

PART 27 MEASUREMENT REPORT

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

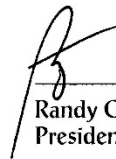
Date of Testing:
06/23 – 10/18/2021
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2106040064-02.QLJ

FCC ID:	QLJMRU-19212326
APPLICANT:	Tecore Networks

Application Type: Certification
Model: MRU-20W060785
EUT Type: Mid Band mRU
FCC Classification: PCS Licensed Transmitter (PCB)
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







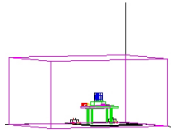
FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 1 of 65

TABLE OF CONTENTS

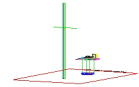
1.0	INTRODUCTION	4
1.1	Scope	4
1.2	PCTEST Test Location	4
1.3	Test Facility / Accreditations	4
2.0	PRODUCT INFORMATION	5
2.1	Equipment Description	5
2.2	Device Capabilities	5
2.3	Test Configuration	5
2.4	EMI Suppression Device(s)/Modifications	5
3.0	DESCRIPTION OF TESTS	6
3.1	Evaluation Procedure	6
3.2	Radiated Power and Radiated Spurious Emissions	6
4.0	MEASUREMENT UNCERTAINTY	7
5.0	TEST EQUIPMENT CALIBRATION DATA	8
6.0	SAMPLE CALCULATIONS	9
7.0	TEST RESULTS	10
7.1	Summary	10
7.2	Transmitter Conducted Output Power / Equivalent Isotropic Radiated Power	11
7.3	Occupied Bandwidth	13
7.4	Spurious and Harmonic Emissions at Antenna Terminal	20
7.5	Band Edge Emissions at Antenna Terminal	26
7.6	Peak-Average Ratio	50
7.7	Radiated Spurious Emissions Measurements	57
7.8	Frequency Stability / Temperature Variation	63
8.0	CONCLUSION	65

FCC ID: QLJMRU-19212326	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 2 of 65





MEASUREMENT REPORT

FCC Part 27



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	Conducted Power		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 66/10/4	20 MHz	QPSK	2120 - 2190	21.038	43.23	18M0G7D
		QAM	2120 - 2190	21.577	43.34	18M0W7D
	15 MHz	QPSK	2117.5 - 2192.5	22.182	43.46	13M5G7D
		QAM	2117.5 - 2192.5	22.336	43.49	13M5W7D
	10 MHz	QPSK	2115 - 2195	23.121	43.64	9M02G7D
		QAM	2115 - 2195	22.803	43.58	9M04W7D
	5 MHz	QPSK	2112.5 - 2197.5	23.281	43.67	4M51G7D
		QAM	2112.5 - 2197.5	23.174	43.65	4M50W7D
	3 MHz	QPSK	2111.5 - 2198.5	23.496	43.71	2M71G7D
		QAM	2111.5 - 2198.5	23.442	43.70	2M71W7D
	1.4 MHz	QPSK	2110.7 - 2199.3	23.714	43.75	1M10G7D
		QAM	2110.7 - 2199.3	23.823	43.77	1M11W7D

FCC ID: QLJMRU-19212326	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 3 of 65

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, Inc. 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.

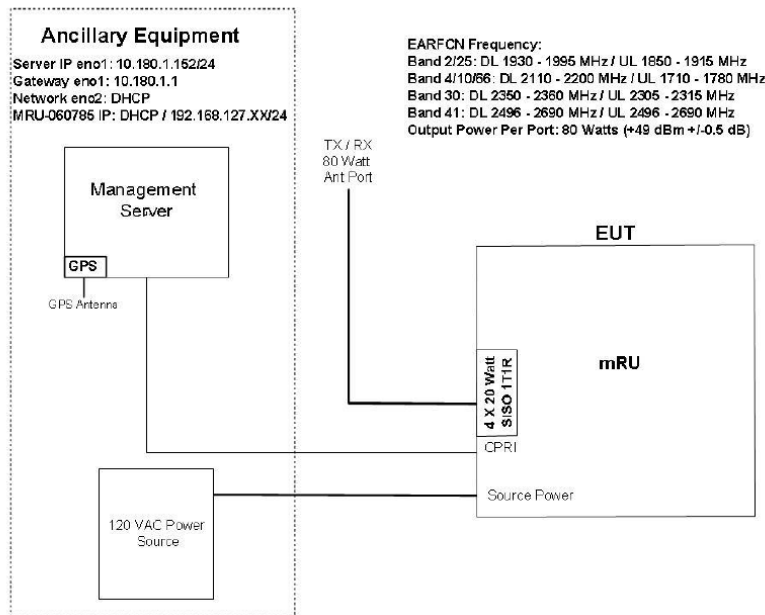
FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of @element	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 4 of 65

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Tecore Mid Band mRU FCC ID: QLJMRU-19212326**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate 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 three different LTE mid 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 60W 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.: 20270009, 20270007
Software Revision: mRU 8.0
Firmware: MRAN_015



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.

FCC ID: QLJMRU-19212326	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 5 of 65

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 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 D01 v03r01.



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:

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

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 $P_g \text{ [dBm]} - \text{cable loss [dB]}$.

For fundamental radiated power measurements, the guidance of KDB 971168 D01 v03r01 is used to record the EUT power level that is subsequently matched via the aforementioned substitution method given in ANSI/TIA-603-E-2016.




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 v01r01.

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of @element	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 6 of 65	

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

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 7 of 65

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
-	AP2	EMC Cable and Switch System	3/4/2021	Annual	3/4/2022	AP2
-	ETS	EMC Cable and Switch System	3/4/2021	Annual	3/4/2022	ETS
-	LTx1	Licensed Transmitter Cable Set	3/12/2021	Annual	3/12/2022	LTx1
-	LTx2	Licensed Transmitter Cable Set	3/12/2021	Annual	3/12/2022	LTx2
Agilent	N9030A	50GHz PXA Signal Analyzer	1/20/2021	Annual	1/20/2022	US51350301
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	6/18/2022	9704-5182
Espec	ESX-2CA	Environmental Chamber	8/27/2020	Annual	8/27/2022	17620
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	3/12/2020	Biennial	3/12/2022	128337
Keysight Technologies	N9030B	PXA Signal Analyzer, Multi-touch	11/17/2020	Annual	11/17/2021	MY57141001
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	1/21/2021	Annual	1/21/2022	101716
Sunol	JB6	LB6 Antenna	11/13/2020	Biennial	11/13/2022	A082816

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.

FCC ID: QLJMRU-19212326	 PART 27 MEASUREMENT REPORT 		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 8 of 65

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 2nd 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 25.501 dBm so this harmonic was 25.501 dBm $- (-24.80)$.

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 9 of 65

7.0 TEST RESULTS

7.1 Summary



Company Name: Tecore Networks
 FCC ID: QLJMRU-19212326
 FCC Classification: PCS Licensed Transmitter (PCB)
 Mode(s): LTE

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Transmitter Conducted Output Power / Equivalent Isotropic Radiated Power	2.1046, 27.50(d)(2)	1640W/MHz	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 ₁₀ (P[Watts]) at Band Edge and for all out-of-band emissions	PASS	Sections 7.4, 7.5
	Peak-to-Average Ratio	27.50(a)(1)	13 dB	PASS	Section 7.6
	Frequency Stability	2.1055, 27.54	Fundamental emissions stay within authorized frequency block	PASS	Section 7.7
RADIATED	Radiated Spurious Emissions	2.1053, 27.53	> 43 + 10 log ₁₀ (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 between the call box and 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.

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 10 of 65

7.2 Transmitter Conducted Output Power / Equivalent Isotropic 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.

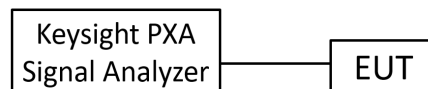




Figure 7-1. Test Instrument & Measurement Setup

Test Notes



None.

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 11 of 65	

LTE Band 66/10/4

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Conducted Power [Watts]	Ant Gain [dBi]	EIRP [dBm/MHz]	EIRP [Watts/MHz]	EIRP Limit [dBm/MHz]	Margin [dB]
20 MHz	QPSK	132072	2120.0	100 / 0	43.23	21.04	15.00	58.23	665.27	62.15	-3.92
		132322	2155.0	100 / 0	43.31	21.43	15.00	58.31	677.64	62.15	-3.84
		132572	2190.0	100 / 0	43.07	20.28	15.00	58.07	641.21	62.15	-4.08
	16-QAM	132322	2155.0	100 / 0	43.32	21.48	15.00	58.32	679.20	62.15	-3.83
	64-QAM	132322	2155.0	100 / 0	43.33	21.53	15.00	58.33	680.77	62.15	-3.82
	256-QAM	132322	2155.0	100 / 0	43.34	21.58	15.00	58.34	682.34	62.15	-3.81
15 MHz	QPSK	132047	2117.5	75 / 0	43.31	21.43	15.00	58.31	677.64	62.15	-3.84
		132322	2155.0	75 / 0	43.46	22.18	15.00	58.46	701.46	62.15	-3.69
		132597	2192.5	75 / 0	43.13	20.56	15.00	58.13	650.13	62.15	-4.02
	16-QAM	132322	2155.0	75 / 0	43.42	21.98	15.00	58.42	695.02	62.15	-3.73
	64-QAM	132322	2155.0	75 / 0	43.38	21.78	15.00	58.38	688.65	62.15	-3.77
	256-QAM	132322	2155.0	75 / 0	43.49	22.34	15.00	58.49	706.32	62.15	-3.66
10 MHz	QPSK	132022	2115.0	50 / 0	43.37	21.73	15.00	58.37	687.07	62.15	-3.78
		132322	2155.0	50 / 0	43.64	23.12	15.00	58.64	731.14	62.15	-3.51
		132622	2195.0	50 / 0	43.25	21.13	15.00	58.25	668.34	62.15	-3.90
	16-QAM	132322	2155.0	50 / 0	43.54	22.59	15.00	58.54	714.50	62.15	-3.61
	64-QAM	132322	2155.0	50 / 0	43.58	22.80	15.00	58.58	721.11	62.15	-3.57
	256-QAM	132322	2155.0	50 / 0	43.53	22.54	15.00	58.53	712.85	62.15	-3.62
5 MHz	QPSK	131997	2112.5	25 / 0	43.31	21.43	15.00	58.31	677.64	62.15	-3.84
		132322	2155.0	25 / 0	43.67	23.28	15.00	58.67	736.21	62.15	-3.48
		132647	2197.5	25 / 0	43.26	21.18	15.00	58.26	669.88	62.15	-3.89
	16-QAM	132322	2155.0	25 / 0	43.65	23.17	15.00	58.65	732.82	62.15	-3.50
	64-QAM	132322	2155.0	25 / 0	43.25	21.13	15.00	58.25	668.34	62.15	-3.90
256-QAM	132322	2155.0	25 / 0	43.71	23.50	15.00	58.71	743.02	62.15	-3.44	
3 MHz	QPSK	131987	2111.5	15 / 0	43.22	20.99	15.00	58.22	663.74	62.15	-3.93
		132322	2155.0	15 / 0	43.71	23.50	15.00	58.71	743.02	62.15	-3.44
		132657	2198.5	15 / 0	43.34	21.58	15.00	58.34	682.34	62.15	-3.81
	16-QAM	132322	2155.0	15 / 0	43.70	23.44	15.00	58.70	741.31	62.15	-3.45
	64-QAM	132322	2155.0	15 / 0	43.59	22.86	15.00	58.59	722.77	62.15	-3.56
256-QAM	132322	2155.0	15 / 0	43.69	23.39	15.00	58.69	739.61	62.15	-3.46	
1.4 MHz	QPSK	131979	2110.7	6 / 0	43.20	20.89	15.00	58.20	660.69	62.15	-3.95
		132322	2155.0	6 / 0	43.75	23.71	15.00	58.75	749.89	62.15	-3.40
		132665	2199.3	6 / 0	43.34	21.58	15.00	58.34	682.34	62.15	-3.81
	16-QAM	132322	2155.0	6 / 0	43.77	23.82	15.00	58.77	753.36	62.15	-3.38
	64-QAM	132322	2155.0	6 / 0	43.49	22.34	15.00	58.49	706.32	62.15	-3.66
256-QAM	132322	2155.0	6 / 0	43.71	23.50	15.00	58.71	743.02	62.15	-3.44	

Table 7-2. Transmitter Conducted Output Power / Effective Radiated Power (LTE Band 66/10/4)

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 12 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 $\geq 3 \times$ 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.

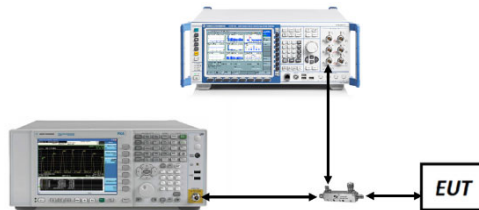





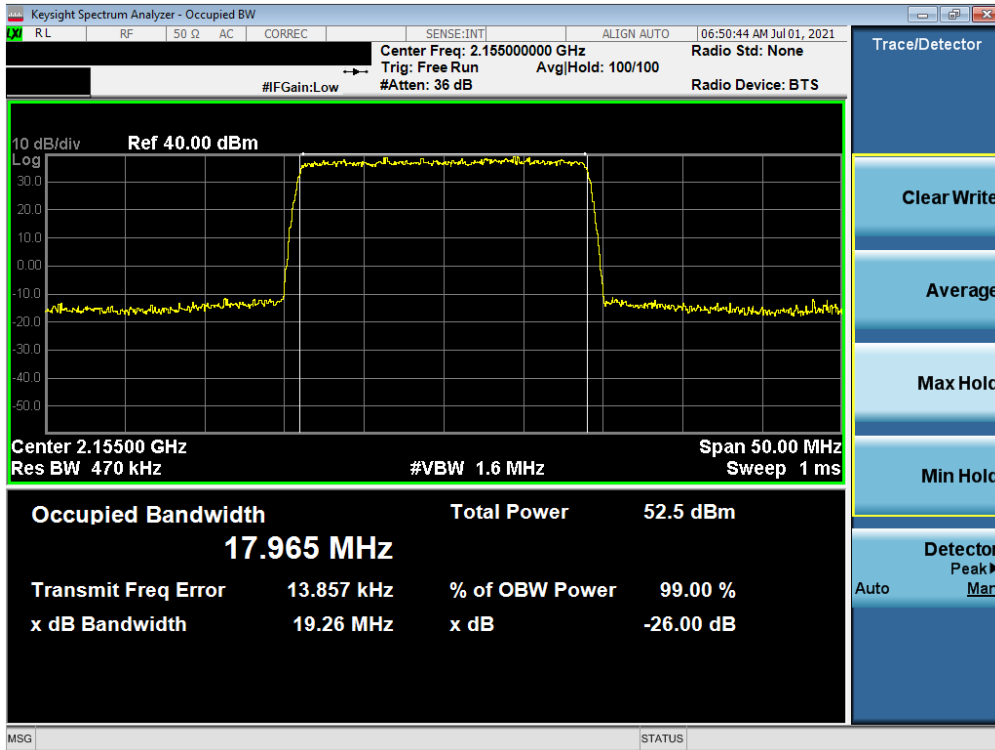
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

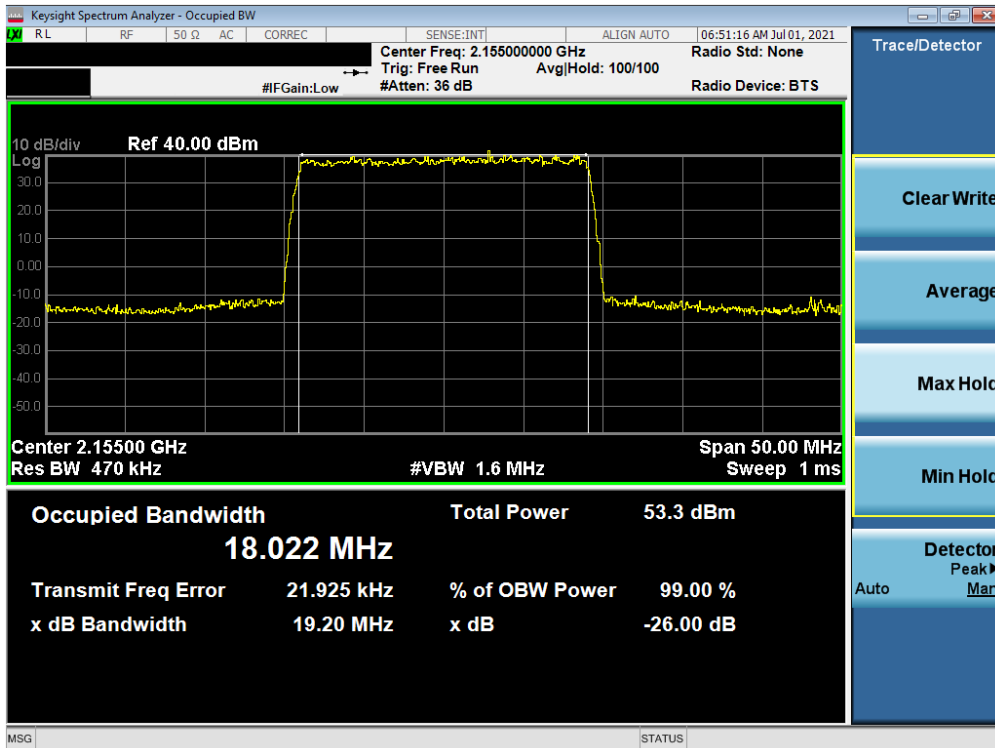
None.

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 13 of 65

LTE Band 66/10/4

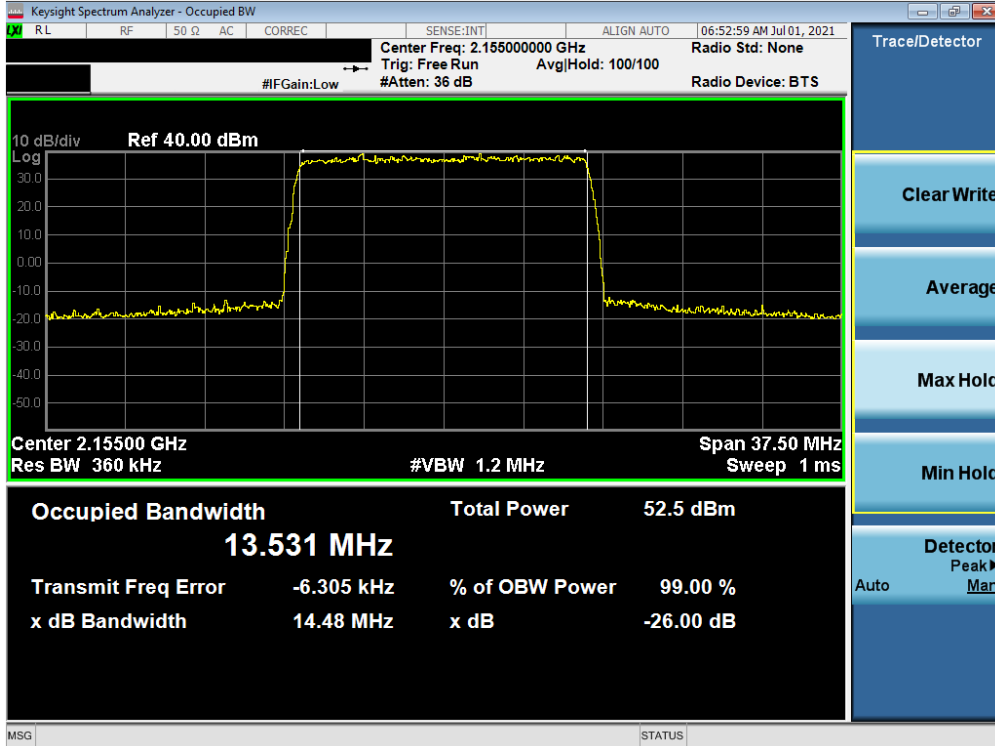


Plot 7-1. Occupied Bandwidth Plot (LTE Band 66/10/4 - 20MHz QPSK - Full RB)

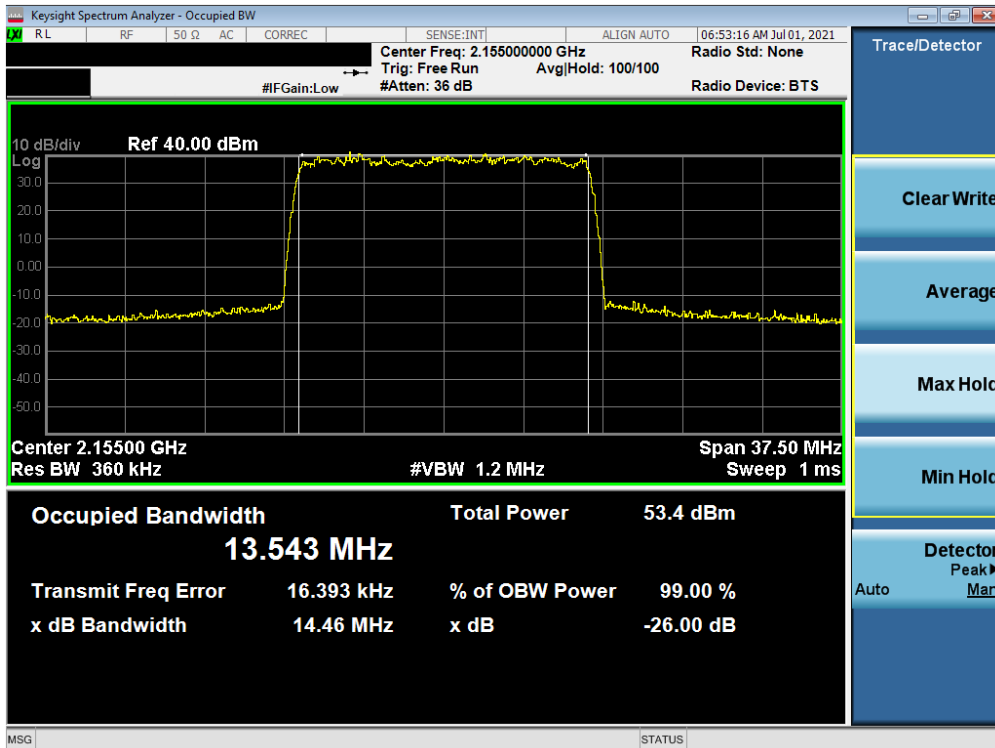


Plot 7-2. Occupied Bandwidth Plot (LTE Band 66/10/4 - 20MHz 16-QAM - Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 14 of 65

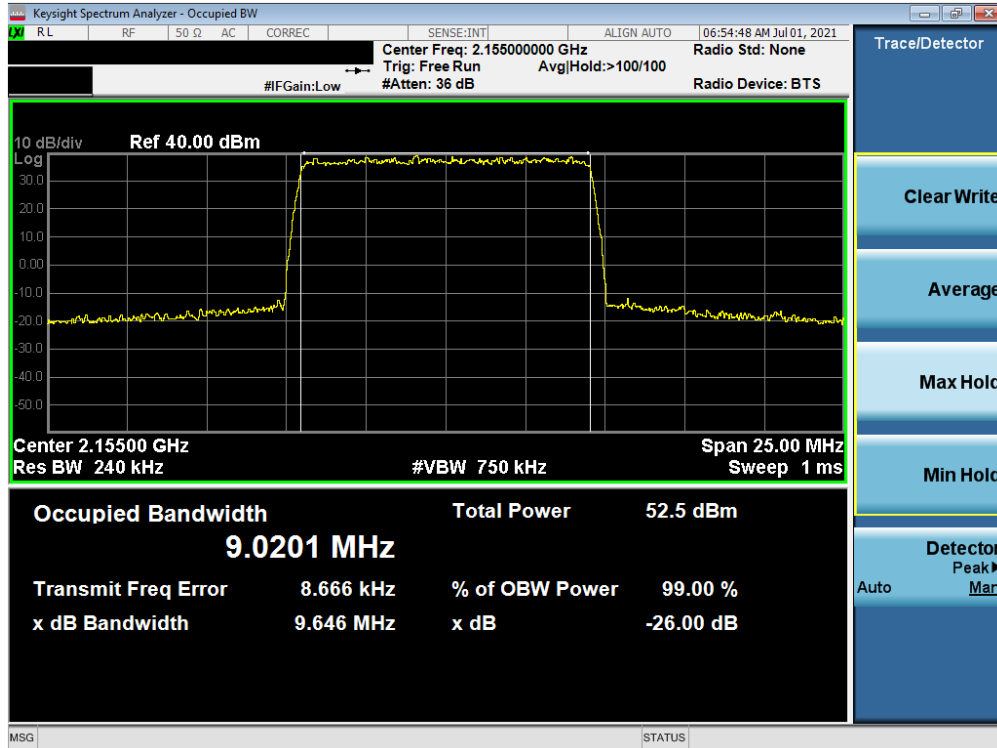


Plot 7-3. Occupied Bandwidth Plot (LTE Band 66/10/4 - 15MHz QPSK - Full RB)

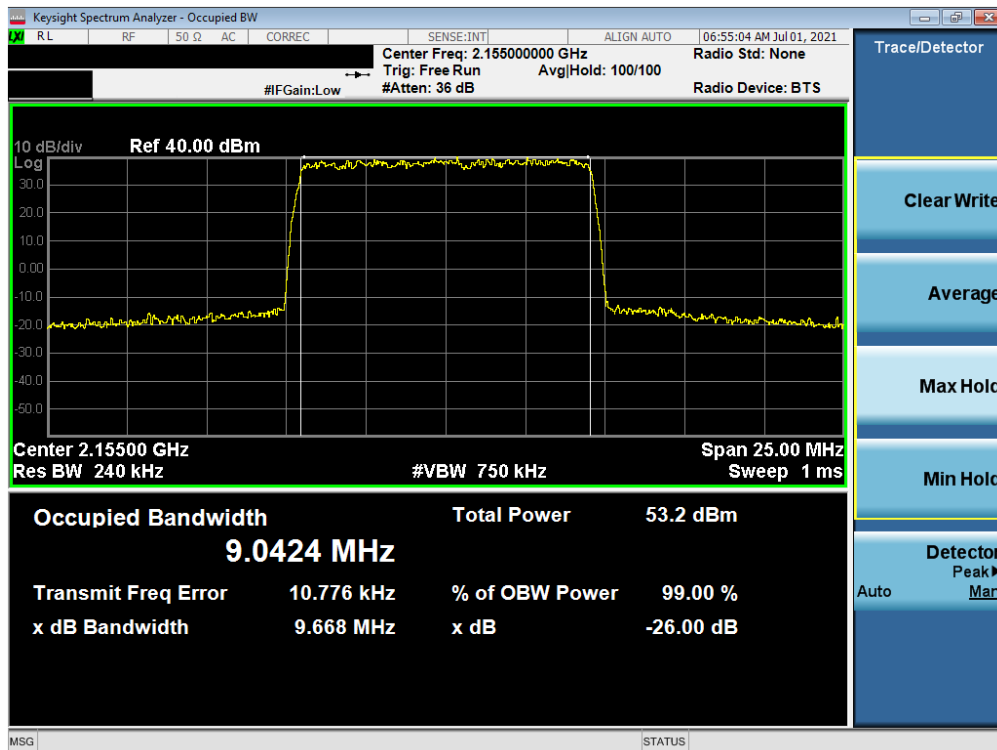


Plot 7-4. Occupied Bandwidth Plot (LTE Band 66/10/4 - 15MHz 16-QAM - Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 15 of 65

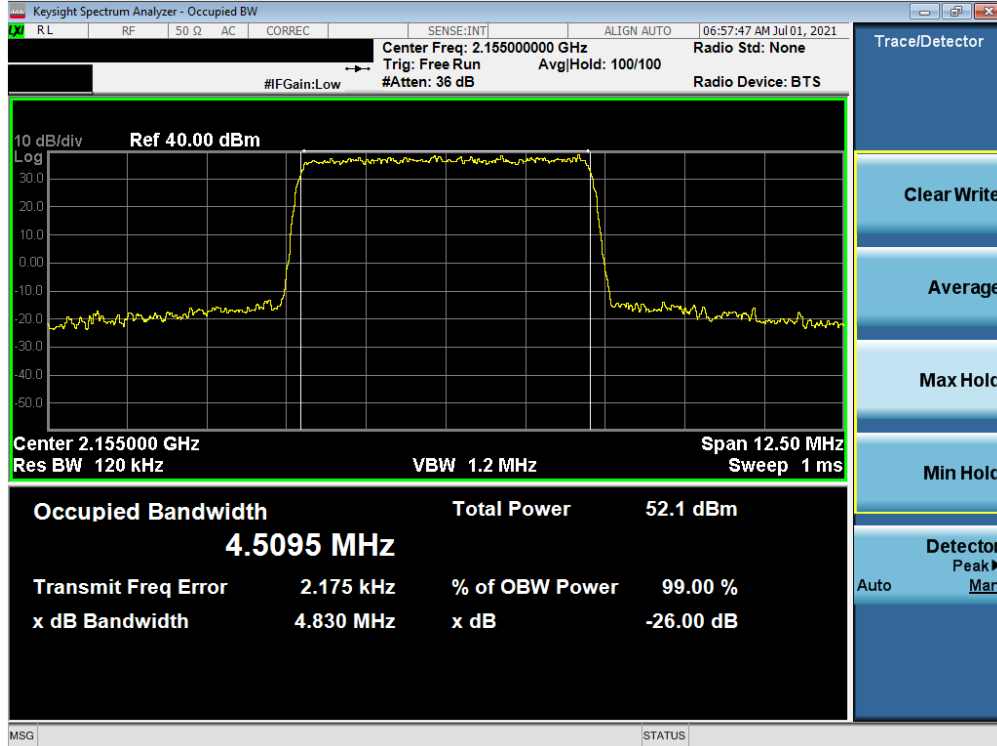


Plot 7-5. Occupied Bandwidth Plot (LTE Band 66/10/4 - 10MHz QPSK - Full RB)

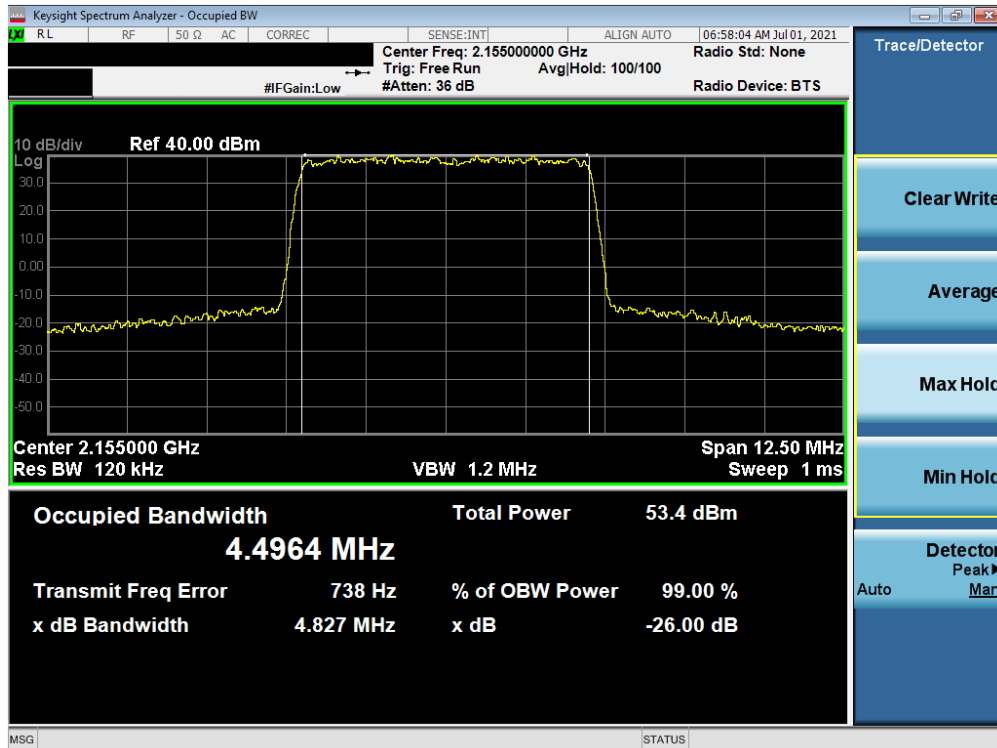


Plot 7-6. Occupied Bandwidth Plot (LTE Band 66/10/4 - 10MHz 16-QAM - Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 16 of 65

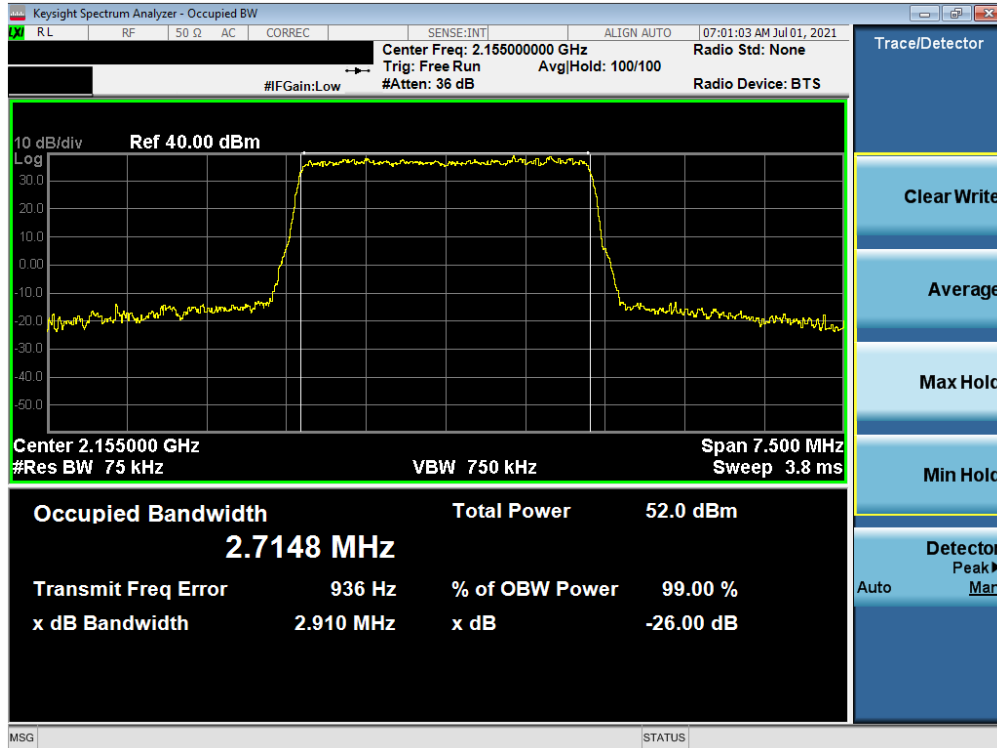


Plot 7-7. Occupied Bandwidth Plot (LTE Band 66/10/4 - 5MHz QPSK - Full RB)

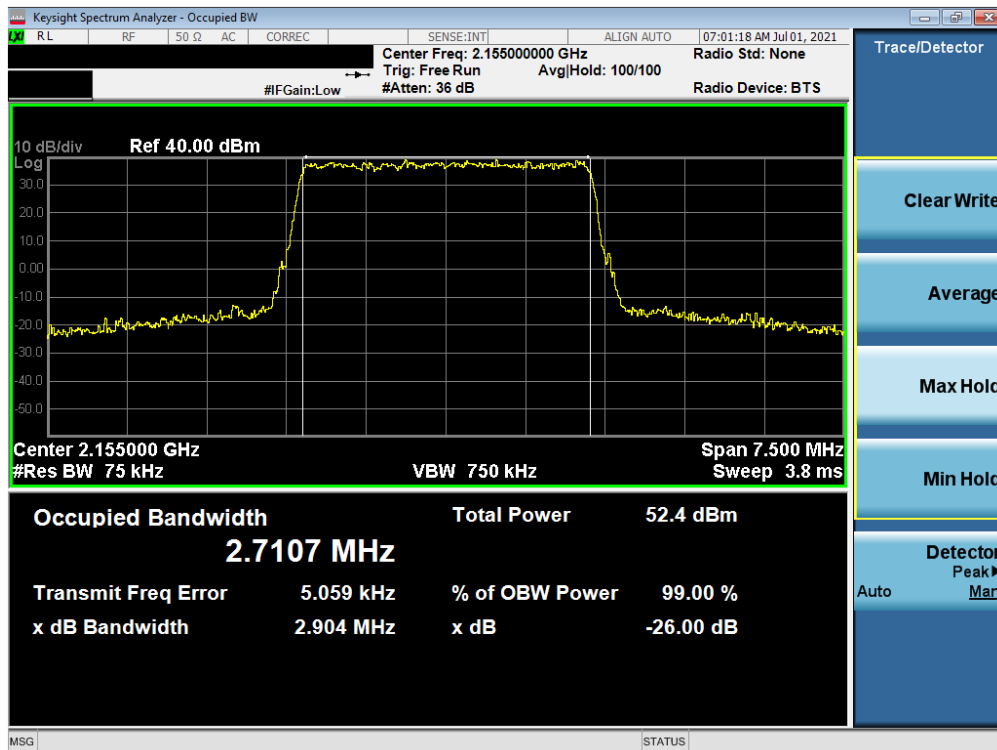


Plot 7-8. Occupied Bandwidth Plot (LTE Band 66/10/4 - 5MHz 16-QAM - Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 17 of 65

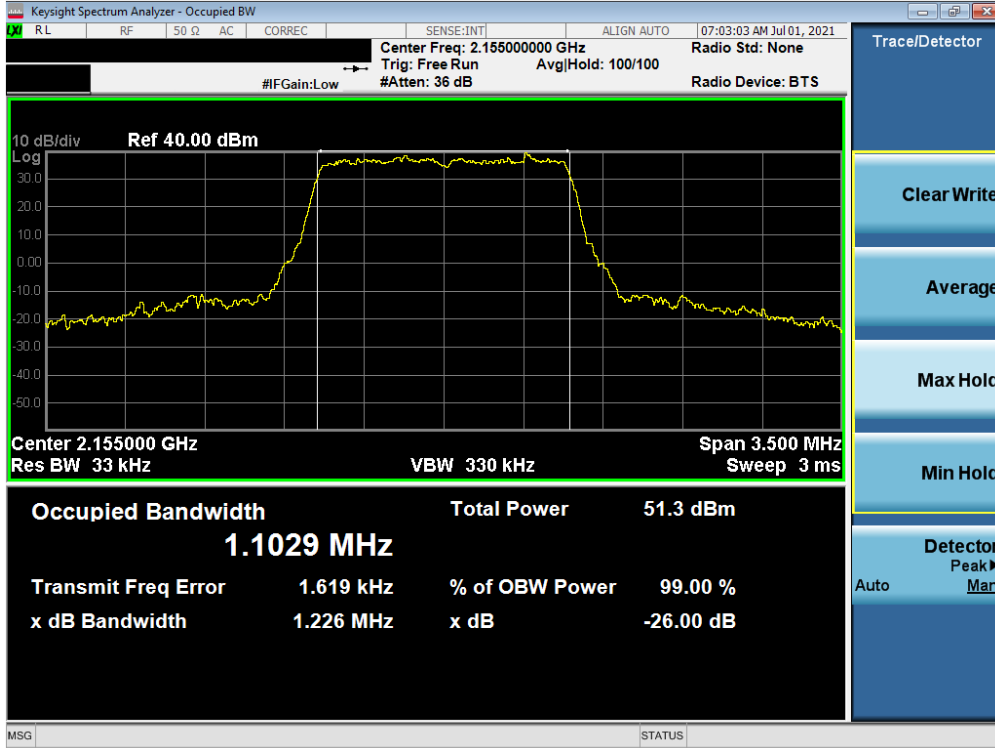


Plot 7-9. Occupied Bandwidth Plot (LTE Band 66/10/4 - 3MHz QPSK - Full RB)

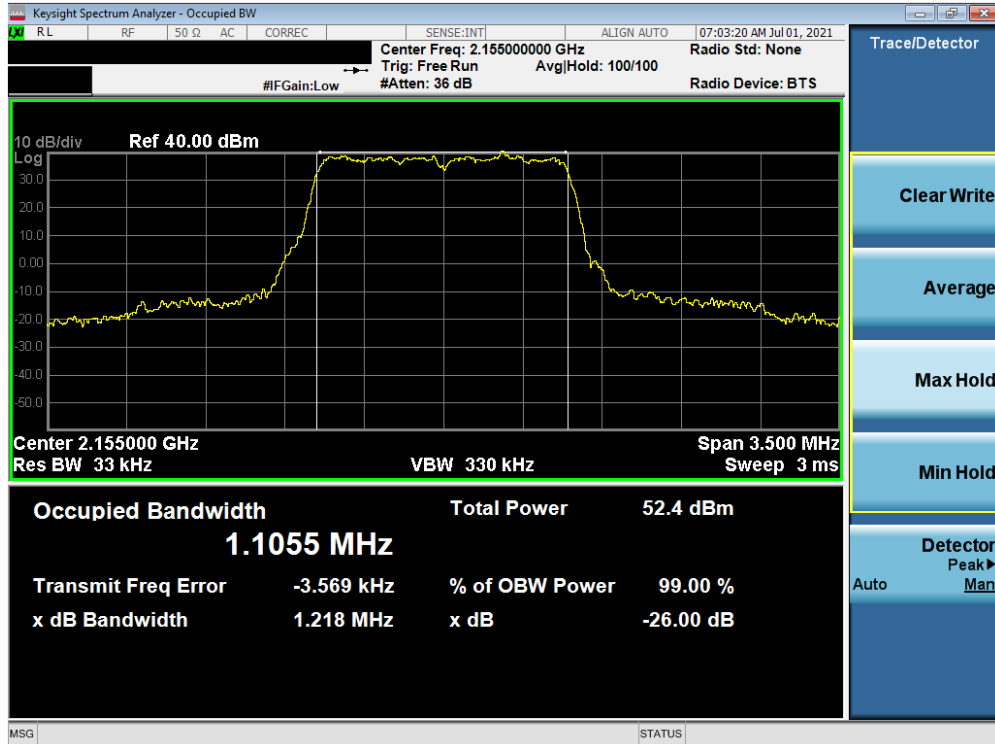


Plot 7-10. Occupied Bandwidth Plot (LTE Band 66/10/4 - 3MHz 16-QAM - Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 18 of 65



Plot 7-11. Occupied Bandwidth Plot (LTE Band 66/10/4 - 1.4MHz QPSK - Full RB)



Plot 7-12. Occupied Bandwidth Plot (LTE Band 66/10/4 - 1.4MHz 16-QAM - Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 19 of 65

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 10th 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 18GHz (separated into at least two plots per channel)
2. RBW \geq 100kHz
3. VBW \geq 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
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.

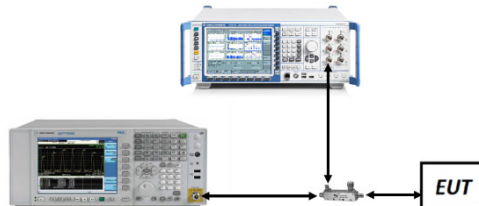




Figure 7-3. Test Instrument & Measurement Setup

Test Notes

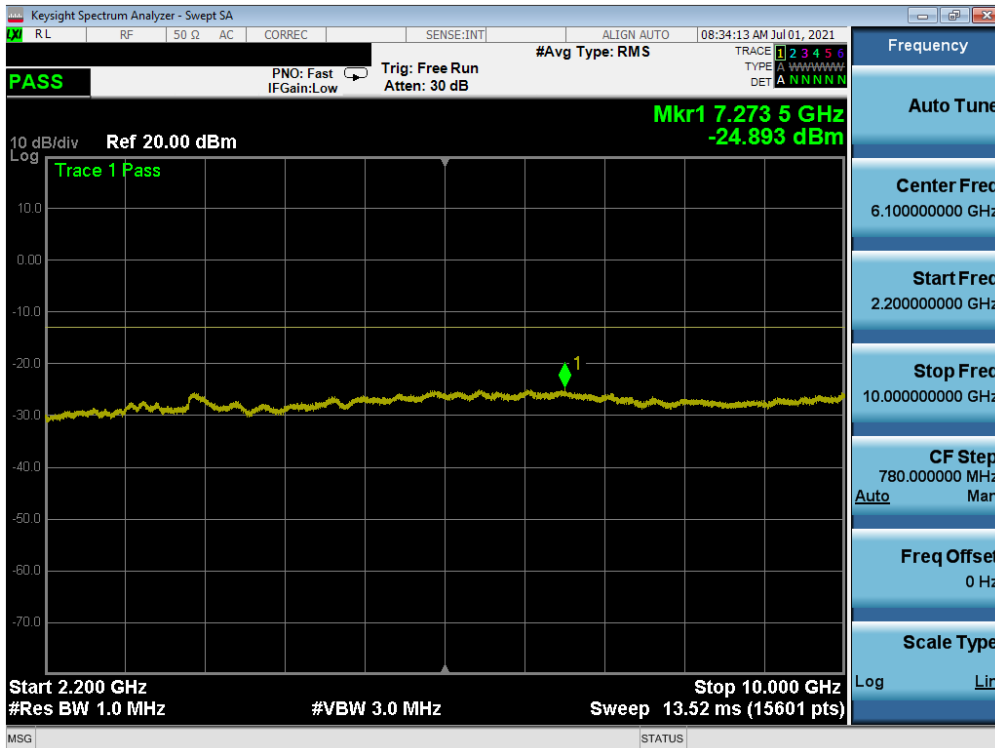
Per Part 27, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 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-19212326	 Proud to be part of element	PART 27 MEASUREMENT REPORT	 networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 20 of 65

LTE Band 66/10/4

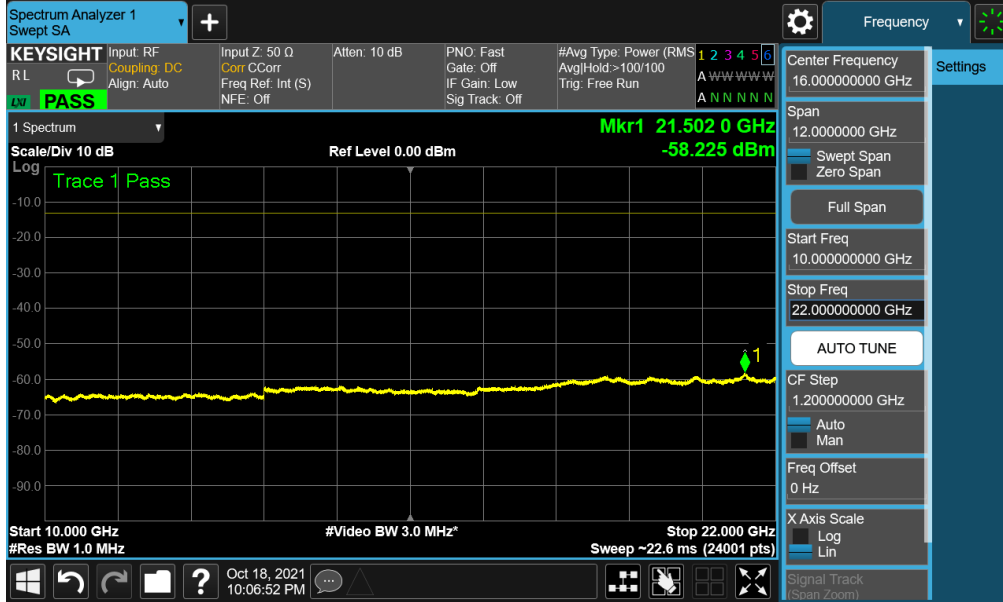


Plot 7-13. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - Low Channel)

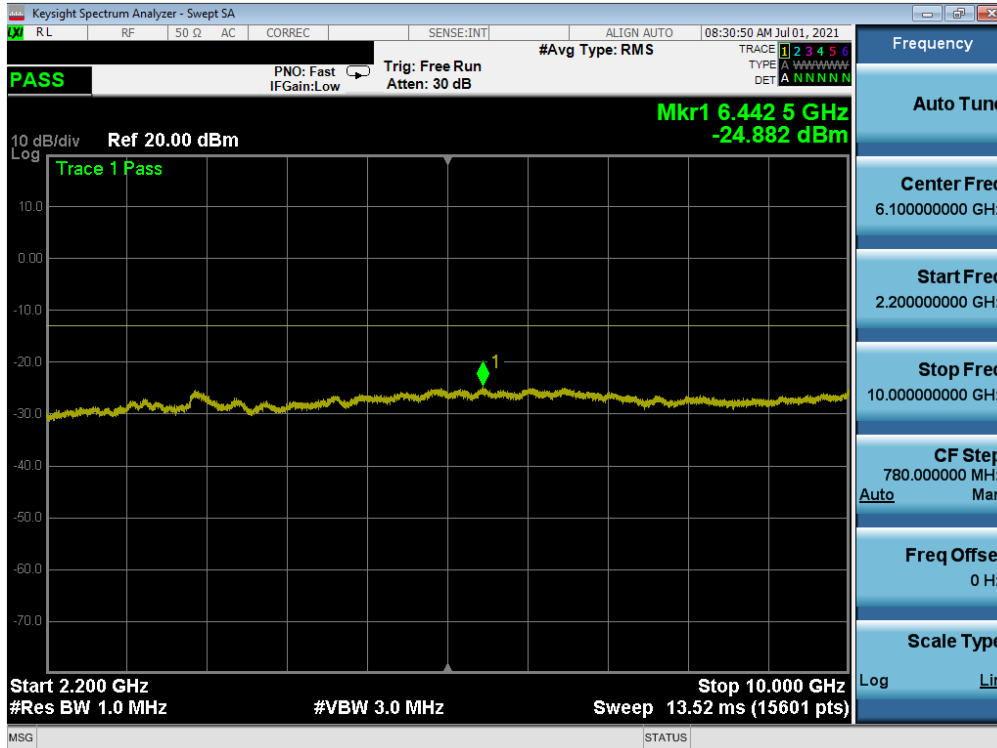


Plot 7-14. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - Low Channel)

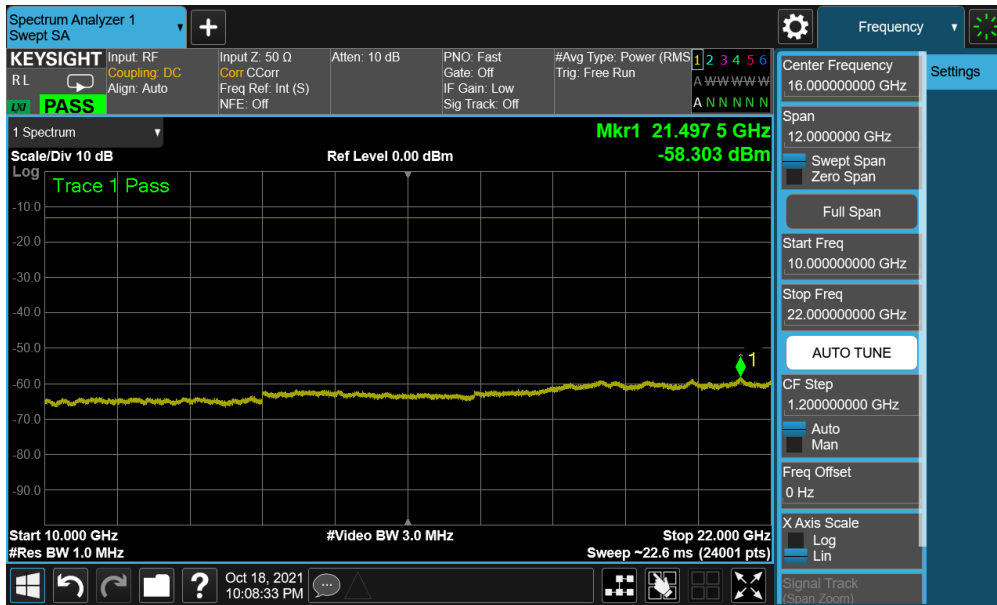
FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 21 of 65



FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 22 of 65

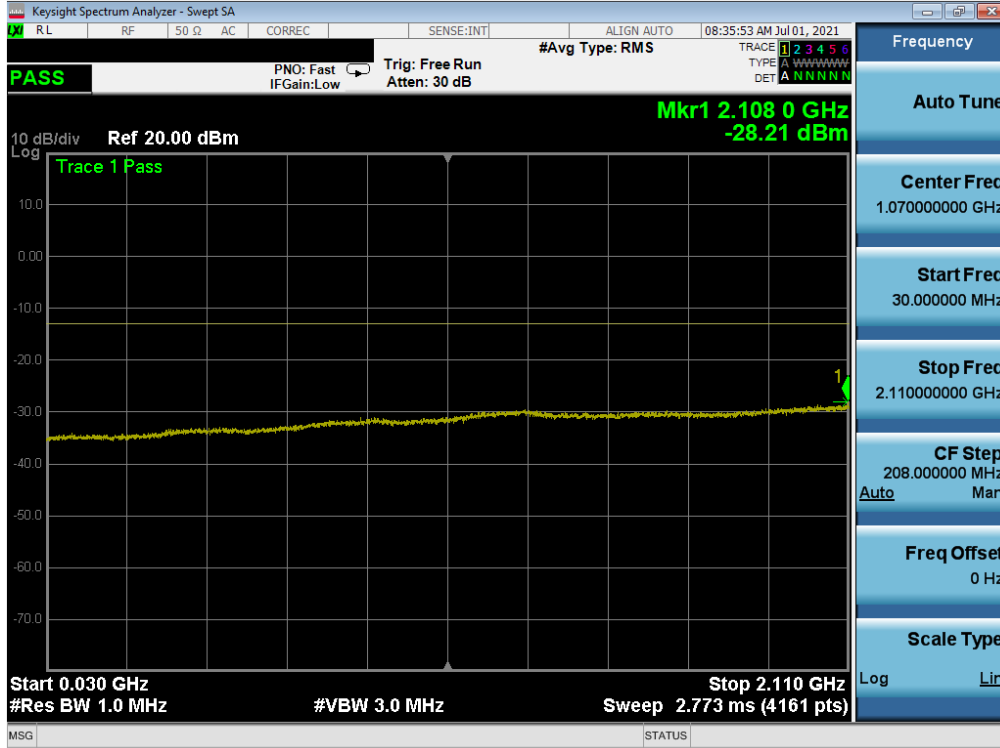


Plot 7-17. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - Mid Channel)

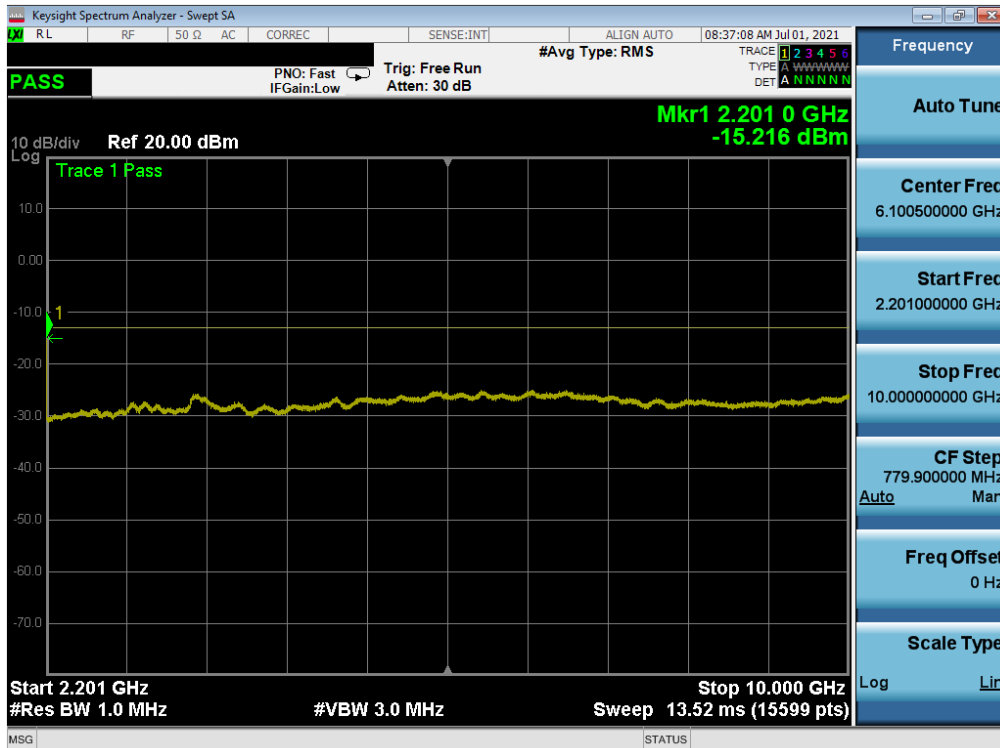


Plot 7-18. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - Mid Channel)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 23 of 65

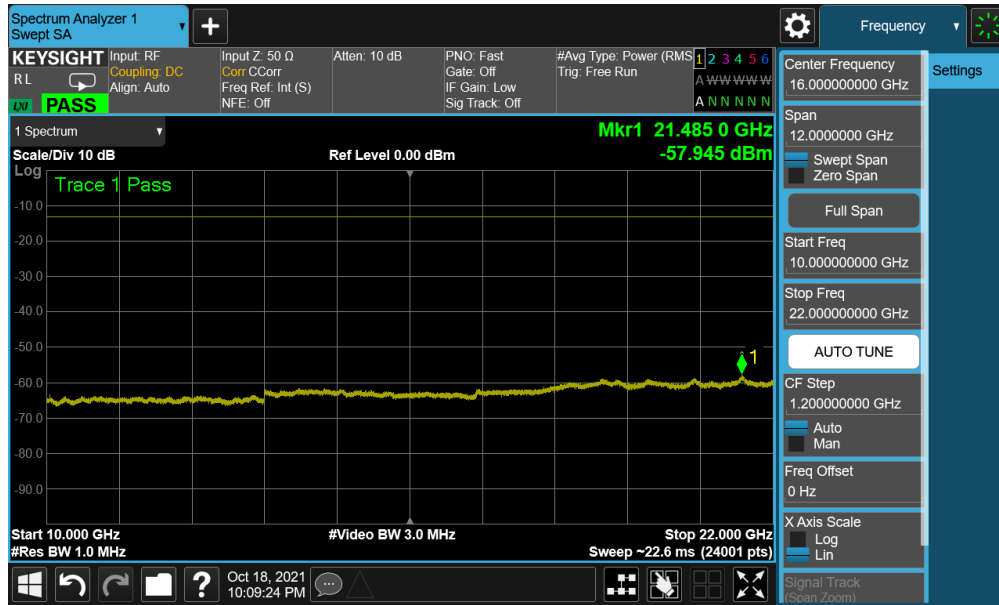


Plot 7-19. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - High Channel)



Plot 7-20. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - High Channel)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 24 of 65



Plot 7-21. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - High Channel)

<p>FCC ID: QLJMRU-19212326</p>		<p>PART 27 MEASUREMENT REPORT</p>	<p>Approved by: Technical Manager</p>
<p>Test Report S/N: 1M2106040064-02.QLJ</p>	<p>Test Dates: 06/23 – 10/18/2021</p>	<p>EUT Type: Mid Band mRU</p>	<p>Page 25 of 65</p>

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.

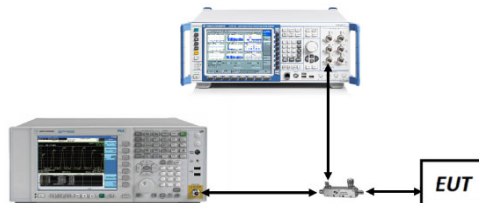







Figure 7-4. Test Instrument & Measurement Setup

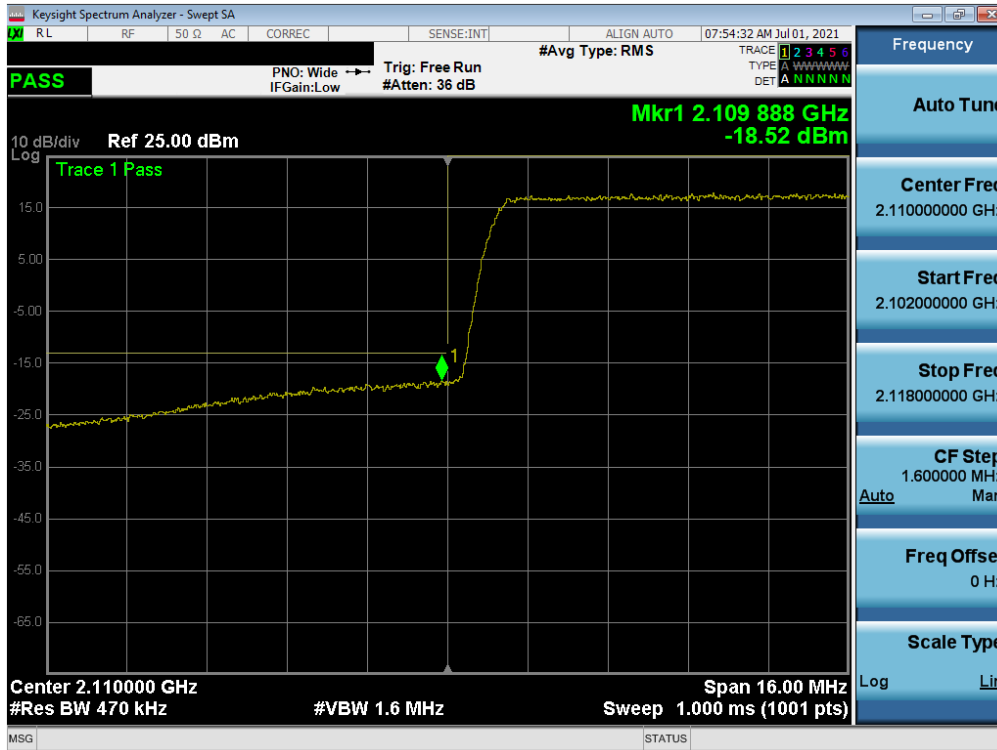
FCC ID: QLJMRU-19212326	 Proud to be part of 	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 26 of 65

Test Notes

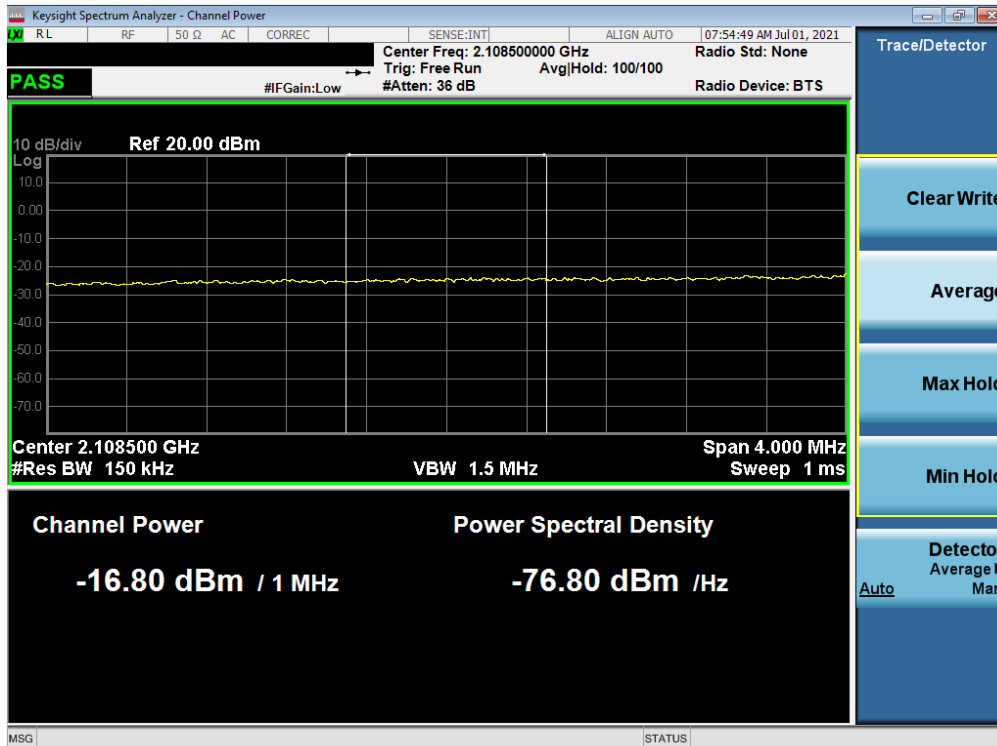
Per 27.53(h) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission 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-19212326		PART 27 MEASUREMENT REPORT	 Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 27 of 65

LTE Band 66/10/4

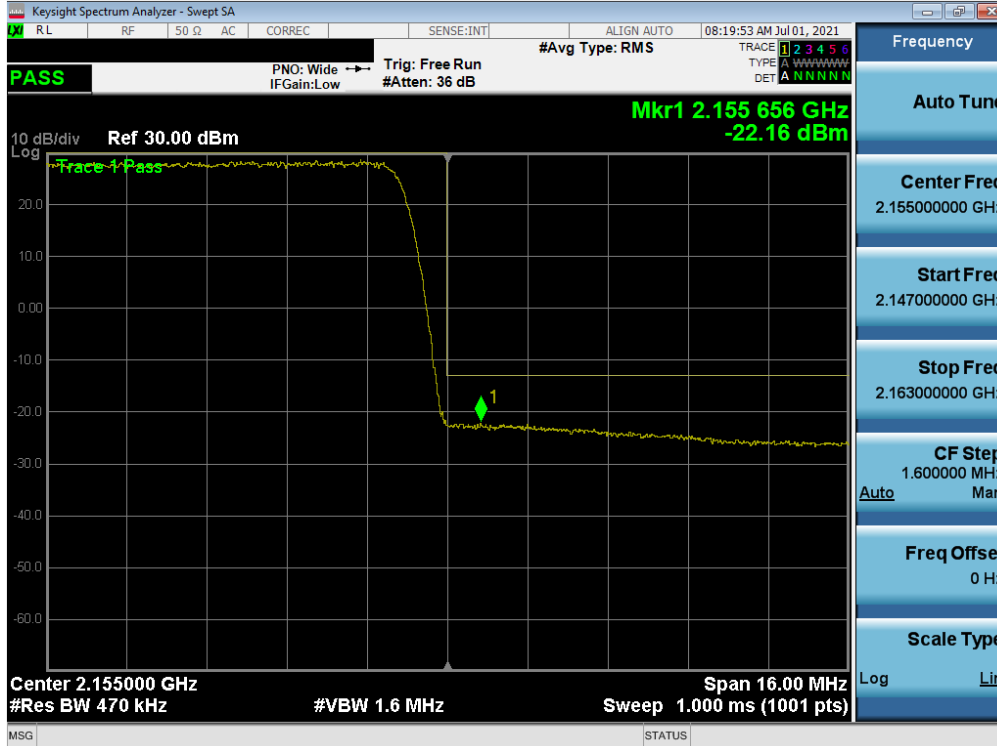


Plot 7-22. Lower Band Edge Plot (LTE Band 66/10/4 - 20MHz QPSK – Full RB)

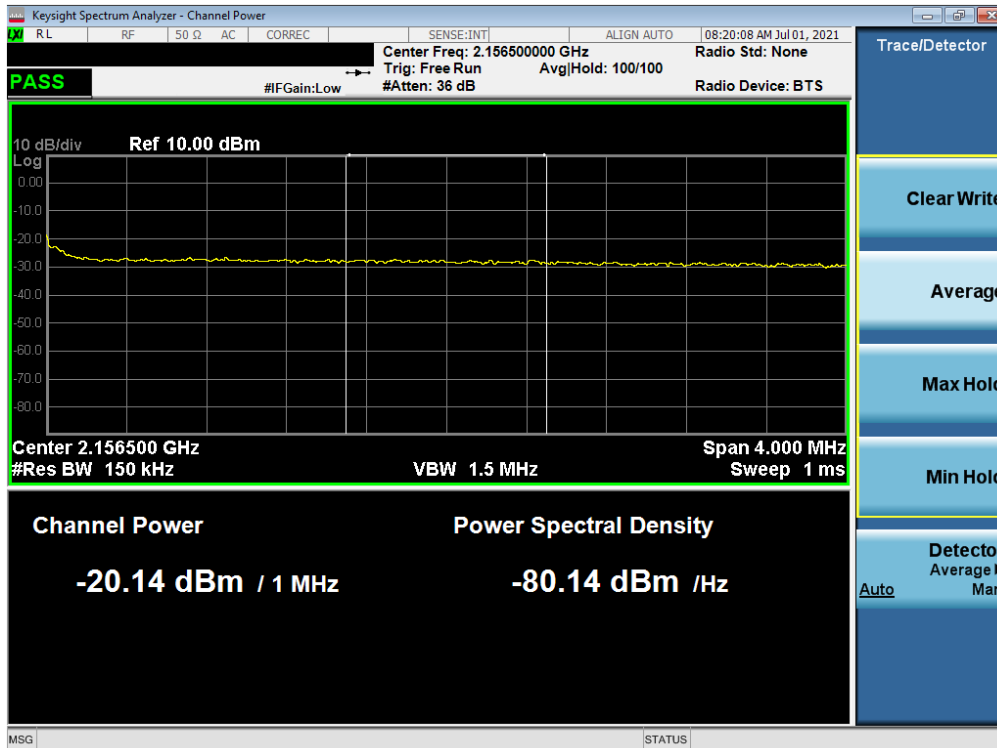


Plot 7-23. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 20MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 28 of 65

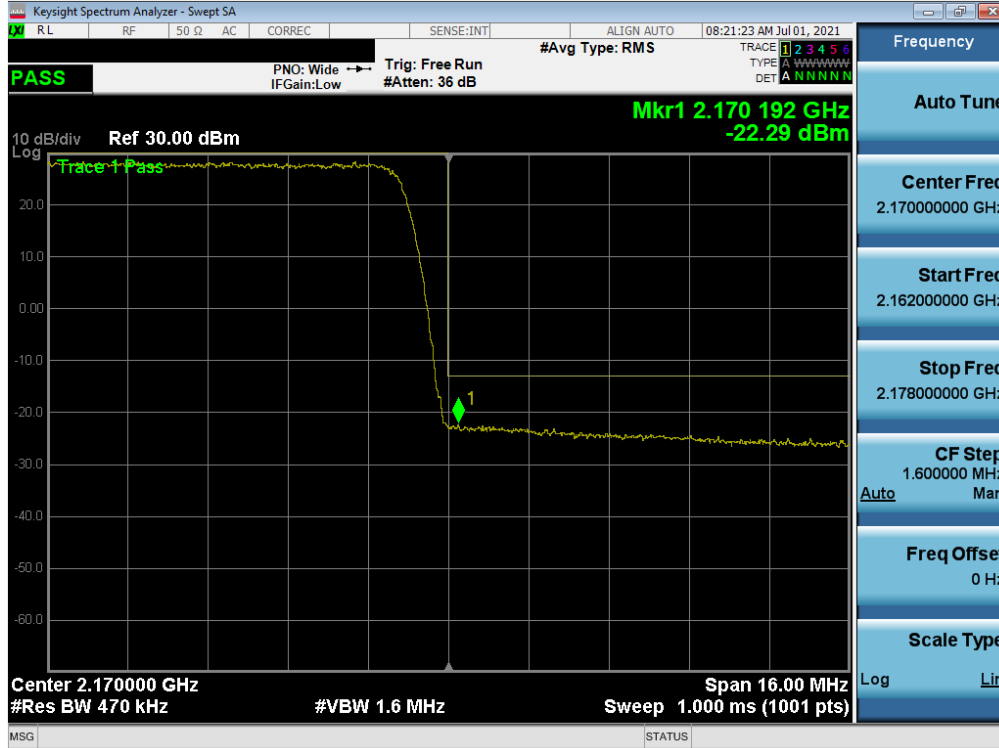


Plot 7-24. Upper Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)

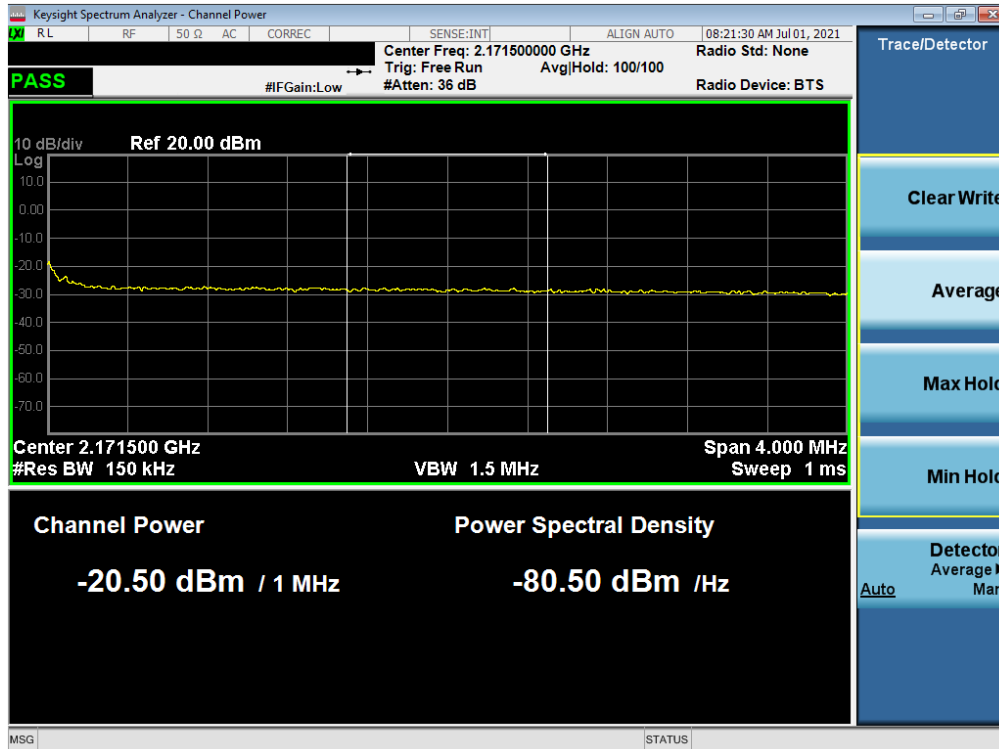


Plot 7-25. Upper Extended Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 29 of 65

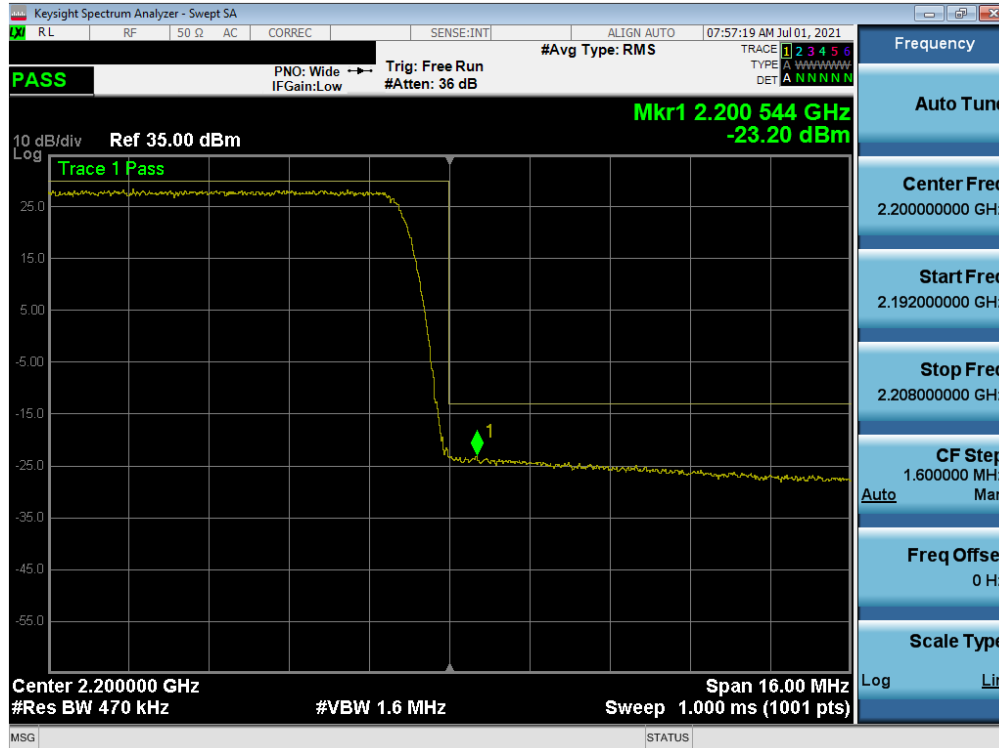


Plot 7-26. Upper Band Edge Plot (LTE Band 10 - 20MHz QPSK – Full RB)

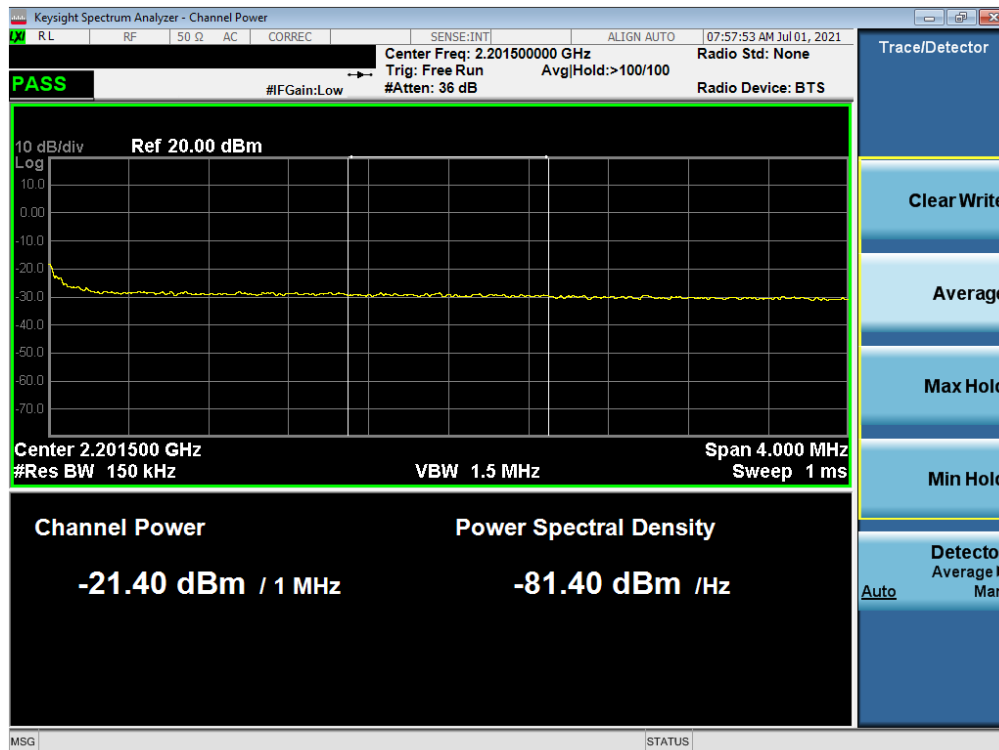


Plot 7-27. Upper Extended Band Edge Plot (LTE Band 10 - 20MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 30 of 65

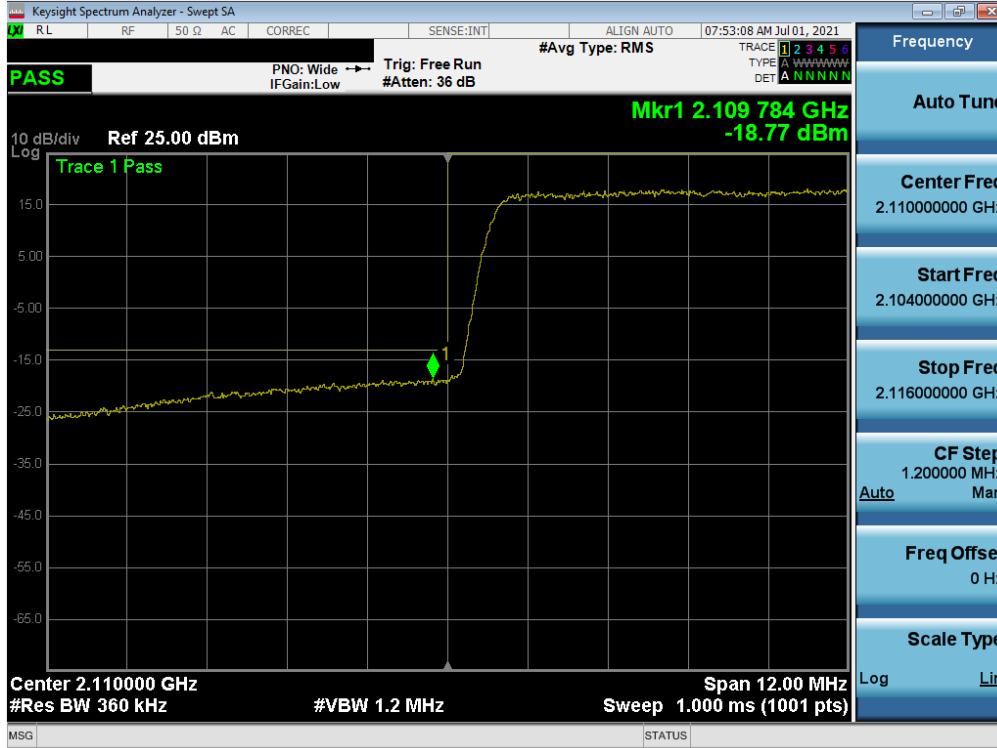


Plot 7-28. Upper Band Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)

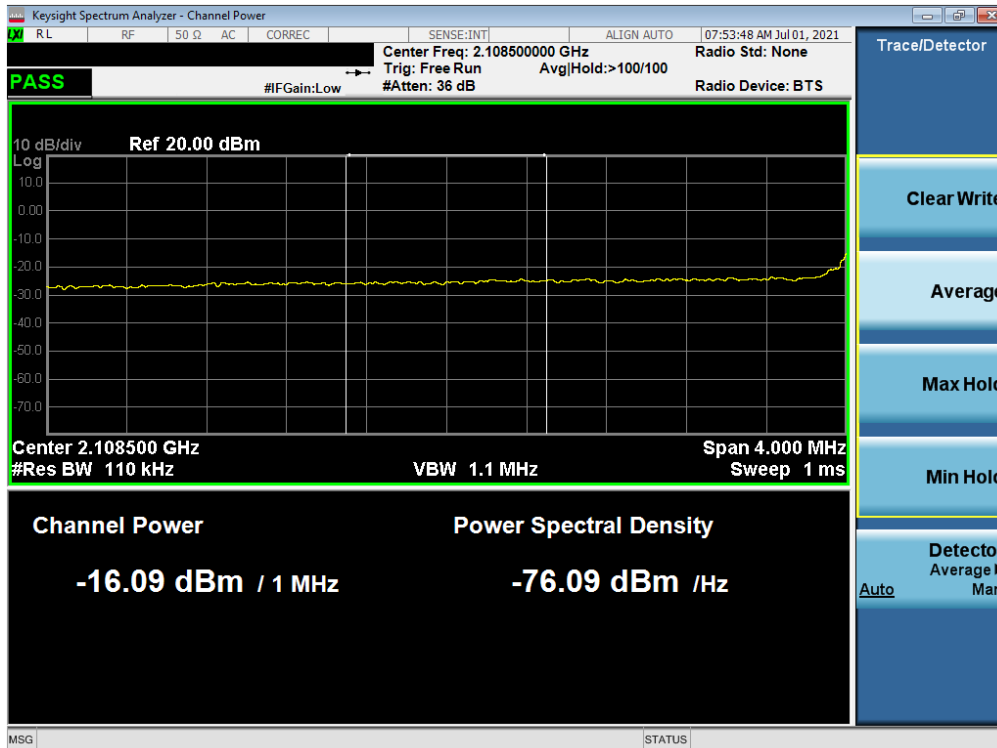


Plot 7-29. Channel Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 31 of 65



Plot 7-30. Lower Band Edge Plot (LTE Band 66/10/4 - 15MHz QPSK – Full RB)

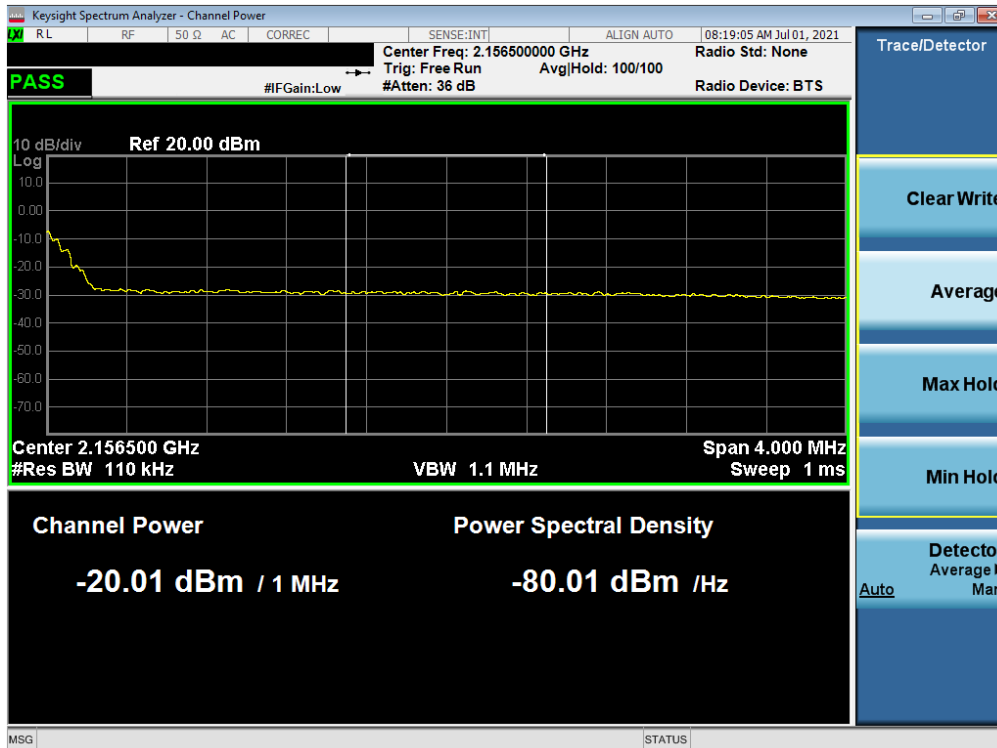


Plot 7-31. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 15MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 32 of 65



Plot 7-32. Upper Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)

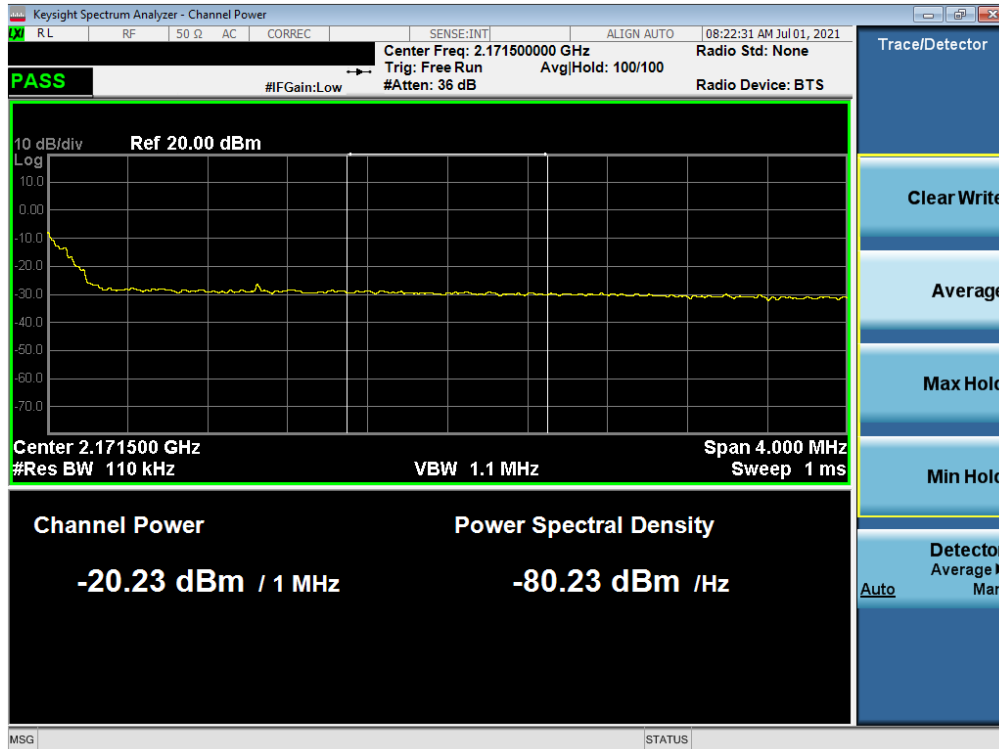


Plot 7-33. Upper Extended Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 33 of 65



Plot 7-34. Upper Band Edge Plot (LTE Band 10 - 15MHz QPSK – Full RB)

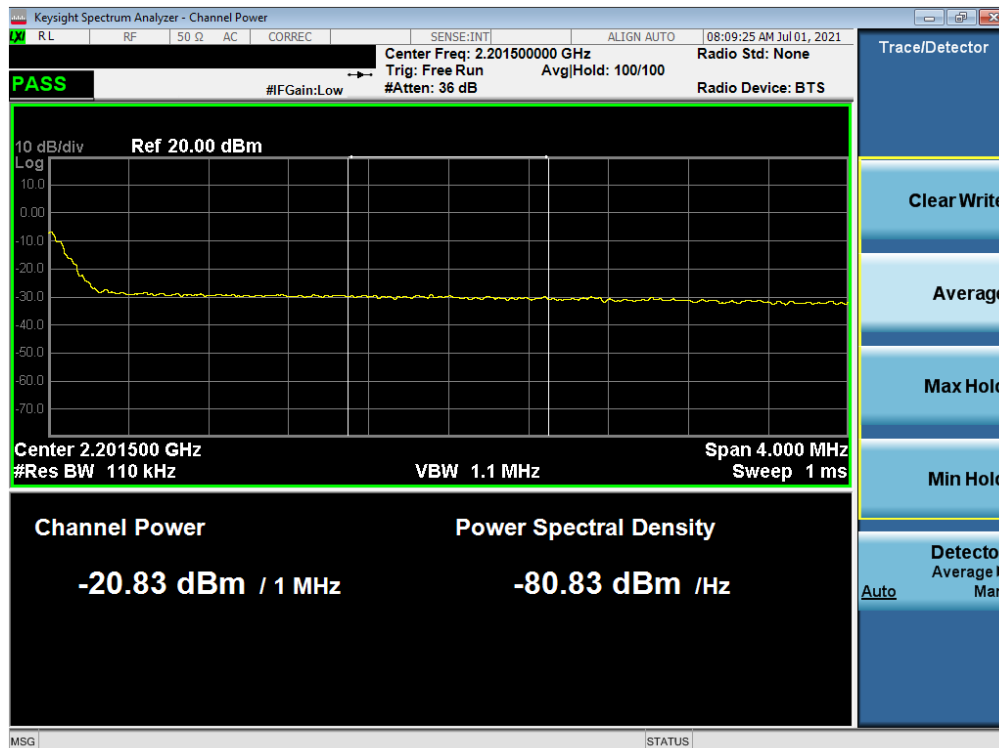


Plot 7-35. Upper Extended Band Edge Plot (LTE Band 10 - 15MHz QPSK – Full RB)




FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 34 of 65

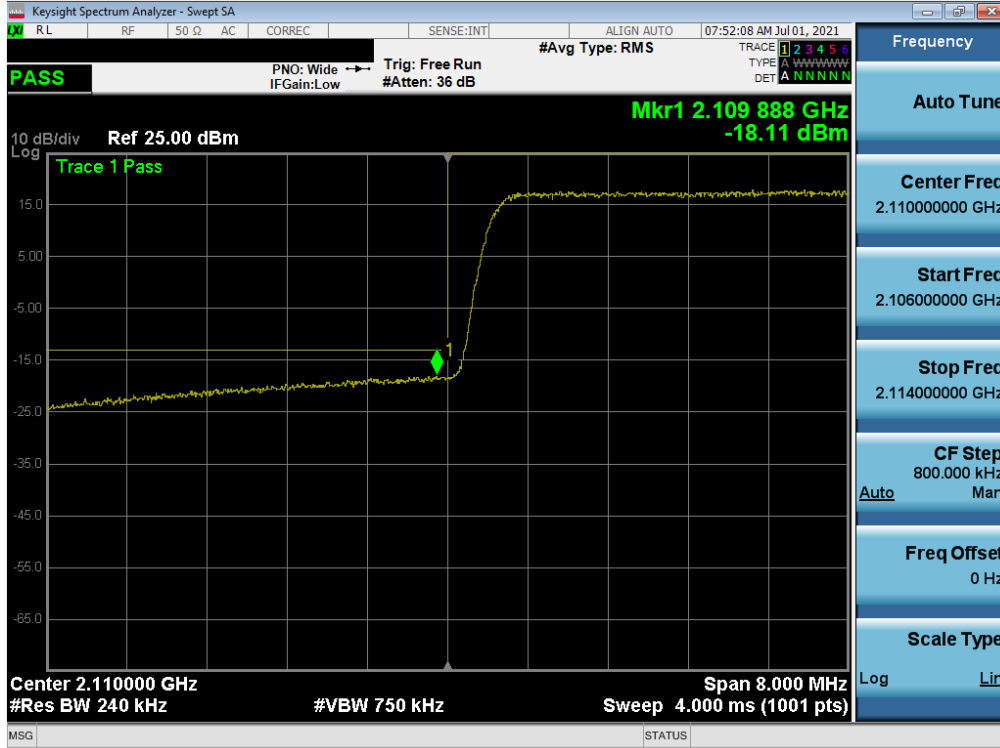


Plot 7-36. Upper Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)

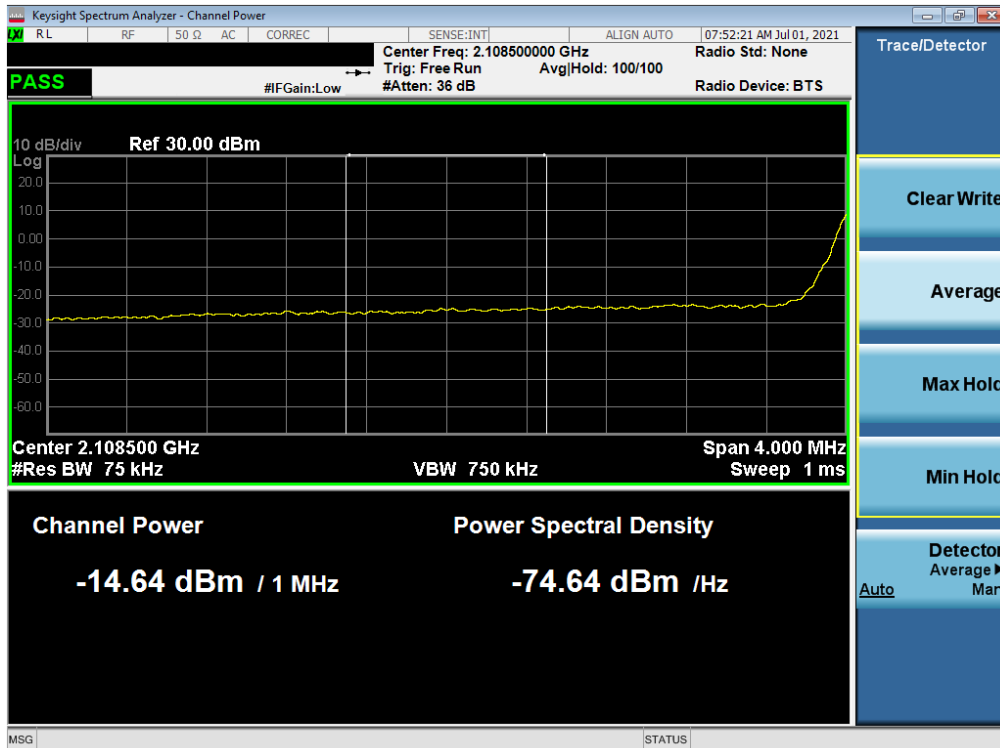


Plot 7-37. Upper Extended Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 35 of 65

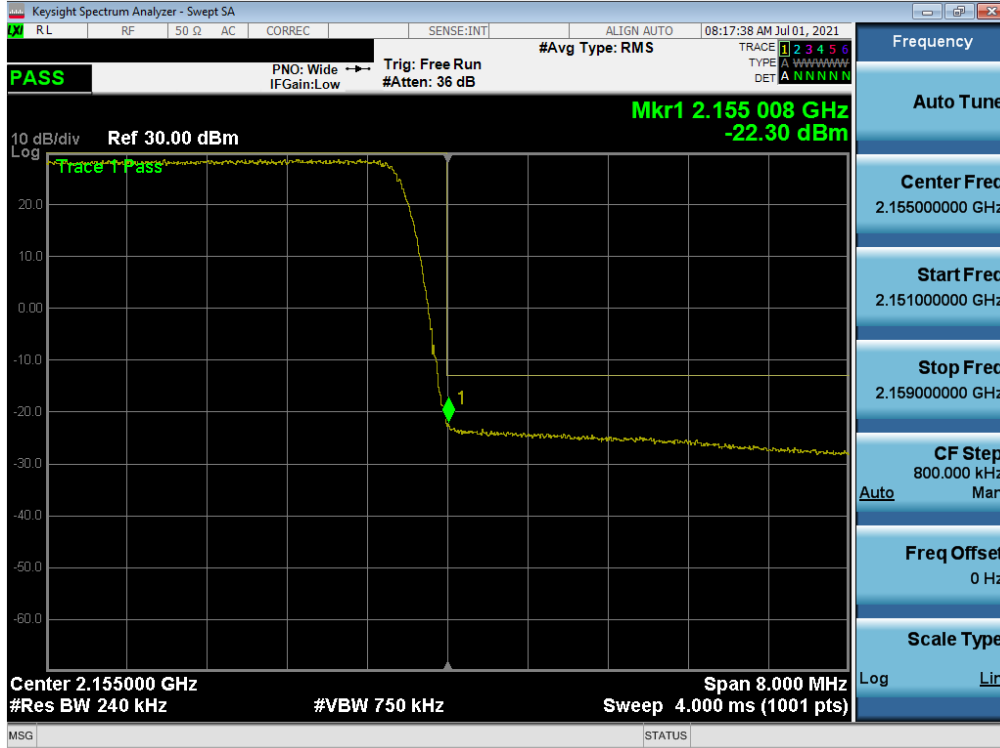


Plot 7-38. Lower Band Edge Plot (LTE Band 66/10/4 - 10MHz QPSK – Full RB)

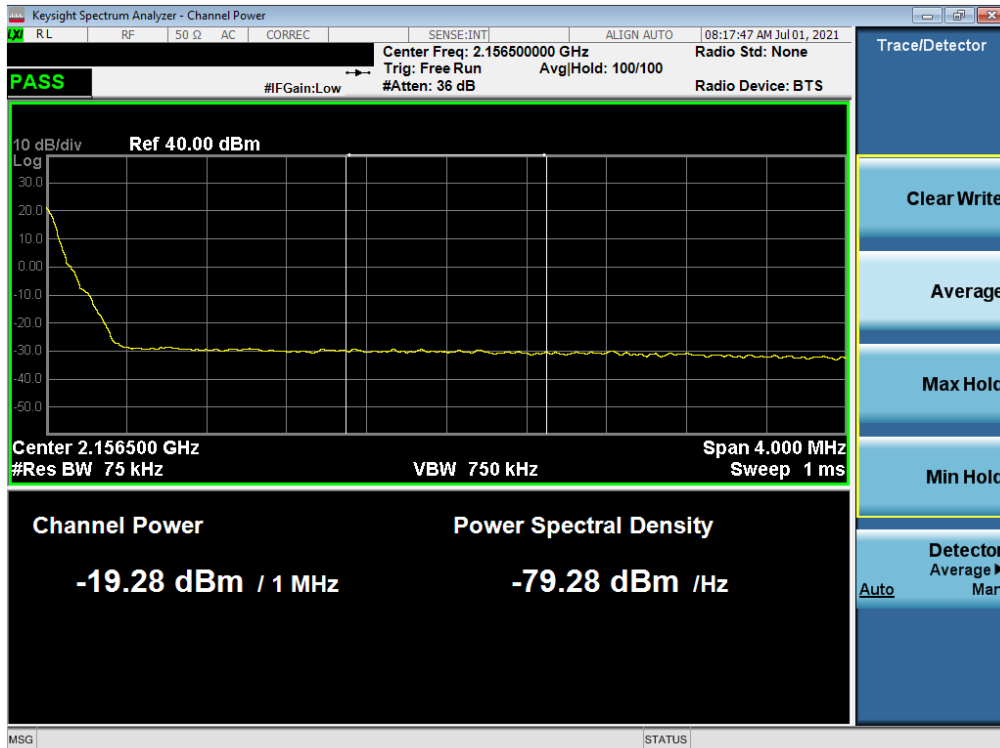


Plot 7-39. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 10MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 36 of 65

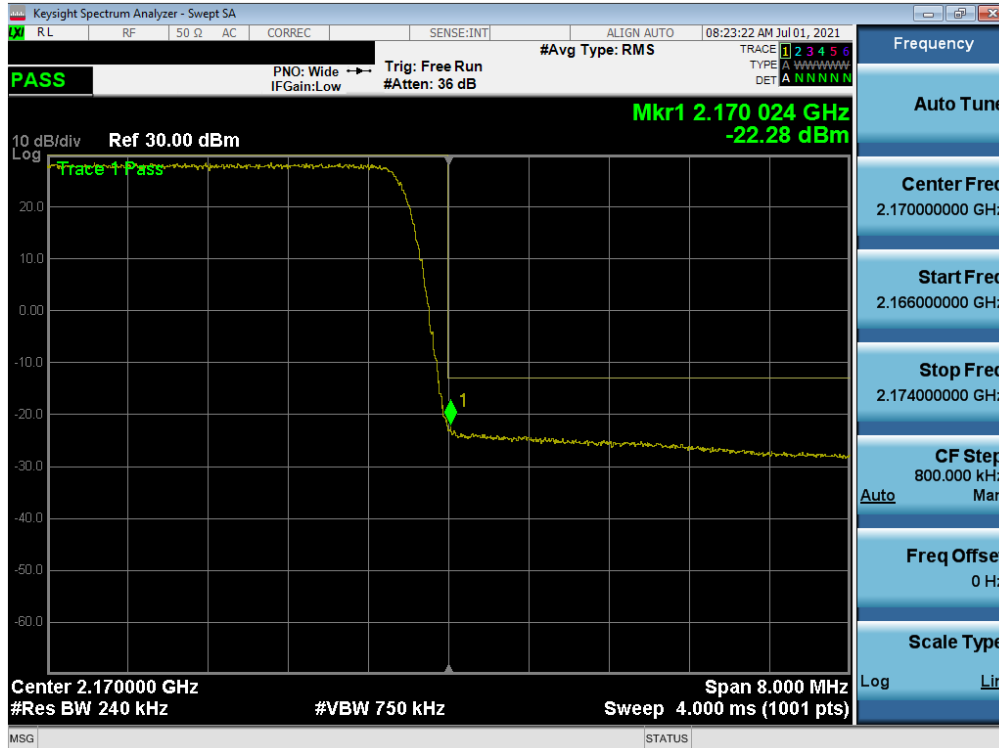


Plot 7-40. Upper Band Edge Plot (LTE Band 4 - 10MHz QPSK – Full RB)

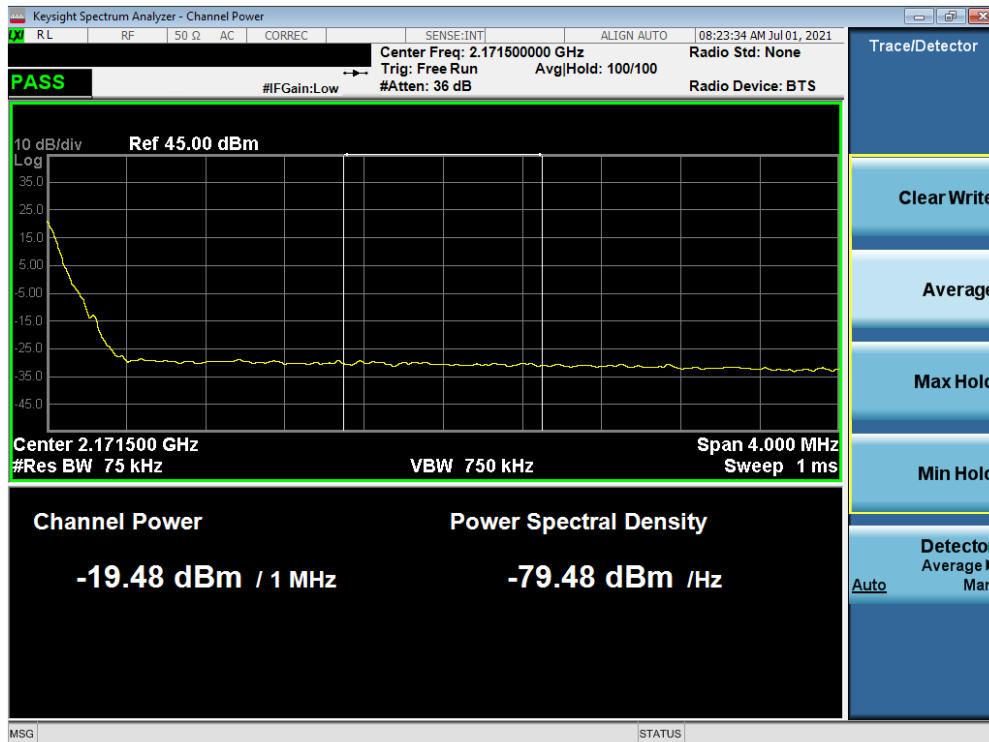


Plot 7-41. Upper Extended Band Edge Plot (LTE Band 4 - 10MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 37 of 65

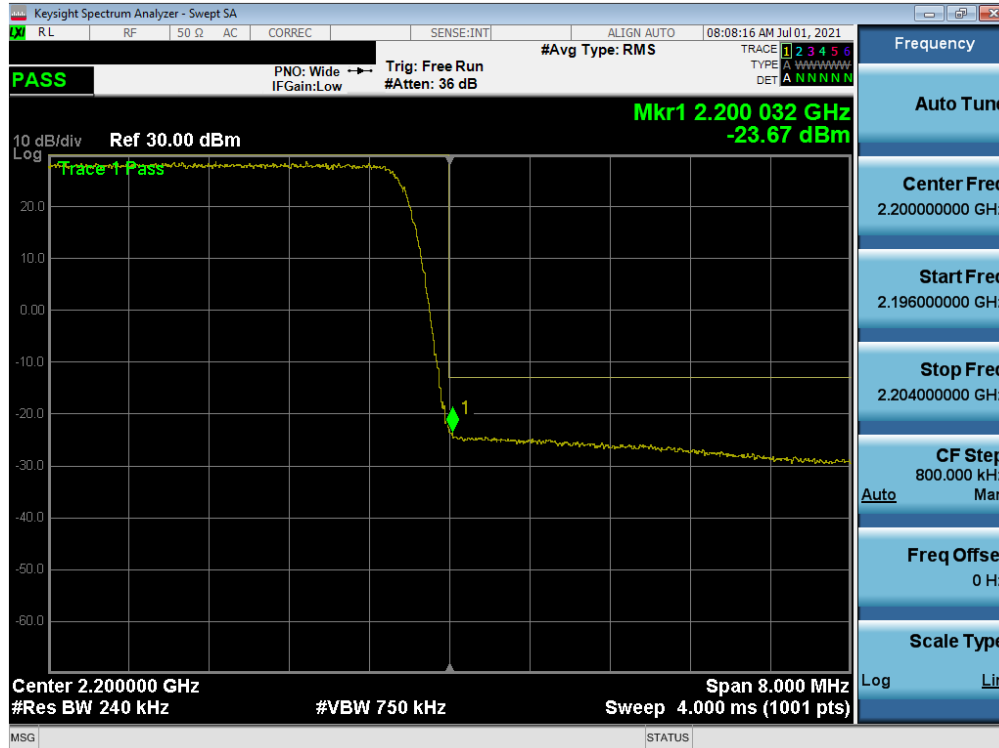


Plot 7-42. Upper Band Edge Plot (LTE Band 10 - 10MHz QPSK – Full RB)

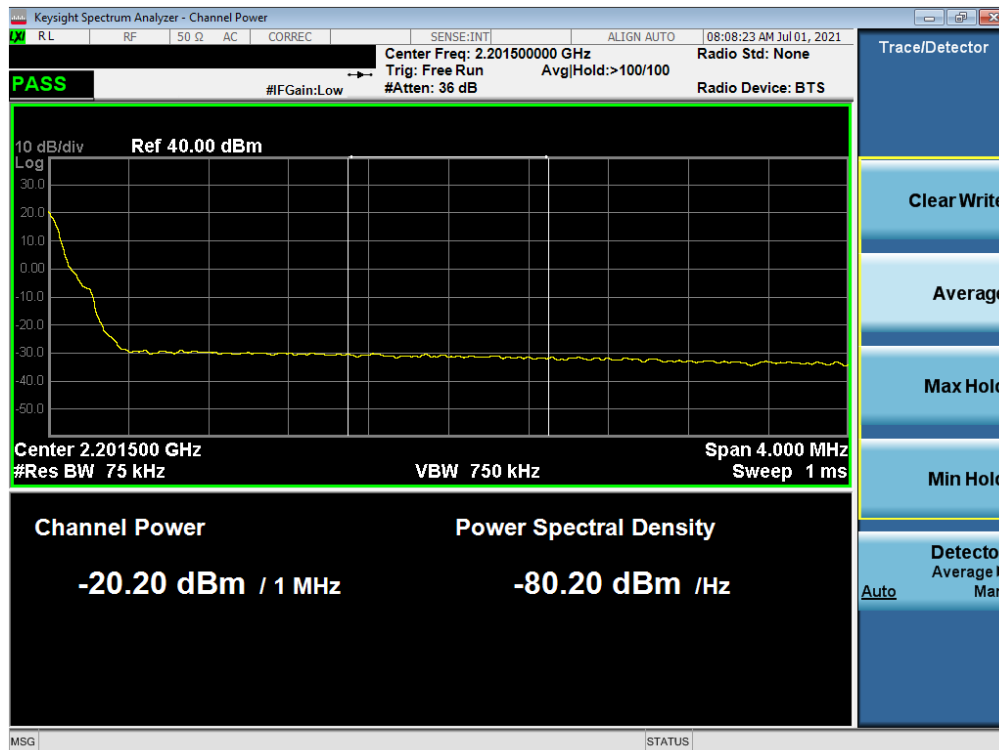


Plot 7-43. Upper Extended Band Edge Plot (LTE Band 10 - 10MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 38 of 65

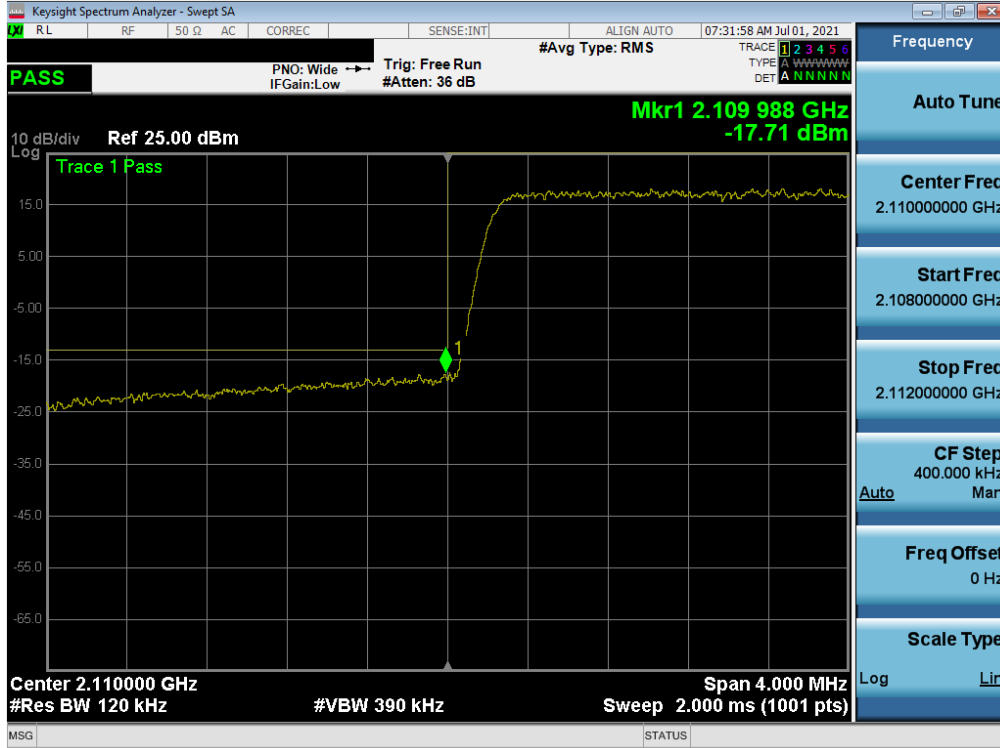


Plot 7-44. Upper Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)

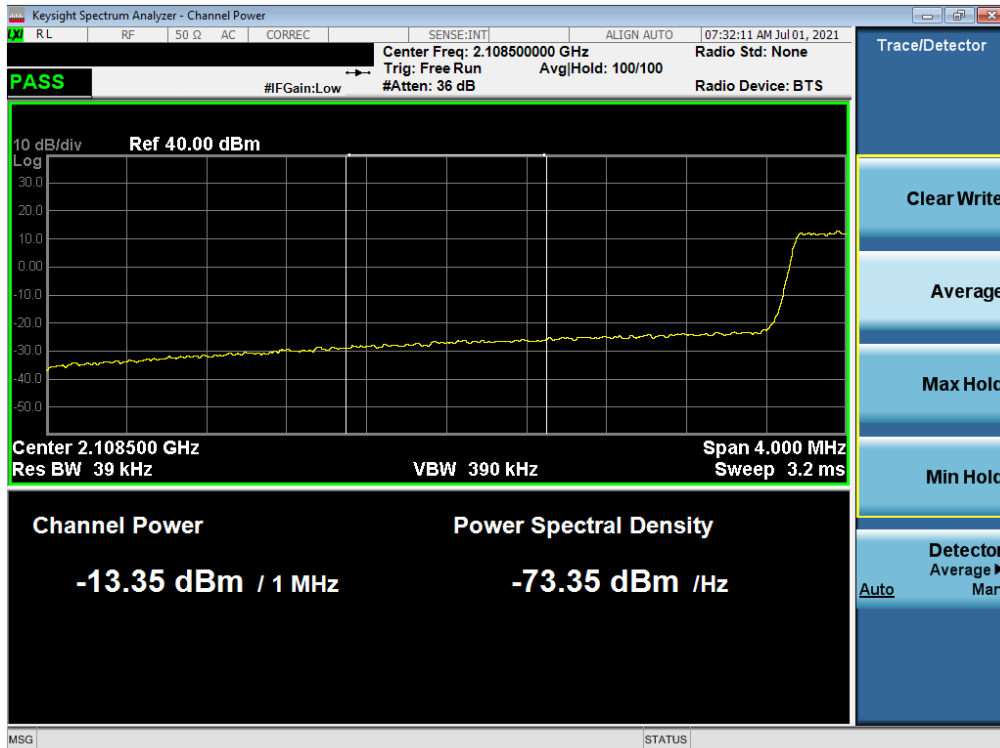


Plot 7-45. Upper Extended Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 39 of 65



Plot 7-46. Lower Band Edge Plot (LTE Band 66/10/4 - 5MHz QPSK – Full RB)

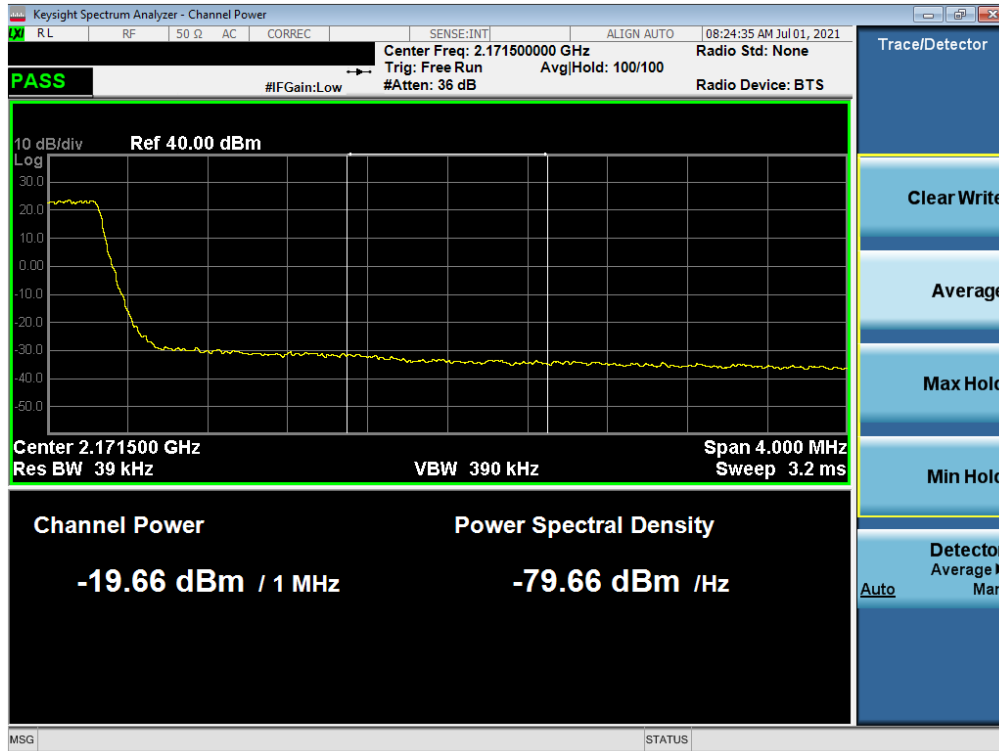


Plot 7-47. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 40 of 65



Plot 7-48. Upper Band Edge Plot (LTE Band 10 - 5MHz QPSK – Full RB)

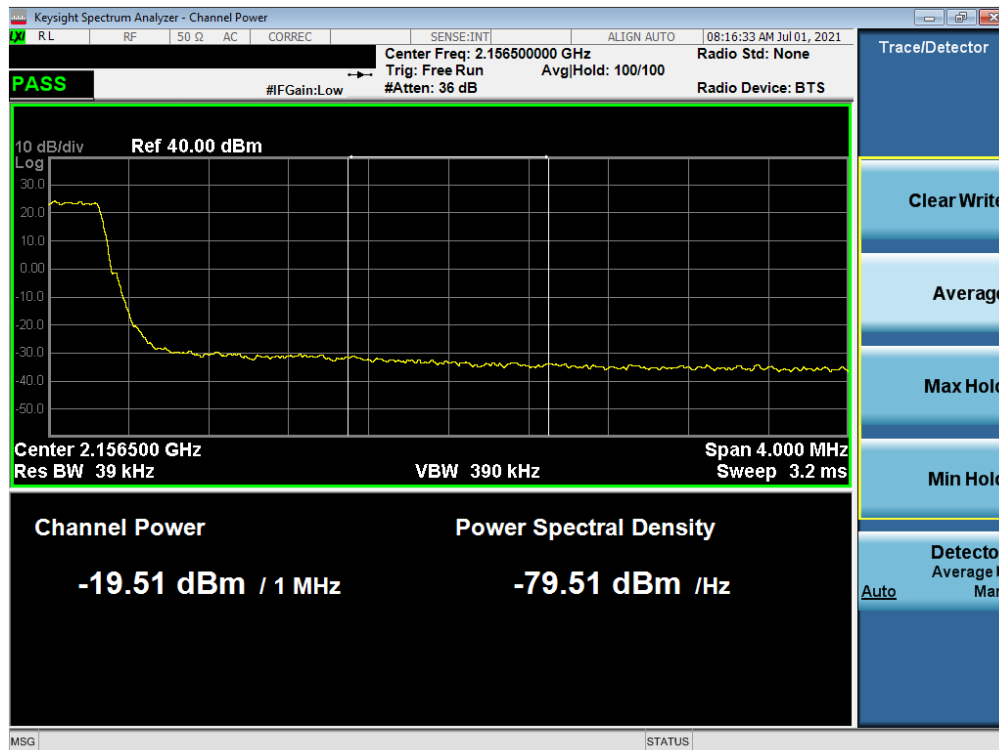


Plot 7-49. Upper Extended Band Edge Plot (LTE Band 10 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 41 of 65

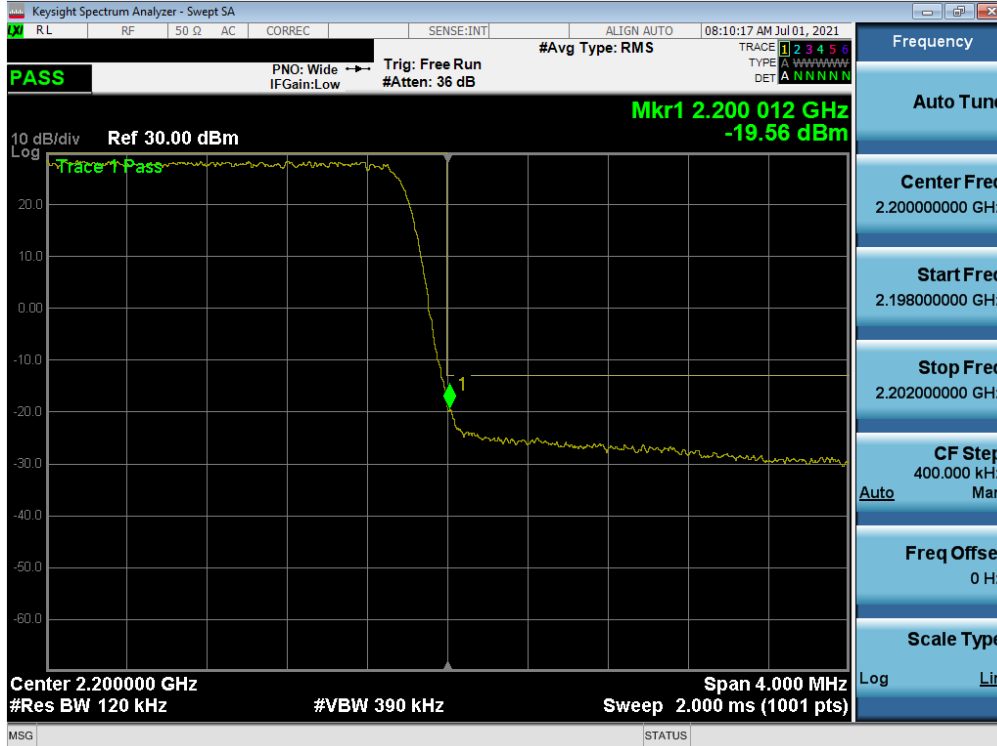


Plot 7-50. Upper Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)

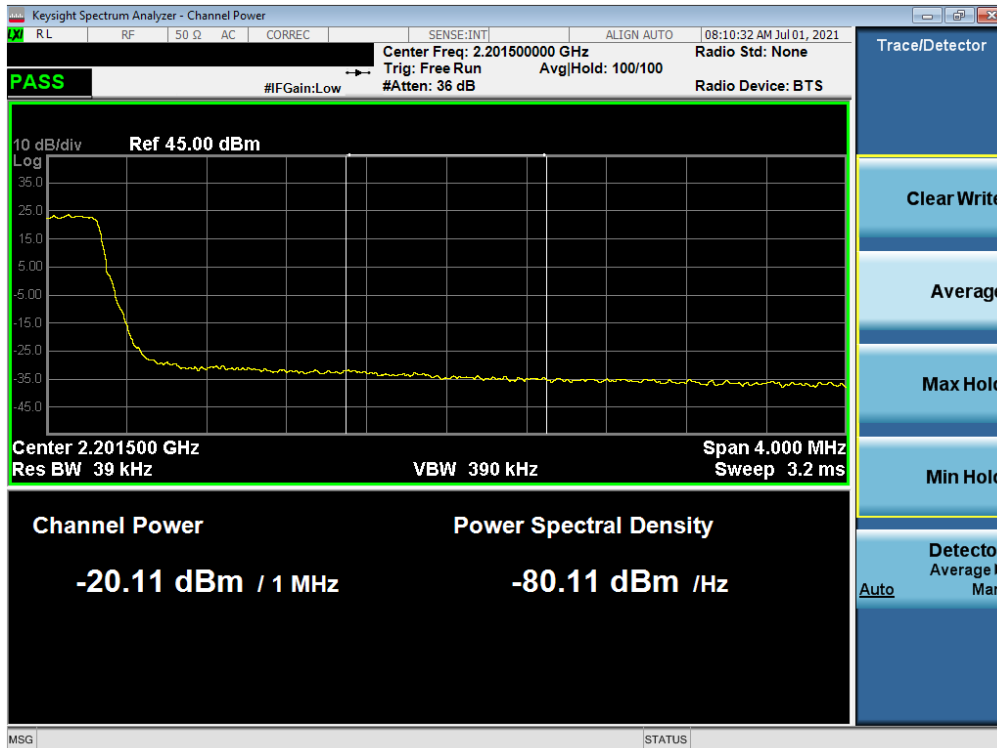


Plot 7-51. Upper Extended Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 42 of 65

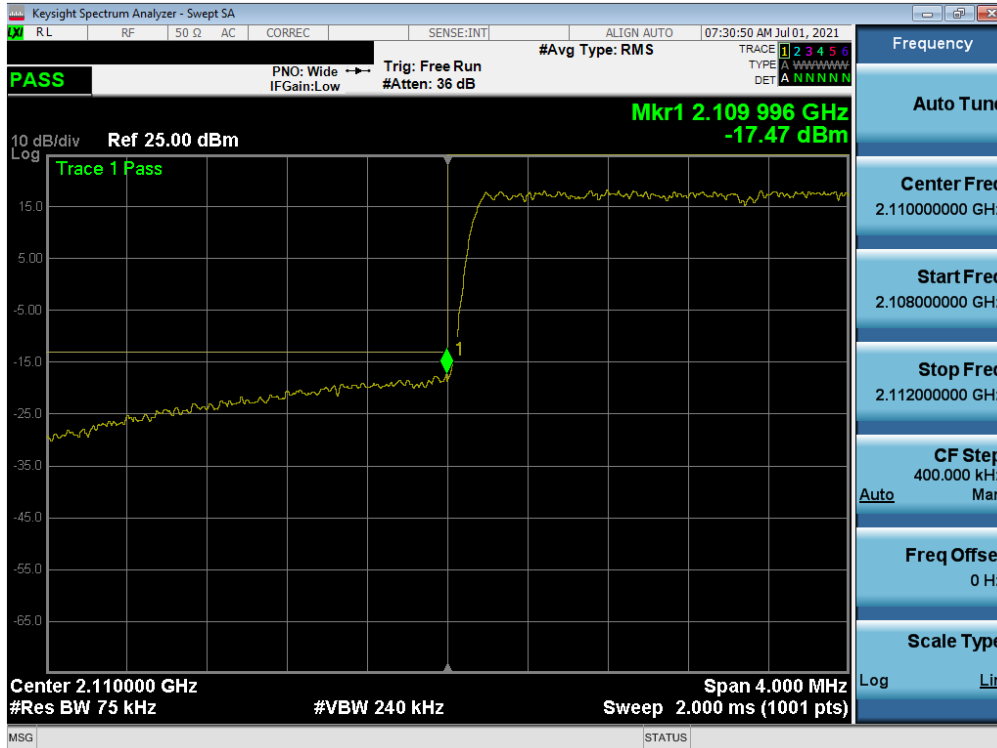


Plot 7-52. Upper Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)

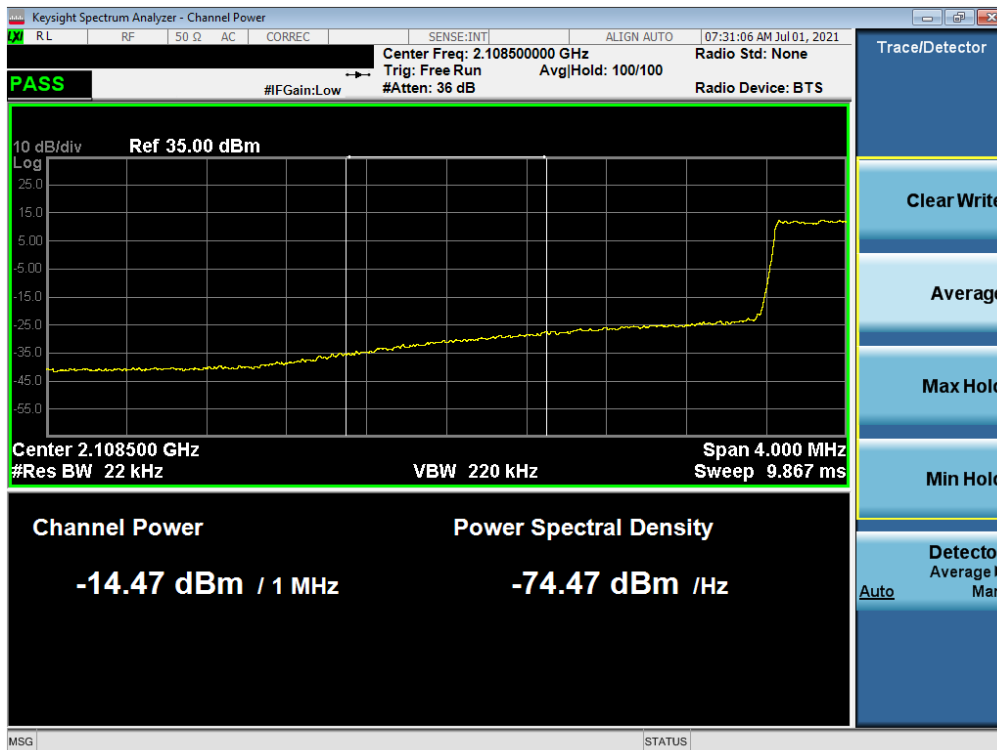


Plot 7-53. Upper Extended Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 43 of 65



Plot 7-54. Lower Band Edge Plot (LTE Band 66/10/4 - 3MHz QPSK – Full RB)

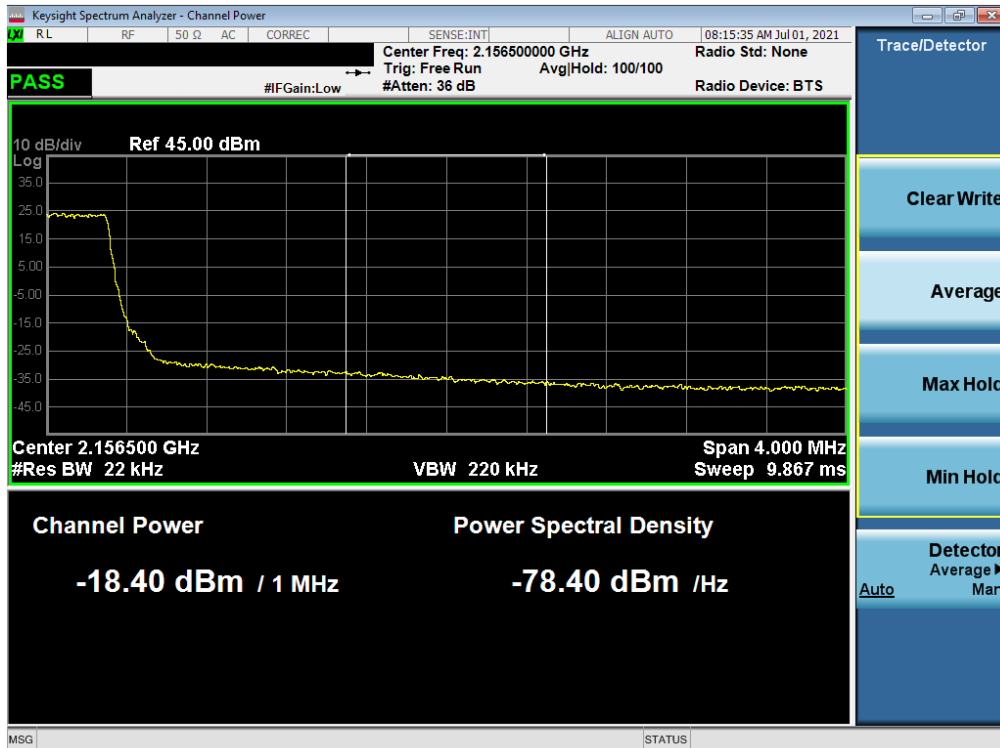


Plot 7-55. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 3MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 44 of 65

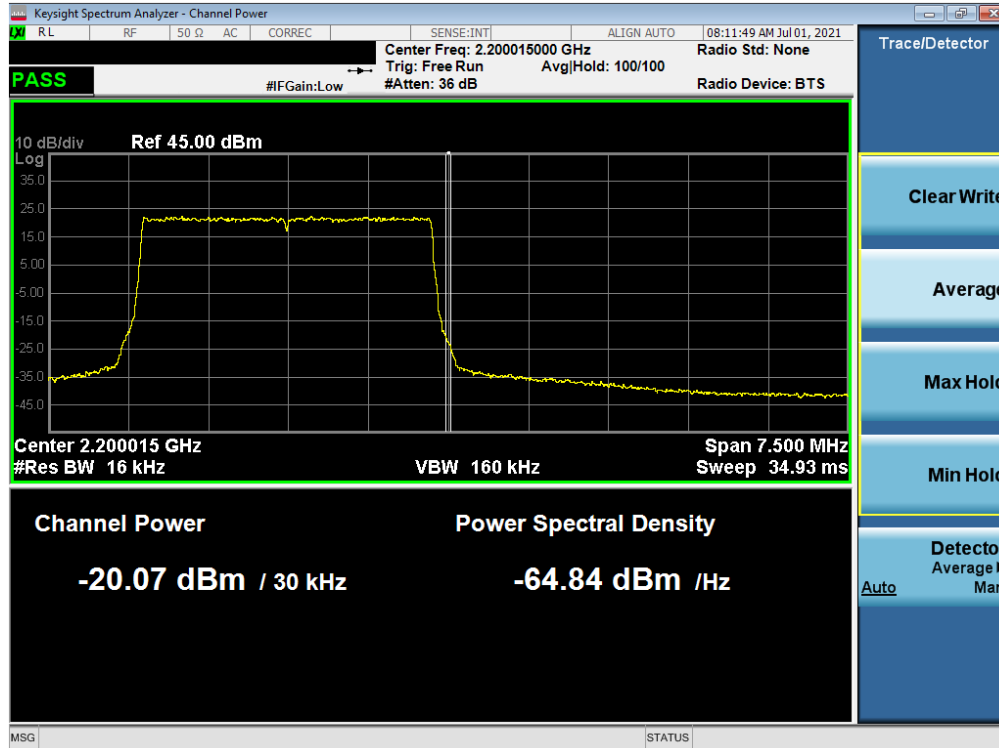


Plot 7-56. Upper Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)

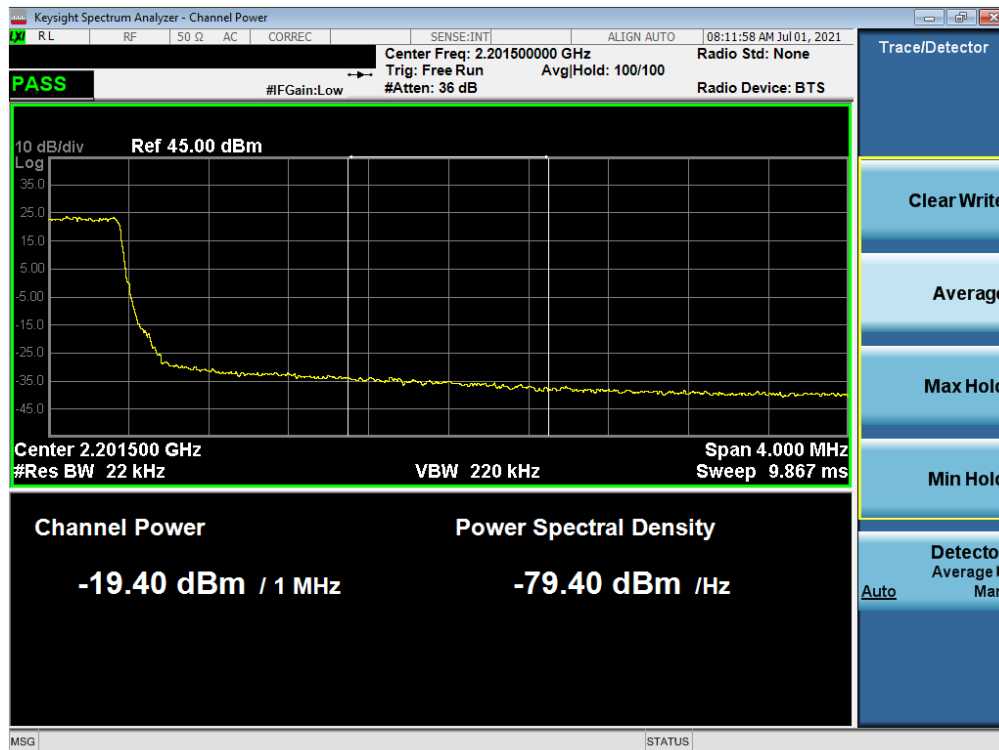


Plot 7-57. Upper Extended Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 45 of 65

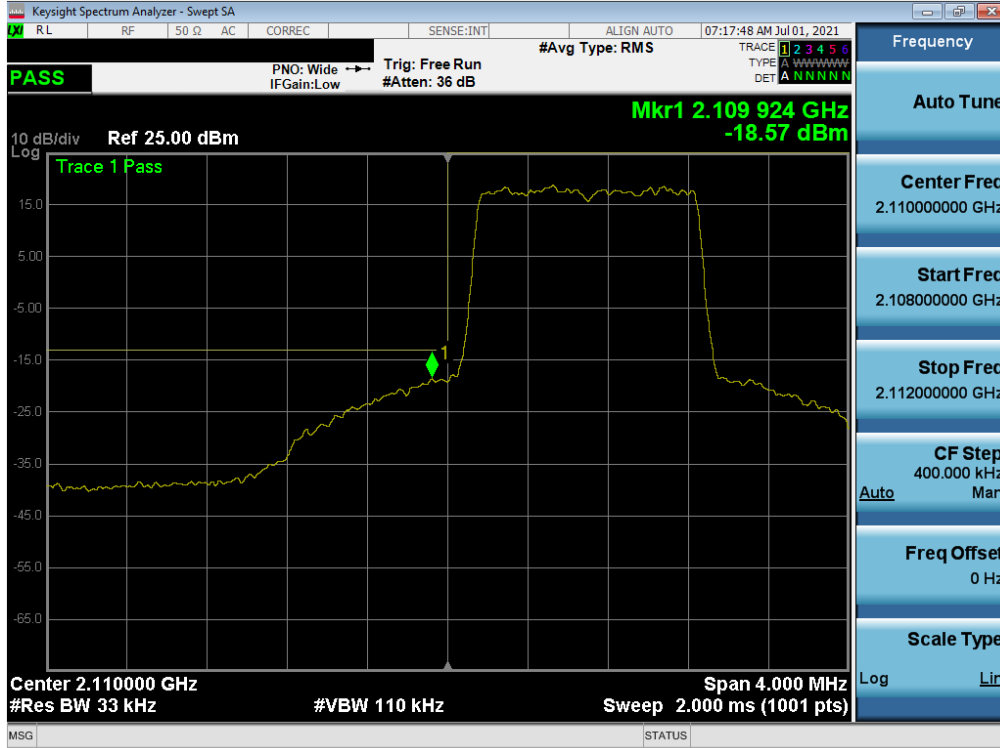


Plot 7-58. Upper Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)

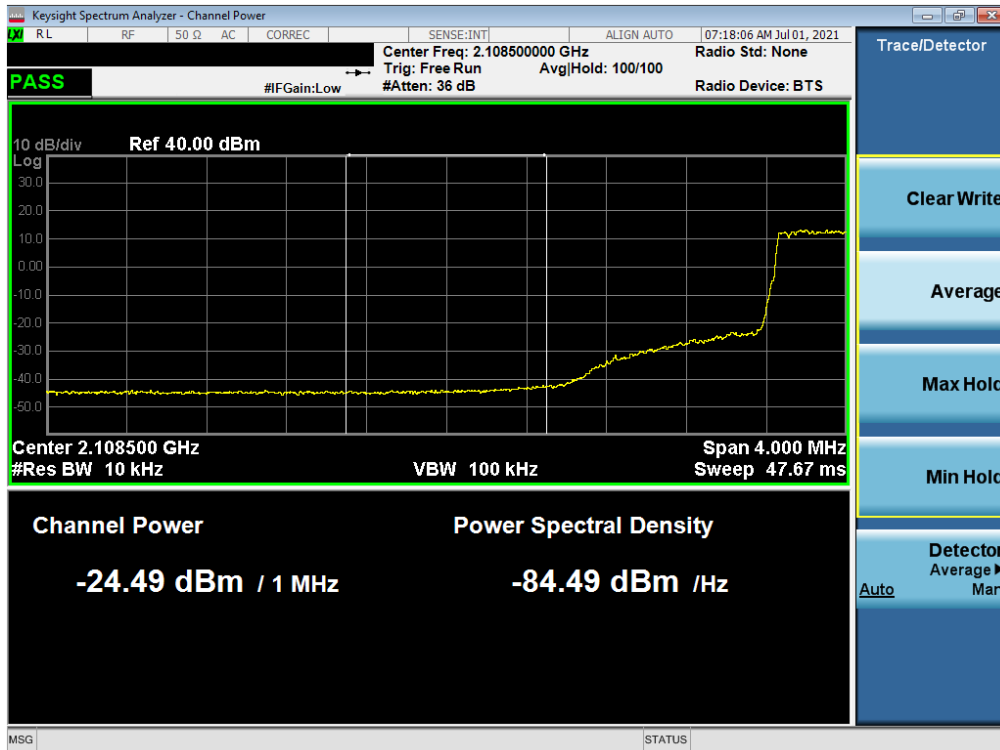


Plot 7-59. Upper Extended Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 46 of 65



Plot 7-60. Lower Band Edge Plot (LTE Band 66/10/4 – 1.4MHz QPSK – Full RB)

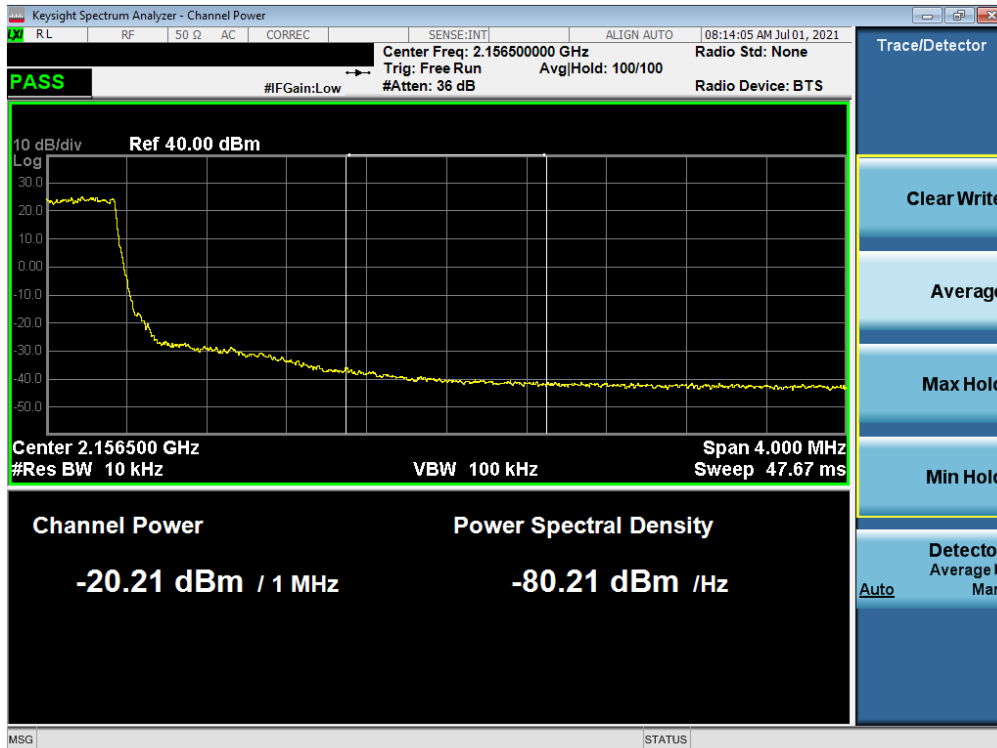


Plot 7-61. Lower Extended Band Edge Plot (LTE Band 66/10/4 – 1.4MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 47 of 65

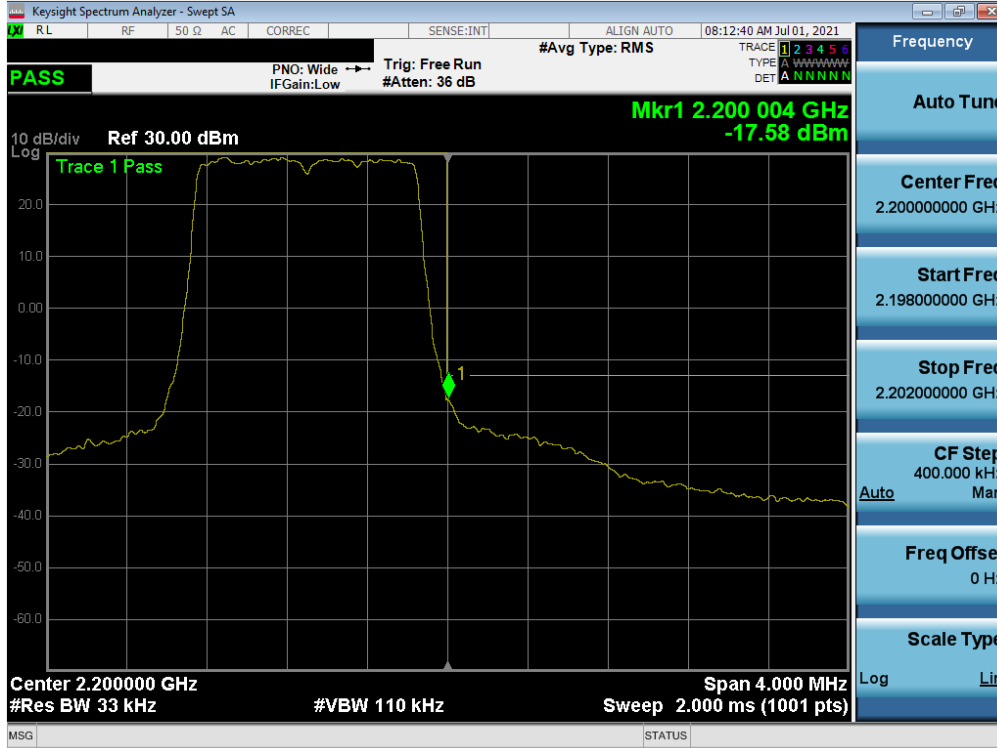


Plot 7-62. Upper Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)

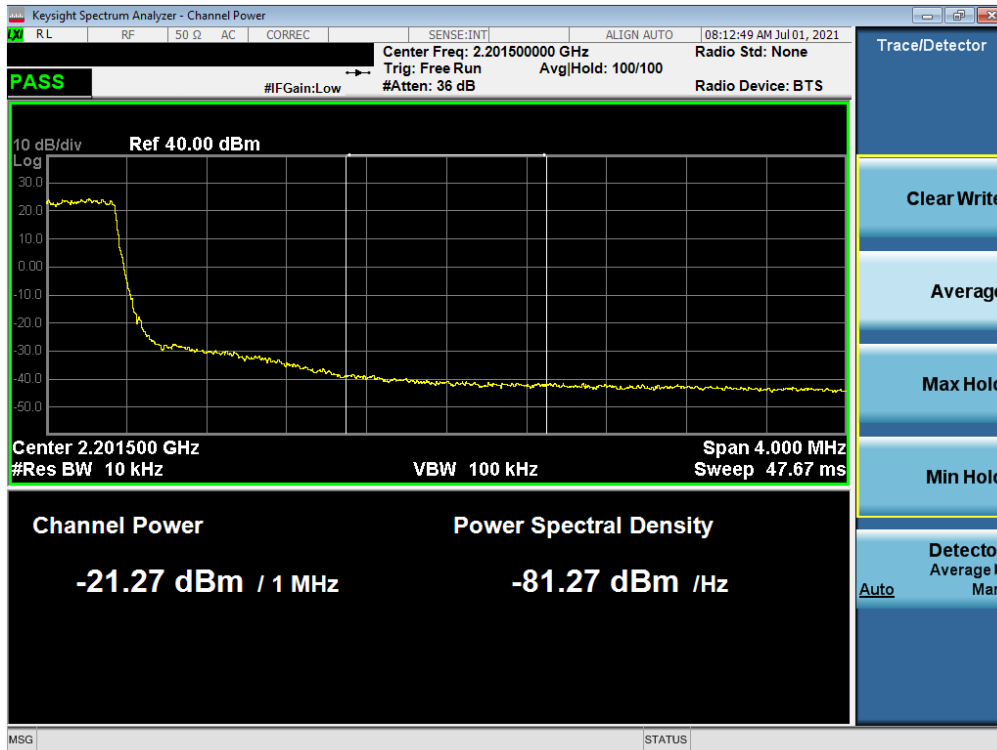


Plot 7-63. Upper Extended Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 48 of 65



Plot 7-64. Upper Band Edge Plot (LTE Band 66 – 1.4MHz QPSK – Full RB)



Plot 7-65. Upper Extended Band Edge Plot (LTE Band 66 – 1.4MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 49 of 65

7.6 Peak-Average Ratio

Test Overview

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.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.7.1

Test Settings

1. The signal analyzer’s CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW \geq OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, 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

Test Setup

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

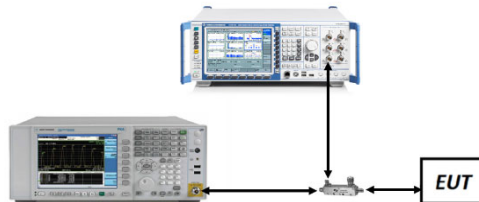





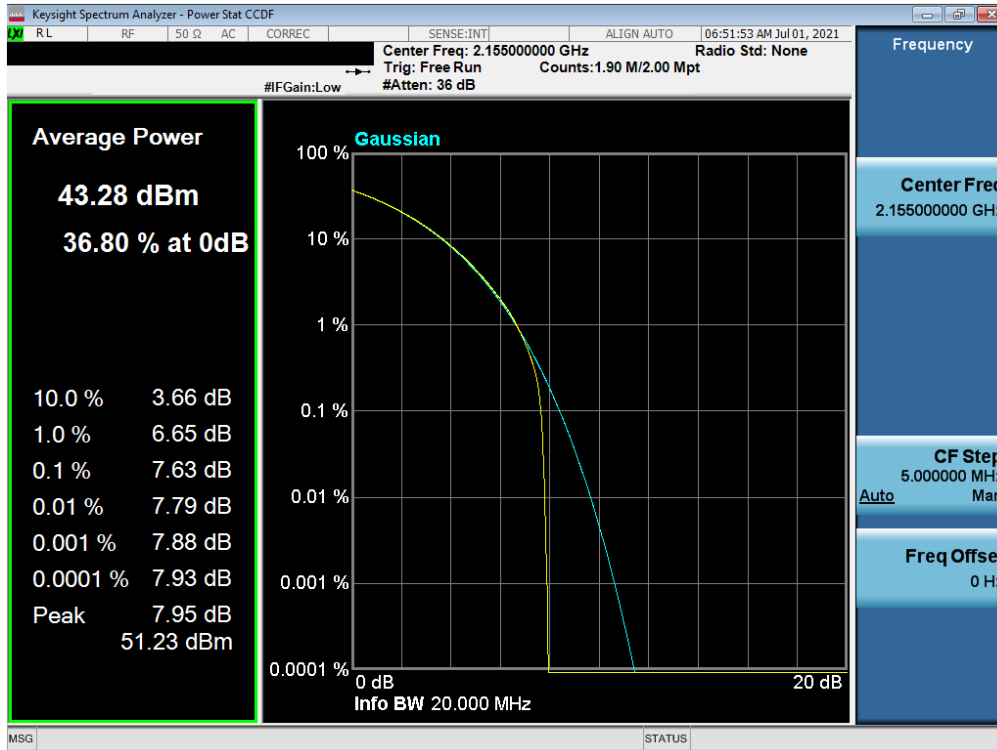
Figure 7-5. Test Instrument & Measurement Setup

Test Notes

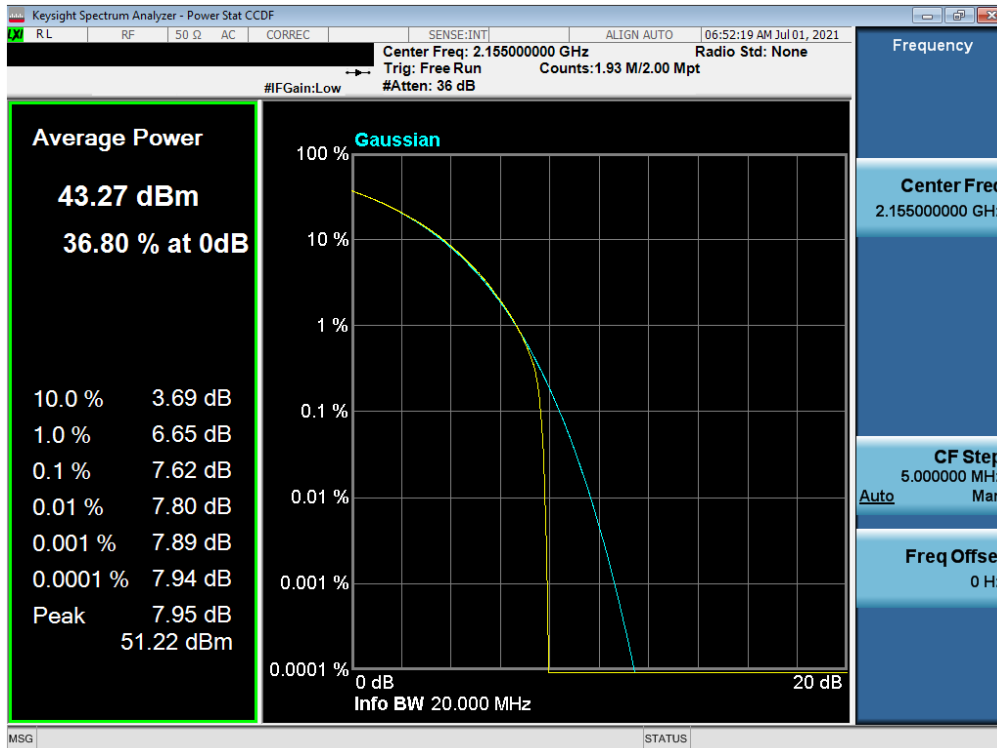
None.

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT	 Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 50 of 65

LTE Band 66/10/4

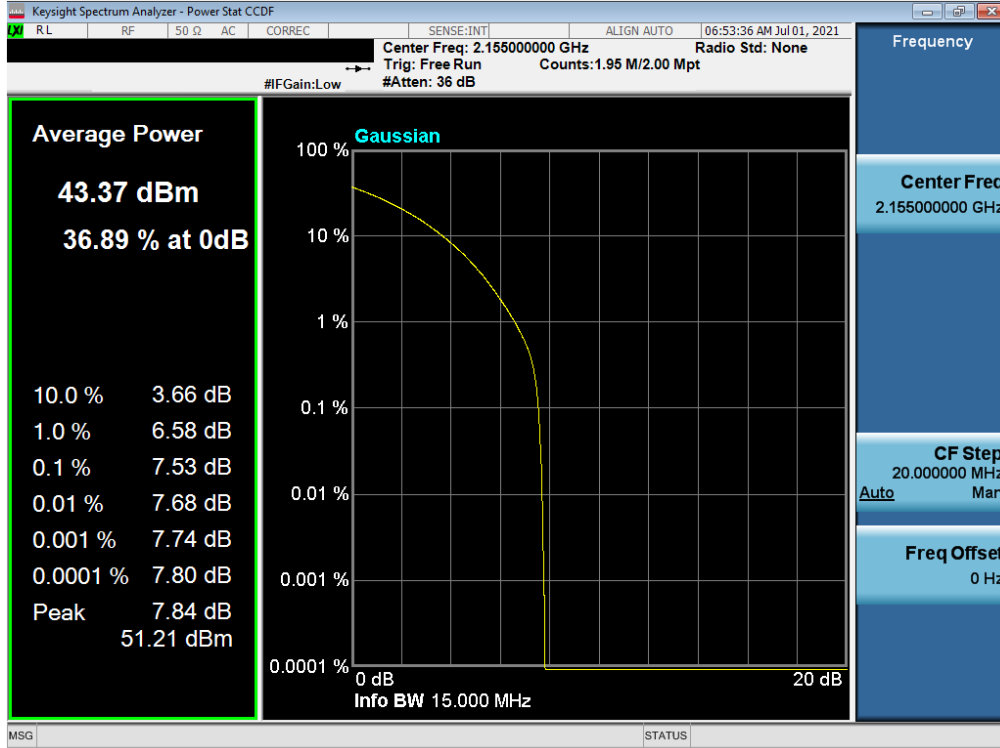


Plot 7-66. PAR Plot (LTE Band 66/10/4 - 20MHz QPSK - Full RB)

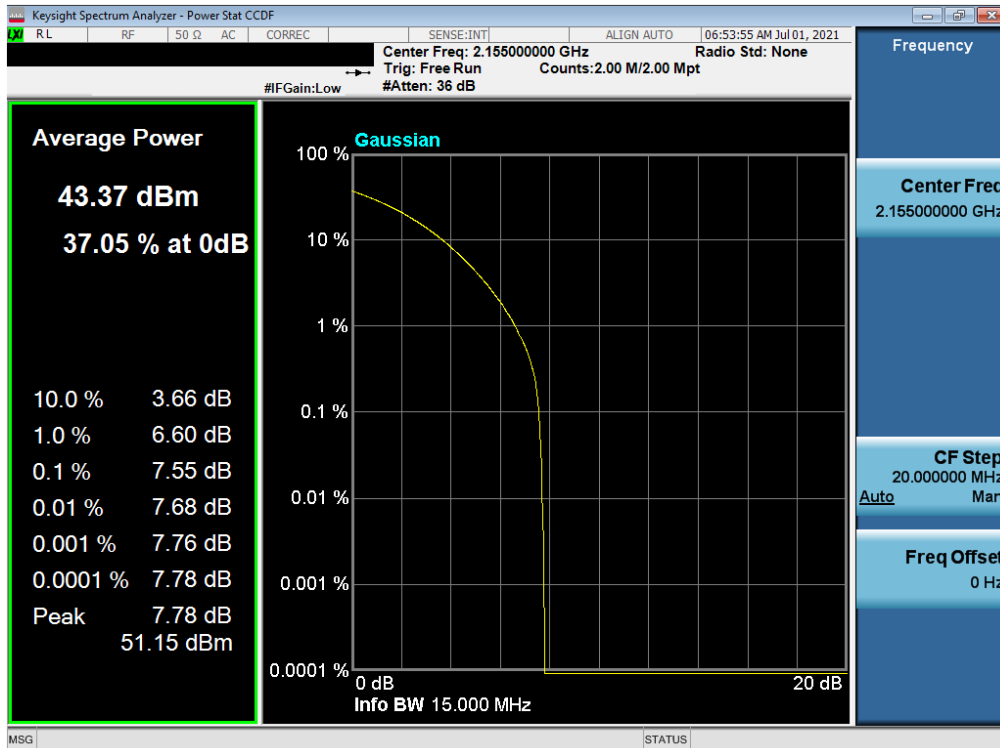


Plot 7-67. PAR Plot (LTE Band 66/10/4 - 20MHz 256-QAM - Full RB)




FCC ID: QLJMRU-19212326	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 51 of 65

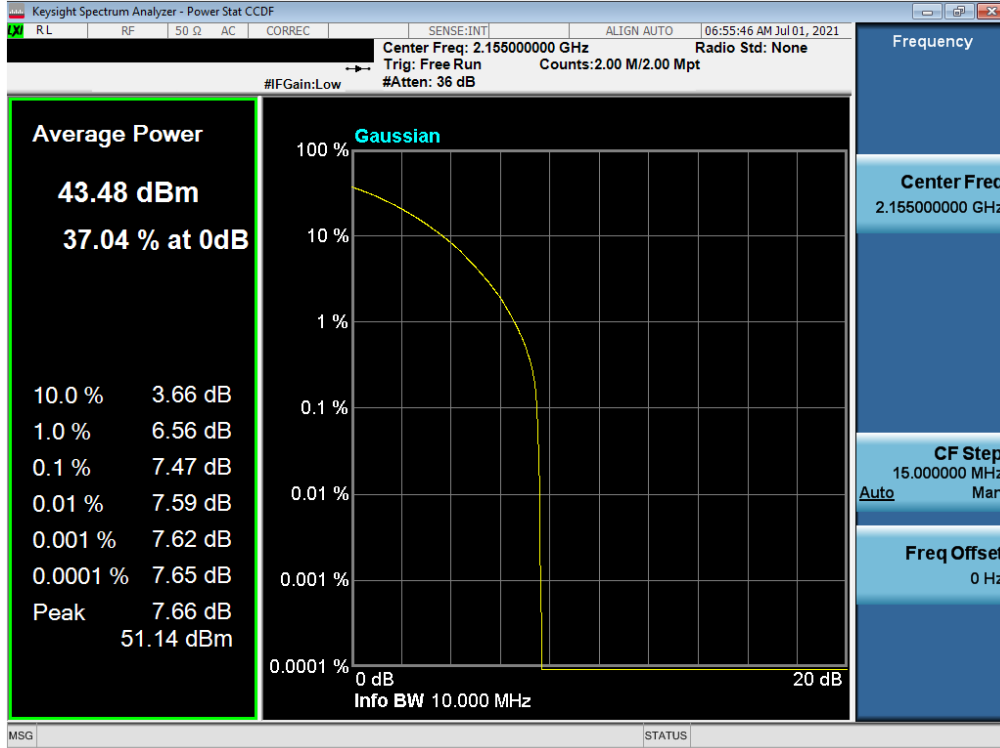


Plot 7-68. PAR Plot (LTE Band 66/10/4 - 15MHz QPSK - Full RB)

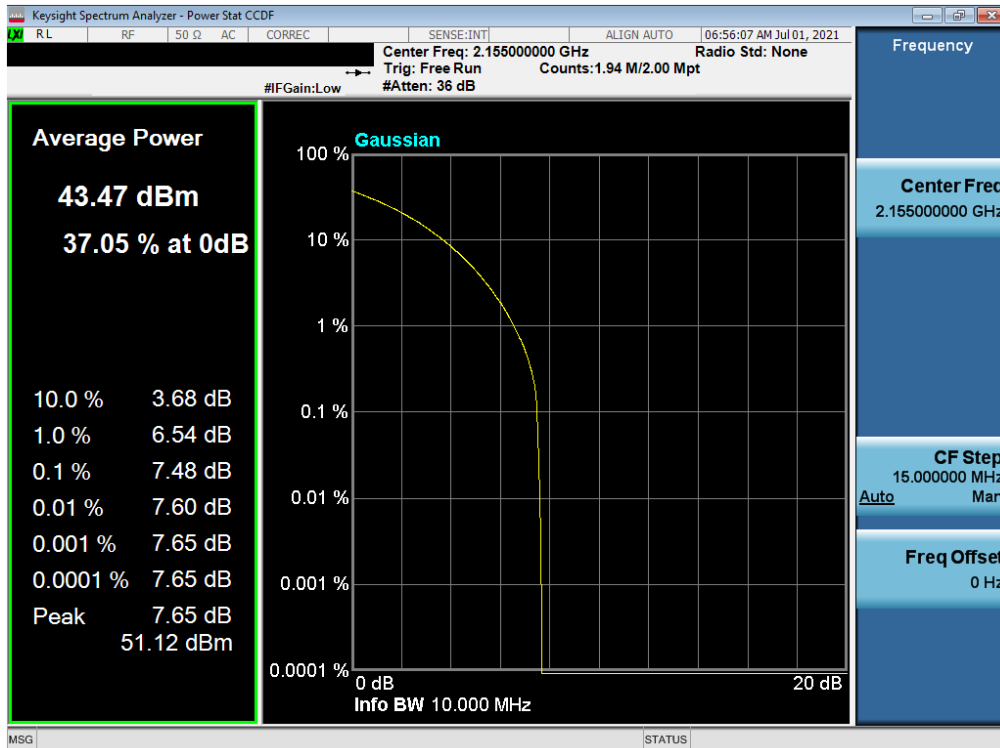


Plot 7-69. PAR Plot (LTE Band 66/10/4 - 15MHz 256-QAM - Full RB)




FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 52 of 65

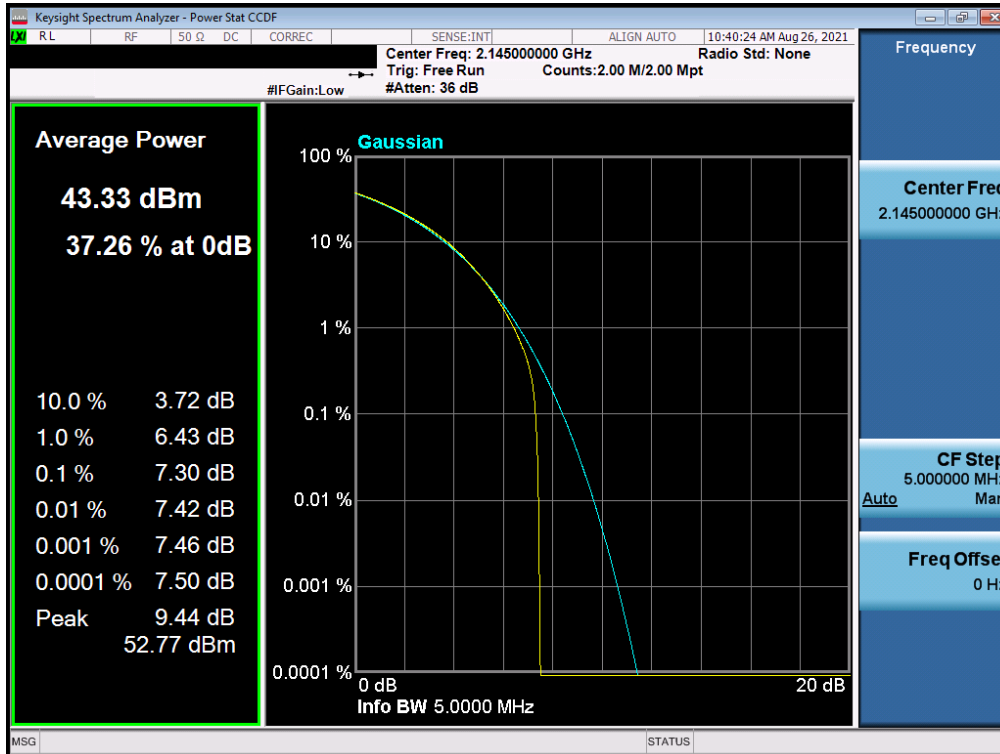
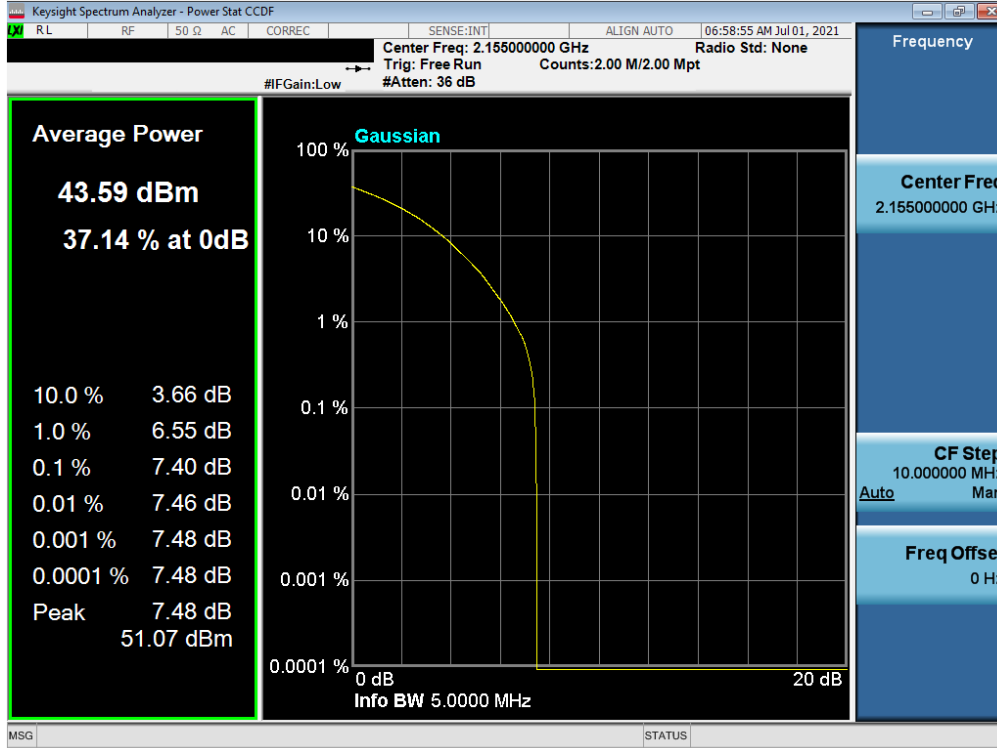





Plot 7-70. PAR Plot (LTE Band 66/10/4 - 10MHz QPSK - Full RB)

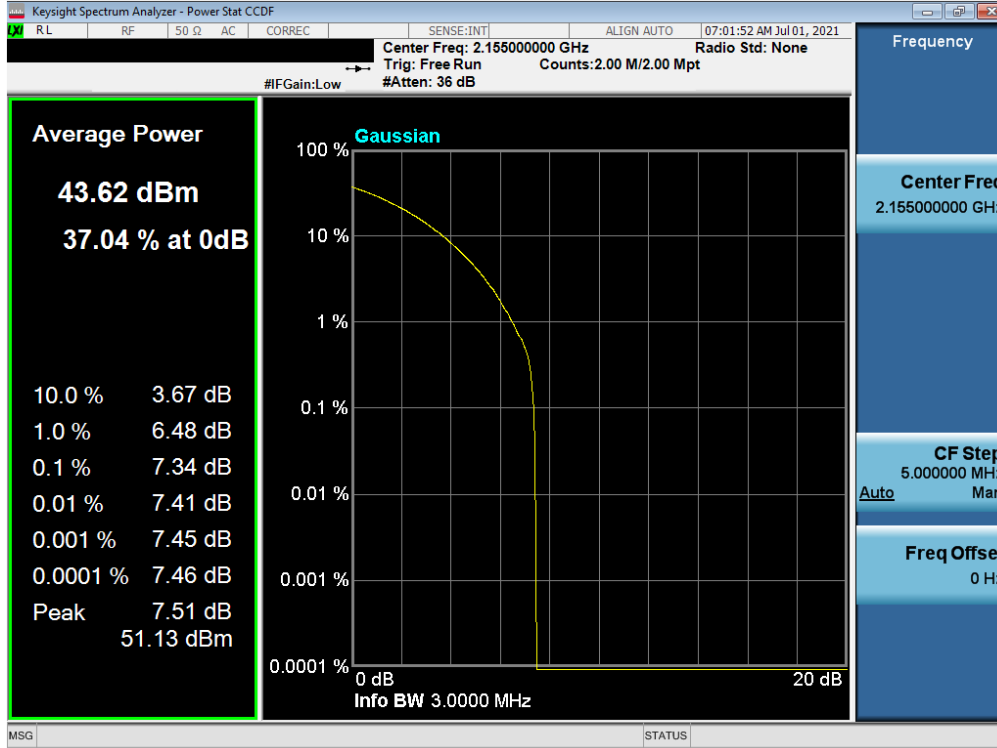


Plot 7-71. PAR Plot (LTE Band 66/10/4 - 10MHz 256-QAM - Full RB)

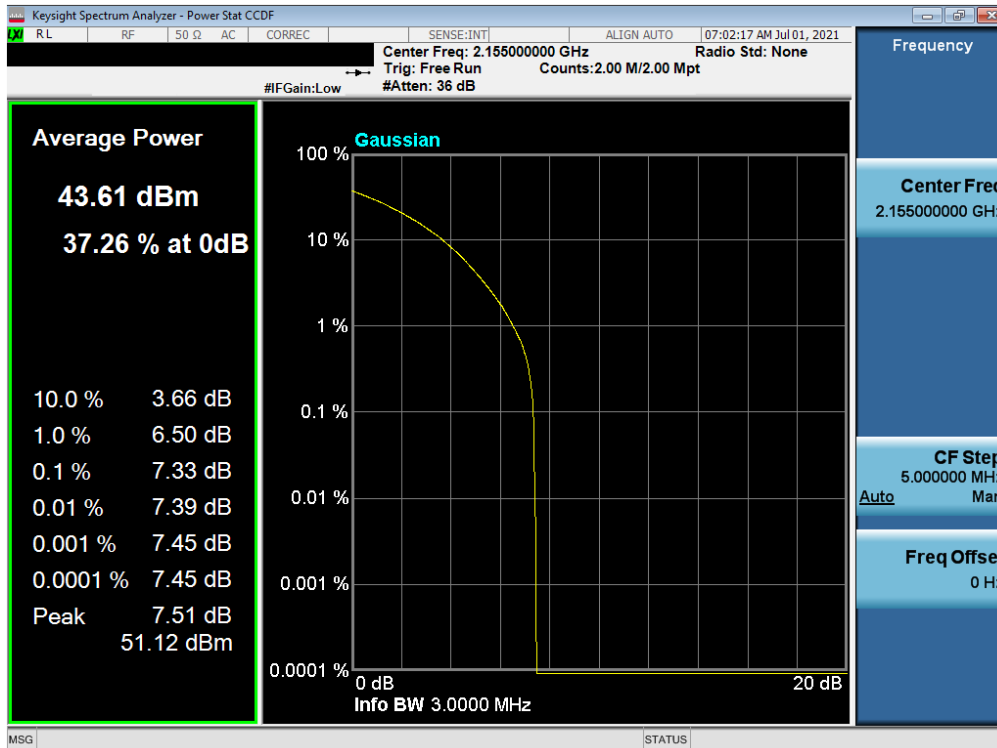
FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 53 of 65






FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 54 of 65

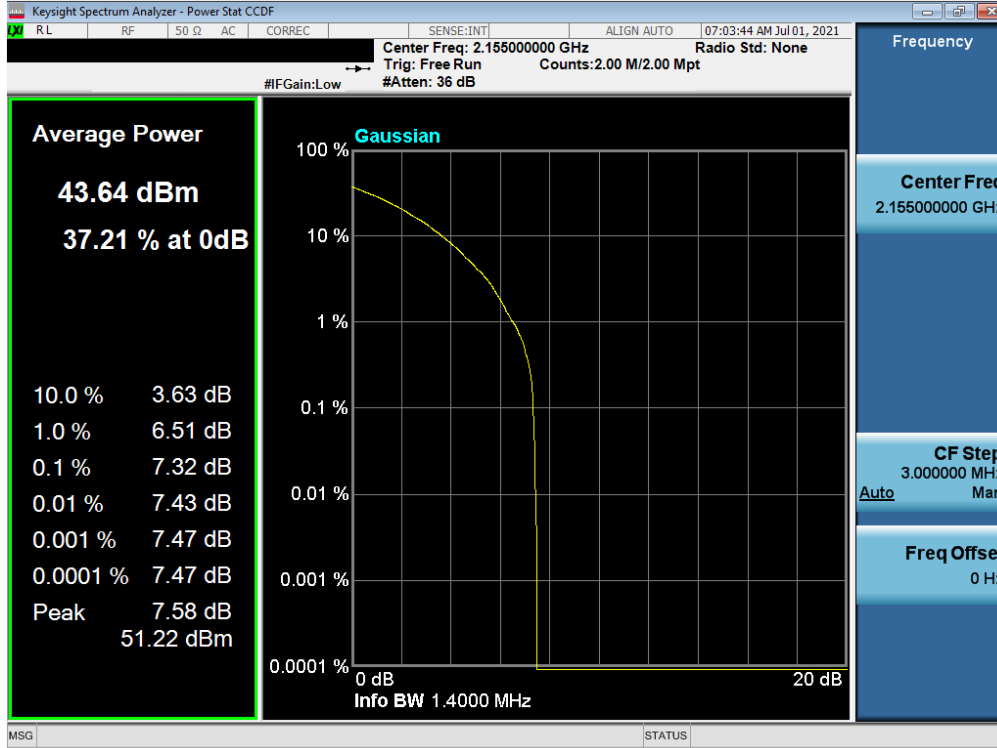


Plot 7-74. PAR Plot (LTE Band 66/10/4 - 3MHz QPSK - Full RB)

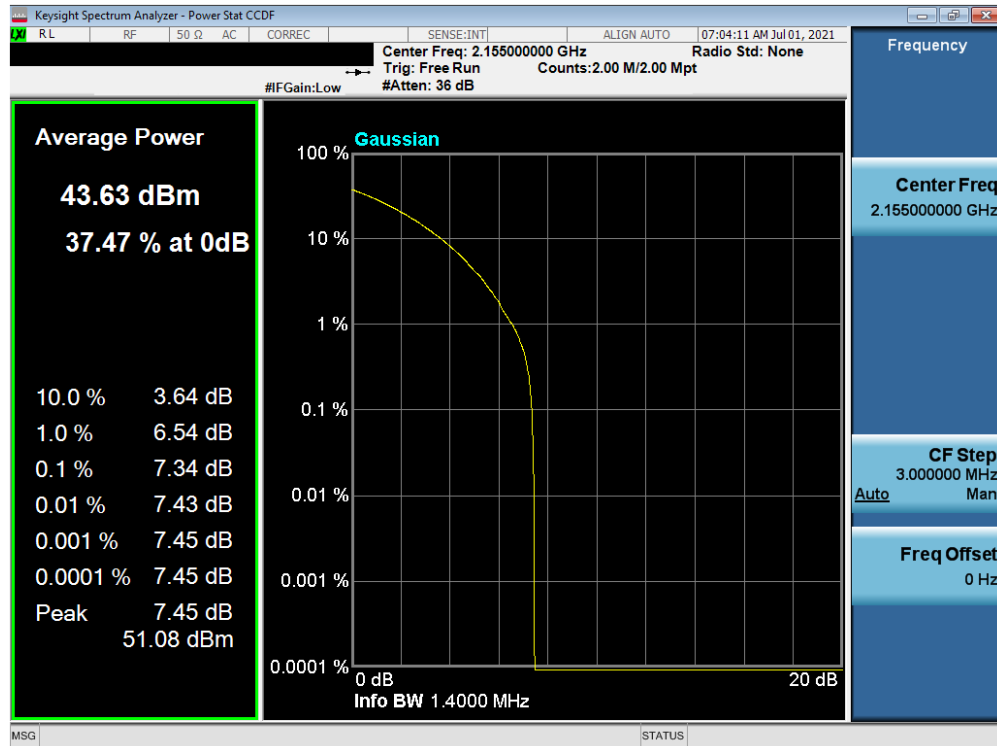


Plot 7-75. PAR Plot (LTE Band 66/10/4 - 3MHz 256-QAM - Full RB)



FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of 	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 55 of 65



Plot 7-76. PAR Plot (LTE Band 66/10/4 - 1.4MHz QPSK - Full RB)



Plot 7-77. PAR Plot (LTE Band 66/10/4 - 1.4MHz 256-QAM - Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 - 10/18/2021	EUT Type: Mid Band mRU		Page 56 of 65

7.7 Radiated Spurious Emissions Measurements

Test Overview



Radiated spurious emissions measurements are performed as average/RMS measurements with the EUT transmitting into a 50 ohm termination. Measurements on signals operating below 1GHz are performed using hybrid bi-log antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as Average/RMS 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

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 57 of 65	

Test Setup

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

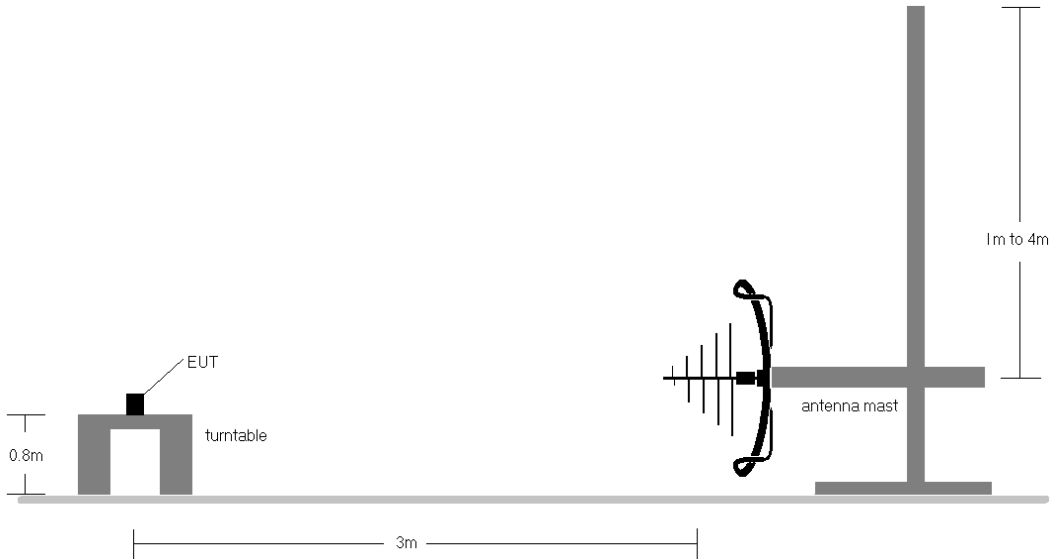


Figure 7-6. Test Instrument & Measurement Setup <1GHz

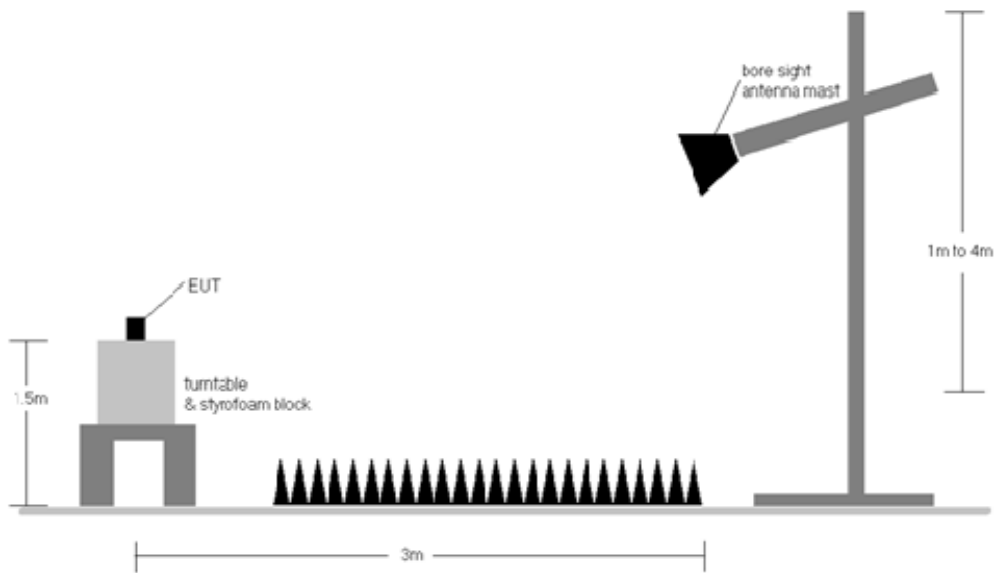







Figure 7-7. Test Instrument & Measurement Setup

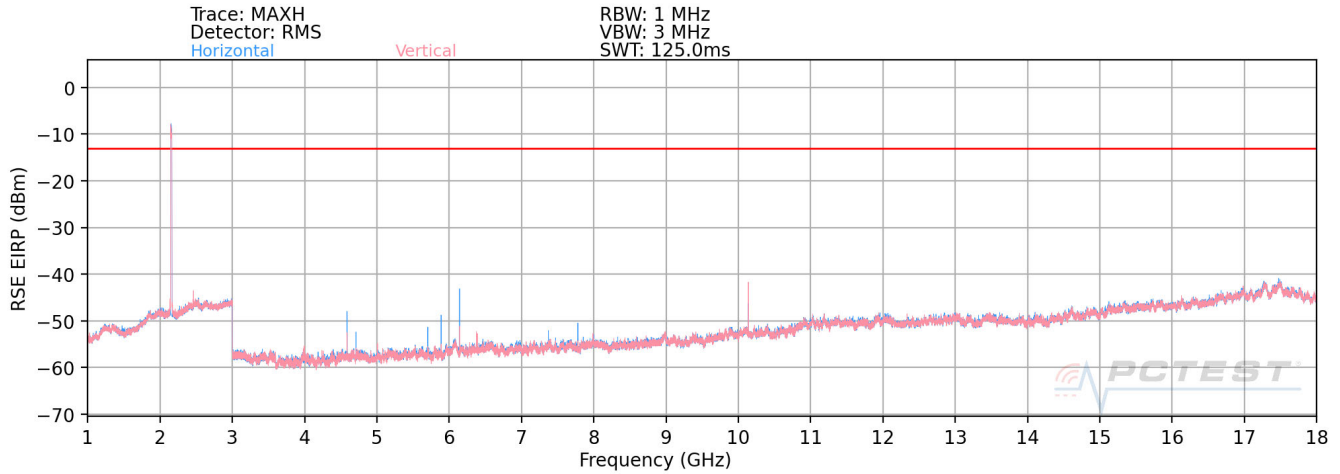
<p>FCC ID: QLJMRU-19212326</p>	<p> PCTEST Proud to be part of </p>	<p>PART 27 MEASUREMENT REPORT</p>	<p> Approved by: Technical Manager</p>
<p>Test Report S/N: 1M2106040064-02.QLJ</p>	<p>Test Dates: 06/23 – 10/18/2021</p>	<p>EUT Type: Mid Band mRU</p>	<p>Page 58 of 65</p>

Test Notes

- 1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - b) $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - d) $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$; where D is the measurement distance in meters.
- 2) The EUT was tested in three orthogonal planes and 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 EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.
- 5) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. 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.
- 8) Radiated Emissions were also investigated for the case of all supported bands transmitting simultaneously. Data is included in the section below.

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of @element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 59 of 65	

LTE Band 66/10/4



Plot 7-78. Radiated Spurious Plot (LTE Band 66/10/4)

Bandwidth (MHz):	20
Frequency (MHz):	2120.0
RB / Offset:	1 / 50
Detector / Trace Mode:	RMS / Average
RBW / VBW:	1MHz / 3MHz



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]
4240.0	H	172	234	-64.85	3.64	45.79	-49.47	-13.00	-36.47
6360.0	H	162	145	-71.69	7.38	42.69	-52.57	-13.00	-39.57
8480.0	H	-	-	-75.54	9.56	41.02	-54.24	-13.00	-41.24
10600.0	H	-	-	-76.15	12.68	43.53	-51.73	-13.00	-38.73
12720.0	H	-	-	-76.33	14.30	44.97	-50.28	-13.00	-37.28

Table 7-3. Radiated Spurious Data (LTE Band 66/10/4 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	2155.0
RB / Offset:	1 / 50
Detector / Trace Mode:	RMS / Average
RBW / VBW:	1MHz / 3MHz

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]
4310.0	H	158	232	-70.99	3.41	39.42	-55.84	-13.00	-42.84
6465.0	H	112	186	-71.24	7.49	43.25	-52.01	-13.00	-39.01
8620.0	H	263	223	-72.76	8.83	43.07	-52.19	-13.00	-39.19
10775.0	H	-	-	-75.55	11.80	43.25	-52.01	-13.00	-39.01
12930.0	H	-	-	-76.10	15.09	45.99	-49.27	-13.00	-36.27
15085.0	H	-	-	-75.83	15.91	47.08	-48.18	-13.00	-35.18



Table 7-4. Radiated Spurious Data (LTE Band 66/10/4 – Mid Channel)

FCC ID: QLJMRU-19212326	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 60 of 65

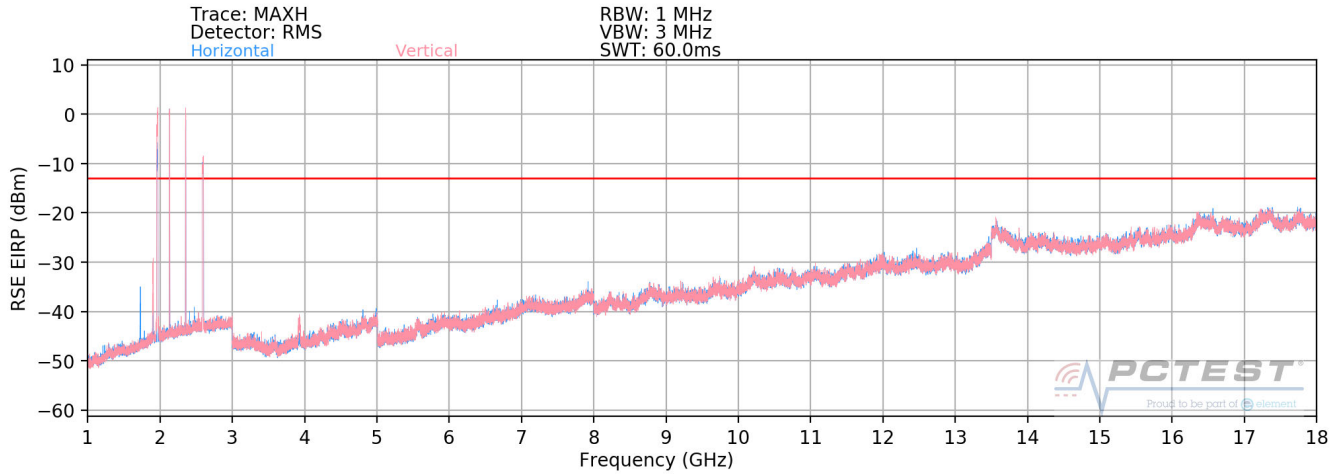
Bandwidth (MHz):	20								
Frequency (MHz):	2190.0								
RB / Offset:	1 / 50								
Detector / Trace Mode:	RMS / Average								
RBW / VBW:	1MHz / 3MHz								

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]
4380.00	H	267	230	-70.30	4.46	41.16	-54.10	-13.00	-41.10
6570.00	H	154	160	-70.83	8.40	44.57	-50.69	-13.00	-37.69
8760.00	H	-	-	-75.00	8.90	40.90	-54.36	-13.00	-41.36
10950.00	H	-	-	-75.56	13.15	44.59	-50.67	-13.00	-37.67
13140.00	H	-	-	-75.72	14.00	45.28	-49.98	-13.00	-36.98
15330.00	H	-	-	-76.00	18.17	49.17	-46.09	-13.00	-33.09

Table 7-5. Radiated Spurious Data (LTE Band 66/10/4 – High Channel)

FCC ID: QLJMRU-19212326	 PART 27 MEASUREMENT REPORT 		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 61 of 65

LTE Band 66/10/4, Band 25/2, Band 41, Band 30





Plot 7-79. Radiated Spurious Plot (LTE Band 66/10/4 – 25/2 – 41 – 30)

Mode:	LTE Band 66 - 25 - 41 - 30
Bandwidth (MHz):	20 - 20 - 20 - 20
Frequency (MHz):	1960 + 2132.5 + 2593 + 2355
RB / Offset:	1 / 50

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]
1163.4	V	257	118	-64.84	2.42	44.58	-50.68	-13.00	-37.68
1093.5	V	260	111	-66.93	2.35	42.42	-52.84	-13.00	-39.84
2017.0	V	-	-	-70.77	5.98	42.21	-53.05	-13.00	-40.05
2305.0	V	146	267	-67.13	6.24	46.11	-49.15	-13.00	-36.15
2420.5	V	-	-	-72.37	7.52	42.15	-53.11	-13.00	-40.11
3754.0	V	101	222	-71.24	14.31	50.07	-45.19	-13.00	-32.19
4627.0	V	168	147	-70.66	10.40	46.74	-48.51	-13.00	-35.51
5074.5	V	122	180	-72.88	14.31	48.43	-46.83	-13.00	-33.83
6144.5	V	285	193	-70.91	15.57	51.66	-43.60	-13.00	-30.60
7779.0	V	114	217	-72.79	18.53	52.74	-42.52	-13.00	-29.52
8987.5	V	-	-	-72.50	21.21	55.71	-39.54	-13.00	-26.54
10145.0	V	120	234	-72.68	21.70	56.02	-39.24	-13.00	-26.24

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

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 62 of 65	

7.8 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

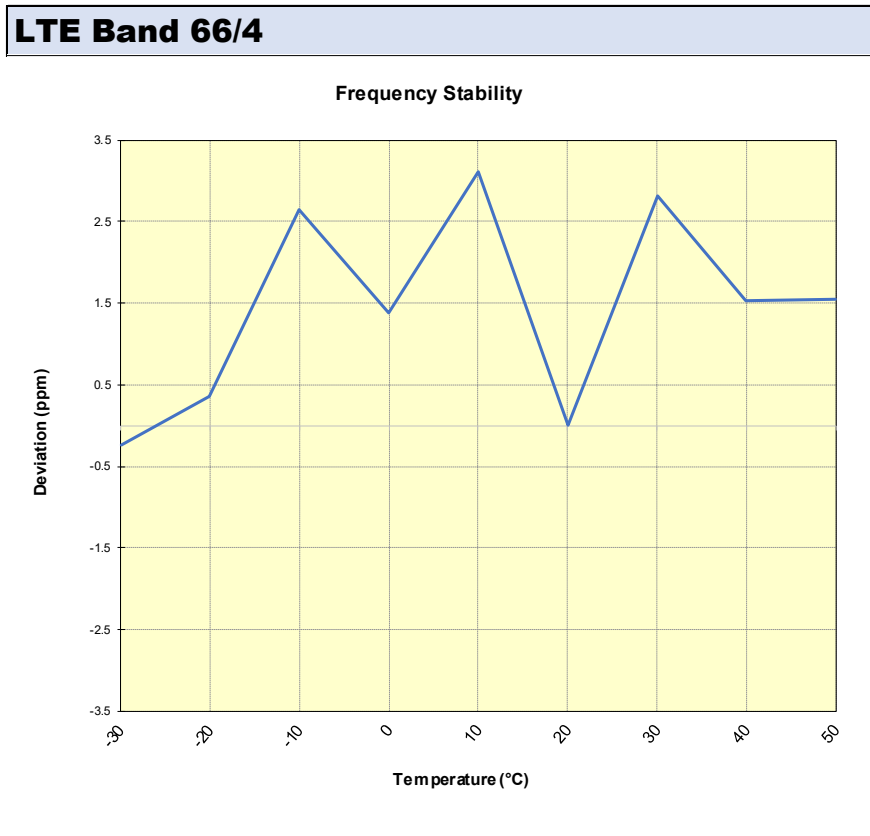
None

FCC ID: QLJMRU-19212326	 Proud to be part of 	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU		Page 63 of 65



Frequency Stability / Temperature Variation

LTE Band 66/4					
Operating Frequency (Hz):		2,155,000,000			
Ref. Voltage (VAC):		120.00			
Deviation Limit:		± 0.00025% or 2.5 ppm			
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	120.00	- 30	2,155,110,272	-526	-0.0000244
		- 20	2,155,111,581	783	0.0000363
		- 10	2,155,116,487	5,689	0.0002640
		0	2,155,113,786	2,988	0.0001386
		+ 10	2,155,117,516	6,718	0.0003117
		+ 20 (Ref)	2,155,110,798	0	0.0000000
		+ 30	2,155,116,880	6,082	0.0002822
		+ 40	2,155,114,075	3,277	0.0001521
85 %	102.00	+ 20	2,155,116,041	5,243	0.0002433
115 %	138.00	+ 20	2,155,110,111	-687	-0.0000319

Table 7-7. LTE Band 66/10/4 Frequency Stability Data





Plot 7-80. LTE Band 66/10/4 Frequency Stability Chart

FCC ID: QLJMRU-19212326	 PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	 Tecore networks	Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 64 of 65	

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Tecore Mid Band mRU FCC ID: QLJMRU-19212326** complies with all the requirements of Part 27 of the FCC rules.

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2106040064-02.QLJ	Test Dates: 06/23 – 10/18/2021	EUT Type: Mid Band mRU	Page 65 of 65	