



# PCTEST ENGINEERING LABORATORY, INC.

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## MEASUREMENT REPORT FCC Part 22 LTE

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


**Date of Testing:**  
8/24-8/30/2016  
**Test Site/Location:**  
PCTEST Lab., Columbia, MD, USA  
**Test Report Serial No.:**  
0Y1608231491.A3L

<b>FCC ID :</b>	<b>A3LSMG532F</b>
<b>APPLICANT:</b>	<b>SAMSUNG ELECTRONICS CO., LTD.</b>



**Application Type:** Certification  
**FCC Classification:** PCS Licensed Transmitter Held to Ear (PCE)  
**FCC Rule Part(s):** §2; §22  
**Test Procedure(s):** ANSI/TIA-603-D-2010, KDB 971168 D01 v02r02  
**EUT Type:** Portable Handset  
**Model(s):** SM-G532F/DS, SM-G532F  
**Test Device Serial No.:** *identical prototype* [S/N: 97455]

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

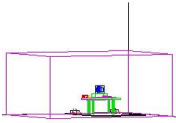


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# T A B L E O F C O N T E N T S

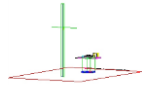
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## FCC Part 22



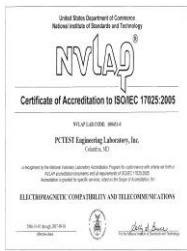
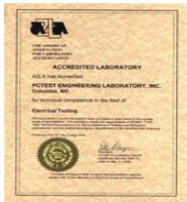
### §2.1033 General Information



**APPLICANT:** Samsung Electronics Co., Ltd.  
**APPLICANT ADDRESS:** 129, Samsung-ro,  
 Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea  
**TEST SITE:** PCTEST ENGINEERING LABORATORY, INC.  
**TEST SITE ADDRESS:** 7185 Oakland Mills Road, Columbia, MD 21045 USA  
**FCC RULE PART(S):** §2; §22  
**BASE MODEL:** SM-G532F/DS  
**FCC ID:** A3LSMG532F  
**FCC CLASSIFICATION:** PCS Licensed Transmitter Held to Ear (PCE)  
**FREQUENCY TOLERANCE:** ±0.00025 % (2.5 ppm)  
**Test Device Serial No.:** 97455  Production  Pre-Production  Engineering  
**DATE(S) OF TEST:** 8/24-8/30/2016  
**TEST REPORT S/N:** 0Y1608231491.A3L

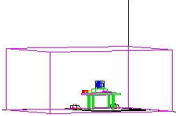
### Test Facility / Accreditations

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 Innovation, Science, and Economic Development 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 Innovation, Science, and Economic Development 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 Innovation, Science, and Economic Development Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Innovation, Science, and Economic Development 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.

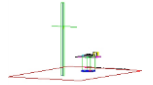


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## MEASUREMENT REPORT

### FCC Part 22



Mode	FCC Rule Part	Tx Frequency (MHz)	ERP		Emission Designator	Modulation
			Max. Power (W)	Max. Power (dBm)		
LTE Band 5	22H	824.7 - 848.3	0.115	20.61	1M12G7D	QPSK
LTE Band 5	22H	824.7 - 848.3	0.078	18.92	1M13W7D	16QAM
LTE Band 5	22H	825.5 - 847.5	0.116	20.65	2M72G7D	QPSK
LTE Band 5	22H	825.5 - 847.5	0.079	19.00	2M73W7D	16QAM
LTE Band 5	22H	826.5 - 846.5	0.116	20.65	4M53G7D	QPSK
LTE Band 5	22H	826.5 - 846.5	0.080	19.02	4M52W7D	16QAM
LTE Band 5	22H	829 - 844	0.108	20.31	9M00G7D	QPSK
LTE Band 5	22H	829 - 844	0.074	18.70	9M00W7D	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 Innovation, Science, and Economic Development 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.

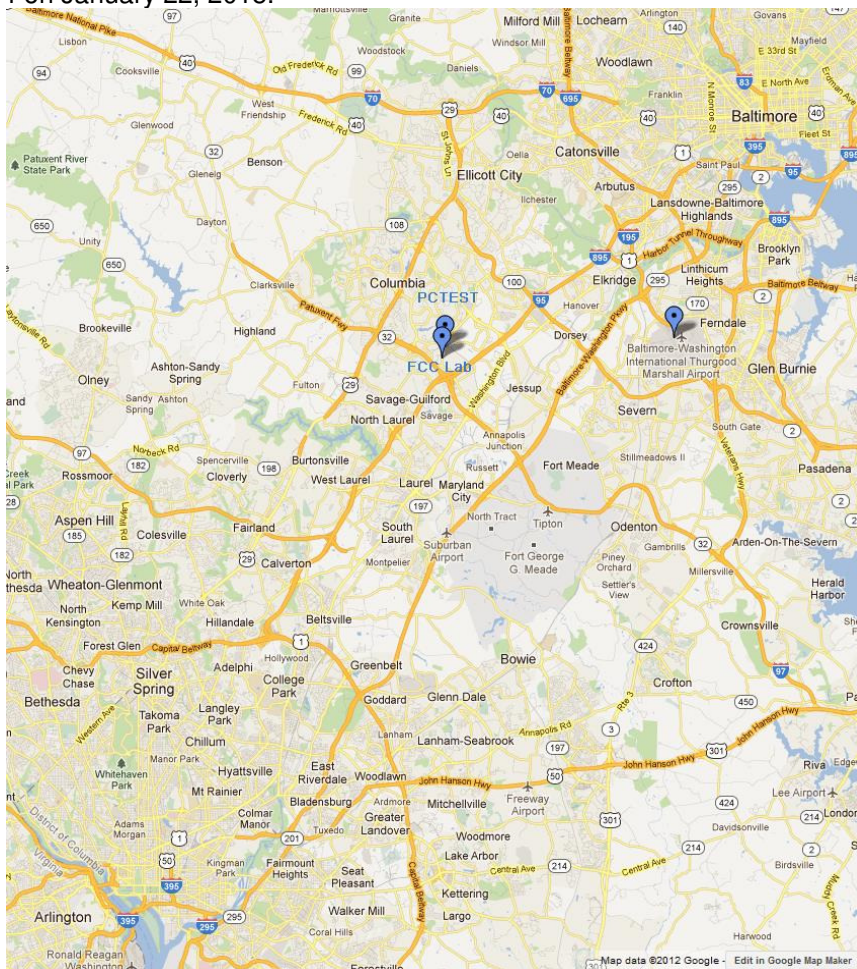


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG532F**. 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 GSM/GPRS/EDGE, 850/1900 WCDMA/HSPA, Single-band LTE, 802.11b/g/n WLAN, Bluetooth (1x, EDR, LE)

### 2.3 Test Configuration

The Samsung Portable Handset FCC ID: A3LSMG532F 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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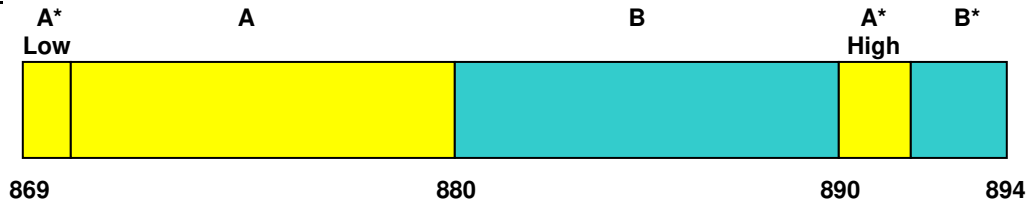
## 3.0 DESCRIPTION OF TESTS

### 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 **Samsung Portable Handset FCC ID: A3LSMG532F**.

### 3.2 Cellular - Base Frequency Blocks

§22.905



**BLOCK 1:** 869 – 880 MHz (A\* Low + A)

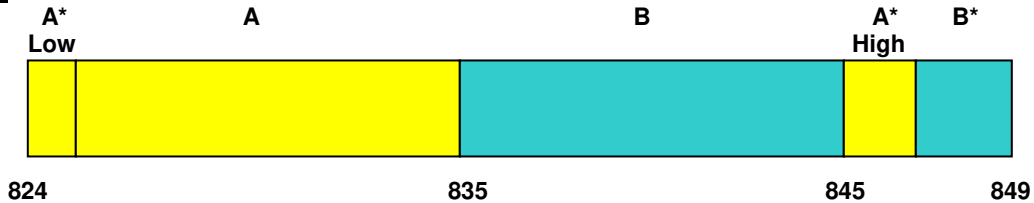
**BLOCK 2:** 880 – 890 MHz (B)

**BLOCK 3:** 890 – 891.5 MHz (A\* High)

**BLOCK 4:** 891.5 – 894 MHz (B\*)

### 3.3 Cellular - Mobile Frequency Blocks

§22.905



**BLOCK 1:** 824 – 835 MHz (A\* Low + A)

**BLOCK 2:** 835 – 845 MHz (B)

**BLOCK 3:** 845 – 846.5 MHz (A\* High)



**BLOCK 4:** 846.5 – 849 MHz (B\*)

### 3.4 Radiated Power and Radiated Spurious Emissions

§2.1053 §22.913(a.2) §22.917(a)

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

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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:

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

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



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

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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
-	LTX3	Licensed Transmitter Cable Set	7/12/2016	Annual	7/12/2017	LTX3
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	7/11/2016	Annual	7/11/2017	RE1
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
Anritsu	MT8820C	Radio Communication Analyzer	4/14/2016	Annual	4/14/2017	6201240328
Espec	ESX-2CA	Environmental Chamber	3/4/2016	Annual	3/4/2017	17620
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	4/26/2016	Biennial	4/26/2018	125518
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	10/22/2014	Biennial	10/22/2016	128338
Mini Circuits	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11403100002
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	3/4/2016	Annual	3/4/2017	11401010036
PCTEST	-	EMC Switch System	7/6/2016	Annual	7/6/2017	NM2
Rohde & Schwarz	CMW500	Radio Communication Tester	10/21/2015	Annual	10/21/2016	102060
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	7/15/2016	Annual	7/15/2017	100348
Schwarzbeck	UHA 9105	Dipole Antenna (400 - 1GHz) Rx	11/18/2015	Biennial	11/18/2017	91052523RX
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/2/2016	Biennial	3/2/2018	N/A

**Table 5-1. Test Equipment**

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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: Samsung Electronics Co., Ltd.  
 FCC ID: A3LSMG532F  
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)  
 Mode(s): LTE

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Result	Reference
<b>TRANSMITTER MODE (TX)</b>					
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051 22.917(a)	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
2.1046	Transmitter Conducted Output Power	N/A		PASS	See RF Exposure Report
2.1055. 22.355	Frequency Stability	< 2.5 ppm (Part 22)		PASS	Section 7.7
22.913(a.2)	Effective Radiated Power (Band 5)	< 7 Watts max. ERP	RADIATED	PASS	Section 7.5
2.1053 22.917(a)	Undesirable Emissions	> 43 + 10log <sub>10</sub> (P[Watts]) for all out-of-band emissions		PASS	Section 7.6

**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) 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 4.2.

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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

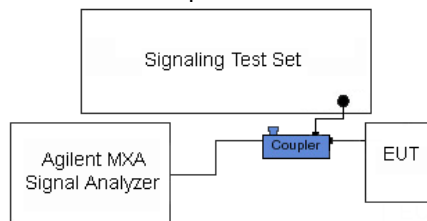
KDB 971168 D01 v02r02 – Section 4.2

### 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.

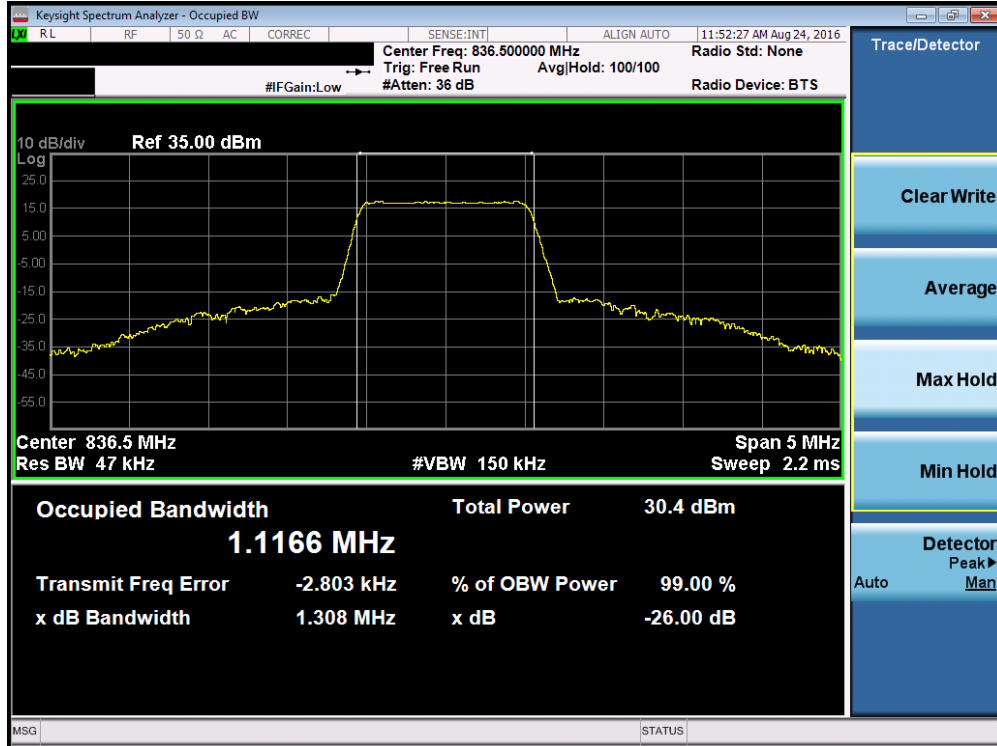


**Figure 7-1. Test Instrument & Measurement Setup**

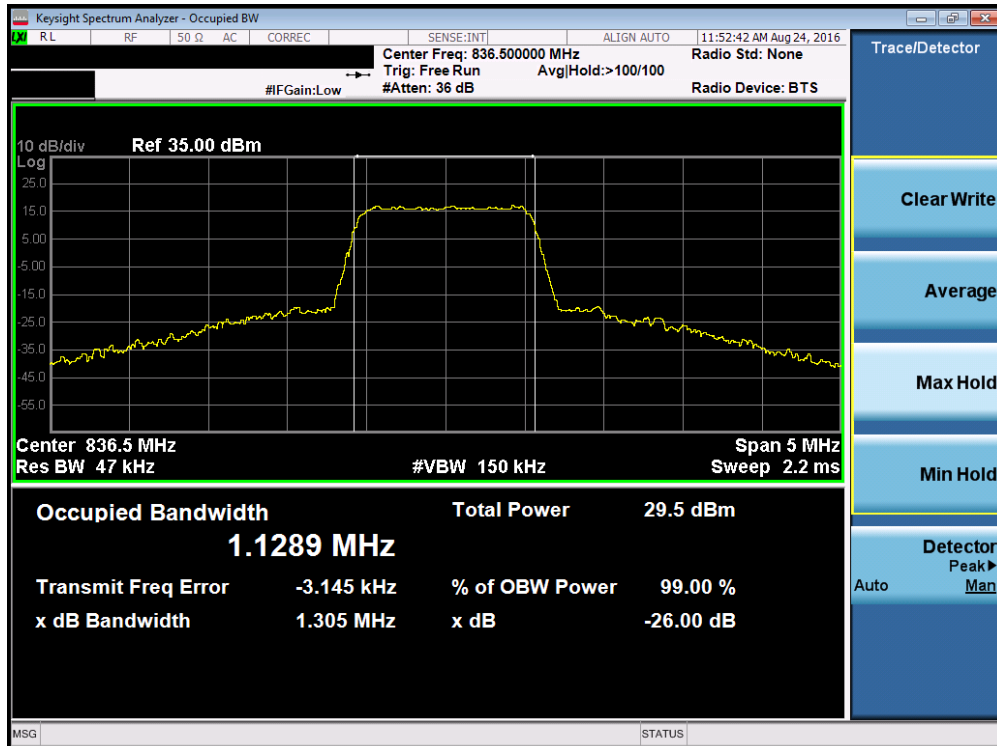
### Test Notes

None.

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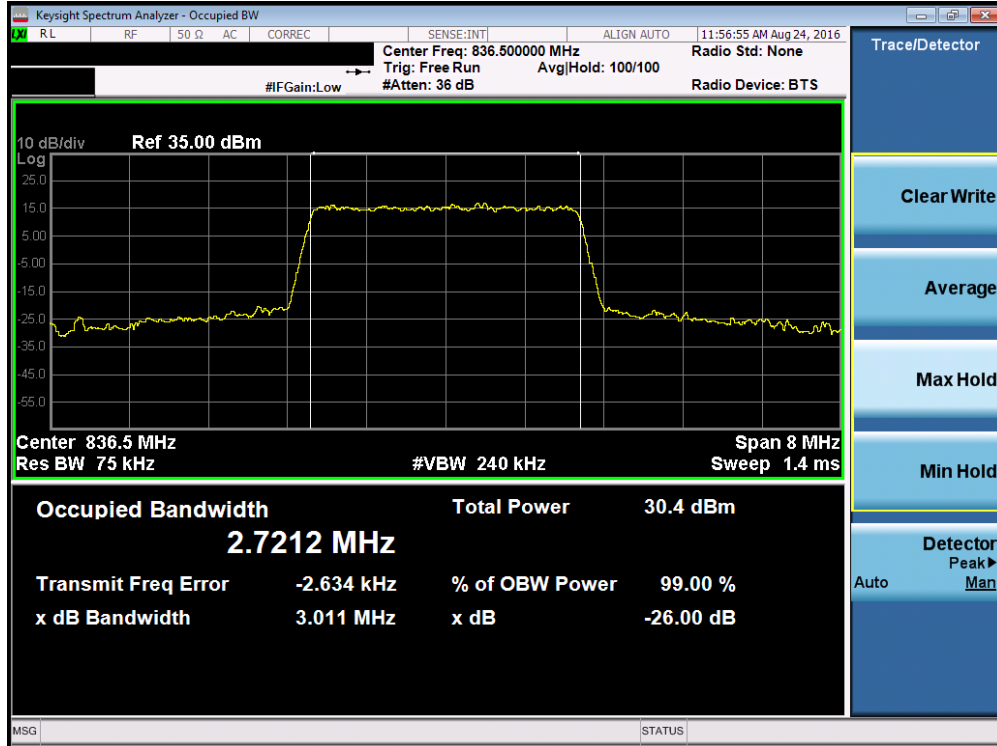


Plot 7-1. Occupied Bandwidth Plot (Band 5 – 1.4MHz QPSK – RB Size 6)

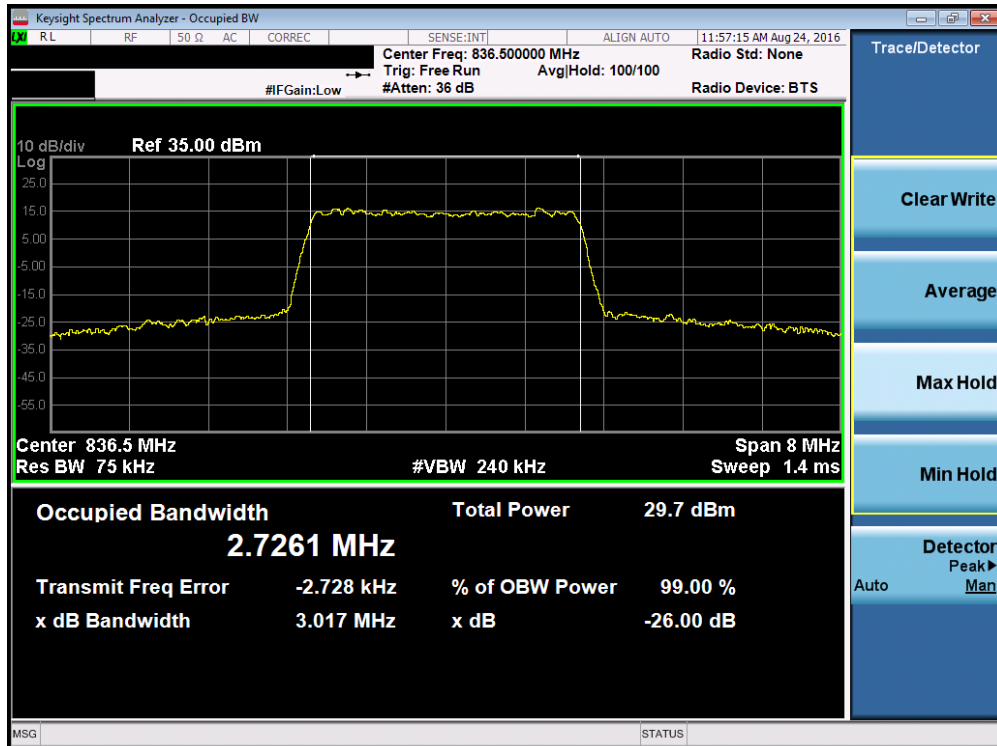


Plot 7-2. Occupied Bandwidth Plot (Band 5 – 1.4MHz 16-QAM – RB Size 6)

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 14 of 39

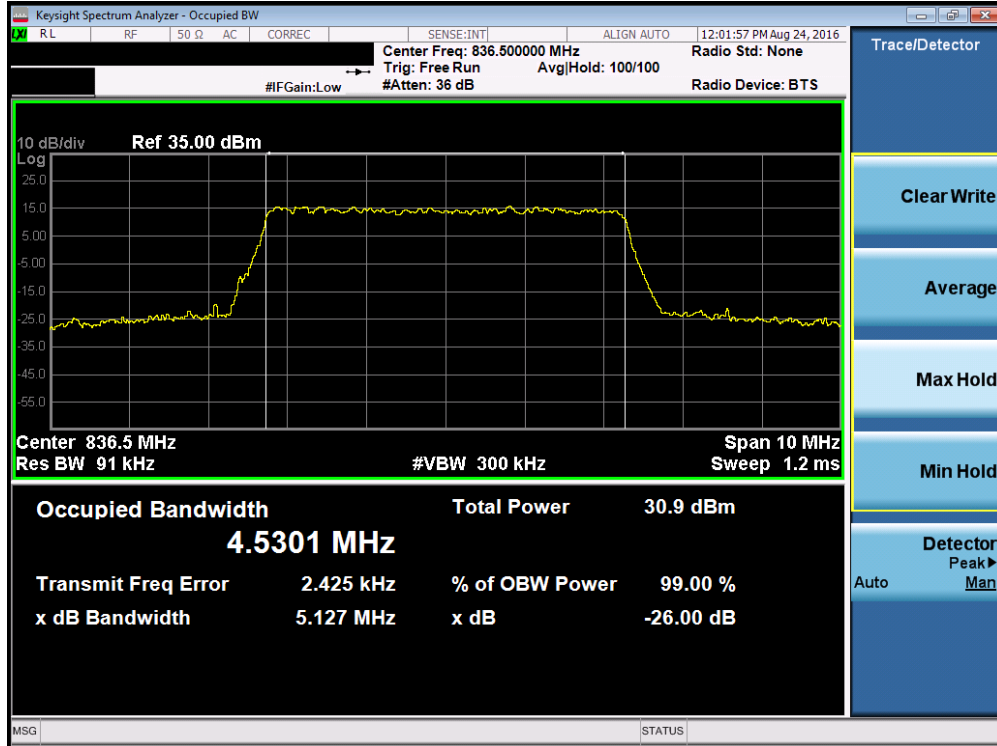


Plot 7-3. Occupied Bandwidth Plot (Band 5 – 3.0MHz QPSK – RB Size 15)

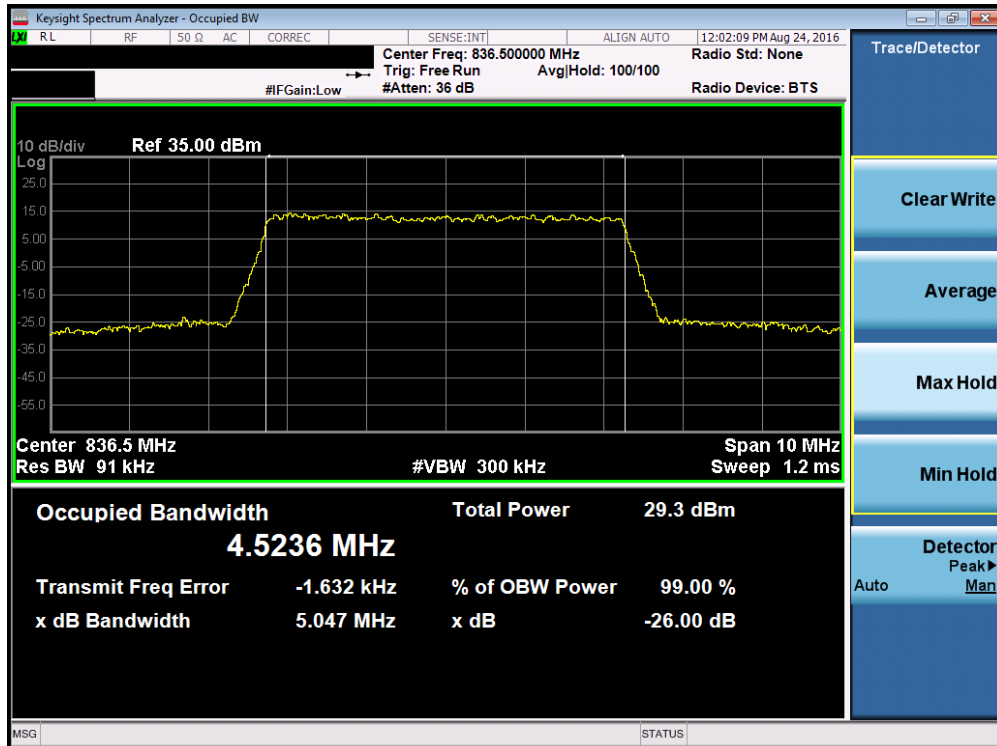


Plot 7-4. Occupied Bandwidth Plot (Band 5 – 3.0MHz 16-QAM – RB Size 15)

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 15 of 39

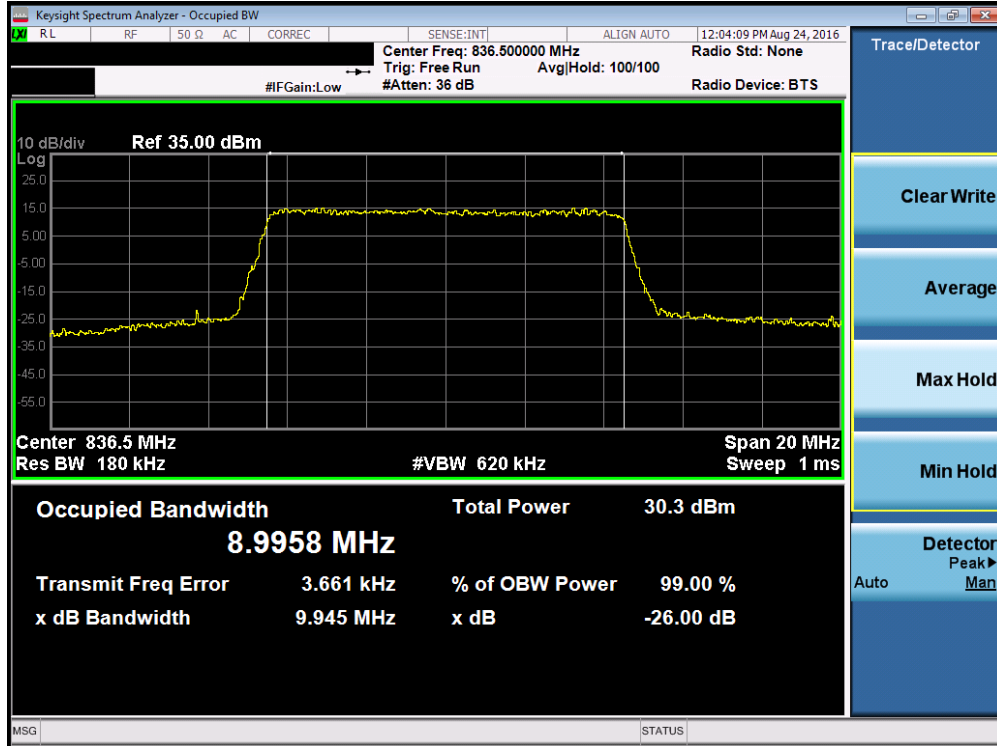


Plot 7-5. Occupied Bandwidth Plot (Band 5 – 5.0MHz QPSK – RB Size 25)

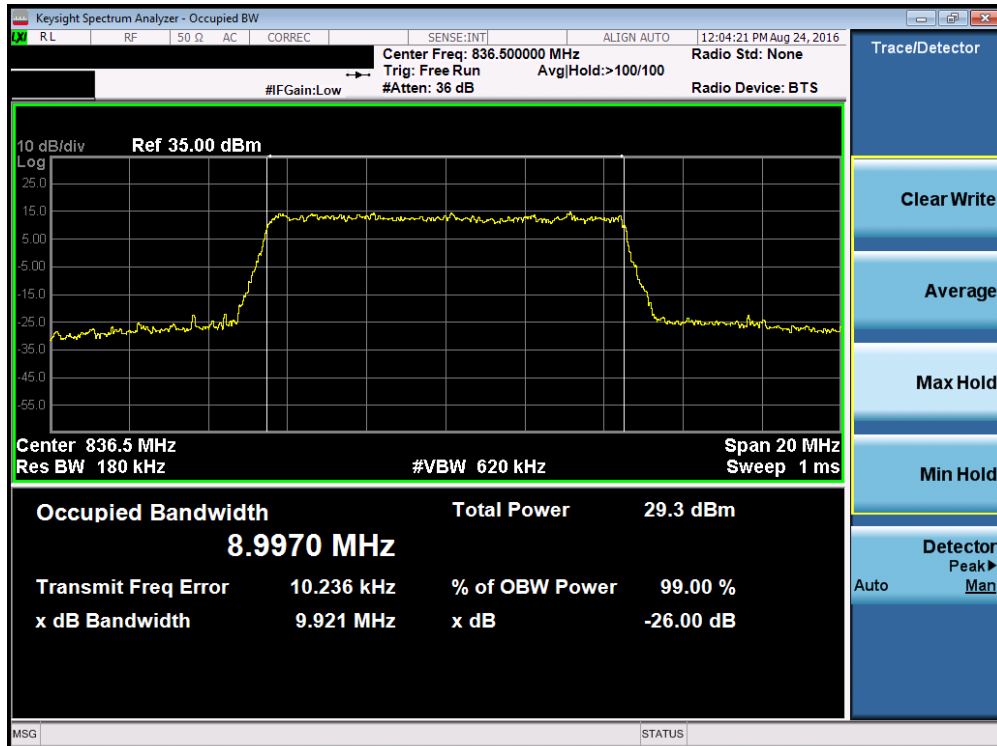


Plot 7-6. Occupied Bandwidth Plot (Band 5 – 5.0MHz 16-QAM – RB Size 25)

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 16 of 39



Plot 7-7. Occupied Bandwidth Plot (Band 5 – 10.0MHz QPSK – RB Size 50)



Plot 7-8. Occupied Bandwidth Plot (Band 5 – 10.0MHz 16-QAM – RB Size 50)

FCC ID: A3LSMG532F	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)	<b>SAMSUNG</b>	Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 17 of 39

### 7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §22.917(a)

#### 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.

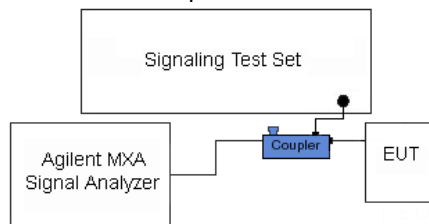




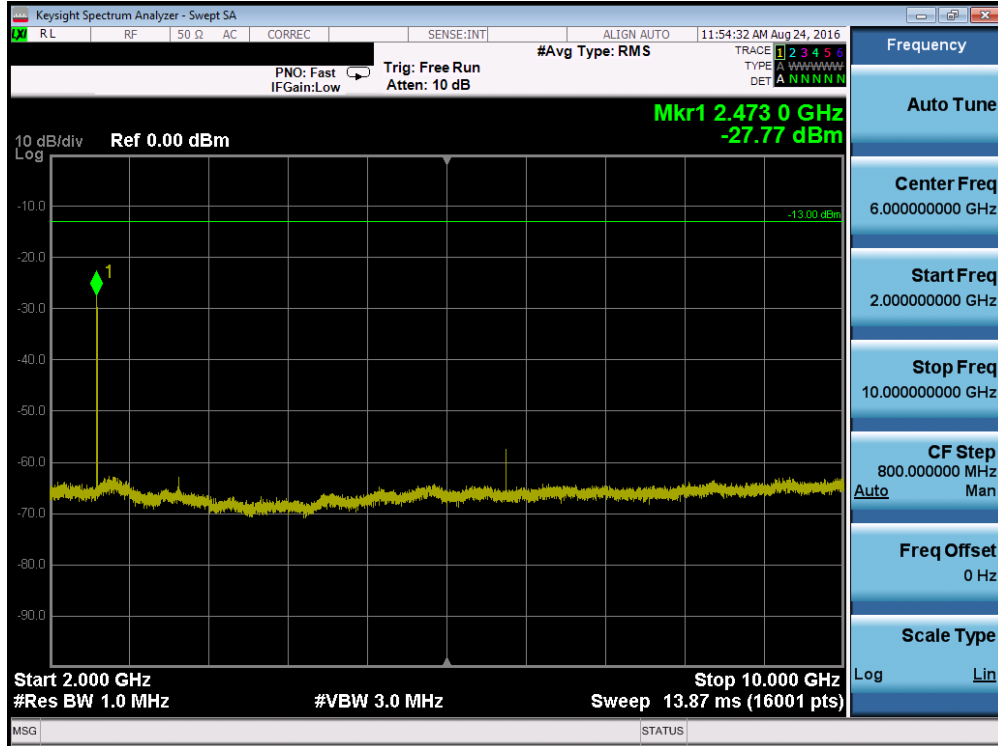
Figure 7-2. Test Instrument & Measurement Setup

#### Test Notes

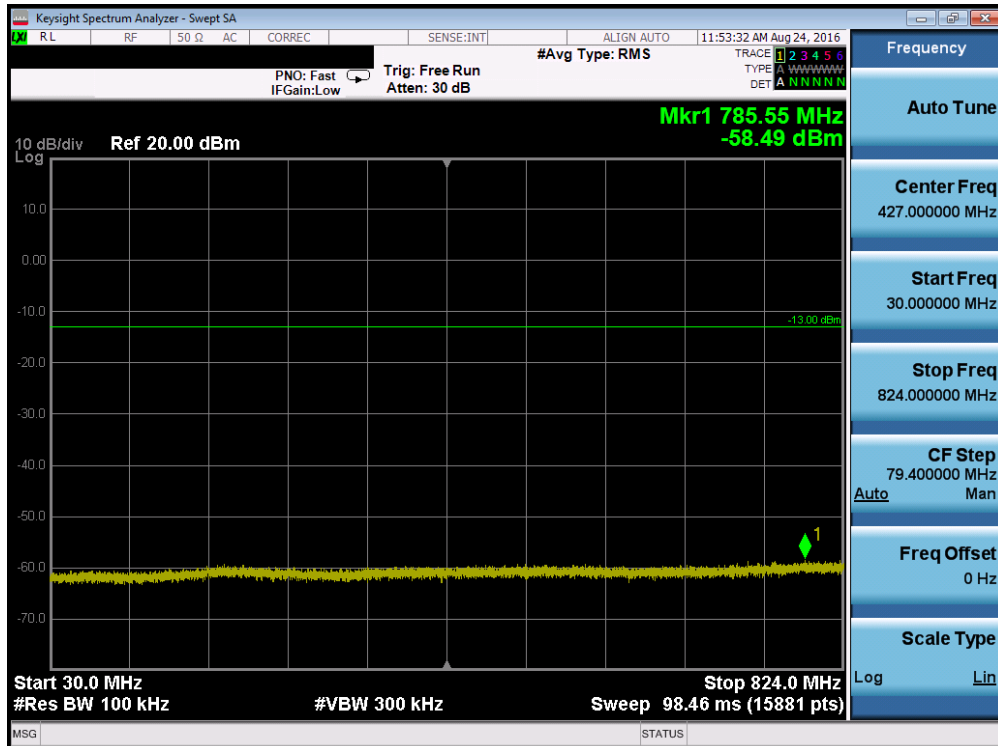
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent 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: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 18 of 39



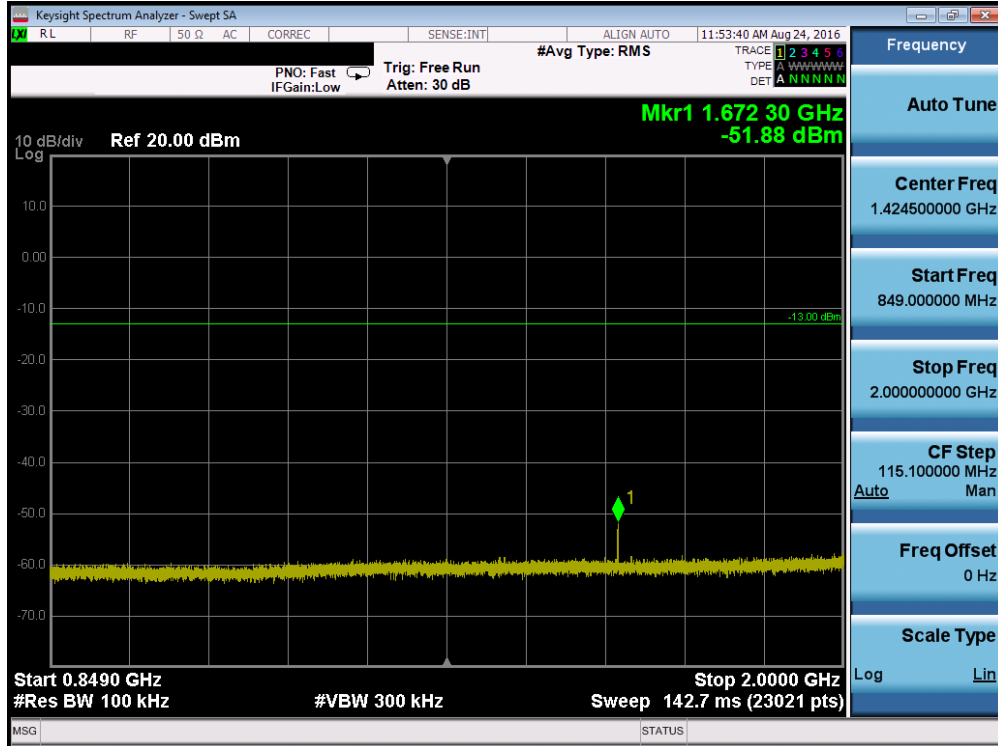


Plot 7-11. Conducted Spurious Plot (Band 5 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

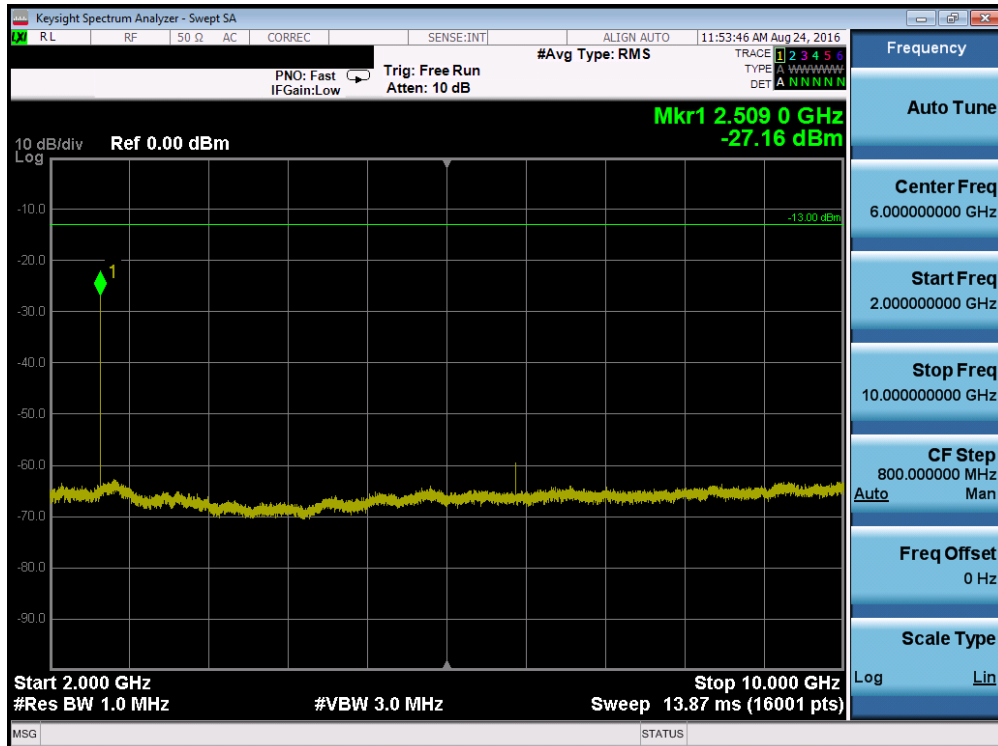


Plot 7-12. Conducted Spurious Plot (Band 5 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: A3LSMG532F	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 20 of 39

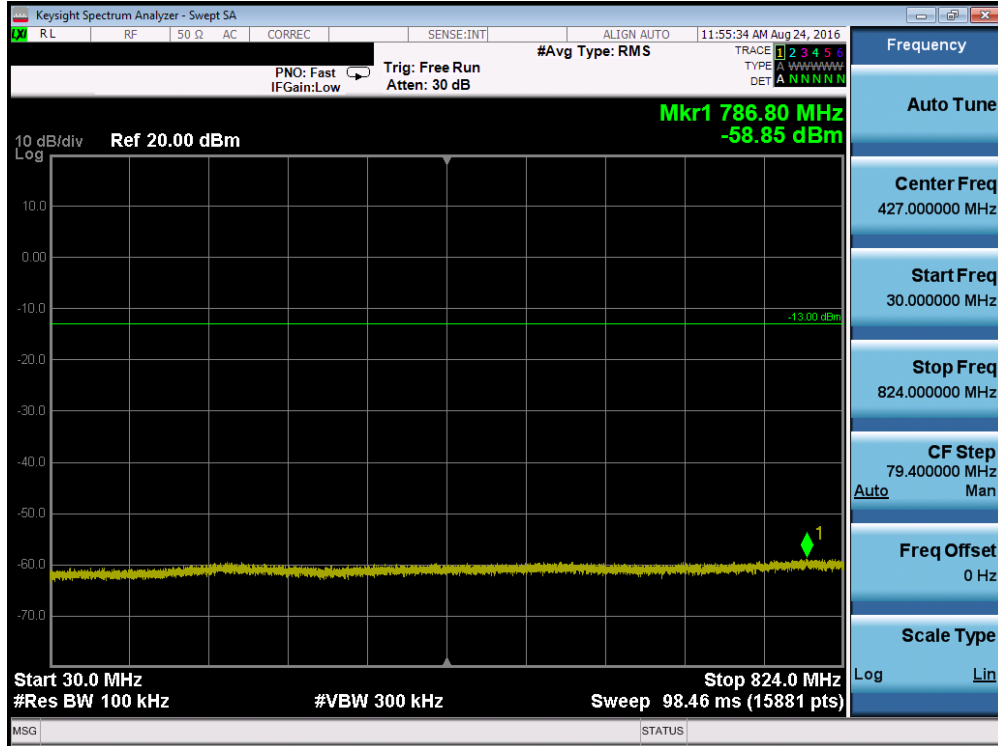


Plot 7-13. Conducted Spurious Plot (Band 5 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

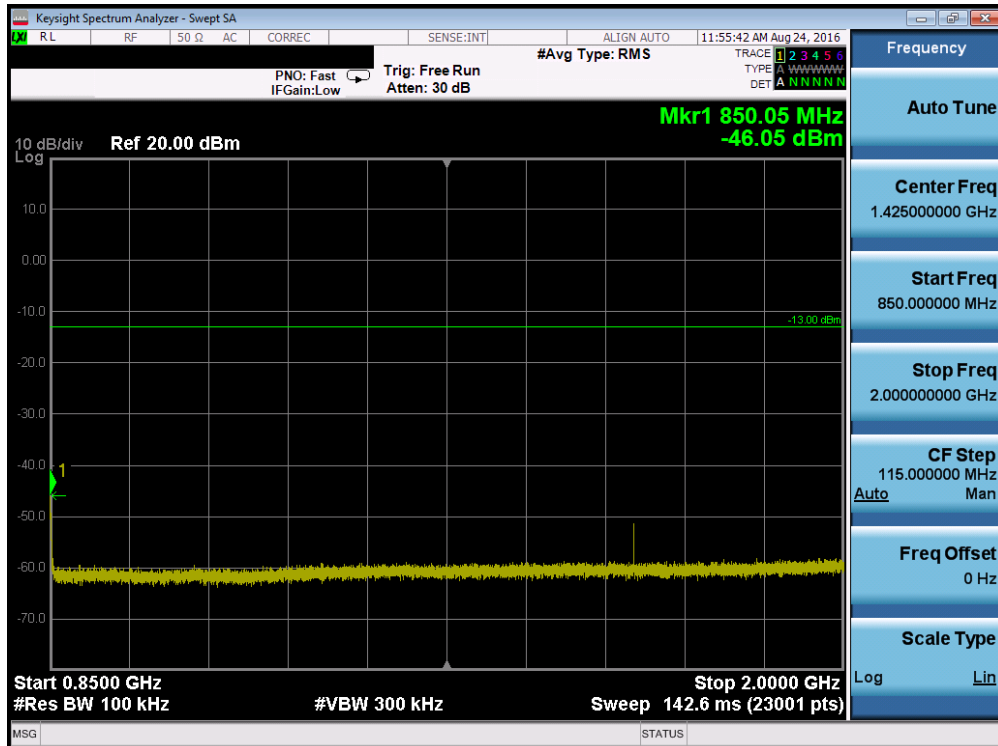


Plot 7-14. Conducted Spurious Plot (Band 5 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 21 of 39

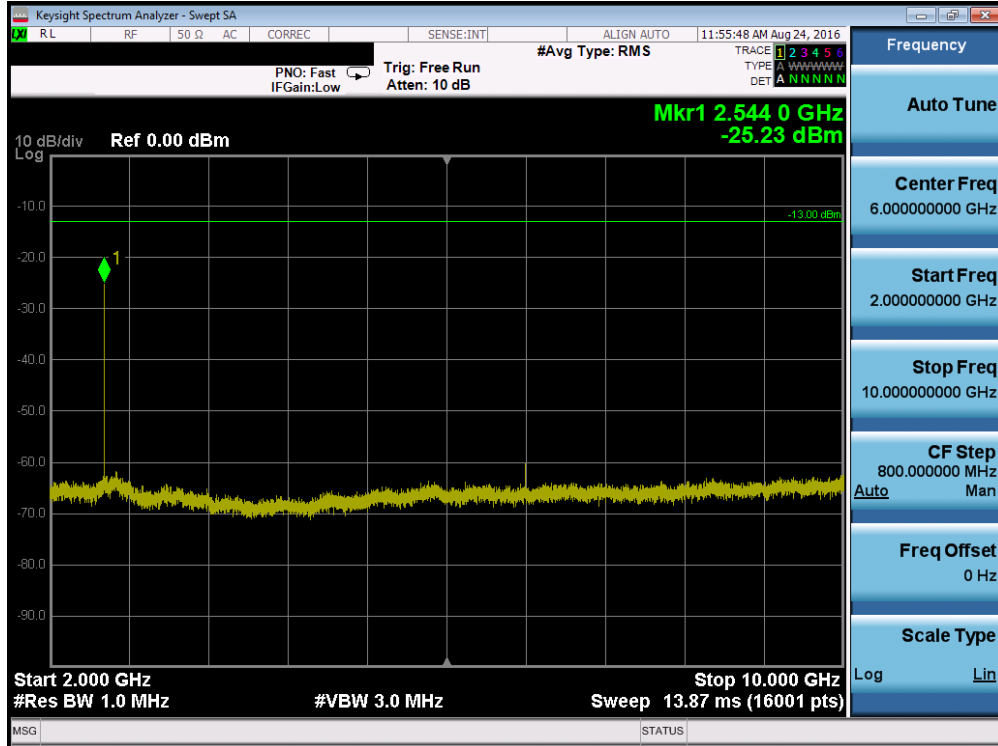


Plot 7-15. Conducted Spurious Plot (Band 5 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)





Plot 7-16. Conducted Spurious Plot (Band 5 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 22 of 39



Plot 7-17. Conducted Spurious Plot (Band 5 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 23 of 39

## 7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §22.917(a)

### 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

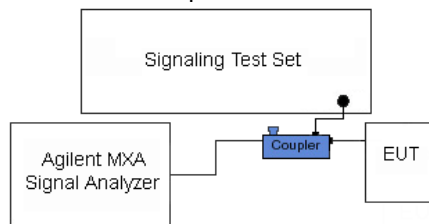
KDB 971168 D01 v02r02 – Section 6.0

### 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.  $VBW \geq 3 \times RBW$
5. Detector = RMS
6. Number of sweep points  $\geq 2 \times \text{Span}/RBW$
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.

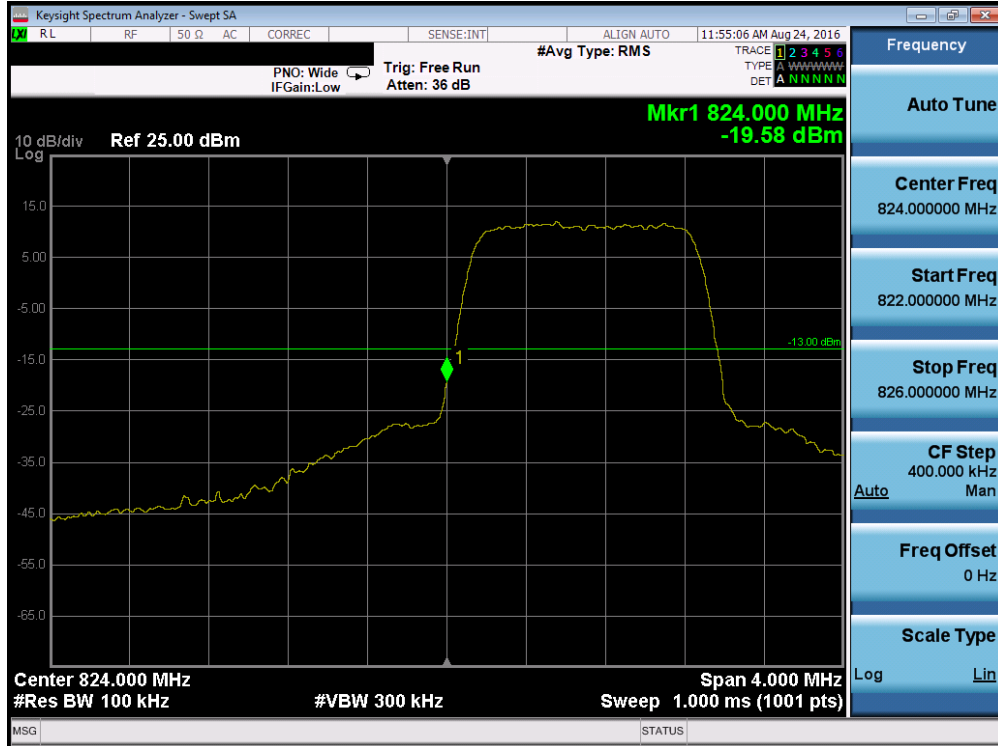


**Figure 7-3. Test Instrument & Measurement Setup**

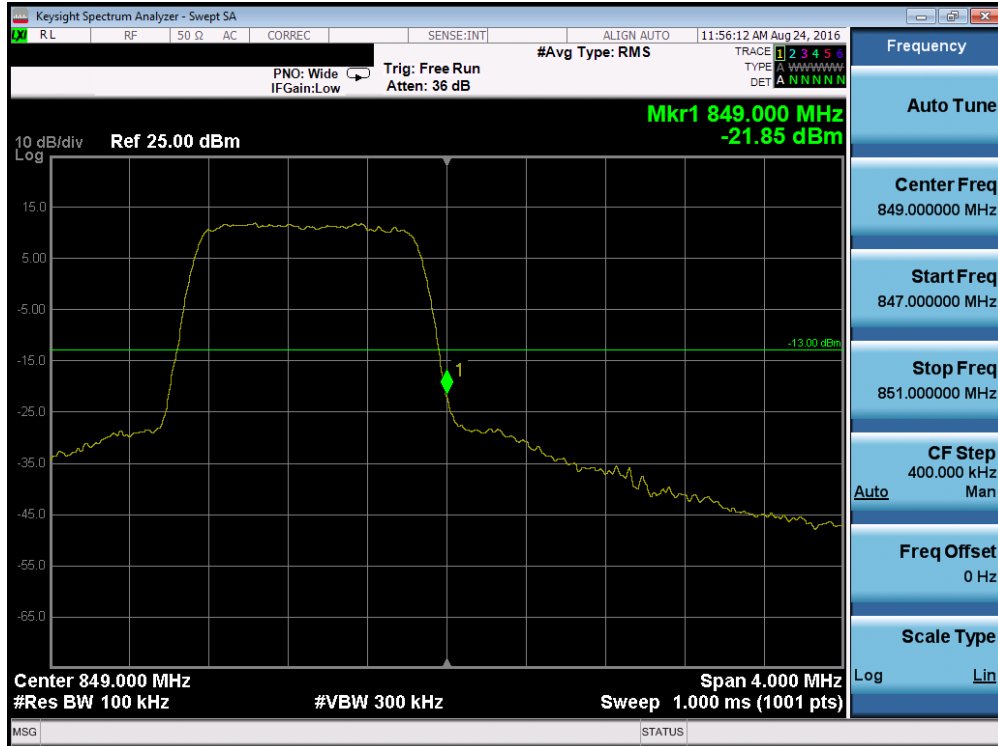
### Test Notes

Per 22.917(b) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 24 of 39

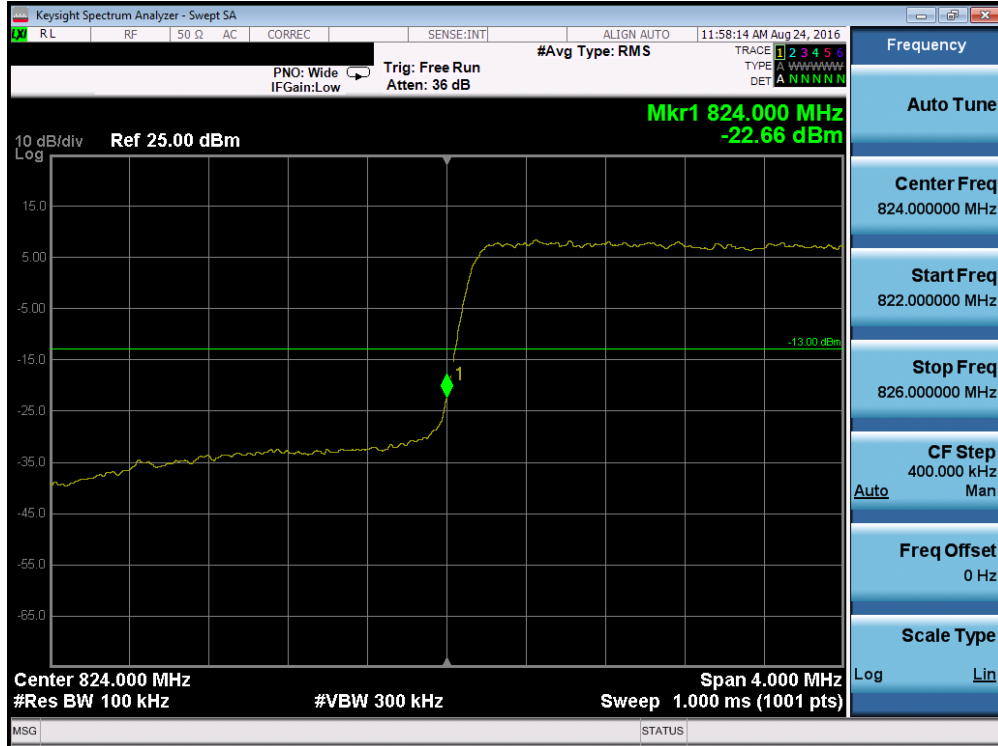


Plot 7-18. Lower Band Edge Plot (Band 5 – 1.4MHz QPSK – RB Size 6)

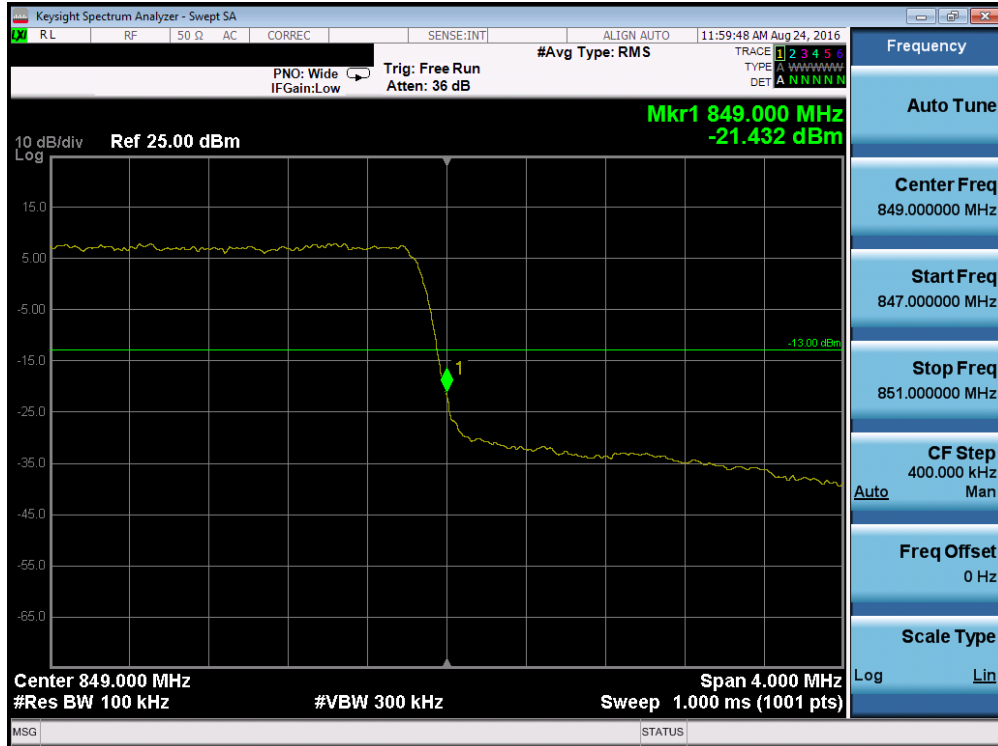


Plot 7-19. Upper Band Edge Plot (Band 5 – 1.4MHz QPSK – RB Size 6)

FCC ID: A3LSMG532F	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 25 of 39

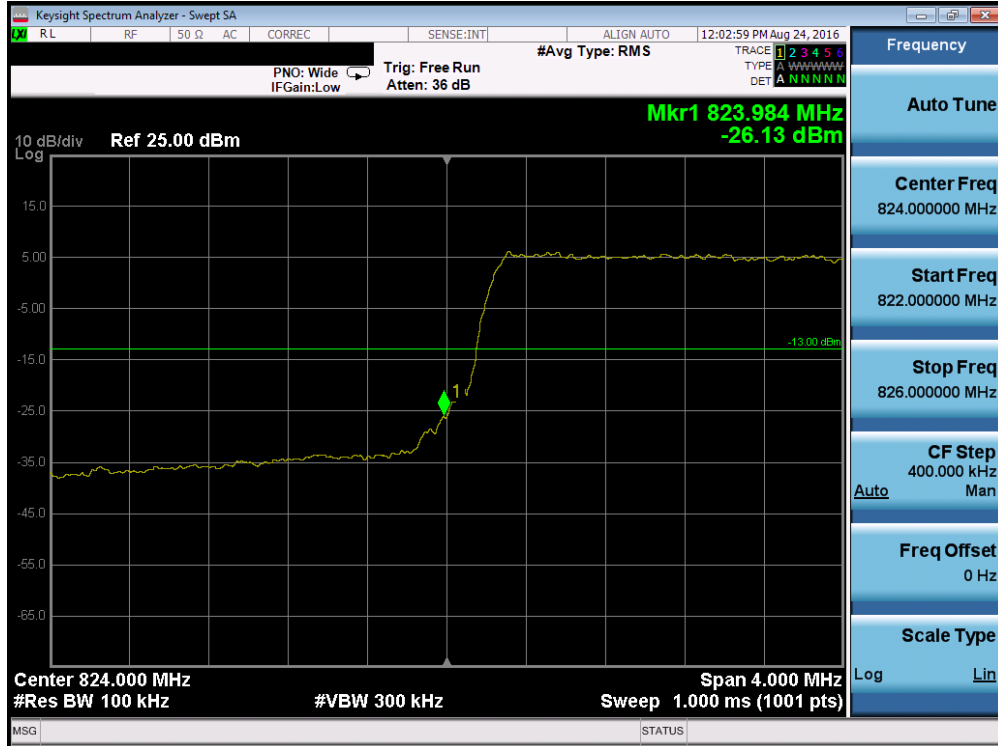


Plot 7-20. Lower Band Edge Plot (Band 5 – 3.0MHz QPSK – RB Size 15)

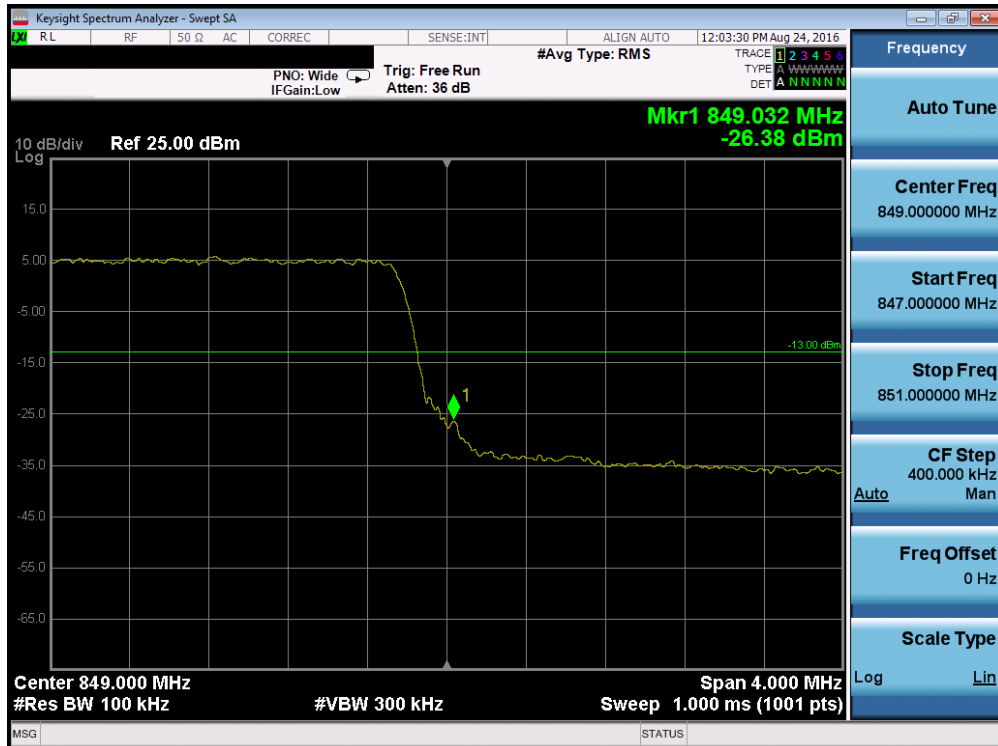


Plot 7-21. Upper Band Edge Plot (Band 5 – 3.0MHz QPSK – RB Size 15)

FCC ID: A3LSMG532F	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 26 of 39

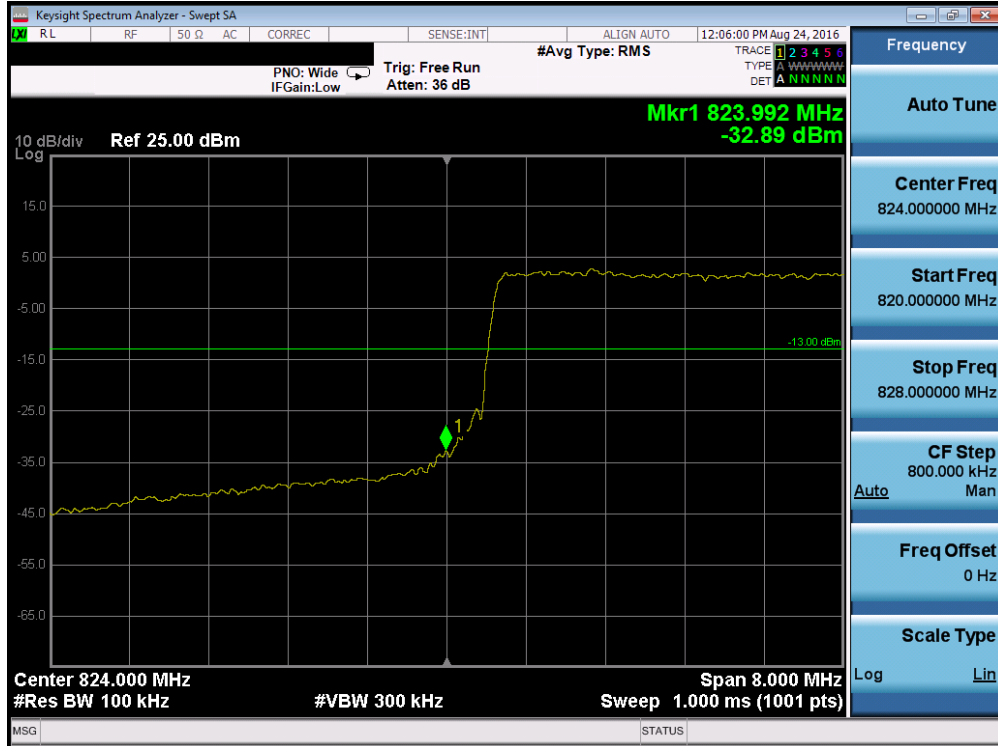


Plot 7-22. Lower Band Edge Plot (Band 5 – 5.0MHz QPSK – RB Size 25)

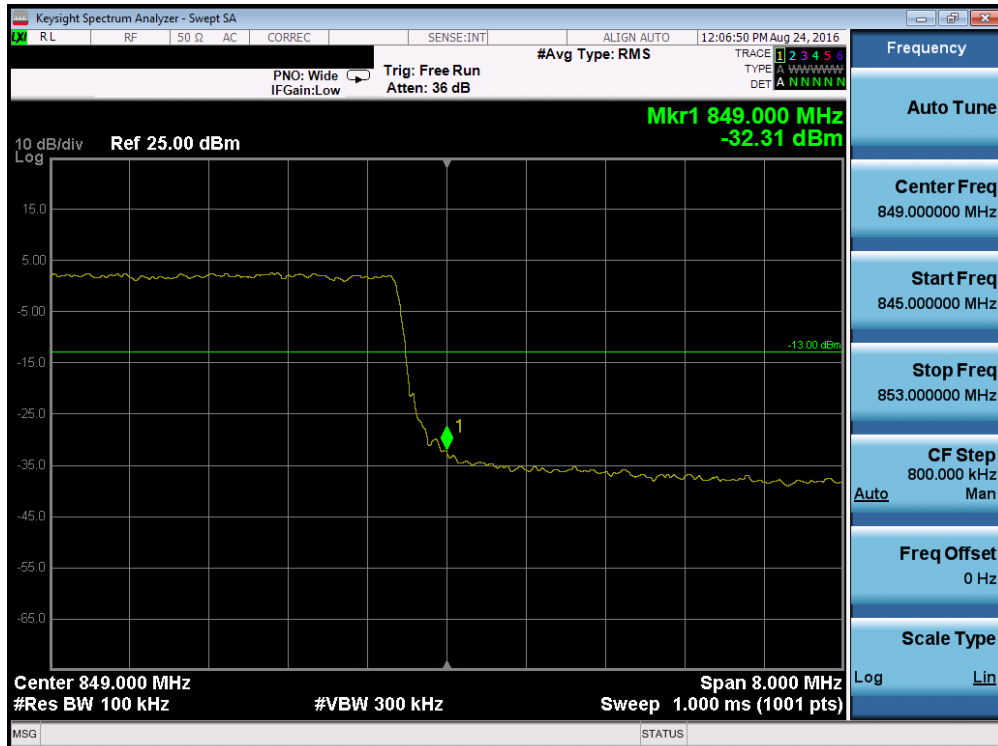


Plot 7-23. Upper Band Edge Plot (Band 5 – 5.0MHz QPSK – RB Size 25)

FCC ID: A3LSMG532F	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 27 of 39



Plot 7-24. Lower Band Edge Plot (Band 5 – 10.0MHz QPSK – RB Size 50)



Plot 7-25. Upper Band Edge Plot (Band 5 – 10.0MHz QPSK – RB Size 50)

FCC ID: A3LSMG532F	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 28 of 39

## 7.5 Radiated Power (ERP)

§22.913(a.2) §24.232(c.2)

### Test Overview

Effective Radiated Power (ERP) 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. 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

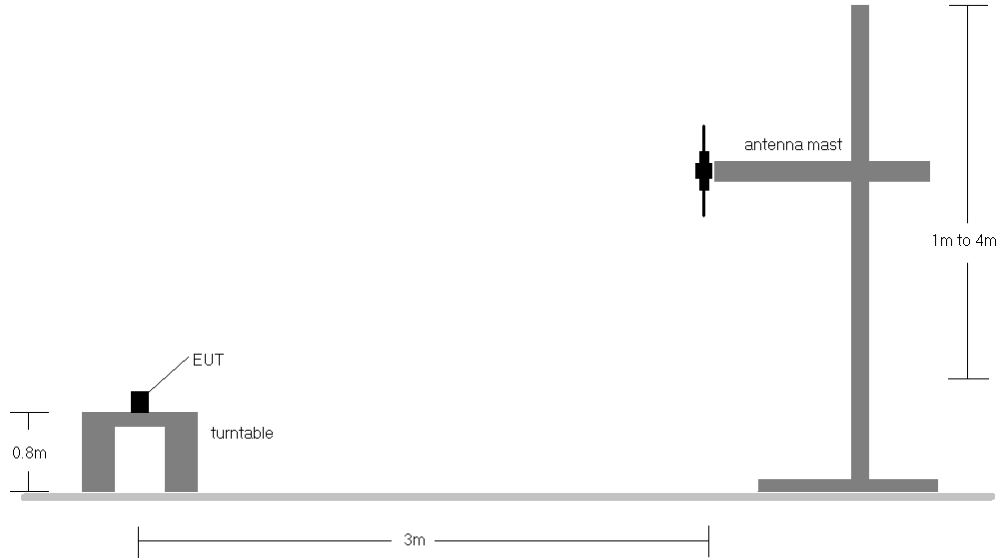
### Test Settings

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: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset	Page 29 of 39	

**Test Setup**



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



**Figure 7-4. Radiated Test Setup <1GHz**



**Test Notes**

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

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset	Page 30 of 39	

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]
824.70	1.4	QPSK	H	205	163	3 / 2	15.60	5.01	20.61	38.45	-17.84
836.50	1.4	QPSK	H	183	174	1 / 0	14.62	5.16	19.78	38.45	-18.67
848.30	1.4	QPSK	H	190	160	3 / 2	13.71	5.30	19.01	38.45	-19.44
824.70	1.4	16-QAM	H	205	163	3 / 2	13.91	5.01	18.92	38.45	-19.53
836.50	1.4	16-QAM	H	183	174	1 / 0	12.84	5.16	18.00	38.45	-20.45
848.30	1.4	16-QAM	H	190	160	3 / 2	11.83	5.30	17.13	38.45	-21.32
825.50	3	QPSK	H	204	165	1 / 0	15.63	5.02	20.65	38.45	-17.80
836.50	3	QPSK	H	206	165	1 / 0	14.98	5.16	20.14	38.45	-18.31
847.50	3	QPSK	H	197	172	1 / 0	13.91	5.29	19.20	38.45	-19.25
825.50	3	16-QAM	H	204	165	1 / 0	13.98	5.02	19.00	38.45	-19.45
836.50	3	16-QAM	H	206	165	1 / 0	13.18	5.16	18.34	38.45	-20.11
847.50	3	16-QAM	H	197	172	1 / 0	12.22	5.29	17.51	38.45	-20.94
826.50	5	QPSK	H	206	164	1 / 0	15.62	5.03	20.65	38.45	-17.80
836.50	5	QPSK	H	186	174	1 / 0	15.12	5.16	20.28	38.45	-18.17
846.50	5	QPSK	H	197	155	1 / 0	13.85	5.28	19.13	38.45	-19.32
826.50	5	16-QAM	H	206	164	1 / 0	13.99	5.03	19.02	38.45	-19.43
836.50	5	16-QAM	H	186	174	1 / 0	13.42	5.16	18.58	38.45	-19.87
846.50	5	16-QAM	H	197	155	1 / 0	12.31	5.28	17.59	38.45	-20.86
829.00	10	QPSK	H	205	162	1 / 0	15.25	5.06	20.31	38.45	-18.14
836.50	10	QPSK	H	207	162	1 / 0	15.00	5.16	20.16	38.45	-18.29
844.00	10	QPSK	H	188	164	1 / 0	14.67	5.25	19.92	38.45	-18.53
829.00	10	16-QAM	H	205	162	1 / 0	13.64	5.06	18.70	38.45	-19.75
836.50	10	16-QAM	H	207	162	1 / 0	13.25	5.16	18.41	38.45	-20.04
844.00	10	16-QAM	H	188	164	1 / 0	13.03	5.25	18.28	38.45	-20.17
826.50	5	QPSK	V	129	38	1 / 0	14.77	5.16	19.93	38.45	-18.52

**Table 7-2. ERP Data (Band 5)**

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset	Page 31 of 39	

## 7.6 Radiated Spurious Emissions Measurements

### §2.1053 §22.917(a)

#### 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

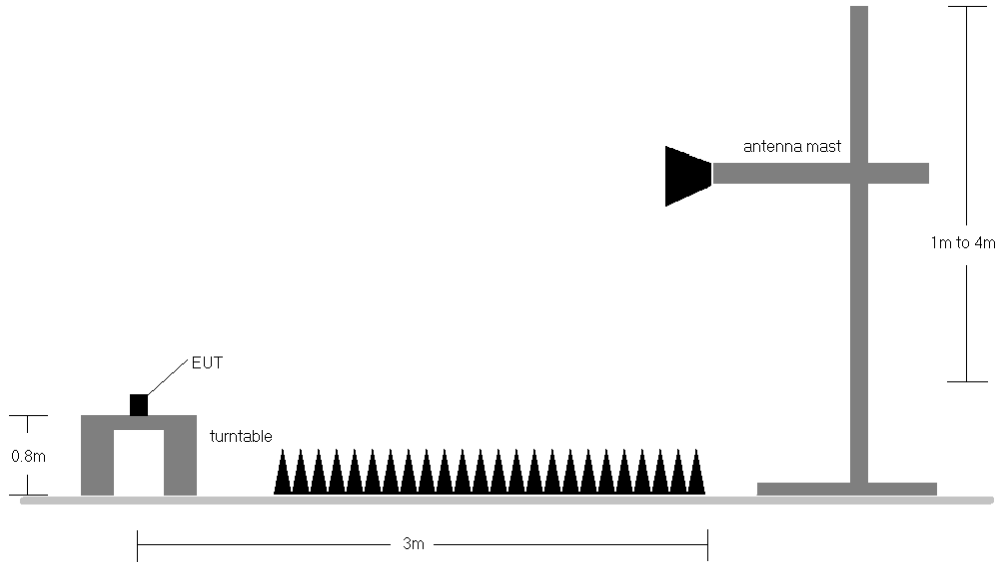
#### Test Settings

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 = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 32 of 39

**Test Setup**



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



**Figure 7-5. Test Instrument & Measurement Setup**

**Test Notes**

- 1) 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.

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1608231491.A3L	Test Dates: 8/24-8/30/2016	EUT Type: Portable Handset		Page 33 of 39

OPERATING FREQUENCY: 826.50 MHz  
 CHANNEL: 20425  
 MEASURED OUTPUT POWER: 20.65 dBm = 0.116 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 5.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  33.65 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]
1653.00	H	225	178	-56.82	3.62	-53.20	73.9
2479.50	H	242	329	-56.66	3.56	-53.10	73.8
3306.00	H	-	-	-67.25	5.83	-61.42	82.1
4132.50	H	-	-	-66.85	7.00	-59.85	80.5
4959.00	H	166	353	-64.37	7.97	-56.41	77.1
5785.50	H	115	348	-62.37	8.63	-53.74	74.4
6612.00	H	117	328	-53.14	9.06	-44.08	64.7
7438.50	H	-	-	-63.84	9.86	-53.98	74.6

**Table 7-3. Radiated Spurious Data (Band 5 – Low Channel)**

OPERATING FREQUENCY: 836.50 MHz  
 CHANNEL: 20525  
 MEASURED OUTPUT POWER: 20.28 dBm = 0.107 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 5.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  33.28 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]
1673.00	H	124	197	-66.06	3.52	-62.54	82.8
2509.50	H	240	337	-56.78	3.59	-53.19	73.5
3346.00	H	-	-	-67.37	5.87	-61.50	81.8
4182.50	H	-	-	-66.61	7.16	-59.45	79.7
5019.00	H	173	354	-64.60	8.03	-56.57	76.9
5855.50	H	119	40	-60.05	8.58	-51.47	71.7
6692.00	H	122	316	-54.60	9.11	-45.49	65.8
7528.50	H	-	-	-63.05	9.91	-53.15	73.4



**Table 7-4. Radiated Spurious Data (Band 5 – Mid Channel)**

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OPERATING FREQUENCY: 846.50 MHz  
 CHANNEL: 20625  
 MEASURED OUTPUT POWER: 19.13 dBm = 0.082 W  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 5.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  32.13 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]
1693.00	H	124	205	-65.39	3.42	-61.97	81.1
2539.50	H	238	336	-56.41	3.72	-52.69	71.8
3386.00	H	-	-	-67.48	5.91	-61.56	80.7
4232.50	H	-	-	-67.29	7.28	-60.01	79.1
5079.00	H	188	90	-64.79	8.14	-56.64	75.8
5925.50	H	122	45	-62.44	8.56	-53.88	73.0
6772.00	H	112	303	-60.44	9.25	-51.19	70.3
7618.50	H	-	-	-63.15	10.01	-53.14	72.3

**Table 7-5. Radiated Spurious Data (Band 5 – High Channel)**

FCC ID: A3LSMG532F		FCC Pt. 22 LTE MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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## 7.7 Frequency Stability / Temperature Variation

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### 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 22, the frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm) of the center frequency.***

### 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 5 Frequency Stability Measurements

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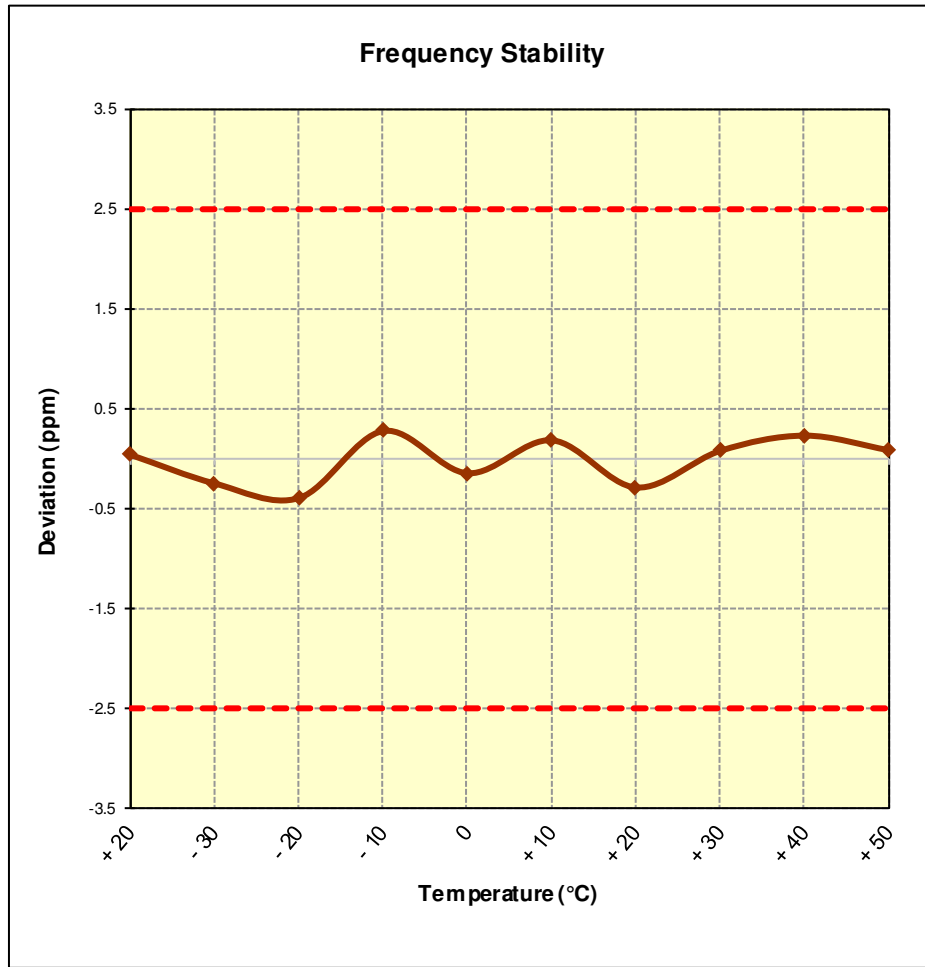
OPERATING FREQUENCY: 836,500,000 Hz  
 CHANNEL: 20525  
 REFERENCE VOLTAGE: 3.80 VDC  
 DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	836,500,029	29	0.0000035
100 %		- 30	836,499,790	-210	-0.0000251
100 %		- 20	836,499,670	-330	-0.0000395
100 %		- 10	836,500,229	229	0.0000274
100 %		0	836,499,876	-124	-0.0000148
100 %		+ 10	836,500,151	151	0.0000181
100 %		+ 20	836,499,757	-243	-0.0000290
100 %		+ 30	836,500,064	64	0.0000077
100 %		+ 40	836,500,190	190	0.0000227
100 %		+ 50	836,500,068	68	0.0000081
BATT. ENDPOINT	3.40	+ 20	836,500,036	36	0.0000043

**Table 7-6. Frequency Stability Data (Band 5)**

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**Band 5 Frequency Stability Measurements**  
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**Figure 7-6. Frequency Stability Graph (Band 5)**

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## 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMG532F** complies with all the requirements of Parts 22 of the FCC rules for LTE operation only.

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<b>Test Report S/N:</b> 0Y1608231491.A3L	<b>Test Dates:</b> 8/24-8/30/2016	<b>EUT Type:</b> Portable Handset	Page 39 of 39	