

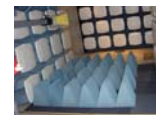


# PCTEST ENGINEERING LABORATORY, INC.

7185 Oakland Mills Road, Columbia, MD 21046 USA

Tel. 410.290.6652 / Fax 410.290.6654

<http://www.pctestlab.com>



## MEASUREMENT REPORT FCC Part 24 & 27 LTE

**Applicant Name:**

LG Electronics MobileComm U.S.A  
1000 Sylvan Avenue  
Englewood Cliffs, NJ 07632  
United States

**Date of Testing:**

12/28/2016 - 1/17/2017

**Test Site/Location:**

PCTEST Lab., Columbia, MD, USA

**Test Report Serial No.:**

1M1701030003-03.ZNF

<b>FCC ID :</b>	<b>ZNFL84VL</b>
<b>APPLICANT:</b>	<b>LG ELECTRONICS MOBILECOMM U.S.A</b>

**Application Type:**

Certification

**FCC Classification:**

PCS Licensed Transmitter Held to Ear (PCE)

**FCC Rule Part(s):**

§2; §24; §27

**Test Procedure(s):**

ANSI/TIA-603-D-2010, KDB 971168 D01 v02r02

**EUT Type:**

Portable Handset

**Model:**

LGL84VL

**Additional Model(s):**

LG-L84VL, L84VL

**Test Device Serial No.:**



*identical prototype* [S/N: 04590, 04582, 04640]

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



FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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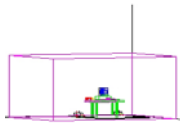
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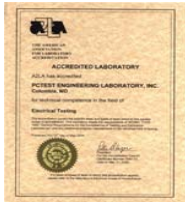


### §2.1033 General Information

**APPLICANT:** LG Electronics MobileComm U.S.A  
**APPLICANT ADDRESS:** 1000 Sylvan Avenue  
 Englewood Cliffs, NJ 07632, United States  
**TEST SITE:** PCTEST ENGINEERING LABORATORY, INC.  
**TEST SITE ADDRESS:** 7185 Oakland Mills Road, Columbia, MD 21045 USA  
**FCC RULE PART(S):** §2; §24; §27  
**BASE MODEL:** LGL84VL  
**FCC ID:** ZNFL84VL  
**FCC CLASSIFICATION:** PCS Licensed Transmitter Held to Ear (PCE)  
**FREQUENCY TOLERANCE:** ±0.00025 % (2.5 ppm)  
**Test Device Serial No.:** 04590, 04582, 04640       Production     Pre-Production     Engineering  
**DATE(S) OF TEST:** 12/28/2016 - 1/17/2017  
**TEST REPORT S/N:** 1M1701030003-03.ZNF

### Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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## FCC Part 24 & 27



Mode	FCC Rule Part	Tx Frequency (MHz)	ERP/EIRP		Emission Designator	Modulation
			Max. Power (W)	Max. Power (dBm)		
LTE Band 13	27	779.5 - 784.5	0.086	19.36	4M50G7D	QPSK
LTE Band 13	27	779.5 - 784.5	0.056	17.51	4M50W7D	16QAM
LTE Band 13	27	782	0.088	19.45	8M97G7D	QPSK
LTE Band 13	27	782	0.053	17.28	8M91W7D	16QAM
LTE Band 4	27	1710.7 - 1754.3	0.338	25.29	1M12G7D	QPSK
LTE Band 4	27	1710.7 - 1754.3	0.281	24.49	1M13W7D	16QAM
LTE Band 4	27	1711.5 - 1753.5	0.319	25.04	2M72G7D	QPSK
LTE Band 4	27	1711.5 - 1753.5	0.253	24.03	2M71W7D	16QAM
LTE Band 4	27	1712.5 - 1752.5	0.342	25.34	4M50G7D	QPSK
LTE Band 4	27	1712.5 - 1752.5	0.275	24.39	4M50W7D	16QAM
LTE Band 4	27	1715 - 1750	0.367	25.65	8M98G7D	QPSK
LTE Band 4	27	1715 - 1750	0.314	24.97	8M94W7D	16QAM
LTE Band 4	27	1717.5 - 1747.5	0.371	25.70	13M4G7D	QPSK
LTE Band 4	27	1717.5 - 1747.5	0.305	24.84	13M4W7D	16QAM
LTE Band 4	27	1720 - 1745	0.317	25.01	17M9G7D	QPSK
LTE Band 4	27	1720 - 1745	0.267	24.26	17M9W7D	16QAM
LTE Band 2	24E	1850.7 - 1909.3	0.304	24.83	1M12G7D	QPSK
LTE Band 2	24E	1850.7 - 1909.3	0.215	23.33	1M12W7D	16QAM
LTE Band 2	24E	1851.5 - 1908.5	0.273	24.36	2M72G7D	QPSK
LTE Band 2	24E	1851.5 - 1908.5	0.200	23.02	2M71W7D	16QAM
LTE Band 2	24E	1852.5 - 1907.5	0.279	24.46	4M50G7D	QPSK
LTE Band 2	24E	1852.5 - 1907.5	0.194	22.88	4M50W7D	16QAM
LTE Band 2	24E	1855 - 1905	0.267	24.27	8M97G7D	QPSK
LTE Band 2	24E	1855 - 1905	0.187	22.73	8M94W7D	16QAM
LTE Band 2	24E	1857.5 - 1902.5	0.269	24.30	13M4G7D	QPSK
LTE Band 2	24E	1857.5 - 1902.5	0.177	22.48	13M4W7D	16QAM
LTE Band 2	24E	1860 - 1900	0.247	23.94	17M9G7D	QPSK
LTE Band 2	24E	1860 - 1900	0.196	22.92	17M9W7D	16QAM

### EUT Overview

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# 1.0 INTRODUCTION

## 1.1 Scope

Measurement and determination of electromagnetic emissions (EME) 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 Industry Canada Certification and Engineering Bureau.

## 1.2 Testing Facility

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Intern't'l (BWI) airport, the city of Baltimore and the Washington, DC area. (See Figure 1-1).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39° 10'23" N latitude and 76° 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

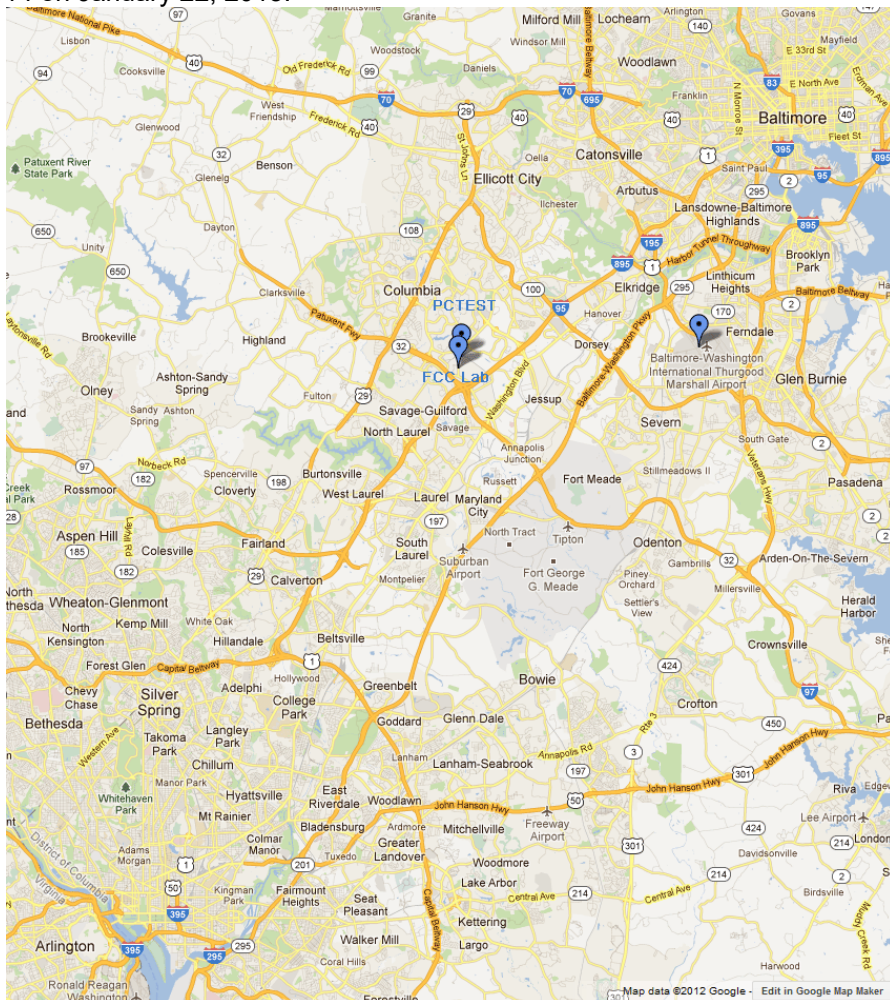


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFL84VL**. The test data contained in this report pertains only to the emissions due to the EUT's LTE function.

### 2.2 Device Capabilities

This device contains the following capabilities:


850/1900 CDMA (BC0, BC1), Multi-band LTE, 802.11b/g/n WLAN, Bluetooth (1x, EDR, LE)

### 2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-D-2010 and KDB 971168 D01 v02r02. 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.

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## 3.0 DESCRIPTION OF TESTS

### 3.1 Measurement Procedure

The measurement procedures described in the document titled “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI/TIA-603-D-2010) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168 D01 v02r02) were used in the measurement of the EUT.

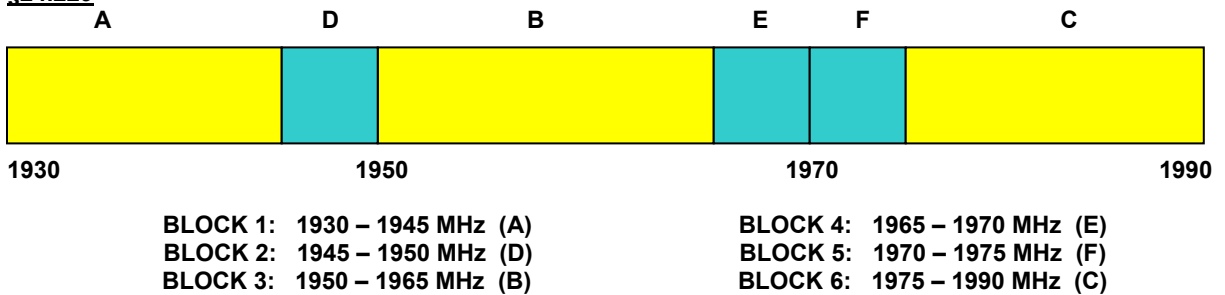
### 3.1 Block C Frequency Range

#### §27.5(b)(3)

Two paired channels of 11 megahertz each are available for assignment in Block C in the 746-757 MHz and 776-787 MHz bands. In the event that no licenses for two channels in this Block C are assigned based on the results of the first auction in which such licenses were offered because the auction results do not satisfy the applicable reserve price, the spectrum in the 746-757 MHz and 776-787 MHz bands will instead be made available for assignment at a subsequent auction as follows: (i) Two paired channels of 6 megahertz each available for assignment in Block C1 in the 746-752 MHz and 776-782 MHz bands. (ii) Two paired channels of 5 megahertz each available for assignment in Block C2 in the 752-757 MHz and 782-787 MHz bands.

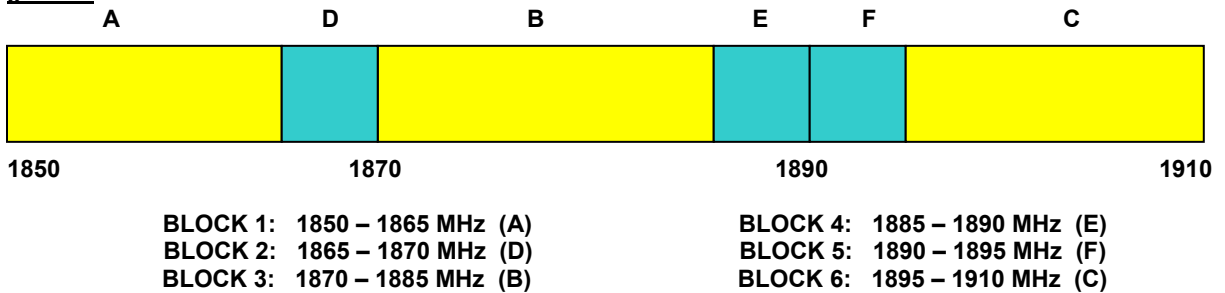
### 3.2 PCS - Base Frequency Blocks



#### §24.229



### 3.3 PCS - Mobile Frequency Blocks

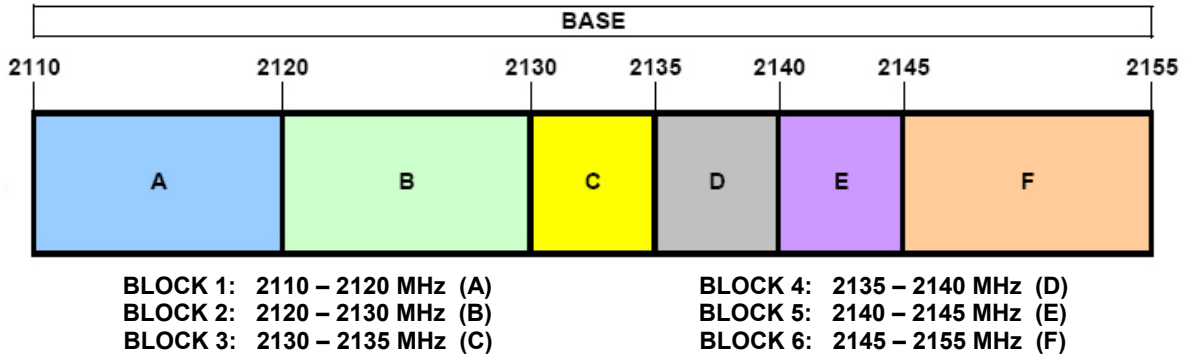
#### §24.229



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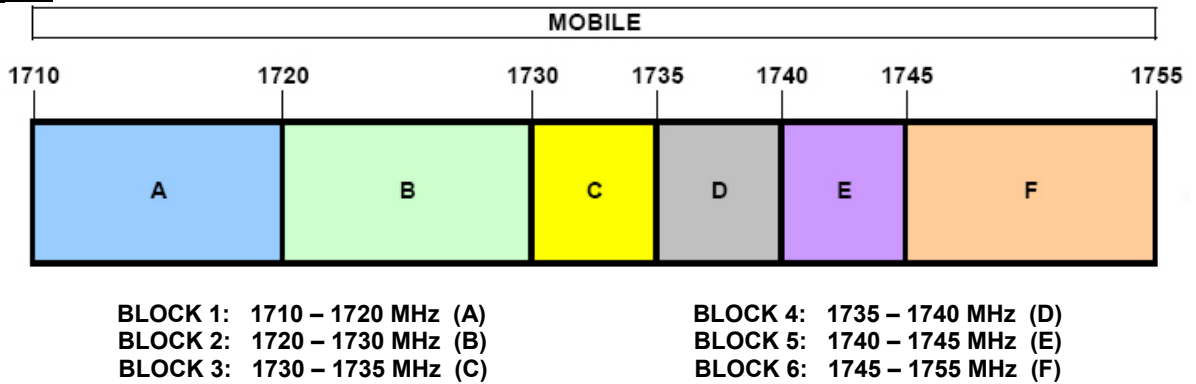
### 3.4 AWS - Base Frequency Blocks



§27.5(h)



### 3.5 AWS - Mobile Frequency Blocks

§27.5(h)



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### 3.6 Radiated Power and Radiated Spurious Emissions

§2.1053 §24.232(c) §24.238(a) §27.50(b.10) §27.50(d.4) §27.53(f) §27.53(h)

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. A 72.4cm high PVC support structure is placed on top of the turntable. A 3" (~7.6cm) sheet of high density polystyrene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm.



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. 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 v02r02.

Per the guidance of ANSI/TIA-603-D-2010, 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:

$$P_d [dBm] = P_g [dBm] - \text{cable loss} [dB] + \text{antenna gain} [dBi/dBd]$$

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 (dBi) or an isotropic source (dBd). The substitute level is equal to  $P_g [dBm] - \text{cable loss} [dB]$ .



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  $43 + 10\log_{10}(\text{Power} [Watts])$ .

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## 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 data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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

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## 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 C63.5-2006.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	LTX1	Licensed Transmitter Cable Set	4/11/2016	Annual	4/11/2017	LTX1
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	7/11/2016	Annual	7/11/2017	RE1
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/26/2016	Annual	10/26/2017	3613A00315
Agilent	E5515C	Wireless Communications Test Set	1/29/2016	Biennial	1/29/2018	GB46310798
Agilent	N9020A	MXA Signal Analyzer	10/28/2016	Annual	10/28/2017	US46470561
Agilent	N9030A	PXA Signal Analyzer (44GHz)	3/1/2016	Annual	3/1/2017	MYS2350166
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	7/30/2015	Biennial	7/30/2017	121034
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	7/6/2016	Annual	7/6/2017	441119
Emco	3115	Horn Antenna (1-18GHz)	3/10/2016	Biennial	3/10/2018	9704-5182
Espec	ESX-2CA	Environmental Chamber	3/4/2016	Annual	3/4/2017	17620
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	12/1/2016	Biennial	12/1/2018	125518
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	4/26/2016	Biennial	4/26/2018	128337
Mini Circuits	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	3/4/2016	Annual	3/4/2017	11401010036
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
Mini-Circuits	PWR-SENS-4RMS	USB Power Sensor	3/4/2016	Annual	3/4/2017	11210140001
Mini-Circuits	TVA-11-422	RF Power Amp	N/A			QA1303002
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11403100002
PCTEST	-	EMC Switch System	7/11/2016	Annual	7/11/2017	NM1
Rhode & Schwarz	TS-PR18	Pre-Amplifier	7/6/2016	Annual	7/6/2017	101622
Rohde & Schwarz	CMW500	Radio Communication Tester	4/26/2016	Annual	4/26/2017	112347
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	5/16/2016	Annual	5/16/2017	100342
Schwarzbeck	UHA 9105	Dipole Antenna (400 - 1GHz) Rx	3/30/2016	Biennial	3/30/2018	9105-2404
Schwarzbeck	UHA 9105	Dipole Antenna (400 - 1GHz) Tx	3/30/2016	Biennial	3/30/2018	9105-2403
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	3/14/2016	Biennial	3/14/2018	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.

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## 6.0 SAMPLE CALCULATIONS

### Emission Designator

#### QPSK Modulation

**Emission Designator = 8M62G7D**

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

#### 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 2<sup>nd</sup> 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 analyzer. 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).

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## 7.0 TEST RESULTS

### 7.1 Summary



Company Name: LG Electronics MobileComm U.S.A  
 FCC ID: ZNFL84VL  
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)  
 Mode(s): LTE

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051 24.238(a) 27.53(c) 27.53(h)	Out of Band Emissions	> 43 + 10log <sub>10</sub> (P[Watts]) at Band Edge and for all out-of-band emissions		PASS	Section 7.3, 7.4
24.232(d)	Peak-Average Ratio	< 13 dB		PASS	Section 7.5
2.1046	Transmitter Conducted Output Power	N/A		PASS	See RF Exposure Report
2.1055. 24.235 27.54	Frequency Stability	Fundamental emissions stay within authorized frequency block (Part 24, 27)		PASS	Section 7.8
27.50(b.10)	Effective Radiated Power (Band 13)	< 3 Watts max. ERP	RADIATED	PASS	Section 7.6
24.232(c)	Equivalent Isotropic Radiated Power (Band 2)	< 2 Watts max. EIRP		PASS	Section 7.6
27.50(d.4)	Equivalent Isotropic Radiated Power (Band 4)	< 1 Watts max. EIRP		PASS	Section 7.6
2.1053 24.238(a) 27.53(c) 27.53(h)	Undesirable Emissions	> 43 + 10log <sub>10</sub> (P[Watts]) for all out-of-band emissions		PASS	Section 7.7
27.53(f)	Undesirable Emissions (Band 13)	< -70 dBW/MHz (for wideband signals) < -80 dBW (for discrete emissions less than 700Hz BW) For all emissions in the band 1559 – 1610 MHz		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 (Sections 7.2, 7.3, 7.4, 7.5) 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) 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 "LTE Automation," Version 4.5.

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## 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

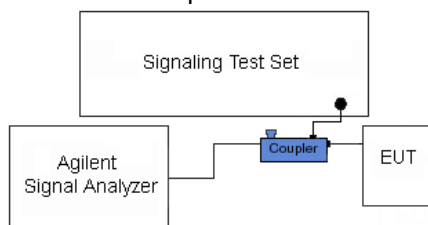
KDB 971168 D01 v02r02 – Section 4.2

#### 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  $\geq$  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.



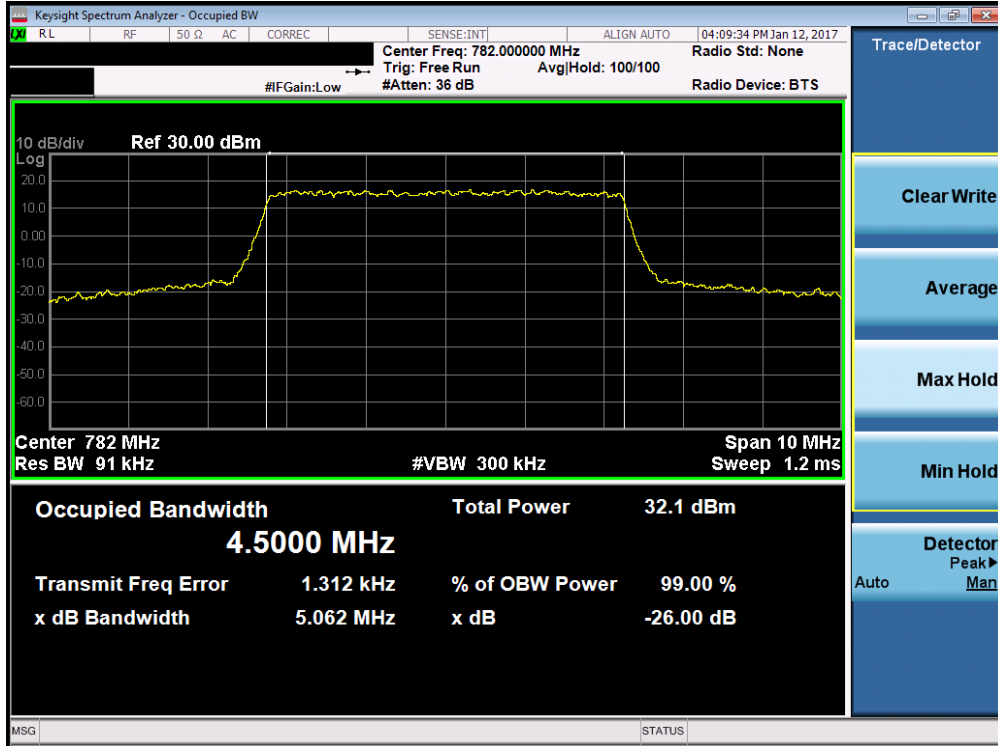
**Figure 7-1. Test Instrument & Measurement Setup**

#### Test Notes

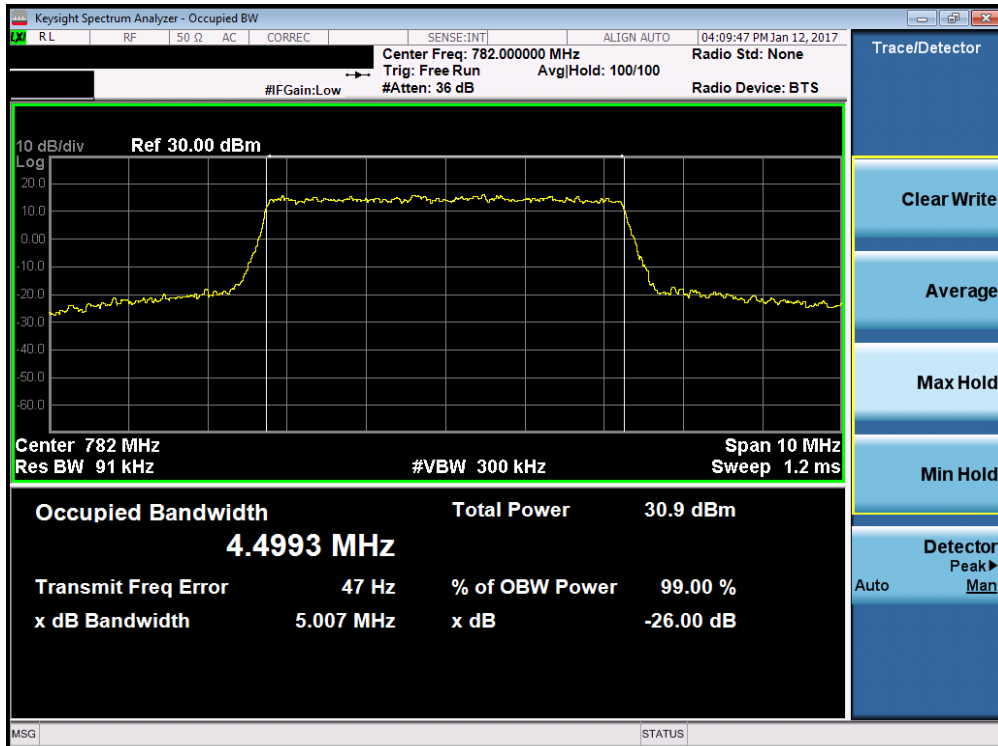
None.

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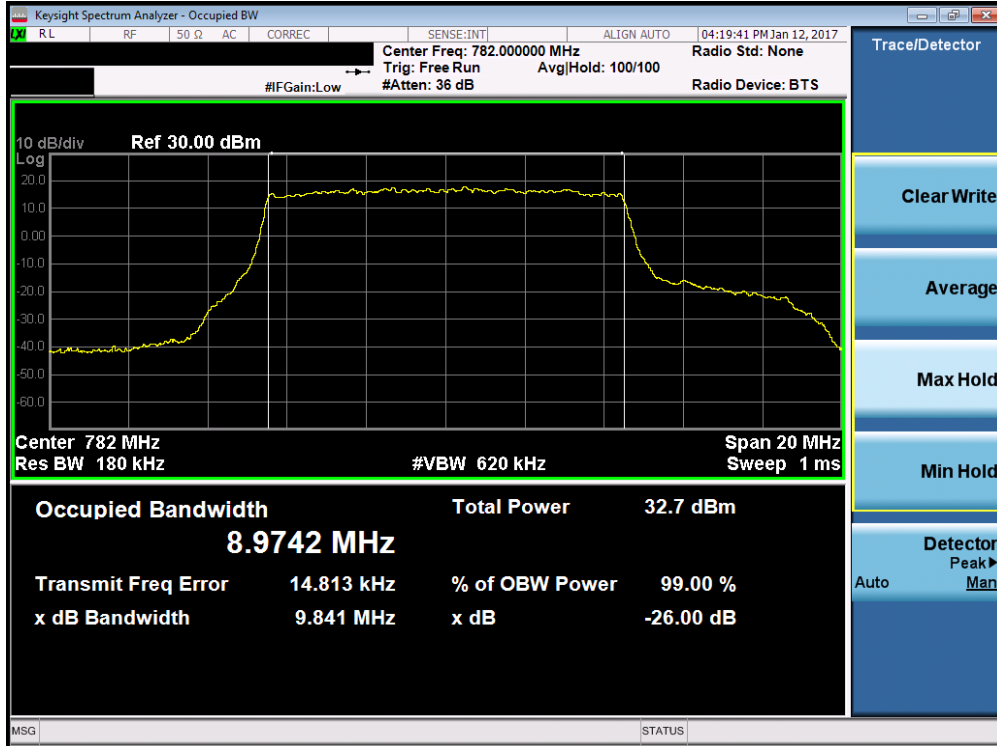


Plot 7-1. Occupied Bandwidth Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

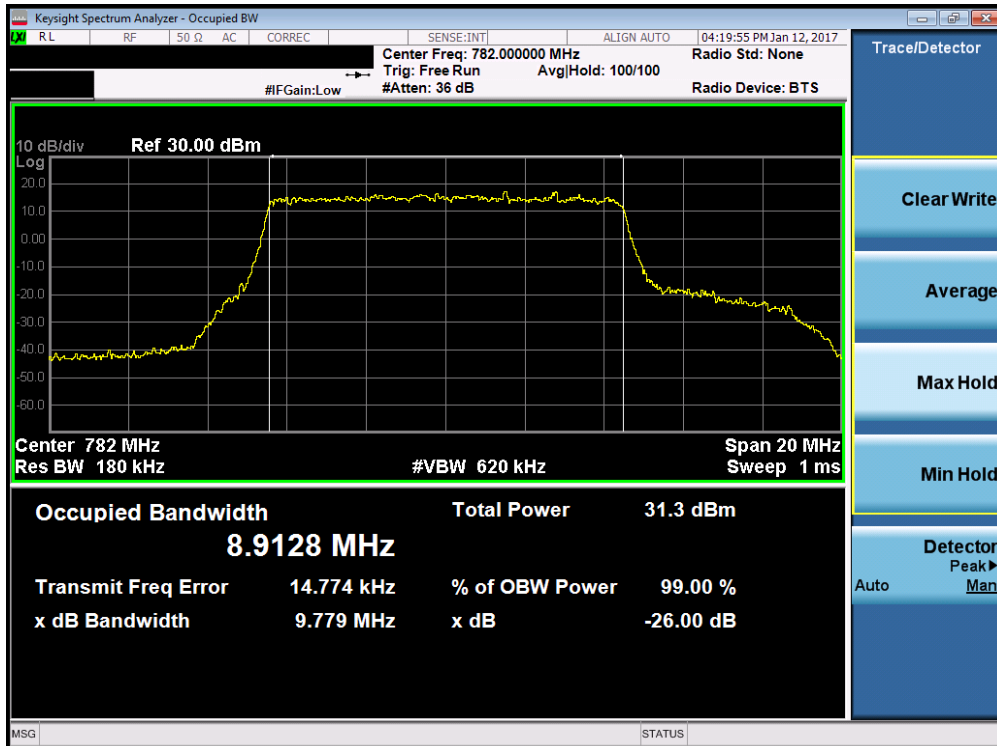


Plot 7-2. Occupied Bandwidth Plot (Band 13 – 5.0MHz 16-QAM – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 15 of 96

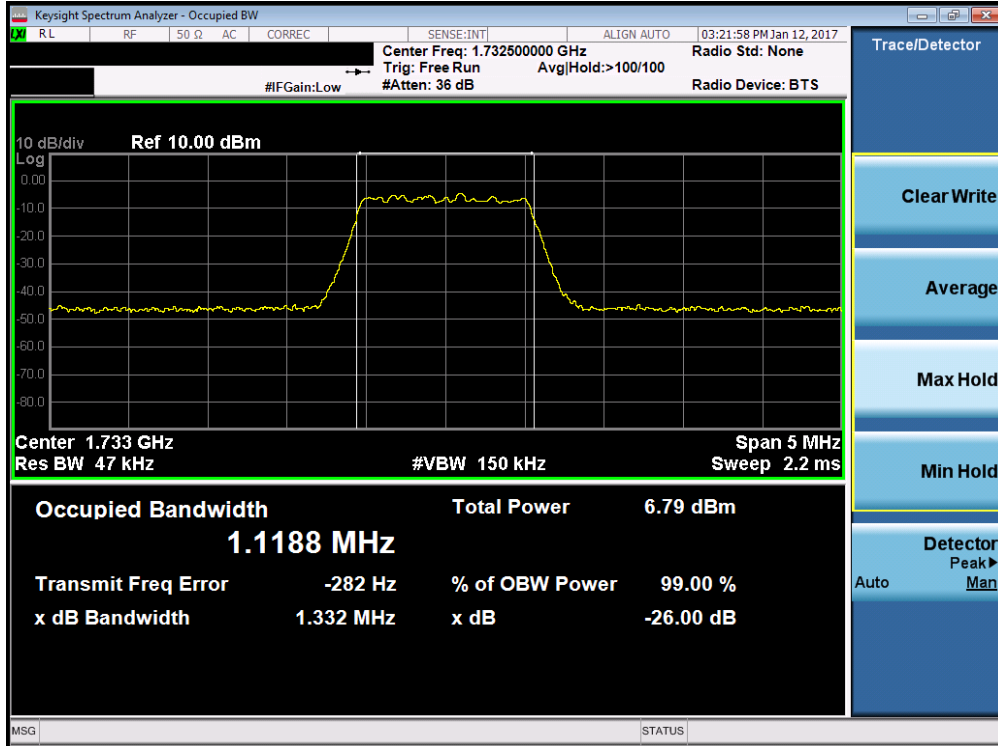


Plot 7-3. Occupied Bandwidth Plot (Band 13 – 10.0MHz QPSK – RB Size 50)

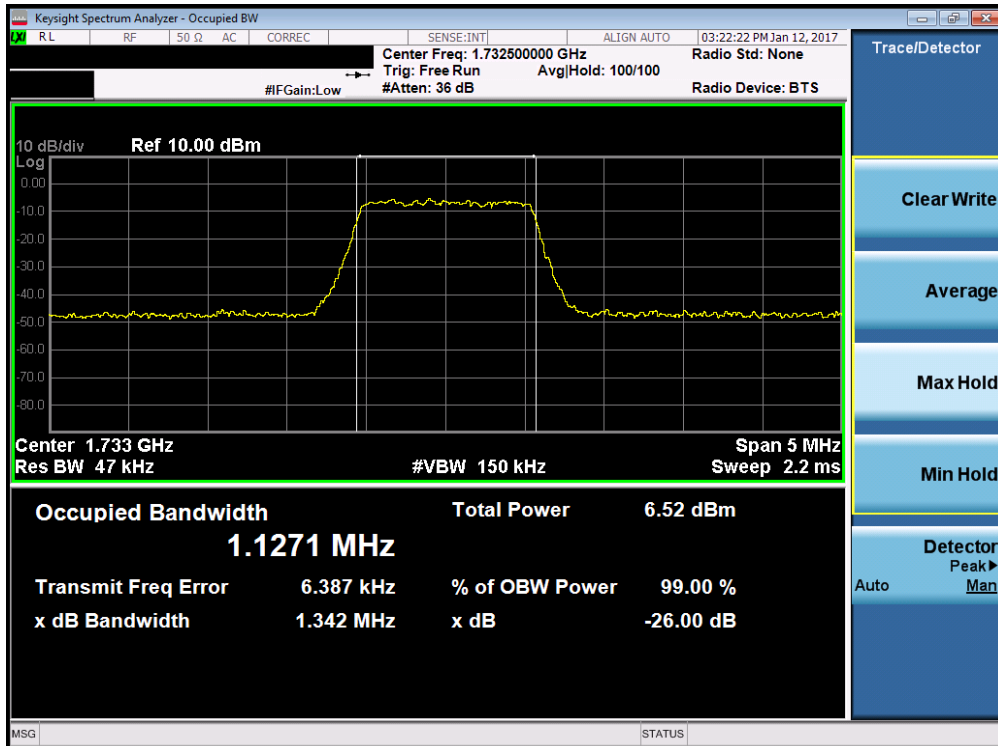


Plot 7-4. Occupied Bandwidth Plot (Band 13 – 10.0MHz 16-QAM – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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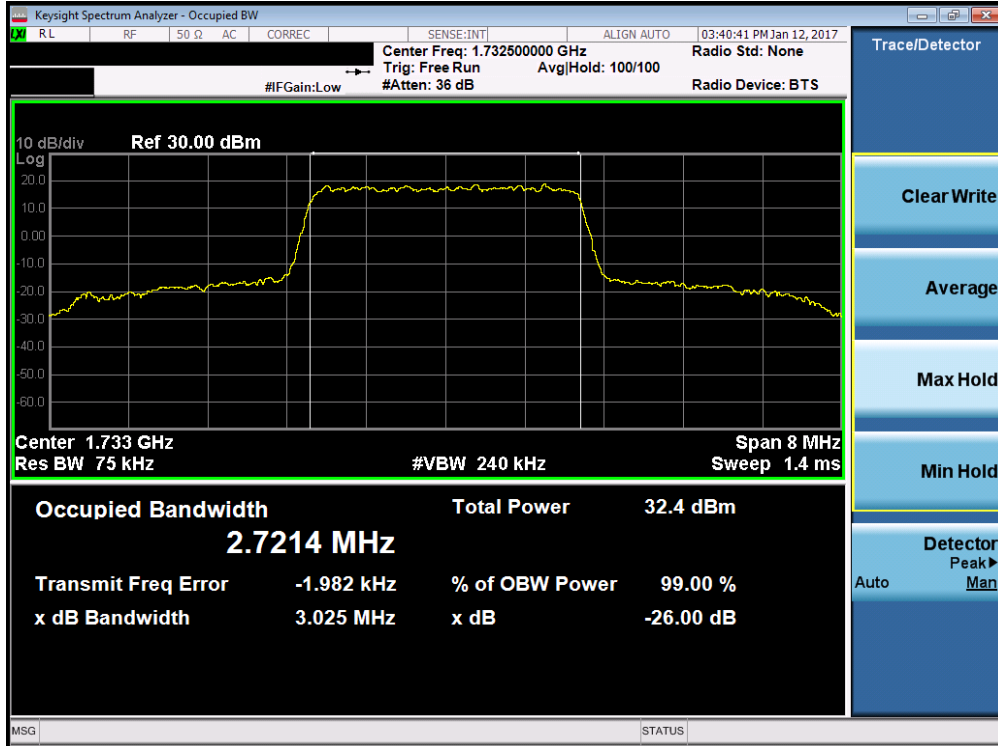


Plot 7-5. Occupied Bandwidth Plot (Band 4 – 1.4MHz QPSK – RB Size 6)

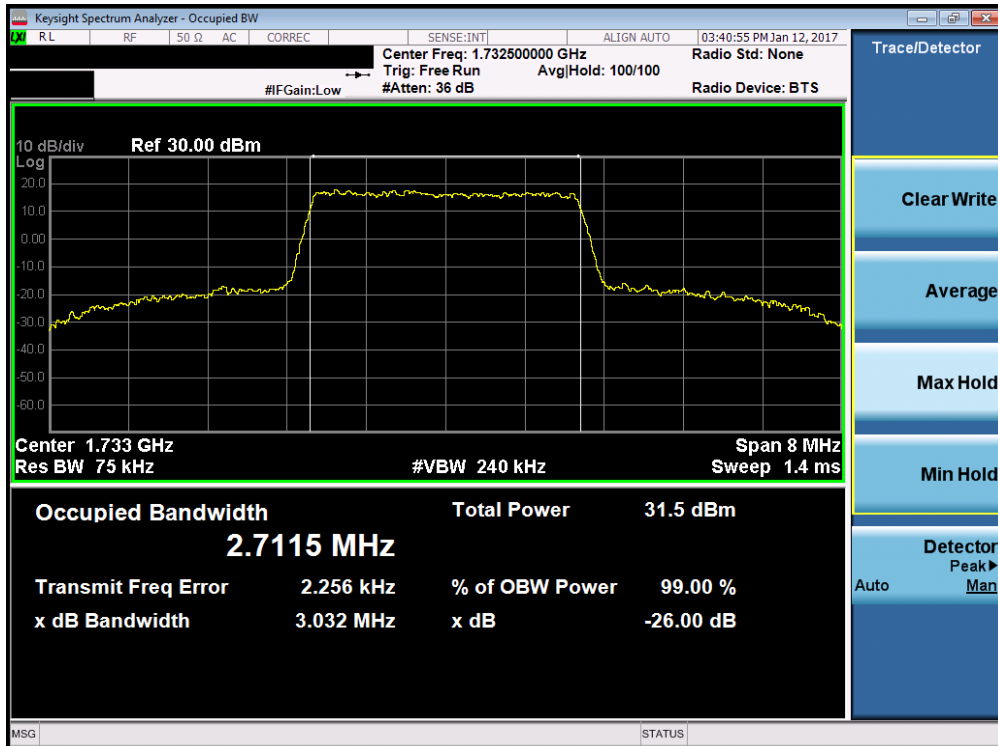


Plot 7-6. Occupied Bandwidth Plot (Band 4 – 1.4MHz 16-QAM – RB Size 6)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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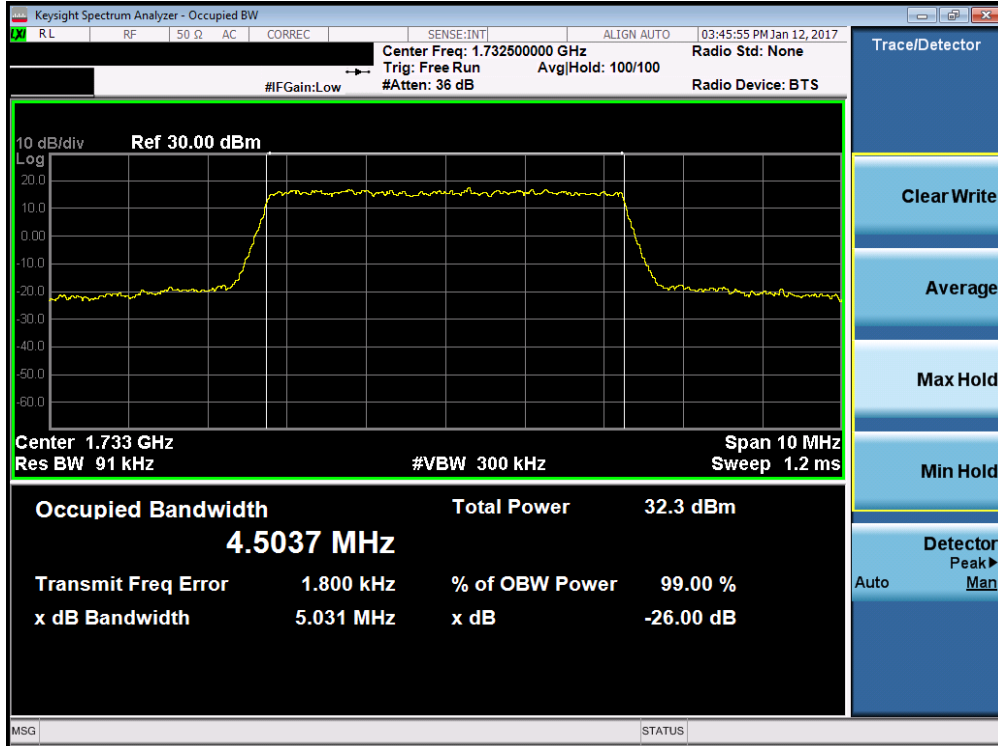


Plot 7-7. Occupied Bandwidth Plot (Band 4 – 3.0MHz QPSK – RB Size 15)

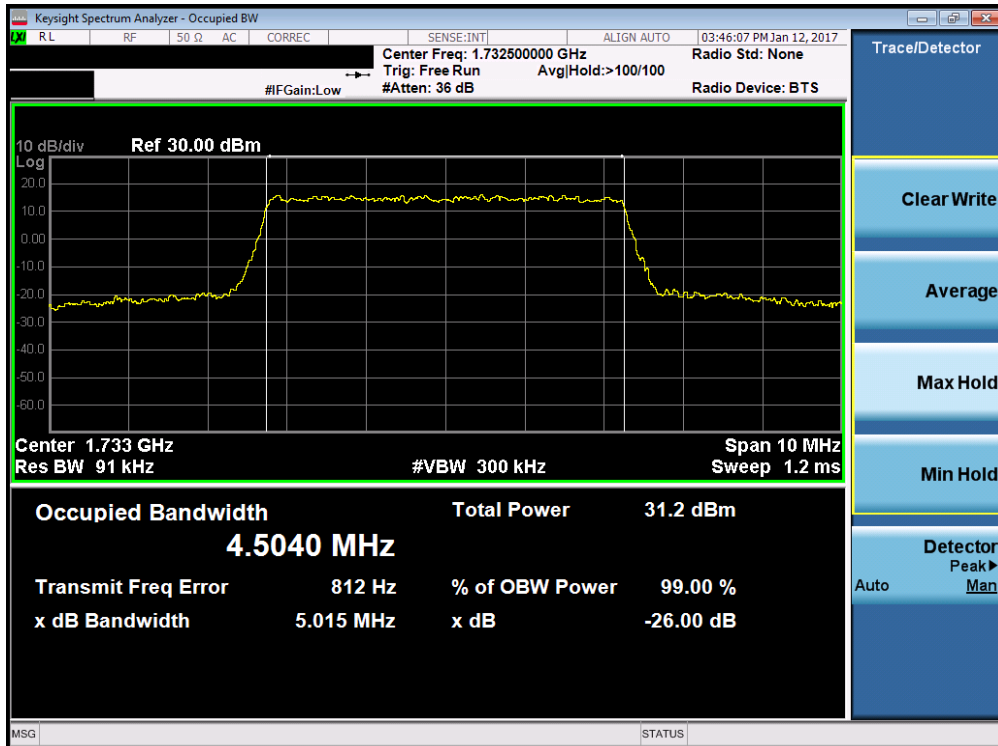


Plot 7-8. Occupied Bandwidth Plot (Band 4 – 3.0MHz 16-QAM – RB Size 15)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 18 of 96

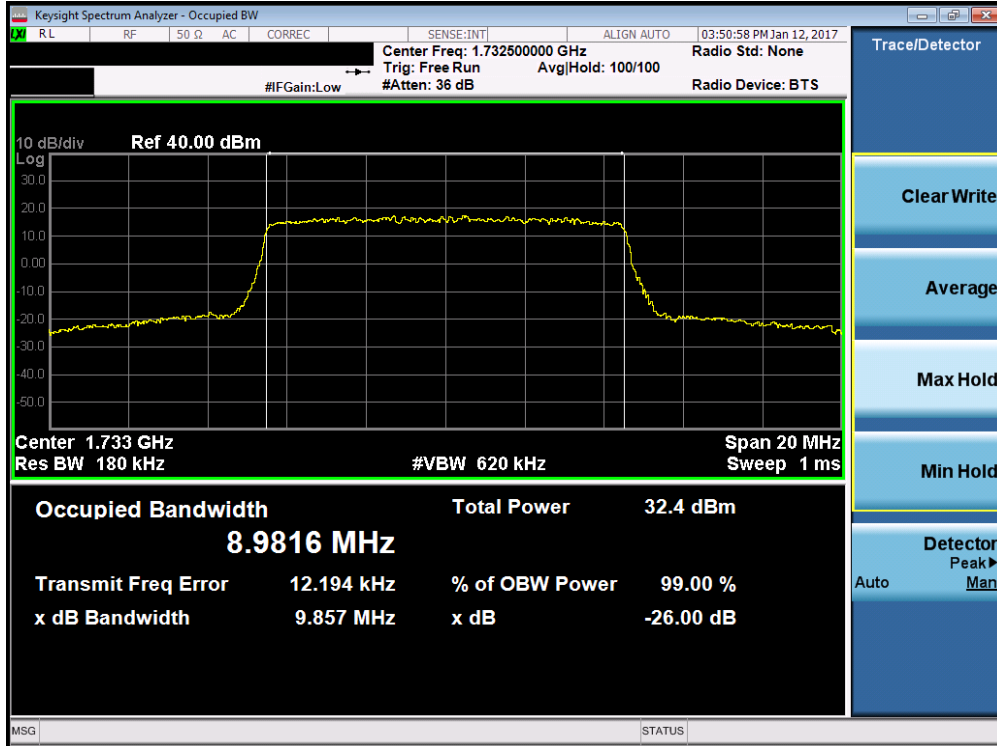


Plot 7-9. Occupied Bandwidth Plot (Band 4 – 5.0MHz QPSK – RB Size 25)

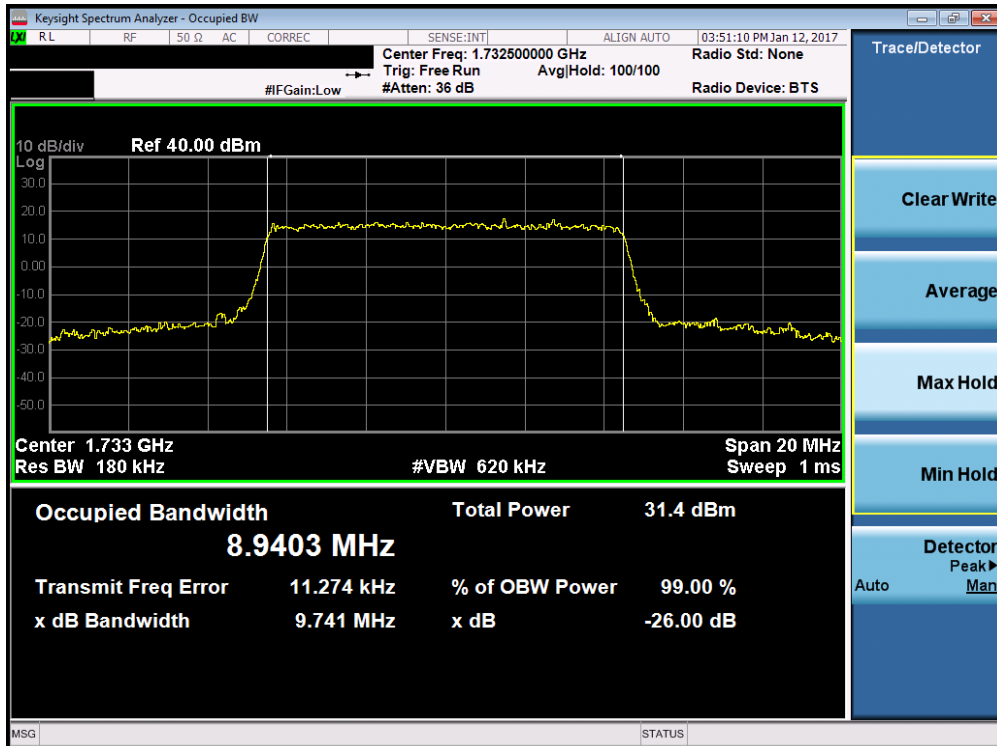


Plot 7-10. Occupied Bandwidth Plot (Band 4 – 5.0MHz 16-QAM – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Plot 7-11. Occupied Bandwidth Plot (Band 4 – 10.0MHz QPSK – RB Size 50)



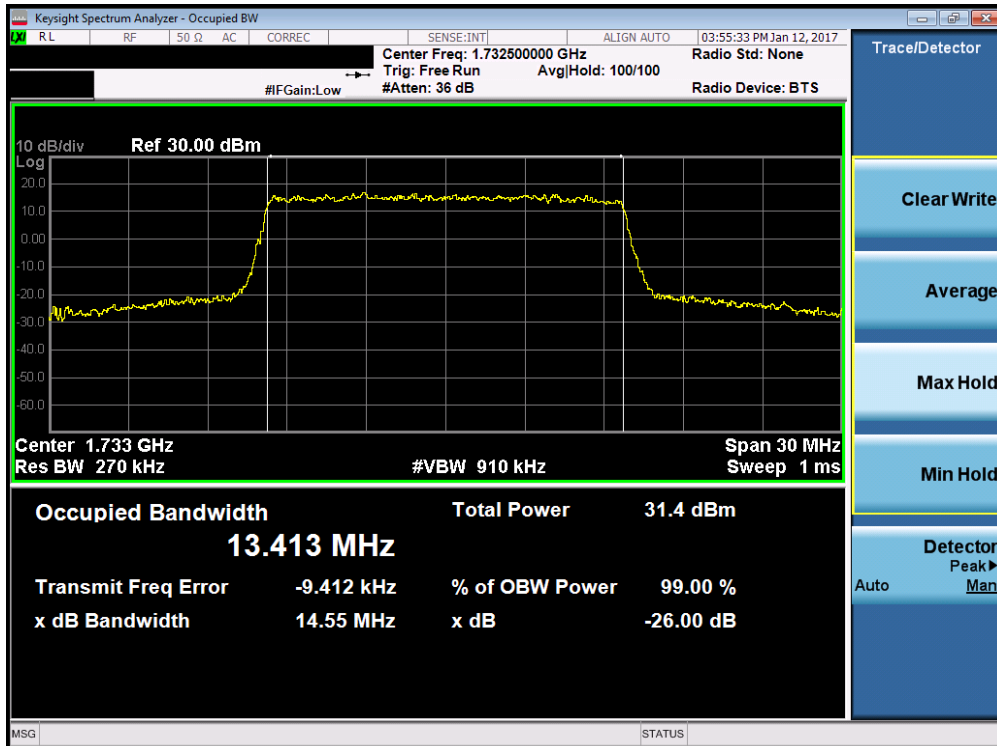
Plot 7-12. Occupied Bandwidth Plot (Band 4 – 10.0MHz 16-QAM – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 20 of 96



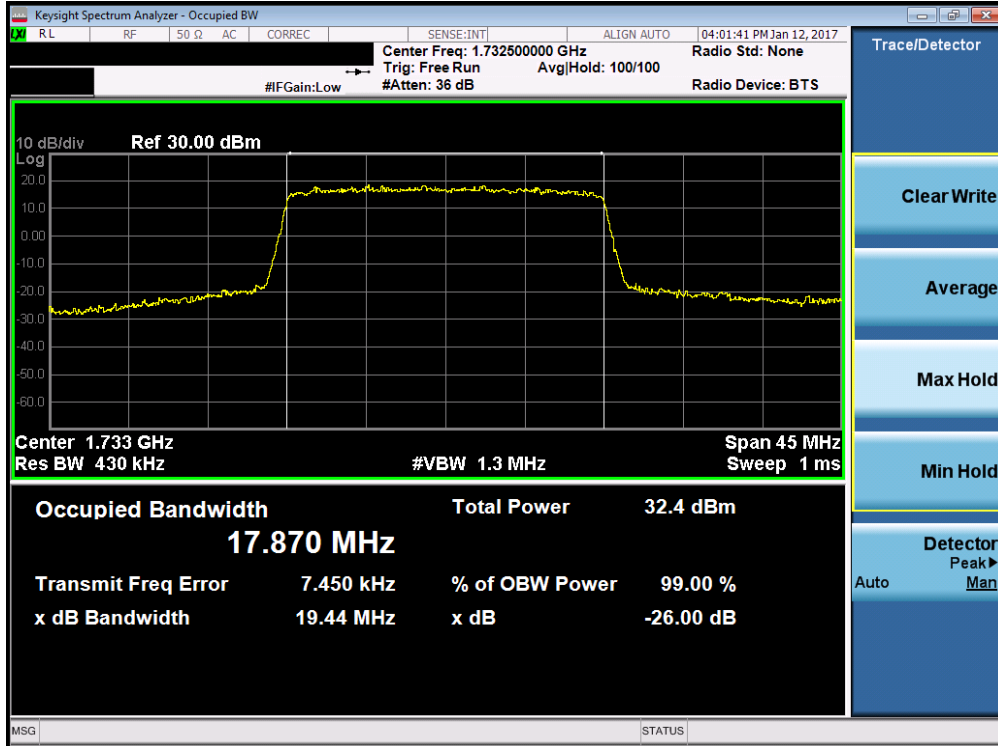


Plot 7-13. Occupied Bandwidth Plot (Band 4 – 15.0MHz QPSK – RB Size 75)

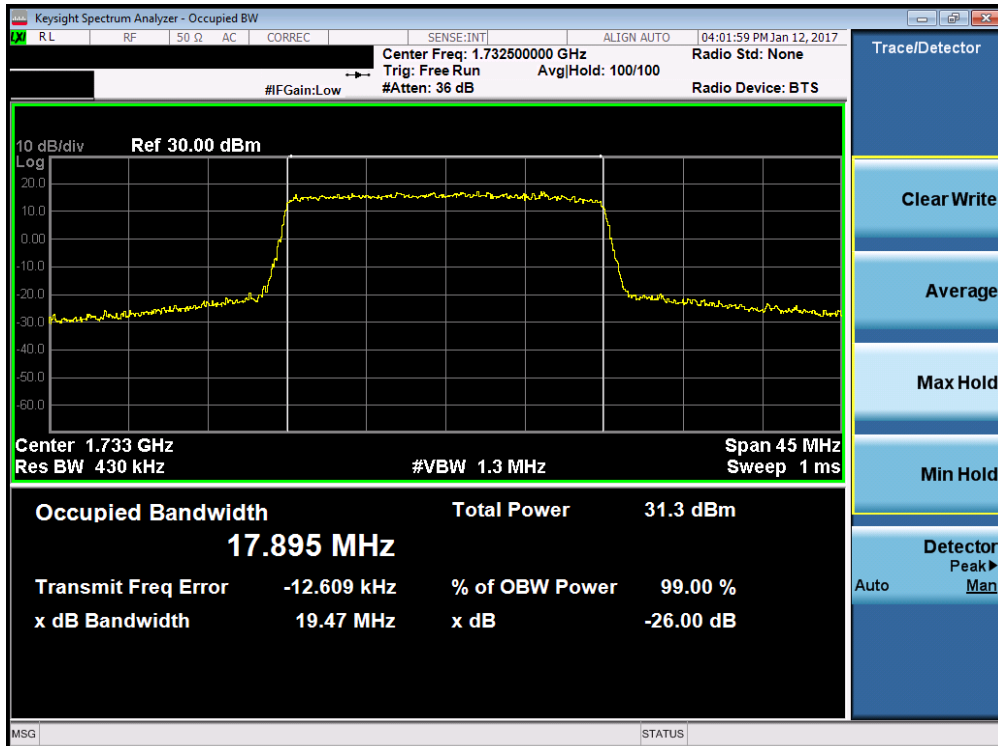


Plot 7-14. Occupied Bandwidth Plot (Band 4 – 15.0MHz 16-QAM – RB Size 75)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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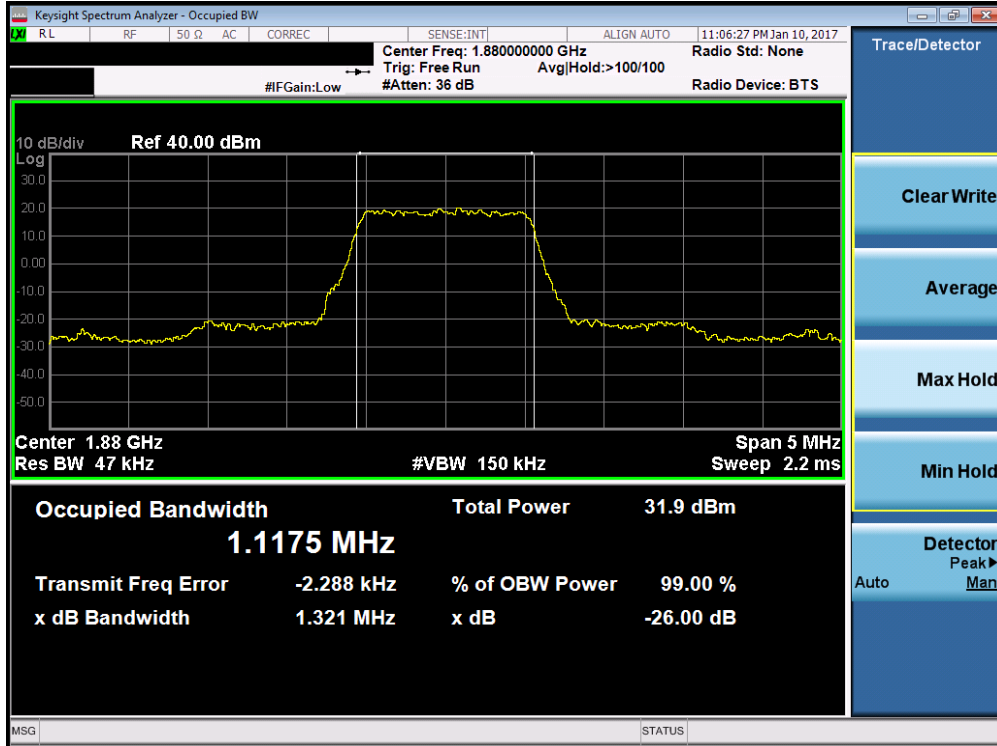


Plot 7-15. Occupied Bandwidth Plot (Band 4 – 20.0MHz QPSK – RB Size 100)

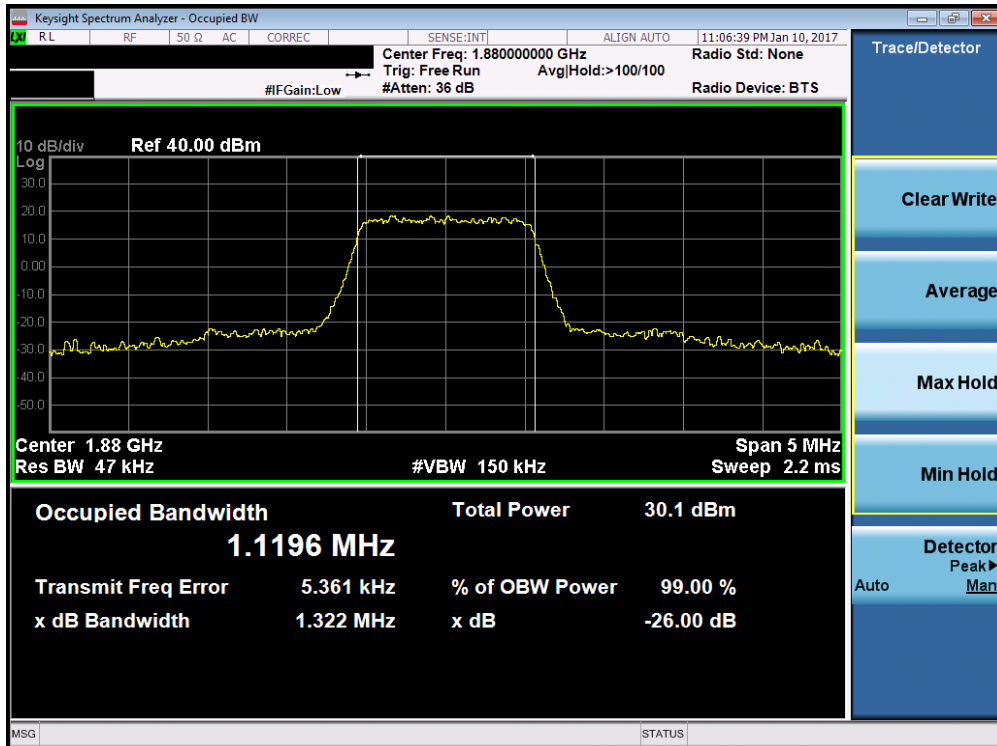


Plot 7-16. Occupied Bandwidth Plot (Band 4 – 20.0MHz 16-QAM – RB Size 100)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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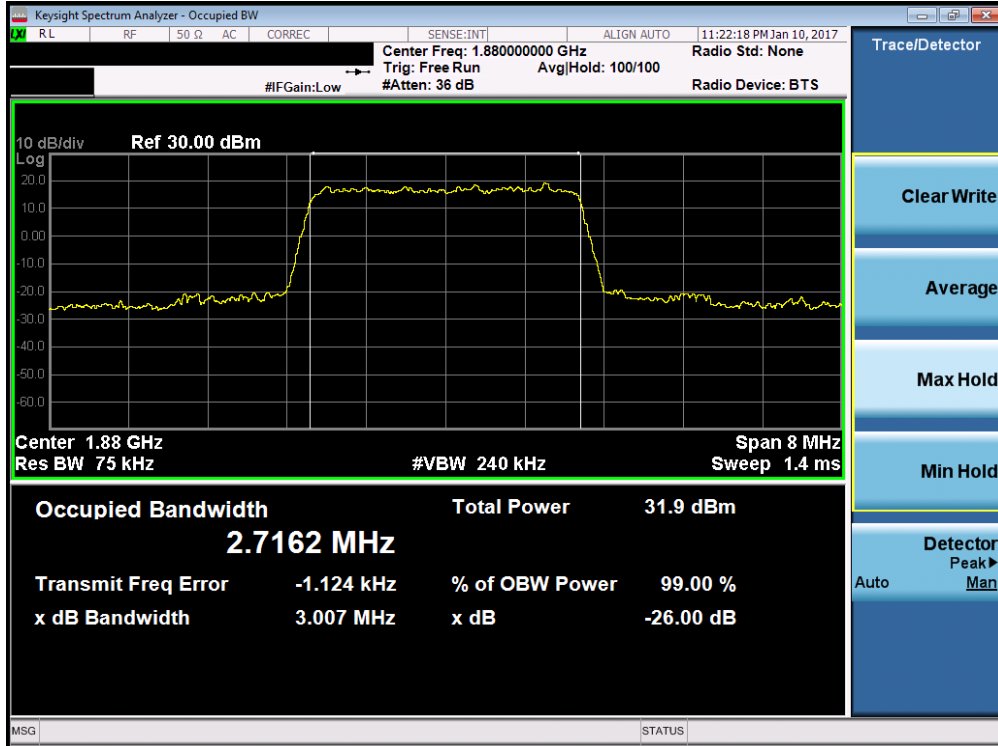


Plot 7-17. Occupied Bandwidth Plot (Band 2 – 1.4MHz QPSK – RB Size 6)

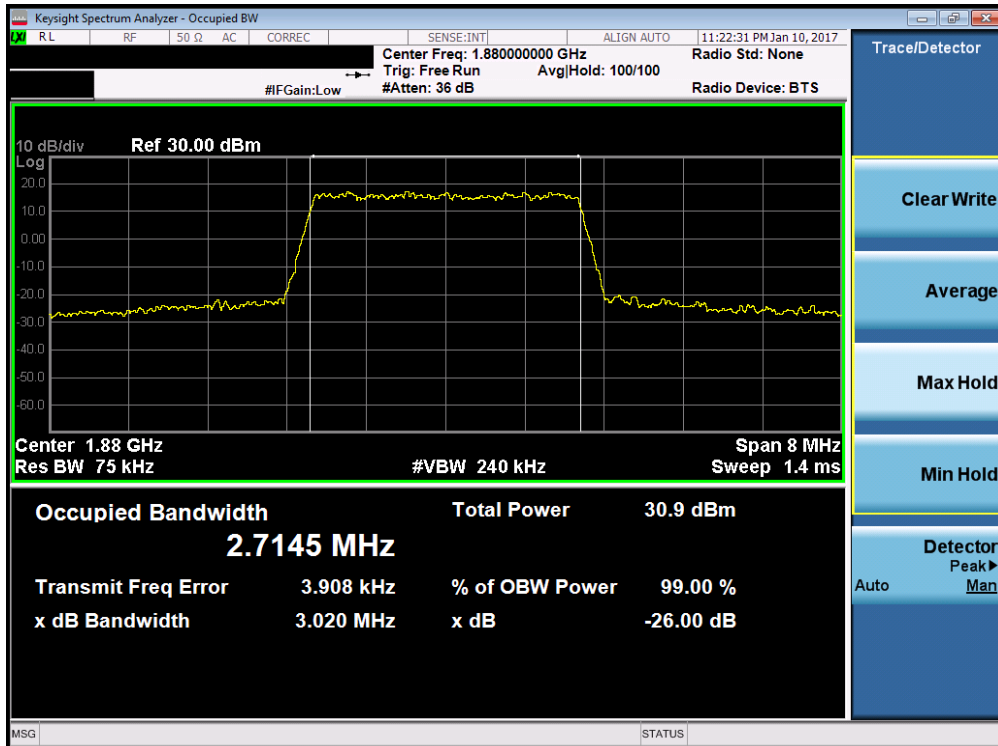


Plot 7-18. Occupied Bandwidth Plot (Band 2 – 1.4MHz 16-QAM – RB Size 6)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 23 of 96

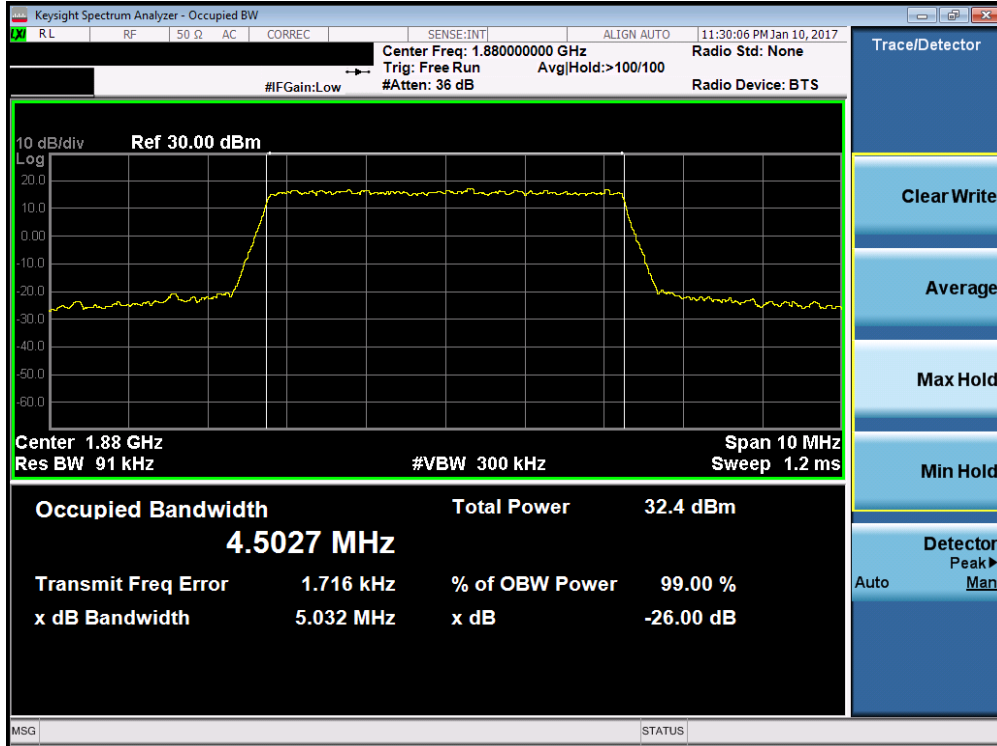


Plot 7-19. Occupied Bandwidth Plot (Band 2 – 3.0MHz QPSK – RB Size 15)

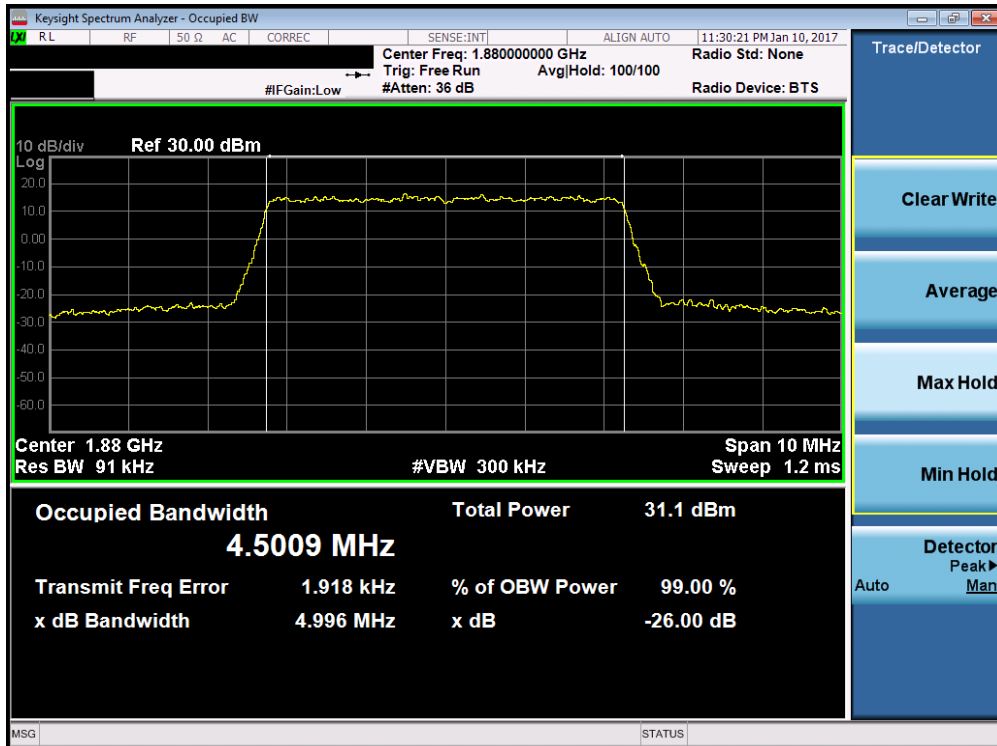


Plot 7-20. Occupied Bandwidth Plot (Band 2 – 3.0MHz 16-QAM – RB Size 15)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 24 of 96

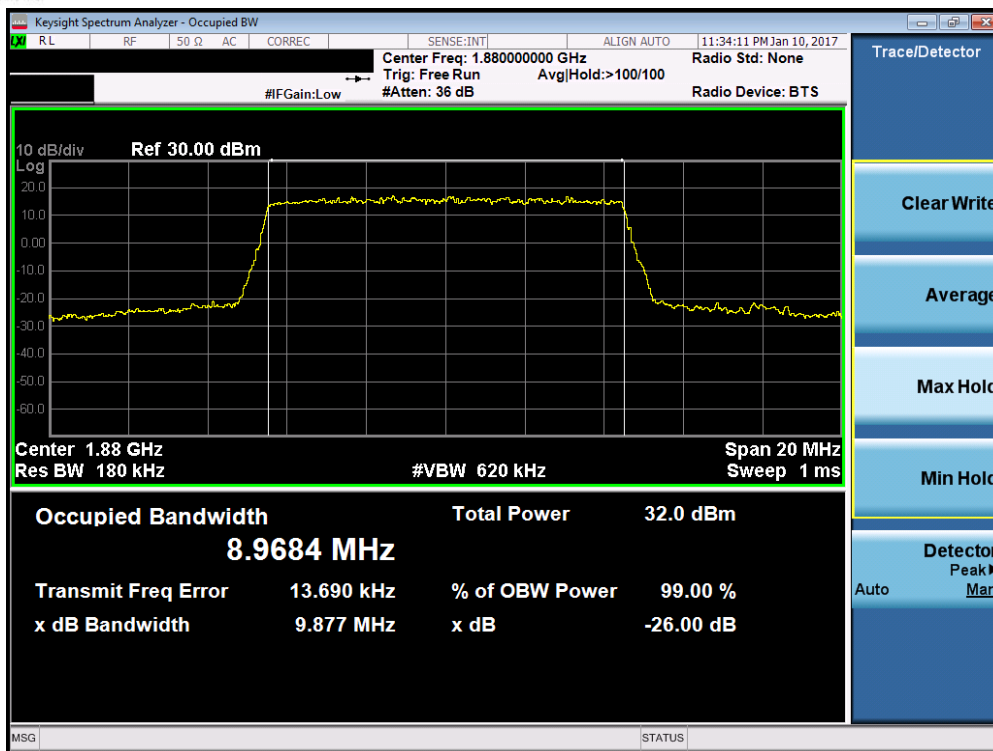


Plot 7-21. Occupied Bandwidth Plot (Band 2 – 5.0MHz QPSK – RB Size 25)

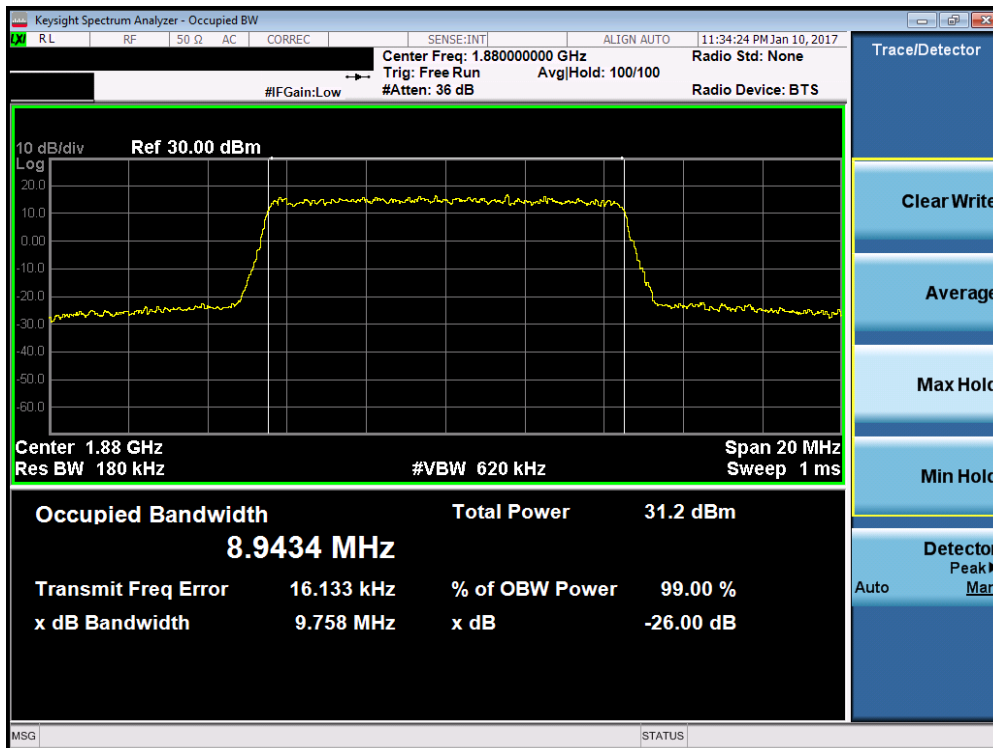


Plot 7-22. Occupied Bandwidth Plot (Band 2 – 5.0MHz 16-QAM – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 25 of 96



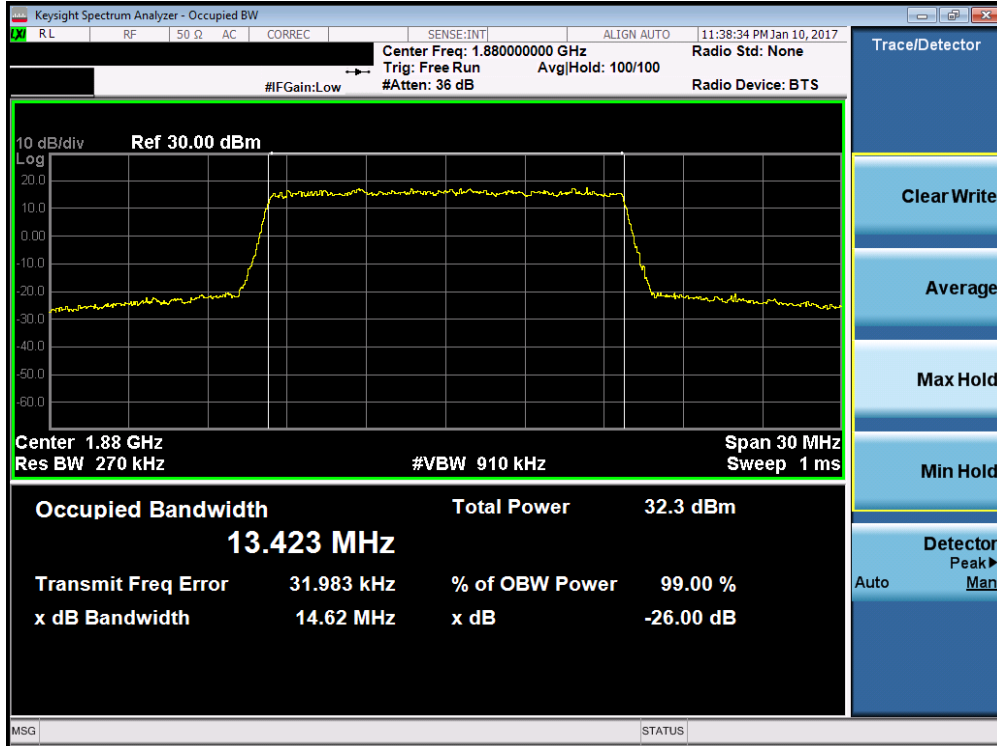
Plot 7-23. Occupied Bandwidth Plot (Band 2 – 10.0MHz QPSK – RB Size 50)



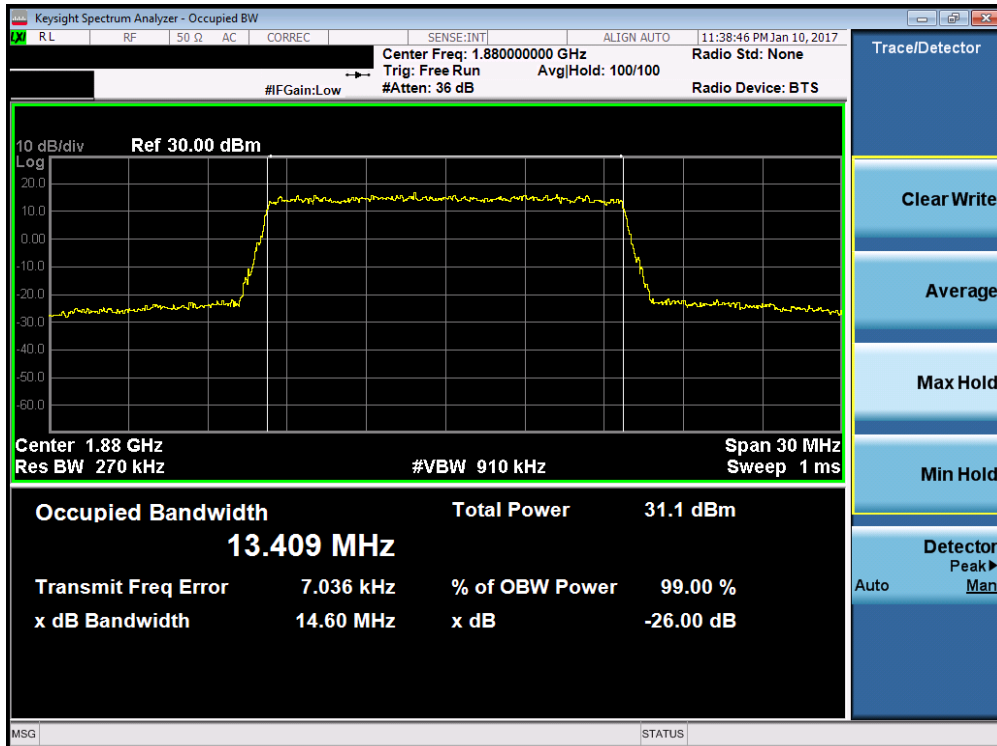
Plot 7-24. Occupied Bandwidth Plot (Band 2 – 10.0MHz 16-QAM – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 26 of 96



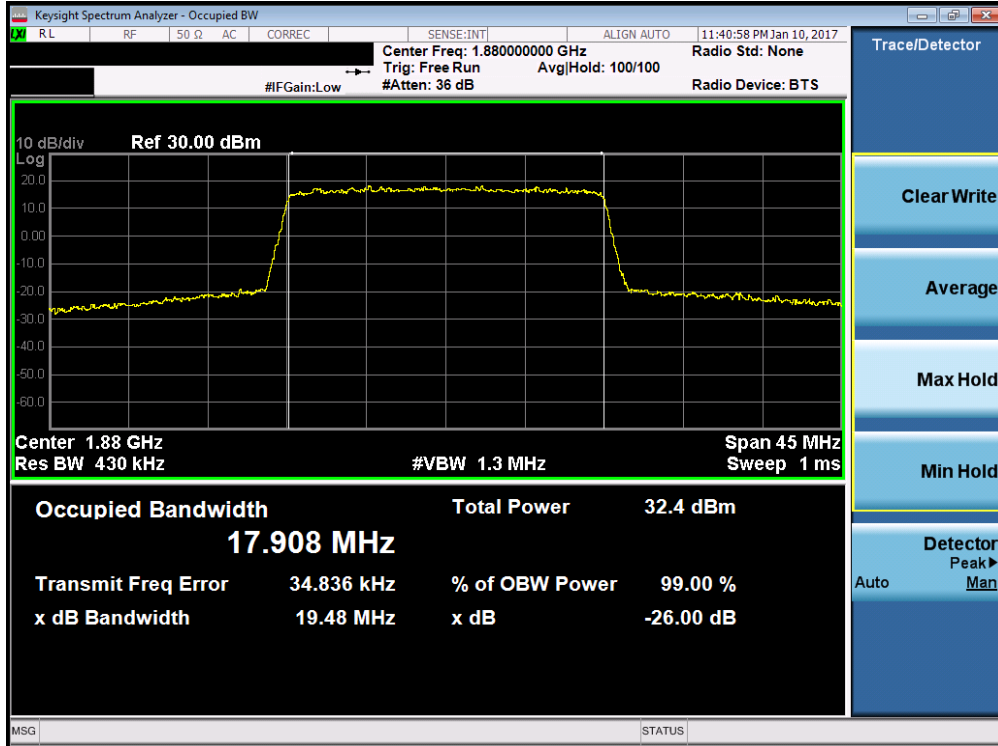


Plot 7-25. Occupied Bandwidth Plot (Band 2 – 15.0MHz QPSK – RB Size 75)

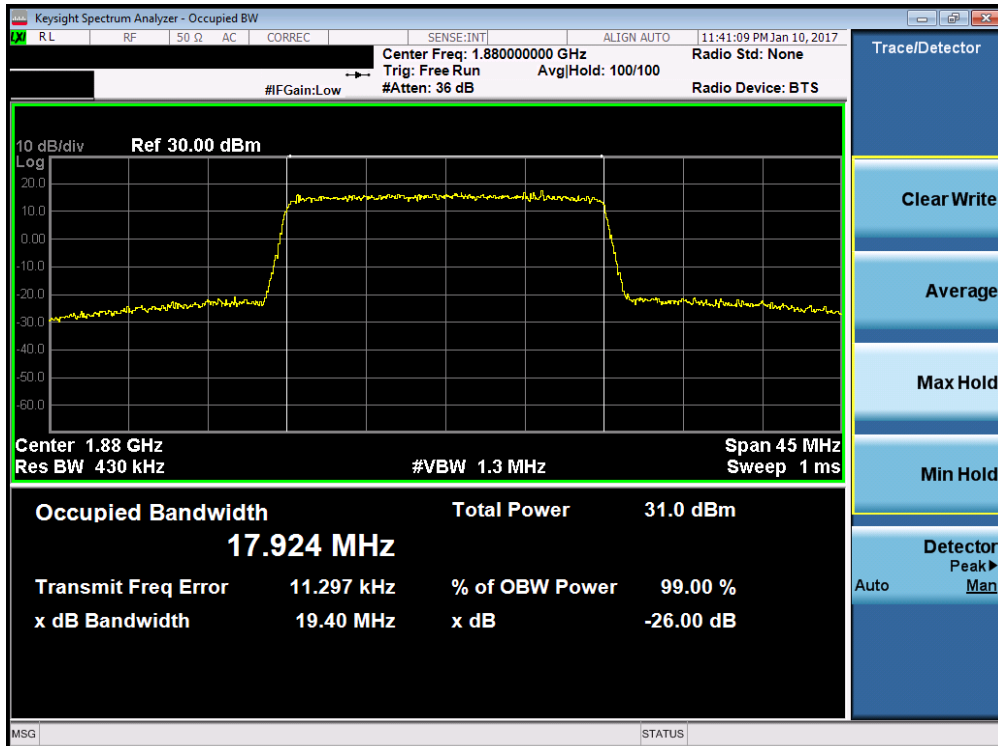


Plot 7-26. Occupied Bandwidth Plot (Band 2 – 15.0MHz 16-QAM – RB Size 75)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Plot 7-27. Occupied Bandwidth Plot (Band 2 – 20.0MHz QPSK – RB Size 100)



Plot 7-28. Occupied Bandwidth Plot (Band 2 – 20.0MHz 16-QAM – RB Size 100)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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### 7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §24.238(a) §27.53(c.2) §27.53(h)

#### 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 10<sup>th</sup> 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.

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

#### Test Procedure Used

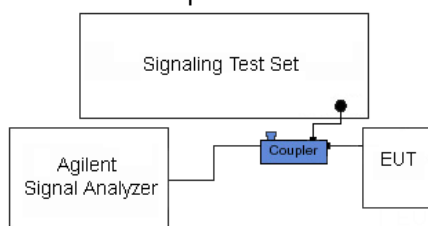
KDB 971168 D01 v02r02 – Section 6.0

#### 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
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.

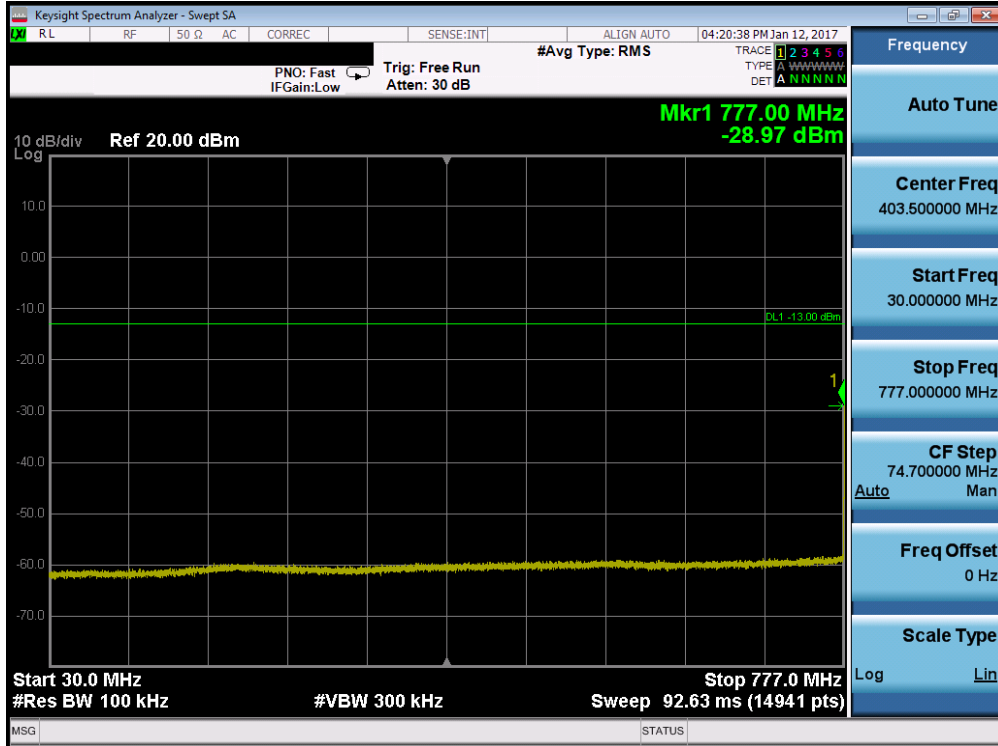


**Figure 7-2. Test Instrument & Measurement Setup**

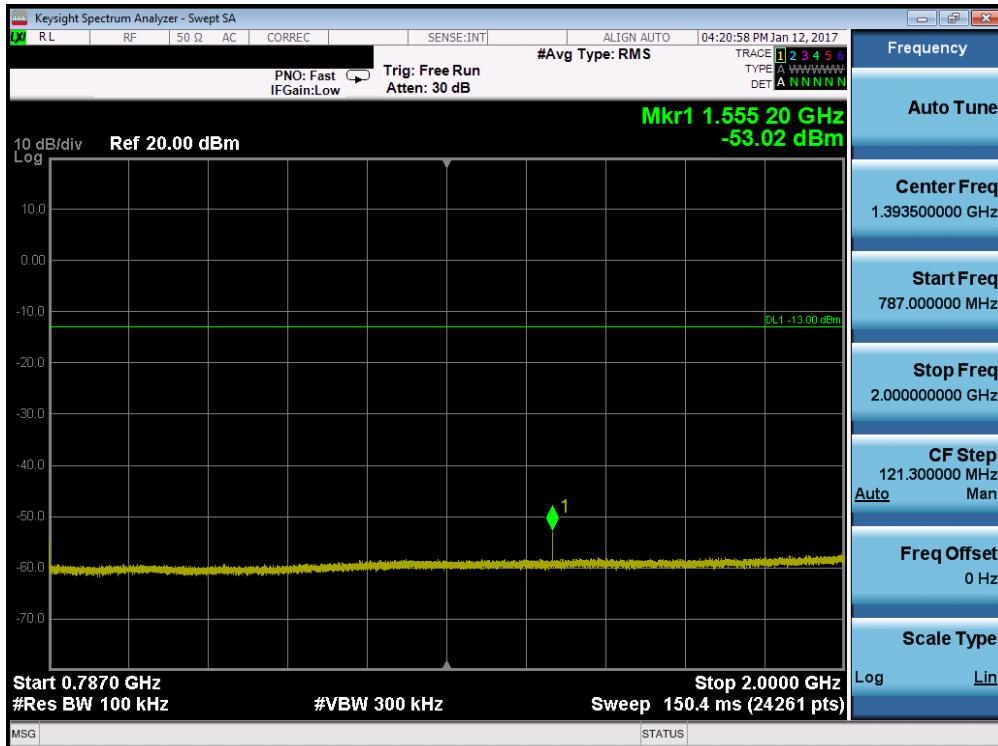
#### Test Notes

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. 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.

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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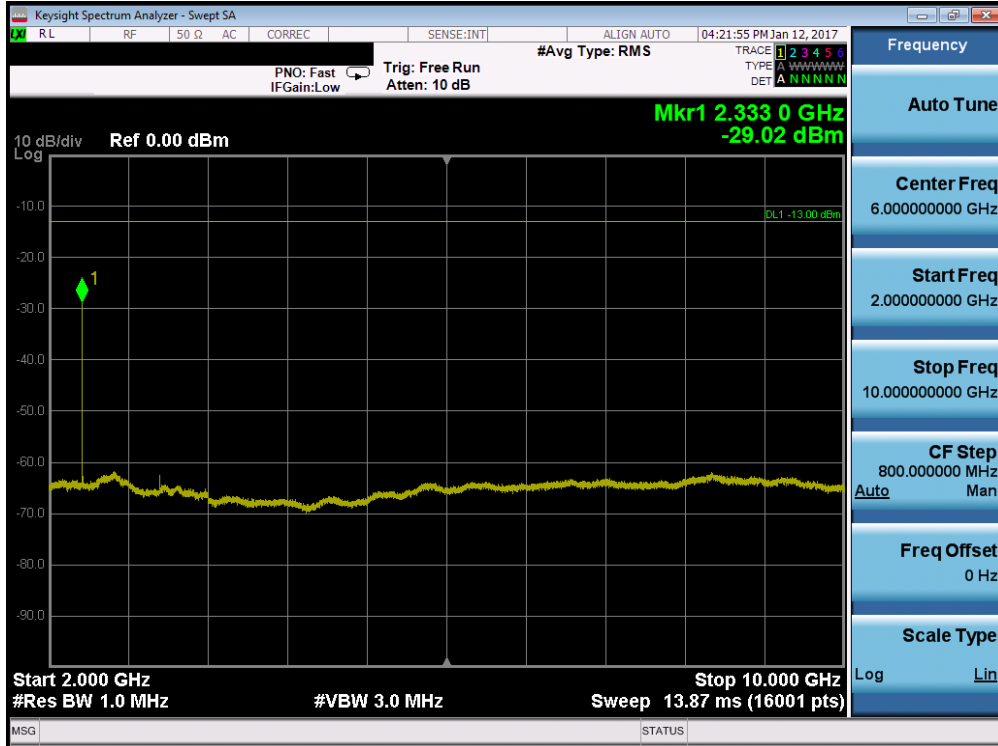


Plot 7-29. Conducted Spurious Plot (Band 13 – 10.0MHz QPSK – RB Size 1, RB Offset 0)

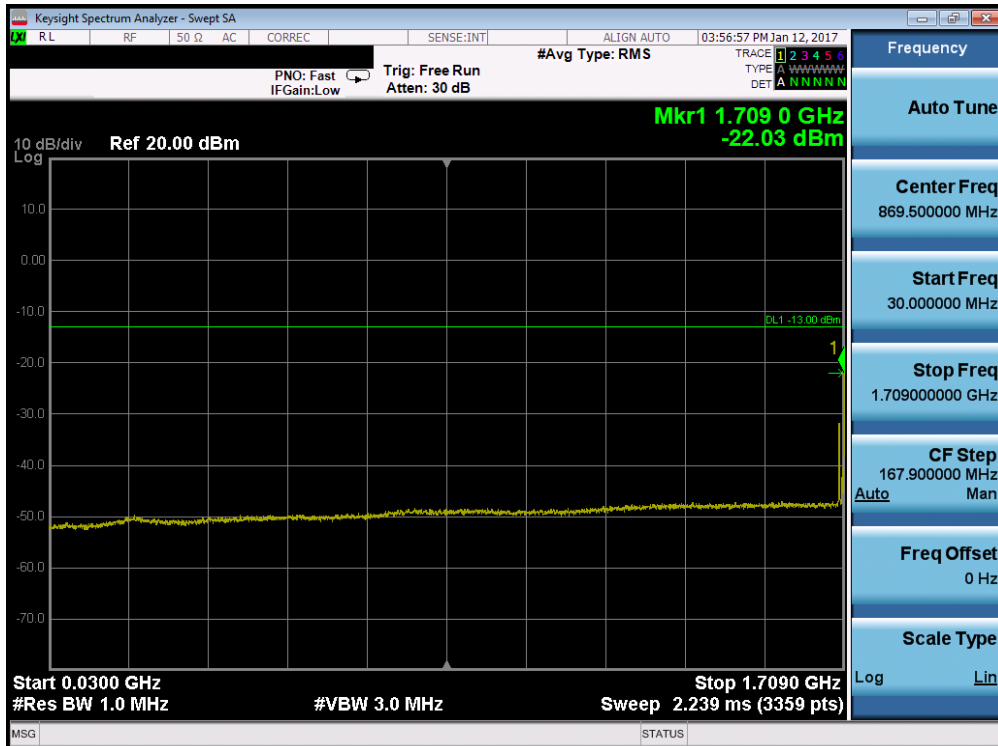


Plot 7-30. Conducted Spurious Plot (Band 13 – 10.0MHz QPSK – RB Size 1, RB Offset 0)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 30 of 96

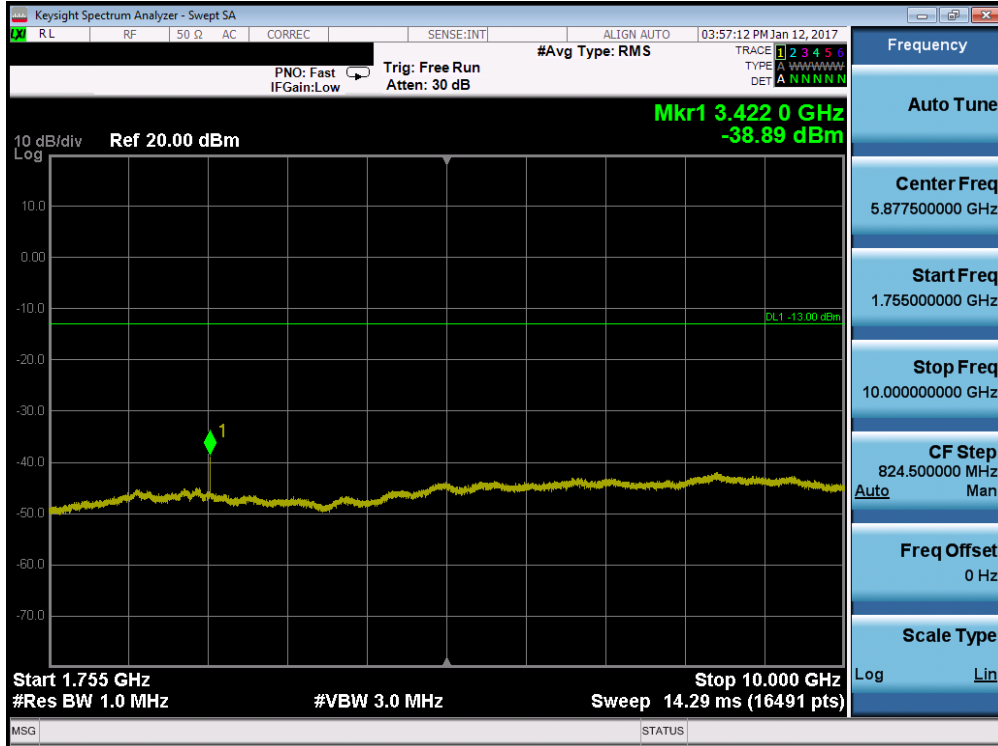


Plot 7-31. Conducted Spurious Plot (Band 13 – 10.0MHz QPSK – RB Size 1, RB Offset 0)

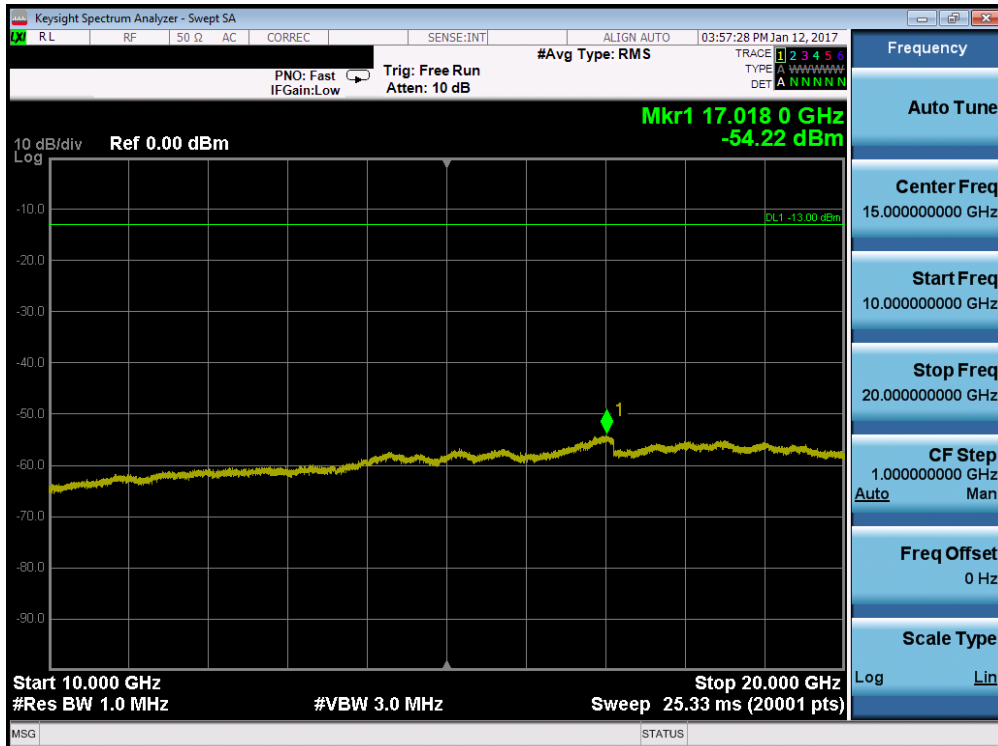


Plot 7-32. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 31 of 96

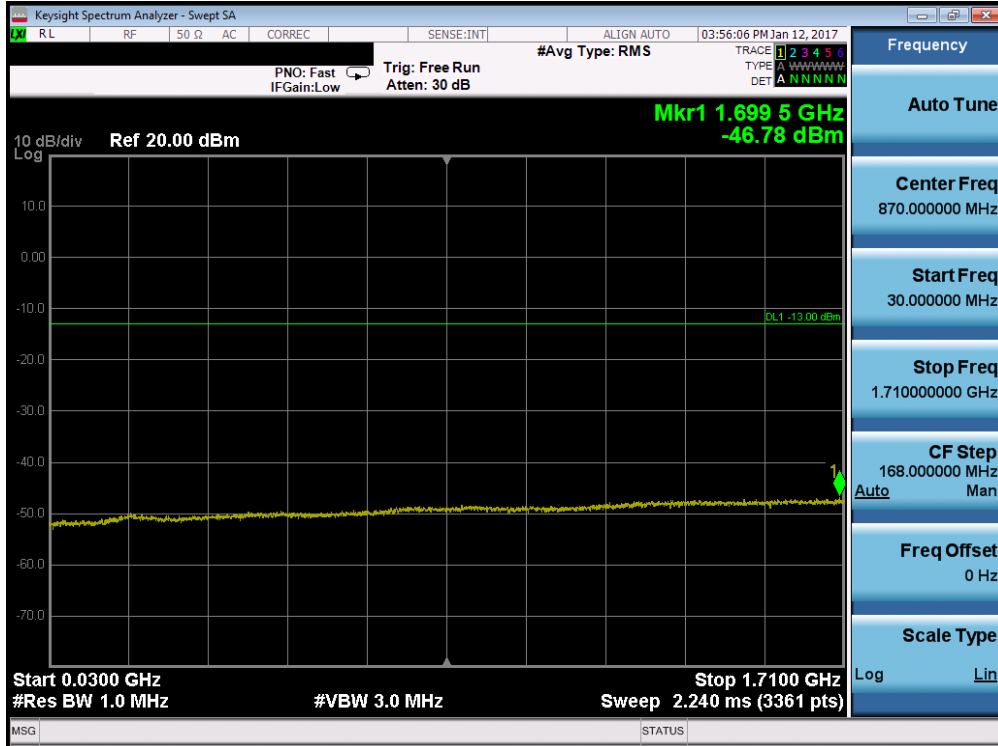


Plot 7-33. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

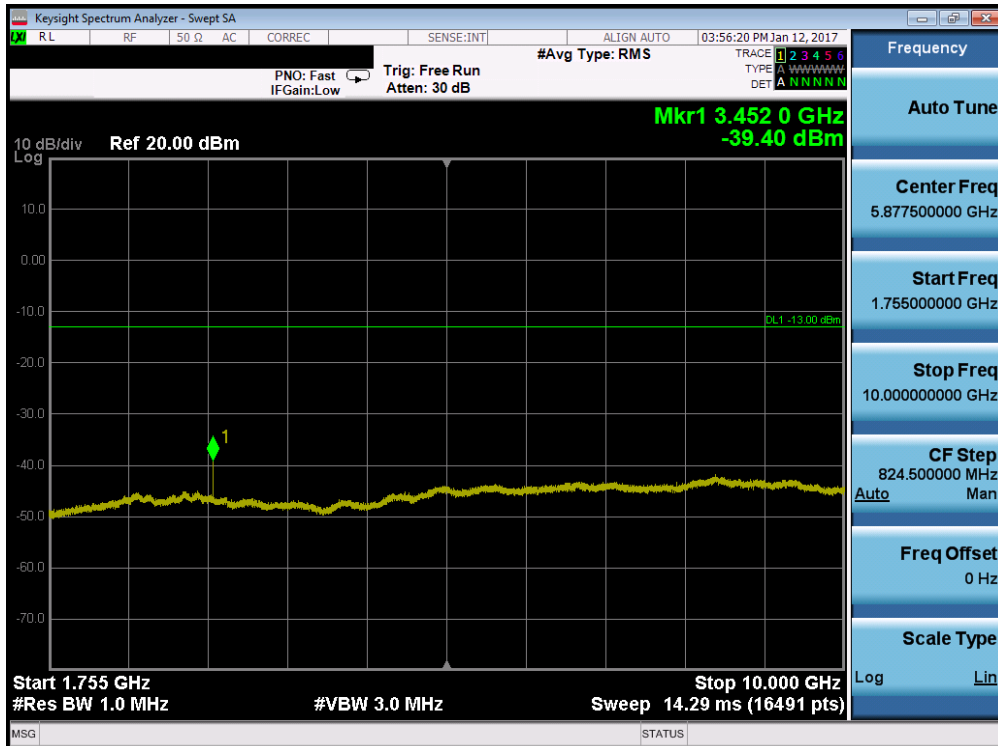


Plot 7-34. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 32 of 96



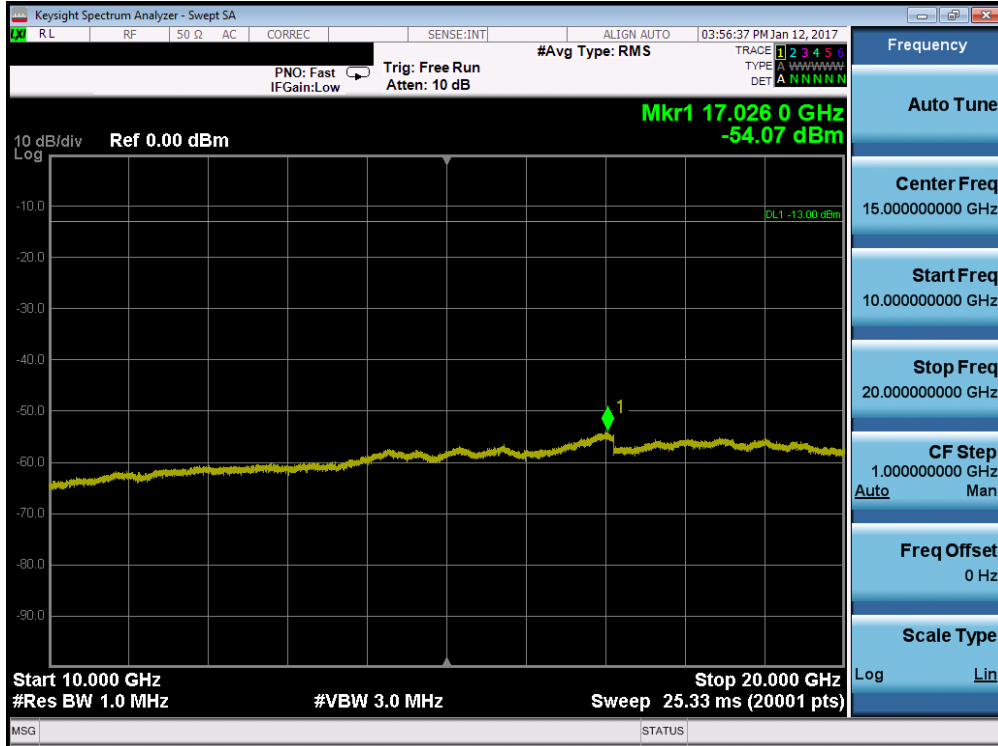
Plot 7-35. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



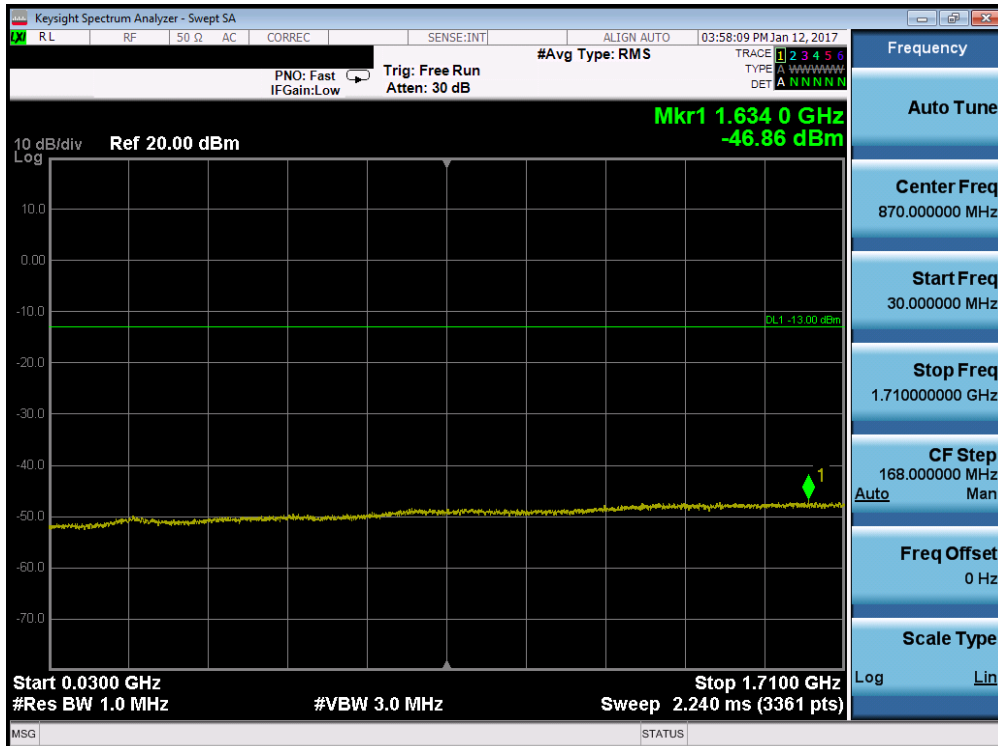
Plot 7-36. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 33 of 96



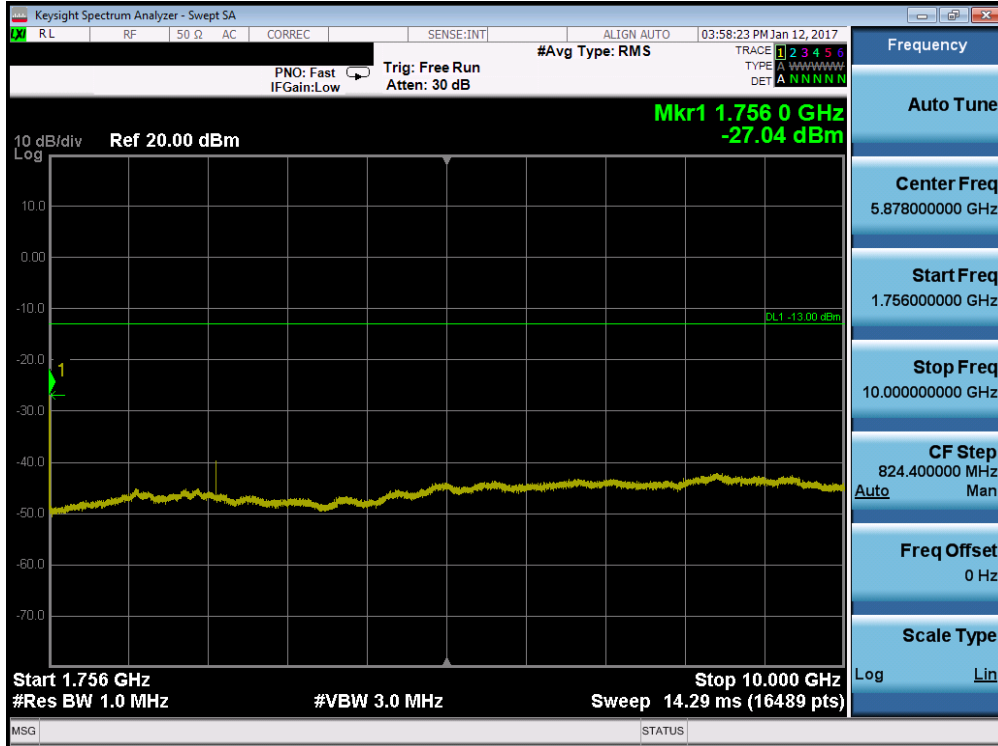


Plot 7-37. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

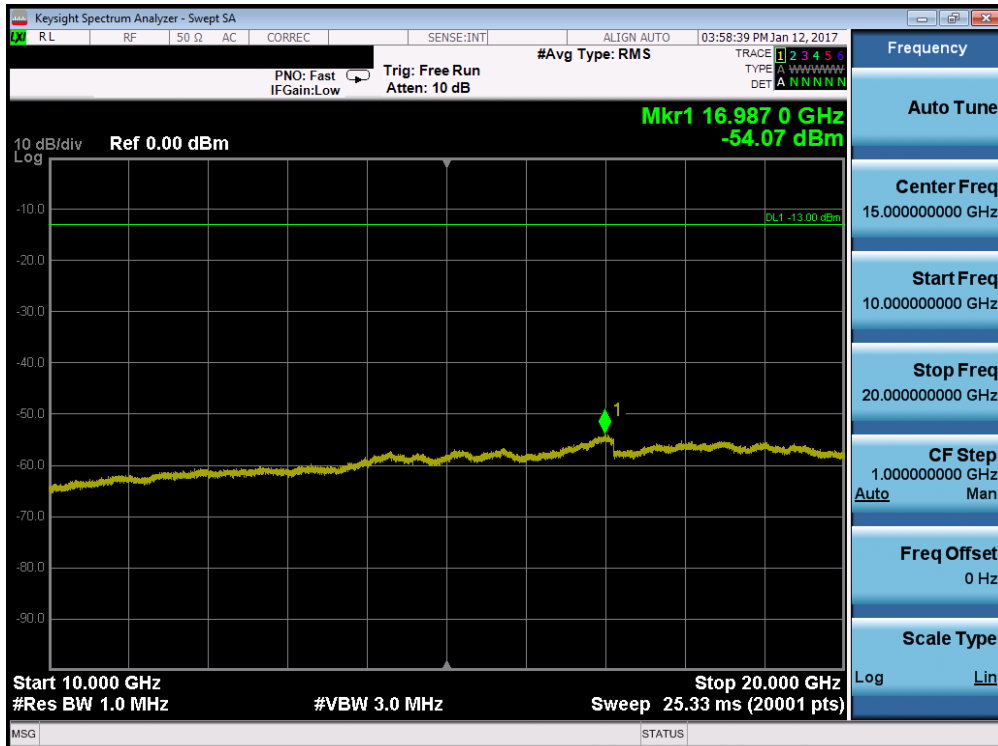


Plot 7-38. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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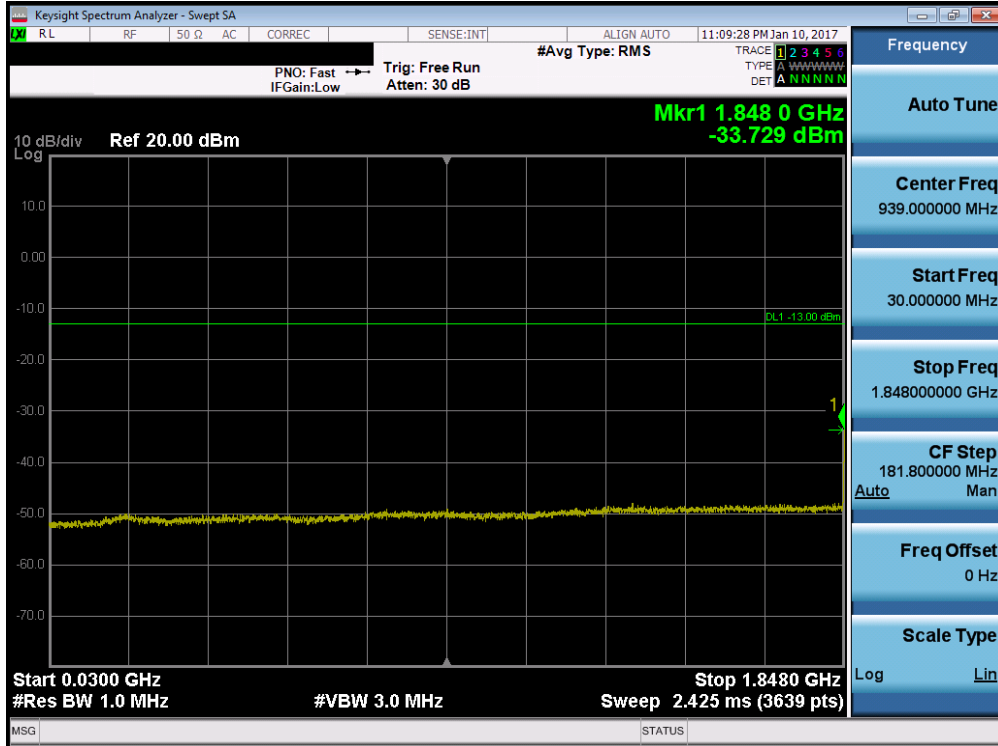


Plot 7-39. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

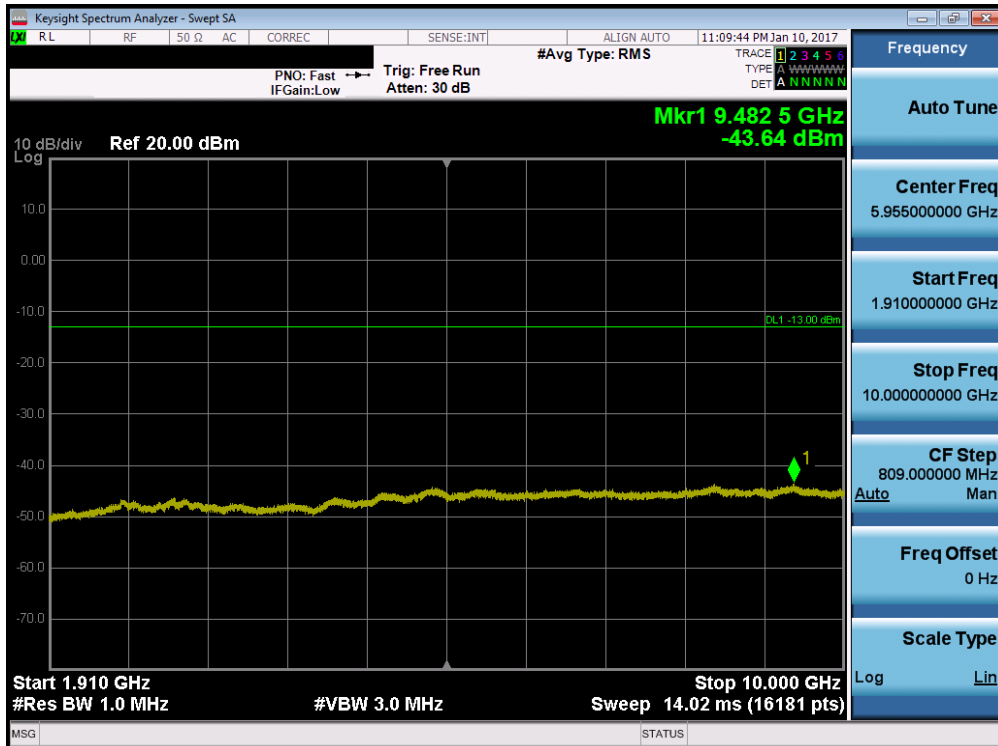


Plot 7-40. Conducted Spurious Plot (Band 4 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 35 of 96

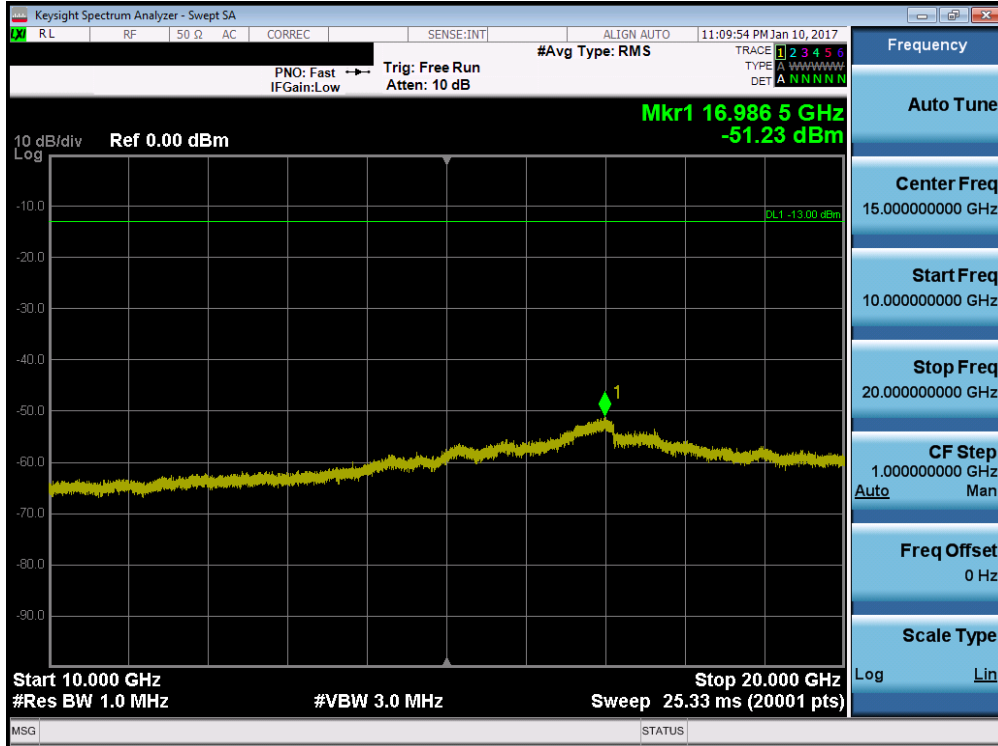


Plot 7-41. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

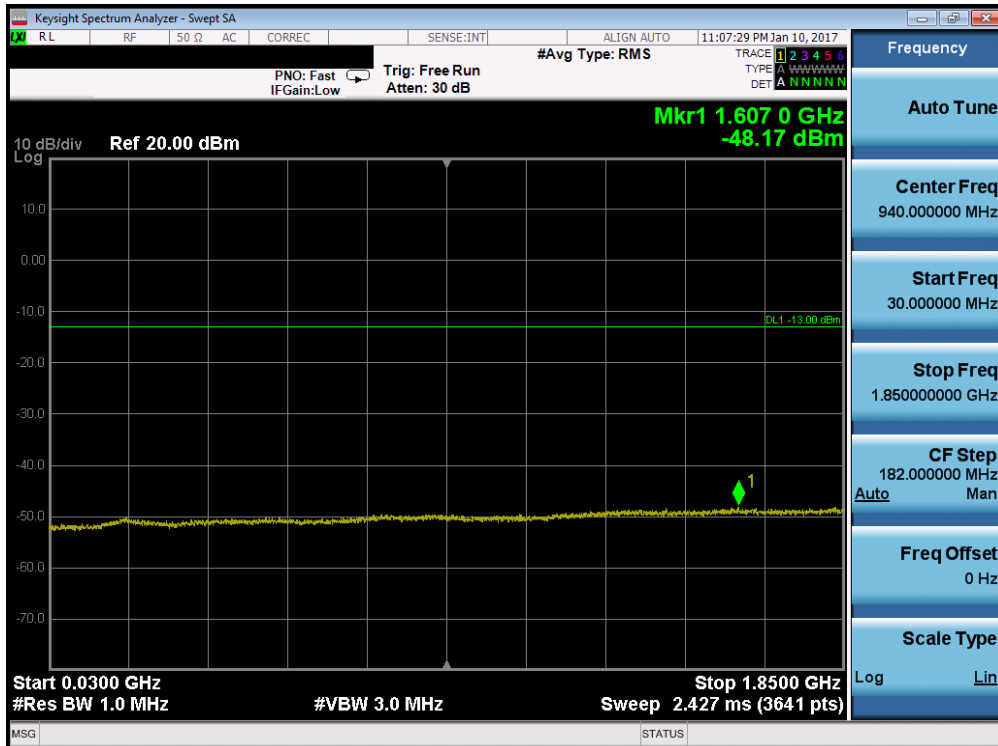


Plot 7-42. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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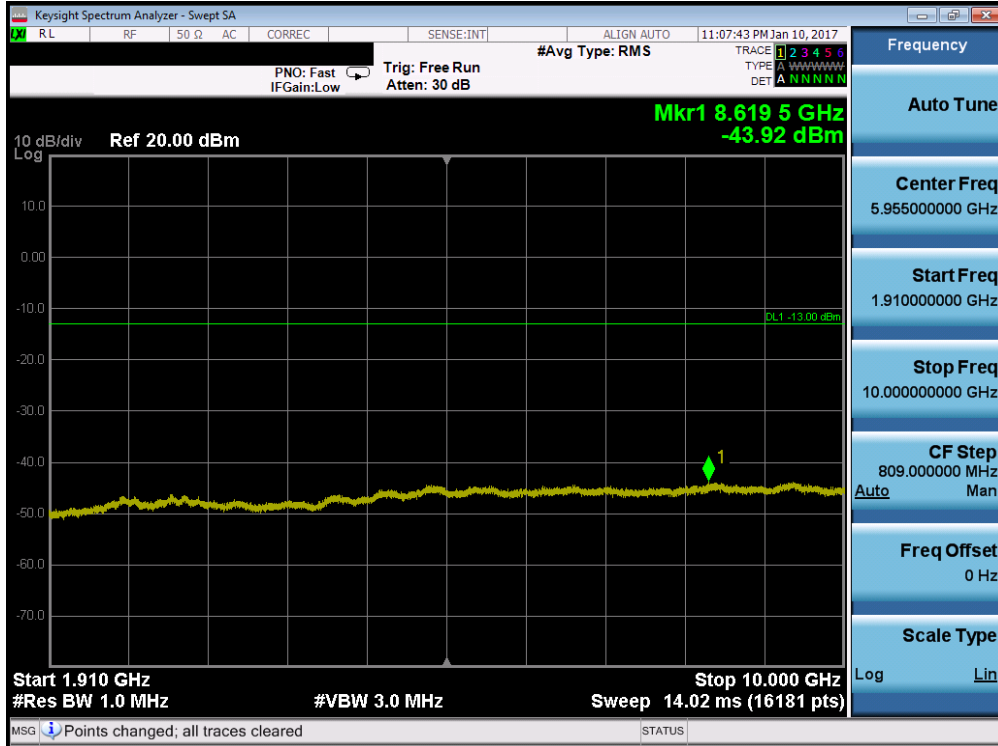


Plot 7-43. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

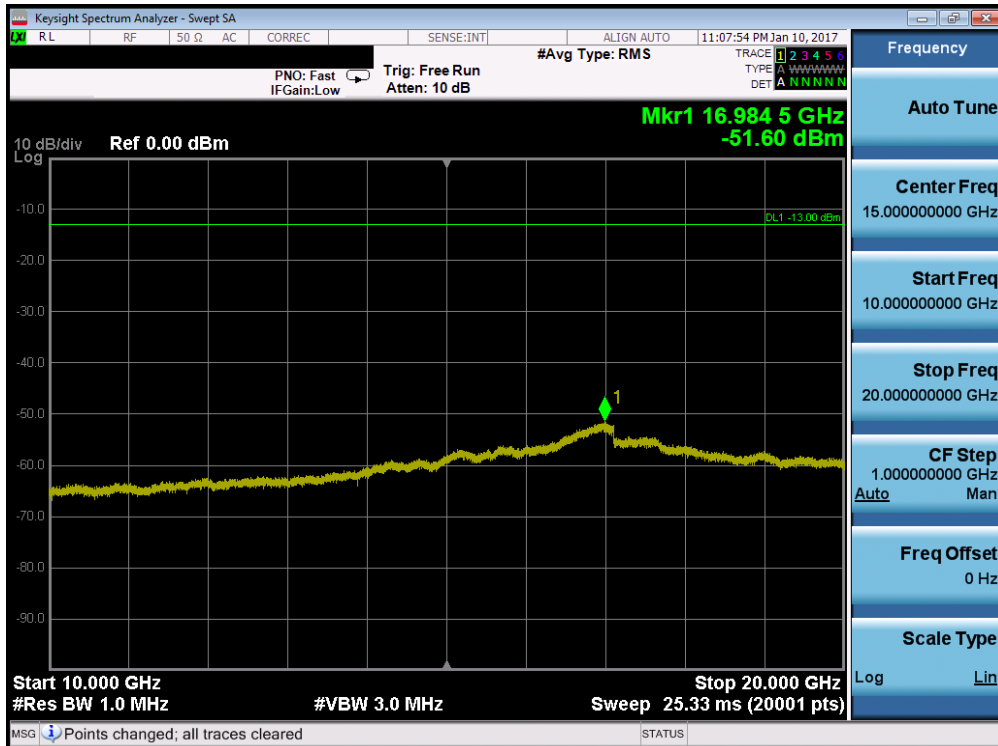


Plot 7-44. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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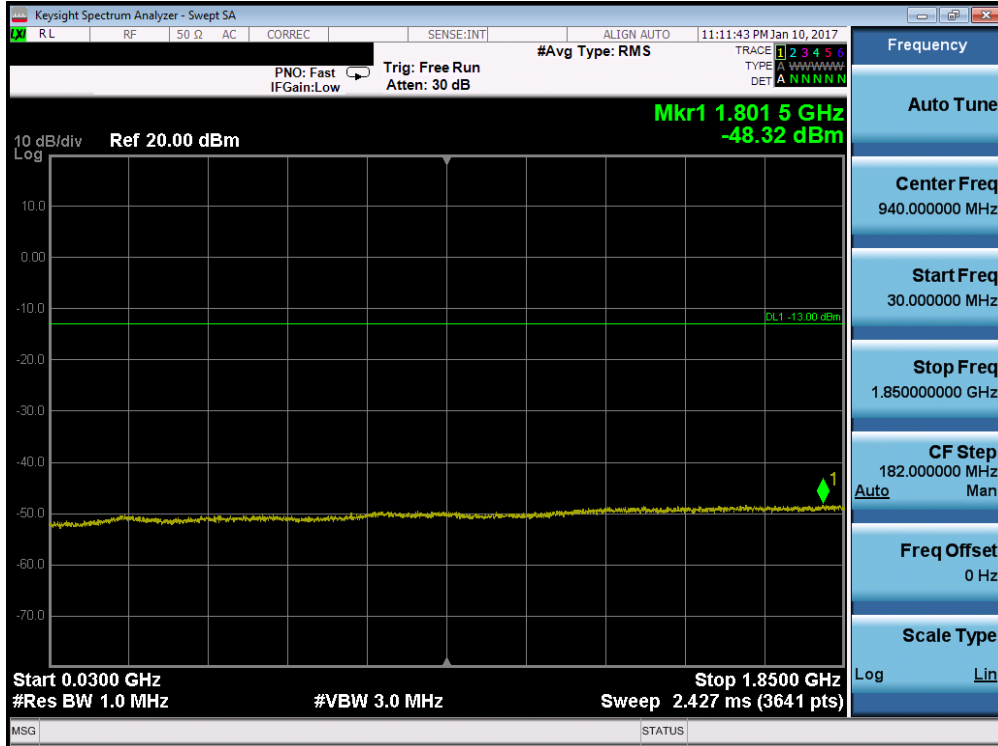


Plot 7-45. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

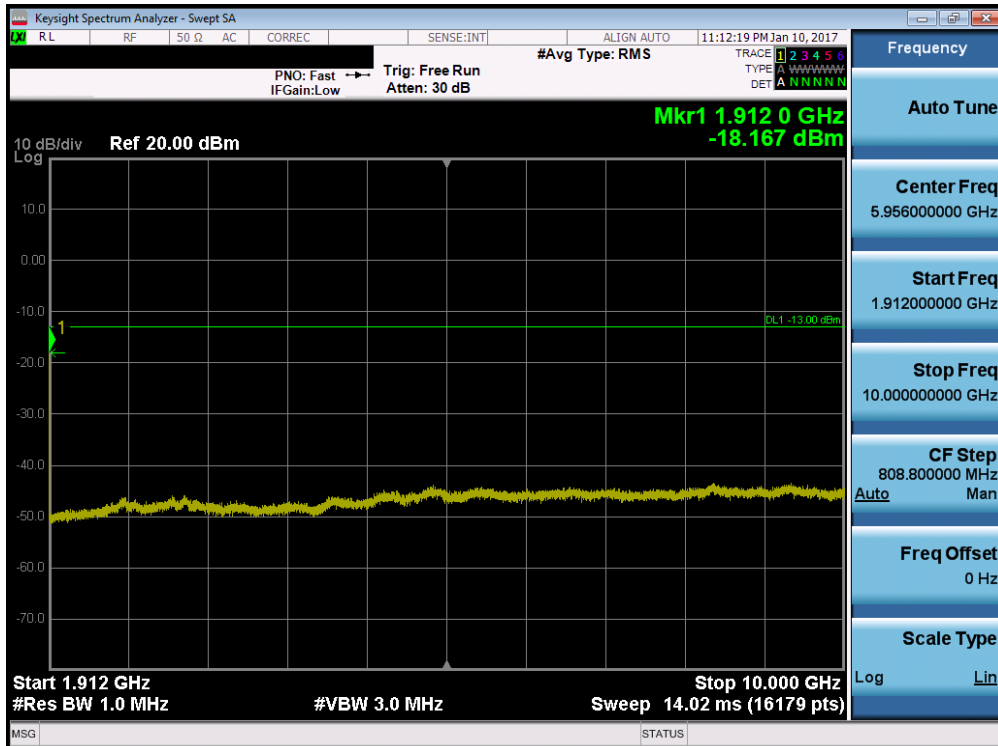


Plot 7-46. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 38 of 96

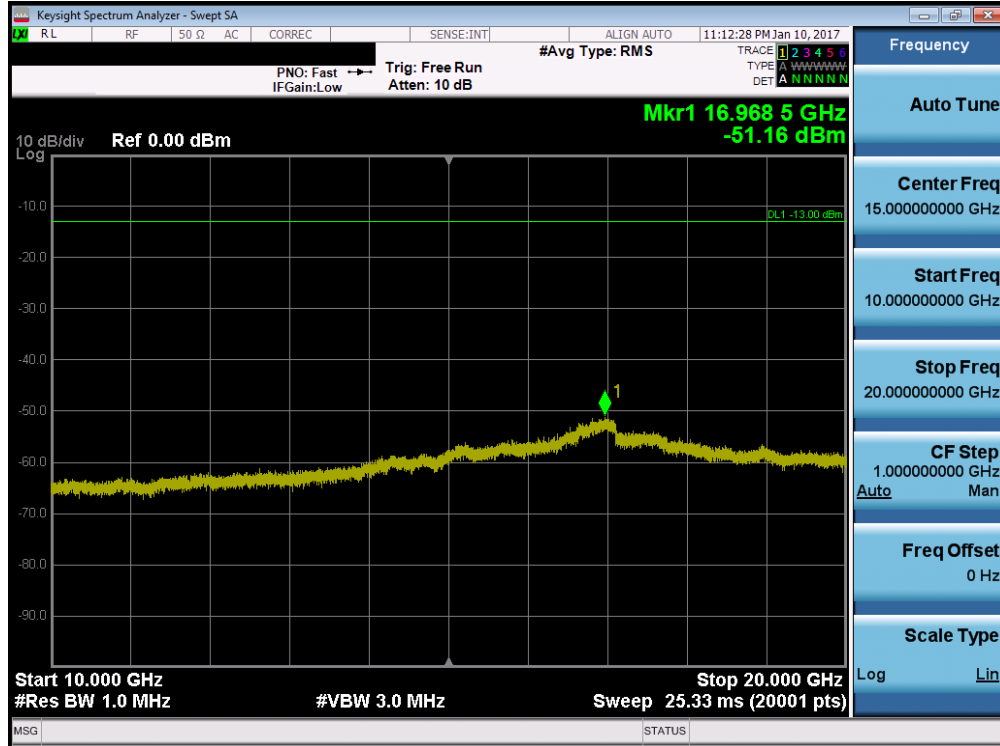


Plot 7-47. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-48. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Plot 7-49. Conducted Spurious Plot (Band 2 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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## 7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §24.238(a) §27.53(c) §27.53(h)

### Test Overview

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

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

### Test Procedure Used

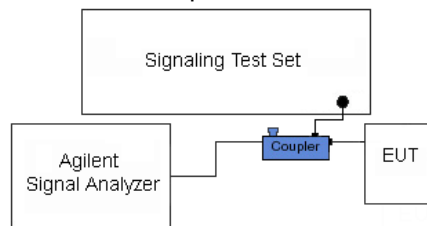
KDB 971168 D01 v02r02 – Section 6.0

### 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  $\geq$  1% of the emission bandwidth
4. VBW  $\geq$  3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq$  2 x Span/RBW
7. Trace mode = trace average
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**

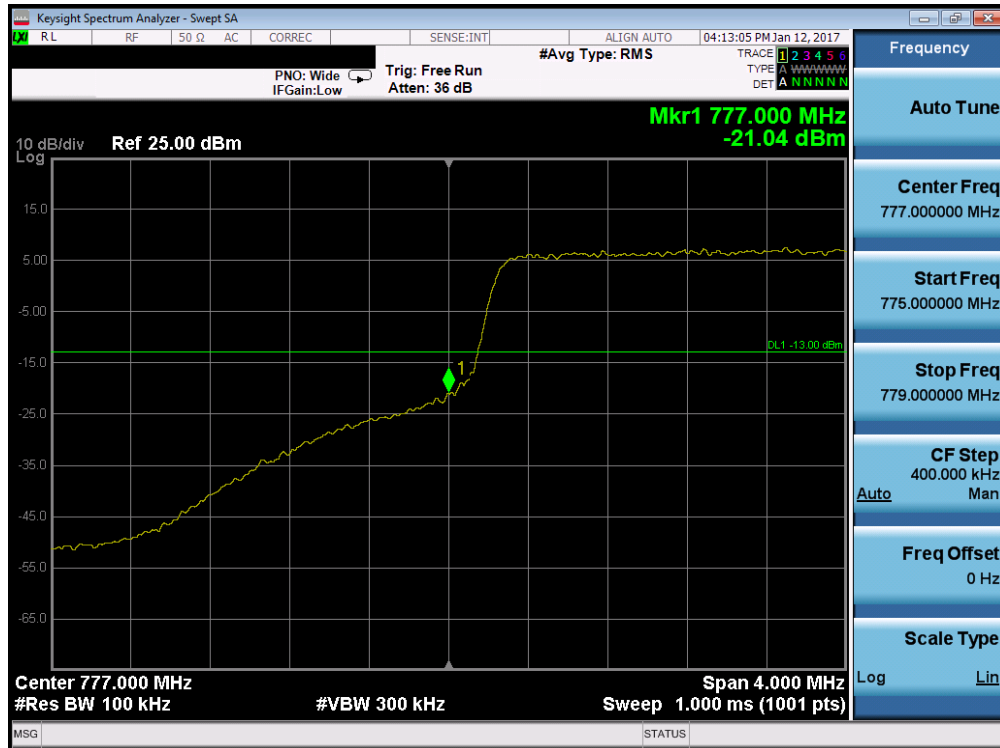
### Test Notes

Per 24.238(a) 27.53(h) 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.

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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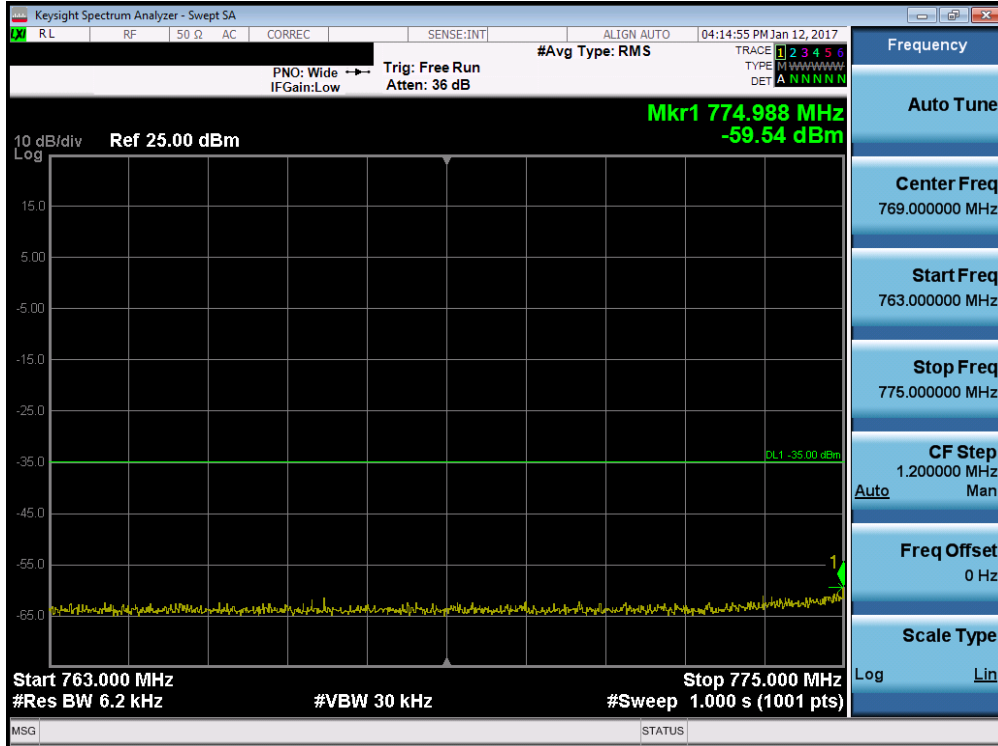
Per 27.53(c.5) for operations in the 776-788 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c.4) is  $65 + 10\log_{10}(P) = -35\text{dBm}$  in a 6.25kHz bandwidth.



Plot 7-50. Lower Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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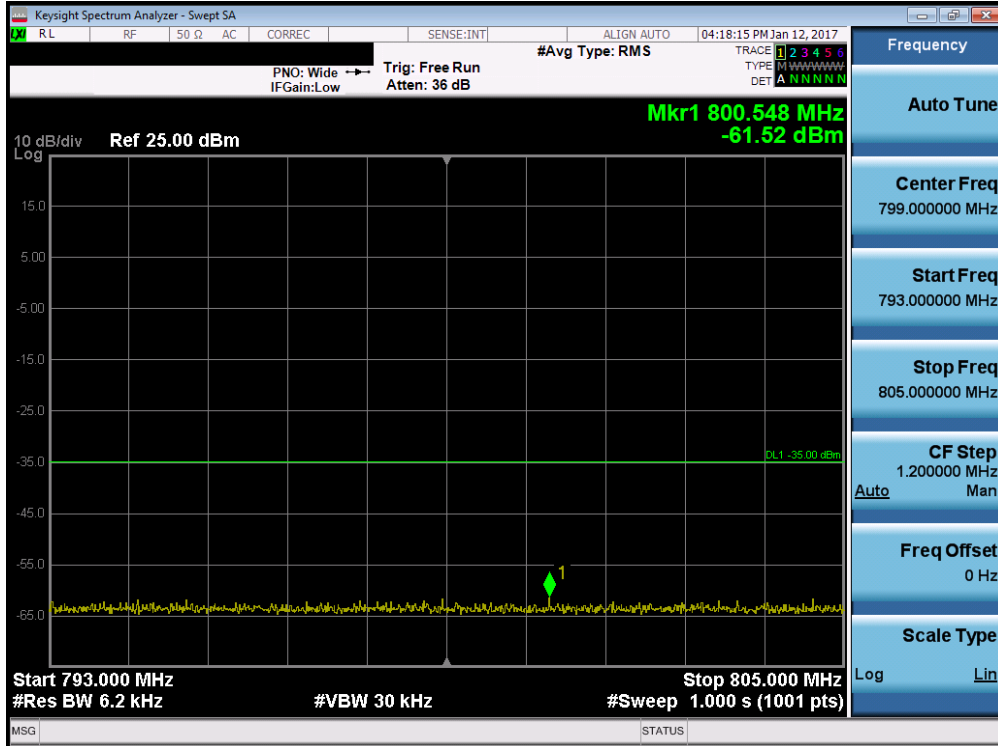


Plot 7-51. Lower Emission Mask Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

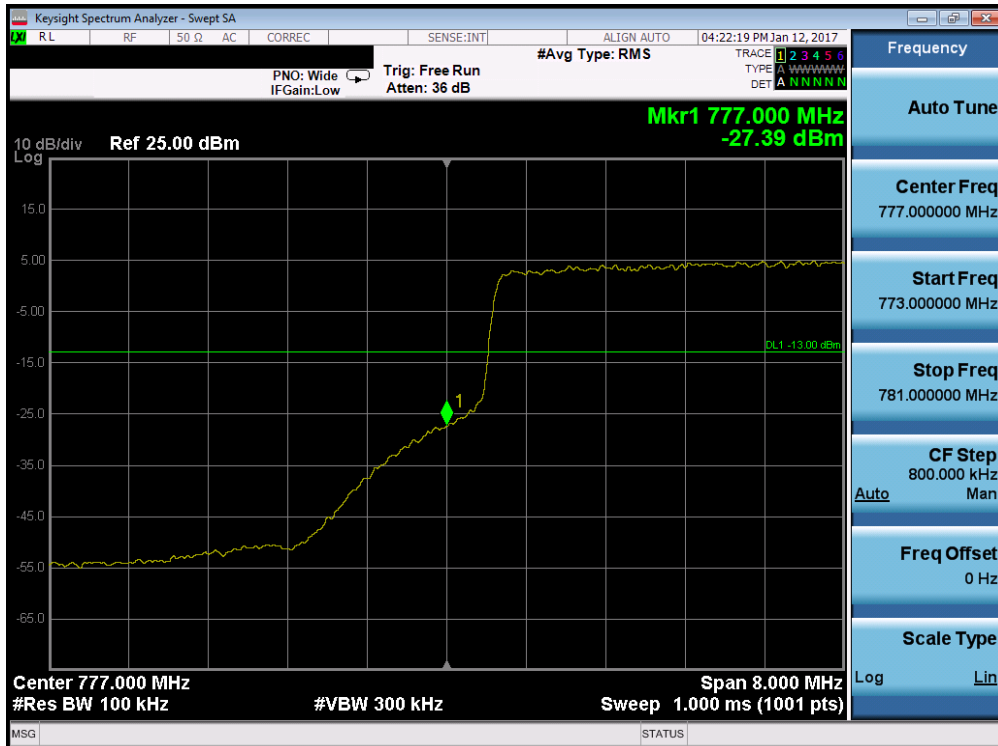


Plot 7-52. Upper Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 43 of 96

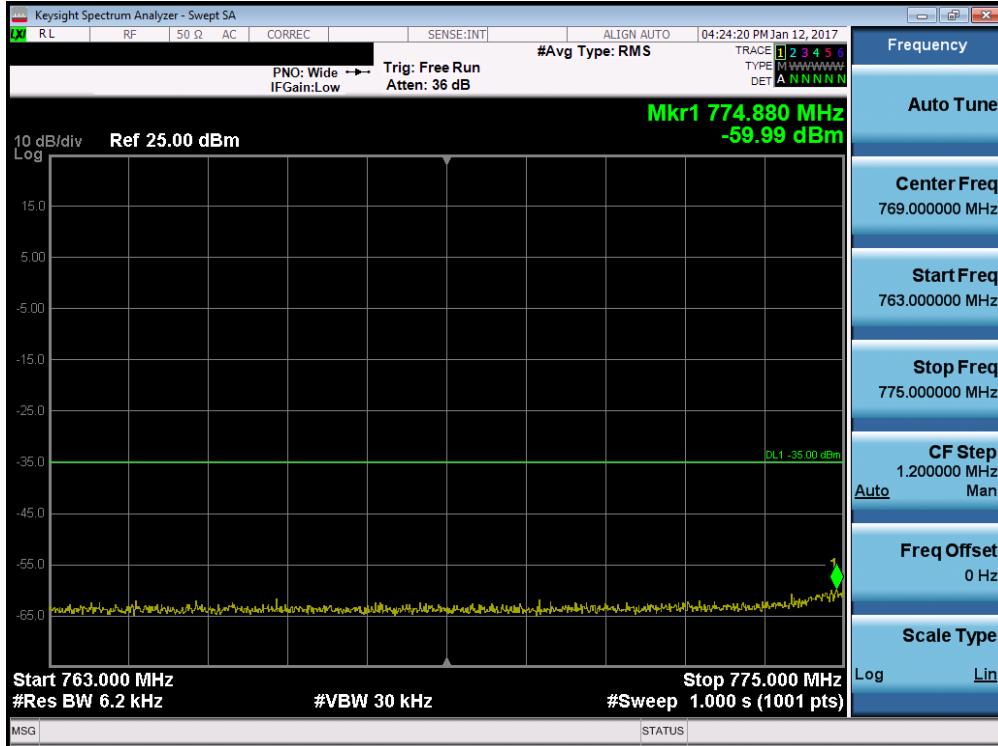


Plot 7-53. Upper Emission Mask Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)



Plot 7-54. Lower Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 44 of 96

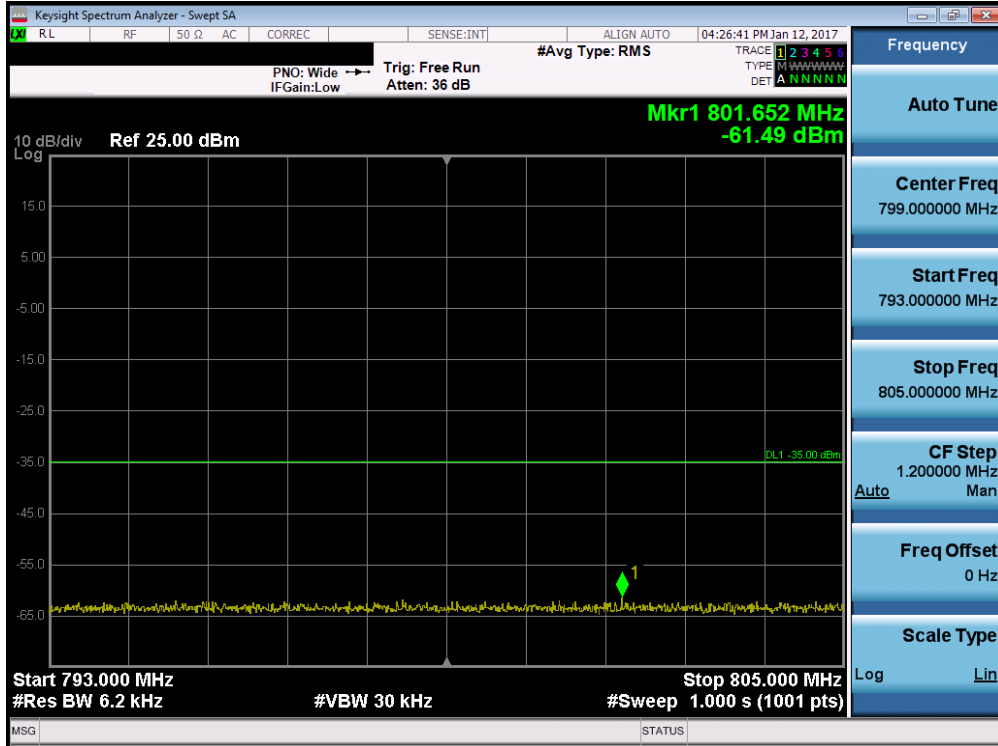


Plot 7-55. Lower Emission Mask Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)

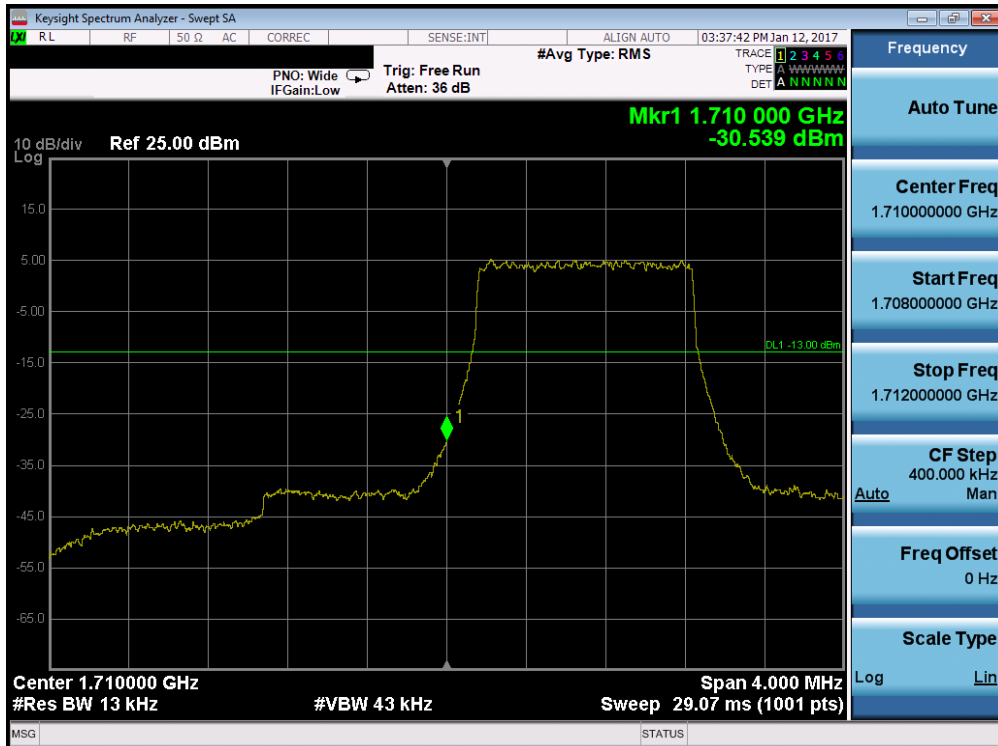


Plot 7-56. Upper Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 45 of 96

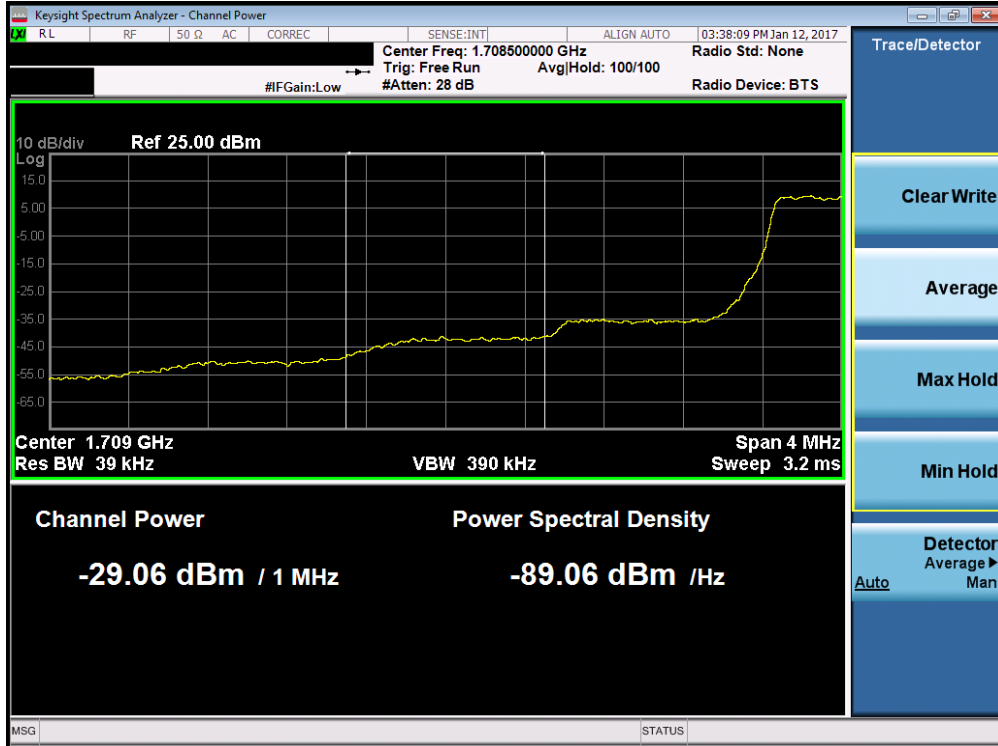


Plot 7-57. Upper Emission Mask Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)

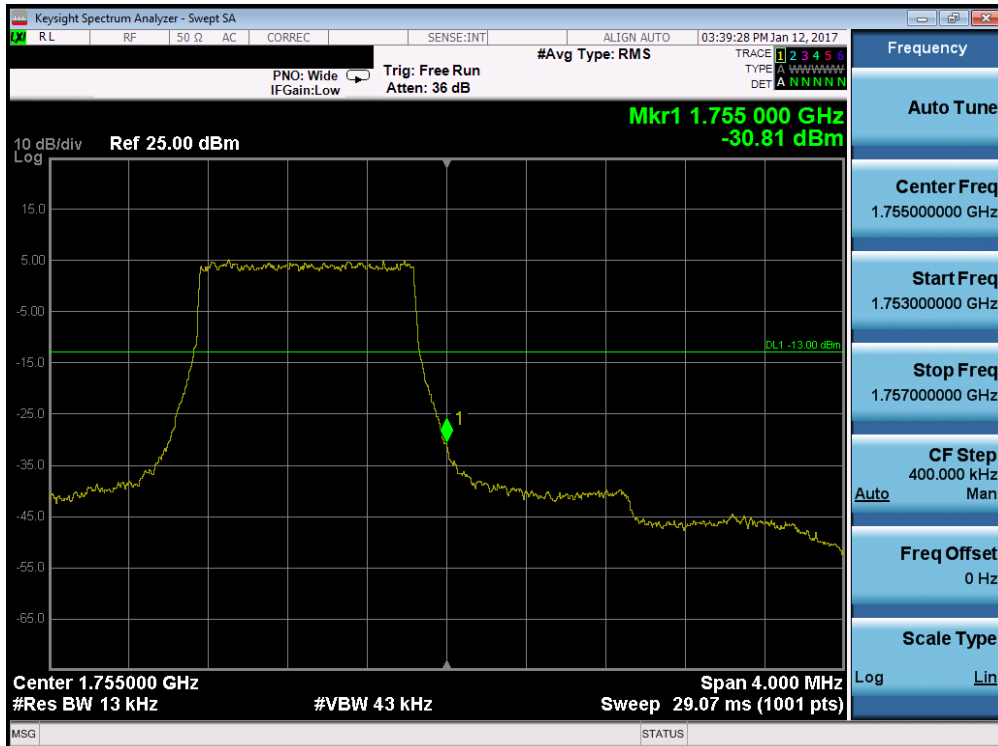


Plot 7-58. Lower Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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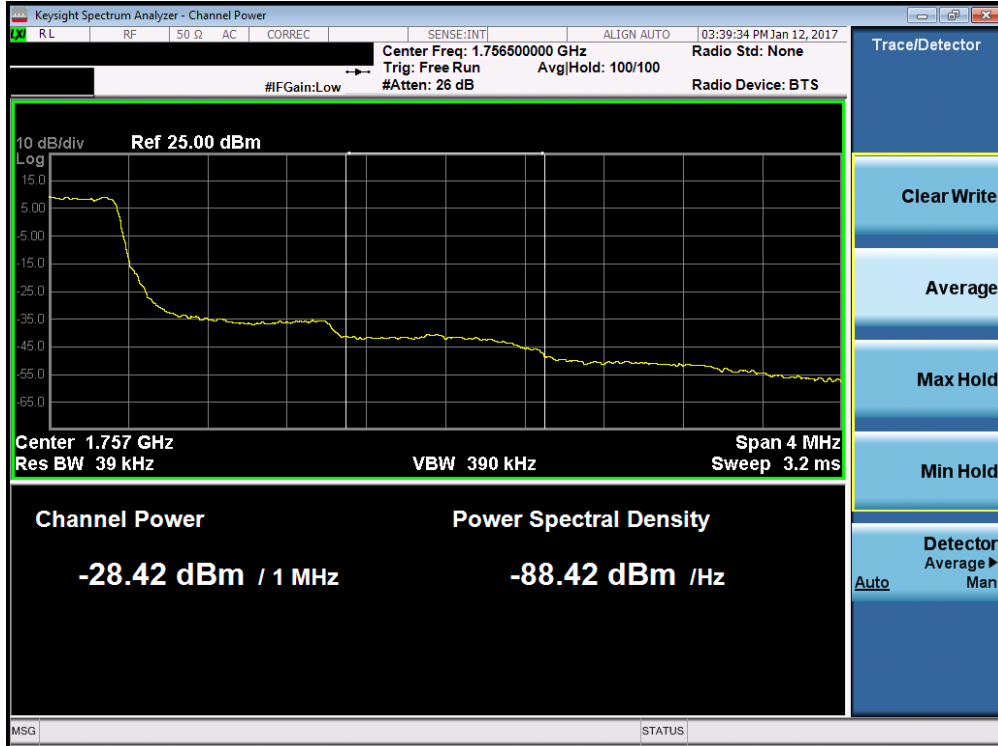
Plot 7-59. Lower Extended Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)



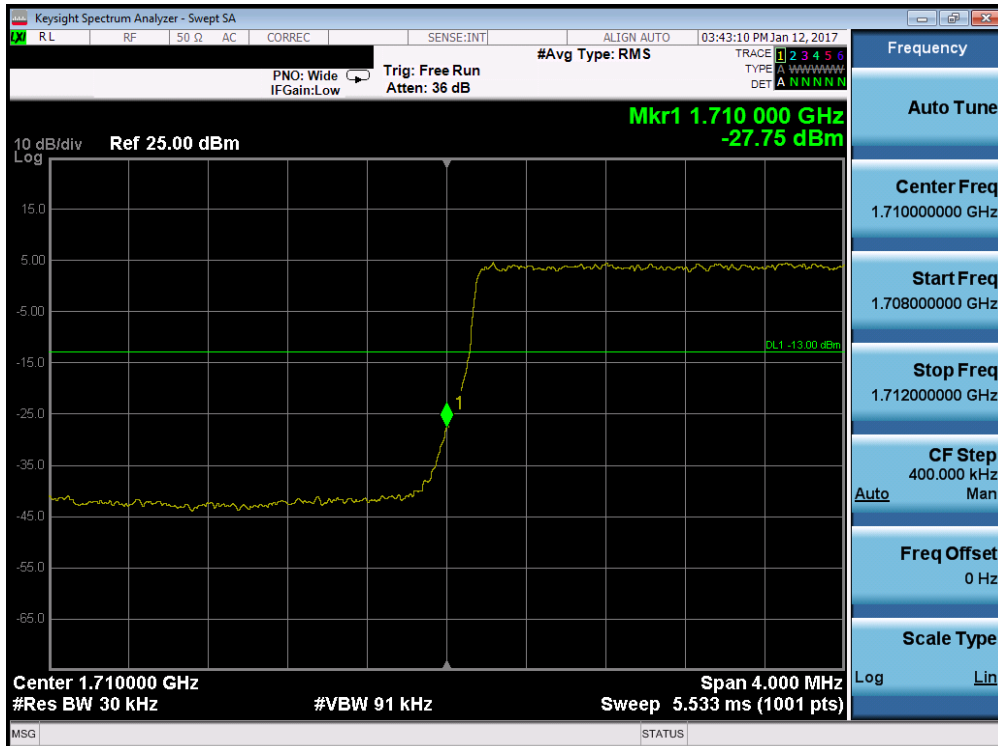
Plot 7-60. Upper Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 47 of 96



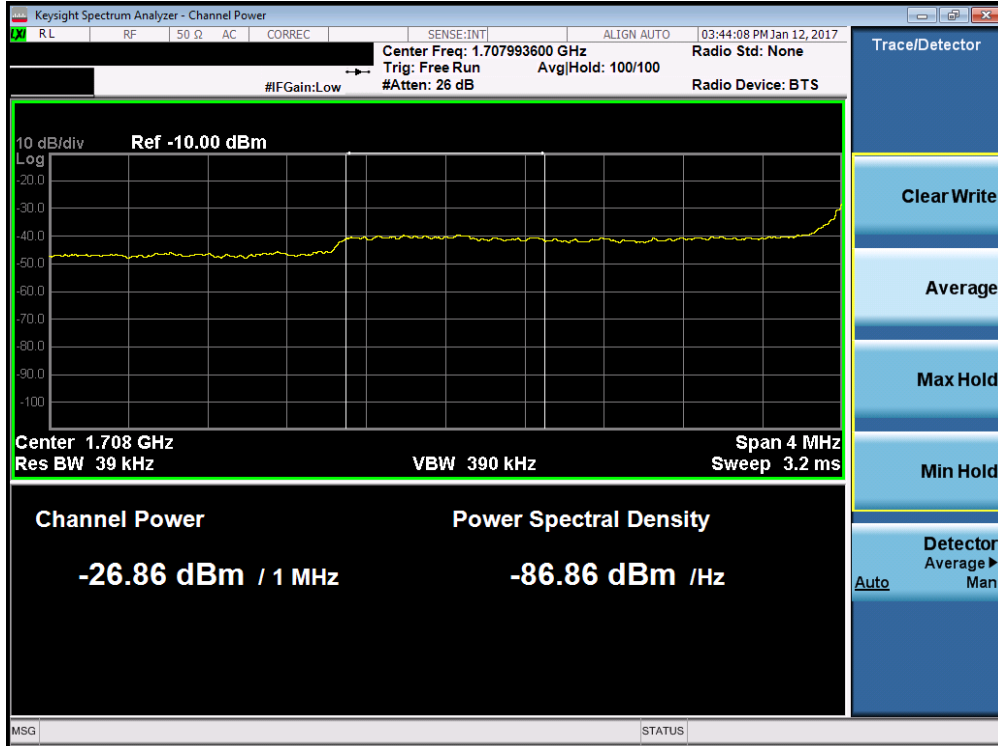


Plot 7-61. Upper Extended Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)

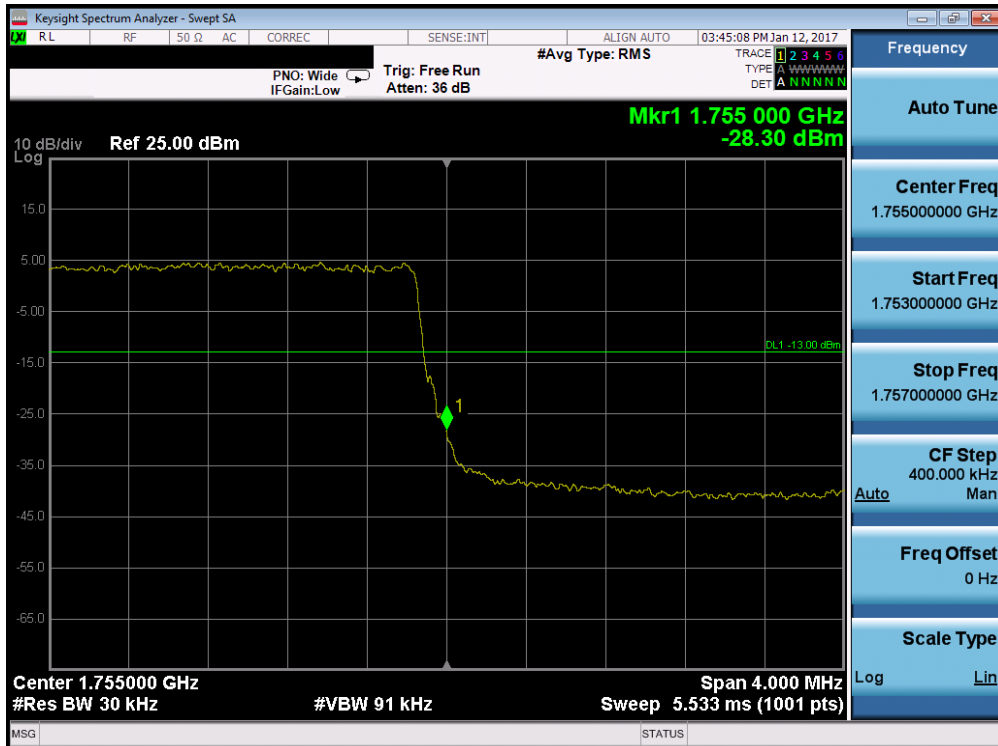


Plot 7-62. Lower Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 48 of 96

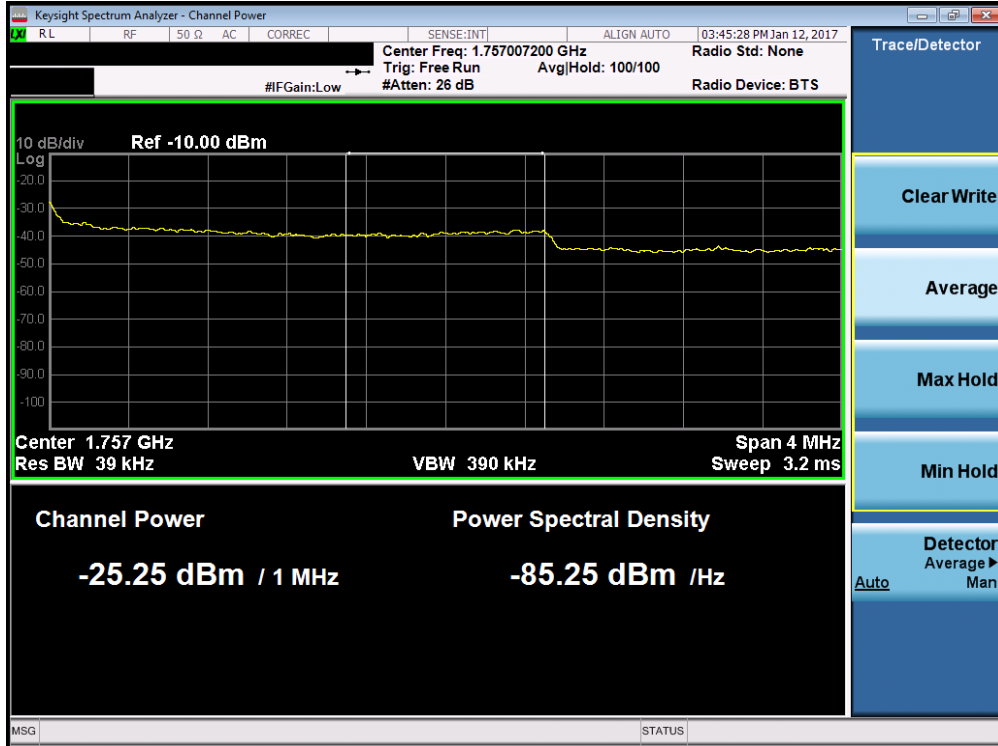


Plot 7-63. Lower Extended Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)

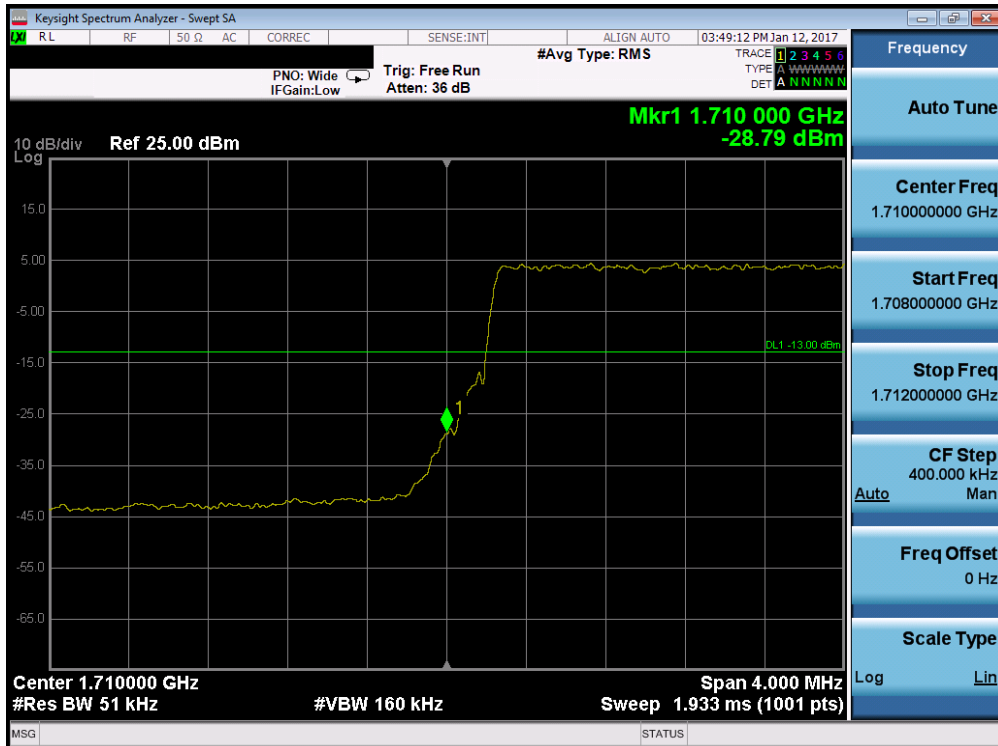


Plot 7-64. Upper Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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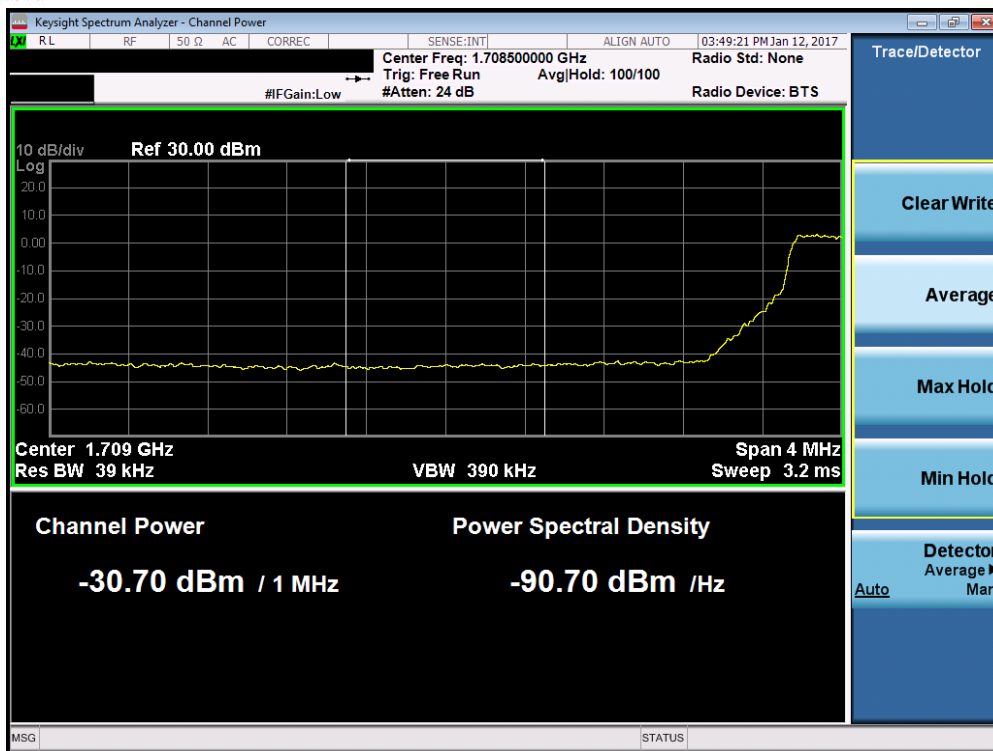


Plot 7-65. Upper Extended Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)



Plot 7-66. Lower Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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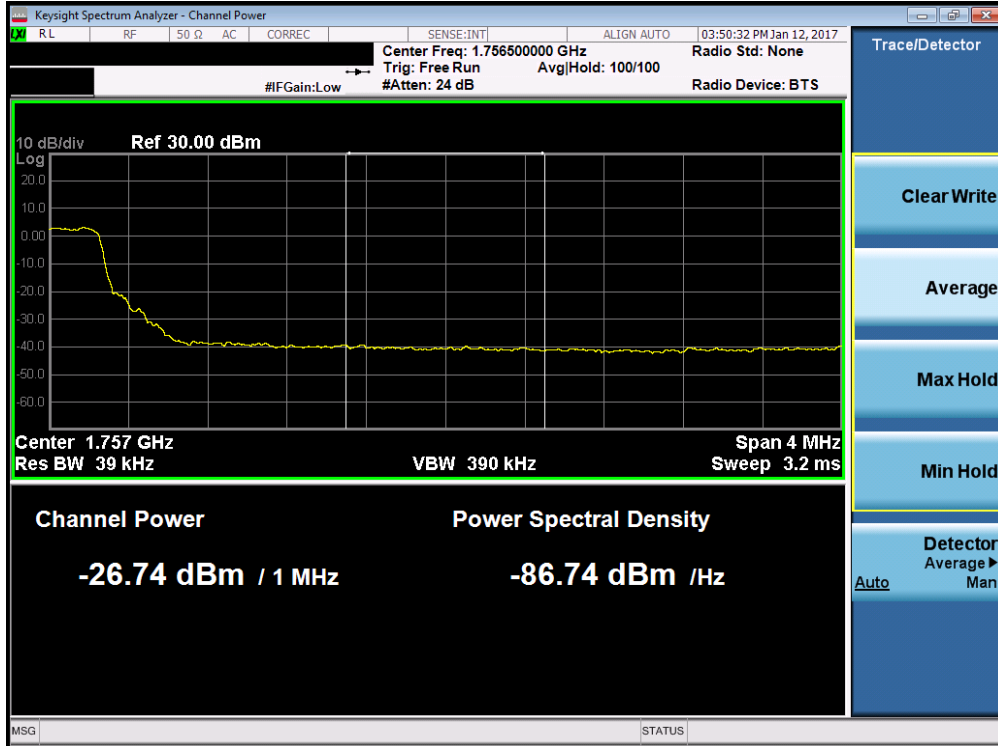


Plot 7-67. Lower Extended Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)

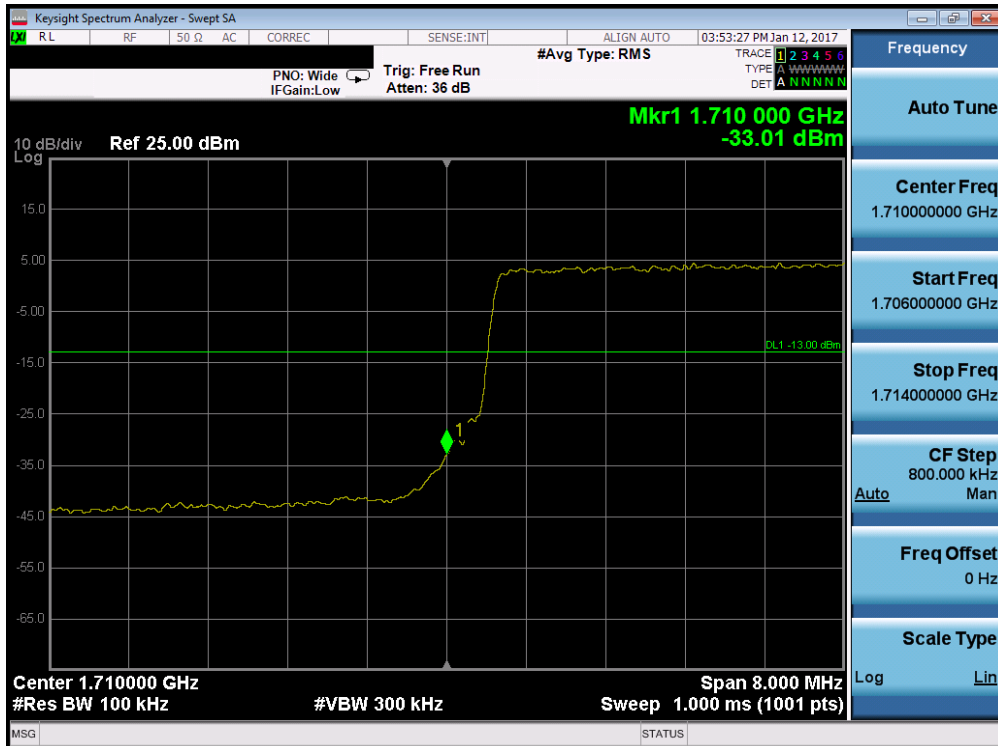


Plot 7-68. Upper Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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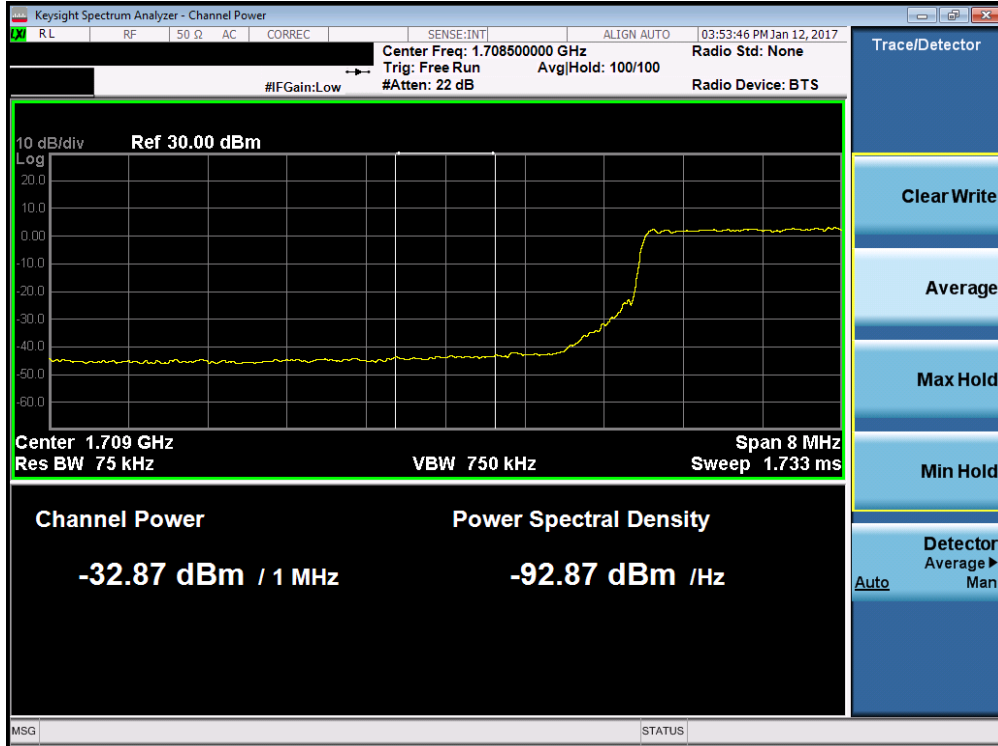


Plot 7-69. Upper Extended Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)

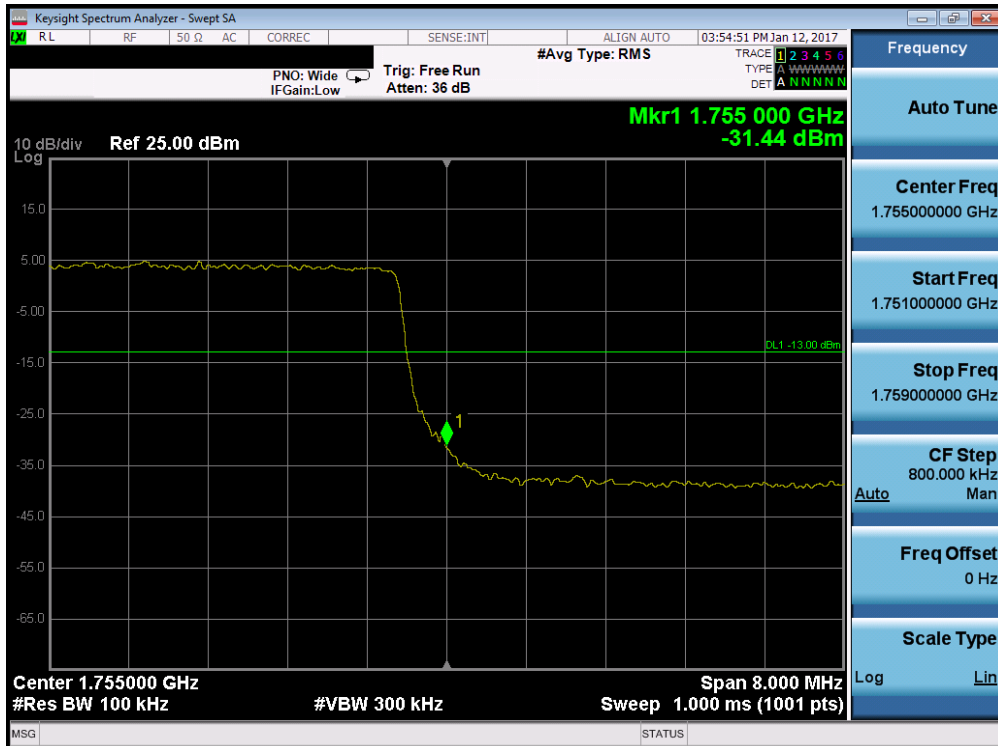


Plot 7-70. Lower Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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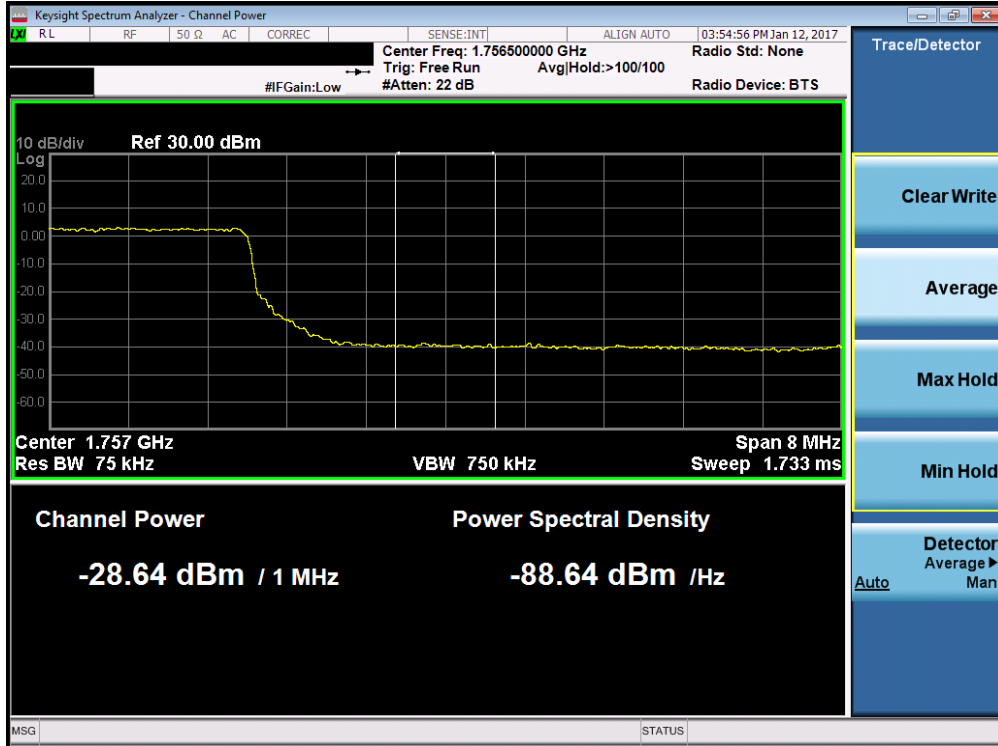


Plot 7-71. Lower Extended Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)

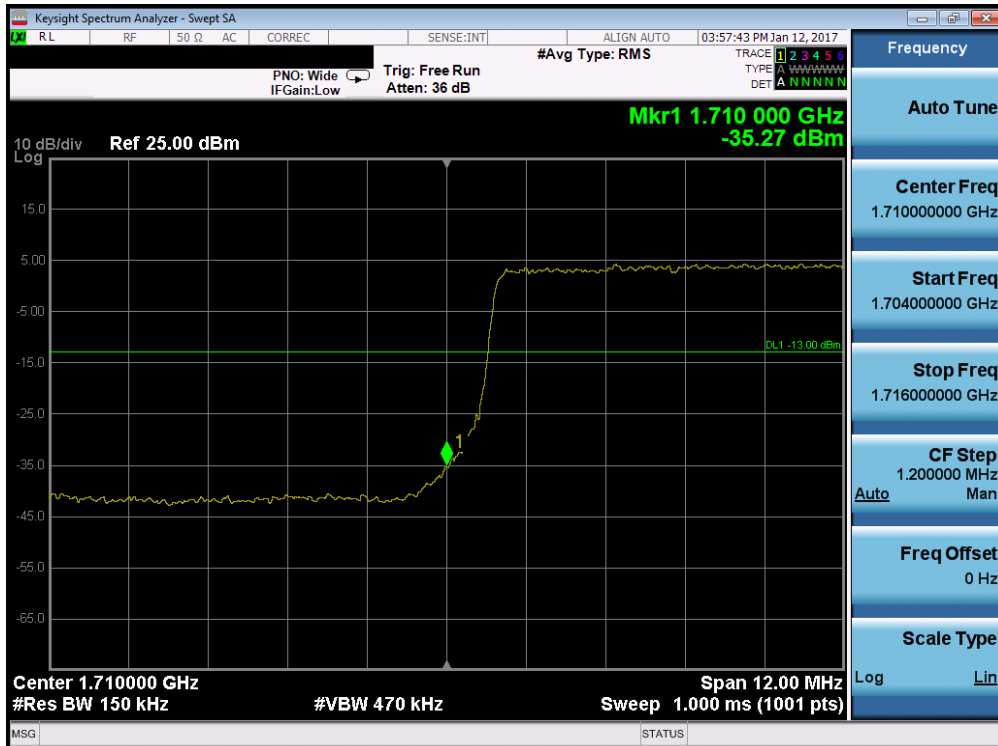


Plot 7-72. Upper Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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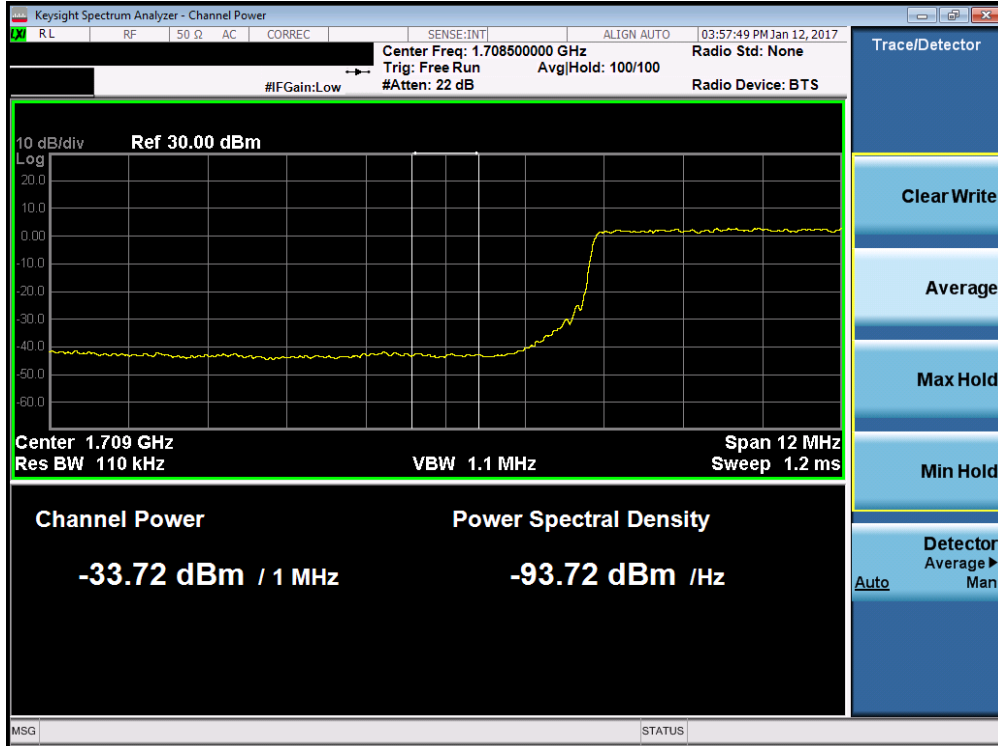
Plot 7-73. Upper Extended Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)



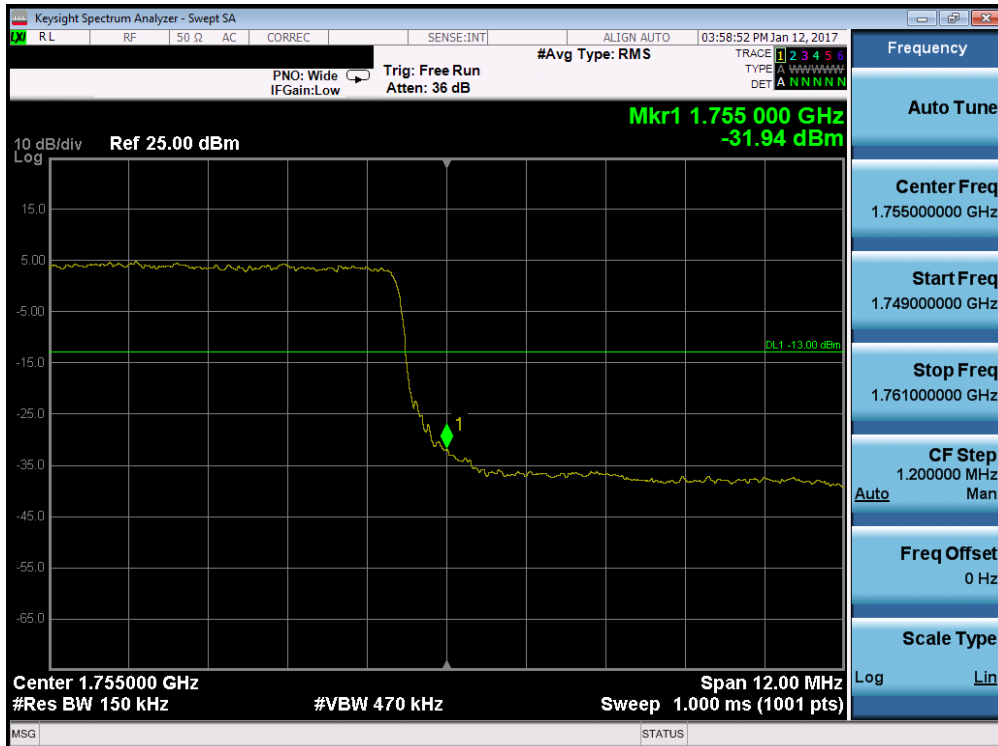
Plot 7-74. Lower Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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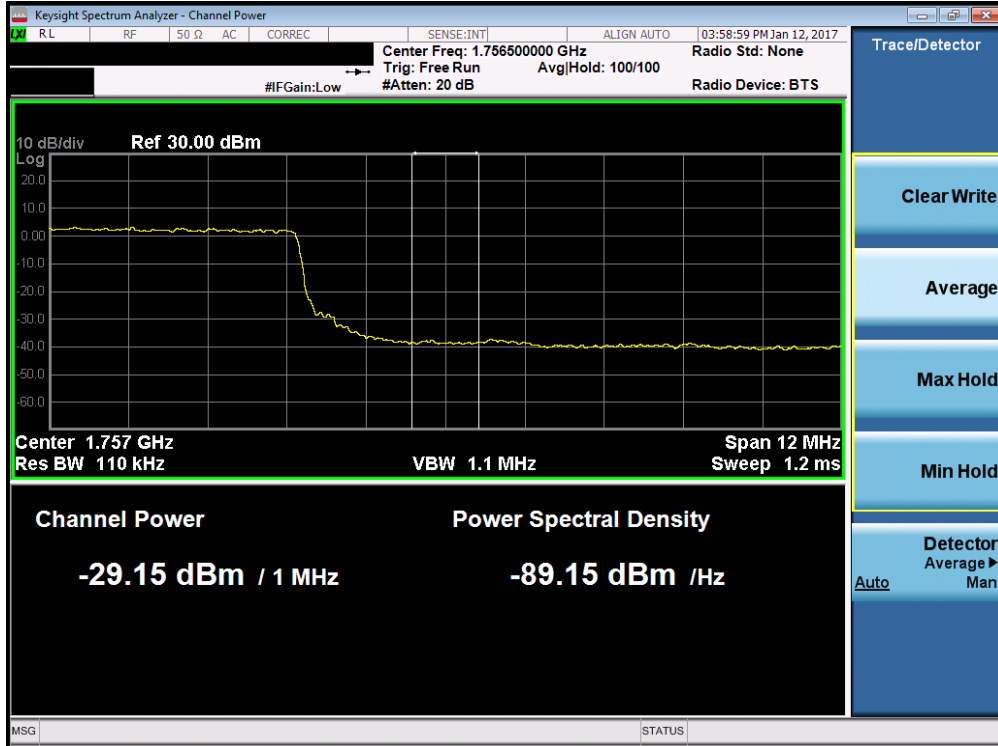


Plot 7-75. Lower Extended Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)

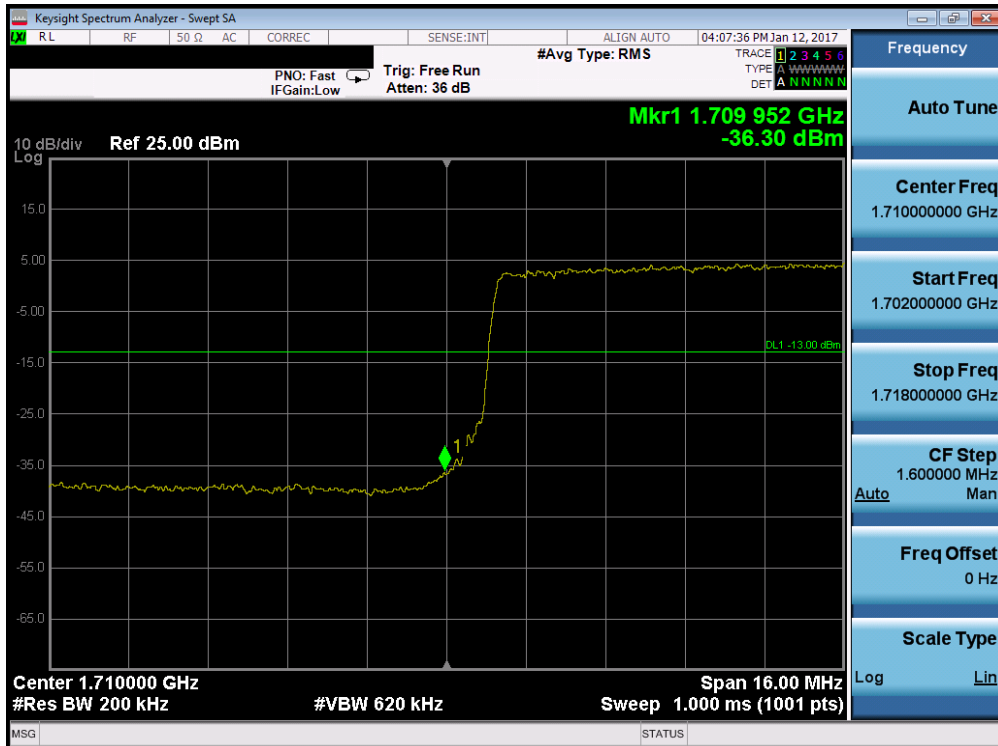


Plot 7-76. Upper Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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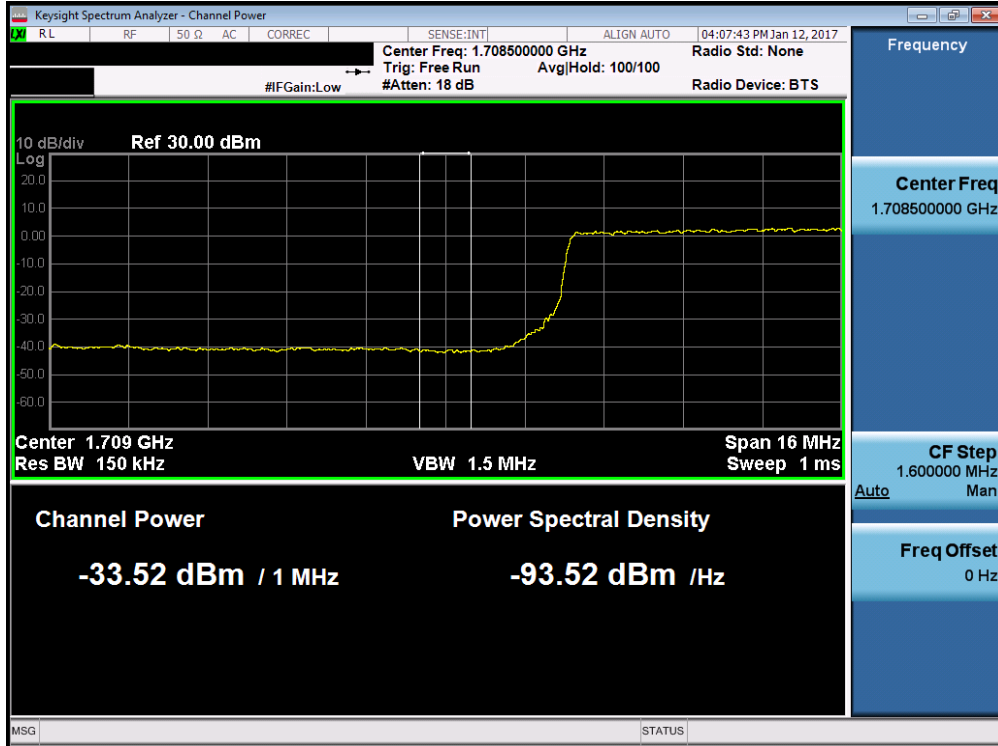


Plot 7-77. Upper Extended Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)

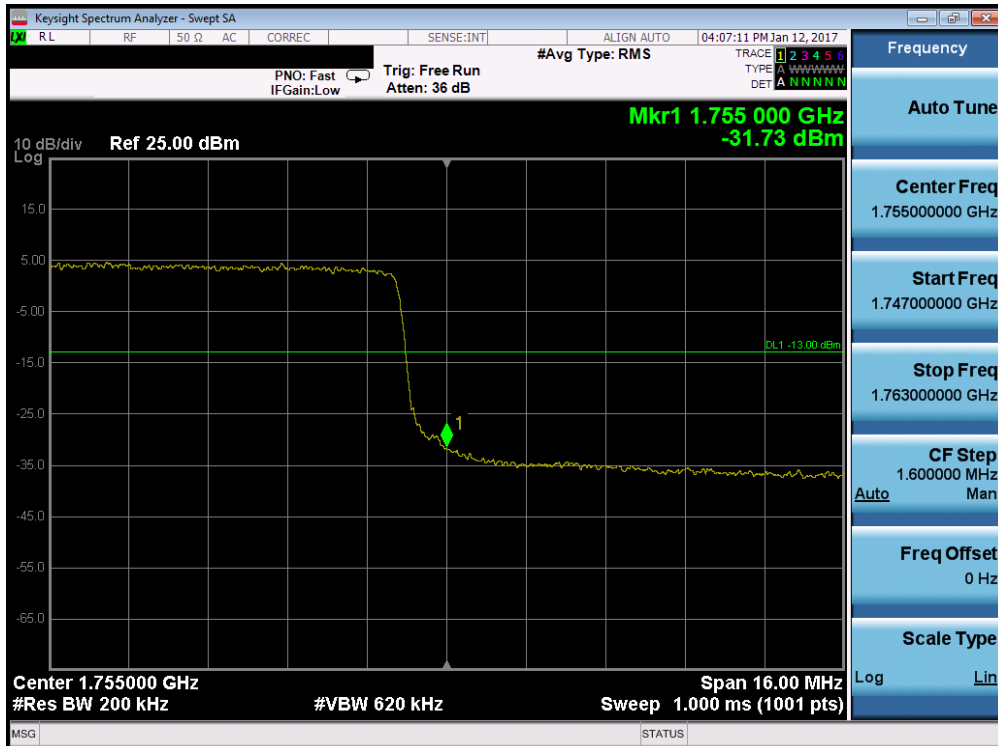


Plot 7-78. Lower Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 56 of 96

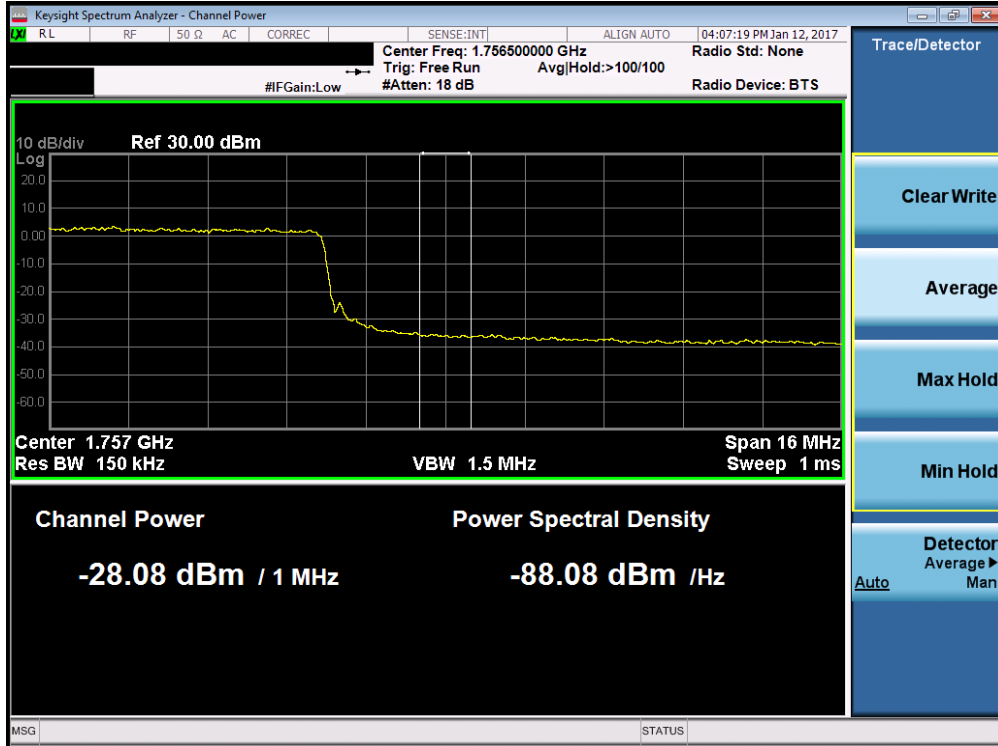


Plot 7-79. Lower Extended Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)

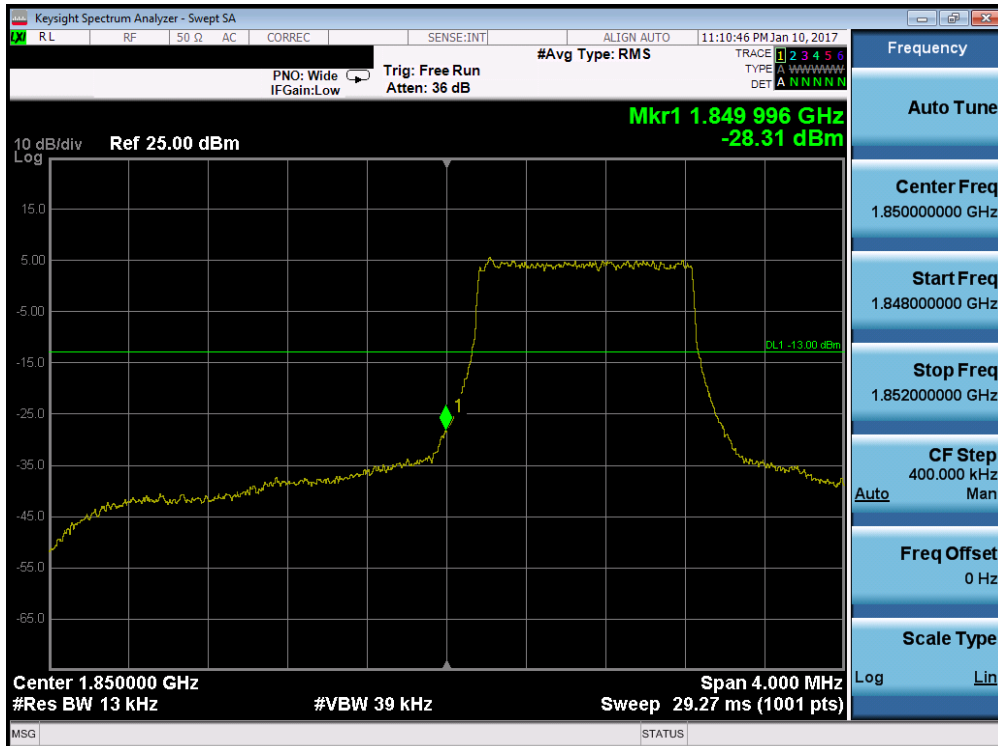


Plot 7-80. Upper Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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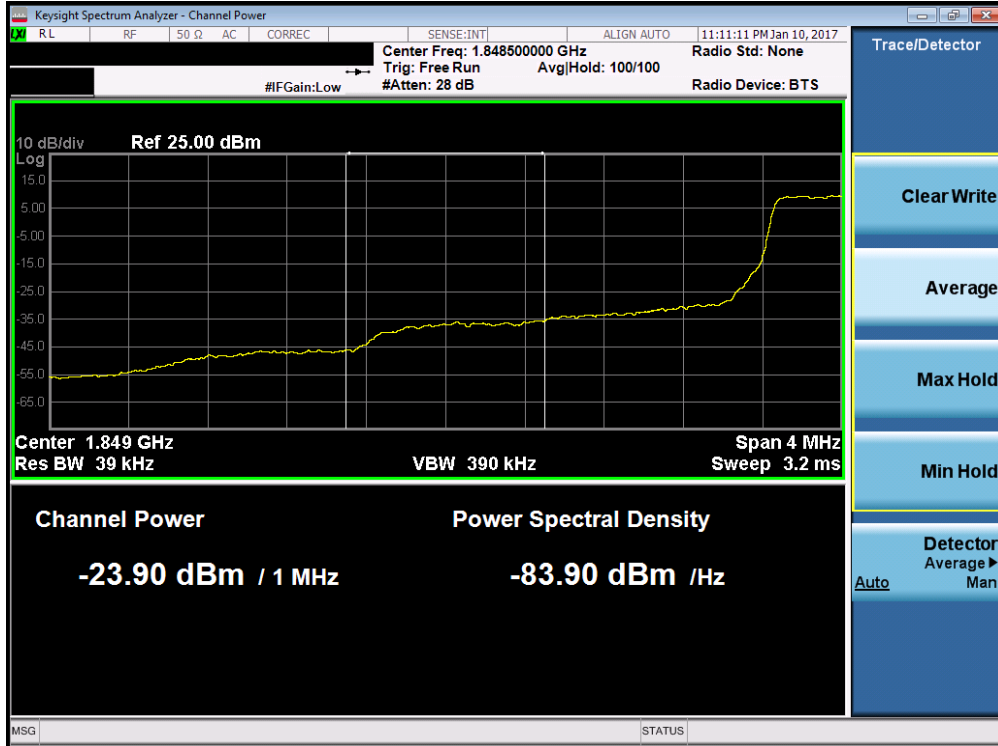


Plot 7-81. Upper Extended Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)



Plot 7-82. Lower Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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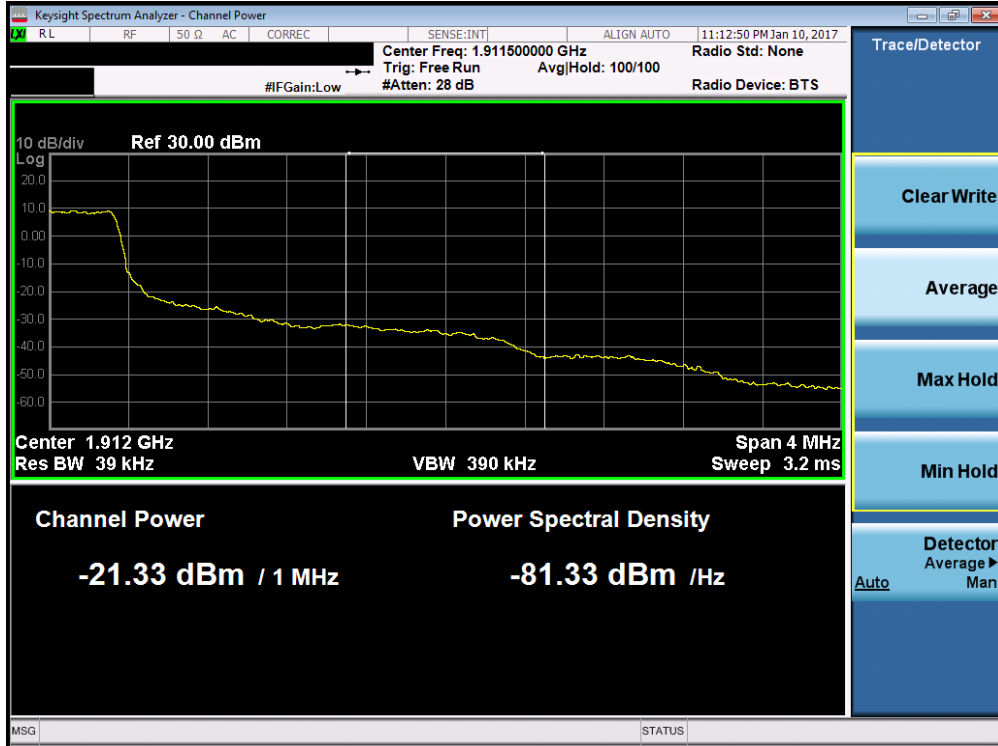


Plot 7-83. Lower Extended Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)

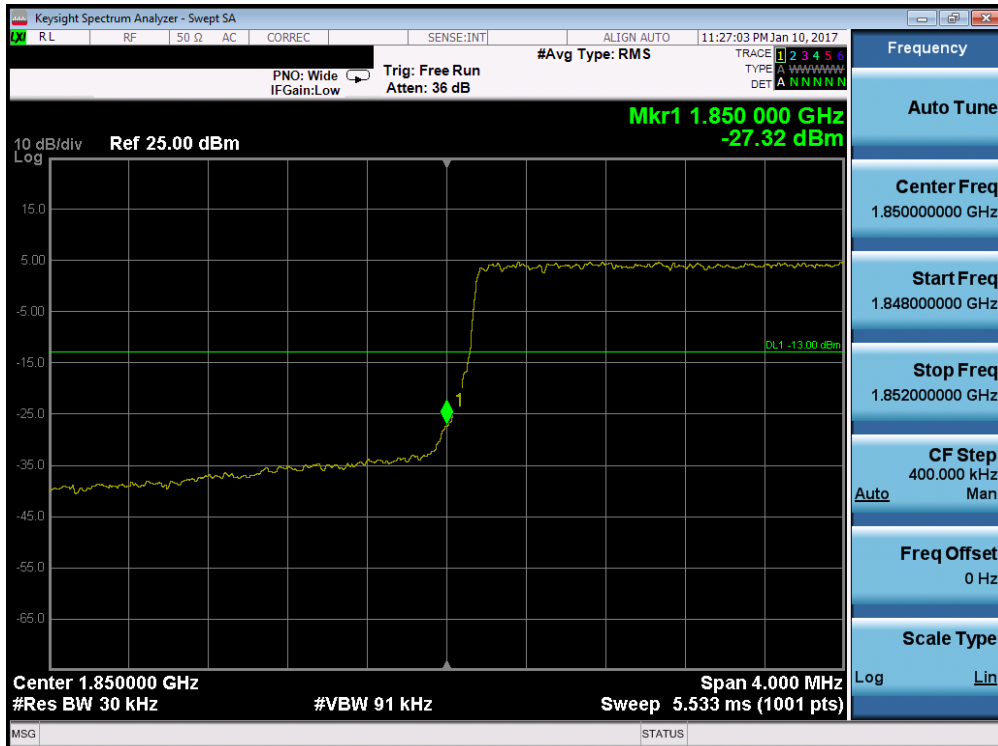


Plot 7-84. Upper Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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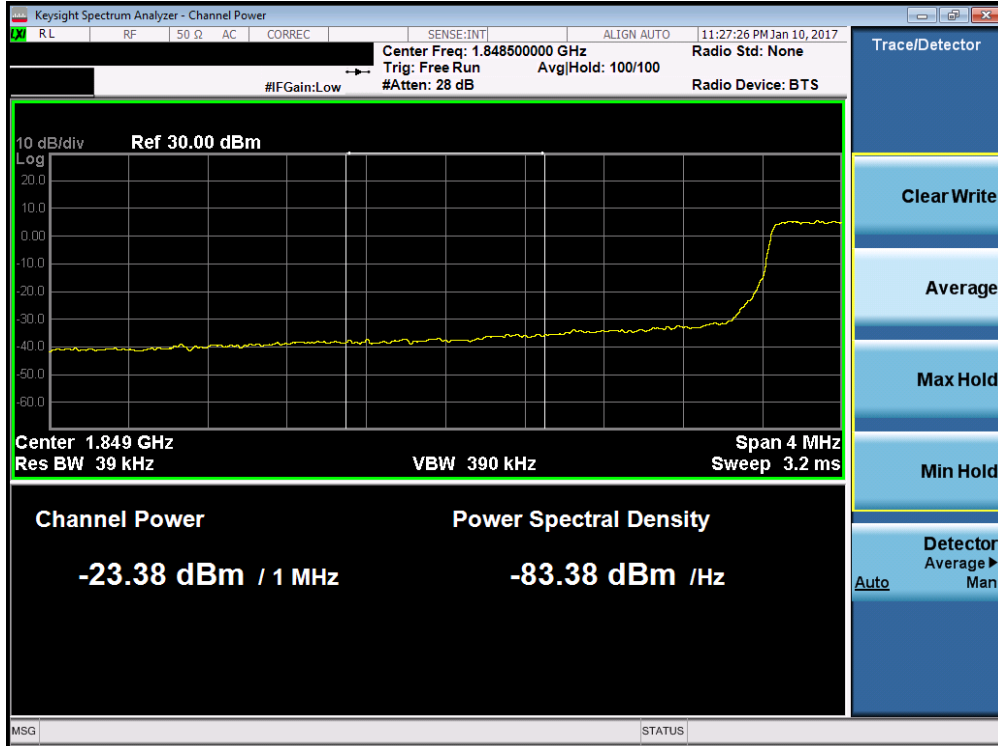


Plot 7-85. Upper Extended Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)

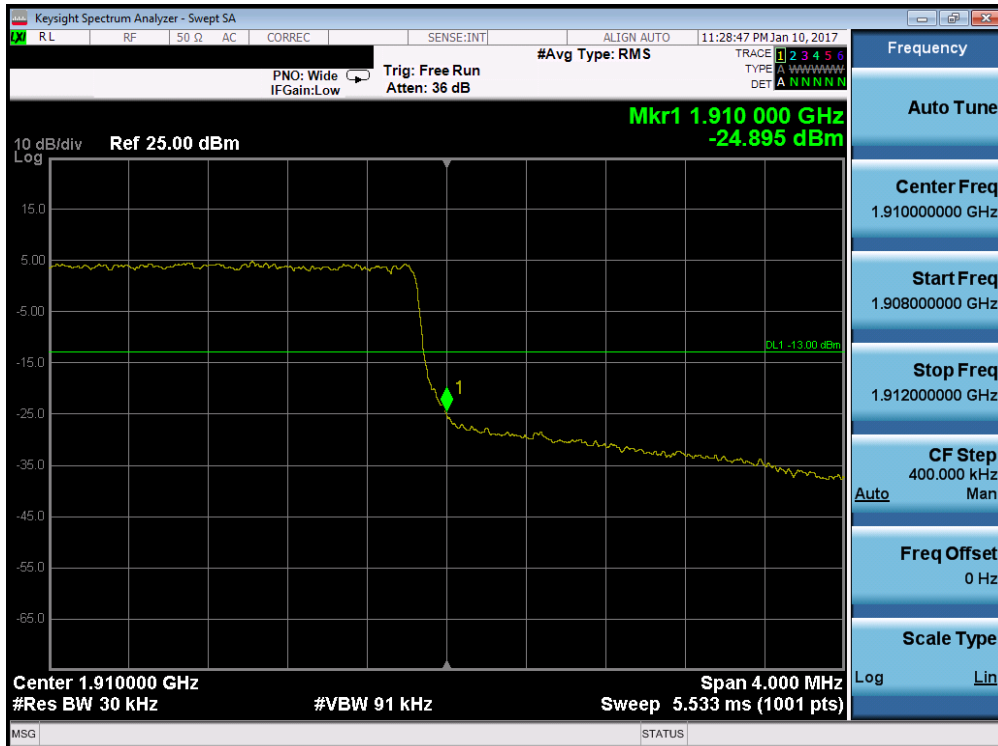


Plot 7-86. Lower Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 60 of 96



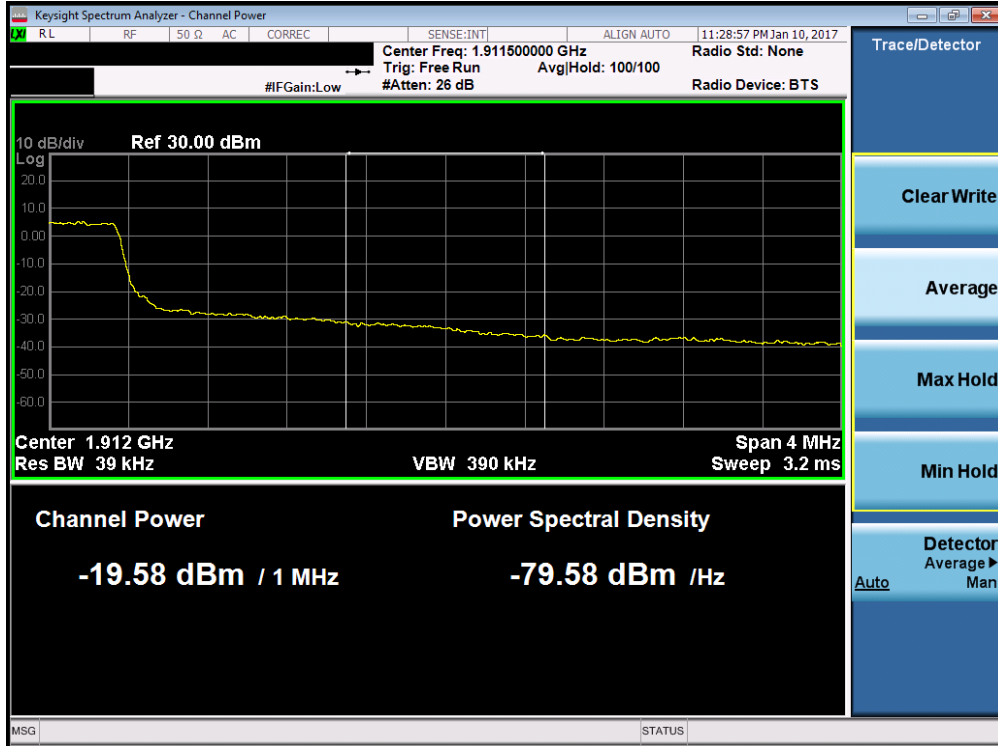
Plot 7-87. Lower Extended Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)



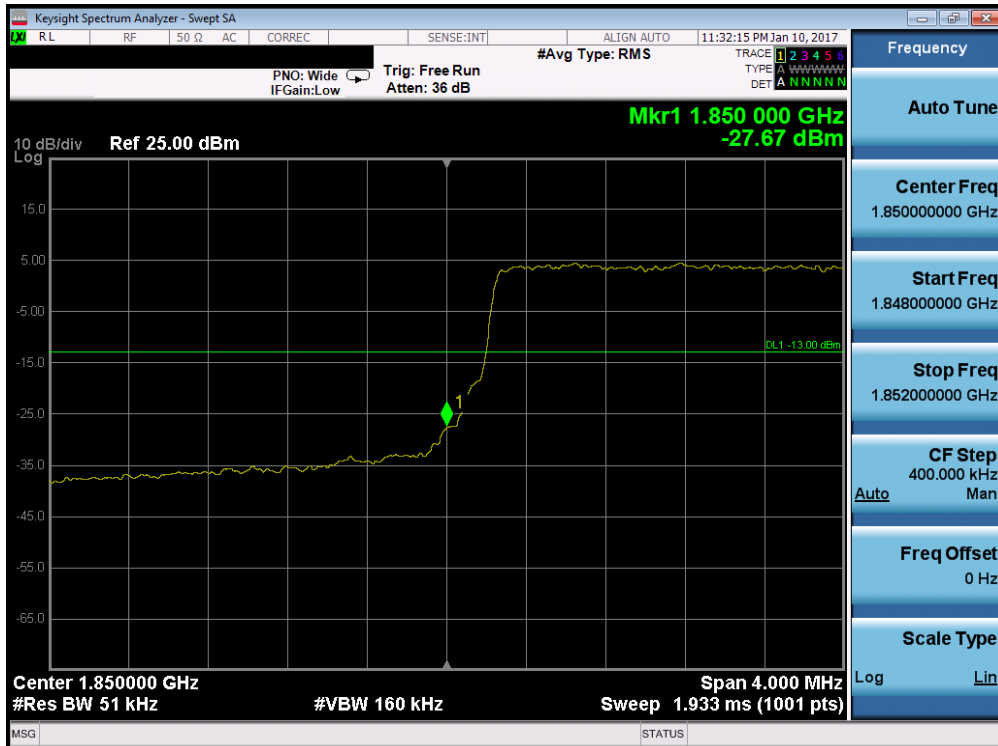
Plot 7-88. Upper Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 61 of 96



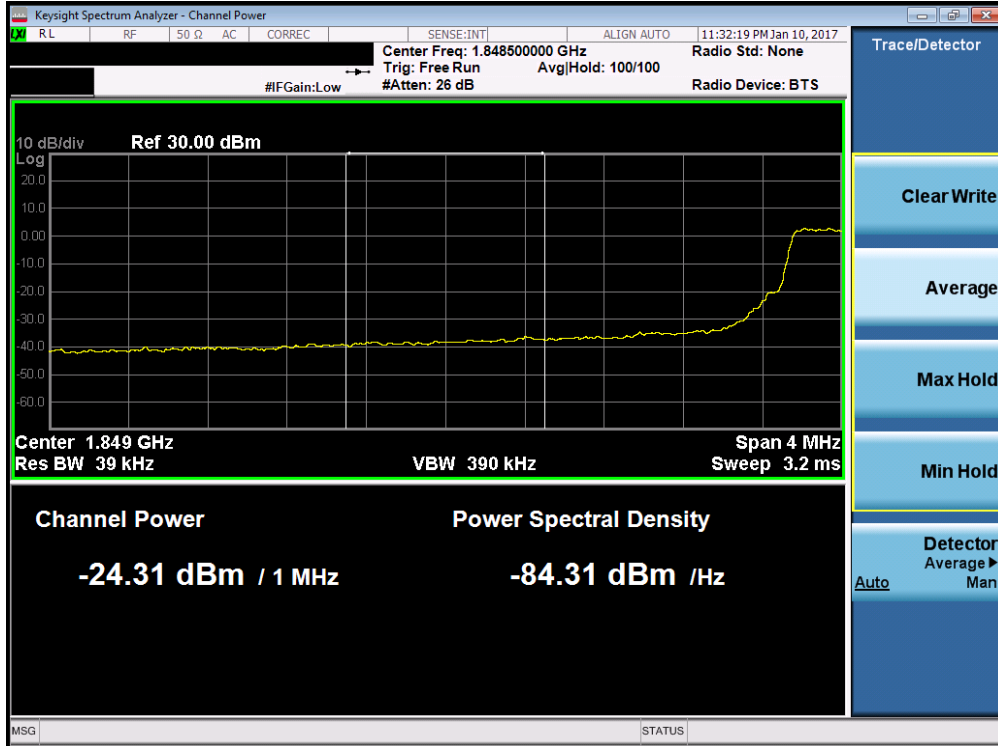


Plot 7-89. Upper Extended Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)

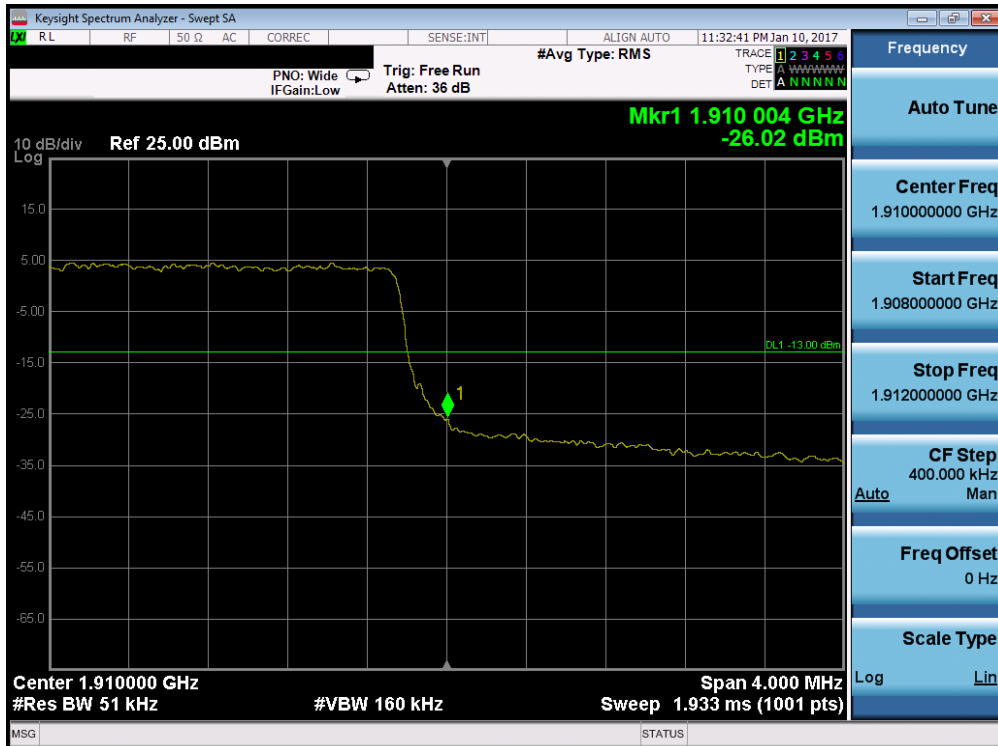


Plot 7-90. Lower Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 62 of 96

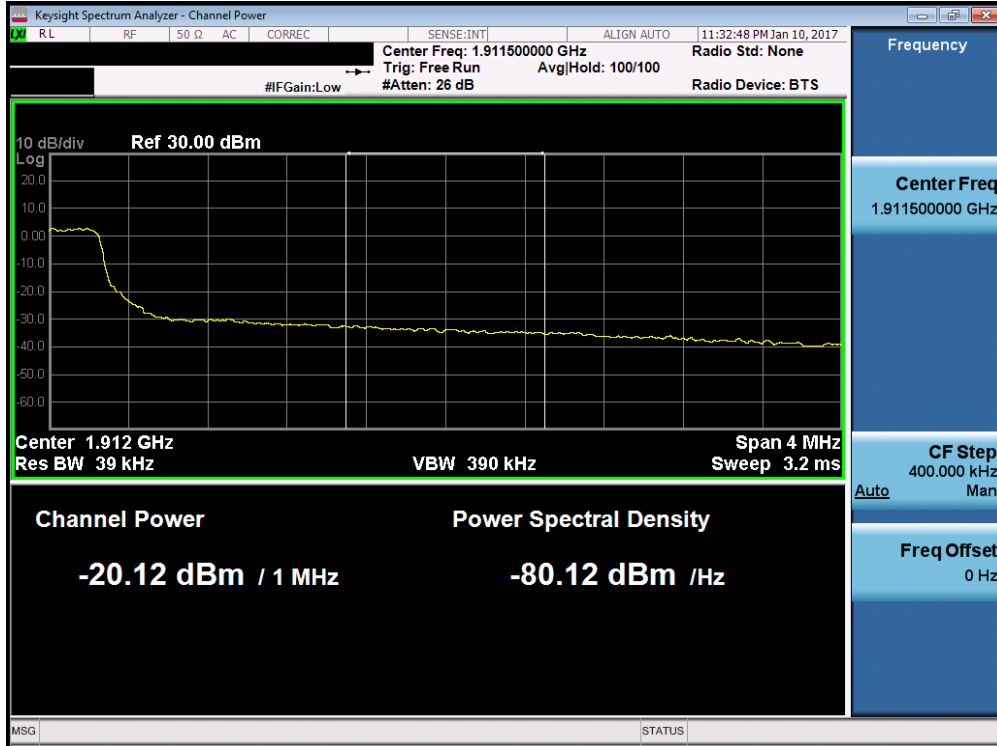


Plot 7-91. Lower Extended Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)

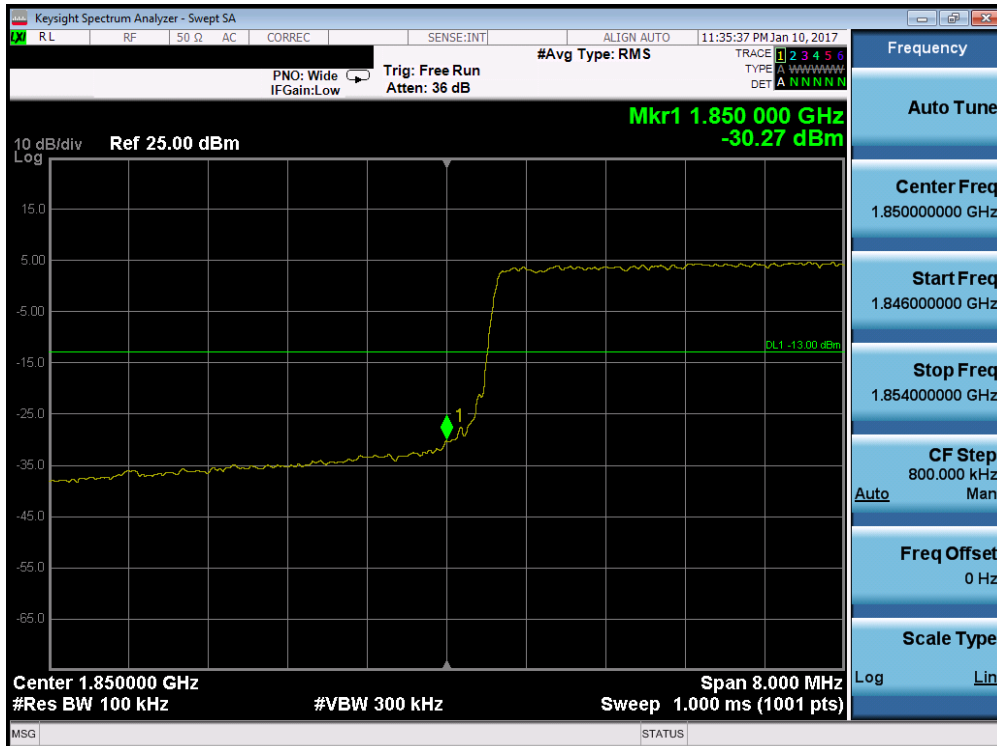


Plot 7-92. Upper Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 63 of 96

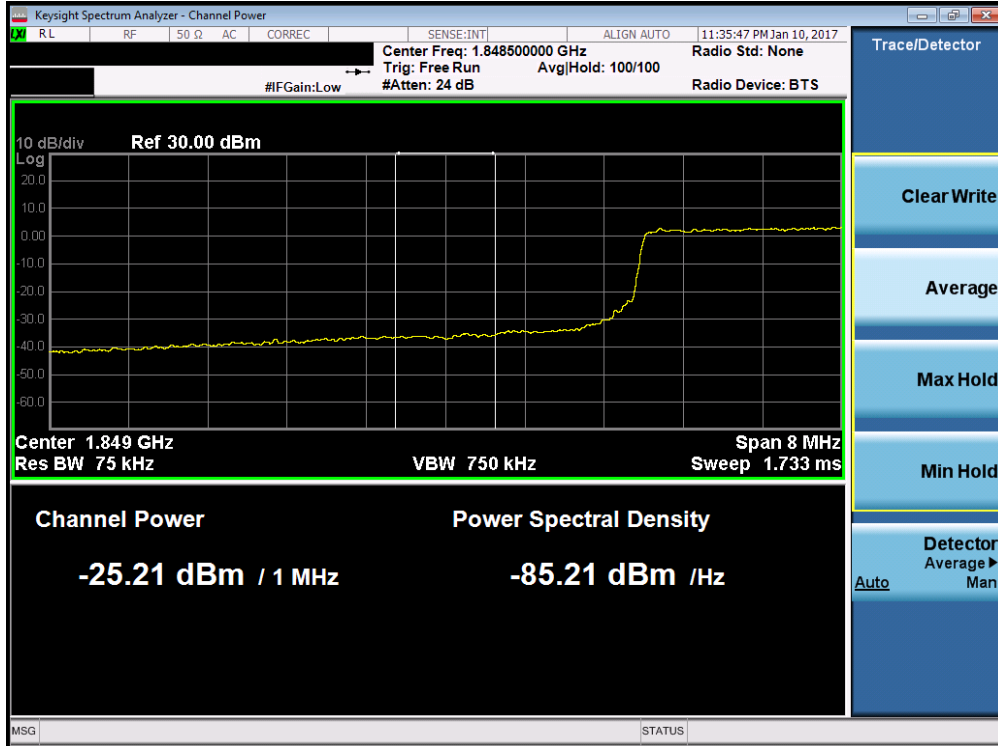


Plot 7-93. Upper Extended Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)

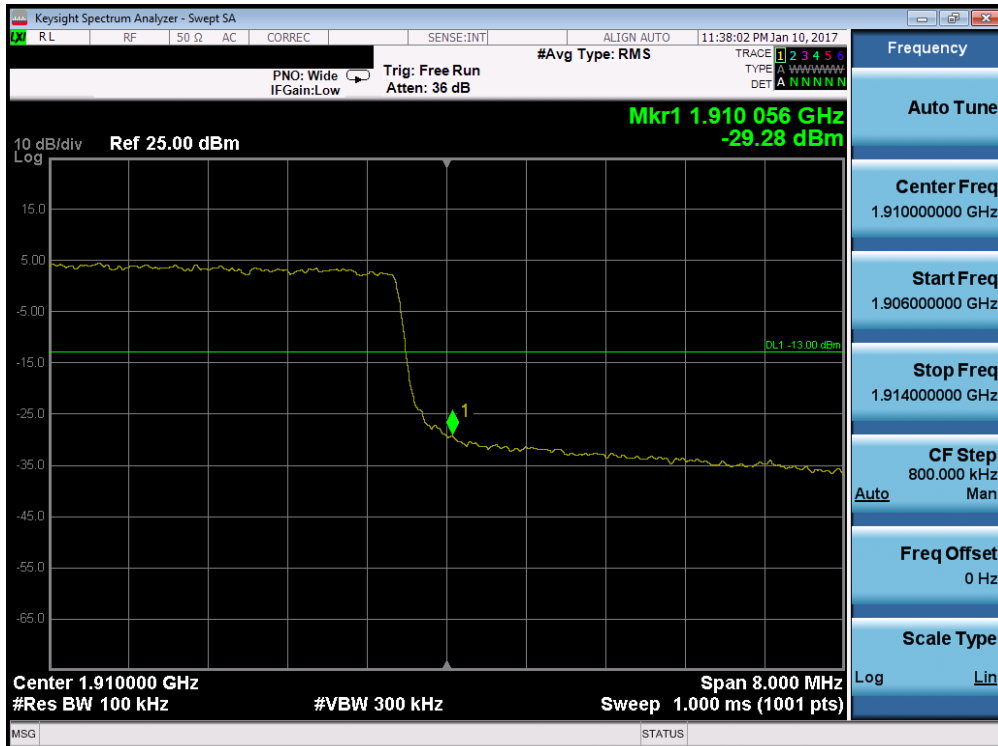


Plot 7-94. Lower Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 64 of 96

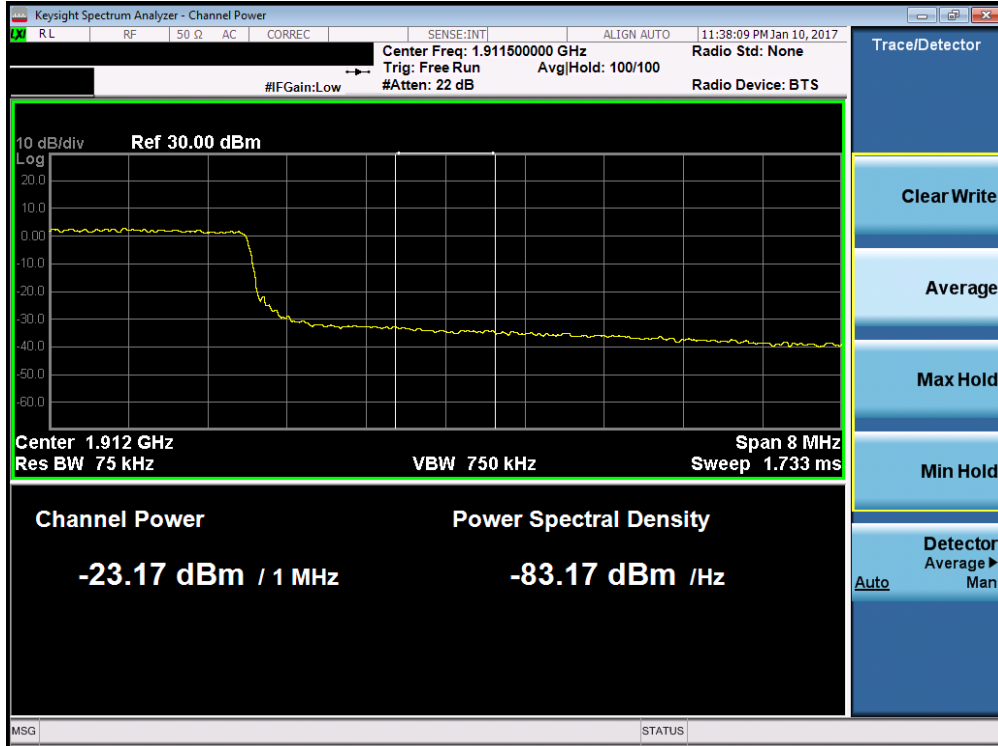


Plot 7-95. Lower Extended Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)

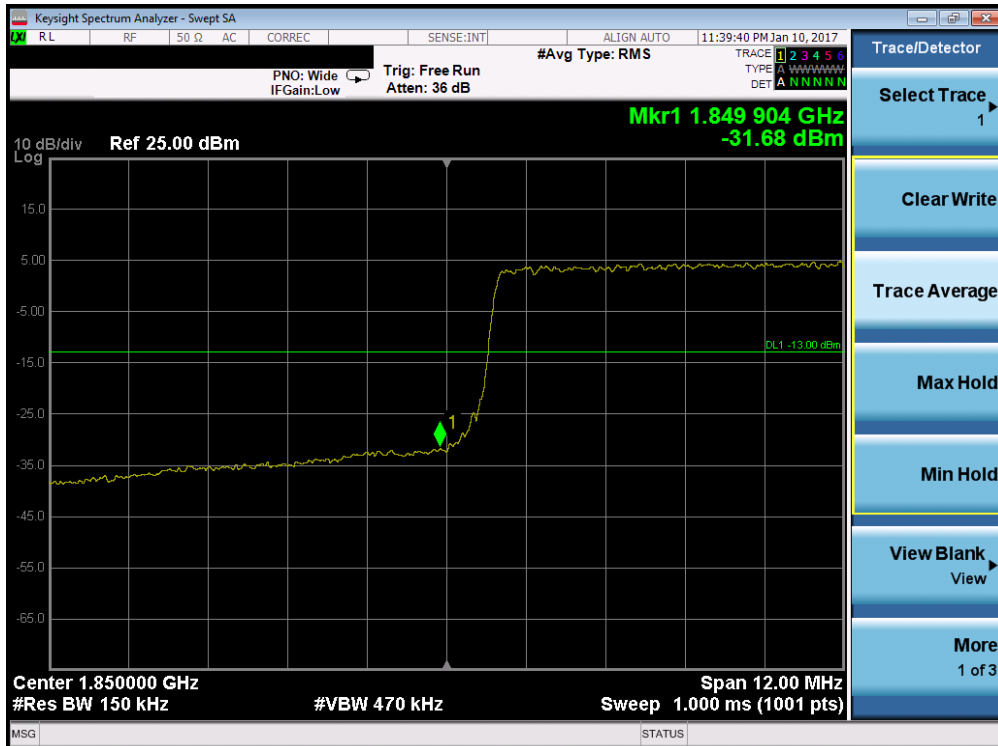


Plot 7-96. Upper Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 65 of 96

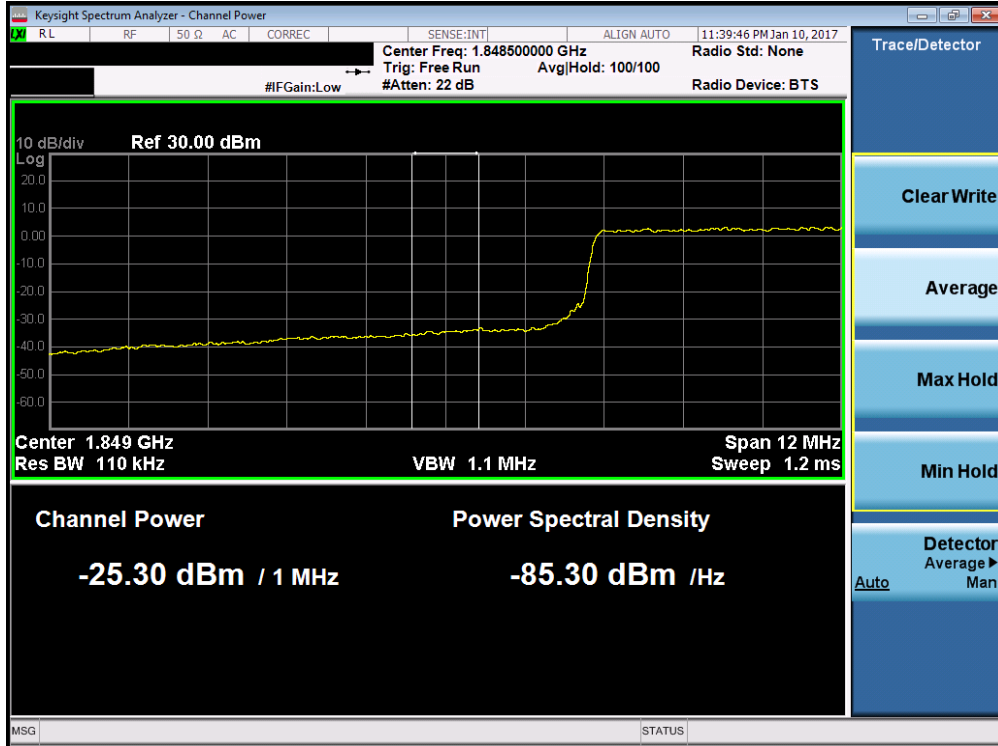


Plot 7-97. Upper Extended Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)

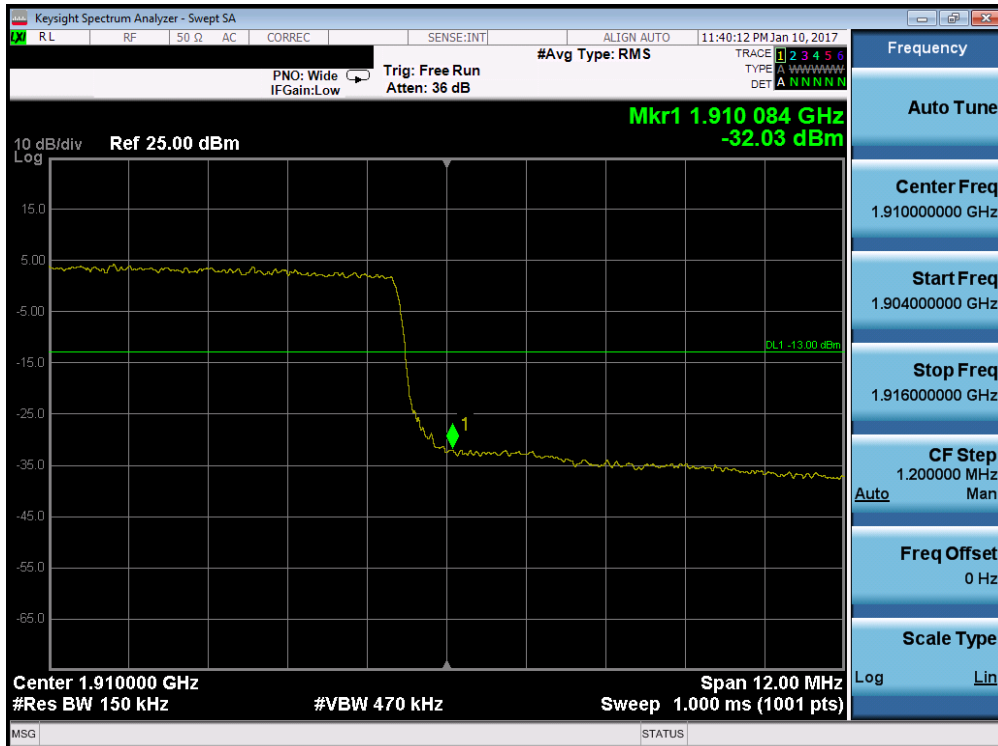


Plot 7-98. Lower Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 66 of 96

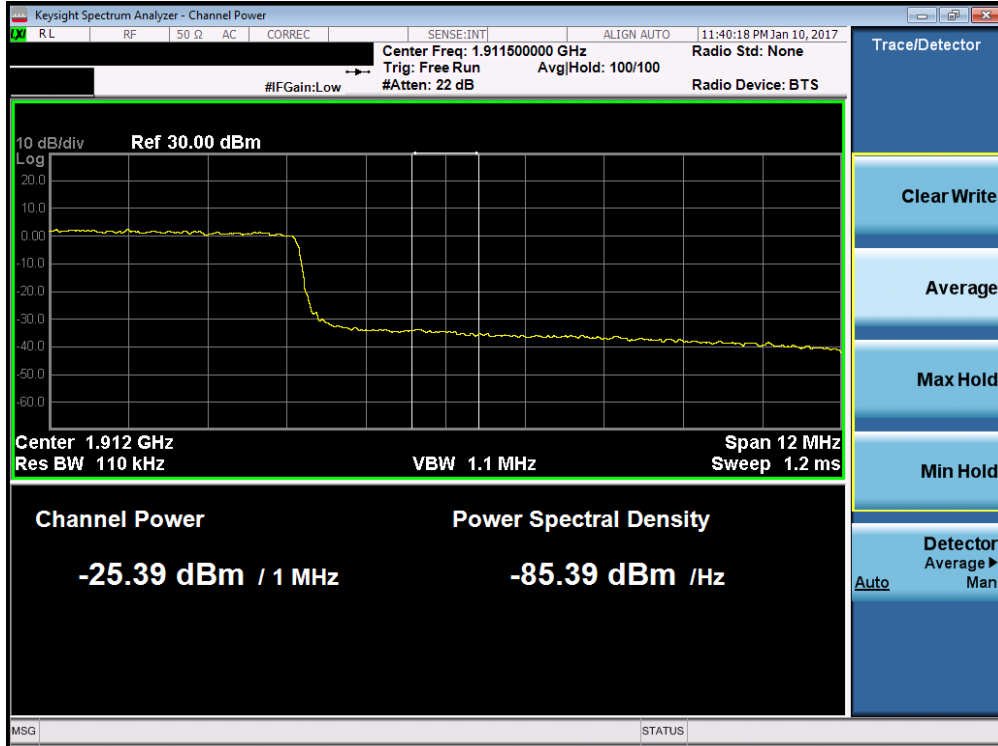


Plot 7-99. Lower Extended Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)

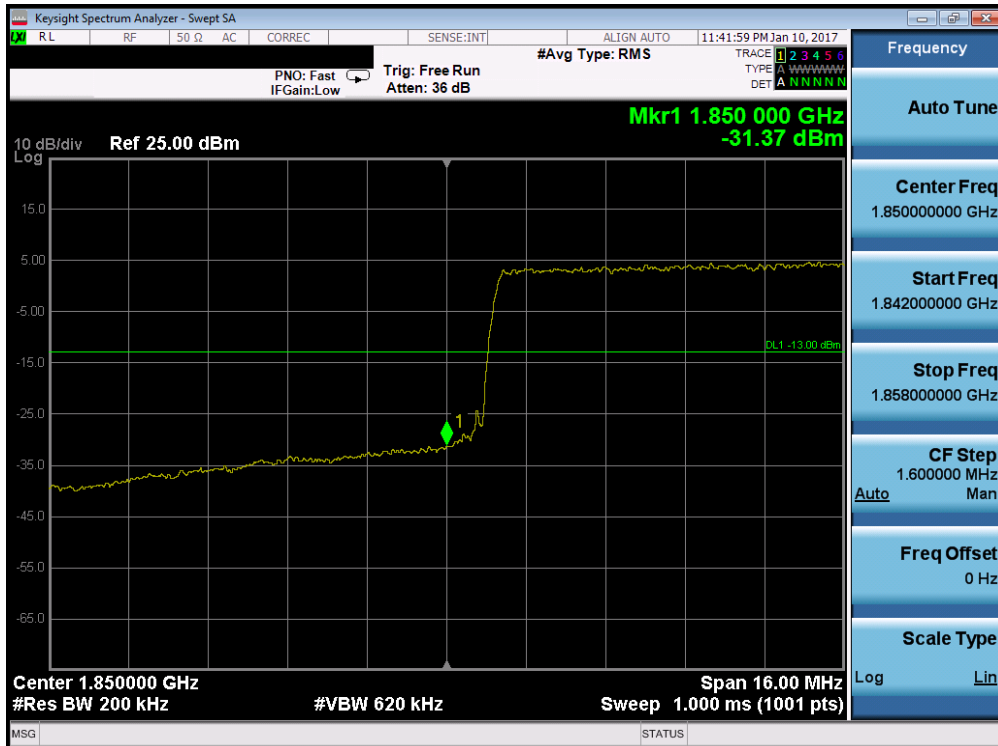


Plot 7-100. Upper Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 67 of 96



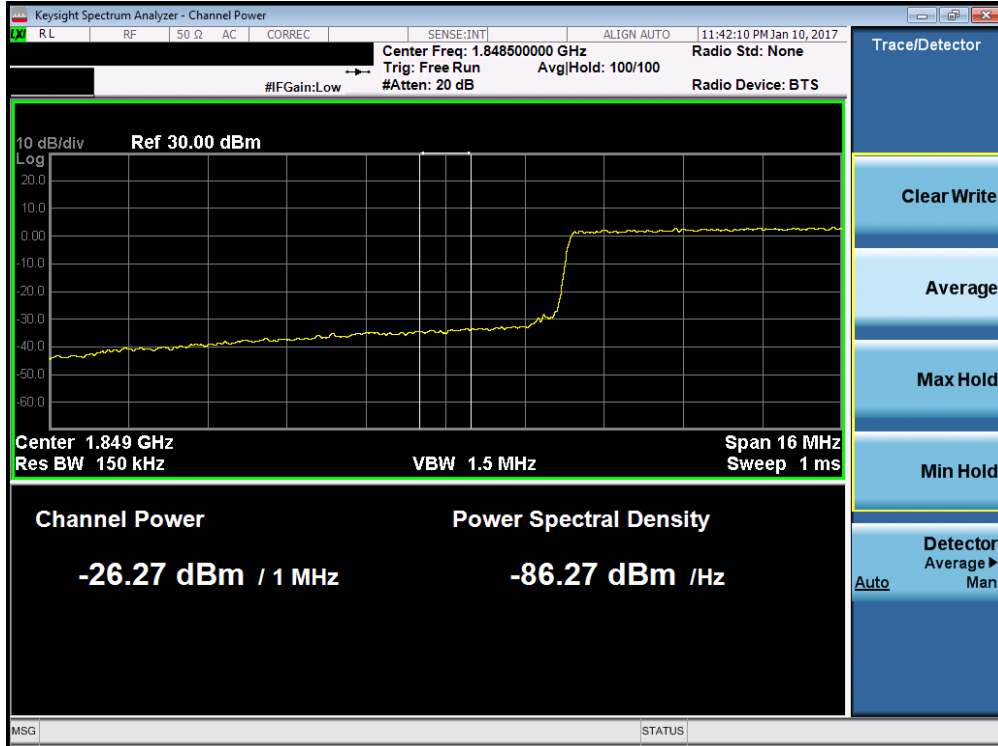
Plot 7-101. Upper Extended Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)



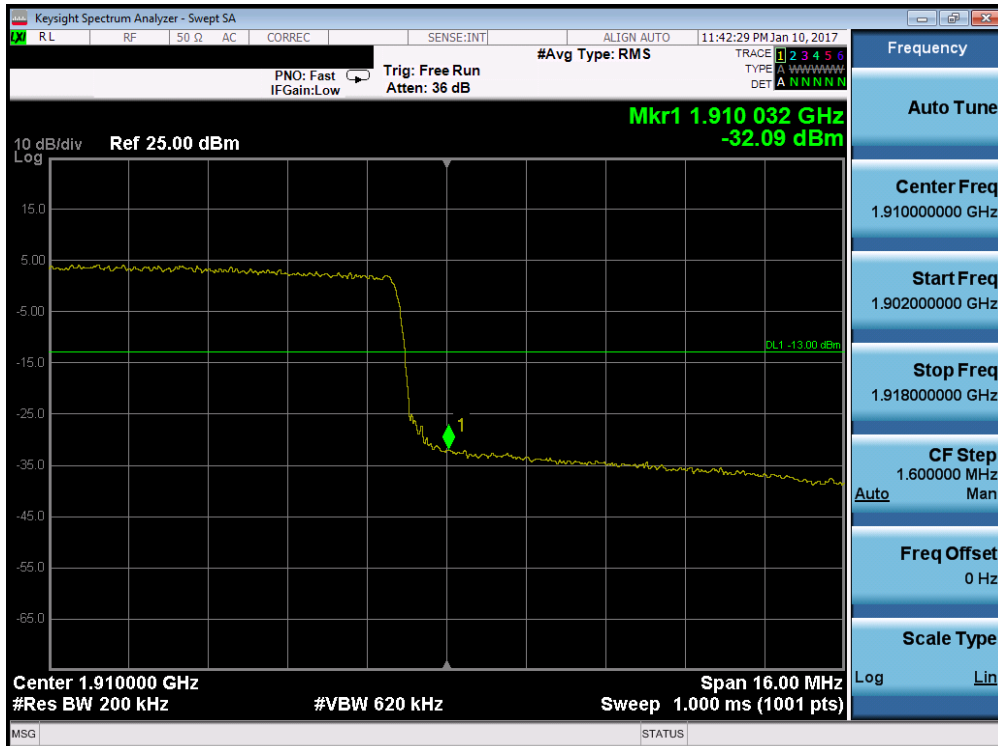
Plot 7-102. Lower Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 68 of 96



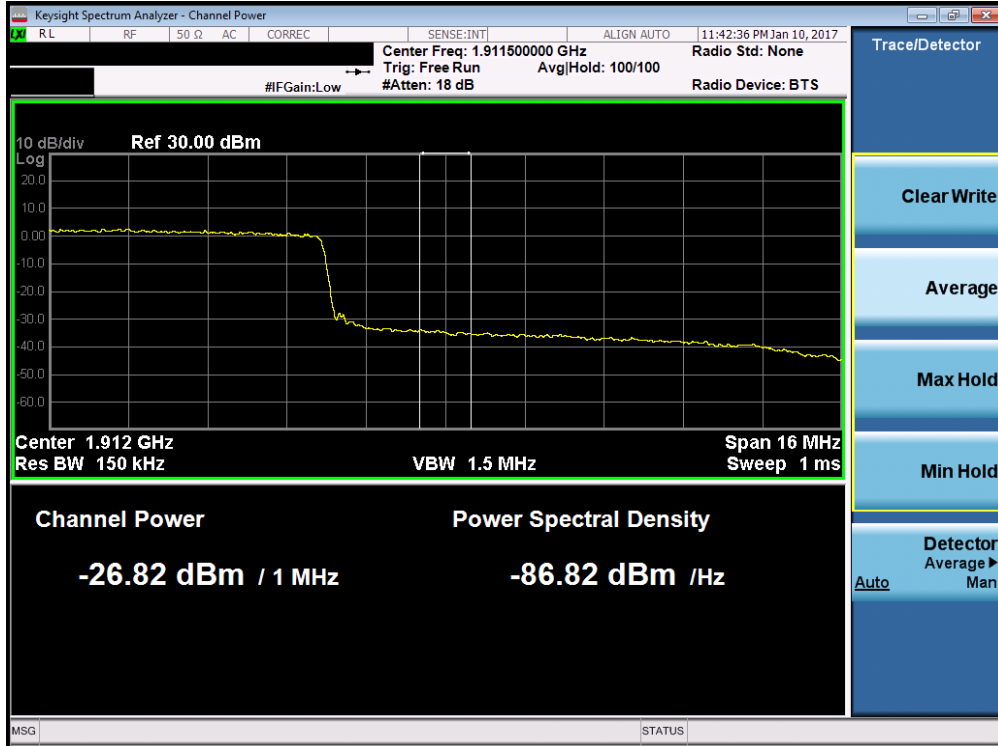


Plot 7-103. Lower Extended Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)



Plot 7-104. Upper Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 69 of 96



Plot 7-105. Upper Extended Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 70 of 96

## 7.5 Peak-Average Ratio

### §24.232(d)

#### Test Overview

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

#### Test Procedure Used

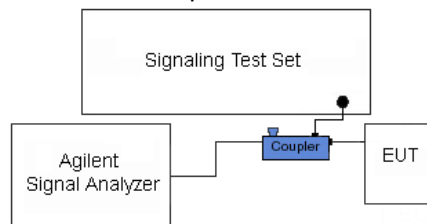
KDB 971168 D01 v02r02 – Section 5.7.1

#### Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms.

#### Test Setup



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

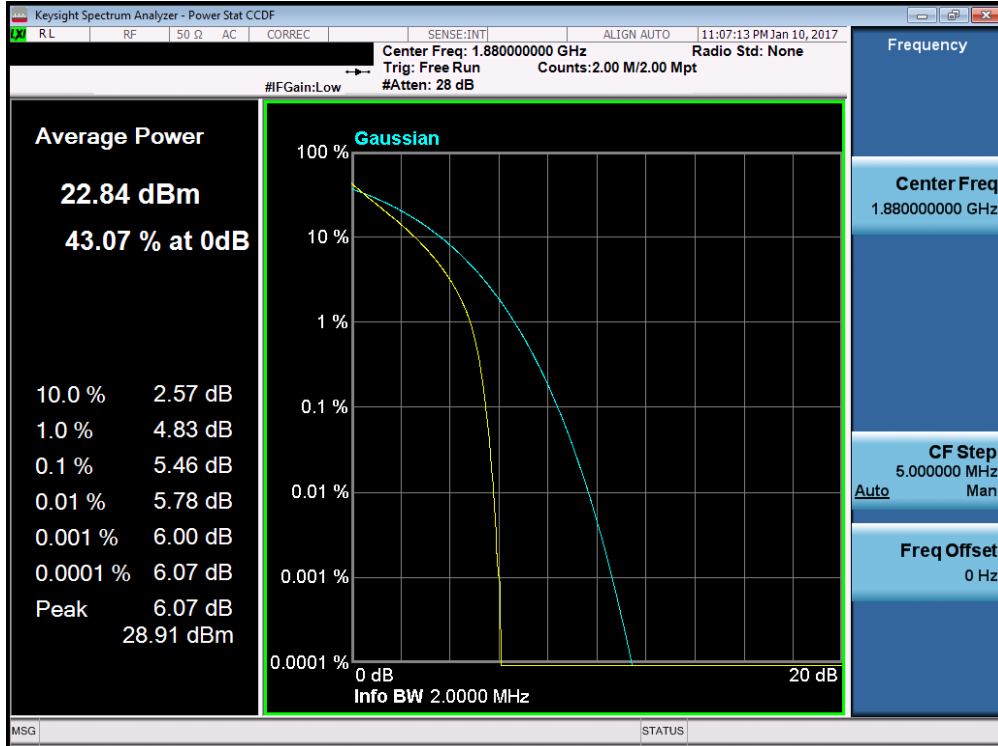


**Figure 7-4. Test Instrument & Measurement Setup**

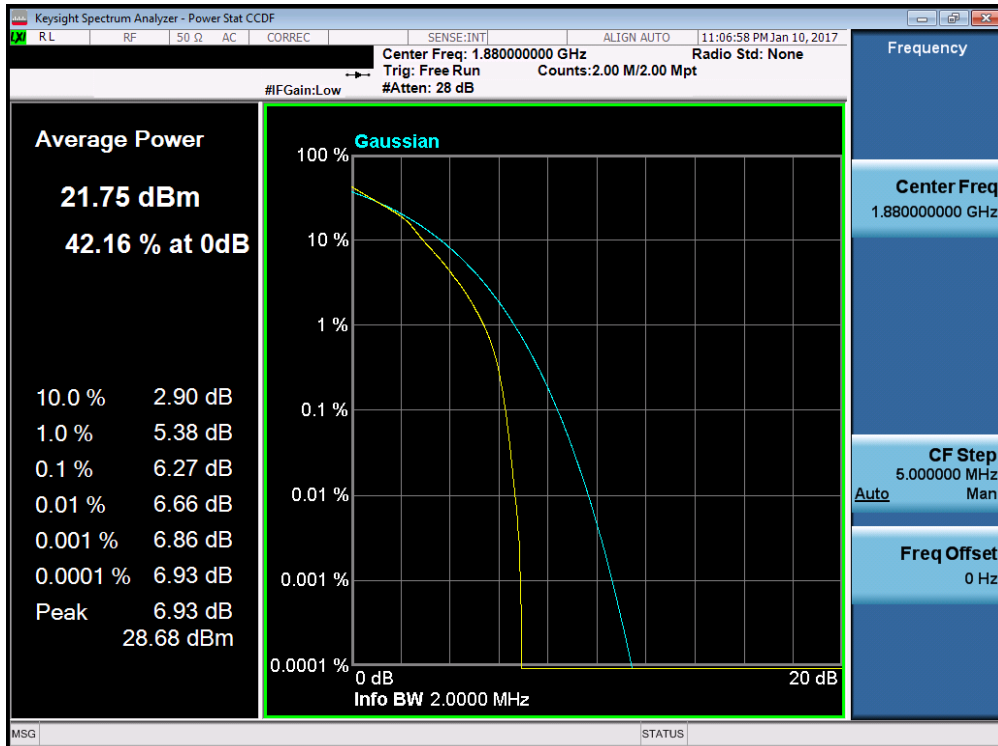
#### Test Notes

None.

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset	Page 71 of 96	

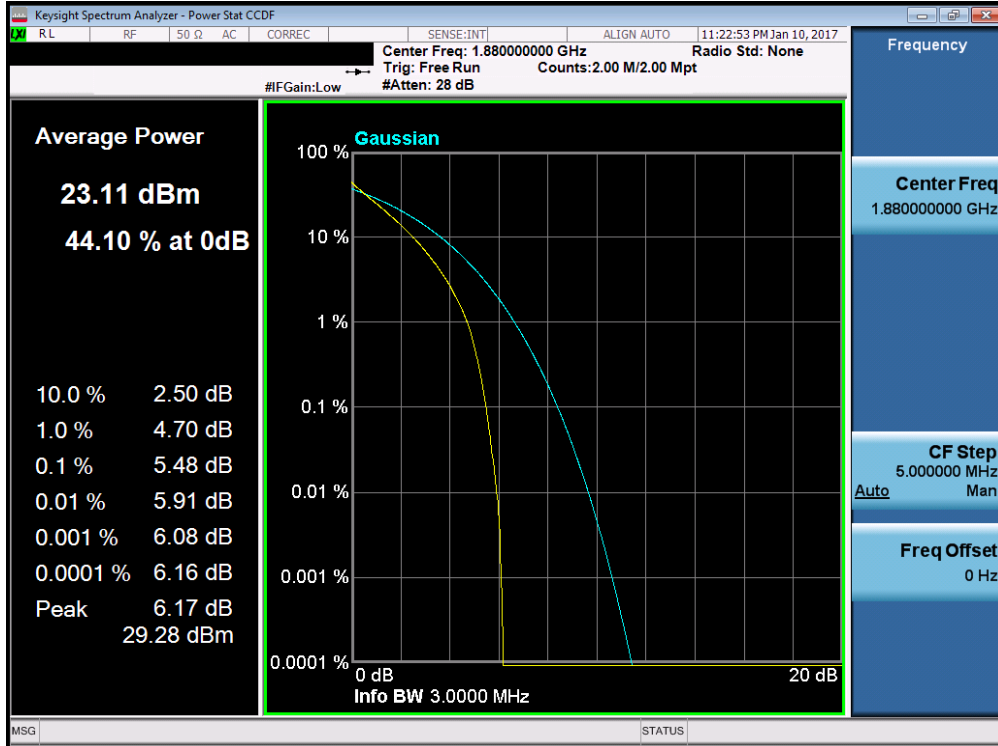


**Plot 7-106. PAR Plot (Band 2 – 1.4MHz QPSK – RB Size 6)**

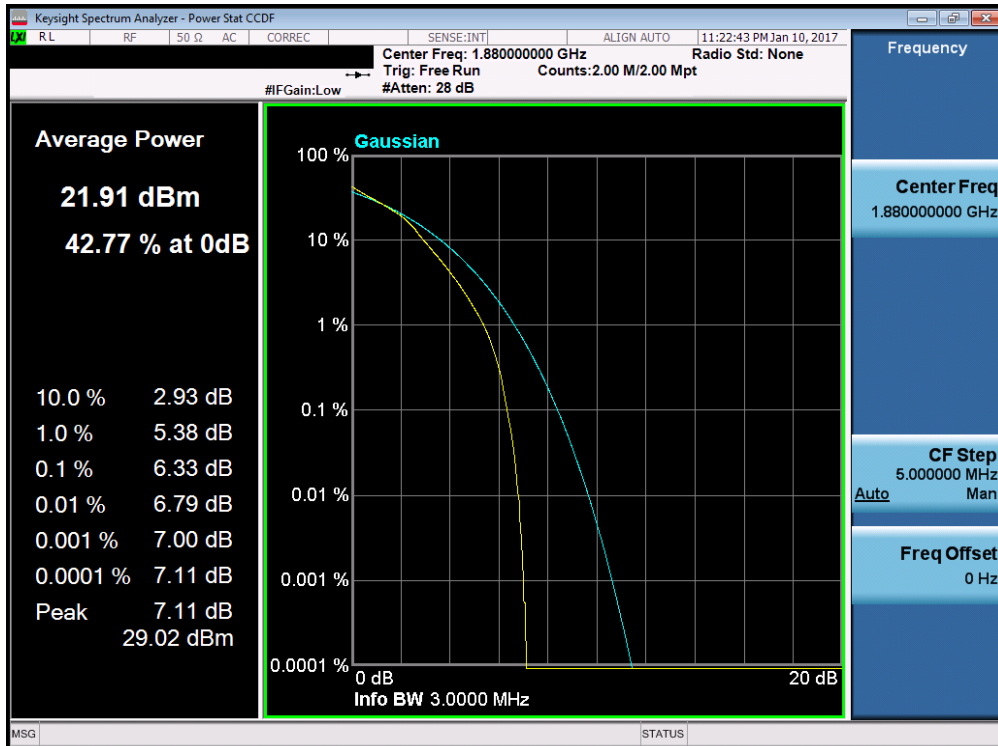


**Plot 7-107. PAR Plot (Band 2 – 1.4MHz 16-QAM – RB Size 6)**

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 72 of 96

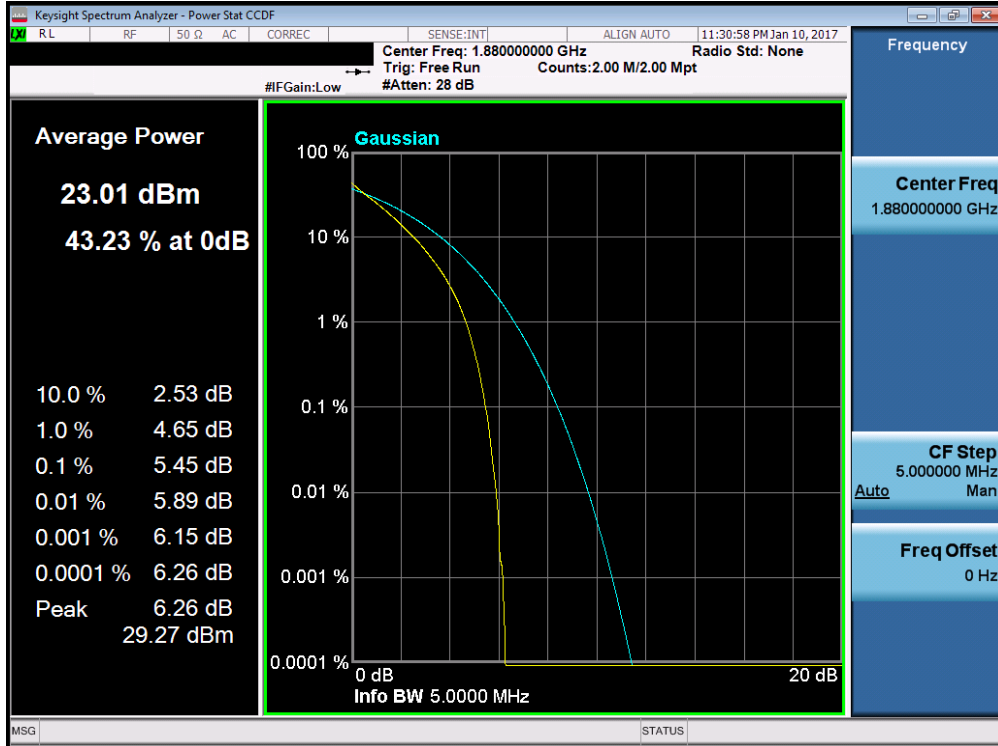


Plot 7-108. PAR Plot (Band 2 – 3.0MHz QPSK – RB Size 15)

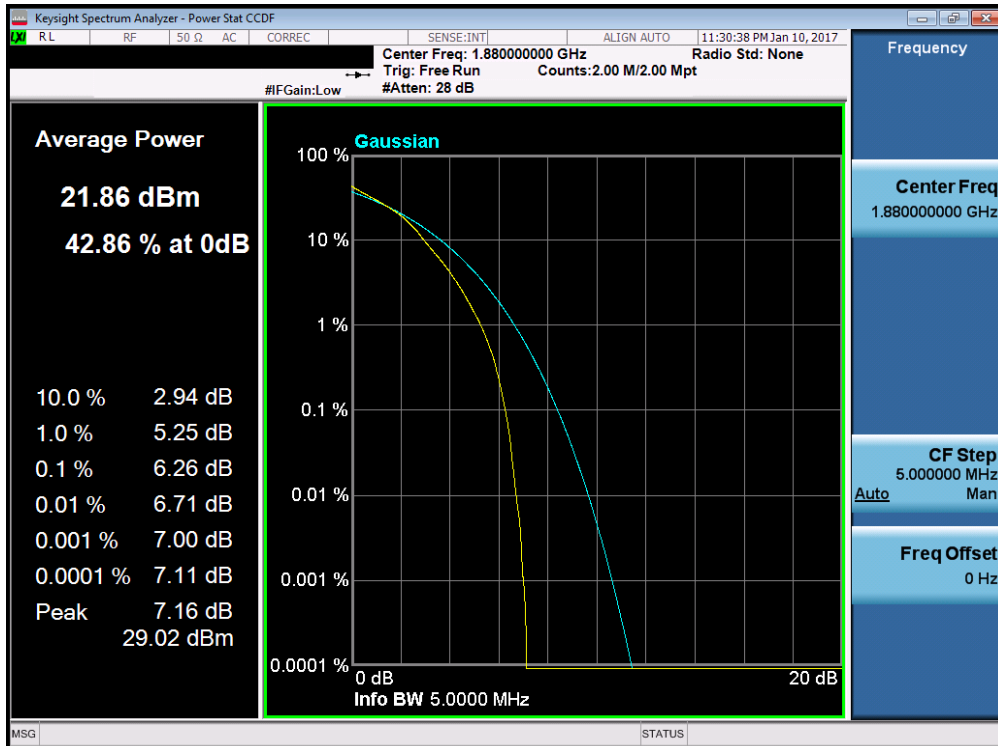


Plot 7-109. PAR Plot (Band 2 – 3.0MHz 16-QAM – RB Size 15)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 73 of 96

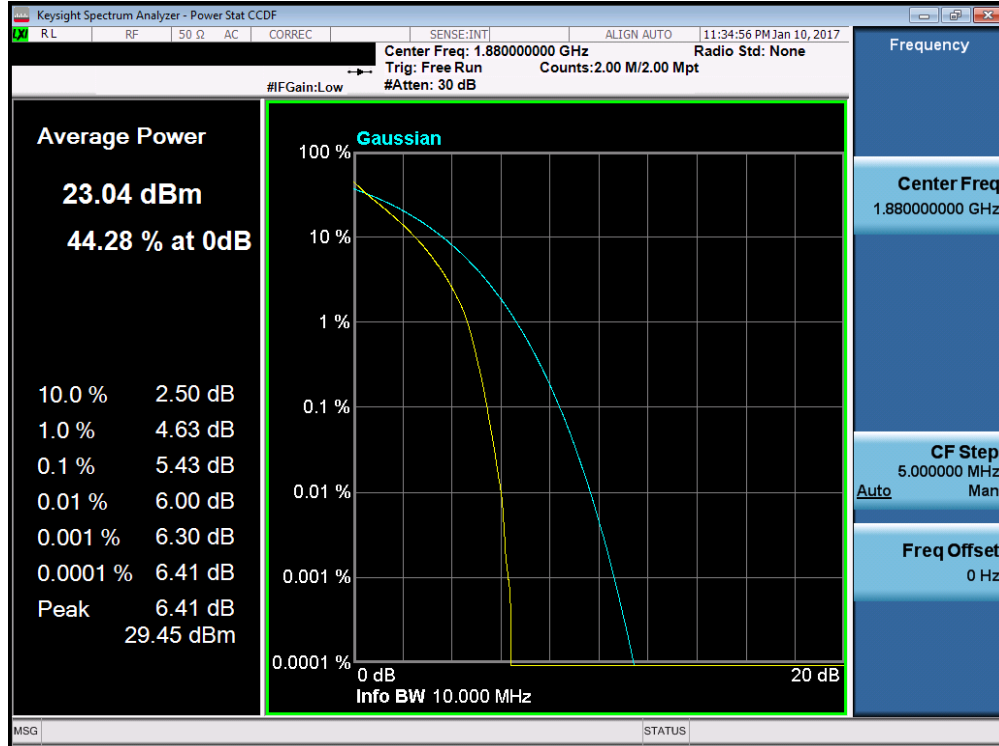


Plot 7-110. PAR Plot (Band 2 – 5.0MHz QPSK – RB Size 25)

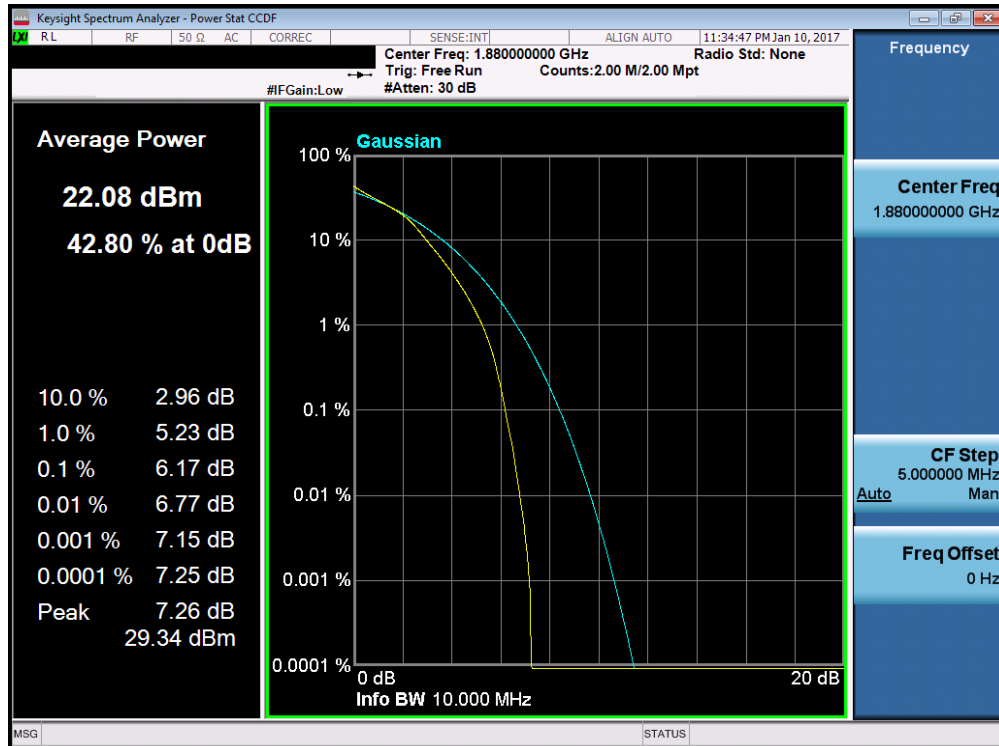


Plot 7-111. PAR Plot (Band 2 – 5.0MHz 16-QAM – RB Size 25)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 74 of 96



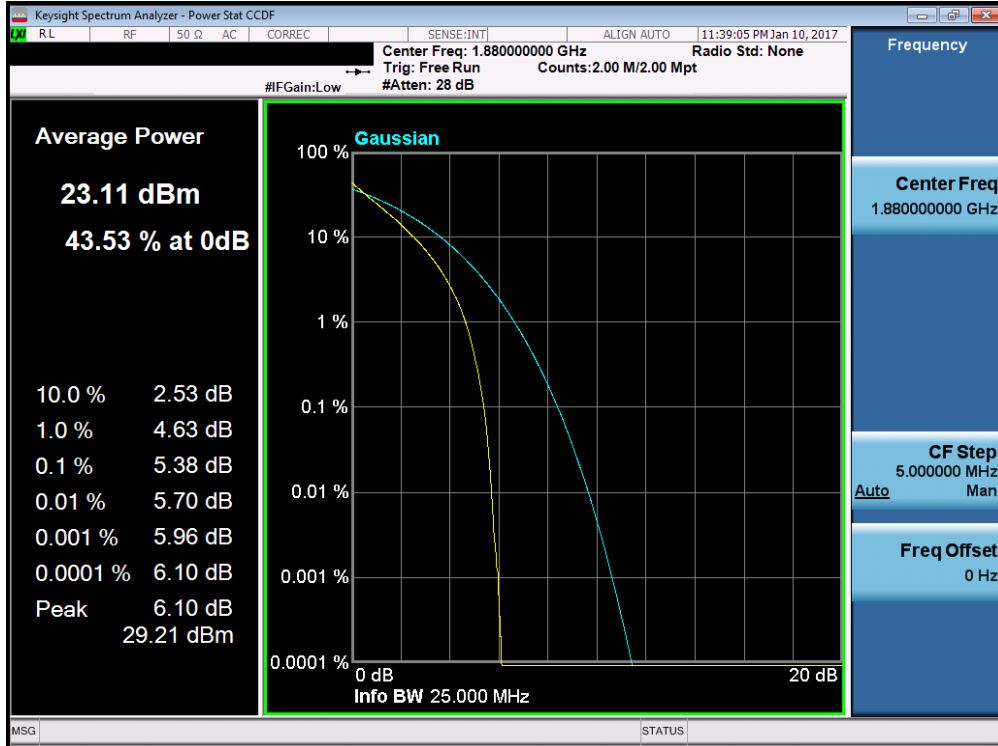
Plot 7-112. PAR Plot (Band 2 – 10.0MHz QPSK – RB Size 50)



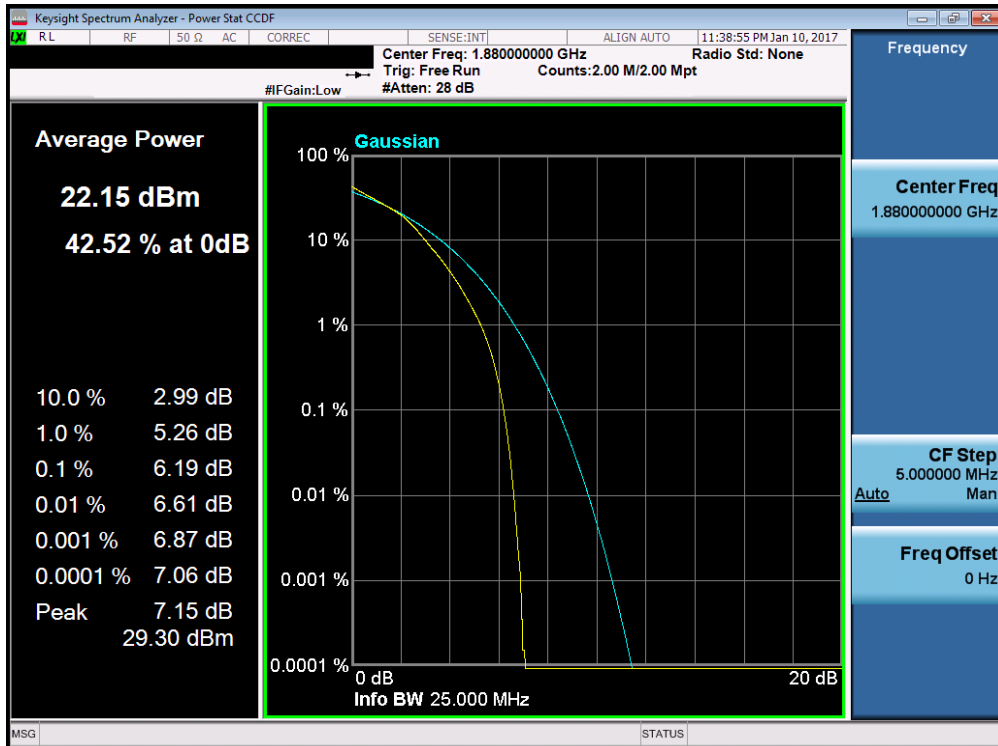
Plot 7-113. PAR Plot (Band 2 – 10.0MHz 16-QAM – RB Size 50)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 75 of 96



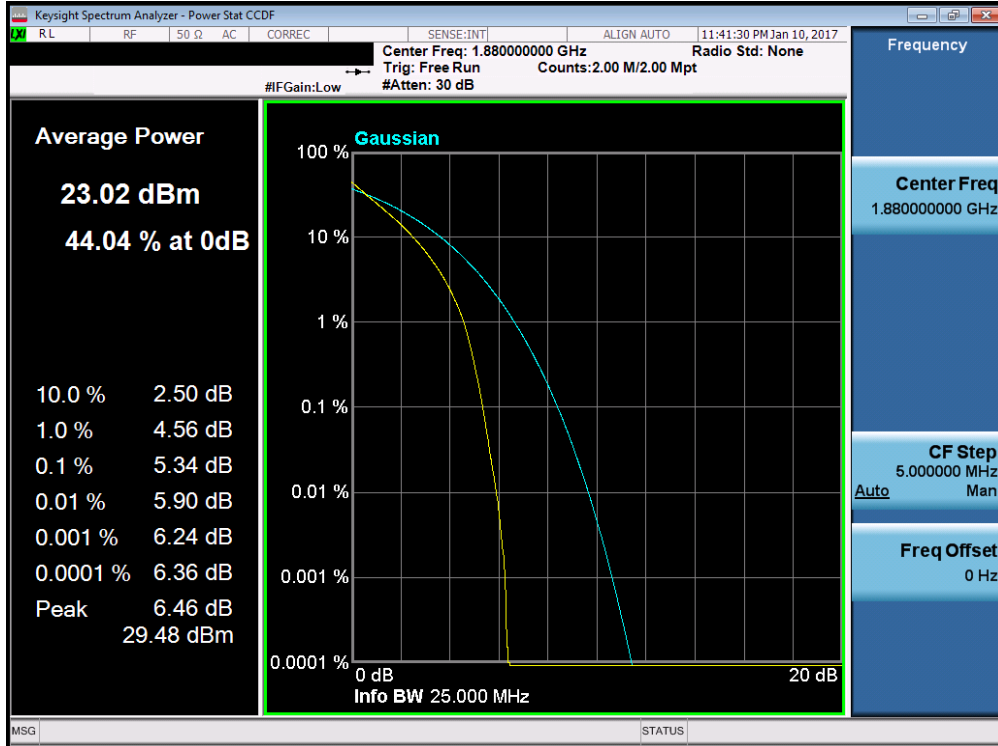


Plot 7-114. PAR Plot (Band 2 – 15.0MHz QPSK – RB Size 75)

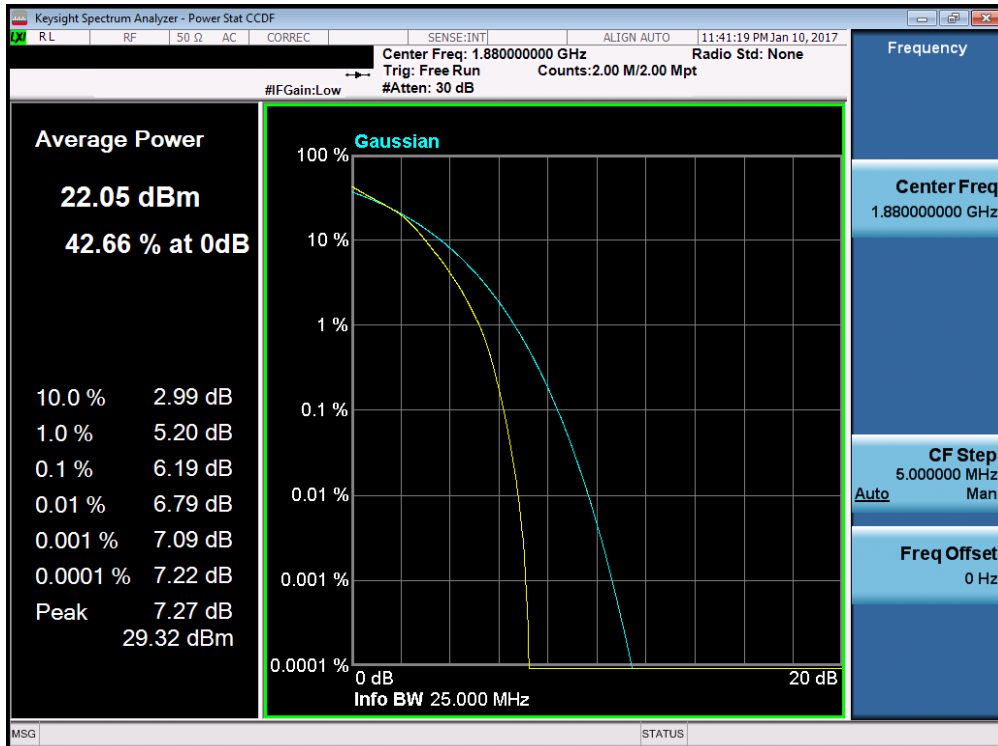


Plot 7-115. PAR Plot (Band 2 – 15.0MHz 16-QAM – RB Size 75)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 76 of 96



Plot 7-116. PAR Plot (Band 2 – 20.0MHz QPSK – RB Size 100)



Plot 7-117. PAR Plot (Band 2 – 20.0MHz 16-QAM – RB Size 100)

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 77 of 96

## 7.6 Radiated Power (ERP/EIRP)

§24.232(c.2) §27.50(b.10) §27.50(d.4)

### Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-D-2010 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 its maximum duty cycle, at maximum power, and at the appropriate frequencies.



### Test Procedures Used

KDB 971168 D01 v02r02 – Section 5.2.1

ANSI/TIA-603-D-2010 – Section 2.2.17

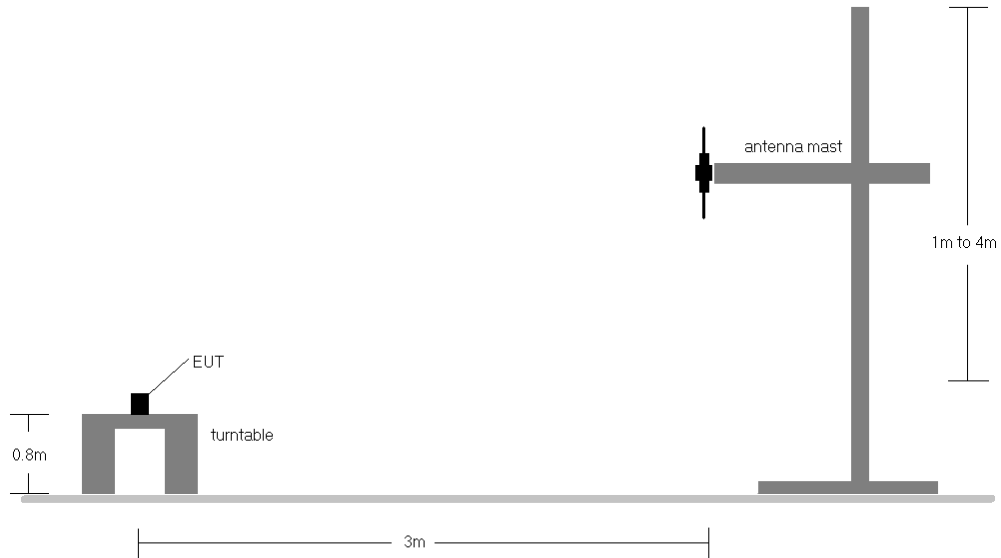
### Test Settings

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  $\geq$  3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points  $\geq$  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

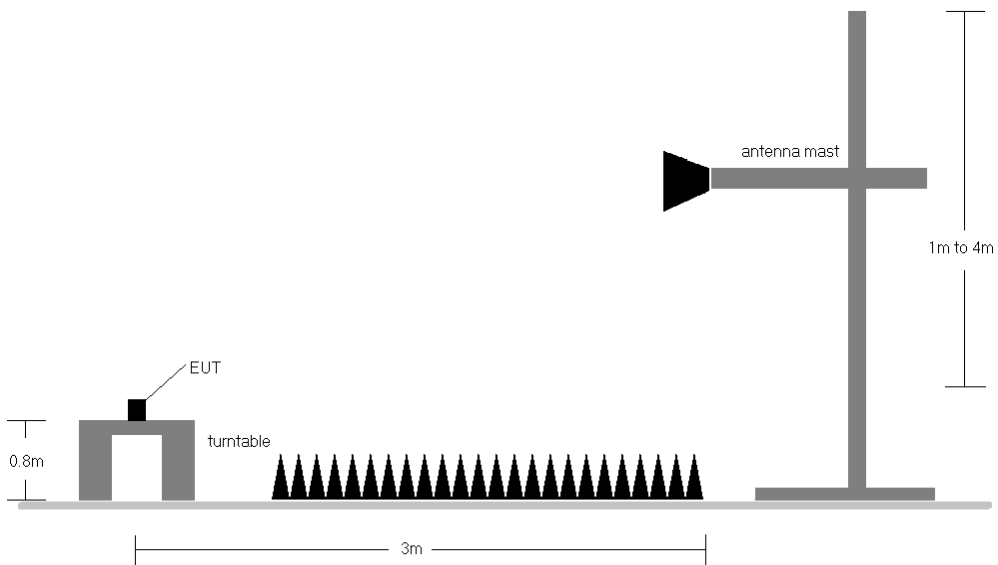
FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset	Page 78 of 96	

## Test Setup

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





**Figure 7-5. Radiated Test Setup <1GHz**



**Figure 7-6. Radiated Test Setup >1GHz**



## Test Notes

- 1) 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.

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset		Page 79 of 96



Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBd]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]
779.50	5	QPSK	H	150	65	1 / 0	20.08	-0.83	19.25	34.77	-15.52
782.00	5	QPSK	H	150	65	1 / 0	19.93	-0.82	19.11	34.77	-15.66
784.50	5	QPSK	H	150	65	1 / 0	20.17	-0.81	19.36	34.77	-15.41
779.50	5	16-QAM	H	150	65	1 / 0	18.16	-0.83	17.33	34.77	-17.44
782.00	5	16-QAM	H	150	65	1 / 0	18.28	-0.82	17.46	34.77	-17.31
784.50	5	16-QAM	H	150	65	1 / 0	18.32	-0.81	17.51	34.77	-17.26
782.00	10	QPSK	H	150	60	1 / 0	20.27	-0.82	19.45	34.77	-15.32
782.00	10	16-QAM	H	150	60	1 / 0	18.10	-0.82	17.28	34.77	-17.49
782.00	10	QPSK	V	150	260	1 / 0	16.33	-0.82	15.51	34.77	-19.26

**Table 7-2. ERP Data (Band 13)**

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
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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]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
1710.70	1.4	QPSK	H	150	76	1 / 0	19.76	5.53	25.29	30.00	-4.71
1732.50	1.4	QPSK	H	150	75	1 / 0	19.74	5.41	25.15	30.00	-4.85
1754.30	1.4	QPSK	H	150	66	1 / 0	19.20	5.29	24.49	30.00	-5.51
1710.70	1.4	16-QAM	H	150	76	1 / 0	18.96	5.53	24.49	30.00	-5.51
1732.50	1.4	16-QAM	H	150	75	1 / 0	18.79	5.41	24.20	30.00	-5.80
1754.30	1.4	16-QAM	H	150	66	1 / 0	18.52	5.29	23.81	30.00	-6.19
1711.50	3	QPSK	H	150	76	1 / 0	19.51	5.53	25.04	30.00	-4.96
1732.50	3	QPSK	H	150	79	1 / 0	19.10	5.41	24.51	30.00	-5.49
1753.50	3	QPSK	H	150	68	15 / 0	18.99	5.29	24.28	30.00	-5.72
1711.50	3	16-QAM	H	150	76	1 / 0	18.50	5.53	24.03	30.00	-5.97
1732.50	3	16-QAM	H	150	79	1 / 0	18.34	5.41	23.75	30.00	-6.25
1753.50	3	16-QAM	H	150	68	1 / 0	18.08	5.29	23.37	30.00	-6.63
1712.50	5	QPSK	H	150	73	1 / 0	19.66	5.53	25.19	30.00	-4.81
1732.50	5	QPSK	H	150	69	1 / 24	19.93	5.41	25.34	30.00	-4.66
1752.50	5	QPSK	H	150	72	1 / 0	18.91	5.29	24.20	30.00	-5.80
1712.50	5	16-QAM	H	150	73	1 / 0	18.82	5.53	24.35	30.00	-5.65
1732.50	5	16-QAM	H	150	69	1 / 24	18.98	5.41	24.39	30.00	-5.61
1752.50	5	16-QAM	H	150	72	1 / 0	18.17	5.29	23.46	30.00	-6.54
1715.00	10	QPSK	H	150	72	1 / 0	19.59	5.53	25.12	30.00	-4.88
1732.50	10	QPSK	H	150	65	1 / 0	20.24	5.41	25.65	30.00	-4.35
1750.00	10	QPSK	H	150	69	1 / 0	19.55	5.29	24.84	30.00	-5.16
1715.00	10	16-QAM	H	150	72	1 / 0	18.79	5.53	24.32	30.00	-5.68
1732.50	10	16-QAM	H	150	65	1 / 0	19.56	5.41	24.97	30.00	-5.03
1750.00	10	16-QAM	H	150	69	1 / 0	18.26	5.29	23.55	30.00	-6.45
1717.50	15	QPSK	H	150	71	1 / 0	19.53	5.53	25.06	30.00	-4.94
1732.50	15	QPSK	H	150	65	1 / 0	20.29	5.41	25.70	30.00	-4.30
1747.50	15	QPSK	H	150	66	1 / 0	19.42	5.29	24.71	30.00	-5.29
1717.50	15	16-QAM	H	150	71	1 / 0	18.61	5.53	24.14	30.00	-5.86
1732.50	15	16-QAM	H	150	65	1 / 0	19.43	5.41	24.84	30.00	-5.16
1747.50	15	16-QAM	H	150	66	1 / 0	18.70	5.29	23.99	30.00	-6.01
1720.00	20	QPSK	H	150	63	1 / 99	19.48	5.53	25.01	30.00	-4.99
1732.50	20	QPSK	H	150	65	1 / 0	19.49	5.41	24.90	30.00	-5.10
1745.00	20	QPSK	H	150	62	1 / 0	19.40	5.29	24.69	30.00	-5.31
1720.00	20	16-QAM	H	150	63	1 / 99	18.24	5.53	23.77	30.00	-6.23
1732.50	20	16-QAM	H	150	65	1 / 0	18.43	5.41	23.84	30.00	-6.16
1745.00	20	16-QAM	H	150	62	1 / 0	18.97	5.29	24.26	30.00	-5.74
1732.50	15	QPSK	V	150	119	1 / 0	15.26	5.41	20.67	30.00	-9.33

**Table 7-3. EIRP Data (Band 4)**

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset	Page 81 of 96	

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]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
1850.70	1.4	QPSK	H	150	177	1 / 0	20.01	4.82	24.83	33.01	-8.18
1880.00	1.4	QPSK	H	150	177	1 / 0	19.28	4.74	24.02	33.01	-8.99
1909.30	1.4	QPSK	H	150	178	1 / 0	18.54	4.68	23.22	33.01	-9.79
1850.70	1.4	16-QAM	H	150	177	1 / 0	18.51	4.82	23.33	33.01	-9.68
1880.00	1.4	16-QAM	H	150	177	1 / 0	17.55	4.74	22.29	33.01	-10.72
1909.30	1.4	16-QAM	H	150	178	1 / 0	16.66	4.68	21.34	33.01	-11.67
1851.50	3	QPSK	H	150	178	1 / 0	19.54	4.82	24.36	33.01	-8.65
1880.00	3	QPSK	H	150	175	1 / 0	19.27	4.74	24.01	33.01	-9.00
1908.50	3	QPSK	H	150	176	1 / 0	18.49	4.68	23.17	33.01	-9.84
1851.50	3	16-QAM	H	150	178	1 / 0	18.20	4.82	23.02	33.01	-9.99
1880.00	3	16-QAM	H	150	175	1 / 0	17.77	4.74	22.51	33.01	-10.50
1908.50	3	16-QAM	H	150	176	1 / 0	17.24	4.68	21.92	33.01	-11.09
1852.50	5	QPSK	H	150	179	1 / 0	19.64	4.82	24.46	33.01	-8.55
1880.00	5	QPSK	H	150	179	1 / 0	19.04	4.74	23.78	33.01	-9.23
1907.50	5	QPSK	H	150	178	1 / 24	18.63	4.68	23.31	33.01	-9.70
1852.50	5	16-QAM	H	150	179	1 / 0	18.06	4.82	22.88	33.01	-10.13
1880.00	5	16-QAM	H	150	179	1 / 0	17.79	4.74	22.53	33.01	-10.48
1907.50	5	16-QAM	H	150	178	1 / 24	17.30	4.68	21.98	33.01	-11.03
1855.00	10	QPSK	H	150	178	1 / 49	19.45	4.82	24.27	33.01	-8.74
1880.00	10	QPSK	H	150	178	1 / 0	19.15	4.74	23.89	33.01	-9.12
1905.00	10	QPSK	H	150	177	1 / 0	18.54	4.68	23.22	33.01	-9.79
1855.00	10	16-QAM	H	150	178	1 / 49	17.91	4.82	22.73	33.01	-10.28
1880.00	10	16-QAM	H	150	178	1 / 0	17.44	4.74	22.18	33.01	-10.83
1905.00	10	16-QAM	H	150	177	1 / 0	16.67	4.68	21.35	33.01	-11.66
1857.50	15	QPSK	H	150	178	1 / 74	19.48	4.82	24.30	33.01	-8.71
1880.00	15	QPSK	H	150	177	1 / 0	19.20	4.74	23.94	33.01	-9.07
1902.50	15	QPSK	H	150	178	1 / 0	18.63	4.68	23.31	33.01	-9.70
1857.50	15	16-QAM	H	150	178	1 / 74	17.62	4.82	22.44	33.01	-10.57
1880.00	15	16-QAM	H	150	177	1 / 0	17.74	4.74	22.48	33.01	-10.53
1902.50	15	16-QAM	H	150	178	1 / 0	17.42	4.68	22.10	33.01	-10.91
1860.00	20	QPSK	H	150	178	1 / 99	19.12	4.82	23.94	33.01	-9.07
1880.00	20	QPSK	H	150	177	1 / 0	19.12	4.74	23.86	33.01	-9.15
1900.00	20	QPSK	H	150	177	1 / 0	18.64	4.68	23.32	33.01	-9.69
1860.00	20	16-QAM	H	150	178	1 / 99	17.78	4.82	22.60	33.01	-10.41
1880.00	20	16-QAM	H	150	177	1 / 0	18.18	4.74	22.92	33.01	-10.09
1900.00	20	16-QAM	H	150	177	1 / 0	17.38	4.68	22.06	33.01	-10.95
1850.70	1.4	QPSK	V	150	231	1 / 0	16.93	4.82	21.75	33.01	-11.26

**Table 7-4. EIRP Data (Band 2)**

FCC ID: ZNFL84VL	 <b>FCC Pt. 24 &amp; 27 LTE MEASUREMENT REPORT (CERTIFICATION)</b> 		Approved by: Quality Manager
Test Report S/N: 1M1701030003-03.ZNF	Test Dates: 12/28/2016 - 1/17/2017	EUT Type: Portable Handset	Page 82 of 96



## 7.7 Radiated Spurious Emissions Measurements

§2.1053 §24.238(a) §27.53(c) §27.53(f) §27.53(h)

### Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-D-2010 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 peak 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 v02r02 – Section 5.8

ANSI/TIA-603-D-2010 – Section 2.2.12

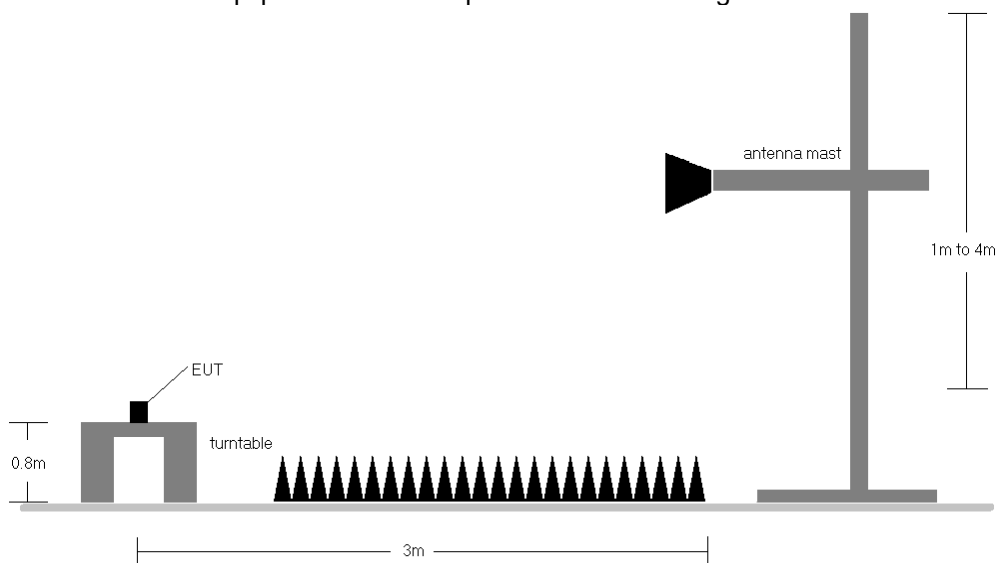
### Test Settings

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

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## Test Setup



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



**Figure 7-7. Test Instrument & Measurement Setup**

## 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.
- 3) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 4) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
- 5) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

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OPERATING FREQUENCY: 782.00 MHz  
 CHANNEL: 23230  
 MEASURED OUTPUT POWER: 19.45 dBm = 0.088 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 10.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  32.45 dBc



Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
2346.00	H	110	359	-67.27	7.00	-60.27	79.7
3128.00	H	-	-	-64.09	7.21	-56.87	76.3

**Table 7-5. Radiated Spurious Data (Band 13)**

MODULATION SIGNAL: QPSK  
 BANDWIDTH: 10.00 MHz  
 DISTANCE: 3 meters  
 NARROWBAND EMISSION LIMIT: -50 dBm  
 WIDEBAND EMISSION LIMIT: -40 dBm/MHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1564.00	H	-	-	-70.22	6.41	-63.81	-23.8

**Table 7-6. Radiated Spurious Data (Band 13 – 1559-1610MHz Band)**

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
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OPERATING FREQUENCY: 1717.50 MHz  
 CHANNEL: 20025  
 MEASURED OUTPUT POWER: 25.06 dBm = 0.320 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 15.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  38.06 dBc



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]	[dBc]
3435.00	H	121	78	-54.27	9.68	-44.59	69.6
5152.50	H	121	99	-58.65	10.89	-47.76	72.8
6870.00	H	-	-	-55.67	10.79	-44.87	69.9

**Table 7-7. Radiated Spurious Data (Band 4 – Low Channel)**

OPERATING FREQUENCY: 1732.50 MHz  
 CHANNEL: 20175  
 MEASURED OUTPUT POWER: 25.70 dBm = 0.371 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 15.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  38.70 dBc

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]	[dBc]
3465.00	H	125	212	-56.63	9.77	-46.86	72.6
5197.50	H	125	188	-59.15	10.81	-48.34	74.0
6930.00	H	-	-	-55.48	10.89	-44.59	70.3

**Table 7-8. Radiated Spurious Data (Band 4 – Mid Channel)**

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
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OPERATING FREQUENCY: 1747.50 MHz  
 CHANNEL: 20325  
 MEASURED OUTPUT POWER: 24.71 dBm = 0.296 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 15.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  37.71 dBc



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]	[dBc]
3495.00	H	116	212	-57.87	9.86	-48.00	72.7
5242.50	H	116	190	-54.35	10.89	-43.46	68.2
6990.00	H	-	-	-55.45	11.03	-44.42	69.1

**Table 7-9. Radiated Spurious Data (Band 4 – High Channel)**

OPERATING FREQUENCY: 1850.70 MHz  
 CHANNEL: 18607  
 MEASURED OUTPUT POWER: 24.83 dBm = 0.304 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 1.4 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  37.83 dBc

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]	[dBc]
3701.40	H	-	-	-64.12	10.03	-54.10	78.9
5552.10	H	-	-	-60.79	11.18	-49.61	74.4

**Table 7-10. Radiated Spurious Data (Band 2 – Low Channel)**

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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OPERATING FREQUENCY: 1880.00 MHz  
 CHANNEL: 18900  
 MEASURED OUTPUT POWER: 24.02 dBm = 0.252 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 1.4 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  37.02 dBc



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]	[dBc]
3760.00	H	-	-	-63.71	9.79	-53.93	77.9
5640.00	H	113	173	-58.82	11.35	-47.47	71.5
7520.00	H	-	-	-54.77	11.22	-43.56	67.6

**Table 7-11. Radiated Spurious Data (Band 2 – Mid Channel)**

OPERATING FREQUENCY: 1909.30 MHz  
 CHANNEL: 19193  
 MEASURED OUTPUT POWER: 23.22 dBm = 0.210 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 1.4 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  36.22 dBc

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]	[dBc]
3818.60	H	-	-	-62.94	9.56	-53.38	76.6
5727.90	H	-	-	-61.20	11.43	-49.76	73.0

**Table 7-12. Radiated Spurious Data (Band 2 – High Channel)**

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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## 7.8 Frequency Stability / Temperature Variation

§2.1055 §24.235 §27.54

### Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-D-2010. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

***For Part 24 and Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.***

### Test Procedure Used

ANSI/TIA-603-D-2010

### 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

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## Band 13 Frequency Stability Measurements

§2.1055 §27.54



OPERATING FREQUENCY: 782,000,000 Hz  
 CHANNEL: 23230  
 REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	782,000,291	291	0.0000372
100 %		- 30	782,000,291	291	0.0000372
100 %		- 20	782,000,074	74	0.0000095
100 %		- 10	781,999,982	-18	-0.0000023
100 %		0	782,000,175	175	0.0000224
100 %		+ 10	782,000,172	172	0.0000220
100 %		+ 20	782,000,105	105	0.0000134
100 %		+ 30	781,999,990	-10	-0.0000013
100 %		+ 40	782,000,104	104	0.0000133
100 %		+ 50	781,999,984	-16	-0.0000020
BATT. ENDPOINT		3.45	+ 20	781,999,957	-43

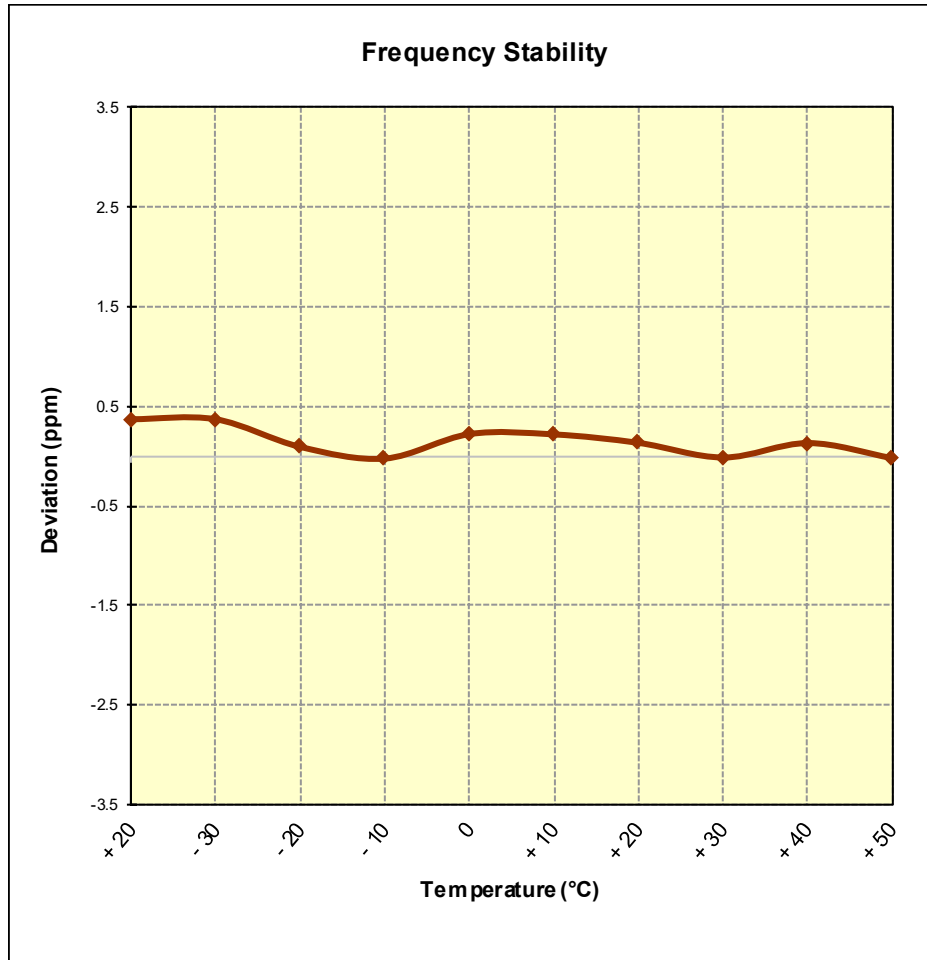
**Table 7-13. Frequency Stability Data (Band 13)**

**Note:**



Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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**Band 13 Frequency Stability Measurements**  
**§2.1055 §27.54**



**Figure 7-8. Frequency Stability Graph (Band 13)**

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## Band 4 Frequency Stability Measurements

§2.1055 §§27.54



OPERATING FREQUENCY: 1,732,500,000 Hz  
 CHANNEL: 20175  
 REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	1,732,499,991	-9	-0.0000005
100 %		- 30	1,732,500,028	28	0.0000016
100 %		- 20	1,732,499,894	-106	-0.0000061
100 %		- 10	1,732,500,000	0	0.0000000
100 %		0	1,732,500,387	387	0.0000223
100 %		+ 10	1,732,499,836	-164	-0.0000095
100 %		+ 20	1,732,500,081	81	0.0000047
100 %		+ 30	1,732,499,826	-174	-0.0000100
100 %		+ 40	1,732,499,681	-319	-0.0000184
100 %		+ 50	1,732,500,178	178	0.0000103
BATT. ENDPOINT	3.45	+ 20	1,732,499,817	-183	-0.0000106

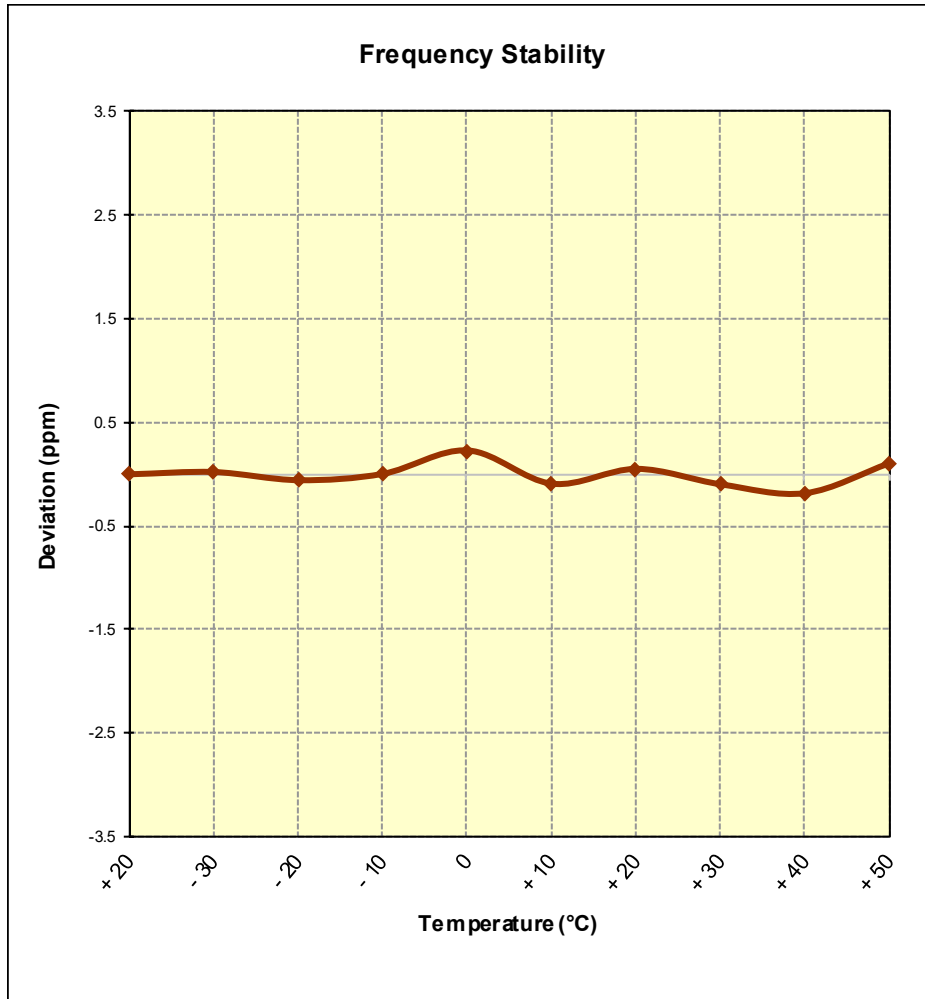
Table 7-14. Frequency Stability Data (Band 4)

**Note:**

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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**Band 4 Frequency Stability Measurements**  
**§2.1055 §§27.54**



**Figure 7-9. Frequency Stability Graph (Band 4)**

FCC ID: ZNFL84VL		FCC Pt. 24 & 27 LTE MEASUREMENT REPORT (CERTIFICATION)	 Approved by: Quality Manager
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## Band 2 Frequency Stability Measurements

§2.1055 §24.235



OPERATING FREQUENCY: 1,880,000,000 Hz  
 CHANNEL: 18900  
 REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	1,879,999,618	-382	-0.0000203
100 %		- 30	1,880,000,221	221	0.0000118
100 %		- 20	1,879,999,866	-134	-0.0000071
100 %		- 10	1,879,999,961	-39	-0.0000021
100 %		0	1,879,999,978	-22	-0.0000012
100 %		+ 10	1,879,999,801	-199	-0.0000106
100 %		+ 20	1,879,999,662	-338	-0.0000180
100 %		+ 30	1,880,000,071	71	0.0000038
100 %		+ 40	1,879,999,712	-288	-0.0000153
100 %		+ 50	1,879,999,946	-54	-0.0000029
BATT. ENDPOINT	3.45	+ 20	1,880,000,283	283	0.0000151

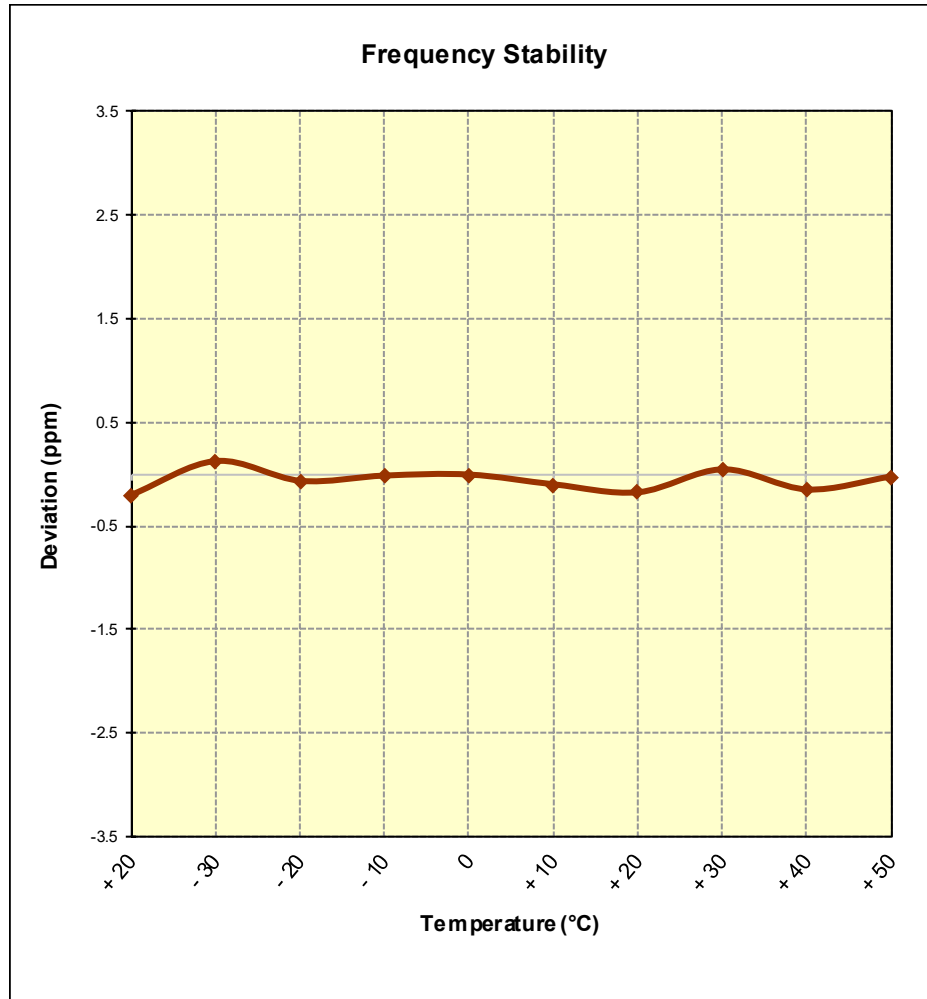
**Table 7-15. Frequency Stability Data (Band 2)**

**Note:**

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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**Band 2 Frequency Stability Measurements**  
**§2.1055 §24.235**





**Figure 7-10. Frequency Stability Graph (Band 2)**

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## 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFL84VL** complies with all the requirements of Parts 24 & 27 of the FCC rules for LTE operation only.

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<b>Test Report S/N:</b> 1M1701030003-03.ZNF	<b>Test Dates:</b> 12/28/2016 - 1/17/2017	<b>EUT Type:</b> Portable Handset		Page 96 of 96