



PCTEST ENGINEERING LABORATORY, INC.

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MEASUREMENT REPORT LTE

Applicant Name:

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

Date of Testing:

4/10-5/06/2019

Test Site/Location:

PCTEST Lab. Columbia, MD, USA

Test Report Serial No.:

1M1904050054-02.A3L

FCC ID:

A3LSMG977KOR

APPLICANT:

Samsung Electronics Co., Ltd.

Application Type:

Class II Permissive Change

Model:

SM-G977B

EUT Type:

Portable Handset

FCC Classification:

PCS Licensed Transmitter Held to Ear (PCE)

FCC Rule Part(s):

27

Test Procedure(s):

ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01,
KDB 648474 D03 v01r04

Class II Permissive Change:

Please see FCC document

Original Grant Date:

03/14/2019

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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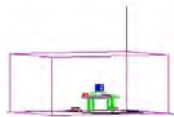
V 9.0 02/01/2019

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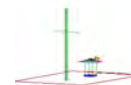
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FCC Part 27



Mode	FCC Rule Part	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
			Max. Power (W)	Max. Power (dBm)		
LTE Band 7	27	2502.5 - 2567.5	0.051	17.07	4M57G7D	QPSK
LTE Band 7	27	2502.5 - 2567.5	0.035	15.49	4M54W7D	16QAM
LTE Band 7	27	2502.5 - 2567.5	0.030	14.78	4M53W7D	64QAM
LTE Band 7	27	2505 - 2565	0.050	17.02	9M06G7D	QPSK
LTE Band 7	27	2505 - 2565	0.037	15.73	9M08W7D	16QAM
LTE Band 7	27	2505 - 2565	0.031	14.89	9M07W7D	64QAM
LTE Band 7	27	2507.5 - 2562.5	0.051	17.09	13M5G7D	QPSK
LTE Band 7	27	2507.5 - 2562.5	0.035	15.43	13M5W7D	16QAM
LTE Band 7	27	2507.5 - 2562.5	0.029	14.58	13M5W7D	64QAM
LTE Band 7	27	2510 - 2560	0.051	17.10	18M0G7D	QPSK
LTE Band 7	27	2510 - 2560	0.033	15.14	18M1W7D	16QAM
LTE Band 7	27	2510 - 2560	0.025	14.05	18M0W7D	64QAM

EUT Overview (High Bands)

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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 and the Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

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

1.3 Test Facility / Accreditations

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

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and 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: A3LSMG977KOR**. The test data contained in this report pertains only to the emissions due to the EUT's LTE function.

Test Device Serial No.: 20784, 21162, 0788J, 0785W

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC, ANT+

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

2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 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.

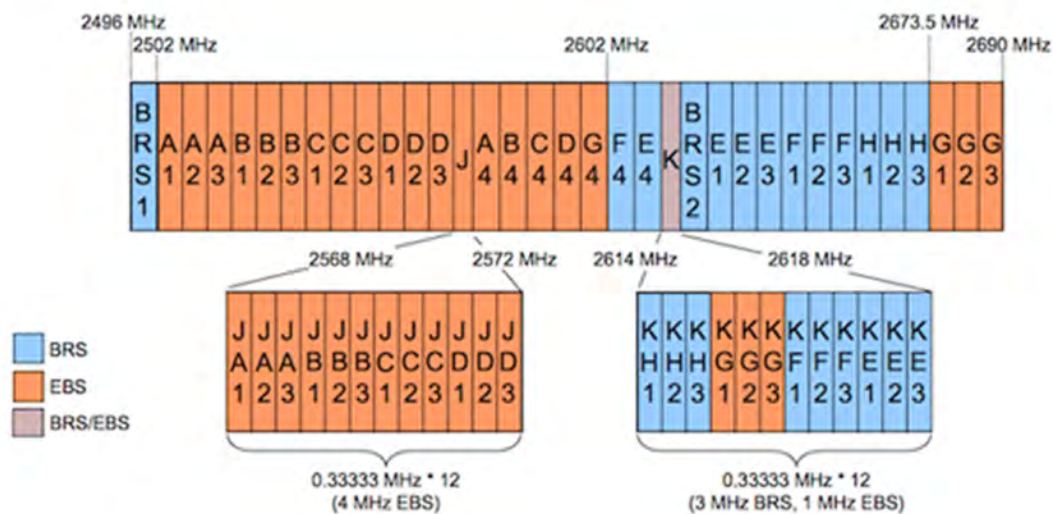
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3.0 DESCRIPTION OF TESTS

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 BRS/EBS Frequency Block



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3.3 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 $P_g \text{ [dBm]} - \text{cable loss [dB]}$.

For Band 7 and 38, the calculated P_d levels are compared to the absolute spurious emission limit of -25dBm which is equivalent to the required minimum attenuation of $55 + 10 \log_{10}(\text{Power [Watts]})$.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 474788 D01.

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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
-	LTx2	Licensed Transmitter Cable Set	8/23/2018	Annual	8/23/2019	LTx2
Agilent	N9030A	PXA Signal Analyzer (44GHz)	5/25/2018	Annual	5/25/2019	MY52350166
Anritsu	MT8821C	Radio Communication Analyzer	7/24/2018	Annual	7/24/2019	6201664756
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2017	Biennial	10/10/2019	121034
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	9/17/2018	Annual	9/17/2019	441119
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	6/7/2018	Triennial	6/7/2021	9203-2178
Espec	ESX-2CA	Environmental Chamber	3/28/2018	Annual	4/28/2019	17620
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	3/28/2018	Biennial	3/28/2020	128337
Huber + Suhner	Sucoflex 102A	40GHz Radiated Cable Set	8/23/2018	Annual	8/23/2019	251425001
Agilent	N9030A	PXA Signal Analyzer (44GHz)	5/25/2018	Annual	5/25/2019	MY52350166
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	4/19/2019	Annual	4/19/2020	11401010036
Mini Circuits	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
Rohde & Schwarz	CMW500	Radio Communication Tester	9/25/2018	Annual	9/25/2019	102060
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	5/21/2018	Annual	5/21/2019	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	8/9/2018	Annual	8/9/2019	100348
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	6/18/2018	Annual	6/18/2019	102134
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	6/25/2018	Annual	6/25/2019	102133
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Test Antenna	7/16/2018	Biennial	7/16/2020	101073
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	9/19/2018	Annual	9/19/2019	100040
Seekonk	NC-100	Torque Wrench	5/9/2018	Biennial	5/9/2020	22217
Sunol	DRH-118	Horn Antenna (1-18GHz)	8/11/2017	Biennial	8/11/2019	A050307
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 (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: A3LSMG977KOR
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)
 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
27.53(m)	Out of Band Emissions	Undesirable emissions must meet the limits detailed in 27.53(m)			Section 7.3, 7.4
2.1046	Transmitter Conducted Output Power	N/A			See RF Exposure Report
2.1055 27.54	Frequency Stability	Fundamental emissions stay within authorized frequency block (Part 7)			Section 7.7

Table 7-1. Summary of Conducted Test Results

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
27.50(h)(2)	Equivalent Isotropic Radiated Power (Band 7)	< 2 Watts max. EIRP	RADIATED	PASS	Section 7.5
27.53(m)	Undesirable Emissions	Undesirable emissions must meet the limits detailed in 27.53(m)			Section 7.6

Table 7-2. Summary of Radiated Test Results

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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 5.0.
- 5) For operation <1GHz, the EIRP limits in the table above are referenced to the specifications written in the relevant Radio Standards Specifications for Innovation, Science, and Economic Development Canada.

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7.2 Occupied Bandwidth

Test Overview

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW $\geq 3 \times$ 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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Band 7

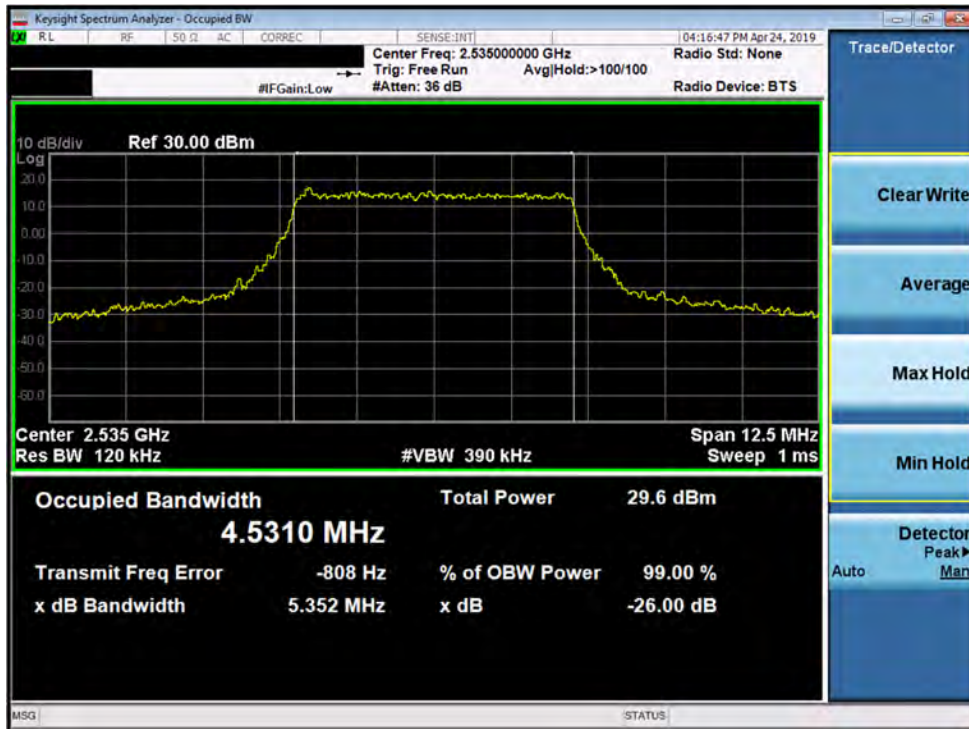


Plot 7-1. Occupied Bandwidth Plot (Band 7 - 5.0MHz QPSK - Full RB Configuration)

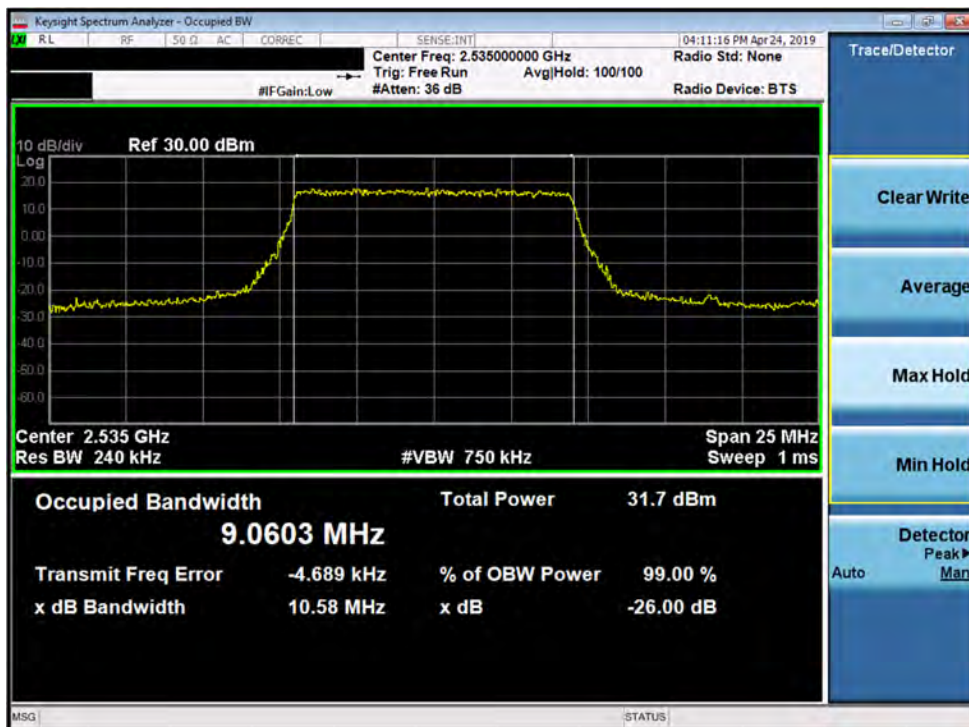


Plot 7-2. Occupied Bandwidth Plot (Band 7 - 5.0MHz 16-QAM - Full RB Configuration)

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



Plot 7-4. Occupied Bandwidth Plot (Band 7 - 10.0MHz QPSK - Full RB Configuration)

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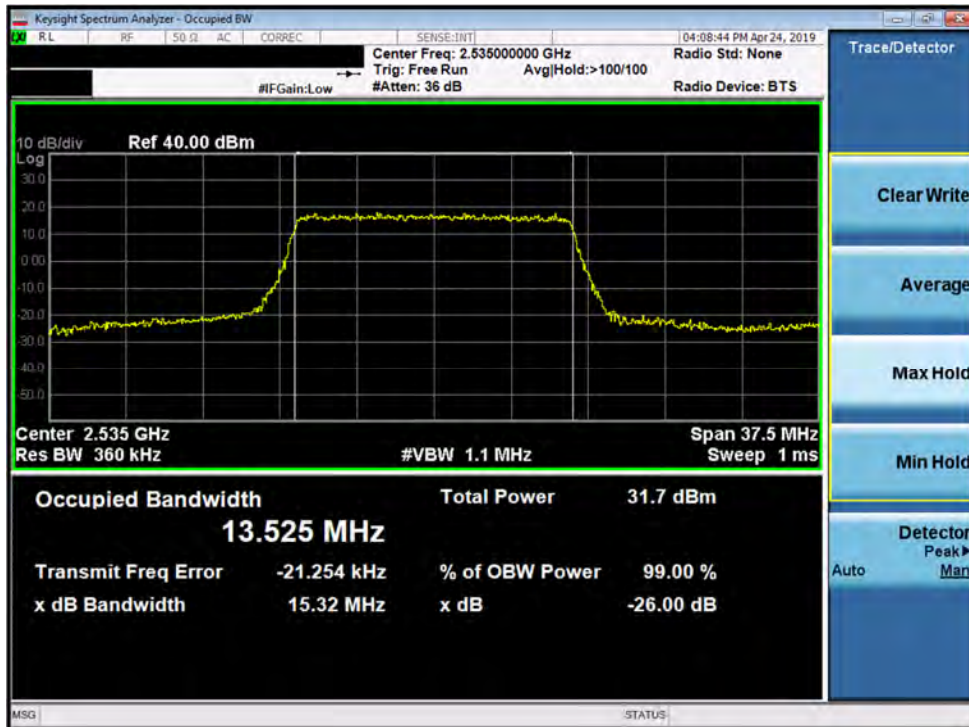


Plot 7-5. Occupied Bandwidth Plot (Band 7 - 10.0MHz 16-QAM - Full RB Configuration)



Plot 7-6. Occupied Bandwidth Plot (Band 7 - 10.0MHz 64-QAM - Full RB Configuration)

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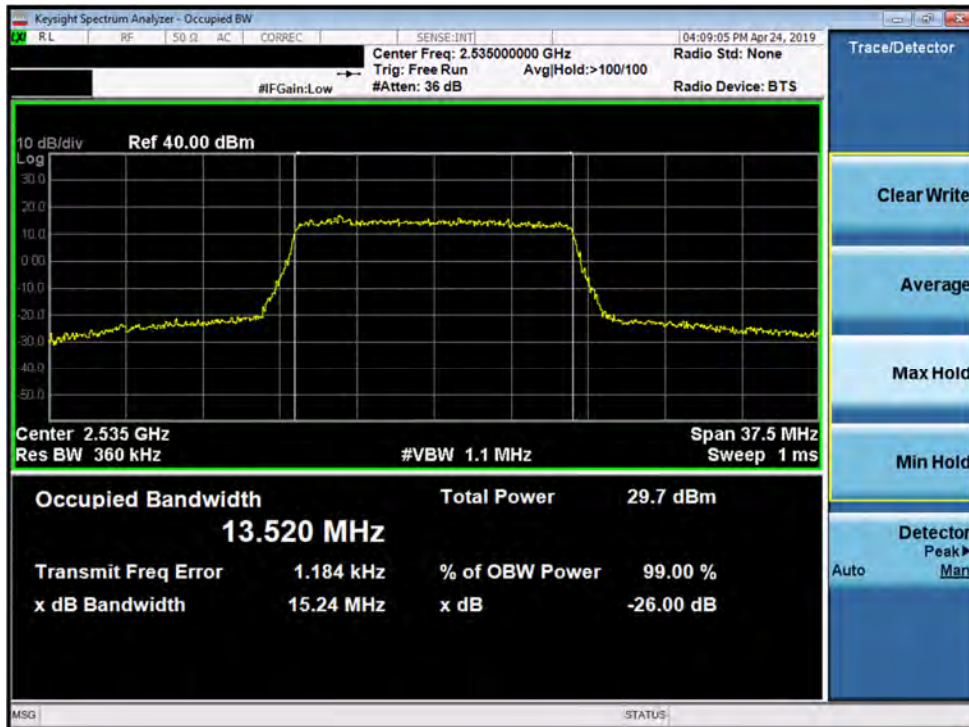


Plot 7-7. Occupied Bandwidth Plot (Band 7 - 15.0MHz QPSK - Full RB Configuration)



Plot 7-8. Occupied Bandwidth Plot (Band 7 - 15.0MHz 16-QAM - Full RB Configuration)

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Plot 7-9. Occupied Bandwidth Plot (Band 7 - 15.0MHz 64-QAM - Full RB Configuration)



Plot 7-10. Occupied Bandwidth Plot (Band 7 - 20.0MHz QPSK - Full RB Configuration)

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Plot 7-11. Occupied Bandwidth Plot (Band 7 - 20.0MHz 16-QAM - Full RB Configuration)



Plot 7-12. Occupied Bandwidth Plot (Band 7 - 20.0MHz 64-QAM - Full RB Configuration)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 19 of 47

7.3 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at 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.

For Band 7, the minimum permissible attenuation level of any spurious emission is $55 + 10 \log_{10}(P_{\text{Watts}})$.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 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.



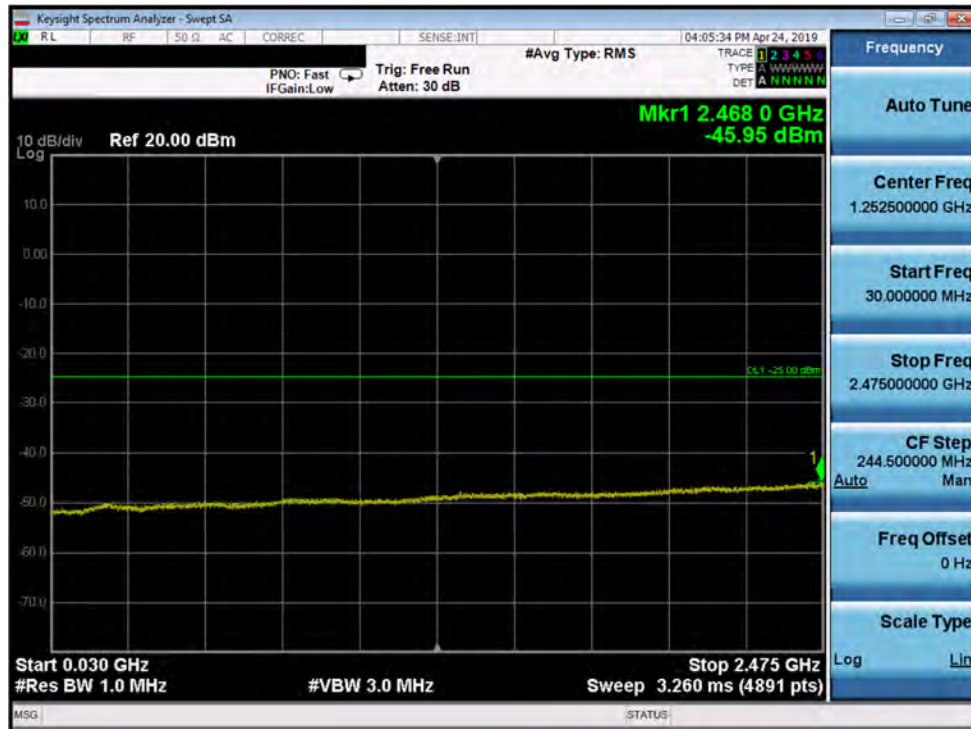
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

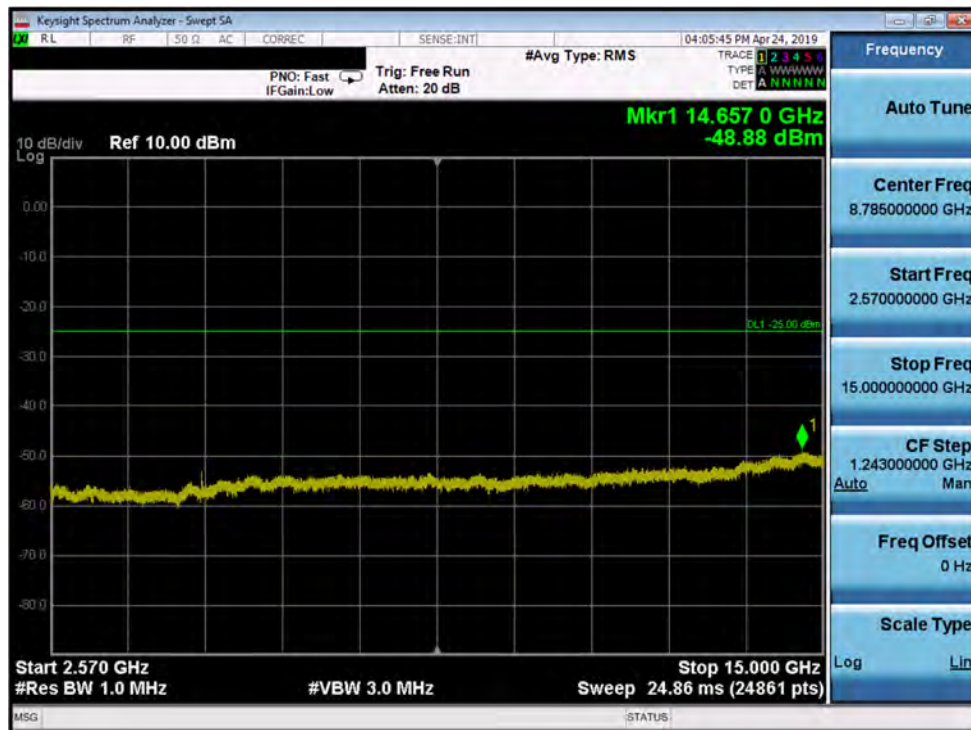
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the 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: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 20 of 47

Band 7

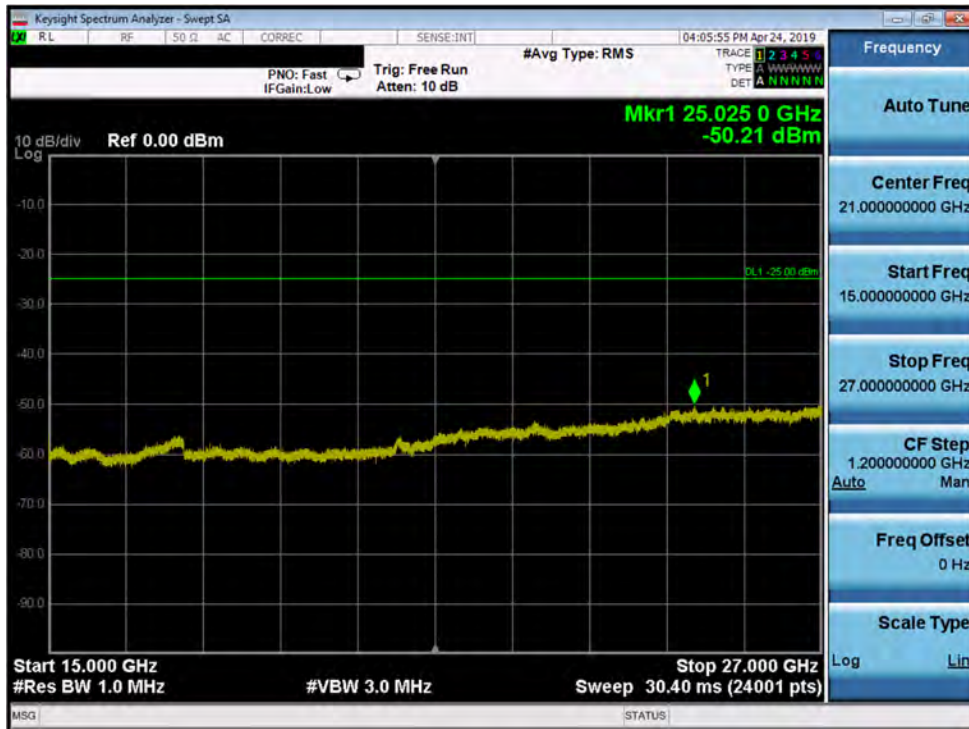


Plot 7-13. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

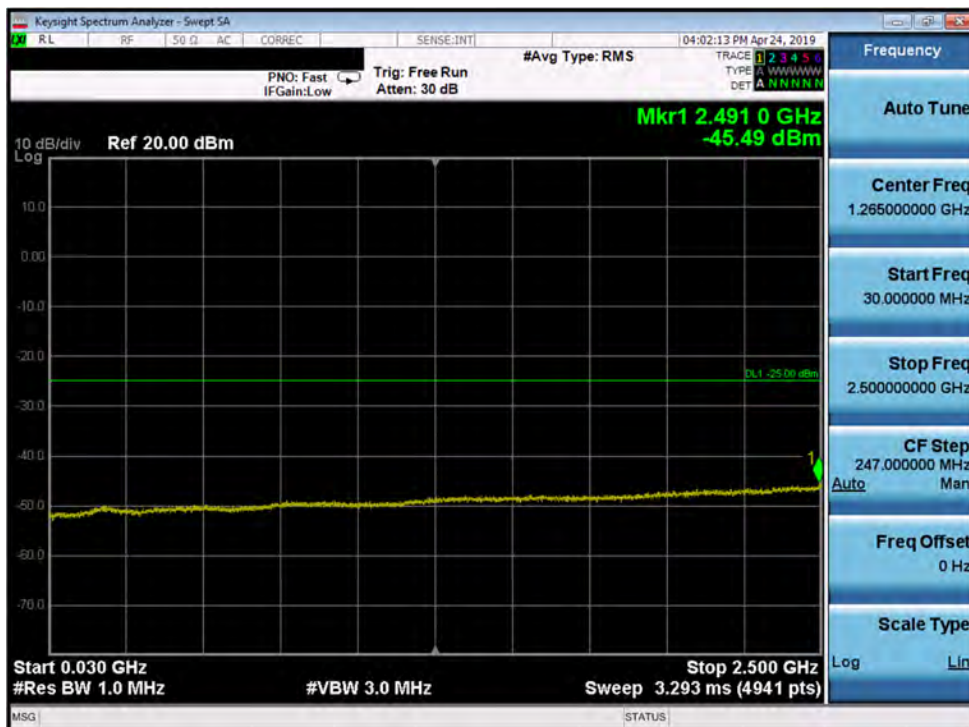


Plot 7-14. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 21 of 47

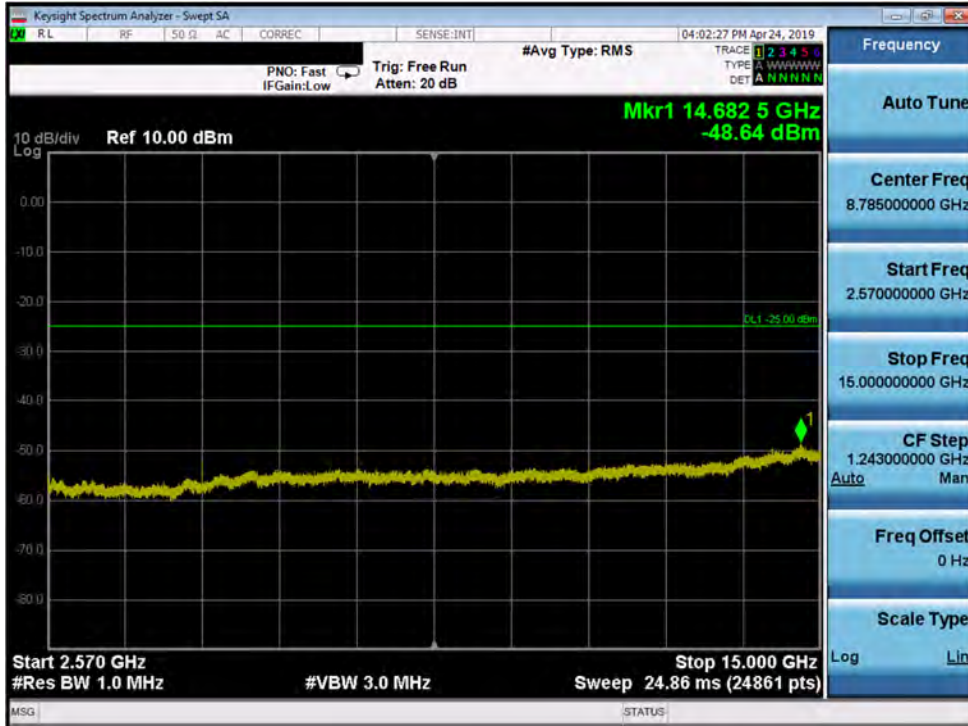


Plot 7-15. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

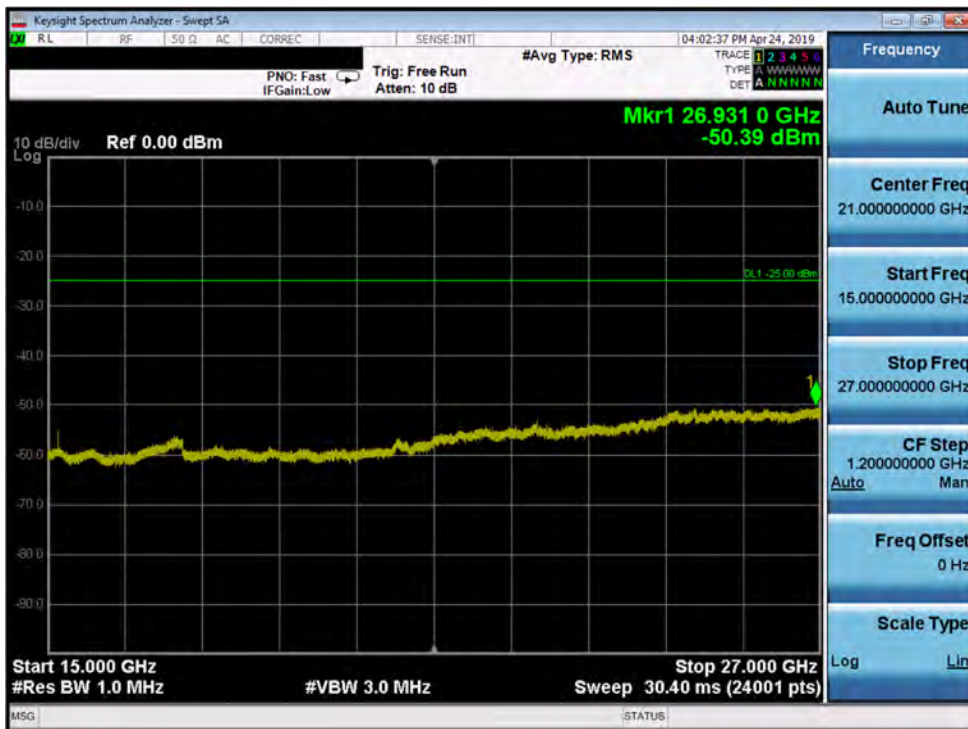


Plot 7-16. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 22 of 47

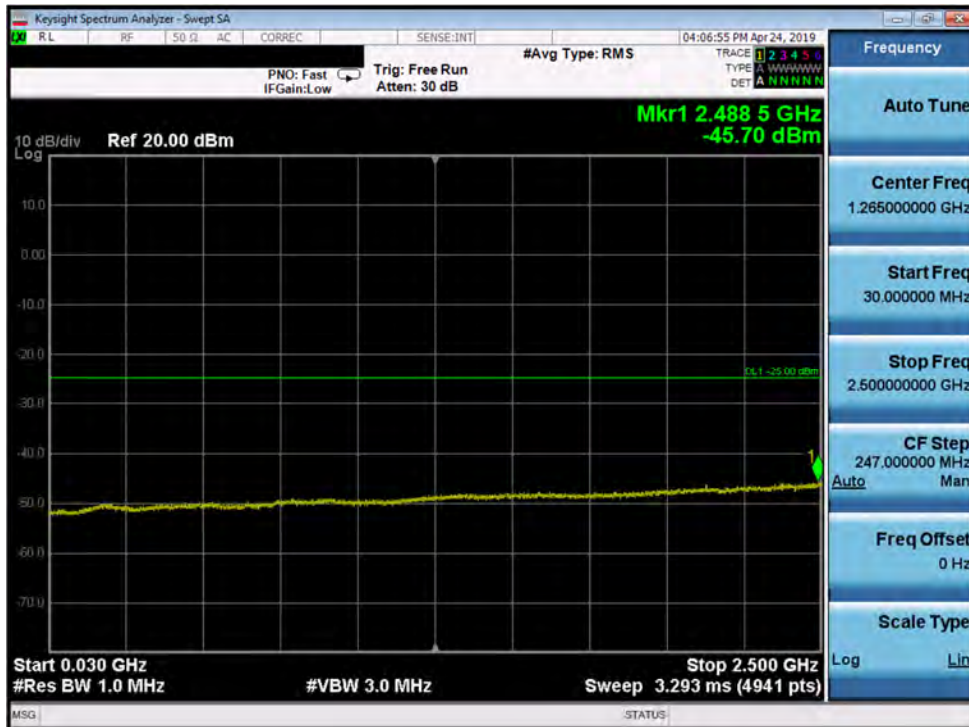


Plot 7-17. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

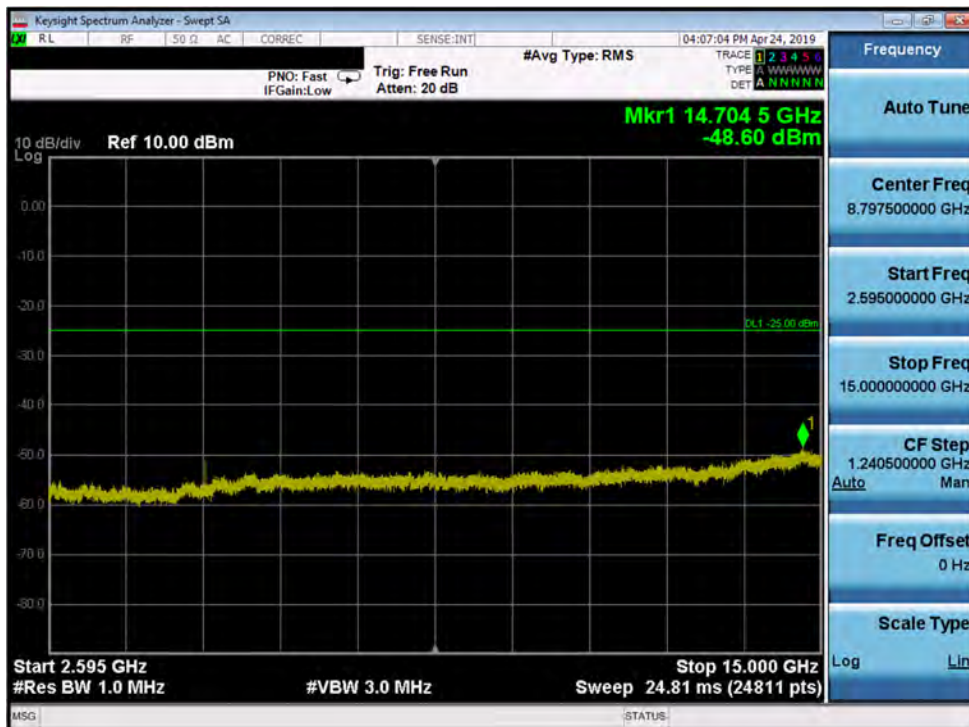


Plot 7-18. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 23 of 47

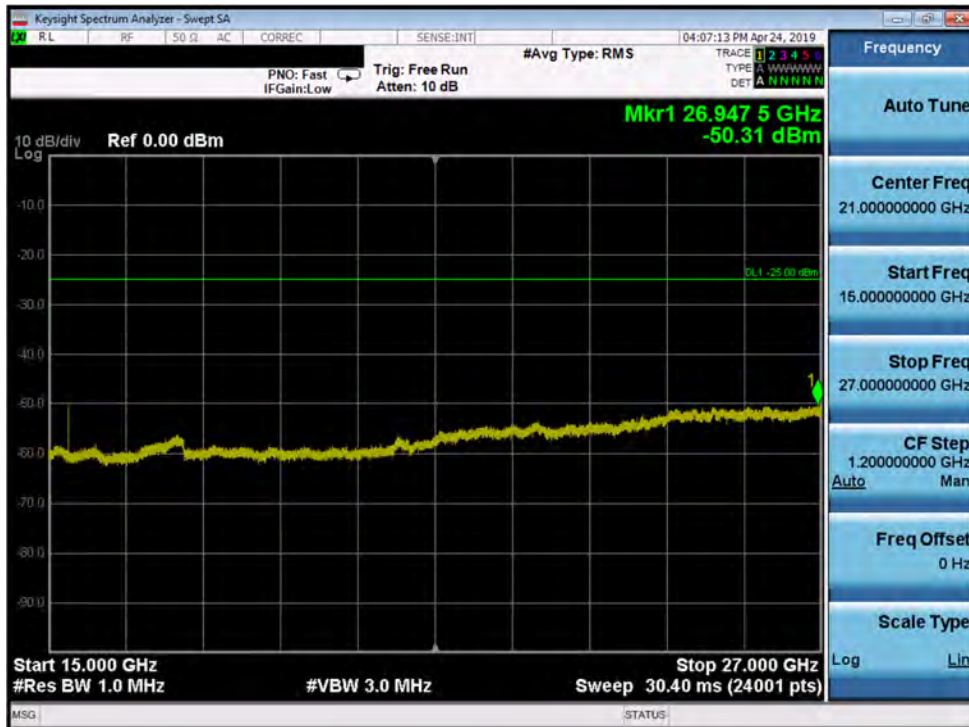


Plot 7-19. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-20. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 24 of 47



Plot 7-21. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 25 of 47

7.4 Band Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at 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 for Band 7 and 38 are as noted in the Test Notes on the following page.

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 $\geq 3 \times$ RBW
5. Detector = RMS
6. Number of sweep points $\geq 2 \times$ Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

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



Figure 7-3. Test Instrument & Measurement Setup

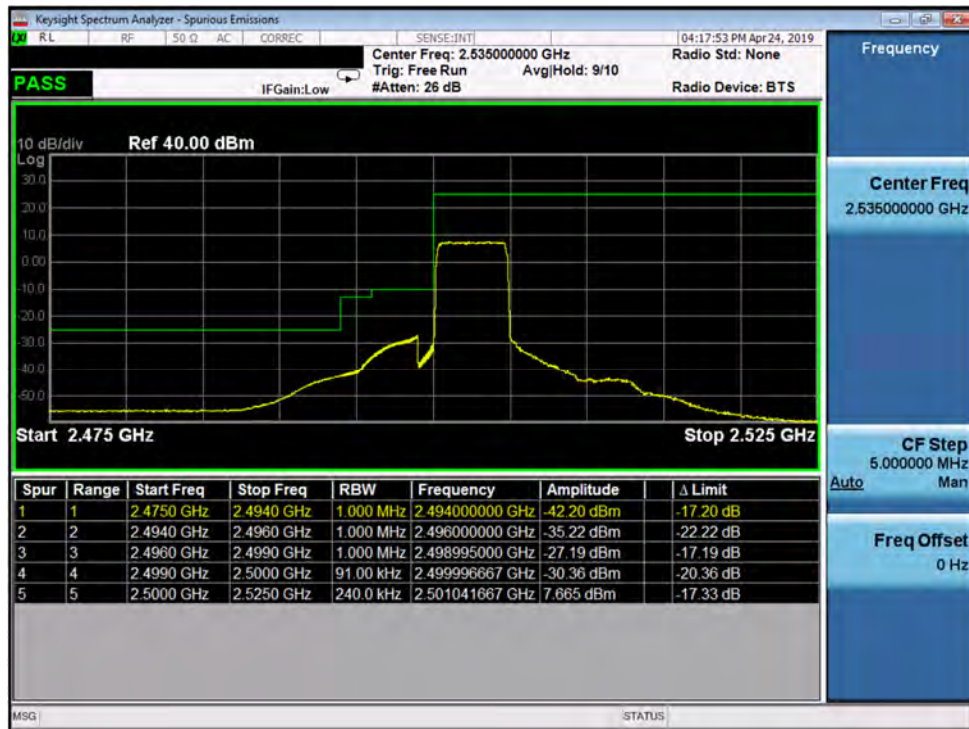
FCC ID: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 26 of 47

Test Notes

Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz.

FCC ID: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 27 of 47

Band 7

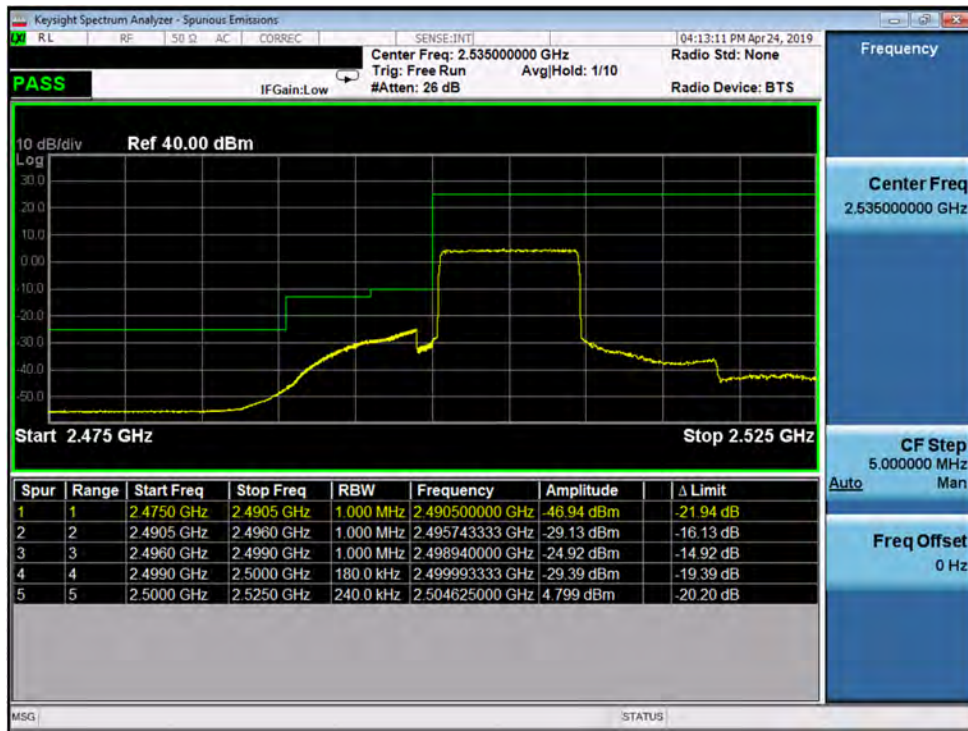


Plot 7-22. Lower ACP Plot (Band 7 - 5.0MHz QPSK - Full RB Configuration)

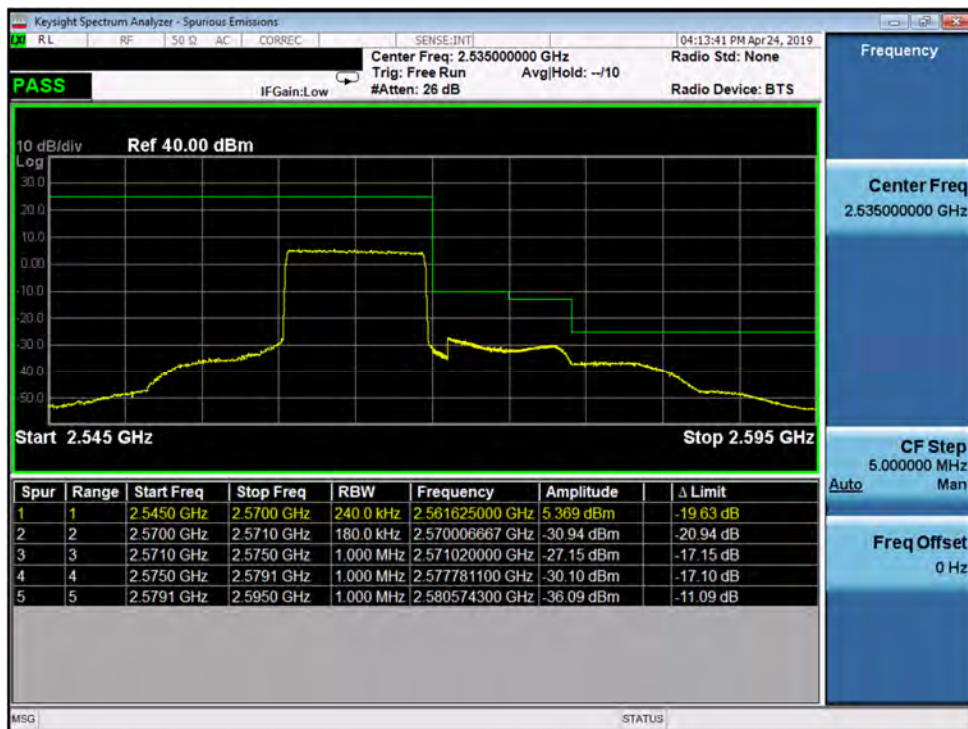


Plot 7-23. Upper ACP Plot (Band 7 - 5.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 28 of 47

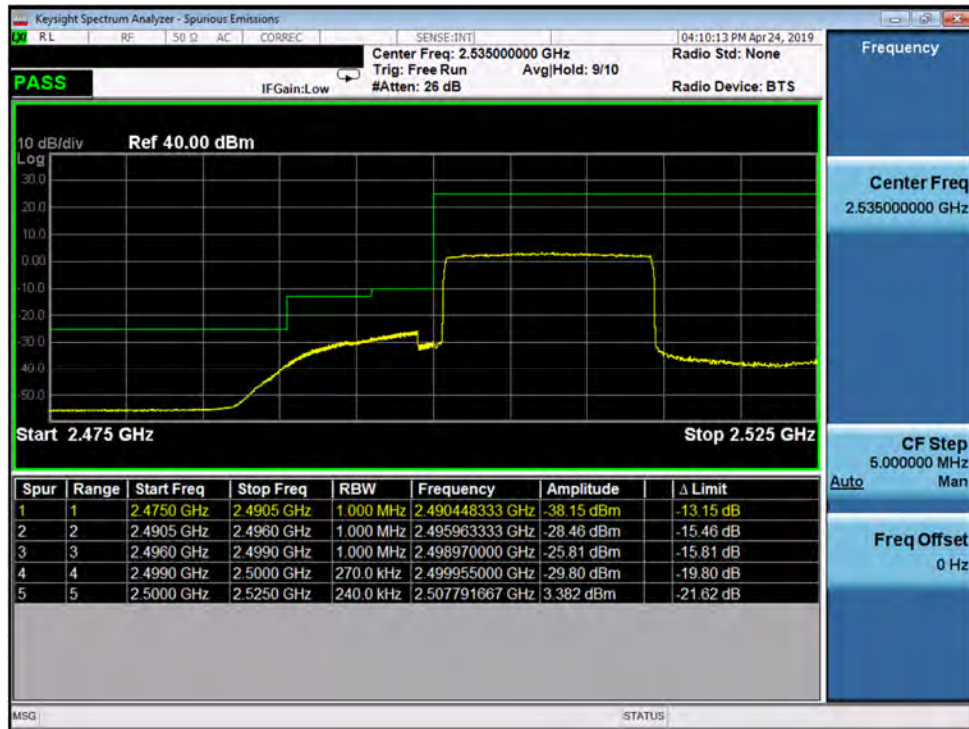


Plot 7-24. Lower ACP Plot (Band 7 - 10.0MHz QPSK - Full RB Configuration)



Plot 7-25. Upper ACP Plot (Band 7 - 10.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 29 of 47

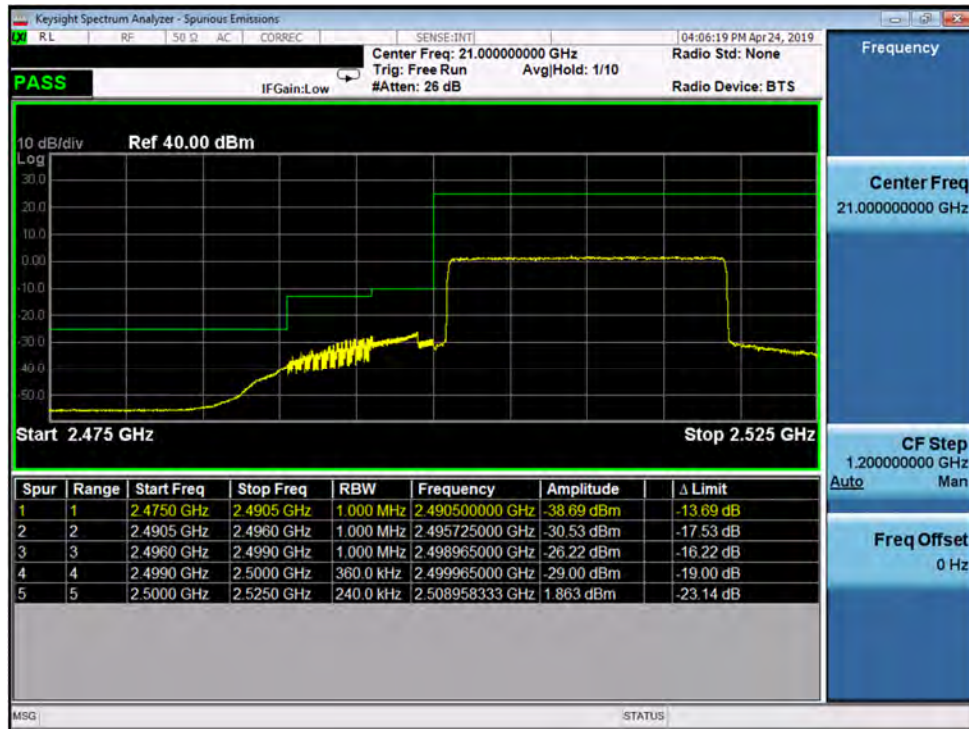


Plot 7-26. Lower ACP Plot (Band 7 - 15.0MHz QPSK - Full RB Configuration)



Plot 7-27. Upper ACP Plot (Band 7 - 15.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 30 of 47



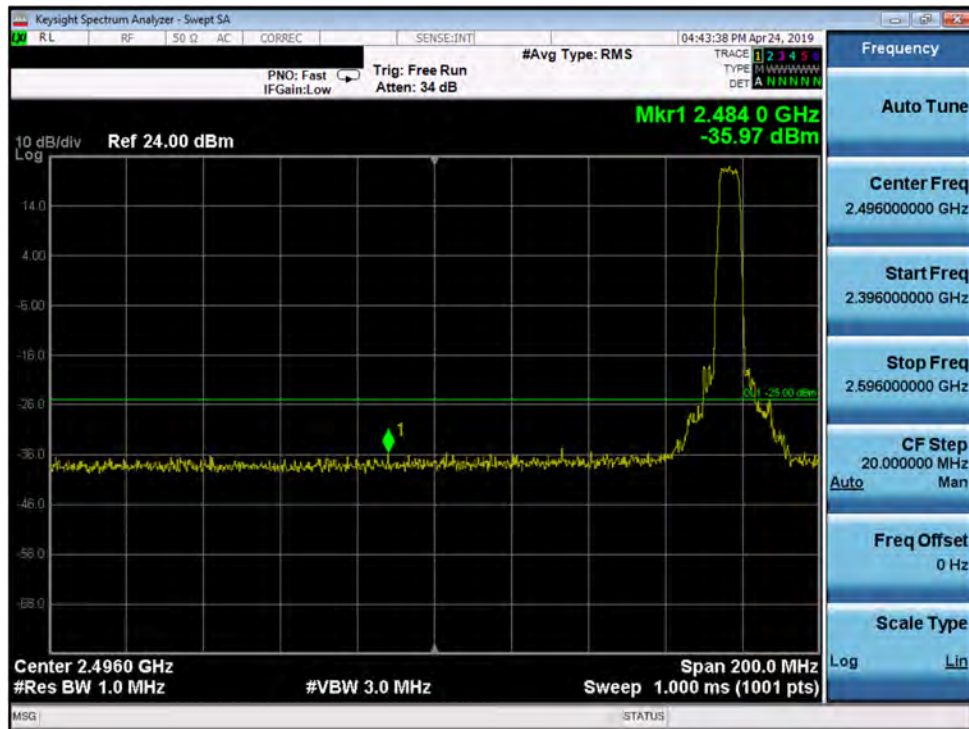
Plot 7-28. Lower ACP Plot (Band 7 - 20.0MHz QPSK - Full RB Configuration)



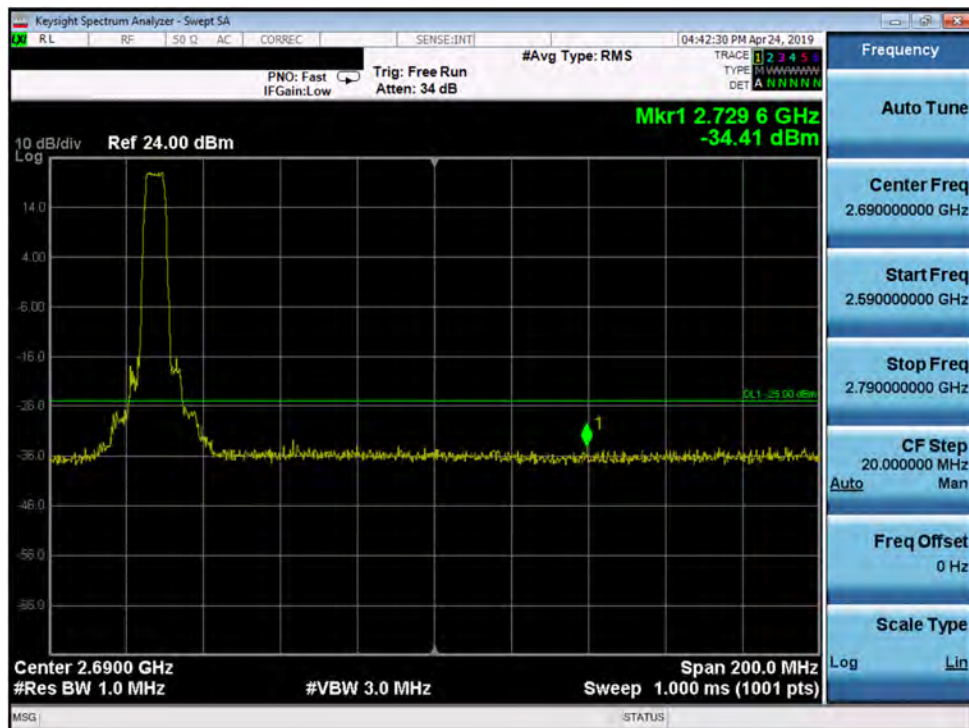
Plot 7-29. Upper ACP Plot (Band 7 - 20.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 31 of 47

Band 38

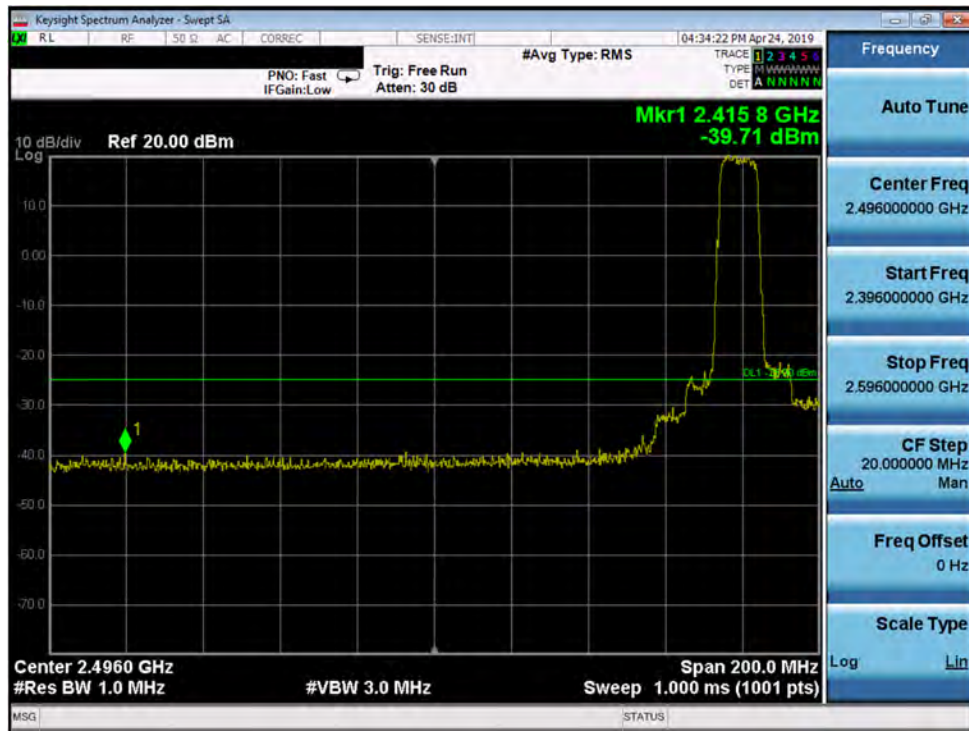


Plot 7-30. Lower Band Edge Plot (Band 38 - 5.0MHz QPSK - Full RB Configuration)

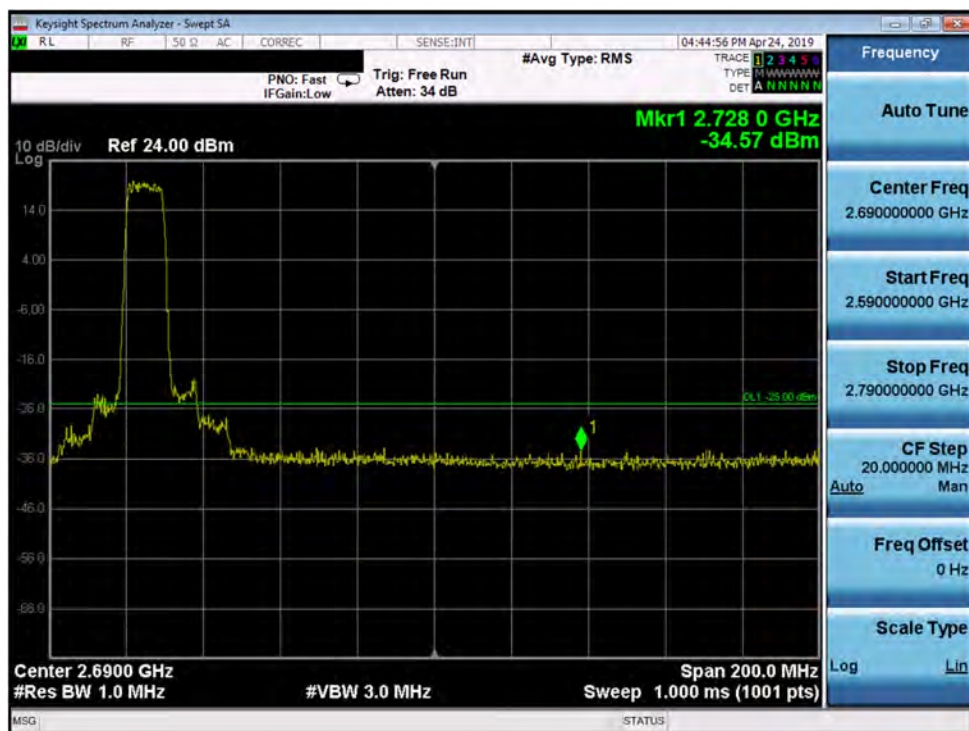


Plot 7-31. Upper Band Edge Plot (Band 38 - 5.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 32 of 47

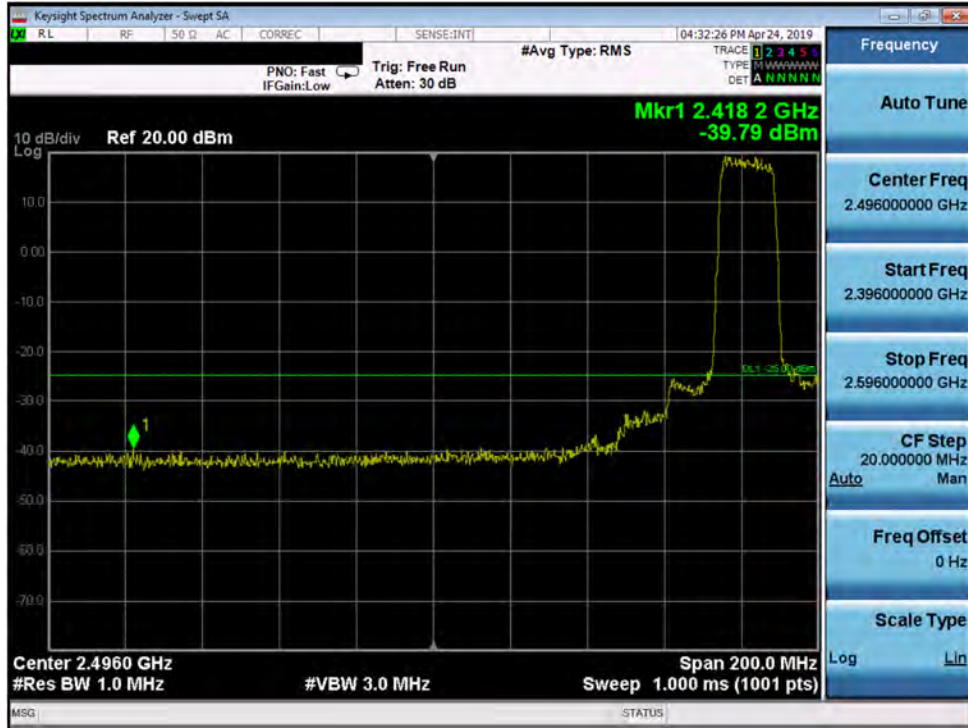


Plot 7-32. Lower Band Edge Plot (Band 38 - 10.0MHz QPSK - Full RB Configuration)

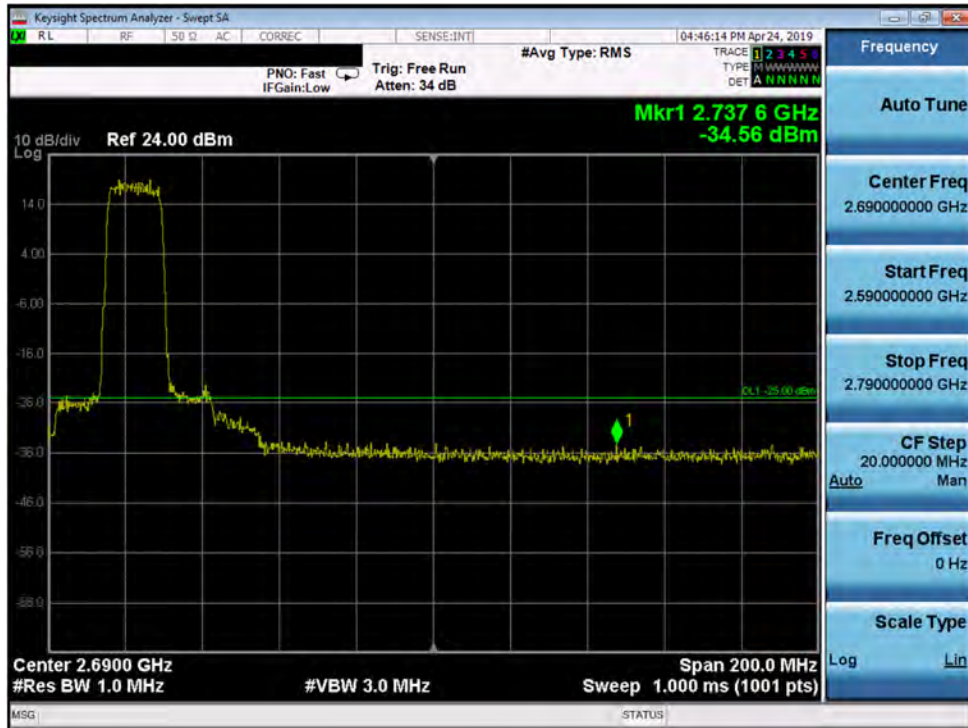


Plot 7-33. Upper Band Edge Plot (Band 38 - 10.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 33 of 47

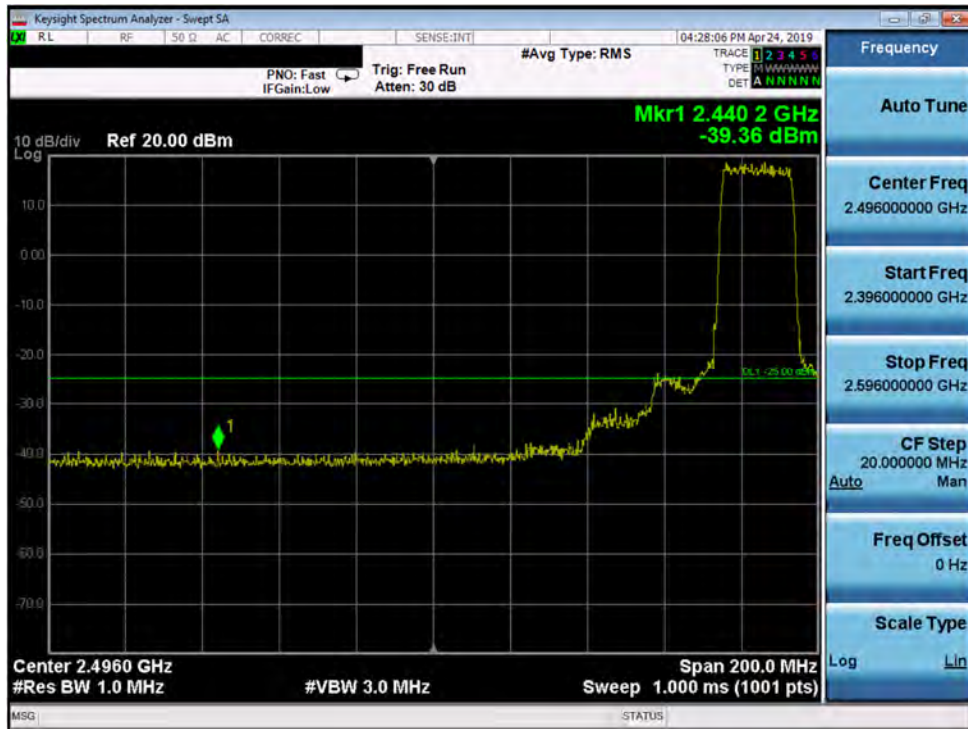


Plot 7-34. Lower Band Edge Plot (Band 38 - 15.0MHz QPSK - Full RB Configuration)

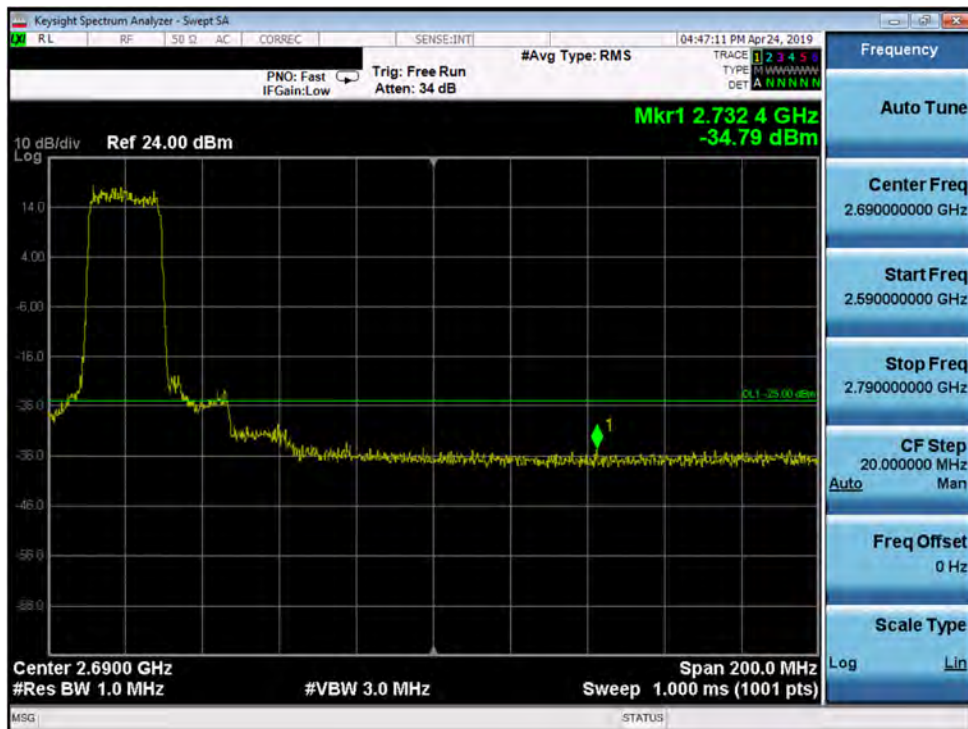


Plot 7-35. Upper Band Edge Plot (Band 38 - 15.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 34 of 47



Plot 7-36. Lower Band Edge Plot (Band 38 - 20.0MHz QPSK - Full RB Configuration)



Plot 7-37. Upper Band Edge Plot (Band 38 - 20.0MHz QPSK - Full RB Configuration)

FCC ID: A3LSMG977KOR	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 35 of 47

7.5 Radiated Power (ERP/EIRP)

Test Overview

Effective Radiated Power (ERP) and 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 below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 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 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: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset	Page 36 of 47	

Test Setup

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

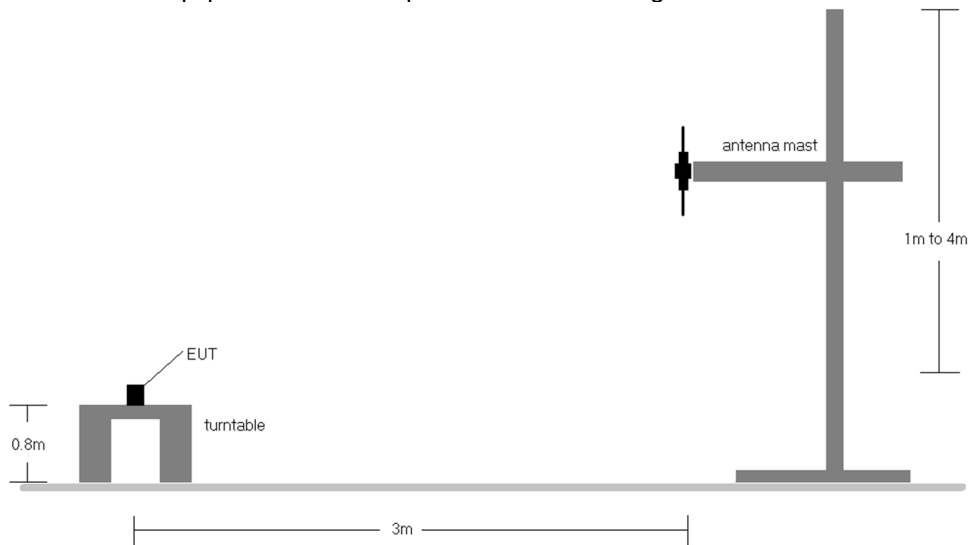


Figure 7-4. Radiated Test Setup <1GHz

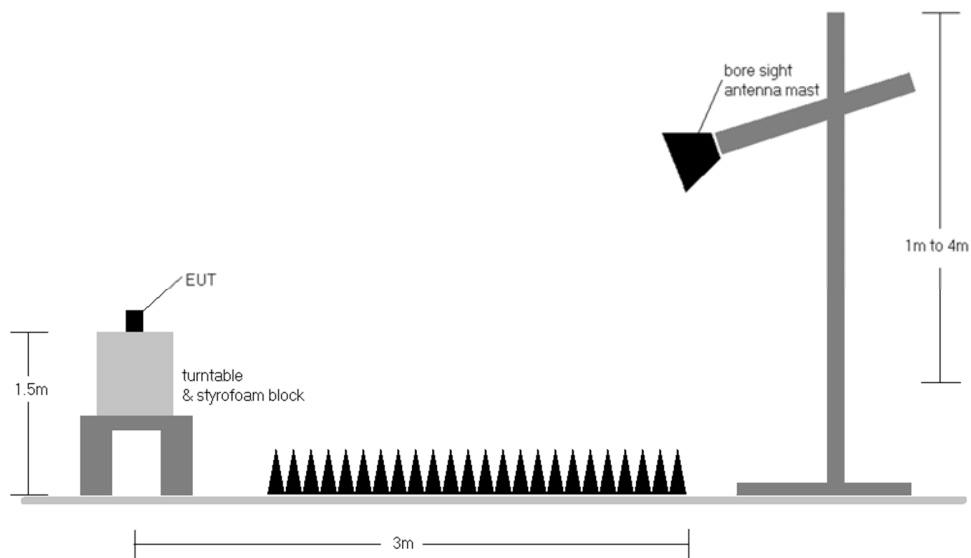


Figure 7-5. Radiated Test Setup >1GHz

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: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 37 of 47

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
2502.50	5	QPSK	H	101	210	1 / 0	13.05	3.78	16.83	0.048	33.01	-16.18
2535.00	5	QPSK	H	108	217	1 / 0	13.07	4.00	17.07	0.051	33.01	-15.94
2567.50	5	QPSK	H	110	223	1 / 0	12.83	4.12	16.95	0.049	33.01	-16.06
2535.00	5	16-QAM	H	108	217	1 / 0	11.49	4.00	15.49	0.035	33.01	-17.52
2535.00	5	64-QAM	H	108	217	1 / 0	10.78	4.00	14.78	0.030	33.01	-18.23
2505.00	10	QPSK	H	105	213	1 / 0	12.86	3.80	16.66	0.046	33.01	-16.35
2535.00	10	QPSK	H	106	222	1 / 0	12.99	4.00	16.99	0.050	33.01	-16.02
2565.00	10	QPSK	H	109	228	1 / 0	12.91	4.11	17.02	0.050	33.01	-15.99
2565.00	10	16-QAM	H	109	228	1 / 0	11.62	4.11	15.73	0.037	33.01	-17.28
2565.00	10	64-QAM	H	109	228	1 / 0	10.78	4.11	14.89	0.031	33.01	-18.12
2507.50	15	QPSK	H	100	210	1 / 0	12.91	3.81	16.72	0.047	33.01	-16.29
2535.00	15	QPSK	H	107	229	1 / 0	13.09	4.00	17.09	0.051	33.01	-15.92
2562.50	15	QPSK	H	112	234	1 / 0	12.84	4.11	16.95	0.050	33.01	-16.06
2535.00	15	16-QAM	H	107	229	1 / 0	11.43	4.00	15.43	0.035	33.01	-17.58
2535.00	15	64-QAM	H	107	229	1 / 0	10.58	4.00	14.58	0.029	33.01	-18.43
2510.00	20	QPSK	H	100	217	1 / 0	12.89	3.83	16.72	0.047	33.01	-16.29
2535.00	20	QPSK	H	105	221	1 / 0	13.00	4.00	17.00	0.050	33.01	-16.01
2560.00	20	QPSK	H	106	225	1 / 0	12.99	4.11	17.10	0.051	33.01	-15.91
2560.00	20	16-QAM	H	106	225	1 / 0	11.03	4.11	15.14	0.033	33.01	-17.87
2560.00	20	64-QAM	H	106	225	1 / 0	9.94	4.11	14.05	0.025	33.01	-18.96
2560.00	20	QPSK	V	147	87	1 / 0	12.51	4.11	16.62	0.046	33.01	-16.39
2560.00	20 (WCP)	QPSK	H	157	102	1 / 0	11.02	4.11	15.13	0.033	33.01	-17.88

Table 7-3. EIRP Data (Band 7)

FCC ID: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 38 of 47

7.6 Radiated Spurious Emissions Measurements

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 = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

FCC ID: A3LSMG977KOR		MEASUREMENT REPORT (CLASS II PERMISSIVE CHANGE)		Approved by: Quality Manager
Test Report S/N: 1M1904050054-02.A3L	Test Dates: 4/10-5/06/2019	EUT Type: Portable Handset		Page 39 of 47

Test Setup

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

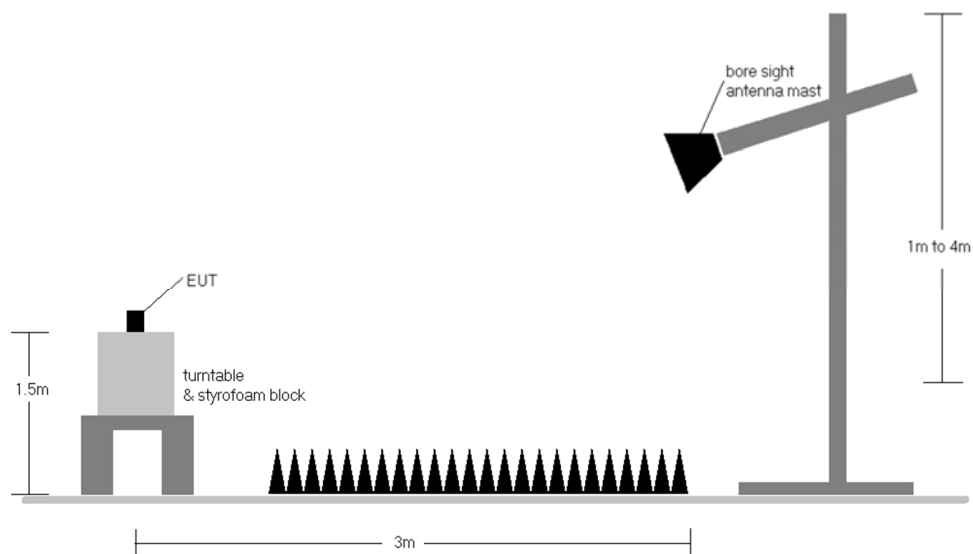


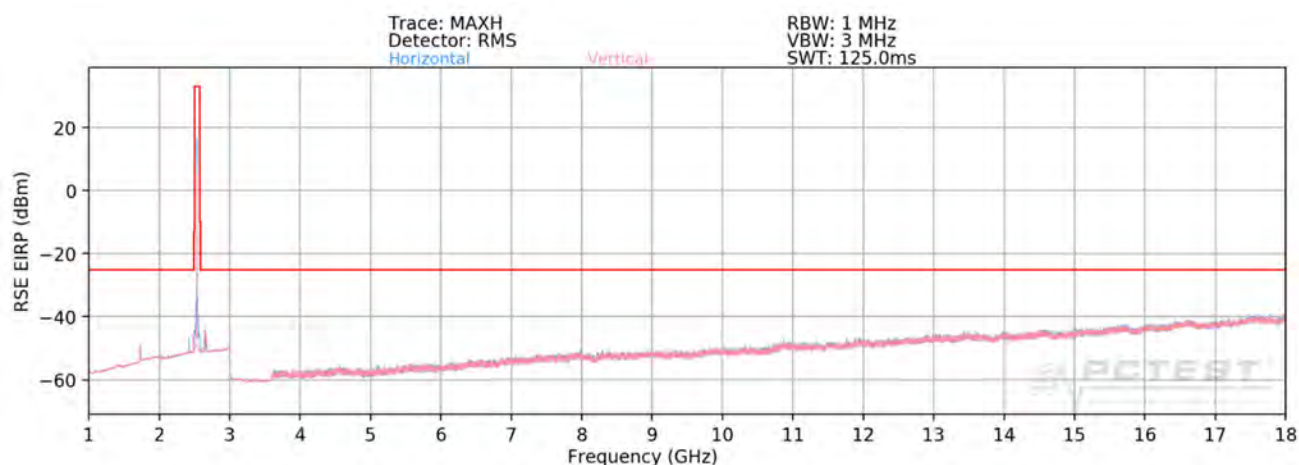
Figure 7-6. Test Instrument & Measurement Setup

Test Notes

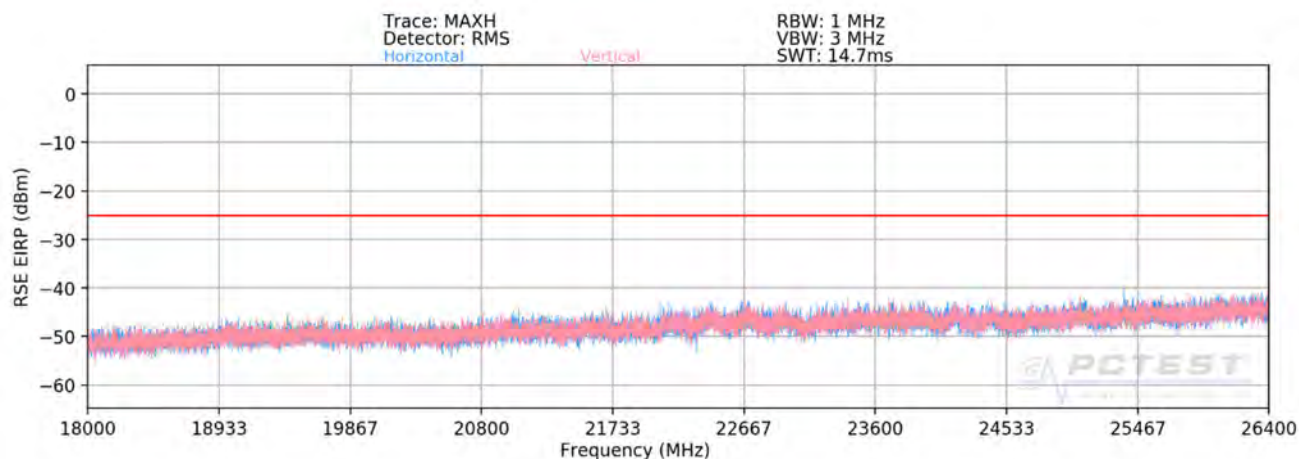
- 1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
- 2) This unit was tested with its standard battery.
- 3) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 4) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
- 5) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

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Band 7



Plot 7-38. Radiated Spurious Plot 1GHz - 18GHz (Band 7)



Plot 7-39. Radiated Spurious Plot 18GHz - 26.5GHz (Band 7)

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OPERATING FREQUENCY: 2510.00 MHz
 MODULATION SIGNAL: QPSK
 BANDWIDTH: 20.0 MHz
 DISTANCE: 3 meters
 LIMIT: -25 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]
5020.00	V	116	336	-67.91	8.56	-59.35	-34.3
7530.00	V	-	-	-65.17	8.46	-56.72	-31.7
10040.00	V	102	242	-59.00	9.85	-49.14	-24.1
12550.00	V	-	-	-61.06	9.06	-52.00	-27.0
15060.00	V	105	133	-57.48	8.74	-48.74	-23.7
17570.00	V	-	-	-51.84	7.63	-44.21	-19.2

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

OPERATING FREQUENCY: 2535.00 MHz
 MODULATION SIGNAL: QPSK
 BANDWIDTH: 20.0 MHz
 DISTANCE: 3 meters
 LIMIT: -25 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]
5070.00	V	-	-	-67.83	8.60	-59.23	-34.2
7605.00	V	-	-	-63.83	8.48	-55.34	-30.3
10140.00	V	102	315	-58.57	9.78	-48.79	-23.8
12675.00	V	-	-	-58.90	9.08	-49.83	-24.8
15210.00	V	-	-	-55.43	8.47	-46.96	-22.0

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

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OPERATING FREQUENCY: 2560.00 MHz
 MODULATION SIGNAL: QPSK
 BANDWIDTH: 20.0 MHz
 DISTANCE: 3 meters
 LIMIT: -25 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]
5120.00	V	115	341	-66.50	8.66	-57.84	-32.8
7680.00	V	-	-	-64.99	8.58	-56.42	-31.4
10240.00	V	102	126	-59.97	9.65	-50.31	-25.3
12800.00	V	-	-	-60.60	9.07	-51.52	-26.5
15360.00	V	100	183	-55.14	8.46	-46.68	-21.7

Table 7-6. Radiated Spurious Data (Band 7 – High Channel)

OPERATING FREQUENCY: 2560.00 MHz
 MODULATION SIGNAL: QPSK
 BANDWIDTH: 20.0 MHz
 DISTANCE: 3 meters
 LIMIT: -25 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]
5120.00	V	190	47	-68.32	8.66	-59.66	-34.7
7680.00	V	-	-	-65.15	8.58	-56.58	-31.6
10240.00	V	168	204	-61.99	9.65	-52.33	-27.3
12800.00	V	-	-	-60.71	9.07	-51.63	-26.6

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

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7.7 Frequency Stability / Temperature Variation

Test Overview and Limit

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

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

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

Test Procedure Used

ANSI/TIA-603-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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Band 7 Frequency Stability Measurements

OPERATING FREQUENCY: 2,535,000,000 Hz
 CHANNEL: 21100
 REFERENCE VOLTAGE: 4.29 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.29	- 30	2,534,999,636	-364	-0.0000144
100 %		- 20	2,534,999,741	-259	-0.0000102
100 %		- 10	2,535,000,005	5	0.0000002
100 %		0	2,535,000,045	45	0.0000018
100 %		+ 10	2,535,000,012	12	0.0000005
100 %		+ 20	2,535,000,416	416	0.0000164
100 %		+ 30	2,534,999,992	-8	-0.0000003
100 %		+ 40	2,534,999,649	-351	-0.0000138
100 %		+ 50	2,534,999,963	-37	-0.0000015
BATT. ENDPOINT	3.67	+ 20	2,535,000,227	227	0.0000090

Table 7-8. Frequency Stability Data (Band 7)

Note:

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

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Band 7 Frequency Stability Measurements

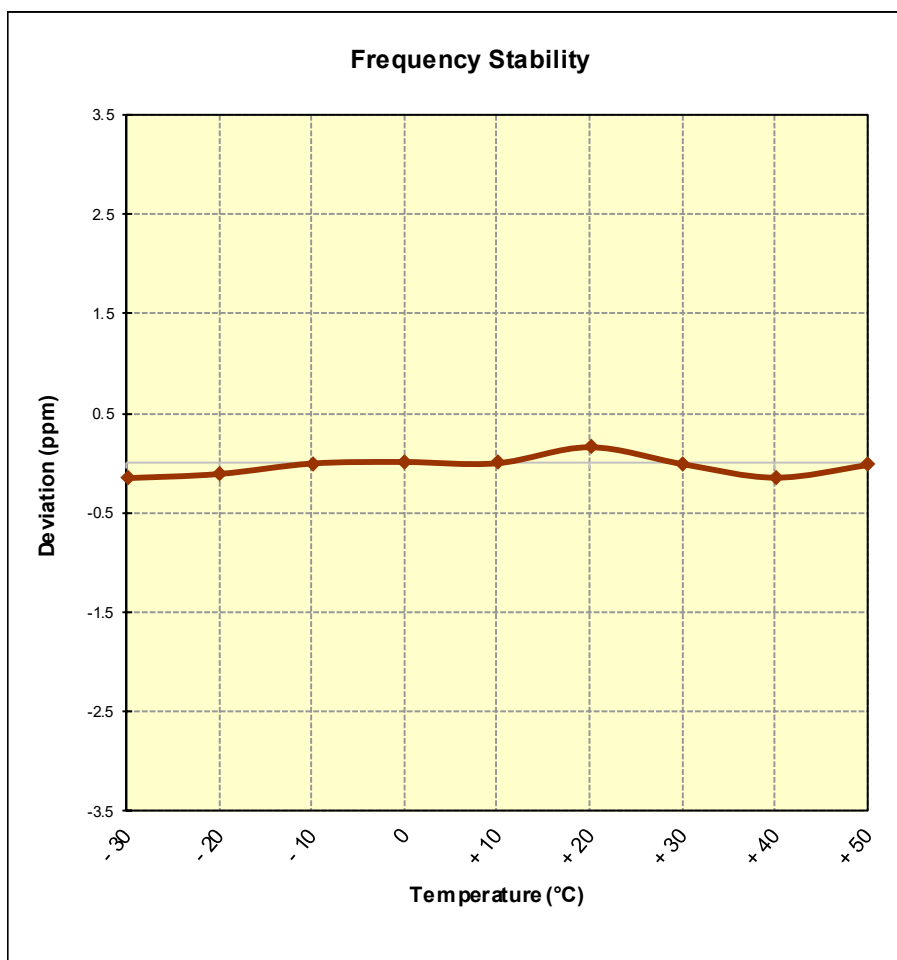


Figure 7-7. Frequency Stability Graph (Band 7)

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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: A3LSMG977KOR** complies with all the requirements of Part 27 of the FCC Rules for LTE operation only.

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