

## PART 27 MEASUREMENT REPORT

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

**Date of Testing:**  
2/10/2021 - 2/16/2021  
**Test Site/Location:**  
PCTEST Lab. Columbia, MD, USA  
**Test Report Serial No.:**  
1M2102050006-07-R1.A3L

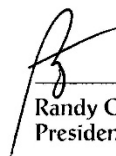
<b>FCC ID:</b>	<b>A3LSMG998U</b>
<b>Applicant Name:</b>	<b>Samsung Electronics Co., Ltd.</b>

**Application Type:** Class II Permissive Change  
**Model:** SM-G998U  
**Additional Model(s):** SM-G998U1  
**EUT Type:** Portable Handset  
**FCC Classification:** PCS Licensed Transmitter Held to Ear (PCE)  
**FCC Rule Part:** 27  
**Test Procedure(s):** ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01  
**Class II Permissive Change:** Please see FCC change document  
**Original Grant Date:** 12/22/2020



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.

Note: This revised Test Report (S/N: 1M2102050006-07-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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

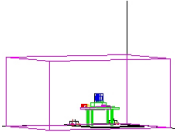


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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
NR Band n41	100 MHz	π/2 BPSK	2546.0 - 2640.0	0.394	25.95	96M5G7D
		QPSK	2546.0 - 2640.0	0.318	25.02	97M8G7D
		16QAM	2546.0 - 2640.0	0.269	24.30	97M7W7D
		64QAM	2546.0 - 2640.0	0.236	23.72	97M7W7D
		256QAM	2546.0 - 2640.0	0.113	20.55	97M9W7D
	90 MHz	π/2 BPSK	2541.0 - 2645.0	0.373	25.72	87M0G7D
		QPSK	2541.0 - 2645.0	0.308	24.88	87M6G7D
		16QAM	2541.0 - 2645.0	0.250	23.98	87M7W7D
		64QAM	2541.0 - 2645.0	0.224	23.50	87M3W7D
		256QAM	2541.0 - 2645.0	0.103	20.14	87M7W7D
	80 MHz	π/2 BPSK	2536.0 - 2650.0	0.368	25.66	77M1G7D
		QPSK	2536.0 - 2650.0	0.309	24.90	77M6G7D
		16QAM	2536.0 - 2650.0	0.252	24.02	77M6W7D
		64QAM	2536.0 - 2650.0	0.223	23.48	77M6W7D
		256QAM	2536.0 - 2650.0	0.104	20.17	77M5W7D
	60 MHz	π/2 BPSK	2526.0 - 2660.0	0.353	25.48	58M3G7D
		QPSK	2526.0 - 2660.0	0.305	24.84	58M2G7D
		16QAM	2526.0 - 2660.0	0.254	24.05	58M3W7D
		64QAM	2526.0 - 2660.0	0.224	23.51	58M1W7D
		256QAM	2526.0 - 2660.0	0.105	20.21	58M3W7D
	50 MHz	π/2 BPSK	2521.0 - 2665.0	0.359	25.55	46M1G7D
		QPSK	2521.0 - 2665.0	0.303	24.82	47M8G7D
		16QAM	2521.0 - 2665.0	0.250	23.98	47M7W7D
		64QAM	2521.0 - 2665.0	0.221	23.44	47M6W7D
		256QAM	2521.0 - 2665.0	0.105	20.20	47M7W7D
	40 MHz	π/2 BPSK	2516.0 - 2670.0	0.361	25.57	35M6G7D
		QPSK	2516.0 - 2670.0	0.306	24.86	35M7G7D
		16QAM	2516.0 - 2670.0	0.255	24.06	35M7W7D
		64QAM	2516.0 - 2670.0	0.216	23.35	35M9W7D
		256QAM	2516.0 - 2670.0	0.106	20.24	35M8W7D
	30 MHz	π/2 BPSK	2511.0 - 2675.0	0.359	25.55	27M0G7D
		QPSK	2511.0 - 2675.0	0.301	24.78	28M1G7D
		16QAM	2511.0 - 2675.0	0.256	24.08	27M9W7D
		64QAM	2511.0 - 2675.0	0.224	23.50	28M1W7D
		256QAM	2511.0 - 2675.0	0.102	20.10	27M9W7D
	20 MHz	π/2 BPSK	2506.0 - 2680.0	0.371	25.69	18M1G7D
		QPSK	2506.0 - 2680.0	0.308	24.88	18M8G7D
		16QAM	2506.0 - 2680.0	0.261	24.16	18M7W7D
		64QAM	2506.0 - 2680.0	0.216	23.34	18M8W7D
		256QAM	2506.0 - 2680.0	0.106	20.25	18M7W7D

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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 17025-2017 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 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:A3LSMG998U**. 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 27.

**Test Device Serial No.:** 01071, 01212, 01279, 01311

### 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, 5G NR (n5, n71, n41, n66, n2, n12, n25, n30, n77, n260, n261), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer, UWB



This EUT supports 2 antennas (Antenna B and Antenna E) for band 41 operations. This report includes supplemental conducted and radiated data to ensure compliance for additional EN-DC combinations, which were not covered in the original filing.

### 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 of this test report for a description of the radiated and antenna port conducted emissions tests.

### 2.4 EMI Suppression Device(s)/Modifications

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

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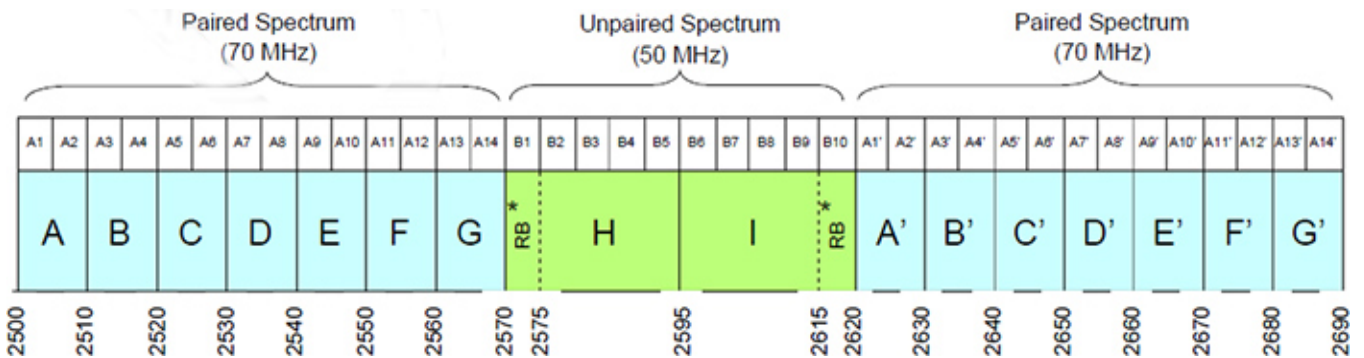
## 3.0 DESCRIPTION OF TESTS



### 3.1 Evaluation Procedure

The measurement procedures described in the “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI/TIA-603-E-2016) and “Measurement Guidance for Certification of Licensed Digital Transmitters” (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure.....None

### 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.

For radiated power measurements, substitution method is used per the guidance of ANSI/TIA-603-E-2016. A half-wave dipole is 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 radiated spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:



$$E_{\text{[dB}\mu\text{V/m]}} = \text{Measured amplitude level}_{\text{[dBm]}} + 107 + \text{Cable Loss}_{\text{[dB]}} + \text{Antenna Factor}_{\text{[dB/m]}}$$

And

$$\text{EIRP}_{\text{[dBm]}} = E_{\text{[dB}\mu\text{V/m]}} + 20\log D - 104.8; \text{ where } D \text{ is the measurement distance in meters.}$$

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.




Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI/TIA-603-E-2016.

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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  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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

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## 5.0 TEST EQUIPMENT CALIBRATION DATA



Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	LTX3	Licensed Transmitter Cable Set	8/28/2020	Annual	8/28/2021	LTX3
Agilent	E5515C	Wireless Communications Test Set	N/A			GB45360985
Anritsu	MT8821C	Radio Communication Analyzer	N/A			6200901190
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	6/18/2022	9704-5182
Emco	3116	Horn Antenna (18-40GHz)	8/7/2018	Triennial	8/7/2021	9203-2178
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	2/22/2019	Biennial	2/22/2021	128338
Keysight Technologies	N9030B	PXA Signal Analyzer, Multi-touch	9/17/2020	Annual	9/17/2021	MY57141001
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			100976
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			112347
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	7/15/2020	Annual	7/15/2021	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/21/2020	Annual	2/21/2021	102133
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107

**Table 5-1. Test Equipment**

### Notes:

1. 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.
2. 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

### 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

#### Example: Spurious emission at 3700.40 MHz

The receive 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 3700.40 MHz. So 6.1 dB is added to the signal generator reading of  $-30.9$  dBm yielding  $-24.80$  dBm. The fundamental EIRP was 25.50 dBm so this harmonic was  $25.50$  dBm  $- (-24.80) = 50.3$  dBc.

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## 7.0 TEST RESULTS

### 7.1 Summary



Company Name: Samsung Electronics Co., Ltd.  
 FCC ID: A3LSMG998U  
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)  
 Mode(s): 5G NR

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Transmitter Conducted Output Power	2.1046	N/A	PASS	Section 7.2
	Occupied Bandwidth	2.1049	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions (NR Band n41)	2.1051, 27.53(m)	Undesirable emissions must meet the limits detailed in 27.53(m)	PASS	Sections 7.4, 7.5
RADIATED	Effective Radiated Power / Equivalent Isotropic Radiated Power (NR Band n41)	27.50(h)(2)	< 2 Watts max. EIRP	PASS	Section 7.6
	Radiated Spurious Emissions (NR Band n41)	2.1053, 27.53(m)	Undesirable emissions must meet the limits detailed in 27.53(m)	PASS	Section 7.7

**Table 7-1. Summary of Test Results**

#### Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots 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) All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST EMC Software Tool Beta 8.
- 5) For radiated spurious emissions, automated test software was used to maximize emissions. The measurement software utilized is Chamber Control v1.3.1.

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## 7.2 Conducted Power Output Data

### Test Overview

The EUT is set up to transmit two contiguous LTE channels. The power level of both carriers is measured by means of a calibrated spectrum analyzer. All 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.

A-MPR is implemented in this device when operating at Power Class 2 in LTE Band 41 per the A-MPR specification in 3GPP TS 36.101. The conducted powers are shown herein to cover the different A-MPR levels specified in the standard. Measurement equipment was set up with triggering/gating on the spectrum analyzer such that powers were measured only during the on-time of the signal.

### Test Procedure Used

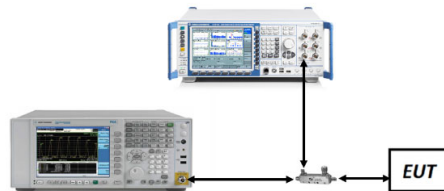
KDB 971168 D01 v03r01 – Section 6.0

### Test Settings

1. Span = 2 x OBW to 3 x OBW
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 7-1. Test Instrument & Measurement Setup**



### Test Notes

None.

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Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
100 MHz	π/2 BPSK	509202	2546.01	1/136	25.96
		518598	2592.99	1/68	25.90
		528000	2640.00	1/68	25.88
	QPSK	509202	2546.01	1/136	25.36
		518598	2592.99	1/68	25.34
		528000	2640.00	1/68	25.37
	16-QAM	528000	2640.00	1/68	24.94
	64-QAM	518598	2592.99	1/68	24.05
	256-QAM	528000	2640.00	1/68	22.50
90 MHz	π/2 BPSK	508200	2541.00	1/122	25.57
		518592	2592.99	1/61	25.67
		529002	2644.98	1/61	25.54
	QPSK	508200	2541.00	1/122	25.29
		518592	2592.99	1/61	25.27
		529002	2644.98	1/61	25.23
	16-QAM	529002	2644.98	1/61	24.62
	64-QAM	518592	2592.99	1/61	23.83
	256-QAM	518592	2592.99	1/61	22.28
80 MHz	π/2 BPSK	507204	2536.02	1/108	25.47
		518598	2592.99	1/54	25.61
		529998	2649.99	1/108	25.51
	QPSK	507204	2536.02	1/108	25.17
		518598	2592.99	1/54	25.22
		529998	2649.99	1/108	25.25
	16-QAM	529998	2649.99	1/108	24.66
	64-QAM	518598	2592.99	1/54	23.81
	256-QAM	529998	2649.99	1/108	22.12
60 MHz	π/2 BPSK	505200	2526.00	1/40	25.45
		518598	2592.99	1/81	25.43
		531996	2659.98	1/81	25.54
	QPSK	505200	2526.00	1/40	25.10
		518598	2592.99	1/81	25.15
		531996	2659.98	1/81	25.19
	16-QAM	531996	2659.98	1/81	24.69
	64-QAM	518598	2592.99	1/81	23.84
	256-QAM	531996	2659.98	1/81	22.16
50 MHz	π/2 BPSK	504204	2521.02	1/66	25.61
		518598	2592.99	1/66	25.50
		532998	2664.99	1/33	25.44
	QPSK	504204	2521.02	1/66	25.25
		518598	2592.99	1/66	25.24
		532998	2664.99	1/33	25.17
	16-QAM	532998	2664.99	1/33	24.62
	64-QAM	518598	2592.99	1/66	23.77
	256-QAM	532998	2664.99	1/33	22.15
40 MHz	π/2 BPSK	503202	2516.01	1/79	25.55
		518598	2592.99	1/26	25.52
		534000	2670.00	1/53	25.56
	QPSK	503202	2516.01	1/79	25.16
		518598	2592.99	1/26	25.28
		534000	2670.00	1/53	25.21
	16-QAM	534000	2670.00	1/53	24.70
	64-QAM	518598	2592.99	1/26	23.68
	256-QAM	534000	2670.00	1/53	22.19
30 MHz	π/2 BPSK	502203	2511.00	1/39	25.40
		518598	2592.99	1/39	25.50
		534999	2674.98	1/39	25.53
	QPSK	502203	2511.00	1/39	25.24
		518598	2592.99	1/39	25.18
		534999	2674.98	1/39	25.13
	16-QAM	534999	2674.98	1/39	24.72
	64-QAM	518598	2592.99	1/39	23.83
	256-QAM	534999	2674.98	1/39	22.05
20 MHz	π/2 BPSK	501204	2506.02	1/13	25.51
		518598	2592.99	1/25	25.64
		535998	2679.99	1/13	25.53
	QPSK	501204	2506.02	1/13	25.18
		518598	2592.99	1/25	25.26
		535998	2679.99	1/13	25.23
	16-QAM	535998	2679.99	1/13	24.80
	64-QAM	518598	2592.99	1/25	23.67
	256-QAM	535998	2679.99	1/13	22.20

Table 7-2. Conducted Powers n41

FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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## 7.3 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

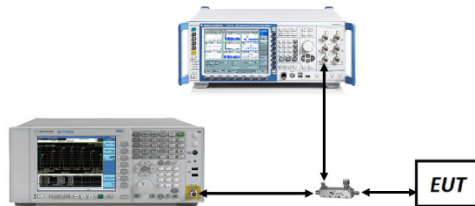
KDB 971168 D01 v03r01 – Section 4.2

### 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 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

### Test Setup

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



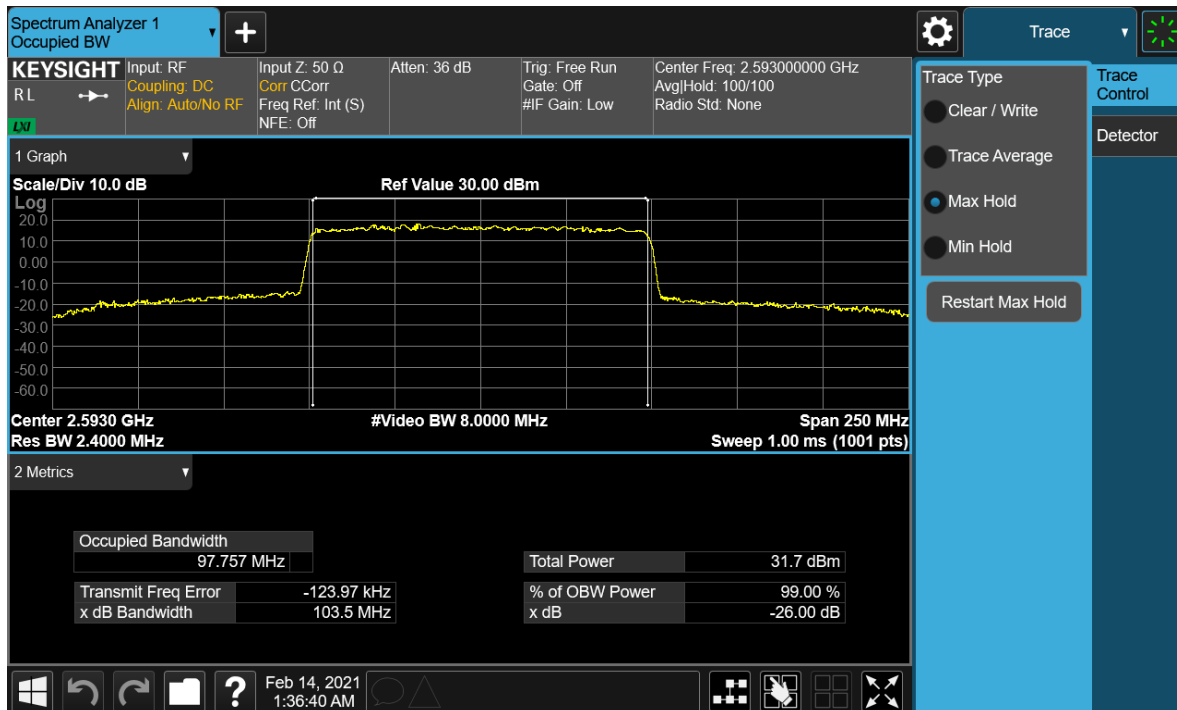
**Figure 7-2. Test Instrument & Measurement Setup**



### Test Notes

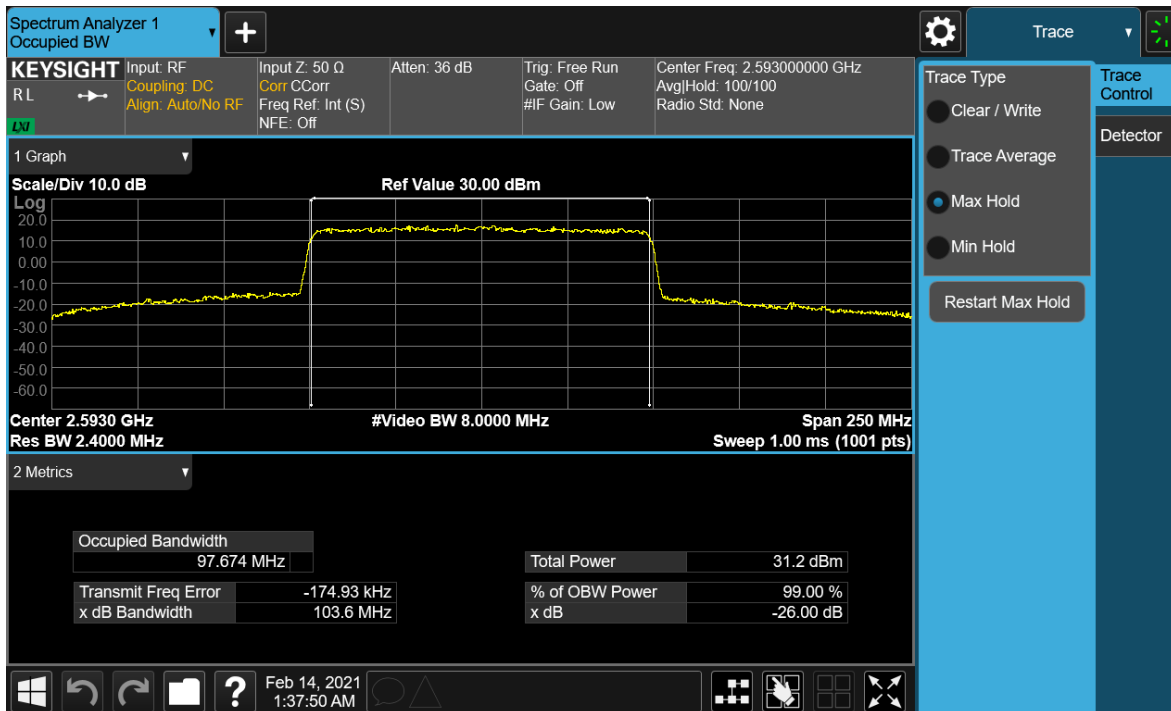
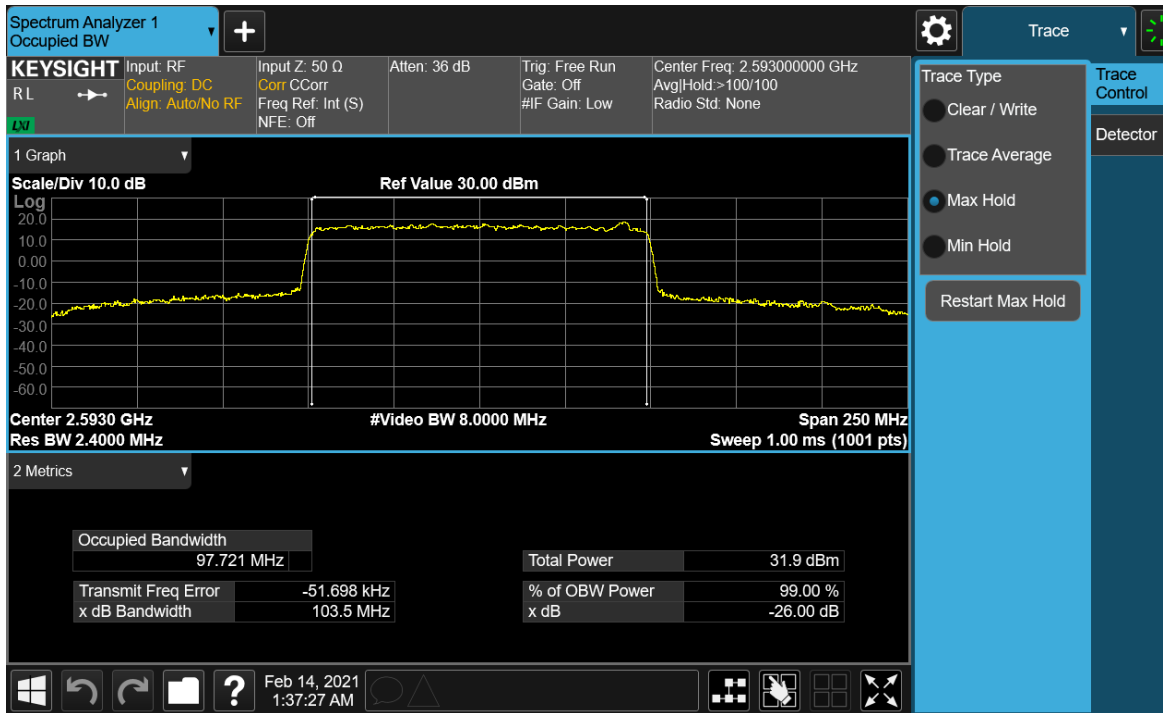
For NR Band n41, only the 100 MHz Bandwidth was investigated as it provided the worst-case conducted power output.



FCC ID: A3LSMG998U	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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# NR Band n41



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Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset		Page 15 of 37



FCC ID: A3LSMG998U		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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Plot 7-5. Occupied Bandwidth Plot (NR Band n41 - 100MHz 256-QAM - Full RB)

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<b>Test Report S/N:</b> 1M2102050006-07-R1.A3L	<b>Test Dates:</b> 2/10/2021 - 2/16/2021	<b>EUT Type:</b> Portable Handset		Page 17 of 37

## 7.4 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 10<sup>th</sup> harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at 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 NR Band n41, the minimum permissible attenuation level of any spurious emission is 55 + 10log<sub>10</sub>(P<sub>[Watts]</sub>).**

### Test Procedure Used

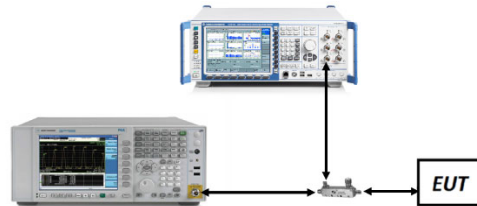
KDB 971168 D01 v03r01 – Section 6.0

### 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. 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.



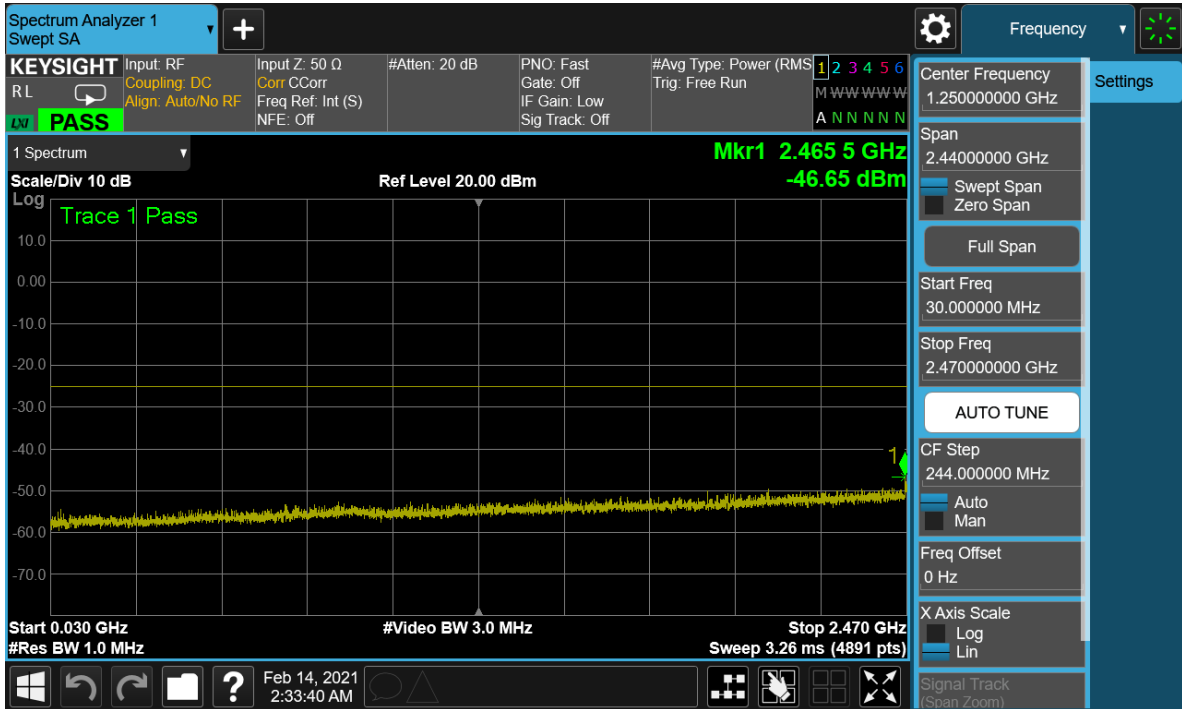
**Figure 7-3. Test Instrument & Measurement Setup**

### Test Notes

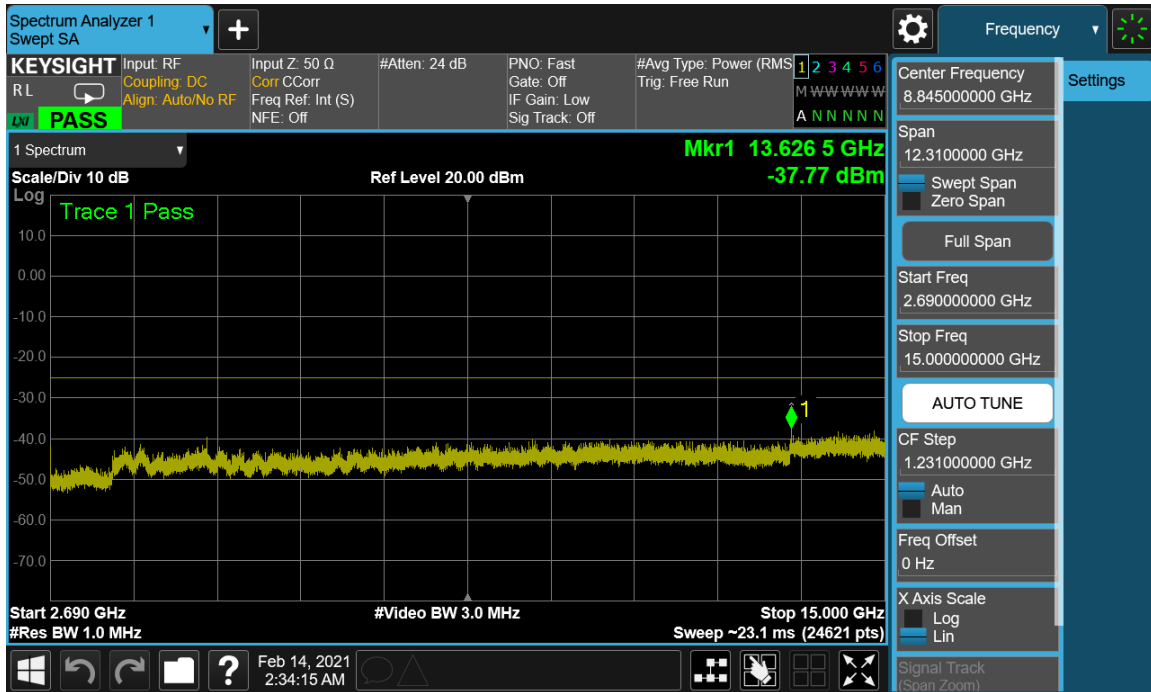
1. Per Part 27, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 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.
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

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Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset		Page 18 of 37

## NR Band n41

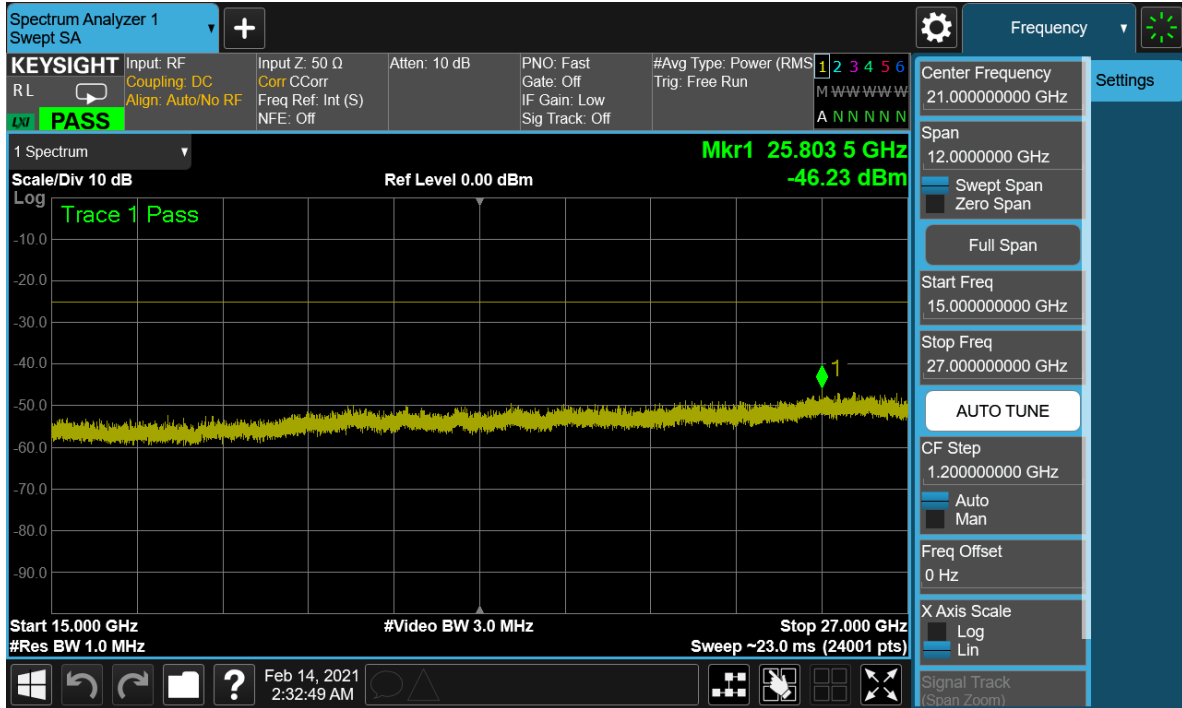


Plot 7-6. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

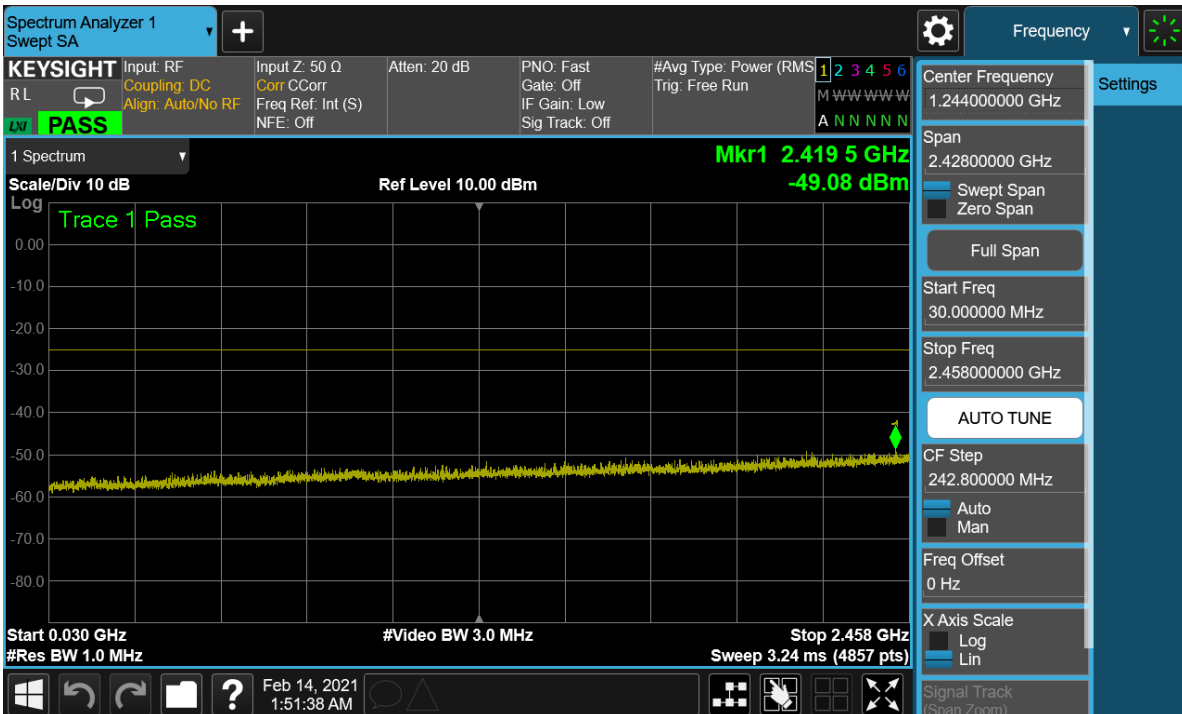


Plot 7-7. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset		Page 19 of 37

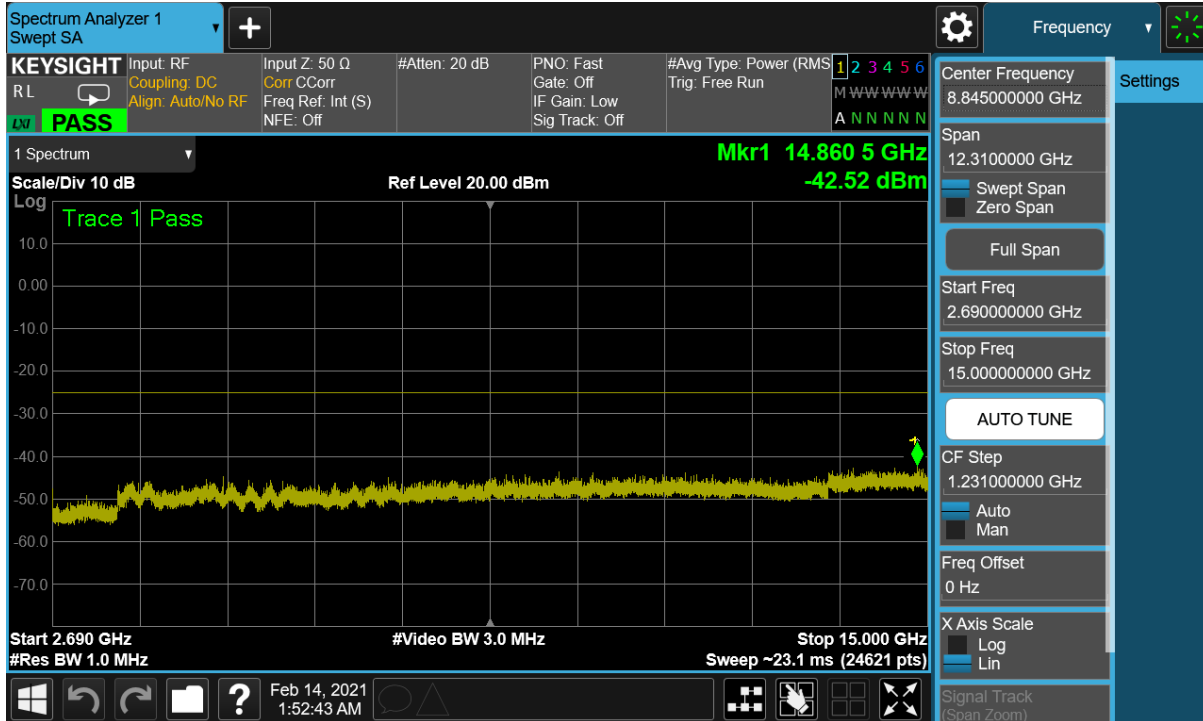


Plot 7-8. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

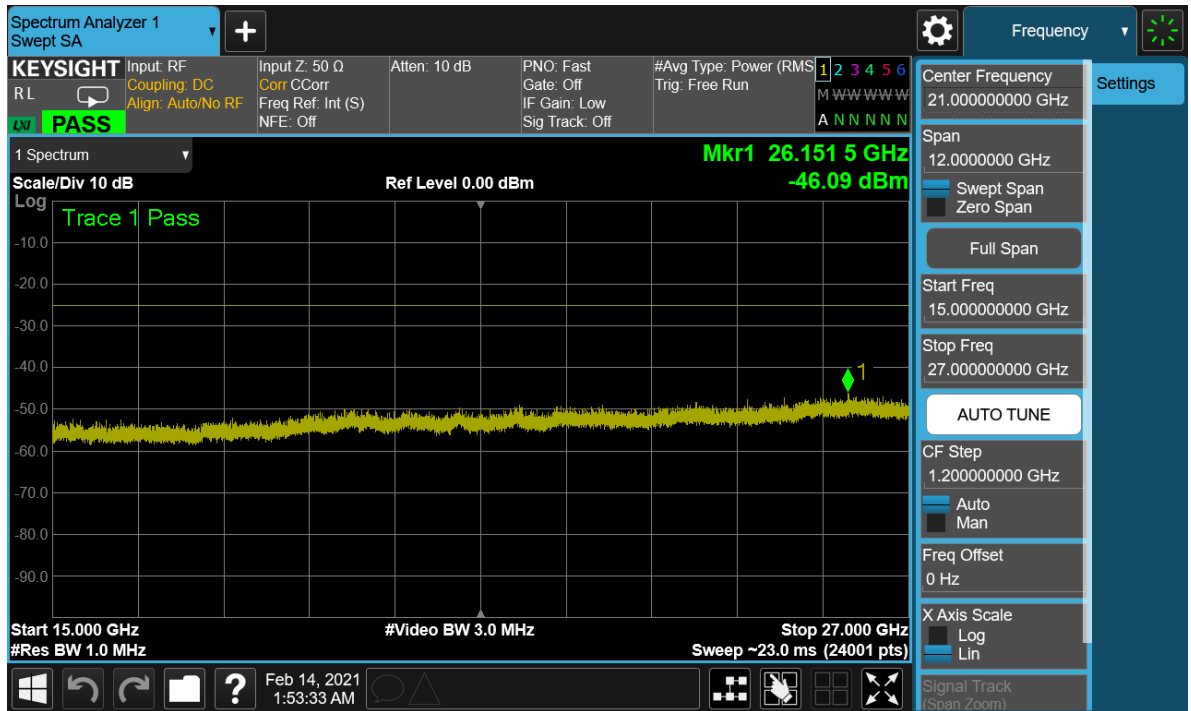


Plot 7-9. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG998U	<b>PCTEST</b> Proud to be part of element	PART 27 MEASUREMENT REPORT	<b>SAMSUNG</b>	Approved by: Technical Manager
Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset		Page 20 of 37

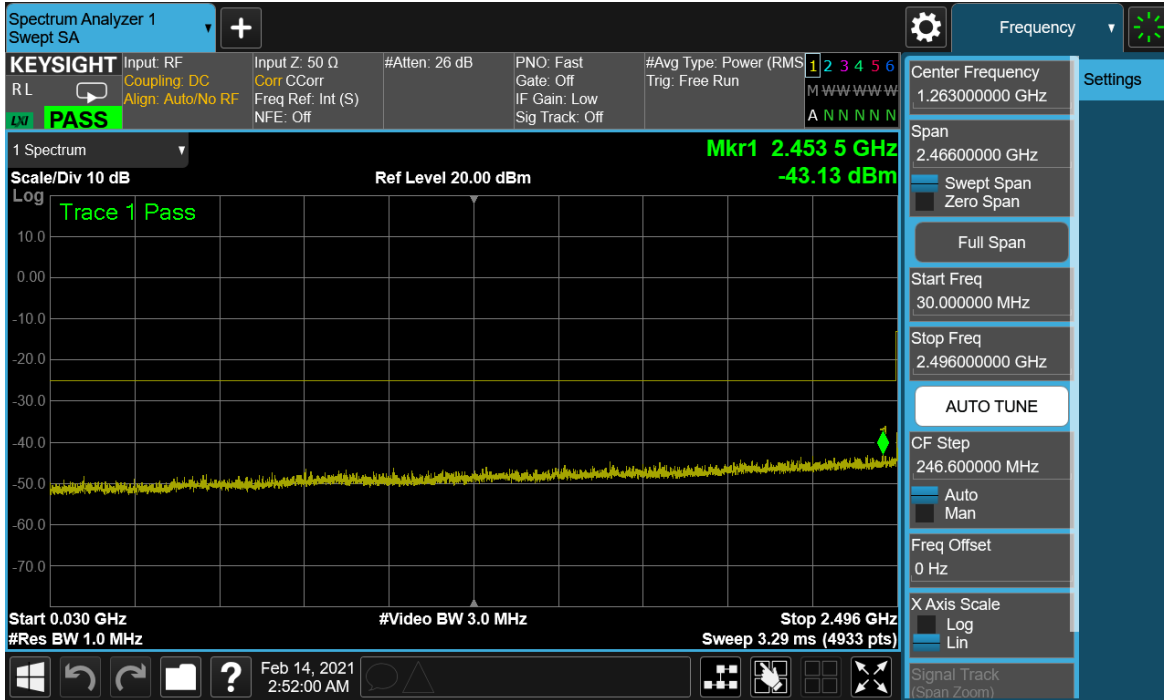


Plot 7-10. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

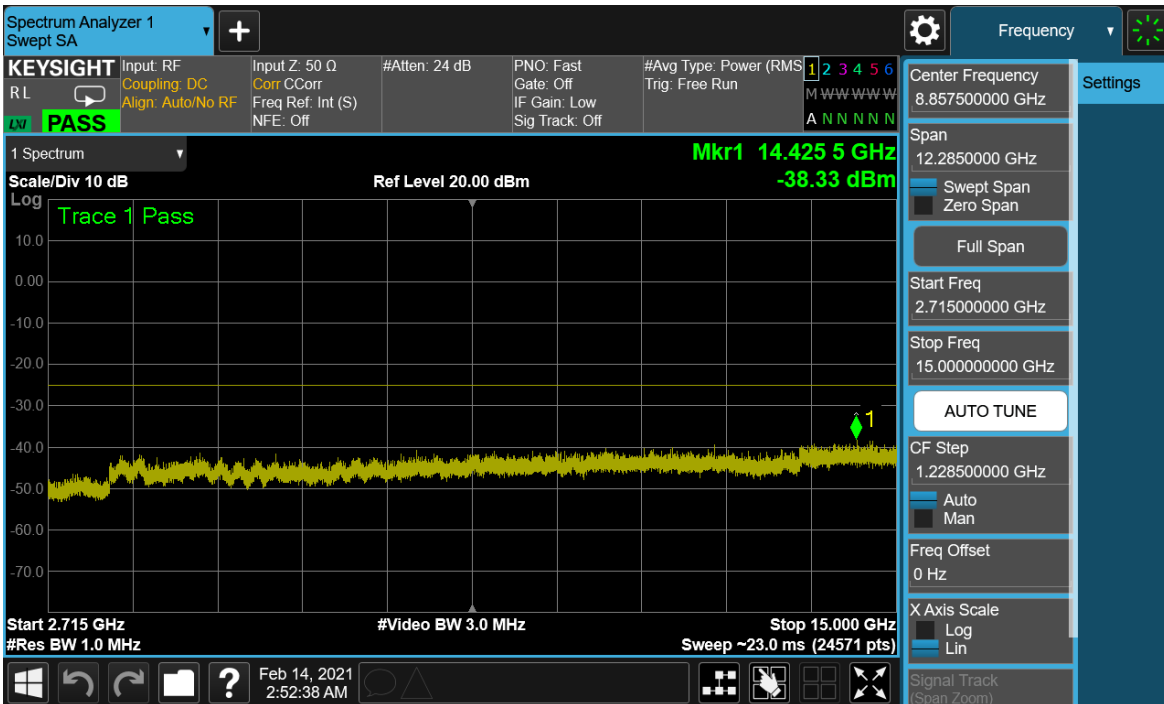


Plot 7-11. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG998U	<b>PCTEST</b> Proud to be part of  element	<b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset		Page 21 of 37

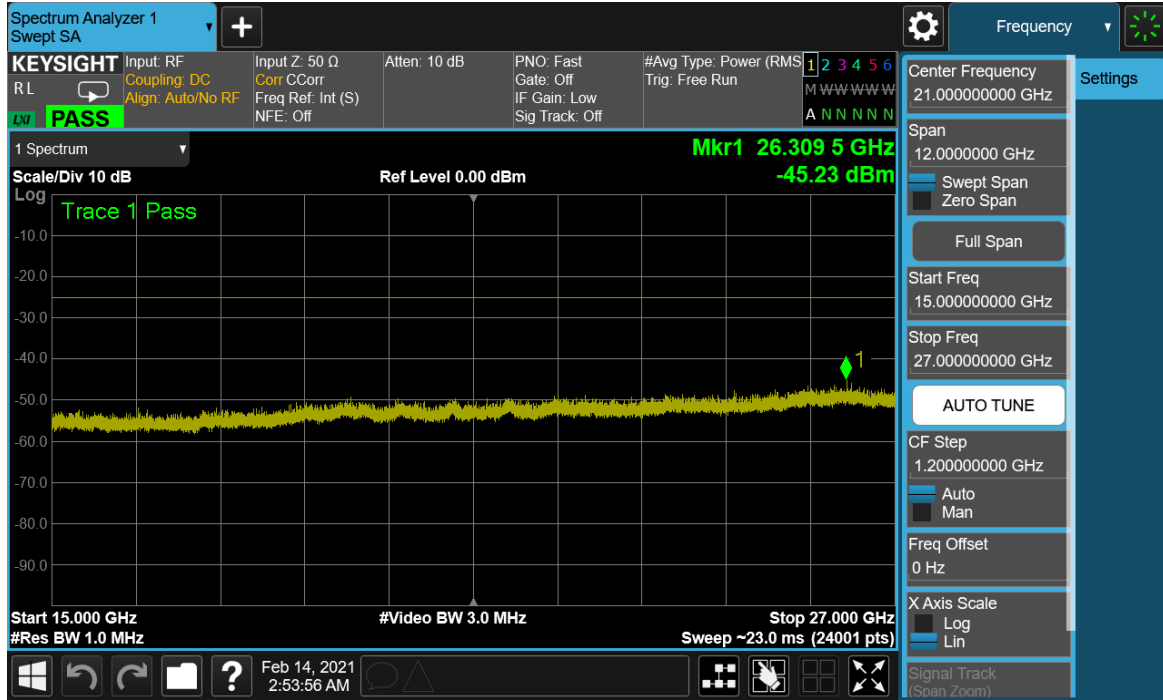


Plot 7-12. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-13. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG998U	<b>PCTEST</b> Proud to be part of  element	<b>PART 27 MEASUREMENT REPORT</b>		Approved by: Technical Manager
Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset		Page 22 of 37



Plot 7-14. Conducted Spurious Plot (NR Band n41 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG998U	<b>PCTEST</b> Proud to be part of element	<b>PART 27 MEASUREMENT REPORT</b>		<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1M2102050006-07-R1.A3L	<b>Test Dates:</b> 2/10/2021 - 2/16/2021	<b>EUT Type:</b> Portable Handset		Page 23 of 37

## 7.5 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 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 NR Band n41 is as noted in the Test Notes on the following page.***

### Test Procedure Used

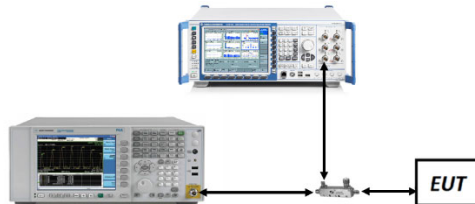
KDB 971168 D01 v03r01 – Section 6.0

### 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 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq$  2 x 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 7-4. Test Instrument & Measurement Setup**

FCC ID: A3LSMG998U	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset	Page 24 of 37

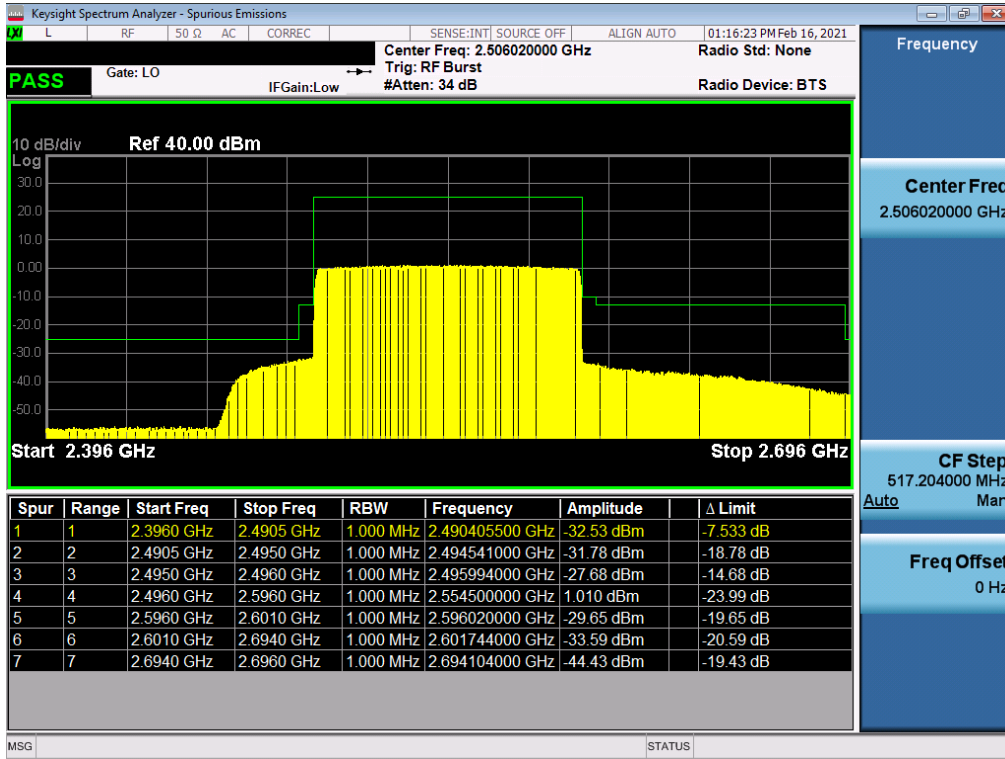


## Test Notes

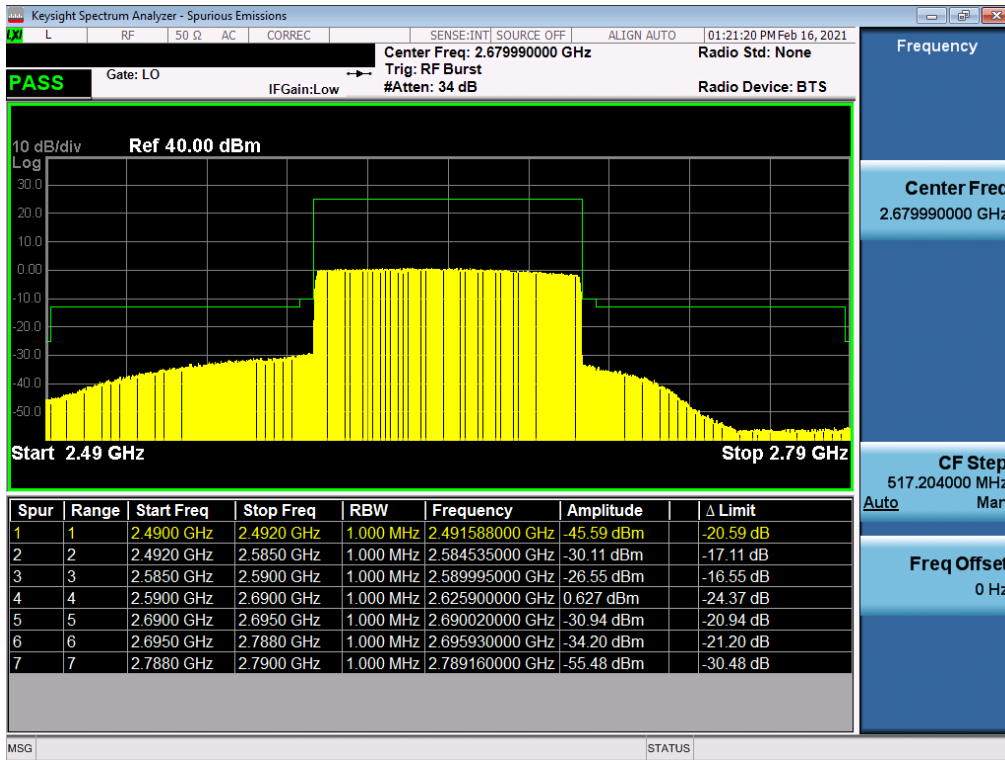
1. Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than  $40 + 10 \log (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel 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.
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.
3. For NR Band n41, only the 100 MHz Bandwidth was investigated as it provided the worst-case conducted power output.

FCC ID: A3LSMG998U		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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**NR Band n41**



**Plot 7-15. Lower ACP Plot (NR Band n41 - 100MHz CP-OFDM-QPSK – Full RB)**



**Plot 7-16. Upper ACP Plot (NR Band n41 - 100MHz CP-OFDM-QPSK – Full RB)**

FCC ID: A3LSMG998U	<b>PCTEST</b> Proud to be part of element	<b>PART 27 MEASUREMENT REPORT</b>	<b>SAMSUNG</b>	Approved by: Technical Manager
Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset		Page 26 of 37

## 7.6 Radiated Power (EIRP)

### Test Overview

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

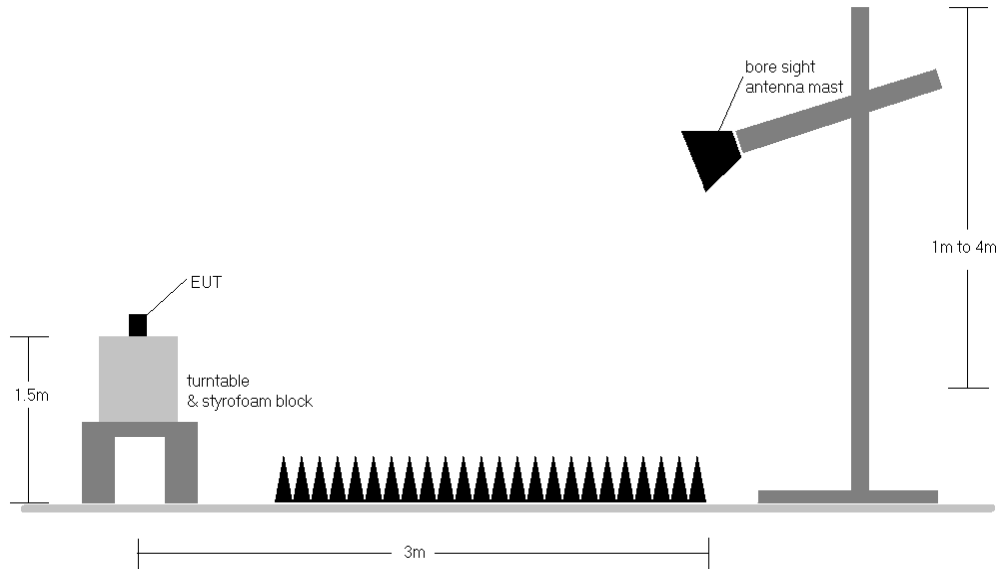
### Test Settings

1. Radiated power measurements are performed using the signal analyzer’s “channel power” measurement capability for signals with continuous operation. For signals with burst transmission, the signal analyzer’s “time domain power” measurement capability is used
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW  $\geq$  3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points  $\geq$  2 x span / RBW
6. Detector = RMS
7. Trigger is set to “free run” for signals with continuous operation with the sweep times set to “auto”. Trigger is set to enable triggering only on full power bursts with the sweep time set less than or equal to the transmission burst duration
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation. For signals with burst transmission, the “gating” function was enabled to ensure that measurements are performed during times in which the transmitter is operating at its maximum power
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

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<b>Test Report S/N:</b> 1M2102050006-07-R1.A3L	<b>Test Dates:</b> 2/10/2021 - 2/16/2021	<b>EUT Type:</b> Portable Handset		Page 27 of 37

**Test Setup**



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



**Figure 7-5. Test Instrument & Measurement Setup >1 GHz**

**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 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.
- 4) For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

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<b>Test Report S/N:</b> 1M2102050006-07-R1.A3L	<b>Test Dates:</b> 2/10/2021 - 2/16/2021	<b>EUT Type:</b> Portable Handset	Page 28 of 37



## 7.7 Radiated Spurious Emissions Measurements

### Test Overview



Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 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

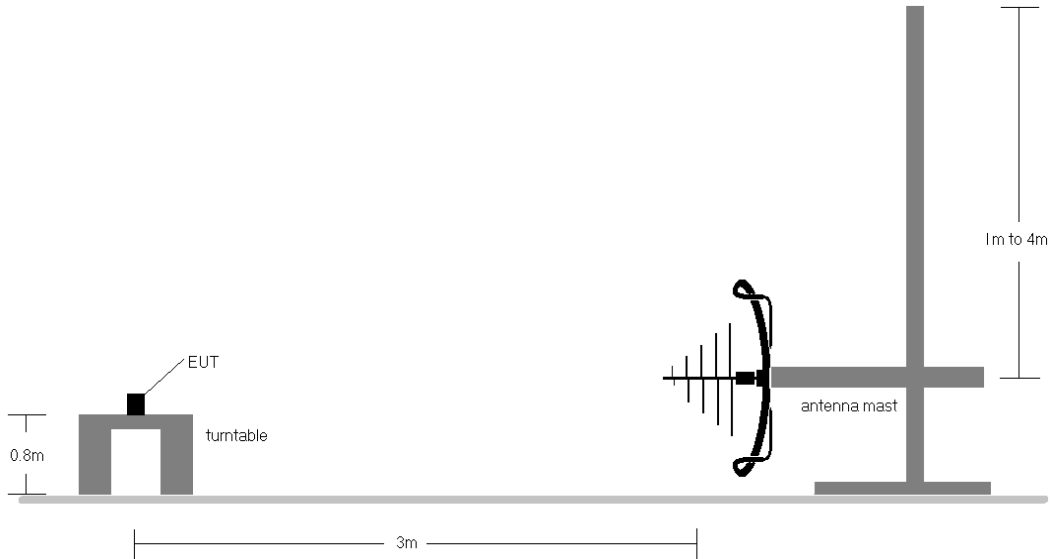
### Test Settings

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

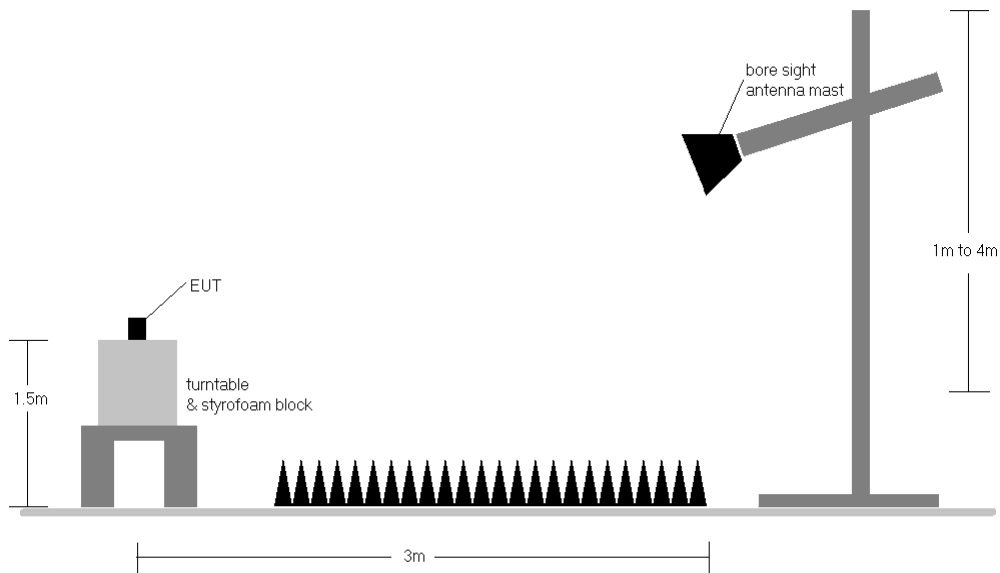
FCC ID: A3LSMG998U		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2102050006-07-R1.A3L	Test Dates: 2/10/2021 - 2/16/2021	EUT Type: Portable Handset		Page 30 of 37

**Test Setup**

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



**Figure 7-6. Test Instrument & Measurement Setup < 1GHz**





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

FCC ID: A3LSMG998U	<b>PCTEST</b> Proud to be part of element	<b>PART 27 MEASUREMENT REPORT</b>		<b>Approved by:</b> Technical Manager
<b>Test Report S/N:</b> 1M2102050006-07-R1.A3L	<b>Test Dates:</b> 2/10/2021 - 2/16/2021	<b>EUT Type:</b> Portable Handset		Page 31 of 37

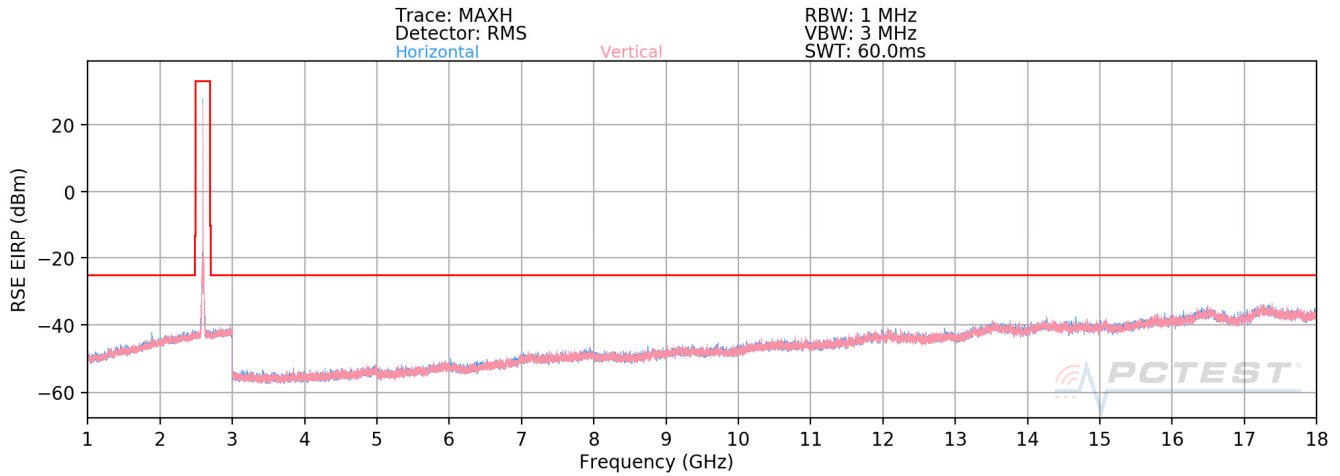
## Test Notes

- 1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
  - b)  $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
  - d)  $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$ ; where D is the measurement distance in meters.
- 2) 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.
- 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 spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 6) 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.
- 7) The "-" shown in the following RSE tables are used to denote a noise floor measurement.
- 8) For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.
- 9) Spurious emissions shown in this section are measured while operating in EN-DC mode with Sub 6GHz NR carrier as well as an LTE carrier (anchor). Spurious emissions from the NR carrier device, is subject to the rules under which the NR carrier operates. Spurious emission caused by the LTE carrier must meet the requirements of the rules under which the LTE carrier operates.

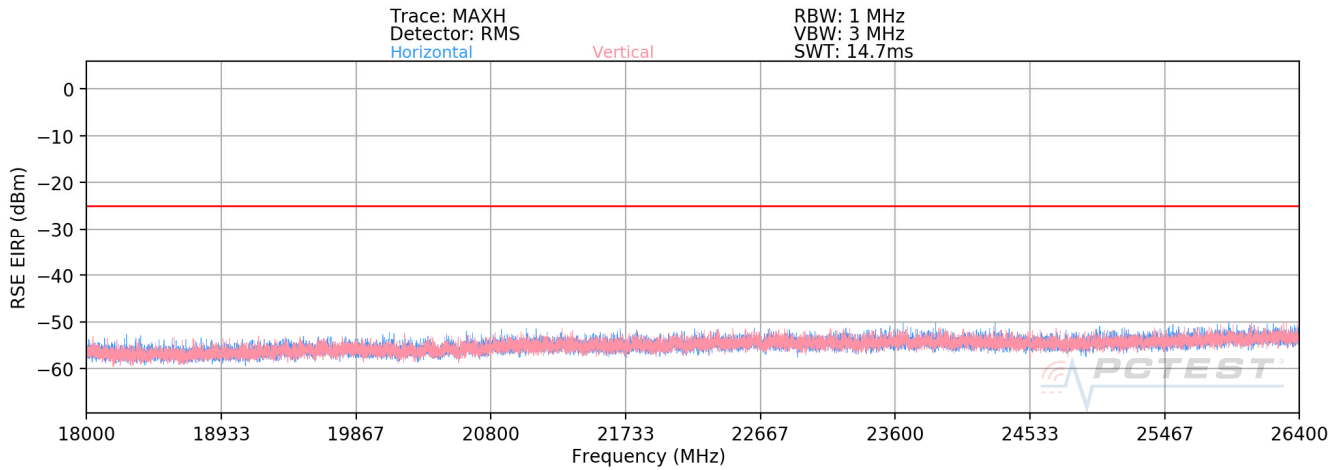
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<b>Test Report S/N:</b> 1M2102050006-07-R1.A3L	<b>Test Dates:</b> 2/10/2021 - 2/16/2021	<b>EUT Type:</b> Portable Handset	Page 32 of 37	



## NR Band n41



**Plot 7-17. Radiated Spurious Plot – 1-18 GHz (NR Band n41)**





**Plot 7-18. Radiated Spurious Plot – 18-26.4 GHz (NR Band n41)**

Bandwidth (MHz):	100
Frequency (MHz):	2546.0
RB / Offset:	1/136
Mode:	Standalone

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
5092.0	H	-	-	-73.10	10.29	44.19	-51.06	-25.00	-26.06
7638.0	H	-	-	-75.05	16.37	48.32	-46.94	-25.00	-21.94
10184.0	H	-	-	-76.89	20.67	50.78	-44.47	-25.00	-19.47

**Table 7-4. Radiated Spurious Data (NR Band n41 – Low Channel)**

FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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Bandwidth (MHz):	100
Frequency (MHz):	2593.0
RB / Offset:	1/136
Mode:	Standalone



Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
5186.0	H	-	-	-73.39	10.36	43.97	-51.29	-25.00	-26.29
7779.0	H	-	-	-74.67	16.01	48.34	-46.92	-25.00	-21.92
10372.0	H	-	-	-75.63	19.91	51.28	-43.98	-25.00	-18.98

**Table 7-5. Radiated Spurious Data (NR Band n41 – Mid Channel)**

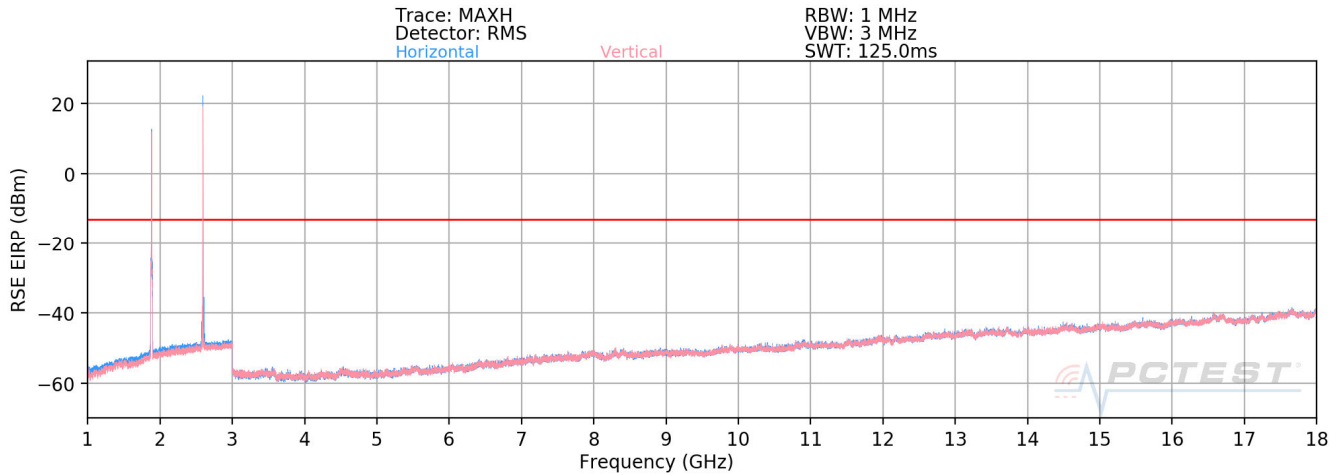
Bandwidth (MHz):	100
Frequency (MHz):	2640.0
RB / Offset:	1/136
Mode:	Standalone

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
5280.0	H	-	-	-75.00	10.56	42.56	-52.70	-25.00	-27.70
7920.0	H	-	-	-76.11	16.27	47.16	-48.09	-25.00	-23.09
10560.0	H	-	-	-77.12	20.23	50.11	-45.15	-25.00	-20.15

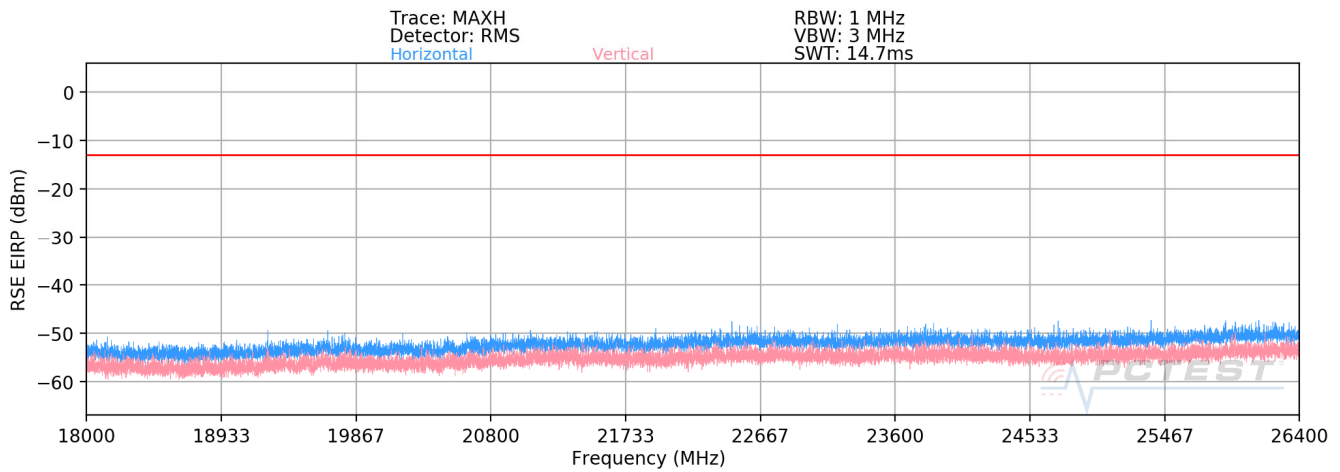
**Table 7-6. Radiated Spurious Data (NR Band n41 – High Channel)**

FCC ID: A3LSMG998U	 <b>PCTEST</b> Proud to be part of element	<b>PART 27 MEASUREMENT REPORT</b>		<b>Approved by:</b> Technical Manager
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## EN-DC – n41 + B2/25



**Plot 7-19. Radiated Spurious Plot – 1-18 GHz (NR Band n41+B25)**





**Plot 7-20. Radiated Spurious Plot – 18-26.4 GHz (NR Band n41+B25)**

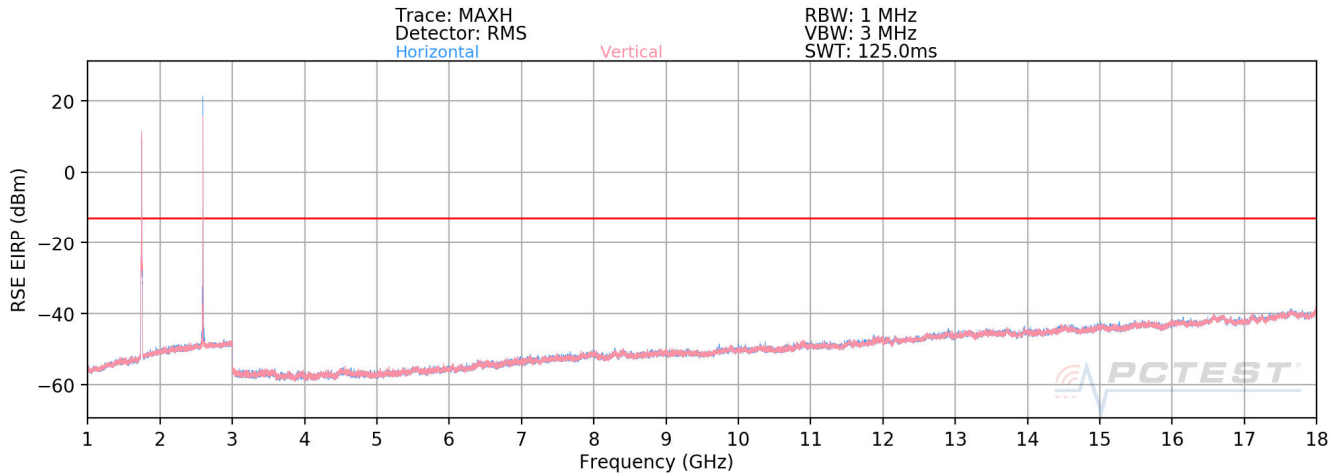
Case:	n41+B25
Bandwidth (MHz):	100MHz (n41) / 20MHz (B25)
Frequency (MHz):	2593MHz (n41) / 1882.5MHz (B25)
RB / Offset:	1/136 (n41) & 1/50 (B25)
Mode:	EN-DC
Anchor Band:	B25

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1172.0	H	-	-	-71.43	5.35	40.92	-54.34	-13.00	-41.34
3303.5	H	-	-	-75.57	5.48	36.91	-58.34	-13.00	-45.34
4014.0	H	-	-	-77.50	5.42	34.92	-60.34	-13.00	-47.34
4724.0	H	-	-	-78.13	5.87	34.74	-60.52	-13.00	-47.52
5435.0	H	-	-	-80.84	8.56	34.72	-60.54	-13.00	-47.54

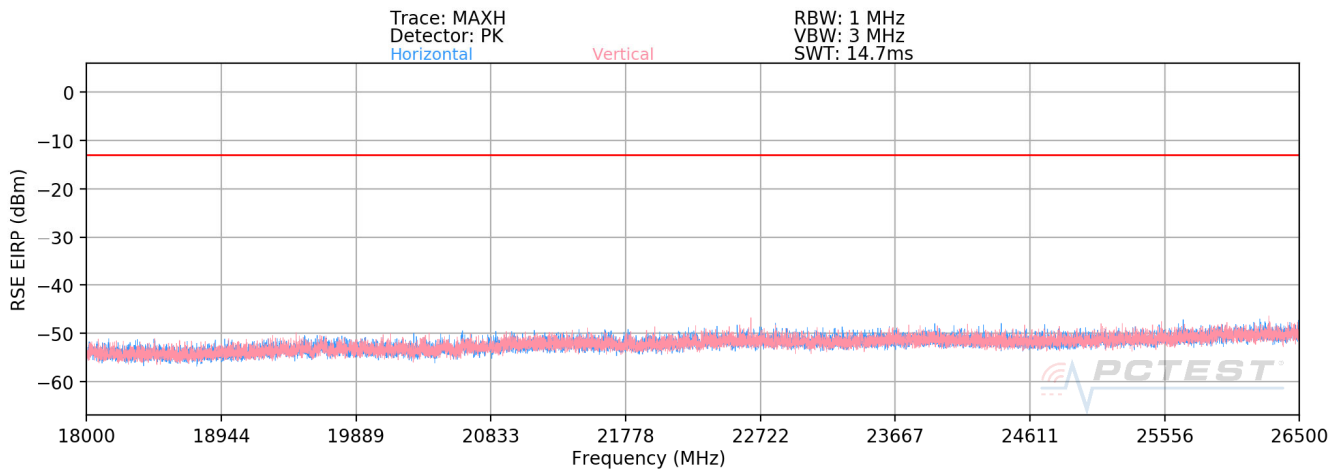
**Table 7-7. Radiated Spurious Data (NR Band n41 – B25)**

FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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## EN-DC – n41 + B66



**Plot 7-21. Radiated Spurious Plot – 1-18 GHz (NR Band n41+B66)**





**Plot 7-22. Radiated Spurious Plot – 18-26.5 GHz (NR Band n41+B66)**

Case:	n41+B66
Bandwidth (MHz):	100MHz (n41) / 20MHz (B66)
Frequency (MHz):	2593MHz (n41) / 1745MHz (B66)
RB / Offset:	1/136 (n41) & 1/50 (B66)
Mode:	EN-DC
Anchor Band:	B66



Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1647.0	H	-	-	-74.10	8.42	41.32	-53.93	-13.00	-40.93
3441.0	H	-	-	-73.21	5.48	39.27	-55.98	-13.00	-42.98
4289.0	H	-	-	-77.75	6.23	35.48	-59.77	-13.00	-46.77
5137.0	H	-	-	-77.79	7.68	36.89	-58.37	-13.00	-45.37
5985.0	H	-	-	-78.18	9.13	37.95	-57.31	-13.00	-44.31

**Table 7-8. Radiated Spurious Data (NR Band n41 – B66)**

FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT		Approved by: Technical 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: A3LSMG998U** complies with all the requirements of Part 27 of the FCC rules.

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