ELEMENT WASHINGTON DC LLC
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PART 27 MEASUREMENT REPORT

Applicant Name:
Centum Research & Technology S.L
Fonte das Abelleiras S/N
Edificio Citexvi
36310 Vigo (Spain)

Date of Testing:
08/14 - 08/27/2024
Test Report Issue Date:
1/16/2025
Test Site/Location:
Element lab., Columbia, MD, USA
Test Report Serial No.:
1M2407310061-03.2A93U

FCC ID:	**2A93U-55041-402**
APPLICANT:	**Centum Research & Technology S.L**

Application Type:	Class II Permissive Change
Model:	Lifeseeker Mini S10
EUT Type:	Geolocation System
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part:	27
Test Procedure(s):	ANSI C63.26-2015
Class II Permissive Change:	Adding additional 2G/3G bands and modes of operation
Original Grant Date:	03/02/2023

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

ACCREDITED
CERT #2041.01

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Mode	Modulation	Tx Frequency Range [MHz]	ERP		EIRP		Emission Designator
			Max. Power [W]	Max. Power [dBm]	Max. Power [W]	Max. Power [dBm]	
UMTS B4/10	Spread Spectrum	2112.4 - 2152.6	0.187	22.72	0.307	24.87	4M39F9W
UMTS B12	Spread Spectrum	731.4 - 743.6	0.198	22.96	0.324	25.11	4M40F9W
UMTS B13	Spread Spectrum	748.4 - 753.6	0.116	20.65	0.191	22.80	4M36F9W

Overview Table

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 Test Location

These measurement tests were conducted at the Element laboratory located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at Element lab located in Columbia, MD 21046, 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 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- 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 (2451B) 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 Recognition Agreement.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Centum Geolocation System FCC ID: 2A93U-55041-402**. 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.: 213014

2.2 Device Capabilities

This device was tested for the following capabilities:

UMTS Bands: 2, 4/10, 5/26, 12, 13 and GSM Bands: 850 and 1900

2.3 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

RF was generated by a test tool provided by the manufacturer.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version 2.1 installed on the EUT.

2.5 EMI Suppression Device(s)/Modifications

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

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services" (ANSI C63.26-2015) 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, the field strength conversion method is used per the formulas in Section 5.2.7 of ANSI C63.26-2015. Field Strength (EIRP) is calculated using the following formulas:

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

And

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

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01 v01r01.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015.

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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
-	AP2	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	AP2
-	ETS	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	ETS
-	WL25-3	Conducted Cable Set (25GHz)	4/2/2024	Annual	4/2/2025	WL25-3
-	WL40-1	WLAN Cable Set (40GHz)	4/2/2024	Annual	4/2/2025	WL40-1
Keysight Technologies	N9020A	MXA Signal Analyzer	4/11/2024	Annual	4/11/2025	MY54500644
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	4/9/2024	Annual	4/9/2025	MY52350166
Emco	3115	Horn Antenna (1-18GHz)	6/7/2024	Biennial	6/7/2026	9704-5182
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	8/30/2022	Biennial	8/30/2024	A051107
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	9/25/2023	Annual	9/25/2024	100342
Keysight Technologies	N9038A	MXE EMI Receiver	8/30/2023	Annual	8/30/2024	MY51210133

Table 5-1. Test Equipment

Notes:

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

2. Equipment with a calibration date of “N/A” shown in this list was not used to make direct calibrated measurements.

6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 8M45W7D

LTE BW = 8.45 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 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 analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80) = 50.3 dBc.

7.0 TEST RESULTS

7.1 Summary

Company Name: Centum Research & Technology S.L

FCC ID: 2A93U-55041-402

FCC Classification: PCS Licensed Transmitter (PCB)

Mode(s): UMTS/GSM

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Transmitter Conducted Output Power	2.1046, 27.50(c)(3)	N/A	PASS	Section 7.2
	Effective Radiated Power (Band 12)	27.50(b)(9)	≤ 30 Watts max. ERP	PASS	Section 7.2
	Effective Radiated Power (Band 13)	27.50(c)(9)	≤ 30 Watts max. ERP	PASS	Section 7.2
	Equivalent Isotropic Radiated Power (UMTS Band 4/10)	27.50(d)(4)	≤ 1 Watts max. EIRP	PASS	Section 7.2
	Occupied Bandwidth	2.1049	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions	2.1051, 27.53(c)(1), 27.53(c)(4), 27.53(g), 27.53(h)(1)	≥ 43 + 10 log (P[Watts]) dB at Band Edge and for all out-of-band emissions	PASS	Sections 7.4, 7.5
	Conducted Band Edge / Spurious Emissions (Band 13)	2.1051, 27.53(c)(4)	≥ 65 + 10 log (P[Watts]) dB for operations between 763-775 MHz and 793-805 MHz in a 6.25kHz band segment	PASS	Sections 7.4, 7.5
	Conducted Band Edge / Spurious Emissions (UMTS B4/10)	2.1051, 27.53(h)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Sections 7.4, 7.5
	Peak-to-Average Ratio	27.50(d)(5)	≤ 13 dB	PASS	Section 7.6
	Frequency Stability	2.1055, 27.54	Fundamental emissions stay within authorized frequency block	PASS	Section 7.8
RADIATED	Radiated Spurious Emissions (Band 12/13)	2.1053, 27.53(f)	≤-40dBm/MHz	PASS	Section 7.7
	Radiated Spurious Emissions (UMTS B4/10)	2.1053, 27.53(h)(1)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Section 7.8

Table 7-1. Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.

2) The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is EMC Software Tool v1.2.2.

7.2 Transmitter Conducted Output Power/ Equivalent Isotropic Radiated Power

Test Overview

All 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.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2.4.4.1

Test Settings

1. Power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. Span = 2 - 3 times the OBW
3. RBW = 1 – 5% of the expected OBW
4. VBW ≥ 3 x RBW
5. No. of sweep points > 2 x span / RBW
6. Sweep time = auto-couple
7. Detector = RMS
8. Trigger is set to "free run" for signals with continuous operation.
9. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
10. Trace mode = trace averaging (RMS) over 100 sweeps
11. The trace was allowed to stabilize.

Test Setup

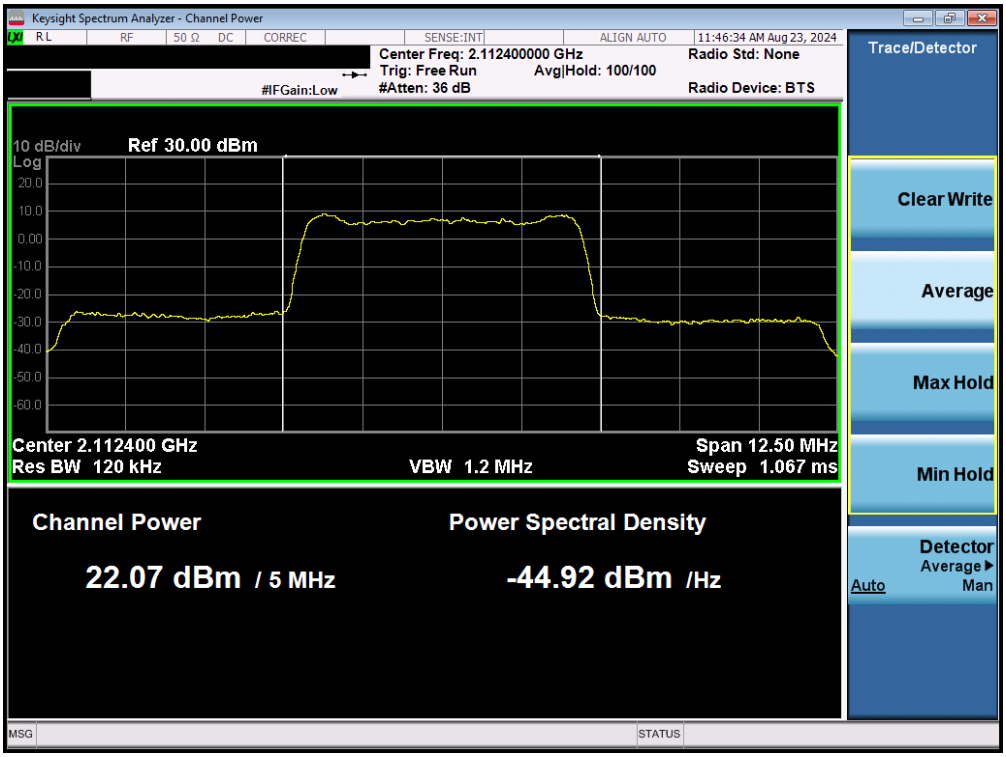
The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-1. Test Instrument & Measurement Setup

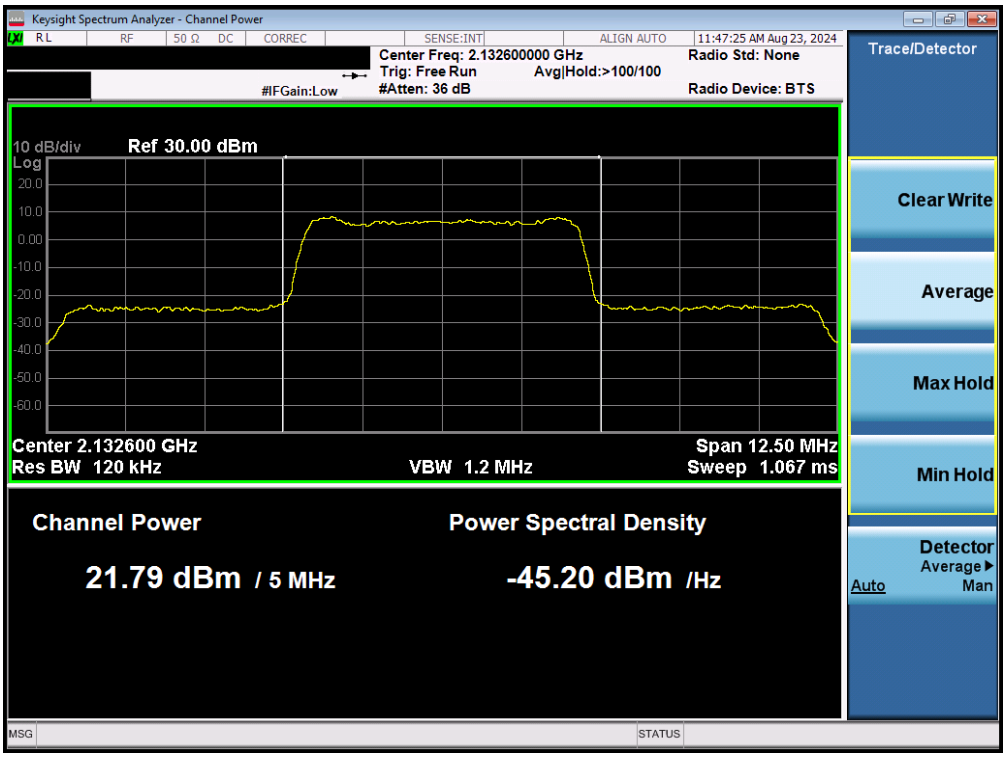
Test Notes
None.

Channel	Frequency [MHz]	Conducted Power [dBm]	Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
1537	2112.4	22.07	2.80	24.87	0.307	22.72	0.187	30.00	-7.28
1638	2132.6	21.79	2.80	24.59	0.288	22.44	0.175	30.00	-7.56
1738	2152.6	21.12	2.80	23.92	0.247	21.77	0.150	30.00	-8.23

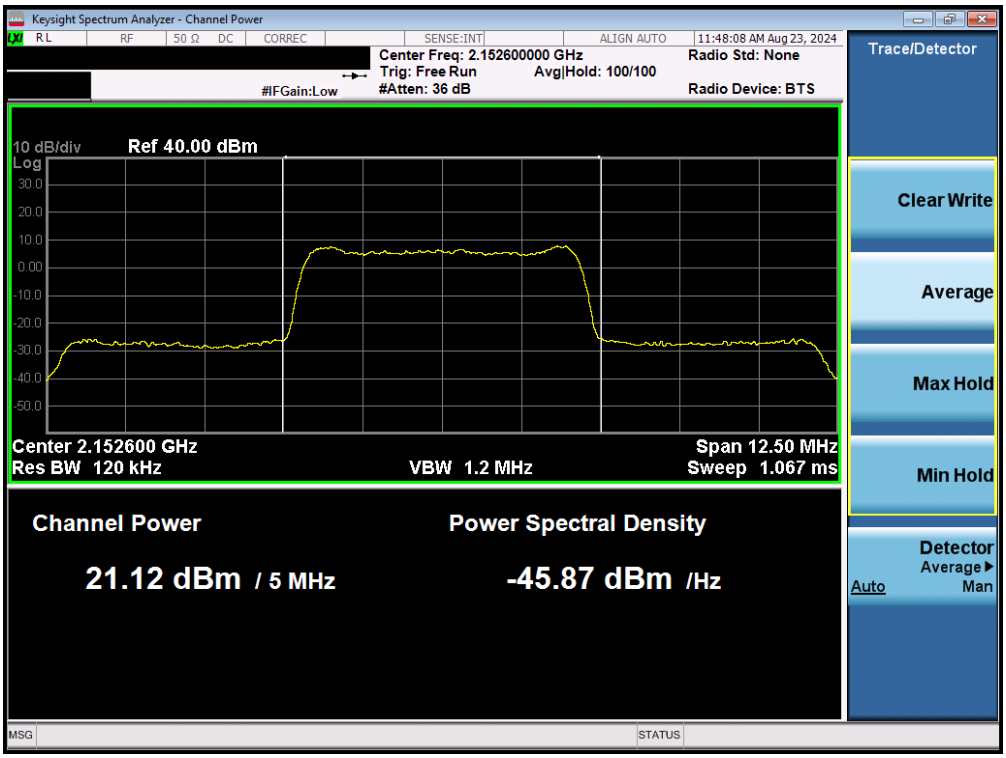
Table 7-2. Transmitter Conducted Output Power/ Equivalent Isotropic Radiated Power (UMTS B4/10)



Plot 7-1. Conducted Power Output Data (UMTS B4/10 – Low Channel)



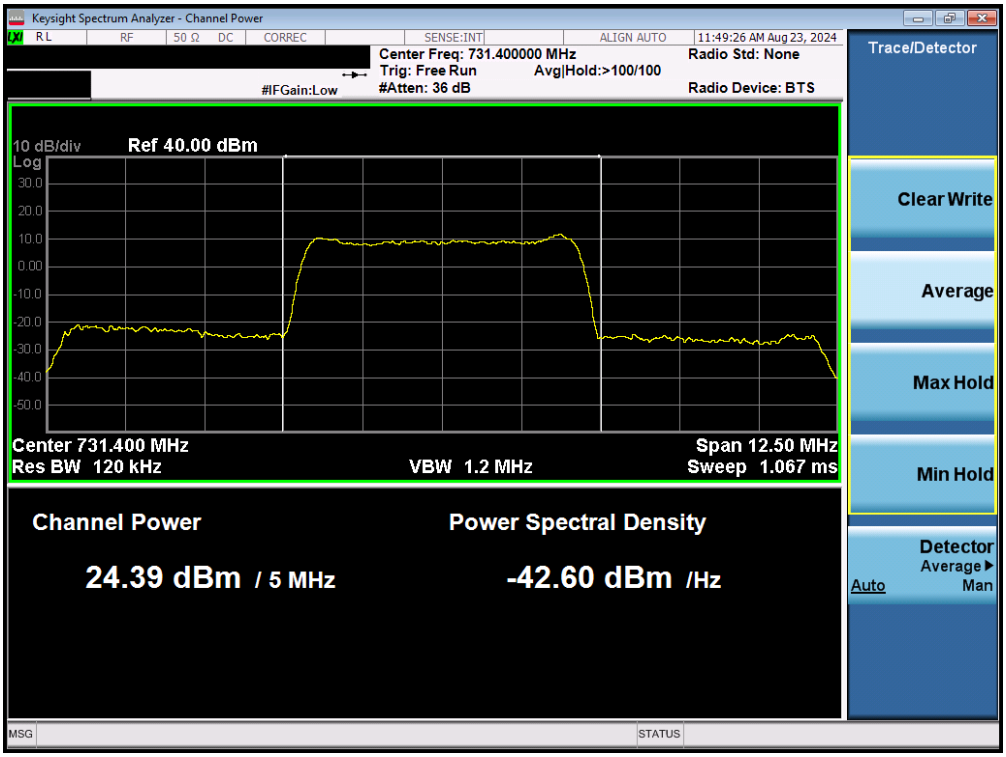
Plot 7-2. Conducted Power Output Data (UMTS B4/10 – Mid Channel)



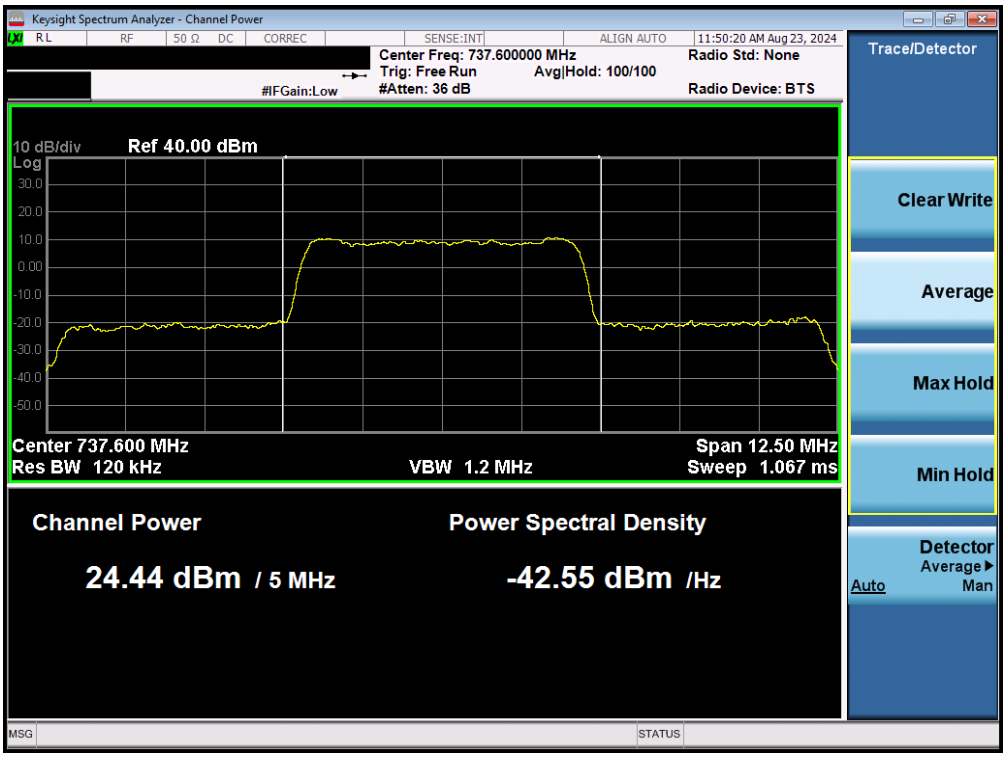
Plot 7-3. Conducted Power Output Data (UMTS B4/10 – High Channel)

Channel	Frequency [MHz]	Conducted Power [dBm]	Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
3842	731.4	24.39	0.62	25.01	0.317	22.86	0.193	44.77	-21.91
3873	737.6	24.44	0.62	25.06	0.321	22.91	0.195	44.77	-21.86
3903	743.6	24.49	0.62	25.11	0.324	22.96	0.198	44.77	-21.81

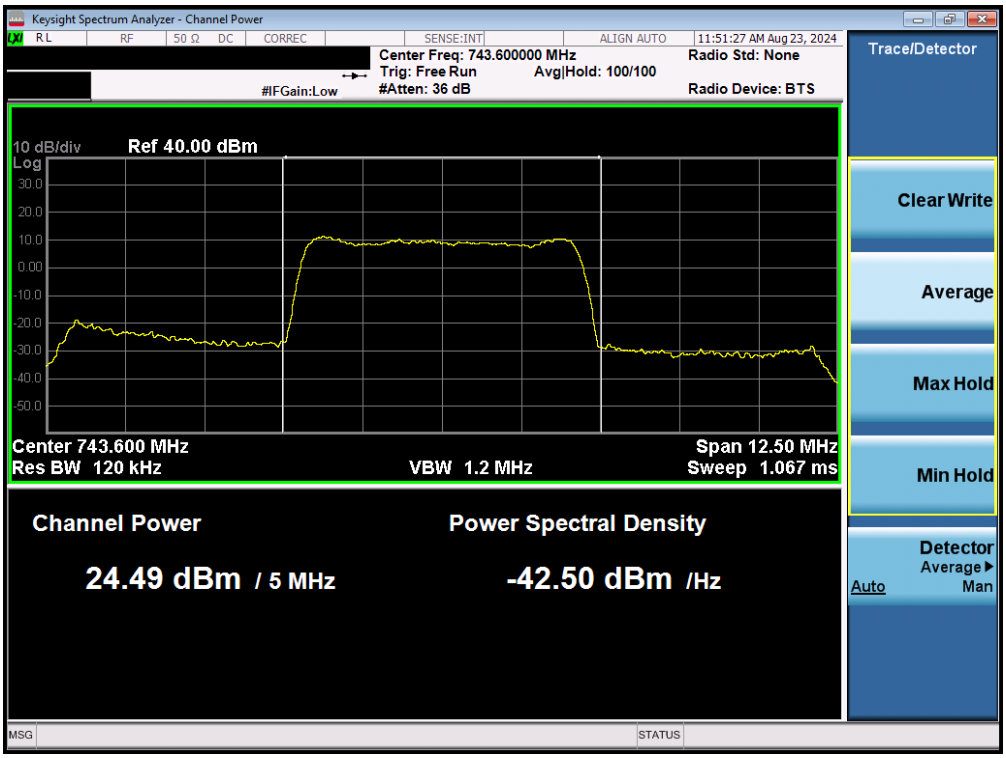
Table 7-3. Transmitter Conducted Output Power/ Effective Radiated Power (UMTS B12)



Plot 7-4. Conducted Power Output Data (UMTS B12 – Low Channel)



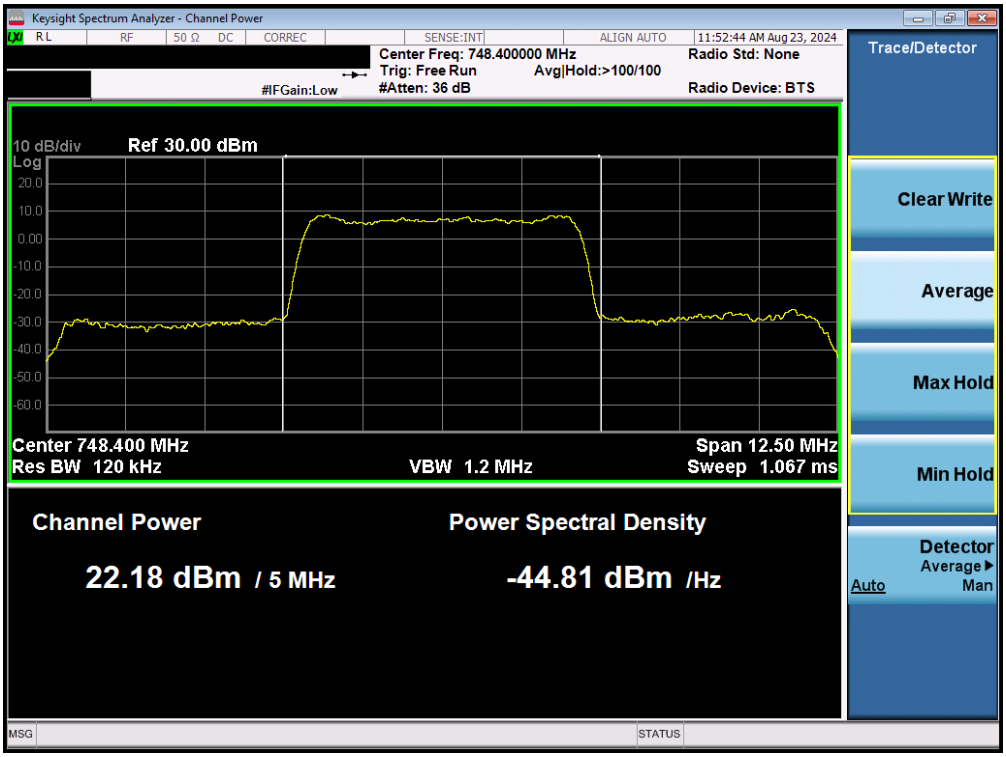
Plot 7-5. Conducted Power Output Data (UMTS B12 – Mid Channel)



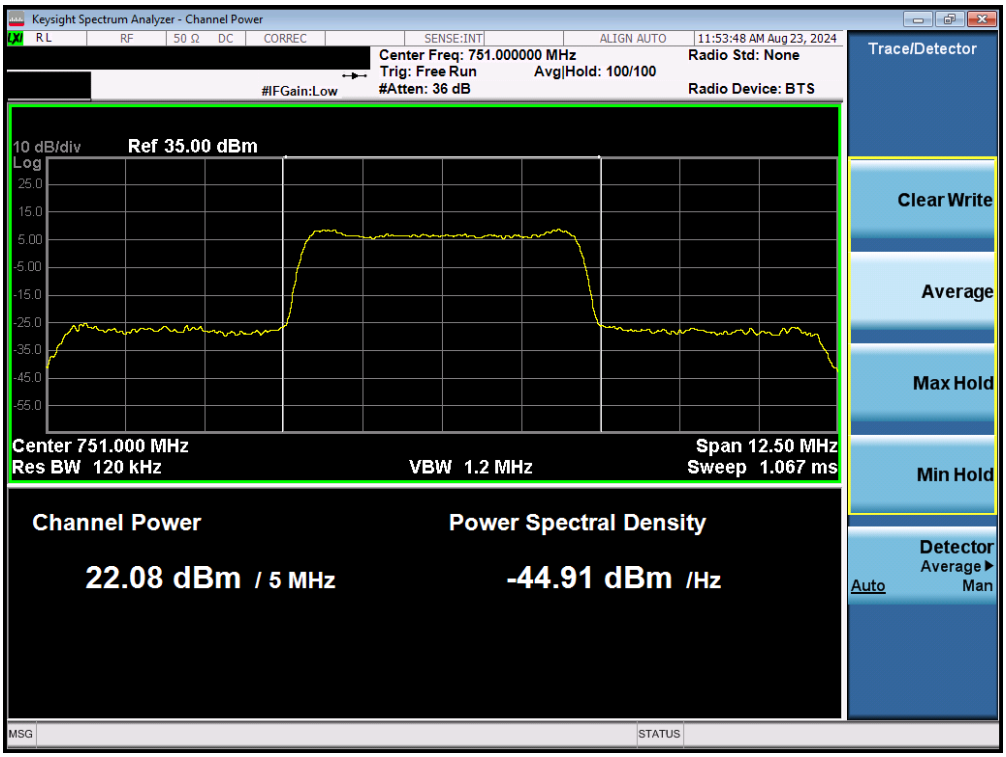
Plot 7-6. Conducted Power Output Data (UMTS B12 – High Channel)

Channel	Frequency [MHz]	Conducted Power [dBm]	Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
4017	748.4	22.18	0.62	22.80	0.191	20.65	0.116	44.77	-24.12
4030	751.0	22.08	0.62	22.70	0.186	20.55	0.113	44.77	-24.22
4043	753.6	22.01	0.62	22.63	0.183	20.48	0.112	44.77	-24.29

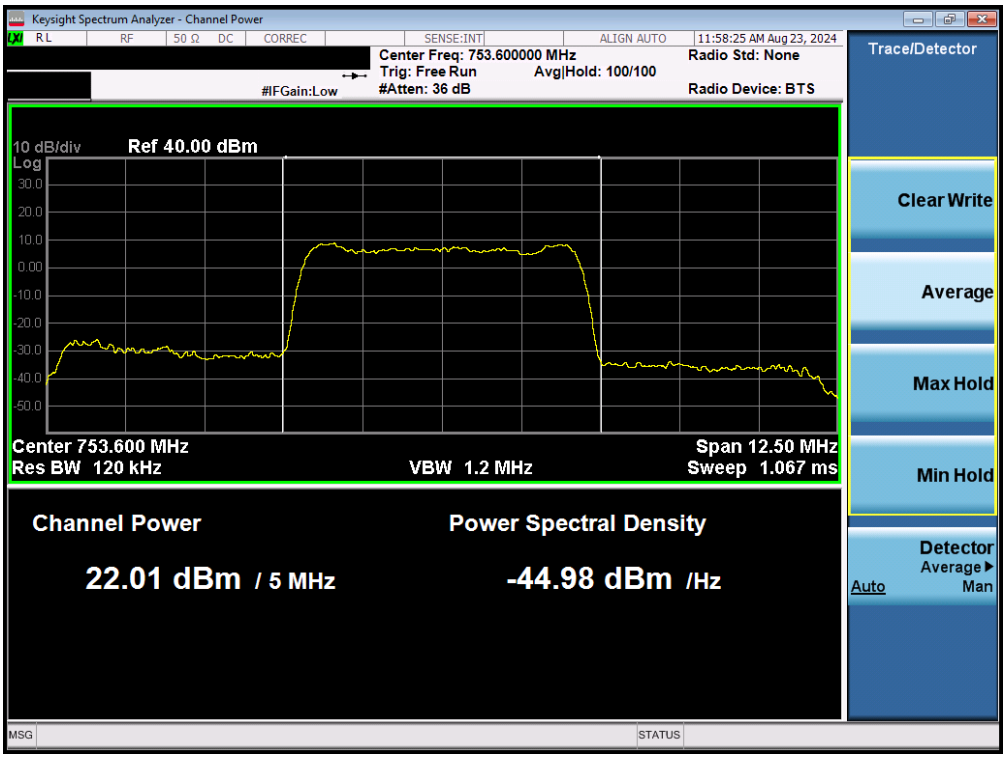
Table 7-4. Transmitter Conducted Output Power/ Effective Radiated Power (UMTS B13)



Plot 7-7. Conducted Power Output Data (UMTS B13 – Low Channel)



Plot 7-8. Conducted Power Output Data (UMTS B13 – Mid Channel)



Plot 7-9. Conducted Power Output Data (UMTS B13 – High Channel)

7.3 Occupied Bandwidth

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst-case configuration results are reported in this section.

Test Procedure Used

ANSI C63.26-2015 – Section 5.4.4

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 ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

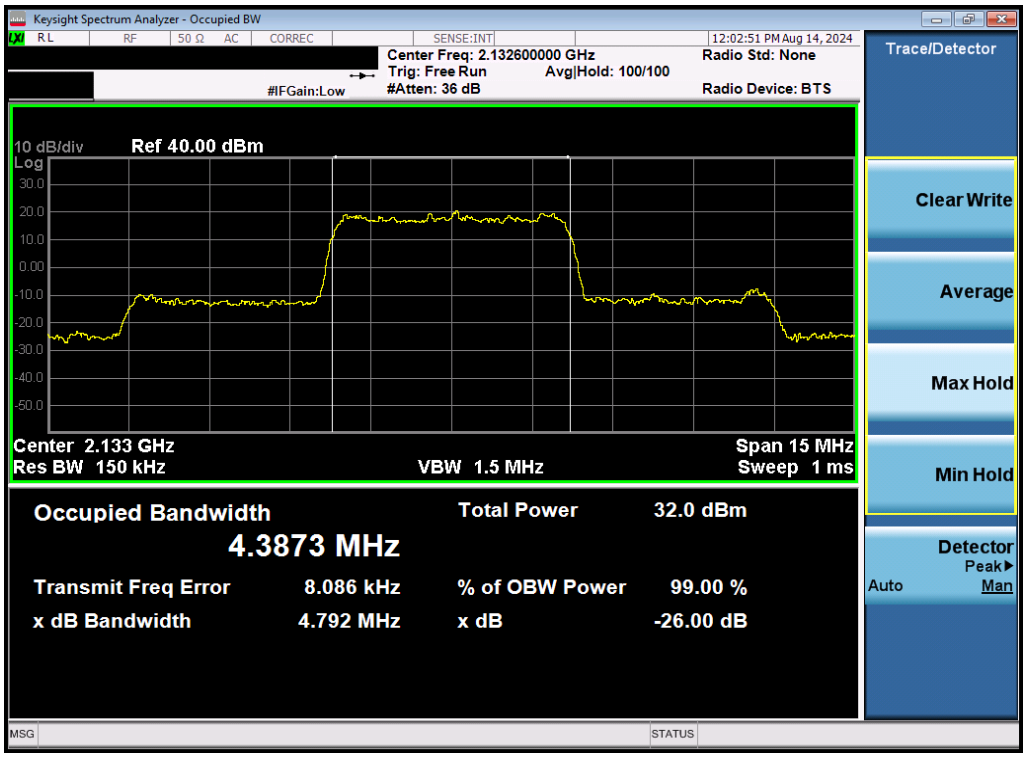
Test Setup

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

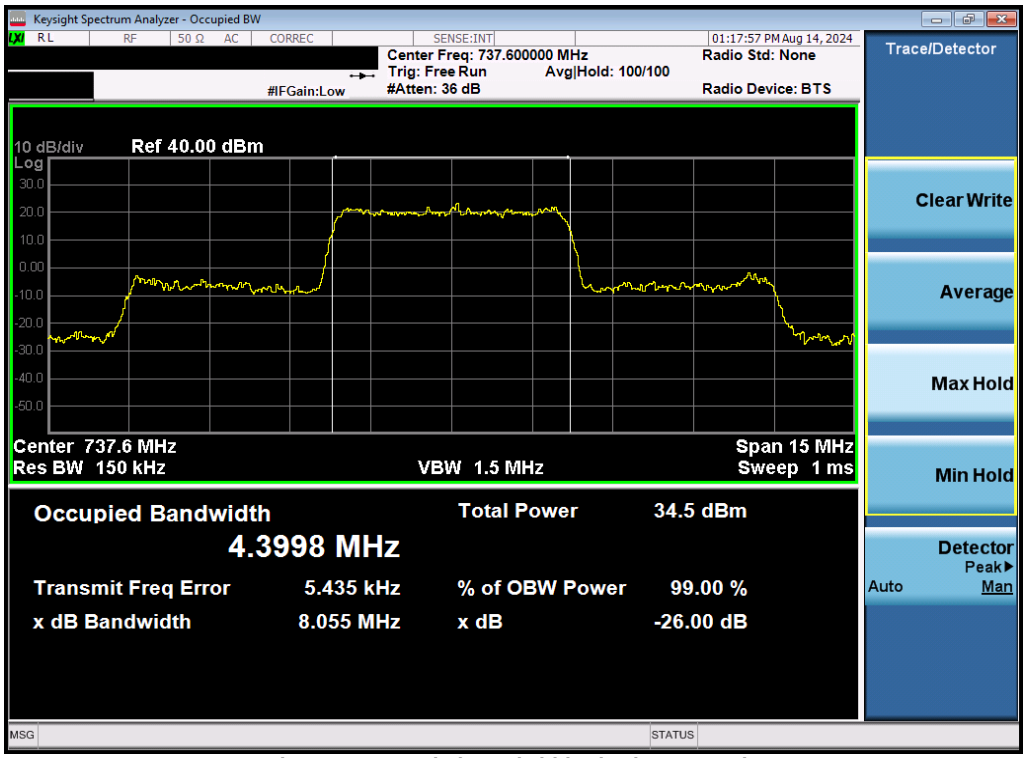
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

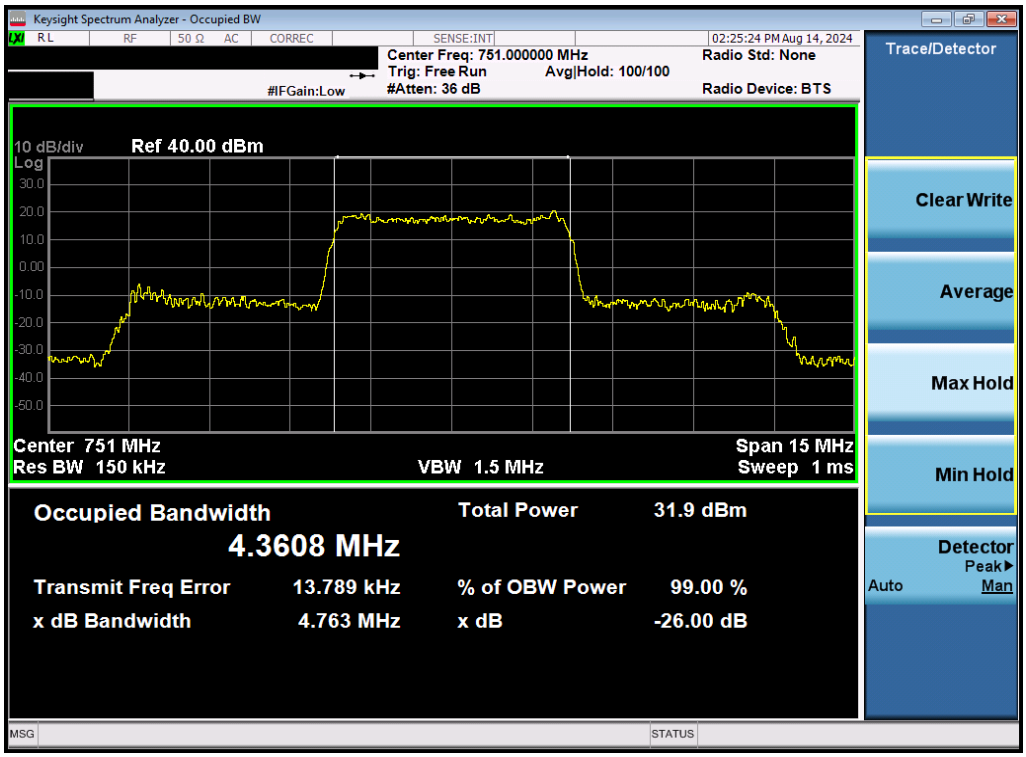
None.



Plot 7-10. Occupied Bandwidth Plot (UMTS, Ch. 1638)



Plot 7-11. Occupied Bandwidth Plot (UMTS B12)



Plot 7-12. Occupied Bandwidth Plot (UMTS B13)

7.4 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 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 $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

ANSI C63.26-2015 – Section 5.7.4

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 18GHz (separated into at least two plots per channel)
2. RBW ≥ 100kHz
3. VBW ≥ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

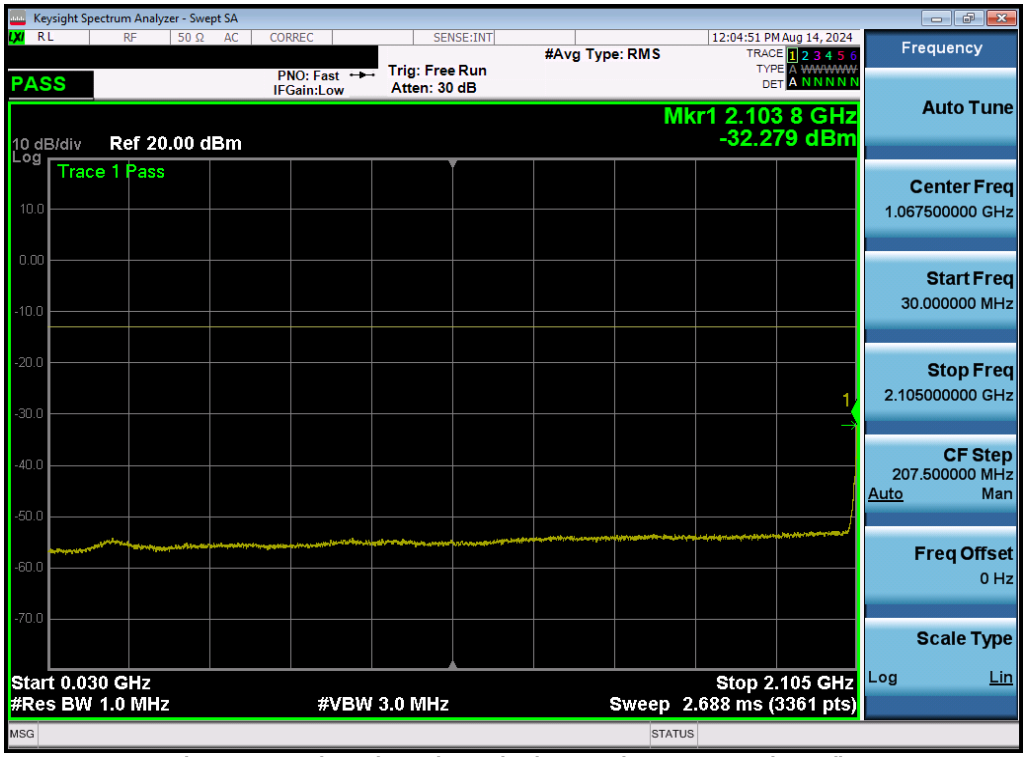
The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-3. Test Instrument & Measurement Setup

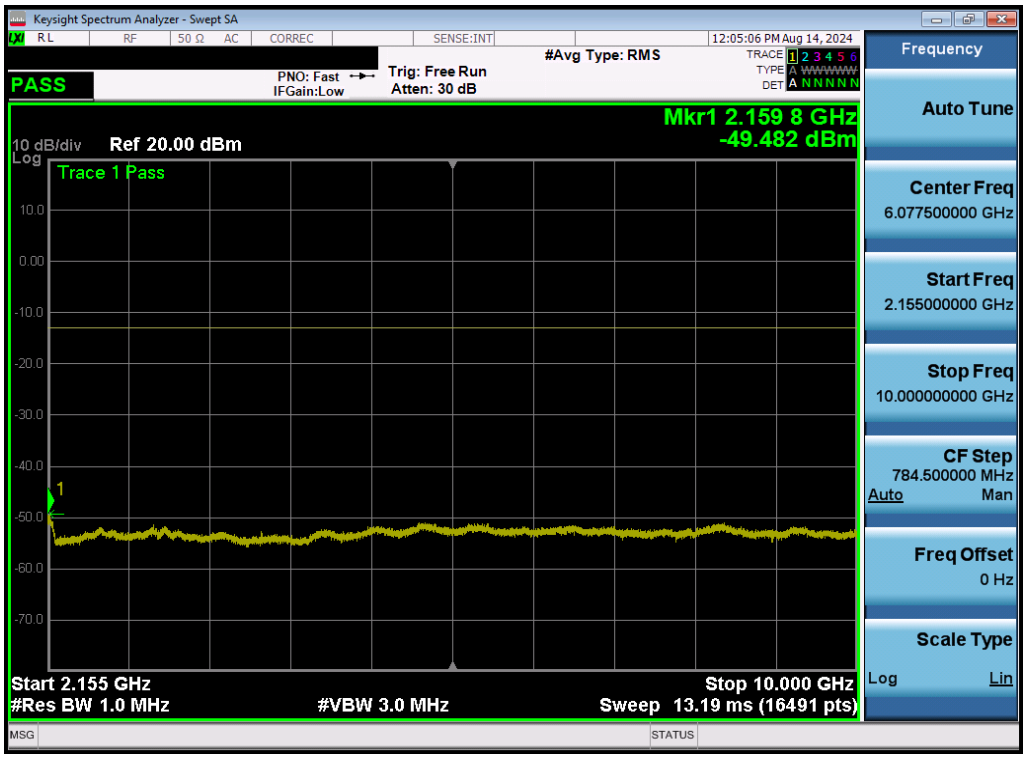
Test Notes

Per Part 27, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz and a resolution bandwidth of 1MHz for measurements above 1GHz.

UMTS B4

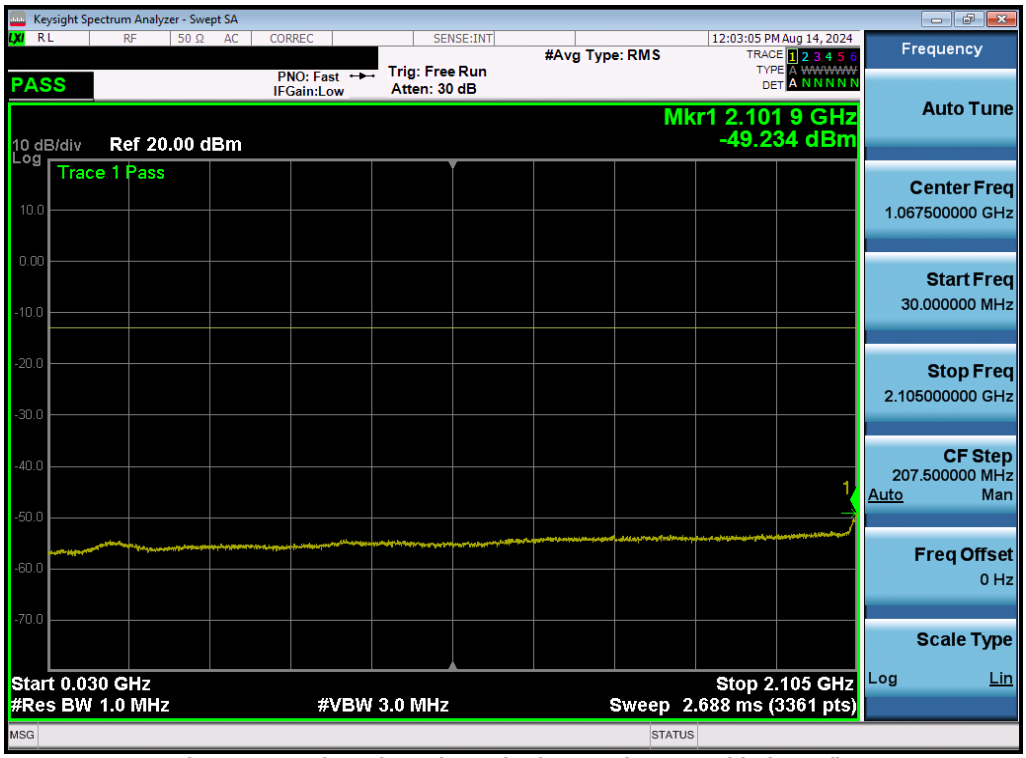


Plot 7-13. Conducted Spurious Plot (UMTS Ch. 1537- Low Channel)

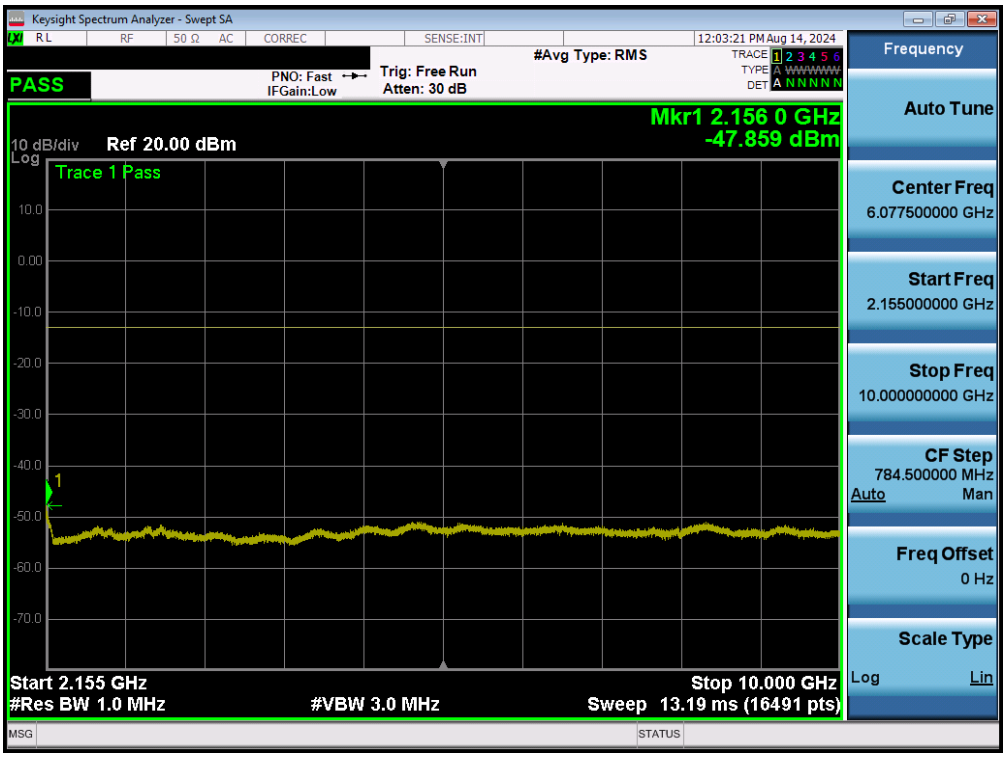


Plot 7-14. Conducted Spurious Plot (UMTS Ch. 1537- Low Channel)

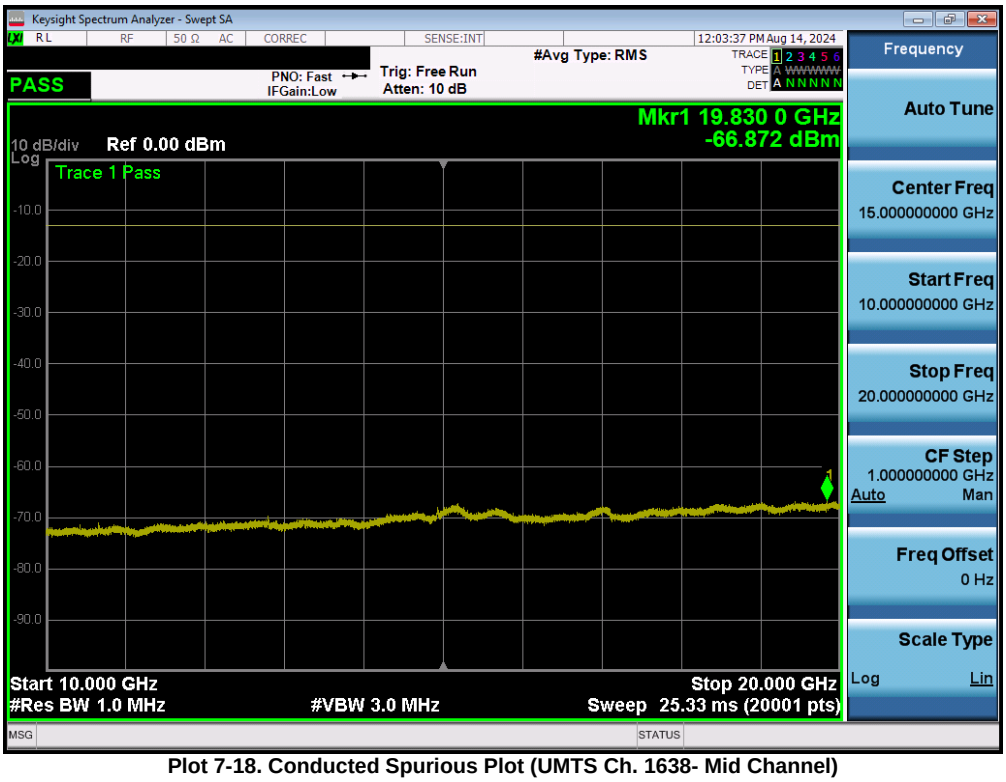
Plot 7-15. Conducted Spurious Plot (UMTS Ch. 1537- Low Channel)



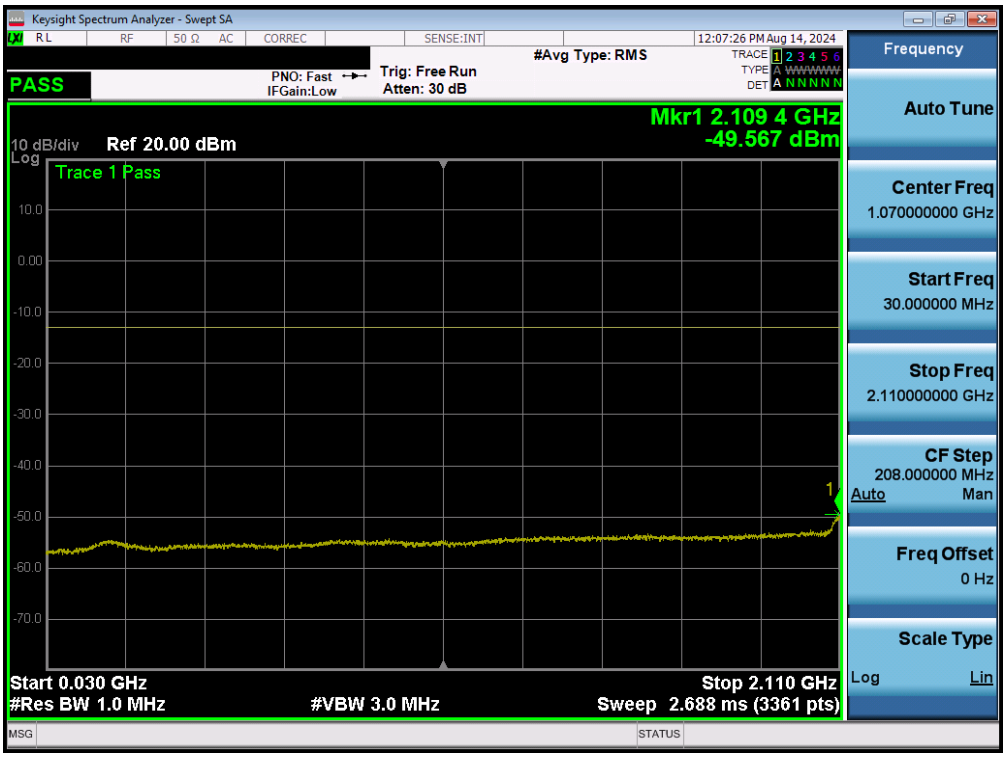
Plot 7-16. Conducted Spurious Plot (UMTS Ch. 1638- Mid Channel)



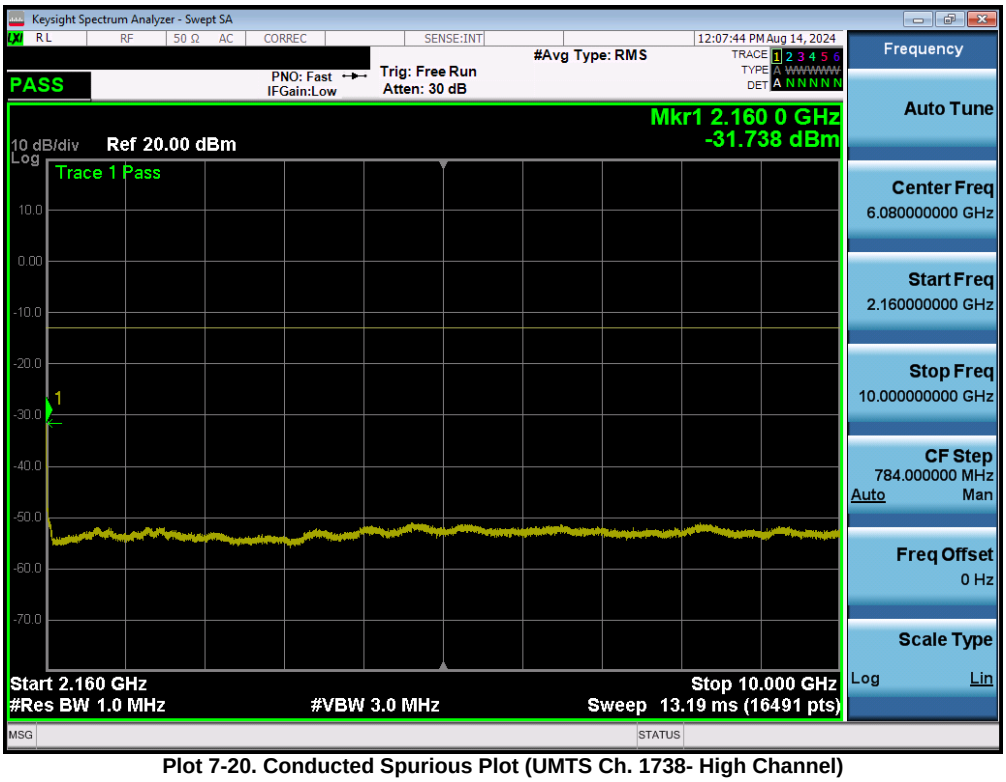
Plot 7-17. Conducted Spurious Plot (UMTS Ch. 1638- Mid Channel)



Plot 7-18. Conducted Spurious Plot (UMTS Ch. 1638- Mid Channel)



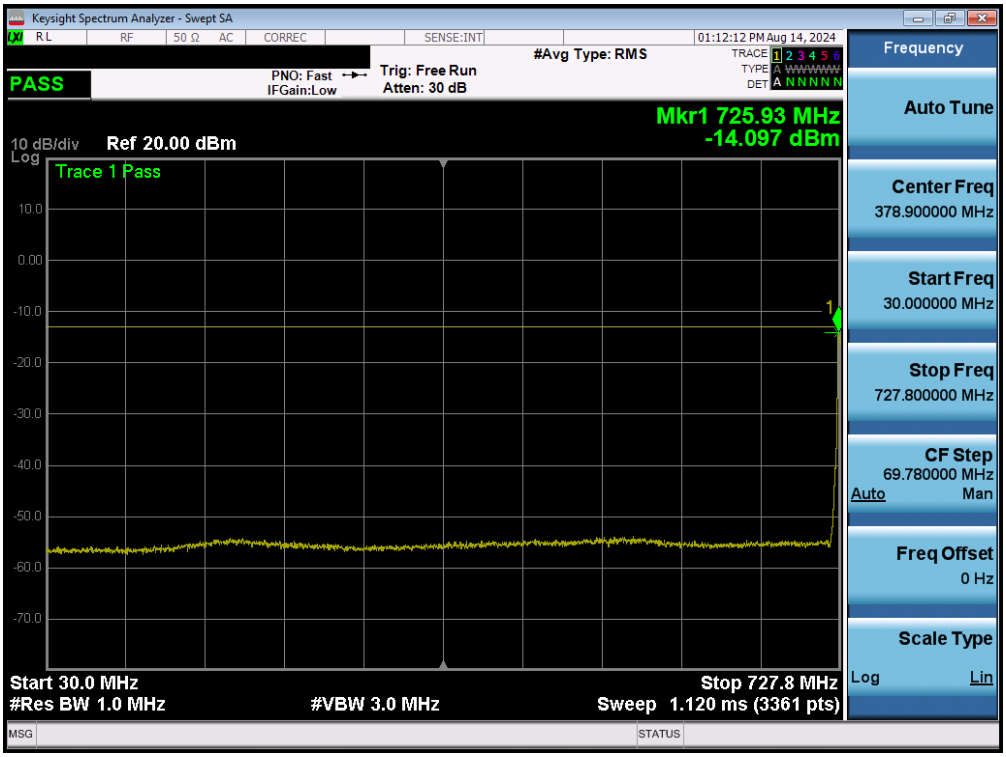
Plot 7-19. Conducted Spurious Plot (UMTS Ch. 1738- High Channel)



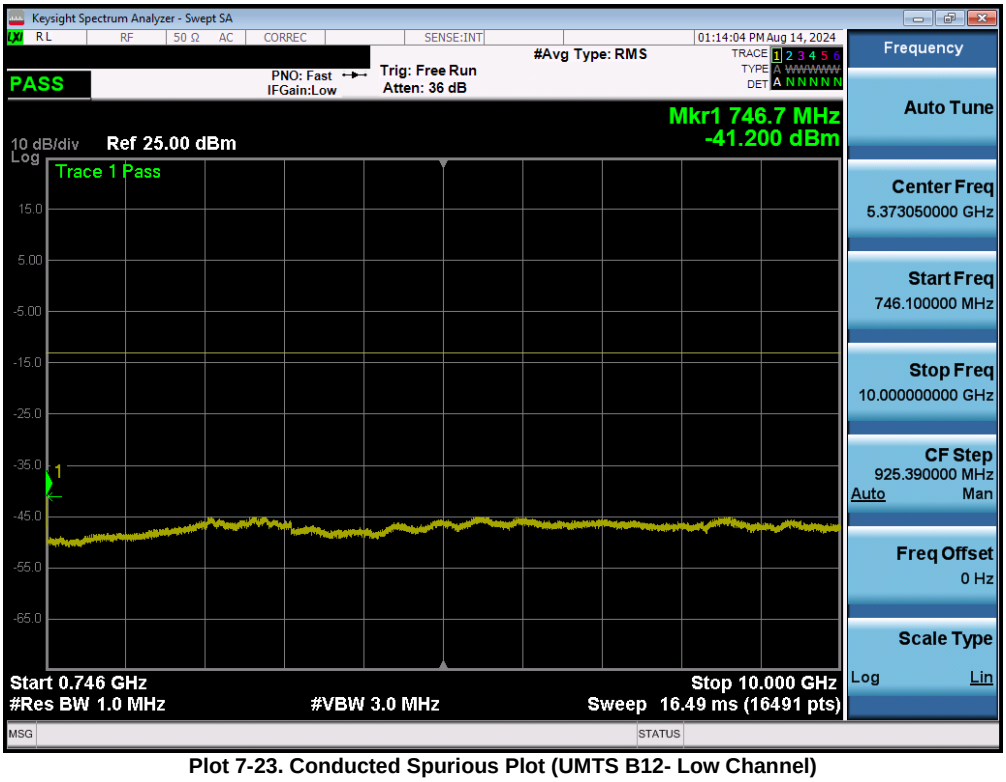
Plot 7-20. Conducted Spurious Plot (UMTS Ch. 1738- High Channel)

Plot 7-21. Conducted Spurious Plot (UMTS Ch. 1738- High Channel)

UMTS B12

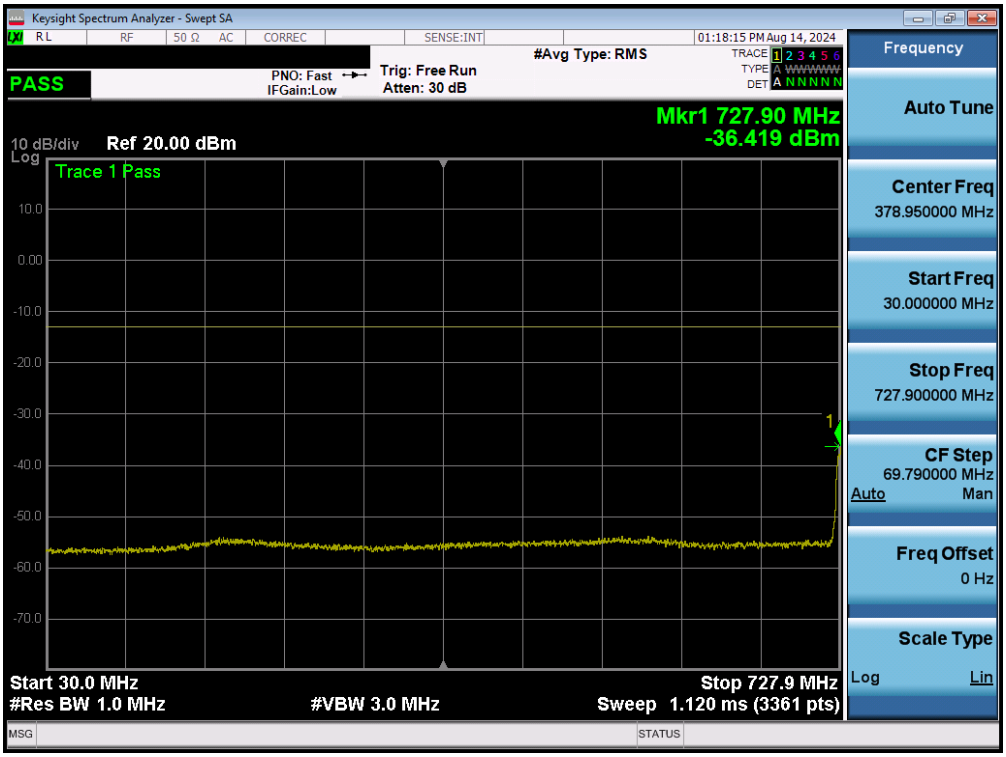


Plot 7-22. Conducted Spurious Plot (UMTS B12- Low Channel)

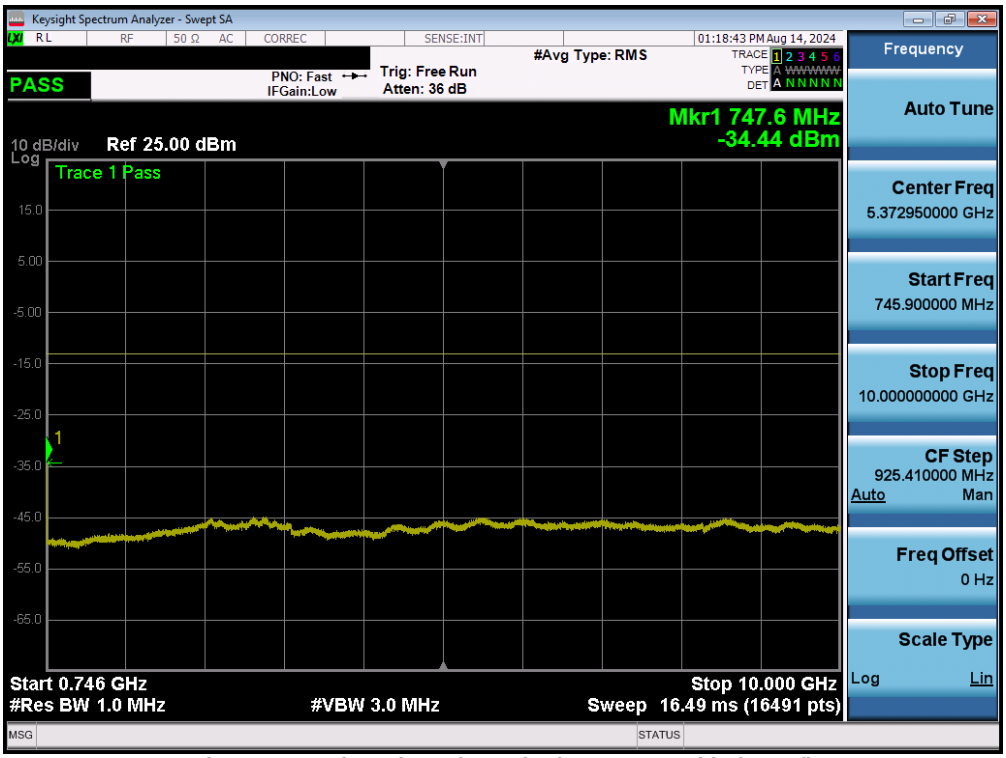


Plot 7-23. Conducted Spurious Plot (UMTS B12- Low Channel)

Plot 7-24. Conducted Spurious Plot (UMTS B12- Low Channel)

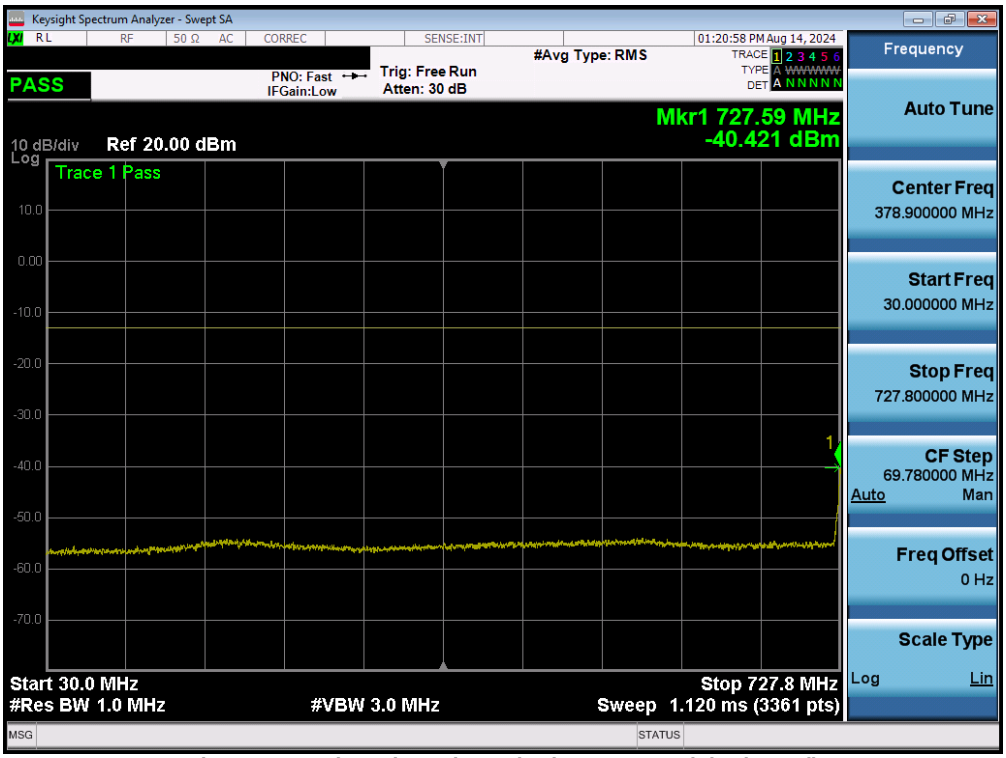


Plot 7-25. Conducted Spurious Plot (UMTS B12- Mid Channel)

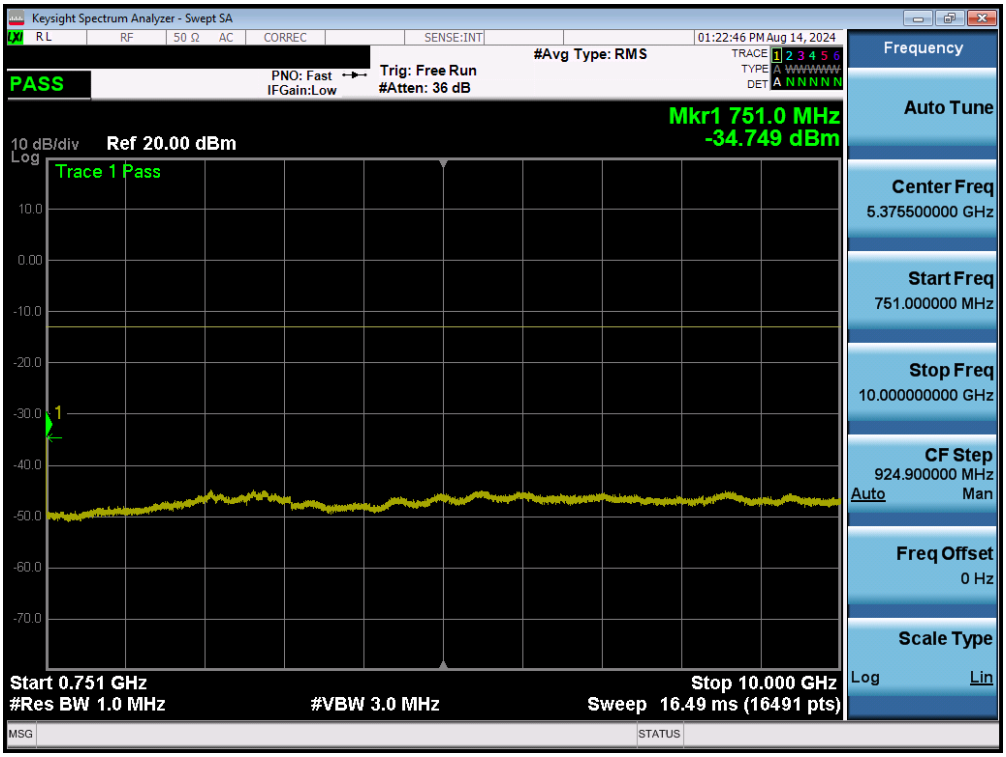


Plot 7-26. Conducted Spurious Plot (UMTS B12- Mid Channel)

Plot 7-27. Conducted Spurious Plot (UMTS B12- Mid Channel)



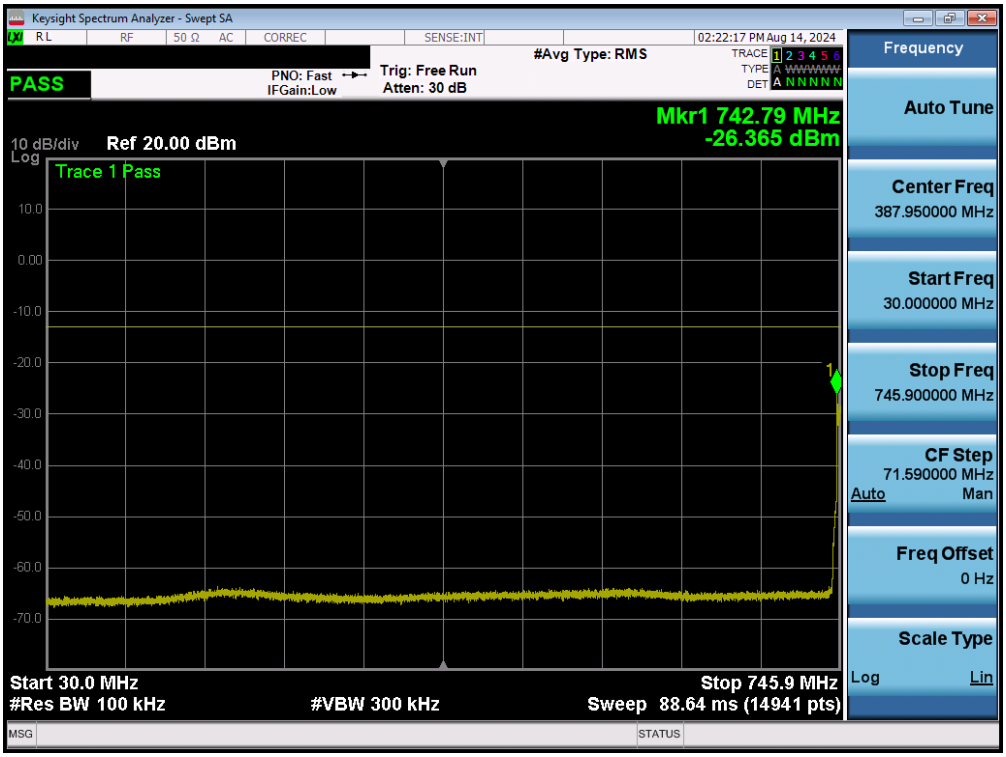
Plot 7-28. Conducted Spurious Plot (UMTS B12- High Channel)



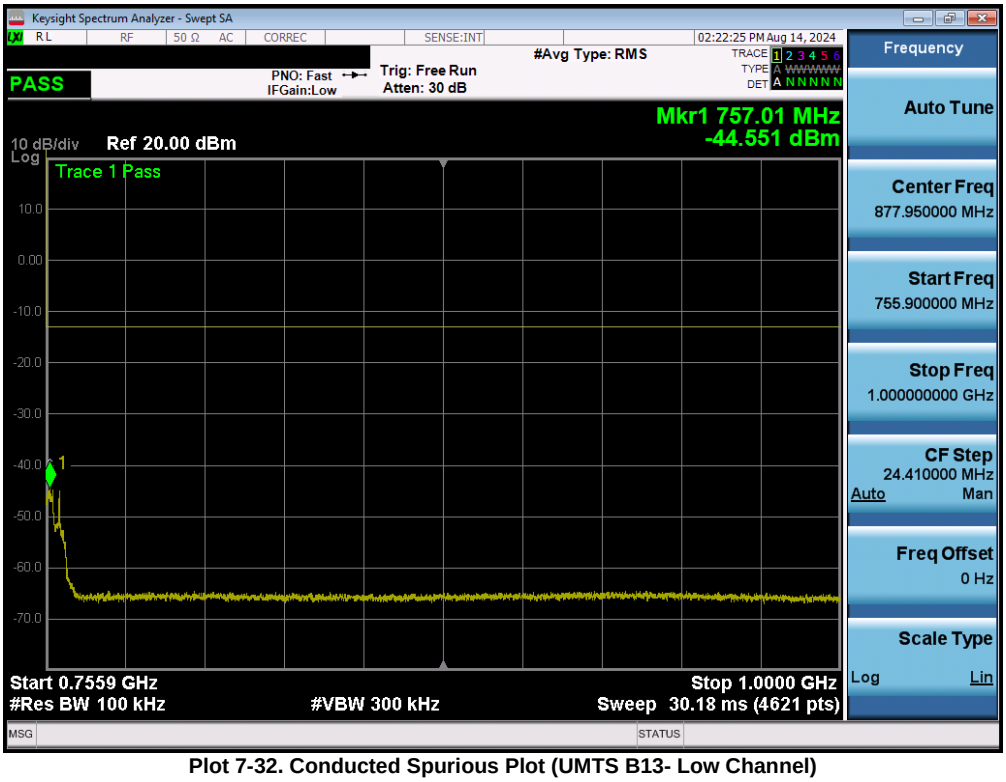
Plot 7-29. Conducted Spurious Plot (UMTS B12- High Channel)

Plot 7-30. Conducted Spurious Plot (UMTS B12- High Channel)

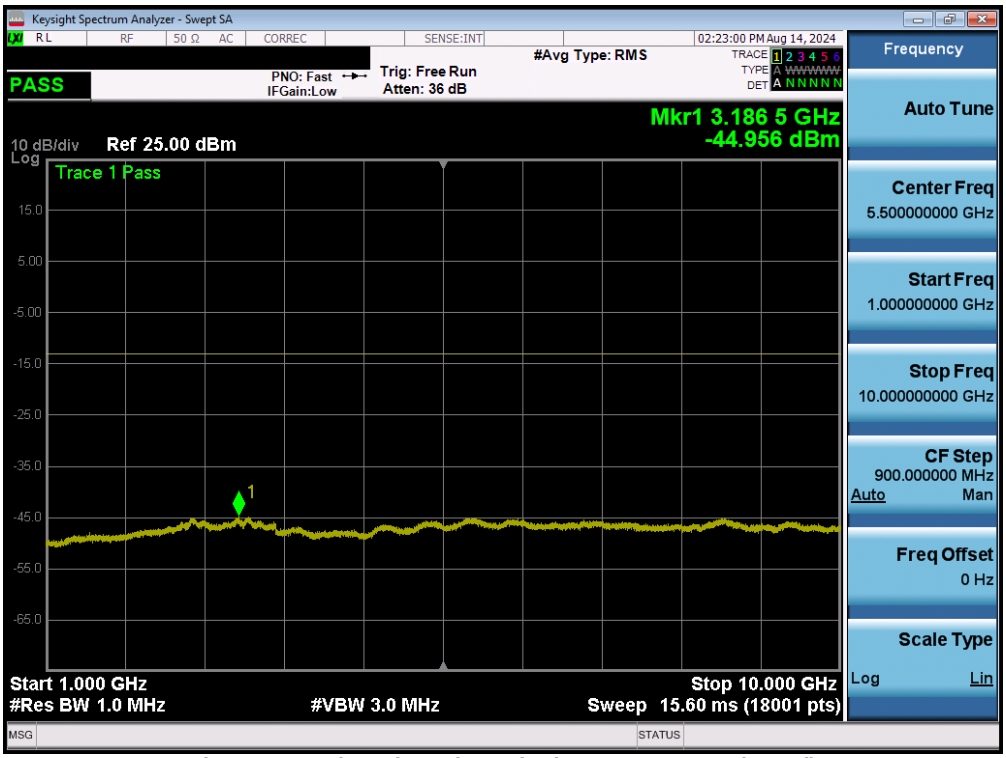
UMTS B13



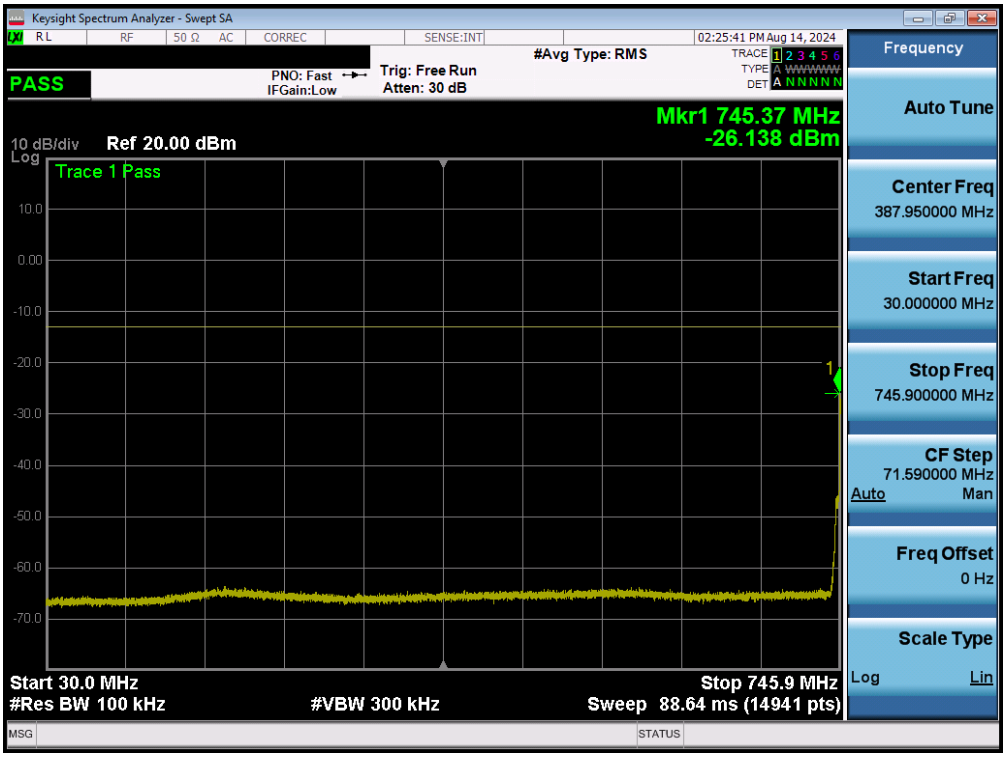
Plot 7-31. Conducted Spurious Plot (UMTS B13- Low Channel)



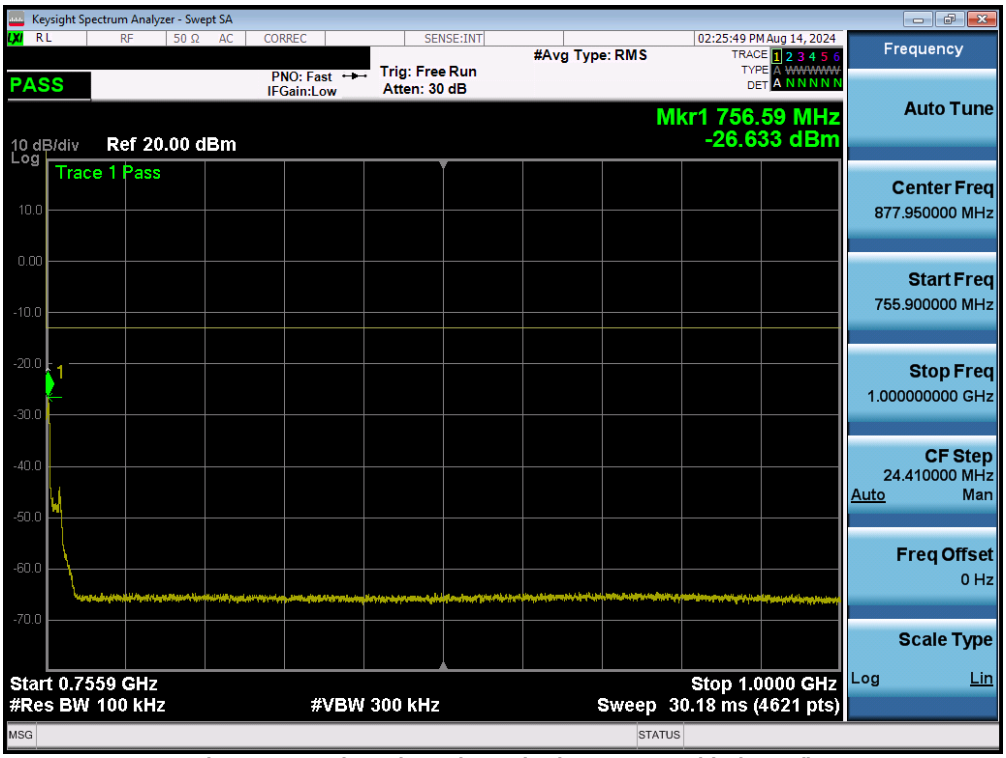
Plot 7-32. Conducted Spurious Plot (UMTS B13- Low Channel)



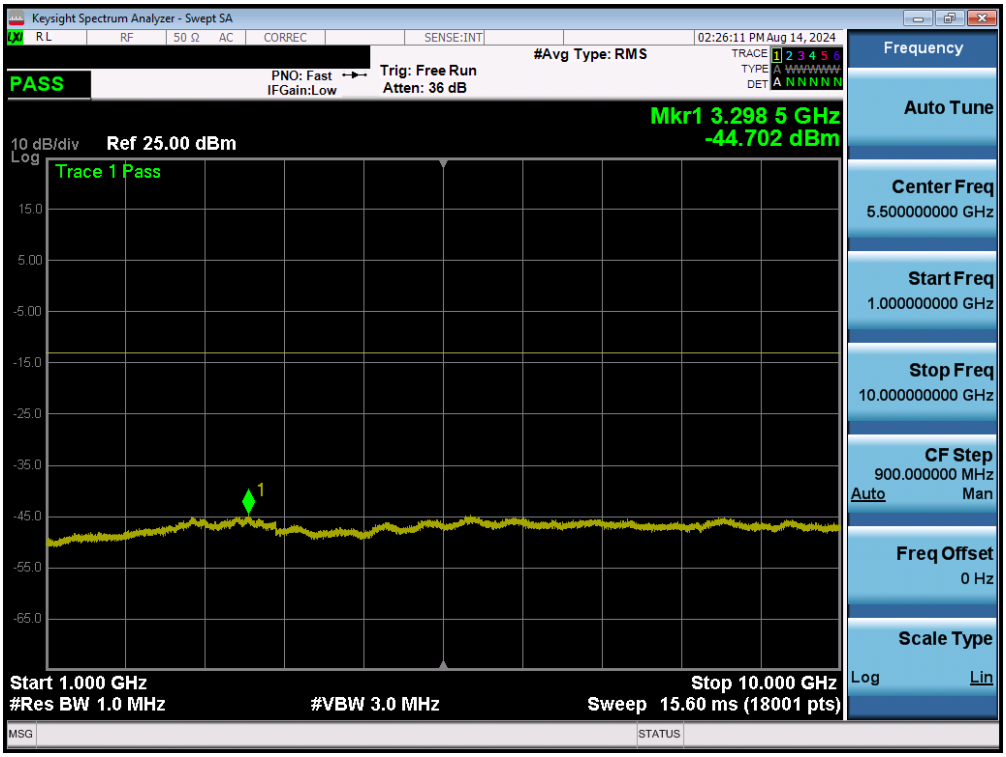
Plot 7-33. Conducted Spurious Plot (UMTS B13- Low Channel)



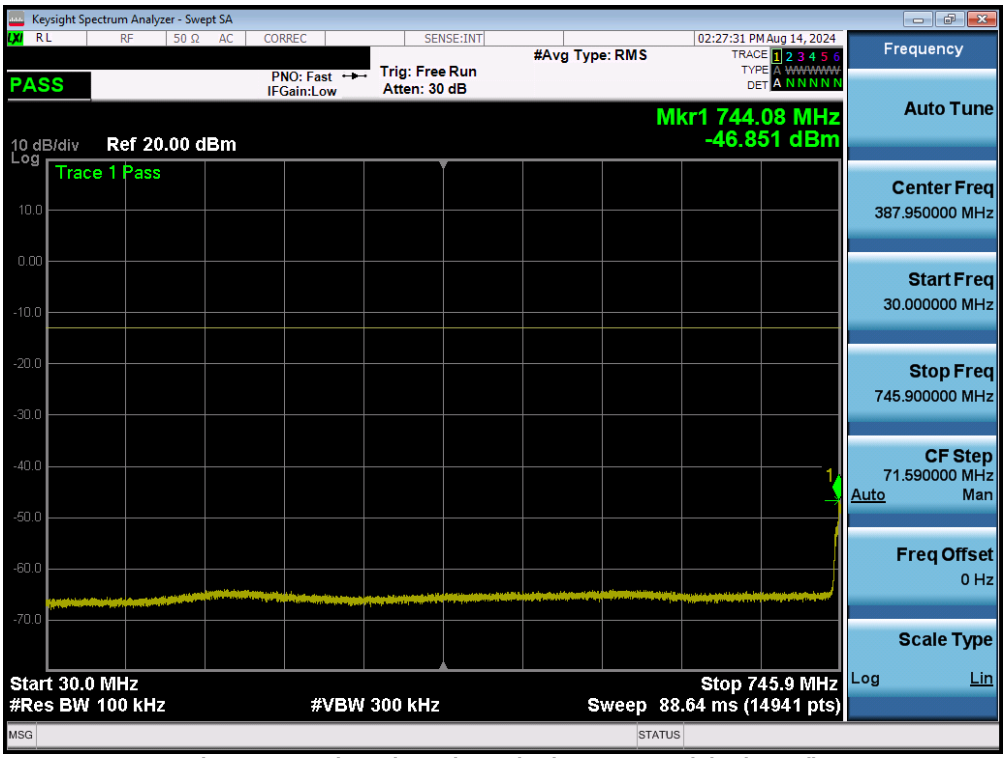
Plot 7-34. Conducted Spurious Plot (UMTS B13- Mid Channel)



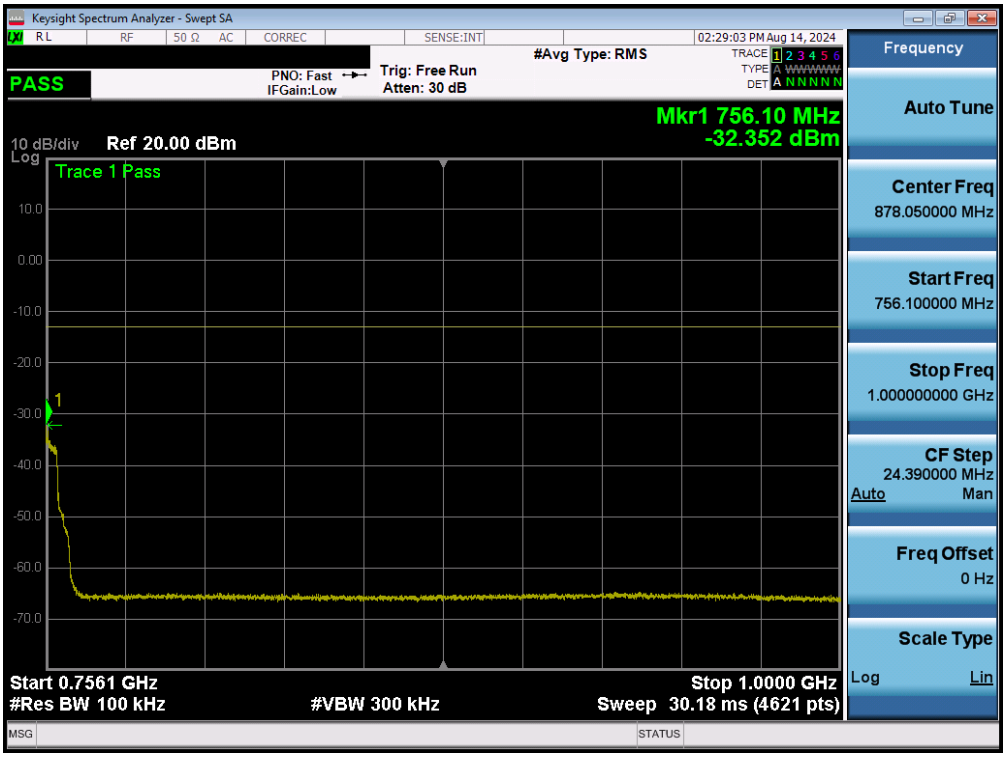
Plot 7-35. Conducted Spurious Plot (UMTS B13- Mid Channel)



Plot 7-36. Conducted Spurious Plot (UMTS B13- Mid Channel)



Plot 7-37. Conducted Spurious Plot (UMTS B13- High Channel)



Plot 7-38. Conducted Spurious Plot (UMTS B13- High Channel)

Plot 7-39. Conducted Spurious Plot (UMTS B13- High Channel

7.5 Band Edge Emissions at Antenna Terminal

Test Overview

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

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

Test Procedure Used

ANSI C63.26-2015 – Section 5.7.3

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 ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 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 7-4. Test Instrument & Measurement Setup

Test Notes

1. Per 27.53(h) for AWS band operation, 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.

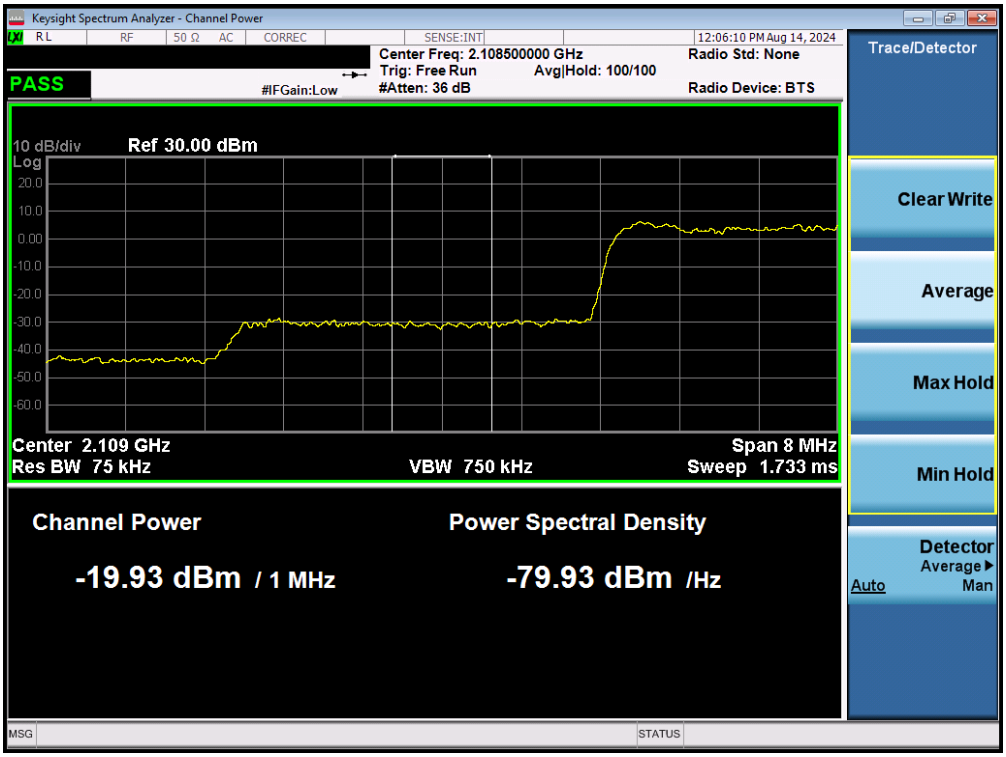
2. Per 27.53(g) for operations in the 663 - 698 MHz and 698 – 746MHz bands, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

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 $65 + 10 \log_{10}(P) = -35$dBm in a 6.25kHz bandwidth.

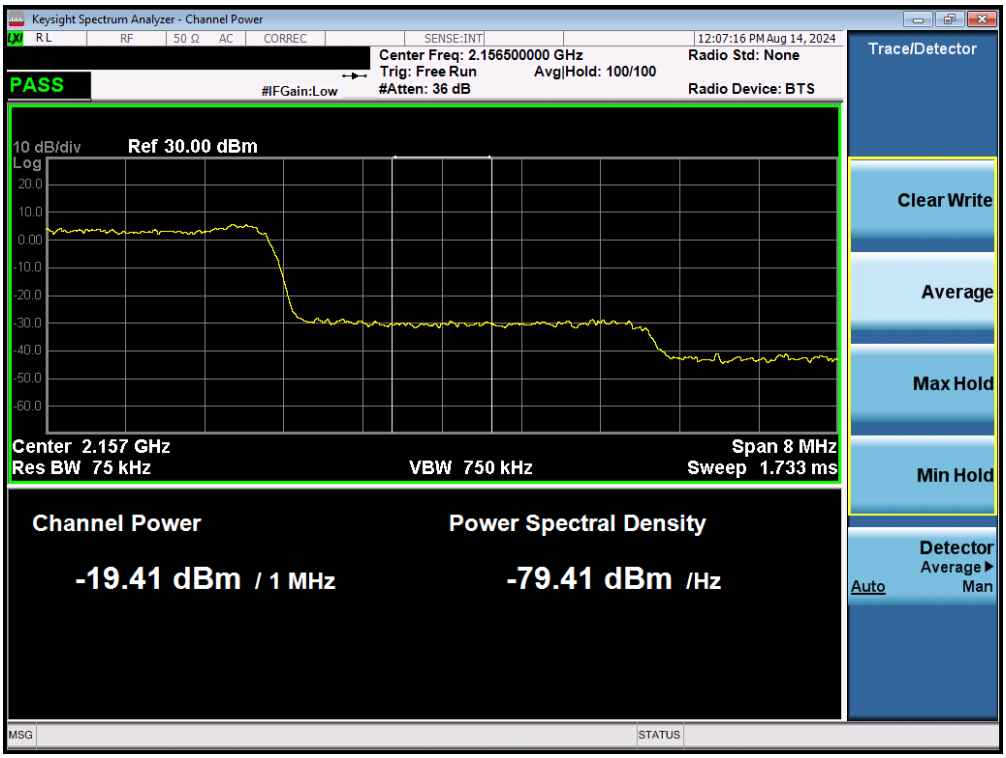
UMTS B4/10

Plot 7-40. Lower Band Edge Plot (UMTS B4 – Ch. 1537)

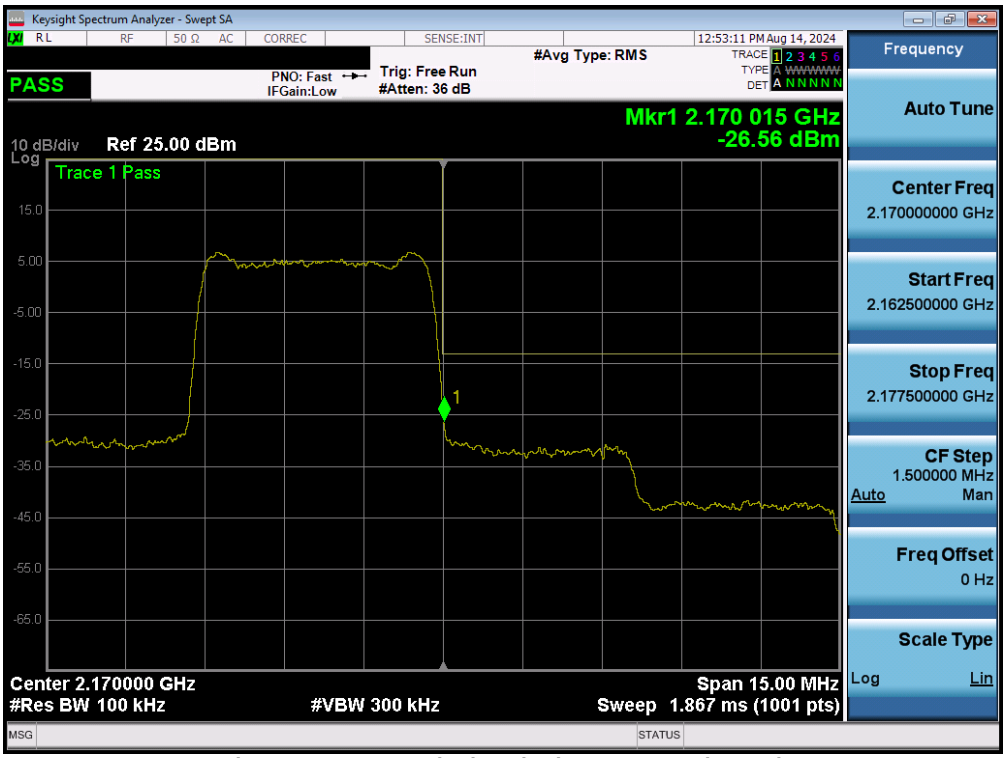


Plot 7-41. Lower Extended Band Edge Plot (UMTS B4 – Ch. 1537)

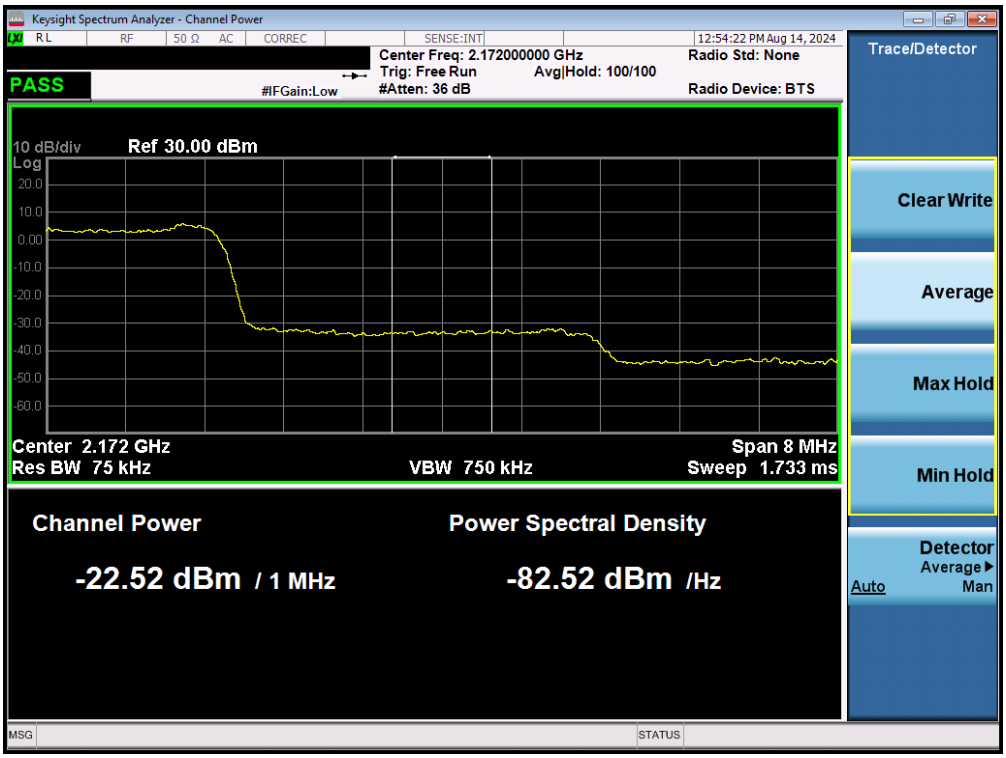
Plot 7-42. Upper Band Edge Plot (UMTS B4 – Ch. 1738)



Plot 7-43. Upper Extended Band Edge Plot (UMTS B4 – Ch. 1738)

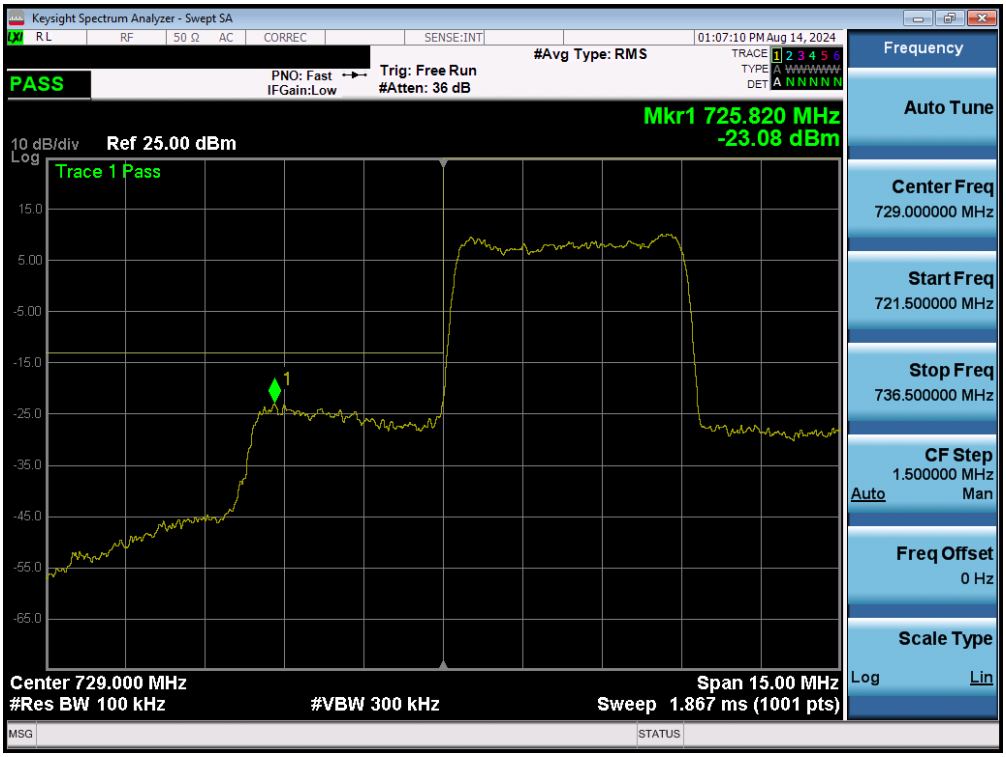


Plot 7-44. Upper Band Edge Plot (UMTS B10 – Ch. 1738)



Plot 7-45. Upper Extended Band Edge Plot (UMTS B10 – Ch. 1738)

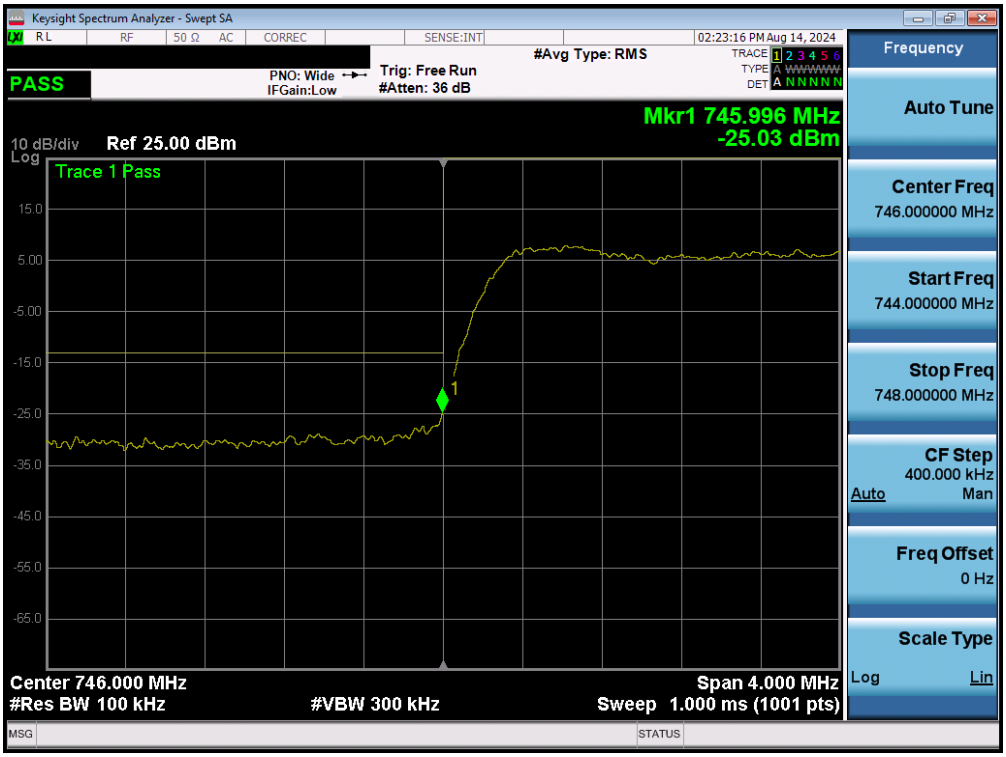
UMTS B12



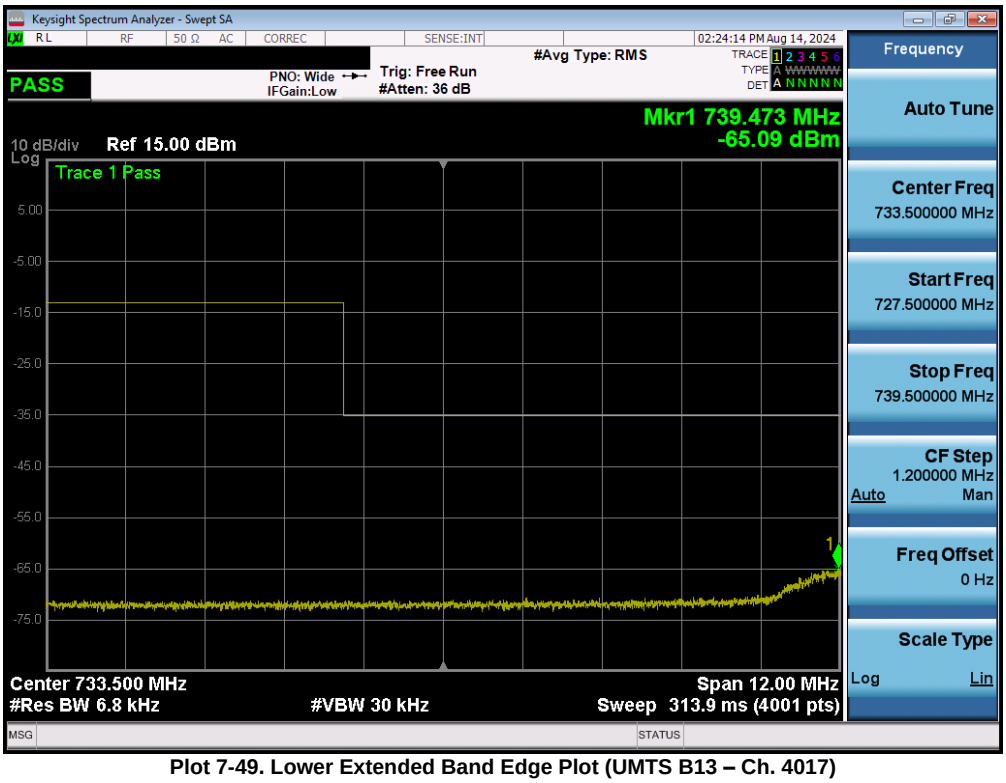
Plot 7-46. Lower Band Edge Plot (UMTS B12 – Ch. 3842)

Plot 7-47. Upper Band Edge Plot (UMTS B12 – Ch. 3903)

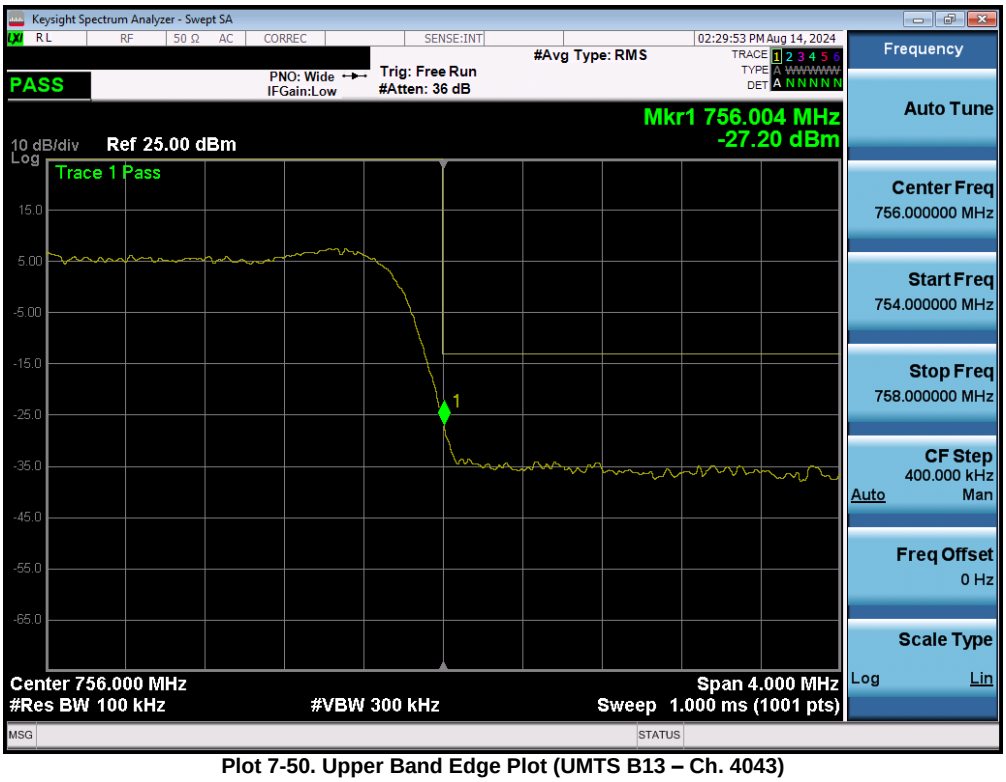
UMTS B13



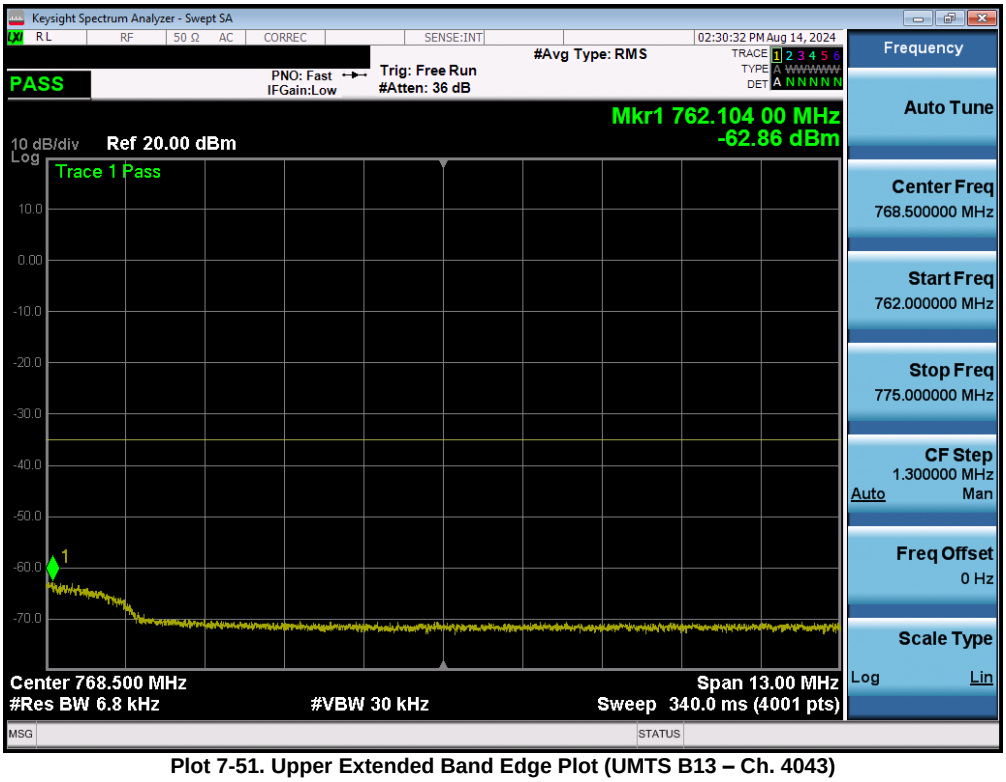
Plot 7-48. Lower Band Edge Plot (UMTS B13 – Ch. 4017)



Plot 7-49. Lower Extended Band Edge Plot (UMTS B13 – Ch. 4017)



Plot 7-50. Upper Band Edge Plot (UMTS B13 – Ch. 4043)



Plot 7-51. Upper Extended Band Edge Plot (UMTS B13 – Ch. 4043)

7.6 Peak-Average Ratio

Test Overview

A peak-to-average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2.3.4

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW ≥ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

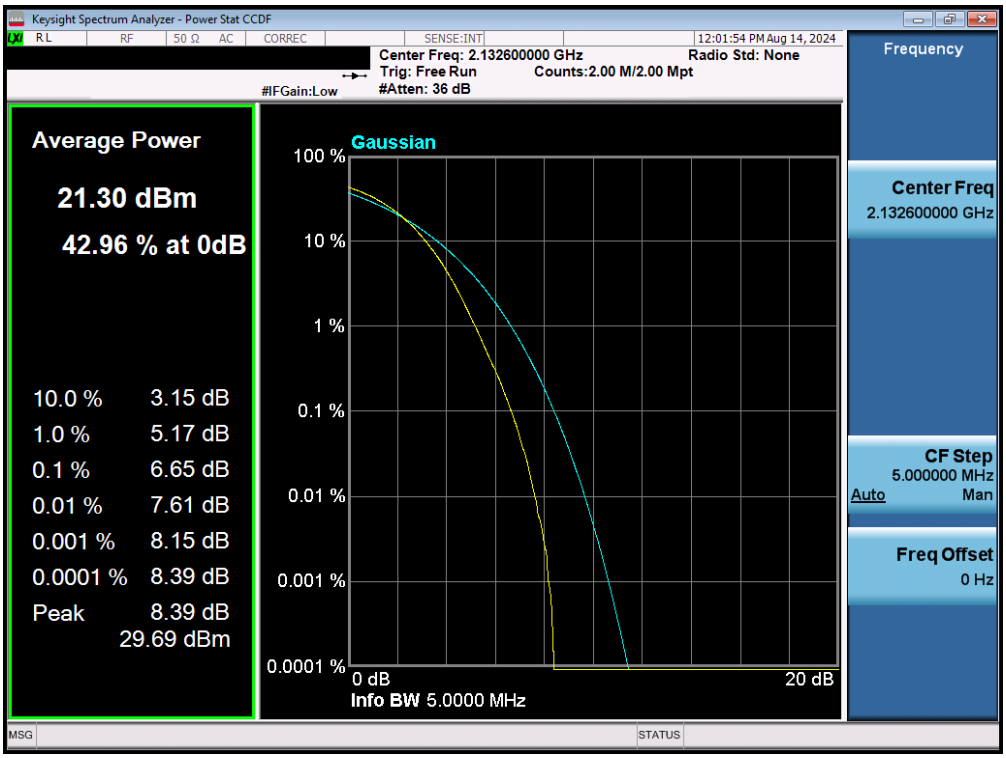
Test Setup

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

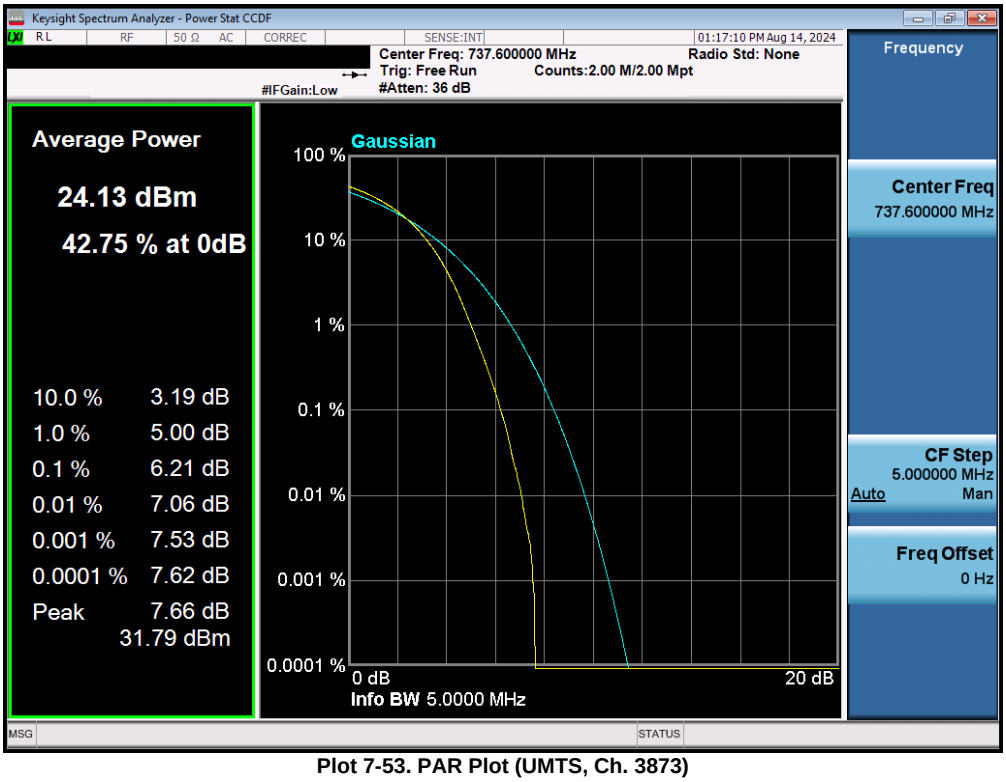
Figure 7-5. Test Instrument & Measurement Setup

Test Notes

None.



Plot 7-52. PAR Plot (UMTS, Ch. 1638)



Plot 7-53. PAR Plot (UMTS, Ch. 3873)

7.7 Radiated Spurious Emissions Measurements

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in ANSI C63.26-2015 with the EUT transmitting into an external antenna. Measurements on signals operating below 1GHz are performed using hybrid (biconical/log) antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

ANSI C63.26-2015 – Section 5.5.4

Test Settings

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

Test Setup

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

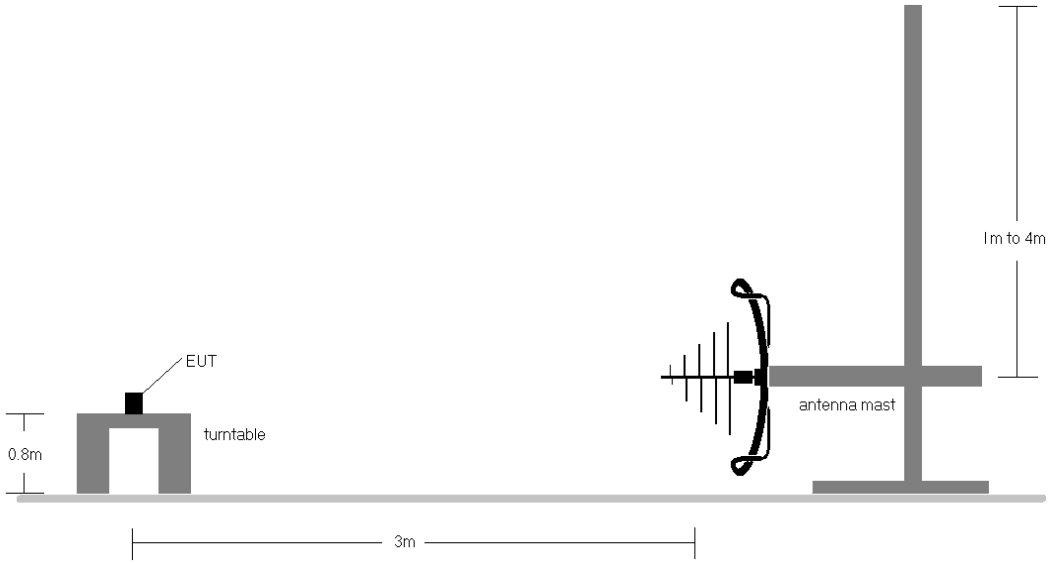


Figure 7-6. Test Instrument & Measurement Setup < 1GHz

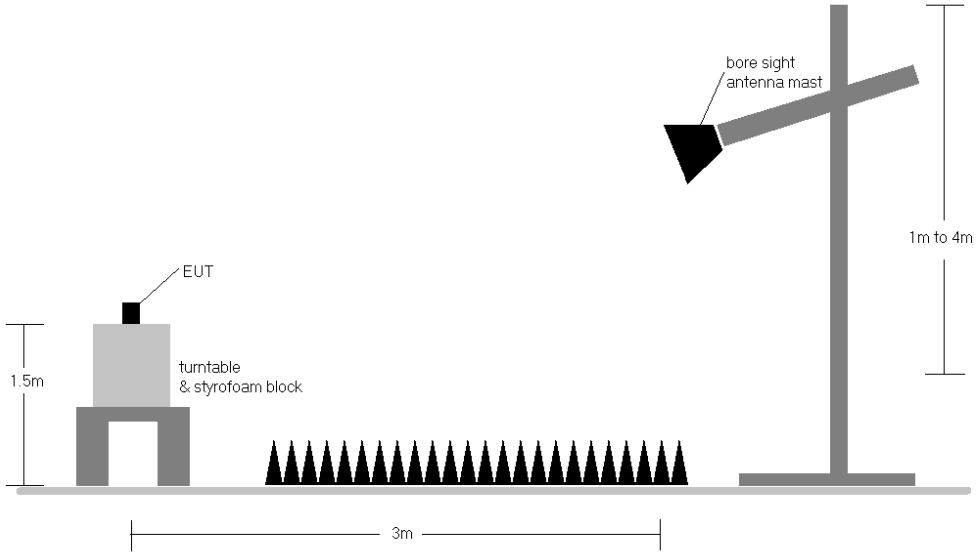


Figure 7-7. Test Instrument & Measurement Setup > 1GHz

Test Notes

1) Field strengths are calculated using the Measurement quantity conversions in ANSI C63.26-2015 Section 5.2.7:
   a) E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
   b) EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

2) This unit was tested while powered by a 12VDC power supply.

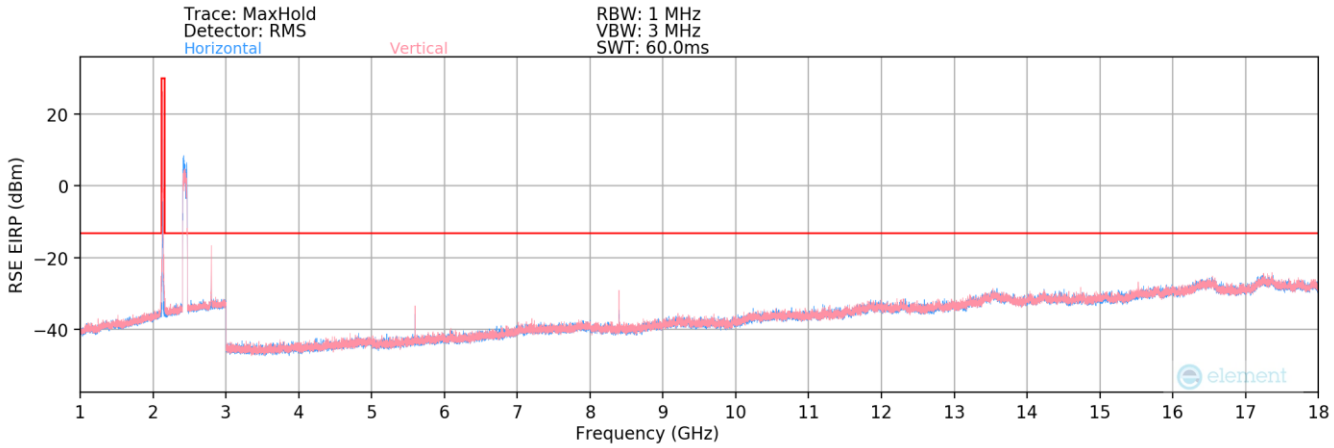
3) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

4) 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.

5) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

6) This unit has a WLAN Transmitter.

UMTS B4



Plot 7-54. Radiated Spurious Plot (UMTS B4)

Mode:	WCDMA RMC
Channel:	1537
Frequency (MHz):	2112.4

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
4224.80	V	112	13	-76.80	7.04	37.24	-58.01	-13.00	-45.01
6337.20	V	112	13	-81.58	10.72	36.14	-59.11	-13.00	-46.11
8449.60	V	-	-	-83.07	14.07	38.00	-57.26	-13.00	-44.26
10562.00	V	-	-	-83.44	16.69	40.25	-55.01	-13.00	-42.01
12674.40	V	-	-	-84.97	19.59	41.62	-53.64	-13.00	-40.64

7-5. Radiated Spurious Data (UMTS B4 – Low Channel)

Mode:	WCDMA RMC
Channel:	1638
Frequency (MHz):	2132.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
4265.20	V	108	1	-74.82	7.06	39.24	-56.02	-13.00	-43.02
6397.80	V	-	-	-81.86	10.29	35.43	-59.83	-13.00	-46.83
8530.40	V	107	358	-81.74	13.73	38.99	-56.27	-13.00	-43.27
10663.00	V	107	358	-82.50	17.16	41.66	-53.59	-13.00	-40.59
12795.60	V	-	-	-85.05	19.76	41.71	-53.55	-13.00	-40.55
14928.20	V	-	-	-85.31	22.22	43.91	-51.35	-13.00	-38.35
17060.80	V	-	-	-85.39	25.05	46.66	-48.60	-13.00	-35.60

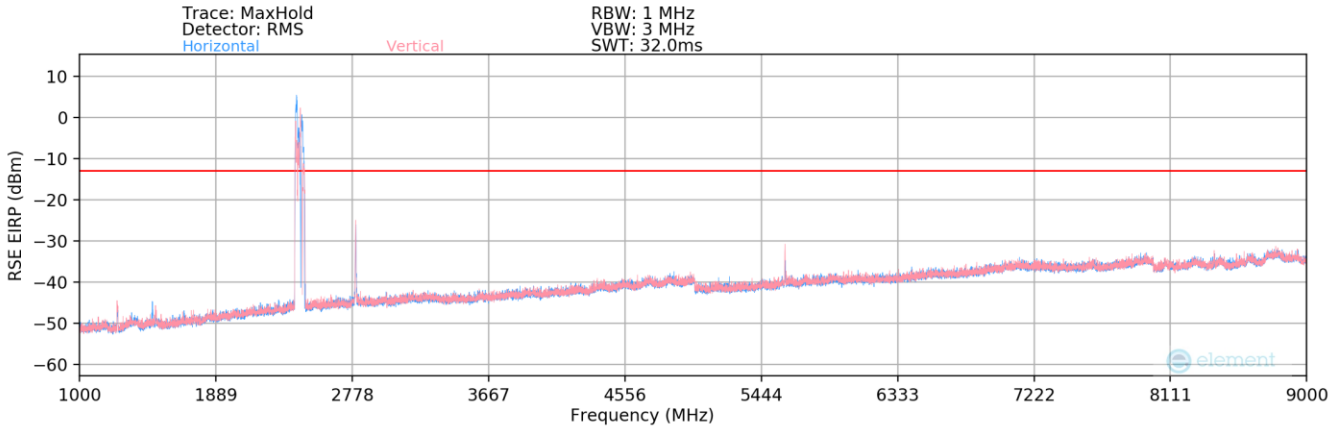
Table 7-6. Radiated Spurious Data (UMTS B4 – Mid Channel)

Mode:	WCDMA RMC
Channel:	1738
Frequency (MHz):	2152.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
4305.20	V	123	28	-76.51	7.20	37.69	-57.57	-13.00	-44.57
6457.80	V	122	28	-81.75	10.32	35.57	-59.69	-13.00	-46.69
8610.40	V	-	-	-83.44	14.47	38.03	-57.23	-13.00	-44.23
10763.00	V	-	-	-84.08	16.62	39.54	-55.72	-13.00	-42.72
12915.60	V	-	-	-84.49	19.86	42.37	-52.89	-13.00	-39.89

Table 7-7. Radiated Spurious Data (UMTS B4 – High Channel)

UMTS B12



Plot 7-55. Radiated Spurious Plot (UMTS B12)

Mode:	WCDMA B12
Channel:	3842
Frequency (MHz):	731.4

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1462.80	V	190	257	-61.02	-0.43	45.55	-49.71	-13.00	-36.71
2194.20	V	-	-	-78.51	2.88	31.37	-63.89	-13.00	-50.89
2925.60	V	190	257	-76.84	4.92	35.08	-60.18	-13.00	-47.18
3657.00	V	-	-	-80.38	7.24	33.86	-61.40	-13.00	-48.40
4388.40	V	-	-	-81.18	9.30	35.12	-60.14	-13.00	-47.14
5119.80	V	-	-	-81.01	10.37	36.36	-58.89	-13.00	-45.89

7-8. Radiated Spurious Data (UMTS B12 – Low Channel)

Mode:	WCDMA B12
Channel:	3873
Frequency (MHz):	737.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1475.20	V	200	257	-59.19	-0.37	47.44	-47.82	-13.00	-34.82
2212.80	V	-	-	-78.60	3.00	31.40	-63.86	-13.00	-50.86
2950.40	V	200	257	-77.97	5.27	34.30	-60.96	-13.00	-47.96
3688.00	V	-	-	-80.64	7.39	33.75	-61.51	-13.00	-48.51
4425.60	V	-	-	-81.29	9.16	34.87	-60.38	-13.00	-47.38
5163.20	V	-	-	-81.30	10.85	36.55	-58.71	-13.00	-45.71

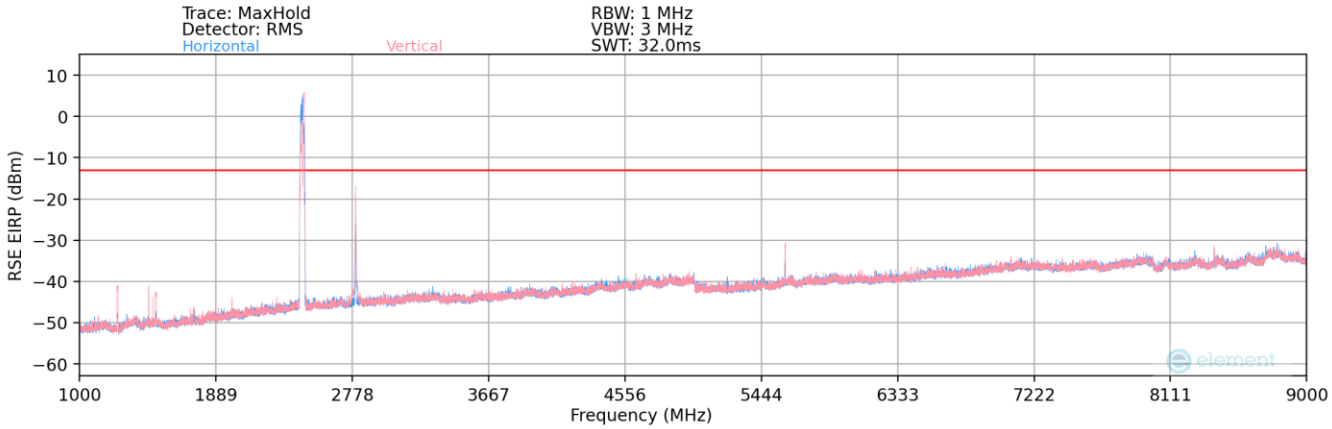
Table 7-9. Radiated Spurious Data (UMTS B12 – Mid Channel)

Mode:	WCDMA B12
Channel:	3903
Frequency (MHz):	743.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1487.20	V	177	268	-59.24	-0.30	47.46	-47.80	-13.00	-34.80
2230.80	V	-	-	-78.95	3.16	31.21	-64.04	-13.00	-51.04
2974.40	V	177	268	-76.44	5.45	36.01	-59.25	-13.00	-46.25
3718.00	V	-	-	-80.32	7.46	34.14	-61.11	-13.00	-48.11
4461.60	V	-	-	-80.82	8.73	34.91	-60.34	-13.00	-47.34
5205.20	V	-	-	-81.69	10.50	35.81	-59.44	-13.00	-46.44

Table 7-10. Radiated Spurious Data (UMTS B12 – High Channel)

UMTS B13



Plot 7-56. Radiated Spurious Plot (UMTS B13)

Mode:	WCDMA B13
Channel:	4017
Frequency (MHz):	748.4

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1496.80	V	126	268	-61.07	-0.30	45.63	-49.63	-13.00	-36.63
2245.20	V	-	-	-78.82	3.06	31.24	-64.02	-13.00	-51.02
2993.60	V	126	268	-78.08	5.89	34.81	-60.45	-13.00	-47.45
3742.00	V	-	-	-80.37	7.44	34.07	-61.18	-13.00	-48.18
4490.40	V	-	-	-80.74	8.67	34.93	-60.33	-13.00	-47.33
5238.80	V	-	-	-81.46	10.46	36.00	-59.26	-13.00	-46.26

Table 7-11. Radiated Spurious Data (UMTS B13 – Low Channel)

Mode:	WCDMA B13
Channel:	4030
Frequency (MHz):	751

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1502.00	V	127	264	-58.96	-0.31	47.73	-47.52	-13.00	-34.52
2253.00	V	-	-	-78.75	3.03	31.28	-63.98	-13.00	-50.98
3004.00	V	122	257	-78.61	5.80	34.19	-61.06	-13.00	-48.06
3755.00	V	-	-	-80.42	7.54	34.12	-61.14	-13.00	-48.14
4506.00	V	-	-	-80.95	8.89	34.94	-60.32	-13.00	-47.32
5257.00	V	-	-	-81.61	10.62	36.01	-59.24	-13.00	-46.24

Table 7-12. Radiated Spurious Data (UMTS B13 – Mid Channel)

Mode:	WCDMA B13
Channel:	4043
Frequency (MHz):	753.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1507.20	V	115	258	-61.00	-0.37	45.63	-49.63	-13.00	-36.63
2260.80	V	-	-	-78.82	3.02	31.20	-64.06	-13.00	-51.06
3014.40	V	115	258	-78.38	5.69	34.31	-60.95	-13.00	-47.95
3768.00	V	-	-	-80.41	7.64	34.23	-61.03	-13.00	-48.03
4521.60	V	-	-	-81.05	9.47	35.42	-59.84	-13.00	-46.84
5275.20	V	-	-	-81.85	10.75	35.90	-59.36	-13.00	-46.36

Table 7-13. Radiated Spurious Data (UMTS B13 – High Channel)

7.8 Frequency Stability / Temperature Variation

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

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

Test Procedure Used

ANSI C63.26-2015 – Section 5.6

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

Test Notes

None

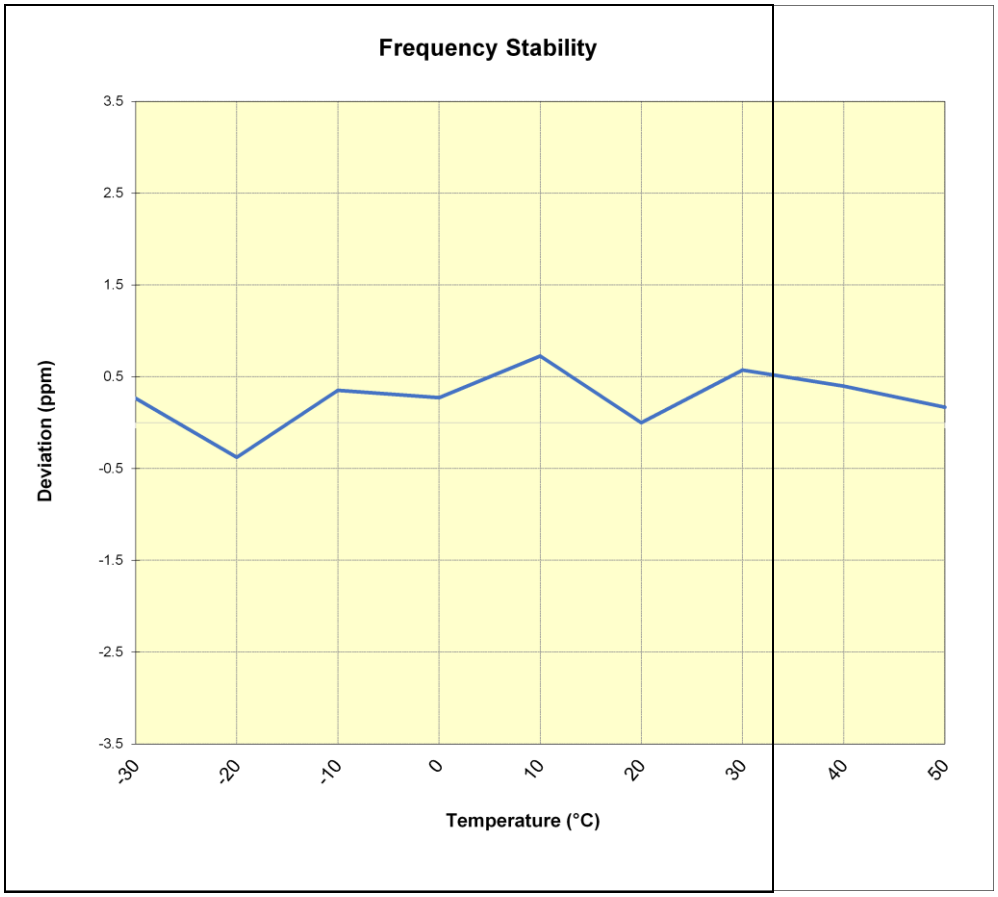
Frequency Stability / Temperature Variation

UMTS B4/10

Operating Frequency (Hz):	2,132,600,000
Ref. Voltage (VDC):	12

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	12	- 30	2,132,642,671	569	0.0000267
		- 20	2,132,641,298	-804	-0.0000377
		- 10	2,132,642,851	749	0.0000351
		0	2,132,642,681	579	0.0000271
		+ 10	2,132,643,652	1,550	0.0000727
		+ 20 (Ref)	2,132,642,102	0	0.0000000
		+ 30	2,132,643,323	1,221	0.0000573
		+ 40	2,132,642,951	849	0.0000398
		+ 50	2,132,642,461	359	0.0000168

Table 7-14. UMTS B4 Frequency Stability Data



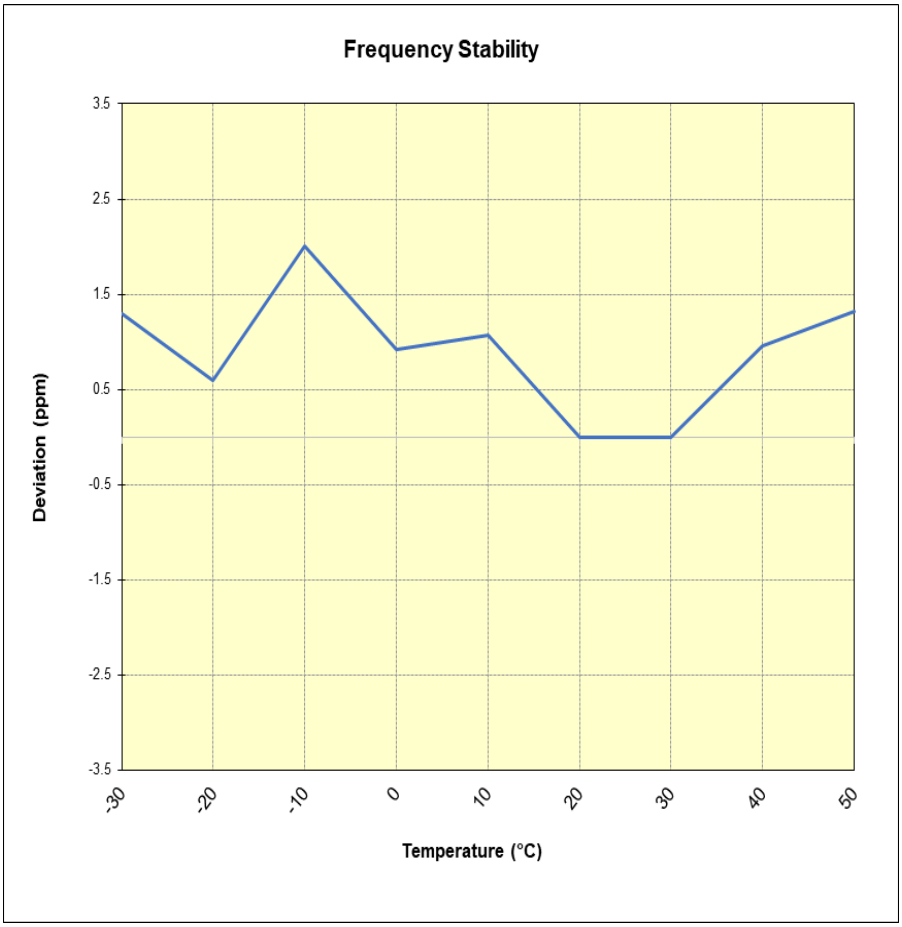
Plot 7-57. UMTS B4 Frequency Stability Chart

UMTS B12

Operating Frequency (Hz):	737,600,000
Ref. Voltage (VDC):	12

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	12	- 30	737,632,687	960	0.0001301
		- 20	737,632,168	441	0.0000598
		- 10	737,633,211	1,484	0.0002012
		0	737,632,403	676	0.0000916
		+ 10	737,632,514	787	0.0001067
		+ 20 (Ref)	737,631,727	0	0.0000000
		+ 30	737,631,722	-5	-0.0000007
		+ 40	737,632,430	703	0.0000953
		+ 50	737,632,700	973	0.0001319

Table 7-15. UMTS B12 Frequency Stability Data



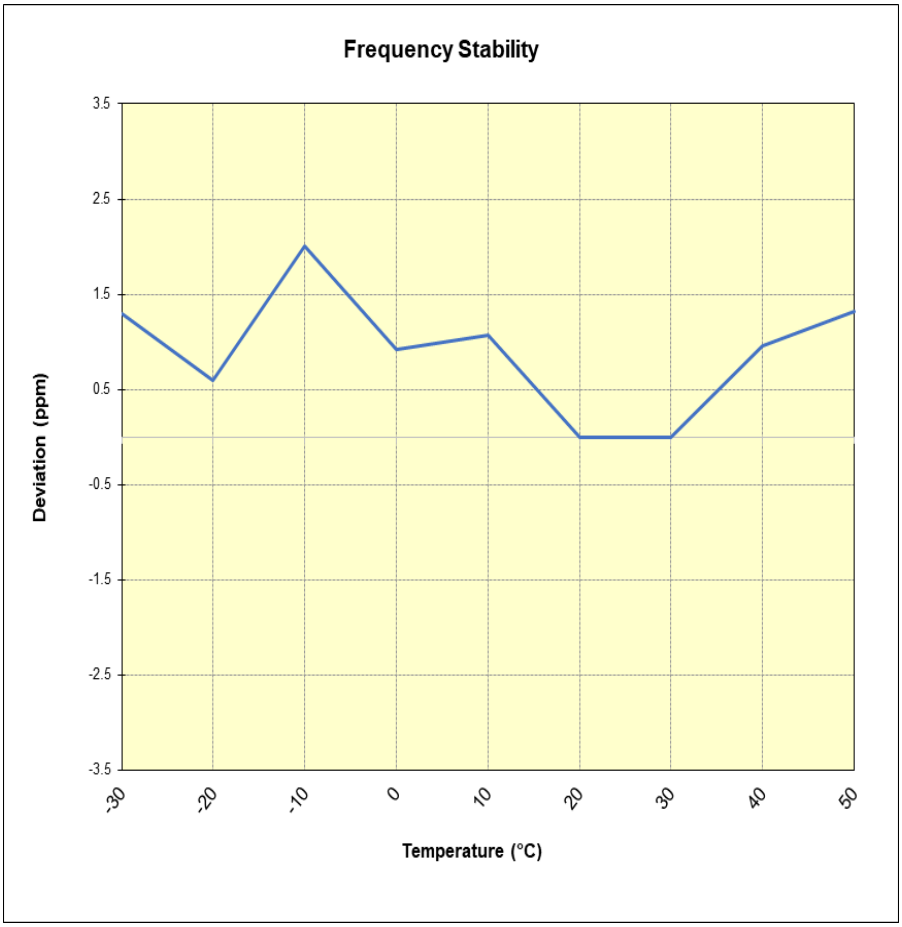
Plot 7-58. UMTS B12 Frequency Stability Chart

UMTS B13

Operating Frequency (Hz):	751,000,000
Ref. Voltage (VDC):	12

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	12	- 30	751,009,264	-695	-0.0000925
		- 20	751,009,093	-866	-0.0001153
		- 10	751,009,201	-758	-0.0001009
		0	751,009,634	-325	-0.0000433
		+ 10	751,009,670	-289	-0.0000385
		+ 20 (Ref)	751,009,959	0	0.0000000
		+ 30	751,009,755	-204	-0.0000272
		+ 40	751,009,349	-610	-0.0000812
		+ 50	751,009,714	-245	-0.0000326

Table 7-16. UMTS B13 Frequency Stability Data



Plot 7-59. UMTS B13 Frequency Stability Chart

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Centum Geolocation System FCC ID: 2A93U-55041-402** complies with all the requirements of Part 27 of the FCC rules.