



## MEASUREMENT REPORT

**FCC ID** : XBG-BA1GMNRCH12


**APPLICANT** : AVALUE TECHNOLOGY INCORPORATION

**Application Type** : Certification

**Product** : Intercom

**Model Name** : Monarch 12

**Model Number** : BUTTERFLYMX.M12.1

**Trade Mark** :   
ButterflyMX


**FCC Classification** : PCS Licensed Transmitter (PCB)


**FCC Rule Part(s)** : Part2, Part22 Subpart H, Part24 Subpart E, Part27


**Test Procedure(s)** : ANSI/TIA-603-E-2016

**Received Date** : September 13, 2022

**Test Date** : September 23 ~ November 18, 2022

**Tested By** :   
( Wen Lee )

**Reviewed By** :   
( Paddy Chen )

**Approved By** :   
( Chenz Ker )



The test results only relate to the tested sample.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Taiwan) Co., Ltd.

---

## Revision History

Report No.	Version	Description	Issue Date	Note
2209TWI301-U8	1.0	Original Report	2022-12-15	

# CONTENTS

Description	Page
<b>1. INTRODUCTION .....</b>	<b>6</b>
1.1. Scope .....	6
1.2. MRT Test Location .....	6
<b>2. PRODUCT INFORMATION .....</b>	<b>7</b>
2.1. Feature of Equipment under Test.....	7
2.2. Equipment Description .....	8
2.3. Device Capabilities .....	8
2.4. Test Configuration .....	8
2.5. EMI Suppression Device(s)/Modifications.....	8
<b>3. DESCRIPTION OF TEST .....</b>	<b>9</b>
3.1. Evaluation Procedure .....	9
3.2. Cellular – Base Frequency Blocks .....	9
3.3. Cellular – Mobile Frequency Blocks.....	9
3.4. PCS – Base Frequency Blocks.....	10
3.5. PCS – Mobile Frequency Blocks .....	10
3.6. Occupied Bandwidth.....	11
3.7. Spurious and Harmonic Emissions at Antenna Terminal .....	11
3.8. Power and Radiated Spurious Emissions .....	12
3.9. Peak-Average Ratio .....	13
3.10. Frequency Stability / Temperature Variation .....	13
<b>4. TEST EQUIPMENT CALIBRATION DATE.....</b>	<b>14</b>
<b>5. SAMPLE CALCULATIONS.....</b>	<b>15</b>
<b>6. MEASUREMENT UNCERTAINTY.....</b>	<b>16</b>
<b>7. TEST RESULT .....</b>	<b>17</b>
7.1. Summary.....	17
7.2. Occupied Bandwidth.....	20
7.2.1. Test Limit .....	20
7.2.2. Test Procedure used.....	20
7.2.3. Test Setting.....	20
7.2.4. Test Setup .....	20
7.2.5. Test Result.....	21
7.3. Conducted Spurious Emissions .....	40
7.3.1. Test Limit .....	40

7.3.2. Test Procedure Used.....	40
7.3.3. Test Setting.....	40
7.3.4. Test Setup .....	40
7.3.5. Test Result.....	41
7.4. Band Edge at Antenna Terminal.....	110
7.4.1. Test Limit .....	110
7.4.2. Test Procedure Used.....	111
7.4.3. Test Setting.....	111
7.4.4. Test Setup .....	111
7.4.5. Test Result.....	112
7.5. Power and Radiated Spurious Emissions .....	165
7.5.1 Test Limit .....	165
7.5.2 Test Procedure Used.....	166
7.5.3 Test Setting.....	166
7.5.4 Test Setup .....	168
7.5.5 Test Result.....	169
7.6. Peak-Average Ratio .....	187
7.6.1 Test Limit .....	187
7.6.2 Test Procedure .....	187
7.6.3 Test Setup .....	187
7.6.4 Test Result.....	188
7.7. Frequency Stability Under Temperature & Voltage Variations .....	208
7.7.1 Test Limit .....	208
7.7.2 Test Procedure .....	208
7.7.3 Test Setup .....	208
7.7.4 Test Result.....	209

## §2.1033 General Information

<b>Applicant</b>	AVALUE TECHNOLOGY INCORPORATION
<b>Applicant Address</b>	7F, 228, Lian-cheng Road, Zhonghe Dist., New Taipei City 235, Taiwan
<b>Manufacturer</b>	ButterflyMX, inc.
<b>Manufacturer Address</b>	44 West 28th Street, 4th Floor New York, NY 10001
<b>Test Site</b>	MRT Technology (Taiwan) Co., Ltd
<b>Test Site Address</b>	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
<b>MRT FCC Registration No.</b>	291082
<b>FCC Rule Part(s)</b>	Part 22H, Part 24E, Part27
<b>Test Device Serial No.</b>	#1-1 <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering

### Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Fuxing Rd., Taoyuan, Taiwan ( R.O.C )

- MRT facility is a FCC registered (Reg. No. 291082) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.
- MRT facility is an IC registered (MRT Reg. No. 21723) test laboratory with the site description on file at Industry Canada.
- MRT Lab is accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC (Designation Number: TW3261), Industry Taiwan, EU and TELEC Rules.

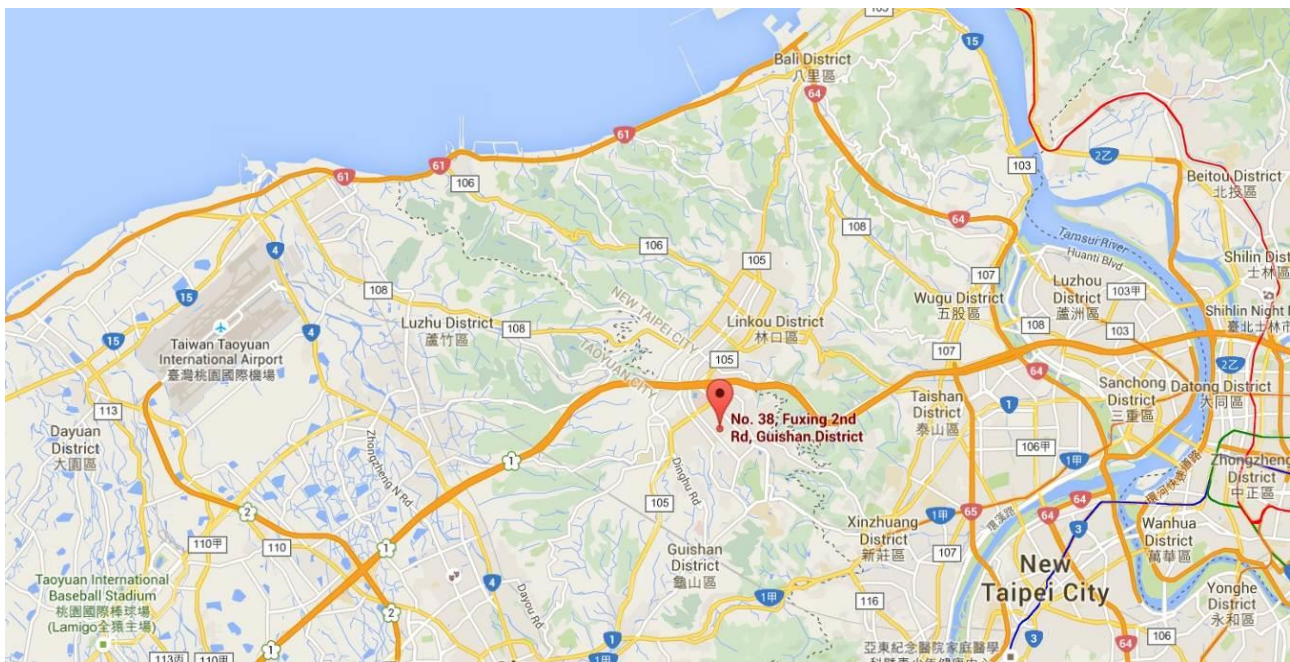
# 1. INTRODUCTION

## 1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.


## 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



## 2. PRODUCT INFORMATION

### 2.1. Feature of Equipment under Test

Product Name	Intercom
Trade Mark	 ButterflyMX
Model Name	Monarch 12
Model Number	BUTTERFLYMX.M12.1
Supports Radios Spec.	<b>WPAN:</b> Bluetooth Dual Mode: V5.0 RFID: 125kHz & 13.56MHz <b>WLAN:</b> 2.4G: 802.11b/g/n-20/n-40 5G: 802.11a/n-20/ac-20/n-40/ac-40/ac-80, Band 1,4 <b>WWAN:</b> 4G: Band 2,4,5,7,12,13,25,26,38,41
4G Operation Band (s)	Band 2, 4, 5, 7, 12, 13, 25, 26, 38, 41
Frequency Range	Band2: 1850MHz–1910MHz (LTE Band 2 is covered by Band 25) Band4: 1710MHz–1755MHz Band5: 824MHz–849MHz (LTE Band 5 is covered by Band 26) Band7: 2500MHz–2570MHz Band12: 699MHz–716MHz Band13: 777MHz–787MHz Band25: 1850MHz–1915MHz (Covered B2) Band26: 814MHz–849MHz (Covered B5) Band38: 2570MHz–2620MHz (LTE Band 38 is covered by Band 41) Band41: 2496MHz–2690MHz (Covered B38)

## 2.2. Equipment Description

Antenna Type	FPCB
Antenna M/N	YFCA002FA
Antenna Gain	Band 2: 2.46dBi, Band 4: 2.50dBi, Band 5: -3.00dBi, Band 7: 2.10dBi, Band 12: -4.52dBi, Band 13: -4.52dBi, Band 25: 2.46dBi, Band 26: -3.00dBi, Band 38: 2.80dBi, Band 41: 2.80dBi
Type of Modulation	QPSK, 16QAM

Note:

1. The test report has showed the worst test mode.

## 2.3. Device Capabilities

This device contains the following capabilities:

LTE Band 2, 4, 5, 7, 12, 13, 25, 26, 38, 41.

## 2.4. Test Configuration

The **Intercom** was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01v02r02. See section 3.0 of this report for a description of the radiated and antenna port conducted emissions tests.

## 2.5. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.



### 3. DESCRIPTION OF TEST

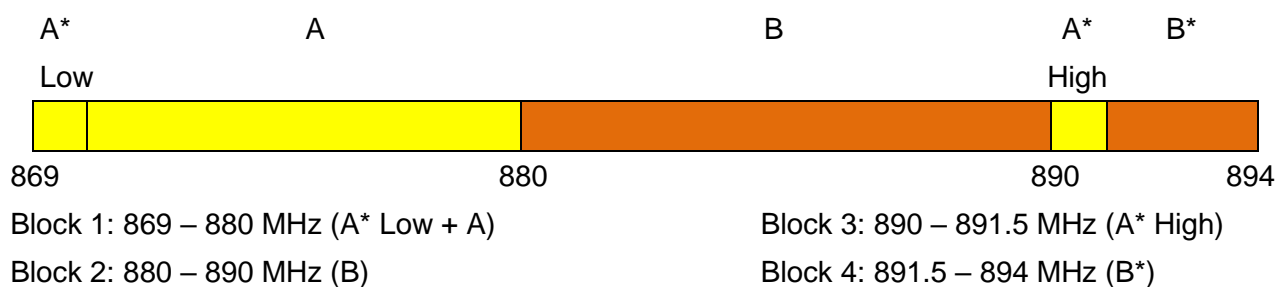
#### 3.1. Evaluation Procedure

The measurement procedures described in the “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI/TIA-603-E-2016) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168) were used in the measurement of the **Intercom**

Deviation from measurement procedure.....None

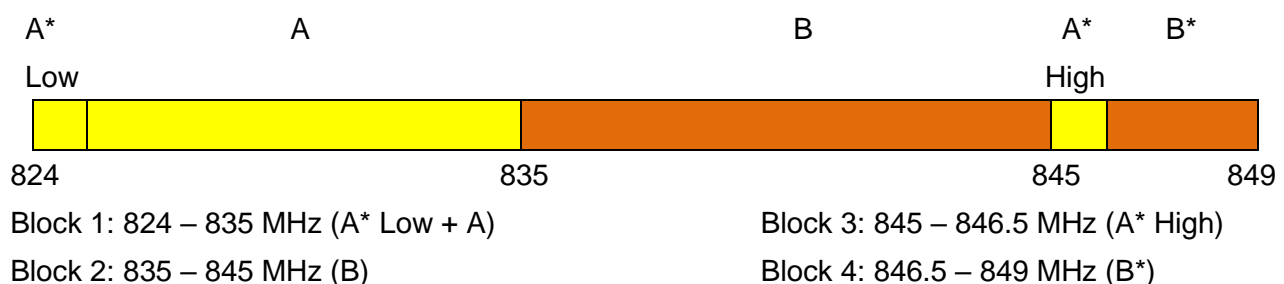
#### 3.2. Cellular – Base Frequency Blocks

\$22.905



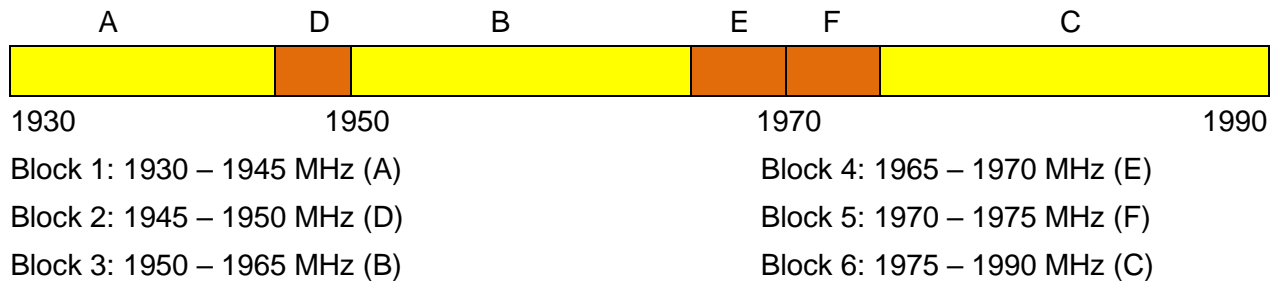
#### 3.3. Cellular – Mobile Frequency Blocks

\$22.905



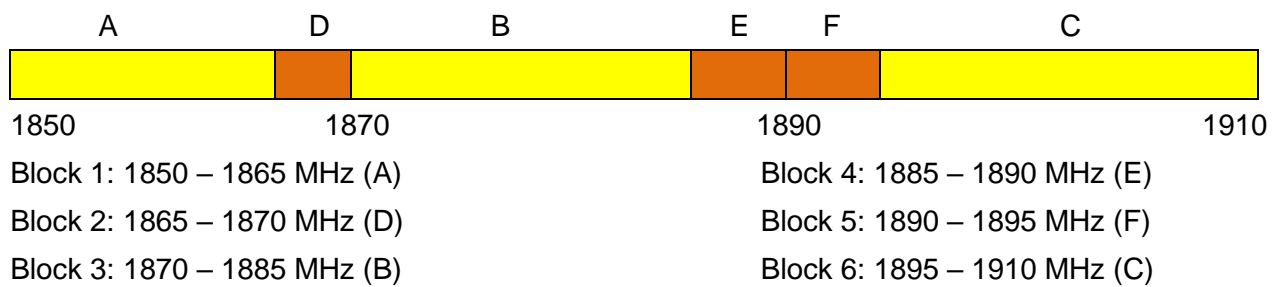
### 3.4. PCS – Base Frequency Blocks

#### §24.229



### 3.5. PCS – Mobile Frequency Blocks

#### §24.229



### 3.6. Occupied Bandwidth

#### §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 percent of the total mean power radiated by a given emission shall be measured. The spectrum analyzers' "occupied bandwidth" measurement function was used to record the occupied bandwidth in accordance with KDB 971168.

### 3.7. Spurious and Harmonic Emissions at Antenna Terminal

#### §2.1051 §22.917(a) §24.238(a)

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10<sup>th</sup> harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for Part 22. However, 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. 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 emission are attenuated at least 26 dB below the transmitter power.

### 3.8. Power and Radiated Spurious Emissions

#### §2.1053 §22.913(a.2) §22.917(a) §24.232(c) §24.238(a)

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurement and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. A 80cm high PVC support structure is placed on top of the turntable.

The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer "Channel Power" function with the integration band set to the emissions' occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168.

Per the guidance of ANSI/TIA-603-E-2016, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_d [\text{dBm}] = P_g [\text{dBm}] - \text{cable loss} [\text{dB}] + \text{antenna gain} [\text{dBd/dBi}]$$

Where,  $P_d$  is the dipole equivalent power,  $P_g$  is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to  $P_g [\text{dBm}] - \text{cable loss} [\text{dB}]$ .

The calculated  $P_d$  levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of  $43 + 10 \cdot \log_{10}(\text{Power} [\text{Watts}])$  specified in 22.917(a).

### 3.9. Peak-Average Ratio

#### §24.232(d)

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

For pulsed signals, the spectrum analyzer is set to use an internal “RF Burst” trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the “on time” of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power. For continuous signals, the trigger is set to “free run” in the CCDF measurement mode.

### 3.10. Frequency Stability / Temperature Variation

#### §2.1055 §22.355 §22.863 §22.905 §24.229 §24.235

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

- a.) Temperature: The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – For Part 22, the frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm) of the center frequency.

Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

## 4. TEST EQUIPMENT CALIBRATION DATE

### Conducted Emissions – SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2023/3/7
Cable	Rosnol	N1C50-RG400-B 1C50-500CM	MRTTWE00013	1 year	2023/6/21
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2023/3/9

### Radiated Emissions – AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2022/12/30
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2023/3/9
Active Loop Antenna	Schwarzbeck	FMZB 1519B	MRTTWA00002	1 year	2023/5/24
Broadband Horn antenna	SCHWARZBECK	BBHA 9120D	MRTTWA00003	1 year	2023/3/30
Breitband Hornantenna	Schwarzbeck	BBHA 9170	MRTTWA00004	1 year	2023/3/29
Broadband Amplifier	Schwarzbeck	BBV 9721	MRTTWA00006	1 year	2023/3/30
Broadband Preamplifier	SCHWARZBECK	BBV 9718	MRTTWA00005	1 year	2023/3/30
Cable	HUBERSUHNER	SF106	MRTTWE00010	1 year	2023/6/14
Cable	Rosnol	K1K50-UP0264- K1K50-4M	MRTTWE00012	1 year	2023/6/19

### Conducted Test Equipment –SR5

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2023/10/5
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2023/7/19
USB Wideband Power Sensor	KEYSIGHT	U2021XA	MRTTWA00015	1 year	2023/3/16
Wideband Radio Communication Taster	R&S	CMW 500	MRTTWA00084	1 year	2023/10/18

### Test Software

Software	Version	Function
e3	9.160520a	EMI Test Software
EMI	V3	EMI Test Software

## 5. SAMPLE CALCULATIONS

### **GSM Emission Designator**

Emission Designator = 250KGXW

GSM BW = 250 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

### **EGPRS Emission Designator**

Emission Designator = 250KG7W

GSM BW = 250 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

### **WCDMA / CDMA Emission Designator**

Emission Designator = 1M25F9W

WCDMA BW = 1.25 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

### **LTE Emission Designator**

Emission Designator = QPSK 5M00G7D / 16QAM 5M00W7D

LTE BW = 1.4/3/5/10/15/20 MHz

QPSK G = Phase Modulation /

16QAM W= in a combination of two or more of the following modes: amplitude, angle, pulse

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

### **Spurious Radiated Emission**

Example: Spurious emission at 1688.10 MHz

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was  $-65.0\text{dBm}$ . The gain of the substituted antenna is  $6.5\text{dBi}$ . The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of  $-65.0\text{dBm}$  on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is  $4.5\text{ dB}$  at  $1688.1\text{MHz}$ . So  $2\text{ dB}$  is added to the signal generator reading of  $-25\text{dBm}$  yielding  $-23\text{dBm}$ . The fundamental EIRP was  $24.0\text{dBm}$  so this harmonic was  $24.0\text{dBm} - (-23) = 47\text{dBc}$ .

## 6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

<b>Radiated Spurious Emission - AC1</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 3.92\text{dB}$ (Below 30M)
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 4.25\text{dB}$ (30M~1G)
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 4.40\text{dB}$ (1G~18G)
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 4.45\text{dB}$ (18G~40G)
<b>Frequency Error</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 78.4\text{Hz}$
<b>Conducted Power</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 0.84\text{dB}$
<b>Conducted Spurious Emission</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 2.65\text{ dB}$
<b>Occupied Bandwidth</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 3.3%
<b>Temp. / Humidity</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 0.82^\circ\text{C}$ / $\pm 3\%$
<b>DC Voltage</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): $\pm 0.3\%$



## 7. TEST RESULT

### 7.1. Summary

FCC Classification: PCS Licensed Transmitter (PCB)  
Mode(s): LTE Band 2, 4, 5, 7, 12, 13, 25, 26, 38, 41

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied bandwidth	N/A	Conducted	Pass	Section 7.2
2.1051 22.917(a) 24.238(a) 27.53(c) 27.52(h)	Conducted Spurious Emissions	$> 43 + 10\log_{10} (P[\text{Watts}])$ for all out-of-band emissions (Band 2, 4, 5, 12, 13, 17, 25, 26, 66)		Pass	Section 7.3
27.53(m)		$> 55 + 10\log_{10} (P[\text{Watts}])$ for all out-of-band emissions (Band 7, 38, 41)			
27.53(a)		$> 70 + 10\log_{10} (P[\text{Watts}])$ for all out-of-band emissions (Band 30)			
2.1051 22.917(a) 24.238(a) 27.53(c) 27.52(h)	Band Edge	$> 43 + 10\log_{10} (P[\text{Watts}])$ for all out-of-band emissions		Pass	Section 7.4
27.53(m)		27.53(m)(4) (Band 7, 38, 41)			
27.53(a)		27.53(a)(4) (Band 30)			
2.1046	Conducted Output Power	N/A		Pass	Section 7.5
22.913(a)		$< 7 \text{ Watts max. ERP}$ (Band 5, 26)			
24.232(c) 27.50(h)		$< 2 \text{ Watts max. EIRP}$ (Band 2, 7, 25, 38, 41)			
27.50(b)		$< 3 \text{ Watts max. ERP}$ (Band 12,13)			
27.50(d)		$< 1 \text{ Watts max. EIRP}$ (Band 4, 66)			
27.50(a)		$< 0.25 \text{ Watts max. EIRP}$ (Band 30)			

2.1053 22.917(a) 24.238(a) 27.53(c) 27.53(h)	RSS-GEN 6.6, RSS-130 4.6, RSS-132 5.4, RSS-133 6.5, RSS-139 6.6	Radiated Spurious Emissions	> 43 + log <sub>10</sub> (P[Watts]) for all out-of-band emissions (Band 2,4,5,12,13,17)	Radiated	Pass	Section 7.5
27.53(m)	RSS-199 4.5		> 55 + 10log <sub>10</sub> (P[Watts]) for all out-of-band emissions (Band 7, 38, 41)			
27.53(a)	RSS-195 5.6		> 70 + 10log <sub>10</sub> (P[Watts]) for all out-of-band emissions (Band 30)			
24.232(d) 27.50(B)	RSS-GEN 6.12, RSS-130 4.4, RSS-132 5.4, RSS-133 6.4, RSS-139 6.5, RSS-199 4.4, RSS-199 5.5	Peak-Average Ratio	<13dB	Conducted	Pass	Section 7.6
2.1055 22.355	RSS-GEN 8.11, RSS-130 4.3, RSS-132 5.3,	Frequency Stability	< 2.5 ppm		Pass	Section 7.7
2.1055 24.235 27.54	RSS-133 6.3, RSS-139 6.4, RSS-199 4.3 RSS-199 5.4		Within Authorized Band			

**Notes:**

- 1) Determining compliance is based on the test results met the regulation limits or requirements declared by clients, and the test results don't take into account the value of measurement uncertainty.
- 2) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.

## 7.2. Occupied Bandwidth

### 7.2.1. Test Limit

N/A

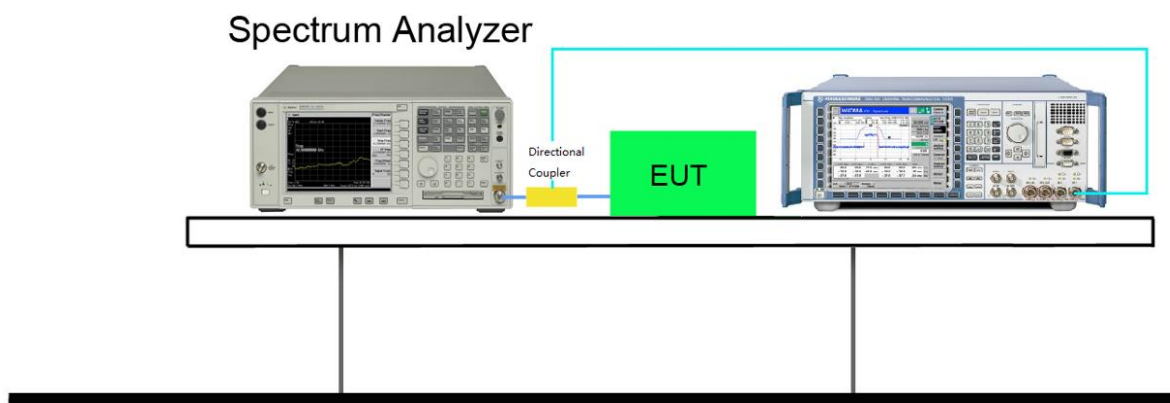
### 7.2.2. Test Procedure used

KDB 971168 D01v02r02 – Section 4.2 & ANSI/TIA-603-E-2016

### 7.2.3. Test Setting

1. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency.  
The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
2. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW. (RBW = approximately 1% of the emission bandwidth).
3. Set the detection mode to peak, and the trace mode to max hold.
4. Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.

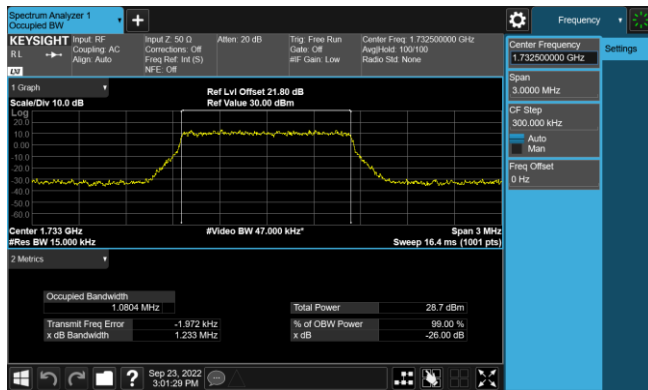
### 7.2.4. Test Setup



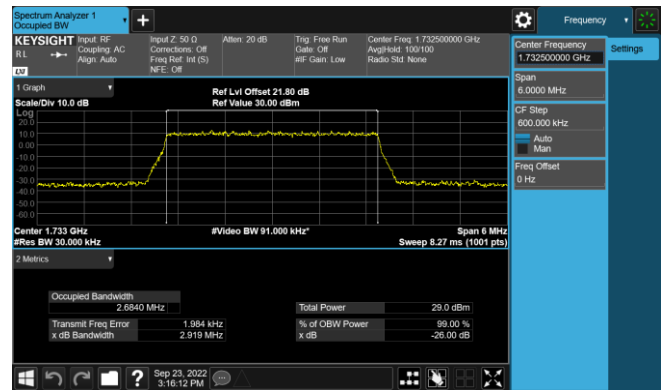
### 7.2.5. Test Result

Test Mode	Channel/ Frequency (MHz)	Modulation	Bandwidth (MHz)	RB Size	RB Offset	99% Occupied Bandwidth (MHz)	-26dB Occupied Bandwidth (MHz)	Test Result
LTE Band 4	CH20175 (1732.5MHz)	QPSK	1.4	6	0	1.0804	1.233	Pass
			3	15	0	2.6840	2.919	Pass
			5	25	0	4.4537	4.886	Pass
			10	50	0	8.9160	9.533	Pass
			15	75	0	13.338	14.21	Pass
			20	100	0	17.785	18.90	Pass
		16QAM	1.4	6	0	1.0781	1.229	Pass
			3	15	0	2.6779	2.932	Pass
			5	25	0	4.4659	4.848	Pass
			10	50	0	8.9405	9.515	Pass
			15	75	0	13.385	14.32	Pass
			20	100	0	17.850	18.86	Pass

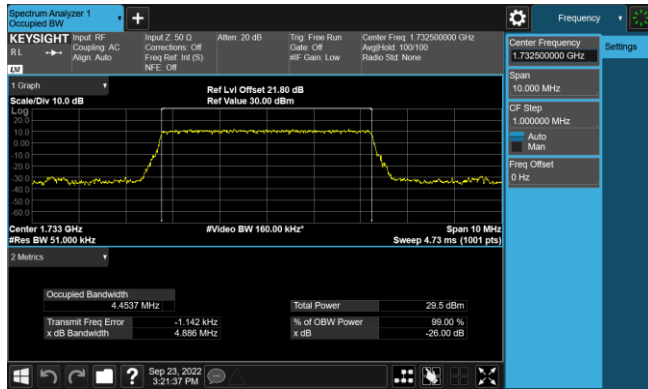
### LTE Band 4 QPSK 1.4MHz CH20175 6RB#0



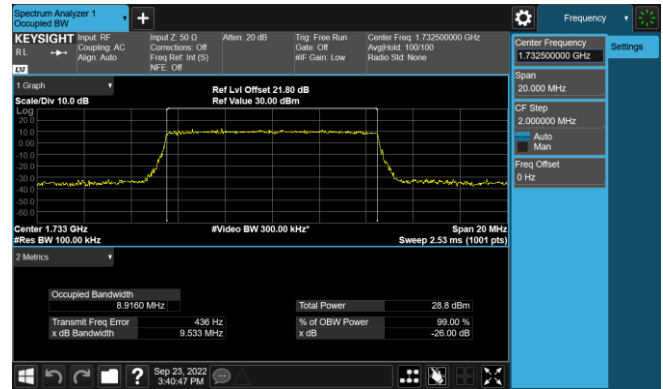
### LTE Band 4 QPSK 3MHz CH20175 15RB#0



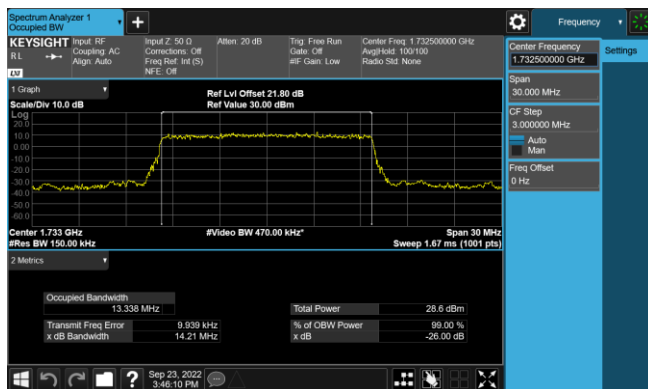
### LTE Band 4 QPSK 5MHz CH20175 25RB#0



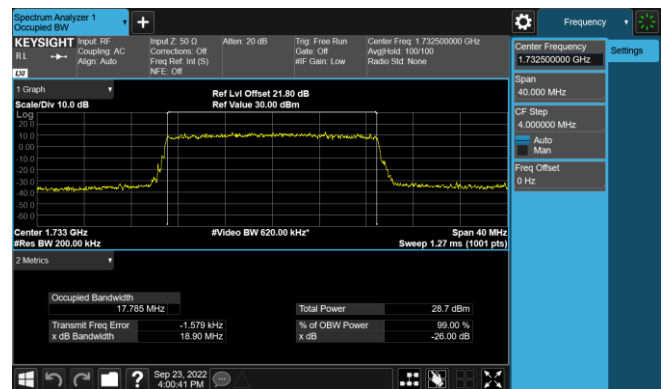
### LTE Band 4 QPSK 10MHz CH20175 50RB#0



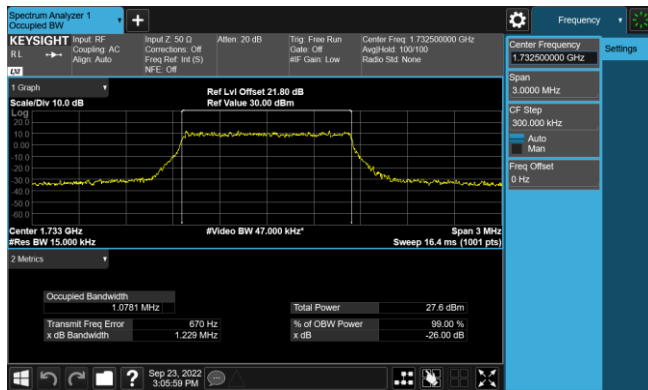
### LTE Band 4 QPSK 15MHz CH20175 75RB#0



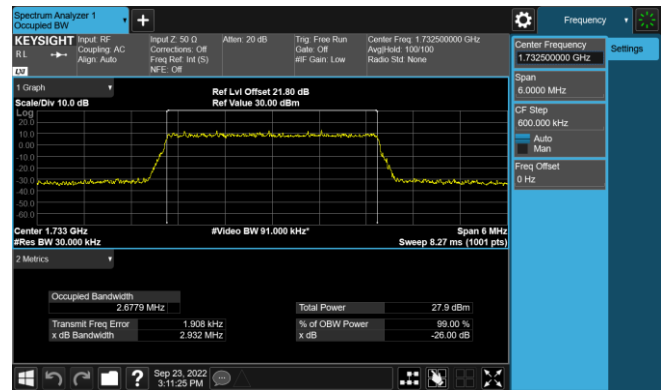
### LTE Band 4 QPSK 20MHz CH20175 100RB#0



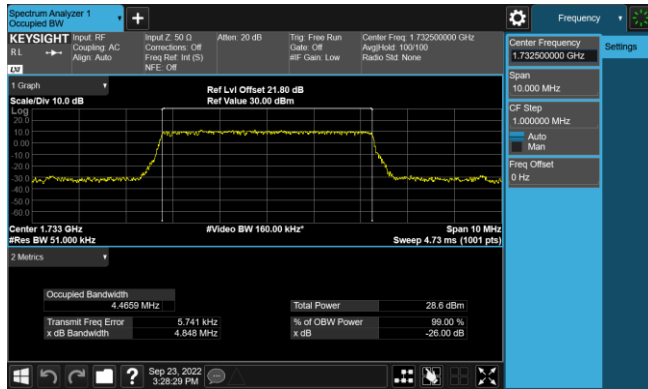
### LTE Band 4 16QAM 1.4MHz CH20175 6RB#0



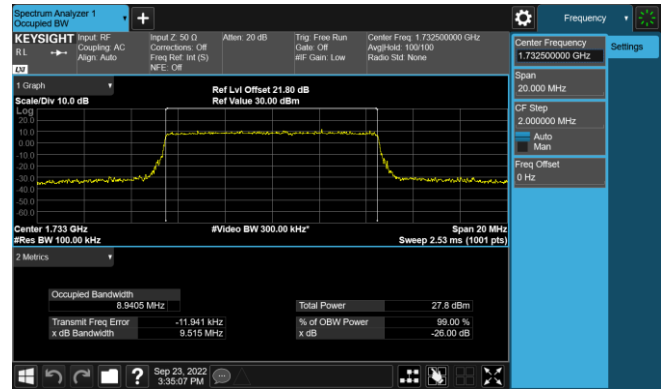
### LTE Band 4 16QAM 3MHz CH20175 15RB#0



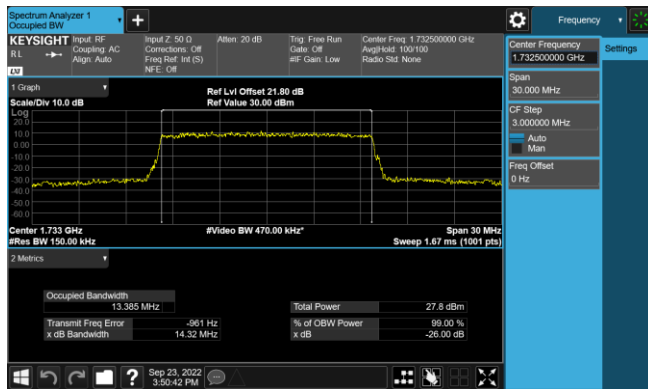
### LTE Band 4 16QAM 5MHz CH20175 25RB#0



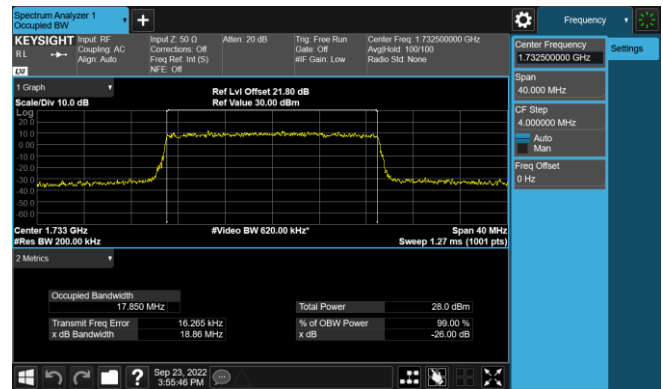
### LTE Band 4 16QAM 10MHz CH20175 50RB#0



### LTE Band 4 16QAM 15MHz CH20175 75RB#0



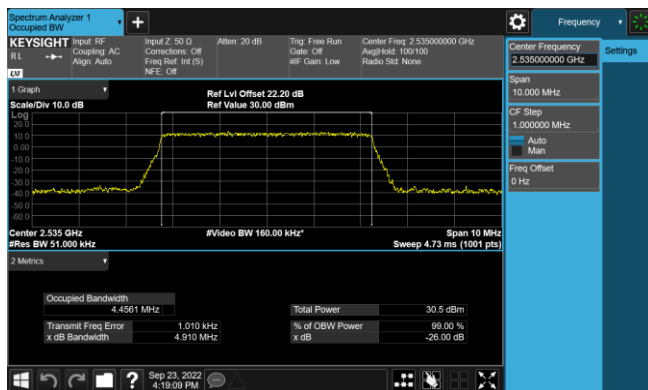
### LTE Band 4 16QAM 20MHz CH20175 100RB#0



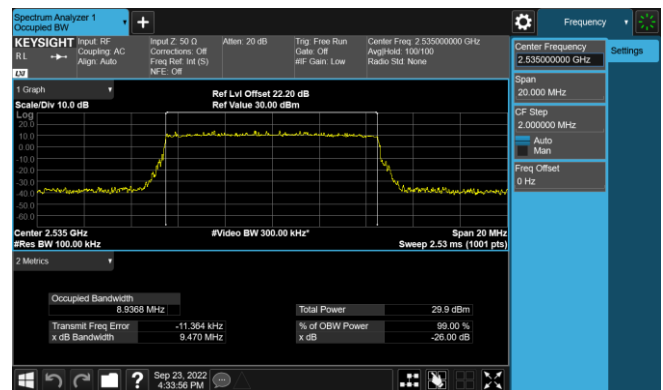
Test Mode	Channel/ Frequency (MHz)	Modulation	Bandwidth (MHz)	RB Size	RB Offset	99% Occupied Bandwidth (MHz)	-26dB Occupied Bandwidth (MHz)	Test Result
LTE Band 7	CH21100 (2535MHz)	QPSK	5	25	0	4.4561	4.910	Pass
			10	50	0	8.9368	9.470	Pass
			15	75	0	13.405	14.24	Pass
			20	100	0	17.837	19.32	Pass
		16QAM	5	25	0	4.4551	4.841	Pass
			10	50	0	8.9277	9.536	Pass
			15	75	0	13.342	14.15	Pass
			20	100	0	17.796	18.80	Pass



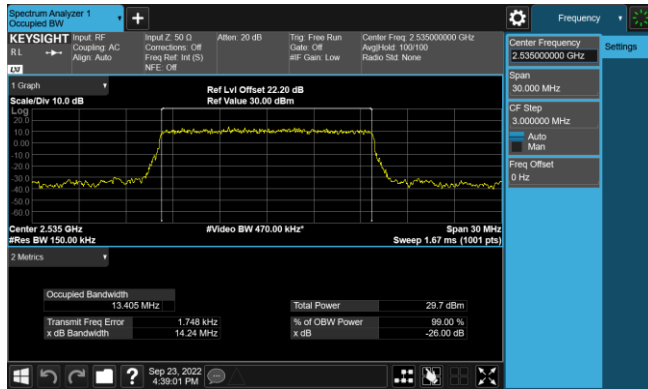
### LTE Band 7 QPSK 5MHz CH21100 6RB#0



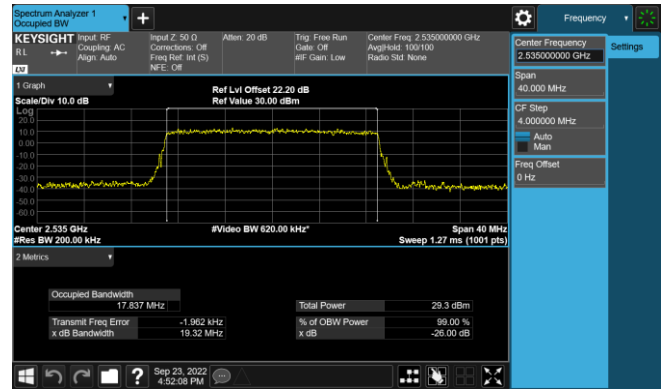
### LTE Band 7 QPSK 10MHz CH21100 15RB#0



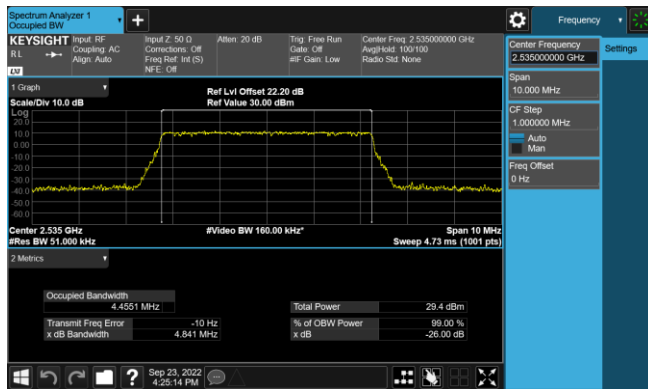
### LTE Band 7 QPSK 15MHz CH21100 25RB#0



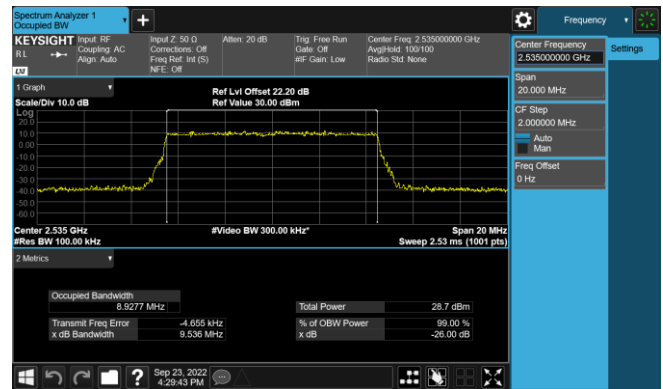
### LTE Band 7 QPSK 20MHz CH21100 50RB#0



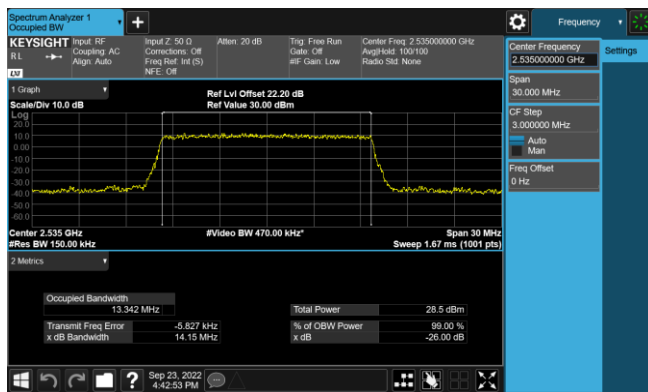
### LTE Band 7 16QAM 5MHz CH21100 6RB#0



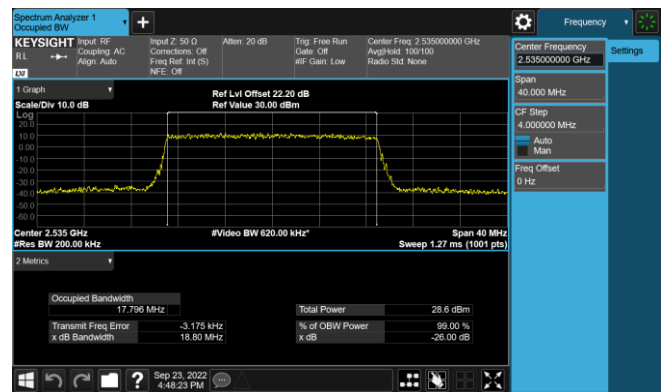
### LTE Band 7 16QAM 10MHz CH21100 15RB#0



### LTE Band 7 16QAM 15MHz CH21100 6RB#0

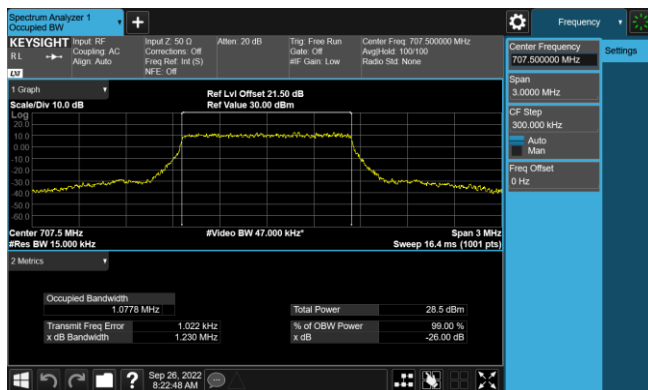


### LTE Band 7 16QAM 20MHz CH21100 15RB#0

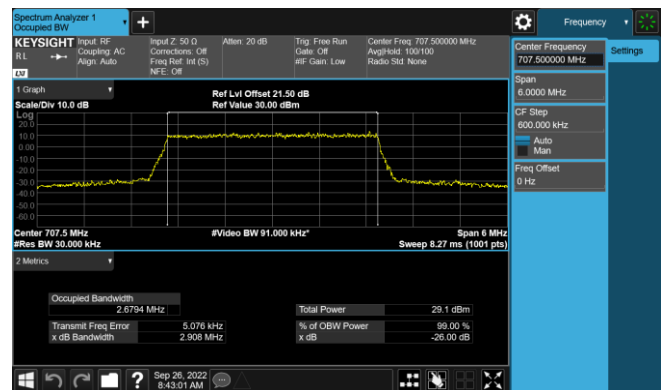


Test Mode	Channel/ Frequency (MHz)	Modulation	Bandwidth (MHz)	RB Size	RB Offset	99% Occupied Bandwidth (MHz)	-26dB Occupied Bandwidth (MHz)	Test Result
LTE Band 12	CH23095 (707.5MHz)	QPSK	1.4	6	0	1.0778	1.230	Pass
			3	15	0	2.6794	2.908	Pass
			5	25	0	4.4547	4.825	Pass
			10	50	0	8.9324	9.616	Pass
		16QAM	1.4	6	0	1.0800	1.218	Pass
			3	15	0	2.6787	2.895	Pass
			5	25	0	4.4601	4.914	Pass
			10	50	0	8.9129	9.744	Pass

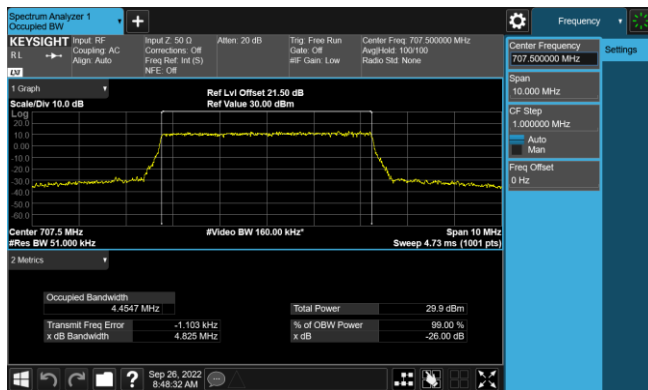
### LTE Band 12 QPSK 1.4MHz CH23095 6RB#0



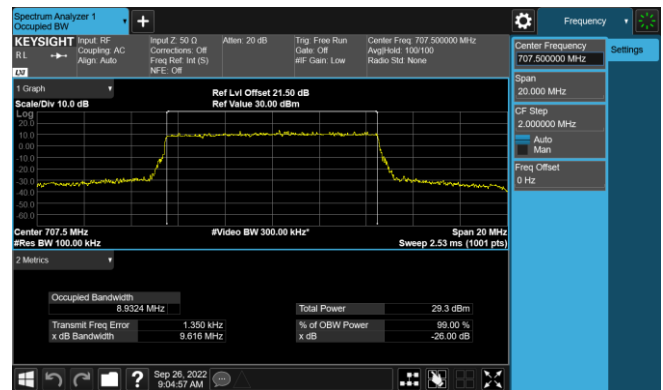
### LTE Band 12 QPSK 3MHz CH23095 15RB#0



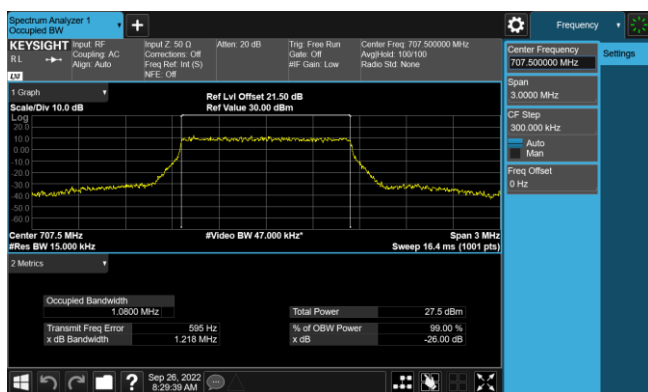
### LTE Band 12 QPSK 5MHz CH23095 25RB#0



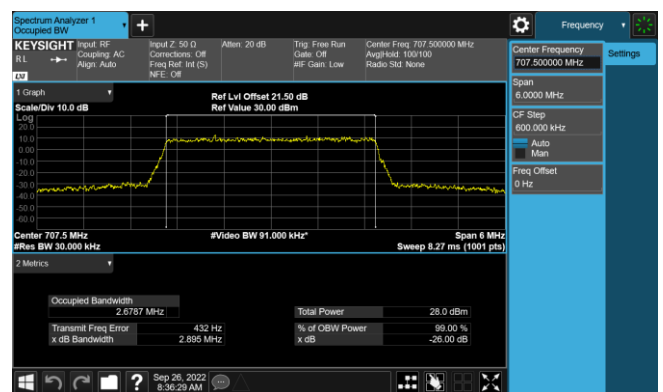
### LTE Band 12 QPSK 10MHz CH23095 50RB#0



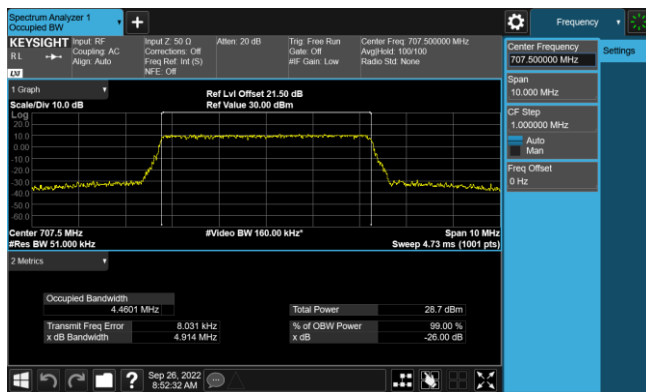
### LTE Band 12 16QAM 1.4MHz CH23095 6RB#0



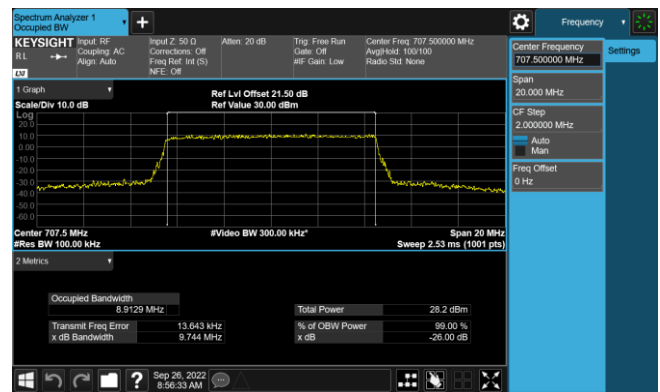
### LTE Band 12 16QAM 3MHz CH23095 15RB#0



### LTE Band 12 16QAM 5MHz CH23095 25RB#0

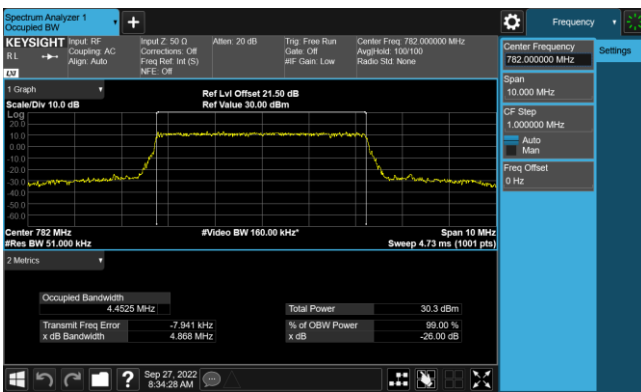


### LTE Band 12 16QAM 10MHz CH23095 50RB#0

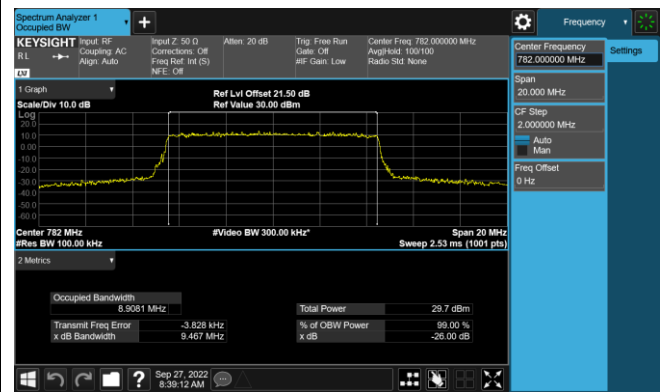


Test Mode	Channel/ Frequency (MHz)	Modulation	Bandwidth (MHz)	RB Size	RB Offset	99% Occupied Bandwidth (MHz)	-26dB Occupied Bandwidth (MHz)	Test Result
LTE Band 13	CH23230 (782MHz)	QPSK	5	25	0	4.4525	4.868	Pass
			10	50	0	8.9081	9.467	Pass
		16QAM	5	25	0	4.4520	4.818	Pass
			10	50	0	8.9062	9.543	Pass

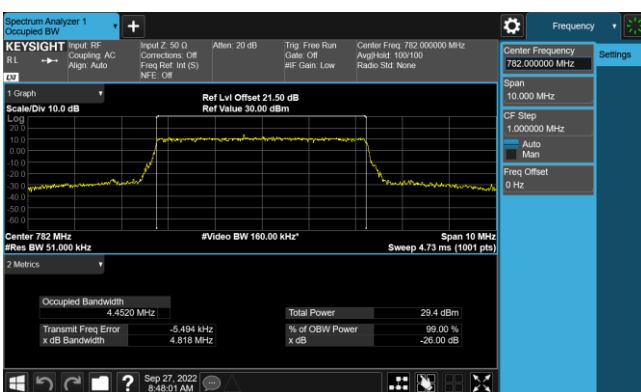
LTE Band 13 QPSK 5MHz CH23230 25RB#0



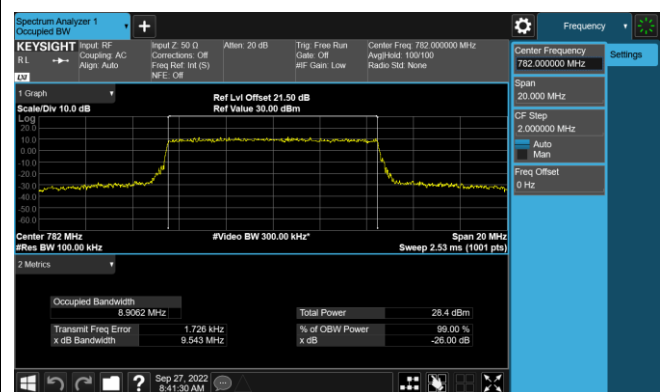
LTE Band 13 QPSK 10MHz CH23230 50RB#0



LTE Band 13 16QAM 5MHz CH23230 25RB#0



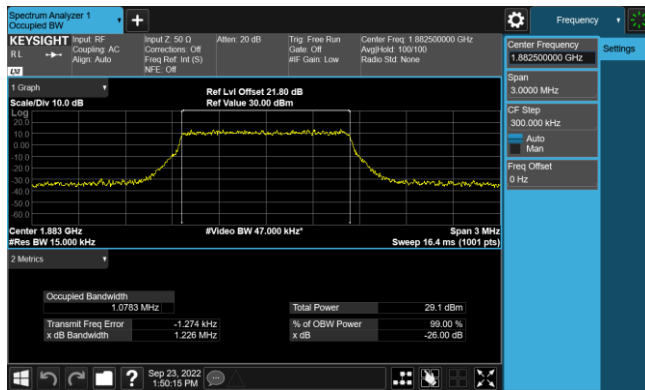
LTE Band 13 16QAM 10MHz CH23230 50RB#0



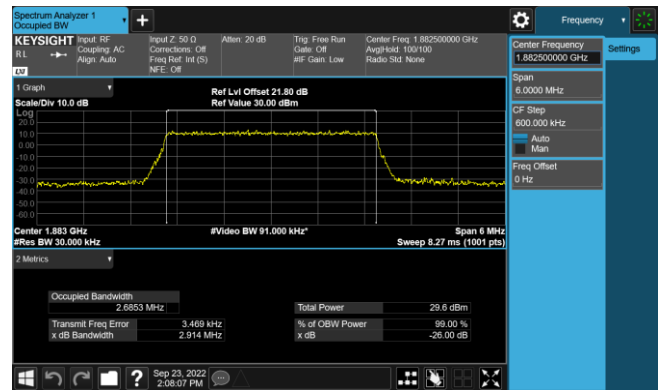
Test Mode	Channel/ Frequency (MHz)	Modulation	Bandwidth (MHz)	RB Size	RB Offset	99% Occupied Bandwidth (MHz)	-26dB Occupied Bandwidth (MHz)	Test Result
LTE Band 25	CH26365 (1882.5MHz)	QPSK	1.4	6	0	1.0783	1.226	Pass
			3	15	0	2.6853	2.914	Pass
			5	25	0	4.4440	4.840	Pass
			10	50	0	8.9162	9.543	Pass
			15	75	0	13.335	14.14	Pass
			20	100	0	17.767	18.91	Pass
		16QAM	1.4	6	0	1.0825	1.236	Pass
			3	15	0	2.6781	2.940	Pass
			5	25	0	4.4674	4.870	Pass
			10	50	0	8.9187	9.636	Pass
			15	75	0	13.355	14.07	Pass
			20	100	0	17.841	18.74	Pass

Note: Band25 Covered Band2.

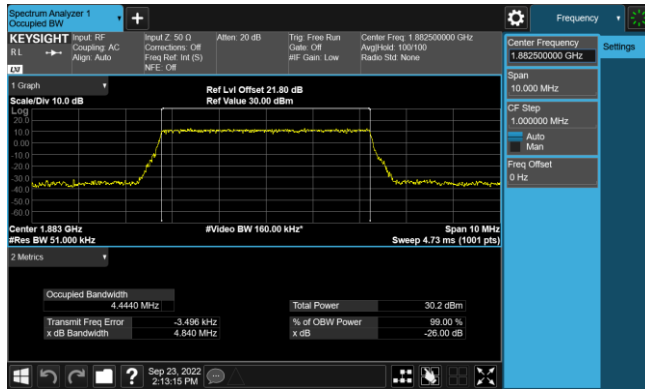
### LTE Band 25 QPSK 1.4MHz CH26365 6RB#0



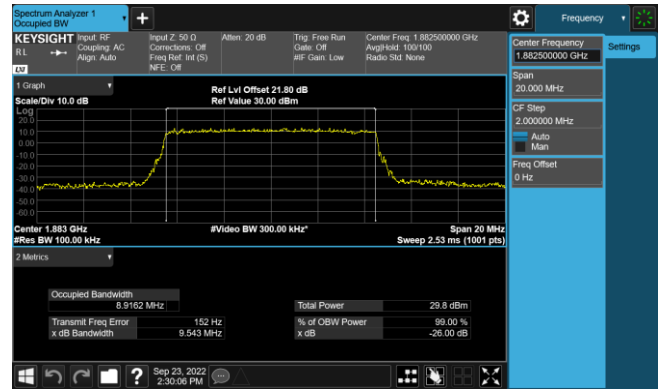
### LTE Band 25 QPSK 3MHz CH26365 15RB#0



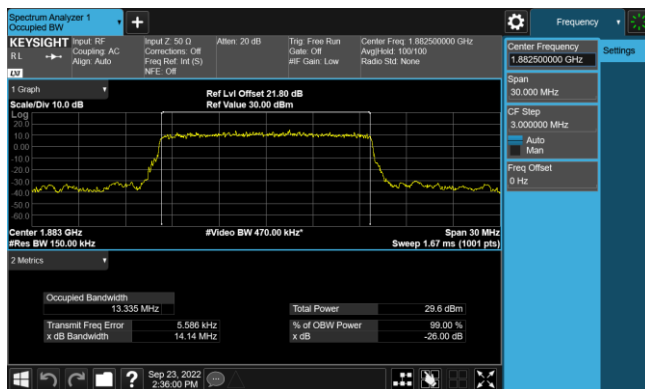
### LTE Band 25 QPSK 5MHz CH26365 25RB#0



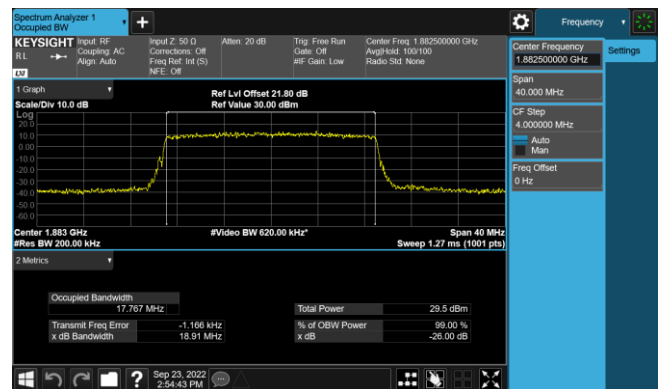
### LTE Band 25 QPSK 10MHz CH26365 50RB#0



### LTE Band 25 QPSK 15MHz CH26365 75RB#0

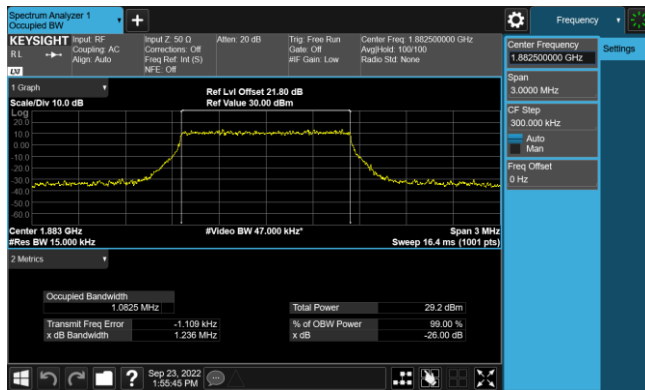


### LTE Band 25 QPSK 20MHz CH26365 100RB#0

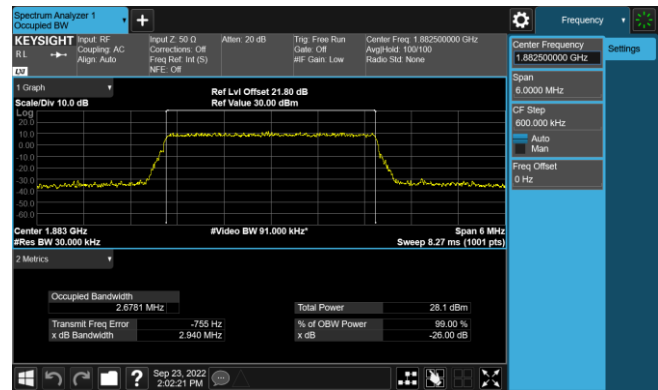




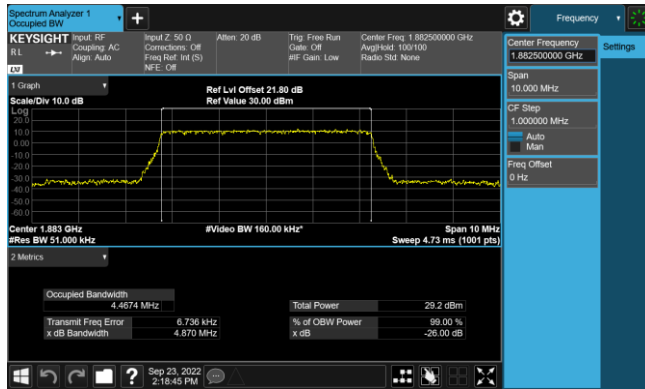
### LTE Band 25 16QAM 1.4MHz CH26365 6RB#0



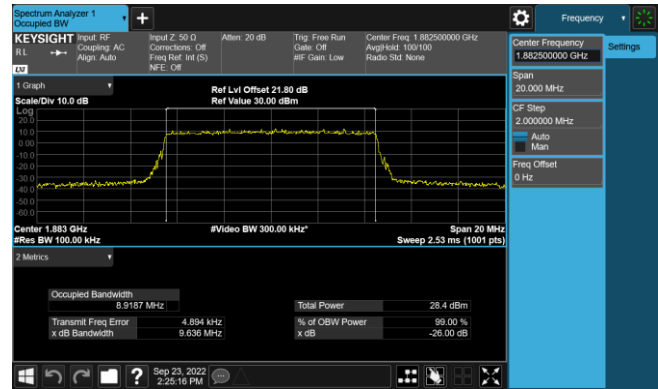
### LTE Band 25 16QAM 3MHz CH26365 15RB#0



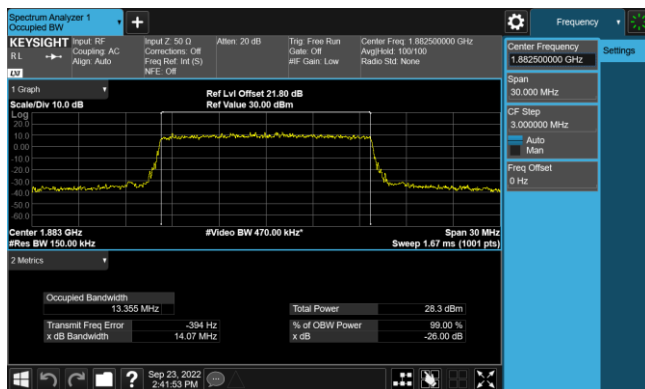
### LTE Band 25 16QAM 5MHz CH26365 25RB#0



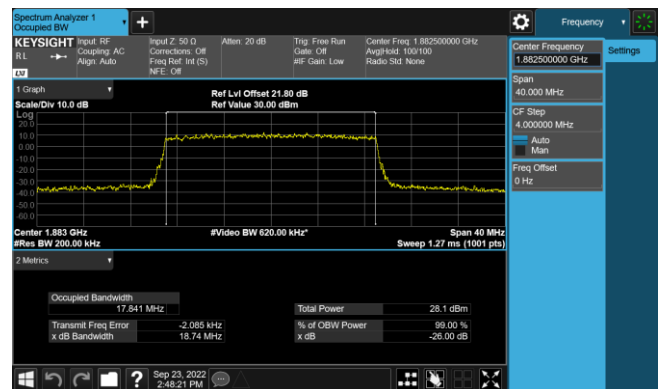
### LTE Band 25 16QAM 10MHz CH26365 50RB#0



### LTE Band 25 16QAM 15MHz CH26365 75RB#0



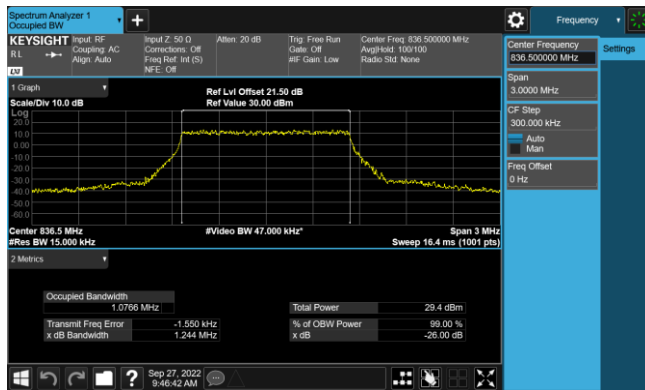
### LTE Band 25 16QAM 20MHz CH26365 100RB#0



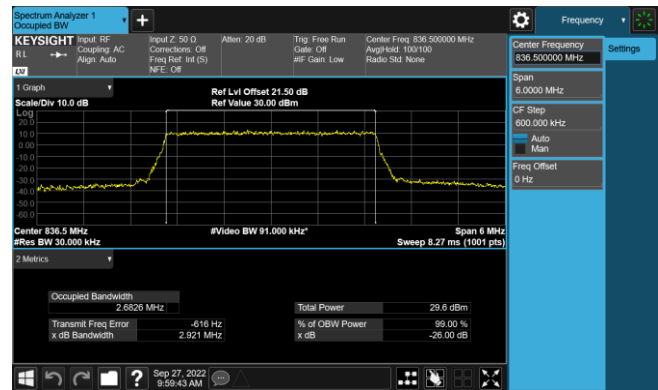
Test Mode	Channel/ Frequency (MHz)	Modulation	Bandwidth (MHz)	RB Size	RB Offset	99% Occupied Bandwidth (MHz)	-26dB Occupied Bandwidth (MHz)	Test Result
LTE Band 26	CH26915 (836.5MHz)	QPSK	1.4	6	0	1.0766	1.244	Pass
			3	15	0	2.6826	2.921	Pass
			5	25	0	4.4578	4.860	Pass
			10	50	0	8.9198	9.553	Pass
			15	75	0	13.383	14.37	Pass
		16QAM	1.4	6	0	1.0815	1.238	Pass
			3	15	0	2.6800	2.934	Pass
			5	25	0	4.4534	4.804	Pass
			10	50	0	8.9270	9.695	Pass
			15	75	0	13.370	14.30	Pass

Note: Band26 Covered Band5.

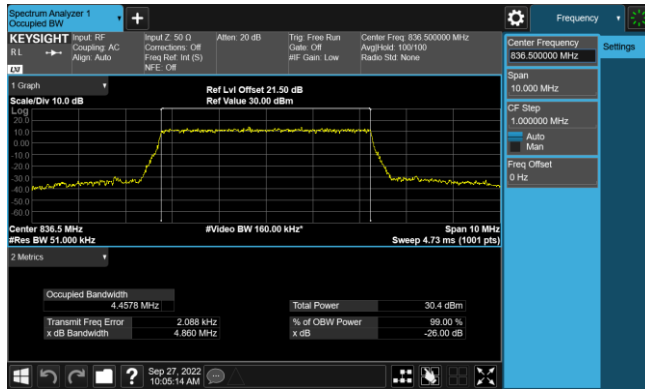
### LTE Band 26 QPSK 1.4MHz CH26915 6RB#0



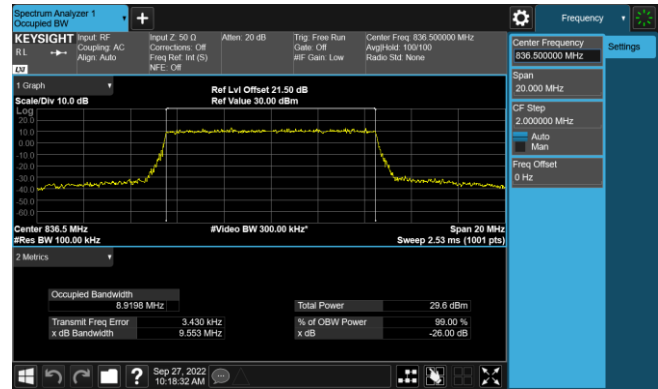
### LTE Band 26 QPSK 3MHz CH26915 15RB#0



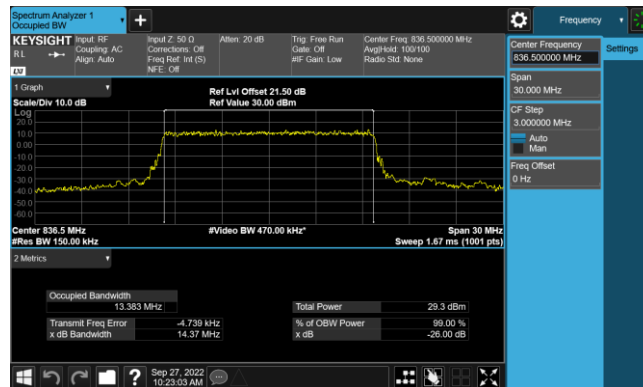
### LTE Band 26 QPSK 5MHz CH26915 25RB#0



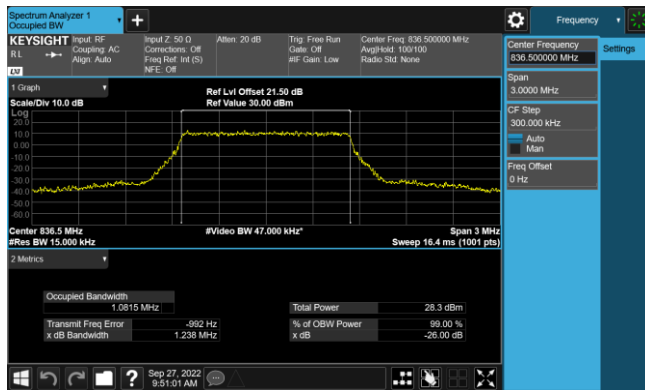
### LTE Band 26 QPSK 10MHz CH26915 50RB#0



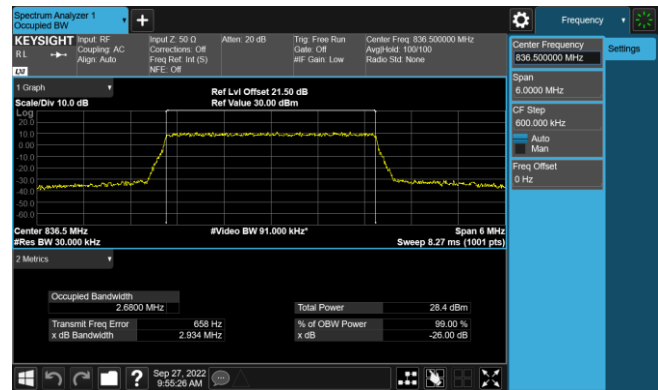
### LTE Band 26 QPSK 15MHz CH26915 75RB#0



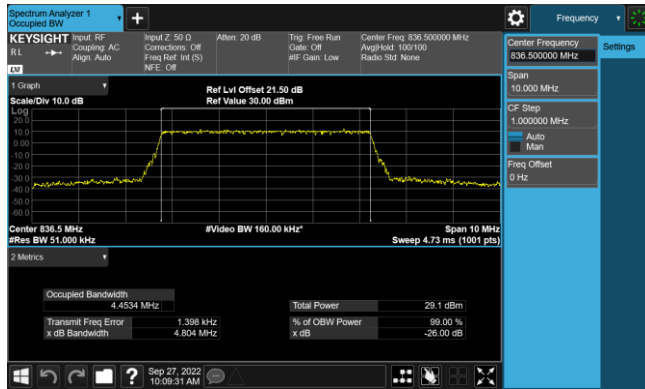
### LTE Band 26 16QAM 1.4MHz CH26915 6RB#0



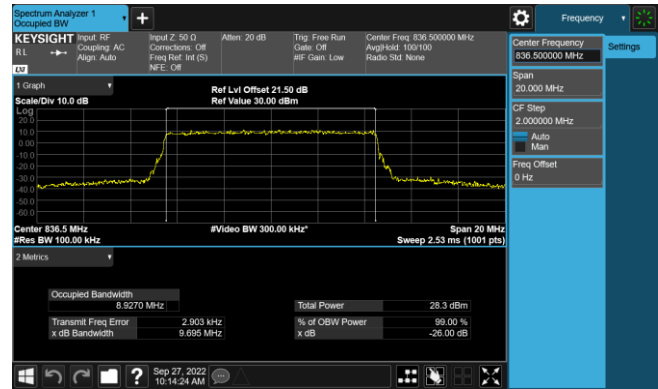
### LTE Band 26 16QAM 3MHz CH26915 15RB#0



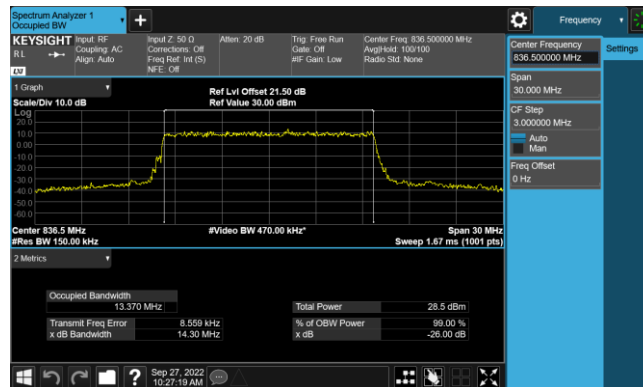
### LTE Band 26 16QAM 5MHz CH26915 25RB#0



### LTE Band 26 16QAM 10MHz CH26915 50RB#0



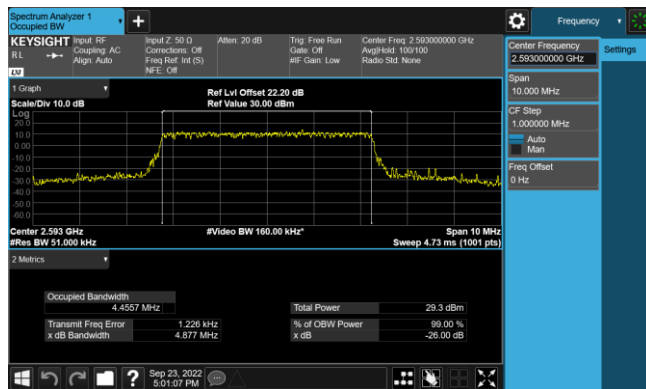
### LTE Band 26 16QAM 15MHz CH26915 75RB#0



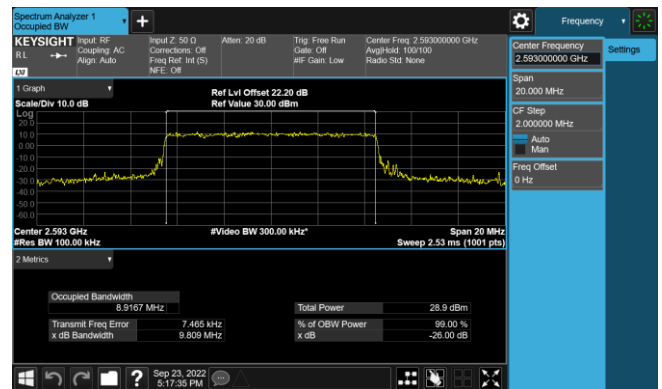
Test Mode	Channel/ Frequency (MHz)	Modulation	Bandwidth (MHz)	RB Size	RB Offset	99% Occupied Bandwidth (MHz)	-26dB Occupied Bandwidth (MHz)	Test Result
LTE Band 41	CH40620 (2593MHz)	QPSK	5	25	0	4.4557	4.877	Pass
			10	50	0	8.9167	9.809	Pass
			15	75	0	13.355	14.38	Pass
			20	100	0	17.839	18.82	Pass
		16QAM	5	25	0	4.4568	4.897	Pass
			10	50	0	8.9282	9.420	Pass
			15	75	0	13.405	14.58	Pass
			20	100	0	17.800	18.72	Pass

Note: Band41 Covered Band38.

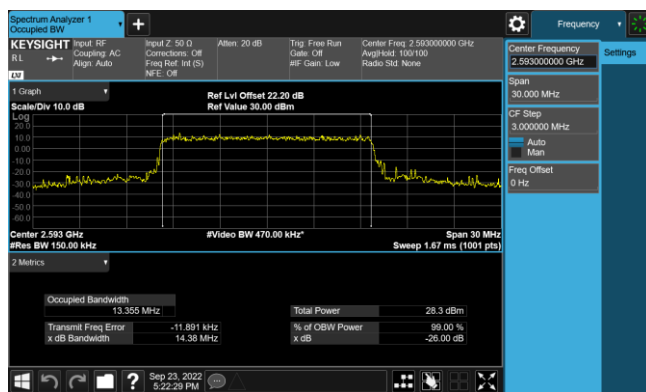
### LTE Band 41 QPSK 5MHz CH40620 25RB#0



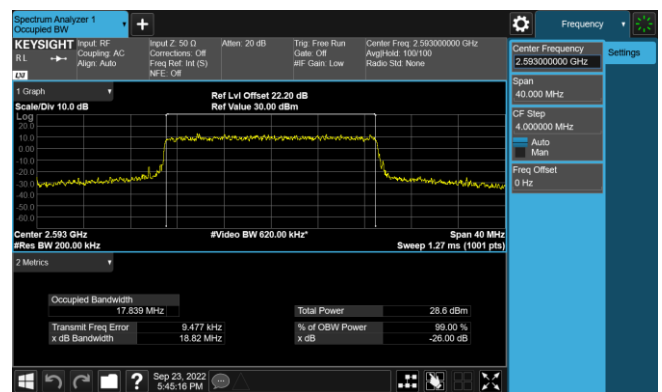
### LTE Band 41 QPSK 10MHz CH40620 50RB#0



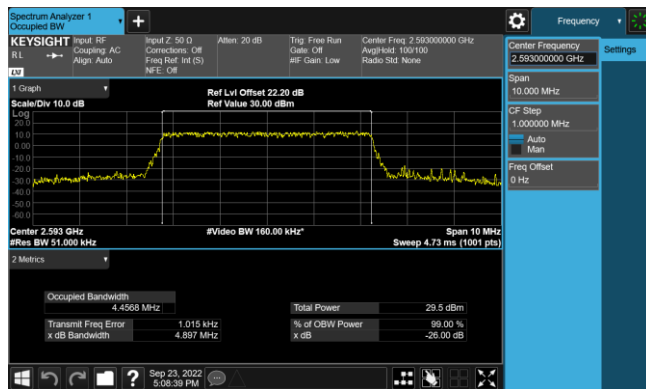
### LTE Band 41 QPSK 15MHz CH40620 75RB#0



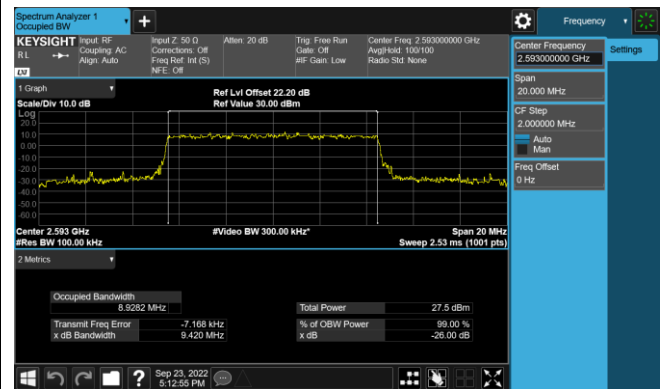
### LTE Band 41 QPSK 20MHz CH40620 100RB#0



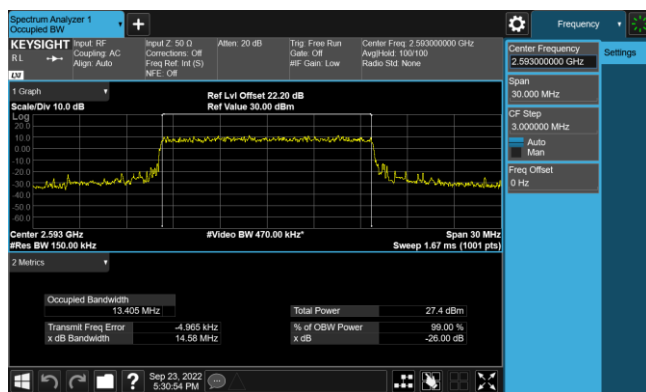
### LTE Band 41 16QAM 5MHz CH40620 25RB#0



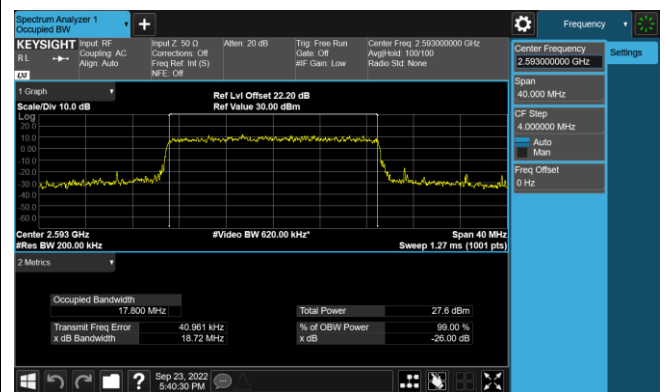
### LTE Band 41 16QAM 10MHz CH40620 50RB#0



### LTE Band 41 16QAM 15MHz CH40620 75RB#0



### LTE Band 41 16QAM 20MHz CH40620 100RB#0



## 7.3. Conducted Spurious Emissions

### 7.3.1. Test Limit

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  $43 + 10\log_{10}(P)$  dB for Band 2, 4, 5, 12, 13, 17, 25, 26, 66/  $55 + 10\log_{10}(P)$  dB for Band 7, 38, 41/  $70 + 10\log_{10}(P)$  dB for Band 30.

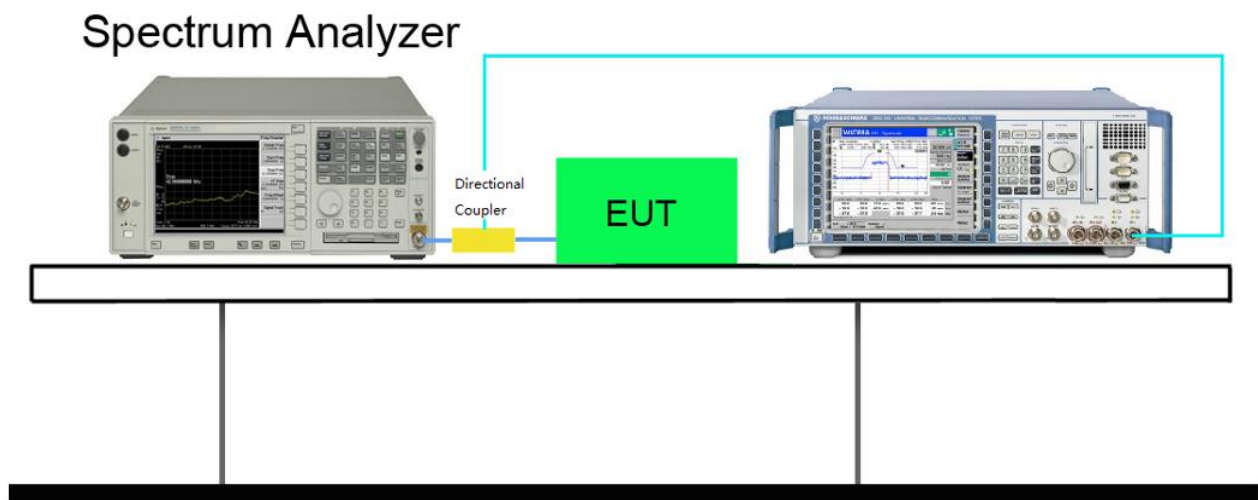
### 7.3.2. Test Procedure Used

KDB 971168 D01v02r02 – Section 6.0 & ANSI/TIA-603-E-2016

### 7.3.3. Test Setting

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz is at or below 1GHz and 1MHz is above 1GHz, If any, up to 10<sup>th</sup> harmonic.

### 7.3.4. Test Setup

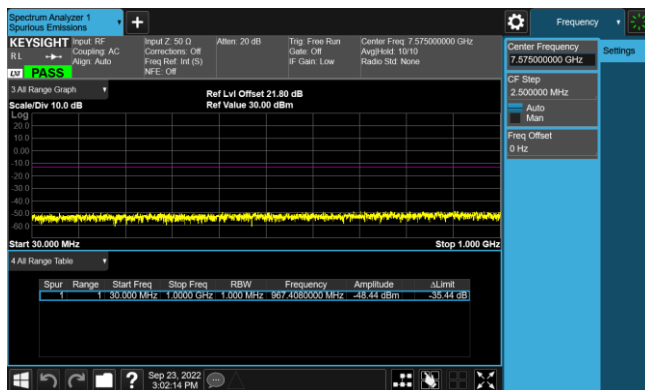




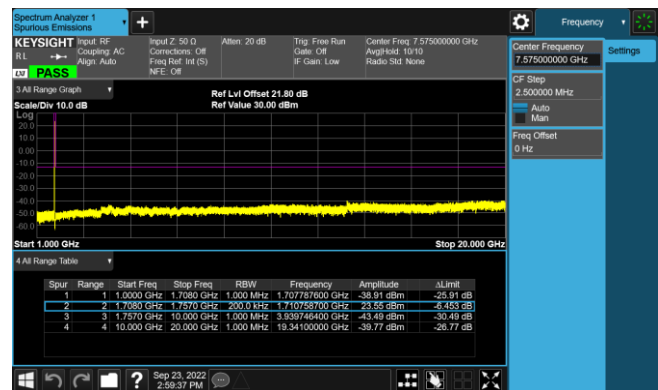
### 7.3.5. Test Result

Test Mode			LTE Band 4			
Modulation	Channel	Frequency (MHz)	Bandwidth (MHz)	RB Size	RB Offset	Test Result
QPSK & 16QAM	19957	1710.7	1.4M	1	2	Pass
	20175	1732.5	1.4M	1	2	Pass
	20393	1754.3	1.4M	1	2	Pass
	19965	1711.5	3M	1	7	Pass
	20175	1732.5	3M	1	7	Pass
	20385	1753.5	3M	1	7	Pass
	19975	1712.5	5M	1	12	Pass
	20175	1732.5	5M	1	12	Pass
	20375	1752.5	5M	1	12	Pass
	20000	1715	10M	1	25	Pass
	20175	1732.5	10M	1	25	Pass
	20350	1750	10M	1	25	Pass
	20025	1717.5	15M	1	36	Pass
	20175	1732.5	15M	1	36	Pass
	20325	1747.5	15M	1	36	Pass
	20050	1720	20M	1	49	Pass
	20175	1732.5	20M	1	49	Pass
	20300	1745	20M	1	49	Pass

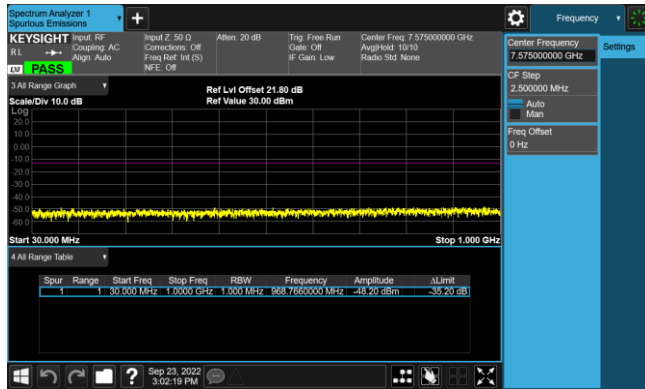
## LTE Band 4 QPSK 1.4MHz CH19957 1RB#2\_30MHz-1GHz



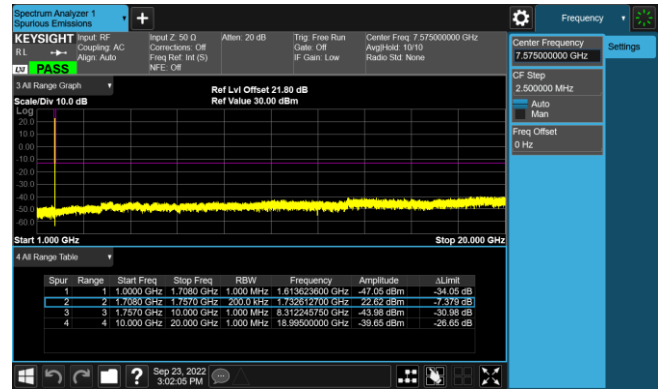
## LTE Band 4 QPSK 1.4MHz CH19957 1RB#2\_1GHz-20GHz



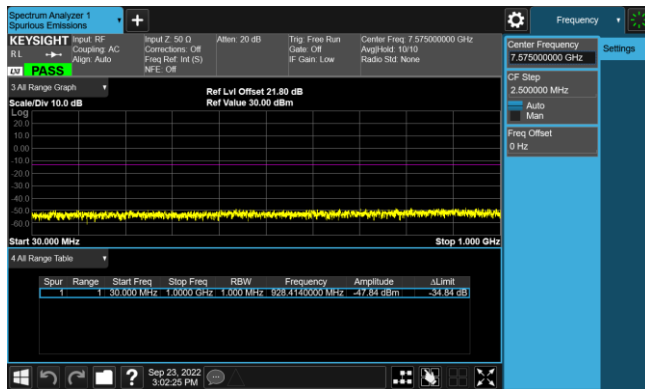
## LTE Band 4 QPSK 1.4MHz CH20175 1RB#2\_30MHz-1GHz



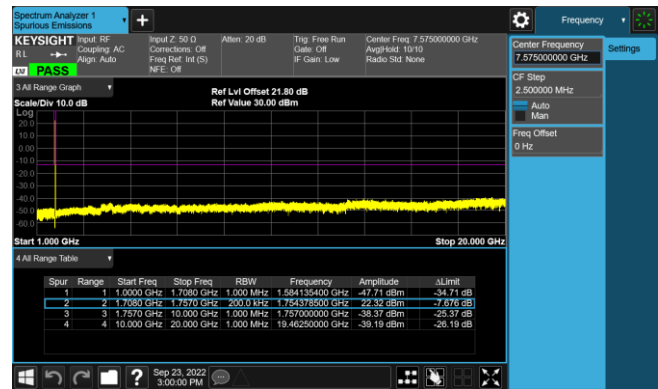
## LTE Band 4 QPSK 1.4MHz CH20175 1RB#2\_1GHz-20GHz



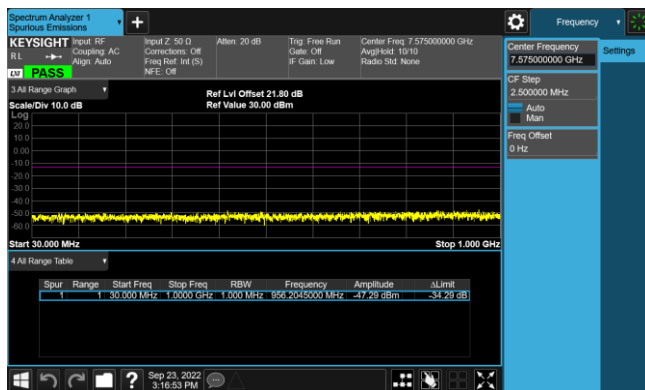
## LTE Band 4 QPSK 1.4MHz CH20393 1RB#2\_30MHz-1GHz



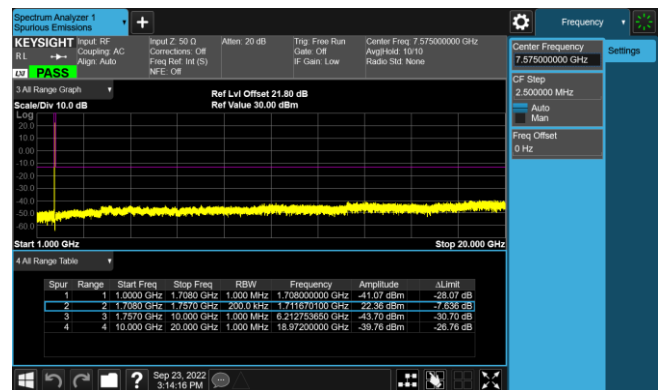
## LTE Band 4 QPSK 1.4MHz CH20393 1RB#2\_1GHz-20GHz



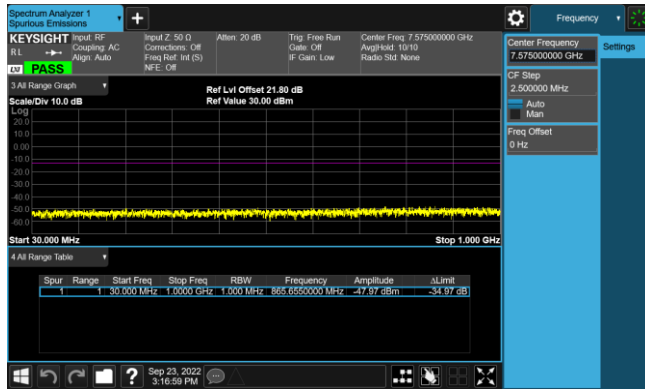
### LTE Band 4 QPSK 3MHz CH19965 1RB#7\_30MHz-1GHz



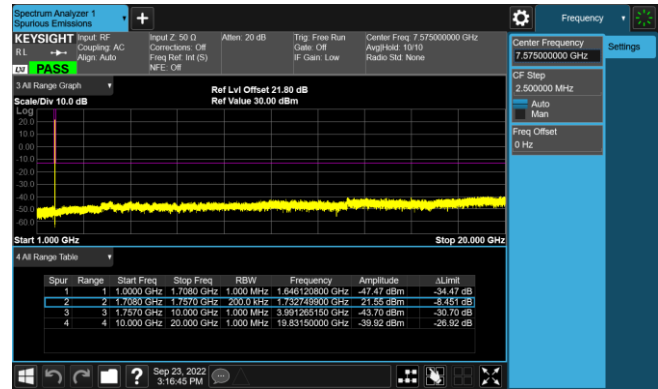
### LTE Band 4 QPSK 3MHz CH19965 1RB#7\_1GHz-20GHz



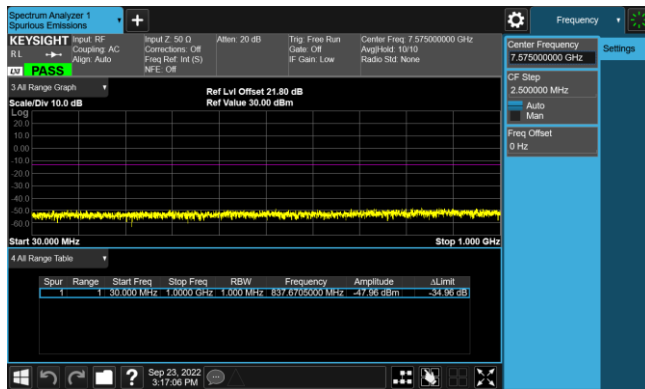
### LTE Band 4 QPSK 3MHz CH20175 1RB#7\_30MHz-1GHz



### LTE Band 4 QPSK 3MHz CH20175 1RB#7\_1GHz-20GHz



### LTE Band 4 QPSK 3MHz CH20385 1RB#7\_30MHz-1GHz



### LTE Band 4 QPSK 3MHz CH20385 1RB#7\_1GHz-20GHz

