PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
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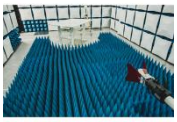

MEASUREMENT REPORT
FCC Part 22 & 90

Applicant Name:
LG Electronics USA, Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

Date of Testing:
10/28 - 11/22/2019
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M1910280174-04-R1.ZNF

FCC ID:	**ZNFL455DL**
APPLICANT:	**LG Electronics USA, Inc.**

Application Type:	Certification
Model:	LG L455DL
Additional Model(s):	LG-L455DL, LM-K400UM, LM-K400MM, LM-K400QM, LM-K400VPP, LM-K400QM5, LM-K400QM6, LGL455DL, LMK400UM, LMK400MM, LMK400QM, LMK400QM5, LMK400QM6, LMK400VPP, L455DL, K400UM, K400MM, K400QM, K400QM5, K400QM6, K400VPP
EUT Type:	Portable Handset
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part:	§2.1049, §22(S), §90(S)
Test Procedure(s):	ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Note: This revised Test Report (S/N: 1M1910280174-04-R1.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

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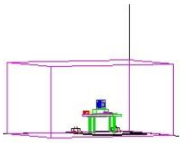
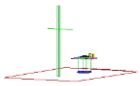


MEASUREMENT REPORT
FCC Part 90



Mode	Tx Frequency (MHz)	Measurement	Max. Power (W)	Max. Power (dBm)	Emission Designator	Modulation
CDMA800 (BC10)	817.9 - 823.1	Conducted	0.294	24.68	1M27F9W	CDMA
LTE Band 26	814.7 - 823.3	Conducted	0.330	25.19	1M08G7D	QPSK
LTE Band 26	814.7 - 823.3	Conducted	0.261	24.16	1M09W7D	16-QAM
LTE Band 26	814.7 - 823.3	Conducted	0.208	23.19	1M08W7D	64-QAM
LTE Band 26	815.5 - 822.5	Conducted	0.330	25.19	2M69G7D	QPSK
LTE Band 26	815.5 - 822.5	Conducted	0.263	24.20	2M68W7D	16-QAM
LTE Band 26	815.5 - 822.5	Conducted	0.209	23.20	2M68W7D	64-QAM
LTE Band 26	816.5 - 821.5	Conducted	0.331	25.20	4M47G7D	QPSK
LTE Band 26	816.5 - 821.5	Conducted	0.263	24.20	4M48W7D	16-QAM
LTE Band 26	816.5 - 821.5	Conducted	0.209	23.20	4M50W7D	64-QAM
LTE Band 26	819	Conducted	0.316	25.00	8M97G7D	QPSK
LTE Band 26	819	Conducted	0.258	24.11	8M97W7D	16-QAM
LTE Band 26	819	Conducted	0.207	23.16	8M98W7D	64-QAM
LTE Band 26	821.5	Conducted	0.330	25.18	13M5G7D	QPSK
LTE Band 26	821.5	Conducted	0.263	24.20	13M5W7D	16-QAM
LTE Band 26	821.5	Conducted	0.205	23.11	13M4W7D	64-QAM
LTE Band 26	821.5	ERP	0.071	18.52	13M5G7D	QPSK
LTE Band 26	821.5	ERP	0.060	17.77	13M5W7D	16-QAM
LTE Band 26	821.5	ERP	0.049	16.88	13M4W7D	64-QAM

EUT Overview

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 17025-2005 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 **LG Portable Handset FCC ID: ZNFL455DL**. 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 90(S).

Test Device Serial No.: 00350, 00368, 00376, 00384

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, 802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE)

2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

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 document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-E-2016) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v03r01) were used in the measurement of the EUT**.**

3.2 Radiated Power and Radiated Spurious Emissions

§2.1053, §90.635, §90(S)

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 wooden turntable 80cm above the ground plane and 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. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer "Channel Power" function with the integration band set to the emissions' occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v03r01.

Per the guidance of ANSI/TIA-603-E-2016, a half-wave dipole is then 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 $_{[dB]}$.

The calculated P_d levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of 43 + 10 $\log_{10}$(Power $_{[Watts]}$) specified in 90(S).

For fundamental radiated power measurements, the guidance of KDB 971168 D01 v03r01 is used to record the EUT power level that is subsequently matched via the aforementioned substitution method given in ANSI/TIA-603-E-2016.

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.

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
-	LTx1	Licensed Transmitter Cable Set	6/4/2019	Annual	6/4/2020	LTx1
-	LTx3	LIcensed Transmitter Cable Set	6/3/2019	Annual	6/3/2020	LTx3
Agilent	N9020A	MXA Signal Analyzer	4/20/2019	Annual	4/20/2020	US46470561
Agilent	N9030A	PXA Signal Analyzer (44GHz)	6/12/2019	Annual	6/12/2020	MY52350166
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	5/10/2019	Annual	5/10/2020	441112
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
EMCO	3160-09	Small Horn (18 - 26.5GHz)	8/9/2018	Biennial	8/9/2020	135427
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	PWR-SEN-4GHS	USB Power Sensor	4/19/2019	Annual	4/19/2020	11401010036
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)	6/5/2019	Annual	6/5/2020	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/11/2019	Annual	7/11/2020	102134
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/8/2019	Annual	7/8/2020	102133
Seekonk	NC-100	Torque Wrench (8" lb)	5/10/2018	Biennial	5/10/2020	N/A
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	A051107

Table 5-1. Test Equipment

Notes:

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

6.0 SAMPLE CALCULATIONS

Emission Designator

Emission Designator = 1M25F9W

CDMA BW = 1.25 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data) (Measured at the 99.75% power bandwidth)

Spurious Radiated Emission – BC10

Example: Channel 476 CDMA BC10 Mode 3rd Harmonic (2453.70MHz)

The average spectrum analzyer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 2453.70 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80) = 50.3 dBc.

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

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

16QAM Modulation

Emission Designator = 8M45W7D

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

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80).

7.0 TEST RESULTS

7.1 Summary

Company Name: LG Electronics USA, Inc.

FCC ID: ZNFL455DL

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

Mode(s): CDMA / EvDO / LTE

Band: Band Class 10 / Band 26

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051 90(S).691(a) 90(R).543(a)	Conducted Band Edge / Spurious Emissions	> 43 + 10 $\log_{10}$ (P[Watts]) for all out-of-band emissions except > 50 + 10 $\log_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge (Band 26)		PASS	Sections 7.3, 7.4
2.1055 90.213	Frequency Stability	< 2.5 ppm		PASS	Section 7.8
2.1046 90.635	Conducted Power	< 100 Watts		PASS	Section 7.5
22.913(a.2)	Effective Radiated Power (Band 26)	< 7 Watts max. ERP	RADIATED	PASS	Section 7.6
2.1053 90(S).691(a) 90(R).543(e)	Radiated Spurious Emissions	> 43 + 10 $\log_{10}$ (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 shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "2G/3G Automation," Version 4.3.

7.2 Occupied Bandwidth

§2.1049

Test Overview

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth 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.

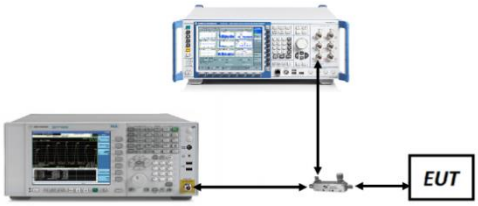
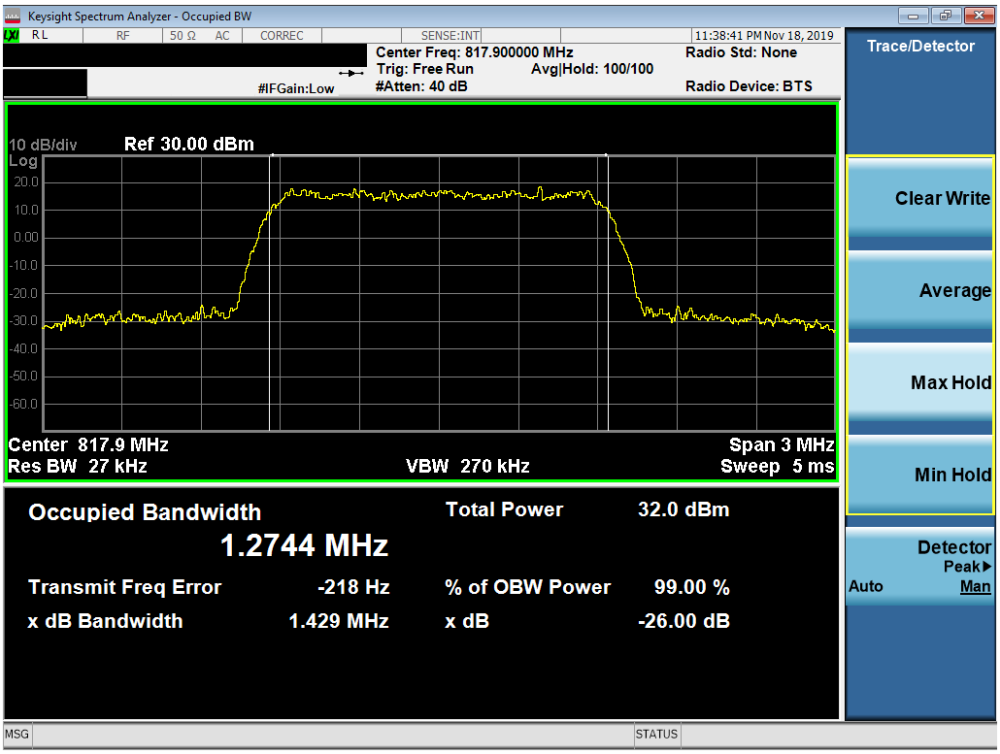


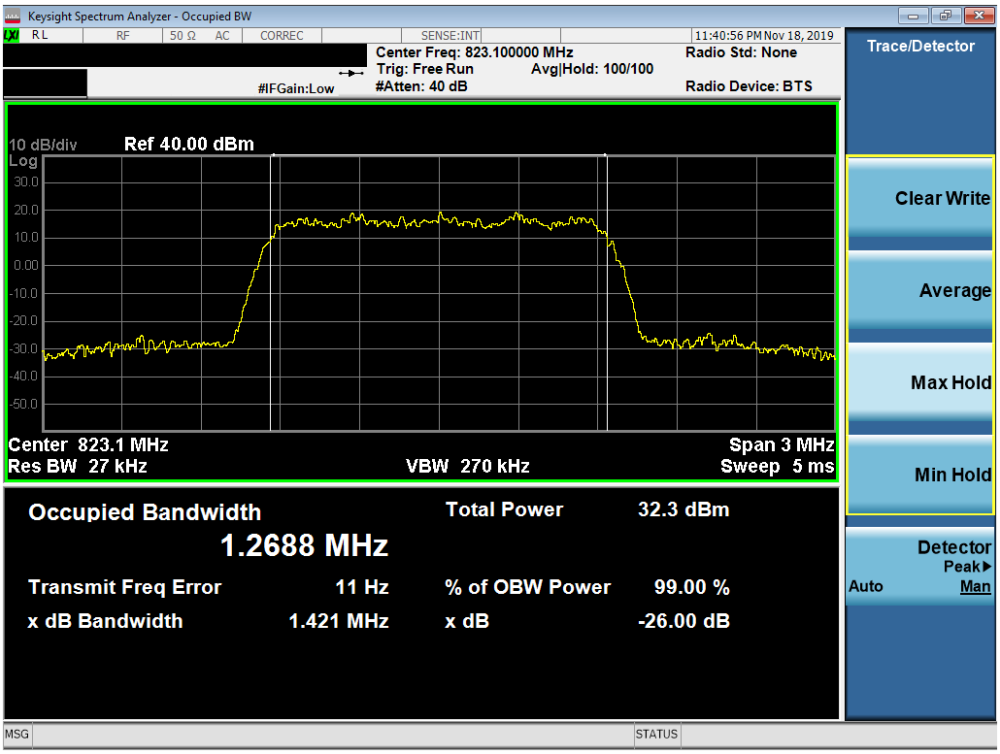
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

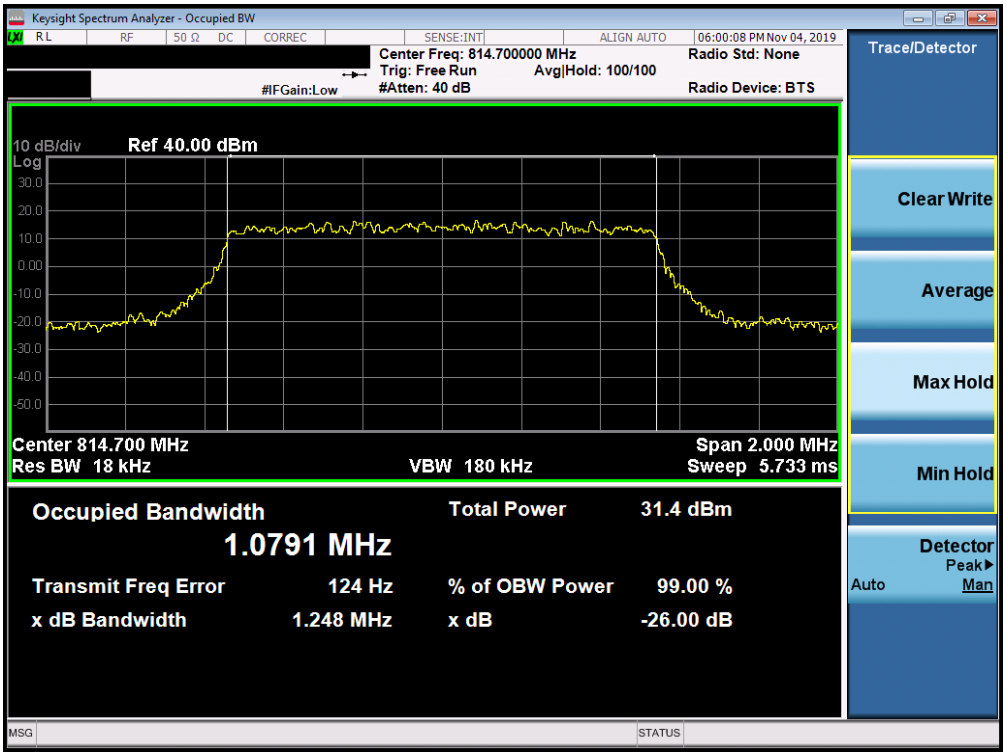
None.



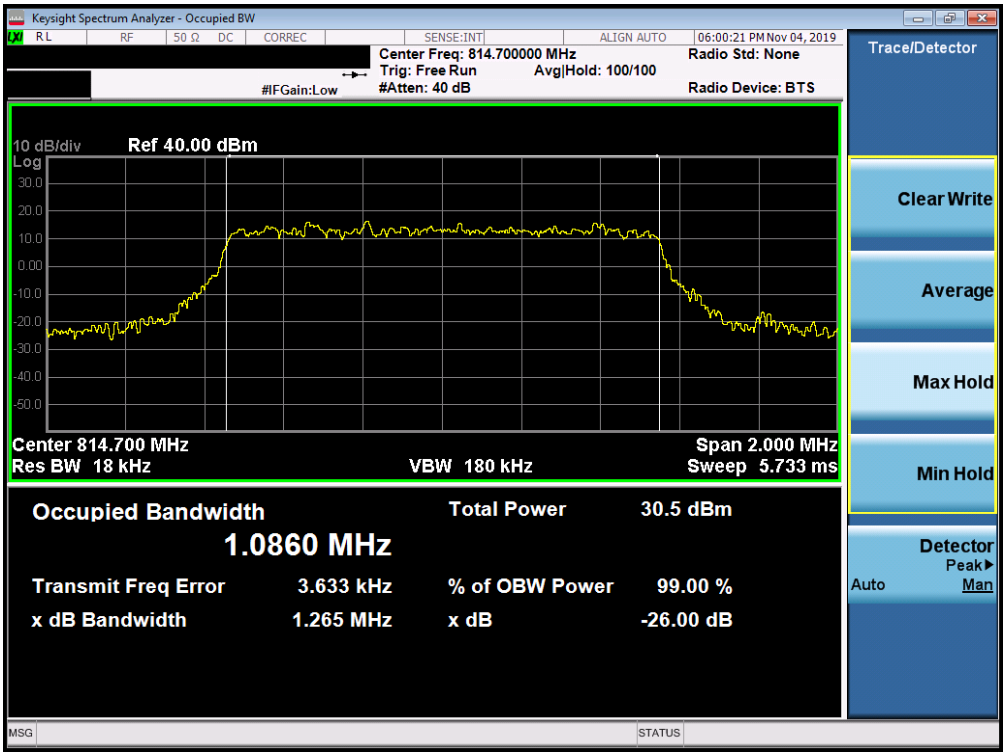
Plot 7-1. Occupied Bandwidth Plot (CDMA BC10, Ch. 476)



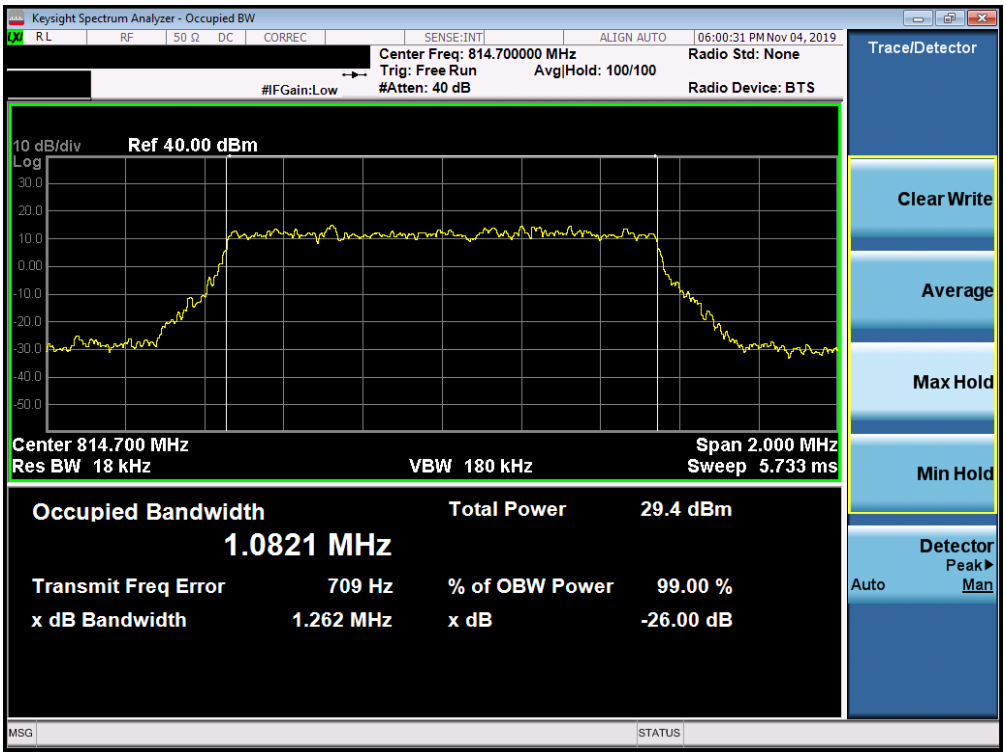
Plot 7-2. Occupied Bandwidth Plot (CDMA BC10, Ch. 684)



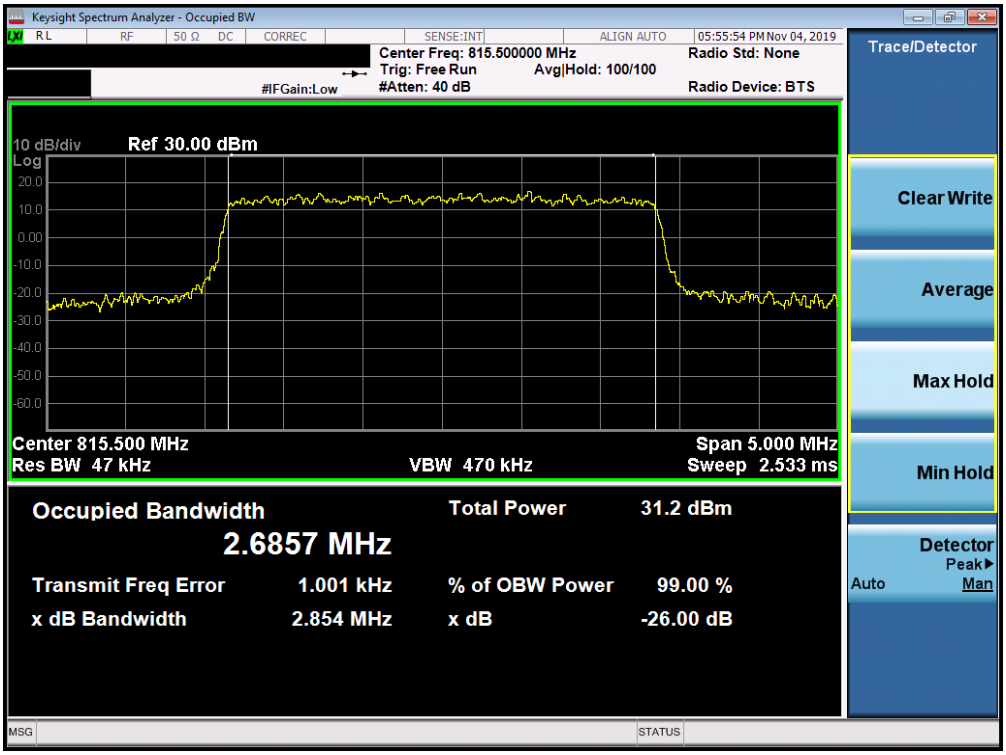
Plot 7-3. Occupied Bandwidth Plot (LTE Band 26, 1.4MHz QPSK – RB Size 6 – Low Channel)



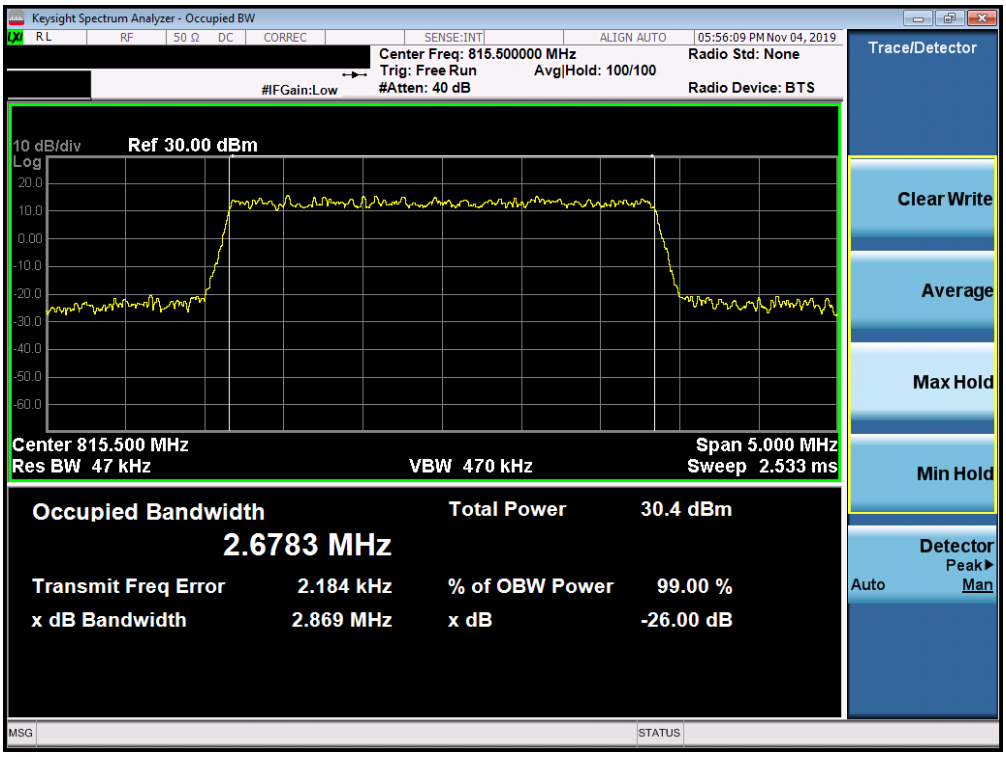
Plot 7-4. Occupied Bandwidth Plot (LTE Band 26, 1.4MHz 16Q – RB Size 6 – Low Channel)



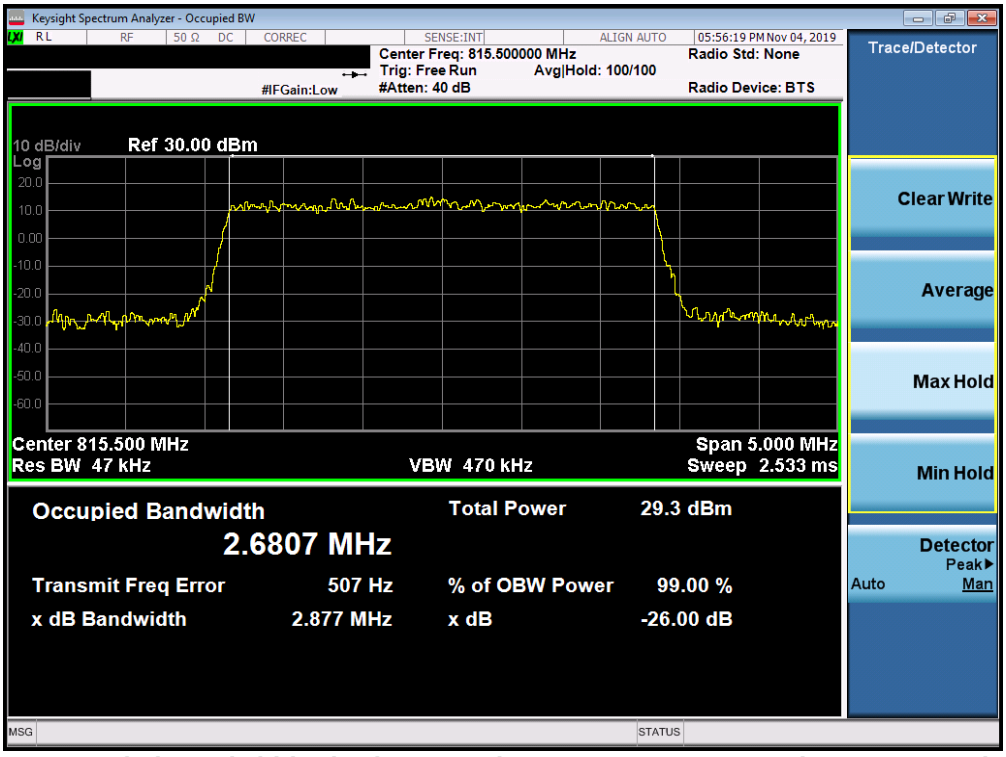
Plot 7-5. Occupied Bandwidth Plot (LTE Band 26, 1.4MHz 64Q – RB Size 6 – Low Channel)



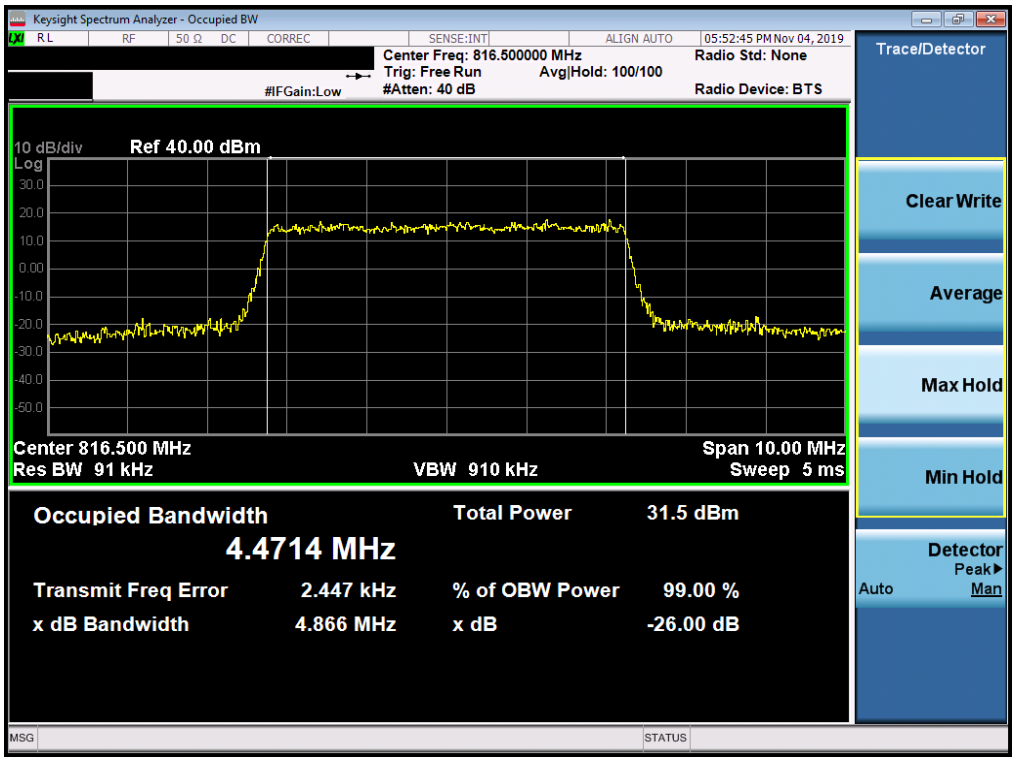
Plot 7-6. Occupied Bandwidth Plot (LTE Band 26, 3.0MHz QPSK – RB Size 15 – Low Channel)



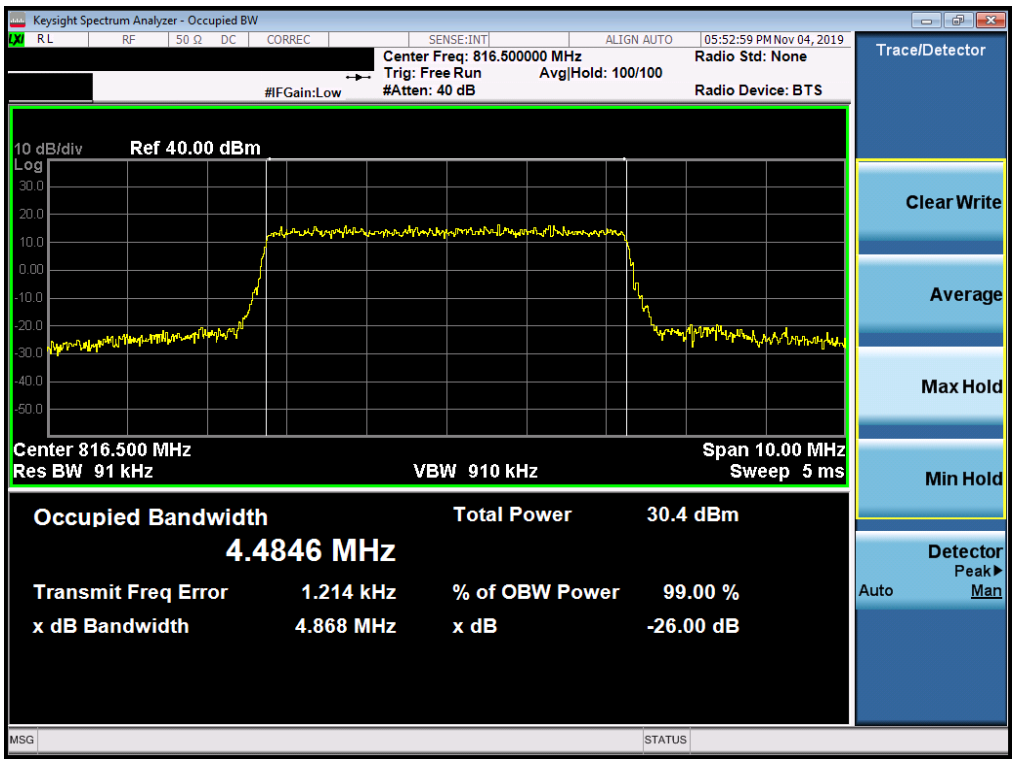
Plot 7-7. Occupied Bandwidth Plot (LTE Band 26, 3.0MHz 16Q – RB Size 15 – Low Channel)



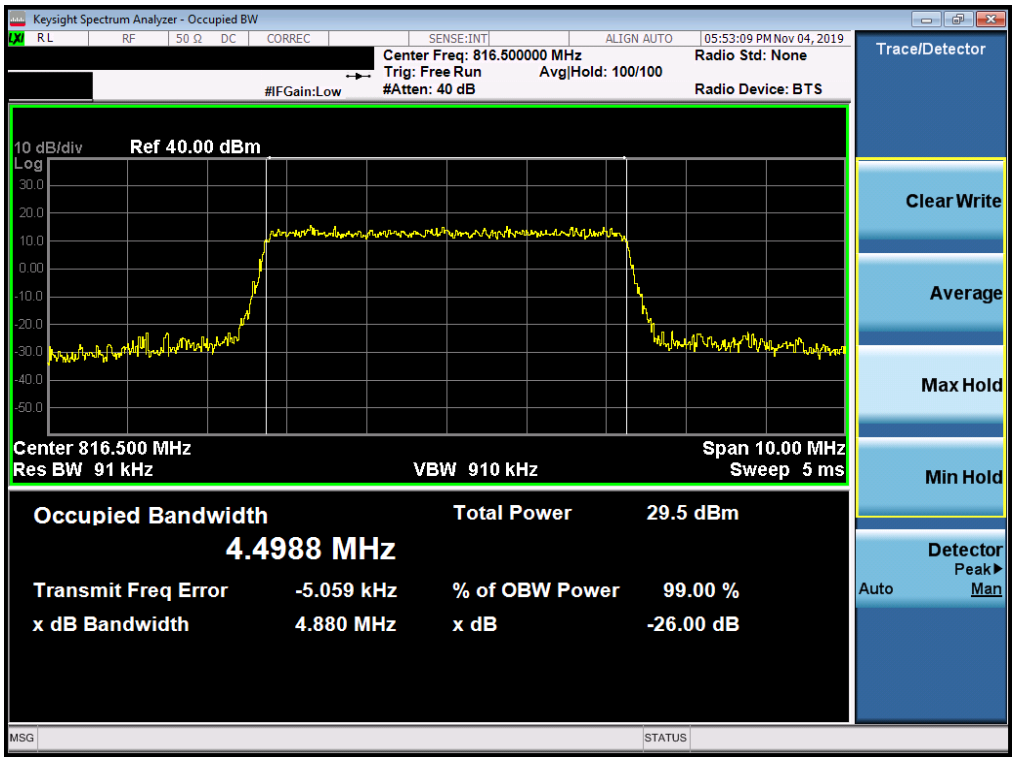
Plot 7-8. Occupied Bandwidth Plot (LTE Band 26, 3.0MHz 64Q – RB Size 15 – Low Channel)



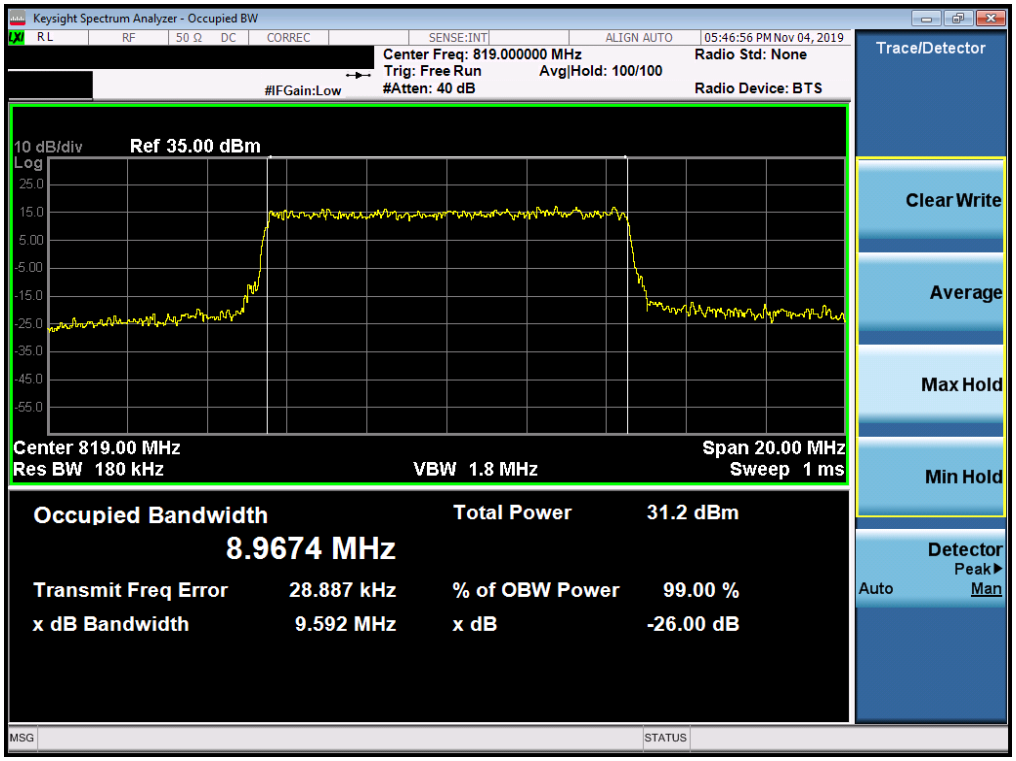
Plot 7-9. Occupied Bandwidth Plot (LTE Band 26, 5.0MHz QPSK – RB Size 25 – Low Channel)



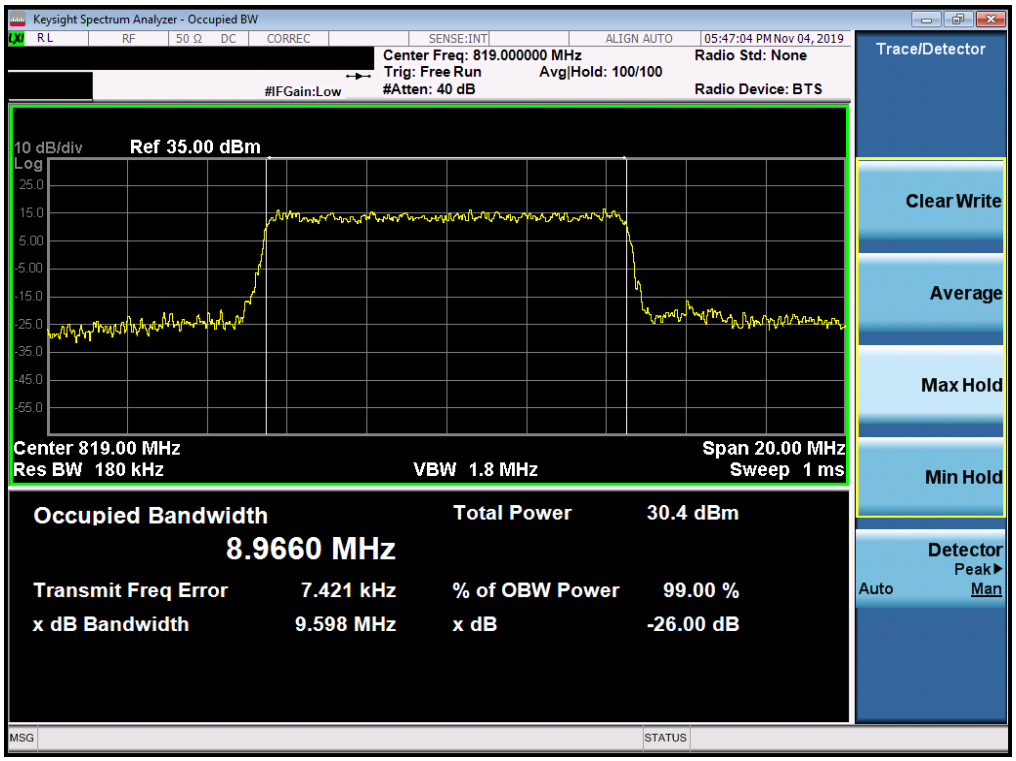
Plot 7-10. Occupied Bandwidth Plot (LTE Band 26, 5.0MHz 16Q – RB Size 25 – Low Channel)



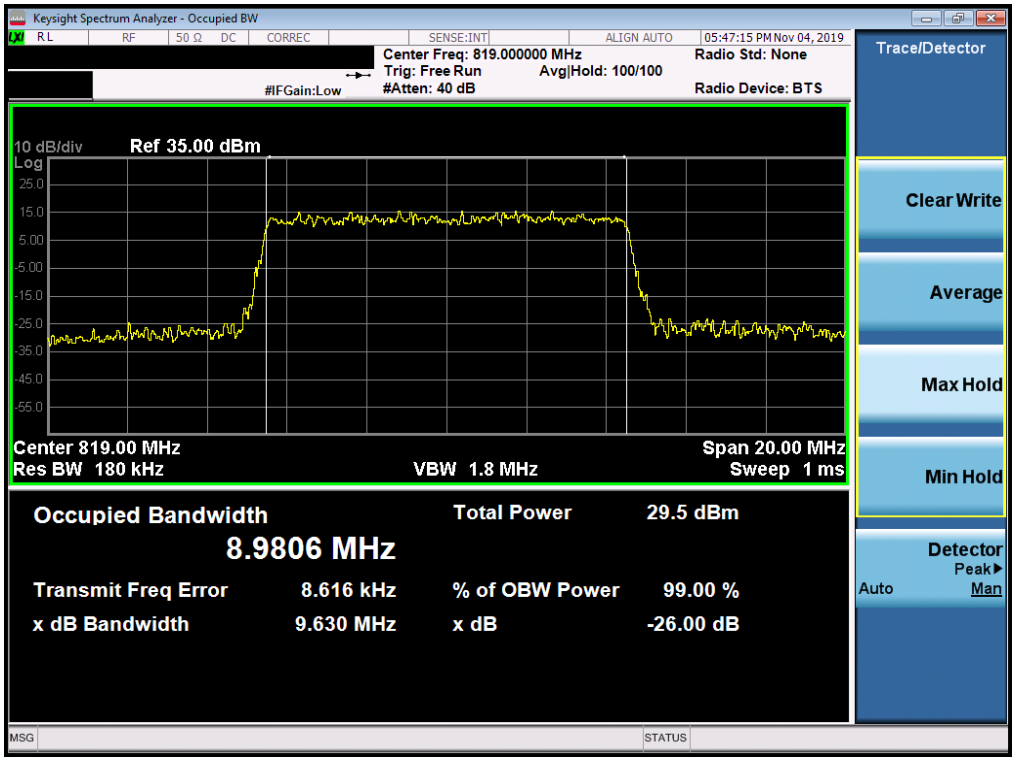
Plot 7-11. Occupied Bandwidth Plot (LTE Band 26, 5.0MHz 64Q – RB Size 25 – Low Channel)



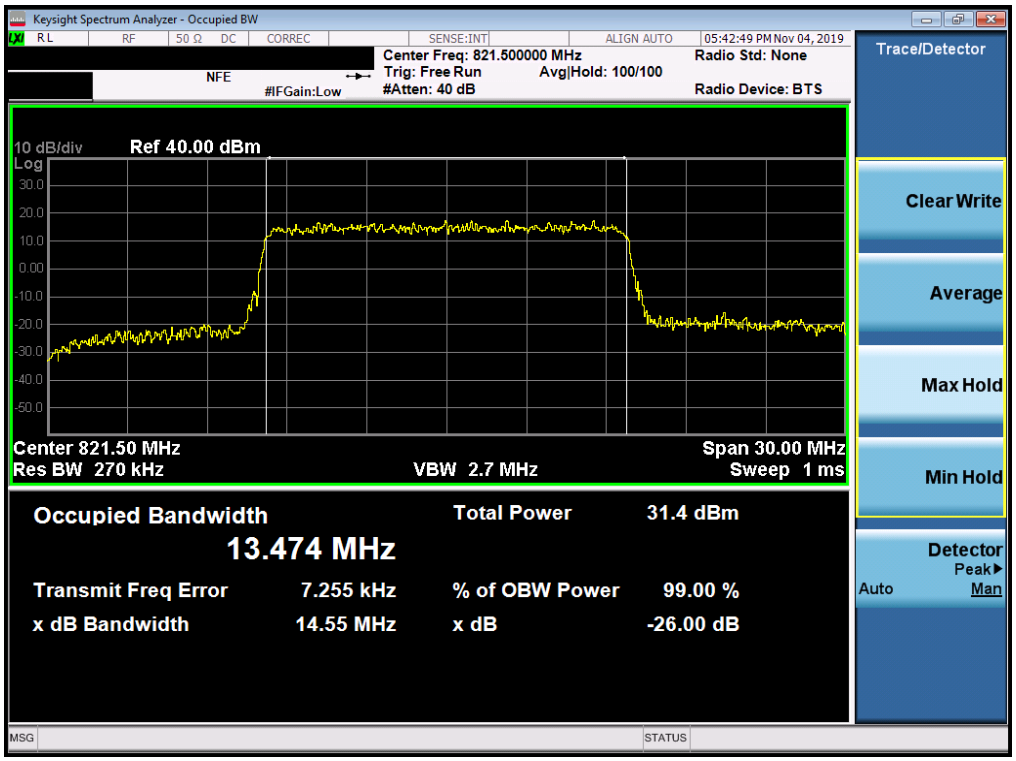
Plot 7-12. Occupied Bandwidth Plot (LTE Band 26, 10.0MHz QPSK – RB Size 50)



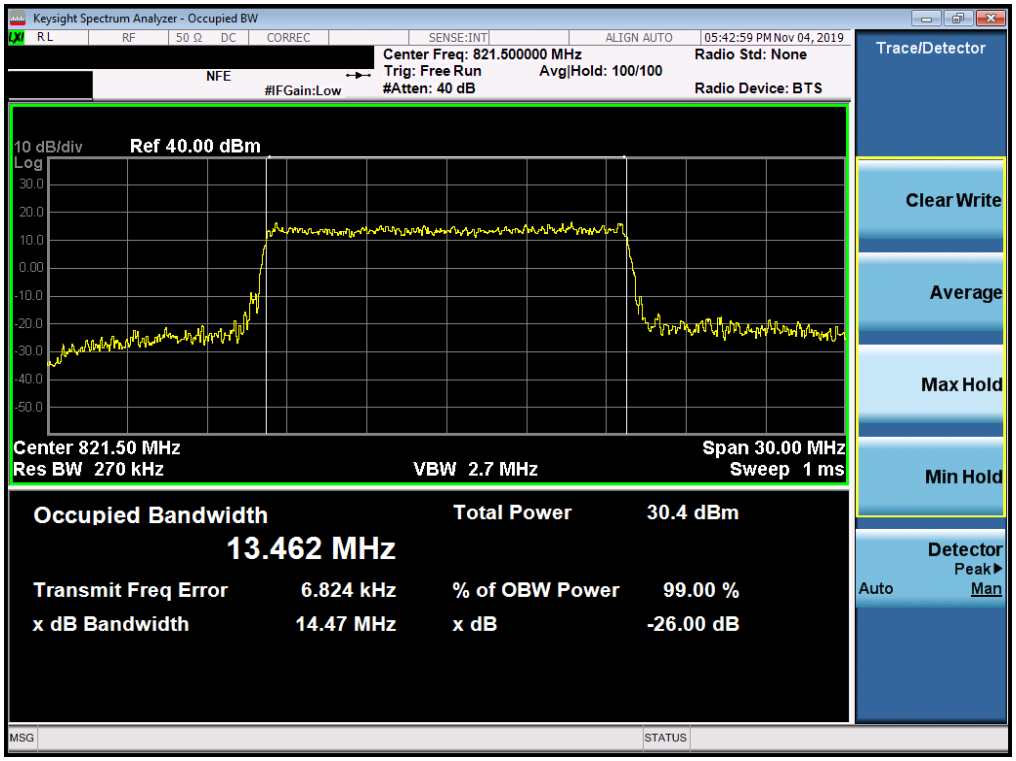
Plot 7-13. Occupied Bandwidth Plot (LTE Band 26, 10.0MHz 16Q – RB Size 50)



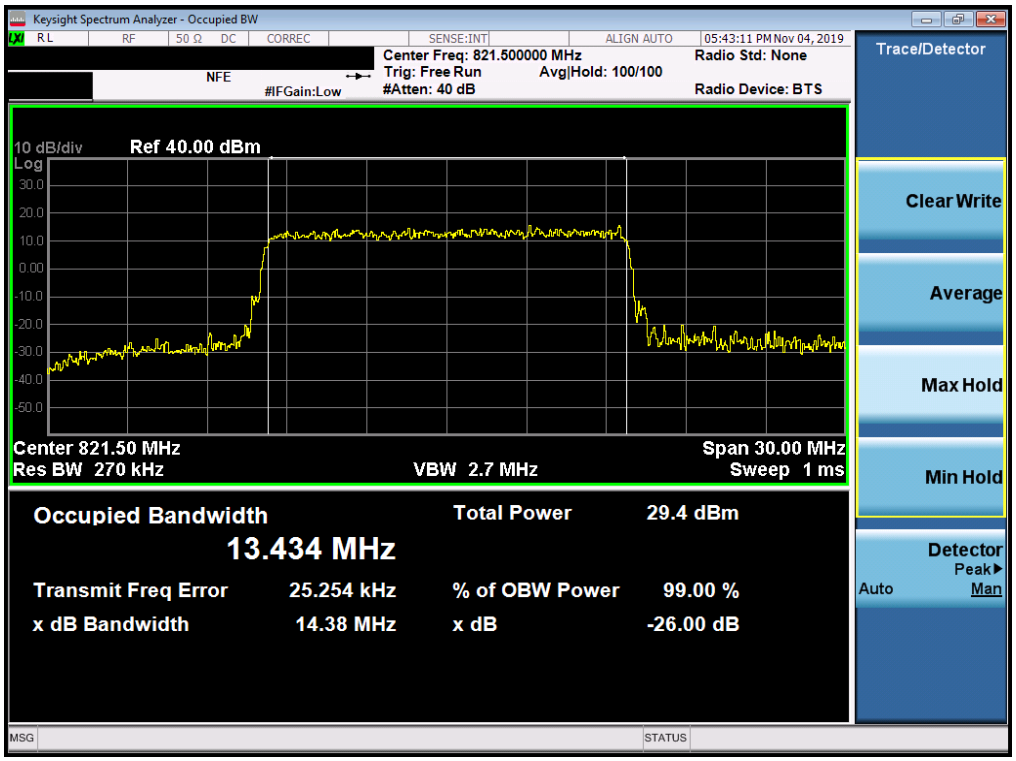
Plot 7-14. Occupied Bandwidth Plot (LTE Band 26, 10.0MHz 64Q – RB Size 50)



Plot 7-15. Occupied Bandwidth Plot (LTE Band 26, 15.0MHz QPSK – RB Size 75)



Plot 7-16. Occupied Bandwidth Plot (LTE Band 26, 15.0MHz 16Q – RB Size 75)



Plot 7-17. Occupied Bandwidth Plot (LTE Band 26, 15.0MHz 64Q – RB Size 75)

7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §90(S)

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. RBW ≥ 100kHz
3. VBW ≥ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

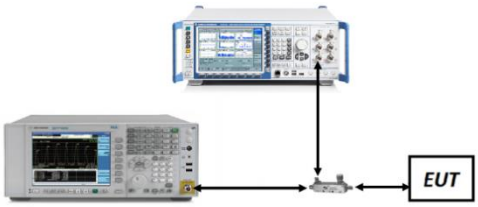
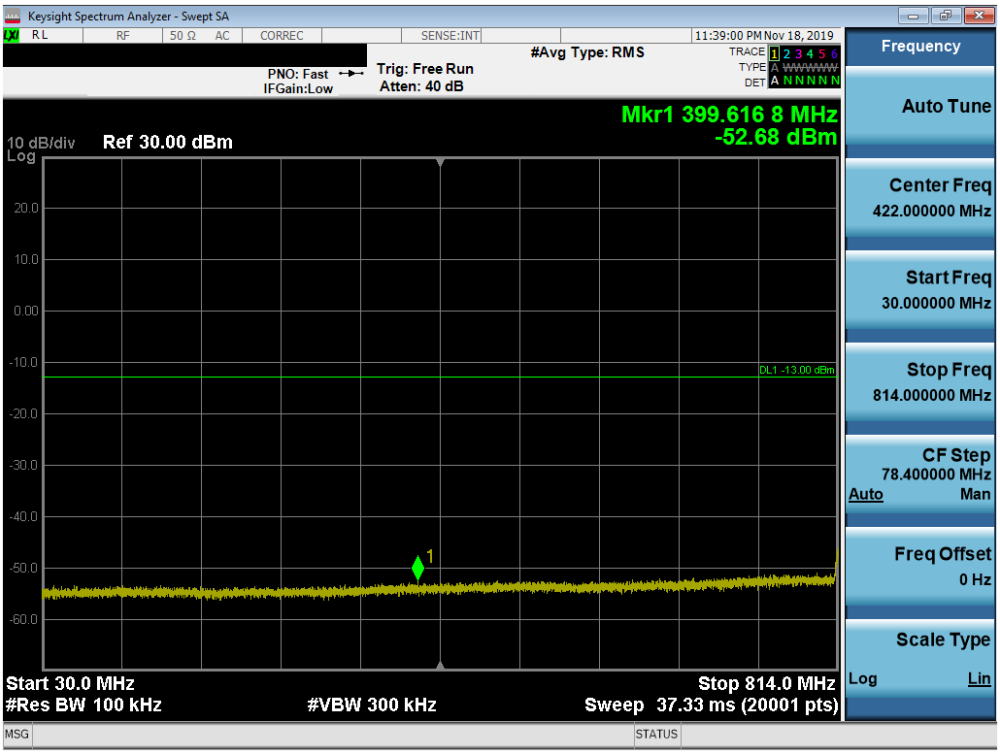


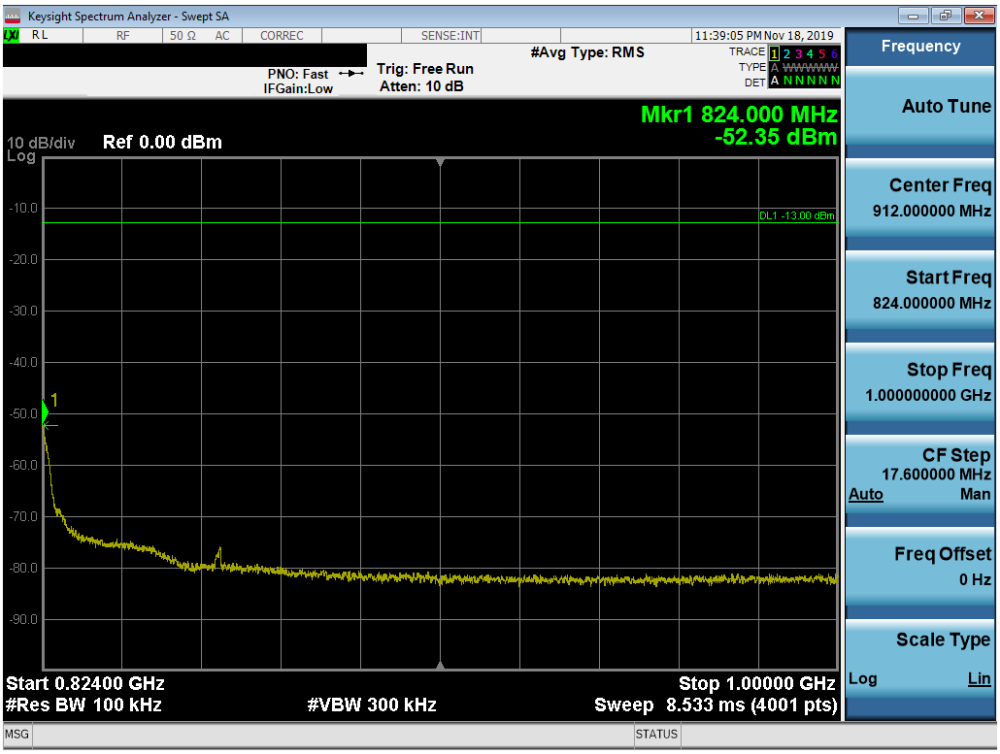
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

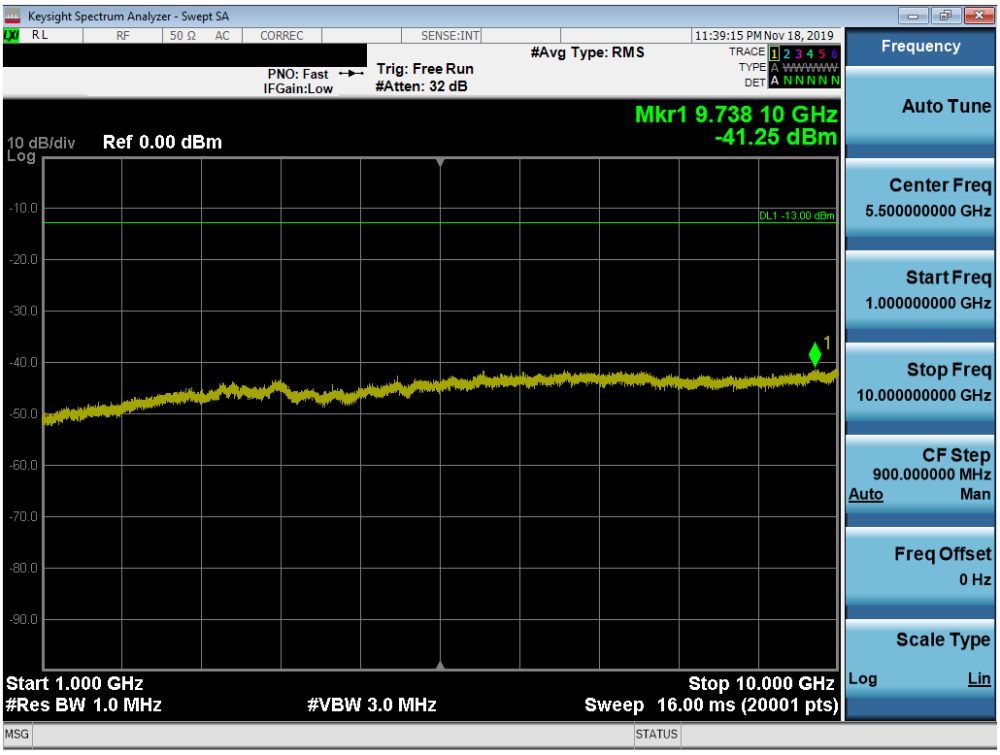
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for Part 22. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission 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.



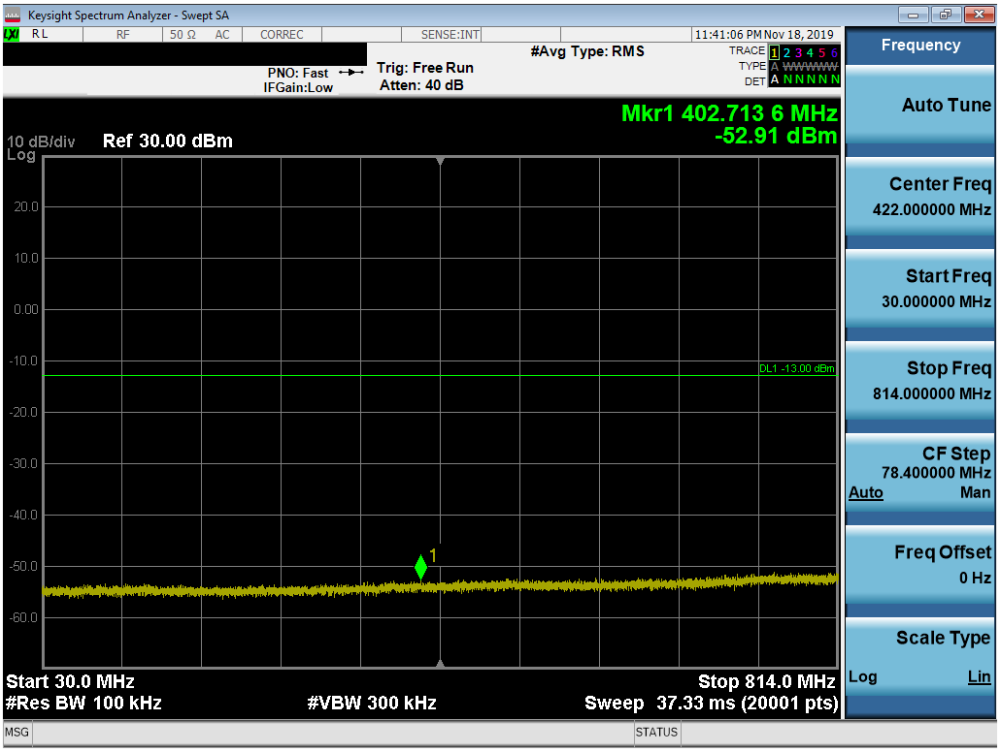
Plot 7-18. Conducted Spurious Plot (CDMA BC10, Ch. 476)



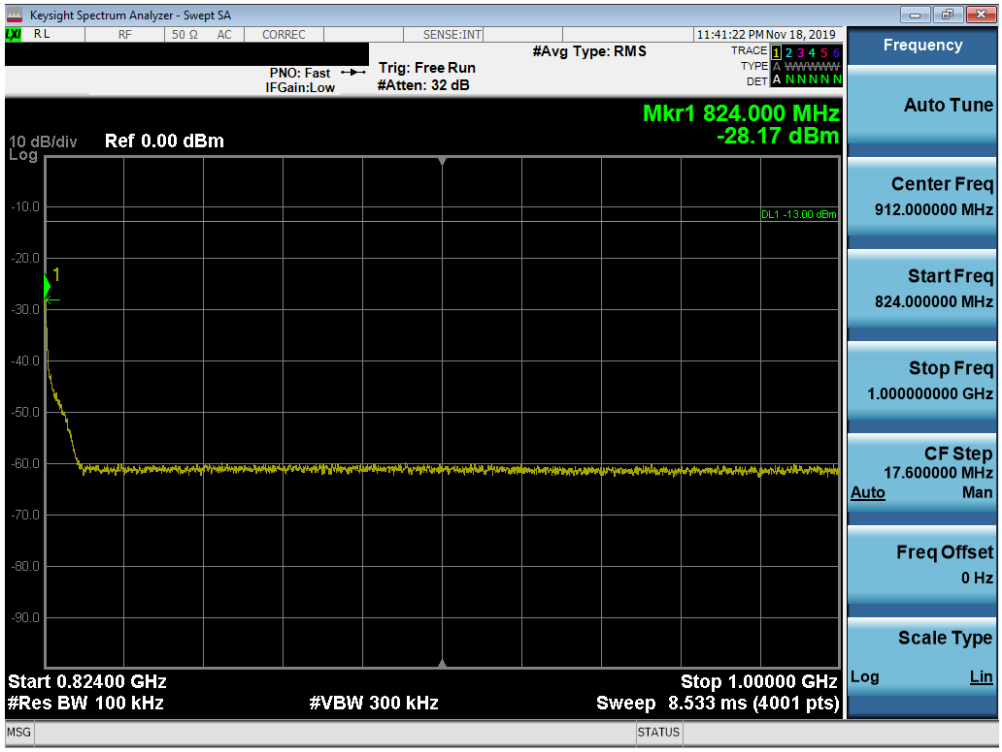
Plot 7-19. Conducted Spurious Plot (CDMA BC10, Ch. 476)



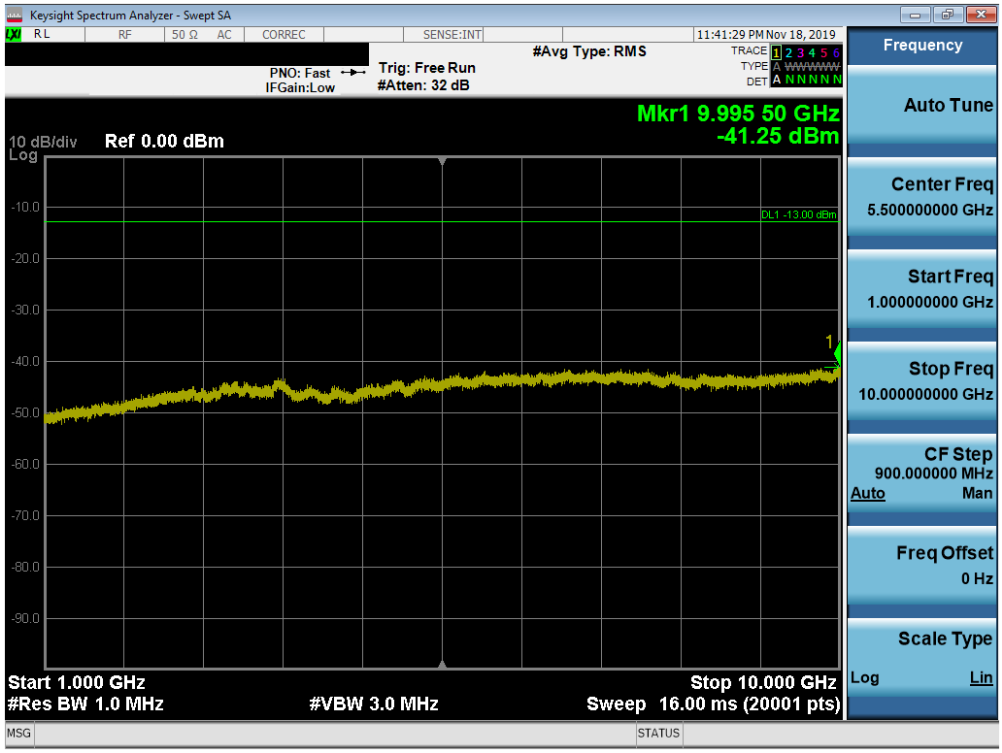
Plot 7-20. Conducted Spurious Plot (CDMA BC10, Ch. 476)



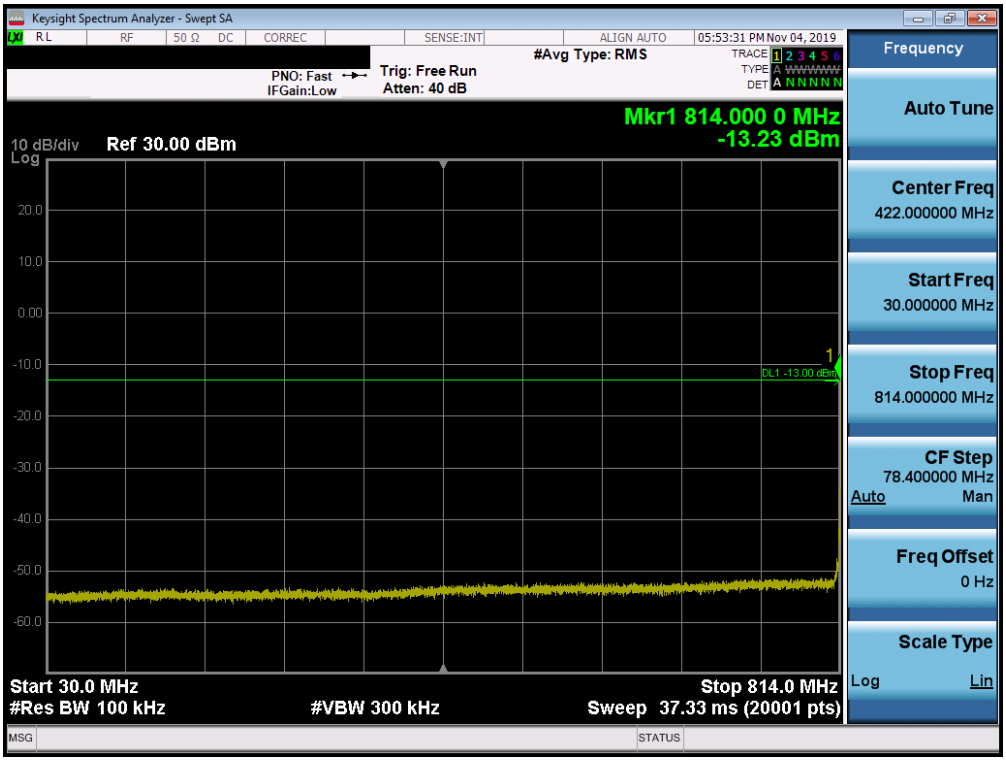
Plot 7-21. Conducted Spurious Plot (CDMA BC10, Ch. 684)



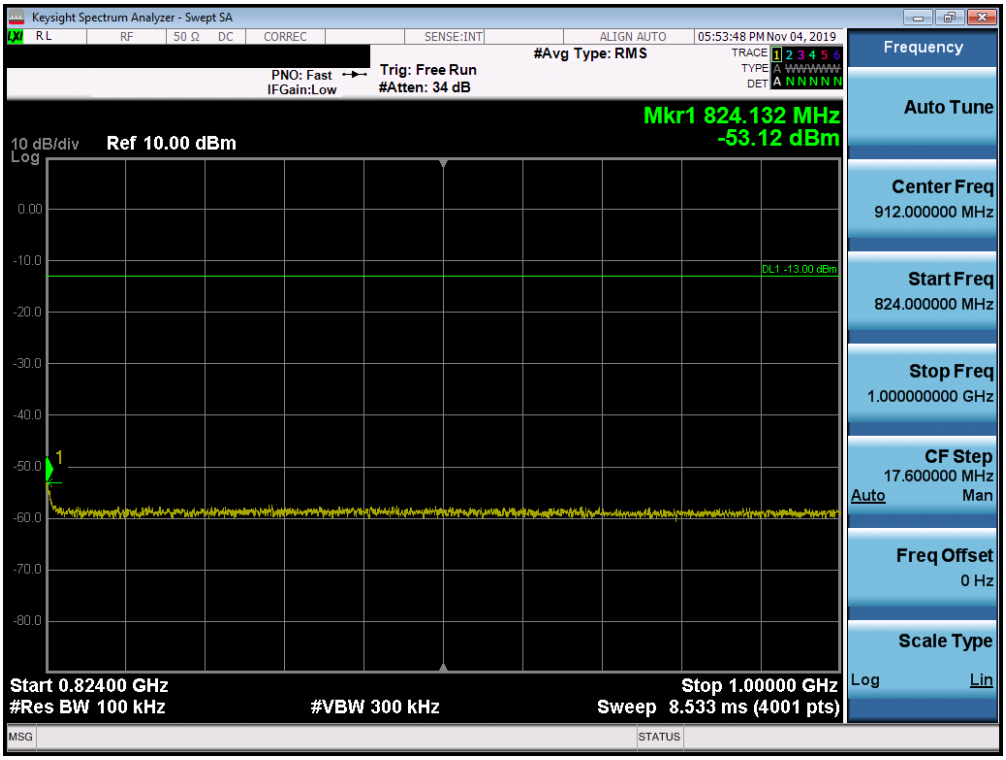
Plot 7-22. Conducted Spurious Plot (CDMA BC10, Ch. 684)



Plot 7-23. Conducted Spurious Plot (CDMA BC10, Ch. 684)

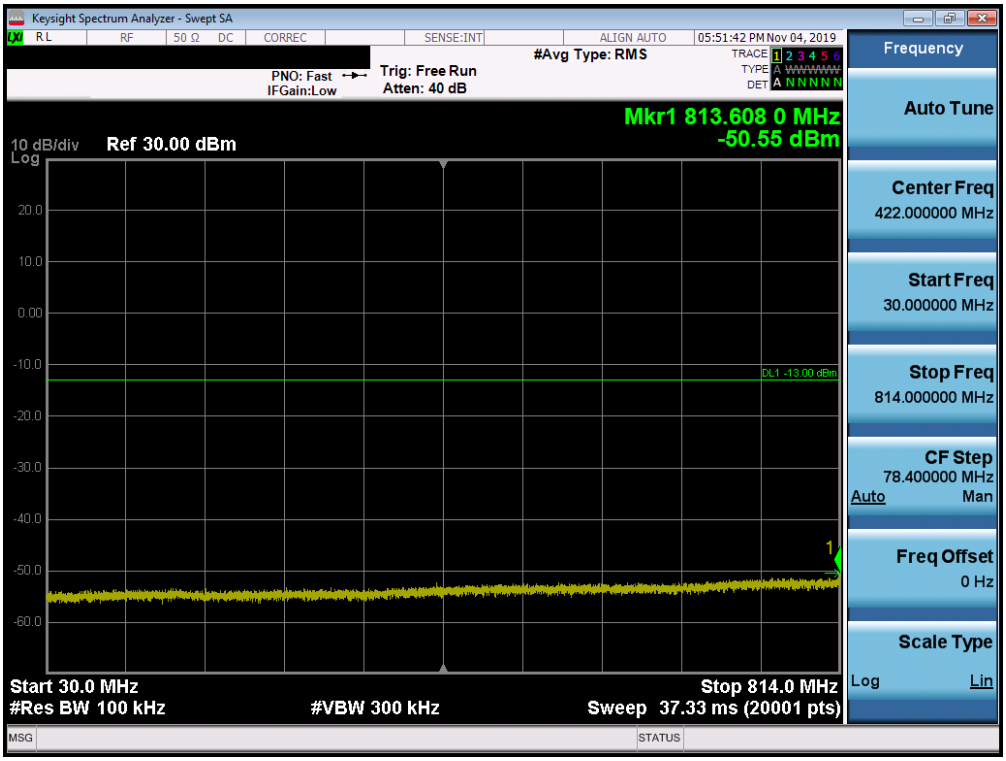


Plot 7-24. Conducted Spurious Plot (LTE Band 26, 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

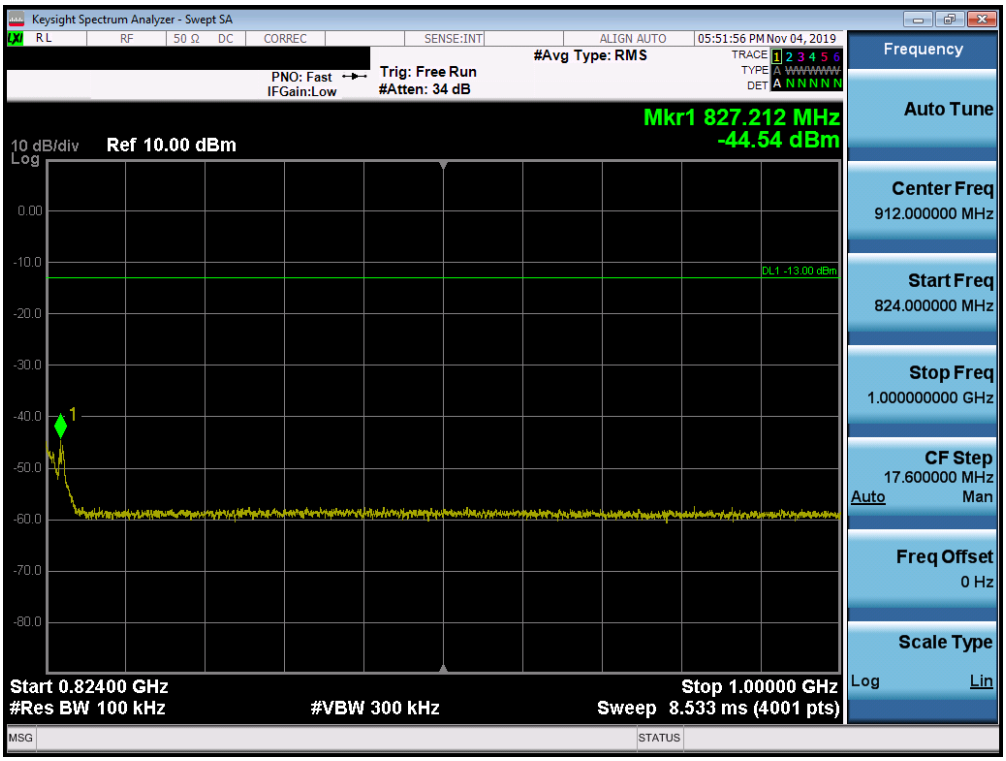


Plot 7-25. Conducted Spurious Plot (LTE Band 26, 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

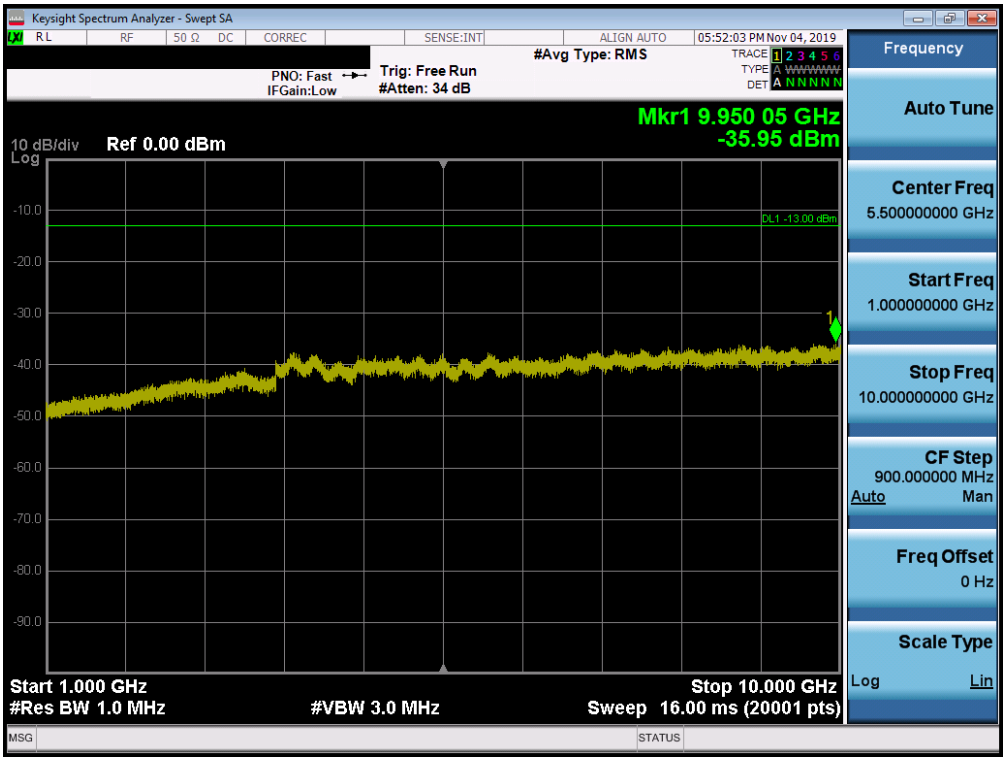
Plot 7-26. Conducted Spurious Plot (LTE Band 26, 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-27. Conducted Spurious Plot (LTE Band 26, 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-28. Conducted Spurious Plot (LTE Band 26, 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-29. Conducted Spurious Plot (LTE Band 26, 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §90(S)

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.

For LTE B26 operation under Part 90.691, the minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by greater than 37.5 kHz is 43 + 10log$_{10}$(P$_{[Watts]}$), where P is the transmitter power in Watts. The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by up to and including 37.5 kHz is 50 + 10log$_{10}$(P$_{[Watts]}$), where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Span was set large enough so as to capture all out of band emissions near the band edge
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Detector = RMS
5. Trace mode = trace average
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

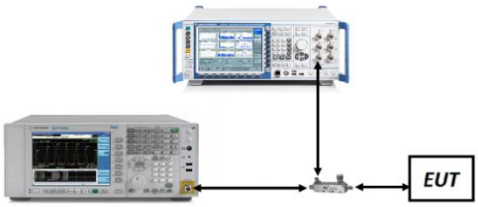
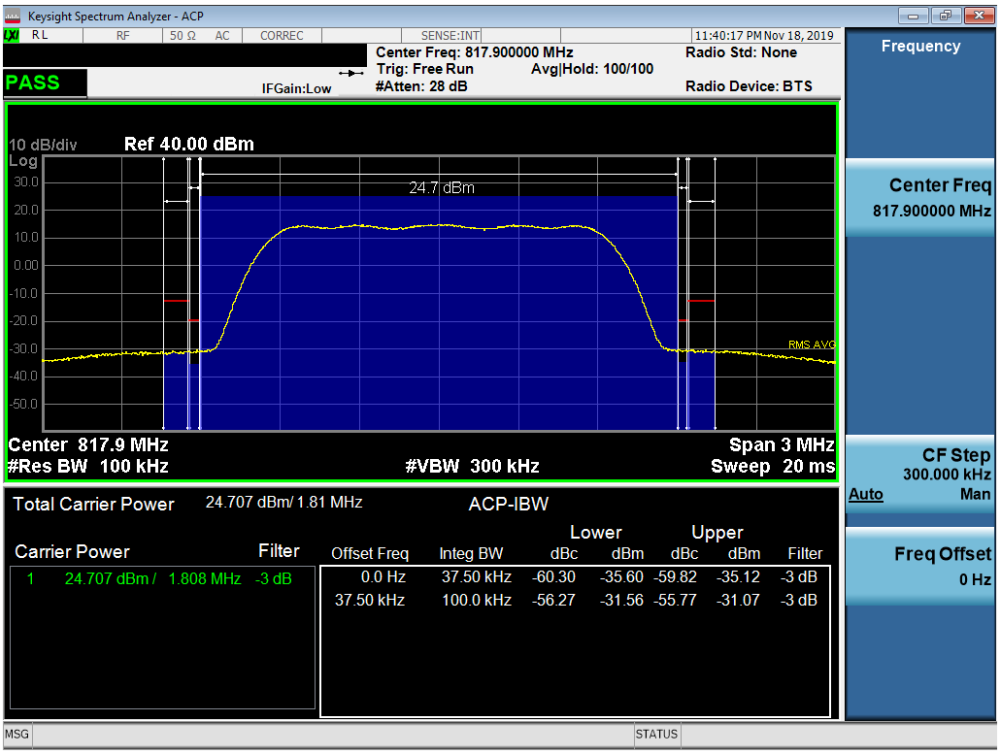


Figure 7-3. Test Instrument & Measurement Setup

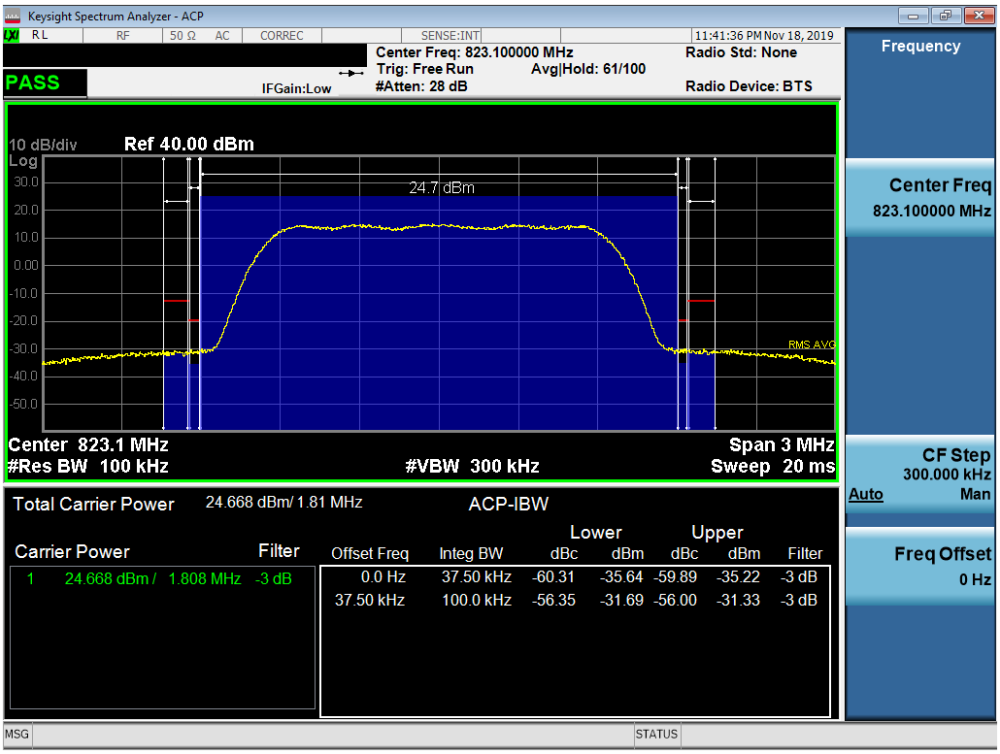
Test Notes

For channel edge emission, the signal analyzer's "ACP" measurement capability is used.

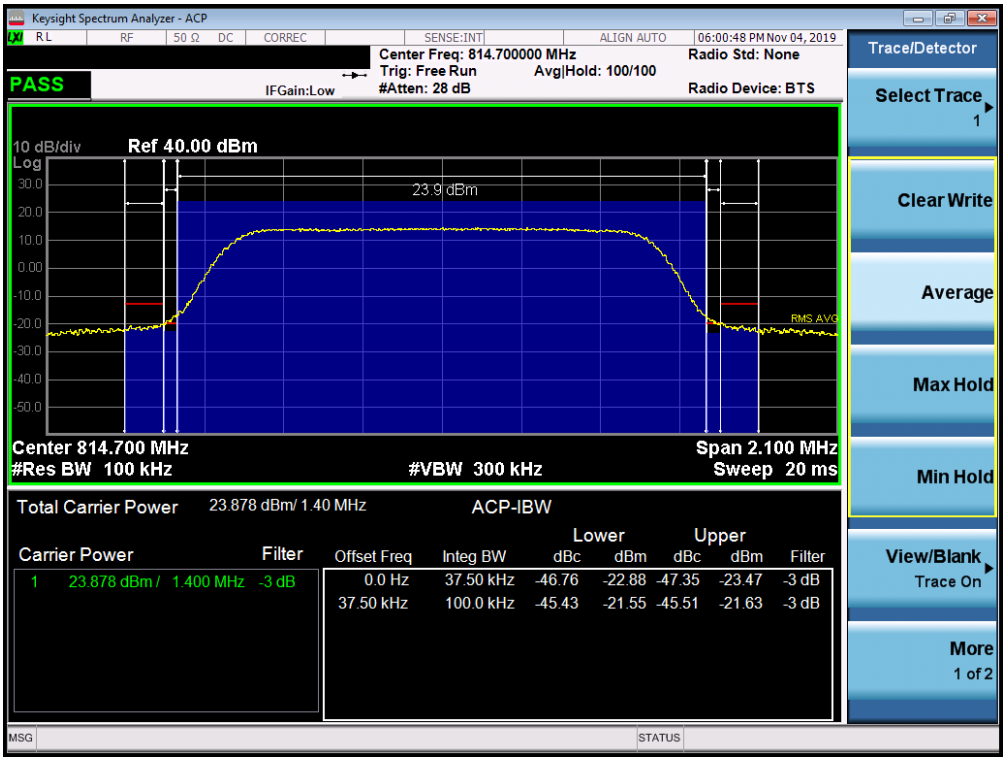
Per 22.917(b) in the 1MHz Bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission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



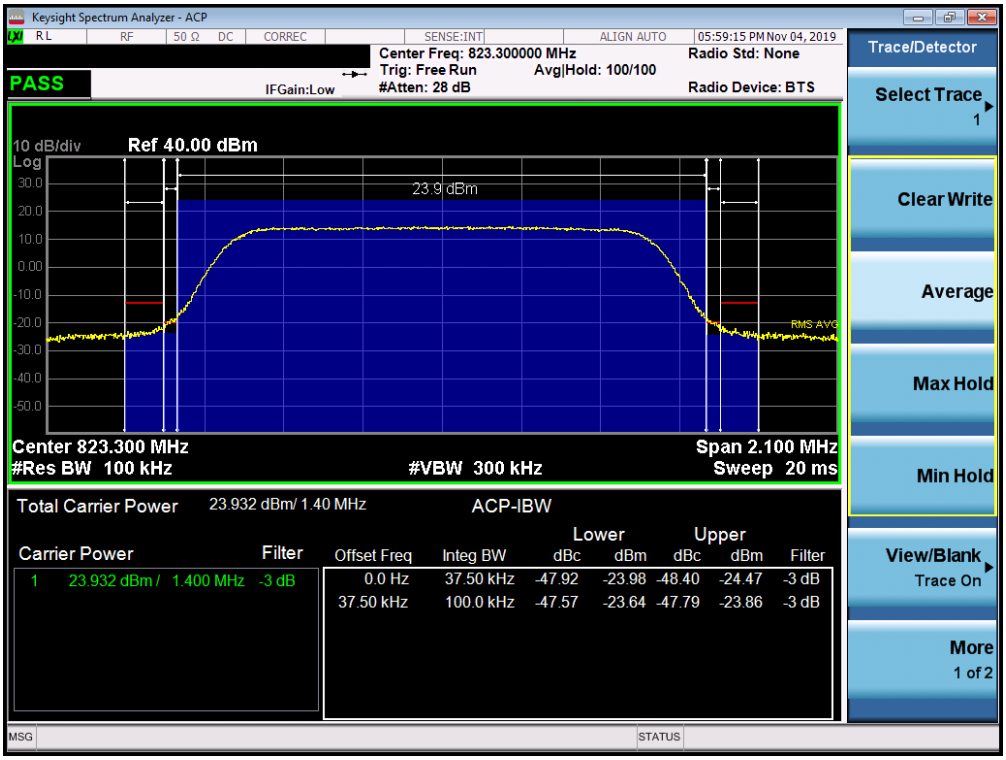
Plot 7-30. Channel Edge Plot (CDMA BC10 - Ch. 476)



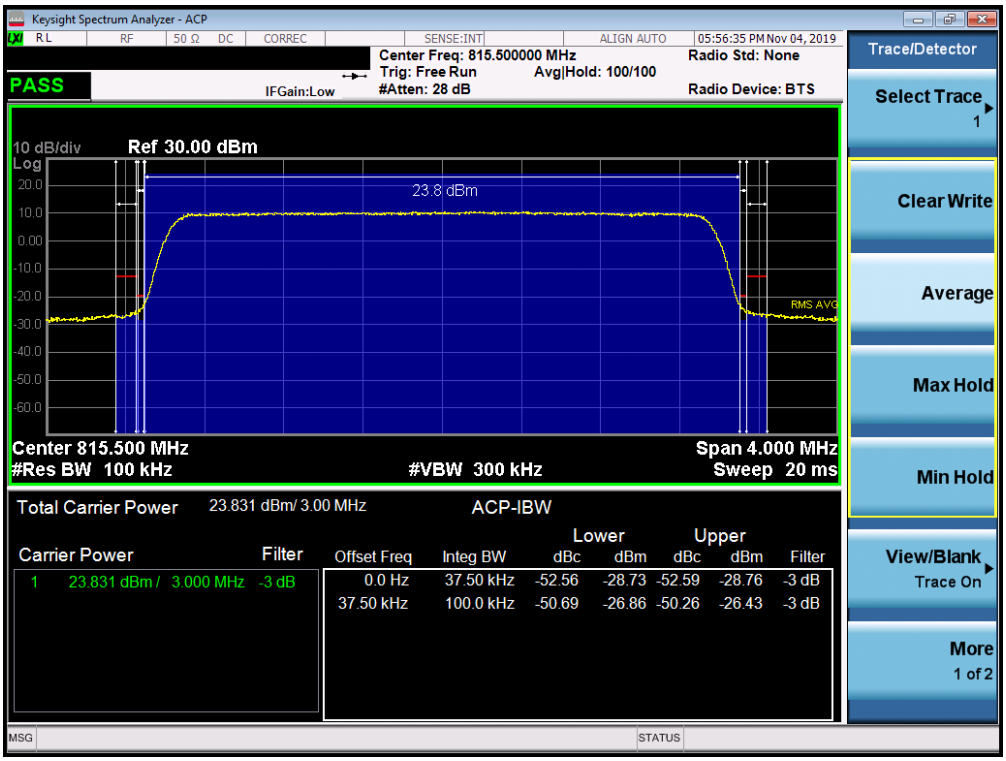
Plot 7-31. Channel Edge Plot (CDMA BC10 - Ch. 684)



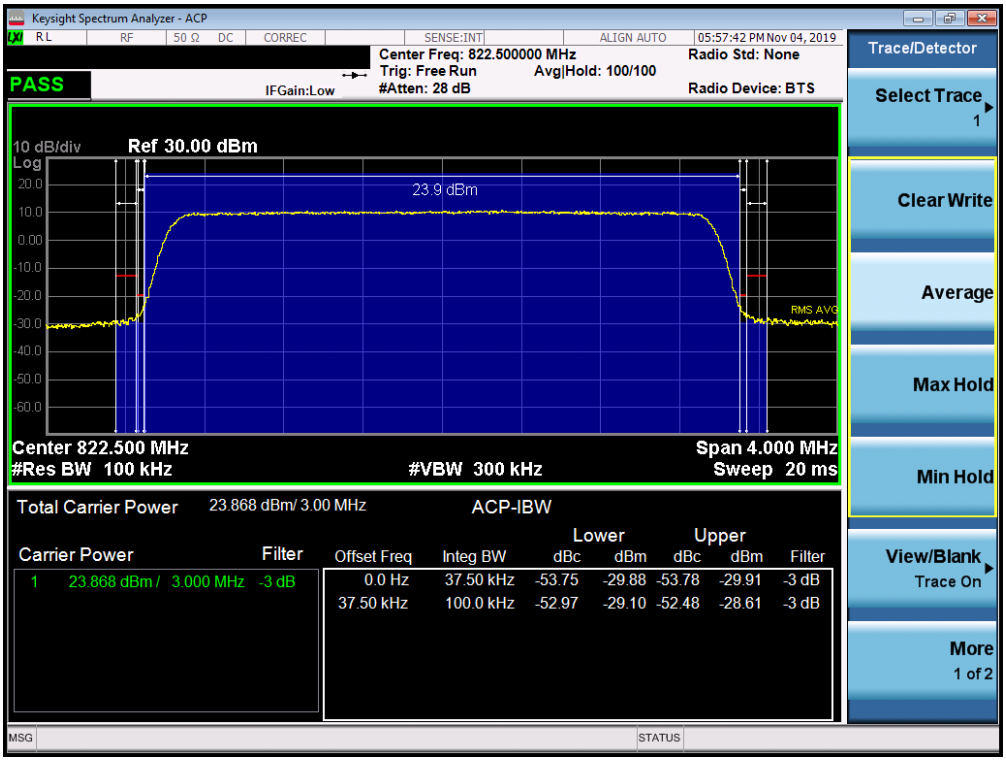
Plot 7-32. Channel Edge Plot (LTE Band 26, 1.4MHz QPSK – RB Size 6 – Low Channel)



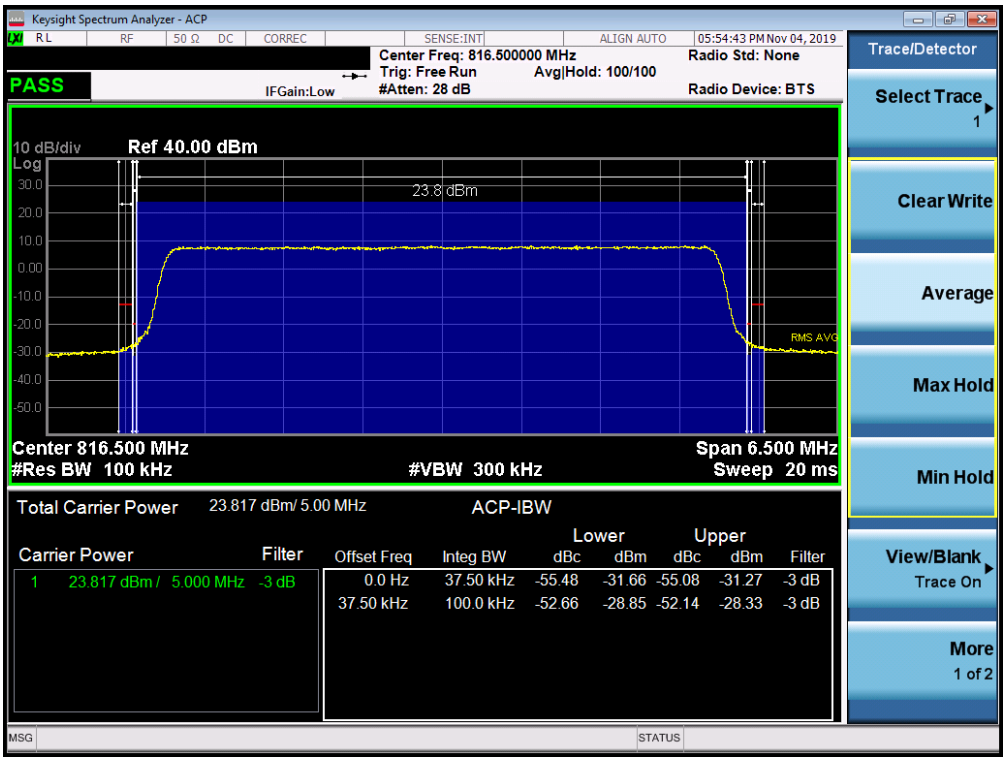
Plot 7-33. Channel Edge Plot (LTE Band 26, 1.4MHz QPSK – RB Size 6 – High Channel)



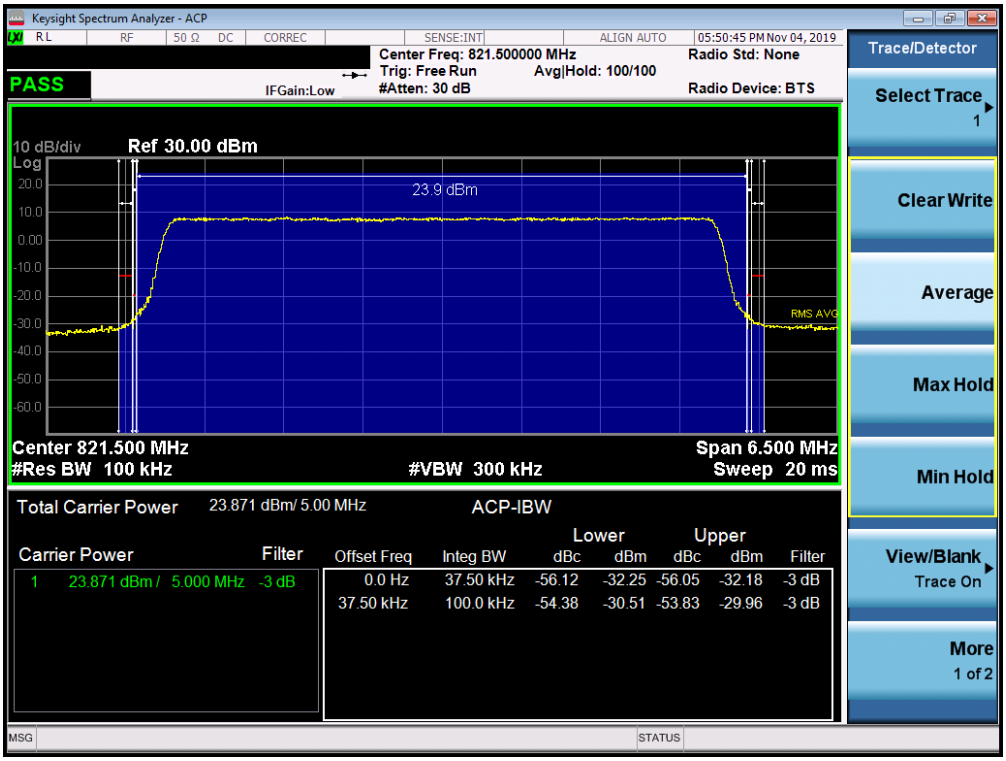
Plot 7-34. Channel Edge Plot (LTE Band 26, 3.0MHz QPSK – RB Size 15 – Low Channel)



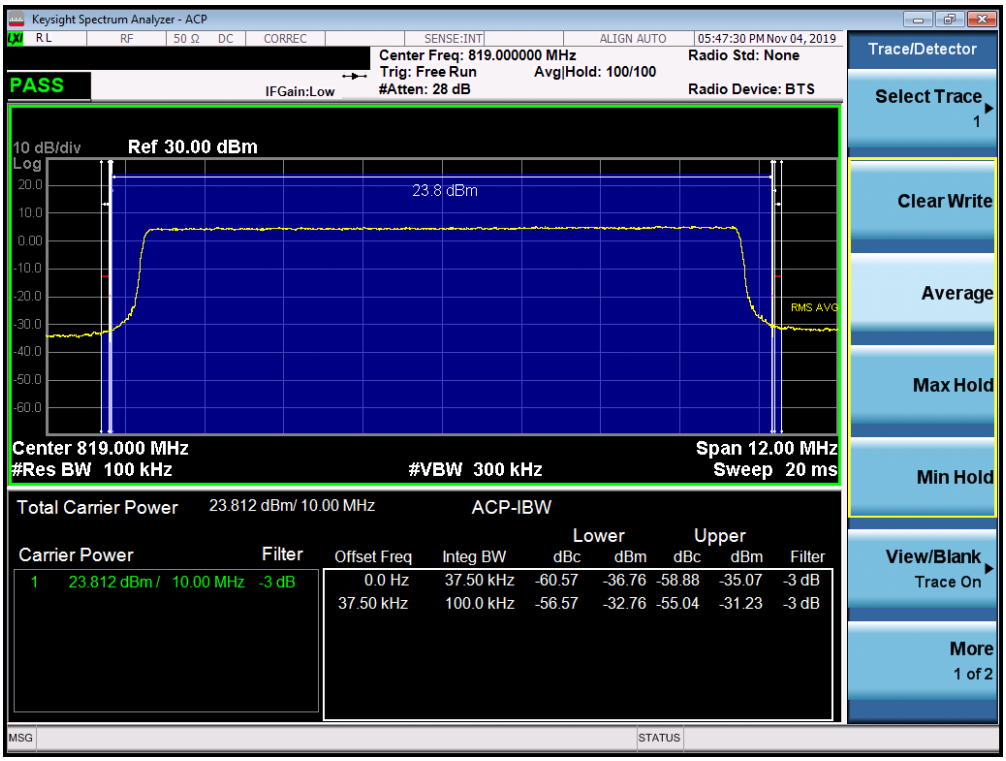
Plot 7-35. Channel Edge Plot (LTE Band 26, 3.0MHz QPSK – RB Size 15 – High Channel)



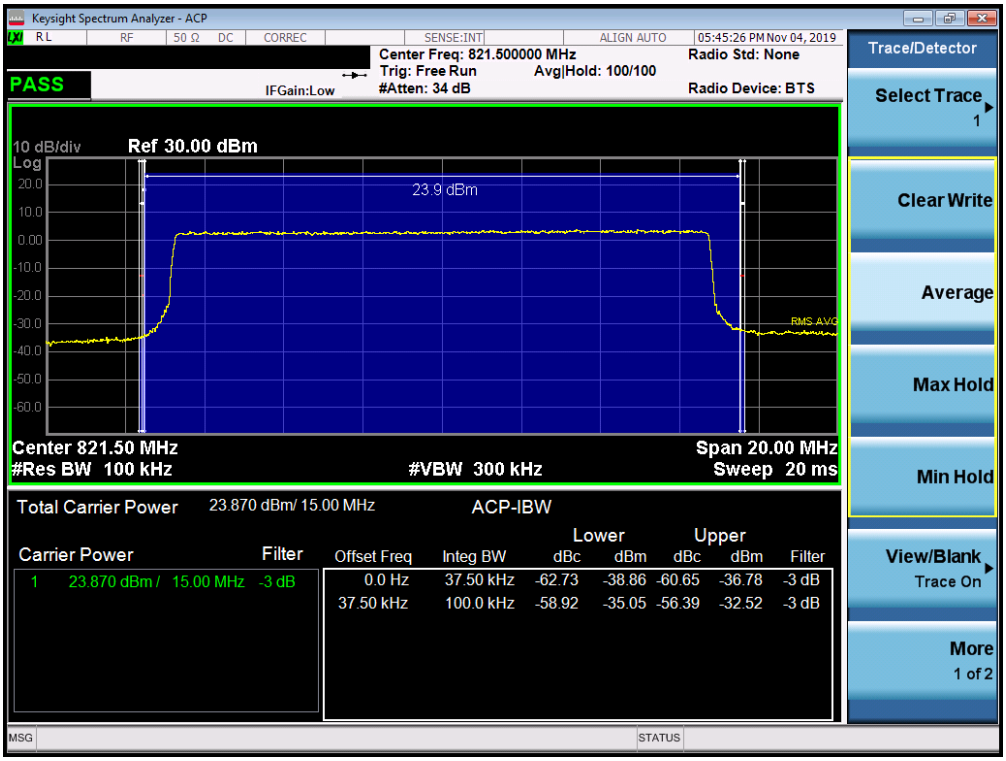
Plot 7-36. Channel Edge Plot (LTE Band 26, 5.0MHz QPSK – RB Size 25 – Low Channel)



Plot 7-37. Channel Edge Plot (LTE Band 26, 5.0MHz QPSK – RB Size 25 – High Channel)



Plot 7-38. Channel Edge Plot (LTE Band 26, 10.0MHz QPSK – RB Size 50)



Plot 7-39. Channel Edge Plot (LTE Band 26, 10.0MHz QPSK – RB Size 75)

7.5 Conducted Power Output Data

§2.1046 §90.635

Frequency [MHz]	BC10 [Channel]	Battery Type	Cond. PWR [dBm]	Cond. PWR [Watts]	Cond. PWR Limit [dBm]	Margin [dB]
817.90	476	Standard	**24.68**	**0.294**	50.00	-25.32
823.10	684	Standard	24.66	0.292	50.00	-25.34

Table 7-2. CDMA BC10 Conducted Power Output Data

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Cond. PWR [dBm]	Cond. PWR [Watts]	Cond. PWR Limit [dBm]	Margin [dB]
814.70	1.4	QPSK	25.04	0.319	50.00	-24.96
823.30	1.4	QPSK	**25.19**	0.330	50.00	-24.81
823.30	1.4	16-QAM	**24.16**	0.261	50.00	-25.84
823.30	1.4	64-QAM	23.19	0.208	50.00	-26.81
815.50	3	QPSK	25.17	0.329	50.00	-24.83
822.50	3	QPSK	**25.19**	0.330	50.00	-24.81
822.50	3	16-QAM	**24.20**	0.263	50.00	-25.80
822.50	3	64-QAM	**23.20**	0.209	50.00	-26.80
816.50	5	QPSK	25.00	0.316	50.00	-25.00
821.50	5	QPSK	**25.20**	**0.331**	50.00	-24.80
821.50	5	16-QAM	**24.20**	0.263	50.00	-25.80
821.50	5	64-QAM	**23.20**	0.209	50.00	-26.80
819.00	10	QPSK	**25.00**	0.316	50.00	-25.00
819.00	10	16-QAM	**24.11**	0.258	50.00	-25.89
819.00	10	64-QAM	**23.16**	0.207	50.00	-26.84
821.50	15	QPSK	**25.18**	0.330	50.00	-24.82
821.50	15	16-QAM	**24.20**	0.263	50.00	-25.80
821.50	15	64-QAM	**23.11**	0.205	50.00	-26.89

Table 7-3. LTE Band 26 Conducted Power Output Data

NOTES:

1. For CDMA mode, this device was tested under all R.C.s and S.O.s and the worst case is reported with RC3/SO55 with "All Up" power control bits.

2. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.

3. This unit was tested with its standard battery.

7.6 Radiated Power (ERP)

§22.913(a.2) §90.542(a)(7)

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. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/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.
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".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
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.

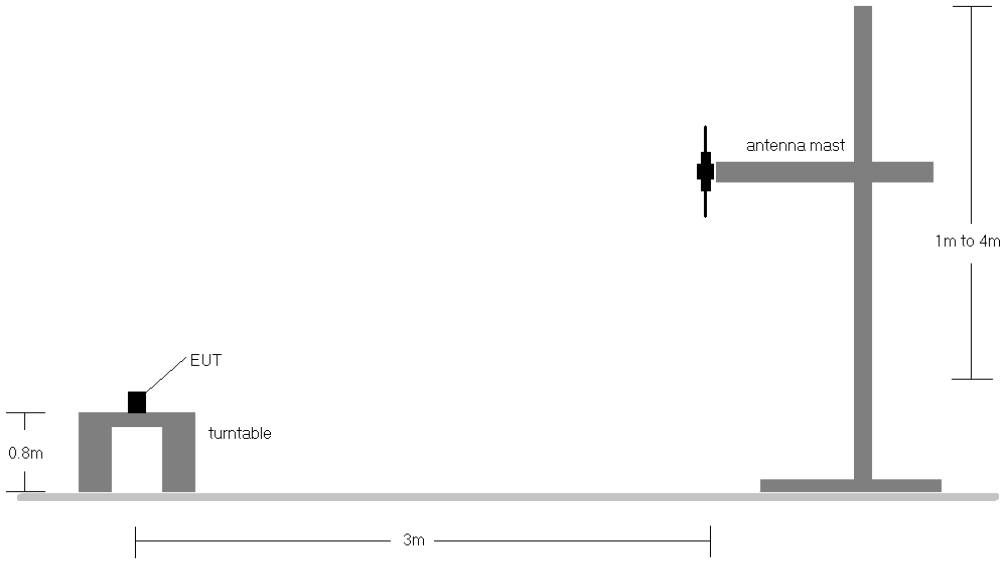


Figure 7-4. Radiated Test Setup <1GHz

Test Notes

1) 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.

2) This unit was tested with its standard battery.

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
821.50	15	QPSK	H	214	164	1 / 74	13.97	6.70	**18.52**	0.071	38.45	-19.93
821.50	15	16-QAM	H	214	164	1 / 74	13.22	6.70	**17.77**	0.060	38.45	-20.68
821.50	15	64-QAM	H	214	164	1 / 74	12.33	6.70	**16.88**	0.049	38.45	-21.57
821.50	15	QPSK	V	157	189	1 / 74	12.98	6.30	17.13	**0.052**	38.45	-21.32

Table 7-4. ERP Data (Band 26)

7.7 Radiated Spurious Emissions Measurements

§2.1053 §90(S)

Test Overview

Radiated spurious emissions 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 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 peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI/TIA-603-E-2016 – Section 2.2.12

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.

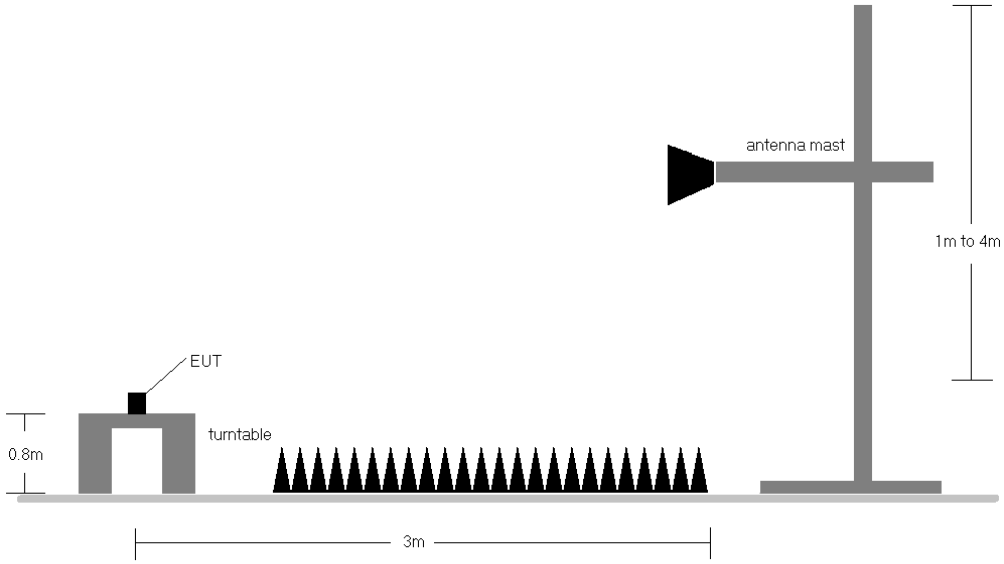


Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1. For CDMA mode, this device was tested under all R.C.s and S.O.s and the worst case is reported with RC3/SO55 with "All Up" power control bits.

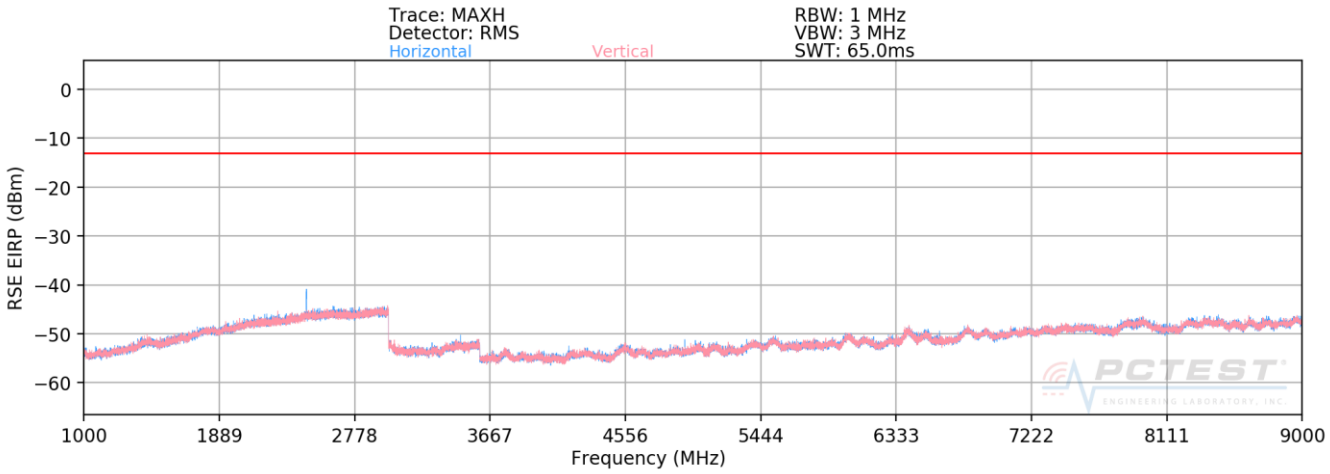
2. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.

3. This unit was tested with its standard battery.

4. 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.

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

CDMA BC10



Plot 7-40. Radiated Spurious Plot (CDMA BC10)

OPERATING FREQUENCY: 817.90 MHz
MODULATION SIGNAL: CDMA
DISTANCE: 3 meters
LIMIT: -13.00 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1635.80	V	387	241	-69.45	3.59	-65.85	-52.9
2453.70	V	-	-	-66.77	4.17	-62.60	-49.6
3271.60	V	-	-	-67.30	5.69	-61.61	-48.6

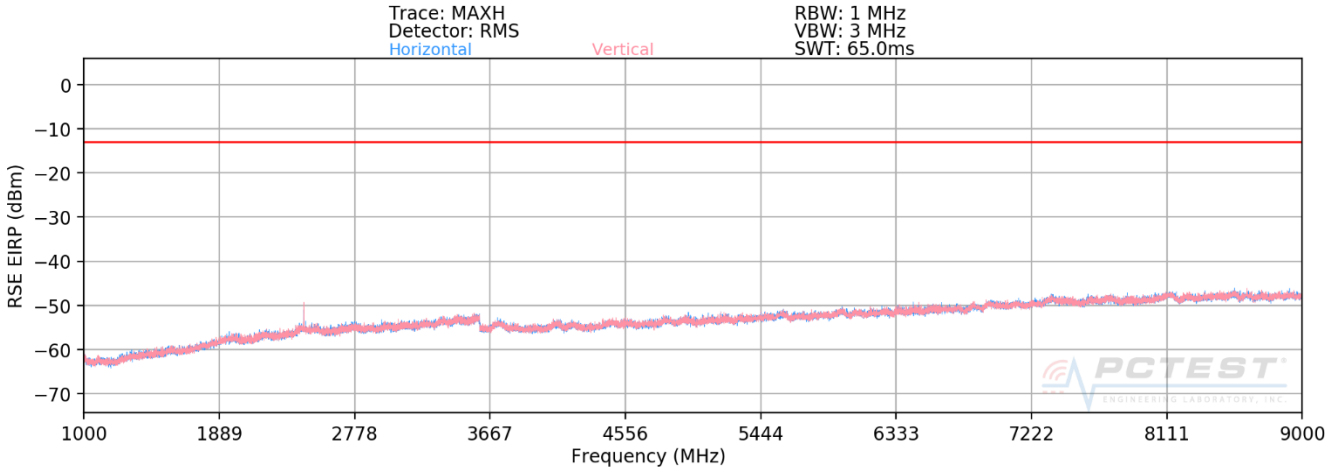
Table 7-5. CDMA BC10 Radiated Spurious Data (Ch. 476)

OPERATING FREQUENCY: 823.10 MHz
MODULATION SIGNAL: CDMA
DISTANCE: 3 meters
LIMIT: -13.00 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1646.20	V	139	236	-69.42	3.60	-65.81	-52.8
2469.30	V	-	-	-66.87	4.21	-62.67	-49.7
3292.40	V	-	-	-67.30	5.76	-61.55	-48.5

Table 7-6. CDMA BC10 Radiated Spurious Data (Ch. 684)

LTE Band 26



Plot 7-41. Radiated Spurious Plot (LTE Band 26)

OPERATING FREQUENCY:	814.70	MHz
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	1.4	MHz
DISTANCE:	3	meters
LIMIT:	-13.00	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1629.40	V	118	135	-68.01	3.59	-64.42	-51.4
2444.10	V	194	233	-63.51	4.16	-59.35	-46.3
3258.80	V	-	-	-66.99	5.65	-61.34	-48.3
4073.50	V	-	-	-69.03	7.50	-61.53	-48.5

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

OPERATING FREQUENCY:	823.30	MHz
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	1.4	MHz
DISTANCE:	3	meters
LIMIT:	-13.00	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1646.60	V	117	130	-67.59	3.60	-63.98	-51.0
2469.90	V	180	227	-61.15	4.21	-56.94	-43.9
3293.20	V	-	-	-67.54	5.76	-61.78	-48.8
4116.50	V	-	-	-68.75	7.58	-61.17	-48.2

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

7.8 Frequency Stability / Temperature Variation

§2.1055 §90.213

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.

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

Frequency Stability / Temperature Variation

§2.1055, §90.213

OPERATING FREQUENCY: 817,900,000 Hz

CHANNEL: 476

REFERENCE VOLTAGE: 4.25 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.25	- 30	817,900,110	110	0.0000134
100 %		- 20	817,899,966	-34	-0.0000042
100 %		- 10	817,899,978	-22	-0.0000027
100 %		0	817,900,087	87	0.0000106
100 %		+ 10	817,899,584	-416	-0.0000509
100 %		+ 20	817,900,043	43	0.0000053
100 %		+ 30	817,899,633	-367	-0.0000449
100 %		+ 40	817,899,975	-25	-0.0000031
100 %		+ 50	817,900,131	131	0.0000160
BATT. ENDPOINT	2.78	+ 20	817,900,186	186	0.0000227

Table 7-9. CDMA BC10 Frequency Stability Data

Frequency Stability / Temperature Variation

§2.1055, §90.213

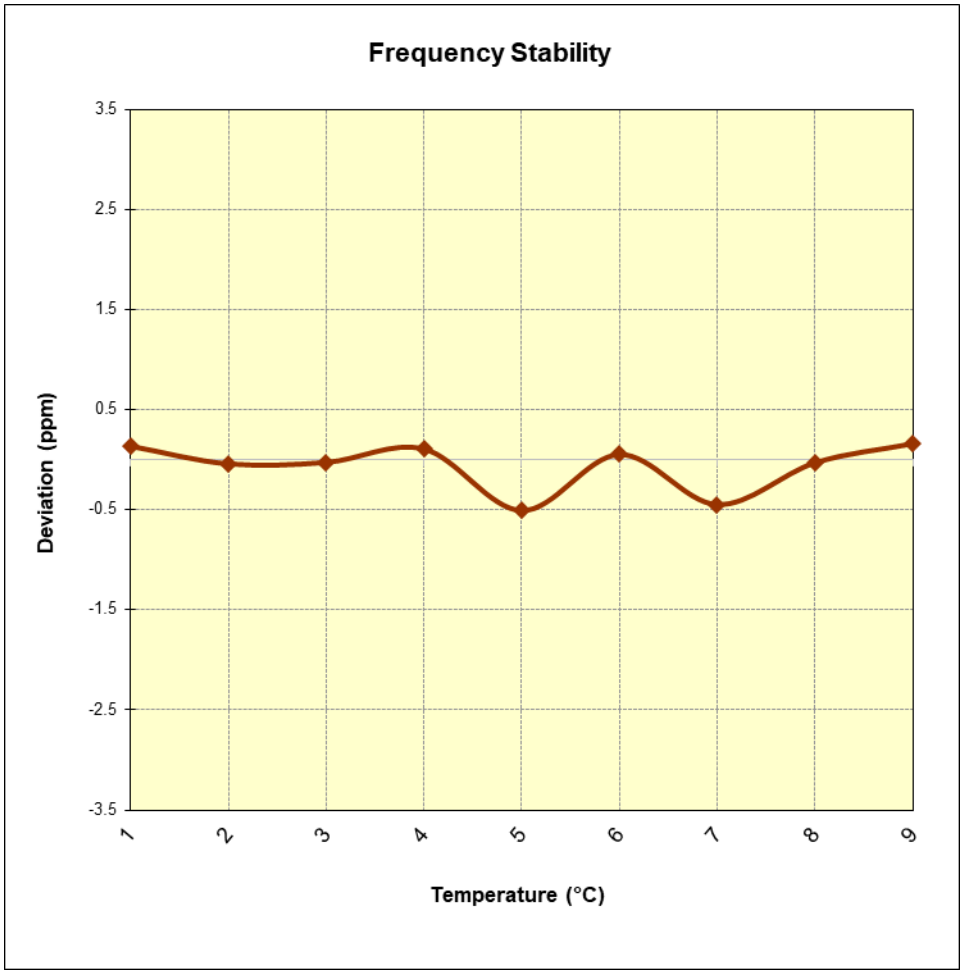


Figure 7-6. CDMA BC10 Frequency Stability Chart

Frequency Stability / Temperature Variation

§2.1055, §90.213

OPERATING FREQUENCY: 819,000,000 Hz

CHANNEL: 26740

REFERENCE VOLTAGE: 4.25 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.25	- 30	819,000,131	131	0.0000160
100 %		- 20	818,999,984	-16	-0.0000020
100 %		- 10	818,999,767	-233	-0.0000284
100 %		0	819,000,129	129	0.0000158
100 %		+ 10	818,999,581	-419	-0.0000512
100 %		+ 20	819,000,222	222	0.0000271
100 %		+ 30	818,999,628	-372	-0.0000454
100 %		+ 40	818,999,952	-48	-0.0000059
100 %		+ 50	819,000,095	95	0.0000116
BATT. ENDPOINT	2.78	+ 20	819,000,011	11	0.0000013

Table 7-10. LTE Band 26 Frequency Stability Data

Frequency Stability / Temperature Variation

§2.1055, §90.213

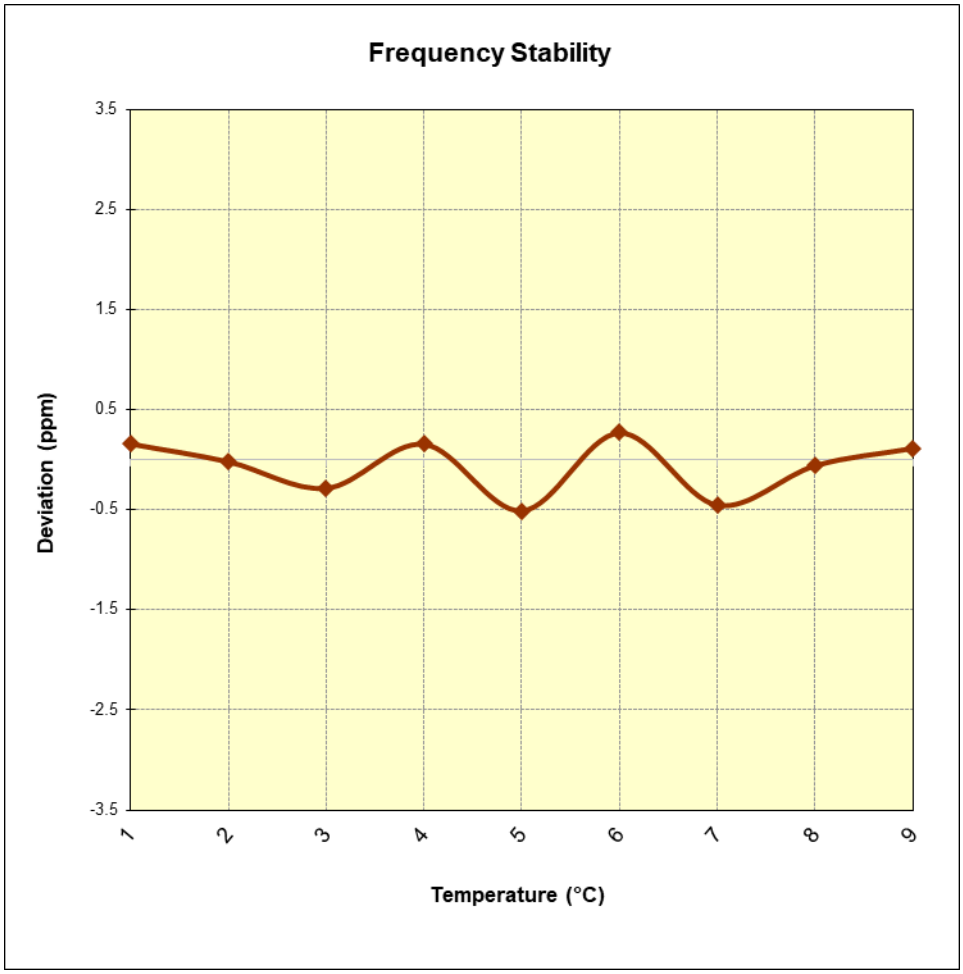


Figure 7-7. LTE Band 26 Frequency Stability Chart

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFL455DL** complies with all the requirements of Parts 90 of the FCC rules.