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 22 MEASUREMENT REPORT

Applicant Name:
Microsoft Corporation
One Microsoft Way
Redmond, WA 98052
United States

Date of Testing:
12/12/2023 - 3/12/2024
Test Report Issue Date:
3/15/2024
Test Site/Location:
Element lab., Columbia, MD, USA
Test Report Serial No.:
1M2312040120-08.C3K

FCC ID:	**C3K2077**
Applicant Name:	**Microsoft Corporation**

Application Type:	Certification
Model:	2077
EUT Type:	Portable Computing Device
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part:	22
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

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PART 22 MEASUREMENT REPORT

Antenna-4						
Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	ERP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
WCDMA	N/A	Spread Spectrum	826.4 - 846.6	0.068	18.36	4M17F9W
LTE Band 26/5	15MHz (Band 26 only)	QPSK	831.5 - 841.5	0.087	19.40	13M5G7D
		16QAM	831.5 - 841.5	0.071	18.48	13M5W7D
	10 MHz	QPSK	829.0 - 844.0	0.083	19.17	9M05G7D
		16QAM	829.0 - 844.0	0.069	18.37	9M03W7D
	5 MHz	QPSK	826.5 - 846.5	0.084	19.22	4M54G7D
		16QAM	826.5 - 846.5	0.067	18.27	4M55W7D
	3 MHz	QPSK	825.5 - 847.5	0.082	19.15	2M72G7D
		16QAM	825.5 - 847.5	0.068	18.29	2M72W7D
	1.4 MHz	QPSK	824.7 - 848.3	0.082	19.16	1M10G7D
		16QAM	824.7 - 848.3	0.068	18.33	1M11W7D
NR Band n26/5	20 MHz	π/2 BPSK	834.0 - 839.0	0.080	19.04	18M0G7D
		QPSK	834.0 - 839.0	0.084	19.22	19M1G7D
		16QAM	834.0 - 839.0	0.062	17.95	19M0W7D
	15 MHz	π/2 BPSK	831.5 - 841.5	0.081	19.11	13M6G7D
		QPSK	831.5 - 841.5	0.084	19.23	14M0G7D
		16QAM	831.5 - 841.5	0.065	18.14	14M0W7D
	10 MHz	π/2 BPSK	829.0 - 844.0	0.078	18.95	9M06G7D
		QPSK	829.0 - 844.0	0.083	19.18	9M38G7D
		16QAM	829.0 - 844.0	0.062	17.92	9M34W7D
	5 MHz	π/2 BPSK	826.5 - 846.5	0.078	18.95	4M53G7D
		QPSK	826.5 - 846.5	0.084	19.22	4M53G7D
		16QAM	826.5 - 846.5	0.063	17.97	4M52W7D

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 **Microsoft Corporation Portable Computing Device FCC ID: C3K2077.** 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 22.

Test Device Serial No.: B44F2, 7CBR2, B44G2, 7CBC2, B44D2

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1), 802.11b/g/n/ac/ax/be WLAN, 802.11a/n/ac/ax/be UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE)

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.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version 2024.111.46 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 Power and 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 power measurements, substitution method is used per the guidance of ANSI C63.26-2015. For emissions below 1GHz, a half-wave dipole is substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_{d\ [dBm]} = P_{g\ [dBm]} - \text{cable loss}_{\ [dB]} + \text{antenna gain}_{\ [dBd/dBi]};$$

where P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_{g\ [dBm]}$ – cable loss $_{[dB]}$.

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
-	AP2-001	EMC Cable and Switch System	11/15/2023	Annual	11/15/2024	AP2-001
-	AP2-002	EMC Cable and Switch System	11/15/2023	Annual	11/15/2024	AP2-002
-	AP1-002	EMC Cable and Switch System	11/15/2023	Annual	11/15/2024	AP1-002
-	LTx3	LIcensed Transmitter Cable Set	11/15/2023	Annual	11/15/2024	LTx3
-	LTx4	Licensed Transmitter Cable Set	11/15/2023	Annual	11/15/2024	LTx4
-	LTx5	LIcensed Transmitter Cable Set	11/15/2023	Annual	11/15/2024	LTx5
Anritsu	MT8821C	Radio Communication Analyzer	7/5/2023	Annual	7/5/2024	6262150000
Espec	SCP-220	Environmental Chamber	5/25/2022	Annual	5/25/2024	OCPS5H0612K05
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	3/15/2023	Annual	3/15/2024	MY52350166
Keysight Technologies	N9020A	MXA Signal Analyzer	3/15/2023	Annual	3/15/2024	MY54500644
Keysight Technologies	N9030A	PXA Signal Analyzer	2/29/2024	Annual	3/1/2025	MY55410501
Keysight Technologies	N9030B	PXA Signal Analyzer, Multi-touch	9/7/2023	Annual	9/7/2024	MY57141001
Keysight Technologies	N9038A	MXE EMI Receiver	8/30/2023	Annual	8/30/2024	MY51210133
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			100976
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	9/25/2023	Annual	9/25/2024	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	9/11/2020	Annual	9/11/2024	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	2/15/2024	Annual	2/15/2025	103200
Schwarzbeck	VULB9162	Bilog Antenna	2/21/2023	Biennial	2/21/2025	83706
Rohde & Schwarz	TC-TA18	Vivaldi Antenna	2/23/2023	Biennial	2/23/2025	101072

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

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

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

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: Microsoft Corporation

FCC ID: C3K2077

FCC Classification: PCS Licensed Transmitter (PCB)

Mode(s): WCDMA/LTE/NR/ULCA

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
	Occupied Bandwidth	2.1049(h)	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions	2.1051, 22.917(a)	≥ 43 + 10 log (P[Watts]) dB of attenuation below transmitter power	PASS	Sections 7.4, 7.5
	Frequency Stability	2.1055, 22.355	The carrier frequency of the transmitter must be maintained within the 2.5ppm	PASS	Section 7.8
RADIATED	Effective Radiated Power / Equivalent Isotropic Radiated Power	22.913(a)(5)	< 7 Watts max. ERP	PASS	Section 7.6
	Radiated Spurious Emissions	2.1053, 22.917(a)	> 43 + 10 log10 (P[Watts]) for all out-of-band emissions	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 Conducted Power Output Data

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

Test Settings

1. Detector = RMS
2. Trace mode = trace average for continuous emissions, max hold for pulse emissions
3. Sweep time = auto couple
4. The trace was allowed to stabilize
5. 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.

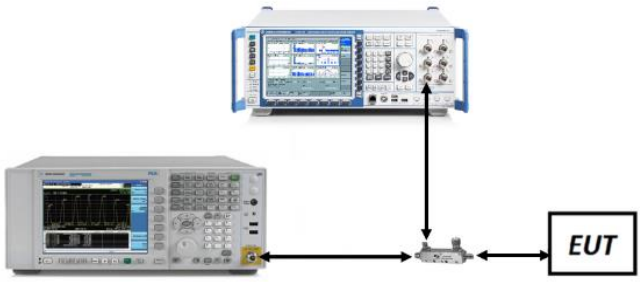


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. Uplink carrier aggregation is only supported in this EUT while operating in Power Class 3.

2. Conducted power measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device.

3. All other conducted power measurements are contained in the RF exposure report for this filing.

4. Conducted power was found to reduce for the higher order QAM modulations when compared to 16QAM. Due to this trend, only the worst-case QAM (16QAM) powers are included in this section.

Power State	Band	Bandwidth (PCC + SCC)	PCC					SCC					ULCA Tx. Power [dBm]
			Modulation	UL Channel	UL Frequency	UL # RB	UL RB Offset	Modulation	UL Channel	UL Frequency	UL # RB	UL RB Offset	
Max	LTE B5	10MHz + 10MHz	QPSK	20450	829.0	1	49	QPSK	20549	838.9	1	0	24.90
				20475	831.5	1	49		20574	841.4	1	0	24.83
				20600	844.0	1	0		20501	834.1	1	49	24.93
			QPSK	20600	844	50	0	QPSK	20501	834.1	50	0	23.17
			16-QAM	20600	844	50	0	16-QAM	20501	834.1	50	0	22.18
			64-QAM	20600	844	50	0	64-QAM	20501	834.1	50	0	22.17
			256-QAM	20600	844	50	0	256-QAM	20501	834.1	50	0	20.15

Table 7-2. Conducted Power Output Data (ULCA LTE Band 5 – Ant4)

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.

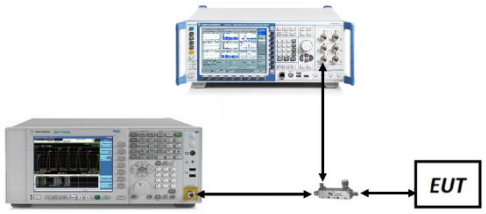


Figure 7-2. Test Instrument & Measurement Setup

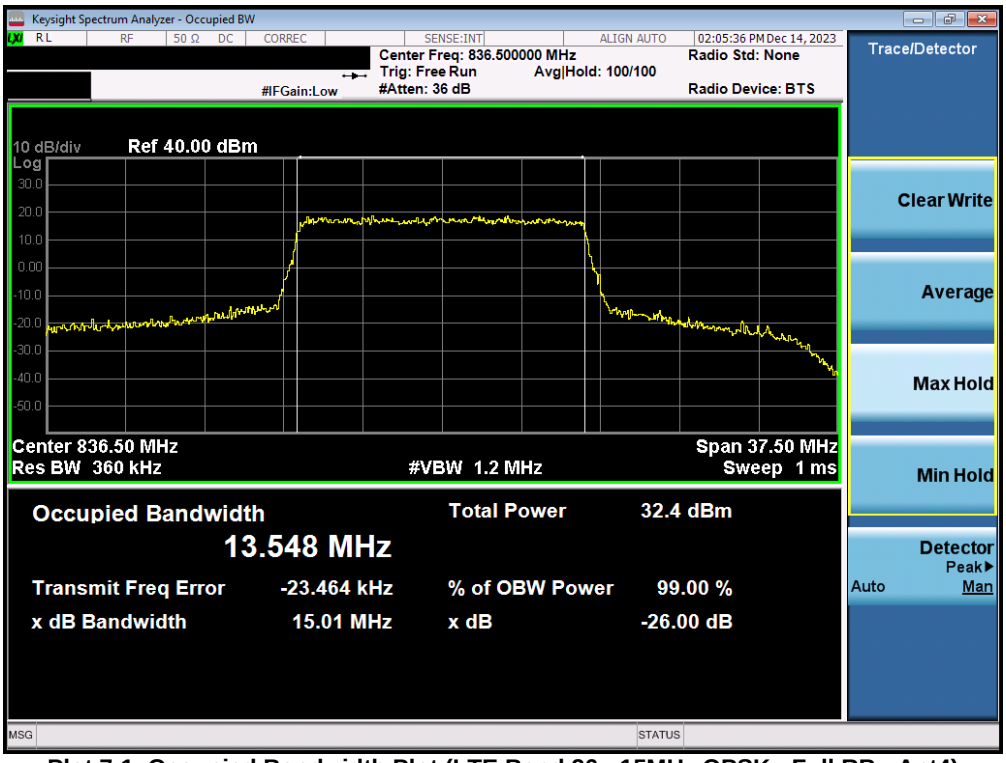
Test Notes

None.

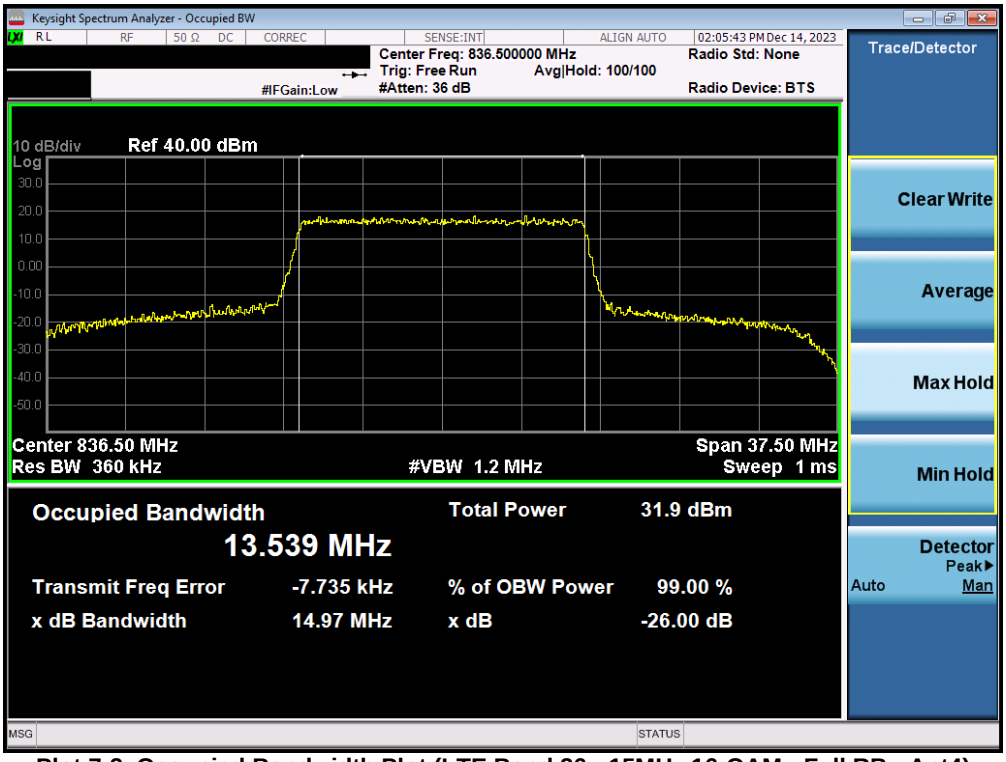
Mode	Bandwidth	Modulation	OBW [MHz]
WCDMA-Cell	N/A	Spread Spectrum	4.17
LTE-B26-5	15MHz	QPSK	13.55
		16QAM	13.51
	10MHz	QPSK	9.05
		16QAM	9.03
	5 MHz	QPSK	4.54
		16QAM	4.55
	3 MHz	QPSK	2.72
		16QAM	2.72
	1.4 MHz	QPSK	1.10
		16QAM	1.11
NR-n26-5	20 MHz	π/2 BPSK	17.95
		QPSK	19.07
		16QAM	19.00
	15 MHz	π/2 BPSK	13.56
		QPSK	14.05
		16QAM	14.03
	10 MHz	π/2 BPSK	9.06
		QPSK	9.38
		16QAM	9.34
	5 MHz	π/2 BPSK	4.53
		QPSK	4.53
		16QAM	4.52

Table 7-3. Occupied Bandwidth Test Results

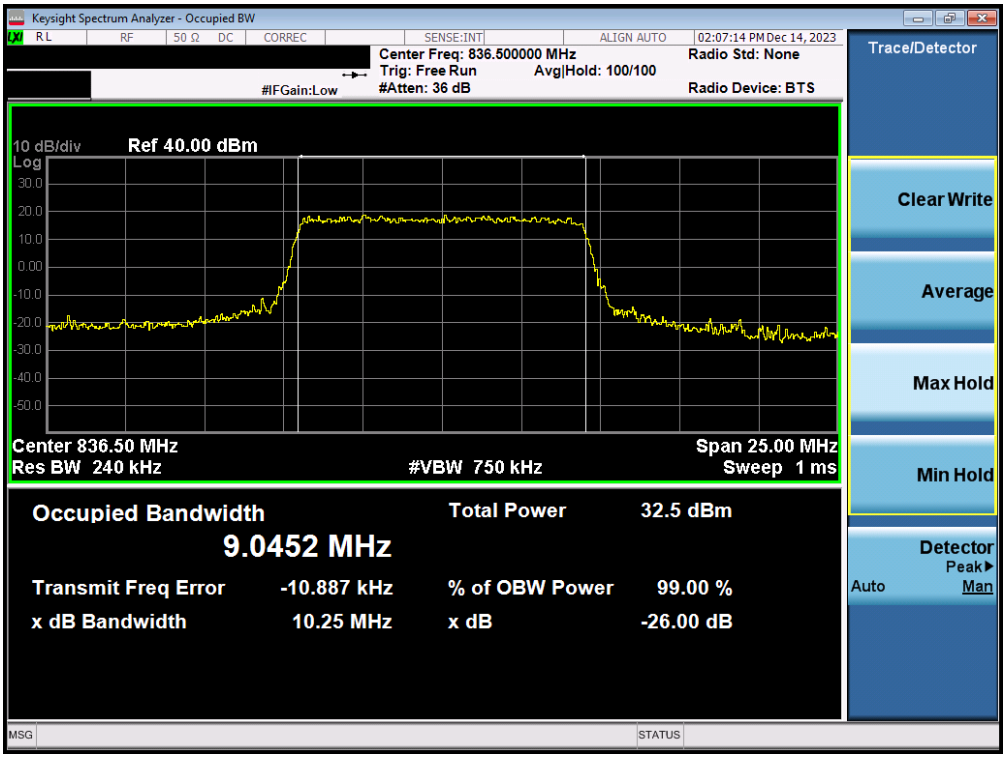
LTE Band 26/5 – Ant4



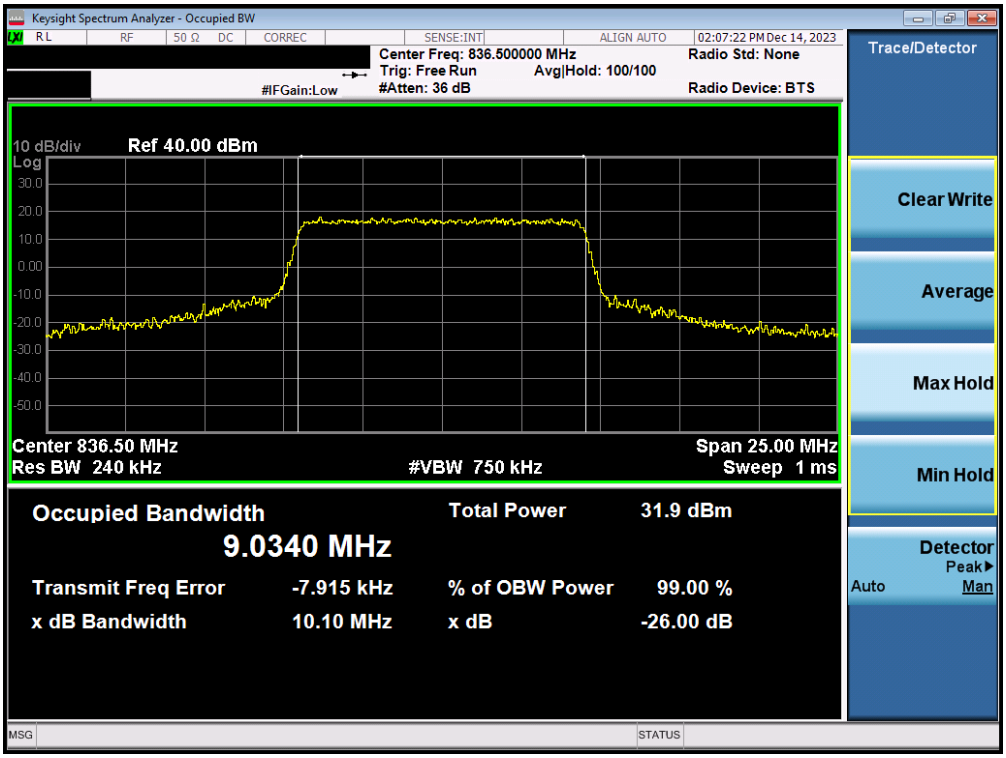
Plot 7-1. Occupied Bandwidth Plot (LTE Band 26 - 15MHz QPSK - Full RB - Ant4)



Plot 7-2. Occupied Bandwidth Plot (LTE Band 26 - 15MHz 16-QAM - Full RB - Ant4)

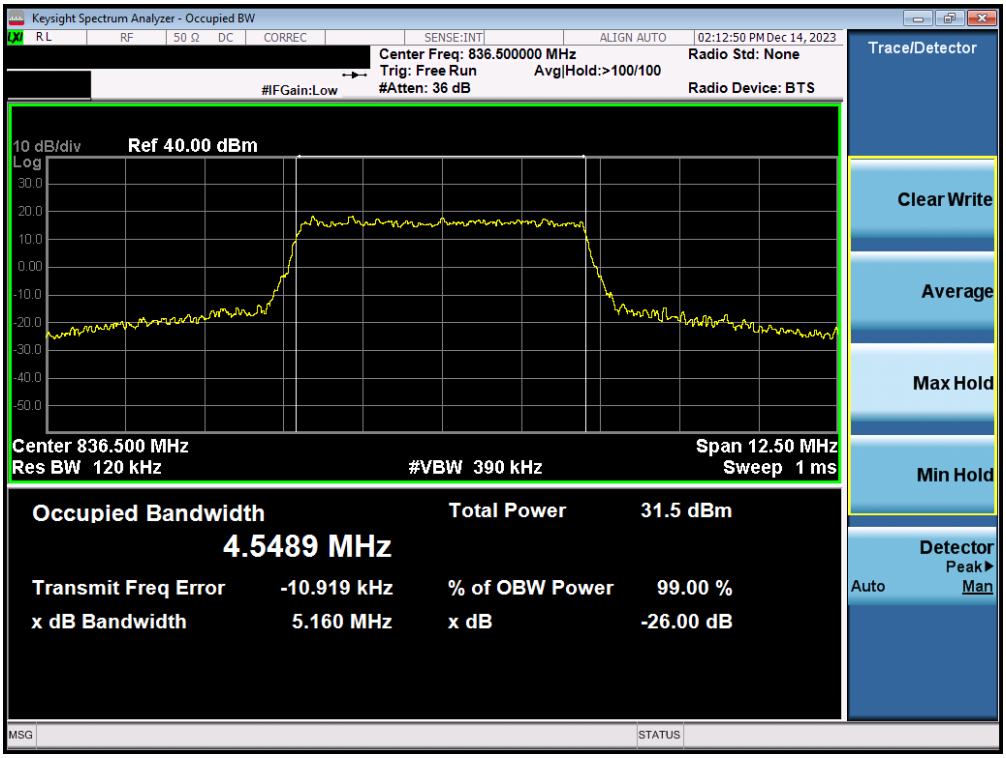


Plot 7-3. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz QPSK - Full RB - Ant4)

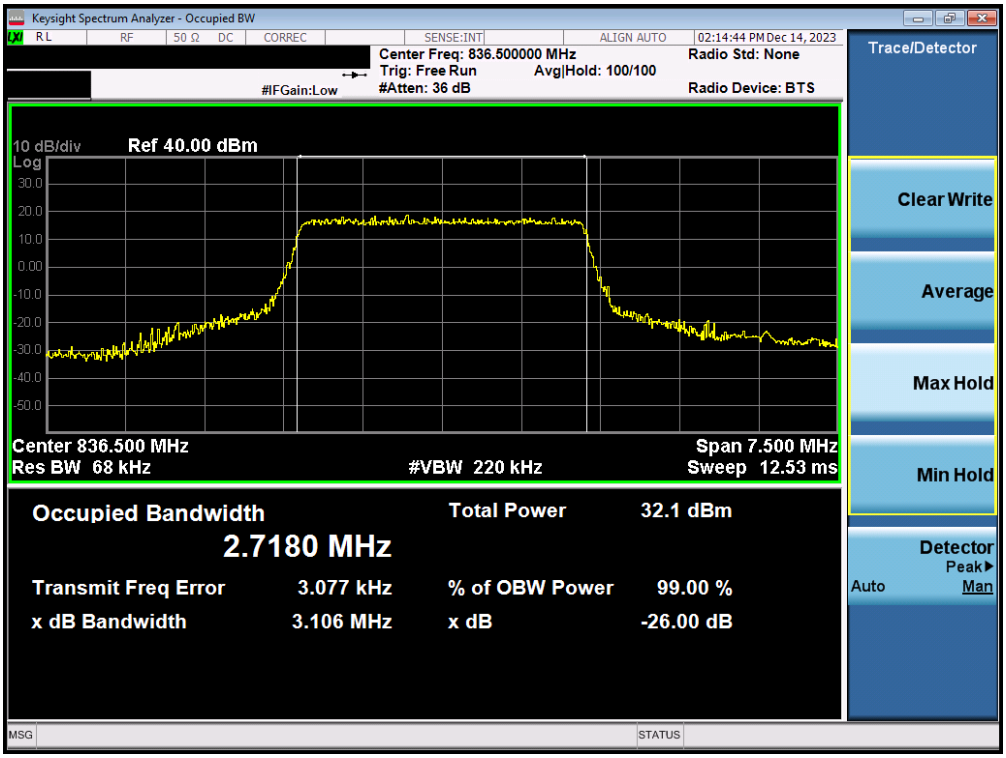


Plot 7-4. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz 16-QAM - Full RB - Ant4)

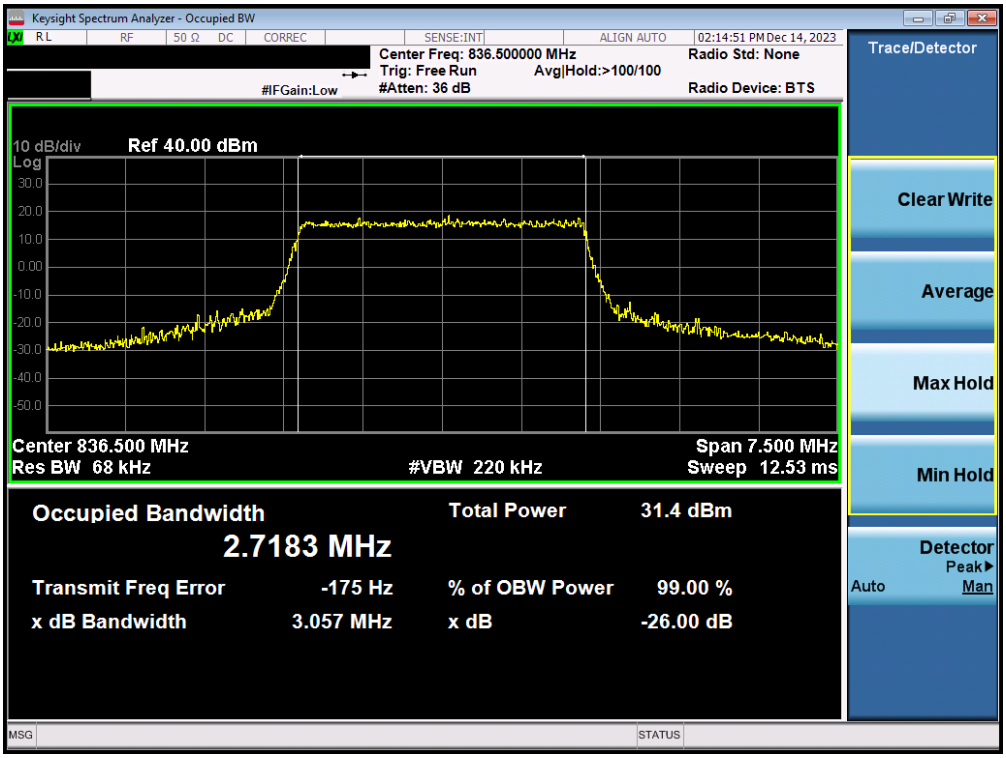
Plot 7-5. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz QPSK - Full RB - Ant4)



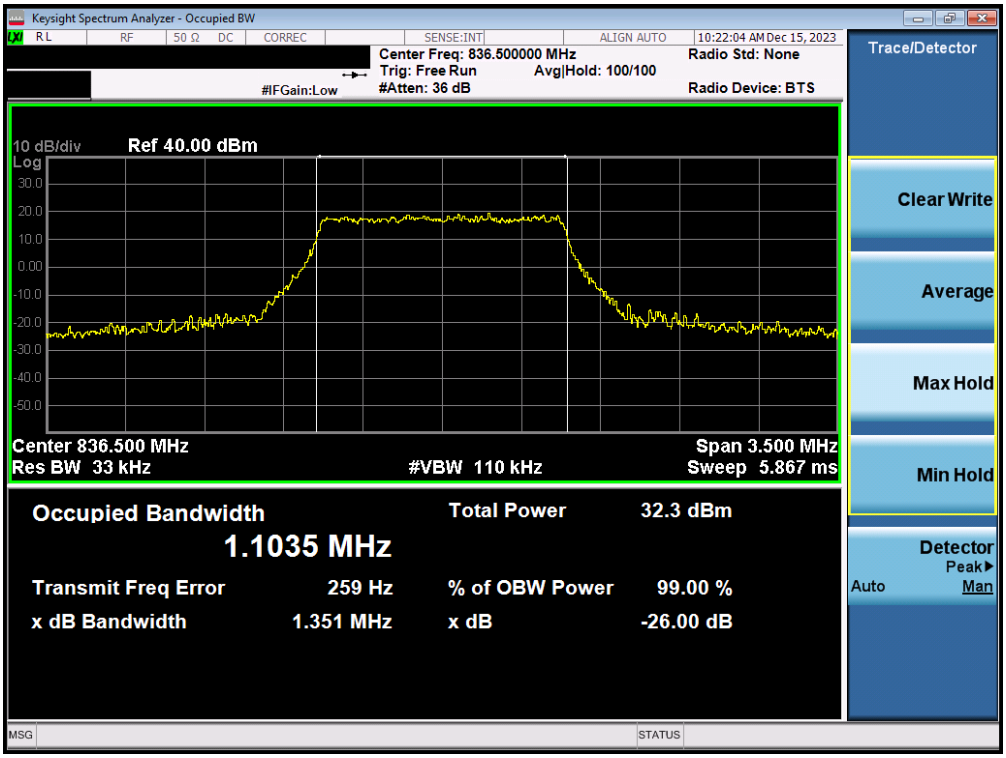
Plot 7-6. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz 16-QAM - Full RB - Ant4)



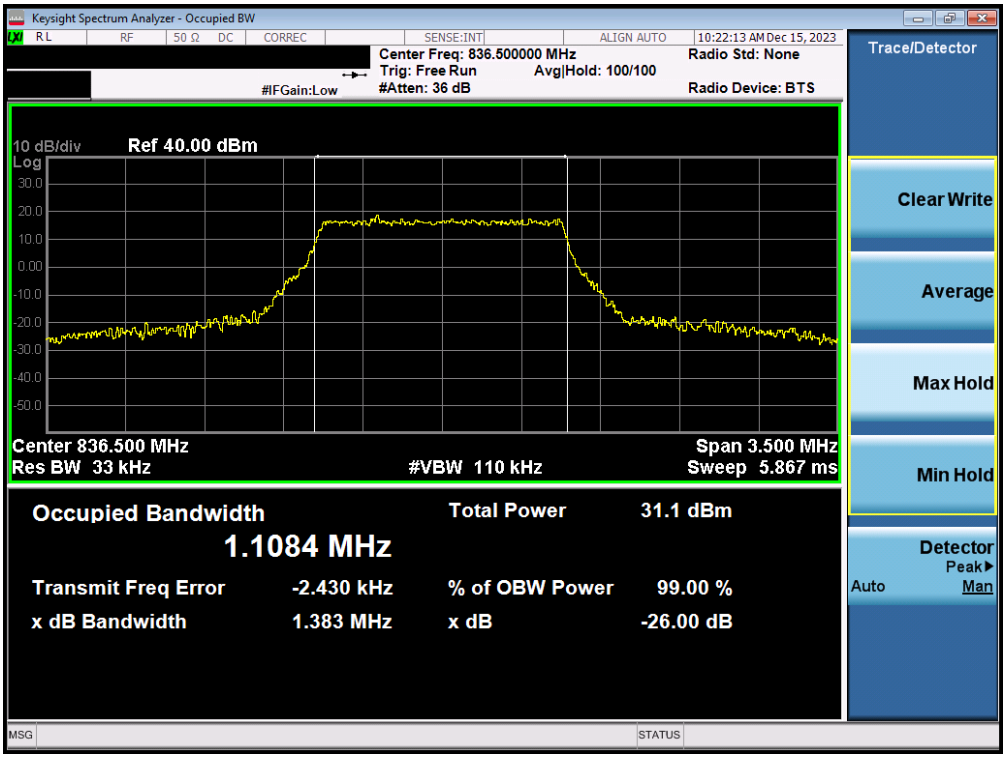
Plot 7-7. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz QPSK - Full RB - Ant4)



Plot 7-8. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz 16-QAM - Full RB - Ant4)



Plot 7-9. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz QPSK - Full RB - Ant4)



Plot 7-10. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz 16-QAM - Full RB - Ant4)

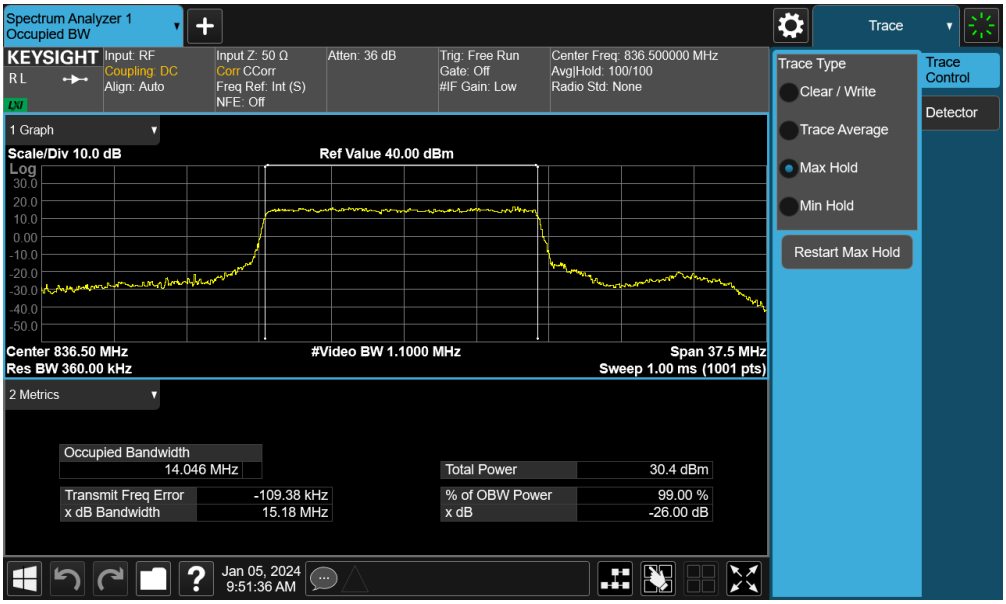
NR Band n26/5 – Ant4

Plot 7-11. Occupied Bandwidth Plot (NR Band n26/5 - 20MHz π/2 BPSK - Full RB - Ant4)

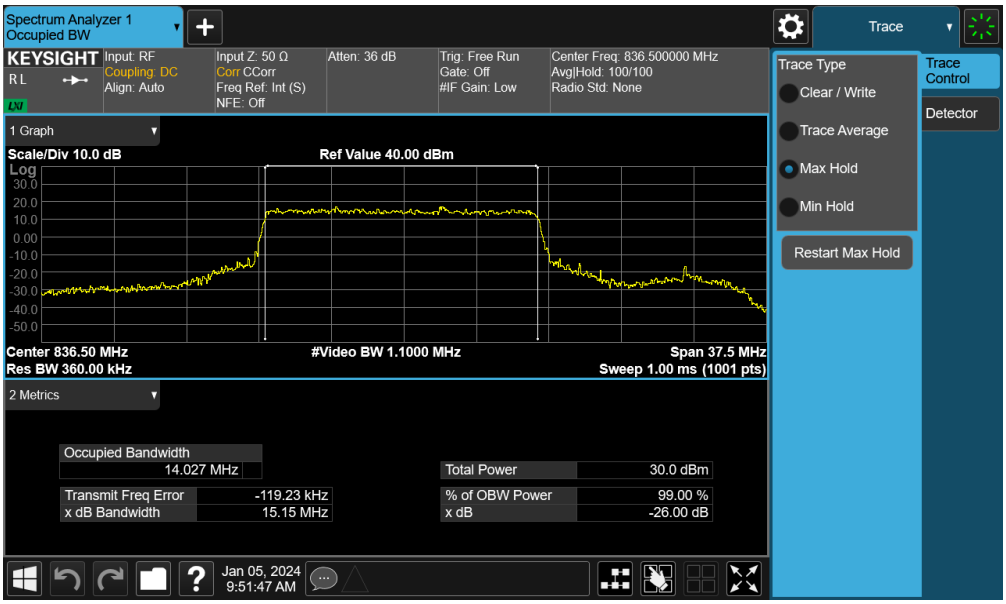
Plot 7-12. Occupied Bandwidth Plot (NR Band n26/5 - 20MHz QPSK - Full RB - Ant4)

Plot 7-13. Occupied Bandwidth Plot (NR Band n26/5 - 20MHz 16-QAM - Full RB - Ant4)

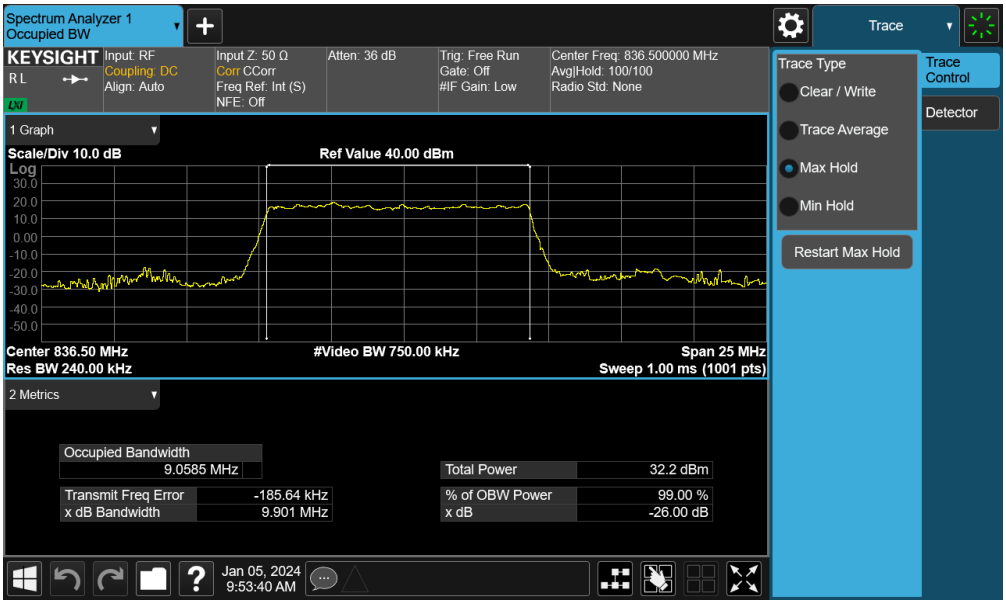
Plot 7-14. Occupied Bandwidth Plot (NR Band n26/5 - 15MHz π/2 BPSK - Full RB - Ant4)



Plot 7-15. Occupied Bandwidth Plot (NR Band n26/5 - 15MHz QPSK - Full RB - Ant4)



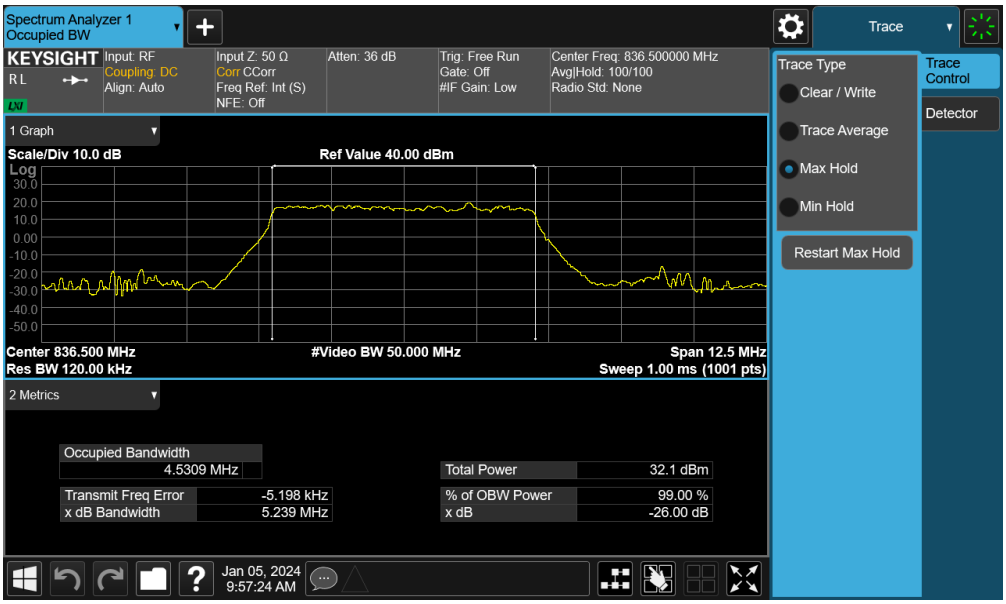
Plot 7-16. Occupied Bandwidth Plot (NR Band n26/5 - 15MHz 16-QAM - Full RB - Ant4)



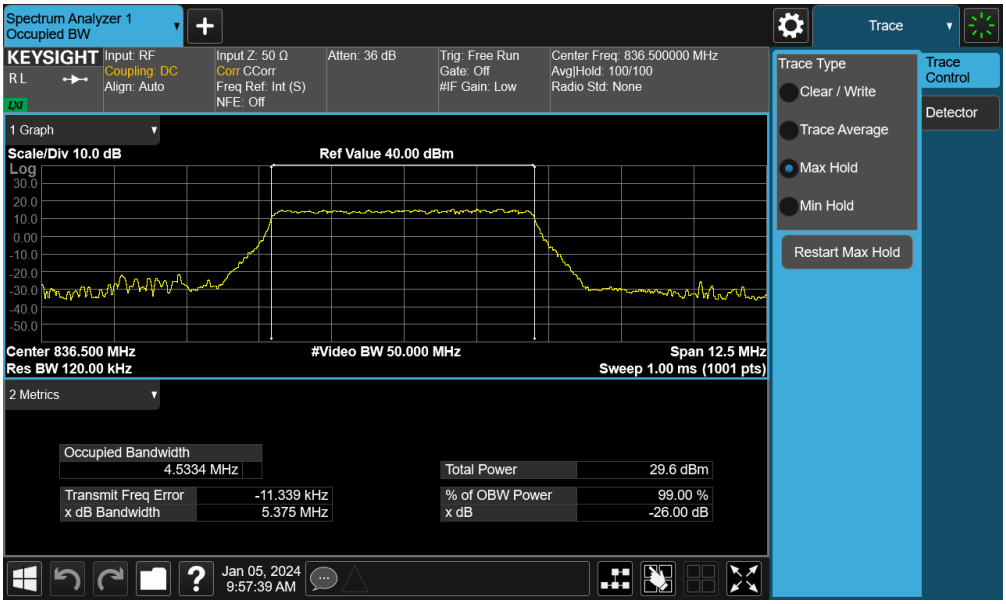
Plot 7-17. Occupied Bandwidth Plot (NR Band n26/5 - 10MHz π/2 BPSK - Full RB - Ant4)

Plot 7-18. Occupied Bandwidth Plot (NR Band n26/5 - 10MHz QPSK - Full RB - Ant4)

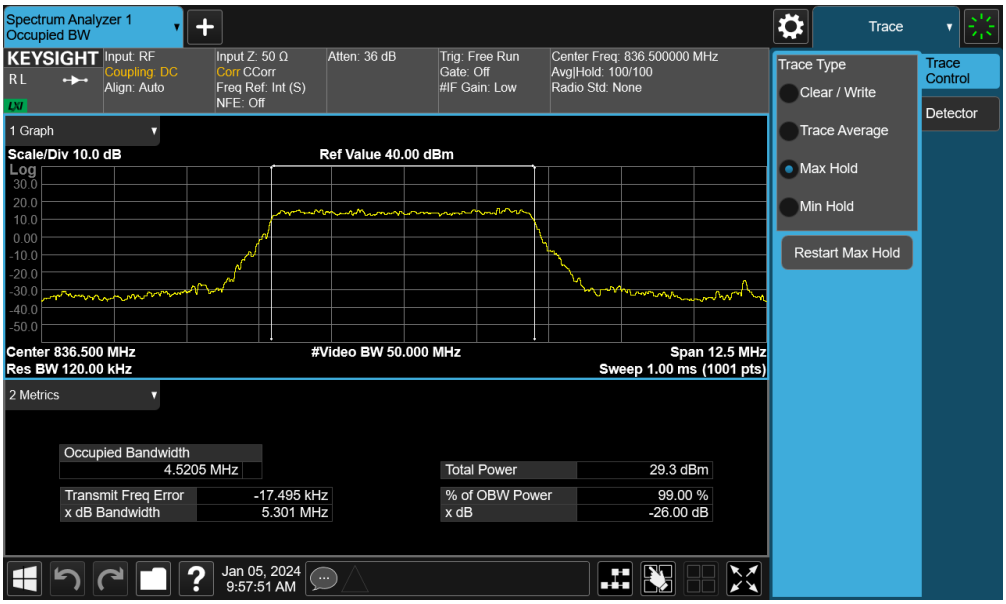
Plot 7-19. Occupied Bandwidth Plot (NR Band n26/5 - 10MHz 16-QAM - Full RB - Ant4)



Plot 7-20. Occupied Bandwidth Plot (NR Band n26/5 - 5MHz π/2 BPSK - Full RB - Ant4)



Plot 7-21. Occupied Bandwidth Plot (NR Band n26/5 - 5MHz QPSK - Full RB - Ant4)



Plot 7-22. Occupied Bandwidth Plot (NR Band n26/5 - 5MHz 16-QAM - Full RB - Ant4)

WCDMA Cell – Ant4

Plot 7-23. Occupied Bandwidth Plot (WCDMA, Ch. 4183 – Ant4)

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 10GHz (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

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

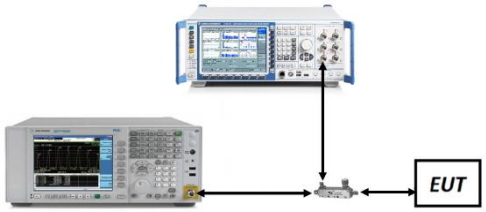


Figure 7-3. Test Instrument & Measurement Setup

Test Notes

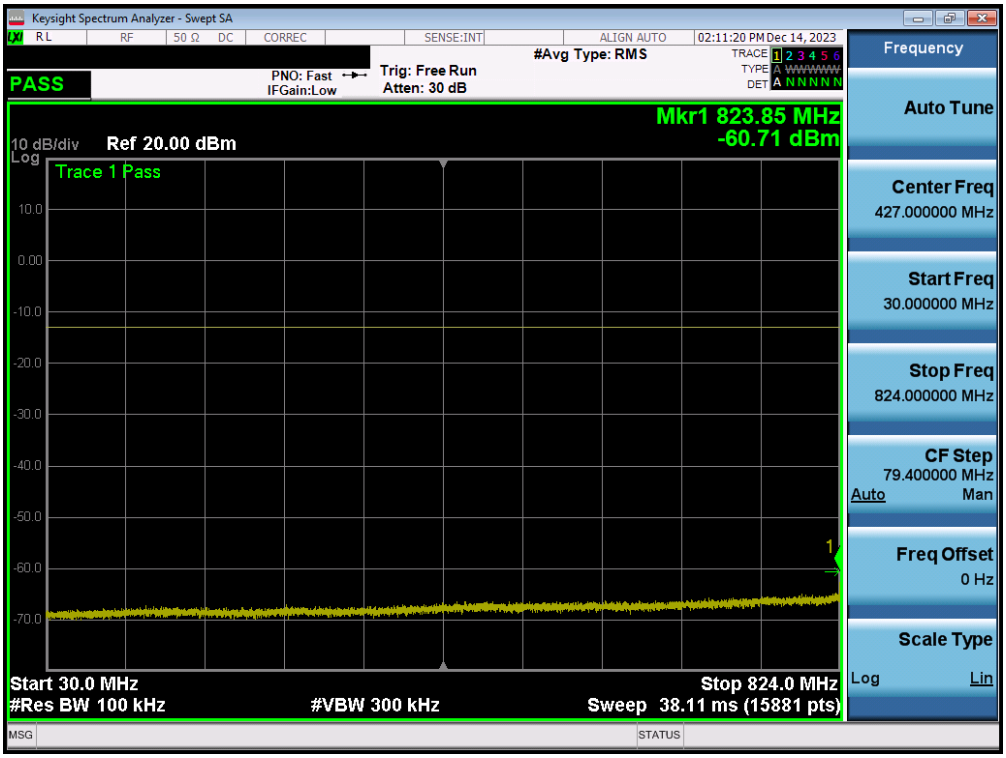
1. Per Part 22, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

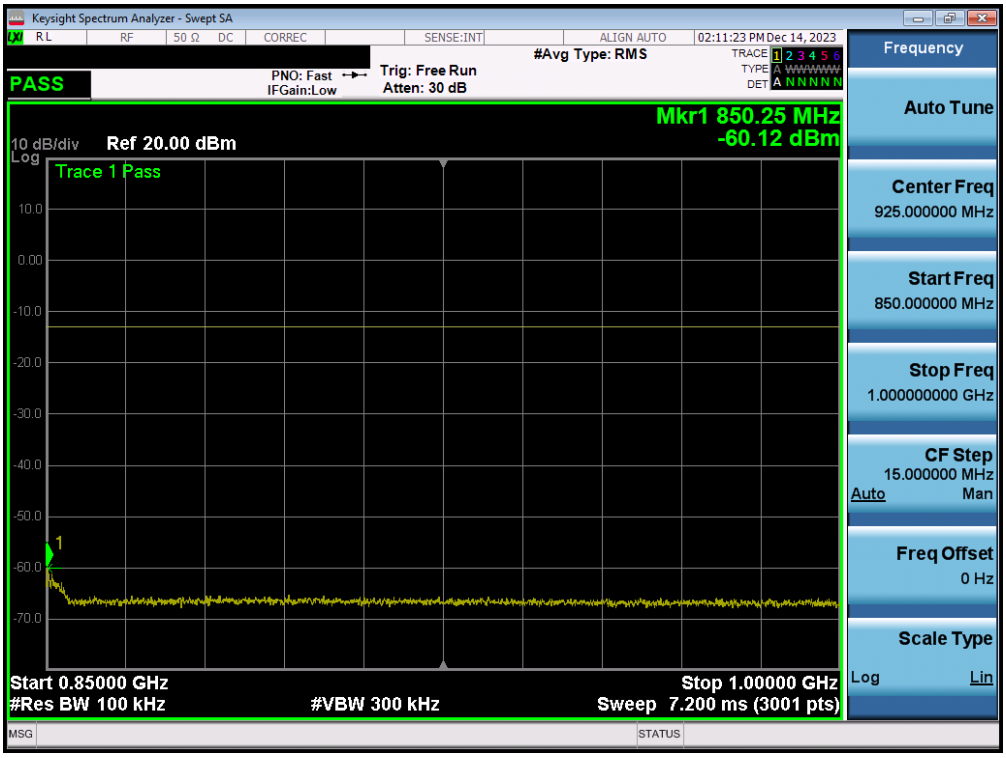
Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
WCDMA-Cell	5MHz	Low	30.0 - 823.0	-32.81	-13.0	-19.81
		Low	849.0 - 1000.0	-65.64	-13.0	-52.64
		Low	1000.0 - 10000.0	-46.70	-13.0	-33.70
		Mid	30.0 - 824.0	-56.93	-13.0	-43.93
		Mid	849.0 - 1000.0	-51.32	-13.0	-38.32
		Mid	1000.0 - 10000.0	-46.34	-13.0	-33.34
		High	30.0 - 824.0	-65.22	-13.0	-52.22
		High	850.0 - 1000.0	-31.34	-13.0	-18.34
		High	1000.0 - 10000.0	-46.67	-13.0	-33.67
LTE-B26-5	10MHz	Low	30.0 - 823.0	-59.43	-13.0	-46.43
		Low	849.0 - 1000.0	-65.35	-13.0	-52.35
		Low	1000.0 - 10000.0	-46.37	-13.0	-33.37
		Mid	30.0 - 824.0	-63.95	-13.0	-50.95
		Mid	849.0 - 1000.0	-64.23	-13.0	-51.23
		Mid	1000.0 - 10000.0	-46.37	-13.0	-33.37
		High	30.0 - 824.0	-60.71	-13.0	-47.71
		High	850.0 - 1000.0	-60.12	-13.0	-47.12
		High	1000.0 - 10000.0	-46.31	-13.0	-33.30
ULCA LTE-B5	10+10MHz	Low	30.0 - 824.0	-53.92	-13.0	-40.92
		Low	849.0 - 1000.0	-61.30	-13.0	-48.30
		Low	1000.0 - 10000.0	-46.92	-13.0	-33.92
		Mid	30.0 - 824.0	-57.05	-13.0	-44.05
		Mid	849.0 - 1000.0	-58.24	-13.0	-45.24
		Mid	1000.0 - 10000.0	-46.14	-13.0	-33.14
		High	30.0 - 824.0	-60.64	-13.0	-47.64
		High	850.0 - 1000.0	-54.95	-13.0	-41.95
		High	1000.0 - 10000.0	-46.11	-13.0	-33.11
NR-n26-5	20MHz	Low	30.0 - 824.0	-52.13	-13.0	-39.12
		Low	849.0 - 1000.0	-61.86	-13.0	-48.86
		Low	1000.0 - 10000.0	-43.21	-13.0	-30.21
		Mid	30.0 - 824.0	-53.81	-13.0	-40.81
		Mid	849.0 - 1000.0	-61.41	-13.0	-48.41
		Mid	1000.0 - 10000.0	-43.05	-13.0	-30.05
		High	30.0 - 824.0	-56.77	-13.0	-43.77
		High	849.0 - 1000.0	-61.72	-13.0	-48.72
		High	1000.0 - 10000.0	-41.76	-13.0	-28.76

Table 7-4. Conducted Spurious Emission Test Results

LTE Band 26/5 – Ant4



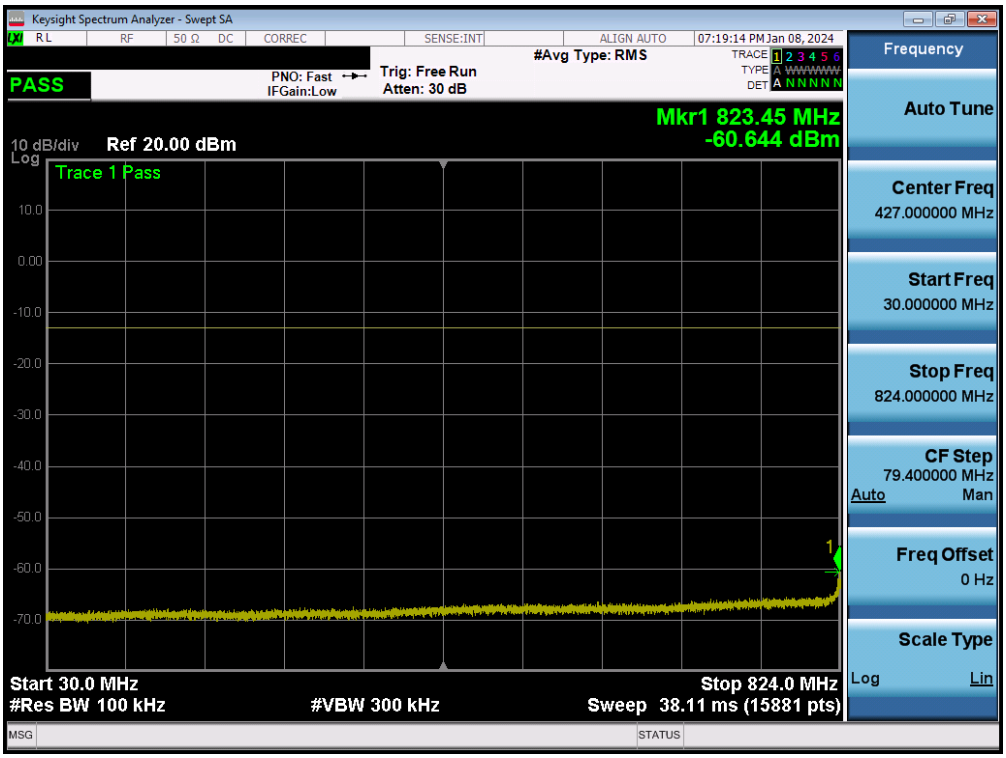
Plot 7-24. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - High Channel – Ant4)



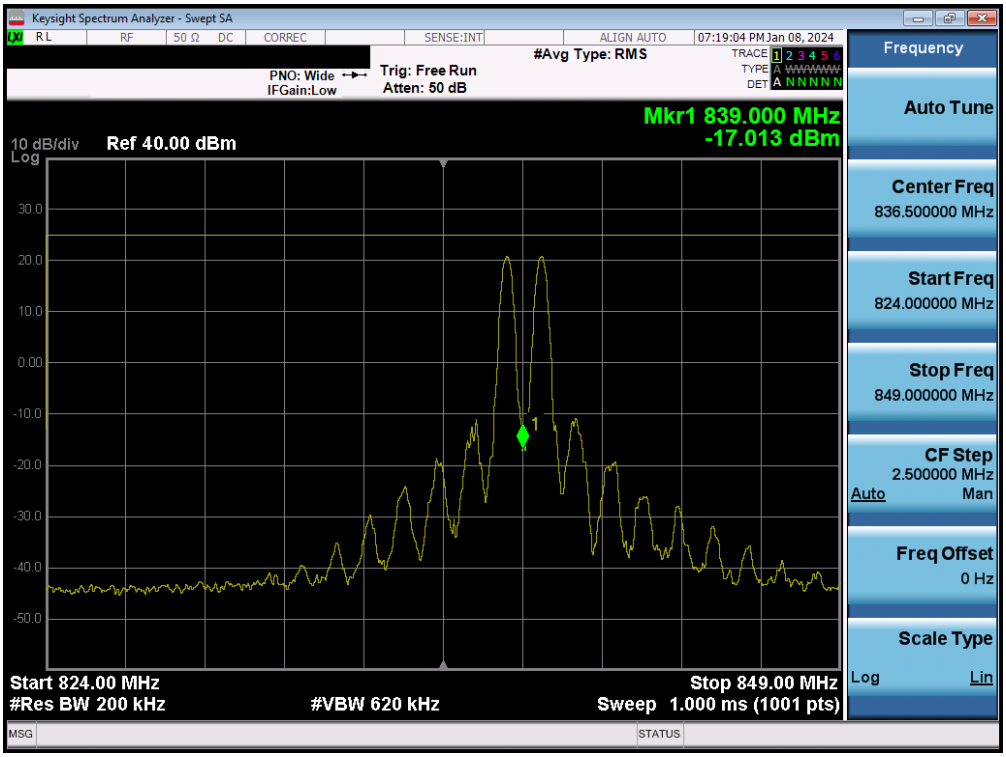
Plot 7-25. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - High Channel – Ant4)

Plot 7-26. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - High Channel – Ant4)

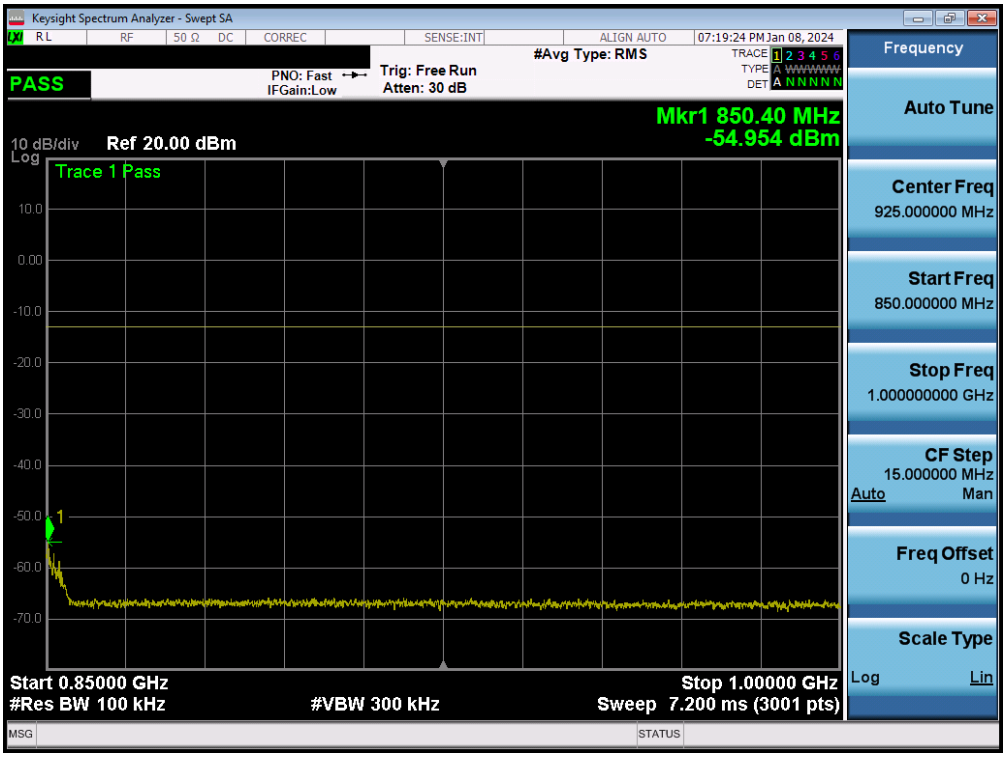
ULCA LTE Band 5 Ant4



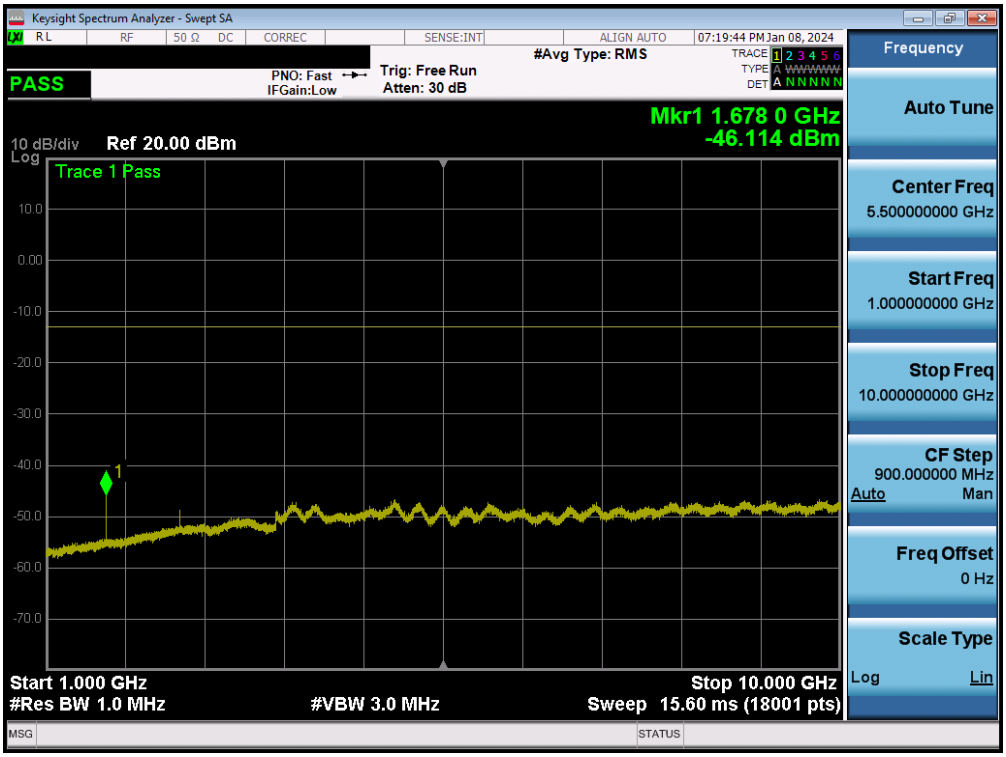
Plot 7-27. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/0 SCC 1/49 - High Channel – Ant4)



Plot 7-28. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/0 SCC 1/49 - High Channel – Ant4)

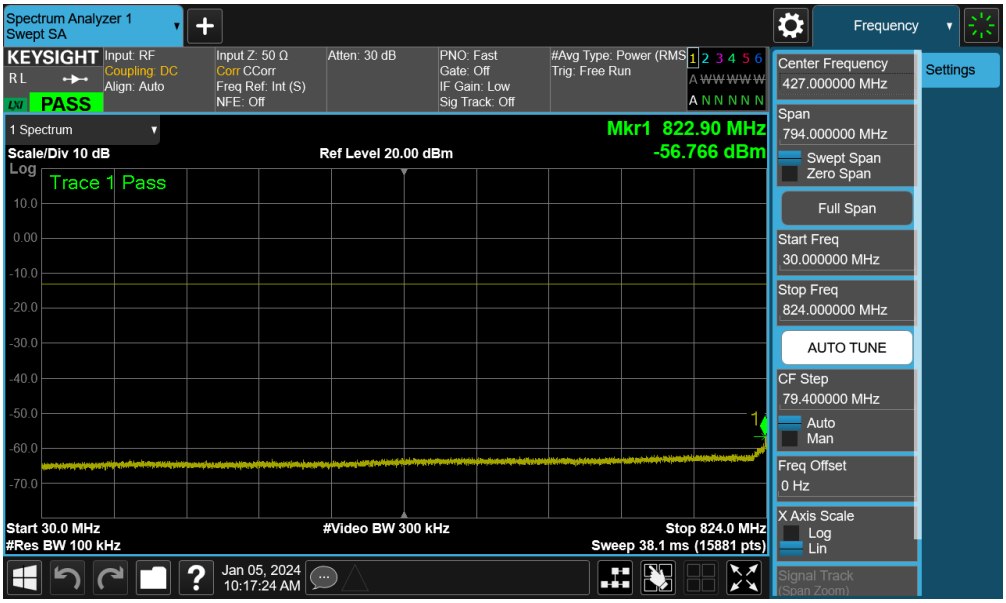


Plot 7-29. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/0 SCC 1/49 - High Channel – Ant4)

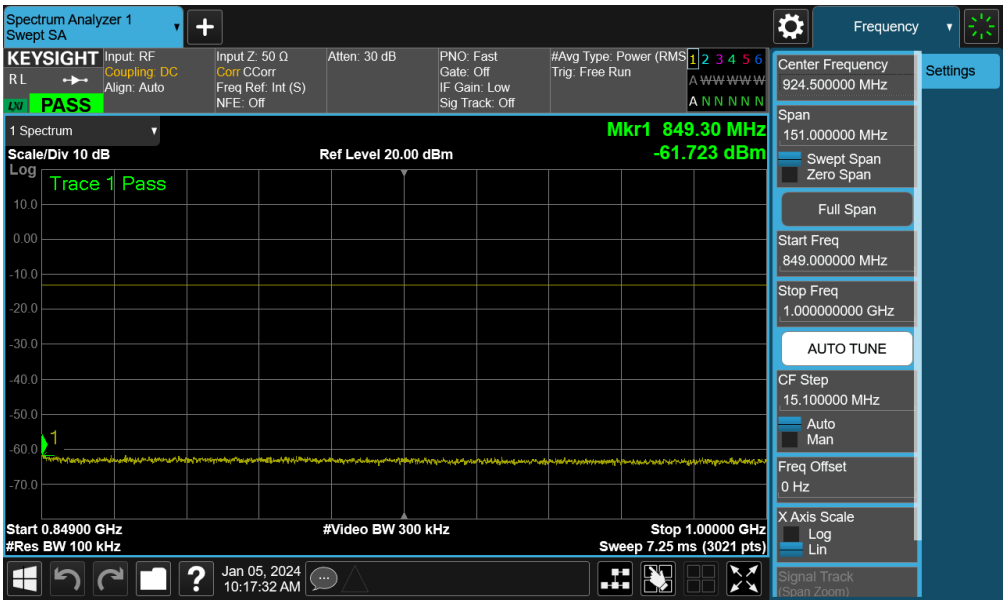


Plot 7-30. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/0 SCC 1/49 - High Channel – Ant4)

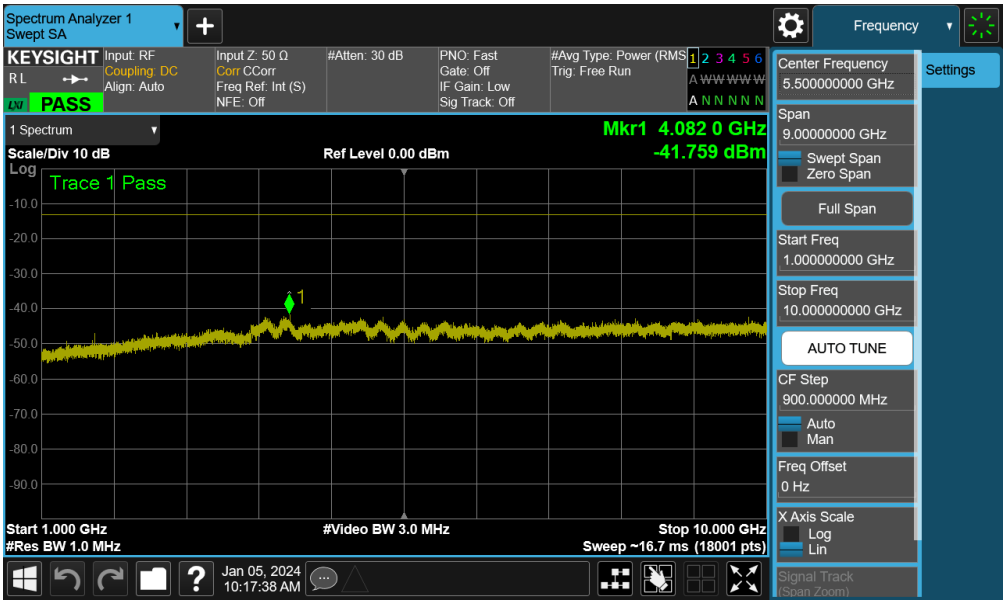
NR Band n26/5 – Ant4



Plot 7-31. Conducted Spurious Plot (NR Band n26/5 - 20.0MHz - 1 RB - High Channel - Ant4)

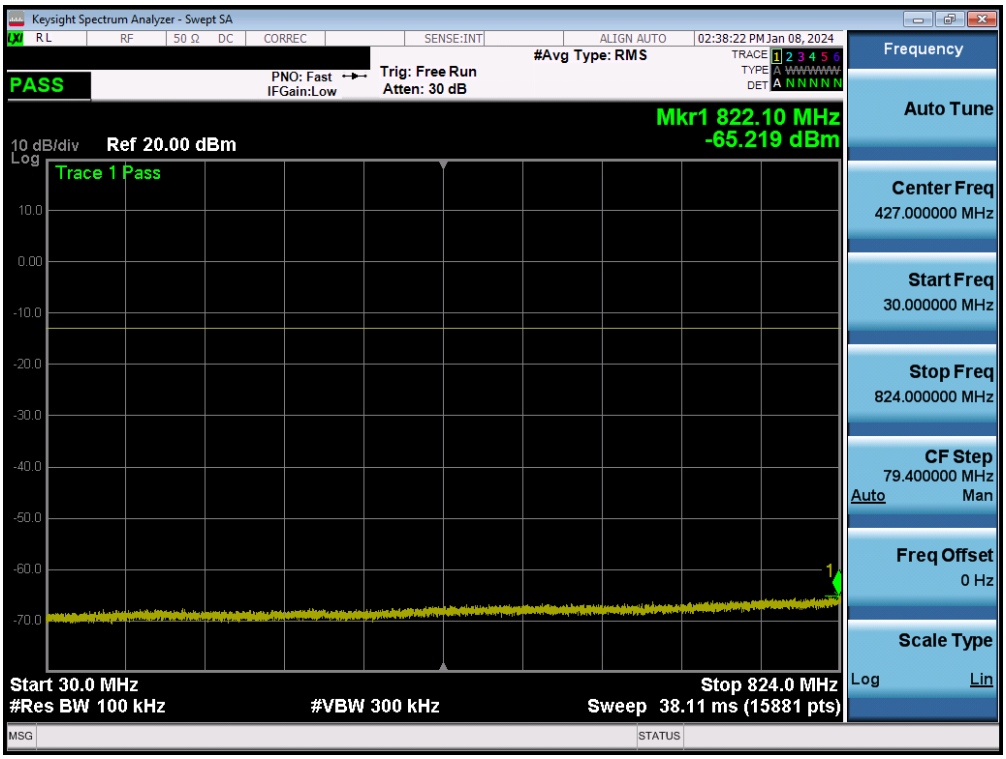


Plot 7-32. Conducted Spurious Plot (NR Band n26/5 - 20.0MHz - 1 RB - High Channel - Ant4)

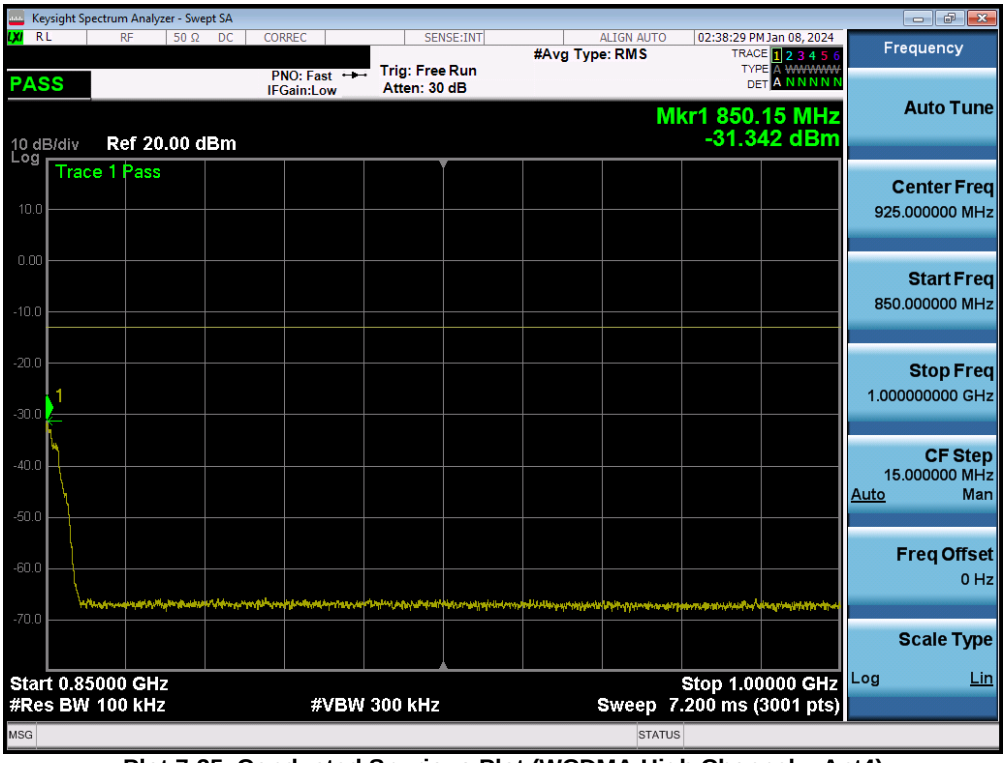


Plot 7-33. Conducted Spurious Plot (NR Band n26/5 - 20.0MHz - 1 RB - High Channel - Ant4)

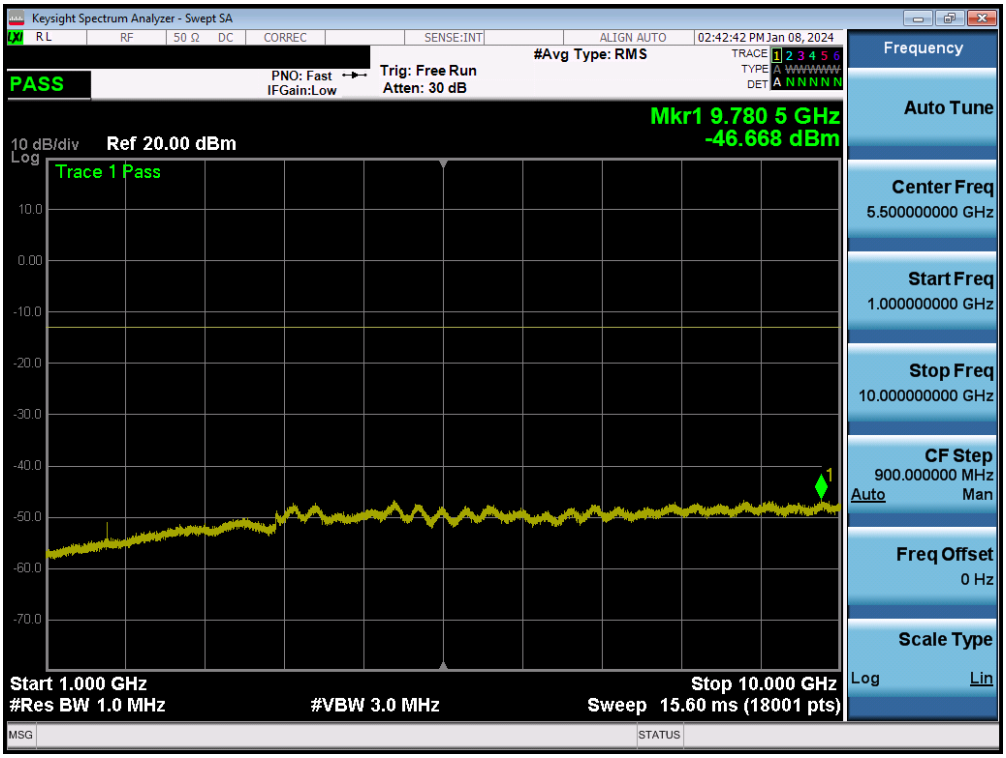
WCDMA Cell – Ant4



Plot 7-34. Conducted Spurious Plot (WCDMA High Channel – Ant4)



Plot 7-35. Conducted Spurious Plot (WCDMA High Channel – Ant4)



Plot 7-36. Conducted Spurious Plot (WCDMA High Channel – Ant4)

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.

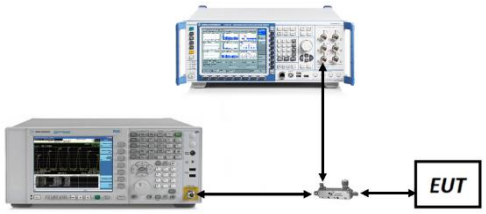


Figure 7-4. Test Instrument & Measurement Setup

Test Notes

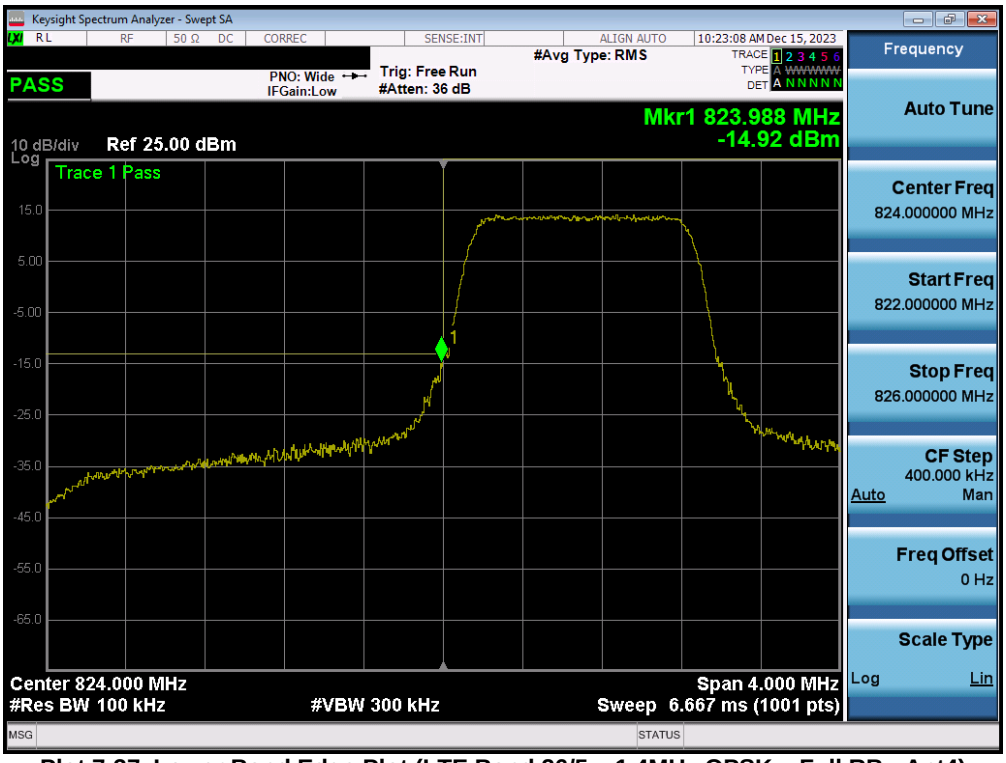
1. Per 22.917(b), in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission 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.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

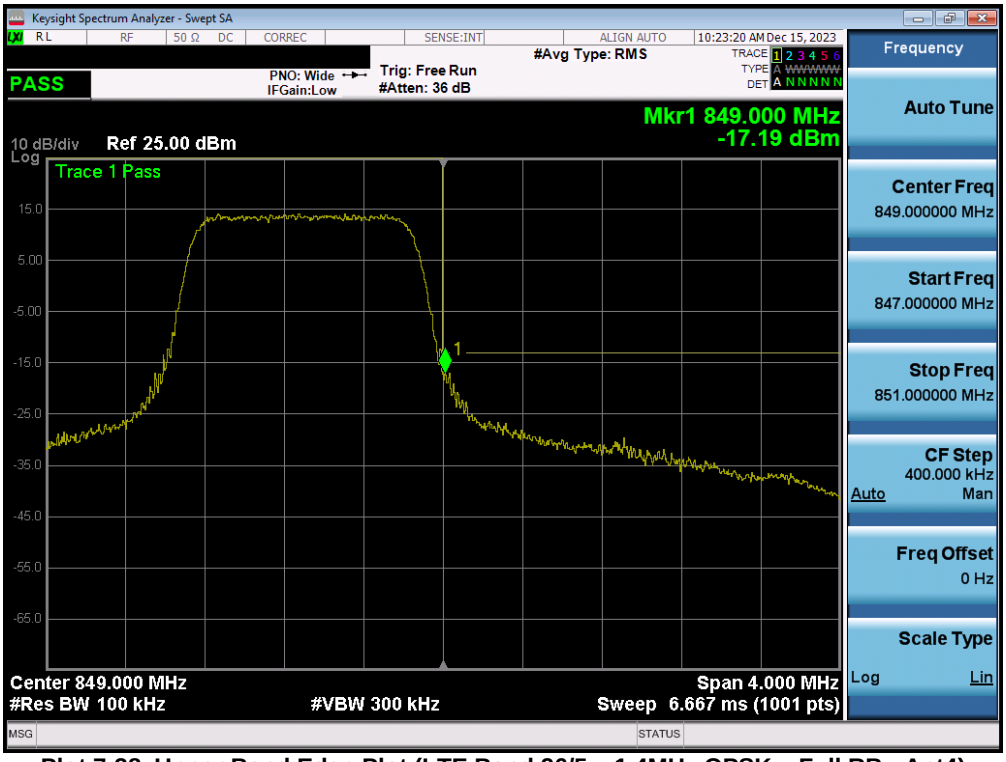
Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
WCDMA-Cell	5MHz	Low	Band Edge	-22.01	-13	-9.01
		High	Band Edge	-22.03	-13	-9.03
LTE-B26-5	15 MHz	Low	Band Edge	-28.76	-13	-15.76
		High	Band Edge	-28.92	-13	-15.92
	10 MHz	Low	Band Edge	-29.44	-13	-16.44
		High	Band Edge	-29.56	-13	-16.56
	5 MHz	Low	Band Edge	-23.04	-13	-10.04
		High	Band Edge	-21.60	-13	-8.60
	3 MHz	Low	Band Edge	-17.72	-13	-4.72
		High	Band Edge	-17.55	-13	-4.55
	1.4 MHz	Low	Band Edge	-14.92	-13	-1.92
		High	Band Edge	-17.19	-13	-4.19
NR-n26-5	20 MHz	Low	Band Edge	-28.62	-13	-15.62
		High	Band Edge	-29.26	-13	-16.26
	15 MHz	Low	Band Edge	-25.54	-13	-12.54
		High	Band Edge	-28.93	-13	-15.93
	10 MHz	Low	Band Edge	-28.25	-13	-15.25
		High	Band Edge	-23.54	-13	-10.54
	5 MHz	Low	Band Edge	-21.84	-13	-8.84
		High	Band Edge	-22.83	-13	-9.83
ULCA LTE-B5	10+10 MHz	Low	Band Edge	-30.07	-13	-17.07
		High	Band Edge	-32.32	-13	-19.32

Table 7-5. Conducted Band Edge Test Results

LTE Band 26/5 – Ant4

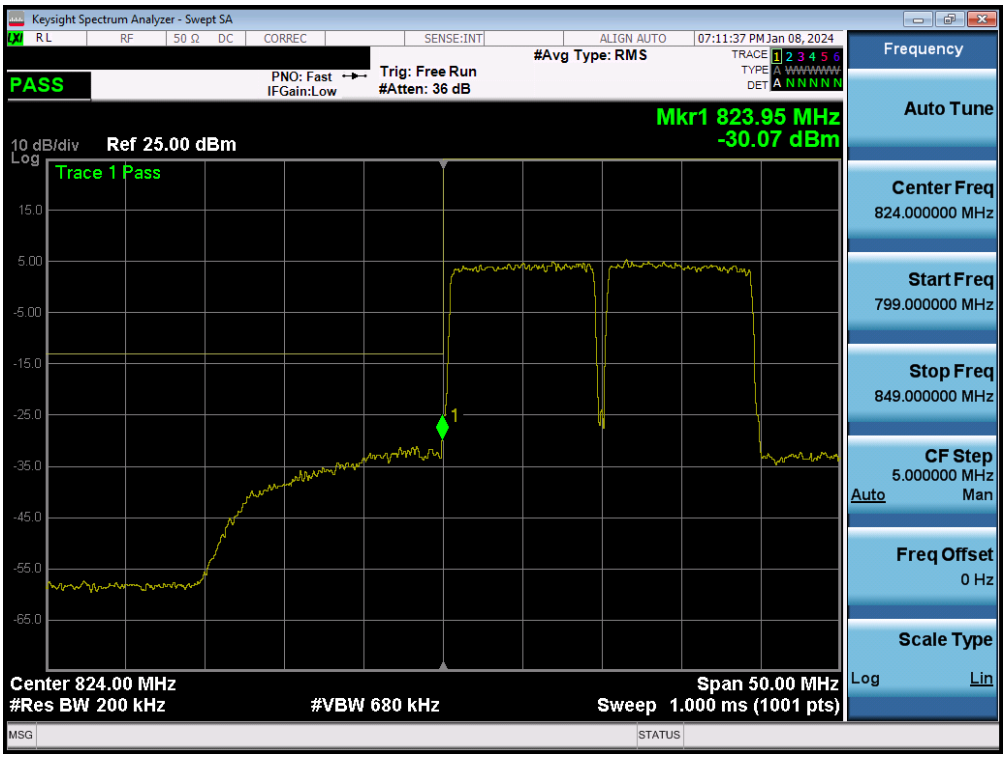


Plot 7-37. Lower Band Edge Plot (LTE Band 26/5 – 1.4MHz QPSK – Full RB - Ant4)

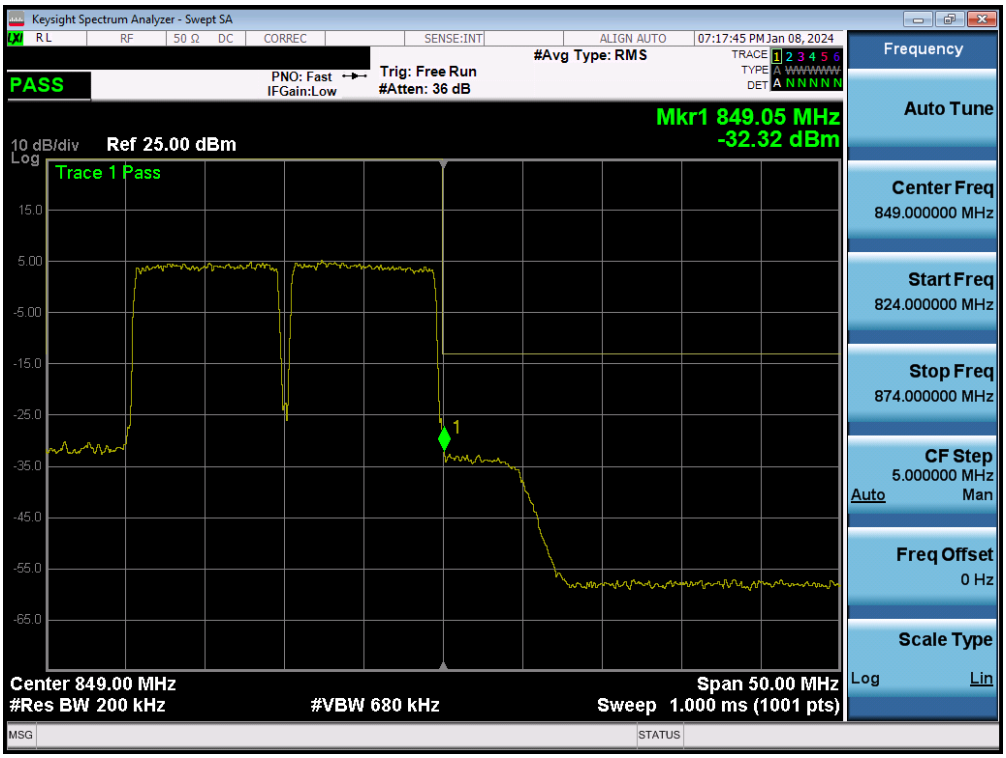


Plot 7-38. Upper Band Edge Plot (LTE Band 26/5 – 1.4MHz QPSK – Full RB - Ant4)

ULCA LTE Band 5 Ant4

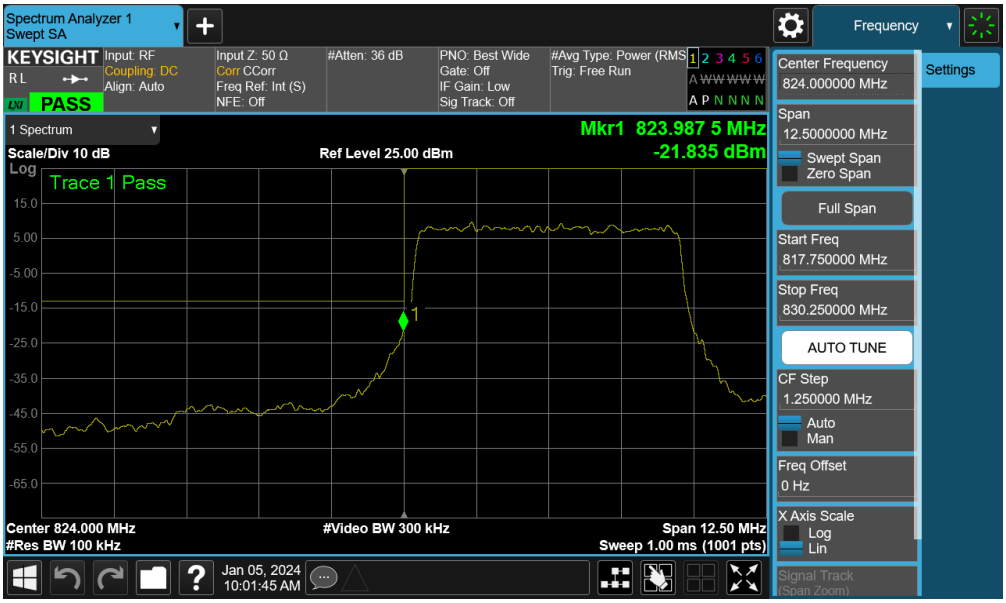


Plot 7-39. Lower Band Edge Plot (ULCA LTE Band 5 – 10+10MHz QPSK – Full RB – Ant4)



Plot 7-40. Upper Band Edge Plot (ULCA LTE Band 5 – 10+10MHz QPSK – Full RB – Ant4)

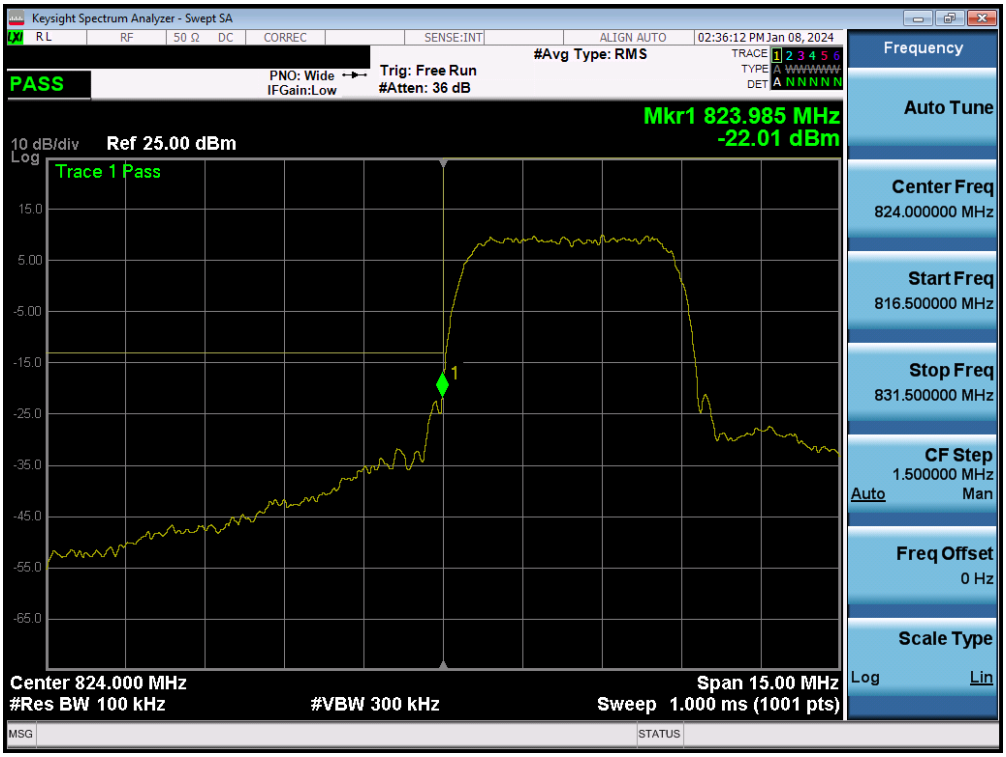
NR Band n26/5 – Ant4



Plot 7-41. Lower Band Edge Plot (NR Band n26/5 – 5.0MHz - Full RB - Ant4)

Plot 7-42. Upper Band Edge Plot (NR Band n26/5 – 5.0MHz - Full RB - Ant4)

WCDMA Cell – Ant4



Plot 7-43. Lower Band Edge Plot (WCDMA Cell – Ch. 4132 – Ant4)

Plot 7-44. Upper Band Edge Plot (WCDMA Cell – Ch. 4233 – Ant4)

7.6 Radiated Power (ERP)

Test Overview

Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI C63.26-2015 with the EUT transmitting into an integral antenna. Measurements are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

ANSI C63.26-2015 – Section 5.2.4.4

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation. For signals with burst transmission, the signal analyzer's "time domain power" measurement capability is used.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto". Trigger is set to enable triggering only on full power bursts with the sweep time set less than or equal to the transmission burst duration.
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation. For signals with burst transmission, the "gating" function was enabled to ensure that measurements are performed during times in which the transmitter is operating at its maximum power.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize.

Test Setup

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

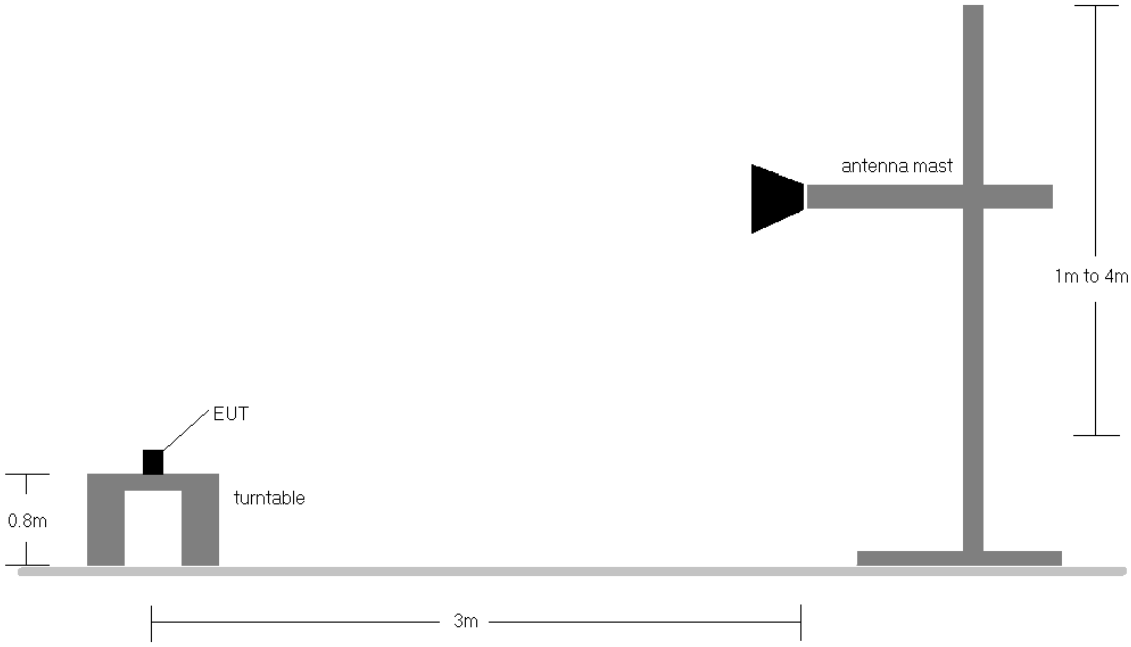


Figure 7-5. Radiated Test Setup < 1GHz

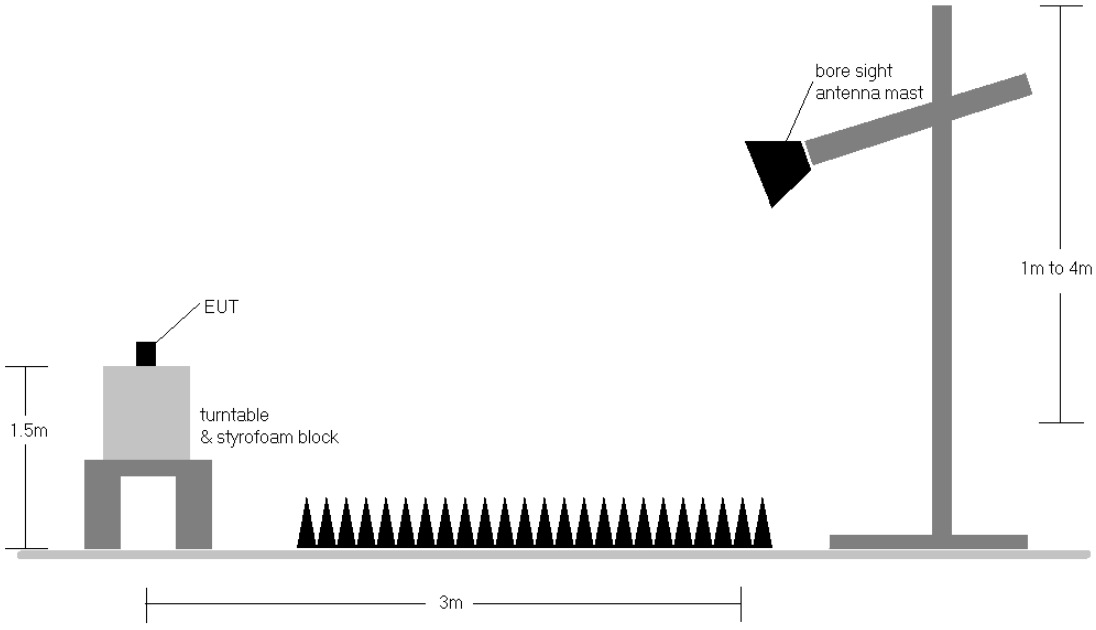


Figure 7-6. Radiated Test Setup > 1GHz

Test Notes

1) This device employs UMTS technology with WCDMA (AMR/RMC) and HSDPA capabilities. The EUT was tested under all configurations and the highest powers are reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to “1”.

2) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst-case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

3) This unit was tested with its standard battery.

4) For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
15MHz (Band 26 only)	QPSK	831.50	H	207	121	1.46	1 / 37	19.69	19.00	0.079	38.45	-19.45
	QPSK	836.50	H	206	118	1.54	1 / 74	20.01	**19.40**	0.087	38.45	-19.05
	QPSK	841.50	H	204	122	1.62	1 / 37	19.83	19.30	0.085	38.45	-19.15
	16-QAM	836.50	H	206	118	1.54	1 / 74	19.09	18.48	0.071	38.45	-19.97
10 MHz	QPSK	829.00	H	207	121	1.42	1 / 25	19.73	19.00	0.079	38.45	-19.45
	QPSK	836.50	H	206	118	1.54	1 / 0	19.78	**19.17**	0.083	38.45	-19.28
	QPSK	844.00	H	204	122	1.66	1 / 49	19.59	19.10	0.081	38.45	-19.35
	16-QAM	844.00	H	204	122	1.66	1 / 49	18.86	18.37	0.069	38.45	-20.08
5 MHz	QPSK	826.50	H	207	121	1.38	1 / 12	19.61	18.84	0.077	38.45	-19.61
	QPSK	836.50	H	206	118	1.54	1 / 12	19.75	19.14	0.082	38.45	-19.31
	QPSK	846.50	H	204	122	1.70	1 / 12	19.67	**19.22**	0.084	38.45	-19.23
	16-QAM	846.50	H	204	122	1.70	1 / 12	18.72	18.27	0.067	38.45	-20.18
3 MHz	QPSK	825.50	H	207	121	1.36	1 / 7	19.68	18.89	0.077	38.45	-19.56
	QPSK	836.50	H	206	118	1.54	1 / 7	19.73	19.12	0.082	38.45	-19.33
	QPSK	847.50	H	204	122	1.72	1 / 7	19.58	**19.15**	0.082	38.45	-19.30
	16-QAM	847.50	H	204	122	1.72	1 / 7	18.72	18.29	0.068	38.45	-20.16
1.4 MHz	QPSK	824.70	H	207	121	1.35	1 / 0	19.65	18.85	0.077	38.45	-19.60
	QPSK	836.50	H	206	118	1.54	1 / 3	19.77	**19.16**	0.082	38.45	-19.29
	QPSK	848.30	H	204	122	1.73	1 / 0	19.42	19.00	0.080	38.45	-19.45
	16-QAM	848.30	H	204	122	1.73	1 / 0	18.75	18.33	0.068	38.45	-20.12

Table 7-6. ERP Data (LTE Band 26/5 – Ant4)

Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
20 MHz	π/2 BPSK	834.00	H	208	289	1.50	1 / 104	19.19	18.54	0.071	38.45	-19.91
	π/2 BPSK	836.50	H	202	307	1.54	1 / 53	18.64	18.03	0.064	38.45	-20.42
	π/2 BPSK	839.00	H	208	294	1.58	1 / 53	19.61	19.04	0.080	38.45	-19.41
	QPSK	834.00	H	208	289	1.50	1 / 104	19.19	18.54	0.071	38.45	-19.91
	QPSK	836.50	H	202	307	1.54	1 / 53	18.65	18.04	0.064	38.45	-20.41
	QPSK	839.00	H	208	294	1.58	1 / 53	19.79	**19.22**	0.084	38.45	-19.23
	16-QAM	839.00	H	208	294	1.58	1 / 53	18.52	17.95	0.062	38.45	-20.50
15 MHz	π/2 BPSK	831.50	H	208	289	1.46	1 / 1	19.23	18.55	0.072	38.45	-19.90
	π/2 BPSK	836.50	H	202	307	1.54	1 / 39	18.73	18.13	0.065	38.45	-20.33
	π/2 BPSK	841.50	H	208	294	1.62	1 / 1	19.63	19.11	0.081	38.45	-19.34
	QPSK	831.50	H	208	289	1.46	1 / 1	19.25	18.56	0.072	38.45	-19.89
	QPSK	836.50	H	202	307	1.54	1 / 39	18.72	18.11	0.065	38.45	-20.34
	QPSK	841.50	H	208	294	1.62	1 / 1	19.76	**19.23**	0.084	38.45	-19.22
	16-QAM	841.50	H	208	294	1.62	1 / 1	18.67	18.14	0.065	38.45	-20.31
10 MHz	π/2 BPSK	829.00	H	208	289	1.42	1 / 1	19.18	18.45	0.070	38.45	-20.00
	π/2 BPSK	836.50	H	202	307	1.54	1 / 50	18.55	17.94	0.062	38.45	-20.51
	π/2 BPSK	844.00	H	208	294	1.66	1 / 26	19.43	18.95	0.078	38.45	-19.50
	QPSK	829.00	H	208	289	1.42	1 / 1	19.19	18.46	0.070	38.45	-19.99
	QPSK	836.50	H	202	307	1.54	1 / 50	18.56	17.95	0.062	38.45	-20.50
	QPSK	844.00	H	208	294	1.66	1 / 26	19.66	**19.18**	0.083	38.45	-19.27
	16-QAM	844.00	H	208	294	1.66	1 / 26	18.40	17.92	0.062	38.45	-20.54
5 MHz	π/2 BPSK	829.00	H	208	289	1.38	1 / 1	19.23	18.46	0.070	38.45	-19.99
	π/2 BPSK	836.50	H	202	307	1.54	1 / 23	18.59	17.98	0.063	38.45	-20.47
	π/2 BPSK	844.00	H	208	294	1.70	1 / 23	19.39	18.95	0.078	38.45	-19.50
	QPSK	829.00	H	208	289	1.38	1 / 1	19.33	18.56	0.072	38.45	-19.89
	QPSK	836.50	H	202	307	1.54	1 / 23	18.53	17.92	0.062	38.45	-20.53
	QPSK	844.00	H	208	294	1.70	1 / 23	19.67	**19.22**	0.084	38.45	-19.23
	16-QAM	844.00	H	208	294	1.70	1 / 23	18.42	17.97	0.063	38.45	-20.48
20 MHz	QPSK (CP-OFDM)	839.00	H	202	290	1.58	1 / 53	17.95	**17.38**	0.055	38.45	-21.07

Table 7-7. ERP Data (NR Band n26/5 – Ant4)

Frequency [MHz]	Mode	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
826.40	WCDMA850	H	120	167	16.77	1.38	16.00	0.040	38.45	-22.45
836.60	WCDMA850	H	120	111	17.61	1.54	17.00	0.050	38.45	-21.45
846.60	WCDMA850	H	126	186	18.80	1.71	**18.36**	**0.068**	38.45	-20.09

Table 7-8. ERP Data (WCDMA Cell – Ant4)

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 integral 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.

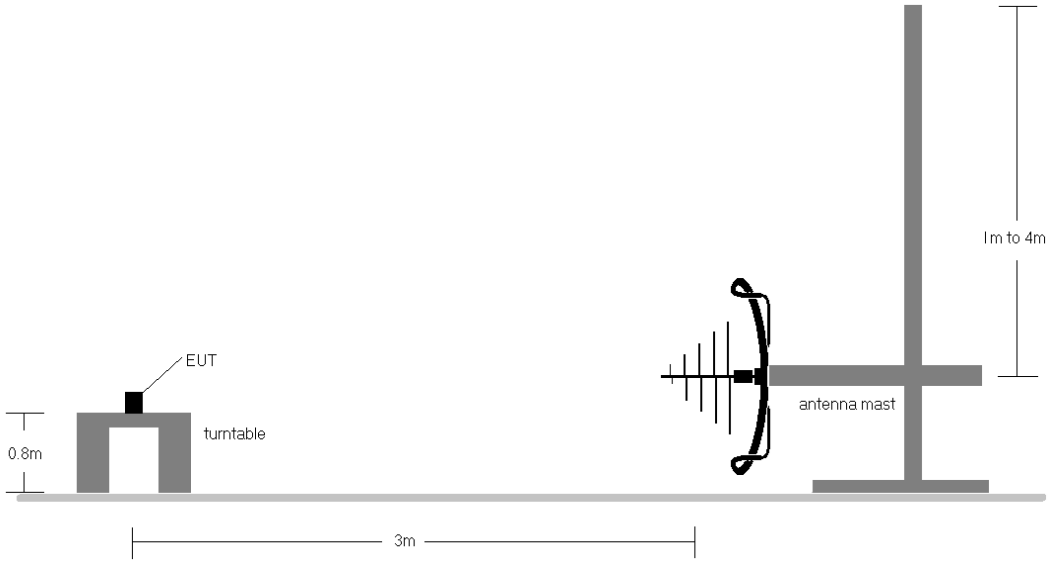


Figure 7-7. Test Instrument & Measurement Setup < 1GHz

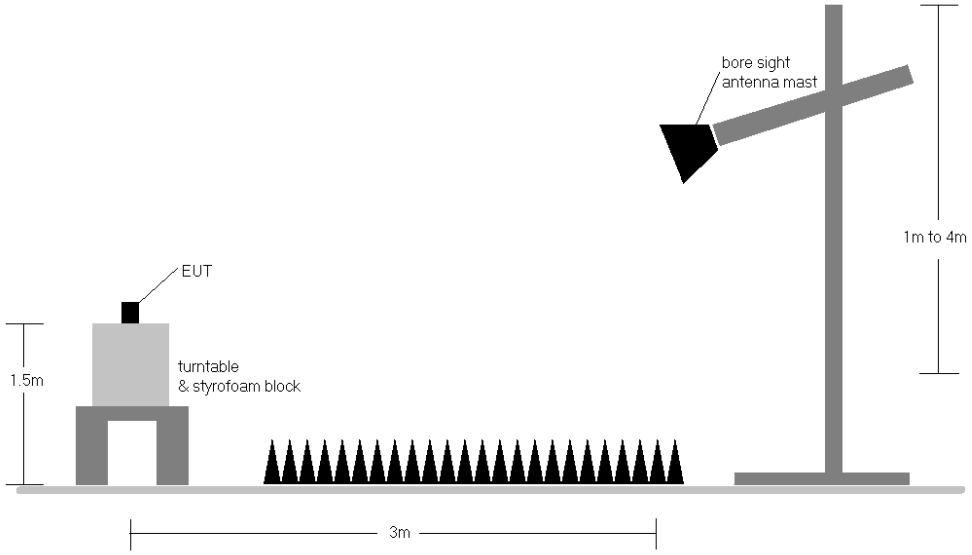


Figure 7-8. Test Instrument & Measurement Setup > 1GHz

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 device employs UMTS technology with WCDMA (AMR/RMC) and HSDPA capabilities. The EUT was tested under all configurations and the highest powers are reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to “1”.

3) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst-case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

4) This unit was tested with its standard battery.

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

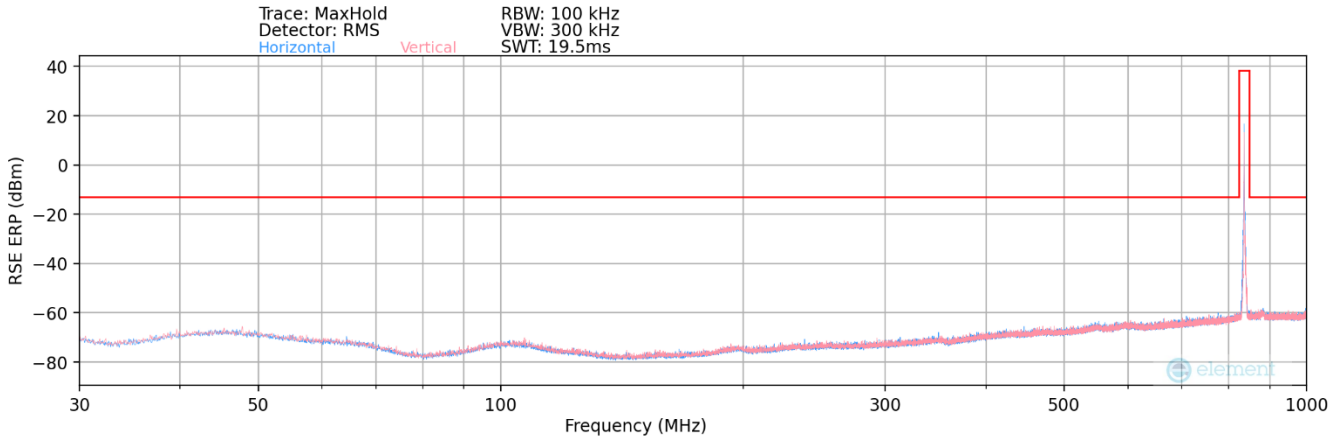
6) Emissions below 18GHz were measured at a 3-meter test distance while emissions above 18GHz were measured at a 1-meter test distance with the application of a distance correction factor.

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

8) ULCA spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device.

9) For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

LTE Band 26/5 – Ant4

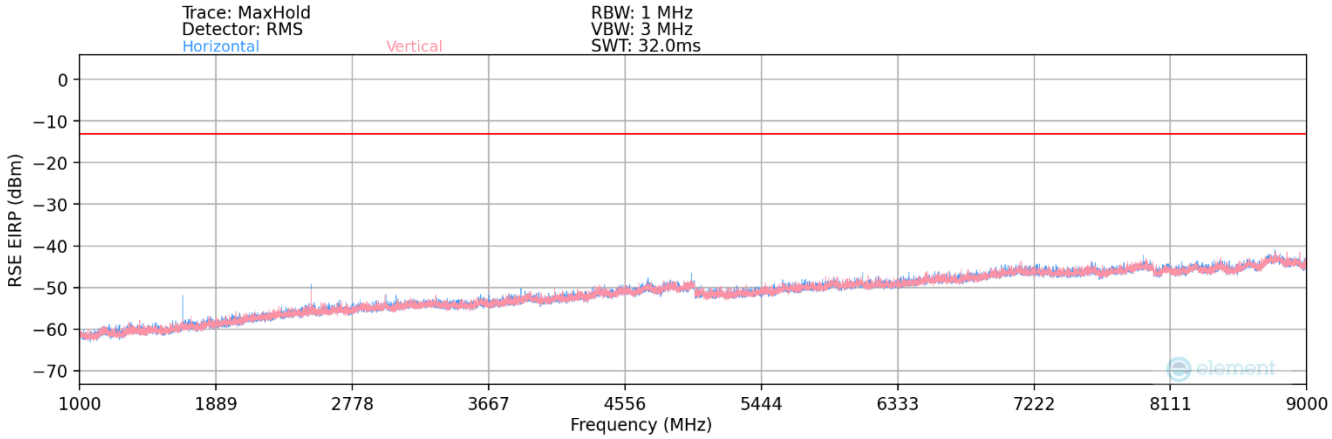


Plot 7-45. Radiated Spurious Plot Below 1GHz (LTE Band 26/5 – Ant4)

Bandwidth (MHz):	10
Frequency (MHz):	836.5
RB / Offset:	1 / 37

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]
612.50	H	-	-	-86.34	-4.58	16.08	-81.33	-13.00	-68.33

Table 7-9. Radiated Spurious Data (LTE Band 26/5 – Mid Channel – Ant4)



Plot 7-46. Radiated Spurious Plot Above 1GHz (LTE Band 26/5 – Ant4)

Bandwidth (MHz):	10
Frequency (MHz):	829
RB / Offset:	1 / 37

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]
1658.00	H	171	27	-69.08	0.82	38.74	-56.52	-13.00	-43.52
2487.00	H	162	312	-73.85	4.78	37.93	-57.32	-13.00	-44.32
3316.00	H	-	-	-79.51	7.19	34.68	-60.58	-13.00	-47.58
4145.00	H	-	-	-80.26	8.12	34.86	-60.40	-13.00	-47.40
4974.00	H	-	-	-80.38	9.93	36.55	-58.71	-13.00	-45.71

Table 7-10. Radiated Spurious Data (LTE Band 26/5 – Low Channel – Ant4)

Bandwidth (MHz):	10
Frequency (MHz):	836.5
RB / Offset:	1 / 37

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]
1673.00	H	174	25	-68.81	1.19	39.38	-55.88	-13.00	-42.88
2509.50	H	134	305	-72.20	4.99	39.79	-55.47	-13.00	-42.47
3346.00	H	-	-	-79.67	7.07	34.40	-60.86	-13.00	-47.86
4182.50	H	-	-	-80.24	7.99	34.75	-60.51	-13.00	-47.51
5019.00	H	-	-	-80.90	10.51	36.61	-58.65	-13.00	-45.65

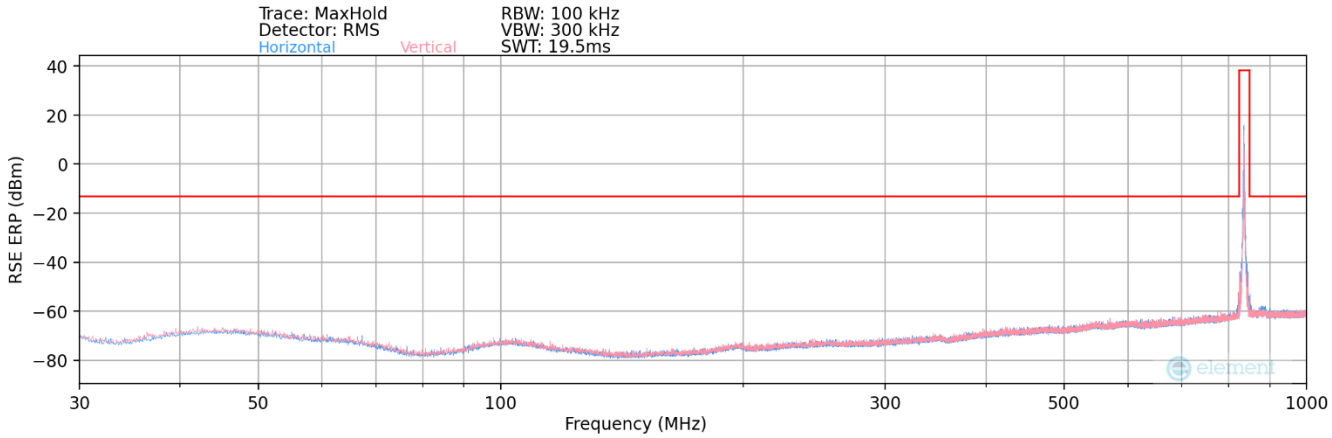
Table 7-11. Radiated Spurious Data (LTE Band 26/5 – Mid Channel – Ant4)

Bandwidth (MHz):	10
Frequency (MHz):	844
RB / Offset:	1 / 37

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]
1688.00	H	132	19	-68.68	1.39	39.71	-55.55	-13.00	-42.55
2532.00	H	165	309	-71.50	5.16	40.66	-54.60	-13.00	-41.60
3376.00	H	-	-	-79.51	6.79	34.28	-60.98	-13.00	-47.98
4220.00	H	-	-	-80.36	8.41	35.05	-60.20	-13.00	-47.20
5064.00	H	-	-	-80.95	10.37	36.42	-58.83	-13.00	-45.83

Table 7-12. Radiated Spurious Data (LTE Band 26/5 – High Channel – Ant4)

ULCA LTE Band 5 – Ant4

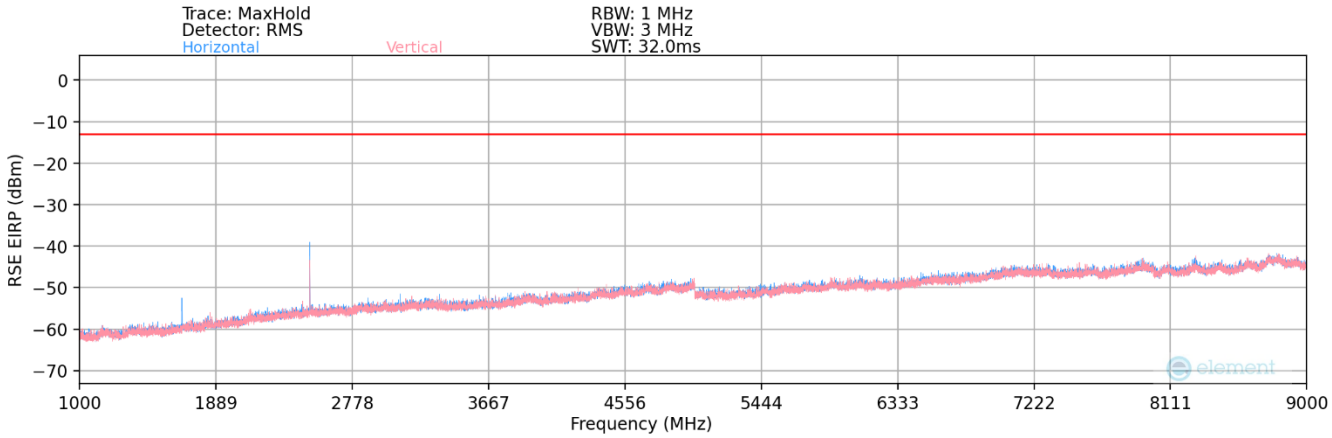


Plot 7-47. Radiated Spurious Plot Below 1GHz (ULCA LTE Band 5 – Ant4)

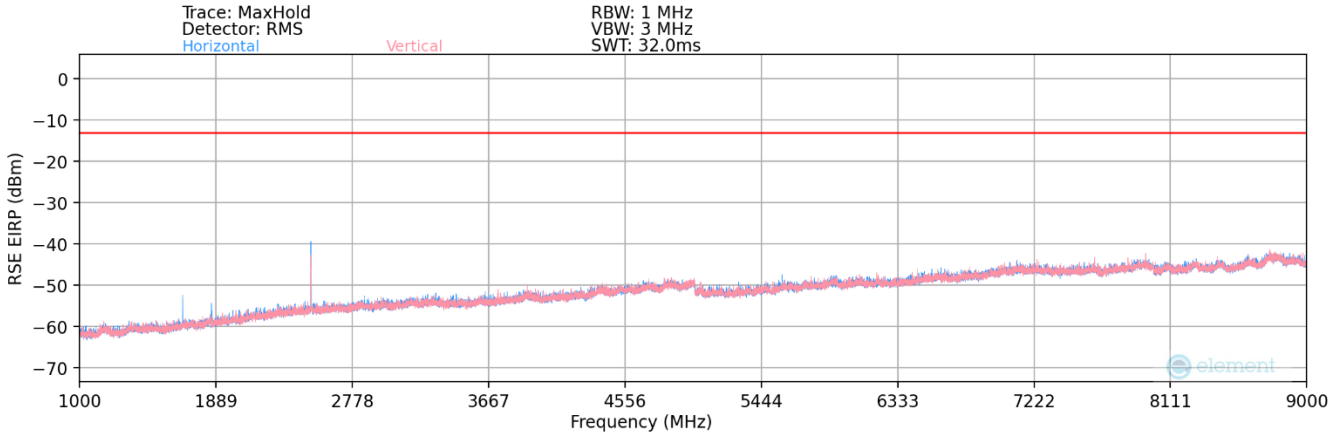
PCC Bandwidth (MHz):	10
PCC Frequency (MHz):	831.5
PCC RB / Offset:	1 / 49
SCC Bandwidth (MHz):	10
SCC Frequency (MHz):	841.4
SCC RB / Offset:	1 / 0

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]
636..5	H	-	-	-85.77	-4.48	16.75	-80.66	-13.00	-67.66

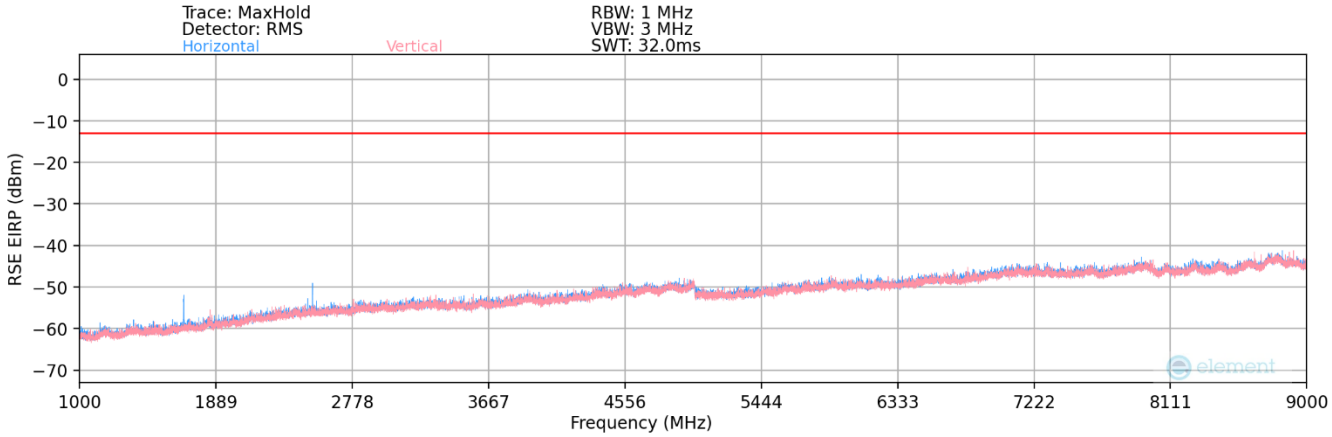
Table 7-13. Radiated Spurious Data (ULCA LTE Band 5 – Mid Channel – Ant4)



Plot 7-48. Radiated Spurious Plot Above 1GHz (ULCA LTE Band 5 – Low Channel – Ant4)



Plot 7-49. Radiated Spurious Plot Above 1GHz (ULCA LTE Band 5 – Mid Channel – Ant4)



Plot 7-50. Radiated Spurious Plot Above 1GHz (ULCA LTE Band 5 – High Channel – Ant4)

PCC Bandwidth (MHz):	10
PCC Frequency (MHz):	829.0
PCC RB / Offset:	1 / 49
SCC Bandwidth (MHz):	10
SCC Frequency (MHz):	838.9
SCC RB / Offset:	1 / 0

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]
1658.00	H	227	22	-67.85	9.35	48.50	-46.75	-13.00	-33.75
2487.00	H	147	287	-74.66	13.61	45.95	-49.31	-13.00	-36.31
3316.00	H	-	-	-79.89	15.90	43.01	-52.24	-13.00	-39.24
4145.00	H	-	-	-80.43	17.39	43.96	-51.29	-13.00	-38.29
4974.00	H	-	-	-80.64	19.45	45.81	-49.45	-13.00	-36.45

Table 7-14. Radiated Spurious Data (ULCA LTE Band 5 – Low Channel – Ant4)

PCC Bandwidth (MHz):	10
PCC Frequency (MHz):	831.5
PCC RB / Offset:	1 / 49
SCC Bandwidth (MHz):	10
SCC Frequency (MHz):	841.4
SCC RB / Offset:	1 / 0

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]
1663.00	H	226	20	-67.16	9.41	49.25	-46.00	-13.00	-33.00
2494.50	H	165	37	-74.11	13.64	46.53	-48.73	-13.00	-35.73
3326.00	H	-	-	-79.97	15.92	42.95	-52.31	-13.00	-39.31
4157.50	H	-	-	-80.34	17.46	44.12	-51.14	-13.00	-38.14
4989.00	H	-	-	-81.05	19.54	45.49	-49.77	-13.00	-36.77

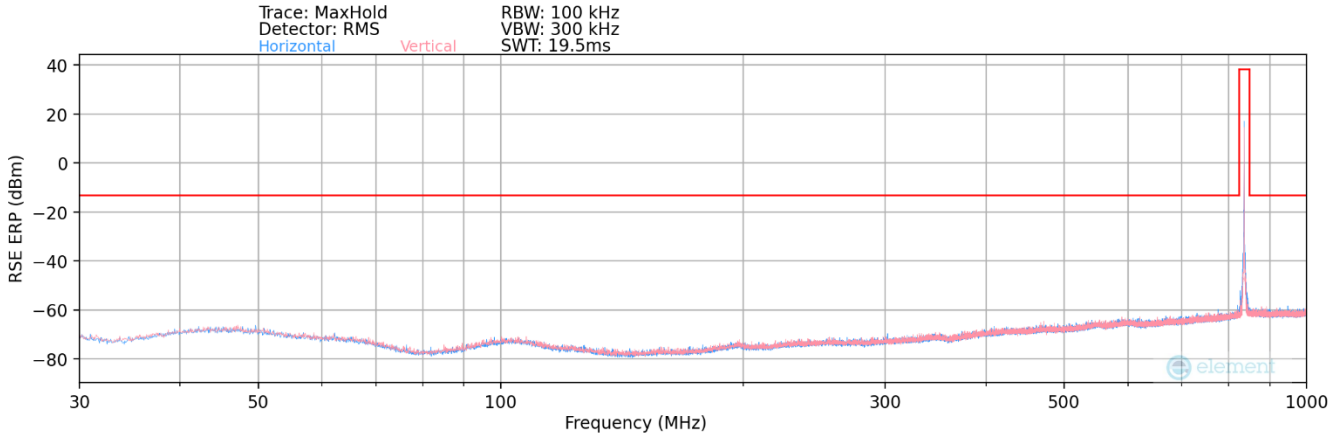
Table 7-15. Radiated Spurious Data (ULCA LTE Band 5 – Mid Channel – Ant4)

PCC Bandwidth (MHz):	10
PCC Frequency (MHz):	844.0
PCC RB / Offset:	1 / 0
SCC Bandwidth (MHz):	10
SCC Frequency (MHz):	834.1
SCC RB / Offset:	1 / 49

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]
1688.00	H	123	20	-67.76	9.58	48.82	-46.43	-13.00	-33.43
2532.00	H	123	297	-72.88	13.54	47.66	-47.60	-13.00	-34.60
3376.00	H	-	-	-79.93	15.74	42.81	-52.44	-13.00	-39.44
4220.00	H	-	-	-80.39	17.70	44.31	-50.95	-13.00	-37.95
5064.00	H	-	-	-81.20	19.66	45.46	-49.79	-13.00	-36.79

Table 7-16. Radiated Spurious Data (ULCA LTE Band 5 – High Channel – Ant4)

NR Band n26/5 – Ant4

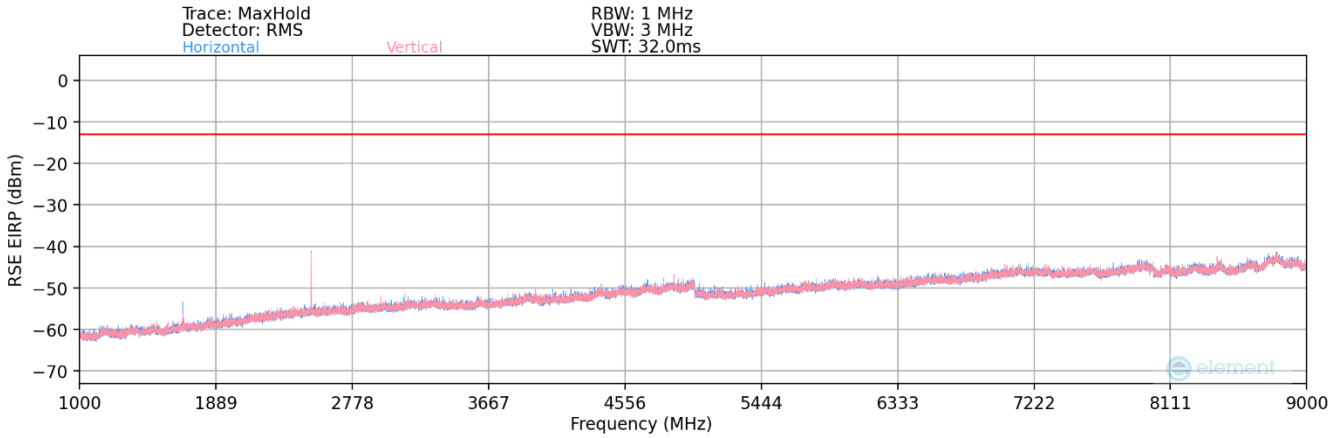


Plot 7-51. Radiated Spurious Plot Below 1GHz (NR Band n26/5 – Ant4)

Bandwidth (MHz):	20
Frequency (MHz):	836.5
RB / Offset:	1 / 53
Mode:	Stand Alone
Anchor Band:	-

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]
636.63	H	-	-	-86.30	-4.47	16.23	-81.17	-13.00	-68.17

Table 7-17. Radiated Spurious Data (NR Band n26/5 – Mid Channel – Ant4)



Plot 7-52. Radiated Spurious Plot Above 1GHz (NR Band n26/5 – Ant4)

Bandwidth (MHz):	20
Frequency (MHz):	834
RB / Offset:	1 / 53
Mode:	Stand Alone

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]
1668.00	H	234	20	-68.98	0.47	38.49	-56.76	-13.00	-43.76
2502.00	H	170	36	-75.58	4.28	35.70	-59.55	-13.00	-46.55
3336.00	H	-	-	-79.77	6.84	34.07	-61.19	-13.00	-48.19
4170.00	H	-	-	-80.19	8.13	34.94	-60.31	-13.00	-47.31
5004.00	H	-	-	-80.76	10.61	36.85	-58.41	-13.00	-45.41

Table 7-18. Radiated Spurious Data (NR Band n26/5 – Low Channel – Ant4)

Bandwidth (MHz):	20
Frequency (MHz):	836.5
RB / Offset:	1 / 53
Mode:	Stand Alone

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]
1673.00	H	246	301	-70.47	0.55	37.08	-58.18	-13.00	-45.18
2509.50	H	121	42	-60.77	4.36	50.59	-44.66	-13.00	-31.66
3346.00	H	-	-	-79.81	6.71	33.90	-61.36	-13.00	-48.36
4182.50	H	-	-	-80.20	8.10	34.90	-60.36	-13.00	-47.36
5019.00	H	-	-	-80.82	10.67	36.85	-58.41	-13.00	-45.41

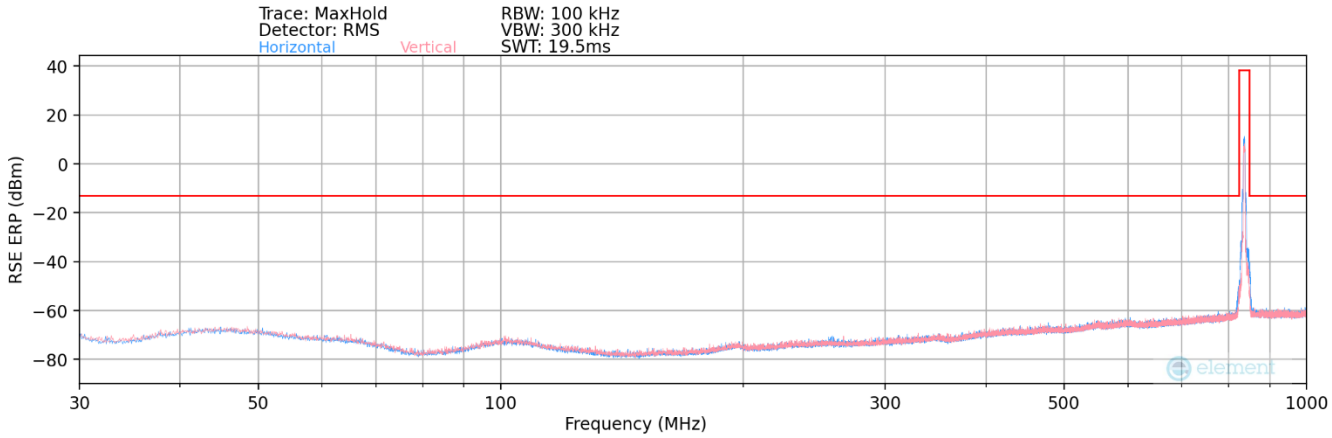
Table 7-19. Radiated Spurious Data (NR Band n26/5 – Mid Channel – Ant4)

Bandwidth (MHz):	20
Frequency (MHz):	839
RB / Offset:	1 / 53
Mode:	Stand Alone

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]
1678.00	H	122	25	-70.32	0.62	37.30	-57.96	-13.00	-44.96
2517.00	H	170	50	-65.43	4.44	46.01	-49.24	-13.00	-36.24
3356.00	H	-	-	-79.70	6.60	33.90	-61.36	-13.00	-48.36
4195.00	H	-	-	-80.16	8.30	35.14	-60.12	-13.00	-47.12
5034.00	H	-	-	-80.97	10.79	36.82	-58.44	-13.00	-45.44

Table 7-20. Radiated Spurious Data (NR Band n26/5 – High Channel – Ant4)

WCDMA Cell – Ant4

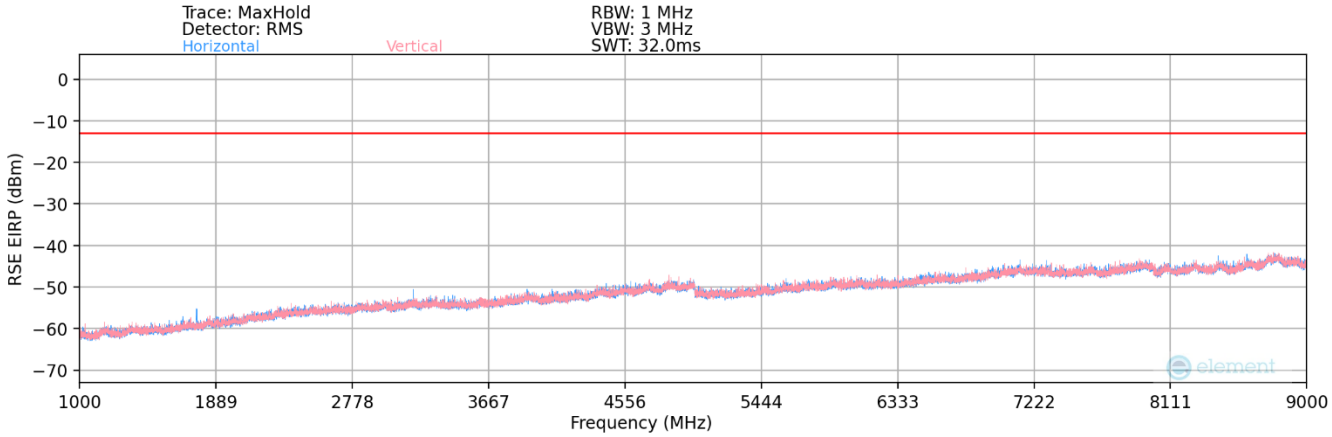


Plot 7-53. Radiated Spurious Plot Below 1GHz (WCDMA Cell – Ant4)

Mode:	WCDMA RMC
Channel:	4183
Frequency (MHz):	836.6

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]
262.50	H	-	-	-74.16	-11.92	20.92	-76.49	-13.00	-63.49

Table 7-21. Radiated Spurious Data (WCDMA Cell – Mid Channel – Ant4)



Plot 7-54. Radiated Spurious Plot Above 1GHz (WCDMA Cell – Ant4)

Mode:	WCDMA RMC
Channel:	4132
Frequency (MHz):	826.4

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]
1652.80	H	171	20	-73.53	0.02	33.49	-61.77	-13.00	-48.77
2479.20	H	168	32	-77.45	4.19	33.74	-61.52	-13.00	-48.52
3305.60	H	-	-	-79.59	6.64	34.05	-61.21	-13.00	-48.21
4132.00	H	-	-	-80.41	8.24	34.83	-60.43	-13.00	-47.43
4958.40	H	-	-	-80.42	9.79	36.37	-58.89	-13.00	-45.89

Table 7-22. Radiated Spurious Data (WCDMA Cell – Low Channel – Ant4)

Mode:	WCDMA RMC
Channel:	4183
Frequency (MHz):	836.6

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]
1673.20	H	123	36	-72.65	0.55	34.90	-60.35	-13.00	-47.35
2509.80	H	231	39	-74.51	4.37	36.86	-58.40	-13.00	-45.40
3346.40	H	-	-	-79.68	6.70	34.02	-61.23	-13.00	-48.23
4183.00	H	-	-	-80.36	8.10	34.74	-60.51	-13.00	-47.51
5019.60	H	-	-	-80.79	10.67	36.88	-58.38	-13.00	-45.38

Table 7-23. Radiated Spurious Data (WCDMA Cell – Mid Channel – Ant4)

Mode:	WCDMA RMC
Channel:	4233
Frequency (MHz):	846.6

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]
1693.20	H	208	31	-73.67	0.73	34.06	-61.20	-13.00	-48.20
2539.80	H	261	48	-75.31	4.38	36.07	-59.18	-13.00	-46.18
3386.40	H	-	-	-79.59	6.41	33.82	-61.44	-13.00	-48.44
4233.00	H	-	-	-80.44	8.65	35.21	-60.05	-13.00	-47.05
5079.60	H	-	-	-81.10	10.15	36.05	-59.21	-13.00	-46.21

Table 7-24. Radiated Spurious Data (WCDMA Cell – High Channel – Ant4)

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 22, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency.

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

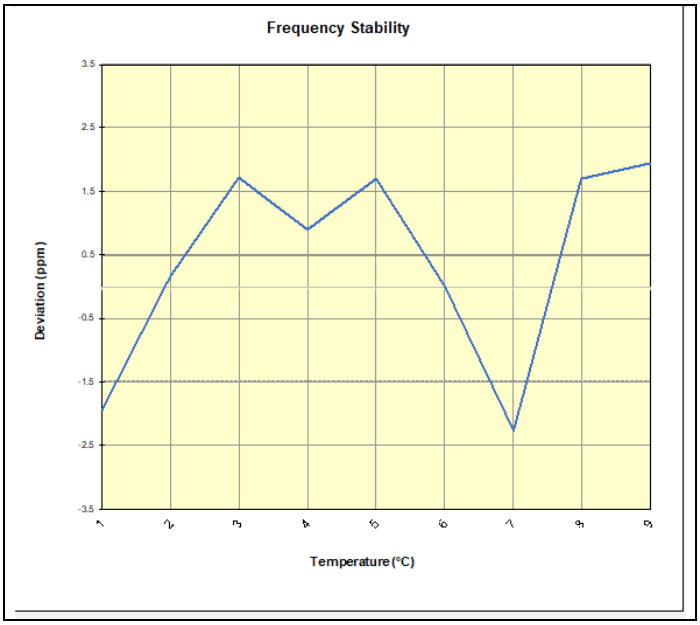
LTE Band 26/5

LTE Band 26/5

Operating Frequency (Hz):	836,500,000
Ref. Voltage (VDC):	8.8
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	8.8	- 30	836,500,353	-1,614	-0.0001930
		- 20	836,502,101	134	0.0000160
		- 10	836,503,409	1,441	0.0001723
		0	836,502,715	748	0.0000894
		+ 10	836,503,389	1,422	0.0001700
		+ 20 (Ref)	836,501,967	0	0.0000000
		+ 30	836,500,072	-1,896	-0.0002266
		+ 40	836,503,389	1,422	0.0001700
		+ 50	836,503,581	1,614	0.0001930
Battery Endpoint	6.0	+ 20	836,502,495	528	0.0000631

Table 7-25. LTE Band 26/5 Frequency Stability Data



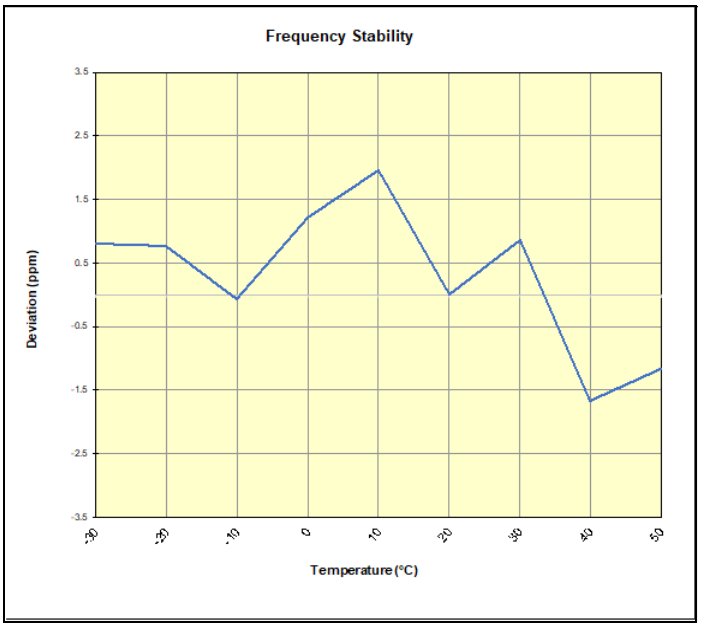
Plot 7-55. LTE Band 26/5 Frequency Stability Chart

NR Band n26/5

NR Band n26/5	
Operating Frequency (Hz):	836,500,000
Ref. Voltage (VDC):	8.8
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	8.8	- 30	836,493,535	669	0.0000800
		- 20	836,493,502	637	0.0000761
		- 10	836,492,805	-61	-0.0000073
		0	836,493,879	1,013	0.0001211
		+ 10	836,494,497	1,631	0.0001949
		+ 20 (Ref)	836,492,866	0	0.0000000
		+ 30	836,493,581	715	0.0000855
		+ 40	836,491,476	-1,390	-0.0001662
		+ 50	836,491,884	-982	-0.0001174
Battery Endpoint	6.0	+ 20	836,492,833	-33	-0.0000039

Table 7-26. NR Band n26/5 Frequency Stability Data



Plot 7-56. NR Band n26/5 Frequency Stability Chart

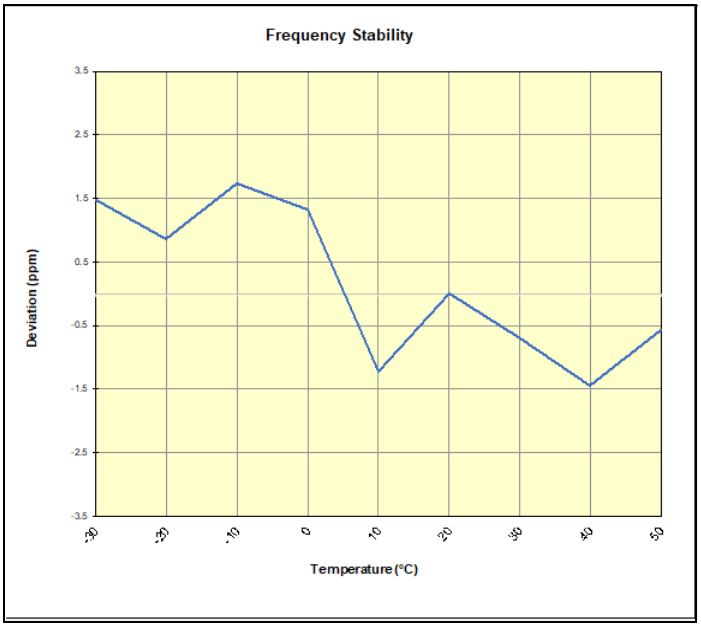
WCDMA Cell

WCDMA Cellular

Operating Frequency (Hz):	836,600,000
Ref. Voltage (VDC):	8.8
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	8.8	- 30	836,664,292	1,241	0.0001483
		- 20	836,663,778	727	0.0000869
		- 10	836,664,503	1,452	0.0001735
		0	836,664,162	1,111	0.0001328
		+ 10	836,662,026	-1,025	-0.0001225
		+ 20 (Ref)	836,663,051	0	0.0000000
		+ 30	836,662,456	-595	-0.0000711
		+ 40	836,661,833	-1,218	-0.0001455
		+ 50	836,662,573	-477	-0.0000571
Battery Endpoint	6.0	+ 20	836,663,954	903	0.0001080

Table 7-27. WCDMA Cell Frequency Stability Data



Plot 7-57. WCDMA Cell Frequency Stability Chart

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Microsoft Corporation Portable Computing Device FCC ID: C3K2077** complies with all the requirements of Part 22 of the FCC rules.