
-	Frequency Stability	174300 to 178300	174300(871.5MHz), 178300(891.5MHz)	5MHz	QPSK	Full RB
		174800 to 177800	174800(874.0MHz), 177800(889.0MHz)	10MHz	QPSK	Full RB
		175300 to 177300	175300(876.5MHz), 177300(886.5MHz)	15MHz	QPSK	Full RB
		175800 to 176800	175800(879.0MHz), 176800(884.0MHz)	20MHz	QPSK	Full RB
-	Occupied Bandwidth	174300 to 178300	174300(871.5MHz), 176300(881.5MHz), 178300(891.5MHz)	5MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		174800 to 177800	174800(874.0MHz), 176300(881.5MHz), 177800(889.0MHz)	10MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		175300 to 177300	175300(876.5MHz), 176300(881.5MHz), 177300(886.5MHz)	15MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		175800 to 176800	175800(879.0MHz), 176300(881.5MHz), 176800(884.0MHz)	20MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB

EUT Configure Mode	Test item	Available channel	Tested channel	Channel Bandwidth	Modulation	Mode
-	Band Edge	174300 to 178300	174300(871.5MHz), 178300(891.5MHz)	5MHz	QPSK	Full RB
		174800 to 177800	174800(874.0MHz), 177800(889.0MHz)	10MHz	QPSK	Full RB
		175300 to 177300	175300(876.5MHz), 177300(886.5MHz)	15MHz	QPSK	Full RB
		175800 to 176800	175800(879.0MHz), 176800(884.0MHz)	20MHz	QPSK	Full RB
-	Peak to Average Ratio	174300 to 178300	174300(871.5MHz), 176300(881.5MHz), 178300(891.5MHz)	5MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		174800 to 177800	174800(874.0MHz), 176300(881.5MHz), 177800(889.0MHz)	10MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		175300 to 177300	175300(876.5MHz), 176300(881.5MHz), 177300(886.5MHz)	15MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
		175800 to 176800	175800(879.0MHz), 176300(881.5MHz), 176800(884.0MHz)	20MHz	QPSK / 16QAM / 64QAM/256QAM	Full RB
-	Conducted Emission	174300 to 178300	174300(871.5MHz), 176300(881.5MHz), 178300(891.5MHz)	5MHz	QPSK	Full RB
		174800 to 177800	174800(874.0MHz), 176300(881.5MHz), 177800(889.0MHz)	10MHz	QPSK	Full RB
		175300 to 177300	175300(876.5MHz), 176300(881.5MHz), 177300(886.5MHz)	15MHz	QPSK	Full RB
		175800 to 176800	175800(879.0MHz), 176300(881.5MHz), 176800(884.0MHz)	20MHz	QPSK	Full RB
-	Radiated Emission Below 1GHz	174300 to 178300	174300(871.5MHz)	5MHz	QPSK	Full RB
		175800 to 176800	175800(879.0MHz)	20MHz	QPSK	Full RB
-	Radiated Emission Above 1GHz	174300 to 178300	174300(871.5MHz), 176300(881.5MHz), 178300(891.5MHz)	5MHz	QPSK	Full RB
		175800 to 176800	175800(879.0MHz), 176300(881.5MHz), 176800(884.0MHz)	20MHz	QPSK	Full RB

Note:

1. For radiated emission below 1GHz, low, mid and high channels were pre-tested in chamber with 5, 20MHz mode. Low channel was found to be the worst case and therefore had been chosen for all final tests.
2. The conducted output power for QPSK, 16QAM, 64QAM and 256QAM measured value of QPSK is higher than other mode. Therefore, Occupied bandwidth and Peak to average ratio items were tested under QPSK, 16QAM, 64QAM and 256QAM modes, and the other test items were tested under QPSK mode only.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
ERP	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Modulation characteristics	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Frequency Stability	24deg. C, 64%RH	-54Vdc	James Yang
Occupied Bandwidth	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Band Edge	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Peak To Average Ratio	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Conducted Emission	24deg. C, 64%RH	120Vac, 60Hz	James Yang
Radiated Emission	22deg. C, 66%RH 22deg. C, 68%RH	120Vac, 60Hz	Han 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 22**

**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 662911 D01 Multiple Transmitter Output 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 ERP of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

- (i) 500 watts per emission; or
- (ii) 400 watts/MHz (PSD) per sector.

#### 4.1.2 Test Procedures

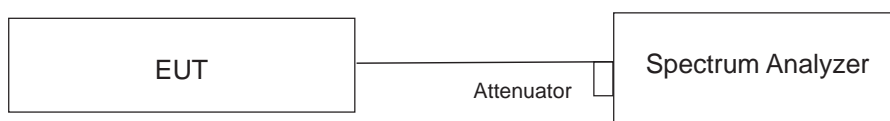
##### Conducted Power Measurement:

The EUT was set up for the maximum power link data modulation and link up with spectrum. Set the EUT to transmit under low, middle and high channel and record the power level.

$$\text{EIRP} = \text{Conducted Power} + \text{gain}$$

#### 4.1.3 Test Setup

##### Conducted Power Measurement:



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

#### 4.1.4 Test Results

##### Conducted Output Power (dBm)

For 1TX:

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174300	176300	178300	174300	176300	178300	174300	176300	178300	174300	176300	178300
		871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz
5 / 5M	0	36.55	36.61	36.86	36.48	36.62	36.81	36.45	36.59	36.83	36.46	36.52	36.75
	1	36.60	36.66	36.92	36.64	36.64	36.89	36.55	36.56	36.85	36.53	36.51	36.80
	2	36.58	36.68	36.88	36.51	36.68	36.82	36.58	36.60	36.78	36.60	36.63	36.71
	3	36.59	36.72	36.99	36.56	36.66	36.90	36.53	36.62	36.89	36.55	36.61	36.82

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174800	176300	177800	174800	176300	177800	174800	176300	177800	174800	176300	177800
		874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz
5 / 10M	0	36.66	36.61	36.95	36.52	36.55	36.82	36.59	36.55	36.78	36.58	36.55	36.78
	1	36.64	36.76	36.95	36.58	36.68	36.88	36.62	36.72	36.86	36.64	36.57	36.81
	2	36.69	36.68	37.01	36.63	36.64	36.97	36.62	36.66	36.93	36.65	36.65	36.89
	3	36.71	36.63	36.92	36.61	36.59	36.85	36.64	36.58	36.82	36.66	36.83	36.88

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175300	176300	177300	175300	176300	177300	175300	176300	177300	175300	176300	177300
		876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz
5 / 15M	0	36.61	36.69	36.88	36.52	36.63	36.85	36.59	36.61	36.82	36.53	36.51	36.81
	1	36.66	36.73	36.93	36.60	36.67	36.82	36.56	36.65	36.88	36.59	36.56	36.75
	2	36.58	36.67	36.90	36.62	36.62	36.91	36.63	36.58	36.85	36.64	36.59	36.88
	3	36.64	36.55	36.92	36.53	36.51	36.88	36.54	36.53	36.94	36.57	36.65	36.90

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175800	176300	176800	175800	176300	176800	175800	176300	176800	175800	176300	176800
		879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz
5 / 20M	0	36.67	36.65	36.87	36.62	36.52	36.81	36.69	36.65	36.81	36.70	36.58	36.82
	1	36.73	36.59	36.97	36.68	36.60	37.02	36.61	36.52	36.90	36.61	36.53	36.91
	2	36.67	36.68	36.92	36.55	36.66	36.91	36.64	36.70	36.98	36.64	36.62	36.94
	3	36.61	36.75	37.03	36.64	36.71	36.89	36.52	36.63	36.82	36.59	36.68	36.97



For 2TX:

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174300	176300	178300	174300	176300	178300	174300	176300	178300	174300	176300	178300
		871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz
5 / 5M	0+1	39.59	39.65	39.90	39.57	39.64	39.86	39.51	39.59	39.85	39.51	39.53	39.79
	2+3	39.60	39.71	39.95	39.55	39.68	39.87	39.57	39.62	39.85	39.59	39.63	39.78

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174800	176300	177800	174800	176300	177800	174800	176300	177800	174800	176300	177800
		874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz
5 / 10M	0+1	39.66	39.70	39.96	39.56	39.63	39.86	39.62	39.65	39.83	39.62	39.57	39.81
	2+3	39.71	39.67	39.98	39.63	39.63	39.92	39.64	39.63	39.89	39.67	39.75	39.90

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175300	176300	177300	175300	176300	177300	175300	176300	177300	175300	176300	177300
		876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz
5 / 15M	0+1	39.65	39.72	39.92	39.57	39.66	39.85	39.59	39.64	39.86	39.57	39.55	39.79
	2+3	39.62	39.62	39.92	39.59	39.58	39.91	39.60	39.57	39.91	39.62	39.63	39.90

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175800	176300	176800	175800	176300	176800	175800	176300	176800	175800	176300	176800
		879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz
5 / 20M	0+1	39.71	39.63	39.93	39.66	39.57	39.93	39.66	39.60	39.87	39.67	39.57	39.88
	2+3	39.65	39.73	39.99	39.61	39.70	39.91	39.59	39.68	39.91	39.63	39.66	39.97

For 3TX:

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174300	176300	178300	174300	176300	178300	174300	176300	178300	174300	176300	178300
		871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz
5 / 5M	0+1+2	41.35	41.42	41.66	41.32	41.42	41.61	41.30	41.36	41.59	41.30	41.33	41.53

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174800	176300	177800	174800	176300	177800	174800	176300	177800	174800	176300	177800
		874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz
5 / 10M	0+1+2	41.44	41.46	41.74	41.35	41.40	41.66	41.38	41.42	41.63	41.40	41.36	41.60

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175300	176300	177300	175300	176300	177300	175300	176300	177300	175300	176300	177300
		876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz
5 / 15M	0+1+2	41.39	41.47	41.68	41.35	41.41	41.63	41.37	41.39	41.62	41.36	41.33	41.59

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175800	176300	176800	175800	176300	176800	175800	176300	176800	175800	176300	176800
		879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz
5 / 20M	0+1+2	41.46	41.41	41.69	41.39	41.37	41.69	41.42	41.40	41.67	41.42	41.35	41.66

For 4TX:

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174300	176300	178300	174300	176300	178300	174300	176300	178300	174300	176300	178300
		871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz
5 / 5M	0+1 +2+3	42.60	42.69	42.93	42.57	42.67	42.88	42.55	42.61	42.86	42.56	42.59	42.79

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174800	176300	177800	174800	176300	177800	174800	176300	177800	174800	176300	177800
		874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz
5 / 10M	0+1 +2+3	42.70	42.69	42.98	42.61	42.64	42.90	42.64	42.65	42.87	42.65	42.67	42.86

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175300	176300	177300	175300	176300	177300	175300	176300	177300	175300	176300	177300
		876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz
5 / 15M	0+1 +2+3	42.64	42.68	42.93	42.59	42.63	42.89	42.60	42.61	42.89	42.60	42.60	42.86

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175800	176300	176800	175800	176300	176800	175800	176300	176800	175800	176300	176800
		879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz
5 / 20M	0+1 +2+3	42.69	42.69	42.97	42.64	42.64	42.93	42.64	42.65	42.90	42.66	42.62	42.93

\*All available TX Chain combination as below:

2TX:

1. Chain 0+ Chain 1
2. Chain 0+ Chain 2
3. Chain 0+ Chain 3
4. Chain 1+ Chain 2
5. Chain 1+ Chain 3
6. Chain 2+ Chain 3

The worst combination is Chain 0+Chain 1 & Chain 2+Chain 3, therefore they were chosen for the final test.

3TX:

1. Chain 0+ Chain 1+ Chain 2
2. Chain 0+ Chain 1+ Chain 3
3. Chain 1+ Chain 2+ Chain 3

The worst combination is Chain 0+Chain 1+Chain 2, therefore it was chosen for the final test.

**ERP Power**  
For 1TX:

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174300	176300	178300	174300	176300	178300	174300	176300	178300	174300	176300	178300
		871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz
5 / 5M	0	42.40	42.46	42.71	42.33	42.47	42.66	42.30	42.44	42.68	42.31	42.37	42.60
	1	42.45	42.51	42.77	42.49	42.49	42.74	42.40	42.41	42.70	42.38	42.36	42.65
	2	42.43	42.53	42.73	42.36	42.53	42.67	42.43	42.45	42.63	42.45	42.48	42.56
	3	42.44	42.57	42.84	42.41	42.51	42.75	42.38	42.47	42.74	42.40	42.46	42.67

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174800	176300	177800	174800	176300	177800	174800	176300	177800	174800	176300	177800
		874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz
5 / 10M	0	42.51	42.46	42.80	42.37	42.40	42.67	42.44	42.40	42.63	42.43	42.40	42.63
	1	42.49	42.61	42.80	42.43	42.53	42.73	42.47	42.57	42.71	42.49	42.42	42.66
	2	42.54	42.53	42.86	42.48	42.49	42.82	42.47	42.51	42.78	42.50	42.50	42.74
	3	42.56	42.48	42.77	42.46	42.44	42.70	42.49	42.43	42.67	42.51	42.68	42.73

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175300	176300	177300	175300	176300	177300	175300	176300	177300	175300	176300	177300
		876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz
5 / 15M	0	42.46	42.54	42.73	42.37	42.48	42.70	42.44	42.46	42.67	42.38	42.36	42.66
	1	42.51	42.58	42.78	42.45	42.52	42.67	42.41	42.50	42.73	42.44	42.41	42.60
	2	42.43	42.52	42.75	42.47	42.47	42.76	42.48	42.43	42.70	42.49	42.44	42.73
	3	42.49	42.40	42.77	42.38	42.36	42.73	42.39	42.38	42.79	42.42	42.50	42.75

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175800	176300	176800	175800	176300	176800	175800	176300	176800	175800	176300	176800
		879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz
5 / 20M	0	42.52	42.50	42.72	42.47	42.37	42.66	42.54	42.50	42.66	42.55	42.43	42.67
	1	42.58	42.44	42.82	42.53	42.45	42.87	42.46	42.37	42.75	42.46	42.38	42.76
	2	42.52	42.53	42.77	42.40	42.51	42.76	42.49	42.55	42.83	42.49	42.47	42.79
	3	42.46	42.60	42.88	42.49	42.56	42.74	42.37	42.48	42.67	42.44	42.53	42.82

For 2TX:

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174300	176300	178300	174300	176300	178300	174300	176300	178300	174300	176300	178300
		871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz
5 / 5M	0+1	45.44	45.50	45.75	45.42	45.49	45.71	45.36	45.44	45.70	45.36	45.38	45.64
	2+3	45.45	45.56	45.80	45.40	45.53	45.72	45.42	45.47	45.70	45.44	45.48	45.63

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174800	176300	177800	174800	176300	177800	174800	176300	177800	174800	176300	177800
		874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz
5 / 10M	0+1	45.51	45.55	45.81	45.41	45.48	45.71	45.47	45.50	45.68	45.47	45.42	45.66
	2+3	45.56	45.52	45.83	45.48	45.48	45.77	45.49	45.48	45.74	45.52	45.60	45.75

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175300	176300	177300	175300	176300	177300	175300	176300	177300	175300	176300	177300
		876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz
5 / 15M	0+1	45.50	45.57	45.77	45.42	45.51	45.70	45.44	45.49	45.71	45.42	45.40	45.64
	2+3	45.47	45.47	45.77	45.44	45.43	45.76	45.45	45.42	45.76	45.47	45.48	45.75

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175800	176300	176800	175800	176300	176800	175800	176300	176800	175800	176300	176800
		879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz
5 / 20M	0+1	45.56	45.48	45.78	45.51	45.42	45.78	45.51	45.45	45.72	45.52	45.42	45.73
	2+3	45.50	45.58	45.84	45.46	45.55	45.76	45.44	45.53	45.76	45.48	45.51	45.82

For 3TX:

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174300	176300	178300	174300	176300	178300	174300	176300	178300	174300	176300	178300
		871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz
5 / 5M	0+1+2	47.20	47.27	47.51	47.17	47.27	47.46	47.15	47.21	47.44	47.15	47.18	47.38

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174800	176300	177800	174800	176300	177800	174800	176300	177800	174800	176300	177800
		874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz
5 / 10M	0+1+2	47.29	47.31	47.59	47.20	47.25	47.51	47.23	47.27	47.48	47.25	47.21	47.45

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175300	176300	177300	175300	176300	177300	175300	176300	177300	175300	176300	177300
		876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz
5 / 15M	0+1+2	47.24	47.32	47.53	47.20	47.26	47.48	47.22	47.24	47.47	47.21	47.18	47.44

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175800	176300	176800	175800	176300	176800	175800	176300	176800	175800	176300	176800
		879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz
5 / 20M	0+1+2	47.31	47.26	47.54	47.24	47.22	47.54	47.27	47.25	47.52	47.27	47.20	47.51

For 4TX:

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174300	176300	178300	174300	176300	178300	174300	176300	178300	174300	176300	178300
		871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz	871.5 MHz	881.5 MHz	891.5 MHz
5 / 5M	0+1 +2+3	48.45	48.54	<b>48.78</b>	48.42	48.52	<b>48.73</b>	48.40	48.46	<b>48.71</b>	48.41	48.44	<b>48.64</b>

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		174800	176300	177800	174800	176300	177800	174800	176300	177800	174800	176300	177800
		874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz	874 MHz	881.5 MHz	889 MHz
5 / 10M	0+1 +2+3	48.55	48.54	<b>48.83</b>	48.46	48.49	<b>48.75</b>	48.49	48.50	<b>48.72</b>	48.50	48.52	<b>48.71</b>

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175300	176300	177300	175300	176300	177300	175300	176300	177300	175300	176300	177300
		876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz	876.5 MHz	881.5 MHz	886.5 MHz
5 / 15M	0+1 +2+3	48.49	48.53	<b>48.78</b>	48.44	48.48	<b>48.74</b>	48.45	48.46	<b>48.74</b>	48.45	48.45	<b>48.71</b>

Band / BW	Chain	QPSK			16QAM			64QAM			256QAM		
		Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
		175800	176300	176800	175800	176300	176800	175800	176300	176800	175800	176300	176800
		879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz	879 MHz	881.5 MHz	884 MHz
5 / 20M	0+1 +2+3	48.54	48.54	<b>48.82</b>	48.49	48.49	<b>48.78</b>	48.49	48.50	<b>48.75</b>	48.51	48.47	<b>48.78</b>

Note: ERP (dBm) = Conducted Output Power (dBm) + antenna gain (dBi) – 2.15.

\*All available TX Chain combination as below:

2TX:

1. Chain 0+ Chain 1
2. Chain 0+ Chain 2
3. Chain 0+ Chain 3
4. Chain 1+ Chain 2
5. Chain 1+ Chain 3
6. Chain 2+ Chain 3

The worst combination is Chain 0+Chain 1 & Chain 2+Chain 3, therefore they were chosen for the final test.

3TX:

1. Chain 0+ Chain 1+ Chain 2
2. Chain 0+ Chain 1+ Chain 3
3. Chain 1+ Chain 2+ Chain 3

The worst combination is Chain 0+Chain 1+Chain 2, therefore it was chosen for the final test.

## 4.2 Modulation Characteristics Measurement

### 4.2.1 Limits of Modulation Characteristics

N/A

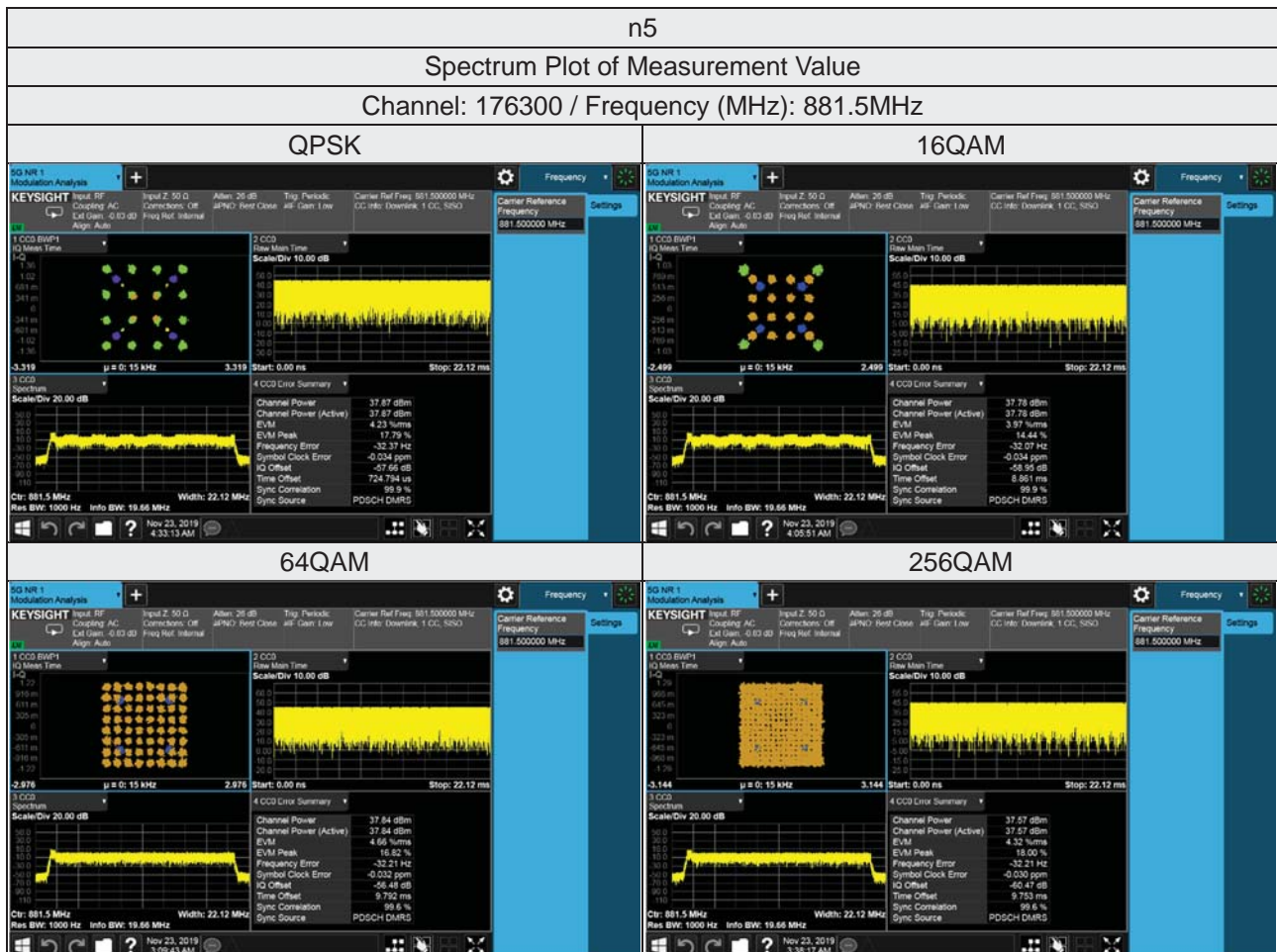
### 4.2.2 Test Procedure

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.

### 4.2.3 Test Setup



### 4.2.4 Test Results





### 4.3 Frequency Stability Measurement

#### 4.3.1 Limits of Frequency Stability Measurement

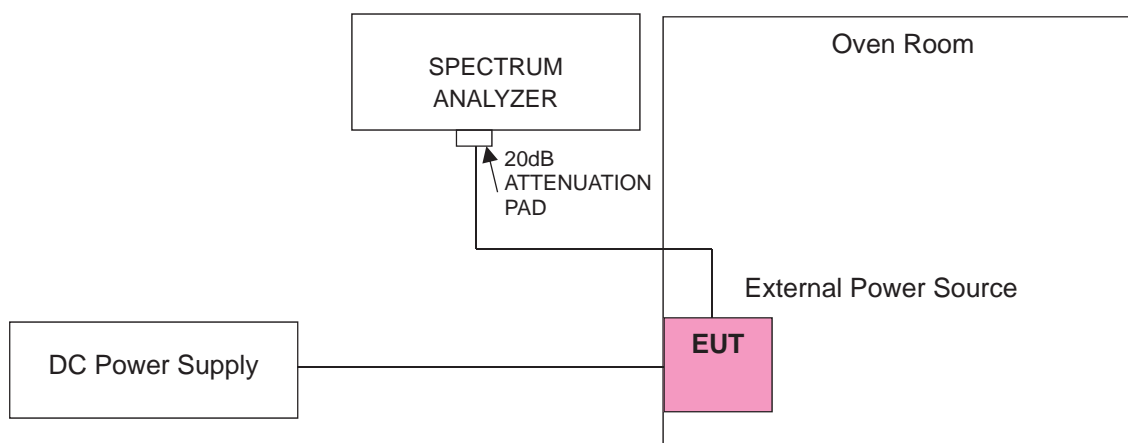
1.5 ppm is for base and fixed station.

#### 4.3.2 Test Procedure

- 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  $\pm 0.5$  °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.

#### 4.3.3 Test Setup



#### 4.3.4 Test Results

##### Frequency Error vs. Voltage

Voltage (Volts)	n5			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-62.1	871.500003	0.004	891.500003	0.003
-54.0	871.500002	0.002	891.500001	0.001
-45.9	871.500001	0.002	891.500003	0.003

Note: The applicant defined the normal working voltage is from -45.9Vdc to -62.1Vdc.

##### Frequency Error vs. Temperature

Temp. (°C)	n5			
	Channel Bandwidth: 5 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	871.500002	0.003	891.500001	0.001
-20	871.500002	0.002	891.500004	0.004
-10	871.500004	0.004	891.500002	0.002
0	871.500001	0.001	891.500002	0.002
10	871.500002	0.002	891.500003	0.004
20	871.499998	-0.003	891.499998	-0.003
30	871.499998	-0.003	891.499999	-0.001
40	871.499999	-0.001	891.499999	-0.002
50	871.499999	-0.001	891.499997	-0.003

### Frequency Error vs. Voltage

Voltage (Volts)	n5			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-62.1	874.000004	0.004	889.000003	0.004
-54.0	874.000002	0.003	889.000003	0.003
-45.9	874.000001	0.002	889.000003	0.003

Note: The applicant defined the normal working voltage is from -45.9Vdc to -62.1Vdc.

### Frequency Error vs. Temperature

Temp. (°C)	n5			
	Channel Bandwidth: 10 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	874.000001	0.001	889.000001	0.001
-20	874.000002	0.002	889.000003	0.003
-10	874.000002	0.003	889.000003	0.003
0	874.000002	0.002	889.000002	0.002
10	874.000003	0.004	889.000004	0.004
20	873.999997	-0.003	888.999997	-0.004
30	873.999997	-0.003	888.999998	-0.002
40	873.999998	-0.003	888.999996	-0.004
50	873.999999	-0.001	888.999999	-0.001

### Frequency Error vs. Voltage

Voltage (Volts)	n5			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-62.1	876.500004	0.004	886.500003	0.003
-54.0	876.500004	0.004	886.500003	0.003
-45.9	876.500003	0.004	886.500004	0.004

Note: The applicant defined the normal working voltage is from -45.9Vdc to -62.1Vdc.

### Frequency Error vs. Temperature

Temp. (°C)	n5			
	Channel Bandwidth: 15 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	876.500003	0.003	886.500004	0.004
-20	876.500002	0.002	886.500003	0.003
-10	876.500004	0.005	886.500004	0.005
0	876.500001	0.001	886.500002	0.002
10	876.500004	0.004	886.500004	0.005
20	876.499996	-0.004	886.499998	-0.002
30	876.499998	-0.003	886.499996	-0.004
40	876.499997	-0.003	886.499998	-0.002
50	876.499998	-0.002	886.499998	-0.002

### Frequency Error vs. Voltage

Voltage (Volts)	n5			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-62.1	879.000003	0.003	884.000003	0.003
-54.0	879.000003	0.004	884.000004	0.004
-45.9	879.000003	0.003	884.000002	0.002

Note: The applicant defined the normal working voltage is from -45.9Vdc to -62.1Vdc.

### Frequency Error vs. Temperature

Temp. (°C)	n5			
	Channel Bandwidth: 20 MHz			
	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	879.000003	0.004	884.000001	0.001
-20	879.000002	0.002	884.000001	0.001
-10	879.000001	0.001	884.000001	0.001
0	879.000003	0.003	884.000001	0.001
10	879.000003	0.003	884.000004	0.004
20	878.999998	-0.003	883.999997	-0.003
30	878.999998	-0.002	883.999996	-0.005
40	878.999997	-0.003	883.999998	-0.002
50	878.999999	-0.001	883.999997	-0.003

## 4.4 Occupied Bandwidth Measurement

### 4.4.1 Test Procedure

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth.

### 4.4.2 Test Setup



#### 4.4.3 Test Result

Occupied Bandwidth

n5

Chain 0

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	4.47	4.48	4.47	4.47
176300	881.5	4.48	4.48	4.48	4.48
178300	891.5	4.47	4.47	4.47	4.47
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	9.31	9.31	9.31	9.31
176300	881.5	9.31	9.31	9.30	9.31
177800	889.0	9.30	9.30	9.29	9.30
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	14.16	14.16	14.16	14.16
176300	881.5	14.16	14.16	14.16	14.16
177300	886.5	14.15	14.15	14.16	14.15
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	19.01	19.00	19.00	19.01
176300	881.5	19.01	19.01	19.01	19.01
176800	884.0	19.00	19.00	19.00	18.99

### Spectrum Plot of Worst Value



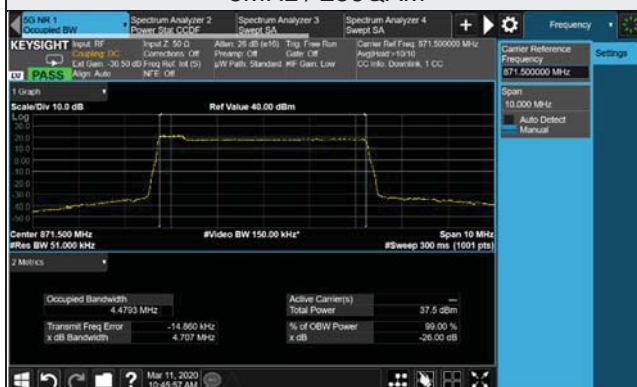


26dB Bandwidth  
n5

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	4.70	4.68	4.70	4.70
176300	881.5	4.70	4.68	4.70	4.69
178300	891.5	4.68	4.67	4.68	4.68
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	9.61	9.61	9.60	9.61
176300	881.5	9.59	9.59	9.59	9.59
177800	889.0	9.58	9.60	9.59	9.59
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	14.56	14.56	14.55	14.57
176300	881.5	14.56	14.53	14.57	14.56
177300	886.5	14.56	14.54	14.55	14.55
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	19.50	19.50	19.49	19.51
176300	881.5	19.50	19.49	19.50	19.50
176800	884.0	19.47	19.50	19.46	19.50

### Spectrum Plot of Worst Value

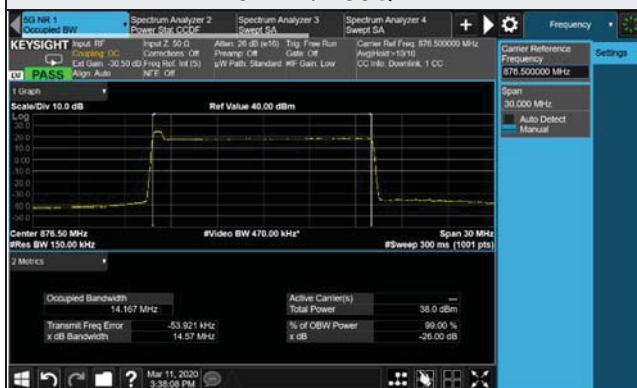
#### 5MHz / 256QAM



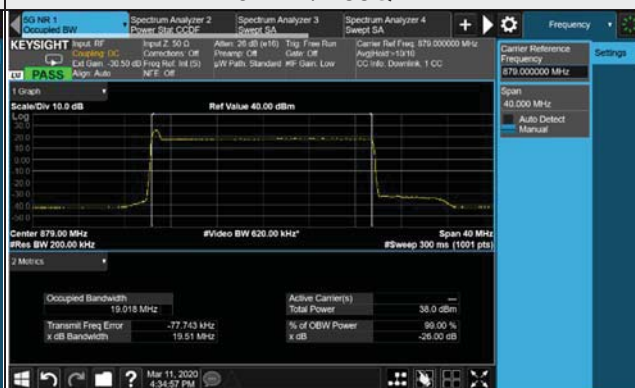
#### 10MHz / 256QAM



#### 15MHz / 256QAM



#### 20MHz / 256QAM



Chain 1

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	4.47	4.47	4.47	4.48
176300	881.5	4.47	4.48	4.47	4.47
178300	891.5	4.47	4.47	4.47	4.47
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	9.31	9.31	9.31	9.31
176300	881.5	9.31	9.31	9.31	9.31
177800	889.0	9.31	9.30	9.30	9.30
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	14.16	14.16	14.16	14.16
176300	881.5	14.16	14.16	14.16	14.16
177300	886.5	14.14	14.14	14.15	14.15
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	19.02	19.01	19.01	19.01
176300	881.5	19.01	19.01	19.01	19.01
176800	884.0	18.99	18.99	19.00	18.99

### Spectrum Plot of Worst Value

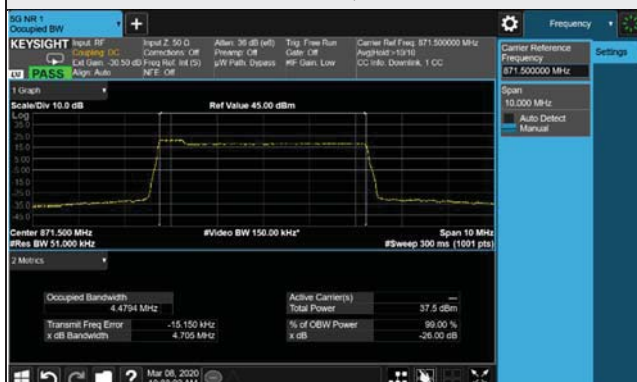


26dB Bandwidth  
n5

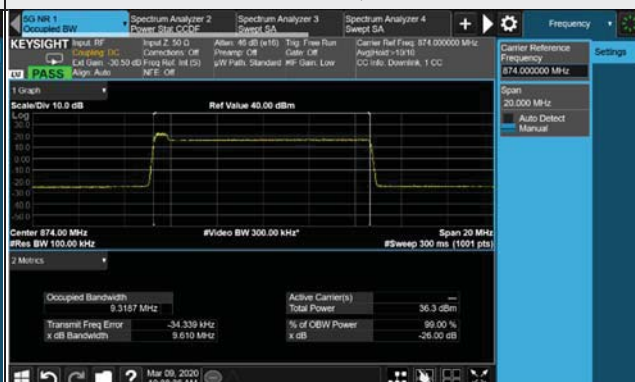
n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	4.70	4.70	4.70	4.69
176300	881.5	4.69	4.69	4.68	4.69
178300	891.5	4.68	4.68	4.68	4.68
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	9.61	9.60	9.59	9.60
176300	881.5	9.59	9.59	9.59	9.60
177800	889.0	9.59	9.59	9.59	9.59
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	14.54	14.54	14.54	14.57
176300	881.5	14.56	14.56	14.56	14.56
177300	886.5	14.55	14.55	14.55	14.55
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	19.50	19.50	19.50	19.50
176300	881.5	19.50	19.50	19.50	19.50
176800	884.0	19.49	19.49	19.49	19.50

### Spectrum Plot of Worst Value

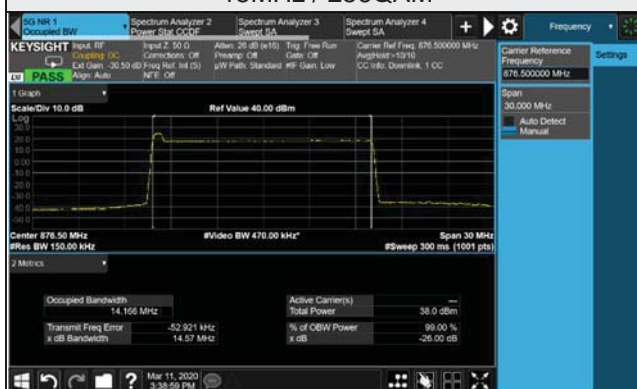
#### 5MHz / QPSK



#### 10MHz / QPSK



#### 15MHz / 256QAM



#### 20MHz / 256QAM



Chain 2

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	4.47	4.47	4.47	4.47
176300	881.5	4.47	4.47	4.47	4.47
178300	891.5	4.47	4.47	4.47	4.47
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	9.31	9.31	9.31	9.31
176300	881.5	9.31	9.31	9.31	9.31
177800	889.0	9.30	9.30	9.30	9.30
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	14.16	14.16	14.16	14.16
176300	881.5	14.16	14.16	14.16	14.16
177300	886.5	14.15	14.14	14.15	14.15
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	19.01	19.01	19.01	19.01
176300	881.5	19.00	19.01	19.01	19.02
176800	884.0	18.99	19.00	19.00	18.99



### Spectrum Plot of Worst Value

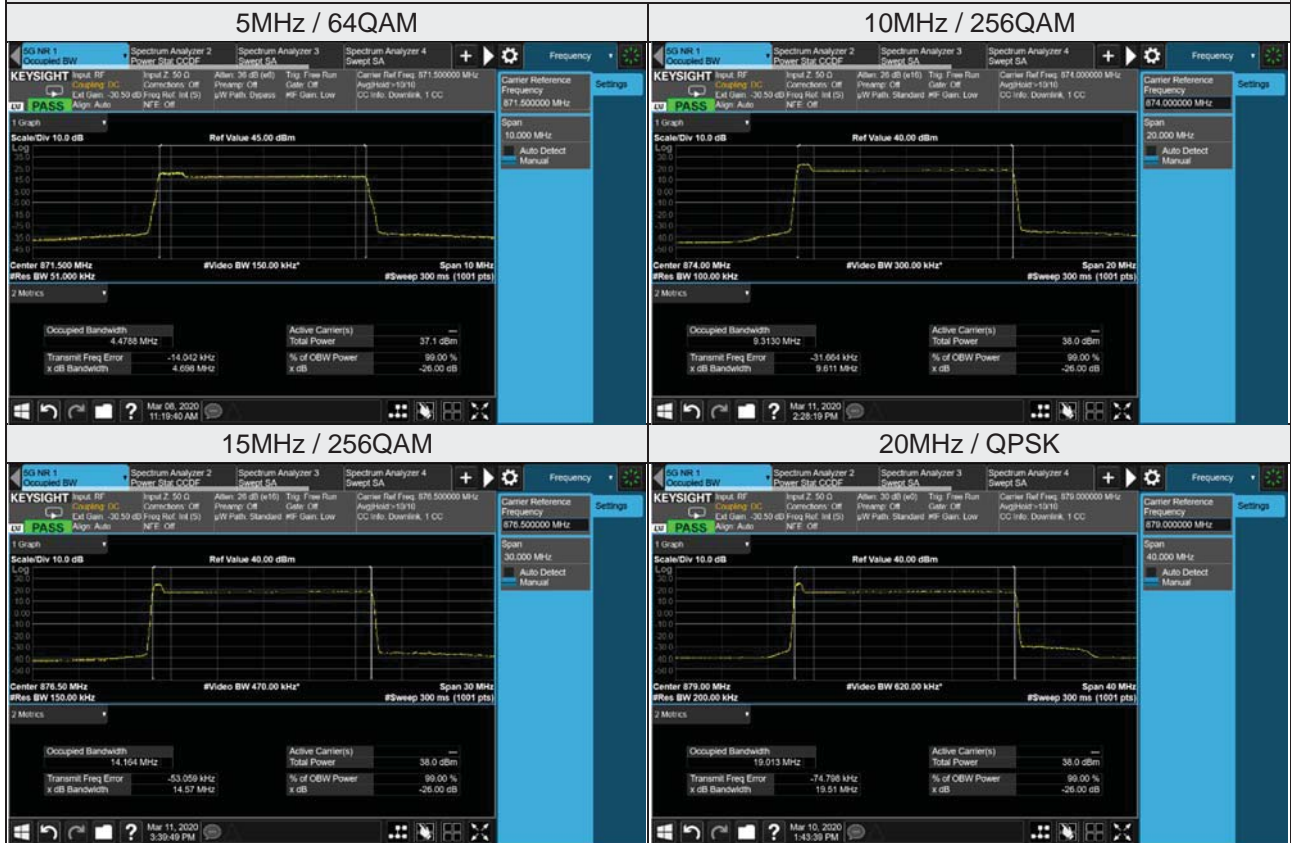




26dB Bandwidth  
n5

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	4.69	4.69	4.69	4.69
176300	881.5	4.70	4.67	4.68	4.69
178300	891.5	4.68	4.68	4.69	4.68
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	9.60	9.59	9.60	9.61
176300	881.5	9.59	9.59	9.60	9.60
177800	889.0	9.59	9.60	9.59	9.59
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	14.57	14.55	14.56	14.57
176300	881.5	14.55	14.53	14.56	14.55
177300	886.5	14.55	14.55	14.55	14.55
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	19.51	19.50	19.50	19.49
176300	881.5	19.50	19.50	19.50	19.49
176800	884.0	19.49	19.48	19.49	19.49

### Spectrum Plot of Worst Value



Chain 3

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	4.47	4.47	4.47	4.48
176300	881.5	4.47	4.47	4.47	4.48
178300	891.5	4.47	4.47	4.47	4.47
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	9.31	9.31	9.31	9.31
176300	881.5	9.31	9.31	9.31	9.31
177800	889.0	9.30	9.30	9.30	9.30
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	14.17	14.16	14.16	14.16
176300	881.5	14.16	14.16	14.17	14.17
177300	886.5	14.15	14.14	14.14	14.15
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	19.01	19.01	19.02	19.01
176300	881.5	19.01	19.01	19.01	19.01
176800	884.0	18.98	18.98	18.99	18.99

### Spectrum Plot of Worst Value



26dB Bandwidth  
n5

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	4.70	4.70	4.69	4.68
176300	881.5	4.69	4.69	4.70	4.69
178300	891.5	4.68	4.68	4.69	4.68
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	9.60	9.60	9.61	9.60
176300	881.5	9.60	9.60	9.59	9.60
177800	889.0	9.59	9.59	9.59	9.59
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	14.56	14.56	14.56	14.56
176300	881.5	14.56	14.56	14.56	14.56
177300	886.5	14.53	14.54	14.55	14.54
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	26dB Bandwidth (MHz)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	19.50	19.50	19.51	19.50
176300	881.5	19.50	19.50	19.50	19.49
176800	884.0	19.49	19.49	19.50	19.50

### Spectrum Plot of Worst Value



## 4.5 Band Edge Measurement

### 4.5.1 Limits of Band Edge Measurement

Power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Note: The device has 4x4 MIMO function, so the limit of spurious emissions needs to be reduced by  $-13 - 10 \cdot \log(4) = -19.02$  dBm according to FCC KDB 662911 D01 guidance.

### 4.5.2 Test Setup



### 4.5.3 Test Procedures

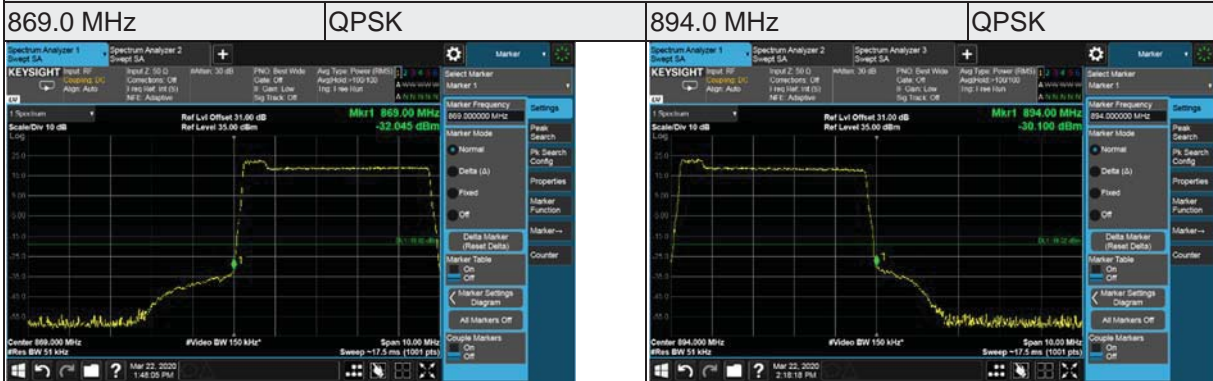
- a. All measurements were done at low and high operational frequency range.
- b. The center frequency of spectrum is the band edge frequency and span is 10MHz. RB of the spectrum is 51kHz and VB of the spectrum is 150kHz.(Channel Bandwidth 5MHz).  
 The center frequency of spectrum is the band edge frequency and span is 10MHz. RB of the spectrum is 100kHz and VB of the spectrum is 300kHz.(Channel Bandwidth 10MHz).  
 The center frequency of spectrum is the band edge frequency and span is 10MHz. RB of the spectrum is 150kHz and VB of the spectrum is 470kHz.(Channel Bandwidth 15MHz).  
 The center frequency of spectrum is the band edge frequency and span is 10MHz. RB of the spectrum is 200kHz and VB of the spectrum is 620kHz.(Channel Bandwidth 20MHz).
- c. Record the max trace plot into the test report.



### 4.5.4 Test Results

#### Chain 0

n5, Channel Bandwidth 5MHz



n5, Channel Bandwidth 10MHz



n5, Channel Bandwidth 15MHz



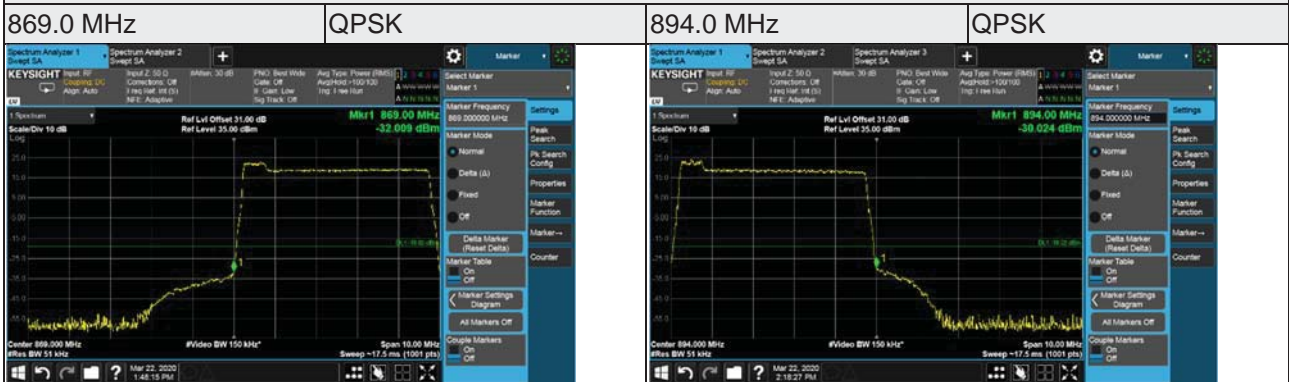
n5, Channel Bandwidth 20MHz



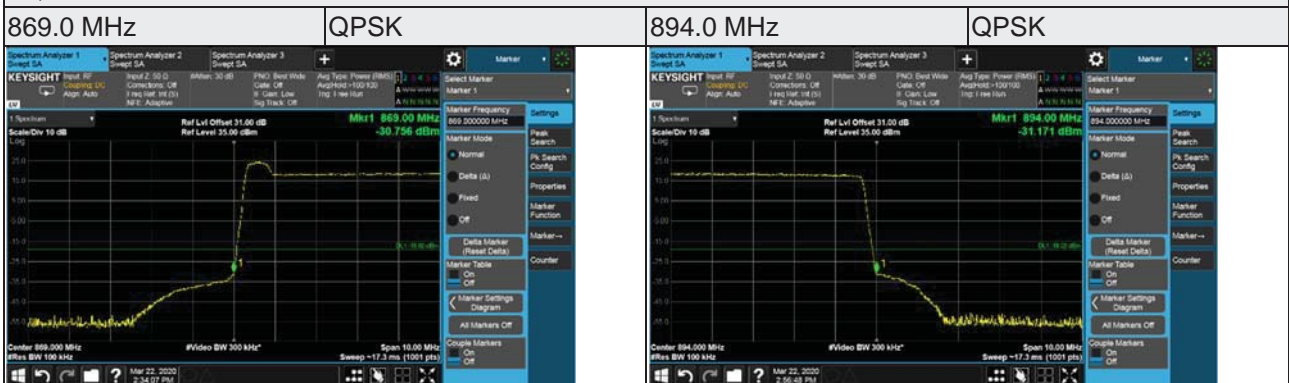


Chain 1

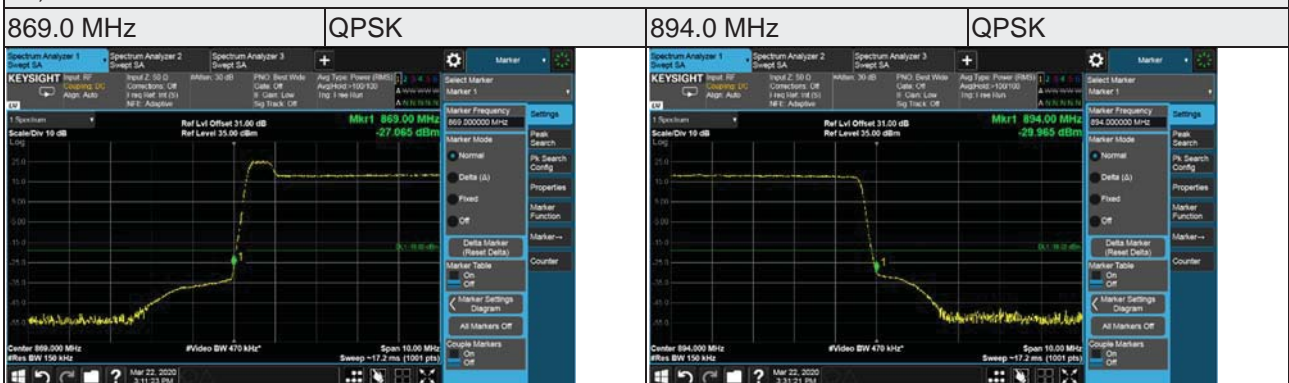
n5, Channel Bandwidth 5MHz



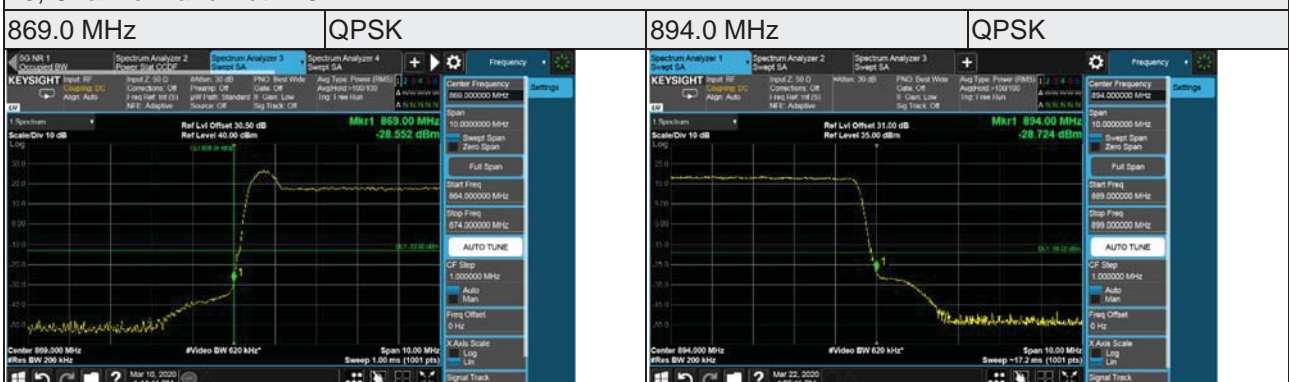
n5, Channel Bandwidth 10MHz



n5, Channel Bandwidth 15MHz



n5, Channel Bandwidth 20MHz



Chain 2

n5, Channel Bandwidth 5MHz



n5, Channel Bandwidth 10MHz



n5, Channel Bandwidth 15MHz



n5, Channel Bandwidth 20MHz





Chain 3

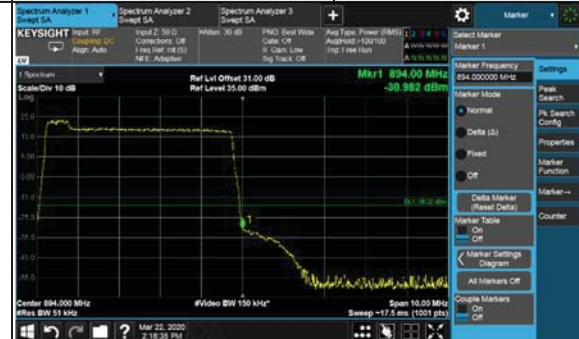
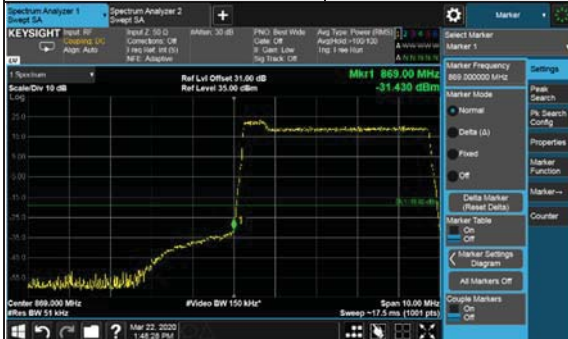
n5, Channel Bandwidth 5MHz

869.0 MHz

QPSK

894.0 MHz

QPSK



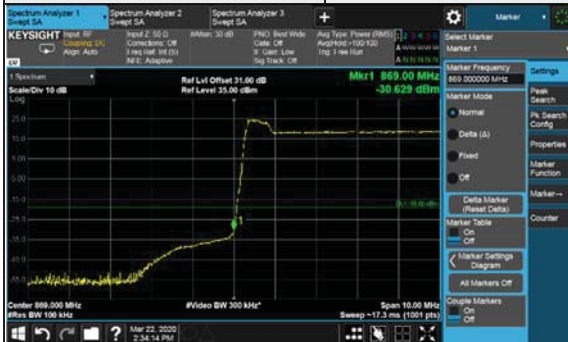
n5, Channel Bandwidth 10MHz

869.0 MHz

QPSK

894.0 MHz

QPSK



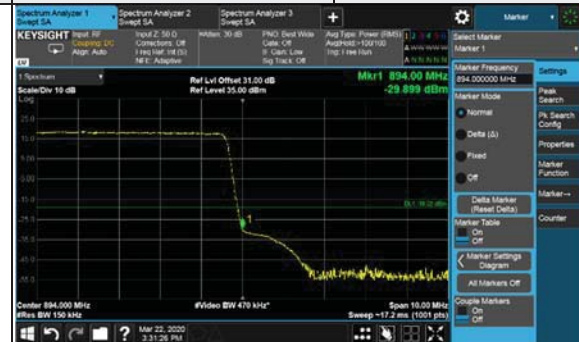
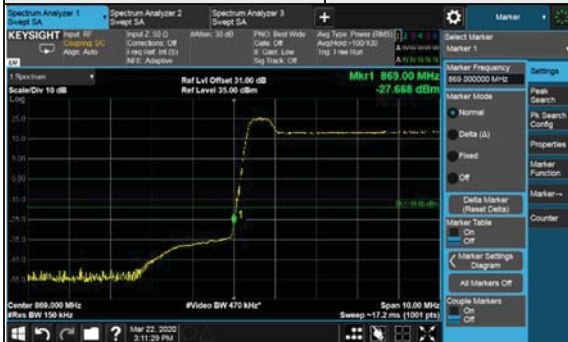
n5, Channel Bandwidth 15MHz

869.0 MHz

QPSK

894.0 MHz

QPSK



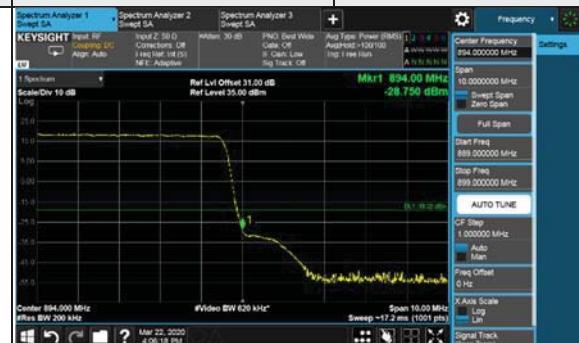
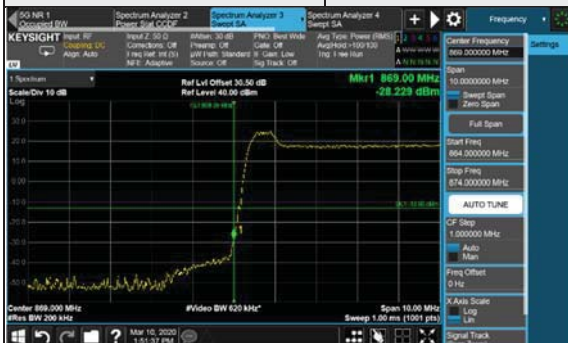
n5, Channel Bandwidth 20MHz

869.0 MHz

QPSK

894.0 MHz

QPSK

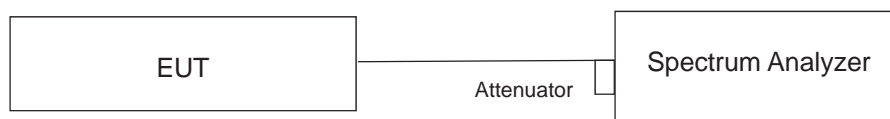


## 4.6 Peak to Average Ratio

### 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

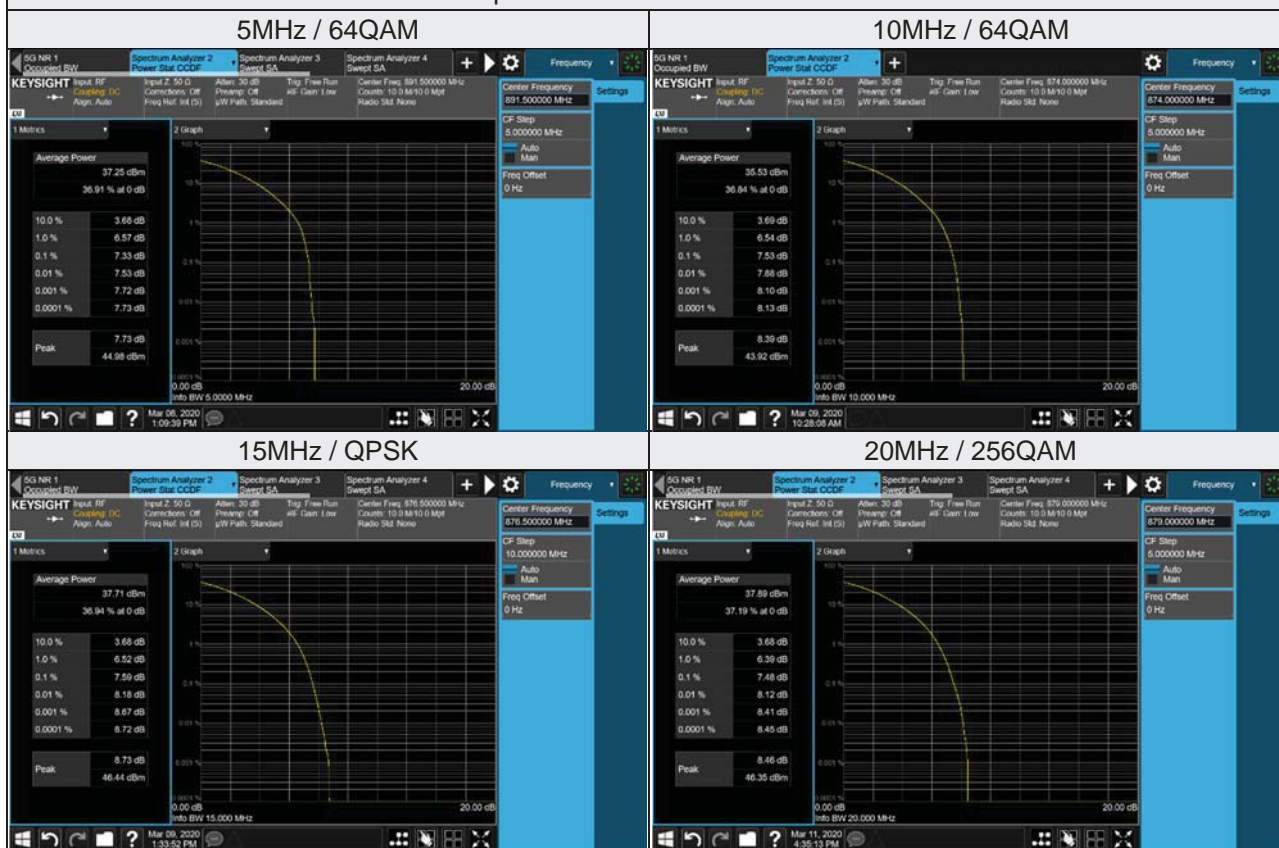
- Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

#### 4.6.4 Test Results

##### Chain 0

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	7.26	7.27	7.28	7.29
176300	881.5	7.13	7.14	7.14	7.11
178300	891.5	7.32	7.33	7.33	7.30
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	7.53	7.52	7.53	7.42
176300	881.5	7.15	7.14	7.15	7.12
177800	889.0	7.29	7.28	7.29	7.28
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	7.59	7.58	7.58	7.52
176300	881.5	7.13	7.13	7.13	7.12
177300	886.5	7.33	7.34	7.34	7.26
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	7.48	7.47	7.48	7.48
176300	881.5	7.13	7.13	7.14	7.11
176800	884.0	7.16	7.16	7.16	7.17

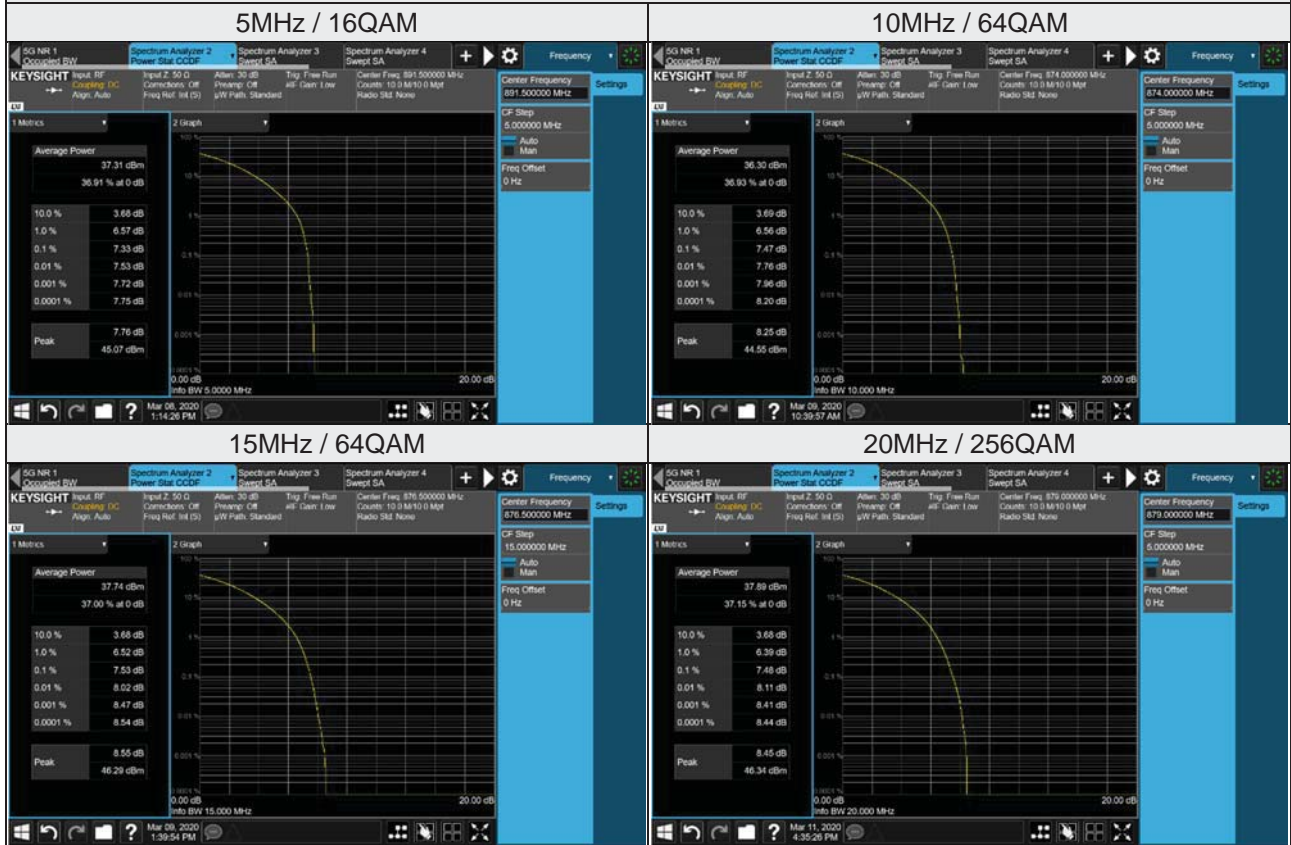
### Spectrum Plot of Worst Value



Chain 1

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	7.30	7.24	7.25	7.31
176300	881.5	7.14	7.14	7.14	7.11
178300	891.5	7.32	7.33	7.32	7.30
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	7.46	7.45	7.47	7.46
176300	881.5	7.16	7.16	7.15	7.12
177800	889.0	7.30	7.30	7.29	7.28
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	7.53	7.52	7.53	7.51
176300	881.5	7.13	7.13	7.13	7.27
177300	886.5	7.29	7.29	7.29	7.19
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	7.39	7.39	7.39	7.48
176300	881.5	7.11	7.11	7.11	7.12
176800	884.0	7.18	7.18	7.18	7.18

### Spectrum Plot of Worst Value

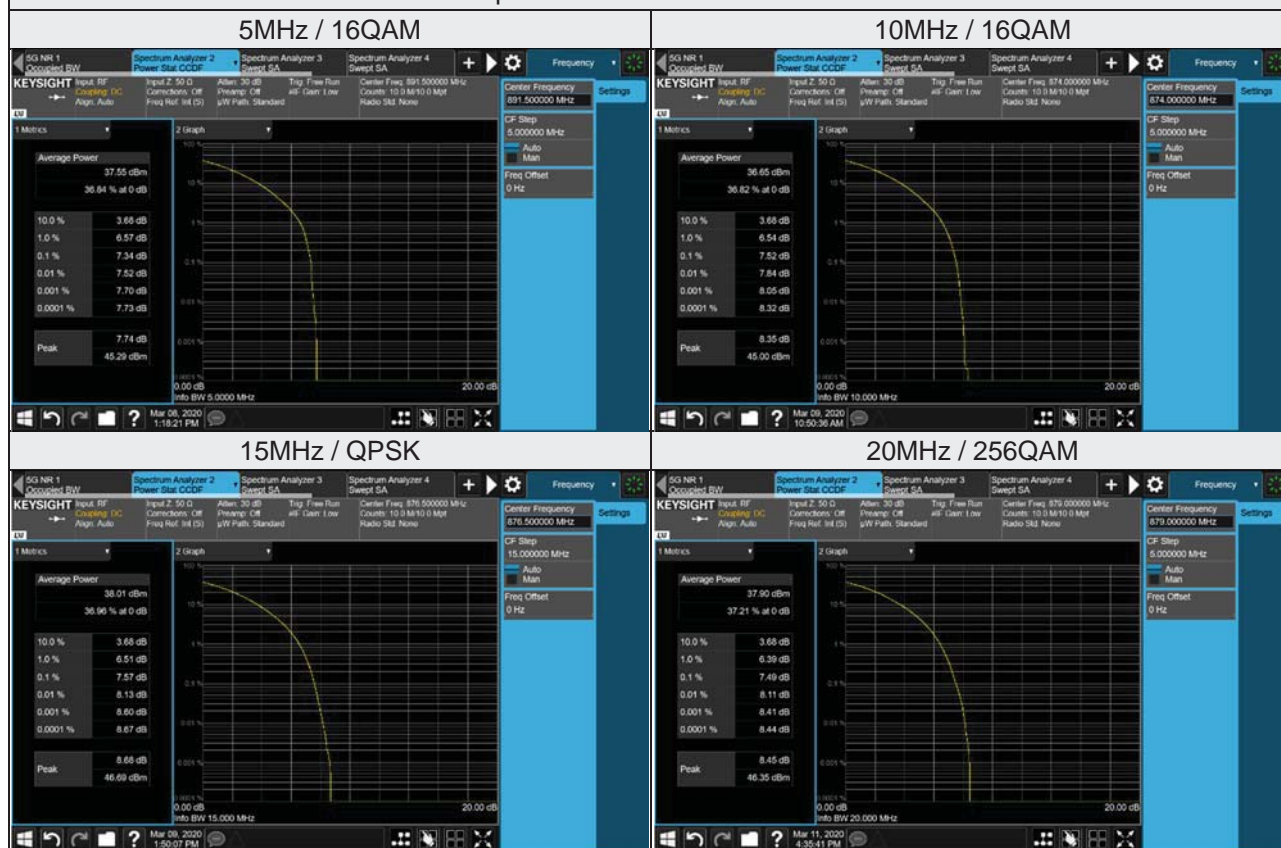




Chain 2

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	7.27	7.26	7.26	7.24
176300	881.5	7.15	7.14	7.14	7.11
178300	891.5	7.33	7.34	7.33	7.29
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	7.51	7.52	7.51	7.40
176300	881.5	7.16	7.15	7.15	7.12
177800	889.0	7.30	7.30	7.29	7.27
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	7.57	7.56	7.56	7.52
176300	881.5	7.13	7.14	7.13	7.13
177300	886.5	7.28	7.29	7.29	7.28
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	7.45	7.45	7.45	7.49
176300	881.5	7.12	7.13	7.11	7.11
176800	884.0	7.18	7.28	7.18	7.17

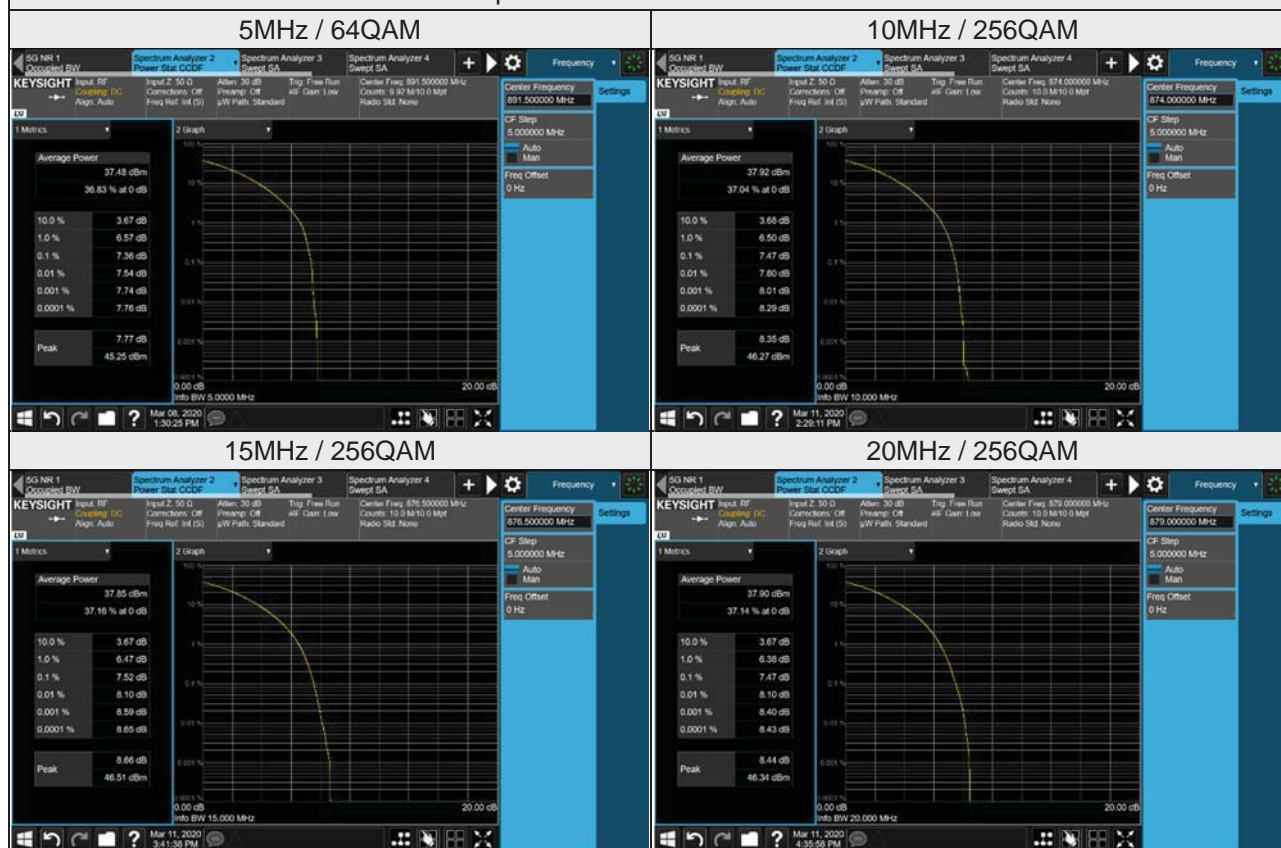
### Spectrum Plot of Worst Value



Chain 3

n5, Channel Bandwidth 5MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
174300	871.5	7.31	7.23	7.23	7.22
176300	881.5	7.12	7.14	7.13	7.14
178300	891.5	7.35	7.35	7.36	7.32
n5, Channel Bandwidth 10MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
174800	874.0	7.45	7.45	7.46	7.47
176300	881.5	7.16	7.15	7.16	7.12
177800	889.0	7.30	7.30	7.31	7.28
n5, Channel Bandwidth 15MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
175300	876.5	7.51	7.51	7.50	7.52
176300	881.5	7.13	7.13	7.13	7.11
177300	886.5	7.30	7.30	7.30	7.27
n5, Channel Bandwidth 20MHz					
Channel	Frequency (MHz)	Peak To Average Ratio (dB)			
		QPSK	16QAM	64QAM	256QAM
175800	879.0	7.39	7.40	7.40	7.47
176300	881.5	7.11	7.11	7.10	7.12
176800	884.0	7.21	7.20	7.20	7.17

### Spectrum Plot of Worst Value



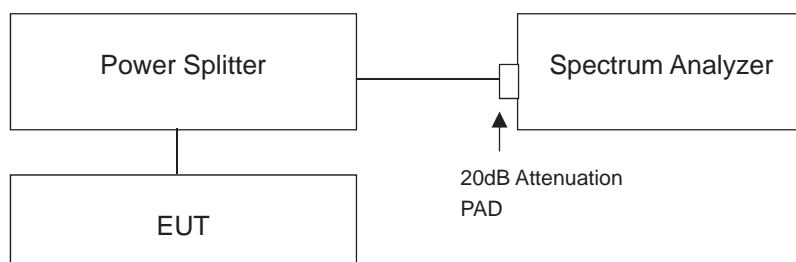
## 4.7 Conducted Spurious Emissions

### 4.7.1 Limits of Conducted Spurious Emissions Measurement

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

Note: The device has 4x4 MIMO function, so the limit of spurious emissions needs to be reduced by  $-13 - 10 \cdot \log(4) = -19.02$  dBm according to FCC KDB 662911 D01 guidance.

### 4.7.2 Test Setup



### 4.7.3 Test Procedure

- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range is from 9GHz to 10GHz. 20dB attenuation pad is connected with spectrum. RBW= 1MHz and VBW= 3MHz is used for conducted emission measurement.

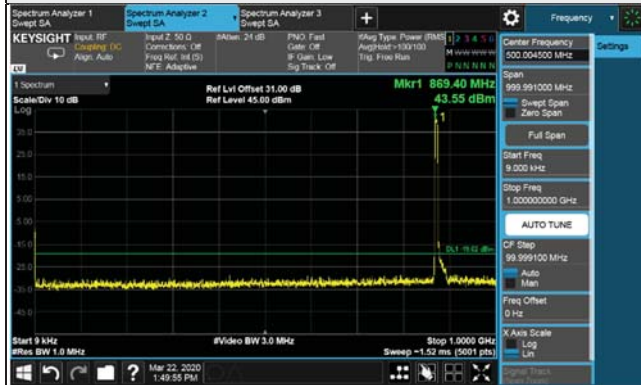
### 4.7.4 Test Results

#### Chain 0

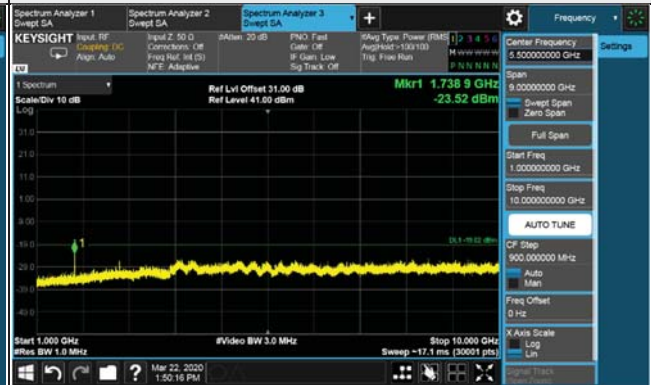
n5, Channel Bandwidth 5MHz

871.5MHz

Frequency Range : 9kHz~1GHz

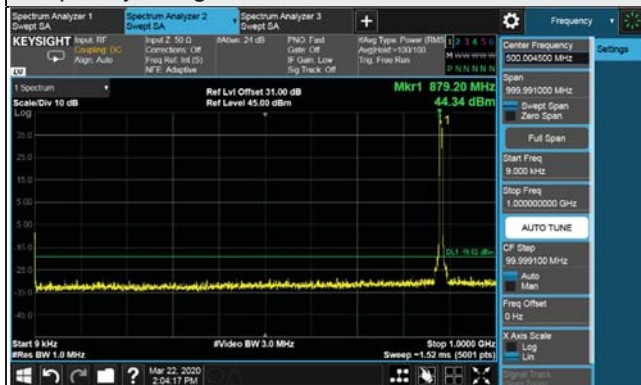


Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz



891.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

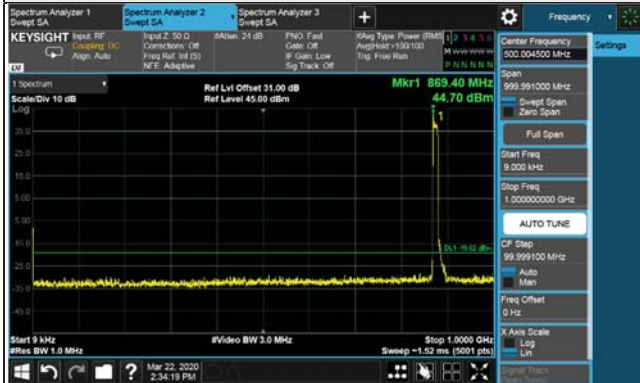




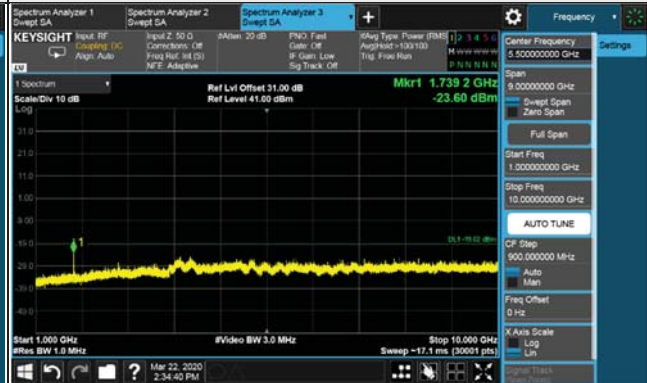
n5, Channel Bandwidth 10MHz

874.0MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

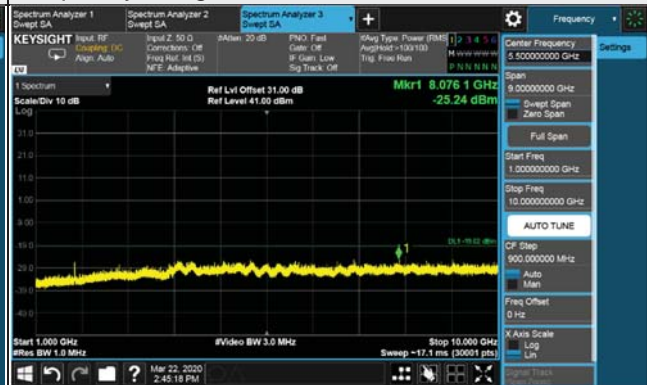


881.5MHz

Frequency Range : 9kHz~1GHz

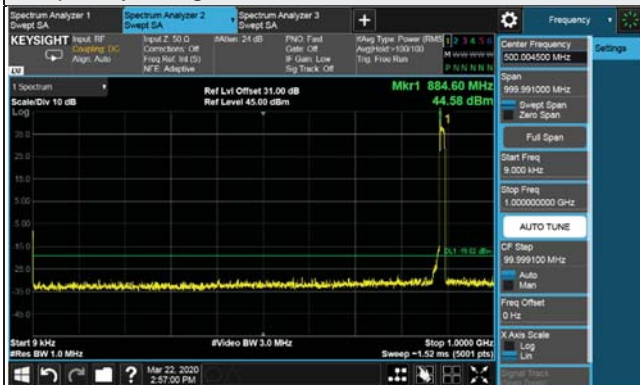


Frequency Range : 1GHz~10GHz

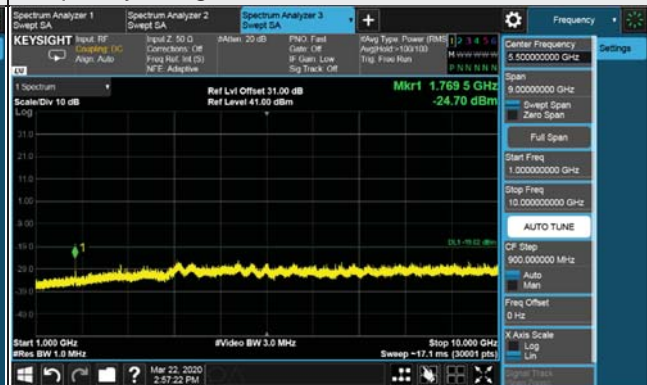


889.0MHz

Frequency Range : 9kHz~1GHz



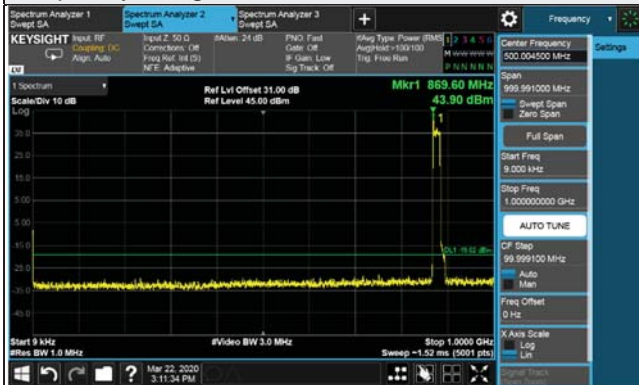
Frequency Range : 1GHz~10GHz



n5, Channel Bandwidth 15MHz

876.5MHz

Frequency Range : 9kHz~1GHz

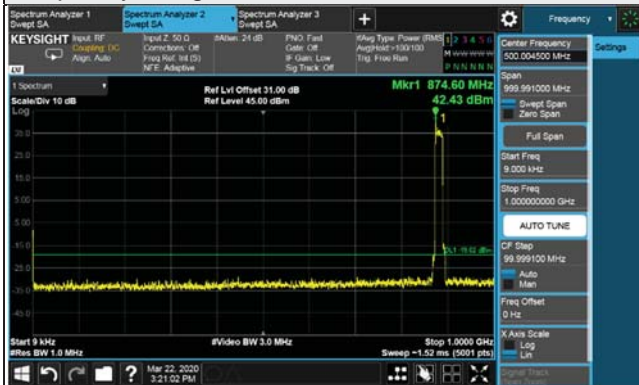


Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz

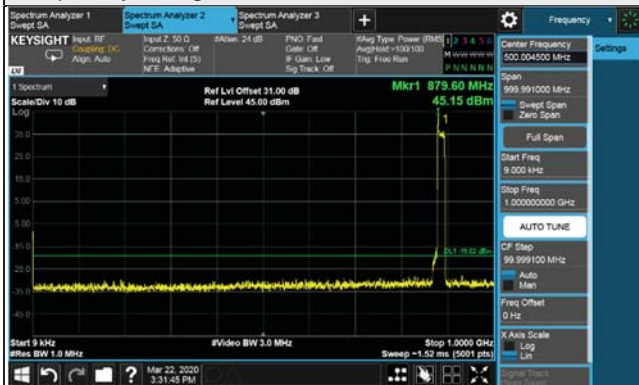


Frequency Range : 1GHz~10GHz



886.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

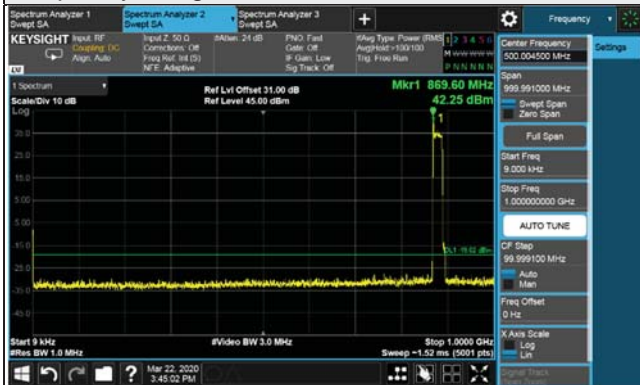




n5, Channel Bandwidth 20MHz

879.0MHz

Frequency Range : 9kHz~1GHz

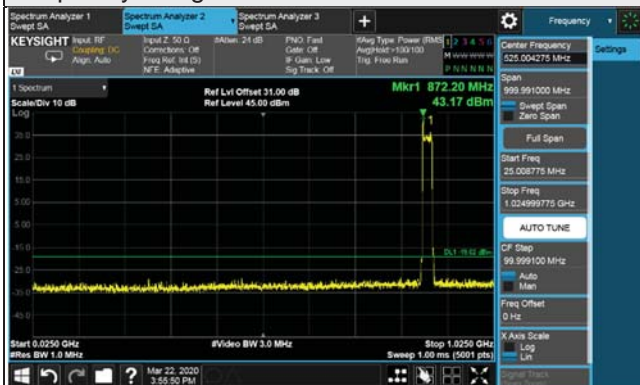


Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

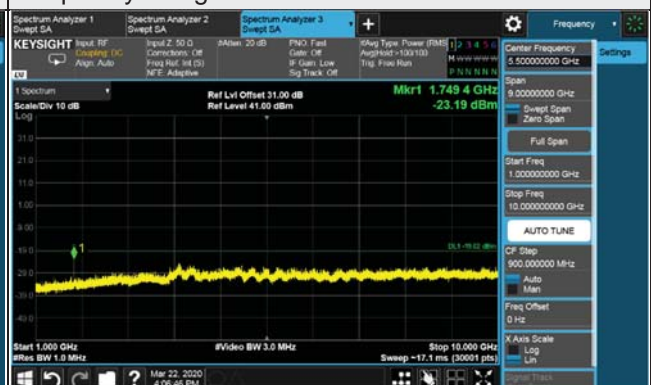


884.0MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

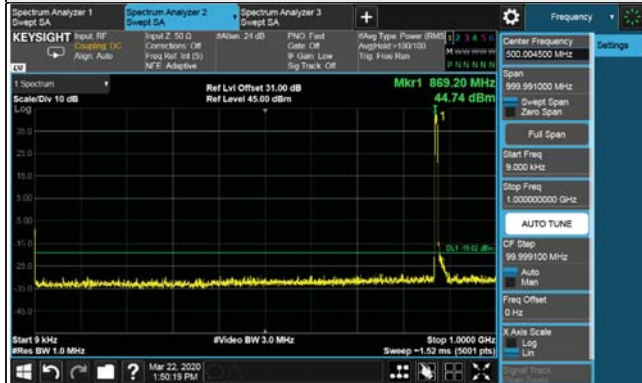


Chain 1

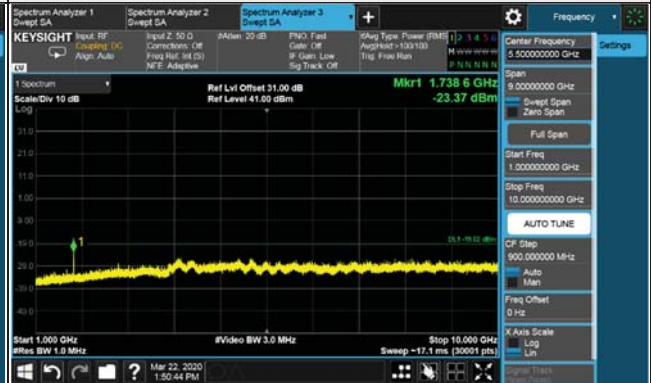
n5, Channel Bandwidth 5MHz

871.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz

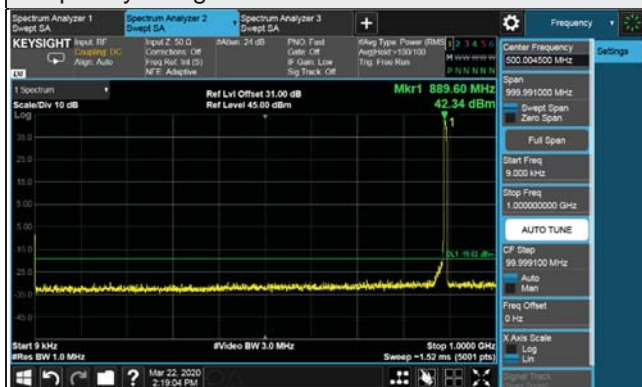


Frequency Range : 1GHz~10GHz

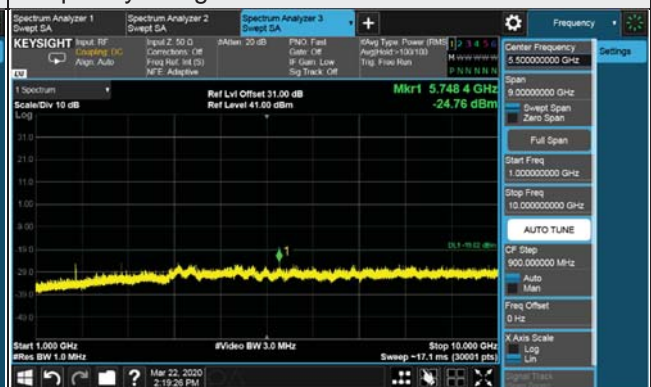


891.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

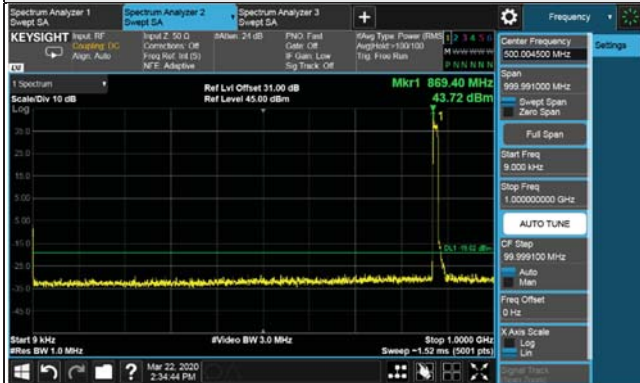




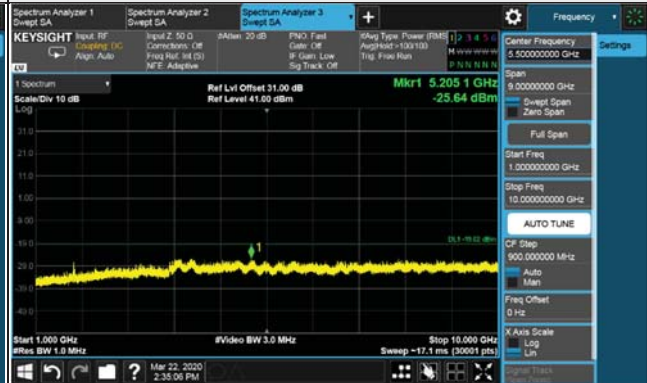
n5, Channel Bandwidth 10MHz

874.0MHz

Frequency Range : 9kHz~1GHz

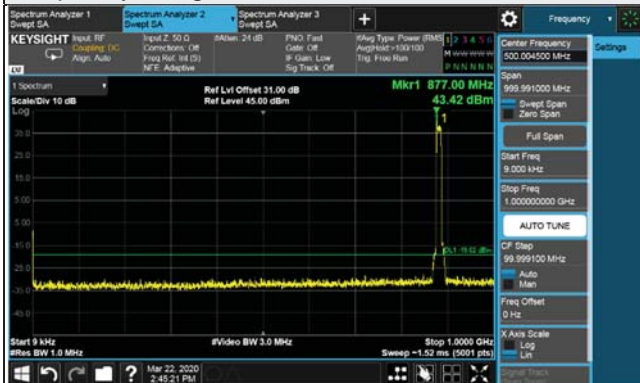


Frequency Range : 1GHz~10GHz

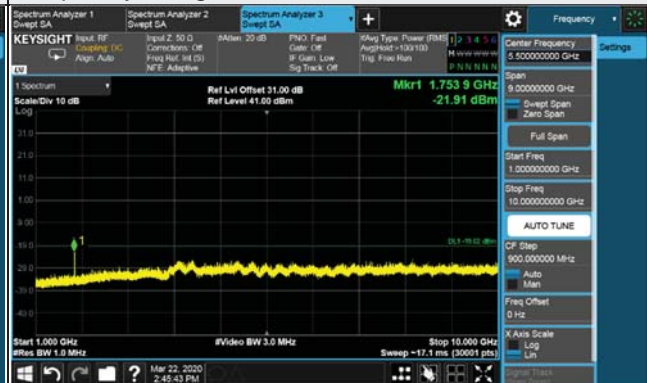


881.5MHz

Frequency Range : 9kHz~1GHz

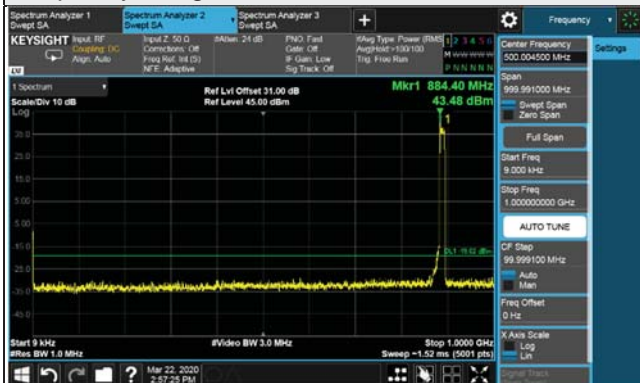


Frequency Range : 1GHz~10GHz

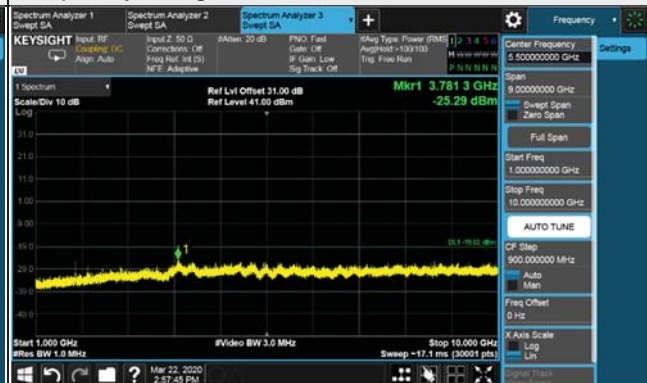


889.0MHz

Frequency Range : 9kHz~1GHz



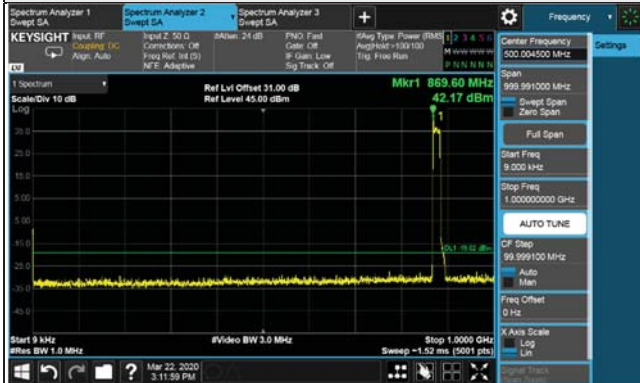
Frequency Range : 1GHz~10GHz



n5, Channel Bandwidth 15MHz

876.5MHz

Frequency Range : 9kHz~1GHz

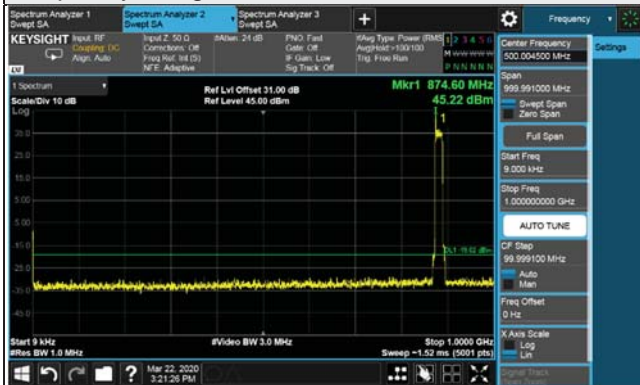


Frequency Range : 1GHz~10GHz

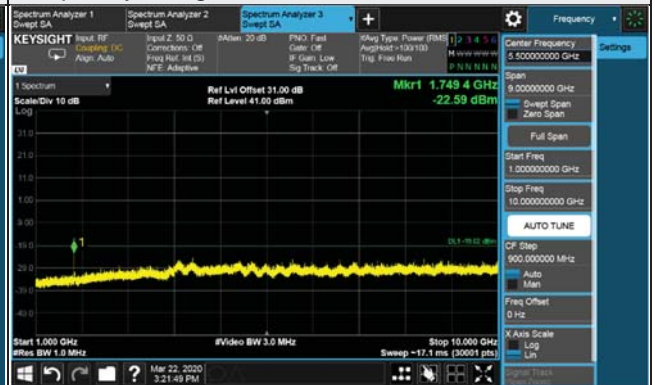


881.5MHz

Frequency Range : 9kHz~1GHz

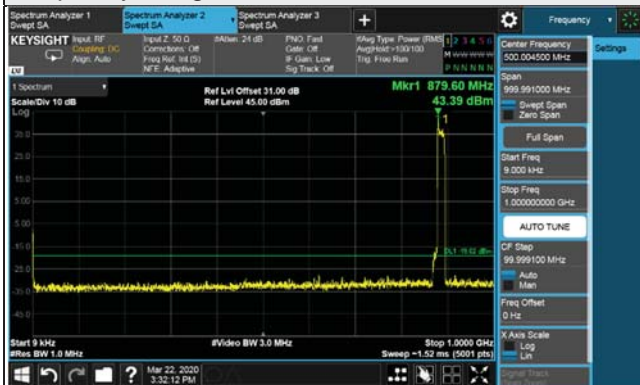


Frequency Range : 1GHz~10GHz

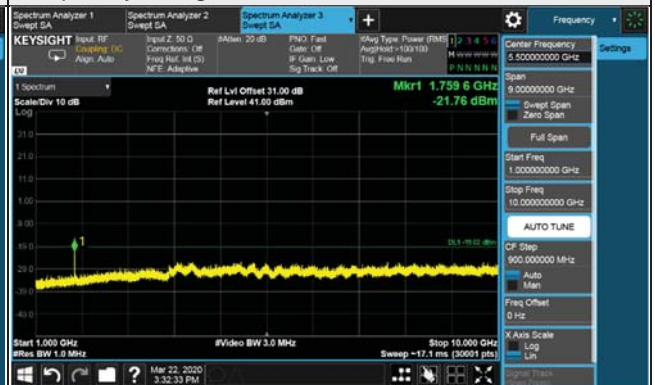


886.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

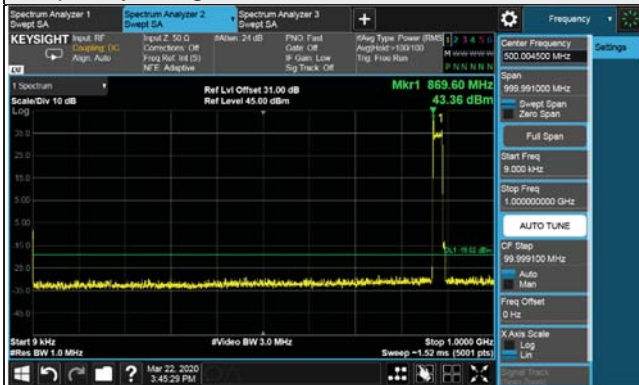




n5, Channel Bandwidth 20MHz

879.0MHz

Frequency Range : 9kHz~1GHz

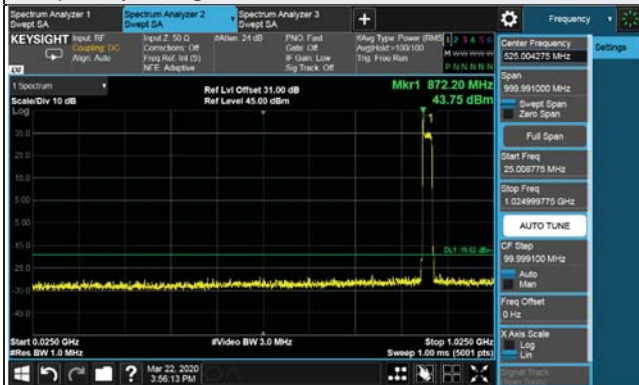


Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz

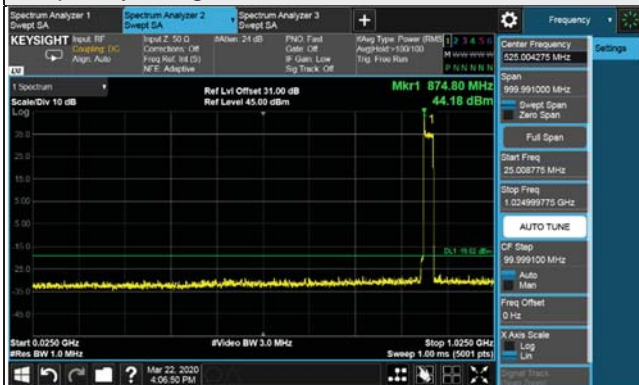


Frequency Range : 1GHz~10GHz

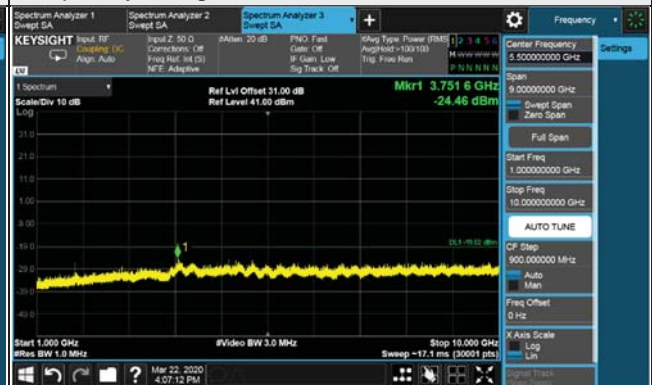


884.0MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

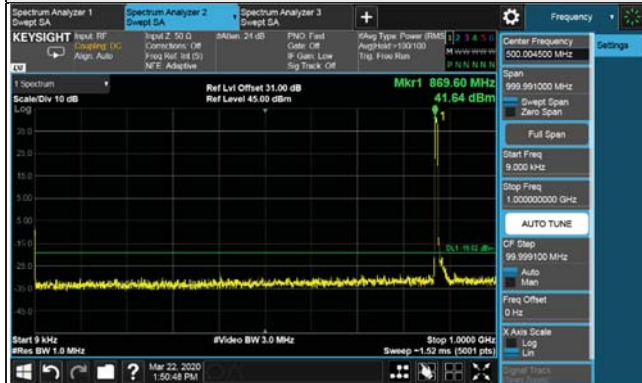


Chain 2

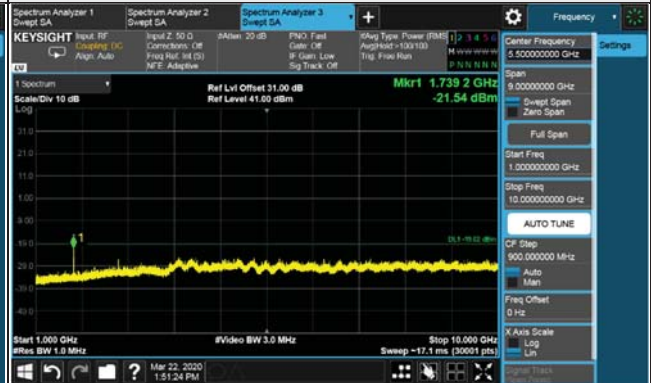
n5, Channel Bandwidth 5MHz

871.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz

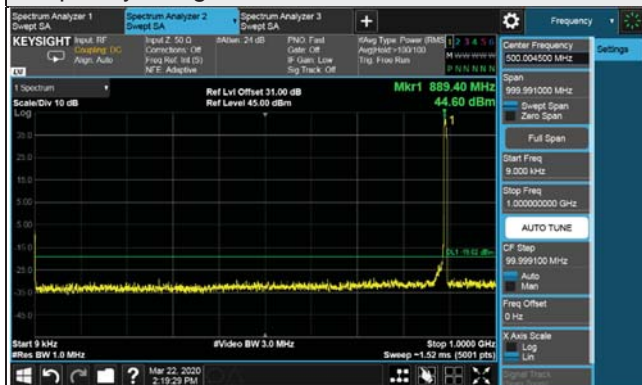


Frequency Range : 1GHz~10GHz



891.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

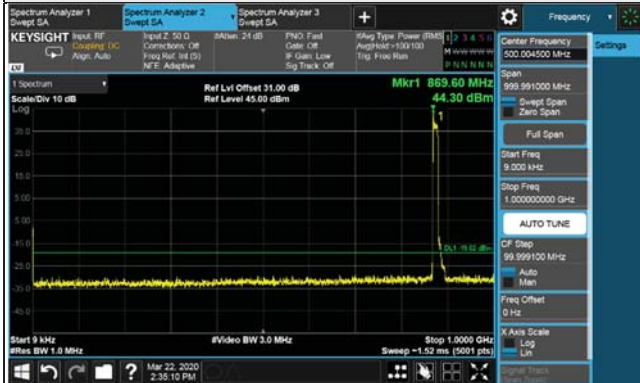




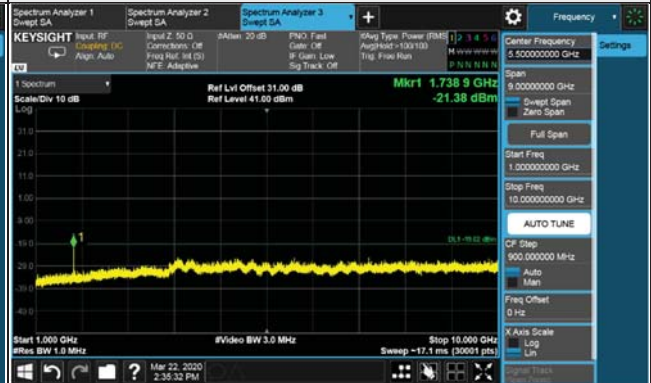
n5, Channel Bandwidth 10MHz

874.0MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz

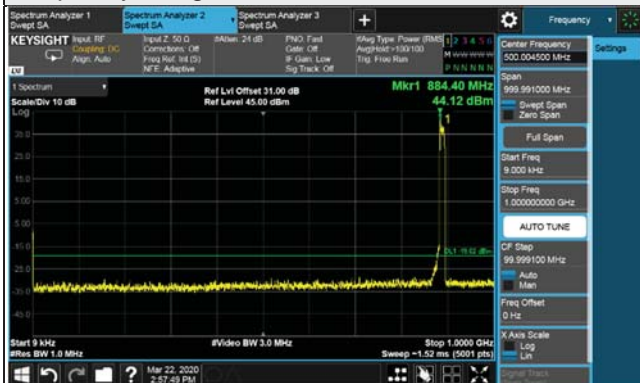


Frequency Range : 1GHz~10GHz



889.0MHz

Frequency Range : 9kHz~1GHz



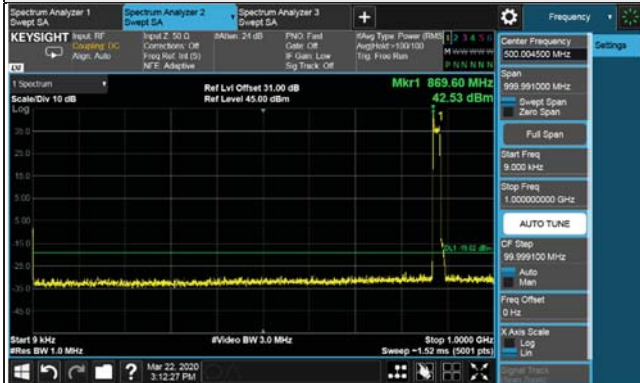
Frequency Range : 1GHz~10GHz



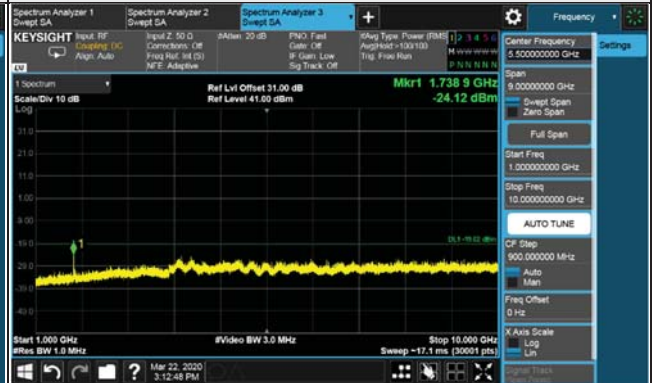
n5, Channel Bandwidth 15MHz

876.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz

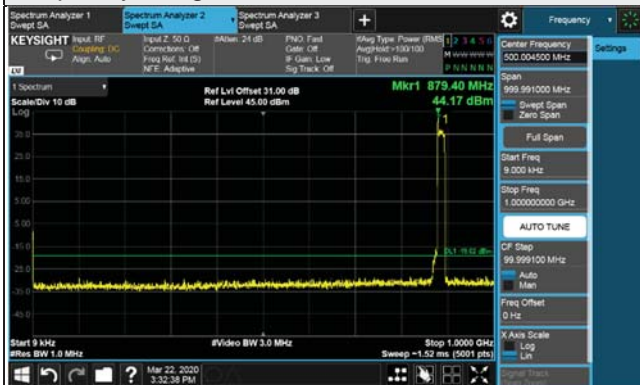


Frequency Range : 1GHz~10GHz



886.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

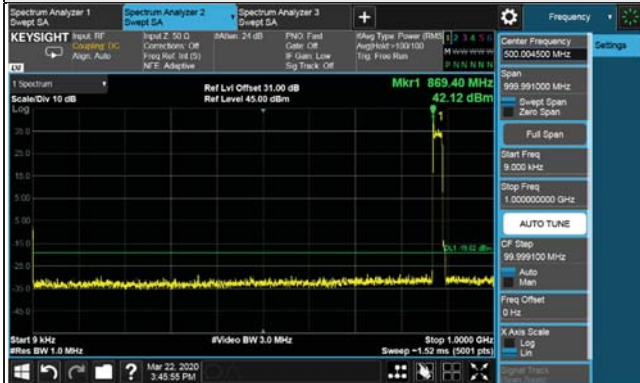




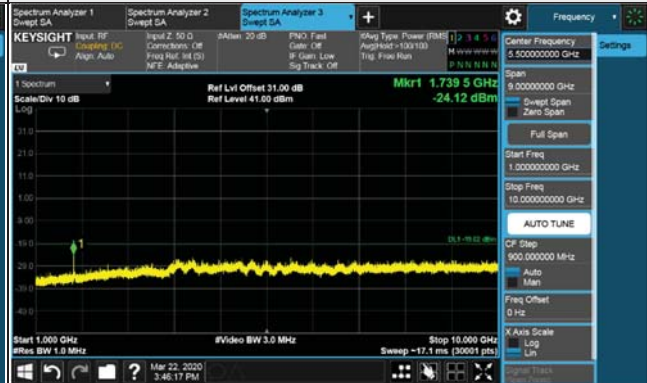
n5, Channel Bandwidth 20MHz

879.0MHz

Frequency Range : 9kHz~1GHz

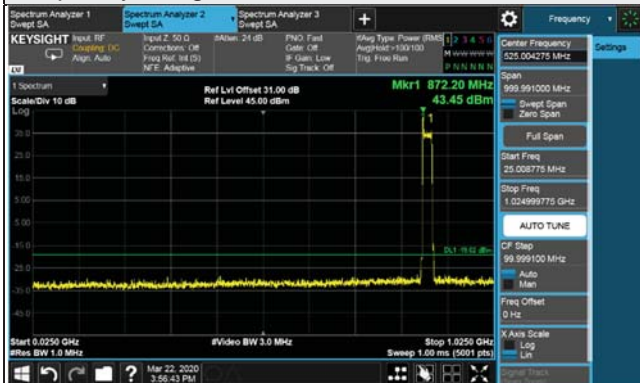


Frequency Range : 1GHz~10GHz

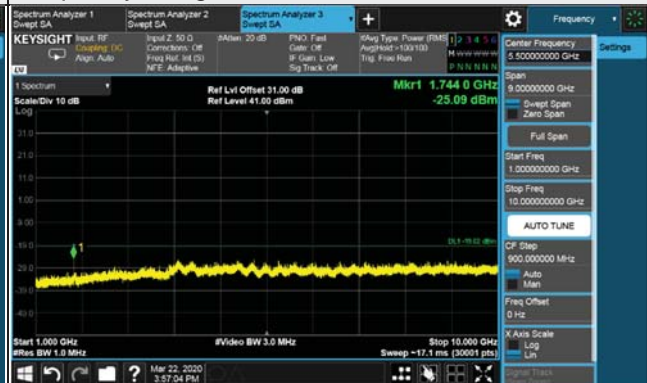


881.5MHz

Frequency Range : 9kHz~1GHz

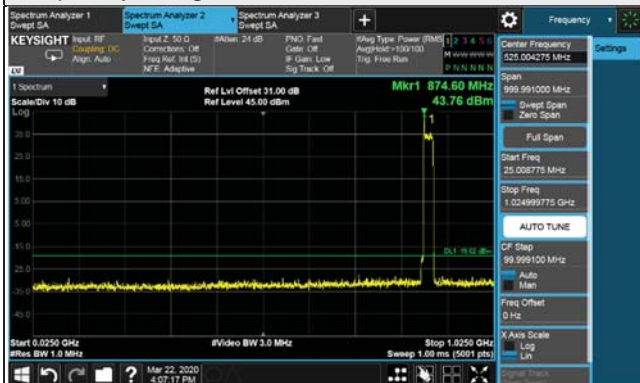


Frequency Range : 1GHz~10GHz

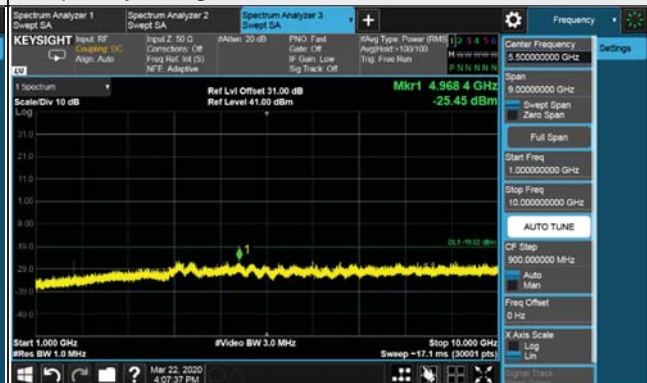


884.0MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

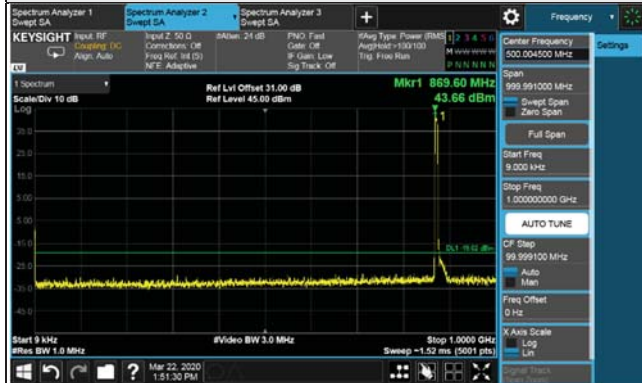


Chain 3

n5, Channel Bandwidth 5MHz

871.5MHz

Frequency Range : 9kHz~1GHz

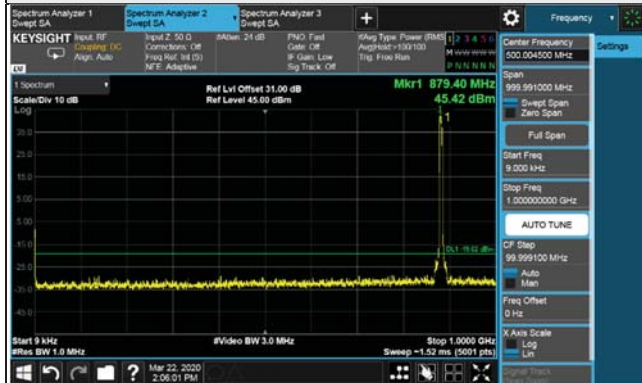


Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz

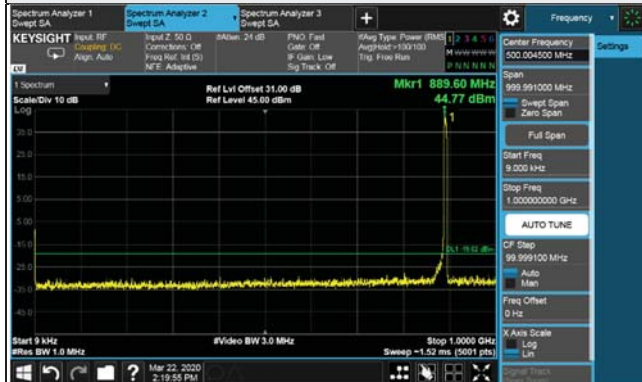


Frequency Range : 1GHz~10GHz

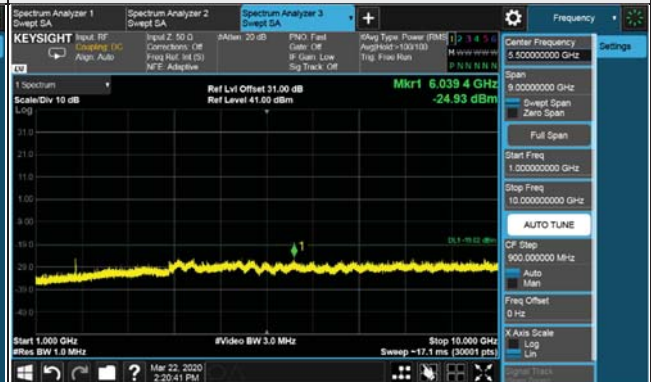


891.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

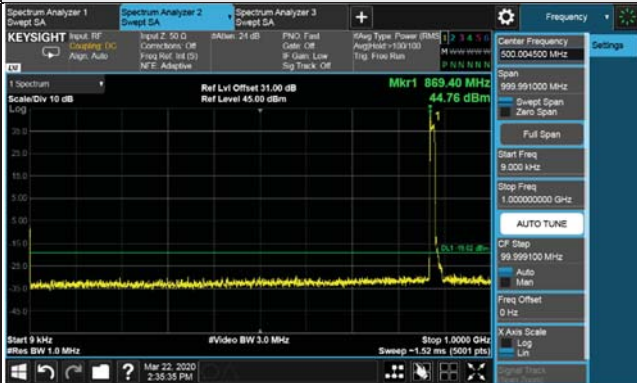




n5, Channel Bandwidth 10MHz

874.0MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz



881.5MHz

Frequency Range : 9kHz~1GHz

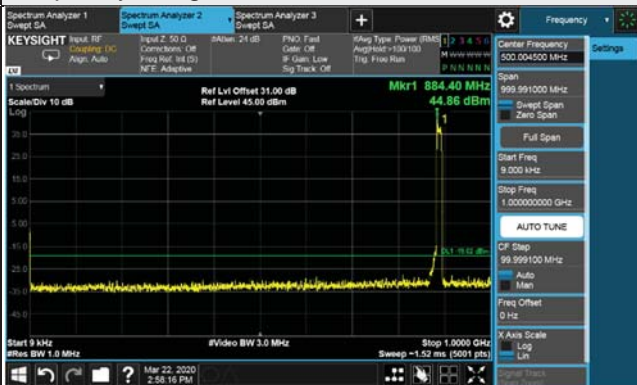


Frequency Range : 1GHz~10GHz



889.0MHz

Frequency Range : 9kHz~1GHz



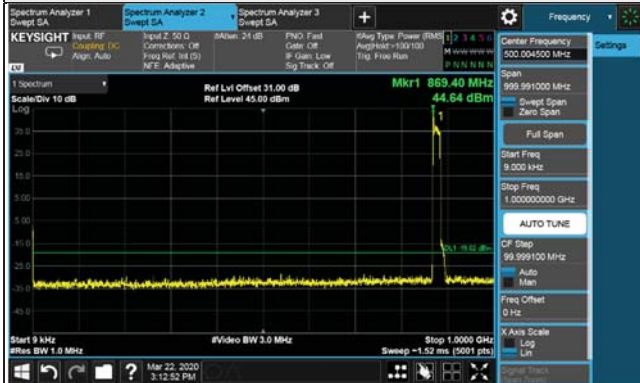
Frequency Range : 1GHz~10GHz



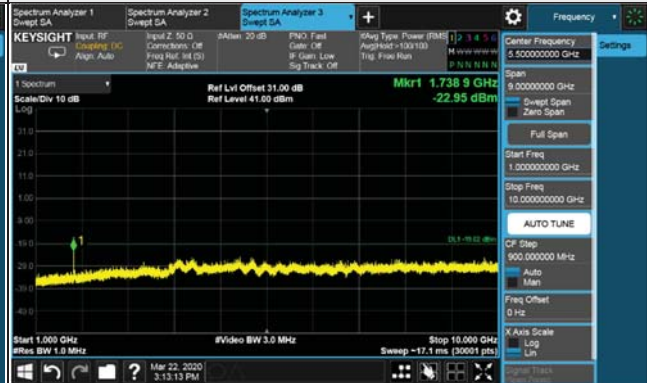
n5, Channel Bandwidth 15MHz

876.5MHz

Frequency Range : 9kHz~1GHz

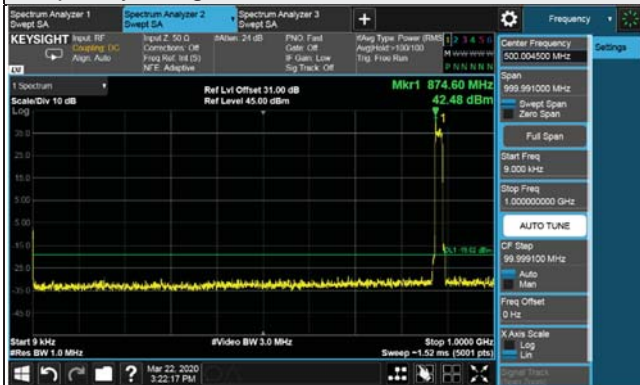


Frequency Range : 1GHz~10GHz

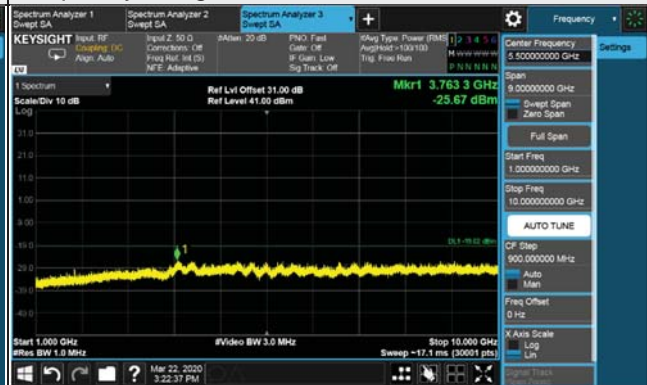


881.5MHz

Frequency Range : 9kHz~1GHz

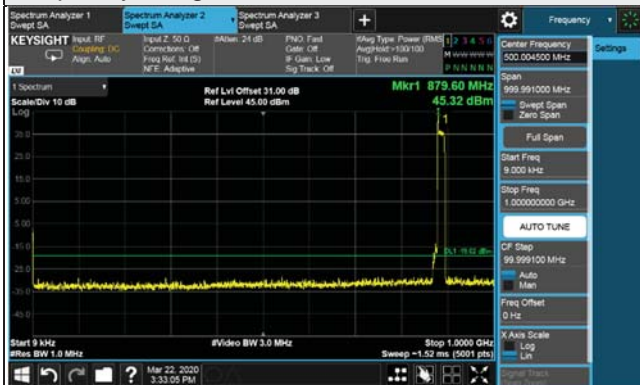


Frequency Range : 1GHz~10GHz

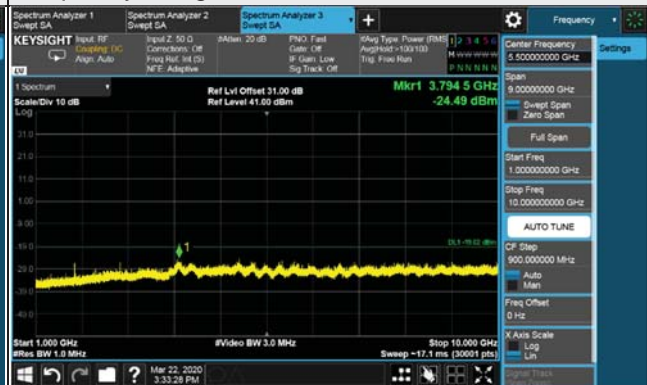


886.5MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz

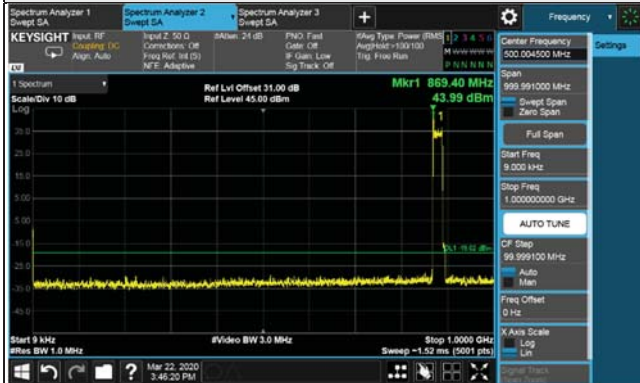




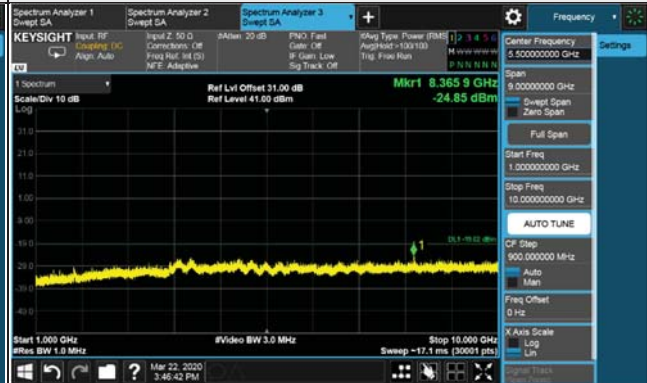
n5, Channel Bandwidth 20MHz

879.0MHz

Frequency Range : 9kHz~1GHz

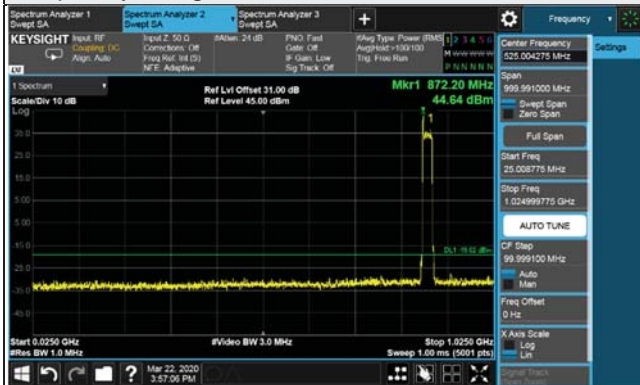


Frequency Range : 1GHz~10GHz

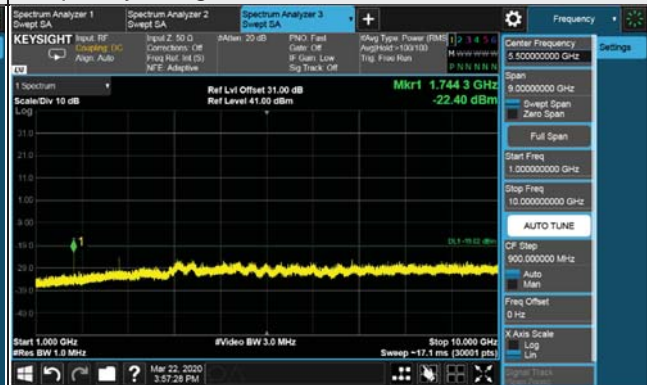


881.5MHz

Frequency Range : 9kHz~1GHz

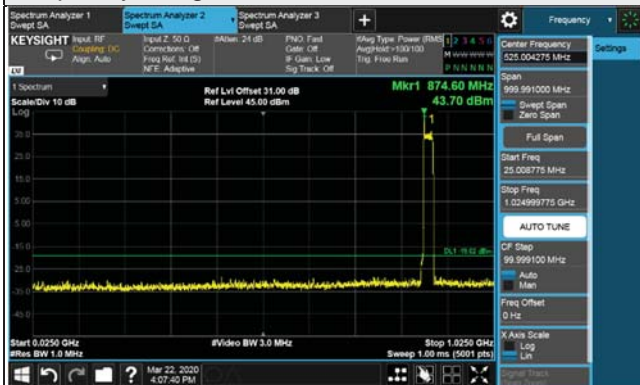


Frequency Range : 1GHz~10GHz

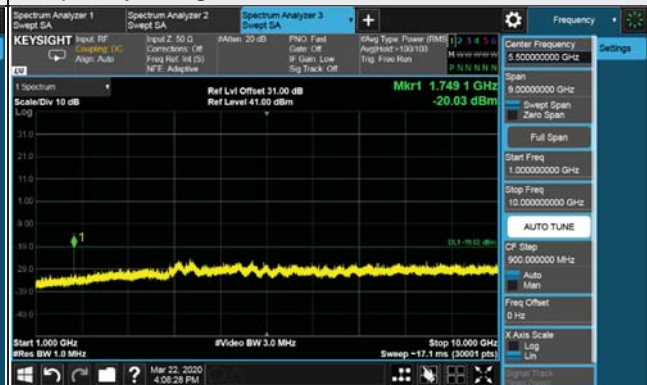


884.0MHz

Frequency Range : 9kHz~1GHz



Frequency Range : 1GHz~10GHz



## 4.8 Radiated Emission Measurement

### 4.8.1 Limits of Radiated Emission Measurement

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

### 4.8.2 Test Procedure

- a. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m 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 substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value" of step a. Record the power level of S.G
- c.  $EIRP = \text{Output power level of S.G} - \text{TX cable loss} + \text{Antenna gain of substitution horn}$ .
- d. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole,  $E.R.P \text{ power} = E.I.R.P \text{ power} - 2.15\text{dBi}$ .

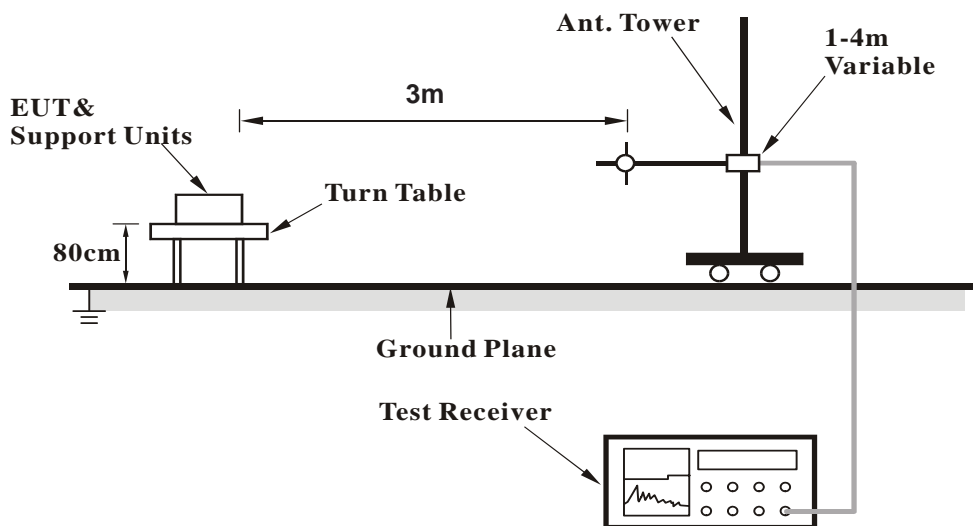
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

### 4.8.3 Deviation from Test Standard

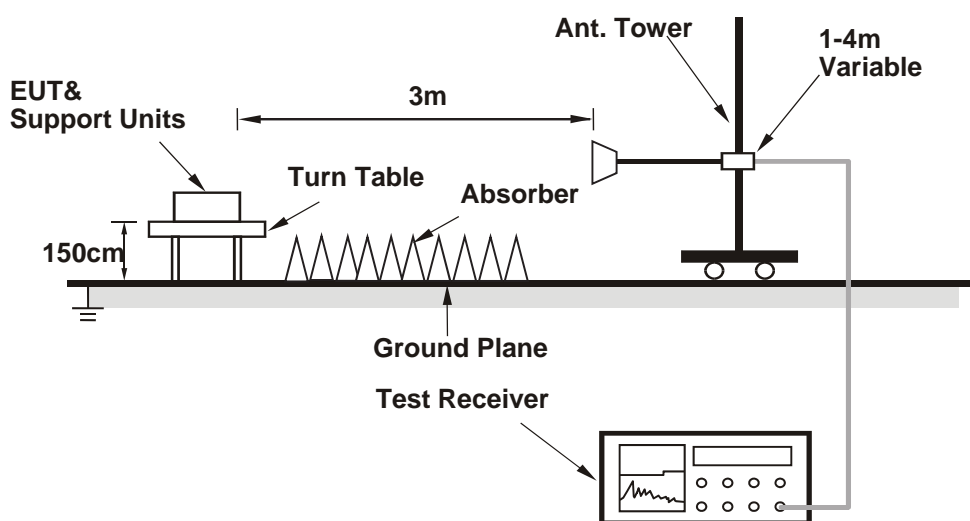
No deviation.

#### 4.8.4 Test Setup

##### For Radiated Emission below or equal 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

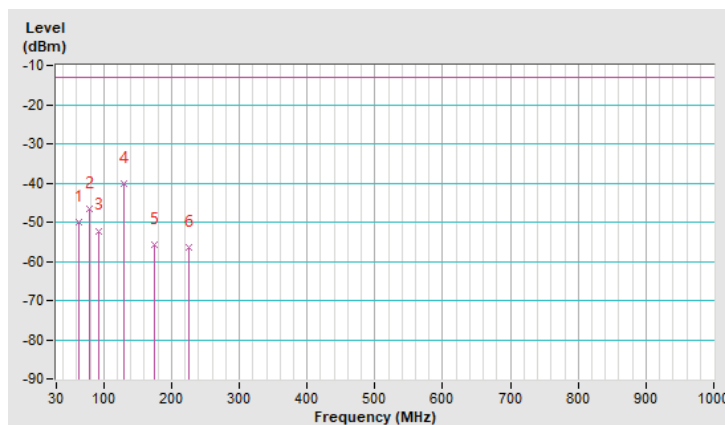
n5, Channel Bandwidth: 5MHz

Mode	TX channel 174300 (871.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 68%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	62.98	-42.0	-47.7	-2.4	-50.1	-13.0	-37.1
2	78.50	-39.4	-47.2	0.6	-46.6	-13.0	-33.6
3	92.08	-41.5	-51.6	-0.6	-52.2	-13.0	-39.2
4	128.94	-31.9	-37.0	-3.2	-40.2	-13.0	-27.2
5	174.53	-46.0	-52.8	-2.8	-55.6	-13.0	-42.6
6	224.97	-46.1	-54.4	-1.9	-56.3	-13.0	-43.3

Remarks:

1. ERP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).



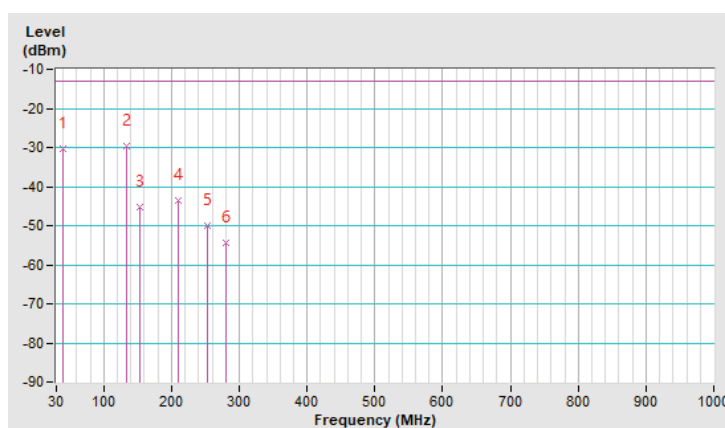
Mode	TX channel 174300 (871.5MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 68%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	40.67	-18.9	-17.4	-13.1	-30.5	-13.0	-17.5
<b>2</b>	<b>133.79</b>	<b>-23.8</b>	<b>-26.5</b>	<b>-3.3</b>	<b>-29.8</b>	<b>-13.0</b>	<b>-16.8</b>
3	154.16	-40.8	-42.4	-2.9	-45.3	-13.0	-32.3
4	209.45	-38.4	-41.6	-2.0	-43.6	-13.0	-30.6
5	252.13	-47.8	-48.5	-1.4	-49.9	-13.0	-36.9
6	280.26	-55.5	-52.9	-1.6	-54.5	-13.0	-41.5

Remarks:

- ERP (dBm) = S.G Value (dBm) + Correction Factor (dB).
- Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).



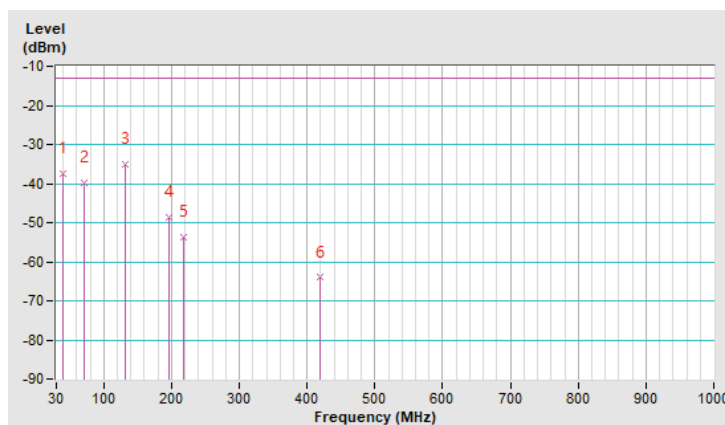
n5, Channel Bandwidth: 20MHz

Mode	TX channel 175800 (879.0MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 68%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	40.67	-37.4	-24.3	-13.1	-37.4	-13.0	-24.4
2	70.74	-31.5	-39.5	-0.4	-39.9	-13.0	-26.9
3	131.85	-26.6	-31.7	-3.3	-35.0	-13.0	-22.0
4	195.87	-38.0	-46.1	-2.5	-48.6	-13.0	-35.6
5	217.21	-43.2	-51.8	-2.0	-53.8	-13.0	-40.8
6	418.97	-61.7	-67.6	3.5	-64.1	-13.0	-51.1

Remarks:

1. ERP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

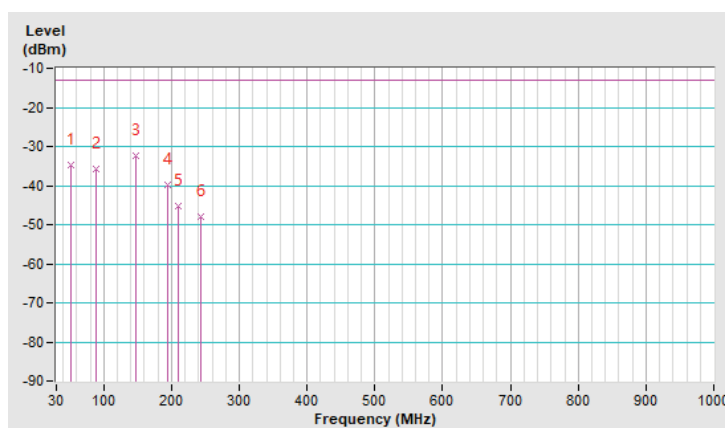


Mode	TX channel 175800 (879.0MHz)	Frequency Range	Below 1000 MHz
Environmental Conditions	22deg. C, 68%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	51.34	-25.4	-27.5	-7.3	-34.8	-13.0	-21.8
2	88.20	-27.1	-35.4	-0.2	-35.6	-13.0	-22.6
3	147.37	-28.0	-29.4	-2.9	-32.3	-13.0	-19.3
4	193.93	-36.3	-37.2	-2.6	-39.8	-13.0	-26.8
5	210.42	-39.8	-43.3	-2.0	-45.3	-13.0	-32.3
6	242.43	-44.5	-46.7	-1.4	-48.1	-13.0	-35.1

Remarks:

1. ERP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).



Above 1GHz  
n5, Channel Bandwidth: 5MHz

Mode	TX channel 174300 (871.5MHz)	Frequency Range	1GHz ~ 18GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1743.00	-64.2	-57.4	0.5	-56.9	-13.0	-43.9
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1743.00	-63.6	-57.3	0.5	-56.8	-13.0	-43.8

Remarks:

1. ERP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 176300 (881.5MHz)	Frequency Range	1GHz ~ 18GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1763.00	-64.7	-58.2	0.5	-57.7	-13.0	-44.7
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1763.00	-63.5	-57.6	0.5	-57.1	-13.0	-44.1

Remarks:

1. ERP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 178300 (891.5MHz)	Frequency Range	1GHz ~ 18GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1783.00	-64.2	-58.1	0.4	-57.7	-13.0	-44.7

Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1783.00	-63.5	-58.1	0.4	-57.7	-13.0	-44.7

Remarks:

1.  $ERP (dBm) = S.G \text{ Value (dBm)} + \text{Correction Factor (dB)}$ .
2.  $\text{Correction Factor (dB)} = \text{Substitution Antenna Gain (dB)} + \text{Cable Loss (dB)}$ .



n5, Channel Bandwidth: 20MHz

Mode	TX channel 175800 (879.0MHz)	Frequency Range	1GHz ~ 18GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1758.00	-64.5	-57.9	0.5	-57.4	-13.0	-44.4

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1758.00	-63.3	-57.4	0.5	-56.9	-13.0	-43.9

Remarks:

1. ERP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 176300 (881.5MHz)	Frequency Range	1GHz ~ 18GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1763.00	-64.2	-57.8	0.5	-57.3	-13.0	-44.3

Antenna Polarity & Test Distance: Vertical at 3 M

No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1763.00	-63.6	-57.7	0.5	-57.2	-13.0	-44.2

Remarks:

1. ERP (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

Mode	TX channel 176800 (884.0MHz)	Frequency Range	1GHz ~ 18GHz
Environmental Conditions	22deg. C, 66%RH	Input Power	120Vac, 60Hz
Tested By	Han Wu		

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1768.00	-64.6	-58.3	0.5	-57.8	-13.0	-44.8
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)
1	1768.00	-63.4	-57.6	0.5	-57.1	-13.0	-44.1

Remarks:

1.  $ERP (dBm) = S.G \text{ Value (dBm)} + \text{Correction Factor (dB)}$ .
2.  $\text{Correction Factor (dB)} = \text{Substitution Antenna Gain (dB)} + \text{Cable Loss (dB)}$ .

## 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:

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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

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