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PART 22 MEASUREMENT REPORT

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
9/23 - 11/20/2020
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2009230152-22.A3L

FCC ID:	**A3LSMG998U**
Applicant Name:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-G998U
Additional Model(s):	SM-G998U1
EUT Type:	Portable Handset
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part:	22
Test Procedure(s):	ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01, KDB 648474 D03 v01r04

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.

Randy Ortanez
President

ACCREDITED
CERT #2041.01

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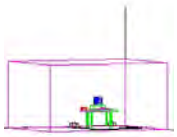
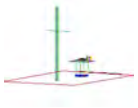


PART 22 MEASUREMENT REPORT



Mode	Modulation	Tx Frequency Range [MHz]	ERP		EIRP		Emission Designator
			Max. Power [W]	Max. Power [dBm]	Max. Power [W]	Max. Power [dBm]	
GSM/GPRS	GMSK	824.2 - 848.8	0.407	26.10	0.668	28.25	244KGXW
EDGE	8-PSK	824.2 - 848.8	0.083	19.19	0.136	21.34	242KG7W
WCDMA	Spread Spectrum	826.4 - 846.6	0.066	18.21	0.109	20.36	4M17F9W
CDMA	Spread Spectrum	824.70 - 848.31	0.070	18.43	0.114	20.58	1M28F9W

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	ERP		EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	Max. Power [W]	Max. Power [dBm]	
LTE Band 26/5	15MHz (Band 26 only)	QPSK	831.5 - 841.5	0.076	18.79	0.124	20.94	13M5G7D
		16QAM	831.5 - 841.5	0.064	18.08	0.105	20.23	13M5W7D
		64QAM	831.5 - 841.5	0.062	17.94	0.102	20.09	13M5W7D
		256QAM	831.5 - 841.5	0.032	15.00	0.052	17.15	13M5W7D
	10 MHz	QPSK	829.0 - 844.0	0.075	18.75	0.123	20.90	9M01G7D
		16QAM	829.0 - 844.0	0.071	18.51	0.116	20.66	8M99W7D
		64QAM	829.0 - 844.0	0.064	18.06	0.105	20.21	9M01W7D
		256QAM	829.0 - 844.0	0.031	14.98	0.052	17.13	8M99W7D
	5 MHz	QPSK	826.5 - 846.5	0.078	18.92	0.128	21.07	4M52G7D
		16QAM	826.5 - 846.5	0.070	18.45	0.115	20.60	4M51W7D
		64QAM	826.5 - 846.5	0.070	18.47	0.115	20.62	4M53W7D
		256QAM	826.5 - 846.5	0.032	15.05	0.052	17.20	4M51W7D
	3 MHz	QPSK	825.5 - 847.5	0.075	18.75	0.123	20.90	2M70G7D
		16QAM	825.5 - 847.5	0.071	18.49	0.116	20.64	2M72W7D
		64QAM	825.5 - 847.5	0.065	18.10	0.106	20.25	2M71W7D
		256QAM	825.5 - 847.5	0.032	15.02	0.052	17.17	2M71W7D
	1.4 MHz	QPSK	824.7 - 848.3	0.075	18.73	0.122	20.88	1M10G7D
		16QAM	824.7 - 848.3	0.071	18.49	0.116	20.64	1M10W7D
		64QAM	824.7 - 848.3	0.064	18.06	0.105	20.21	1M10W7D
		256QAM	824.7 - 848.3	0.032	15.10	0.053	17.25	1M09W7D
NR Band n5	20 MHz	π/2 BPSK	834.0 - 839.0	0.075	18.77	0.124	20.92	18M0G7D
		QPSK	834.0 - 839.0	0.075	18.73	0.122	20.88	19M0G7D
		16QAM	834.0 - 839.0	0.059	17.69	0.096	19.84	19M0W7D
		64QAM	834.0 - 839.0	0.038	15.83	0.063	17.98	19M0W7D
		256QAM	834.0 - 839.0	0.027	14.25	0.044	16.40	19M0W7D
	15 MHz	π/2 BPSK	831.5 - 841.5	0.076	18.79	0.124	20.94	13M4G7D
		QPSK	831.5 - 841.5	0.074	18.70	0.122	20.85	14M2G7D
		16QAM	831.5 - 841.5	0.058	17.66	0.096	19.81	14M2W7D
		64QAM	831.5 - 841.5	0.040	15.97	0.065	18.12	14M2W7D
		256QAM	831.5 - 841.5	0.027	14.28	0.044	16.43	14M2W7D
	10 MHz	π/2 BPSK	829.0 - 844.0	0.074	18.70	0.122	20.85	8M96G7D
		QPSK	829.0 - 844.0	0.074	18.69	0.121	20.84	9M34G7D
		16QAM	829.0 - 844.0	0.059	17.72	0.097	19.87	9M35W7D
		64QAM	829.0 - 844.0	0.038	15.82	0.063	17.97	9M32W7D
		256QAM	829.0 - 844.0	0.028	14.51	0.046	16.66	9M39W7D
	5 MHz	π/2 BPSK	826.5 - 846.5	0.078	18.93	0.128	21.08	4M51G7D
		QPSK	826.5 - 846.5	0.077	18.88	0.127	21.03	4M56G7D
		16QAM	826.5 - 846.5	0.061	17.83	0.100	19.98	4M50W7D
		64QAM	826.5 - 846.5	0.040	16.04	0.066	18.19	4M52W7D
		256QAM	826.5 - 846.5	0.026	14.21	0.043	16.36	4M50W7D

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 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility 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 PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST 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.

- PCTEST 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).

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG998U**. 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.: 0788M, 0722M, 0695M, 0706M, 0707M, 0752M, 0705M, 0144M

2.2 Device Capabilities

This device contains the following capabilities:

800/850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (n5, n71, n41, n66, n2, n12, n25, n30, n77, n260, n261), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer, UWB

LTE Band 26 (814.7 – 849 MHz) overlaps the entire frequency range of LTE Band 5 (824 – 849 MHz). Therefore, test data provided in this report covers Band 5 and the portion of Band 26 subject to Part 22.

This device uses a tuner circuit that dynamically updates the antenna impedance parameters to optimize antenna performance for certain bands and modes of operation. The tuner for this device was set to simulate a "free space" condition where the transmit antenna is matched to the medium into which it is transmitting and, thus, the power is at its maximum level.

2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 3 of this test report for a description of the radiated and antenna port conducted emissions tests.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on an authorized wireless charging pad (WCP) Model: EP-N5100 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

2.4 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 "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-E-2016) and "Measurement Guidance for Certification of Licensed Digital Transmitters" (KDB 971168 D01 v03r01) 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/TIA-603-E-2016. 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 and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:

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

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 474788 D01.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI/TIA-603-E-2016.

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
-	LTx2	Licensed Transmitter Cable Set	4/9/2020	Annual	4/9/2021	LTx2
-	LTx3	LIcensed Transmitter Cable Set	10/30/2019	Annual	10/30/2020	LTx3
Agilent	N9020A	MXA Signal Analyzer	8/4/2020	Annual	8/4/2021	US46470561
Agilent	N9030A	PXA Signal Analyzer (44GHz)	7/17/2020	Annual	7/17/2021	MY52350166
Agilent	E5515C	Wireless Communications Test Set	N/A			GB45360985
Agilent	E5515C	Wireless Communications Test Set	N/A			GB46310798
Anritsu	MT8820C	Radio Communication Analyzer	N/A			6201300731
Anritsu	MT8821C	Radio Communication Analyzer	N/A			6201381794
Anritsu	MT8821C	Radio Communication Analyzer	N/A			6200901190
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2019	Biennial	10/10/2021	121034
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	6/18/2022	9704-5182
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	3/12/2020	Biennial	3/12/2022	128337
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	2/22/2019	Biennial	2/22/2021	128338
Mini Circuits	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11403100002
Rohde & Schwarz	CMU200	Base Station Simulator	N/A			836371/0079
Rohde & Schwarz	CMU200	Base Station Simulator	N/A			836536/0005
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			100976
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			112347
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	7/15/2020	Annual	7/15/2021	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/21/2020	Annual	2/21/2021	102133
Sunol	DRH-118	Horn Antenna (1-18GHz)	10/3/2019	Biennial	10/3/2021	A050307
Sunol	DRH-118	Horn Antenna (1-18 GHz)	8/27/2019	Biennial	8/27/2021	A042511
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107

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

GPRS Emission Designator

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

EDGE Emission Designator

Emission Designator = 250KG7W
EDGE BW = 250 kHz
G = Phase Modulation
7 = Quantized/Digital Info
W = Combination (Audio/Data)

CDMA Emission Designator

Emission Designator = 1M25F9W
CDMA BW = 1.25 MHz
F = Frequency Modulation
9 = Composite Digital Info
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

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: Samsung Electronics Co., Ltd.

FCC ID: A3LSMG998U

FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)

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

Test Condition	Test Description	FCC Part Section(s)	RSS Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Occupied Bandwidth	2.1049	RSS-139(2.3)	N/A	PASS	Section 7.2
	Conducted Band Edge / Spurious Emissions	2.1051, 22.917(a)	RSS-132(5.5)	> 43 + 10log10(P[Watts]) at Band Edge and for all out-of-band emissions	PASS	Sections 7.3, 7.4
	Transmitter Conducted Output Power	2.1046	RSS-132(5.4)	N/A	PASS	See RF Exposure Report
	Frequency Stability	2.1055, 22.355	RSS-132(5.3)	Fundamental emissions stay within authorized frequency block	PASS	Section 7.8
RADIATED	Effective Radiated Power / Equivalent Isotropic Radiated Power	22.913(a)(5)	RSS-132(5.4)	< 7 Watts max. ERP	PASS	Section 7.6
	Radiated Spurious Emissions	2.1053, 22.917(a)	RSS-132(5.5)	> 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 PCTEST 2G/3G Automation Version 4.5, LTE Automation Version 5.3

7.2 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

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 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.

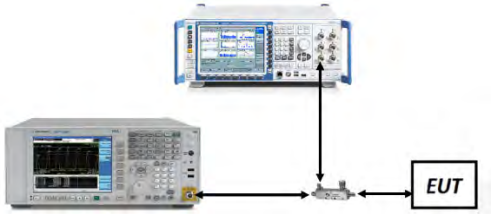
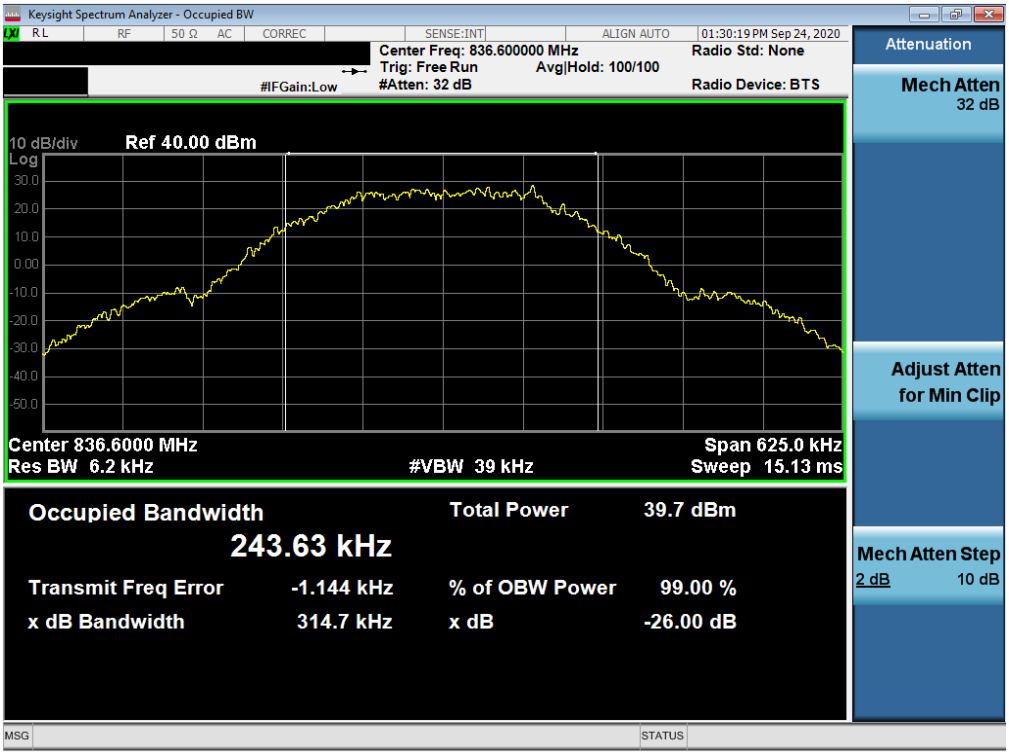


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None.

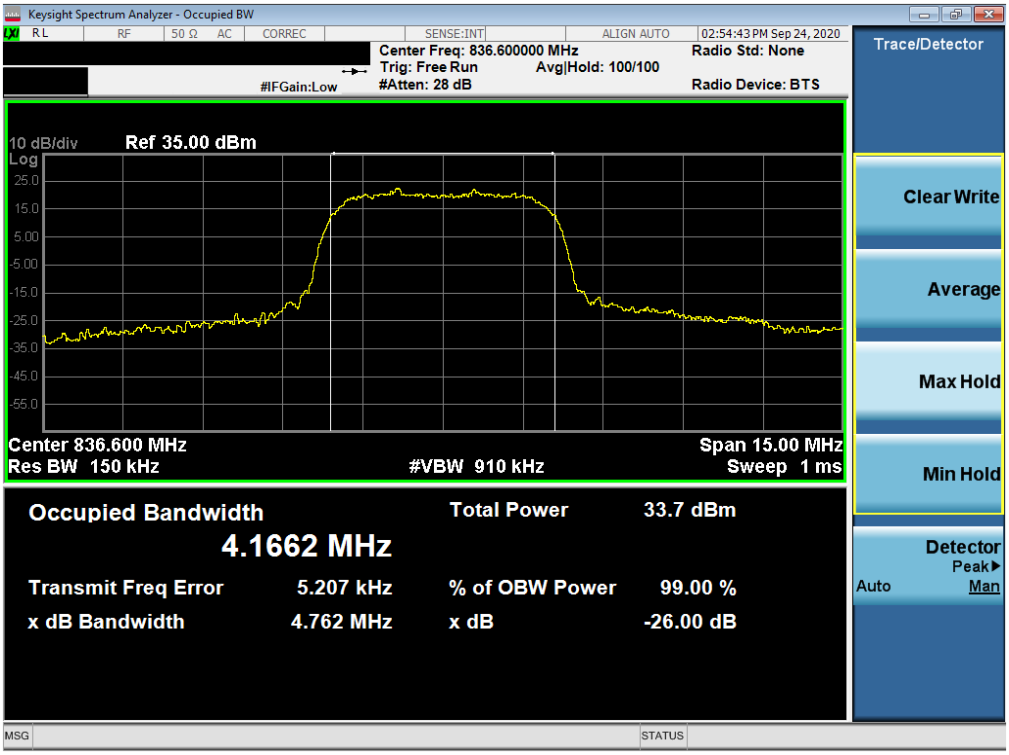
GPRS Cell



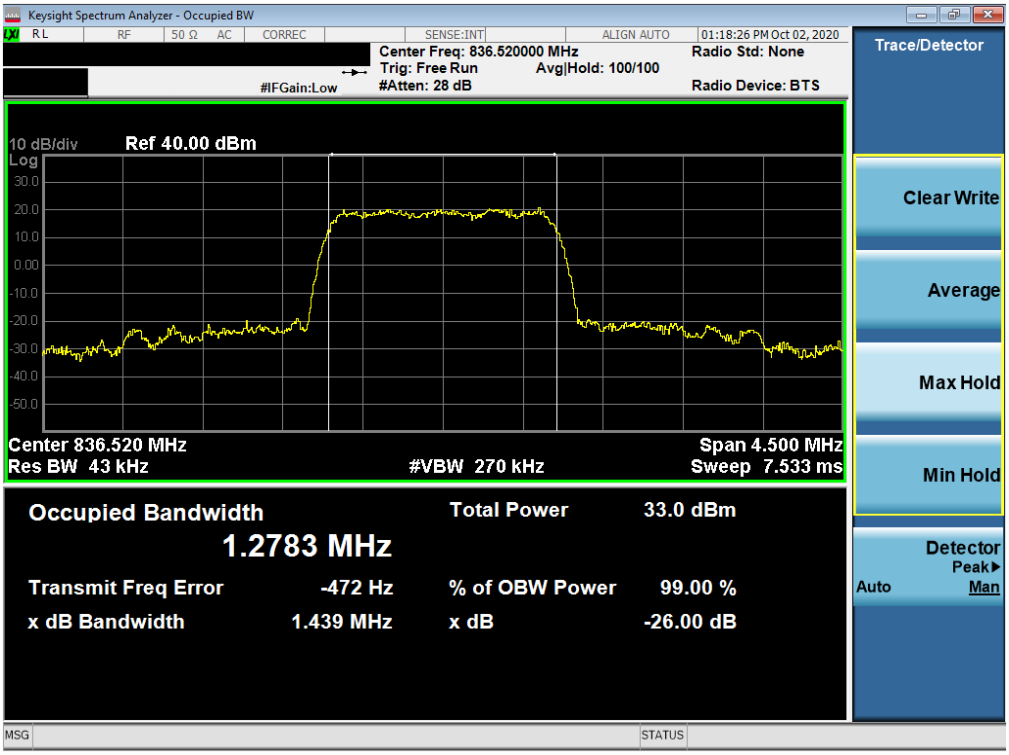
Plot 7-1. Occupied Bandwidth Plot (GPRS, Ch. 190)

Plot 7-2. Occupied Bandwidth Plot (EDGE, Ch. 190)

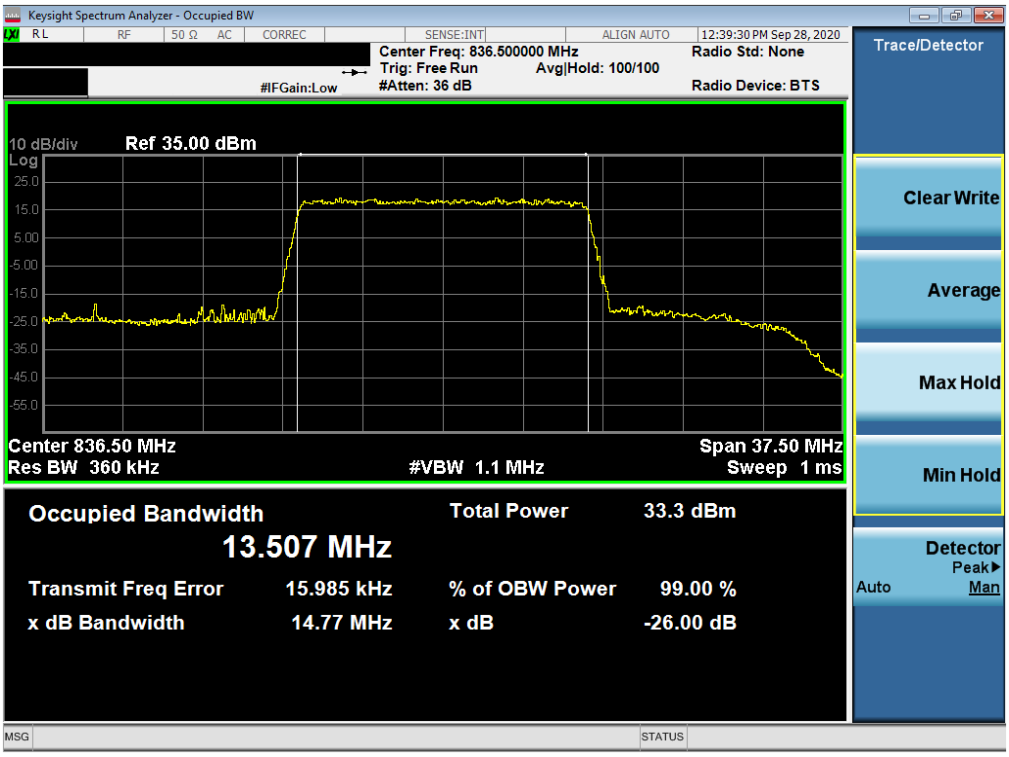
WCDMA Cell



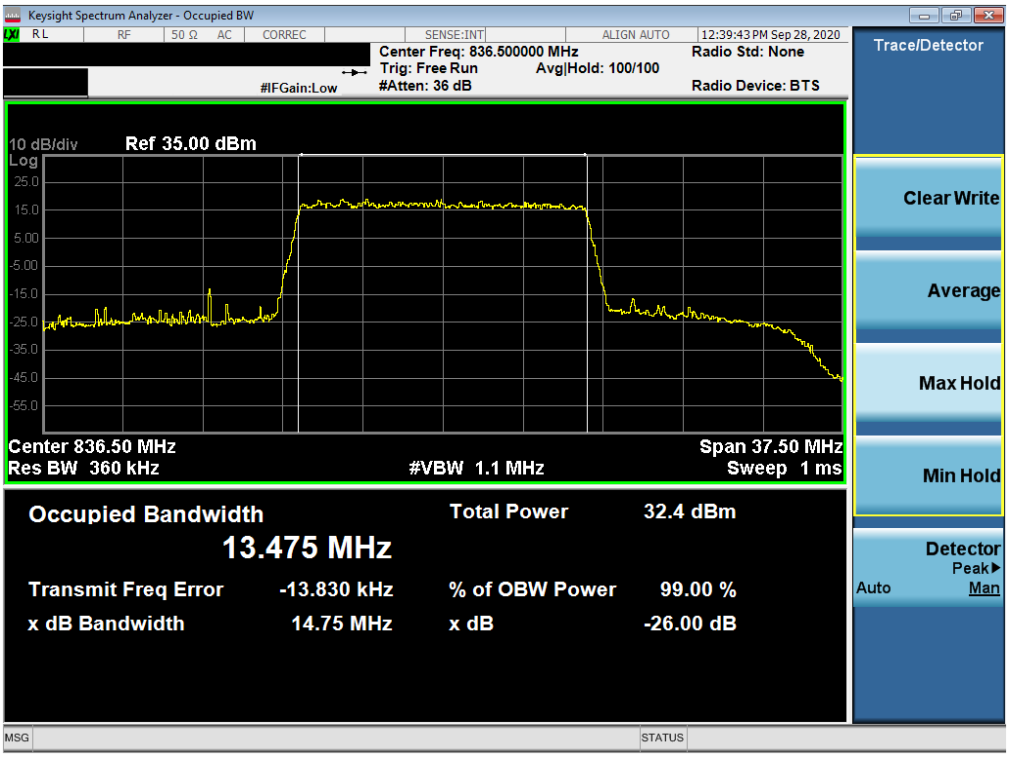
Plot 7-3. Occupied Bandwidth Plot (WCDMA, Ch. 4183)



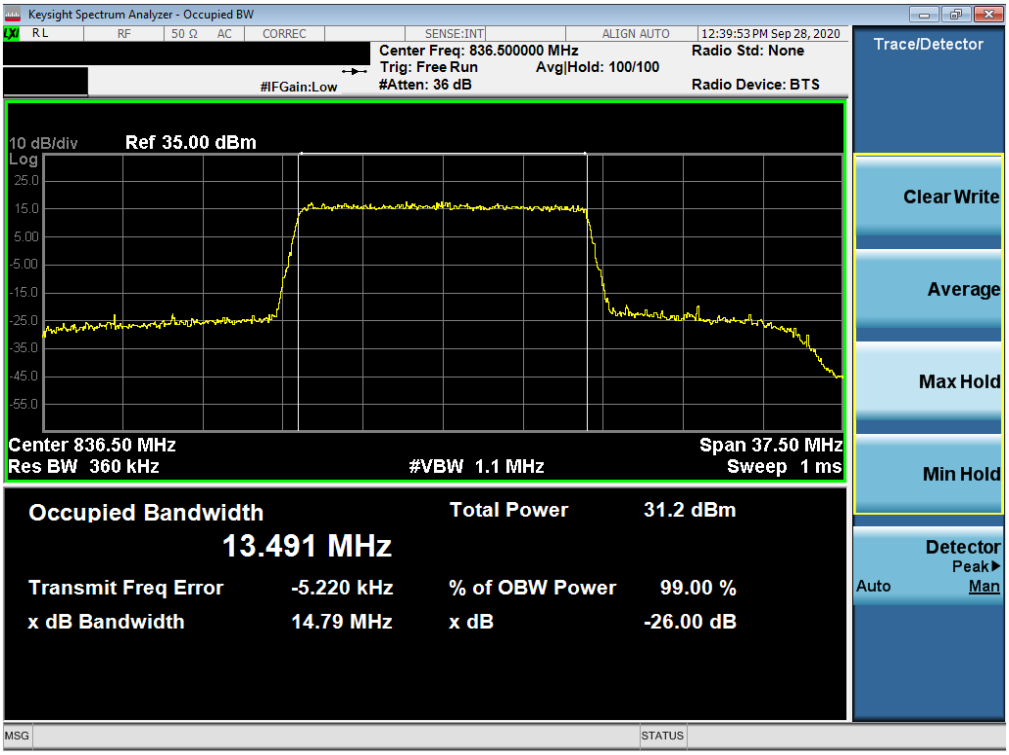
Plot 7-4. Occupied Bandwidth Plot (CDMA, Ch. 384)



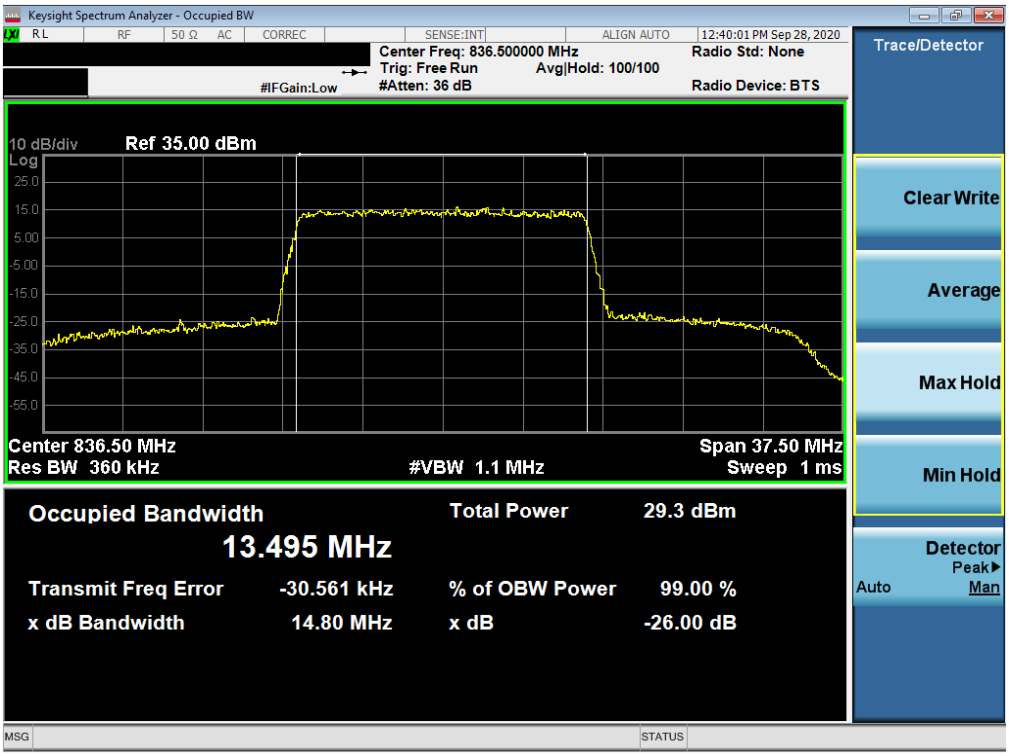
Plot 7-5. Occupied Bandwidth Plot (LTE Band 26 - 15MHz QPSK - Full RB Configuration)



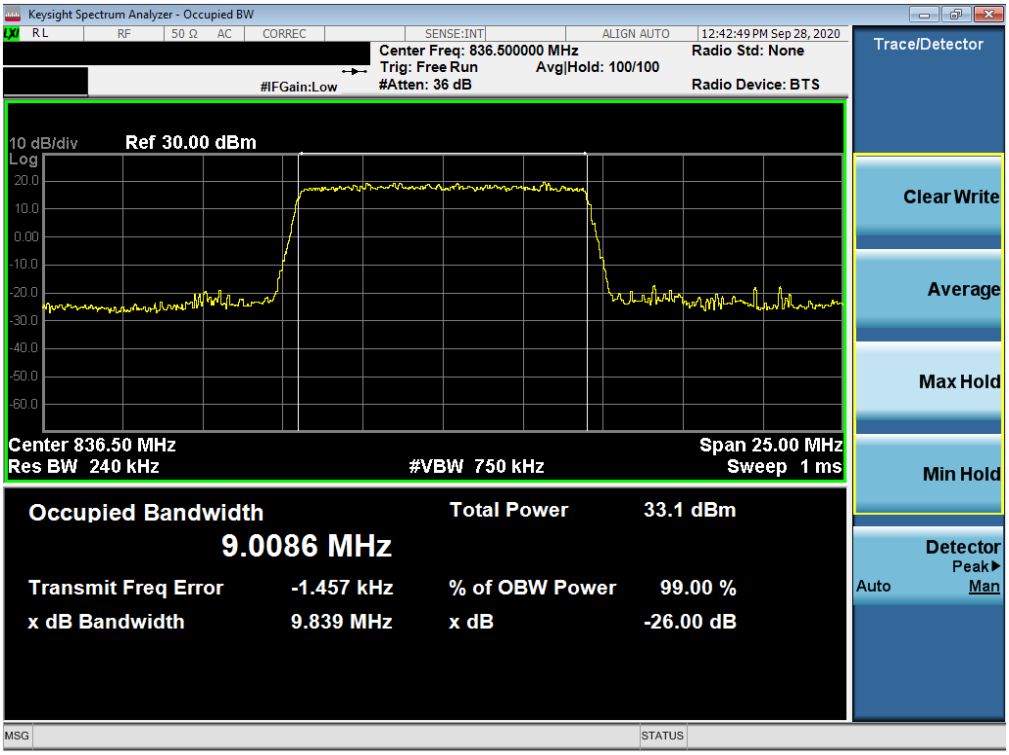
Plot 7-6. Occupied Bandwidth Plot (LTE Band 26 - 15MHz 16-QAM - Full RB Configuration)



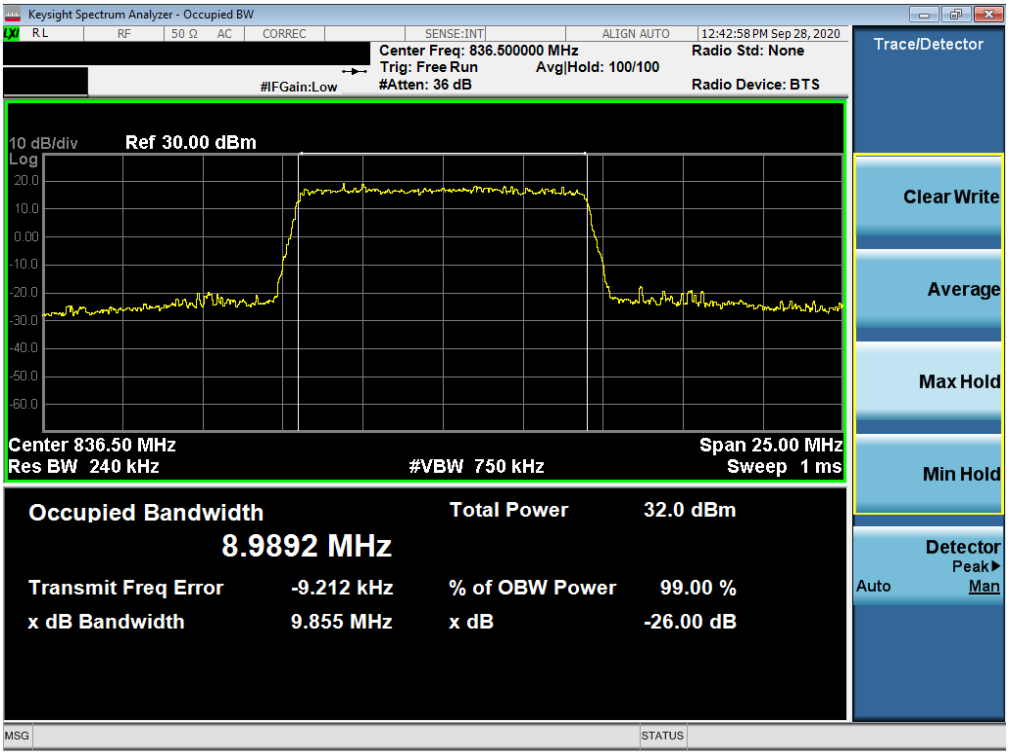
Plot 7-7. Occupied Bandwidth Plot (LTE Band 26 - 15MHz 64-QAM - Full RB Configuration)



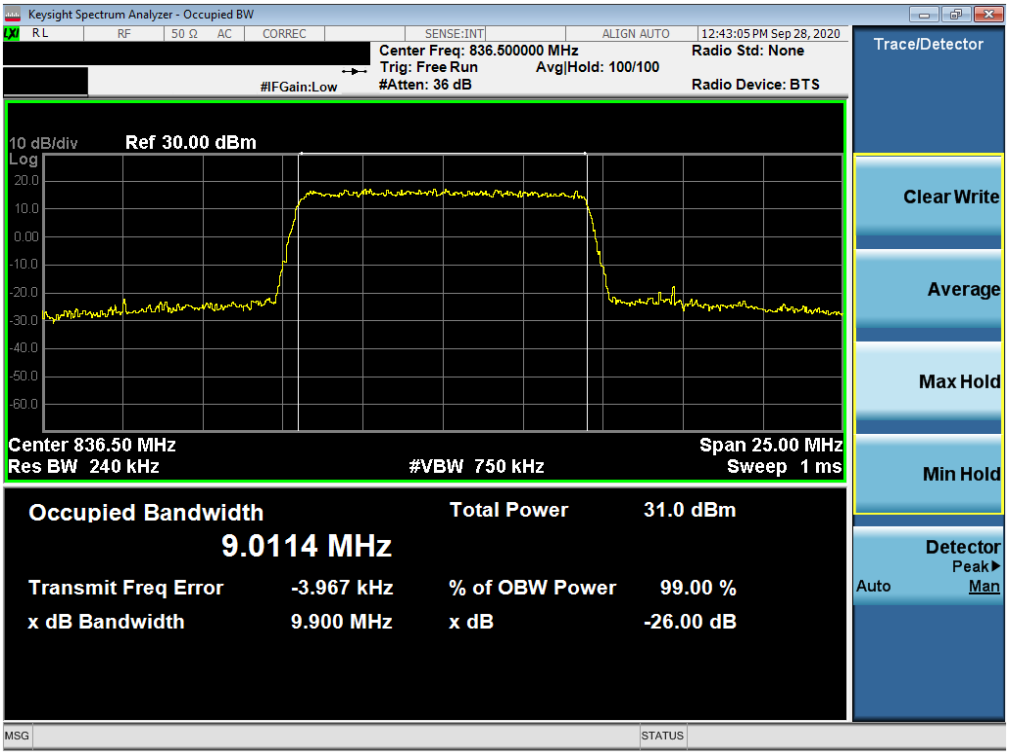
Plot 7-8. Occupied Bandwidth Plot (LTE Band 26 - 15MHz 256-QAM - Full RB Configuration)



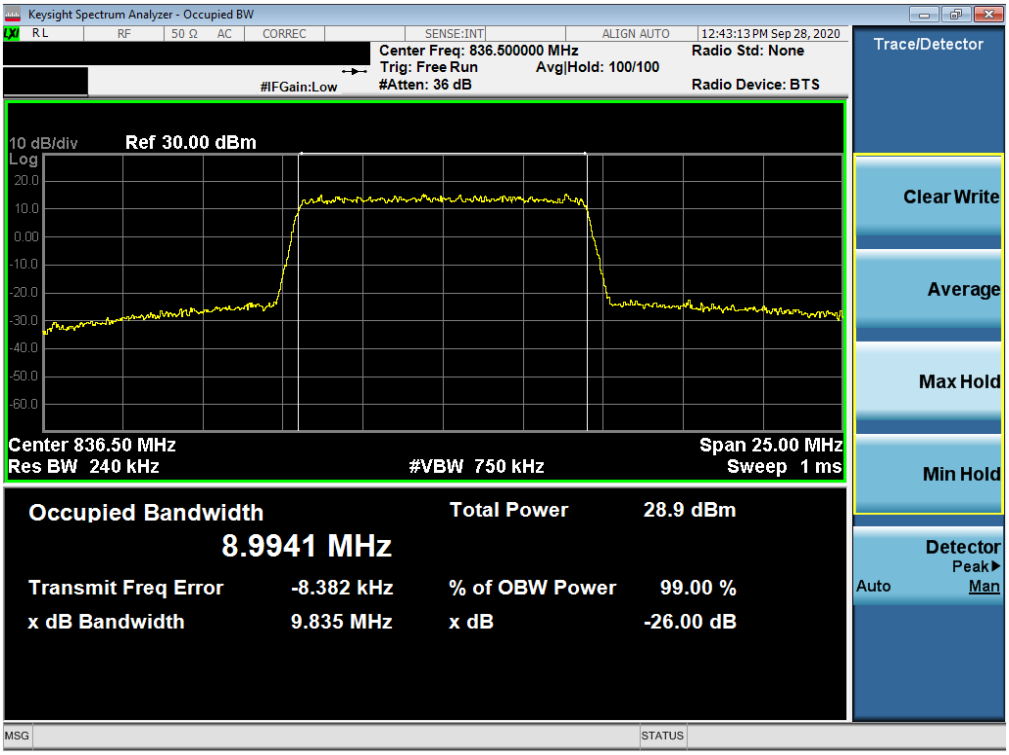
Plot 7-9. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz QPSK - Full RB Configuration)



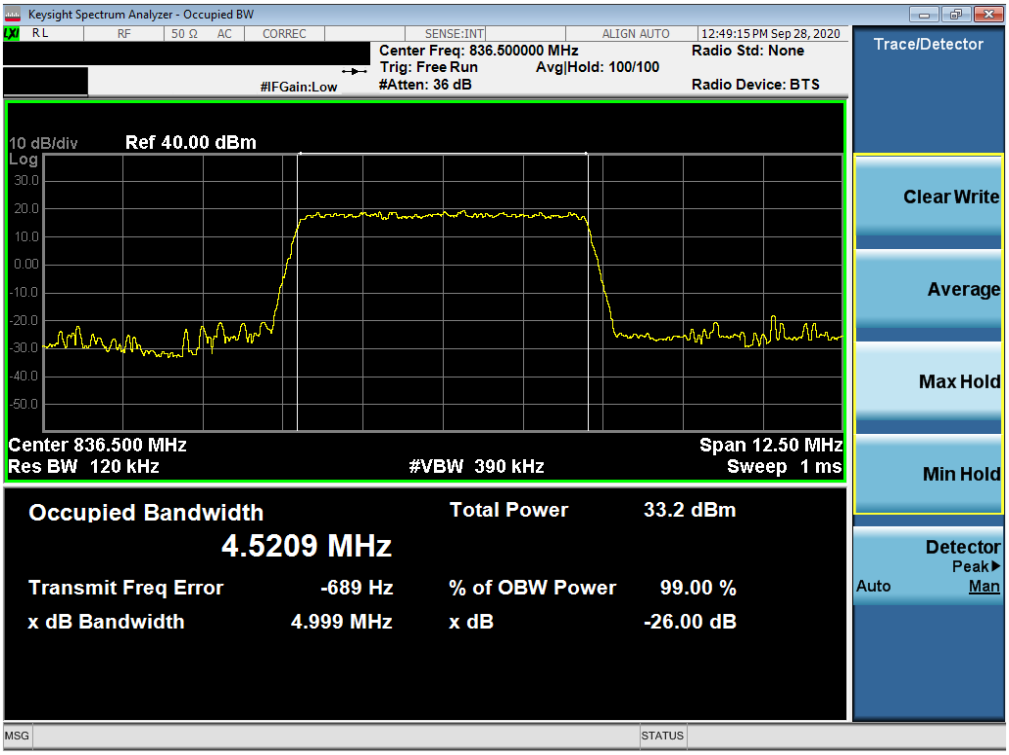
Plot 7-10. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz 16-QAM - Full RB Configuration)



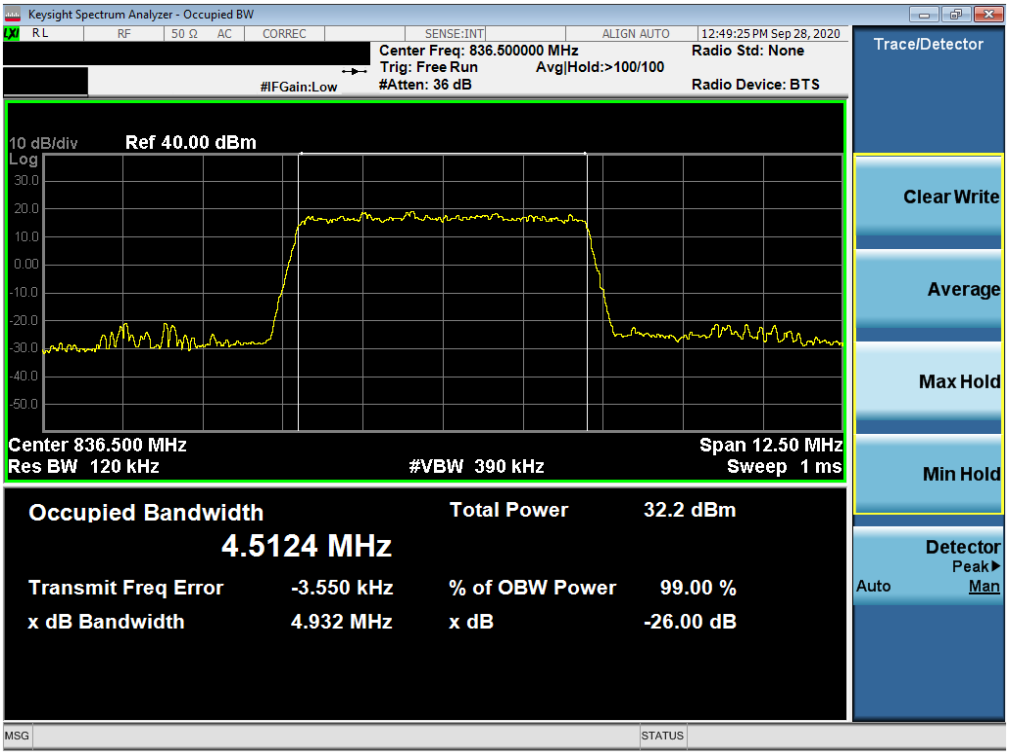
Plot 7-11. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz 64-QAM - Full RB Configuration)



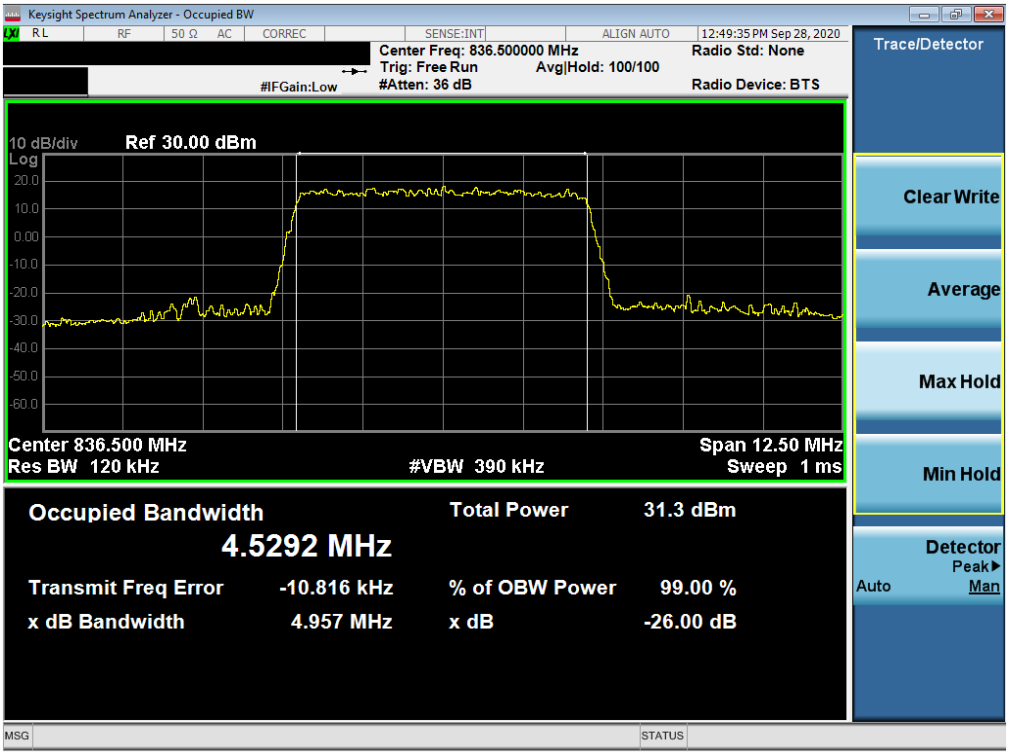
Plot 7-12. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz 256-QAM - Full RB Configuration)



Plot 7-13. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz QPSK - Full RB Configuration)

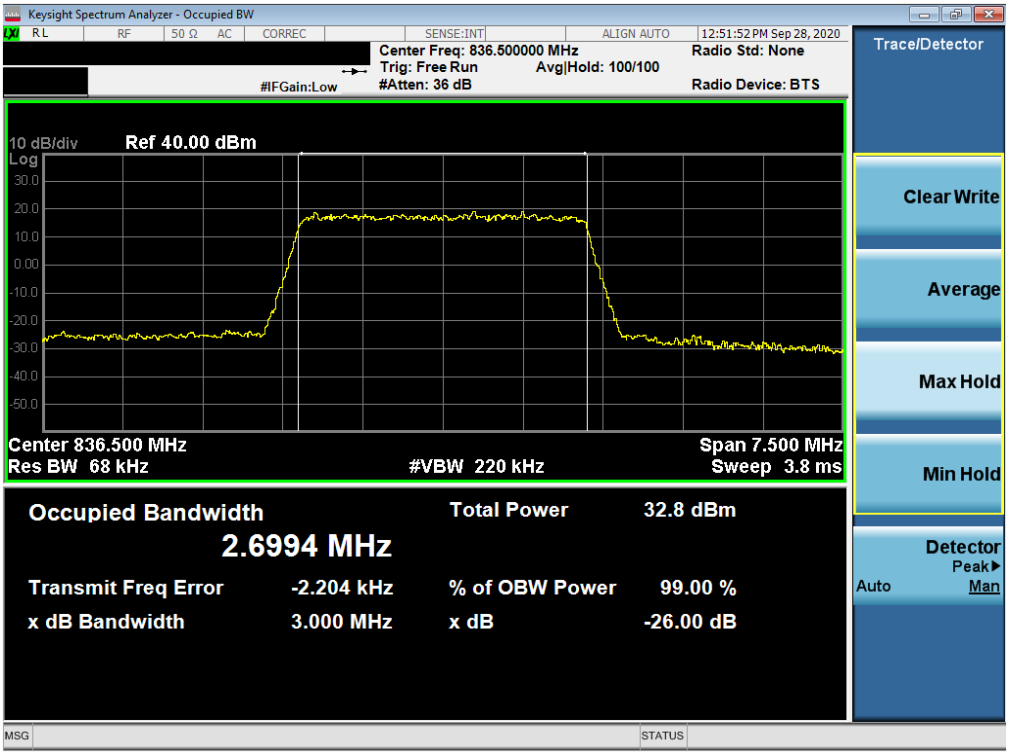


Plot 7-14. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz 16-QAM - Full RB Configuration)

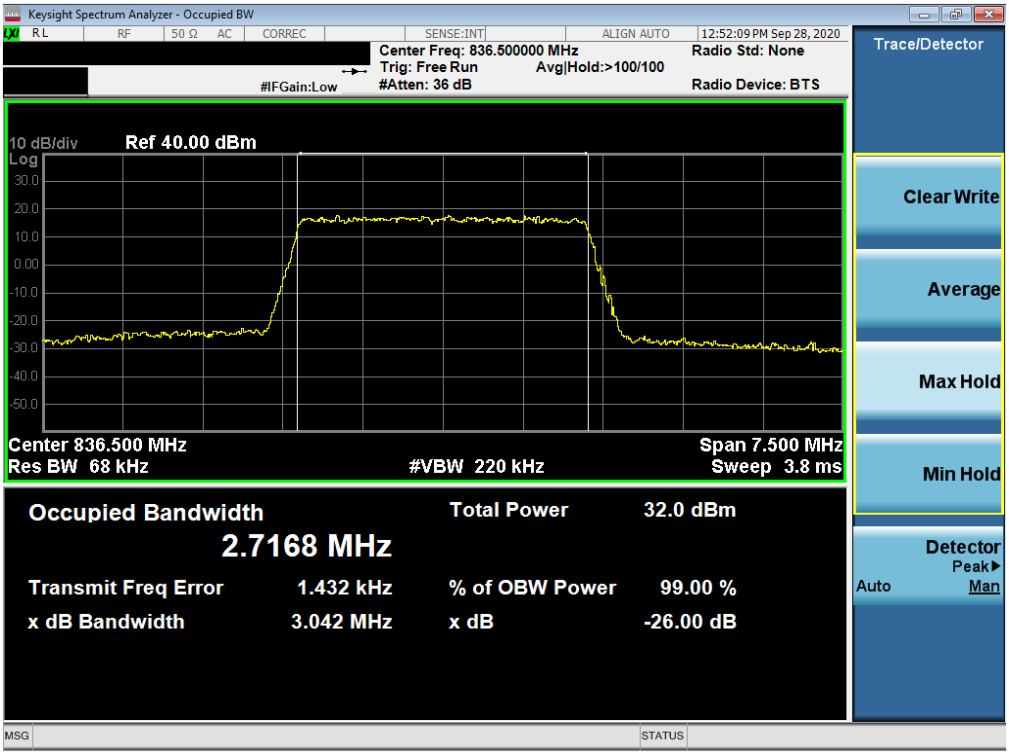


Plot 7-15. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz 64-QAM - Full RB Configuration)

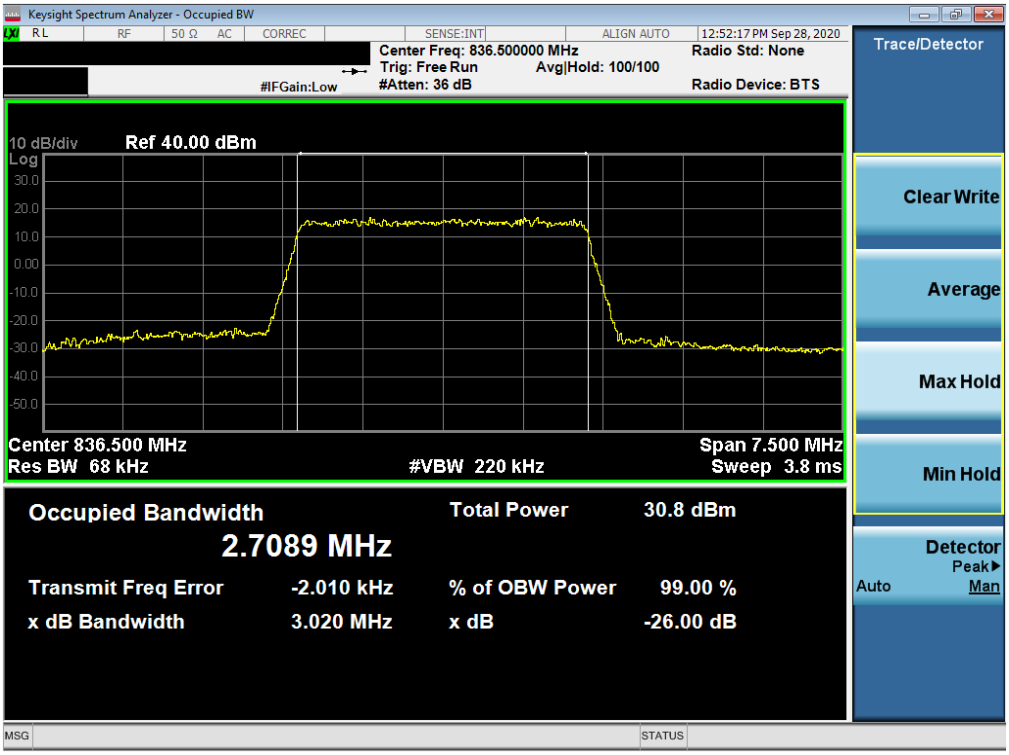
Plot 7-16. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz 256-QAM - Full RB Configuration)



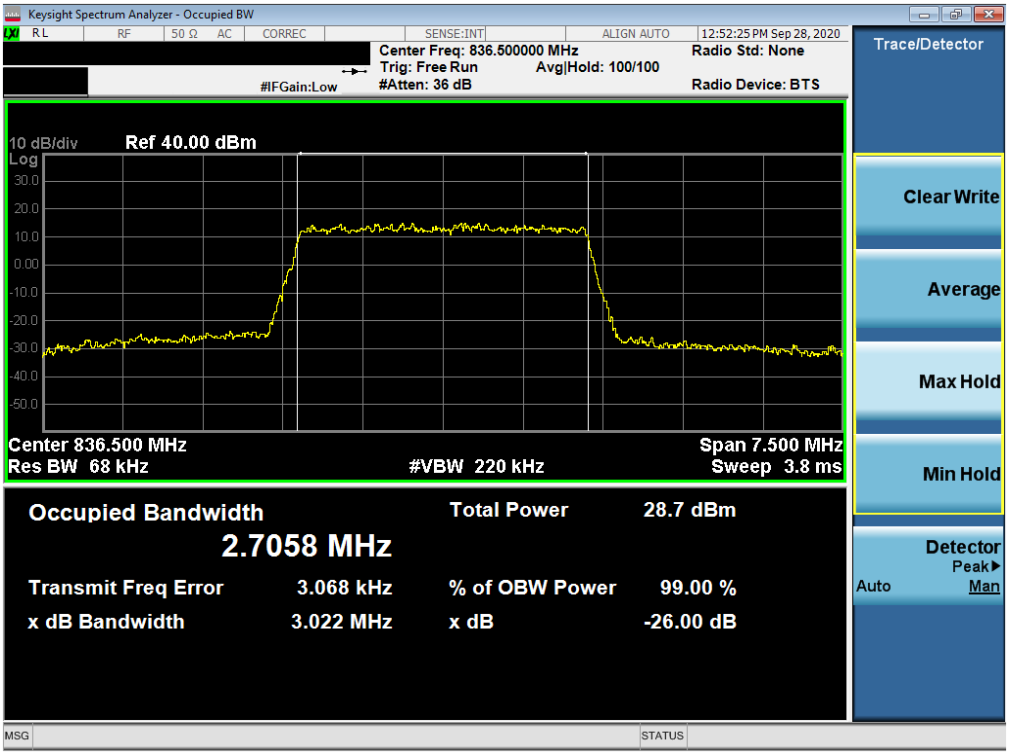
Plot 7-17. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz QPSK - Full RB Configuration)



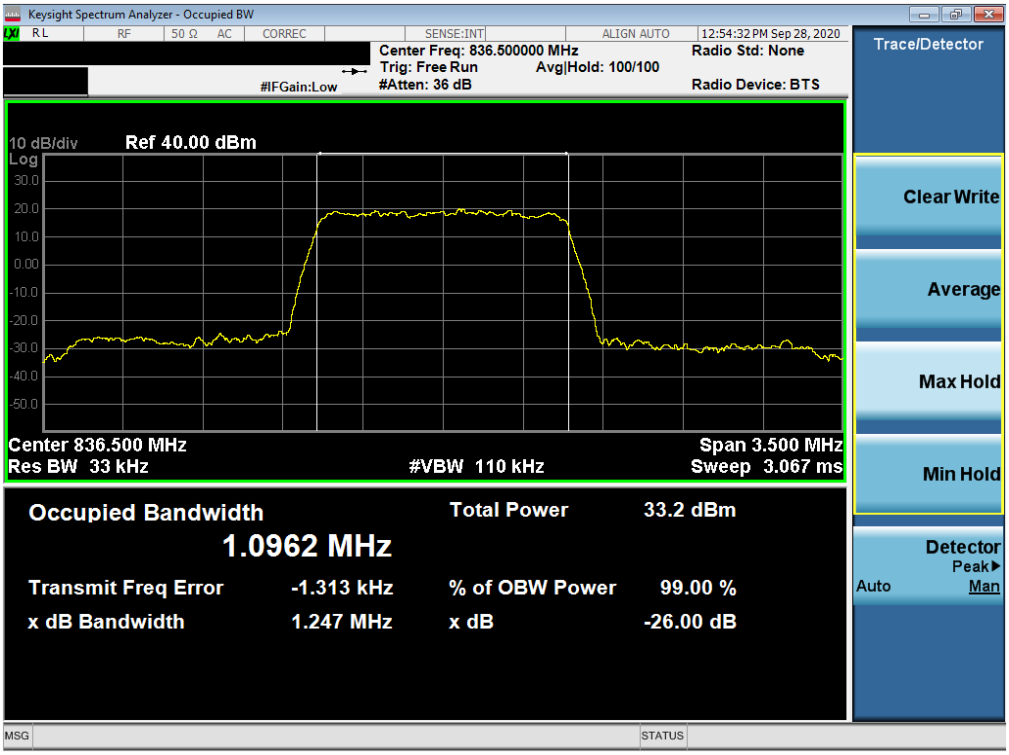
Plot 7-18. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz 16-QAM - Full RB Configuration)



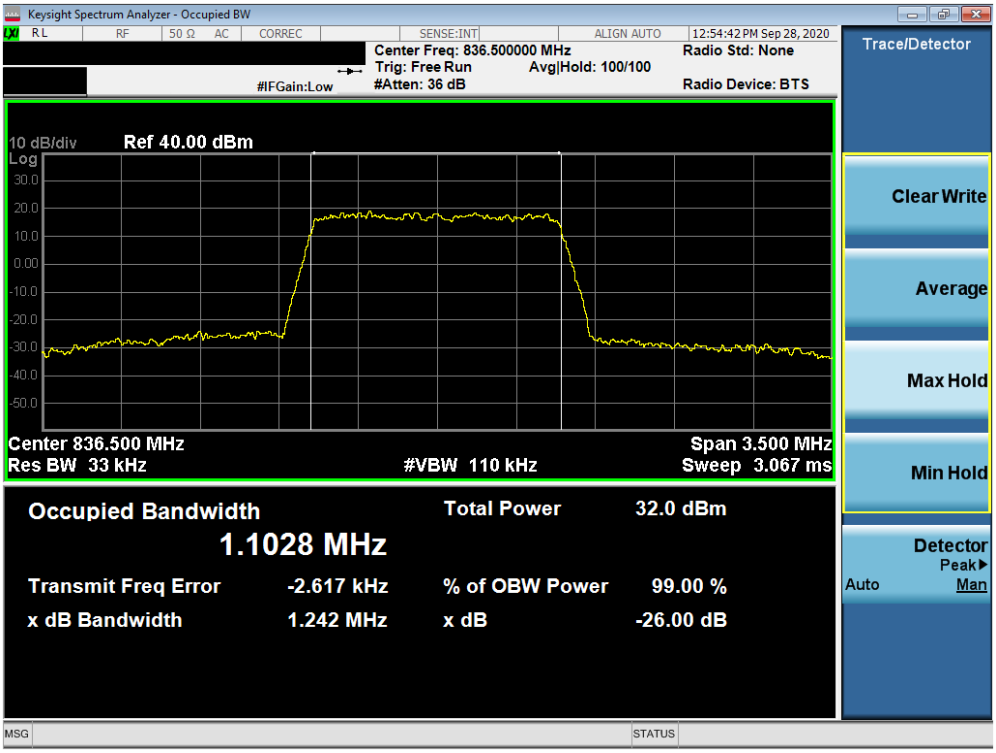
Plot 7-19. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz 64-QAM - Full RB Configuration)



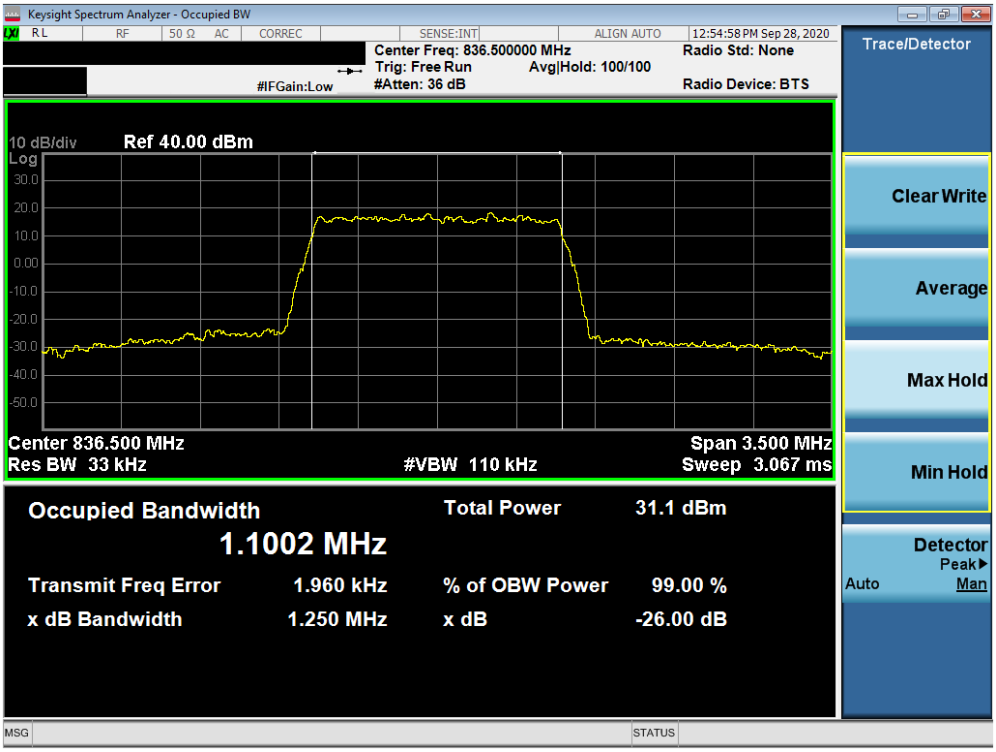
Plot 7-20. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz 256-QAM - Full RB Configuration)



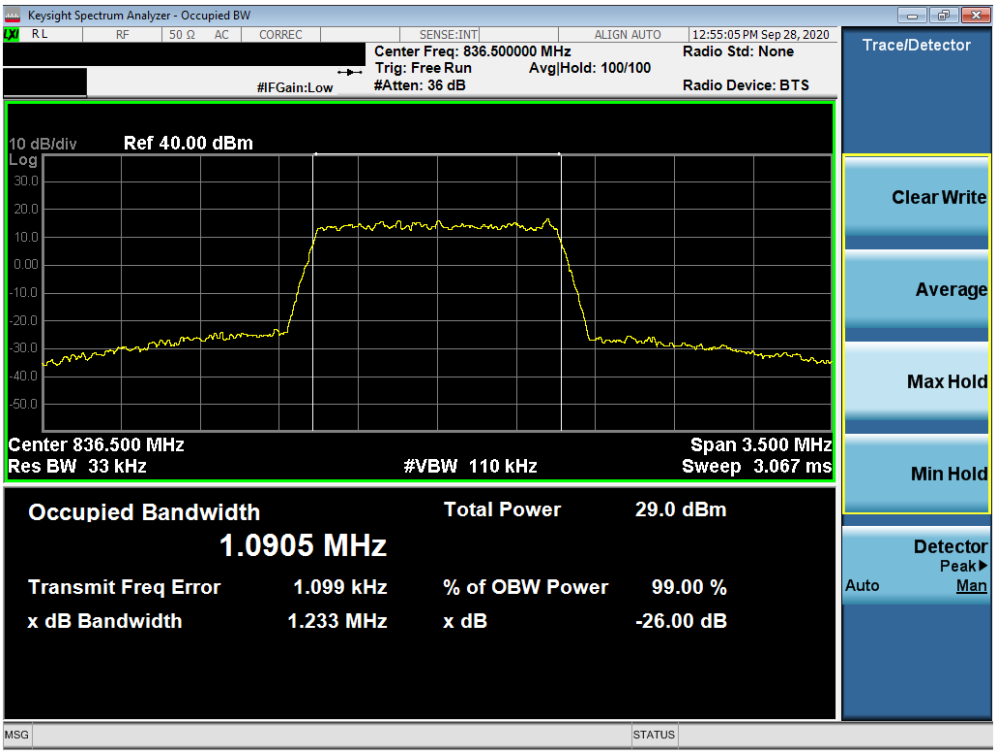
Plot 7-21. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz QPSK - Full RB Configuration)



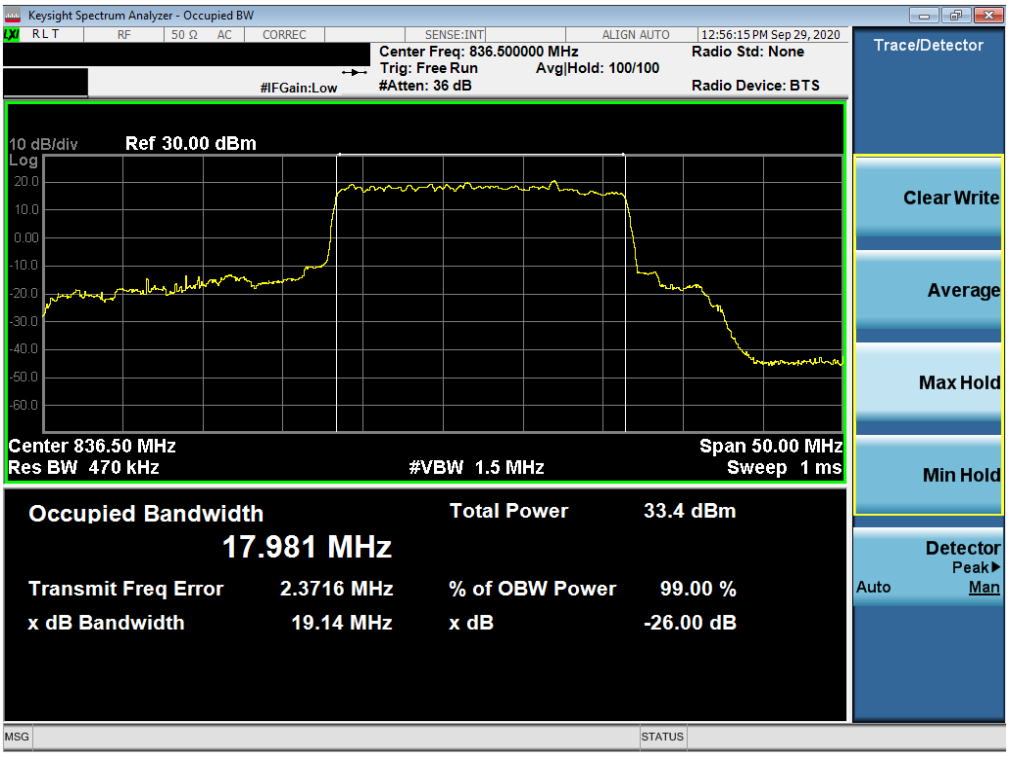
Plot 7-22. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz 16-QAM - Full RB Configuration)



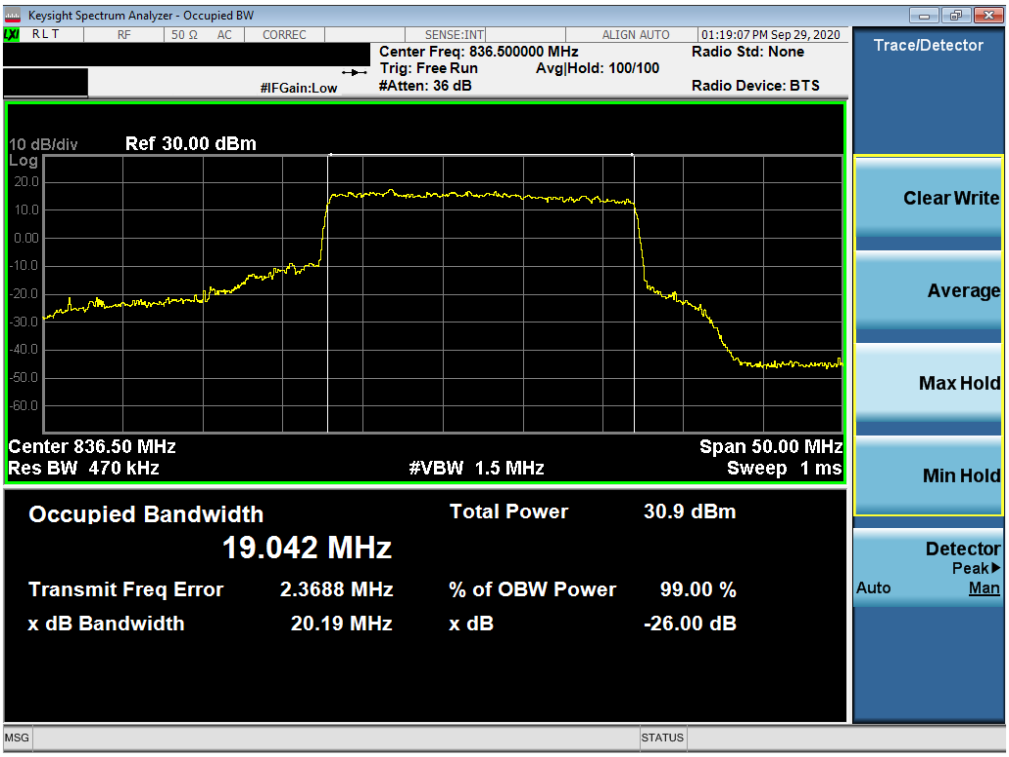
Plot 7-23. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz 64-QAM - Full RB Configuration)



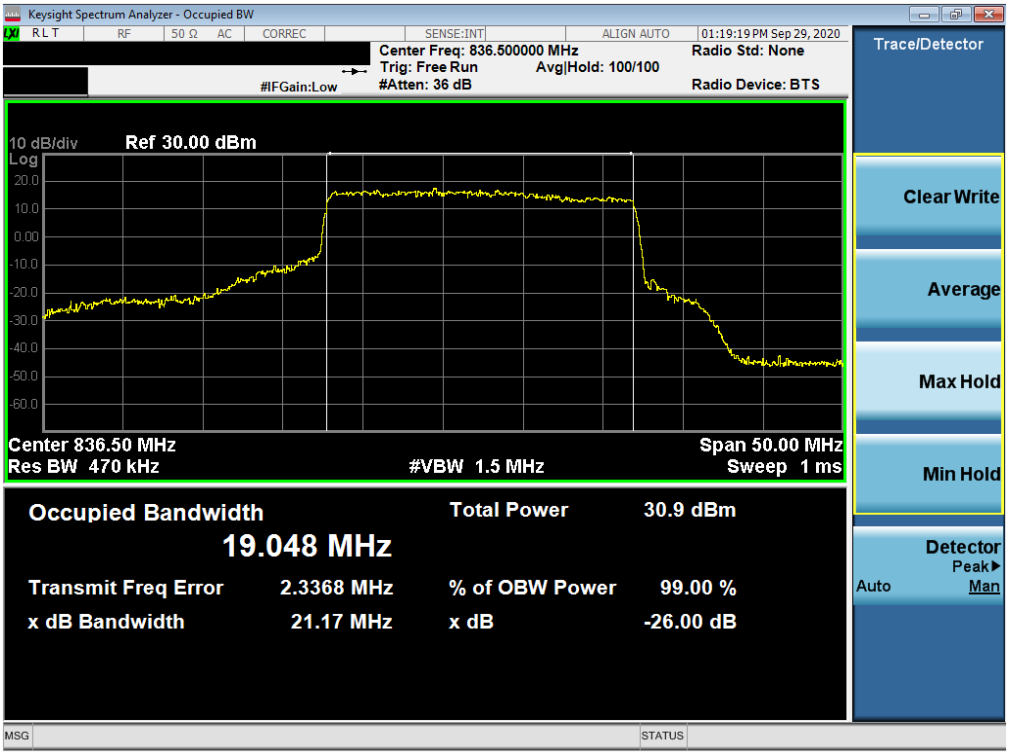
Plot 7-24. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz 256-QAM - Full RB Configuration)



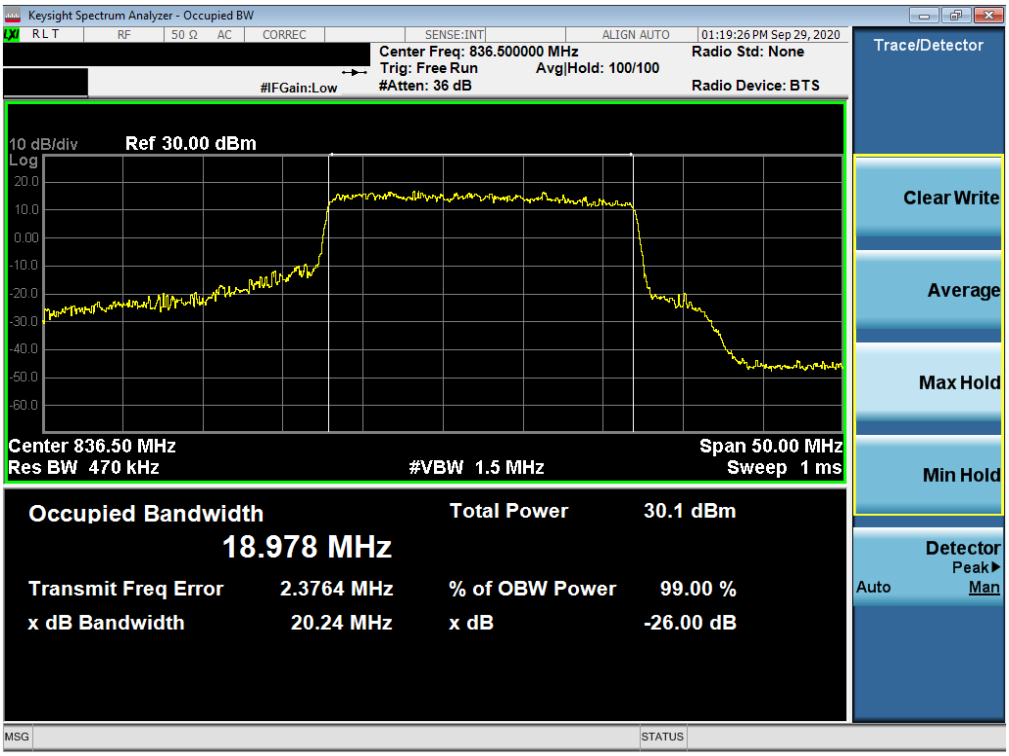
Plot 7-25. Occupied Bandwidth Plot (NR Band n5 - 20MHz π/2 BPSK - Full RB Configuration)



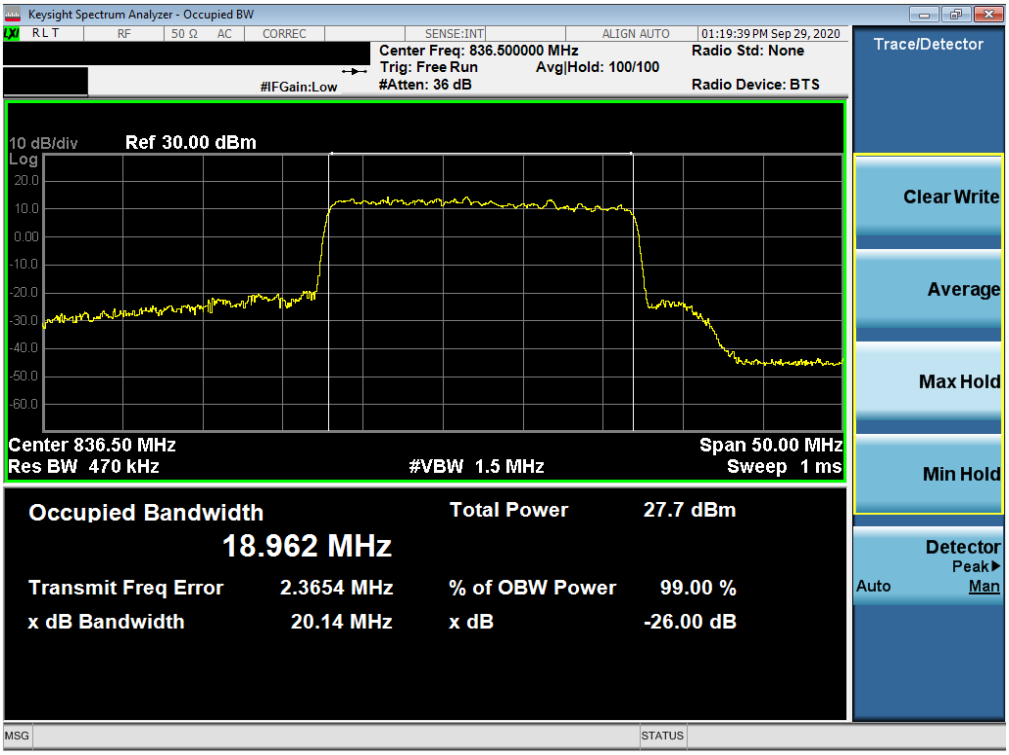
Plot 7-26. Occupied Bandwidth Plot (NR Band n5 - 20MHz QPSK - Full RB Configuration)



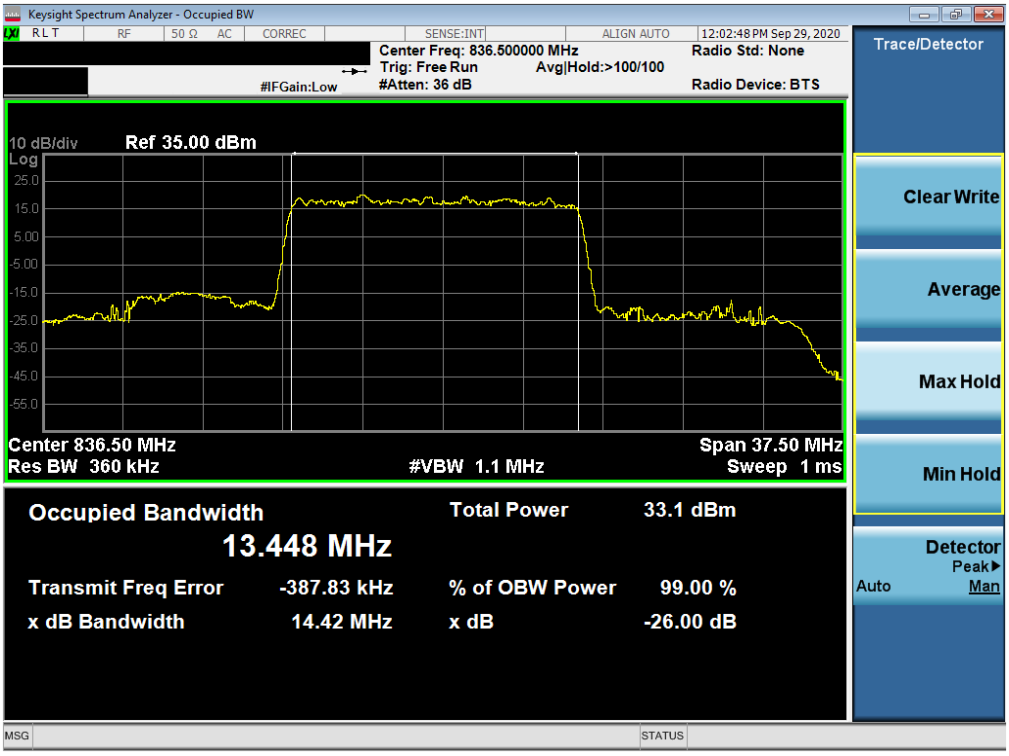
Plot 7-27. Occupied Bandwidth Plot (NR Band n5 - 20MHz 16-QAM - Full RB Configuration)



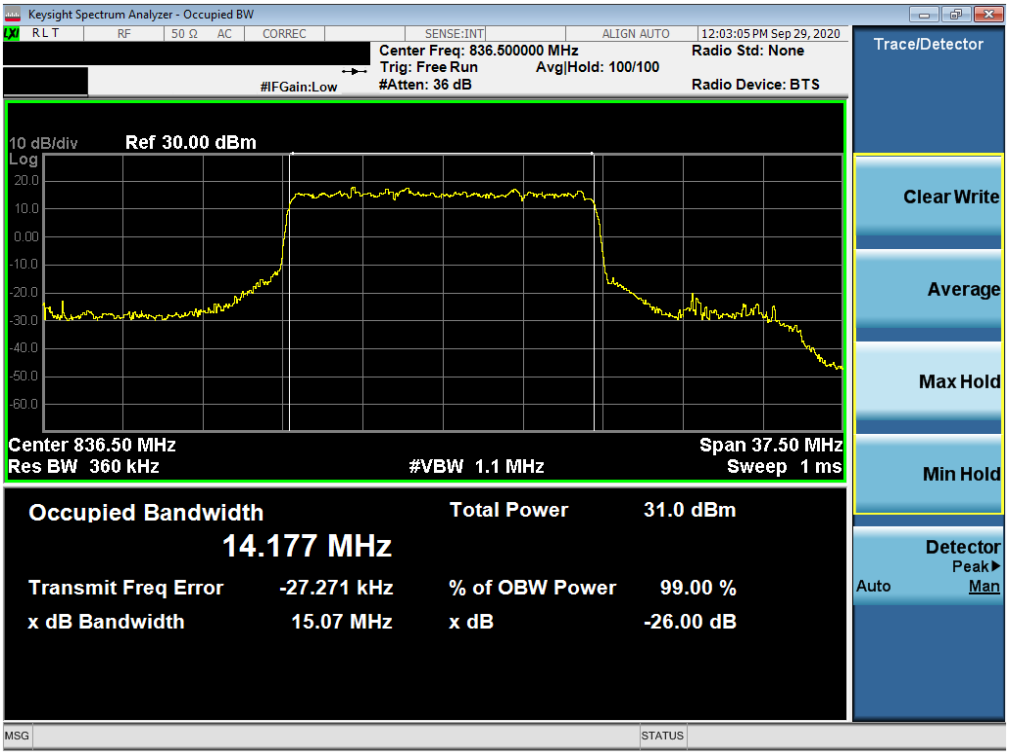
Plot 7-28. Occupied Bandwidth Plot (NR Band n5 - 20MHz 64-QAM - Full RB Configuration)



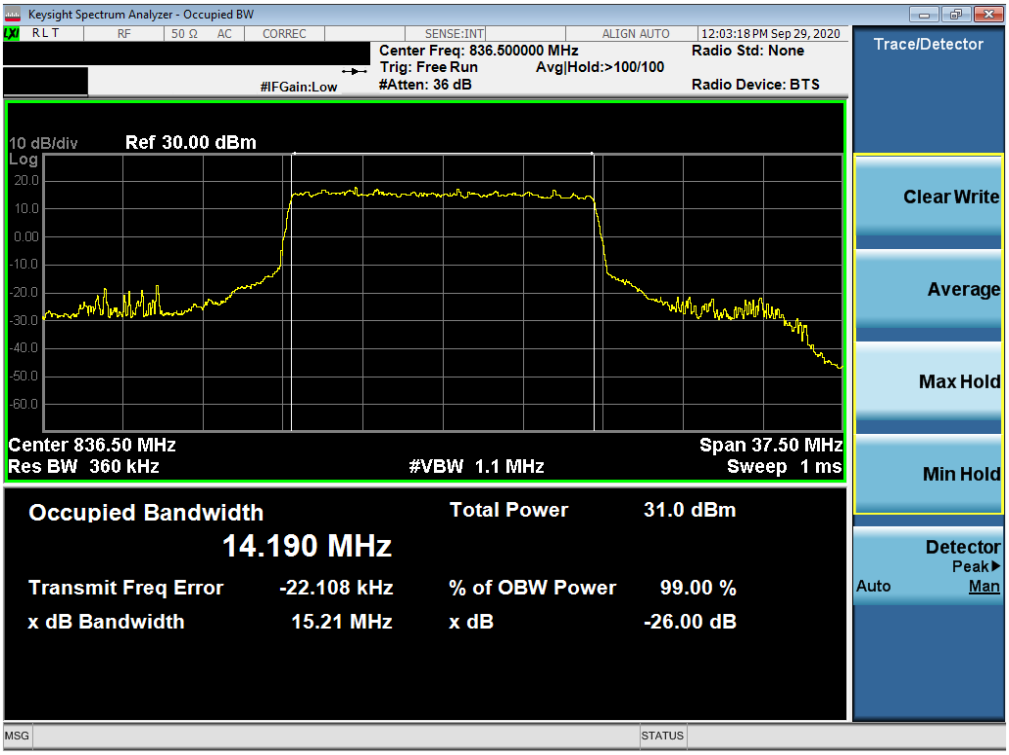
Plot 7-29. Occupied Bandwidth Plot (NR Band n5 - 20MHz 256-QAM - Full RB Configuration)



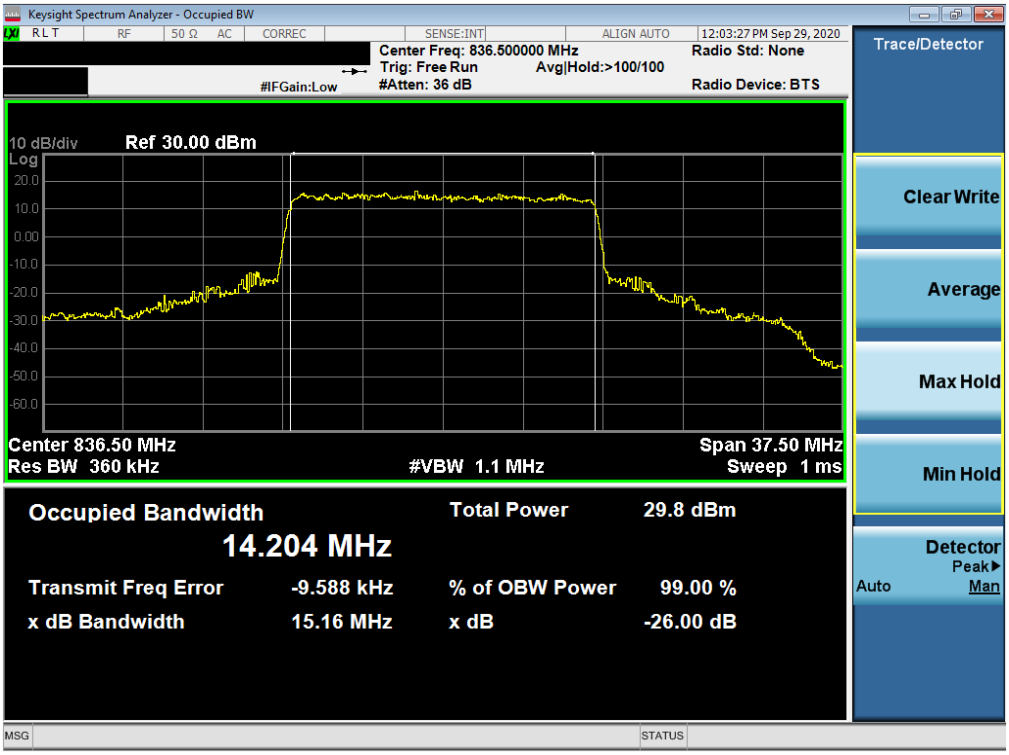
Plot 7-30. Occupied Bandwidth Plot (NR Band n5 - 15MHz π/2 BPSK - Full RB Configuration)



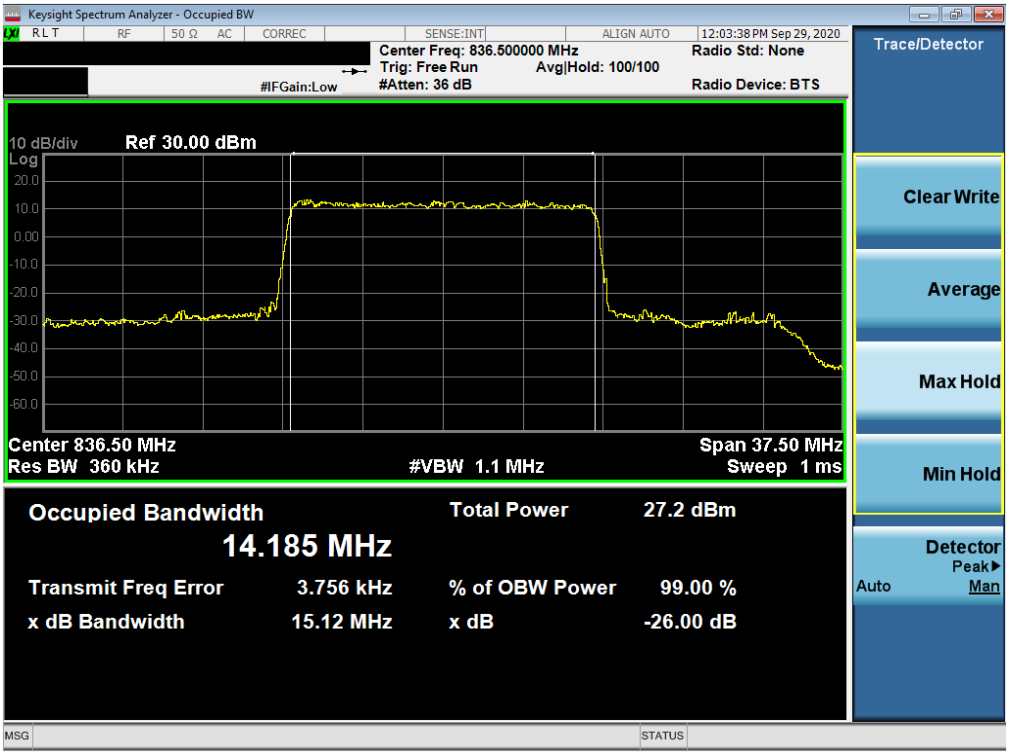
Plot 7-31. Occupied Bandwidth Plot (NR Band n5 - 15MHz QPSK - Full RB Configuration)



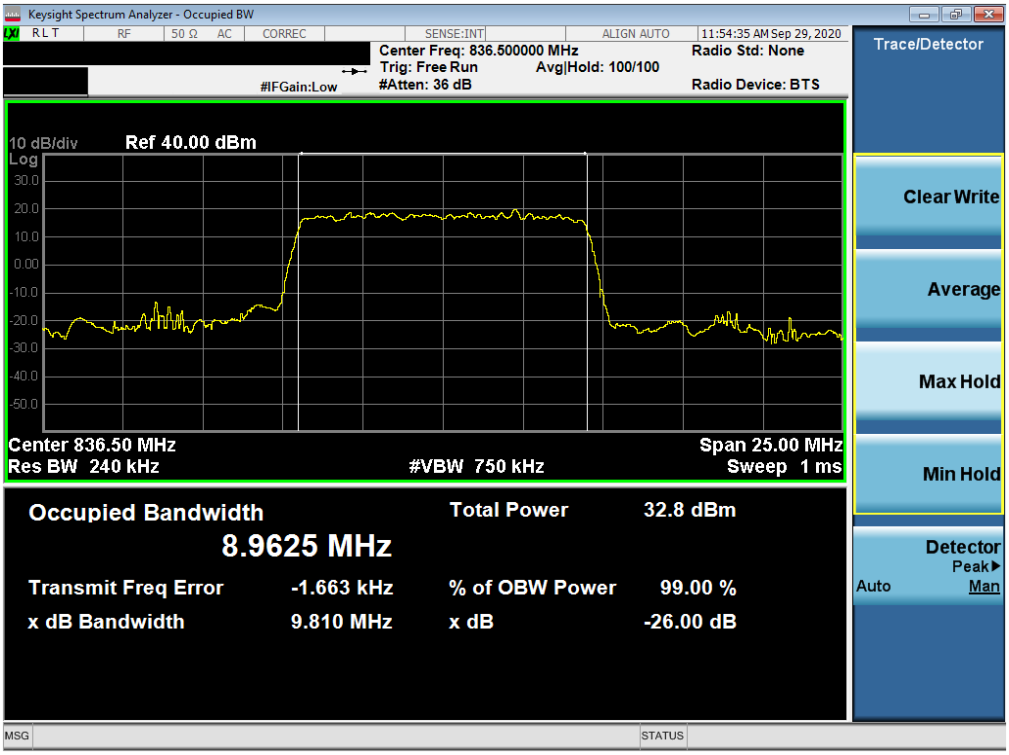
Plot 7-32. Occupied Bandwidth Plot (NR Band n5 - 15MHz 16-QAM - Full RB Configuration)



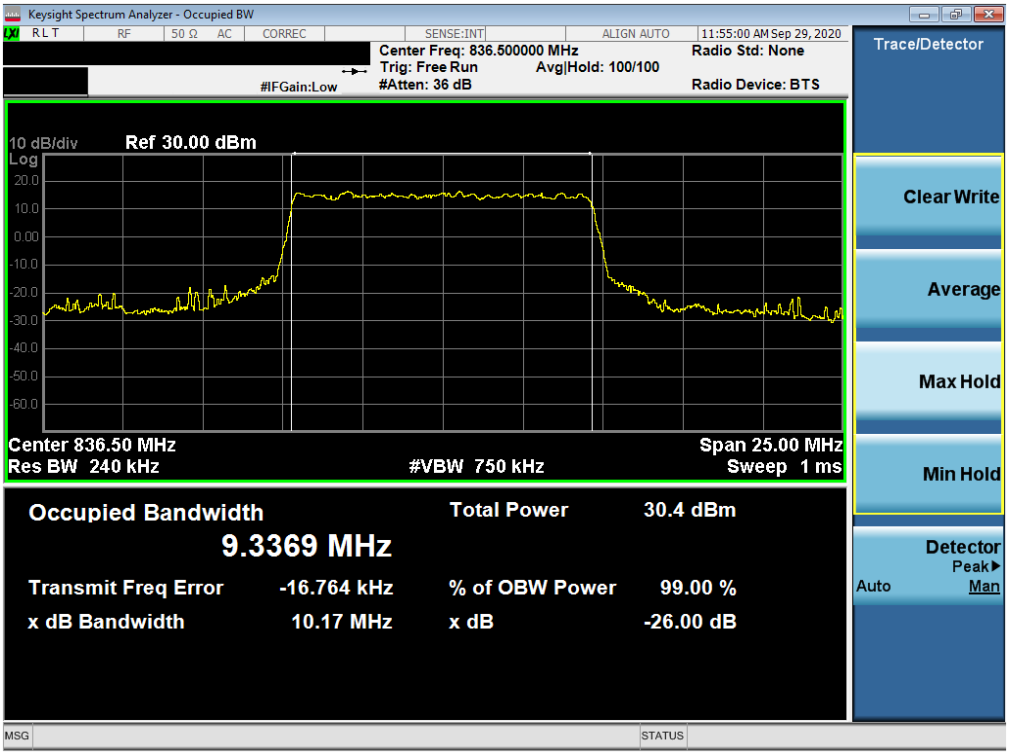
Plot 7-33. Occupied Bandwidth Plot (NR Band n5 - 15MHz 64-QAM - Full RB Configuration)



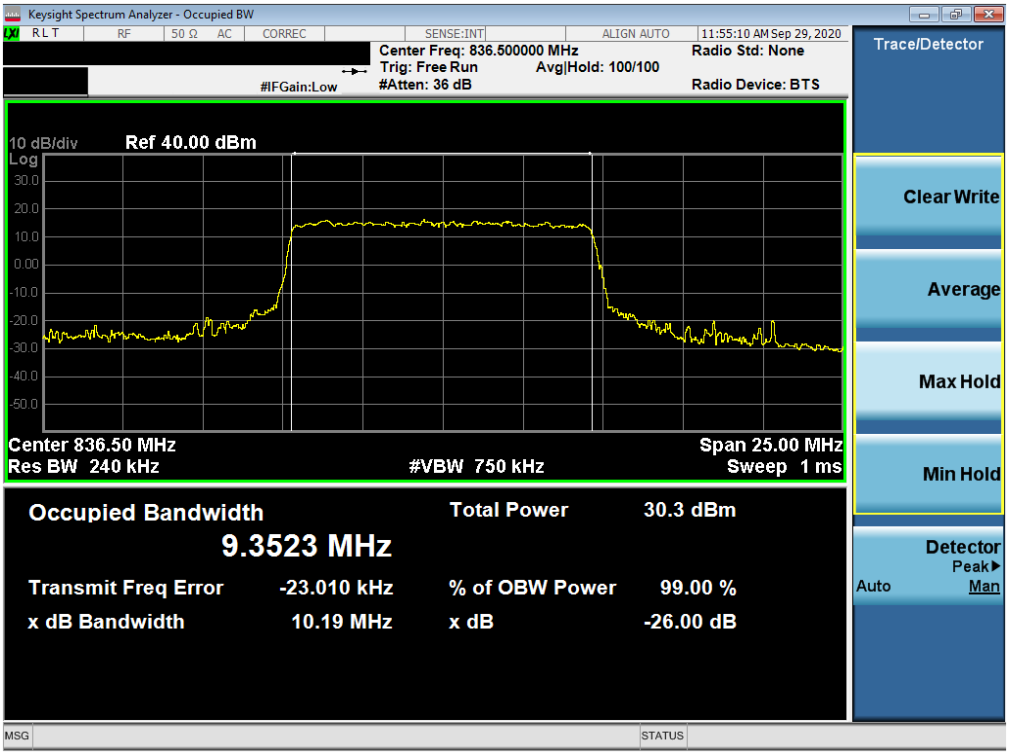
Plot 7-34. Occupied Bandwidth Plot (NR Band n5 - 15MHz 256-QAM - Full RB Configuration)



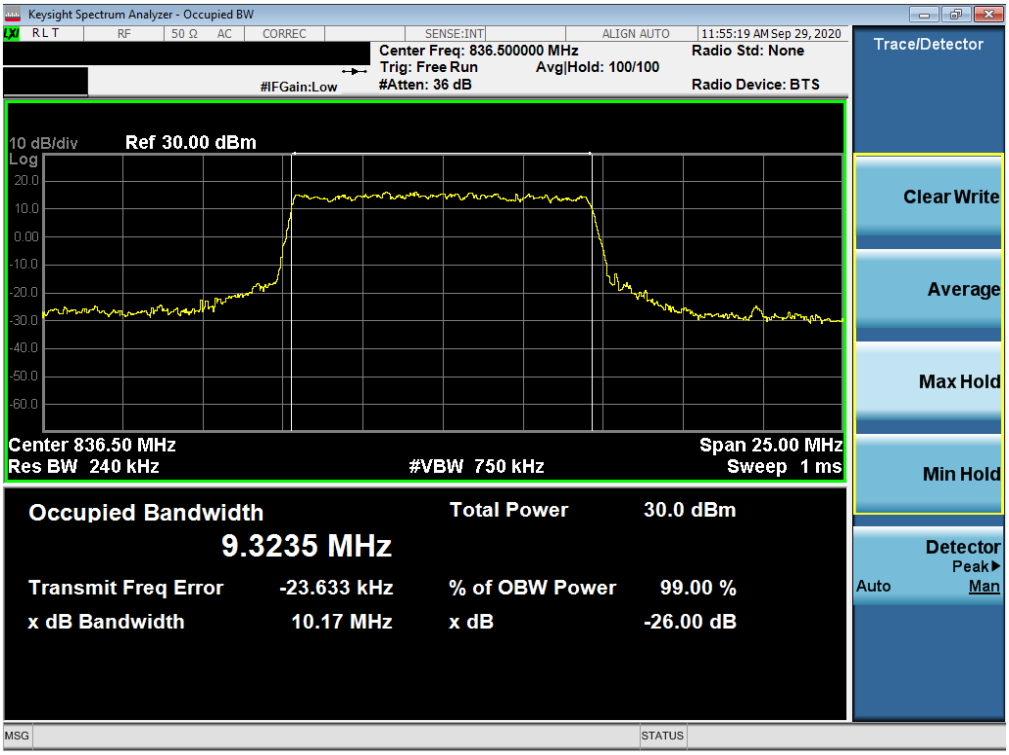
Plot 7-35. Occupied Bandwidth Plot (NR Band n5 - 10MHz π/2 BPSK - Full RB Configuration)



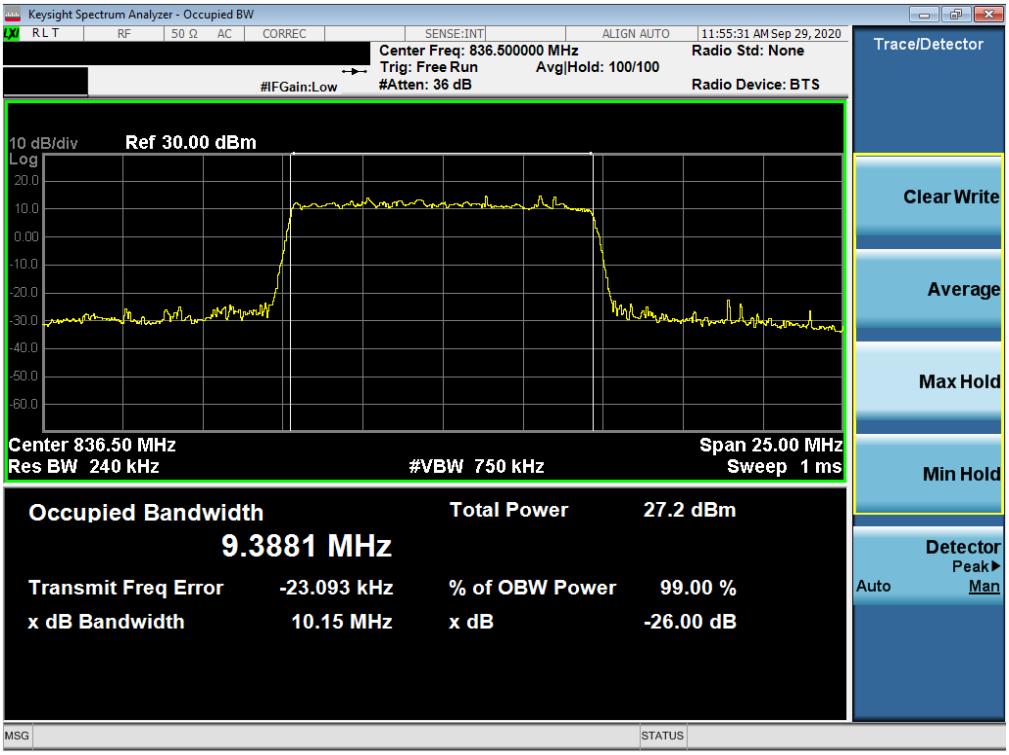
Plot 7-36. Occupied Bandwidth Plot (NR Band n5 - 10MHz QPSK - Full RB Configuration)



Plot 7-37. Occupied Bandwidth Plot (NR Band n5 - 10MHz 16-QAM - Full RB Configuration)

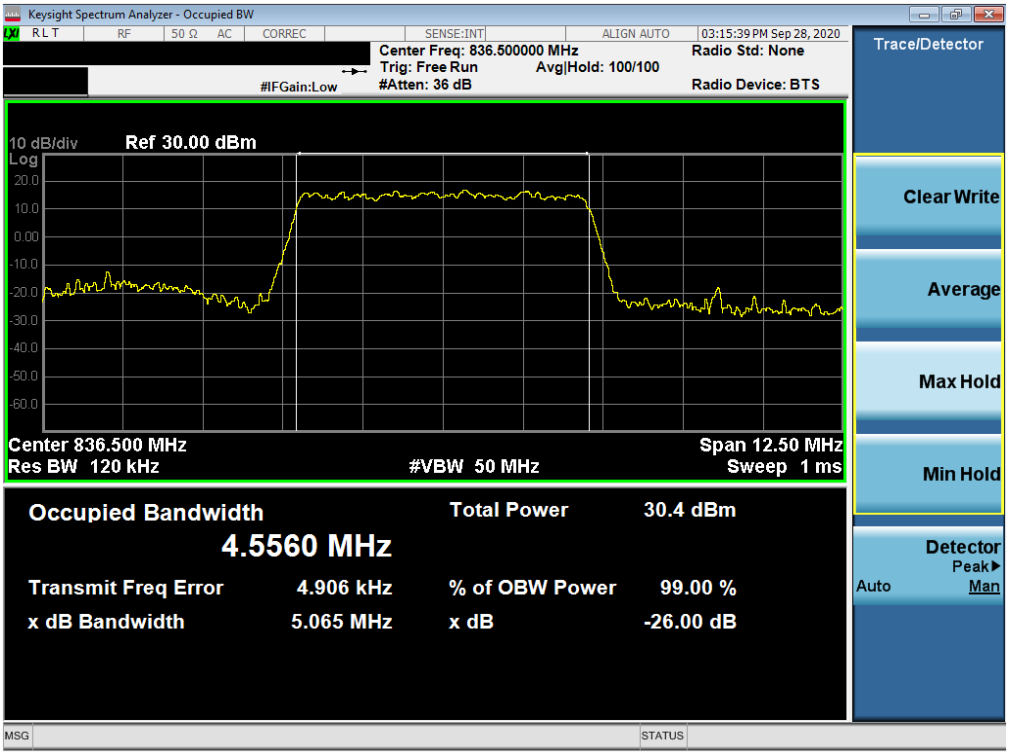


Plot 7-38. Occupied Bandwidth Plot (NR Band n5 - 10MHz 64-QAM - Full RB Configuration)

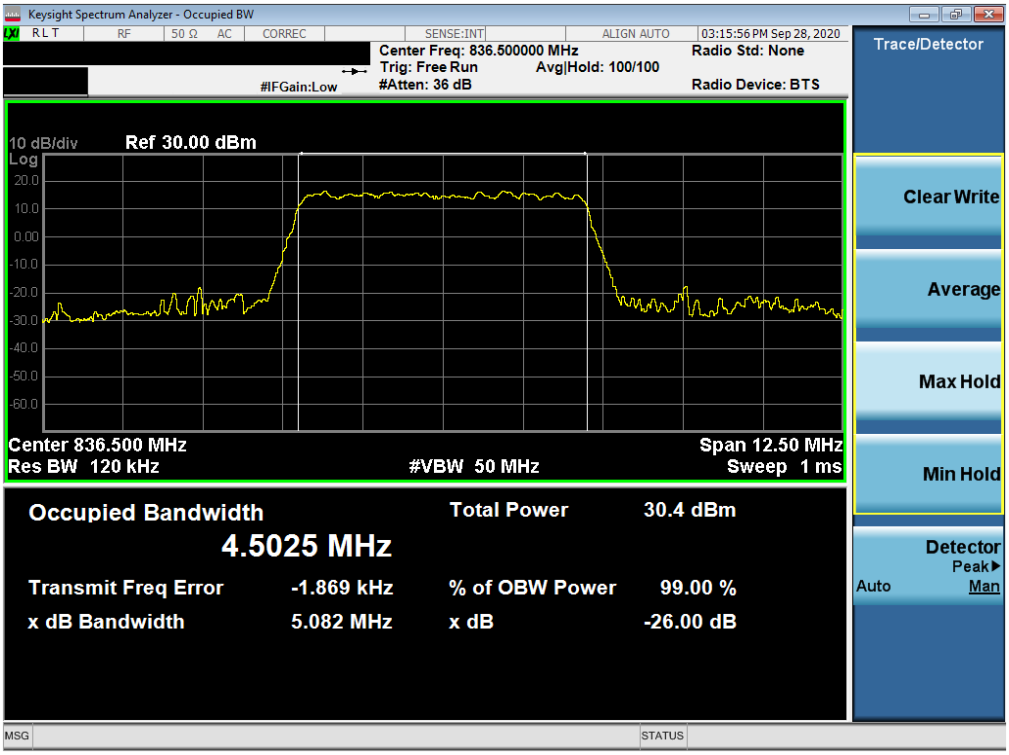


Plot 7-39. Occupied Bandwidth Plot (NR Band n5 - 10MHz 256-QAM - Full RB Configuration)

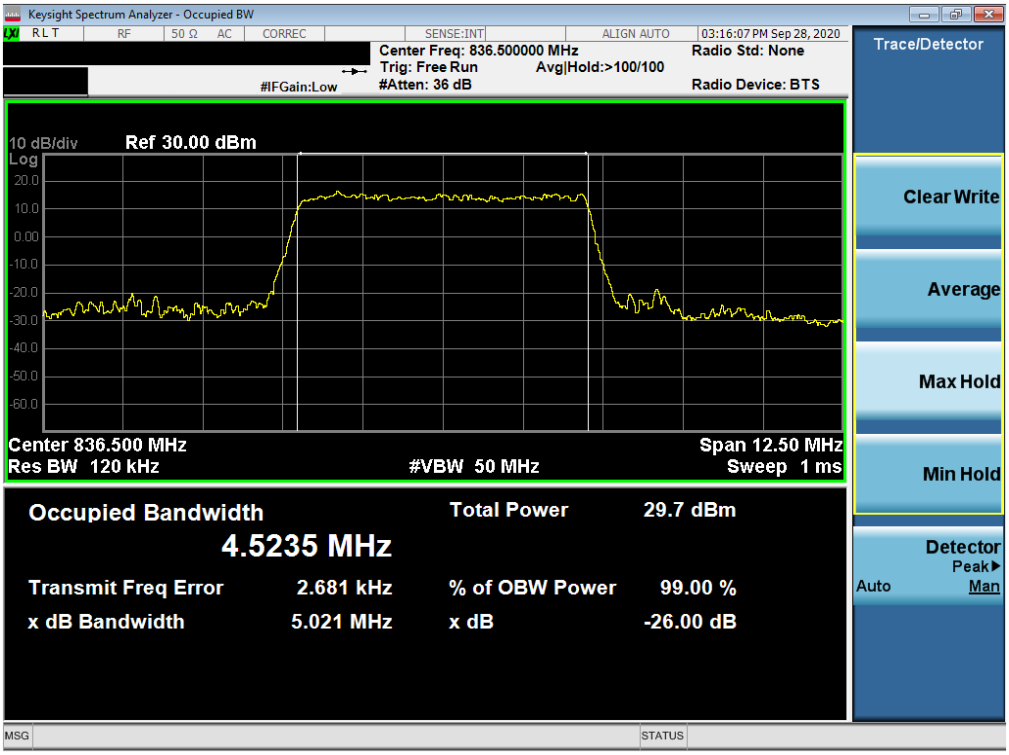
Plot 7-40. Occupied Bandwidth Plot (NR Band n5 - 5MHz π/2 BPSK - Full RB Configuration)



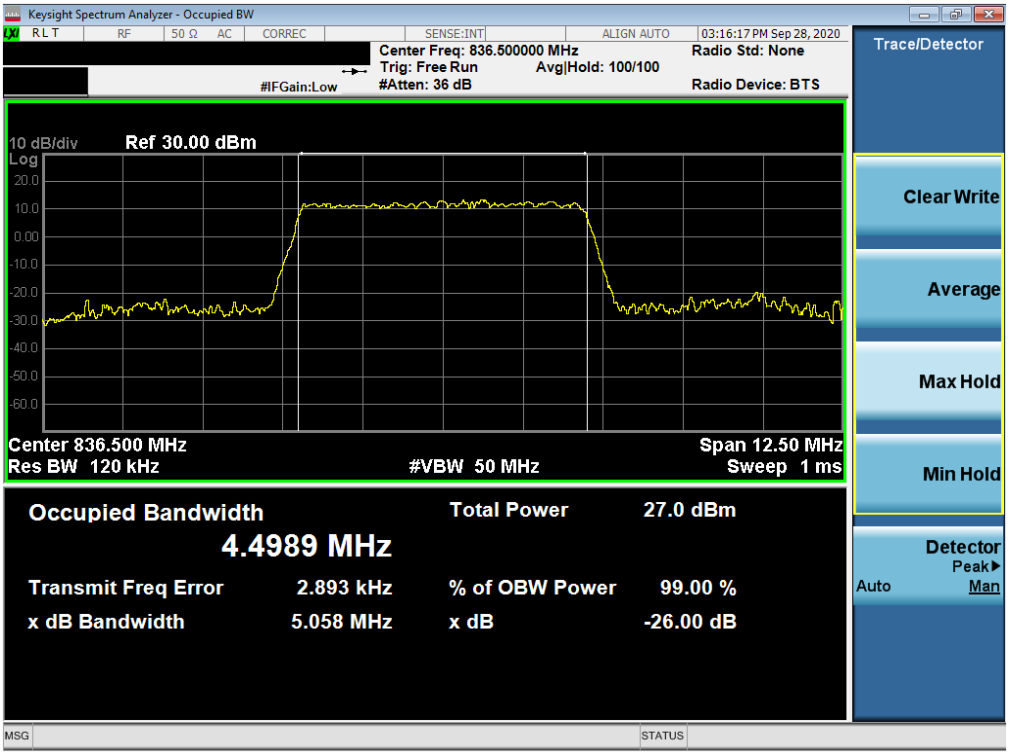
Plot 7-41. Occupied Bandwidth Plot (NR Band n5 - 5MHz QPSK - Full RB Configuration)



Plot 7-42. Occupied Bandwidth Plot (NR Band n5 - 5MHz 16-QAM - Full RB Configuration)



Plot 7-43. Occupied Bandwidth Plot (NR Band n5 - 5MHz 64-QAM - Full RB Configuration)



Plot 7-44. Occupied Bandwidth Plot (NR Band n5 - 5MHz 256-QAM - Full RB Configuration)

7.3 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

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

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

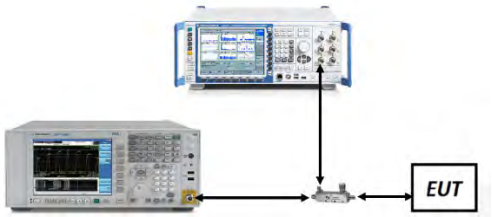
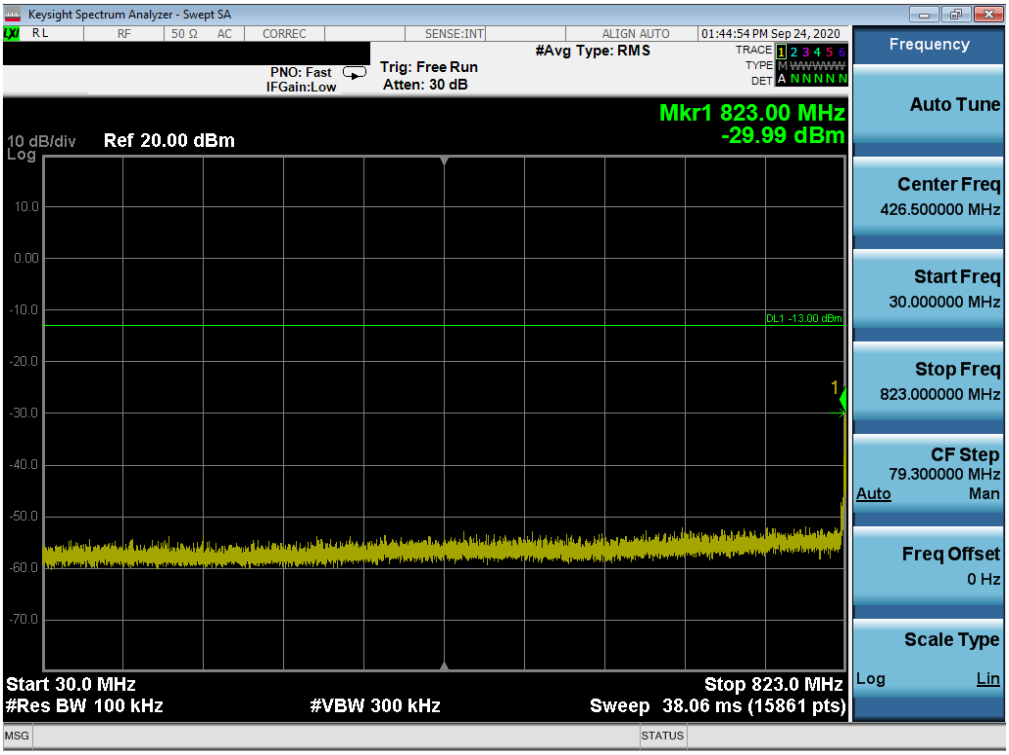


Figure 7-2. Test Instrument & Measurement Setup

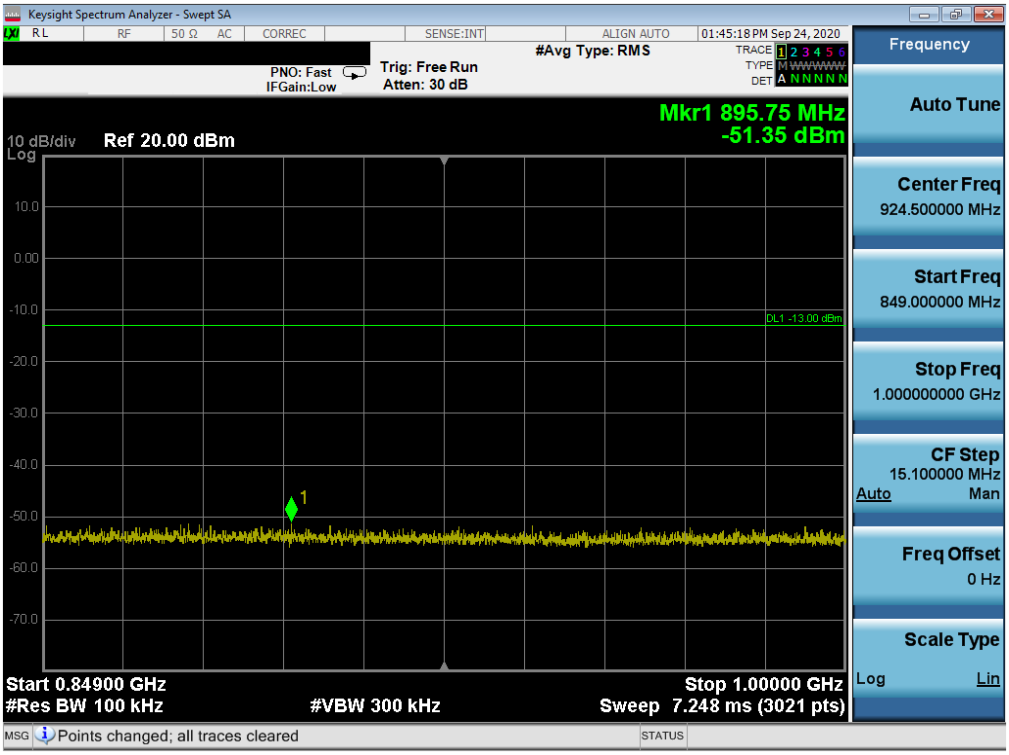
Test Notes

1. Per Part 22 and RSS-132, 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.

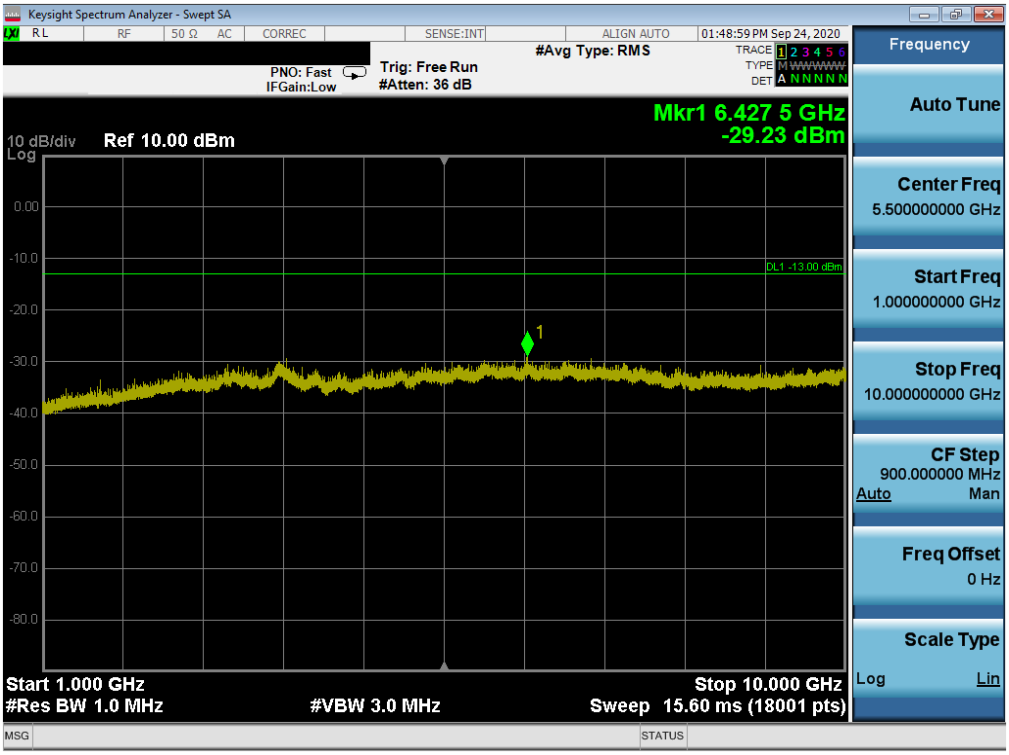
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.



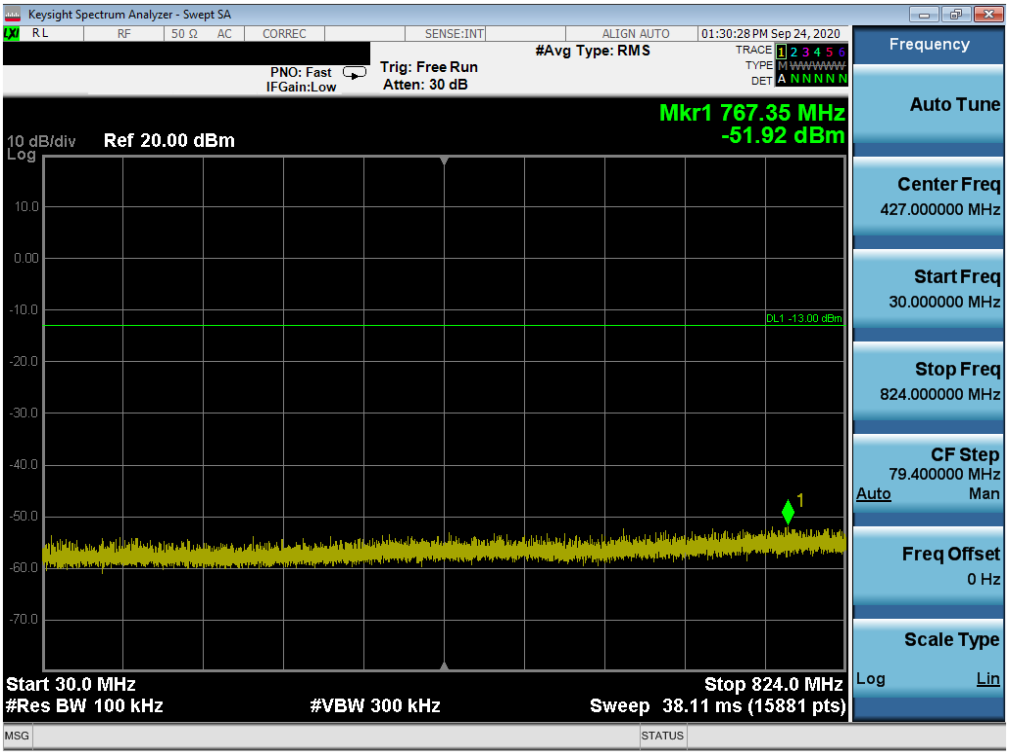
Plot 7-45.. **Conducted Spurious Plot (GPRS Ch. 128)**



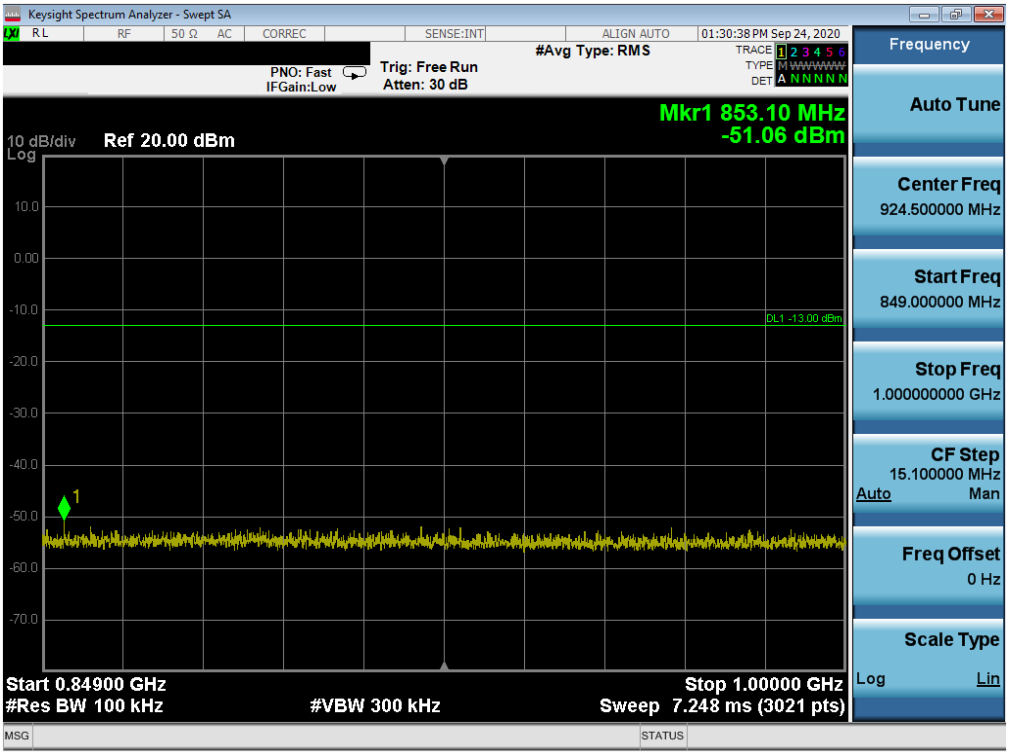
Plot 7-46.. **Conducted Spurious Plot (GPRS Ch. 128)**



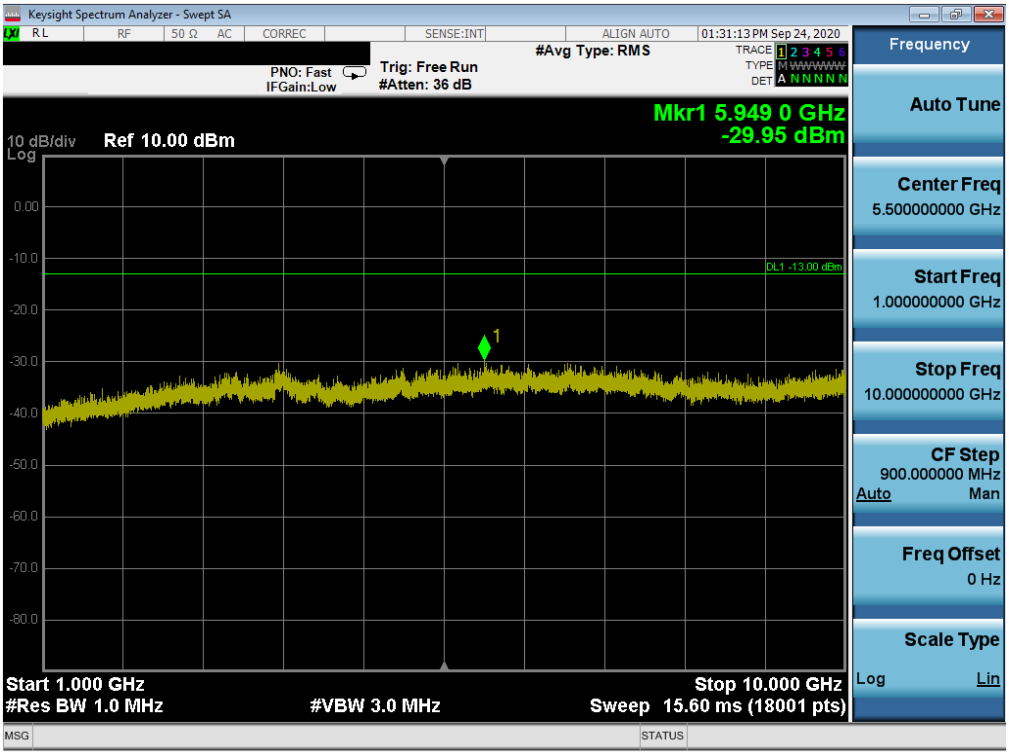
Plot 7-47.. Conducted Spurious Plot (GPRS Ch. 128)



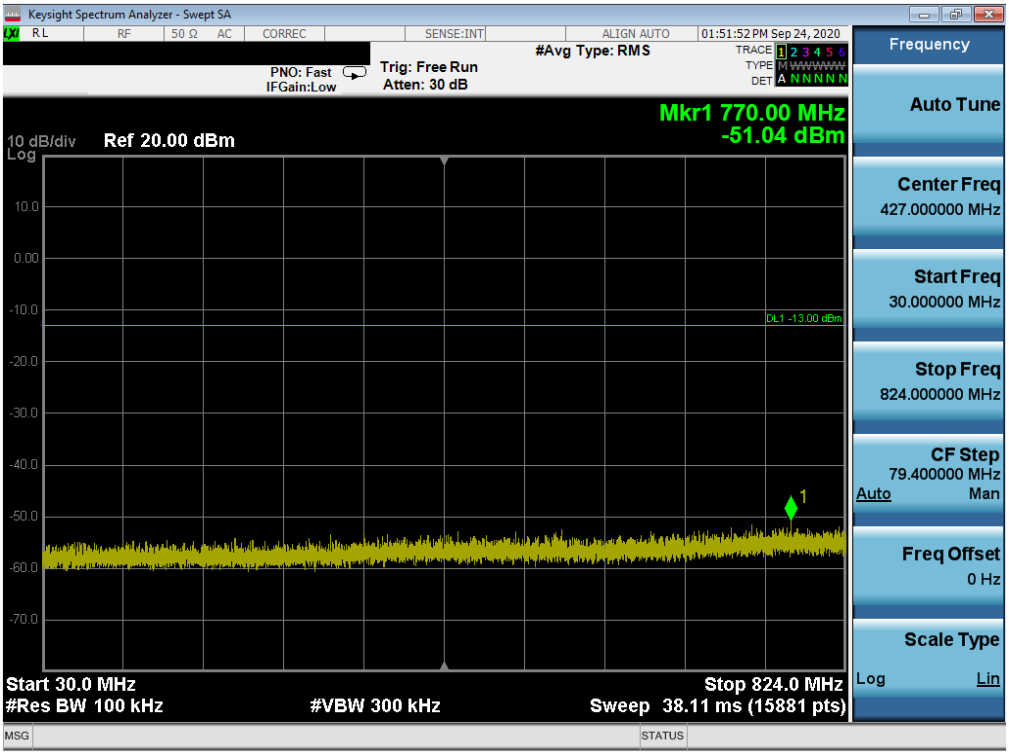
Plot 7-48.. Conducted Spurious Plot (GPRS Ch. 190)



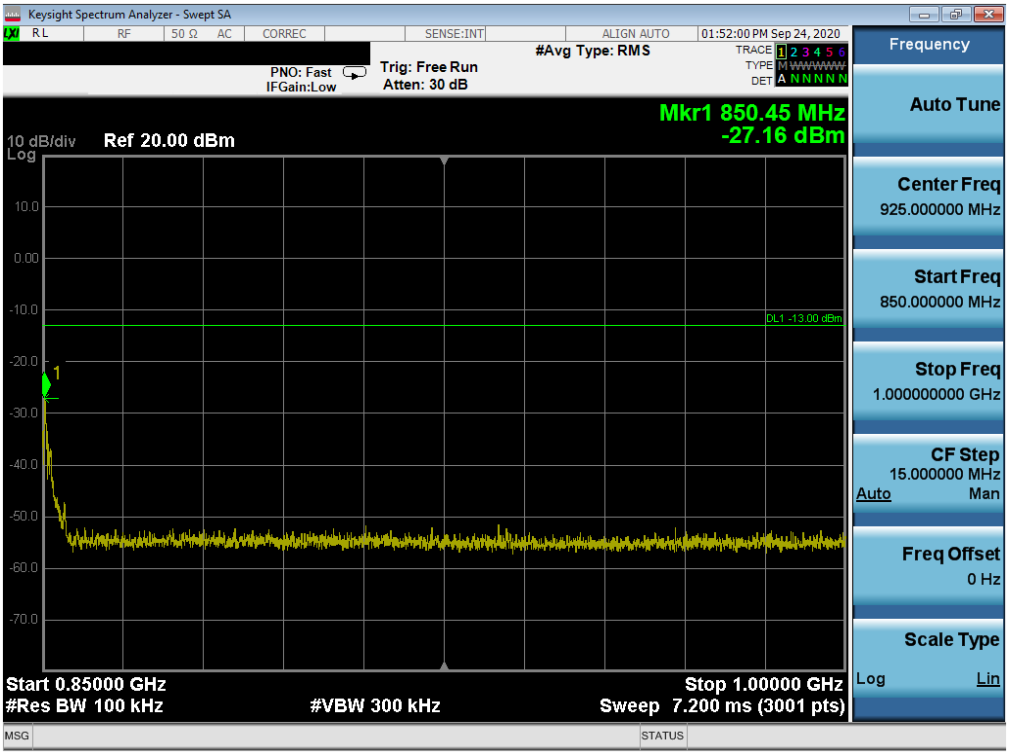
Plot 7-49.. Conducted Spurious Plot (GPRS Ch. 190)



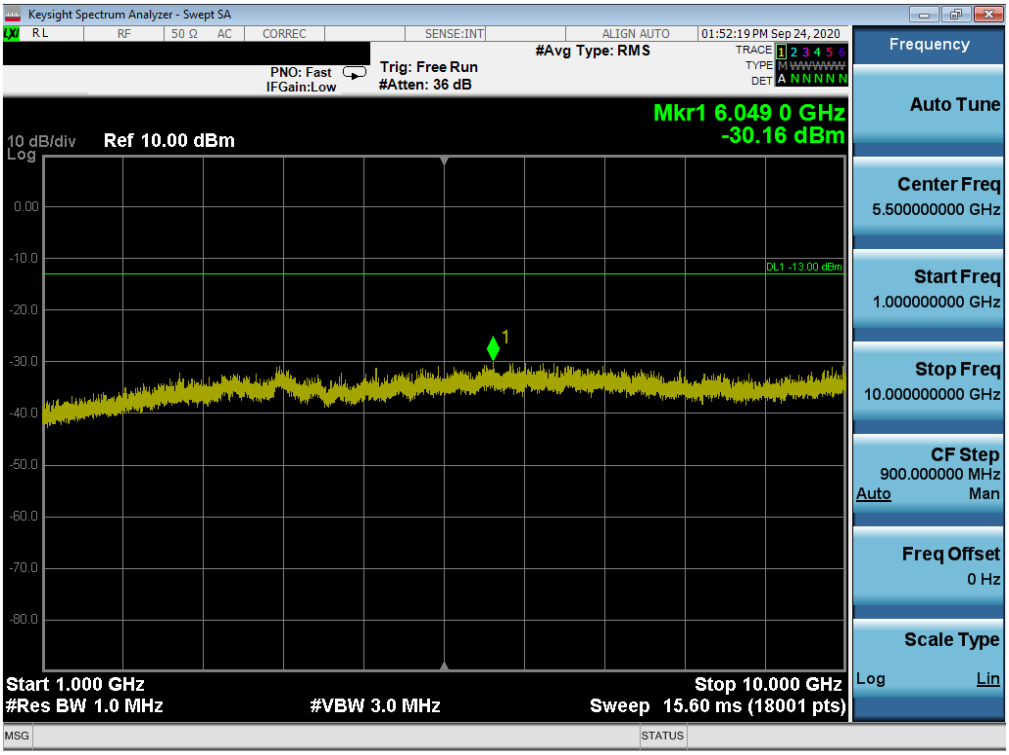
Plot 7-50.. Conducted Spurious Plot (GPRS Ch. 190)



Plot 7-51.. Conducted Spurious Plot (GPRS Ch. 251)

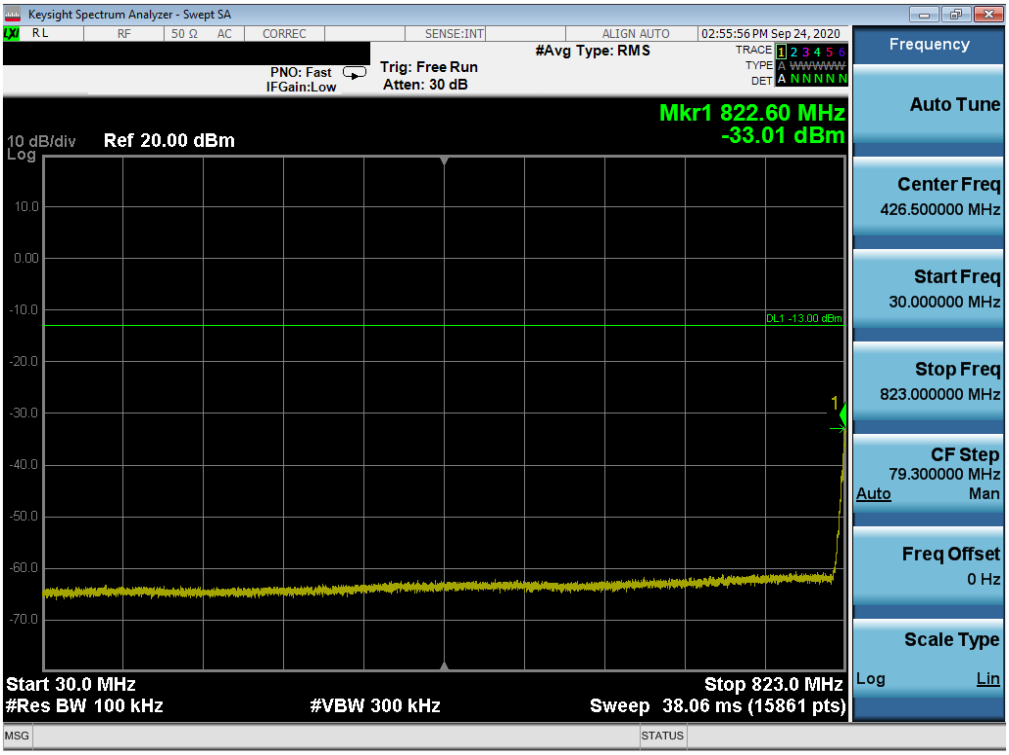


Plot 7-52. Conducted Spurious Plot (GPRS Ch. 251)

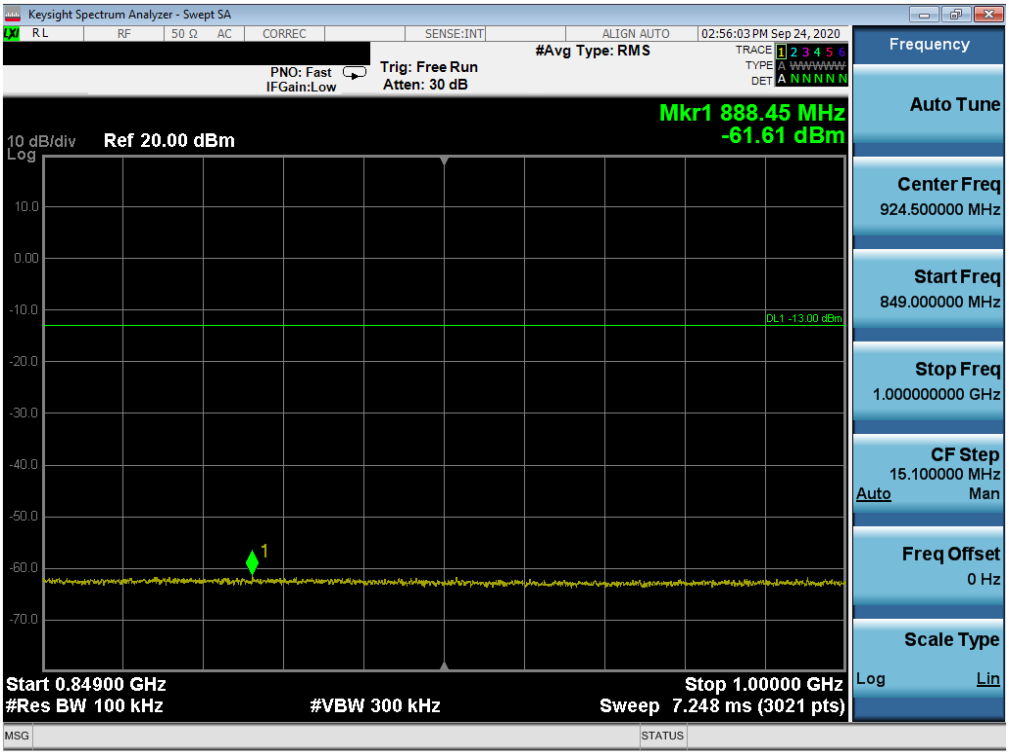


Plot 7-53.. Conducted Spurious Plot (GPRS Ch. 251)

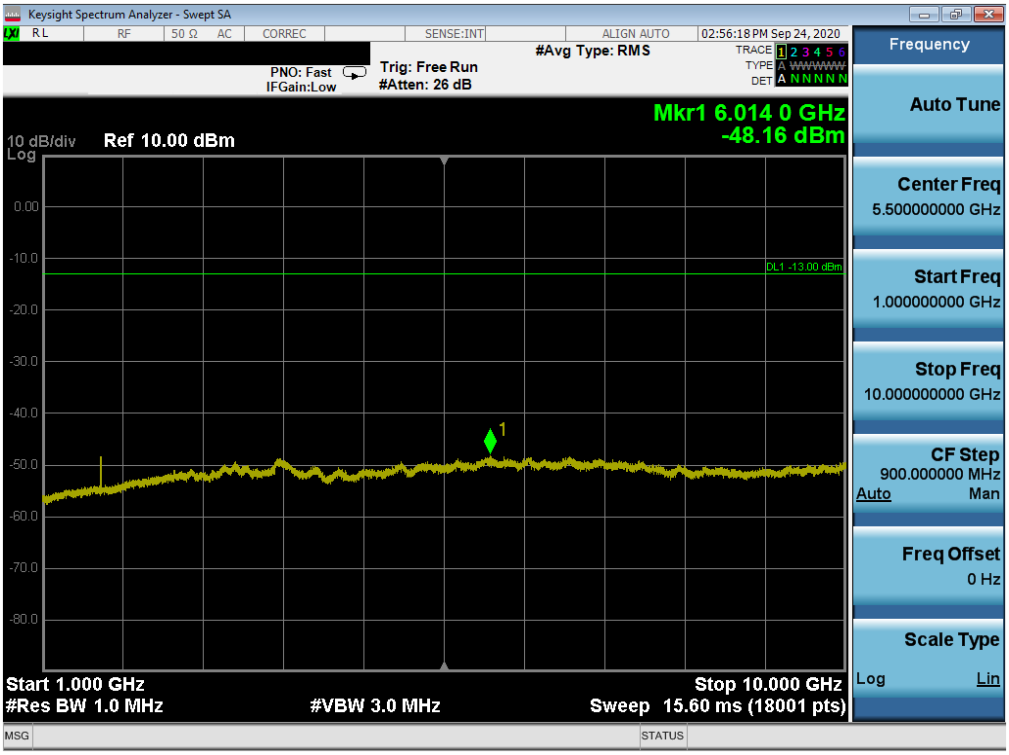
WCDMA Cell



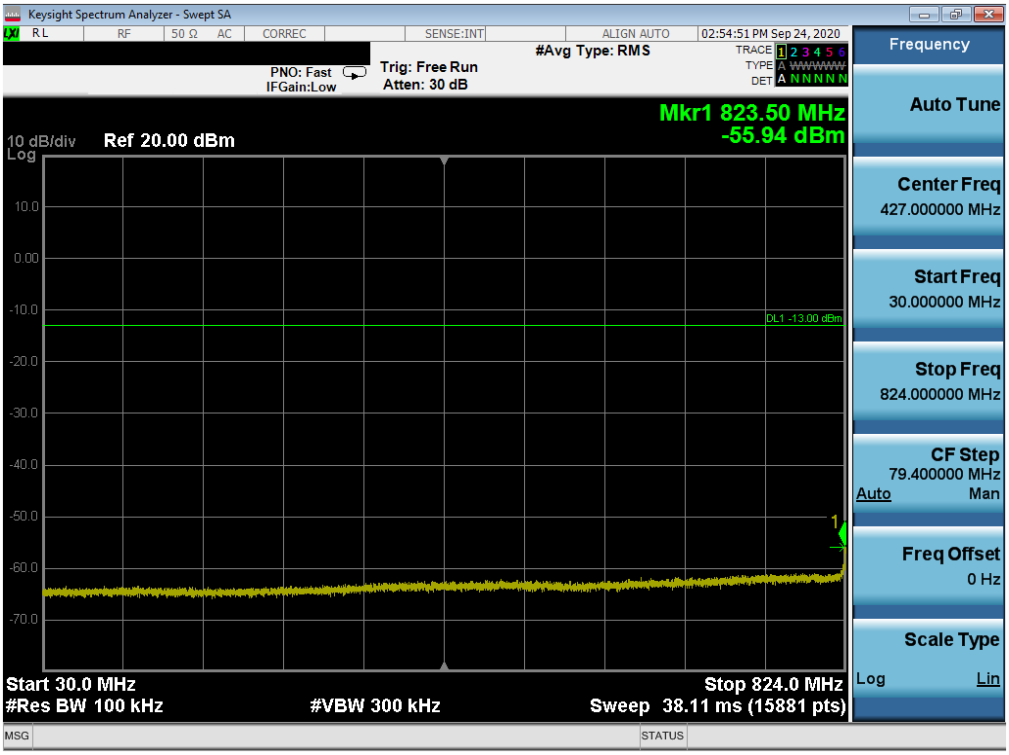
Plot 7-54.. Conducted Spurious Plot (WCDMA Ch. 4132)



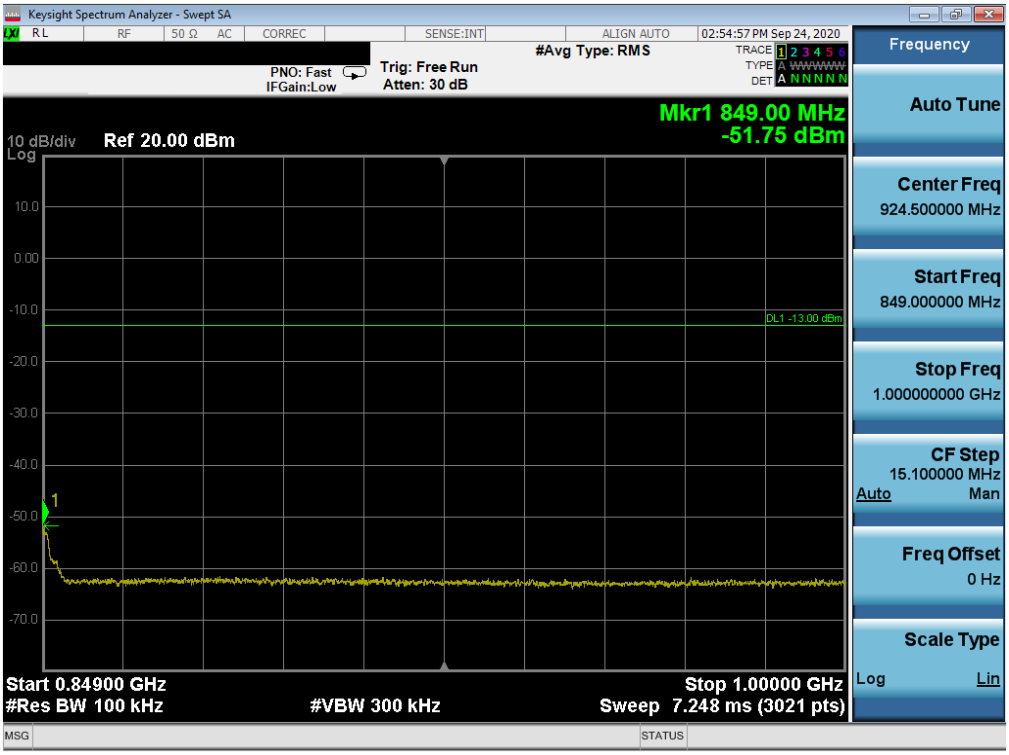
Plot 7-55. Conducted Spurious Plot (WCDMA Ch. 4132)



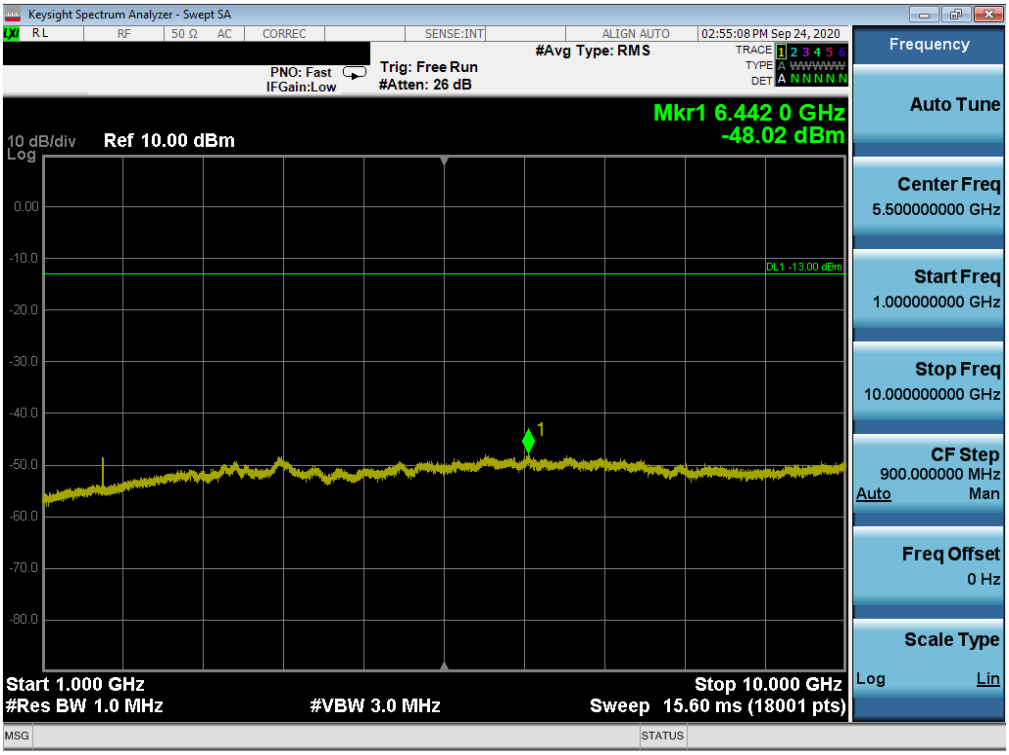
Plot 7-56. Conducted Spurious Plot (WCDMA Ch. 4132)



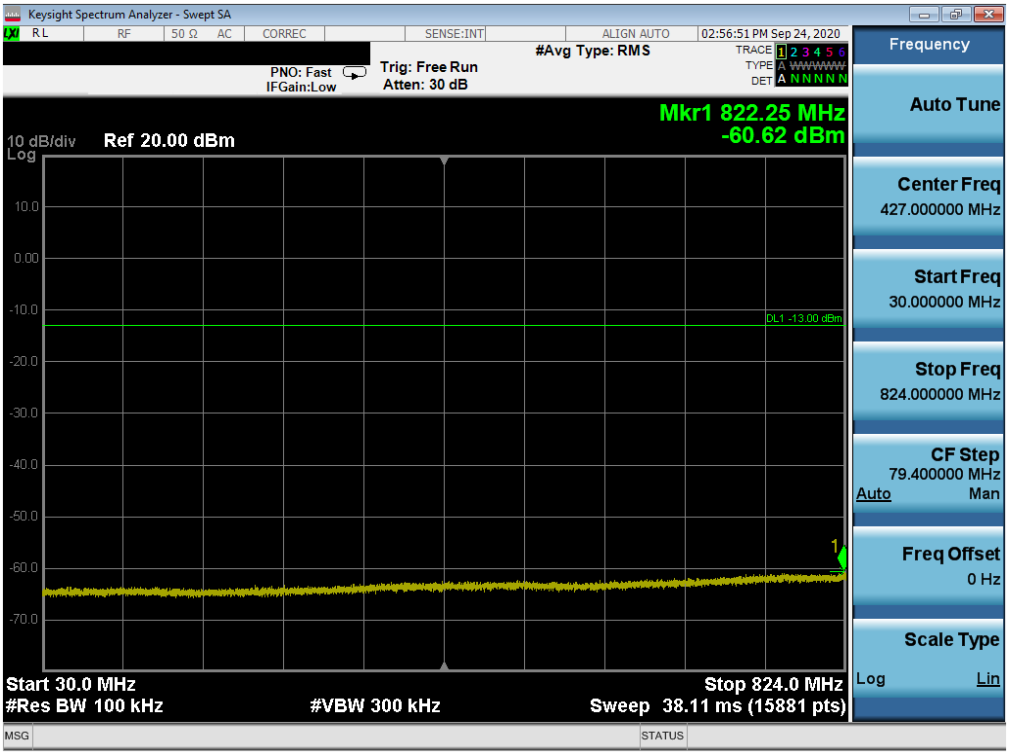
Plot 7-57. Conducted Spurious Plot (WCDMA Ch. 4183)



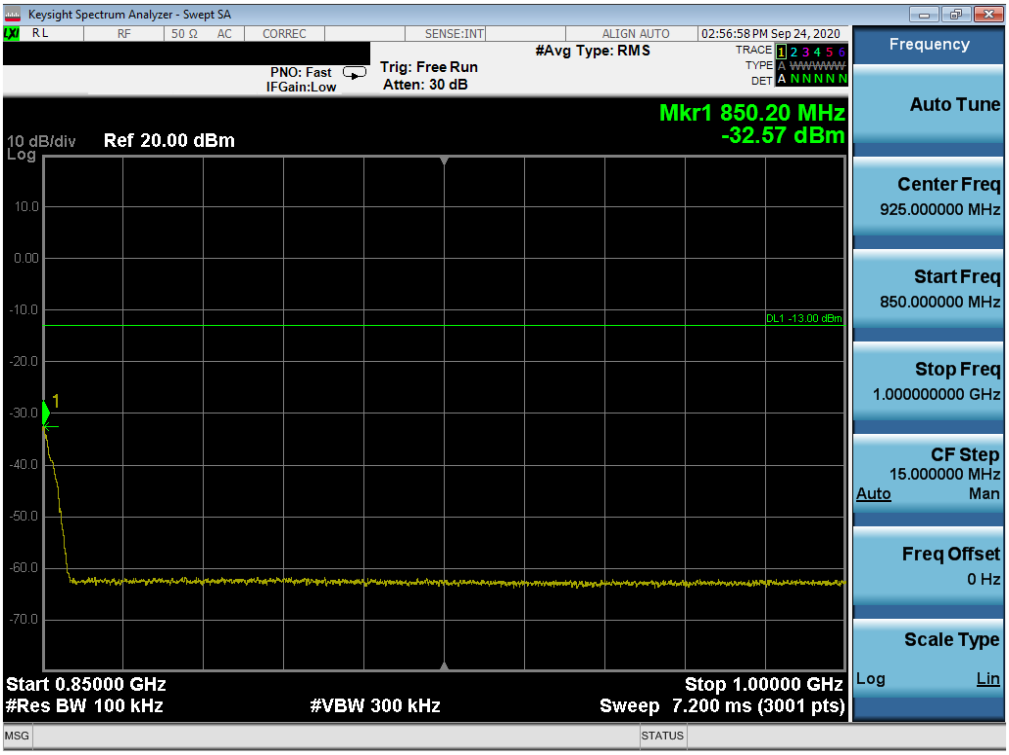
Plot 7-58. Conducted Spurious Plot (WCDMA Ch. 4183)



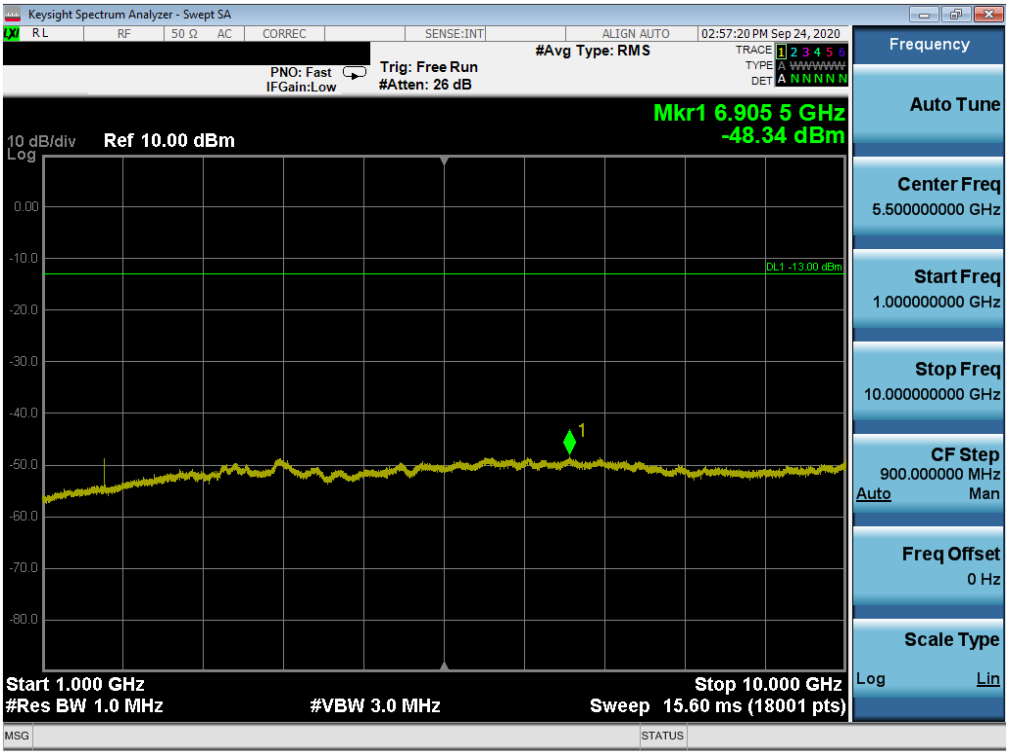
Plot 7-59. Conducted Spurious Plot (WCDMA Ch. 4183)



Plot 7-60.Conducted Spurious Plot (WCDMA Ch. 4233)

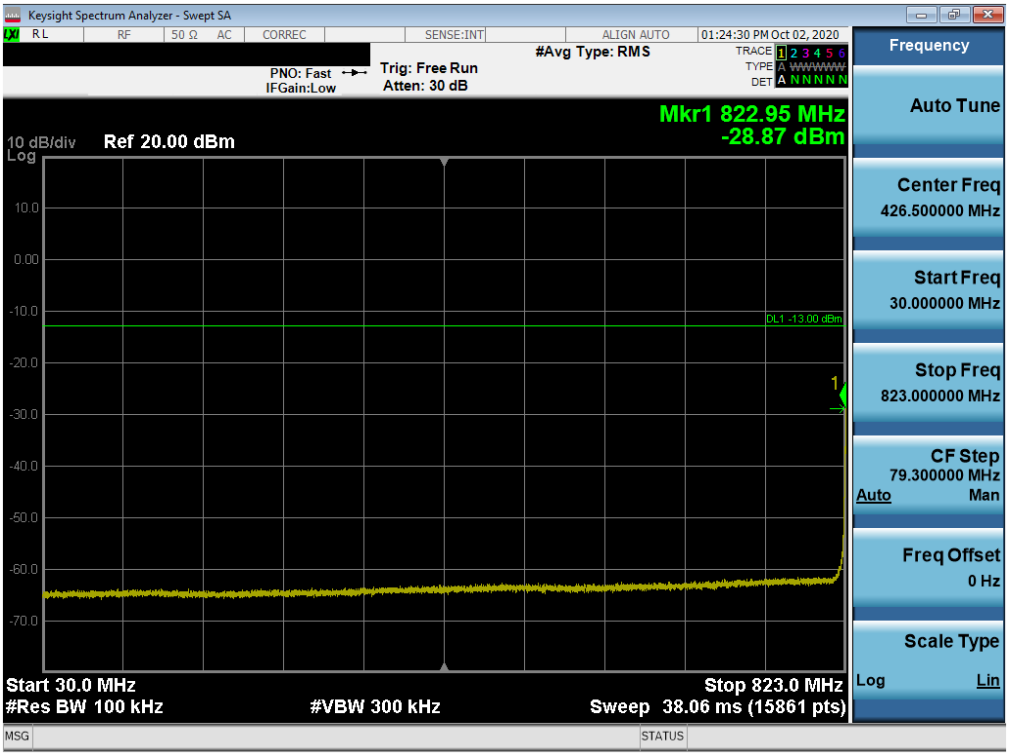


Plot 7-61. Conducted Spurious Plot (WCDMA Ch. 4233)

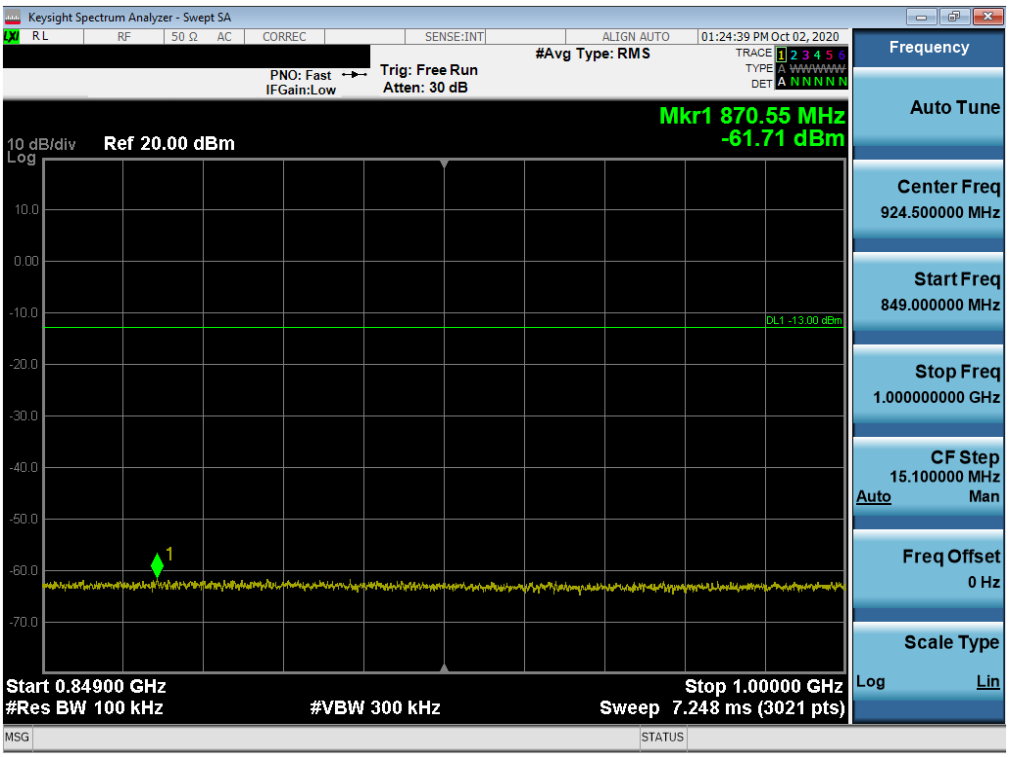


Plot 7-62. Conducted Spurious Plot (WCDMA Ch. 4233)

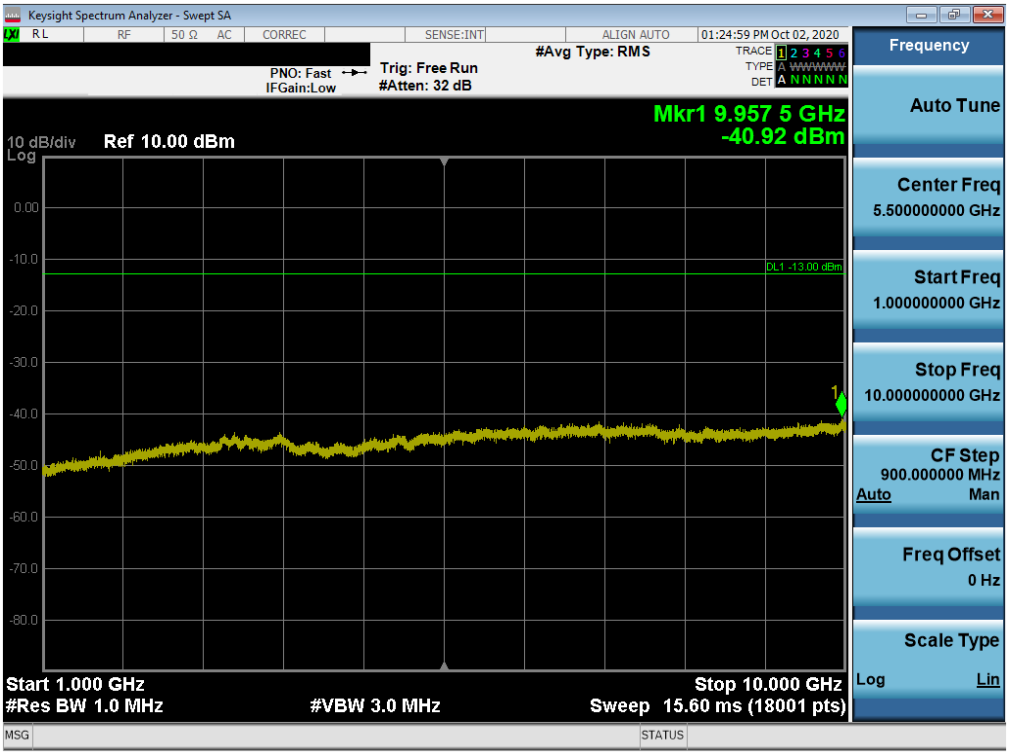
CDMA Cell



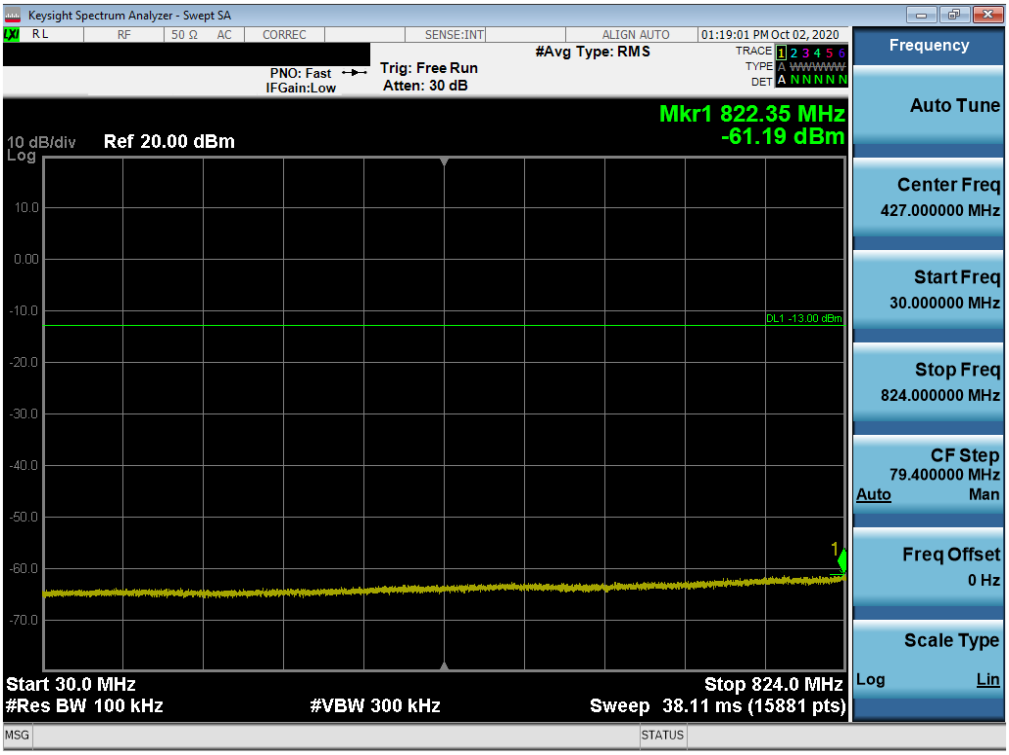
Plot 7-63. Conducted Spurious Plot (CDMA Ch. 1013)



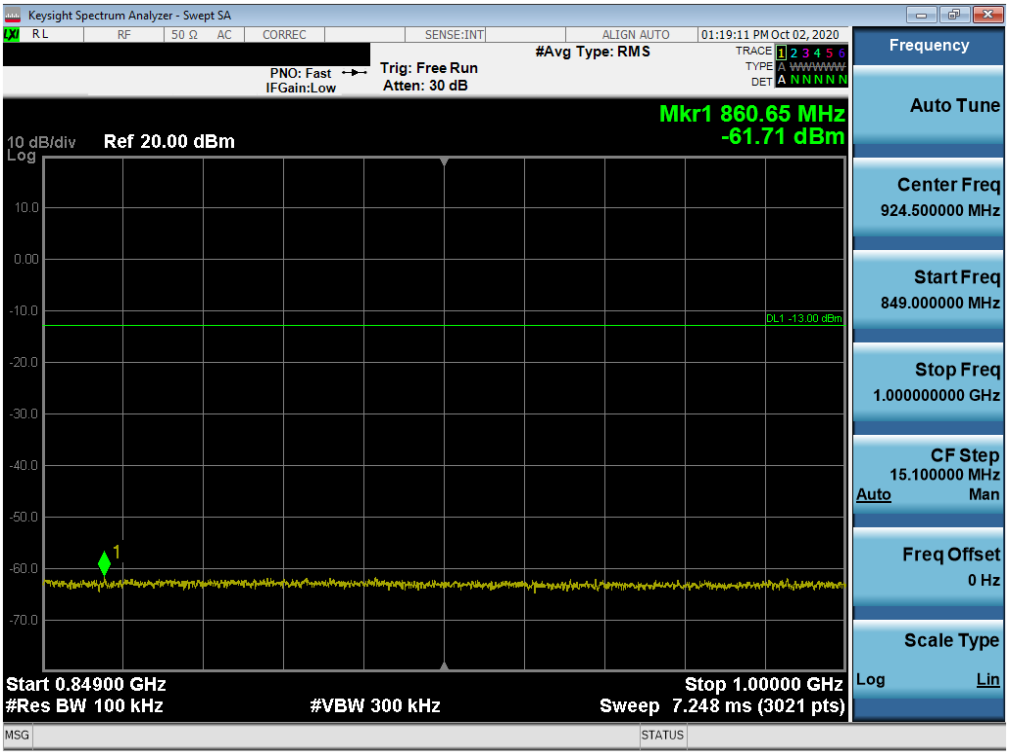
Plot 7-64. Conducted Spurious Plot (CDMA Ch. 1013)



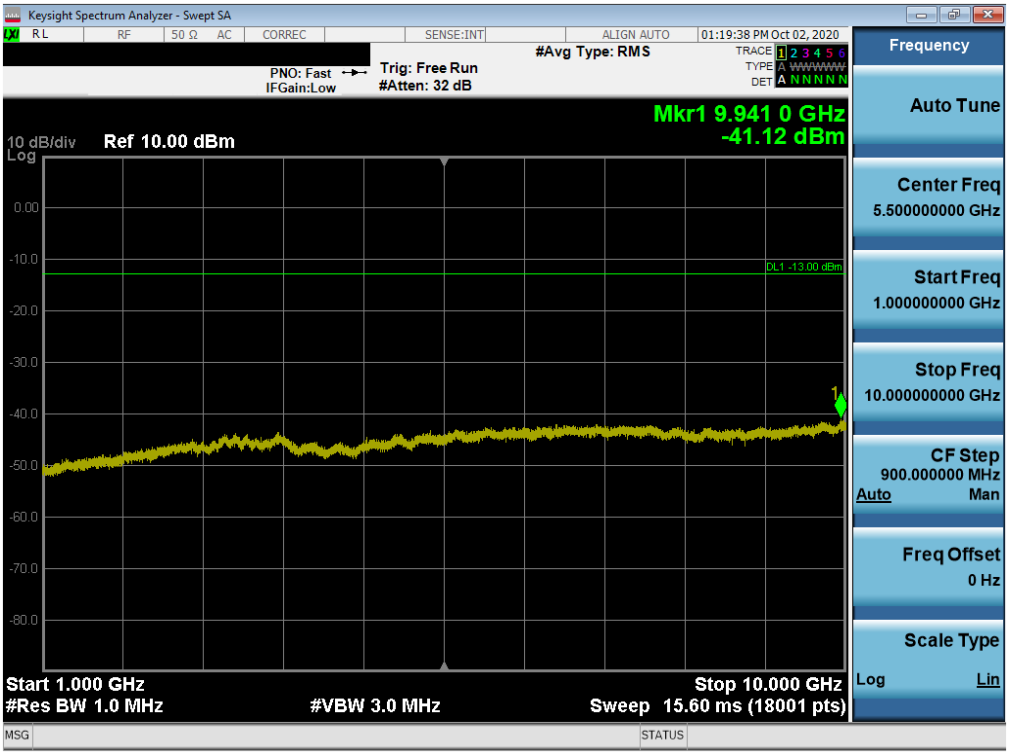
Plot 7-65. Conducted Spurious Plot (CDMA Ch. 1013)



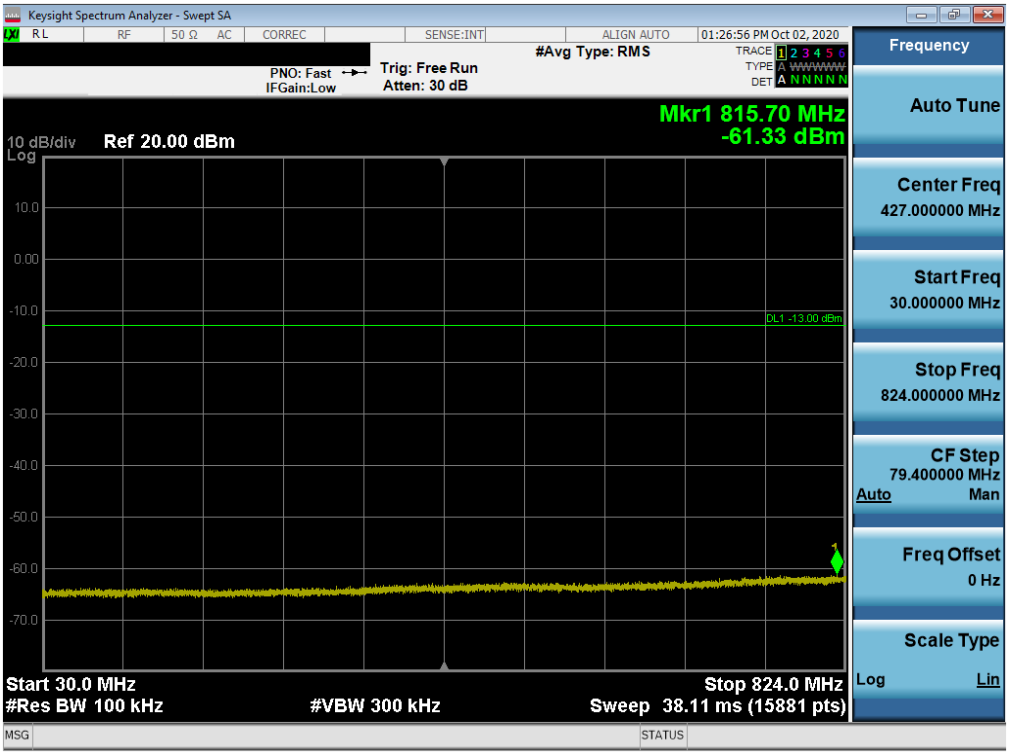
Plot 7-66. Conducted Spurious Plot (CDMA Ch. 384)



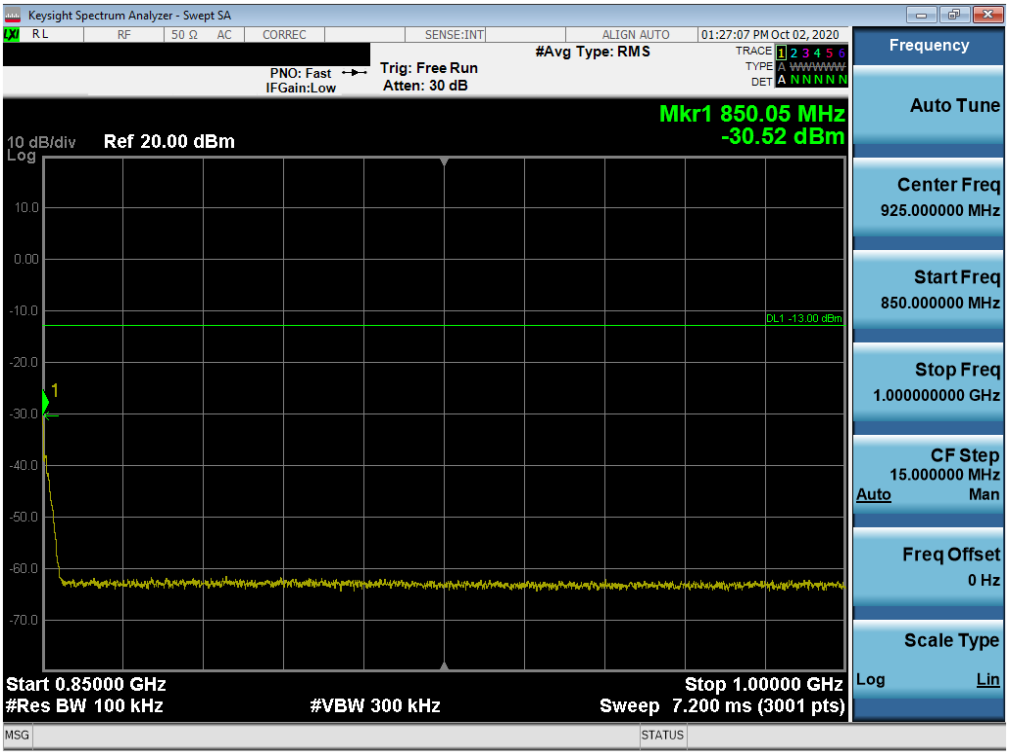
Plot 7-67. Conducted Spurious Plot (CDMA Ch. 384)



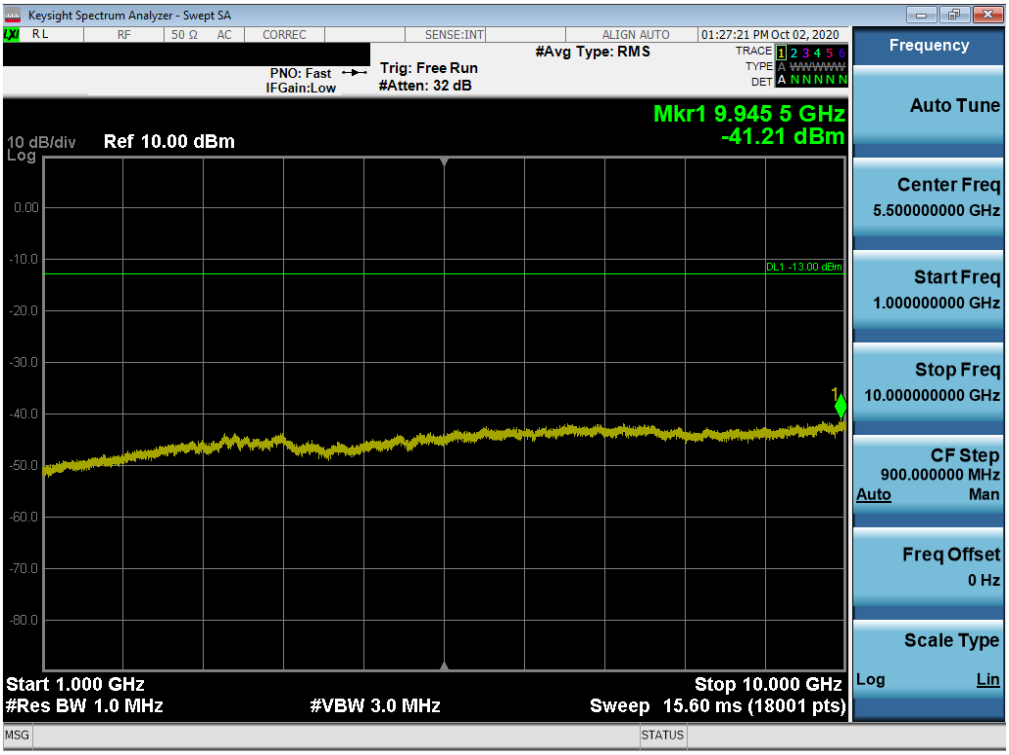
Plot 7-68. Conducted Spurious Plot (CDMA Ch. 384)



Plot 7-69. Conducted Spurious Plot (CDMA Ch. 777)

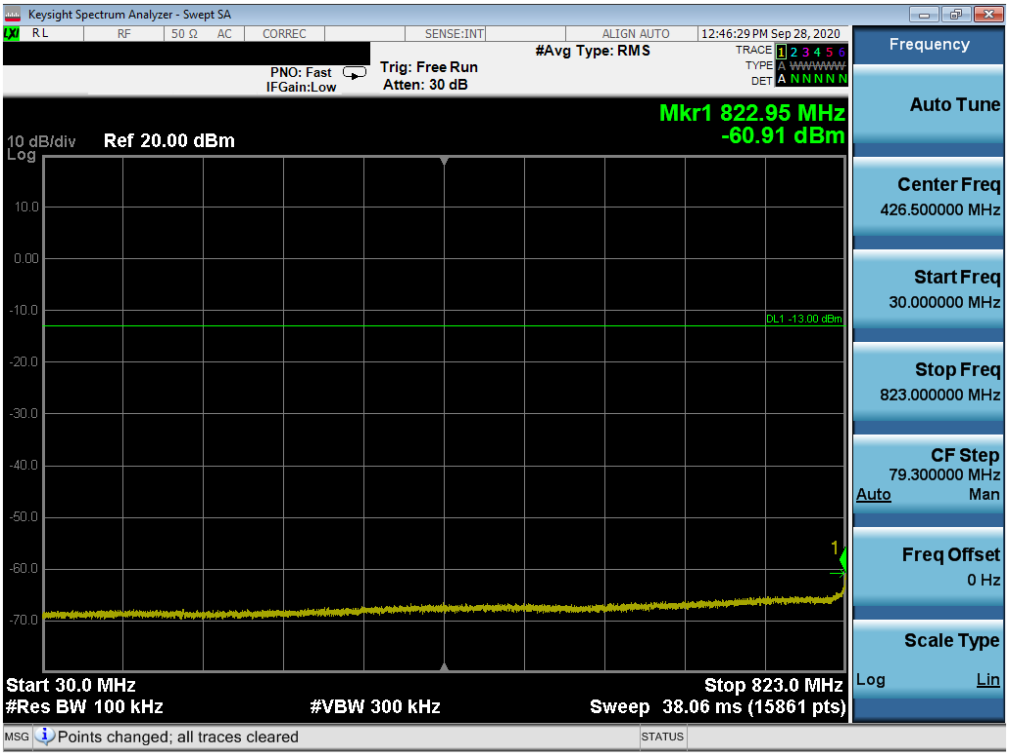


Plot 7-70. Conducted Spurious Plot (CDMA Ch. 777)

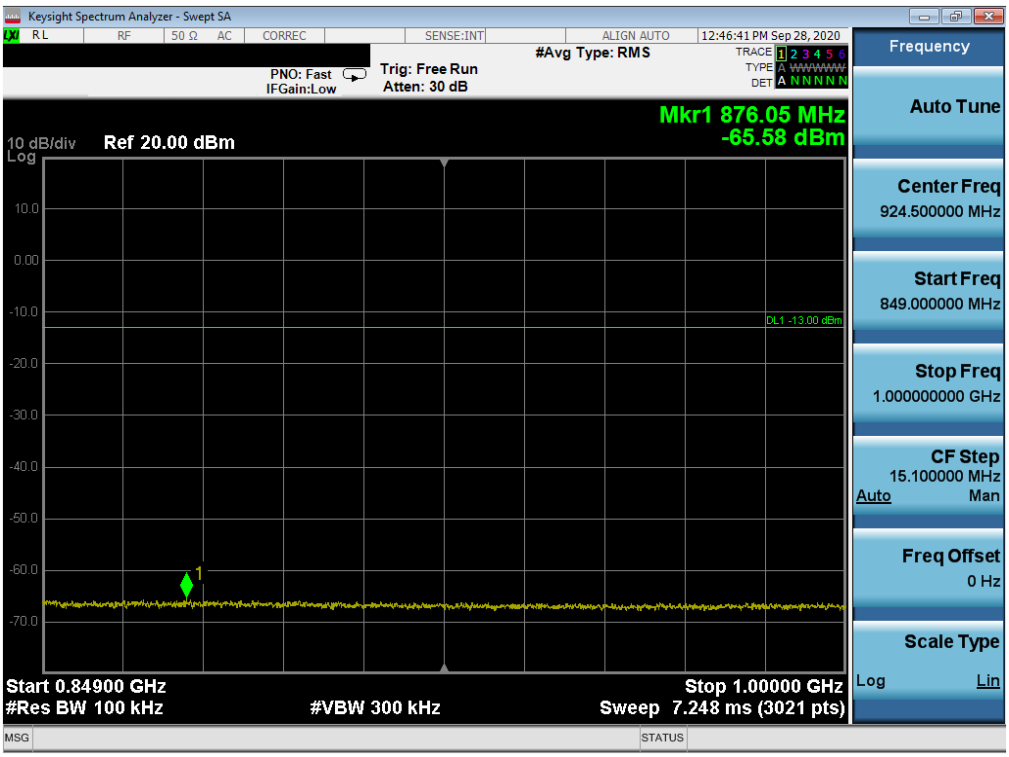


Plot 7-71. Conducted Spurious Plot (CDMA Ch. 777)

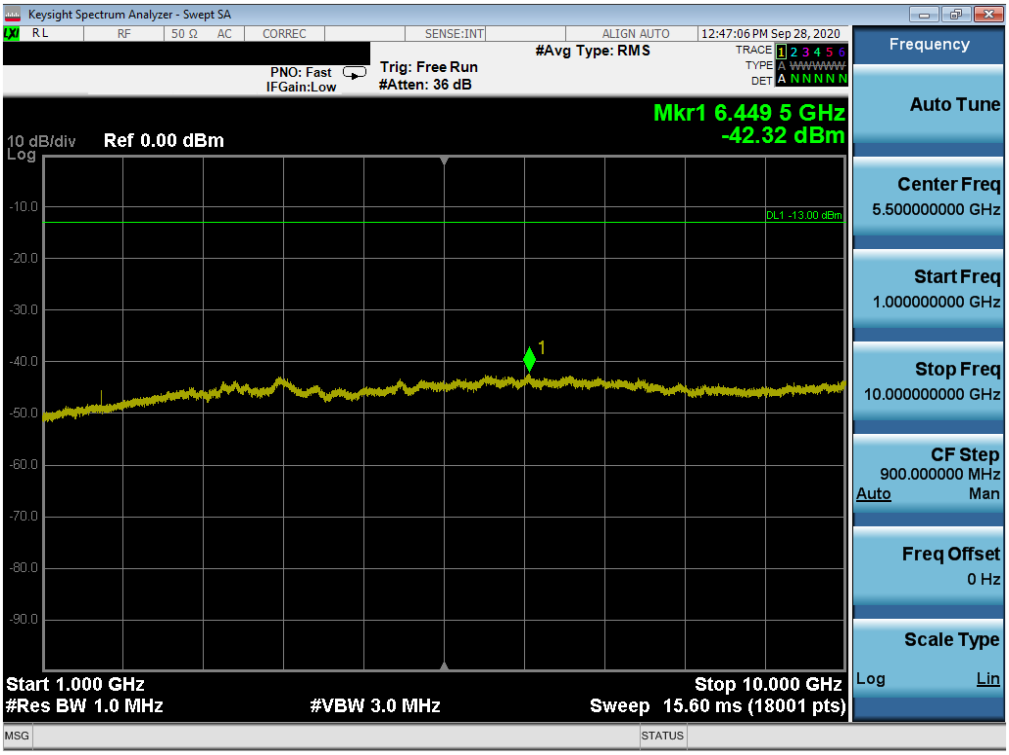
LTE Band 26/5



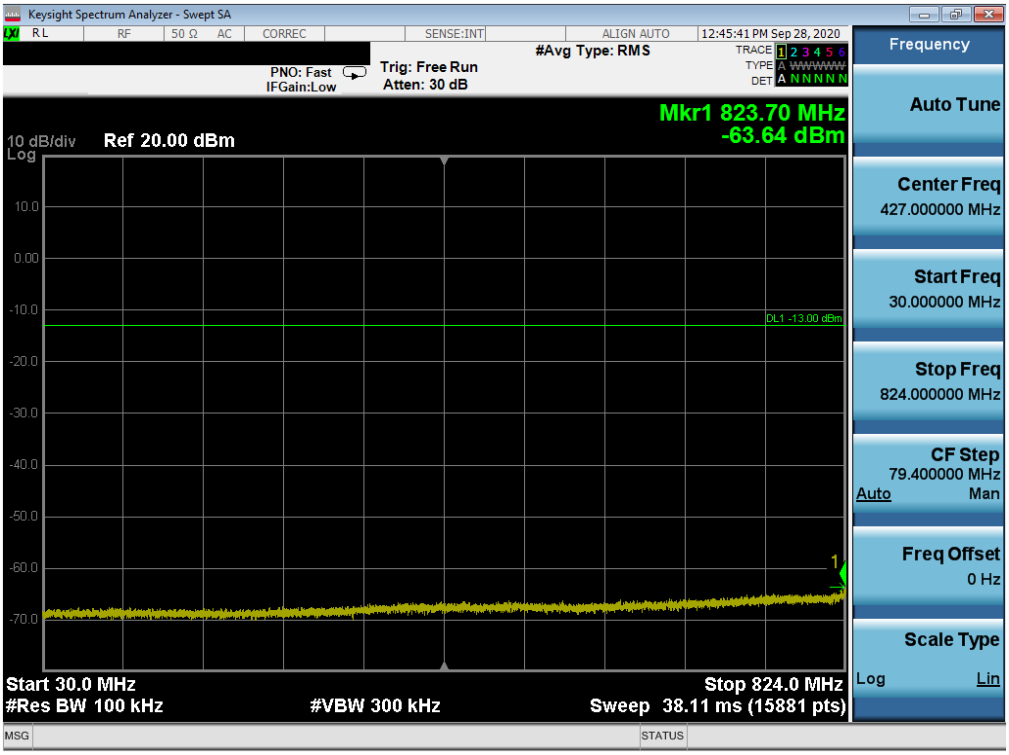
Plot 7-72. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



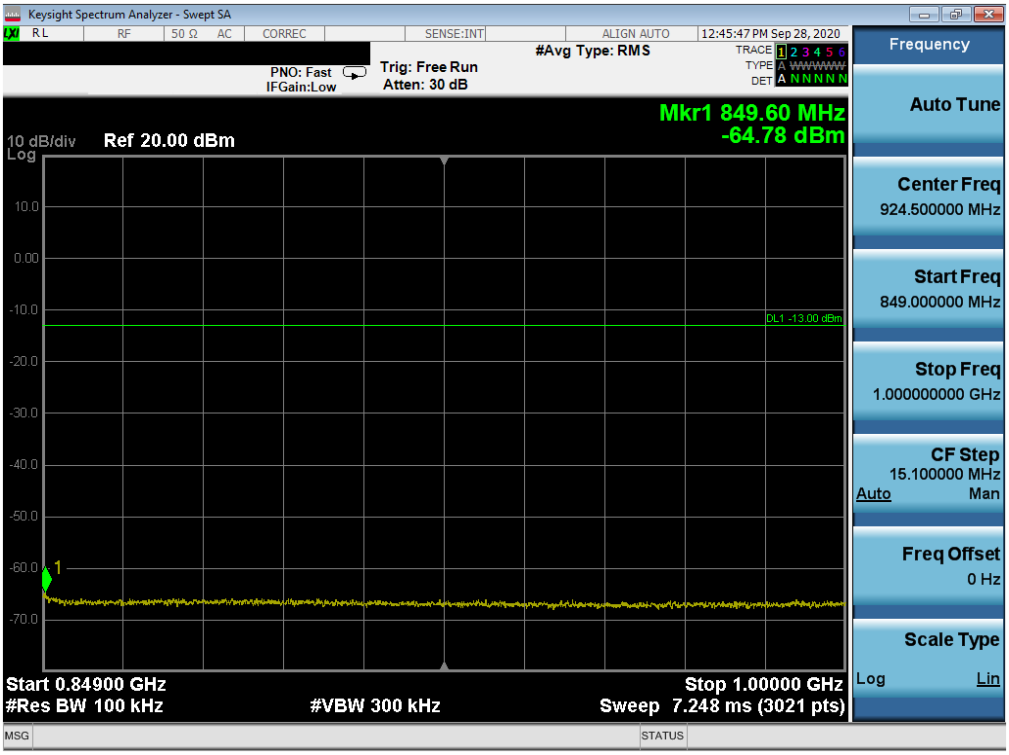
Plot 7-73. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



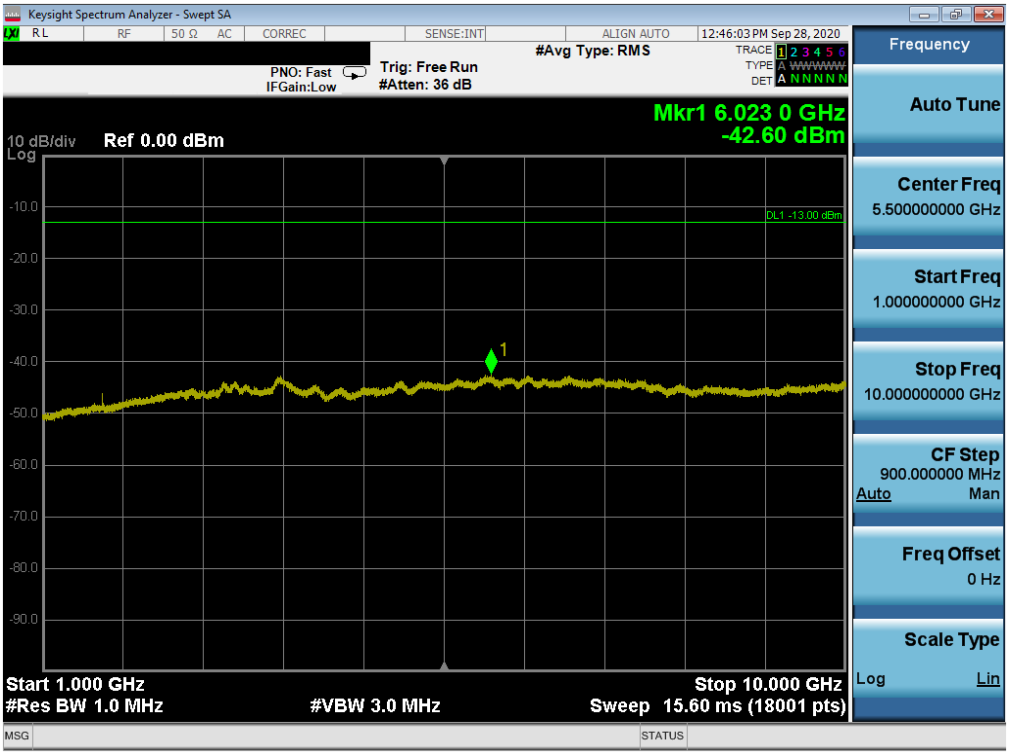
Plot 7-74. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



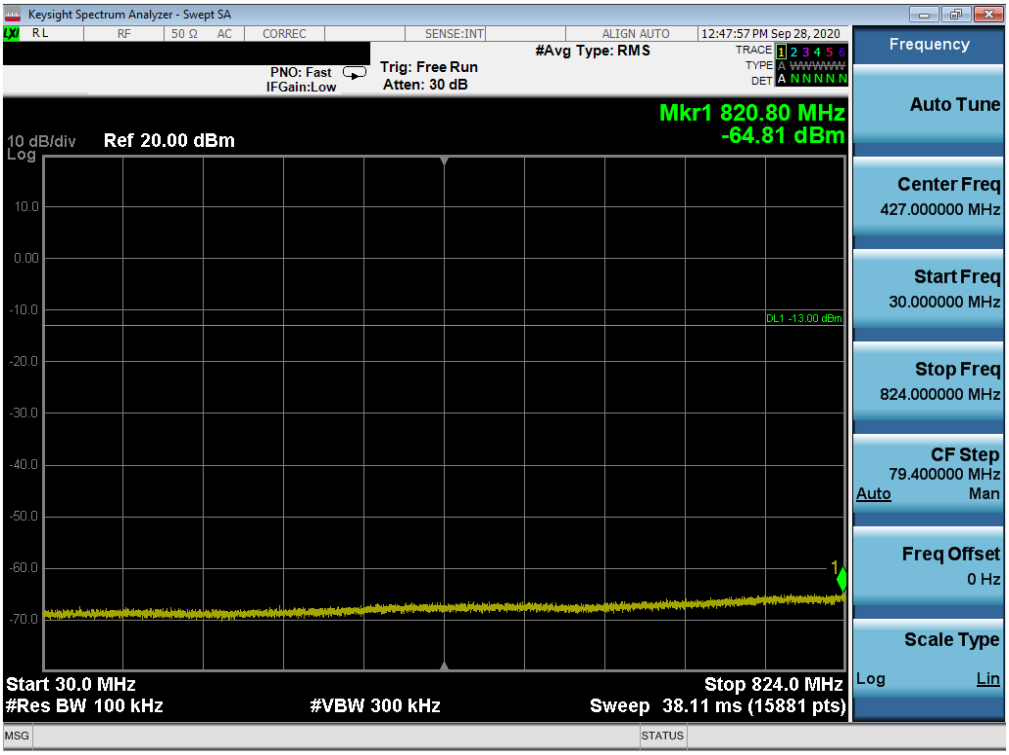
Plot 7-75. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



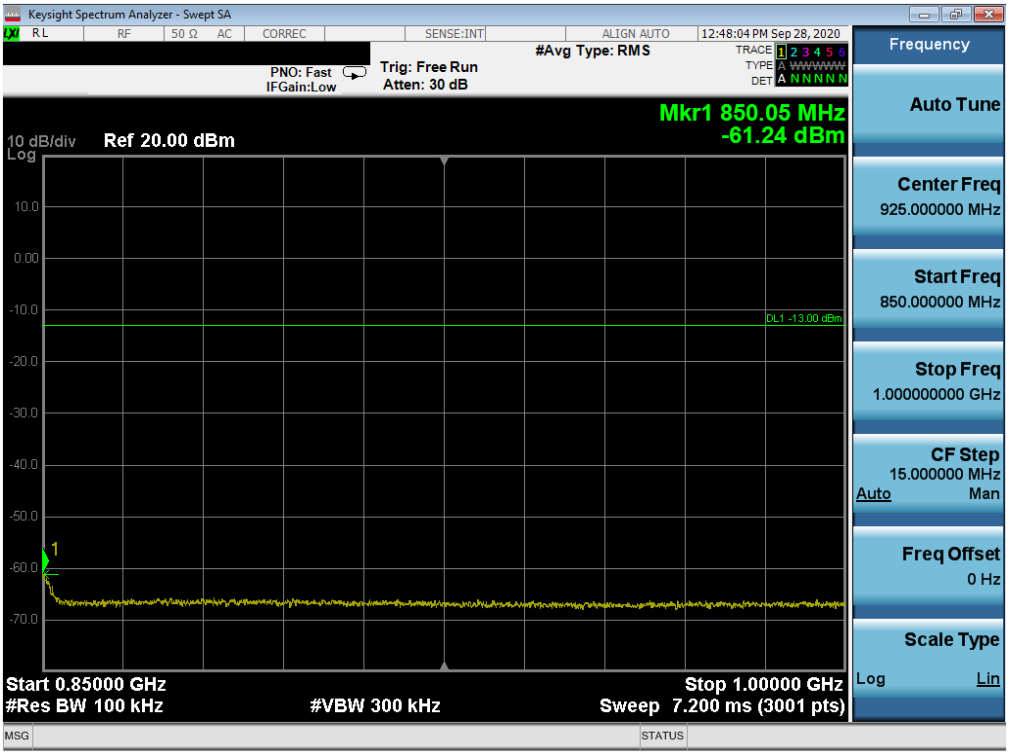
Plot 7-76. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



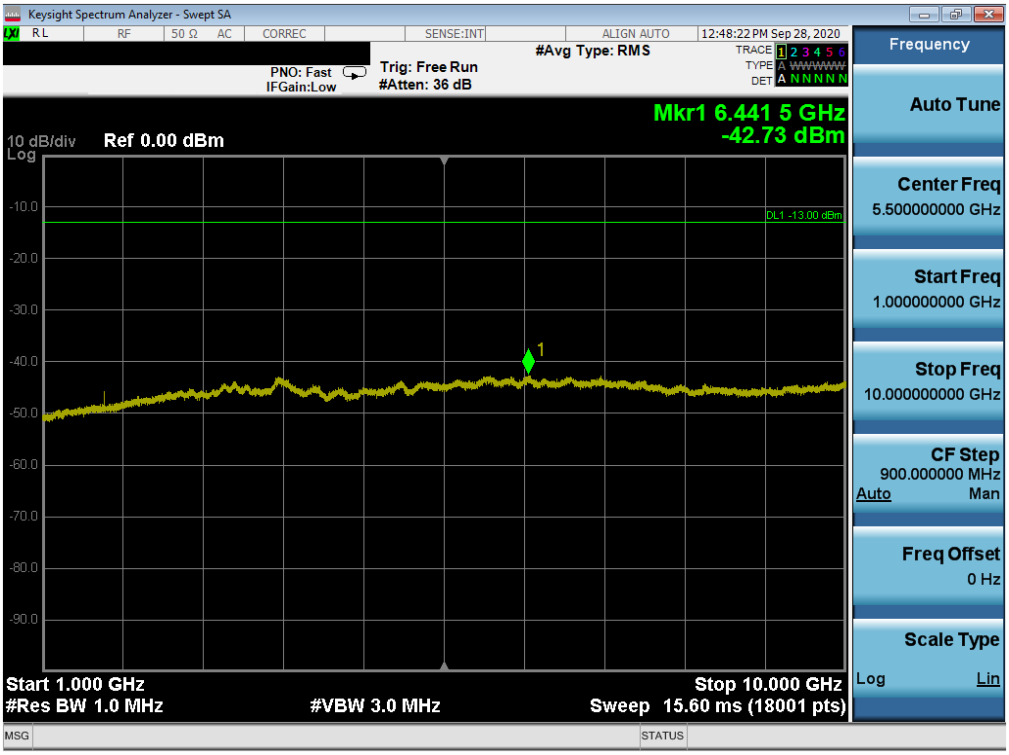
Plot 7-77. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



Plot 7-78. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

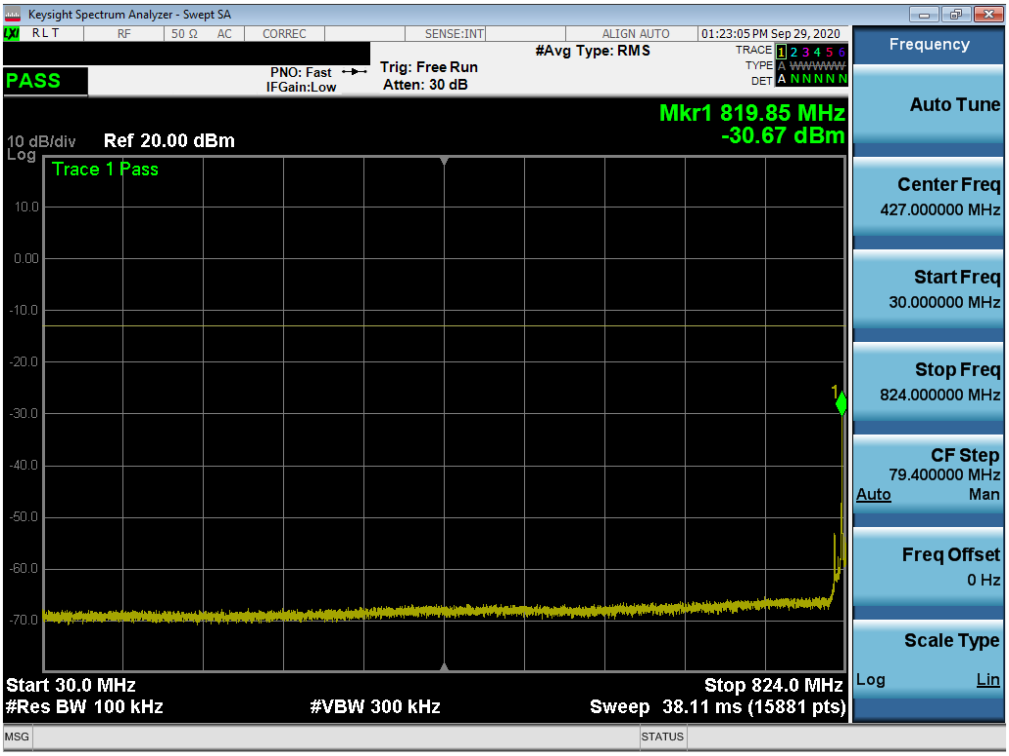


Plot 7-79. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

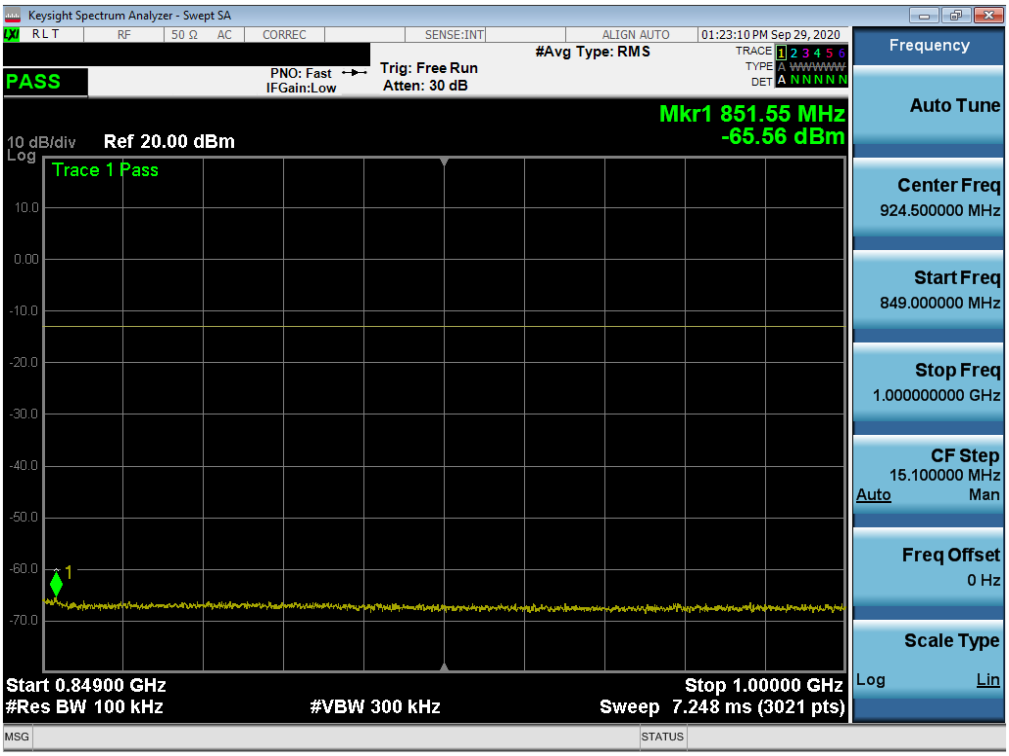


Plot 7-80. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

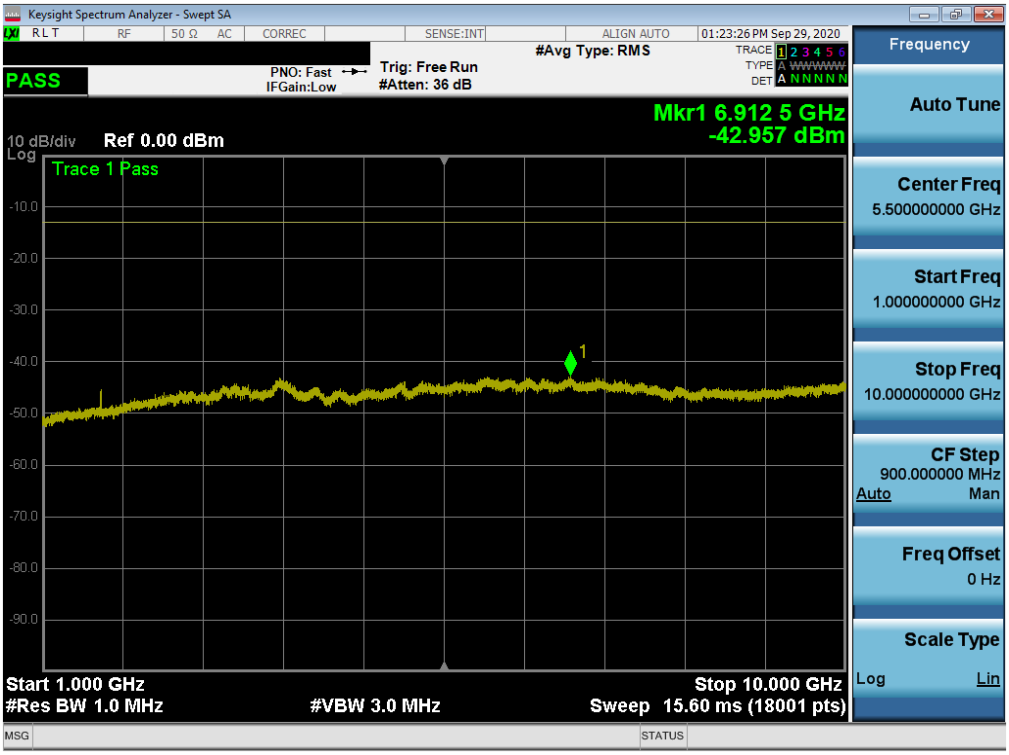
NR Band n5



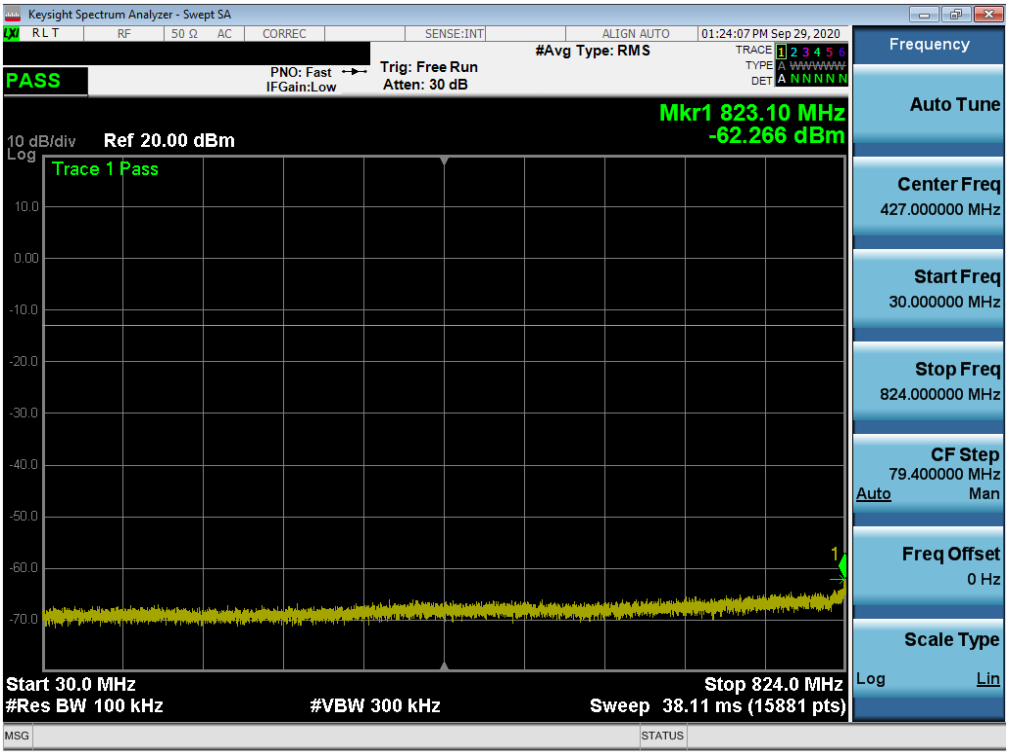
Plot 7-81. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - Low Channel)



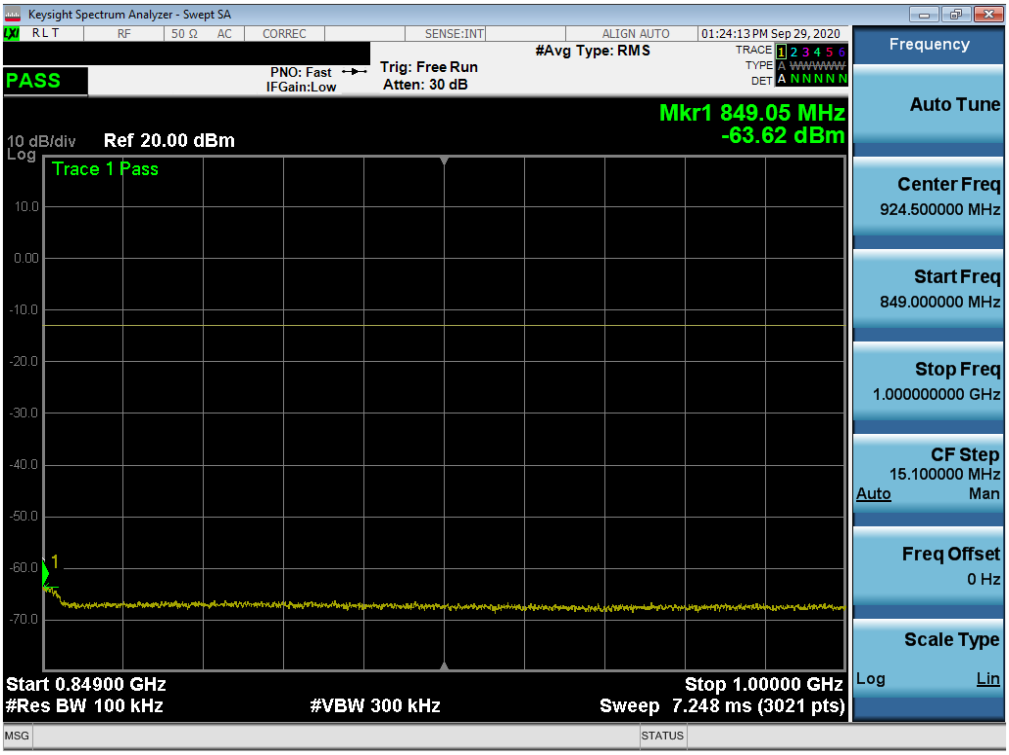
Plot 7-82. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - Low Channel)



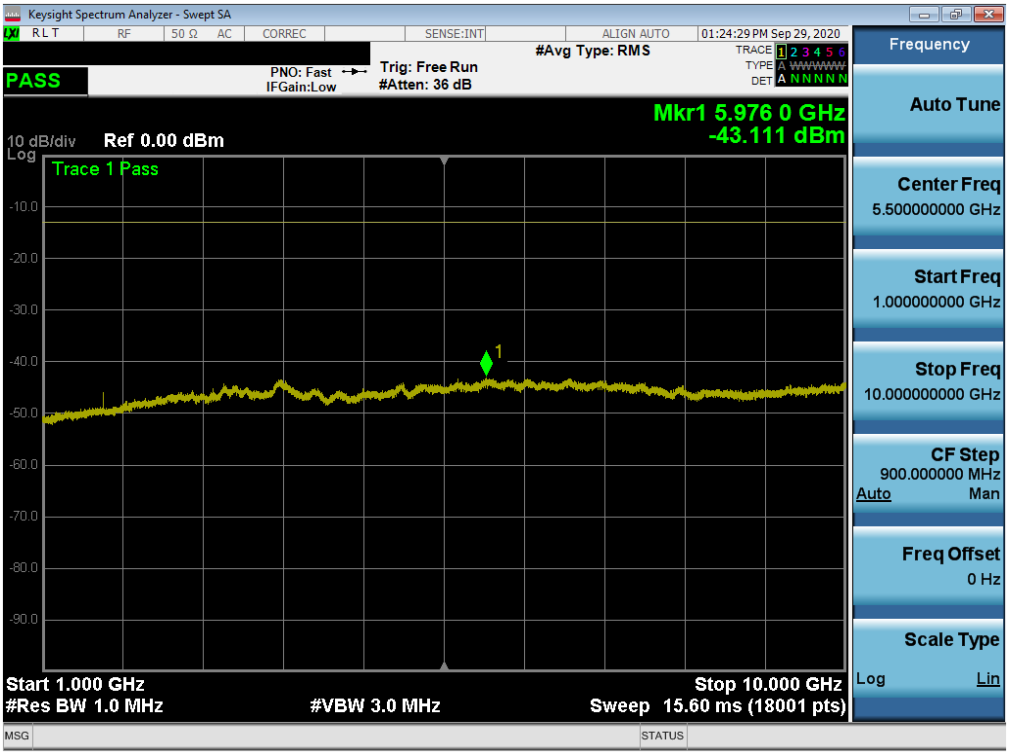
Plot 7-83. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - Low Channel)



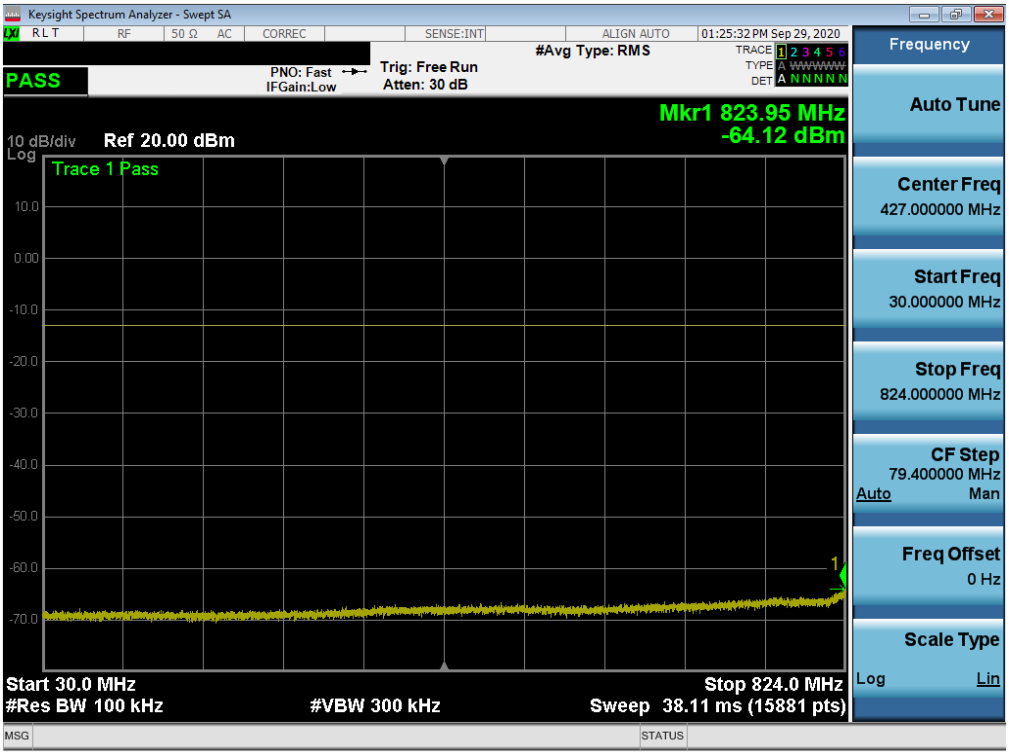
Plot 7-84. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - Mid Channel)



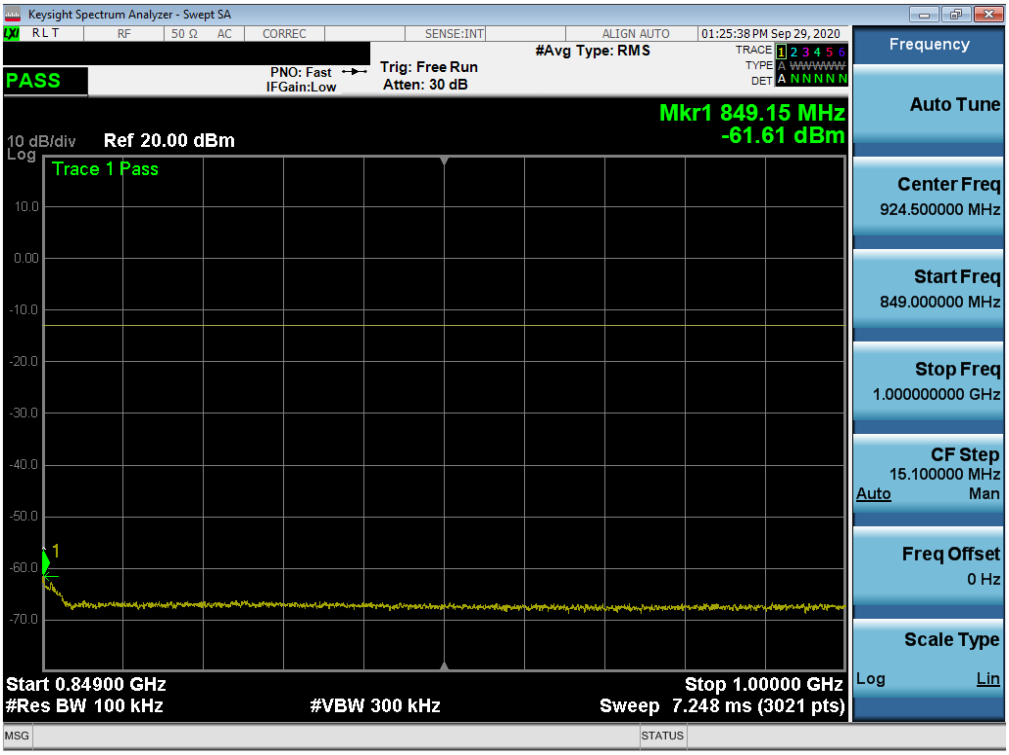
Plot 7-85. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - Mid Channel)



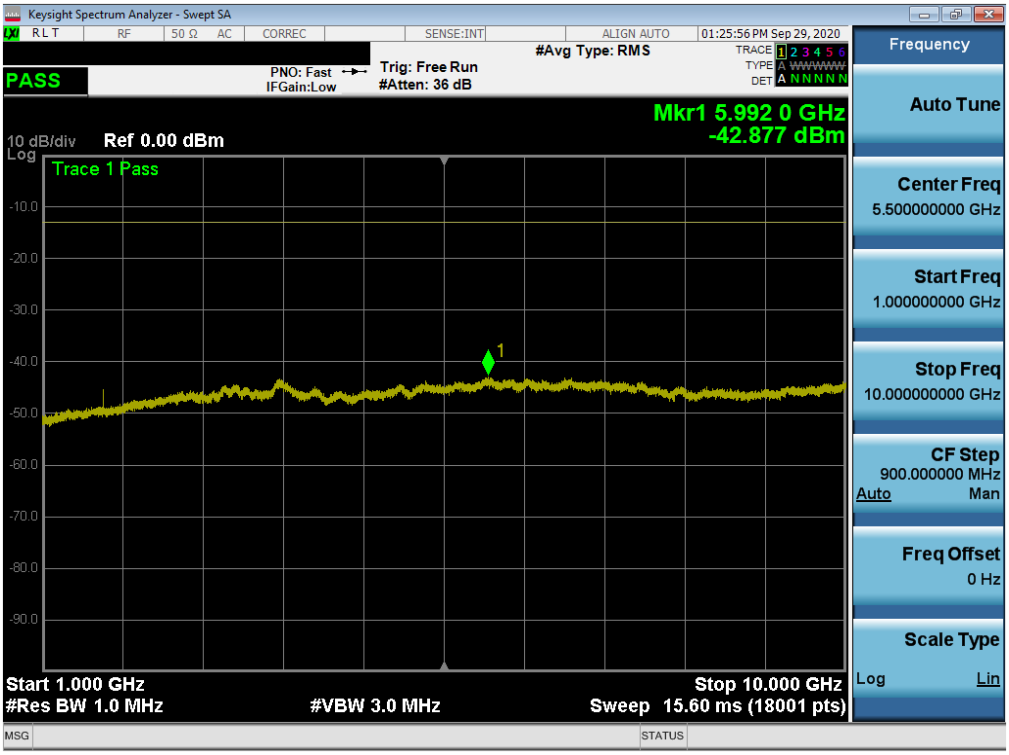
Plot 7-86. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - Mid Channel)



Plot 7-87. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - High Channel)



Plot 7-88. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - High Channel)



Plot 7-89. Conducted Spurious Plot (NR Band n5 - 20.0MHz - RB Size 1, RB Offset 0 - High Channel)

7.4 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

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 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.

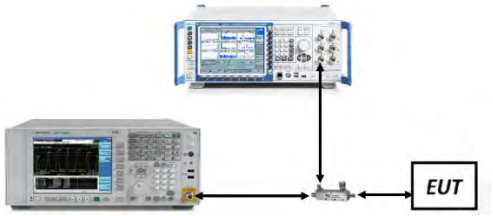
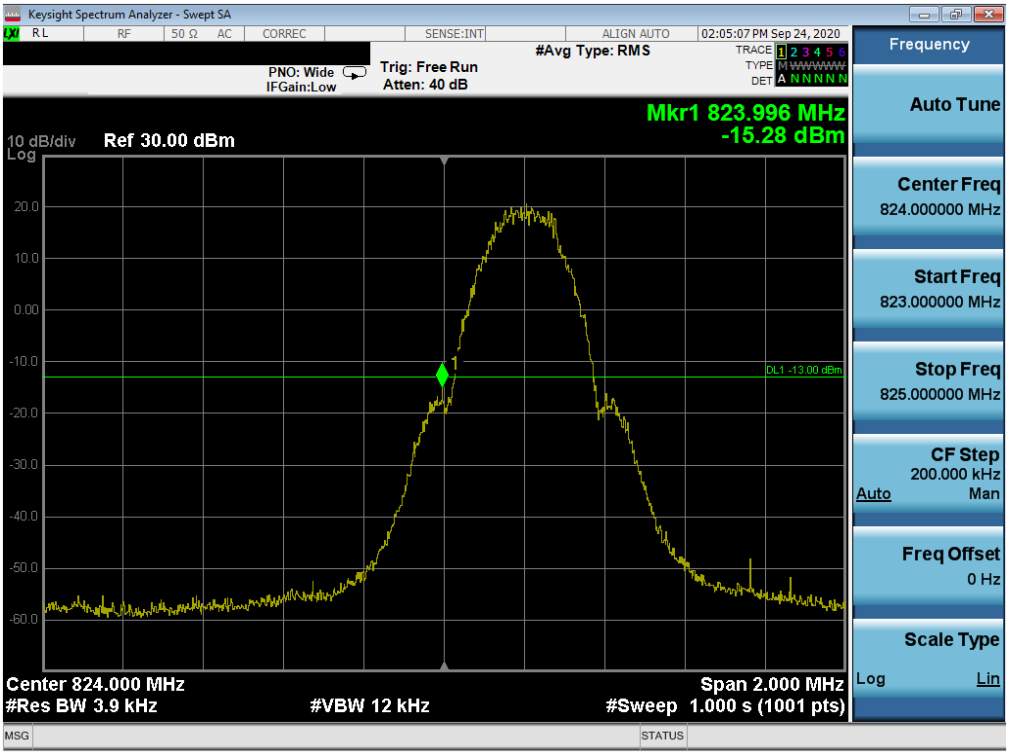


Figure 7-3. Test Instrument & Measurement Setup

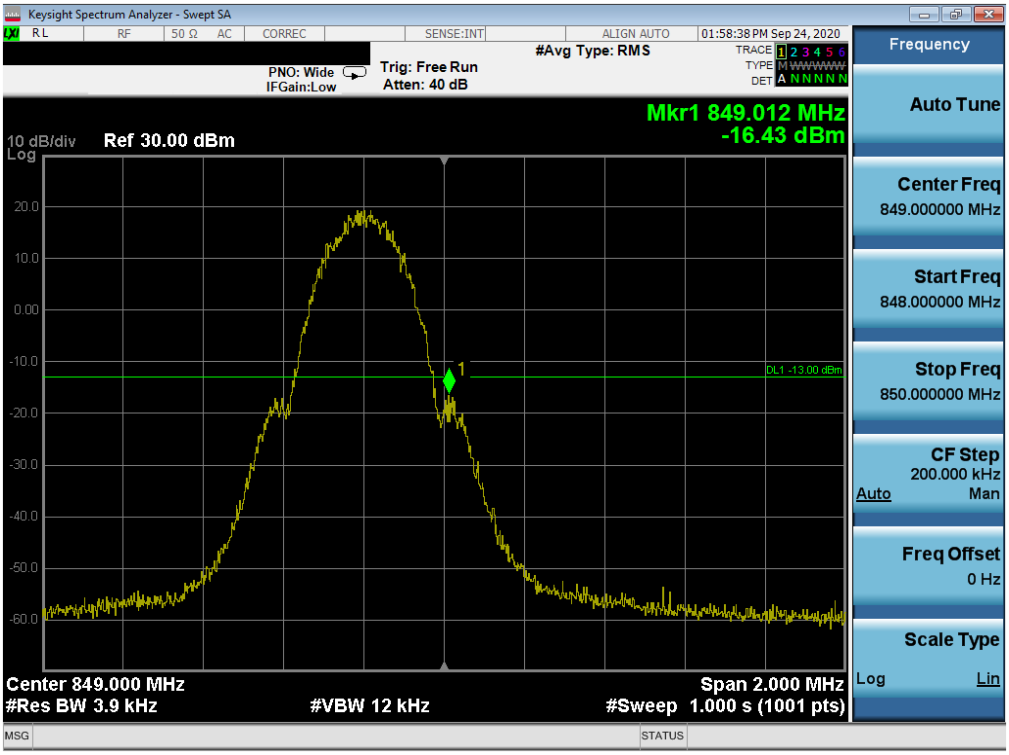
Test Notes

1. Per 22.917(b) and RSS-132(5.5), 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.



Plot 7-90. Lower Band Edge Plot (GPRS Cell – Ch. 128)



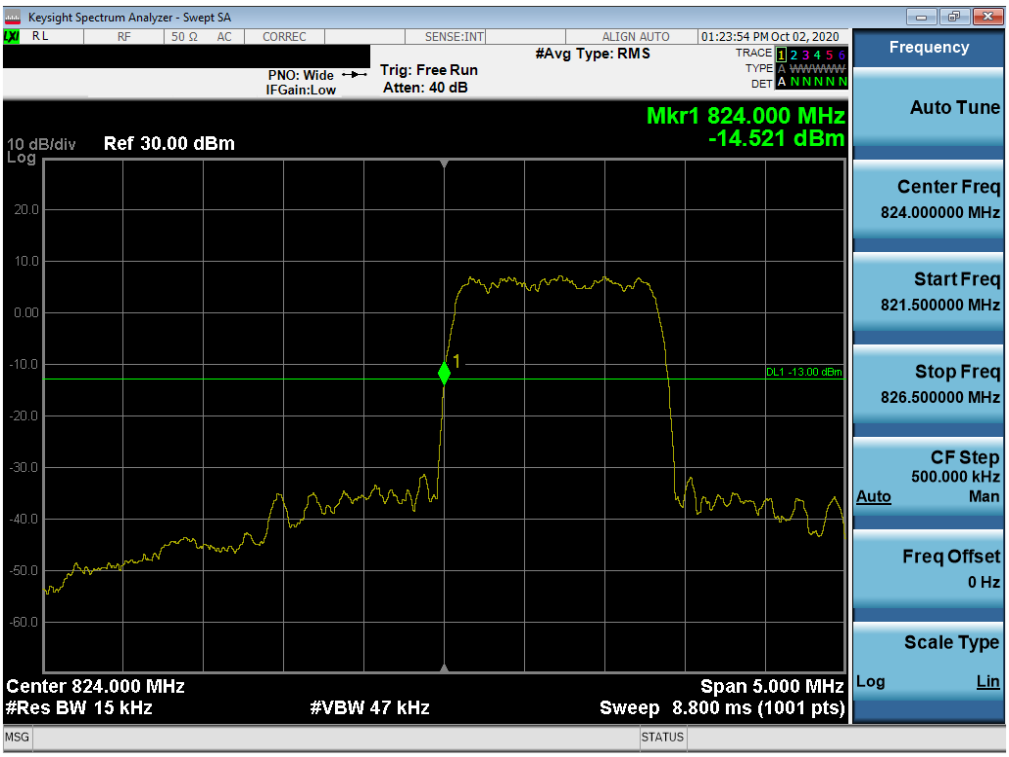
Plot 7-91. Upper Band Edge Plot (GPRS Cell – Ch. 251)

WCDMA Cell

Plot 7-92. Lower Band Edge Plot (WCDMA Cell – Ch. 4132)

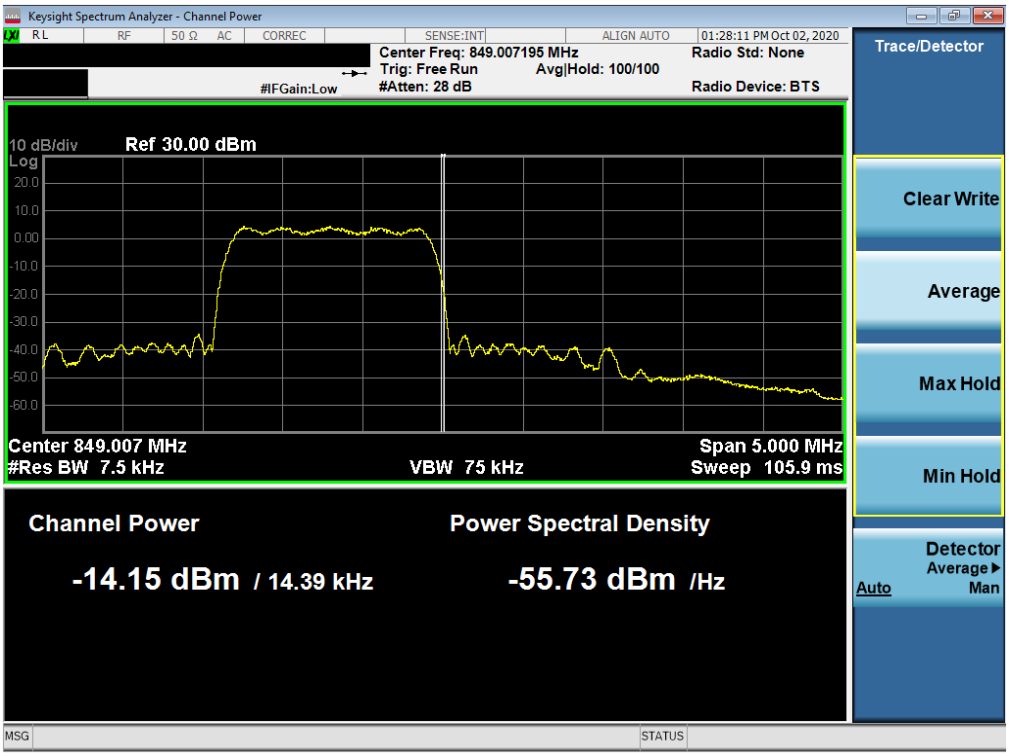
Plot 7-93. Upper Band Edge Plot (WCDMA Cell – Ch. 4233)

CDMA Cell

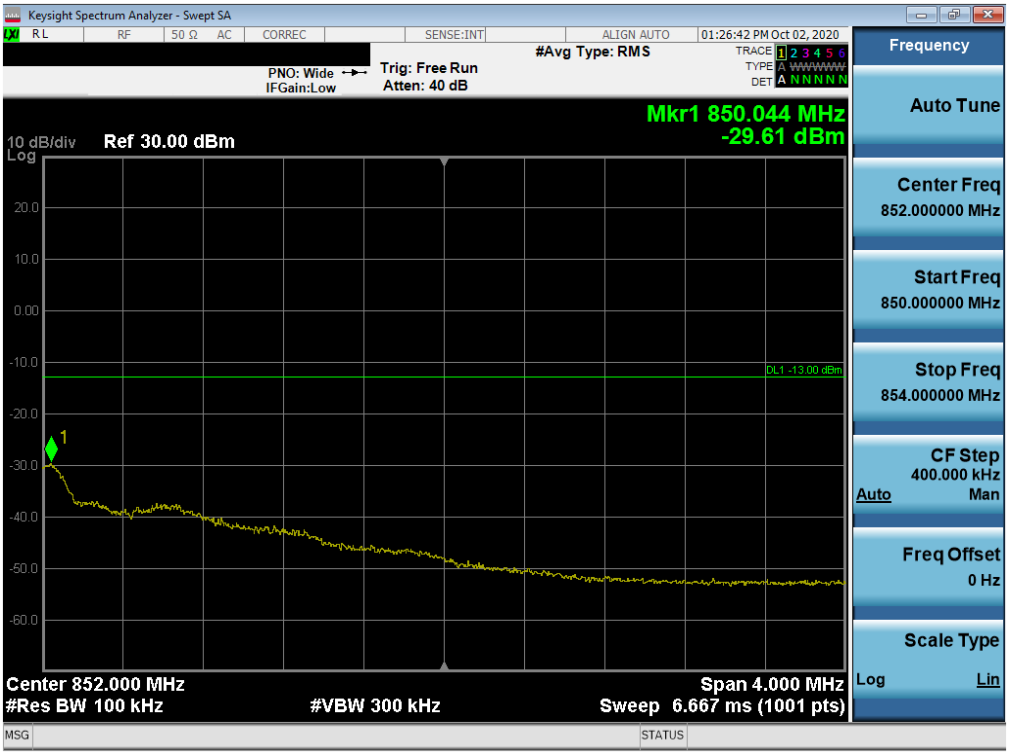


Plot 7-94. Lower Band Edge Plot (CDMA Cell – Ch. 1013)

Plot 7-95. Lower Extended Band Edge Plot (CDMA Cell – Ch. 1013)

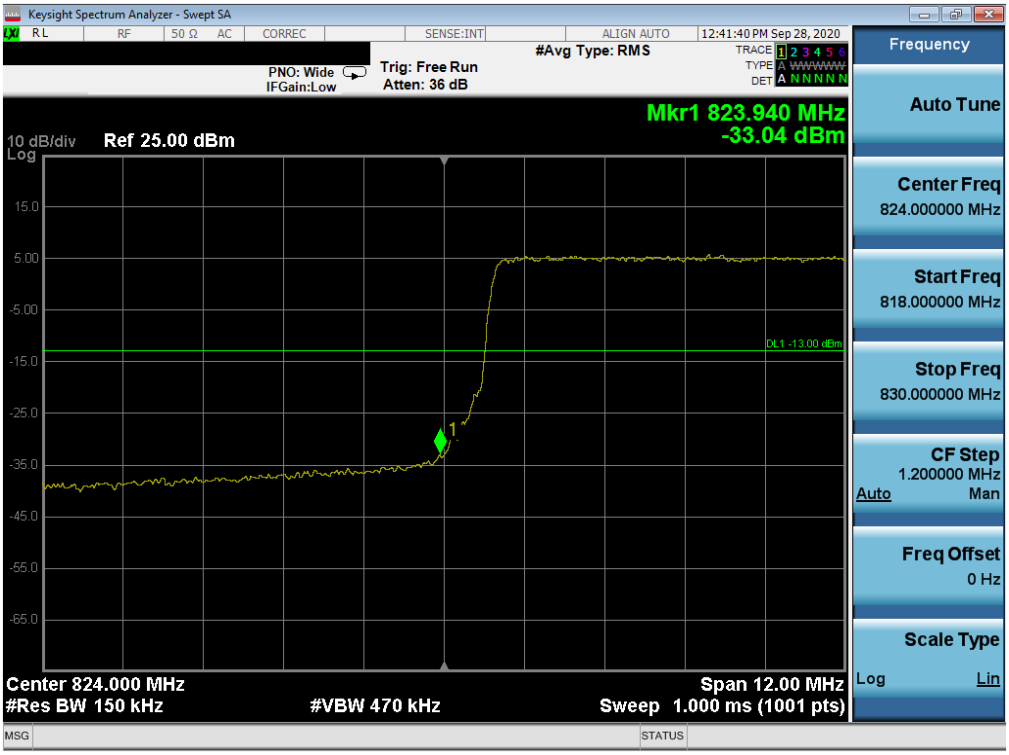


Plot 7-96. Upper Band Edge Plot (CDMA Cell – Ch. 777)



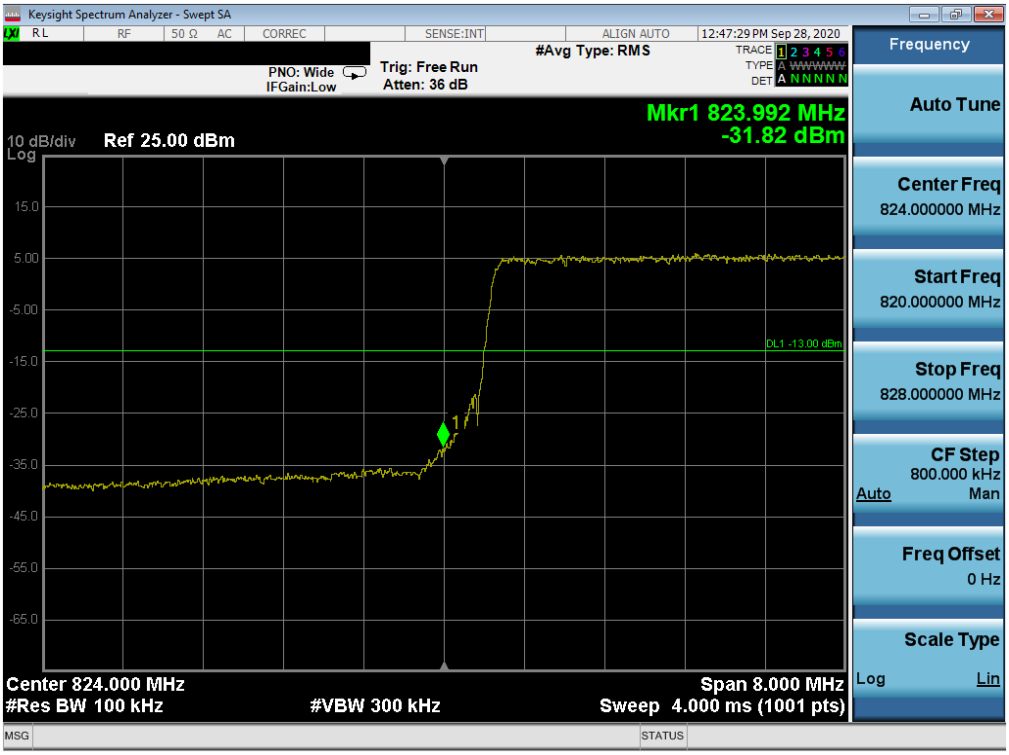
Plot 7-97. Upper Extended Band Edge Plot (CDMA Cell – Ch. 777)

LTE Band 26/5

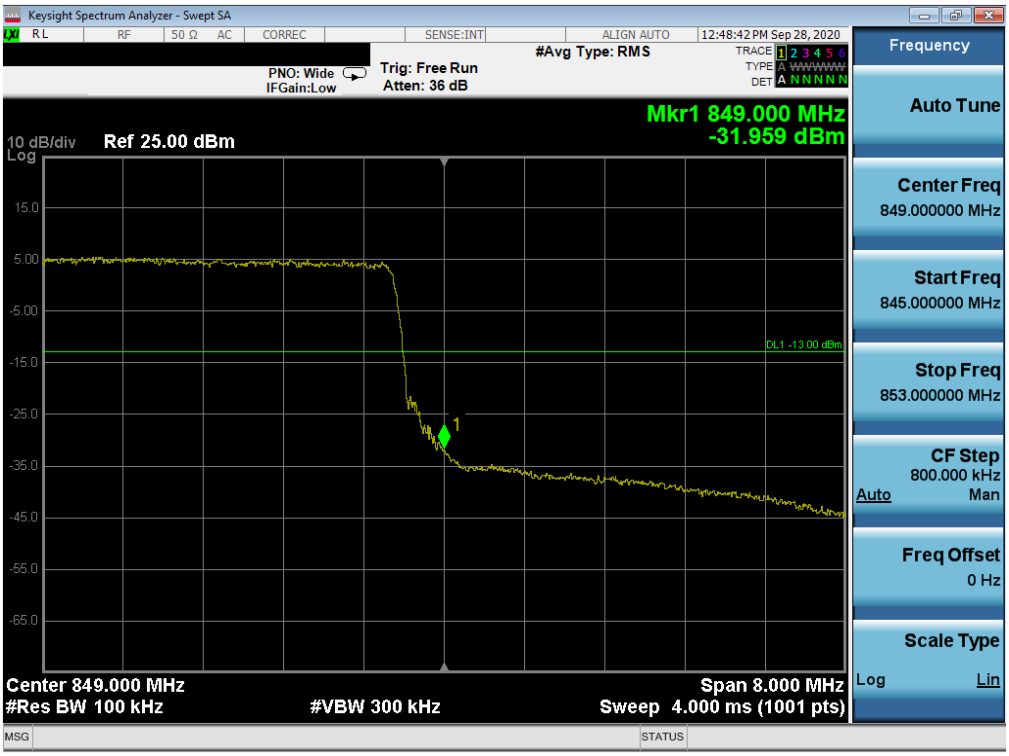


Plot 7-98. Lower Band Edge Plot (LTE Band 26 - 15MHz QPSK – Full RB Configuration)

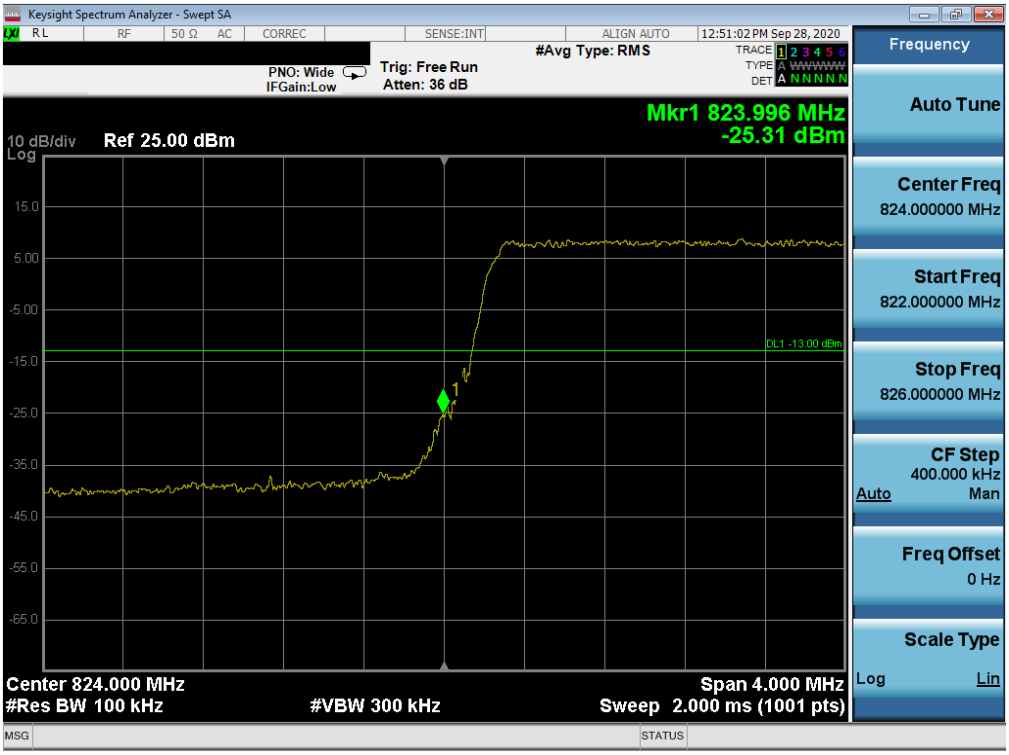
Plot 7-99. Upper Band Edge Plot (LTE Band 26 - 15MHz QPSK – Full RB Configuration)



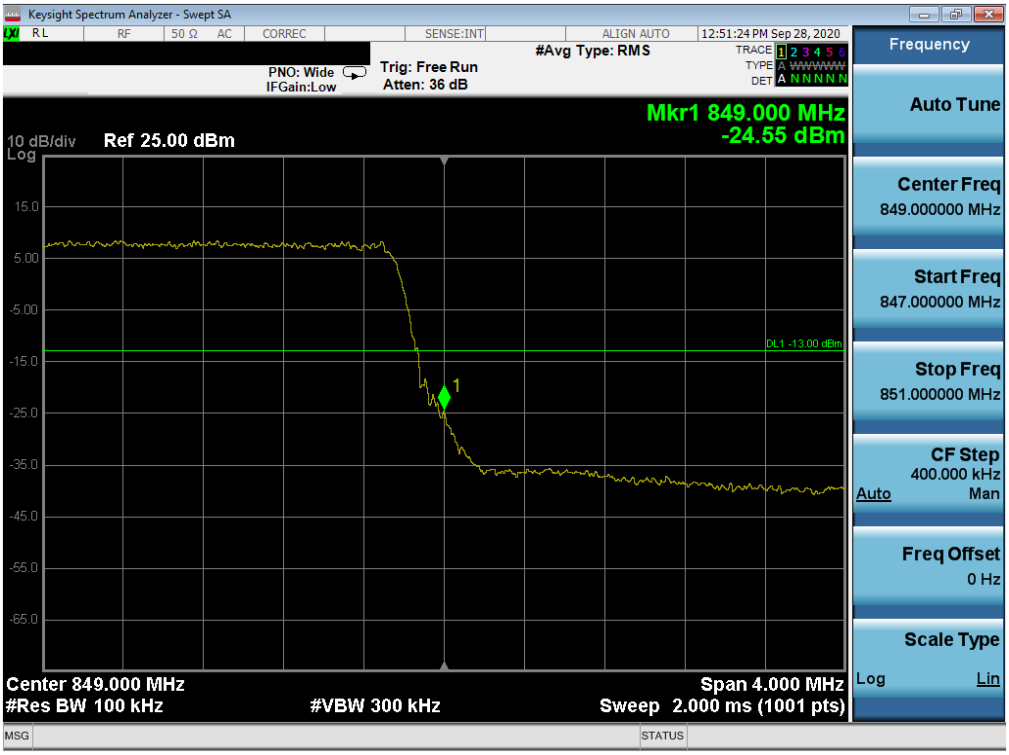
Plot 7-100. Lower Band Edge Plot (LTE Band 26/5 - 10MHz QPSK – Full RB Configuration)



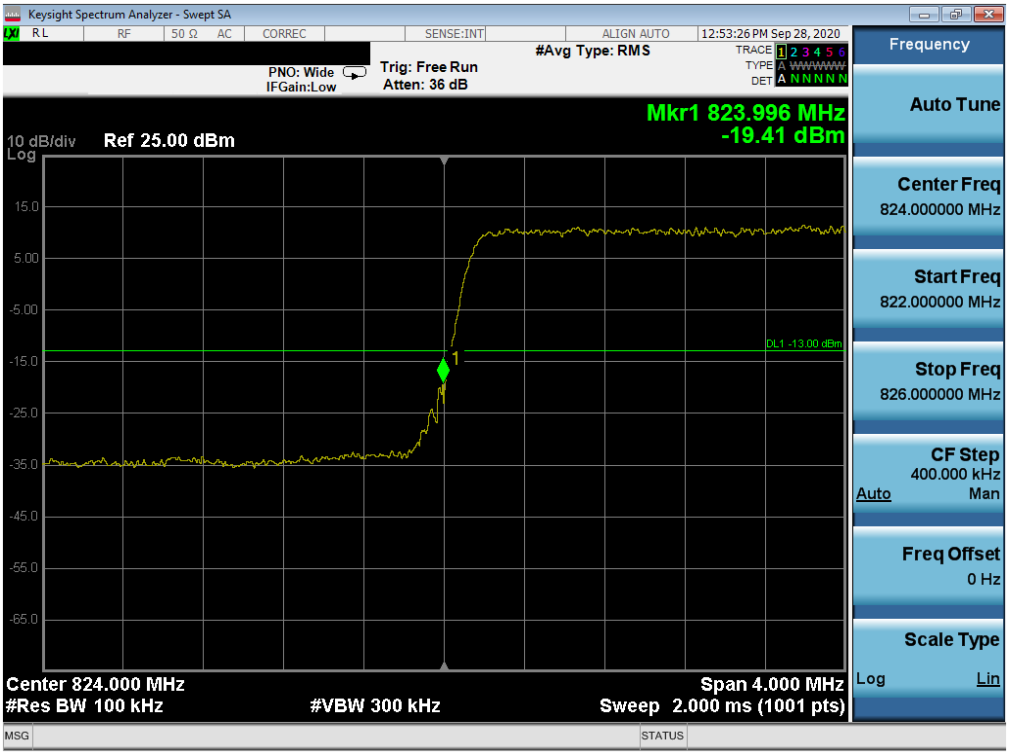
Plot 7-101. Upper Band Edge Plot (LTE Band 26/5 - 10MHz QPSK – Full RB Configuration)



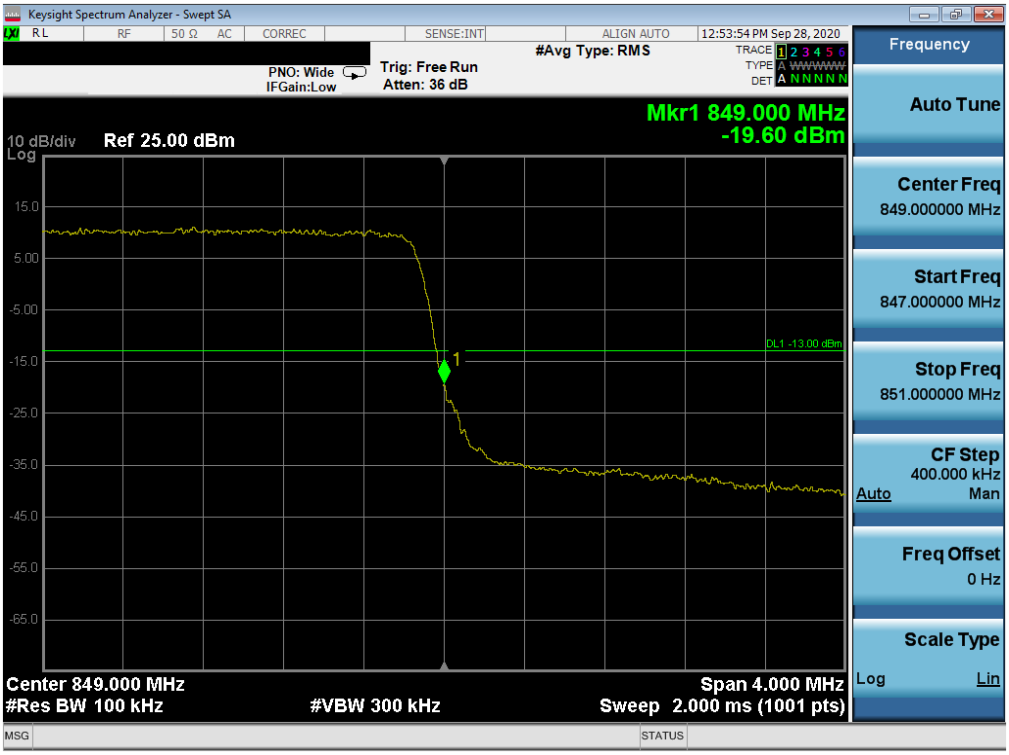
Plot 7-102. Lower Band Edge Plot (LTE Band 26/5 - 5MHz QPSK – Full RB Configuration)



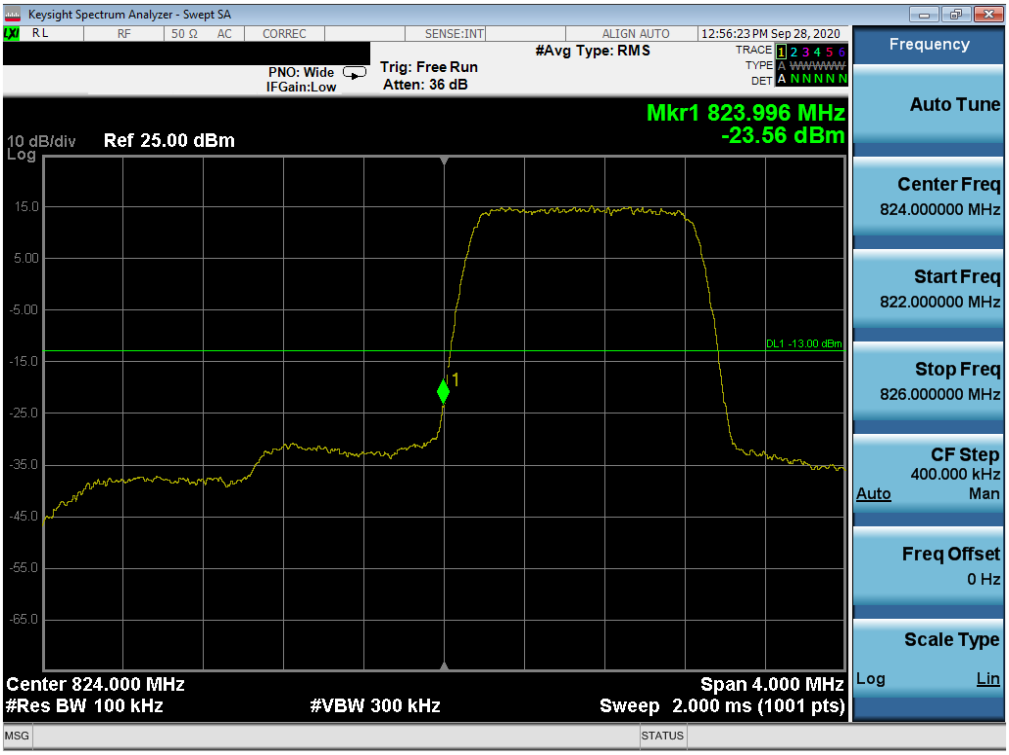
Plot 7-103. Upper Band Edge Plot (LTE Band 26/5 - 5MHz QPSK – Full RB Configuration)



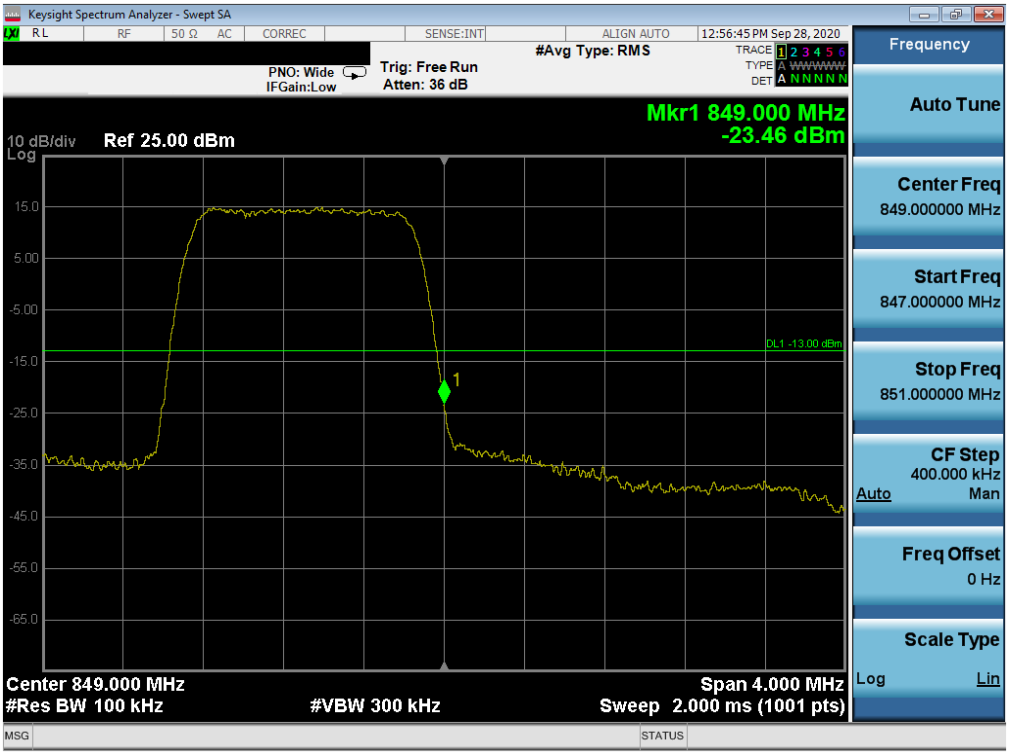
Plot 7-104. Lower Band Edge Plot (LTE Band 26/5 - 3MHz QPSK – Full RB Configuration)



Plot 7-105. Upper Band Edge Plot (LTE Band 26/5 - 3MHz QPSK – Full RB Configuration)

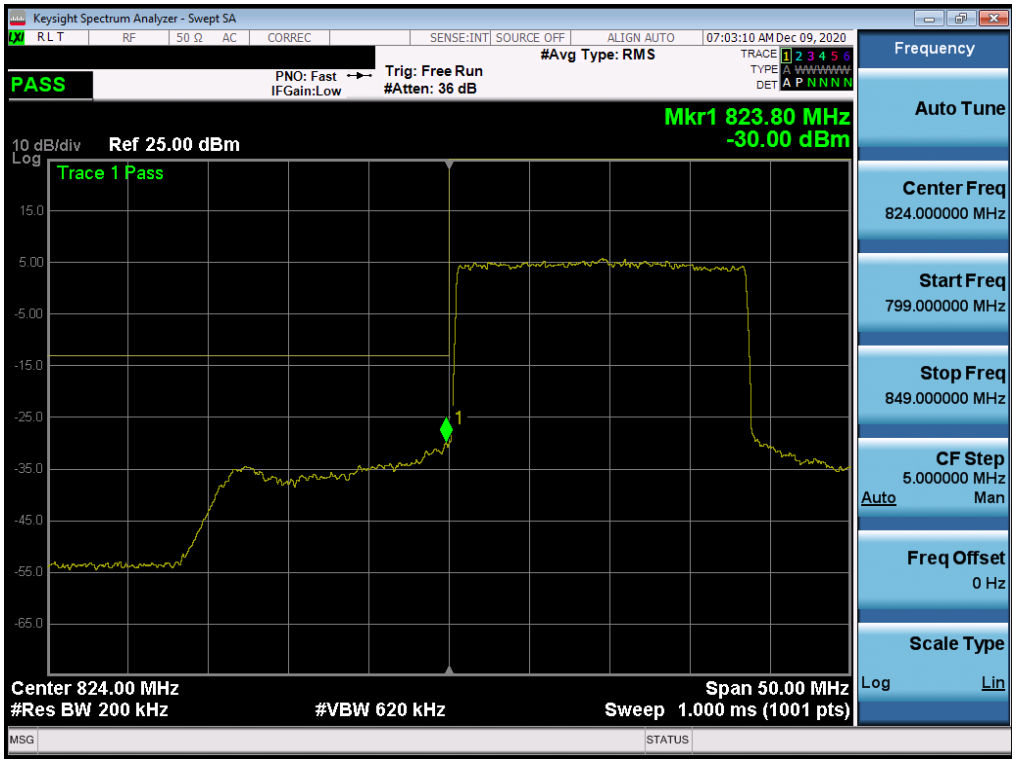


Plot 7-106. Lower Band Edge Plot (LTE Band 26/5 – 1.4MHz QPSK – Full RB Configuration)

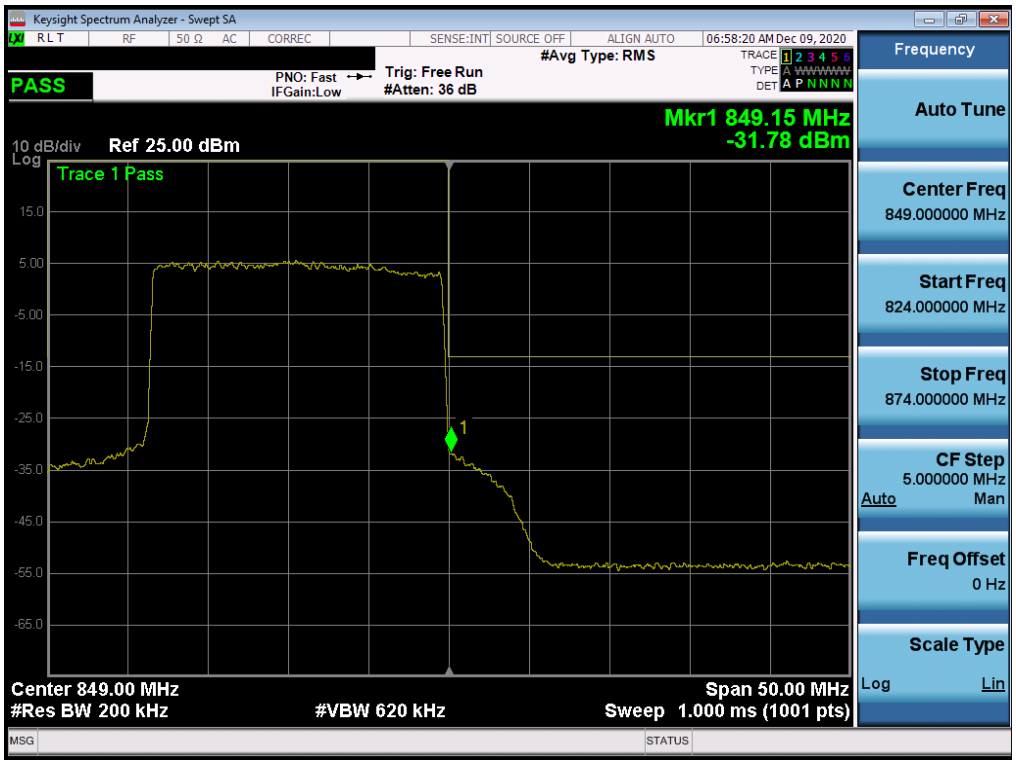


Plot 7-107. Upper Band Edge Plot (LTE Band 26/5 – 1.4MHz QPSK – Full RB Configuration)

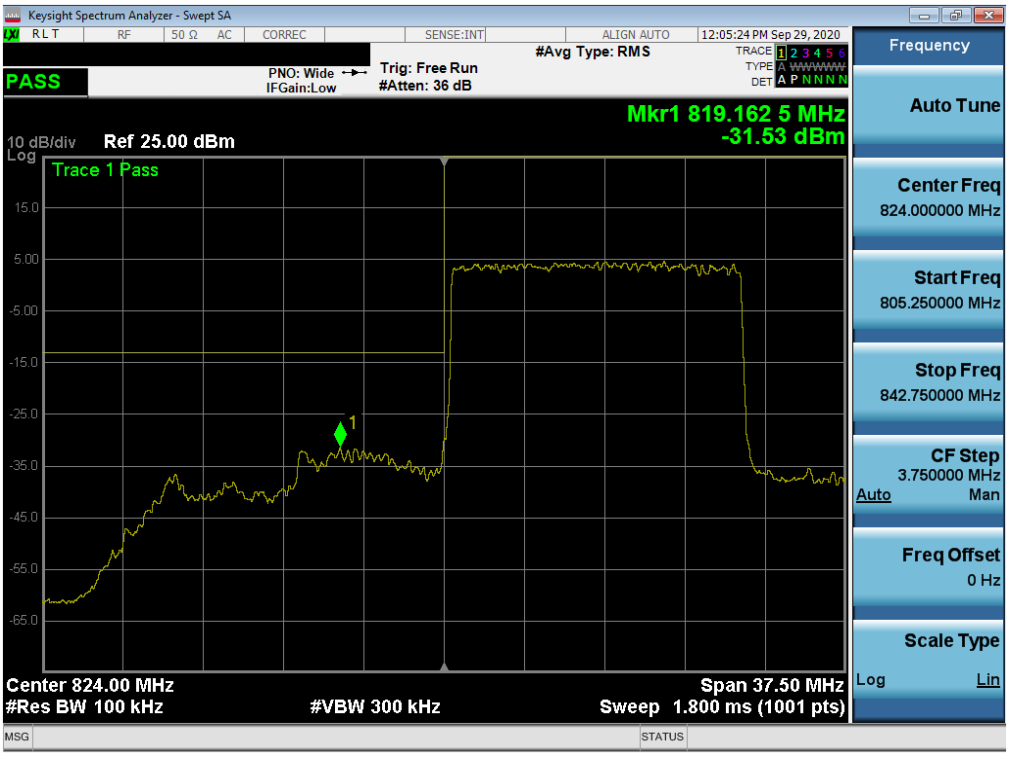
NR Band n5



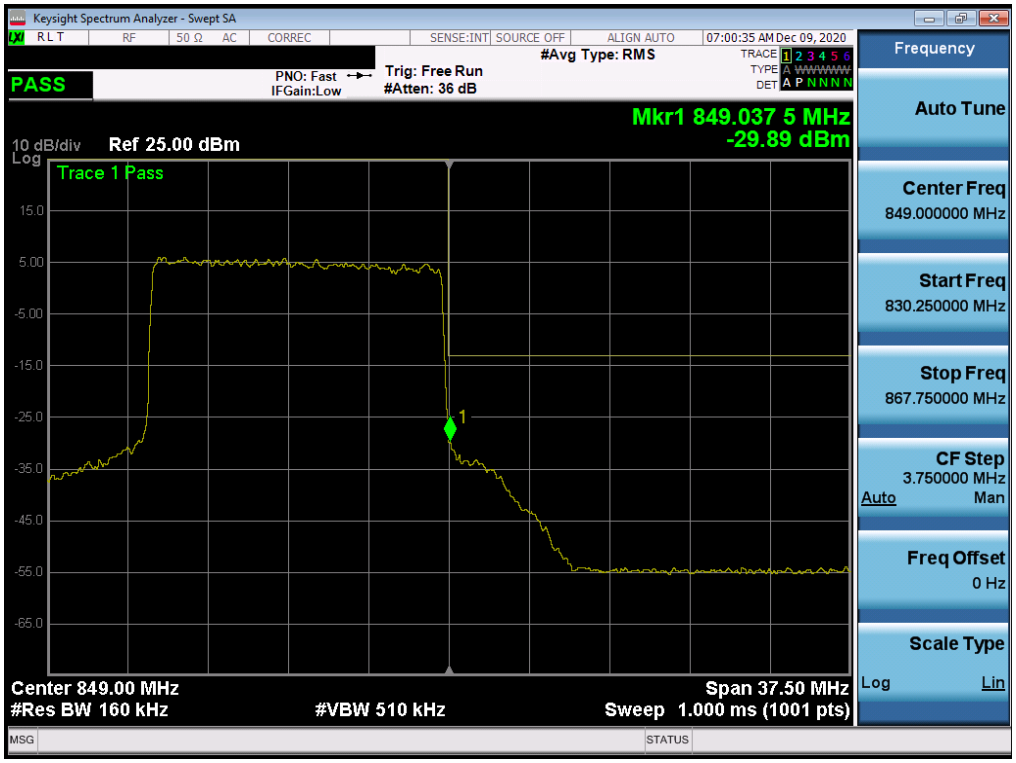
Plot 7-108. Lower Band Edge Plot (NR Band n5 – 20.0MHz - Full RB)



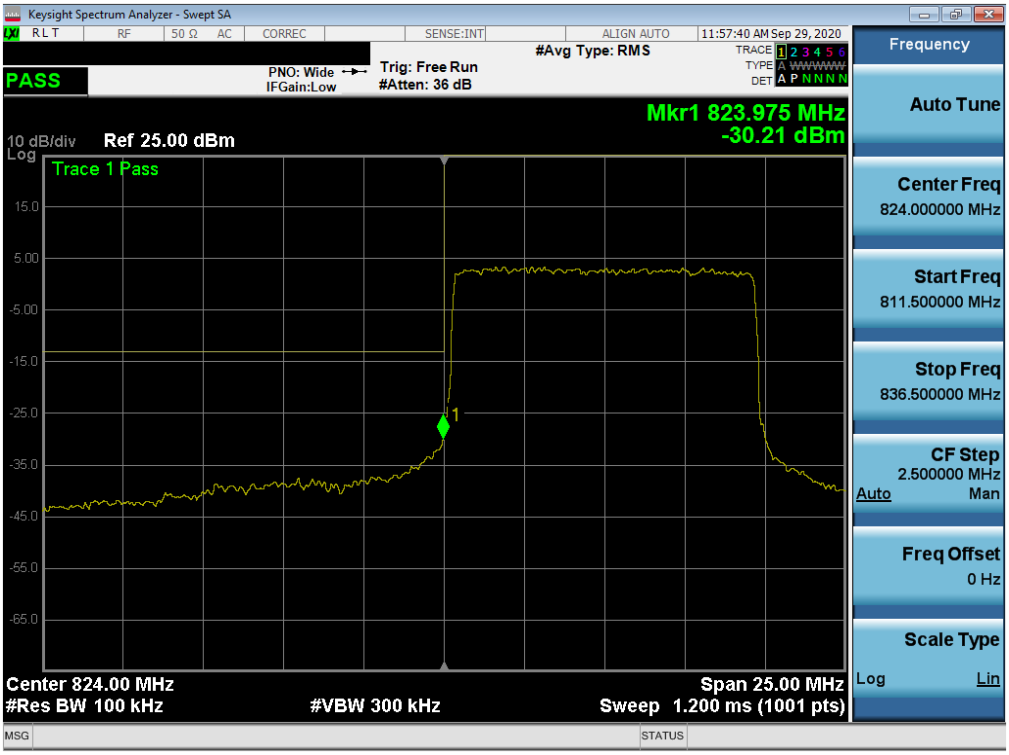
Plot 7-109. Upper Band Edge Plot (NR Band n5 – 20.0MHz - Full RB)



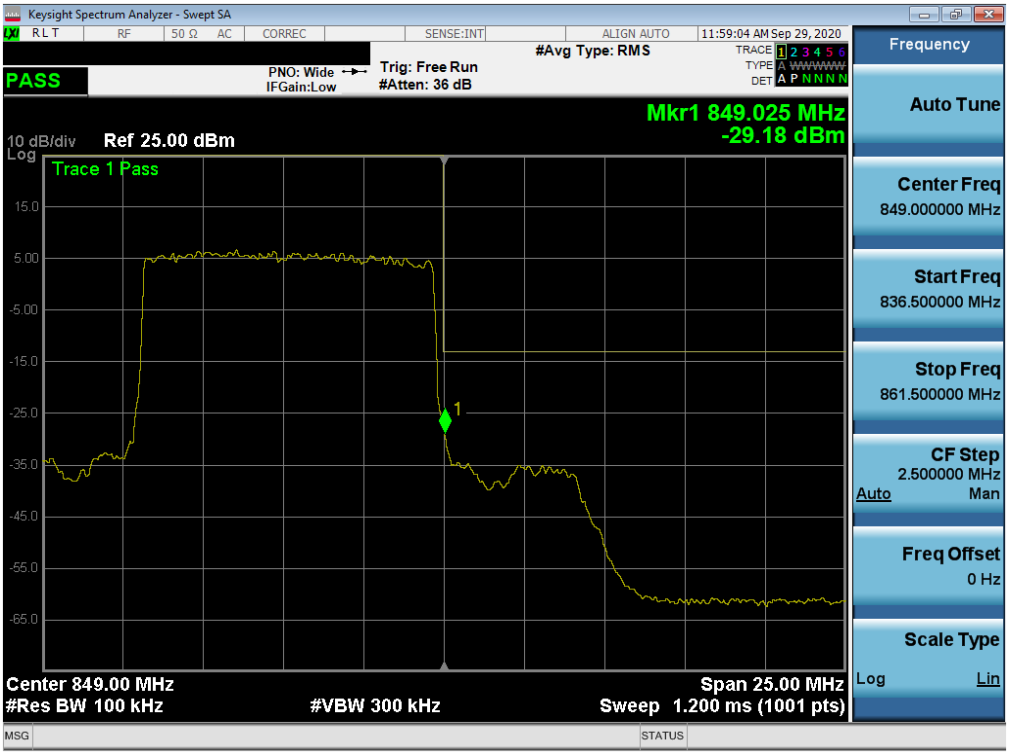
Plot 7-110. Lower Band Edge Plot (NR Band n5 – 15.0MHz - Full RB)



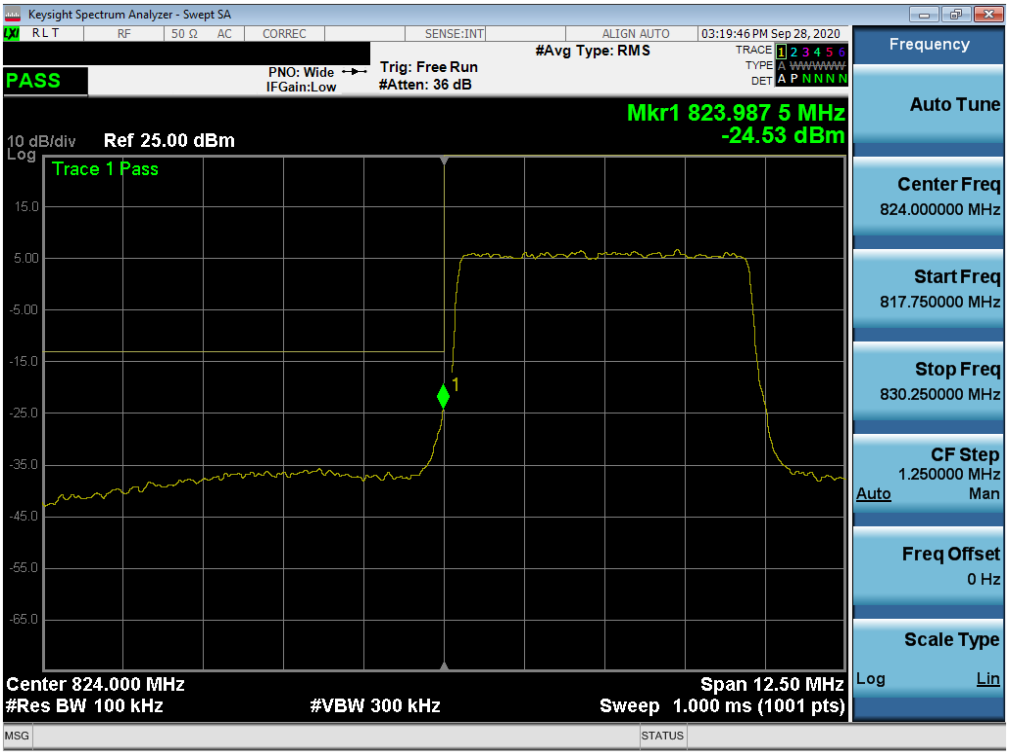
Plot 7-111. Upper Band Edge Plot (NR Band n5 – 15.0MHz - Full RB)



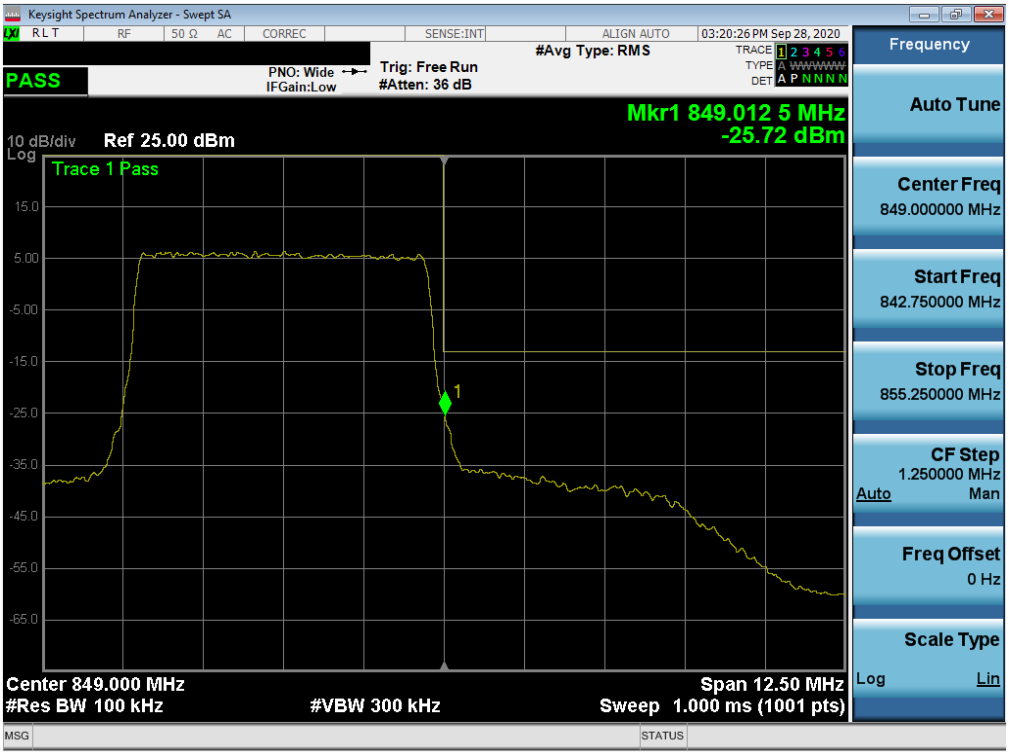
Plot 7-112. Lower Band Edge Plot (NR Band n5 – 10.0MHz - Full RB)



Plot 7-113. Upper Band Edge Plot (NR Band n5 – 10.0MHz - Full RB)



Plot 7-114. Lower Band Edge Plot (NR Band n5 – 5.0MHz - Full RB)



Plot 7-115. Upper Band Edge Plot (NR Band n5 – 5.0MHz - Full RB)

7.5 Radiated Power (ERP)

Test Overview

Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz 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

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

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.

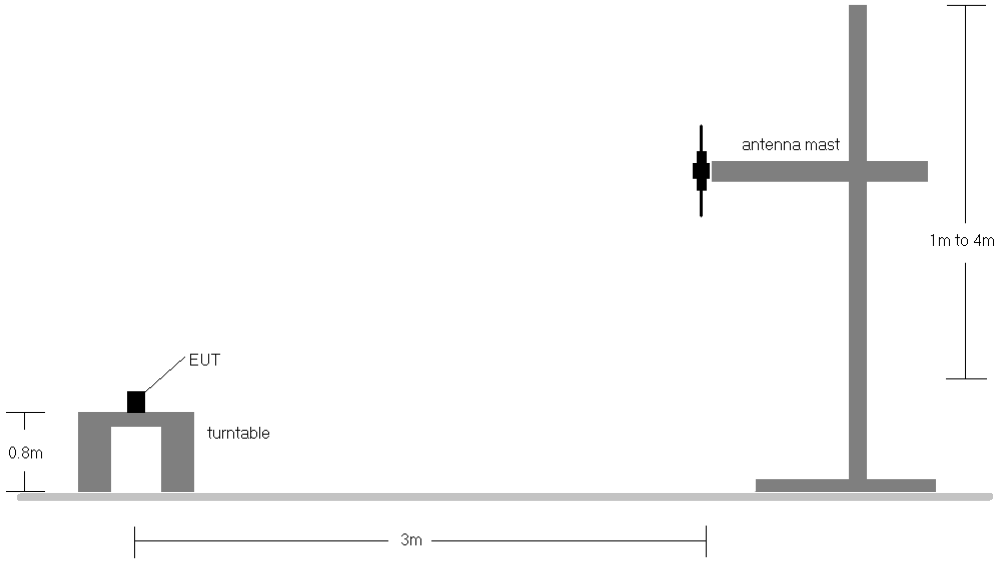


Figure 7-4. Radiated Test Setup <1GHz

Test Notes

1) This device employs GSM, GPRS, and EDGE capabilities. The EUT was tested under all configurations and the highest powers is reported in GPRS mode while transmitting with one slot active.

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

3) This device was tested under all RC and SO combinations and the worst case is reported with RC3/SO55 with "All Up" power control bits.

4) 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.

5) This unit was tested with its standard battery.

6) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.

7) 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.

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]
824.20	GPRS850	V	139	255	21.49	6.35	25.69	0.371	38.45	-12.76
836.60	GPRS850	V	150	253	21.87	6.38	**26.10**	**0.407**	38.45	-12.35
848.80	GPRS850	V	142	260	21.23	6.51	25.59	0.362	38.45	-12.87
836.60	GPRS850	H	373	305	16.49	6.38	20.72	0.118	38.45	-17.73
836.60	EDGE850	V	150	253	14.96	6.38	19.19	0.083	38.45	-19.26
836.60	GPRS850 (WCP)	V	169	74	19.08	6.38	23.31	0.214	38.45	-15.14

Table 7-2. ERP Data (GPRS Cell)

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	V	137	250	13.99	6.37	**18.21**	**0.066**	38.45	-20.24
836.60	WCDMA850	V	148	256	13.78	6.38	18.01	0.063	38.45	-20.44
846.60	WCDMA850	V	134	260	13.73	6.48	18.06	0.064	38.45	-20.39
826.40	WCDMA850	H	204	291	12.00	6.37	16.22	0.042	38.45	-22.23
826.40	WCDMA850 (WCP)	V	145	141	10.38	6.37	14.60	0.029	38.45	-23.85

Table 7-3. ERP Data (WCDMA Cell)

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]
824.70	CDMA850	V	142	236	13.68	6.36	17.89	0.061	38.45	-20.57
836.52	CDMA850	V	145	246	14.20	6.38	**18.43**	**0.070**	38.45	-20.02
848.31	CDMA850	V	145	246	13.65	6.50	18.00	0.063	38.45	-20.45
836.52	CDMA850	H	196	289	13.37	6.38	17.60	0.058	38.45	-20.85
836.52	CDMA850 (WCP)	V	221	149	12.96	6.38	17.19	0.052	38.45	-21.26

Table 7-4. ERP Data (CDMA Cell)

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	831.5	V	147	254	6.43	1 / 37	14.51	**18.79**	0.076	38.45	-19.67
		836.5	V	139	259	6.38	1 / 37	14.37	18.60	0.072	38.45	-19.86
		841.5	V	133	255	6.43	1 / 37	14.22	18.50	0.071	38.45	-19.96
	16-QAM	831.5	V	147	254	6.43	1 / 37	13.80	**18.08**	0.064	38.45	-20.38
	64-QAM	831.5	V	147	254	6.43	1 / 74	13.66	**17.94**	0.062	38.45	-20.52
	256-QAM	831.5	V	147	254	6.43	1 / 74	10.72	**15.00**	0.032	38.45	-23.46
10 MHz	QPSK	829.0	V	147	254	6.40	1 / 0	14.50	**18.75**	0.075	38.45	-19.71
		836.5	V	139	259	6.38	1 / 0	14.46	18.69	0.074	38.45	-19.77
		844.0	V	133	255	6.46	1 / 0	14.08	18.39	0.069	38.45	-20.07
	16-QAM	829.0	V	147	254	6.40	1 / 0	14.26	**18.51**	0.071	38.45	-19.95
	64-QAM	829.0	V	147	254	6.40	1 / 0	13.81	**18.06**	0.064	38.45	-20.40
	256-QAM	829.0	V	147	254	6.40	1 / 0	10.73	**14.98**	0.031	38.45	-23.48
5 MHz	QPSK	826.5	V	147	254	6.37	1 / 24	14.69	**18.92**	0.078	38.45	-19.54
		836.5	V	139	259	6.38	1 / 24	14.52	18.75	0.075	38.45	-19.71
		846.5	V	133	255	6.48	1 / 12	13.93	18.26	0.067	38.45	-20.20
	16-QAM	826.5	V	147	254	6.37	1 / 24	14.22	**18.45**	0.070	38.45	-20.01
	64-QAM	826.5	V	147	254	6.37	1 / 24	14.24	**18.47**	0.070	38.45	-19.99
	256-QAM	826.5	V	147	254	6.37	1 / 24	10.82	**15.05**	0.032	38.45	-23.41
3 MHz	QPSK	825.5	V	147	254	6.36	1 / 14	14.53	**18.75**	0.075	38.45	-19.71
		836.5	V	139	259	6.38	1 / 14	14.45	18.68	0.074	38.45	-19.78
		847.5	V	133	255	6.49	1 / 0	13.99	18.33	0.068	38.45	-20.13
	16-QAM	825.5	V	147	254	6.36	1 / 14	14.27	**18.49**	0.071	38.45	-19.97
	64-QAM	825.5	V	147	254	6.36	1 / 14	13.88	**18.10**	0.065	38.45	-20.36
	256-QAM	825.5	V	147	254	6.36	1 / 14	10.80	**15.02**	0.032	38.45	-23.44
1.4 MHz	QPSK	824.7	V	147	254	6.36	1 / 2	14.52	**18.73**	0.075	38.45	-19.73
		836.5	V	139	259	6.38	1 / 2	14.42	18.65	0.073	38.45	-19.81
		848.3	V	133	255	6.50	1 / 2	14.11	18.46	0.070	38.45	-20.00
	16-QAM	824.7	V	147	254	6.36	1 / 2	14.28	**18.49**	0.071	38.45	-19.97
	64-QAM	824.7	V	147	254	6.36	1 / 2	13.85	**18.06**	0.064	38.45	-20.40
	256-QAM	824.7	V	147	254	6.36	1 / 2	10.89	**15.10**	0.032	38.45	-23.36
15 MHz	Opposite Pol.	831.5	H	205	288	6.43	1 / 37	10.32	16.75	0.047	38.45	-21.71
	WCP	831.5	V	118	241	6.43	1 / 37	8.87	15.30	0.034	38.45	-23.16

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

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	834.0	V	139	242	6.35	1 / 99	14.47	18.67	0.074	38.45	-19.78
		836.5	V	139	249	6.38	1 / 0	14.53	18.76	0.075	38.45	-19.70
		839.0	V	139	275	6.40	1 / 0	14.52	**18.77**	0.075	38.45	-19.68
	QPSK	834.0	V	139	242	6.35	1 / 99	14.46	18.66	0.073	38.45	-19.79
		836.5	V	139	249	6.38	1 / 0	14.50	**18.73**	0.075	38.45	-19.73
		839.0	V	139	275	6.40	1 / 0	14.45	18.70	0.074	38.45	-19.75
	16-QAM	839.0	V	139	275	6.40	1 / 0	13.44	**17.69**	0.059	38.45	-20.76
	64-QAM	839.0	V	139	275	6.40	1 / 0	11.58	**15.83**	0.038	38.45	-22.62
	256-QAM	839.0	V	139	275	6.40	1 / 0	10.00	**14.25**	0.027	38.45	-24.20
15 MHz	π/2 BPSK	831.5	V	139	242	6.43	1 / 58	14.30	18.57	0.072	38.45	-19.88
		836.5	V	139	249	6.38	1 / 20	14.56	**18.79**	0.076	38.45	-19.67
		841.5	V	139	275	6.43	1 / 20	14.48	18.76	0.075	38.45	-19.69
	QPSK	831.5	V	139	242	6.43	1 / 58	14.28	18.55	0.072	38.45	-19.90
		836.5	V	139	249	6.38	1 / 20	14.45	18.68	0.074	38.45	-19.78
		841.5	V	139	275	6.43	1 / 20	14.42	**18.70**	0.074	38.45	-19.75
	16-QAM	836.5	V	139	249	6.38	1 / 20	13.43	**17.66**	0.058	38.45	-20.80
	64-QAM	836.5	V	139	249	6.38	1 / 20	11.74	**15.97**	0.040	38.45	-22.49
	256-QAM	836.5	V	139	249	6.38	1 / 20	10.05	**14.28**	0.027	38.45	-24.18
10 MHz	π/2 BPSK	829.0	V	139	242	6.40	1 / 38	14.13	18.38	0.069	38.45	-20.07
		836.5	V	139	249	6.38	1 / 13	14.47	**18.70**	0.074	38.45	-19.76
		844.0	V	139	275	6.46	1 / 13	14.29	18.59	0.072	38.45	-19.86
	QPSK	829.0	V	139	242	6.40	1 / 38	14.24	18.49	0.071	38.45	-19.96
		836.5	V	139	249	6.38	1 / 13	14.41	18.64	0.073	38.45	-19.82
		844.0	V	139	275	6.46	1 / 13	14.39	**18.69**	0.074	38.45	-19.76
	16-QAM	836.5	V	139	249	6.38	1 / 13	13.49	**17.72**	0.059	38.45	-20.74
	64-QAM	836.5	V	139	249	6.38	1 / 13	11.59	**15.82**	0.038	38.45	-22.64
	256-QAM	836.5	V	139	249	6.38	1 / 13	10.28	**14.51**	0.028	38.45	-23.95
5 MHz	π/2 BPSK	829.0	V	139	242	6.37	1 / 18	14.46	18.68	0.074	38.45	-19.77
		836.5	V	139	249	6.38	1 / 6	14.70	**18.93**	0.078	38.45	-19.53
		844.0	V	139	275	6.48	1 / 6	14.55	18.88	0.077	38.45	-19.57
	QPSK	829.0	V	139	242	6.37	1 / 18	14.34	18.56	0.072	38.45	-19.89
		836.5	V	139	249	6.38	1 / 6	14.61	18.84	0.077	38.45	-19.62
		844.0	V	139	275	6.48	1 / 6	14.55	**18.88**	0.077	38.45	-19.57
	16-QAM	836.5	V	139	249	6.38	1 / 6	13.60	**17.83**	0.061	38.45	-20.63
	64-QAM	836.5	V	139	249	6.38	1 / 6	11.81	**16.04**	0.040	38.45	-22.42
	256-QAM	836.5	V	139	249	6.38	1 / 6	9.98	**14.21**	0.026	38.45	-24.25
20MHz	QPSK (CP-OFDM)	839.0	V	139	275	6.38	1 / 0	10.75	**17.13**	0.052	38.45	-21.33
	QPSK (Opposite Pol.)	839.0	H	202	290	6.38	1 / 0	11.30	17.68	0.059	38.45	-20.78
	QPSK (WCP)	839.0	V	144	71	6.38	1 / 0	6.18	12.56	0.018	38.45	-25.90

Table 7-6. ERP Data (NR Band n5)

7.6 Uplink Carrier Aggregation

§27.53(m)

Test Overview

The EUT is set up to transmit two contiguous LTE channels. The power level of both carriers 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 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

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (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 7-5. Test Instrument & Measurement Setup

Test Notes

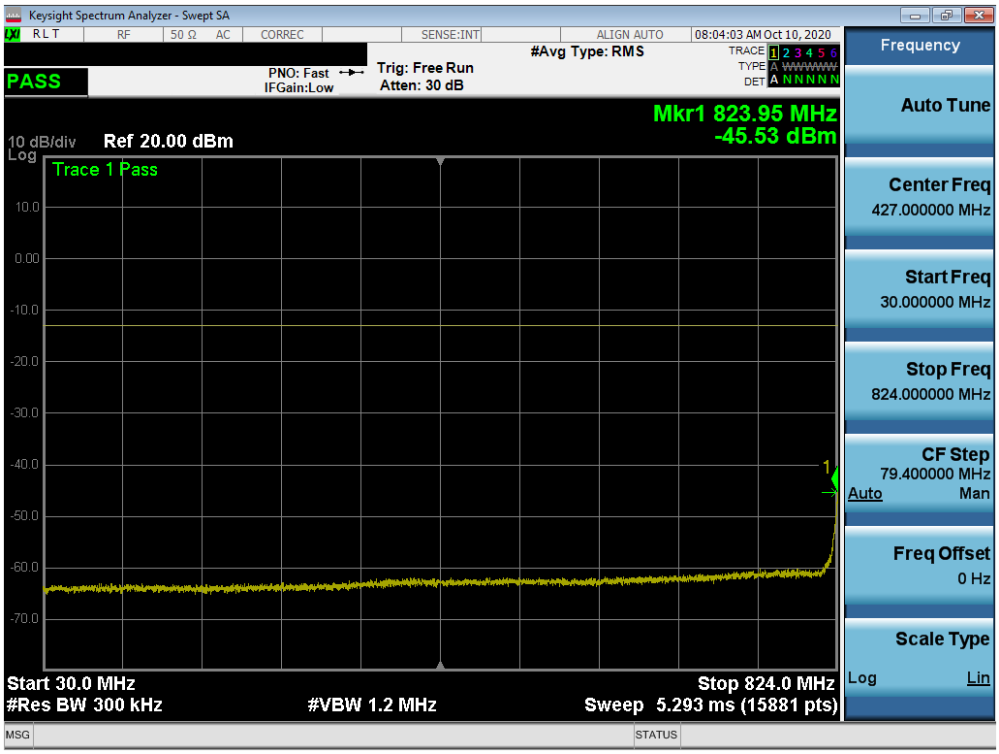
1. Conducted power and spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device. The worst case (highest) powers were found while operating with QPSK modulation with both carriers set to transmit using 1RB.

2. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. 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.

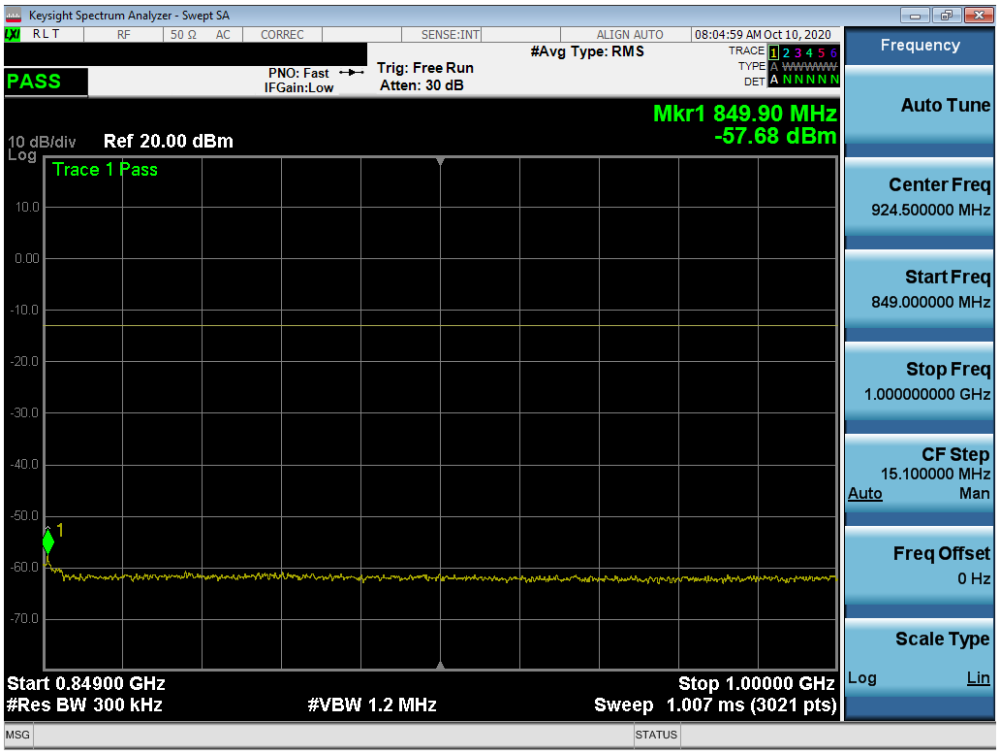
Uplink CA Configuration 5B

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	25.26
				20475	831.5	1	49		20574	841.4	1	0	25.30
				20600	844.0	1	0		20501	834.1	1	49	25.21
			QPSK	20475	831.5	50	0	QPSK	20574	841.4	50	0	25.25
			16-QAM	20475	831.5	50	0	16-QAM	20574	841.4	50	0	24.25
			64-QAM	20475	831.5	50	0	64-QAM	20574	841.4	50	0	23.52
			256-QAM	20475	831.5	50	0	256-QAM	20574	841.4	50	0	22.14

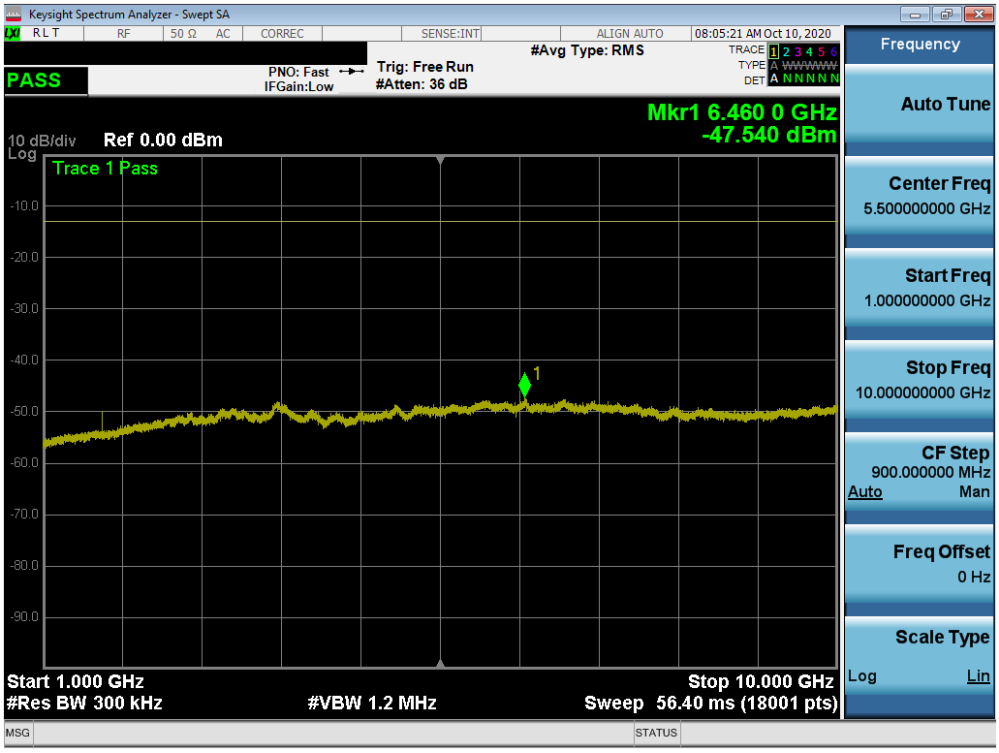
Table 7-7. Conducted Powers (5B)



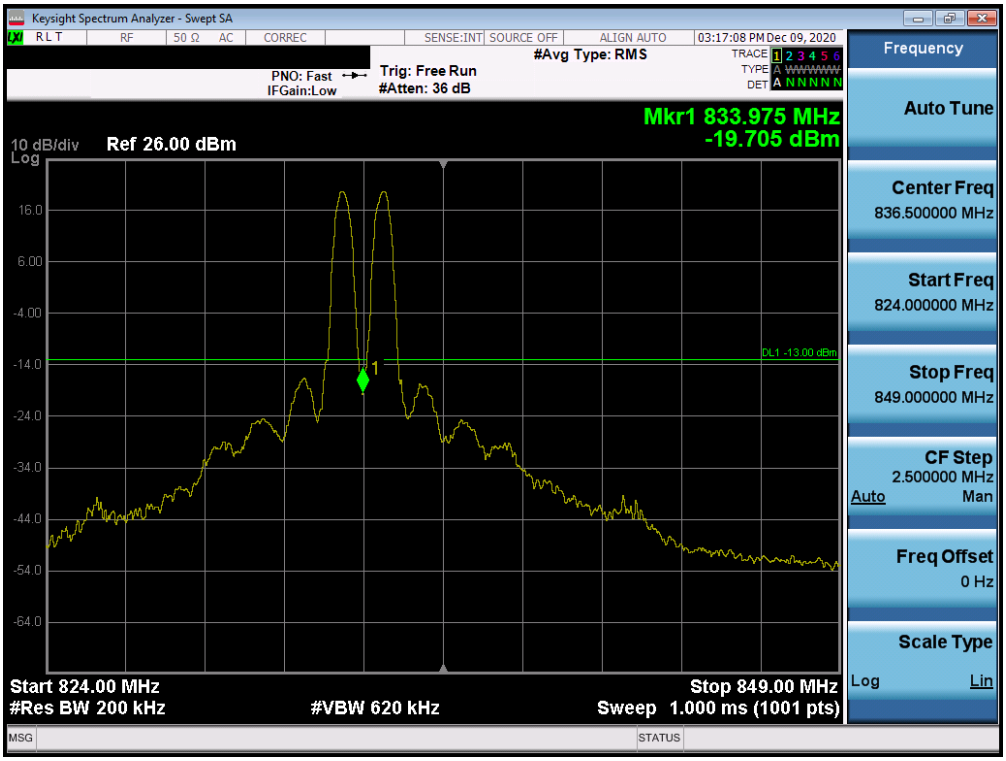
Plot 7-116. Conducted Spurious Plot (Band 5 – 10.0MHz QPSK – PCC 1/49 SCC 1/0 – Low Channel)



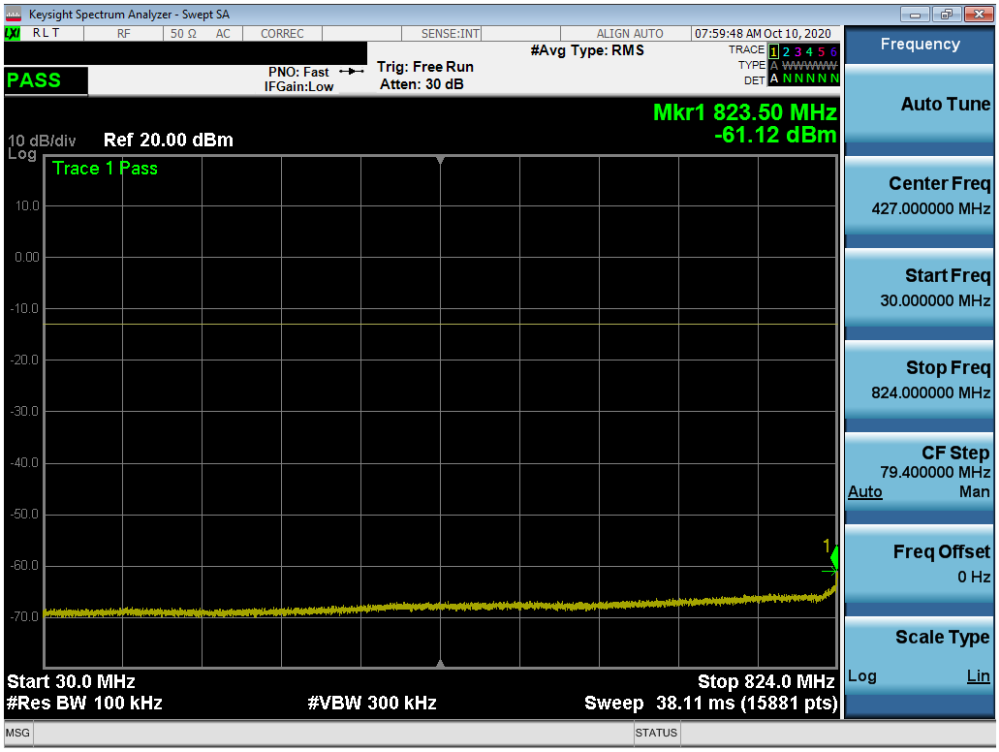
Plot 7-117. Conducted Spurious Plot (Band 5 – 10.0MHz QPSK – PCC 1/49 SCC 1/0 – Low Channel)



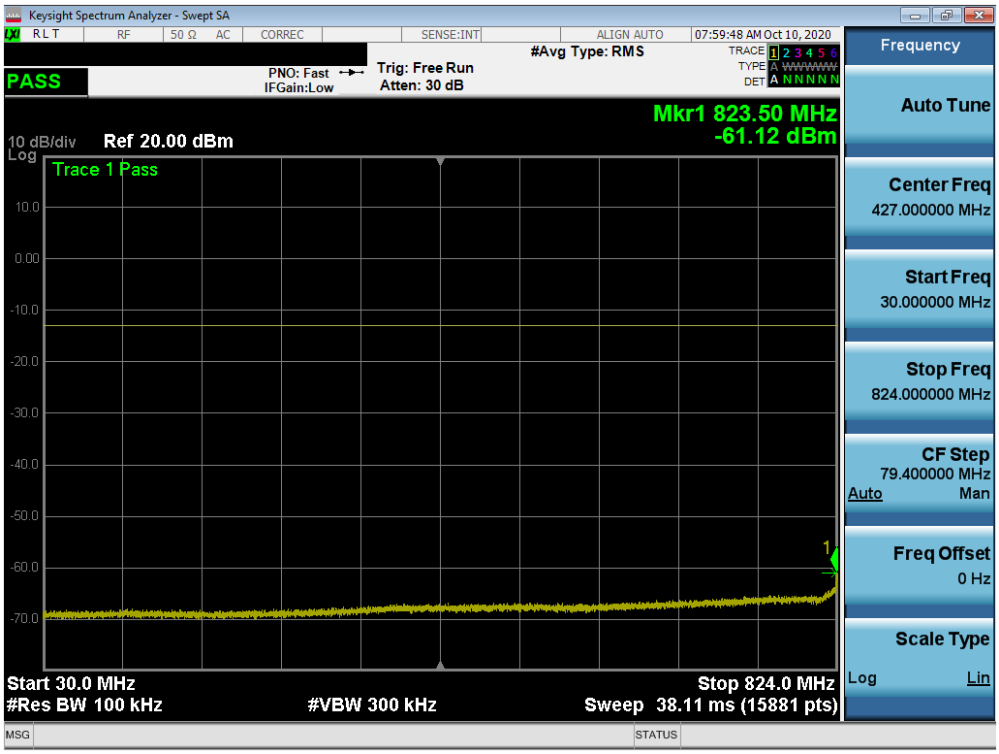
Plot 7-118. Conducted Spurious Plot (Band 5 – 10.0MHz QPSK – PCC 1/49 SCC 1/0 – Low Channel)



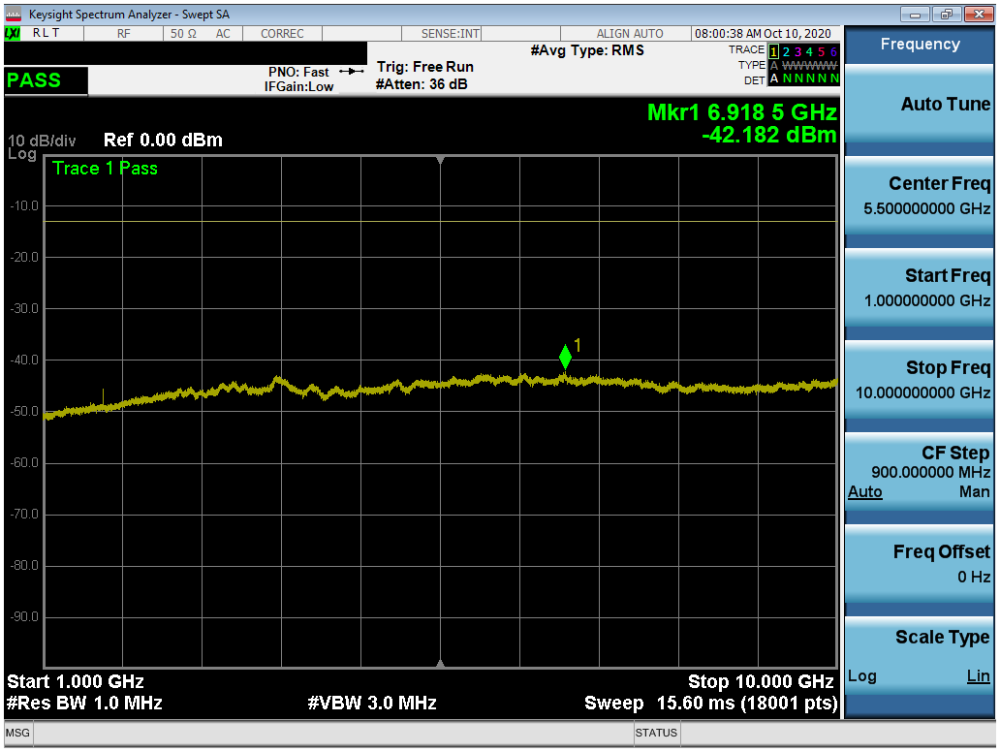
Plot 7-119. Conducted Spurious Plot (Band 5 – 10.0MHz QPSK – PCC 1/49 SCC 1/0 – Low Channel)



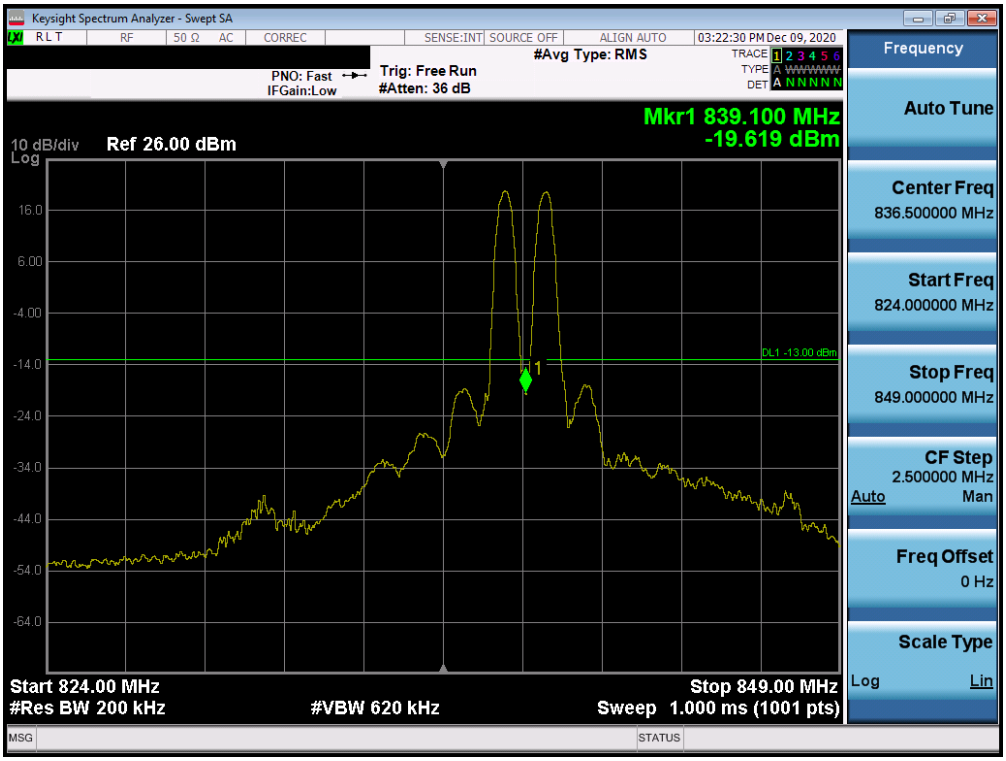
Plot 7-120. Conducted Spurious Plot (Band 5 – 10.0MHz QPSK – PCC 1/0 SCC 1/49 – High Channel)



Plot 7-121. Conducted Spurious Plot (Band 5 – 10.0MHz QPSK – PCC 1/0 SCC 1/49 – High Channel)

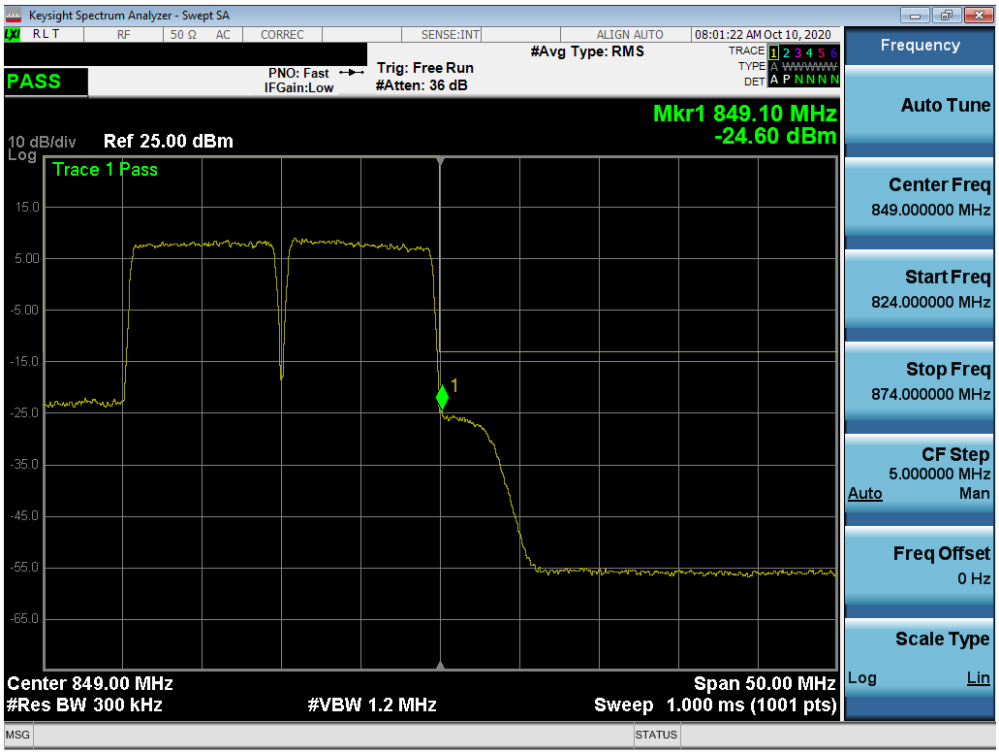


Plot 7-122. Conducted Spurious Plot (Band 5 – 10.0MHz QPSK – PCC 1/0 SCC 1/49 – High Channel)



Plot 7-123. Conducted Spurious Plot (Band 5 – 10.0MHz QPSK – PCC 1/0 SCC 1/49 – High Channel)

Plot 7-124. Lower Band Edge Plot (Band 5 QPSK – PCC:10 MHz SCC:10 MHz – Full RB)



Plot 7-125. Upper Band Edge Plot (Band 5 QPSK – PCC:10 MHz SCC:10 MHz – Full RB)

7.7 Radiated Spurious Emissions Measurements

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz 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

KDB 971168 D01 v03r01 – Section 5.8

Test Settings

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

Test Setup

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

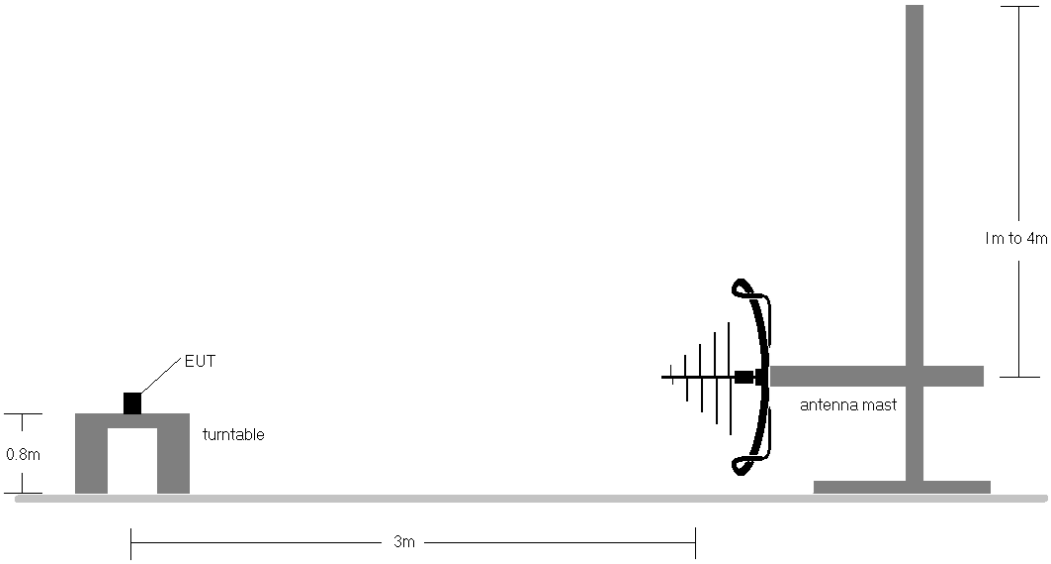


Figure 7-6. Test Instrument & Measurement Setup < 1GHz

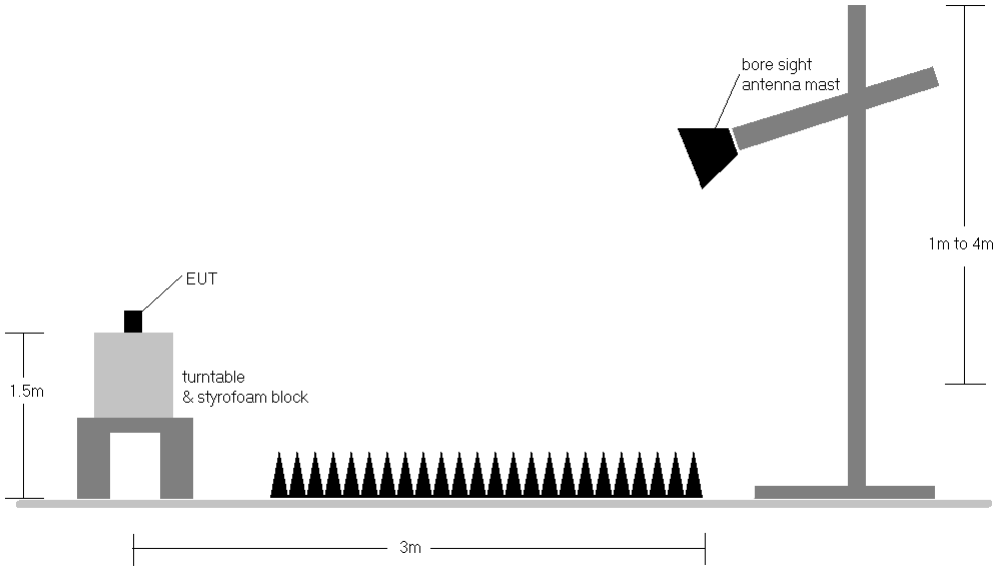


Figure 7-7. Test Instrument & Measurement Setup >1 GHz

Test Notes

1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
   b) E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
   d) EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

2) This device employs GSM, GPRS, and EDGE capabilities. The EUT was tested under all configurations and the highest powers is reported in GPRS mode while transmitting with one slot active.

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

4) For CDMA, this device was tested under all RC and SO combinations and the worst case is reported with RC3/SO55 with "All Up" power control bits.

5) 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.

6) This unit was tested with its standard battery.

7) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.

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

9) 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.

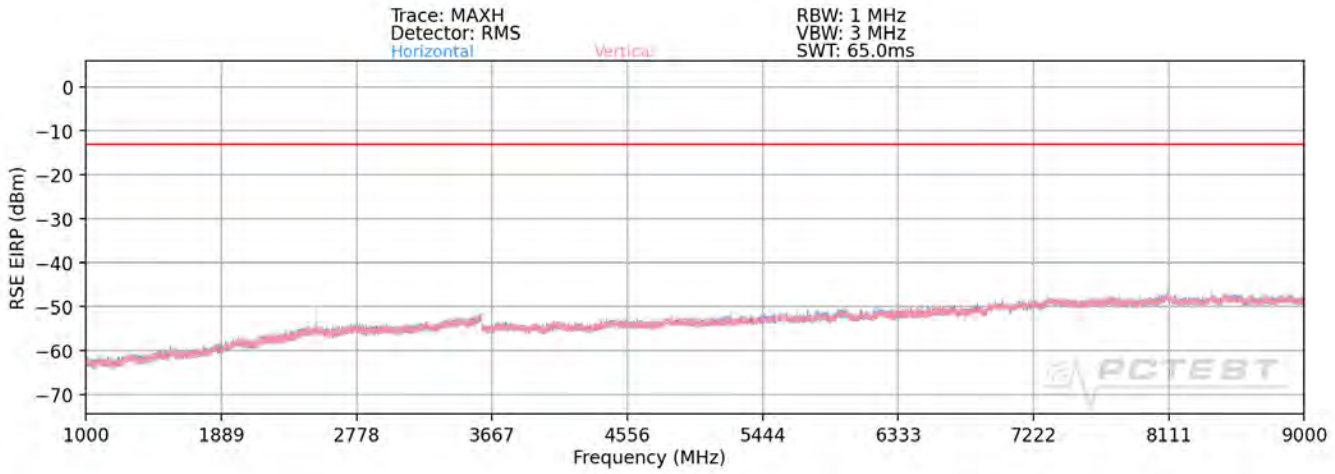
10) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

11) 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.

12) 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.

13) Spurious emissions shown in this section are measured while operating in EN-DC mode with Sub 6GHz NR carrier as well as an LTE carrier (anchor). Spurious emissions from the NR carrier device, is subject to the rules under which the NR carrier operates. Spurious emission caused by the LTE carrier must meet the requirements of the rules under which the LTE carrier operates.

LTE Band 26



Plot 7-126. Radiated Spurious Plot (LTE Band 26)

Bandwidth (MHz):	15
Frequency (MHz):	831.5
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]
1663.0	V	-	-	-70.21	-1.22	35.57	-59.69	-13.00	-46.69
2494.5	V	147	251	-68.78	3.11	41.33	-53.93	-13.00	-40.93
3326.0	V	-	-	-69.27	4.65	42.38	-52.88	-13.00	-39.88
4157.5	V	-	-	-75.02	5.98	37.96	-57.30	-13.00	-44.30

Table 7-8. Radiated Spurious Data (LTE Band 26 – Low Channel)

Bandwidth (MHz):	15
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]
1673.0	V	-	-	-69.80	-1.15	36.05	-59.21	-13.00	-46.21
2509.5	V	144	221	-63.20	3.29	47.09	-48.16	-13.00	-35.16
3346.0	V	-	-	-69.18	5.03	42.85	-52.40	-13.00	-39.40
4182.5	V	-	-	-74.88	5.94	38.06	-57.20	-13.00	-44.20

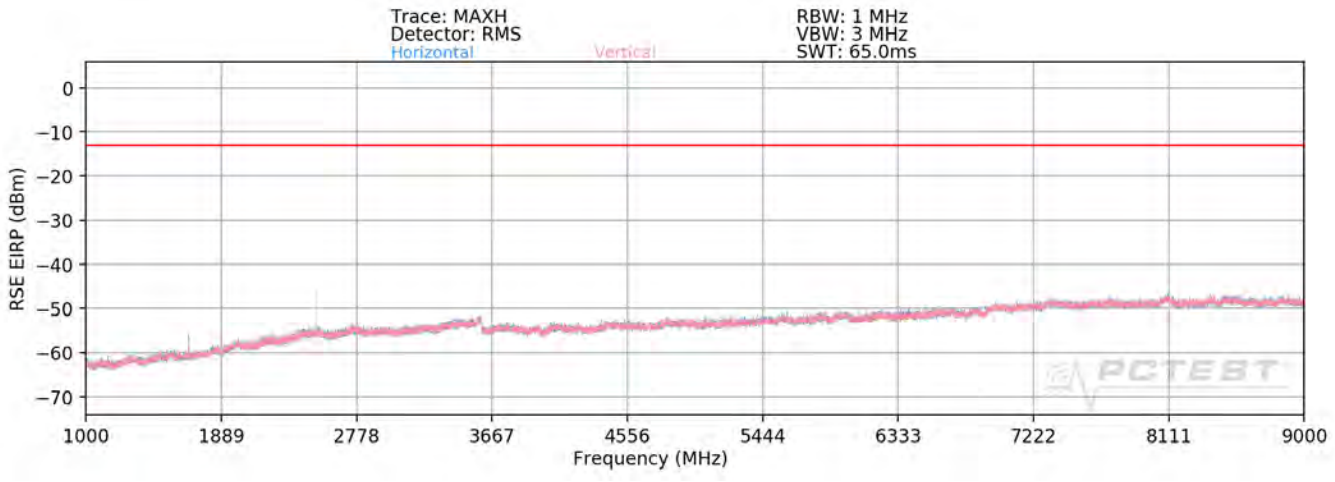
Table 7-9. Radiated Spurious Data (LTE Band 26 – Mid Channel)

Bandwidth (MHz):	15
Frequency (MHz):	841.5
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]
1683.00	V	-	-	-70.18	-1.07	35.75	-59.50	-13.00	-46.50
2524.50	V	138	228	-61.62	3.28	48.66	-46.60	-13.00	-33.60
3366.00	V	-	-	-69.66	5.13	42.47	-52.79	-13.00	-39.79
4207.50	V	-	-	-74.57	5.90	38.33	-56.93	-13.00	-43.93

Table 7-10. Radiated Spurious Data (LTE Band 26 – High Channel)

ULCA LTE Band 5



Plot 7-127. Radiated Spurious Plot (ULCA LTE Band 5)

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]
1668.0	H	139	299	-66.53	-1.20	39.27	-55.99	-13.00	-42.99
2502.0	H	224	183	-56.32	3.23	53.91	-41.35	-13.00	-28.35
3336.0	H	-	-	-69.53	4.92	42.39	-52.87	-13.00	-39.87
4170.0	H	-	-	-74.52	5.92	38.40	-56.86	-13.00	-43.86

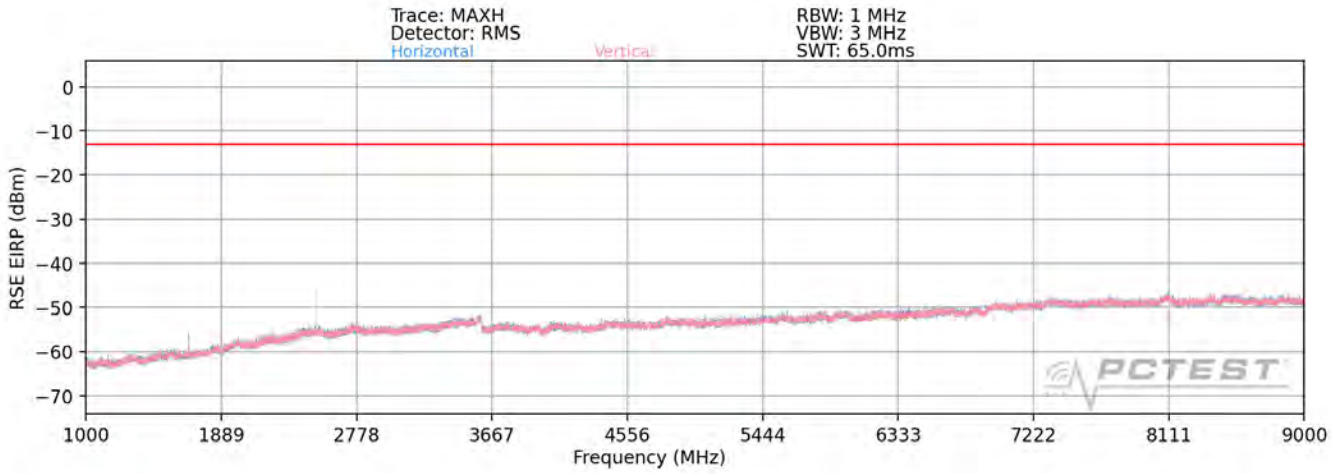
Table 7-11. Radiated Spurious Data (ULCA LTE Band 5 – Low Channel)

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]
1678.0	H	114	307	-65.98	-1.11	39.91	-55.35	-13.00	-42.35
2517.0	H	119	247	-56.41	3.29	53.88	-41.38	-13.00	-28.38
3356.0	H	-	-	-70.21	5.12	41.91	-53.35	-13.00	-40.35
4195.0	H	-	-	-73.80	5.89	39.09	-56.17	-13.00	-43.17

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

NR Band n5



Plot 7-128. Radiated Spurious Plot (NR Band n5)

Bandwidth (MHz):	20
Frequency (MHz):	834.0
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1668.0	H	141	302	-67.20	-1.20	38.60	-56.66	-13.00	-43.66
2502.0	H	245	320	-62.30	3.23	47.93	-47.33	-13.00	-34.33
3336.0	H	262	353	-65.32	4.92	46.60	-48.66	-13.00	-35.66
4170.0	H	-	-	-67.58	5.92	45.34	-49.92	-13.00	-36.92
5004.0	H	-	-	-71.70	7.05	42.35	-52.91	-13.00	-39.91

Table 7-13. Radiated Spurious Data (NR Band n5 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	836.5
RB / Offset:	1 / 50

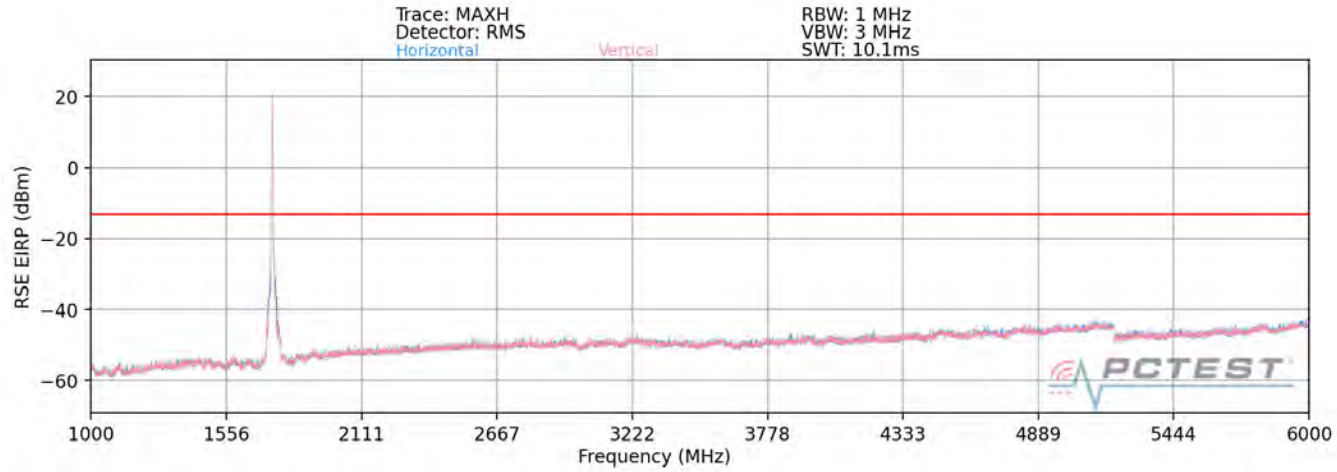
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.0	H	141	302	-64.02	-1.15	41.83	-53.43	-13.00	-40.43
2509.5	H	144	292	-58.45	3.29	51.84	-43.41	-13.00	-30.41
3346.0	H	-	-	-67.64	5.03	44.39	-50.86	-13.00	-37.86
4182.5	H	-	-	-71.64	5.94	41.30	-53.96	-13.00	-40.96

Table 7-14. Radiated Spurious Data (NR Band n5 – Mid Channel)

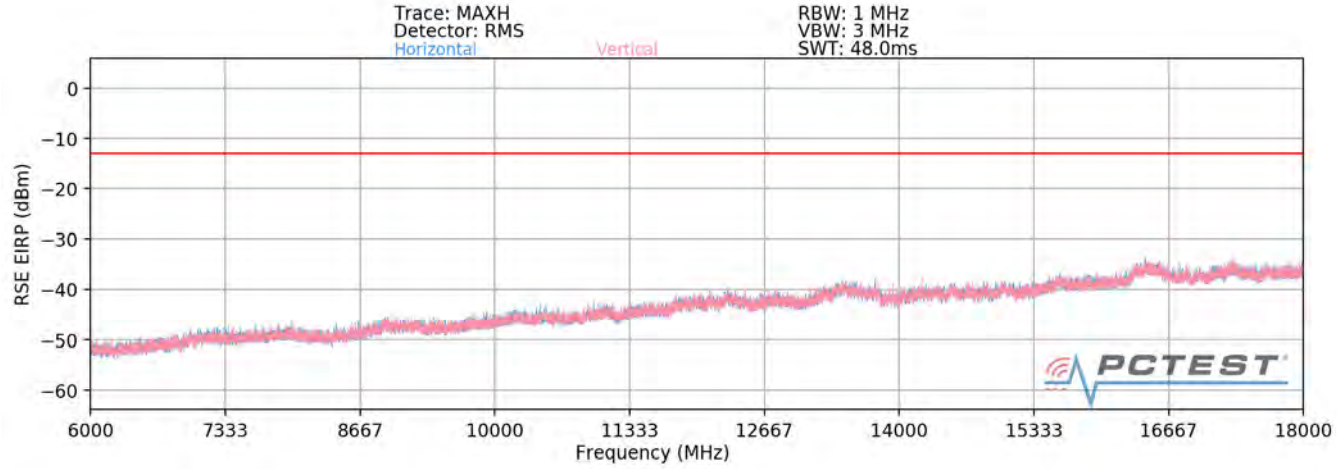
Bandwidth (MHz):	20
Frequency (MHz):	839.0
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1678.0	H	182	312	-61.32	-1.11	44.57	-50.69	-13.00	-37.69
2517.0	H	147	283	-58.45	3.29	51.84	-43.42	-13.00	-30.42
3356.0	H	-	-	-68.25	5.12	43.87	-51.39	-13.00	-38.39
4195.0	H	-	-	-66.89	5.89	46.00	-49.26	-13.00	-36.26

Table 7-15. Radiated Spurious Data (NR Band n5 – High Channel)



Plot 7-129. Radiated Spurious Plot (NR Band n5 + B66)

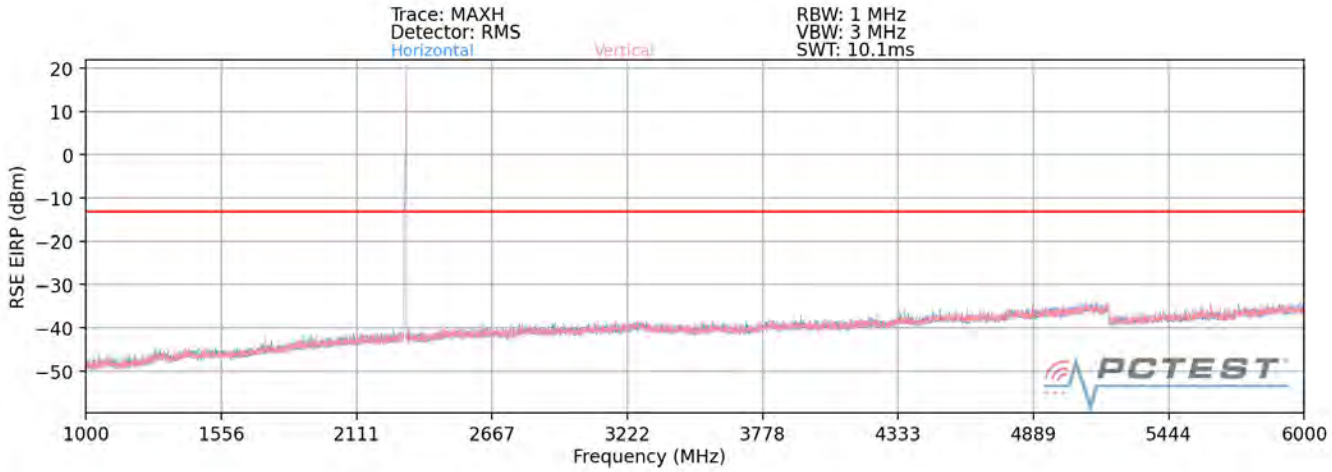


Plot 7-130. Radiated Spurious Plot (NR Band n5 + B66)

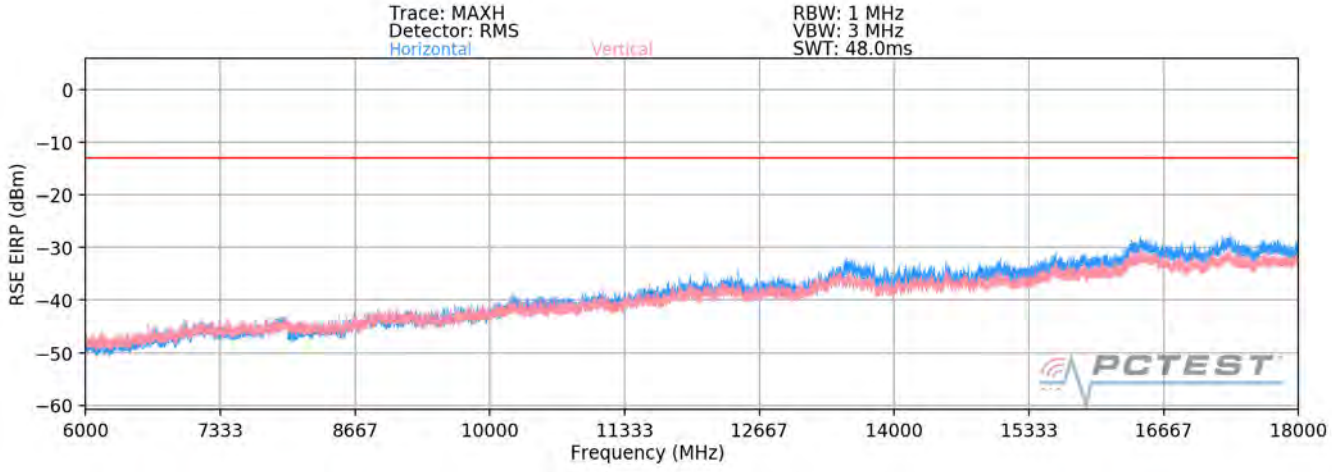
Bandwidth (MHz):	20
Frequency (MHz):	836.5
RB / Offset:	1 / 50
Mode:	EN-DC
Anchor Band:	LTE Band 66

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]
1899.0	H	-	-	-73.97	5.39	38.42	-56.84	-13.00	-43.84
2656.0	H	-	-	-73.04	6.90	40.86	-54.39	-13.00	-41.39
2810.0	H	-	-	-70.55	7.56	44.01	-51.24	-13.00	-38.24

Table 7-16. Radiated Spurious Data (NR Band n5 – B66)



Plot 7-131. Radiated Spurious Plot (NR Band n5 + B30)



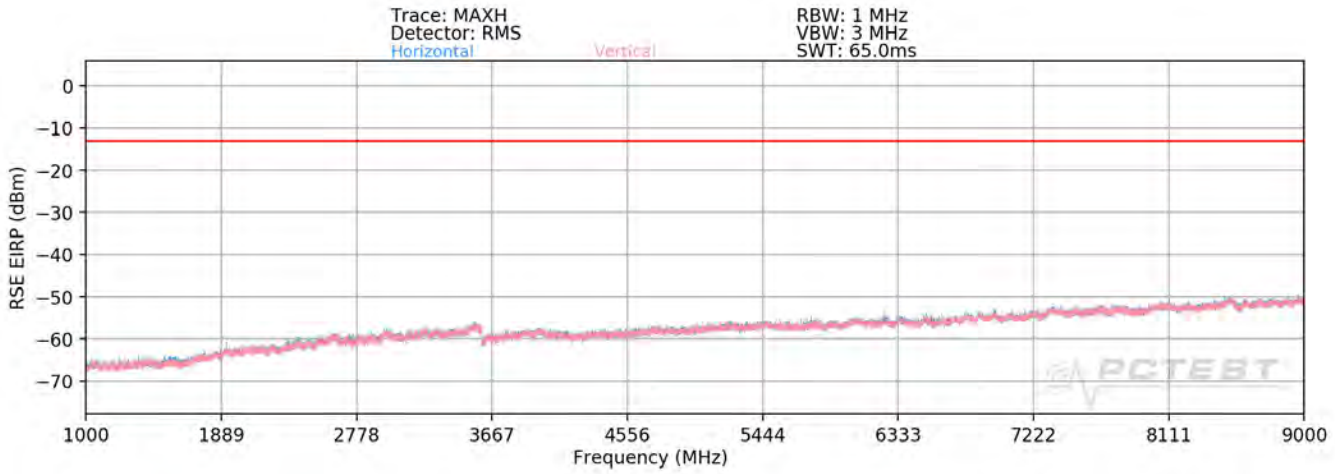
Plot 7-132. Radiated Spurious Plot (NR Band n5 + B30)

Bandwidth (MHz):	20
Frequency (MHz):	836.5
RB / Offset:	1 / 50
Mode:	EN-DC
Anchor Band:	LTE Band 30

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]
2118.0	V	-	-	-67.85	5.86	45.01	-50.25	-13.00	-37.25
3594.0	V	-	-	-69.18	10.16	47.98	-47.28	-13.00	-34.28
3786.0	V	130	258	-68.07	11.76	50.69	-44.56	-13.00	-31.56
5070.0	V	-	-	-70.02	13.39	50.37	-44.89	-13.00	-31.89

Table 7-17. Radiated Spurious Data (NR Band n5 – B30)

GPRS Cell



Plot 7-133. Radiated Spurious Plot (GPRS Cell)

Mode:	GPRS 1 Tx Slot
Channel:	128
Frequency (MHz):	824.2

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]
1648.4	V	334	239	-57.08	-5.22	44.70	-50.56	-13.00	-37.56
2472.6	V	-	-	-57.04	-2.22	47.74	-47.52	-13.00	-34.52
3296.8	V	-	-	-58.72	0.59	48.87	-46.39	-13.00	-33.39

Table 7-18. Radiated Spurious Data (GPRS Cell – Low Channel)

Mode:	GPRS 1 Tx Slot
Channel:	190
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]
1673.2	V	257	210	-61.88	-5.23	39.89	-55.36	-13.00	-42.36
2509.8	V	-	-	-56.12	-2.32	48.56	-46.70	-13.00	-33.70
3346.4	V	-	-	-58.66	0.30	48.64	-46.62	-13.00	-33.62

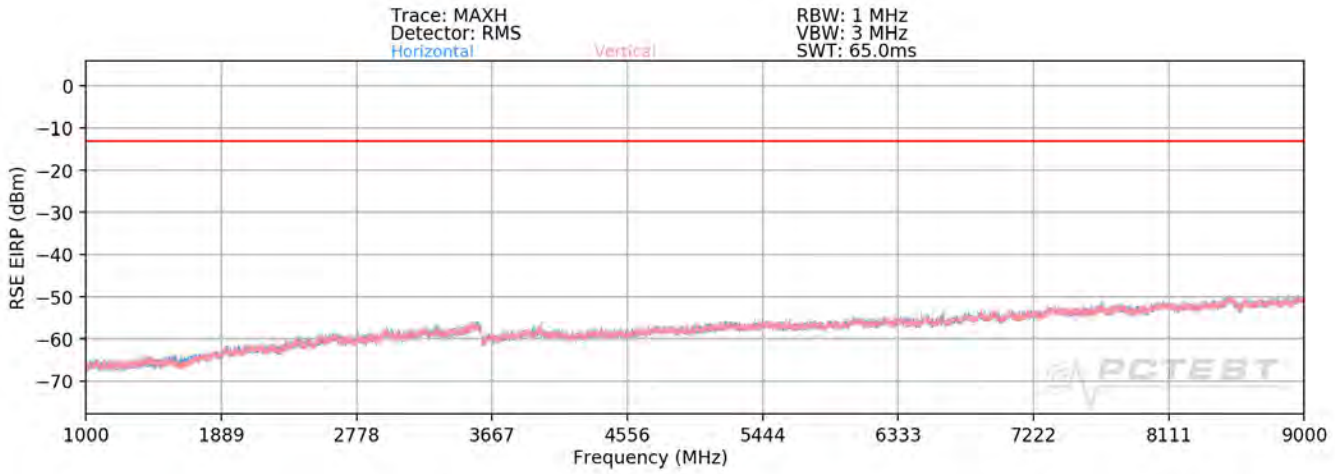
Table 7-19. Radiated Spurious Data (GPRS Cell – Mid Channel)

Mode:	GPRS 1 Tx Slot
Channel:	251
Frequency (MHz):	848.8

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]
1697.6	V	147	138	-57.50	-5.13	44.37	-50.89	-13.00	-37.89
2546.4	V	-	-	-57.42	-1.67	47.91	-47.35	-13.00	-34.35

Table 7-20. Radiated Spurious Data (GPRS Cell – High Channel)

WCDMA Cell



Plot 7-134. Radiated Spurious Plot (WCDMA Cell)

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]
1652.8	V	-	-	-70.01	-5.23	31.76	-63.49	-13.00	-50.49
2479.2	V	-	-	-68.59	-2.46	35.95	-59.31	-13.00	-46.31
3305.6	V	-	-	-70.00	0.61	37.61	-57.65	-13.00	-44.65

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

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]
1673.2	V	-	-	-69.64	-5.23	32.13	-63.12	-13.00	-50.12
2509.8	V	-	-	-68.47	-2.32	36.21	-59.05	-13.00	-46.05
3346.4	V	-	-	-69.27	0.30	38.03	-57.23	-13.00	-44.23

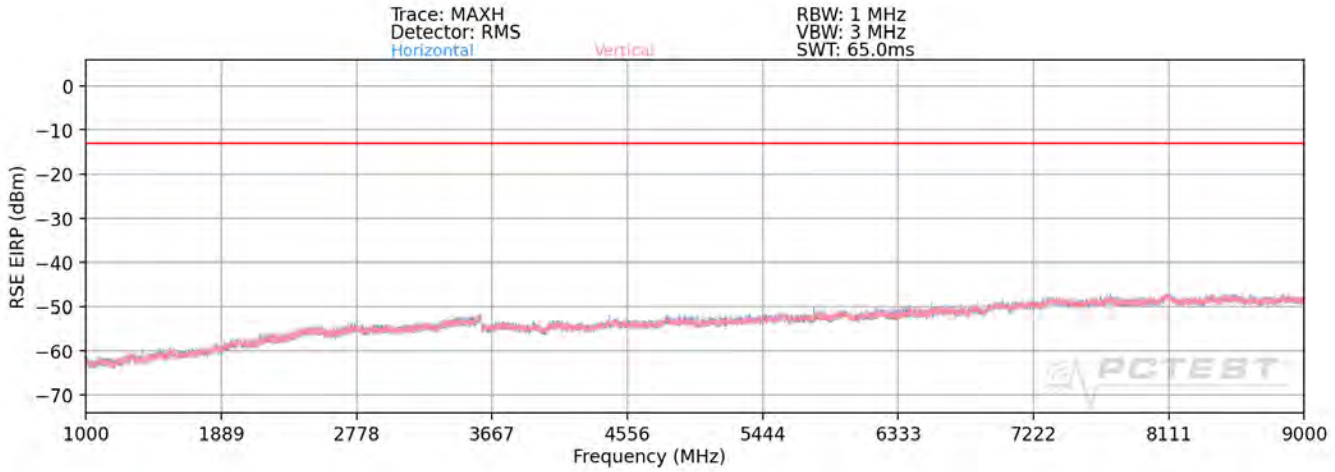
Table 7-22. Radiated Spurious Data (WCDMA Cell – Mid Channel)

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]
1693.2	V	-	-	-70.01	-5.17	31.82	-63.44	-13.00	-50.44
2539.8	V	-	-	-69.04	-1.69	36.27	-58.99	-13.00	-45.99
3386.4	V	-	-	-70.22	0.30	37.08	-58.18	-13.00	-45.18

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

CDMA Cell



Plot 7-135. Radiated Spurious Plot (CDMA Cell)

Mode:	CDMA
Channel:	1013
Frequency (MHz):	824.7

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]
1649.40	V	107	169	-68.64	-1.22	37.14	-58.12	-13.00	-45.12
2474.10	V	121	187	-67.84	2.99	42.15	-53.11	-13.00	-40.11
3298.80	V	-	-	-70.45	4.13	40.68	-54.58	-13.00	-41.58

Table 7-24. Radiated Spurious Data (CDMA Cell – Low Channel)

Mode:	CDMA
Channel:	384
Frequency (MHz):	836.52

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]
1673.04	V	102	174	-68.14	-1.15	37.71	-57.55	-13.00	-44.55
2509.56	V	-	-	-67.88	3.29	42.41	-52.84	-13.00	-39.84
3346.08	V	-	-	-68.24	5.04	43.80	-51.46	-13.00	-38.46

Table 7-25. Radiated Spurious Data (CDMA Cell – Mid Channel)

Mode:	CDMA
Channel:	777
Frequency (MHz):	848.31

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]
1696.62	V	104	174	-68.44	-1.15	37.41	-57.85	-13.00	-44.85
2544.93	V	-	-	-68.00	3.03	42.03	-53.22	-13.00	-40.22
3393.24	V	-	-	-68.23	4.86	43.63	-51.63	-13.00	-38.63

Table 7-26. Radiated Spurious Data (CDMA Cell – High Channel)

7.8 Frequency Stability / Temperature Variation

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. 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 and RSS-132, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency.

Test Procedure Used

ANSI/TIA-603-E-2016

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

GSM/GPRS Cellular

Operating Frequency (Hz):	836,600,000
Ref. Voltage (VDC):	4.18
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.18	- 30	836,599,961	231	0.0000276
		- 20	836,600,191	461	0.0000551
		- 10	836,599,937	207	0.0000247
		0	836,600,048	318	0.0000380
		+ 10	836,600,068	338	0.0000404
		+ 20 (Ref)	836,599,730	0	0.0000000
		+ 30	836,600,203	473	0.0000565
		+ 40	836,600,001	271	0.0000324
		+ 50	836,600,236	506	0.0000605
Battery Endpoint	2.98	+ 20	836,599,566	-164	-0.0000196

Table 7-9. GSM/GPRS Cell Frequency Stability Data

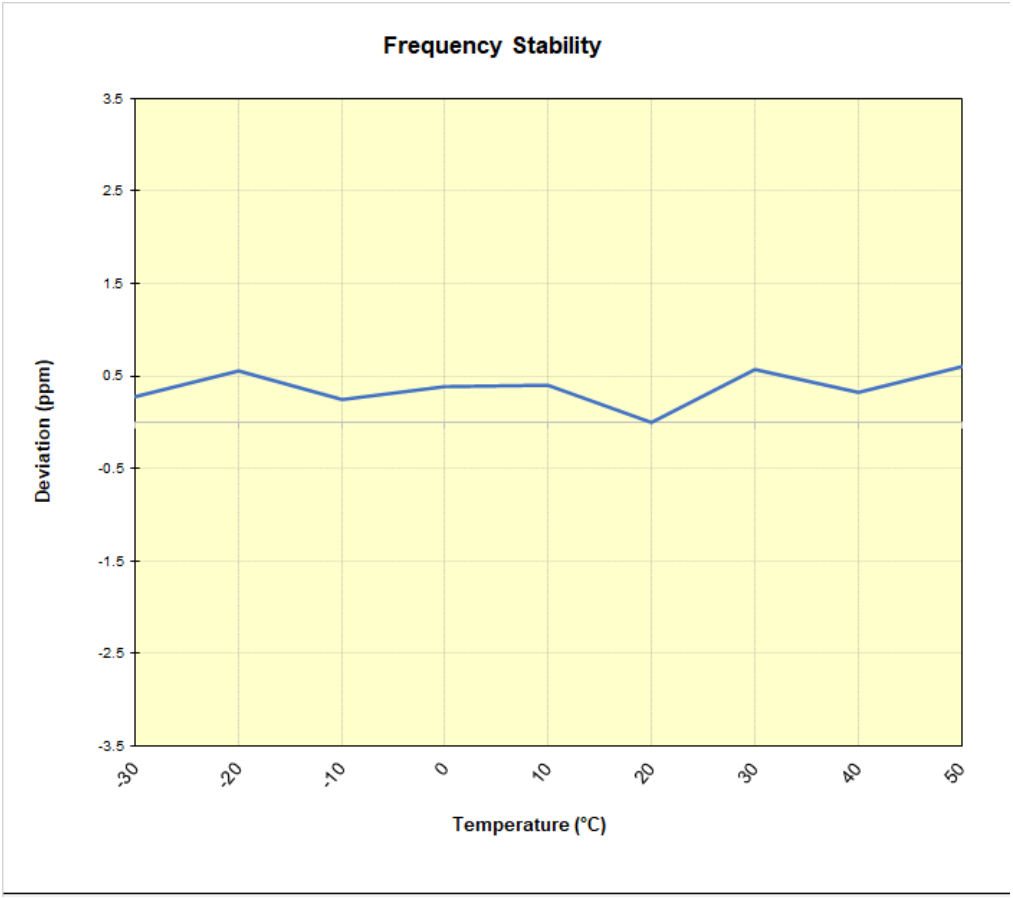


Table 7-9. GSM/GPRS Cell Frequency Stability Chart

WCDMA Cellular

Operating Frequency (Hz):	836,600,000
Ref. Voltage (VDC):	4.18
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.18	- 30	836,600,181	316	0.0000378
		- 20	836,599,962	97	0.0000116
		- 10	836,599,961	96	0.0000115
		0	836,600,379	514	0.0000614
		+ 10	836,599,906	41	0.0000049
		+ 20 (Ref)	836,599,865	0	0.0000000
		+ 30	836,599,717	-148	-0.0000177
		+ 40	836,600,035	170	0.0000203
		+ 50	836,599,636	-229	-0.0000274
Battery Endpoint	2.98	+ 20	836,599,778	-87	-0.0000104

Table 7-27.WCDMA Cell Frequency Stability Data

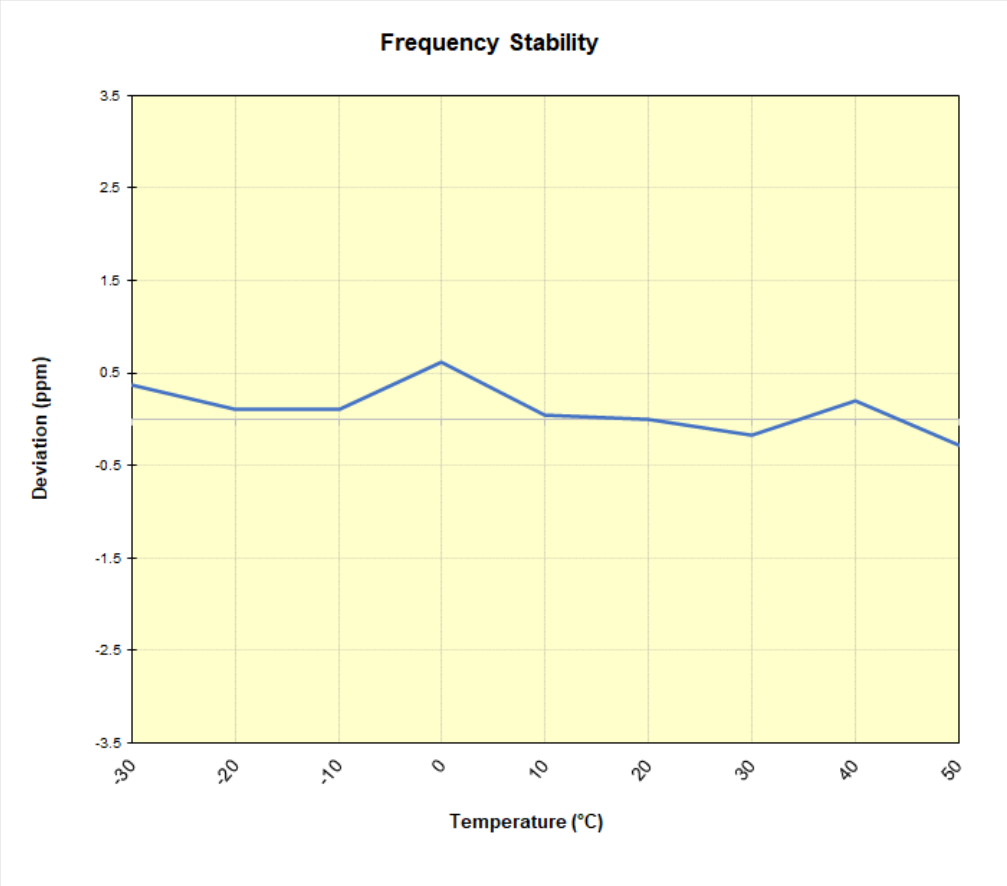


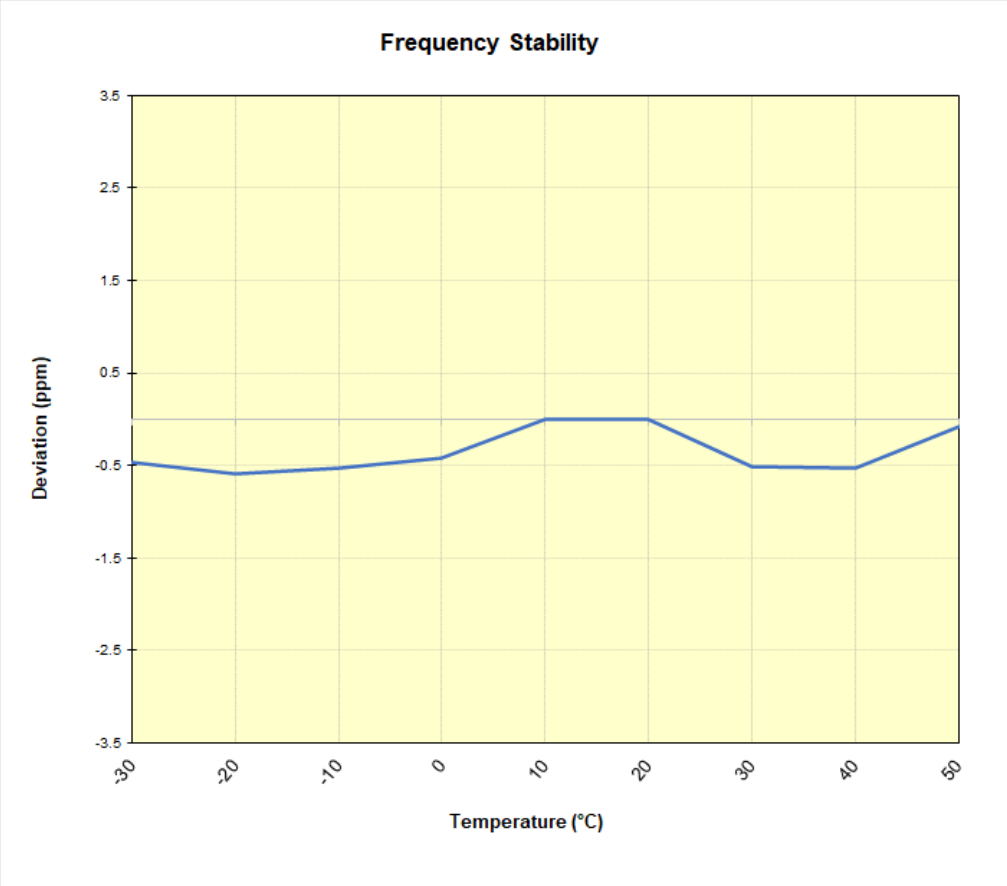
Table 7-9. WCDMA Cell Frequency Stability Chart

CDMA Cellular

Operating Frequency (Hz):	836,520,000
Ref. Voltage (VDC):	4.18
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.18	- 30	836,519,846	-385	-0.0000460
		- 20	836,519,743	-488	-0.0000583
		- 10	836,519,786	-445	-0.0000532
		0	836,519,878	-353	-0.0000422
		+ 10	836,520,233	2	0.0000002
		+ 20 (Ref)	836,520,231	0	0.0000000
		+ 30	836,519,808	-423	-0.0000506
		+ 40	836,519,786	-445	-0.0000532
		+ 50	836,520,165	-66	-0.0000079
Battery Endpoint	2.98	+ 20	836,519,842	-389	-0.0000465

Table 7-28.CDMA Cell Frequency Stability Data



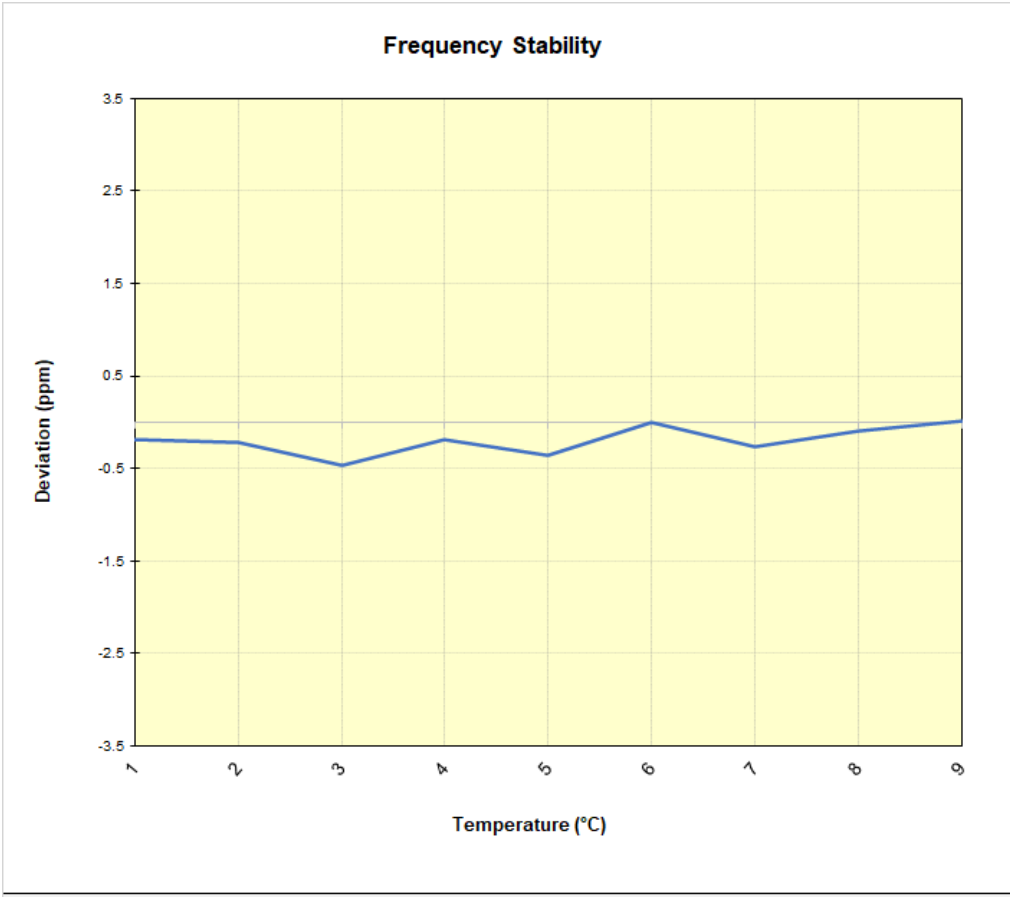
Plot 7-136. CDMA Cell Frequency Stability Chart

LTE Band 26/5

Operating Frequency (Hz):	836,500,000
Ref. Voltage (VDC):	4.18
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.18	- 30	831,499,970	-153	-0.0000184
		- 20	831,499,947	-176	-0.0000212
		- 10	831,499,738	-385	-0.0000463
		0	831,499,965	-158	-0.0000190
		+ 10	831,499,830	-293	-0.0000352
		+ 20 (Ref)	831,500,123	0	0.0000000
		+ 30	831,499,905	-218	-0.0000262
		+ 40	831,500,049	-74	-0.0000089
		+ 50	831,500,136	13	0.0000016
Battery Endpoint	2.98	+ 20	831,499,821	-302	-0.0000363

Table 7-29. LTE Band 26/5 Frequency Stability Data



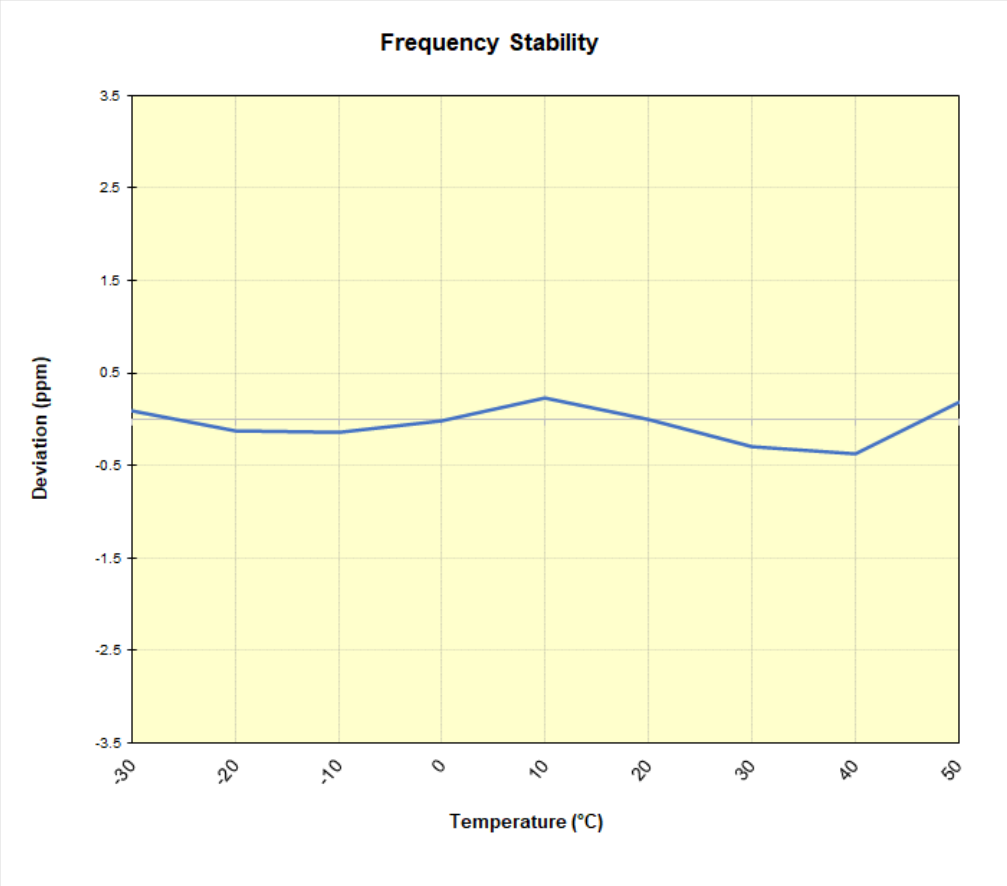
Plot 7-137. LTE Band 26/5 Frequency Stability Chart

NR Band n5

Operating Frequency (Hz):	836,500,000
Ref. Voltage (VDC):	4.18
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.18	- 30	836,499,974	80	0.0000096
		- 20	836,499,790	-104	-0.0000124
		- 10	836,499,776	-118	-0.0000141
		0	836,499,886	-8	-0.0000010
		+ 10	836,500,091	197	0.0000236
		+ 20 (Ref)	836,499,894	0	0.0000000
		+ 30	836,499,651	-243	-0.0000290
		+ 40	836,499,587	-307	-0.0000367
		+ 50	836,500,047	153	0.0000183
Battery Endpoint	2.98	+ 20	836,500,101	207	0.0000247

Table 7-30.NR Band n5 Frequency Stability Data



Plot 7-138. NR Band n5 Frequency Stability Chart

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the Samsung **Portable Handset FCC ID: A3LSMG998U** complies with all the requirements of Part 22 of the FCC rules.