

**MEASUREMENT REPORT**
FCC Part 22 & 90**Applicant Name:**

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

Date of Testing:

05/22 - 07/10/2019

Test Site/Location:

PCTEST Lab. Columbia, MD, USA

Test Report Serial No.:

1M1905220084-05.A3L

FCC ID:

A3LSMN970U

APPLICANT:

Samsung Electronics Co., Ltd.

Application Type:

Certification

Model:

SM-N970U

Additional Model(s):

SM-N970U1, SM-N970XU, SM-N970W

EUT Type:

Portable Handset

FCC Classification:

PCS Licensed Transmitter Held to Ear (PCE)

FCC Rule Part: Test

§2.1049, §22(H), §90(S), §90(R)

Procedure(s):

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

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.

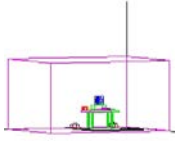

Randy Ortanez
President

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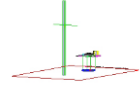
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Mode	Tx Frequency (MHz)	Measurement	Max. Power (W)	Max. Power (dBm)	Emission Designator	Modulation
LTE Band 14	790.5 - 795.5	ERP	0.080	19.01	4M52G7D	QPSK
LTE Band 14	790.5 - 795.5	ERP	0.064	18.03	4M50W7D	16-QAM
LTE Band 14	790.5 - 795.5	ERP	0.054	17.33	4M52W7D	64-QAM
LTE Band 14	790.5 - 795.5	ERP	0.033	15.23	4M51W7D	256-QAM
LTE Band 14	793	ERP	0.085	19.30	9M05G7D	QPSK
LTE Band 14	793	ERP	0.069	18.41	8M99W7D	16-QAM
LTE Band 14	793	ERP	0.059	17.70	9M03W7D	64-QAM
LTE Band 14	793	ERP	0.037	15.64	9M01W7D	256-QAM
CDMA800 (BC10)	817.9 - 823.1	Conducted	0.296	24.71	1M27F9W	CDMA
LTE Band 26	814.7 - 823.3	Conducted	0.317	25.01	1M08G7D	QPSK
LTE Band 26	814.7 - 823.3	Conducted	0.251	24.00	1M09W7D	16-QAM
LTE Band 26	814.7 - 823.3	Conducted	0.217	23.37	1M09W7D	64-QAM
LTE Band 26	814.7 - 823.3	Conducted	0.101	20.05	1M08W7D	256-QAM
LTE Band 26	815.5 - 822.5	Conducted	0.306	24.86	2M68G7D	QPSK
LTE Band 26	815.5 - 822.5	Conducted	0.249	23.96	2M70W7D	16-QAM
LTE Band 26	815.5 - 822.5	Conducted	0.195	22.89	2M70W7D	64-QAM
LTE Band 26	815.5 - 822.5	Conducted	0.101	20.03	2M69W7D	256-QAM
LTE Band 26	816.5 - 821.5	Conducted	0.310	24.91	4M49G7D	QPSK
LTE Band 26	816.5 - 821.5	Conducted	0.252	24.02	4M48W7D	16-QAM
LTE Band 26	816.5 - 821.5	Conducted	0.214	23.31	4M49W7D	64-QAM
LTE Band 26	816.5 - 821.5	Conducted	0.102	20.09	4M49W7D	256-QAM
LTE Band 26	819	Conducted	0.317	25.01	9M01G7D	QPSK
LTE Band 26	819	Conducted	0.263	24.20	8M95W7D	16-QAM
LTE Band 26	819	Conducted	0.201	23.04	9M00W7D	64-QAM
LTE Band 26	819	Conducted	0.103	20.12	8M96W7D	256-QAM
LTE Band 26	821.5	Conducted	0.317	25.01	13M4G7D	QPSK
LTE Band 26	821.5	Conducted	0.269	24.30	13M4W7D	16-QAM
LTE Band 26	821.5	Conducted	0.203	23.07	13M5W7D	64-QAM
LTE Band 26	821.5	Conducted	0.104	20.19	13M4W7D	256-QAM
LTE Band 26	821.5	ERP	0.101	20.05	13M4G7D	QPSK
LTE Band 26	821.5	ERP	0.092	19.62	13M4W7D	16-QAM
LTE Band 26	821.5	ERP	0.086	19.32	13M5W7D	64-QAM
LTE Band 26	821.5	ERP	0.055	17.38	13M4W7D	256-QAM

EUT Overview

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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 and KDB 414788 D01 v01.

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 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMN970U**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 90(R), 22(H) and 90(S).

Test Device Serial No.: 1017M, 1291M, 1292M, 1032M, 1281M

2.2 Device Capabilities

This device contains the following capabilities:

800/850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC, ANT+, Wireless Power Transfer

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 lying flat 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 Evaluation Procedure

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

3.2 Radiated Power and Radiated Spurious Emissions

§2.1053, §90.635, §90(S), §90(R)

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

The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer “Channel Power” function with the integration band set to the emissions’ occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v03r01.

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

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

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

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

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

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

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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	8/23/2018	Annual	8/23/2019	LTx1
Agilent	E5515C	Wireless Communications Test Set	N/A			GB45360985
Agilent	N9030A	PXA Signal Analyzer (44GHz)	6/12/2019	Annual	6/12/2020	MY52350166
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	3160-09	Small Horn (18 - 26.5GHz)	8/9/2018	Biennial	8/9/2020	135427
Espec	ESX-2CA	Environmental Chamber	6/13/2019	Annual	6/13/2020	17620
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
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			11403100002
Rohde & Schwarz	CMU200	Base Station Simulator	N/A			109892
Rohde & Schwarz	CMU200	Base Station Simulator	N/A			836536/0005
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			100976
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	9/19/2018	Annual	9/19/2019	100040
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	6/5/2019	Annual	6/5/2020	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	8/9/2018	Annual	8/9/2019	100348
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/18/2019	Annual	7/18/2019	102134
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	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
Sunol	DRH-118	Horn Antenna (1-18 GHz)	8/11/2017	Biennial	8/11/2019	A042511

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

Emission Designator = 1M25F9W

CDMA BW = 1.25 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data) (Measured at the 99.75% power bandwidth)

Spurious Radiated Emission – BC10

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

The average spectrum 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 2453.70 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80) = 50.3 dBc.

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

LTE BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

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: A3LSMN970U
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)
 Mode(s): CDMA / EVDO / LTE
 Band: Band Class 10 / Band 26 / Band 14

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051 90(S) 90(R)	Conducted Band Edge / Spurious Emissions	On all frequencies between 769-775 MHz and 799-805 MHz, attenuation by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations. On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, attenuation by at least $43 + 10 \log(P)$ dB.(Band 14) > $43 + 10 \log_{10}(P[\text{Watts}])$ for all out-of-band emissions except > $50 + 10 \log_{10}(P[\text{Watts}])$ at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge (Band 26)		PASS	Sections 7.3, 7.4
2.1055 90.213	Frequency Stability	< 2.5 ppm		PASS	Section 7.8
2.1046 90.635	Conducted Power	< 100 Watts		PASS	Section 7.5
22.913(a.2)	Effective Radiated Power (Band 26)	< 7 Watts max. ERP	RADIATED	PASS	Section 7.6
90.542(a)(7)	Effective Radiated Power (Band 14)	< 3 Watts max. ERP		PASS	Section 7.6
2.1053 90(S) 90(R)	Radiated Spurious Emissions	> $43 + 10 \log_{10}(P[\text{Watts}])$ for all out-of-band emissions except > $50 + 10 \log_{10}(P[\text{Watts}])$ at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge		PASS	Section 7.7

Table 7-1. Summary of 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 shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
- 4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "2G/3G Automation," Version 4.1.

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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.

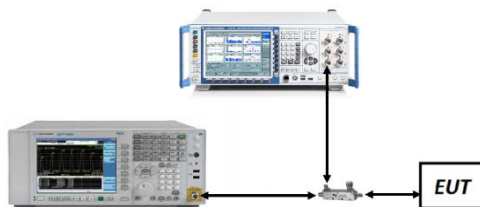


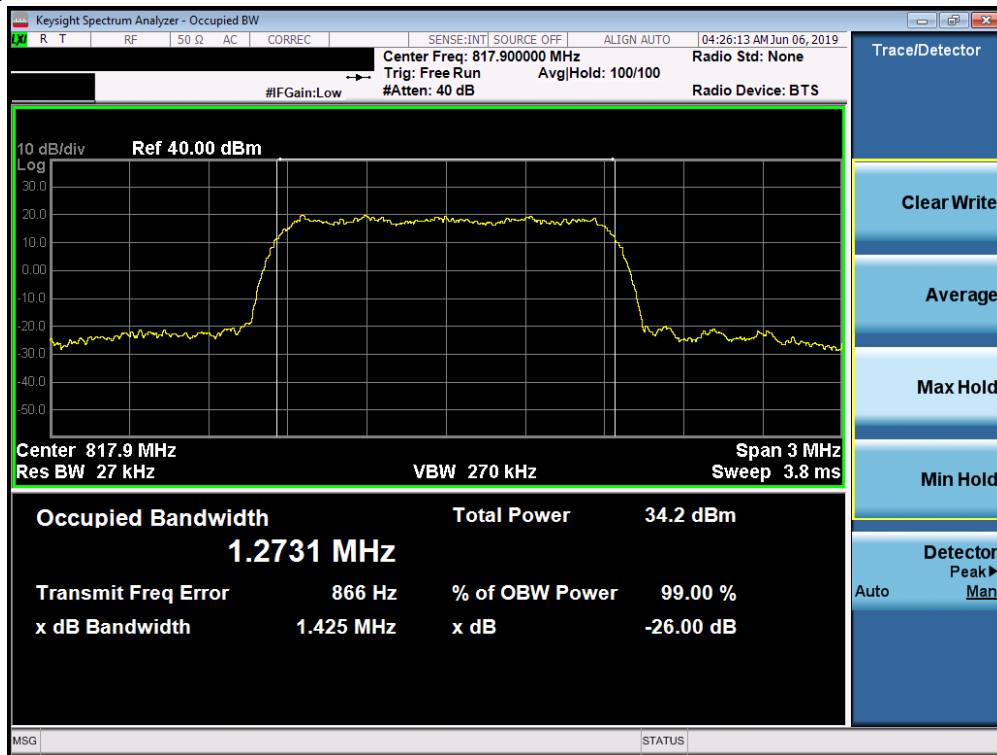
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

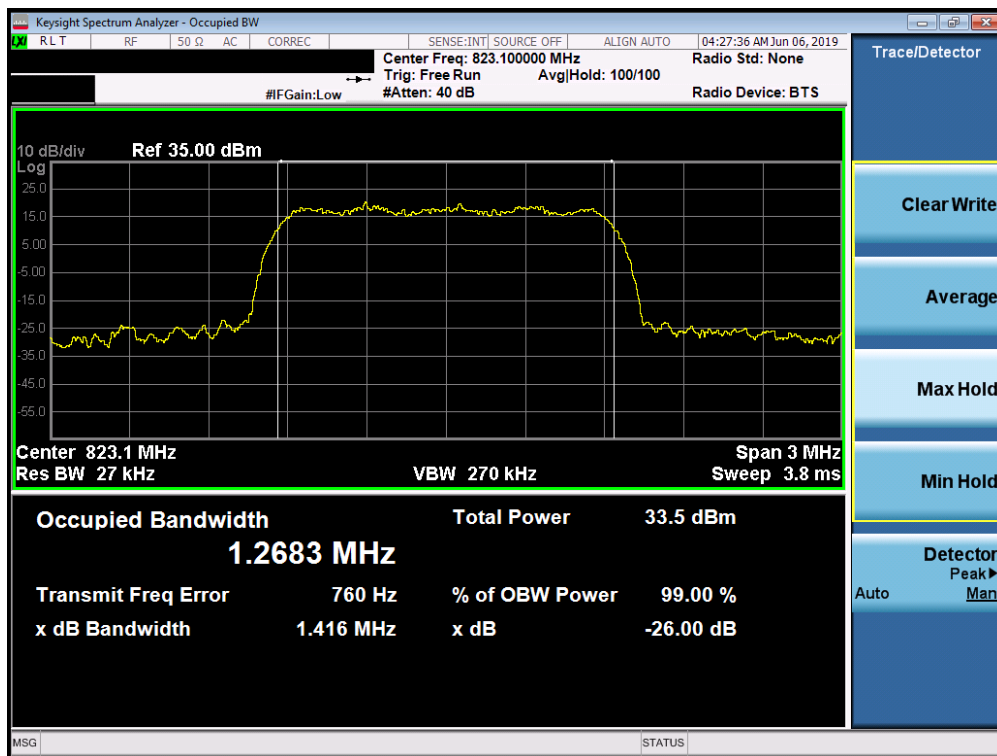
None.

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 12 of 62

CDMA BC10



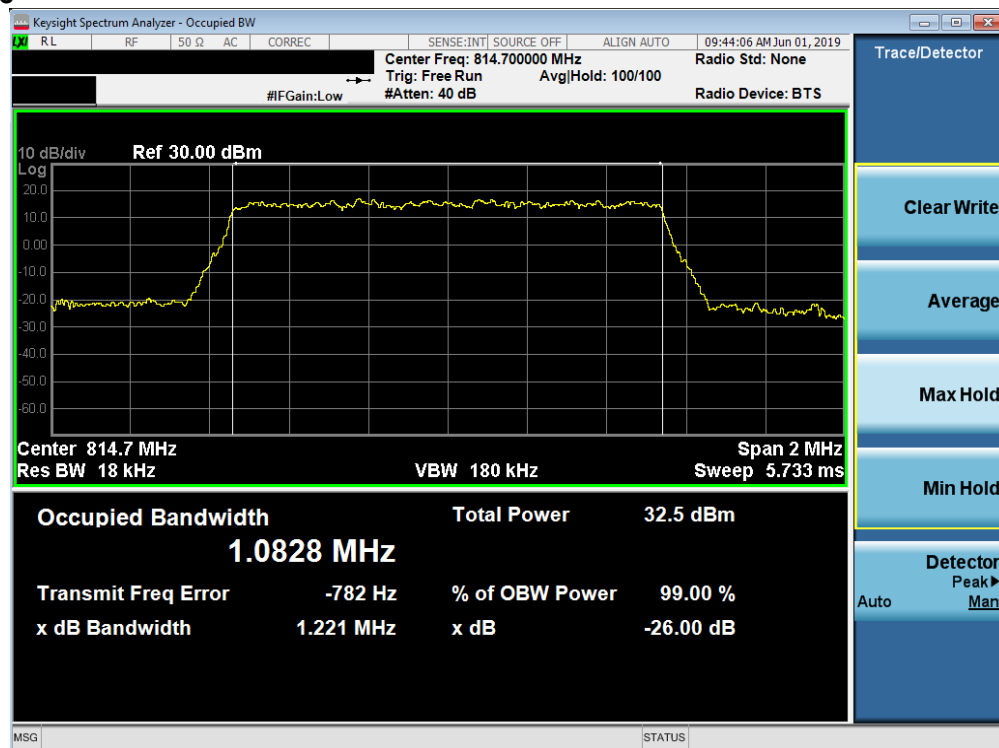
Plot 7-1. Occupied Bandwidth Plot (CDMA BC10 - Ch. 476)



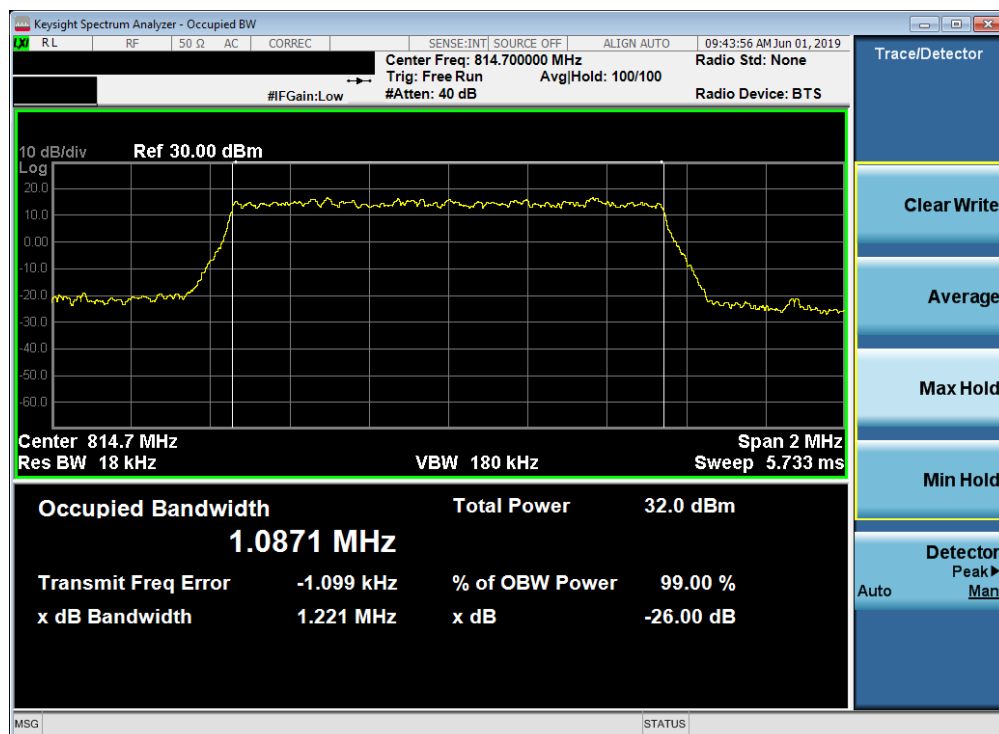
Plot 7-2. Occupied Bandwidth Plot (CDMA BC10 - Ch. 684)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 13 of 62

LTE Band 26

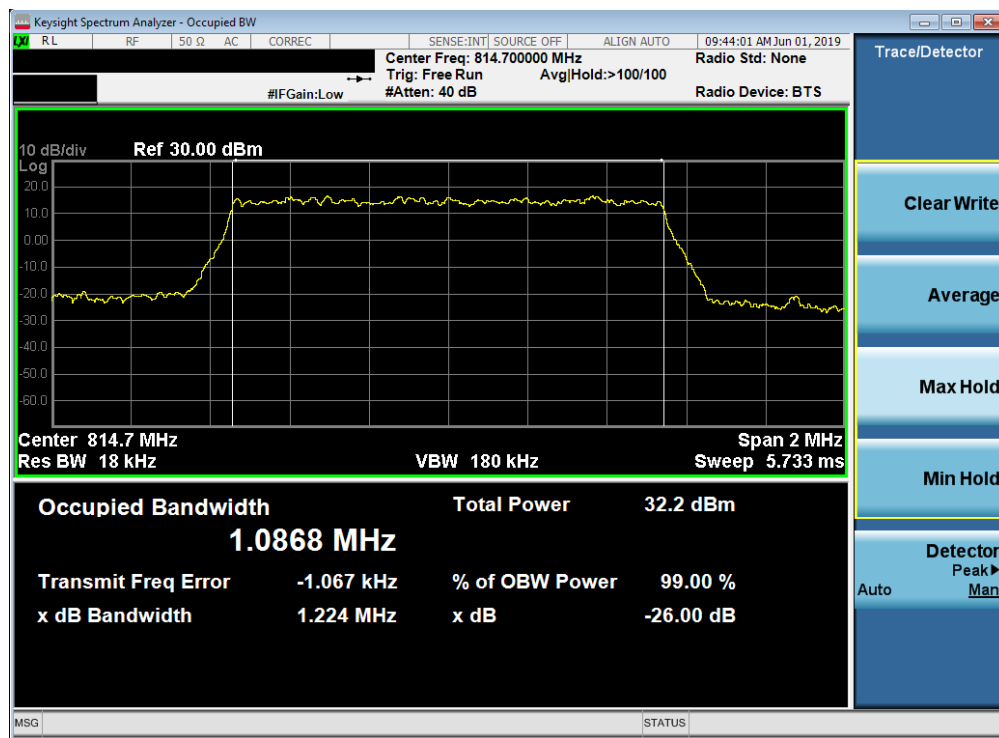


Plot 7-3. Occupied Bandwidth Plot (LTE Band 26, 1.4MHz QPSK – RB Size 6– Low Channel)

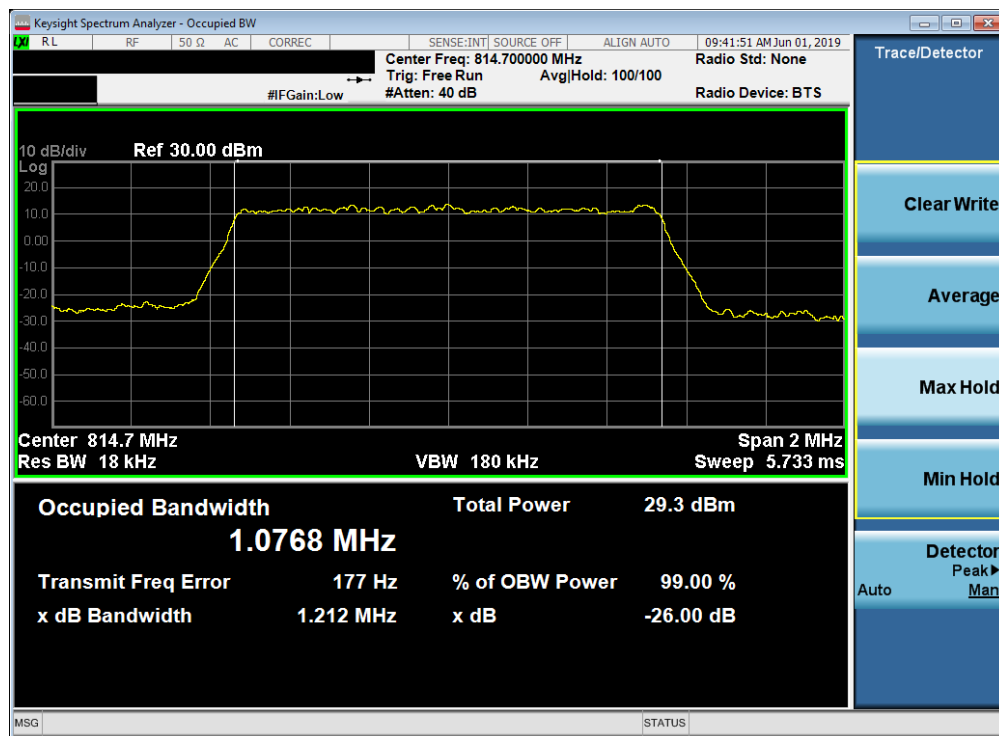


Plot 7-4. Occupied Bandwidth Plot (LTE Band 26, 1.4MHz 16-QAM – RB Size 6– Low Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 14 of 62

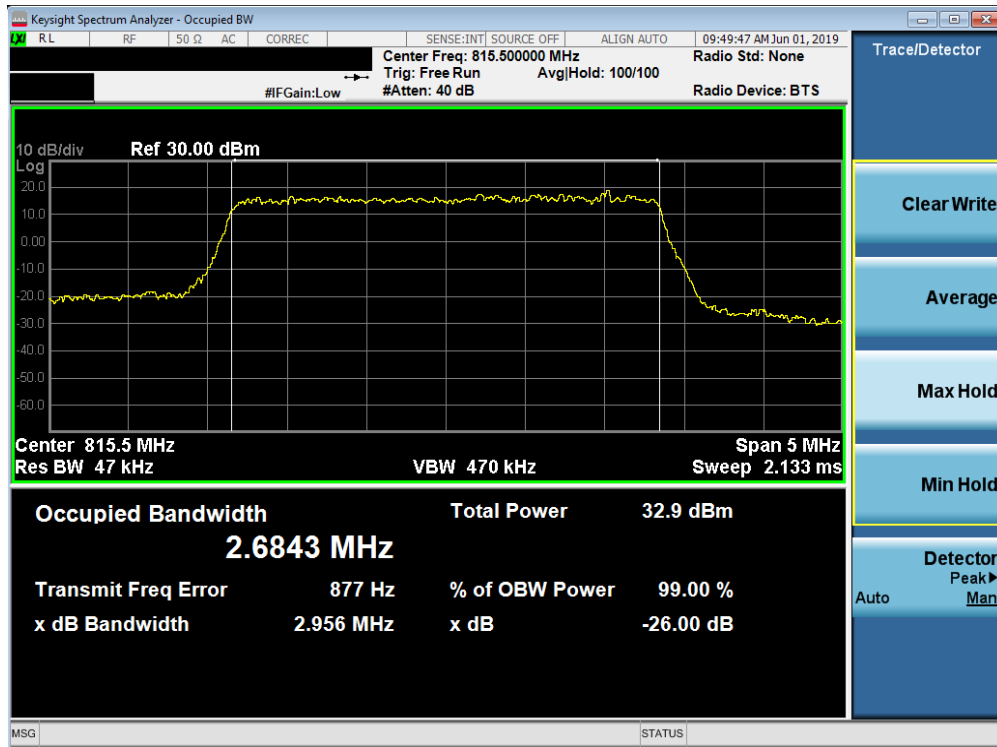


Plot 7-5. Occupied Bandwidth Plot (LTE Band 26, 1.4MHz 64-QAM – RB Size 6– Low Channel)

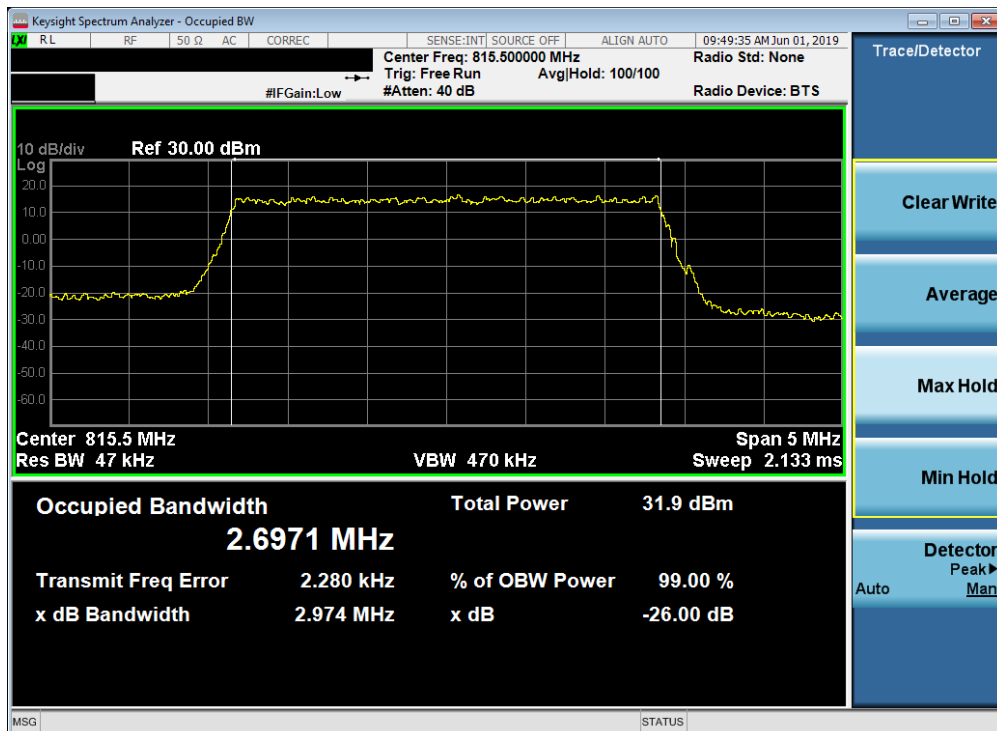


Plot 7-6. Occupied Bandwidth Plot (LTE Band 26, 1.4MHz 256-QAM – RB Size 6– Low Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 15 of 62

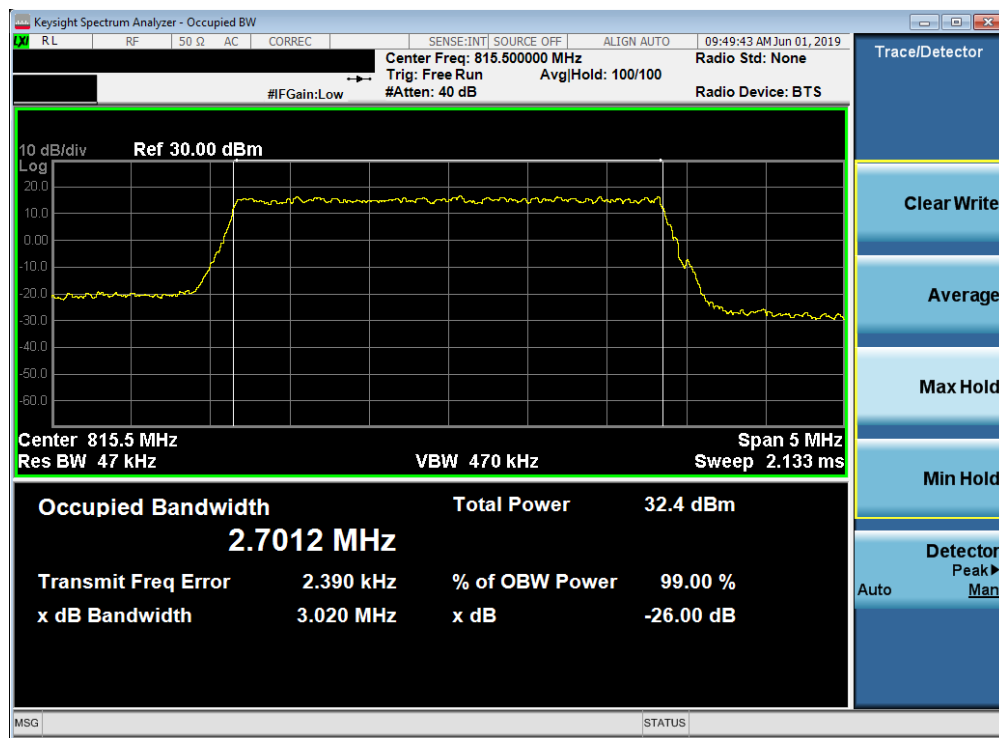


Plot 7-7. Occupied Bandwidth Plot (LTE Band 26, 3MHz QPSK – RB Size 15– Low Channel)

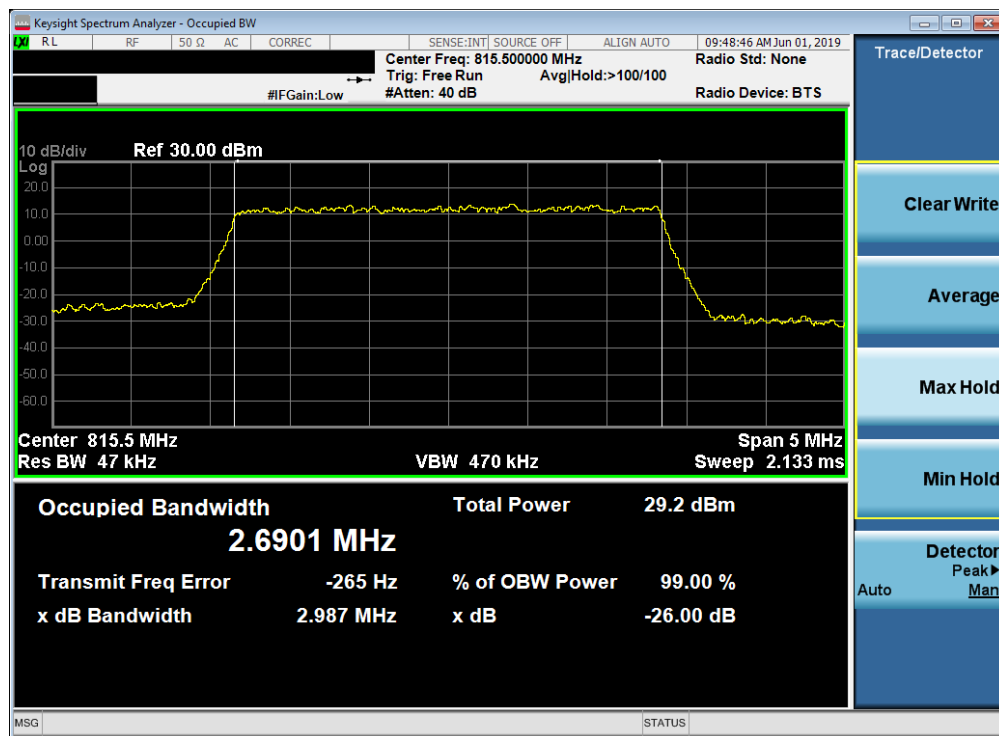


Plot 7-8. Occupied Bandwidth Plot (LTE Band 26, 3MHz 16-QAM – RB Size 15– Low Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 16 of 62

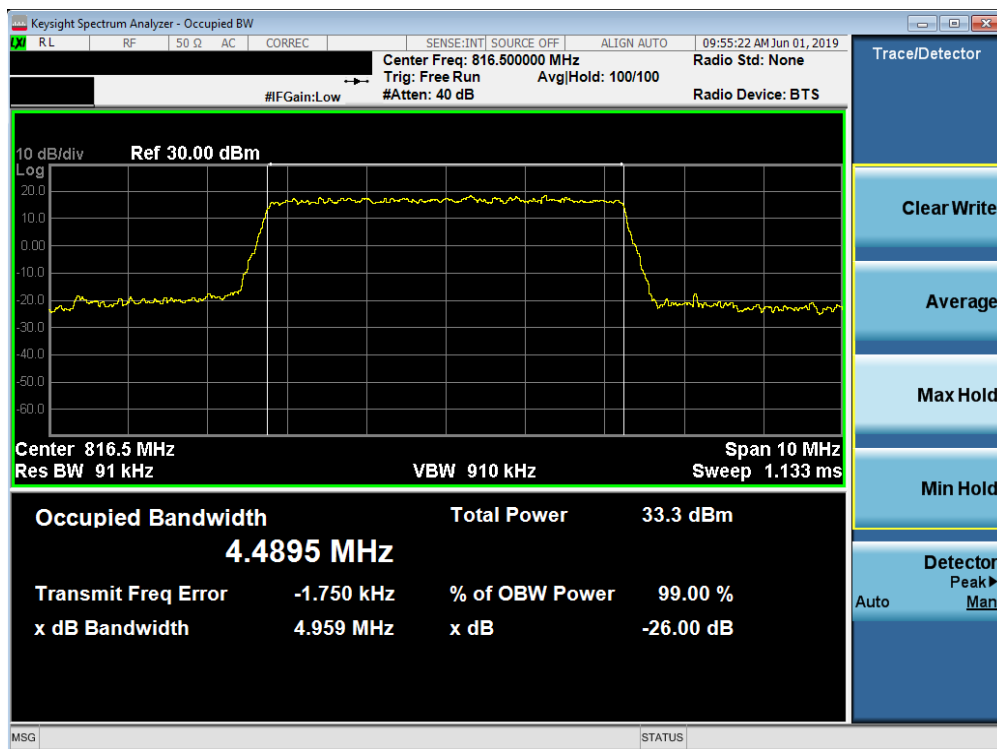


Plot 7-9. Occupied Bandwidth Plot (LTE Band 26, 3MHz 64-QAM – RB Size 15– Low Channel)

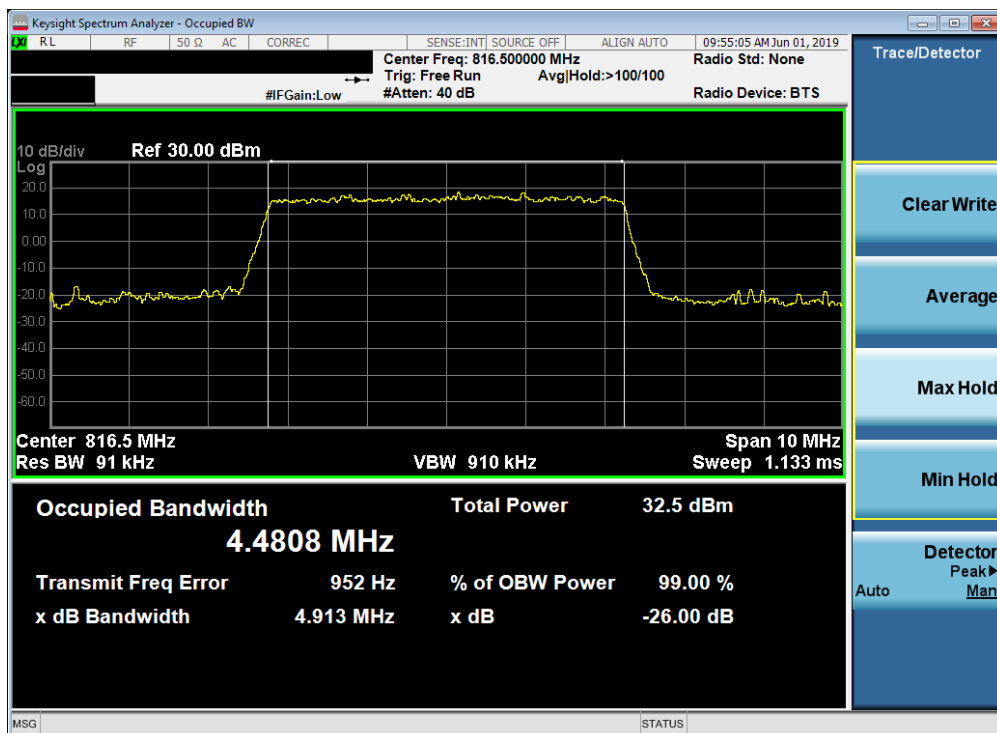


Plot 7-10. Occupied Bandwidth Plot (LTE Band 26, 3MHz 256-QAM – RB Size 15– Low Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 17 of 62

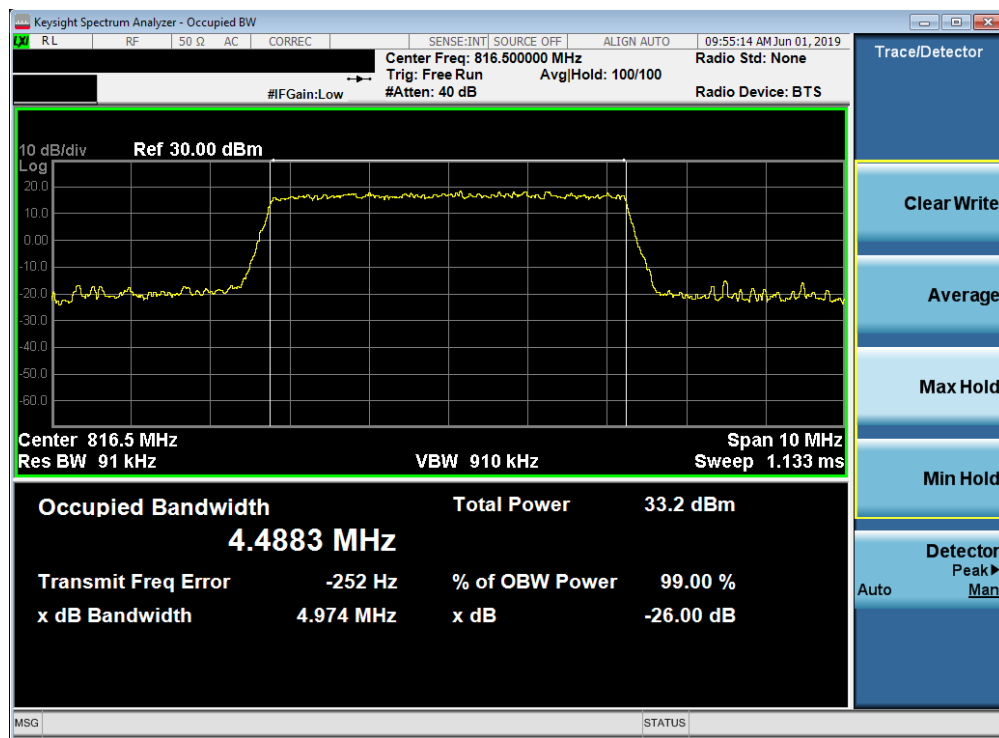


Plot 7-11. Occupied Bandwidth Plot (LTE Band 26, 5MHz QPSK – RB Size 25– Low Channel)

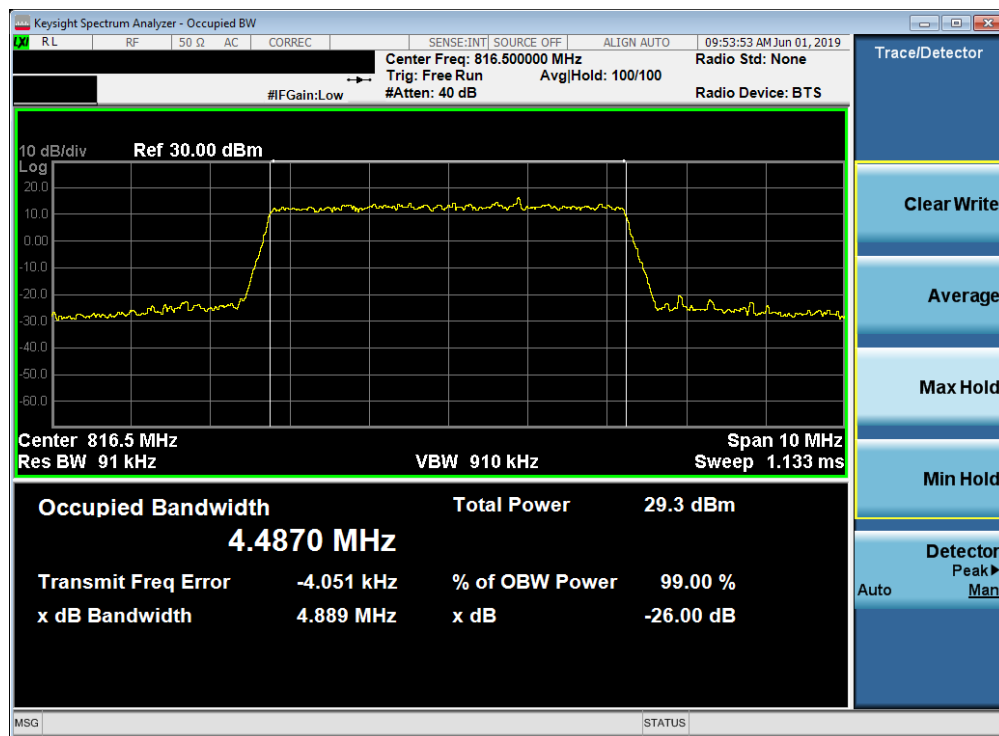


Plot 7-12. Occupied Bandwidth Plot (LTE Band 26, 5MHz 16-QAM – RB Size 25– Low Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 18 of 62

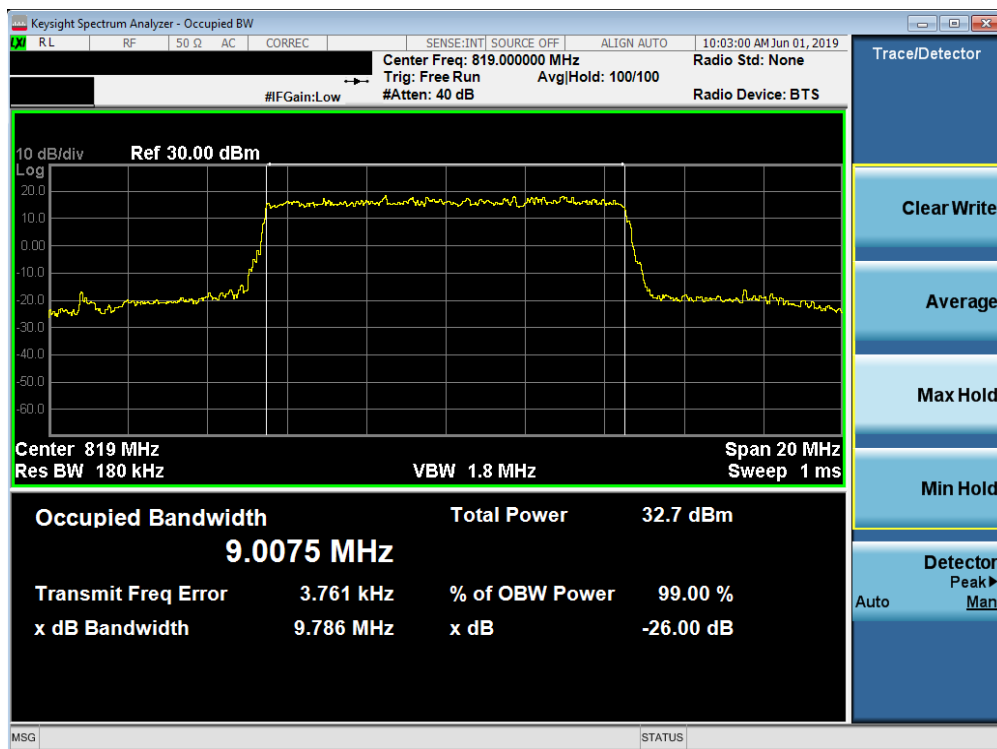


Plot 7-13. Occupied Bandwidth Plot (LTE Band 26, 5MHz 64-QAM – RB Size 25– Low Channel)

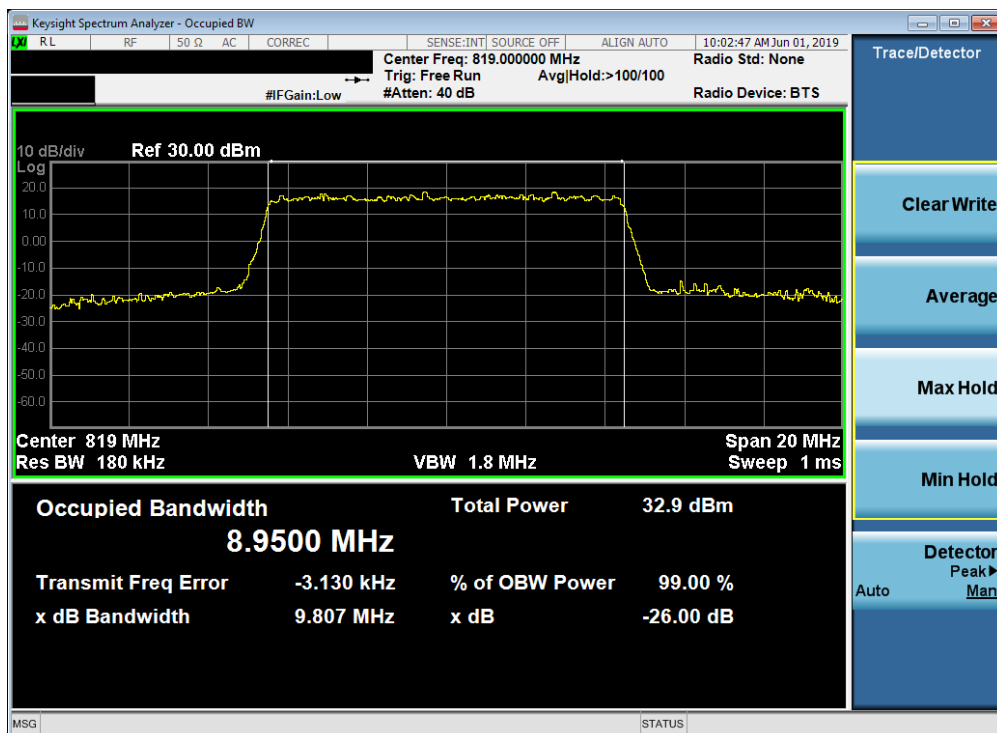


Plot 7-14. Occupied Bandwidth Plot (LTE Band 26, 5MHz 256-QAM – RB Size 25– Low Channel)

FCC ID: A3LSMN970U	MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 19 of 62

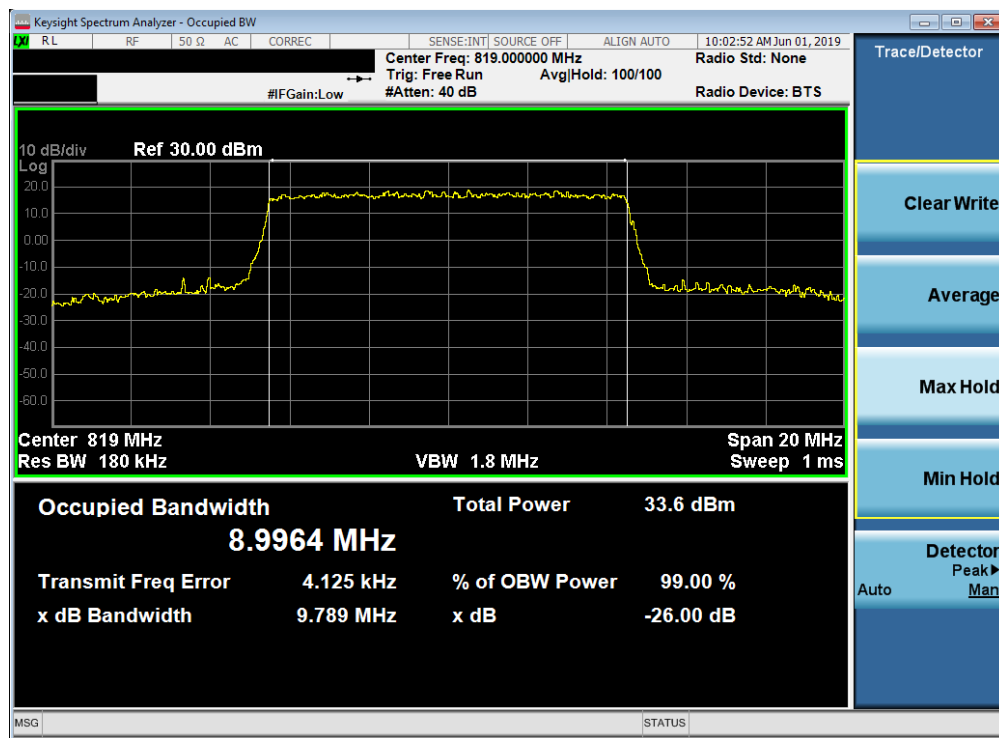


Plot 7-15. Occupied Bandwidth Plot (LTE Band 26, 10MHz QPSK – RB Size 50)

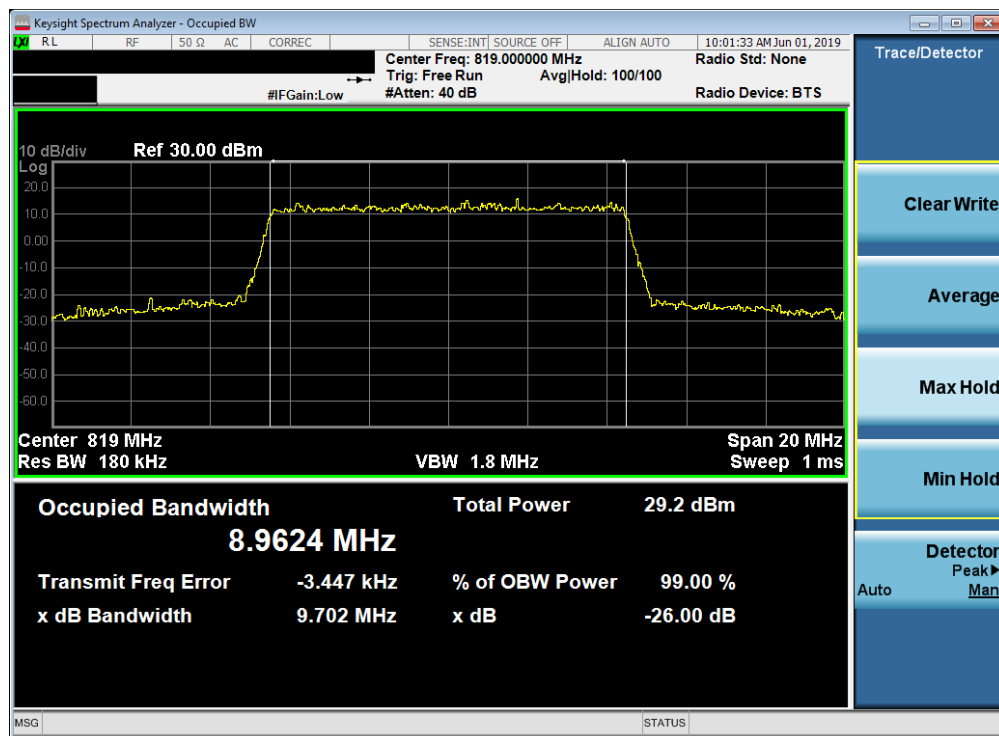


Plot 7-16. Occupied Bandwidth Plot (LTE Band 26, 10MHz 16-QAM – RB Size 50)

FCC ID: A3LSMN970U	MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 20 of 62

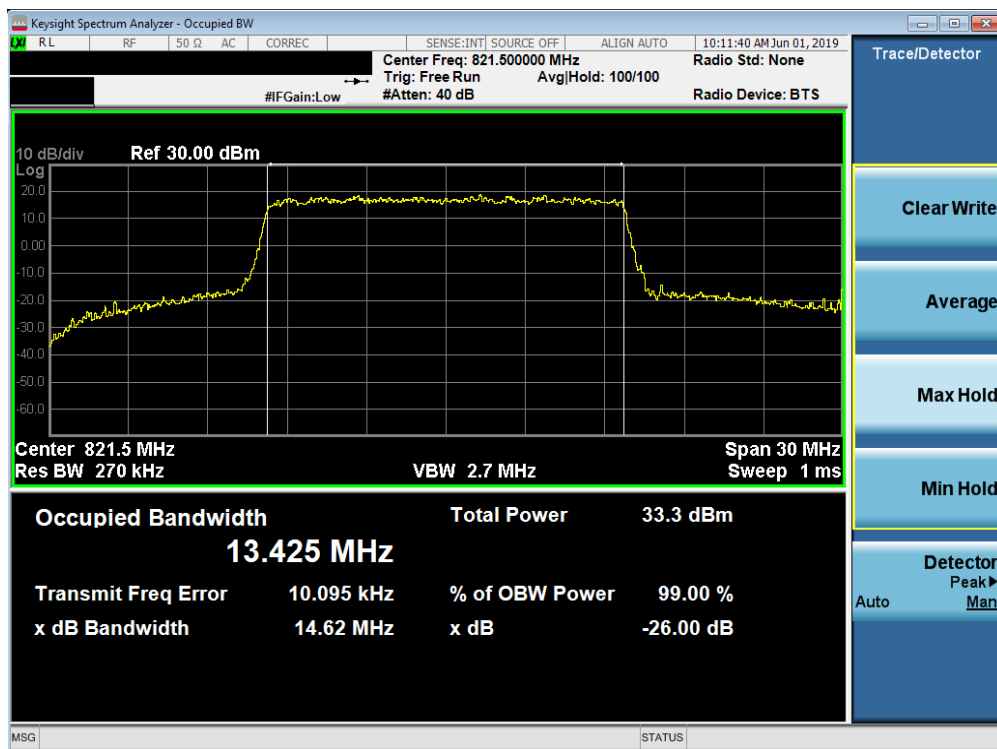


Plot 7-17. Occupied Bandwidth Plot (LTE Band 26, 10MHz 64-QAM – RB Size 50)

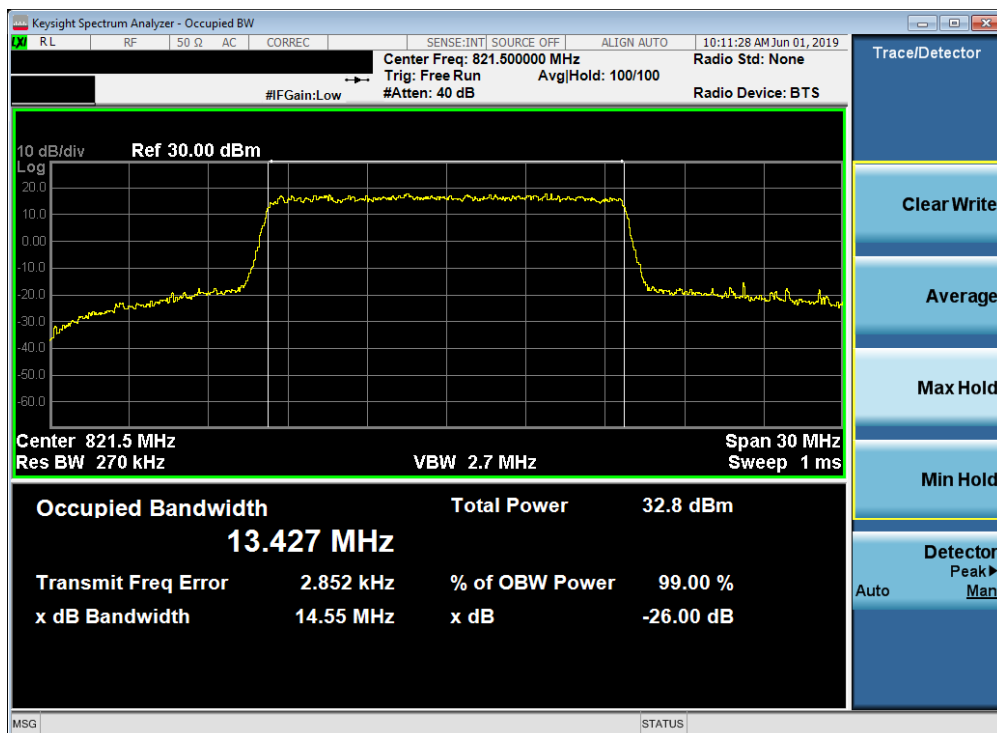


Plot 7-18. Occupied Bandwidth Plot (LTE Band 26, 10MHz 256-QAM – RB Size 50)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 21 of 62

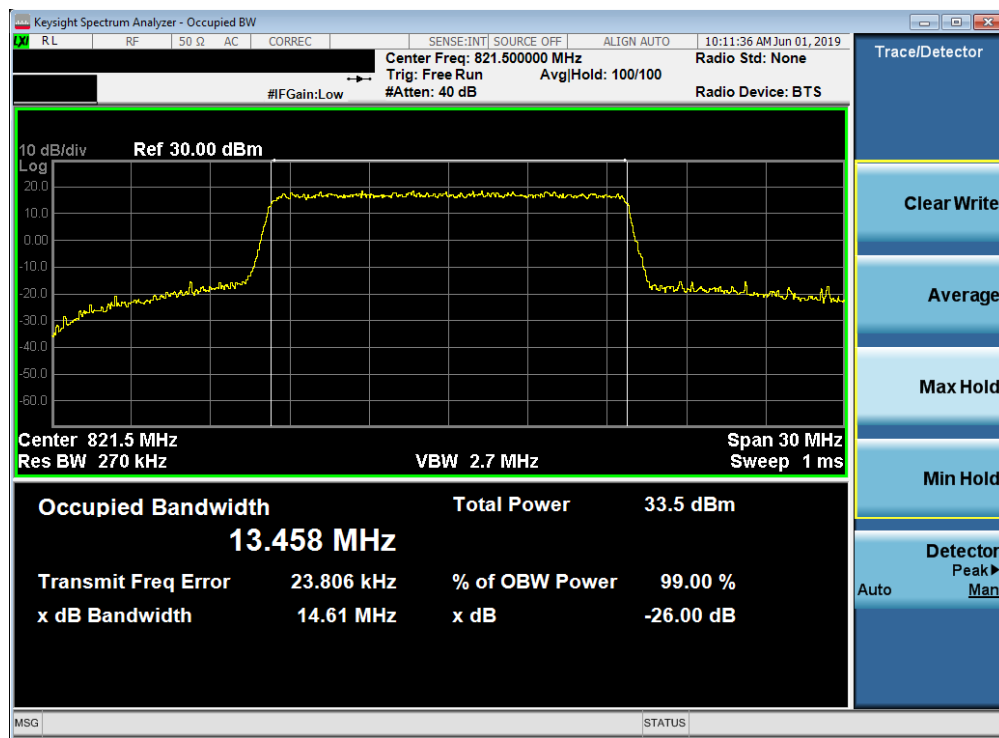


Plot 7-19. Occupied Bandwidth Plot (LTE Band 26, 15MHz QPSK – RB Size 75)

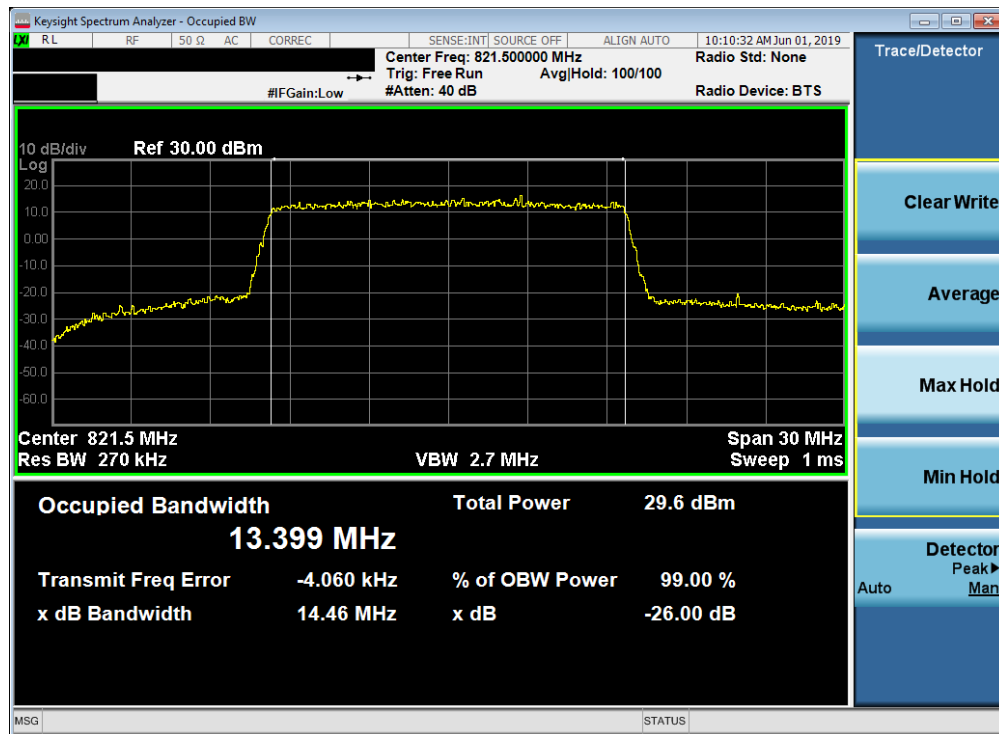


Plot 7-20. Occupied Bandwidth Plot (LTE Band 26, 15MHz 16-QAM – RB Size 75)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 22 of 62



Plot 7-21. Occupied Bandwidth Plot (LTE Band 26, 15MHz 64-QAM – RB Size 75)



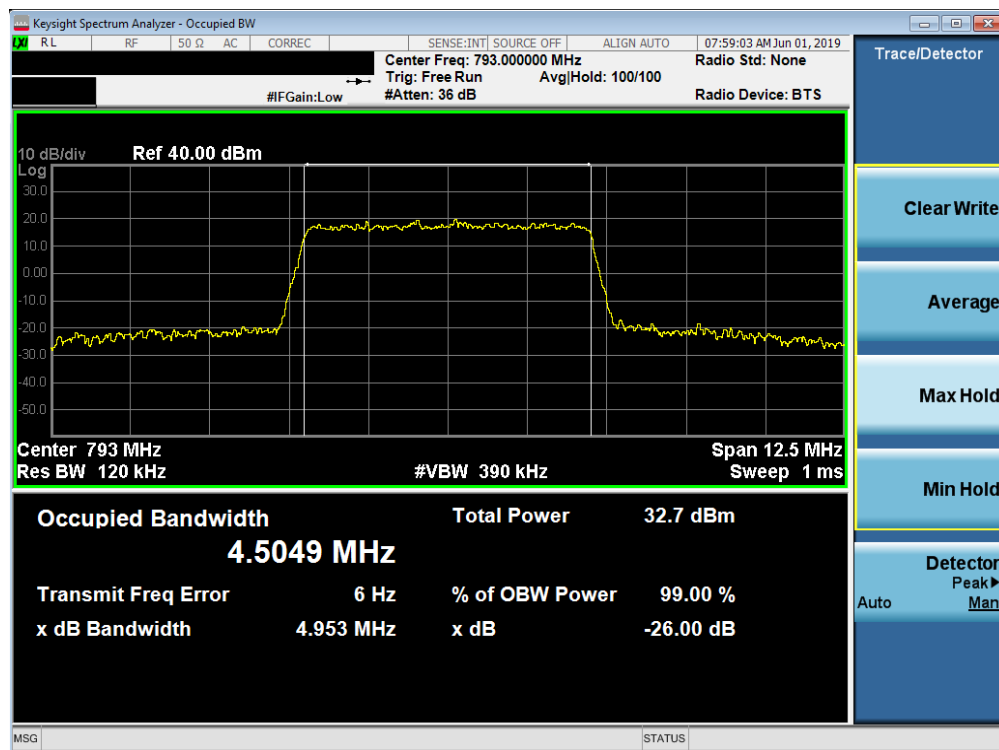
Plot 7-22. Occupied Bandwidth Plot (LTE Band 26, 15MHz 256-QAM – RB Size 75)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 23 of 62

LTE Band 14

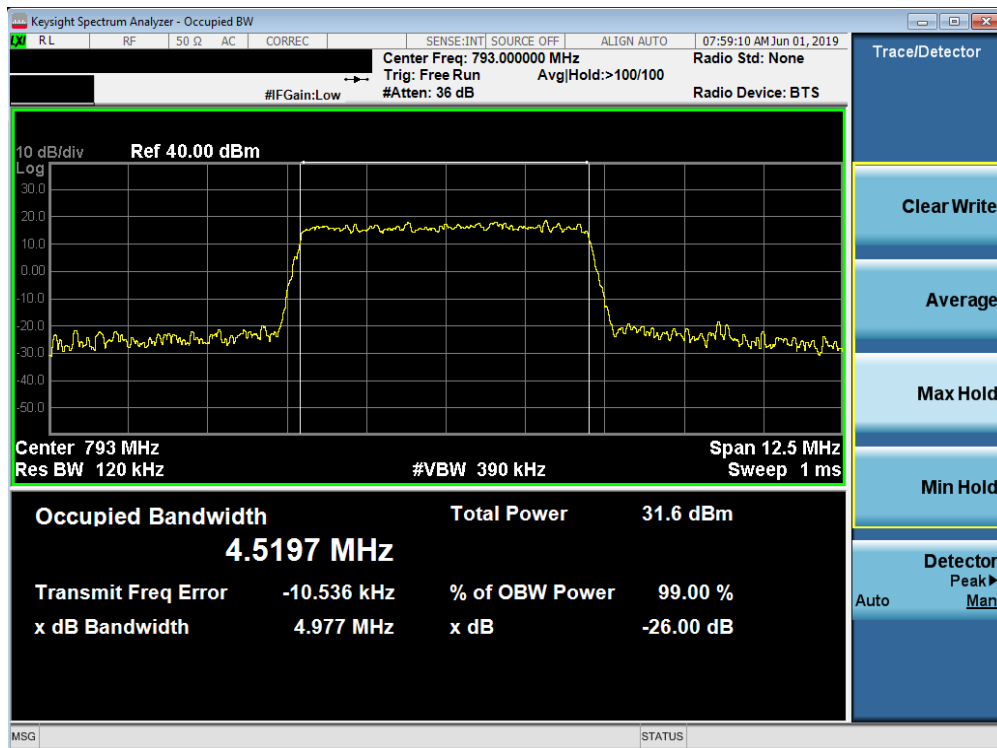


Plot 7-23. Occupied Bandwidth Plot (LTE Band 14, 5MHz QPSK – RB Size 25)

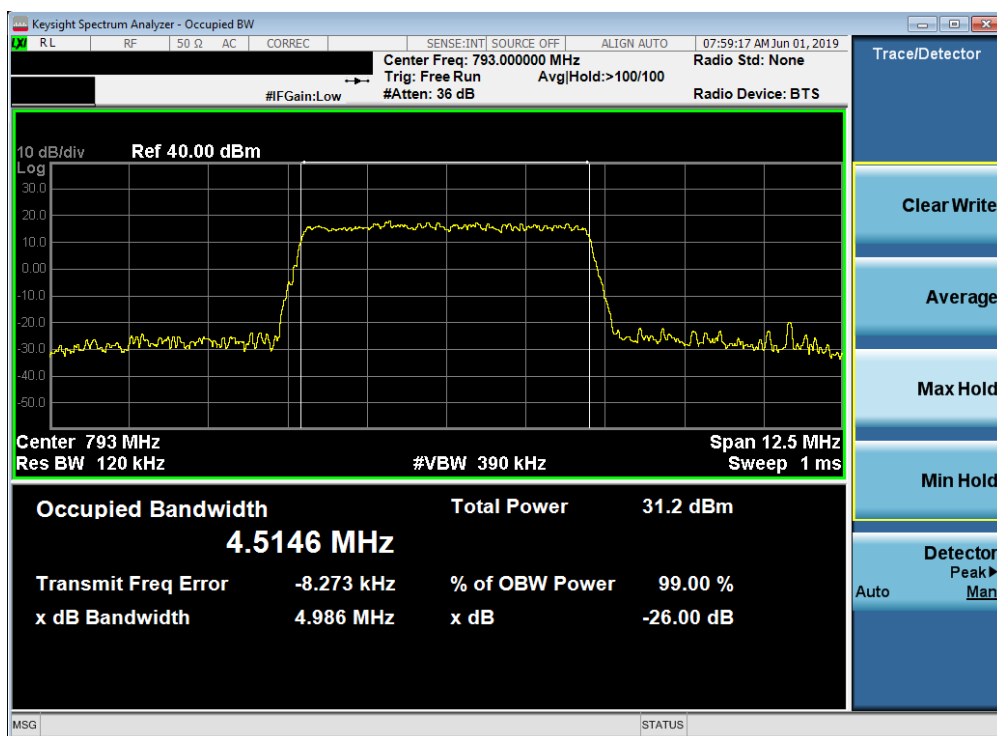


Plot 7-24. Occupied Bandwidth Plot (LTE Band 14, 5MHz 16-QAM – RB Size 25)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 24 of 62

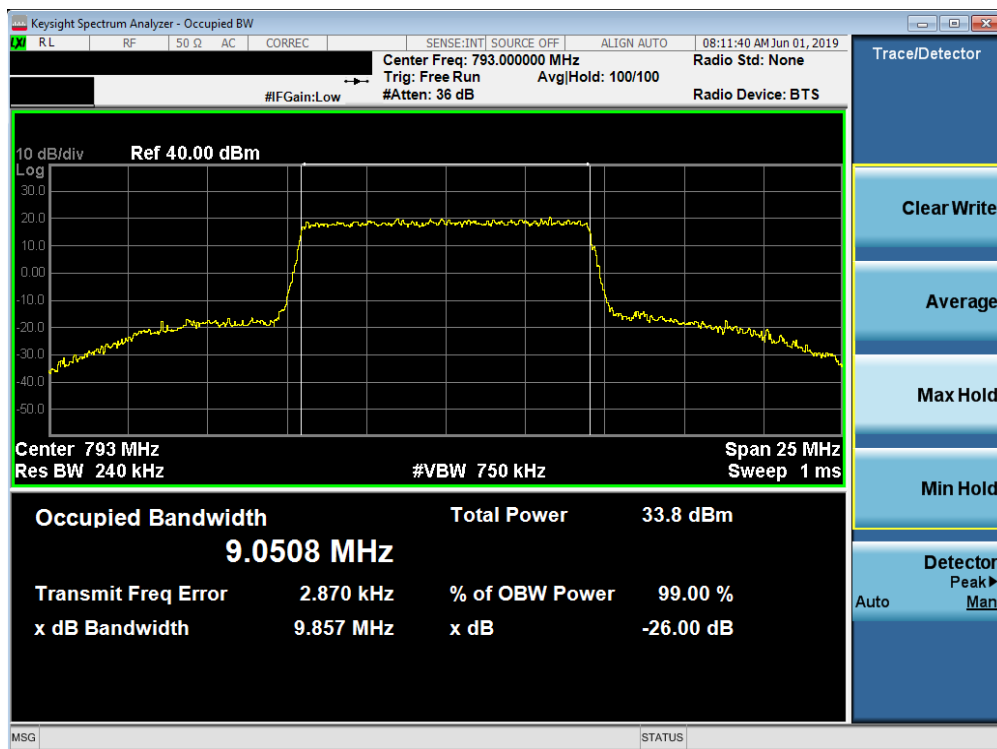


Plot 7-25. Occupied Bandwidth Plot (LTE Band 14, 5MHz 64-QAM – RB Size 25)

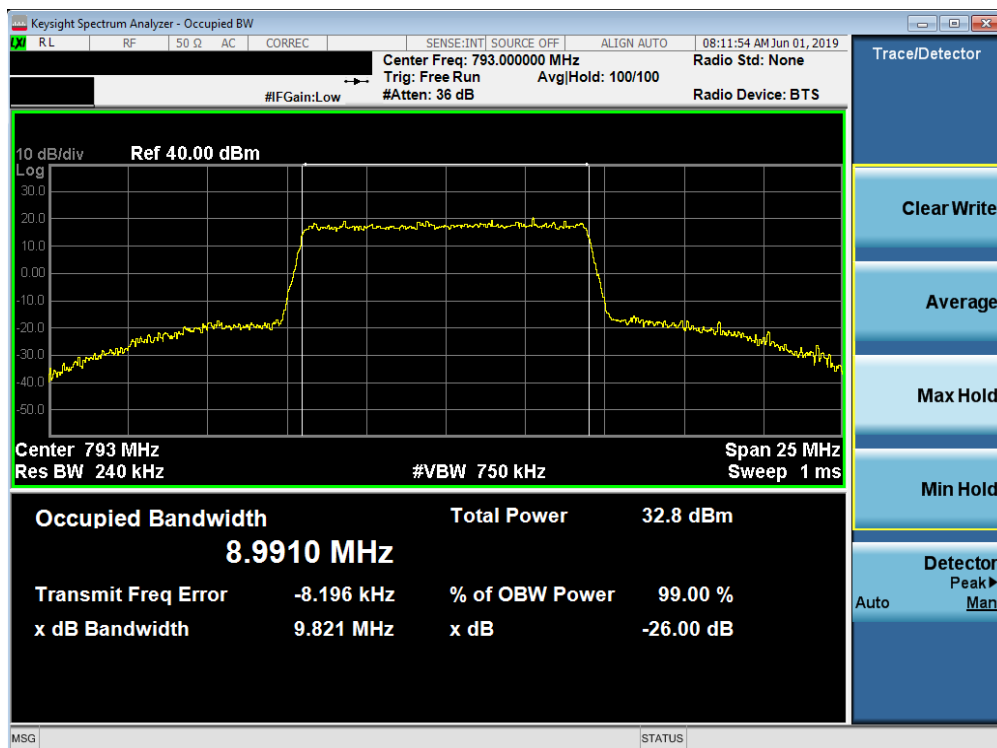


Plot 7-26. Occupied Bandwidth Plot (LTE Band 14, 5MHz 256-QAM – RB Size 25)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 25 of 62

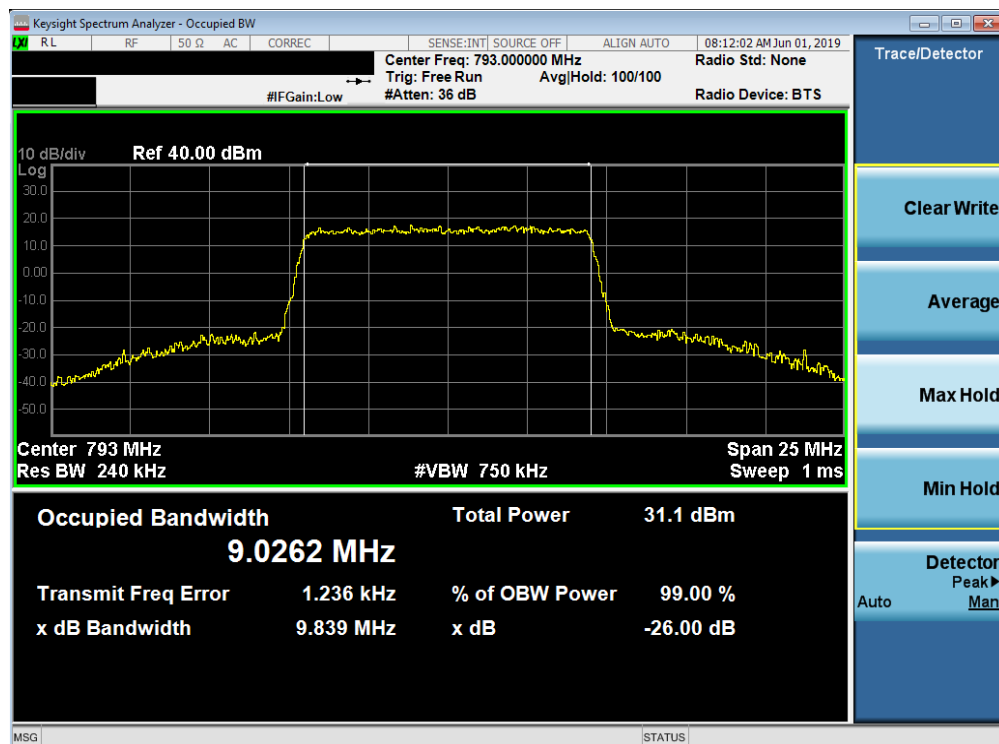


Plot 7-27. Occupied Bandwidth Plot (LTE Band 14, 10MHz QPSK – RB Size 50)

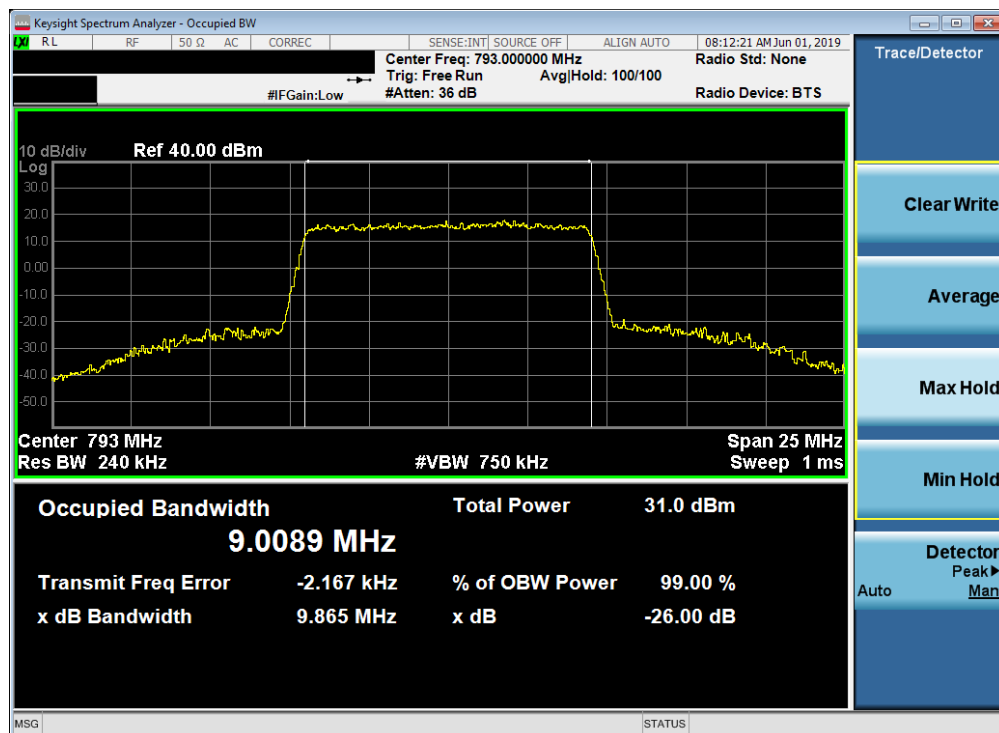


Plot 7-28. Occupied Bandwidth Plot (LTE Band 14, 10MHz 16-QAM – RB Size 50)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 26 of 62



Plot 7-29. Occupied Bandwidth Plot (LTE Band 14, 10MHz 64-QAM – RB Size 50)



Plot 7-30. Occupied Bandwidth Plot (LTE Band 14, 10MHz 256-QAM – RB Size 50)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 27 of 62

7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §90(S) §90(R)

Test Overview

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

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. RBW $\geq$ 100kHz
3. VBW $\geq$ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

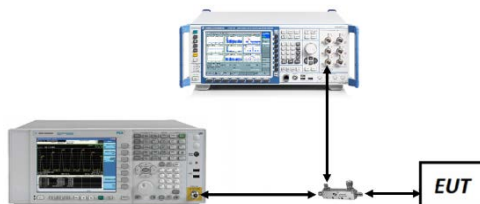


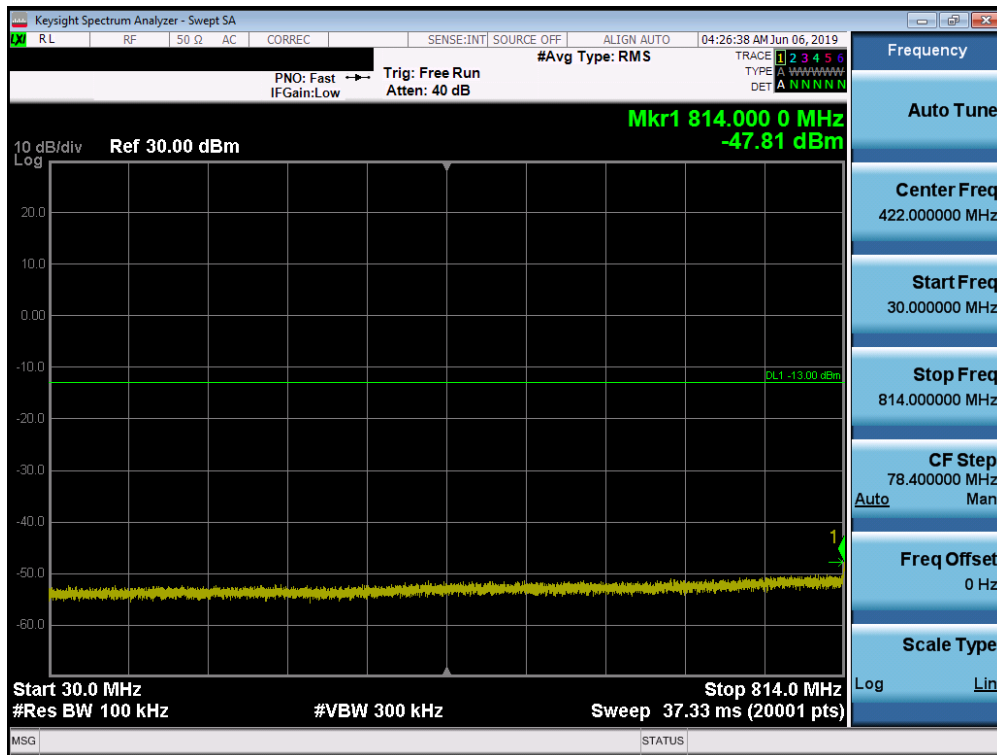
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

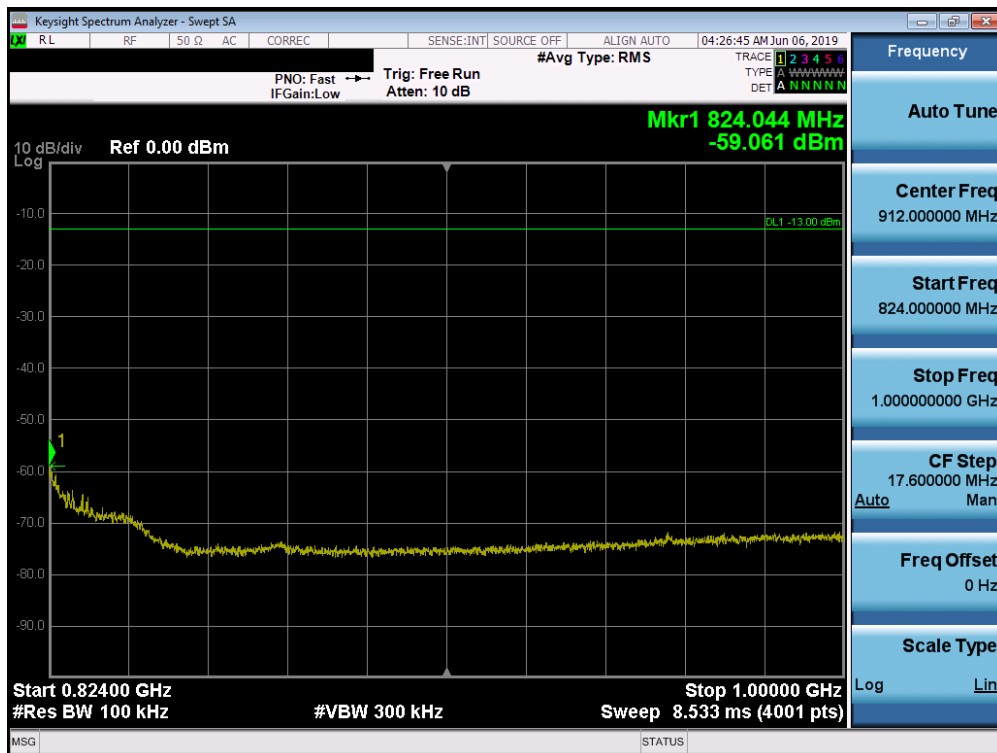
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for Part 22. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05-A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 28 of 62

CDMA BC10

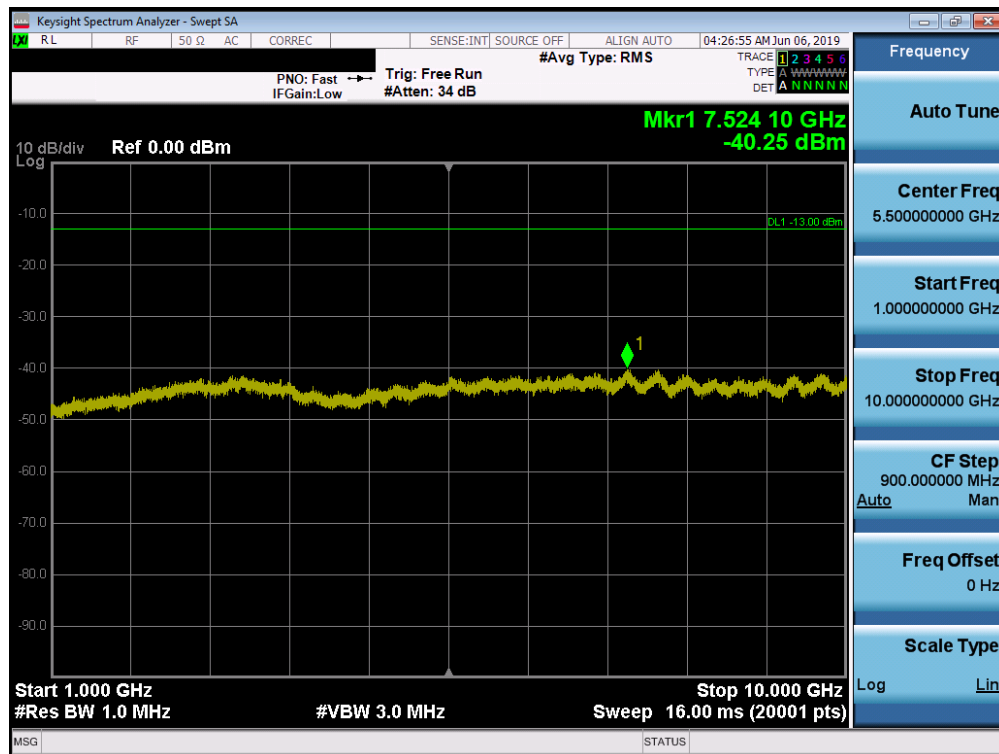


Plot 7-31. Conducted Spurious Plot (CDMA BC10 - Ch. 476)

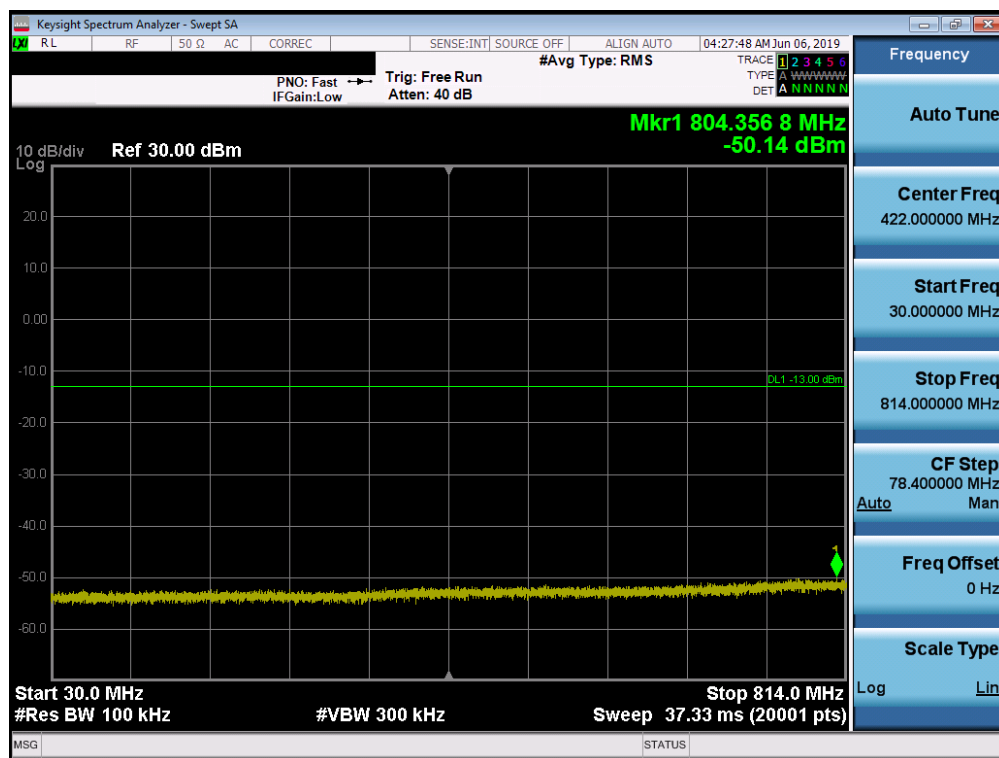


Plot 7-32. Conducted Spurious Plot (CDMA BC10 - Ch. 476)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 29 of 62

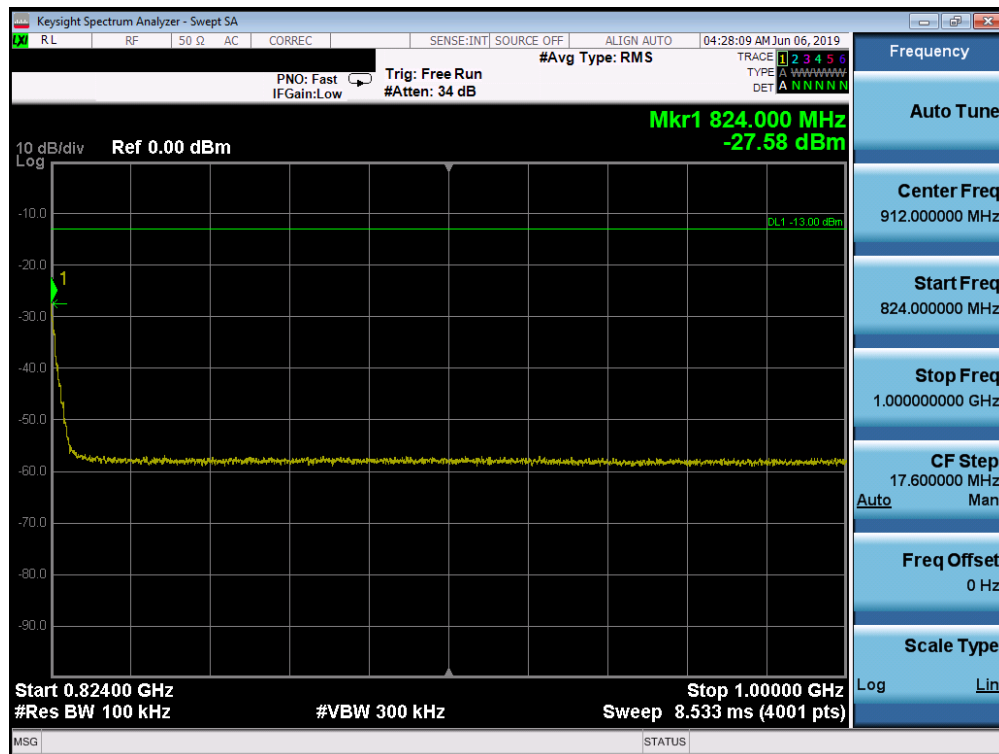


Plot 7-33. Conducted Spurious Plot (CDMA BC10 - Ch. 476)

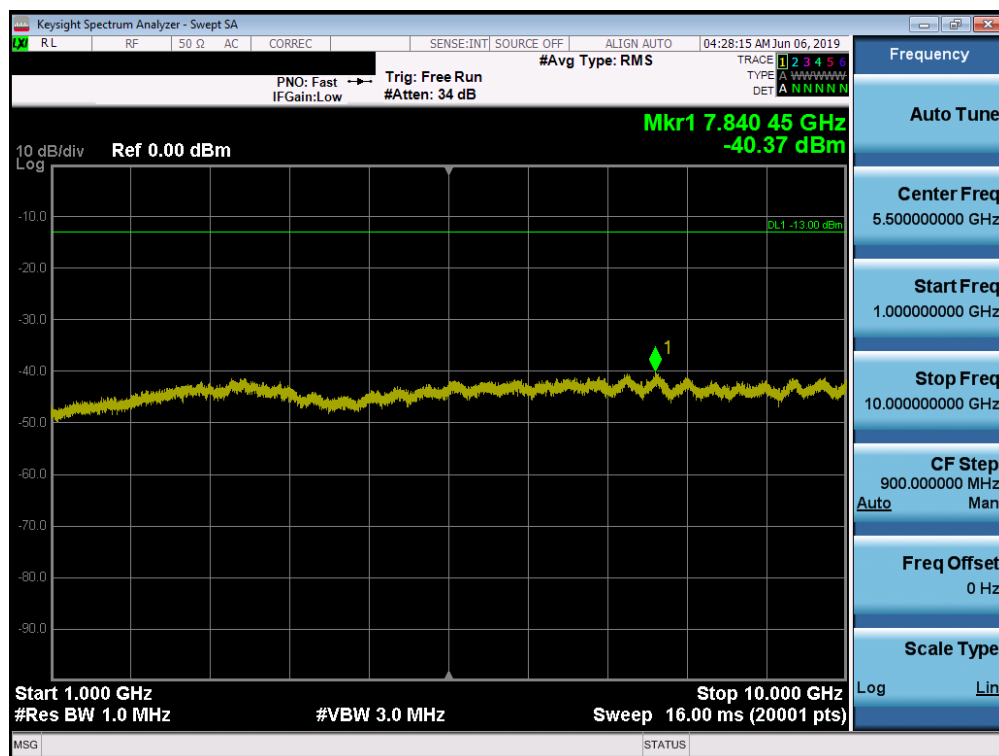


Plot 7-34. Conducted Spurious Plot (CDMA BC10 - Ch. 684)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 30 of 62



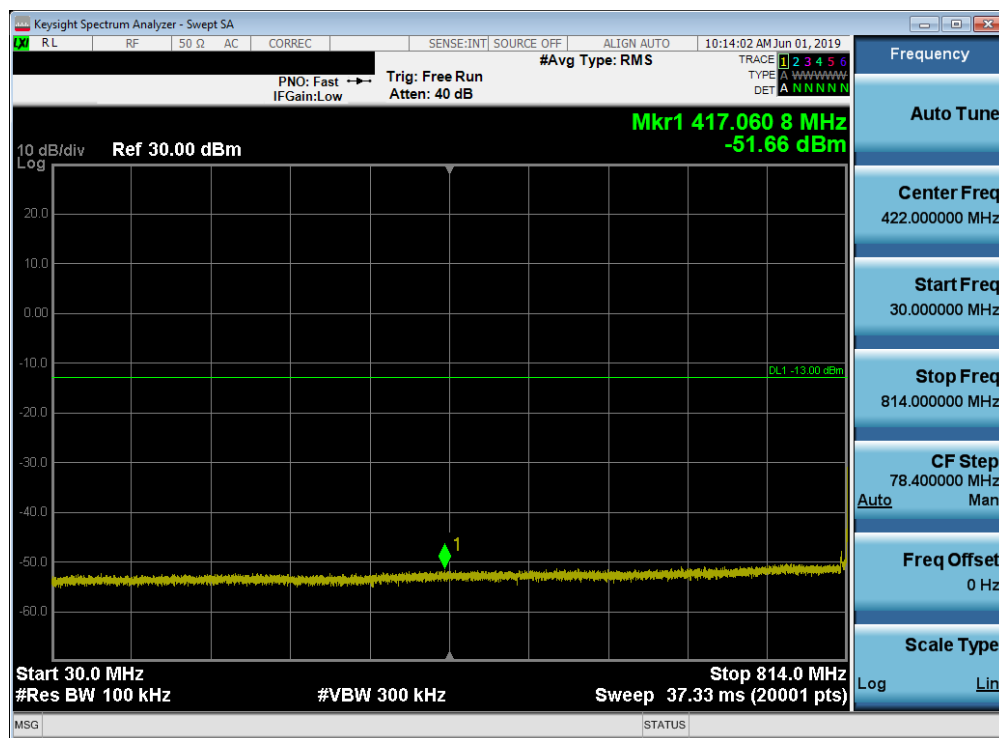
Plot 7-35. Conducted Spurious Plot (CDMA BC10 - Ch. 684)



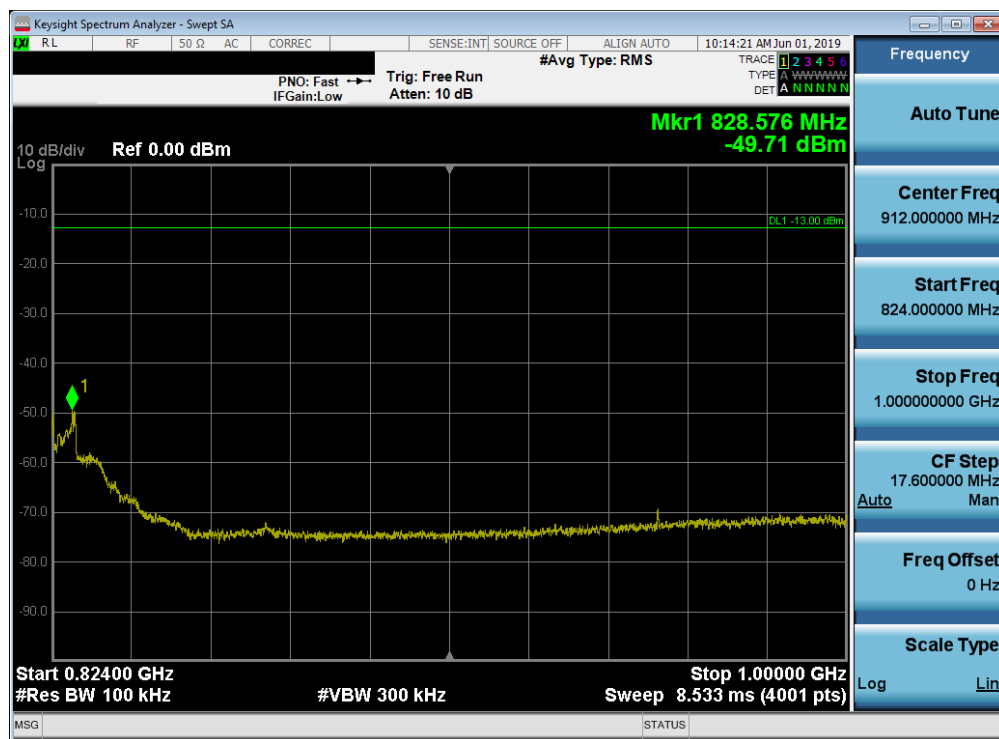
Plot 7-36. Conducted Spurious Plot (CDMA BC10 - Ch. 684)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 31 of 62

LTE Band 26

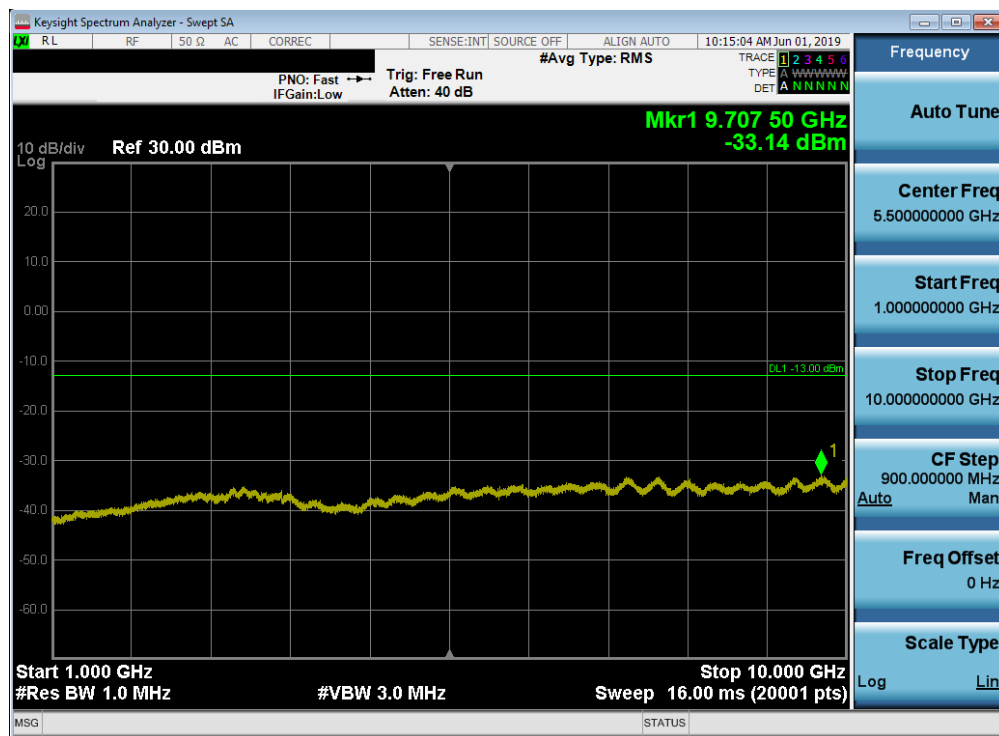


Plot 7-37. Conducted Spurious Plot (LTE Band 26, 15MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-38. Conducted Spurious Plot (LTE Band 26, 15MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

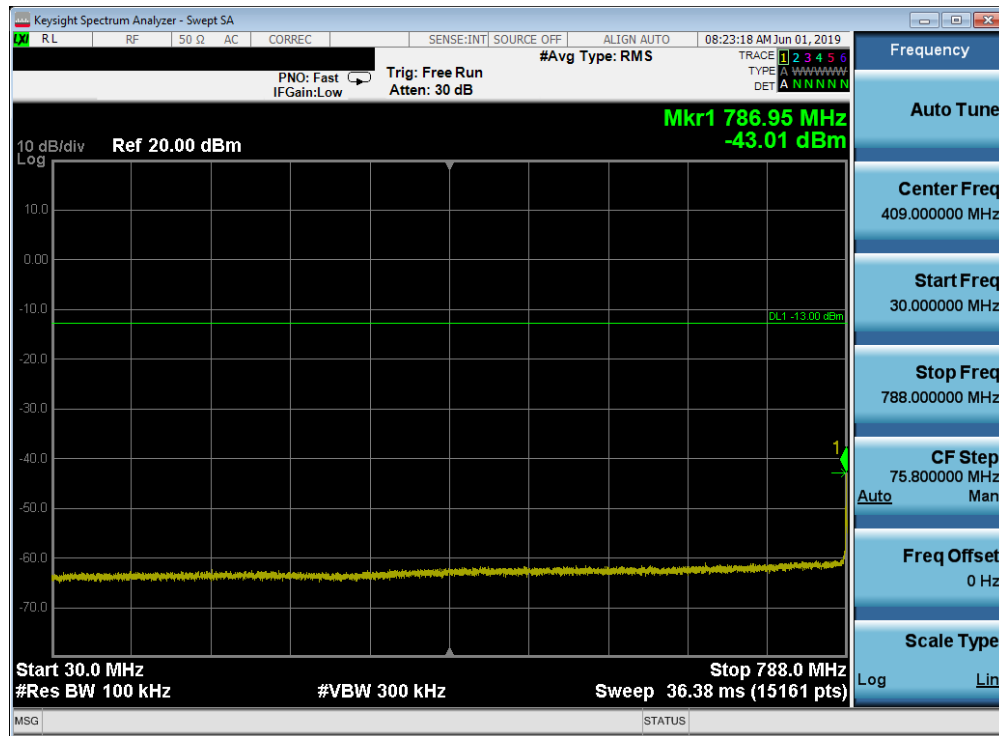
FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 32 of 62



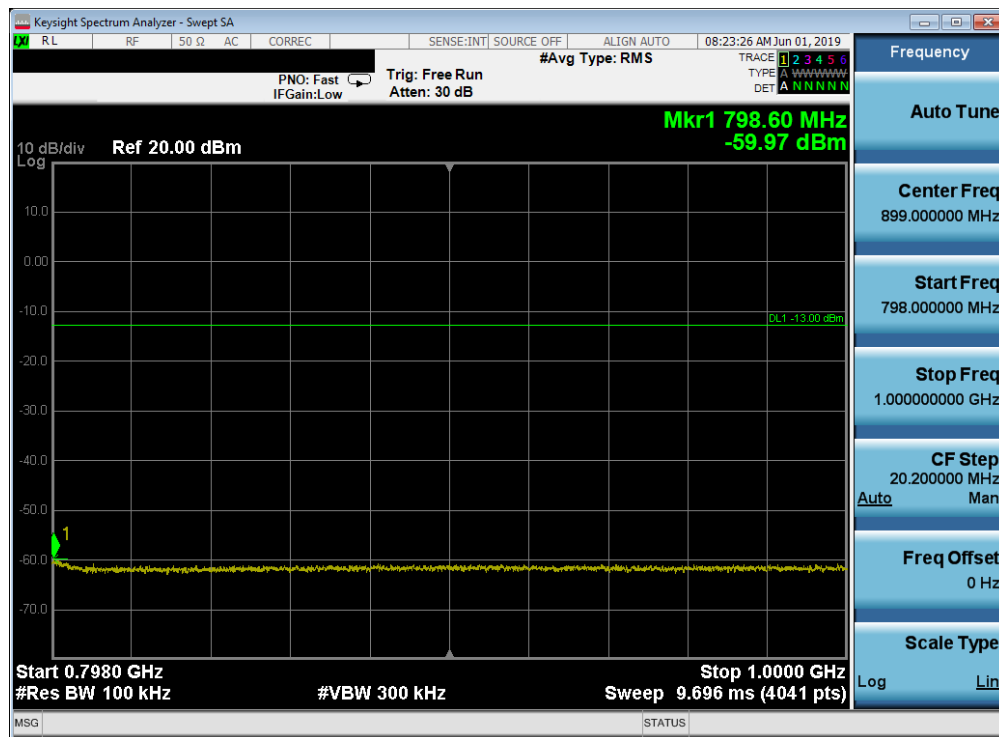
Plot 7-39. Conducted Spurious Plot (LTE Band 26, 15MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 33 of 62

LTE Band 14

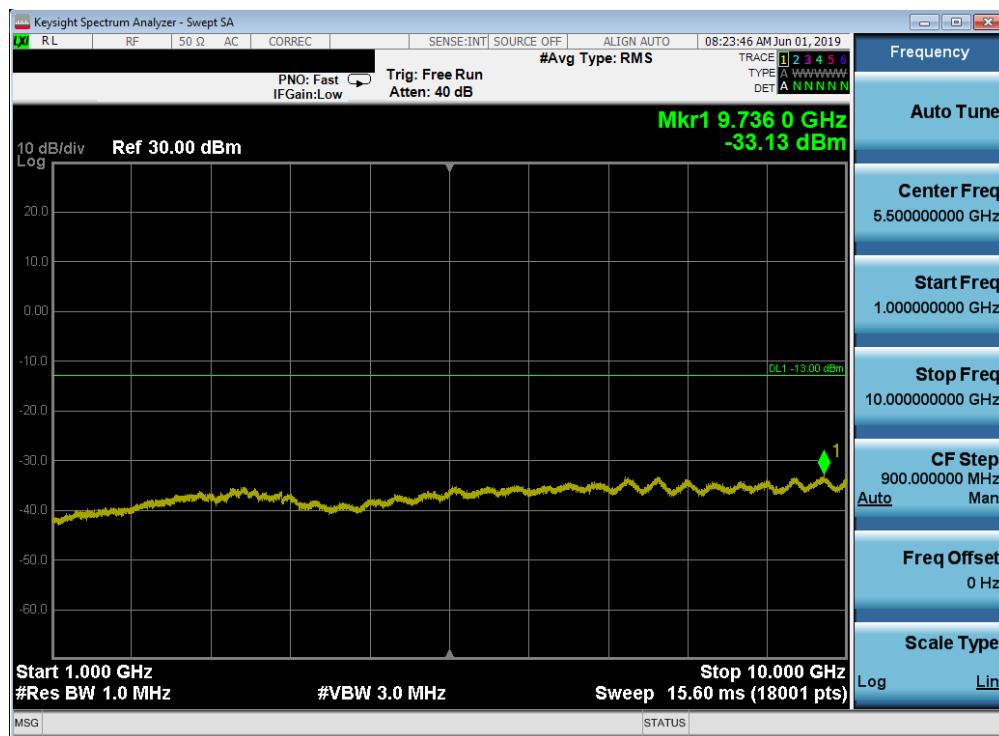


Plot 7-40. Conducted Spurious Plot (LTE Band 14, 10MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-41. Conducted Spurious Plot (LTE Band 14, 10MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 34 of 62



Plot 7-42. Conducted Spurious Plot (LTE Band 14, 10MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 35 of 62

7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §90(S) §90(R)

Test Overview

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

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

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

Test Setup

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

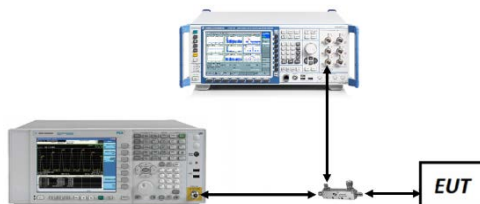


Figure 7-3. Test Instrument & Measurement Setup

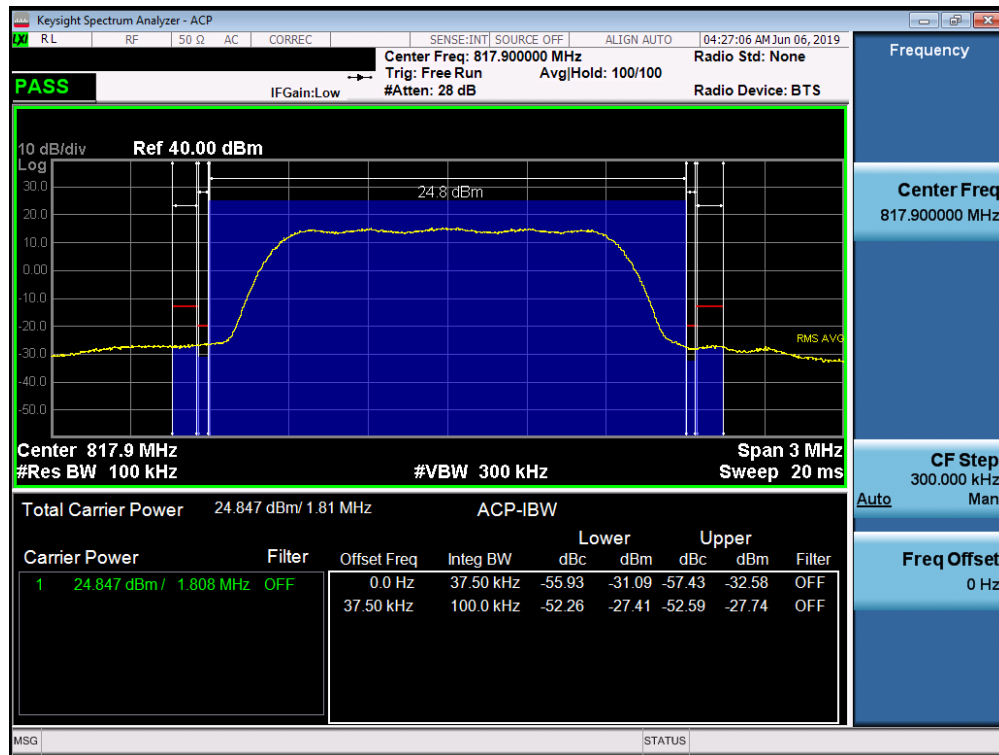
Test Notes

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

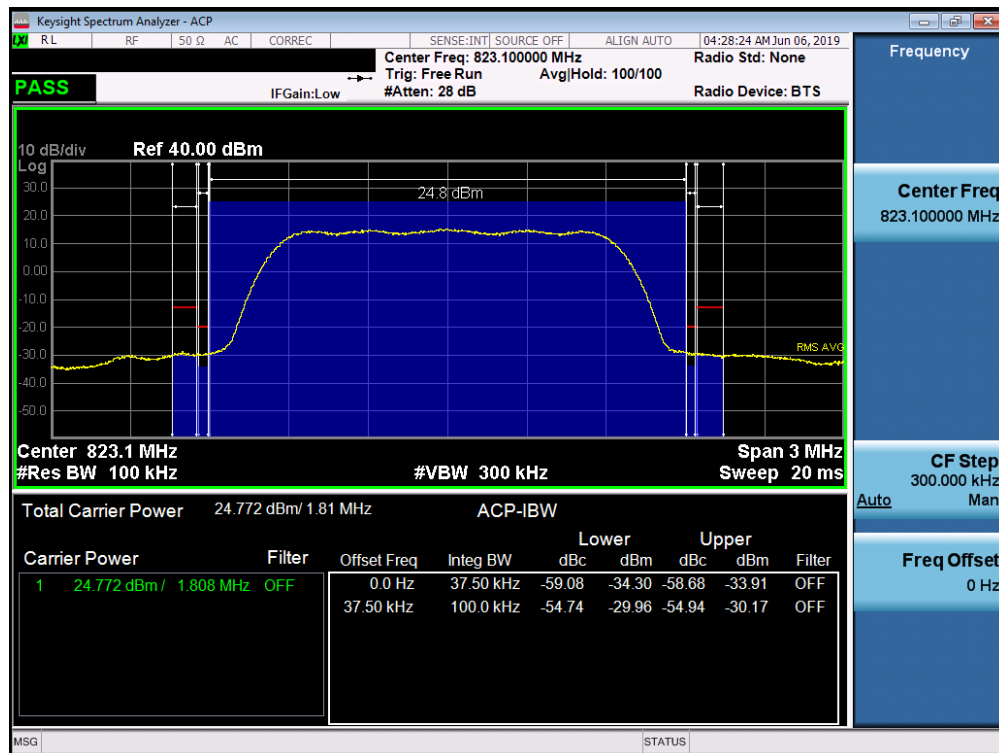
Per 22.917(b) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission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

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CDMA BC10



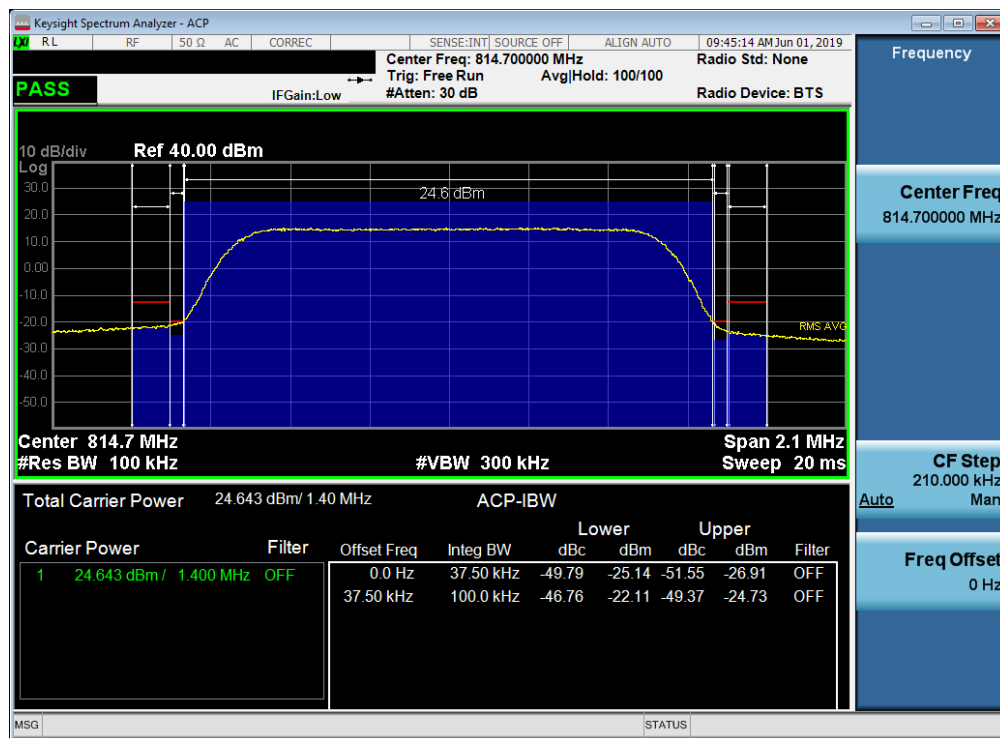
Plot 7-43. Channel Edge Plot (CDMA BC10 - Ch. 476)



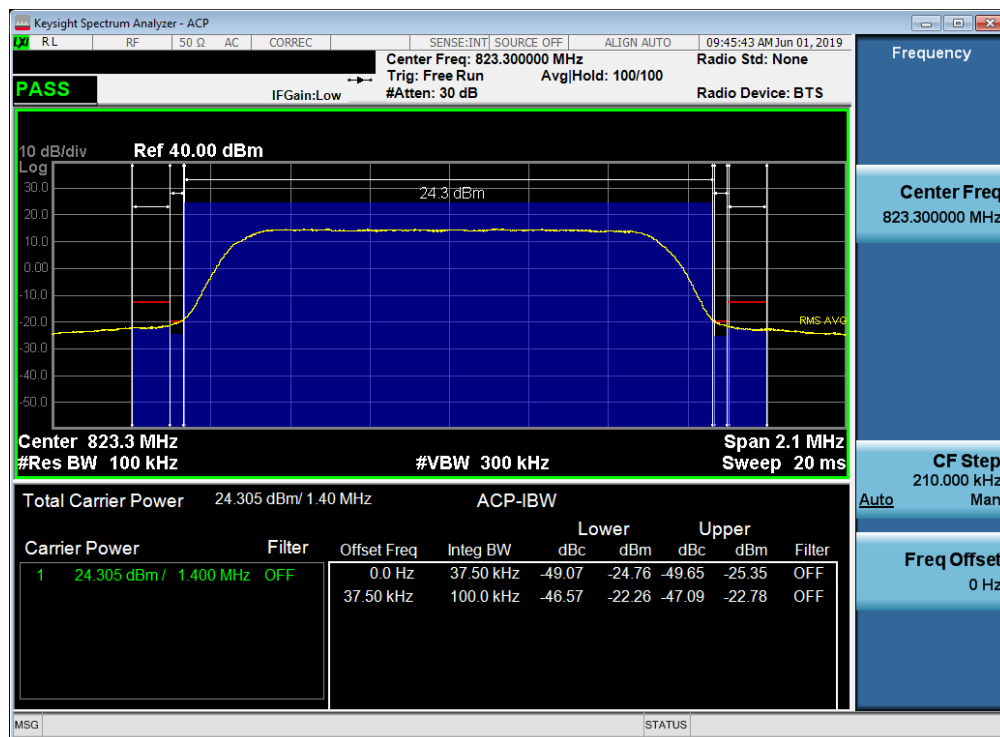
Plot 7-44. Channel Edge Plot (CDMA BC10 - Ch. 684)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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LTE Band 26

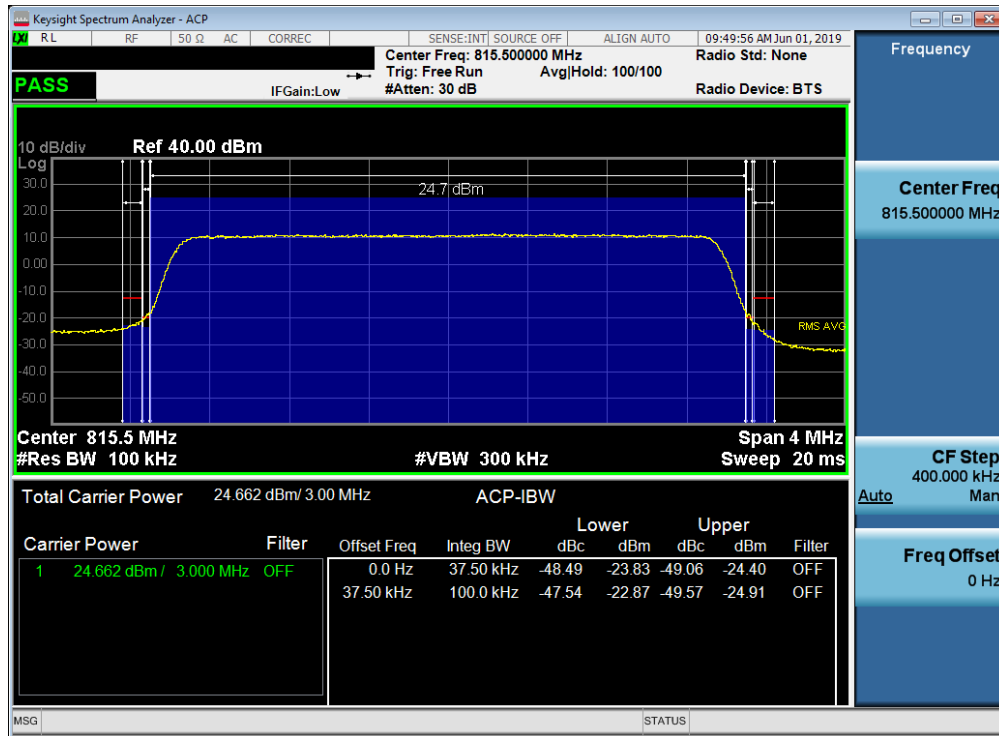


Plot 7-45. Channel Edge Plot (LTE Band 26, 1.4MHz QPSK – RB Size 6– Low Channel)

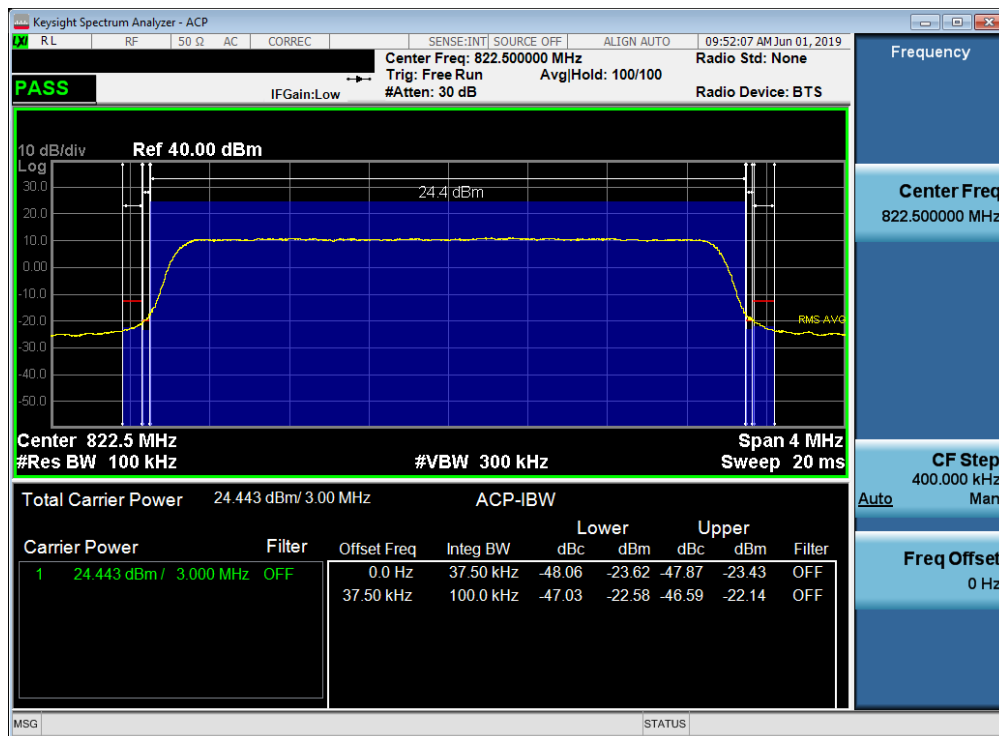


Plot 7-46. Channel Edge Plot (LTE Band 26, 1.4MHz QPSK – RB Size 6 – High Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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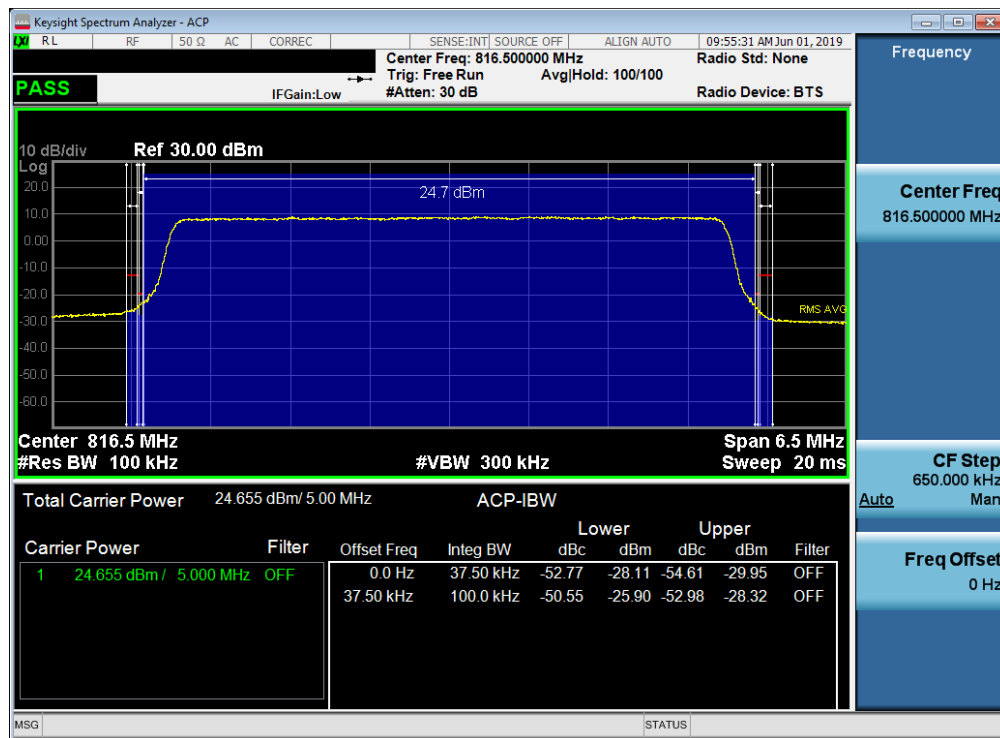


Plot 7-47. Channel Edge Plot (LTE Band 26, 3MHz QPSK – RB Size 15– Low Channel)

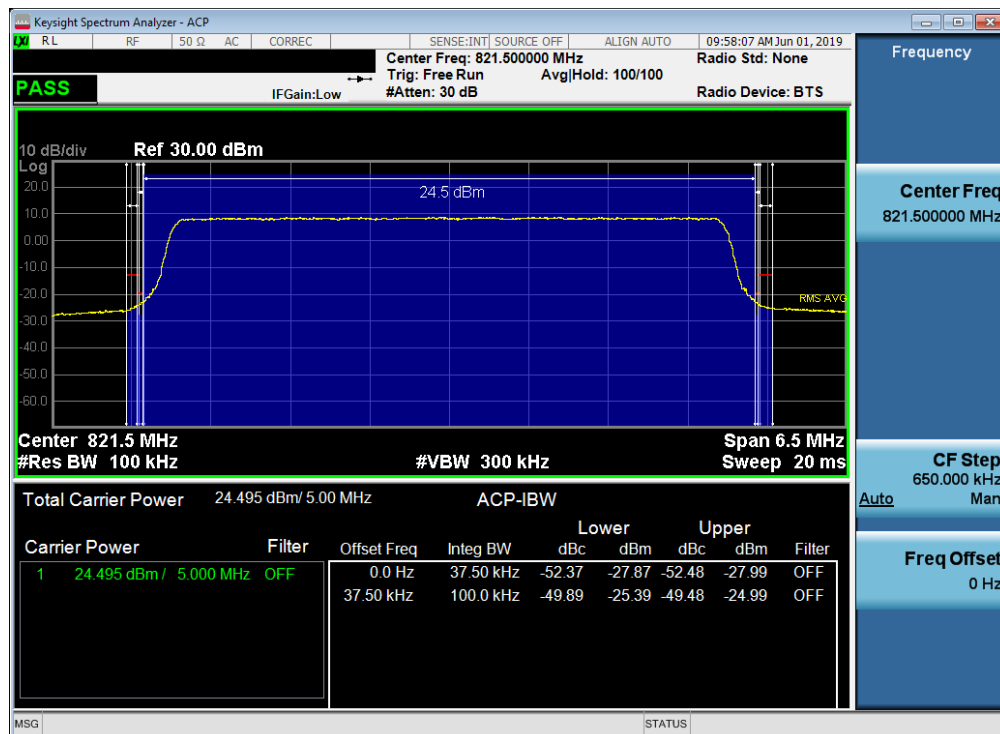


Plot 7-48. Channel Edge Plot (LTE Band 26, 3MHz QPSK – RB Size 15 – High Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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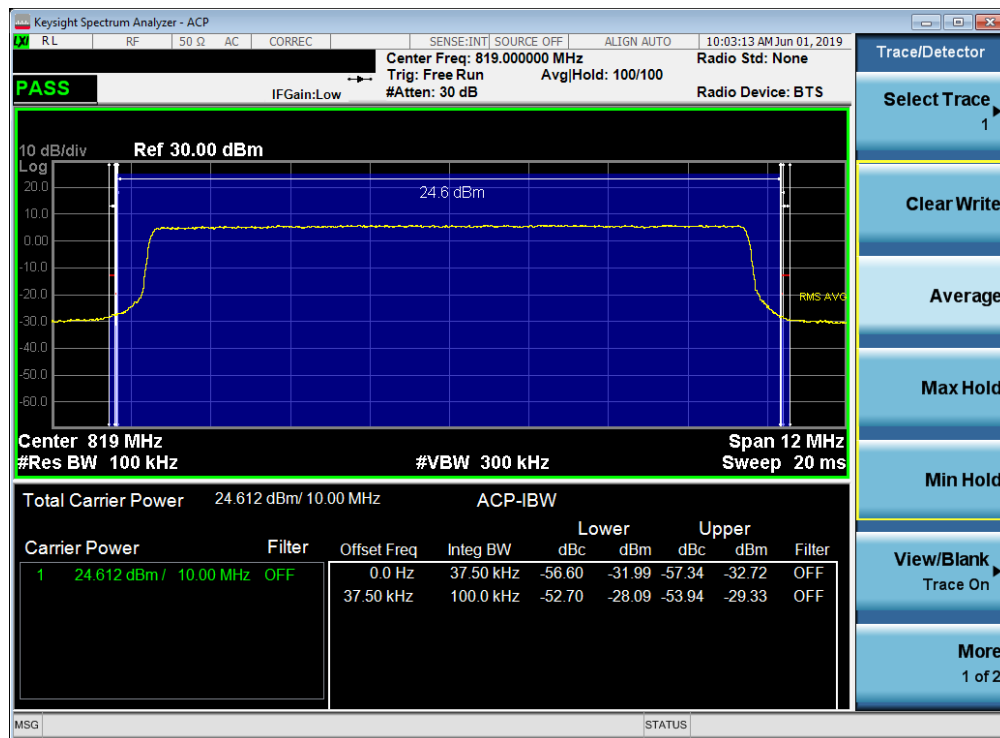


Plot 7-49. Channel Edge Plot (LTE Band 26, 5MHz QPSK – RB Size 25– Low Channel)

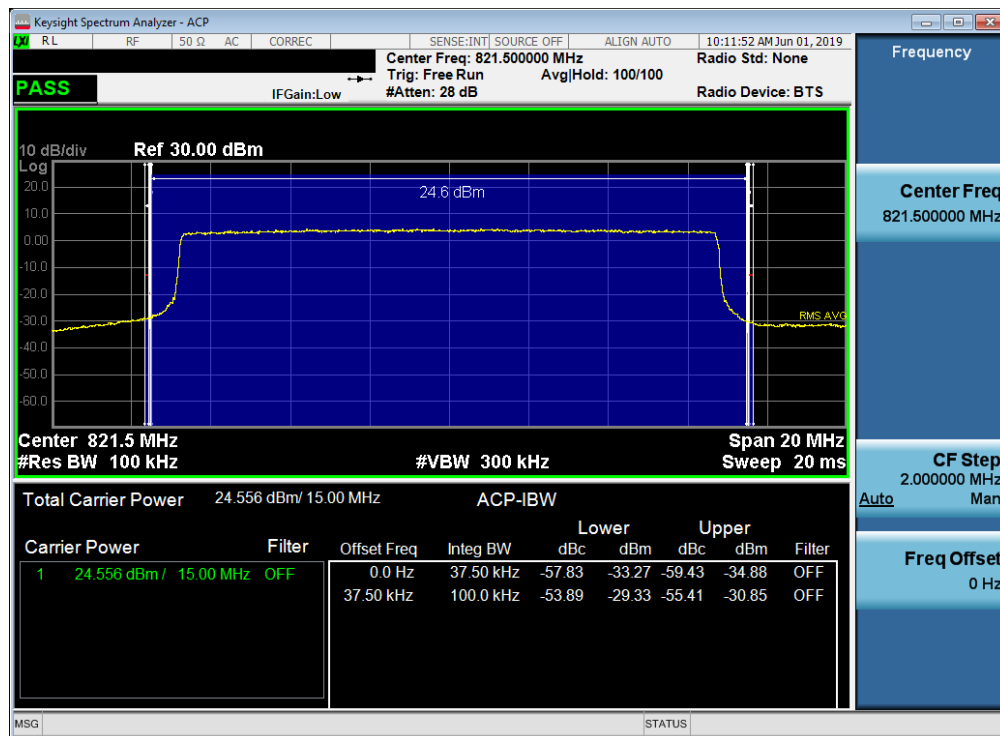


Plot 7-50. Channel Edge Plot (LTE Band 26, 5MHz QPSK – RB Size 25 – High Channel)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 40 of 62



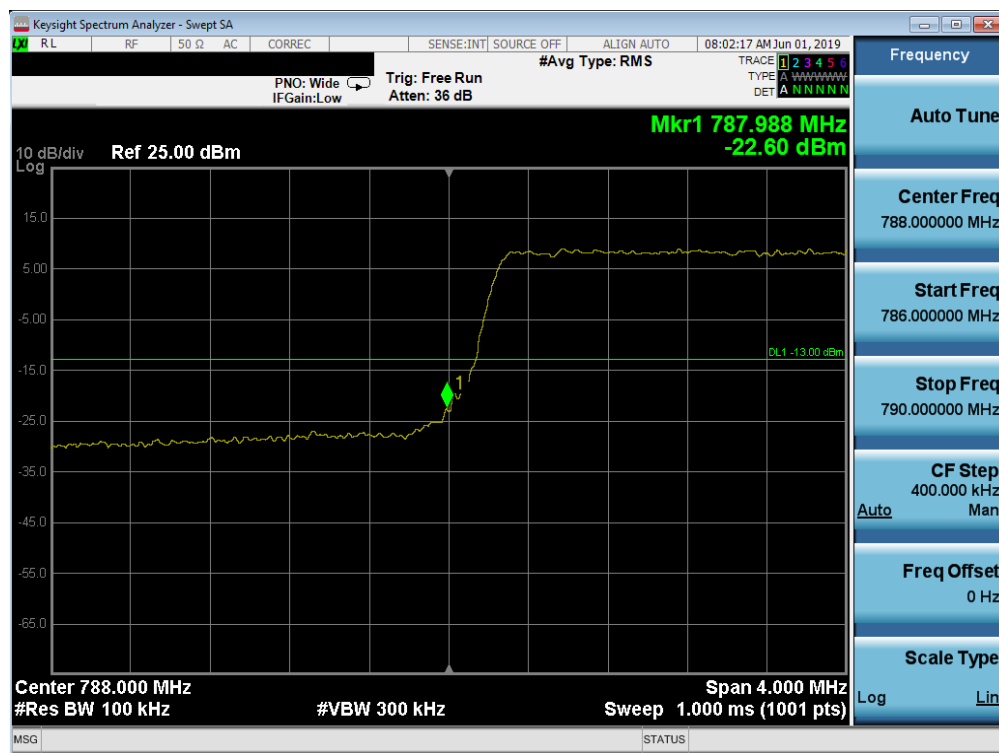
Plot 7-51. Channel Edge Plot (LTE Band 26, 10MHz QPSK – RB Size 50)



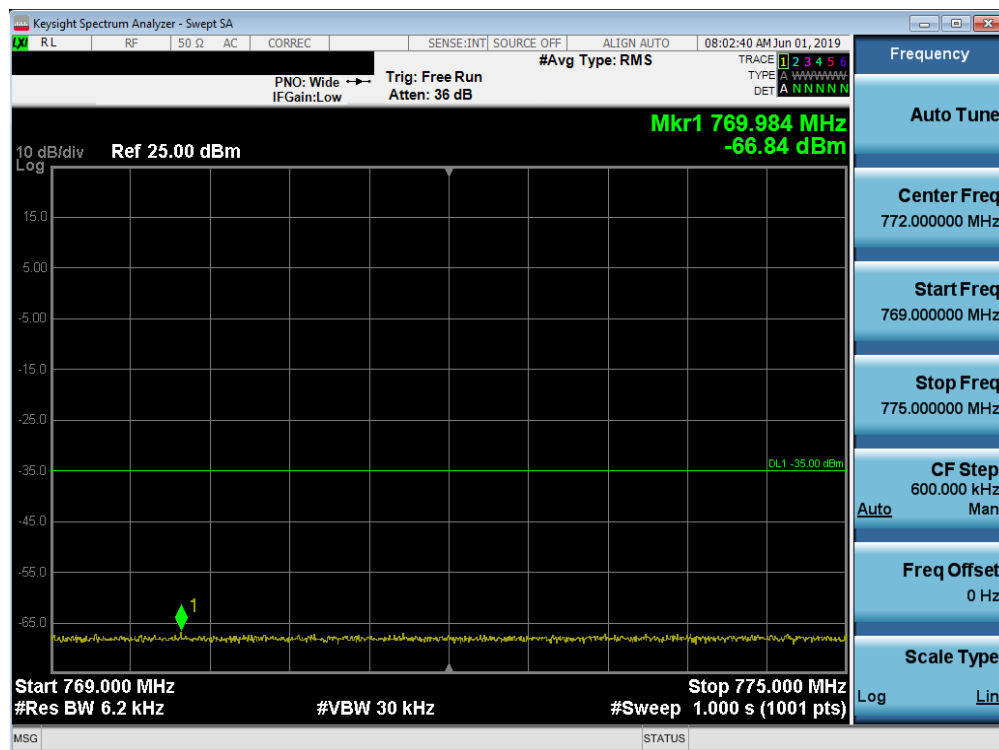
Plot 7-52. Channel Edge Plot (LTE Band 26, 15MHz QPSK – RB Size 75)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 41 of 62

LTE Band 14



Plot 7-53. Lower Band Edge Plot (LTE Band 14, 5MHz QPSK – RB Size 25)



Plot 7-54. Lower Emission Mask Plot (LTE Band 14, 5MHz QPSK – RB Size 25)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset		Page 42 of 62

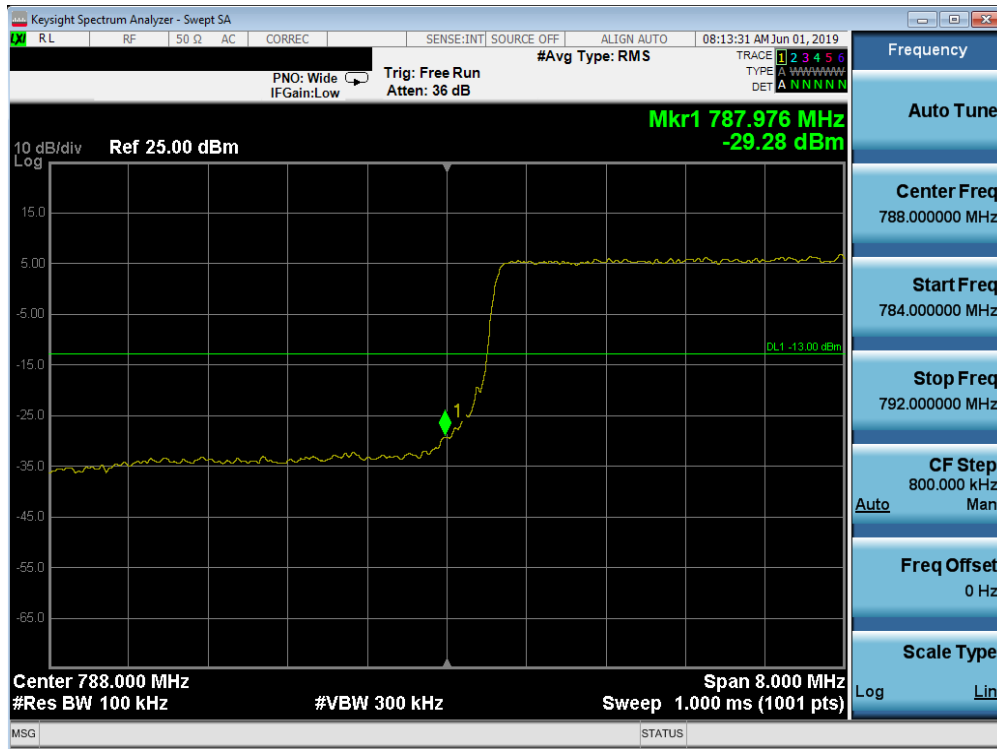


Plot 7-55. Upper Band Edge Plot (LTE Band 14, 5MHz QPSK - RB Size 25)

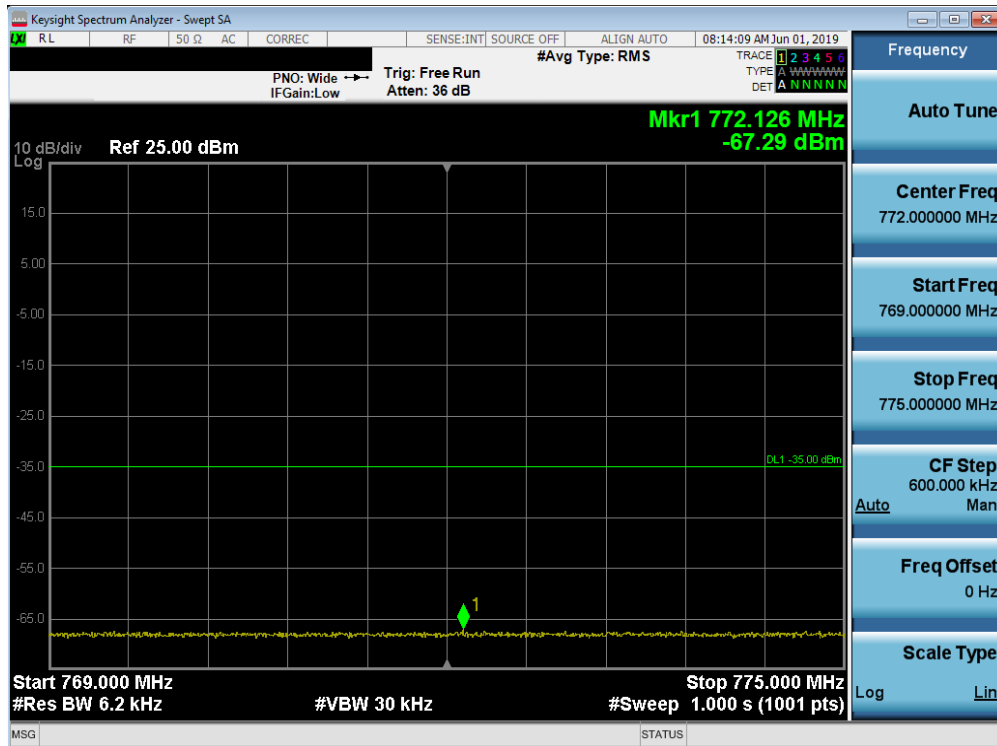


Plot 7-56. Upper Emission Mask Plot (LTE Band 14, 5MHz QPSK - RB Size 25)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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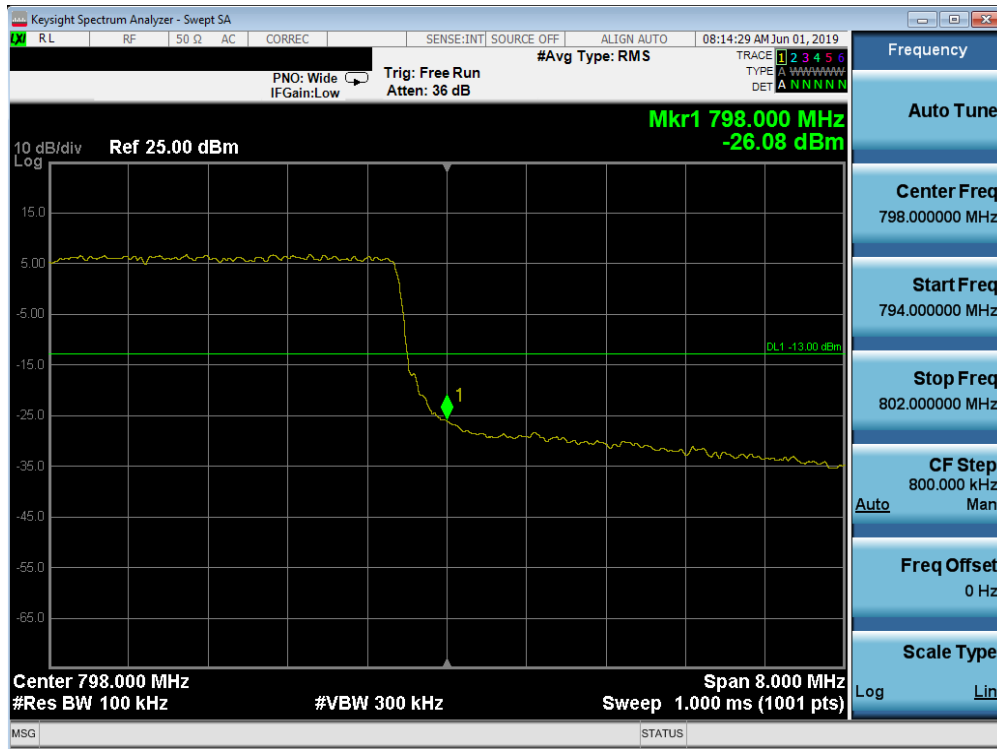


Plot 7-57. Lower Band Edge Plot (LTE Band 14, 10MHz QPSK – RB Size 50)

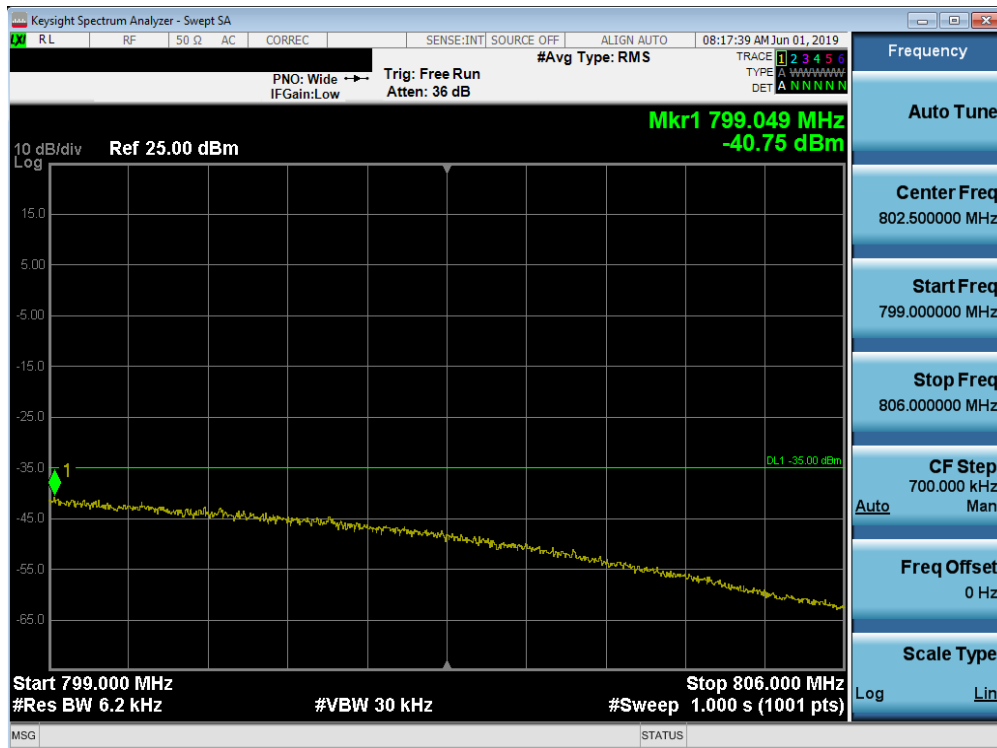


Plot 7-58. Lower Emission Mask Plot (LTE Band 14, 10MHz QPSK – RB Size 50)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Plot 7-59. Upper Band Edge Plot (LTE Band 14, 10MHz QPSK – RB Size 50)



Plot 7-60. Upper Emission Mask Plot (LTE Band 14, 10MHz QPSK – RB Size 50)

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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7.5 Conducted Power Output Data

§2.1046 §90.635

Frequency [MHz]	BC10 [Channel]	Battery Type	Cond. PWR [dBm]	Cond. PWR [Watts]	Cond. PWR Limit [dBm]	Margin [dB]
817.90	476	Standard	24.71	0.296	50.00	-25.29
823.10	684	Standard	24.67	0.293	50.00	-25.33

Table 7-2. CDMA BC10 Conducted Power Output Data

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Cond. PWR [dBm]	Cond. PWR [Watts]	Cond. PWR Limit [dBm]	Margin [dB]
814.70	1.4	QPSK	25.01	0.317	50.00	-24.99
823.30	1.4	QPSK	24.66	0.292	50.00	-25.34
814.70	1.4	16-QAM	24.00	0.251	50.00	-26.00
823.30	1.4	16-QAM	23.96	0.249	50.00	-26.04
814.70	1.4	64-QAM	23.37	0.217	50.00	-26.63
823.30	1.4	64-QAM	22.83	0.192	50.00	-27.17
814.70	1.4	256-QAM	20.05	0.101	50.00	-29.95
823.30	1.4	256-QAM	19.83	0.096	50.00	-30.17
815.50	3	QPSK	24.86	0.306	50.00	-25.14
822.50	3	QPSK	24.70	0.295	50.00	-25.30
815.50	3	16-QAM	23.66	0.232	50.00	-26.34
822.50	3	16-QAM	23.96	0.249	50.00	-26.04
815.50	3	64-QAM	22.80	0.191	50.00	-27.20
822.50	3	64-QAM	22.89	0.195	50.00	-27.11
815.50	3	256-QAM	20.03	0.101	50.00	-29.97
822.50	3	256-QAM	19.87	0.097	50.00	-30.13
816.50	5	QPSK	24.91	0.310	50.00	-25.09
821.50	5	QPSK	24.80	0.302	50.00	-25.20
816.50	5	16-QAM	23.91	0.246	50.00	-26.09
821.50	5	16-QAM	24.02	0.252	50.00	-25.98
816.50	5	64-QAM	23.31	0.214	50.00	-26.69
821.50	5	64-QAM	22.88	0.194	50.00	-27.12
816.50	5	256-QAM	20.09	0.102	50.00	-29.91
821.50	5	256-QAM	20.01	0.100	50.00	-29.99
819.00	10	QPSK	25.01	0.317	50.00	-24.99
819.00	10	16-QAM	24.20	0.263	50.00	-25.80
819.00	10	64-QAM	23.04	0.201	50.00	-26.96
819.00	10	256-QAM	20.12	0.103	50.00	-29.88
821.50	15	QPSK	25.01	0.317	50.00	-24.99
821.50	15	16-QAM	24.30	0.269	50.00	-25.70
821.50	15	64-QAM	23.07	0.203	50.00	-26.93
821.50	15	256-QAM	20.19	0.104	50.00	-29.81

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

NOTES:

1. For CDMA mode, this device was tested under all R.C.s and S.O.s and the worst case is reported with RC3/SO55 with "All Up" power control bits.
2. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.
3. This unit was tested with its standard battery.

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7.6 Radiated Power (ERP)

§22.913(a.2) §90.542(a)(7)

Test Overview

Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

Test Settings

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured is:

$$\text{ERP/EIRP} = \text{PMeas} - \text{LC} + \text{GT}$$

Where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

Test Setup

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



Figure 7-4. ERP/EIRP 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.

FCC ID: A3LSMN970U	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Quality Manager
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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
821.50	15	QPSK	V	140	291	1 / 74	15.90	6.30	20.05	0.101	38.45	-18.40
821.50	15	16-QAM	V	140	291	1 / 74	15.47	6.30	19.62	0.092	38.45	-18.83
821.50	15	64-QAM	V	140	291	1 / 74	15.17	6.30	19.32	0.086	38.45	-19.13
821.50	15	256-QAM	V	140	291	1 / 74	13.23	6.30	17.38	0.055	38.45	-21.07
821.50	15 (WCP)	QPSK	V	135	71	1 / 74	8.77	6.30	12.92	0.020	38.45	-25.53

Table 7-61. ERP Data (Band 26)

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
790.50	5	QPSK	V	142	270	1 / 24	15.09	5.80	18.74	0.075	34.77	-16.03
793.00	5	QPSK	V	142	270	1 / 24	15.08	5.90	18.83	0.076	34.77	-15.94
795.50	5	QPSK	V	143	269	1 / 24	15.21	5.95	19.01	0.080	34.77	-15.76
795.50	5	16-QAM	V	143	269	1 / 24	14.23	5.95	18.03	0.064	34.77	-16.74
790.50	5	64-QAM	V	142	270	1 / 24	13.68	5.80	17.33	0.054	34.77	-17.44
795.50	5	256-QAM	V	143	269	1 / 24	11.43	5.95	15.23	0.033	34.77	-19.54
793.00	10	QPSK	V	142	269	1 / 49	15.55	5.90	19.30	0.085	34.77	-15.47
793.00	10	16-QAM	V	142	269	1 / 49	14.66	5.90	18.41	0.069	34.77	-16.36
793.00	10	64-QAM	V	142	269	1 / 49	13.95	5.90	17.70	0.059	34.77	-17.07
793.00	10	256-QAM	V	142	269	1 / 49	11.89	5.90	15.64	0.037	34.77	-19.13
793.00	10	QPSK	H	100	295	1 / 49	14.49	6.10	18.44	0.070	34.77	-16.33
793.00	10 (WCP)	QPSK	V	169	67	1 / 49	12.36	5.90	16.11	0.041	34.77	-18.66

Table 7-62. ERP Data (Band 14)

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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7.7 Radiated Spurious Emissions Measurements

§2.1053 §90(S) §90(R)

Test Overview

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

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI/TIA-603-E-2016 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW $\geq 3 \times$ 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: A3LSMN970U		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.

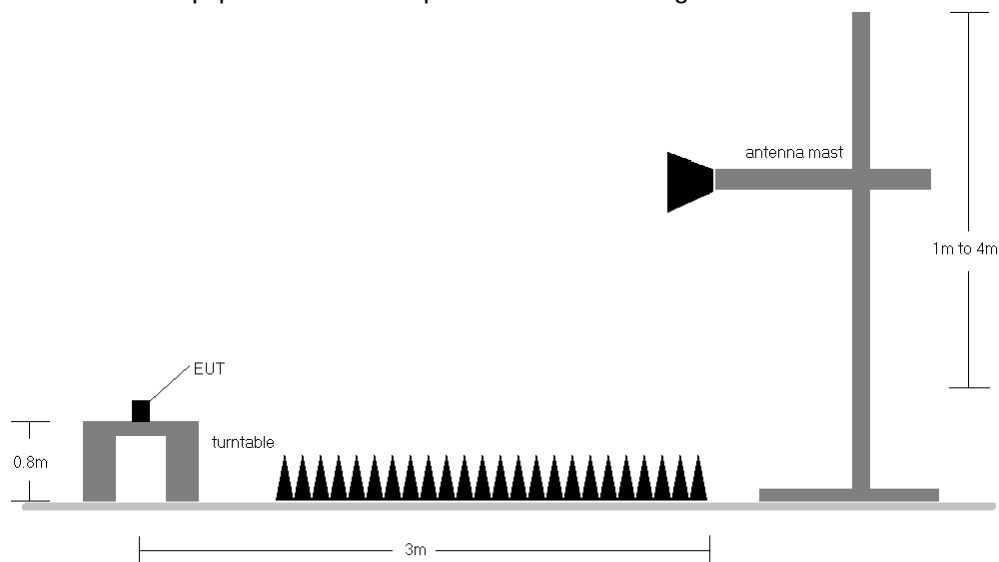


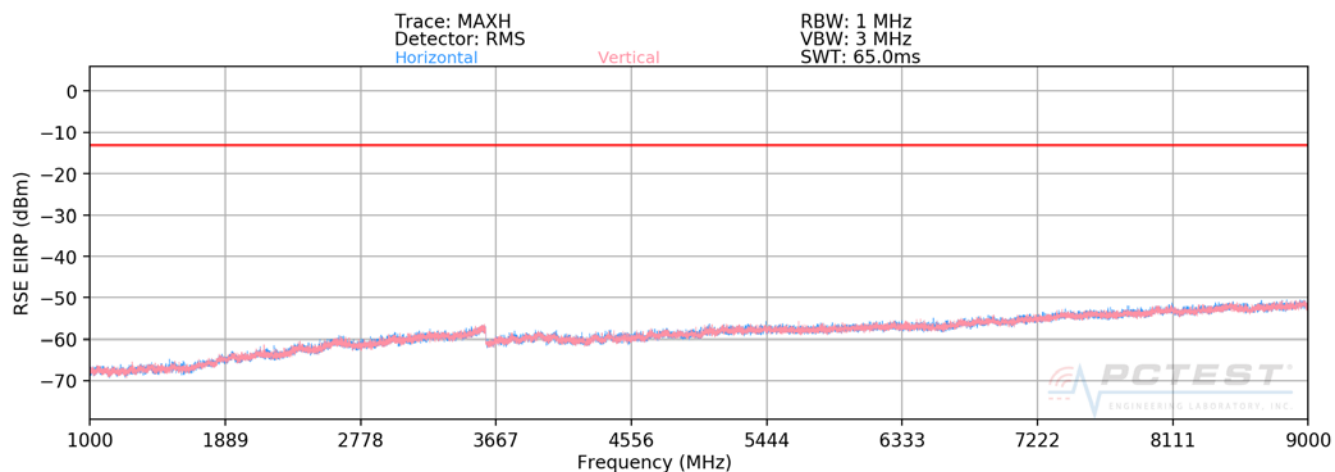
Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1. For CDMA mode, this device was tested under all R.C.s and S.O.s and the worst case is reported with RC3/SO55 with "All Up" power control bits.
2. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.
3. This unit was tested with its standard battery.
4. The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.
5. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
6. Per 90(R)(f), emissions in the 1559 – 1610MHz band are subject to a limit of -40dBm/MHz for wideband signals. These emission measurements are shown in this section below.

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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CDMA BC10



Plot 7-63. Radiated Spurious Plot above 1GHz (CDMA BC10)

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

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1635.80	V	116	222	-78.46	8.87	-69.59	-69.6
2453.70	V	365	359	-73.42	9.57	-63.85	-63.8
3271.60	V	-	-	-75.39	9.55	-65.84	-65.8
4089.50	V	-	-	-74.76	10.08	-64.68	-64.7
4907.40	V	-	-	-74.01	10.82	-63.20	-63.2

Table 7-4. CDMA BC10 Radiated Spurious Data (Ch. 476)

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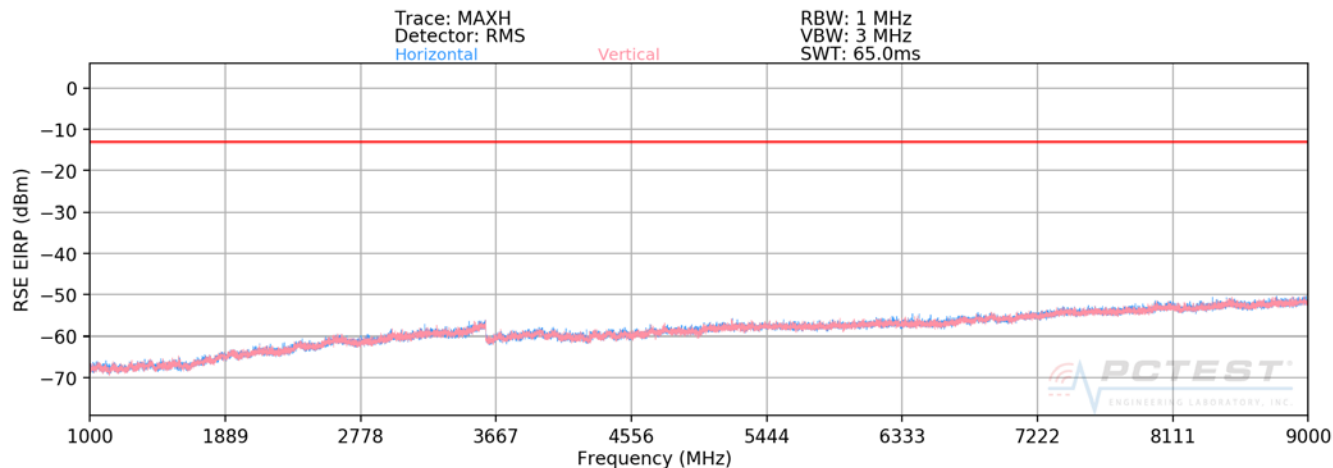
OPERATING FREQUENCY: 823.10 MHz
 MODULATION SIGNAL: CDMA
 DISTANCE: 3 meters
 LIMIT: -13.00 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1646.20	V	111	153	-77.58	8.93	-68.65	-68.6
2469.30	V	126	31	-74.34	9.63	-64.71	-64.7
3292.40	V	-	-	-74.47	9.57	-64.90	-64.9
4115.50	V	-	-	-74.65	10.16	-64.49	-64.5
4938.60	V	-	-	-73.80	10.89	-62.91	-62.9

Table 7-5. CDMA BC10 Radiated Spurious Data (Ch. 684)

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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LTE Band 26



Plot 7-64. Radiated Spurious Plot above 1GHz (LTE Band 26)

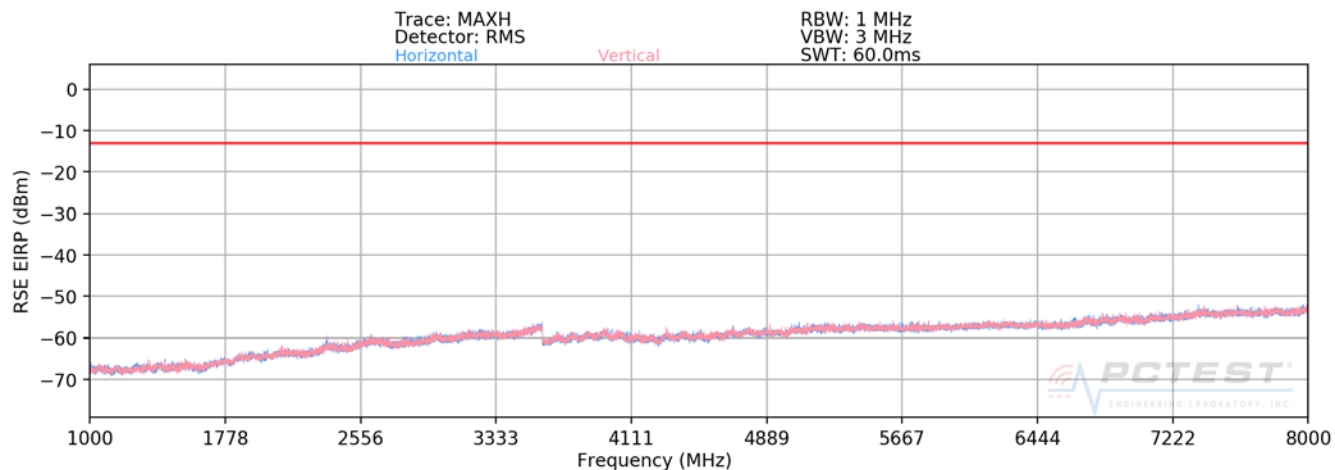
OPERATING FREQUENCY: 821.50 MHz
 MODULATION SIGNAL: QPSK
 BANDWIDTH: 15.0 MHz
 DISTANCE: 3 meters
 LIMIT: -13.00 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1643.00	V	136	324	-72.38	8.91	-63.47	-63.5
2464.50	V	130	233	-66.40	9.61	-56.79	-56.8
3286.00	V	-	-	-74.01	9.56	-64.45	-64.5

Table 7-6. Radiated Spurious Data (LTE Band 26 – Mid Channel)

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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LTE Band 14



Plot 7-65. Radiated Spurious Plot above 1GHz (LTE Band 14)

OPERATING FREQUENCY: 793.00 MHz
MODULATION SIGNAL: QPSK
BANDWIDTH: 10.0 MHz
DISTANCE: 3 meters
LIMIT: -13 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]
2379.00	V	132	189	-61.66	3.77	-57.89	-44.9
3172.00	V	-	-	-69.19	5.86	-63.34	-50.3
3965.00	V	-	-	-68.76	7.29	-61.47	-48.5

Table 7-7. Radiated Spurious Data (LTE Band 14 – Mid Channel)

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

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1586.00	H	157	25	-63.93	2.68	-61.25	-21.3

Table 7-8. Radiated Spurious Data (LTE Band 14 – Wide Band)

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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7.8 Frequency Stability / Temperature Variation

§2.1055 §90.213

Test Overview and Limit

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

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

The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency.

Test Procedure Used

ANSI/TIA-603-E-2016

Test Settings

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

Test Setup

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

Test Notes

None

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Frequency Stability / Temperature Variation

§2.1055, §90.213

OPERATING FREQUENCY: 817,900,000 Hz
 CHANNEL: 476
 REFERENCE VOLTAGE: 4.32 VDC
 DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.32	- 30	817,899,997	-3	-0.0000004
100 %		- 20	817,899,938	-62	-0.0000076
100 %		- 10	817,900,032	32	0.0000039
100 %		0	817,899,547	-453	-0.0000554
100 %		+ 10	817,899,979	-21	-0.0000026
100 %		+ 20	817,899,920	-80	-0.0000098
100 %		+ 30	817,899,803	-197	-0.0000241
100 %		+ 40	817,899,607	-393	-0.0000480
100 %		+ 50	817,900,187	187	0.0000229
BATT. ENDPOINT	3.36	+ 20	817,899,631	-369	-0.0000451

Table 7-9. CDMA BC10 Frequency Stability Data

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Frequency Stability / Temperature Variation

§2.1055, §90.213

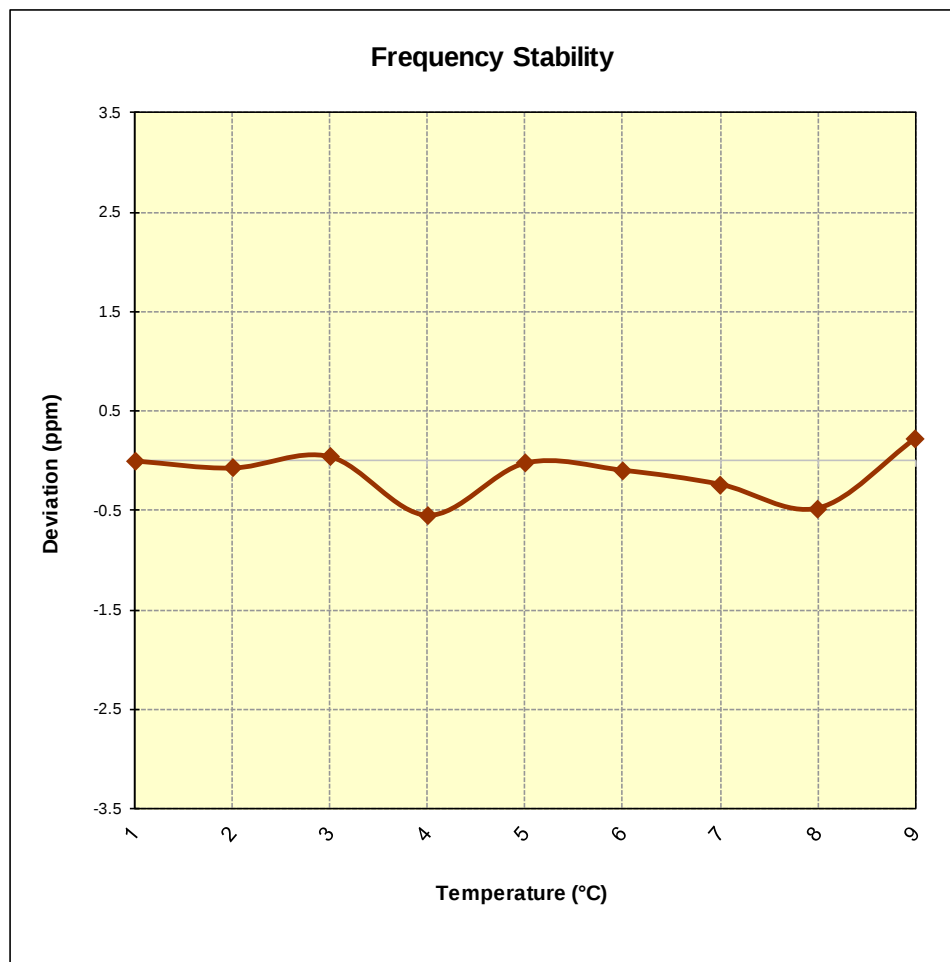


Figure 7-6. CDMA BC10 Frequency Stability Graph

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Frequency Stability / Temperature Variation

§2.1055, §90.213

OPERATING FREQUENCY: 819,000,000 Hz
 CHANNEL: 26740
 REFERENCE VOLTAGE: 4.32 VDC
 DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.32	- 30	819,000,022	22	0.0000027
100 %		- 20	818,999,700	-300	-0.0000366
100 %		- 10	819,000,285	285	0.0000348
100 %		0	818,999,970	-30	-0.0000037
100 %		+ 10	819,000,004	4	0.0000005
100 %		+ 20	818,999,852	-148	-0.0000181
100 %		+ 30	818,999,892	-108	-0.0000132
100 %		+ 40	819,000,173	173	0.0000211
100 %		+ 50	819,000,233	233	0.0000284
BATT. ENDPOINT	3.36	+ 20	818,999,684	-316	-0.0000386

Table 7-10. LTE Band 26 Frequency Stability Data

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Frequency Stability / Temperature Variation

§2.1055, §90.213

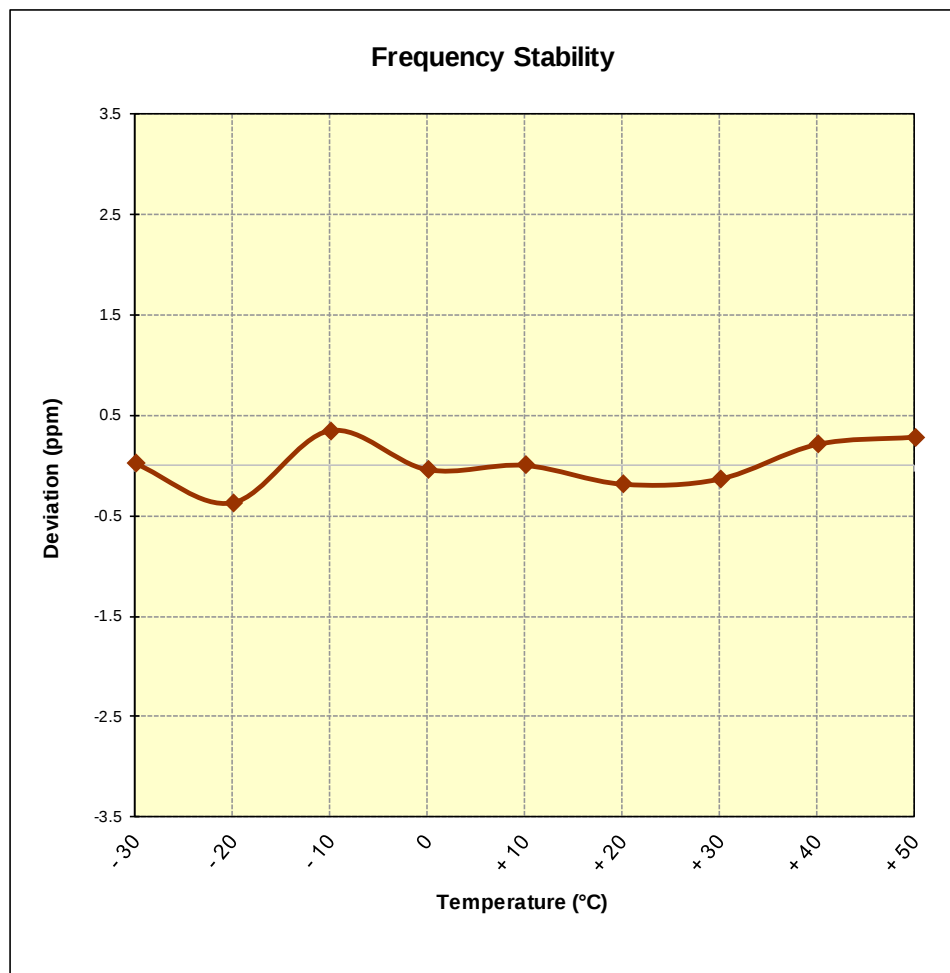


Table 7-11. LTE Band 26 Frequency Stability Data

Frequency Stability / Temperature Variation

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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OPERATING FREQUENCY: 793,000,000 Hz
 CHANNEL: 23330
 REFERENCE VOLTAGE: 4.32 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.32	- 30	793,000,443	443	0.0000559
100 %		- 20	793,000,172	172	0.0000217
100 %		- 10	792,999,831	-169	-0.0000213
100 %		0	793,000,313	313	0.0000395
100 %		+ 10	792,999,936	-64	-0.0000081
100 %		+ 20	793,000,167	167	0.0000211
100 %		+ 30	792,999,961	-39	-0.0000049
100 %		+ 40	793,000,041	41	0.0000052
100 %		+ 50	793,000,051	51	0.0000064
BATT. ENDPOINT	3.36	+ 20	792,999,874	-126	-0.0000159

Table 7-12. LTE Band 14 Frequency Stability Data

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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Frequency Stability / Temperature Variation

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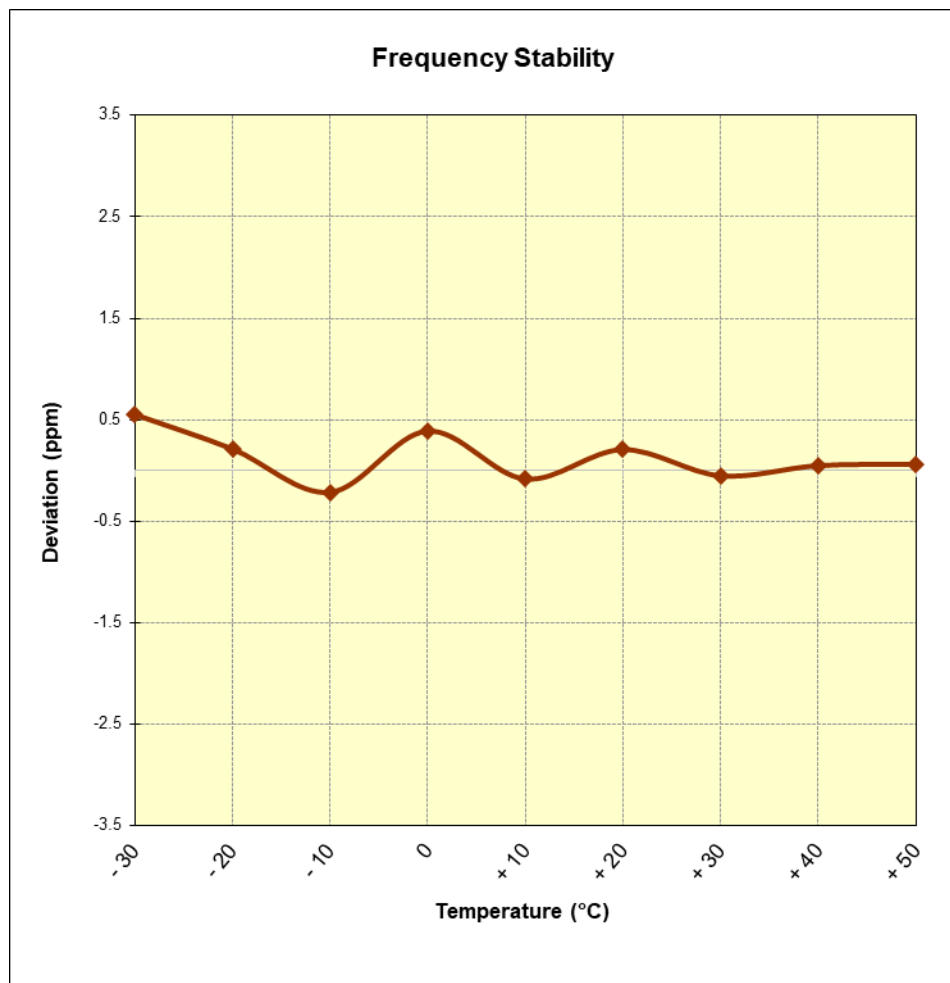


Table 7-13. LTE Band 14 Frequency Stability Data

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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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: A3LSMN970U** complies with all the requirements of Parts 22(H) and 90 of the FCC rules.

FCC ID: A3LSMN970U		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1905220084-05.A3L	Test Dates: 05/22 - 07/10/2019	EUT Type: Portable Handset	Page 62 of 62	