



PART 22 MEASUREMENT REPORT

Applicant Name:

Apple Inc.
 One Apple Park Way
 Cupertino, CA 95014
 United States

Date of Testing:

06/08/2021 - 08/16/2021

Test Site/Location:

PCTEST Morgan Hill, CA, USA

Test Report Serial No.:

1C2106070046-01.BCG

FCC ID:

BCG-A2478

Applicant Name:

Apple Inc.

Application Type:

Certification

Model:

A2478

EUT Type:

Watch

FCC Classification:

PCS Licensed Transmitter Worn on Body (PCT)

FCC Rule Part:

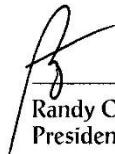
22

Test Procedure(s):

ANSI C63.26-2015, 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

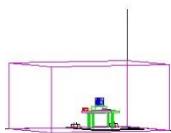


FCC ID: BCG-A2478	PCTEST <small>Proud to be part of element</small>		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 1 of 54

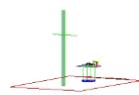
T A B L E O F C O N T E N T S

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	Antenna Description	5
2.4	Test Support Equipment	5
2.5	Test Configuration	6
2.6	Software and Firmware	6
2.7	EMI Suppression Device(s)/Modifications	6
3.0	DESCRIPTION OF TESTS	7
3.1	Measurement Procedure	7
3.2	Radiated Spurious Emissions	7
4.0	MEASUREMENT UNCERTAINTY	8
5.0	TEST EQUIPMENT CALIBRATION DATA	9
6.0	SAMPLE CALCULATIONS	10
7.0	TEST RESULTS	11
7.1	Summary	11
7.2	Occupied Bandwidth	12
7.3	Spurious and Harmonic Emissions at Antenna Terminal	18
7.4	Band Edge Emissions at Antenna Terminal	30
7.5	Radiated Power (ERP/EIRP)	41
7.6	Radiated Spurious Emissions	44
7.7	Frequency Stability / Temperature Variation	51
8.0	CONCLUSION	54

FCC ID: BCG-A2478	 PCTEST <small>Proud to be part of element</small>		MEASUREMENT REPORT (CERTIFICATION)
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Approved by: Quality Manager

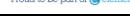


PART 22 MEASUREMENT REPORT



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	ERP		EIRP		Emission Designator
					Max. Power [mW]	Max. Power [dBm]	Max. Power [mW]	Max. Power [dBm]	
WCDMA850	5 MHz	Spread Spectrum	826.4 - 846.6	4.0961	0.279	-5.55	0.457	-3.40	4M10F9W
Band 5	1.4 MHz	QPSK	824.7 - 848.3	1.1103	0.313	-5.05	0.513	-2.90	1M11G7W
		16QAM	824.7 - 848.3	1.1087	0.274	-5.62	0.450	-3.47	1M11D7W
	3 MHz	QPSK	825.5 - 847.5	2.7257	0.313	-5.05	0.513	-2.90	2M73G7W
		16QAM	825.5 - 847.5	2.7232	0.268	-5.72	0.440	-3.57	2M72D7W
	5 MHz	QPSK	826.5 - 846.5	4.5845	0.313	-5.05	0.513	-2.90	4M58G7W
		16QAM	826.5 - 846.5	4.5664	0.273	-5.64	0.448	-3.49	4M57D7W
Band 26	10 MHz	QPSK	829.0 - 844.0	9.1066	0.313	-5.05	0.513	-2.90	9M11G7W
		16QAM	829.0 - 844.0	5.3717	0.284	-5.46	0.467	-3.31	5M37D7W
	1.4 MHz	QPSK	824.7 - 848.3	1.1103	0.313	-5.05	0.513	-2.90	1M11G7W
		16QAM	824.7 - 848.3	1.1087	0.275	-5.61	0.451	-3.46	1M11D7W
	3 MHz	QPSK	825.5 - 847.5	2.7257	0.313	-5.05	0.513	-2.90	2M73G7W
		16QAM	825.5 - 847.5	2.7232	0.274	-5.63	0.449	-3.48	2M72D7W
	5 MHz	QPSK	826.5 - 846.5	4.5845	0.313	-5.05	0.513	-2.90	4M58G7W
		16QAM	826.5 - 846.5	4.5664	0.270	-5.68	0.444	-3.53	4M57D7W
	10 MHz	QPSK	829.0 - 844.0	9.1066	0.313	-5.05	0.513	-2.90	9M11G7W
		16QAM	829.0 - 844.0	5.3717	0.287	-5.42	0.471	-3.27	5M37D7W

EUT Overview

FCC ID: BCG-A2478	 PCTEST® Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 3 of 54	

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 facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST located in Morgan Hill, CA 95037, U.S.A.

- PCTEST is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 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 (22831) test laboratory with the site description on file with ISED.

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 4 of 54	

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Watch FCC ID:BCG-A2478**. 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 22.

Test Device Serial No.: J3DH93TR29, K6GG26L469, H3695YHQYW

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n UNII, Bluetooth (1x, EDR, HDR4, HDR8, LE1M, LE2M), NFC, UWB, 60.5GHz Transmitter

This device supports simultaneous transmission operations, which allows for multiple transmitters to transmit simultaneously on the same antenna. The table below shows all configurations possible.

Simultaneous Tx Config	Antenna FCM				
	WLAN	Bluetooth	LTE/WCDMA	UNII	UWB
	802.11 b/g/n	BDR, EDR, HDR4/8, LE	Mid band/ High band	802.11 a/n	Ch.5, Ch.9
Config 1	✓	✗	✗	✗	✓
Config 2	✗	✓	✗	✗	✓
Config 3	✗	✗	✓	✗	✓
Config 4	✗	✓	✓	✗	✗
Config 5	✓	✗	✓	✗	✗
Config 6	✗	✗	✓	✓	✗
Config 7	✗	✓	✗	✓	✗
Config 8	✓	✗	✓	✗	✓
Config 9	✗	✓	✓	✗	✓
Config 10	✗	✓	✓	✓	✗

Table 2-1. Simultaneous Transmission Configurations

✓ = Support ; ✗ = NOT Support

All the above simultaneous transmission configurations have been tested and the worst case configuration was found to be config 10 and reported in RF UNII, RF Bluetooth and RF Part 27b test reports.

2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Band	Antenna Gain (dBi)
LTE Band 26/5	-28.4
WCDMA 850	-28.4

Table 2-2. Highest Antenna Gain

2.4 Test Support Equipment

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch			

1	Apple Macbook w/AC/DC Adapter	Model: A1398 Model: A1435	S/N:	C2QKP008F6F3 N/A
2	Apple USB-C cable w/ Charging Dock w/Dock	Model: N/A Model: A2687 Model: X241	S/N:	N/A FV411420544MW6M4H N/A
3	Apple Magnetic Charger Apple Magnetic Charger	Model: A2515 Model: A2515	S/N:	DLC035200UJMFR0AJ DLC035202KRMFR0A2
4	Pathfinder Falcon SiP Socket	Model: 920-098626-01 Model: P2 X2011B PF 150	S/N:	DLC034200APQ6PM1E DLC0485009D0KPG24
5	DC Power Supply	Model: KPS3010D	S/N:	N/A
6	Store Bracelet Assy1	Model: N/A	S/N:	DLC1197001R19G21N

Table 2-3. Test Support Equipment

2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.26 2015, 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.

The worst case configuration was investigated for all combinations of the three materials, aluminum, stainless steel, and Titanium and various types of wristbands, metal and non-metal wristbands. The EUT was also investigated with and without wireless charger. The worst case configuration found was used for all testing.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz were tested with the highest transmitting power and the worst case channel.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

This device only supports 27RBs or less for 16-QAM uplink.

2.6 Software and Firmware

The test was conducted with firmware version watchOS 8.0 installed on the EUT.

2.7 EMI Suppression Device(s)/Modifications

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

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 6 of 54

3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the document titled “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI C63.26-2015/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.

Deviation from Measurement Procedure.....None

3.2 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 turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

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

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

And

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

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

Per KDB 414788 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

Radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015 and TIA-603-E-2016.

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 7 of 54

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. 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	1.65
Radiated Disturbance (<30MHz)	4.06
Radiated Disturbance (30MHz-1GHz)	4.30
Radiated Disturbance (1-18GHz)	4.78
Radiated Disturbance (>18GHz)	4.79

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 8 of 54	

5.0 TEST EQUIPMENT CALIBRATION DATA

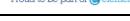
Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	3/31/2021	Annual	3/31/2022	MY49430244
Keysight Technology	N9040B	UXA Signal Analyzer	12/19/2020	Annual	12/19/2021	MY57212015
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	8/11/2020	Annual	8/11/2021	T058701-01
ESPEC	SU-241	Tabletop Temperature Chamber	9/28/2020	Annual	9/28/2021	92009574
ETS-Lindgren	3142E	BiConiLog Antenna (30MHz - 6GHz)	9/15/2020	Annual	9/15/2021	208204
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	5/3/2021	Annual	5/3/2022	205956
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	12/3/2020	Annual	12/3/2021	102327
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	12/3/2020	Annual	12/3/2021	101648
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	3/16/2021	Annual	3/16/2022	101619
Rohde & Schwarz	ESW26	EMI Test Receiver	6/11/2021	Annual	6/11/2022	101299
Rohde & Schwarz	ESW44	EMI Test Receiver	11/9/2020	Annual	11/9/2021	101570
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	10/13/2020	Annual	10/13/2021	161616
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	9/24/2020	Annual	9/24/2021	151888
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	4/29/2021	Annual	4/29/2022	100051
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Antenna (400MHz-18GHz)	10/2/2020	Annual	10/2/2021	101063
Rohde & Schwarz	HFH2-Z2	Loop Antenna	4/5/2021	Annual	4/5/2022	100519

Table 5-1. Test Equipment

Notes:

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

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 9 of 54	

6.0 SAMPLE CALCULATIONS

Emission Designator

WCDMA Emission Designator

Emission Designator = 4M16F9W

WCDMA BW = 4.16 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 8M62G7W

BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination of Any

QAM Modulation

Emission Designator = 8M45D7W

BW = 8.45 MHz

D = Amplitude/Angle Modulated

7 = Quantized/Digital Info

W = Combination of Any

Spurious Radiated Emission

Example: Spurious emission at 3700.40 MHz

The receive 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 3700.40 MHz. So 6.1 dB is added to the signal generator reading of -30.9 dBm yielding -24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm $- (-24.80) = 50.3$ dBc.

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 10 of 54

7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCG-A2478
 FCC Classification: PCS Licensed Transmitter Worn on Body (PCT)
 Mode(s): WCDMA/LTE

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Occupied Bandwidth	2.1049	N/A	N/A	Section 7.2
	Conducted Band Edge / Spurious Emissions	2.1051, 22.917(a)	-13dBm at Band Edge and for all out-of-band emissions	PASS	Sections 7.3, 7.4
	Transmitter Conducted Output Power	2.1046	N/A	N/A	See RF Exposure Report
	Effective Radiated Power / Equivalent Isotropic Radiated Power	22.913(a)(5)	< 7 Watts max. ERP	PASS	Section 7.5
	Frequency Tolerance	2.1055, 22.355	±2.5 ppm	PASS	Section 7.7
RADIATED	Radiated Spurious Emissions	2.1053, 22.917(a)	-13dBm 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 were all 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. All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST EMC Software Tool 1.0.

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 11 of 54

7.2 Occupied Bandwidth

§2.1049

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.

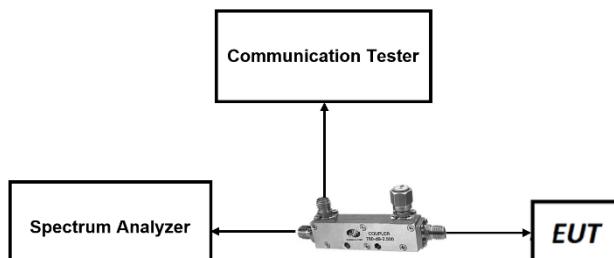


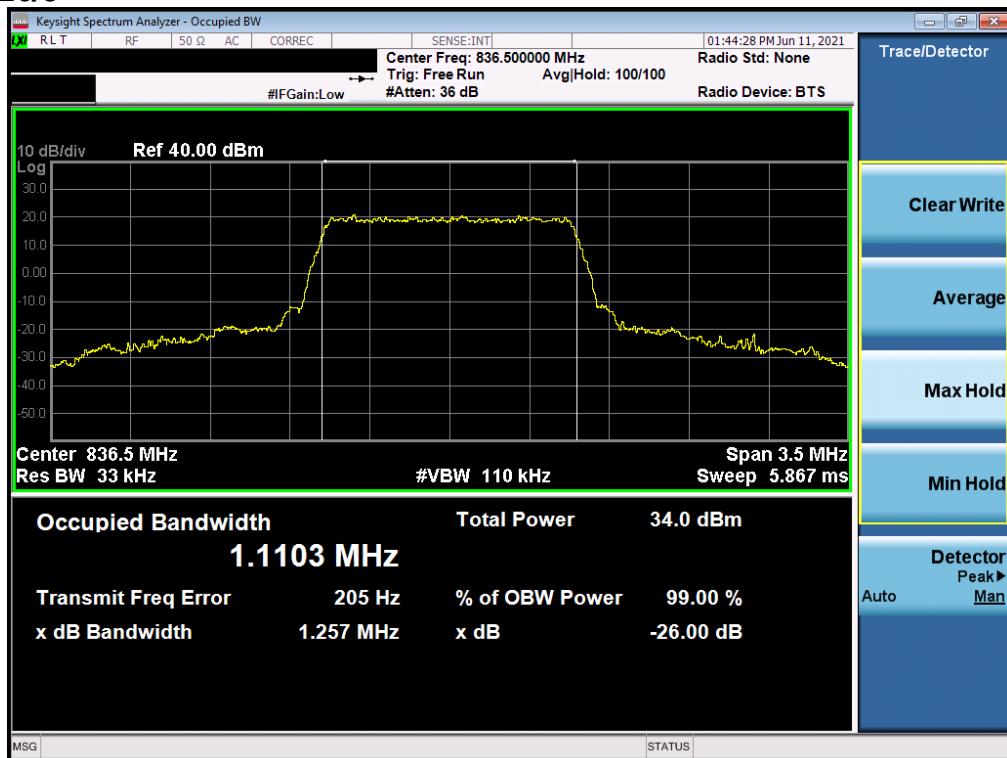
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

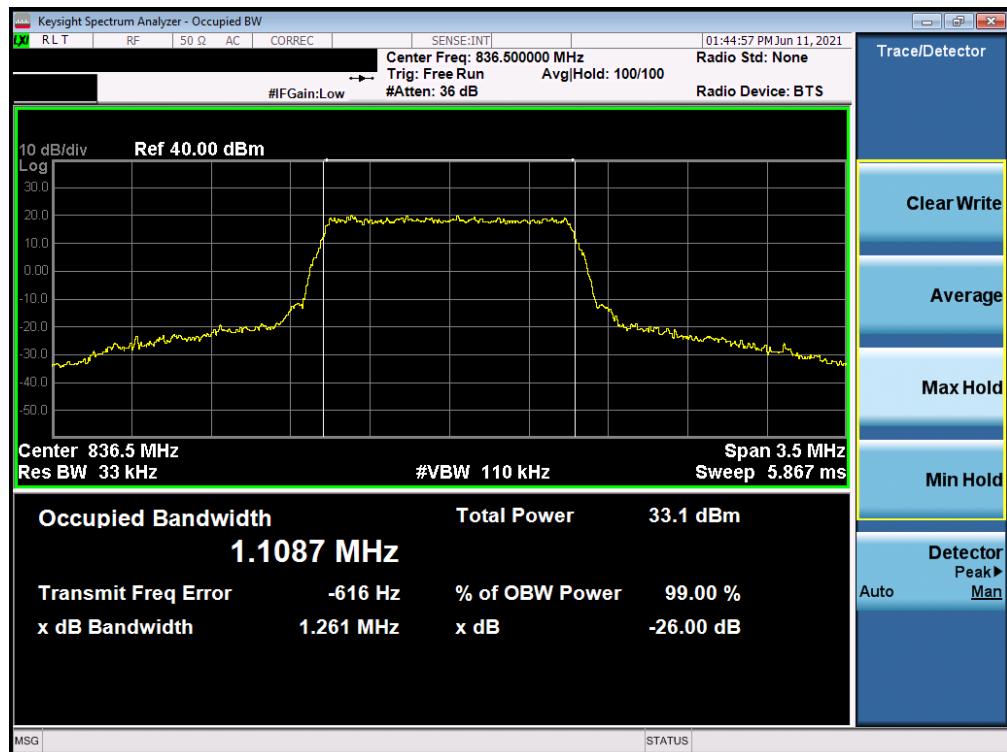
None.

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 12 of 54

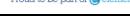
LTE Band 26/5

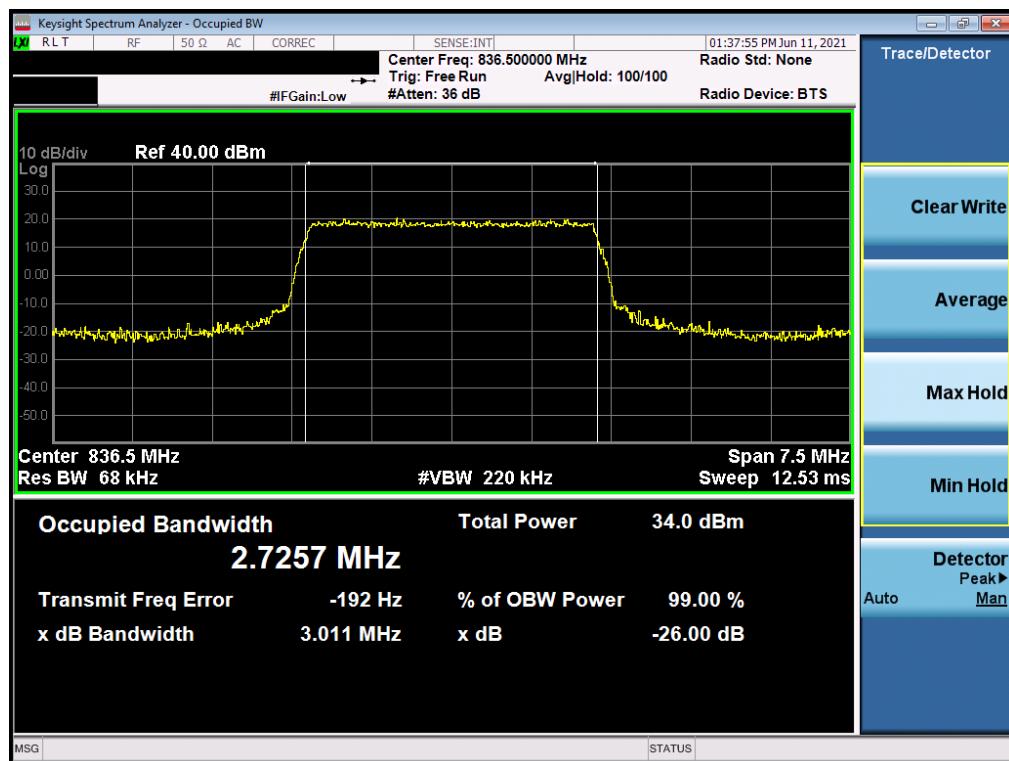


Plot 7-1. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz QPSK - Full RB Configuration)



Plot 7-2. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz 16-QAM - Full RB Configuration)

FCC ID: BCG-A2478	 PCTEST Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 13 of 54



Plot 7-3. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz QPSK - Full RB Configuration)

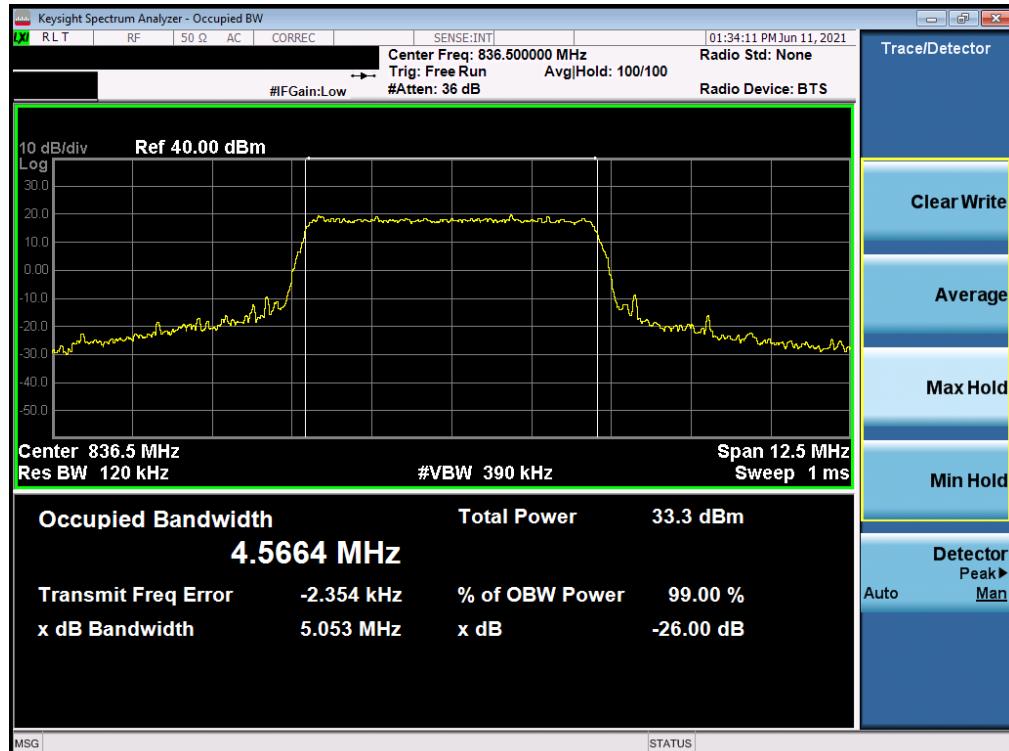


Plot 7-4. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz 16-QAM - Full RB Configuration)

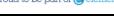
FCC ID: BCG-A2478	 MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 14 of 54



Plot 7-5. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz QPSK - Full RB Configuration)



Plot 7-6. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz 16-QAM - Full RB Configuration)

FCC ID: BCG-A2478	 PCTEST Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 15 of 54



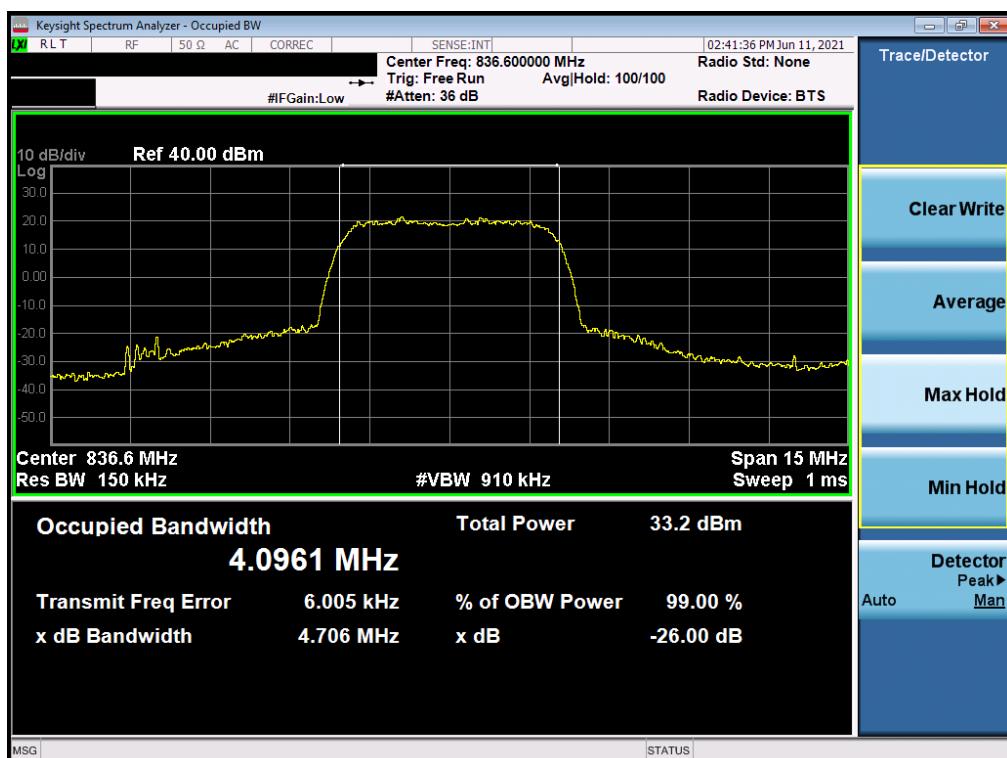
Plot 7-7. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz QPSK - Full RB Configuration)



Plot 7-8. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz 16-QAM - Full RB Configuration)

FCC ID: BCG-A2478	 MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 16 of 54	

WCDMA Cell



Plot 7-9. Occupied Bandwidth Plot (WCDMA, Ch. 4183)

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 17 of 54	

7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051, 22.917(a)

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 $43 + 10 \log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

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

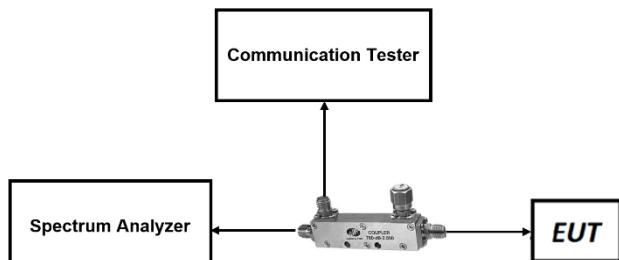


Figure 7-2. Test Instrument & Measurement Setup

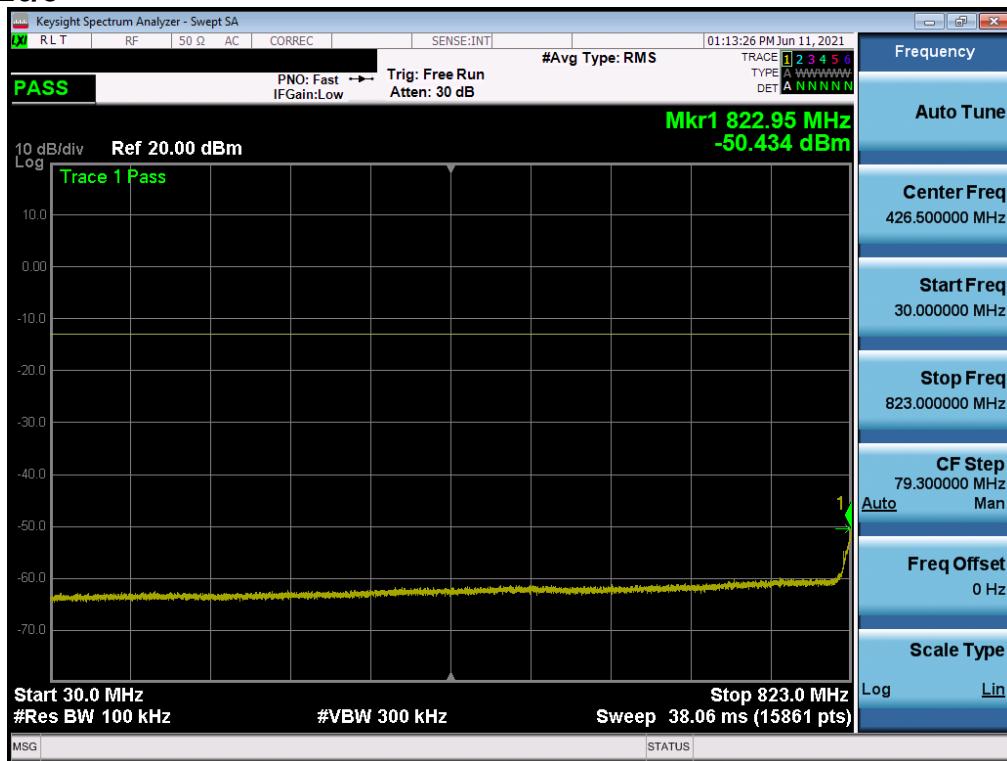
FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 18 of 54

Test Notes

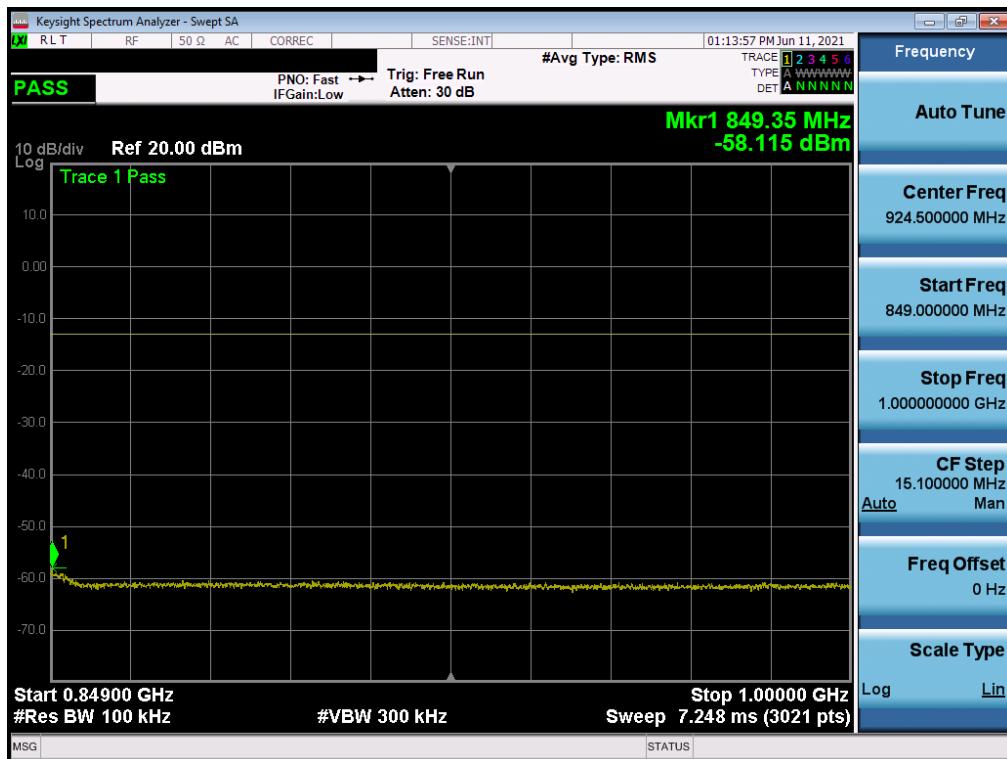
1. Per Part 22, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 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: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 19 of 54

LTE Band 26/5

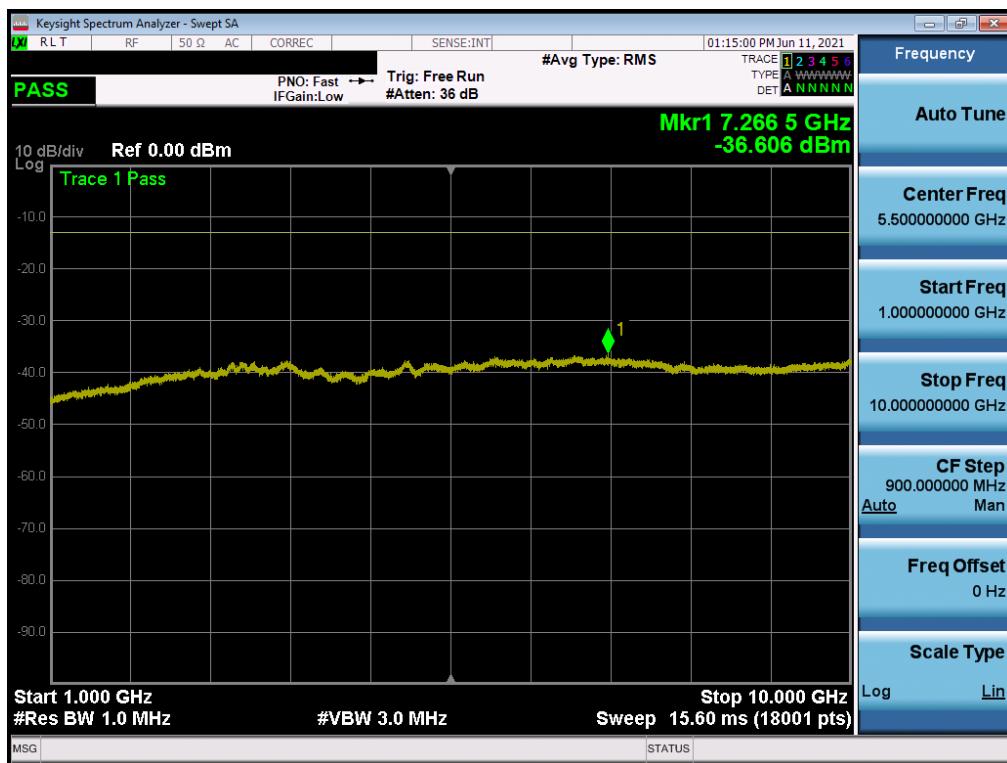


Plot 7-10. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

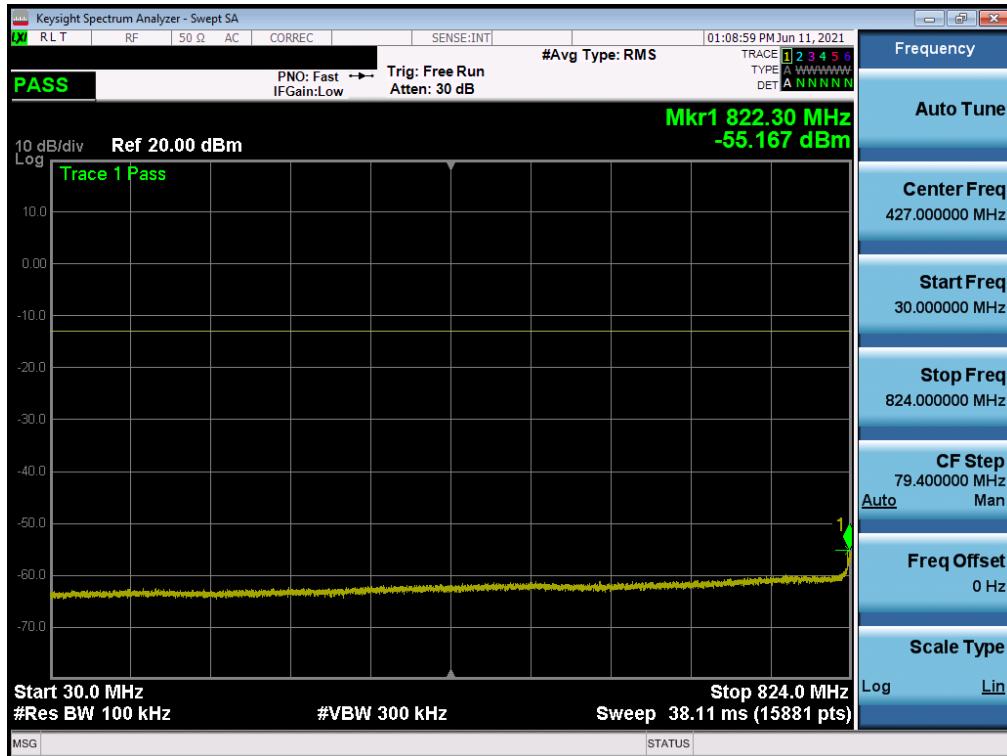


Plot 7-11. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 20 of 54

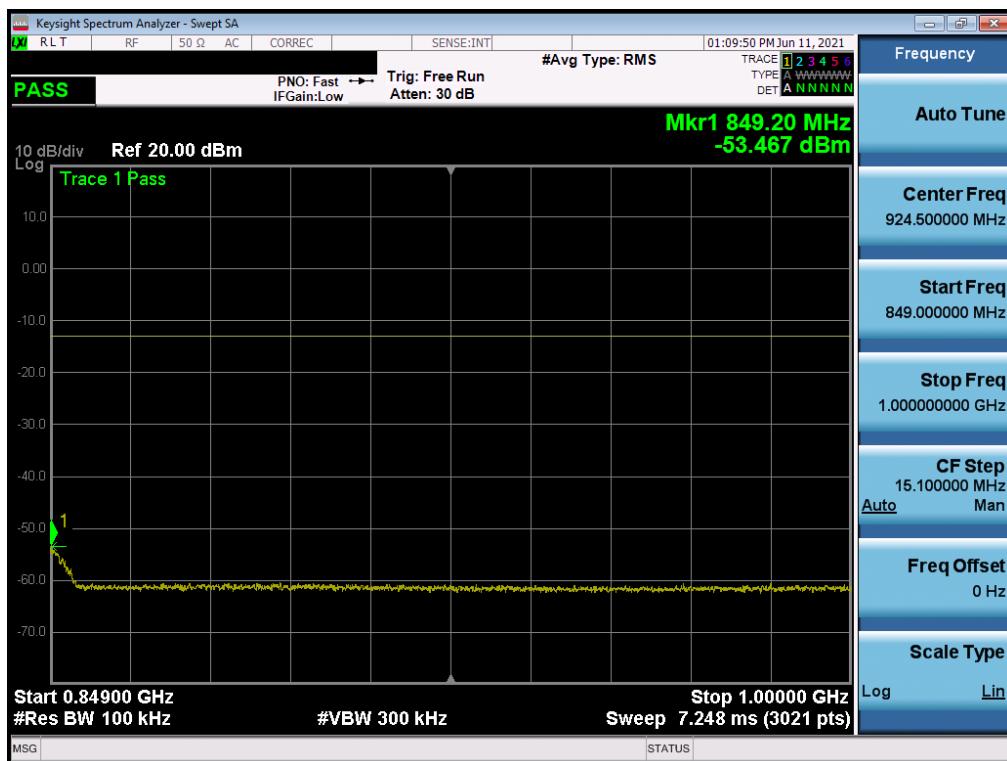


Plot 7-12. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

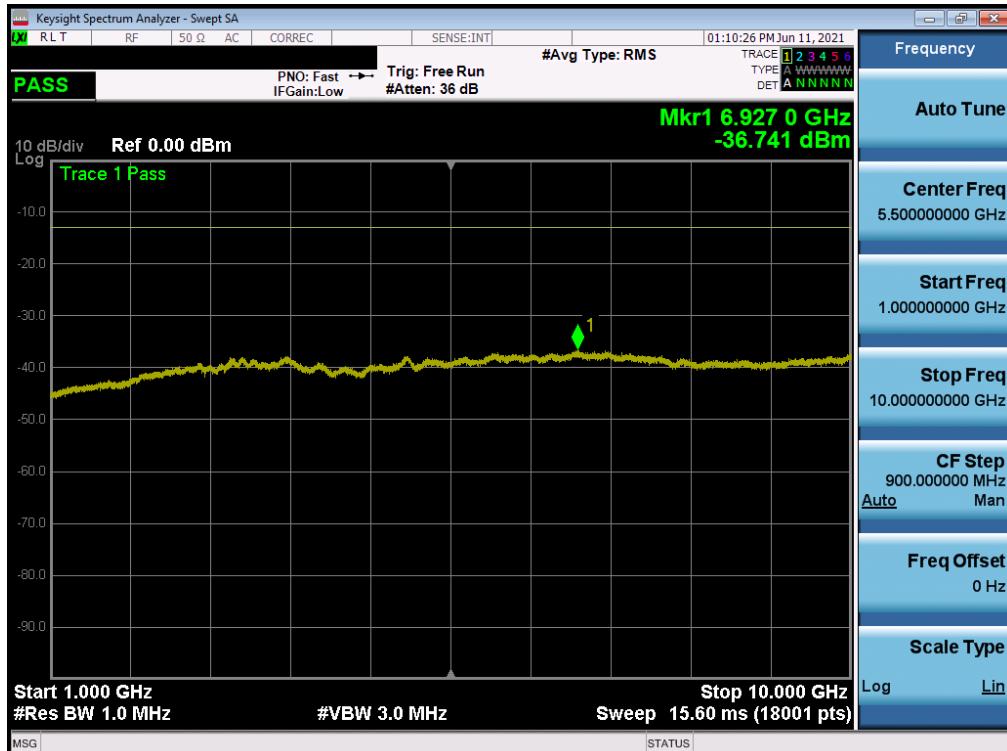


Plot 7-13. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCG-A2478		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 21 of 54

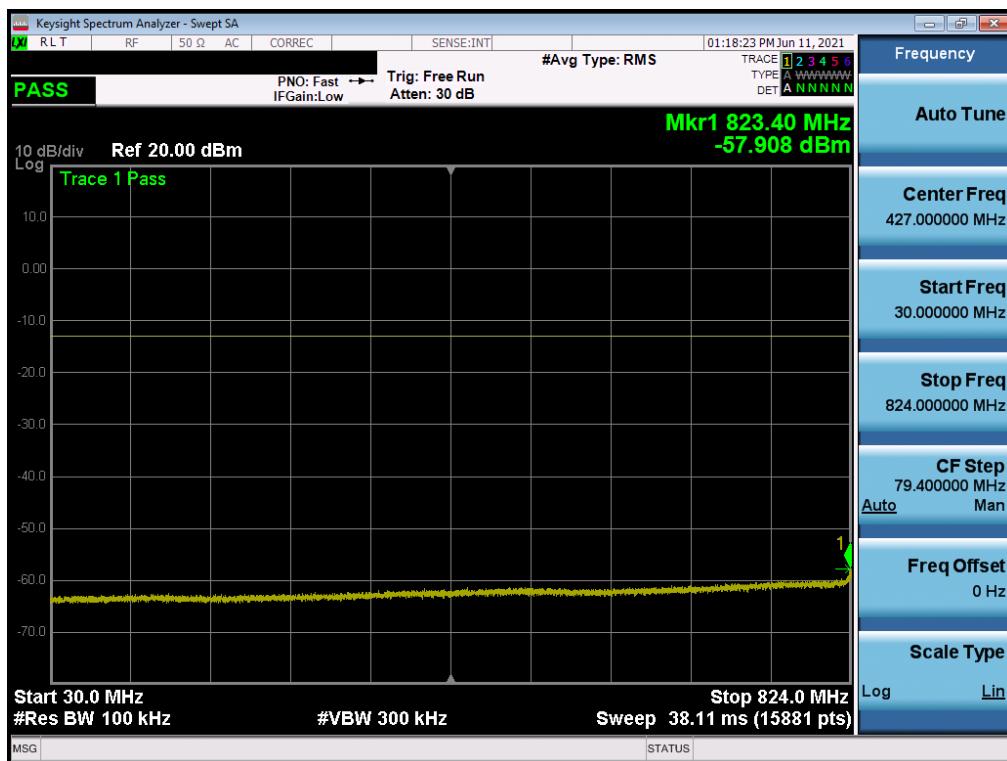


Plot 7-14. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

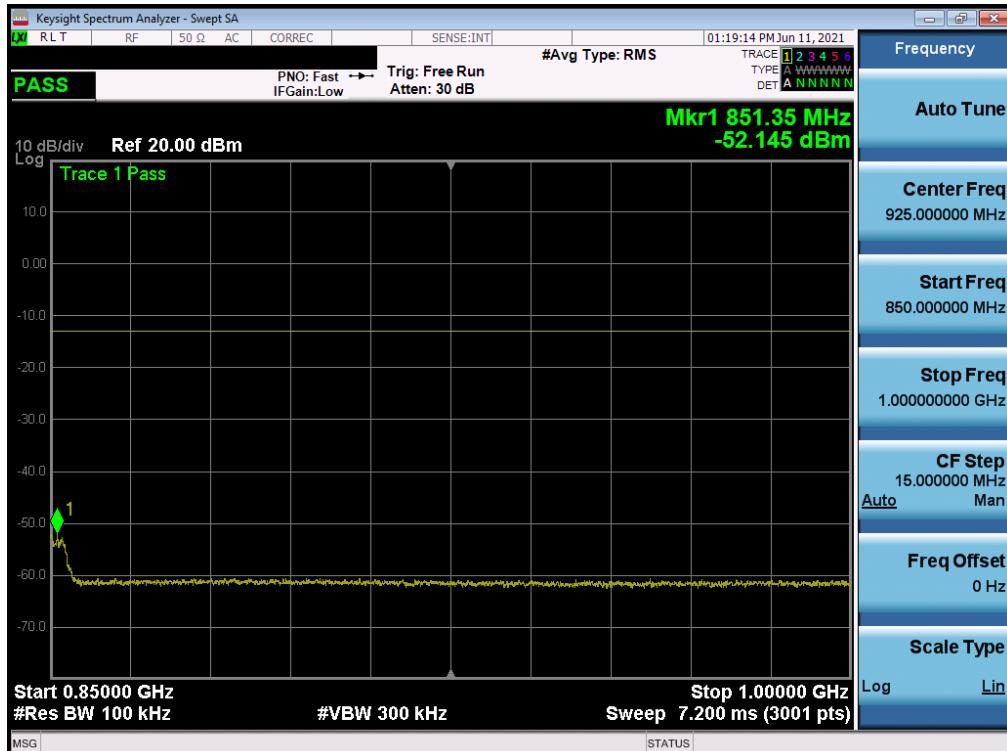


Plot 7-15. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 22 of 54

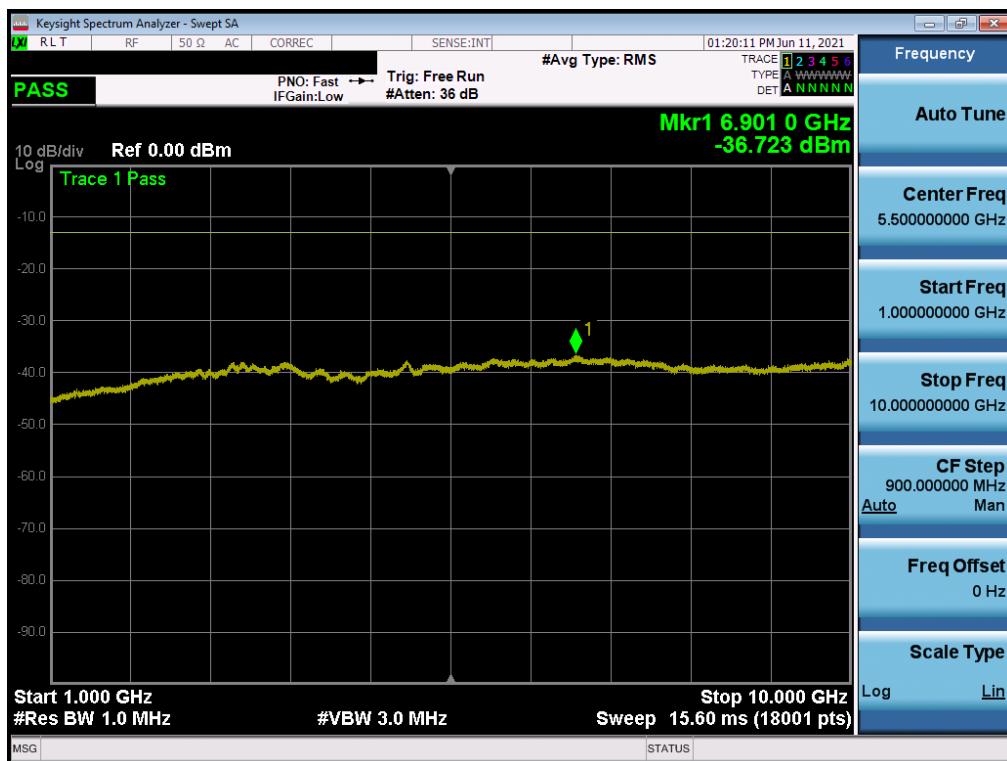


Plot 7-16. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-17. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

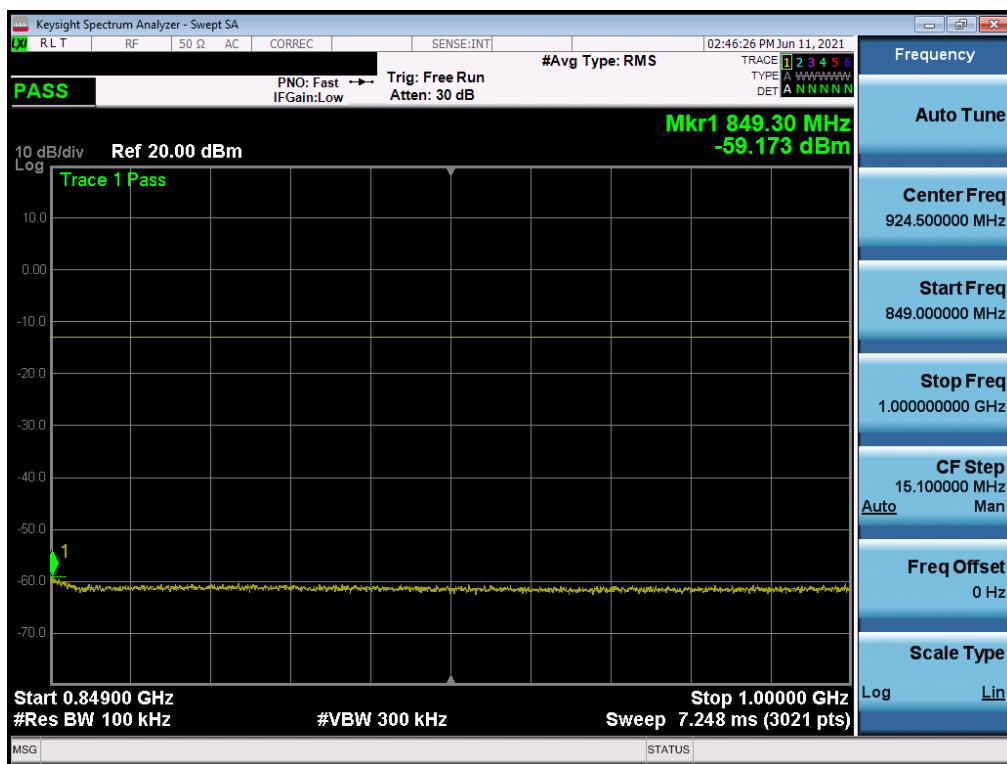
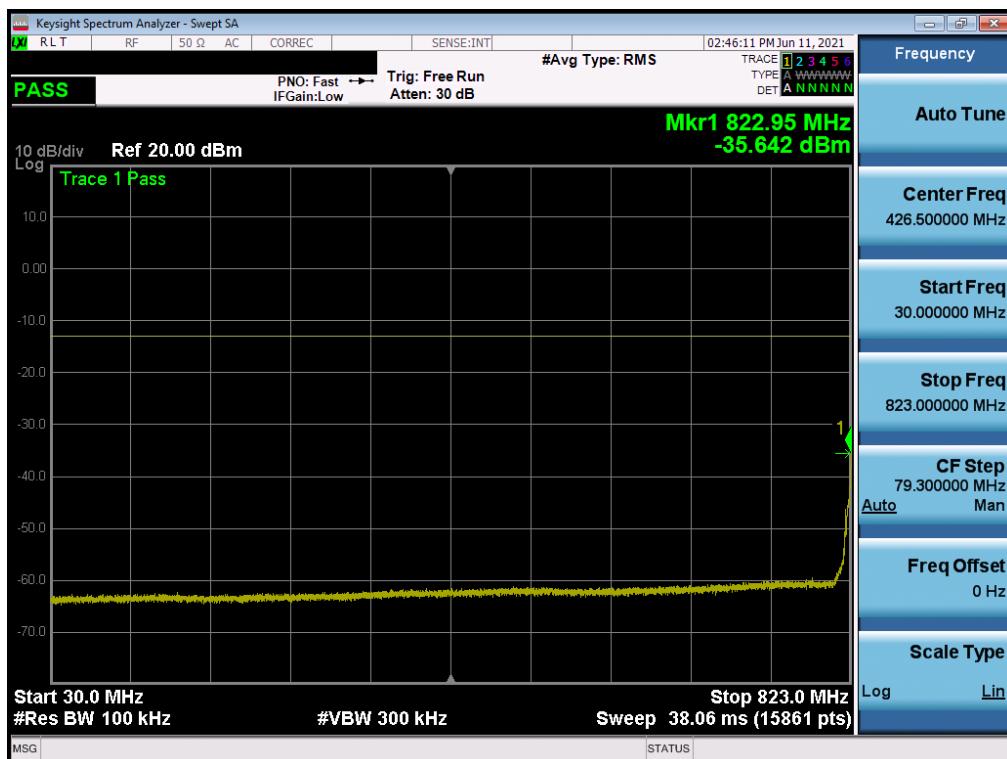
FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 23 of 54

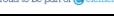


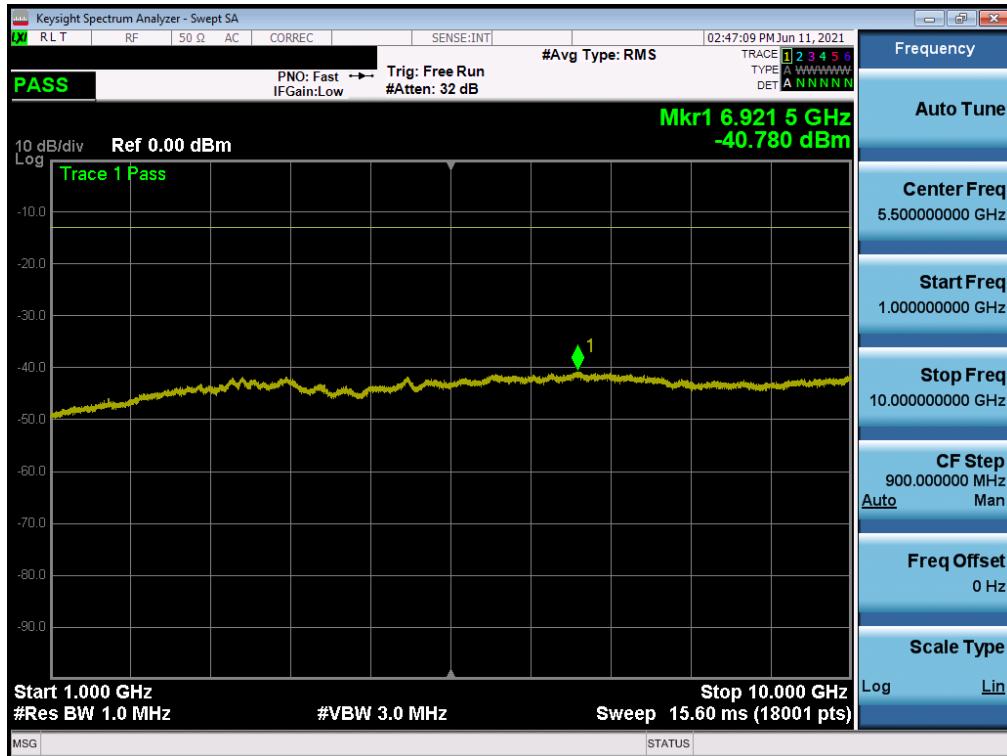
Plot 7-18. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 24 of 54

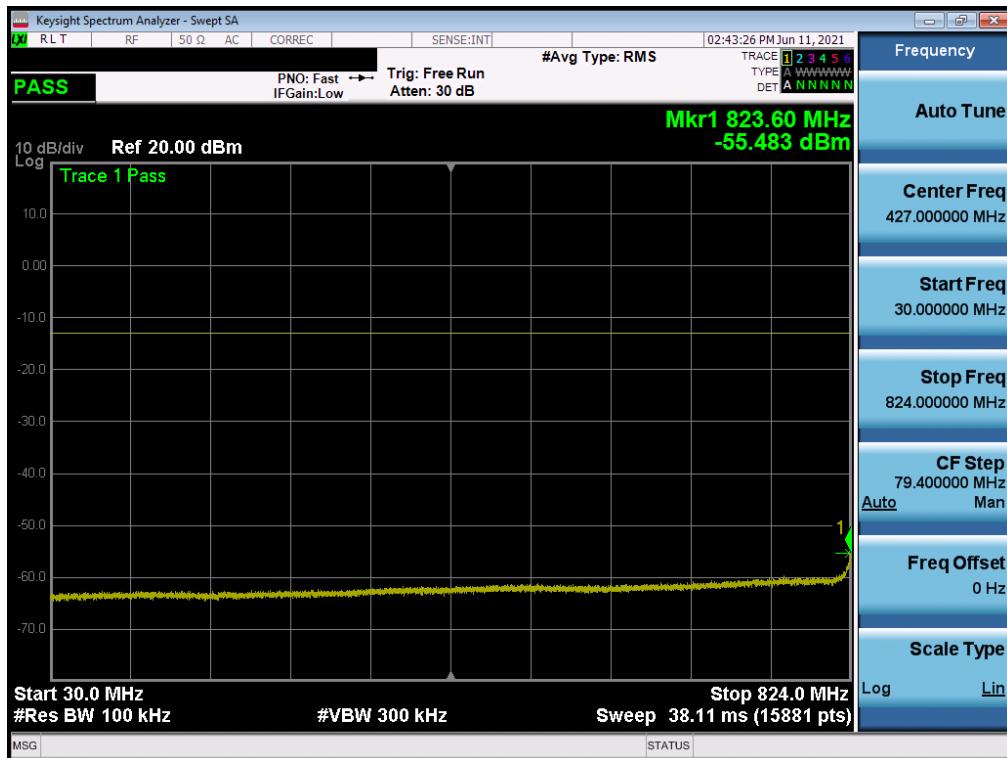
WCDMA Cell



FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 25 of 54

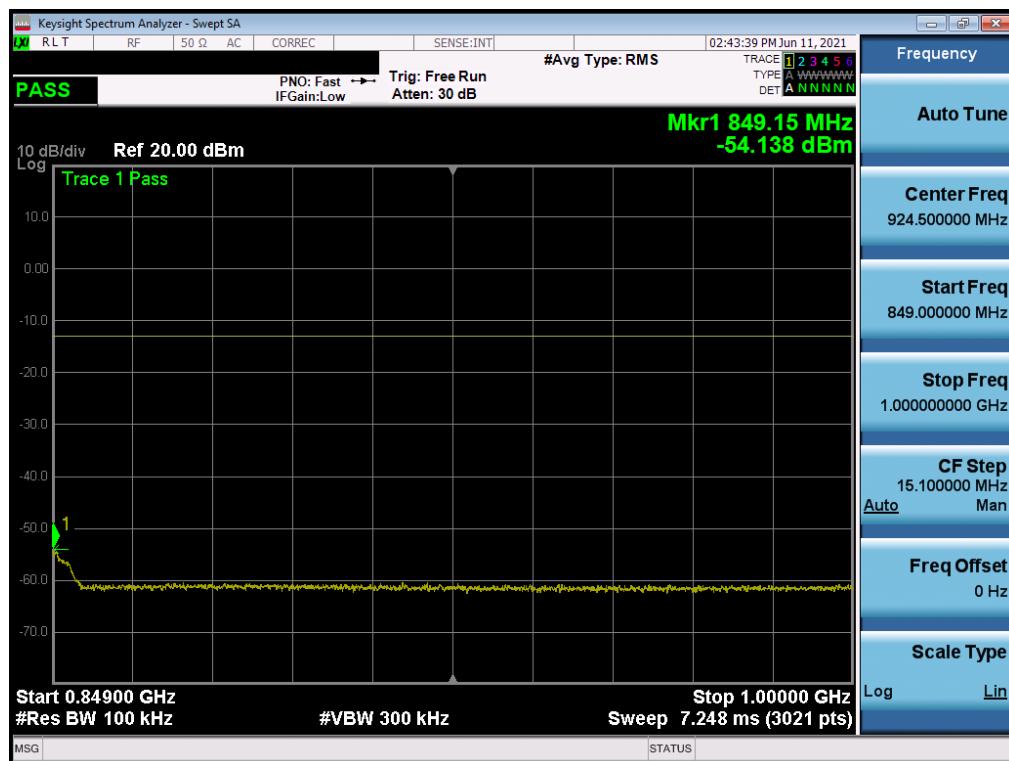


Plot 7-21. Conducted Spurious Plot (WCDMA Ch. 4132)

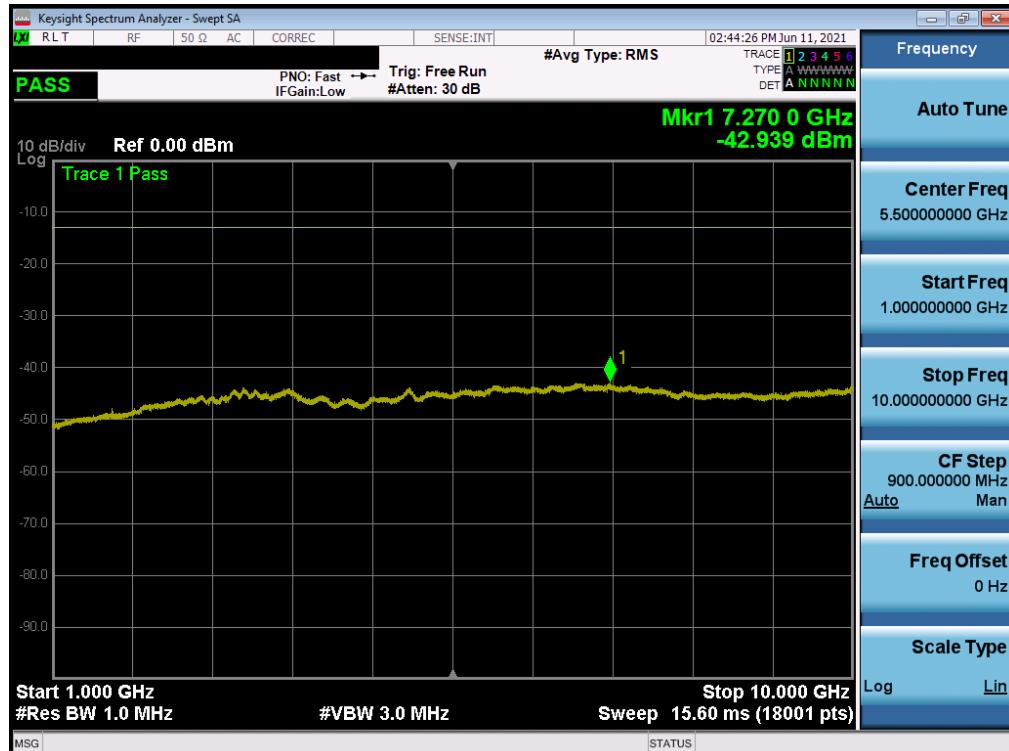


Plot 7-22. Conducted Spurious Plot (WCDMA Ch. 4183)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 26 of 54

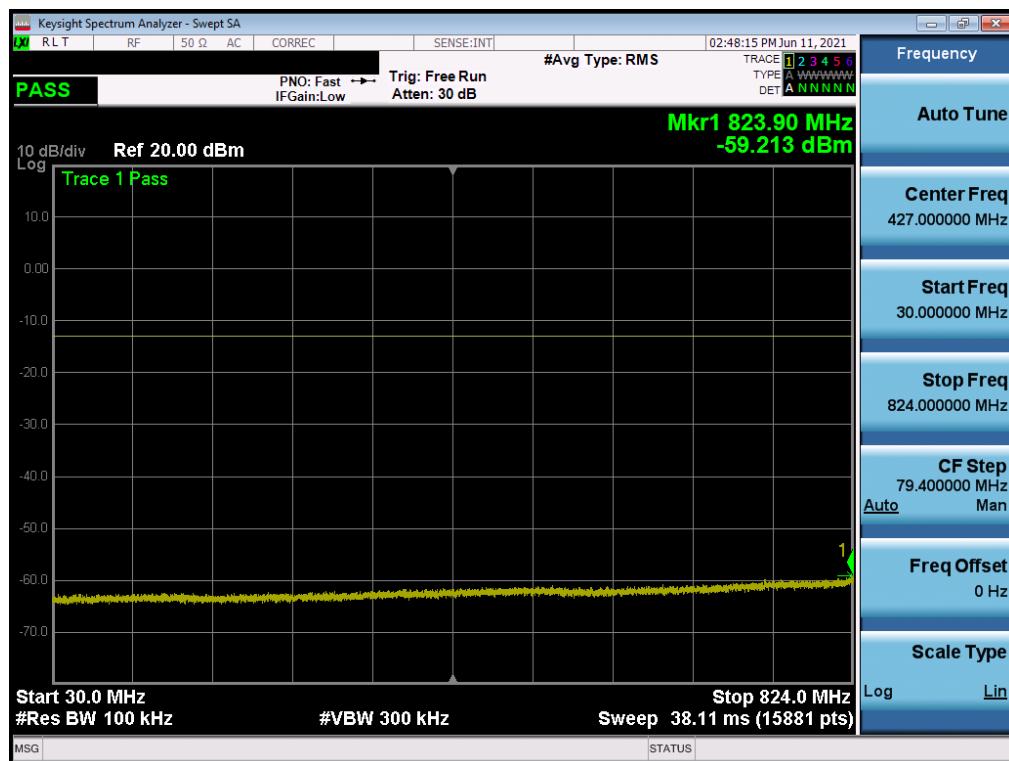


Plot 7-23. Conducted Spurious Plot (WCDMA Ch. 4183)

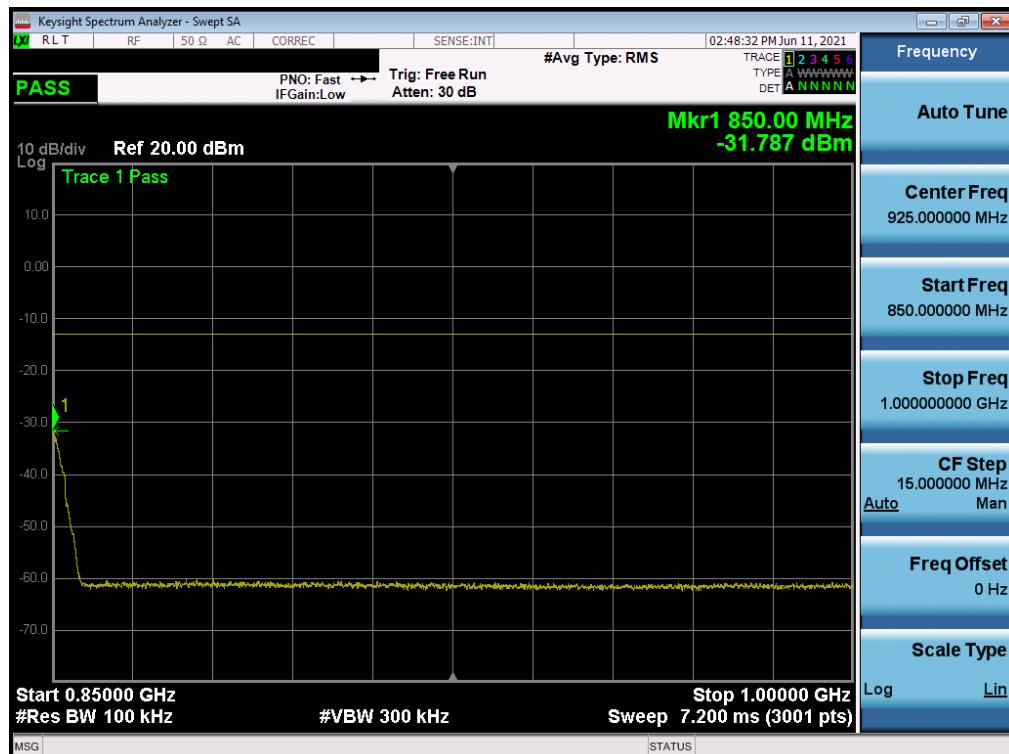


Plot 7-24. Conducted Spurious Plot (WCDMA Ch. 4183)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 27 of 54

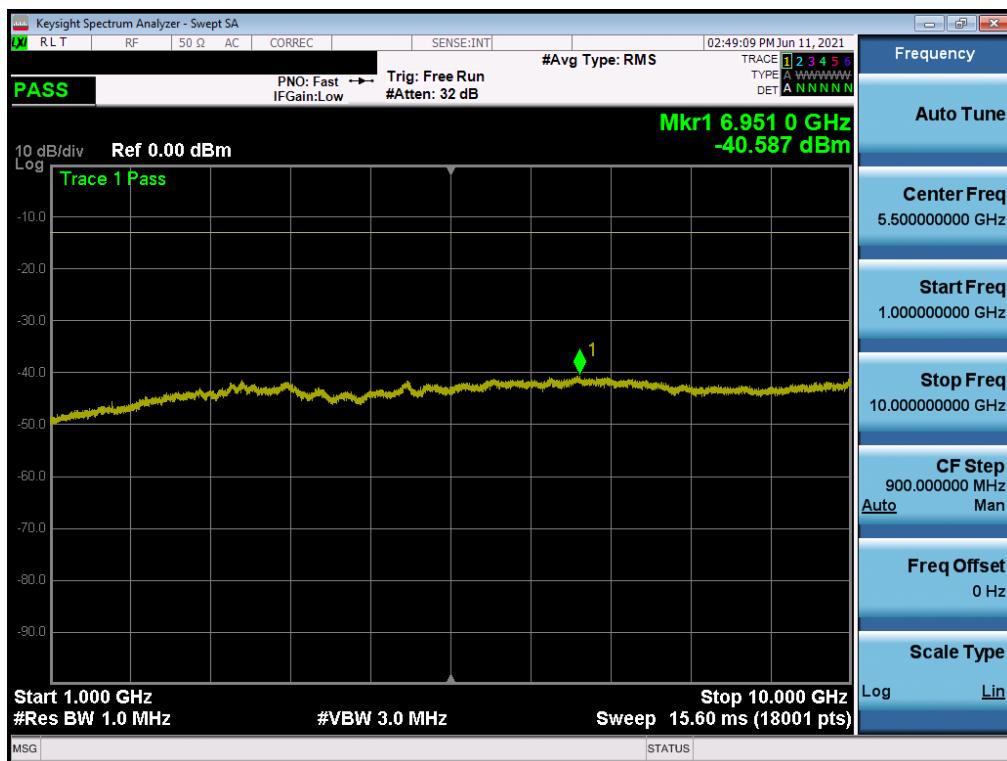


Plot 7-25. Conducted Spurious Plot (WCDMA Ch. 4233)



Plot 7-26. Conducted Spurious Plot (WCDMA Ch. 4233)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 28 of 54



Plot 7-27. Conducted Spurious Plot (WCDMA Ch. 4233)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 29 of 54

7.4 Band Edge Emissions at Antenna Terminal

§2.1051, 22.917(a)

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 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 \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.

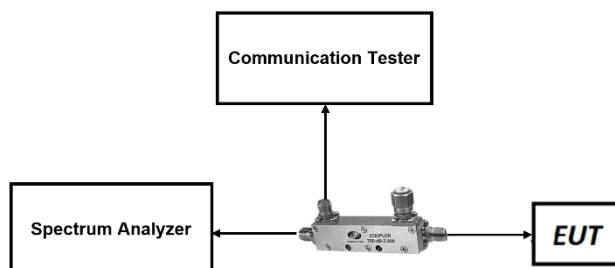


Figure 7-3. Test Instrument & Measurement Setup

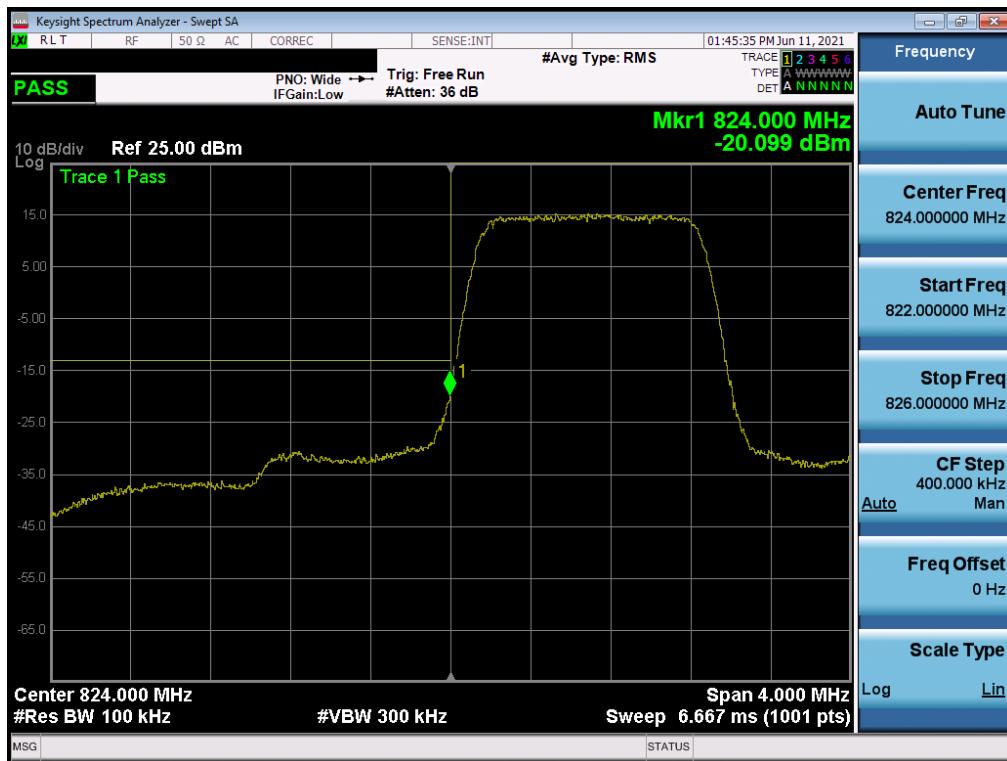
FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 30 of 54

Test Notes

1. Per 22.917(b), 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: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 31 of 54

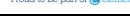
LTE Band 26

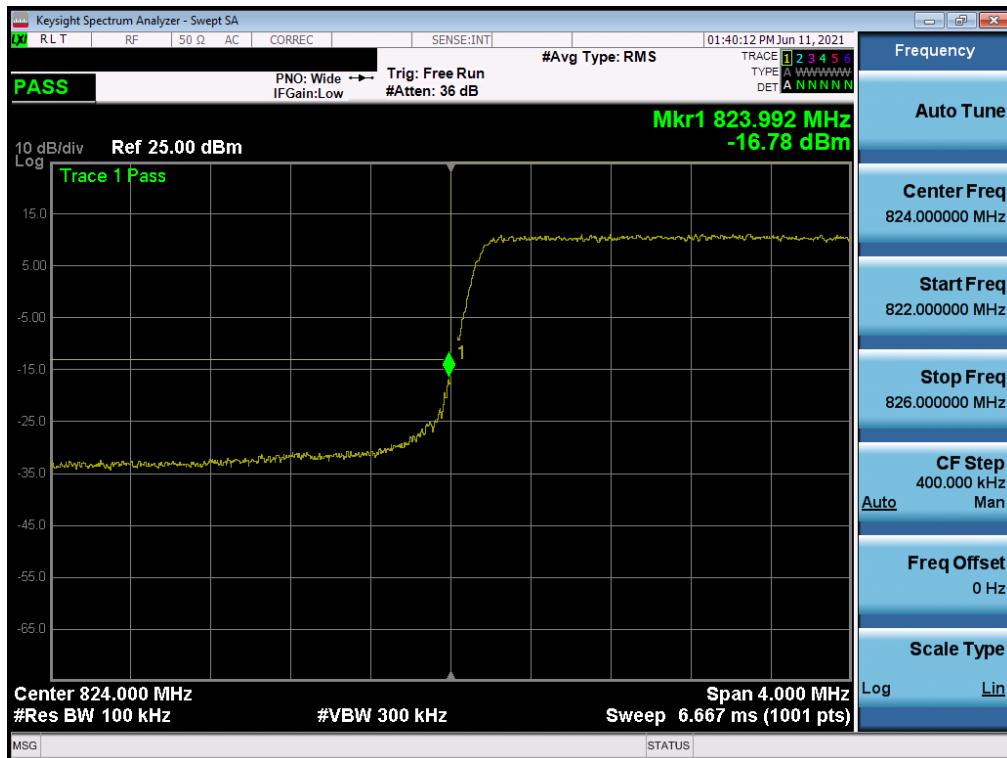


Plot 7-28. Lower BE Plot (LTE Band 26 – 1.4MHz QPSK – Full RB Configuration)



Plot 7-29. Upper BE Plot (LTE Band 26 – 1.4MHz QPSK – Full RB Configuration)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 32 of 54

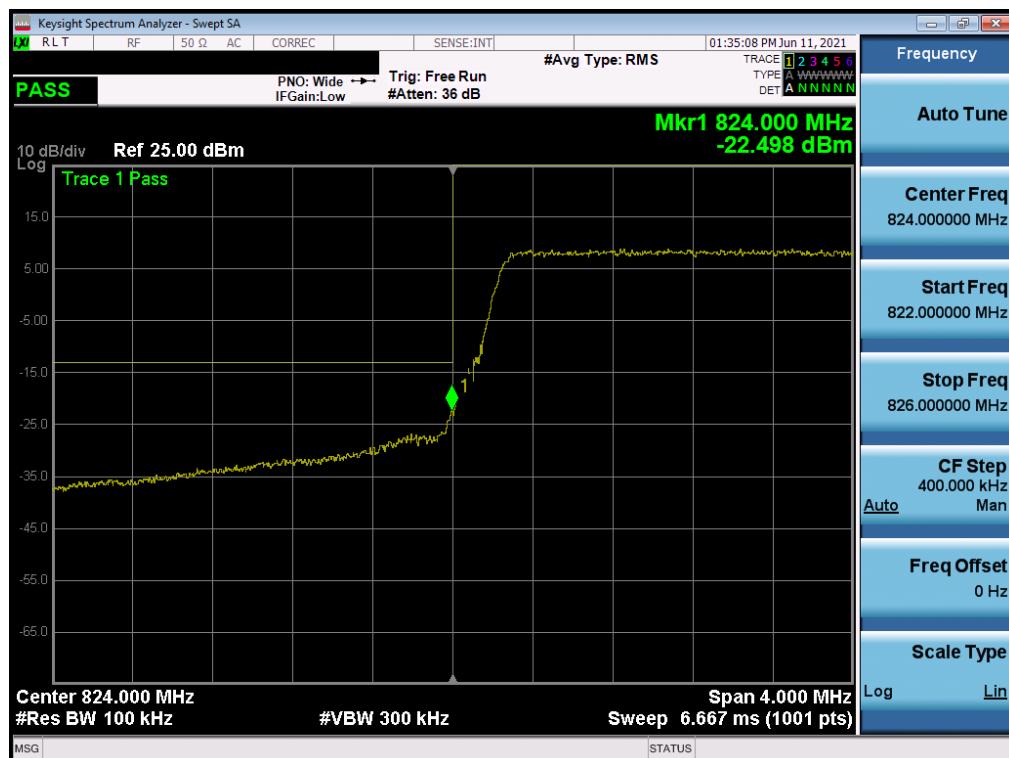


Plot 7-30. Lower BE Plot (LTE Band 26 - 3MHz QPSK – Full RB Configuration)

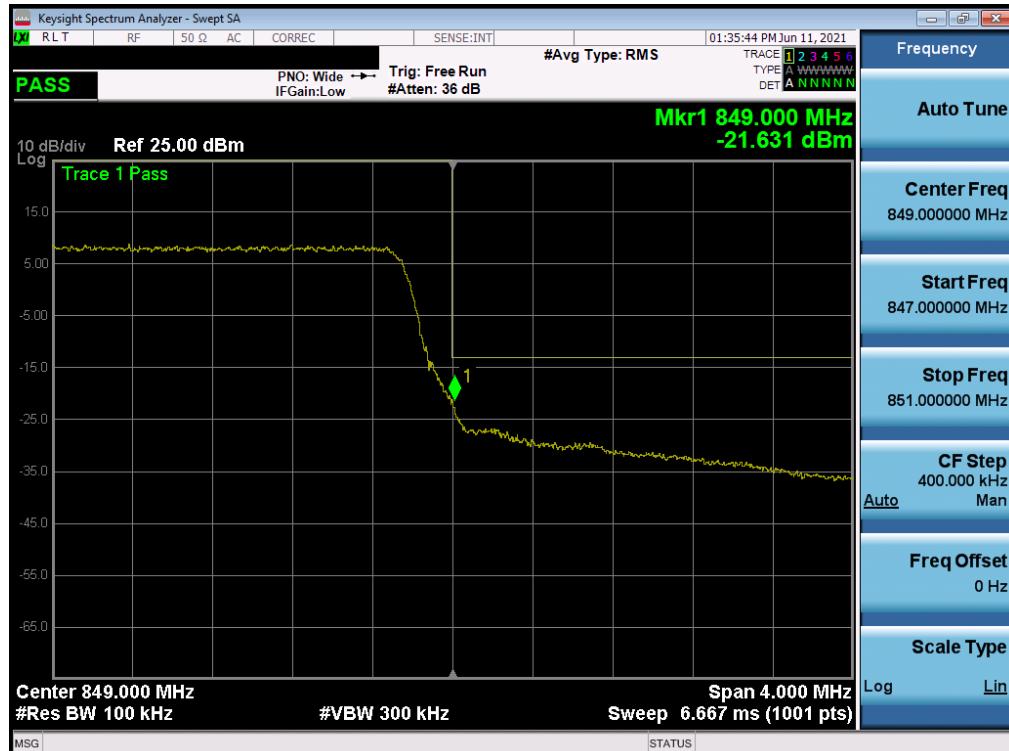


Plot 7-31. Upper BE Plot (LTE Band 26 - 3MHz QPSK – Full RB Configuration)

FCC ID: BCG-A2478	PCTEST Proud to be part of 			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch			Page 33 of 54

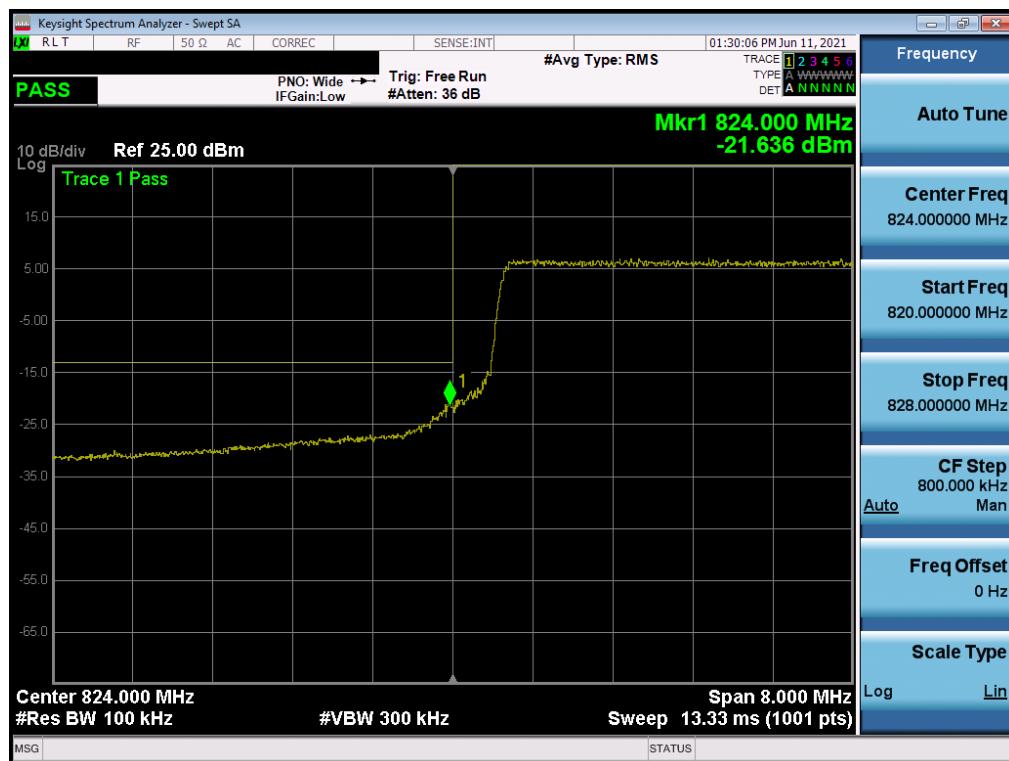


Plot 7-32. Lower BE Plot (LTE Band 26 - 5MHz QPSK – Full RB Configuration)

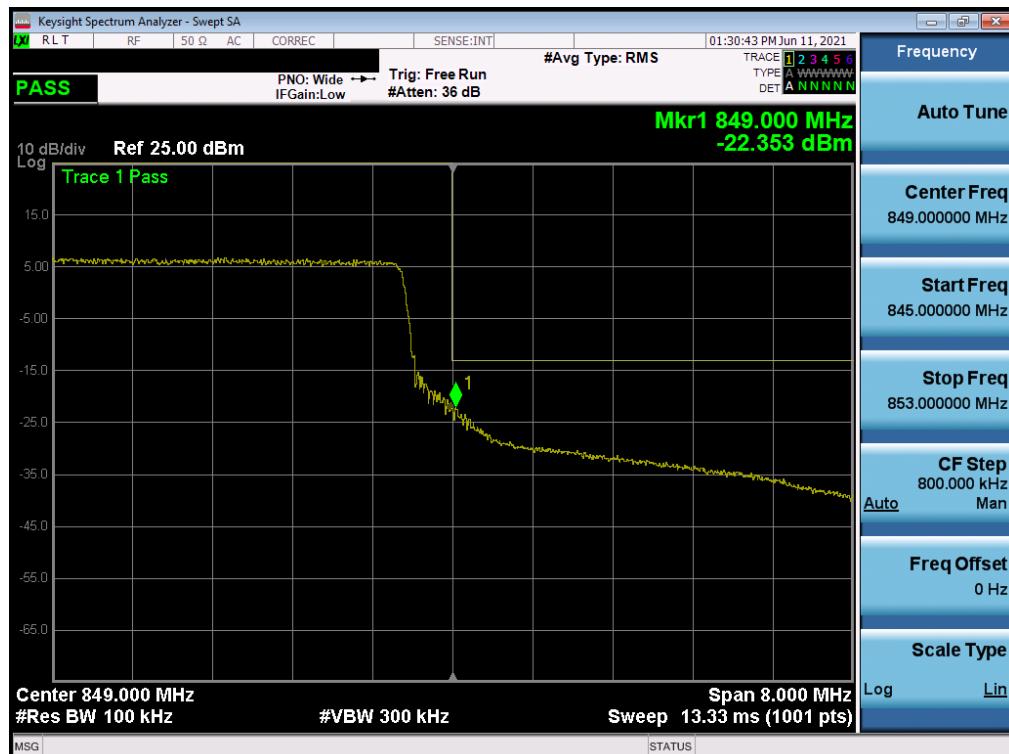


Plot 7-33. Upper BE Plot (LTE Band 26 - 5MHz QPSK – Full RB Configuration)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 34 of 54



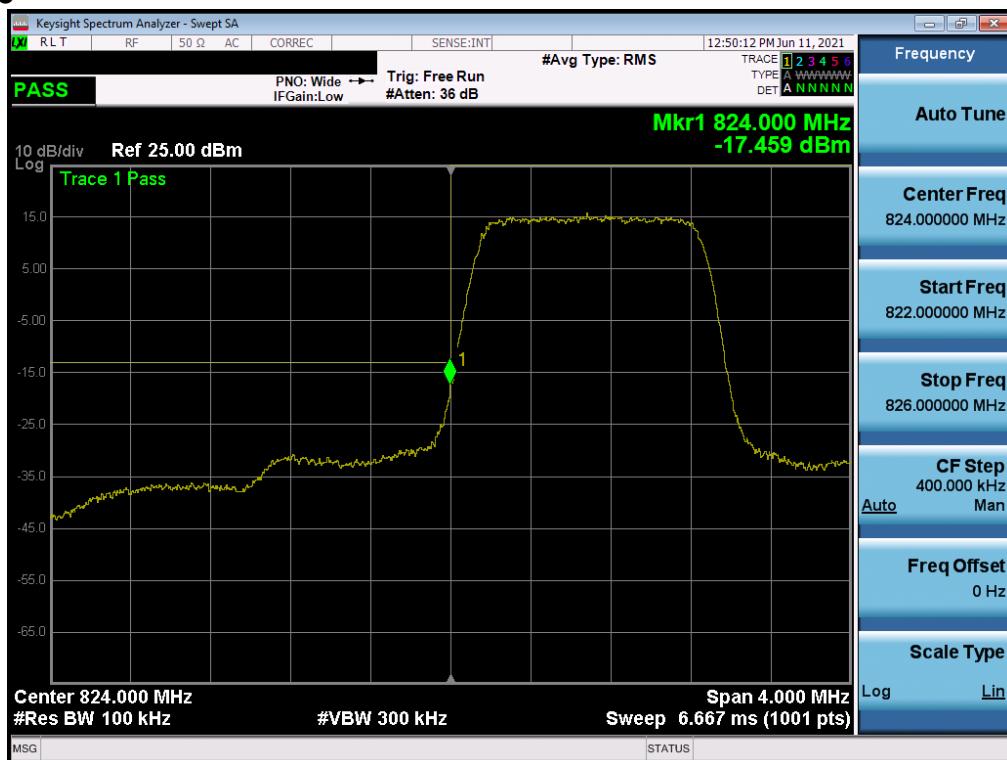
Plot 7-34. Lower BE Plot (LTE Band 26 - 10MHz QPSK – Full RB Configuration)



Plot 7-35. Upper BE Plot (LTE Band 26 - 10MHz QPSK – Full RB Configuration)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 35 of 54

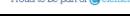
LTE Band 5

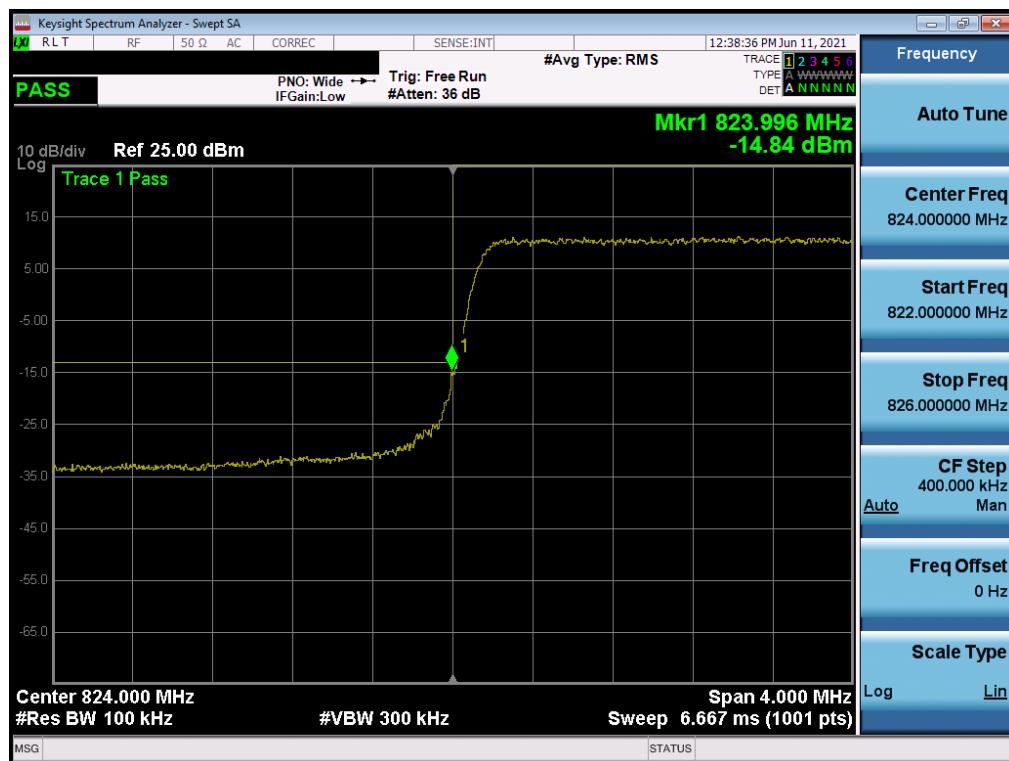


Plot 7-36. Lower BE Plot (LTE Band 5 – 1.4MHz QPSK – Full RB Configuration)



Plot 7-37. Upper BE Plot (LTE Band 5 – 1.4MHz QPSK – Full RB Configuration)

FCC ID: BCG-A2478	 PCTEST Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 36 of 54

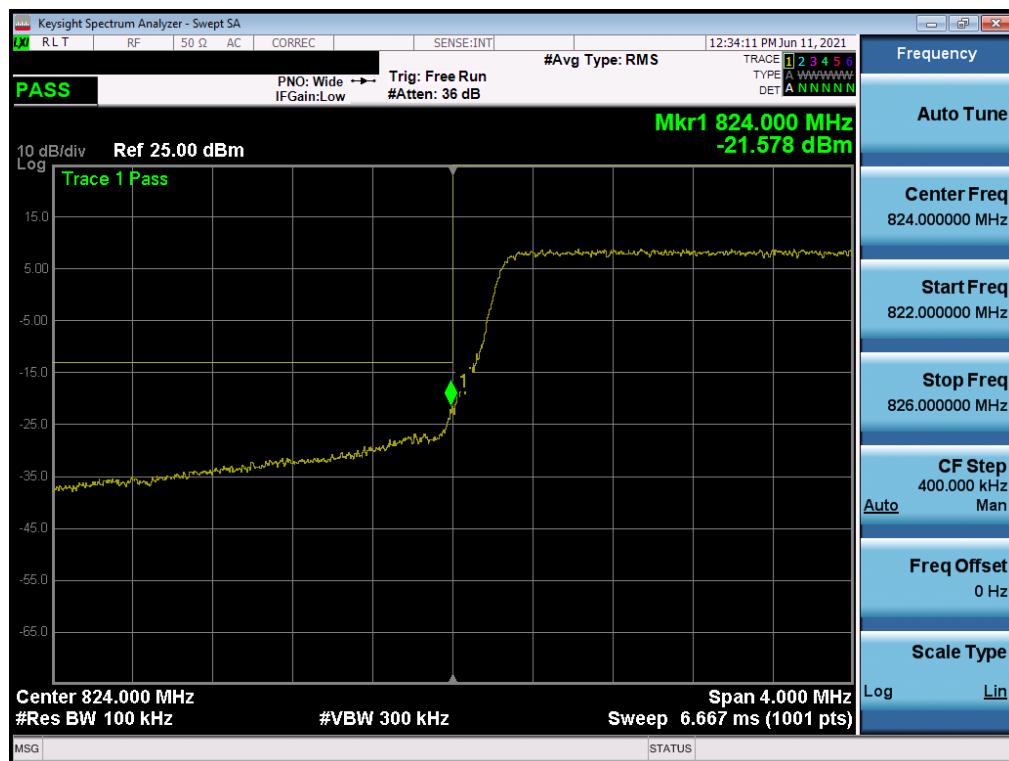


Plot 7-38. Lower BE Plot (LTE Band 5 - 3MHz QPSK – Full RB Configuration)

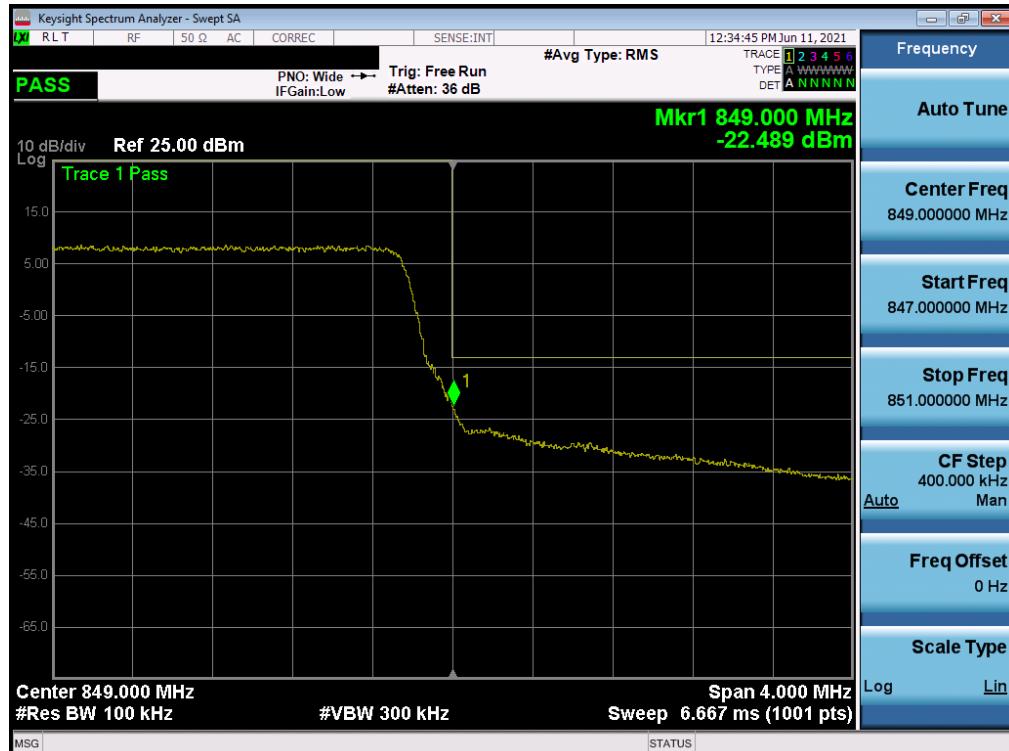


Plot 7-39. Upper BE Plot (LTE Band 5 - 3MHz QPSK – Full RB Configuration)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 37 of 54

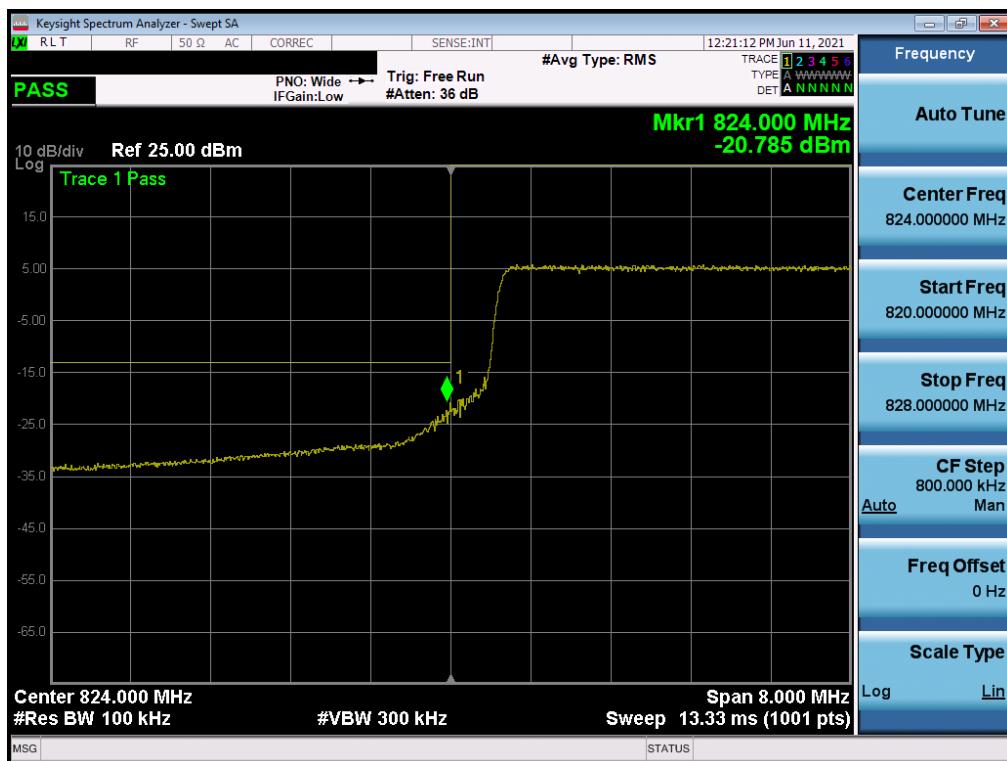


Plot 7-40. Lower BE Plot (LTE Band 5 - 5MHz QPSK – Full RB Configuration)

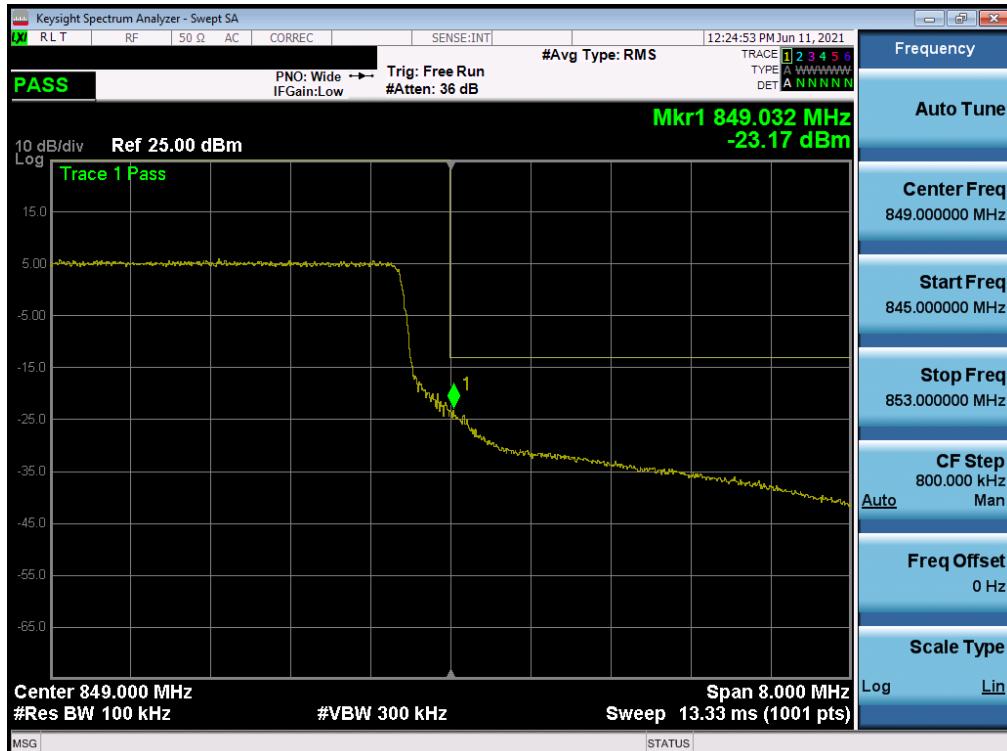


Plot 7-41. Upper BE Plot (LTE Band 5 - 5MHz QPSK – Full RB Configuration)

FCC ID: BCG-A2478	PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 38 of 54



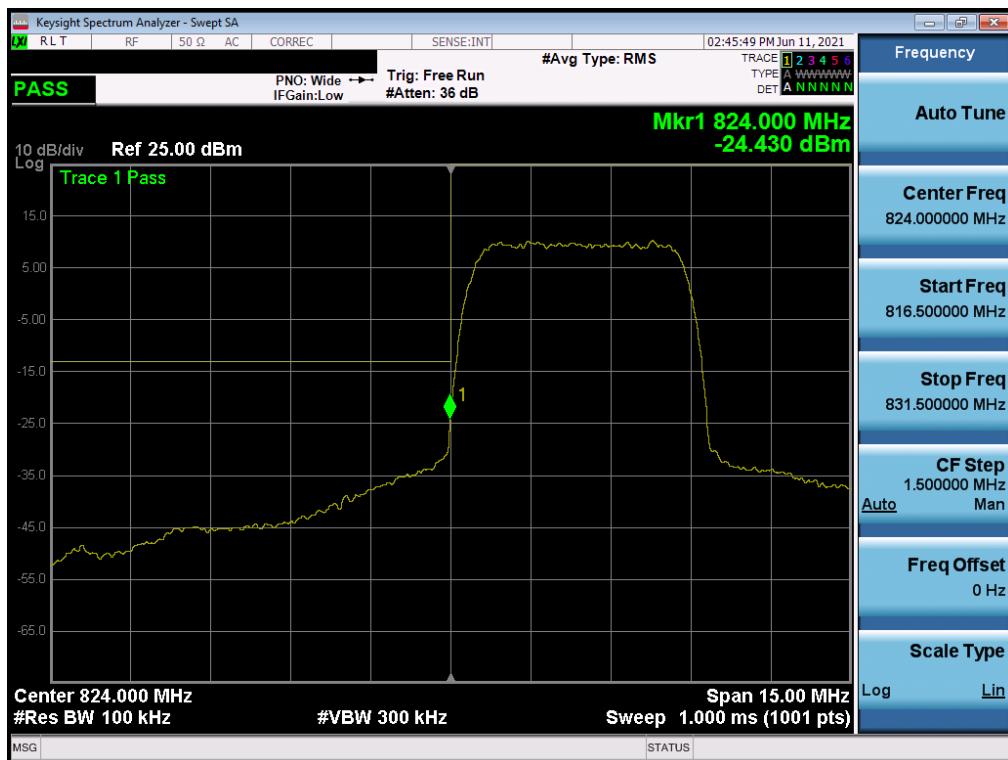
Plot 7-42. Lower BE Plot (LTE Band 5 - 10MHz QPSK – Full RB Configuration)



Plot 7-43. Upper BE Plot (LTE Band 5 - 10MHz QPSK – Full RB Configuration)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 39 of 54

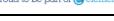
WCDMA Cell



Plot 7-44. Lower BE Plot (WCDMA Cell – Ch. 4132)



Plot 7-45. Upper BE Plot (WCDMA Cell – Ch. 4233)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 40 of 54

7.5 Radiated Power (ERP/EIRP)

§22.913(a)(5)

Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are calculated by adding highest antenna gain to maximum measured conducted output power. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI C63.26-2015 – Section 5.2.5.5

Test Settings

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured is:

$$\text{ERP/EIRP} = \text{PMeas} - \text{LC} + \text{GT}$$

Where:

ERP/EIRP = Effective or Equivalent Isotropic Radiated Power, respectively (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

Test Setup

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

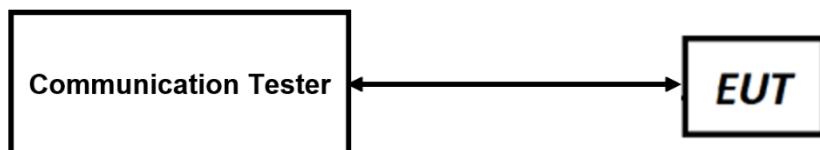
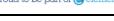


Figure 7-4. ERP/EIRP Measurement Setup

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 41 of 54

Test Notes:

1. The EUT was tested in all possible test configurations. The worst case emissions are reported with the EUT modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
2. This unit was tested with its standard battery.
3. The Level (dBm) readings in the table were taken with a correction table loaded into the base station simulator. The correction table was used to account for the signal attenuation in the connecting cable between the transmitter and antenna.
4. The Ant. Gains (GT) are listed in dBi.

FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 42 of 54

7.5.1 Antenna BCM – ERP/EIRP

LTE Band 26

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	ERP [dBm]	ERP [mW]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
1.4 MHz	QPSK	824.7	-28.40	1 / 0	25.35	-5.20	0.302	38.45	-43.65	-3.05	0.495	40.61	-43.66
		836.5	-28.40	1 / 24	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
		848.3	-28.40	1 / 24	25.26	-5.29	0.296	38.45	-43.74	-3.14	0.485	40.61	-43.75
	16-QAM	836.5	-28.40	1 / 24	24.94	-5.61	0.275	38.45	-44.06	-3.46	0.451	40.61	-44.07
3 MHz	QPSK	825.5	-28.40	1 / 24	25.48	-5.07	0.311	38.45	-43.52	-2.92	0.511	40.61	-43.53
		836.5	-28.40	1 / 24	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
		847.5	-28.40	1 / 12	25.45	-5.10	0.309	38.45	-43.55	-2.95	0.507	40.61	-43.56
	16-QAM	847.5	-28.40	1 / 12	24.92	-5.63	0.274	38.45	-44.08	-3.48	0.449	40.61	-44.09
5 MHz	QPSK	826.5	-28.40	1 / 0	25.30	-5.25	0.299	38.45	-43.70	-3.10	0.490	40.61	-43.71
		836.5	-28.40	1 / 24	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
		846.5	-28.40	1 / 0	25.38	-5.17	0.304	38.45	-43.62	-3.02	0.499	40.61	-43.63
	16-QAM	846.5	-28.40	1 / 0	24.87	-5.68	0.270	38.45	-44.13	-3.53	0.444	40.61	-44.14
10 MHz	QPSK	829.0	-28.40	1 / 12	25.47	-5.08	0.310	38.45	-43.53	-2.93	0.509	40.61	-43.54
		836.5	-28.40	1 / 12	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
		844.0	-28.40	1 / 0	25.49	-5.06	0.312	38.45	-43.51	-2.91	0.512	40.61	-43.52
	16-QAM	844.0	-28.40	1 / 0	25.13	-5.42	0.287	38.45	-43.87	-3.27	0.471	40.61	-43.88

Table 7-2. Antenna BCM ERP/EIRP Data (LTE Band 26)

LTE Band 5

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	ERP [dBm]	ERP [mW]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
1.4 MHz	QPSK	829.0	-28.40	1 / 0	25.33	-5.22	0.301	38.45	-43.67	-3.07	0.493	40.61	-43.68
		836.5	-28.40	1 / 5	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
		844.0	-28.40	1 / 5	25.24	-5.31	0.294	38.45	-43.76	-3.16	0.483	40.61	-43.77
	16-QAM	836.5	-28.40	1 / 5	24.93	-5.62	0.274	38.45	-44.07	-3.47	0.450	40.61	-44.08
3 MHz	QPSK	829.0	-28.40	1 / 14	25.46	-5.09	0.310	38.45	-43.54	-2.94	0.508	40.61	-43.55
		836.5	-28.40	1 / 14	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
		844.0	-28.40	1 / 14	25.48	-5.07	0.311	38.45	-43.52	-2.92	0.511	40.61	-43.53
	16-QAM	836.5	-28.40	1 / 14	24.83	-5.72	0.268	38.45	-44.17	-3.57	0.440	40.61	-44.18
5 MHz	QPSK	829.0	-28.40	1 / 0	25.31	-5.24	0.299	38.45	-43.69	-3.09	0.491	40.61	-43.70
		836.5	-28.40	1 / 24	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
		844.0	-28.40	1 / 24	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
	16-QAM	836.5	-28.40	1 / 24	24.91	-5.64	0.273	38.45	-44.09	-3.49	0.448	40.61	-44.10
10 MHz	QPSK	829.0	-28.40	1 / 25	25.46	-5.09	0.310	38.45	-43.54	-2.94	0.508	40.61	-43.55
		836.5	-28.40	1 / 49	25.42	-5.13	0.307	38.45	-43.58	-2.98	0.504	40.61	-43.59
		844.0	-28.40	1 / 0	25.50	-5.05	0.313	38.45	-43.50	-2.90	0.513	40.61	-43.51
	16-QAM	829.0	-28.40	1 / 25	25.09	-5.46	0.284	38.45	-43.91	-3.31	0.467	40.61	-43.92

Table 7-3. Antenna BCM ERP/EIRP Data (LTE Band 5)

Frequency [MHz]	Mode	Conducted Power [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [mW]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
826.40	WCDMA850	24.96	-28.40	-5.59	0.276	38.45	-44.04	-3.44	0.453	40.61	-44.05
836.60	WCDMA850	25.00	-28.40	-5.55	0.279	38.45	-44.00	-3.40	0.457	40.61	-44.01
846.60	WCDMA850	24.83	-28.40	-5.72	0.268	38.45	-44.17	-3.57	0.440	40.61	-44.18

Table 7-4. Antenna BCM ERP/EIRP Data (WCDMA Cell)

FCC ID: BCG-A2478	MEASUREMENT REPORT (CERTIFICATION)						Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021						EUT Type: Watch

7.6 Radiated Spurious Emissions

§2.1053, 22.917(a)

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

Test Settings

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

FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 44 of 54

Test Setup

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

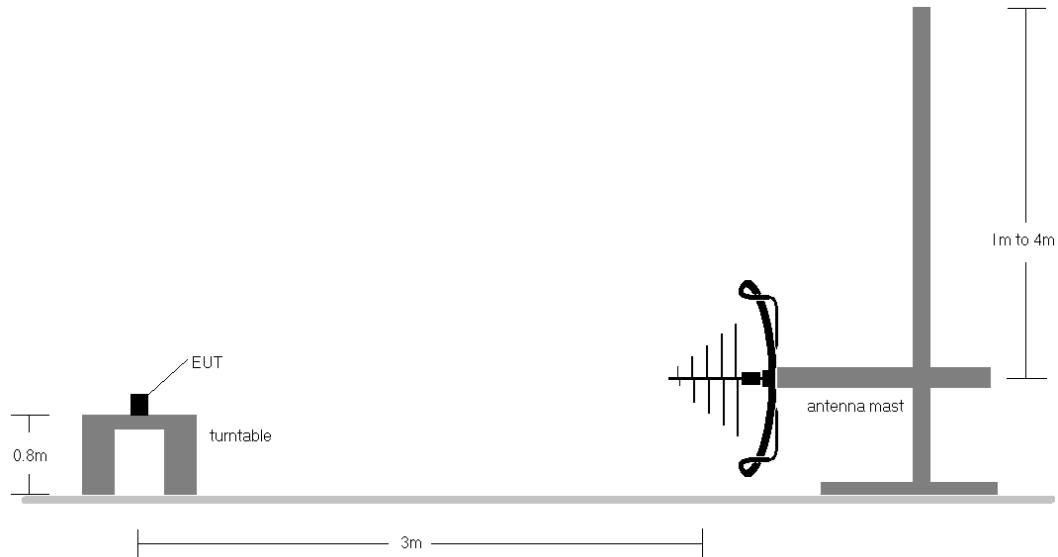


Figure 7-5. Test Instrument & Measurement Setup < 1GHz

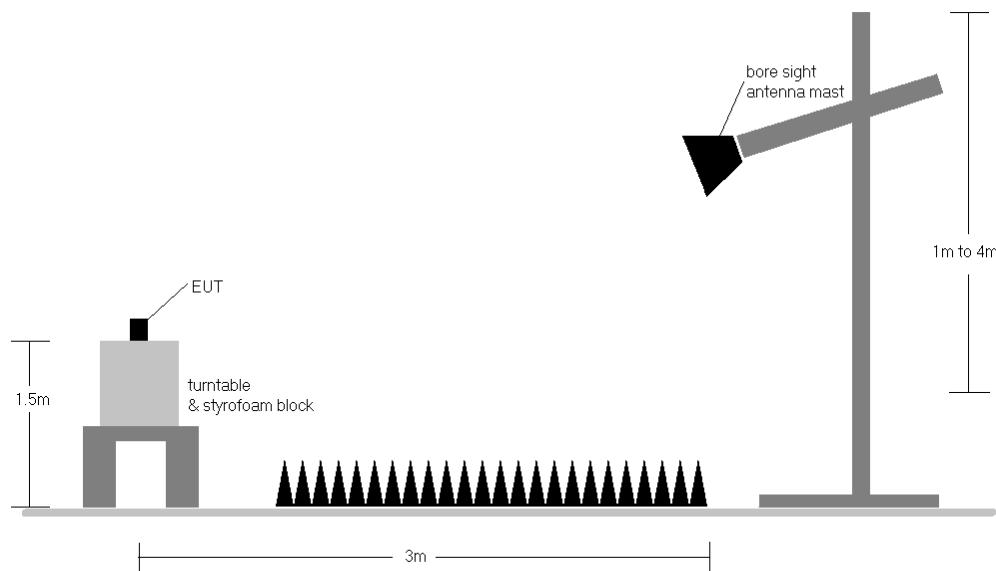


Figure 7-6. Test Instrument & Measurement Setup >1 GHz

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 45 of 54

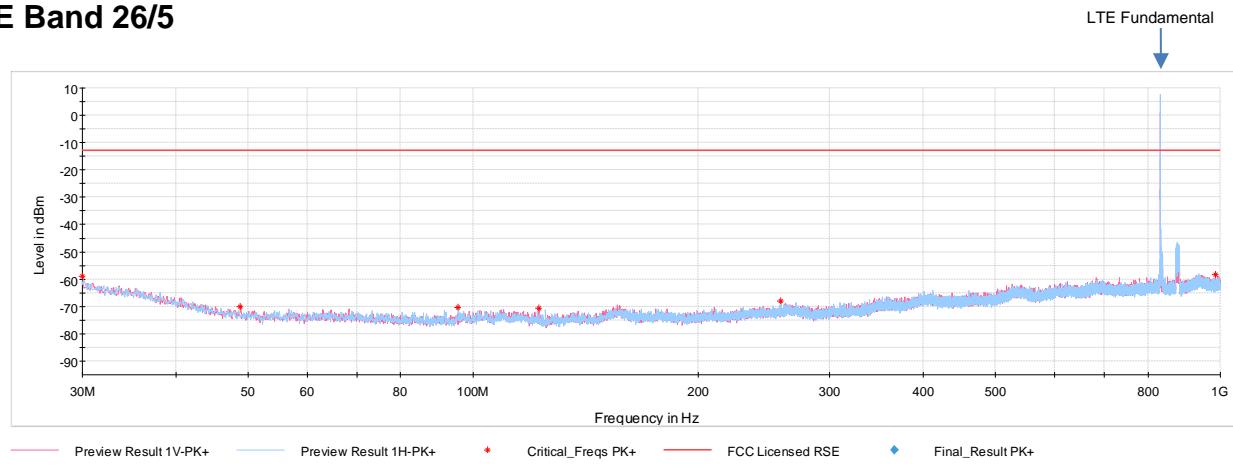
Test Notes

1. Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - a. $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - b. $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$; where D is the measurement distance in meters.
2. This device employs UMTS technology with WCDMA (AMR/RMC) and HSDPA capabilities. The EUT was tested under all configurations and the highest power is reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to "1".
3. 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.
4. This unit was tested with its standard battery.
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. The " - " shown in the following RSE tables are used to denote a noise floor measurement.

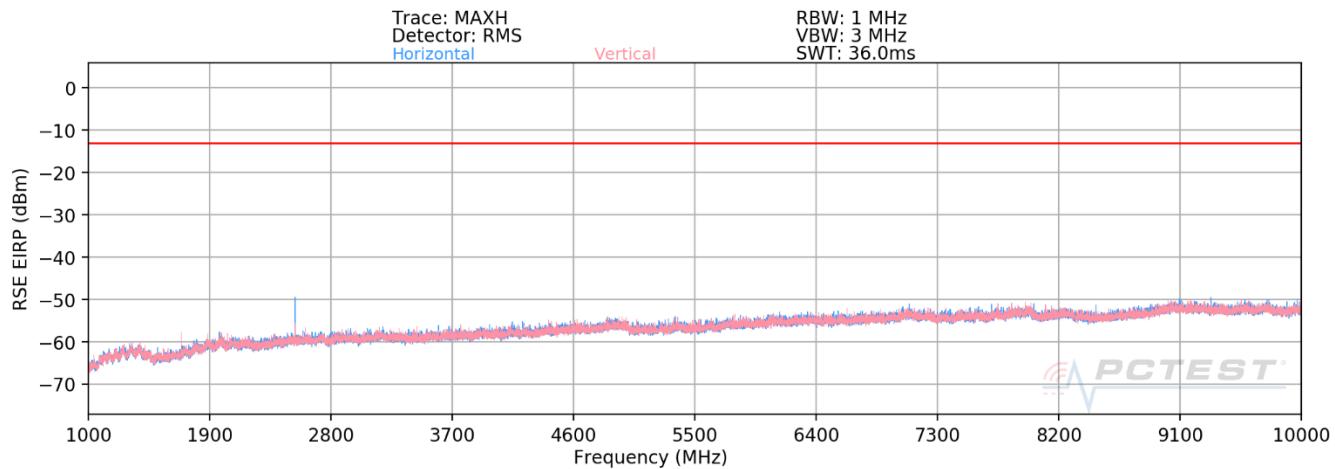
FCC ID: BCG-A2478		 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch			Page 46 of 54

7.6.1 Radiated Spurious Emission Measurements

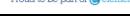
LTE Band 26/5



Plot 7-46. Antenna BCM Radiated Spurious Emission Below 1GHz (LTE Band 26/5)



Plot 7-47. Antenna BCM Radiated Spurious Emission Above 1GHz (LTE Band 26/5)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch	Page 47 of 54	

Bandwidth (MHz):	10								
Frequency (MHz):	829.0								
RB / Offset:	1 / 25								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1658.0	V	158	172	-75.13	-2.84	29.03	-66.22	-13.00	-53.22
2487.0	V	138	172	-68.99	1.69	39.70	-55.56	-13.00	-42.56
3316.0	V	-	-	-79.71	3.35	30.64	-64.62	-13.00	-51.62
4145.0	V	-	-	-80.34	4.83	31.49	-63.76	-13.00	-50.76
4974.0	V	-	-	-80.93	6.35	32.42	-62.84	-13.00	-49.84

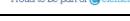
Table 7-5. Antenna BCM Radiated Spurious Data (LTE Band 26/5 – Low Channel)

Bandwidth (MHz):	10								
Frequency (MHz):	836.5								
RB / Offset:	1 / 25								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.0	V	130	130	-76.47	-2.62	27.91	-67.35	-13.00	-54.35
2509.5	V	106	172	-69.93	1.96	39.03	-56.23	-13.00	-43.23
3346.0	V	-	-	-79.53	3.35	30.82	-64.44	-13.00	-51.44
4182.5	V	-	-	-80.47	5.02	31.55	-63.71	-13.00	-50.71
5019.0	V	-	-	-81.08	6.55	32.47	-62.79	-13.00	-49.79

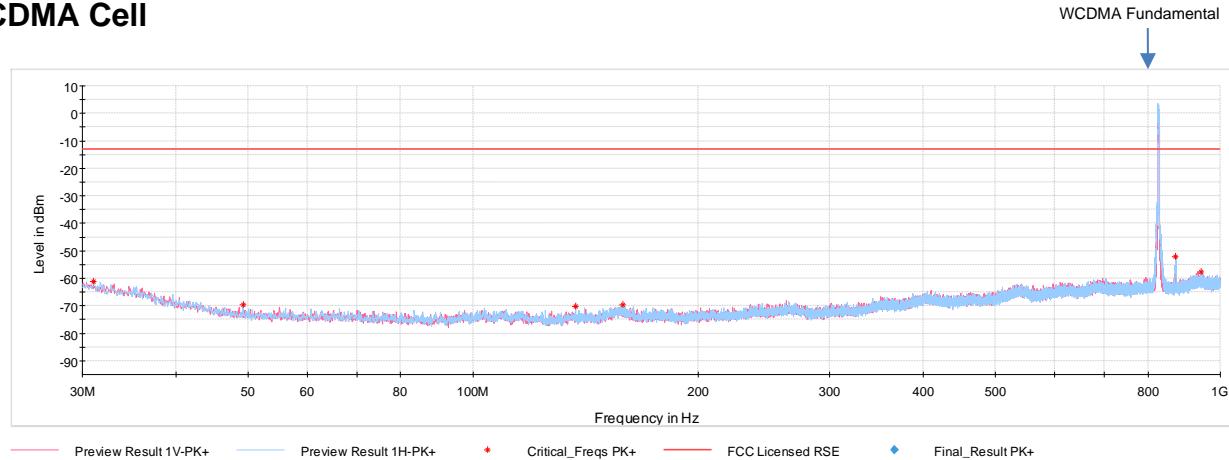
Table 7-6. Antenna BCM Radiated Spurious Data (LTE Band 26/5 – Mid Channel)

Bandwidth (MHz):	10								
Frequency (MHz):	844.0								
RB / Offset:	1 / 25								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1688.0	V	163	123	-73.60	-2.34	31.06	-64.19	-13.00	-51.19
2532.0	H	399	259	-65.45	1.22	42.77	-52.49	-13.00	-39.49
3376.0	V	-	-	-76.82	2.13	32.31	-62.95	-13.00	-49.95
4220.0	V	-	-	-77.72	4.03	33.31	-61.95	-13.00	-48.95
5064.0	V	-	-	-77.90	4.79	33.89	-61.37	-13.00	-48.37

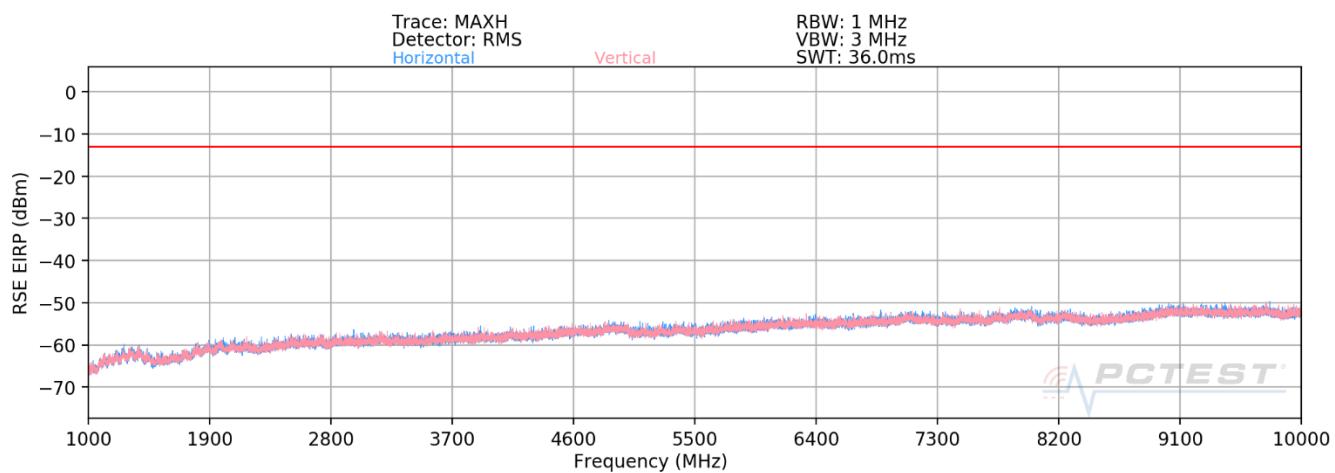
Table 7-7. Antenna BCM Radiated Spurious Data (LTE Band 26/5 – High Channel)

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)						Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch						

WCDMA Cell



Plot 7-48. Antenna BCM Radiated Spurious Plot below 1GHz (WCDMA Cell)



Plot 7-49. Antenna BCM Radiated Spurious Plot above 1GHz (WCDMA Cell)

FCC ID: BCG-A2478	PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 49 of 54

Mode:	WCDMA RMC								
Channel:	4132								
Frequency (MHz):	826.4								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1652.8	V	-	-	-79.47	-0.85	26.68	-68.57	-13.00	-55.57
2479.2	V	-	-	-80.64	3.39	29.75	-65.50	-13.00	-52.50
3305.6	V	-	-	-81.55	5.01	30.46	-64.80	-13.00	-51.80

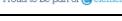
Table 7-8. Antenna BCM Radiated Spurious Data (WCDMA Cell – Low Channel)

Mode:	WCDMA RMC								
Channel:	4183								
Frequency (MHz):	836.6								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.2	V	-	-	-79.93	-0.64	26.43	-68.83	-13.00	-55.83
2509.8	V	-	-	-80.30	3.29	29.99	-65.27	-13.00	-52.27
3346.4	V	-	-	-81.69	4.91	30.22	-65.04	-13.00	-52.04

Table 7-9. Antenna BCM Radiated Spurious Data (WCDMA Cell – Mid Channel)

Mode:	WCDMA RMC								
Channel:	4233								
Frequency (MHz):	846.6								
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1693.2	V	-	-	-79.54	-0.41	27.05	-68.21	-13.00	-55.21
2539.8	V	-	-	-80.63	3.48	29.85	-65.41	-13.00	-52.41
3386.4	V	-	-	-81.50	4.94	30.44	-64.81	-13.00	-51.81

Table 7-10. Antenna BCM Radiated Spurious Data (WCDMA Cell – High Channel)

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)						Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch						

7.7 Frequency Stability / Temperature Variation

§2.1055, 22.355

Test Overview and Limit

Frequency Tolerance testing is performed in accordance with the guidelines of ANSI C63.26-2015 and TIA-603-E-2016. The Frequency Tolerance of the transmitter is measured by:

- Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- 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 22, the Frequency Tolerance of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5 \text{ ppm}$) of the center frequency.

Test Procedure Used

ANSI C63.26-2015

TIA-603-E-2016

Test Settings

- The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
- 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.
- 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

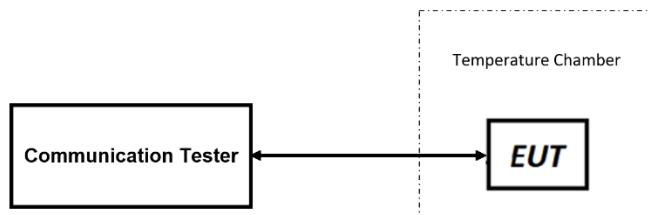


Figure 7-7. Test Instrument & Measurement Setup

Test Notes

None

FCC ID: BCG-A2478	PCTEST <small>Proud to be part of element</small>		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 51 of 54

Frequency Tolerance / Temperature Variation

LTE Band 26/5					
		Operating Frequency (Hz):	836,500,000		
		Ref. Voltage (VDC):	3.80		
		Deviation Limit:	$\pm 0.00025\%$ or 2.5 ppm		
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	836,500,001	0.70	0.0000001
		- 20	836,500,002	0.92	0.0000001
		- 10	836,500,001	0.66	0.0000001
		0	836,500,001	0.49	0.0000001
		+ 10	836,500,001	0.49	0.0000001
		+ 20 (Ref)	836,500,001	0.00	0.0000000
		+ 30	836,500,002	0.90	0.0000001
		+ 40	836,500,002	0.76	0.0000001
		+ 50	836,500,002	1.02	0.0000001
Battery Endpoint	3.40	+ 20	836,500,002	0.83	0.0000001

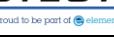
Table 7-11. LTE Band 26/5 Frequency Tolerance Data

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 52 of 54

Frequency Tolerance / Temperature Variation

WCDMA Cellular					
		Operating Frequency (Hz):		836,600,000	
		Ref. Voltage (VDC):		3.80	
		Deviation Limit:		$\pm 0.00025\%$ or 2.5 ppm	
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	836,600,001	1.22	0.0000001
		- 20	836,599,997	-1.99	-0.0000002
		- 10	836,600,001	1.68	0.0000002
		0	836,599,998	-1.20	-0.0000001
		+ 10	836,599,998	-1.92	-0.0000002
		+ 20 (Ref)	836,599,999	0.00	0.0000000
		+ 30	836,599,997	-2.00	-0.0000002
		+ 40	836,599,999	-0.05	0.0000000
		+ 50	836,599,998	-1.67	-0.0000002
		Battery Endpoint	836,599,998	-1.56	-0.0000002

Table 7-12. WCDMA Cell Frequency Tolerance Data

FCC ID: BCG-A2478	PCTEST Proud to be part of 			MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch			

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Apple Watch FCC ID: BCG-A2478** complies with all the requirements of Part 22 of the FCC rules.

FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-01.BCG	Test Dates: 06-08-2021 - 08-16-2021	EUT Type: Watch		Page 54 of 54