ELEMENT WASHINGTON DC LLC
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.element.com

PART 24 MEASUREMENT REPORT

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

Date of Testing:
04/05 - 10/09/2024
Test Report Issue Date:
11/19/2024
Test Site/Location:
Element lab., Columbia, MD, USA
Test Report Serial No.:
1M2402290014-02.2A93U

FCC ID:	**2A93U-58450**
Applicant Name:	**Centum Research & Technology S.L**

Application Type:	Certification
Model:	Lifeseeker SAR XL S10
EUT Type:	Geolocation System
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part:	24
Test Procedure(s):	ANSI C63.26-2015

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

TABLE OF CONTENTS

PART 24 MEASUREMENT REPORT

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
GSM	N/A	GMSK	1930.2 - 1989.8	0.929	29.68	235KGXW
WCDMA	N/A	Spread Spectrum	1932.4 - 1987.6	1.374	31.38	4M38F9W
LTE Band 25/2	5 MHz	QPSK	1932.5 - 1992.5	1.132	30.54	4M77G7D

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-58450**. 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 24.

Test Device Serial No.: 213006

2.2 Device Capabilities

This device contains the following capabilities:

This device contains the following capabilities: LTE Bands 26/5, 25/2, 12, 13, 66/4 (with 5MHz operation only), UMTS 850, UMTS 1700, UMTS 1900, UMTS B12, UMTS B13, GSM 850, and GSM1900

LTE operation only supports QPSK modulation.

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.

The EUT used test software provided by the manufacturer to generate the RF waveforms at maximum (>98%) duty cycle.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version 3.x 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
N/A	ETS-001	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	ETS-001
N/A	ETS-002	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	ETS-002
EMCO	3115	Horn Antenna (1-18GHz)	8/8/2022	Biennial	8/8/2024	9704-5182
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	4/9/2024	Annual	4/9/2025	MY52350166
Keysight Technologies	N9038A	MXE EMI Receiver	8/30/2023	Annual	8/30/2024	MY51210133
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	9/25/2023	Annual	9/25/2024	100342
Sunol Sciences	JB5	Bi-Log Antenna (30M-5GHz)	8/30/2022	Biennial	8/30/2024	A051107
N/A	RF010	SMA-SMA RF Cable	5/21/2024	Annual	5/21/2025	RF010
N/A	WL25-4	WLAN Cable Set (25GHz)	5/21/2024	Annual	5/21/2025	WL25-4

Table 5-1. Test Equipment (04/05 – 06/24/2024)

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Espec	ESX-2CA	Environmental Chamber	9/26/2024	Biennial	9/26/2026	017620

Table 5-2. Test Equipment (10/07 – 10/09/2024)

6.0 SAMPLE CALCULATIONS

GSM Emission Designator

Emission Designator = 250KGXW
GSM BW = 250 kHz
G = Phase Modulation
X = Cases not otherwise covered
W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M16F9W
WCDMA BW = 4.16 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 8M62G7D
LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

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.

7.0 TEST RESULTS

7.1 Summary

Company Name: Centum Research & Technology S.L

FCC ID: 2A93U-58450

FCC Classification: PCS Licensed Transmitter (PCB)

Mode(s): GSM/GPRS/EDGE/WCDMA/LTE

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Transmitter Conducted Output Power	2.1046(a), 2.1046(c)	N/A	PASS	Section 7.2
	Equivalent Isotropic Radiated Power	24.232(c)	< 2 Watts max. EIRP	PASS	Section 7.2
	Occupied Bandwidth	2.1049(h)	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions	2.1051, 24.238(a)	> 43 + 10log10(P[Watts]) at Band Edge and for all out-of-band emissions	PASS	Sections 7.4, 7.5
	Peak-to-Average Ratio	24.232(d)	≤ 13 dB	PASS	Section 7.6
	Frequency Stability	2.1055, 24.235	Fundamental emissions stay within authorized frequency block	PASS	Section 7.8
RADIATED	Radiated Spurious Emissions	2.1053, 24.238(a)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Section 7.7

Table 7-1. Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst-case emissions.
2) The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized 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. Span = 2x to 3x the OBW
2. RBW = 1% to 5% of the OBW
3. VBW > 3 x RBW
4. Number of measurement points per sweep = 1,001
5. Sweep time = auto couple
6. Detector = RMS
7. Trace mode = trace average for continuous emissions
8. Output power was measured using the analyzers built-in Channel Power function using the above settings while setting the integration BW approximately equal to the OBW of the signal
9. The trace was allowed to stabilize

Test Setup

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

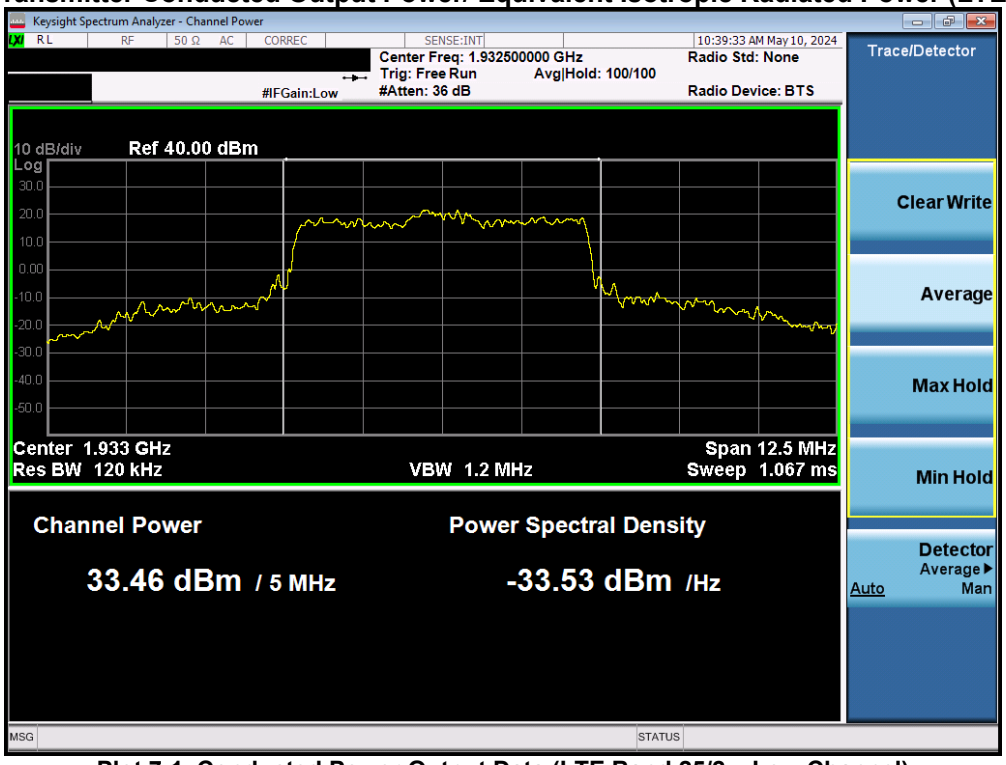
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

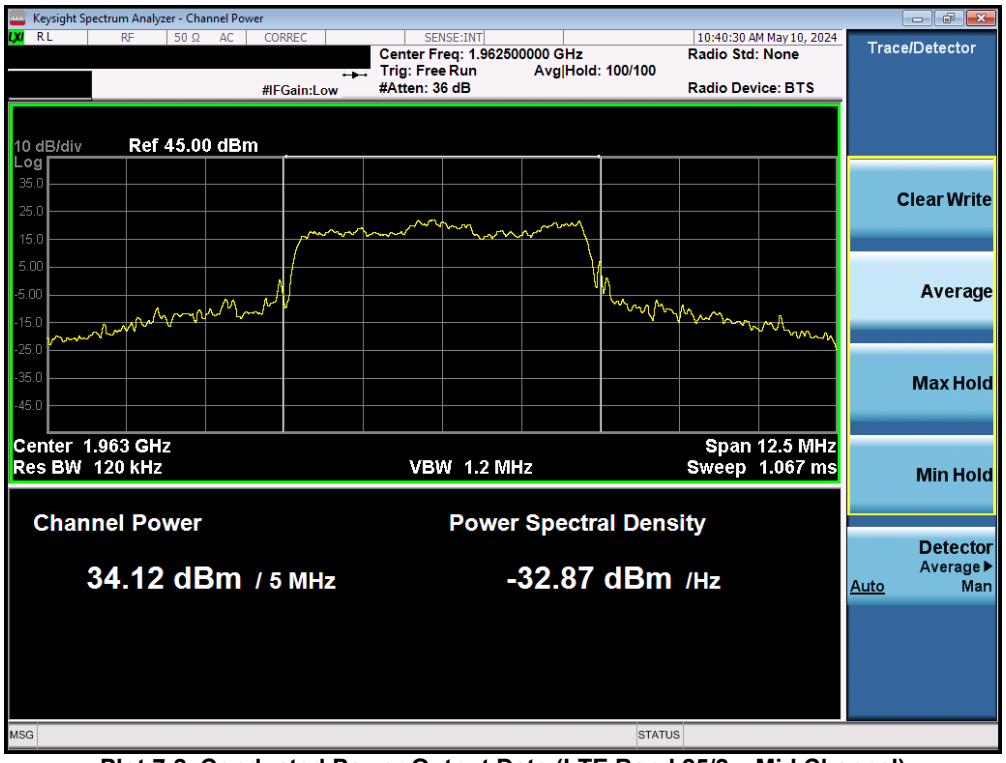
The applicant has declared the usage of a 6dBi antenna for frequencies shown in this test report. Additionally, the applicant has declared that it will always use a long RF cable with similar path loss as shown in the tables in this section. Thus, there is a net antenna gain used to determine ERP compliance per Part 24.

Bandwidth	Channel	Frequency [MHz]	Conducted Power [dBm]	Ant Gain [dBi]	Cable Loss [dBm]	Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
5 MHz	8065	1932.5	33.46	6.00	9.95	-3.95	29.51	0.893	33.01	-3.50
	8365	1962.5	34.12	6.00	10.06	-4.06	30.06	1.014	33.01	-2.95
	8665	1992.5	34.69	6.00	10.15	-4.15	30.54	1.132	33.01	-2.47

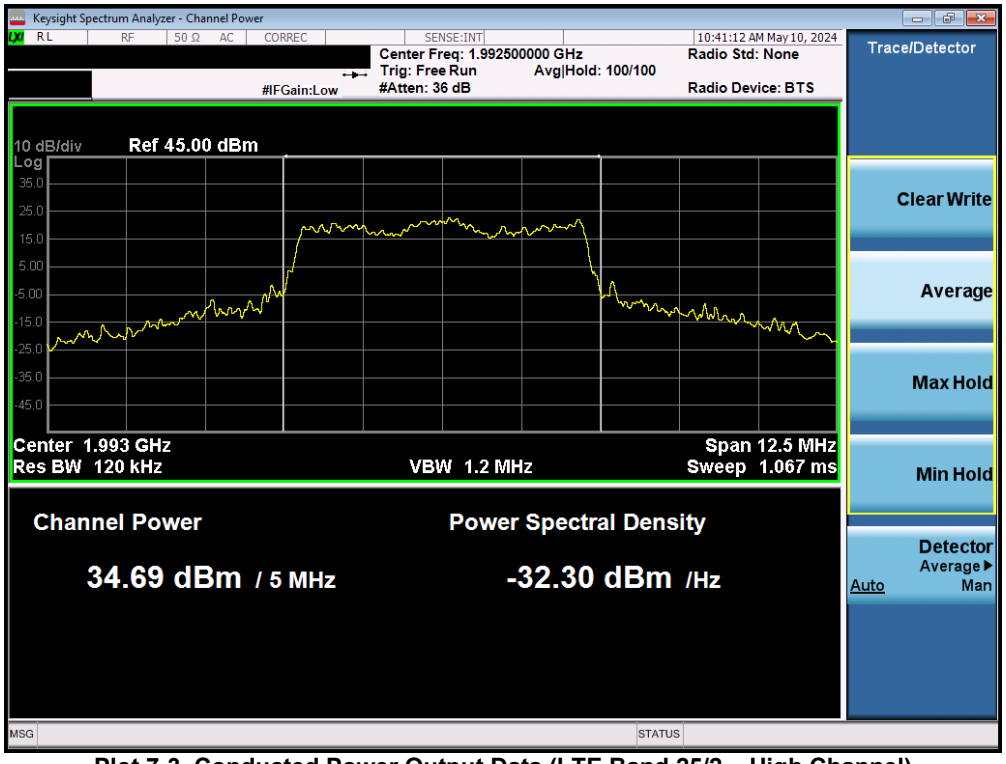
Table 7-2. Transmitter Conducted Output Power/ Equivalent Isotropic Radiated Power (LTE Band 25/2)



Plot 7-1. Conducted Power Output Data (LTE Band 25/2 – Low Channel)



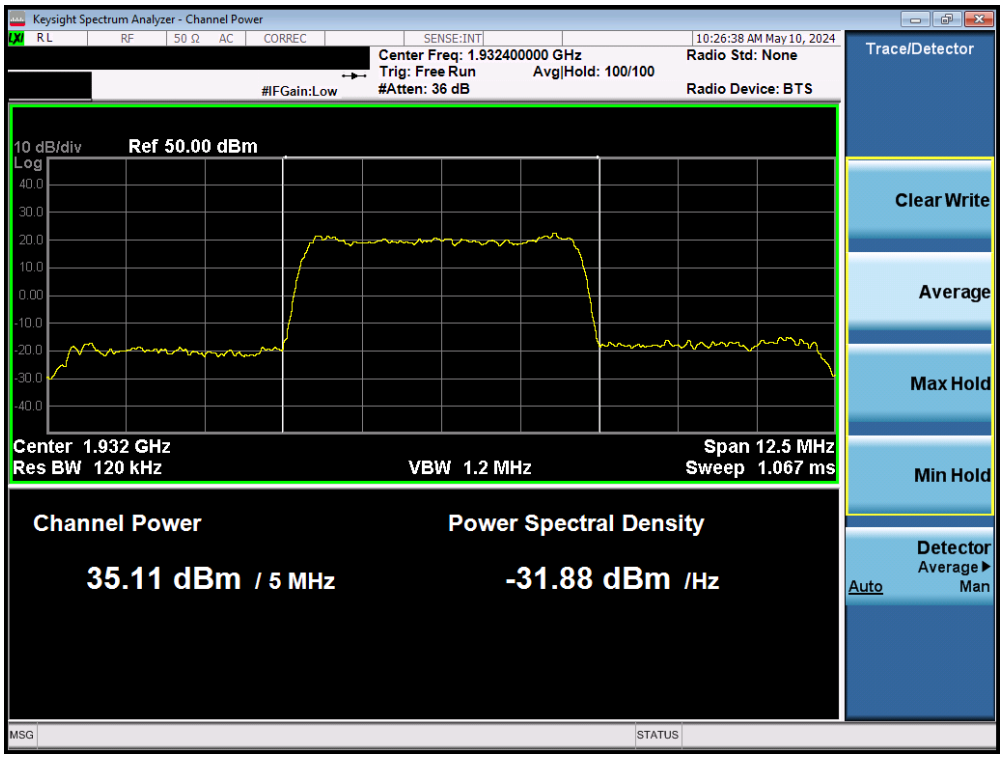
Plot 7-2. Conducted Power Output Data (LTE Band 25/2 – Mid Channel)



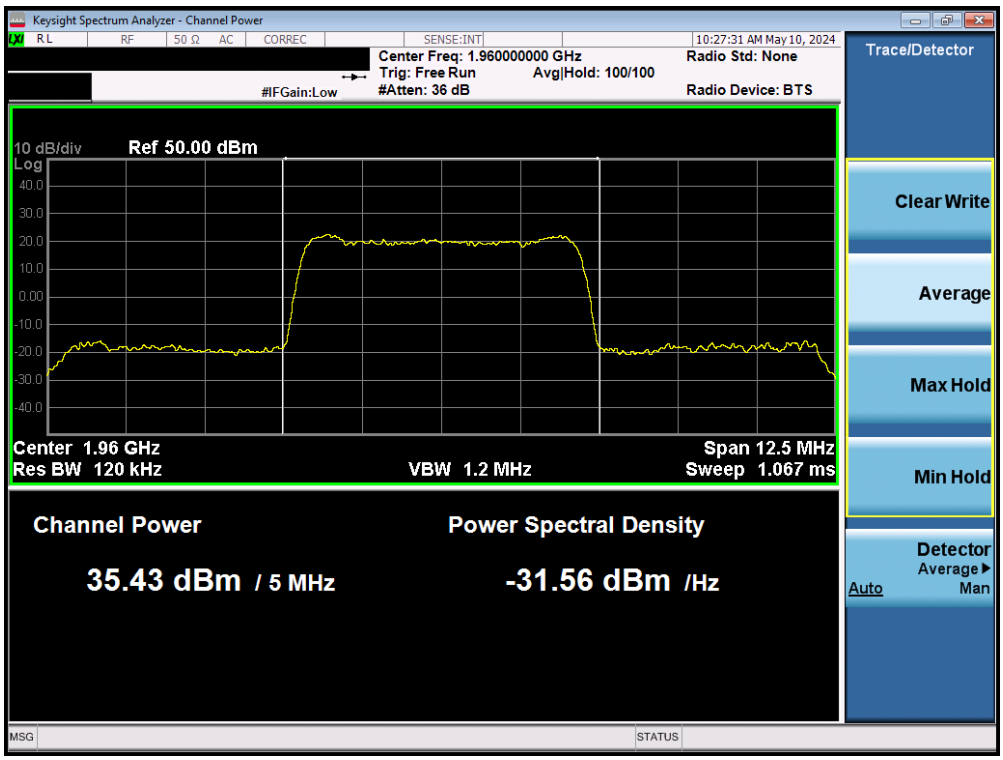
Plot 7-3. Conducted Power Output Data (LTE Band 25/2 – High Channel)

Channel	Frequency [MHz]	Conducted Power [dBm]	Ant Gain [dBi]	Cable Loss [dBm]	Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]	ERP Limit [dBm]	Margin [dB]
9662	1932.4	35.11	6.00	9.95	-3.95	31.16	1.306	33.01	-1.85
9800	1960.0	35.43	6.00	10.05	-4.05	31.38	1.374	33.01	-1.63
9938	1987.6	35.46	6.00	10.13	-4.13	31.33	1.358	33.01	-1.68

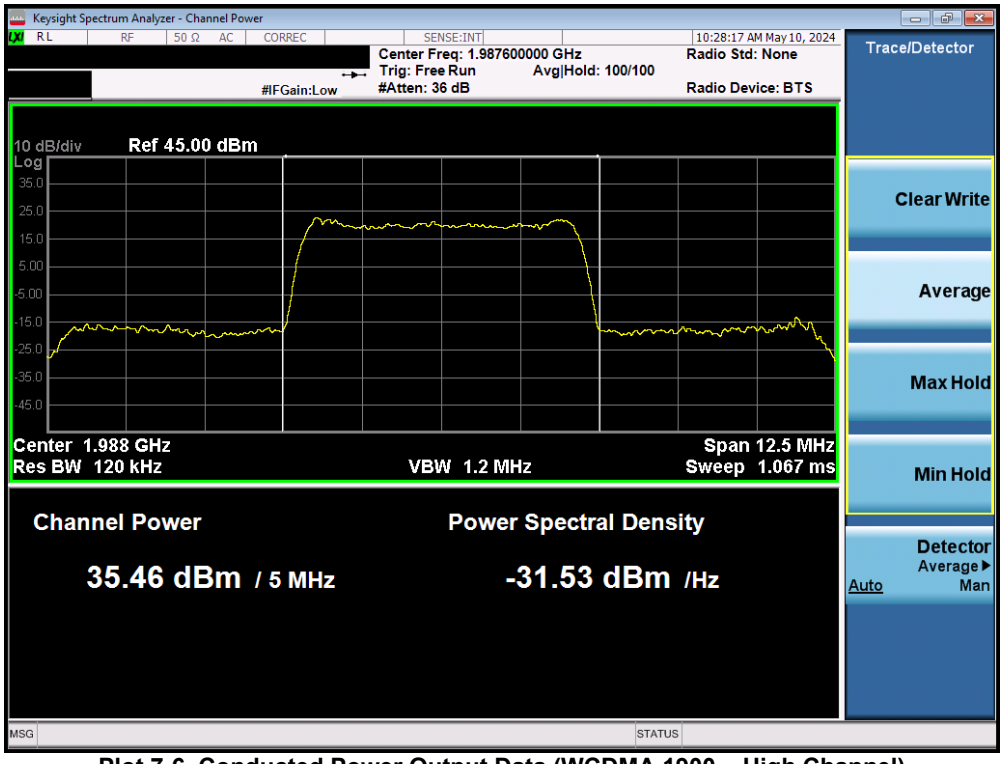
Table 7-3. Transmitter Conducted Output Power/ Equivalent Isotropic Radiated Power (WCDMA 1900)



Plot 7-4. Conducted Power Output Data (WCDMA 1900 – Low Channel)



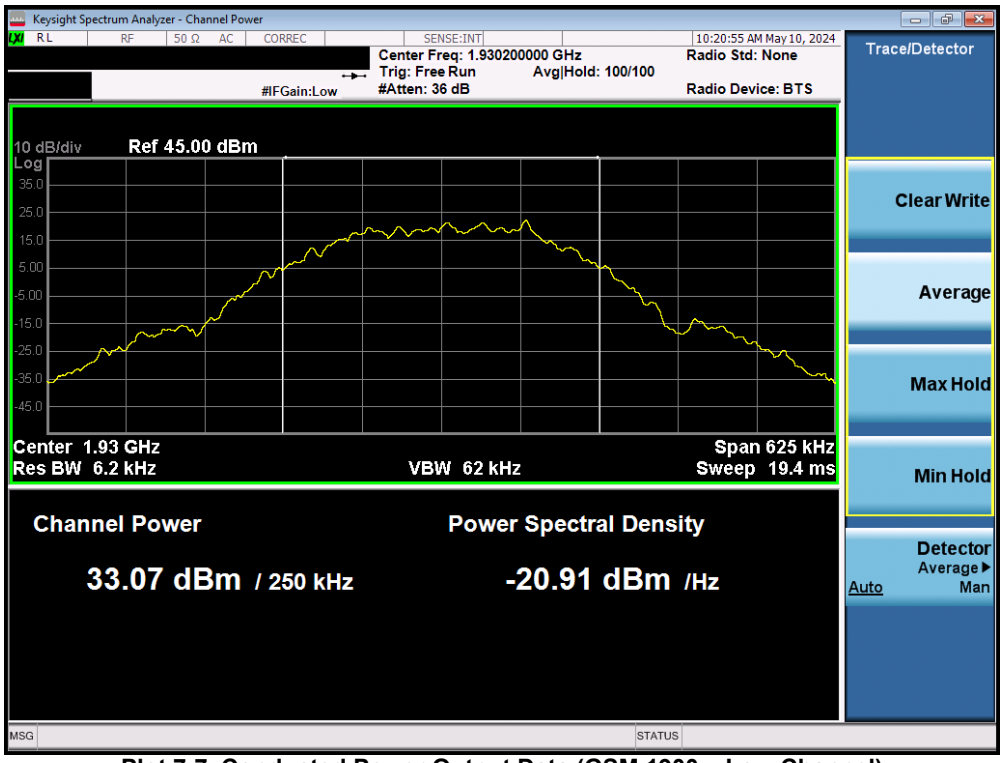
Plot 7-5. Conducted Power Output Data (WCDMA 1900 – Mid Channel)



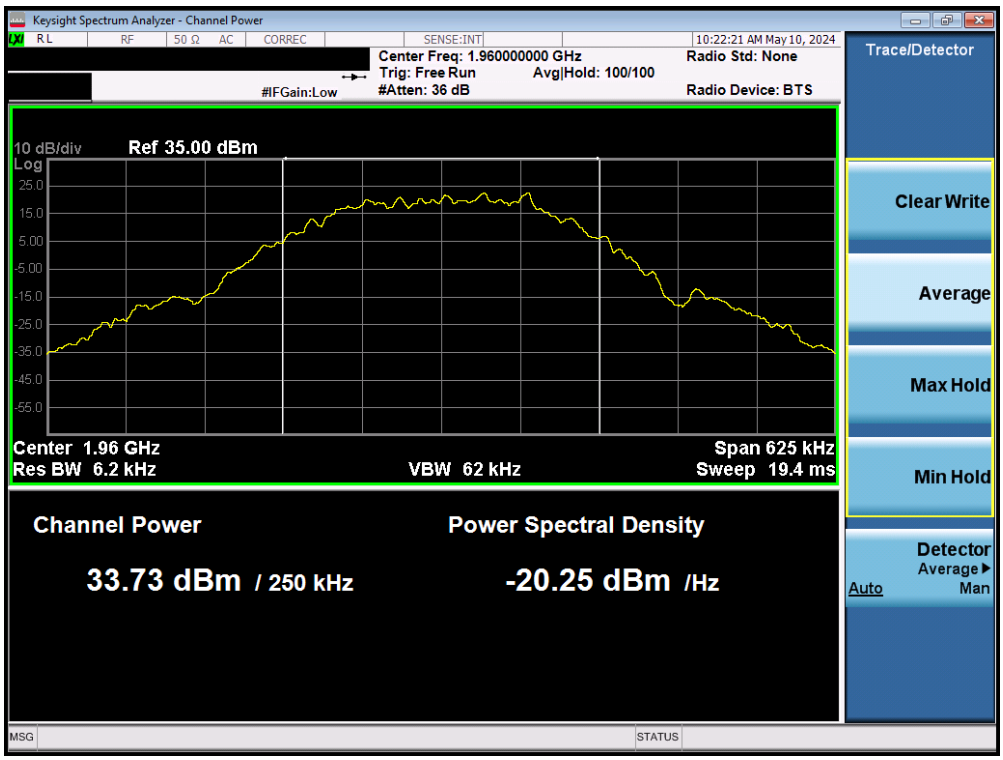
Plot 7-6. Conducted Power Output Data (WCDMA 1900 – High Channel)

Channel	Frequency [MHz]	Conducted Power [dBm]	Ant Gain [dBi]	Cable Loss [dBm]	Ant Gain [dBi]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
512	1930.2	33.07	6.00	9.94	-3.94	29.13	0.818	33.01	-3.88
661	1960.0	33.73	6.00	10.05	-4.05	29.68	0.929	33.01	-3.33
810	1989.8	33.77	6.00	10.14	-4.14	29.63	0.918	33.01	-3.38

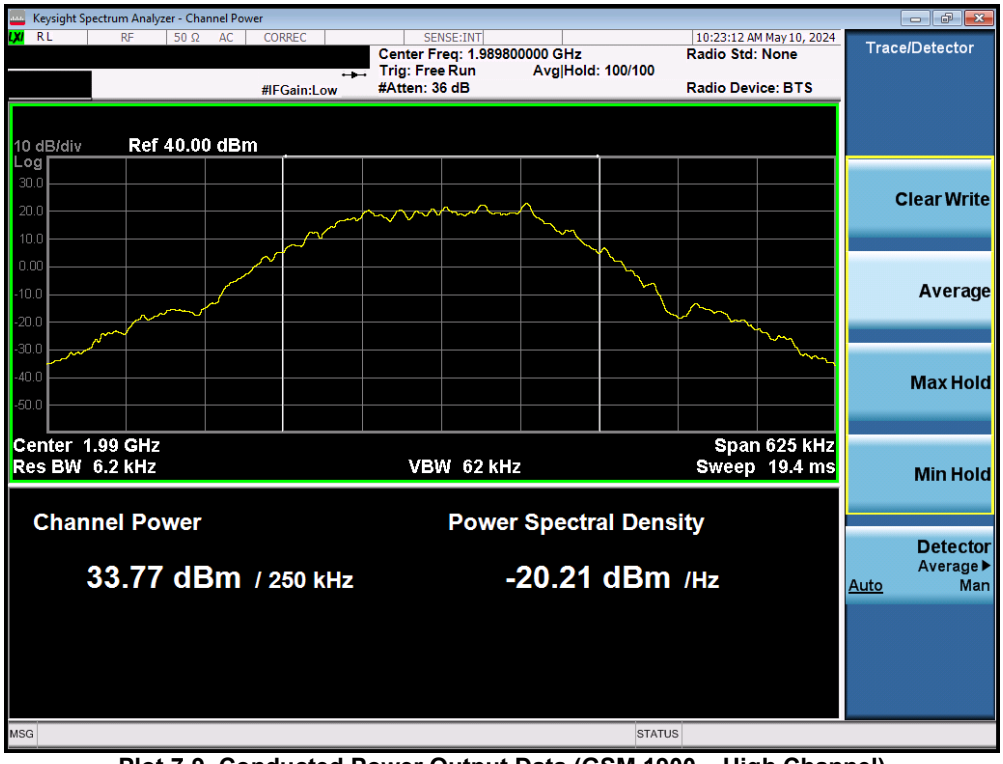
Table 7-4. Transmitter Conducted Output Power/ Equivalent Isotropic Radiated Power (GSM 1900)



Plot 7-7. Conducted Power Output Data (GSM 1900 – Low Channel)



Plot 7-8. Conducted Power Output Data (GSM 1900 – Mid Channel)



Plot 7-9. Conducted Power Output Data (GSM 1900 – 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

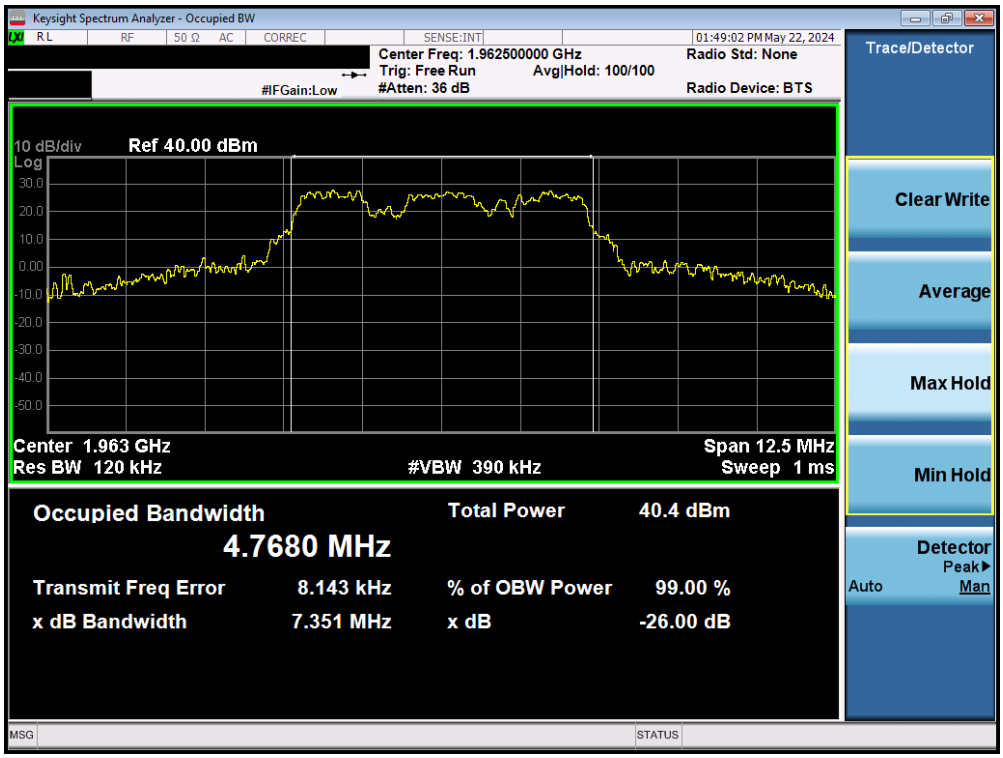
Test Setup

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

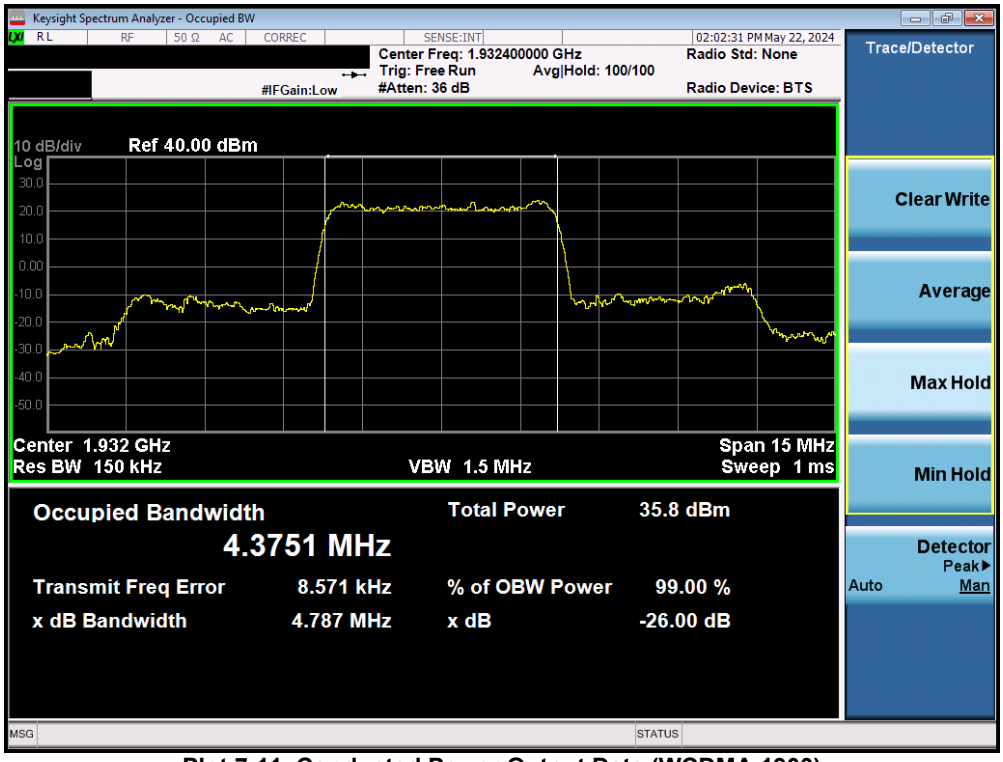
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

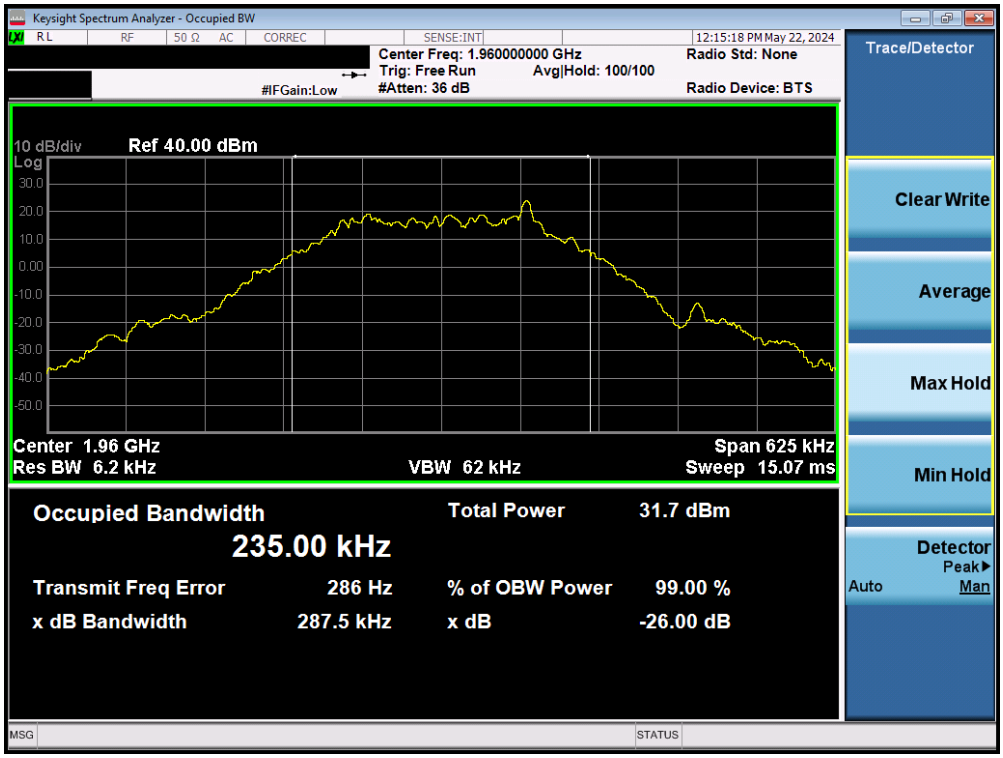
None.



Plot 7-10. Occupied Bandwidth Plot (LTE Band 25/2)



Plot 7-11. Conducted Power Output Data (WCDMA 1900)



Plot 7-12. Conducted Power Output Data (GSM 1900)

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 20GHz (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

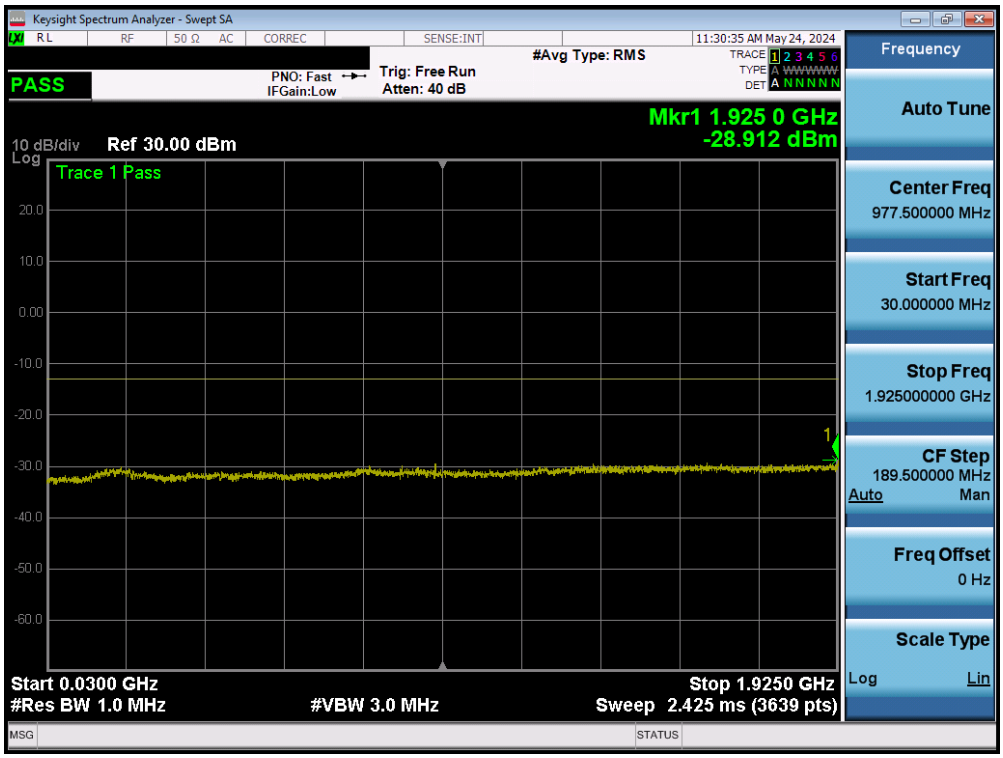
The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-3. Test Instrument & Measurement Setup

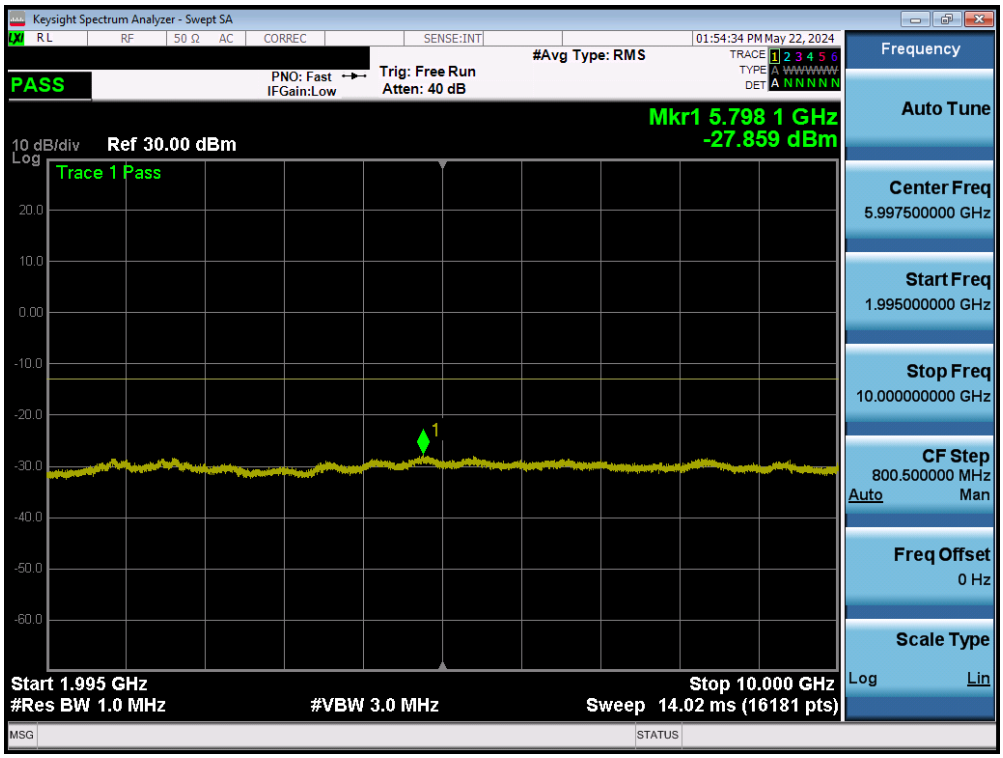
Test Notes

Per Part 24, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz.

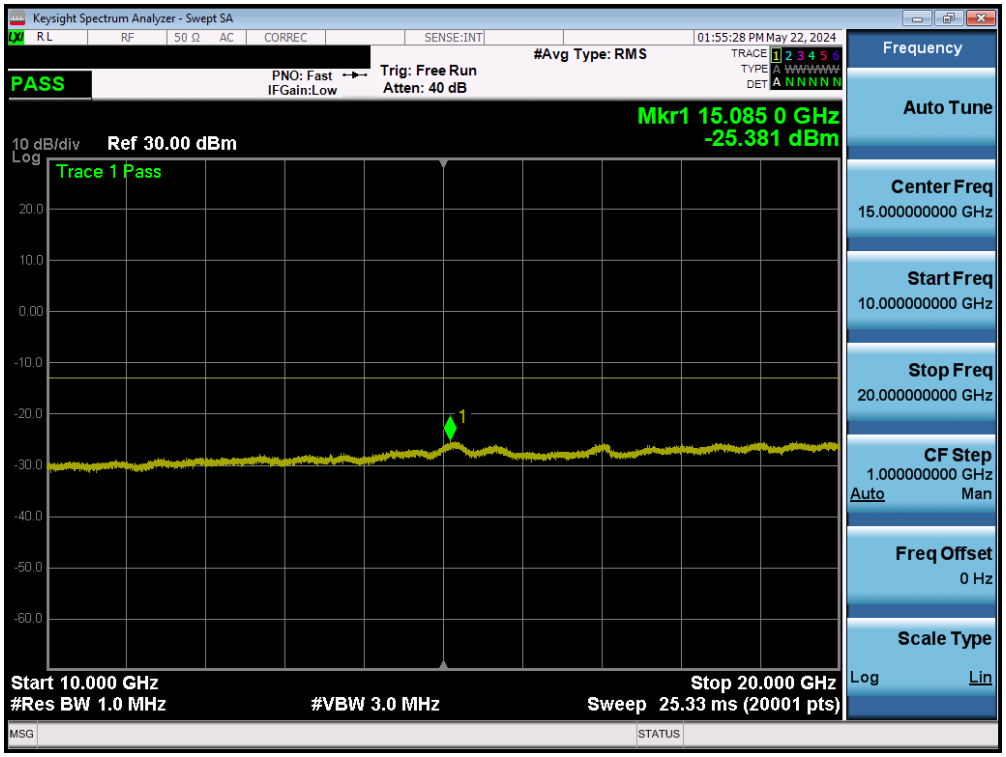
LTE Band 25/2



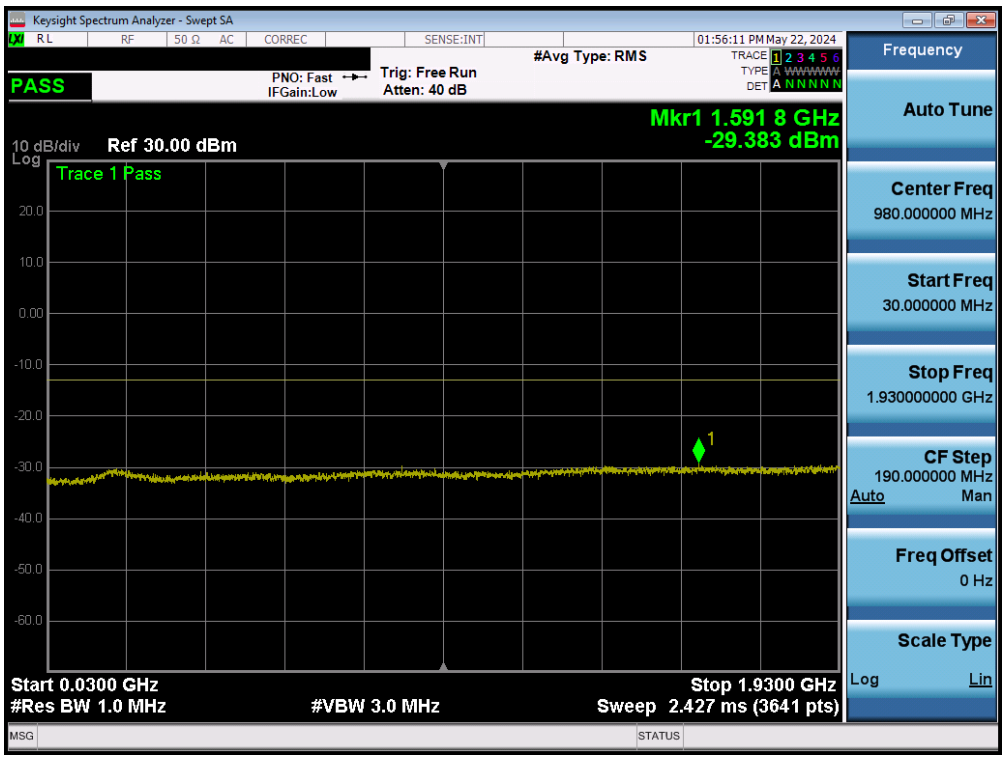
Plot 7-13. Conducted Spurious Plot (LTE Band 25/2 – Low Channel)



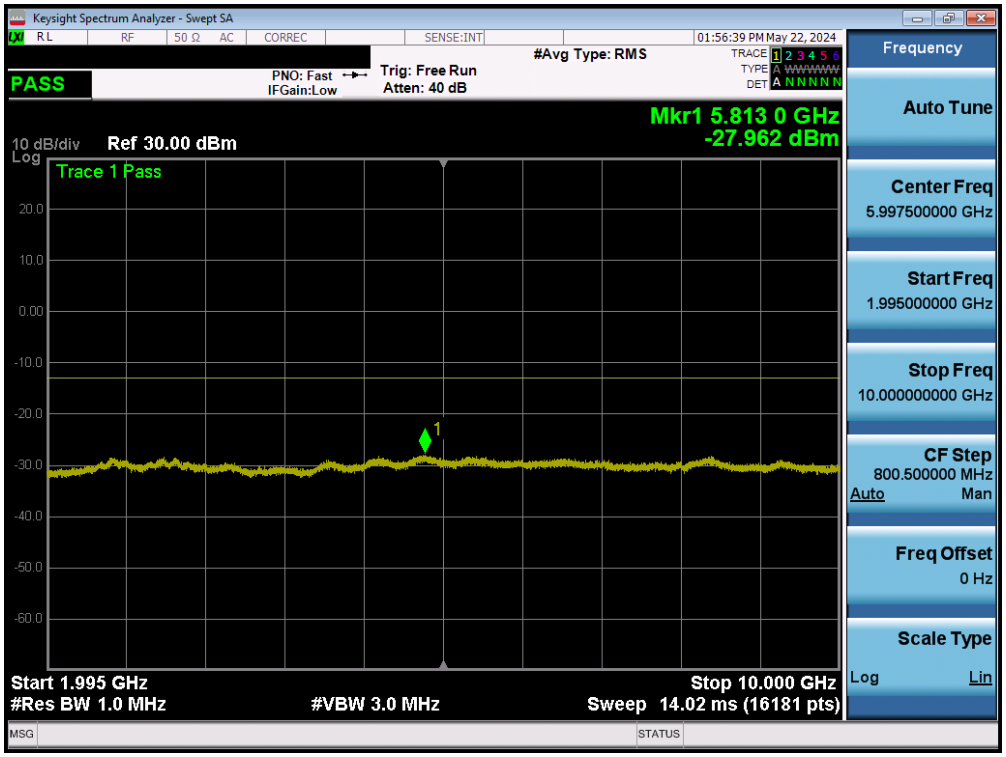
Plot 7-14. Conducted Spurious Plot (LTE Band 25/2 – Low Channel)



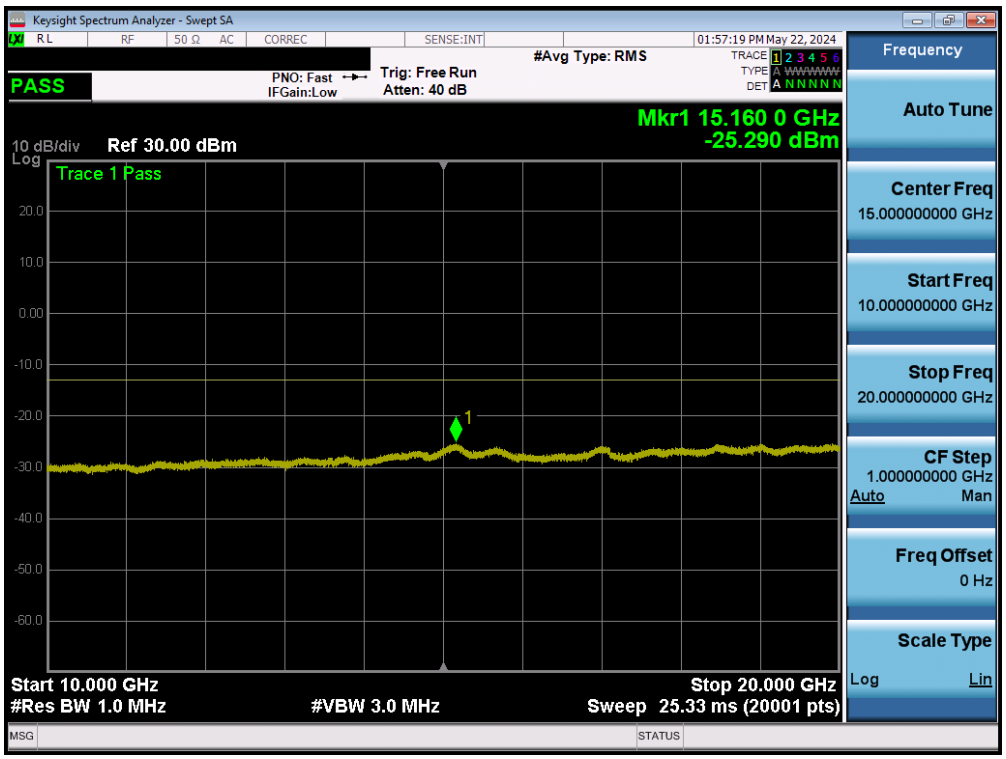
Plot 7-15. Conducted Spurious Plot (LTE Band 25/2 – Low Channel)



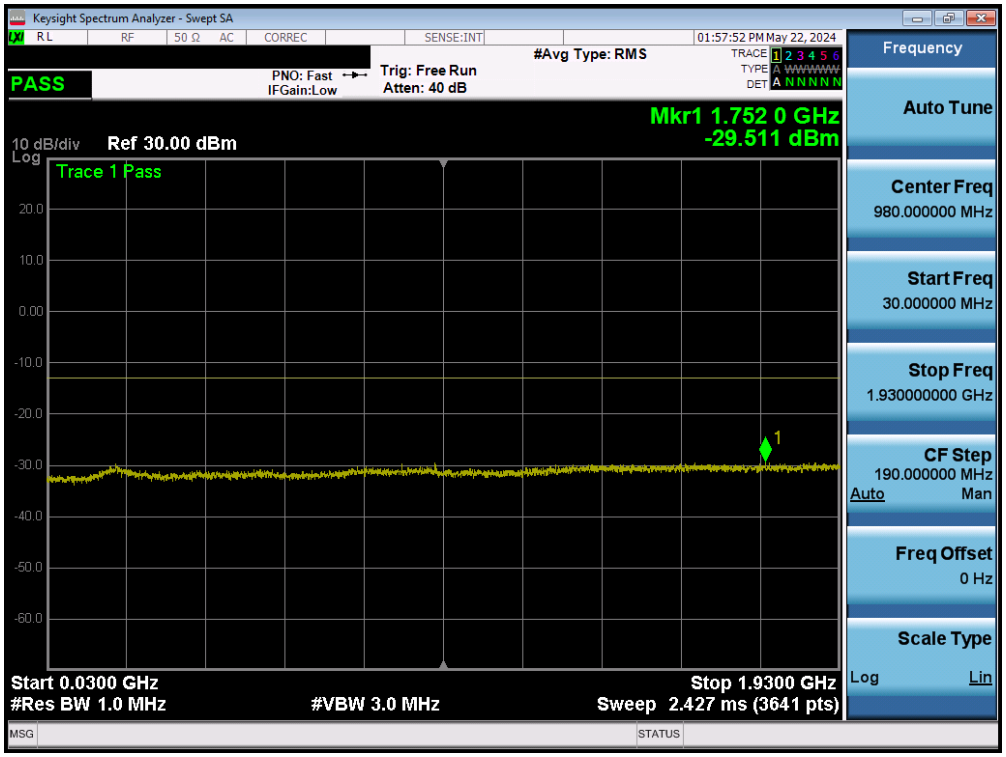
Plot 7-16. Conducted Spurious Plot (LTE Band 25/2 – Mid Channel)



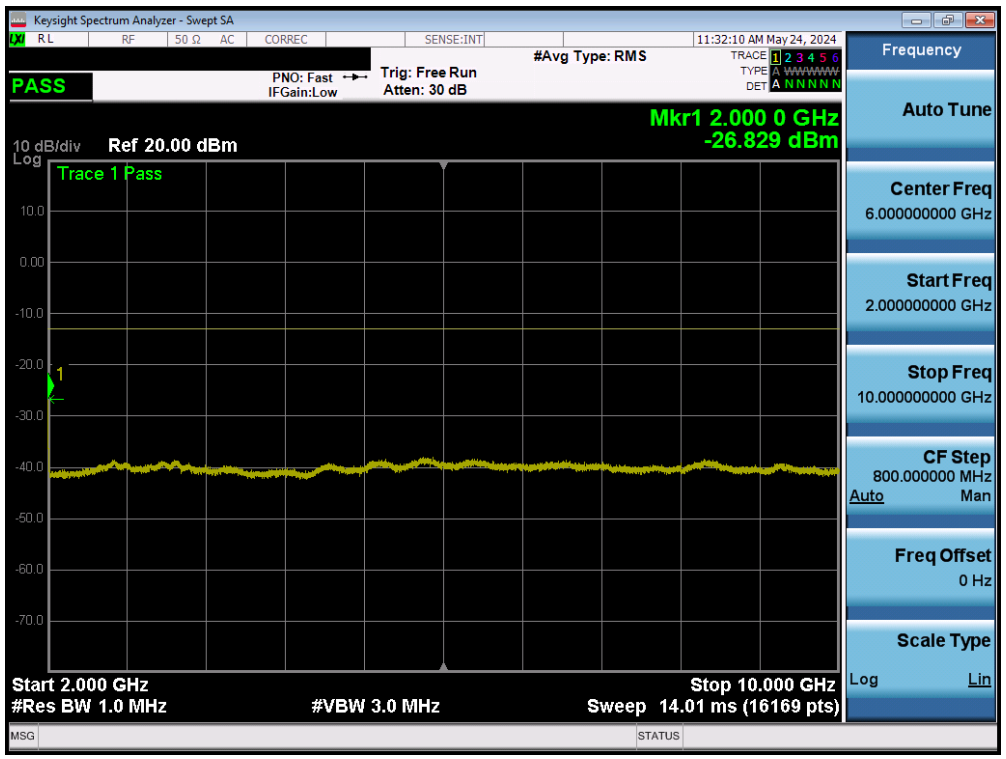
Plot 7-17. Conducted Spurious Plot (LTE Band 25/2 – Mid Channel)



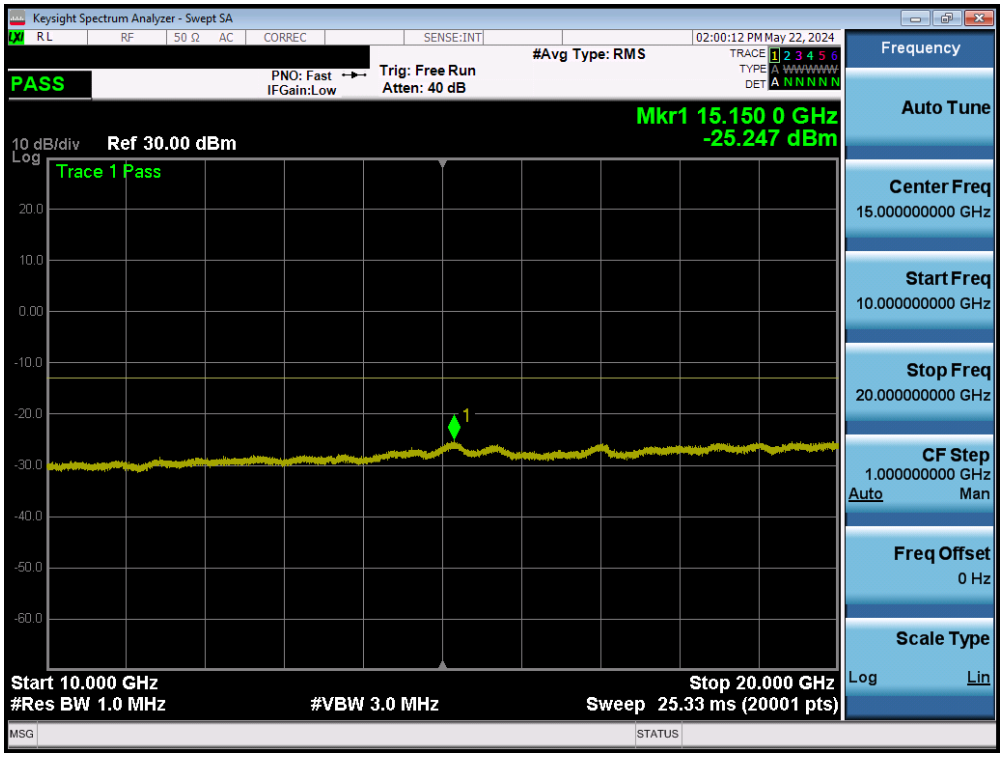
Plot 7-18. Conducted Spurious Plot (LTE Band 25/2 – Mid Channel)



Plot 7-19. Conducted Spurious Plot (LTE Band 25/2 – High Channel)

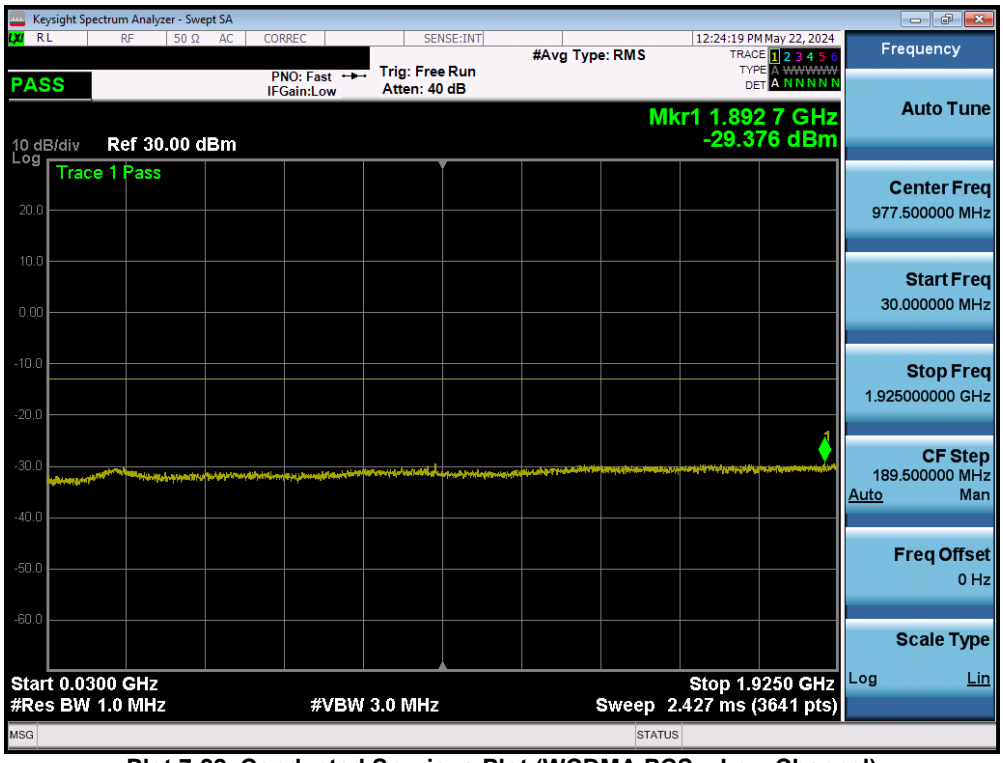


Plot 7-20. Conducted Spurious Plot (LTE Band 25/2 – High Channel)

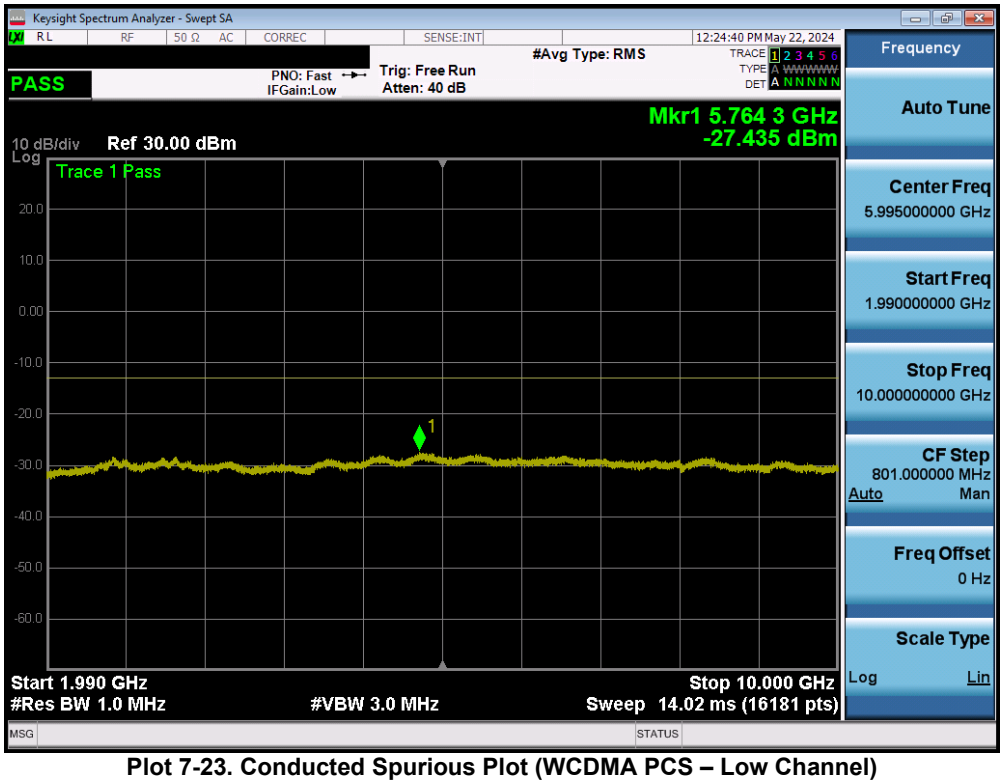


Plot 7-21. Conducted Spurious Plot (LTE Band 25/2 – High Channel)

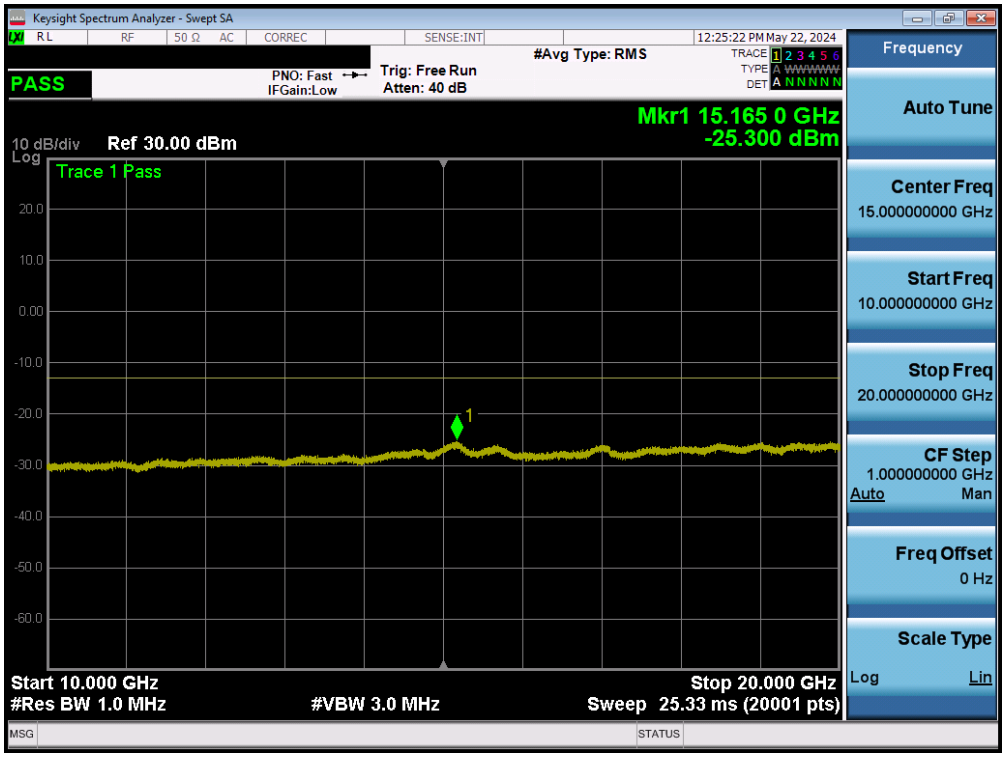
WCDMA PCS



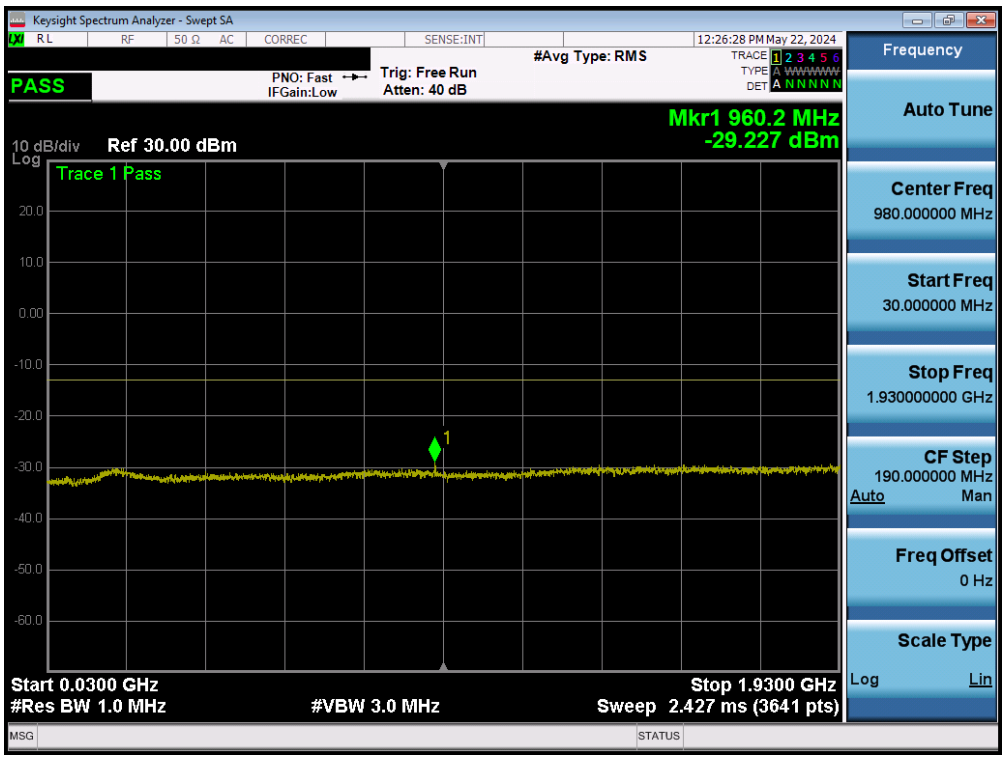
Plot 7-22. Conducted Spurious Plot (WCDMA PCS – Low Channel)



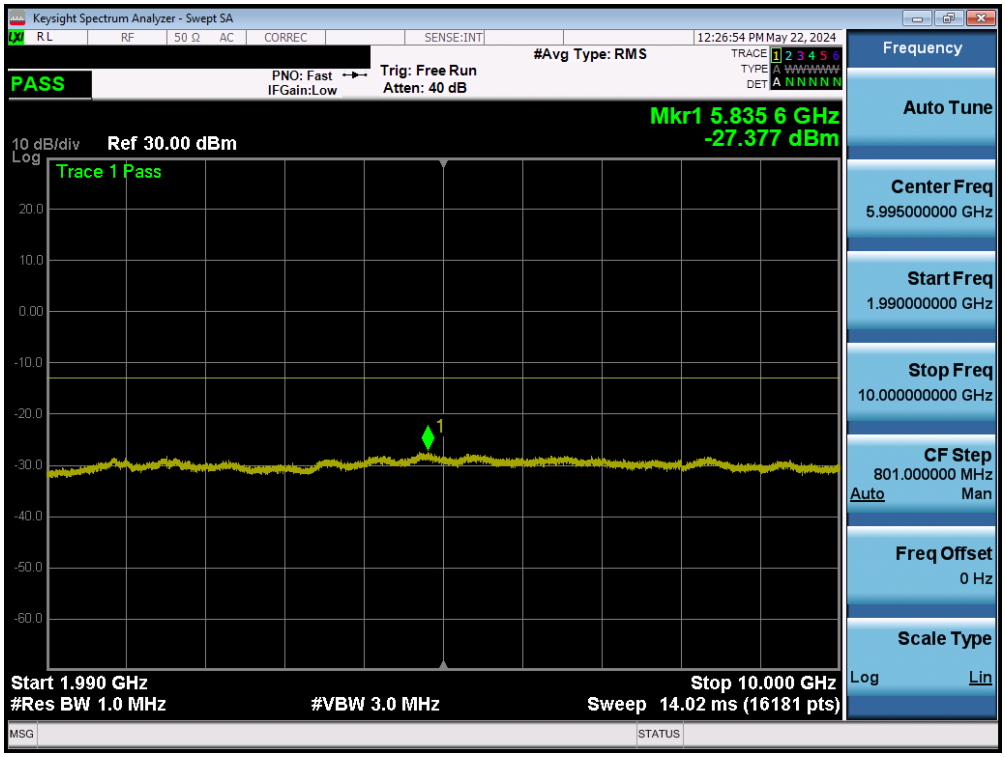
Plot 7-23. Conducted Spurious Plot (WCDMA PCS – Low Channel)



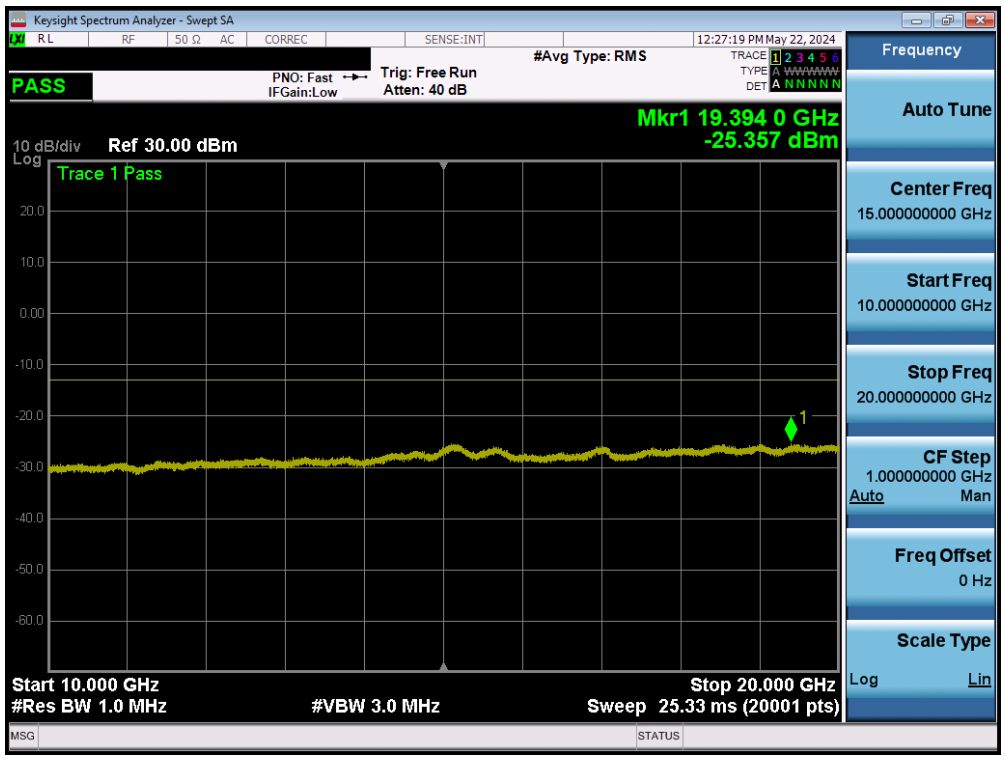
Plot 7-24. Conducted Spurious Plot (WCDMA PCS – Low Channel)



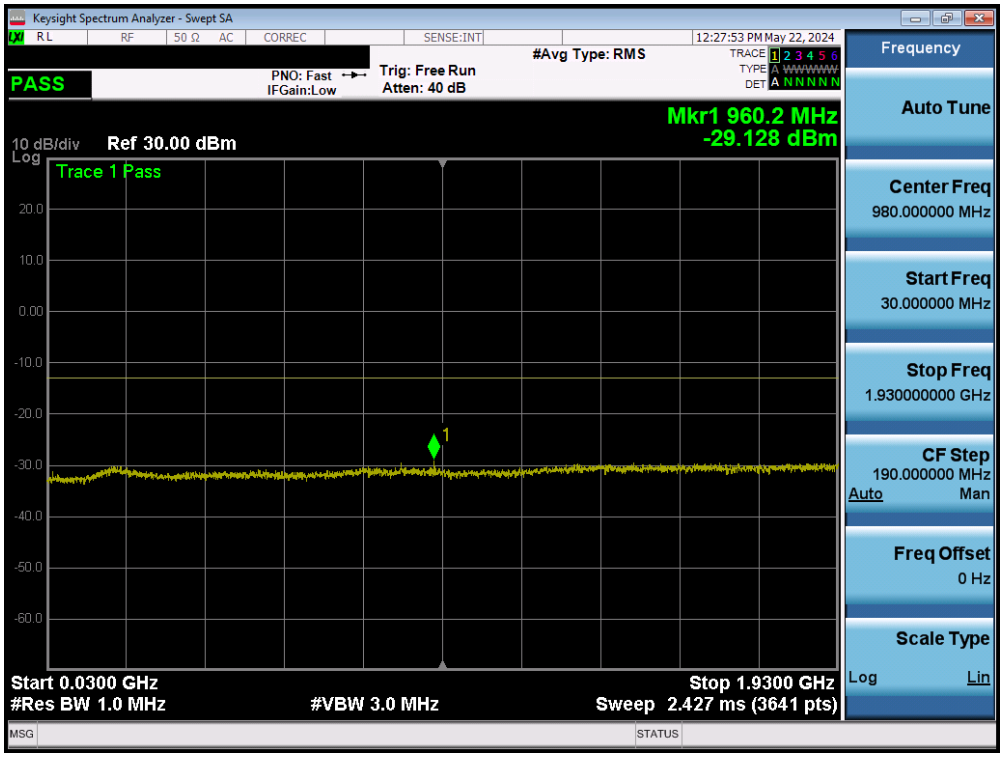
Plot 7-25. Conducted Spurious Plot (WCDMA PCS – Mid Channel)



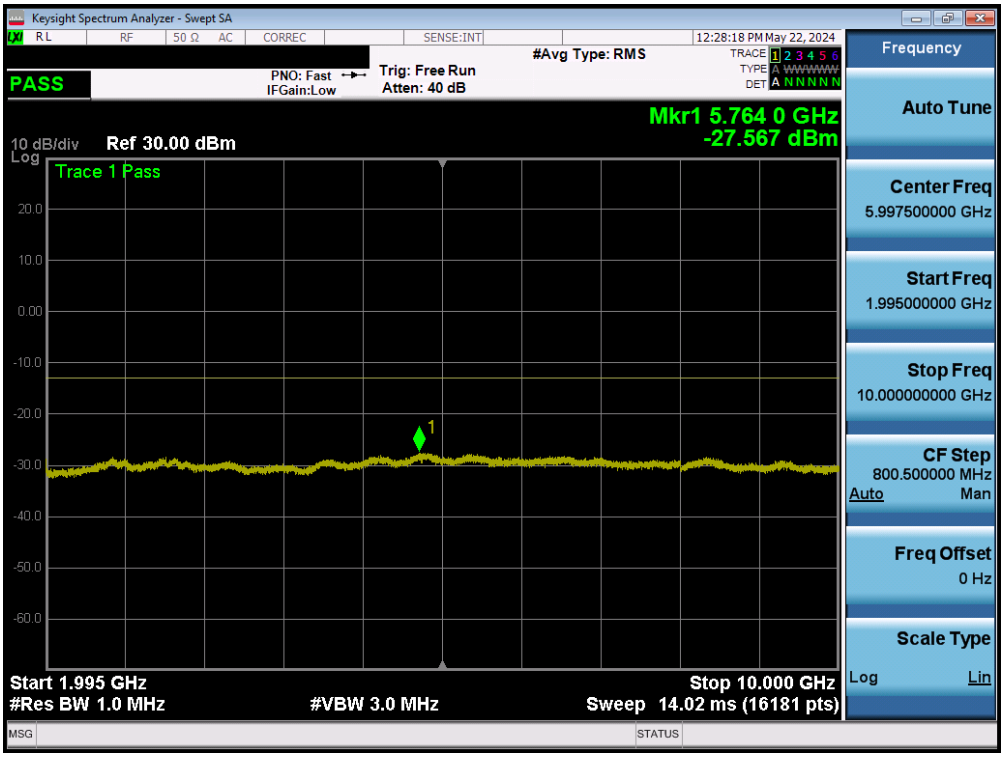
Plot 7-26. Conducted Spurious Plot (WCDMA PCS – Mid Channel)



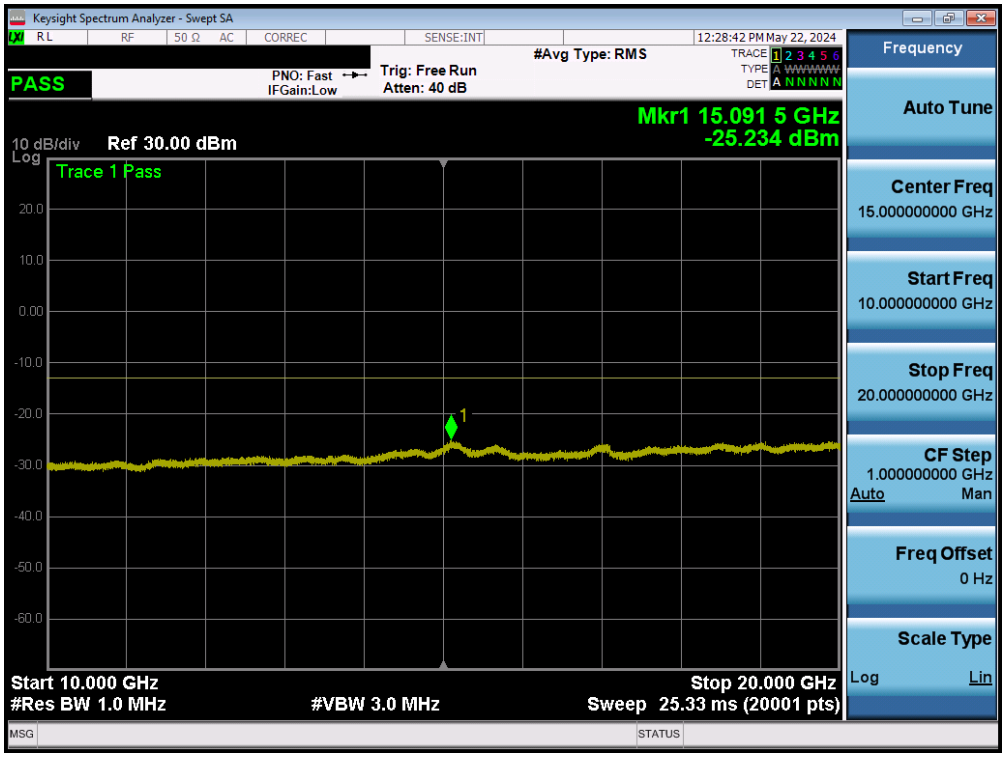
Plot 7-27. Conducted Spurious Plot (WCDMA PCS – Mid Channel)



Plot 7-28. Conducted Spurious Plot (WCDMA PCS – High Channel)

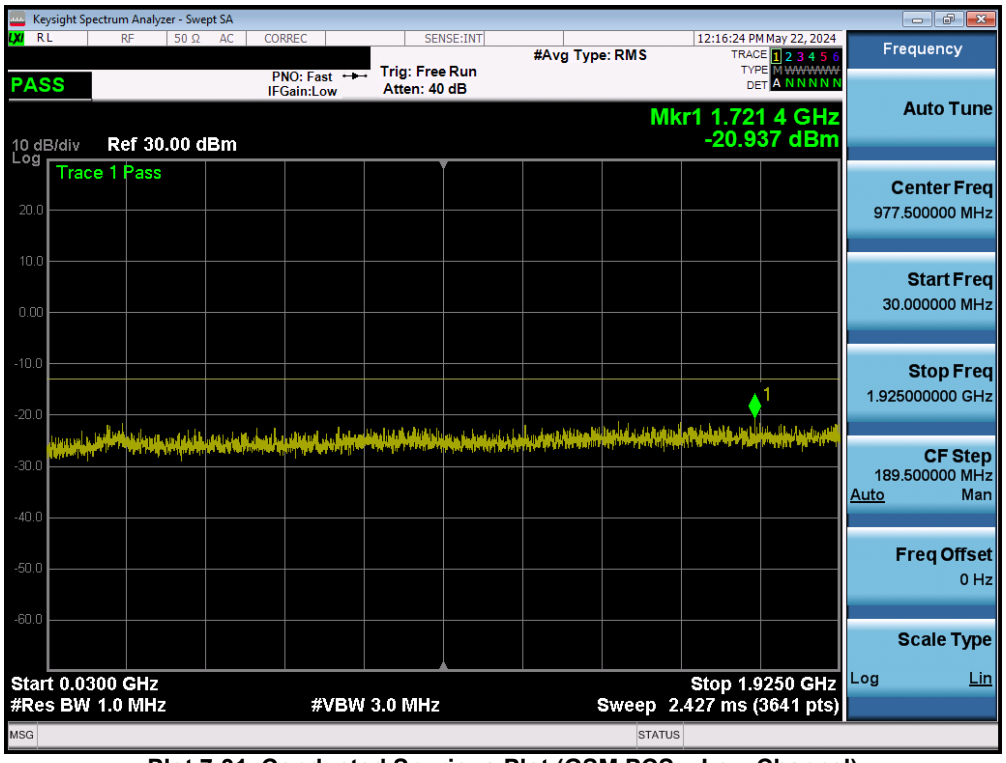


Plot 7-29. Conducted Spurious Plot (WCDMA PCS – High Channel)

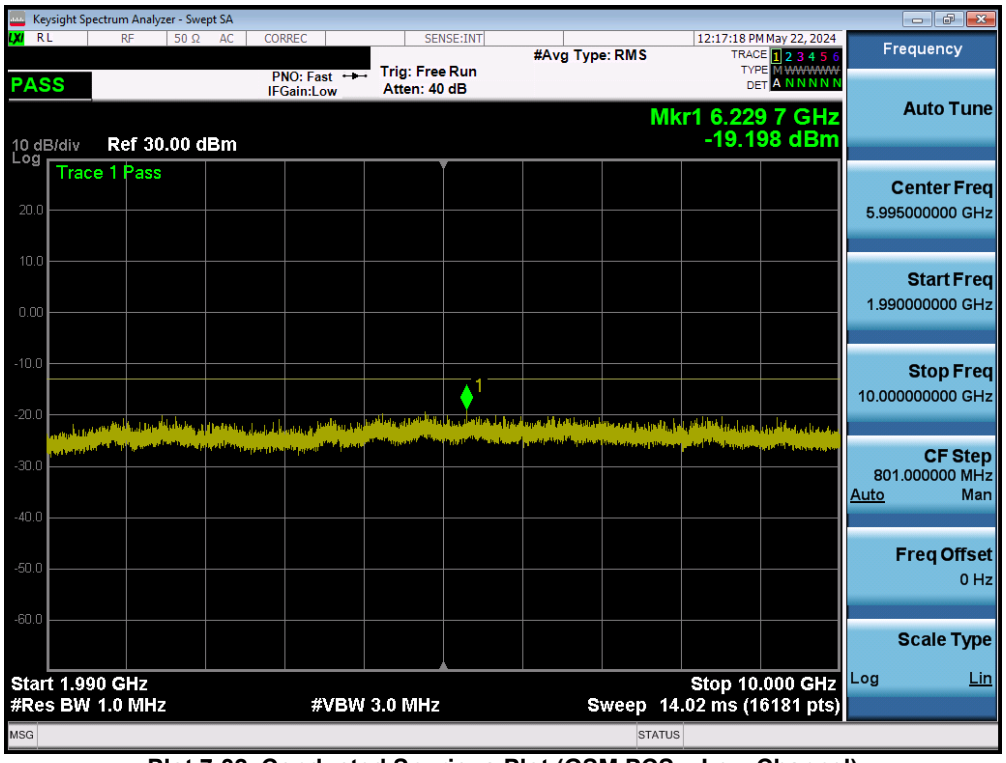


Plot 7-30. Conducted Spurious Plot (WCDMA PCS – High Channel)

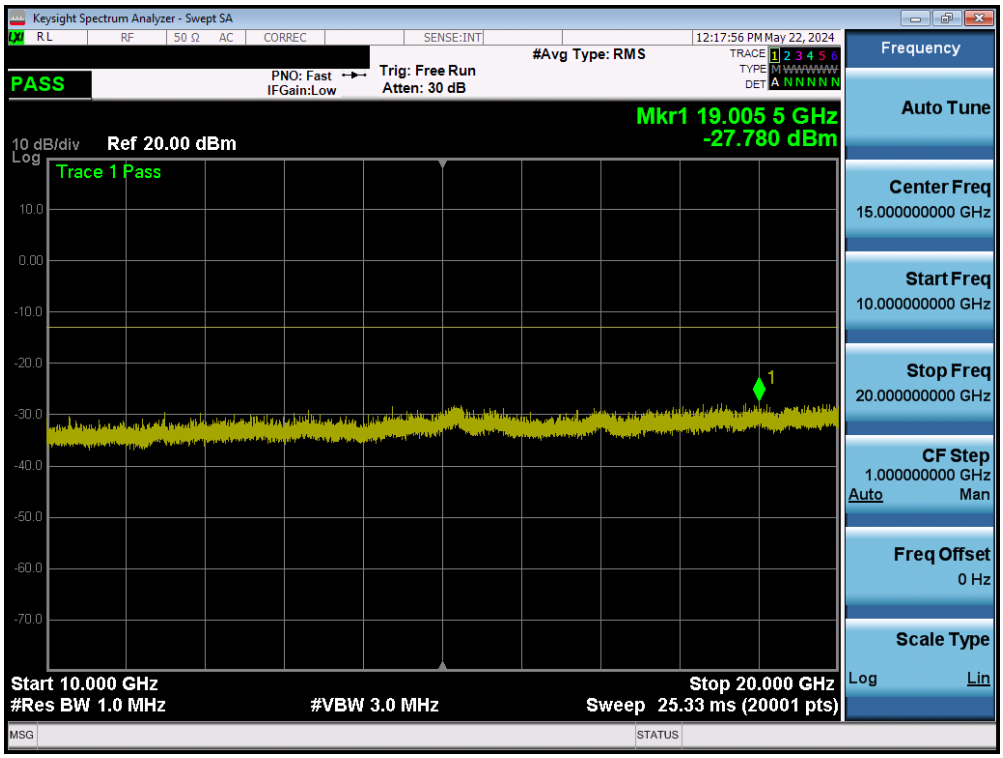
GSM PCS



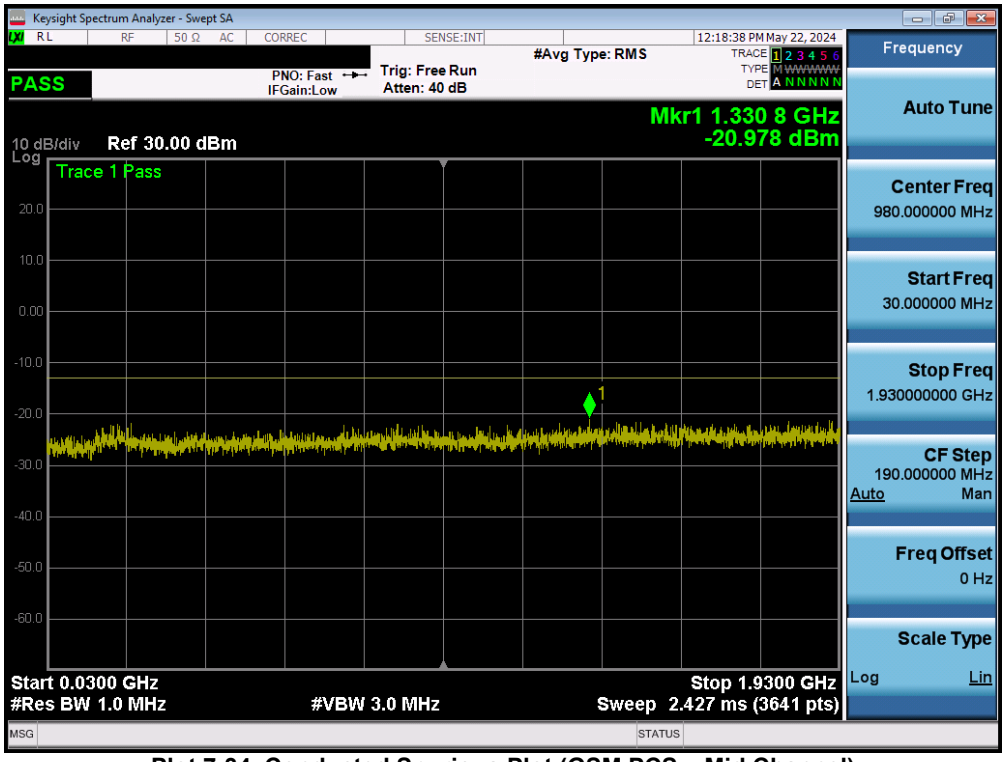
Plot 7-31. Conducted Spurious Plot (GSM PCS – Low Channel)



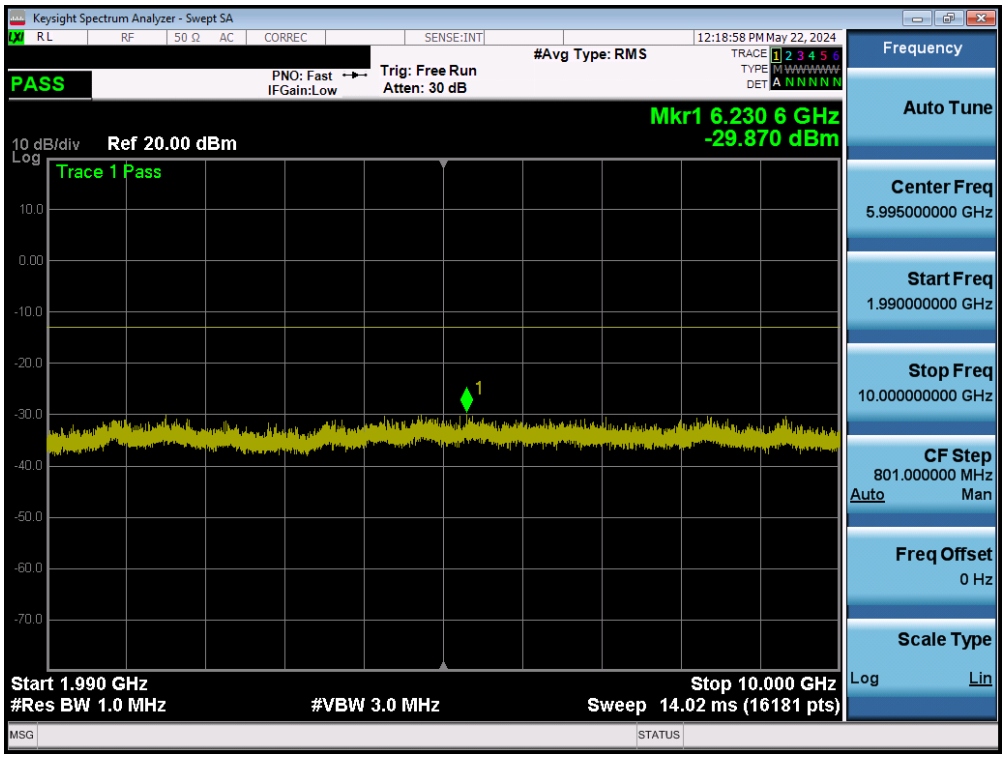
Plot 7-32. Conducted Spurious Plot (GSM PCS – Low Channel)



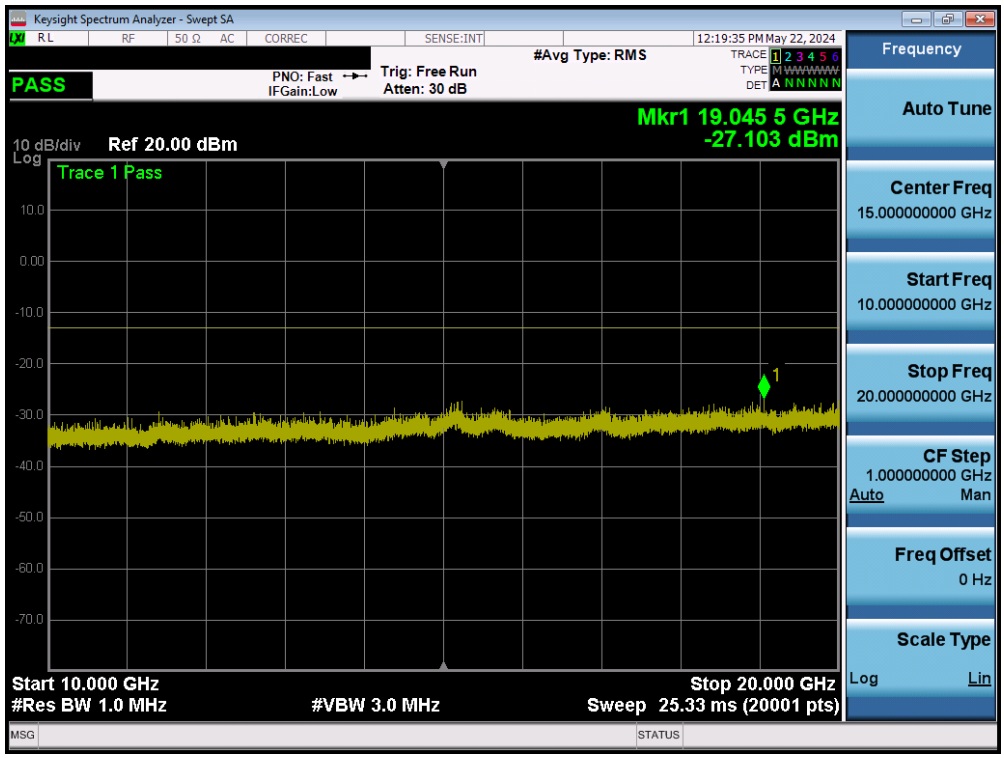
Plot 7-33. Conducted Spurious Plot (GSM PCS – Low Channel)



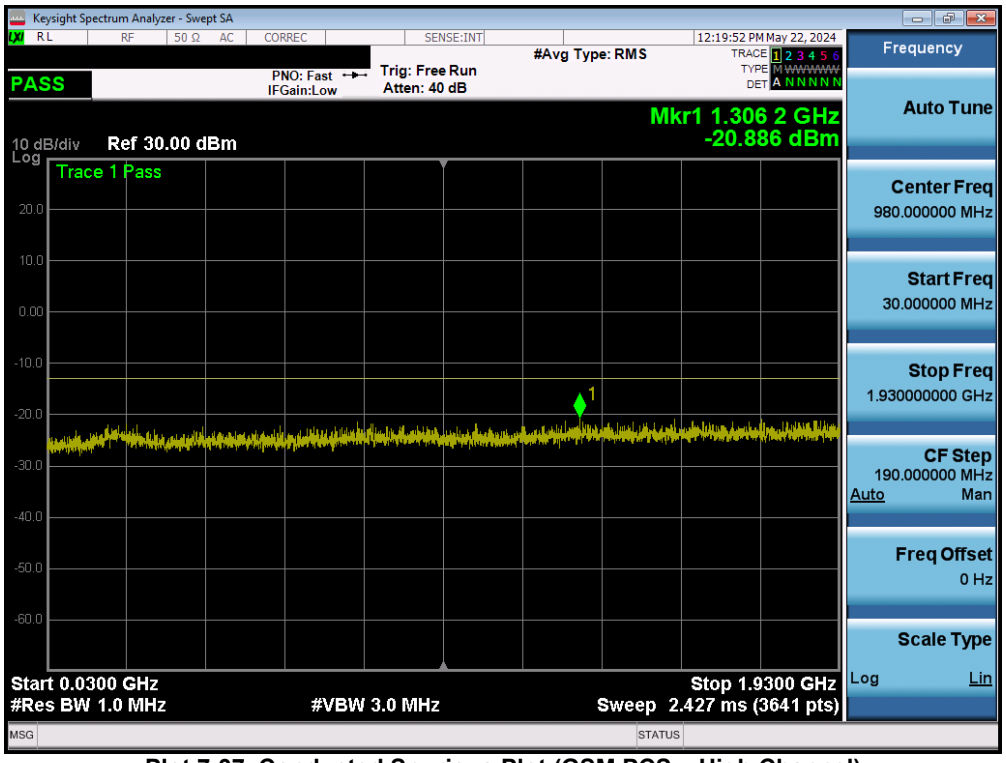
Plot 7-34. Conducted Spurious Plot (GSM PCS – Mid Channel)



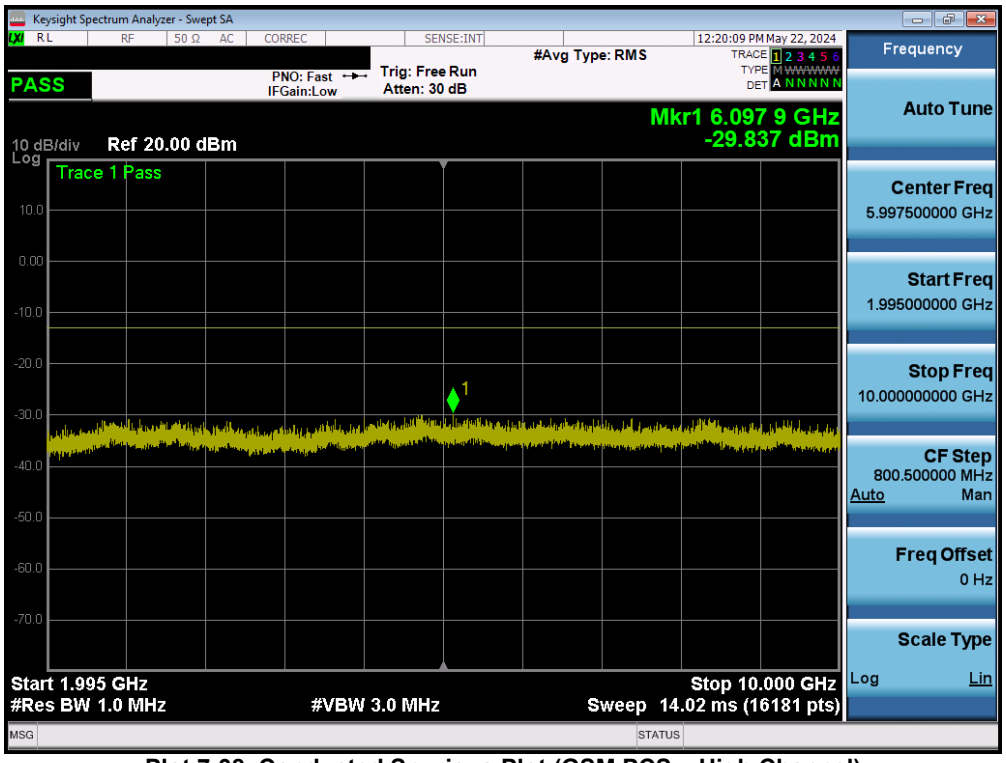
Plot 7-35. Conducted Spurious Plot (GSM PCS – Mid Channel)



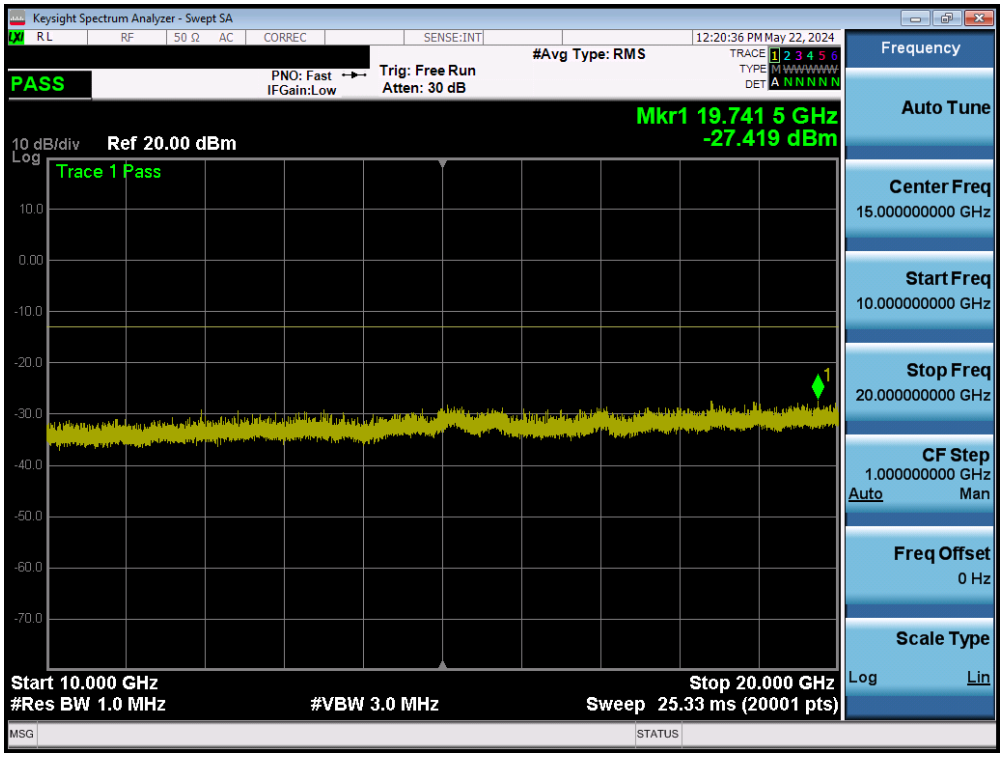
Plot 7-36. Conducted Spurious Plot (GSM PCS – Mid Channel)



Plot 7-37. Conducted Spurious Plot (GSM PCS – High Channel)



Plot 7-38. Conducted Spurious Plot (GSM PCS – High Channel)



Plot 7-39. Conducted Spurious Plot (GSM PCS – 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 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.

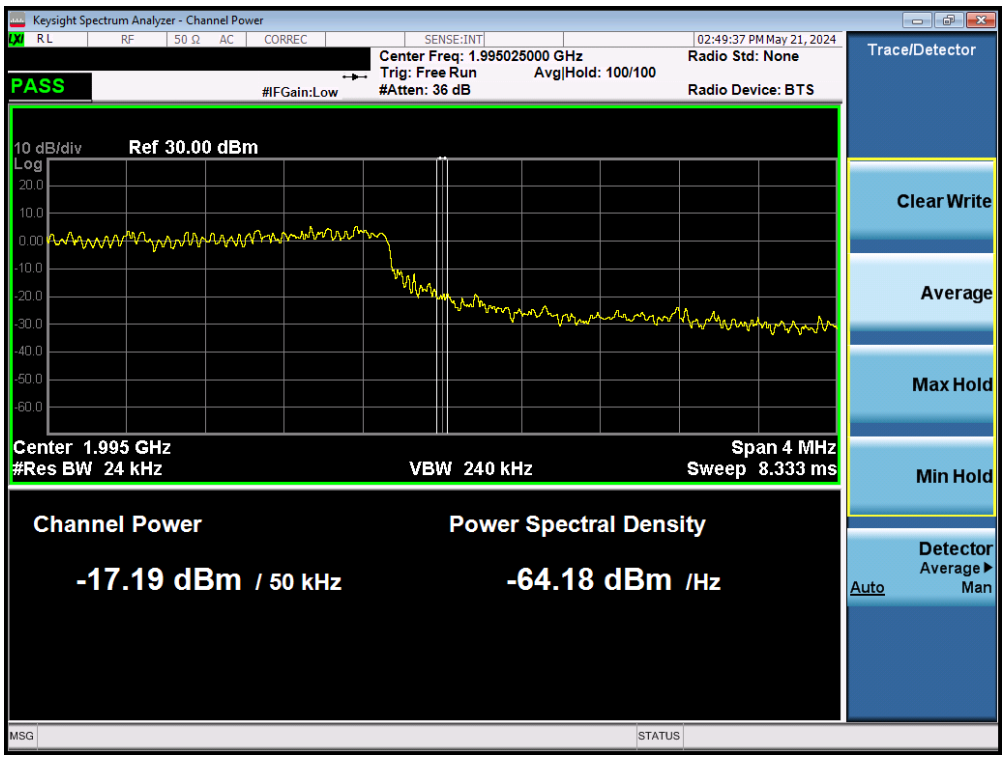
Figure 7-4. Test Instrument & Measurement Setup

Test Notes

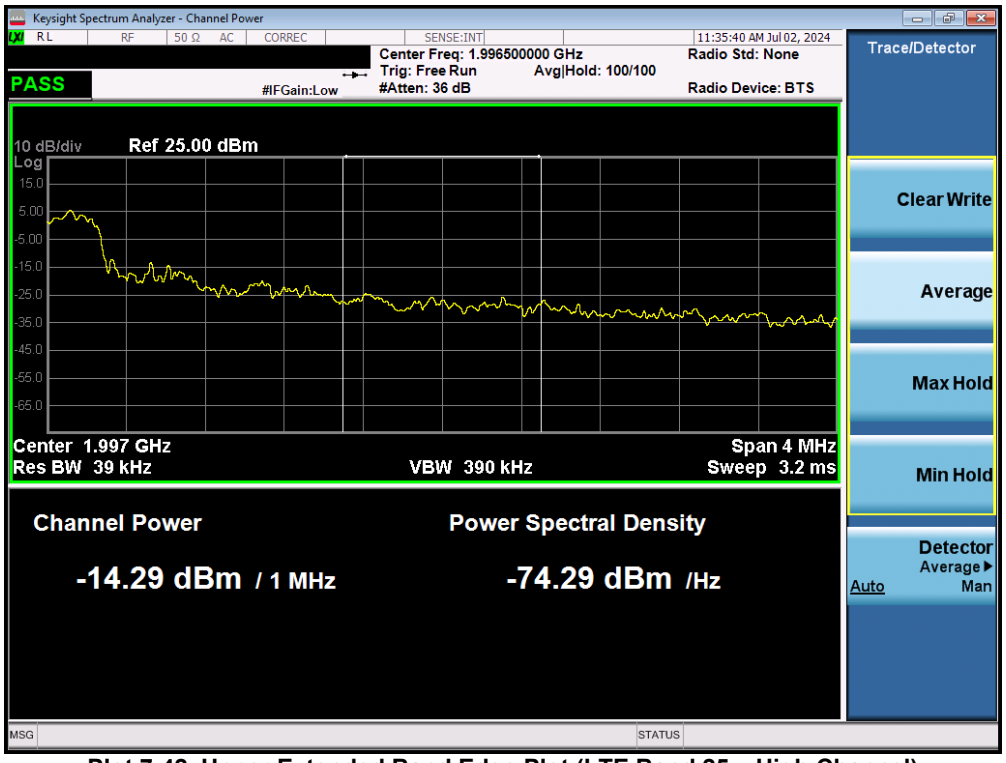
Per 24.238(b) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

LTE Band 25/2

Plot 7-40. Lower Band Edge Plot (LTE Band 25/2 – Low Channel)

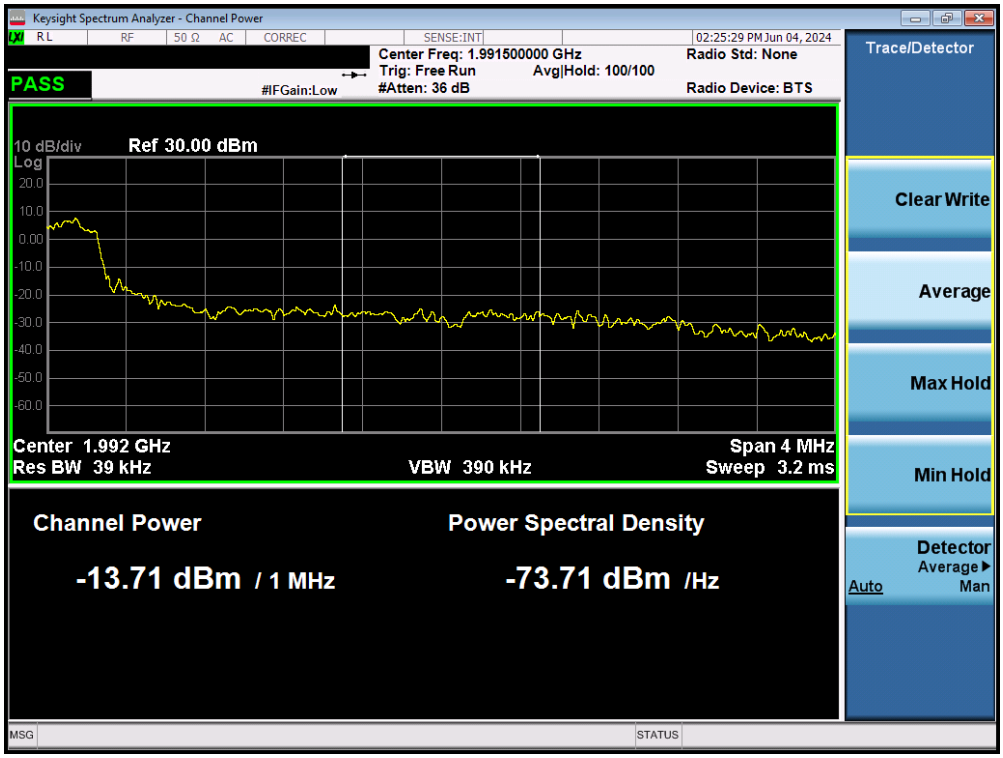


Plot 7-41. Upper Band Edge Plot (LTE Band 25 – High Channel)



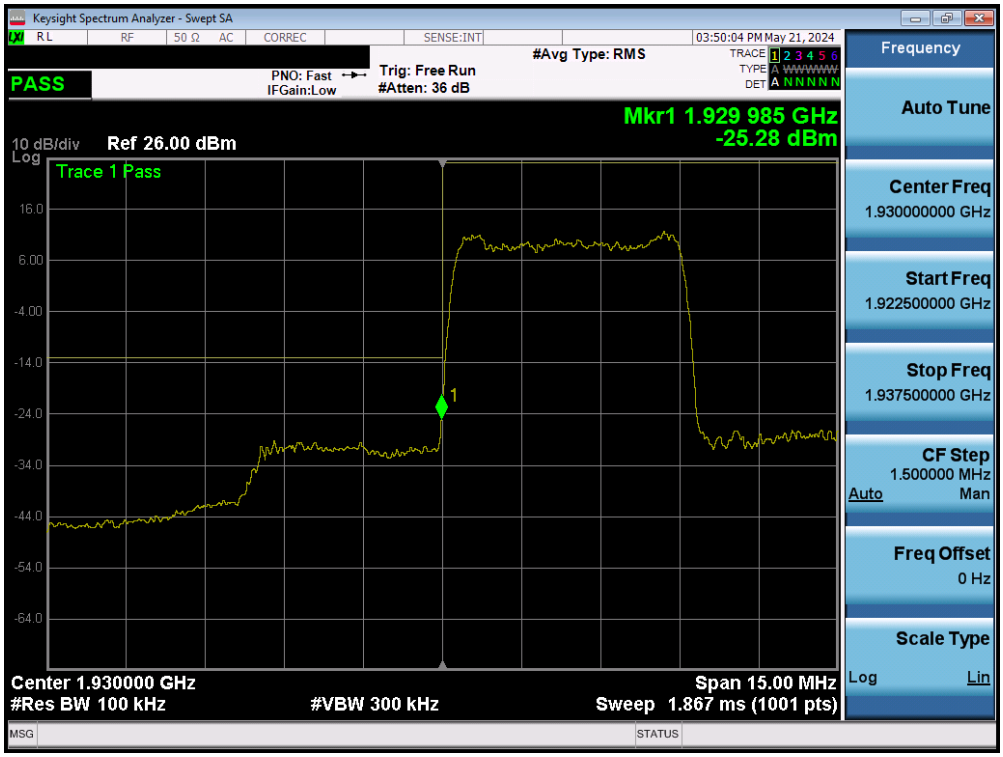
Plot 7-42. Upper Extended Band Edge Plot (LTE Band 25 – High Channel)

Plot 7-5. Upper Band Edge Plot (LTE Band 2 – High Channel)

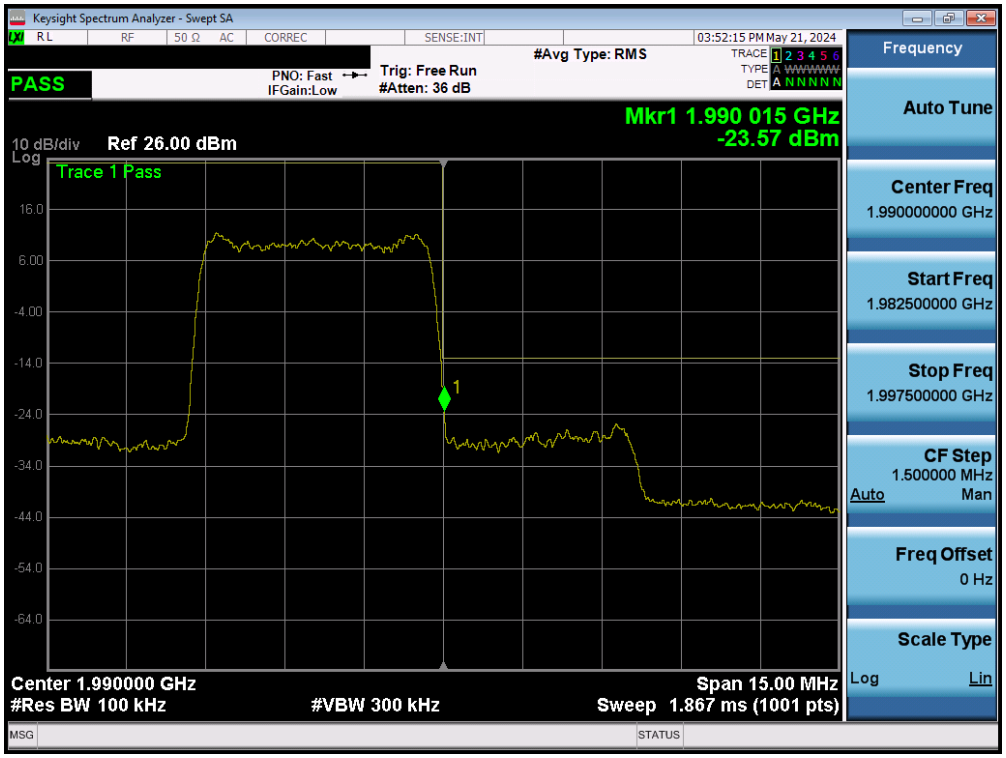


Plot 7-43. Upper Extended Band Edge Plot (LTE Band 2 – High Channel)

WCDMA PCS

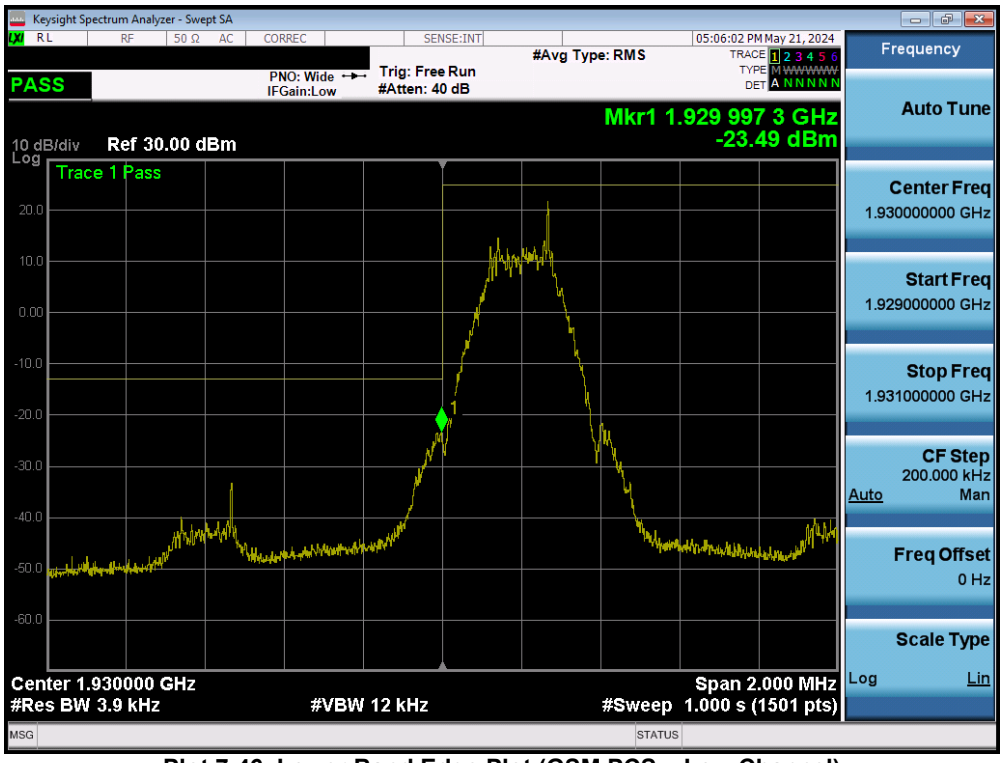


Plot 7-44. Lower Band Edge Plot (WCDMA PCS – Low Channel)

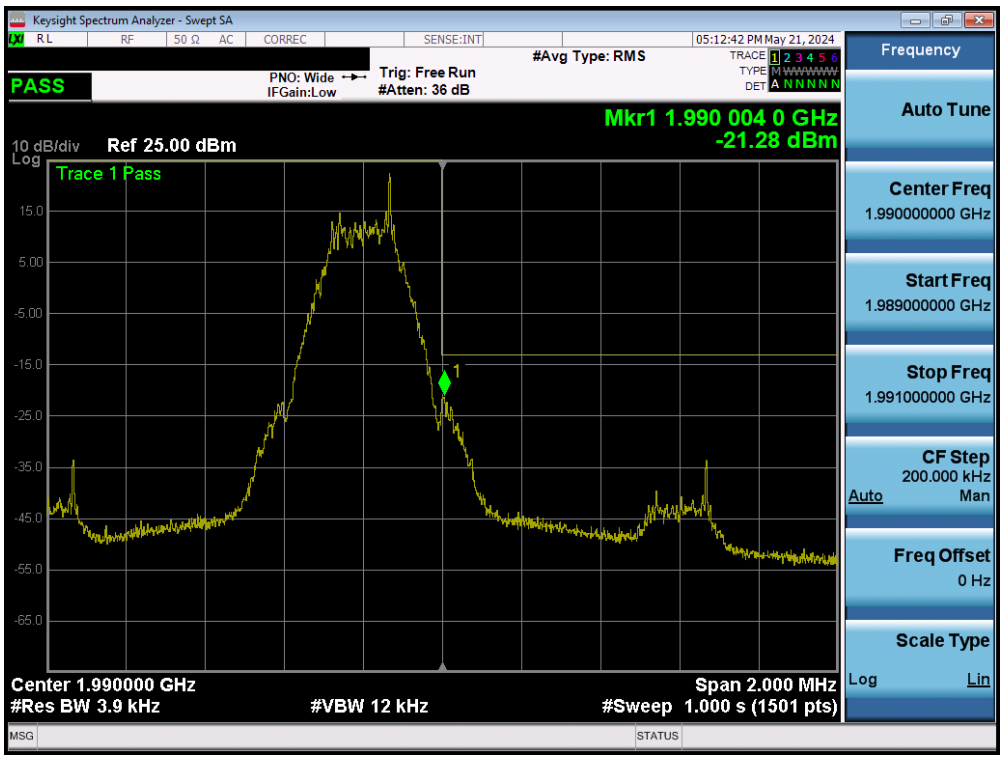


Plot 7-45. Upper Band Edge Plot (WCDMA PCS – High Channel)

GSM PCS



Plot 7-46. Lower Band Edge Plot (GSM PCS – Low Channel)



Plot 7-47. Upper Band Edge Plot (GSM PCS – High Channel)

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.

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

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

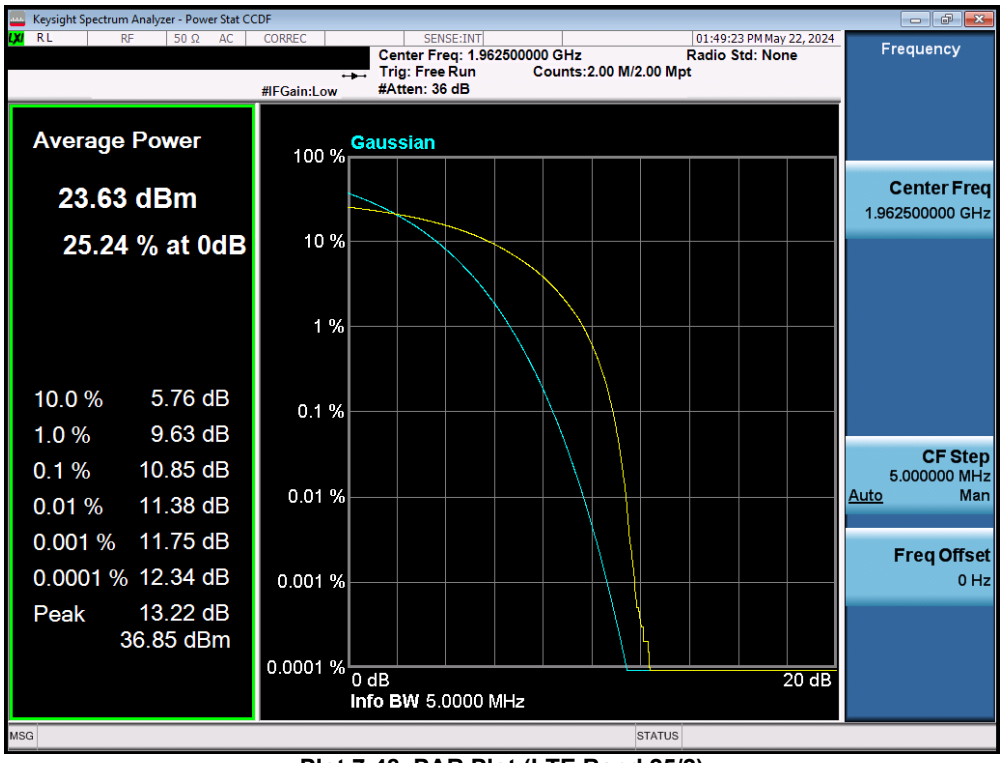
Test Setup

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

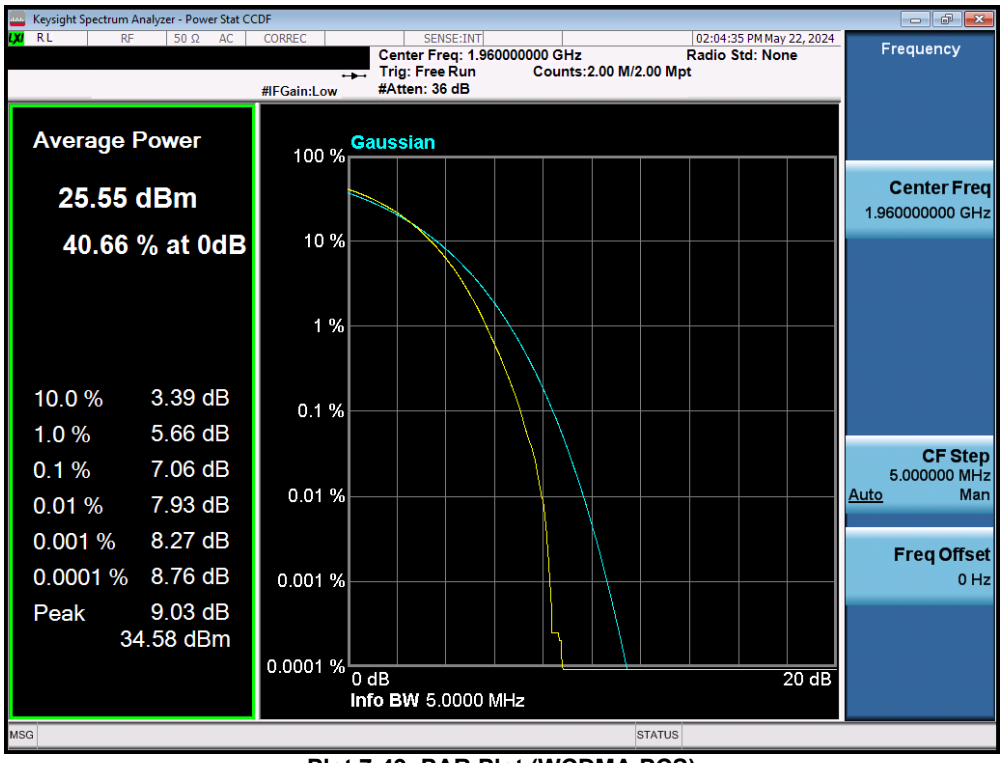
Figure 7-5. Test Instrument & Measurement Setup

Test Notes

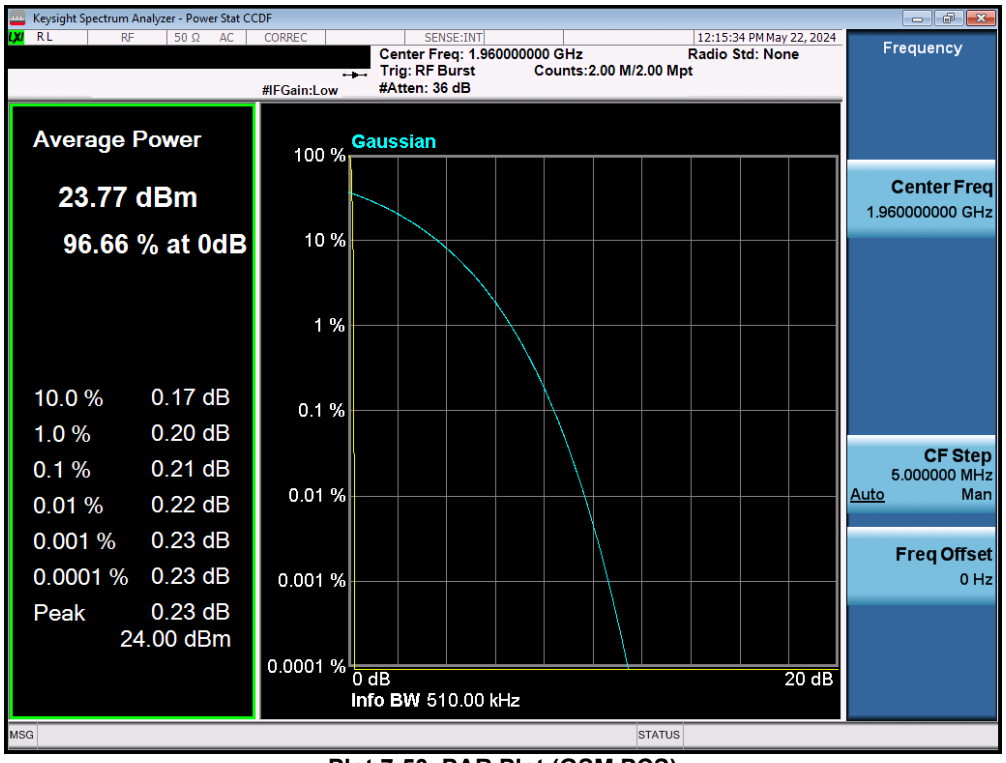
None.



Plot 7-48. PAR Plot (LTE Band 25/2)



Plot 7-49. PAR Plot (WCDMA PCS)



Plot 7-50. PAR Plot (GSM PCS)

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 a 50 ohm termination. 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 = 1MHz
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.

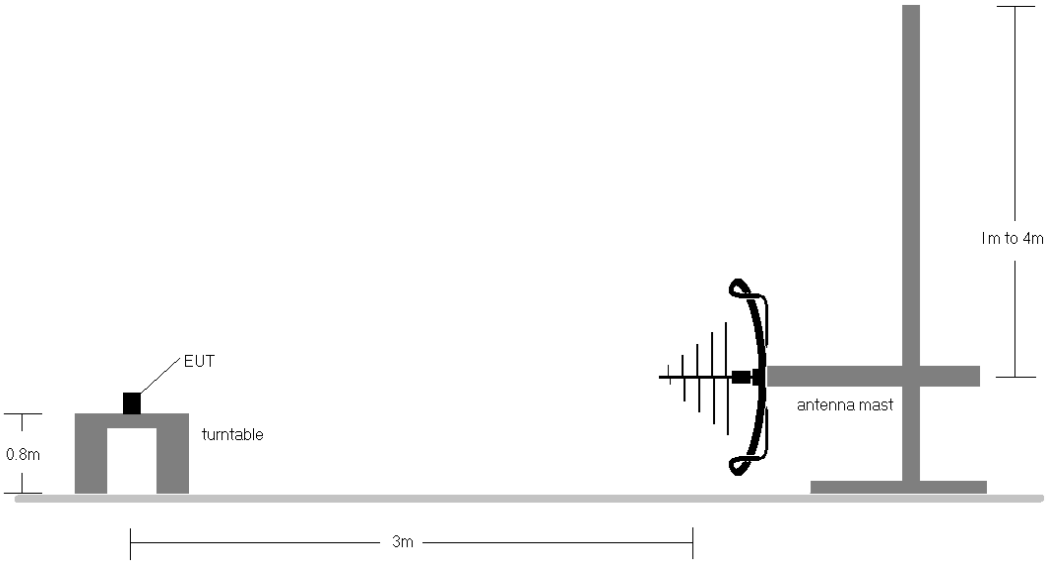


Figure 7-6. Test Instrument & Measurement Setup < 1GHz

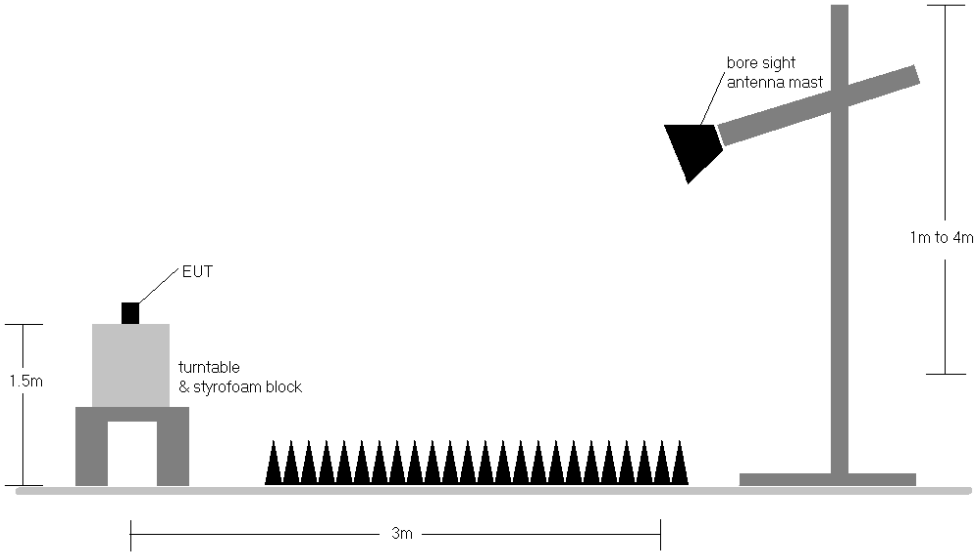


Figure 7-7. Test Instrument & Measurement Setup >1 GHz

Test Notes

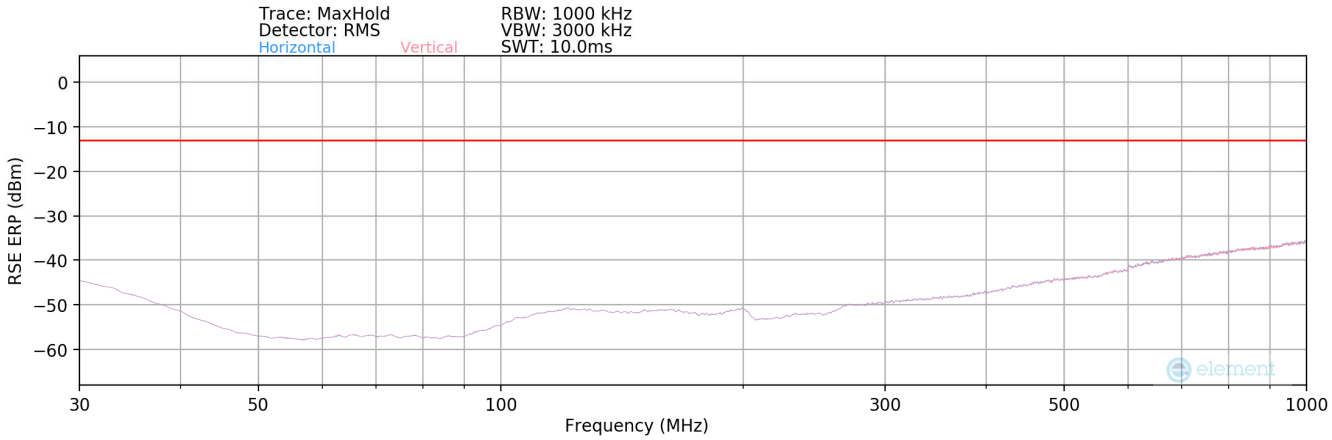
1) Field strengths are calculated using the Measurement quantity conversions in ANSI C63.26-2015 Section 5.2.7:
   a) E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
   b) EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

2) This unit was tested while powered by a 48VDC power source.

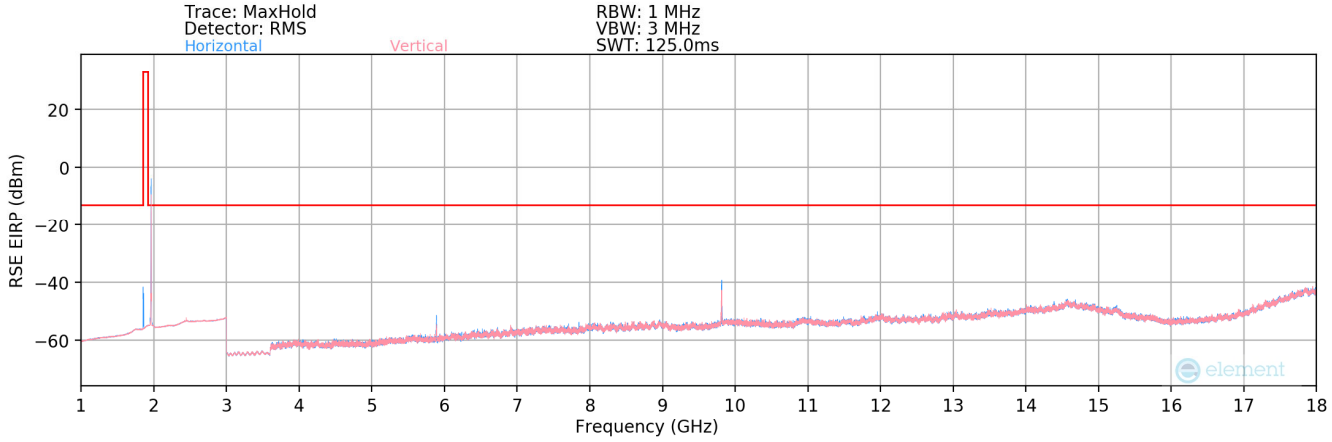
3) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

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.



Plot 7-51. Radiated Spurious Plot (LTE Band 25) - Below 1GHz



Plot 7-52. Radiated Spurious Plot (LTE Band 25) - 1-18GHz

Bandwidth (MHz):	5
Frequency (MHz):	1932.5

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]
3865.00	H	-	-	-77.79	12.37	41.58	-53.67	-13.00	-40.67
5797.50	H	171	187	-75.32	14.50	46.18	-49.08	-13.00	-36.08
7730.00	H	168	191	-74.41	17.91	50.50	-44.76	-13.00	-31.76
9662.50	H	-	-	-77.24	20.65	50.41	-44.84	-13.00	-31.84
11595.00	H	-	-	-80.29	22.48	49.19	-46.07	-13.00	-33.07
13527.50	H	-	-	-80.88	25.33	51.45	-43.80	-13.00	-30.80
15460.00	H	-	-	-80.77	24.86	51.09	-44.17	-13.00	-31.17

Table 7-6. Radiated Spurious Data (LTE Band 25) – Low Channel

Bandwidth (MHz):	5
Frequency (MHz):	1962.5

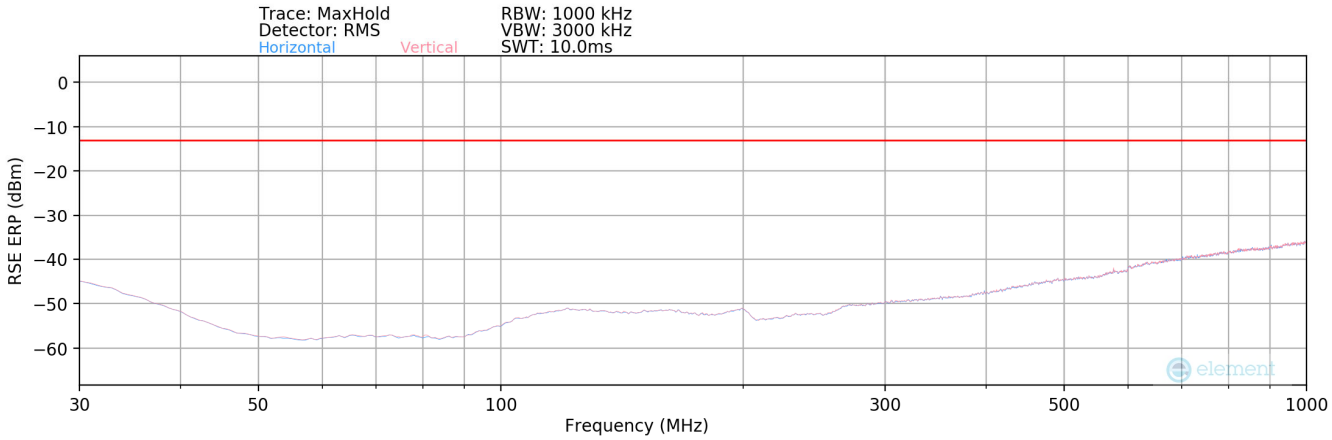
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3925.00	H	-	-	-77.69	12.58	41.89	-53.37	-13.00	-40.37
5887.50	H	171	174	-74.36	15.09	47.73	-47.53	-13.00	-34.53
7850.00	H	-	-	-77.67	18.85	48.18	-47.08	-13.00	-34.08
9812.50	H	171	180	-74.88	21.64	53.76	-41.50	-13.00	-28.50
11775.00	H	-	-	-79.87	23.18	50.31	-44.95	-13.00	-31.95
13737.50	H	-	-	-80.61	26.01	52.40	-42.86	-13.00	-29.86
15700.00	H	-	-	-80.90	24.79	50.89	-44.37	-13.00	-31.37
17662.50	H	-	-	-80.28	31.71	58.43	-36.82	-13.00	-23.82

Table 7-7. Radiated Spurious Data (LTE Band 25) – Mid Channel

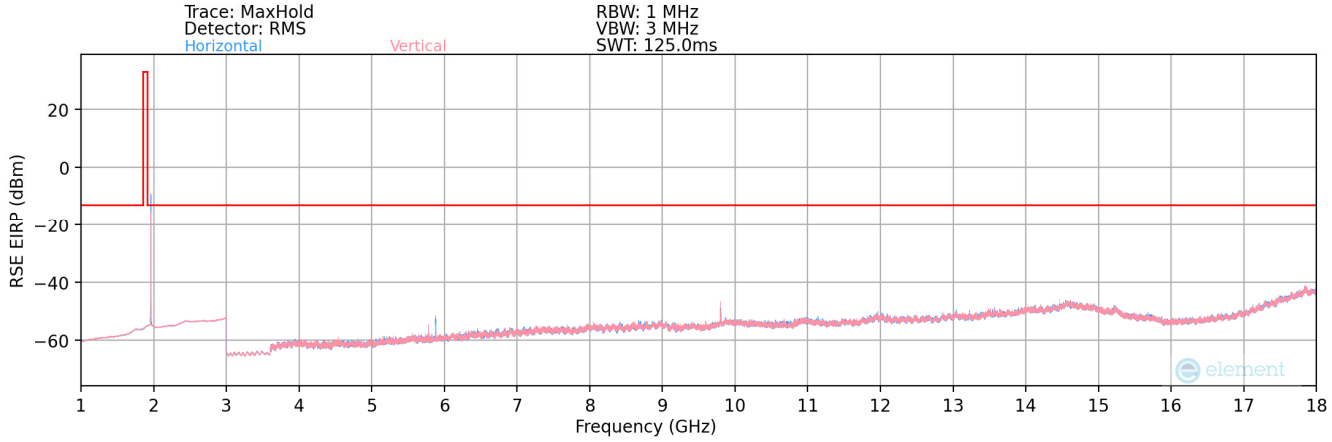
Bandwidth (MHz):	5
Frequency (MHz):	1992.5

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]
3985.00	H	-	-	-78.29	12.87	41.58	-53.67	-13.00	-40.67
5977.50	H	167	153	-74.04	15.68	48.64	-46.62	-13.00	-33.62
7970.00	H	-	-	-76.71	19.34	49.63	-45.62	-13.00	-32.62
9962.50	H	-	-	-78.32	21.58	50.26	-45.00	-13.00	-32.00
11955.00	H	165	152	-76.64	23.65	54.01	-41.24	-13.00	-28.24
13947.50	H	-	-	-79.68	26.37	53.69	-41.57	-13.00	-28.57
15940.00	H	-	-	-79.72	23.21	50.49	-44.76	-13.00	-31.76
17932.50	H	-	-	-79.62	33.29	60.67	-34.59	-13.00	-21.59

Table 7-8. Radiated Spurious Data (LTE Band 25) – High Channel



Plot 7-53. Radiated Spurious Plot (WCDMA 1900) - Below 1GHz



Plot 7-54. Radiated Spurious Plot (WCDMA 1900) - 1-18GHz

Mode:	WCDMA RMC
Frequency (MHz):	1960

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	ERP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
576.00	V	150	232	-102.21	36.98	41.77	-55.63	-13.00	-42.63

Table 7-9. Radiated Spurious Data (WCDMA 1900) – Below 1 GHz

Mode:	WCDMA RMC
Frequency (MHz):	1932.4

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]
3864.80	H	-	-	-77.68	11.93	41.25	-54.01	-13.00	-41.01
5797.20	H	148	189	-70.04	14.78	51.74	-43.52	-13.00	-30.52
7729.60	H	-	-	-77.94	18.69	47.75	-47.51	-13.00	-34.51
9662.00	H	142	195	-73.16	19.96	53.80	-41.46	-13.00	-28.46
11594.40	H	-	-	-80.34	22.20	48.86	-46.40	-13.00	-33.40
13526.80	H	-	-	-80.86	24.51	50.65	-44.61	-13.00	-31.61
15459.20	H	-	-	-80.69	28.25	54.56	-40.70	-13.00	-27.70

Table 7-10. Radiated Spurious Data (WCDMA 1900) – Low Channel

Mode:	WCDMA RMC
Frequency (MHz):	1960

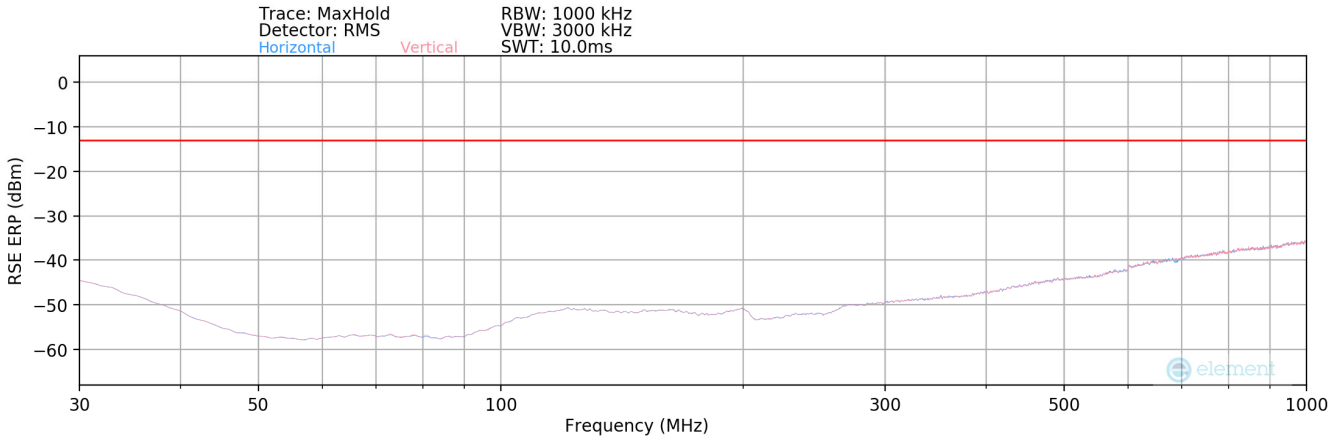
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3920.00	H	-	-	-75.85	11.94	43.09	-52.17	-13.00	-39.17
5880.00	H	132	167	-70.07	14.83	51.76	-43.50	-13.00	-30.50
7840.00	H	133	175	-74.28	18.48	51.20	-44.06	-13.00	-31.06
9800.00	H	132	176	-71.25	21.10	56.85	-38.41	-13.00	-25.41
11760.00	H	132	169	-76.27	22.16	52.89	-42.37	-13.00	-29.37
13720.00	H	-	-	-78.93	24.51	52.58	-42.68	-13.00	-29.68
15680.00	H	-	-	-78.47	26.85	55.38	-39.88	-13.00	-26.88
17640.00	H	-	-	-78.71	25.47	53.76	-41.50	-13.00	-28.50

Table 7-11. Radiated Spurious Data (WCDMA 1900) – Mid Channel

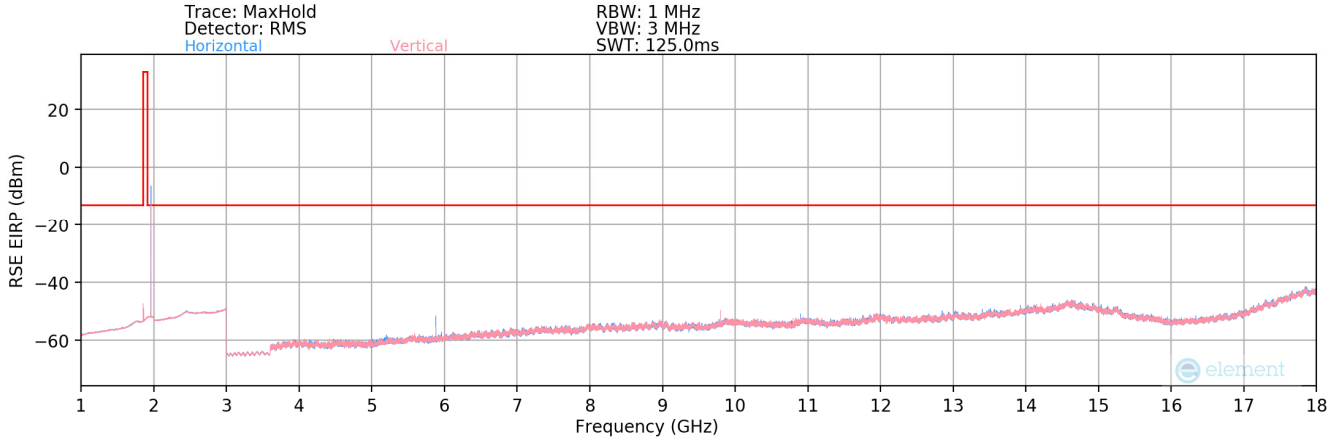
Mode:	WCDMA RMC
Frequency (MHz):	1987.6

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]
3975.20	H	-	-	-78.40	12.20	40.80	-54.46	-13.00	-41.46
5962.80	H	394	176	-73.24	14.78	48.54	-46.72	-13.00	-33.72
7950.40	H	-	-	-79.14	18.65	46.51	-48.75	-13.00	-35.75
9938.00	H	394	176	-76.71	21.11	51.40	-43.86	-13.00	-30.86
11925.60	H	-	-	-80.05	22.79	49.74	-45.52	-13.00	-32.52
13913.20	H	-	-	-80.65	24.63	50.98	-44.28	-13.00	-31.28
15900.80	H	-	-	-81.03	27.21	53.18	-42.07	-13.00	-29.07

Table 7-12. Radiated Spurious Data (WCDMA 1900) – High Channel



Plot 7-55. Radiated Spurious Plot (GSM 1900) - Below 1GHz



Plot 7-56. Radiated Spurious Plot (GSM 1900) - 1-18GHz

Mode:	GPRS 1 Tx Slot
Frequency (MHz):	1930.2

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]
3860.40	H	-	-	-75.51	12.36	43.85	-51.40	-13.00	-38.40
5790.60	H	187	244	-67.66	14.52	53.86	-41.40	-13.00	-28.40
7720.80	H	200	248	-72.66	18.01	52.35	-42.91	-13.00	-29.91
9651.00	H	200	250	-76.91	20.67	50.76	-44.49	-13.00	-31.49
11581.20	H	-	-	-78.52	22.63	51.11	-44.15	-13.00	-31.15
13511.40	H	-	-	-79.28	25.33	53.05	-42.21	-13.00	-29.21
15441.60	H	-	-	-78.95	24.99	53.04	-42.22	-13.00	-29.22
17371.80	H	-	-	-78.72	28.68	56.96	-38.30	-13.00	-25.30

Table 7-13. Radiated Spurious Data (GSM 1900) – Low Channel

Mode:	GPRS 1 Tx Slot
Frequency (MHz):	1960

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]
3920.00	H	-	-	-75.86	12.55	43.69	-51.56	-13.00	-38.56
5880.00	H	129	173	-65.08	14.95	56.87	-38.39	-13.00	-25.39
7840.00	H	131	191	-76.50	18.75	49.25	-46.01	-13.00	-33.01
9800.00	H	155	176	-73.84	21.53	54.69	-40.57	-13.00	-27.57
11760.00	H	152	191	-76.71	23.32	53.61	-41.65	-13.00	-28.65
13720.00	H	-	-	-78.86	25.78	53.92	-41.34	-13.00	-28.34
15680.00	H	-	-	-78.65	24.31	52.66	-42.60	-13.00	-29.60
17640.00	H	-	-	-78.71	31.40	59.69	-35.57	-13.00	-22.57

Table 7-14. Radiated Spurious Data (GSM 1900) – Mid Channel

Mode:	GPRS 1 Tx Slot
Frequency (MHz):	1989.8

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]
3979.60	H	-	-	-76.38	12.88	43.50	-51.75	-13.00	-38.75
5969.40	H	249	162	-67.10	15.59	55.49	-39.77	-13.00	-26.77
7959.20	H	247	177	-73.21	19.34	53.13	-42.13	-13.00	-29.13
9949.00	H	-	-	-77.28	21.75	51.47	-43.79	-13.00	-30.79
11938.80	H	240	178	-70.40	23.66	60.26	-35.00	-13.00	-22.00
13928.60	H	-	-	-78.80	26.32	54.52	-40.74	-13.00	-27.74
15918.40	H	-	-	-79.19	23.47	51.28	-43.97	-13.00	-30.97
17908.20	H	-	-	-79.07	33.37	61.30	-33.96	-13.00	-20.96

Table 7-15. Radiated Spurious Data (GSM 1900) – 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 24, 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

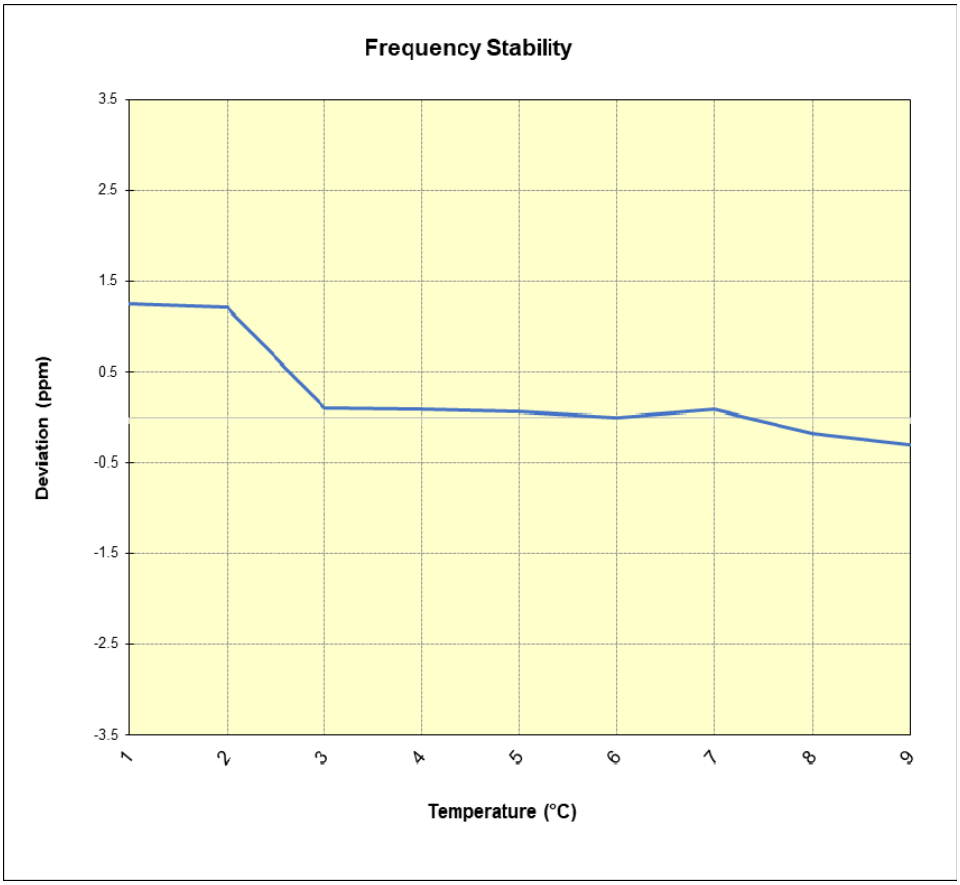
None

LTE Band 25/2

Operating Frequency (Hz):	1,962,500,000
Ref. Voltage (VDC):	28.00

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	28.0	- 30	1,962,501,451	2,446	0.0001246
		- 20	1,962,501,380	2,375	0.0001210
		- 10	1,962,499,194	189	0.0000096
		0	1,962,499,172	167	0.0000085
		+ 10	1,962,499,133	128	0.0000065
		+ 20 (Ref)	1,962,499,005	0	0.0000000
		+ 30	1,962,499,168	163	0.0000083
		+ 40	1,962,498,667	-338	-0.0000172
		+ 50	1,962,498,401	-604	-0.0000308
85 %	23.8	+ 20	1,962,499,316	311	0.0000158
110 %	32.2	+ 20	1,962,499,337	332	0.0000169

Table 7-16. LTE Band 25 Frequency Stability Data



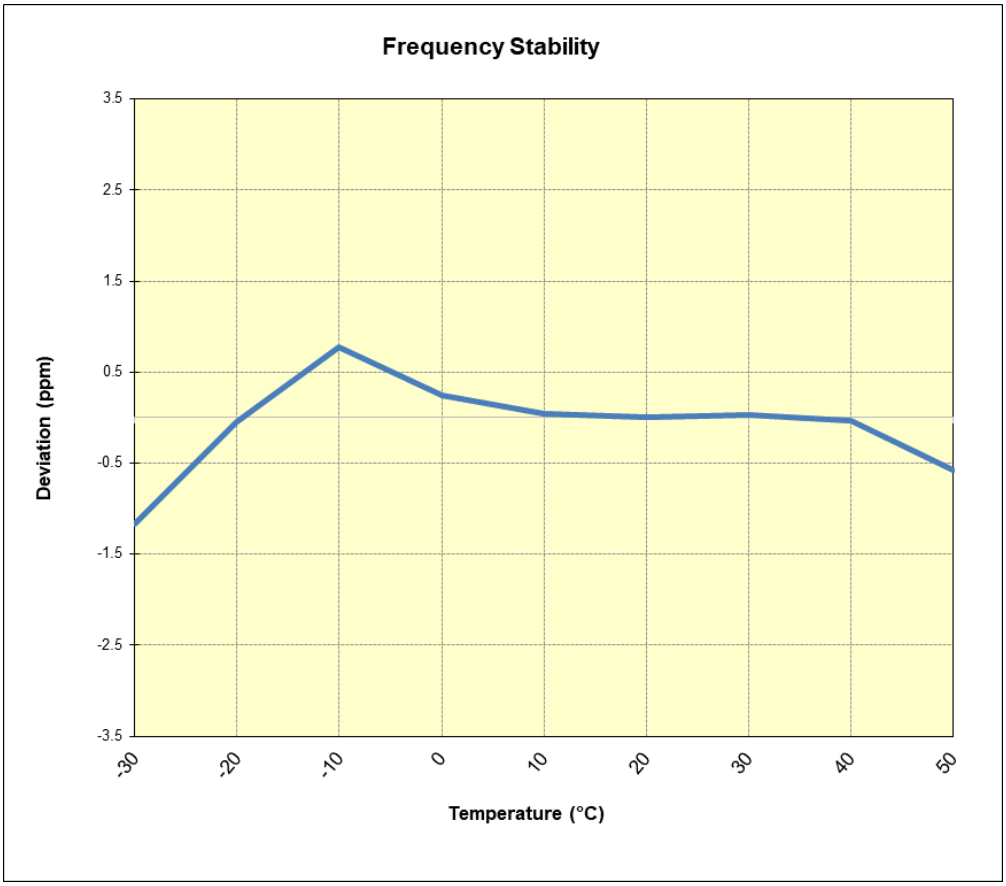
Plot 7-57. LTE Band 25 Frequency Stability Chart

WCDMA PCS

Operating Frequency (Hz):	1,960,000,000
Ref. Voltage (VDC):	28.00

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	28.0	- 30	1,959,997,613	-2,298	-0.0001172
		- 20	1,959,999,827	-84	-0.0000043
		- 10	1,960,001,435	1,524	0.0000778
		0	1,960,000,398	487	0.0000248
		+ 10	1,959,999,994	83	0.0000042
		+ 20 (Ref)	1,959,999,911	0	0.0000000
		+ 30	1,959,999,981	70	0.0000036
		+ 40	1,959,999,848	-63	-0.0000032
		+ 50	1,959,998,783	-1,128	-0.0000576
85 %	23.8	+ 20	1,959,999,069	-842	-0.0000430
110 %	32.2	+ 20	1,959,999,940	29	0.0000015

Table 7-17. WCDMA 1900 Frequency Stability Data



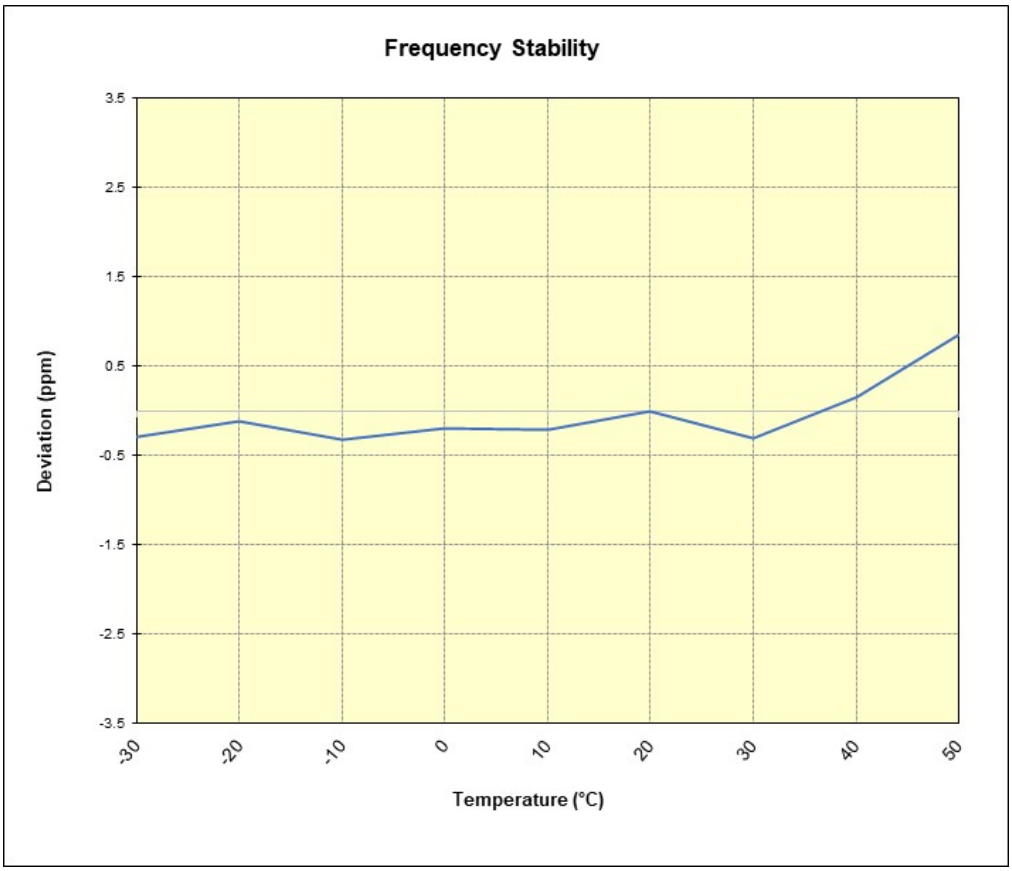
Plot 7-58. WCDMA 1900 Frequency Stability Chart

GSM/GPRS PCS

Operating Frequency (Hz):	1,960,000,000
Ref. Voltage (VDC):	28.00

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	28.0	- 30	1,960,000,676	-562	-0.0000287
		- 20	1,960,001,031	-207	-0.0000106
		- 10	1,960,000,603	-635	-0.0000324
		0	1,960,000,867	-371	-0.0000189
		+ 10	1,960,000,833	-405	-0.0000207
		+ 20 (Ref)	1,960,001,238	0	0.0000000
		+ 30	1,960,000,643	-595	-0.0000304
		+ 40	1,960,001,537	299	0.0000153
		+ 50	1,960,002,915	1,677	0.0000856
85 %	23.8	+ 20	1,960,001,713	475	0.0000242
110 %	32.2	+ 20	1,960,001,446	208	0.0000106

Table 7-18. GSM 1900 Frequency Stability Data



Plot 7-59. GSM 1900 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-58450** complies with all the requirements of Part 24 of the FCC rules.