



PART 27 MEASUREMENT REPORT

Applicant Name:

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

Date of Testing:

06/08/2021 – 08/13/2021

Test Site/Location:

PCTEST Morgan Hill, CA, USA

Test Report Serial No.:

1C2106070046-04.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:

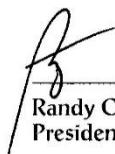
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Test Procedure(s):

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

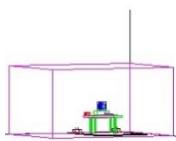


FCC ID: BCG-A2478	PCTEST <small>Proud to be part of element</small>		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 1 of 62

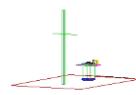
T A B L E O F C O N T E N T S

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.....	6
2.5	Test Configuration	6
2.6	Software and Firmware	7
2.7	EMI Suppression Device(s)/Modifications	7
3.0	DESCRIPTION OF TESTS	8
3.1	Evaluation Procedure	8
3.2	Radiated Spurious Emissions	8
4.0	MEASUREMENT UNCERTAINTY	9
5.0	TEST EQUIPMENT CALIBRATION DATA	10
6.0	SAMPLE CALCULATIONS	11
7.0	TEST RESULTS.....	12
7.1	Summary.....	12
7.2	Occupied Bandwidth	13
7.3	Spurious and Harmonic Emissions at Antenna Terminal	22
7.4	Band Edge Emissions at Antenna Terminal	34
7.5	Radiated Power (EIRP)	44
7.6	Radiated Spurious Emissions	47
7.7	Frequency Stability / Temperature Variation	59
8.0	CONCLUSION.....	62

FCC ID: BCG-A2478	 Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 2 of 62



PART 27 MEASUREMENT REPORT



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	EIRP		Emission Designator
					Max. Power [mW]	Max. Power [dBm]	
LTE Band 7	5 MHz	QPSK	2502.5 - 2567.5	4.5872	42.658	16.30	4M59G7W
		16QAM	2502.5 - 2567.5	4.5673	37.844	15.78	4M57D7W
	10 MHz	QPSK	2505.0 - 2565.0	9.1275	42.658	16.30	9M13G7W
		16QAM	2505.0 - 2565.0	5.4202	36.898	15.67	5M42D7W
	15 MHz	QPSK	2507.5 - 2562.5	13.6821	42.658	16.30	13M7G7W
		16QAM	2507.5 - 2562.5	6.1675	36.898	15.67	6M17D7W
	20 MHz	QPSK	2510.0 - 2560.0	18.3182	42.658	16.30	18M3G7W
		16QAM	2510.0 - 2560.0	7.4093	38.548	15.86	7M41D7W
LTE Band 41	5 MHz	QPSK	2498.5 - 2687.5	4.5671	53.703	17.30	4M57G7W
		16QAM	2498.5 - 2687.5	4.5705	41.687	16.20	4M57D7W
	10 MHz	QPSK	2501.0 - 2685.0	9.1342	53.703	17.30	9M13G7W
		16QAM	2501.0 - 2685.0	5.5283	42.364	16.27	5M53D7W
	15 MHz	QPSK	2503.5 - 2682.5	13.7075	53.703	17.30	13M7G7W
		16QAM	2503.5 - 2682.5	6.6340	43.551	16.39	6M63D7W
	20 MHz	QPSK	2506.0 - 2680.0	18.2206	53.703	17.30	18M2G7W
		16QAM	2506.0 - 2680.0	8.2798	43.652	16.40	8M28D7W

EUT Overview

FCC ID: BCG-A2478	 PCTEST® Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 3 of 62

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.

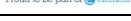
1.2 PCTEST Test Location

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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 4 of 62	

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 27.

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

2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Frequency [MHz]	Antenna Gain (dBi)
LTE Band 7	-7.2
LTE Band 41	-6.2

Table 2-2. Highest Antenna Gain

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 5 of 62

2.4 Test Support Equipment

1	Apple Macbook w/AC/DC Adapter	Model: A1398 Model: A1435	S/N: C2QKP008F6F3 S/N: N/A
2	Apple USB-C cable w/ Charging Dock w/Dock	Model: N/A Model: A2687 Model: X241	S/N: N/A S/N: FV411420544MW6M4H S/N: N/A
3	Apple Magnetic Charger Apple Magnetic Charger	Model: A2515 Model: A2515	S/N: DLC035200UJMFR0AJ S/N: DLC035202KRMFR0A2
4	Pathfinder Falcon SiP Socket	Model: 920-098626-01 Model: P2 X2011B PF 150	S/N: DLC034200APQ6PM1E S/N: 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 and above 18GHz were tested with the highest transmitting power and the worst case channel.

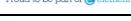
The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

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

All possible simultaneous transmission configurations have been investigated and the worst case config has been reported.

Description	Bluetooth	UNII	LTE (Band 41)
Antenna	Antenna FCM	Antenna FCM	Antenna FCM
Channel	78	36	40620
Operating Frequency (MHz)	2480	5180	2593
Mode/Modulation	GFSK ePA	802.11n	QPSK/1RB/20MHz

Table 2-4. Worst Case Simultaneous Transmission Configuration

FCC ID: BCG-A2478	 PCTEST Proud to be part of  MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 6 of 62

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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 7 of 62

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI C63.26 2015, TIA-603-E-2016) and “Measurement Guidance for Certification of Licensed Digital Transmitters” (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:

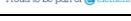
$$E_{[\text{dB}\mu\text{V}/\text{m}]} = \text{Measured amplitude level}_{[\text{dBm}]} + 107 + \text{Cable Loss}_{[\text{dB}]} + \text{Antenna Factor}_{[\text{dB}/\text{m}]} \\ \text{And}$$

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

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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 8 of 62

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 element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 9 of 62

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
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
Keysight Technology	N9040B	UXA Signal Analyzer	12/19/2020	Annual	12/19/2021	MY57212015
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	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	12/3/2020	Annual	12/3/2021	102327
Rohde & Schwarz	ESW44	EMI Test Receiver	8/6/2020	Annual	8/6/2021	101668
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:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 10 of 62	

6.0 SAMPLE CALCULATIONS

Emission Designator

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

W = 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 element		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 11 of 62

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): 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 (LTE Band 7)	2.1051, 27.53(m)	Undesirable emissions must meet the limits detailed in 27.53(m)	PASS	Sections 7.3, 7.4
	Conducted Band Edge / Spurious Emissions (LTE Band 41)			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 (LTE Band 7)	27.50(h)(2)	< 2 Watts max. EIRP	PASS	Section 7.6
	Effective Radiated Power / Equivalent Isotropic Radiated Power (LTE Band 41)			PASS	Section 7.6
	Frequency Stability	2.1055, 27.54	Fundamental emissions stay within authorized frequency block over the temperature and voltage range as tested	PASS	Section 7.8
RADIATED	Radiated Spurious Emissions (LTE Band 7)	2.1053, 27.53(m)	Undesirable emissions must meet the limits detailed in 27.53(m)	PASS	Section 7.7
	Radiated Spurious Emissions (LTE Band 41)			PASS	Section 7.7

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 was 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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 12 of 62

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.

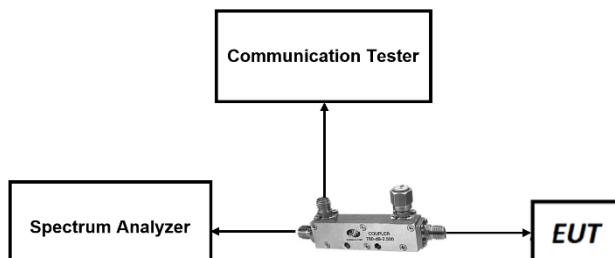


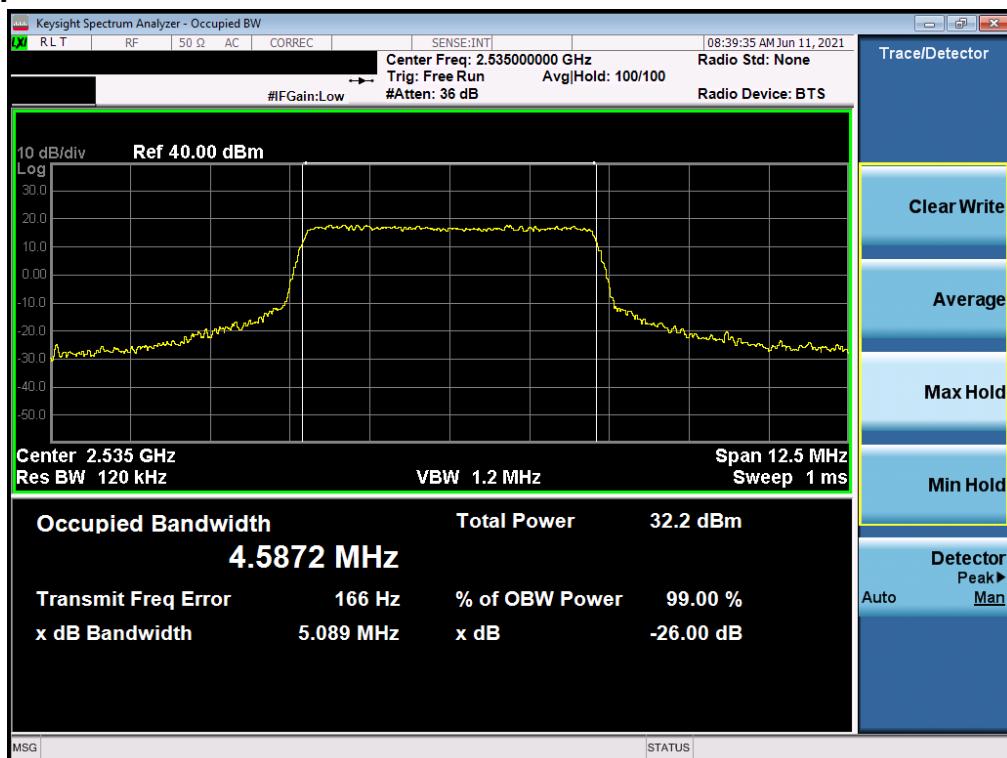
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

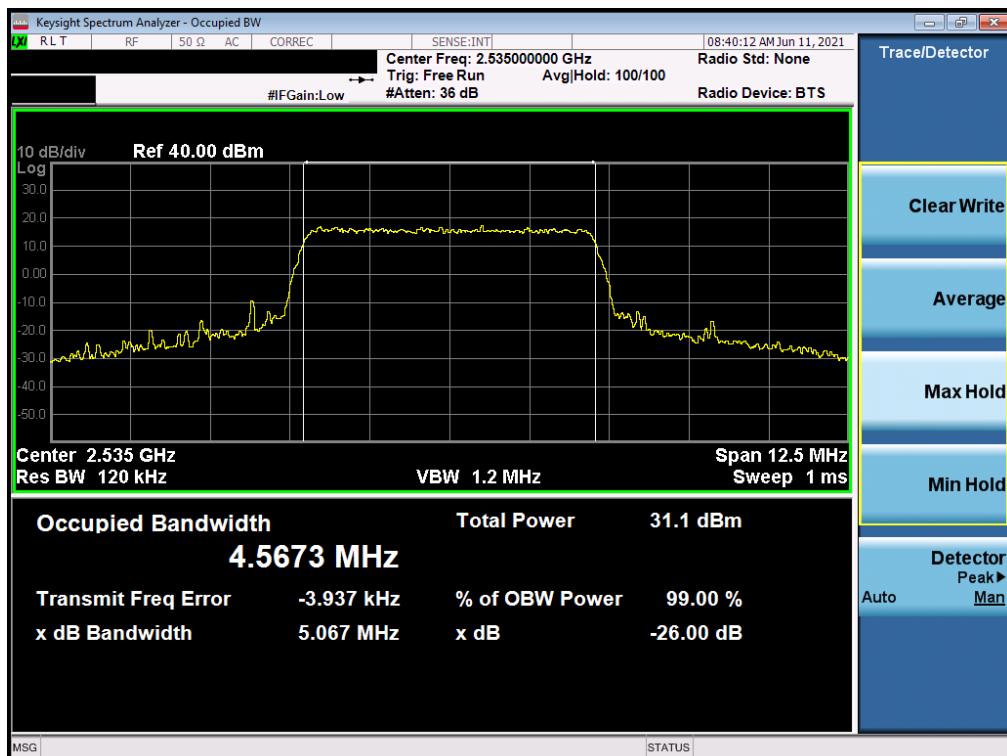
None.

FCC ID: BCG-A2478	 PCTEST Proud to be part of element		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 13 of 62

LTE Band 7

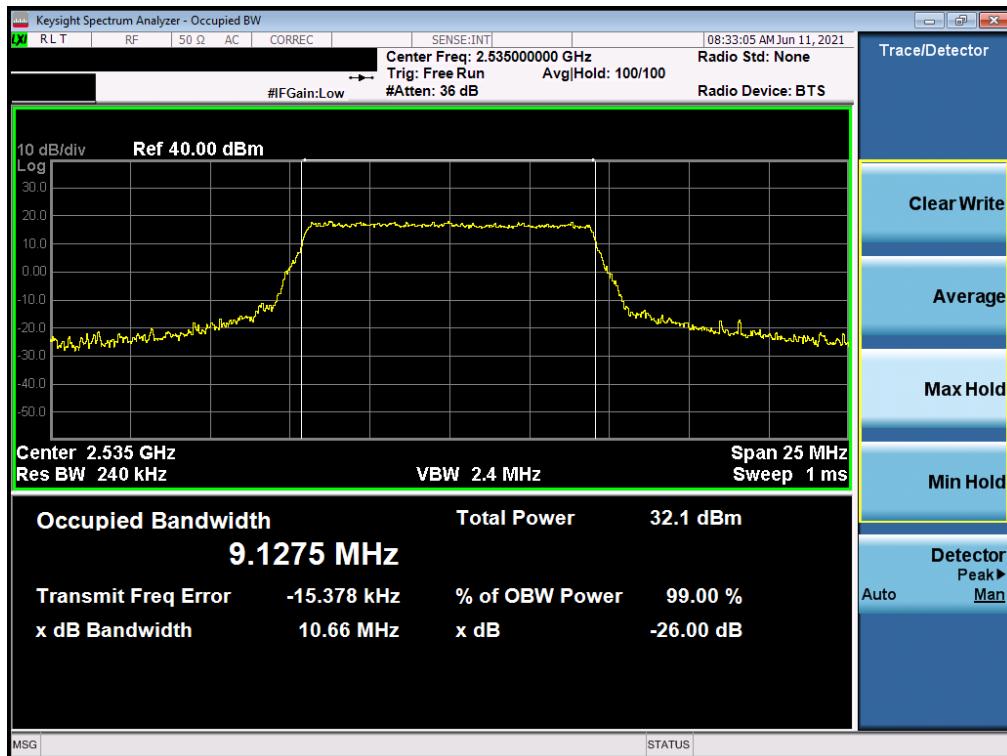


Plot 7-1. Occupied Bandwidth Plot (LTE Band 7 - 5MHz QPSK - Full RB)

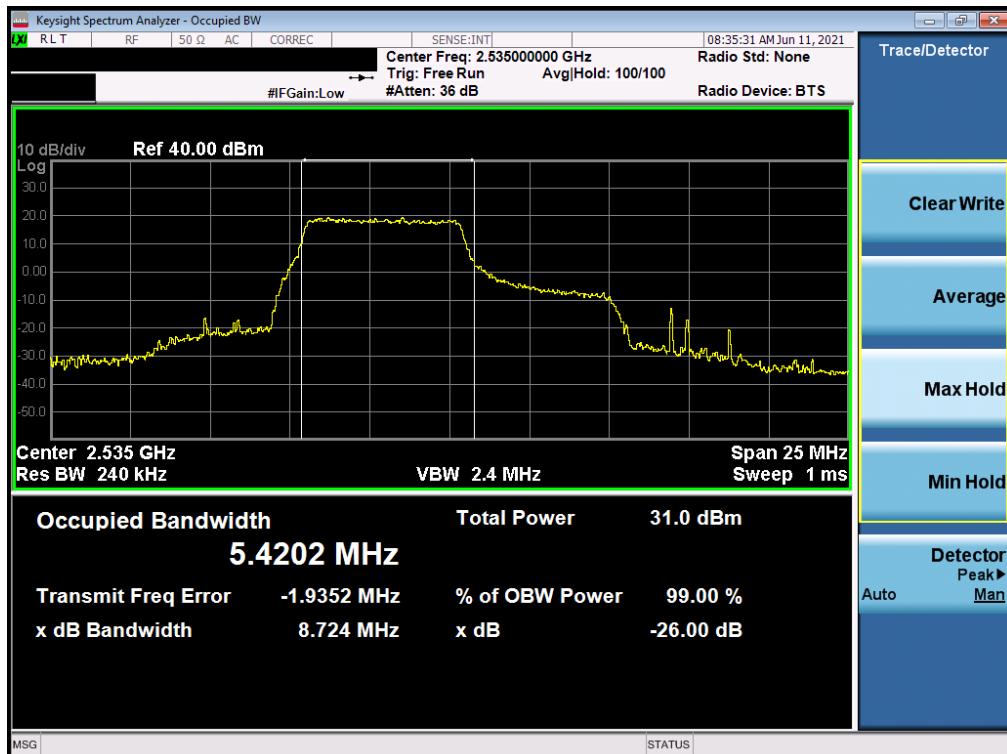


Plot 7-2. Occupied Bandwidth Plot (LTE Band 7 - 5MHz 16-QAM - Full RB)

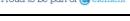
FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 14 of 62



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



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

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 15 of 62



Plot 7-5. Occupied Bandwidth Plot (LTE Band 7 - 15MHz QPSK - Full RB)

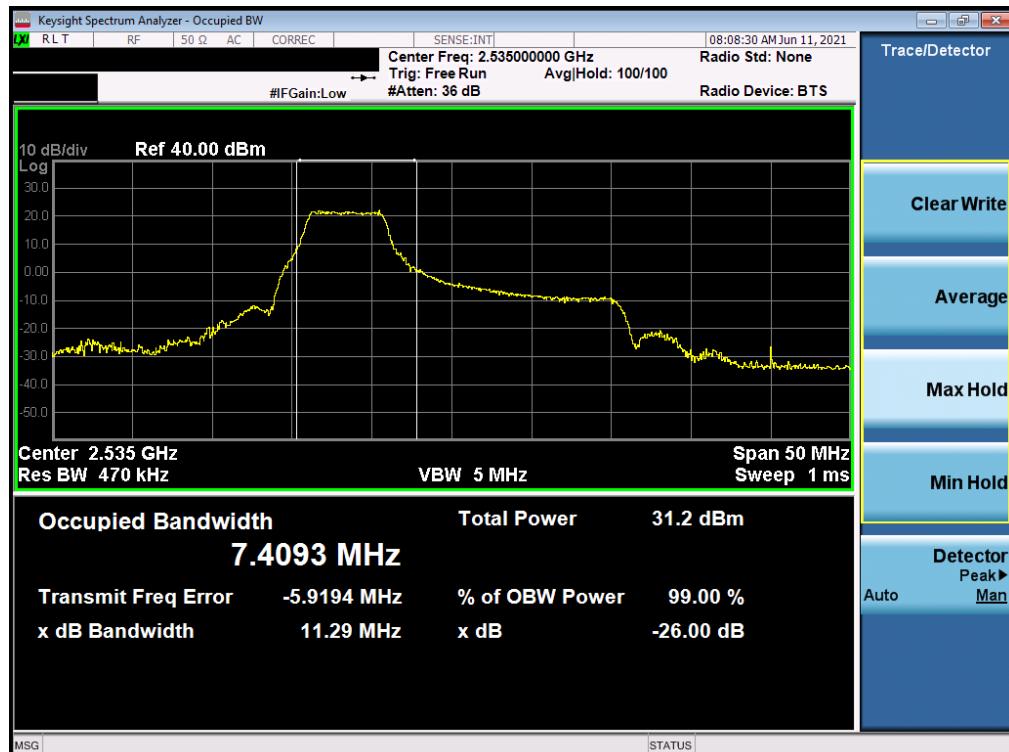


Plot 7-6. Occupied Bandwidth Plot (LTE Band 7 - 15MHz 16-QAM - Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 16 of 62



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



Plot 7-8. Occupied Bandwidth Plot (LTE Band 7 - 20MHz 16-QAM - Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 17 of 62

LTE Band 41

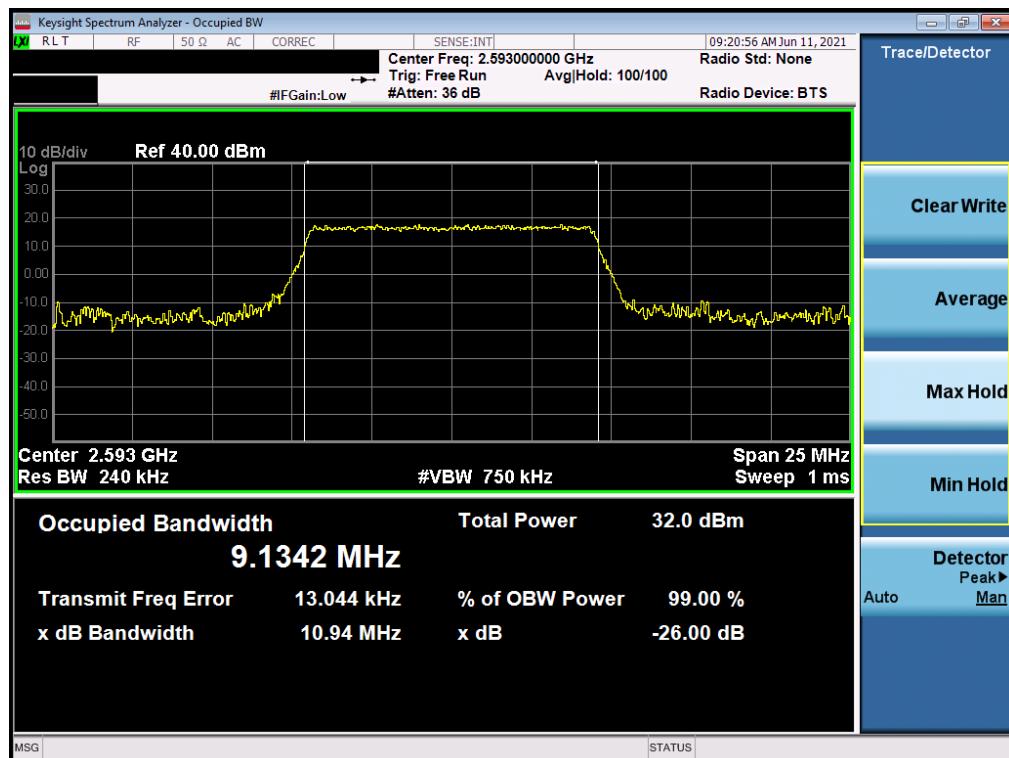


Plot 7-9. Occupied Bandwidth Plot (LTE Band 41 - 5MHz QPSK - Full RB)



Plot 7-10. Occupied Bandwidth Plot (LTE Band 41 - 5MHz 16-QAM - Full RB)

FCC ID: BCG-A2478	 PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 - 08-13-2021	EUT Type: Watch	Page 18 of 62



Plot 7-11. Occupied Bandwidth Plot (LTE Band 41 - 10MHz QPSK - Full RB)



Plot 7-12. Occupied Bandwidth Plot (LTE Band 41 - 10MHz 16-QAM - Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 19 of 62

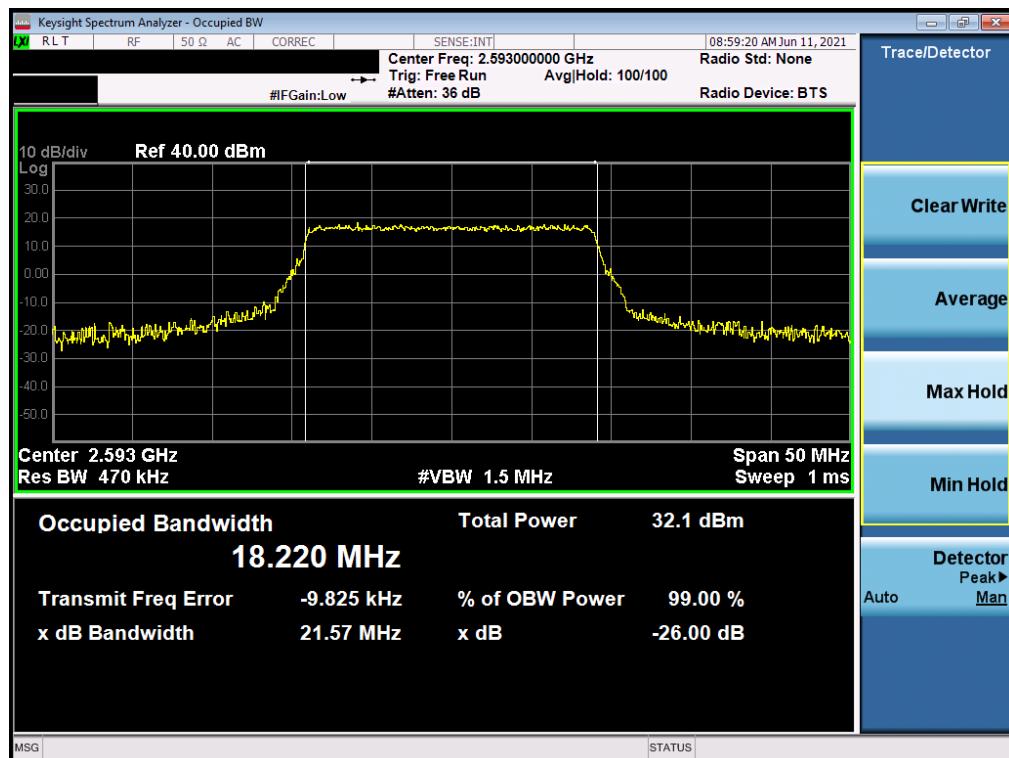


Plot 7-13. Occupied Bandwidth Plot (LTE Band 41 - 15MHz QPSK - Full RB)

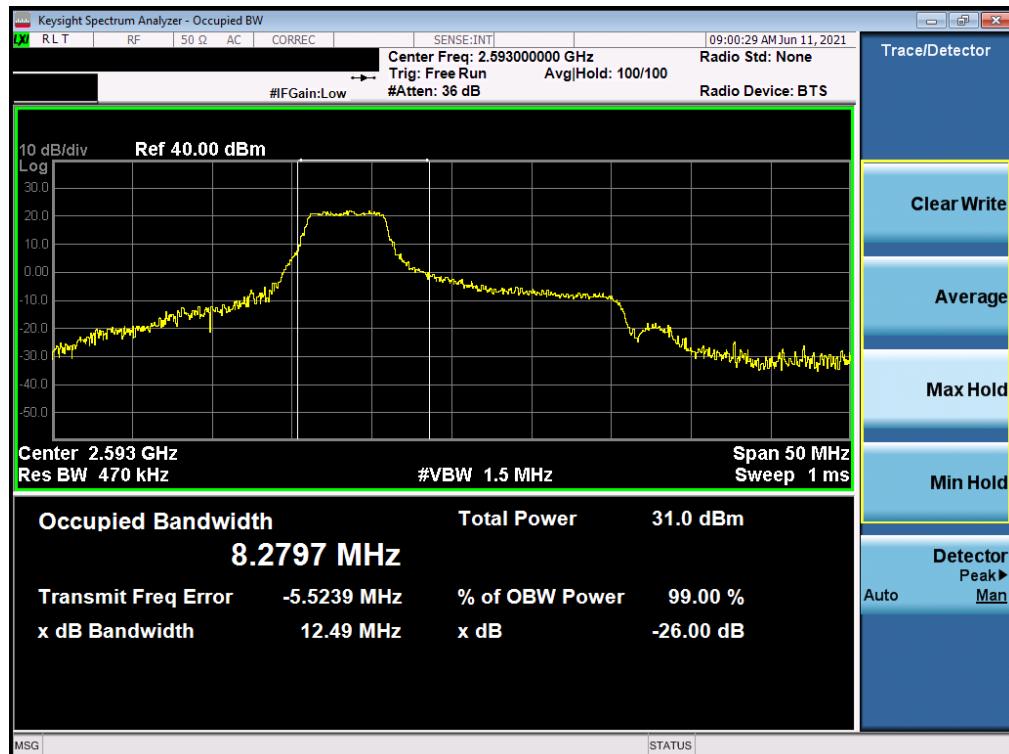


Plot 7-14. Occupied Bandwidth Plot (LTE Band 41 - 15MHz 16-QAM - Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 20 of 62



Plot 7-15. Occupied Bandwidth Plot (LTE Band 41 - 20MHz QPSK - Full RB)



Plot 7-16. Occupied Bandwidth Plot (LTE Band 41 - 20MHz 16-QAM - Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 21 of 62

7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051, §27.53(a), §27.53(m)

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.

For Band 30, the minimum permissible attenuation level of any spurious emission <2288MHz and >2365MHz is $70 + 10 \log_{10}(P_{[Watts]})$.

For LTE Bands 7, and 41, the minimum permissible attenuation level of any spurious emission is $55 + 10\log_{10}(P_{[Watts]})$.

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.

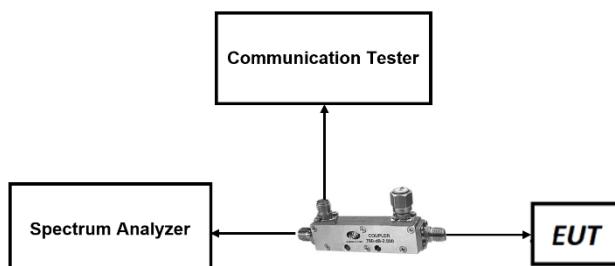


Figure 7-2. Test Instrument & Measurement Setup

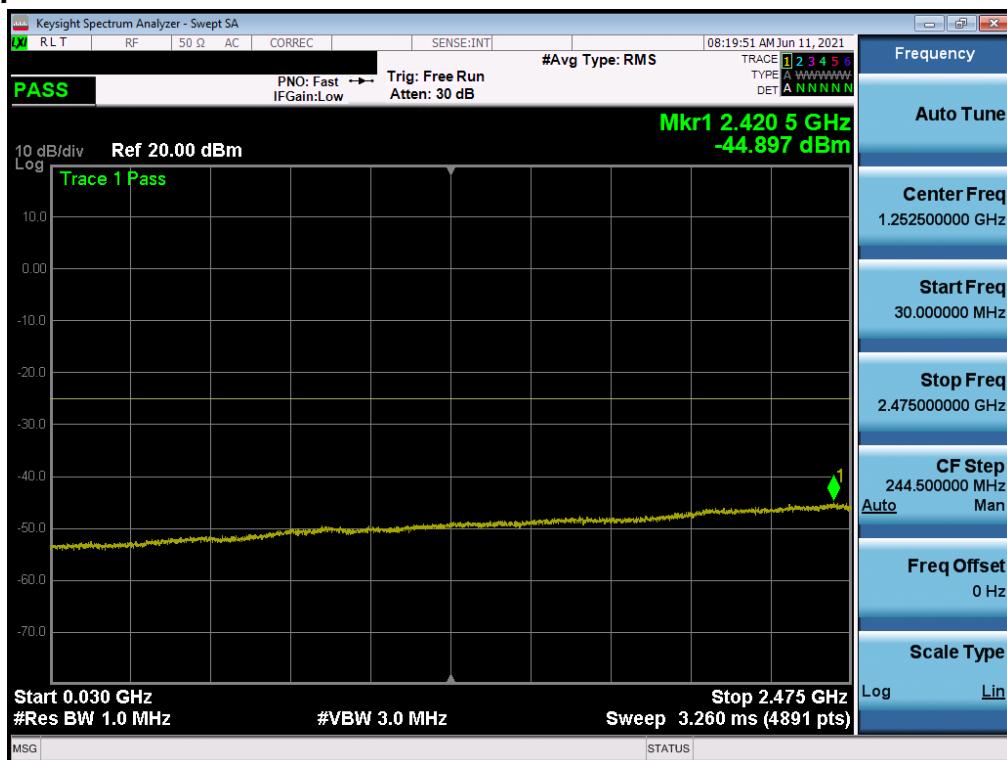
FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 22 of 62

Test Notes

1. 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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 23 of 62

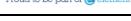
LTE Band 7



Plot 7-17. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



Plot 7-18. Conducted Spurious Plot (LTE Band 7 - 20MHz 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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 - 08-13-2021	EUT Type: Watch	Page 24 of 62



Plot 7-19. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



Plot 7-20. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 25 of 62



Plot 7-21. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



Plot 7-22. Conducted Spurious Plot (LTE Band 7 - 20MHz 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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 26 of 62



Plot 7-23. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-24. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

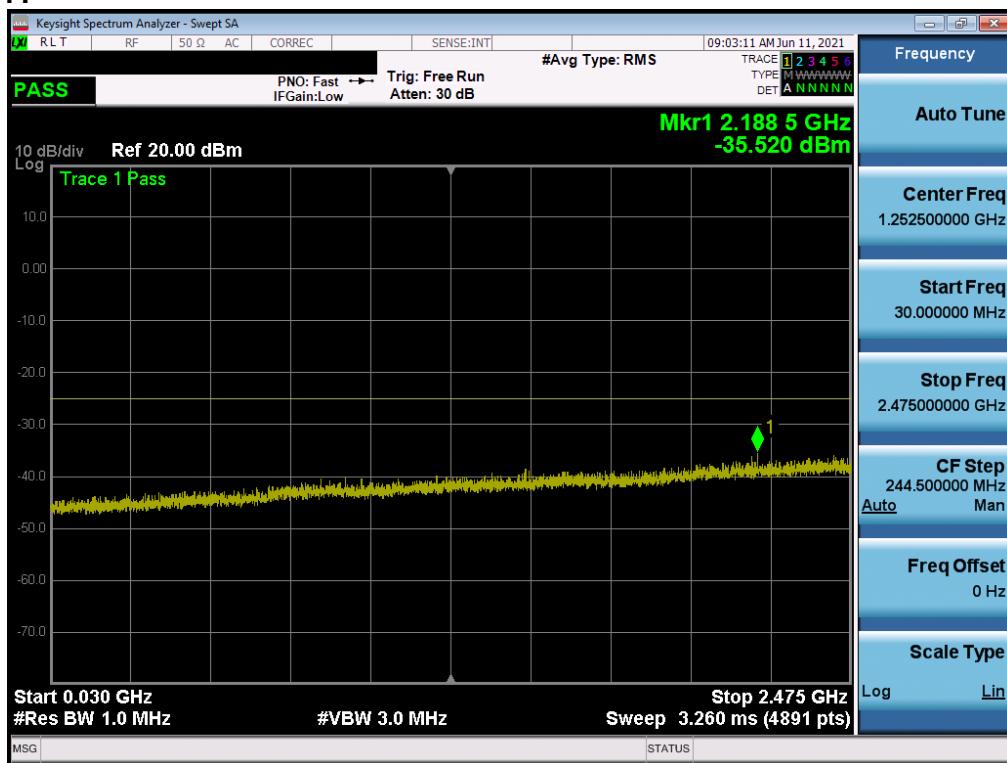
FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 27 of 62



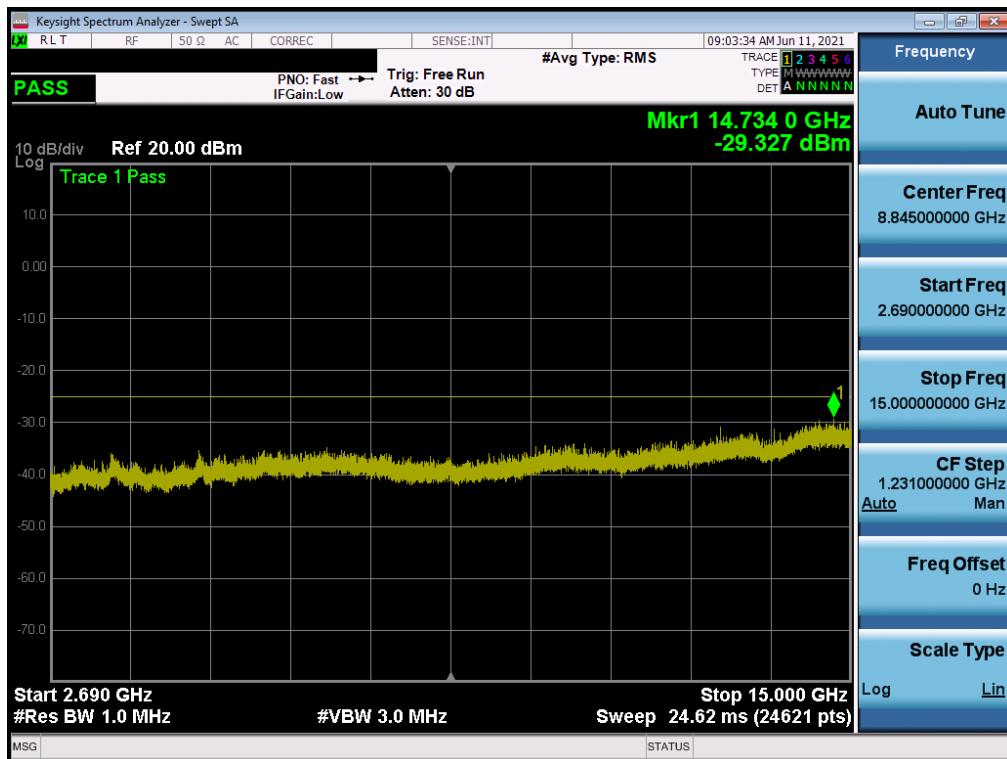
Plot 7-25. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCG-A2478	PCTEST Proud to be part of element		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 28 of 62	

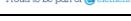
LTE Band 41

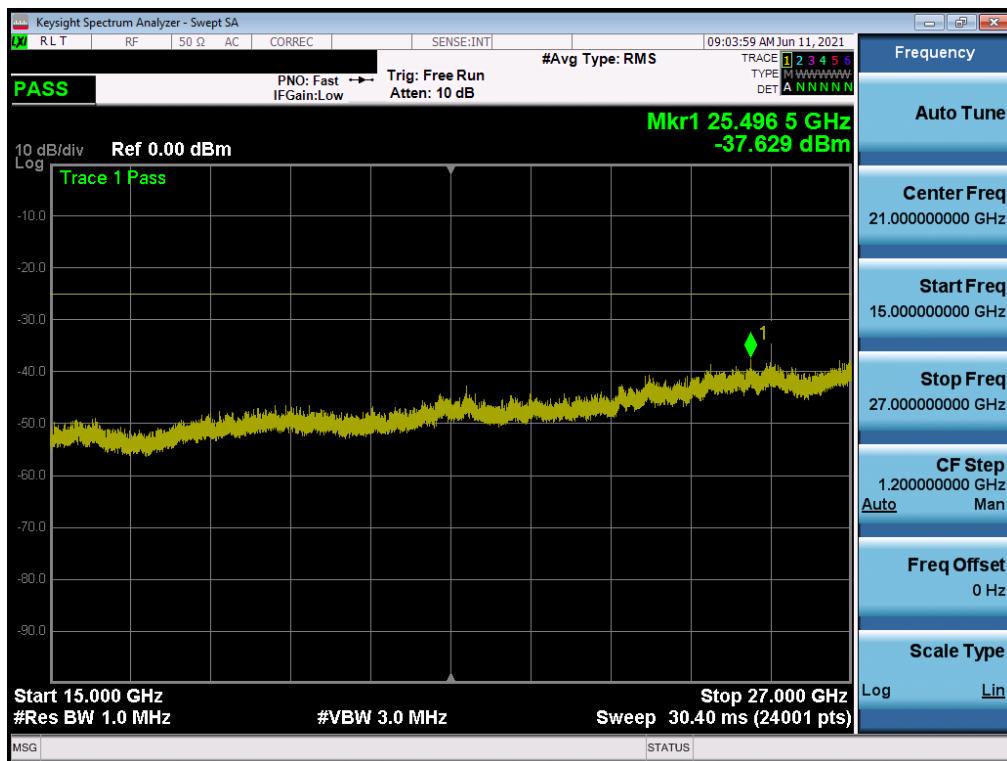


Plot 7-26. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

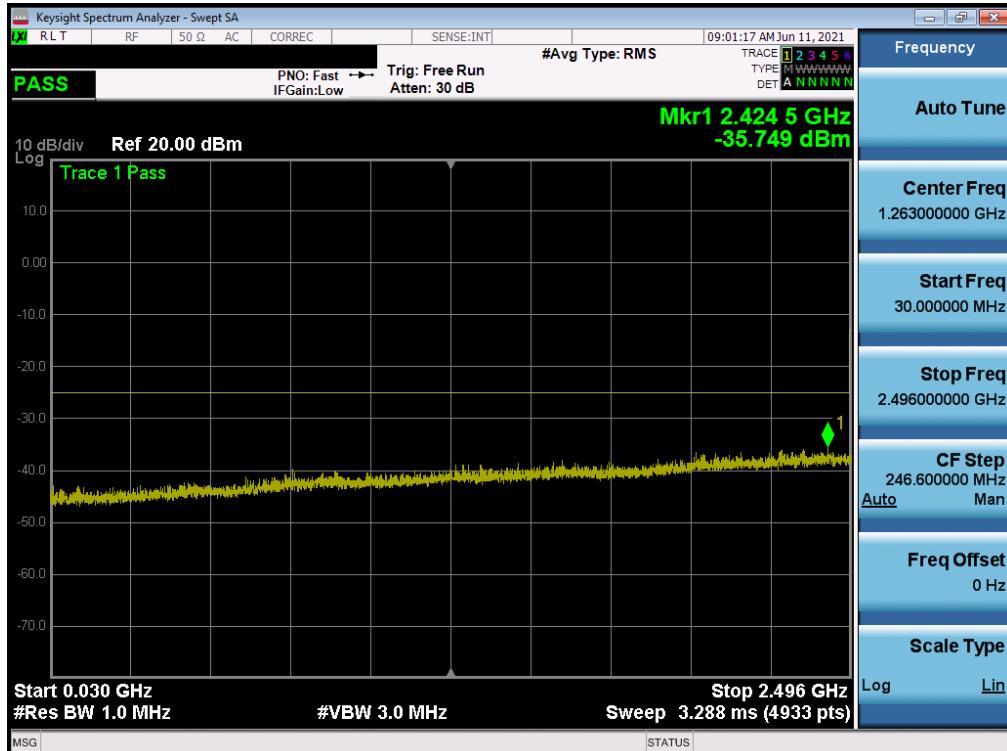


Plot 7-27. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 29 of 62

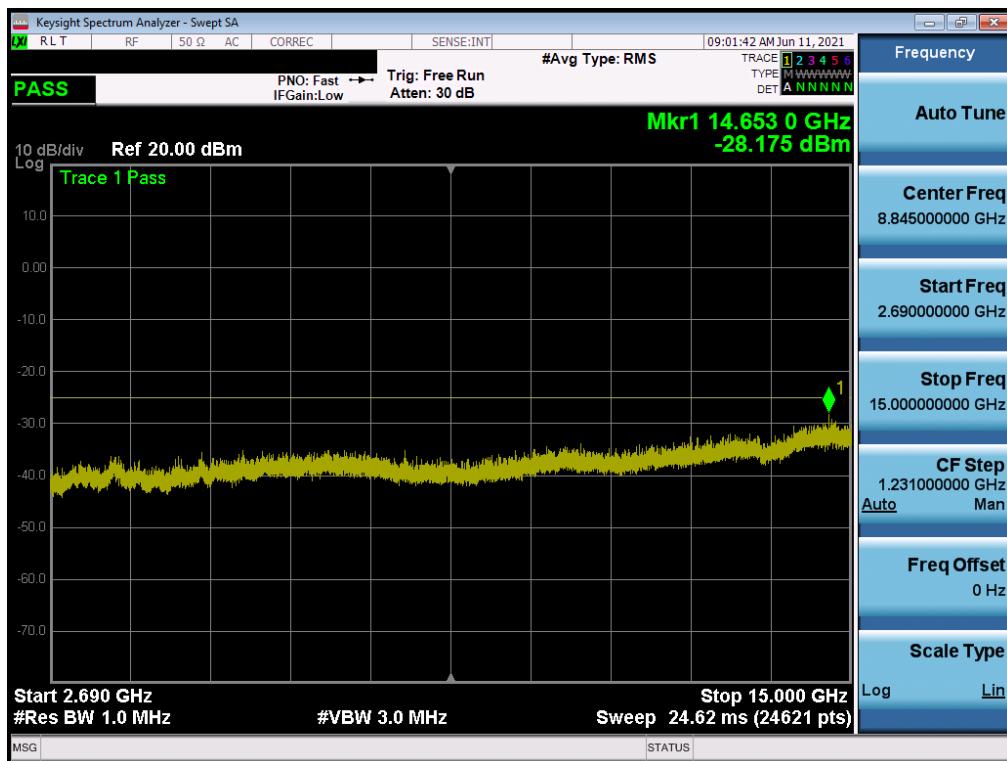


Plot 7-28. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

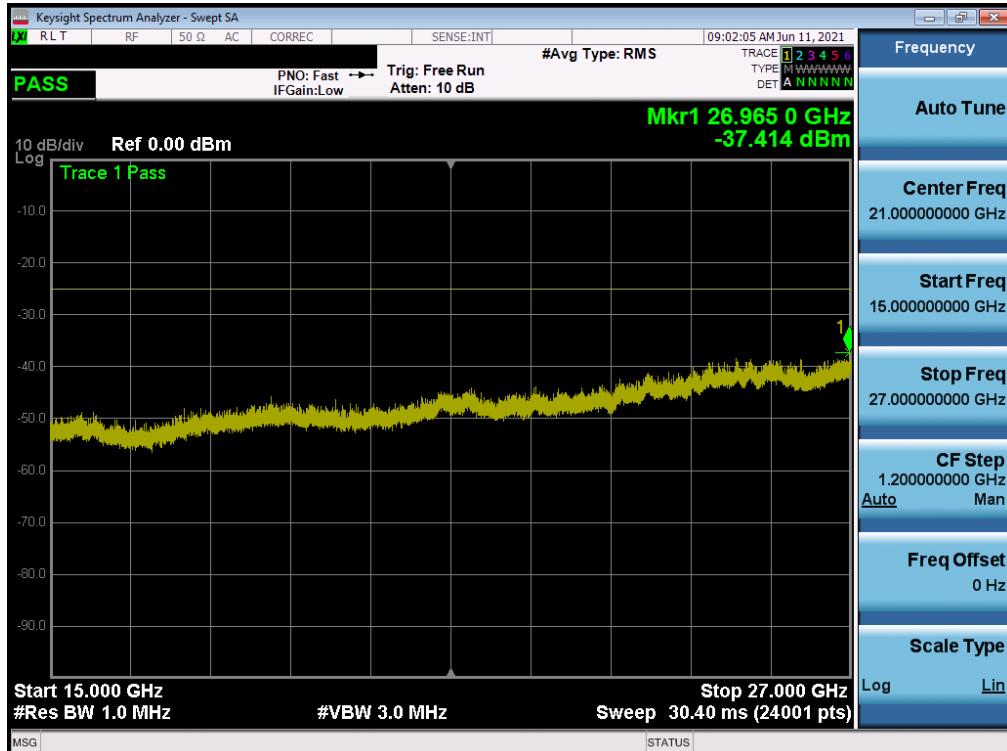


Plot 7-29. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 30 of 62

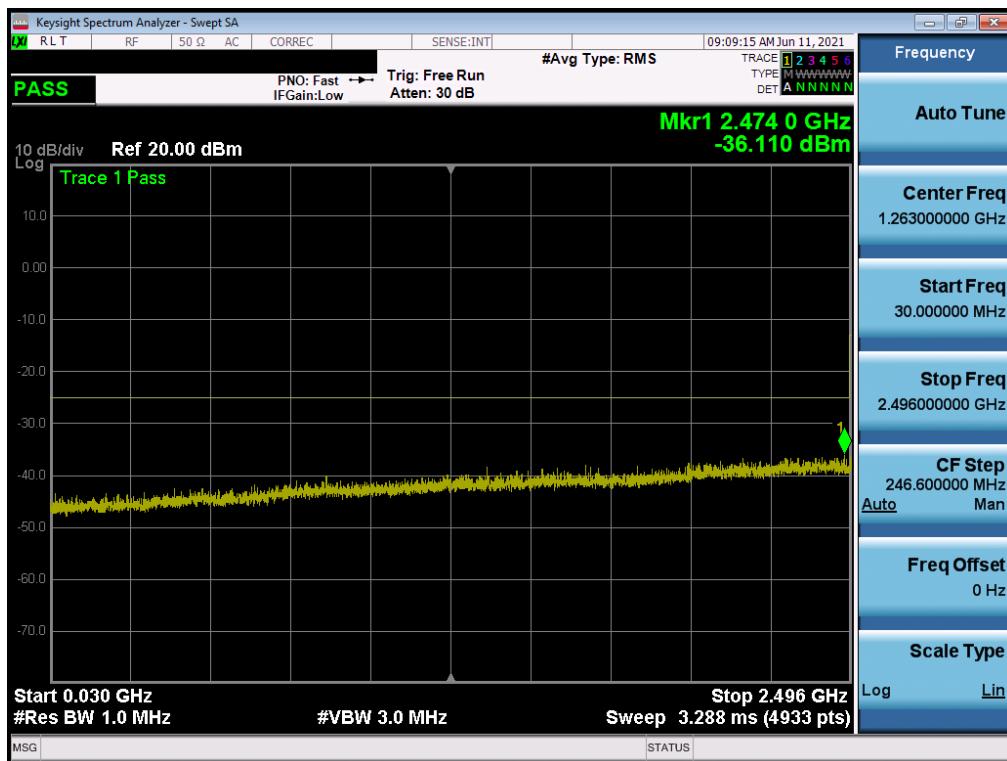


Plot 7-30. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

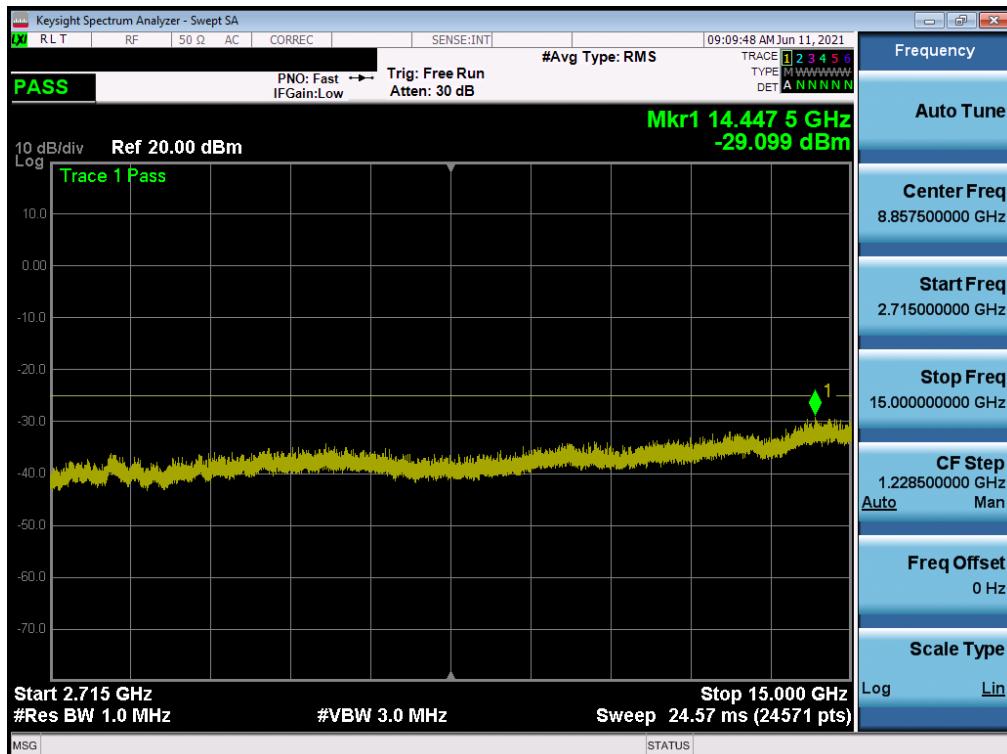


Plot 7-31. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

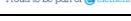
FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 31 of 62

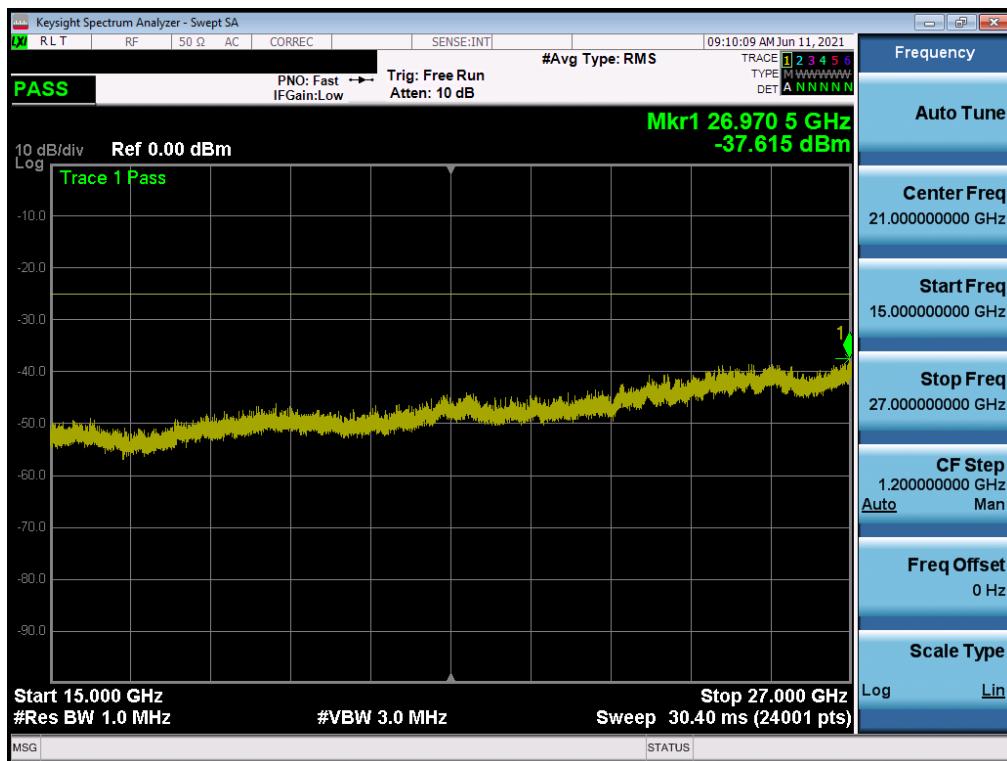


Plot 7-32. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-33. Conducted Spurious Plot (LTE Band 41 - 20MHz 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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 32 of 62



Plot 7-34. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 33 of 62

7.4 Band Edge Emissions at Antenna Terminal

§2.1051, §27.53(a), §27.53(m)

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 for Band 30 is $> 43 + 10 \log_{10} (P[\text{Watts}])$ at 2300-2305MHz & 2345-2360MHz, $> 55 + 10 \log_{10} (P[\text{Watts}])$ at 2320-2324MHz & 2341-2345MHz, $> 61 + 10 \log_{10} (P[\text{Watts}])$ at 2324-2328MHz & 2337-2341MHz, $> 67 + 10 \log_{10} (P[\text{Watts}])$ at 2288-2292MHz & 2328-2337MHz, and $> 70 + 10 \log_{10} (P[\text{Watts}])$ at frequencies $< 2288\text{MHz}$ & $> 2365\text{MHz}$.

For LTE Bands 7 and 41, the minimum permissible attenuation level is noted in the Test Notes on the following page.

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 $\geq 3 \times \text{RBW}$
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.

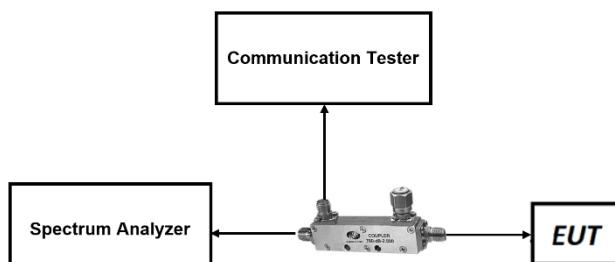
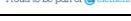


Figure 7-3. Test Instrument & Measurement Setup

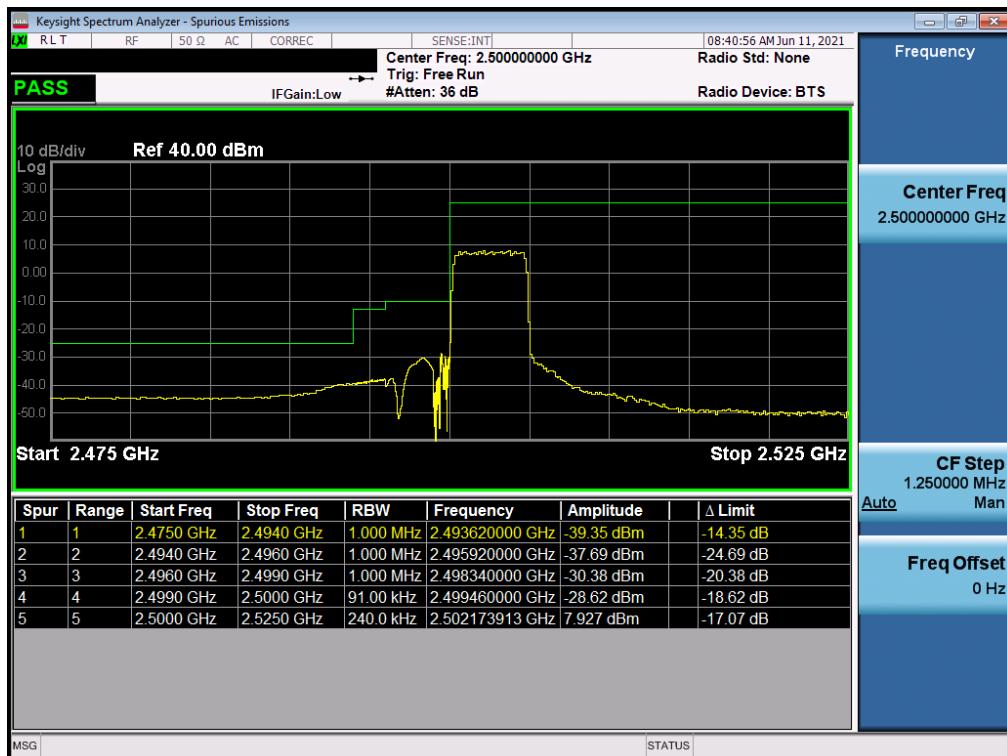
FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 34 of 62

Test Notes

1. 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.
2. Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz.

FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 35 of 62

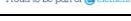
LTE Band 7



Plot 7-35. Lower ACP Plot (LTE Band 7 - 5MHz QPSK – Full RB)

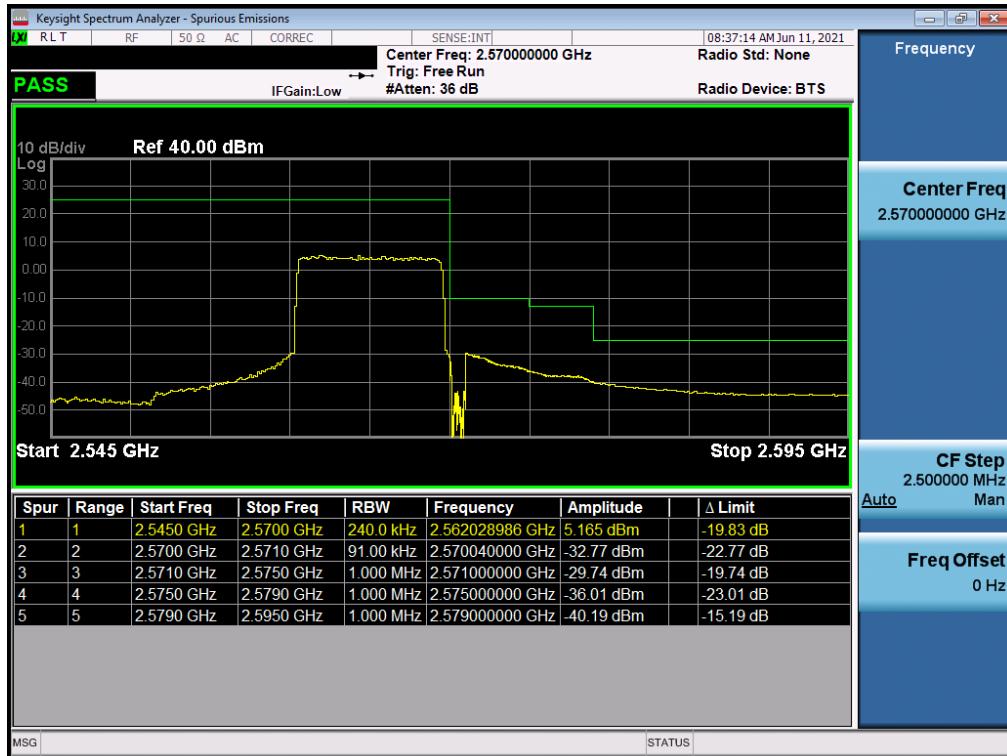


Plot 7-36. Upper ACP Plot (LTE Band 7 - 5MHz QPSK – Full RB)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 - 08-13-2021	EUT Type: Watch		Page 36 of 62

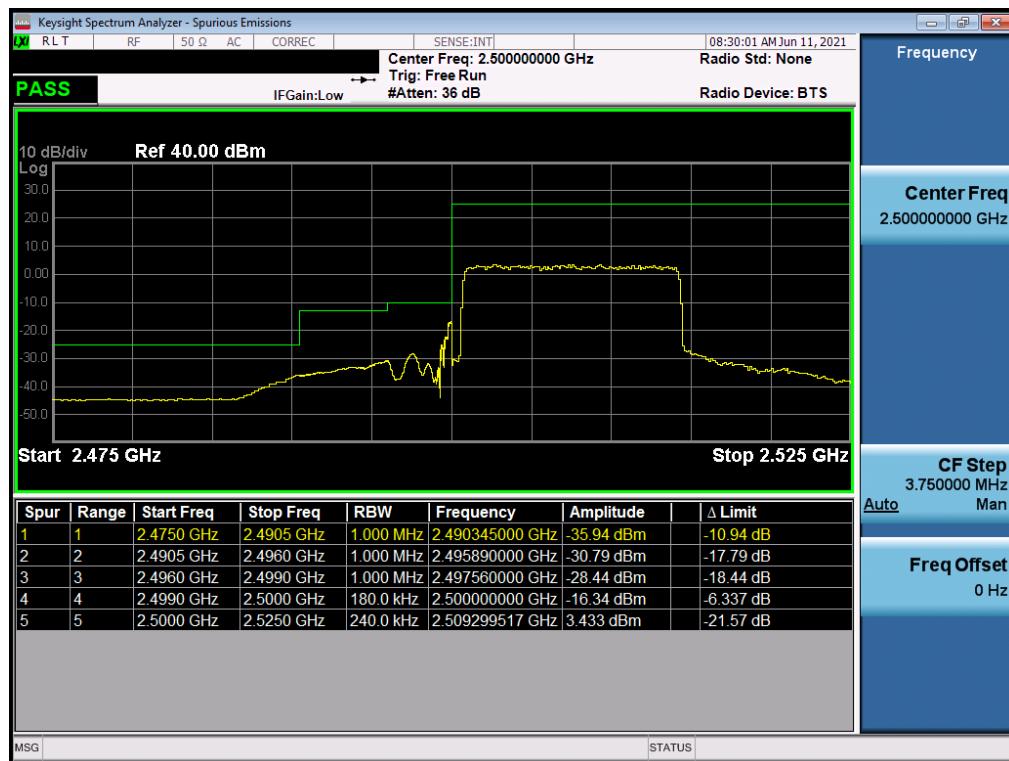


Plot 7-37. Lower ACP Plot (LTE Band 7 - 10MHz QPSK – Full RB)

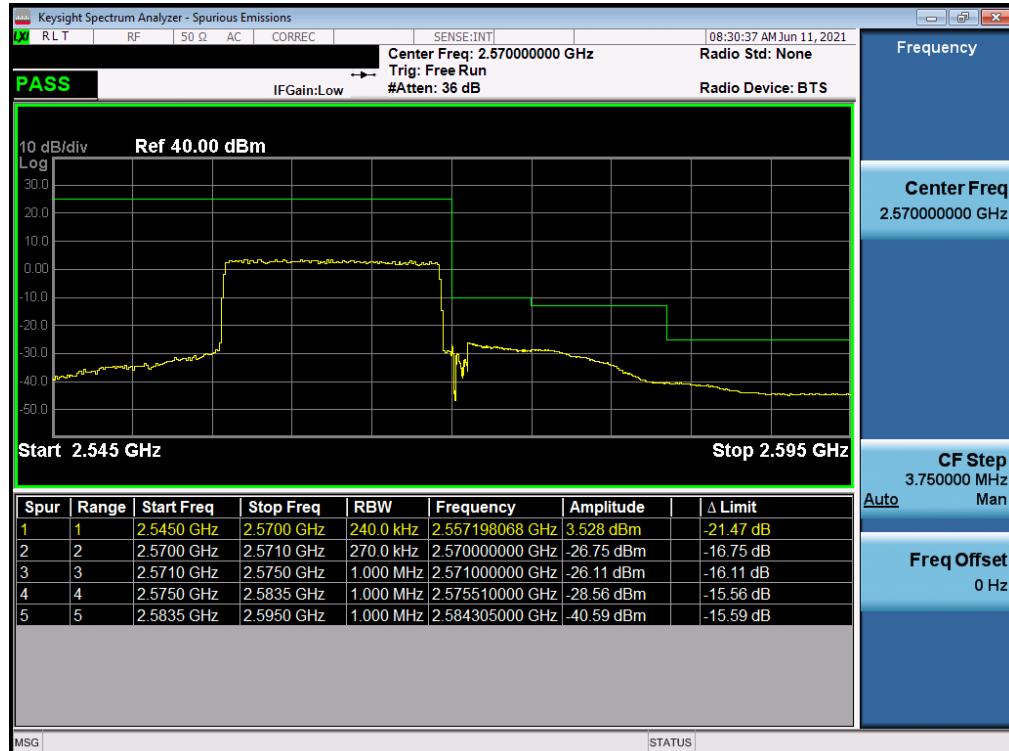


Plot 7-38. Upper ACP Plot (LTE Band 7 - 10MHz QPSK – Full RB)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 37 of 62



Plot 7-39. Lower ACP Plot (LTE Band 7 - 15MHz QPSK – Full RB)



Plot 7-40. Upper ACP Plot (LTE Band 7 - 15MHz QPSK – Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 38 of 62



Plot 7-41. Lower ACP Plot (LTE Band 7 - 20MHz QPSK – Full RB)



Plot 7-42. Upper ACP Plot (LTE Band 7 - 20MHz QPSK – Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 39 of 62

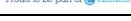
LTE Band 41

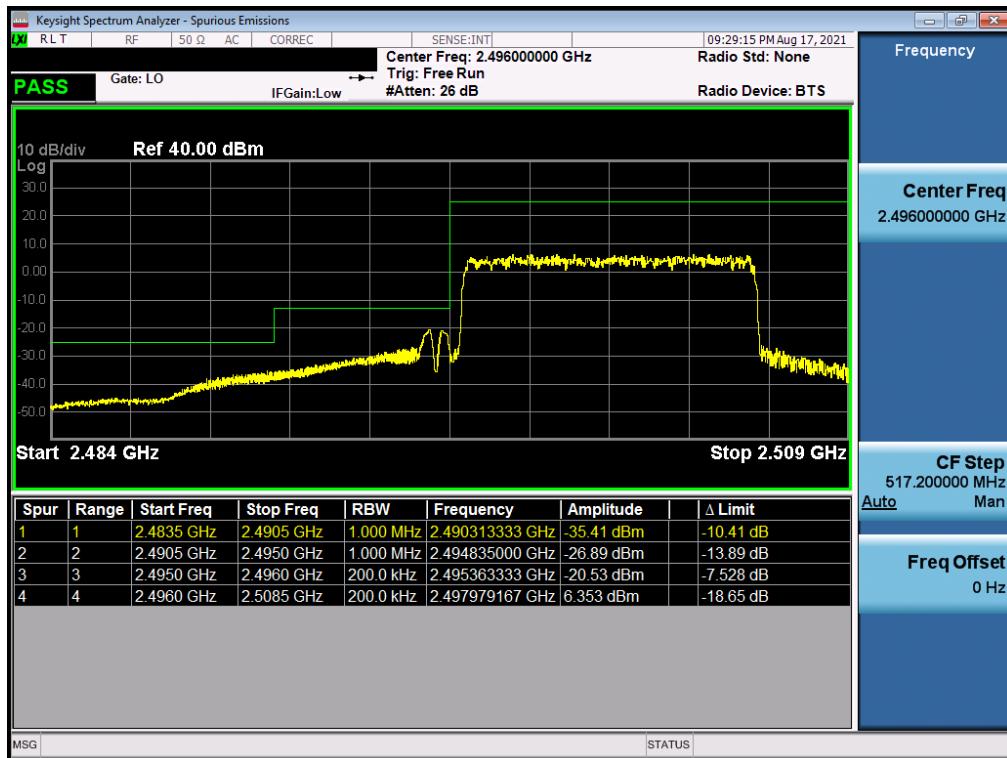


Plot 7-43. Lower ACP Plot (LTE Band 41 - 5MHz QPSK – Full RB)

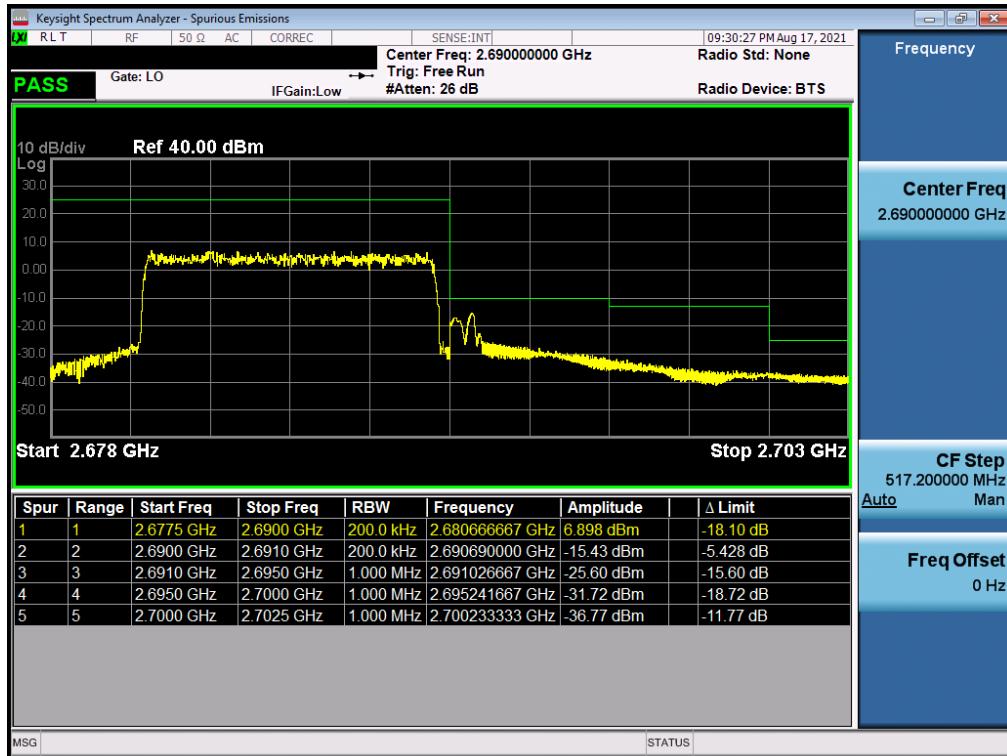


Plot 7-44. Upper ACP Plot (LTE Band 41 - 5MHz QPSK – Full RB)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 - 08-13-2021	EUT Type: Watch		Page 40 of 62

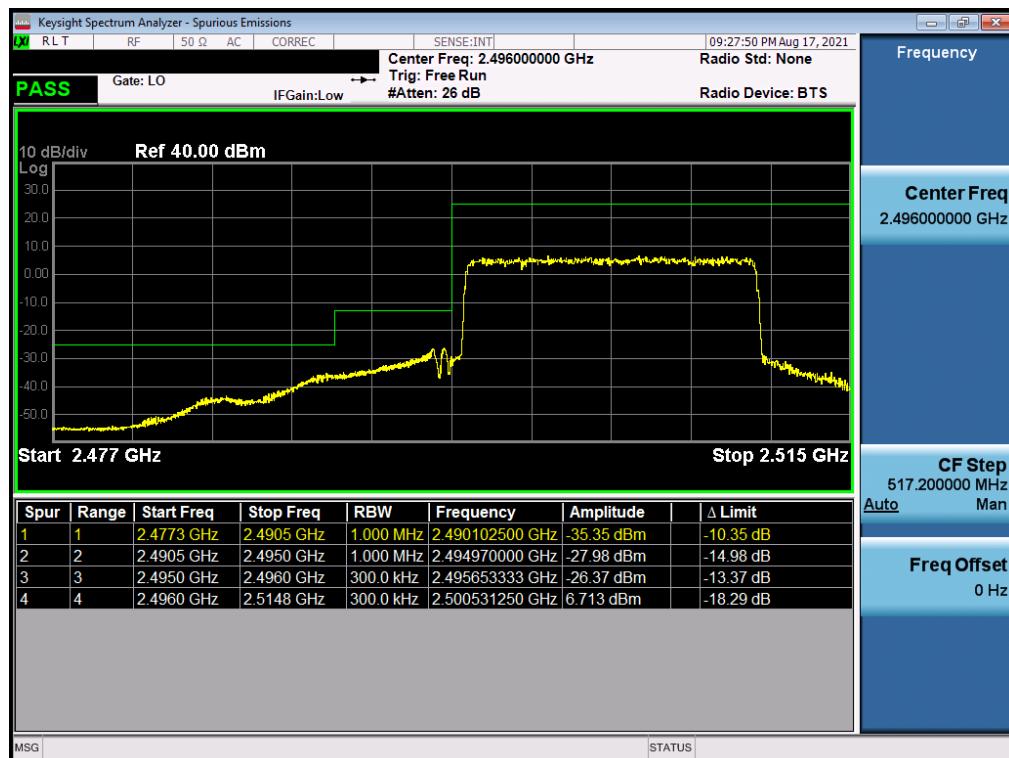


Plot 7-45. Lower ACP Plot (LTE Band 41 - 10MHz QPSK – Full RB)



Plot 7-46. Upper ACP Plot (LTE Band 41 - 10MHz QPSK – Full RB)

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 41 of 62	



Plot 7-47. Lower ACP Plot (LTE Band 41 - 15MHz QPSK – Full RB)



Plot 7-48. Upper ACP Plot (LTE Band 41 - 15MHz QPSK – Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 42 of 62



Plot 7-49. Lower ACP Plot (LTE Band 41 - 20MHz QPSK – Full RB)



Plot 7-50. Upper ACP Plot (LTE Band 41 - 20MHz QPSK – Full RB)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 43 of 62

7.5 Radiated Power (EIRP)

§27.50(a)(3), §27.50(h)(2)

Test Overview

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:

$$\text{EIRP} = \text{PMes} - \text{LC} + \text{GT}$$

Where:

EIRP = Equivalent Isotropic Radiated Power (expressed in the same units as PMes, typically dBW or dBm)

PMes = 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 dBi (EIRP)

Test Setup

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

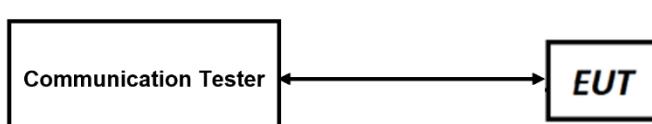


Figure 7-4. EIRP Measurement Setup

FCC ID: BCG-A2478	 PCTEST <small>Proud to be part of element</small>		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 44 of 62

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.

FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 45 of 62

LTE Band 7

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
5 MHz	QPSK	2502.5	-7.20	1 / 0	23.50	16.30	42.658	33.01	-16.71
		2535.0	-7.20	1 / 0	23.40	16.20	41.687	33.01	-16.81
		2567.5	-7.20	1 / 24	23.31	16.11	40.832	33.01	-16.90
	16-QAM	2502.5	-7.20	1 / 0	22.98	15.78	37.844	33.01	-17.23
10 MHz	QPSK	2505.0	-7.20	1 / 0	23.50	16.30	42.658	33.01	-16.71
		2535.0	-7.20	1 / 0	23.50	16.30	42.658	33.01	-16.71
		2565.0	-7.20	1 / 0	23.37	16.17	41.400	33.01	-16.84
	16-QAM	2565.0	-7.20	1 / 25	22.87	15.67	36.898	33.01	-17.34
15 MHz	QPSK	2507.5	-7.20	1 / 0	23.50	16.30	42.658	33.01	-16.71
		2535.0	-7.20	1 / 74	23.30	16.10	40.738	33.01	-16.91
		2562.5	-7.20	1 / 37	23.39	16.19	41.591	33.01	-16.82
	16-QAM	2562.5	-7.20	1 / 0	22.87	15.67	36.898	33.01	-17.34
20 MHz	QPSK	2510.0	-7.20	1 / 0	23.50	16.30	42.658	33.01	-16.71
		2535.0	-7.20	1 / 0	23.49	16.29	42.560	33.01	-16.72
		2560.0	-7.20	1 / 0	23.47	16.27	42.364	33.01	-16.74
	16-QAM	2535.0	-7.20	1 / 0	23.06	15.86	38.548	33.01	-17.15

Table 7-2. Antenna FCM EIRP Data (LTE Band 7)

LTE Band 41

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
5 MHz	QPSK	2502.5	-6.20	1 / 12	23.46	17.26	53.211	33.01	-15.75
		2593.0	-6.20	1 / 24	23.32	17.12	51.523	33.01	-15.89
		2687.5	-6.20	1 / 0	23.36	17.16	52.000	33.01	-15.85
	16-QAM	2687.5	-6.20	1 / 12	22.40	16.20	41.687	33.01	-16.81
10 MHz	QPSK	2505.0	-6.20	1 / 25	23.50	17.30	53.703	33.01	-15.71
		2593.0	-6.20	1 / 49	23.29	17.09	51.168	33.01	-15.92
		2685.0	-6.20	1 / 0	23.40	17.20	52.481	33.01	-15.81
	16-QAM	2685.0	-6.20	1 / 25	22.47	16.27	42.364	33.01	-16.74
15 MHz	QPSK	2507.5	-6.20	1 / 0	23.40	17.20	52.481	33.01	-15.81
		2593.0	-6.20	1 / 74	23.21	17.01	50.234	33.01	-16.00
		2682.5	-6.20	1 / 0	23.42	17.22	52.723	33.01	-15.79
	16-QAM	2682.5	-6.20	1 / 37	22.59	16.39	43.551	33.01	-16.62
20 MHz	QPSK	2510.0	-6.20	1 / 0	23.50	17.30	53.703	33.01	-15.71
		2593.0	-6.20	1 / 99	23.29	17.09	51.168	33.01	-15.92
		2680.0	-6.20	1 / 0	23.47	17.27	53.333	33.01	-15.74
	16-QAM	2506.0	-6.20	1 / 0	22.60	16.40	43.652	33.01	-16.61

Table 7-3. Antenna FCM EIRP Data (LTE Band 41)

FCC ID: BCG-A2478	 PCTEST® Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 46 of 62

7.6 Radiated Spurious Emissions

§2.1053, 27.53(a), 27.53(m)

Test Overview

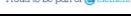
Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized broadband hybrid antennas.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

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

Test Settings

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

FCC ID: BCG-A2478	 PCTEST Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 47 of 62

Test Setup

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

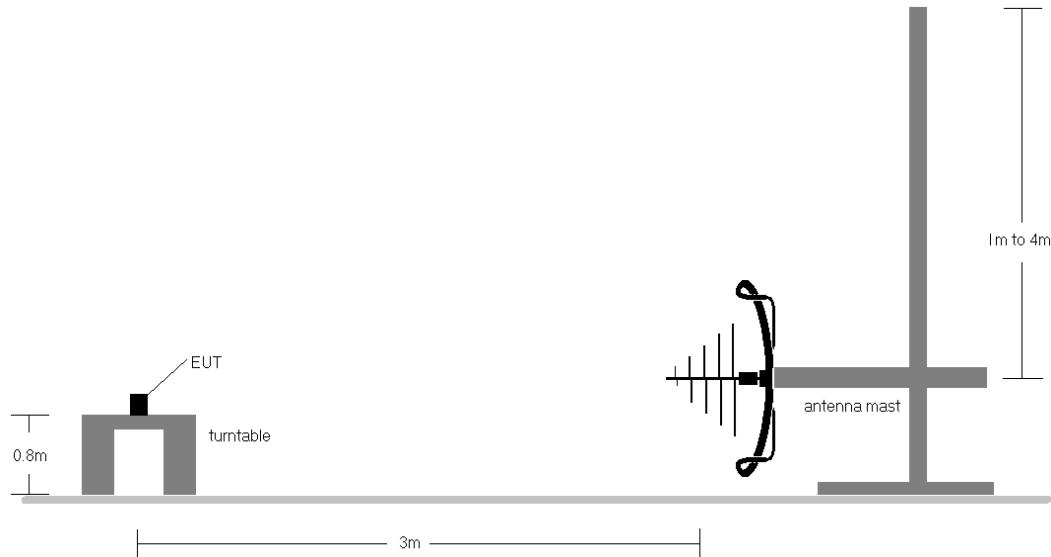


Figure 7-5. Test Instrument & Measurement Setup < 1GHz

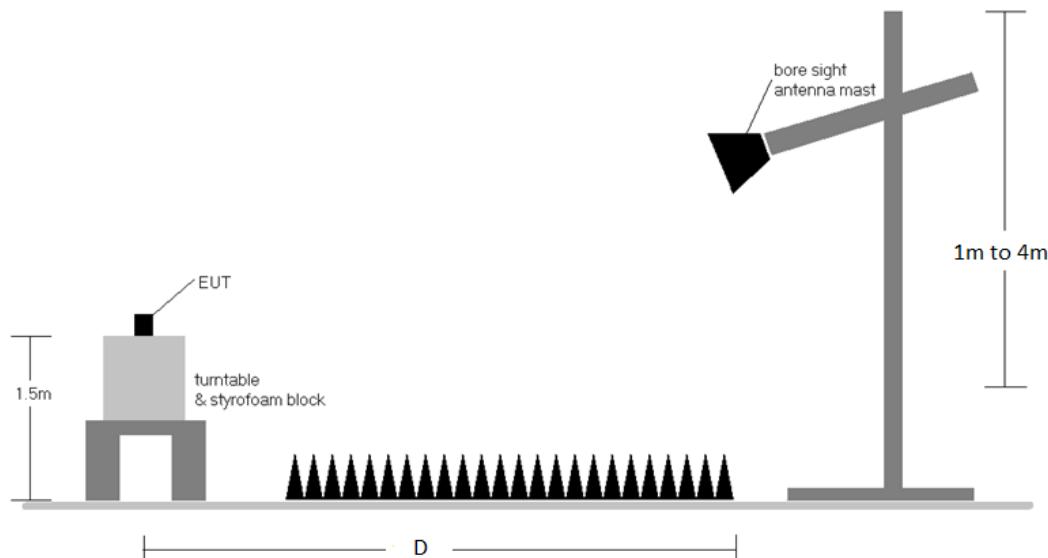


Figure 7-6. Test Instrument & Measurement Setup > 1 GHz

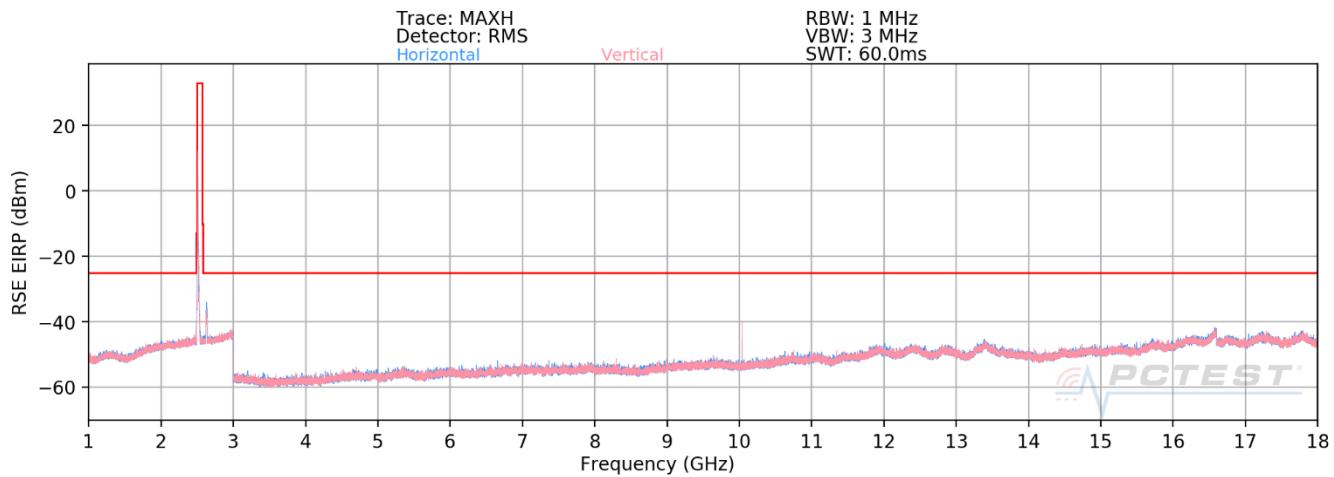
FCC ID: BCG-A2478	 PCTEST® Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 48 of 62

Test Notes

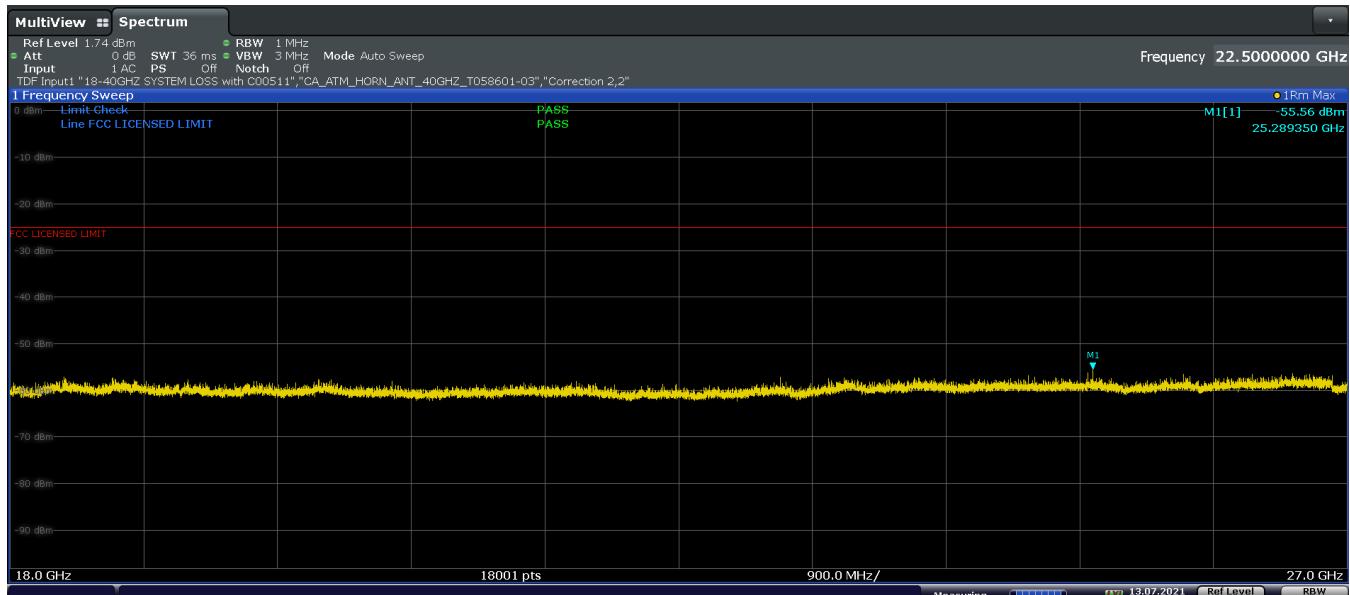
1. Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - a. $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - b. $EIRP (\text{dBm}) = E(\text{dB}\mu\text{V}/\text{m})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

FCC ID: BCG-A2478	 PCTEST® <small>Proud to be part of </small>		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 49 of 62

7.6.1 Antenna FCM – Radiated Spurious Emission Measurements LTE Band 7

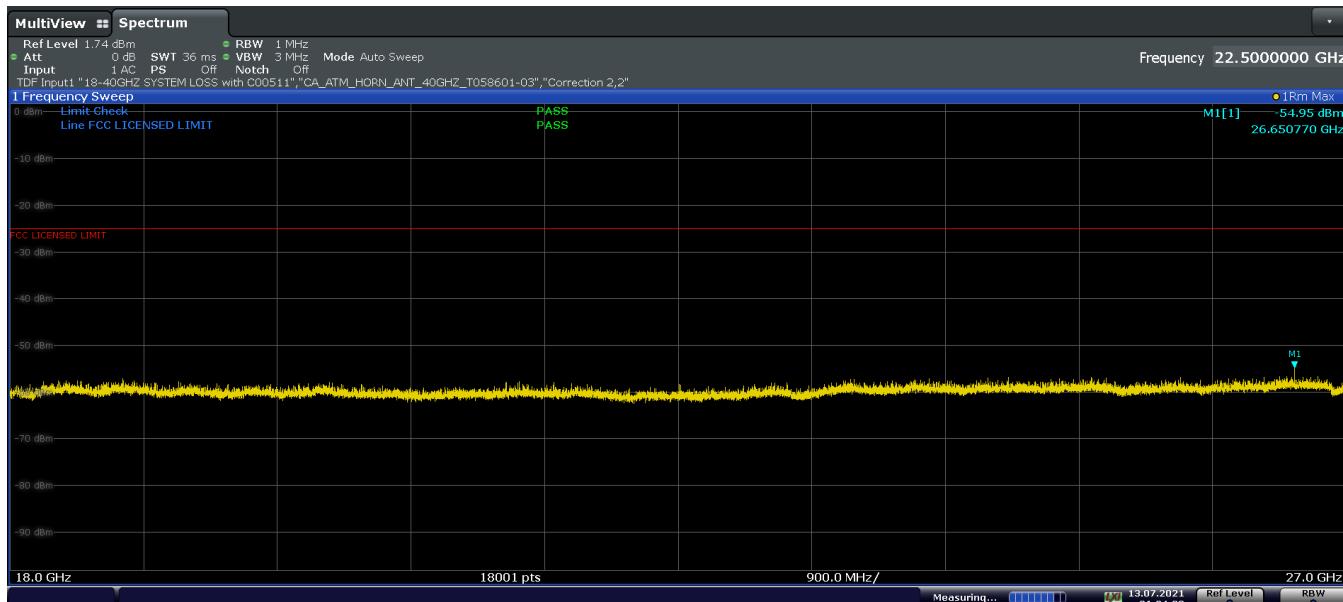


Plot 7-51. Antenna FCM Radiated Spurious Plot 1GHz – 18GHz (LTE Band 7)



Plot 7-52. Antenna FCM Radiated Spurious Emission above 18GHz (LTE Band 7, Pol. H)

FCC ID: BCG-A2478	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 50 of 62



Plot 7-53. Antenna FCM Radiated Spurious Emission above 18GHz (LTE Band 7, Pol. V)

FCC ID: BCG-A2478	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 51 of 62

Bandwidth (MHz):	20								
Frequency (MHz):	2510.0								
RB / Offset:	1 / 50								
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]
5020.0	V	-	-	-81.30	6.84	32.54	-62.72	-25.00	-37.72
7530.0	V	-	-	-82.80	10.30	34.50	-60.76	-25.00	-35.76
10040.0	V	106	191	-67.14	12.70	52.56	-42.69	-25.00	-17.69
12550.0	V	-	-	-83.53	16.17	39.64	-55.62	-25.00	-30.62
15060.0	V	-	-	-84.59	17.35	39.76	-55.50	-25.00	-30.50
17570.0	V	-	-	-84.23	19.81	42.58	-52.68	-25.00	-27.68

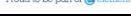
Table 7-4. Radiated Spurious Data (LTE Band 7 – Low Channel)

Bandwidth (MHz):	20								
Frequency (MHz):	2535.0								
RB / Offset:	1 / 50								
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]
5070.0	V	-	-	-81.14	7.10	32.96	-62.30	-25.00	-37.30
7605.0	V	110	17	-82.18	10.62	35.44	-59.82	-25.00	-34.82
10140.0	V	106	194	-79.92	12.90	39.98	-55.28	-25.00	-30.28
12675.0	V	-	-	-83.84	16.25	39.41	-55.85	-25.00	-30.85
15210.0	V	-	-	-84.62	17.55	39.93	-55.32	-25.00	-30.32
17745.0	V	-	-	-83.92	20.84	43.92	-51.34	-25.00	-26.34

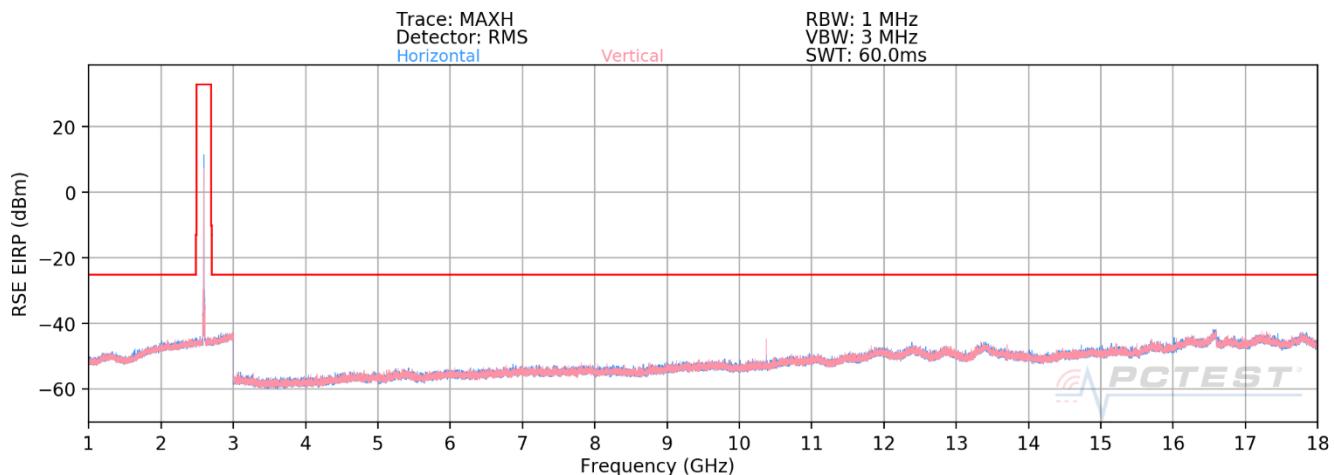
Table 7-5. Radiated Spurious Data (LTE Band 7 – Mid Channel)

Bandwidth (MHz):	20								
Frequency (MHz):	2560.0								
RB / Offset:	1 / 50								
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]
5120.00	V	-	-	-80.73	7.09	33.36	-61.90	-25.00	-36.90
7680.00	V	-	-	-82.52	9.88	34.36	-60.90	-25.00	-35.90
10240.00	V	102	191	-79.38	13.09	40.71	-54.54	-25.00	-29.54
12800.00	V	-	-	-84.65	17.08	39.43	-55.83	-25.00	-30.83
15360.00	V	-	-	-84.72	17.88	40.16	-55.10	-25.00	-30.10
17920.00	V	-	-	-84.03	20.13	43.10	-52.16	-25.00	-27.16

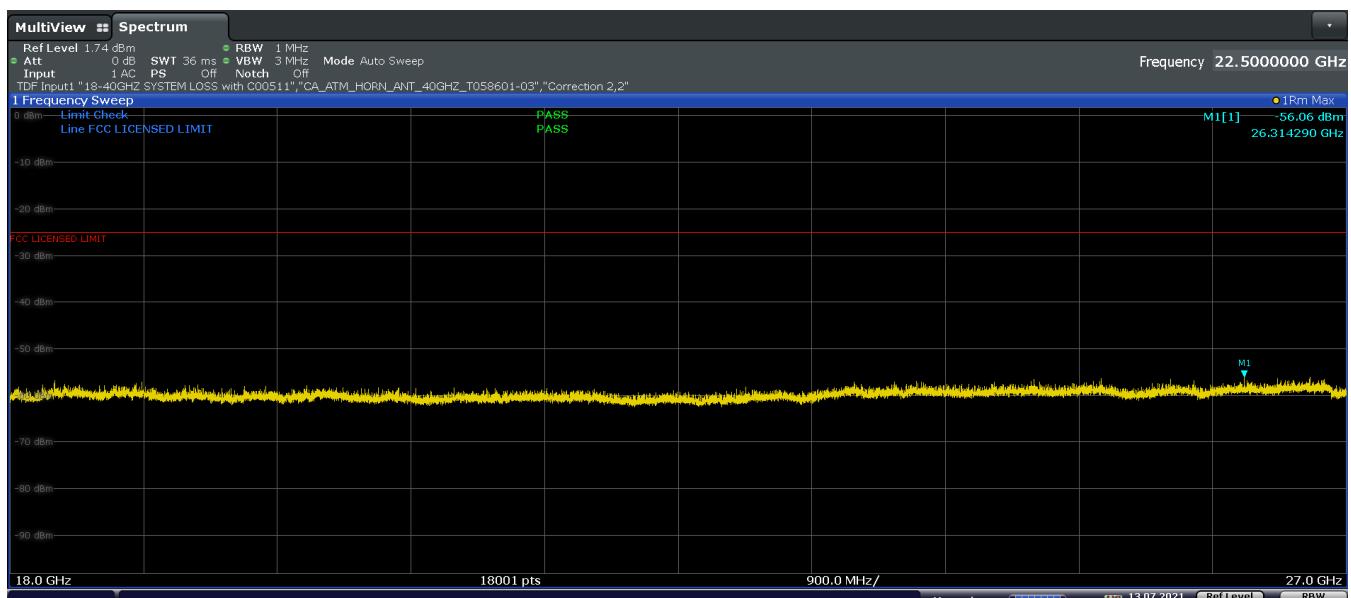
Table 7-6. Radiated Spurious Data (LTE Band 7 – High Channel)

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)					Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch					

LTE Band 41

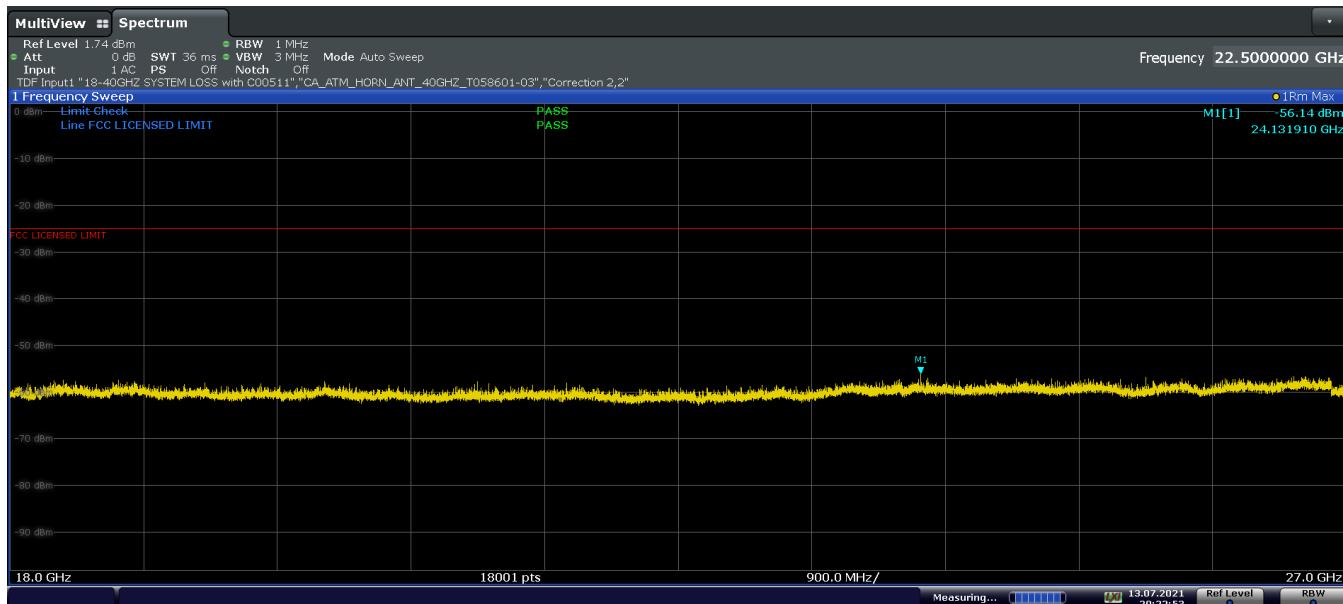


Plot 7-54. Antenna FCM Radiated Spurious Plot 1GHz – 18GHz (LTE Band 41)



Plot 7-55. Antenna FCM Radiated Spurious Emission above 18GHz (LTE Band 41, Pol. H)

FCC ID: BCG-A2478	 PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 53 of 62	



Plot 7-56. Antenna FCM Radiated Spurious Emission above 18GHz (LTE Band 41, Pol. V)

FCC ID: BCG-A2478	 PCTEST® Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 54 of 62	

Bandwidth (MHz):	20								
Frequency (MHz):	2506.0								
RB / Offset:	1 / 50								

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]
5012.0	V	-	-	-77.82	4.49	33.67	-61.58	-25.00	-36.58
7518.0	V	-	-	-79.57	8.86	36.29	-58.97	-25.00	-33.97
10024.0	V	227	239	-82.75	13.55	37.80	-57.46	-25.00	-32.46
12530.0	V	-	-	-84.50	17.92	40.42	-54.84	-25.00	-29.84
15036.0	V	-	-	-85.14	20.13	41.99	-53.27	-25.00	-28.27
17542.0	V	-	-	-84.85	22.59	44.74	-50.52	-25.00	-25.52

Table 7-7. Radiated Spurious Data (LTE Band 41 – Low Channel)

Bandwidth (MHz):	20								
Frequency (MHz):	2593.0								
RB / Offset:	1 / 50								

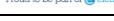
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
5186.0	V	-	-	-77.83	5.39	34.56	-60.70	-25.00	-35.70
7779.0	V	-	-	-79.03	8.98	36.95	-58.31	-25.00	-33.31
10372.0	V	104	227	-72.89	14.13	48.24	-47.02	-25.00	-22.02
12965.0	V	-	-	-85.19	18.52	40.33	-54.93	-25.00	-29.93
15558.0	V	-	-	-84.29	20.30	43.01	-52.25	-25.00	-27.25

Table 7-8. Radiated Spurious Data (LTE Band 41 – Mid Channel)

Bandwidth (MHz):	20								
Frequency (MHz):	2680.0								
RB / Offset:	1 / 50								

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]
5360.0	V	-	-	-78.02	5.51	34.49	-60.77	-25.00	-35.77
8040.0	V	-	-	-81.21	9.67	35.46	-59.80	-25.00	-34.80
10720.0	V	103	54	-78.12	15.04	43.92	-51.34	-25.00	-26.34
13400.0	V	-	-	-85.19	18.56	40.37	-54.89	-25.00	-29.89
16080.0	V	-	-	-85.39	21.30	42.91	-52.35	-25.00	-27.35

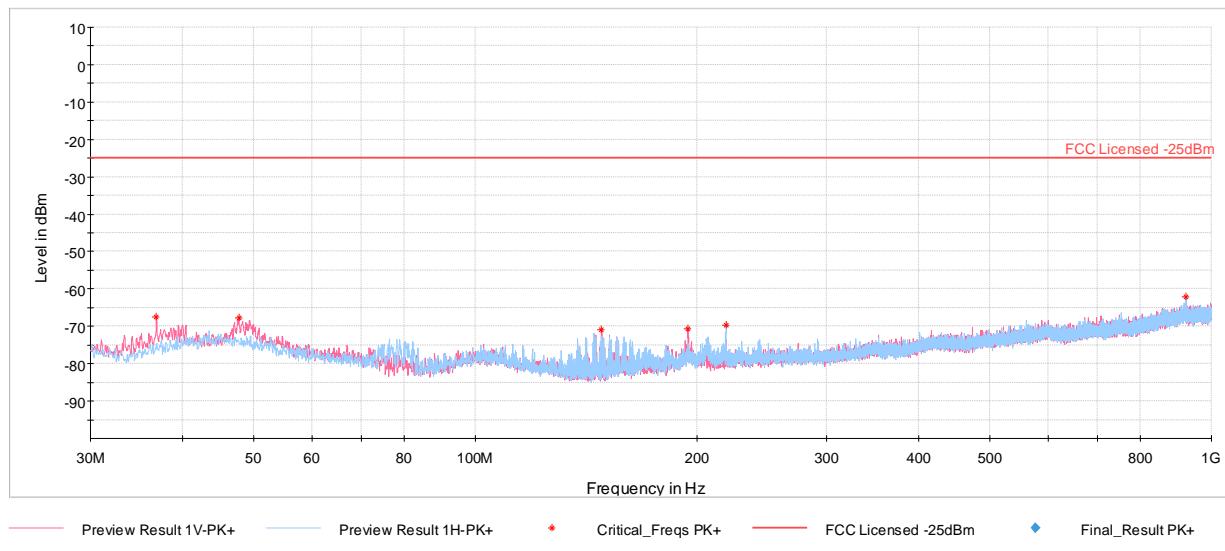
Table 7-9. Radiated Spurious Data (LTE Band 41 – High Channel)

FCC ID: BCG-A2478	 PCTEST® Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)						Approved by: Quality Manager	
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch							Page 55 of 62

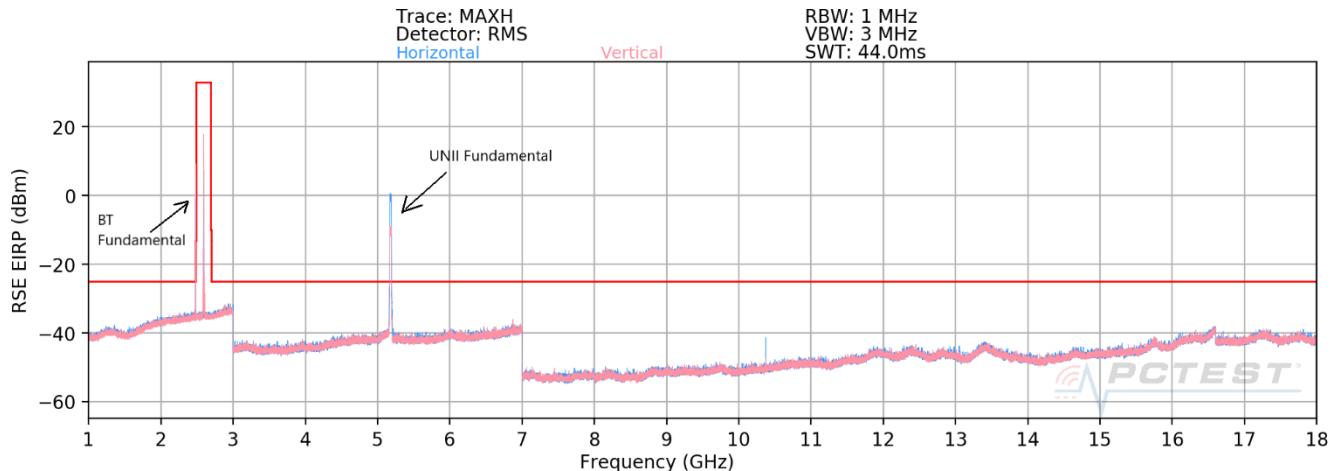
7.6.2 Simultaneous Tx Radiated Spurious Emissions Measurements

Description	Bluetooth	LTE	UNII
Antenna	Antenna FCM	Antenna FCM	Antenna FCM
Channel	78	40620	36
Operating Frequency (MHz)	2480	2593	5180
Mode	GFSK ePA	QPSK/1RB/20MHz	11n

Table 7-10. Worst Case Simultaneous Transmission Configuration

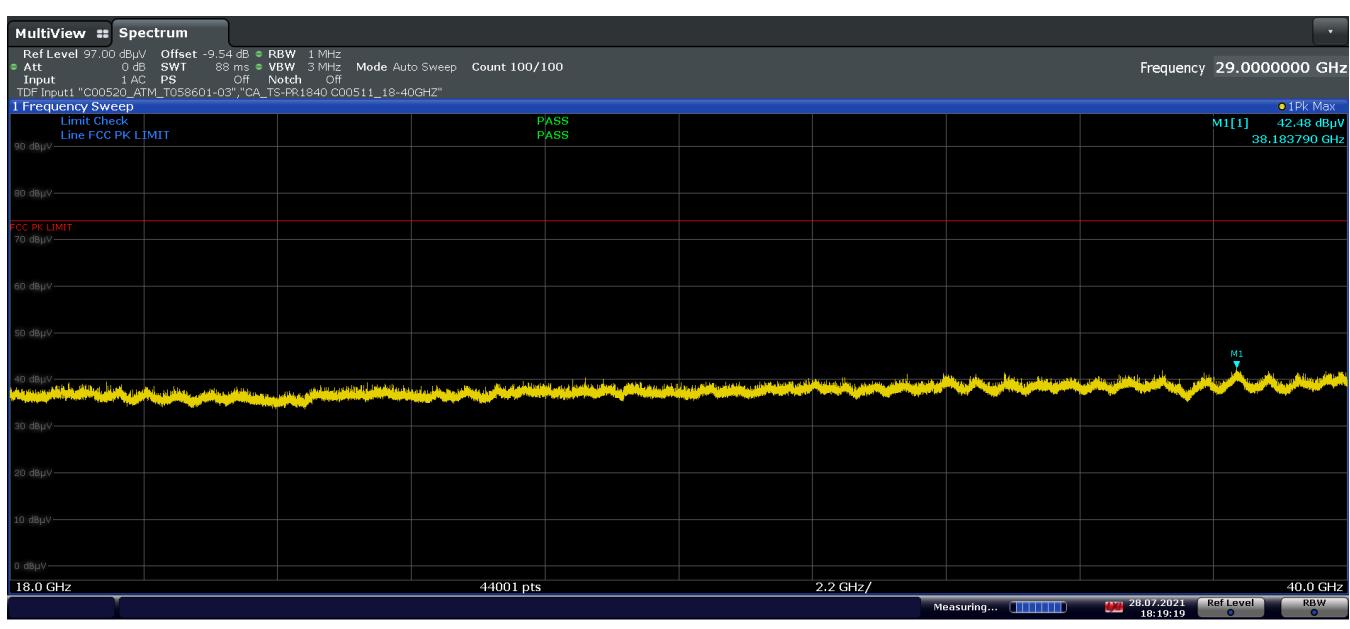
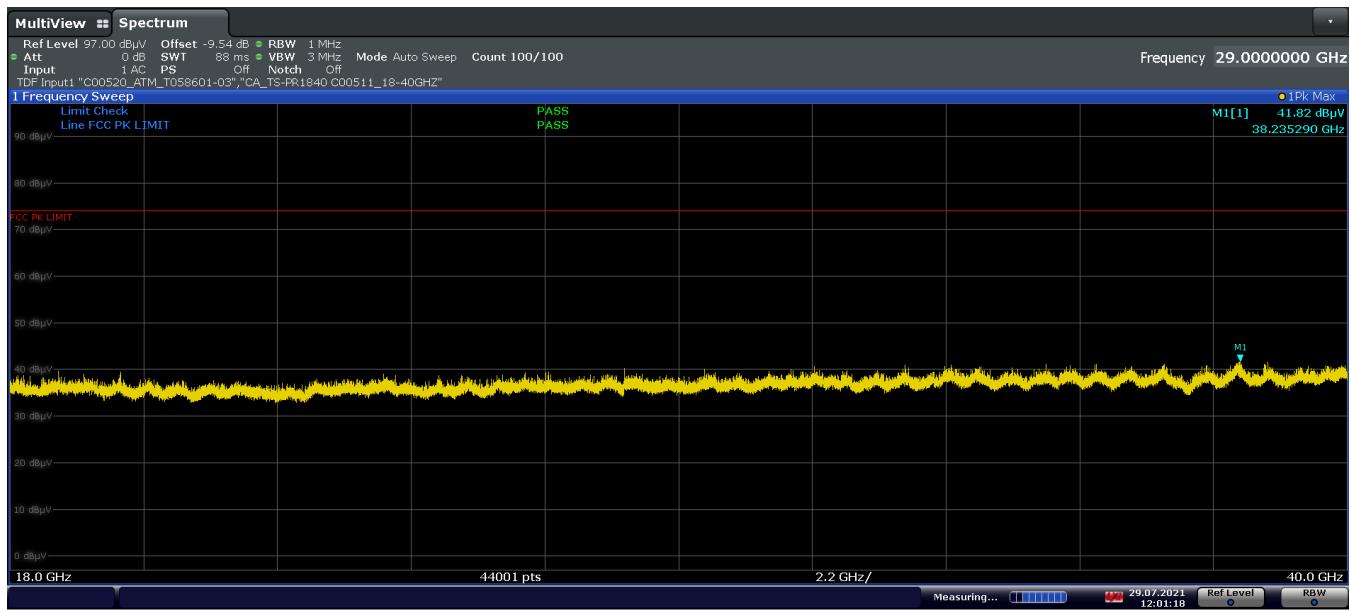


Plot 7-57. Radiated Spurious Emissions – Simultaneous Transmission 30MHz – 1GHz



Plot 7-58. Radiated Spurious Emissions - Simultaneous Transmission 1-18GHz

FCC ID: BCG-A2478	 PCTEST Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 56 of 62	



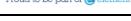
FCC ID: BCG-A2478	 MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 57 of 62

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
4960.00	Peak	H	-	-	-68.70	16.06	54.36	73.98	-19.62
7440.00	Peak	H	289	97	-73.41	14.24	47.83	73.98	-26.15
12400.00	Peak	H	-	-	-74.01	20.45	53.44	73.98	-20.53
10360.00	Peak	H	-	-	-74.88	17.53	49.65	68.20	-18.55
15540.00	Avg	H	-	-	-87.50	23.28	42.78	53.98	-11.20
15540.00	Peak	H	-	-	-75.73	23.28	54.55	73.98	-19.43

Table 7-11. BT and UNII Harmonics Emissions Measurement in Simultaneous Transmission Mode

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dBm]	Field Strength [dB μ V/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7779.00	H	-	-	-76.42	15.03	45.6	-49.62	-25.0	-24.6
10372.00	H	240	350	-79.02	17.60	45.6	-49.65	-25.0	-24.7
12965.00	H	-	-	-78.25	21.14	49.9	-45.34	-25.0	-20.3
15558.00	H	-	-	-78.20	23.21	52.0	-43.21	-25.0	-18.2
2367.00	H	-	-	-78.34	16.69	45.4	-49.88	-25.0	-24.9
2706.00	H	126	139	-76.61	17.38	47.8	-47.46	-25.0	-22.5

Table 7-12. LTE Harmonics and Intermodulations Emissions Measurement in Simultaneous Transmission Mode

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 	MEASUREMENT REPORT (CERTIFICATION)				Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch				

7.7 Frequency Stability / Temperature Variation

§2.1055, §27.54

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015 and TIA-603-E-2016. The frequency stability 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.

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

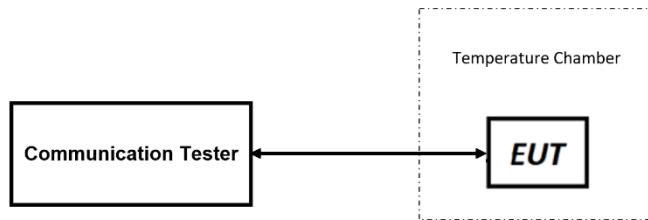
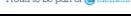


Figure 7-7. Test Instrument & Measurement Setup

Test Notes

None.

FCC ID: BCG-A2478	 PCTEST [®] Proud to be part of 		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 59 of 62

LTE Band 7

LTE Band 7							
		Low Channel Frequency (Hz):		2,510,000,000			
		High Channel Frequency (Hz):		2,560,000,000			
		Ref. Voltage (VDC):		3.8			
Voltage (%)	Power (VDC)	Temp (°C)	Low Freq. (Hz)	High Freq. (Hz)	Low Freq. Dev. (Hz)	High Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	2,510,000,061	2,560,000,077	37.56	40.80	0.0000016
		- 20	2,510,000,050	2,560,000,060	26.59	24.40	0.0000011
		- 10	2,510,000,047	2,560,000,074	23.56	38.36	0.0000015
		0	2,510,000,054	2,560,000,060	31.32	24.44	0.0000012
		+ 10	2,510,000,056	2,560,000,062	33.30	26.16	0.0000013
		+ 20 (Ref)	2,510,000,023	2,560,000,036	0.00	0.00	0.0000000
		+ 30	2,510,000,055	2,560,000,079	31.89	42.65	0.0000017
		+ 40	2,510,000,067	2,560,000,084	43.59	48.49	0.0000019
		+ 50	2,510,000,079	2,560,000,090	55.60	53.50	0.0000022
Battery Endpoint	3.40	+ 20	2,510,000,042	2,560,000,072	19.05	35.64	0.0000014

Table 7-13. LTE Band 7 Frequency Stability Data

FCC ID: BCG-A2478	 PCTEST® Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 60 of 62

LTE Band 41

LTE Band 41							
		Low Channel Frequency (Hz):		2,506,000,000			
		High Channel Frequency (Hz):		2,680,000,000			
		Ref. Voltage (VDC):		3.8			
Voltage (%)	Power (VDC)	Temp (°C)	Low Freq. (Hz)	High Freq. (Hz)	Low Freq. Dev. (Hz)	High Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	2,506,000,009	2,680,000,025	-15.65	-14.32	-0.0000006
		- 20	2,506,000,006	2,680,000,029	-19.05	-10.49	-0.0000008
		- 10	2,506,000,007	2,680,000,027	-18.29	-11.88	-0.0000007
		0	2,506,000,011	2,680,000,023	-13.56	-16.09	-0.0000006
		+ 10	2,506,000,020	2,680,000,030	-5.30	-9.23	-0.0000003
		+ 20 (Ref)	2,506,000,025	2,680,000,039	0.00	0.00	0.0000000
		+ 30	2,506,000,015	2,680,000,031	-10.46	-7.53	-0.0000004
		+ 40	2,506,000,007	2,680,000,000	-17.80	-39.45	-0.0000015
		+ 50	2,506,000,012	2,679,999,990	-13.19	-49.00	-0.0000018
		Battery Endpoint	3.40	+ 20	2,506,000,017	2,680,000,029	-8.00
					-8.00	-10.00	-0.0000004

Table 7-14. LTE Band 41 Frequency Stability Data

FCC ID: BCG-A2478	 PCTEST® Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch	Page 61 of 62	

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 27 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: 1C2106070046-04.BCG	Test Dates: 06-08-2021 – 08-13-2021	EUT Type: Watch		Page 62 of 62