



MEASUREMENT REPORT

Part 96 LTE

Applicant Name:

Samsung Electronics Co., Ltd.

129, Samsung-ro,

Yeongtong-gu, Suwon-si

Gyeonggi-do, 16677, Korea

Date of Testing:

10/22 - 12/31/2019

Test Site/Location:

PCTEST Lab. Columbia, MD, USA

Test Report Serial No.:

1M1910220165-21.A3L

FCC ID:

A3LSMG981U

APPLICANT:

Samsung Electronics Co., Ltd.

Application Type:

Certification

Model:

SM-G981U

Additional Models:

SM-G981U1, SM-G981W, SM-G981XU

EUT Type:

Portable Handset

FCC Classification:

Citizens Band End User Devices (CBE)

FCC Rule Part(s):

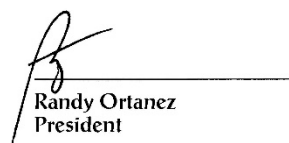
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Test Procedure(s):

ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01,
KDB 648474 D03 v01r04, KDB 940660 D01 v02, WINNF-TS-0122 V1.0.0

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

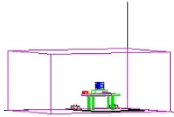


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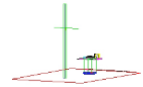
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FCC Part 96



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 48	40 MHz	QPSK	3570.0 - 3680.0	0.061	17.87	37M5G7D
		16QAM	3570.0 - 3680.0	0.041	16.10	37M4W7D
		64QAM	3570.0 - 3680.0	0.035	15.44	37M4W7D
		256QAM	3570.0 - 3680.0	0.029	14.66	37M5W7D
	35 MHz	QPSK	3567.5 - 3682.5	0.040	16.01	32M6G7D
		16QAM	3567.5 - 3682.5	0.034	15.36	32M6W7D
		64QAM	3567.5 - 3682.5	0.027	14.24	32M5W7D
		256QAM	3567.5 - 3682.5	0.019	12.76	32M7W7D
	30 MHz	QPSK	3565.0 - 3685.0	0.045	16.51	27M7G7D
		16QAM	3565.0 - 3685.0	0.034	15.28	27M7W7D
		64QAM	3565.0 - 3685.0	0.027	14.25	27M7W7D
		256QAM	3565.0 - 3685.0	0.023	13.61	27M6W7D
	25 MHz	QPSK	3562.5 - 3687.5	0.044	16.41	22M9G7D
		16QAM	3562.5 - 3687.5	0.035	15.48	22M8W7D
		64QAM	3562.5 - 3687.5	0.028	14.43	22M9W7D
		256QAM	3562.5 - 3687.5	0.023	13.61	22M8W7D
	20 MHz	QPSK	3560.0 - 3690.0	0.068	18.33	18M1G7D
		16QAM	3560.0 - 3690.0	0.058	17.62	18M0W7D
		64QAM	3560.0 - 3690.0	0.049	16.86	18M0W7D
		256QAM	3560.0 - 3690.0	0.030	14.75	18M0W7D
	15 MHz	QPSK	3557.5 - 3692.5	0.066	18.18	13M5G7D
		16QAM	3557.5 - 3692.5	0.055	17.38	13M6W7D
		64QAM	3557.5 - 3692.5	0.049	16.93	13M5W7D
		256QAM	3557.5 - 3692.5	0.024	13.72	13M5W7D
	10 MHz	QPSK	3555.0 - 3695.0	0.066	18.19	9M04G7D
		16QAM	3555.0 - 3695.0	0.057	17.57	8M99W7D
		64QAM	3555.0 - 3695.0	0.049	16.87	9M02W7D
		256QAM	3555.0 - 3695.0	0.023	13.62	8M67W7D
	5 MHz	QPSK	3552.5 - 3697.5	0.066	18.21	4M54G7D
		16QAM	3552.5 - 3697.5	0.055	17.38	4M52W7D
		64QAM	3552.5 - 3697.5	0.048	16.82	4M50W7D
		256QAM	3552.5 - 3697.5	0.024	13.72	4M51W7D

EUT Overview (LTE B48)

Note: EIRP levels shown in the table above are measured over the full channel bandwidth. These values will appear on the Grant of Authorization.

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

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

- PCTEST is a CBRS Alliance (OnGo) Approved Test Lab
- PCTEST is a WinnForum Approved Test Lab
- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for CBRS Alliance Certification Test Plan and WinnForum Conformance and Performance Test Technical Standard.
- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISSED Standards (RSS).
- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISSED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG981U**. The test data contained in this report pertains only to the emissions due to the EUT's LTE Band 48 operation in the CBRS band. Per FCC Part 96, this device is evaluated under Citizens Band End User Devices (CBE).

Test Device Serial No.: 1022M, 1011M, 1070M, 0098S, 0460M, 0939M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 CDMA (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (n71, n5, n66, n2, n41), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC, ANT+, Wireless Power Transfer

2.3 Test Configuration

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

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

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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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-E-2016) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

3.2 Radiated Power and Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer “Channel Power” function with the integration band set to the emissions’ occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v03r01.

Per the guidance of ANSI/TIA-603-E-2016, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

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

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 -40dBm/MHz for End User Devices.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01.

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

Contribution	Expanded Uncertainty ($\pm$ 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 C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	LTx1	Licensed Transmitter Cable Set	6/4/2019	Annual	6/4/2020	LTx1
-	LTx5	Licensed Transmitter Cable Set	6/5/2019	Annual	6/5/2020	LTx5
Agilent	N9020A	MXA Signal Analyzer	4/20/2019	Annual	4/20/2020	US46470561
Agilent	N9038A	MXE EMI Receiver	7/17/2019	Annual	7/17/2020	MY51210133
Agilent	N9030A	PXA Signal Analyzer (44GHz)	6/12/2019	Annual	6/12/2020	MY52350166
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	5/10/2019	Annual	5/10/2020	441112
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
EMCO	3160-09	Small Horn (18 - 26.5GHz)	8/9/2018	Biennial	8/9/2020	135427
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	2/14/2019	Biennial	2/14/2021	125518
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	3/28/2018	Biennial	3/28/2020	128337
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	2/22/2019	Biennial	2/22/2021	128338
Mini Circuits	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	4/19/2019	Annual	4/19/2020	11401010036
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
Mini-Circuits	PWR-SEN-4RMS	USB Power Sensor	4/20/2019	Annual	4/20/2020	11210140001
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11403100002
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			100976
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			112347
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			102060
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	6/5/2019	Annual	6/5/2020	100342
Schwarzbeck	UHA 9105	Dipole Antenna (400 - 1GHz) Rx	4/30/2018	Biennial	4/30/2020	9105-2404
Schwarzbeck	UHA 9105	Dipole Antenna (400 - 1GHz) Tx	4/30/2018	Biennial	4/30/2020	9105-2403
Seekonk	NC-100	Torque Wrench (8" lb)	5/10/2018	Biennial	5/10/2020	N/A
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	A051107

Table 5-1. Test Equipment

Notes:

- For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
- 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

QAM Modulation

Emission Designator = 8M45W7D

LTE BW = 8.45 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (7250 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: A3LSMG981U
 FCC Classification: Citizens Band End User Devices (CBE)
 Mode(s): LTE

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1046	Transmitter Conducted Output Power	N/A			See RF Exposure Report
2.1051 96.41(e)(ii)	Out of Band Emissions	-13 dBm/MHz at frequencies within 0-B MHz of channel edge (where B is the bandwidth of the assigned channel) -25 dBm/MHz at frequencies greater than B MHz above and below channel edge -40 dBm/MHz at frequencies below 3530 MHz and above 3720 MHz			Section 7.3, 7.4
2.1046	Additional Maximum Power Reduction (A-MPR)	N/A			Section 7.5
2.1055	Frequency Stability	Fundamental emissions stay within authorized frequency block			Section 7.10
96.47	End User Device Additional Requirements (CBSD Protocol)	End User Devices may operate only if they can positively receive and decode an authorization signal transmitted by a CBSD, including the frequencies and power limits for their operation. An End User Device must discontinue operations, change frequencies, or change its operational power level within 10 seconds of receiving instructions from its associated CBSD.			Section 7.11
96.41(e)	Uplink Carrier Aggregation	$>43 + 10\log(P[\text{Watts}])$ at Band Edge and for all out-of-band emissions			Section 7.6

Table 7-1. Summary of Conducted Test Results

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FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
96.41(b)	Equivalent Isotropic Radiated Power (EIRP)	23 dBm/10MHz	RADIATED	PASS	Section 7.7
2.1053 96.41(e)	Undesirable Emissions	-40 dBm/MHz			Section 7.8
96.41(e)	Uplink Carrier Aggregation	Undesirable emissions must meet the limits detailed in 27.53(m)			Section 7.9

Table 7-2. Summary of Radiated Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
- 4) 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 5.1.

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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 v03r01 – Section 4.2

Test Settings

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

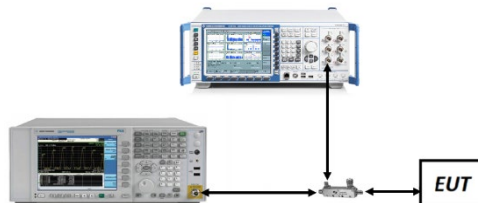


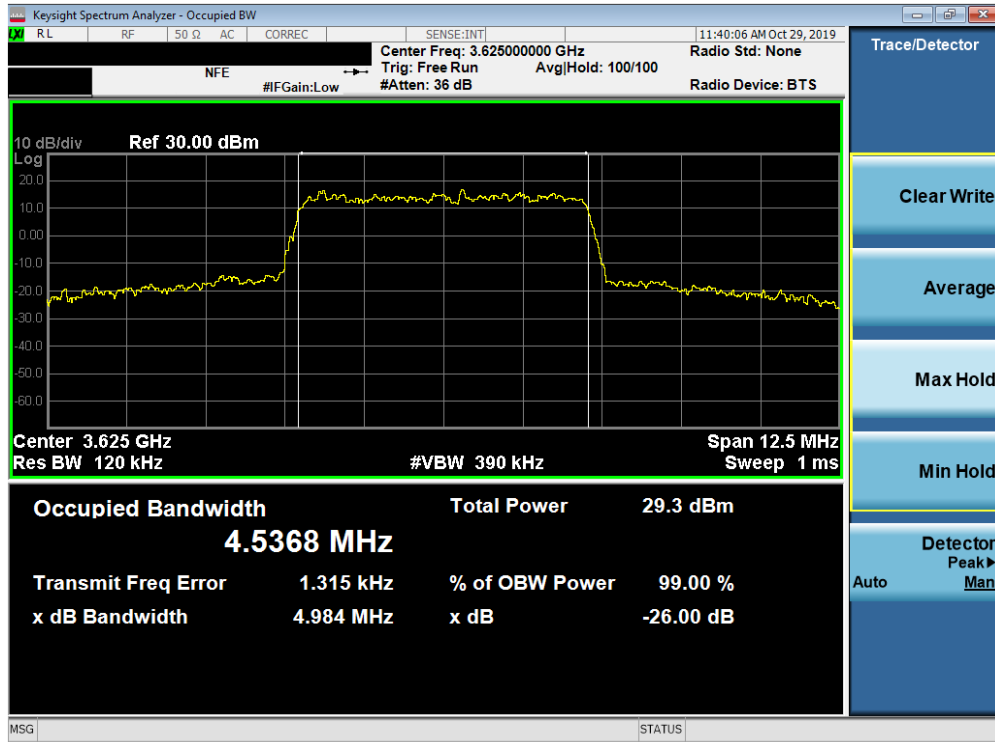
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

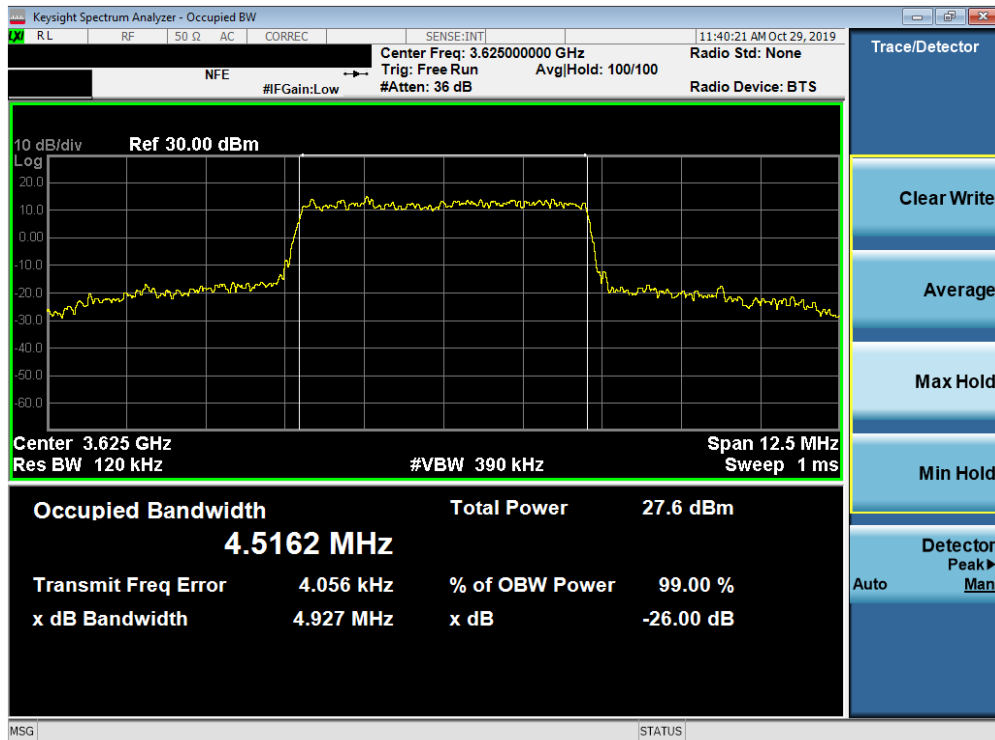
None.

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LTE Band 48

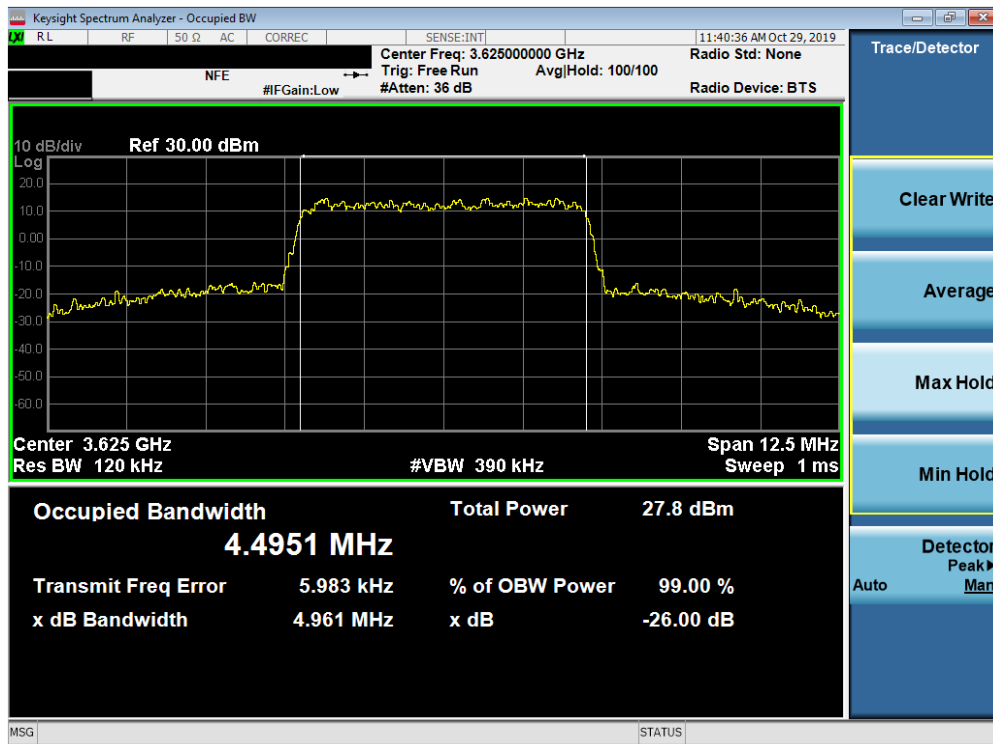


Plot 7-1. Occupied Bandwidth Plot (LTE Band 48 - 5.0MHz QPSK - Full RB Configuration)

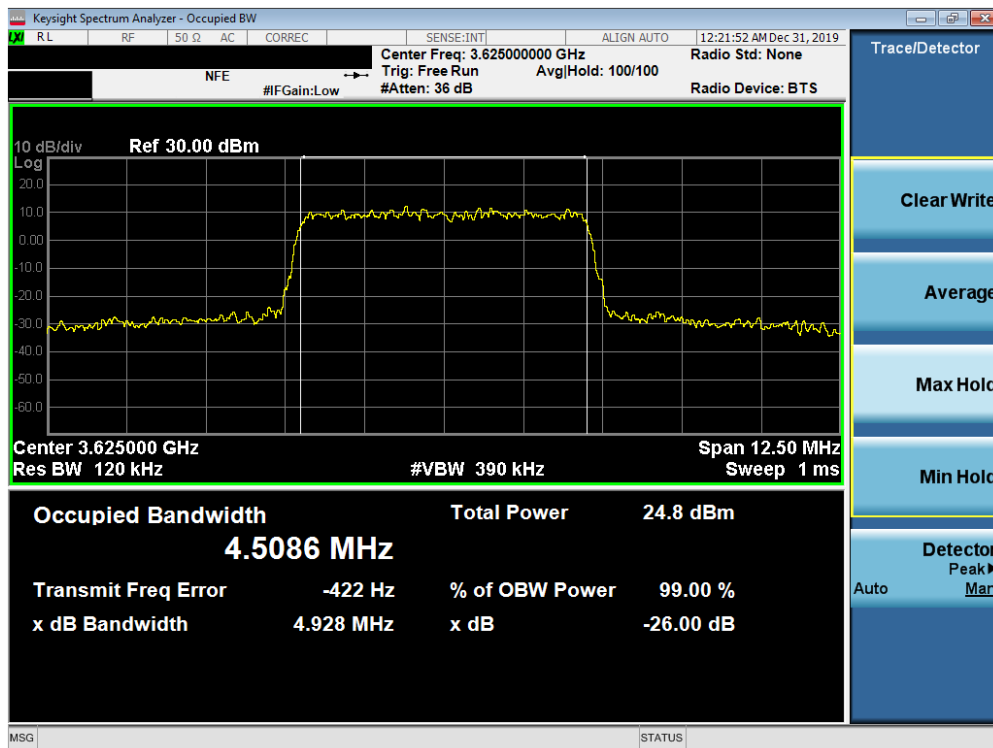


Plot 7-2. Occupied Bandwidth Plot (LTE Band 48 - 5.0MHz 16-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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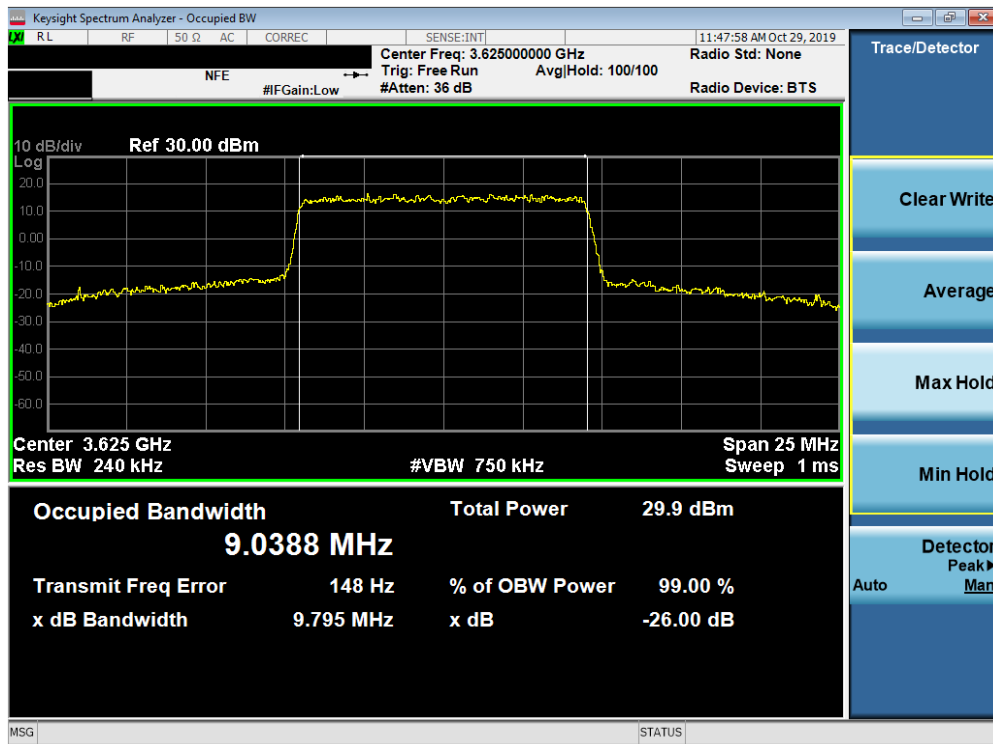


Plot 7-3. Occupied Bandwidth Plot (LTE Band 48 - 5.0MHz 64-QAM - Full RB Configuration)

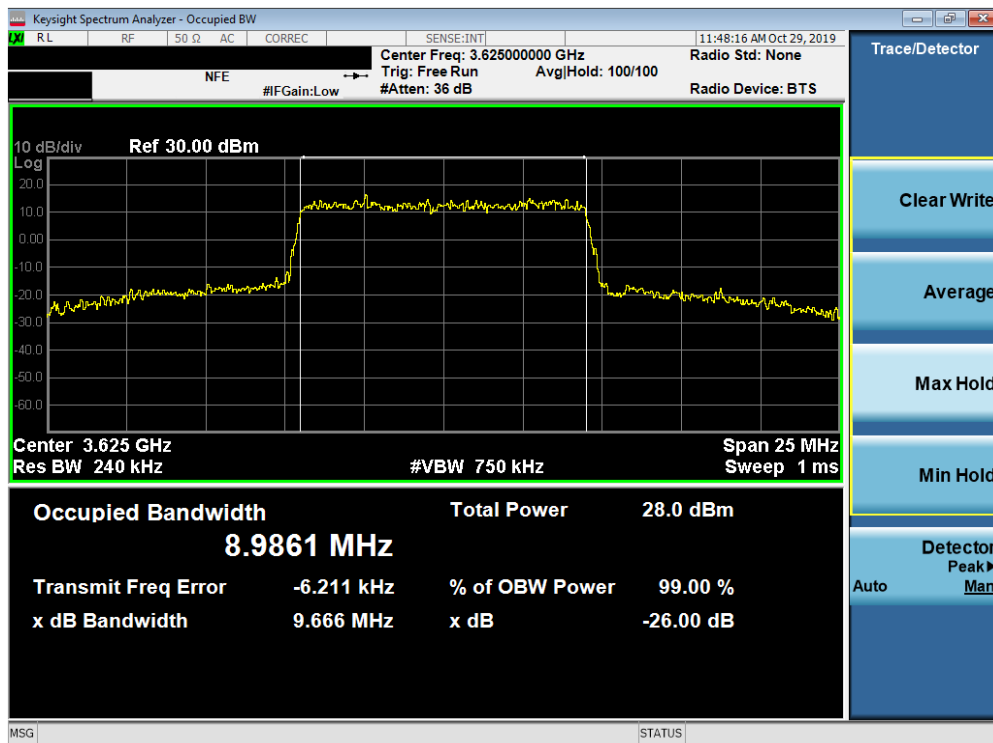


Plot 7-4. Occupied Bandwidth Plot (LTE Band 48 - 5.0MHz -256QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 14 of 78

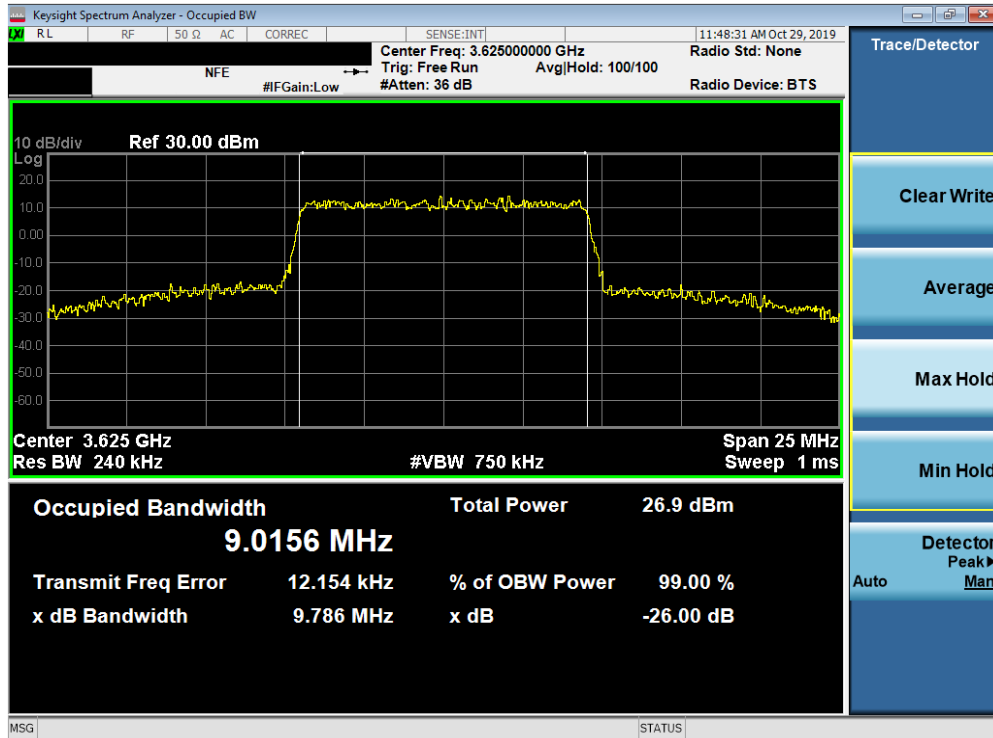


Plot 7-5. Occupied Bandwidth Plot (LTE Band 48 - 10.0MHz QPSK - Full RB Configuration)

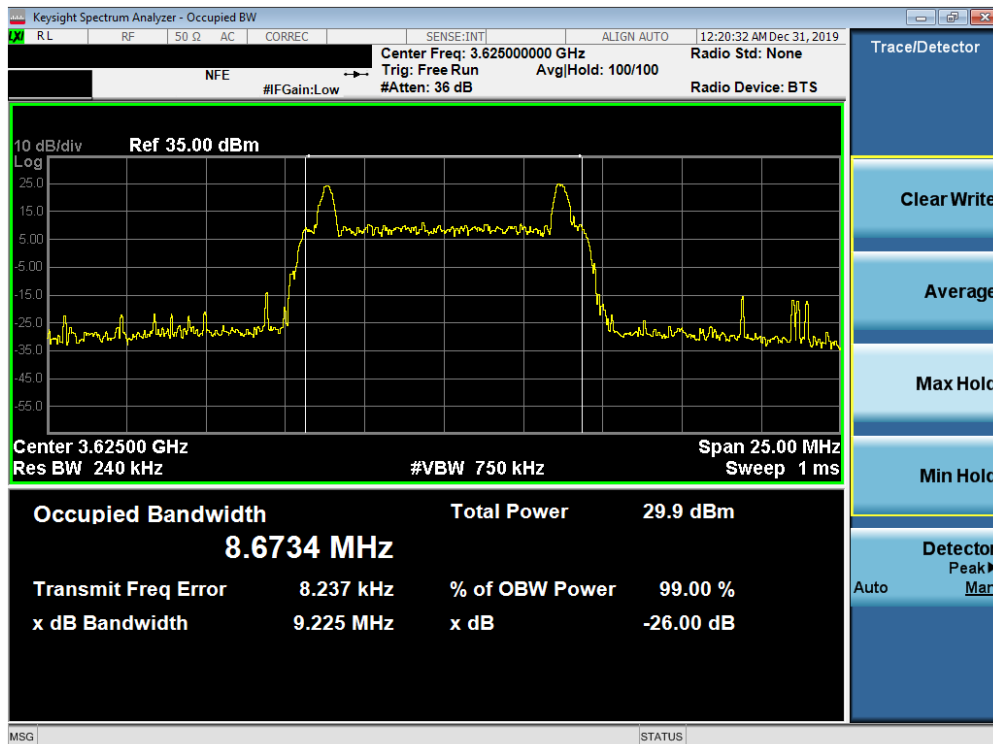


Plot 7-6. Occupied Bandwidth Plot (LTE Band 48 - 10.0MHz 16-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 15 of 78

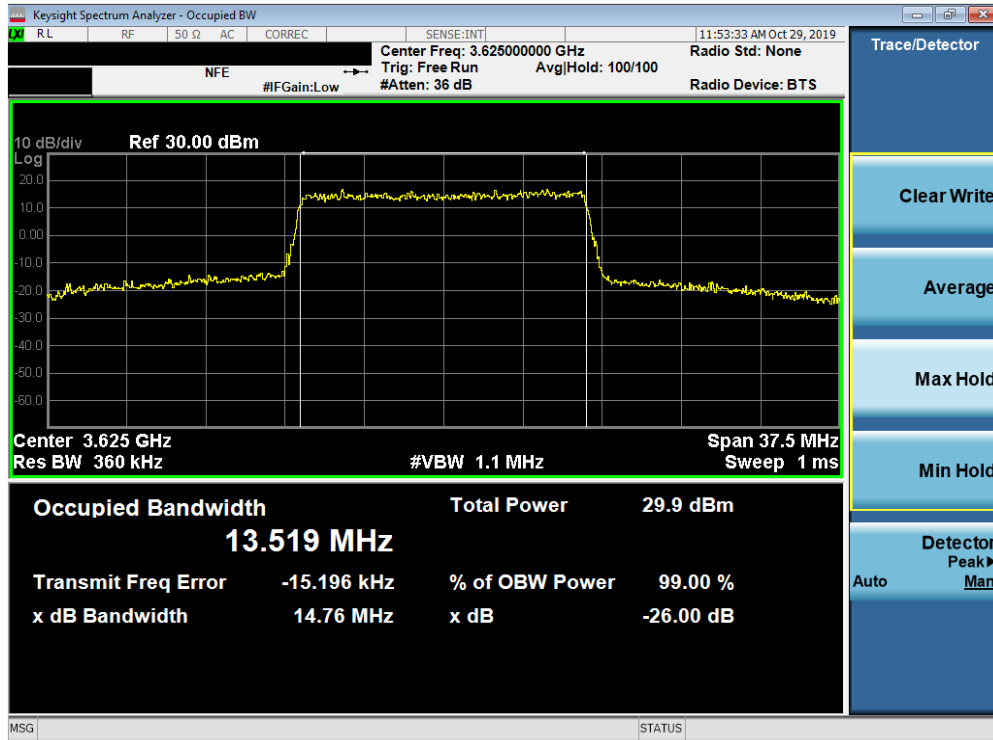


Plot 7-7. Occupied Bandwidth Plot (LTE Band 48 - 10.0MHz 64-QAM - Full RB Configuration)

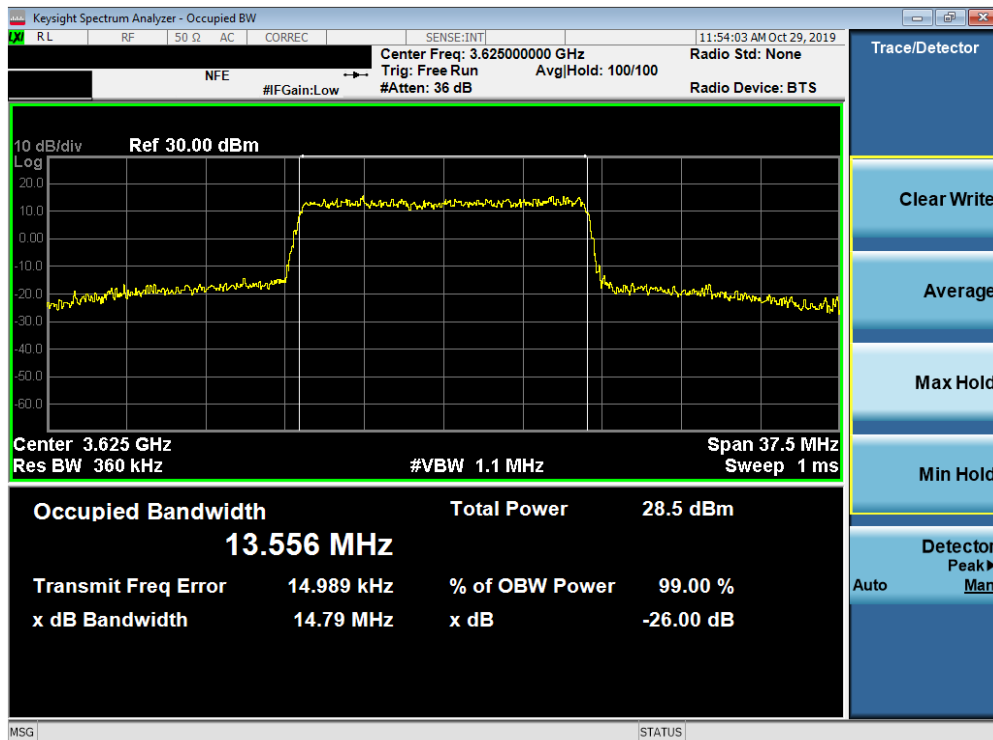


Plot 7-8. Occupied Bandwidth Plot (LTE Band 48 - 10.0MHz 256-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 16 of 78



Plot 7-9. Occupied Bandwidth Plot (LTE Band 48 - 15.0MHz QPSK - Full RB Configuration)

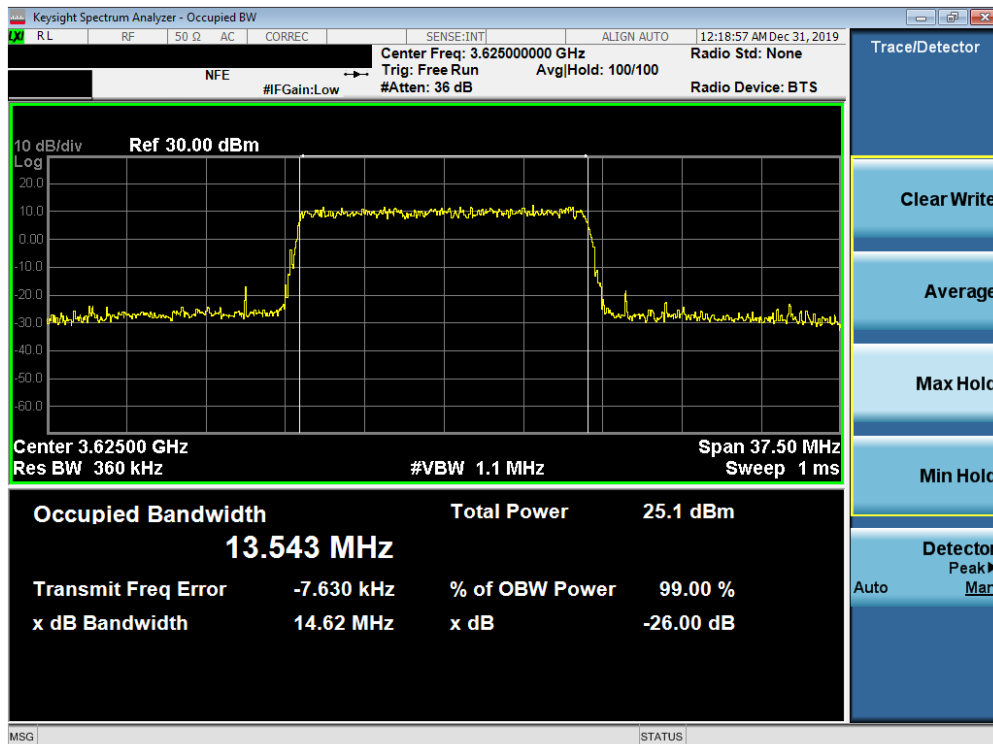


Plot 7-10. Occupied Bandwidth Plot (LTE Band 48 - 15.0MHz 16-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 17 of 78

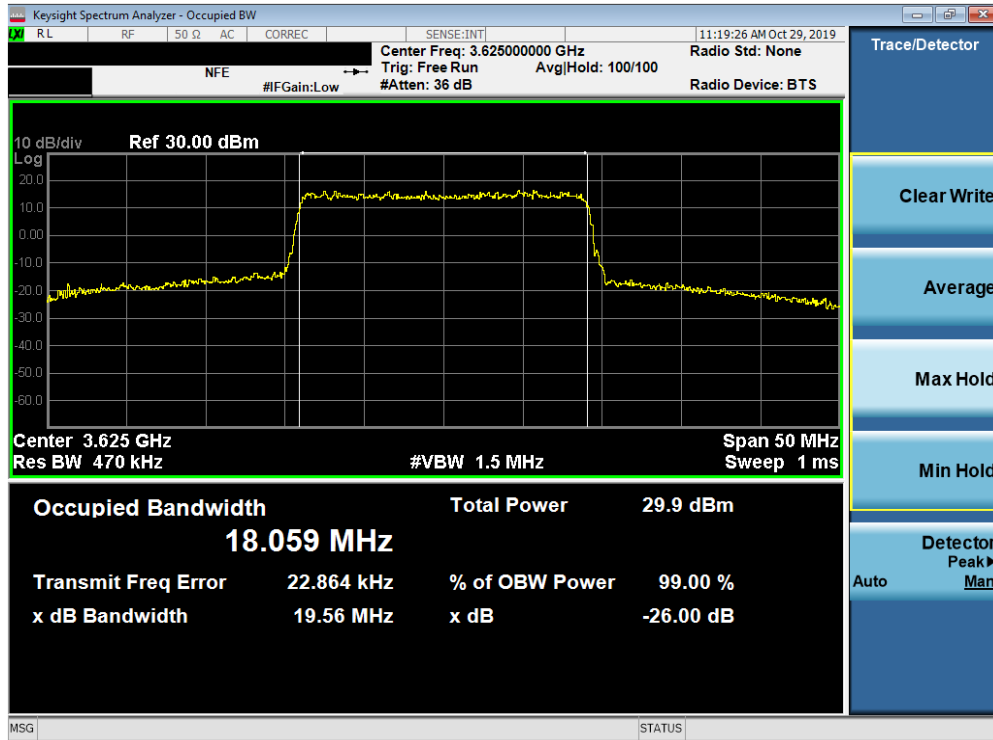


Plot 7-11. Occupied Bandwidth Plot (LTE Band 48 - 15.0MHz 64-QAM - Full RB Configuration)

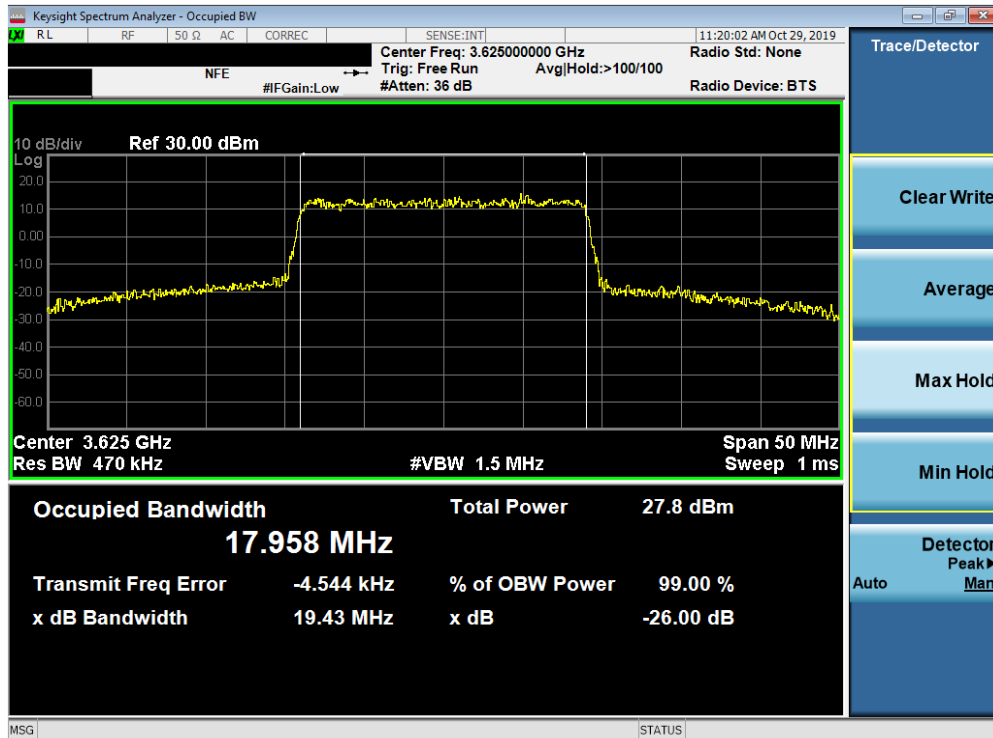


Plot 7-12. Occupied Bandwidth Plot (LTE Band 48 - 15.0MHz 256-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 18 of 78

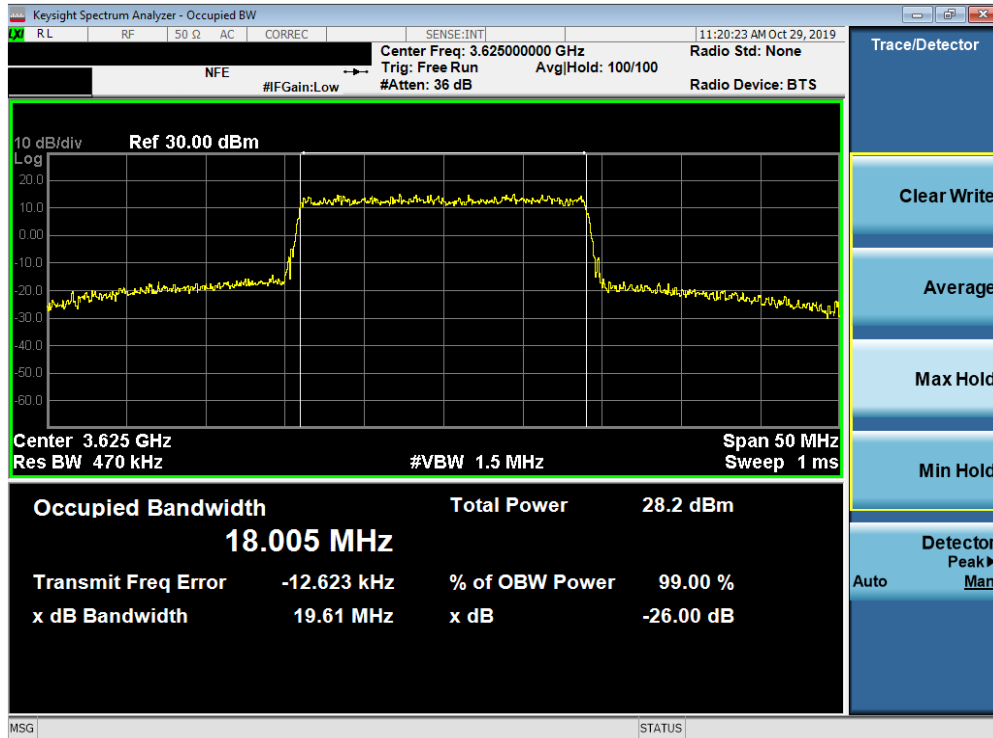


Plot 7-13. Occupied Bandwidth Plot (LTE Band 48 - 20.0MHz QPSK - Full RB Configuration)



Plot 7-14. Occupied Bandwidth Plot (LTE Band 48 - 20.0MHz 16-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 19 of 78

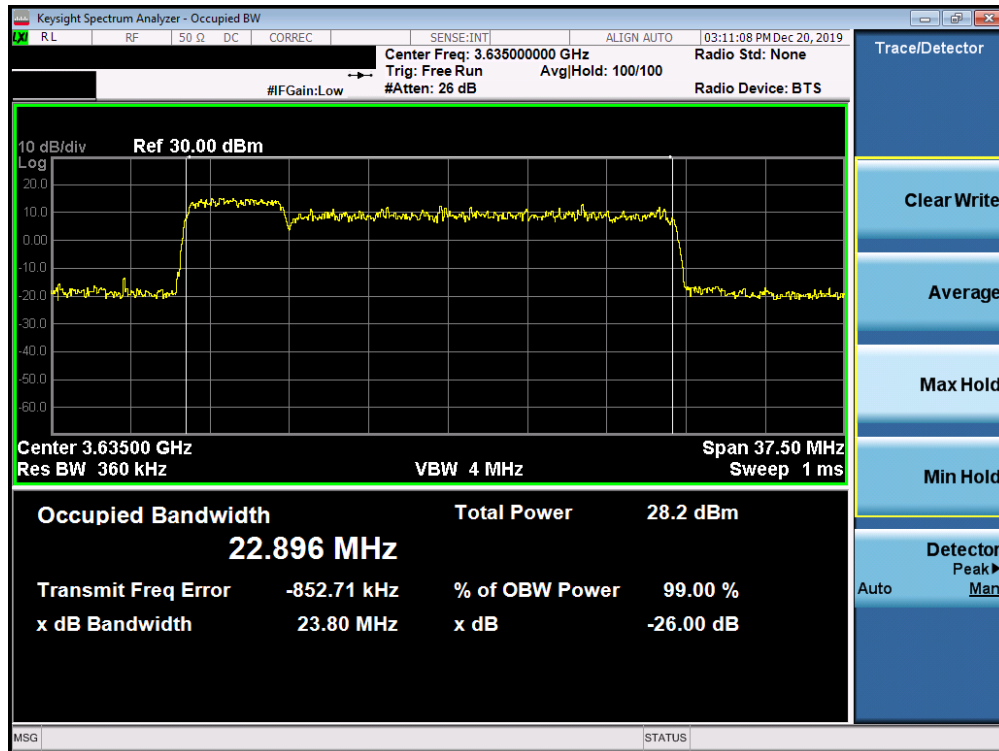


Plot 7-15. Occupied Bandwidth Plot (LTE Band 48 - 20.0MHz 64-QAM - Full RB Configuration)

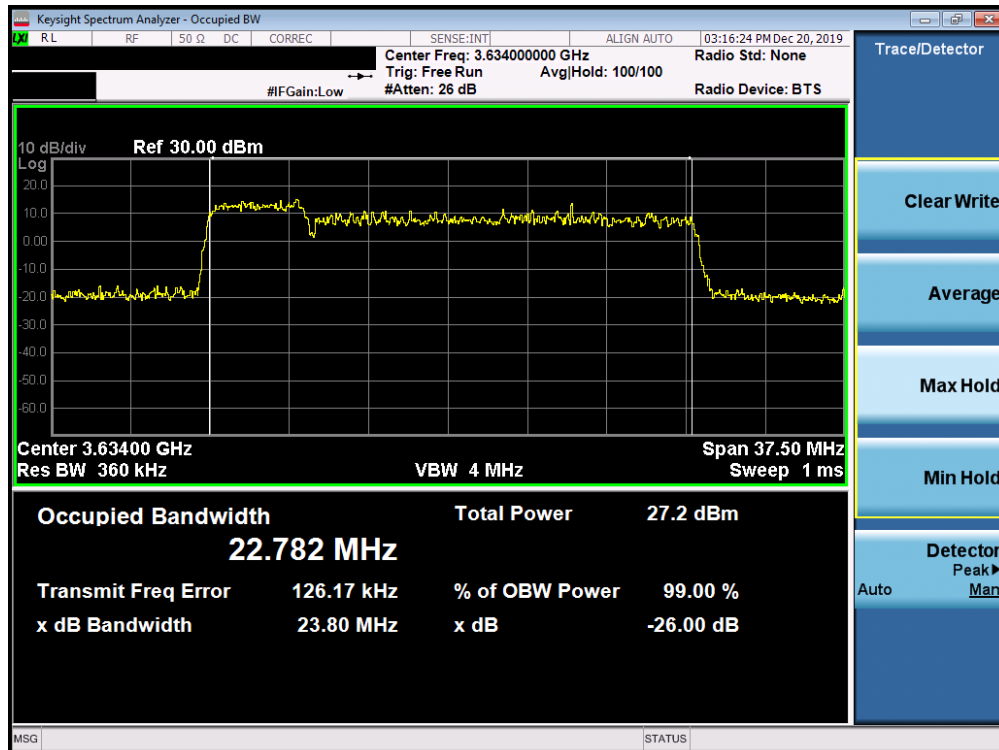


Plot 7-16. Occupied Bandwidth Plot (LTE Band 48 - 20.0MHz 256-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 20 of 78

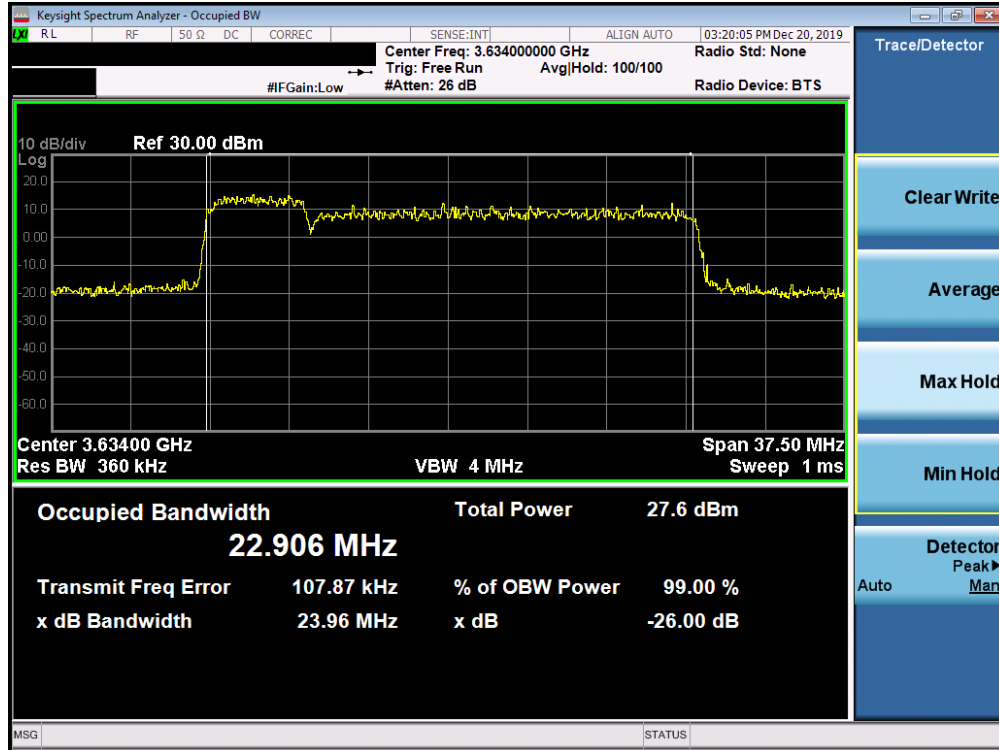


Plot 7-17. Occupied Bandwidth Plot (LTE Band 48 - 25.0MHz QPSK - Full RB Configuration)

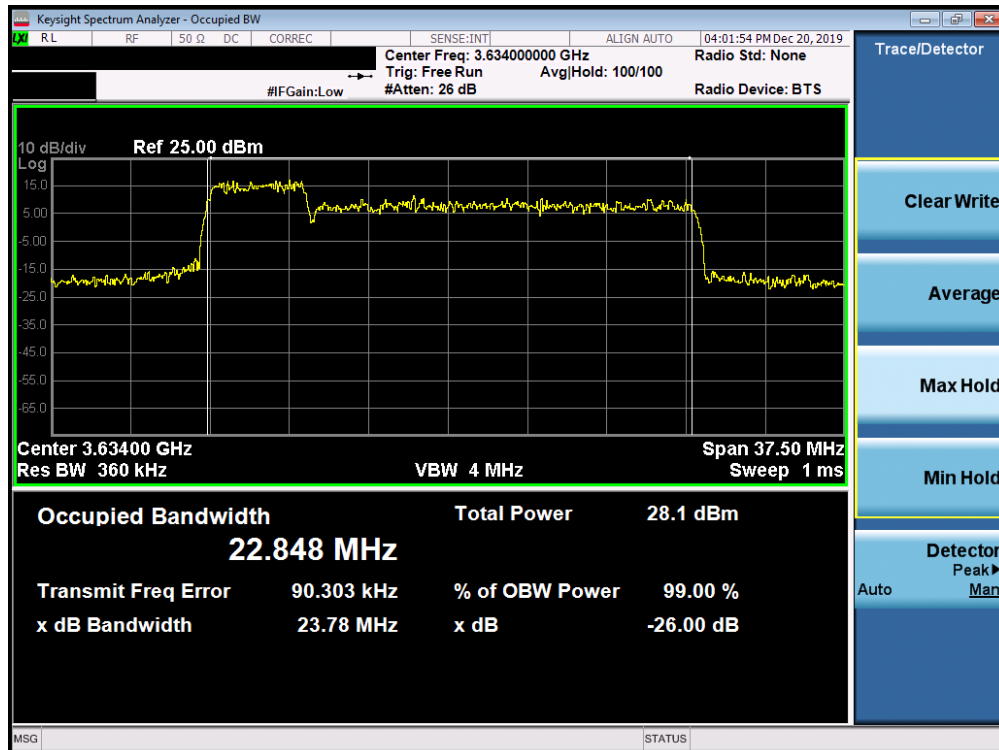


Plot 7-18. Occupied Bandwidth Plot (LTE Band 48 - 25.0MHz 16-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 21 of 78

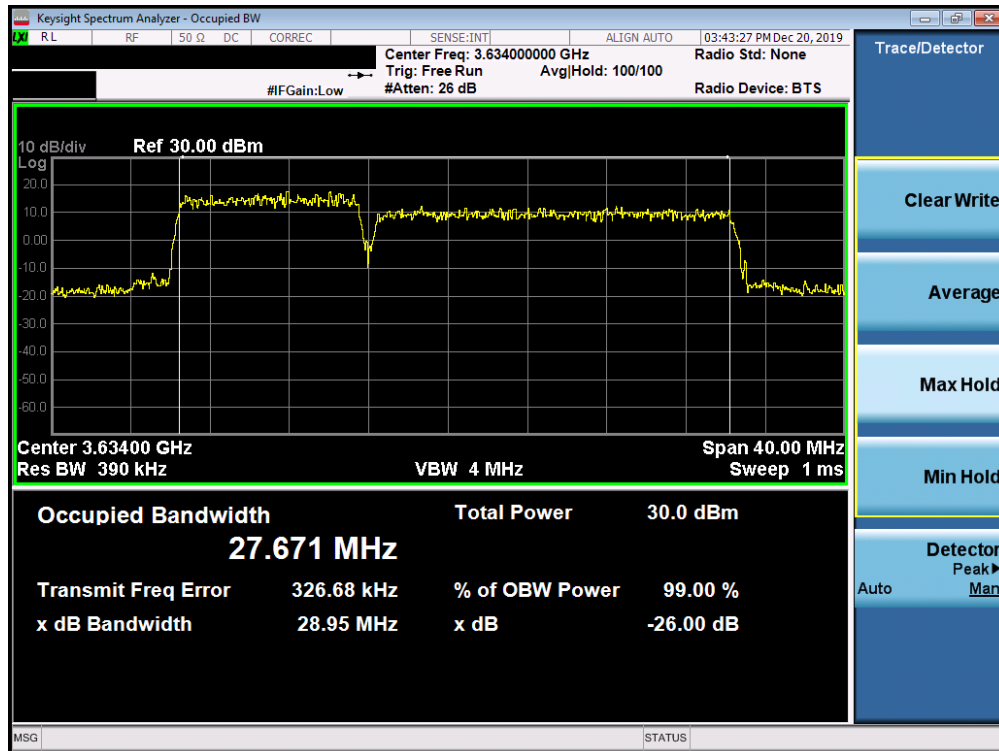


Plot 7-19. Occupied Bandwidth Plot (LTE Band 48 - 25.0MHz 64-QAM - Full RB Configuration)

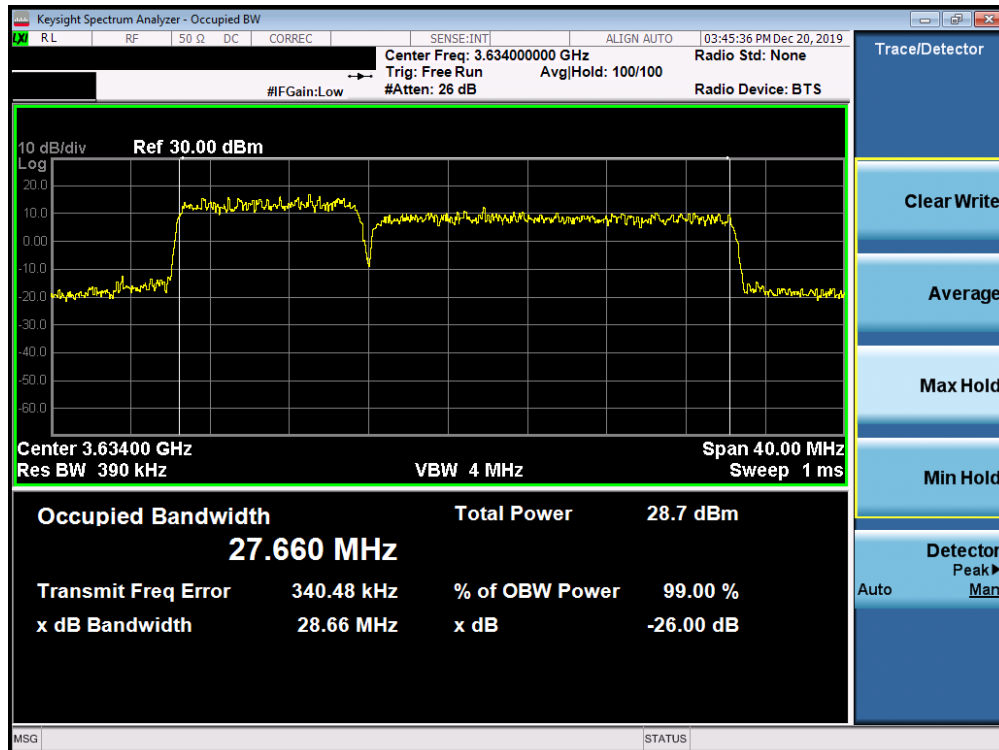


Plot 7-20. Occupied Bandwidth Plot (LTE Band 48 - 25.0MHz 256-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 22 of 78

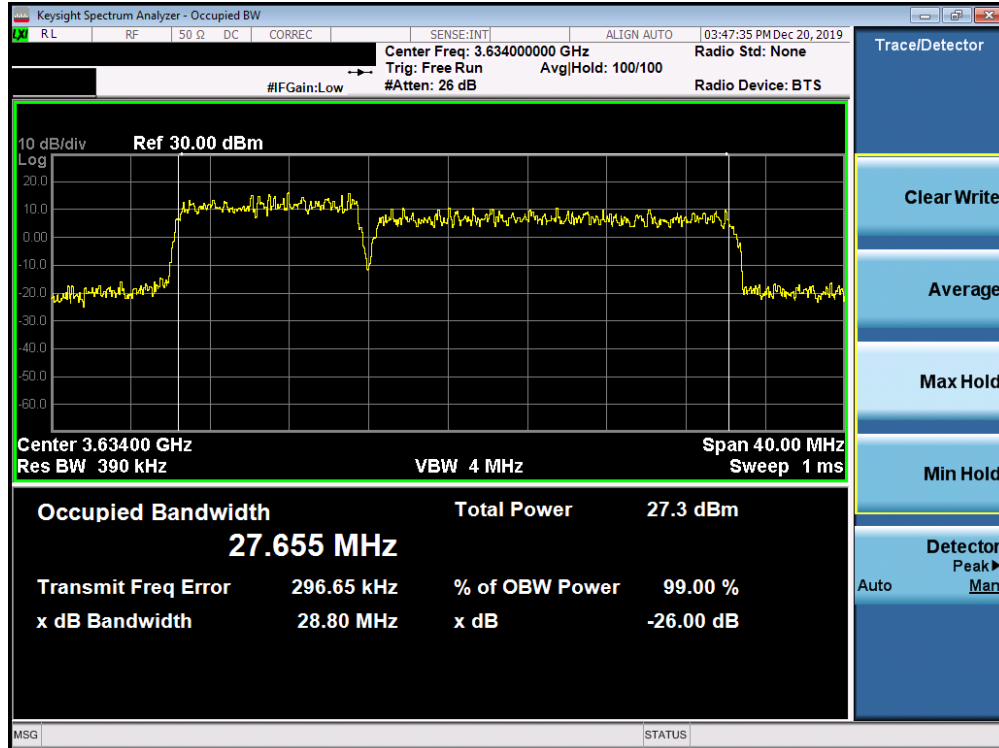


Plot 7-21. Occupied Bandwidth Plot (LTE Band 48 - 30.0MHz QPSK - Full RB Configuration)

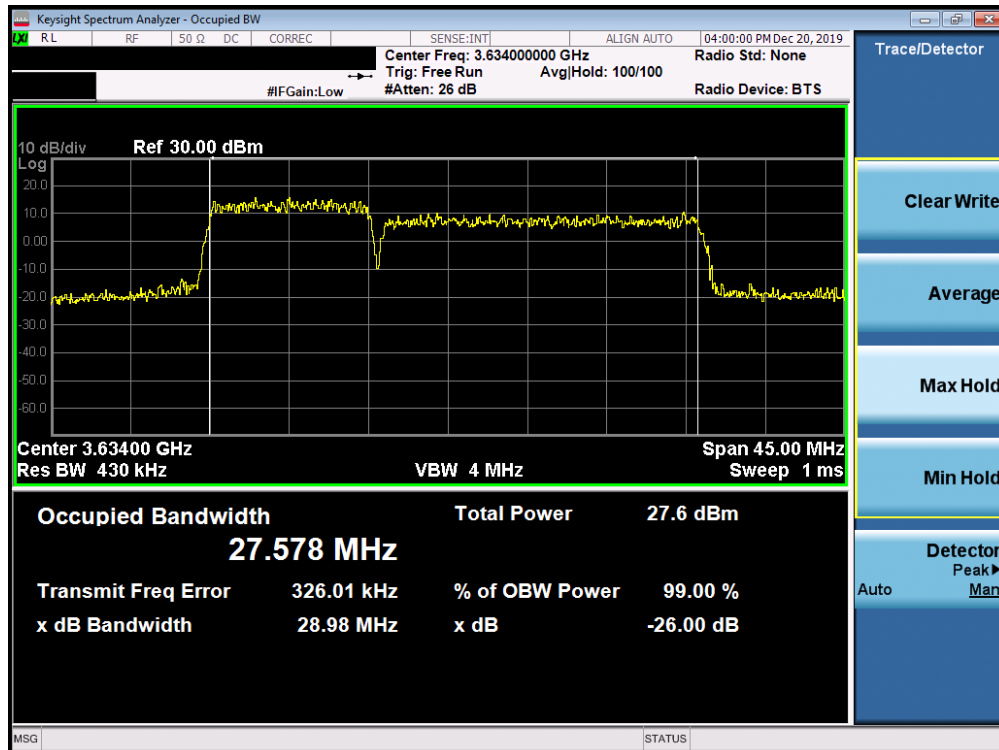


Plot 7-22. Occupied Bandwidth Plot (LTE Band 48 - 30.0MHz 16-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 23 of 78

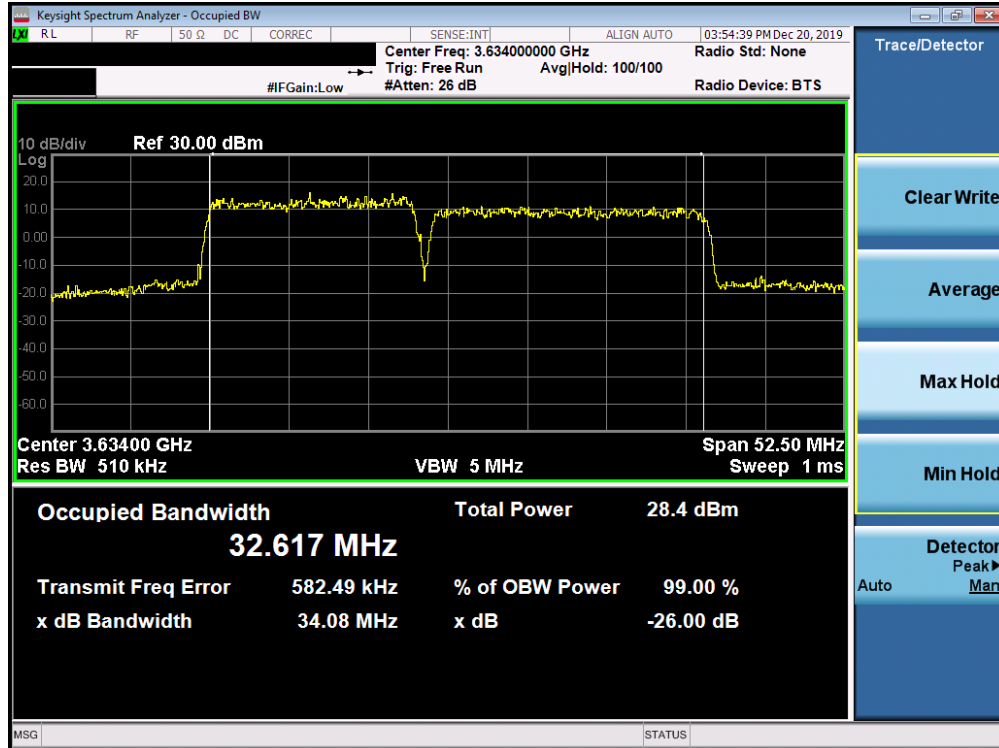


Plot 7-23. Occupied Bandwidth Plot (LTE Band 48 - 30.0MHz 64-QAM - Full RB Configuration)

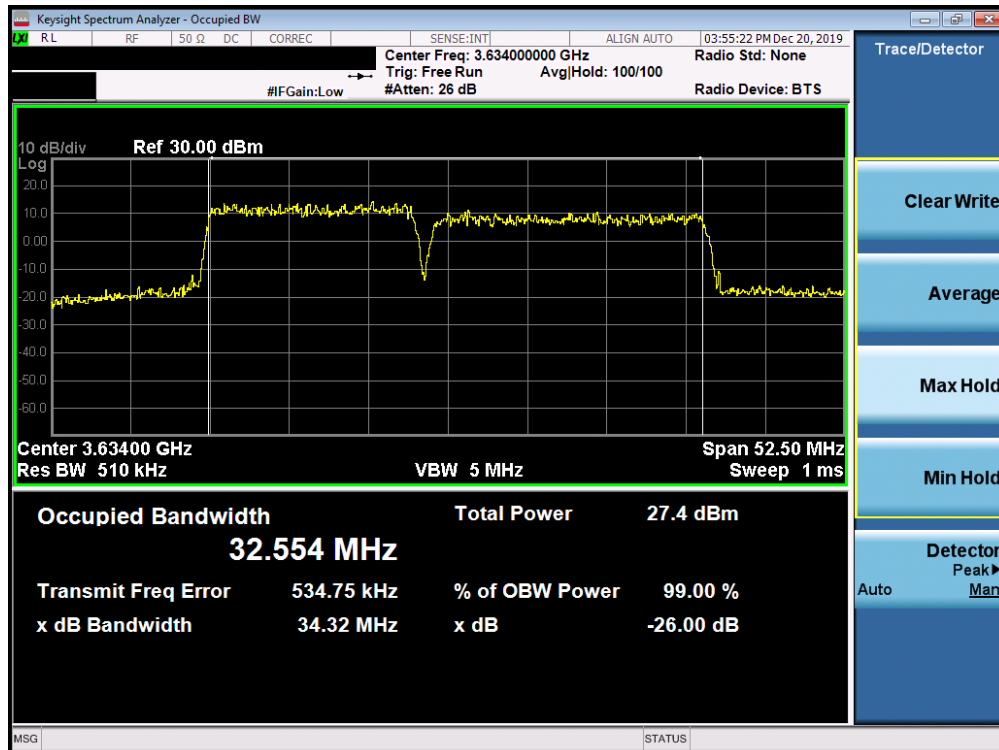


Plot 7-24. Occupied Bandwidth Plot (LTE Band 48 - 30.0MHz 256-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 24 of 78

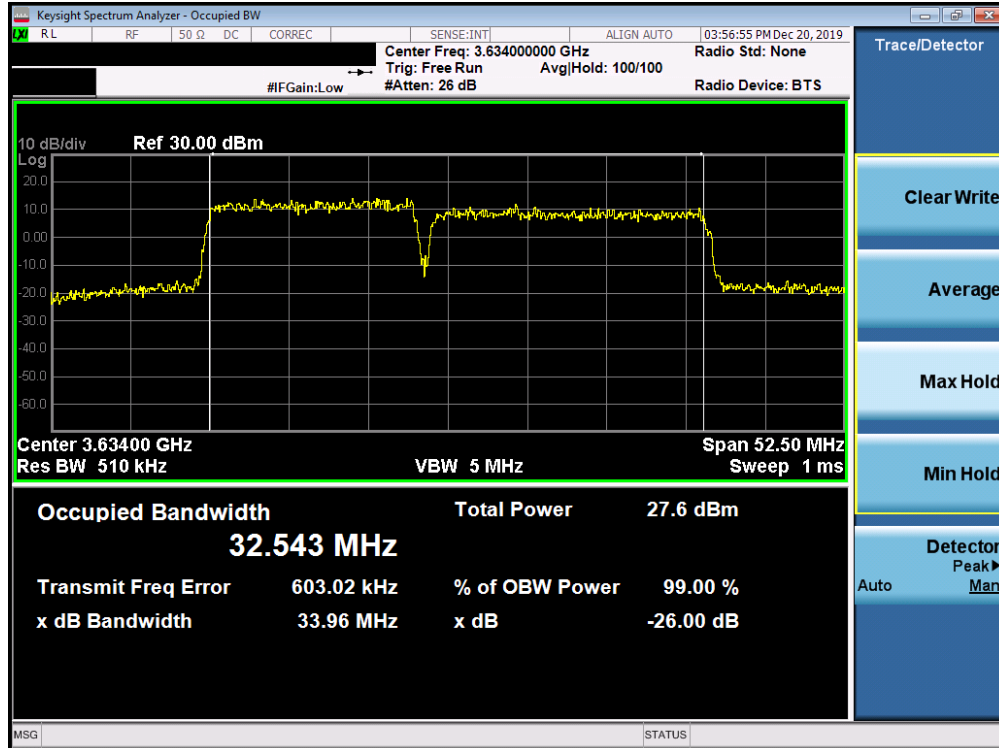


Plot 7-25. Occupied Bandwidth Plot (LTE Band 48 - 35.0MHz QPSK - Full RB Configuration)

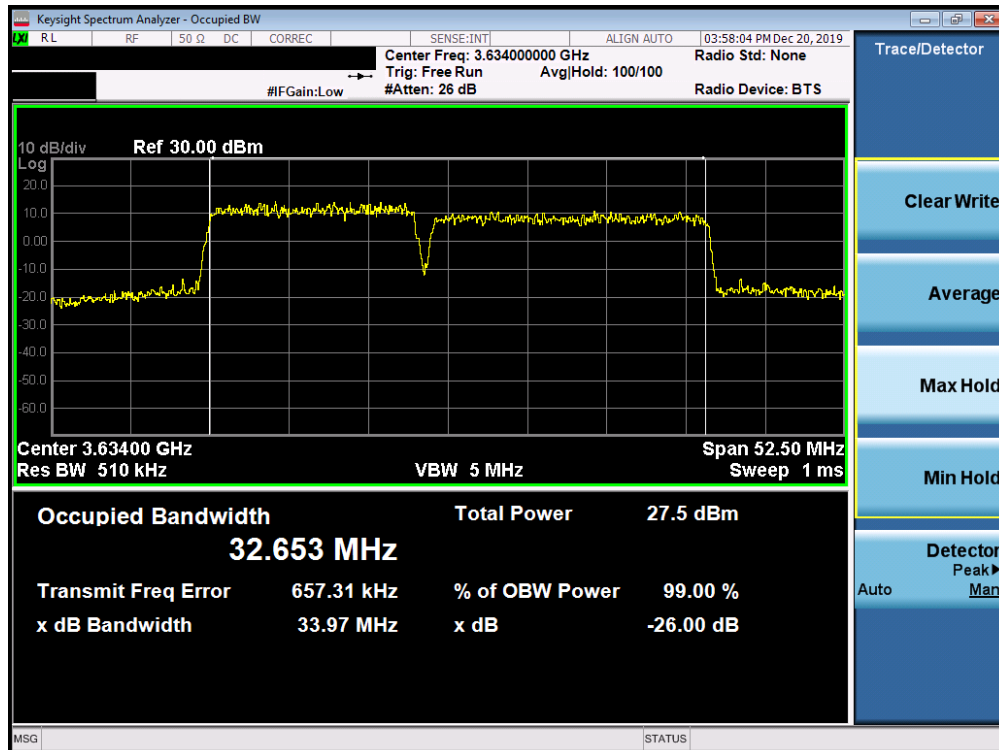


Plot 7-26. Occupied Bandwidth Plot (LTE Band 48 - 35.0MHz 16-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset	Page 25 of 78

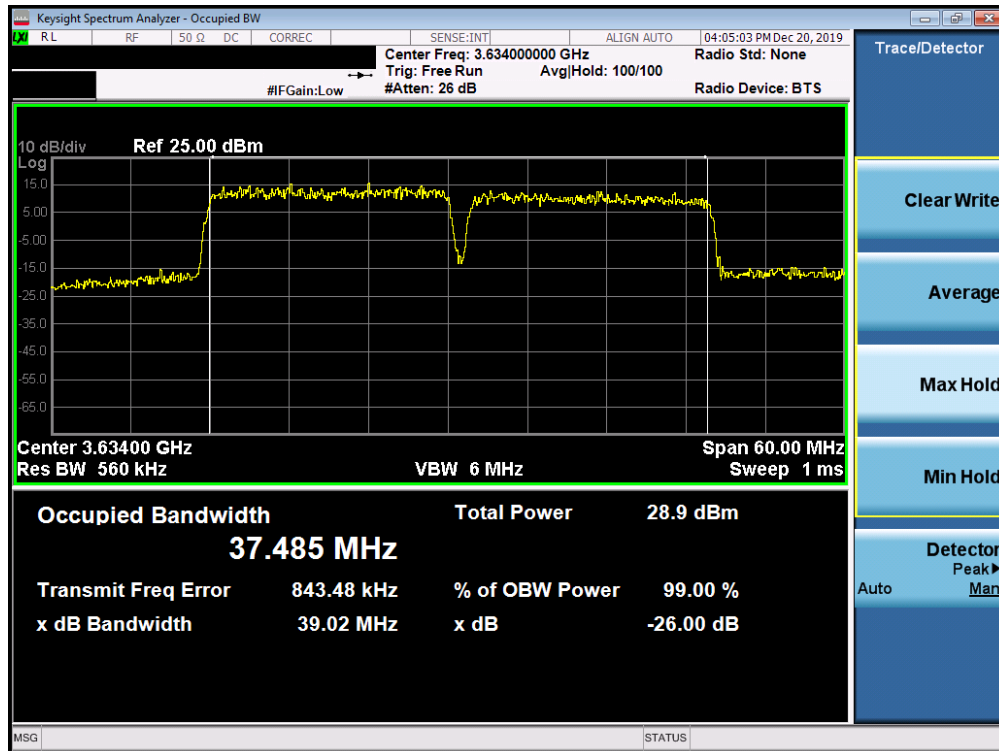


Plot 7-27. Occupied Bandwidth Plot (LTE Band 48 - 35.0MHz 64-QAM - Full RB Configuration)

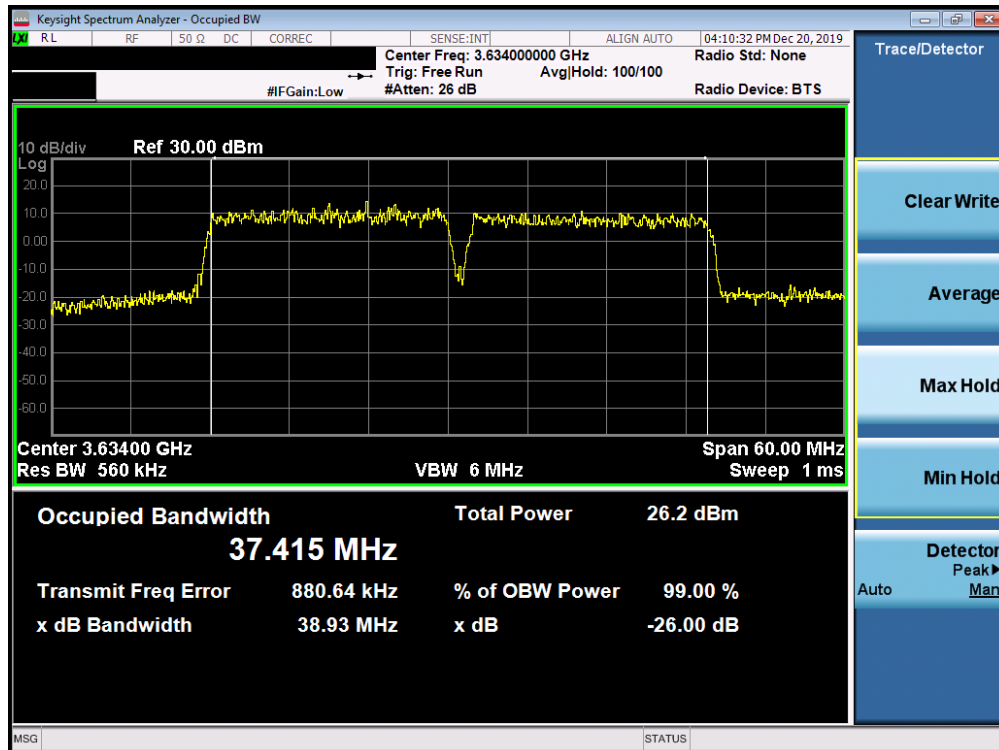


Plot 7-28. Occupied Bandwidth Plot (LTE Band 48 - 35.0MHz 256-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 26 of 78

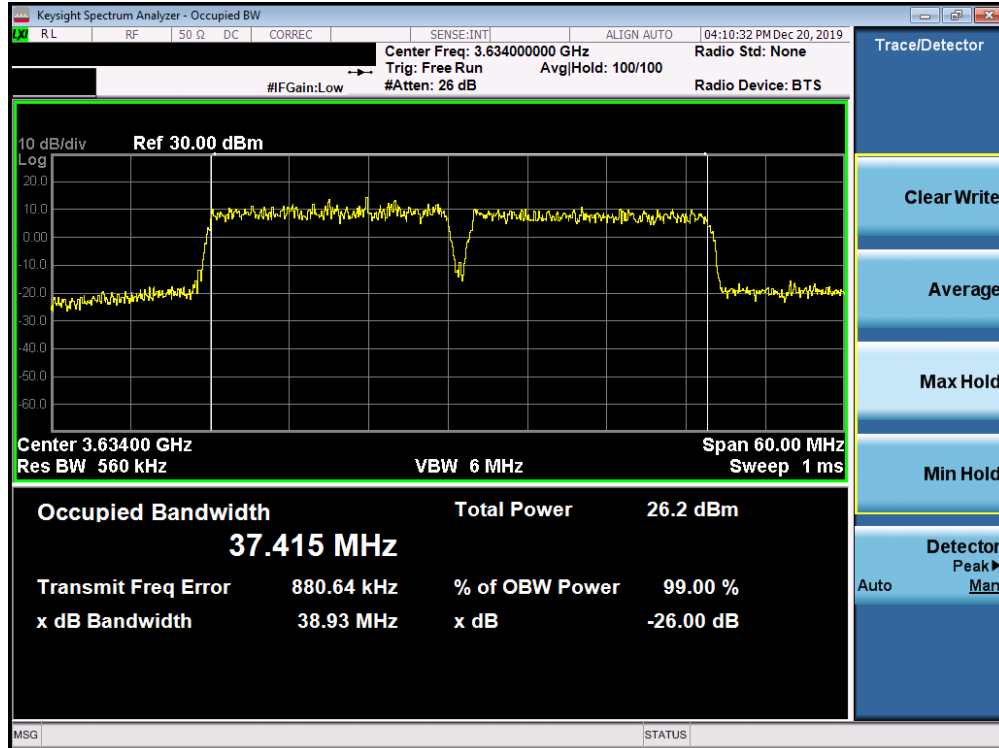


Plot 7-29. Occupied Bandwidth Plot (LTE Band 48 - 40.0MHz QPSK - Full RB Configuration)

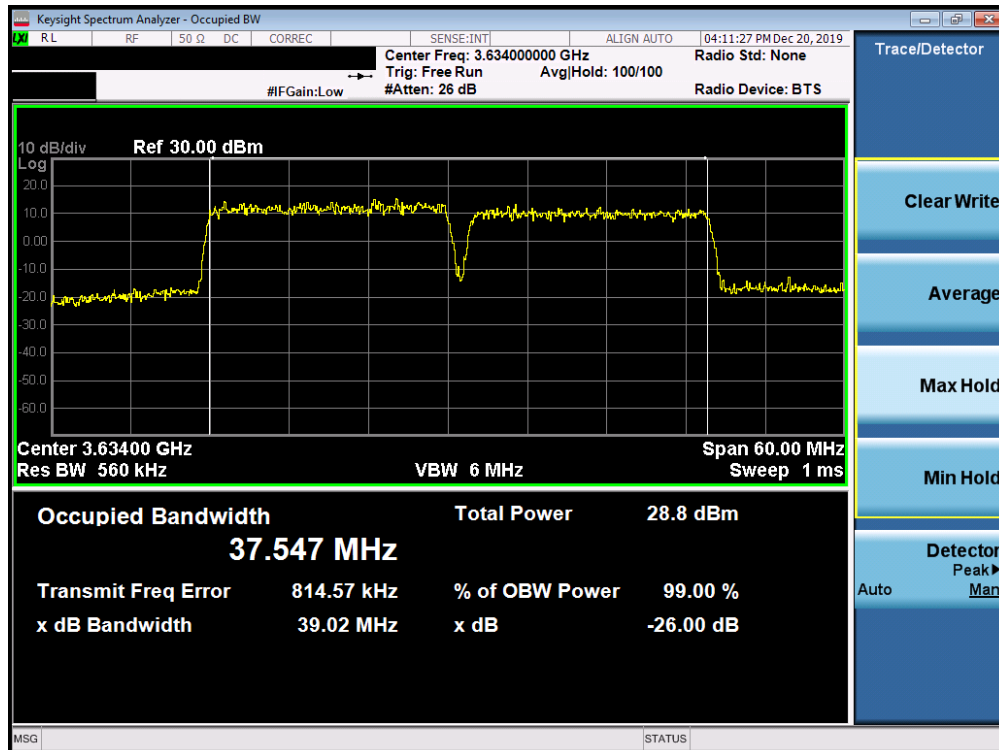


Plot 7-30. Occupied Bandwidth Plot (LTE Band 48 - 40.0MHz 16-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 27 of 78



Plot 7-31. Occupied Bandwidth Plot (LTE Band 48 - 40.0MHz 64-QAM - Full RB Configuration)



Plot 7-32. Occupied Bandwidth Plot (LTE Band 48 - 40.0MHz 256-QAM - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 28 of 78

7.3 Spurious and Harmonic Emissions at Antenna Terminal §2.1051 §96.41(e)

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at 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 conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/Mhz.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = Max Hold
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.

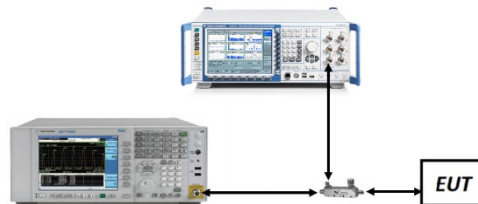


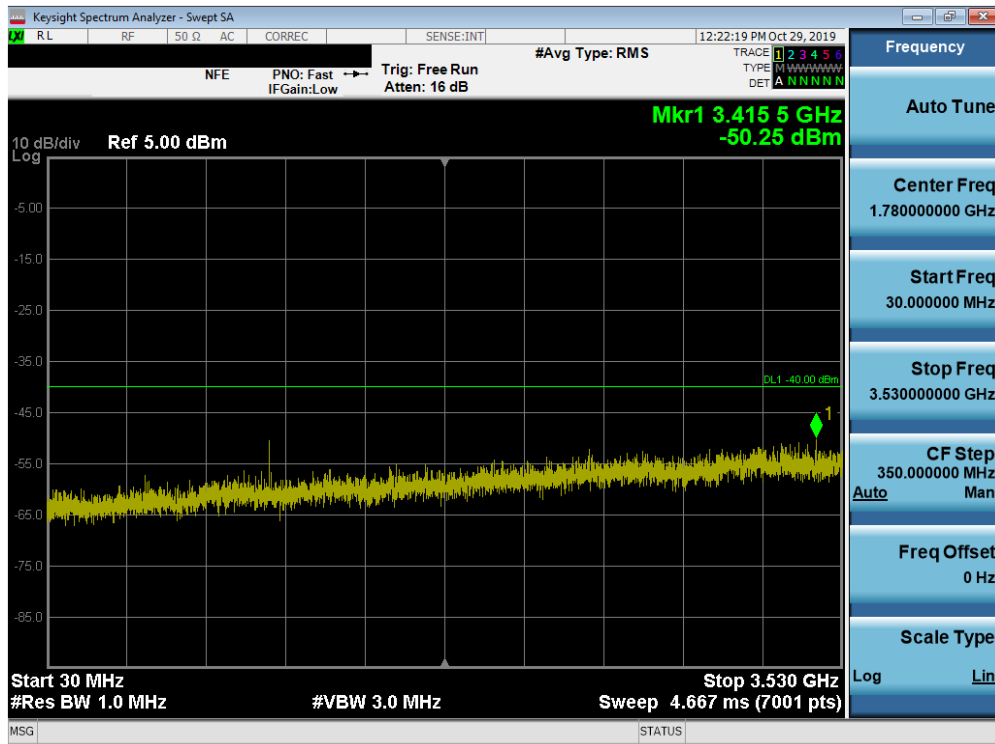
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

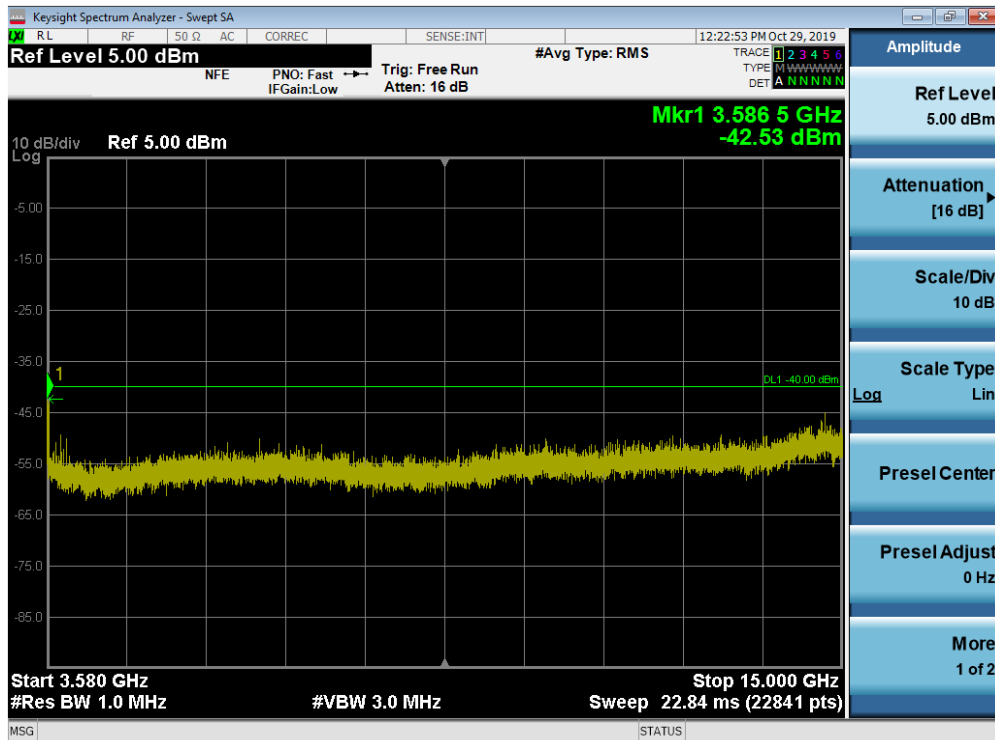
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the 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: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 29 of 78

LTE Band 48

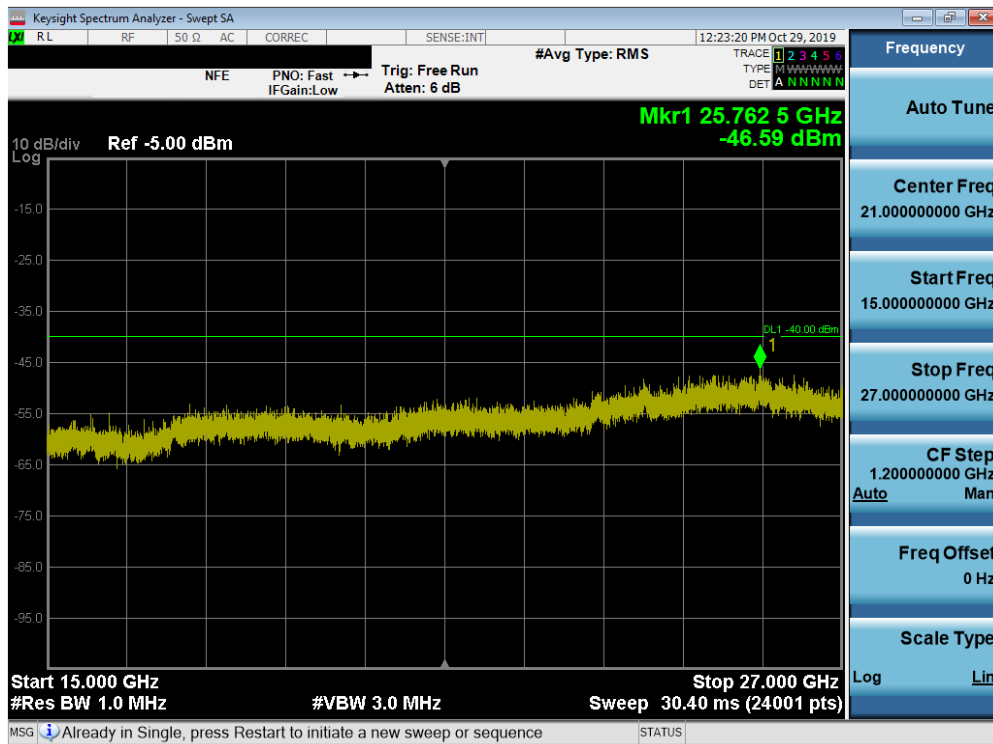


Plot 7-33. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

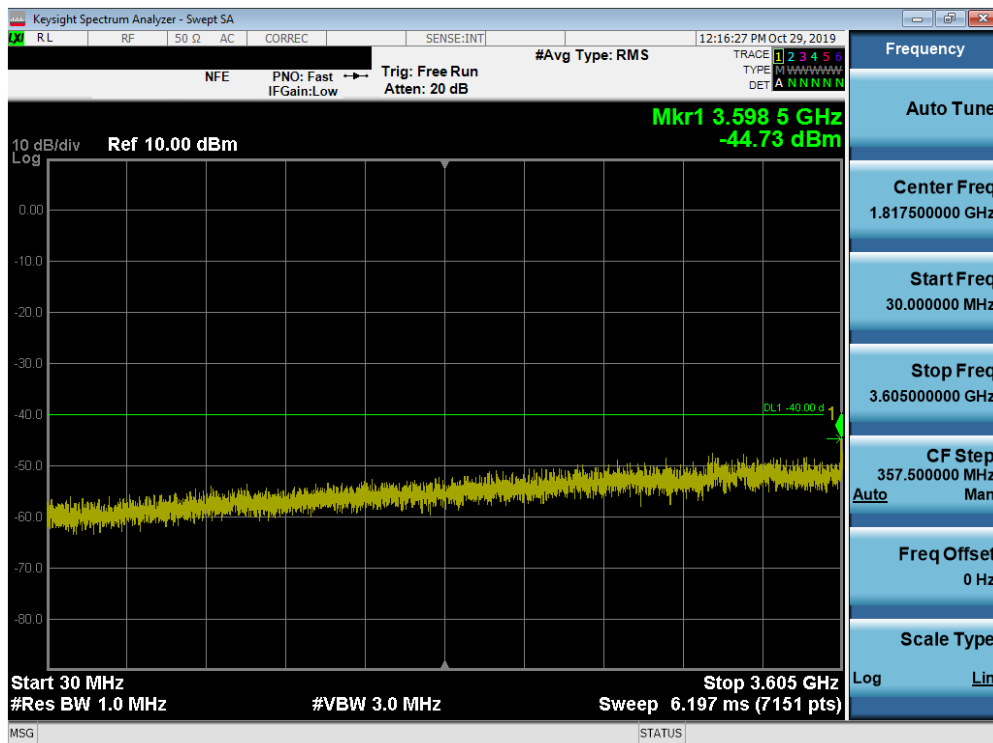


Plot 7-34. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 30 of 78

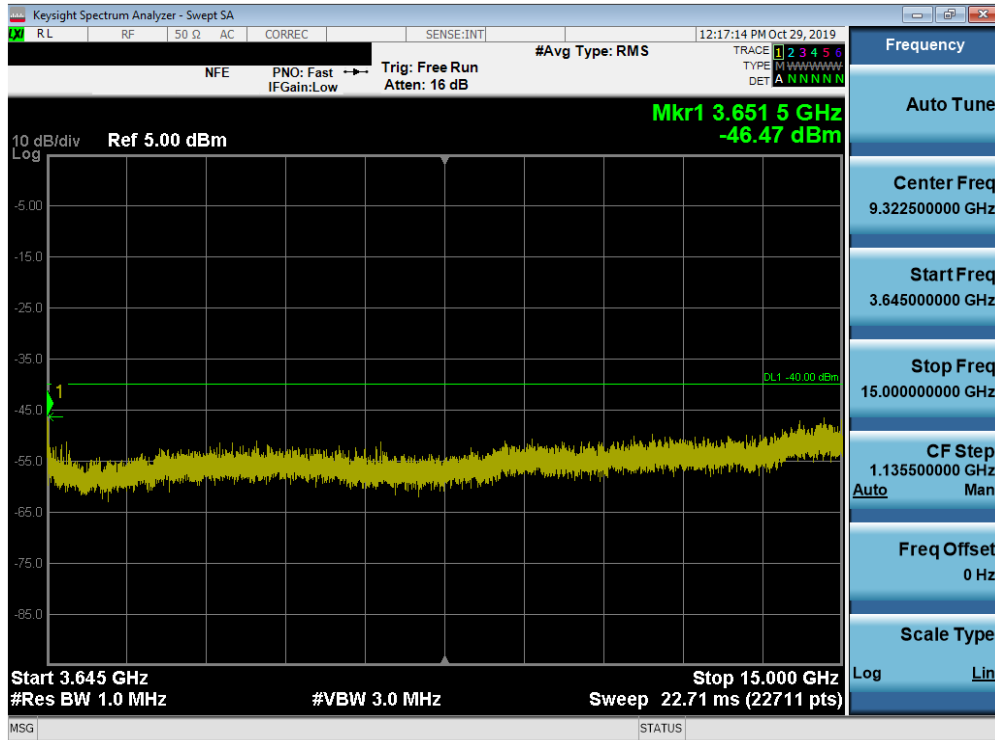


Plot 7-35. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

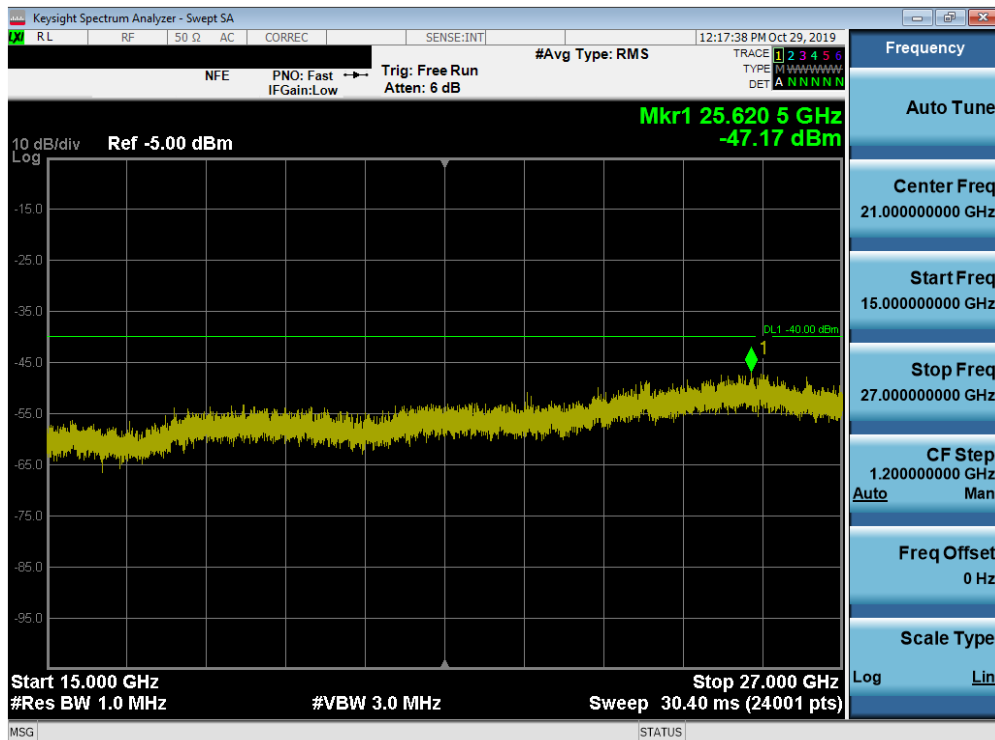


Plot 7-36. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 31 of 78

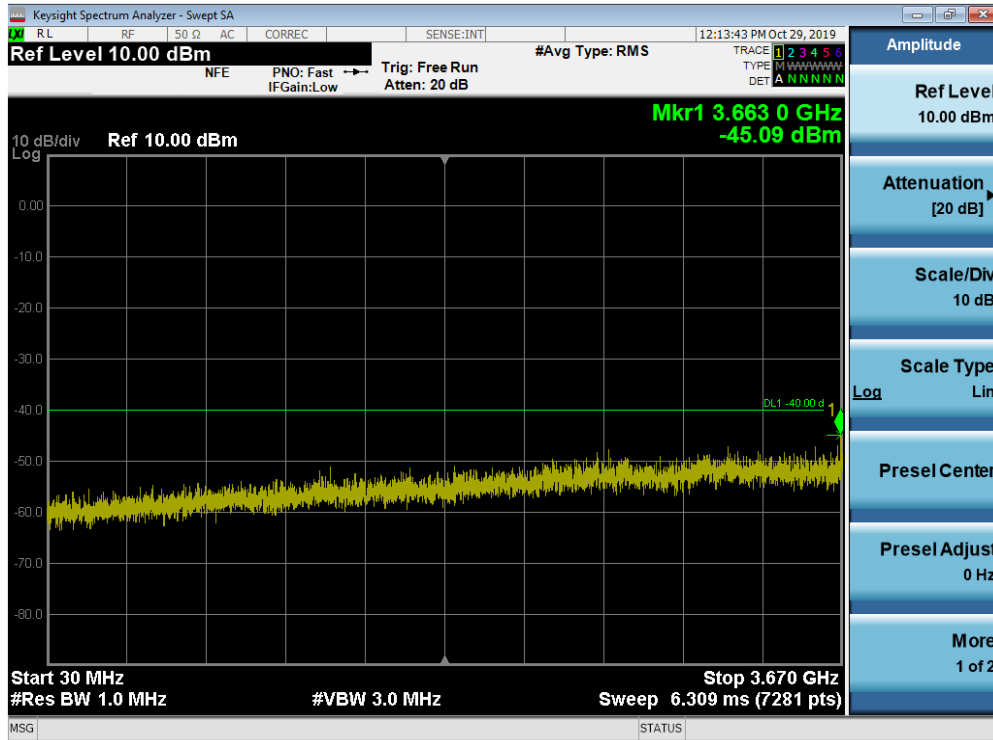


Plot 7-37. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

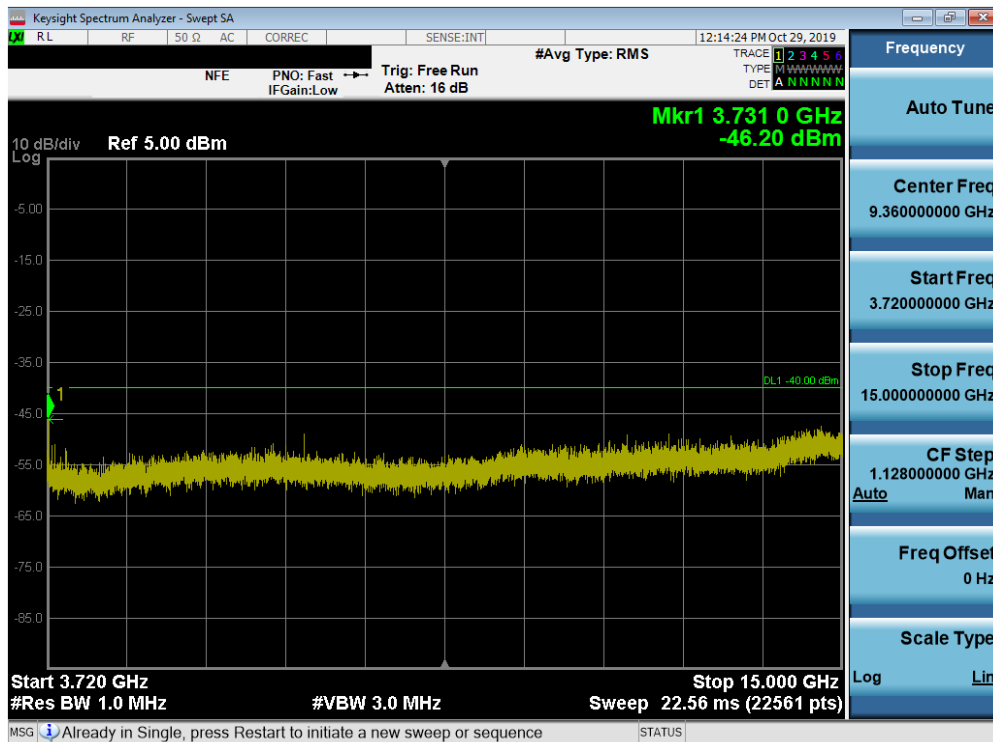


Plot 7-38. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset	Page 32 of 78

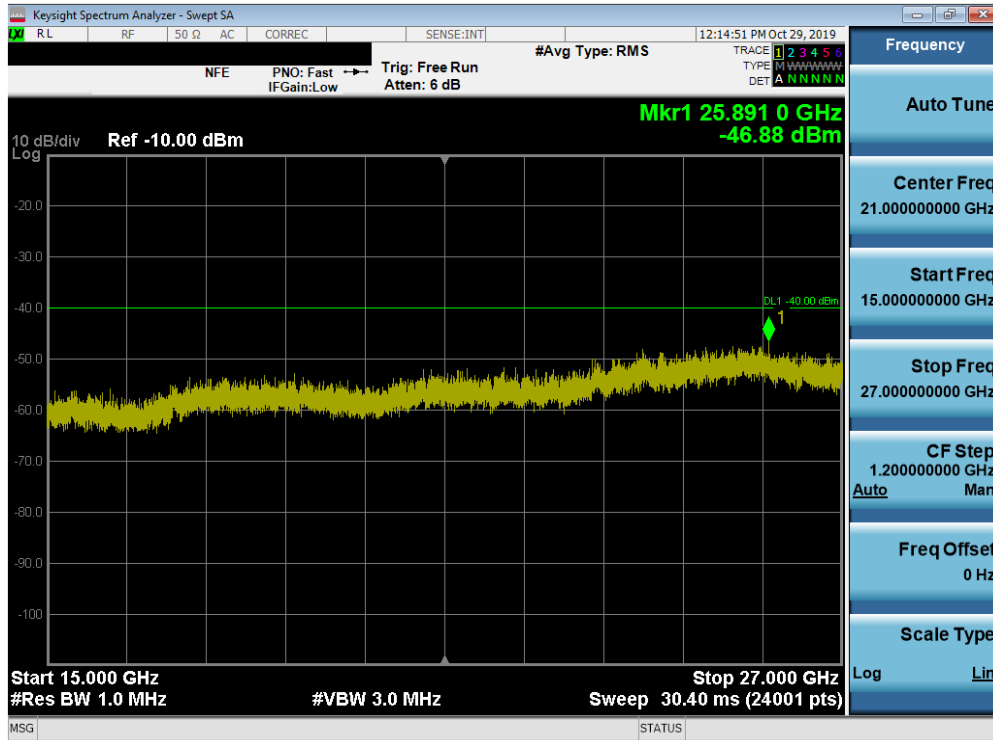


Plot 7-39. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-40. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 33 of 78



Plot 7-41. Conducted Spurious Plot (LTE Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 34 of 78

7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §96.41(e)(ii)

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 conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0 to B MHz (where B is the bandwidth in MHz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B MHz below the lower CBSD-assigned channel edge. At all frequencies greater than B MHz above the upper CBSD assigned channel edge and less than B MHz below the lower CBSD-assigned channel edge, the conducted power of any end user device emission shall not exceed -25 dBm/MHz. The conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

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

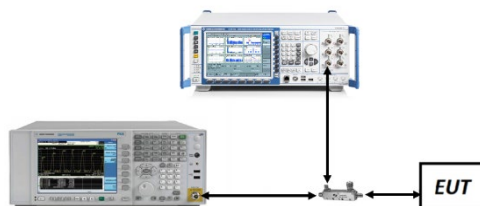
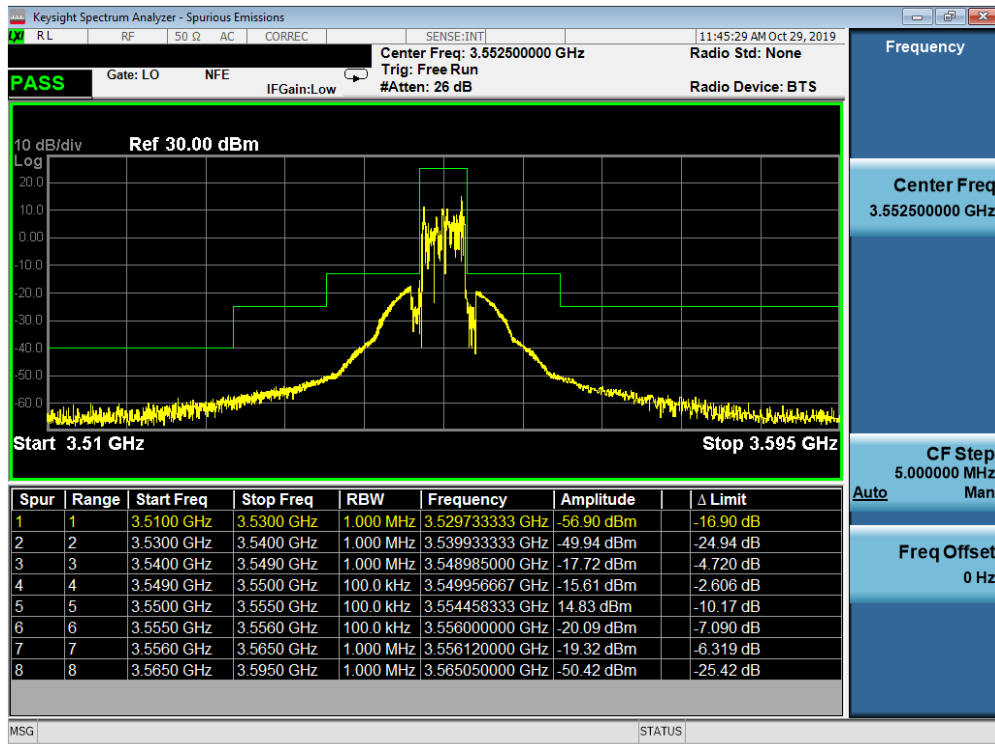


Figure 7-3. Test Instrument & Measurement Setup

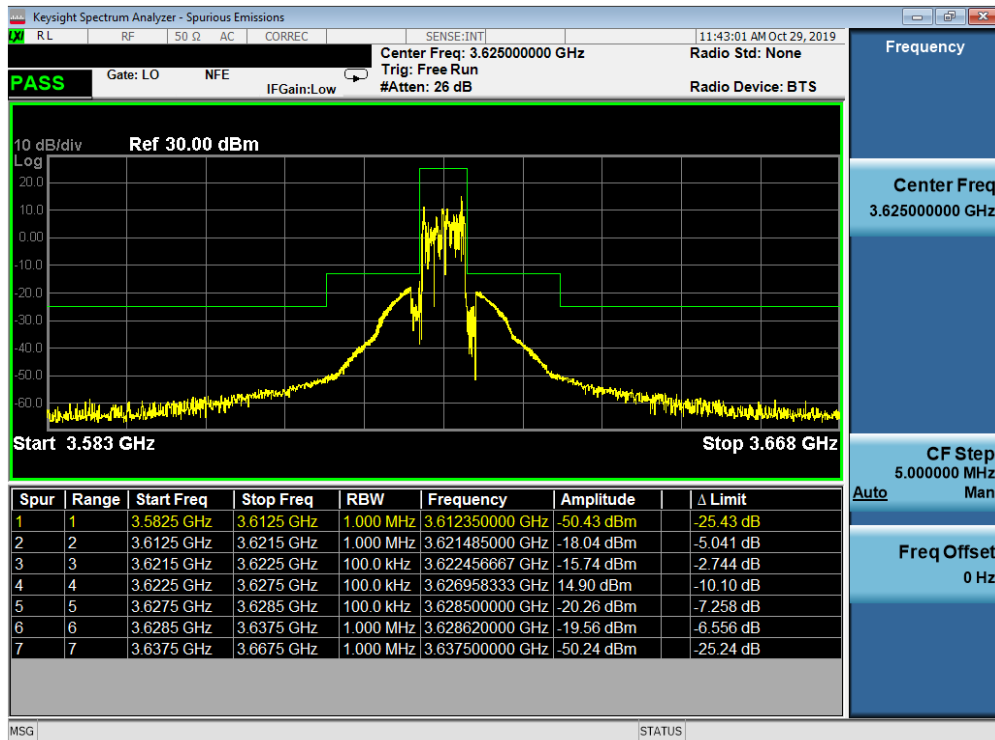
Test Notes

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 35 of 78

LTE Band 48

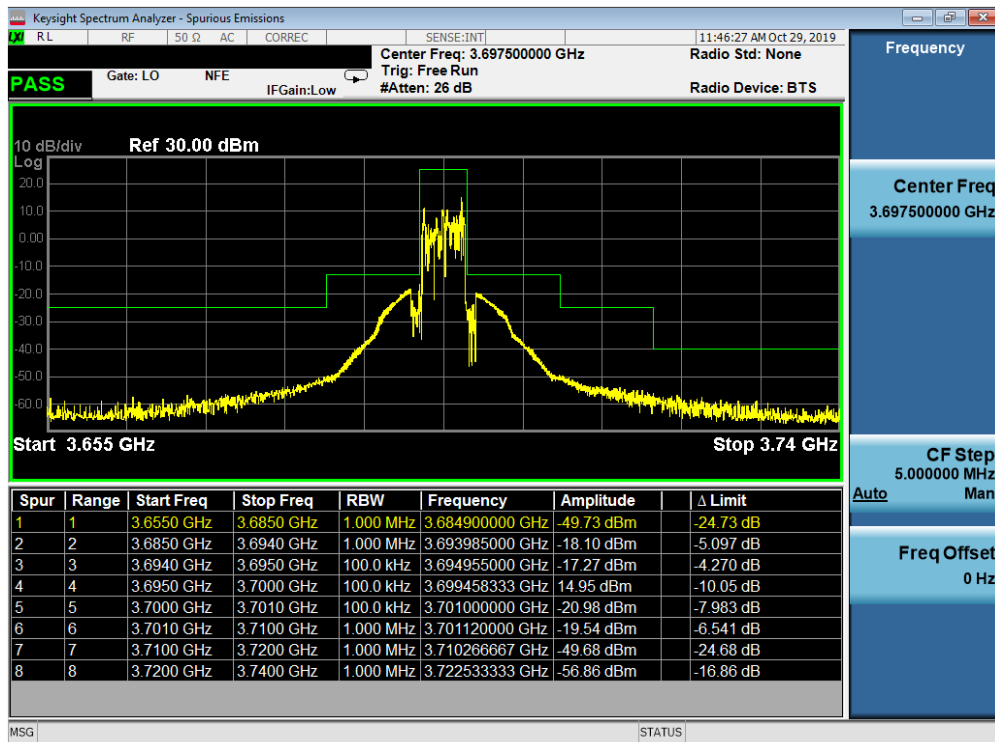


Plot 7-42. Lower ACP Plot (LTE Band 48 - 5.0MHz QPSK - Full RB Configuration)

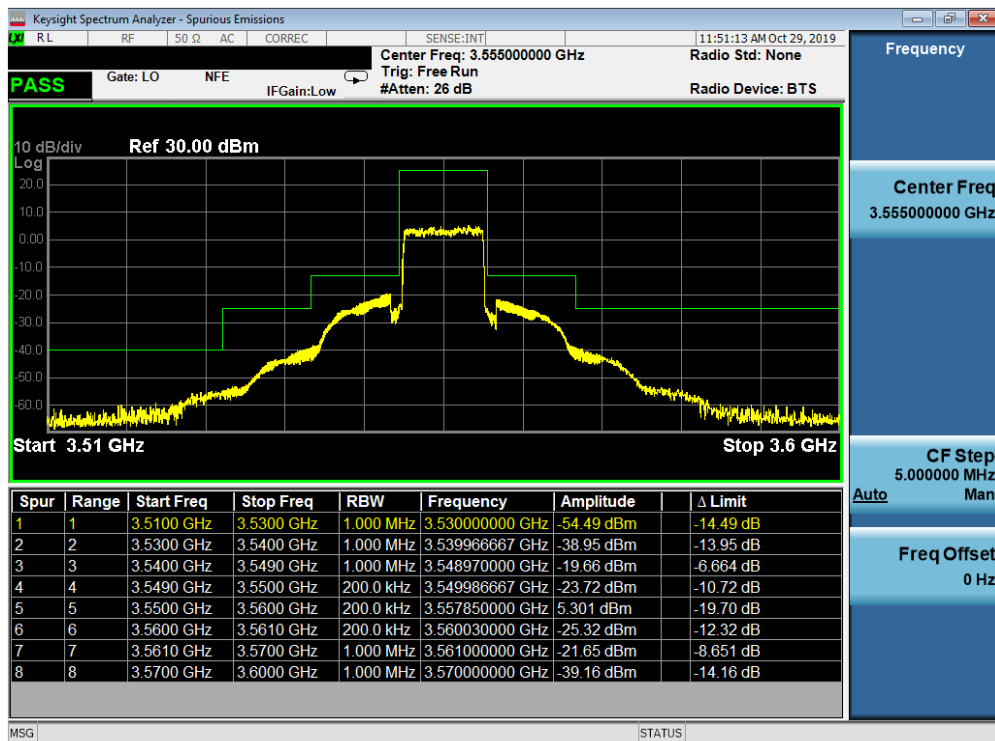


Plot 7-43. Mid ACP Plot (LTE Band 48 - 5.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 36 of 78

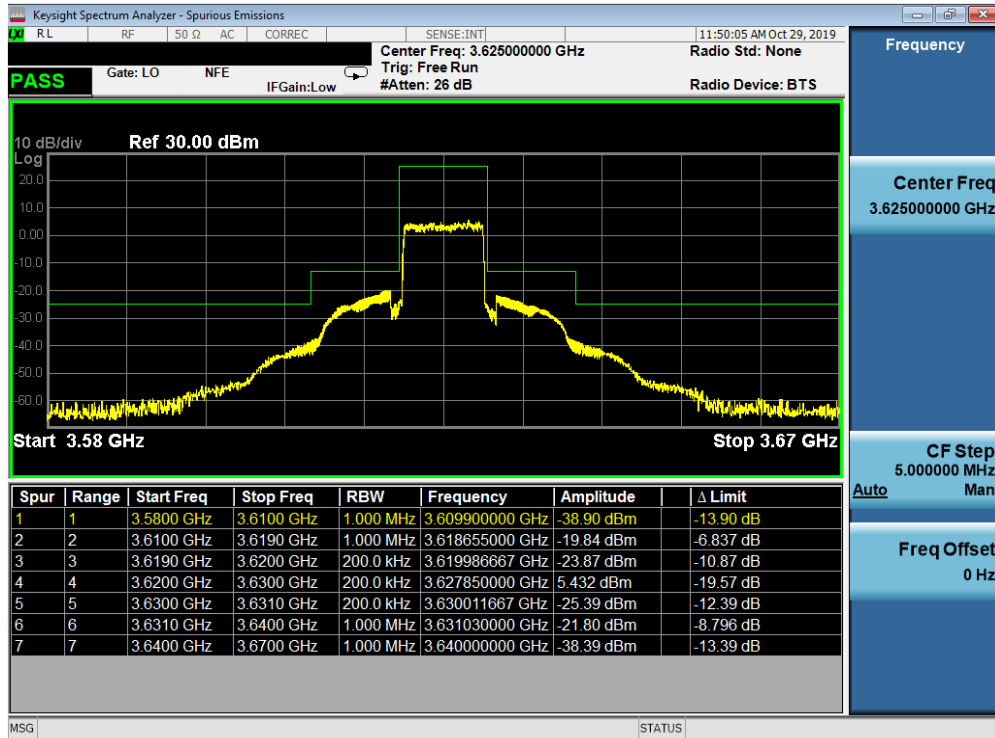


Plot 7-44. Upper ACP Plot (LTE Band 48 - 5.0MHz QPSK - Full RB Configuration)

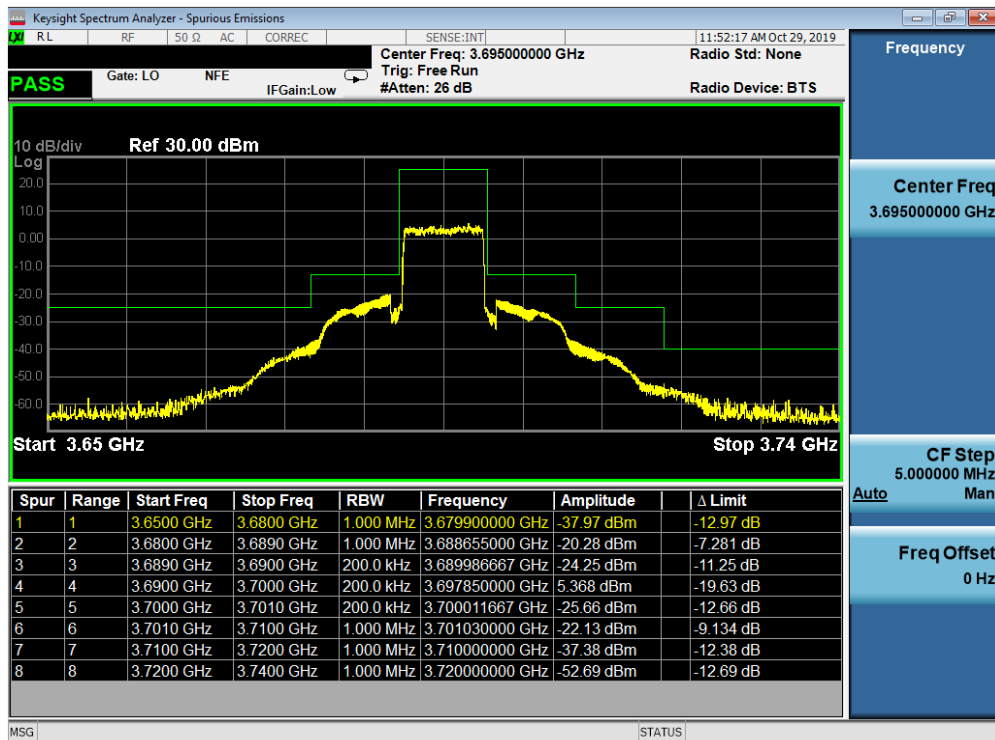


Plot 7-45. Lower ACP Plot (LTE Band 48 - 10.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG981U	MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset	Page 37 of 78	

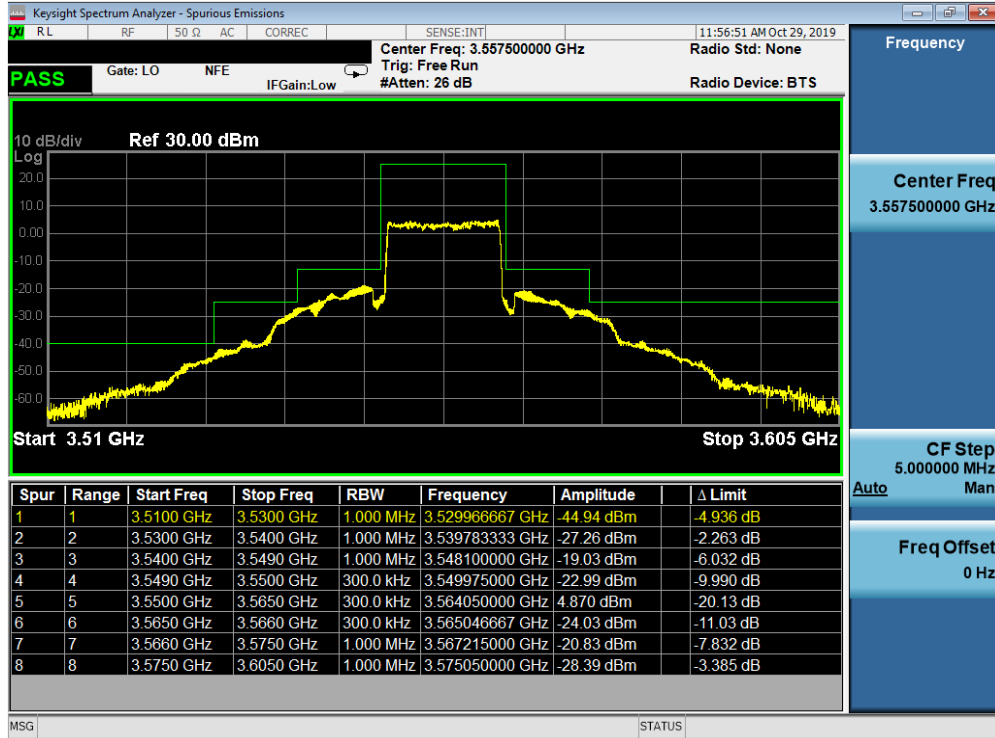


Plot 7-46. Mid ACP Plot (LTE Band 48 - 10.0MHz QPSK - Full RB Configuration)

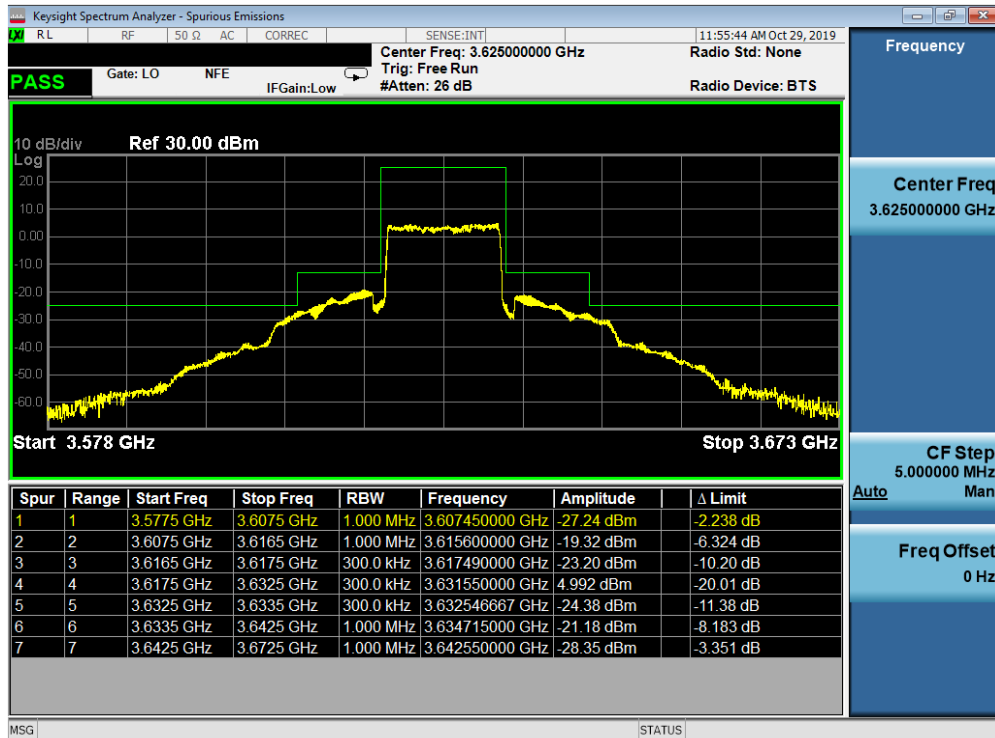


Plot 7-47. Upper ACP Plot (LTE Band 48 - 10.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 38 of 78

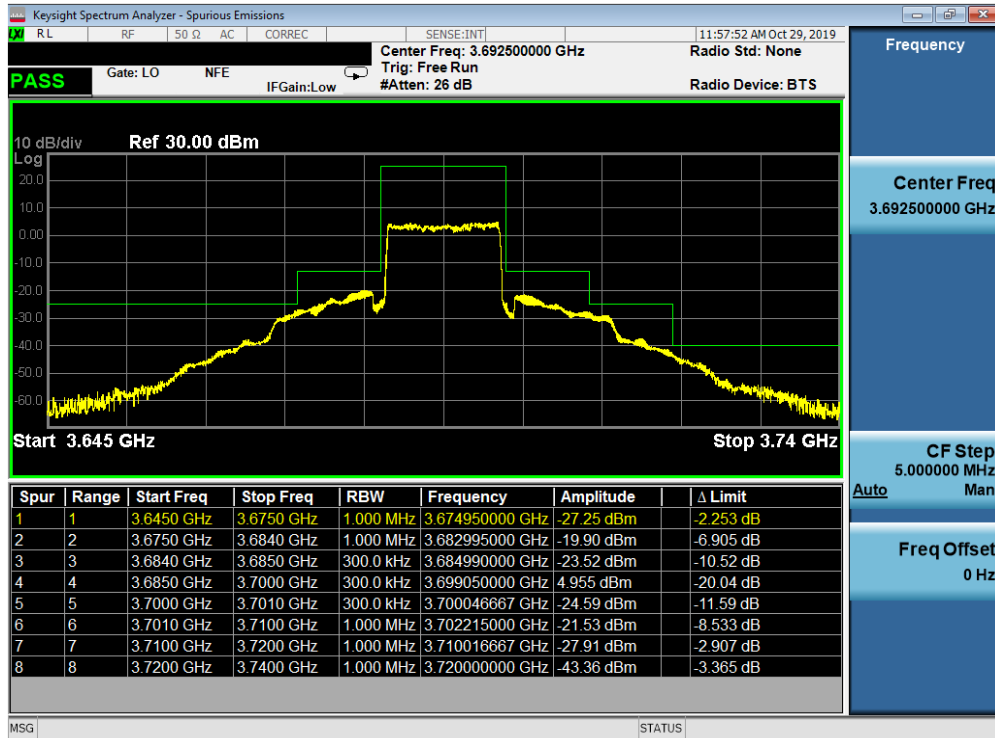


Plot 7-48. Lower ACP Plot (LTE Band 48 - 15.0MHz QPSK - Full RB Configuration)

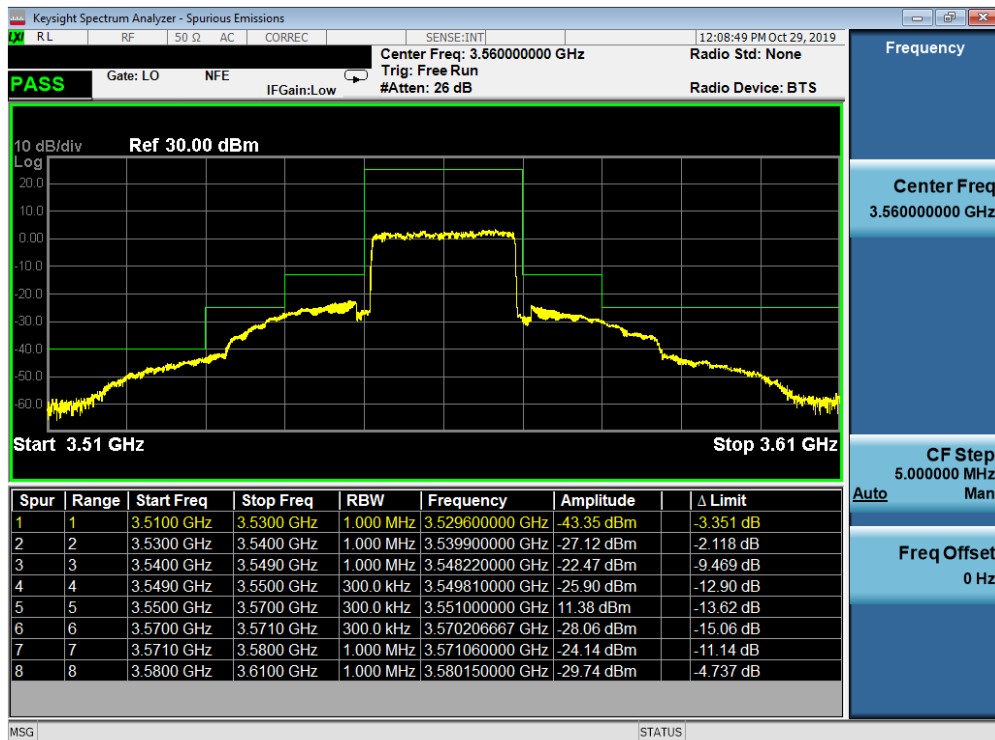


Plot 7-49. Mid ACP Plot (LTE Band 48 - 15.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 39 of 78

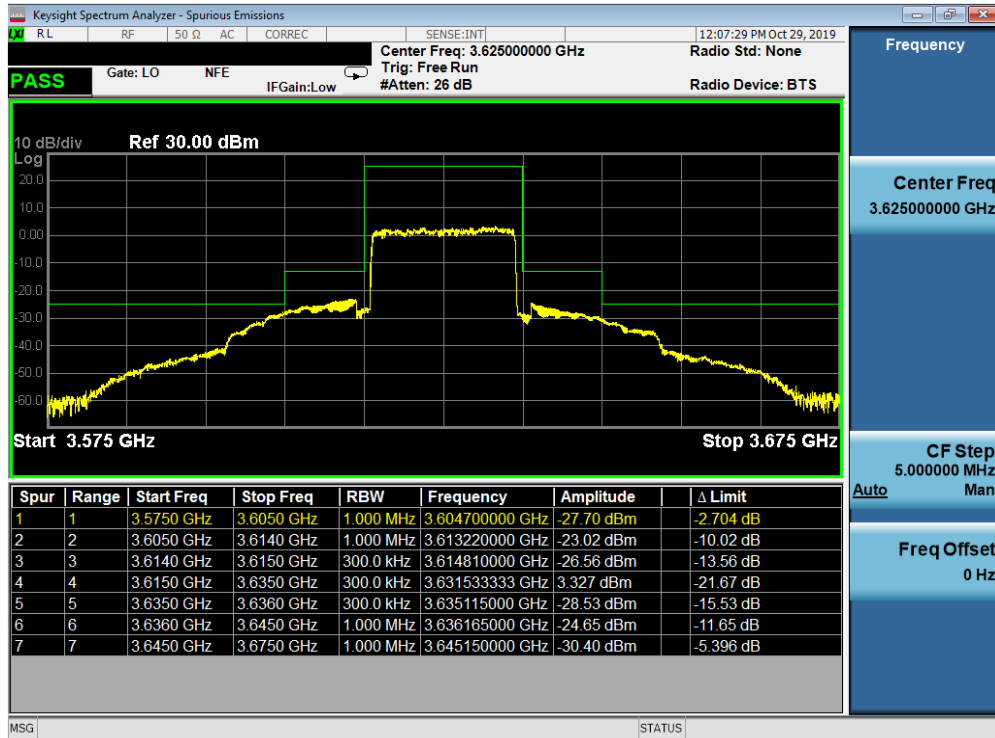


Plot 7-50. Upper ACP Plot (LTE Band 48 - 15.0MHz QPSK - Full RB Configuration)

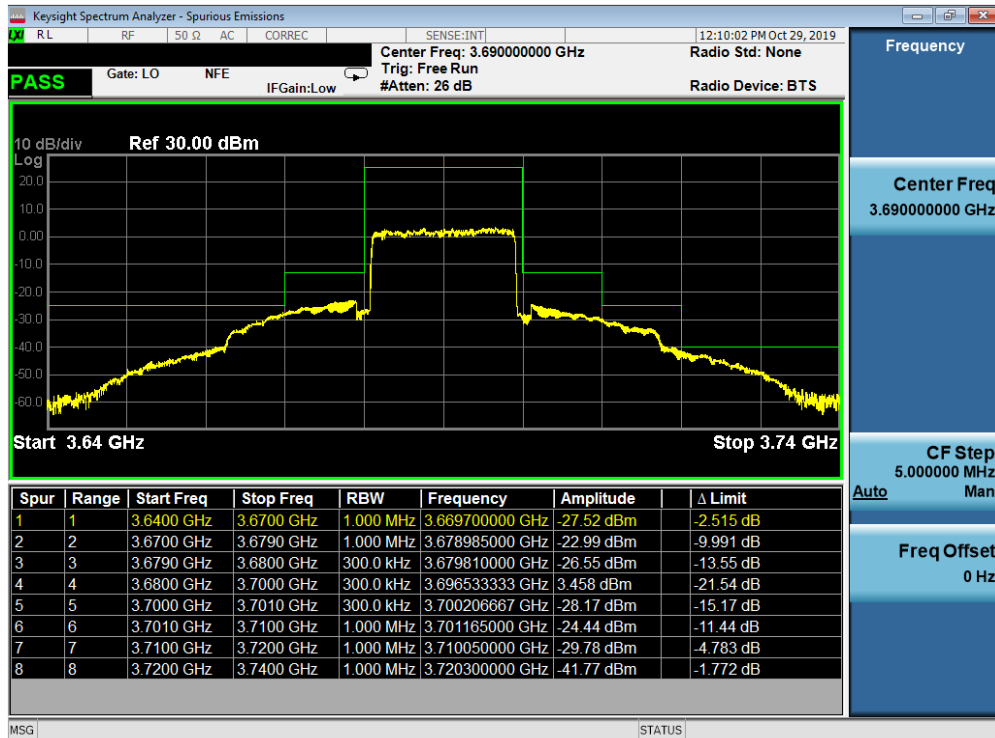


Plot 7-51. Lower ACP Plot (LTE Band 48 - 20.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)		SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 40 of 78	



Plot 7-52. Mid ACP Plot (LTE Band 48 - 20.0MHz QPSK - Full RB Configuration)



Plot 7-53. Upper ACP Plot (LTE Band 48 - 20.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 41 of 78

7.5 Additional Maximum Power Reduction (A-MPR)

§2.1046

Test Overview

A-MPR is implemented in this device per the A-MPR specification in 3GPP TS 36.101. The conducted powers are shown herein to cover the different A-MPR levels specified in the standard. Measurement equipment was set up with triggering/gating on the spectrum analyzer such that powers were measured only during the on-time of the signal.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.2.2

Test Settings

1. Span = 2 x OBW to 3 x OBW
2. RBW = 1% to 5% of the OBW
3. Number of measurement points in sweep $\geq 2 \times \text{span} / \text{RBW}$
4. Sweep = auto-couple (less than transmission burst duration)
5. Detector = RMS (power)
6. Trigger was set to enable power measurements only on full power bursts
7. Trace was allowed to stabilize
8. Spectrum analyzer's "Channel Power" function was used to compute the power by integrating the spectrum across the OBW of the signal

Test Setup

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

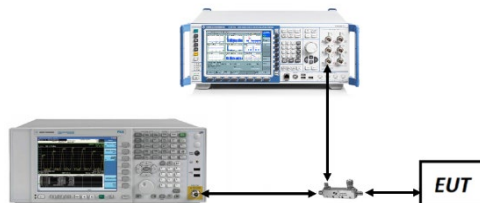


Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1. A-MPR was only applied for test purposes to the 2CC case since the 1CC case was compliant for all testing at max power.
2. A-MPR was verified to comply with the "CA_NS_10" specification in the 3GPP TS 36.101 standard by setting the MCC to a U.S. code and the MNC to a U.S. carrier supporting LTE B48 operation.
3. 256-QAM modulation is not supported when operating in A-MPR mode.

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 42 of 78

Test Case	NS	MCC	MNC	Channel BW [MHz]	PCC Channel Frequency [MHz]	SCC Channel Frequency [MHz]	Modulation	PCC RB Size	PCC RB Offset	SCC RB Size	SCC RB Offset	MPR [dB]	Maximum Target Output Power (dBm)	A-MPR [dB]	A-MPR Measured Power [dBm]
1	NS_01	310	910	20 + 20	3560	3579.8	QPSK	100	0	100	0	0	22.50	≤ 11	13.00
							16-QAM	100	0	100	0	≤ 1	21.50		12.53
							64-QAM	100	0	100	0	≤ 2	20.50		12.38
2				20 + 20	3560	3579.8	QPSK	1	99	1	0	0	22.50	≤ 11	18.36
							16-QAM	1	99	1	0	≤ 1	21.50		20.15
							64-QAM	1	99	1	0	≤ 2	20.50		21.47
4				20 + 20	3605.1	3624.9	QPSK	100	0	100	0	0	22.50	≤ 4.5	20.90
							16-QAM	100	0	100	0	≤ 1	21.50		20.57
							64-QAM	100	0	100	0	≤ 2	20.50		19.99
5				20 + 20	3605.1	3624.9	QPSK	1	99	1	0	0	22.50	≤ 4.5	22.24
							16-QAM	1	99	1	0	≤ 1	21.50		22.57
							64-QAM	1	99	1	0	≤ 2	20.50		22.06
7				20 + 20	3667.1	3689.9	QPSK	100	0	100	0	0	22.50	≤ 11	13.80
							16-QAM	100	0	100	0	≤ 1	21.50		13.30
							64-QAM	100	0	100	0	≤ 2	20.50		13.12
8				20 + 20	3667.1	3689.9	QPSK	1	99	1	0	0	22.50	≤ 11	19.14
							16-QAM	1	99	1	0	≤ 1	21.50		20.77
							64-QAM	1	99	1	0	≤ 2	20.50		22.23

Table 7-3. A-MPR Conducted Power Measurements

FCC ID: A3LSMG981U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset	Page 43 of 78	

7.6 Uplink Carrier Aggregation

§96.41(e)

Test Overview

The EUT is set up to transmit two contiguous LTE channels. The power level of both carriers and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0-B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B MHz below the lower CBSD assigned channel edge, the conducted power of any emission shall not exceed -25 dBm/MHz.

The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/MHz.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

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

Test Setup

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

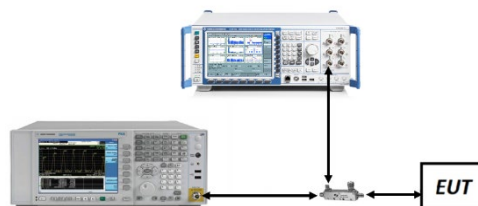


Figure 7-5. Test Instrument & Measurement Setup

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 44 of 78

Test Notes

1. Uplink carrier aggregation is only supported in this EUT while operating in Power Class 3.
2. Conducted power and spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device. The worst case (highest) powers were found while operating with QPSK modulation, as shown in Table 7-4 and 7-5 below, with both carriers set to transmit using 1RB.
3. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed.

FCC ID: A3LSMG981U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 45 of 78

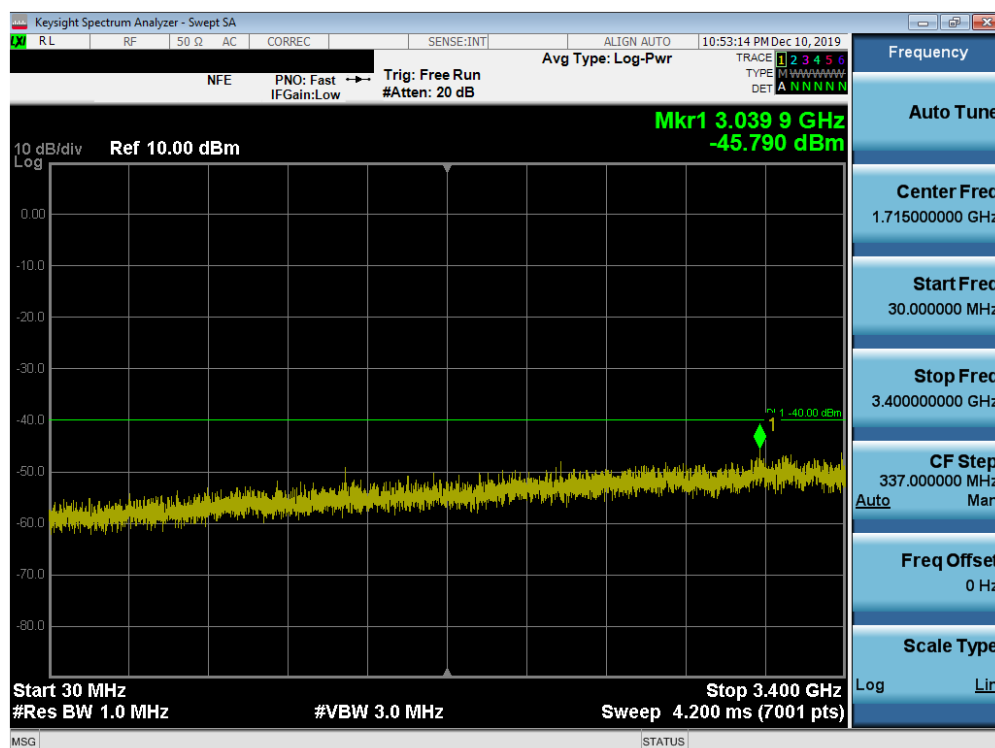
Uplink CA Configuration 48C

Power State	PCC							SCC							Power ULCA Tx.Power (dBm)
	PCC Band	PCC Bandwidth [MHz]	PCC (UL) Channel	PCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	SCC Band	SCC Bandwidth [MHz]	SCC (UL) Channel	SCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	
Max	LTE B48	20	55990	3625	QPSK	100	0	LTE B48	20	56188	3644.8	QPSK	100	0	20.72
Max	LTE B48	20	55990	3625	16-QAM	100	0	LTE B48	20	56188	3644.8	16-QAM	100	0	19.83
Max	LTE B48	20	55990	3625	64-QAM	100	0	LTE B48	20	56188	3644.8	64-QAM	100	0	19.66
Max	LTE B48	20	55990	3625	256-QAM	100	0	LTE B48	20	56188	3644.8	256-QAM	100	0	17.66

Table 7-4. Conducted Powers (B48 with 20MHz BW for all modulations)

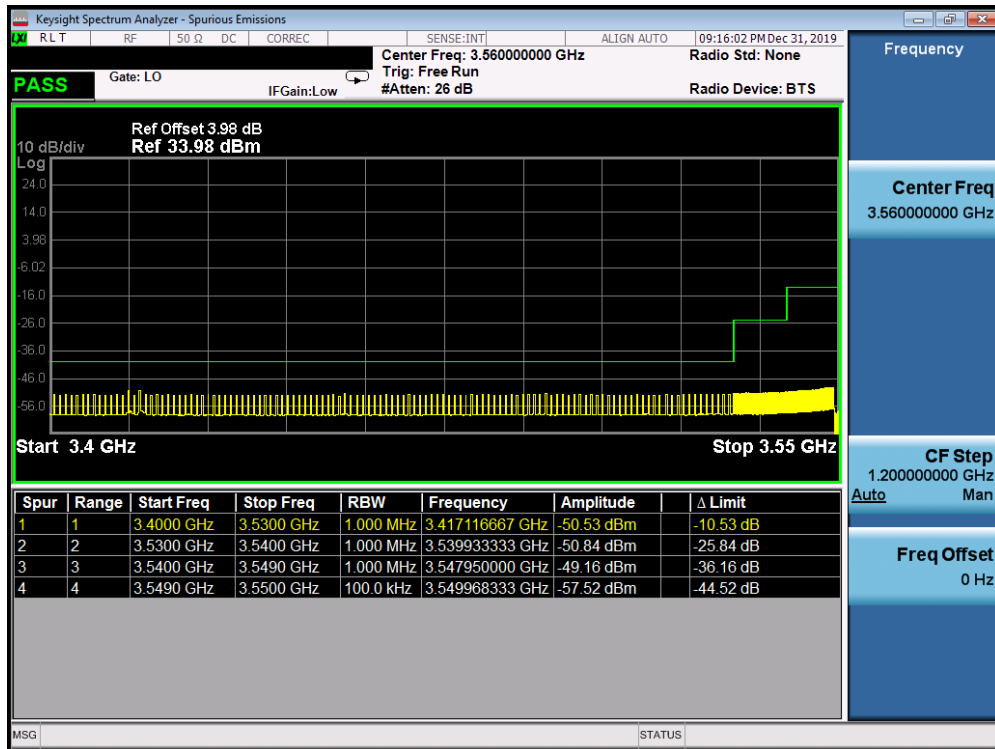
Power State	PCC							SCC							Power ULCA Tx.Power (dBm)
	PCC Band	PCC Bandwidth [MHz]	PCC (UL) Channel	PCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	SCC Band	SCC Bandwidth [MHz]	SCC (UL) Channel	SCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	
Max	LTE B48	20	55340	3560	QPSK	1	99	LTE B48	20	55538	3579.8	QPSK	1	0	20.95
Max	LTE B48	20	55990	3625	QPSK	1	99	LTE B48	20	56188	3644.8	QPSK	1	0	21.12
Max	LTE B48	20	56640	3690	QPSK	1	0	LTE B48	20	56442	3670.2	QPSK	1	99	20.76

Table 7-5. Conducted Powers (B48 – PCC/SCC: RB Size 1)

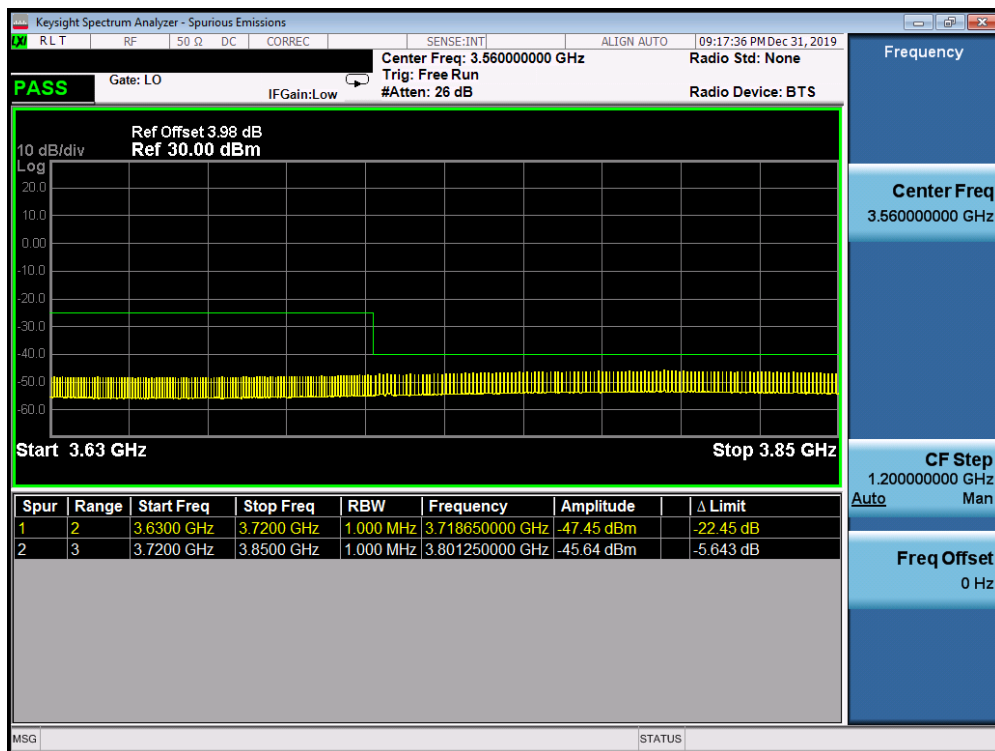


Plot 7-54. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Low Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 46 of 78

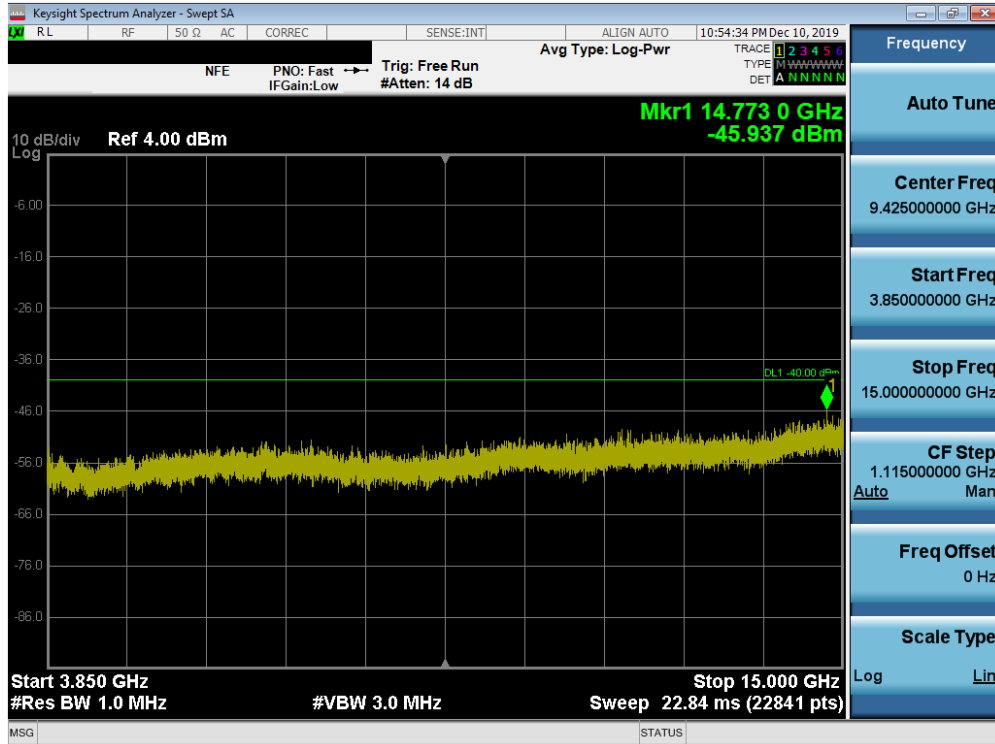


Plot 7-55. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Low Channel)

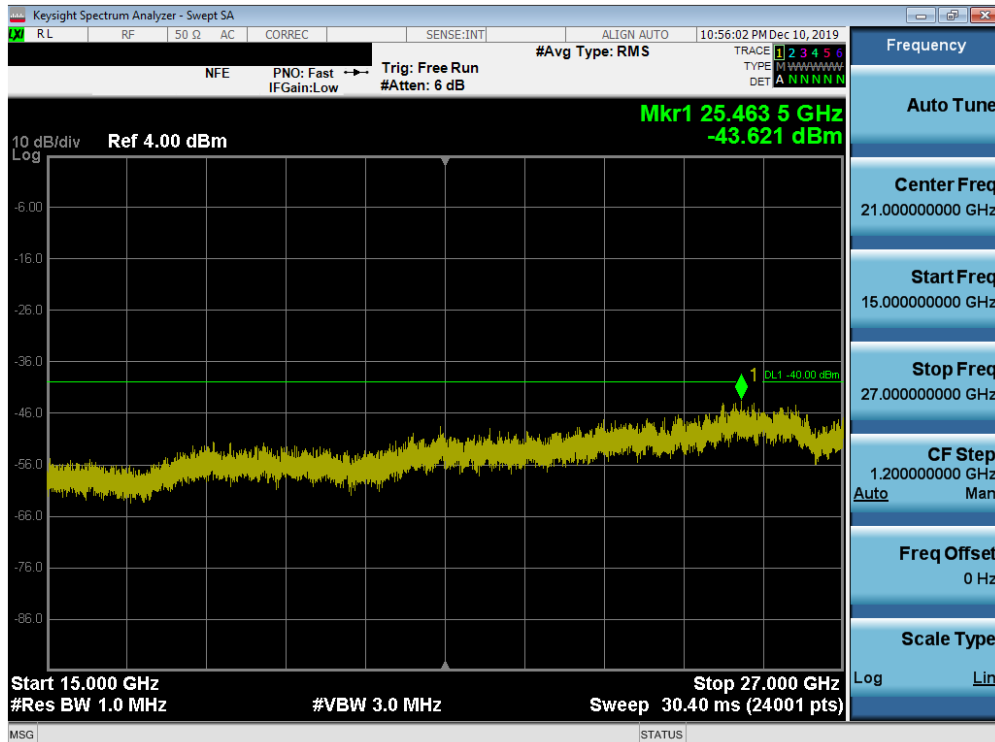


Plot 7-56. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Low Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 47 of 78

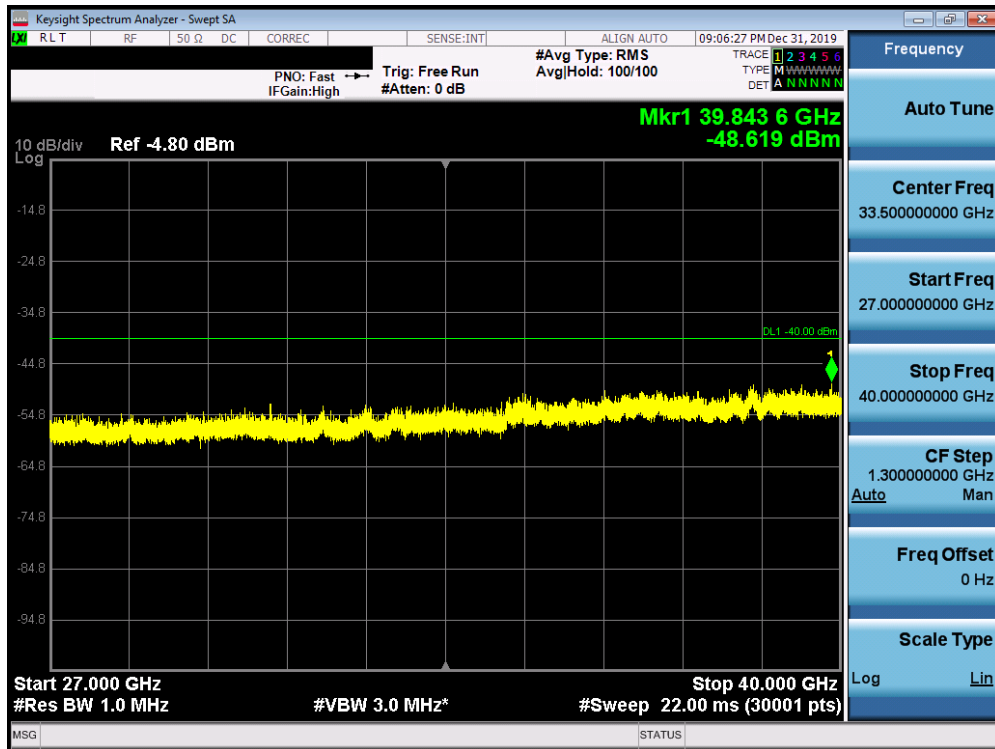


Plot 7-57. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Low Channel)

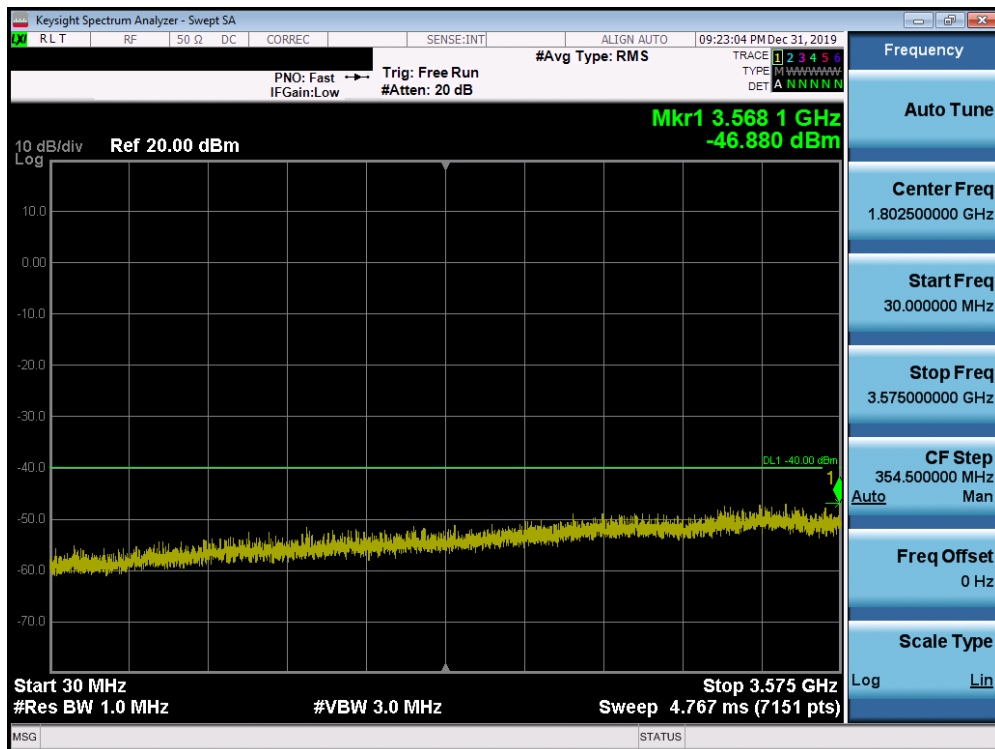


Plot 7-58. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Low Channel)

FCC ID: A3LSMG981U	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset	Page 48 of 78

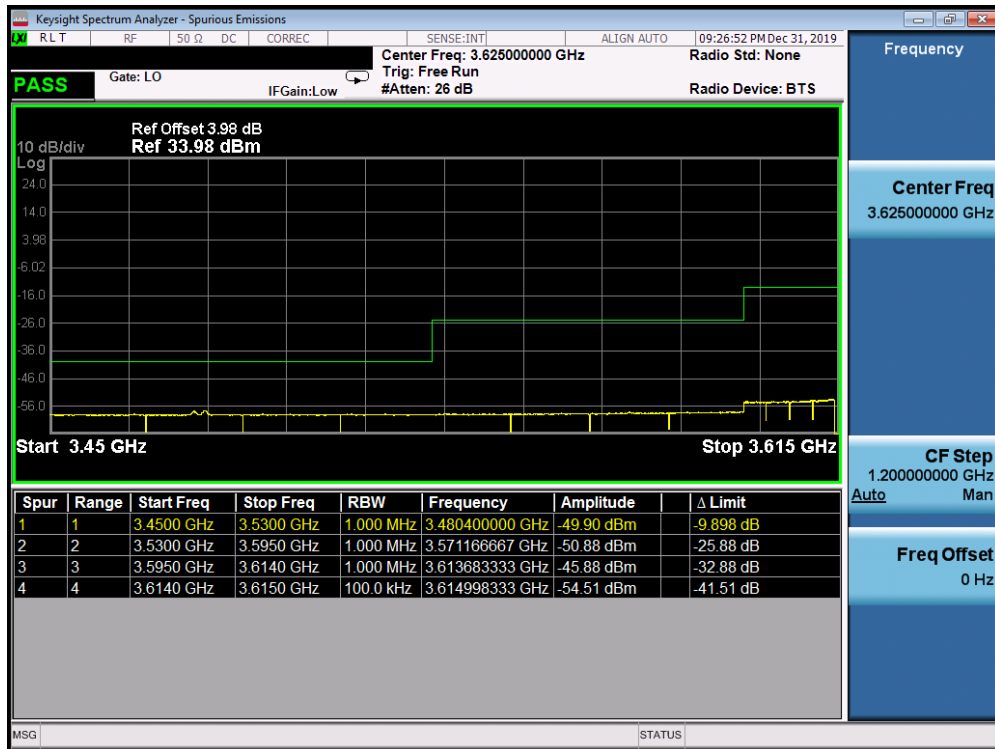


Plot 7-59. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Low Channel)

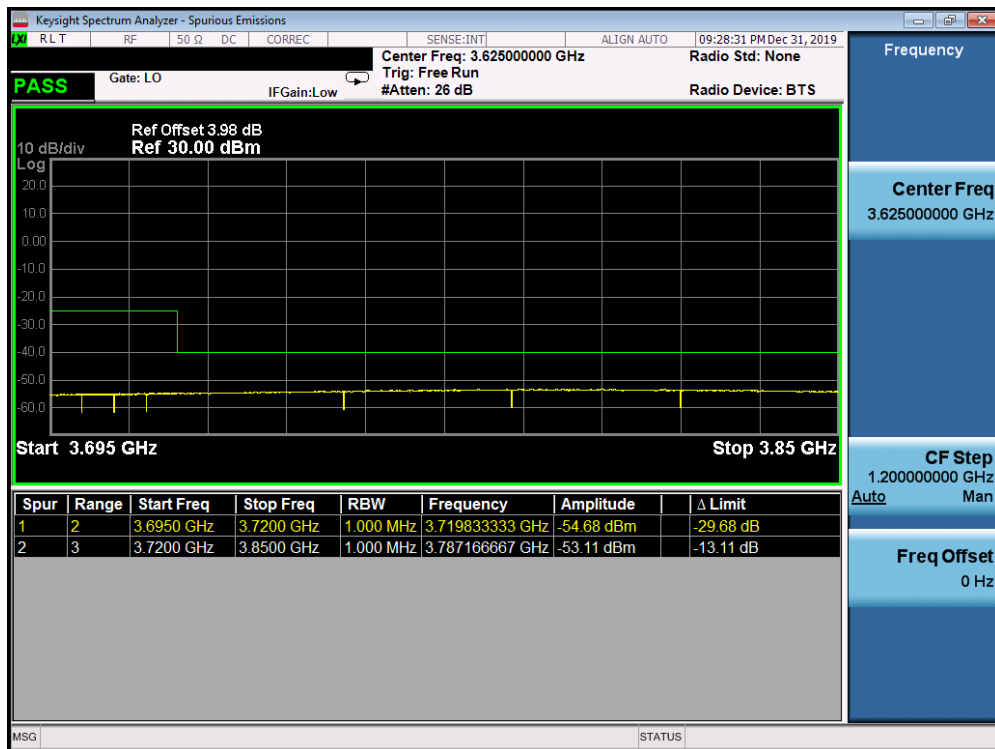


Plot 7-60. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 49 of 78

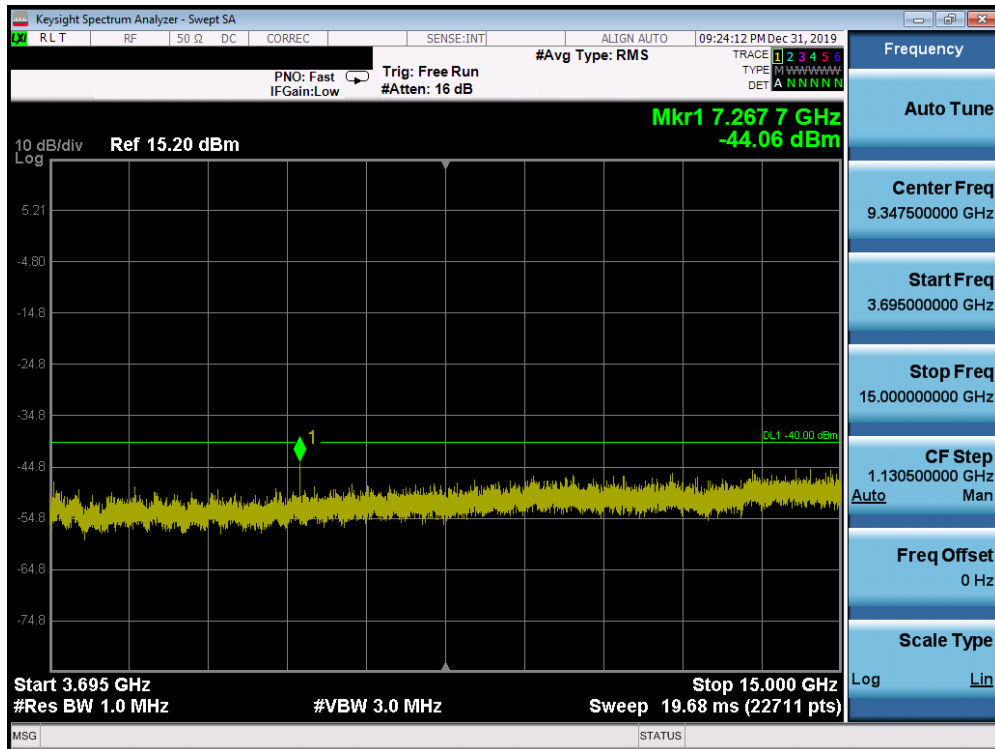


Plot 7-61. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)

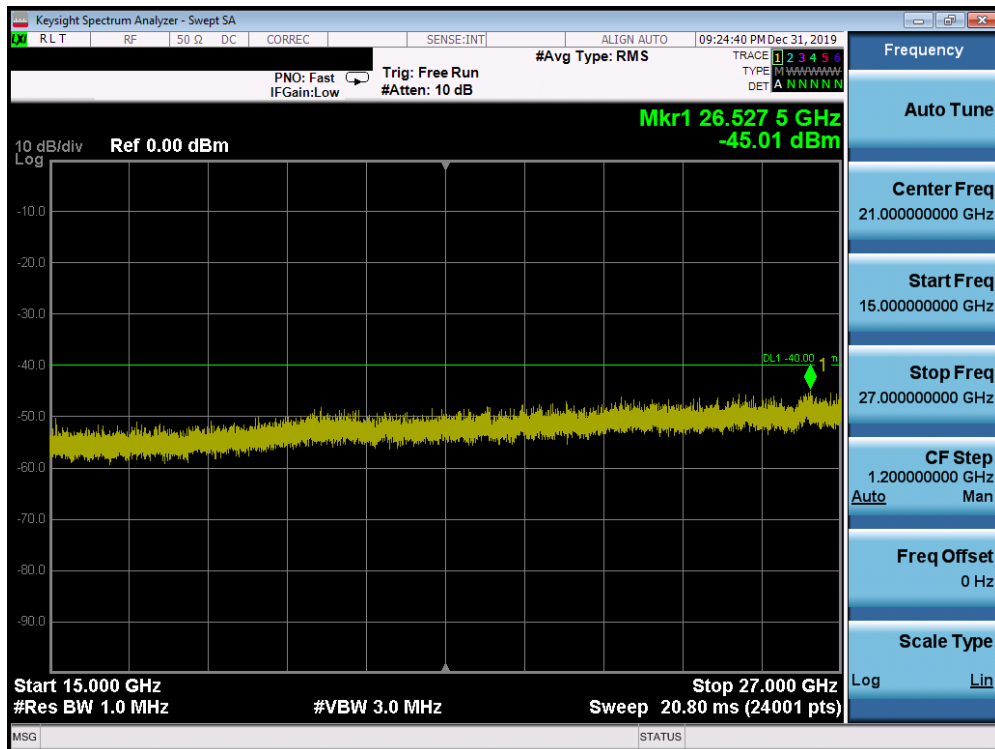


Plot 7-62. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 50 of 78

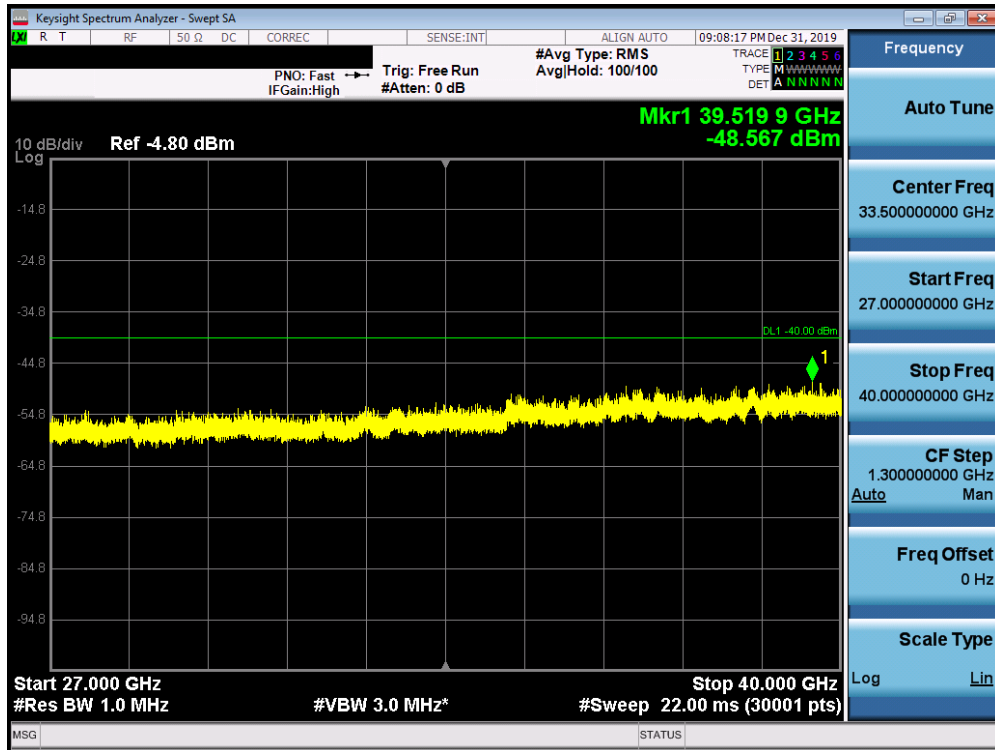


Plot 7-63. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)

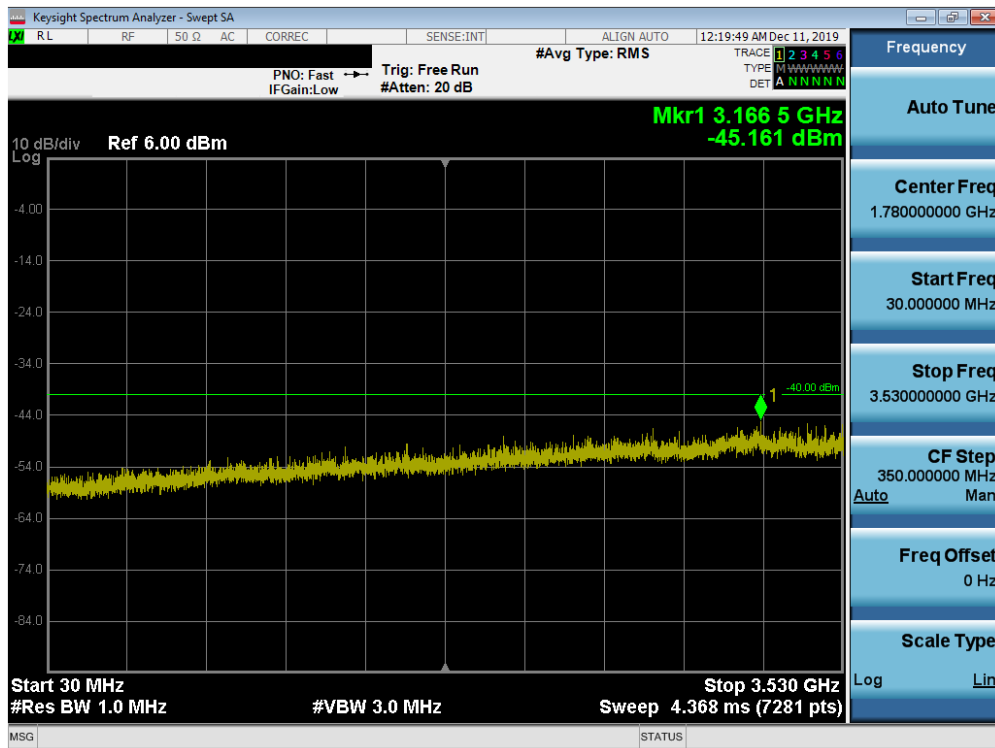


Plot 7-64. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 51 of 78

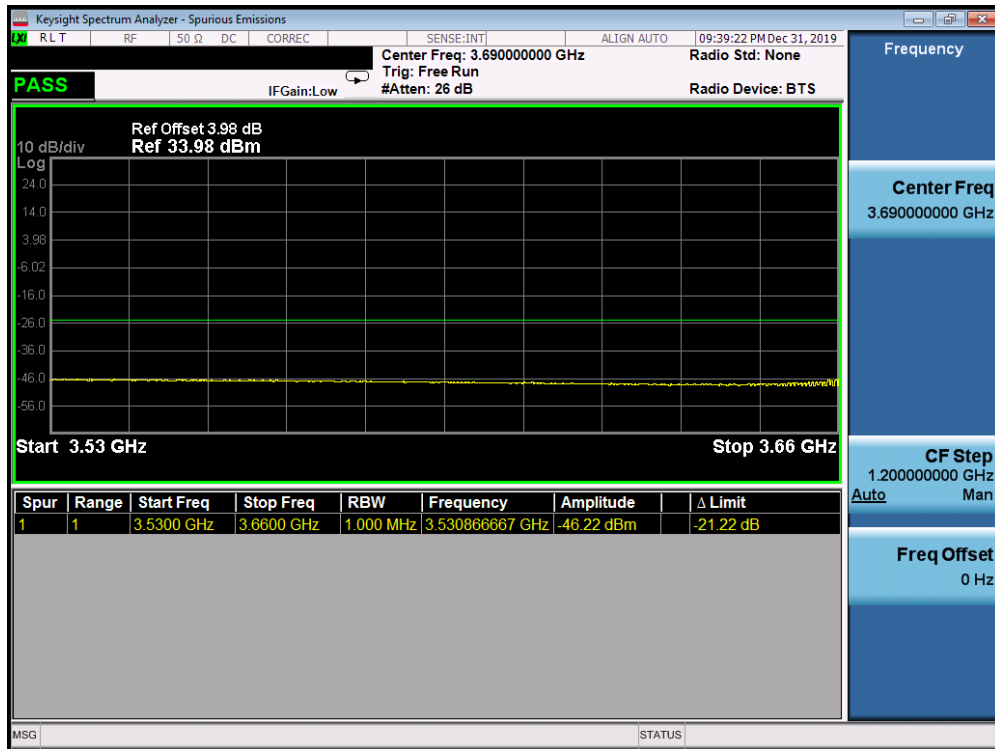


Plot 7-65. Conducted Spurious Plot (Band 48 – 20.0MHZ QPSK – PCC 1/99 SCC 1/0 – Mid Channel)

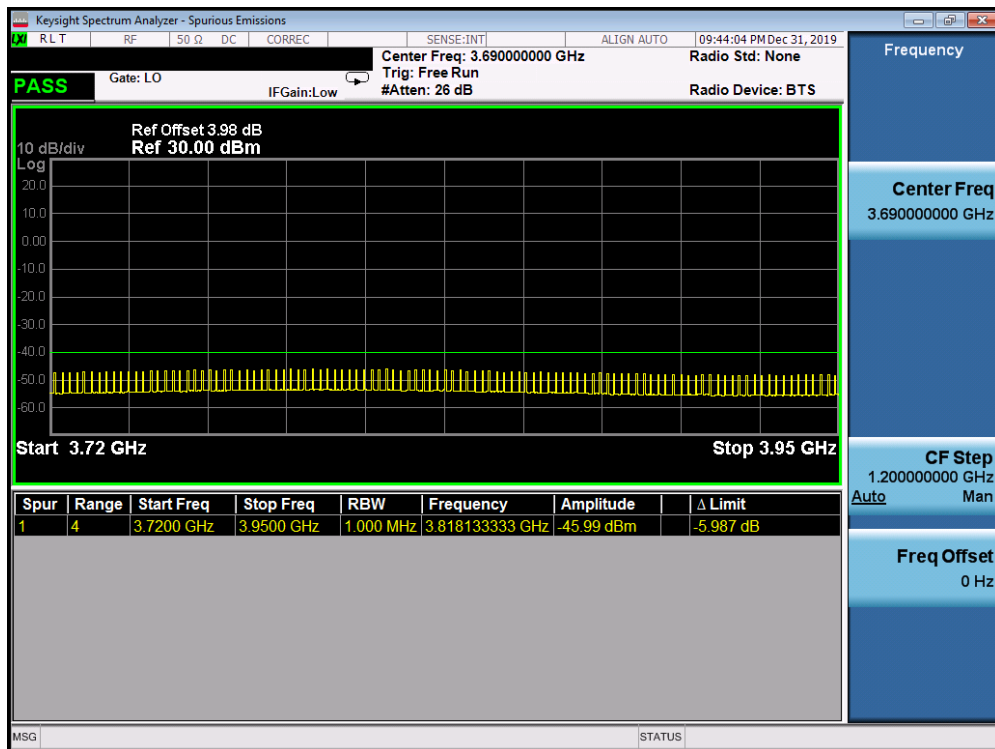


Plot 7-66. Conducted Spurious Plot (Band 48 – 20.0MHZ QPSK – PCC 1/0 SCC 1/99 – High Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 52 of 78

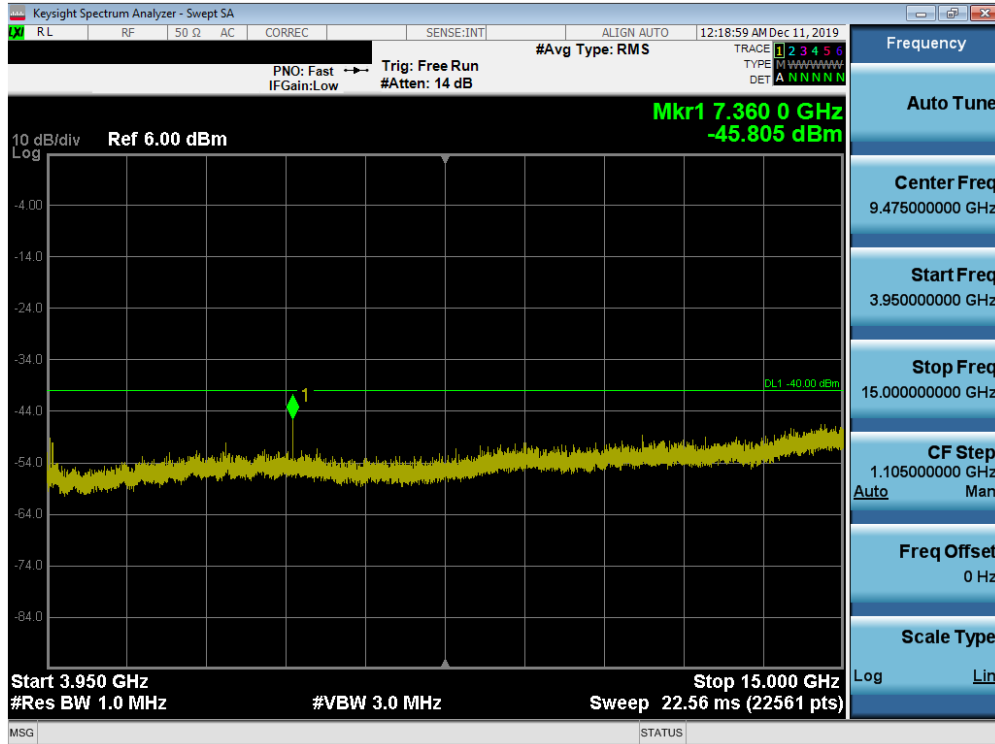


Plot 7-67. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/0 SCC 1/99 – High Channel)

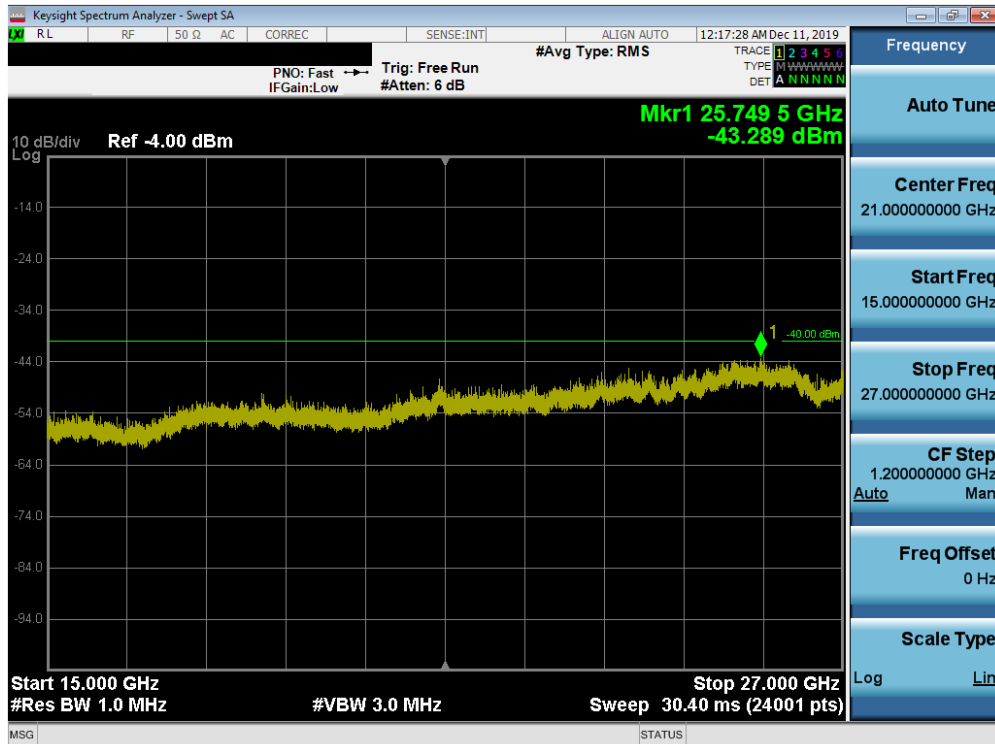


Plot 7-68. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/0 SCC 1/99 – High Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset	Page 53 of 78

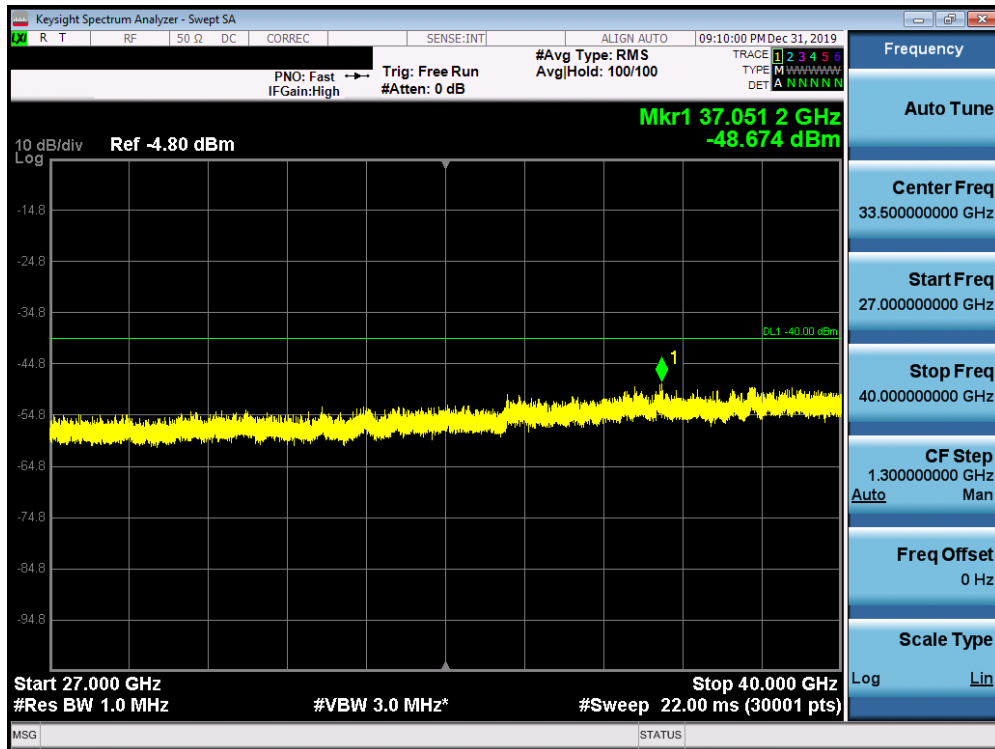


Plot 7-69. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/0 SCC 1/99 – High Channel)

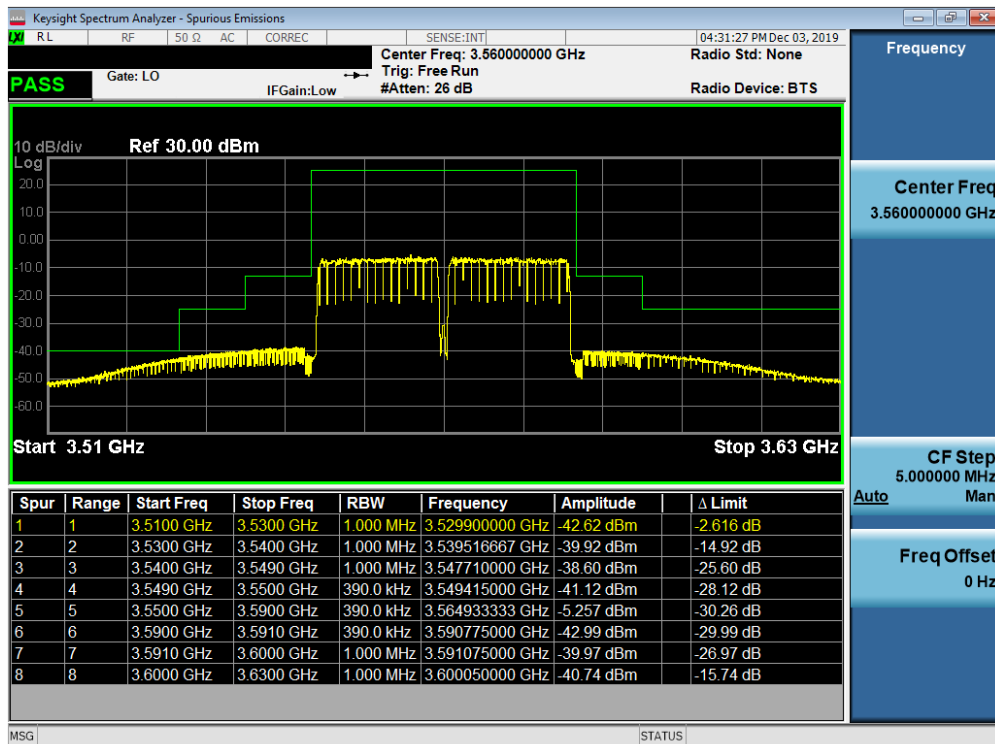


Plot 7-70. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/0 SCC 1/99 – High Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 54 of 78

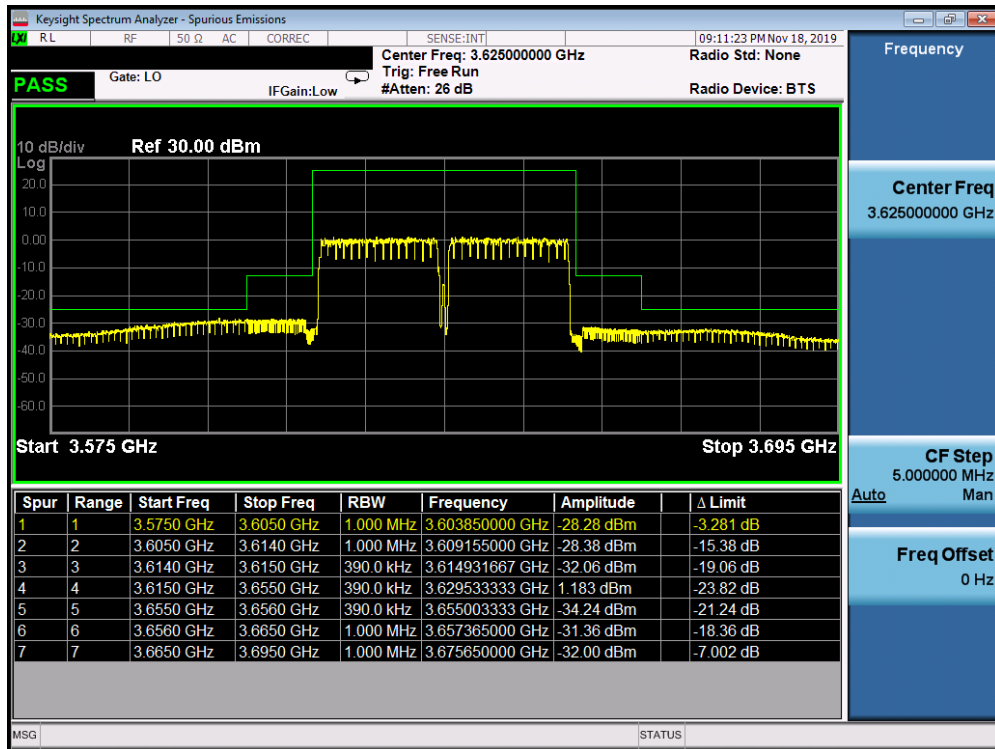


Plot 7-71. Conducted Spurious Plot (Band 48 – 20.0MHz QPSK – PCC 1/0 SCC 1/99 – High Channel)

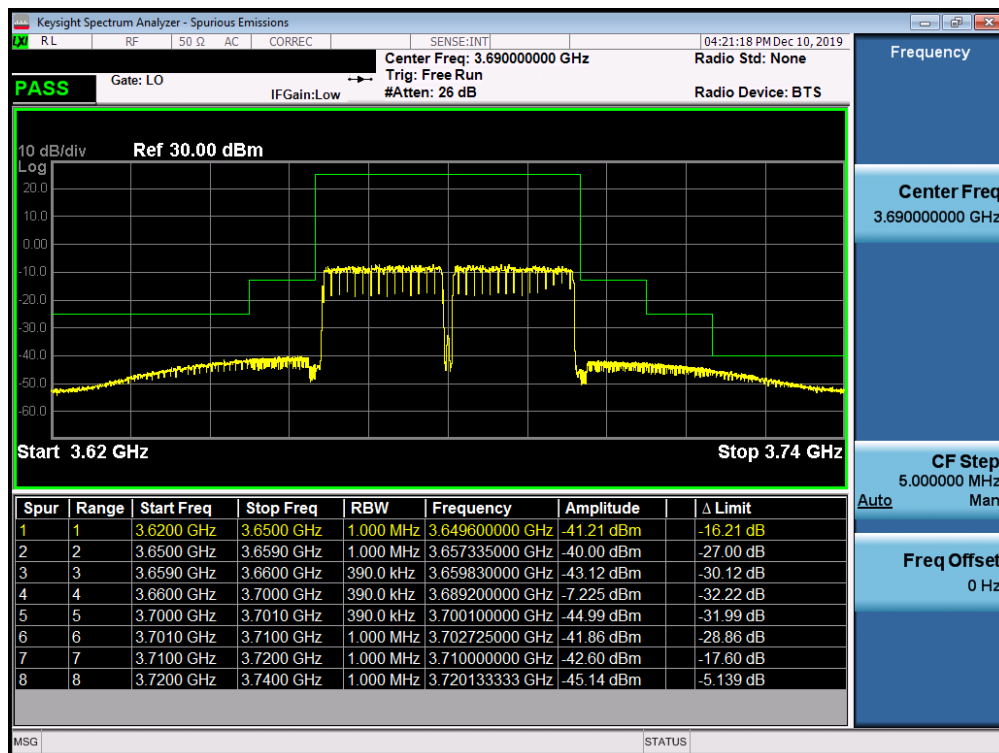


Plot 7-72. Lower Band Edge Plot (Band 48 QPSK – PCC:20 MHz SCC:20 MHz – Full RB)

FCC ID: A3LSMG981U	MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
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Plot 7-73. Mid Band Edge Plot (Band 48 QPSK – PCC:20 MHz SCC:20 MHz – Full RB)



Plot 7-74. Upper Band Edge Plot (Band 48 QPSK – PCC:20 MHz SCC:20 MHz – Full RB)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 56 of 78

7.7 Radiated Power (EIRP)

§96.41(b)

Test Overview

Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating 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 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW $\geq 3 \times$ RBW
4. Span = 1.5 times the OBW
5. No. of sweep points $\geq 2 \times$ 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 set equal to 10MHz.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

FCC ID: A3LSMG981U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Test Setup

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

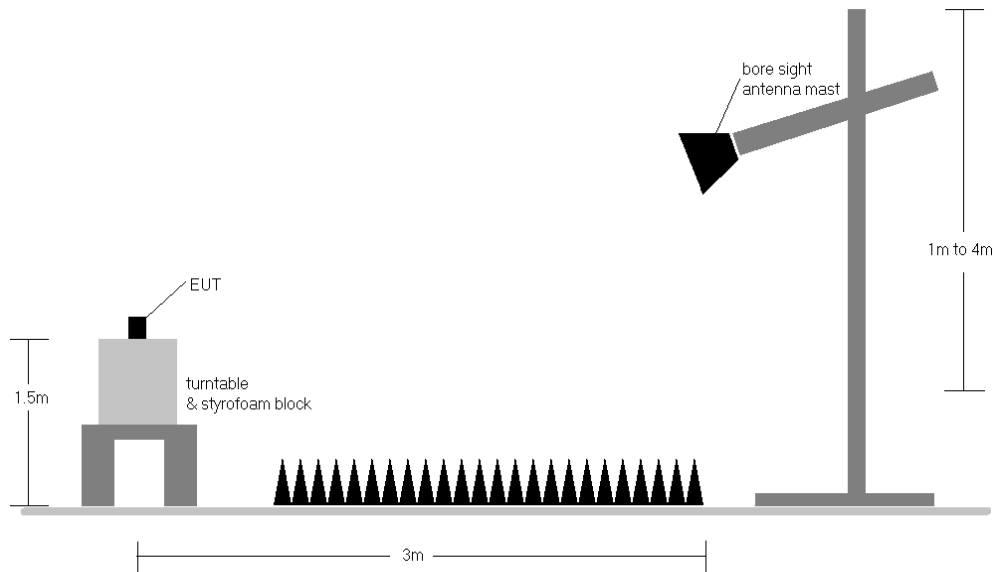


Figure 7-6. Radiated Test Setup >1GHz

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.
- 3) The worst case EIRP shown in this section is found with LTE operating only using 1RB. As such, the EIRP/10MHz and full channel EIRP values will be identical since 1RB is fully contained within all available channel bandwidths for LTE Band 48.

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Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	EUT Pol.	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
20 MHz	QPSK	3560.0	V	Y	121.0	60.0	7.21	1 / 99	8.92	16.13	0.041	23.00	-6.87
		3625.0	V	Y	124.0	29.0	6.96	1 / 99	11.04	18.00	0.063	23.00	-5.00
		3690.0	V	Y	110.0	71.0	6.47	1 / 0	11.86	18.33	0.068	23.00	-4.67
	16-QAM	3690.0	V	Y	110.0	71.0	6.47	1 / 0	11.15	17.62	0.058	23.00	-5.38
	64-QAM	3690.0	V	Y	110.0	71.0	6.47	1 / 0	10.39	16.86	0.049	23.00	-6.14
15 MHz	QPSK	3557.5	V	Y	121.0	60.0	7.22	1 / 36	10.03	17.25	0.053	23.00	-5.75
		3625.0	V	Y	124.0	29.0	6.96	1 / 36	11.22	18.18	0.066	23.00	-4.82
		3692.5	V	Y	110.0	71.0	6.45	1 / 36	11.09	17.54	0.057	23.00	-5.46
	16-QAM	3625.0	V	Y	124.0	29.0	6.96	1 / 36	10.42	17.38	0.055	23.00	-5.62
	64-QAM	3625.0	V	Y	124.0	29.0	6.96	1 / 36	9.97	16.93	0.049	23.00	-6.07
10 MHz	QPSK	3555.0	V	Y	121.0	60.0	7.22	1 / 25	9.92	17.14	0.052	23.00	-5.86
		3625.0	V	Y	124.0	29.0	6.96	1 / 49	11.23	18.19	0.066	23.00	-4.81
		3695.0	V	Y	110.0	71.0	6.43	1 / 25	11.47	17.90	0.062	23.00	-5.10
	16-QAM	3625.0	V	Y	124.0	29.0	6.96	1 / 49	10.61	17.57	0.057	23.00	-5.43
	64-QAM	3625.0	V	Y	124.0	29.0	6.96	1 / 49	9.91	16.87	0.049	23.00	-6.13
5 MHz	QPSK	3552.5	V	Y	121.0	60.0	7.23	1 / 12	9.87	17.10	0.051	23.00	-5.90
		3625.0	V	Y	124.0	29.0	6.96	1 / 12	11.25	18.21	0.066	23.00	-4.79
		3697.5	V	Y	110.0	71.0	6.41	1 / 12	11.48	17.89	0.062	23.00	-5.11
	16-QAM	3625.0	V	Y	124.0	29.0	6.96	1 / 12	10.42	17.38	0.055	23.00	-5.62
	64-QAM	3625.0	V	Y	124.0	29.0	6.96	1 / 12	9.86	16.82	0.048	23.00	-6.18
20 MHz	256-QAM	3625.0	V	Y	124.0	29.0	6.96	1 / 12	6.76	13.72	0.024	23.00	-9.28
	QPSK (WCP)	3557.5	H	Z	178.0	211.0	6.47	1 / 0	10.63	17.10	0.051	23.00	-5.90
		3625.0	V	Z	169.0	224.0	6.47	1 / 0	10.85	17.32	0.054	23.00	-5.68

Table 7-6. EIRP Data (Band 48)

Bandwidth	Mod.	PCC Frequency [MHz]	SCC Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
40 MHz	QPSK	3560.0	3579.8	V	104.0	177.0	7.13	50 / 25	7.16	14.29	0.027	23.00	-8.71
		3625.0	3644.8	V	103.0	144.0	6.85	50 / 25	11.02	17.87	0.061	23.00	-5.13
		3690.0	3670.2	V	118.0	135.0	6.26	50 / 25	10.94	17.20	0.052	23.00	-5.80
	16-QAM	3625.0	3644.8	V	103.0	144.0	6.85	50 / 25	9.25	16.10	0.041	23.00	-6.90
	64-QAM	3625.0	3644.8	V	103.0	144.0	6.85	50 / 25	8.59	15.44	0.035	23.00	-7.56
35 MHz	QPSK	3552.5	3574.6	V	109.0	338.0	7.13	36 / 18	6.69	13.82	0.024	23.00	-9.18
		3625.0	3642.1	V	129.0	329.0	6.85	36 / 18	9.16	16.01	0.040	23.00	-6.99
		3692.5	3675.4	V	124.0	329.0	6.26	36 / 18	9.74	16.00	0.040	23.00	-7.00
	16-QAM	3625.0	3642.1	V	129.0	329.0	6.85	36 / 18	8.51	15.36	0.034	23.00	-7.64
	64-QAM	3625.0	3642.1	V	129.0	329.0	6.85	36 / 18	7.39	14.24	0.027	23.00	-8.76
30 MHz	QPSK	3555.0	3569.4	V	120.0	201.0	7.13	25 / 12	8.36	15.49	0.035	23.00	-7.51
		3625.0	3639.4	V	144.0	159.0	6.85	25 / 12	9.66	16.51	0.045	23.00	-6.49
		3695.0	3680.6	V	159.0	166.0	6.26	25 / 12	9.33	15.59	0.036	23.00	-7.41
	16-QAM	3625.0	3639.4	V	144.0	159.0	6.85	25 / 12	8.43	15.28	0.034	23.00	-7.72
	64-QAM	3625.0	3639.4	V	144.0	159.0	6.85	25 / 12	7.40	14.25	0.027	23.00	-8.75
25 MHz	QPSK	3552.5	3564.2	V	132.0	152.0	7.13	12 / 6	9.01	16.14	0.041	23.00	-6.86
		3625.0	3636.7	V	126.0	147.0	6.85	12 / 6	9.56	16.41	0.044	23.00	-6.59
		3697.5	3685.8	V	149.0	151.0	6.26	12 / 6	9.40	15.66	0.037	23.00	-7.34
	16-QAM	3625.0	3636.7	V	126.0	147.0	6.85	12 / 6	8.63	15.48	0.035	23.00	-7.52
	64-QAM	3625.0	3636.7	V	126.0	147.0	6.85	12 / 6	7.58	14.43	0.028	23.00	-8.57
40 MHz	256-QAM	3625.0	3636.7	V	126.0	147.0	6.85	12 / 6	6.76	13.61	0.023	23.00	-9.39
	QPSK	3625.0	3644.8	H	112.0	154.0	6.85	50 / 25	8.69	15.54	0.036	23.00	-7.46
	QPSK (WCP)	3625.0	3644.8	V	162.0	162.0	6.85	50 / 25	7.86	14.71	0.030	23.00	-8.29

Table 7-7. EIRP Data (Band 48 ULCA)

FCC ID: A3LSMG981U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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7.8 Radiated Spurious Emissions Measurements

\$2.1053 \$96.41(e)

Test Overview

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

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI/TIA-603-E-2016 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW $\geq 3 \times$ RBW
3. Span = 1.5 times the OBW
4. No. of sweep points $\geq 2 \times$ span / RBW
5. Detector = RMS
6. Trace mode = Max Hold (In cases where the level is within 2dB of the limit, the final measurement is taken using triggering/gating and trace averaging.)
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.

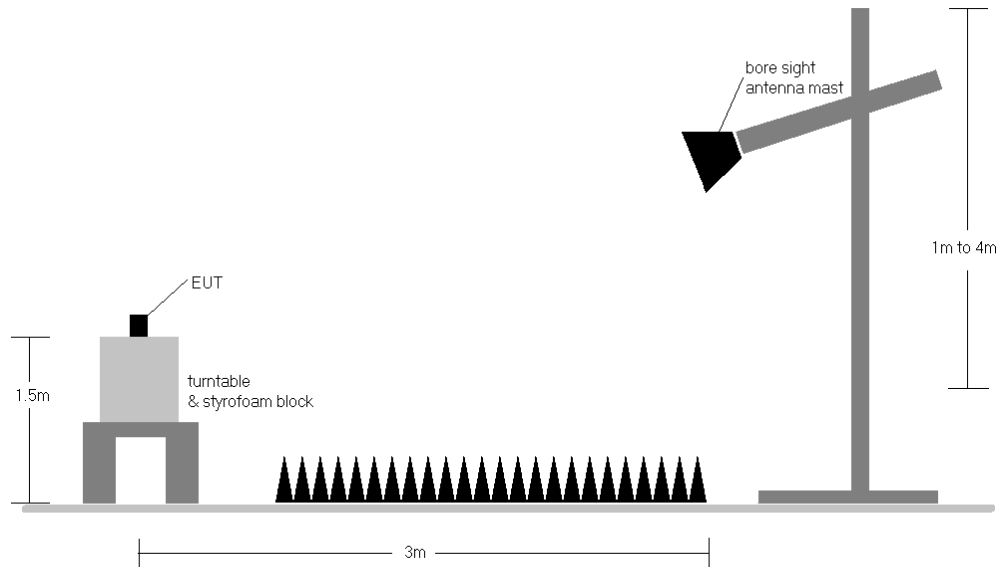


Figure 7-7. Test Instrument & Measurement Setup

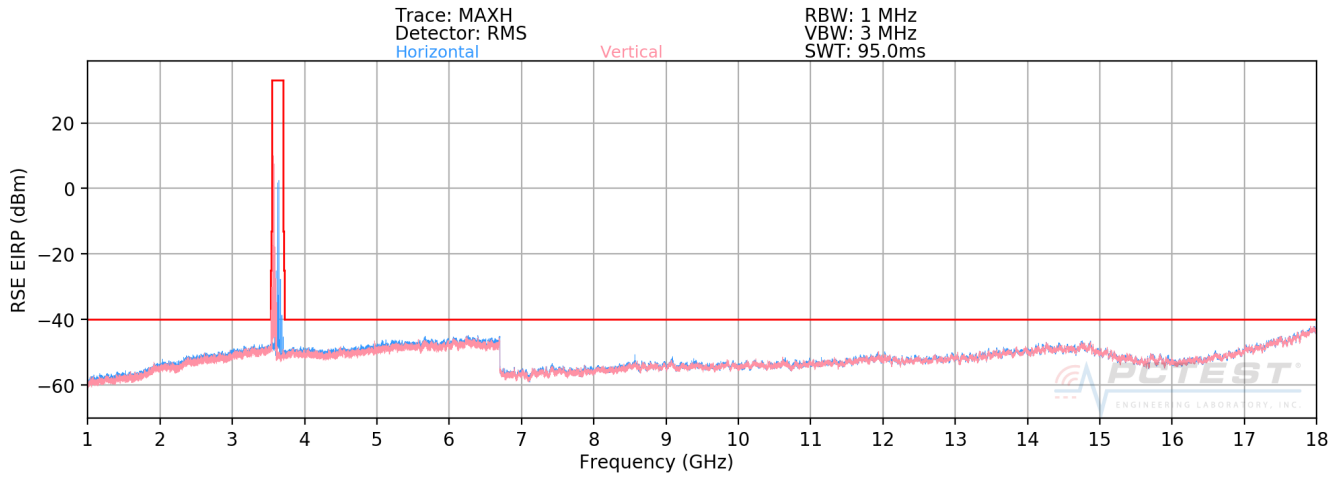
Test Notes

- 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.
- 6) Per KDB 971168, Field Strength Level (dBμV/m) is converted to EIRP Spurious Emission Level (dBm) using the formula in Section 5.8.4 (d):

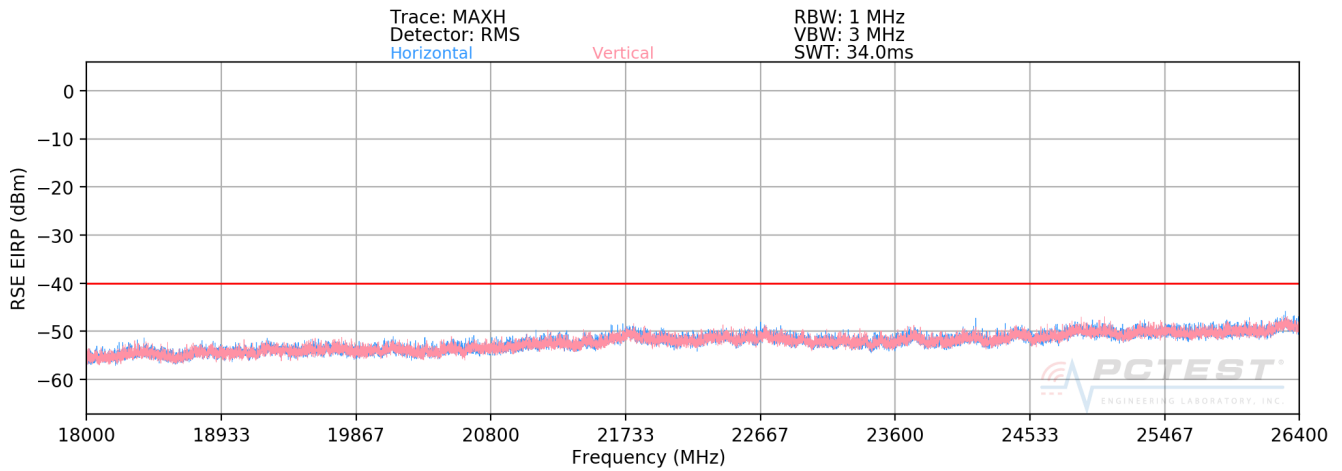
$$\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20 \log D - 104.8; \text{ where } D \text{ is the measurement distance in meters}$$

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LTE Band 48



Plot 7-75. Radiated Spurious Plot 1 - 18GHz (Band 48)



Plot 7-76. Radiated Spurious Plot 18 - 26.5GHz (Band 48)

FCC ID: A3LSMG981U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Bandwidth (MHz):	20
Frequency (MHz):	3560.0
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 99

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7120.0	H	-	-	-82.57	12.95	37.38	-57.87	-40.00	-17.87
10680.0	H	-	-	-83.22	19.81	43.59	-51.67	-40.00	-11.67
14240.0	H	-	-	-85.45	26.23	47.78	-47.48	-40.00	-7.48

Table 7-8. Radiated Spurious Data (Band 48 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3625.0
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7250.0	H	330	212	-75.83	14.18	45.35	-49.91	-40.00	-9.91
10875.0	H	222	140	-78.33	20.03	48.70	-46.56	-40.00	-6.56
14500.0	H	276	118	-82.05	27.05	52.00	-43.25	-40.00	-3.25
18125.0	H	-	-	-85.52	6.70	28.18	-76.62	-40.00	-36.62

Table 7-9. Radiated Spurious Data (Band 48 – Mid Channel)

Bandwidth (MHz):	20
Frequency (MHz):	3690.0
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7380.00	H	330	212	-75.83	14.84	46.01	-49.25	-40.00	-9.25
11070.00	H	222	140	-78.33	20.36	49.03	-46.23	-40.00	-6.23
14760.00	H	276	118	-82.05	25.98	50.93	-44.33	-40.00	-4.33
18450.00	H	-	-	-85.52	7.26	28.74	-76.06	-40.00	-36.06

Table 7-10. Radiated Spurious Data (Band 48 – High Channel)

FCC ID: A3LSMG981U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Bandwidth (MHz):	20
Frequency (MHz):	3690.0
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7380.0	V	270	33	-76.33	12.95	43.62	-51.63	-40.00	-11.63
11070.0	V	180	331	-81.01	19.81	45.80	-49.46	-40.00	-9.46
14760.0	V	169	210	-83.36	26.23	49.87	-45.39	-40.00	-5.39

Table 7-11. Radiated Spurious Data with WCP (Band 48 – High Channel)

FCC ID: A3LSMG981U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 64 of 78

7.9 Uplink Carrier Aggregation Radiated Measurements

\$2.1053, \$96.41(e)

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using 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-E-2016 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW $\geq 3 \times$ RBW
3. No. of sweep points $\geq 2 \times$ span / RBW
4. Detector = RMS
5. Trace mode = trace average for continuous emissions, max hold for pulse emissions
6. The trace was allowed to stabilize

FCC ID: A3LSMG981U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 65 of 78

Test Setup

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

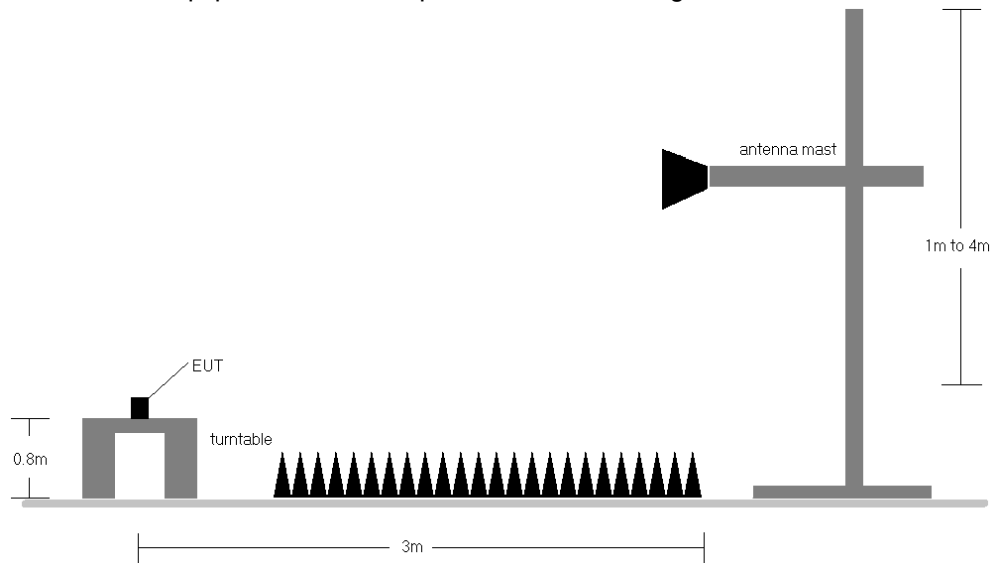


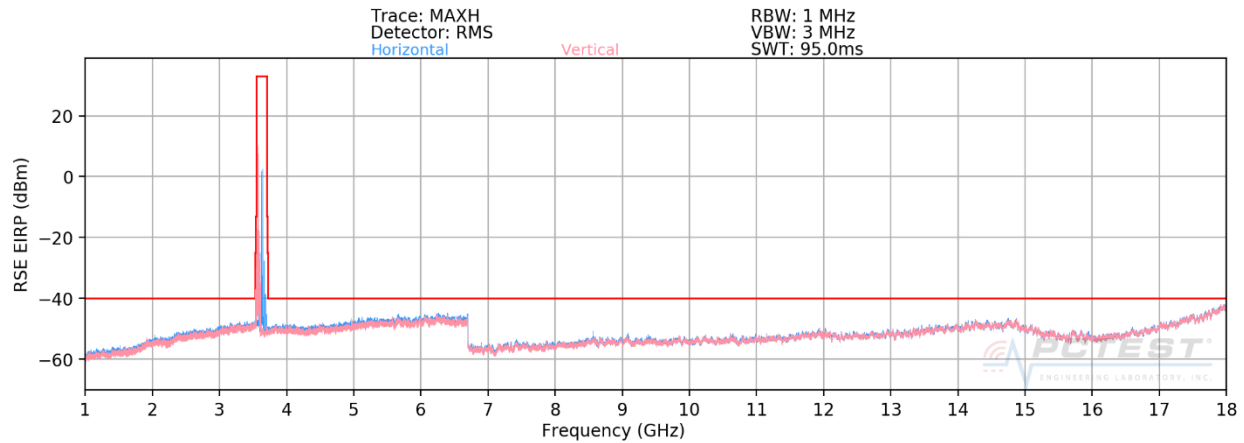
Figure 7-8. Test Instrument & Measurement Setup

Test Notes

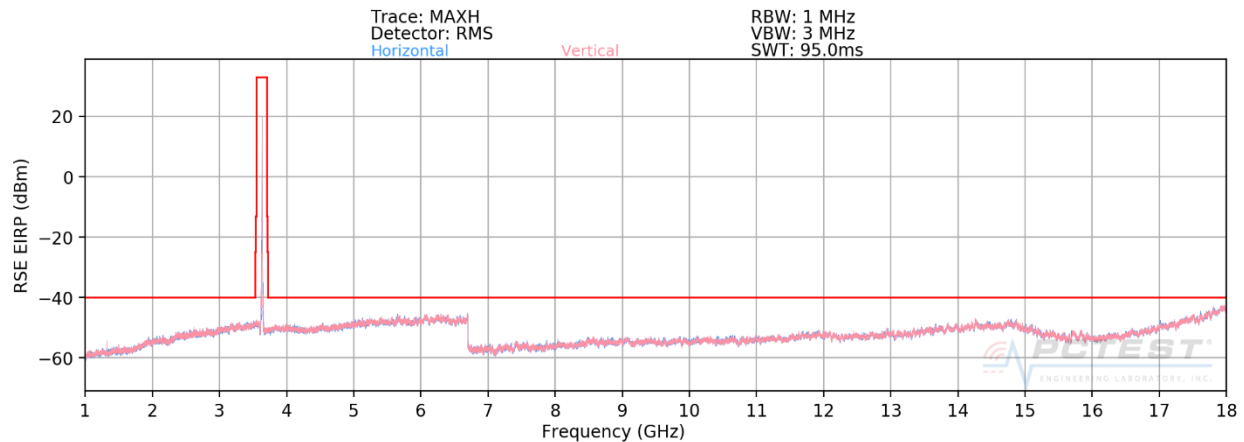
- 1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
- 2) This unit was tested with its standard battery.
- 3) Radiated spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. The worst case (highest) emissions were found while operating with QPSK modulation with both carriers set to transmit using 1RB.
- 4) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 5) 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.
- 6) No significant emissions were found as a result of two uplink carriers operating contiguously.

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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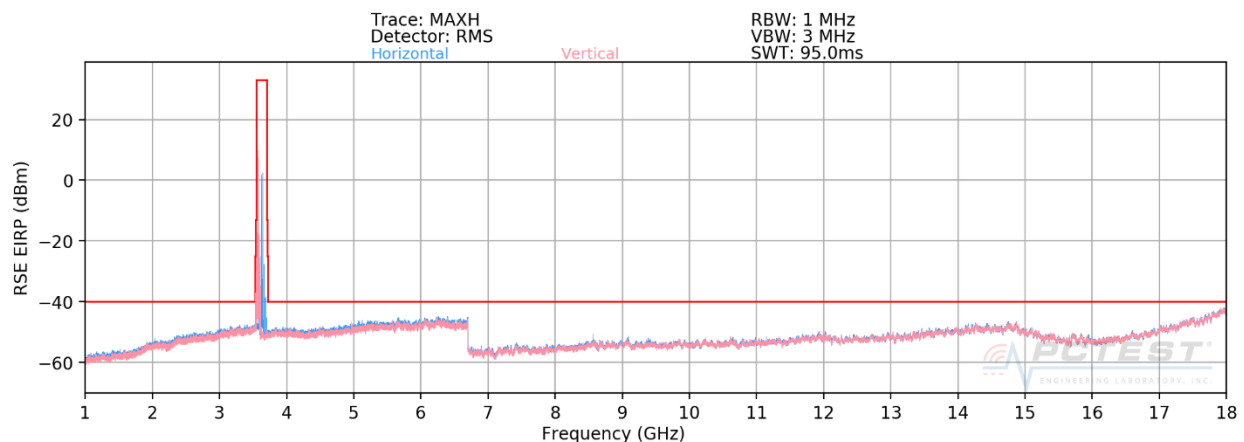
ULCA Band 48



Plot 7-77. Radiated Spurious Plot 1GHz - 18GHz (ULCA Band 48) Low Channel – PCC/SCC: 1RB)

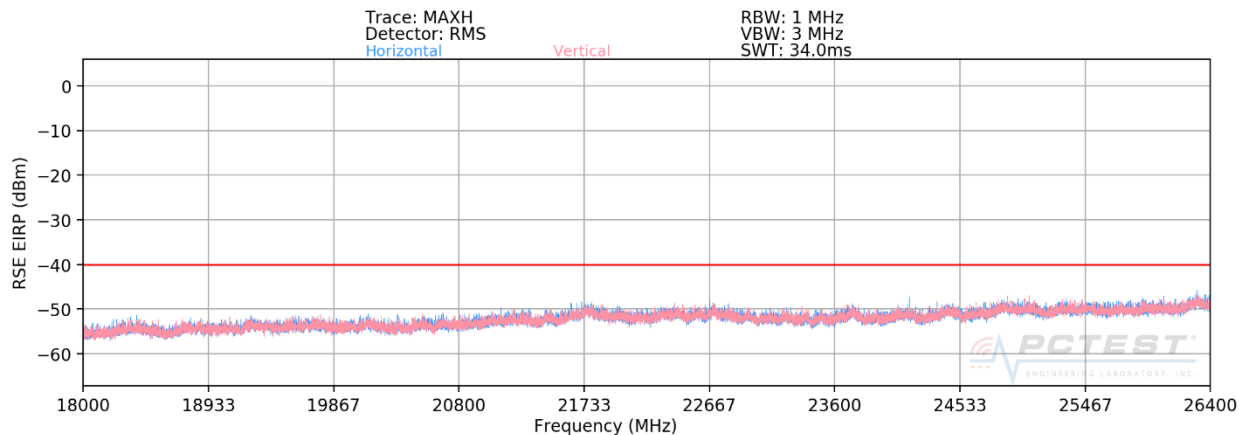


Plot 7-78. Radiated Spurious Plot 1GHz - 18GHz (ULCA Band 48) Mid Channel – PCC/SCC: 1RB)



Plot 7-79. Radiated Spurious Plot 1GHz - 18GHz (ULCA Band 48) High Channel – PCC/SCC: 1RB)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Plot 7-80. Radiated Spurious Plot 18GHz – 26.5GHz (ULCA Band 48))

OPERATING FREQUENCY (PCC):	3560.00	MHz
OPERATING FREQUENCY (SCC):	3579.80	MHz
CHANNEL (PCC):	55340	
CHANNEL (SCC):	55538	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	20.0	MHz
DISTANCE:	3	meters
LIMIT:	-40	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
7120.00	H	214	25	-57.74	8.63	-49.11	-9.1
10680.00	H	-	-	-60.70	9.41	-51.29	-11.3
14240.00	H	348	27	-55.55	8.82	-46.73	-6.7

Table 7-12. Radiated Spurious Data (ULCA 48) PCC: RB 1 Offset 99, SCC: RB 1 Offset 0 – Low Channel)

FCC ID: A3LSMG981U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1910220165-21.A3L	Test Dates: 10/22 - 12/31/2019	EUT Type: Portable Handset		Page 68 of 78

OPERATING FREQUENCY (PCC): 3625.00 MHz
 OPERATING FREQUENCY (SCC): 3644.80 MHz
 CHANNEL (PCC): 55990
 CHANNEL (SCC): 56188
 MODULATION SIGNAL: QPSK
 BANDWIDTH: 20.0 MHz
 DISTANCE: 3 meters
 LIMIT: -40 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
7250.00	H	232	17	-60.53	8.41	-52.12	-12.1
10875.00	H	-	-	-58.98	9.27	-49.72	-9.7
14500.00	H	392	42	-52.63	8.84	-43.79	-3.8

Table 7-13. Radiated Spurious Data (ULCA 48) PCC: RB 1 Offset 99, SCC: RB 1 Offset 0 – Mid Channel)

OPERATING FREQUENCY (PCC): 3690.00 MHz
 OPERATING FREQUENCY (SCC): 3670.20 MHz
 CHANNEL (PCC): 56640
 CHANNEL (SCC): 56442
 MODULATION SIGNAL: QPSK
 BANDWIDTH: 20.0 MHz
 DISTANCE: 3 meters
 LIMIT: -40 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
7380.00	H	207	44	-56.47	8.41	-48.06	-8.1
11070.00	H	-	-	-58.52	9.31	-49.21	-9.2
14760.00	H	381	42	-52.34	8.72	-43.62	-3.6

Table 7-14. Radiated Spurious Data (ULCA 48) PCC: RB 1 Offset 0, SCC: RB 1 Offset 99 – High Channel)

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7.10 Frequency Stability / Temperature Variation

§2.1055

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

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

For Part 96, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI/TIA-603-E-2016

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

Test Notes

None

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LTE Band 48 Frequency Stability Measurements

Operating Frequency (Hz):	3,625,000,000
Ref. Voltage (VDC):	3.80

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	3,625,000,445	445	0.0000123
		- 20	3,625,000,061	61	0.0000017
		- 10	3,625,000,318	318	0.0000088
		0	3,624,999,822	-178	-0.0000049
		+ 10	3,624,999,729	-271	-0.0000075
		+ 20 (Ref)	3,625,000,047	47	0.0000013
		+ 30	3,624,999,784	-216	-0.0000060
		+ 40	3,625,000,266	266	0.0000073
		+ 50	3,624,999,905	-95	-0.0000026
Battery Endpoint	2.76	+ 20	3,625,000,052	52	0.0000014

Table 7-15. Frequency Stability Data (LTE Band 48)

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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LTE Band 48 Frequency Stability Measurements

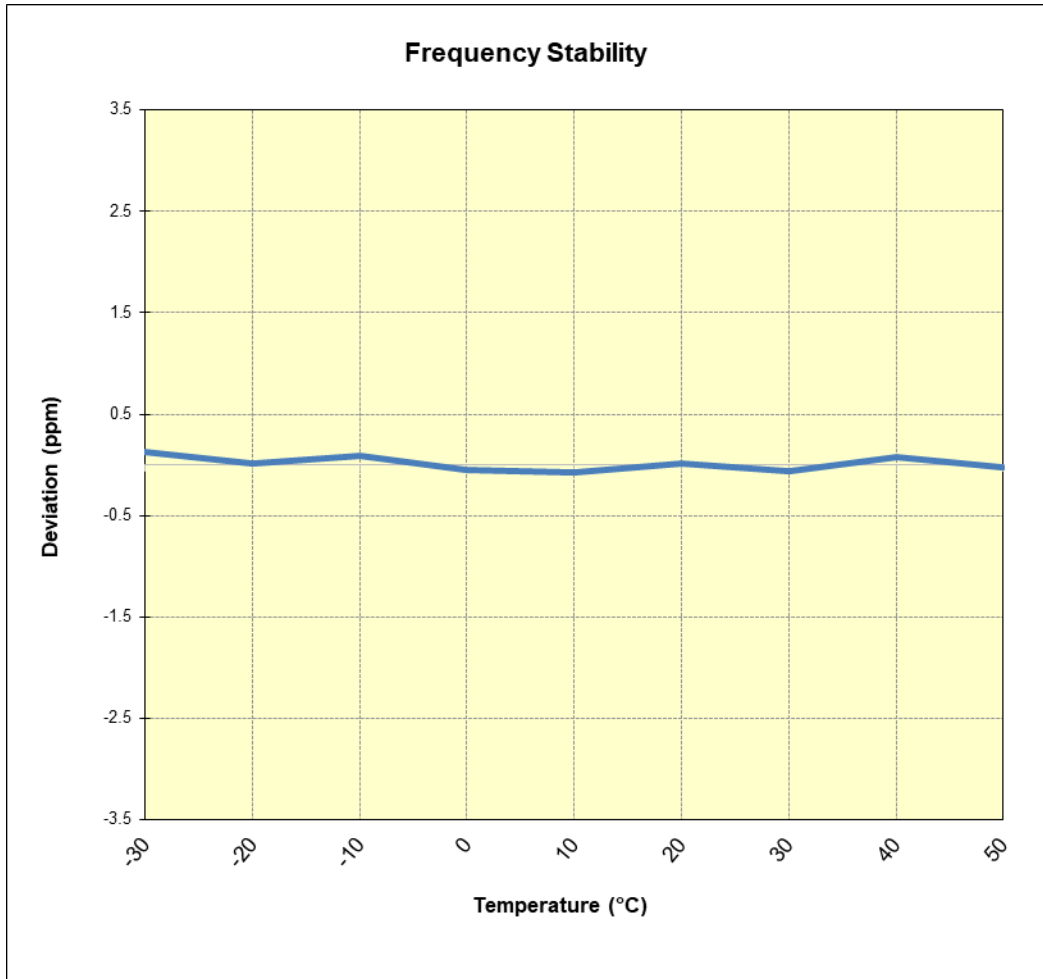


Figure 7-9. Frequency Stability Graph (LTE Band 48)

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7.11 End User Device Additional Requirement (CBSD Protocol)

§96.47

Test Overview and Limit

End user device additional requirements (CBSD Protocol) are tested per the test procedures listed below. During testing, the EUT is connected to a certified CBSD (Ruckus FCC ID: S9GQ910US00) as a companion device to show compliance with Part 96.47.

End User Devices may operate only if they can positively receive and decode an authorization signal transmitted by a CBSD, including the frequencies and power limits for their operation.

An End User Device must discontinue operations, change frequencies, or change its operational power level within 10 seconds of receiving instructions from its associated CBSD.

Test Procedure Used

KDB 940660 D01 v02, WINNF-TS-0122 V1.0.0.

Test Setup/Method

The EUT was connected via an RF cable to a certified CBSD and spectrum analyzer. The following procedure is performed by applying WINNF-TS-0122 CBRs CBSD Test Specification.

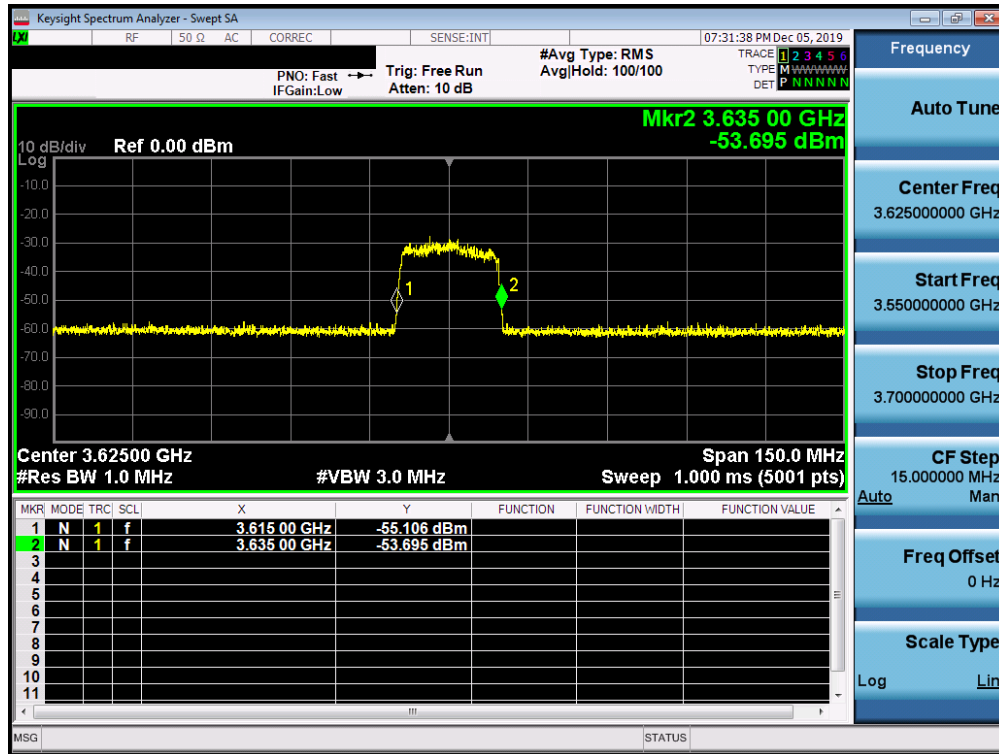
1. Run#1:
 - a. Setup WINNF.PT.C.HBT.1 with 3615MHz – 3635MHz.
 - b. Enable AP service from Ruckus Cloud management.
 - c. Check EUT Tx frequency.
 - d. Disable AP service from Ruckus Cloud management and check EUT stop transmission within 10s.
2. Run#2:
 - a. Setup WINNF.PT.C.HBT.1 with 3660MHz – 3680MHz.
 - b. Enable AP service from Ruckus Cloud management.
 - c. Check EUT Tx frequency.
 - d. Disable AP service from Ruckus Cloud management and check EUT stop transmission within 10s.

Test Notes

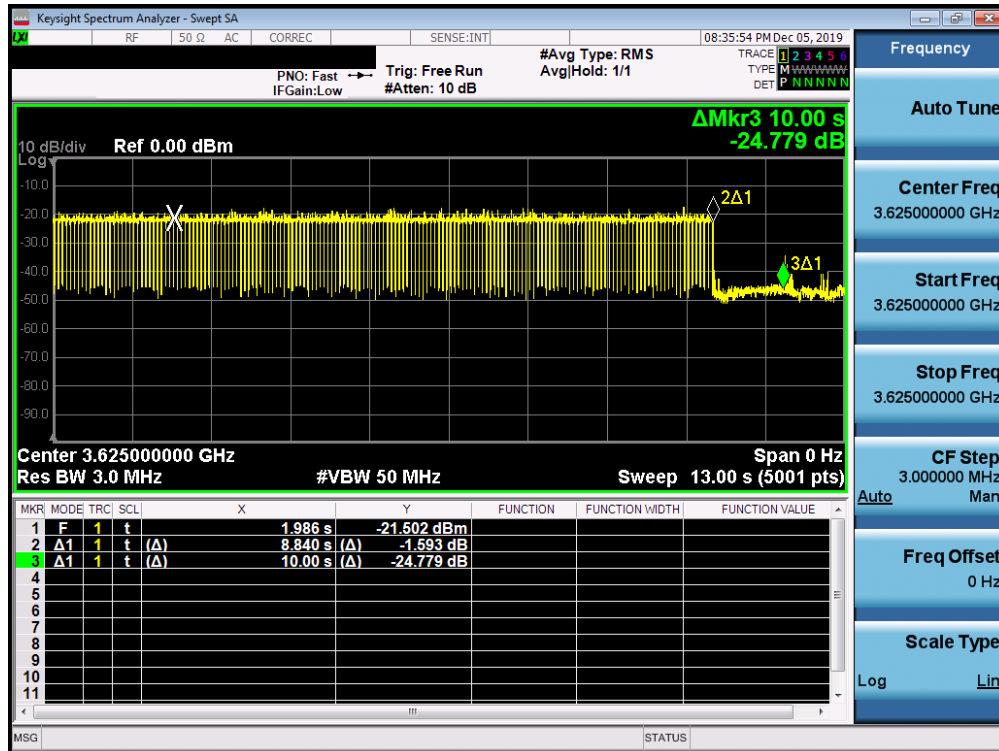
The EUT is an End User Device.

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Run#1:



Plot 7-81. Run#1 End User Device Frequency of Operations



Plot 7-82. Run#1 End User Device Discontinues Operations within 10s

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Note:

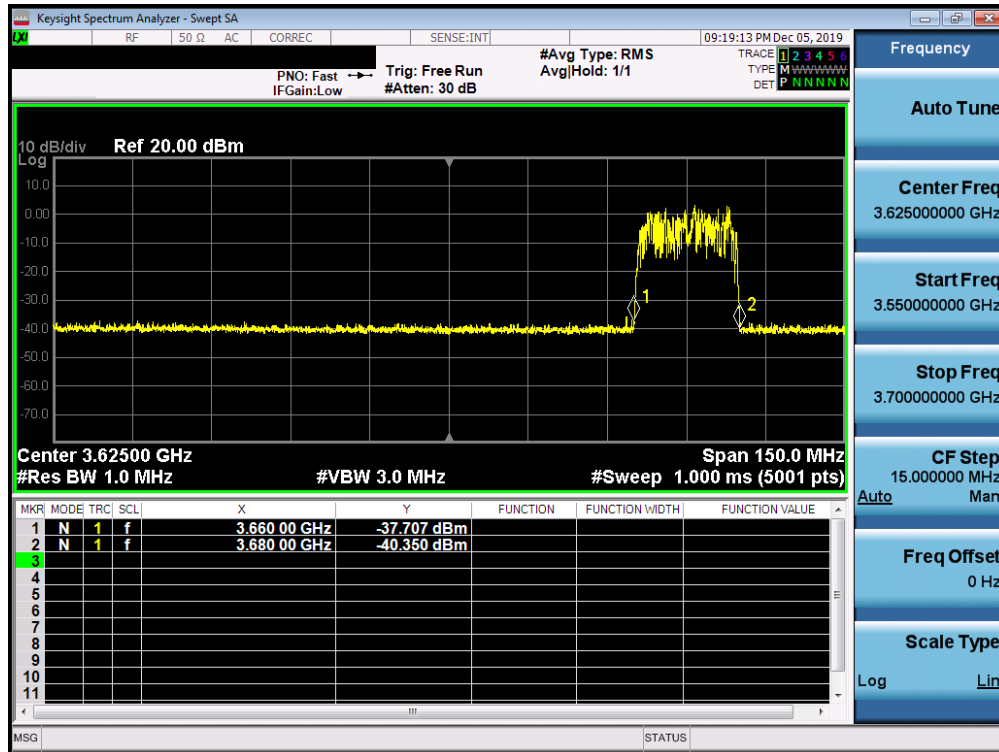
Marker 1: CBSD sends instructions to discontinue LTE operations.

Marker 2: EUT discontinues operation.

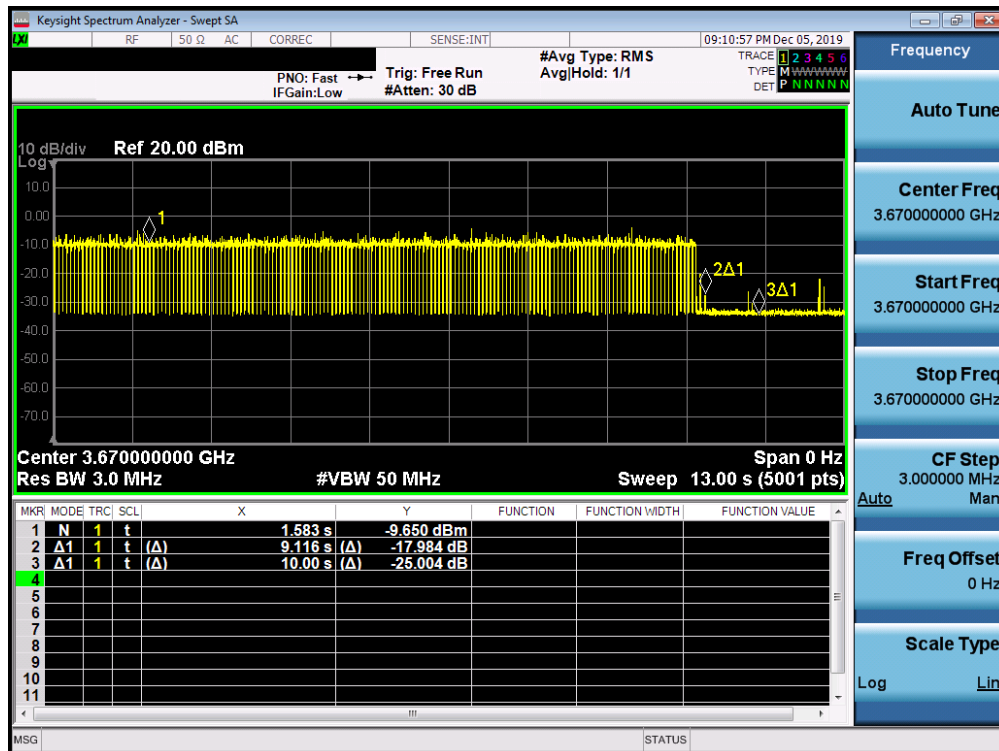
Marker 3: 10 seconds elapsed time from CBSD sending instructions to EUT.

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Run#2:



Plot 7-83. Run#2 End User Device Frequency of Operations



Plot 7-84. Run#2 End User Device Discontinues Operations within 10s

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Note:

Marker 1: CBSD sends instructions to discontinue LTE operations.

Marker 2: EUT discontinues operation.

Marker 3: 10 seconds elapsed time from CBSD sending instructions to EUT.

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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: A3LSMG981U** complies with all of the End User Device requirements of Part 96 of the FCC Rules for LTE operation only.

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