

PART 27 MEASUREMENT REPORT

Applicant Name:

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

Date of Testing:

4/6/2022– 8/25/2022

Test Site/Location:

Element Washington DC LLC
Morgan Hill, CA, USA

Test Report Serial No.:

1C2205090034-03.BCG

FCC ID:

BCG-A2727

APPLICANT:

Apple Inc.

Application Type:

Certification

Model:

A2727

EUT Type:

Watch

FCC Classification:

PCS Licensed Transmitter Worn on Body (PCT)

FCC Rule Part:

27

Test Procedure(s):

ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

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

RJ Ortanez
Executive Vice President




FCC ID: BCG-A2727	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch
		Page 1 of 122

V2.1 11/9/2021

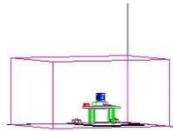
T A B L E O F C O N T E N T S

1.0	INTRODUCTION	4
1.1	Scope	4
1.2	Element Washington DC LLC 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	6
2.4	Test Support Equipment.....	6
2.5	Test Configuration	7
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	14
7.3	Spurious and Harmonic Emissions at Antenna Terminal	28
7.4	Band Edge Emissions at Antenna Terminal	47
7.5	Peak-Average Ratio	85
7.6	Radiated Power (ERP/EIRP).....	99
7.7	Radiated Spurious Emissions	104
7.8	Frequency Stability / Temperature Variation	115
8.0	CONCLUSION.....	120
9.0	Appendix A	121

FCC ID: BCG-A2727		PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 2 of 122

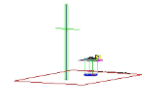
V2.1 11/9/2021

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MEASUREMENT REPORT

FCC Part 27




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]	
LTE Band 12	1.4 MHz	QPSK	699.7 - 715.3	1.0975	0.264	-5.79	0.433	-3.64	1M10G7W
		16QAM	699.7 - 715.3	1.1106	0.222	-6.54	0.364	-4.39	1M11D7W
	3 MHz	QPSK	700.5 - 714.5	2.7152	0.259	-5.87	0.425	-3.72	2M72G7W
		16QAM	700.5 - 714.5	2.7193	0.227	-6.44	0.372	-4.29	2M72D7W
	5 MHz	QPSK	701.5 - 713.5	4.5386	0.267	-5.74	0.438	-3.59	4M54G7W
		16QAM	701.5 - 713.5	4.5369	0.232	-6.34	0.381	-4.19	4M54D7W
	10 MHz	QPSK	704.0 - 711.0	9.1073	0.261	-5.84	0.428	-3.69	9M11G7W
		16QAM	704.0 - 711.0	5.3851	0.225	-6.48	0.369	-4.33	5M39D7W
LTE Band 17	5 MHz	QPSK	706.5 - 713.5	4.5386	0.263	-5.80	0.432	-3.65	4M54G7W
		16QAM	706.5 - 713.5	4.5369	0.224	-6.49	0.368	-4.34	4M54D7W
	10 MHz	QPSK	709.0 - 711.0	9.1073	0.268	-5.72	0.440	-3.57	9M11G7W
		16QAM	709.0 - 711.0	5.3851	0.228	-6.42	0.374	-4.27	5M39D7W
LTE Band 13	5 MHz	QPSK	779.5 - 784.5	4.5309	0.378	-4.22	0.621	-2.07	4M53G7W
		16QAM	779.5 - 784.5	4.5631	0.310	-5.09	0.508	-2.94	4M56D7W
	10 MHz	QPSK	782.0	9.0414	0.358	-4.46	0.587	-2.31	9M04G7W
		16QAM	782.0	5.3934	0.310	-5.09	0.508	-2.94	5M39D7W

Overview Table (<1GHz Band)

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	PAR at 0.1% [dB]	EIRP		Emission Designator
						Max. Power [mW]	Max. Power [dBm]	
WCDMA1700	5 MHz	Spread Spectrum	1712.4 - 1752.6	4.0978	3.18	13.996	11.46	4M10F9W
LTE Band 4	1.4 MHz	QPSK	1710.7 - 1754.3	1.1107	5.70	15.740	11.97	1M11G7W
		16QAM	1710.7 - 1754.3	1.1071	6.51	13.152	11.19	1M11D7W
	3 MHz	QPSK	1711.5 - 1753.5	2.7392	5.78	15.031	11.77	2M74G7W
		16QAM	1711.5 - 1753.5	2.7326	6.64	13.274	11.23	2M73D7W
	5 MHz	QPSK	1712.5 - 1752.5	4.5641	5.78	15.488	11.90	4M56G7W
		16QAM	1712.5 - 1752.5	4.5568	6.56	13.213	11.21	4M56D7W
	10MHz	QPSK	1715.0 - 1750.0	9.1291	5.75	15.524	11.91	9M13G7W
		16QAM	1715.0 - 1750.0	5.5120	6.44	13.032	11.15	5M51D7W
	15 MHz	QPSK	1717.5 - 1747.5	13.7179	5.93	15.631	11.94	13M7G7W
		16QAM	1717.5 - 1747.5	6.6397	6.47	13.274	11.23	6M64D7W
	20 MHz	QPSK	1720.0 - 1745.0	18.3221	5.63	15.776	11.98	18M3G7W
		16QAM	1720.0 - 1745.0	8.8483	6.48	12.764	11.06	8M85D7W
LTE Band 66	1.4 MHz	QPSK	1710.7 - 1779.3	1.1107	5.70	15.668	11.95	1M11G7W
		16QAM	1710.7 - 1779.3	1.1071	6.34	13.932	11.44	1M11D7W
	3 MHz	QPSK	1711.5 - 1778.5	2.7392	5.62	15.488	11.90	2M74G7W
		16QAM	1711.5 - 1778.5	2.7326	6.42	14.454	11.60	2M73D7W
	5 MHz	QPSK	1712.5 - 1777.5	4.5641	5.64	16.032	12.05	4M56G7W
		16QAM	1712.5 - 1777.5	4.5568	6.36	14.355	11.57	4M56D7W
	10 MHz	QPSK	1715.0 - 1775.0	9.1291	5.67	15.885	12.01	9M13G7W
		16QAM	1715.0 - 1775.0	5.5120	6.25	13.900	11.43	5M51D7W
	15 MHz	QPSK	1717.5 - 1772.5	13.7179	5.93	15.996	12.04	13M7G7W
		16QAM	1717.5 - 1772.5	6.6397	6.23	14.825	11.71	6M64D7W
	20 MHz	QPSK	1720.0 - 1770.0	18.3221	5.61	16.032	12.05	18M3G7W
		16QAM	1720.0 - 1770.0	8.8483	6.32	13.996	11.46	8M85D7W

Overview Table (>1GHz Bands)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 3 of 122

V2.1 11/9/2021

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.


1.2 Element Washington DC LLC Test Location

These measurement tests were conducted at the Element Washington DC LLC 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 Element located in Morgan Hill, CA 95037, U.S.A.

- Element Washington DC LLC 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.
- Element Washington DC LLC 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).
- Element Washington DC LLC facility is a registered (22831) test laboratory with the site description on file with ISED.

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch
		Page 4 of 122

V2.1 11/9/2021

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Watch FCC ID: BCG-A2727**. 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.: P34KQY7X0W, QFY90XDQ0F, FN6211203HG17PJ3X

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, Bluetooth (1x, EDR, HDR4, HDR8, LE1M, LE2M), NFC.

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
	802.11 b/g/n	BDR, EDR, HDR4/8, LE1/2M	Mid/High Band
Config 1	✓	✗	✓
Config 2	✗	✓	✓

Table 2-1. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

Note:

All the above simultaneous transmission configurations have been tested and the worst case configuration was found to be config 1 and reported in RF WLAN and RF Part 27b test reports.

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 5 of 122

V2.1 11/9/2021

2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Band	Antenna Gain [dBi]	
	BCM	FCM
LTE Band 12/17	-28.87	-
LTE Band 13	-27.41	-
LTE Band 4/66	-	-12.45
WCDMA1700	-	-12.45


Table 2-2. Highest Antenna Gain

Note: Antenna Specifications has been attached to Appendix A

2.4 Test Support Equipment

1	Apple Macbook	Model:	A1398	S/N:	C2QKP008F6F3
	w/AC/DC Adapter	Model:	A1435	S/N:	N/A
2	Apple SPAM Cable	Model:	N/A	S/N:	N/A
	w/ Charging Dock	Model:	N/A	S/N:	CYV001700087SWK01WMP8
	w/ Cradle	Model:		S/N:	FAPS7319394000064
3	Apple Magnetic Charger	Model:	N/A	S/N:	DLC9223004YLNWL43
3	Apple Magnetic Charger	Model:	N/A	S/N:	DLC824401XHJLW04U
4	Pathfinder Swiss	Model:	920-11361-01	S/N:	DLC1212005Q18H71Y
	SiP Socket	Model:	N/A	S/N:	P1 X2339S PF 198
5	Sugar Cube Power Supply	Model:	A1365	S/N:	D292066H2NLDHLHAE
6	Store Sample Wristband	Model:	N/A	S/N:	DLC219400361YDQ2W

Table 2-3. Test Support Equipment

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 6 of 122

V2.1 11/9/2021

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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 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.

2.6 Software and Firmware

The test was conducted with firmware watchOS 9.0 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-A2727		PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 7 of 122

V2.1 11/9/2021

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI 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.

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-A2727		PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 8 of 122

V2.1 11/9/2021

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	1.77
Radiated Disturbance (<30MHz)	4.38
Radiated Disturbance (30MHz-1GHz)	4.75
Radiated Disturbance (1-18GHz)	5.20
Radiated Disturbance (>18GHz)	4.72

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch
		Page 9 of 122

V2.1 11/9/2021

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	6/10/2022	Annual	6/10/2023	MY49430244
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	8/13/2021	Annual	8/13/2022	T058701-01
ESPEC	SU-241	Tabletop Temperature Chamber	10/26/2021	Annual	10/26/2022	92009574
ETS-Lindgren	3142E	BiConiLog Antenna (30MHz - 6GHz)	10/21/2021	Annual	10/21/2022	208204
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	5/11/2022	Annual	5/11/2023	205956
Keysight Technology	N9040B	UXA Signal Analyzer	2/8/2022	Annual	2/8/2023	MY57212015
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	1/6/2022	Annual	1/6/2023	101639
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	3/4/2022	Annual	3/4/2023	101619
Rohde & Schwarz	ESW26	EMI Test Receiver	5/19/2022	Annual	5/19/2023	101299
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	1/6/2022	Annual	1/6/2023	102327
Rohde & Schwarz	ESW44	EMI Test Receiver	12/2/2021	Annual	12/2/2022	101570
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	10/11/2021	Annual	10/11/2022	161616
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	11/4/2021	Annual	11/4/2022	151888
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	4/18/2022	Annual	4/18/2023	100050
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Antenna (400MHz-18GHz)	1/25/2022	Annual	1/25/2023	101063
Rohde & Schwarz	HFH2-Z2	Loop Antenna	4/3/2022	Annual	4/3/2023	100546

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-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 10 of 122

V2.1 11/9/2021

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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

LTE BW = 8.45 MHz

D = Amplitude/Angle Modulated


7 = Quantized/Digital Info

W = Combination of Any

Spurious Radiated Emission

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was -81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of -81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of -30.9 dBm yielding -24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm - (-24.80).

FCC ID: BCG-A2727		PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 11 of 122

V2.1 11/9/2021

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7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCG-A2727
 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, 27.53	-13 dBm at Band Edge and for all out-of-band emissions	PASS	Sections 7.3, 7.4
	Conducted Band Edge / Spurious Emissions (LTE B13)	2.1051, 27.53	-13 dBm at Band Edge and for all out-of-band emissions < -70 dBW/MHz (for wideband signals) < -80 dBW (for discrete emissions less than 700Hz BW) For all emissions in the band 1559 - 1610 MHz.	PASS	Sections 7.3, 7.4
	Peak-Average Ratio	27.50(d)(5)	< 13 dB	PASS	Section 7.5
	Transmitter Conducted Output Power	2.1046	N/A	N/A	See RF Exposure Report
	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
	Effective Radiated Power / Equivalent Isotropic Radiated Power (LTE Band 12/17)	27.50(c)(10)	< 3 Watts max. ERP	PASS	Section 7.6
	Effective Radiated Power / Equivalent Isotropic Radiated Power (LTE Band 13)	27.50(b)(10)	< 3 Watts max. ERP	PASS	Section 7.6
	Equivalent Isotropic Radiated Power (WCDMA)	27.50(d)(4)	< 1 Watts max. EIRP	PASS	Section 7.6
	Equivalent Isotropic Radiated Power (LTE Band 4/66)			PASS	Section 7.6
RADIATED	Radiated Spurious Emissions (LTE Band 13)	2.1053, 27.53(f)	-13 dBm for all out-of-band emissions < -70 dBW/MHz (for wideband signals) < -80 dBW (for discrete emissions less than 700Hz BW) For all emissions in the band 1559 - 1610 MHz	PASS	Section 7.7
	Radiated Spurious Emissions	2.1053, 27.53	-13 dBm for all out-of-band emissions	PASS	Section 7.7


Table 7-1. Summary of Test Results

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 12 of 122

V2.1 11/9/2021

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 Element EMC Software Tool v1.1.

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 13 of 122

V2.1 11/9/2021

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.

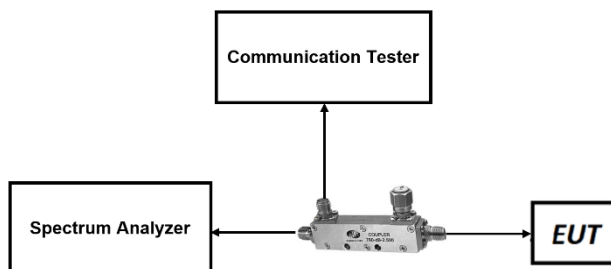



Figure 7-1. Test Instrument & Measurement Setup

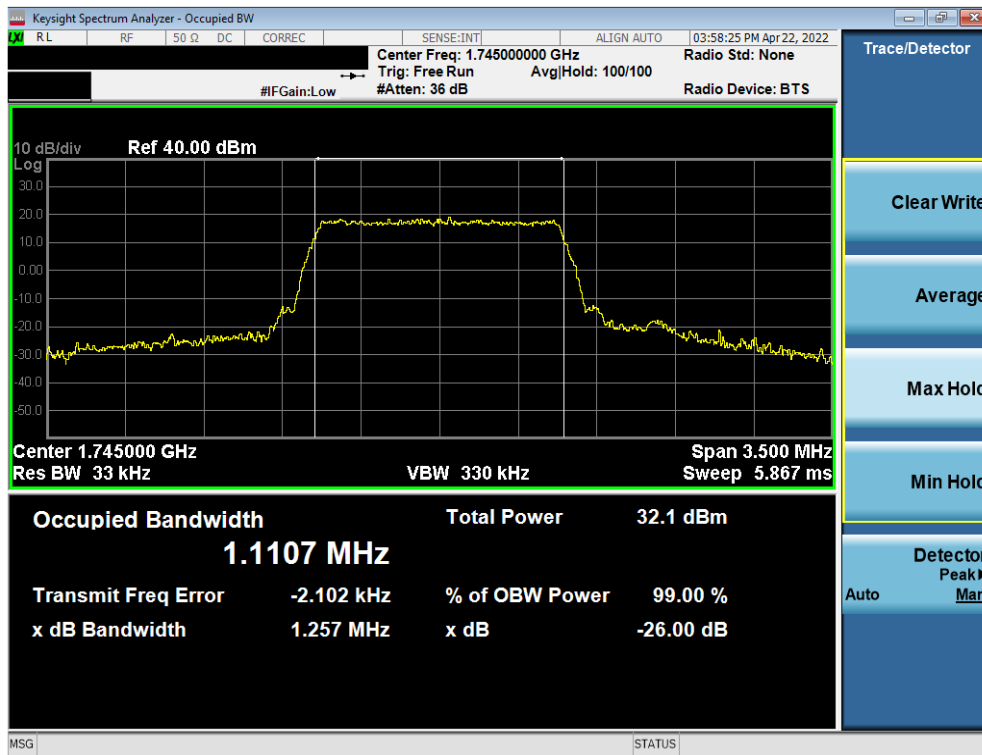
Test Notes

None.

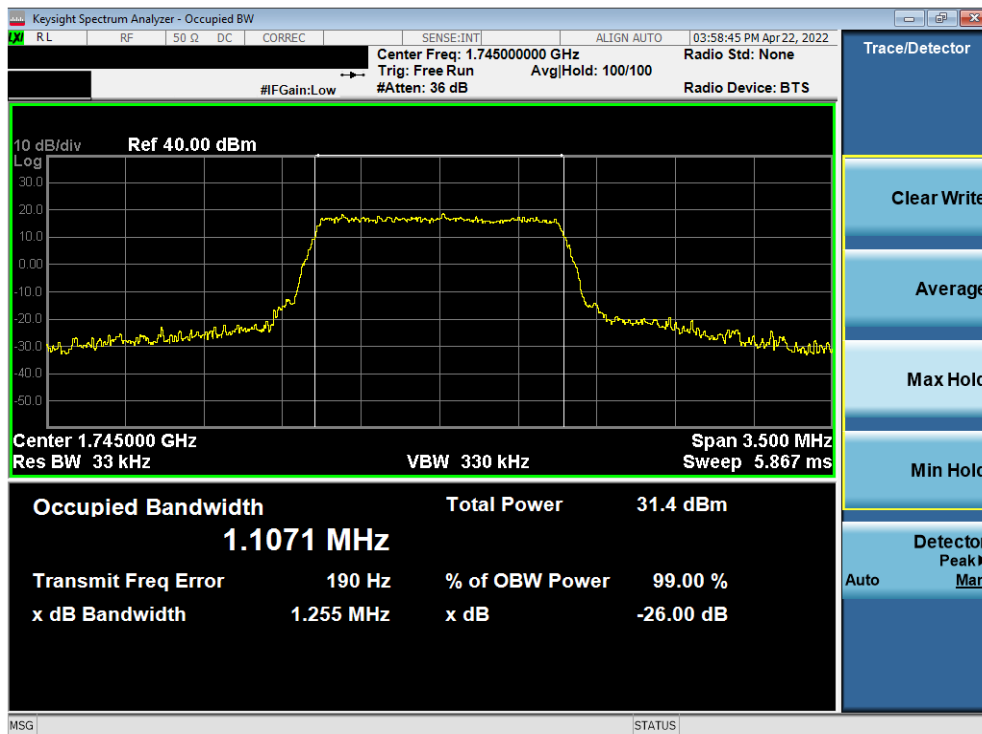
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 14 of 122

V2.1 11/9/2021


LTE Band 66/4



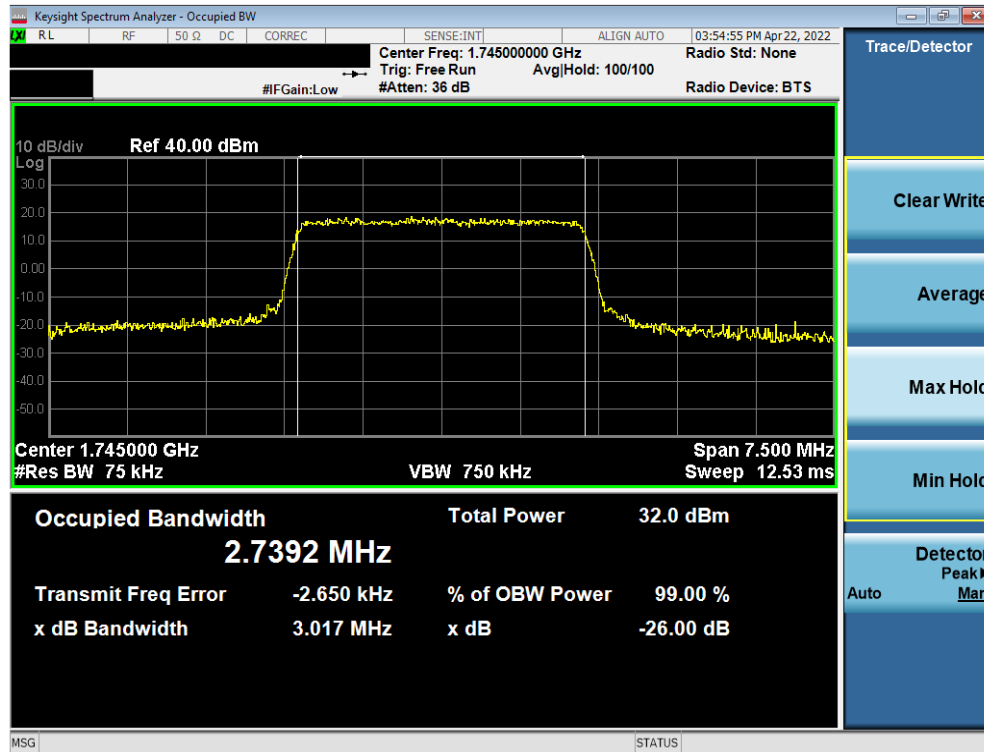
Plot 7-1. Occupied Bandwidth Plot (LTE Band 66/4 - 1.4MHz QPSK - Full RB)



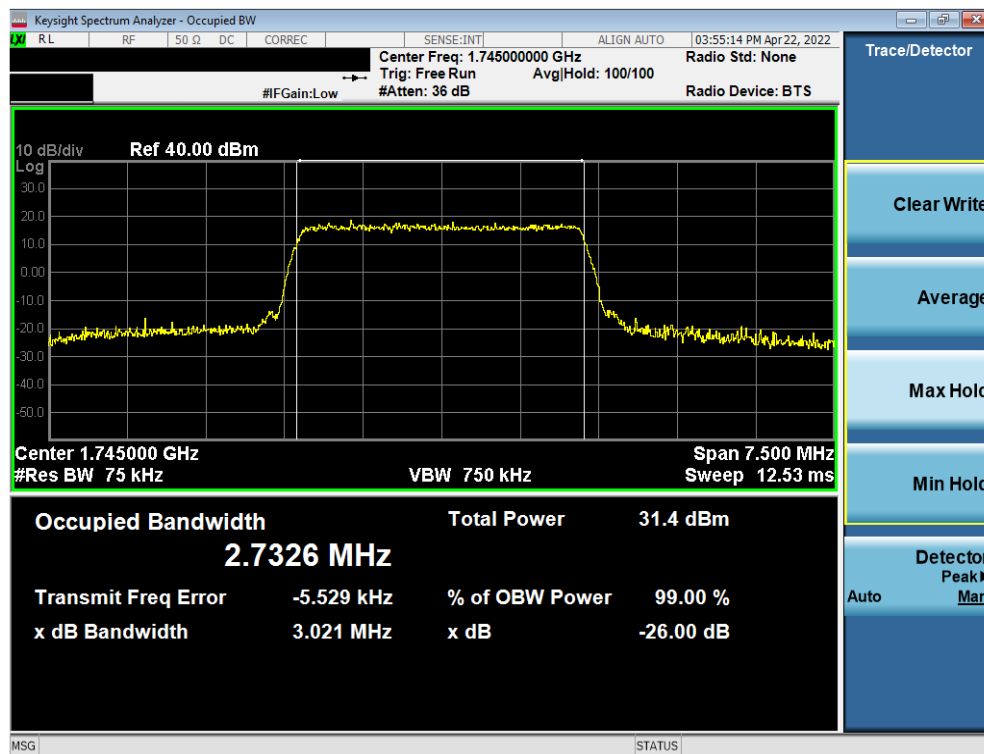
Plot 7-2. Occupied Bandwidth Plot (LTE Band 66/4 - 1.4MHz 16-QAM - Full RB)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 15 of 122


V2.1 11/9/2021

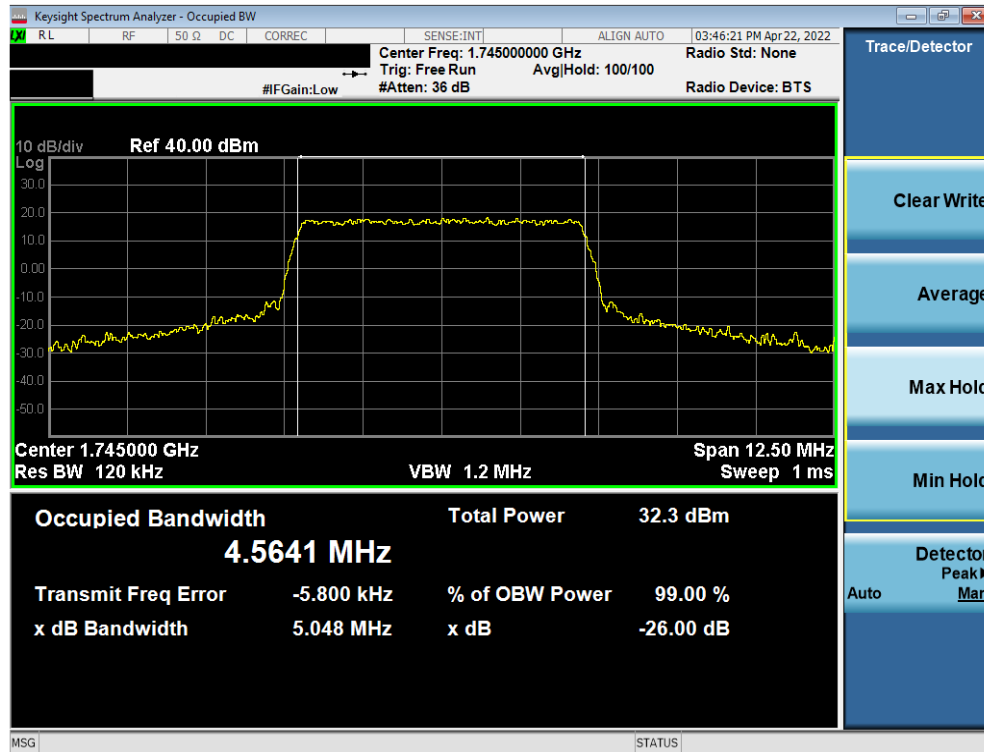


Plot 7-3. Occupied Bandwidth Plot (LTE Band 66/4 - 3MHz QPSK - Full RB)

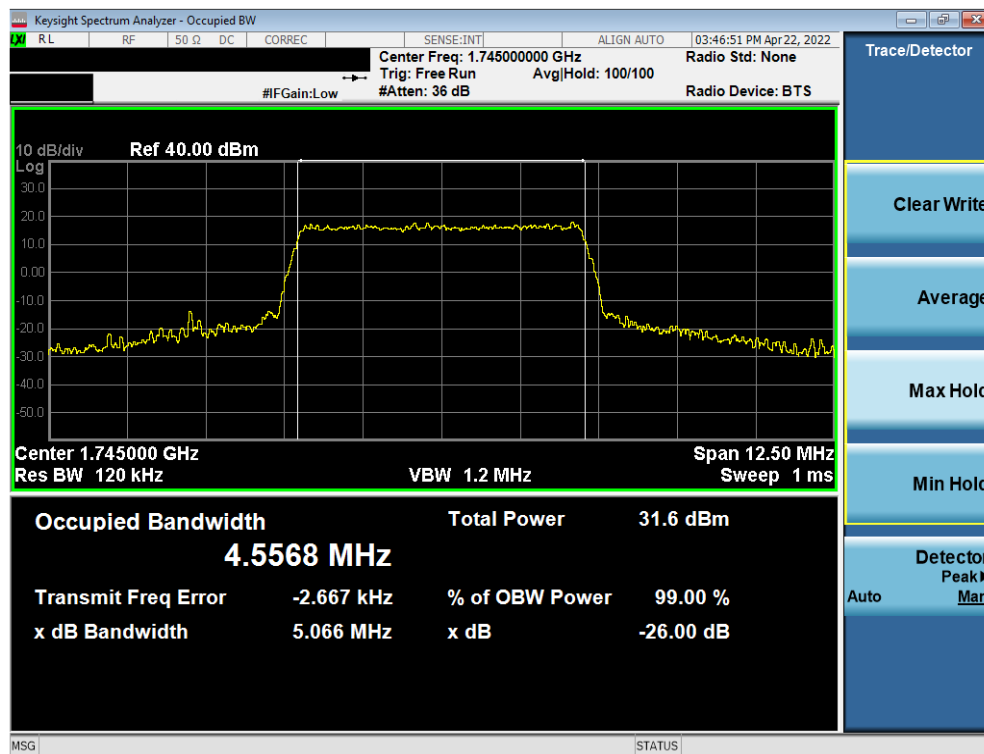


Plot 7-4. Occupied Bandwidth Plot (LTE Band 66/4 - 3MHz 16-QAM - Full RB)


FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 16 of 122



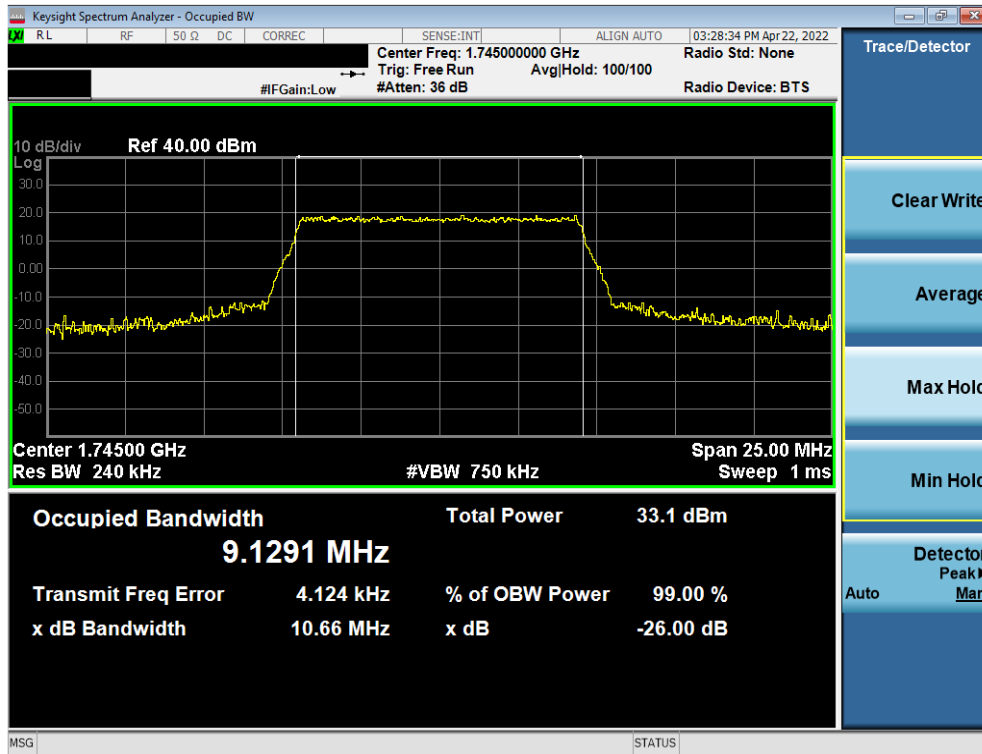
Plot 7-5. Occupied Bandwidth Plot (LTE Band 66/4 - 5MHz QPSK - Full RB)



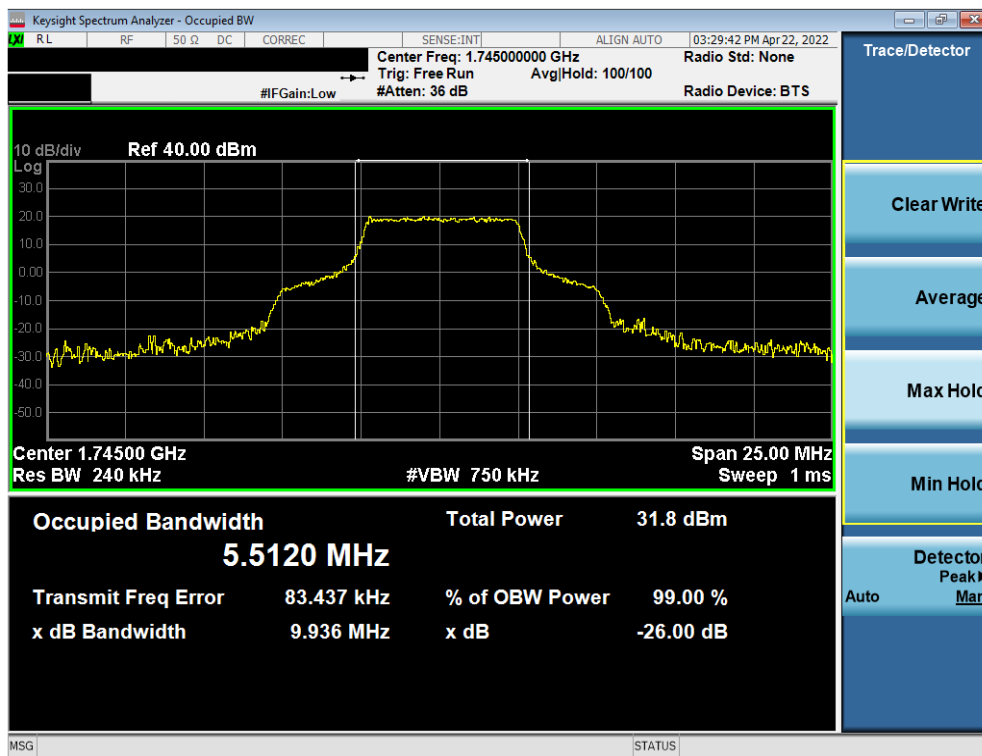
Plot 7-6. Occupied Bandwidth Plot (LTE Band 66/4 - 5MHz 16-QAM - Full RB)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 17 of 122


V2.1 11/9/2021



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

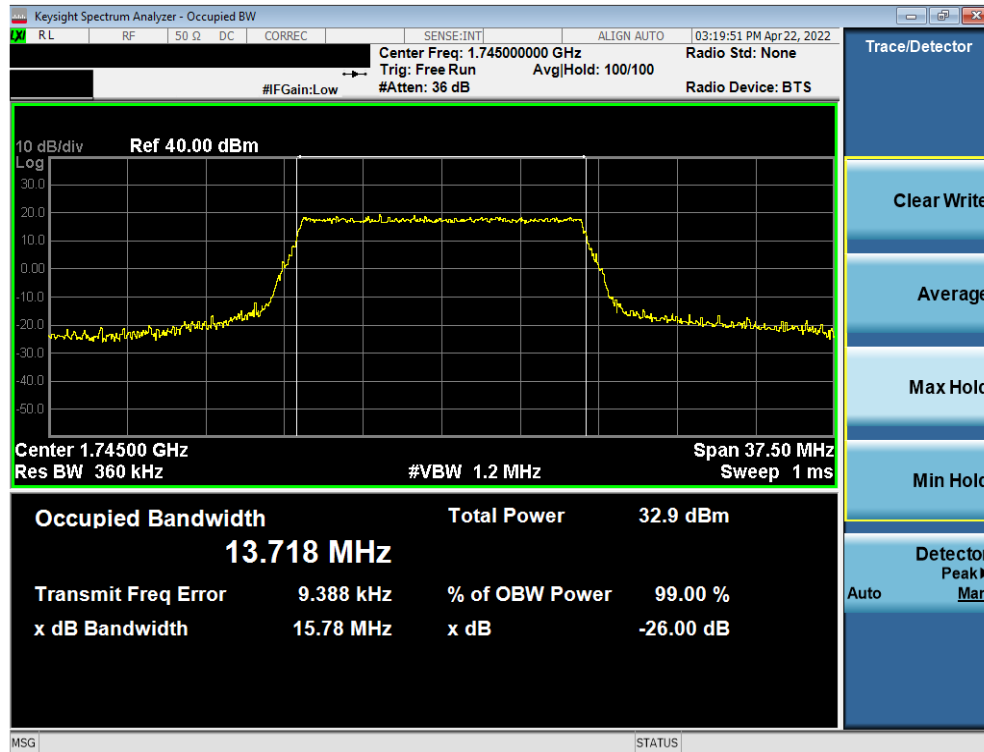


Plot 7-8. Occupied Bandwidth Plot (LTE Band 66/4 - 10MHz 16-QAM - Full RB)

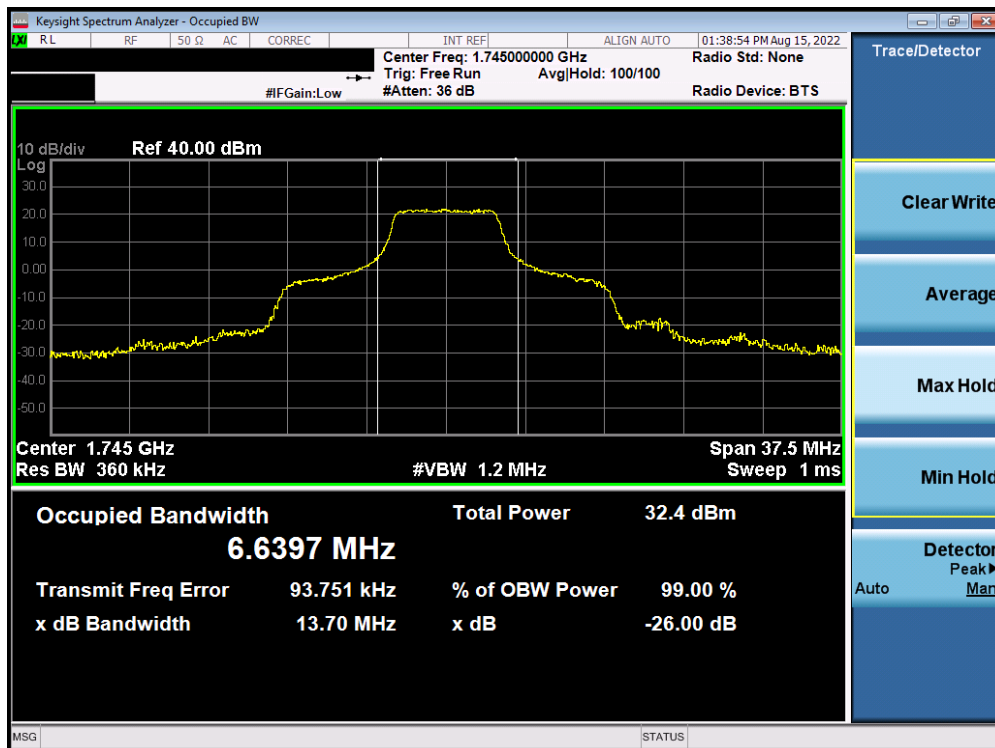
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 18 of 122

V2.1 11/9/2021


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Plot 7-9. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz QPSK - Full RB)

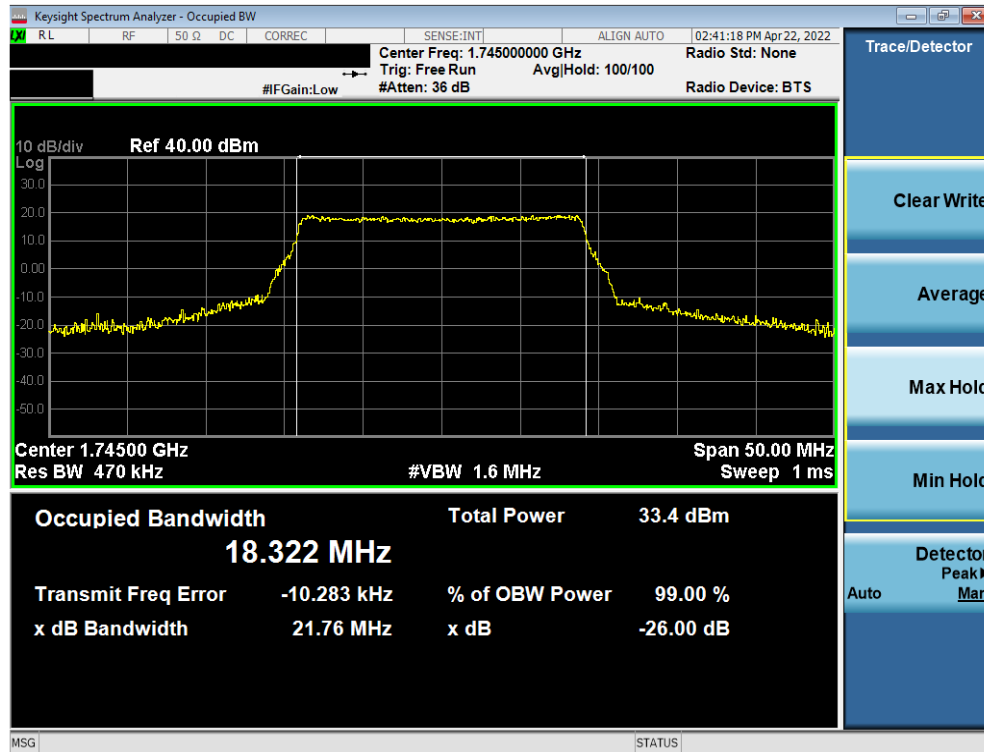


Plot 7-10. Occupied Bandwidth Plot (LTE Band 66/4 - 15MHz 16-QAM - Full RB)

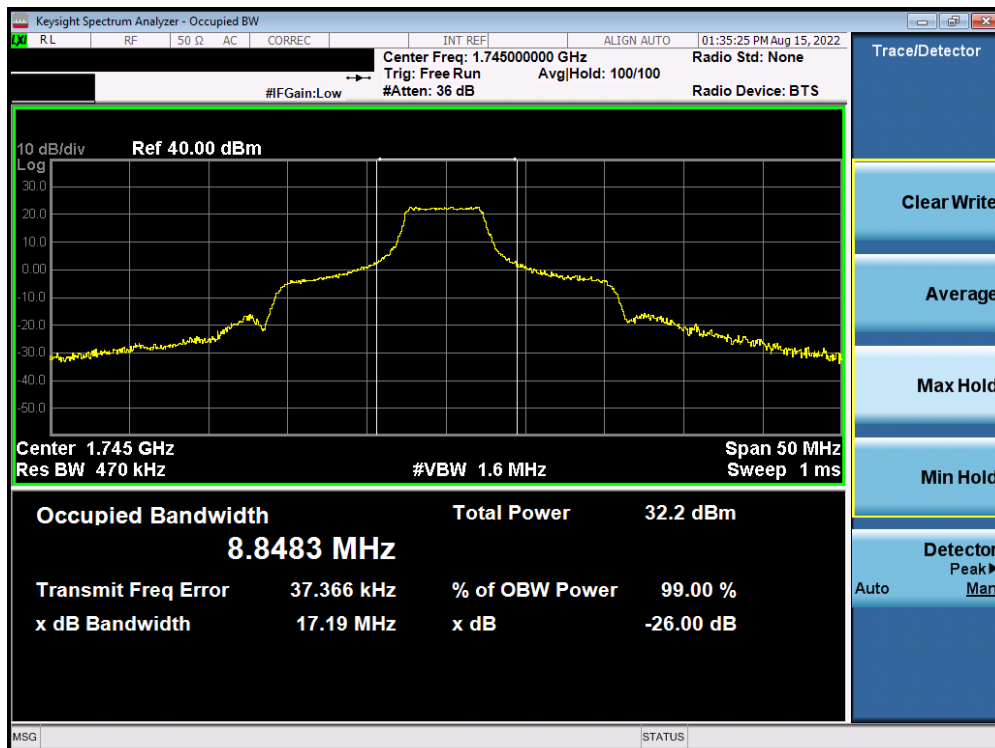
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 19 of 122

V2.1 11/9/2021


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Plot 7-11. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz QPSK - Full RB)

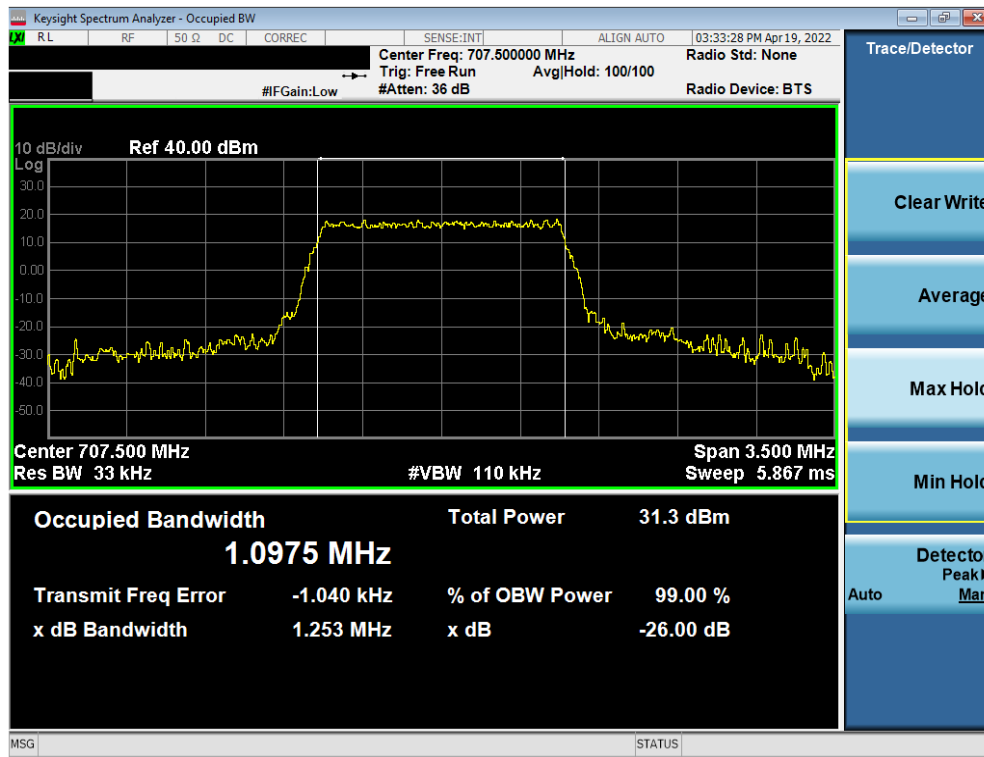


Plot 7-12. Occupied Bandwidth Plot (LTE Band 66/4 - 20MHz 16-QAM - Full RB)

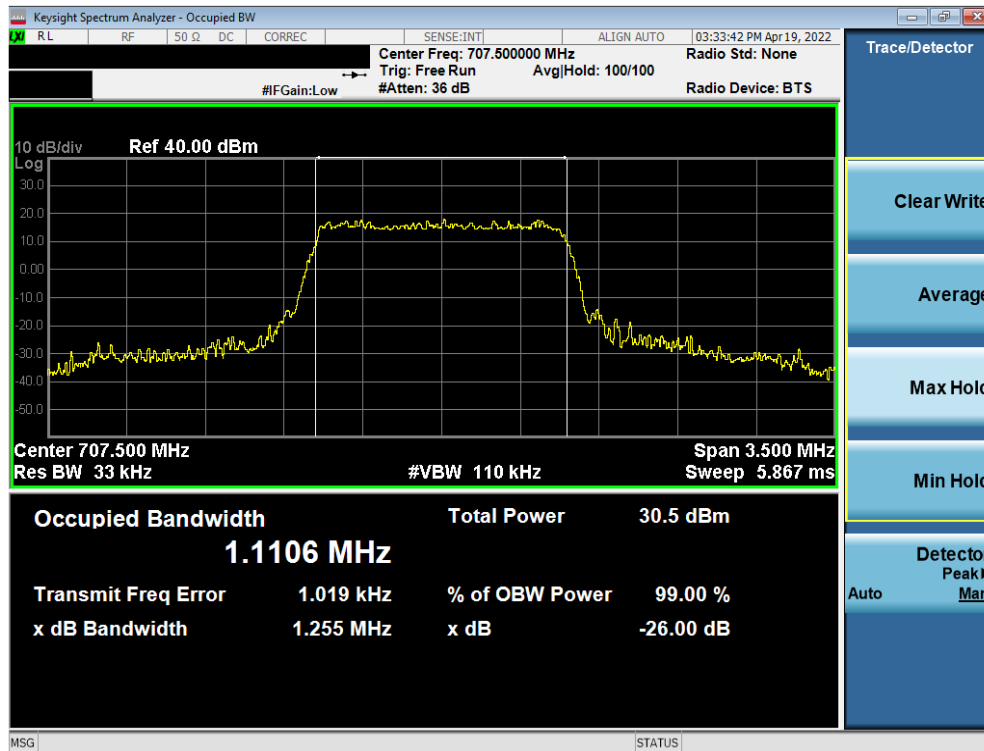
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 20 of 122

V2.1 11/9/2021


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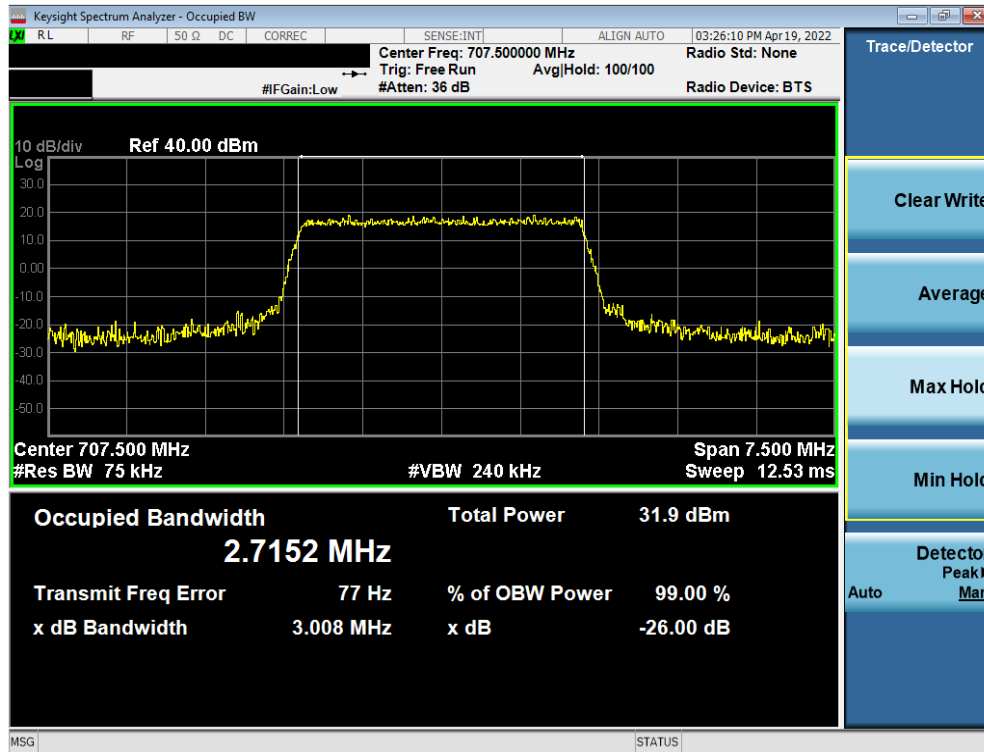


Plot 7-13. Occupied Bandwidth Plot (LTE Band 12 – 1.4MHz QPSK - Full RB)

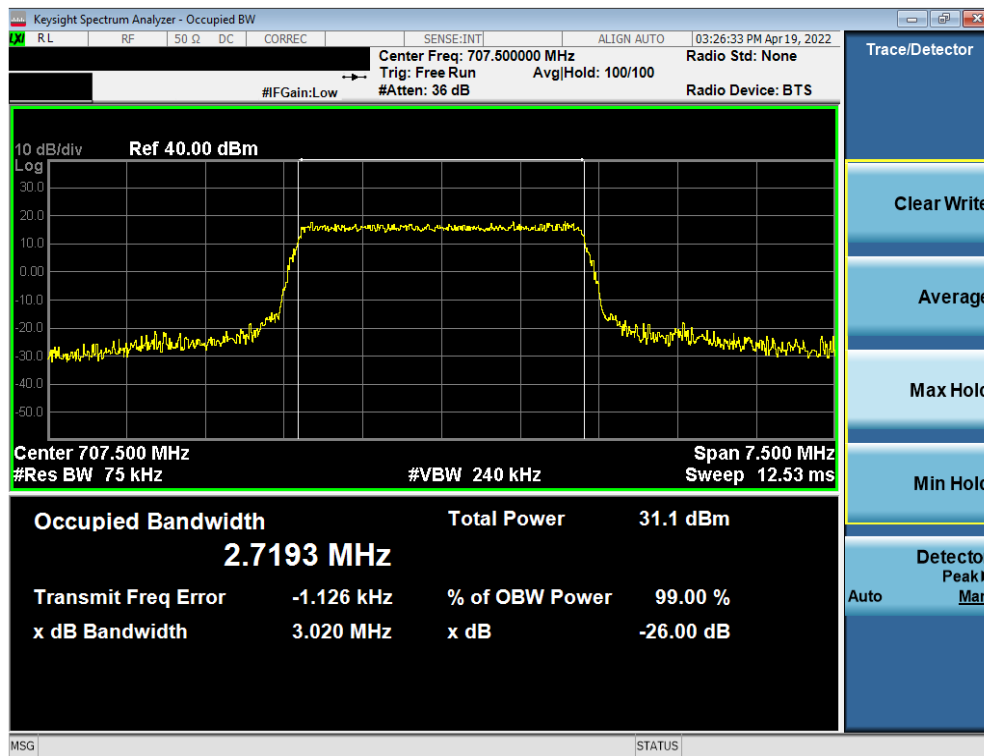


Plot 7-14. Occupied Bandwidth Plot (LTE Band 12 – 1.4MHz 16-QAM - Full RB)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 21 of 122



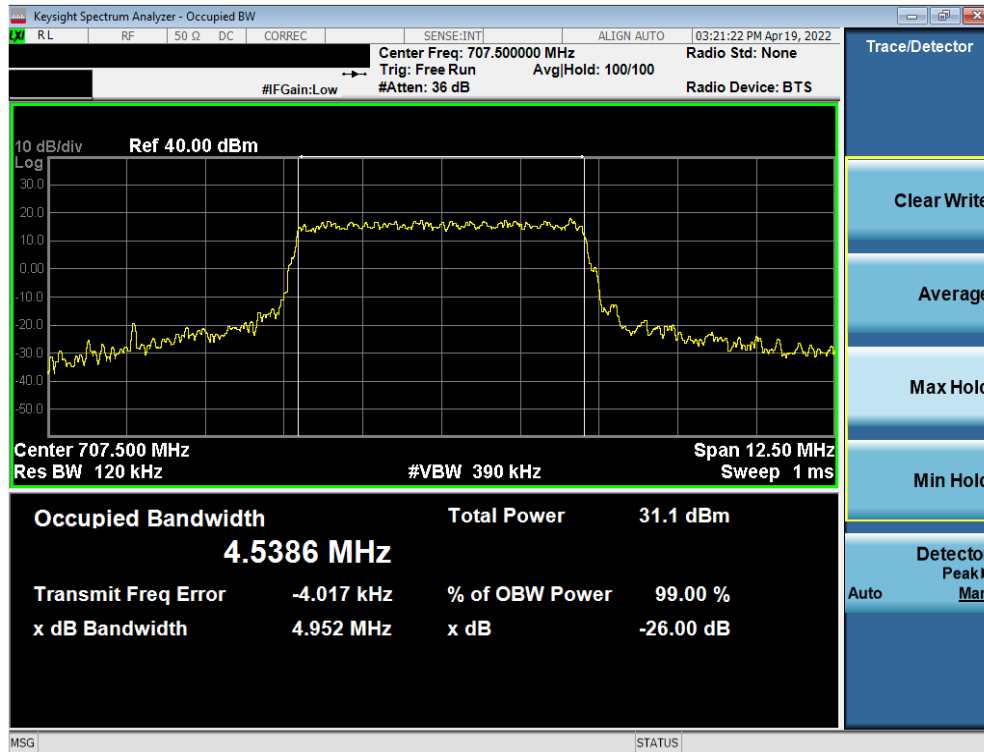
Plot 7-15. Occupied Bandwidth Plot (LTE Band 12 - 3MHz QPSK - Full RB)



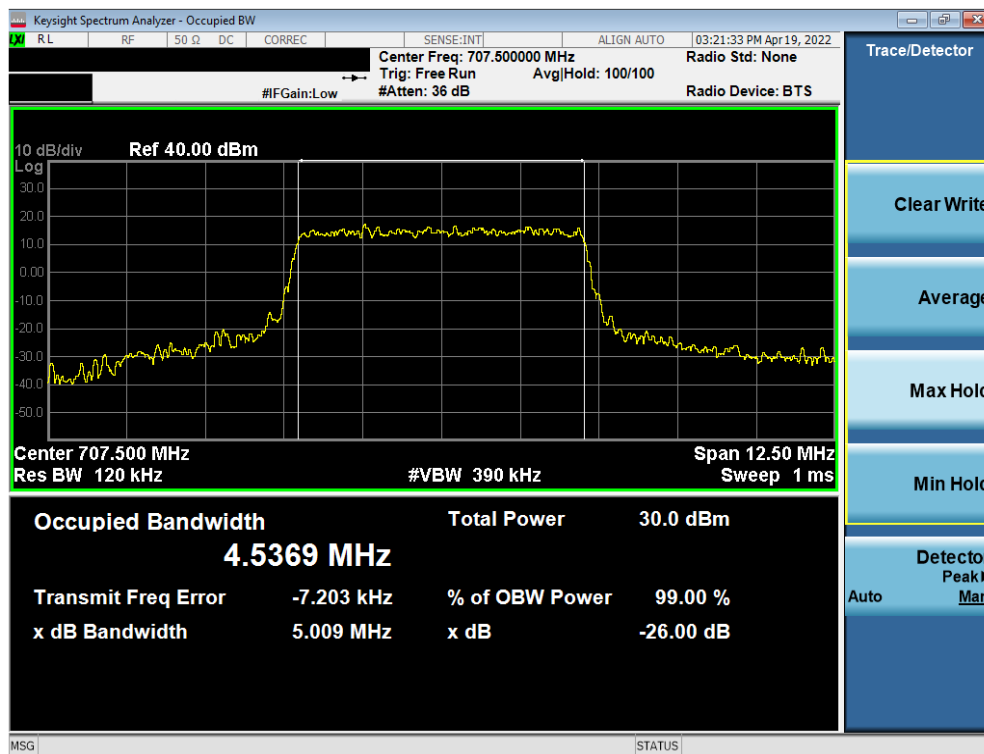
Plot 7-16. Occupied Bandwidth Plot (LTE Band 12 - 3MHz 16-QAM - Full RB)

FCC ID: BCG-A2727	<p>element</p> <p>PART 27 MEASUREMENT REPORT</p>		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 22 of 122


V2.1 11/9/2021



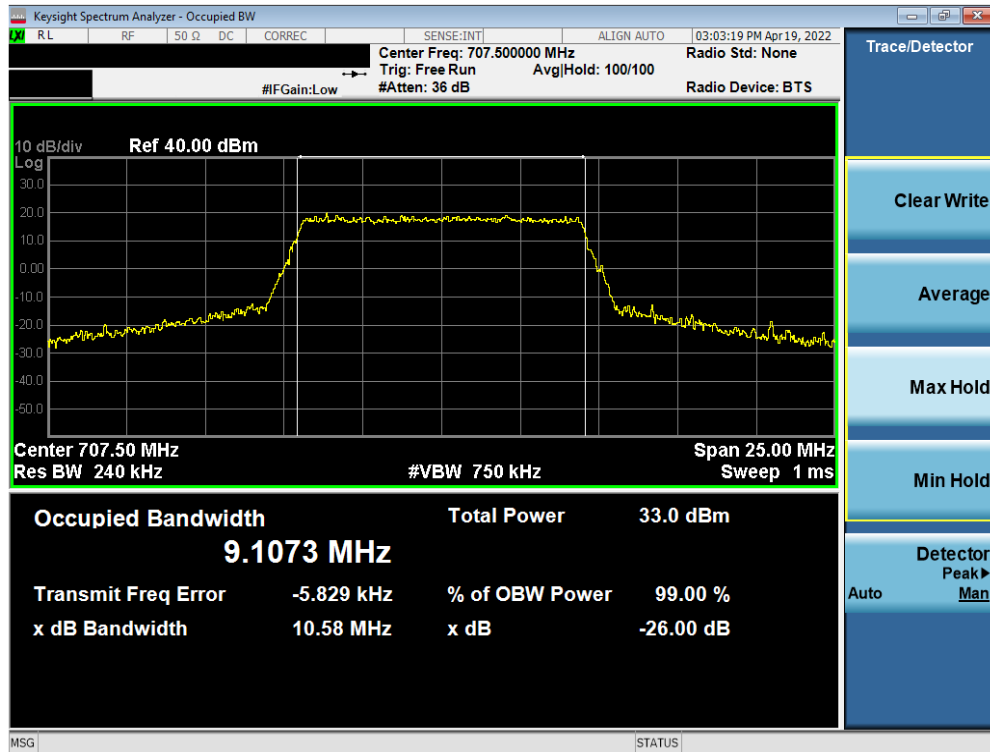
Plot 7-17. Occupied Bandwidth Plot (LTE Band 12/17 - 5MHz QPSK - Full RB)



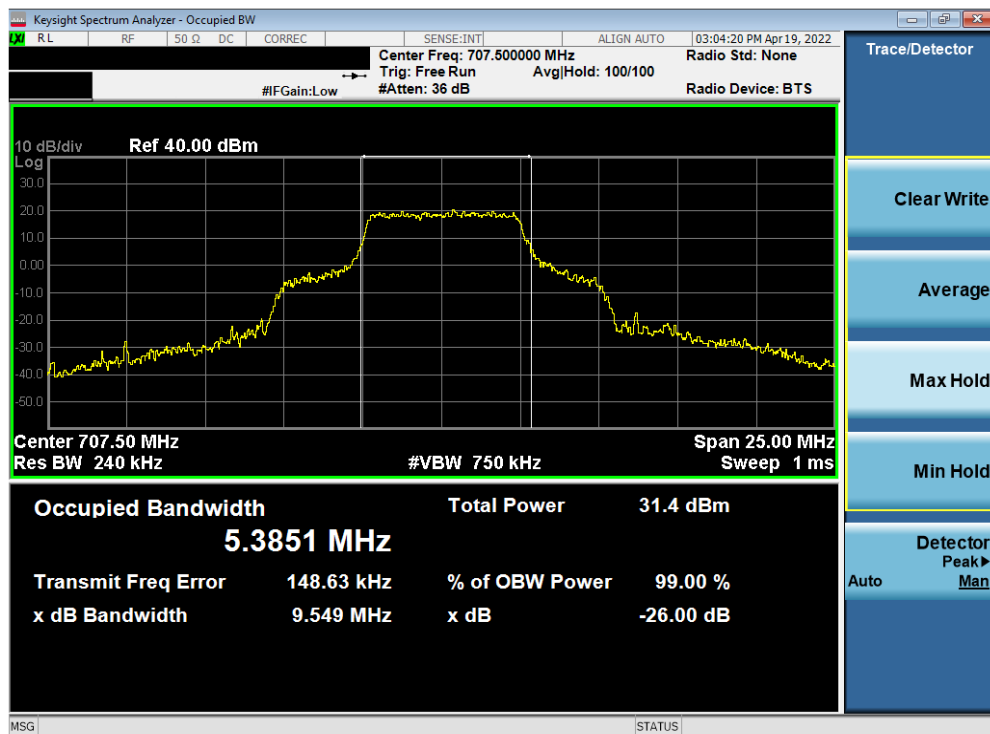
Plot 7-18. Occupied Bandwidth Plot (LTE Band 12/17 - 5MHz 16-QAM - Full RB)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 23 of 122


V2.1 11/9/2021



Plot 7-19. Occupied Bandwidth Plot (LTE Band 12/17 - 10MHz QPSK - Full RB)



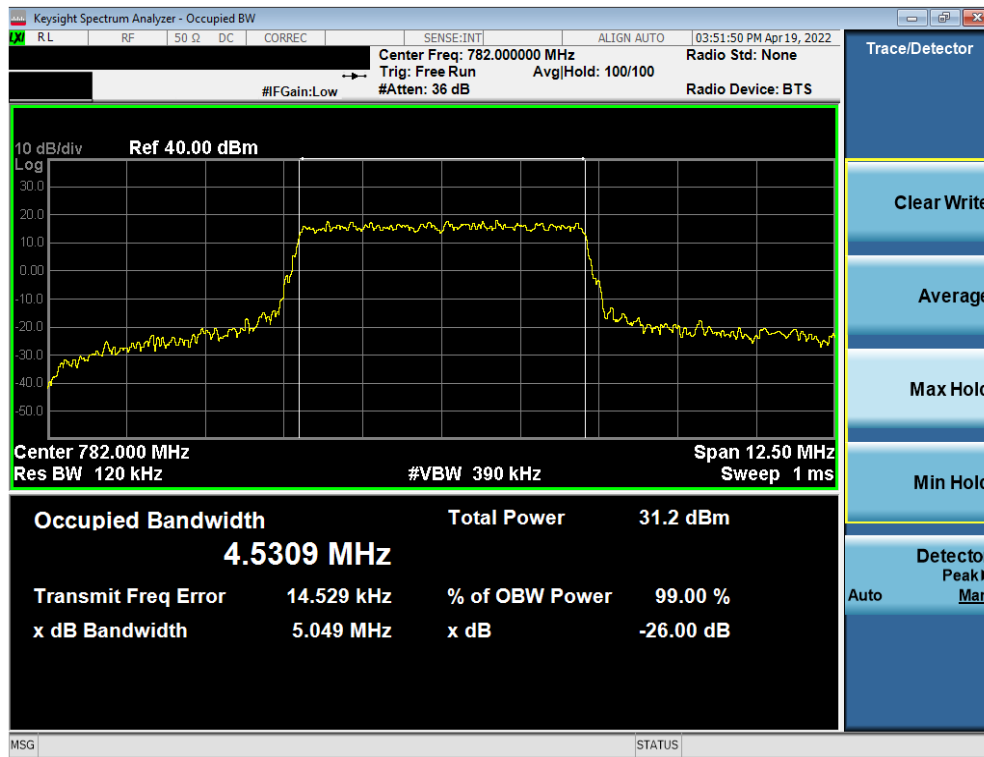
Plot 7-20. Occupied Bandwidth Plot (LTE Band 12/17 - 10MHz 16-QAM - Full RB)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 24 of 122

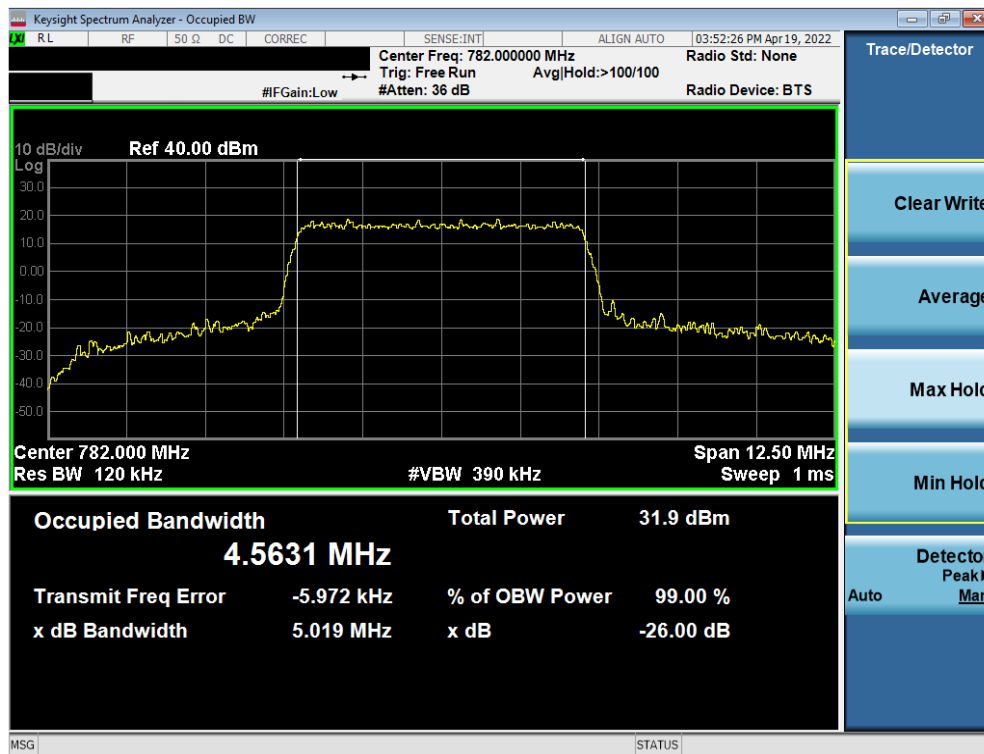
V2.1 11/9/2021

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LTE Band 13



Plot 7-21. Occupied Bandwidth Plot (LTE Band 13 - 5MHz QPSK - Full RB)

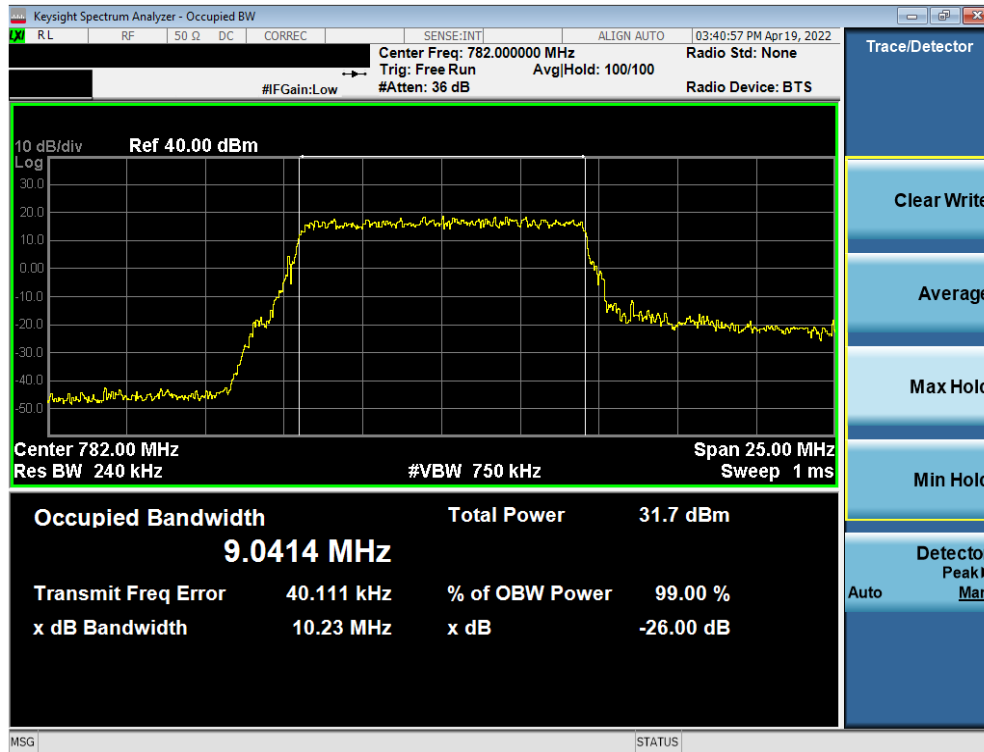


Plot 7-22. Occupied Bandwidth Plot (LTE Band 13 - 5MHz 16-QAM - Full RB)

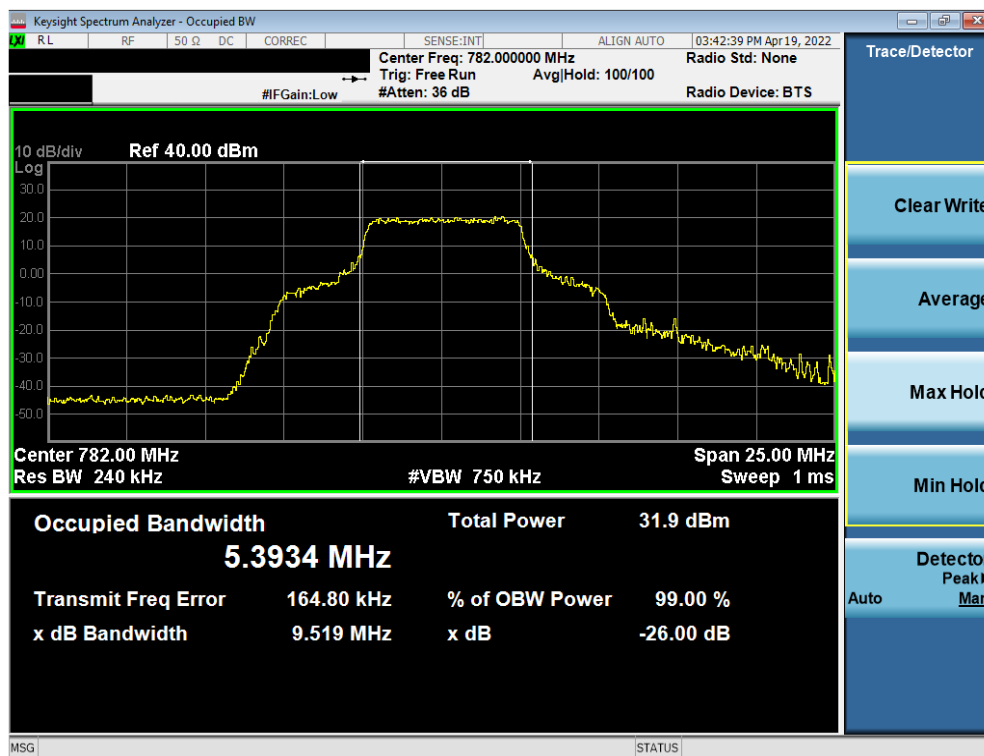
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 25 of 122

V2.1 11/9/2021


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Plot 7-23. Occupied Bandwidth Plot (LTE Band 13 - 10MHz QPSK - Full RB)

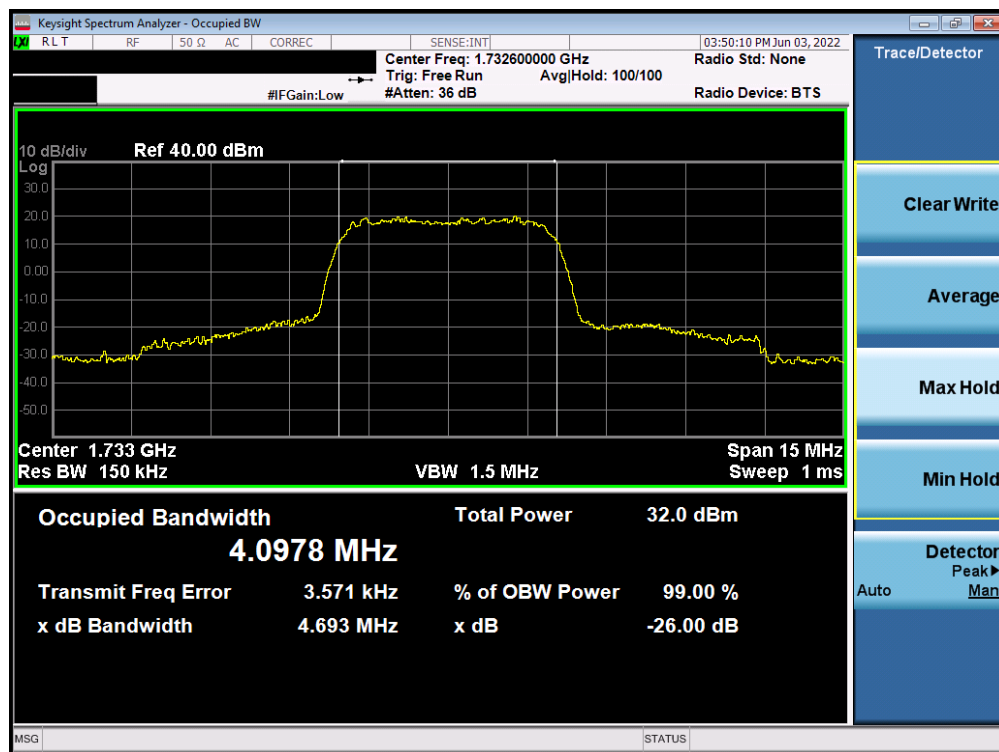


Plot 7-24. Occupied Bandwidth Plot (LTE Band 13 - 10MHz 16-QAM - Full RB)


FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 26 of 122

V2.1 11/9/2021

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Plot 7-25. Occupied Bandwidth Plot (WCDMA, Ch. 1413)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 27 of 122

7.3 Spurious and Harmonic Emissions at Antenna Terminal

\$2.1051, \$27.53

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 18GHz (separated into at least two plots per channel)
2. RBW \geq 100kHz
3. VBW \geq 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

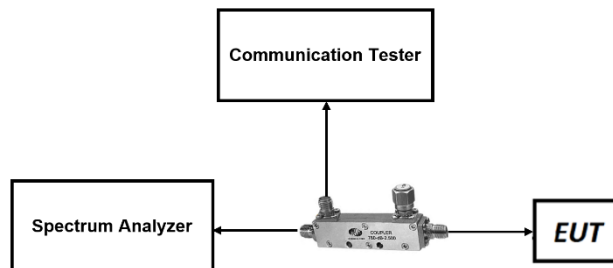




Figure 7-2. Test Instrument & Measurement Setup

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch
		Page 28 of 122

V2.1 11/9/2021

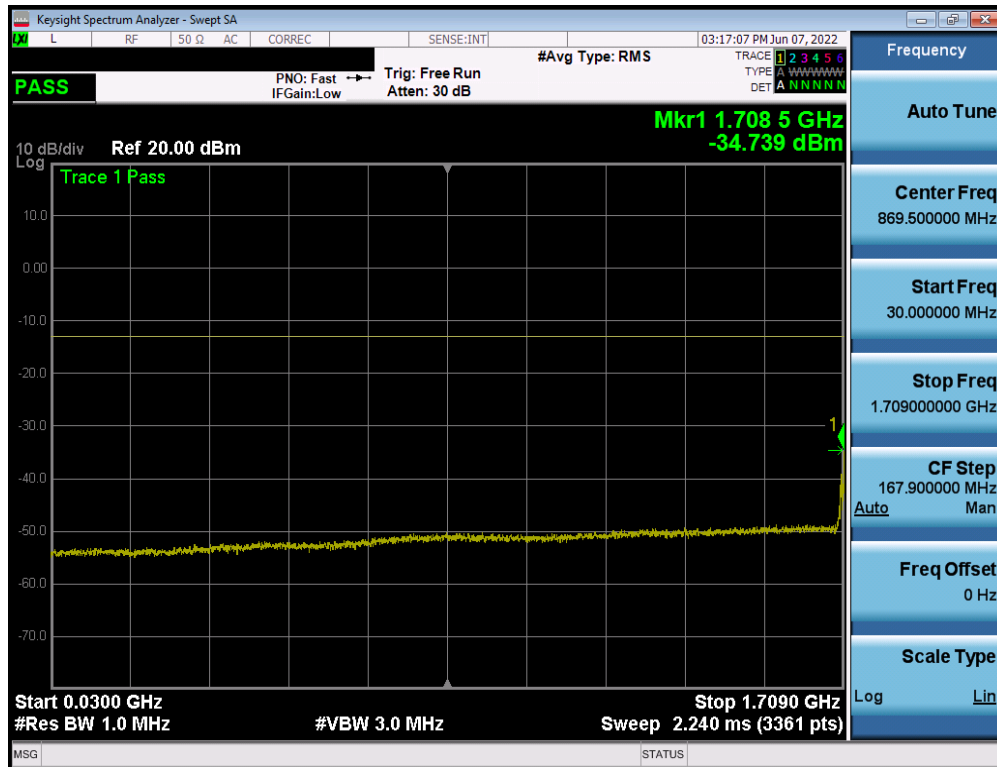
Test Notes

1. Per Part 27, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

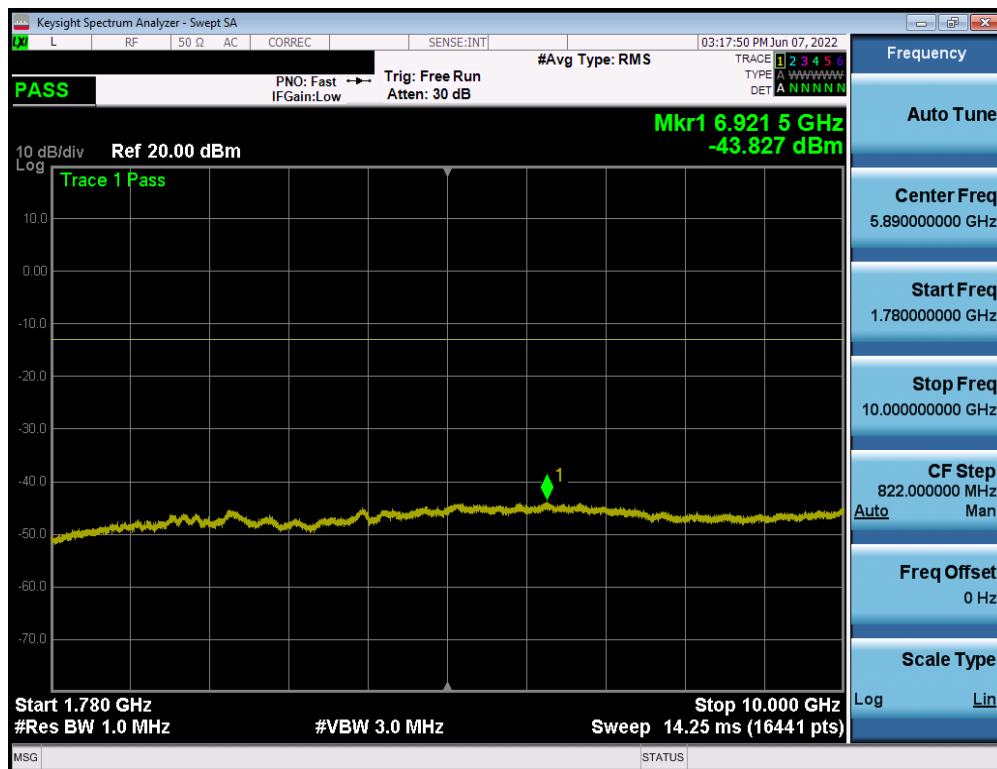
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 29 of 122

V2.1 11/9/2021

LTE Band 66/4



Plot 7-26. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



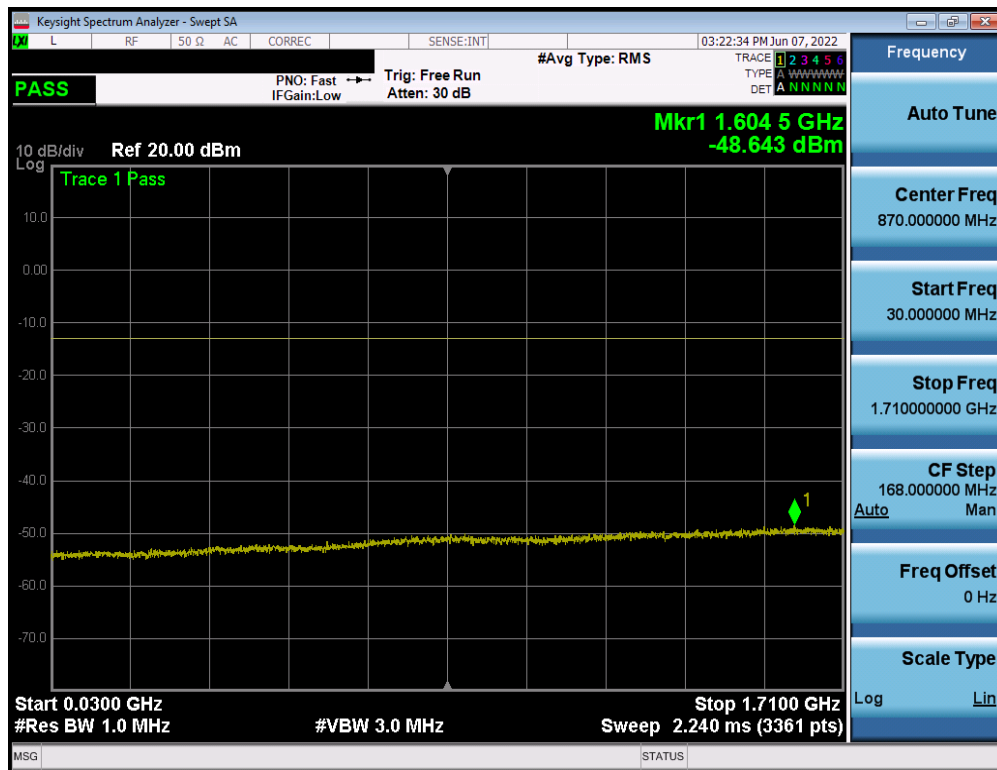
Plot 7-27. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 30 of 122

V2.1 11/9/2021



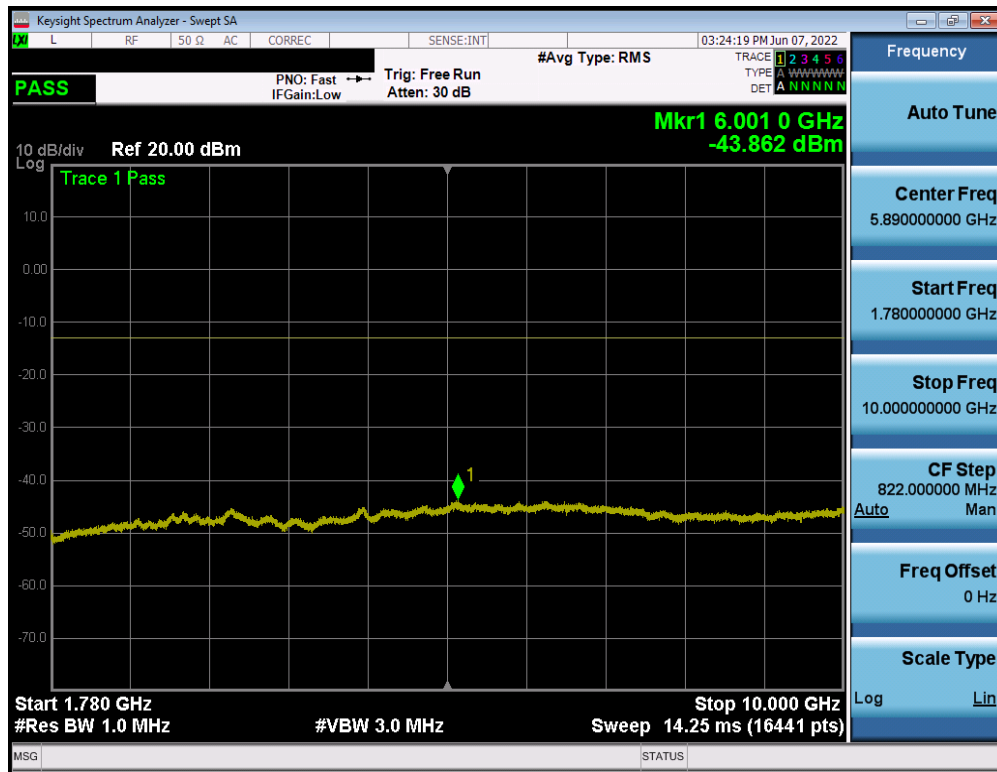
Plot 7-28. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



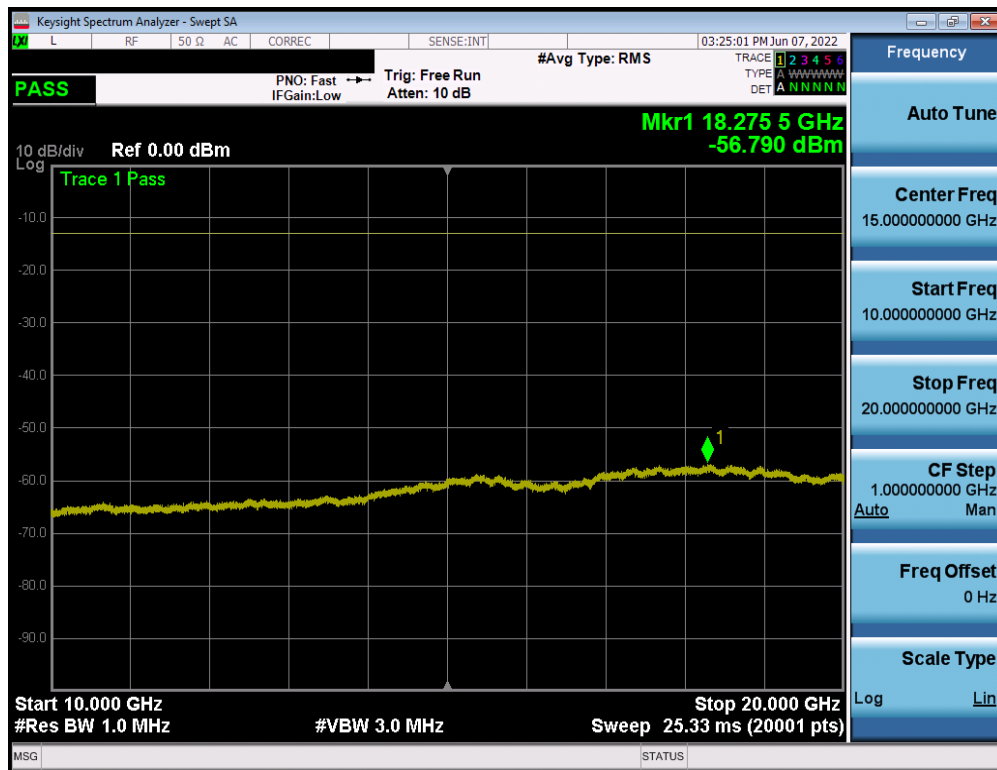
Plot 7-29. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCG-A2727	<p>element</p> <p>PART 27 MEASUREMENT REPORT</p>		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 31 of 122

V2.1 11/9/2021



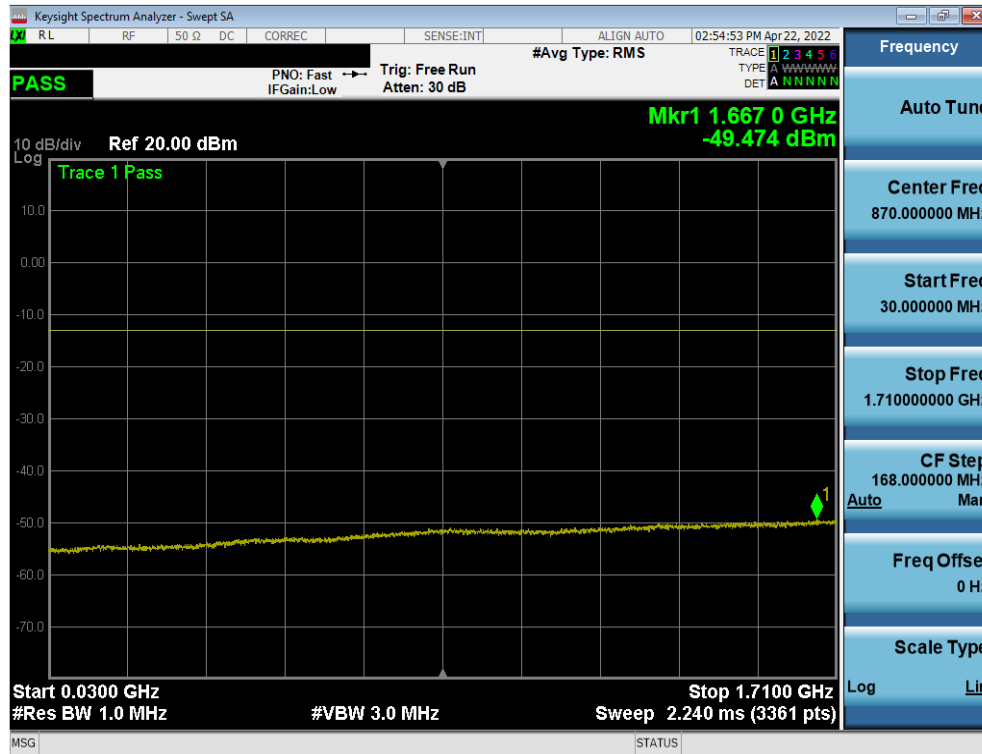
Plot 7-30. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



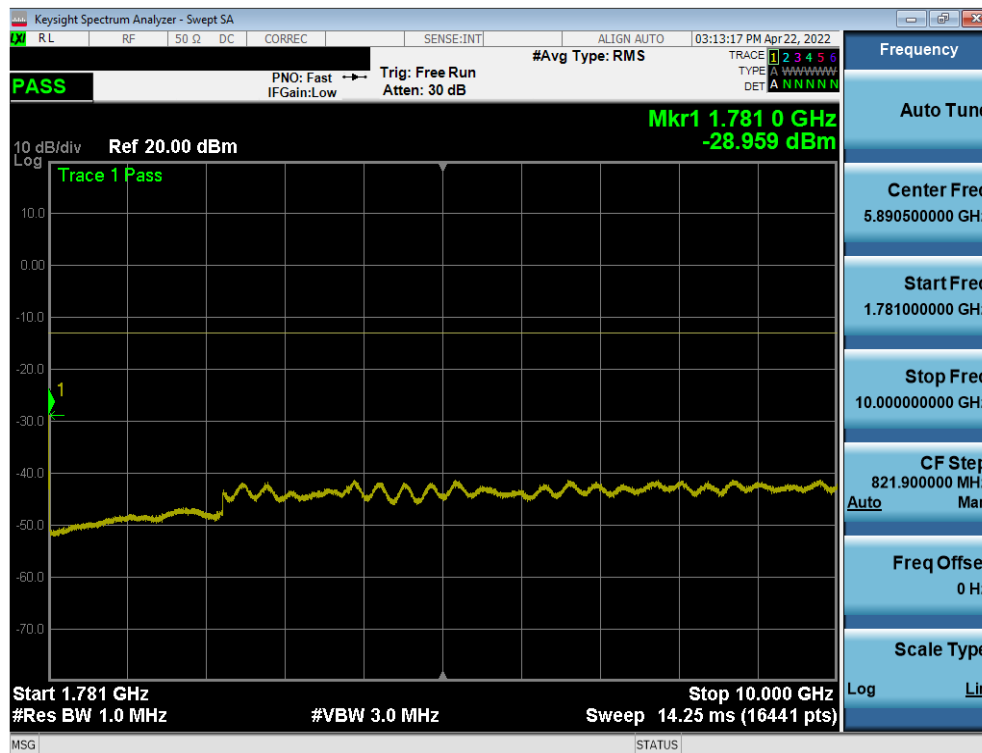
Plot 7-31. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 32 of 122

V2.1 11/9/2021



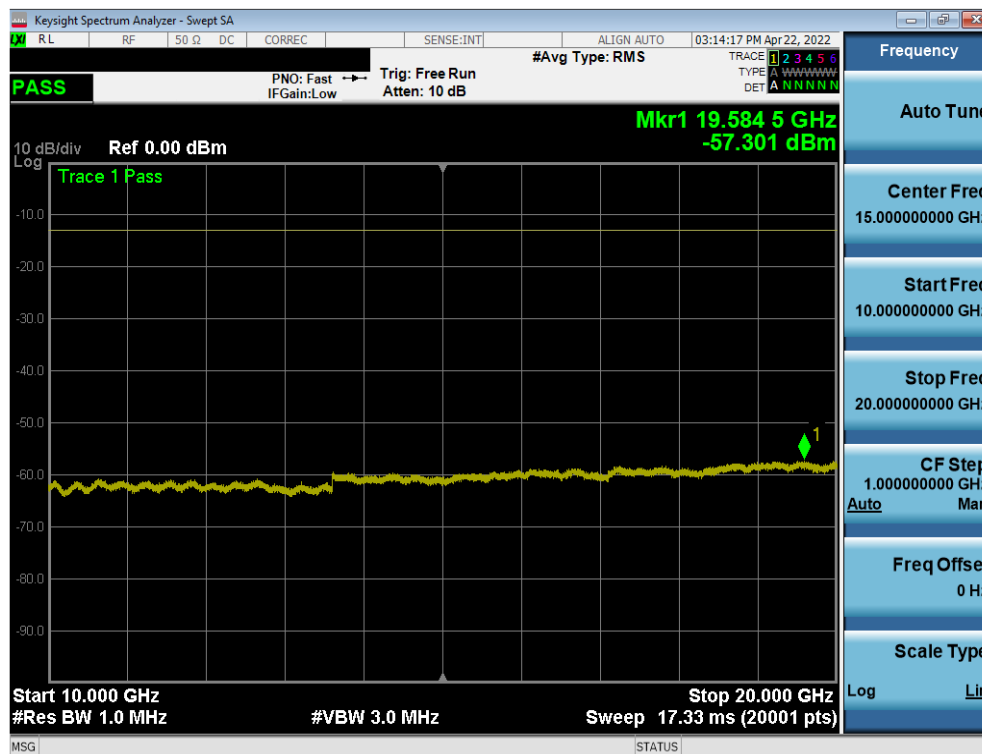
Plot 7-32. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)




Plot 7-33. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 33 of 122

V2.1 11/9/2021

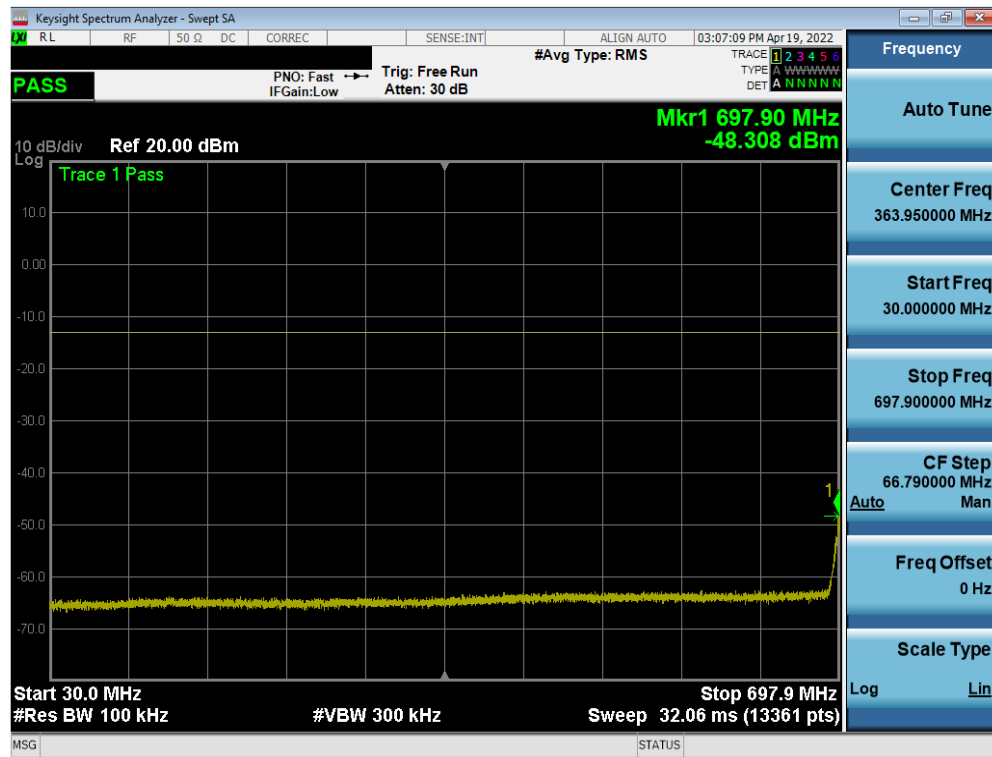


Plot 7-34. Conducted Spurious Plot (LTE Band 66/4 - 20MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

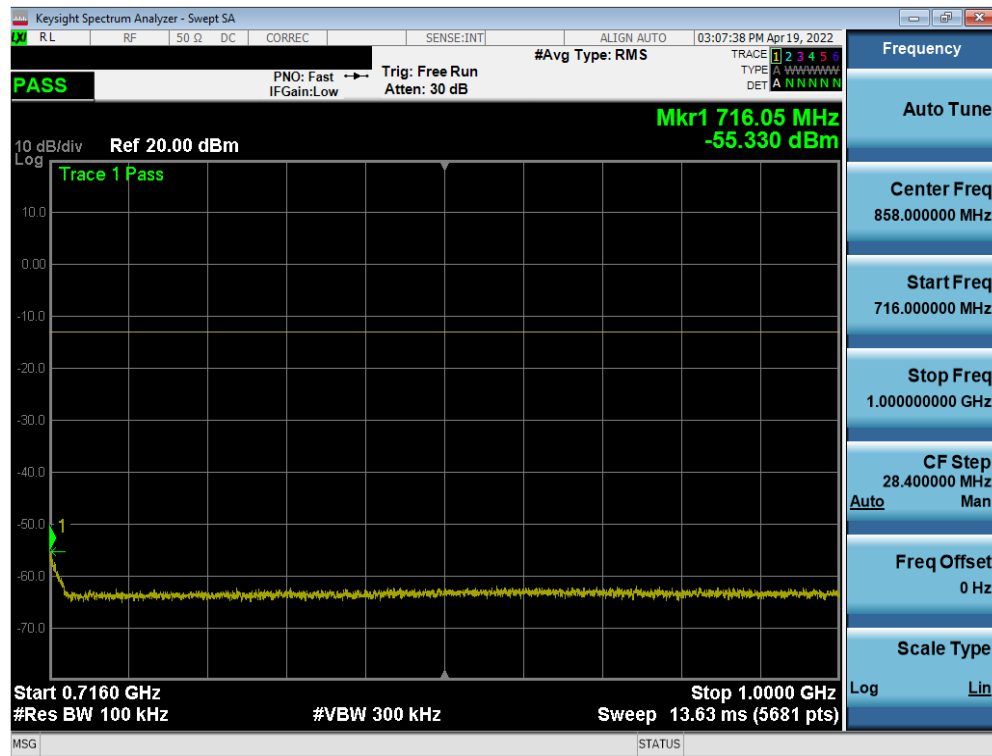
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 34 of 122

V2.1 11/9/2021


LTE Band 12/17



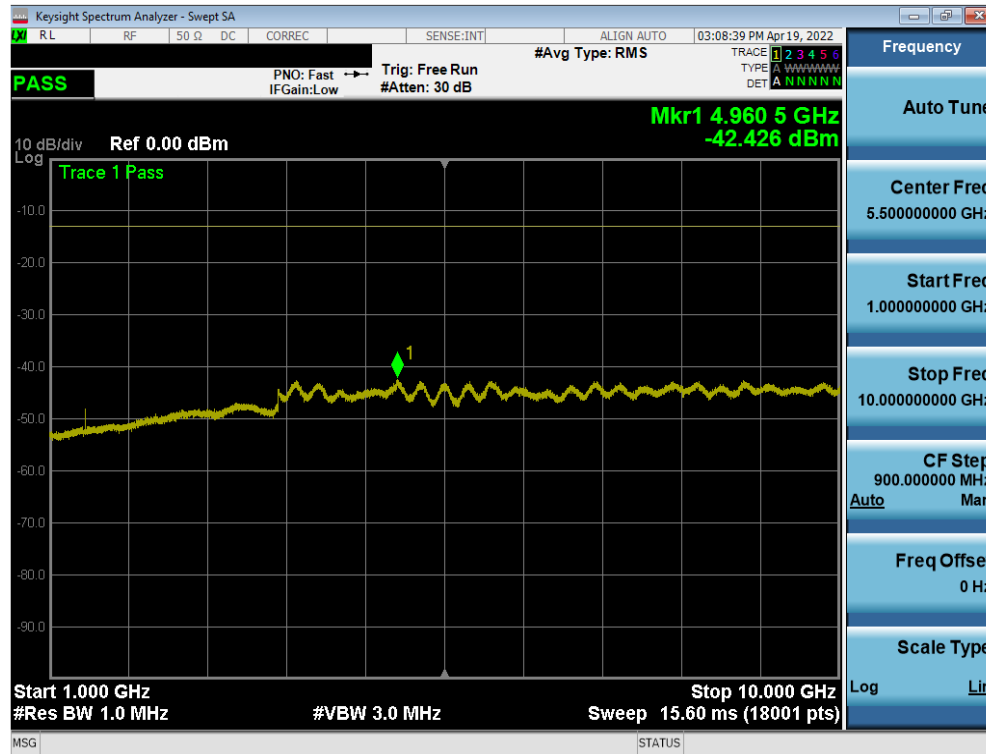
Plot 7-35. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



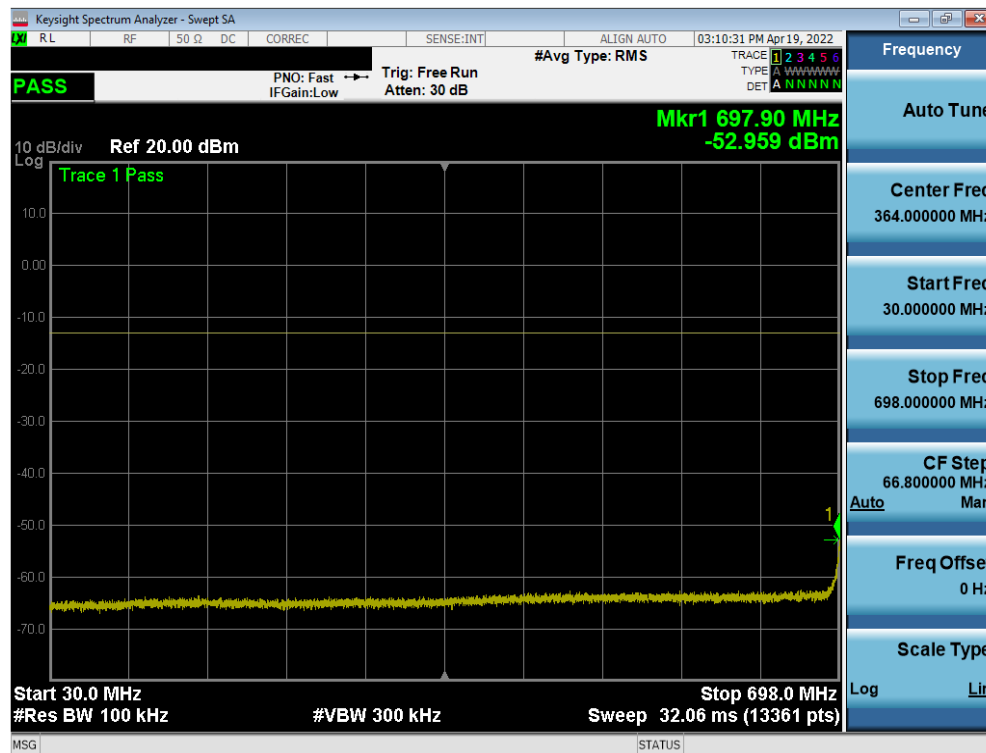
Plot 7-36. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 35 of 122


V2.1 11/9/2021



Plot 7-37. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

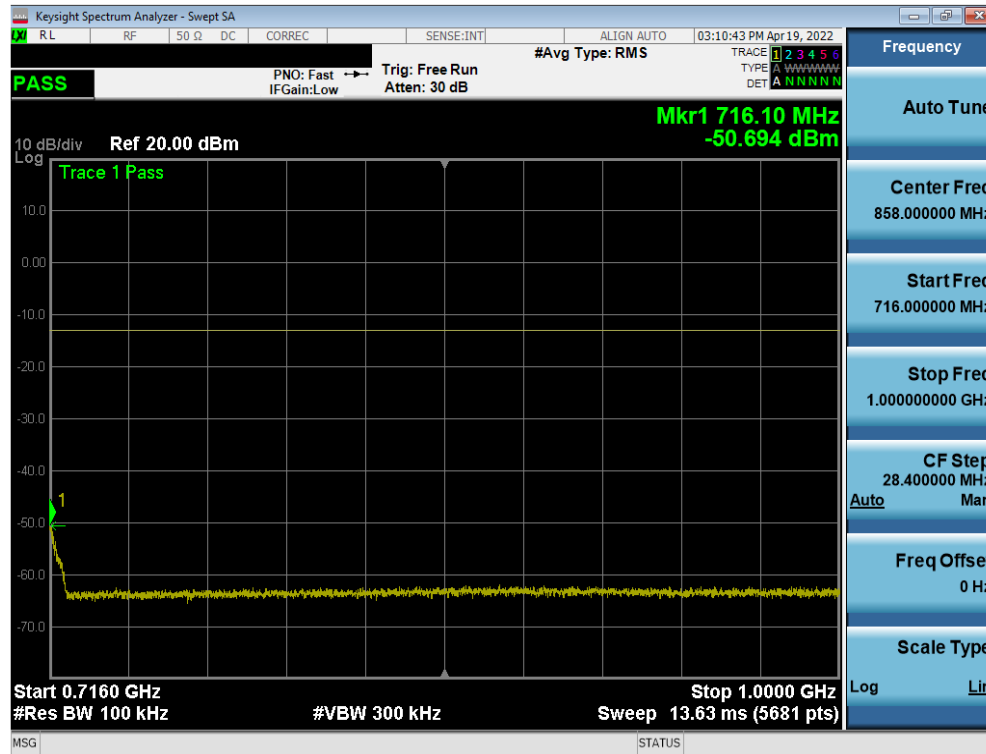


Plot 7-38. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

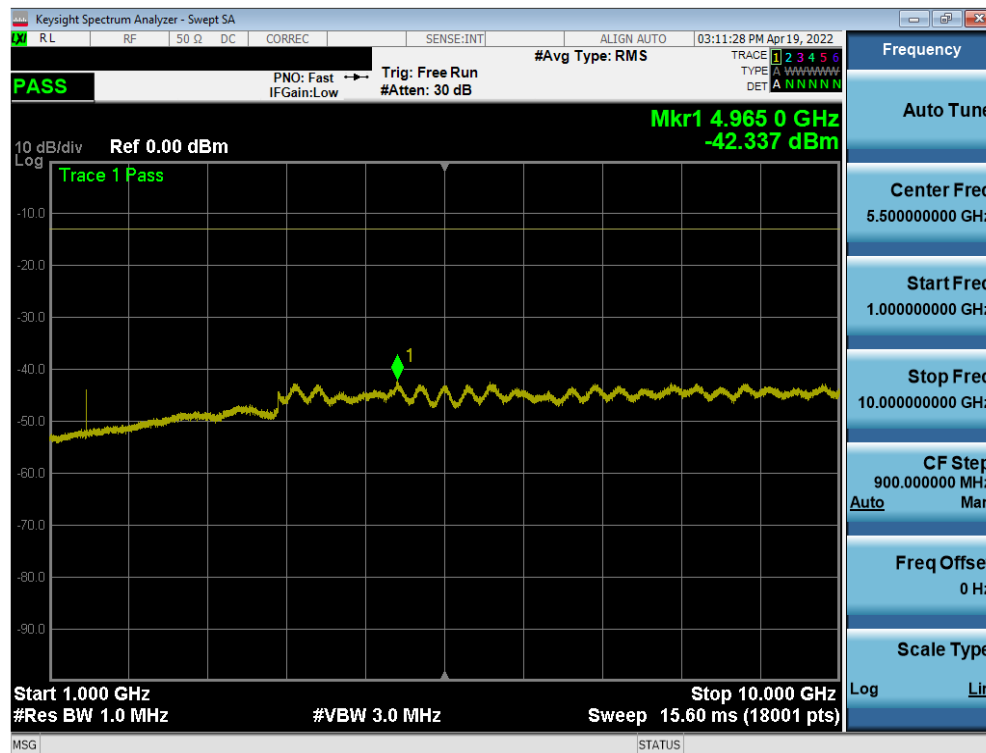
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 36 of 122

V2.1 11/9/2021

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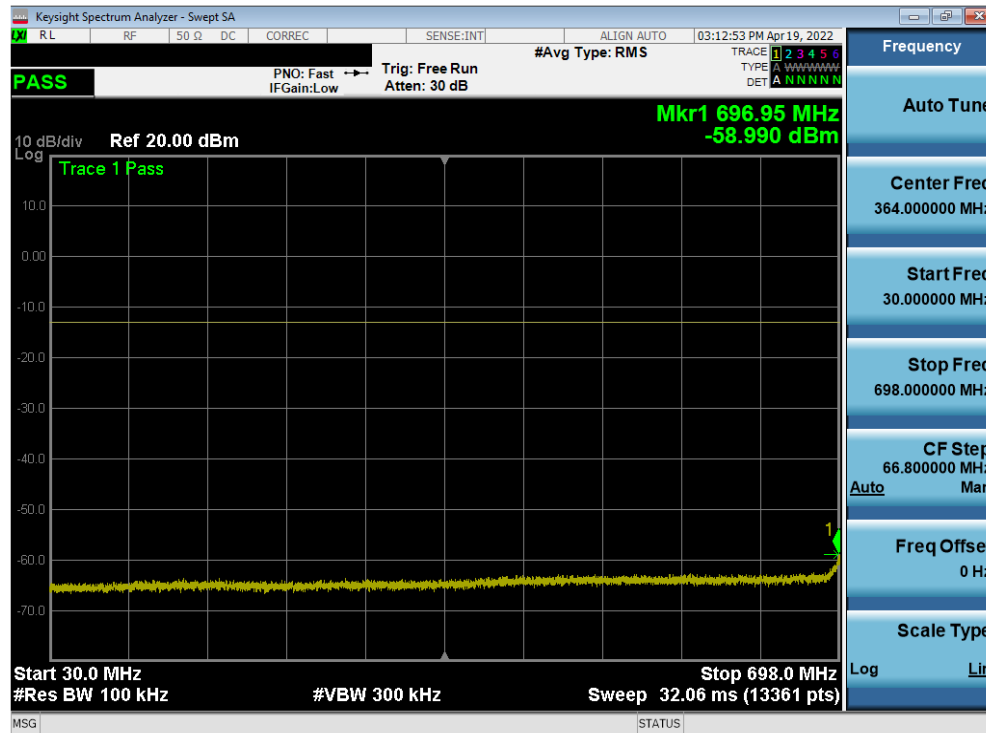


Plot 7-39. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

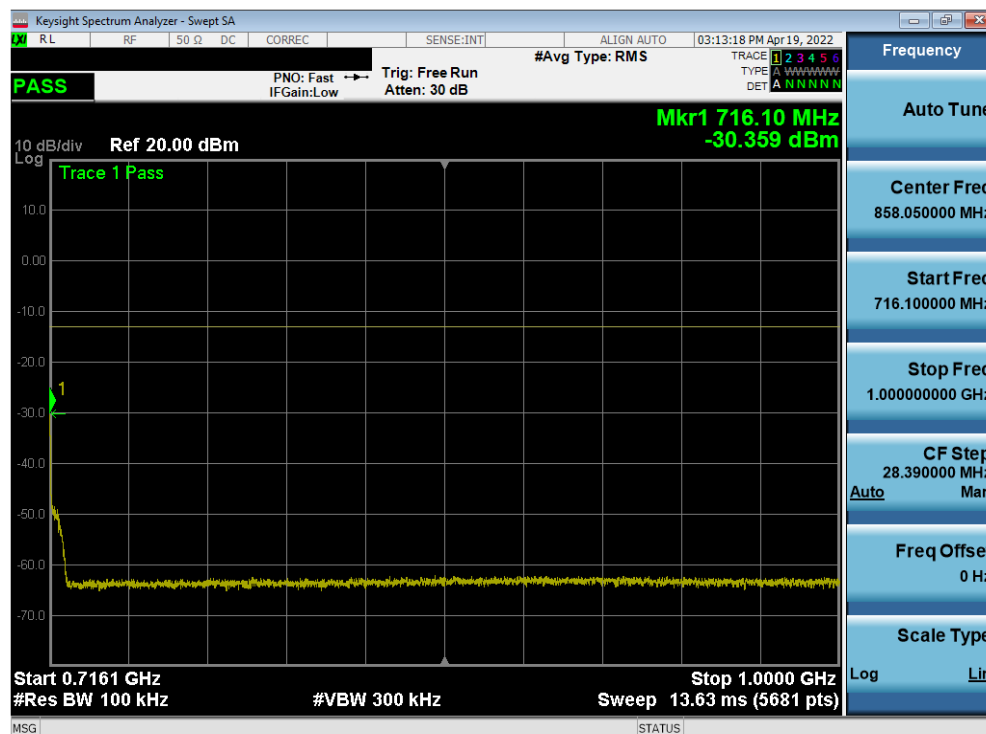


Plot 7-40. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 37 of 122

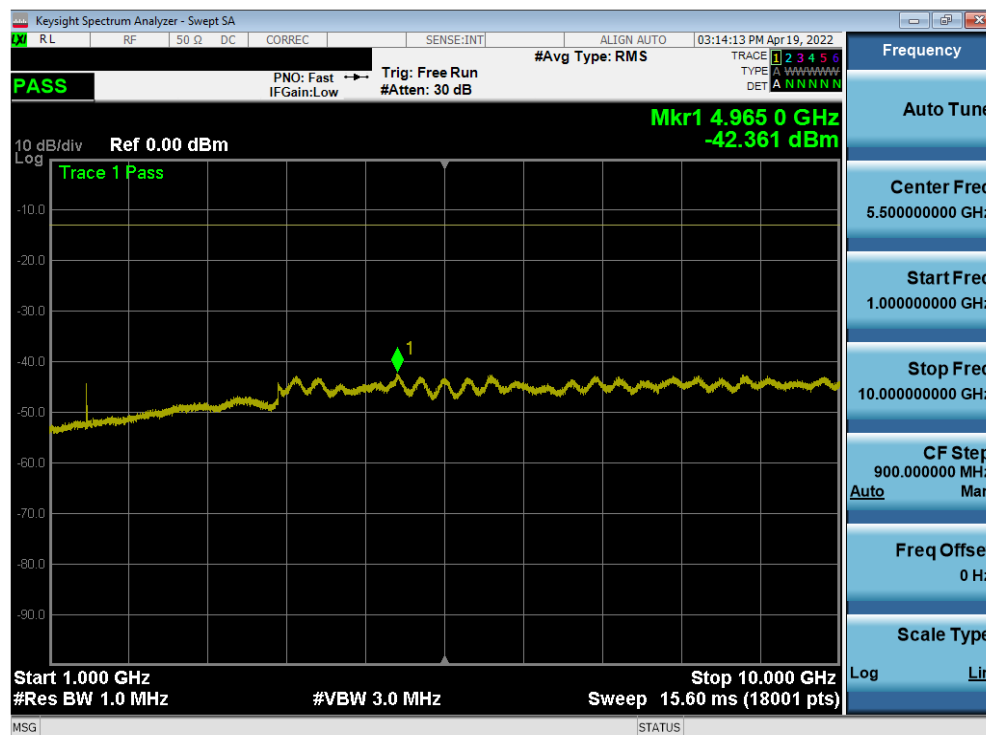


Plot 7-41. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-42. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCG-A2727	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 38 of 122

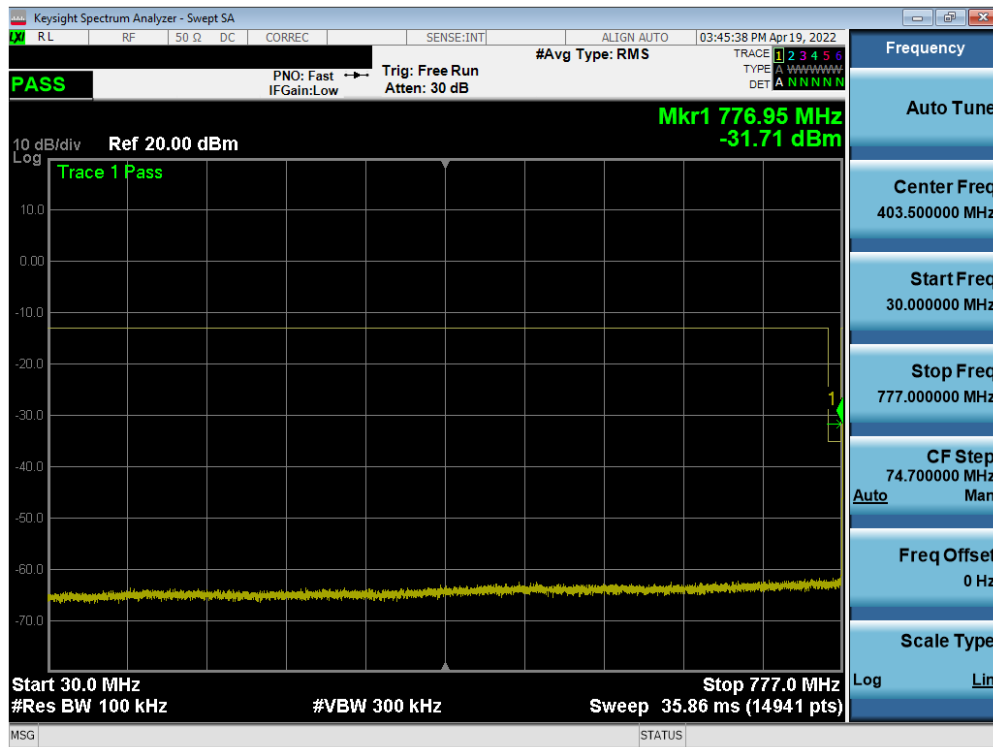


Plot 7-43. Conducted Spurious Plot (LTE Band 12/17 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

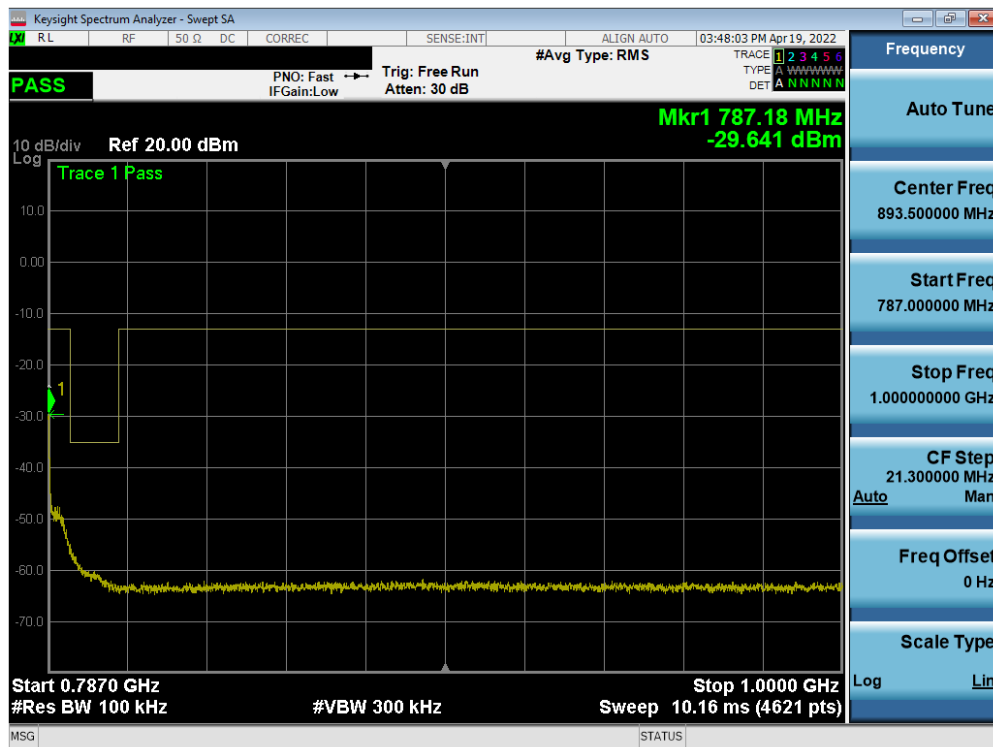
FCC ID: BCG-A2727	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 39 of 122

V2.1 11/9/2021


LTE Band 13



Plot 7-44. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - RB Size 1, RB Offset 0)

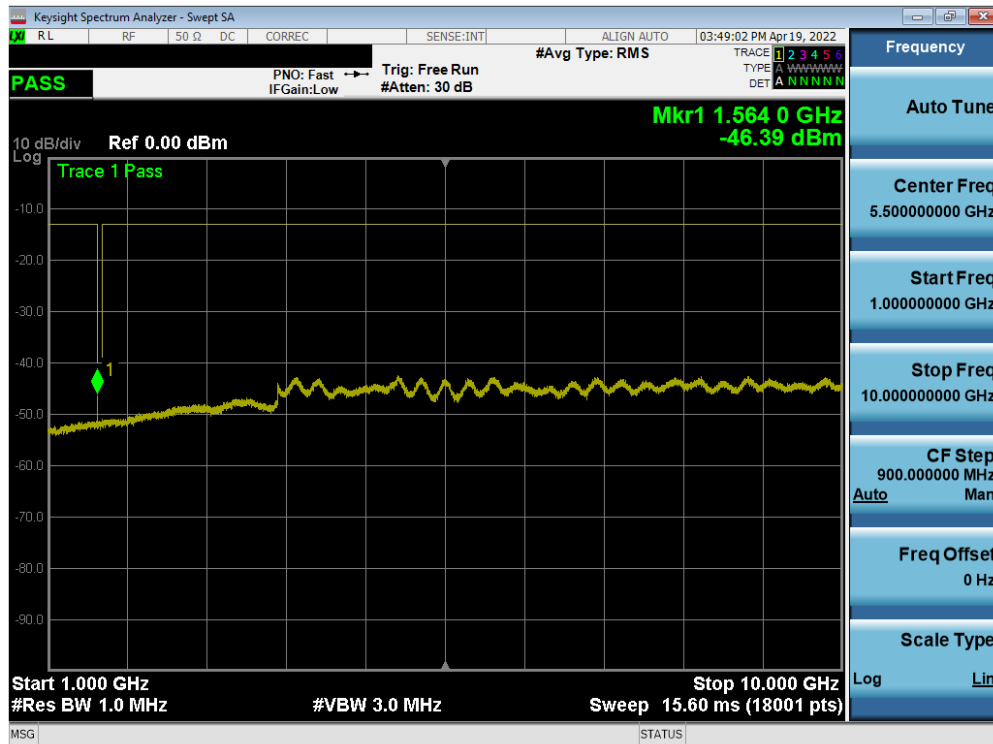


Plot 7-45. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - RB Size 1, RB Offset 0)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 40 of 122

V2.1 11/9/2021

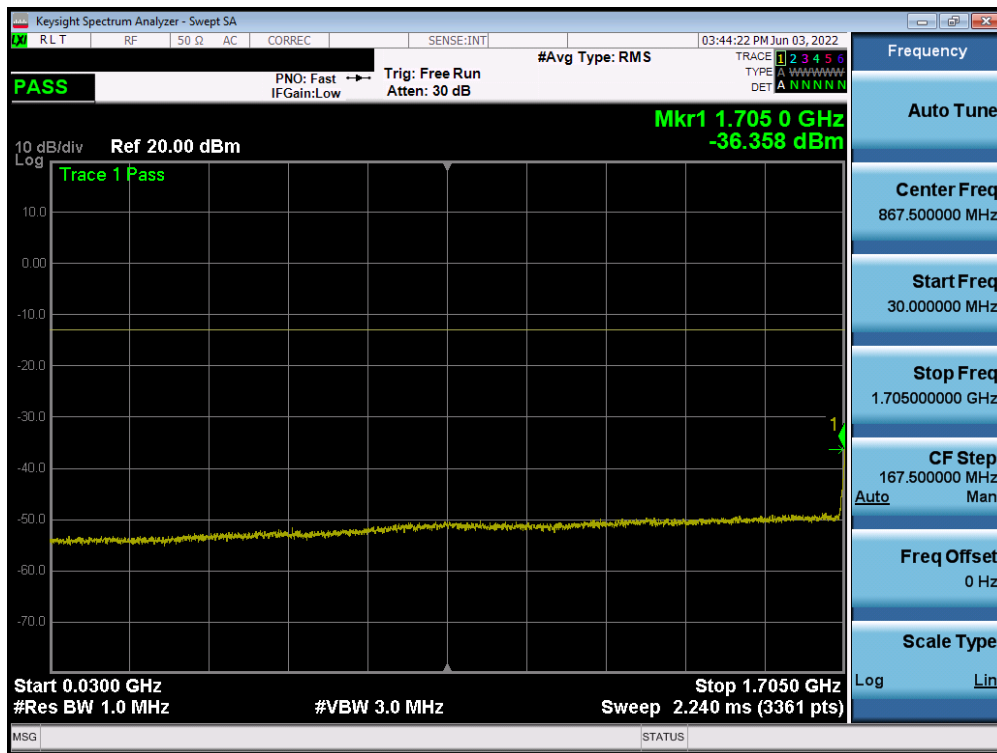
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Plot 7-46. Conducted Spurious Plot (LTE Band 13 - 10MHz QPSK - RB Size 1, RB Offset 0)

FCC ID: BCG-A2727	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 41 of 122


V2.1 11/9/2021



Plot 7-47. Conducted Spurious Plot (WCDMA Ch. 1312- Low Channel)

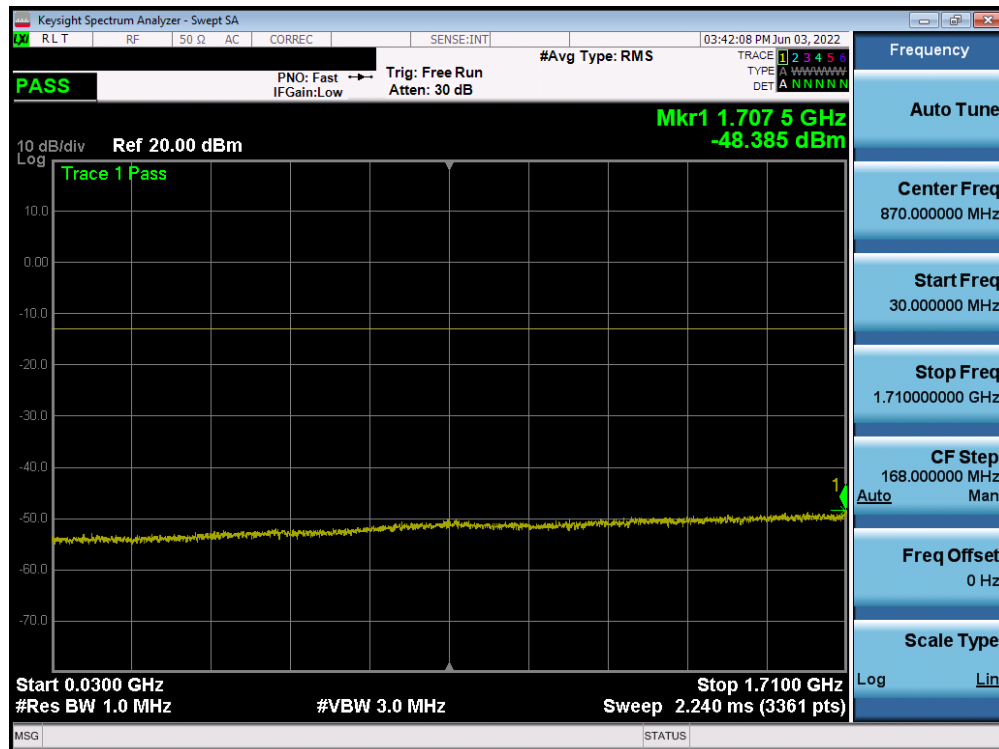


Plot 7-48. Conducted Spurious Plot (WCDMA Ch. 1312- Low Channel)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 42 of 122



Plot 7-49. Conducted Spurious Plot (WCDMA Ch. 1312- Low Channel)



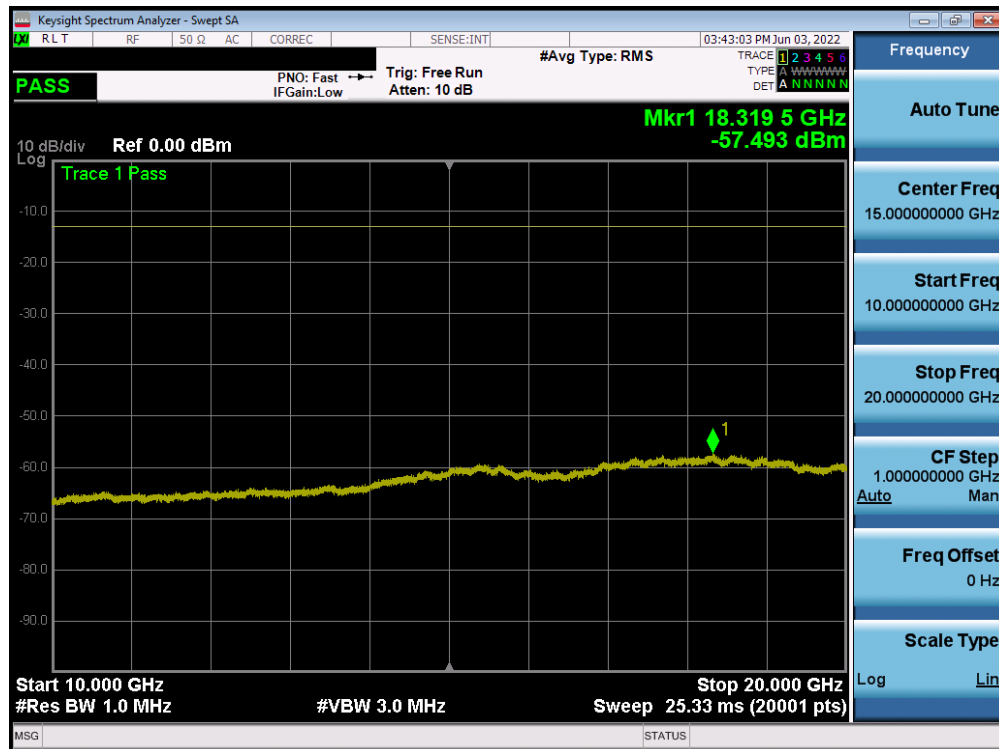
Plot 7-50. Conducted Spurious Plot (WCDMA Ch. 1413- Mid Channel)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 43 of 122

V2.1 11/9/2021

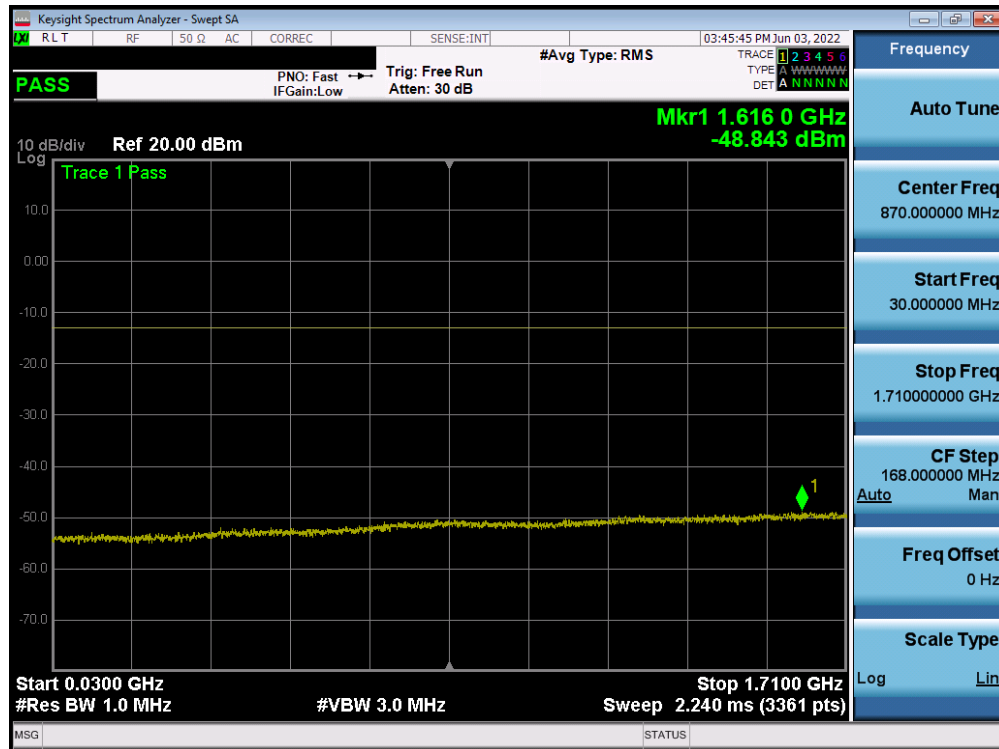


Plot 7-51. Conducted Spurious Plot (WCDMA Ch. 1413- Mid Channel)

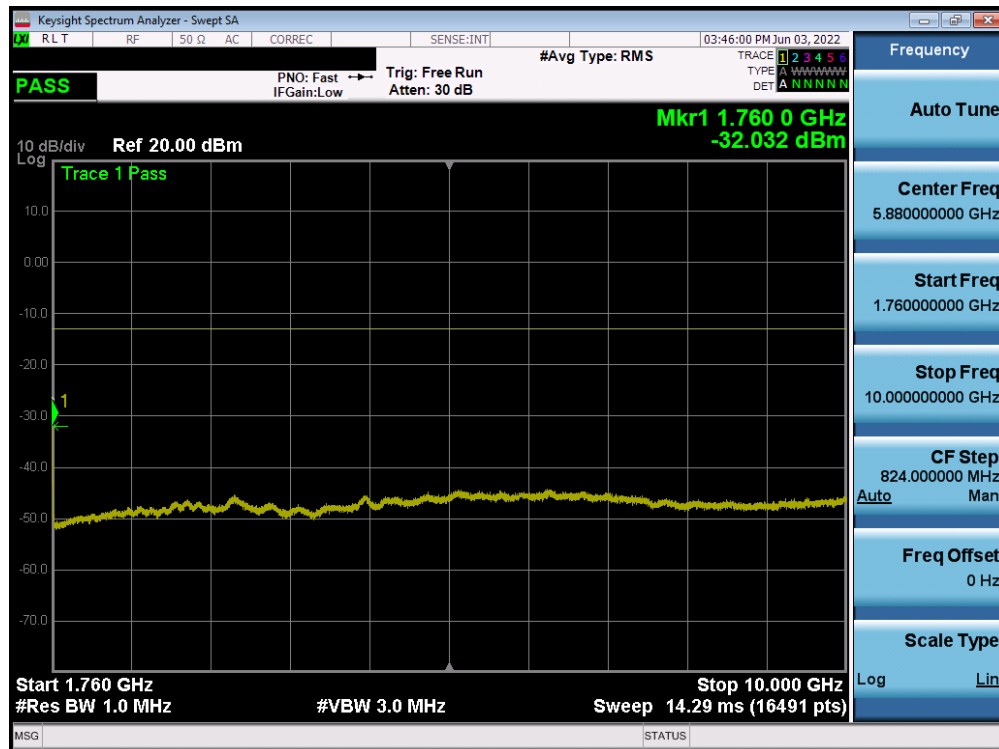


Plot 7-52. Conducted Spurious Plot (WCDMA Ch. 1413- Mid Channel)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 44 of 122

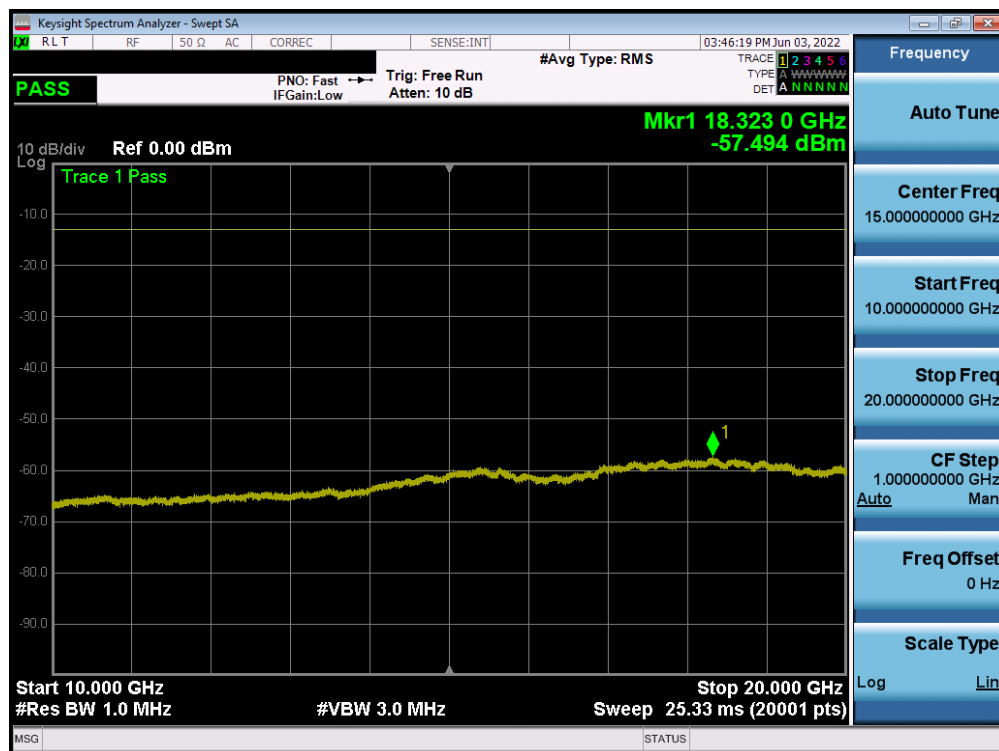


Plot 7-53. Conducted Spurious Plot (WCDMA Ch. 1513- High Channel)



Plot 7-54. Conducted Spurious Plot (WCDMA Ch. 1513- High Channel)

FCC ID: BCG-A2727	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 45 of 122



Plot 7-55. Conducted Spurious Plot (WCDMA Ch. 1513- High Channel)

FCC ID: BCG-A2727	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 46 of 122

V2.1 11/9/2021

7.4 Band Edge Emissions at Antenna Terminal

\$2.1051, \$27.53

Test Overview

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

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. $\text{RBW} \geq 1\%$ of the emission bandwidth
4. $\text{VBW} \geq 3 \times \text{RBW}$
5. Detector = RMS
6. Number of sweep points $\geq 2 \times \text{Span}/\text{RBW}$
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.

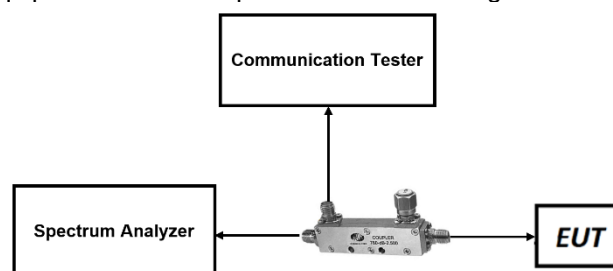




Figure 7-3. Test Instrument & Measurement Setup

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch
		Page 47 of 122

V2.1 11/9/2021

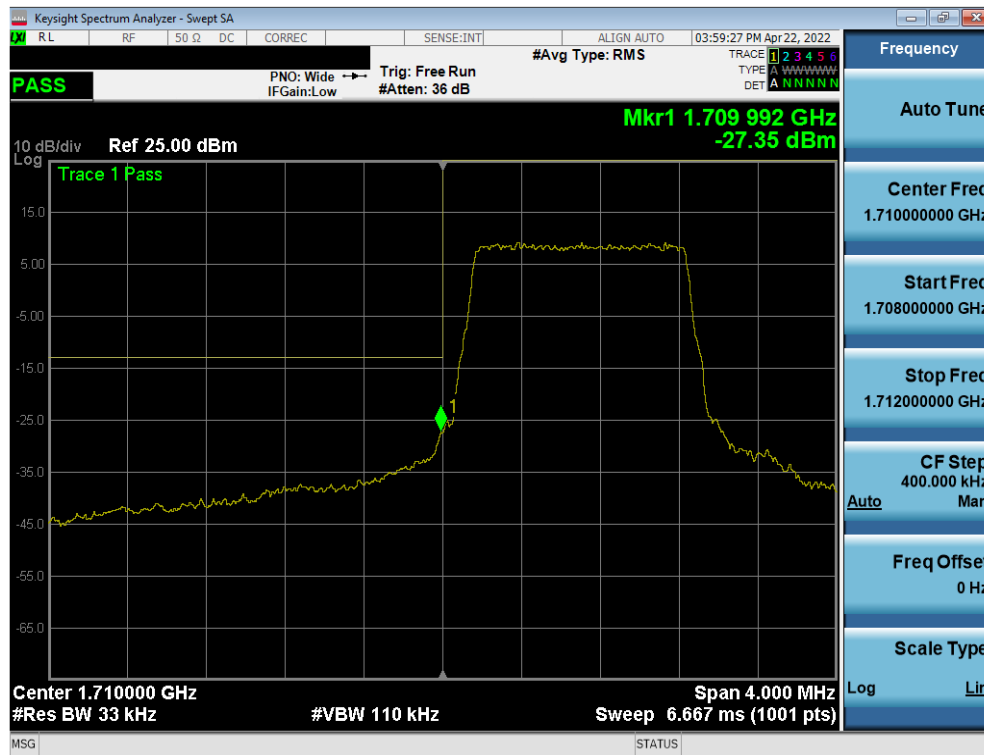
Test Notes

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(g) for operations in the 663 - 698 MHz and 698 – 746MHz bands, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.
3. Per 27.53(c)(5) for operations in the 776-788 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.
4. For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c)(4) is $65 + 10 \log_{10}(P) = -35\text{dBm}$ in a 6.25kHz bandwidth.

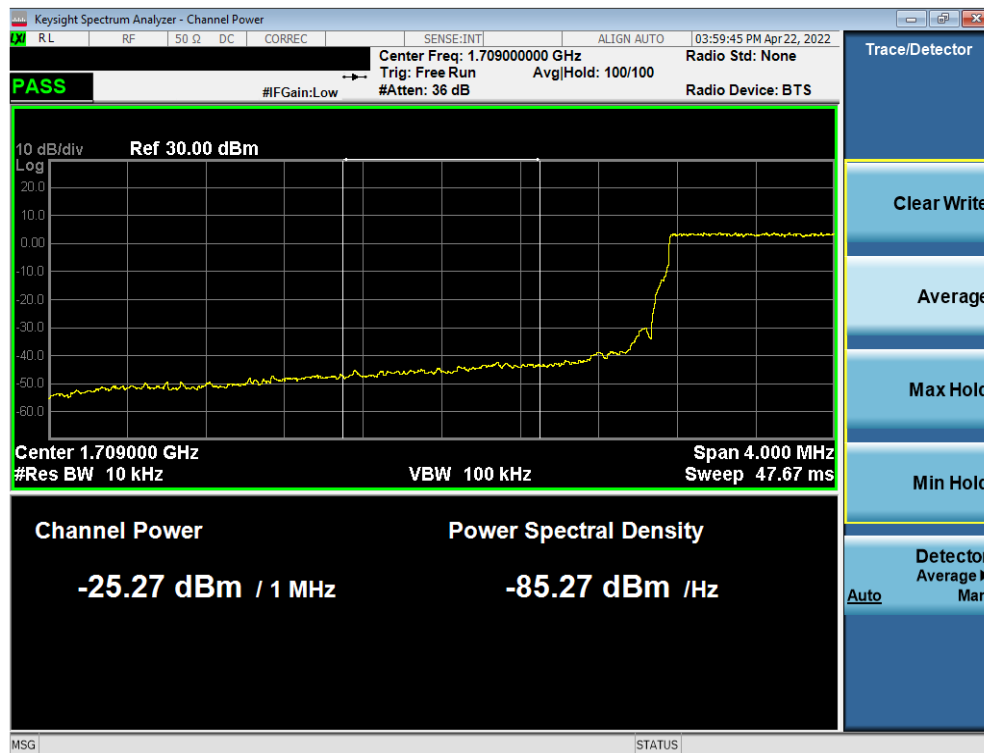
FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 48 of 122

V2.1 11/9/2021


LTE Band 66



Plot 7-56. Lower Band Edge Plot (LTE Band 66 – 1.4MHz QPSK – Full RB)



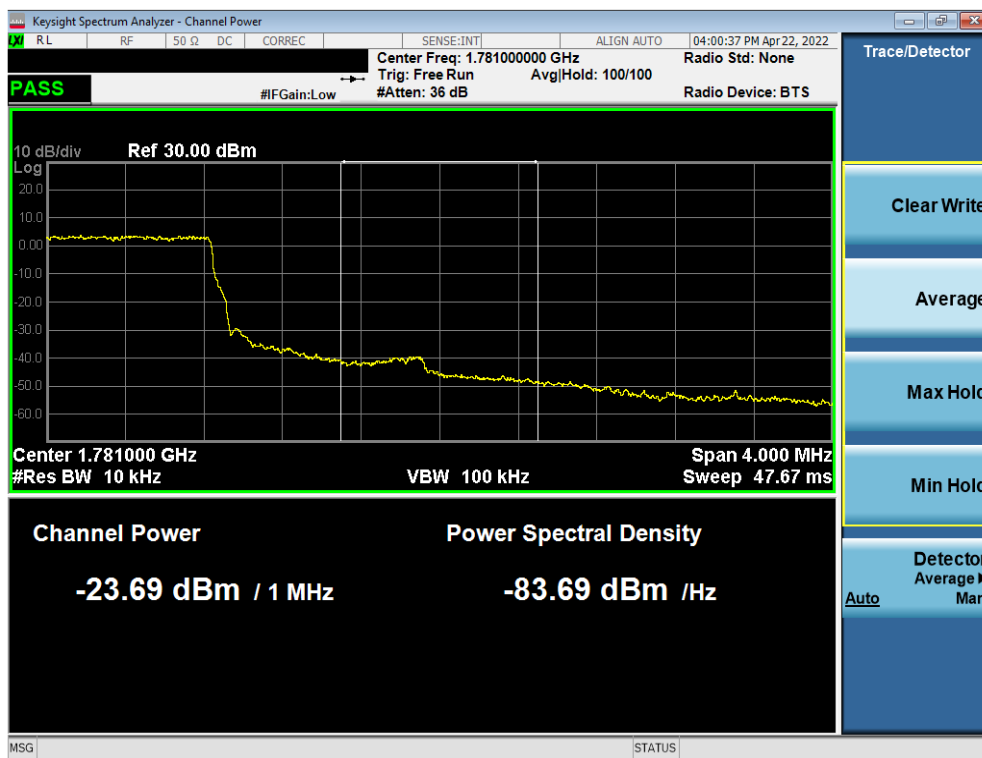
Plot 7-57. Lower Extended Band Edge Plot (LTE Band 66 – 1.4MHz QPSK – Full RB)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 49 of 122

V2.1 11/9/2021

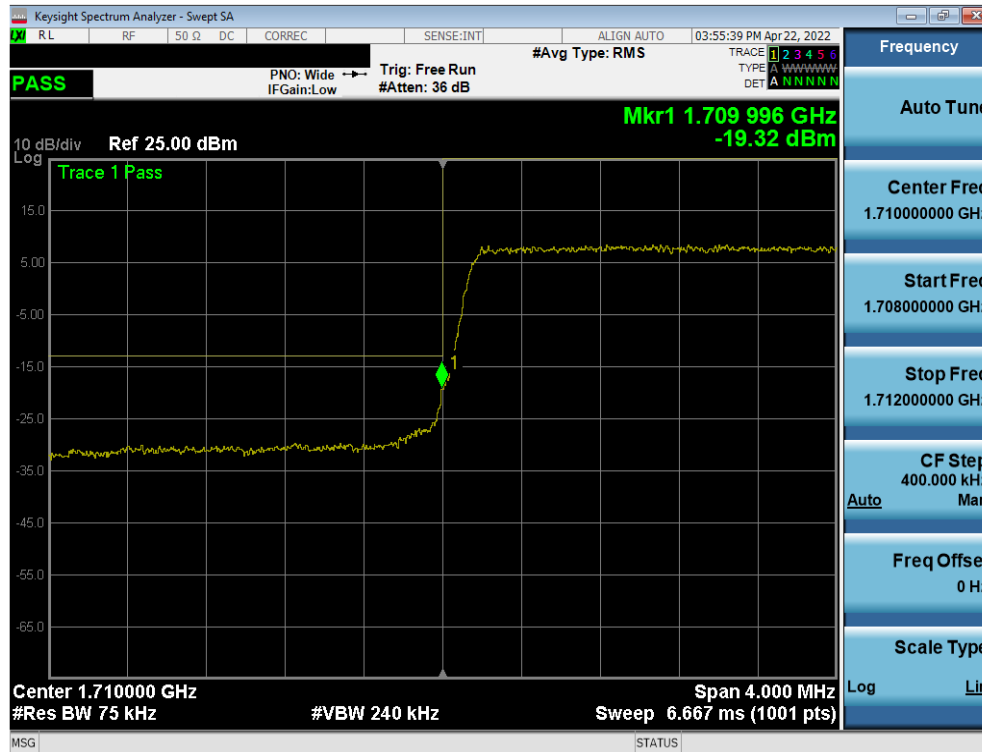


Plot 7-58. Upper Band Edge Plot (LTE Band 66 – 1.4MHz QPSK – Full RB)

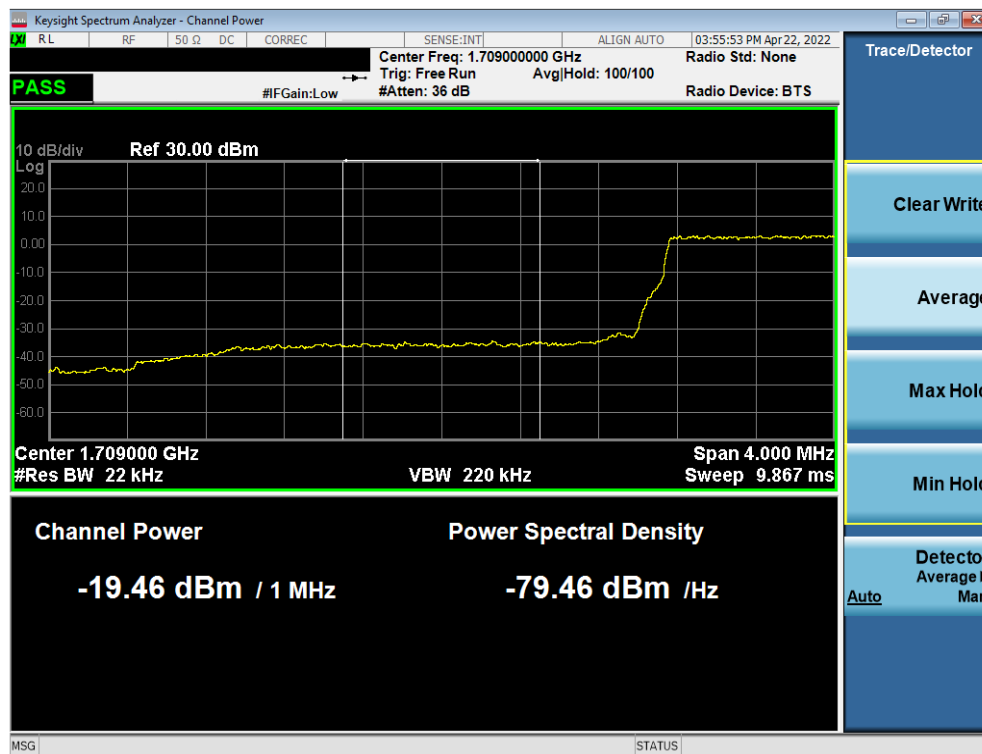


Plot 7-59. Upper Extended Band Edge Plot (LTE Band 66 – 1.4MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 50 of 122

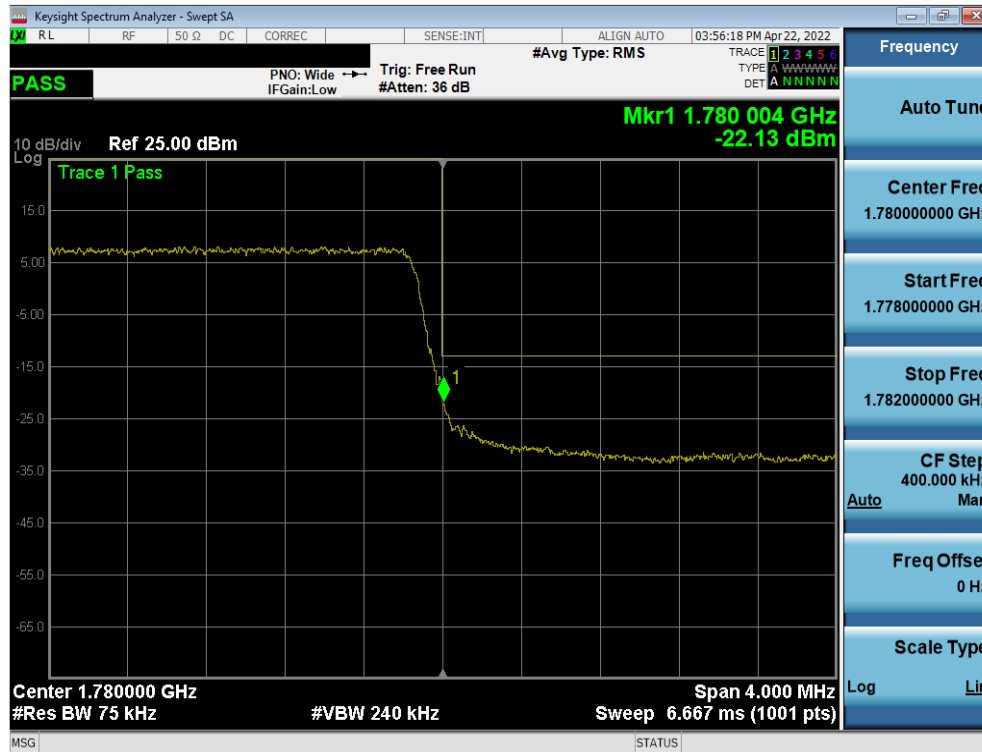


Plot 7-60. Lower Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)

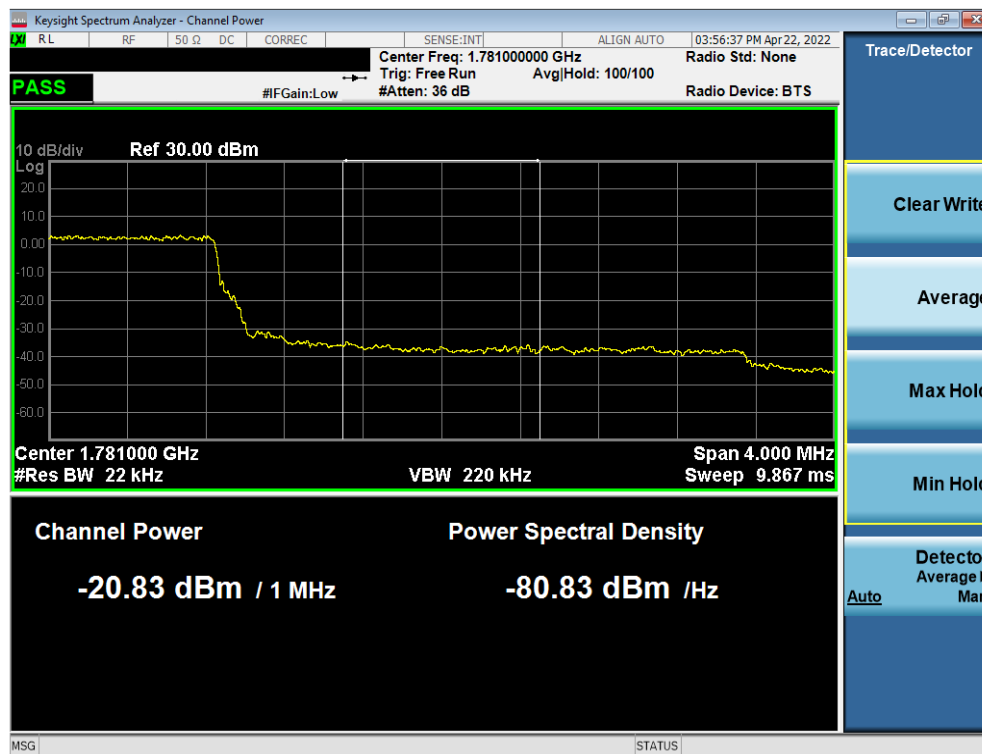


Plot 7-61. Lower Extended Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 51 of 122



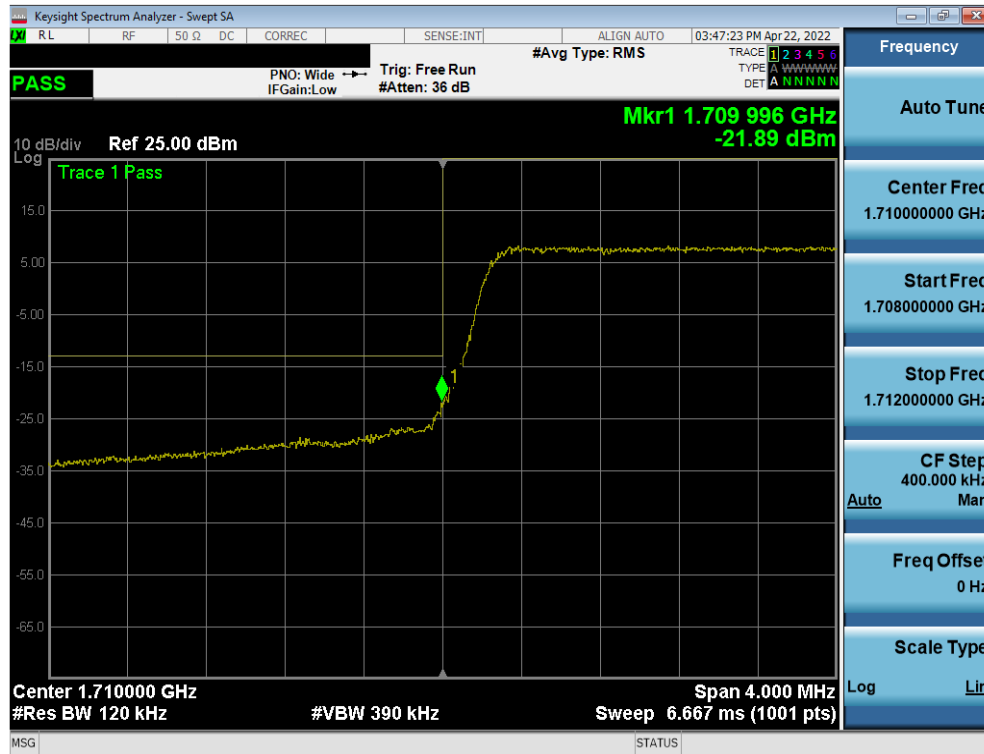
Plot 7-62. Upper Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)



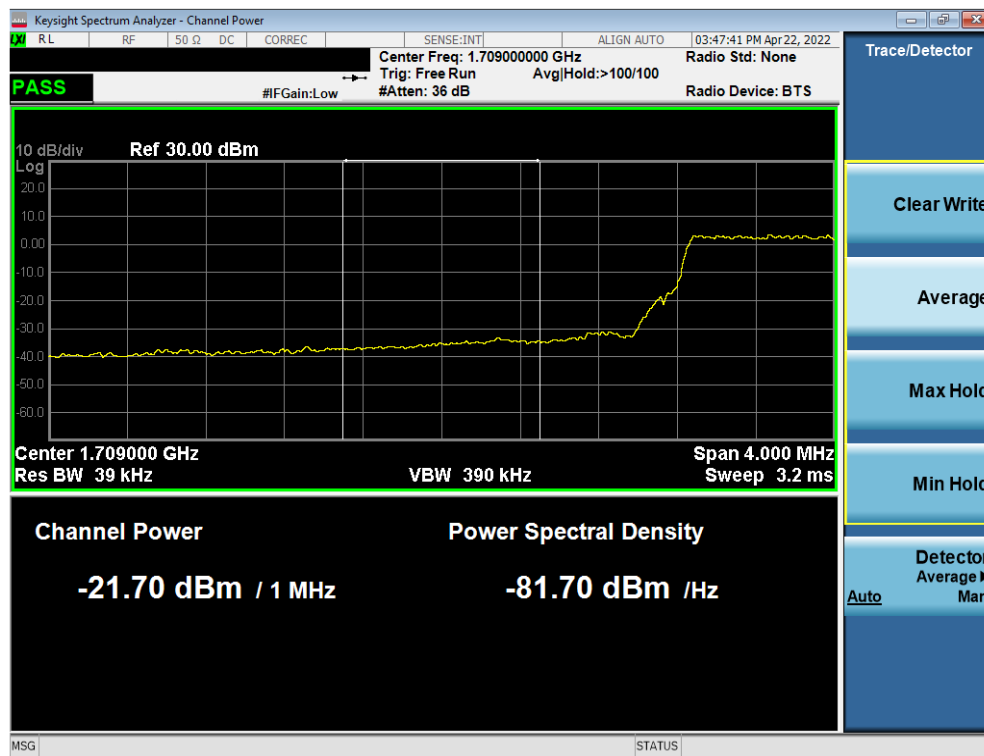
Plot 7-63. Upper Extended Band Edge Plot (LTE Band 66 - 3MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 52 of 122

V2.1 11/9/2021



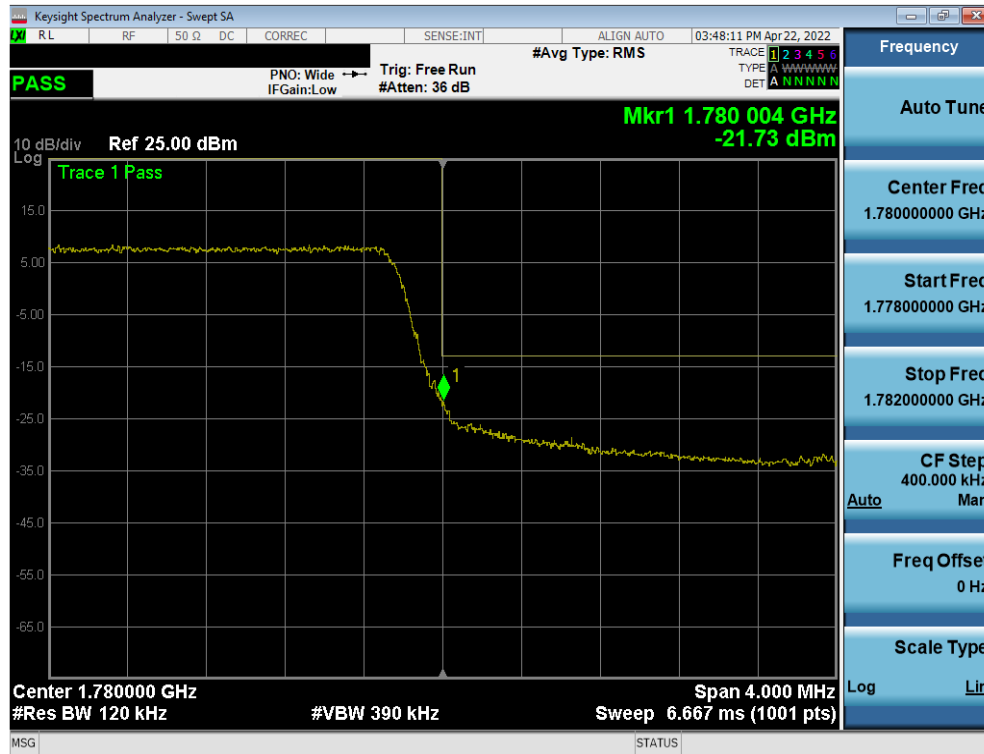
Plot 7-64. Lower Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)



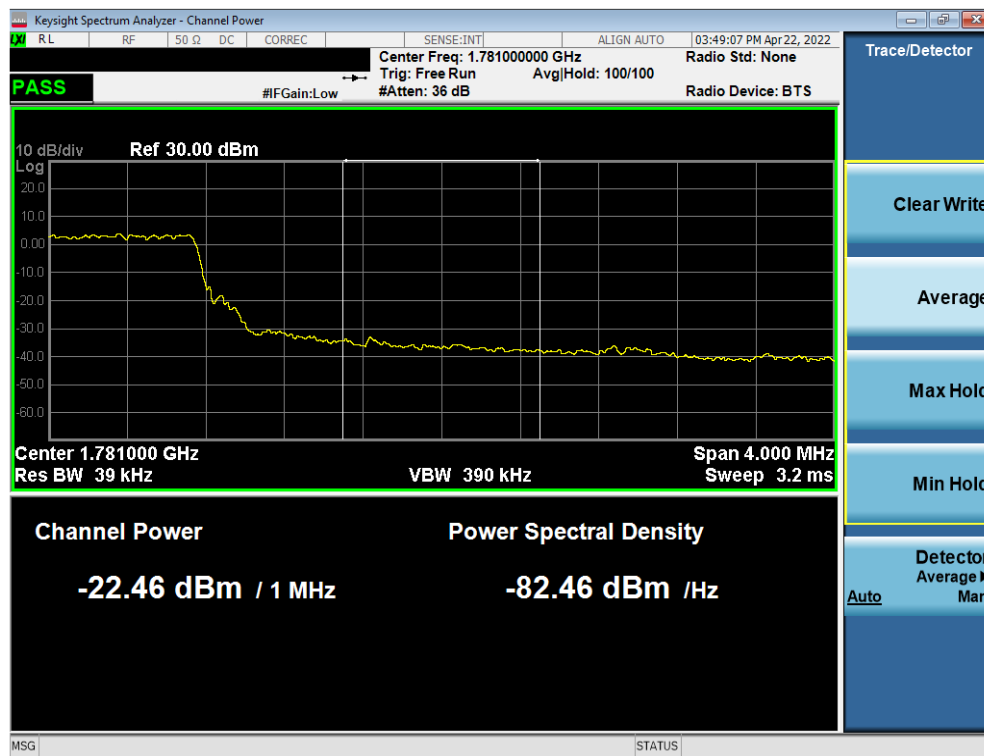
Plot 7-65. Lower Extended Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 53 of 122

V2.1 11/9/2021

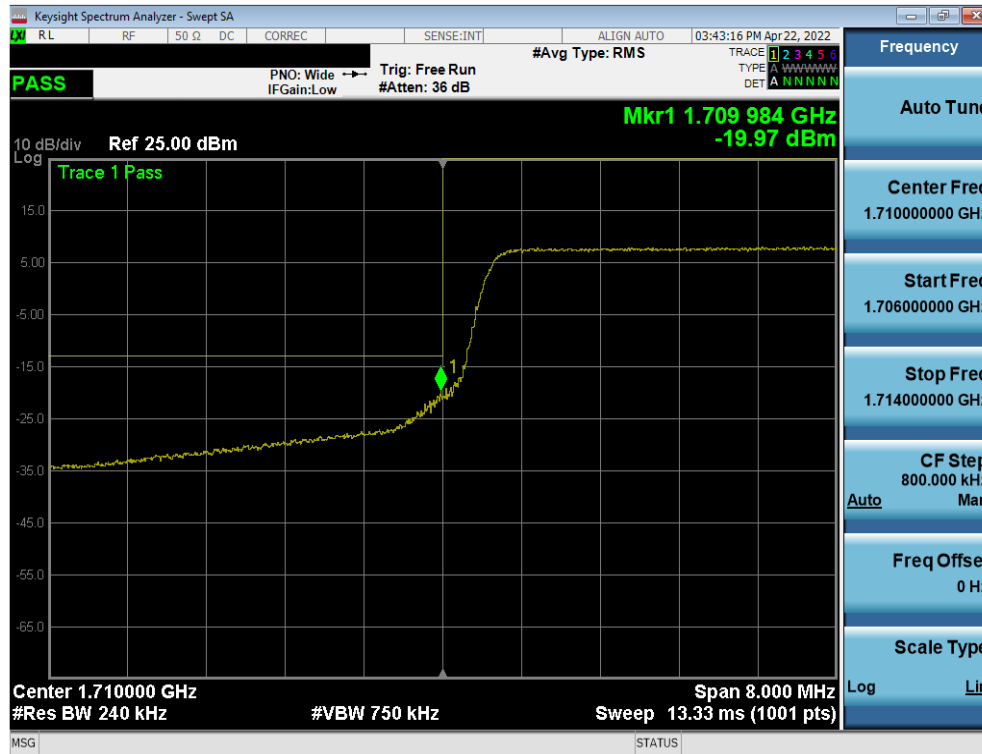


Plot 7-66. Upper Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)



Plot 7-67. Upper Extended Band Edge Plot (LTE Band 66 - 5MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 54 of 122



Plot 7-68. Lower Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)



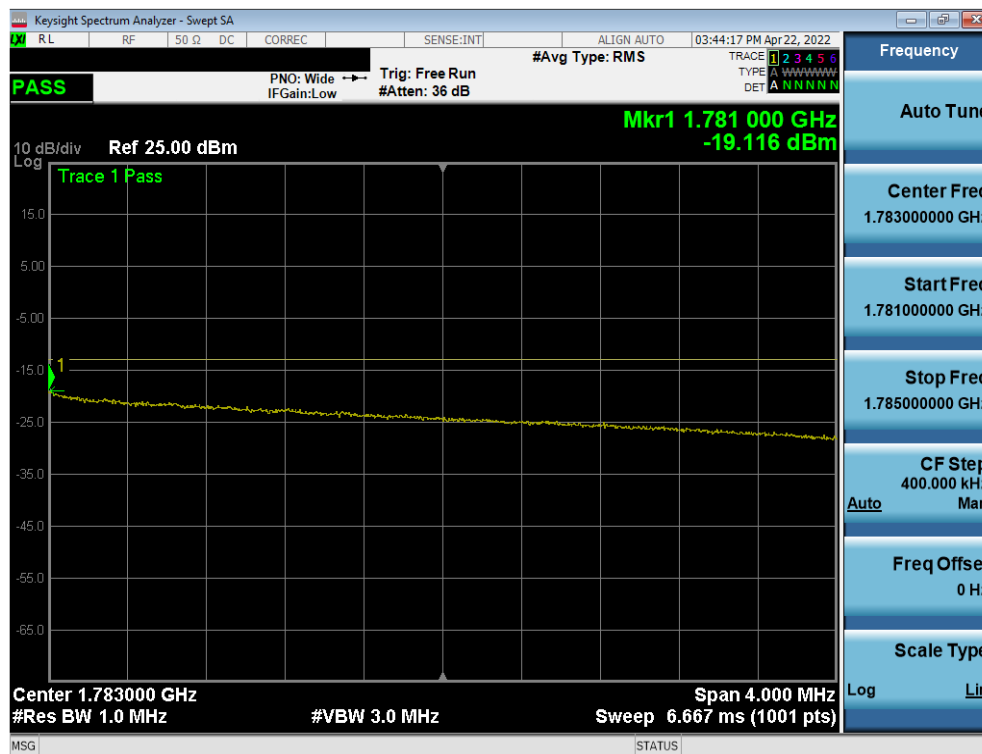
Plot 7-69. Lower Extended Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 55 of 122

V2.1 11/9/2021

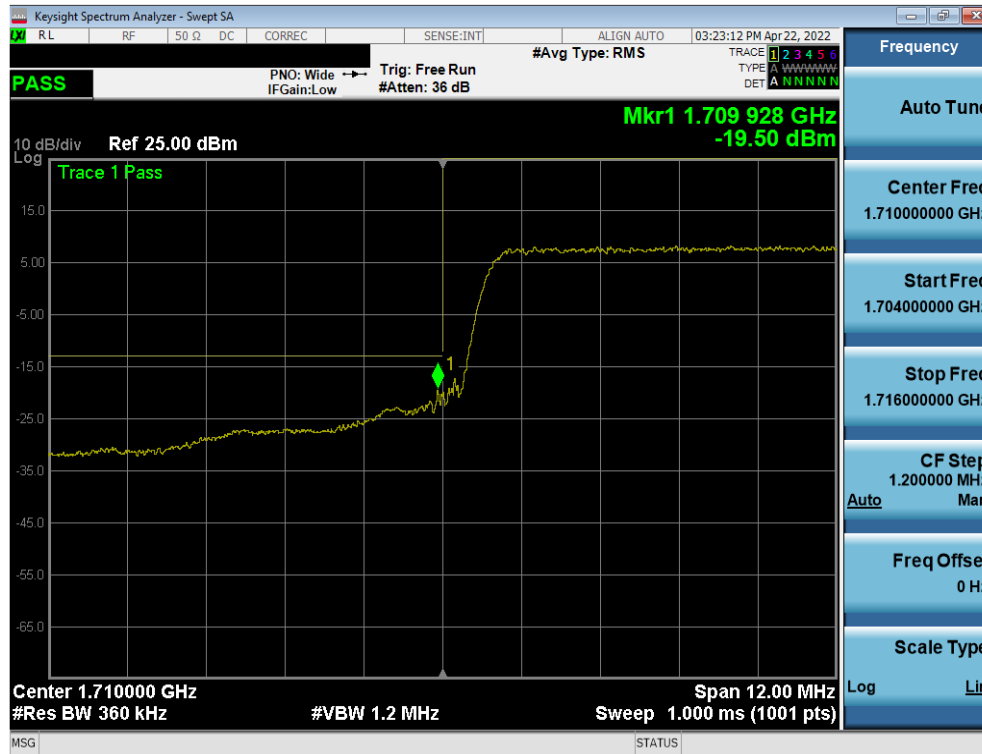


Plot 7-70. Upper Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)



Plot 7-71. Upper Extended Band Edge Plot (LTE Band 66 - 10MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 56 of 122



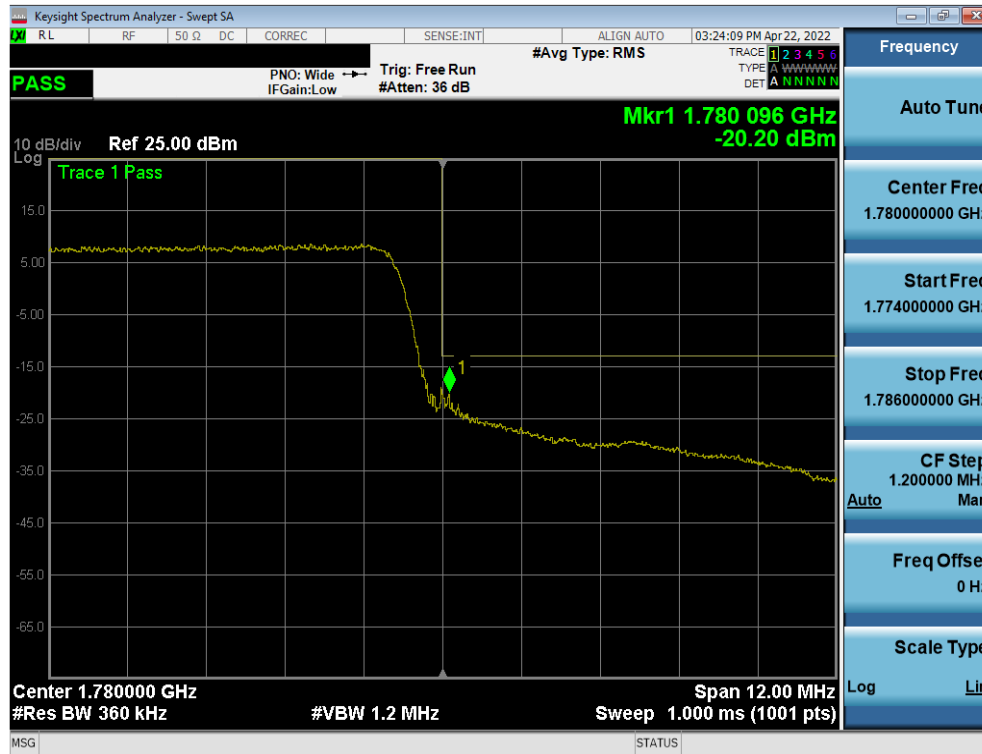
Plot 7-72. Lower Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)



Plot 7-73. Lower Extended Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 57 of 122

V2.1 11/9/2021

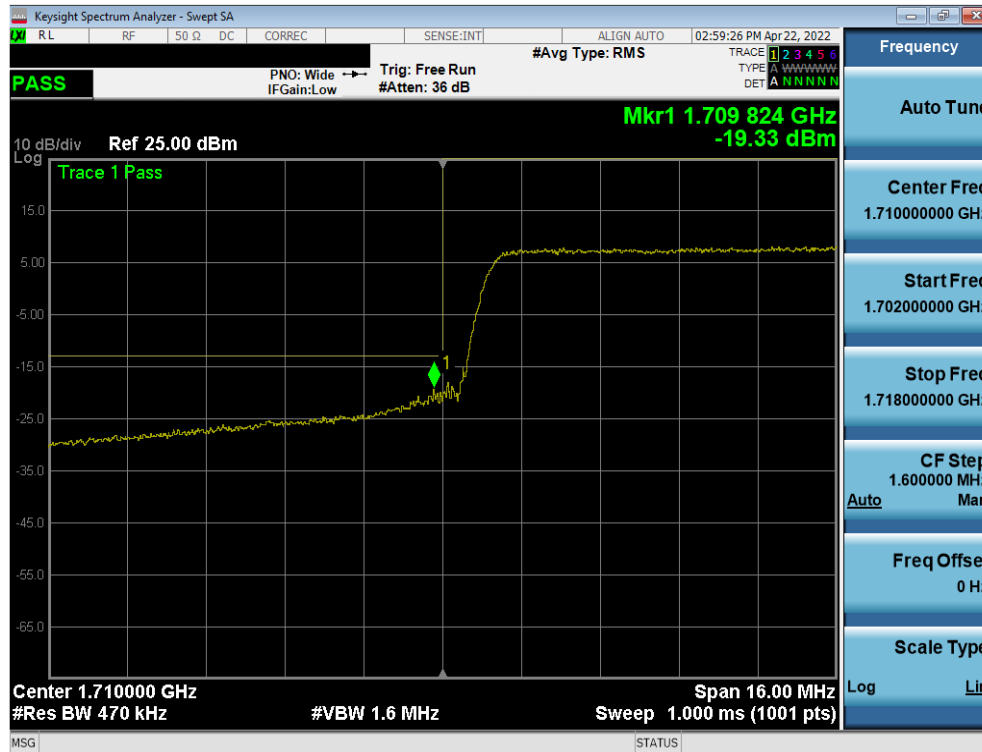


Plot 7-74. Upper Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)

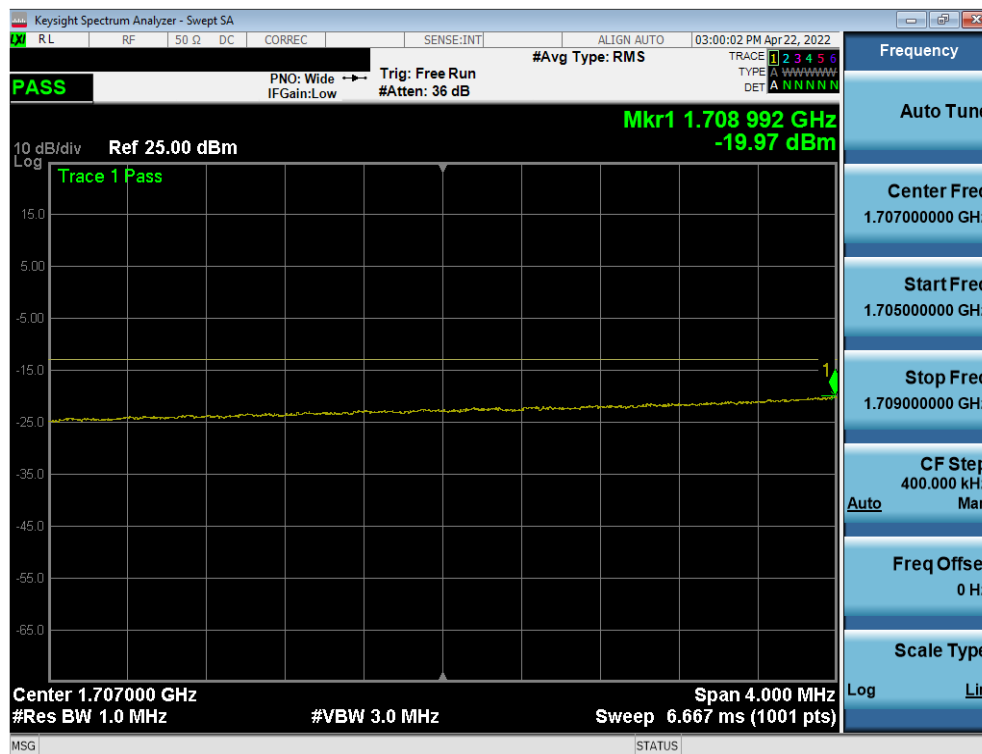


Plot 7-75. Upper Extended Band Edge Plot (LTE Band 66 - 15MHz QPSK – Full RB)

FCC ID: BCG-A2727	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 58 of 122



Plot 7-76. Lower Band Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)



Plot 7-77. Lower Extended Band Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 59 of 122



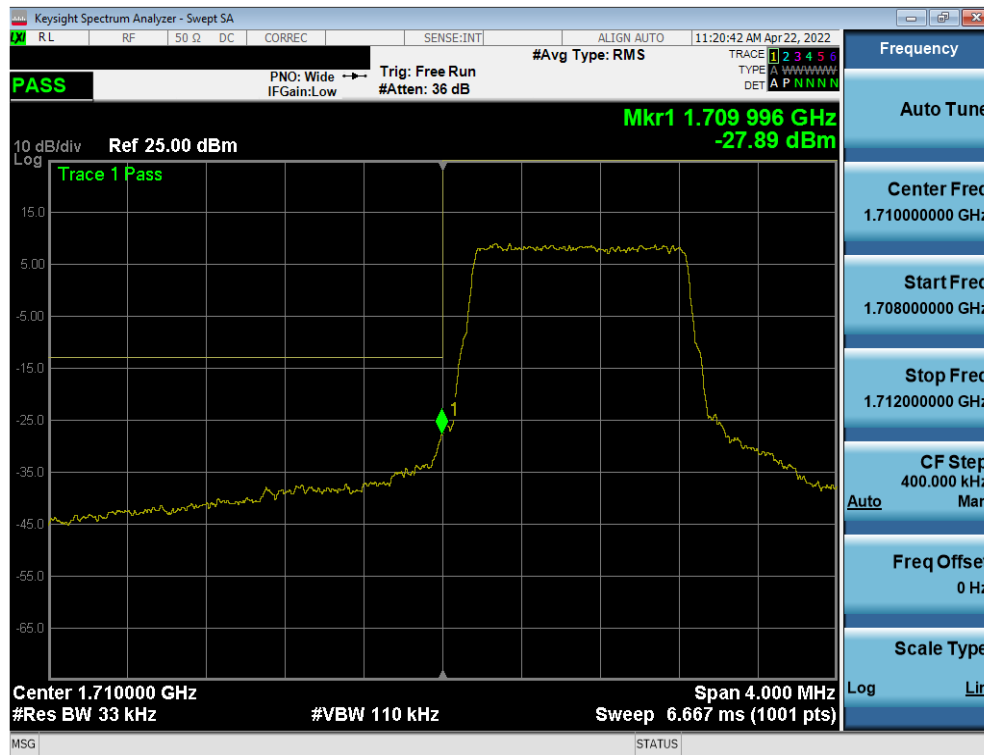
Plot 7-78. Upper Band Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)



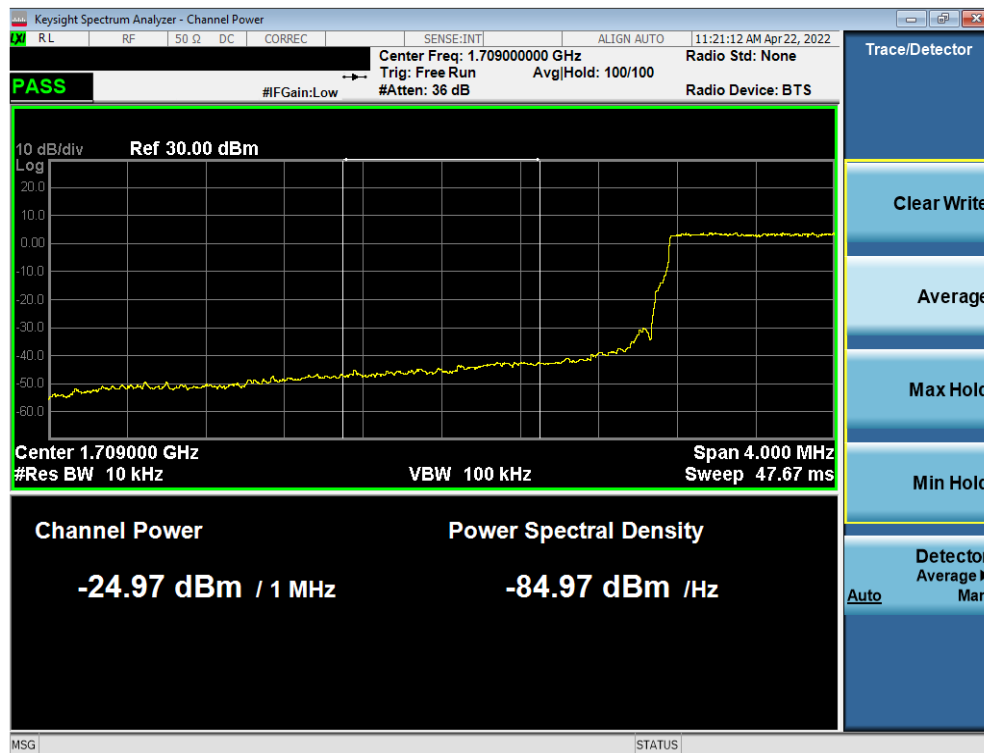
Plot 7-79. Upper Extended Band Edge Plot (LTE Band 66 - 20MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 60 of 122


LTE Band 4



Plot 7-80. Lower Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)



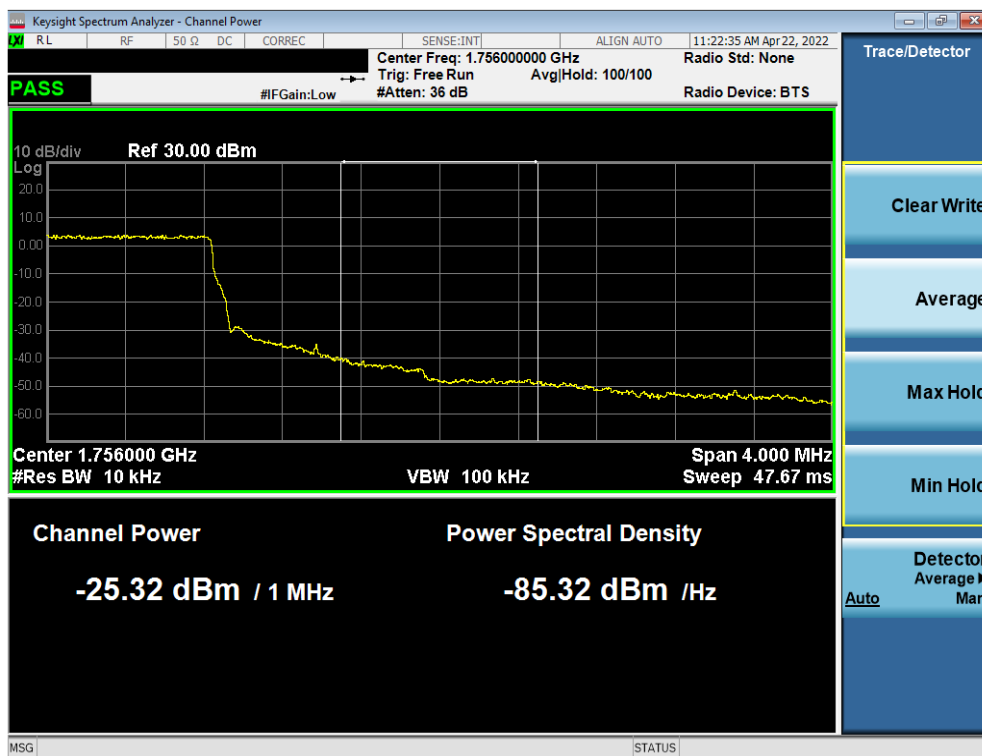
Plot 7-81. Lower Extended Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 61 of 122

V2.1 11/9/2021



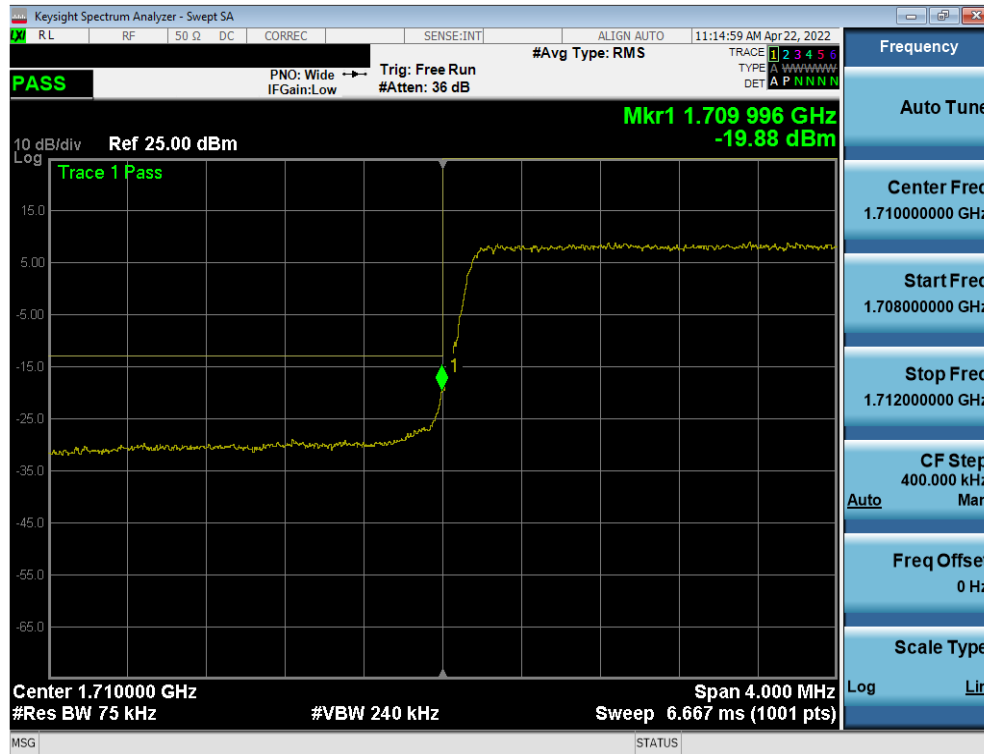
Plot 7-82. Upper Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)



Plot 7-83. Upper Extended Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 62 of 122

V2.1 11/9/2021



Plot 7-84. Lower Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)



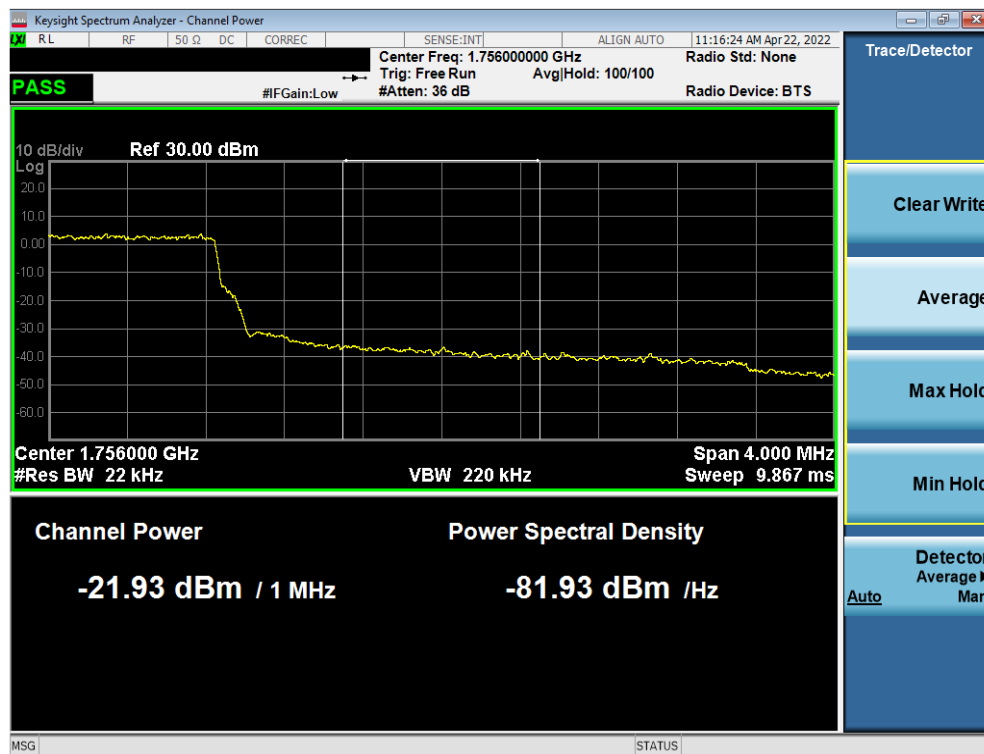
Plot 7-85. Lower Extended Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)

FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 63 of 122

V2.1 11/9/2021



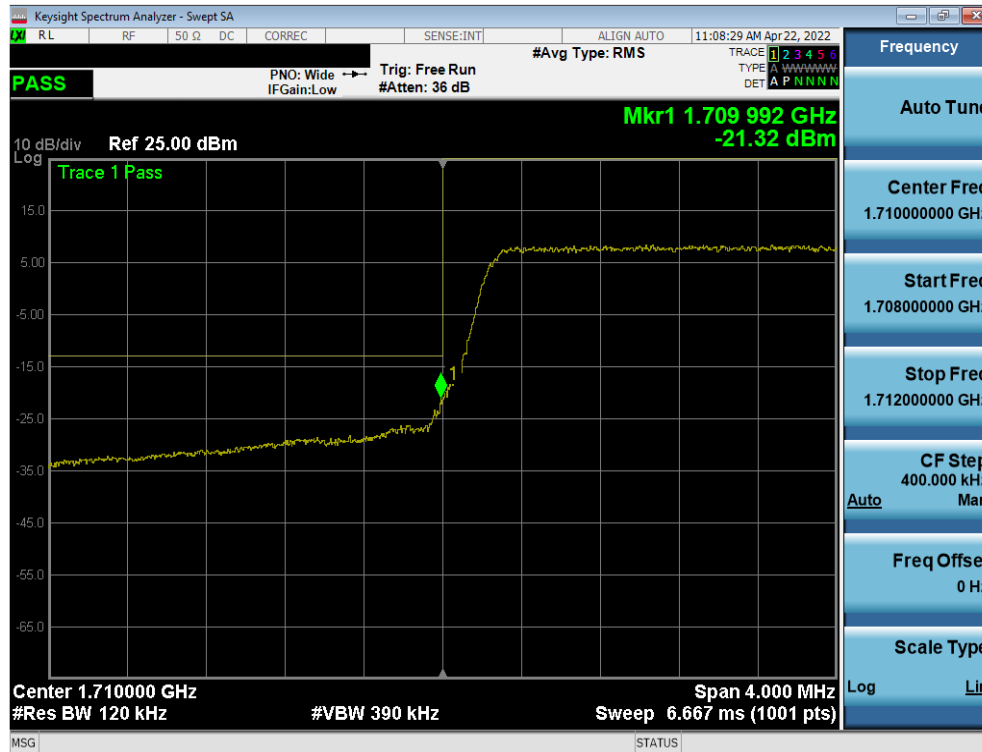
Plot 7-86. Upper Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)



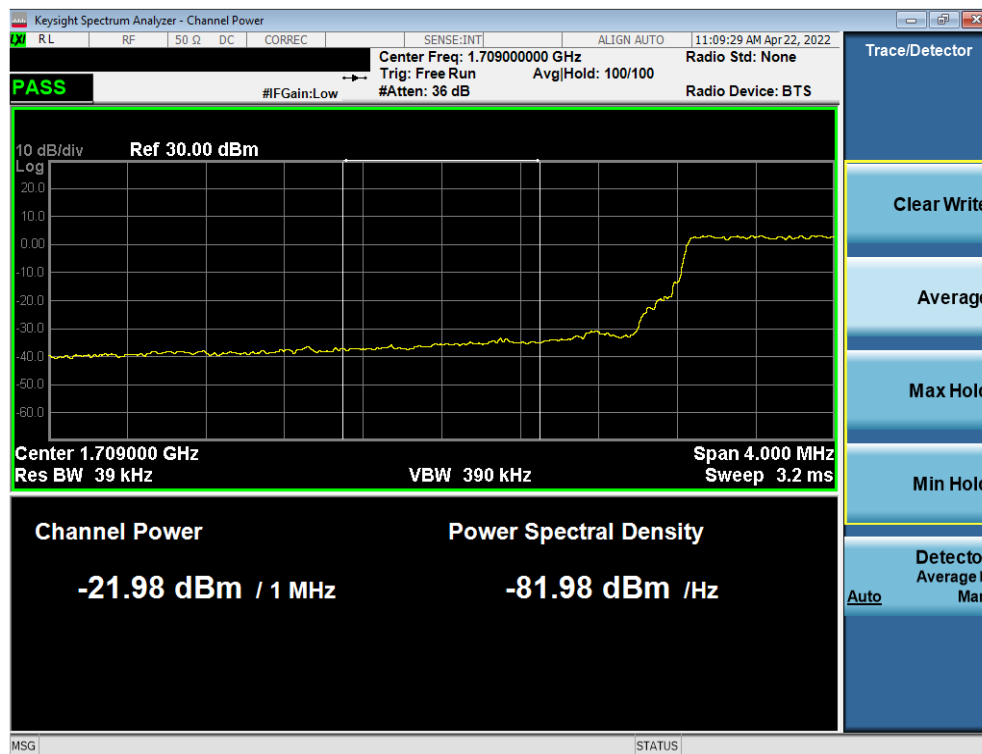
Plot 7-87. Upper Extended Band Edge Plot (LTE Band 4 - 3MHz QPSK – Full RB)

FCC ID: BCG-A2727	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 64 of 122

V2.1 11/9/2021

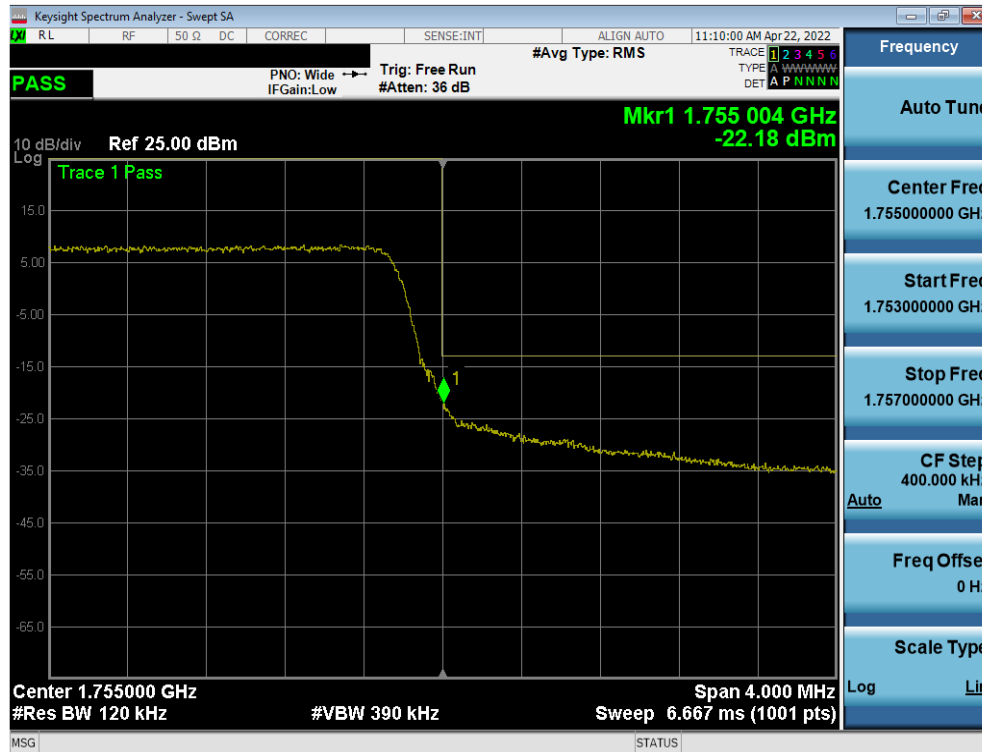


Plot 7-88. Lower Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)

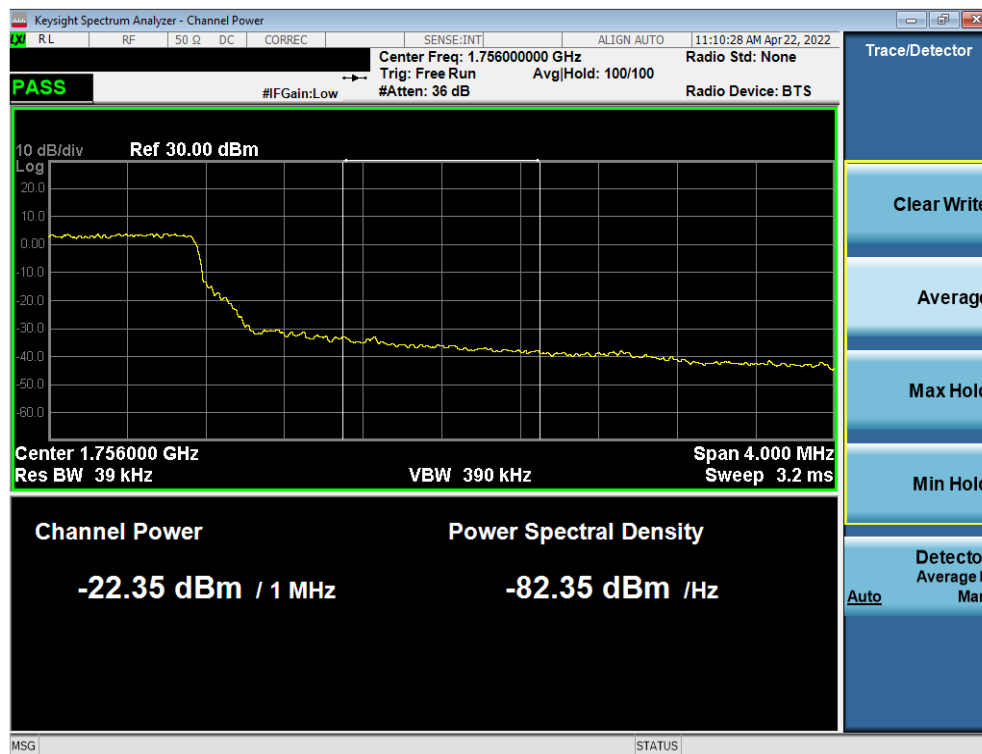


Plot 7-89. Lower Extended Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)


FCC ID: BCG-A2727	element	PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 65 of 122



Plot 7-90. Upper Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)



Plot 7-91. Upper Extended Band Edge Plot (LTE Band 4 - 5MHz QPSK – Full RB)

FCC ID: BCG-A2727	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2205090034-03.BCG	Test Dates: 4/6/2022 – 8/25/2022	EUT Type: Watch	Page 66 of 122

V2.1 11/9/2021