

## PCTEST

7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. 410.290.6652 / Fax 410.290.6654 http://www.pctest.com



## 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: Model: EUT Type: FCC Classification: FCC Rule Part: Test Procedure(s): Certification MRU-20W060785 Mid Band mRU PCS Licensed Transmitter (PCB) 27 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

ACCREDITED CERT #2041.01

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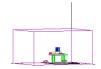


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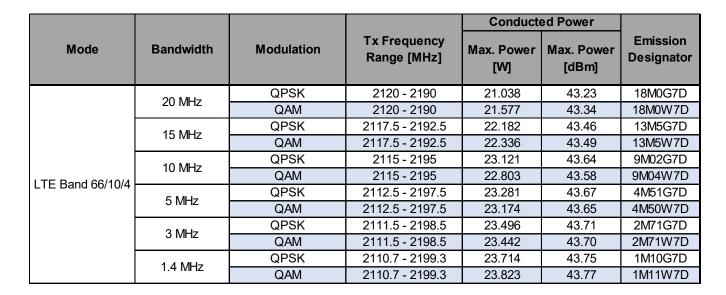
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## **1.0 INTRODUCTION**

#### 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, 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.

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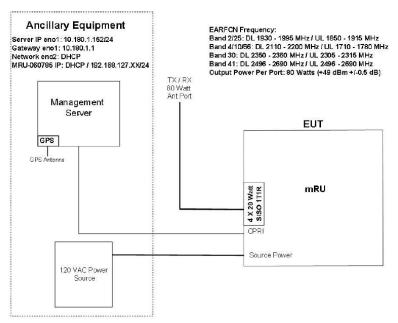


## 2.0 PRODUCT INFORMATION

## 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 50 $\Omega$  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.

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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 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:

 $P_{d [dBm]} = P_{g [dBm]} - cable loss [dB] + antenna gain [dBd/dBi]$ 

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  $P_{g [dBm]}$  – 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.

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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  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±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
-	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.

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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 analzyer. 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).

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## 7.0 TEST RESULTS

## 7.1 Summary

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

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
	Transmitter Conducted Output Pow er / Equivalent Isotropic Radiated Pow er	2.1046, 27.50(d)(2)	1640W/MHz	PASS	Section 7.2
TED	Occupied Bandwidth	2.1049	N/A	PASS	Section 7.3
CONDUCTED	Conducted Band Edge / Spurious Emissions	2.1051, 27.53	> 43 + 10log10(P[Watts]) at Band Edge and for all out- of-band emissions	PASS	Sections 7.4, 7.5
ů C	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 log10 (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.

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## 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 ≥ 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.

Keysight PXA	
Signal Analyzer	EUT

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

#### Test Notes

None.

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## 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]
		132072	2120.0	100 / 0	43.23	21.04	15.00	58.23	665.27	62.15	-3.92
N	QPSK	132322	2155.0	100 / 0	43.31	21.43	15.00	58.31	677.64	62.15	-3.84
20 MHz		132572	2190.0	100 / 0	43.07	20.28	15.00	58.07	641.21	62.15	-4.08
0	16-QAM	132322	2155.0	100 / 0	43.32	21.48	15.00	58.32	679.20	62.15	-3.83
7	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
		132047	2117.5	75 / 0	43.31	21.43	15.00	58.31	677.64	62.15	-3.84
N	QPSK	132322	2155.0	75 / 0	43.46	22.18	15.00	58.46	701.46	62.15	-3.69
H		132597	2192.5	75 / 0	43.13	20.56	15.00	58.13	650.13	62.15	-4.02
15 MHz	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
		132022	2115.0	50 / 0	43.37	21.73	15.00	58.37	687.07	62.15	-3.78
N	QPSK	132322	2155.0	50 / 0	43.64	23.12	15.00	58.64	731.14	62.15	-3.51
H		132622	2195.0	50 / 0	43.25	21.13	15.00	58.25	668.34	62.15	-3.90
10 MHz	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
		131997	2112.5	25 / 0	43.31	21.43	15.00	58.31	677.64	62.15	-3.84
N	QPSK	132322	2155.0	25 / 0	43.67	23.28	15.00	58.67	736.21	62.15	-3.48
또		132647	2197.5	25 / 0	43.26	21.18	15.00	58.26	669.88	62.15	-3.89
5 MHz	16-QAM	132322	2155.0	25 / 0	43.65	23.17	15.00	58.65	732.82	62.15	-3.50
47	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
		131987	2111.5	15 / 0	43.22	20.99	15.00	58.22	663.74	62.15	-3.93
N	QPSK	132322	2155.0	15 / 0	43.71	23.50	15.00	58.71	743.02	62.15	-3.44
3 MHz		132657	2198.5	15 / 0	43.34	21.58	15.00	58.34	682.34	62.15	-3.81
2	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
		131979	2110.7	6/0	43.20	20.89	15.00	58.20	660.69	62.15	-3.95
4	QPSK	132322	2155.0	6/0	43.75	23.71	15.00	58.75	749.89	62.15	-3.40
1.4 MHz		132665	2199.3	6/0	43.34	21.58	15.00	58.34	682.34	62.15	-3.81
4.	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)

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## 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.

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## LTE Band 66/10/4

🔤 Keysight Spectrum A		upied BW	1									- 0 ×
🗶 RL RF	50 Ω	AC	CORREC			NSE:INT		ALIGN AUT	0 06:50:44 A Radio Std	M Jul 01, 2021	Trac	e/Detector
					Trig: Fre	req: 2.1550 e Run		ld: 100/100	Radio Std	: None		
			#IFGain:		#Atten: 3				Radio Dev	vice: BTS		
10 dB/div	Ref 40.00	) dBn				and the second second						
30.0			<i>[</i> ~				40 month 40					
20.0								۲.				Clear Write
			1									
10.0												
0.00												
-10.0												Average
-20.0	en lund	وسراليهم مري	C. C					and an and the	workwanderdawa	mound the west		-
-30.0												
-40.0												Max Hold
-50.0												
Center 2.1550										60.00 MHz		
Res BW/470 k	κHz				#V	BW 1.6	ИHz		Swe	eep 1 ms		Min Hold
						<b>T</b> - 4 - 1 1						
Occupied	Band	widt	h			Total I	ower	54	2.5 dBm			
		17	.965	5 MH	7							Detector
												Peak▶
Transmit F	req Err	or	13.	.857 kH	z	% of O	BW Pov	ver	99.00 %		Auto	Mar
x dB Band	width		10	.26 M⊦	7	x dB		_2	6.00 dB			
			13	-20 Mil	12	X UD						
MSG								STA	TUS			

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)

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Keysight Spectrum Analyzer -	Occupied BV	V							
RL RF 50	Ω AC	CORREC	SENSE:INT		ALIGN AUTO		M Jul 01, 2021	Trace	Detector
			Center Freq: 2.18 Trig: Free Run		i: 100/100	Radio Std:	None	maor	
		+ #IFGain:Low	#Atten: 36 dB	Avginoid	1. 100/100	Radio Dev	ice: BTS		
		In Gameow							
	.00 dBn	n							
og		man	e Inne warmen met	momenter					
30.0				<u> </u>					
0.0								C	lear Writ
		1			Į				
0.0					1				
					<u> </u>				
0.0					<u>}</u>				Averag
	allow had more	-ment			monent	mmillion	and an an		-
0.0 Martin and a second									
0.0									
0.0									Maxila
									Max Hol
50.0									
						<b>A</b>			
enter 2.15500 GHz			20 CB 141 4				7.50 MHz		
es BW 360 kHz			#VBW 1.:	2 MHZ		SWe	ep 1 ms		Min Hol
			_		50.5				
Occupied Ban	idwidt	h	lota	l Power	52.5	dBm			
	1 2	3.531 M	H <sub>7</sub>						Detecto
			112						Peak
Transmit Freq E	rror _	-6.305	kHz % of	OBW Pow	er go	.00 %		Auto	Ma
x dB Bandwidth		14.48	MHz xdB		-26.	00 dB			
G					STATUS				

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)

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Keysight Spectrum Analyzer - O										
RL RF 50 S	2 AC	CORREC		NSE:INT		ALIGN AUTO	06:54:48 A Radio Std	M Jul 01, 2021	Trac	e/Detector
				req: 2.1550		d:>100/100	Radio Std	: None		
		⊶ #IFGain:Low	#Atten: 3		Avginon	4.2100/100	Radio Dev	rice: BTS		
	1	AI Gall.LOW								
dB/div Ref 40.0	0 dBm									
g		مربيه الم	mont	when when the	mann					
		1							(	Clear Wri
1.0		1								
.0						<u>}</u>				
						1				
.0						- da				Avera
0 month marken mark	Marchar	~^					Van Maria	w Muleanumby		
.0										
).0										Max Ho
										maxine
										_
enter 2.15500 GHz							Snan 2	5.00 MHz		
es BW 240 kHz			#\/I	BW 7501	/47			ep 1 ms		
5 DW 240 KHZ			<i>#</i> V	544 750	\11Z		3000	sep mis		Min Ho
				Total F	ower	52.6	dBm			
Occupied Band	awiath			TOLAT	ower	52.5	) UDIII			
	9 0	201 M	H7							Detect
	0.0		112							Pea
Transmit Freq Er	ror	8.666	kHz	% of O	BW Pow	er go	.00 %		Auto	 M
x dB Bandwidth		9.646	MHz	x dB		-26.	00 dB			
										_
						STATUS	5			

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)

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Keysight Spectrum Analyzer											
RL RF 5	i0 Ω AC	COR	REC		SENSE:INT		ALIGN AUTO	06:57:47 A	M Jul 01, 2021	Trac	e/Detector
					Freq: 2.1550 ree Run		d: 100/100	Radio Std	None		
		#IEG	⊶ ain:Low	#Atten		Avginon	1. 100/100	Radio Dev	ice: BTS		
		#11 0	am.Low								
dB/div Ref 4	0.00 dE	Зm									
pg			marian	way mare	march	month					
D.O			1								
D.0			<u> </u>							(	Clear Writ
							{				
D.0							1				
.00											
0.0											Averag
	Re-	mand					how	mon			
								· horanath	montrain		
0.0											
0.0											
											Max Ho
0.0											
enter 2.155000 G	HZ								2.50 MHz		
es BW 120 kHz				V	BW 1.2 M	Hz		Swe	ep 1ms		Min Ho
Occupied Ba	ndwi	dth			Total	Power	52.1	dBm			
		50	95 M	LI-7							Detect
		1.50									Peak
Transmit Freq	Error		2.175	kH7	% of O	BW Pow	or 00	.00 %		Auto	Ma
Hansint Flog			2.113	NI 12	70 01 0	BITTOW	0 33	100 /0			m
x dB Bandwidt	h		4.830	MHz	x dB		-26.	00 dB			

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)

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Keysight Spectrum Analyzer											
RL RF !	50 Ω AC	CORR	EC		SENSE:INT		ALIGN AUTO	07:01:03 A Radio Std	M Jul 01, 2021	Trac	e/Detector
		#IFGa	⊶ iin:Low	Trig: Fr #Atten:			d: 100/100	Radio Std			
	0.00 dB	m									
pg			mound	and a second	~~~~	Marter war					
D.0											Clear Writ
0.0											
0.0		/									
		/					<u>\</u>				
0.0		- 7									Avera
10 Aprono marchene	and he man	and a start					howard	www.			
	-								and a stand of the		
I.O											
).0											Max Ho
).0											
enter 2.155000 G	Hz								'.500 MHz		
Res BW 75 kHz				VE	3W 750 k	Hz		Swee	p 3.8 ms		Min Ho
Occupied Ba	ndwid	lth			Total I	Power	52.0	) dBm			
	2	714	8 MI	17							Detect
											Peal
Transmit Freq	Error		936	Hz	% of C	BW Pov	ver 99	0.00 %		Auto	<u>M</u>
x dB Bandwidt	h		2.910 N	IH7	x dB		-26	00 dB			
							20.				
							STATUS	5			

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



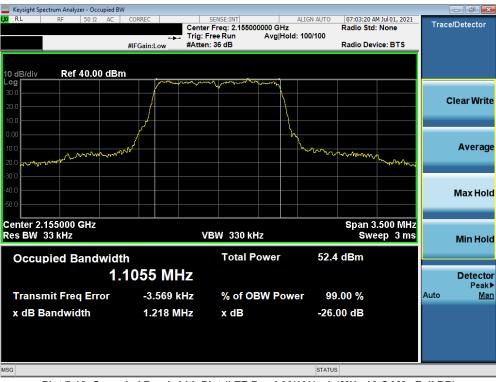
Plot 7-10. Occupied Bandwidth Plot (LTE Band 66/10/4 - 3MHz 16-QAM - Full RB)

FCC ID: QLJMRU-19212326	PCTEST: Proof to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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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 Proad to be past of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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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 18GHz (separated into at least two plots per channel)
- 2. RBW ≥ 100kHz
- 3. VBW  $\ge$  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.

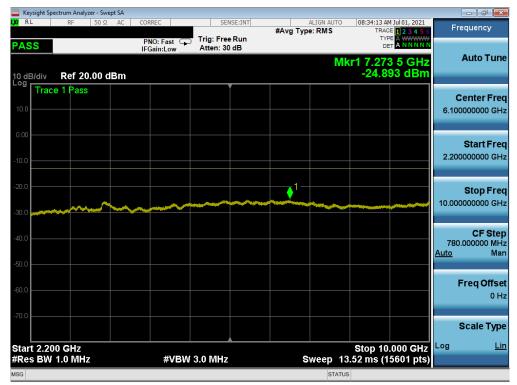
FCC ID: QLJMRU-19212326	PCTEST: Proof to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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## LTE Band 66/10/4

	pectrum Analy											_	- 6 🗾
RL	RF	<b>50</b> Ω	AC	CORREC		SE	NSE:INT		ALIGN AUTO		M Jul 01, 2021	Fre	equency
ASS				PNO: F	ast 🖵 .ow	Trig: Fre Atten: 3		#Avg Ty	pe:RMS	TYP DE	CE 1 2 3 4 5 6 PE A WWWW T A NNNNN		
0 dB/div	Ref 20	).00 dE	3m						Mk	r1 2.05 -28.	1 5 GHz 75 dBm		Auto Tun
og Tra	ce 1 Pass												enter Fre
0.0												30.	Start Fre
0.0								And the second			<b>↓</b> <sup>1</sup>	2.109	<b>Stop Fr</b> 000000 G
	na finansi kata kata kata kata kata kata kata kat	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	****									207. <u>Auto</u>	CF Ste 900000 M M
).0 ).0												F	F <b>req Offs</b> 0
													Scale Ty
	30 GHz / 1.0 MHz	2			≠vвw	3.0 MHz			Sweep 2	Stop 2 .772 ms (	.109 GHz 4159 pts)	Log	L
G									STATUS				

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)

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Spectrum Analyzer 1 Swept SA	+			Frequency v 👯
KEYSIGHT     Input: RF       RL     Coupling: DC       Align: Auto       LNI     PASS	Input Z: 50 Ω Atten: 10 dB Corr CCorr Freq Ref: Int (S) NFE: Off	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Power (RMS 1 2 3 4 5 6 Avg Hold:>100/100 Trig: Free Run A N N N N N	
1 Spectrum v Scale/Div 10 dB	Ref Level 0.0	0 dBm	Mkr1 21.502 0 GHz -58.225 dBm	12.0000000 GHz
Log Trace 1 Pass	Rei Levei 0.0	U abm	-56.225 dBm	Swept Span Zero Span
-10.0				Full Span
-20.0				Start Freq 10.000000000 GHz
				Stop Freq 22.000000000 GHz
				AUTO TUNE
-60.0				CF Step 1.200000000 GHz
-80.0				Auto Man
				Freq Offset 0 Hz
Start 10.000 GHz #Res BW 1.0 MHz	#Video BW 3.	0 MHz*	Stop 22.000 GHz Sweep ~22.6 ms (24001 pts)	
	Oct 18, 2021			Signal Track (Span Zoom)

Plot 7-15. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - Low Channel)

	m Analyzer - Swept SA									
L <mark>XI</mark> RL	RF 50 Ω AC	CORREC	SEN	ISE:INT	#Avg Typ	ALIGN AUTO e: RMS		1 Jul 01, 2021 E 1 2 3 4 5 6	Fr	equency
PASS		PNO: Fast 📮 IFGain:Low	Trig: Free Atten: 30		- //		TYF DE			Auto Tune
10 dB/div R	ef 20.00 dBm					MK	-28.	3 5 GHz 57 dBm		
10.0	Pass									enter Freq
0.00										Start Freq
-10.0									30	.000000 MHz
-20.0								1	2.110	Stop Freq
-30.0		and the second	and a state of the	nan frankline and a start	an a	, pierre anno 1999 a		an a fair an		CF Step
-40.0									208 <u>Auto</u>	.000000 MHz Man
-60.0									i	Freq Offset
-70.0										0 Hz
Start 0.030 G							Stop 2	.110 GHz	Log	Scale Type <u>Lin</u>
#Res BW 1.0		#VBW	/ 3.0 MHz			Sweep 2	.773 ms (	4161 pts)		
MSG						STATUS				

Plot 7-16. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - Mid Channel)

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	ctrum Analyz	er - Swep	t SA									(	
X/RL	RF	50 Ω	AC	CORREC		SEN	ISE:INT	#Avg Typ	ALIGN AUTO		AM Jul 01, 2021	Fre	quency
PASS				PNO: Fa IFGain:L	ast 🖵 .ow	Trig: Free Atten: 30		#7 <b>19</b> 1 J F		т			
10 dB/div Log	Ref 20	.00 dE	3m						M	kr1 6.44 -24.8	12 5 GHz 382 dBm		Auto Tune
Trace	e 1 Pass											с	enter Freg
10.0													000000 GHz
0.00													
0.00													Start Freq
-10.0												2.200	000000 GHz
-20.0							•••••						Stop Freq
-30.0	men m	~	~		~~~							10.000	000000 GHz
													CF Step
-40.0													000000 мн
-50.0												<u>Auto</u>	Man
												F	req Offset
-60.0													0 Hz
-70.0													
												5	Scale Type
Start 2.20	0 GH7									Stop 1	0.000 GHz	Log	Lin
#Res BW				#	¢VBW	3.0 MHz		s	weep 1	3.52 ms (	15601 pts)		
MSG									STAT	us			

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



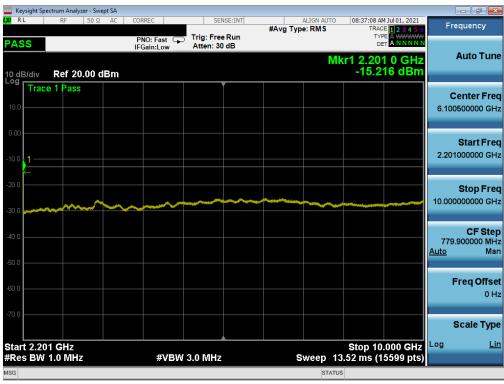
Plot 7-18. Conducted Spurious Plot (LTE Band 66/10/4 - 20MHz QPSK - 1 RB - Mid Channel)

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	ctrum Analyzer										
LXI RL	RF 5	50Ω AC	CORREC	SEI	NSE:INT	#Avg Typ	ALIGN AUTO e: RMS		4 Jul 01, 2021 E <b>1 2 3 4 5 6</b>	Fr	equency
PASS			PNO: Fas IFGain:Lo	Trig: Free Atten: 30				DE			Auto Tune
10 dB/div Log	Ref 20.0	0 dBm					M	(r1 2.10) -28.	3 0 GHz 21 dBm		Autorune
Trac	e 1 Pass									c	enter Freq
10.0										1.070	0000000 GHz
0.00											Start Freq
-10.0										30	.000000 MHz
											_
-20.0									1	2.110	Stop Freq
-30.0			en antiper ant	 ******	a particular and a second		an Canadian an Anna Anna A		and the second secon		
-40.0											CF Step .000000 MHz Man
-50.0										<u>Auto</u>	Man
-60.0										1	Freq Offset
-70.0											0 Hz
-70.0										:	Scale Type
Start 0.03 #Res BW			#	3.0 MHz			Sween 2	Stop 2	.110 GHz 4161 pts)	Log	<u>Lin</u>
MSG				770 IVIT12			STATUS		anor pro)		

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)

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EYSIGHT Input: RF L Align: Auto	Input Ζ: 50 Ω Corr CCorr Freq Ref: Int (S) NFE: Off	Atten: 10 dB	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Power (RMS 1 2 3 4 5 Trig: Free Run A ******* A N N N N	16.00000000 GHz
Spectrum v cale/Div 10 dB		Ref Level 0.00	dBm	Mkr1 21.485 0 GI -57.945 dB	Swept Span
Trace 1 Pass					Zero Span       Full Span       Start Freq
					10.00000000 GHz Stop Freq 22.00000000 GHz
50.0					AUTO TUNE CF Step 1,20000000 GHz
					Auto Man Freq Offset
00.0 tart 10.000 GHz Res BW 1.0 MHz		#Video BW 3.0	MHz	Stop 22.000 G Sweep ~22.6 ms (24001 p	0 Hz X Axis Scale

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

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## 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 $43 + 10 \log_{10}(P_{[Watts]})$ , 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 <u>></u> 3 x RBW
- 5. Detector = RMS
- 6. Number of sweep points  $\geq 2 \times \text{Span/RBW}$
- 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

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#### 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.

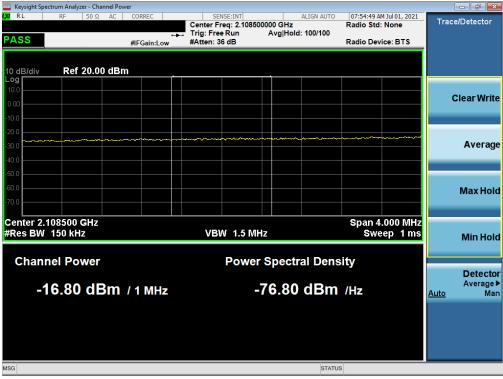
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## LTE Band 66/10/4

	pectrum Analy	zer - Swept	SA										
<mark>(</mark> RL	RF	50 Ω	AC	CORREC		SE	NSE:INT	#Avg Typ	ALIGN AUTO e: RMS	TRAC	1 Jul 01, 2021	Fr	equency
PASS				PNO: Wi IFGain:L		#Atten: 3			Mkr4	2.109 8			Auto Tun
0 dB/div		.00 dB	m							-18.	52 dBm		
Trac	e 1 Pass						Ĭ	and an angeneration		ghyw <b>rh</b> trony Auffr	,		enter Fre
15.0												2.11	000000 GH
5.00													Start Fre
5.00												2.10	2000000 GH
15.0							1/						Stop Fre
25.0	where and	- marine and	and a Martines	source and	man	A1/1-4/2007	<u> </u>					2.11	8000000 GH
35.0													CF Ste
30.0												1 <u>Auto</u>	.600000 MH Ma
45.0													
55.0													FreqOffse ⊣0
35.0													
													Scale Typ
	.110000 470 kH;					1.6 MHz			Swoon-4	Span 1 .000 ms (	6.00 MHz	Log	Li
	470 KH			#	FVBVV	1.0 WHZ			Sweep 1		roor pis)		

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



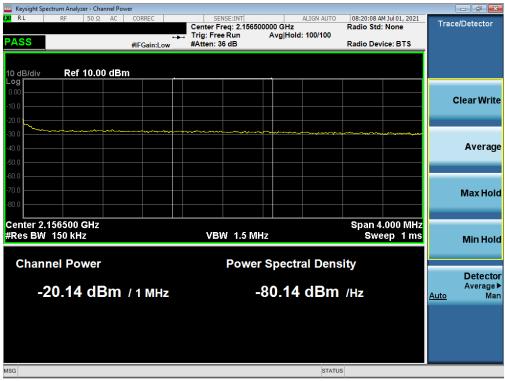
Plot 7-23. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 20MHz QPSK – Full RB)

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	ectrum Analyz		t SA										
RL	RF	50 Ω	AC	CORREC			NSE:INT	#Avg Typ	ALIGN AUTO e: RMS	TRAC	1 Jul 01, 2021 E <mark>1 2 3 4 5</mark> 6	F	requency
ASS	Ref 30	00 di	Зm	PNO: Wi IFGain:L		Trig: Fre #Atten: 3			Mkr1	2.155 6	56 GHz		Auto Tun
00	e-11Pass			-wyywycogłu	ang ang ang the	we							Center Fre 5000000 G⊦
0.00												2.14	<b>Start Fre</b> 7000000 G⊦
20.0												2.16	<b>Stop Fre</b> 3000000 GH
0.0									and the second	**************************************	«اریه»(یاری) ا	<u>Auto</u>	CF Ste 1.600000 MI M
D.O													Freq Offs 0
enter 2.										Span 1	6.00 MHz		Scale Tyj L
Res BW	470 kHz			#	WBW	1.6 MHz			Sweep 1	.000 ms (	1001 pts)		
G									STATUS	3			

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



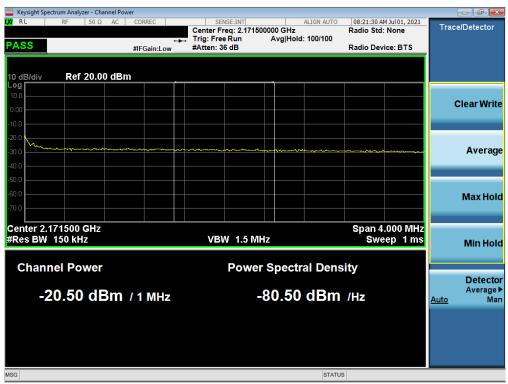
Plot 7-25. Upper Extended Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST: Frond to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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	ectrum Analyze											
XI RL	RF	50 Ω AC	CORREC		SE	NSE:INT	#Avg Typ	ALIGN AUTO		4 Jul 01, 2021 E <b>1 2 3 4 5 6</b>	Fr	equency
PASS			PNO: IFGair	Wide ↔ n:Low	Trig: Fre #Atten: 3				TYP			
10 dB/div	Ref 30.0	)0 dBm						Mkr	1 2.170 1 -22.:	92 GHz 29 dBm		Auto Tune
Log 20.0	entreass-		nn an the start of	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~								<b>Center Freq</b> 0000000 GHz
10.0 0.00											2.16	Start Fred 2000000 GHz
-10.0						<b>↓</b> 1					2.17	Stop Freq B000000 GHz
-30.0						monenen	mana tha and the second	utra progetime		hahaadaaaan	1 Auto	<b>CF Step</b> .600000 MH: Mar
-40.0												F <b>req Offse</b> 0 H:
-60.0												Scale Type
Center 2. <sup>-</sup> #Res BW		Hz		#VBW	1.6 MHz			Sweep	Span 1 1.000 ms (	6.00 MHz 1001 pts)	Log	Lin
MSG								STATU	JS		_	

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



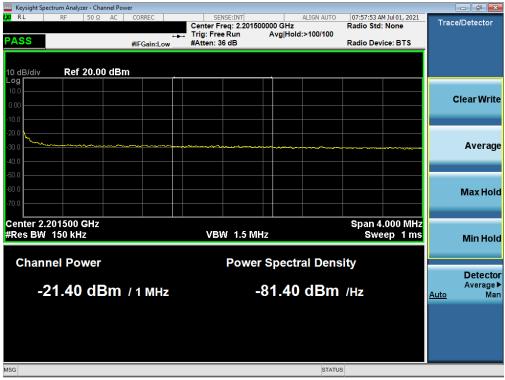
Plot 7-27. Upper Extended Band Edge Plot (LTE Band 10 - 20MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST: Frond to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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	ectrum Analyze	er - Swep	ot SA									
LX/RL	RF	50 Ω	AC	CORREC		SE	NSE:INT	#Avg Typ	ALIGN AUTO		1 Jul 01, 2021	Frequency
PASS				PNO: W IFGain:L	ide ↔ .ow	Trig: Fre #Atten: 3		• /		TYP		
10 dB/div Log	Ref 35.	.00 dE	Bm						Mkr1	2.200 5 -23.2	44 GHz 20 dBm	Auto Tune
Irac	e 1 Pass		<u>๛ๅ๛๛๚๛๛</u> ณ	4,00/%+13+%+++44%,0	٧٠٠٠٠٠		Ĭ					Center Freq
25.0						~						2.200000000 GHz
15.0												Start Freq
5.00												2.192000000 GHz
-5.00												Stop Freq
-15.0							. 1					2.208000000 GHz
-25.0						1	hurringen		mercolor	and the second second	-warder	CF Step 1.600000 MHz
-35.0												<u>Auto</u> Man
-45.0												Freq Offset
												0 Hz
-55.0												Scale Type
Center 2.2 #Res BW					žVBW	1.6 MHz	,		Sween 1	Span 1 .000 ms (	6.00 MHz	Log <u>Lin</u>
MSG									STATUS		reer pts/	

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



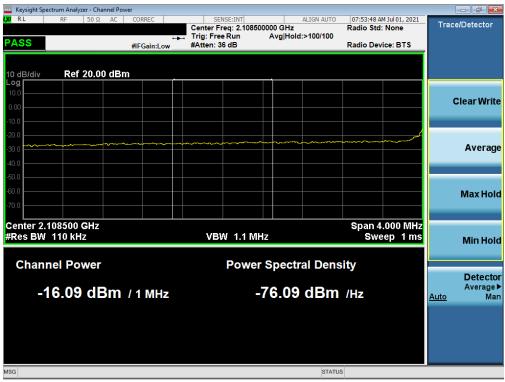
Plot 7-29. Channel Edge Plot (LTE Band 66 - 20MHz QPSK - Full RB)

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	ectrum Analy	zer - Swep	ot SA										
URL	RF	50 Ω	AC	CORREC		SEN	ISE:INT	#Avg Typ	ALIGN AUTO		4 Jul 01, 2021 E 1 2 3 4 5 6	Fre	equency
PASS				PNO: Wi IFGain:L	ide ↔→ ow	Trig: Free #Atten: 3		#/ <b>1</b> 9 19P	e. 10015	TYP			
0 dB/div	Ref 25	i.00 dl	Bm						Mkr1	2.109 7 -18.	'84 GHz 77 dBm		Auto Tune
-og Trac	e 1 Pass							and a farmer and a farmer of the second s	we mine the state of the second	and the second	مري خريك معادمين موسع		enter Freq 0000000 GHz
5.00												2.104	Start Fred
25.0		sannorm	-	and and and	A.A. Janana		<u> </u>					2.116	<b>Stop Fre</b> 000000 GH:
35.0												1. <u>Auto</u>	<b>СF Stej</b> 200000 МН Ма
45.0 55.0												F	F <b>req Offse</b> 0 H
65.0												5	Scale Type
Center 2. Res BW				#	VBW	1.2 MHz			Sweep 1	Span 1 .000 ms (	2.00 MHz 1001 pts)	Log	Lir
ISG									STATUS				

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		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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	ctrum Analyzer - :											f X
X/RL	RF 50	Ω AC	CORREC		SEI	ISE:INT	#Avg Typ	ALIGN AUTO	08:18:44 AM TRACE	Jul 01, 2021	Frequen	су
PASS			PNO: W IFGain:I	/ide ↔ Low	Trig: Free #Atten: 3				DET 2.155 0	12 GHz	Auto	Tune
10 dB/div	Ref 30.00								-22.7	71 dBm		
20.0	entre asservit	mu-atmather	~~~~~~	n hanne de h							Cente 2.15500000	
0.00											<b>Star</b> 2.14900000	<b>t Fre</b> 00 GH
10.0						1					<b>Stor</b> 2.1610000	
30.0						- Unutionerspecture	Mar C. Var. Margadager	when the second second	W. component of	www.waydray	CF 1.20000 <u>Auto</u>	F Ste 00 M⊢ Ma
40.0											Freq	Offso 0⊦
60.0											Scale	
Center 2.1 #Res BW	155000 GH 360 kHz	z		#VBW	1.2 MHz			Sweep_1	Span 12 .000 ms (1	2.00 191112	Log	Lii
ASG								STATUS				-

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



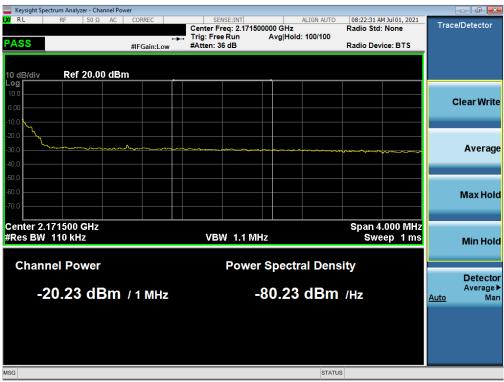
Plot 7-33. Upper Extended Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)

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	ectrum Analyzer - Swe	ept SA								
LX/IRL	RF 50 Ω	AC (	CORREC	SEI	NSE:INT	#Avg Typ	ALIGN AUTO e: RMS	08:22:19 AM Jul 0 TRACE		Frequency
PASS			PNO: Wide ++ IFGain:Low	Trig: Free #Atten: 3				TYPE A I		
10 dB/div Log	Ref 30.00 c	iBm					Mkr1	2.170 012 -22.53	GHz dBm	Auto Tune
Trac	e-1-Pass'	muniphaya	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	wand						Center Freq
20.0										2.170000000 GHz
10.0										Start Freq
0.00										2.164000000 GHz
-10.0										<b>Stop Freq</b> 2.176000000 GHz
-20.0				Y	1					2.176000000 GH2
-30.0					and the second sec	and the second second	and the second	- Mitally - Markow - Ma	man	CF Step
00.0									A	1.200000 MHz <u>uto</u> Man
-40.0										
-50.0										Freq Offset 0 Hz
-60.0										0112
-00.0										Scale Type
	170000 GHz							Span 12.00	0 MHz	og <u>Lin</u>
#Res BW	360 kHz		#VBW	1.2 MHz				.000 ms (100	1 pts)	
MSG							STATUS			

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



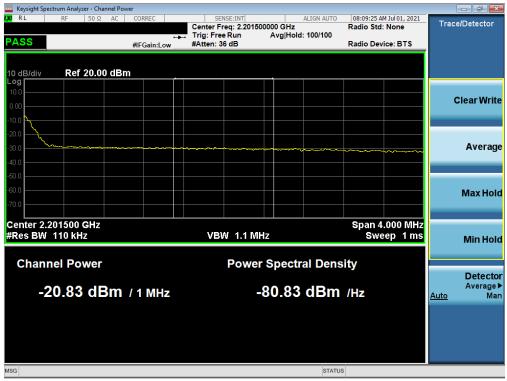
Plot 7-35. Upper Extended Band Edge Plot (LTE Band 10 - 15MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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	ctrum Analyzer - S									
LX/RL	RF 50 !	Ω AC	CORREC	SEI	NSE:INT	#Avg Typ	ALIGN AUTO e: RMS		1 2 3 4 5 6	Frequency
PASS			PNO: Wide ↔ IFGain:Low	, Trig: Free #Atten: 3				DET	A NNNNN	Auto Tur
10 dB/div	Ref 30.00	dBm					Mkr1	2.200 01	2 GHz 3 dBm	Auto Tun
Trace	entreass~~~	and and a second	mun www.	and and a second	Í					Center Fre
20.0										2.200000000 GH
10.0										
10.0										Start Fre
0.00										2.194000000 GH
-10.0										
10.0										Stop Free 2.206000000 GH
-20.0					<b>↓</b> <sup>1</sup>					
-30.0					- marine and	~ caller and grander	hyperstrandinger	yann marine and	Montomate	CF Ste
										1.200000 MH Auto Ma
-40.0										
-50.0										Freq Offse
										0 H
-60.0										Scale Type
Center 2.2 #Res BW	200000 GHz 360 kHz	4	#VBW	1.2 MHz			Sweep ′	Span 12. 1.000 ms (10	00 MHz )01 pts)	Log <u>Li</u>
MSG							STATU		/	

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



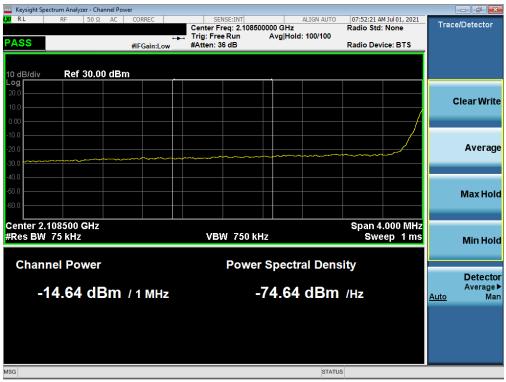
Plot 7-37. Upper Extended Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)

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	pectrum Analy	ter - Swept	SA										
RL	RF	50 Ω	AC	CORREC			NSE:INT	#Avg Typ	ALIGN AUTO e: RMS	07:52:08 AM	123456	Fr	equency
PASS				PNO: Wi IFGain:L		Trig: Fre #Atten: 3							A
0 dB/div	Ref 25	.00 dE	₿m						Mkr1	2.109 8 -18.1	88 GHz I1 dBm		Auto Tun
Tra	ce 1 Pass											c	enter Fre
15.0										an na traff that all the all the all the states of the sta		2.110	000000 GH
5.00													Start Fre
5.00												2.100	5000000 GH
5.0					-	Rev to Aller Andrew	1/						Stop Fre
25.0 25.0	Lange for the same		www.law	HT WALK								2.114	1000000 GH
15.0													CF Ste 800.000 ki
15.0												<u>Auto</u>	Ma
5.0												F	Freq Offs
													01
5.0													Scale Typ
	.110000					7501.1	A		•••••	Span 8.	000 MHz	Log	L
Res BW	/ 240 kHz			#	VBW	750 kHz			Sweep 4	.000 ms (′	1001 pts)		

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



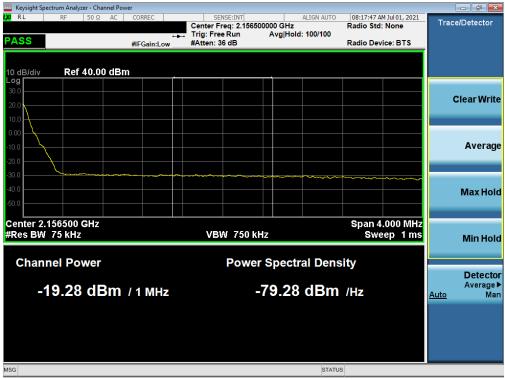
Plot 7-39. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 10MHz QPSK – Full RB)

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	ectrum Analyzer - Sw												
LXU RL	RF 50 Ω	AC	CORREC		SE	NSE:INT	#Ave	ALIGN A Type: RMS			M Jul 01, 2021	F	requency
PASS			PNO: Wie IFGain:Lo		Trig: Fre #Atten: 3					TYI Di			Auto Tune
10 dB/div Log	Ref 30.00 (	dBm						M	<b>kr1</b> :	2.155 ( -22.	08 GHz 30 dBm		Auto Tune
Trac	e TPass	-our mene	and the second	1949-1-44	Merry M	Ĭ							Center Freq
20.0					$\rightarrow$								5000000 GHz
10.0													Start Freq
0.00												2.15	1000000 GHz
-10.0													Stop Freq
-20.0						<u>1</u>						2.15	9000000 GHz
						Commenteres and	<b>~*^*****</b> *********	want the page of the second states	mann	Marris Agencia			07.04
-30.0											an and a second s		CF Step 800.000 kHz
-40.0												<u>Auto</u>	Man
-40.0													
-50.0													Freq Offset 0 Hz
													0112
-60.0													Scale Type
												Log	Lin
Center 2. #Res BW	155000 GHz 240 kHz		#	VBW	750 kHz			Swee	p 4.	Span 8 000 ms (	.000 MHz (1001 pts)	LUg	
MSG									STATUS				

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



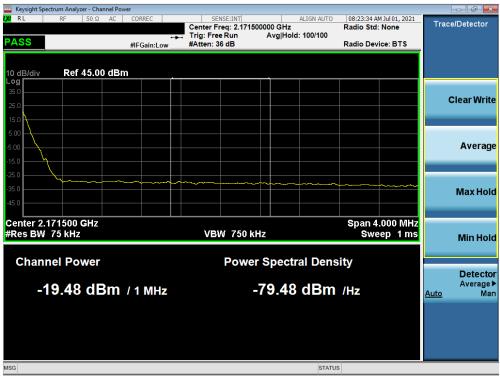
Plot 7-41. Upper Extended Band Edge Plot (LTE Band 4 - 10MHz QPSK – Full RB)

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	ectrum Analyze		: SA										
XI RL	RF	50 Ω	AC	CORREC		SE	NSE:INT	#Avg Typ	ALIGN AUTO		1 Jul 01, 2021 E 1 2 3 4 5 6	Fr	equency
PASS				PNO: Wi IFGain:L	de ↔	Trig: Fre #Atten:				TYP			
,				IFGain:L	ow	#Atten. (			Mkr1	2 170 0	24 GHz		Auto Tune
10 dB/div	Ref 30.	00 dE	ßm							-22.	28 dBm		
Log	e 1 Pass	or a second second	-นุมณาษณาพุธ-	****	alandar gelander by	m	Ĭ						enter Freg
20.0													0000000 GHz
10.0													Start Freq
0.00												2.166	6000000 GHz
-10.0						\ 							Stop Freq
						۱	1					2.174	1000000 GHz
-20.0							human	Minister					
-30.0								and an entropy of the second s	and the second	a nan an a	handor, al sugar at los		CF Step
												Auto	800.000 kHz Man
-40.0													
50.0												F	Freq Offset
-50.0													0 Hz
-60.0													
												:	Scale Type
Center 2.	170000 G	Hz					<b></b>			Span 8	.000 MHz	Log	Lin
#Res BW				#	VBW	750 kHz	2		Sweep 4	.000 ms (	1001 pts)		
ISG									STATUS	5			

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



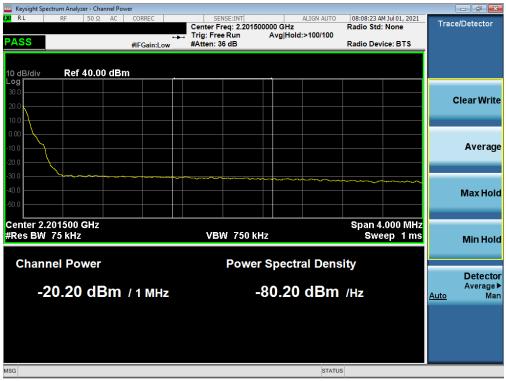
Plot 7-43. Upper Extended Band Edge Plot (LTE Band 10 - 10MHz QPSK – Full RB)

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	ctrum Analyzer -											
X/RL	RF 51	Ω AC	CORREC			VSE:INT	#Avg Ty	ALIGN AUTO	TRAC	M Jul 01, 2021	Fre	quency
PASS			PNO: Wi IFGain:Lo		Trig: Free #Atten: 3							
10 dB/div	Ref 30.0	0 dBm						Mkr1	2.200 0 -23.	32 GHz 67 dBm	<b>'</b>	Auto Tune
Trace	ent Pass	and shares	gragester and south and	and the second se	"The second s						С	enter Freg
20.0					-						2.200	000000 GHz
10.0												
												Start Freq 000000 GHz
0.00											2.100	
-10.0					{							Stop Freq
-20.0					\	1					2.204	000000 GHz
						hannersoner	man man	manne	و در وجو هه معطوله سرکورکور اسم			CF Step
-30.0										the of Weldward	Auto	B00.000 kHz Man
-40.0												India
-50.0											F	req Offset
												0 Hz
-60.0											S	cale Type
Contor 24	200000 GF	-							Enan 9	.000 MHz		Lin
#Res BW		2	#	VBW	750 kHz			Sweep 4	span 8 1.000 ms (	1000 MHZ 1001 pts)		
MSG								STATU	s			

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



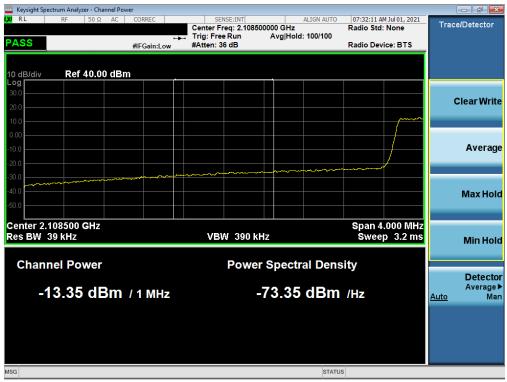
Plot 7-45. Upper Extended Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)

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	ectrum Analyz											
X/RL	RF	50 Ω AC	CORREC		SEI	SE:INT	#Avg Typ	ALIGN AUTO		M Jul 01, 2021	F	requency
PASS			PNO: IFGair	Wide ↔ ∺Low	Trig: Free #Atten: 3		#/18 J.)P	e. Kino	TYP			
10 dB/div Log	Ref 25	.00 dBm	1					Mkr1	2.109 9 -17.	88 GHz 71 dBm		Auto Tune
15.0 Trac	e 1 Pass						waynwaan	er	han the start of the	ManMu		Center Freq 0000000 GHz
-5.00											2.10	Start Fred 8000000 GHz
-15.0	m h		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	www.	Mortmantward	1 w <sup>1</sup>					2.11	<b>Stop Fred</b> 2000000 GHz
-35.0											<u>Auto</u>	<b>CF Step</b> 400.000 kHz Mar
55.0												Freq Offse 0 Hz
-65.0												Scale Type
Center 2. #Res BW				#VBM	390 kHz			Sween_2	Span 4	.000 MHz 1001 pts)	Log	Lin
ARES DAN	120 MH2			#¥CDVV	<b>J90 KHZ</b>			sweep z		roor pts)		

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



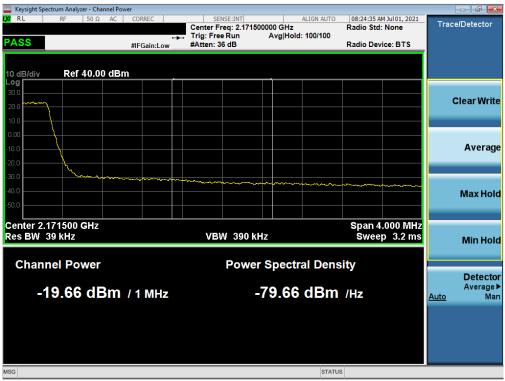
Plot 7-47. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Prood to be post of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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Keysight Spe			pt SA										
(RL	RF	50 Ω	AC	CORREC			ENSE:INT	#Avg Ty	ALIGN AUTO	TRAC	M Jul 01, 2021	F	requency
PASS				PNO: W IFGain:L	ide ↔ ₋ow	Trig: Fr #Atten:				DE			
0 dB/div	Ref 30	.00 d	Bm						Mkr	1 2.170 0 -18.	04 GHz 20 dBm		Auto Tune
og Trace	ert Pass	m	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~^\	~~~	Ĭ						Center Fre
20.0													0000000 GH
10.0													
												2 16	Start Fre 8000000 GH
0.00												2.10	
10.0							1-						Stop Fre
20.0							<b>`</b>					2.17	2000000 GH
2010							mar	many	man				CF Ste
30.0										and man			400.000 kH
40.0												<u>Auto</u>	Ma
F0.0													Freq Offse
50.0													0 H
60.0													Scale Typ
Center 2.1 Res BW				3	≠vBW	390 kH	z		Sweep	Span 4 2.000 ms (	.000 MHz 1001 pts)	Log	Li
ISG									STAT	_			

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



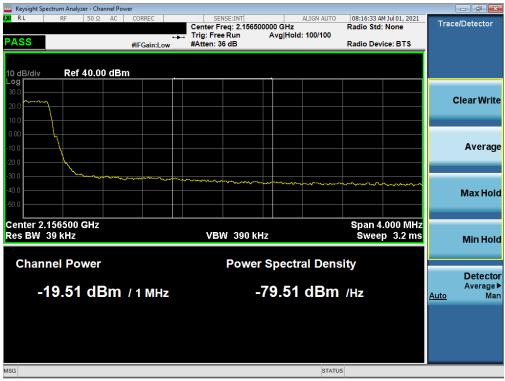
Plot 7-49. Upper Extended Band Edge Plot (LTE Band 10 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST: Pocd to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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	ctrum Analyzer - S											
XURL	RF 50	Ω AC	CORREC		SEI	NSE:INT	#Avg Ty	ALIGN AUTO		M Jul 01, 2021	Fr	equency
PASS			PNO: Wi IFGain:L		Trig: Free #Atten: 3				TYP			
10 dB/div	Ref 30.00	dBm						Mkr1	2.155 0 -18.	04 GHz 65 dBm		Auto Tune
20.0	Pass	and the second sec	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	****								Center Fred 5000000 GH:
10.0 0.00											2.15	Start Free 3000000 GH
-10.0						1					2.15	<b>Stop Fre</b> 7000000 GH
30.0						North and the second se	hannahann	and the second s	lonnon	manna	<u>Auto</u>	CF Stej 400.000 kH Ma
40.0 50.0												Freq Offse 0 H
-60.0												Scale Type
Center 2.′ #Res BW	155000 GH: 120 kHz	Z	#	VBW	390 kHz			Sween	Span 4	.000 MHz 1001 pts)	Log	Lir
ISG								STATU		(a.e. (a.e.)		

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



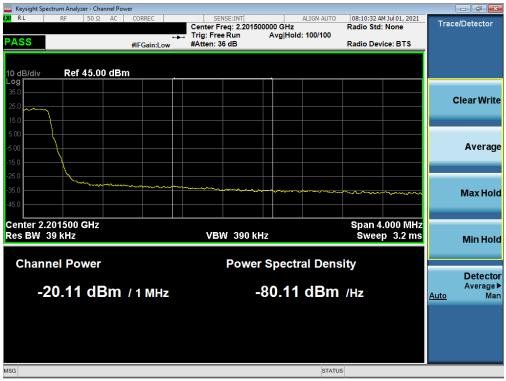
Plot 7-51. Upper Extended Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proof to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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	ctrum Analyzer												
X/RL	RF	50 Ω	AC	CORREC			NSE:INT	#Avg T	ALIGN AUTO	TRAC	M Jul 01, 2021 DE 1 2 3 4 5 6 PE A WWWWW	F	requency
PASS	Ref 30.0	00 dE	3m	PNO: W IFGain:L		Trig: Fre #Atten: 3			Mkr	DI 2.200 0	)12 GHz 56 dBm		Auto Tune
20.0	ent Pass		<u>~~~~~</u> ~~	nn hans	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~							Center Fred 0000000 GH:
0.00												2.19	<b>Start Fred</b> 8000000 GH
20.0							1					2.20	<b>Stop Fre</b> 2000000 GH
-30.0							Janner		mprenter	murray	work a service	<u>Auto</u>	CF Ster 400.000 kH Mar
50.0													Freq Offse 0 H
60.0	200000 G	Hz								Snan 4	.000 MHz	Log	Scale Type
#Res BW				\$	/VBW	390 kHz			Sweep	2.000 ms (	(1001 pts)		
ISG									STATU	IS			

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



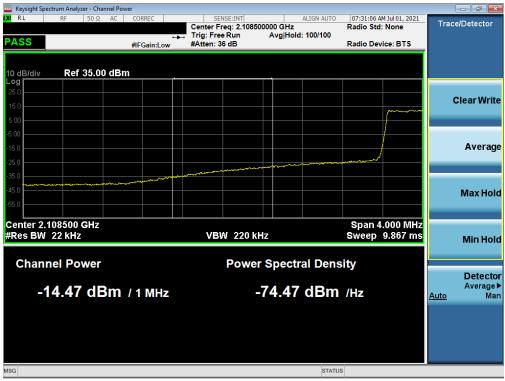
Plot 7-53. Upper Extended Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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	ectrum Analyze												
LXU RL	RF	50 Ω .	AC C	ORREC		SEI	ISE:INT	#Avg Typ	ALIGN AUTO e: RMS		M Jul 01, 2021	F	requency
PASS				PNO: Wi FGain:Lo		Trig: Free #Atten: 3			Mkr1	2.109 9	96 GHz		Auto Tune
10 dB/div Log	Ref 25.	00 dB	m							-17.	47 dBm		
15.0 Trac	e 1 Pass						_~~	www.wwww	hav a a a a a a a a a a a a a a a a a a	······	mm		<b>Center Freq</b> 0000000 GHz
5.00													
-5.00												2.10	Start Freq 8000000 GHz
							1						
-15.0	manna	~~~~	y h N	~~~	~~~~							2.11	Stop Freq 2000000 GHz
-35.0	und web											<u>Auto</u>	CF Step 400.000 kHz Man
-45.0													
-55.0													Freq Offset 0 Hz
-65.0													Scale Type
Center 2.		Hz								Span 4	.000 191112	Log	Lin
#Res BW	75 KHz			#	VBW	240 kHz					1001 pts)		
MSG									STATUS				

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



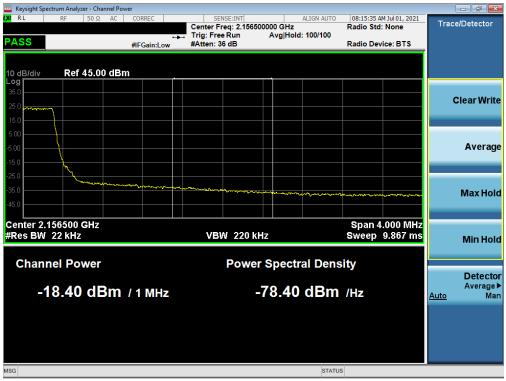
Plot 7-55. Lower Extended Band Edge Plot (LTE Band 66/10/4 - 3MHz QPSK - Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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	ctrum Analyze											_	
X/RL	RF	50 Ω	AC	CORREC			NSE:INT	#Avg Ty	ALIGN AUTO	TRAC	M Jul 01, 2021 DE 1 2 3 4 5 6 PE A WWWWW	F	requency
PASS	Ref 30.	00 dB	3m	PNO: Wi IFGain:L	ide ↔ .ow_	Trig: Fre #Atten: 3			Mkr1	DI 2.155 (	004 GHz 28 dBm		Auto Tune
20.0	€*î <b>\P</b> assĩ`	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		~~~~~~								Center Free 5000000 GH
0.00												2.15	<b>Start Fre</b> 3000000 GH
-10.0							1 1					2.15	<b>Stop Fre</b> 7000000 GH
40.0							~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		mm.	wounn	<u>Auto</u>	CF Ste 400.000 kH Ma
50.0													FreqOffse 0⊦
60.0 Center 2.1	155000 0	·U7								Spand	.000 MHz		Scale Typ
#Res BW				#	¢VBW	240 kHz			Sweep 2	2.000 ms (	(1001 pts)		
ISG									STATU	s			

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



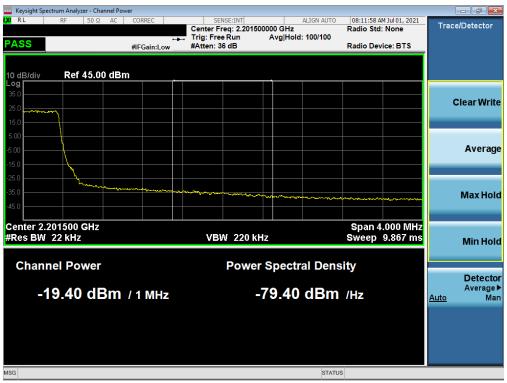
Plot 7-57. Upper Extended Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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	ectrum Analyzer - 0											
LXI RL	RF 50	Ω AC CC	ORREC	Ce		SE:INT a: <b>2.20001</b>	5000 GHz	ALIGN AUTO	08:11:49 A Radio Std	M Jul 01, 2021	Trac	e/Detector
2400				🛶 Tri	g: Free	Run	Avg Hold	: 100/100				
PASS		#1	FGain:Low	#A	tten: 36	dB			Radio Dev	rice: BTS		
10 dB/div	Ref 45.	00 dBm										
Log 35.0												
											(	Clear Write
25.0	proventer	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	J									
15.0												
5.00												
-5.00												Average
-15.0											_	_
-25.0												
-35.0 -35.0	ward -					manan		Charl a				Max Hold
-45.0								the second second	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	•••••••••••••••		
	.200015 GH	Z			1/014	1 460 14	-			.500 MHz		
#Res BW	10 KHZ				VDW	/ 160 kl	12		Sweep	34.93 ms		Min Hold
						_	-					
Chan	nel Powe	r				Power	Spectr	al Dens	ity			
		_						. –				Detector Average ►
-	20.07 d	Bm / 3	30 kHz			-	64.84	dBm	/Hz		Auto	Man
MSG								STATUS	5			

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



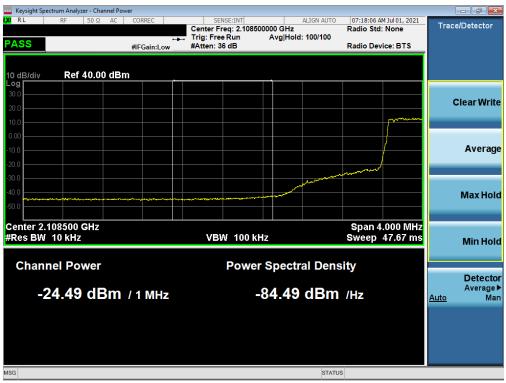
Plot 7-59. Upper Extended Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proof to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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	ectrum Analyz	er - Swept S											
X/RL	RF	50 Ω /	AC C	ORREC		SEN	ISE:INT	#Avg Typ	ALIGN AUTO		M Jul 01, 2021	Fr	equency
PASS				PNO: Wid FGain:Lo		Trig: Free #Atten: 3		#rig iyp		TYP			
10 dB/div Log	Ref 25	.00 dB	m						Mkr1	2.109 9 -18.	24 GHz 57 dBm		Auto Tune
Trac	e 1 Pass					,		m	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	^		c	enter Freq
15.0												2.110	0000000 GHz
5.00												0.40	Start Freq
-5.00												2.100	5000000 GH2
-15.0					~~~~	,1	r			h		2.11	Stop Fred
-25.0				N	M								CF Step
-45.0	~~~~~~		~~~~									<u>Auto</u>	400.000 kHz Mar
55.0													- req Offse
													0 H:
-65.0												:	Scale Type
Center 2. #Res BW	110000 ( 33 kHz	GHz		#\	/BW	110 kHz			Sweep 2	Span 4 .000 ms (	.000 MHz 1001 pts)	Log	Lin
MSG									STATUS				

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



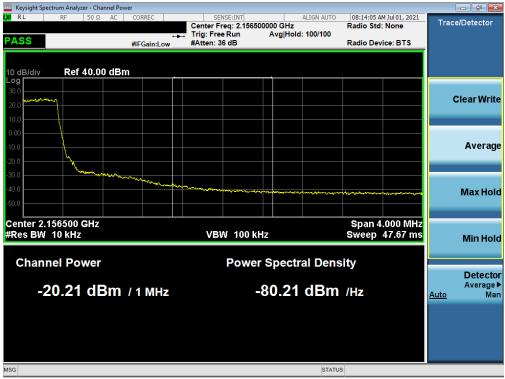
Plot 7-61. Lower Extended Band Edge Plot (LTE Band 66/10/4 – 1.4MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326	PCTEST Proof to be port of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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	ectrum Analyz		ot SA										
KIRL	RF	50 Ω	AC	CORREC		SI	NSE:INT	#Avg Ty	ALIGN AUTO		M Jul 01, 2021	F	requency
PASS				PNO: W IFGain:L	ide ↔ ₋ow	Trig: Fre #Atten:		• • •		TY	PE A WWWWW ET A N N N N N		
I0 dB/div	Ref 30	lo 00.	Bm						Mkr	1 2.155 ( -16.	004 GHz 38 dBm		Auto Tune
.og Trace	e 1 Pass		~~~~										<b>Center Fre</b> 5000000 GH
10.0 D.00												2.15	<b>Start Fre</b> 3000000 GH
20.0		}					1					2.15	<b>Stop Fre</b> 7000000 GH
30.0	~~~								~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		<u>Auto</u>	CF Ste 400.000 k⊢ Ma
i0.0													<b>Freq Offs</b> 0 ⊦
	155000-									0.0.0.00		Log	Scale Typ
Center 2. Res BW	33 kHz	SUZ		3	#VBW	110 kH:	2		Sweep	span 4 2.000 ms	F.000 IVII 12		
ISG									STAT				

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



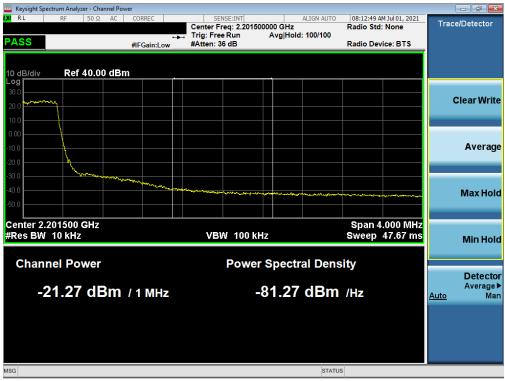
Plot 7-63. Upper Extended Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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	ectrum Analyz		ot SA										
XU RL	RF	50 Ω	AC	CORREC			SENSE:INT	#Ava Tv	ALIGN AUT		AM Jul 01, 2021	F	requency
PASS				PNO: V IFGain:	Vide ↔ Low		ree Run : 36 dB	" <u>ə</u> .,					
10 dB/div	Ref 30.	00 di	Bm						Mk	r1 2.200 -17	004 GHz 7.58 dBm		Auto Tune
-og Trac 20.0	e 1 Pass	ſ	~~~~	~~~~	~~~~~								Center Free
0.00												2.19	Start Free 88000000 GH
20.0		/					1-					2.20	<b>Stop Fre</b> 02000000 GH
30.0								~~~~				<u>Auto</u>	CF Stej 400.000 kH Ma
50.0													Freq Offse 0 H
60.0												Log	Scale Typ
Center 2.: #Res BW		Hz			#VBW	110 ki	Iz		Sweep	Span 2.000 ms	4.000 MHz s (1001 pts)	Lug	
ISG									STA				

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 Proof to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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## 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 ≥ 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

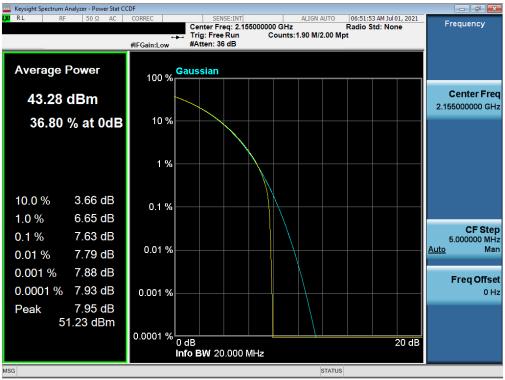
### Test Notes

None.

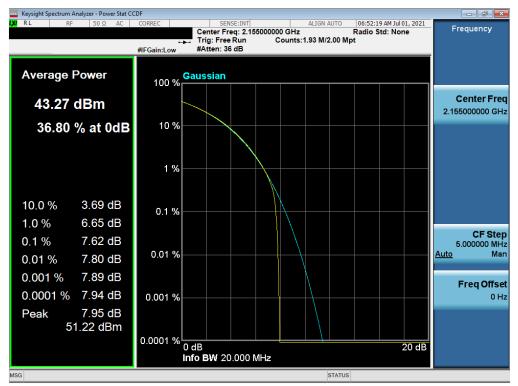
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## LTE Band 66/10/4



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

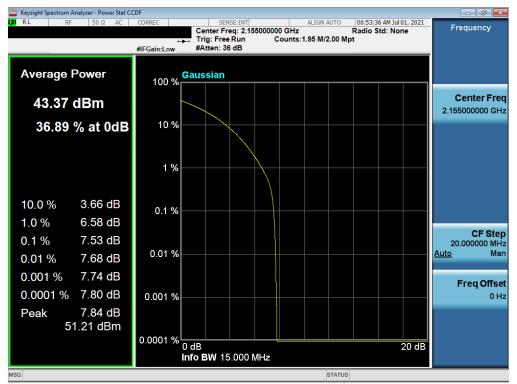


#### Plot 7-67. PAR Plot (LTE Band 66/10/4 - 20MHz 256-QAM - Full RB)

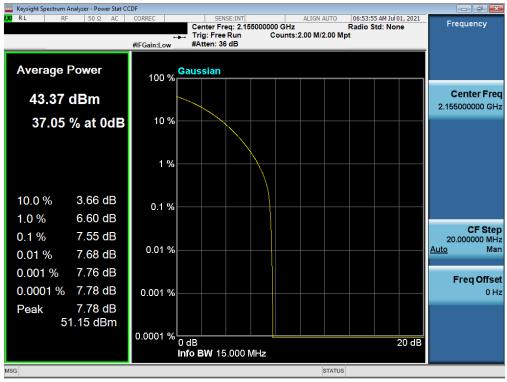
FCC ID: QLJMRU-19212326	PCTEST: Proced to be part of @ element	PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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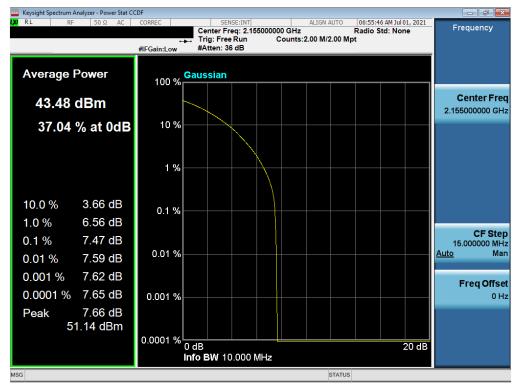


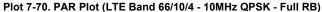


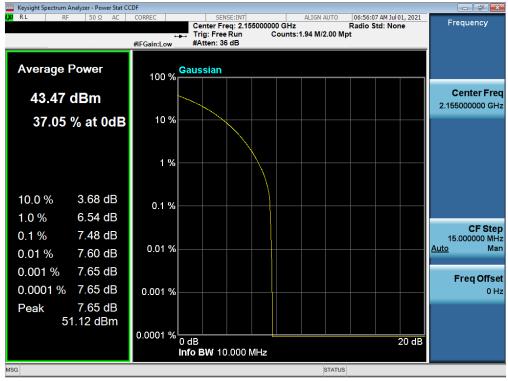
Plot 7-69. PAR Plot (LTE Band 66/10/4 - 15MHz 256-QAM - Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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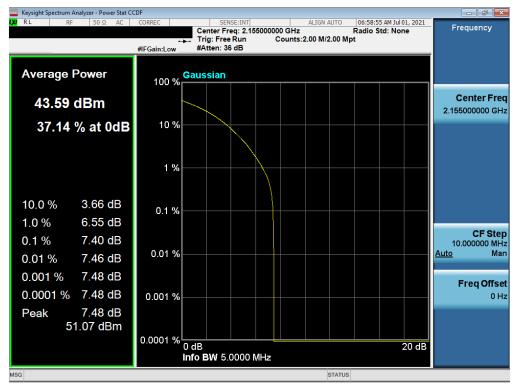


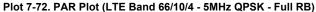


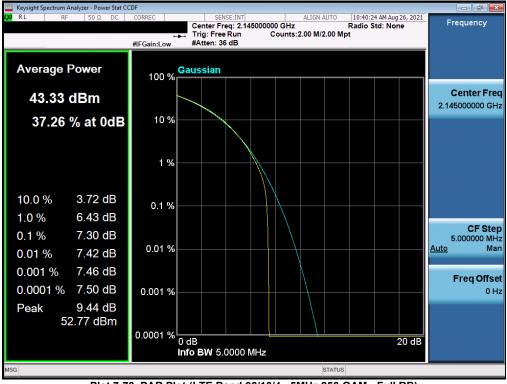
Plot 7-71. PAR Plot (LTE Band 66/10/4 - 10MHz 256-QAM - Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager	
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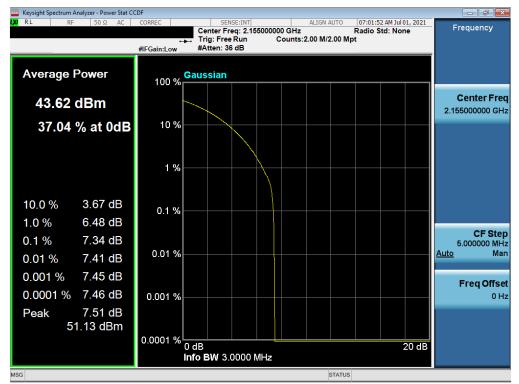




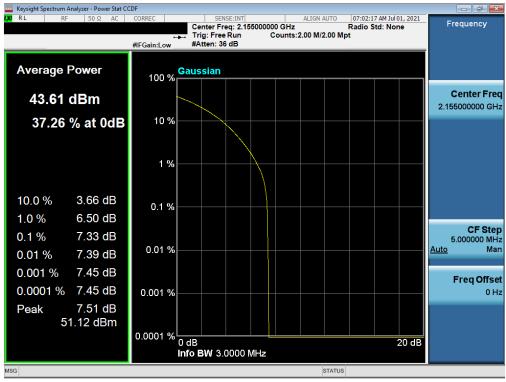
Plot 7-73. PAR Plot (LTE Band 66/10/4 - 5MHz 256-QAM - Full RB)

FCC ID: QLJMRU-19212326		PART 27 MEASUREMENT REPORT	Tecore	Approved by: Technical Manager
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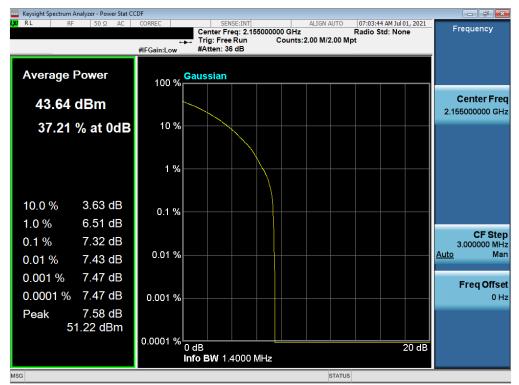




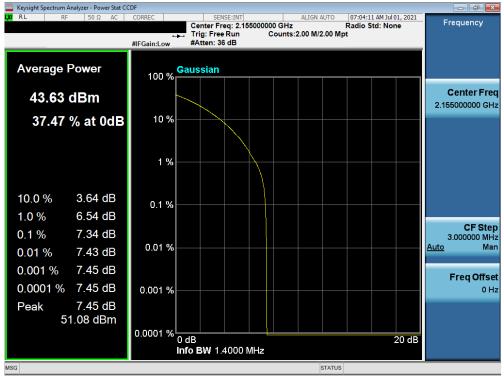
Plot 7-75. PAR Plot (LTE Band 66/10/4 - 3MHz 256-QAM - Full RB)

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

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## 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 x RBW
- 3. Span = 1.5 times the OBW
- 4. No. of sweep points  $\geq$  2 x 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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## <u>Test Setup</u>

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

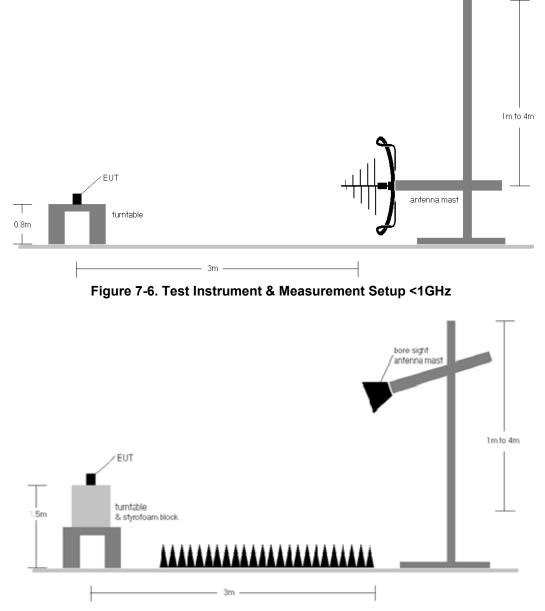


Figure 7-7. Test Instrument & Measurement Setup

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### Test Notes

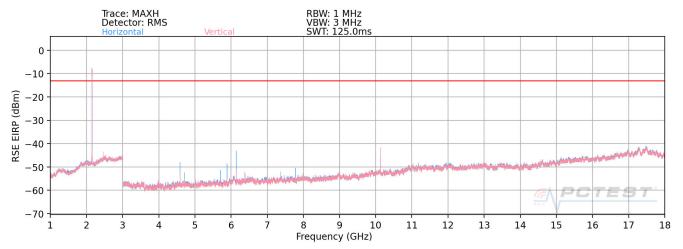
- Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
   b) E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
   d) EIRP (dBm) = E(dBµV/m) + 20logD 104.8; where D is the measurement distance in meters.
- 2) The 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.

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## 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	Н	172	234	-64.85	3.64	45.79	-49.47	-13.00	-36.47
6360.0	Н	162	145	-71.69	7.38	42.69	-52.57	-13.00	-39.57
8480.0	Н	-	-	-75.54	9.56	41.02	-54.24	-13.00	-41.24
10600.0	Н	-	-	-76.15	12.68	43.53	-51.73	-13.00	-38.73
12720.0	Н	-	-	-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	Н	158	232	-70.99	3.41	39.42	-55.84	-13.00	-42.84
6465.0	Н	112	186	-71.24	7.49	43.25	-52.01	-13.00	-39.01
8620.0	Н	263	223	-72.76	8.83	43.07	-52.19	-13.00	-39.19
10775.0	Н	-	-	-75.55	11.80	43.25	-52.01	-13.00	-39.01
12930.0	Н	-	-	-76.10	15.09	45.99	-49.27	-13.00	-36.27
15085.0	Н	-	-	-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)

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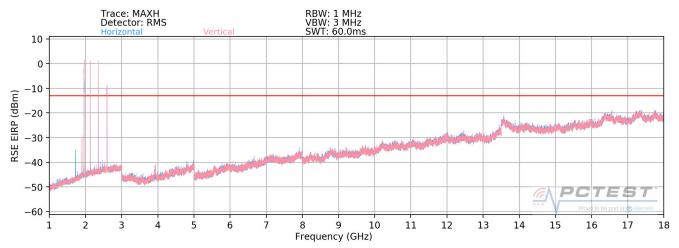
Bandwidth (MHz):	2	0							
Frequency (MHz):	219	0.0							
RB / Offset:	1 /	50							
Detector / Trace Mode:	RMS / A	Verage							
RBW / VBW:	1MHz	/ 3MHz							
	Ant. Pol.	Antenna	Turntable	Analyzer	AFCL	Field	EIRP Spurious	Limit	Margin
Frequency [MHz]	[H/V]	Height [cm]	Azimuth [degree]	Level [dBm]	[dB/m]	Strength [dBµV/m]	Emission Level [dBm]	[dBm]	[dB]
4380.00	<b>[H/V]</b> Н	-			[dB/m] 4.46	-		[dBm] -13.00	
		[cm]	[degree]	[dBm]		[dBµV/m]	[dBm]		-41.10
4380.00	н	[cm] 267	[degree] 230	[dBm] -70.30	4.46	[dBµV/m] 41.16	[dBm] -54.10	-13.00	[dB] -41.10 -37.69 -41.36
4380.00 6570.00	H H	[cm] 267 154	[degree] 230 160	[dBm] -70.30 -70.83	4.46 8.40	[dBµV/m] 41.16 44.57	[dBm] -54.10 -50.69	-13.00 -13.00	-41.10 -37.69
4380.00 6570.00 8760.00	H H H	[cm] 267 154	[degree] 230 160 -	[dBm] -70.30 -70.83 -75.00	4.46 8.40 8.90	[dBµV/m] 41.16 44.57 40.90	[dBm] -54.10 -50.69 -54.36	-13.00 -13.00 -13.00	-41.10 -37.69 -41.36

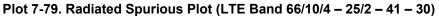
Table 7-5. Radiated Spurious Data (LTE Band 66/10/4 – High Channel)

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## LTE Band 66/10/4, Band 25/2, Band 41, Band 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 (I T	F Multi-F	Sand – Mi	d Channel)		•

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

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## 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

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# Frequency Stability / Temperature Variation

LTE Band 66/4									
	Operating F	Frequency (Hz):	2,155,0	00,000					
	Ref.	Voltage (VAC):	120	.00					
		Deviation Limit:	± 0.00025%	or 2.5 ppm					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)				
		- 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				
100 %	120.00	+ 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				
		+ 50	2,155,114,121	3,323	0.0001542				
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

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## 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.

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