

FCC NFC REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
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16677, Rep. of Korea

Date of Issue:
September 17, 2021

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

Report No.: HCT-RF-2109-FC018

FCC ID: A3LSMG990B

APPLICANT: SAMSUNG Electronics Co., Ltd.

Model: SM-G990E/DS

Additional Model: SM-G990E

EUT Type: Mobile Phone

RF Output Field Strength: 15.64 dB μ 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-2109-FC018

REVIEWED BY



Report prepared by : Jin Gwan Lee
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-2109-FC018	September 17, 2021	- First Approval Report

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1. EUT DESCRIPTION

Model	SM-G990E/DS
Additional Model	SM-G990E
EUT Type	Mobile Phone
Power Supply	DC 4.20 V
Frequency of Operation	13.56 MHz
Transmit Power	15.64 dB μ V/m @30 m
Modulation Type	ASK
Date(s) of Tests	August 18, 2021 ~ September 10, 2021
Serial number	Radiated: R3CR803NW1R Conducted: R3CR803N9YT

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 30 MHz 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, 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 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05 (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 $\mu\text{V/m}$ = 84.0 dB $\mu\text{V/m}$
2. 334 $\mu\text{V/m}$ = 50.47 dB $\mu\text{V/m}$
3. 106 $\mu\text{V/m}$ = 40.51 dB $\mu\text{V/m}$

Limit (Radiated Spurious Emissions)

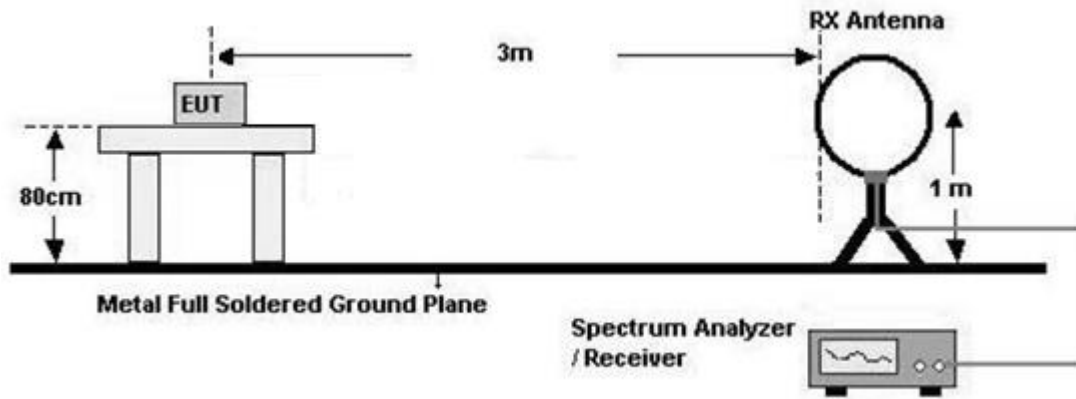
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	* 100	3
88-216	* 150	3
216-960	* 200	3
Above 960	500	3

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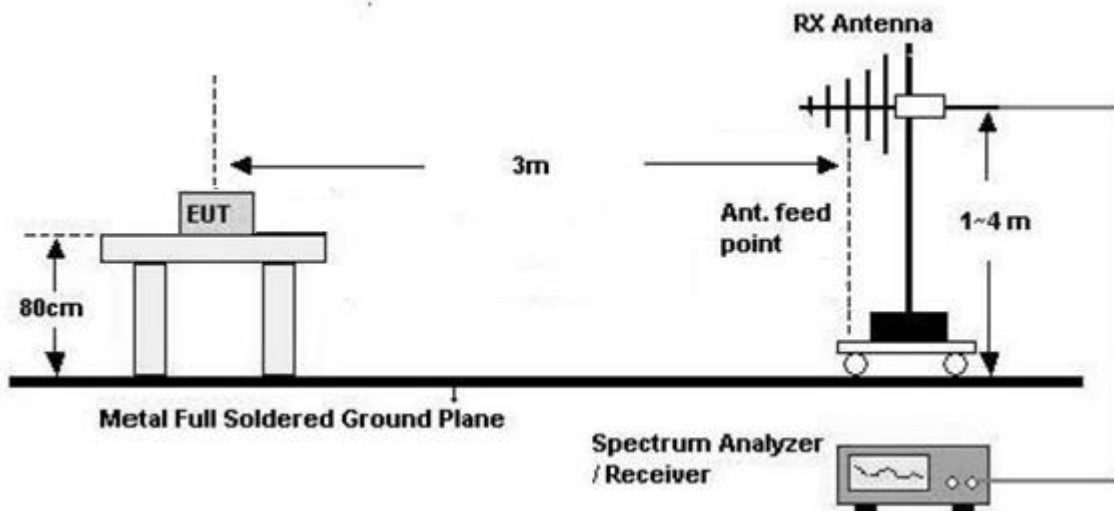
Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, 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 3 m 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 = Max Hold
- RBW = 9 kHz
- VBW $\geq 3 \times$ RBW

8. Total = Measured Level + 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 3 m 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 = Max hold
 - RBW = 9 kHz
 - VBW $\geq 3 \times$ RBW
9. Total = Measured Level + 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.

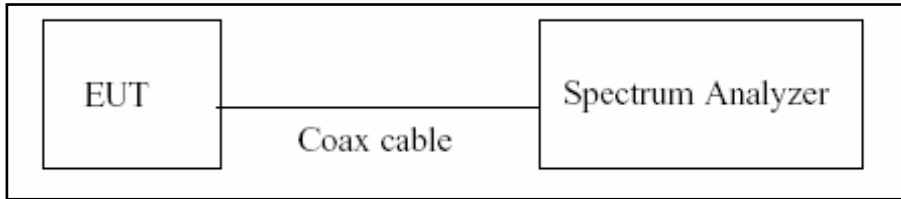
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

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 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 = Max hold
 - RBW = 100 kHz
 - VBW \geq 3 x RBW
7. Total = Measured Level + 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. 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) = Measured Level + Correction Factor

7.4. 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-G990E/DS, SM-G990E were tested and the worst case results are reported.
(Worstcase : SM-G990E/DS)

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-G990E/DS, SM-G990E were tested and the worst case results are reported.
(Worstcase : SM-G990E/DS)

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-G990E/DS, SM-G990E were tested and the worst case results are reported.
(Worstcase : SM-G990E/DS)

8. TEST SUMMARY

Regulation	Requirement	Result
Part 15.225 (a)	Radiated Electric Field Emissions (13.553 MHz to 13.567 MHz)	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 (9 kHz to 30 MHz)	Pass
Part 15.209	Radiated Electric Field Emissions (30 MHz to 1 GHz)	Pass
Part 15.207	AC power conducted emissions (150 kHz to 30 MHz)	Pass
Part 15.215 (c)	20 dB Bandwidth	Pass

9. TEST RESULT

9.1. Operation within the band 13.110 MHz – 14.010 MHz

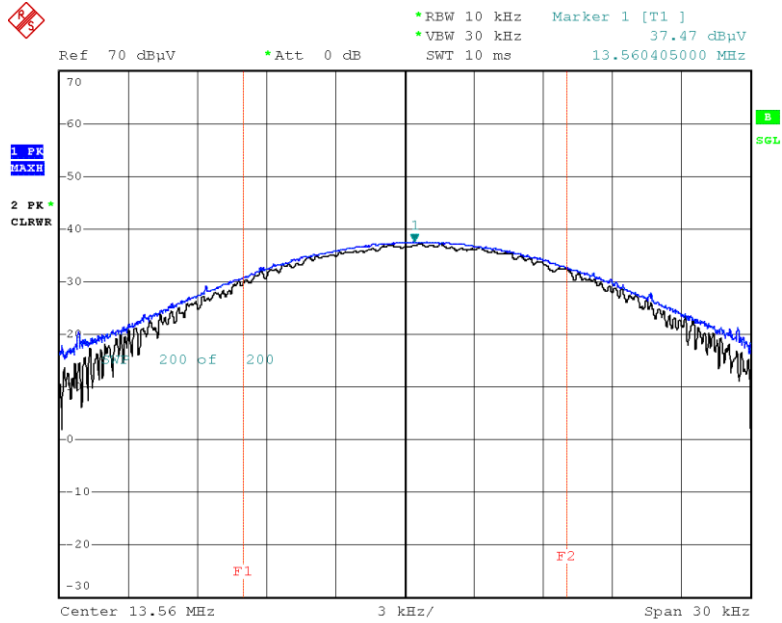
Measured Frequency Range : 13.553 MHz-13.567 MHz							
Frequency (MHz)	Read Level (dBμV/m) @3 m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL	Total (dBμV/m) @30 m	Limit (dBμV/m) @30 m	Margin (dB)
13.5604	37.47	20.07	-40.00	H	17.54	84.00	66.46
13.5993	33.63	20.07	-40.00	V	13.70	84.00	70.30

Measured Frequency Range : 13.410 MHz-13.553 MHz and 13.567 MHz-13.710 MHz							
Frequency (MHz)	Read Level (dBμV/m) @3 m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL	Total (dBμV/m) @30 m	Limit (dBμV/m) @30 m	Margin (dB)
13.553	30.40	20.07	-40.00	H	10.47	50.47	40.00
13.567	32.87	20.07	-40.00	H	12.94	50.47	37.53

Measured Frequency Range : 13.110 MHz – 13.410 MHz and 13.710 MHz-14.010 MHz							
Frequency (MHz)	Read Level (dBμV/m) @3 m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL	Total (dBμV/m) @30 m	Limit (dBμV/m) @30 m	Margin (dB)
13.34805	22.86	20.07	-40.00	H	2.93	40.51	37.58
13.77195	22.33	20.07	-40.00	H	2.40	40.51	38.11

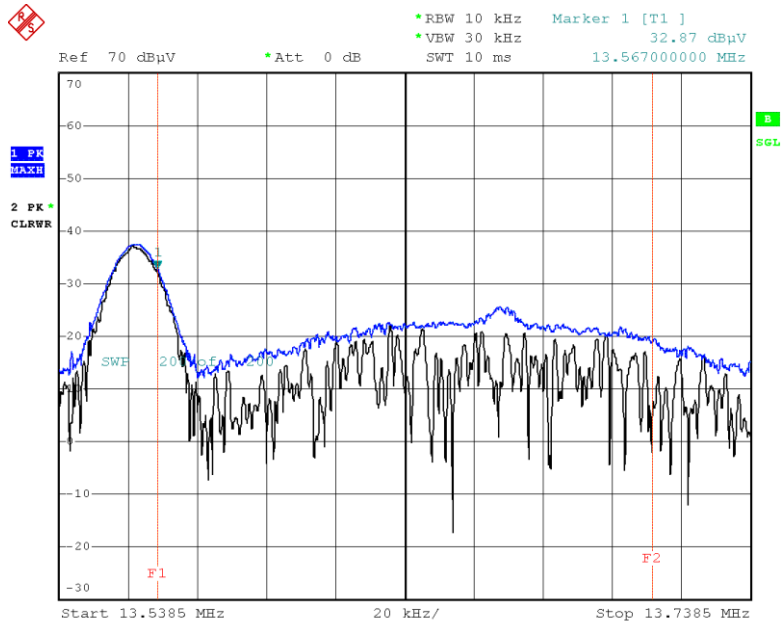
Test Plot

13.553 MHz ~ 13.567 MHz



Date: 18.AUG.2021 17:17:45

Worst Case (13.567 MHz-13.710 MHz)



Date: 18.AUG.2021 17:19:34

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 (dB μ V/m) @3 m	Ant.Factor +Cable Loss (dB/m)	Distance Correction (dB)	Ant. POL	Total (dB μ V/m) @30 m	Limit (dB μ V/m) @30 m	Margin (dB)
7.296	12.99	20.07	-40.00	V	-6.94	29.54	36.48
9.196	12.68	20.07	-40.00	H	-7.25	29.54	36.79
27.119	12.04	20.57	-40.00	H	-7.39	29.54	36.93
27.125	12.02	20.57	-40.00	V	-7.41	29.54	36.95

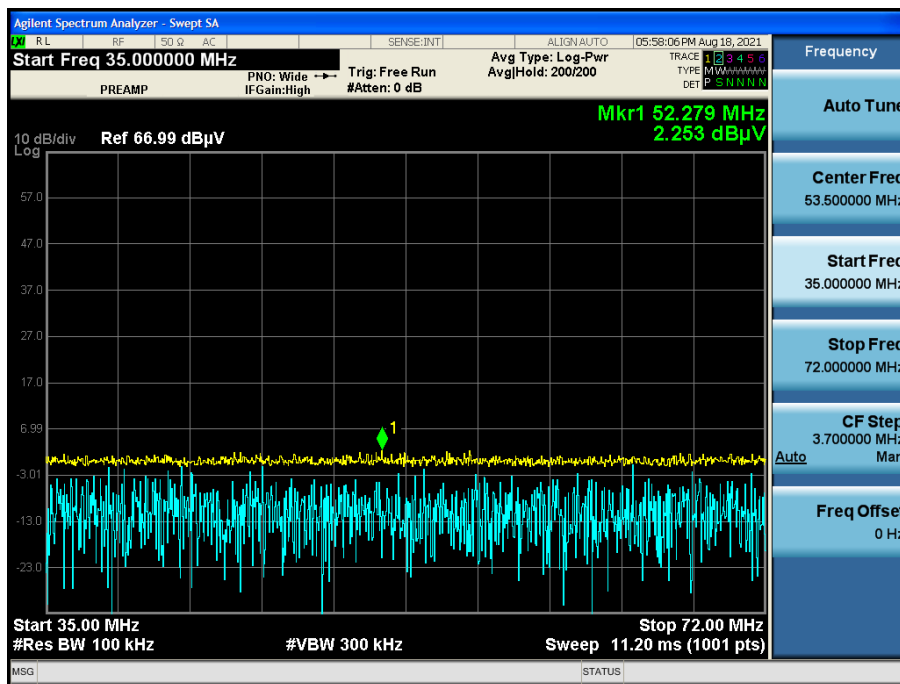
9.3. Radiated Emission 30 MHz – 1000 MHz

Measured Frequency Range :							
30 MHz - 1000 MHz							
Frequency (MHz)	Read Level (dBμV/m) @3 m	Ant.Factor (dB/m)	Cable Loss (dB)	Ant. Pol (H/V)	Total (dBμV/m)	Limit (dBμV/m)	Margin (dB)
52.2790	2.253	19.70	0.62	H	22.57	40.00	17.43
#74.1290	2.462	16.90	0.75	H	20.11	40.00	19.89
84.9760	2.502	13.40	0.86	H	16.76	40.00	23.24
98.2300	1.536	16.90	1.01	V	19.45	40.00	20.55
#131.8045	1.911	17.90	1.04	H	20.85	43.50	22.65
#171.8800	1.937	18.00	1.19	V	21.13	43.50	22.37

Note:

- # is the result for restricted band.

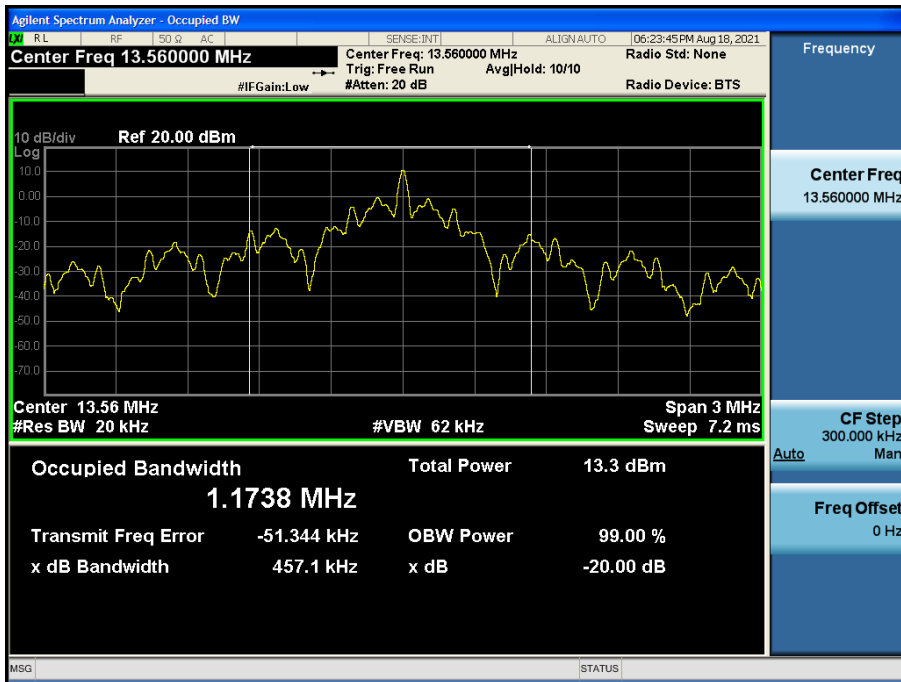
Test Plot



Note:

Plot of worst case are only reported

9.4. 20 dB Bandwidth



9.5. POWERLINE CONDUCTED EMISSIONS

Conducted Emissions (Line 1)

Test

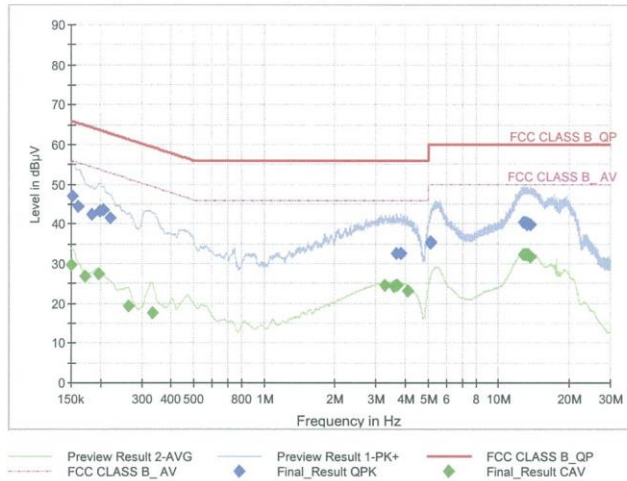
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Test Report

Common Information

EUT : SM-G990E/DS
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : NFC L1 TERM
 Operator Name:
 Comment:

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	47.02	65.88	18.85	9.000	L1	OFF	9.6
0.1613	44.36	65.40	21.04	9.000	L1	OFF	9.6
0.1838	42.29	64.31	22.03	9.000	L1	OFF	9.6
0.1995	43.18	63.63	20.45	9.000	L1	OFF	9.6
0.2063	43.63	63.36	19.73	9.000	L1	OFF	9.6
0.2198	41.55	62.83	21.28	9.000	L1	OFF	9.6
3.6545	32.63	56.00	23.37	9.000	L1	OFF	9.8
3.8435	32.59	56.00	23.41	9.000	L1	OFF	9.8
5.1283	35.28	60.00	24.72	9.000	L1	OFF	9.9
5.1373	35.22	60.00	24.78	9.000	L1	OFF	9.9
5.1463	35.50	60.00	24.50	9.000	L1	OFF	9.9
5.1530	35.57	60.00	24.43	9.000	L1	OFF	9.9
12.7918	40.26	60.00	19.74	9.000	L1	OFF	10.2
12.9898	40.25	60.00	19.75	9.000	L1	OFF	10.2
13.2170	39.90	60.00	20.10	9.000	L1	OFF	10.2
13.3430	40.05	60.00	19.95	9.000	L1	OFF	10.2
13.6108	39.95	60.00	20.05	9.000	L1	OFF	10.2
13.7165	39.70	60.00	20.30	9.000	L1	OFF	10.2

Final Result_CAV

2021-09-01

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Test

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Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1500	29.83	56.00	26.17	9.000	L1	OFF	9.6
0.1725	26.81	54.84	28.03	9.000	L1	OFF	9.6
0.1973	27.30	53.73	26.42	9.000	L1	OFF	9.6
0.2625	19.34	51.35	32.01	9.000	L1	OFF	9.6
0.3323	17.51	49.40	31.89	9.000	L1	OFF	9.6
3.2855	24.39	46.00	21.61	9.000	L1	OFF	9.8
3.5668	24.36	46.00	21.64	9.000	L1	OFF	9.8
3.6568	24.38	46.00	21.62	9.000	L1	OFF	9.8
3.6928	24.53	46.00	21.47	9.000	L1	OFF	9.8
3.6973	24.51	46.00	21.49	9.000	L1	OFF	9.8
4.0843	22.95	46.00	23.05	9.000	L1	OFF	9.8
12.7918	32.21	50.00	17.79	9.000	L1	OFF	10.2
13.0055	32.42	50.00	17.58	9.000	L1	OFF	10.2
13.1248	32.28	50.00	17.72	9.000	L1	OFF	10.2
13.2260	32.22	50.00	17.78	9.000	L1	OFF	10.2
13.3318	32.21	50.00	17.79	9.000	L1	OFF	10.2
13.6828	31.85	50.00	18.15	9.000	L1	OFF	10.2
13.7165	31.78	50.00	18.22	9.000	L1	OFF	10.2

2021-09-01

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Test

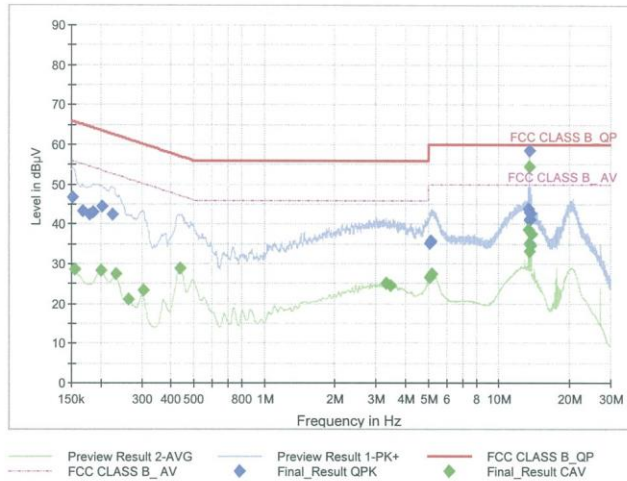
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Test Report

Common Information

EUT : SM-G990E/DS
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : NFC L1 UNTERM
 Operator Name:
 Comment:

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	46.59	65.88	19.29	9.000	L1	OFF	9.6
0.1680	43.37	65.06	21.68	9.000	L1	OFF	9.6
0.1793	42.49	64.52	22.03	9.000	L1	OFF	9.6
0.1860	42.96	64.21	21.26	9.000	L1	OFF	9.6
0.2040	44.35	63.45	19.09	9.000	L1	OFF	9.6
0.2243	42.33	62.66	20.33	9.000	L1	OFF	9.6
5.0945	35.14	60.00	24.86	9.000	L1	OFF	9.9
5.1193	35.38	60.00	24.62	9.000	L1	OFF	9.9
5.1283	35.52	60.00	24.48	9.000	L1	OFF	9.9
5.1395	35.55	60.00	24.45	9.000	L1	OFF	9.9
5.1463	35.69	60.00	24.31	9.000	L1	OFF	9.9
5.1530	35.69	60.00	24.31	9.000	L1	OFF	9.9
13.3475	43.96	60.00	16.04	9.000	L1	OFF	10.2
13.4465	41.02	60.00	18.98	9.000	L1	OFF	10.2
13.4533	42.92	60.00	17.08	9.000	L1	OFF	10.2
13.4623	41.19	60.00	18.81	9.000	L1	OFF	10.2
13.5613	58.63	60.00	1.37	9.000	L1	OFF	10.2
13.6670	42.66	60.00	17.34	9.000	L1	OFF	10.2

Final_Result_CAV

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Test

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Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	28.59	55.75	27.16	9.000	L1	OFF	9.6
0.2018	28.34	53.54	25.20	9.000	L1	OFF	9.6
0.2333	27.36	52.33	24.98	9.000	L1	OFF	9.6
0.2625	20.93	51.35	30.42	9.000	L1	OFF	9.6
0.3030	23.28	50.16	26.88	9.000	L1	OFF	9.6
0.4380	26.94	47.10	18.16	9.000	L1	OFF	9.6
3.3148	25.09	46.00	20.91	9.000	L1	OFF	9.8
3.4610	24.39	46.00	21.61	9.000	L1	OFF	9.8
5.0608	26.54	50.00	23.46	9.000	L1	OFF	9.9
5.1373	27.15	50.00	22.85	9.000	L1	OFF	9.9
5.1508	27.06	50.00	22.94	9.000	L1	OFF	9.9
5.1755	27.39	50.00	22.61	9.000	L1	OFF	9.9
13.3498	38.53	50.00	11.47	9.000	L1	OFF	10.2
13.4555	35.18	50.00	14.82	9.000	L1	OFF	10.2
13.4668	33.31	50.00	16.69	9.000	L1	OFF	10.2
13.5613	54.40	50.00	-4.40	9.000	L1	OFF	10.2
13.6670	34.57	50.00	15.43	9.000	L1	OFF	10.2
13.7728	37.36	50.00	12.64	9.000	L1	OFF	10.2

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Conducted Emissions (Line 2)

Test

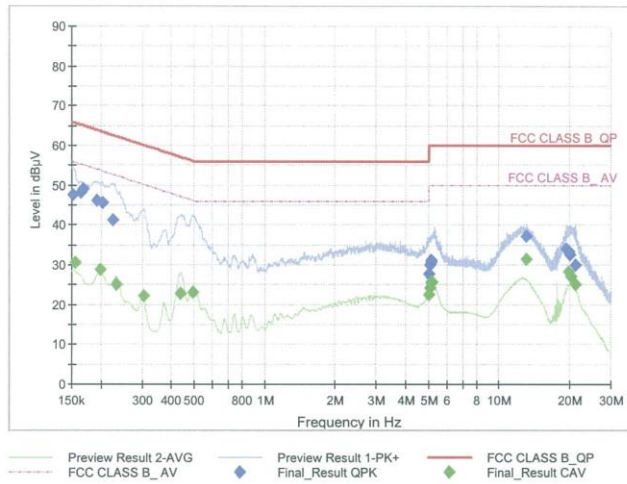
1 / 2

Test Report

Common Information

EUT : SM-G990E/DS
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : NFC N TERM
 Operator Name:
 Comment:

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	47.49	65.88	18.39	9.000	N	OFF	9.6
0.1635	48.07	65.28	17.22	9.000	N	OFF	9.6
0.1680	49.06	65.06	15.99	9.000	N	OFF	9.6
0.1928	46.02	63.92	17.90	9.000	N	OFF	9.6
0.2040	45.46	63.45	17.98	9.000	N	OFF	9.6
0.2243	41.28	62.66	21.38	9.000	N	OFF	9.6
4.9933	27.57	56.00	28.43	9.000	N	OFF	9.9
5.0923	29.89	60.00	30.11	9.000	N	OFF	9.9
5.1328	30.65	60.00	29.35	9.000	N	OFF	9.9
5.1395	30.78	60.00	29.22	9.000	N	OFF	9.9
5.1485	30.86	60.00	29.14	9.000	N	OFF	9.9
5.1553	31.07	60.00	28.93	9.000	N	OFF	9.9
13.0393	37.32	60.00	22.68	9.000	N	OFF	10.2
19.3415	34.11	60.00	25.89	9.000	N	OFF	10.4
19.7195	33.59	60.00	26.41	9.000	N	OFF	10.4
19.7983	33.28	60.00	26.72	9.000	N	OFF	10.5
19.9513	32.69	60.00	27.31	9.000	N	OFF	10.5
21.1100	29.95	60.00	30.05	9.000	N	OFF	10.5

Final Result_CAV

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Test

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Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	30.51	55.75	25.24	9.000	N	OFF	9.6
0.1995	28.81	53.63	24.82	9.000	N	OFF	9.6
0.2333	25.15	52.33	27.18	9.000	N	OFF	9.6
0.3030	22.11	50.16	28.05	9.000	N	OFF	9.6
0.4380	22.90	47.10	24.20	9.000	N	OFF	9.6
0.4965	23.12	46.06	22.94	9.000	N	OFF	9.6
5.0000	22.62	46.00	23.38	9.000	N	OFF	9.9
5.0765	24.34	50.00	25.66	9.000	N	OFF	9.9
5.1238	25.25	50.00	24.75	9.000	N	OFF	9.9
5.1350	25.47	50.00	24.53	9.000	N	OFF	9.9
5.1575	25.69	50.00	24.31	9.000	N	OFF	9.9
5.1620	25.81	50.00	24.19	9.000	N	OFF	9.9
13.0798	31.58	50.00	18.42	9.000	N	OFF	10.2
19.7983	28.24	50.00	21.76	9.000	N	OFF	10.5
19.8028	28.36	50.00	21.64	9.000	N	OFF	10.5
20.1943	27.19	50.00	22.81	9.000	N	OFF	10.5
20.2595	27.11	50.00	22.89	9.000	N	OFF	10.5
21.1078	25.15	50.00	24.85	9.000	N	OFF	10.5

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Test

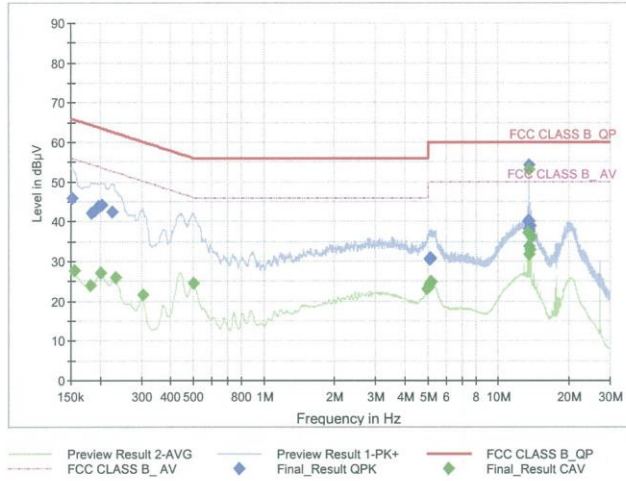
1 / 2

Test Report

Common Information

EUT : SM-G990E/DS
 Manufacturer : SAMSUNG
 Test Site: SHIELD ROOM
 Operating Conditions : NFC N UNTERM
 Operator Name:
 Comment:

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1523	45.85	65.88	20.03	9.000	N	OFF	9.6
0.1838	42.15	64.31	22.17	9.000	N	OFF	9.6
0.1905	42.74	64.02	21.28	9.000	N	OFF	9.6
0.1973	43.97	63.73	19.75	9.000	N	OFF	9.6
0.2040	44.16	63.45	19.29	9.000	N	OFF	9.6
0.2243	42.31	62.66	20.35	9.000	N	OFF	9.6
5.0563	30.51	60.00	29.49	9.000	N	OFF	9.9
5.0675	30.57	60.00	29.43	9.000	N	OFF	9.9
5.0720	30.65	60.00	29.35	9.000	N	OFF	9.9
5.1058	30.64	60.00	29.36	9.000	N	OFF	9.9
5.1328	30.88	60.00	29.12	9.000	N	OFF	9.9
5.1485	30.65	60.00	29.35	9.000	N	OFF	9.9
13.3475	40.05	60.00	19.95	9.000	N	OFF	10.2
13.4465	37.60	60.00	22.40	9.000	N	OFF	10.2
13.4555	39.96	60.00	20.04	9.000	N	OFF	10.2
13.4623	37.98	60.00	22.02	9.000	N	OFF	10.2
13.5613	54.34	60.00	5.66	9.000	N	OFF	10.2
13.6648	38.85	60.00	21.15	9.000	N	OFF	10.2

Final_Result_CAV

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Test

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Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.1545	27.55	55.75	28.20	9.000	N	OFF	9.6
0.1815	23.86	54.42	30.55	9.000	N	OFF	9.6
0.2018	27.24	53.54	26.30	9.000	N	OFF	9.6
0.2333	25.92	52.33	26.41	9.000	N	OFF	9.6
0.3030	21.66	50.16	28.50	9.000	N	OFF	9.6
0.5000	24.49	46.00	21.51	9.000	N	OFF	9.6
4.9865	23.08	46.00	22.92	9.000	N	OFF	9.9
5.0000	23.29	46.00	22.71	9.000	N	OFF	9.9
5.0585	24.16	50.00	25.84	9.000	N	OFF	9.9
5.1283	24.69	50.00	25.31	9.000	N	OFF	9.9
5.1485	24.51	50.00	25.49	9.000	N	OFF	9.9
5.1710	24.66	50.00	25.34	9.000	N	OFF	9.9
13.3498	37.15	50.00	12.85	9.000	N	OFF	10.2
13.4555	33.65	50.00	16.35	9.000	N	OFF	10.2
13.4668	31.68	50.00	18.32	9.000	N	OFF	10.2
13.5613	53.05	50.00	-3.05	9.000	N	OFF	10.2
13.6670	32.99	50.00	17.01	9.000	N	OFF	10.2
13.7728	35.97	50.00	14.03	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
Test Receiver	ESCI	Rohde & Schwarz	100033	06/15/2022	Annual
Temperature Chamber	SU-642	ESPAC	0093008124	03/15/2022	Annual
Signal Analyzer	N9020A	Agilent	MY47380318	01/28/2022	Annual
Signal Analyzer	N9030A	Agilent	MY49431210	01/11/2022	Annual
Power Meter	N1911A	Agilent	MY45100523	04/08/2022	Annual
Power Sensor	N1921A	Agilent	MY57820067	04/08/2022	Annual
Directional Coupler	87300B	Agilent	3116A03621	11/10/2021	Annual
Power Splitter	11667B	Hewlett Packard	05001	05/20/2022	Annual
DC Power Supply	E3632A	Hewlett Packard	KR75303960	06/10/2022	Annual
Attenuator (10 dB)	5910-N-50-010	H+S	00801	10/28/2021	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A
FCC WLAN&BT&BLE Conducted Test Software v3.0	FCC WLAN&BT&BLE Conducted Test Software v3.0	HCT CO., LTD.	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	2090	Emco	060520	N/A	N/A
Turn Table	Turn Table	Ets	N/A	N/A	N/A
Loop Antenna	Loop Antenna	Rohde & Schwarz	1513-333	03/19/2022	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-0895	09/04/2022	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1191	11/18/2021	Biennial
Horn Antenna (15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170541	11/29/2021	Biennial
Spectrum Analyzer	FSP (9 kHz ~ 30 GHz)	Rohde & Schwarz	836650/016	09/14/2021	Annual
Spectrum Analyzer	FSV40-N	Rohde & Schwarz	101068-SZ	09/22/2021	Annual
Band Reject Filter	WRCJV2400/2483.5-2370/2520-60/12SS	Wainwright Instruments	2	01/06/2022	Annual
Band Reject Filter	WRCJV5100/5850-40/50-8EEK	Wainwright Instruments	1	02/08/2022	Annual
Attenuator (10 dB)	CBLU1183540B-01	CERNEX	N/A	12/23/2021	Annual
56-10	56-10	WEINSCHTEL			
Broadband Low Noise Amplifier	CBL06185030	CERNEX	N/A	12/23/2021	Annual
Attenuator (3 dB)	18B-03	Api tech.			
High Pass Filter	WHKX10-2700-3000-18000-40SS	Wainwright Instruments	N/A	12/23/2021	Annual
High Pass Filter	WHKX8-6090-7000-18000-40SS	Wainwright Instruments	N/A	12/23/2021	Annual
Thru	COAXIAL ATTENUATOR	T&M SYSTEM	N/A	12/23/2021	Annual
Power Amplifier	CBL18265035	CERNEX	22966	12/04/2021	Annual
Power Amplifier	CBL26405040	CERNEX	25956	03/23/2022	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-2109-FC018-P