

## PART 27 MEASUREMENT REPORT

**Applicant Name:**  
Tecore Networks  
7030 Hi Tech Drive  
Hanover, MD 21076  
USA

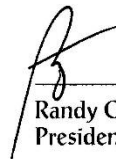
**Date of Testing:**  
06/03 - 08/04/2021  
**Test Site/Location:**  
PCTEST Lab. Columbia, MD, USA  
**Test Report Serial No.:**  
1M2106040064-02.QLJ

<b>FCC ID:</b>	<b>QLJMRU-060785</b>
<b>APPLICANT:</b>	<b>Tecore Networks</b>


**Application Type:** Certification  
**Model:** MRU-20W060785  
**EUT Type:** Low Band mRU  
**FCC Classification:** Licensed Non-Broadcast Station Transmitter (TNB)  
**FCC Rule Part:** 27  
**Test Procedure(s):** ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01

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.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.


  
\_\_\_\_\_  
Randy Ortanez  
President

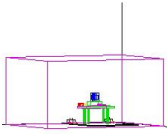


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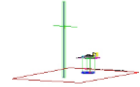
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## MEASUREMENT REPORT

### FCC Part 27



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	Conducted Power		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 71	20 MHz	QPSK	627.0 - 642.0	20.989	43.22	17M9G7D
		QAM	627.0 - 642.0	21.232	43.27	18M0W7D
	15 MHz	QPSK	624.5 - 644.5	21.627	43.35	13M5G7D
		QAM	624.5 - 644.5	21.380	43.30	13M6W7D
	10 MHz	QPSK	622.0 - 647.0	22.080	43.44	9M01G7D
		QAM	622.0 - 647.0	22.336	43.49	9M03W7D
5 MHz	QPSK	619.5 - 649.5	22.080	43.44	4M51G7D	
	QAM	619.5 - 649.5	21.979	43.42	4M51W7D	
LTE Band 12/17	10 MHz	QPSK	734.0 - 741.0	21.928	43.41	9M01G7D
		QAM	734.0 - 741.0	21.928	43.41	9M01W7D
	5 MHz	QPSK	731.5 - 743.5	22.803	43.58	4M52G7D
		QAM	731.5 - 743.5	22.542	43.53	4M50W7D
	3 MHz	QPSK	730.5 - 744.5	22.961	43.61	2M71G7D
		QAM	730.5 - 744.5	22.856	43.59	2M71W7D
1.4 MHz	QPSK	729.7 - 745.3	22.439	43.51	1M10G7D	
	QAM	729.7 - 745.3	22.751	43.57	1M10W7D	
LTE Band 13	10 MHz	QPSK	751.0	22.542	43.53	9M01G7D
		QAM	751.0	22.856	43.59	9M02W7D
	5 MHz	QPSK	748.5 - 753.5	22.856	43.59	4M51G7D
		QAM	748.5 - 753.5	23.014	43.62	4M52W7D

Overview Table

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## 1.0 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 Innovation, Science and Economic Development Canada.


### 1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

### 1.3 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Tecore Low Band mRU FCC ID: QLJMRU-060785**. The test data contained in this report pertains only to the emissions due to the EUT's LTE operation under the provisions of Part 27. The EUT generates LTE signal using QPSK, 16-QAM, 64-QAM, and 256-QAM modulations. The EUT can transmit four different LTE low band signals at the same time with its single antenna port. The signal output level is set to 20W output per band for a total of 80W output from the antenna port and it is fed via a low loss cable to the input of a spectrum analyzer or a 50Ω load, depending on the type of testing performed. EUT was set up to operate as shown below with a 120 VAC power source. Server equipment was used to control the RF functions of the EUT.

**Test Device Serial No.:** 20270011  
**Software Version:** mRU 8.0  
**Firmware:** MRAN\_015

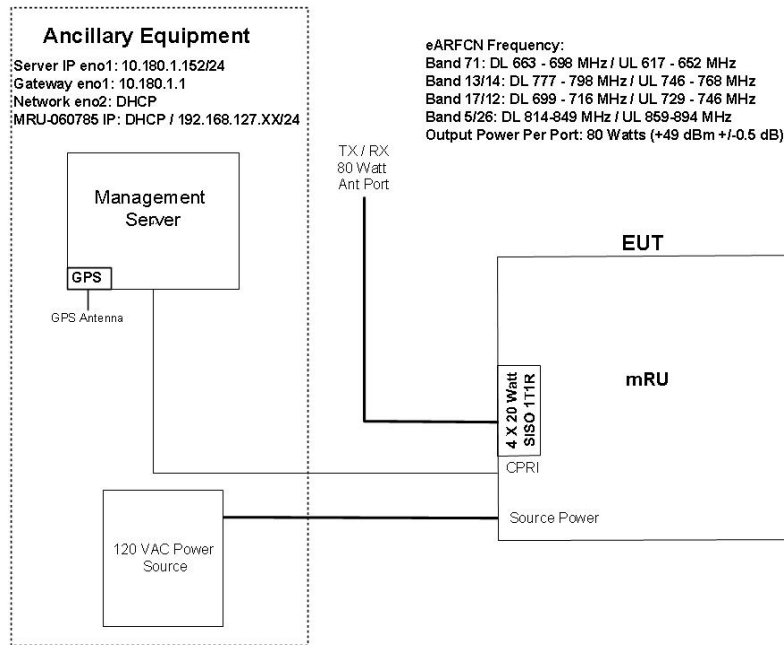


Figure 2-1. Test Setup

### 2.2 Device Capabilities


This device contains the following capabilities: Multi-band LTE

### 2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

### 2.4 EMI Suppression Device(s)/Modifications

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

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## 3.0 DESCRIPTION OF TESTS

### 3.1 Evaluation Procedure

The measurement procedures described in the document titled “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 D01 v03r01) were used in the measurement of the EUT.

### 3.2 Radiated Power and Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. 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 above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table 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. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting with the antenna port terminated in 50 ohms and was placed on a turntable 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.

For radiated powers measurements, the antenna gains declared by the manufacturer are added to the measured conducted powers to assess compliance with the ERP limit.

For radiated spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:


$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$

And

$$\text{EIRP}_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8; \text{ where } D \text{ is the measurement distance in meters.}$$

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01.


Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per KDB 971168 D01.

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## 4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the  $U_{CISPR}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty ( $\pm$ dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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## 5.0 TEST EQUIPMENT CALIBRATION DATA


Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurement antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
	ETS	EMC Cable and Switch System	3/4/2021	Annual	3/4/2022	ETS
-	WL25-1	Conducted Cable Set (25GHz)	2/23/2021	Annual	2/23/2022	WL25-1
-	WL25-3	Conducted Cable Set (25GHz)	3/12/2021	Annual	3/12/2022	WL25-3
Espec	ESX-2CA	Environmental Chamber	8/27/2020	Annual	8/27/2022	17620
Keysight Technologies	N9020A	MXA Signal Analyzer	9/22/2020	Annual	9/22/2021	MYS4500644
Keysight Technologies	N9030A	PXA Signal Analyzer	9/2/2020	Annual	9/2/2021	MYS5410501
Pasternack	NC-100	Torque Wrench (8in-lbs)	8/5/2020	Biennial	8/5/2022	N/A
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	5/25/2021	Annual	5/25/2022	100348

**Table 5-1. Test Equipment**

### Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
2. Equipment with a calibration date of "N/A" shown in this list was not used to make direct calibrated measurements.

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## 6.0 SAMPLE CALCULATIONS

### Emission Designator

#### QPSK Modulation

Emission Designator = 8M62G7D

LTE BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

#### QAM Modulation

Emission Designator = 8M45W7D

LTE BW = 8.45 MHz

W = Amplitude/Angle Modulated


7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

### Spurious Radiated Emission – LTE Band

#### **Example: Middle Channel LTE Mode 2<sup>nd</sup> Harmonic (1564 MHz)**

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was  $-81.0$  dBm. The gain of the substituted antenna is  $8.1$  dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of  $-81.0$  dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is  $2.0$  dB at  $1564$  MHz. So,  $6.1$  dB is added to the signal generator reading of  $-30.9$  dBm yielding  $-24.80$  dBm. The fundamental EIRP was  $25.50$  dBm so this harmonic was  $25.50$  dBm  $- (-24.80) = 50.3$  dBc.

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## 7.0 TEST RESULTS

### 7.1 Summary


Company Name: Tecore Networks  
 FCC ID: QLJMRU-060785  
 FCC Classification: Licensed Non-Broadcast Station Transmitter (TNB)  
 Mode(s): LTE

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
<b>CONDUCTED</b>	Transmitter Conducted Output Power / Effective Radiated Power	2.1046, 27.50(b)(4), 27.50(c)(3)	< 1000 Watts/MHz max. ERP	PASS	Section 7.2
	Occupied Bandwidth	2.1049	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions	2.1051, 27.53	> 43 + 10log <sub>10</sub> (P[Watts]) at Band Edge and for all out-of-band emissions	PASS	Sections 7.4, 7.5
	Frequency Stability	2.1055, 27.54	Fundamental emissions stay within authorized frequency block	PASS	Section 7.7
<b>RADIATED</b>	Radiated Spurious Emissions (LTE Band 13)	2.1053, 27.53(f)	< -70 dBW/MHz (for wideband signals) < -80 dBW (for discrete emissions less than 700Hz BW) For all emissions in the band 1559 - 1610 MHz	PASS	Section 7.6
	Radiated Spurious Emissions	2.1053, 27.53	> 43 + 10 log <sub>10</sub> (P[Watts]) for all out-of-band emissions	PASS	Section 7.6

**Table 7-1. Summary of Test Results**

#### Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link with the EUT at all frequencies of interest.
- 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.
- 4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST EMC Software Tool Ver. 1.1.
- 5) For the Radiated Emissions test, the EUT was tested for case radiated spurious emissions with the antenna port terminated in 50 ohms while the EUT was set to transmit from antenna port (1 x 20W) at maximum power.

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## 7.2 Transmitter Conducted Output Power / Effective Radiated Power

### Test Overview

The EUT was set to transmit in all four available modulations of LTE mode at the maximum output power of 20W for this band or as applicable for the channel through a management server. The output terminal of the EUT was connected through a calibrated cable and 30 dB of external attenuation to a signal analyzer. The signal analyzers' "Channel Power" function was used to measure the conducted output powers in accordance with the guidance of KDB 971168 D01 v03r01.

### Test Procedure Used

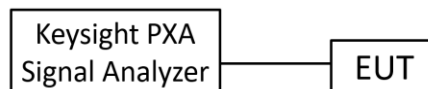
KDB 971168 D01 v03r01 – Section 5.2.1

### Test Settings

1. Power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. Span = 2 - 3 times the OBW
3. RBW = 1 – 5% of the expected OBW
4. VBW  $\geq$  3 x RBW
5. No. of sweep points  $\geq$  2 x span / RBW
6. Sweep time = auto-couple
7. Detector = RMS
8. Trigger is set to "free run" for signals with continuous operation.
9. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
10. Trace mode = trace averaging (RMS) over 100 sweeps
11. The trace was allowed to stabilize

### Test Setup


The EUT and measurement equipment were set up as shown in the diagram below.



**Figure 7-1. Test Instrument & Measurement Setup**

### Test Notes

None.

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## LTE Band 71


Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Conducted Power [Watts]	Ant Gain [dBi]	ERP [dBm/MHz]	ERP [Watts/MHz]	ERP Limit [dBm/MHz]	Margin [dB]
20 MHz	QPSK	68686	627.0	100 / 0	43.20	20.89	15.00	56.05	402.72	60.00	-3.95
		68761	634.5	100 / 0	43.22	20.99	15.00	56.07	404.58	60.00	-3.93
		68836	642.0	100 / 0	43.11	20.46	15.00	55.96	394.46	60.00	-4.04
	16-QAM	68761	634.5	100 / 0	43.23	21.04	15.00	56.08	405.51	60.00	-3.92
	64-QAM	68761	634.5	100 / 0	43.27	21.23	15.00	56.12	409.26	60.00	-3.88
	256-QAM	68761	634.5	100 / 0	43.25	21.13	15.00	56.10	407.38	60.00	-3.90
15 MHz	QPSK	68661	624.5	75 / 0	43.29	21.33	15.00	56.14	411.15	60.00	-3.86
		68761	634.5	75 / 0	43.35	21.63	15.00	56.20	416.87	60.00	-3.80
		68861	644.5	75 / 0	43.07	20.28	15.00	55.92	390.84	60.00	-4.08
	16-QAM	68761	634.5	75 / 0	43.30	21.38	15.00	56.15	412.10	60.00	-3.85
	64-QAM	68761	634.5	75 / 0	43.28	21.28	15.00	56.13	410.20	60.00	-3.87
	256-QAM	68761	634.5	75 / 0	43.30	21.38	15.00	56.15	412.10	60.00	-3.85
10 MHz	QPSK	68636	622.0	50 / 0	43.29	21.33	15.00	56.14	411.15	60.00	-3.86
		68761	634.5	50 / 0	43.44	22.08	15.00	56.29	425.60	60.00	-3.71
		68886	647.0	50 / 0	43.17	20.75	15.00	56.02	399.94	60.00	-3.98
	16-QAM	68761	634.5	50 / 0	43.40	21.88	15.00	56.25	421.70	60.00	-3.75
	64-QAM	68761	634.5	50 / 0	43.42	21.98	15.00	56.27	423.64	60.00	-3.73
	256-QAM	68761	634.5	50 / 0	43.49	22.34	15.00	56.34	430.53	60.00	-3.66
5 MHz	QPSK	68611	619.5	25 / 0	43.39	21.83	15.00	56.24	420.73	60.00	-3.76
		68761	634.5	25 / 0	43.44	22.08	15.00	56.29	425.60	60.00	-3.71
		68911	649.5	25 / 0	43.16	20.70	15.00	56.01	399.02	60.00	-3.99
	16-QAM	68761	634.5	25 / 0	43.42	21.98	15.00	56.27	423.64	60.00	-3.73
	64-QAM	68611	619.5	25 / 0	43.39	21.83	15.00	56.24	420.73	60.00	-3.76
	256-QAM	68761	634.5	25 / 0	43.36	21.68	15.00	56.21	417.83	60.00	-3.79

Table 7-2. Transmitter Conducted Output Power / Effective Radiated Power (LTE Band 71)

## LTE Band 12/17

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Conducted Power [Watts]	Ant Gain [dBi]	ERP [dBm/MHz]	ERP [Watts/MHz]	ERP Limit [dBm/MHz]	Margin [dB]
10 MHz	QPSK	5060	734.0	50 / 0	43.18	20.80	15.00	56.03	400.87	60.00	-3.97
		5095	737.5	50 / 0	43.35	21.63	15.00	56.20	416.87	60.00	-3.80
		5130	741.0	50 / 0	43.41	21.93	15.00	56.26	422.67	60.00	-3.74
	16-QAM	5130	741.0	50 / 0	43.37	21.73	15.00	56.22	418.79	60.00	-3.78
	64-QAM	5130	741.0	50 / 0	43.41	21.93	15.00	56.26	422.67	60.00	-3.74
	256-QAM	5130	741.0	50 / 0	43.40	21.88	15.00	56.25	421.70	60.00	-3.75
5 MHz	QPSK	5035	731.5	25 / 0	43.21	20.94	15.00	56.06	403.65	60.00	-3.94
		5095	737.5	25 / 0	43.50	22.39	15.00	56.35	431.52	60.00	-3.65
		5155	743.5	25 / 0	43.58	22.80	15.00	56.43	439.54	60.00	-3.57
	16-QAM	5155	743.5	25 / 0	43.49	22.34	15.00	56.34	430.53	60.00	-3.66
	64-QAM	5155	743.5	25 / 0	43.52	22.49	15.00	56.37	433.51	60.00	-3.63
	256-QAM	5155	743.5	25 / 0	43.53	22.54	15.00	56.38	434.51	60.00	-3.62
3 MHz (Band 12 only)	QPSK	5025	730.5	15 / 0	43.12	20.51	15.00	55.97	395.37	60.00	-4.03
		5095	737.5	15 / 0	43.44	22.08	15.00	56.29	425.60	60.00	-3.71
		5165	744.5	15 / 0	43.61	22.96	15.00	56.46	442.59	60.00	-3.54
	16-QAM	5165	744.5	15 / 0	43.56	22.70	15.00	56.41	437.52	60.00	-3.59
	64-QAM	5165	744.5	15 / 0	43.59	22.86	15.00	56.44	440.55	60.00	-3.56
1.4 MHz (Band 12 only)	QPSK	5017	729.7	6 / 0	43.06	20.23	15.00	55.91	389.94	60.00	-4.09
		5095	737.5	6 / 0	43.29	21.33	15.00	56.14	411.15	60.00	-3.86
		5173	745.3	6 / 0	43.51	22.44	15.00	56.36	432.51	60.00	-3.64
	16-QAM	5173	745.3	6 / 0	43.52	22.49	15.00	56.37	433.51	60.00	-3.63
	64-QAM	5173	745.3	6 / 0	43.51	22.44	15.00	56.36	432.51	60.00	-3.64
	256-QAM	5173	745.3	6 / 0	43.57	22.75	15.00	56.42	438.53	60.00	-3.58


Table 7-3. Transmitter Conducted Output Power / Effective Radiated Power (LTE Band 12/17)

FCC ID: QLJMRU-060785	 <b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 12 of 65

## LTE Band 13

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Conducted Power [Watts]	Ant Gain [dBi]	ERP [dBm/MHz]	ERP [Watts/MHz]	ERP Limit [dBm/MHz]	Margin [dB]
10 MHz	QPSK	5230	751.0	50 / 0	43.53	22.542	15.00	56.38	434.51	60.00	-3.62
	16-QAM	5230	751.0	50 / 0	43.59	22.856	15.00	56.44	440.55	60.00	-3.56
	64-QAM	5230	751.0	50 / 0	43.54	22.594	15.00	56.39	435.51	60.00	-3.61
	256-QAM	5230	751.0	50 / 0	43.57	22.751	15.00	56.42	438.53	60.00	-3.58
5 MHz	QPSK	5205	748.5	25 / 0	43.55	22.646	15.00	56.40	436.52	60.00	-3.60
		5230	751.0	25 / 0	43.57	22.751	15.00	56.42	438.53	60.00	-3.58
		5255	753.5	25 / 0	43.59	22.856	15.00	56.44	440.55	60.00	-3.56
	16-QAM	5230	751.0	25 / 0	43.62	23.014	15.00	56.47	443.61	60.00	-3.53
	64-QAM	5255	753.5	25 / 0	43.55	22.646	15.00	56.40	436.52	60.00	-3.60
	256-QAM	5205	748.5	25 / 0	43.59	22.856	15.00	56.44	440.55	60.00	-3.56

**Table 7-4. Transmitter Conducted Output Power / Effective Radiated Power (LTE Band 13)**

FCC ID: QLJMRU-060785	 <b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 13 of 65

## 7.3 Occupied Bandwidth

### Test Overview

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. All modes of operation were investigated and the worst case configuration results are reported in this section.

### Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

### Test Settings

1. The signal analyzer’s automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW  $\geq$  3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

### Test Setup


The EUT and measurement equipment were set up as shown in the diagram below.



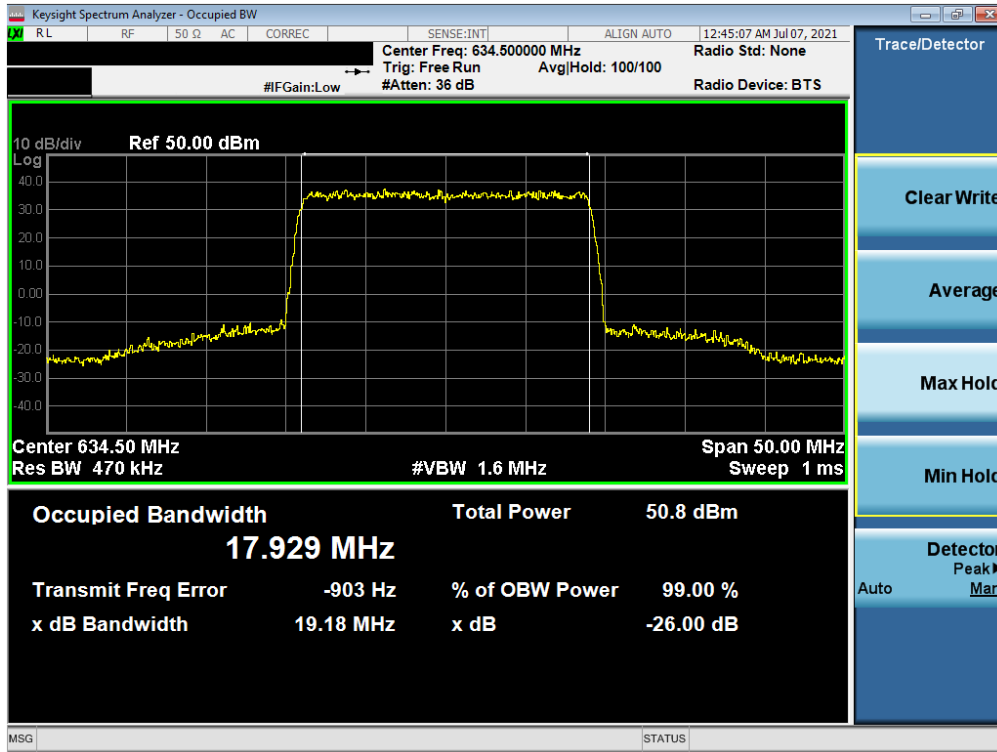
**Figure 7-2. Test Instrument & Measurement Setup**

### Test Notes

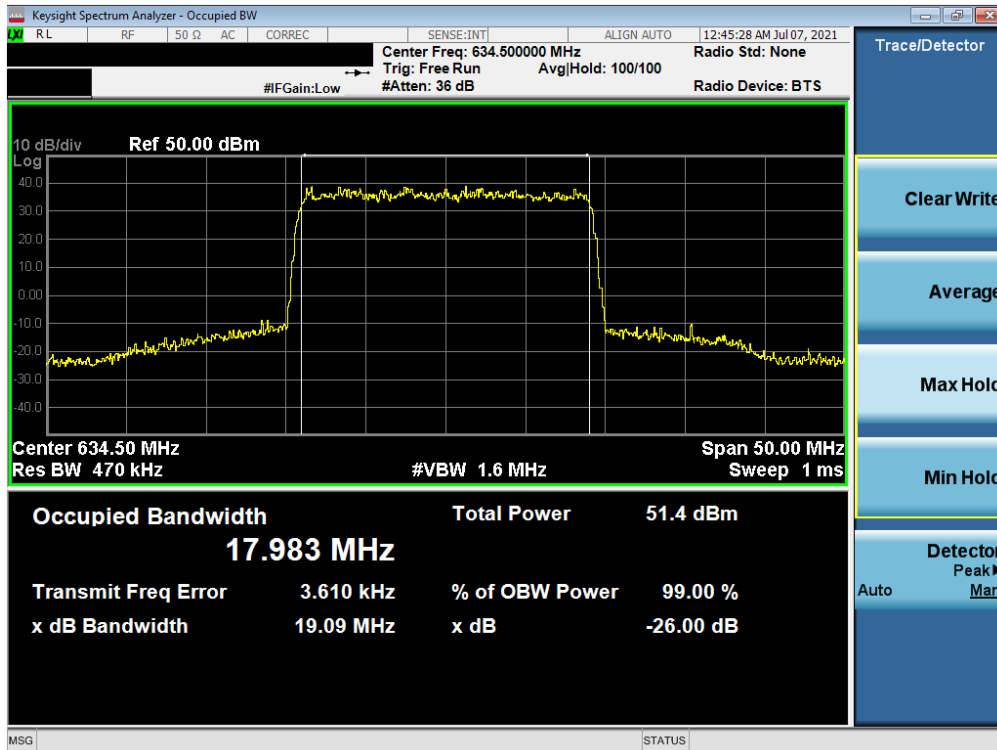
None.

FCC ID: QLJMRU-060785	 <b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 14 of 65

# LTE Band 71

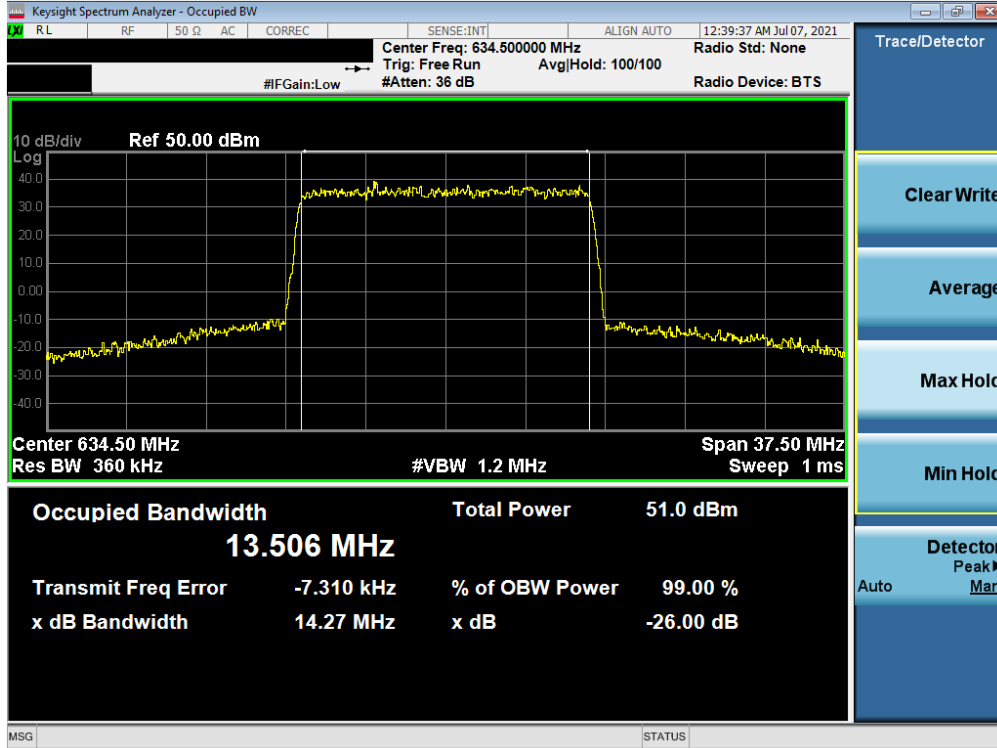


Plot 7-1. Occupied Bandwidth Plot (LTE Band 71 - 20MHz QPSK - Full RB)

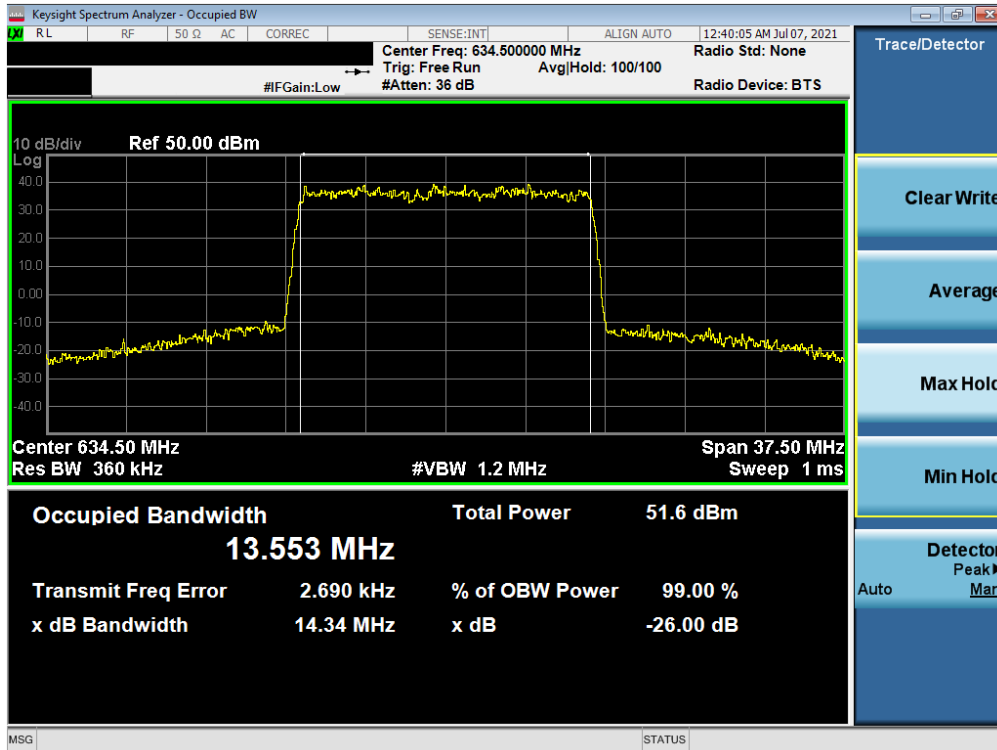


Plot 7-2. Occupied Bandwidth Plot (LTE Band 71 - 20MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 15 of 65



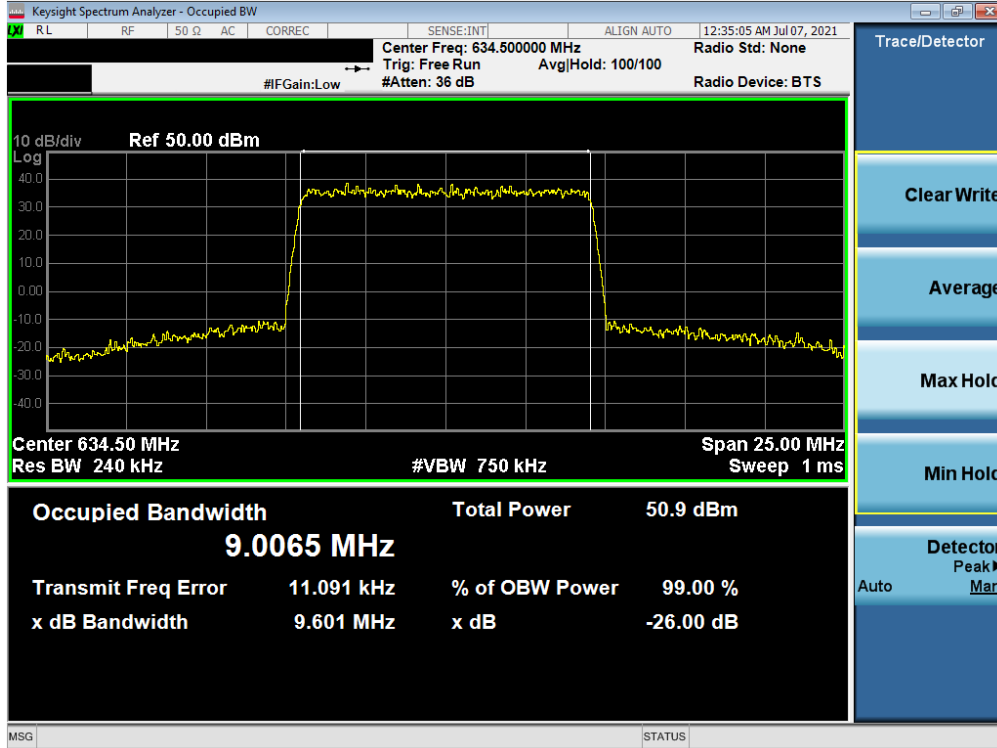
Plot 7-3. Occupied Bandwidth Plot (LTE Band 71 - 15MHz QPSK - Full RB)



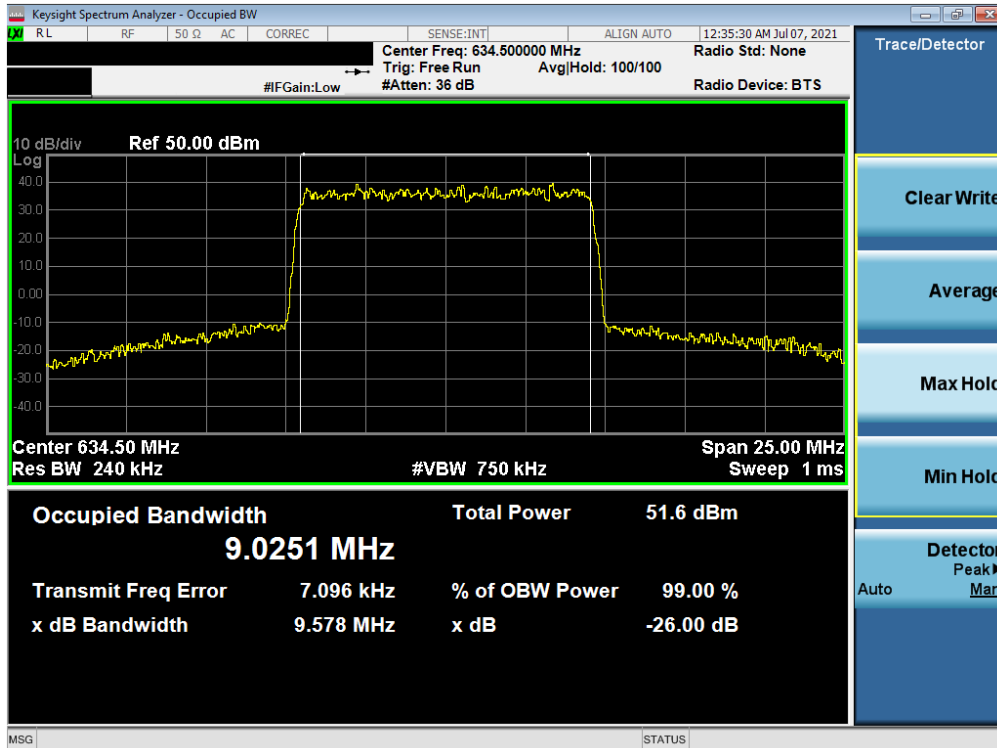
Plot 7-4. Occupied Bandwidth Plot (LTE Band 71 - 15MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 16 of 65



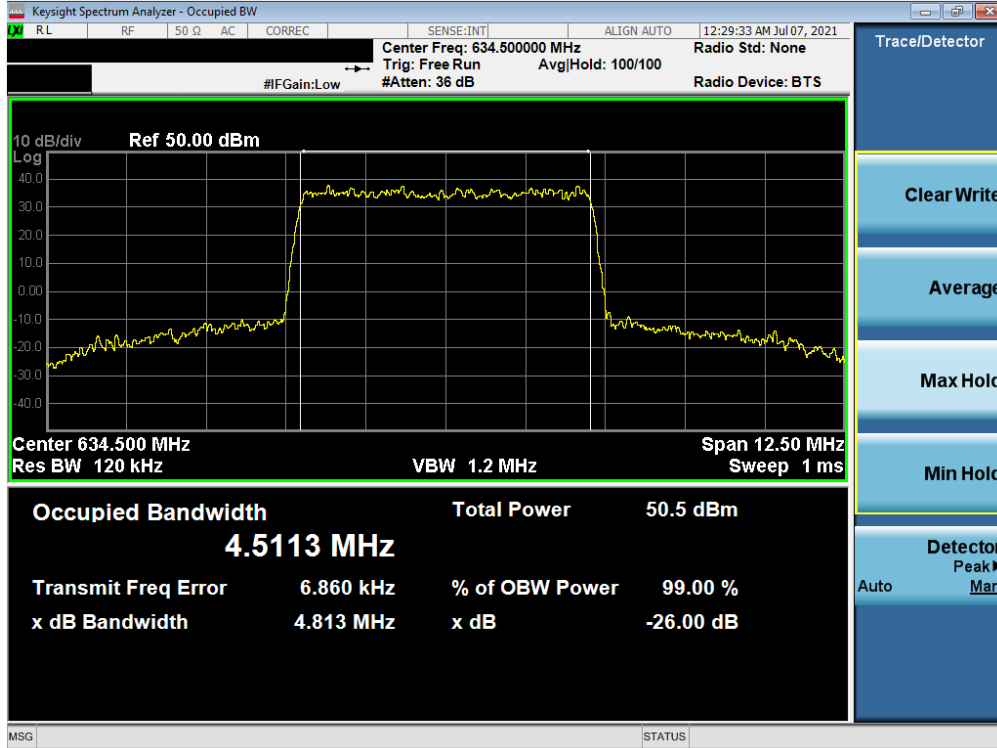


Plot 7-5. Occupied Bandwidth Plot (LTE Band 71 - 10MHz QPSK - Full RB)

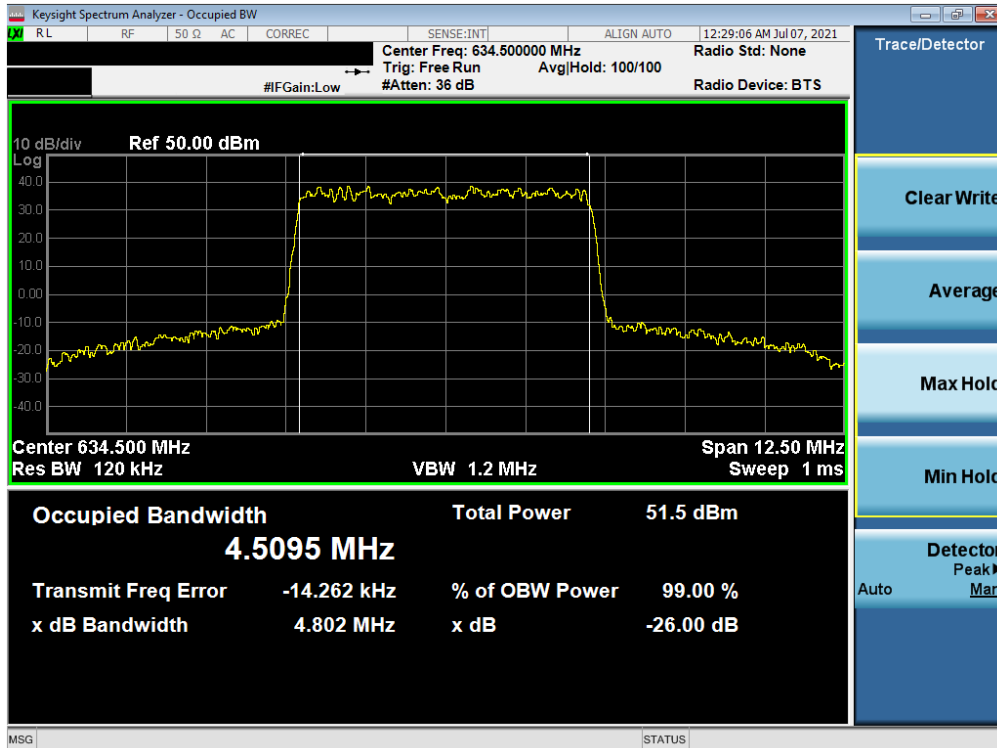


Plot 7-6. Occupied Bandwidth Plot (LTE Band 71 - 10MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 17 of 65



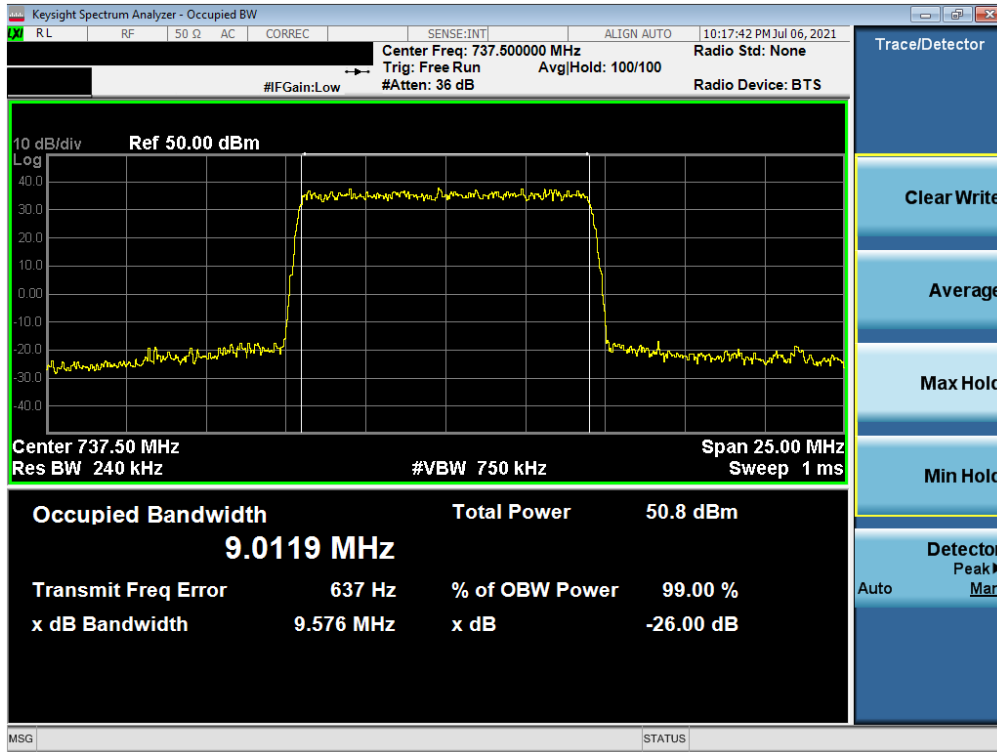
Plot 7-7. Occupied Bandwidth Plot (LTE Band 71 - 5MHz QPSK - Full RB)



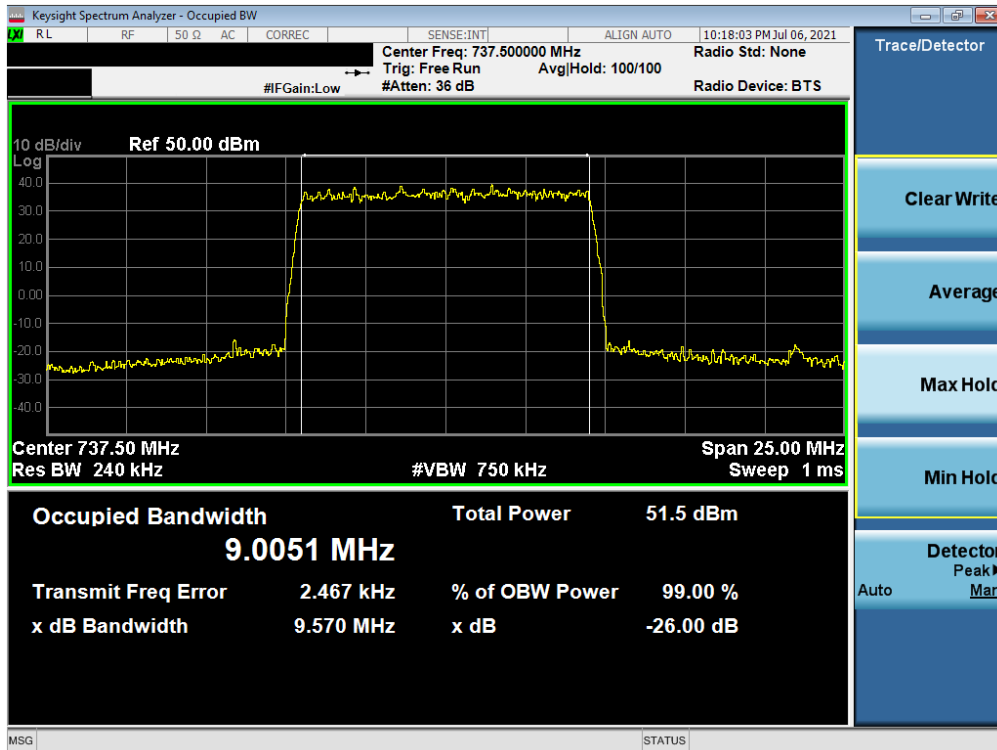
Plot 7-8. Occupied Bandwidth Plot (LTE Band 71 - 5MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 18 of 65

## LTE Band 12/17

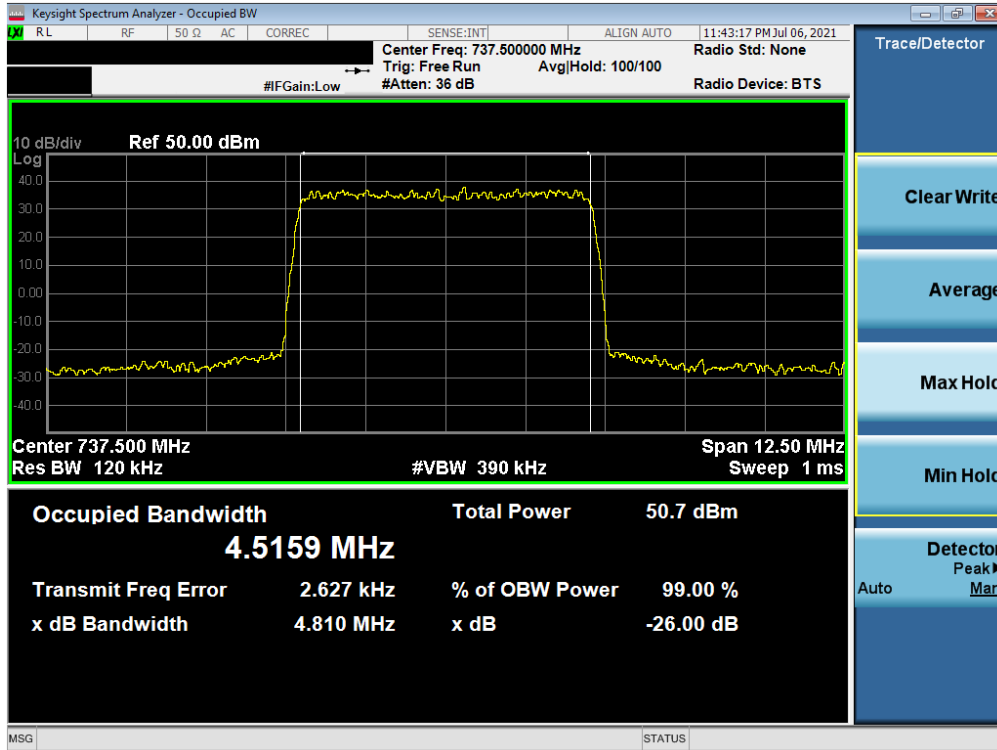


Plot 7-9. Occupied Bandwidth Plot (LTE Band 12/17 - 10MHz QPSK - Full RB)

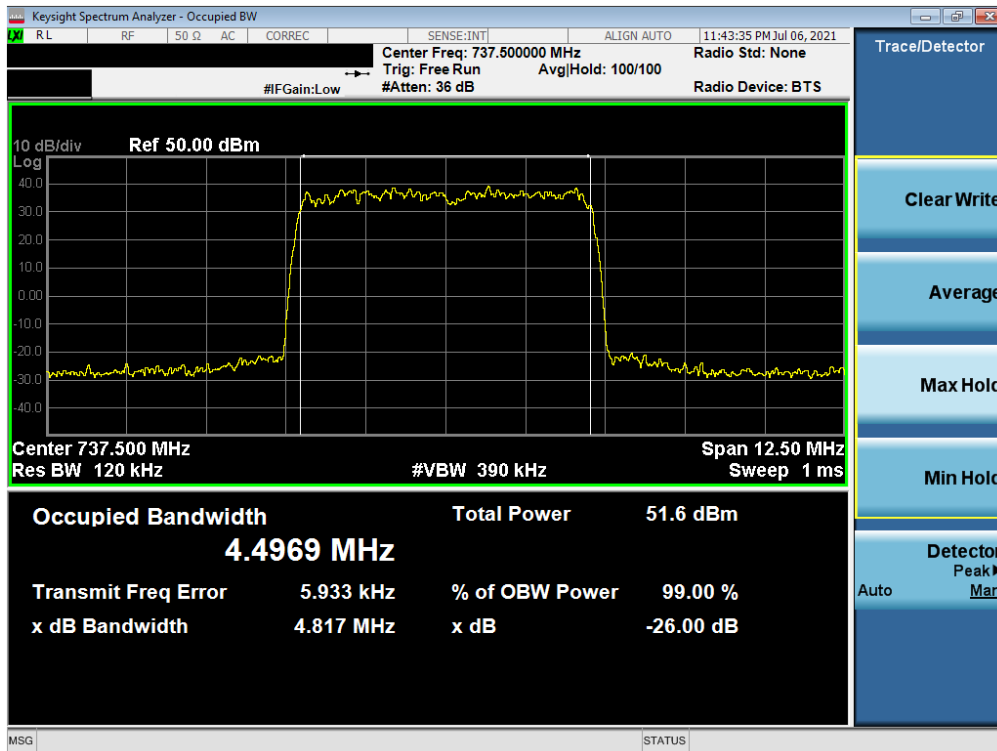


Plot 7-10. Occupied Bandwidth Plot (LTE Band 12/17 - 10MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 19 of 65

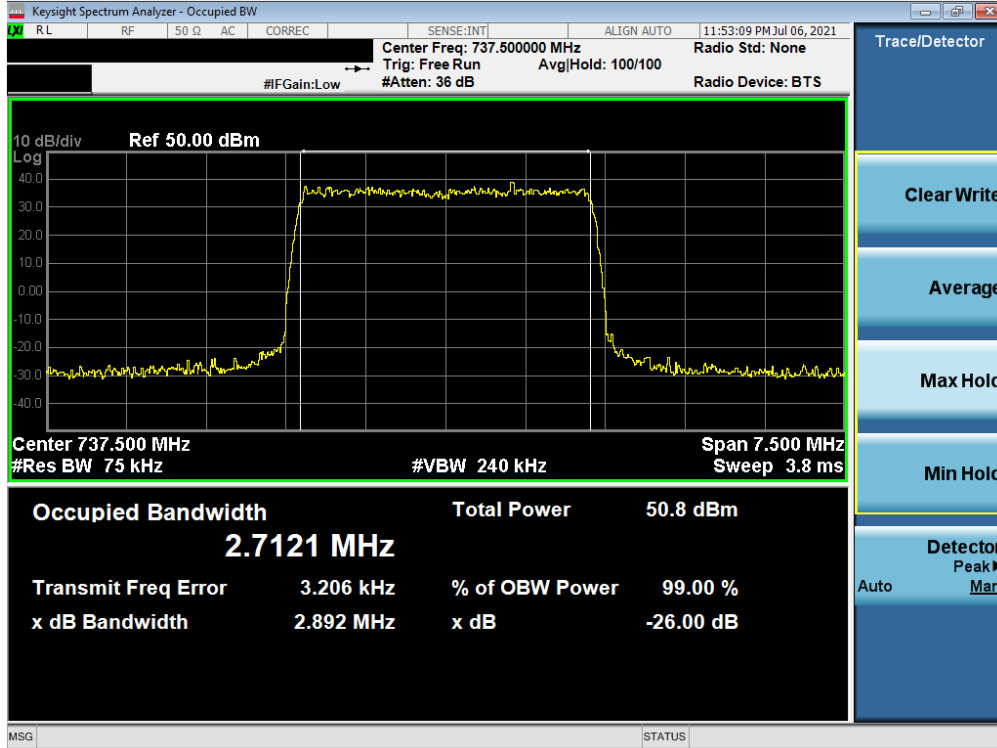


Plot 7-11. Occupied Bandwidth Plot (LTE Band 12/17 - 5MHz QPSK - Full RB)

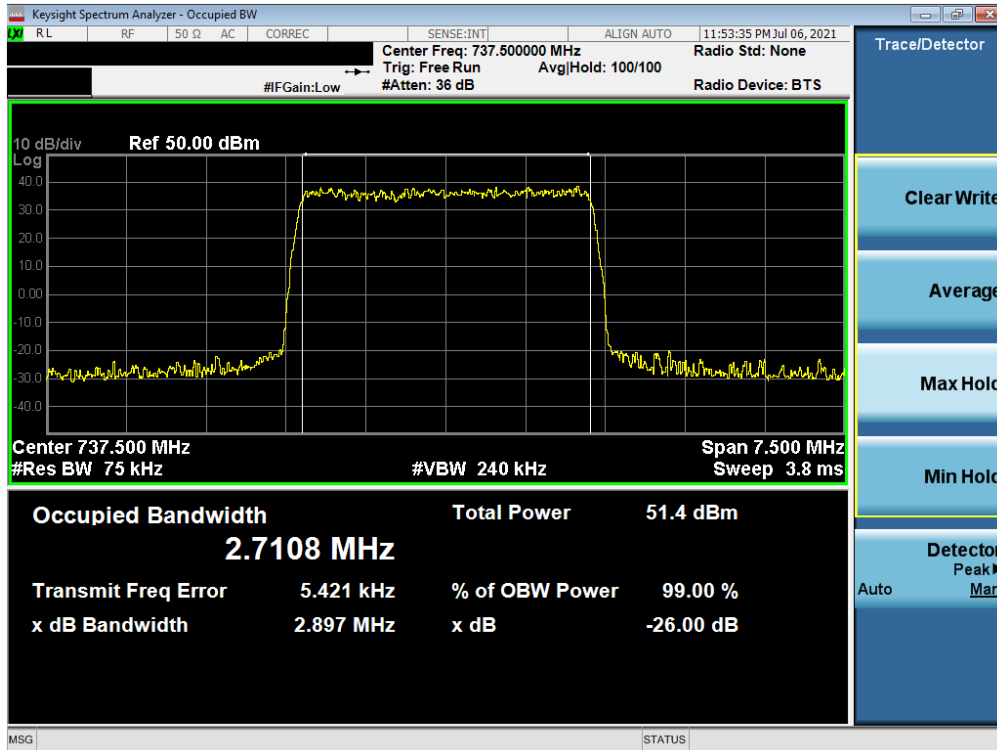


Plot 7-12. Occupied Bandwidth Plot (LTE Band 12/17 - 5MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 20 of 65

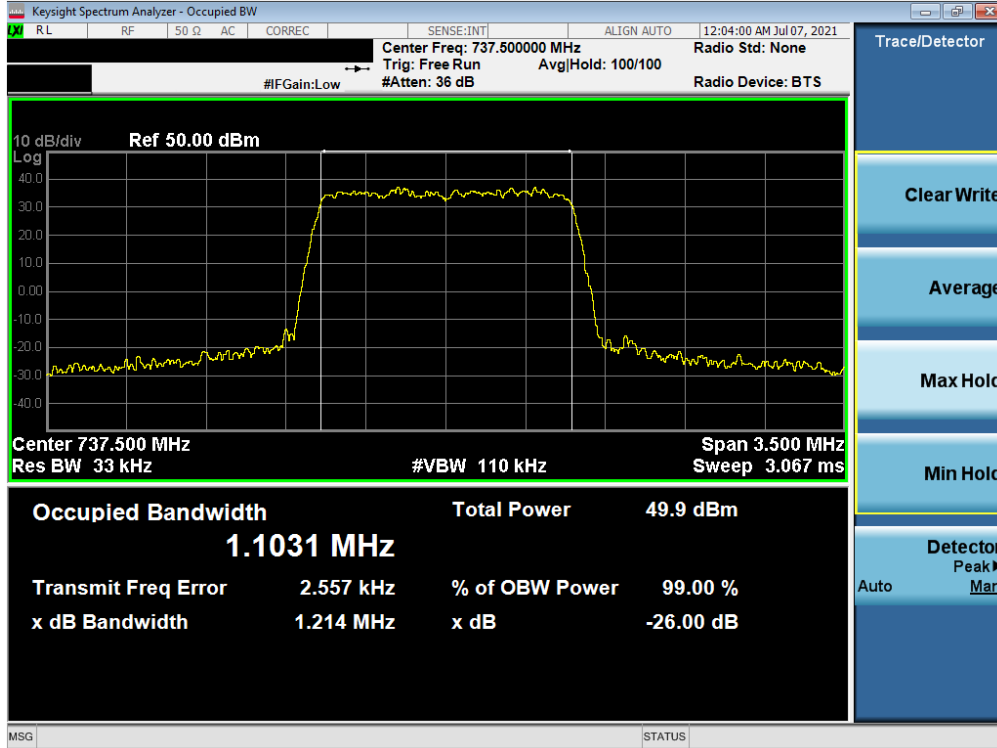


Plot 7-13. Occupied Bandwidth Plot (LTE Band 12 - 3MHz QPSK - Full RB)

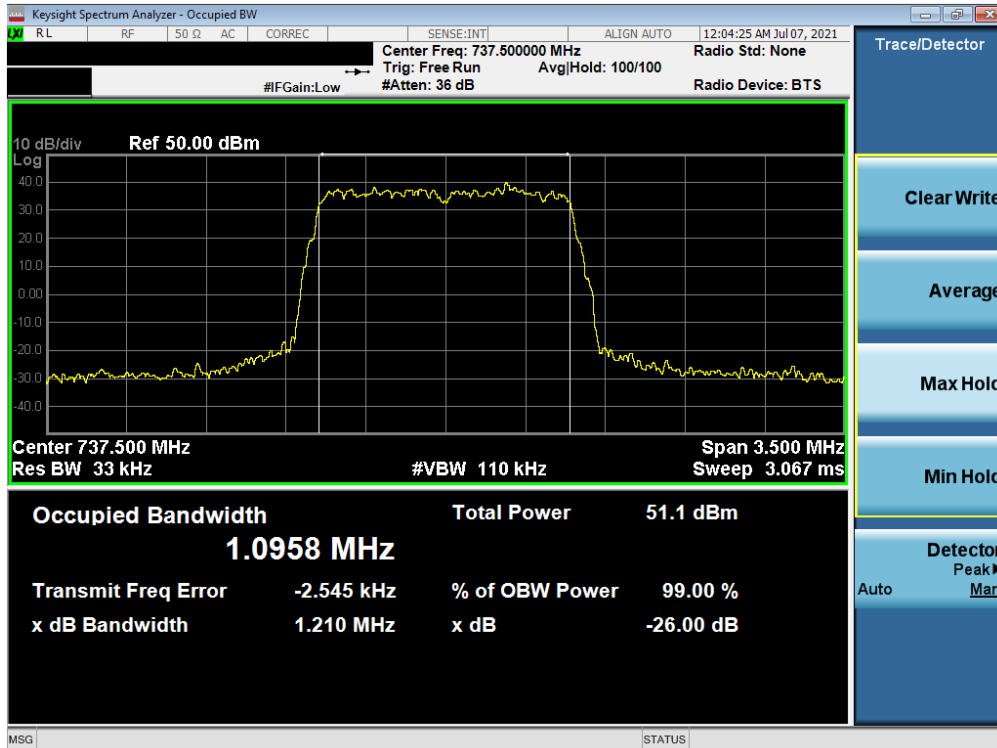


Plot 7-14. Occupied Bandwidth Plot (LTE Band 12 - 3MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 21 of 65



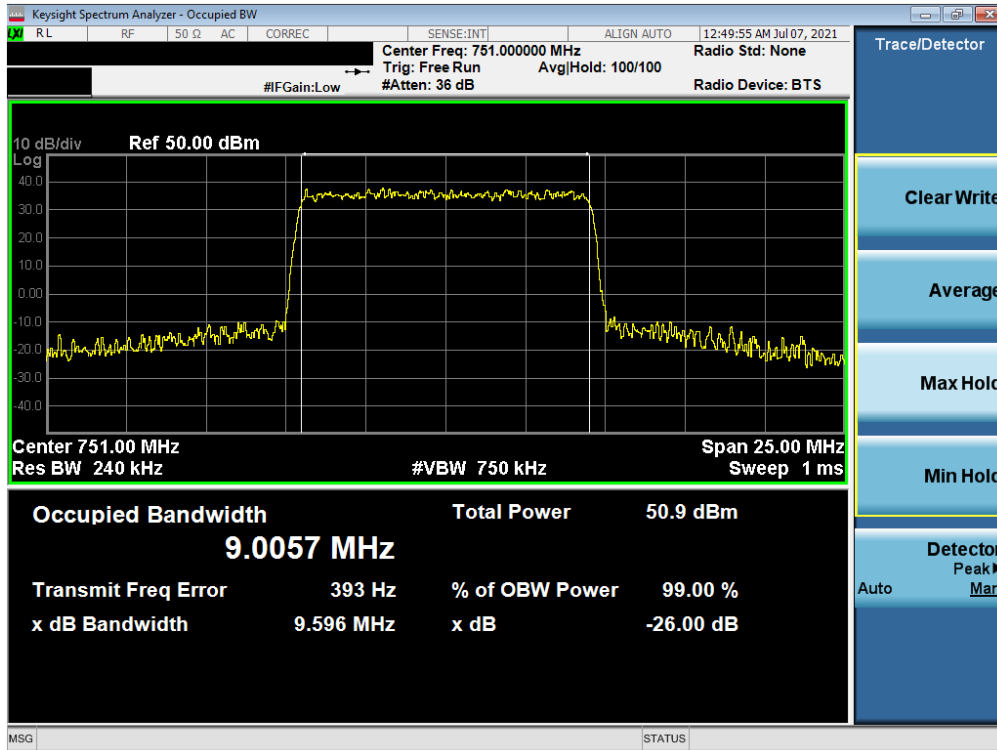
Plot 7-15. Occupied Bandwidth Plot (LTE Band 12 – 1.4MHz QPSK - Full RB)



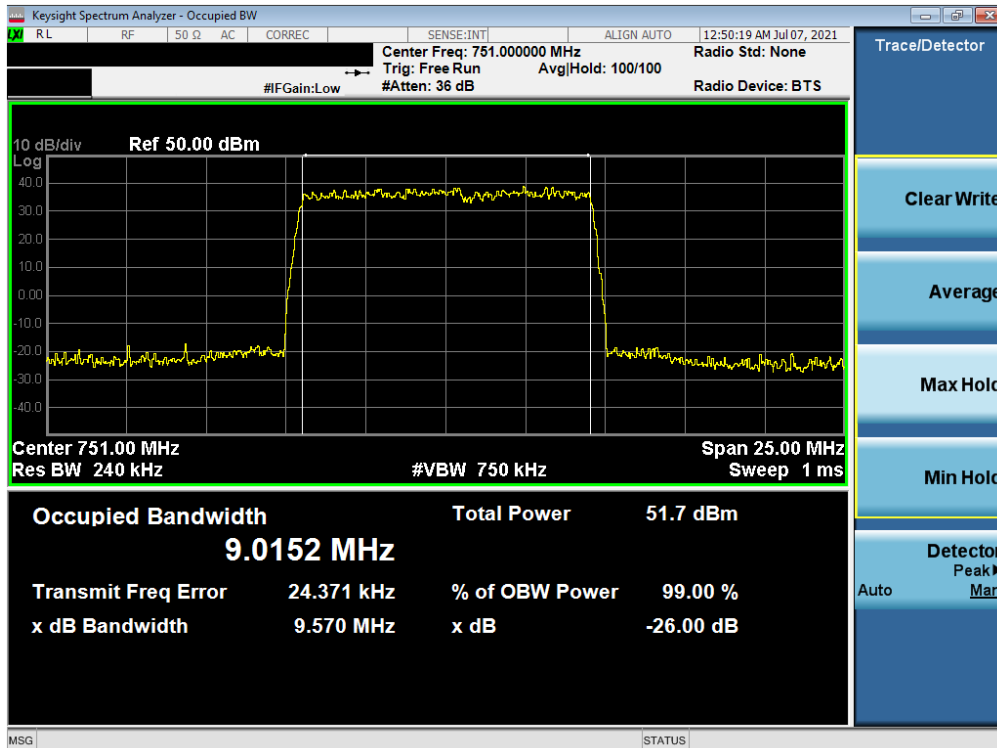
Plot 7-16. Occupied Bandwidth Plot (LTE Band 12 – 1.4MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 22 of 65


## LTE Band 13

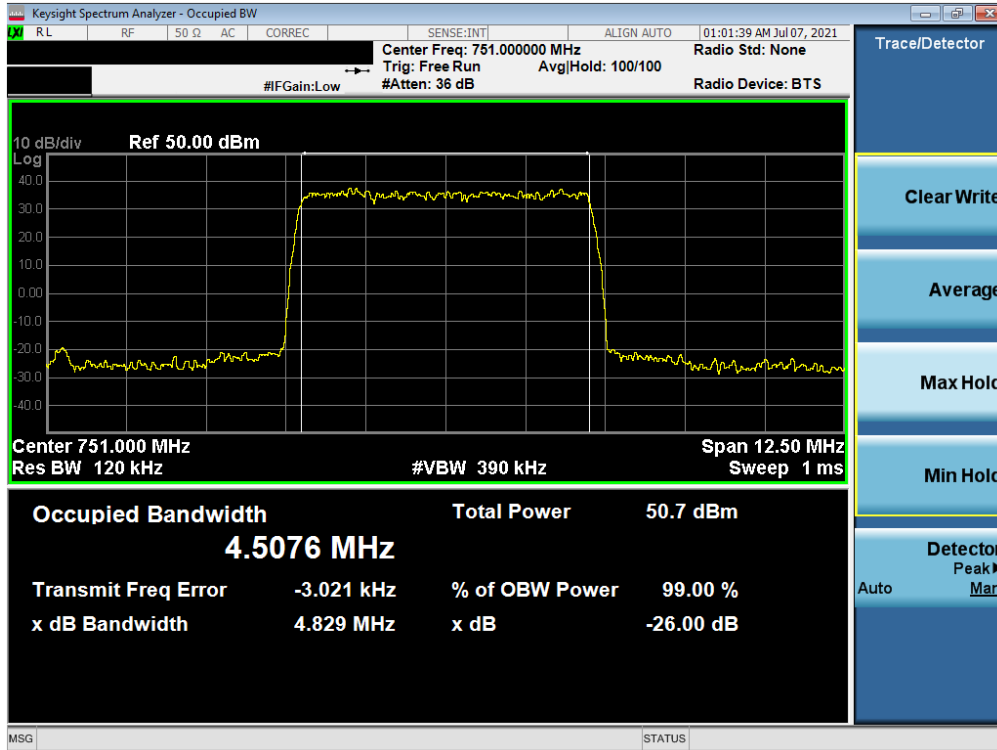


Plot 7-17. Occupied Bandwidth Plot (LTE Band 13 - 10MHz QPSK - Full RB)

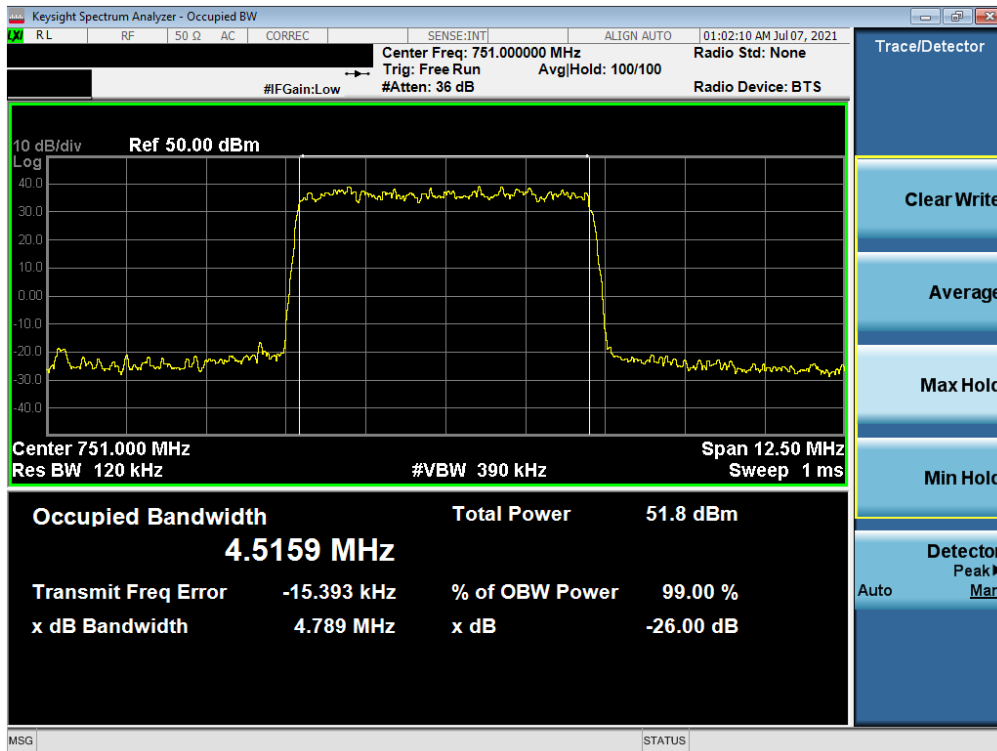


Plot 7-18. Occupied Bandwidth Plot (LTE Band 13 - 10MHz 16-QAM - Full RB)


FCC ID: QLJMRU-060785	 PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU
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Plot 7-19. Occupied Bandwidth Plot (LTE Band 13 - 5MHz QPSK - Full RB)



Plot 7-20. Occupied Bandwidth Plot (LTE Band 13 - 5MHz 16-QAM - Full RB)

FCC ID: QLJMRU-060785	 PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU
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## 7.4 Spurious and Harmonic Emissions at Antenna Terminal

### Test Overview

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. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

**The minimum permissible attenuation level of any spurious emission is  $43 + 10 \log_{10}(P_{[Watts]})$ , where  $P$  is the transmitter power in Watts.**

### Test Procedure Used

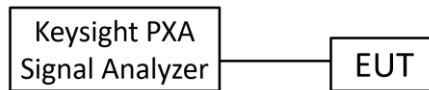
KDB 971168 D01 v03r01 – Section 6.0

### Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. RBW  $\geq$  100kHz
3. VBW  $\geq$  3 x RBW
4. Detector = RMS
5. Trace mode = trace average for continuous emissions, max hold for pulse emissions
6. Sweep time = auto couple
7. The trace was allowed to stabilize

### Test Setup


The EUT and measurement equipment were set up as shown in the diagram below.



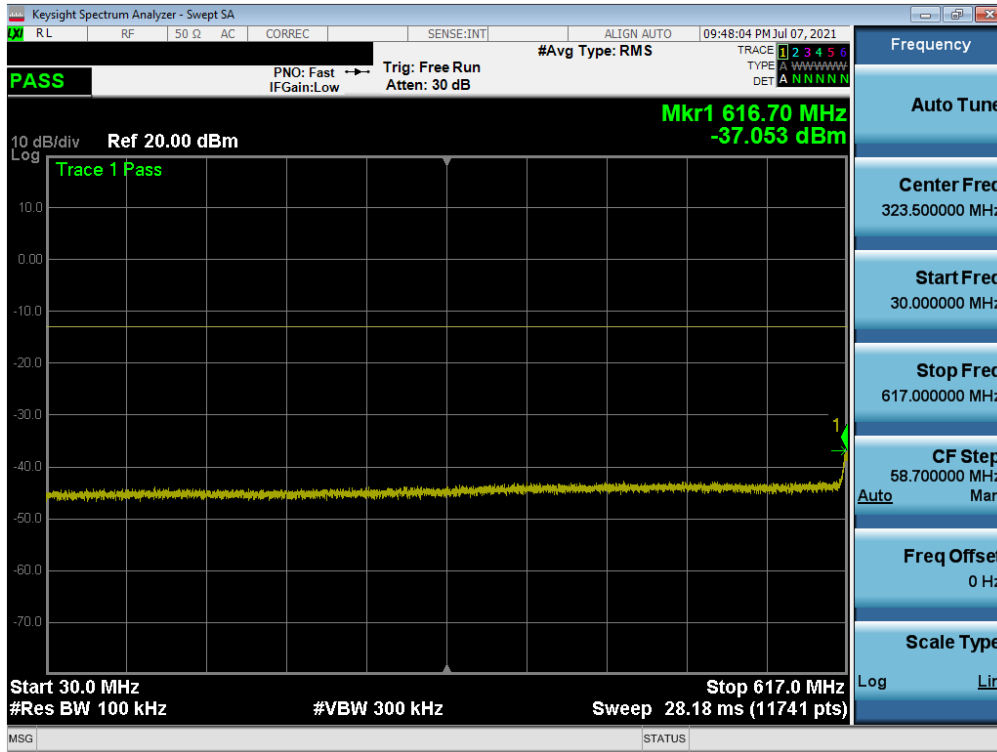
**Figure 7-3. Test Instrument & Measurement Setup**

### Test Notes

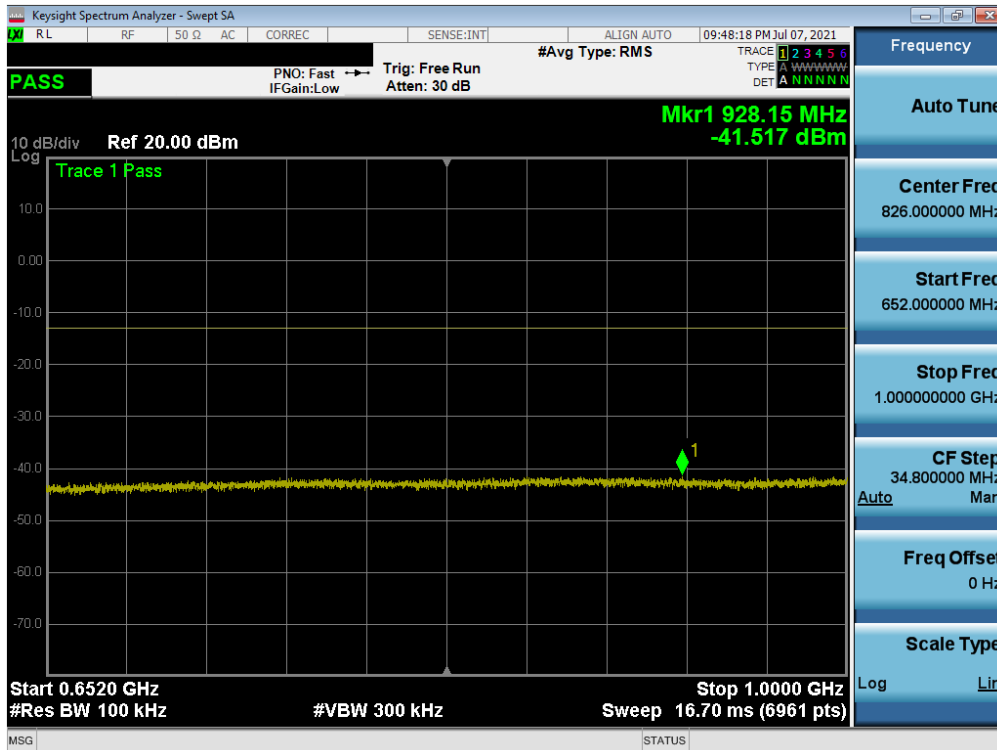
Per Part 27 and RSS-139, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth 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.

FCC ID: QLJMRU-060785	 <b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 25 of 65

# LTE Band 71

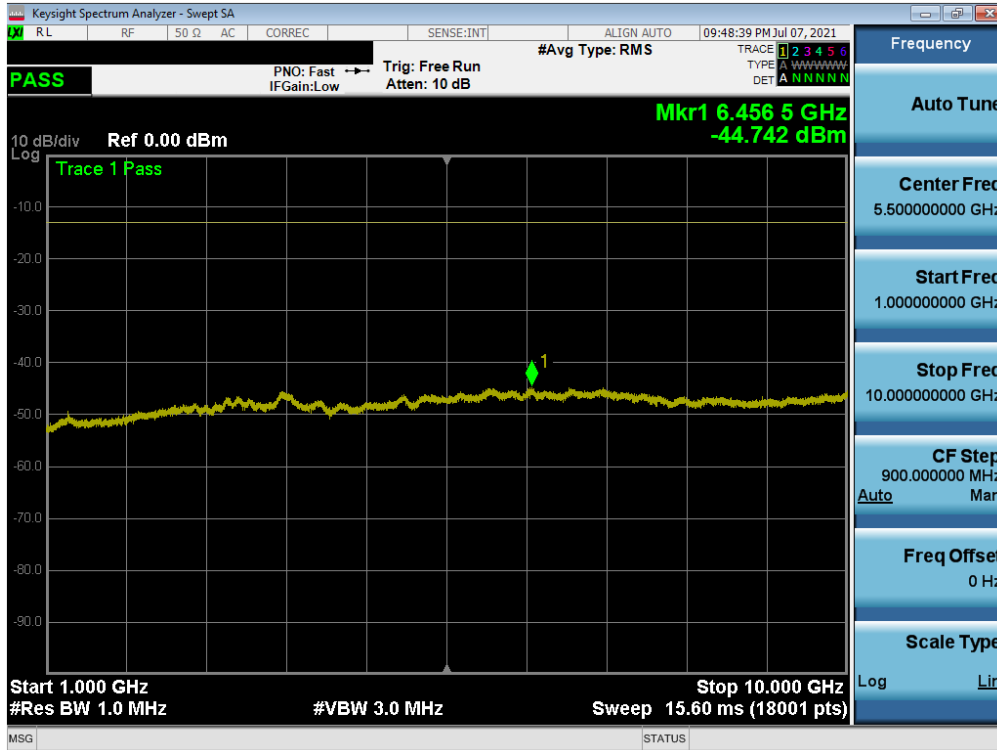


Plot 7-21. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - Low Channel)

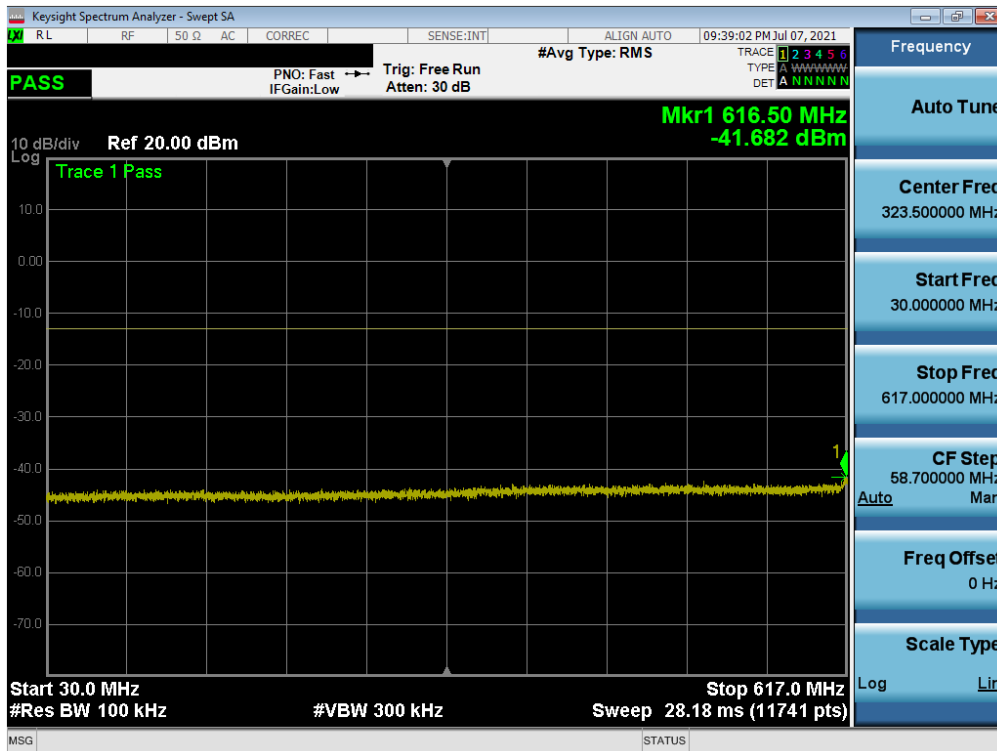


Plot 7-22. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - Low Channel)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 26 of 65

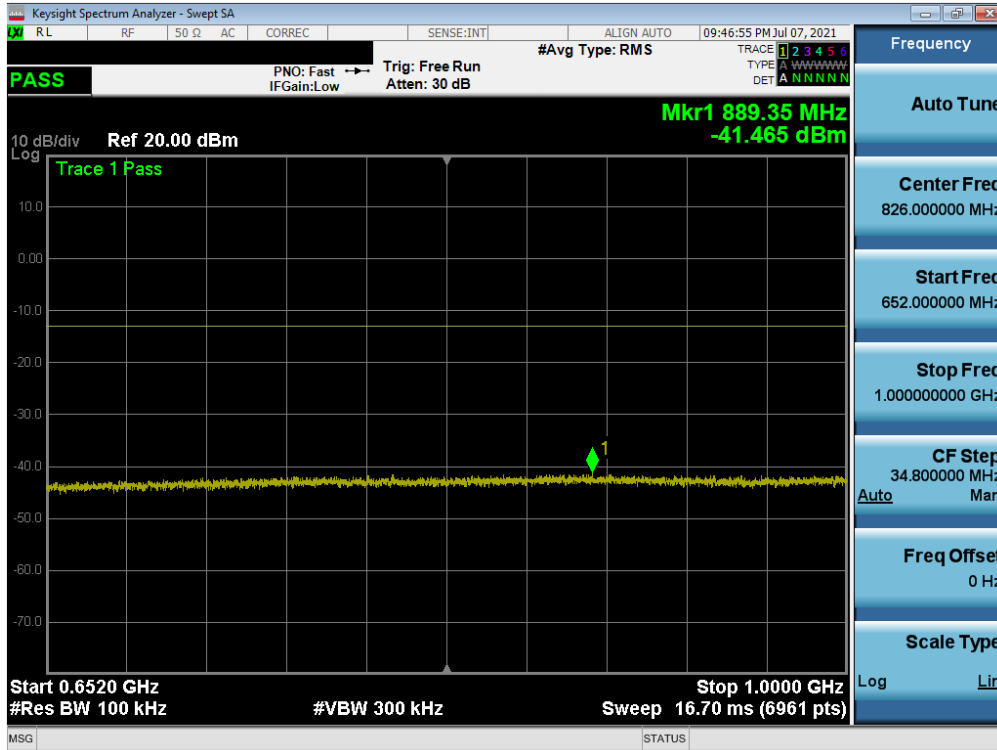


Plot 7-23. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - Low Channel)

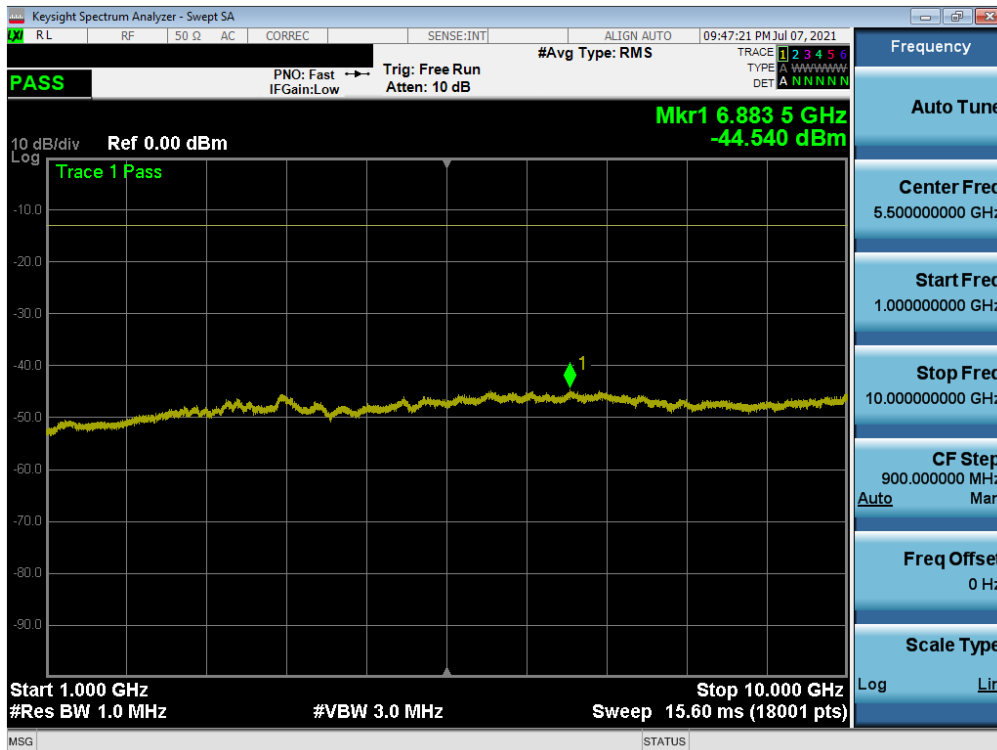


Plot 7-24. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - Mid Channel)

FCC ID: QLJMRU-060785	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 27 of 65

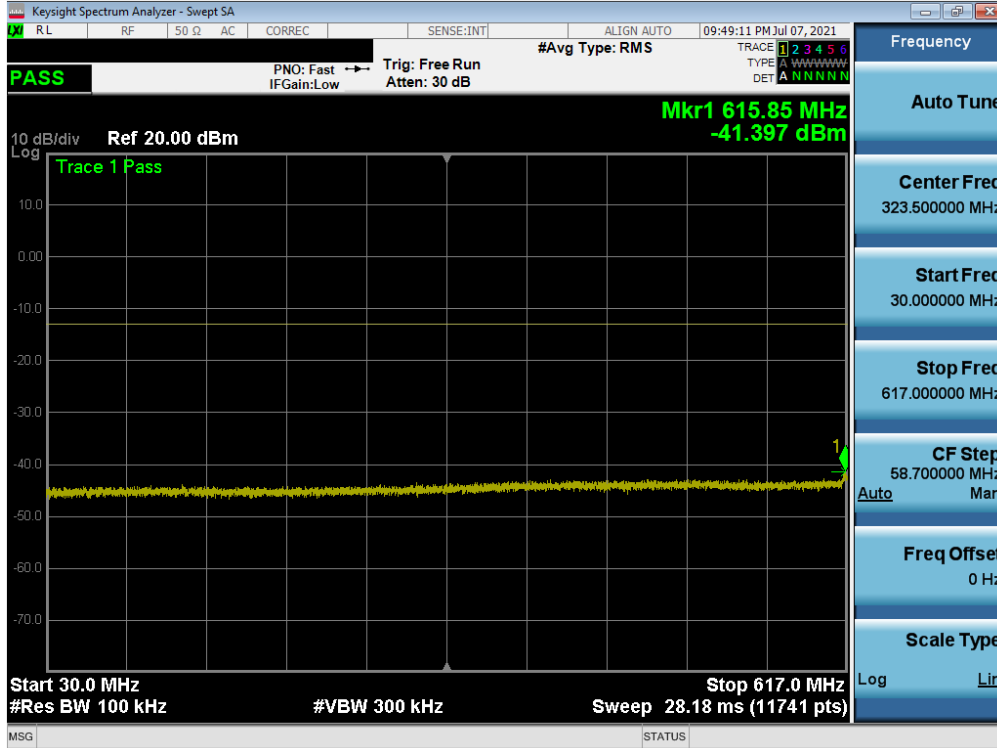


Plot 7-25. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - Mid Channel)

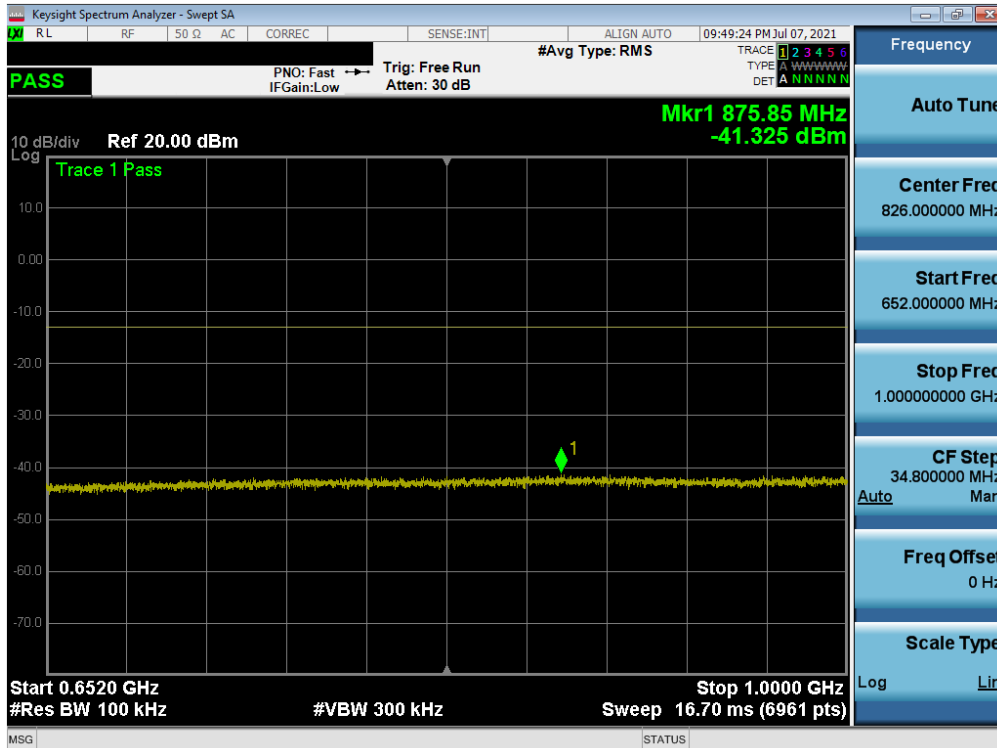


Plot 7-26. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - Mid Channel)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 28 of 65

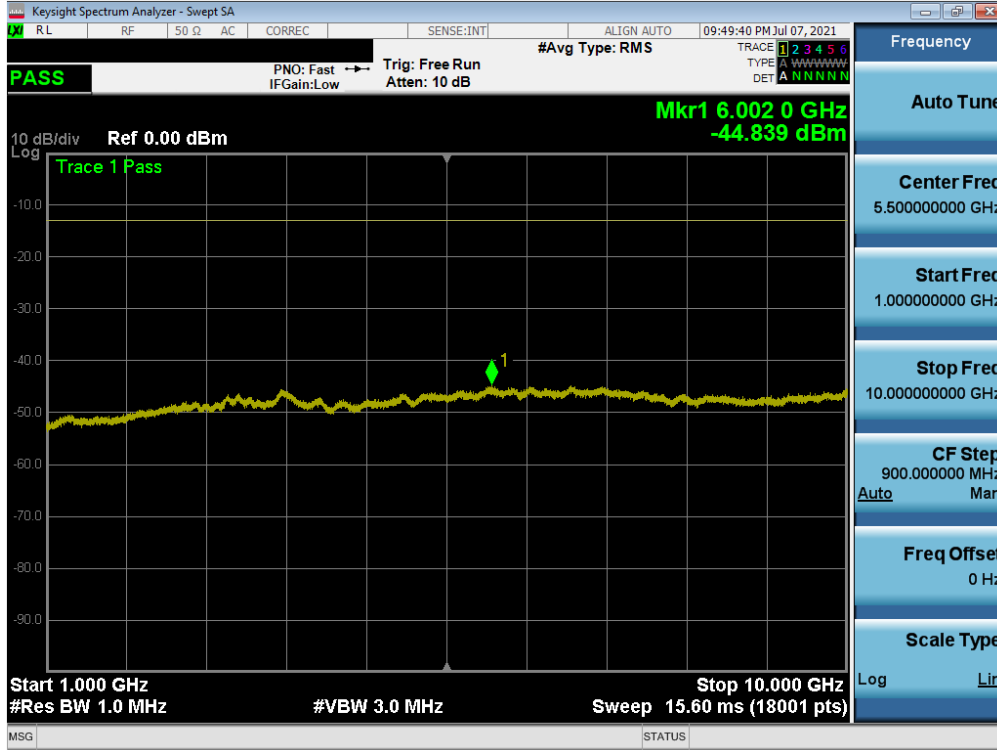


Plot 7-27. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - High Channel)



Plot 7-28. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - High Channel)

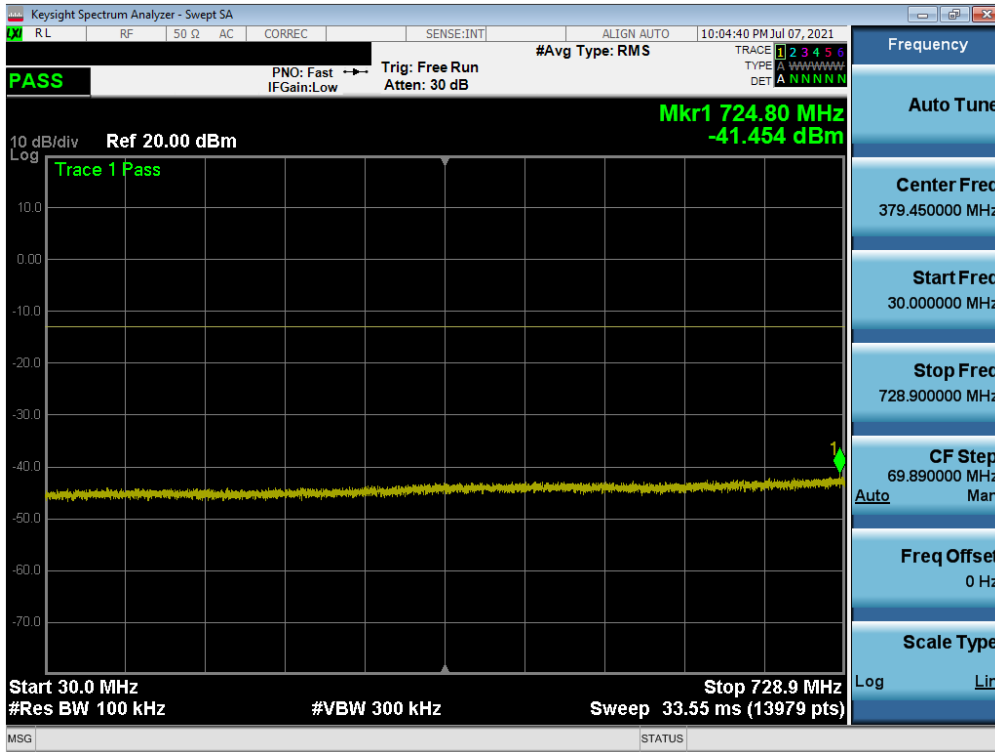
FCC ID: QLJMRU-060785	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 29 of 65



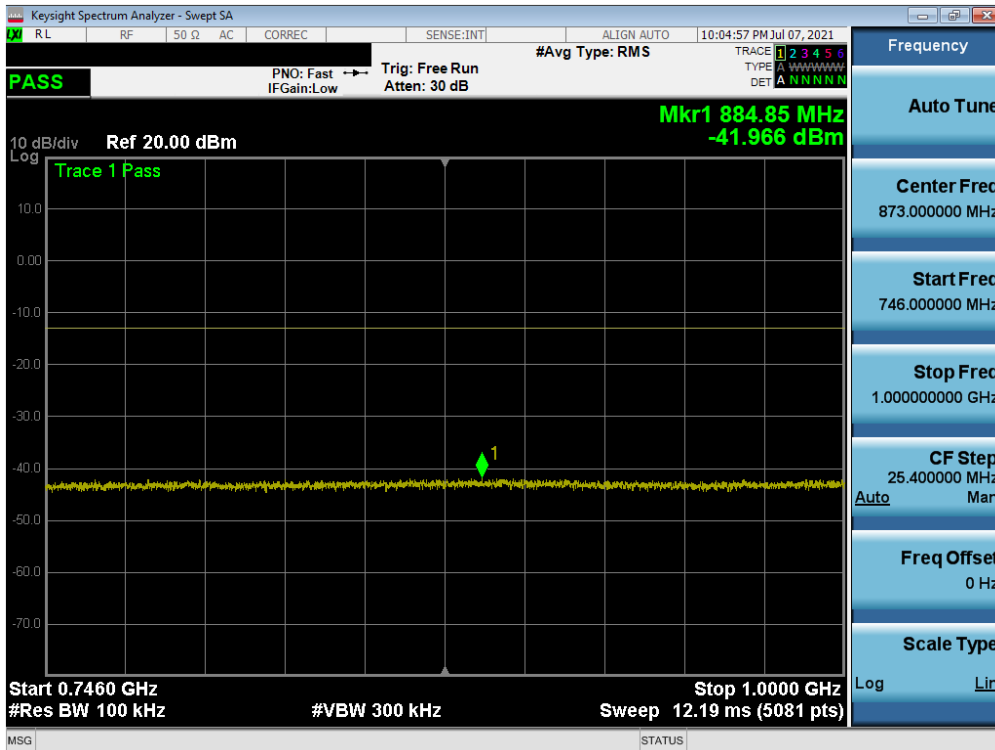
Plot 7-29. Conducted Spurious Plot (LTE Band 71 - 20MHz QPSK - Full RB - High Channel)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	<b>PART 27 MEASUREMENT REPORT</b>	<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1M2106040064-02.QLJ	<b>Test Dates:</b> 06/03 - 08/04/2021	<b>EUT Type:</b> Low Band mRU	Page 30 of 65

# LTE Band 12/17

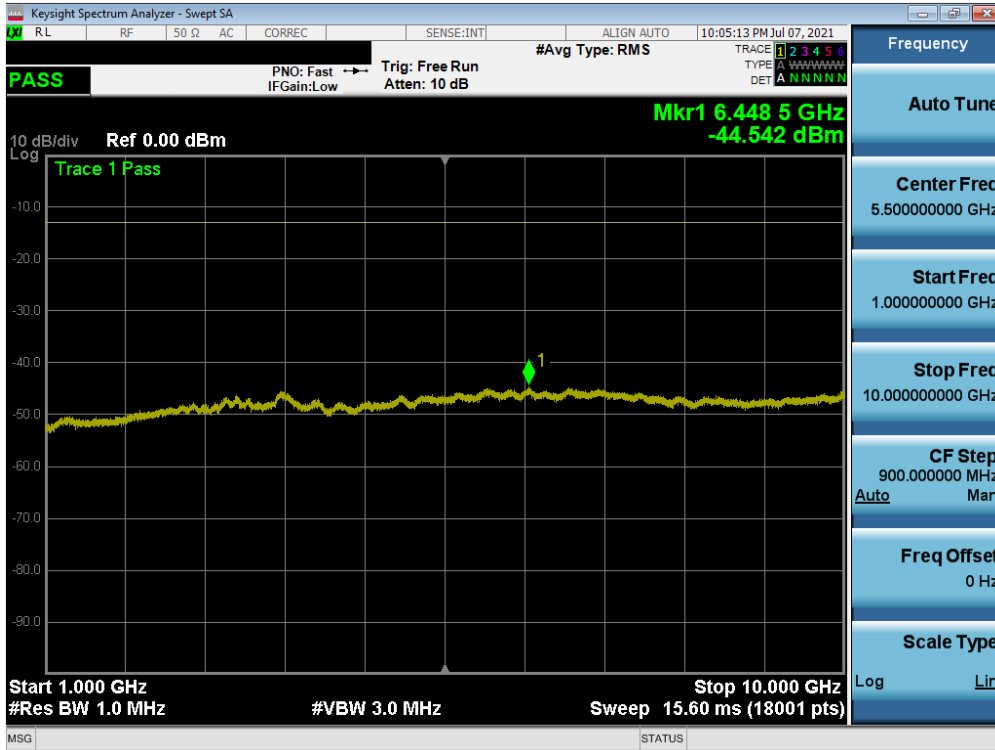


Plot 7-30. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - Low Channel)

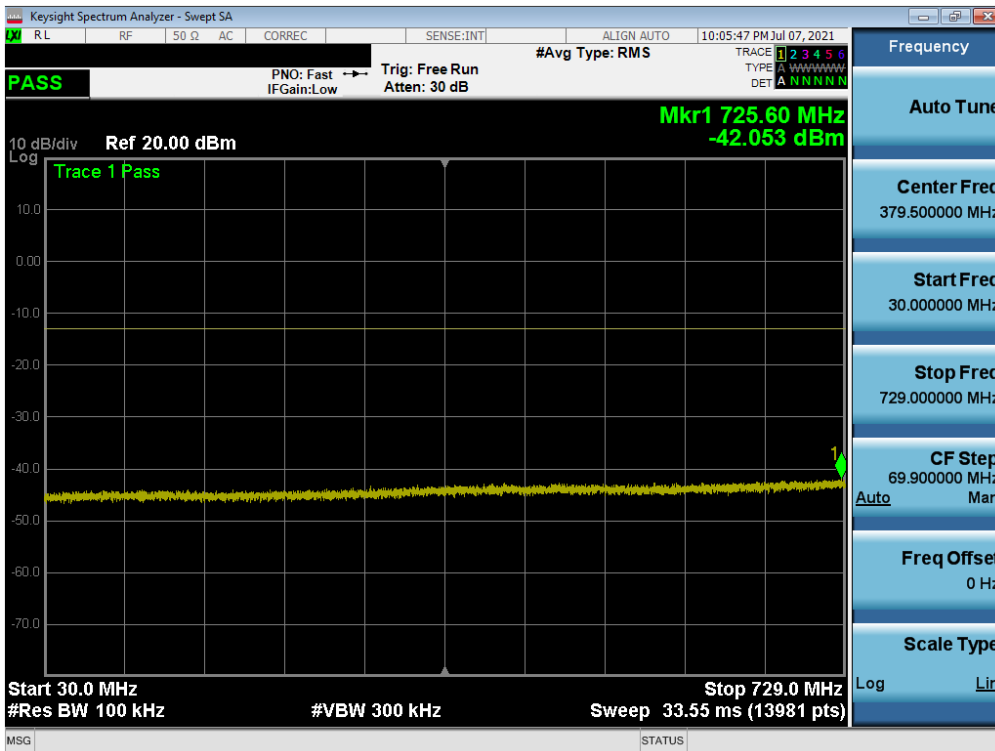


Plot 7-31. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - Low Channel)


FCC ID: QLJMRU-060785	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 31 of 65



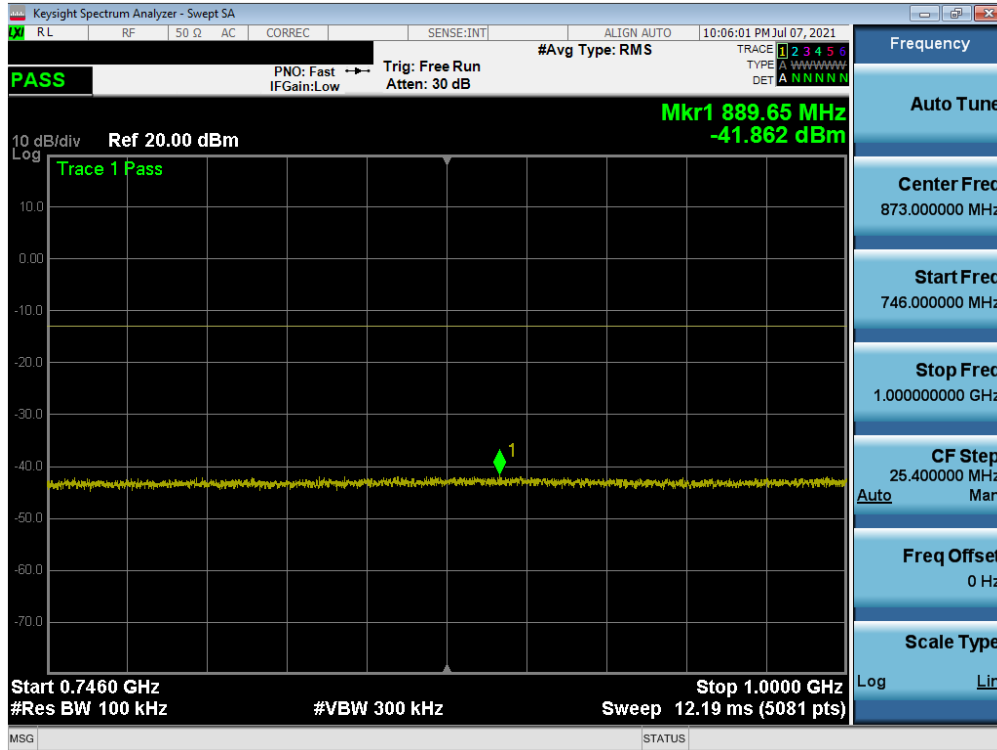
Plot 7-32. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - Low Channel)



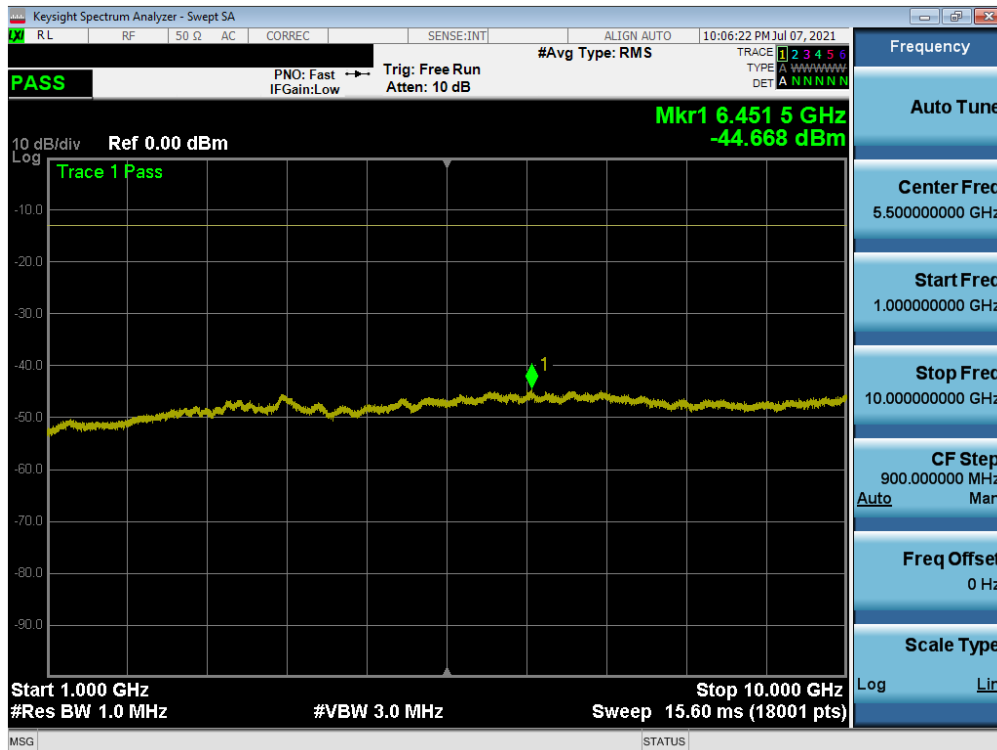
Plot 7-33. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - Mid Channel)

FCC ID: QLJMRU-060785		PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 32 of 65



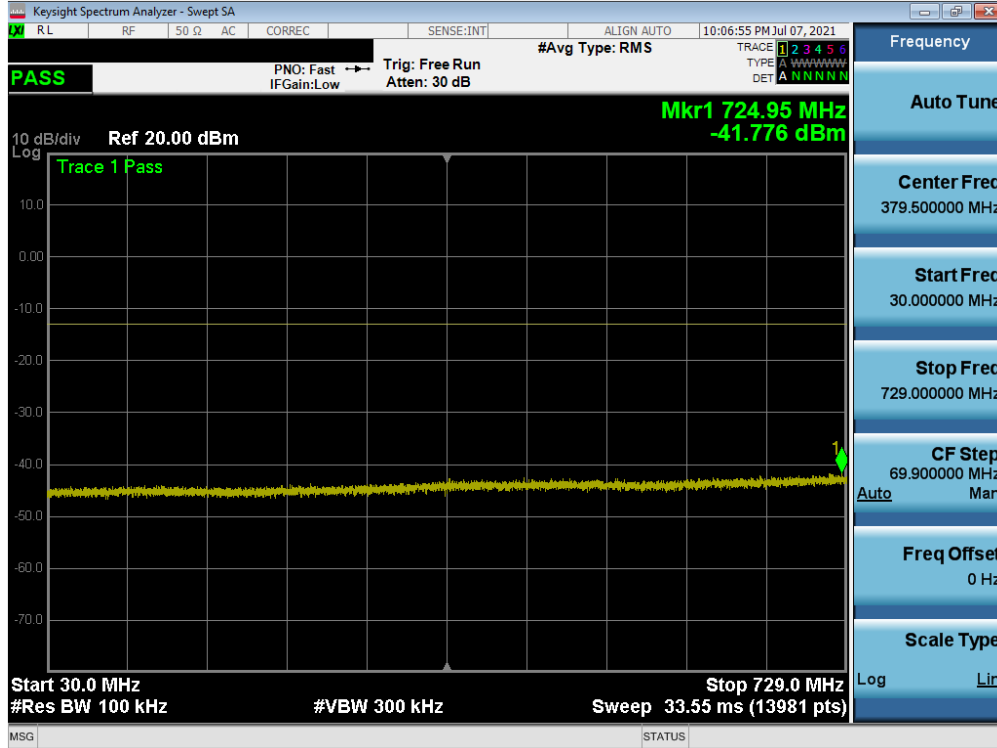


Plot 7-34. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - Mid Channel)

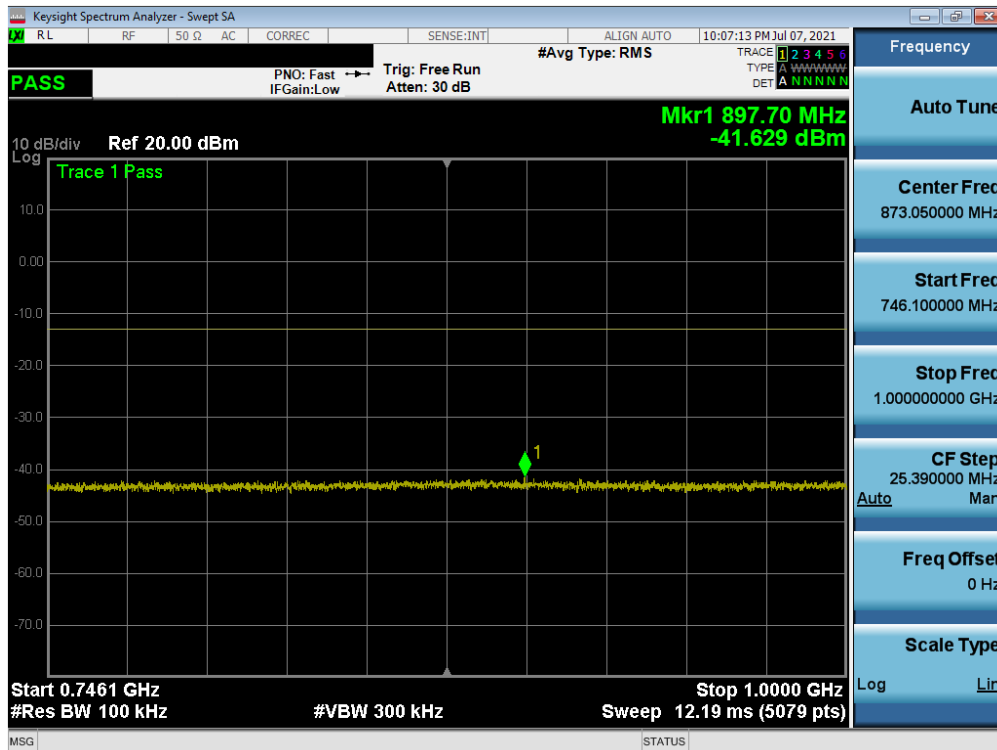


Plot 7-35. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - Mid Channel)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 33 of 65

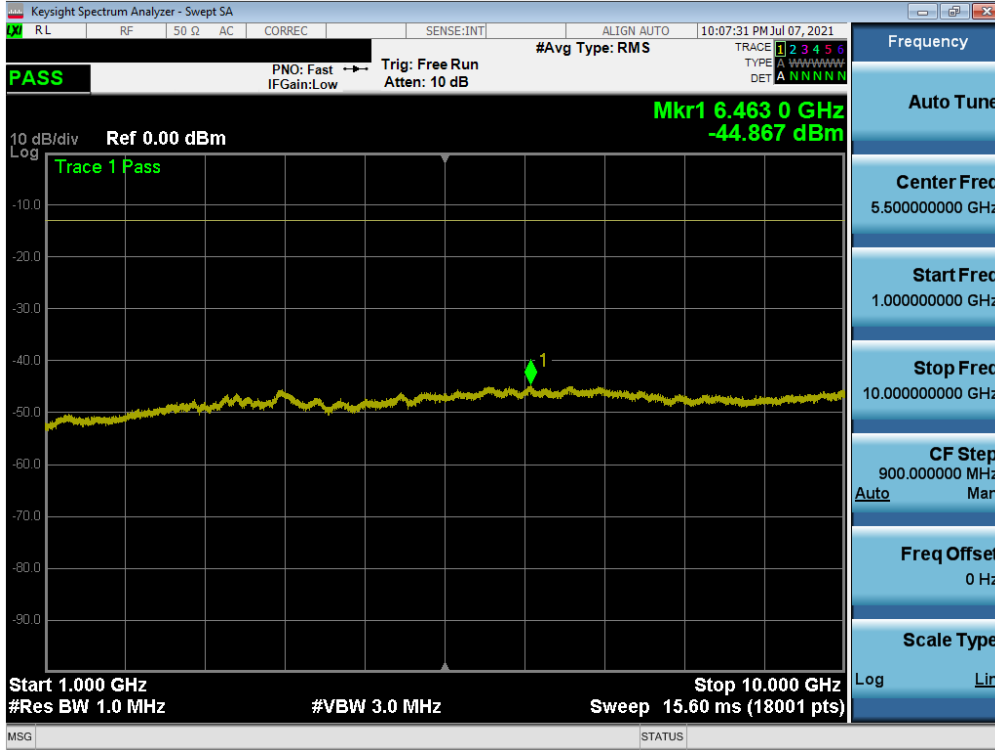


Plot 7-36. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - High Channel)




Plot 7-37. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - High Channel)

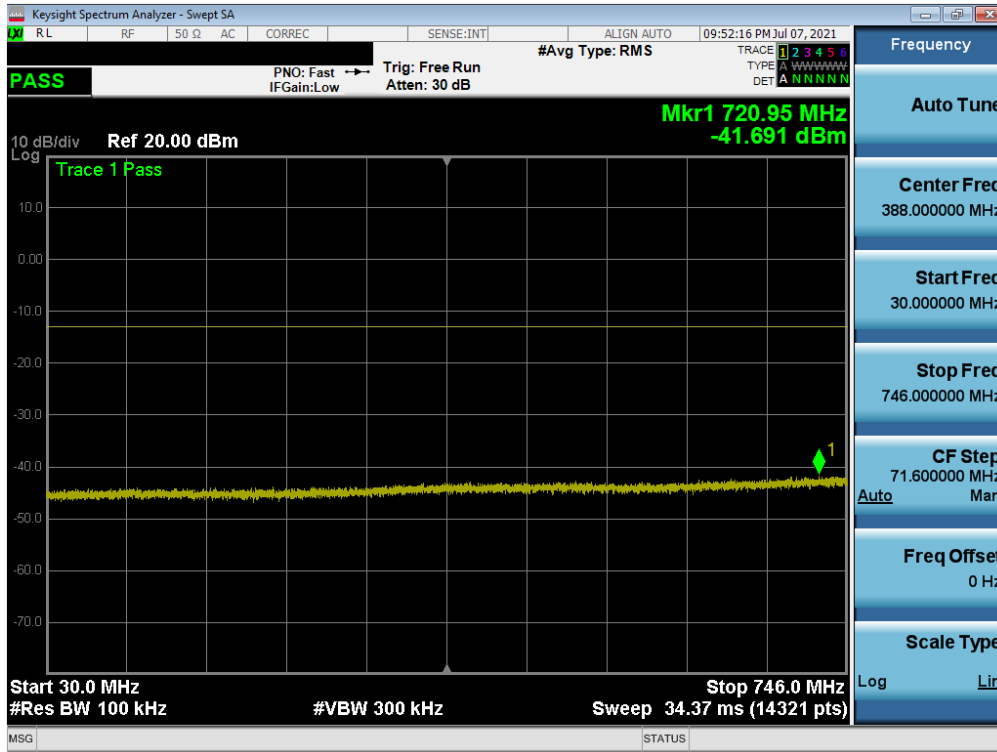
FCC ID: QLJMRU-060785	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 34 of 65



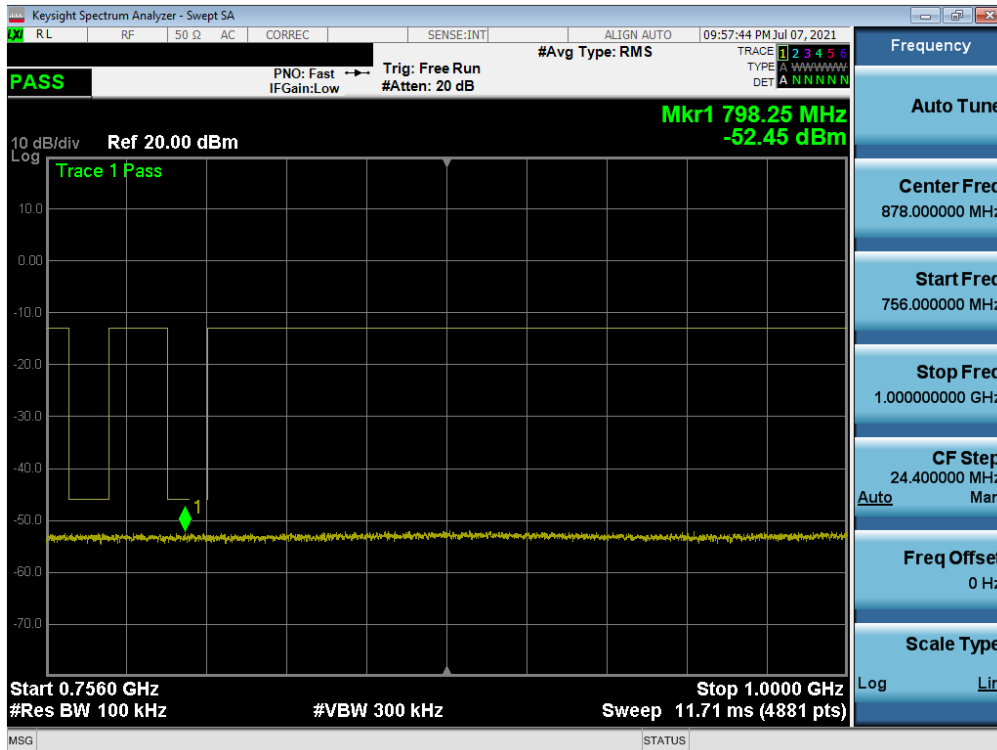
Plot 7-38. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - Full RB - High Channel)

FCC ID: QLJMRU-060785	 <b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 35 of 65


# LTE Band 13

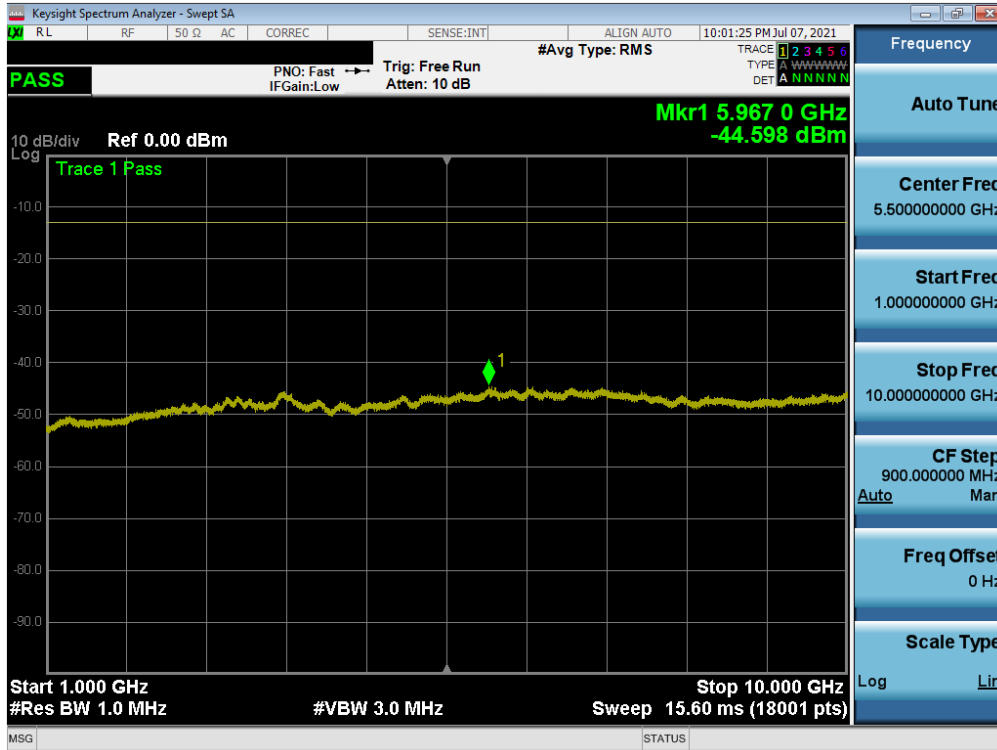


Plot 7-39. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - Full RB)




Plot 7-40. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - Full RB)

FCC ID: QLJMRU-060785	 PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU
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Plot 7-41. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - Full RB)

FCC ID: QLJMRU-060785	 <b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 37 of 65

## 7.5 Band Edge Emissions at Antenna Terminal

### Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

**The minimum permissible attenuation level of any spurious emission is  $43 + 10 \log_{10}(P_{\text{Watts}})$ , where  $P$  is the transmitter power in Watts.**

### Test Procedure Used

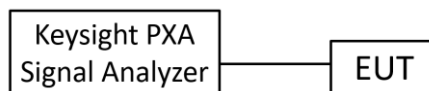
KDB 971168 D01 v03r01 – Section 6.0

### Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW  $\geq$  1% of the emission bandwidth
4. VBW  $\geq$  3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq$  2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.




**Figure 7-4. Test Instrument & Measurement Setup**

### Test Notes

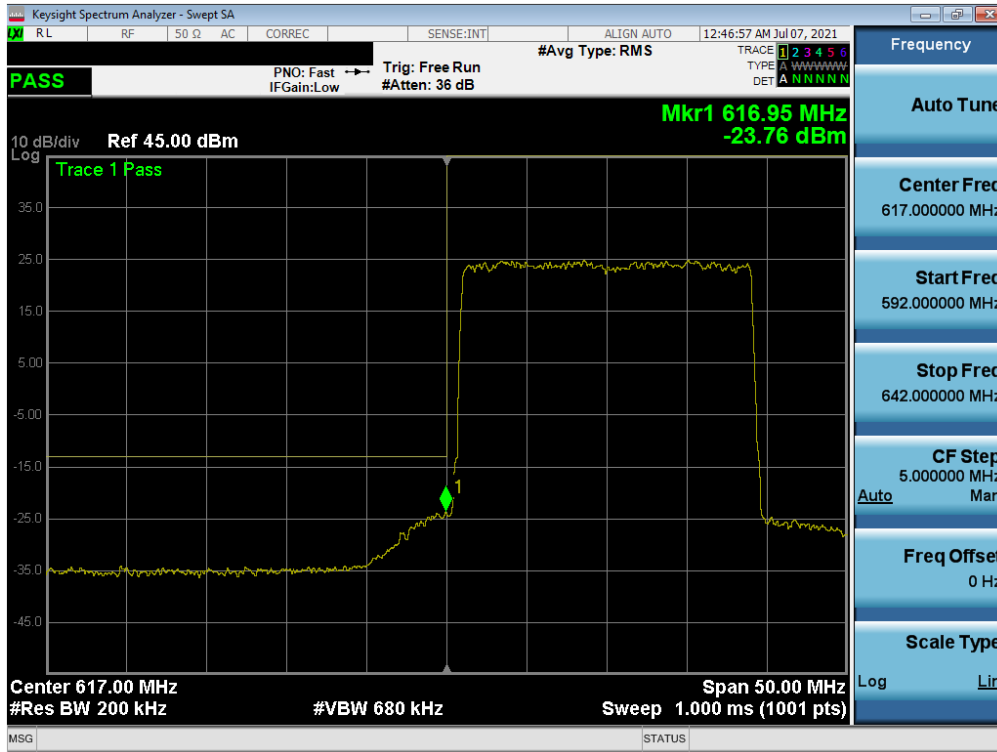
Per 27.53(g) for operations in the 617 – 652MHz and 698 – 746MHz bands, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

Per 27.53(c)(5) for operations in the 746 – 758 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

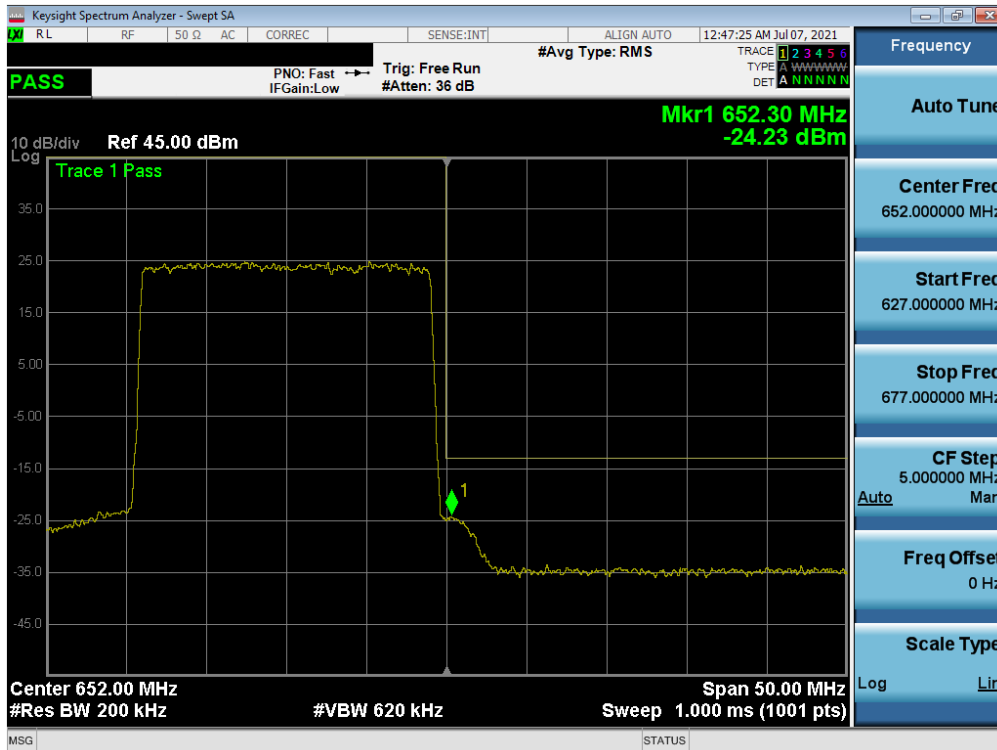
For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c)(3) is  $76 + 10 \log_{10}(P) = -46$  dBm in a 6.25kHz bandwidth.

FCC ID: QLJMRU-060785	 <b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 38 of 65

# LTE Band 71

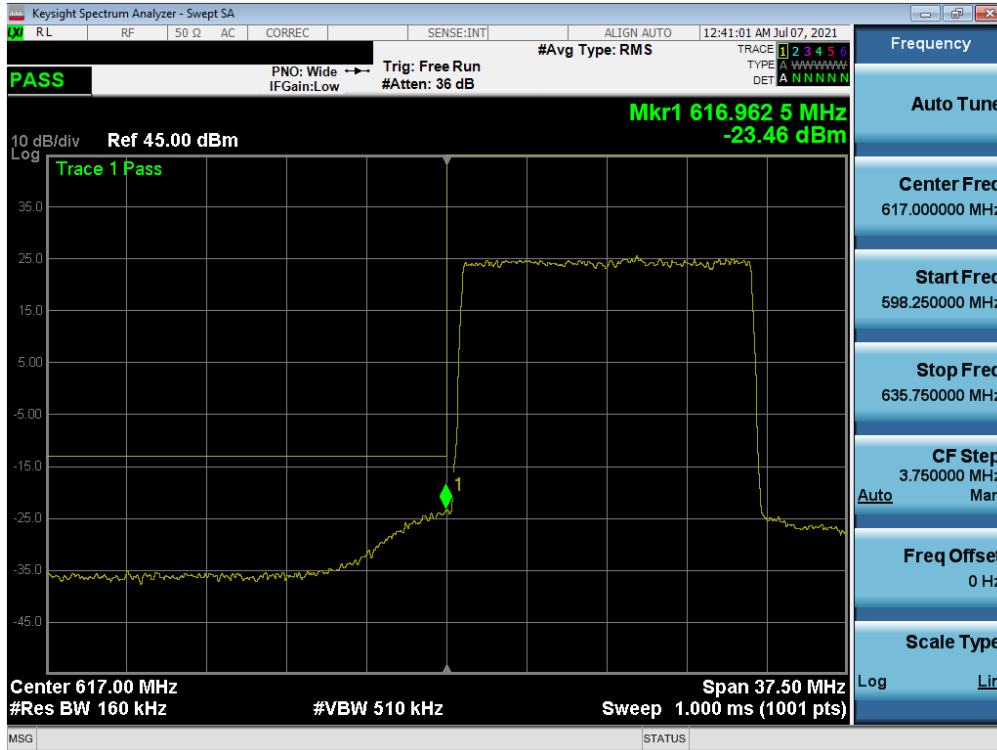


Plot 7-42. Lower Band Edge Plot (LTE Band 71 - 20MHz QPSK – Full RB)

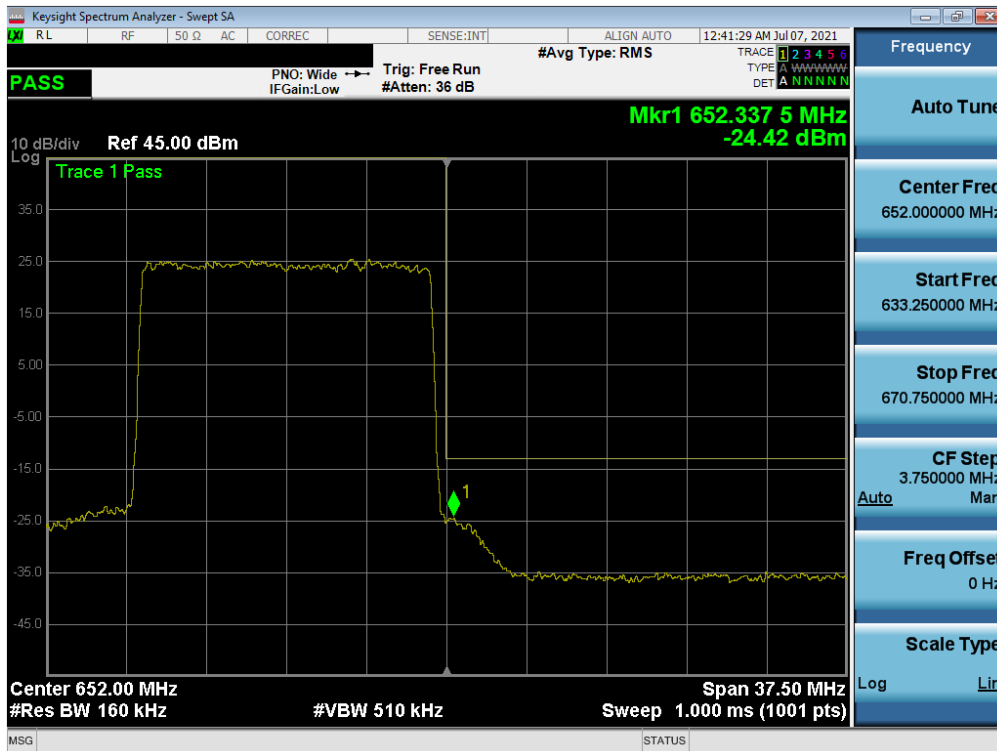


Plot 7-43. Upper Band Edge Plot (LTE Band 71 - 20MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
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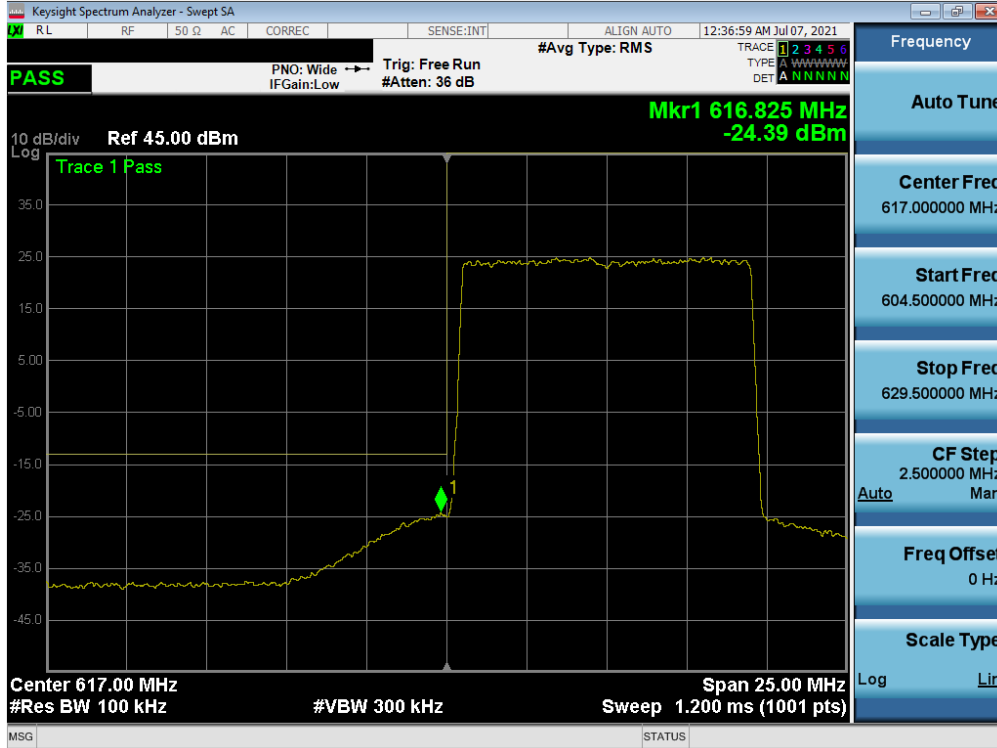
Plot 7-44. Lower Band Edge Plot (LTE Band 71 - 15MHz QPSK – Full RB)



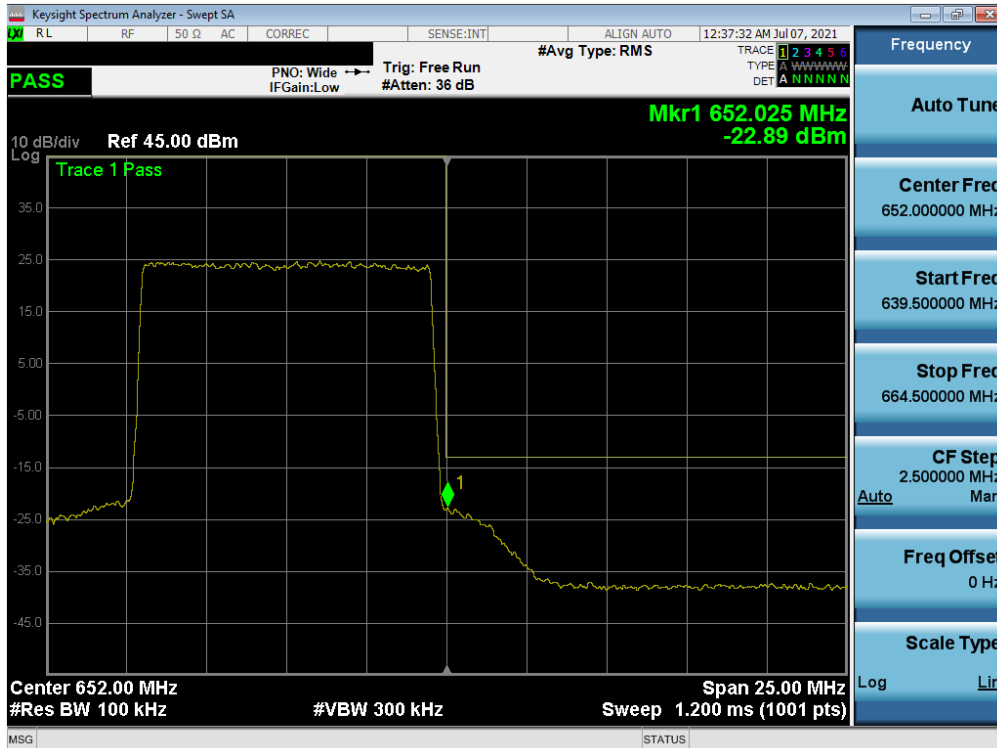
Plot 7-45. Upper Band Edge Plot (LTE Band 71 - 15MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 40 of 65



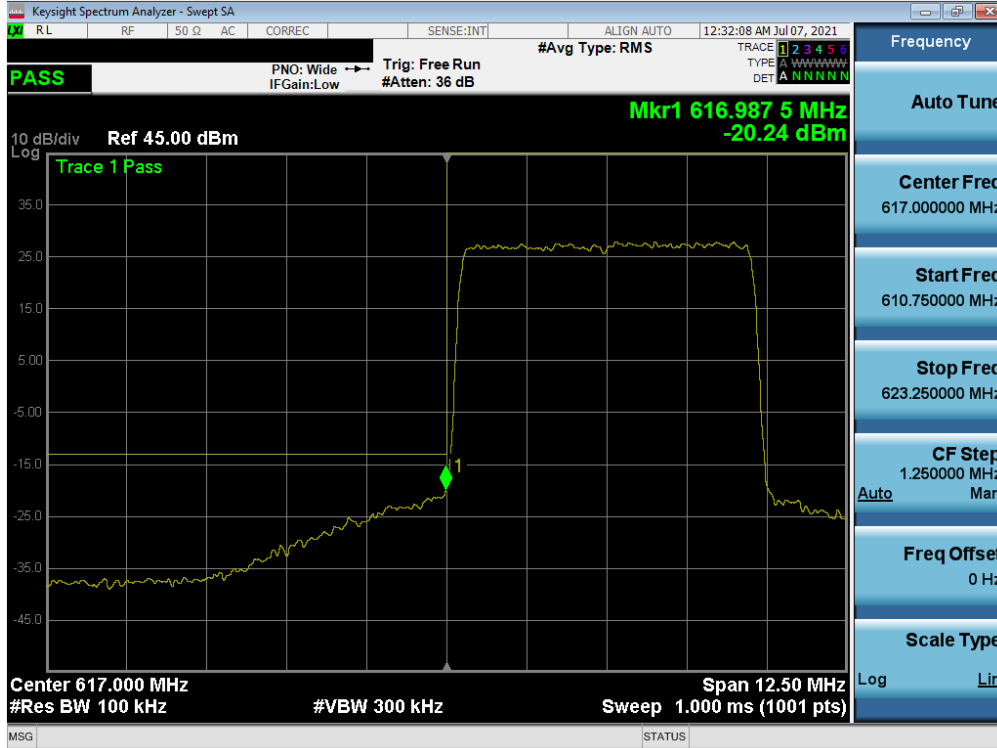


Plot 7-46. Lower Band Edge Plot (LTE Band 71 - 10MHz QPSK – Full RB)



Plot 7-47. Upper Band Edge Plot (LTE Band 71 - 10MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 41 of 65



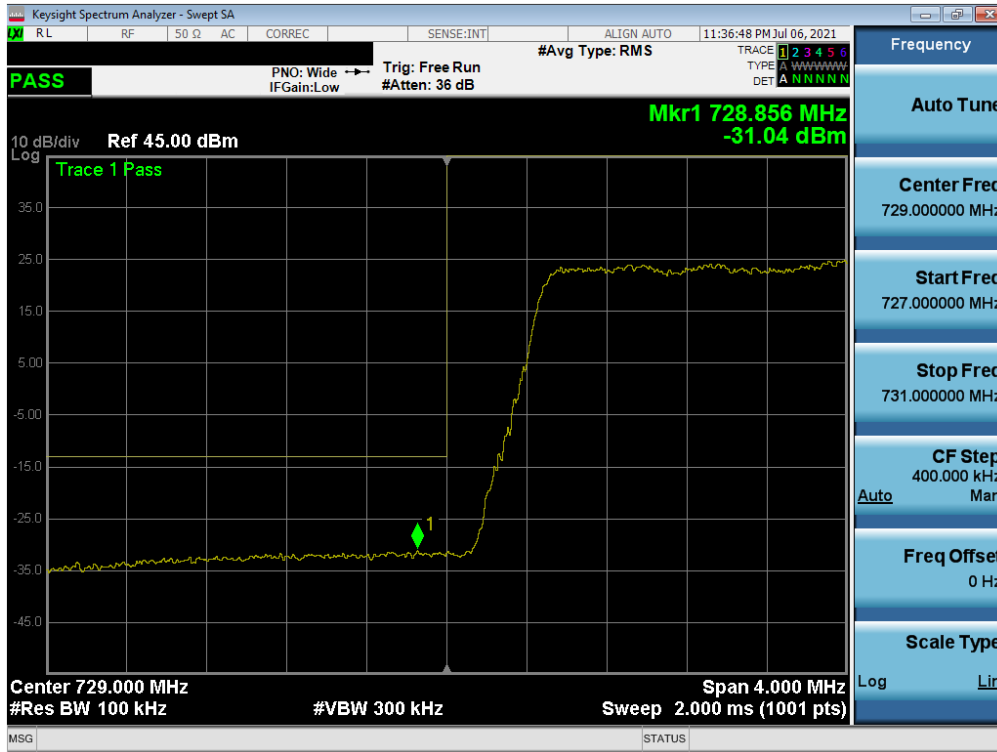
Plot 7-48. Lower Band Edge Plot (LTE Band 71 - 5MHz QPSK – Full RB)



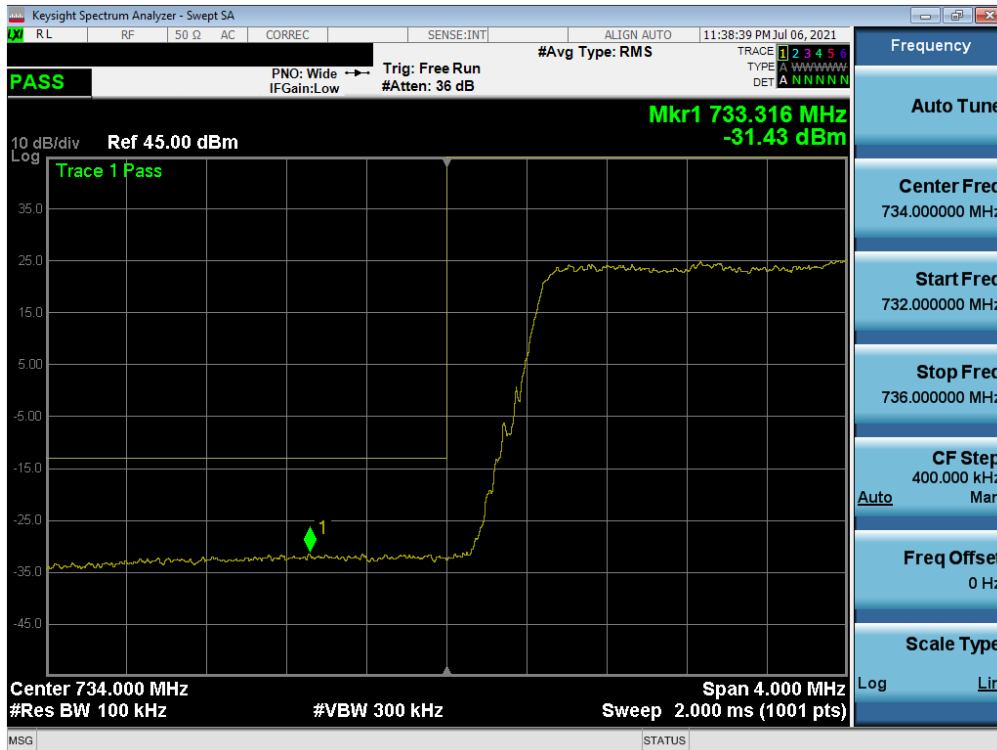
Plot 7-49. Upper Band Edge Plot (LTE Band 71 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 42 of 65

# LTE Band 12/17



Plot 7-50. Lower Band Edge Plot (LTE Band 12 - 10MHz QPSK – Full RB)

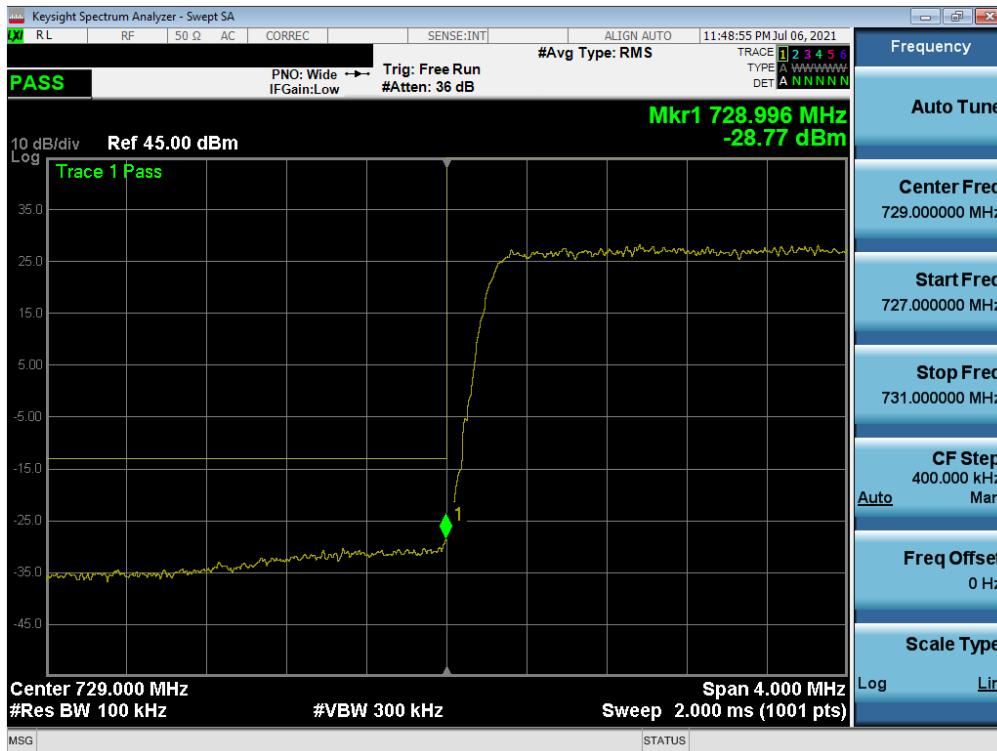


Plot 7-51. Lower Band Edge Plot (LTE Band 17 - 10MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 43 of 65

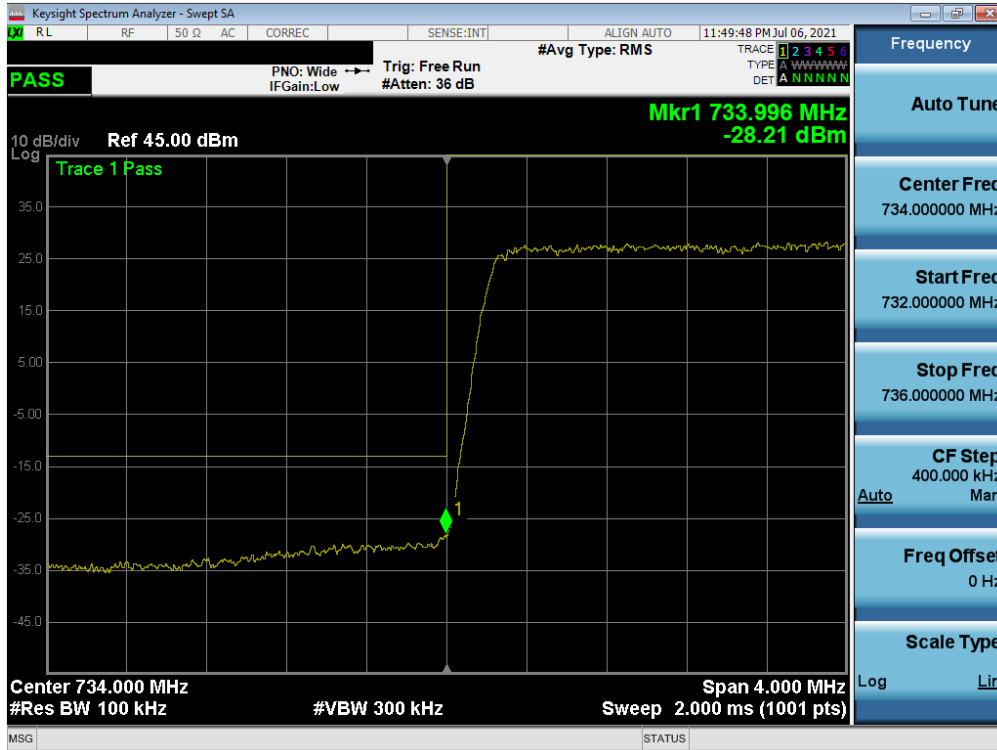


Plot 7-52. Upper Band Edge Plot (LTE Band 12/17 - 10MHz QPSK – Full RB)

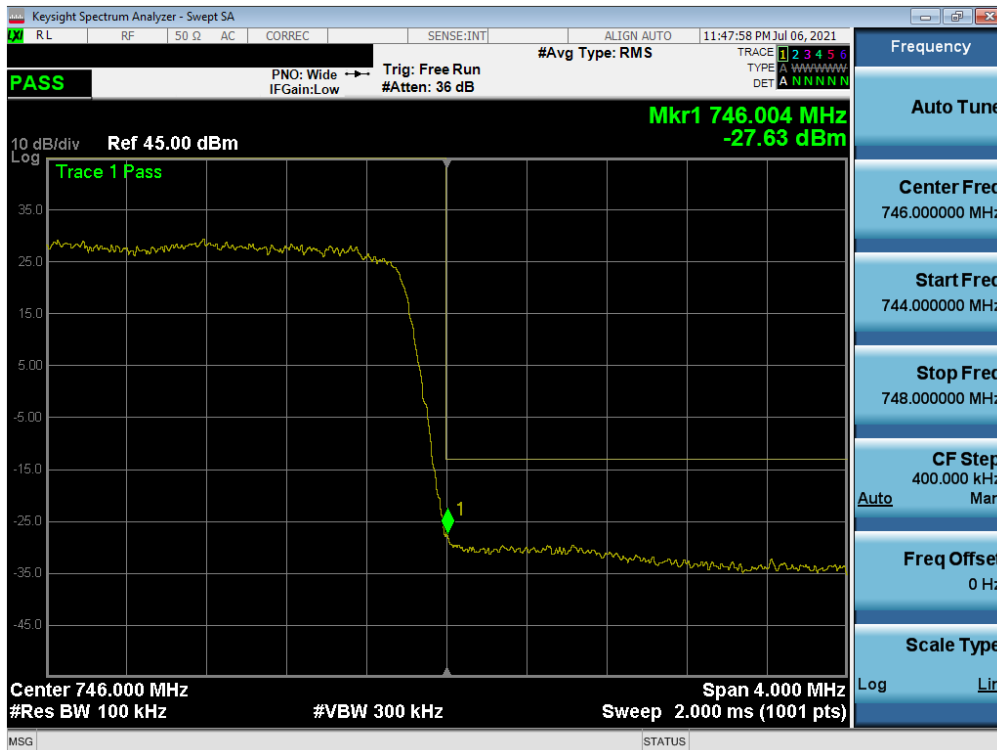


Plot 7-53. Lower Band Edge Plot (LTE Band 12 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU
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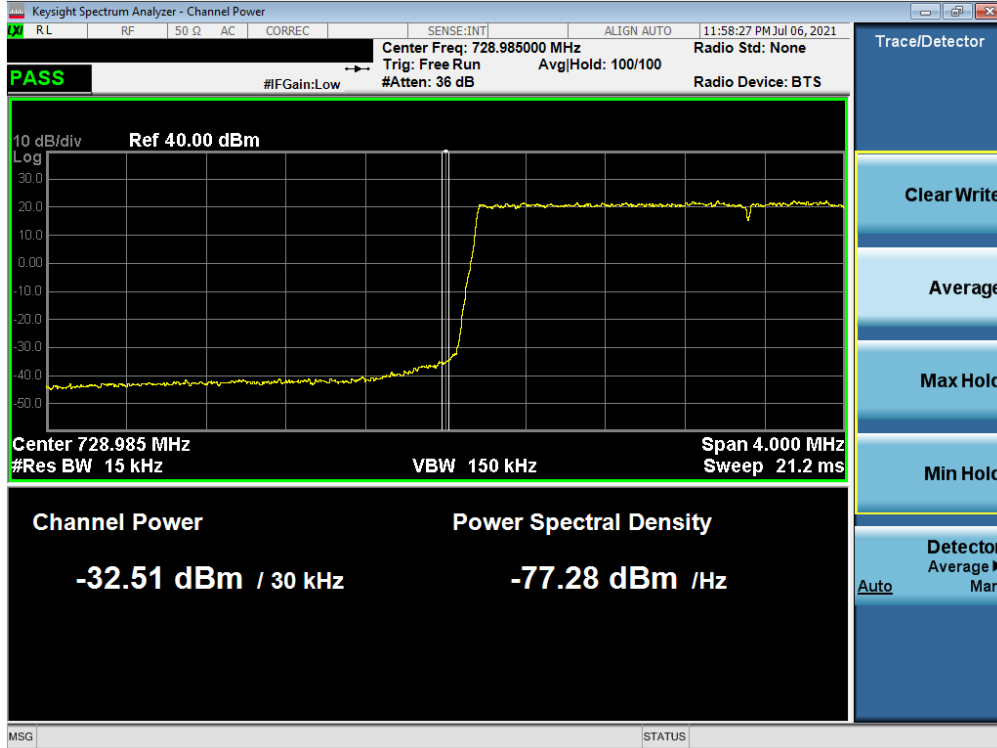


Plot 7-54. Lower Band Edge Plot (LTE Band 17 - 5MHz QPSK – Full RB)

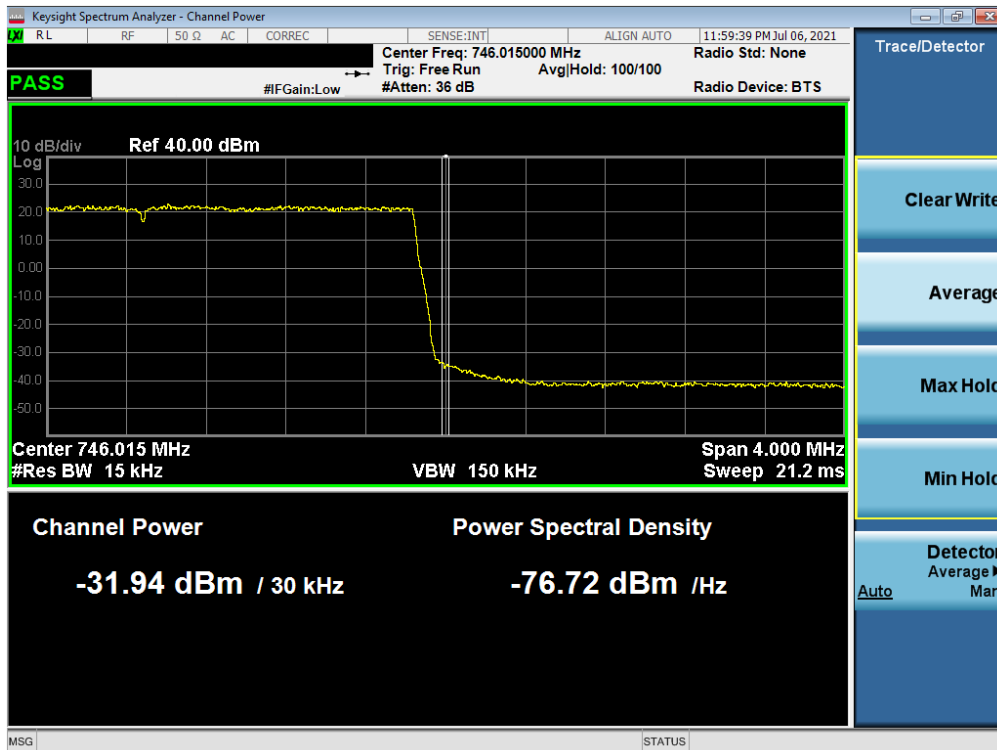


Plot 7-55. Upper Band Edge Plot (LTE Band 12/17 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 45 of 65

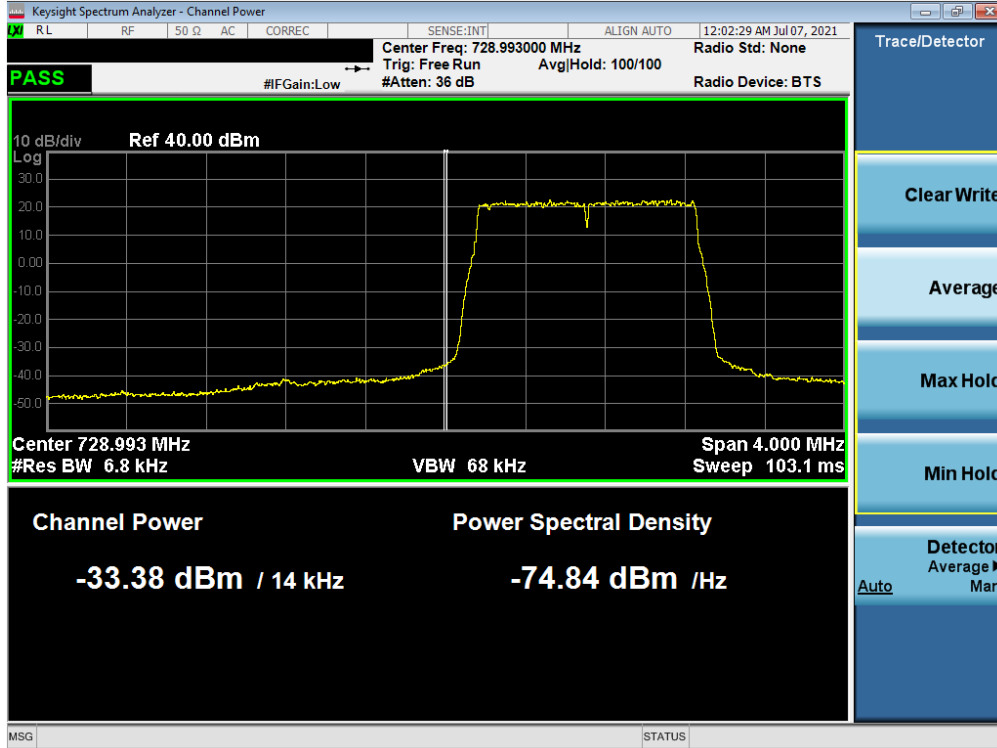


Plot 7-56. Lower Band Edge Plot (LTE Band 12 - 3MHz QPSK – Full RB)

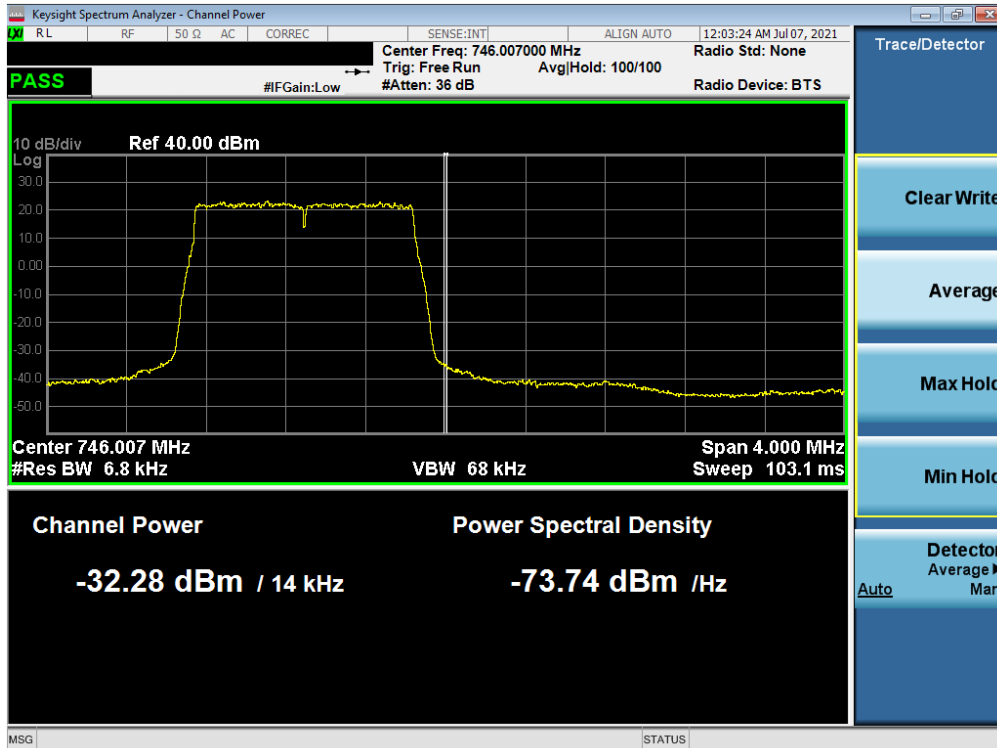


Plot 7-57. Upper Band Edge Plot (LTE Band 12 - 3MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 46 of 65



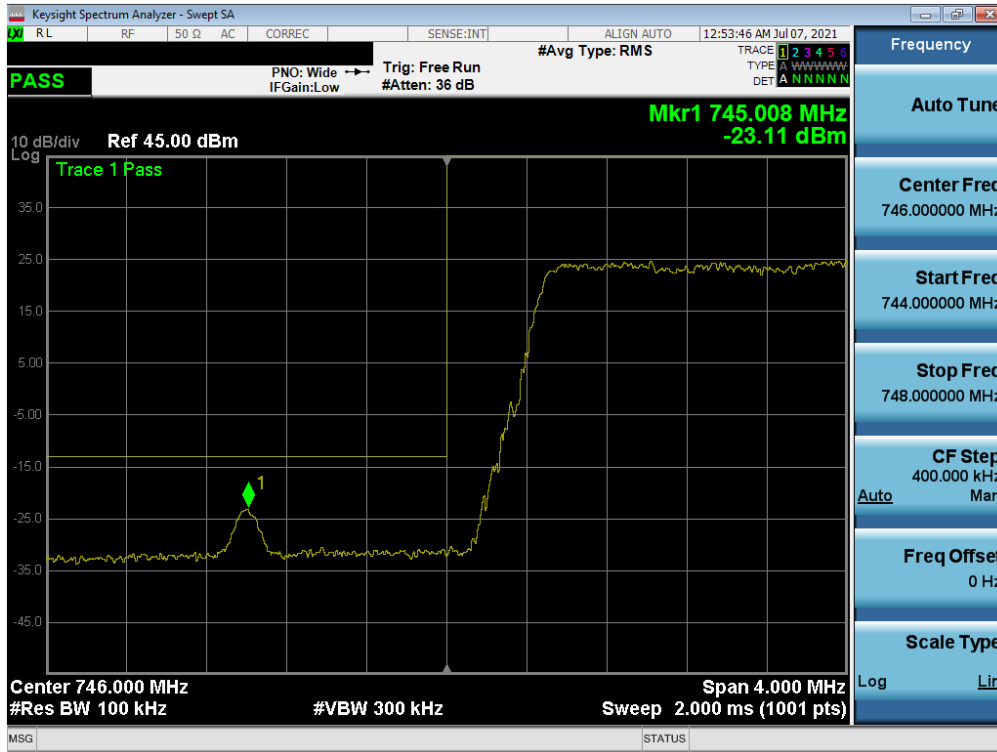
Plot 7-58. Lower Band Edge Plot (LTE Band 12 – 1.4MHz QPSK – Full RB)



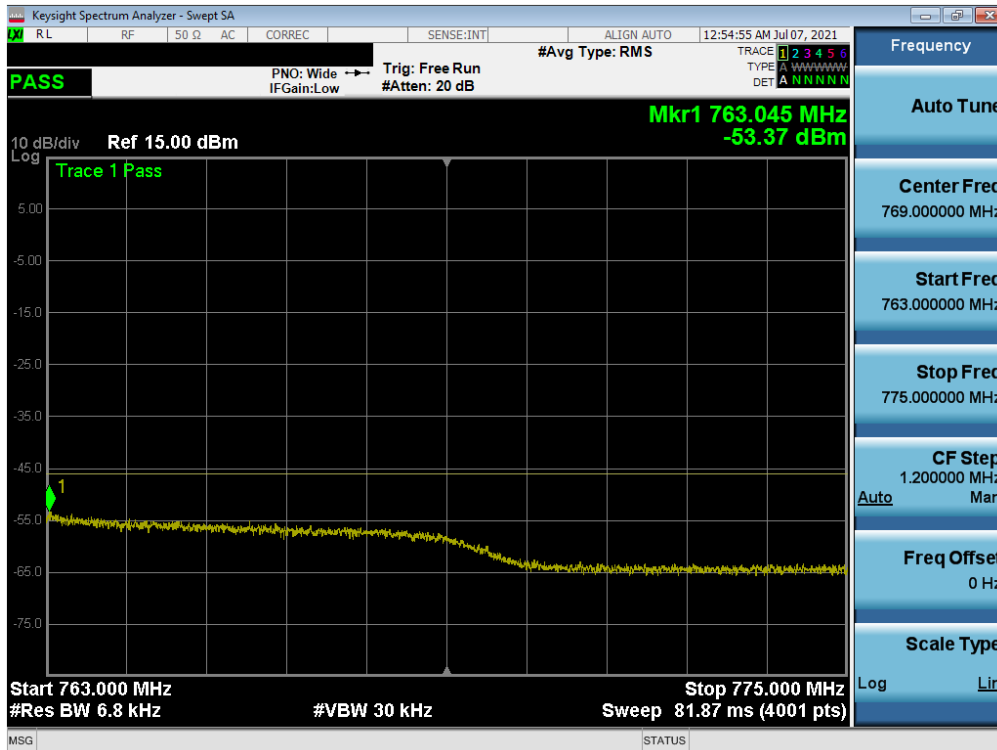
Plot 7-59. Upper Band Edge Plot (LTE Band 12 – 1.4MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
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# LTE Band 13



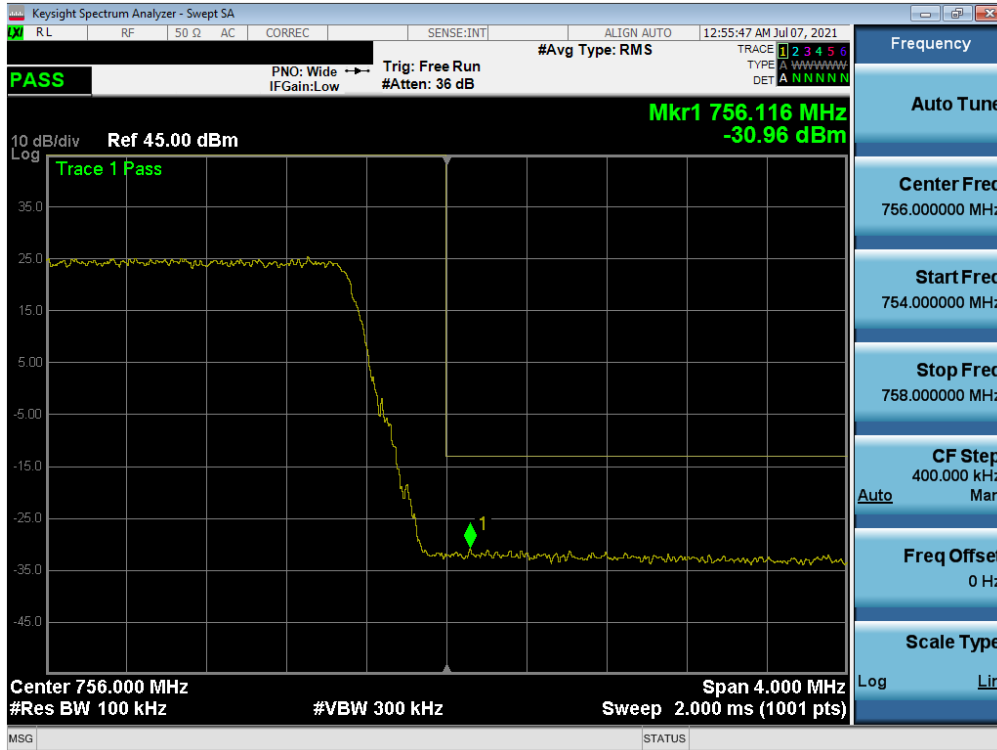
Plot 7-60. Lower Band Edge Plot (LTE Band 13 - 10MHz QPSK – Full RB)



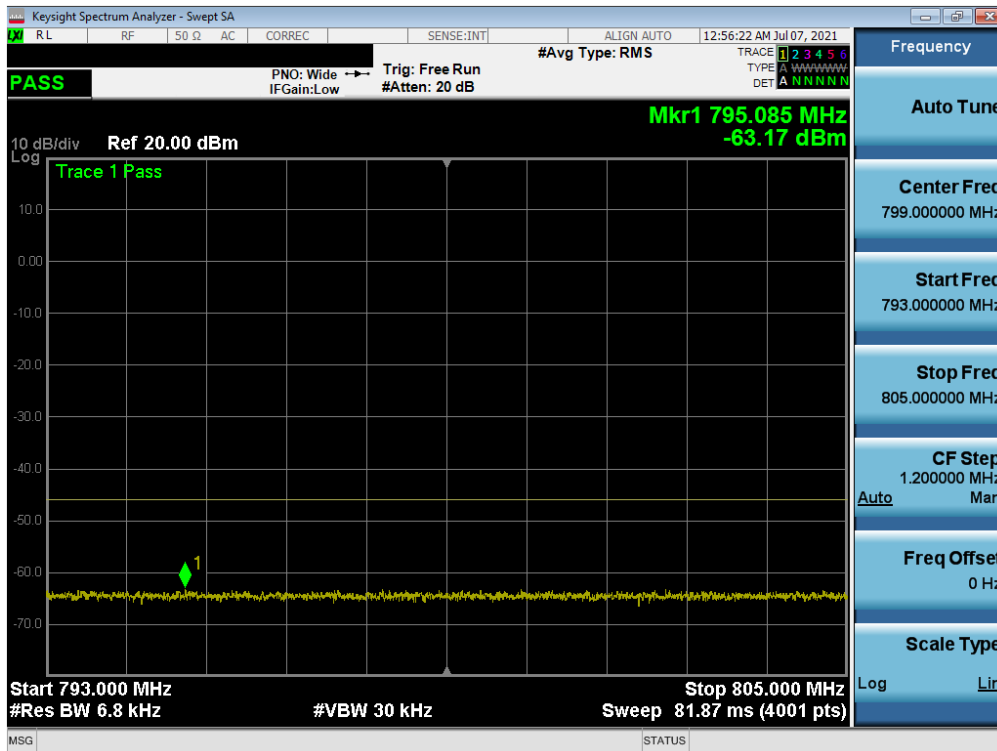
Plot 7-61. Lower Emission Mask Plot (LTE Band 13 - 10MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU
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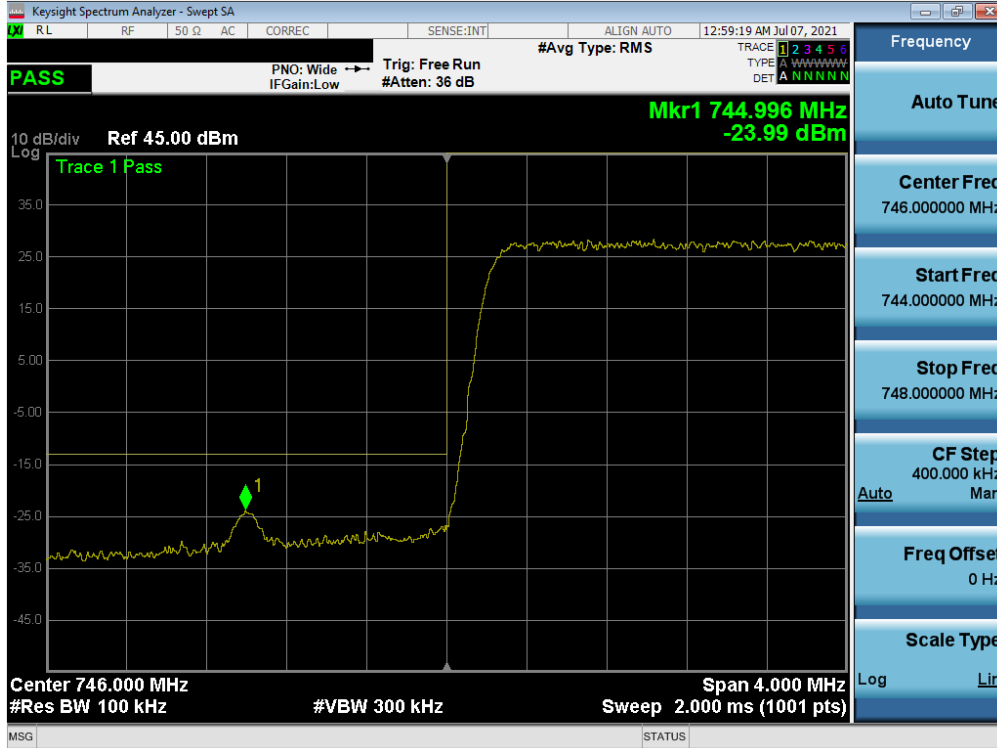


Plot 7-62. Upper Band Edge Plot (LTE Band 13 - 10MHz QPSK – Full RB)

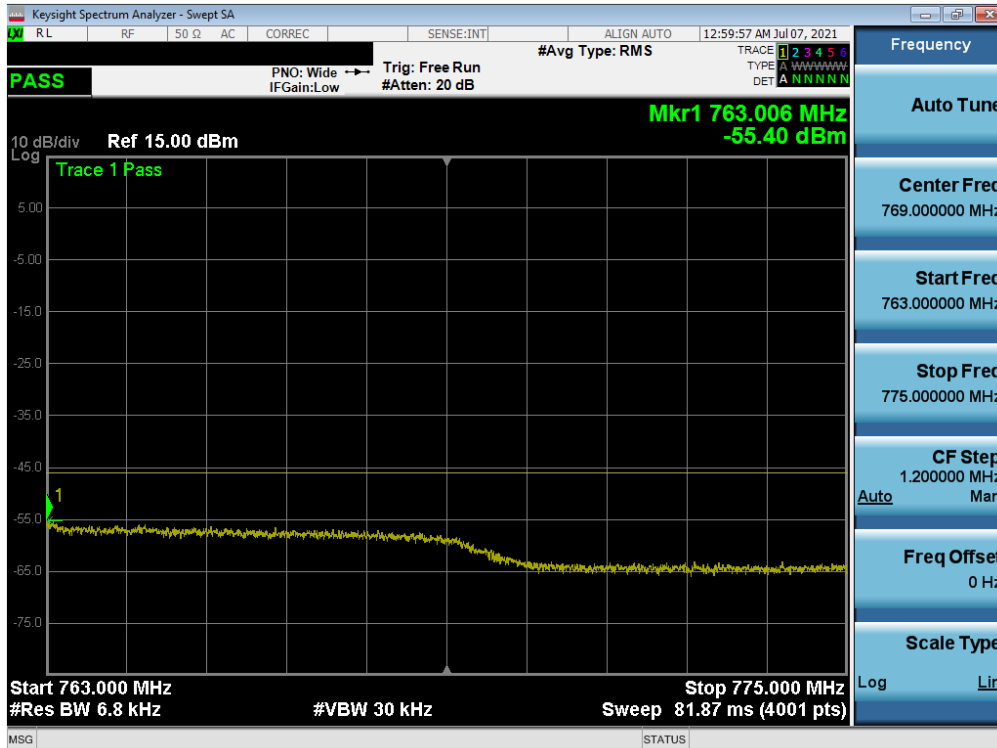


Plot 7-63. Upper Emission Mask Plot (LTE Band 13 - 10MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/03 - 08/04/2021	EUT Type: Low Band mRU	Page 49 of 65

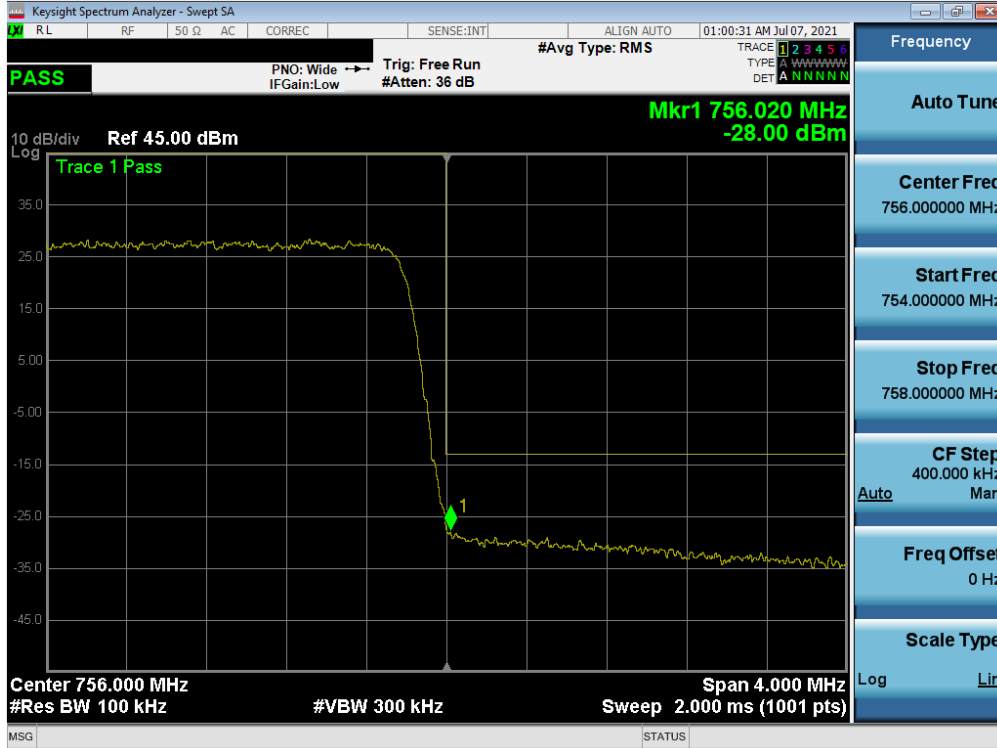


Plot 7-64. Lower Band Edge Plot (LTE Band 13 - 5MHz QPSK – Full RB)

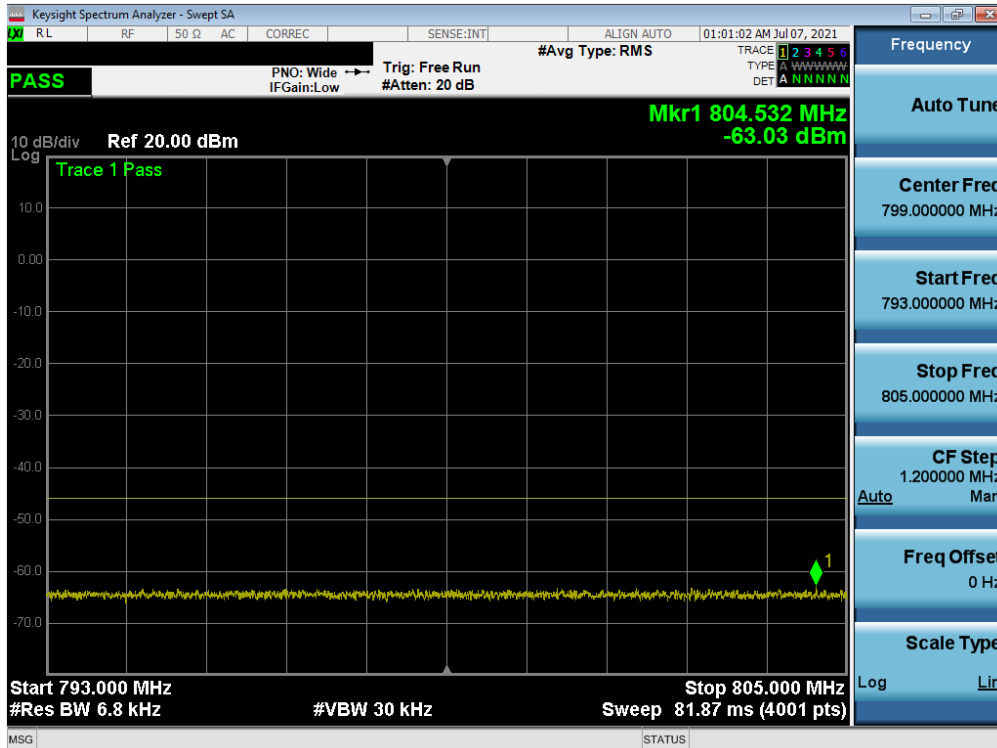


Plot 7-65. Lower Emission Mask Plot (LTE Band 13 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-66. Upper Band Edge Plot (LTE Band 13 - 5MHz QPSK – Full RB)



Plot 7-67. Upper Emission Mask Plot (LTE Band 13 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-060785	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
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## 7.6 Radiated Spurious Emissions Measurements

### Test Overview


Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting with a RF port terminated by a 50-ohm load. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

### Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

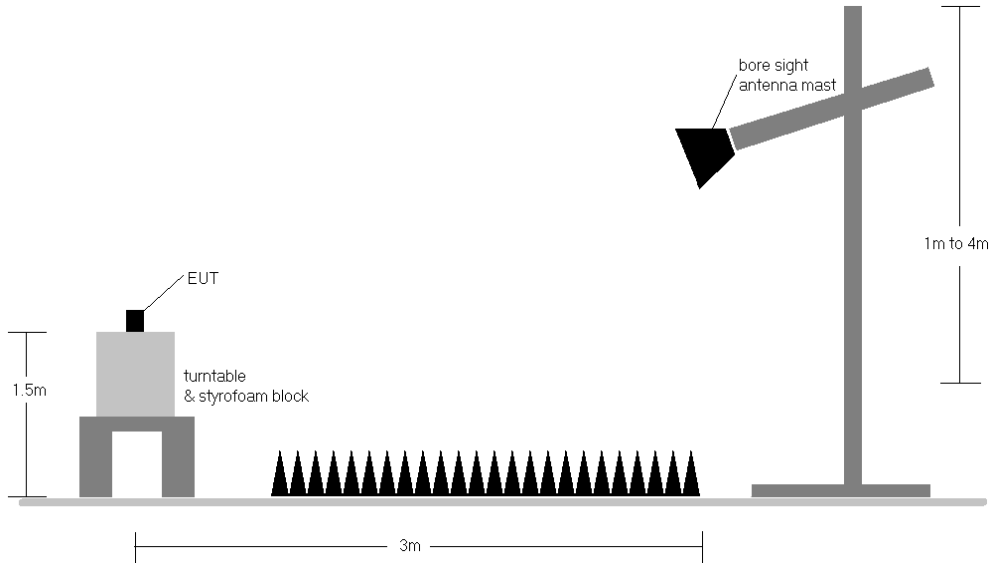
### Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW  $\geq 3 \times$  RBW
3. Span = 1.5 times the OBW
4. No. of sweep points  $\geq 2 \times$  span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

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**Test Setup**

The EUT and measurement equipment were set up as shown in the diagram below.



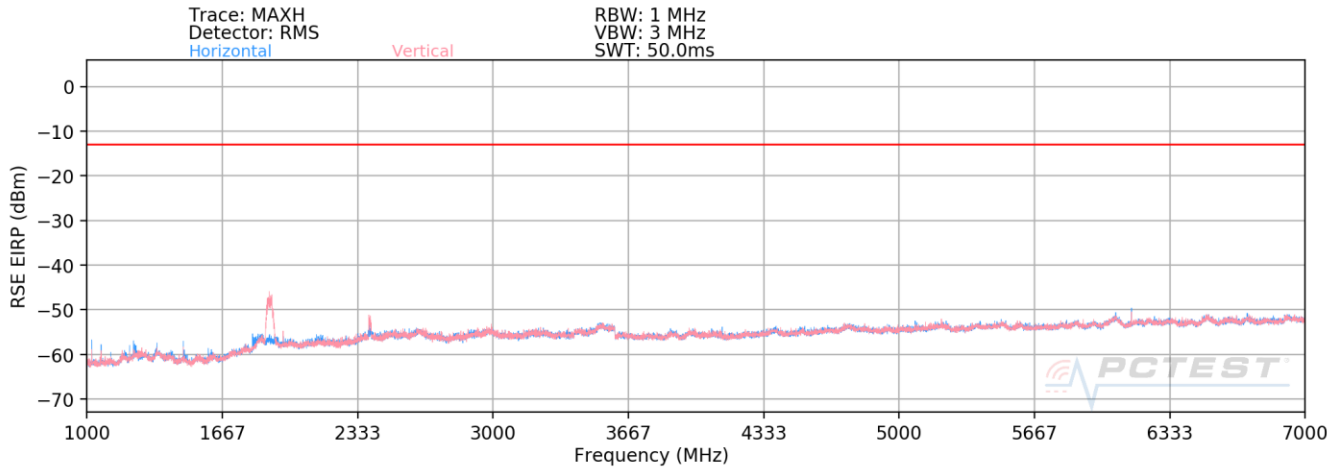
**Figure 7-5. Test Instrument & Measurement Setup >1 GHz**

**Test Notes**

- 1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
  - a)  $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
  - b)  $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$ ; where D is the measurement distance in meters.
- 2) The EUT was tested in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
- 3) This unit was tested with an external 120 VAC power source
- 4) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 5) The EUT was also tested with all four LTE bands transmitting at the same time for a total of 80W output power. The worst-case emissions are reported.
- 6) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
- 7) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

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<b>Test Report S/N:</b> 1M2106040064-02.QLJ	<b>Test Dates:</b> 06/03 - 08/04/2021	<b>EUT Type:</b> Low Band mRU	Page 53 of 65

## LTE Band 71



Plot 7-68. Radiated Spurious Plot (LTE Band 71)

Bandwidth (MHz):	20
Frequency (MHz):	627.0
RB / Offset:	100 / 0


Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1254.0	V	210	127	-69.97	-1.85	35.18	-60.08	-13.00	-47.08
1881.0	V	187	358	-57.68	1.14	50.46	-44.80	-13.00	-31.80
2508.0	V	-	-	-76.46	2.22	32.76	-62.50	-13.00	-49.50
3135.0	V	-	-	-77.16	2.36	32.20	-63.06	-13.00	-50.06
3762.0	V	-	-	-77.82	3.27	32.45	-62.81	-13.00	-49.81

Table 7-5. Radiated Spurious Data (LTE Band 71 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	634.5
RB / Offset:	100 / 0


Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1269.0	V	135	362	-73.24	-1.62	32.14	-63.12	-13.00	-50.12
1903.5	V	182	8	-60.55	0.64	47.09	-48.17	-13.00	-35.17
2538.0	V	-	-	-76.20	2.30	33.10	-62.15	-13.00	-49.15
3172.5	V	-	-	-75.91	2.87	33.96	-61.30	-13.00	-48.30
3807.0	V	-	-	-76.33	3.14	33.81	-61.45	-13.00	-48.45

Table 7-6. Radiated Spurious Data (LTE Band 71 – Mid Channel)

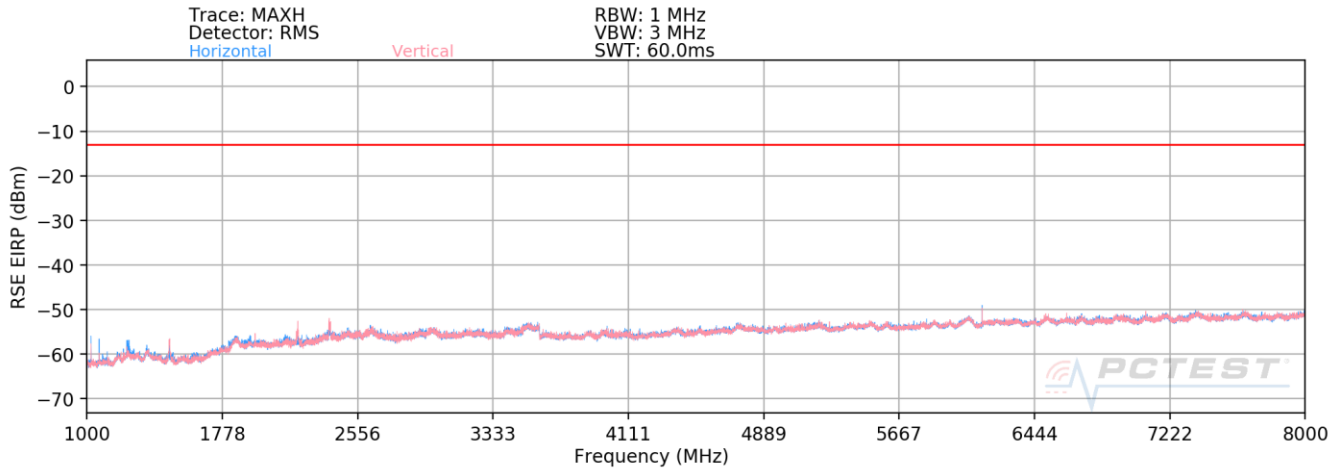
FCC ID: QLJMRU-060785	 PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
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Bandwidth (MHz):	20								
Frequency (MHz):	642.0								
RB / Offset:	100 / 0								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1284.0	V	-	-	-75.57	-1.63	29.80	-65.46	-13.00	-52.46
1926.0	V	257	356	-61.32	0.58	46.26	-48.99	-13.00	-35.99
2568.0	V	-	-	-76.91	2.45	32.54	-62.71	-13.00	-49.71
3210.0	V	-	-	-77.56	2.74	32.18	-63.08	-13.00	-50.08
3852.0	V	-	-	-75.46	3.12	34.66	-60.60	-13.00	-47.60

**Table 7-7. Radiated Spurious Data (LTE Band 71 – High Channel)**

FCC ID: QLJMRU-060785	 <b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
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## LTE Band 12/17



Plot 7-69. Radiated Spurious Plot (LTE Band 12/17)

Bandwidth (MHz):	10
Frequency (MHz):	734.0
RB / Offset:	50 / 0


Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1468.0	V	143	325	-65.98	-2.61	38.41	-56.85	-13.00	-43.85
2202.0	V	142	12	-60.84	1.13	47.29	-47.97	-13.00	-34.97
2936.0	V	-	-	-76.63	2.82	33.19	-62.07	-13.00	-49.07
3670.0	V	-	-	-77.18	3.37	33.19	-62.07	-13.00	-49.07
4404.0	V	-	-	-77.23	4.58	34.35	-60.91	-13.00	-47.91

Table 7-8. Radiated Spurious Data (LTE Band 12/17 – Low Channel)

Bandwidth (MHz):	10
Frequency (MHz):	737.5
RB / Offset:	50 / 0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1475.0	V	193	323	-67.51	-2.67	36.82	-58.43	-13.00	-45.43
2212.5	V	160	313	-70.47	0.90	37.43	-57.83	-13.00	-44.83
2950.0	V	-	-	-76.56	3.01	33.45	-61.81	-13.00	-48.81
3687.5	V	-	-	-76.88	3.12	33.24	-62.02	-13.00	-49.02
4425.0	V	-	-	-77.31	4.12	33.81	-61.45	-13.00	-48.45


Table 7-9. Radiated Spurious Data (LTE Band 12/17 – Mid Channel)

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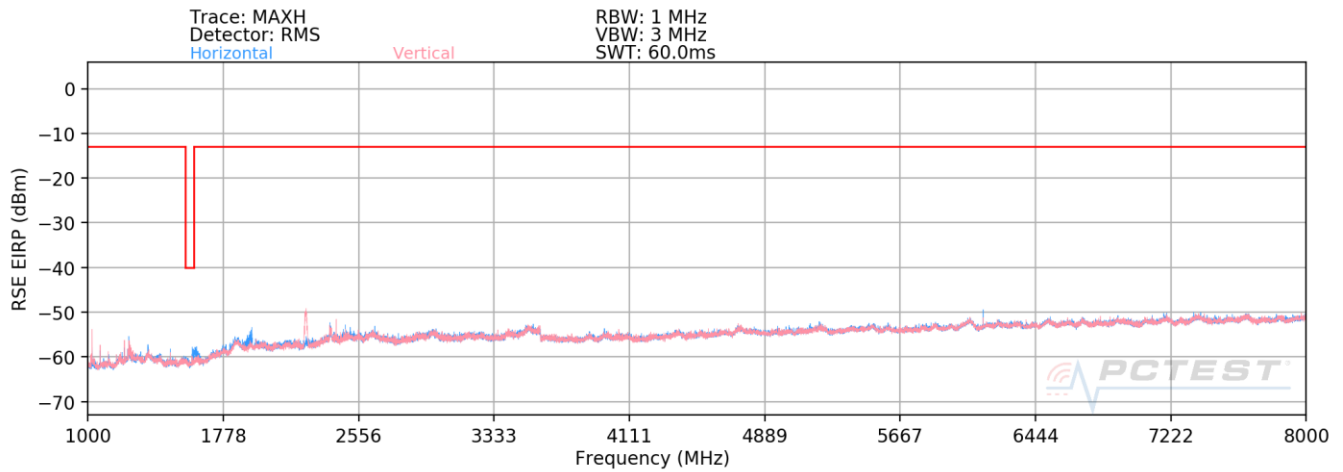


Bandwidth (MHz):	10								
Frequency (MHz):	741.0								
RB / Offset:	50 / 0								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1482.0	V	264	327	-67.17	-2.72	37.11	-58.15	-13.00	-45.15
2223.0	V	113	328	-64.41	0.67	43.26	-52.00	-13.00	-39.00
2964.0	V	122	339	-75.59	3.36	34.77	-60.49	-13.00	-47.49
3705.0	V	-	-	-77.89	3.05	32.16	-63.10	-13.00	-50.10
4446.0	V	-	-	-78.01	4.12	33.11	-62.15	-13.00	-49.15
5187.0	V	-	-	-78.90	6.04	34.14	-61.12	-13.00	-48.12

**Table 7-10. Radiated Spurious Data (LTE Band 12/17 – High Channel)**

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## LTE Band 13



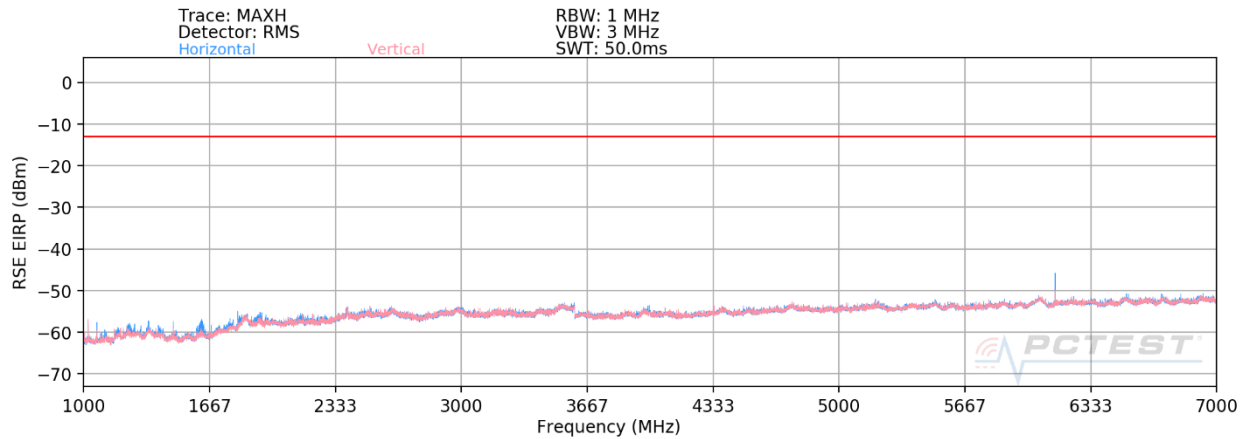
Plot 7-70. Radiated Spurious Plot (LTE Band 13)

Bandwidth (MHz):	10								
Frequency (MHz):	751.0								
RB / Offset:	50 / 0								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1502.0	V	-	-	-75.16	-2.99	28.85	-66.40	-13.00	-53.40
2253.0	V	188	336	-64.62	0.83	43.21	-52.05	-13.00	-39.05
3004.0	V	183	80	-71.15	3.15	39.00	-56.25	-13.00	-43.25
3755.0	V	-	-	-76.47	3.21	33.74	-61.51	-13.00	-48.51
4506.0	V	-	-	-77.57	4.34	33.77	-61.49	-13.00	-48.49
5257.0	V	-	-	-78.56	5.20	33.64	-61.61	-13.00	-48.61
6008.0	V	167	46	-75.31	6.52	38.21	-57.05	-13.00	-44.05
6759.0	V	396	187	-77.03	7.17	37.14	-58.12	-13.00	-45.12

Table 7-11. Radiated Spurious Data (LTE Band 13 – Mid Channel)

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## LTE Band 71 – 12 – 14 – 26



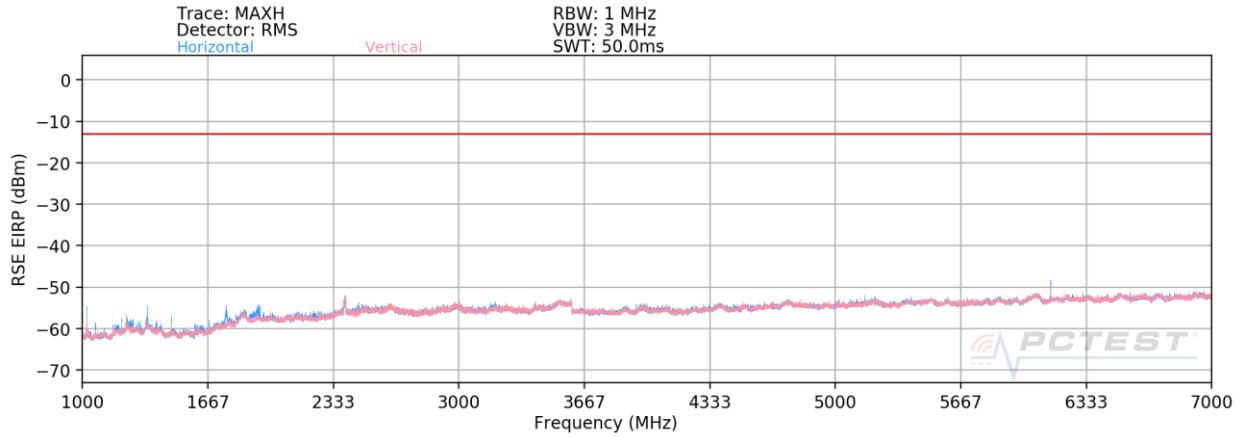
**Plot 7-71. Radiated Spurious Plot (LTE Band 71 – 12 – 14 – 26)**

<b>Mode:</b>	LTE Band 71 + 12 + 14 + 26								
<b>Bandwidth (MHz):</b>	20 + 10 + 10 + 15								
<b>Frequency (MHz):</b>	634.5 + 737.5 + 763 + 881.5								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1023.5	H	149	347	-67.43	-3.76	35.81	-59.45	-13.00	-46.45
1070.3	H	136	346	-65.65	-3.42	37.93	-57.32	-13.00	-44.32
1966.1	H	269	287	-69.66	1.04	38.38	-56.88	-13.00	-43.88
6144.0	H	180	174	-64.93	6.70	48.77	-46.49	-13.00	-33.49
7052.0	H	-	-	-78.54	7.12	35.58	-59.68	-13.00	-46.68

**Table 7-12. Radiated Spurious Data (LTE Band 71 – 12 – 14 – 26) – Mid Channel)**

<b>FCC ID:</b> QLJMRU-060785	 PART 27 MEASUREMENT REPORT		<b>Approved by:</b> Technical Manager
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# LTE Band 71 – 17 – 13 – 5



**Plot 7-72. Radiated Spurious Plot (LTE Band 71 – 17 – 13 – 5)**

<b>Mode:</b>		LTE Band 71 + 17 + 13 + 5							
<b>Bandwidth (MHz):</b>		20 + 10 + 10 + 10							
<b>Frequency (MHz):</b>		634.5 + 740 + 751 + 881.5							
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1023.9	H	141	244	-66.64	-3.75	36.61	-58.65	-13.00	-45.65
1303.0	H	248	37	-68.07	-2.02	36.91	-58.35	-13.00	-45.35
1966.0	H	146	155	-73.89	1.04	34.15	-61.11	-13.00	-48.11
2388.0	H	-	-	-75.97	2.02	33.05	-62.21	-13.00	-49.21
6144.0	H	383	164	-64.33	6.70	49.37	-45.89	-13.00	-32.89
7052.0	H	-	-	-78.85	7.12	35.27	-59.99	-13.00	-46.99

**Table 7-13. Radiated Spurious Data (LTE Band 71 – 17 – 13 – 5) – Mid Channel)**

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## 7.7 Frequency Stability / Temperature Variation

### Test Overview and Limit

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.

***For Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.***

### Test Procedure Used

ANSI/TIA-603-E-2016

### Test Settings


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.

### Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

### Test Notes

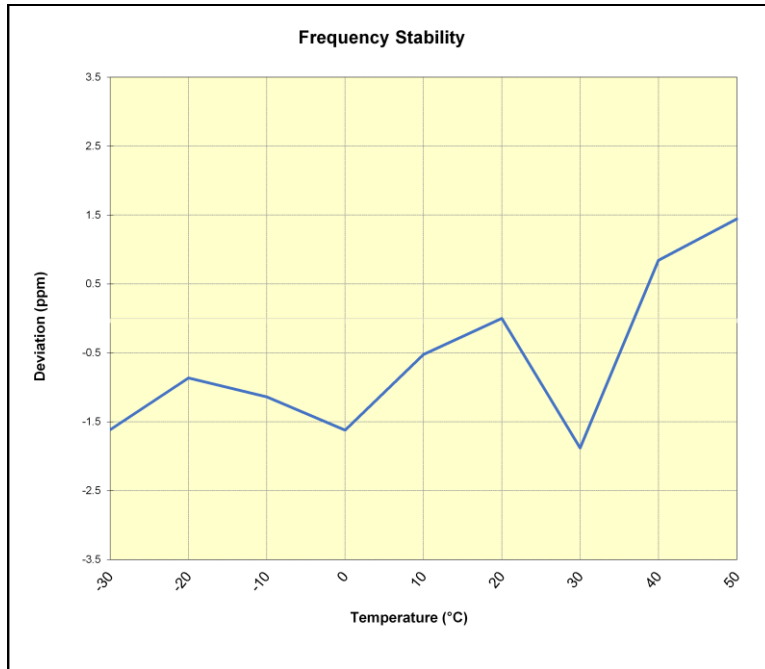
None

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# LTE Band 71

Operating Frequency (Hz):		634,500,000			
Ref. Voltage (VAC):		120.00			
Voltage (%)	Power (VAC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	120.00	- 30	634,498,665	-1,025	-0.0001615
		- 20	634,499,141	-549	-0.0000865
		- 10	634,498,968	-722	-0.0001138
		0	634,498,661	-1,029	-0.0001622
		+ 10	634,499,358	-332	-0.0000523
		+ 20 (Ref)	634,499,690	0	0.0000000
		+ 30	634,498,497	-1,193	-0.0001880
		+ 40	634,500,225	535	0.0000843
85 %	102.00	+ 20	634,499,610	-80	-0.0000126
115 %	138.00	+ 20	634,500,197	507	0.0000799

**Table 7-14. LTE Band 71 Frequency Stability Data**



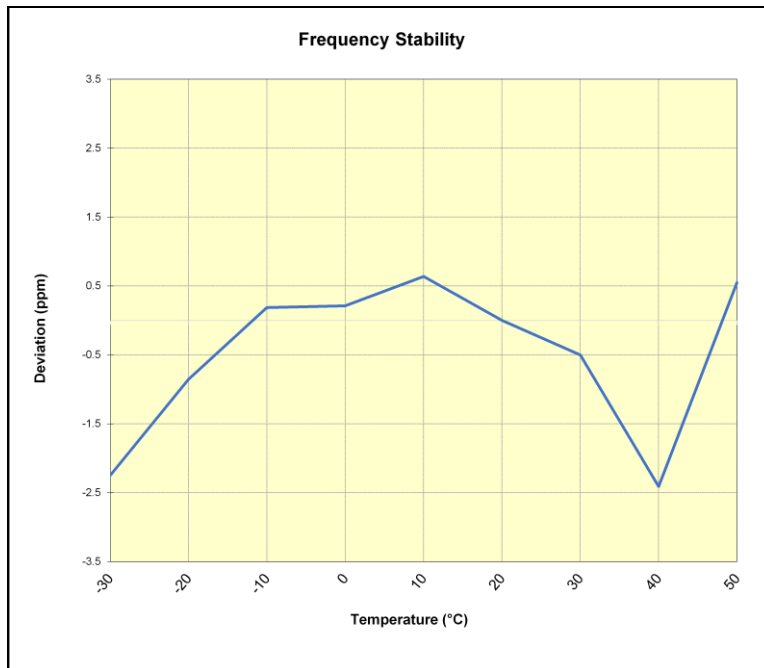
**Plot 7-73. LTE Band 71 Frequency Stability Chart**

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## LTE Band 12/17

		Operating Frequency (Hz):		737,500,000	
		Ref. Voltage (VAC):		120.00	
Voltage (%)	Power (VAC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	120.00	- 30	737,500,207	-1,660	-0.0002251
		- 20	737,501,237	-630	-0.0000854
		- 10	737,502,004	137	0.0000186
		0	737,502,024	157	0.0000213
		+ 10	737,502,337	470	0.0000637
		+ 20 (Ref)	737,501,867	0	0.0000000
		+ 30	737,501,497	-370	-0.0000502
		+ 40	737,500,089	-1,778	-0.0002411
		+ 50	737,502,272	405	0.0000549
85 %	102.00	+ 20	737,502,550	683	0.0000926
115 %	138.00	+ 20	737,502,959	1,092	0.0001481

**Table 7-15. LTE Band 12/17 Frequency Stability Data**



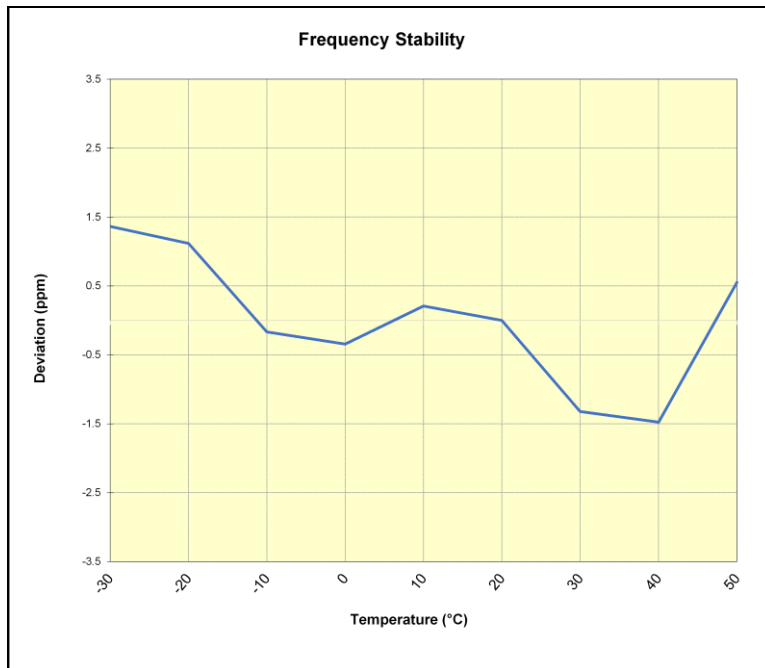
**Plot 7-74. LTE Band 12/17 Frequency Stability Chart**

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## LTE Band 13

		Operating Frequency (Hz):		751,000,000	
		Ref. Voltage (VAC):		120.00	
Voltage (%)	Power (VAC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	120.00	- 30	751,002,419	1,023	0.0001362
		- 20	751,002,236	840	0.0001119
		- 10	751,001,270	-126	-0.0000168
		0	751,001,139	-257	-0.0000342
		+ 10	751,001,553	157	0.0000209
		+ 20 (Ref)	751,001,396	0	0.0000000
		+ 30	751,000,404	-992	-0.0001321
		+ 40	751,000,286	-1,110	-0.0001478
		+ 50	751,001,811	415	0.0000553
85 %	102.00	+ 20	751,001,889	493	0.0000656
115 %	138.00	+ 20	751,002,907	1,511	0.0002012

**Table 7-16. LTE Band 13 Frequency Stability Data**




**Plot 7-75. LTE Band 13 Frequency Stability Chart**

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## 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Tecore Low Band mRU FCC ID: QLJMRU-060785** complies with all the requirements of Part 27 of the FCC rules.

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