



Element Materials Technology

(formerly PCTEST)

18855 Adams Court, Morgan Hill, CA 95037 USA

Tel. 408.538.5600

<http://www.element.com>



MEASUREMENT REPORT

PART 27

Applicant Name

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

Date of Testing:

04/11/2024 – 07/30/2024

Test Report Issue Date:

8/1/2024

Test Site/Location:

Element Materials Technology, Morgan Hill, CA, USA

Test Report Serial No.:

1C2405230022-06.BCG

FCC ID:**BCG-A3003****Applicant Name:****Apple Inc.****Application Type:**

Certification

Model:

A3003, A3206

EUT Type:

Watch

FCC Classification:

PCS Licensed Transmitter Worn on Body (PCT)

FCC Rule Part:

27

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.

RJ Ortanez
Executive Vice President

Prepared by: WKR0000006184

Reviewed by: WKR0000005849



FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT	
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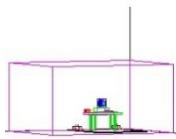
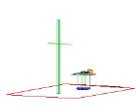
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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	EIRP		Emission Designator
					Max. Power [mW]	Max. Power [dBm]	
LTE Band 7	5 MHz	QPSK	2502.5 - 2567.5	4.5444	67.764	18.31	4M54G7W
		16QAM	2502.5 - 2567.5	4.5294	57.677	17.61	4M53D7W
	10 MHz	QPSK	2505 - 2565	9.0285	67.920	18.32	9M03G7W
		16QAM	2505 - 2565	5.2470	59.293	17.73	5M25D7W
	15 MHz	QPSK	2507.5 - 2562.5	13.5679	69.663	18.43	13M6G7W
		16QAM	2507.5 - 2562.5	5.6367	60.534	17.82	5M64D7W
	20 MHz	QPSK	2510 - 2560	18.2264	69.502	18.42	18M2G7W
		16QAM	2510 - 2560	7.2190	59.566	17.75	7M22D7W
LTE Band 41	5 MHz	QPSK	2498.5 - 2687.5	4.5404	69.343	18.41	4M54G7W
		16QAM	2498.5 - 2687.5	4.5239	53.827	17.31	4M52D7W
	10 MHz	QPSK	2501 - 2685	9.0292	69.343	18.41	9M03G7W
		16QAM	2501 - 2685	5.1342	55.976	17.48	5M13D7W
	15 MHz	QPSK	2503.5 - 2682.5	13.5067	69.343	18.41	13M5G7W
		16QAM	2503.5 - 2682.5	5.7463	55.208	17.42	5M75D7W
	20 MHz	QPSK	2506 - 2680	18.1180	69.343	18.41	18M1G7W
		16QAM	2506 - 2680	6.4345	55.081	17.41	6M43D7W

EUT Overview

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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 Materials Technology Test Location

These measurement tests were conducted at the Element Materials Technology 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 Materials Technology located in Morgan Hill, CA 95037, U.S.A.

- Element Materials Technology 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 Materials Technology facility is a registered (22831) test laboratory with the site description on file with ISED.
- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Agreements (MRAs).

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Watch FCC ID:BCG-A3003**. 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.: GPNY9N0FQT, F125J29M12, LK9V6HD6DC, DLCH2R0004K0000DVM, DLCH5S000J30000P87

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, 802.15.4 ab-NB, 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	802.15.4ab - NB	LTE/WCDMA	UNII	UWB
	802.11b/g/n	BDR, EDR, HDR4/8, LE1/2M	O-QPSK	Mid/High Band	802.11a/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	✗	✓	✗	✗	✓	✗
Config 11	✗	✓	✗	✓	✗	✗
Config 12	✗	✓	✓	✗	✗	✗
Config 13	✗	✓	✗	✗	✗	✓
Config 14	✗	✗	✓	✓	✗	✗
Config 15	✗	✗	✗	✓	✓	✗
Config 16	✗	✗	✗	✓	✗	✓

Table 2-1. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

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2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Frequency [MHz]	Antenna Gain [dBi]
Antenna FCM	
LTE Band 7	-5.40
LTE Band 41	-5.59

Table 2-2. Highest Antenna Gain

2.4 Test Support Equipment

1	Apple Macbook w/AC/DC Adapter	Model: A1398	S/N: FVFDHG8TP3XY	
		Model: A1435	S/N: N/A	
2	Apple USB-C cable w/ Charging Dock w/ Cradle	Model: N/A A2921 N/A	S/N: N/A DQ812910CU008V22F S/N: CYV10420060A2LE03MP2C	
3	Apple Magnetic Charger Apple Magnetic Charger	Model: A2515	S/N: DLC217301Z91NR11B	
		Model: A2515	S/N: DLC217301YM1NR112	
4	Pathfinder Mocha X3100 SiP Socket	Model: 920-13353-01 P1 N20X B PF 307	S/N: DLCGMW0007D00000N7 S/N: FN6GUA000JD00000M7	
5	DC Power Supply	Model: KPS3010D	S/N: N/A	
6	Store Sample Wristband	Model: N/A	S/N: DLC316300CU1QGKA2	

Table 2-3. Test Support Equipment

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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 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.

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

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

Table 2-4. Worst Case Simultaneous Transmission Configuration

2.6 Software and Firmware

The test was conducted with firmware version watchOS 11 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.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the documents titled “American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services” (ANSI C63.26-2015 and TIA-603-E-2016) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure.....None

3.2 Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

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

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

And

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

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

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

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

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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	2.07
Radiated Disturbance (<30MHz)	4.12
Radiated Disturbance (30MHz-1GHz)	4.85
Radiated Disturbance (1-18GHz)	5.08
Radiated Disturbance (>18GHz)	5.22

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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
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	3/14/2024	Annual	3/14/2025	T058701-01
ESPEC	SU-241	Tabletop Temperature Chamber	11/17/2023	Annual	11/17/2024	92009574
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	4/9/2024	Annual	4/9/2025	00218555
Fairview Microwave	FMCA1975-36	30MHz-40GHz Conducted Cable *	6/10/2024	Annual	6/10/2025	-
Fairview Microwave	M2CP1122-10	30MHz-40GHz Conducted Coupler *	6/10/2024	Annual	6/10/2025	1946
Rohde & Schwarz	ESW44	EMI Test Receiver	5/1/2024	Annual	5/1/2025	101867
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	5/29/2024	Annual	5/29/2025	101619
Rohde & Schwarz	FSW67	Signal and Spectrum Analyzer (2Hz-67GHz)	7/5/2024	Annual	7/5/2025	101366
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	8/15/2023	Annual	8/15/2024	101639
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	11/30/2023	Annual	11/30/2024	161616
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	12/27/2023	Annual	12/27/2024	164715
Rohde & Schwarz	HFH2-Z2	Loop Antenna	6/21/2024	Annual	6/21/2025	100519
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	6/10/2024	Annual	6/10/2025	100057
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	7/3/2024	Annual	7/3/2025	102356
Schwarzbeck	VULB 9162	Bilog Antenna (30MHz - 6GHz)	4/29/2024	Annual	4/29/2025	00304

Table 5-1. Test Equipment

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
2. * denotes passive equipment that have been internally verified/calibrated.

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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

D = Amplitude/Angle Modulated

7 = Quantized/Digital Info

W = Combination of Any

Spurious Radiated Emission

Example: Spurious emission at 3700.40 MHz

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was -81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of -81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40 MHz. So 6.1 dB is added to the signal generator reading of -30.9 dBm yielding -24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm $- (-24.80) = 50.3$ dBc.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCG-A3003
 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
	Equivalent Isotropic Radiated Power (LTE Band 7)	27.50(h)(2)	< 2 Watts max. EIRP	PASS	Section 7.5
	Equivalent Isotropic Radiated Power (LTE Band 41)			PASS	Section 7.5
	Frequency Stability	2.1055, 27.54	Fundamental emissions stay within authorized frequency block over the temperature and voltage range as tested	PASS	Section 7.7
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 7.6
	Radiated Spurious Emissions (LTE Band 41)			PASS	Section 7.6

Table 7-1. Summary of Test Results

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3. All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4. All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized was Element EMC Software Tool v1.2.
5. For radiated emission, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element "Chamber Automation," Version 3.0.0.

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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. 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.

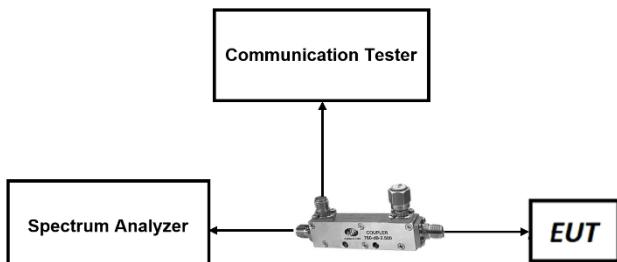


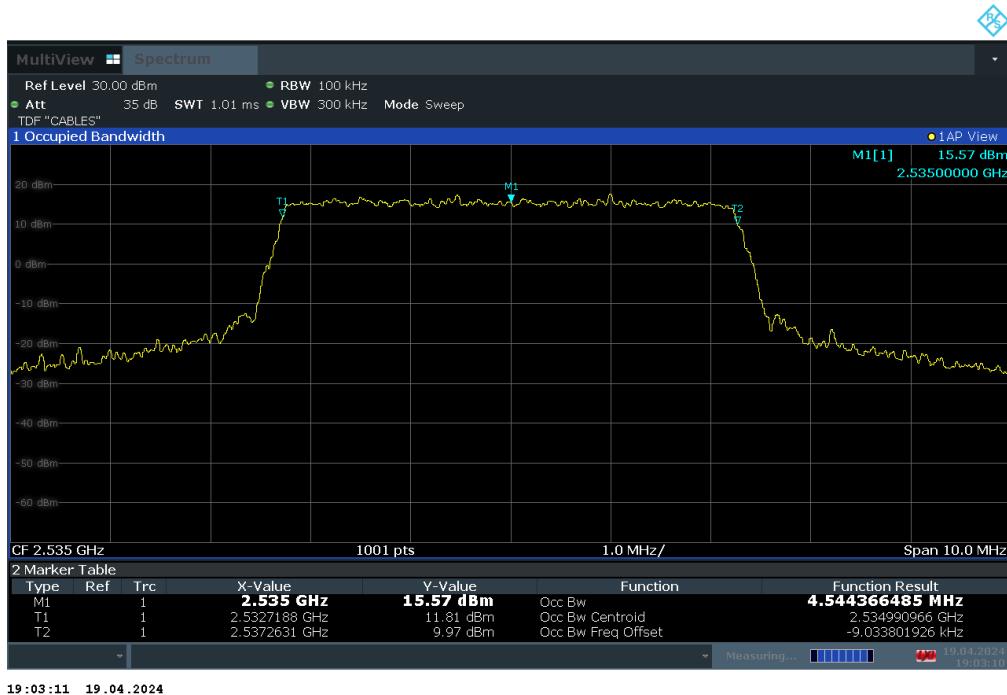
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

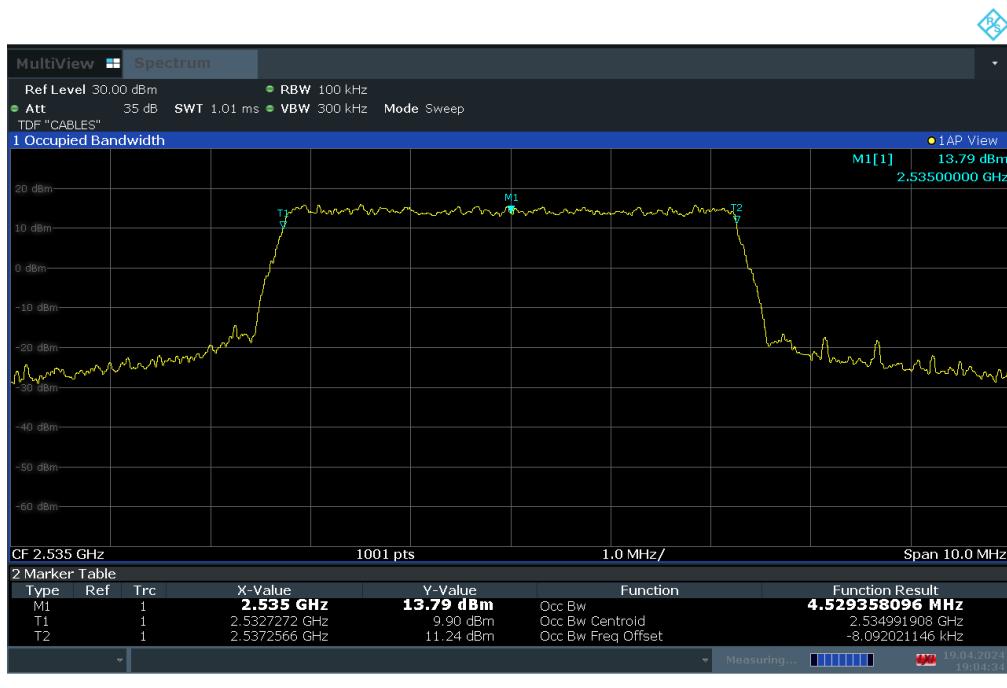
None.

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LTE Band 7

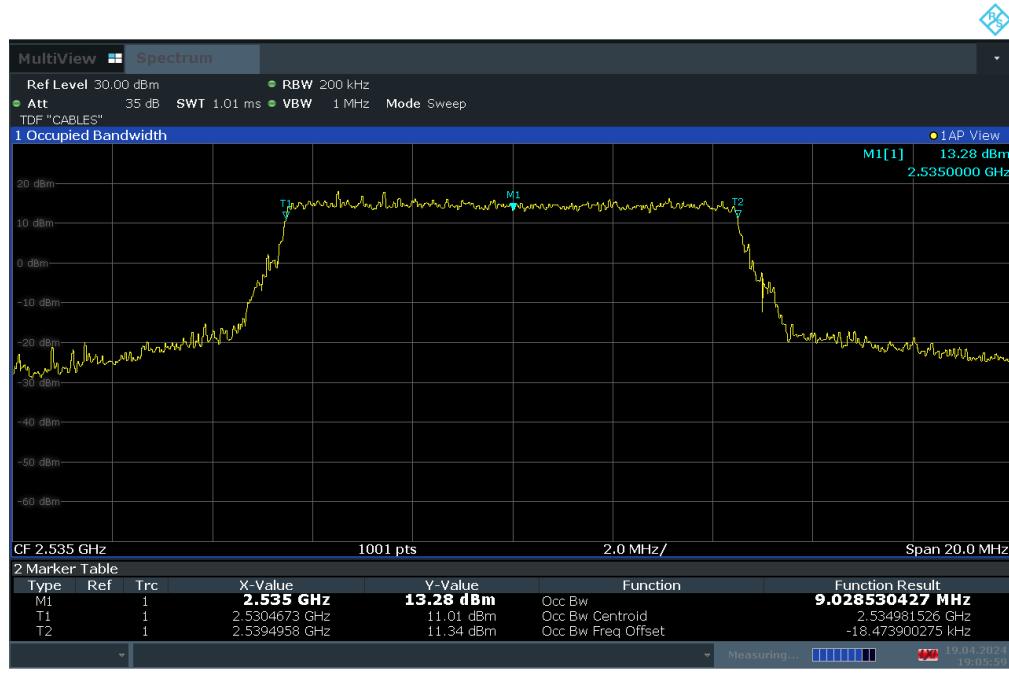


Plot 7-1. Occupied Bandwidth Plot (LTE Band 7 - 5MHz QPSK - Full RB)

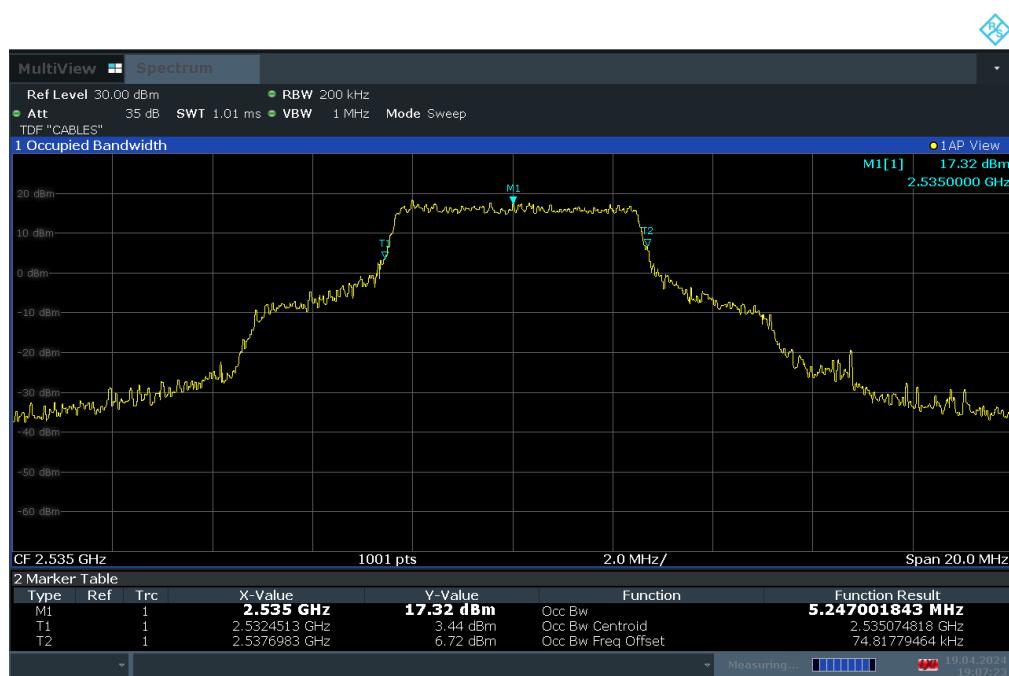


Plot 7-2. Occupied Bandwidth Plot (LTE Band 7 - 5MHz 16-QAM - Full RB)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 14 of 69	

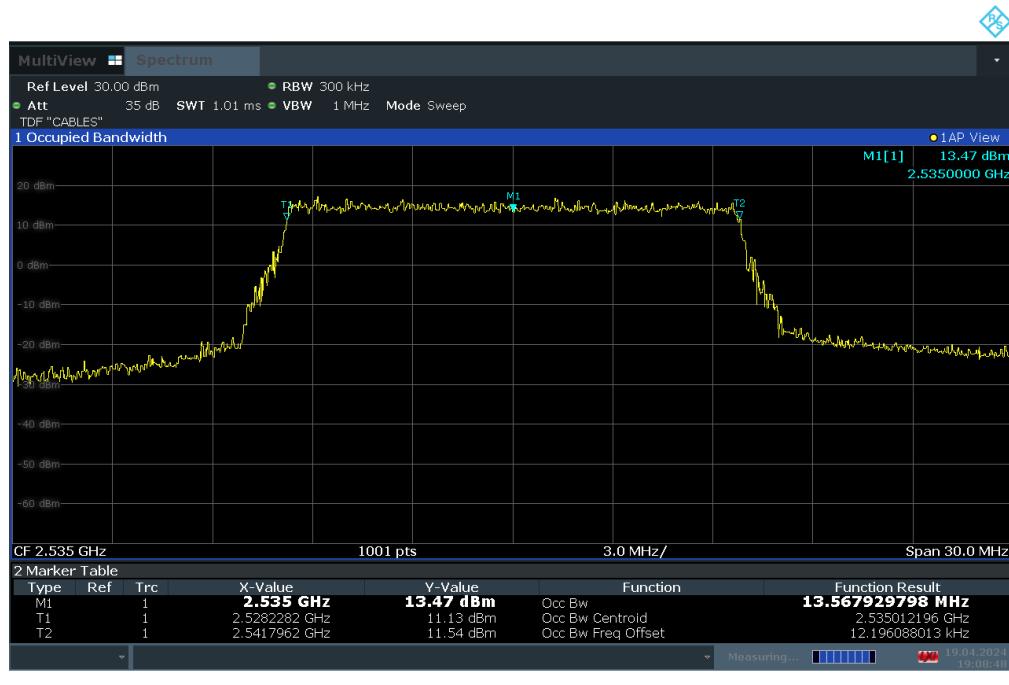


Plot 7-3. Occupied Bandwidth Plot (LTE Band 7 - 10MHz QPSK - Full RB)

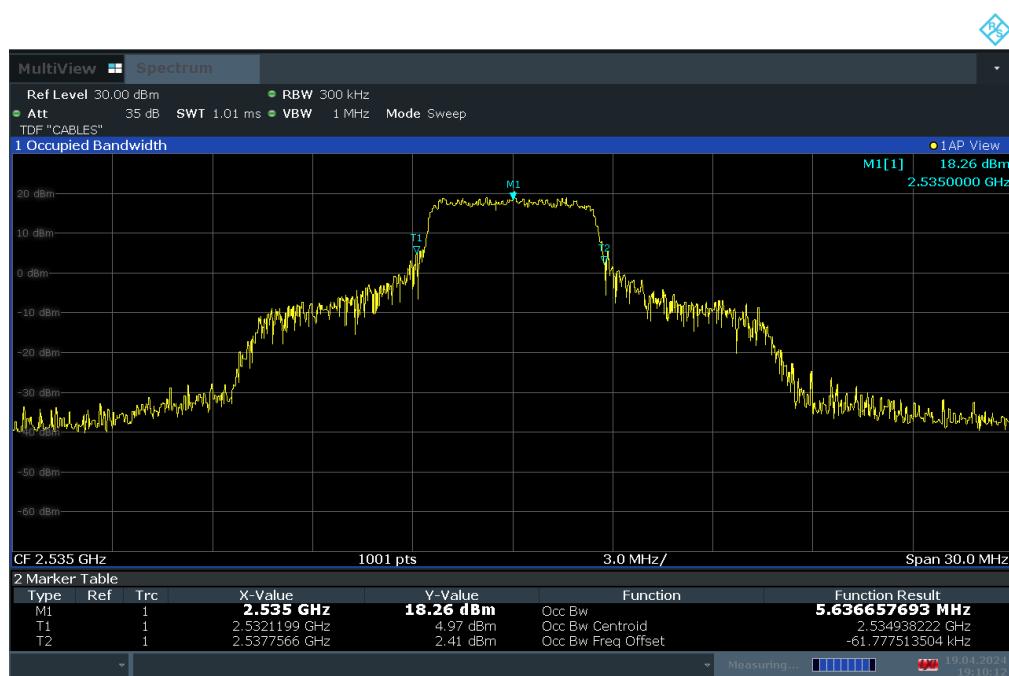


Plot 7-4. Occupied Bandwidth Plot (LTE Band 7 - 10MHz 16-QAM - Full RB)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 15 of 69	

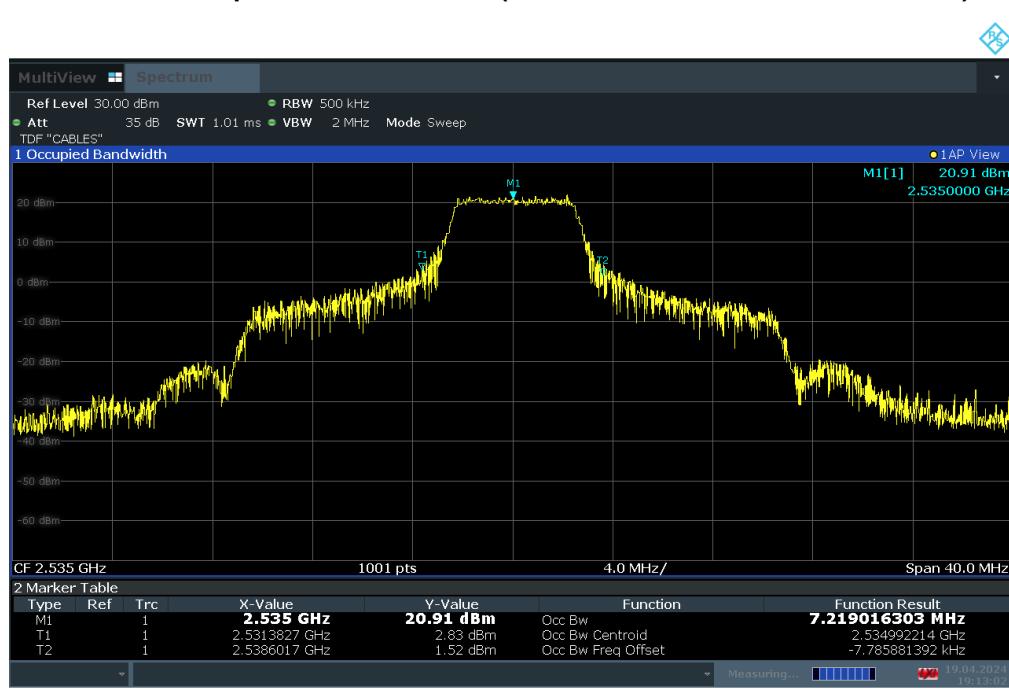
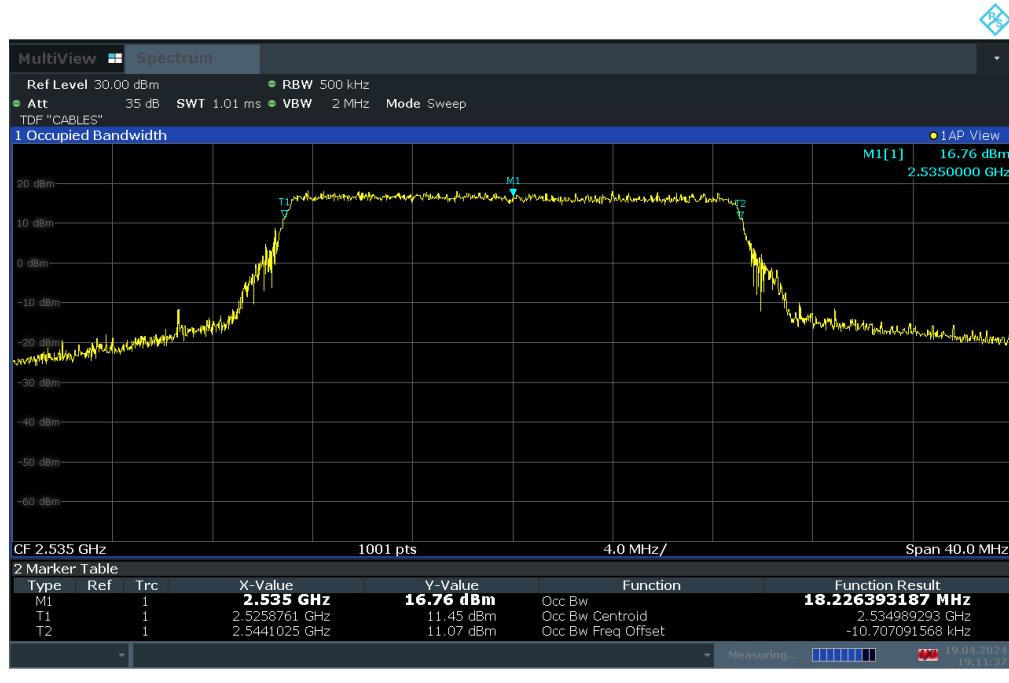


Plot 7-5. Occupied Bandwidth Plot (LTE Band 7 - 15MHz QPSK - Full RB)



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

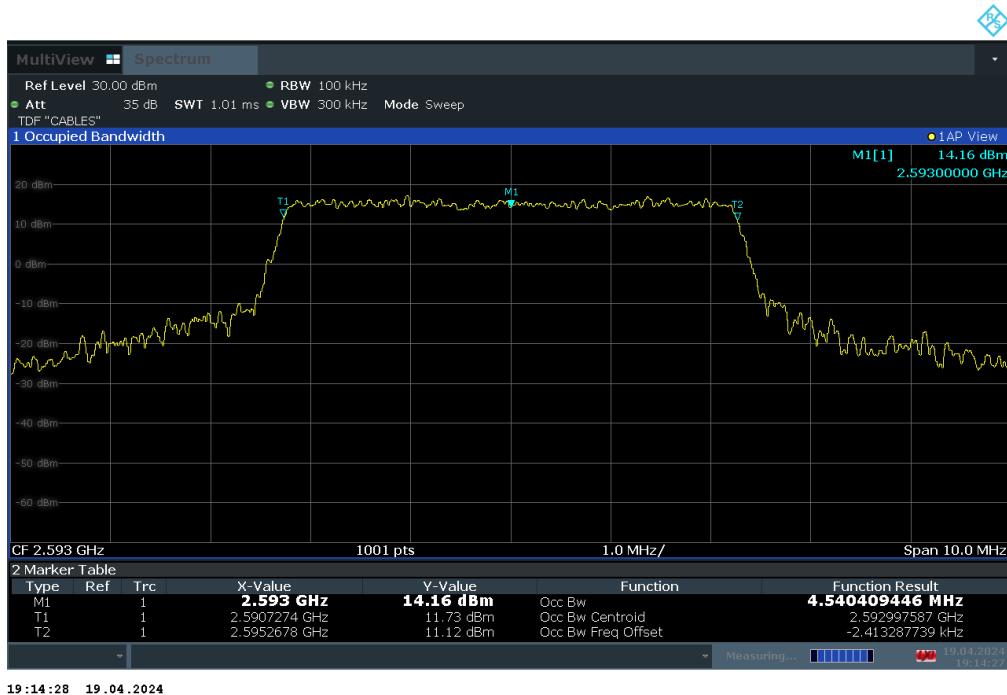
FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 16 of 69	



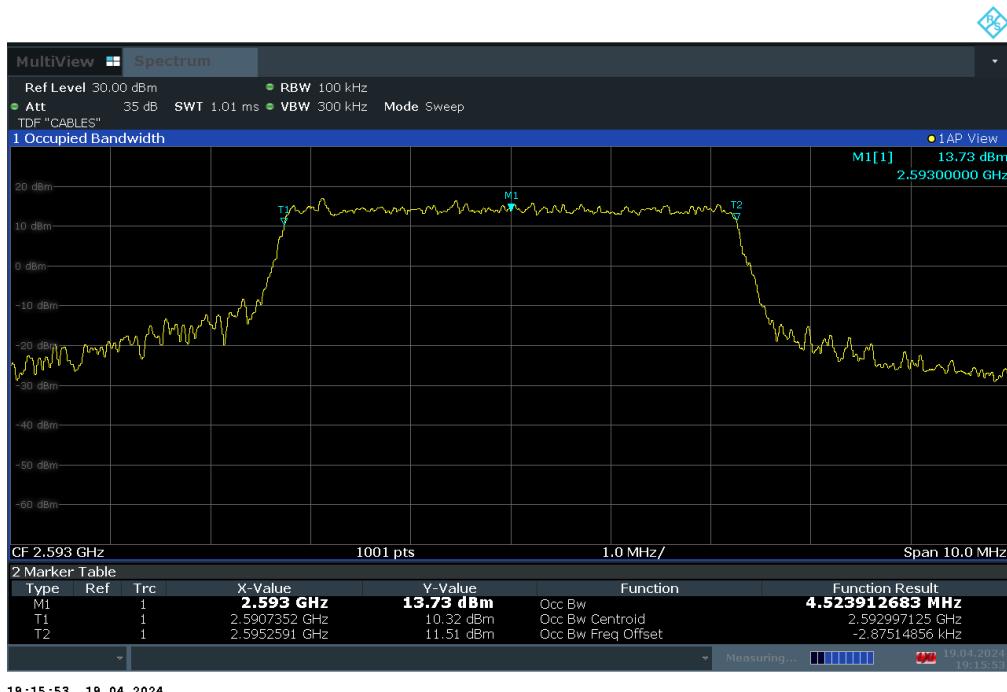
Plot 7-8. Occupied Bandwidth Plot (LTE Band 7 - 20MHz 16-QAM - Full RB)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 17 of 69	

LTE Band 41

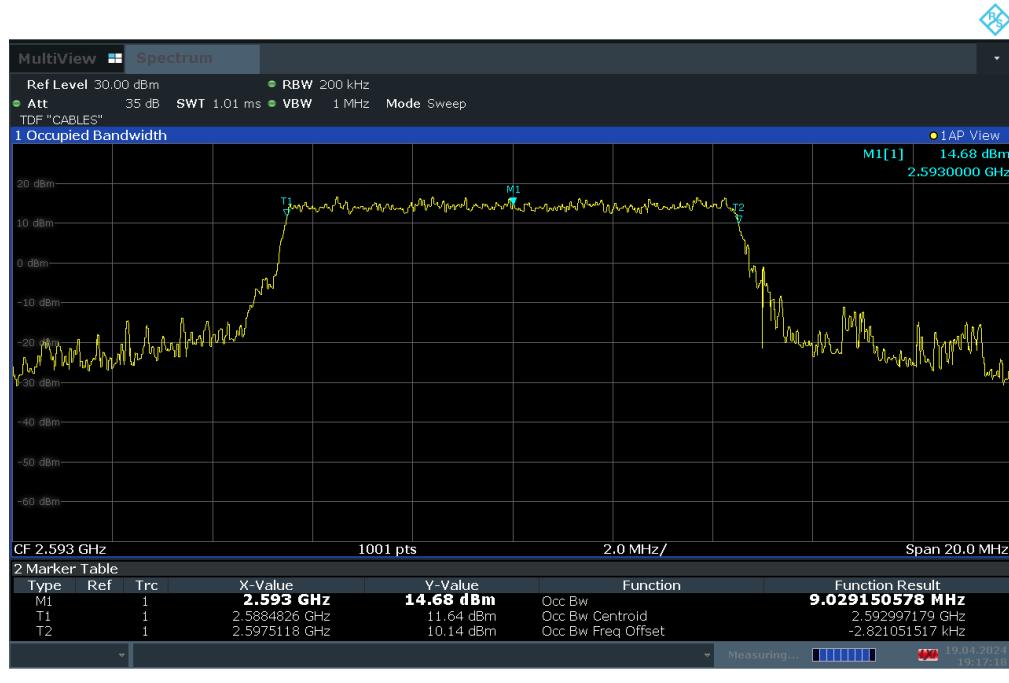


Plot 7-9. Occupied Bandwidth Plot (LTE Band 41 - 5MHz QPSK - Full RB)

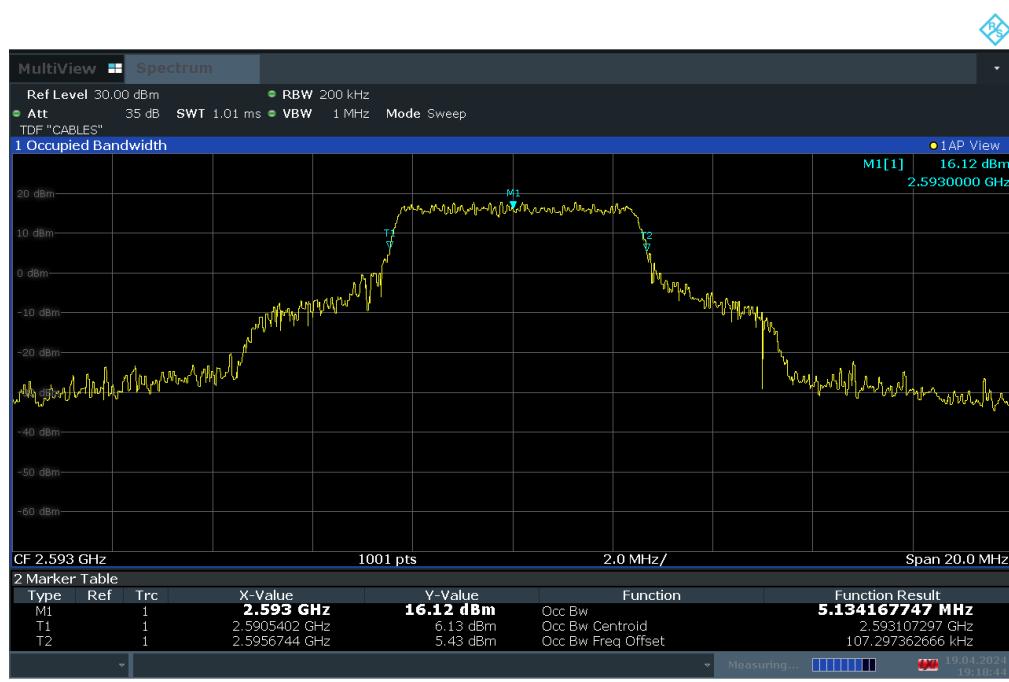


Plot 7-10. Occupied Bandwidth Plot (LTE Band 41 - 5MHz 16-QAM - Full RB)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 18 of 69	



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-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 19 of 69	

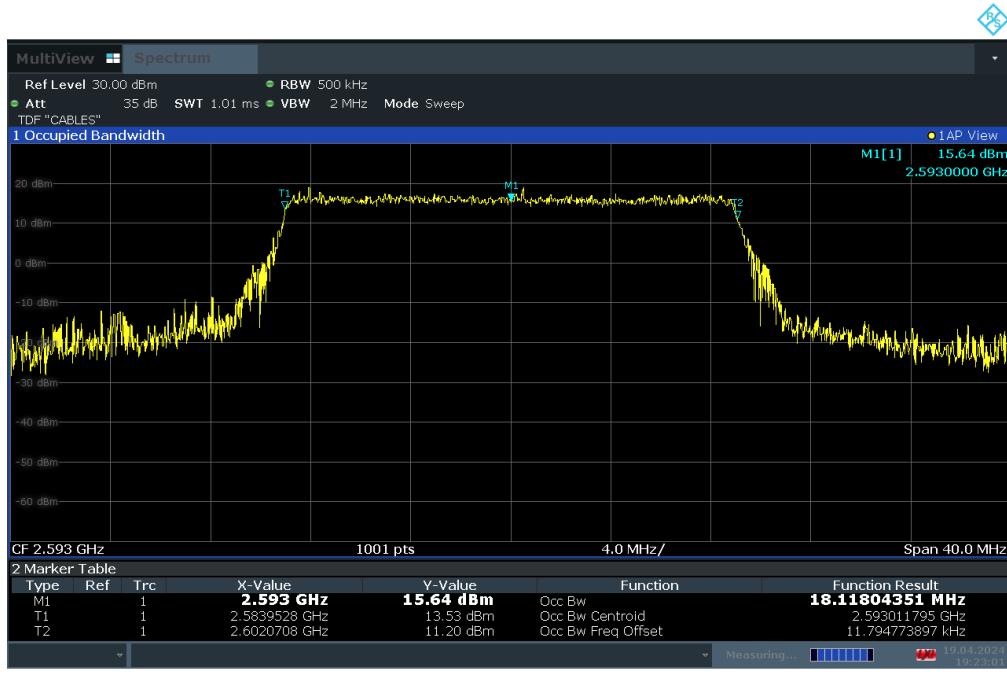


Plot 7-13. Occupied Bandwidth Plot (LTE Band 41 - 15MHz QPSK - Full RB)

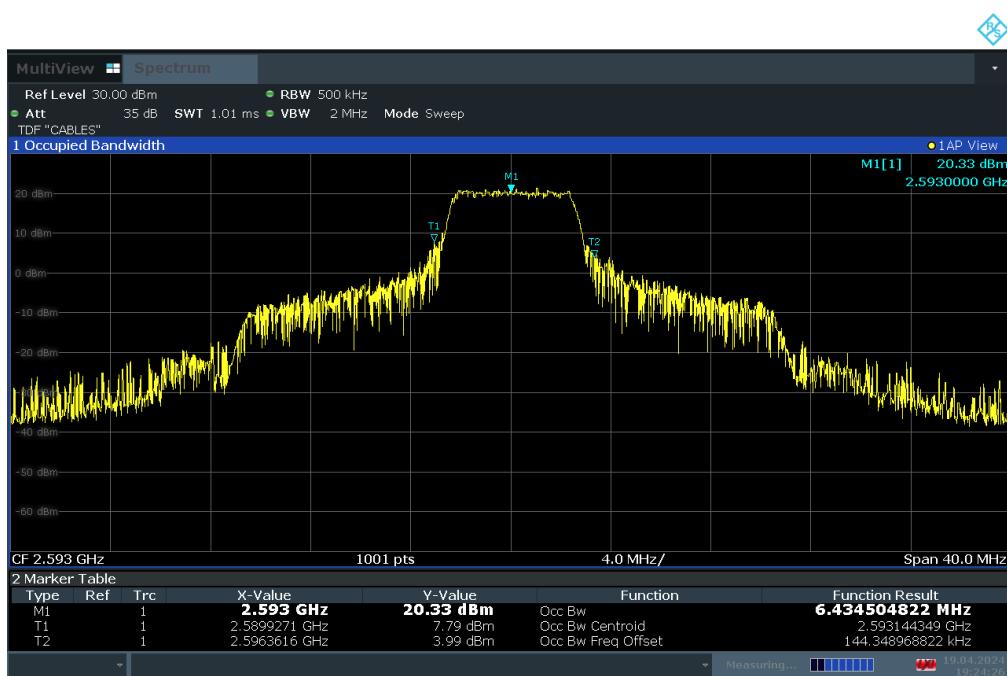


Plot 7-14. Occupied Bandwidth Plot (LTE Band 41 - 15MHz 16-QAM - Full RB)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 20 of 69	



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-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 21 of 69

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7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051, §27.53(a), §27.53(m)

Test Overview and Limit

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

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.

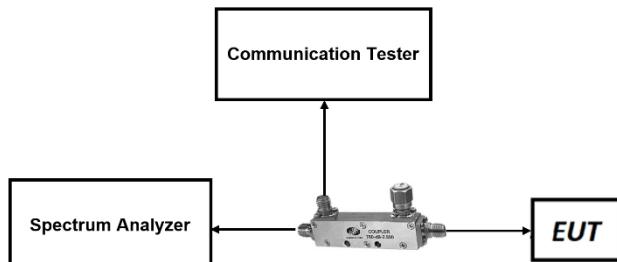


Figure 7-2. Test Instrument & Measurement Setup

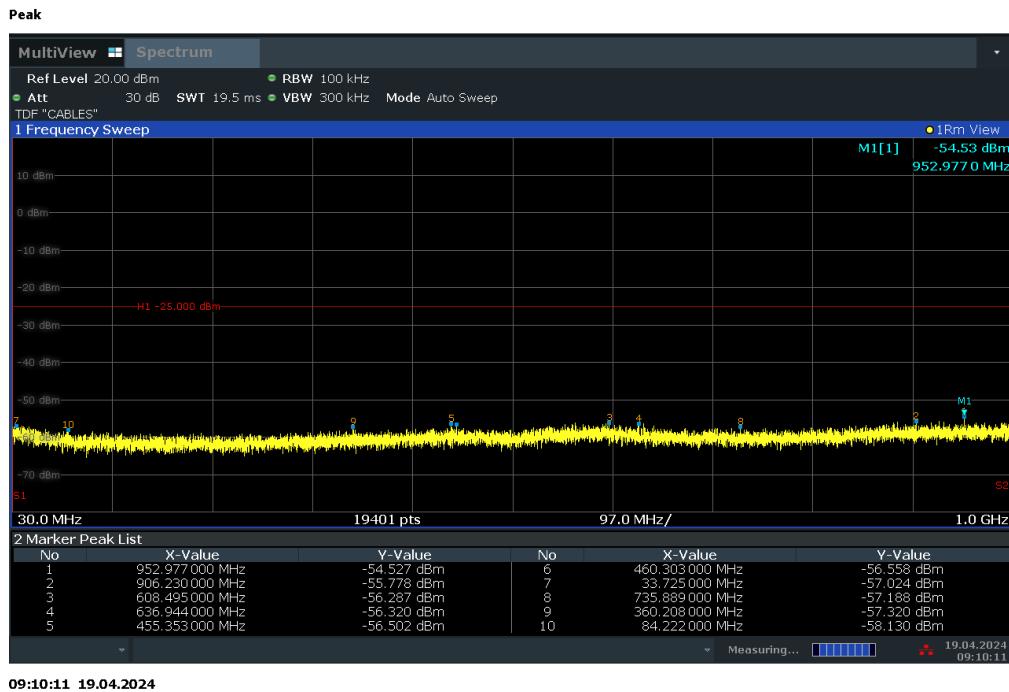
FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 22 of 69	

Test Notes

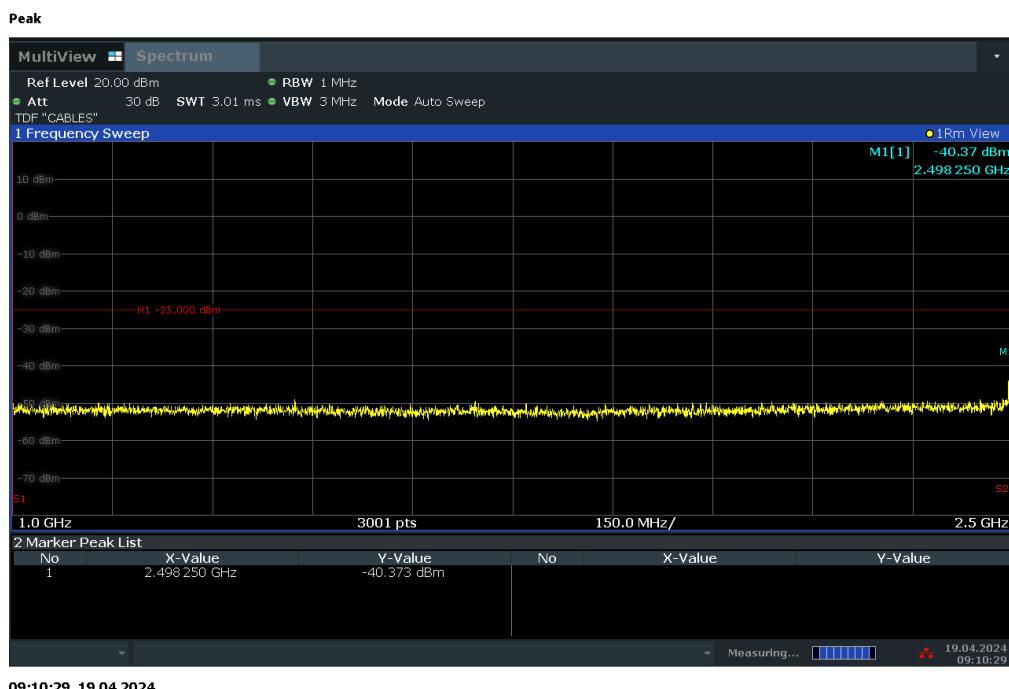
1. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent 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-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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LTE Band 7



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

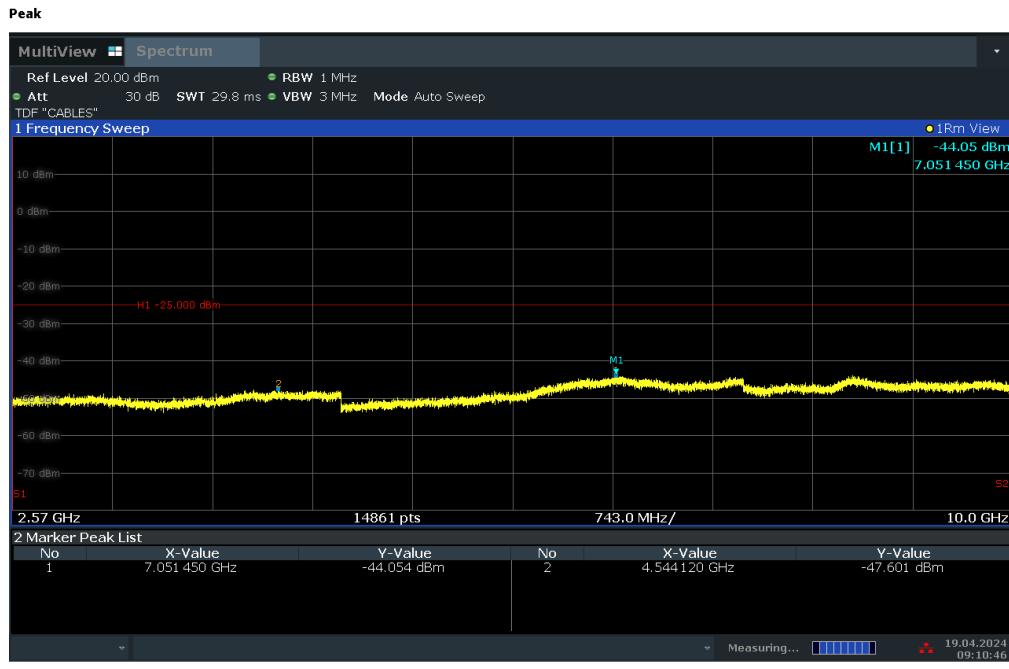


Plot 7-18. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

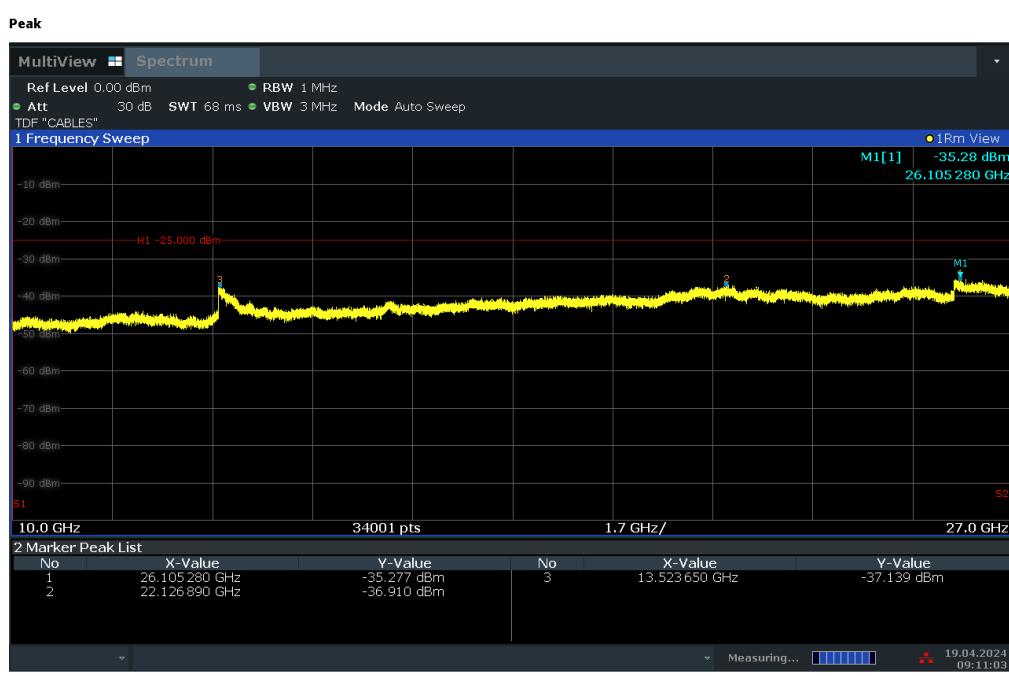
FCC ID: BCG-A3003	PART 27 MEASUREMENT REPORT			Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 24 of 69

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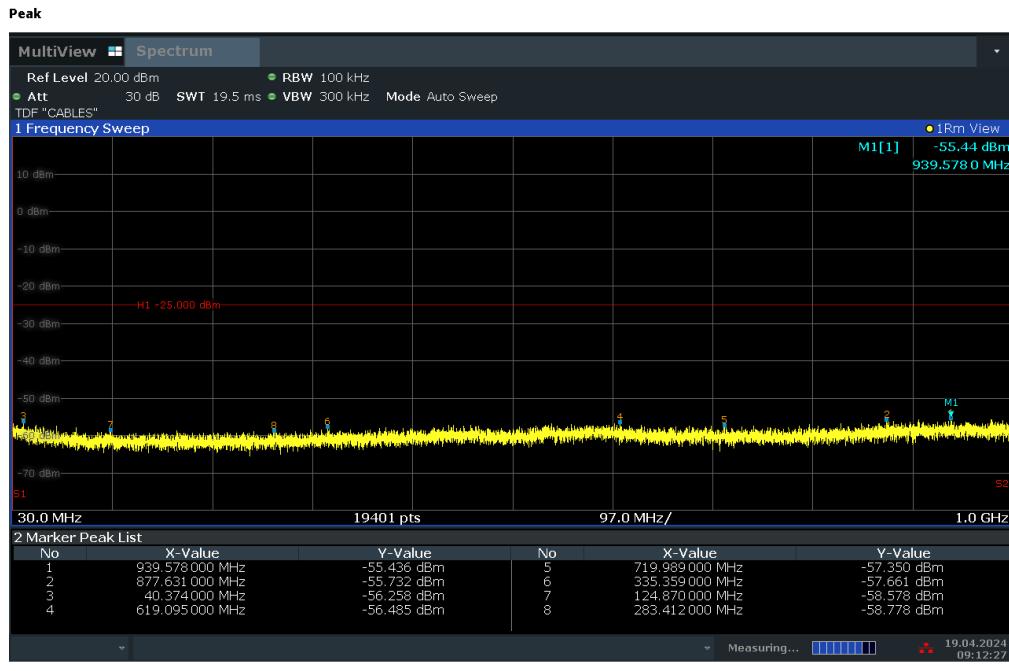


Plot 7-19. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

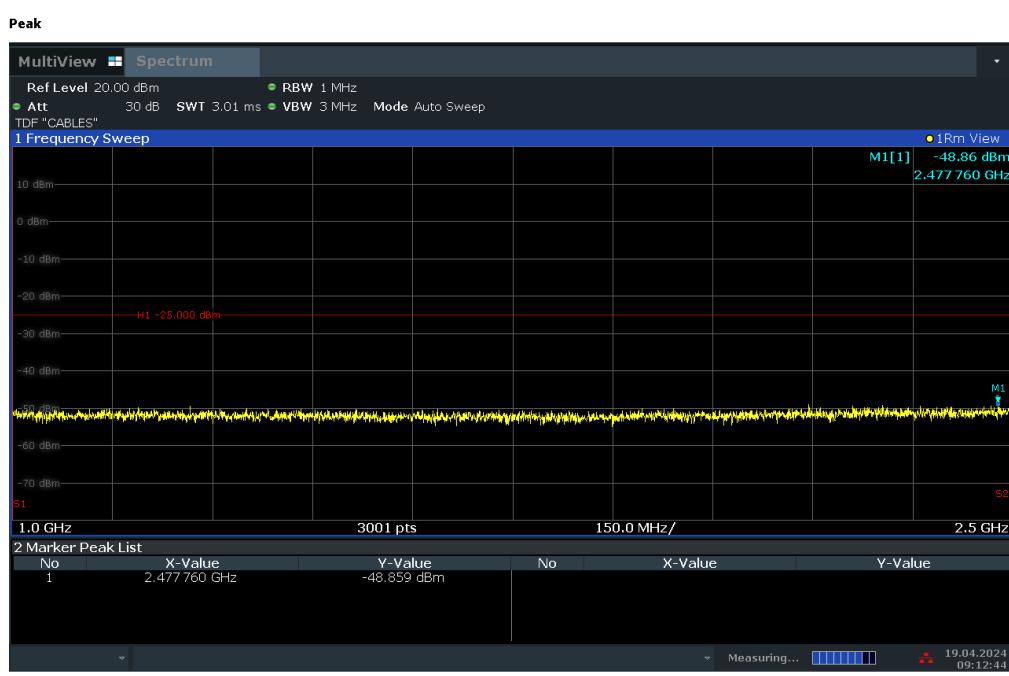


Plot 7-20. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 25 of 69	

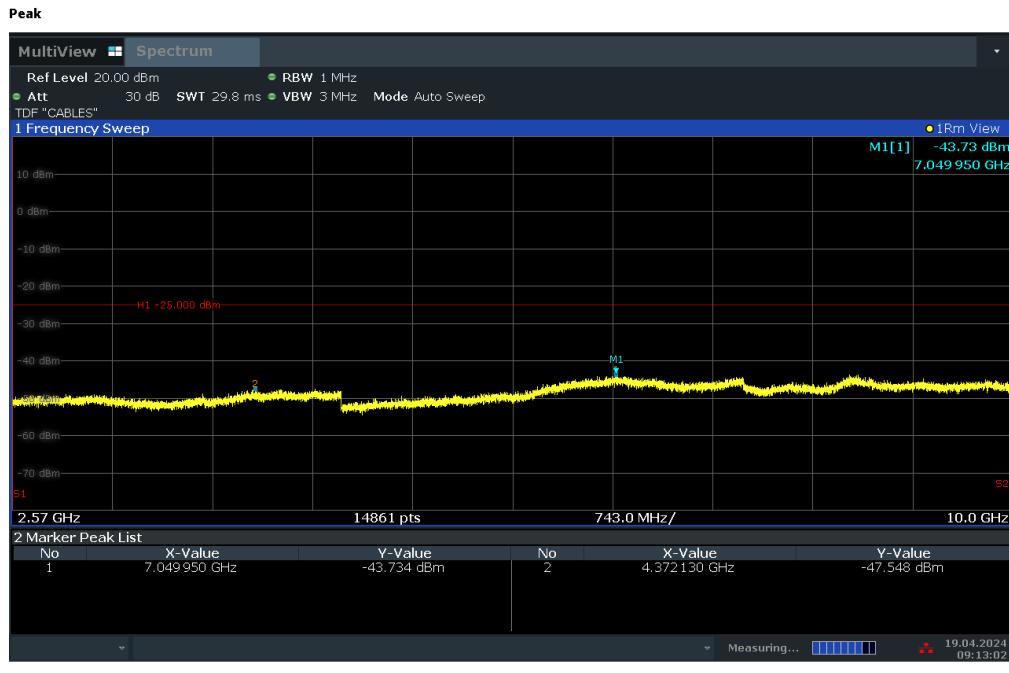


Plot 7-21. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

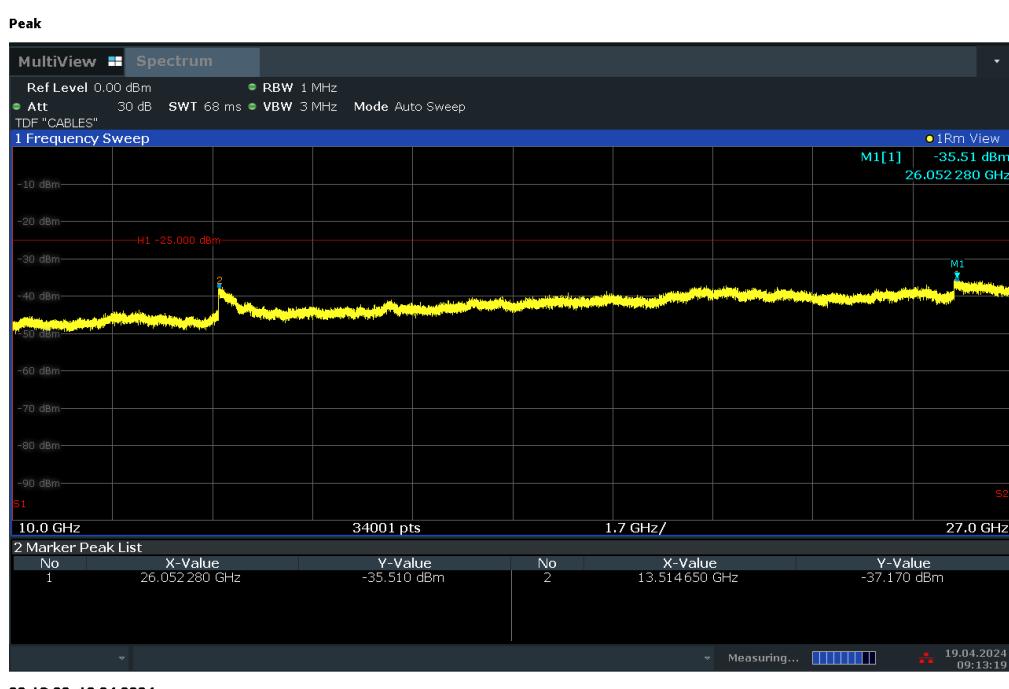


Plot 7-22. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 26 of 69	

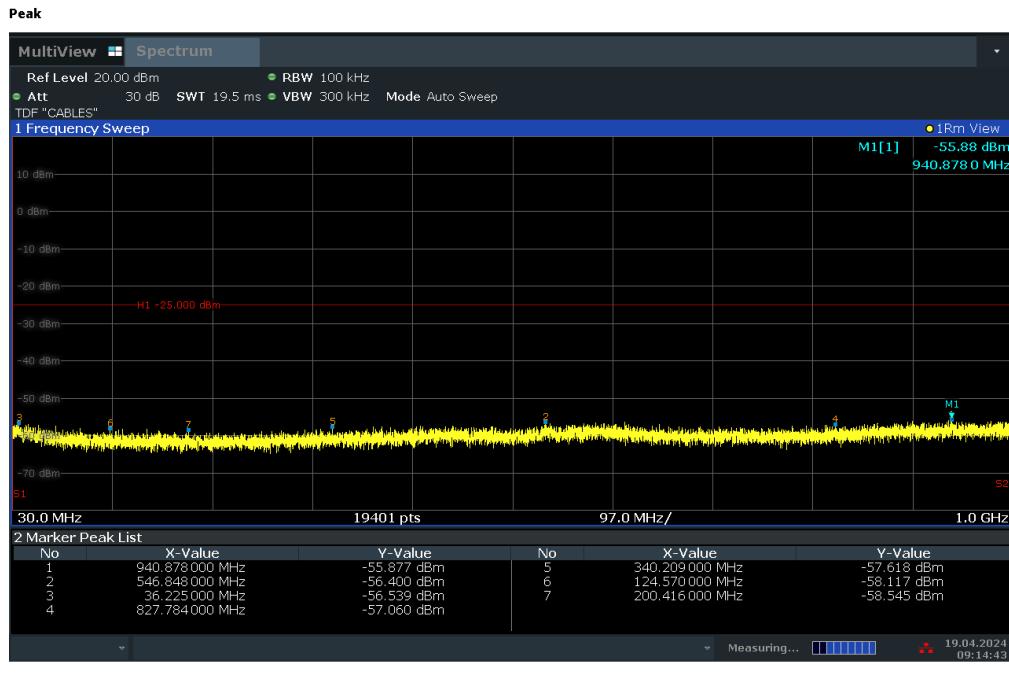


Plot 7-23. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

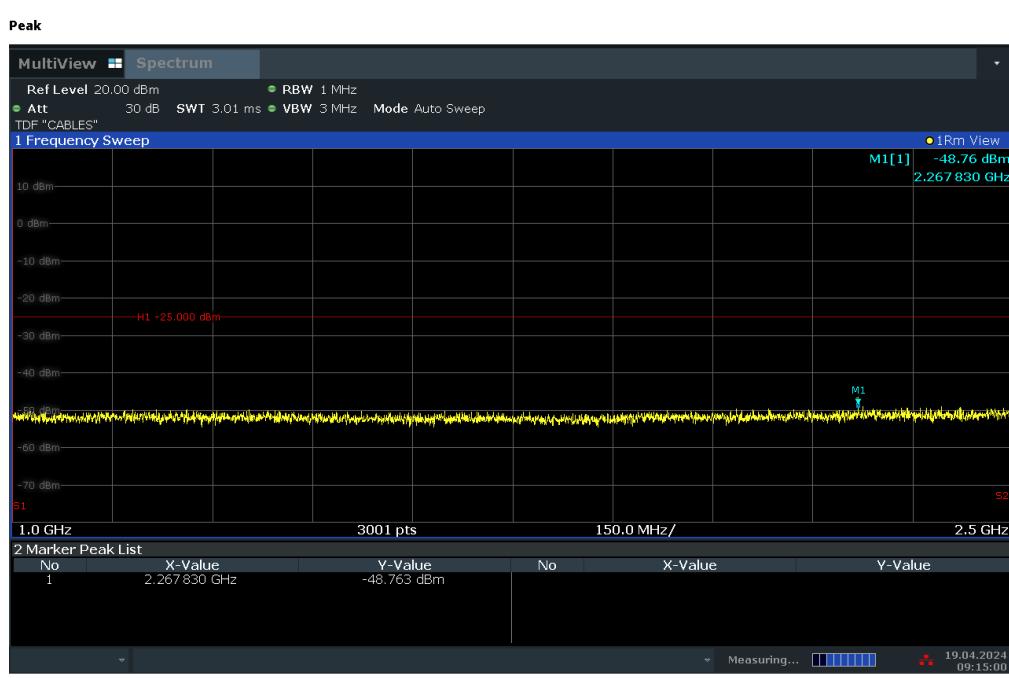


Plot 7-24. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 27 of 69	

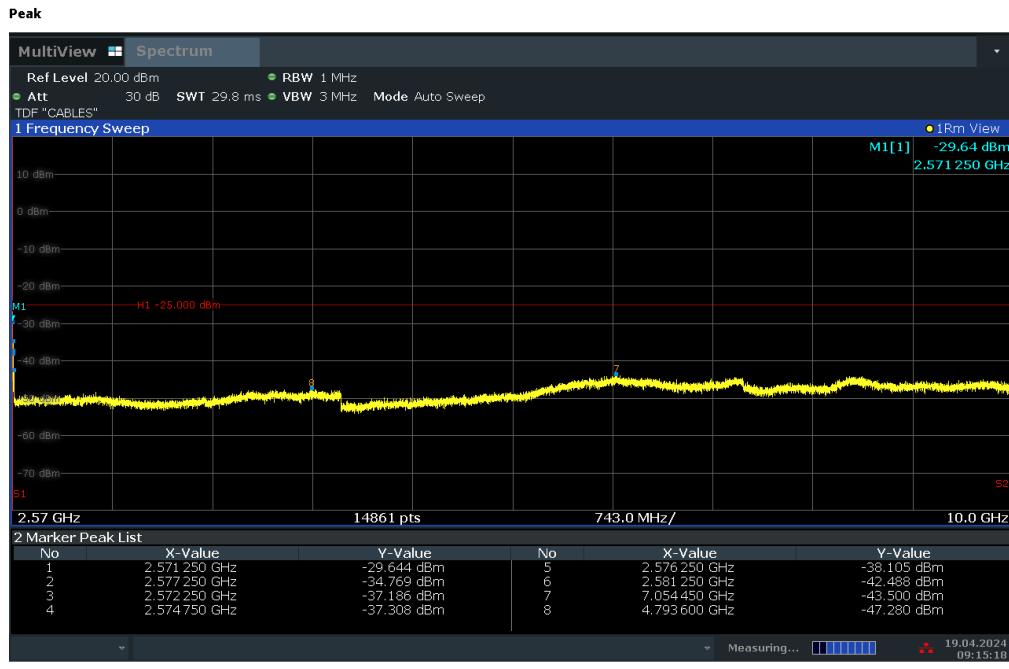


Plot 7-25. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

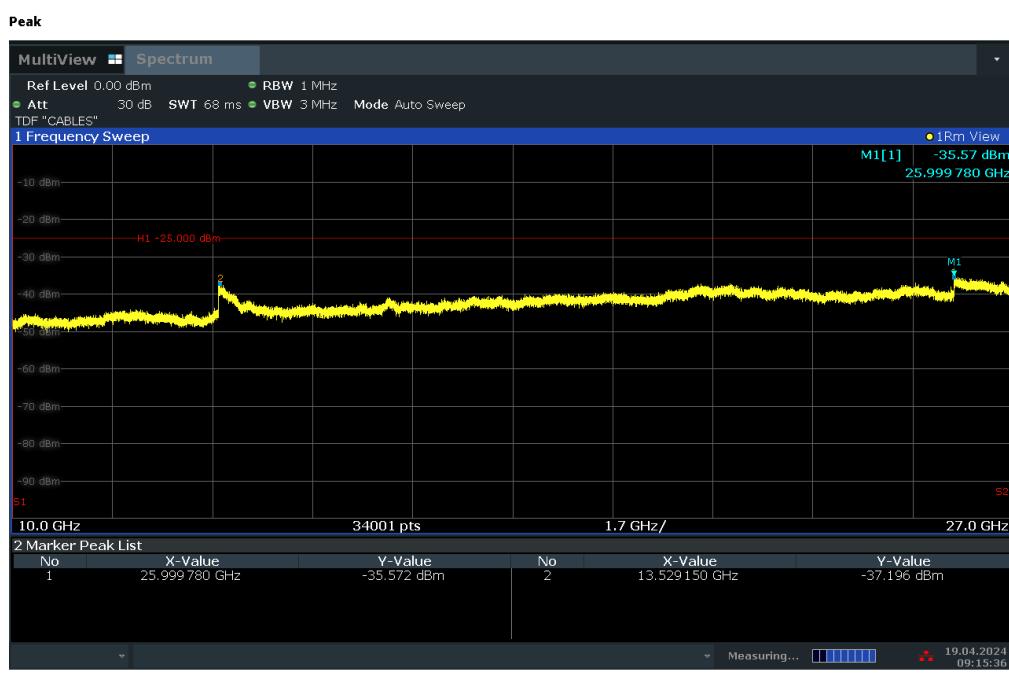


Plot 7-26. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 28 of 69	



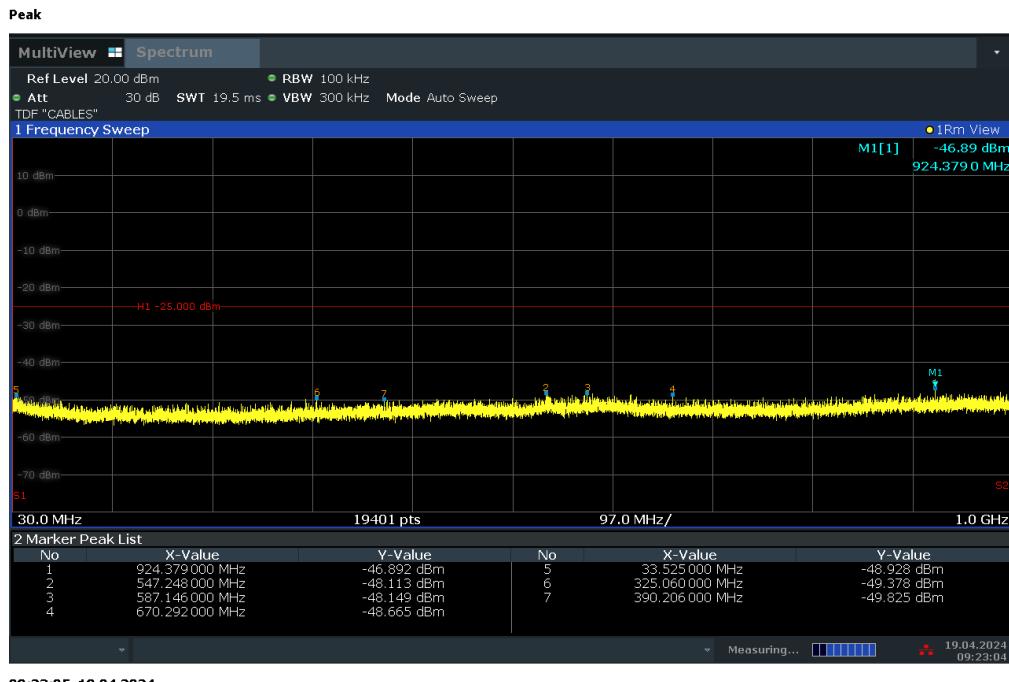
Plot 7-27. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



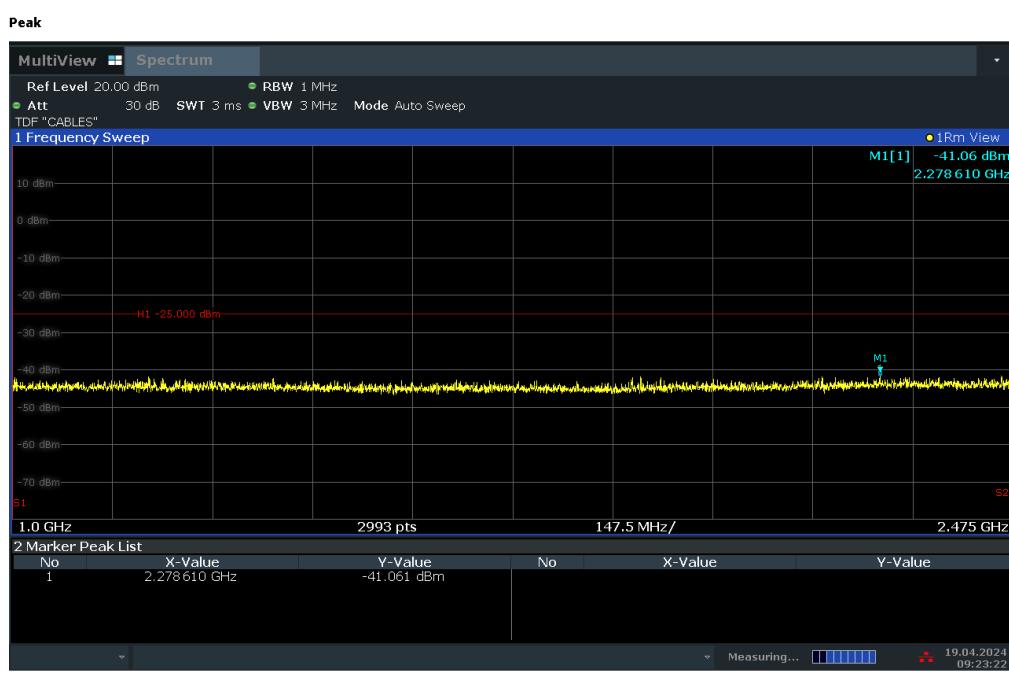
Plot 7-28. Conducted Spurious Plot (LTE Band 7 - 20MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 29 of 69	

LTE Band 41

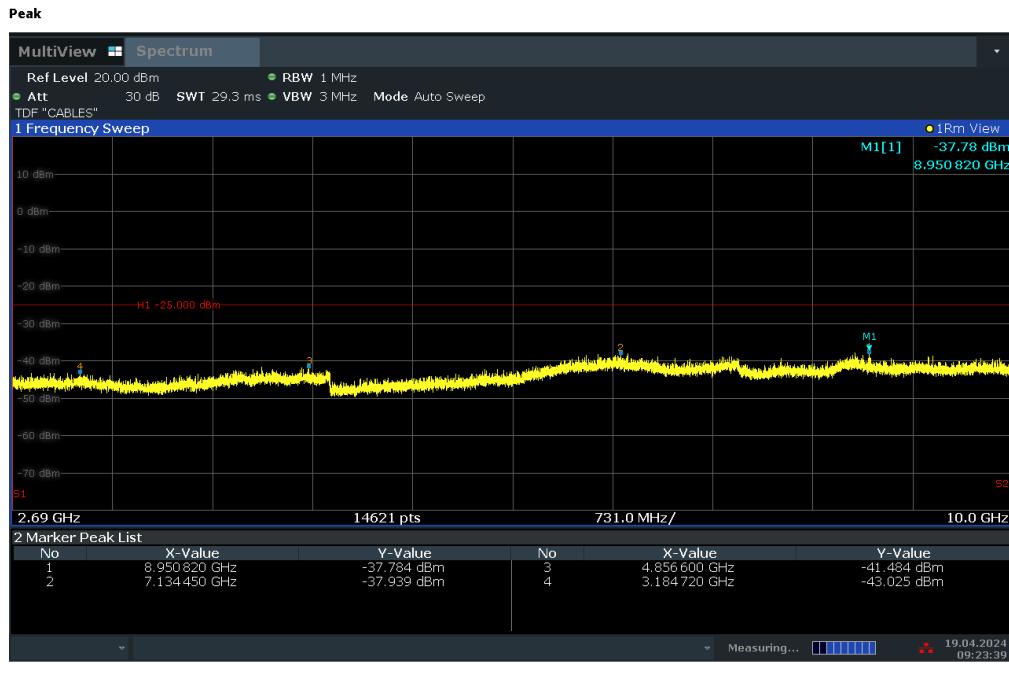


Plot 7-29. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

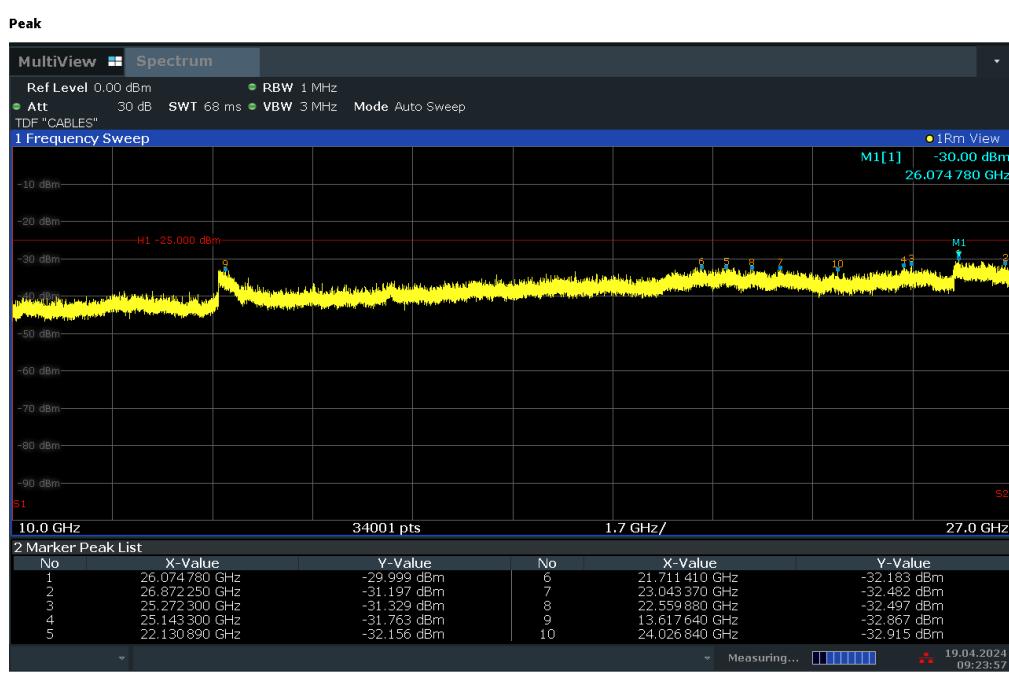


Plot 7-30. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 30 of 69

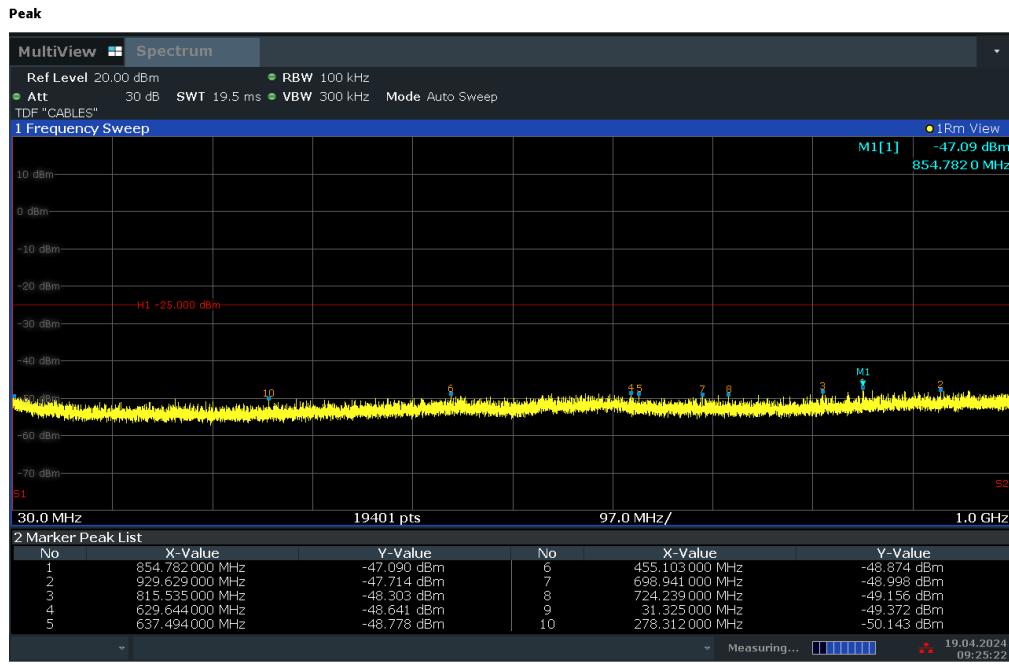


Plot 7-31. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

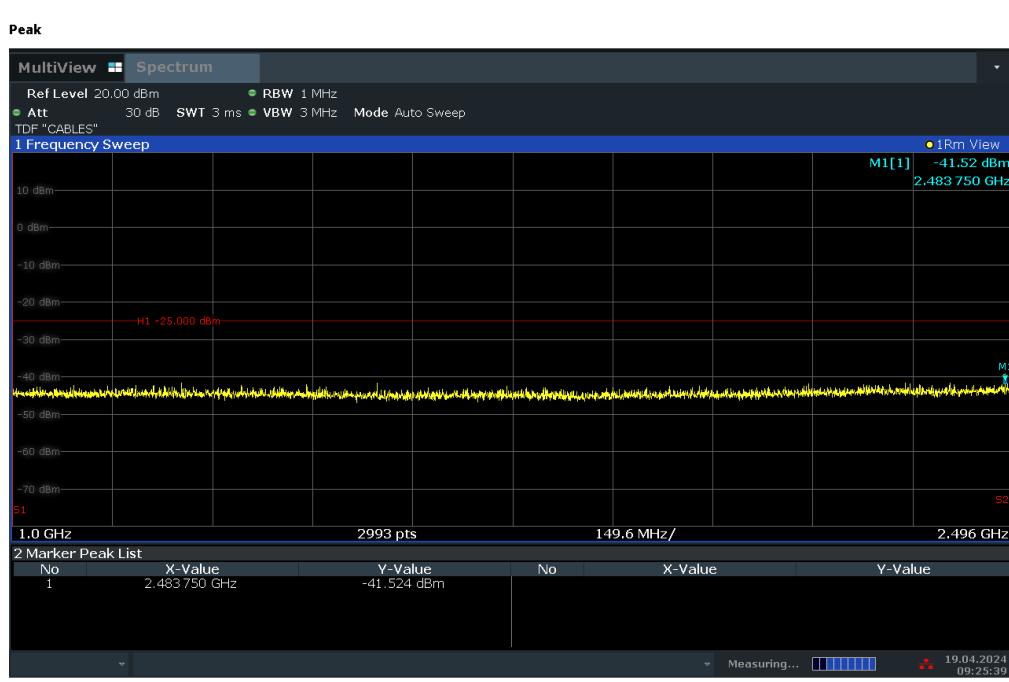


Plot 7-32. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 31 of 69	



Plot 7-33. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

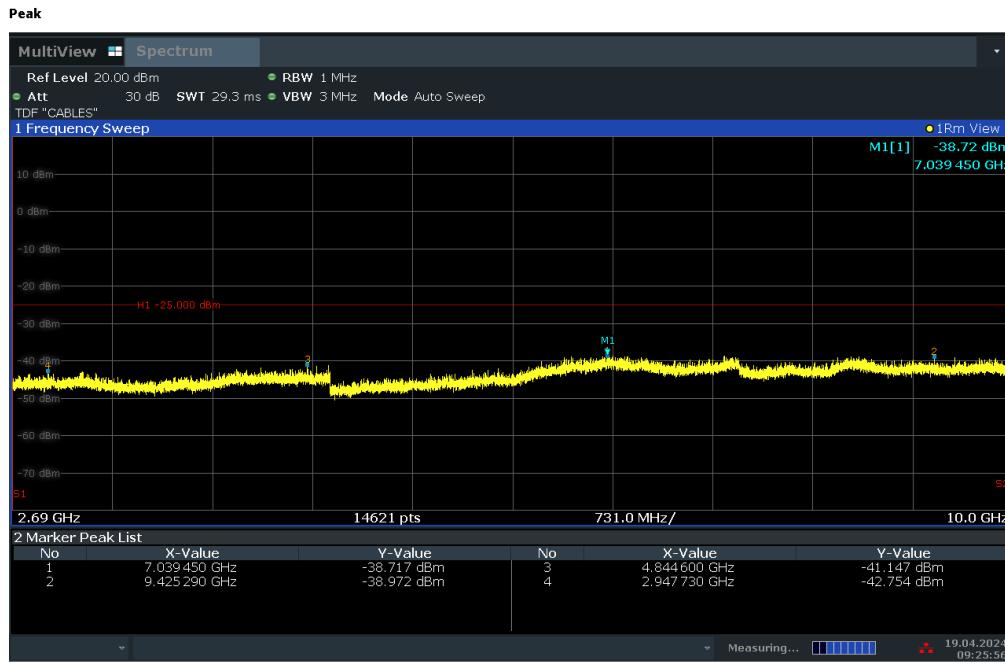


Plot 7-34. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

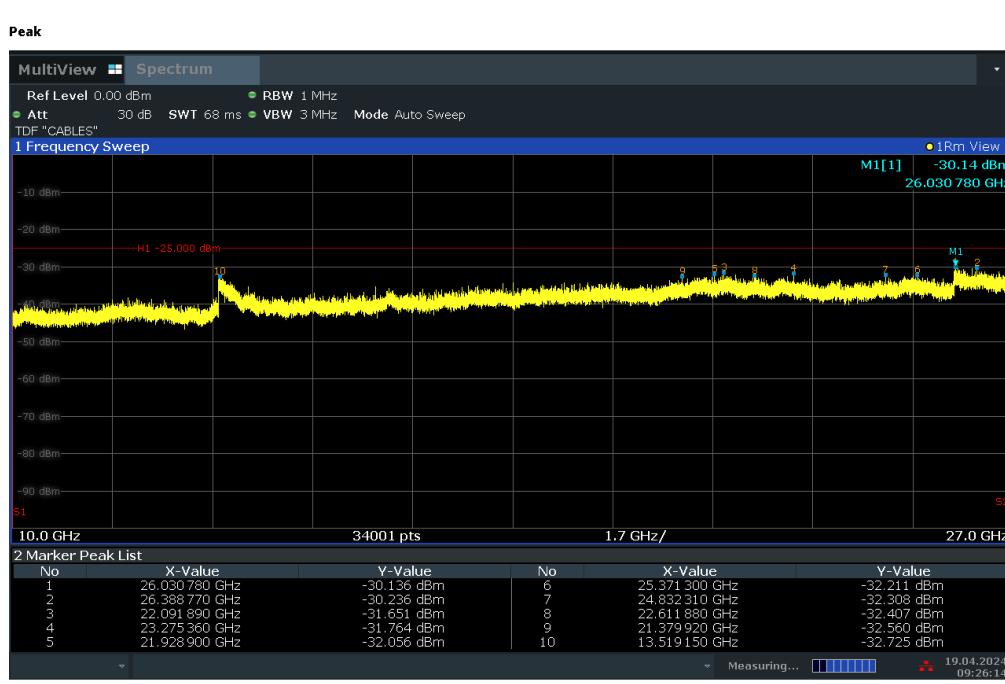
FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 32 of 69	

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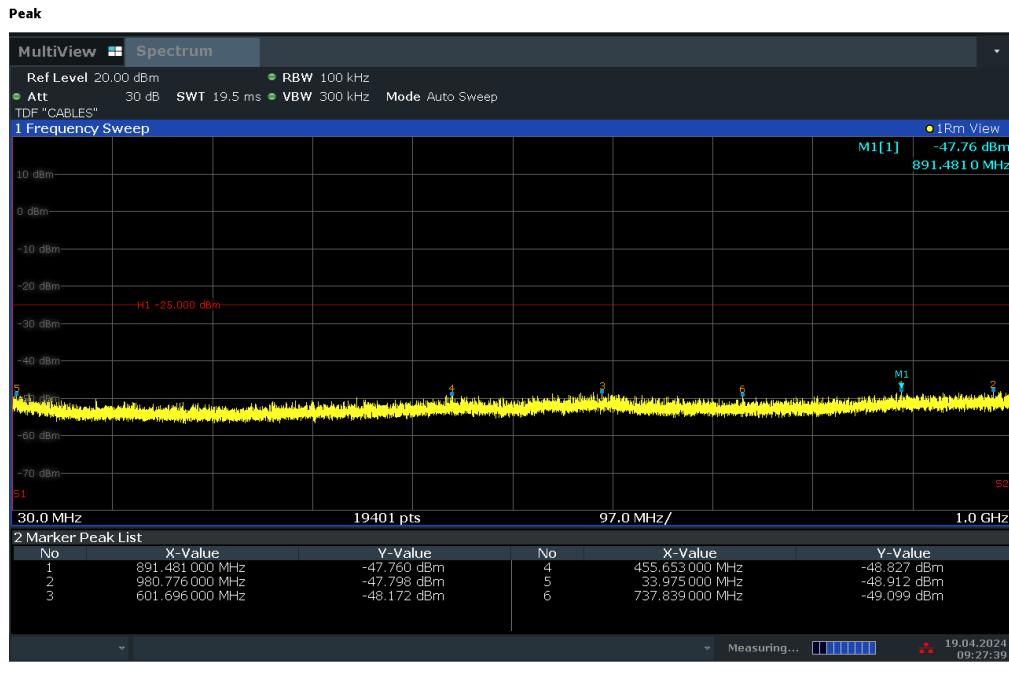


Plot 7-35. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

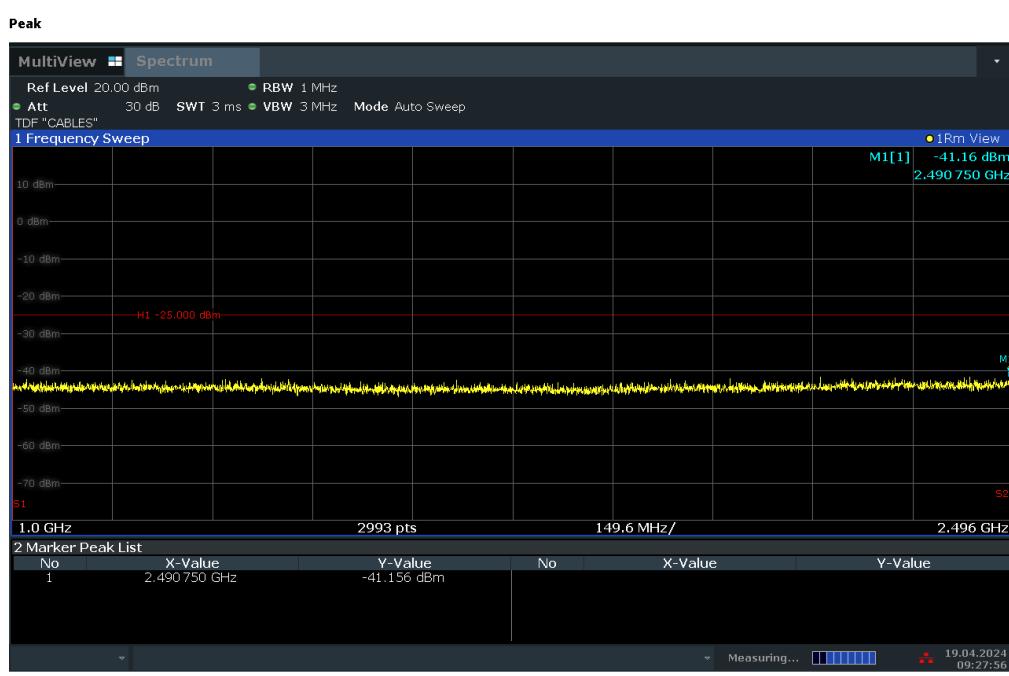


Plot 7-36. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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Plot 7-37. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

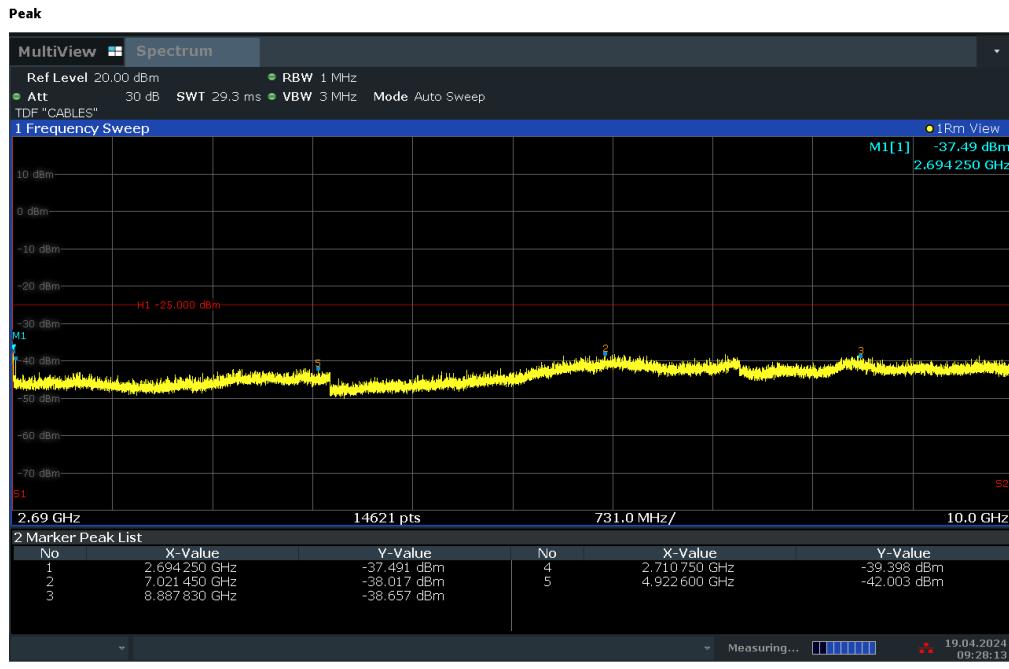


Plot 7-38. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

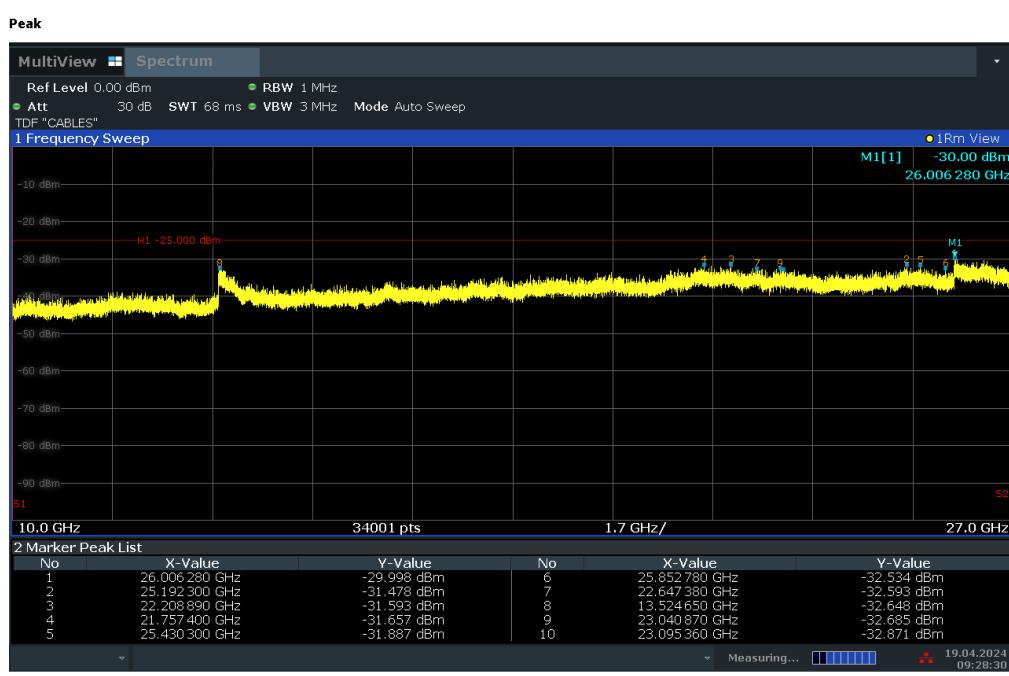
FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 34 of 69	

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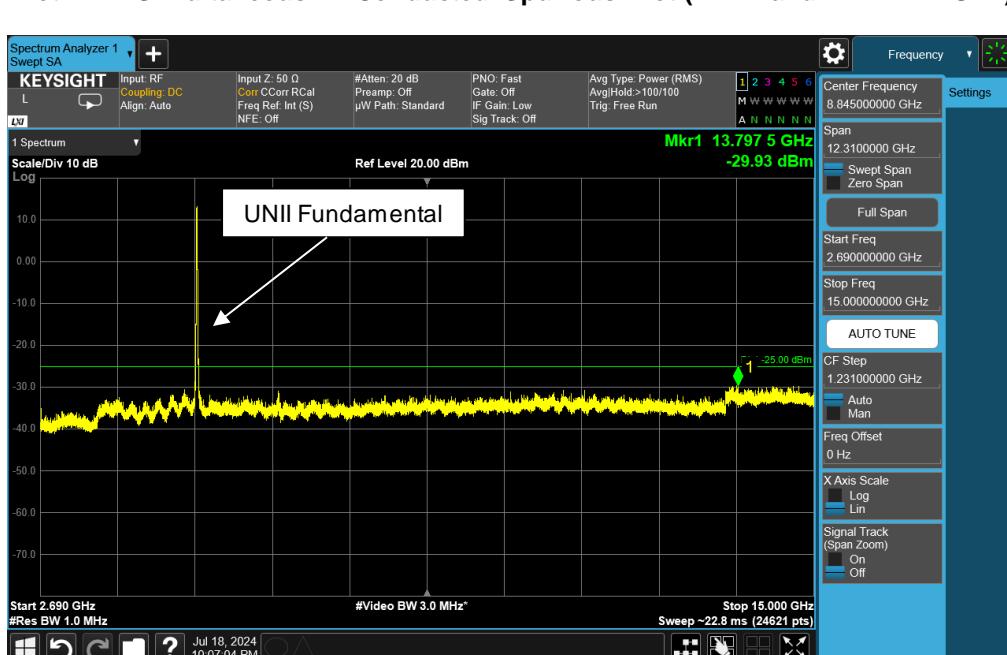
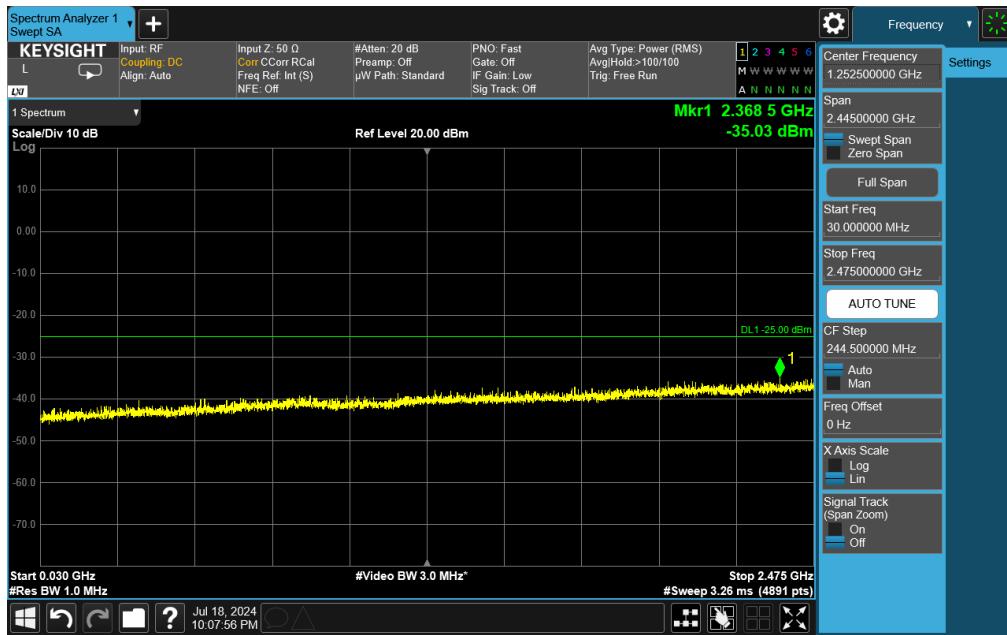
Plot 7-39. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



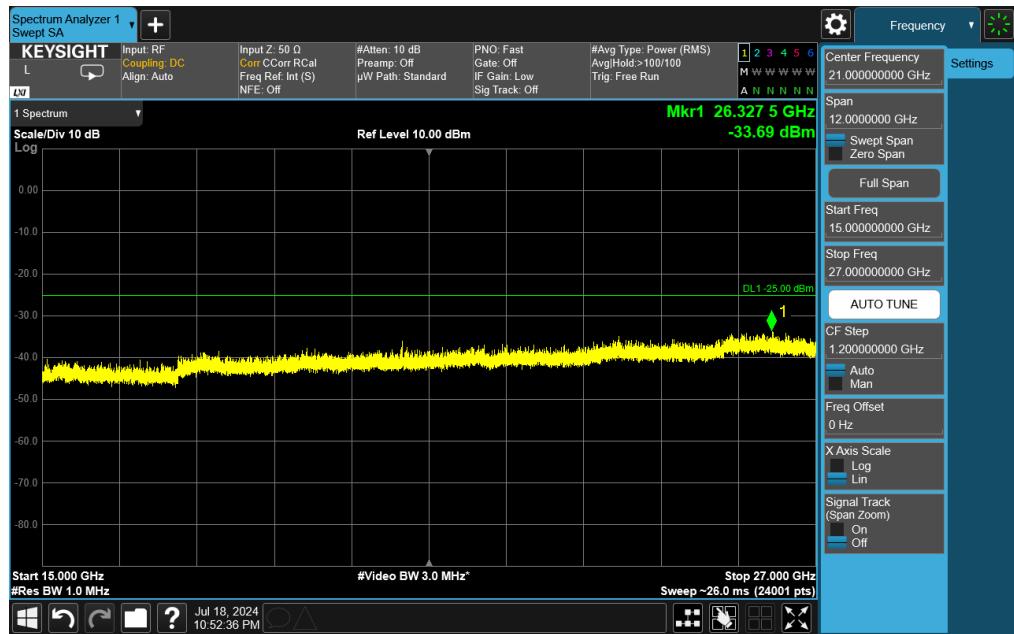
Plot 7-40. Conducted Spurious Plot (LTE Band 41 - 20MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 35 of 69	

Simultaneous Tx Conducted Spurious Emissions Measurements



FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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FCC ID: BCG-A3003	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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7.4 Band Edge Emissions at Antenna Terminal

§2.1051, §27.53(a), §27.53(m)

Test Overview and Limit

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 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 x RBW
5. Detector = RMS
6. Number of sweep points \geq 2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

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

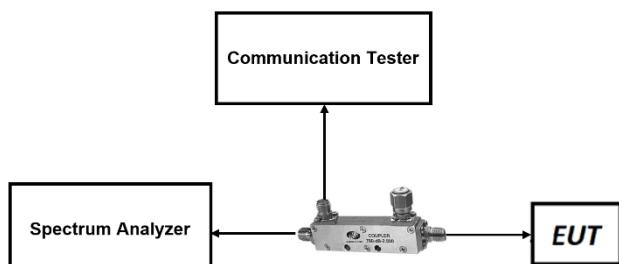


Figure 7-3. Test Instrument & Measurement Setup

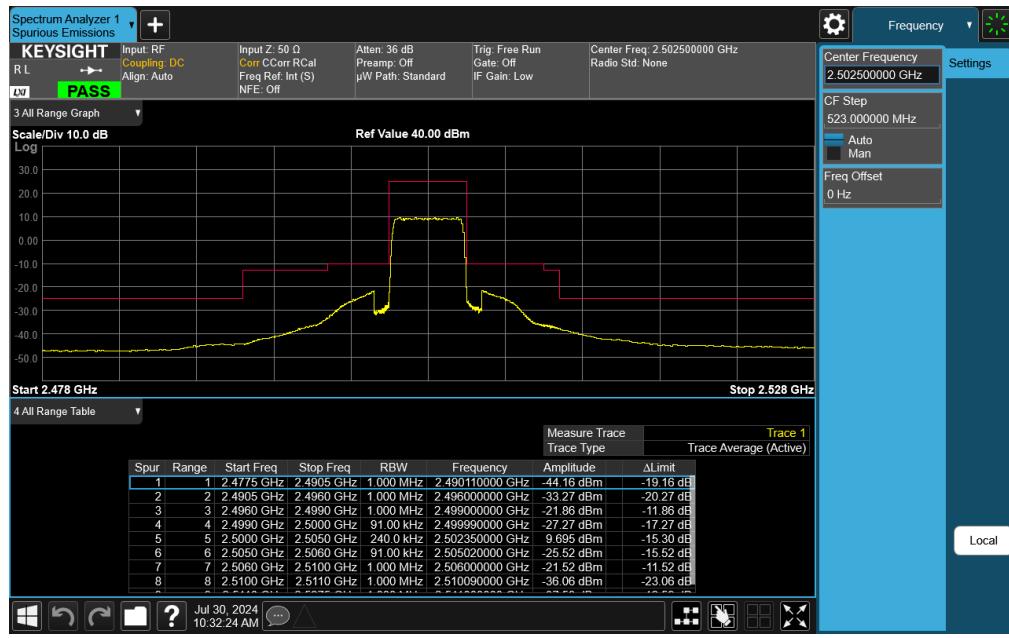
FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 38 of 69

Test Notes

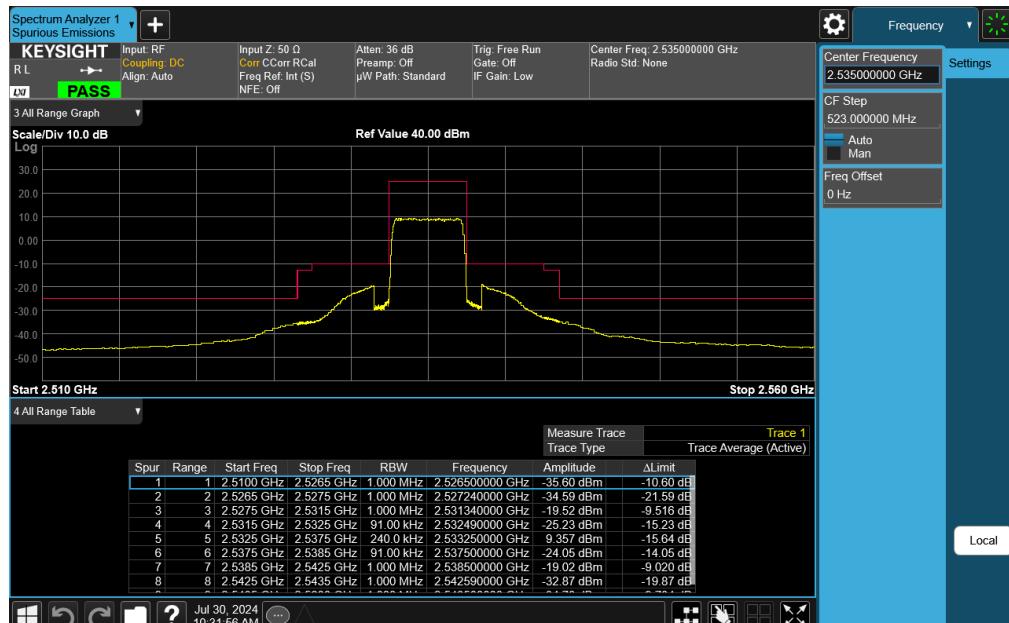
1. Per 27.53(h), in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission 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-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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LTE Band 7

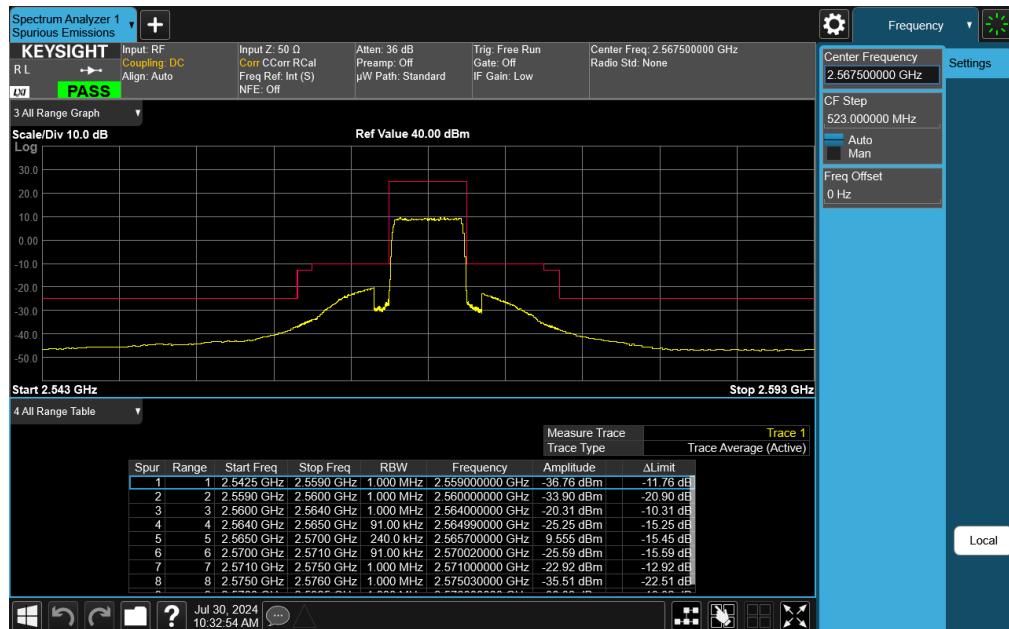


Plot 7-44. Lower ACP Plot (LTE Band 7 - 5MHz QPSK – Full RB)

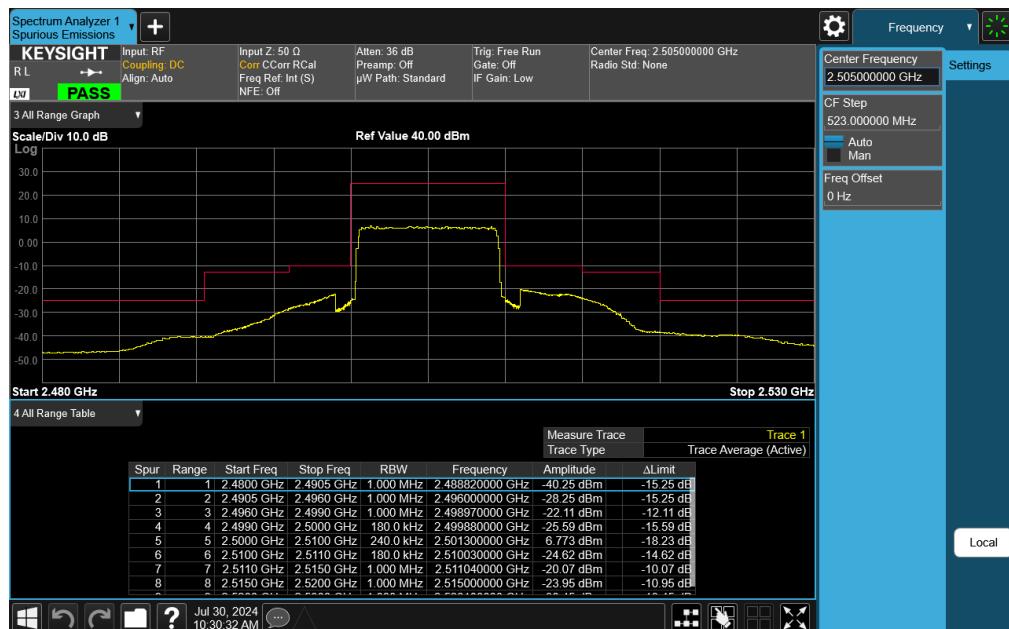


Plot 7-45. Middle ACP Plot (LTE Band 7 - 5MHz QPSK – Full RB)

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 40 of 69

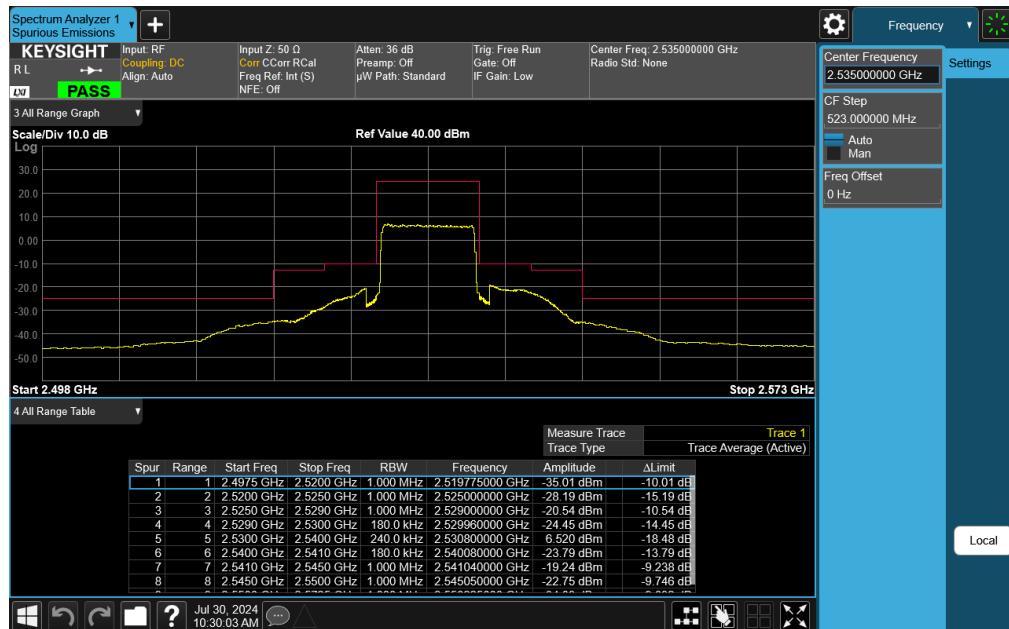


Plot 7-46. Upper ACP Plot (LTE Band 7 - 5MHz QPSK – Full RB)

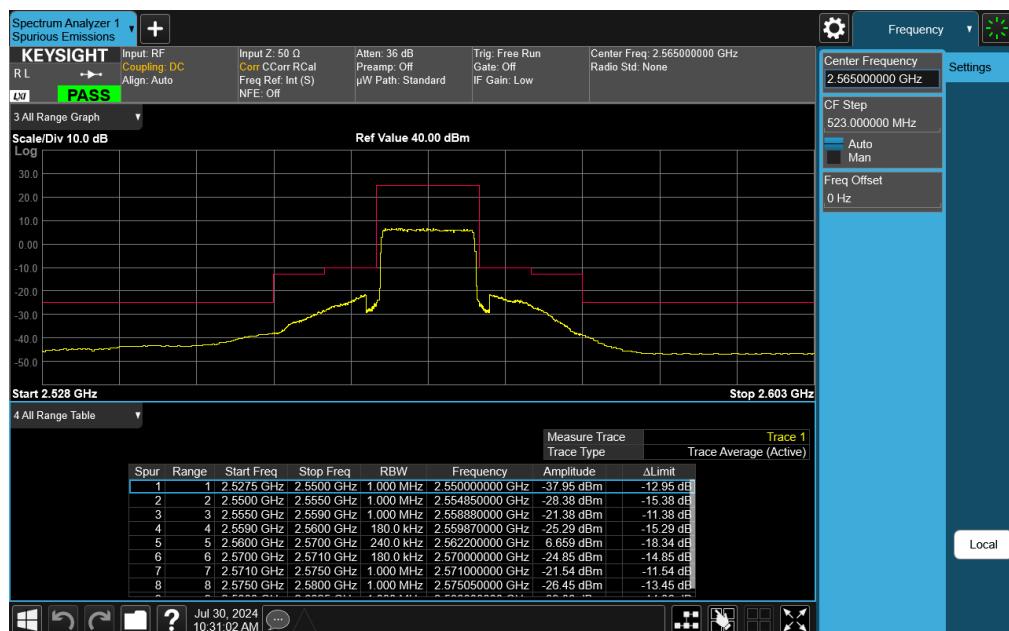


Plot 7-47. Lower ACP Plot (LTE Band 7 - 10MHz QPSK – Full RB)

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 41 of 69



Plot 7-48. Middle ACP Plot (LTE Band 7 - 10MHz QPSK – Full RB)



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

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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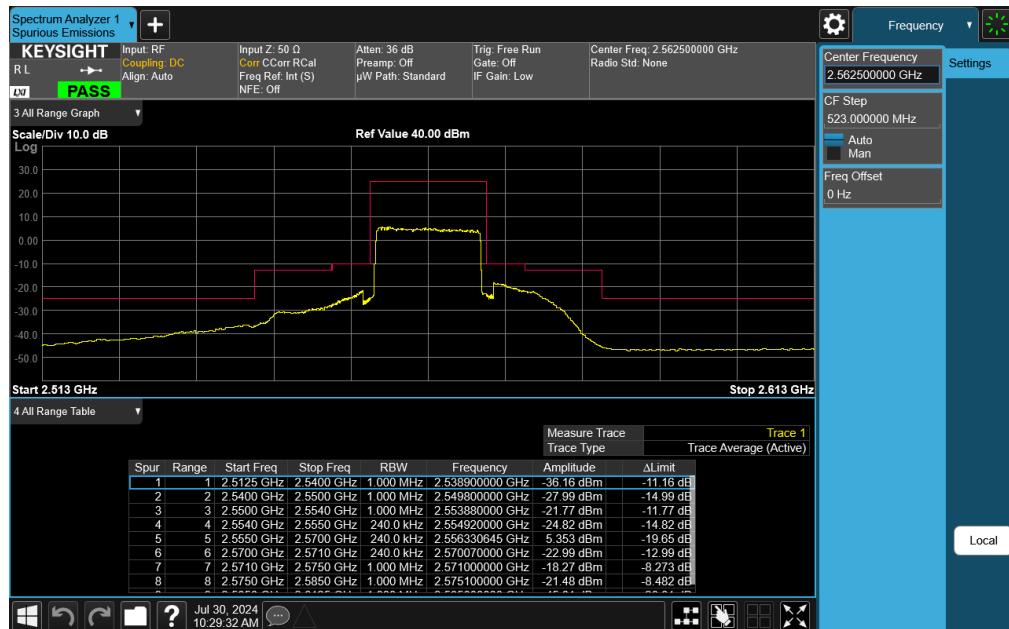


Plot 7-50. Lower ACP Plot (LTE Band 7 - 15MHz QPSK – Full RB)



Plot 7-51. Middle ACP Plot (LTE Band 7 - 15MHz QPSK – Full RB)

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 43 of 69	

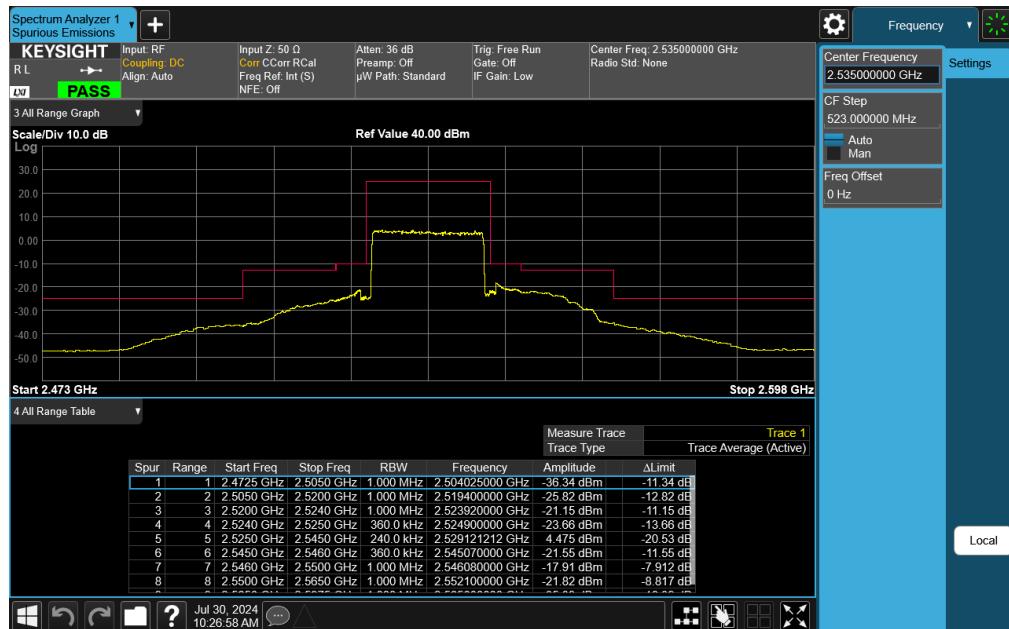


Plot 7-52. Upper ACP Plot (LTE Band 7 - 15MHz QPSK – Full RB)



Plot 7-53. Lower ACP Plot (LTE Band 7 - 20MHz QPSK – Full RB)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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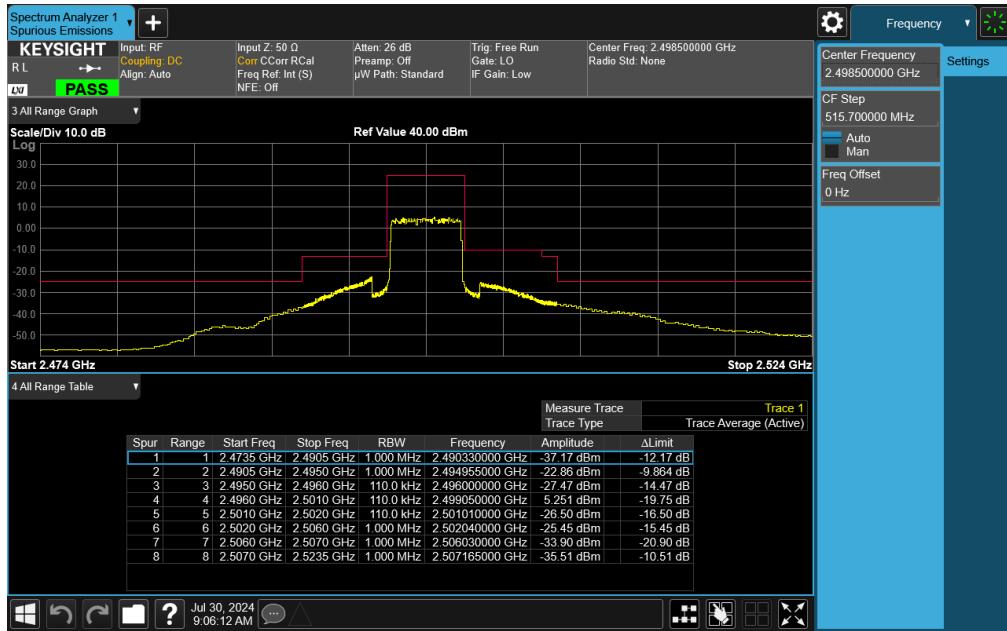
Plot 7-54. Middle ACP Plot (LTE Band 7 - 20MHz QPSK – Full RB)



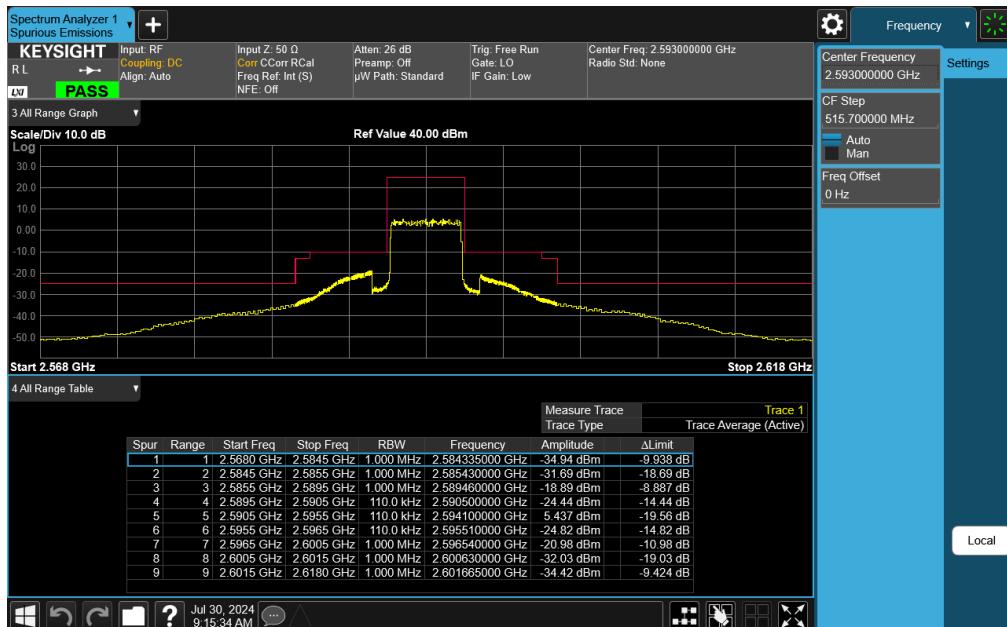
Plot 7-55. Upper ACP Plot (LTE Band 7 - 20MHz QPSK – Full RB)

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 45 of 69

LTE Band 41

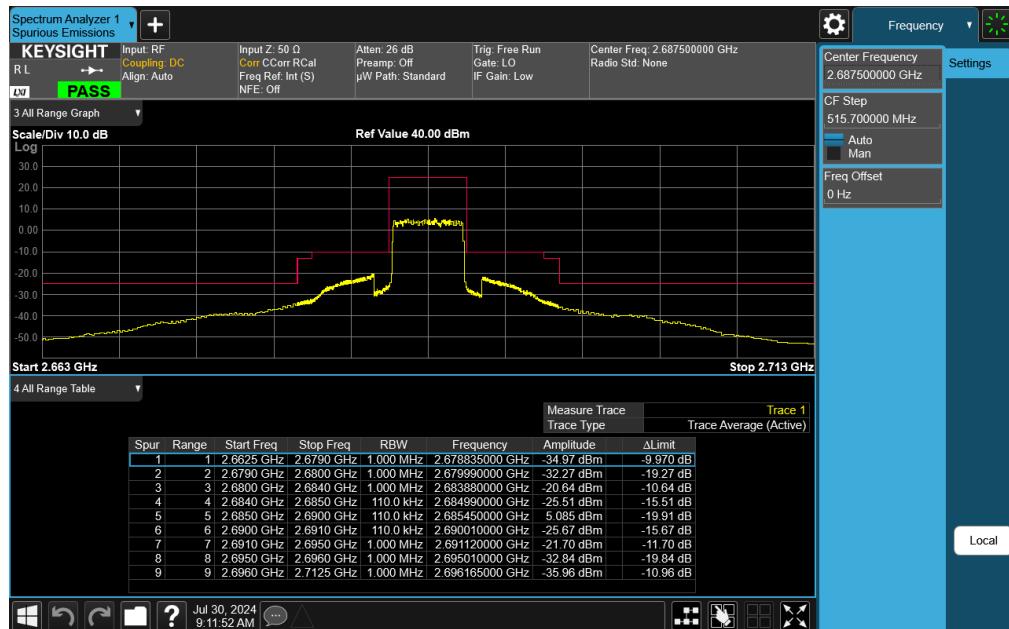


Plot 7-56. Lower ACP Plot (LTE Band 41 - 5MHz QPSK – Full RB)

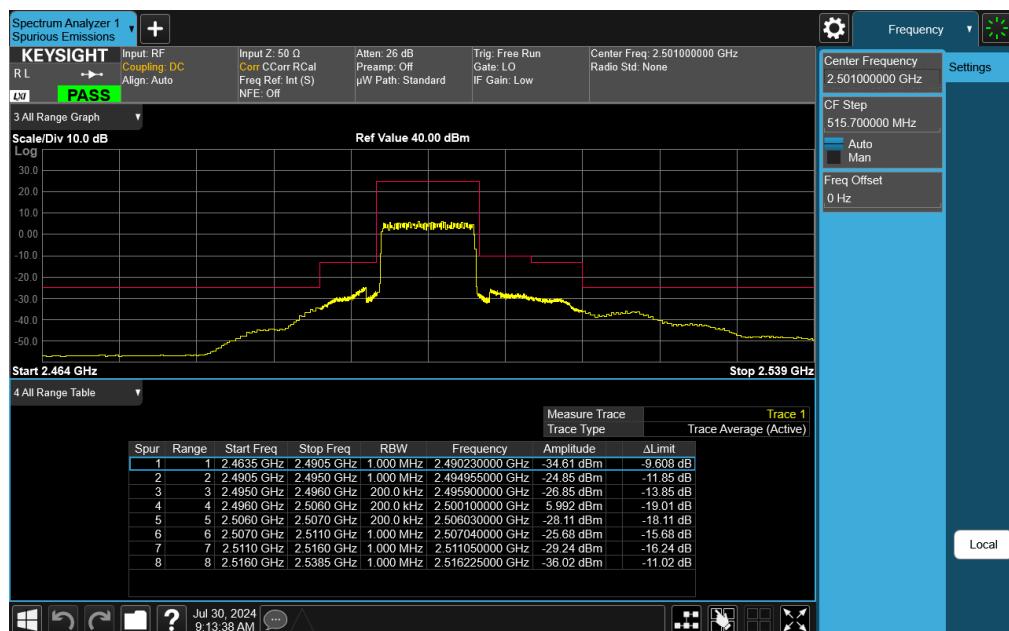


Plot 7-57. Middle ACP Plot (LTE Band 41 - 5MHz QPSK – Full RB)

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 46 of 69



Plot 7-58. Upper ACP Plot (LTE Band 41 - 5MHz QPSK – Full RB)

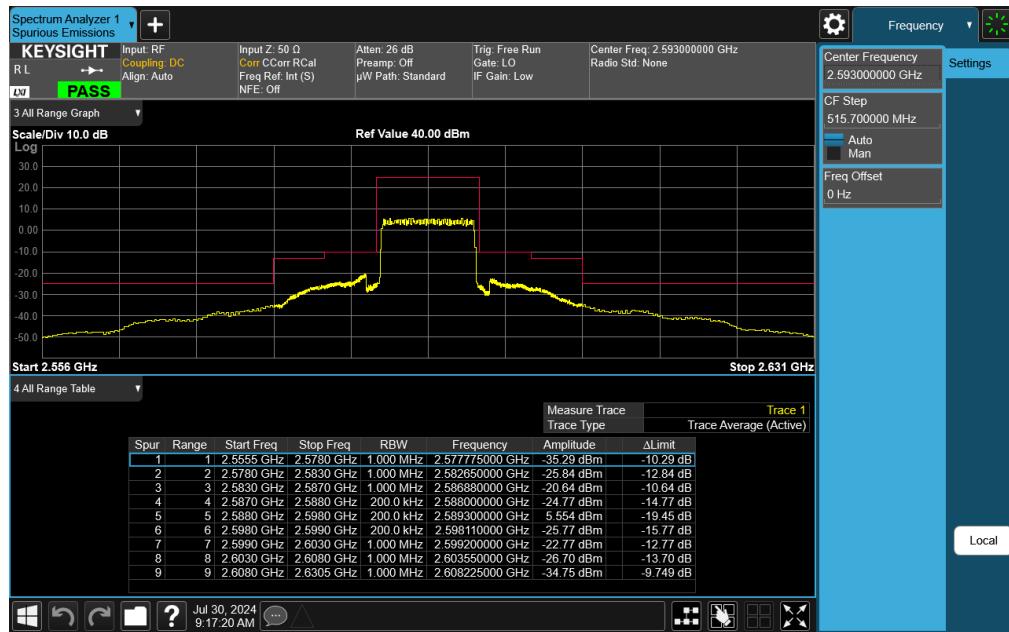


Plot 7-59. Lower ACP Plot (LTE Band 41 - 10MHz QPSK – Full RB)

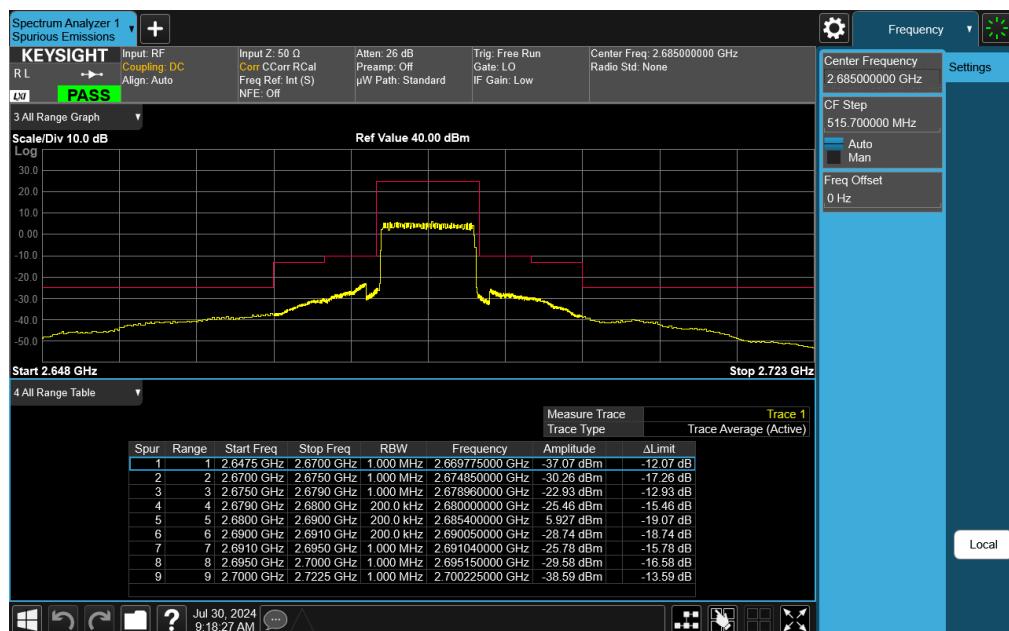
FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 47 of 69	

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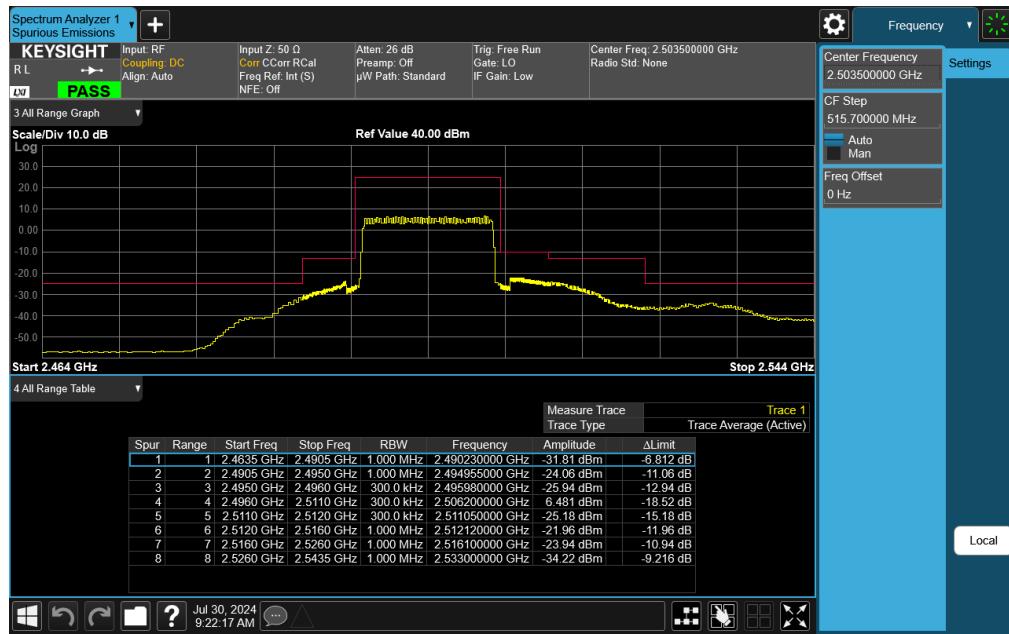


Plot 7-60. Middle ACP Plot (LTE Band 41 - 10MHz QPSK – Full RB)



Plot 7-61. Upper ACP Plot (LTE Band 41 - 10MHz QPSK – Full RB)

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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Plot 7-62. Lower ACP Plot (LTE Band 41 - 15MHz QPSK – Full RB)

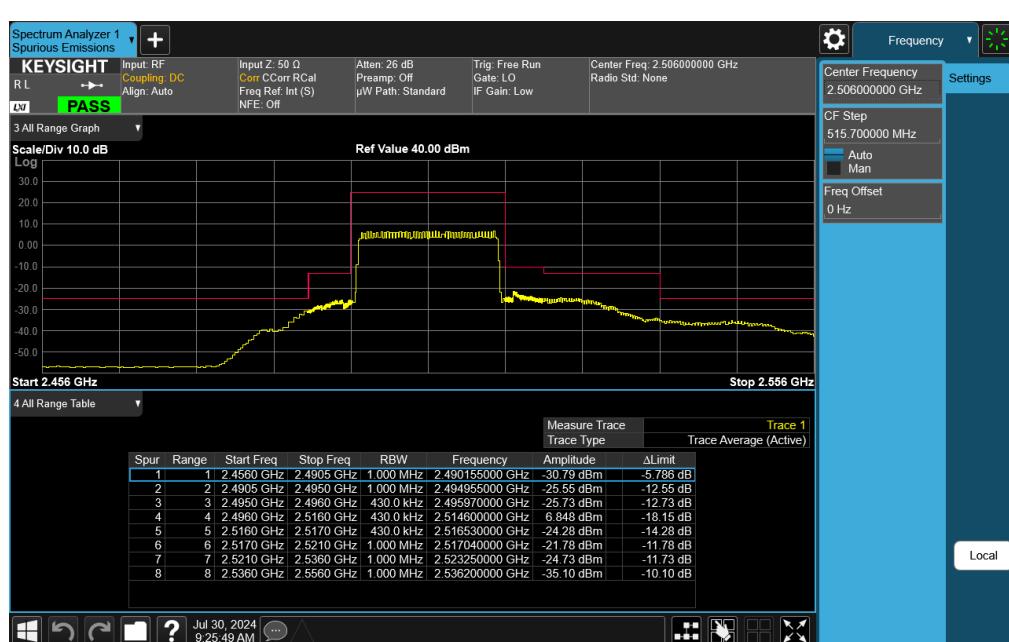


Plot 7-63. Middle ACP Plot (LTE Band 41 - 15MHz QPSK – Full RB)

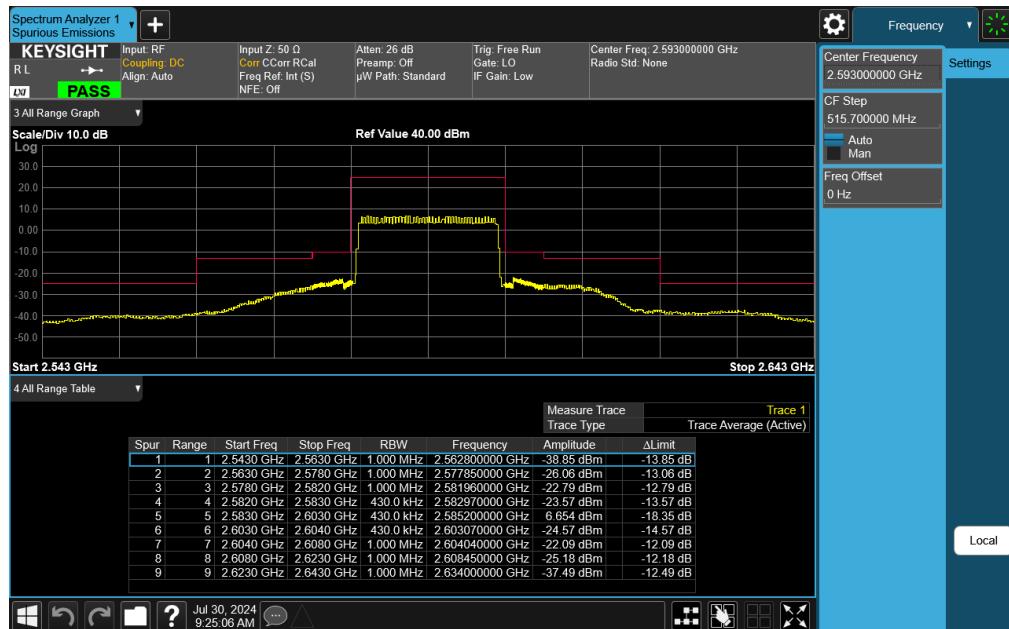
FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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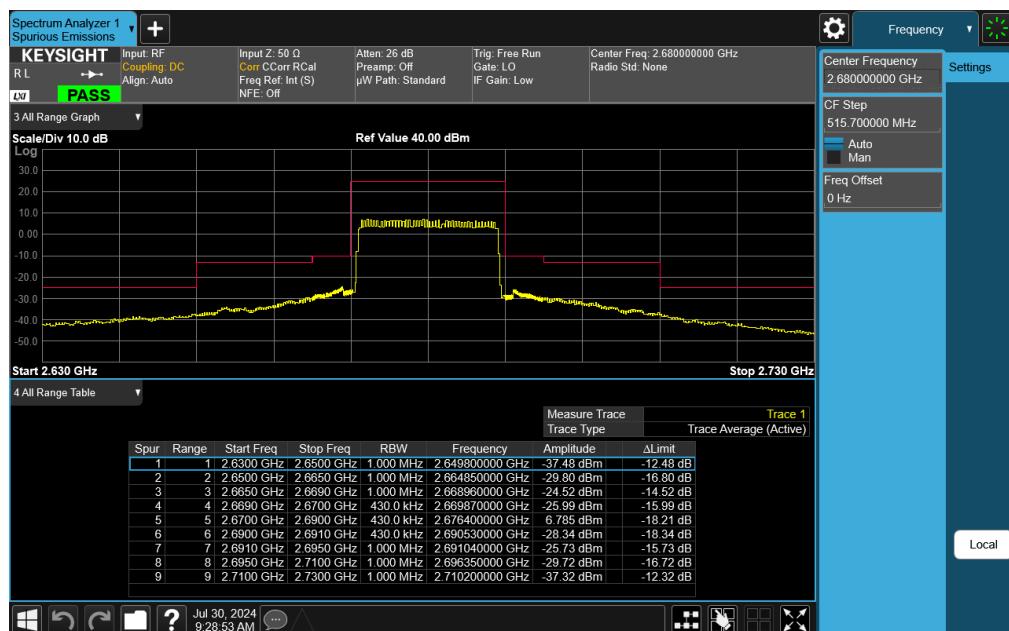
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Plot 7-66. Middle ACP Plot (LTE Band 41 - 20MHz QPSK – Full RB)



Plot 7-67. Upper ACP Plot (LTE Band 41 - 20MHz QPSK – Full RB)

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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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.

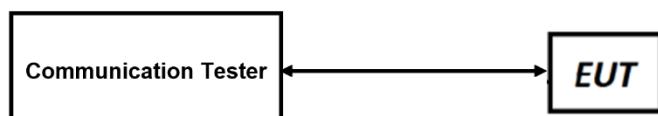


Figure 7-4. EIRP Measurement Setup

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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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-A3003	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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7.5.1 Antenna FCM - EIRP

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	-5.40	1 / 0	23.62	18.22	66.374	33.01	-14.79
		2535.0	-5.40	1 / 0	23.55	18.15	65.313	33.01	-14.86
		2567.5	-5.40	1 / 24	23.71	18.31	67.764	33.01	-14.70
	16-QAM	2567.5	-5.40	1 / 24	23.01	17.61	57.677	33.01	-15.40
10 MHz	QPSK	2505.0	-5.40	1 / 0	23.52	18.12	64.863	33.01	-14.89
		2535.0	-5.40	1 / 0	23.52	18.12	64.863	33.01	-14.89
		2565.0	-5.40	1 / 49	23.72	18.32	67.920	33.01	-14.69
	16-QAM	2565.0	-5.40	1 / 49	23.13	17.73	59.293	33.01	-15.28
15 MHz	QPSK	2507.5	-5.40	1 / 74	23.83	18.43	69.663	33.01	-14.58
		2535.0	-5.40	1 / 0	23.54	18.14	65.163	33.01	-14.87
		2562.5	-5.40	1 / 74	23.70	18.30	67.608	33.01	-14.71
	16-QAM	2562.5	-5.40	1 / 74	23.22	17.82	60.534	33.01	-15.19
20 MHz	QPSK	2510.0	-5.40	1 / 99	23.67	18.27	67.143	33.01	-14.74
		2535.0	-5.40	1 / 99	23.73	18.33	68.077	33.01	-14.68
		2560.0	-5.40	1 / 99	23.82	18.42	69.502	33.01	-14.59
	16-QAM	2560.0	-5.40	1 / 99	23.15	17.75	59.566	33.01	-15.26

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

FCC ID: BCG-A3003	PART 27 MEASUREMENT REPORT			Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 54 of 69	

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	2498.5	-5.59	1 / 0	23.98	18.39	69.024	33.01	-14.62
		2593.0	-5.59	1 / 0	23.67	18.08	64.269	33.01	-14.93
		2687.5	-5.59	1 / 0	24.00	18.41	69.343	33.01	-14.60
	16-QAM	2593.0	-5.59	1 / 0	22.90	17.31	53.827	33.01	-15.70
10 MHz	QPSK	2501.0	-5.59	1 / 49	23.86	18.27	67.143	33.01	-14.74
		2593.0	-5.59	1 / 25	24.00	18.41	69.343	33.01	-14.60
		2685.0	-5.59	1 / 0	23.99	18.40	69.183	33.01	-14.61
	16-QAM	2685.0	-5.59	1 / 25	23.07	17.48	55.976	33.01	-15.53
15 MHz	QPSK	2503.5	-5.59	1 / 0	24.00	18.41	69.343	33.01	-14.60
		2593.0	-5.59	1 / 74	23.96	18.37	68.707	33.01	-14.64
		2682.5	-5.59	1 / 74	23.93	18.34	68.234	33.01	-14.67
	16-QAM	2682.5	-5.59	1 / 0	23.01	17.42	55.208	33.01	-15.59
20 MHz	QPSK	2506.0	-5.59	1 / 50	24.00	18.41	69.343	33.01	-14.60
		2593.0	-5.59	1 / 99	23.98	18.39	69.024	33.01	-14.62
		2680.0	-5.59	1 / 99	23.81	18.22	66.374	33.01	-14.79
	16-QAM	2593.0	-5.59	1 / 99	22.95	17.36	54.450	33.01	-15.65

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

FCC ID: BCG-A3003	PART 27 MEASUREMENT REPORT			Approved by: Technical Manager
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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-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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Test Setup

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

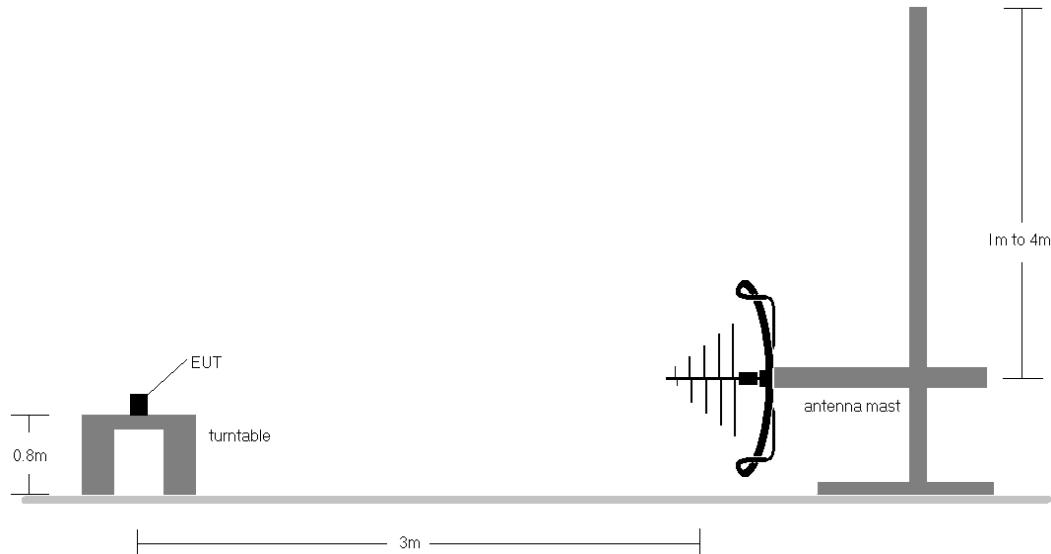


Figure 7-5. Test Instrument & Measurement Setup < 1GHz

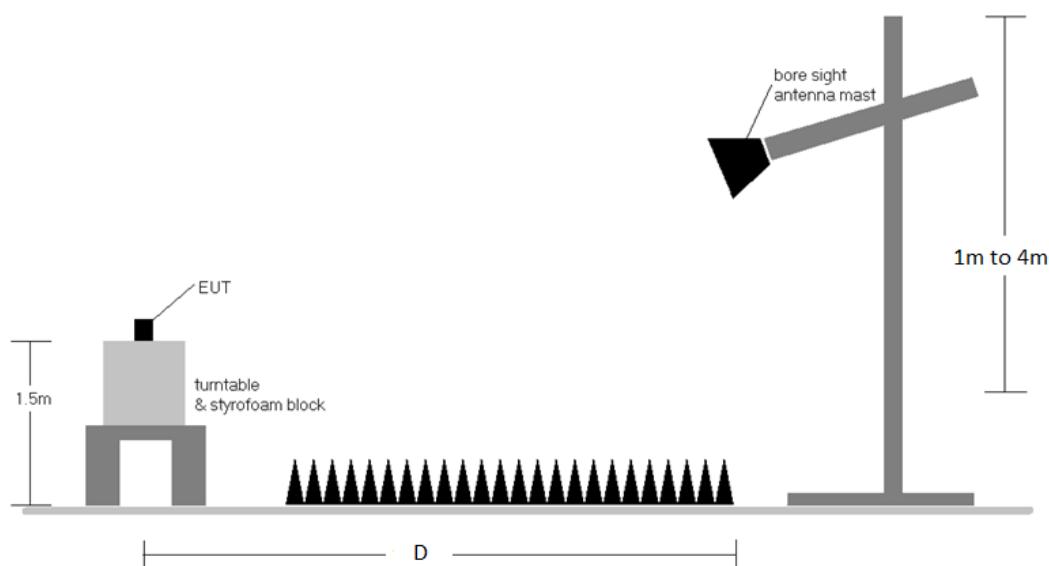


Figure 7-6. Test Instrument & Measurement Setup > 1 GHz

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 57 of 69

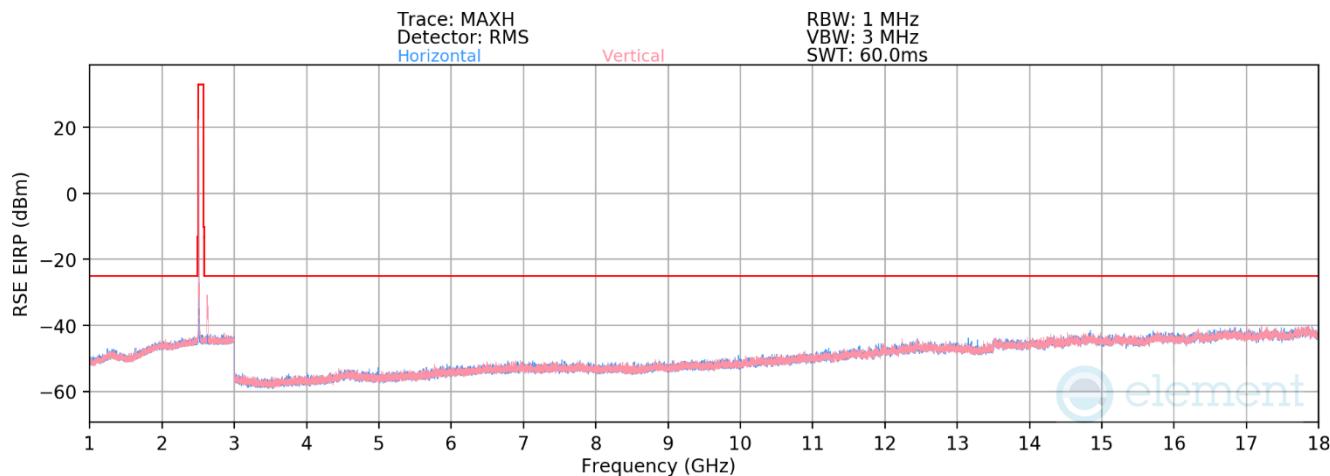
Test Notes

1. Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - a. $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - b. $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$; where D is the measurement distance in meters.
2. 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. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
6. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

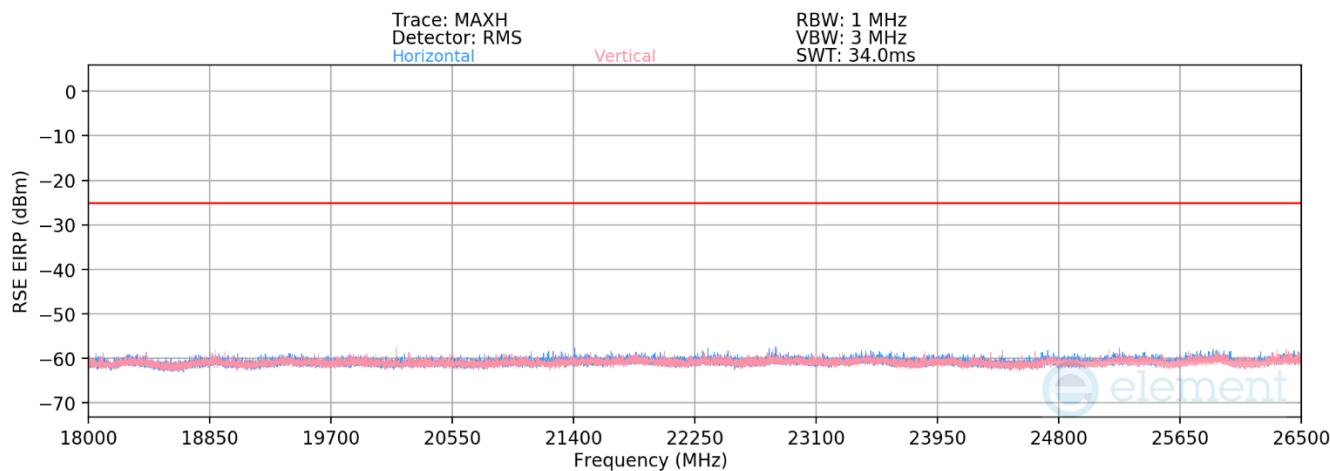
FCC ID: BCG-A3003	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 58 of 69

7.6.1 Antenna FCM Radiated Spurious Emission Measurements

LTE Band 7



Plot 7-68. Antenna FCM Radiated Spurious Plot 1GHz – 18GHz (LTE Band 7)



Plot 7-69. Antenna FCM Radiated Spurious Emission above 18GHz (LTE Band 7)

FCC ID: BCG-A3003	element PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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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	-	-	-80.09	7.31	34.22	-62.07	-25.00	-37.07
7530.0	V	272	153	-75.57	9.99	41.42	-58.67	-25.00	-33.67
10040.0	V	-	-	-80.65	12.53	38.87	-58.53	-25.00	-33.53
12550.0	V	-	-	-82.52	18.26	42.74	-52.52	-25.00	-27.52
15060.0	V	-	-	-82.96	20.91	44.95	-50.30	-25.00	-25.30

Table 7-4. Antenna FCM 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	-	-	-79.94	7.24	34.29	-62.11	-25.00	-37.11
7605.0	V	255	169	-75.42	10.05	41.63	-59.60	-25.00	-34.60
10140.0	V	-	-	-81.43	13.49	39.07	-58.60	-25.00	-33.60
12675.0	V	-	-	-83.33	19.41	43.08	-52.17	-25.00	-27.17
15210.0	V	-	-	-84.09	22.29	45.20	-50.06	-25.00	-25.06

Table 7-5. Antenna FCM 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	-	-	-79.53	7.29	34.75	-62.30	-25.00	-37.30
7680.00	V	250	158	-73.80	10.36	43.56	-59.85	-25.00	-34.85
10240.00	V	-	-	-80.78	12.87	39.09	-58.05	-25.00	-33.05
12800.00	V	-	-	-83.16	18.84	42.68	-52.58	-25.00	-27.58
15360.00	V	-	-	-83.34	21.44	45.10	-50.16	-25.00	-25.16

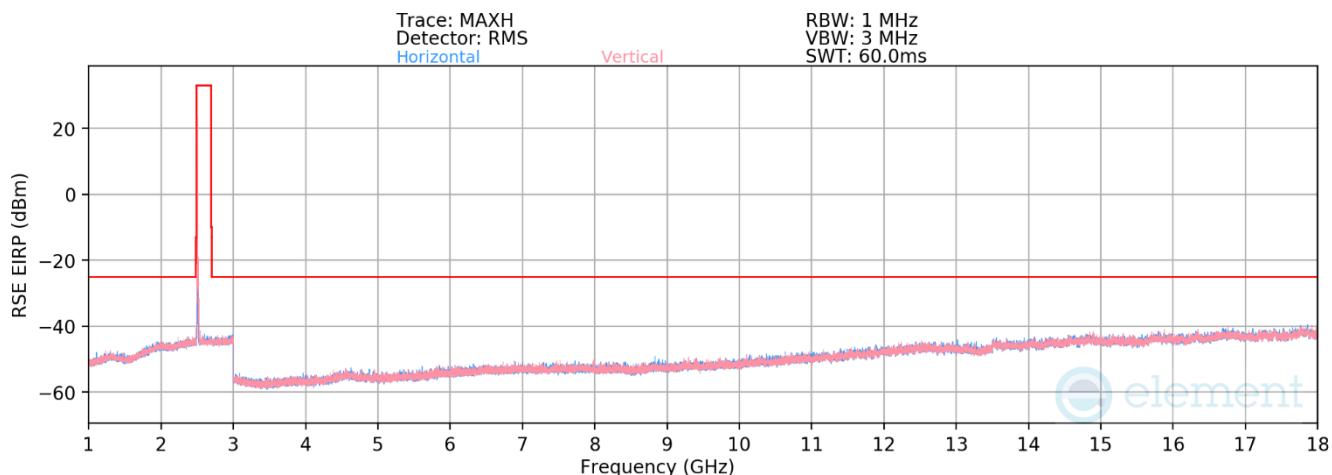
Table 7-6. Antenna FCM Radiated Spurious Data (LTE Band 7 – High Channel)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT				Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch				

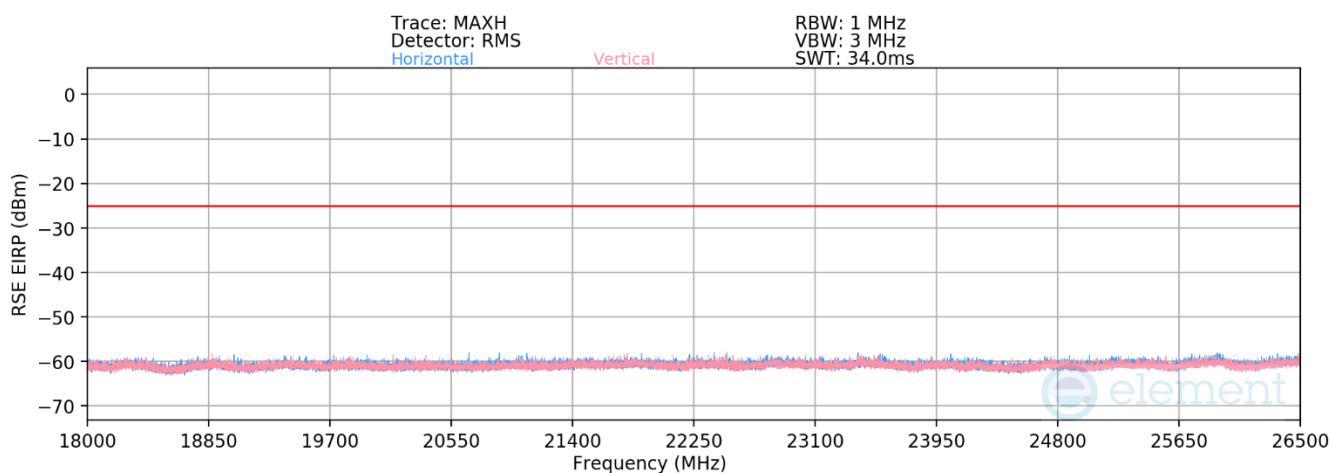
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LTE Band 41



Plot 7-70. Antenna FCM Radiated Spurious Plot 1GHz – 18GHz (LTE Band 41)



Plot 7-71. Antenna FCM Radiated Spurious Emission above 18GHz (LTE Band 41)

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 61 of 69	

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	-	-	-78.92	6.88	34.96	-60.30	-25.00	-35.30
7518.0	V	288	346	-76.16	9.99	40.83	-54.43	-25.00	-29.43
10024.0	H	-	-	-80.32	12.52	39.20	-56.06	-25.00	-31.06
12530.0	H	-	-	-81.96	18.19	43.22	-52.04	-25.00	-27.04
15036.0	H	-	-	-82.06	20.54	45.48	-49.78	-25.00	-24.78

Table 7-7. Antenna FCM 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	H	-	-	-79.45	7.75	35.30	-59.95	-25.00	-34.95
7779.0	V	282	346	-77.94	10.09	39.14	-56.12	-25.00	-31.12
10372.0	V	-	-	-80.90	13.73	39.83	-55.43	-25.00	-30.43
12965.0	H	-	-	-82.55	19.26	43.71	-51.55	-25.00	-26.55
15558.0	V	-	-	-83.12	21.98	45.86	-49.39	-25.00	-24.39

Table 7-8. Antenna FCM 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	-	-	-78.94	7.88	35.94	-59.32	-25.00	-34.32
8040.0	V	113	161	-78.31	10.27	38.95	-56.30	-25.00	-31.30
10720.0	H	-	-	-80.79	14.63	40.84	-54.42	-25.00	-29.42
13400.0	V	-	-	-82.61	18.61	43.00	-52.26	-25.00	-27.26
16080.0	V	-	-	-83.09	22.72	46.63	-48.63	-25.00	-23.63

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

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT					Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch					

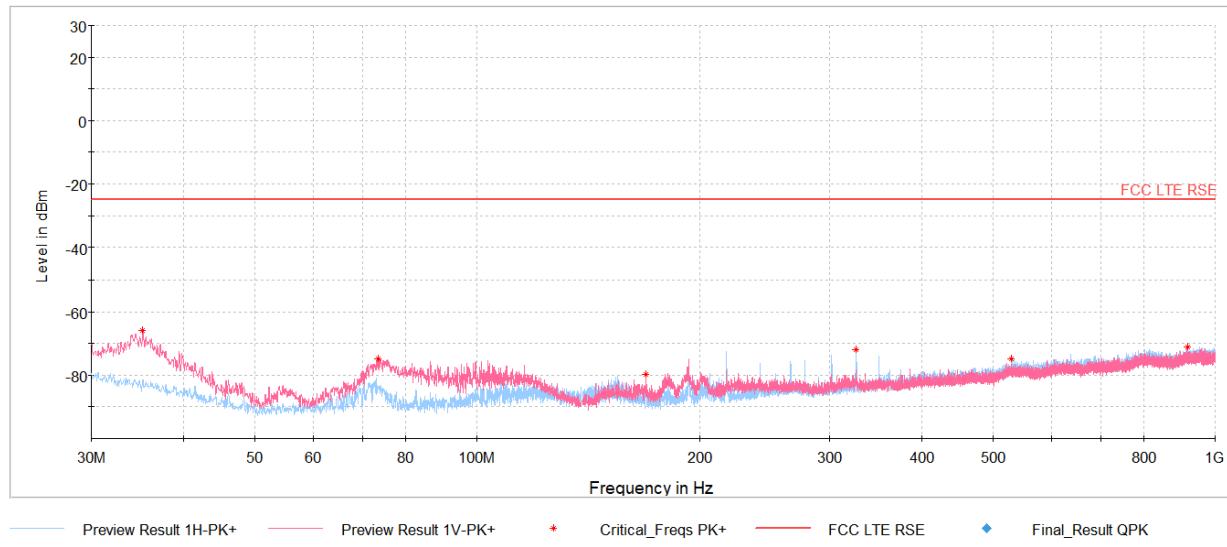
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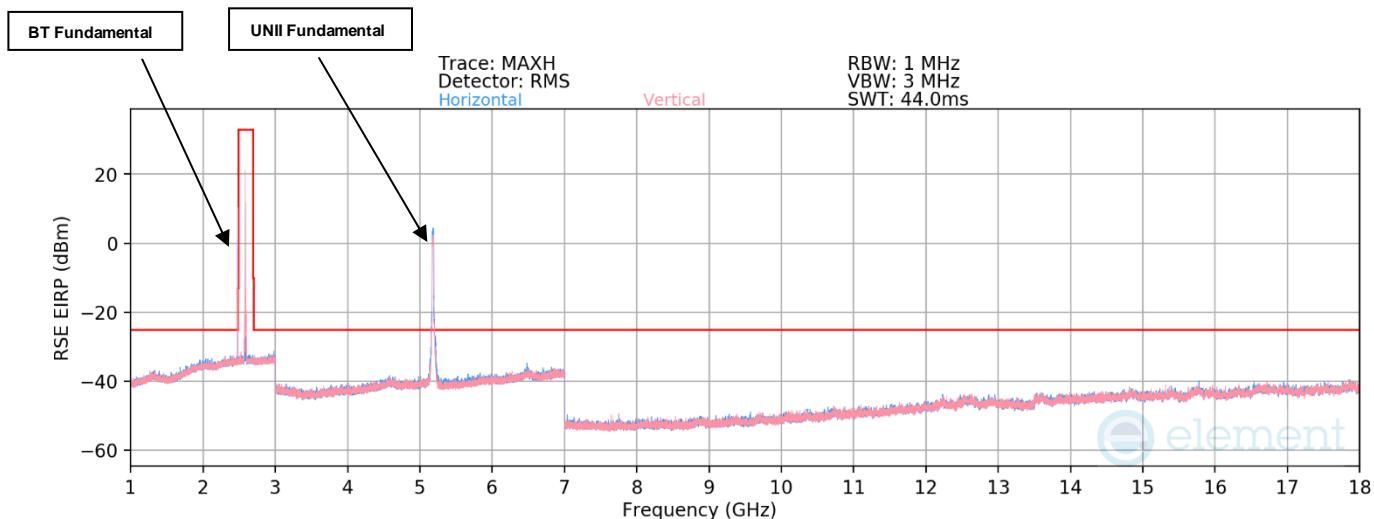
7.6.2 Simultaneous Tx Radiated Spurious Emissions Measurements

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

Table 7-10. Worst Case Simultaneous Transmission Configuration

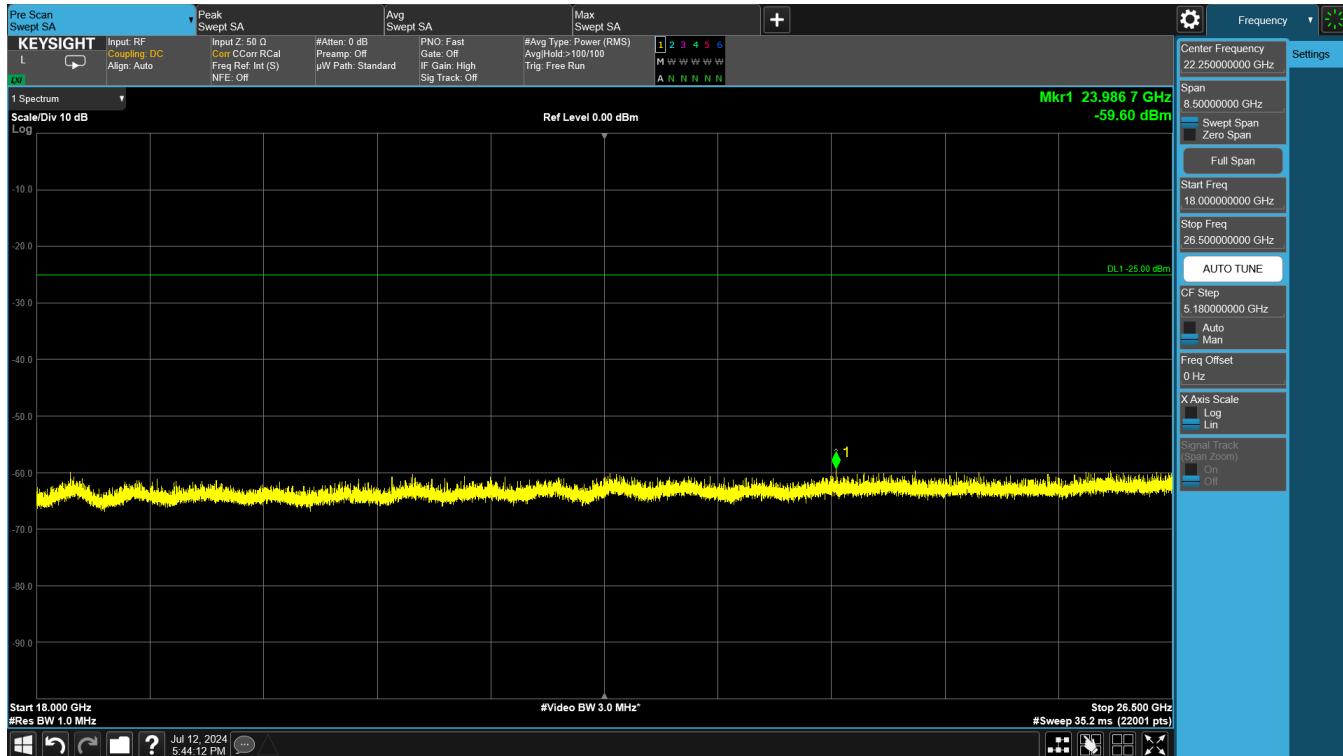


Plot 7-72. Antenna FCM Radiated Spurious Emissions -Simultaneous Transmission 30MHz – 1GHz

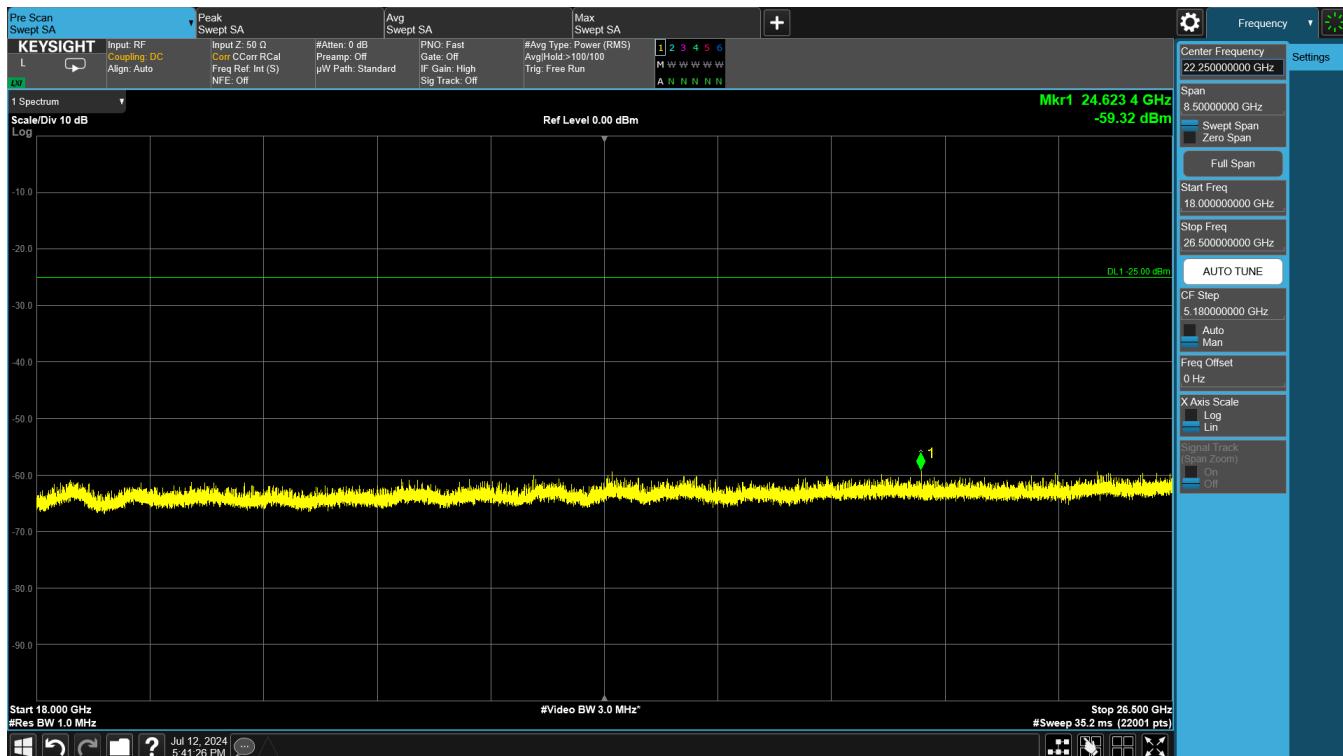


Plot 7-73. Antenna FCM Radiated Spurious Emissions -Simultaneous Transmission 1GHz – 18GHz

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 63 of 69



Plot 7-74. Antenna FCM Radiated Spurious Plot above 18GHz (Simultaneous Transmission, Pol. H)



Plot 7-75. Antenna FCM Radiated Spurious Plot above 18GHz (Simultaneous Transmission, Pol. V)

FCC ID: BCG-A3003	element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 64 of 69

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	V	-	-	-68.12	17.20	56.08	73.98	-17.90
7440.00	Peak	V	-	-	-68.66	10.52	48.86	73.98	-25.12
12400.00	Peak	V	-	-	-71.73	17.38	52.65	73.98	-21.33
10360.00	Peak	V	-	-	-69.60	13.76	51.16	68.20	-17.04
15540.00	Avg	V	-	-	-84.44	21.90	44.46	53.98	-9.52
15540.00	Peak	V	-	-	-72.29	21.90	56.61	73.98	-17.37

Table 7-11. Antenna FCM 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 [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7752.0	V	111	13	-76.39	10.45	41.06	-54.19	-25.00	-29.19
10336.0	V	-	-	-81.02	13.82	39.80	-55.46	-25.00	-30.46
12920.0	V	-	-	-83.30	19.28	42.98	-52.27	-25.00	-27.27
15504.0	V	-	-	-84.07	22.02	44.95	-50.31	-25.00	-25.31
2367.0	V	-	-	-77.04	18.06	48.02	-47.24	-25.00	-22.24
2706.0	V	142	191	-74.81	19.26	51.45	-43.81	-25.00	-18.81

Table 7-12. Antenna FCM LTE Harmonics and Intermodulation Emissions Measurement in Simultaneous Transmission Mode

FCC ID: BCG-A3003	PART 27 MEASUREMENT REPORT				Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch			

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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.

For Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI 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

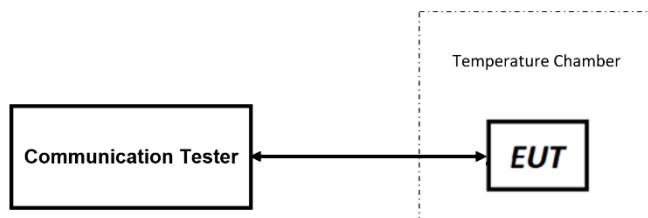


Figure 7-7. Test Instrument & Measurement Setup

Test Notes

None

FCC ID: BCG-A3003	element		PART 27 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch		Page 66 of 69

Frequency Stability / Temperature Variation

LTE Band 7				
Operating Band Lower Boundary (GHz)		2.500		
Ref. Voltage (VDC):		3.80		
Voltage (%)	Power (VDC)	Temp (°C)	Measured Freq. (GHz)	Freq. Delta from Operating Range (GHz)
100 %	3.80	- 30	2.500626200	-0.000626200
		- 20	2.500616600	-0.000616600
		- 10	2.500524800	-0.000524800
		0	2.500554100	-0.000554100
		+ 10	2.500556900	-0.000556900
		+ 20 (Ref)	2.500565700	-0.000565700
		+ 30	2.500544600	-0.000544600
		+ 40	2.500492600	-0.000492600
		+ 50	2.500495100	-0.000495100
		Battery Endpoint	2.500447600	-0.000447600

Table 7-13. Lower Boundary LTE Band 7 Frequency Stability Data

LTE Band 7				
Operating Band Upper Boundary (GHz)		2.570		
Ref. Voltage (VDC):		3.80		
Voltage (%)	Power (VDC)	Temp (°C)	Measured Freq. (GHz)	Freq. Delta from Operating Range (GHz)
100 %	3.80	- 30	2.569396100	-0.000603900
		- 20	2.569385700	-0.000614300
		- 10	2.569359800	-0.000640200
		0	2.569372700	-0.000627300
		+ 10	2.569372900	-0.000627100
		+ 20 (Ref)	2.569356900	-0.000643100
		+ 30	2.569365700	-0.000634300
		+ 40	2.569372000	-0.000628000
		+ 50	2.569414900	-0.000585100
		Battery Endpoint	2.569582400	-0.000417600

Table 7-14. Upper Boundary LTE Band 7 Frequency Stability Data

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 67 of 69	

Frequency Stability / Temperature Variation

LTE Band 41				
Operating Band Lower Boundary (GHz)		2.496		
Ref. Voltage (VDC):		3.80		
Voltage (%)	Power (VDC)	Temp (°C)	Measured Freq. (GHz)	Freq. Delta from Operating Range (GHz)
100 %	3.80	- 30	2.496743100	-0.000743100
		- 20	2.496741800	-0.000741800
		- 10	2.496695600	-0.000695600
		0	2.496709700	-0.000709700
		+ 10	2.496658400	-0.000658400
		+ 20 (Ref)	2.496656900	-0.000656900
		+ 30	2.496630200	-0.000630200
		+ 40	2.496624200	-0.000624200
		+ 50	2.496634100	-0.000634100
		Battery Endpoint	2.496565400	-0.000565400

Table 7-15. Lower Boundary LTE Band 41 Frequency Stability Data

LTE Band 41				
Operating Band Upper Boundary (GHz)		2.690		
Ref. Voltage (VDC):		3.80		
Voltage (%)	Power (VDC)	Temp (°C)	Measured Freq. (GHz)	Freq. Delta from Operating Range (GHz)
100 %	3.80	- 30	2.689265700	-0.000734300
		- 20	2.689316800	-0.000683200
		- 10	2.689282800	-0.000717200
		0	2.689261400	-0.000738600
		+ 10	2.689282200	-0.000717800
		+ 20 (Ref)	2.689313900	-0.000686100
		+ 30	2.689283900	-0.000716100
		+ 40	2.689263100	-0.000736900
		+ 50	2.689227100	-0.000772900
		Battery Endpoint	2.689281800	-0.000718200

Table 7-16. Upper Boundary LTE Band 41 Frequency Stability Data

FCC ID: BCG-A3003	 element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 68 of 69	

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the Apple Watch FCC ID: BCG-A3003 complies with all the requirements of Part 27 of the FCC rules.

FCC ID: BCG-A3003	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1C2405230022-06.BCG	Test Dates: 04/11/2024 – 07/30/2024	EUT Type: Watch	Page 69 of 69