



PART 27 MEASUREMENT REPORT

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

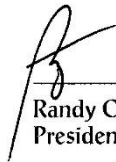
Date of Testing:
02/17/2021 – 02/22/2021
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2012210203-03.A3L

FCC ID:	A3LSMG998U
Applicant Name:	Samsung Electronics Co., Ltd.

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.

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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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**. This device has n77 operation over four total antennas. The test data contained in this report pertains only to the three additional antennas that can transmit in the n77 band under Part 27 not covered in the original filing.

Test Device Serial No.: 3997S, 3982S

2.2 Device Capabilities

This device contains the following capabilities:

800/850/1900 CDMA/EVDO Rev. 0/A (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (FR1/FR2), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC, UWB, Wireless Power Transfer,

This device can transmit in the 5G NR Band n77 over four separate antennas labelled SRS-1, SRS-2, SRS-3, and SRS-4. Test data for transmission in the n77 band via antenna SRS-1 is covered in the original filing. Test data contained in this report covers transmission in the n77 band via the three additional antennas. The test data is marked to indicate the specific antenna transmitting in the n77 band.

Each of the transmission antennas investigated in this report may have an alternative labelling in other filings. The correlation between these labelling schemes is displayed in the following table.

Antenna SRS-label	Alternate Label
SRS-1	Ant I
SRS-2	Ant B
SRS-3	Ant G
SRS-4	Ant D



Table 2-1. Antenna Labelling Scheme Correlation

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 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_{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
Keysight Technologies	N9030B	PXA Signal Analyzer, Multi-touch	9/17/2020	Annual	9/17/2021	MY57141001
Emco	3116	Horn Antenna (18 - 40GHz)	8/7/2018	Triennial	8/7/2021	9203-2178
Rohde & Schwarz	TS-PR1840	Pre-Amp	N/A			100059
Keysight Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	7/17/2020	Annual	7/17/2021	MY49430494
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Test Antenna	8/13/2020	Biennial	8/13/2022	101073
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	9/9/2020	Annual	9/9/2021	102138
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	1/21/2021	Annual	1/21/2022	101716

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): NR Band n77

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
	Conducted Band Edge / Spurious Emissions (NR Band n77)	2.1051, 27.53(l)	Undesirable emissions must meet the limits detailed in 27.53(l)	PASS	Sections 7.3, 7.4
RADIATED	Radiated Spurious Emissions (NR Band n77)	2.1053, 27.53(l)	Undesirable emissions must meet the limits detailed in 27.53(l)	PASS	Section 7.5

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 2G/3G Automation Version 4.5, LTE Automation Version 5.3.
- 5) This device operates in the n77 band on three different antennas not covered in the original filing. All of these antennas operate at lower power compared to the main antenna. As a result, only a subset of test data is included in this report to show compliance for the additional three antennas.

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7.2 Conducted Power Output Data

Test Overview

The EUT is set up to transmit at maximum power for NR channels. All power levels 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 modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.2

Test Settings

1. The signal analyzer's channel power measurement capability was used to perform power output measurement at the RF terminal.
2. Integration BW was set greater or equal to the expected channel bandwidth of the emission
3. RBW = 1-5% of the Integration BW
4. VBW \geq 3 x RBW
5. Trigger Mode = Free Run for continuous emissions, RF Burst for pulsed emissions
6. Gating = Off for continuous emissions, On only during transmission for pulsed emissions
7. Detector = RMS
8. Trace mode = trace averaging
9. Sweep time = auto couple
10. The trace was allowed to stabilize

Test Setup

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



Figure 7-1. Test Instrument & Measurement Setup

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Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
100 MHz	QPSK	650000	3750.00	1/136	23.54
				270/0	22.84
		656000	3840.00	1/136	23.59
				270/0	23.08
		662000	3930.00	1/136	24.37
				270/0	23.53



Table 7-2. Conducted Power Data (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
100 MHz	QPSK	650000	3750.00	1/136	22.13
				270/0	21.22
		656000	3840.00	1/136	21.54
				270/0	20.79
		662000	3930.00	1/136	21.74
				270/0	20.37

Table 7-3. Conducted Power Data (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-QPSK)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
100 MHz	QPSK	650000	3750.00	1/136	22.08
				270/0	21.61
		656000	3840.00	1/136	22.01
				270/0	20.54
		662000	3930.00	1/136	22.90
				270/0	21.66

Table 7-4. Conducted Power Data (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-QPSK)

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7.3 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at 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 $43 + 10 \log_{10}(P_{[Watts]})$, 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 40GHz (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup



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



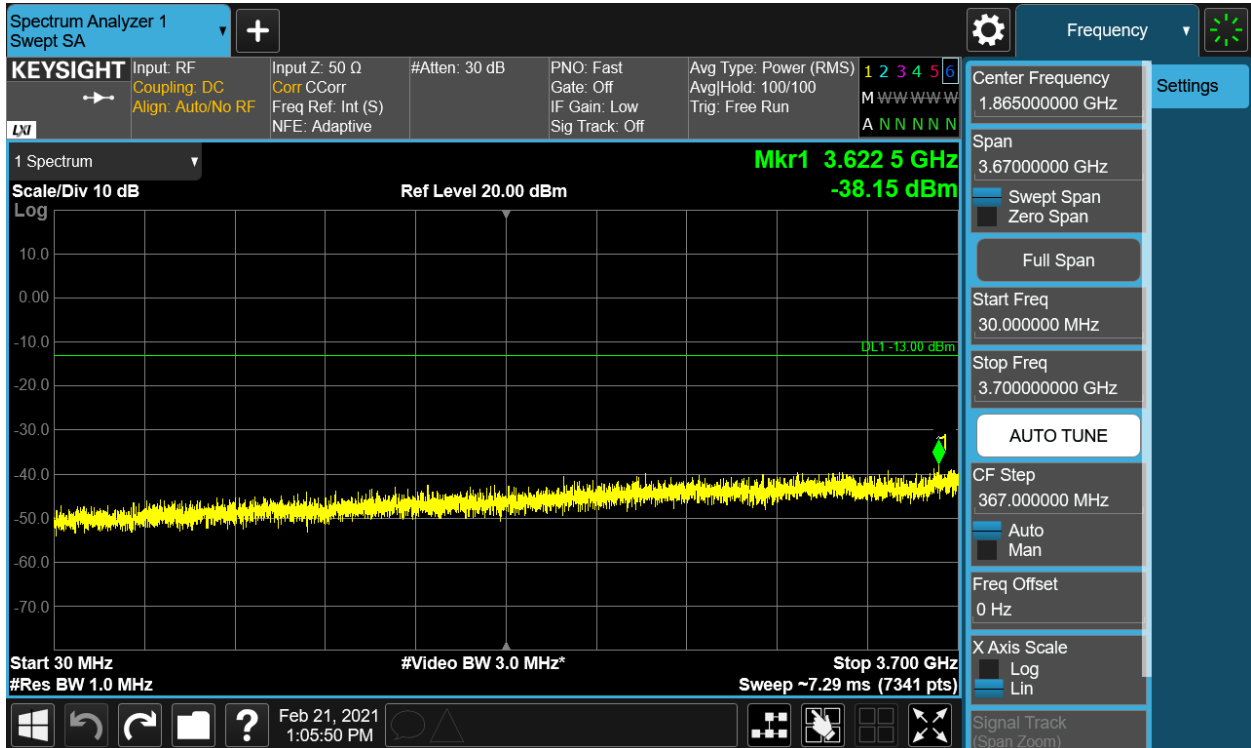
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

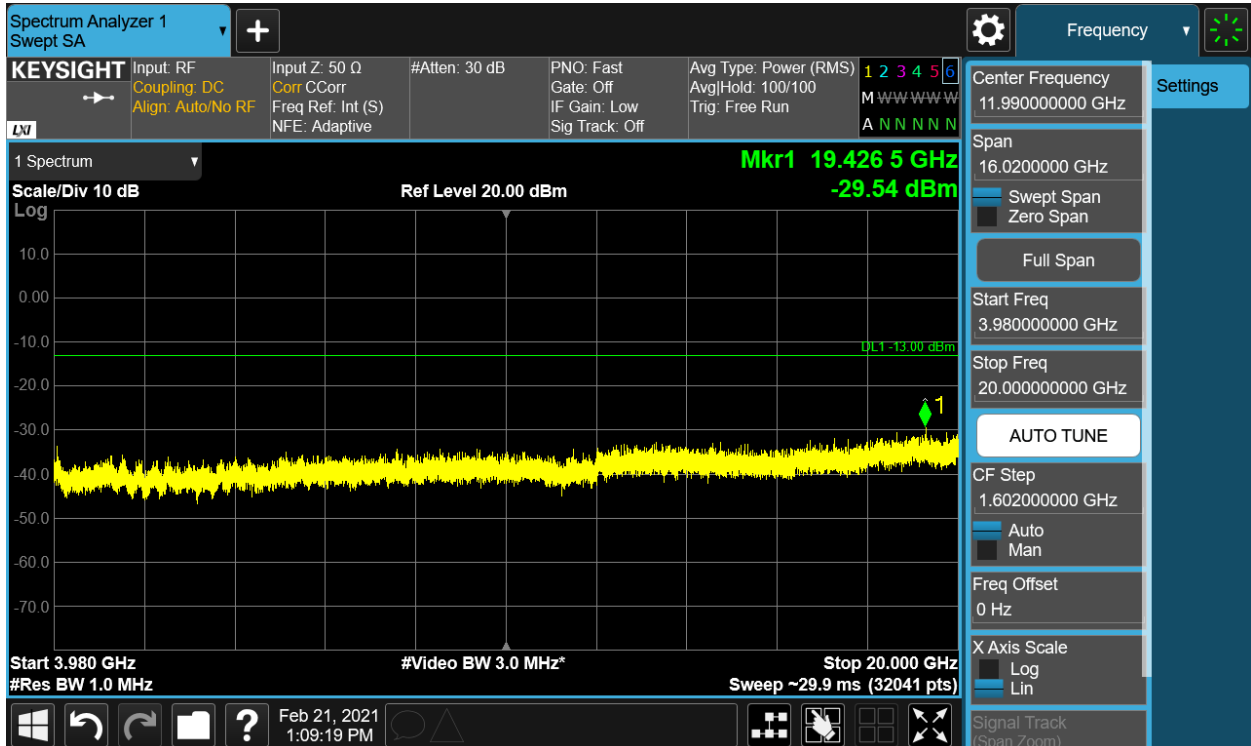
1. Per Part 27, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 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 were determined to occur with the DFT-s-OFDM transmission scheme. These results from this worst case configuration are reported in this section.

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NR Band n77 (PC2) SRS-2

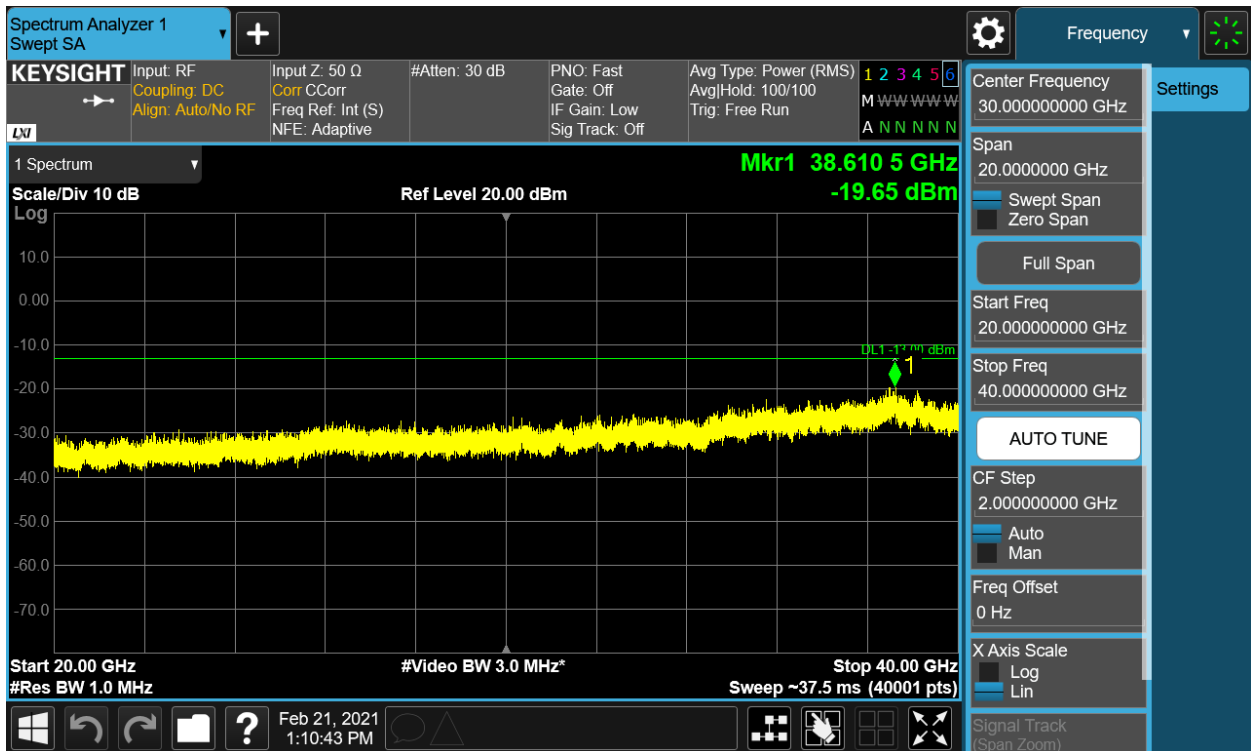


Plot 7-1. Conducted Spurious Plot (NR Band n77 PC2 - SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Low Channel)

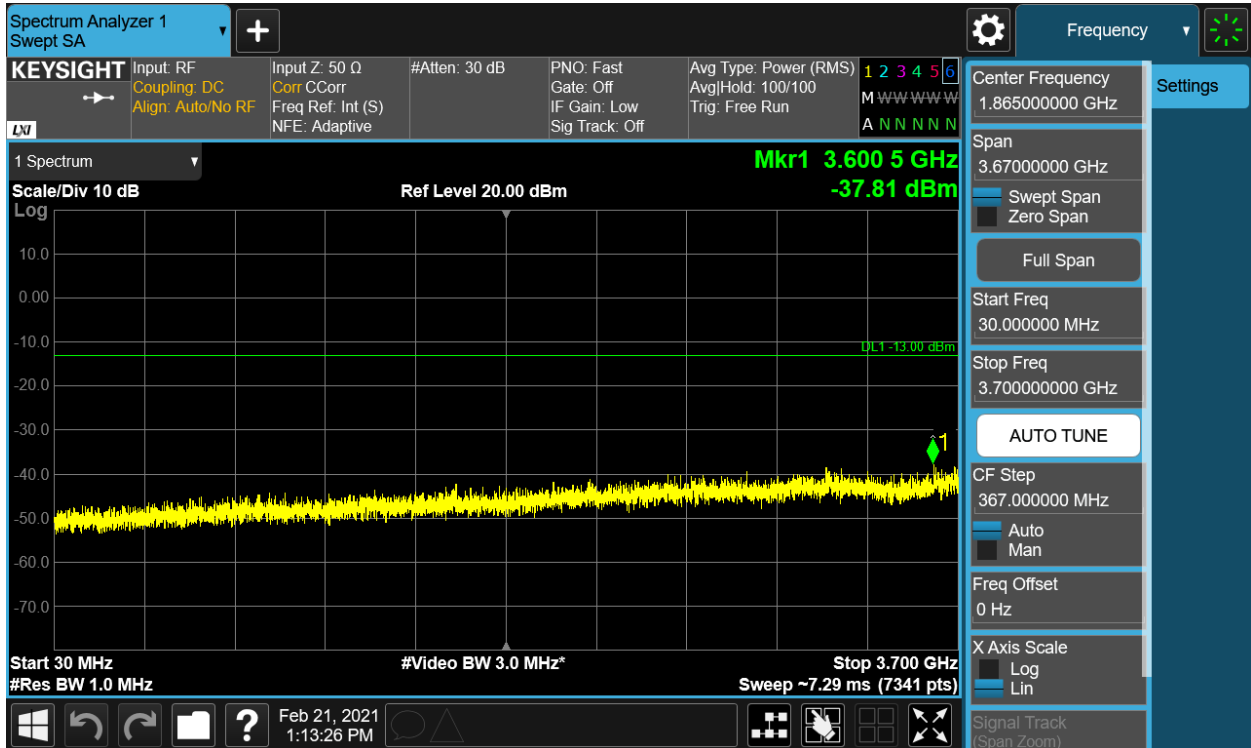


Plot 7-2. Conducted Spurious Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Low Channel)

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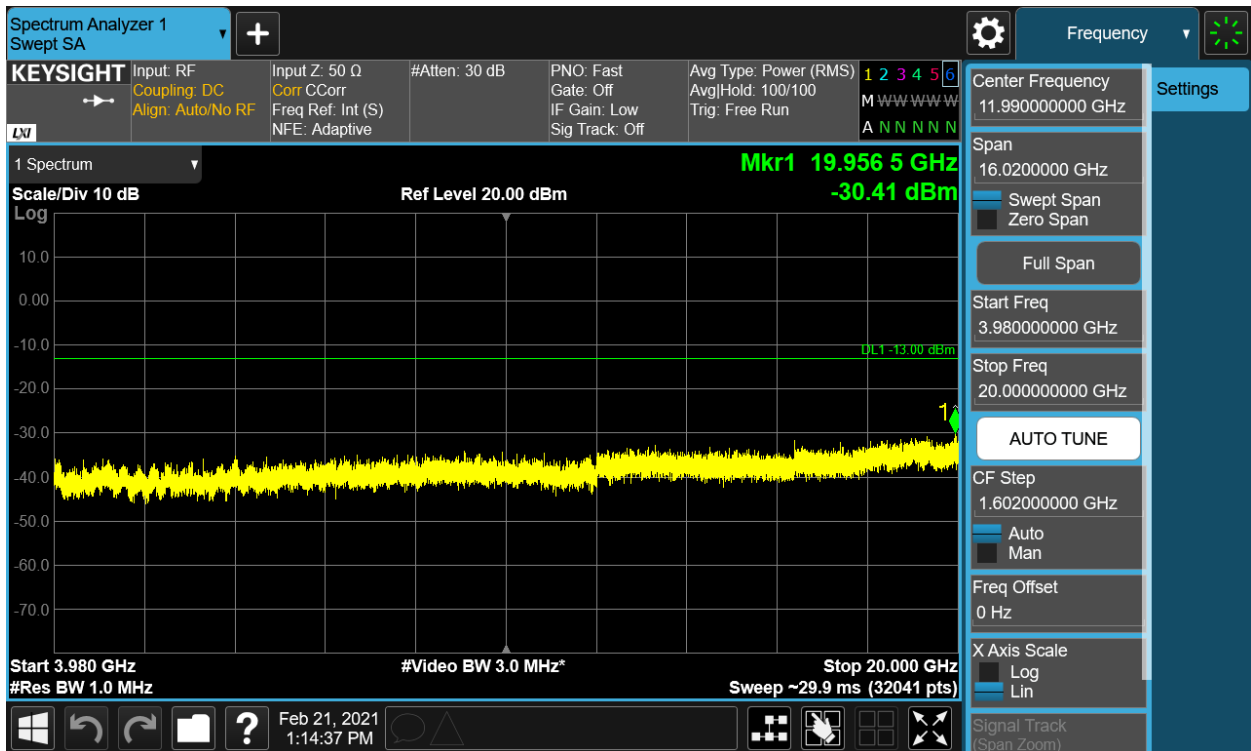


Plot 7-3. Conducted Spurious Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Low Channel)

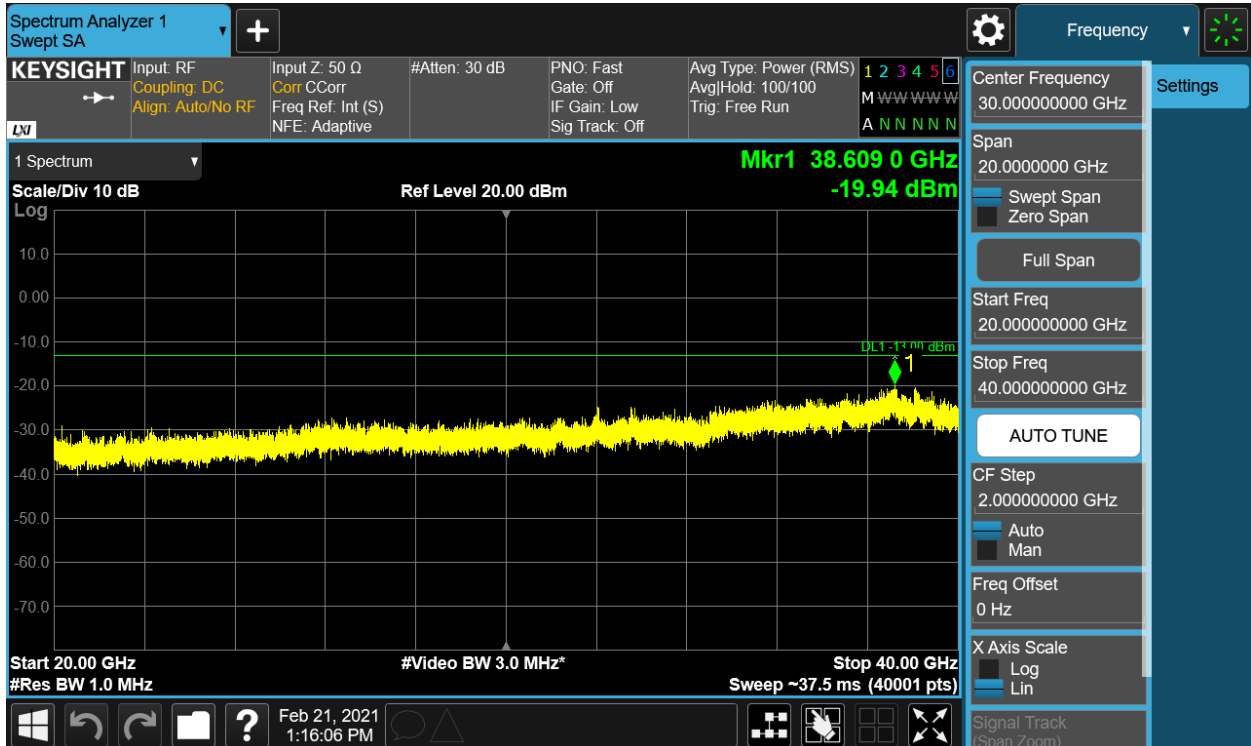


Plot 7-4. Conducted Spurious Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

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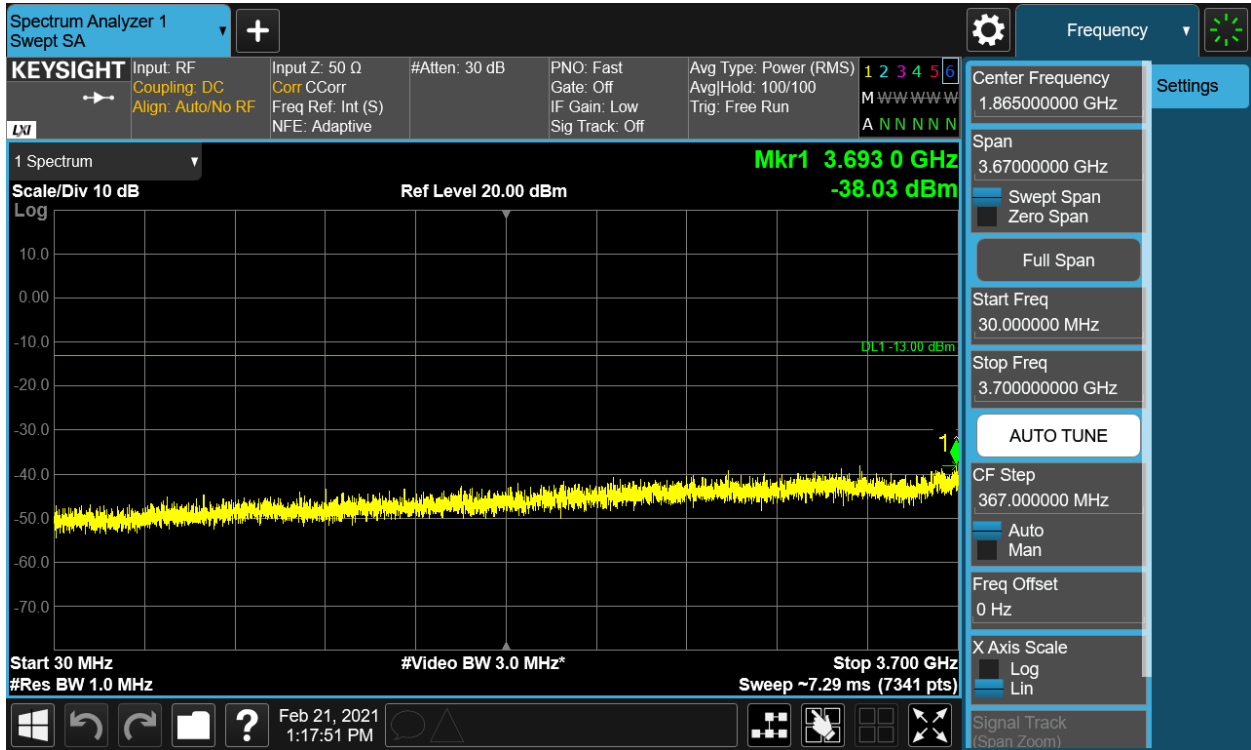


Plot 7-5. Conducted Spurious Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

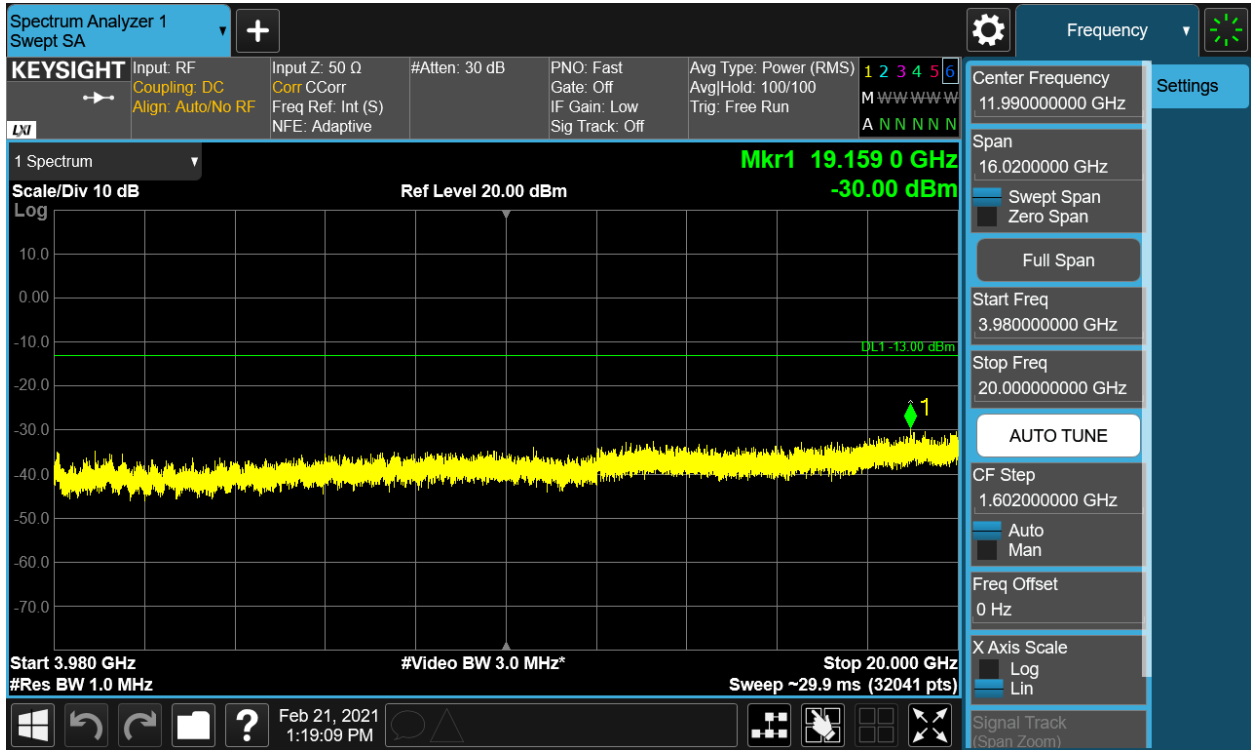


Plot 7-6. Conducted Spurious Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

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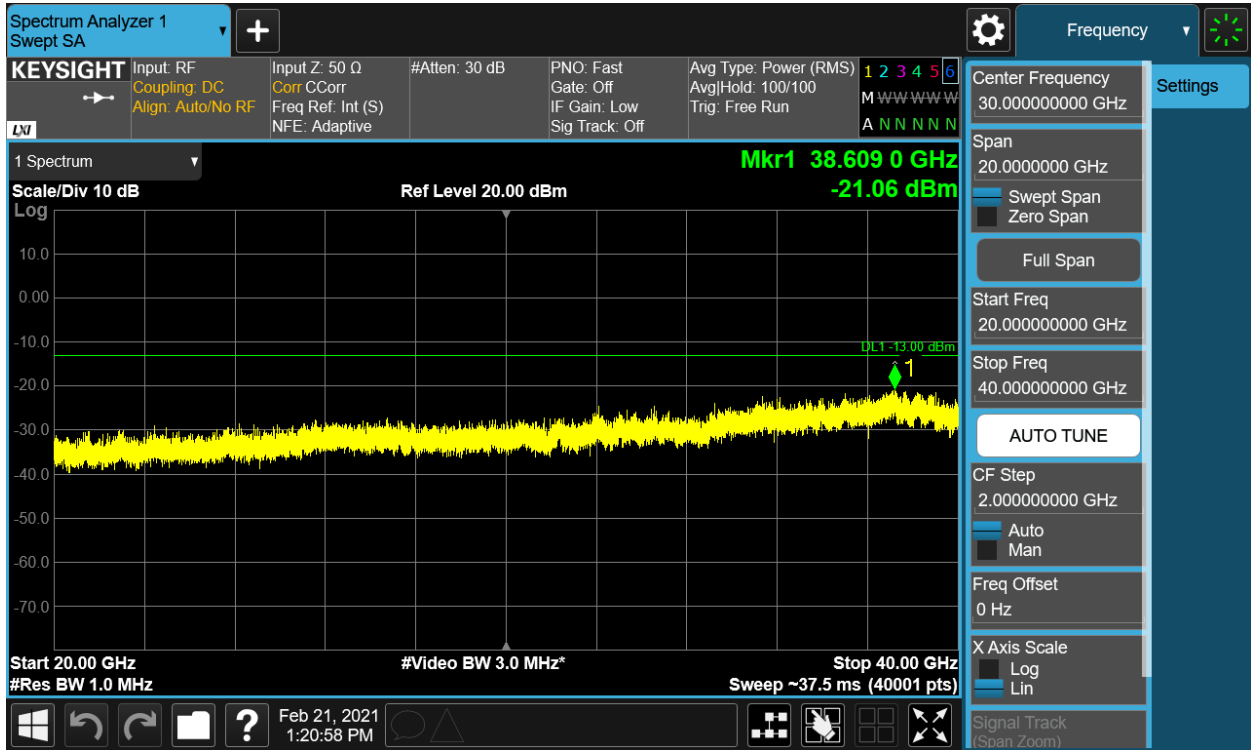


Plot 7-7. Conducted Spurious Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-8. Conducted Spurious Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)

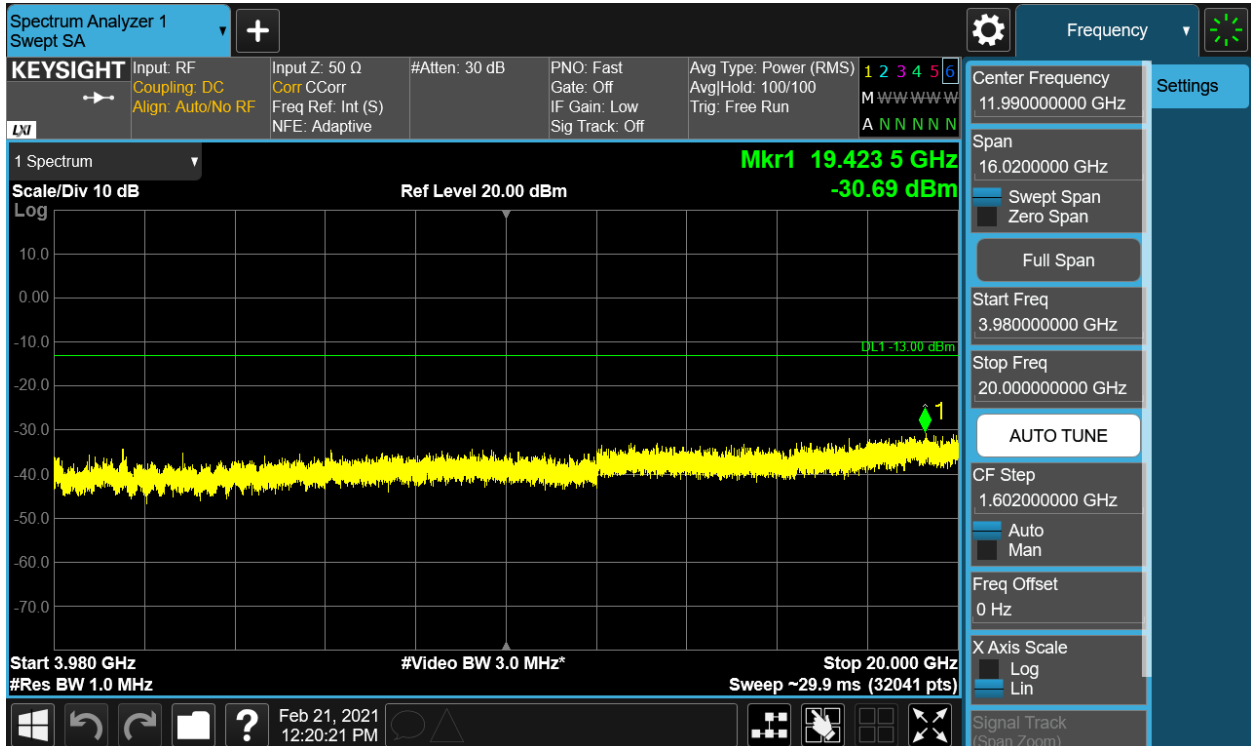
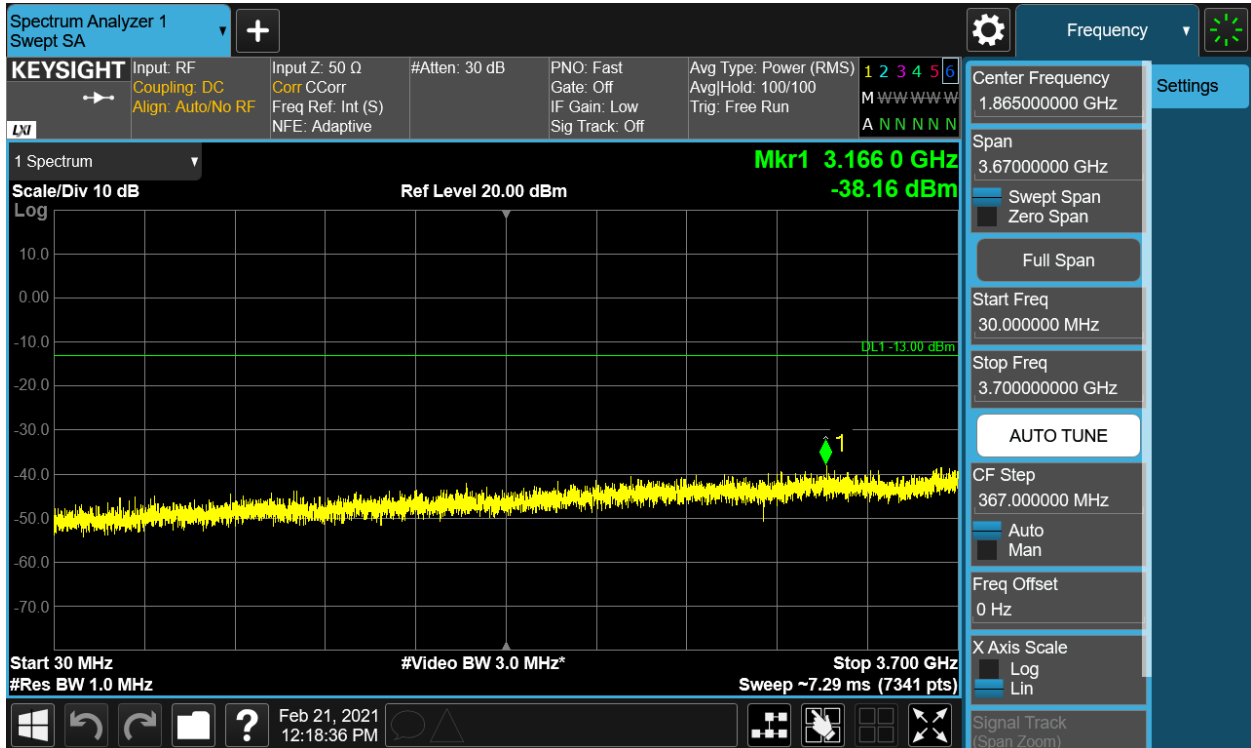
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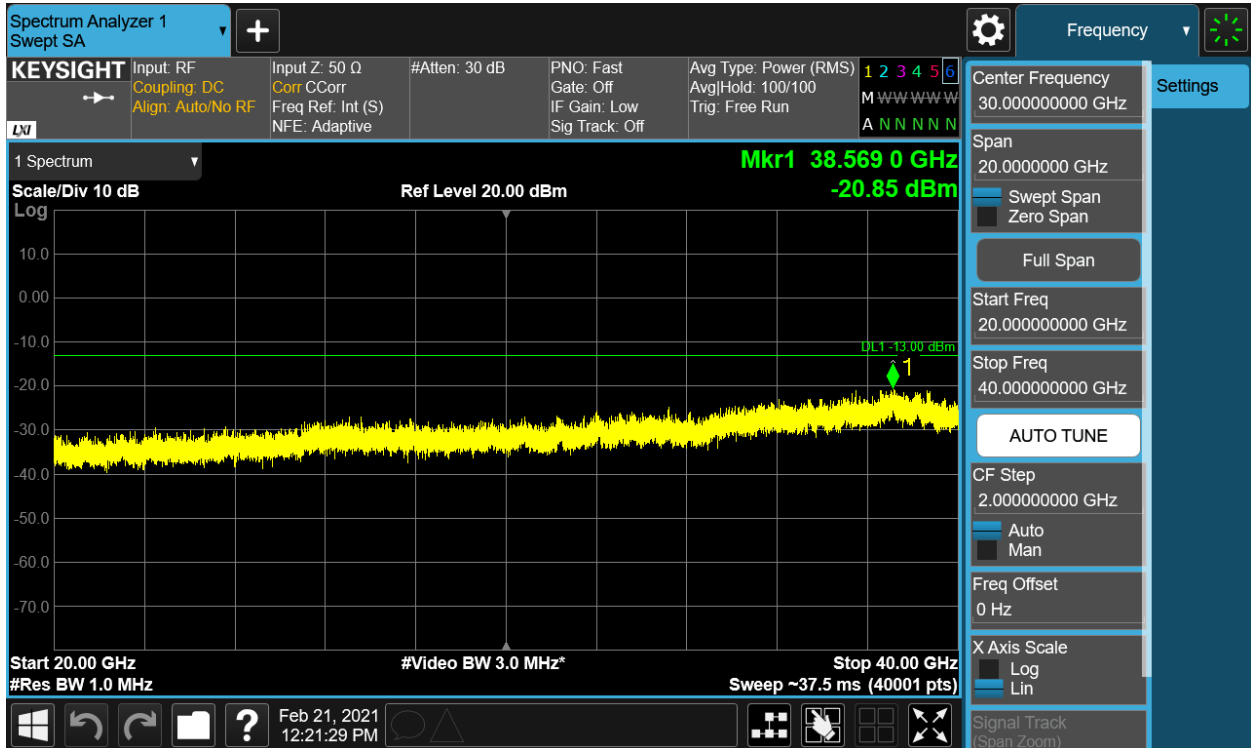
Plot 7-9. Conducted Spurious Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 17 of 42

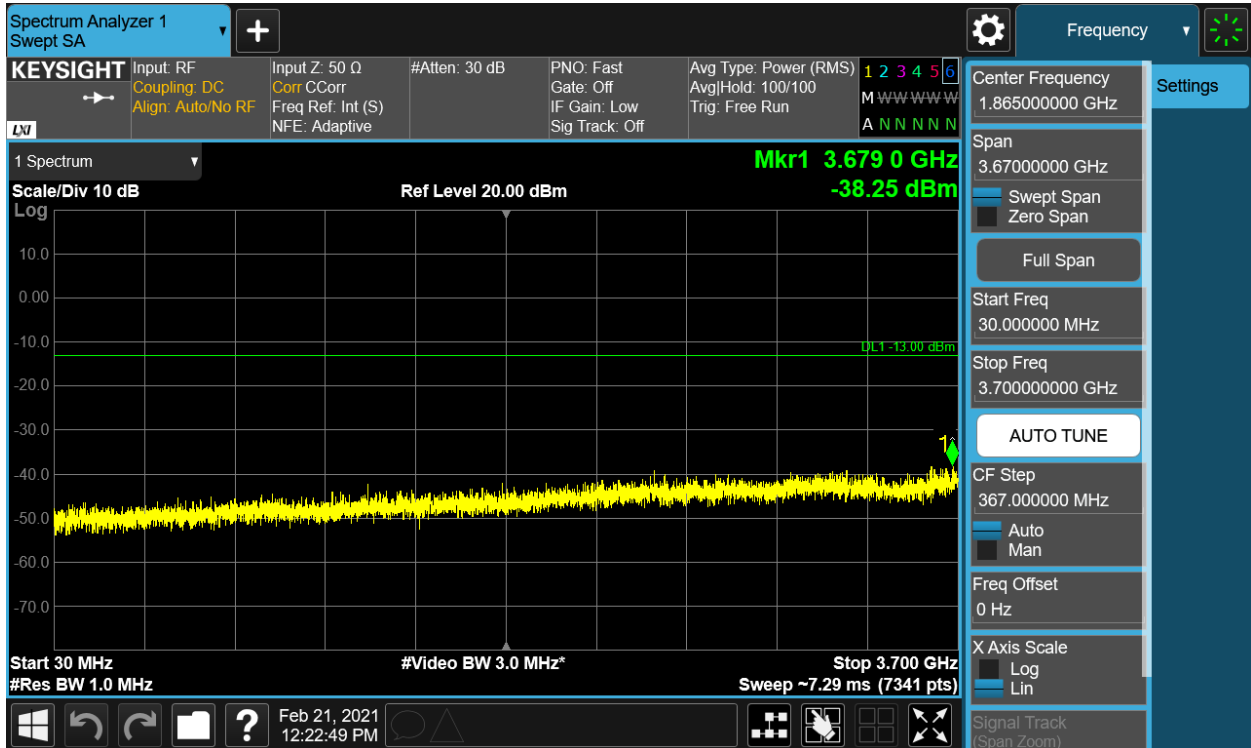
NR Band n77 (PC2) SRS-3



FCC ID: A3LSMG998U	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset	Page 18 of 42

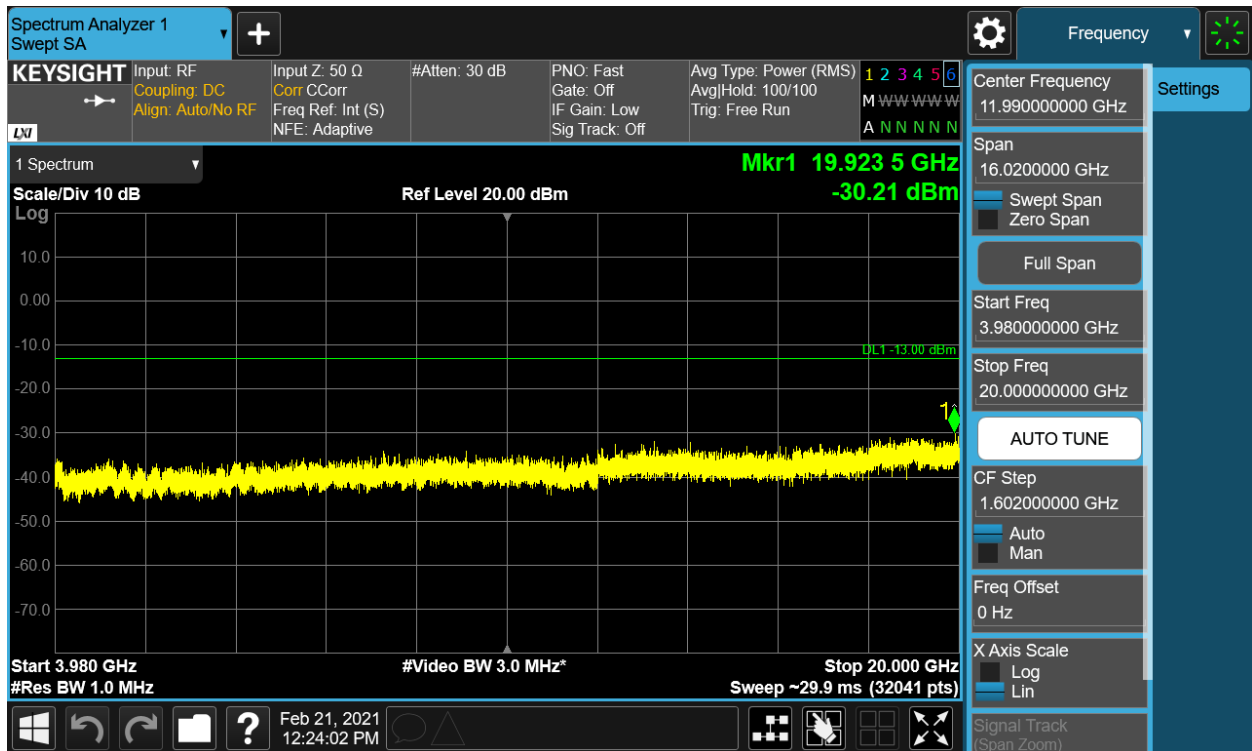


Plot 7-12. Conducted Spurious Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Low Channel)

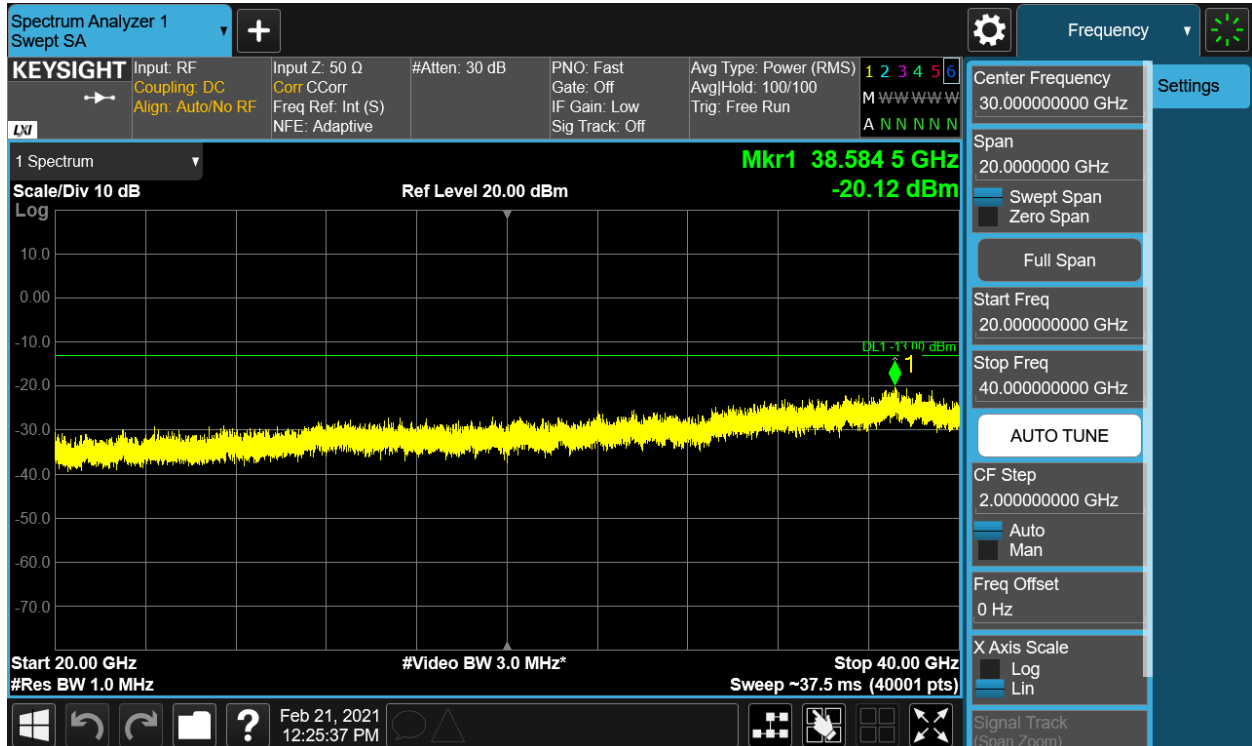


Plot 7-13. Conducted Spurious Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 19 of 42

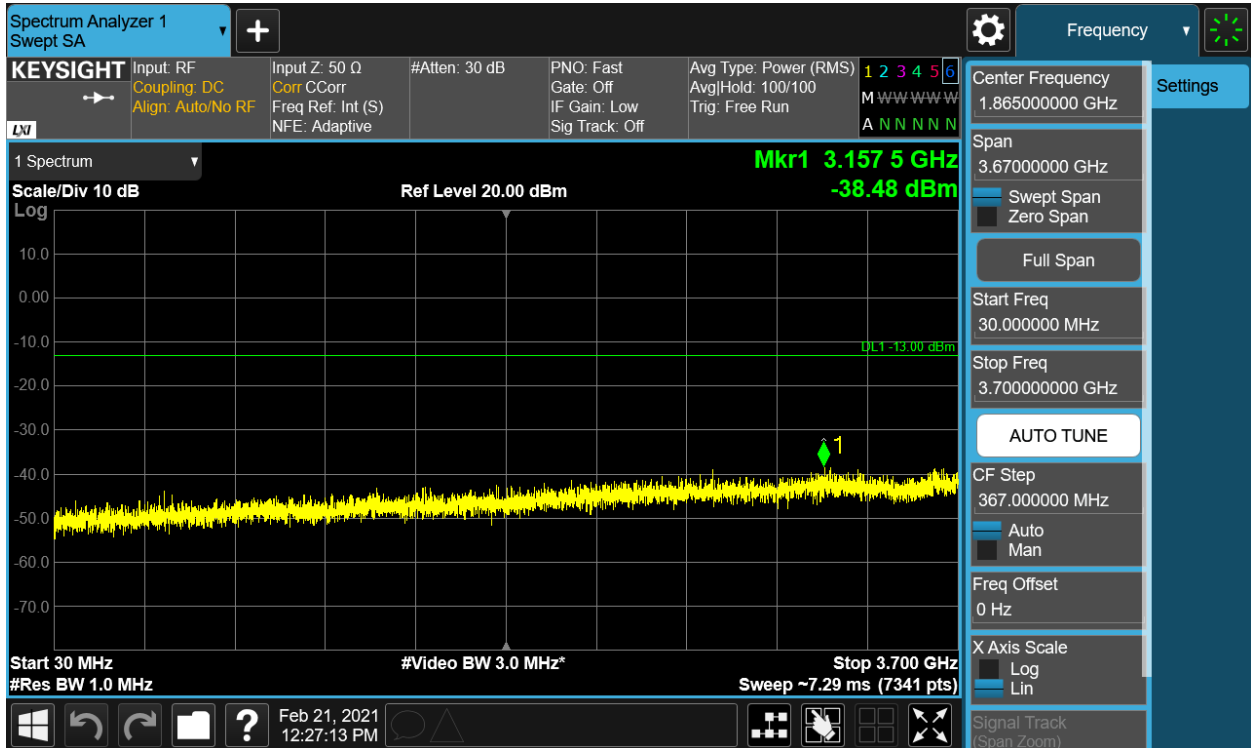


Plot 7-14. Conducted Spurious Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

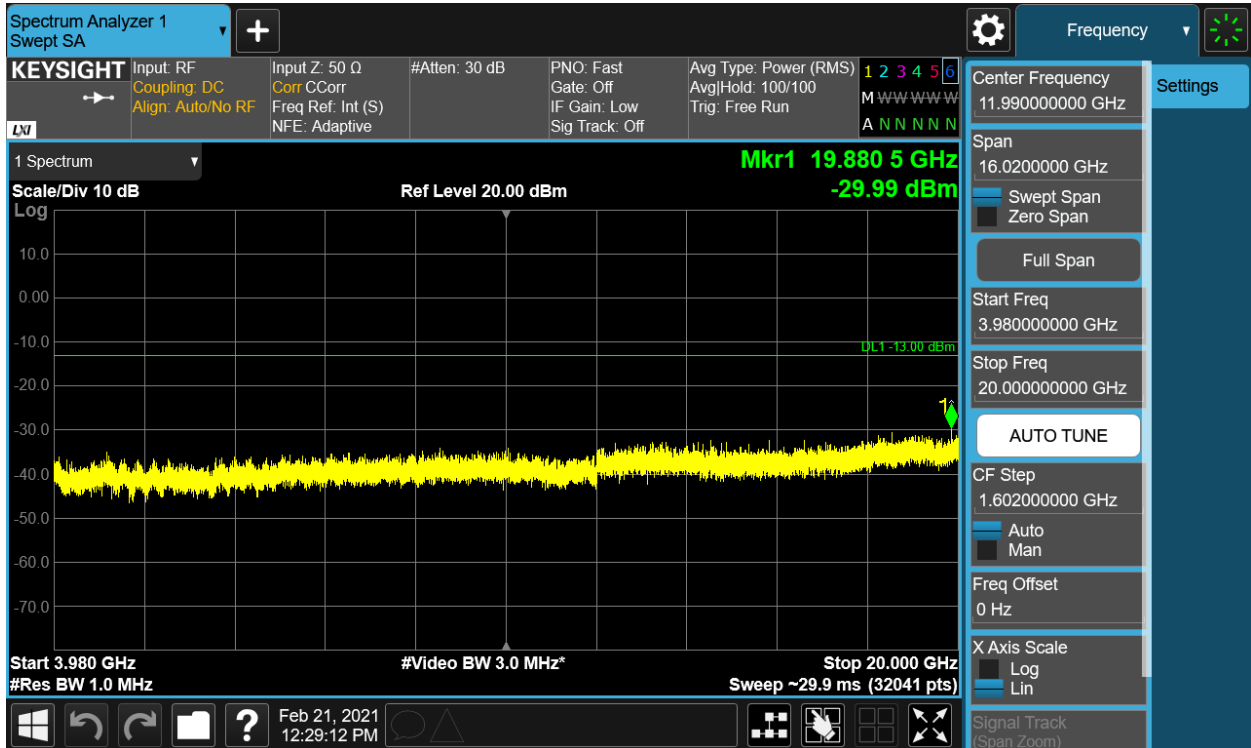


Plot 7-15. Conducted Spurious Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 20 of 42

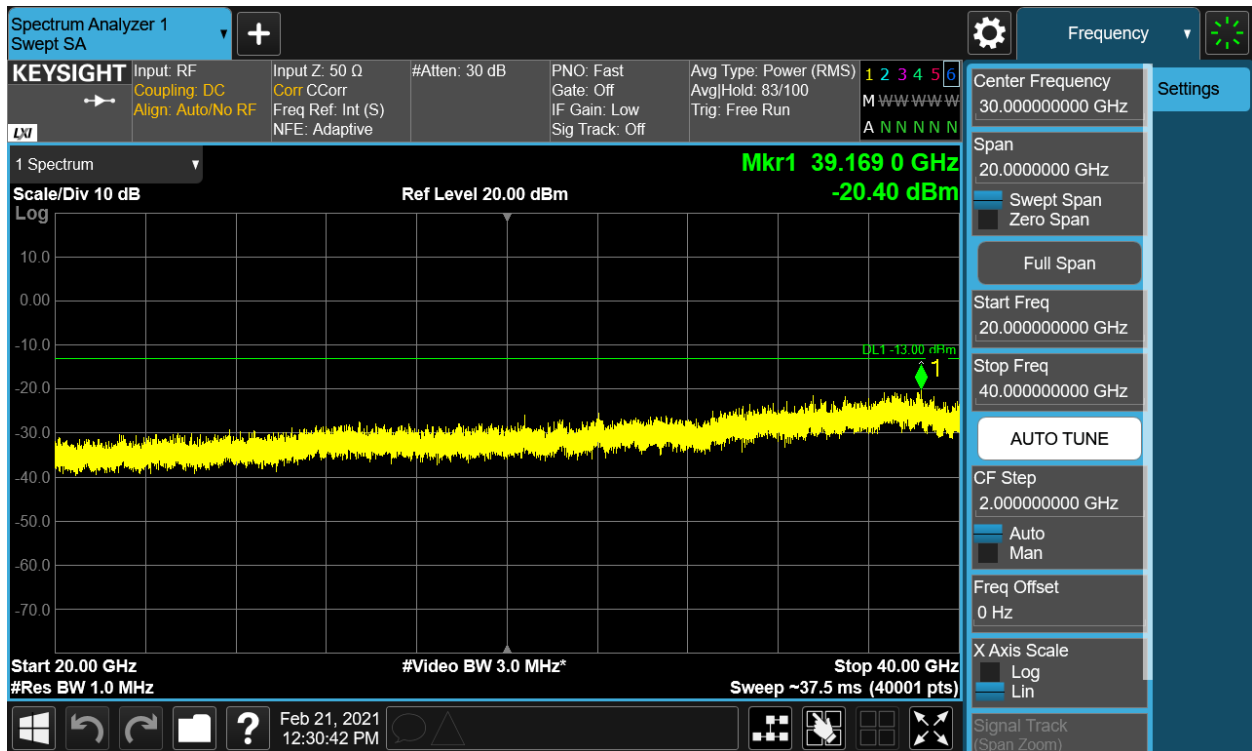


Plot 7-16. Conducted Spurious Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-17. Conducted Spurious Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)

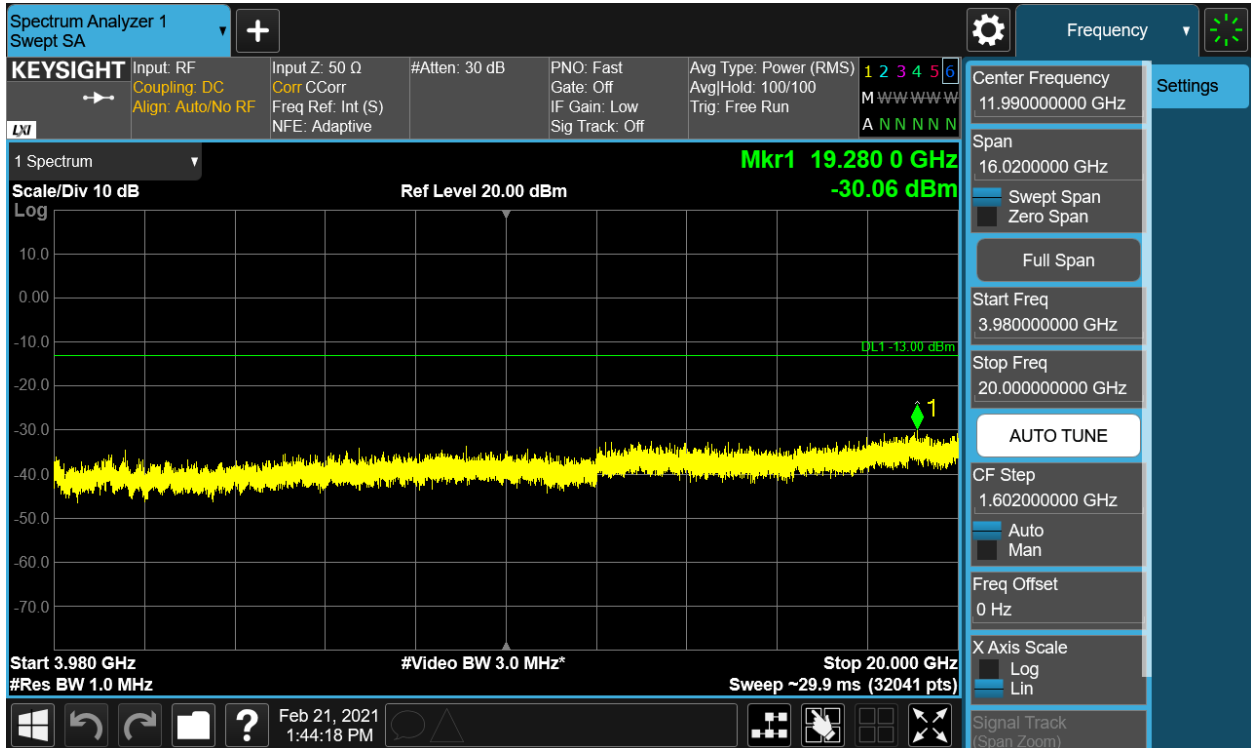
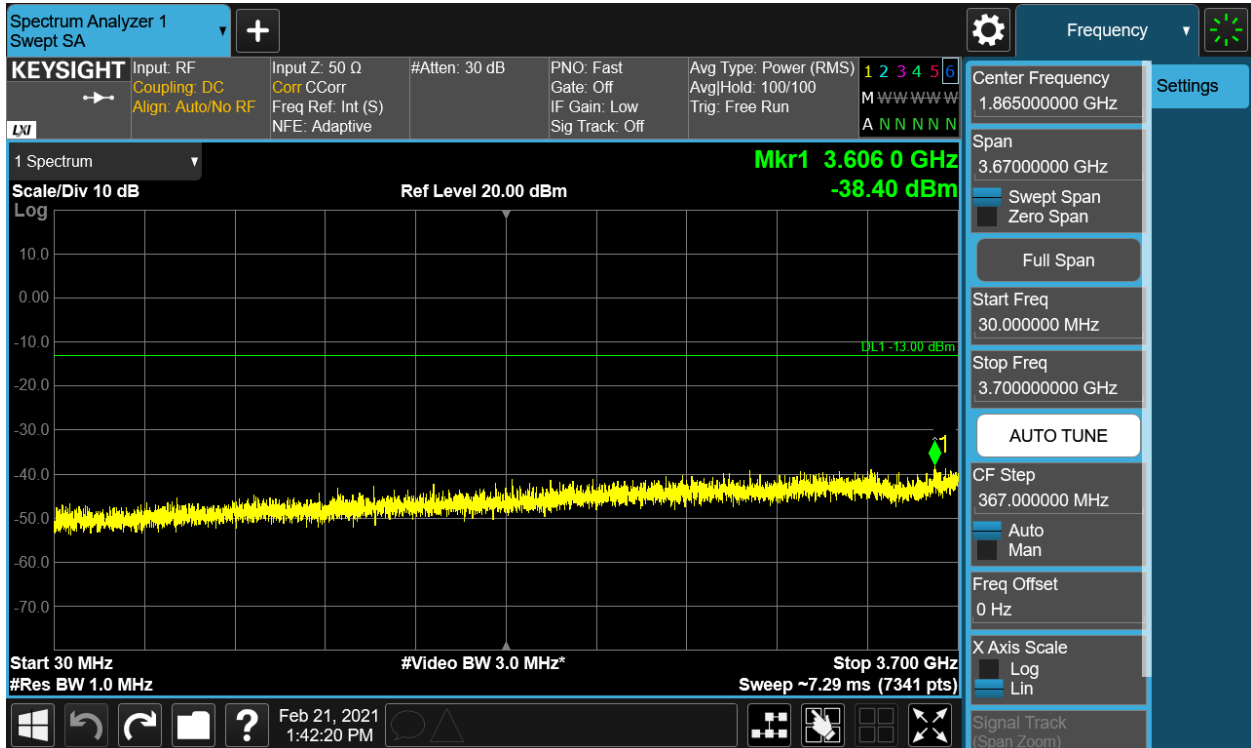
FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 21 of 42



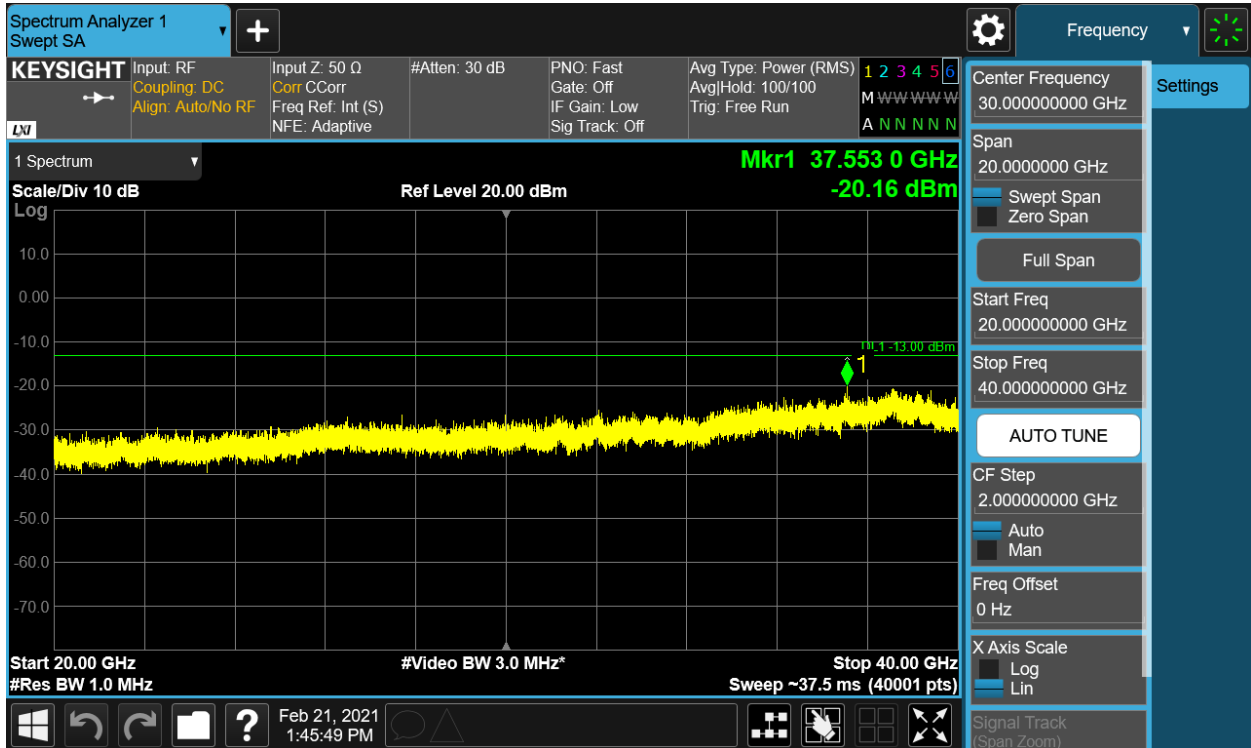
Plot 7-18. Conducted Spurious Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 22 of 42

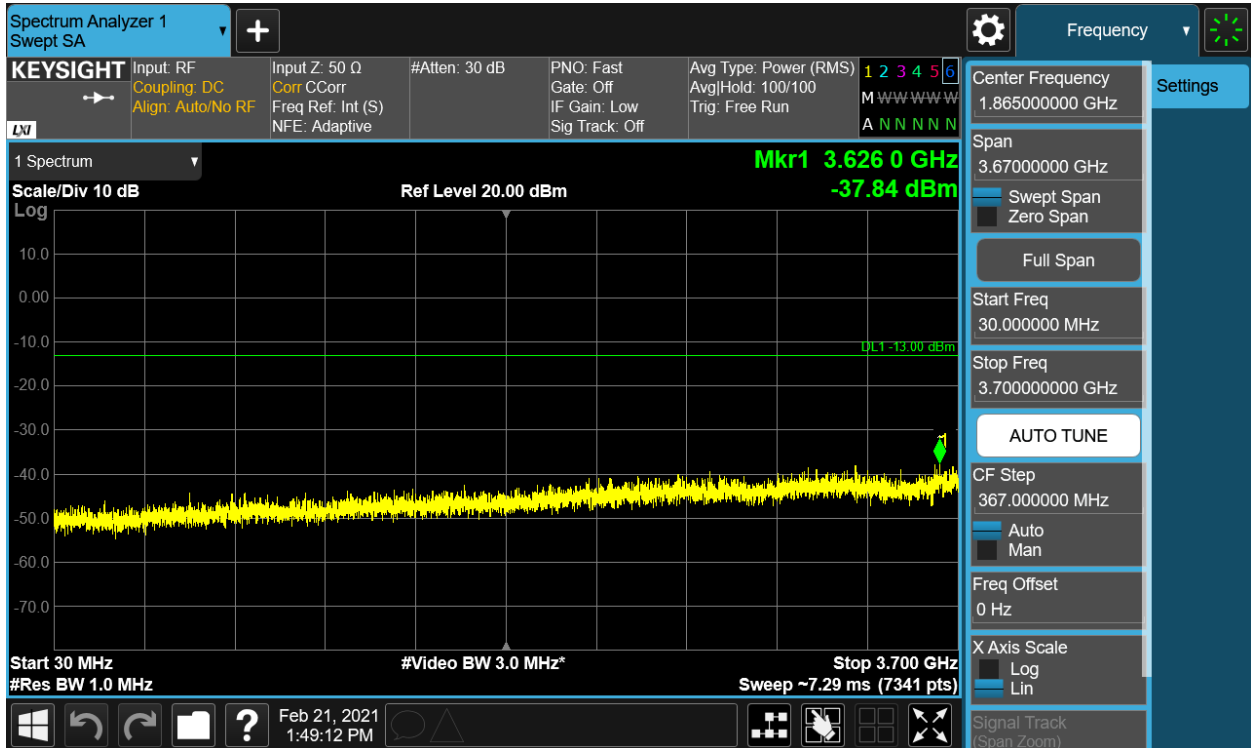
NR Band n77 (PC2) SRS-4



FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 23 of 42

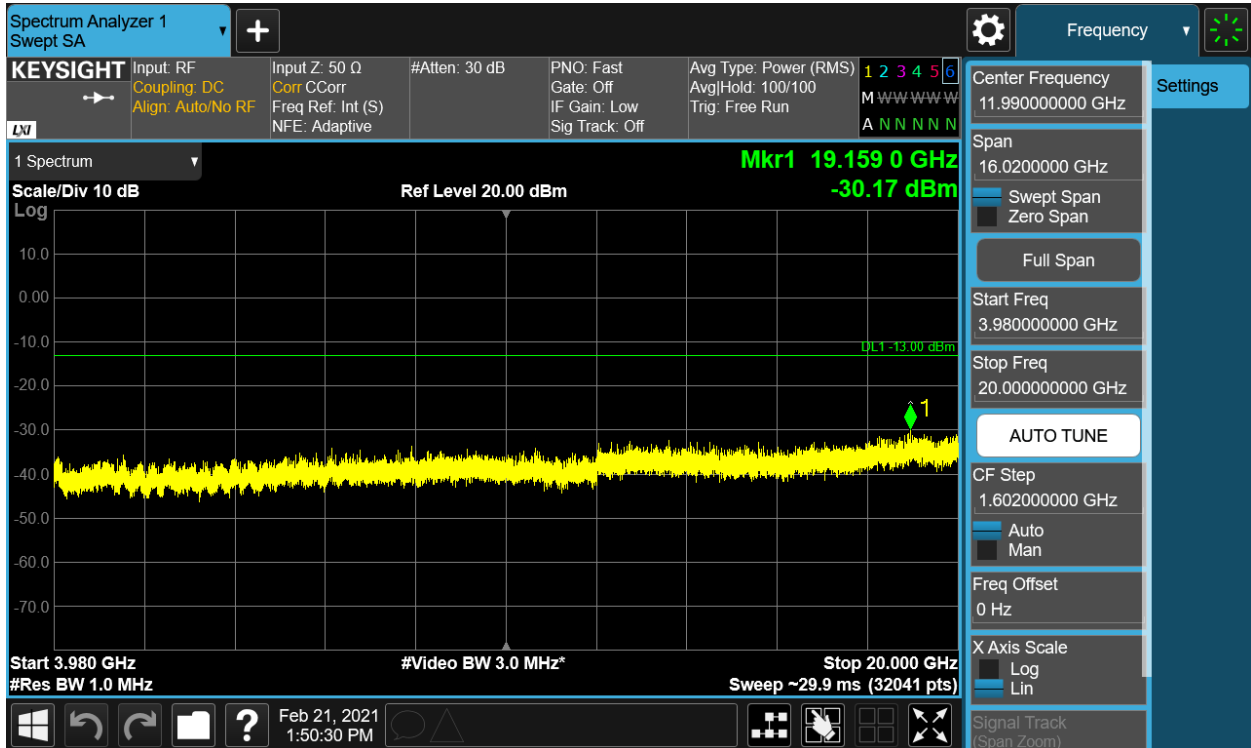


Plot 7-21. Conducted Spurious Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Low Channel)

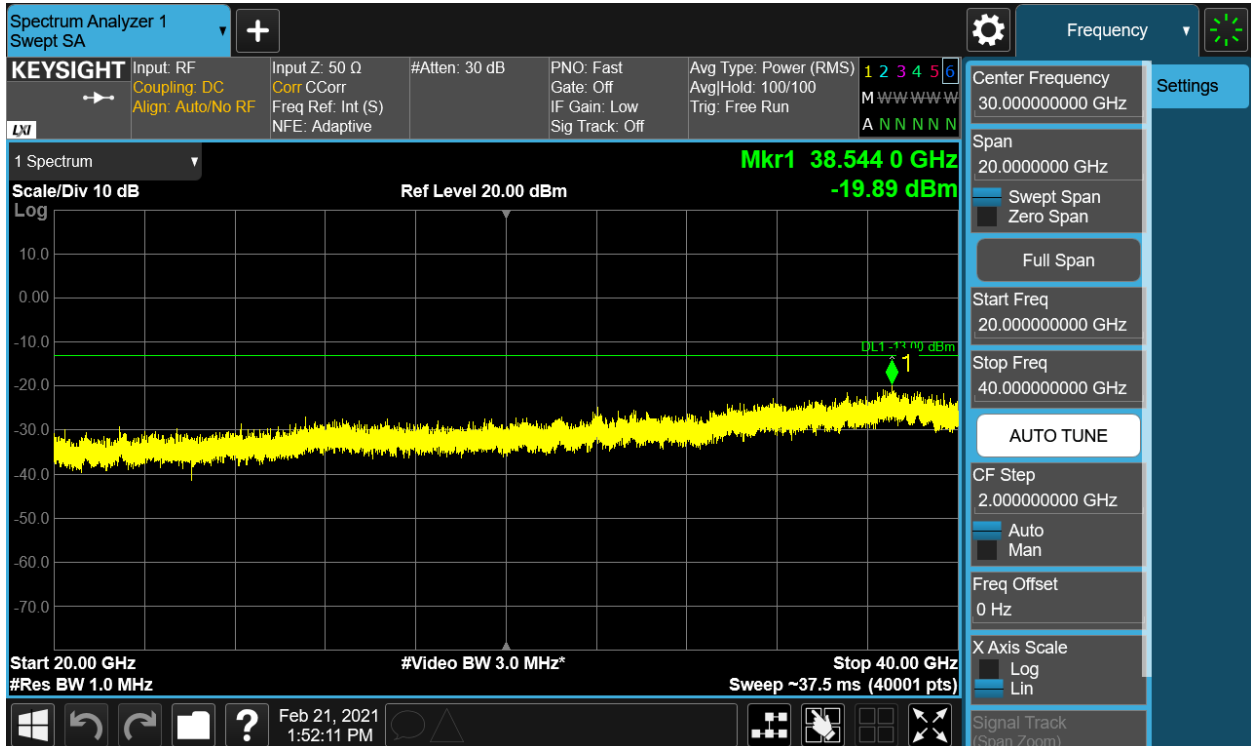


Plot 7-22. Conducted Spurious Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 24 of 42

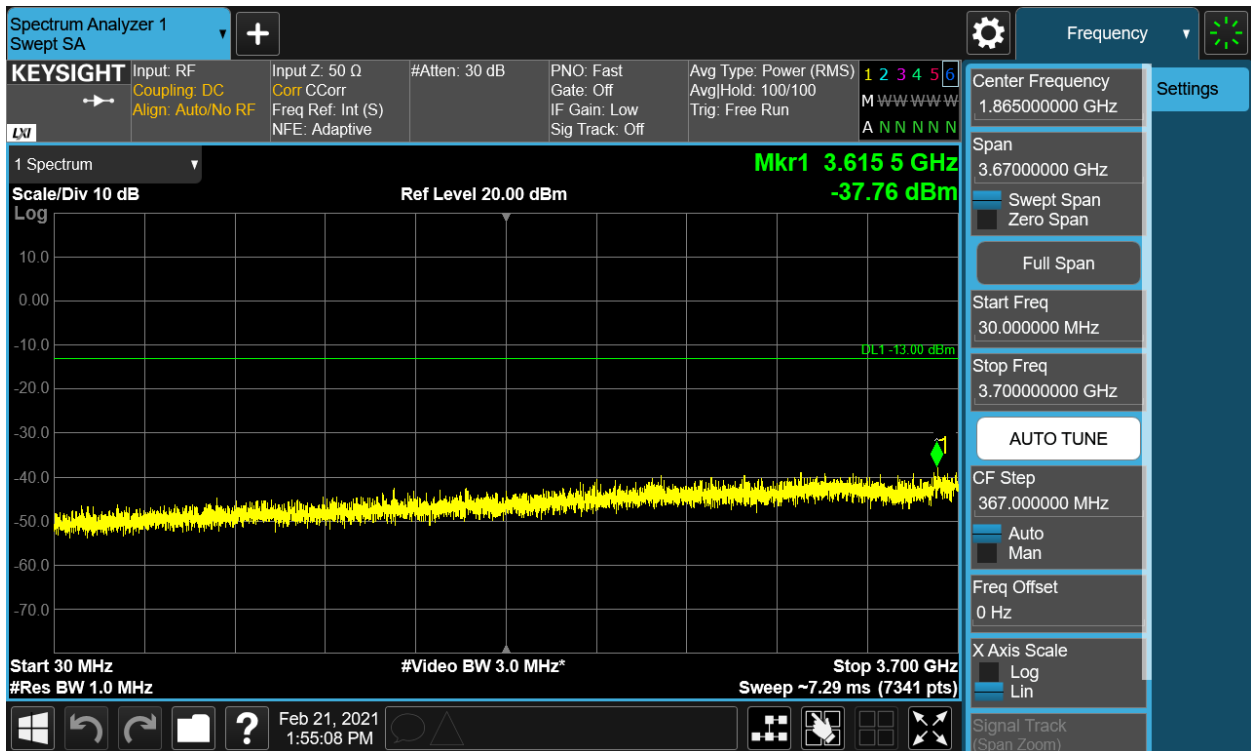


Plot 7-23. Conducted Spurious Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

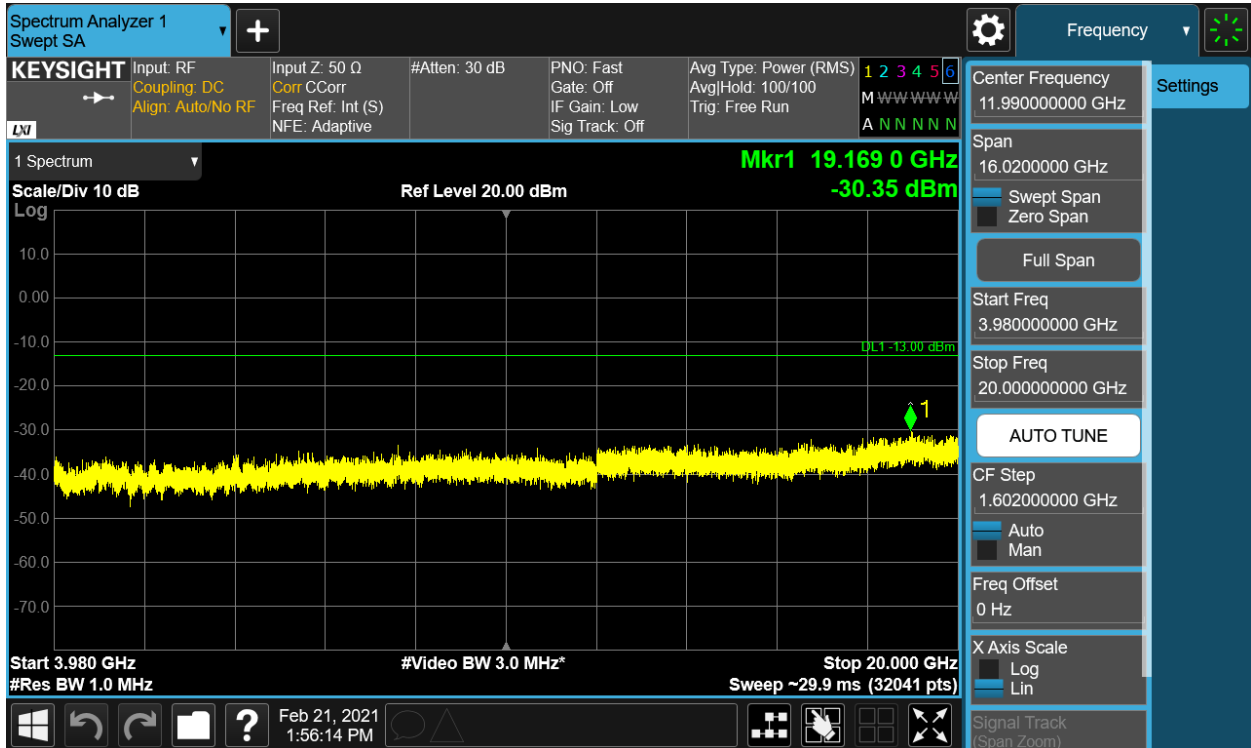


Plot 7-24. Conducted Spurious Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: A3LSMG998U	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset	Page 25 of 42

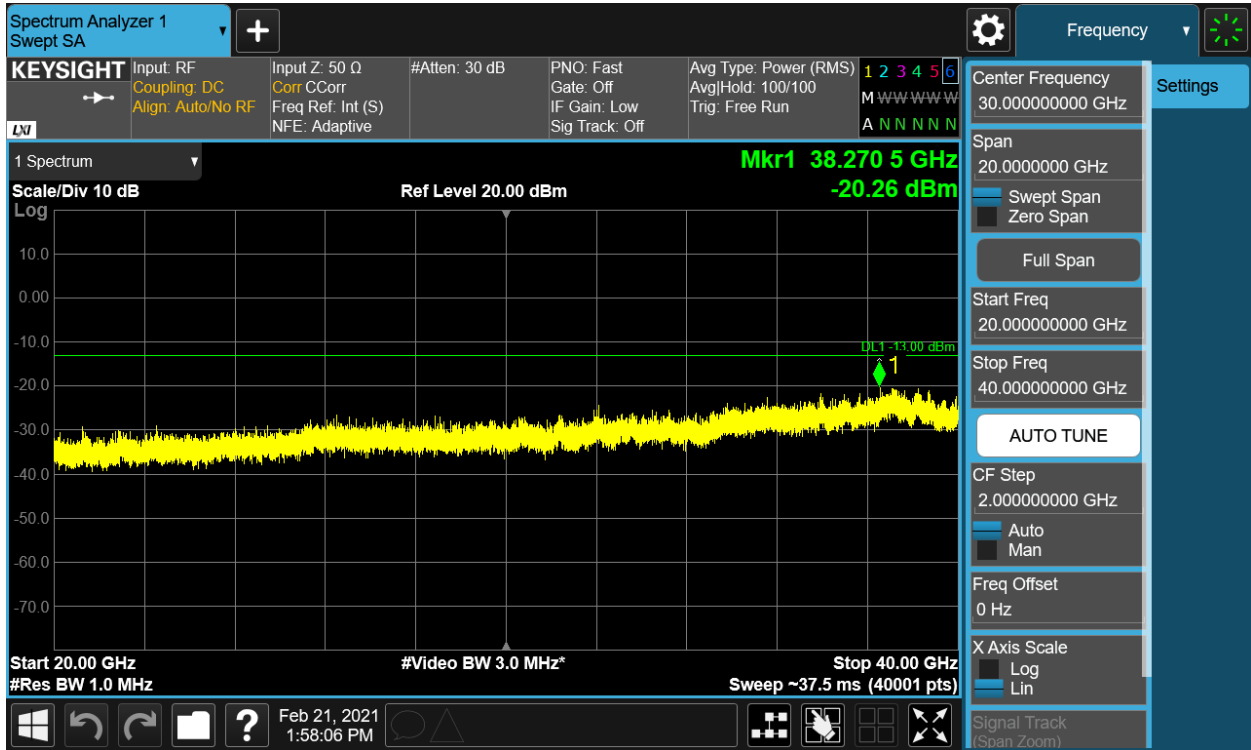


Plot 7-25. Conducted Spurious Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-26. Conducted Spurious Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 26 of 42



Plot 7-27. Conducted Spurious Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 27 of 42

7.4 Band Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at 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 $43 + 10 \log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

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 7-3. Test Instrument & Measurement Setup

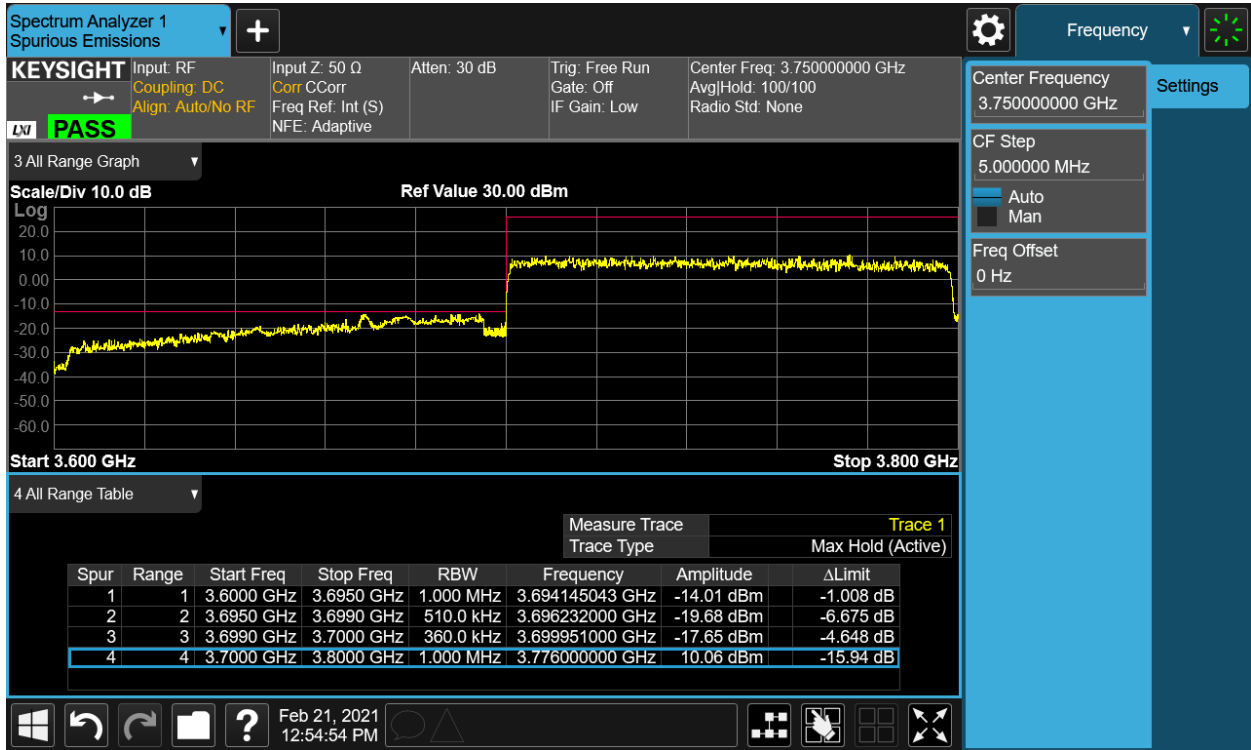
FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset	Page 28 of 42

Test Notes

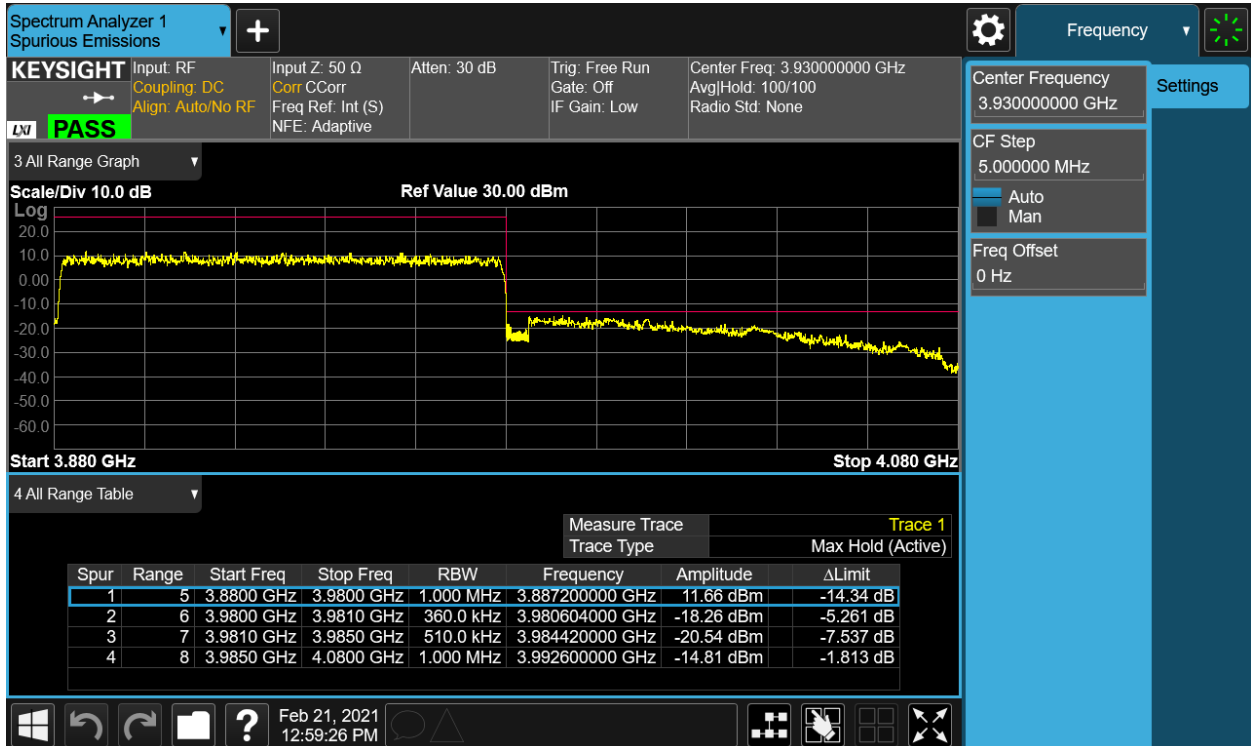
1. Per 27.53(l)(2), in the 1 MHz bands immediately outside and adjacent to the frequency block, a minimum resolution bandwidth of either one percent of the emission bandwidth of the fundamental emission of the transmitter or 350 kHz may be employed to demonstrate compliance with the out-of-band emissions limit. In the bands between 1 and 5 MHz removed from the frequency block, the minimum resolution bandwidth for the measurement shall be 500 kHz. 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 emissions 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 were determined to occur with the CP-OFDM transmission scheme. These results from this worst case configuration are reported in this section.

FCC ID: A3LSMG998U		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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NR Band n77 (PC2) SRS-2



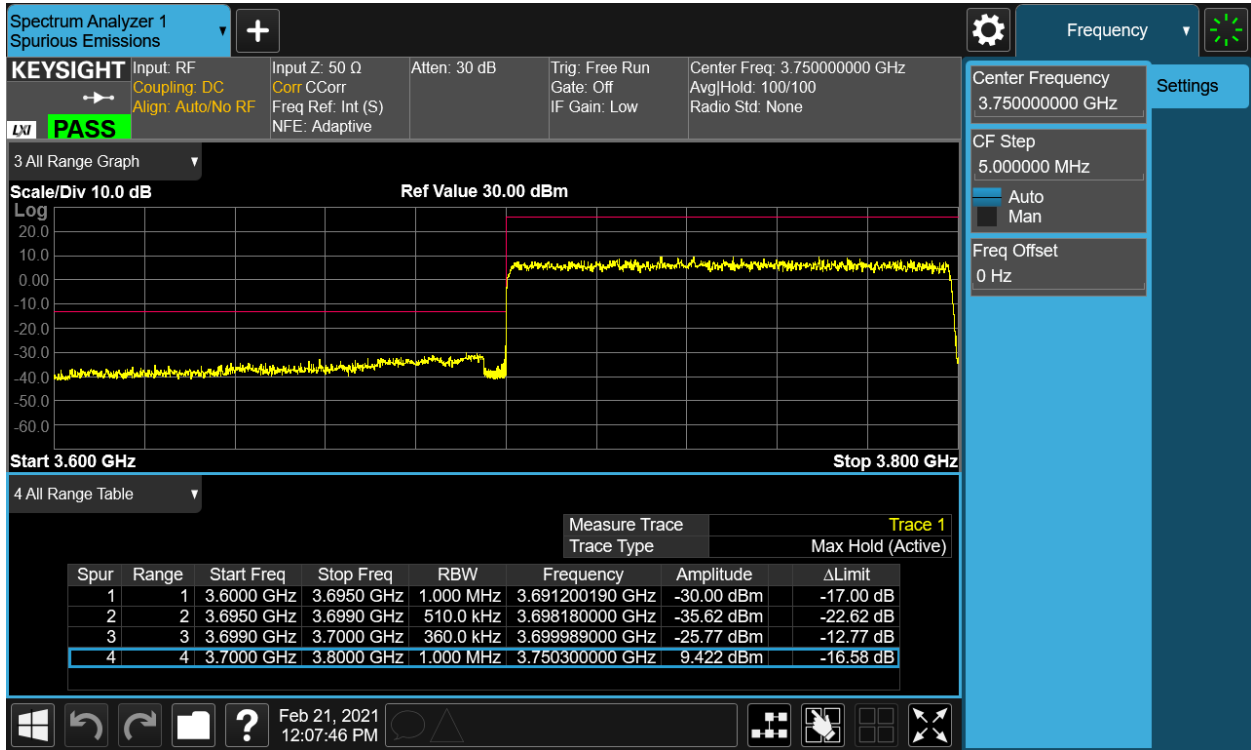
Plot 7-28. Lower Band Edge Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-OFDM-QPSK – Full RB Configuration)



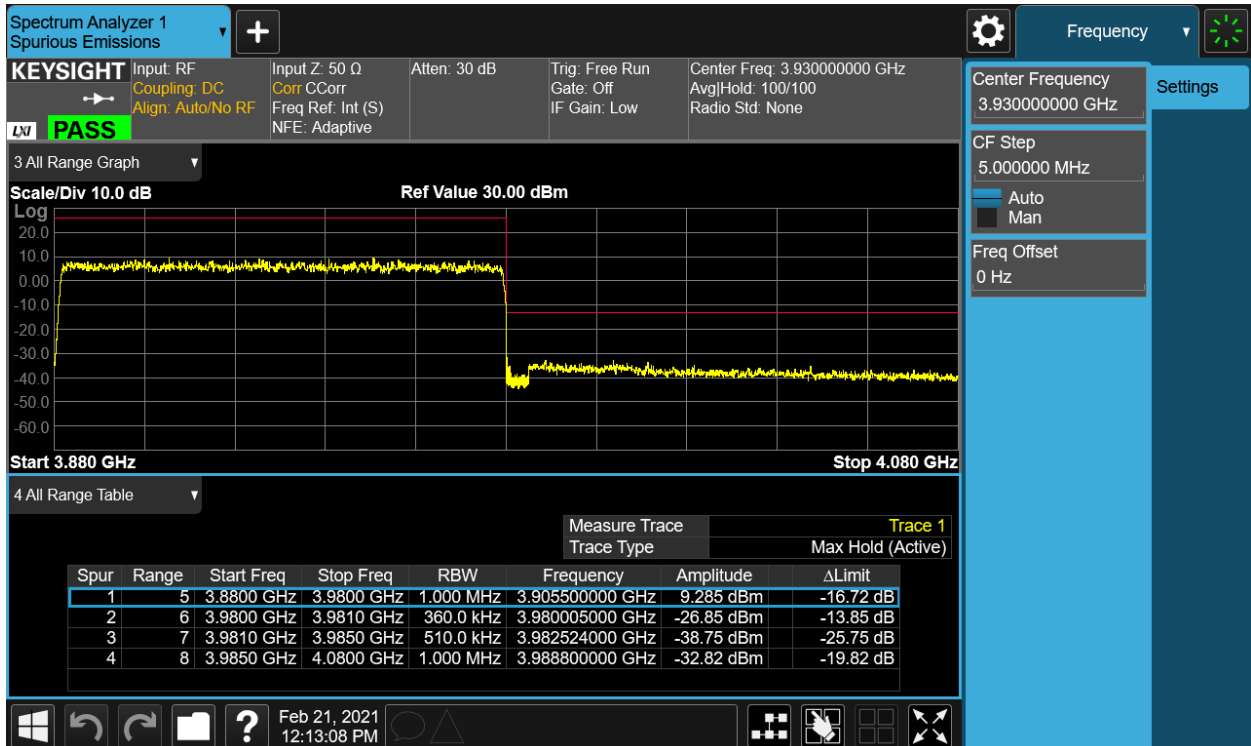
Plot 7-29. Upper Band Edge Plot (NR Band n77 PC2 SRS-2 - 100MHz DFT-s-OFDM-QPSK – Full RB Configuration)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
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NR Band n77 (PC2) SRS-3



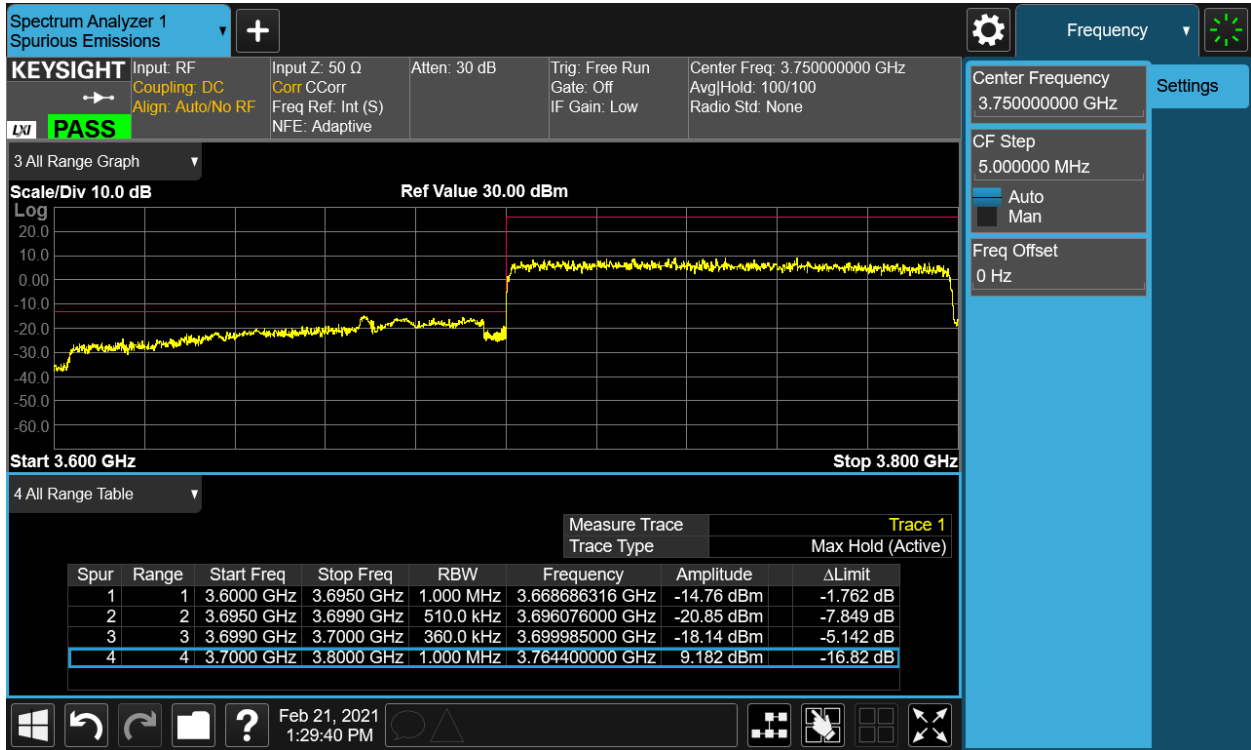
Plot 7-30. Lower Band Edge Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-OFDM-QPSK – Full RB Configuration)



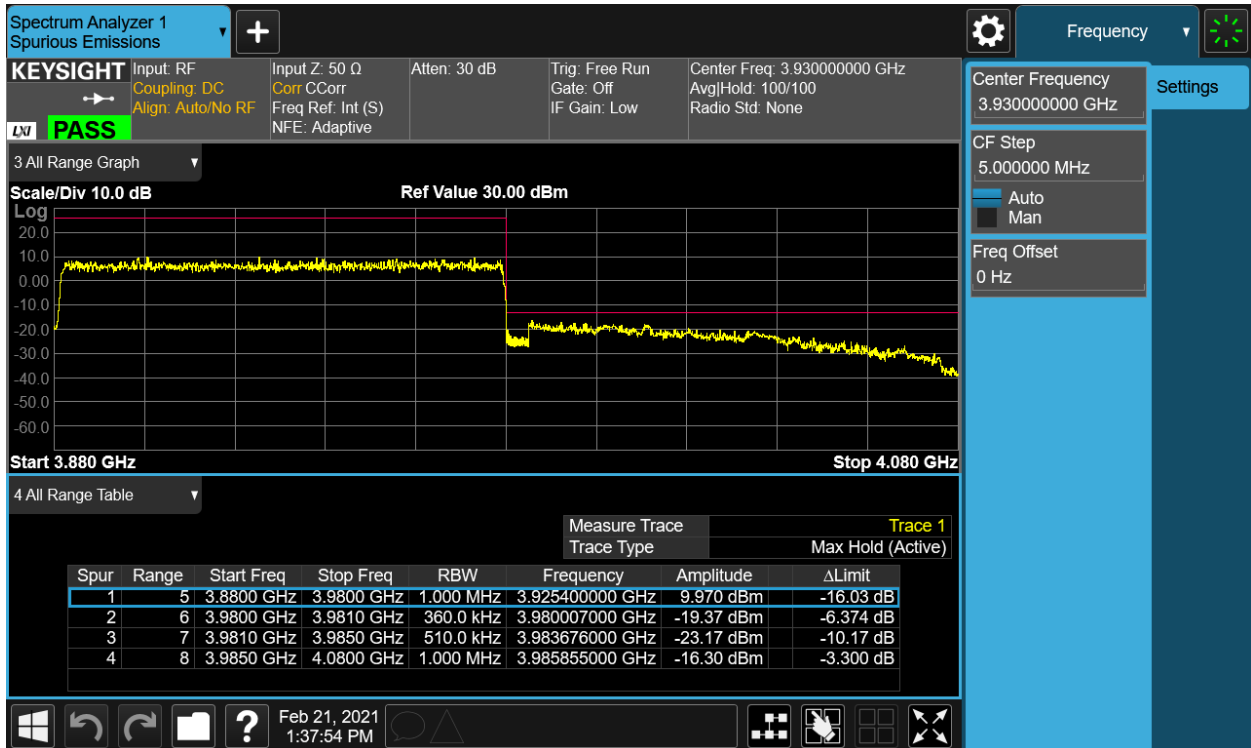
Plot 7-31. Upper Band Edge Plot (NR Band n77 PC2 SRS-3 - 100MHz DFT-s-OFDM-QPSK – Full RB Configuration)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
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NR Band n77 (PC2) SRS-4



Plot 7-32. Lower Band Edge Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-OFDM-QPSK – Full RB Configuration)



Plot 7-33. Upper Band Edge Plot (NR Band n77 PC2 SRS-4 - 100MHz DFT-s-OFDM-QPSK – Full RB Configuration)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
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7.5 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 $\geq 3 \times$ 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

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Test Setup

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

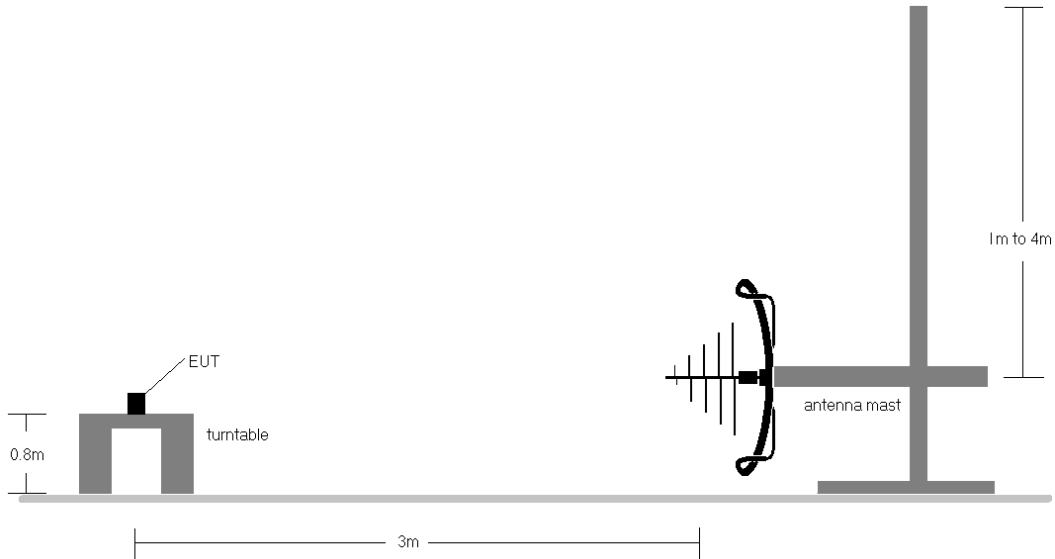


Figure 7-4. Test Instrument & Measurement Setup < 1GHz

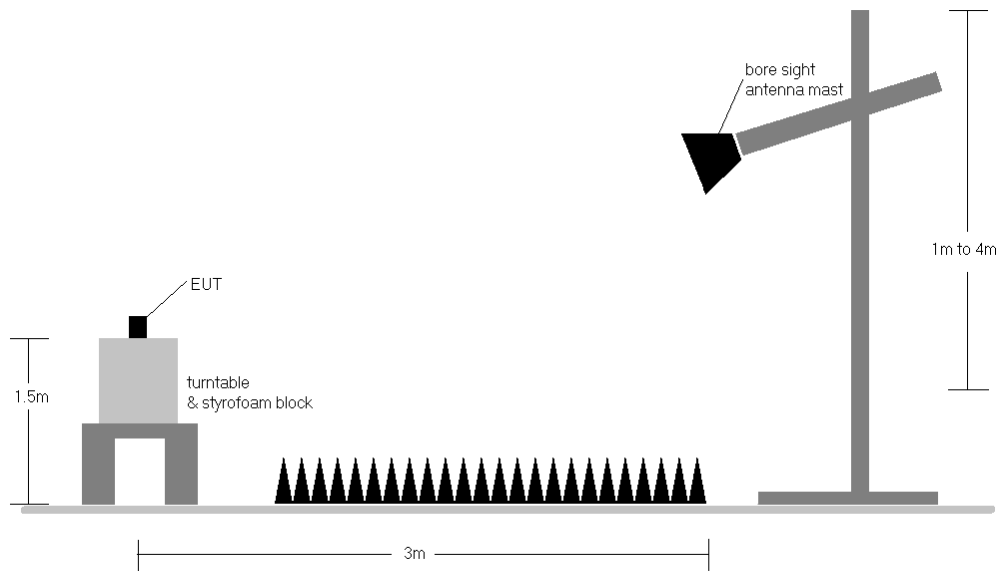




Figure 7-5. Test Instrument & Measurement Setup >1 GHz

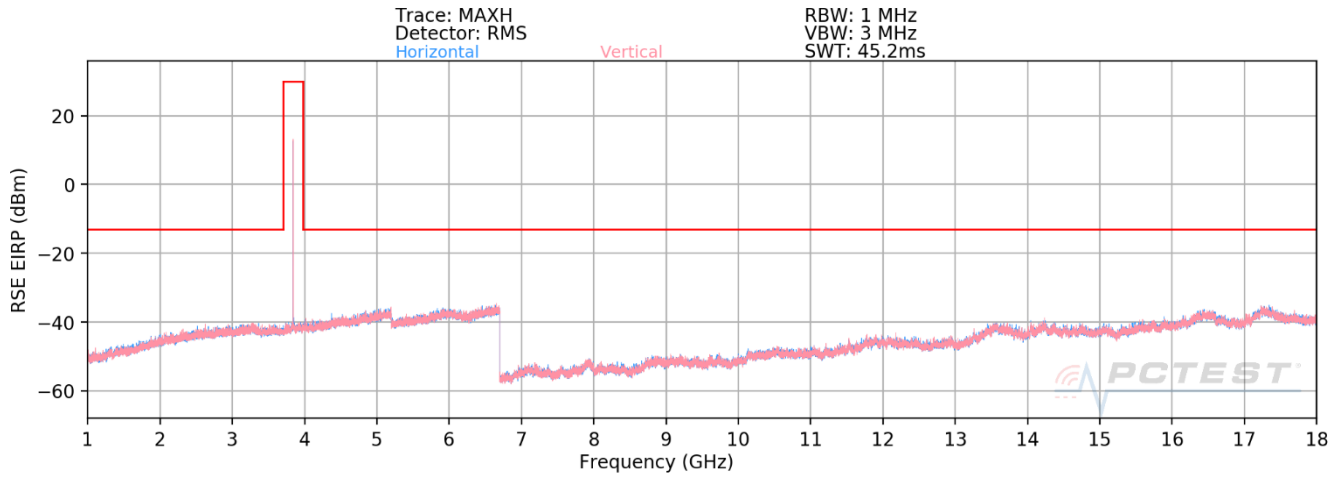
FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
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Test Notes

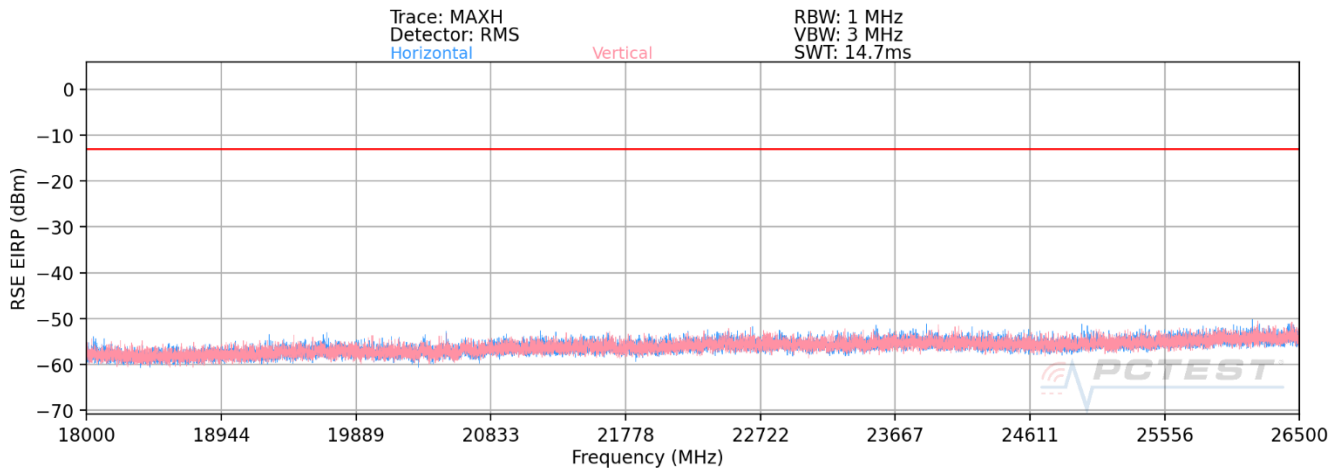
- 1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
 - b) $E(\text{dB}\mu\text{V}/\text{m}) = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$
 - d) $\text{EIRP (dBm)} = E(\text{dB}\mu\text{V}/\text{m}) + 20\log D - 104.8$; 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 were determined to occur with the DFT-s-OFDM transmission scheme. These results from this worst case configuration are reported in this section.
- 9) For emissions above 18GHz, only the antenna with the highest power fundamental transmission was investigated, as it was expected to deliver the worst case spurious emissions.

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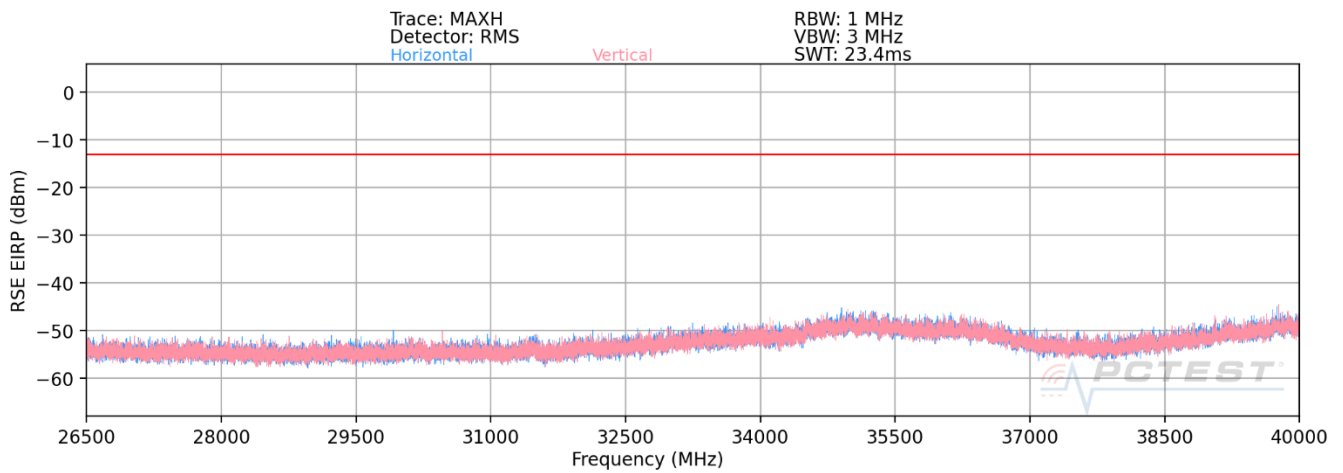
NR Band n77 (PC2) SRS-2



Plot 7-34. Radiated Spurious Plot - 1-18 GHz (NR Band n77 PC2 SRS-2)



Plot 7-35. Radiated Spurious Plot - 18-26.5 GHz (NR Band n77 PC2 SRS-2)



Plot 7-36. Radiated Spurious Plot - 26.5-40 GHz (NR Band n77 PC2 SRS-2)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
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Bandwidth (MHz):	100
Frequency (MHz):	3750.00
RB / Offset:	1 / 136

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]
7500.0	V	396	332	-82.99	16.46	40.47	-54.79	-13.00	-41.79
11250.0	V	-	-	-85.05	21.78	43.73	-51.53	-13.00	-38.53
15000.0	V	-	-	-85.96	28.26	49.30	-45.95	-13.00	-32.95

Table 7-5. Radiated Spurious Data (NR Band n77 PC2 SRS-2 – Low Channel)

Bandwidth (MHz):	100
Frequency (MHz):	3840.00
RB / Offset:	1 / 136



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]
7680.0	V	204	28	-83.48	16.83	40.35	-54.90	-13.00	-41.90
11520.0	V	-	-	-84.79	22.29	44.50	-50.76	-13.00	-37.76
15360.0	V	-	-	-86.27	28.36	49.09	-46.17	-13.00	-33.17

Table 7-6. Radiated Spurious Data (NR Band n77 PC2 SRS-2 – Mid Channel)

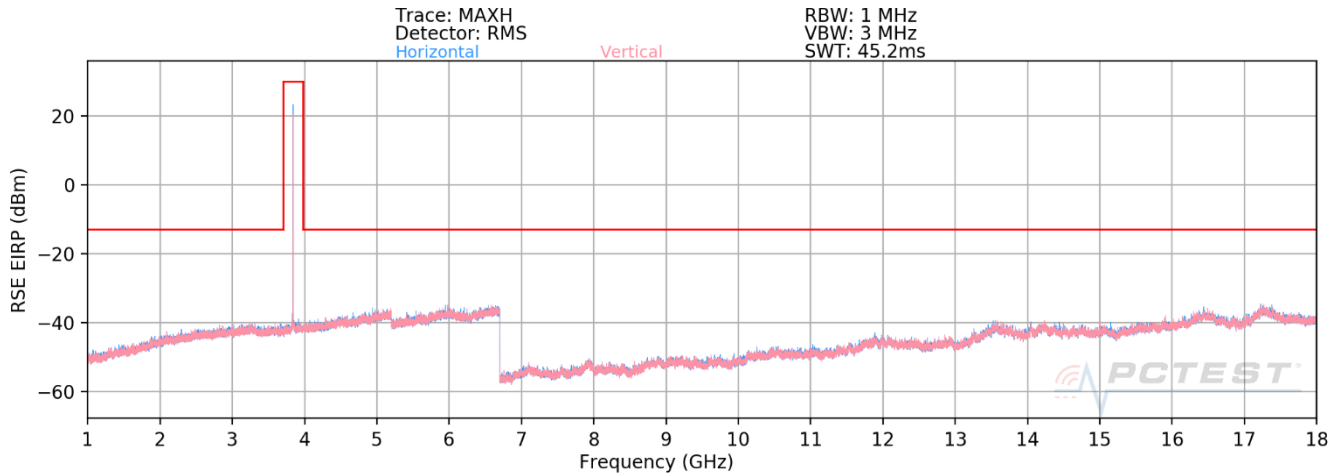
Bandwidth (MHz):	100
Frequency (MHz):	3930.00
RB / Offset:	1 / 136

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]
7860.0	V	100	330	-81.28	16.79	42.51	-52.75	-13.00	-39.75
11790.0	V	-	-	-84.60	22.56	44.96	-50.29	-13.00	-37.29
15720.0	V	-	-	-85.92	28.94	50.02	-45.24	-13.00	-32.24

Table 7-7. Radiated Spurious Data (NR Band n77 PC2 SRS-2 – High Channel)

FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT 		Approved by: Technical Manager
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NR Band n77 (PC2) SRS-3



Plot 7-37. Radiated Spurious Plot - 1-18 GHz (NR Band n77 PC2 SRS-3)

Bandwidth (MHz):	100
Frequency (MHz):	3750.00
RB / Offset:	1 / 136

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]
7500.0	H	100	39	-75.51	16.46	47.95	-47.31	-13.00	-34.31
11250.0	H	-	-	-84.93	21.78	43.85	-51.41	-13.00	-38.41
15000.0	H	-	-	-86.01	28.26	49.25	-46.00	-13.00	-33.00

Table 7-8. Radiated Spurious Data (NR Band n77 PC2 SRS-3 – Low Channel)

Bandwidth (MHz):	100
Frequency (MHz):	3840.00
RB / Offset:	1 / 136

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]
7680.0	H	104	24	-82.56	16.83	41.27	-53.98	-13.00	-40.98
11520.0	H	-	-	-84.69	22.29	44.60	-50.66	-13.00	-37.66
15360.0	H	-	-	-86.24	28.36	49.12	-46.14	-13.00	-33.14



Table 7-9. Radiated Spurious Data (NR Band n77 PC2 SRS-3 – Mid Channel)

FCC ID: A3LSMG998U	PCTEST Proud to be part of element	PART 27 MEASUREMENT REPORT	SAMSUNG	Approved by: Technical Manager
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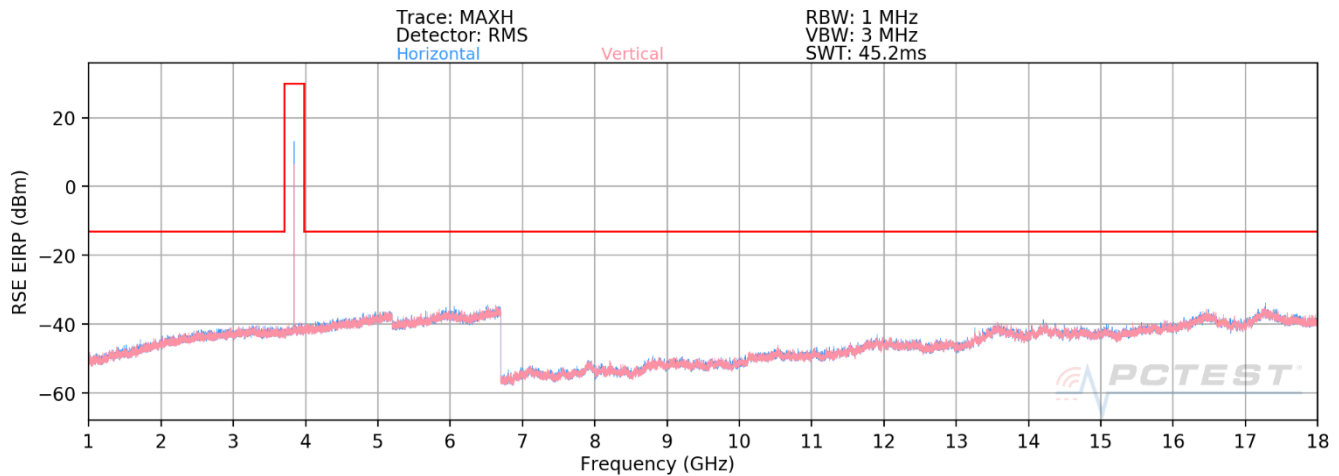
Bandwidth (MHz):	100
Frequency (MHz):	3930.00
RB / Offset:	1 / 136

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7860.0	H	117	89	-83.40	16.79	40.39	-54.87	-13.00	-41.87
11790.0	H	-	-	-84.29	22.56	45.27	-49.98	-13.00	-36.98
15720.0	H	-	-	-85.75	28.94	50.19	-45.07	-13.00	-32.07

Table 7-10. Radiated Spurious Data (NR Band n77 PC2 SRS-3 – High Channel)

FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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NR Band n77 (PC2) SRS-4



Plot 7-38. Radiated Spurious Plot - 1-18 GHz (NR Band n77 PC2 SRS-4)

Bandwidth (MHz):	100
Frequency (MHz):	3750.00
RB / Offset:	1 / 136



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]
7500.0	H	-	-	-83.34	16.46	40.12	-55.14	-13.00	-42.14
11250.0	H	-	-	-84.96	21.78	43.82	-51.44	-13.00	-38.44
15000.0	H	-	-	-85.96	28.26	49.30	-45.95	-13.00	-32.95

Table 7-11. Radiated Spurious Data (NR Band n77 PC2 SRS-4 – Low Channel)

Bandwidth (MHz):	100
Frequency (MHz):	3840.00
RB / Offset:	1 / 136

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]
7680.0	H	273	10	-82.89	16.83	40.94	-54.31	-13.00	-41.31
11520.0	H	-	-	-84.73	22.29	44.56	-50.70	-13.00	-37.70
15360.0	H	-	-	-86.14	28.36	49.22	-46.04	-13.00	-33.04



Table 7-12. Radiated Spurious Data (NR Band n77 PC2 SRS-4 – Mid Channel)

FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
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Bandwidth (MHz):	100
Frequency (MHz):	3930.00
RB / Offset:	1 / 136



Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dB μ V/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7860.0	H	261	6	-82.76	16.79	41.03	-54.23	-13.00	-41.23
11790.0	H	-	-	-84.38	22.56	45.18	-50.07	-13.00	-37.07
15720.0	H	-	-	-85.72	28.94	50.22	-45.04	-13.00	-32.04

Table 7-13. Radiated Spurious Data (NR Band n77 PC2 SRS-4 – High Channel)

FCC ID: A3LSMG998U	 PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset	Page 41 of 42

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.

FCC ID: A3LSMG998U		PART 27 MEASUREMENT REPORT		Approved by: Technical Manager
Test Report S/N: 1M2012210203-03.A3L	Test Dates: 02/17/2021 – 02/22/2021	EUT Type: Portable Handset		Page 42 of 42