

TEST REPORT

FCC WPT Test for SM-S721U
Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-2407-FC007

DATE OF ISSUE
July 18, 2024

Tested by
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Technical Manager
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**TEST
REPORT****REPORT NO.**

HCT-RF-2407-FC007

DATE OF ISSUE

July 18, 2024

Additional Model

SM-S721U1

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

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

Product Name

Mobile Phone

Model Name

SM-S721U

FCC ID

A3LSMS721U

Max. Transmit Power

1.857 dBuV/m @300 m

Date of Test

May 20, 2024 ~ July 18, 2024

Test Results

PASS

FCC Classification

Part 15 Low Power Transmitter Below 1705 kHz (DCD)

Test Standard Used

FCC Rule Part(s): FCC Part 15, Subpart C (15.209)

Location of Test☒ Permanent Testing Lab ☐ On Site Testing Lab

(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	July 18, 2024	Initial Release

Notice

Content

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.

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked *.

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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1. EUT DESCRIPTION

Model	SM-S721U
Additional Model	SM-S721U1
EUT Type	Mobile Phone
Power Supply	DC 3.88 V
Frequency Range	110 kHz ~ 148 kHz
Max. Transmit Power	1.857 dBuV/m @300 m
Serial number	Radiated : 67d50971db197ece

2. TEST METHODOLOGY

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Device (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 15.205, 15.207 and 15.209 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 below 1 GHz. Above 1 GHz with 1.5 m using absorbers between the EUT and receive antenna. 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).

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 March 11, 2024 (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)	1.98 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.36 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.70 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.52 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.66 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (Above 40 GHz)	5.58 (Confidence level about 95 %, $k=2$)

7. WORST CASE CONFIGURATION

Note:

1. Client device:

Of Phone and Wearable device, we tested on Phone.

2. Phone(Client device):

- Model : SM-G986B/DS

- Manufacturer : SAMSUNG

- FCC ID : A3LSMG986B

3. All modes of operation were investigated and the worst case configuration results are reported.

- Mode :

1. Aligned + Charging From TA

2. Aligned Charging from EUT to Phone

3. Cross + Charging From TA

4. Cross Charging from EUT to Phone

- Worst case : Cross + Charging From TA

4. EUT can operate the power sharing mode when battery level is over 30%.

Because test results are not different between fully charged status and battery level 30% status(EUT condition), we were performed the test in fully charged condition.

5. All position of loop antenna were investigated and the worst position results are reported.

- Position : Horizontal, Vertical, Parallel to the ground plane

- Worst Position : Horizontal

6. The EUT was tested in three orthogonal axis(X, Y, Z) and the worst position results are reported.

- Axis : X, Y, Z

- Worst Axis : X

7. SM-S721U, SM-S721U1 were tested and the worst case results are reported.

(Worst case: SM-S721U)

AC Power line Conducted Emissions

1. All modes of operation were investigated and the worst case configuration results are reported.

- Mode : EUT + External accessories(Earphone, etc) + Travel Adapter + Phone(Client device)
, EUT + Travel Adapter + Phone(Client device)

- Worst case : EUT + Travel Adapter + Phone(Client device)

2. SM-S721U, SM-S721U1 were tested and the worst case results are reported.

(Worst case: SM-S721U)

8. TEST SUMMARY

Test Description	FCC Rule	Limit	Condition	Result
Radiated emission	§ 15.209	cf. Section 9	Radiated	Pass
AC Power Line Conducted Emission	§ 15.207	cf. Section 10		Pass
Emission bandwidth.	§ 2.1049	<u>See note1</u>		<u>See note1</u>

Note:

1. For reporting purposes only.

9. RADIATED EMISSION MEASUREMENT

Test Settings

1. Analyzer frequency set to the frequency of the radiated spurious emission of interest.
2. RBW :
 - 9 kHz – 150 kHz : 300 Hz
 - 150 kHz – 30 MHz : 10 kHz
 - 30 MHz – 1G Hz : 100 kHz
3. VBW : $\geq 3 \times$ RBW
4. Sweep time : Auto couple
5. Detector : Peak
6. Trace : Max hold
7. Trace was allowed to stabilize

Limit

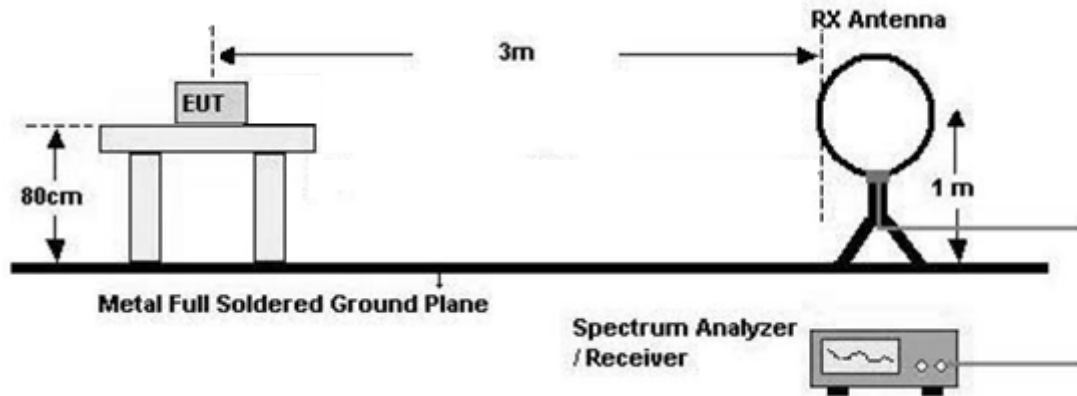
Except as provided elsewhere in this paragraph the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Rule Part	Frequency (MHz)	Limit
Part 15.209	0.009 ~ 0.490	2400/F(kHz) μ V/m@300 m
	0.490 ~1.705	24000/F(kHz) μ V/m@30 m
	1.705 ~ 30	30 μ V/m@30 m
	30 ~ 88	100 ** μ V/m@3 m
	88 ~ 216	150 ** μ V/m@3 m
	216 ~ 960	200 ** μ V/m@3 m
	Above 960	500 μ V/m@3 m

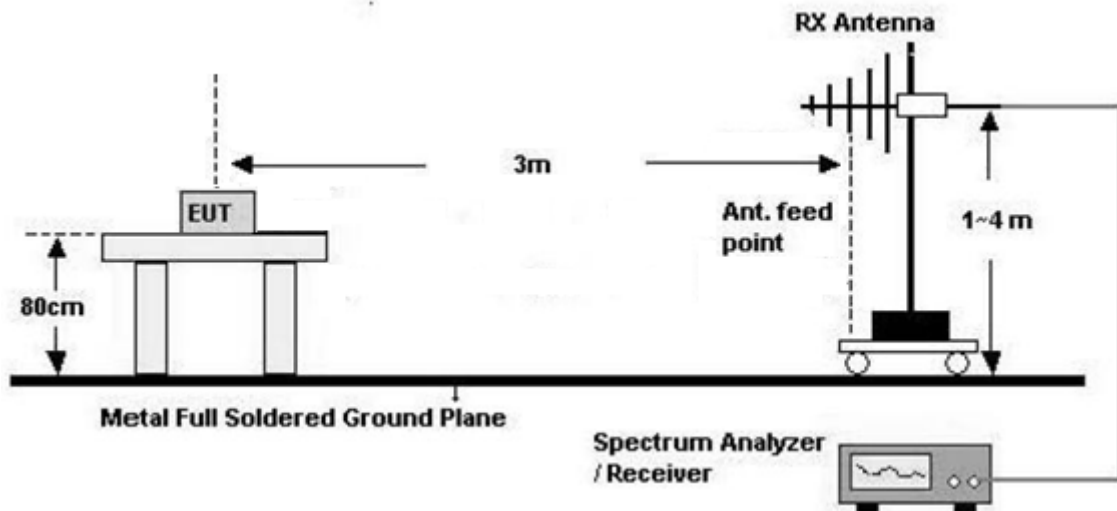
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part,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

Test Set-up

Below 30 MHz



30 MHz - 1 GHz



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 0.8 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 limit is converted from microvolts/meter to decibel microvolts/meter. Sample Calculation:
 - * Result Value(dBμV/m@30 m)
= Measured Value(dBμV/m@3 m) + Ant factor(dB/m) + Cable Loss(dB) - Distance Correction Factor(dB)
6. Distance Correction
 - * 0.009 MHz – 0.490 MHz :
 $40\log(3\text{ m}/300\text{ m}) = -80\text{ dB}$
 - * 0.490 MHz – 30 MHz :
 $40\log(3\text{ m}/30\text{ m}) = -40\text{ dB}$
7. Plots were taken without using any correction factors.
8. The worst case plots are reported.

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(Below 1 GHz)

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
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Max hold
 - RBW = 100 kHz
 - VBW $\geq 3 \times$ 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.

Test Result

Frequency	Measured Value	Ant.Factor	Cable Loss	Distance Correction	Ant. POL	Total Value	Limit	Margin
(kHz)	(dB μ V/m)@3m	(dB/m)	(dB)	(dB)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
9.023	41.220	20.40	0.58	-80.00	H	-17.803	48.50	66.30
#112.331	59.910	20.20	0.58	-80.00	H	0.687	26.59	25.91
336.310	38.840	20.20	0.58	-80.00	H	-20.383	17.07	37.45
556.000	30.620	20.20	0.58	-40.00	H	11.397	32.70	21.31
2281.800	20.610	20.10	0.58	-40.00	H	1.287	29.54	28.25

Note

1. “#” Fundamental Frequency
2. EUT Mode: Charging from EUT to Phone
3. Position: Cross
4. 30 MHz – 1GHz : No Critical peaks found
5. The fundamental frequency(110kHz – 148kHz) varies depending on the position of client device.
All fundamental frequency were investigated and the worst results are reported.

Frequency	Measured Value	Ant.Factor	Cable Loss	Distance Correction	Ant. POL	Total Value	Limit	Margin
(kHz)	(dB μ V/m)@3m	(dB/m)	(dB)	(dB)	(H/V)	(dB μ V/m)	(dB μ V/m)	(dB)
33.444	65.430	20.20	0.58	-80.00	H	6.207	37.12	30.91
#111.982	61.080	20.20	0.58	-80.00	H	1.857	26.62	24.76
150.080	52.030	20.20	0.58	-80.00	H	-7.193	24.08	31.27
512.000	29.450	20.20	0.58	-40.00	H	10.227	33.42	23.19
2296.600	17.450	20.10	0.58	-40.00	H	-1.873	29.54	31.41

Note

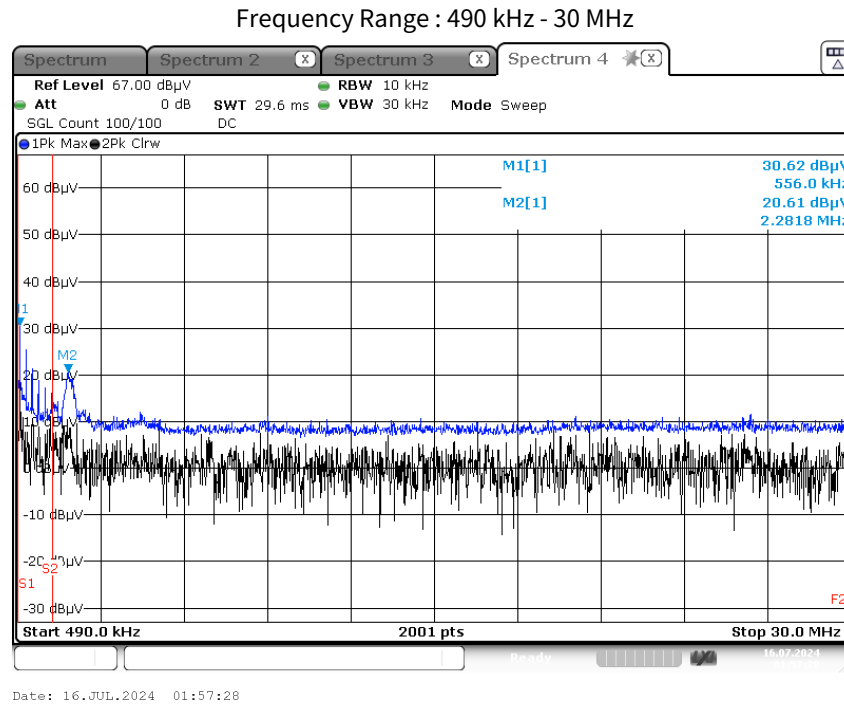
1. “#” Fundamental Frequency
2. EUT Mode: Charging from EUT(Charging from TA) to Phone
3. Position: Cross
4. 30 MHz – 1GHz : No Critical peaks found
5. The fundamental frequency(110kHz – 148kHz) varies depending on the position of client device.
All fundamental frequency were investigated and the worst results are reported.

Test Plot

Note: Only the worst case plots for Radiated Spurious Emissions.

EUT Mode : Charging from EUT to Phone

Position: Cross



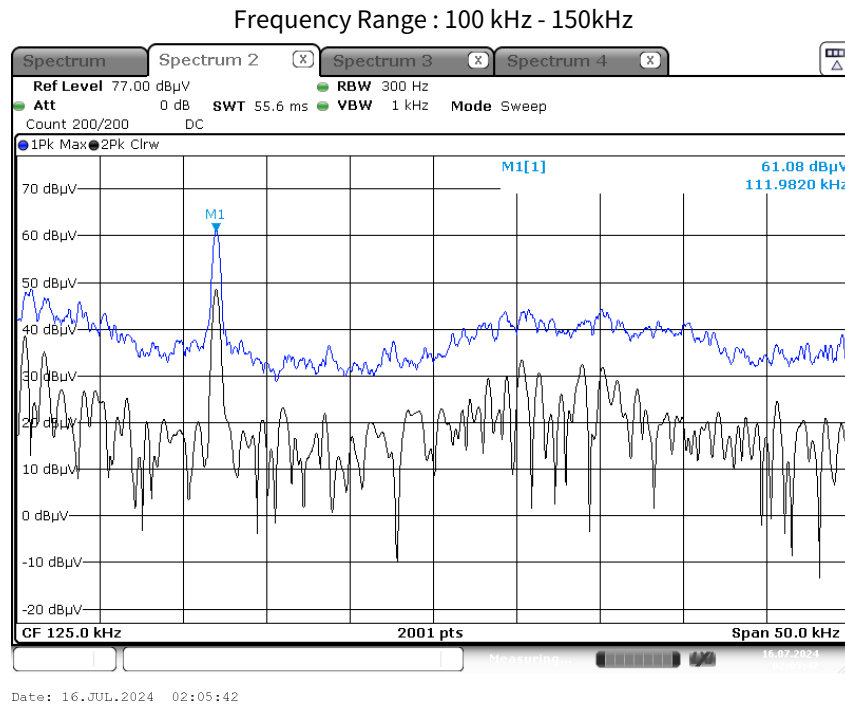
Frequency Range : 30 MHz - 1 GHz
(30 MHz - 1 GHz : No Critical peaks found)

Test Plot

Note: Only the worst case plots for Radiated Spurious Emissions.

EUT Mode : Charging from EUT(Charging from TA) to Phone

Position: Cross



Frequency Range : 30 MHz - 1 GHz
(30 MHz - 1 GHz : No Critical peaks found)

10. POWERLINE 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 Value + Correction Factor

Test Result & Plot

Aligned

Test

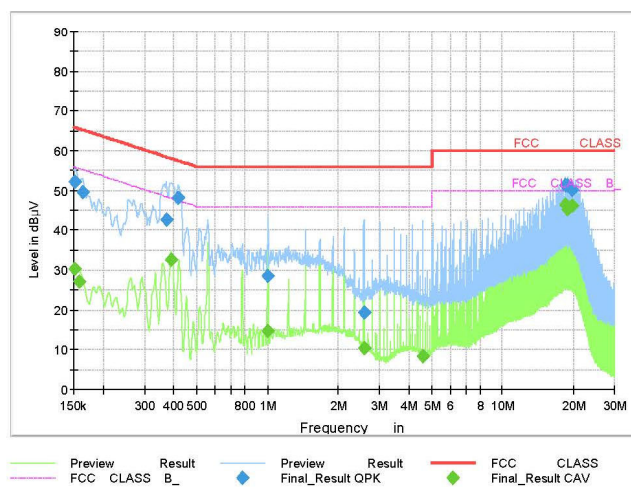
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Test Report

Common Information

EUT : SM-S721U
Operating Conditions : WPT Mode_Align
Comment :

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dB μ V)	Limit (dB μ V)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1523	52.10	65.88	13.77	9.000	L1	9.6
0.1635	49.53	65.28	15.76	9.000	L1	9.6
0.3728	42.70	58.44	15.74	9.000	L1	9.6
0.4178	48.03	57.49	9.46	9.000	L1	9.6
1.0063	28.42	56.00	27.58	9.000	L1	9.7
2.5700	19.20	56.00	36.80	9.000	L1	9.7
18.4010	51.27	60.00	8.73	9.000	L1	10.3
18.8533	51.29	60.00	8.71	9.000	L1	10.4
19.7578	50.15	60.00	9.85	9.000	L1	10.4

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Test

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Final Result CAV

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1523	30.41	55.88	25.46	9.000	L1	9.6
0.1590	27.26	55.52	28.26	9.000	N	9.6
0.3885	32.72	48.10	15.38	9.000	N	9.6
1.0063	14.72	46.00	31.28	9.000	L1	9.7
2.5700	10.27	46.00	35.73	9.000	L1	9.7
4.5815	8.50	46.00	37.50	9.000	L1	9.8
18.4010	46.31	50.00	3.69	9.000	L1	10.3
18.8533	45.31	50.00	4.69	9.000	L1	10.4
19.7555	46.11	50.00	3.89	9.000	L1	10.4

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Crossed

Test

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Test Report

Common Information

EUT :

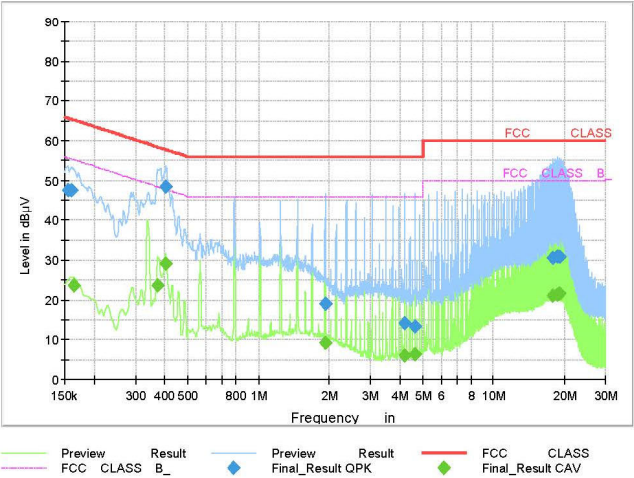
Operating Conditions :

Comment :

SM-S721U

WPT Mode_Cross

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	47.69	65.75	18.06	9.000	N	9.6
0.1613	47.72	65.40	17.68	9.000	N	9.6
0.4043	48.41	57.77	9.36	9.000	L1	9.6
1.9220	19.04	56.00	36.96	9.000	L1	9.7
4.1833	14.07	56.00	41.93	9.000	L1	9.8
4.6355	13.40	56.00	42.60	9.000	L1	9.8
17.9780	30.51	60.00	29.49	9.000	L1	10.3
18.6553	31.00	60.00	29.00	9.000	L1	10.3
19.1098	30.97	60.00	29.03	9.000	L1	10.4

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Test

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Final Result CAV

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1635	23.53	55.28	31.76	9.000	N	9.6
0.3750	23.58	48.39	24.81	9.000	N	9.6
0.4020	29.04	47.81	18.78	9.000	N	9.7
1.9220	9.34	46.00	36.66	9.000	L1	9.7
4.1833	6.05	46.00	39.95	9.000	L1	9.8
4.6355	6.32	46.00	39.68	9.000	L1	9.8
17.9780	21.09	50.00	28.91	9.000	L1	10.3
18.6575	21.29	50.00	28.71	9.000	L1	10.3
19.1098	21.64	50.00	28.36	9.000	L1	10.4

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11. EMISSION BANDWIDTH

Test Settings

1. Analyzer frequency set to the frequency of the radiated spurious emission of interest.
2. RBW : 300 Hz
(Because the measured signal is CW/CW-like, adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.)
3. VBW : $\geq 3 \times \text{RBW}$
4. Sweep time : Auto couple
5. Detector : Peak
6. Trace : Max hold
7. Trace was allowed to stabilize

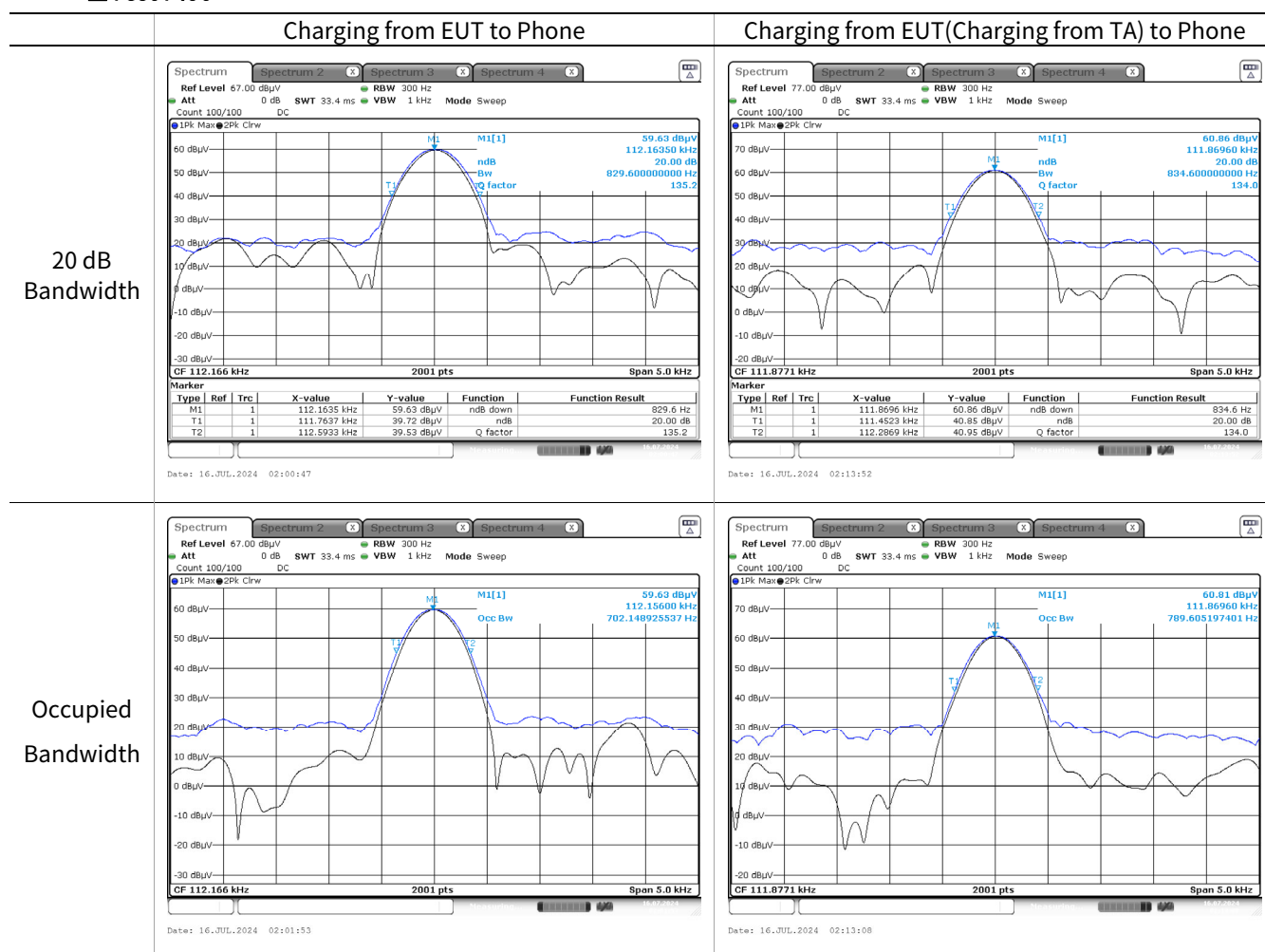
Limit

None (for reporting purposes only.)

Test Result

Mode (Cross)	Test Frequency (kHz)	20 dB Bandwidth (Hz)	Occupied Bandwidth 99% BW(Hz)
Charging from EUT to Phone	112.16	829.6	702.15
Charging from EUT(Charging from TA) to Phone	111.87	834.6	789.61

Test Plot



11. LIST OF TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Controller (Antenna mast & Turn Table)	CO3000	Innco system	CO3000/ 15421/57580623/G	N/A	N/A
Antenna Position Tower	MA4640	Innco system	9320422	04/05/2025	Biennial
Turn Table	N/A	Ets	N/A	N/A	N/A
LISN	ENV216	Rohde & Schwarz	102245	07/17/2025	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	07/02/2025	Annual
Loop Antenna	FMZB 1513	Schwarzbeck	1513-175	01/16/2025	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-1135	08/16/2024	Biennial
Power Amplifier	310N	SONOMA INS TRUMENT	186169	02/14/2025	Annual
Spectrum Analyzer	FSV40 (9 kHz ~ 40 GHz)	Rohde & Schwarz	101510	03/28/2025	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).

12. Annex A_TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2407-FC007-P