

# FCC NFC REPORT

## Certification

**Applicant Name:**  
SAMSUNG Electronics Co., Ltd.

**Address:**  
129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,  
16677, Rep. of Korea

**Date of Issue:**  
May 13, 2022

**Test Site/Location:**  
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-  
si, Gyeonggi-do, 17383 KOREA

**Report No.:** HCT-RF-2205-FC013

**FCC ID:** A3LSMG990U2

**APPLICANT:** SAMSUNG Electronics Co., Ltd.

**Model:** SM-G990U2

**Additional Model:** SM-G990U3/DS

**EUT Type:** Mobile Phone

**RF Output Field Strength:** 17.25 dB $\mu$ V/m @30 m

**Frequency of Operation:** 13.56 MHz

**Modulation type:** ASK

**FCC Classification:** Low Power Communication Device Transmitter (DXX)

**FCC Rule Part(s):** FCC Part 15.225 Subpart C

**Engineering Statement:**

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

Report No.: HCT-RF-2205-FC013

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REVIEWED BY



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Report prepared by : Jin Gwan Lee  
Engineer of Telecommunication Testing Center

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Report approved by : Jong Seok Lee  
Manager of Telecommunication Testing Center

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked \*.

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

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## Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2205-FC013	May 13, 2022	- First Approval Report

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## 1. EUT DESCRIPTION

<b>Model</b>	SM-G990U2
<b>Additional Model</b>	SM-G990U3/DS
<b>EUT Type</b>	Mobile Phone
<b>Power Supply</b>	DC 3.88 V
<b>Frequency of Operation</b>	13.56 MHz
<b>Transmit Power</b>	17.25 dB $\mu$ V/m @30 m
<b>Modulation Type</b>	ASK
<b>Date(s) of Tests</b>	April 06, 2022 ~ May 10, 2022
<b>Serial number</b>	Radiated: R3CT30Q0R8W

## 2. TEST METHODOLOGY

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) is used in the measurement of the test device.

### EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

### EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.225 under the FCC Rules Part 15 Subpart C.

## GENERAL TEST PROCEDURES

### Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

### Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 6.6.5 of ANSI C63.10. (Version: 2013).

## DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

### 3. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards.

Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

### 4. FACILITIES AND ACCREDITATIONS

#### FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.

The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).

#### EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 5. ANTENNA REQUIREMENTS

#### According to FCC 47 CFR §15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

(1) The antennas of this E.U.T are permanently attached.

(2)The E.U.T Complies with the requirement of §15.203

## 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95 % level of confidence.

The measurement data shown herein 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.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	2.00 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (9 kHz ~ 30 MHz)	4.40 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (30 MHz ~ 1 GHz)	5.74 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (1 GHz ~ 18 GHz)	5.51 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (18 GHz ~ 40 GHz)	5.92 ( Confidence level about 95 %, $k=2$ )
Radiated Disturbance (Above 40 GHz)	5.48 ( Confidence level about 95 %, $k=2$ )



## 7. DESCRIPTION OF TESTS

### 7.1. Radiated Test

#### Limit (Operation within the band 13.110 MHz – 14.010 MHz)

Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ )	Measurement Distance (m)
13.553 – 13.567	15,848	30
13.410 $\leq$ f $\leq$ 13.553 13.567 $\leq$ f $\leq$ 13.710	334	30
13.110 $\leq$ f $\leq$ 13.410 13.710 $\leq$ f $\leq$ 14.010	106	30

Note:

1. 15,848  $\mu\text{V/m}$  = 84.0dB $\mu\text{V/m}$
2. 334  $\mu\text{V/m}$  = 50.47 dB $\mu\text{V/m}$
3. 106 $\mu\text{V/m}$  = 40.51dB $\mu\text{V/m}$

#### Limit(Radiated Spurious Emissions)

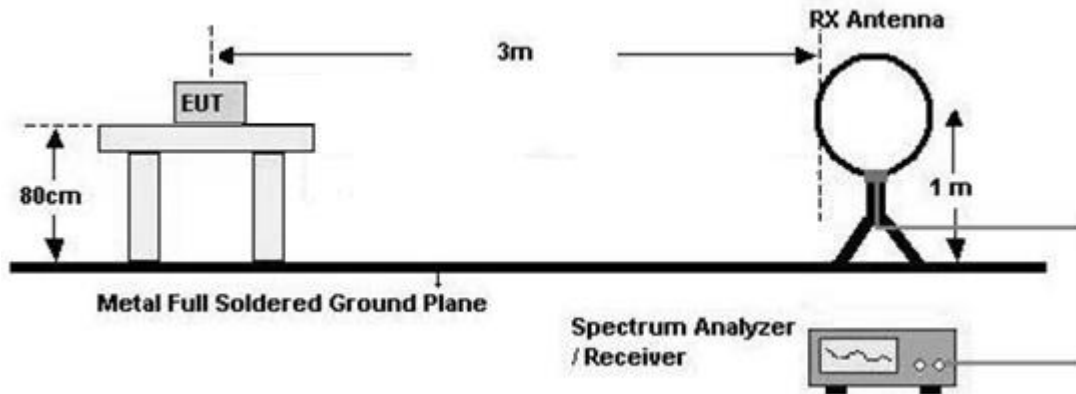
Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ )	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	* 100	3
88-216	* 150	3
216-960	* 200	3
Above 960	500	3

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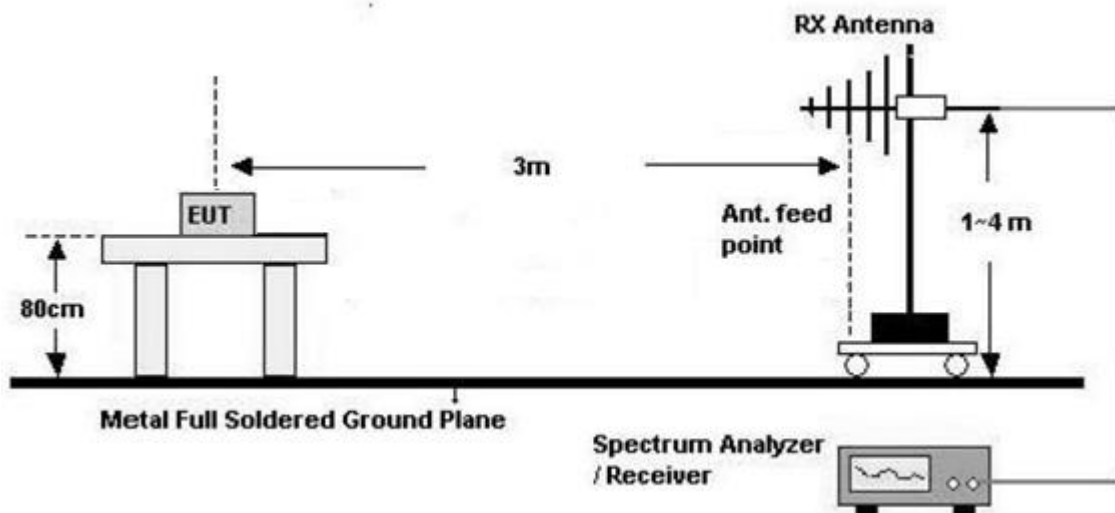
Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

## Test Configuration

Below 30 MHz



30 MHz - 1 GHz



## Test Procedure of in-band

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3 m from the EUT
3. The EUT is placed on a turntable, which is 0.8 m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor =  $40\log(3\text{ m}/30\text{ m}) = -40\text{ dB}$   
Measurement Distance : 3 m(Below30 MHz)
7. Spectrum Setting

- Detector = Peak
- Trace = Max Hold
- RBW = 9 kHz
- VBW  $\geq 3 \times$  RBW

8.Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

### **Test Procedure of Radiated spurious emissions(Below30 MHz)**

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3 m from the EUT
3. The EUT is placed on a turntable, which is 0.8 m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor(0.009 MHz – 0.490 MHz) =  $40\log(3 \text{ m}/300 \text{ m}) = - 80 \text{ dB}$   
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) =  $40\log(3 \text{ m}/30 \text{ m}) = - 40 \text{ dB}$   
Measurement Distance : 3 m
8. Spectrum Setting
  - Frequency Range = 9 kHz ~ 30 MHz
  - Detector = Peak
  - Trace = Maxhold
  - RBW = 9 kHz
  - VBW  $\geq 3 \times$  RBW
- 9.Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

### **KDB 414788 OFS and Chamber Correlation Justification**

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

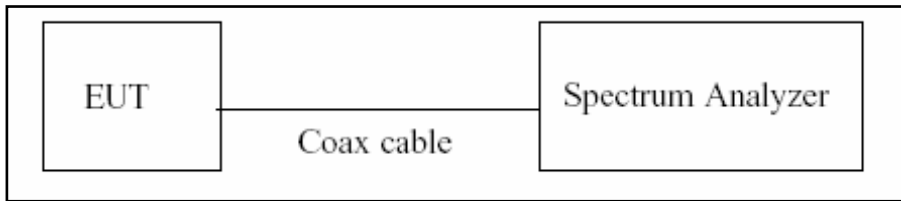
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

**Test Procedure of Radiated spurious emissions(Above30 MHz)**

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3 m from the EUT, which is varied from 1m to 4m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
  - Frequency Range = 30 MHz ~ 1 GHz
  - Detector = Peak
  - Trace = Maxhold
  - RBW = 100 kHz
  - VBW  $\geq$  3 x RBW
7. Total = Measured Value + Antenna Factor(A.F) + Cable Loss(C.L)
8. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

## 7.2. 20 dB Bandwidth

### Test Configuration



### Test Procedure

The 20 dB bandwidth was measured by using a spectrum analyzer.

(Procedure 6.9.2 in ANSI 63.10-2013)

- 1) RBW = 1 % ~ 5 % of the OBW
- 2) VBW = approximately three times RBW
- 3) Span = between two times and five times the OBW
- 4) Detector = Peak
- 5) Trace mode = Max hold
- 6) Allow the trace to stabilize

Note :

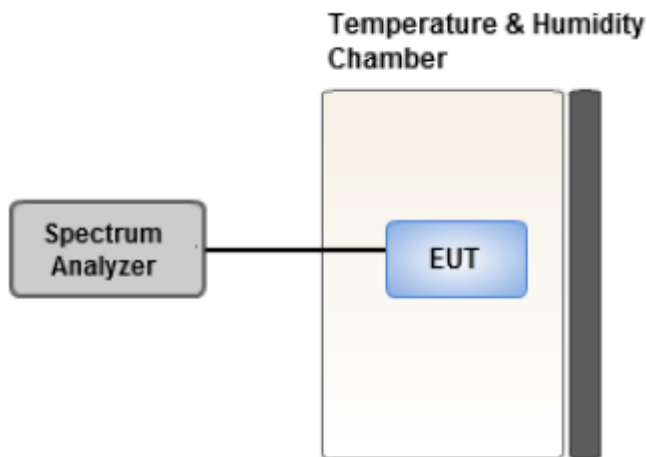
We tested Occupied Bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer.

### 7.3. Frequency Stability

#### Limit

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency.

#### Test Configuration



#### Test Procedure.

For battery operated equipment, the equipment tests shall be performed using a new battery.

- 1) Turn the EUT OFF and place it inside the environmental temperature chamber.  
For devices that have oscillator heaters, energize only the heater circuit.
- 2) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.
- 3) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.
- 4) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency.

#### Note:

- 1) Temperature:  
The temperature is varied from  $-20^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  using an environmental chamber.
- 2) Primary Supply Voltage :  
The primary supply voltage is varied from 85 % to 115 % of the nominal value for non hand-carried battery and AC powered equipment.  
For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

## 7.4. AC Power line Conducted Emissions

### Limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56 <sup>(a)</sup>	56 to 46 <sup>(a)</sup>
0.50 to 5	56	46
5 to 30	60	50

<sup>(a)</sup>Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

### Test Configuration

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

### Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.
5. The EUT is the device operating below 30 MHz.
  - For unterminated the Antenna, the AC line conducted tests are performed with the antenna connected
  - For terminated the Antenna, the AC line conducted tests are performed with a dummy load connected to the EUT antenna output terminal.

### Sample Calculation

Quasi-peak(Final Result) = Measured Value + Correction Factor

## 7.5. Worst case configuration and mode

### **Radiated test**

1. All modes of operation were investigated and the worst case configuration results are reported.
  - Mode : Stand alone, Stand alone + external accessories(Earphone, etc)
  - Worstcase : Stand alone
2. EUT Axis : Z
3. All type and bitrate were investigated and the worst case results are reported.
  - Worstcase : Type A, 106 kbps
4. All mode of without tag and with tag were investigated and the worst case configuration results are reported.
  - Worstcase : Without Tag
5. All position of loop antenna were investigated and the worst case configuration results are reported.
  - Position : Horizontal, Vertical, Parallel to the ground plane
  - Worstcase : Horizontal
6. SM-G990U2, SM-G990U3/DS were tested and the worst case results are reported. (Worst case : SM-G990U2)

### **AC Power line Conducted Emissions**

1. All modes of operation were investigated and the worst case configuration results are reported.
  - Mode : Stand alone+Earphone+Travel Adapter, Stand alone+Travel Adapter
  - Worstcase : Stand alone+Travel Adapter
2. All modes(For unterminated the Antenna, terminated the Antenna) of operation were investigated and the worst case configuration results are reported.
  - Worstcase : Unterminated the Antenna
3. SM-G990U2, SM-G990U3/DS were tested and the worst case results are reported. (Worst case : SM-G990U2)

### **20 dB Bandwidth & Frequency Stability**

1. All type and bitrate were investigated and the worst case results are reported.
  - Worstcase : Type A, 106 kbps
2. SM-G990U2, SM-G990U3/DS were tested and the worst case results are reported. (Worst case : SM-G990U2)



## 8. TEST SUMMARY

Regulation	Requirement	Result
Part 15.225 (a)	Radiated Electric Field Emissions (13.553MHz to 13.567MHz)	Pass
Part 15.225 (b)	Radiated Electric Field Emissions ( $13.410 \leq f \leq 13.553$ , $13.567 \leq f \leq 13.710$ )	Pass
Part 15.225 (c)	Radiated Electric Field Emissions ( $13.110 \leq f \leq 13.410$ , $13.710 \leq f \leq 14.010$ )	Pass
Part 15.209	Radiated Electric Field Emissions (9kHz to 30MHz)	Pass
Part 15.209	Radiated Electric Field Emissions (30MHz to 1GHz)	Pass
Part 15.225 (e)	Frequency Stability	Pass
Part 15.207	AC power conducted emissions (150kHz to 30MHz)	Pass
Part 15.215 (c)	20 dB Bandwidth	Pass

## 9. TEST RESULT

### 9.1. Operation within the band 13.110 MHz – 14.010 MHz

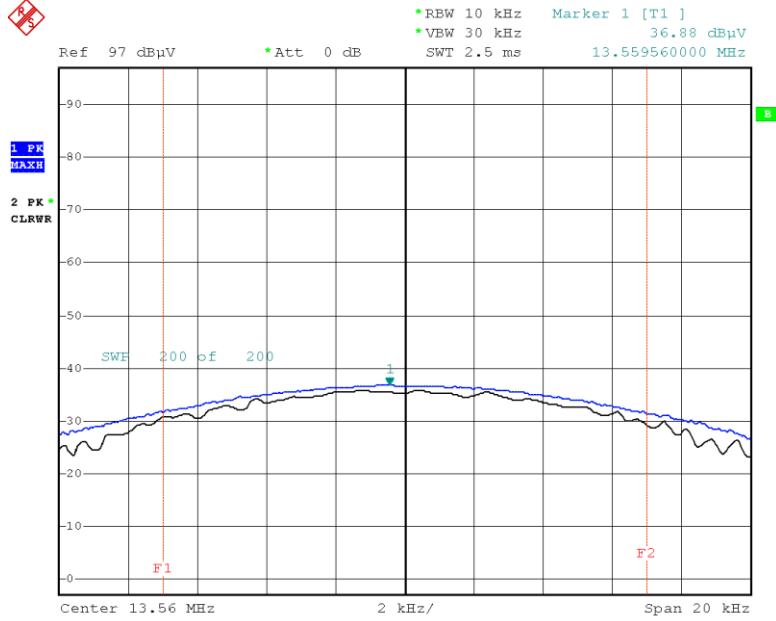
Measured Frequency Range :							
13.553 MHz-13.567 MHz							
Frequency (MHz)	Measured Value (dBμV/m) @3 m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL (H/V)	Total (dBμV/m) @30 m	Limit (dBμV/m) @30 m	Margin (dB)
13.55956	36.88	20.37	-40.00	X-H	17.25	84.00	66.75
13.55936	35.15	20.37	-40.00	X-V	15.52	84.00	68.48

Measured Frequency Range :							
13.410 MHz-13.553 MHz and 13.567 MHz-13.710 MHz							
Frequency (MHz)	Measured Value (dBμV/m) @3 m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL (H/V)	Total (dBμV/m) @30 m	Limit (dBμV/m) @30 m	Margin (dB)
13.5531	31.11	20.37	-40.00	X-H	11.48	50.47	38.99
13.5671	30.95	20.37	-40.00	X-H	11.32	50.47	39.15

Measured Frequency Range :							
13.110 MHz – 13.410 MHz and 13.710 MHz-14.010 MHz							
Frequency (MHz)	Measured Value (dBμV/m) @3 m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL (H/V)	Total (dBμV/m) @30 m	Limit (dBμV/m) @30 m	Margin (dB)
13.34927	23.88	20.37	-40.00	X-H	4.25	40.51	36.26
13.77258	23.22	20.37	-40.00	X-H	3.59	40.51	36.92

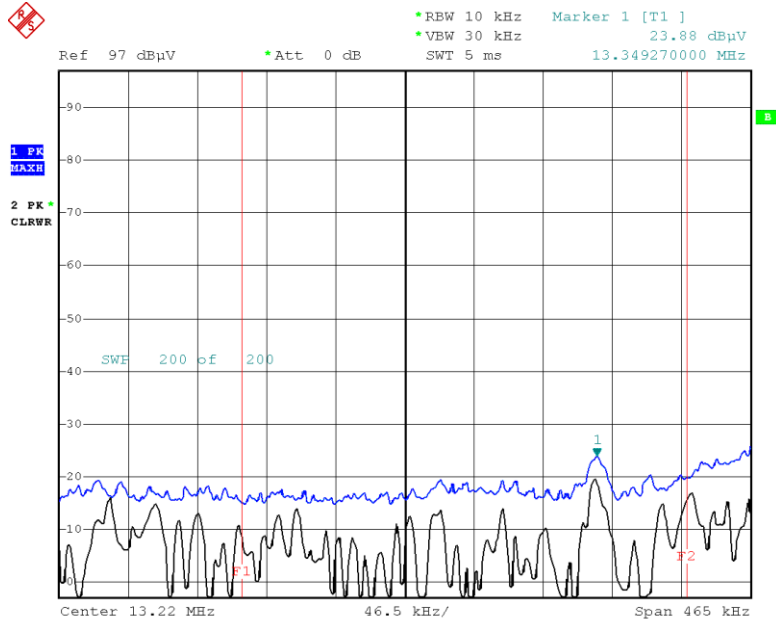
## Test Plot

13.553 MHz ~ 13.567 MHz



Date: 19.APR.2022 15:46:32

Worst Case (13.110 MHz ~ 13.410 MHz)



Date: 19.APR.2022 15:58:01

### Note:

Plot of worst case are only reported.

**9.2. Radiated Emission 9kHz – 30 MHz**

Measured Frequency Range : 9 kHz - 30 MHz							
Frequency (MHz)	Measured Value (dB $\mu$ V/m) @3 m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL (H/V)	Total (dB $\mu$ V/m) @30 m	Limit (dB $\mu$ V/m) @30 m	Margin (dB)
9.76868	26.45	20.37	-40.00	X-H	6.82	29.54	22.72
19.719	26.13	20.77	-40.00	X-H	6.90	29.54	22.64
24.894	27.12	20.57	-40.00	X-H	7.69	29.54	21.85
24.037	27.14	20.57	-40.00	X-V	7.71	29.54	21.84

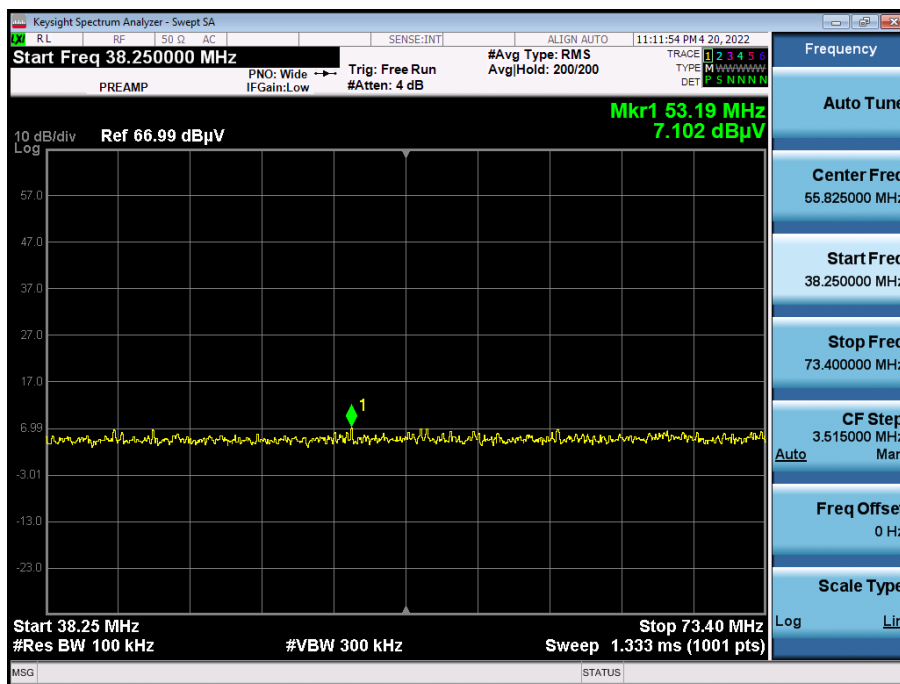
### 9.3. Radiated Emission 30MHz – 1000 MHz

Measured Frequency Range :							
30 MHz - 1000 MHz							
Frequency (MHz)	Measured Value (dBμV/m) @3 m	Ant.Factor (dB/m)	Cable Loss (dB)	Ant. Pol (H/V)	Total (dBμV/m)	Limit (dBμV/m)	Margin (dB)
#37.9476	6.356	19.30	0.55	H	26.21	40.00	13.79
53.1900	7.102	19.70	0.62	H	27.42	40.00	12.58
101.3850	7.133	14.90	0.91	V	22.94	40.00	17.06
#118.8450	6.483	16.90	1.01	H	24.39	43.50	19.11
#133.3870	6.846	17.90	1.04	H	25.79	43.50	17.71
156.8930	7.032	18.70	1.16	V	26.89	43.50	16.61

**Note:**

1. # is the result for restricted band.

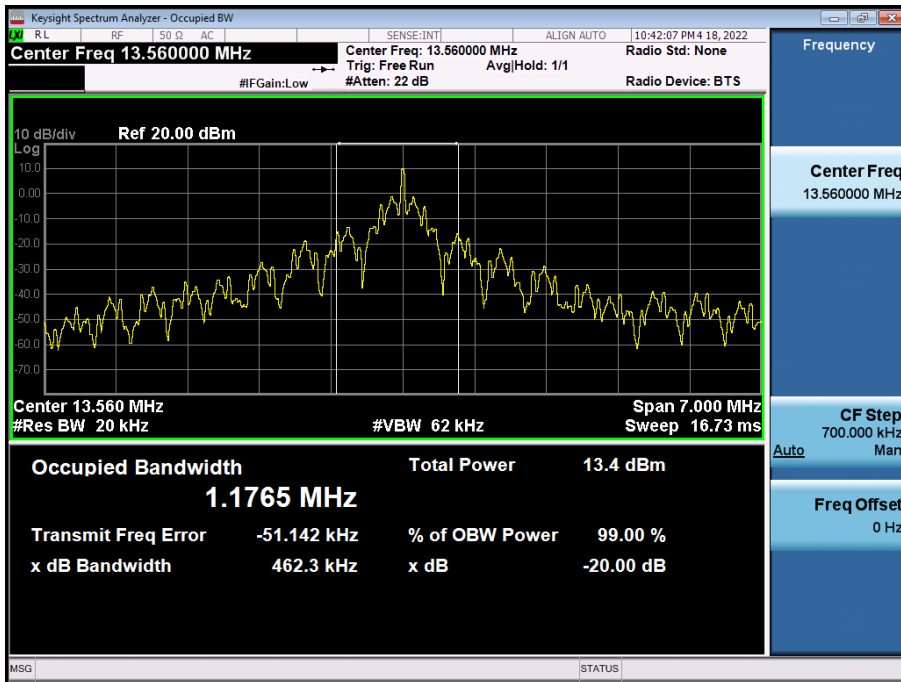
**Test Plot**



**Note:**

Plot of worst case are only reported

### 9.4. 20 dB Bandwidth



## 9.5. Frequency Stability

### Startup

PERATING FREQUENCY: 13.56 MHz  
 REFERENCE VOLTAGE: 3.88 VDC  
 DEVIATION LIMIT: ±0.01 % = ± 1356 Hz

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (MHz)	Frequency Dev. (Hz)	Frequency Dev (%)
100%	3.88	-20	13.560060	60	0.0004425
100%		-10	13.560038	38	0.0002802
100%		0	13.560049	49	0.0003614
100%		+10	13.560048	48	0.0003540
100%		+20(Ref.)	13.560051	51	0.0003761
100%		+30	13.560027	27	0.0001991
100%		+40	13.560063	63	0.0004646
100%		+50	13.560057	57	0.0004204
LOW	3.298	+20	13.560063	63	0.0004646
HIGH	4.462	+20	13.560055	55	0.0004056

**2 minutes**

PERATING FREQUENCY: 13.56 MHz  
REFERENCE VOLTAGE: 3.88 VDC  
DEVIATION LIMIT: ±0.01 % = ± 1356 Hz

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (MHz)	Frequency Dev. (Hz)	Frequency Dev (%)
100%	3.88	-20	13.560048	48	0.0003540
100%		-10	13.560060	60	0.0004425
100%		0	13.560044	44	0.0003245
100%		+10	13.560038	38	0.0002802
100%		+20(Ref.)	13.560027	27	0.0001991
100%		+30	13.560061	61	0.0004499
100%		+40	13.560025	25	0.0001844
100%		+50	13.560048	48	0.0003540
LOW		3.298	+20	13.560041	41
HIGH	4.462	+20	13.560038	38	0.0002802



**5 minutes**OPERATING FREQUENCY: 13.56 MHzREFERENCE VOLTAGE: 3.88 VDCDEVIATION LIMIT: ±0.01 % = ± 1356 Hz

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (MHz)	Frequency Dev. (Hz)	Frequency Dev (%)
100%	3.88	-20	13.560020	20	0.0001475
100%		-10	13.560045	45	0.0003319
100%		0	13.560019	19	0.0001401
100%		+10	13.560047	47	0.0003466
100%		+20(Ref.)	13.560068	68	0.0005015
100%		+30	13.560030	30	0.0002212
100%		+40	13.560069	69	0.0005088
100%		+50	13.560050	50	0.0003687
LOW	3.298	+20	13.560067	67	0.0004941
HIGH	4.462	+20	13.560020	20	0.0001475

**10 minutes**OPERATING FREQUENCY: 13.56 MHzREFERENCE VOLTAGE: 3.88 VDCDEVIATION LIMIT: ±0.01 % = ± 1356 Hz

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (MHz)	Frequency Dev. (Hz)	Frequency Dev (%)
100%	3.88	-20	13.560014	14	0.0001032
100%		-10	13.560030	30	0.0002212
100%		0	13.560012	12	0.0000885
100%		+10	13.560014	14	0.0001032
100%		+20(Ref.)	13.560048	48	0.0003540
100%		+30	13.560045	45	0.0003319
100%		+40	13.560058	58	0.0004277
100%		+50	13.560060	60	0.0004425
LOW	3.298	+20	13.560025	25	0.0001844
HIGH	4.462	+20	13.560020	20	0.0001475

## 9.6. POWERLINE CONDUCTED EMISSIONS

### Conducted Emissions (Line 1)

Test

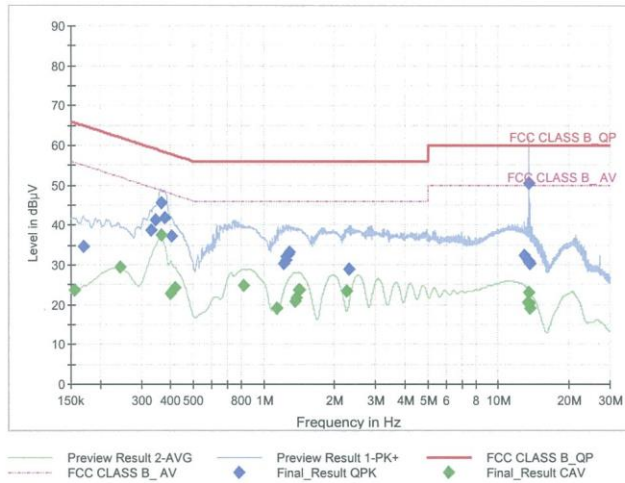
1 / 2

## Test Report

### Common Information

EUT : SM-G990U2  
 Manufacturer : SAMSUNG Electronics Co., Ltd.  
 Test Site: SHIELD ROOM  
 Operating Conditions : NFC\_L1  
 Operator Name:  
 Comment:

Full Spectrum



### Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1703	34.66	64.95	30.29	9.000	L1	OFF	9.6
0.3300	38.61	59.45	20.84	9.000	L1	OFF	9.6
0.3435	41.33	59.12	17.78	9.000	L1	OFF	9.6
0.3638	45.56	58.64	13.08	9.000	L1	OFF	9.6
0.3773	41.80	58.34	16.54	9.000	L1	OFF	9.6
0.4020	37.21	57.81	20.60	9.000	L1	OFF	9.7
1.2200	30.27	56.00	25.73	9.000	L1	OFF	9.7
1.2403	31.14	56.00	24.86	9.000	L1	OFF	9.7
1.2470	32.09	56.00	23.91	9.000	L1	OFF	9.7
1.2673	32.48	56.00	23.52	9.000	L1	OFF	9.7
1.2898	33.28	56.00	22.72	9.000	L1	OFF	9.7
2.3180	28.83	56.00	27.17	9.000	L1	OFF	9.8
12.9223	32.33	60.00	27.67	9.000	L1	OFF	10.1
13.4128	31.03	60.00	28.97	9.000	L1	OFF	10.2
13.4668	30.79	60.00	29.21	9.000	L1	OFF	10.2
13.4960	30.70	60.00	29.30	9.000	L1	OFF	10.2
13.5590	50.50	60.00	9.50	9.000	L1	OFF	10.2
13.6400	30.29	60.00	29.71	9.000	L1	OFF	10.2

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Test

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**Final Result CAV**

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	23.63	55.75	32.12	9.000	L1	OFF	9.6
0.2445	29.29	51.94	22.65	9.000	L1	OFF	9.6
0.3638	37.42	48.64	11.22	9.000	L1	OFF	9.6
0.3998	22.88	47.86	24.98	9.000	L1	OFF	9.6
0.4155	24.29	47.54	23.25	9.000	L1	OFF	9.7
0.8195	24.87	46.00	21.13	9.000	L1	OFF	9.7
1.1323	18.96	46.00	27.04	9.000	L1	OFF	9.7
1.3573	20.64	46.00	25.36	9.000	L1	OFF	9.7
1.3753	21.76	46.00	24.24	9.000	L1	OFF	9.7
1.4068	23.56	46.00	22.44	9.000	L1	OFF	9.7
1.4248	23.65	46.00	22.35	9.000	L1	OFF	9.7
2.2550	23.34	46.00	22.66	9.000	L1	OFF	9.8
13.4105	20.52	50.00	29.48	9.000	L1	OFF	10.2
13.4150	20.36	50.00	29.64	9.000	L1	OFF	10.2
13.4645	20.39	50.00	29.61	9.000	L1	OFF	10.2
13.5433	20.14	50.00	29.86	9.000	L1	OFF	10.2
13.5590	23.00	50.00	27.00	9.000	L1	OFF	10.2
13.6378	18.93	50.00	31.07	9.000	L1	OFF	10.2

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Test

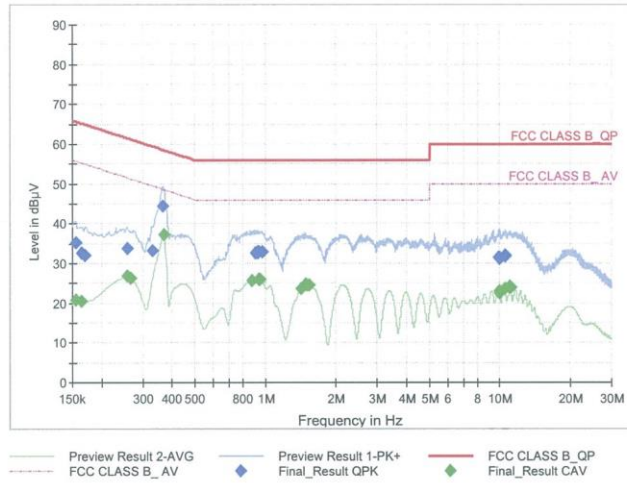
1 / 2

## Test Report

### Common Information

EUT : SM-G990U2  
 Manufacturer : SAMSUNG Electronics Co., Ltd.  
 Test Site: SHIELD ROOM  
 Operating Conditions : NFC Term\_L1  
 Operator Name:  
 Comment:

Full Spectrum



### Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	35.06	65.75	30.69	9.000	L1	OFF	9.6
0.1635	32.56	65.28	32.73	9.000	L1	OFF	9.6
0.1703	31.92	64.95	33.02	9.000	L1	OFF	9.6
0.2580	33.83	61.50	27.67	9.000	L1	OFF	9.6
0.3300	33.25	59.45	26.20	9.000	L1	OFF	9.6
0.3660	44.51	58.59	14.09	9.000	L1	OFF	9.6
0.9073	32.67	56.00	23.33	9.000	L1	OFF	9.7
0.9118	32.59	56.00	23.41	9.000	L1	OFF	9.7
0.9253	32.62	56.00	23.38	9.000	L1	OFF	9.7
0.9320	33.03	56.00	22.97	9.000	L1	OFF	9.7
0.9433	32.99	56.00	23.01	9.000	L1	OFF	9.7
0.9658	32.88	56.00	23.12	9.000	L1	OFF	9.7
9.9028	31.56	60.00	28.44	9.000	L1	OFF	10.0
9.9230	31.32	60.00	28.68	9.000	L1	OFF	10.0
9.9433	31.22	60.00	28.78	9.000	L1	OFF	10.0
10.4923	31.86	60.00	28.14	9.000	L1	OFF	10.1
10.5148	31.93	60.00	28.07	9.000	L1	OFF	10.1
10.5350	31.72	60.00	28.28	9.000	L1	OFF	10.1

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Test

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**Final Result CAV**

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	20.72	55.75	35.04	9.000	L1	OFF	9.6
0.1635	20.55	55.28	34.74	9.000	L1	OFF	9.6
0.2580	26.80	51.50	24.70	9.000	L1	OFF	9.6
0.2670	26.37	51.21	24.84	9.000	L1	OFF	9.6
0.3683	37.20	48.54	11.34	9.000	L1	OFF	9.6
0.8735	25.58	46.00	20.42	9.000	L1	OFF	9.7
0.9410	26.03	46.00	19.97	9.000	L1	OFF	9.7
0.9523	25.82	46.00	20.18	9.000	L1	OFF	9.7
1.4293	23.54	46.00	22.46	9.000	L1	OFF	9.7
1.4945	24.69	46.00	21.31	9.000	L1	OFF	9.7
1.5080	24.47	46.00	21.53	9.000	L1	OFF	9.7
1.5418	24.39	46.00	21.61	9.000	L1	OFF	9.7
9.9208	23.10	50.00	26.90	9.000	L1	OFF	10.0
9.9455	22.41	50.00	27.59	9.000	L1	OFF	10.0
10.5125	23.67	50.00	26.33	9.000	L1	OFF	10.1
11.0120	24.14	50.00	25.86	9.000	L1	OFF	10.1
11.0525	24.07	50.00	25.93	9.000	L1	OFF	10.1
11.1043	23.82	50.00	26.18	9.000	L1	OFF	10.1

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## Conducted Emissions (Line 2)

Test

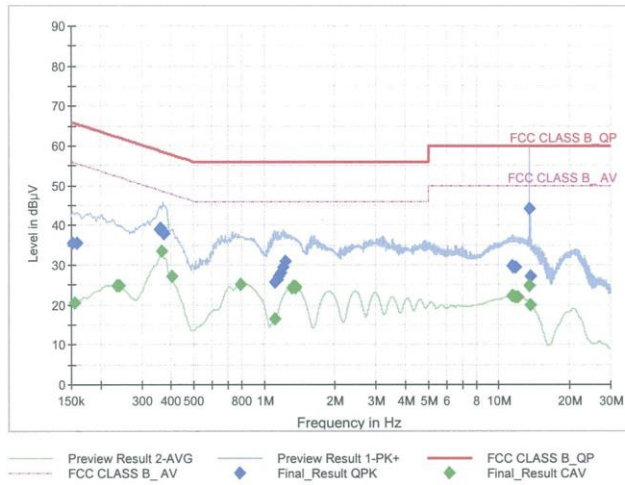
1 / 2

## Test Report

### Common Information

EUT : SM-G990U2  
 Manufacturer : SAMSUNG Electronics Co., Ltd.  
 Test Site: SHIELD ROOM  
 Operating Conditions : NFC\_N  
 Operator Name:  
 Comment:

Full Spectrum



### Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	35.52	65.88	30.36	9.000	N	OFF	9.6
0.1590	35.48	65.52	30.04	9.000	N	OFF	9.6
0.3570	39.04	58.80	19.75	9.000	N	OFF	9.6
0.3615	39.28	58.69	19.41	9.000	N	OFF	9.6
0.3705	38.24	58.49	20.25	9.000	N	OFF	9.6
0.3750	37.76	58.39	20.63	9.000	N	OFF	9.6
1.1053	25.63	56.00	30.37	9.000	N	OFF	9.7
1.1300	26.15	56.00	29.85	9.000	N	OFF	9.7
1.1525	27.06	56.00	28.94	9.000	N	OFF	9.7
1.1773	27.88	56.00	28.12	9.000	N	OFF	9.7
1.1998	29.46	56.00	26.54	9.000	N	OFF	9.7
1.2245	30.78	56.00	25.22	9.000	N	OFF	9.7
11.3855	29.60	60.00	30.40	9.000	N	OFF	10.1
11.4845	29.34	60.00	30.66	9.000	N	OFF	10.1
11.5183	29.32	60.00	30.68	9.000	N	OFF	10.1
11.7590	29.49	60.00	30.51	9.000	N	OFF	10.1
13.5590	44.18	60.00	15.82	9.000	N	OFF	10.2
13.5838	27.21	60.00	32.79	9.000	N	OFF	10.2

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Test

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**Final Result CAV**

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	20.54	55.75	35.21	9.000	N	OFF	9.6
0.2355	24.91	52.25	27.34	9.000	N	OFF	9.6
0.2400	24.75	52.10	27.34	9.000	N	OFF	9.6
0.3638	33.41	48.64	15.23	9.000	N	OFF	9.6
0.4020	27.06	47.81	20.75	9.000	N	OFF	9.7
0.7948	25.15	46.00	20.85	9.000	N	OFF	9.7
1.1053	16.54	46.00	29.46	9.000	N	OFF	9.7
1.3168	24.27	46.00	21.73	9.000	N	OFF	9.7
1.3348	24.43	46.00	21.57	9.000	N	OFF	9.7
1.3483	24.54	46.00	21.46	9.000	N	OFF	9.7
1.3550	24.38	46.00	21.62	9.000	N	OFF	9.7
1.3663	24.35	46.00	21.65	9.000	N	OFF	9.7
11.3720	22.29	50.00	27.71	9.000	N	OFF	10.1
11.5768	22.11	50.00	27.89	9.000	N	OFF	10.1
11.7590	22.01	50.00	27.99	9.000	N	OFF	10.1
12.0560	21.79	50.00	28.21	9.000	N	OFF	10.1
13.5590	24.79	50.00	25.21	9.000	N	OFF	10.2
13.5793	19.82	50.00	30.18	9.000	N	OFF	10.2

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Test

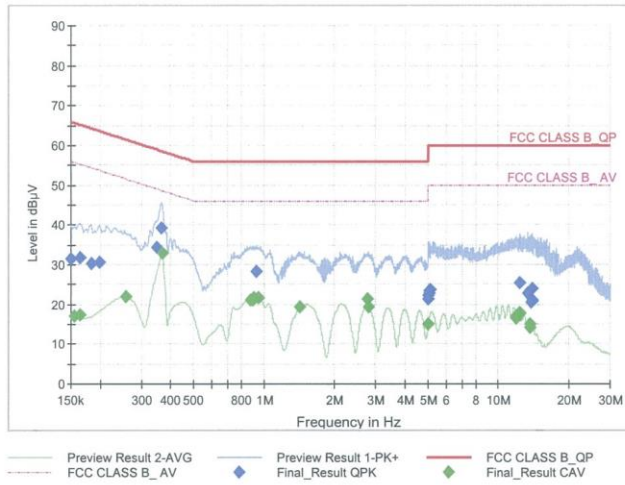
1 / 2

# Test Report

## Common Information

EUT : SM-G990U2  
 Manufacturer : SAMSUNG Electronics Co., Ltd.  
 Test Site: SHIELD ROOM  
 Operating Conditions : NFC Term\_N  
 Operator Name:  
 Comment:

Full Spectrum



## Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1500	31.58	66.00	34.42	9.000	N	OFF	9.6
0.1635	31.77	65.28	33.51	9.000	N	OFF	9.6
0.1838	30.38	64.31	33.93	9.000	N	OFF	9.6
0.1995	30.48	63.63	33.15	9.000	N	OFF	9.6
0.3480	34.45	59.01	24.56	9.000	N	OFF	9.6
0.3660	39.30	58.59	19.29	9.000	N	OFF	9.6
0.9275	28.33	56.00	27.67	9.000	N	OFF	9.7
5.0158	21.46	60.00	38.54	9.000	N	OFF	9.9
5.0405	22.18	60.00	37.82	9.000	N	OFF	9.9
5.0630	22.81	60.00	37.19	9.000	N	OFF	9.9
5.0855	23.35	60.00	36.65	9.000	N	OFF	9.9
5.1080	23.69	60.00	36.31	9.000	N	OFF	9.9
12.3778	25.34	60.00	34.66	9.000	N	OFF	10.2
13.3295	22.84	60.00	37.16	9.000	N	OFF	10.2
13.8065	20.50	60.00	39.50	9.000	N	OFF	10.2
13.9100	20.78	60.00	39.22	9.000	N	OFF	10.2
13.9325	23.91	60.00	36.09	9.000	N	OFF	10.2
13.9573	20.94	60.00	39.06	9.000	N	OFF	10.2

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Test

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**Final Result CAV**

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	16.92	55.75	38.84	9.000	N	OFF	9.6
0.1635	17.18	55.28	38.10	9.000	N	OFF	9.6
0.2580	22.00	51.50	29.50	9.000	N	OFF	9.6
0.3683	32.88	48.54	15.66	9.000	N	OFF	9.6
0.8803	21.18	46.00	24.82	9.000	N	OFF	9.7
0.8938	21.11	46.00	24.89	9.000	N	OFF	9.7
0.9073	21.75	46.00	24.25	9.000	N	OFF	9.7
0.9478	21.57	46.00	24.43	9.000	N	OFF	9.7
1.4270	19.30	46.00	26.70	9.000	N	OFF	9.7
2.7545	21.33	46.00	24.67	9.000	N	OFF	9.8
2.7928	19.22	46.00	26.78	9.000	N	OFF	9.8
5.0000	14.94	46.00	31.06	9.000	N	OFF	9.9
11.8985	16.89	50.00	33.11	9.000	N	OFF	10.1
11.9210	16.33	50.00	33.67	9.000	N	OFF	10.1
12.3778	17.84	50.00	32.16	9.000	N	OFF	10.2
12.3980	17.65	50.00	32.35	9.000	N	OFF	10.2
13.6040	15.06	50.00	34.94	9.000	N	OFF	10.2
13.7210	14.16	50.00	35.84	9.000	N	OFF	10.2

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## 10. LIST OF TEST EQUIPMENT

### Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	08/23/2022	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	06/17/2022	Annual
Temperature Chamber	SU-642	ESPEC	0093008124	03/04/2023	Annual
Signal Analyzer	N9030A	Keysight	MY55410508	09/07/2022	Annual
DC Power Supply	E3646A	Agilent	MY40002937	12/14/2022	Annual
Attenuator(10 dB)(DC-26.5 GHz)	5910-N-50-010	H+S	00801	10/29/2022	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A

### Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

**Radiated Test**

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Controller(Antenna mast)	CO3000	Innco system	CO3000-4p	N/A	N/A
Antenna Position Tower	MA4640/800-XP-EP	Innco system	N/A	N/A	N/A
Controller	EM2090	Emco	060520	N/A	N/A
Turn Table	N/A	Ets	N/A	N/A	N/A
Loop Antenna	FMZB 1513	Rohde & Schwarz	1513-333	03/17/2024	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	09/04/2022	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/18/2023	Biennial
Spectrum Analyzer	FSP(9 kHz ~ 30 GHz)	Rohde & Schwarz	836650/016	09/13/2022	Annual
Spectrum Analyzer	FSV40-N(9 kHz ~ 30 GHz)	Rohde & Schwarz	101068-SZ	09/15/2022	Annual
ATT(3 dB) + LNA2(6~18 GHz)	18B-03, CBL06185030	WEINSCHEL CERNEX	N/A	12/22/2022	Annual
ATT(10 dB) + LNA1(0.1~18 GHz)	56-10, CBLU1183540B-01	Api tech, CERNEX	N/A	12/22/2022	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/02/2022	Annual

**Note:**

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
3. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5(Version : 2017).

## 11. ANNEX A\_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2205-FC013-P