

FCC NFC REPORT

Certification

Applicant Name: SAMSUNG Electronics Co., Ltd.	Date of Issue: June 15, 2021
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	Report No.: HCT-RF-2105-FC037-R1

FCC ID:	A3LSMG990U
APPLICANT:	SAMSUNG Electronics Co., Ltd.
Model:	SM-G990U
Additional Model:	SM-G990U1/DS, SM-G990U1
EUT Type:	Mobile Phone
RF Output Field Strength:	15.52 dBuV/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-2105-FC037-R1

REVIEWED BY



Report prepared by : Jeong Ho Kim
Engineer of Telecommunication Testing Center

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-2105-FC037	May 26, 2021	- First Approval Report
HCT-RF-2105-FC037-R1	June 15, 2021	- Added the Additional Model.

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1. EUT DESCRIPTION

Model	SM-G990U
Additional Model	SM-G990U1/DS, SM-G990U1
EUT Type	Mobile Phone
Power Supply	DC 3.88 V
Frequency of Operation	13.56 MHz
Transmit Power	15.52 dBuV/m @30 m
Modulation Type	ASK
Date(s) of Tests	April 01, 2021 ~ May 26, 2021
Serial number	Radiated: UDE0597M

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 equipments, 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_{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)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

7. DESCRIPTION OF TESTS

7.1. Radiated Test

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

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
13.553 – 13.567	15,848	30
13.410 ≤ f ≤ 13.553 13.567 ≤ f ≤ 13.710	334	30
13.110 ≤ f ≤ 13.410 13.710 ≤ f ≤ 14.010	106	30

Note:

1. 15,848 uV/m = 84.0 dBuV/m
2. 334 uV/m = 50.47 dBuV/m
3. 106 uV/m = 40.51 dBuV/m

Limit (Radiated Spurious Emissions)

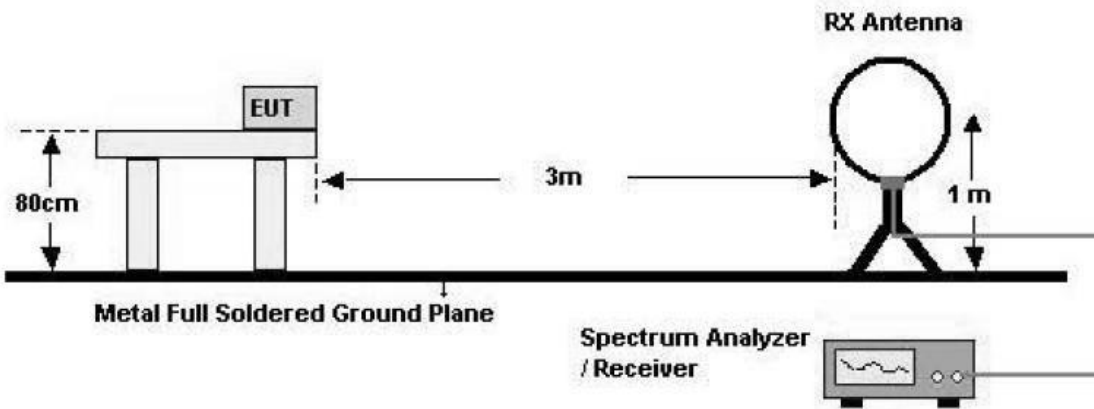
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	* 100	3
88-216	* 150	3
216-960	* 200	3
Above 960	500	3

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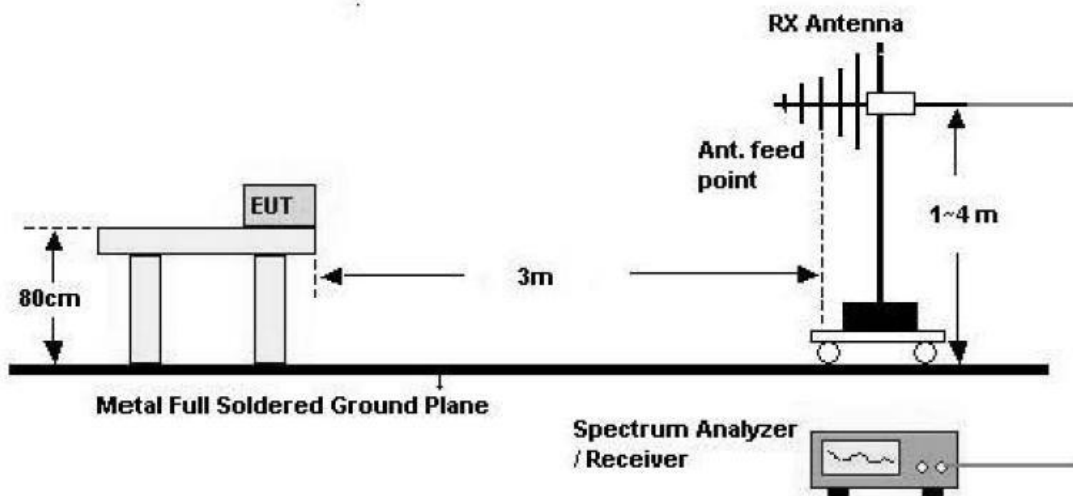
Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part,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

Test Configuration

Below 30 MHz



30 MHz - 1 GHz



Test Procedure of inband

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m 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 (Below 30 MHz)

7. Spectrum Setting

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

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

Test Procedure of Radiated spurious emissions(Below 30 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 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m 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 = Reading 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.

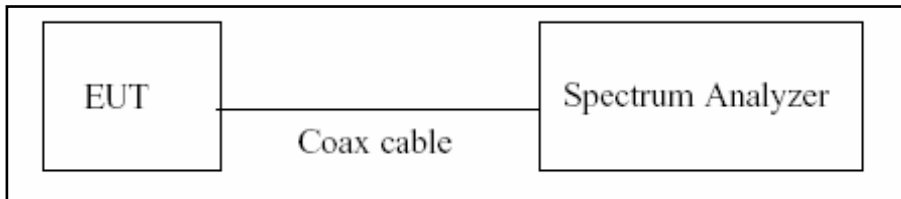
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

Test Procedure of Radiated spurious emissions(Above 30 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 3m 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 = Reading 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. 20dB 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 :

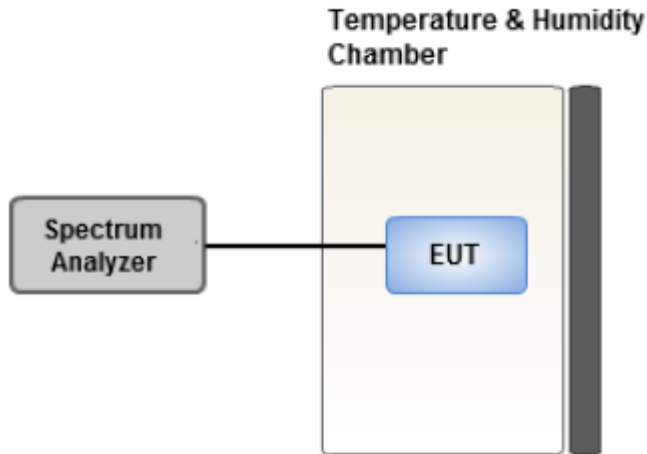
We tested Occupied Bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer.

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°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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56 ^(a)	56 to 46 ^(a)
0.50 to 5	56	46
5 to 30	60	50

^(a)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) = Reading 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.
 - Worst case : 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-G990U, SM-G990U1/DS, SM-G990U1 were tested and the worst case results are reported.
(Worst case : SM-G990U)

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-G990U, SM-G990U1/DS, SM-G990U1 were tested and the worst case results are reported.
(Worst case : SM-G990U)

20dB Bandwidth & Frequency Stability

1. All type and bitrate were investigated and the worst case results are reported.
 - Worst case : Type A, 106 kbps
2. SM-G990U, SM-G990U1/DS, SM-G990U1 were tested and the worst case results are reported.
(Worst case : SM-G990U)

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

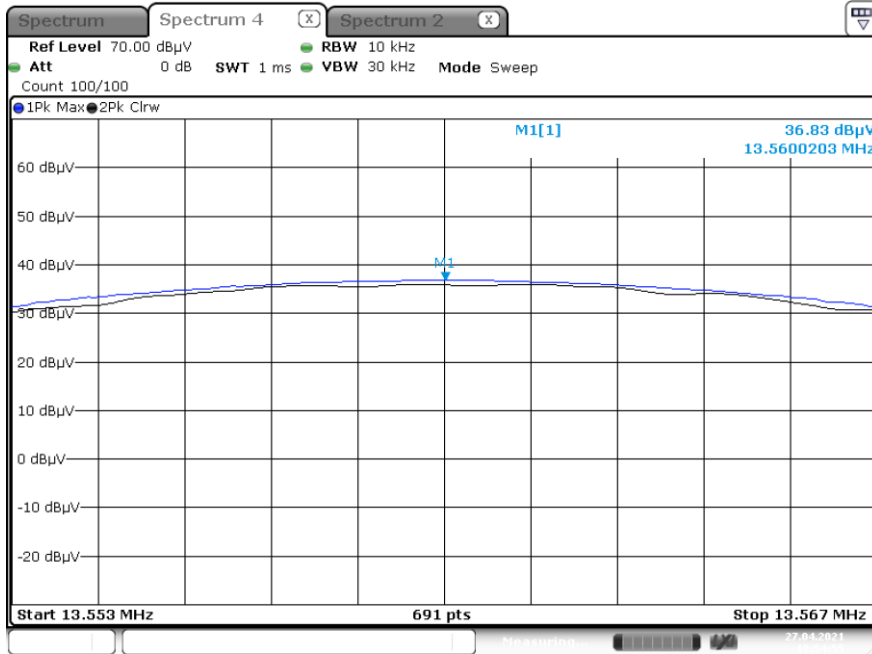
Measured Frequency Range : 13.553 MHz-13.567 MHz							
Frequency (MHz)	Read Level (dBuV/m)@3m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL	Total (dBuV/m)@30m	Limit (dBuV/m)@30m	Margin (dB)
13.5600	36.83	18.69	-40.00	Z-H	15.52	84.00	68.48
13.5606	32.54	18.69	-40.00	X-V	11.23	84.00	72.77

Measured Frequency Range : 13.410 MHz-13.553 MHz and 13.567 MHz-13.710 MHz							
Frequency (MHz)	Read Level (dBuV/m)@3m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL	Total (dBuV/m)@30m	Limit (dBuV/m)@30m	Margin (dB)
13.5529	31.57	18.69	-40.00	Z-H	10.26	50.47	40.21
13.5671	31.25	18.69	-40.00	Z-H	9.94	50.47	40.53

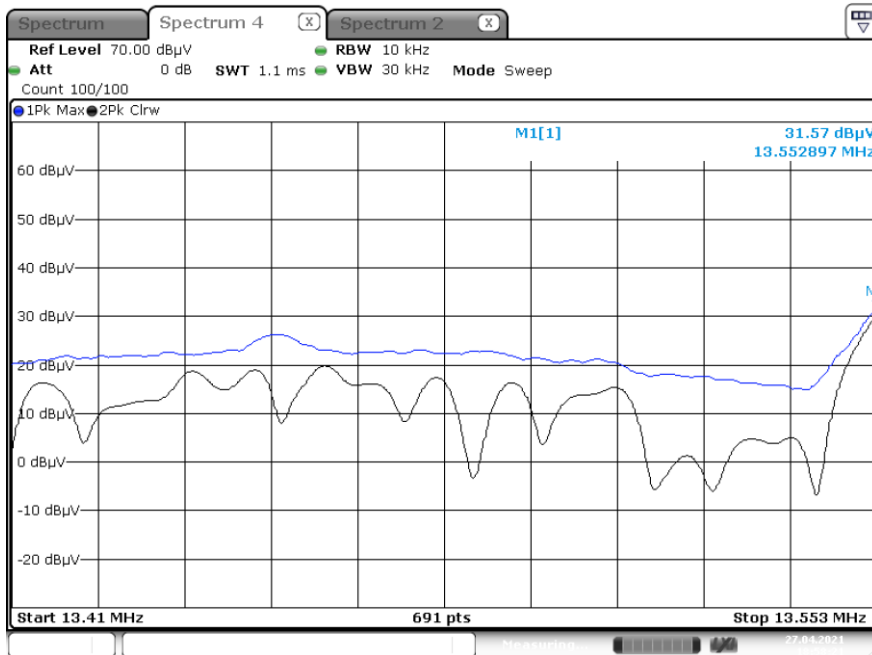
Measured Frequency Range : 13.110 MHz – 13.410 MHz and 13.710 MHz-14.010 MHz							
Frequency (MHz)	Read Level (dBuV/m)@3m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL	Total (dBuV/m)@30m	Limit (dBuV/m)@30m	Margin (dB)
13.3477	22.84	18.69	-40.00	Z-H	1.53	40.51	38.98
13.7719	22.61	18.69	-40.00	Z-H	1.30	40.51	39.21

■ Test Plot

13.553 MHz ~ 13.567 MHz



Worst Case (13.410 MHz-13.553 MHz)



Note:

Plot of worst case are only reported.

9.2. Radiated Emission 9 kHz – 30 MHz

Measured Frequency Range :							
9 kHz - 30 MHz							
Frequency (MHz)	Read Level (dBuV/m)@3m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL	Total (dBuV/m)@30m	Limit (dBuV/m)@30m	Margin (dB)
8.3274	11.95	18.69	-40.00	Z-H	-9.36	29.54	38.90
17.7935	15.92	18.28	-40.00	Z-H	-5.80	29.54	35.34
27.1095	10.39	19.09	-40.00	Z-H	-10.52	29.54	40.06
27.1117	9.17	19.09	-40.00	X-V	-11.74	29.54	41.28

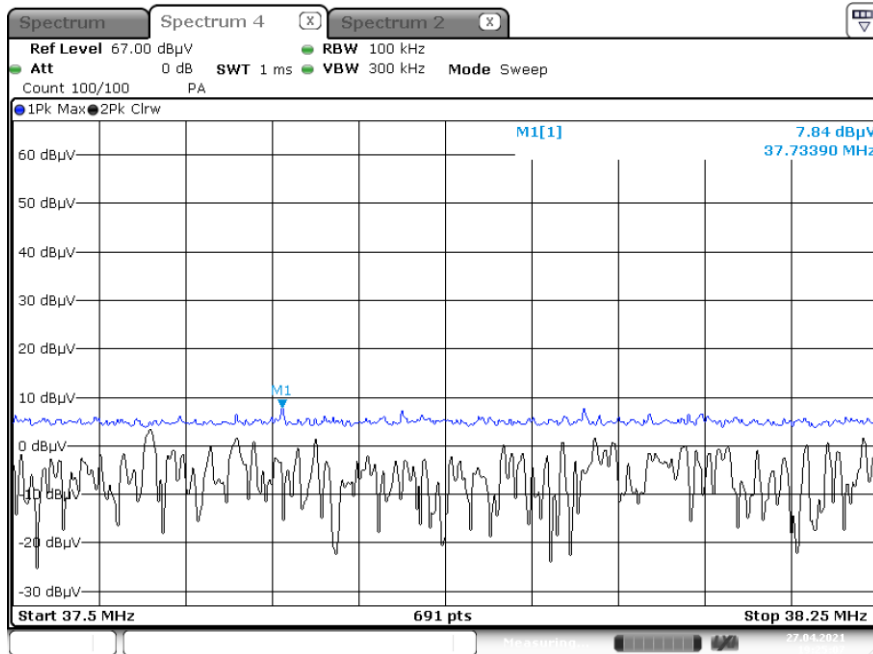
9.3. Radiated Emission 30 MHz – 1000 MHz

Measured Frequency Range : 30 MHz - 1000 MHz							
Frequency (MHz)	Read Level (dBuV/m) @3m	Ant.Factor (dB/m)	Cable Loss (dB)	Ant. Pol (H/V)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.2847	6.24	17.90	0.69	H	24.83	40.00	15.17
#37.7339	7.84	19.00	0.76	H	27.60	40.00	12.40
89.0842	6.63	13.60	1.10	V	21.33	40.00	18.67
#110.8142	7.09	16.10	1.22	H	24.41	43.50	19.09
#136.1223	6.92	18.25	1.37	H	26.54	43.50	16.96
161.7675	6.70	19.30	1.45	V	27.45	43.50	16.05

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	13.560049	49	0.0003614
100%		-10	13.560047	47	0.0003466
100%		0	13.560044	44	0.0003245
100%		+10	13.560041	41	0.0003024
100%		+20(Ref.)	13.560036	36	0.0002655
100%		+30	13.560042	42	0.0003097
100%		+40	13.560043	43	0.0003171
100%		+50	13.560048	48	0.0003513
LOW		3.65	+20	13.560047	47
HIGH	4.47	+20	13.560051	51	0.0003761

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	13.560050	50	0.0003687
100%		-10	13.560049	49	0.0003614
100%		0	13.560047	47	0.0003466
100%		+10	13.560046	46	0.0003392
100%		+20(Ref.)	13.560043	43	0.0003171
100%		+30	13.560045	45	0.0003319
100%		+40	13.560048	48	0.0003540
100%		+50	13.560050	50	0.0003687
LOW		3.65	+20	13.560046	46
HIGH	4.47	+20	13.560054	54	0.0003982

5 minutesOPERATING 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	13.560053	53	0.0003909
100%		-10	13.560052	52	0.0003835
100%		0	13.560048	48	0.0003540
100%		+10	13.560046	46	0.0003392
100%		+20(Ref.)	13.560042	42	0.0003097
100%		+30	13.560045	45	0.0003319
100%		+40	13.560044	44	0.0003245
100%		+50	13.560049	49	0.0003614
LOW		3.65	+20	13.560049	49
HIGH	4.47	+20	13.560056	56	0.0004130

10 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	13.560062	62	0.0004572
100%		-10	13.560059	59	0.0004351
100%		0	13.560057	57	0.0004204
100%		+10	13.560050	50	0.0003687
100%		+20(Ref.)	13.560047	47	0.0003466
100%		+30	13.560053	53	0.0003909
100%		+40	13.560058	58	0.0004277
100%		+50	13.560058	58	0.0004277
LOW		3.65	+20	13.560053	53
HIGH	4.47	+20	13.560063	63	0.0004646

9.6. POWERLINE CONDUCTED EMISSIONS

Conducted Emissions (Line 1)

Note : 13.56MHz is Fundamental Signal. Final result is PASS

NFC MODE_L1

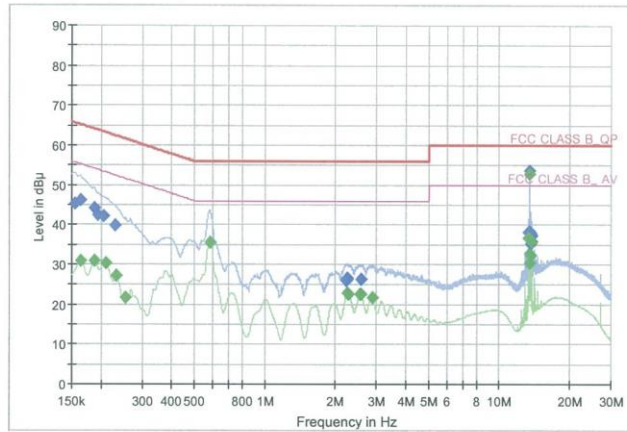
1 / 2

Test Report

Common Information

EUT : SM-G990U
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : NFC MODE_L1

Full Spectrum



Preview Result 2-AVG Preview Result 1-PK+ Final_Result QPK FCC CLASS B_QP
 FCC CLASS B_AV Final_Result CAV

Final Result QPK

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	45.42	65.75	20.34	9.000	L1	OFF	9.6
0.1635	46.28	65.28	19.00	9.000	L1	OFF	9.6
0.1883	44.19	64.11	19.92	9.000	L1	OFF	9.6
0.1950	42.38	63.82	21.44	9.000	L1	OFF	9.6
0.2063	42.07	63.36	21.29	9.000	L1	OFF	9.6
0.2288	39.79	62.50	22.71	9.000	L1	OFF	9.6
2.2190	25.92	56.00	30.08	9.000	L1	OFF	9.7
2.2325	26.22	56.00	29.78	9.000	L1	OFF	9.7
2.2528	26.39	56.00	29.61	9.000	L1	OFF	9.7
2.2618	26.39	56.00	29.61	9.000	L1	OFF	9.7
2.2663	26.44	56.00	29.56	9.000	L1	OFF	9.7
2.5880	26.20	56.00	29.80	9.000	L1	OFF	9.8
13.3475	38.19	60.00	21.81	9.000	L1	OFF	10.2
13.4533	38.35	60.00	21.65	9.000	L1	OFF	10.2
13.5590	53.75	60.00	6.25	9.000	L1	OFF	10.2
13.6423	35.14	60.00	24.86	9.000	L1	OFF	10.2
13.6670	37.84	60.00	22.16	9.000	L1	OFF	10.2
13.7728	37.35	60.00	22.65	9.000	L1	OFF	10.2

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NFC MODE_L1

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Final Result CAV

Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1635	31.00	55.28	24.28	9.000	L1	OFF	9.6
0.1883	30.99	54.11	23.12	9.000	L1	OFF	9.6
0.2108	30.37	53.18	22.81	9.000	L1	OFF	9.6
0.2333	26.97	52.33	25.36	9.000	L1	OFF	9.6
0.2558	21.51	51.57	30.06	9.000	L1	OFF	9.6
0.5855	35.62	46.00	10.38	9.000	L1	OFF	9.6
2.2685	22.71	46.00	23.29	9.000	L1	OFF	9.7
2.2775	22.55	46.00	23.45	9.000	L1	OFF	9.7
2.5565	22.47	46.00	23.53	9.000	L1	OFF	9.8
2.5678	22.36	46.00	23.64	9.000	L1	OFF	9.8
2.5768	22.42	46.00	23.58	9.000	L1	OFF	9.8
2.8828	21.58	46.00	24.42	9.000	L1	OFF	9.8
13.3475	36.72	50.00	13.28	9.000	L1	OFF	10.2
13.4533	32.68	50.00	17.32	9.000	L1	OFF	10.2
13.4668	30.38	50.00	19.62	9.000	L1	OFF	10.2
13.5590	52.71	50.00	-2.71	9.000	L1	OFF	10.2
13.6648	32.25	50.00	17.75	9.000	L1	OFF	10.2
13.7728	35.79	50.00	14.21	9.000	L1	OFF	10.2

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NFC TERM MODE_L1

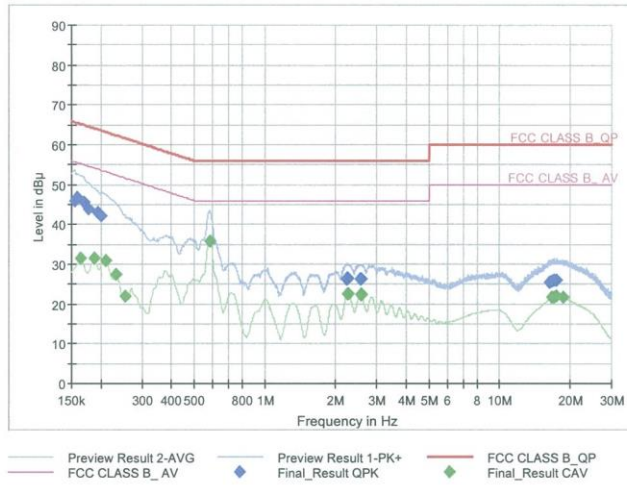
1 / 2

Test Report

Common Information

EUT : SM-G990U
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : NFC TERM MODE_L1
 Operator Name:
 Comment:

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak	Limit (dBuV)	Margin	Bandwidth	Line	Filter	Corr. (dB)
0.1545	45.98	65.75	19.78	9.000	L1	OFF	9.6
0.1590	46.72	65.52	18.79	9.000	L1	OFF	9.6
0.1703	45.52	64.95	19.43	9.000	L1	OFF	9.6
0.1770	43.90	64.63	20.73	9.000	L1	OFF	9.6
0.1950	43.10	63.82	20.72	9.000	L1	OFF	9.6
0.2018	42.23	63.54	21.31	9.000	L1	OFF	9.6
2.2325	26.22	56.00	29.78	9.000	L1	OFF	9.7
2.2415	26.27	56.00	29.73	9.000	L1	OFF	9.7
2.2460	26.33	56.00	29.67	9.000	L1	OFF	9.7
2.2618	26.43	56.00	29.57	9.000	L1	OFF	9.7
2.5543	26.19	56.00	29.81	9.000	L1	OFF	9.8
2.5745	26.24	56.00	29.76	9.000	L1	OFF	9.8
16.2613	25.24	60.00	34.76	9.000	L1	OFF	10.3
16.6685	25.60	60.00	34.40	9.000	L1	OFF	10.3
17.0330	25.82	60.00	34.18	9.000	L1	OFF	10.3
17.3863	25.96	60.00	34.04	9.000	L1	OFF	10.3
17.3930	25.95	60.00	34.05	9.000	L1	OFF	10.3
17.4065	25.91	60.00	34.09	9.000	L1	OFF	10.3

Final Result_CAV

2021-04-28

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NFC TERM MODE_L1

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Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1635	31.42	55.28	23.86	9.000	L1	OFF	9.6
0.1883	31.30	54.11	22.82	9.000	L1	OFF	9.6
0.2108	30.80	53.18	22.38	9.000	L1	OFF	9.6
0.2333	27.46	52.33	24.87	9.000	L1	OFF	9.6
0.2558	22.03	51.57	29.54	9.000	L1	OFF	9.6
0.5855	35.68	46.00	10.32	9.000	L1	OFF	9.6
2.2573	22.56	46.00	23.44	9.000	L1	OFF	9.7
2.2708	22.59	46.00	23.41	9.000	L1	OFF	9.7
2.2753	22.57	46.00	23.43	9.000	L1	OFF	9.7
2.2910	22.44	46.00	23.56	9.000	L1	OFF	9.7
2.5723	22.42	46.00	23.58	9.000	L1	OFF	9.8
2.5835	22.30	46.00	23.70	9.000	L1	OFF	9.8
16.7945	21.56	50.00	28.44	9.000	L1	OFF	10.3
17.1905	21.75	50.00	28.25	9.000	L1	OFF	10.3
17.3930	21.84	50.00	28.16	9.000	L1	OFF	10.3
17.4583	21.83	50.00	28.17	9.000	L1	OFF	10.3
17.5033	21.90	50.00	28.10	9.000	L1	OFF	10.3
18.6125	21.68	50.00	28.32	9.000	L1	OFF	10.4

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Conducted Emissions (Line 2)

Note : 13.56MHz is Fundamental Signal. Final result is PASS

NFC MODE_N

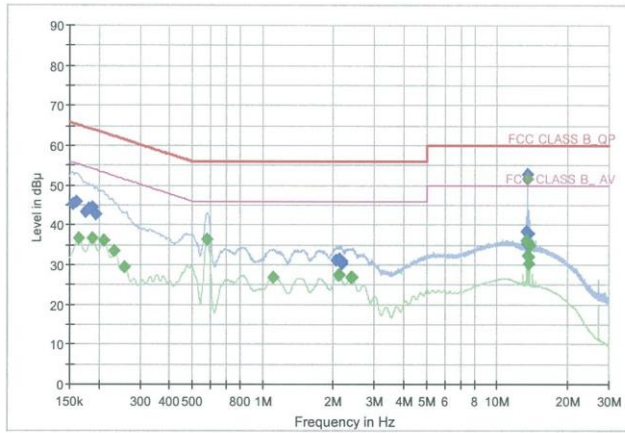
1 / 2

Test Report

Common Information

EUT : SM-G990U
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : NFC MODE_N

Full Spectrum



— Preview Result 2-AVG
— FCC CLASS B_AV
◆ Preview Result 1-PK+ Final_Result QPK
◆ Final_Result CAV

Final Result QPK

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	45.40	65.75	20.36	9.000	N	OFF	9.6
0.1613	45.95	65.40	19.44	9.000	N	OFF	9.6
0.1748	43.15	64.73	21.58	9.000	N	OFF	9.6
0.1815	44.07	64.42	20.35	9.000	N	OFF	9.6
0.1883	44.40	64.11	19.71	9.000	N	OFF	9.6
0.1950	42.83	63.82	20.99	9.000	N	OFF	9.6
2.0615	31.19	56.00	24.81	9.000	N	OFF	9.7
2.0728	31.26	56.00	24.74	9.000	N	OFF	9.7
2.1223	31.37	56.00	24.63	9.000	N	OFF	9.7
2.1515	31.14	56.00	24.86	9.000	N	OFF	9.7
2.1740	30.73	56.00	25.27	9.000	N	OFF	9.7
2.1898	30.25	56.00	25.75	9.000	N	OFF	9.7
13.3475	38.45	60.00	21.55	9.000	N	OFF	10.3
13.4398	35.17	60.00	24.83	9.000	N	OFF	10.3
13.4465	35.83	60.00	24.17	9.000	N	OFF	10.3
13.4533	38.16	60.00	21.84	9.000	N	OFF	10.3
13.5590	52.91	60.00	7.09	9.000	N	OFF	10.3
13.6648	37.70	60.00	22.30	9.000	N	OFF	10.3

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NFC MODE_N

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Final Result CAV

Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1635	36.49	55.28	18.79	9.000	N	OFF	9.6
0.1883	36.75	54.11	17.36	9.000	N	OFF	9.6
0.2108	36.10	53.18	17.08	9.000	N	OFF	9.6
0.2333	33.39	52.33	18.94	9.000	N	OFF	9.6
0.2580	29.38	51.50	22.11	9.000	N	OFF	9.6
0.5810	36.36	46.00	9.64	9.000	N	OFF	9.6
1.1143	26.95	46.00	19.05	9.000	N	OFF	9.7
2.1043	27.54	46.00	18.46	9.000	N	OFF	9.7
2.1133	27.39	46.00	18.61	9.000	N	OFF	9.7
2.1223	27.40	46.00	18.60	9.000	N	OFF	9.7
2.3968	26.93	46.00	19.07	9.000	N	OFF	9.8
2.4080	26.91	46.00	19.09	9.000	N	OFF	9.8
13.3475	35.92	50.00	14.08	9.000	N	OFF	10.3
13.4533	32.42	50.00	17.58	9.000	N	OFF	10.3
13.5590	51.71	50.00	-1.71	9.000	N	OFF	10.3
13.6535	30.17	50.00	19.83	9.000	N	OFF	10.3
13.6648	32.01	50.00	17.99	9.000	N	OFF	10.3
13.7728	34.96	50.00	15.04	9.000	N	OFF	10.3

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NFC TERM MODE_N

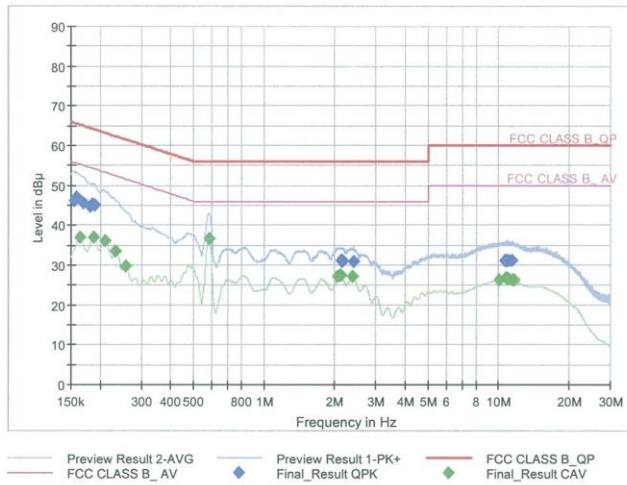
1 / 2

Test Report

Common Information

EUT : SM-G990U
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : NFC TERM MODE_N
 Operator Name:
 Comment:

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak	Limit (dBuV)	Margin	Bandwidth	Line	Filter	Corr. (dB)
0.1545	46.05	65.75	19.71	9.000	N	OFF	9.6
0.1590	46.88	65.52	18.64	9.000	N	OFF	9.6
0.1703	45.69	64.95	19.26	9.000	N	OFF	9.6
0.1815	44.77	64.42	19.65	9.000	N	OFF	9.6
0.1860	45.30	64.21	18.91	9.000	N	OFF	9.6
0.1905	45.08	64.02	18.93	9.000	N	OFF	9.6
2.1313	31.29	56.00	24.71	9.000	N	OFF	9.7
2.1358	31.27	56.00	24.73	9.000	N	OFF	9.7
2.1538	31.04	56.00	24.96	9.000	N	OFF	9.7
2.1628	30.91	56.00	25.09	9.000	N	OFF	9.7
2.1673	30.81	56.00	25.19	9.000	N	OFF	9.7
2.4080	30.88	56.00	25.12	9.000	N	OFF	9.8
10.6813	31.20	60.00	28.80	9.000	N	OFF	10.1
10.7353	31.20	60.00	28.80	9.000	N	OFF	10.1
10.8680	31.14	60.00	28.86	9.000	N	OFF	10.1
10.8928	31.14	60.00	28.86	9.000	N	OFF	10.2
10.9693	31.22	60.00	28.78	9.000	N	OFF	10.2
11.4103	31.21	60.00	28.79	9.000	N	OFF	10.2

Final_Result_CAV

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NFC TERM MODE_N

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Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1635	36.91	55.28	18.38	9.000	N	OFF	9.6
0.1883	37.00	54.11	17.11	9.000	N	OFF	9.6
0.2108	36.20	53.18	16.97	9.000	N	OFF	9.6
0.2333	33.60	52.33	18.74	9.000	N	OFF	9.6
0.2580	29.61	51.50	21.89	9.000	N	OFF	9.6
0.5833	36.50	46.00	9.50	9.000	N	OFF	9.6
2.0705	27.20	46.00	18.80	9.000	N	OFF	9.7
2.0998	27.39	46.00	18.61	9.000	N	OFF	9.7
2.1133	27.40	46.00	18.60	9.000	N	OFF	9.7
2.1223	27.38	46.00	18.62	9.000	N	OFF	9.7
2.1335	27.28	46.00	18.72	9.000	N	OFF	9.7
2.3945	27.09	46.00	18.91	9.000	N	OFF	9.8
10.0333	26.37	50.00	23.63	9.000	N	OFF	10.1
10.7353	26.70	50.00	23.30	9.000	N	OFF	10.1
10.8523	26.68	50.00	23.32	9.000	N	OFF	10.1
11.0480	26.60	50.00	23.40	9.000	N	OFF	10.2
11.4845	26.39	50.00	23.61	9.000	N	OFF	10.2
11.6533	26.25	50.00	23.75	9.000	N	OFF	10.2

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10. LIST OF TEST EQUIPMENT

Conducted Test

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216 / LISN	09/04/2020	Annual	102245
Rohde & Schwarz	ESR / EMI Test Receiver	09/16/2020	Annual	101910
ESPEC	SU-642 / Temperature Chamber	07/30/2020	Annual	0093000718
Agilent	N9020A / Signal Analyzer	05/03/2021	Annual	MY51110085
HP	E3632A / DC Power Supply	09/16/2020	Annual	MY40004427
HP	8493C / Attenuator(10 dB)(DC-26.5 GHz)	06/26/2020	Annual	07560
Rohde & Schwarz	EMC32 / Software	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

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Audix	EM1000 / Controller	N/A	N/A	060520
Audix	Turn Table	N/A	N/A	N/A
Schwarzbeck	Loop Antenna	03/19/2020	Biennial	1513-333
Schwarzbeck	VULB 9168 / Hybrid Antenna	08/02/2019	Biennial	01039
Schwarzbeck	BBHA 9120D / Horn Antenna	08/01/2019	Biennial	9120D-1151
Rohde & Schwarz	FSV(10 Hz ~ 40 GHz) / Spectrum Analyzer	05/14/2021	Annual	101055
Agilent	N9030A / Signal Analyzer	03/09/2021	Annual	MY49432108
Weinschel	2-3 / Attenuator (3 dB)	10/07/2020	Annual	BR0617
H+S	5910-N-50-010 / Attenuator(10 dB)	10/28/2020	Annual	None
CERNEX	CBL18265035 / Power Amplifier	12/04/2020	Annual	22966

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-2105-FC037-P