

RF Test Report

Wireless Power Transmission

Report No. : RF200511K004-4 R3
Customer : Samsung Electronics Co., Ltd.
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,
16677, Korea
Use of Report : Certification
Model Name : SM-T970
FCC ID / IC : A3LSMT970 / 649E-SMT970
Date of Test : 2020.06.01 to 2020.07.15
Test Method Used : FCC 47 CFR PART 15 Subpart C (Section §15.209)
Testing Environment : Refer to the Test Condition

Test Result : ☒ **Pass** ☐ **Fail**

ISSUED BY: BV CPS ADT Korea Ltd., EMC/RF Laboratory

ADDRESS: Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu,
Suwon-si, Gyeonggi-do, Korea 16675

TEST LOCATION: HeungAn-daero 49, DongAn-gu, Anyang-si,
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Tested by

Name : Donghwa Shin

Technical Manager

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2020. 07. 16

BV CPS ADT Korea Ltd.

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RELEASE CONTROL RECORD

REPORT NO.	REASON FOR CHANGE	DATE ISSUED
RF200511K004-4	Original release	2020.07.01
RF200511K004-4 R1	Revised information about the test	2020.07.08
RF200511K004-4 R2	Corrected the regarding distance extrapolation factor	2020.07.15
RF200511K004-4 R3	Revision to FCC-only report	2020.07.16

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1 Summary of Test Results

The EUT has been tested according to the following specifications

Applied Standard : FCC Part 15, Subpart C 15.209					
FCC Part Section(s)	-	Test Description	Limit	Test Result	Reference
15.209(a)	-	Radiated emission	Emissions in Restricted bands must meet the radiated limits detailed in 15.209	PASS	Section 3.2
15.207	-	AC Conducted Emissions (150 kHz – 30 MHz)	< FCC 15.207 limits	PASS	Section 3.3

NOTES

- 1) The general test methods used to test on this devices are ANSI C63.10.
- 2) Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

1.1 Introduction of Test Data Reuse

This report referenced from the FCC ID : A3LSMT975 and the applicant takes full responsibility that test data as referenced in this report represent compliance for this FCC ID.

1.2 Difference

The FCC ID : A3LSMT970 shared the same enclosure and circuit board as FCC ID: A3LSMT975. The WLAN/BT antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emission that the performance of the FCC ID: A3LSMT975 remains representative of FCC ID : A3LSMT970. The test data of FCC ID: A3LSMT975 being submitted for this application to cover the feature.

1.3 Spot Check Verification Results

Frequency Band	Test Item	Test Mode	Measured Frequency (MHz)	Original Model	Spot Check Model	Limit [dBuV/m]	Deviation (dB)	Remark
				SM-T975	SM-T970			
				FCC ID :A3LSMT975	FCC ID :A3LSMT970			
WPT S-PEN	RSE	Charging	0.076328	53.35 dBuV/m	53.02 dBuV/m	122.54	0.70	

Comparison result of two models, upper deviation is within 3 dB and all test results are under FCC Technical Limits.

1.4 Reference Details

Equipment Class	Reference FCC ID (Parent)	Application Type	Reference Test report number	Exhibit Type	Variant Test Report Number	Data Re-used
DTS	A3LSMT975	Original Grant	RF200522K003-2 (802.11b/g/n/ac)	Test Report	RF200511K004-2 (802.11b/g/n/ac)	All
			RF200522K003-3 (802.11ax)	Test Report	RF200511K004-3 (802.11ax)	All
			RF200522K003-1 Bluetooth LE	Test Report	RF200511K004-1 Bluetooth LE	All
DSS	A3LSMT975	Original Grant	RF200522K003 (Bluetooth)	Test Report	RF200511K004 (Bluetooth)	All
NII	A3LSMT975	Original Grant	RF200522K003-6 (802.11a/n/ac)	Test Report	RF200511K004-5 (802.11a/n/ac)	All
			RF200522K003-7 (802.11ax)	Test Report	RF200511K004-6 (802.11ax)	All
DCD	A3LSMT975	Original Grant	RF200522K003-4 (WPT)	Test Report	RF200511K004-4 (WPT)	All

1.5 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2

Measurement Items	Frequency Range	Expanded Uncertainty $U = kU_c (k = 2)$
Conducted Emissions at main ports	150 kHz – 30 MHz	2.62
Radiated Spurious Emissions	9 kHz – 30 MHz	1.97
	30 MHz – 1 GHz	4.04

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of $k = 2$.

2 General Information

2.1 General Description of EUT

Product	Tablet
Brand	Samsung
Model	SM-T970
Identification No. of EUT	-
Series Model	-
Model Difference	-
Power Supply	3.86 V DC By Battery / DC 5/9 V By Adapter
Modulation Type	ASK
Operating Frequency	530 kHz
Number of Channel	N/A
Output Power	16.34 dBuV/m
Antenna Type	Coil Antenna
Antenna Connector	C-Clip
H/W Version	REV0.4
S/W Version	T970.001

NOTES

- 1) The above equipment has been tested by **Bureau Veritas Consumer Products Services ADT Korea**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.
- 2) List of Accessories

Accessories	Brand	Model	Manufacturer	Specification
Ear phone	Samsung	EHS64	Samsung	3.5 mm
S-pen	Samsung	EJ-PT870	Samsung	Bluetooth
Keyboard	Samsung	EF-DT970	Samsung	N/A
TA	Samsung	EP-TA200	Samsung	Input : AC 100-240 V, 50 – 60 Hz, 0.5 A Output : DC 9.0 V, 1.67 A, DC5.0 V, 2.0 A
Cable	Samsung	EP-DG930M	Samsung	A to C type, Shielded, 1.m
Battery	Samsung	EB-BT975ABY	Samsung	Rating: 3.86Vdc, 9800mAh, 37.83Wh

2.2 Description of Test Mode

[Test Channel of EUT]

Mode 1	Test Case	Description
Power Sharing mode	1	Charging from Tablet to S-Pen

2.2.1 Description of EUT

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X axis for radiated emission. Following channel(s) was(were) selected for the final test as listed below :

EUT Configure mode	Applicable to				Description
	RE < 1G	RE ≥ 1G	PLC	APCM	
-	√	-	√	-	-

Where RE ≥ 1 G : Radiated Emission above 1 GHz & Bandedge Measurement
 RE < 1 G : Radiated Emission below 1 GHz
 PLC : Power Line Conducted Emission
 APCM : Antenna Port Conducted Measurement

Radiated Emission Test (Below 1 GHz)

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure mode	Available Frequency	Tested Frequency	Modulation Type
Charging from Tablet to S-Pen	530 kHz	530 kHz	ASK

Radiated Emission Test (Above 1 GHz)

- ☐ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☐ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure mode	Available Frequency	Tested Frequency	Modulation Type
N/A	N/A	N/A	N/A

Power line Conducted Emission Test

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure mode	Available Frequency	Tested Frequency	Modulation Type
Charging from Tablet to S-Pen	530 kHz	530 kHz	ASK

Antenna Port Conducted Measurement

- ☐ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☐ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
- ☐ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure mode	Available Frequency	Tested Frequency	Modulation Type
N/A	N/A	N/A	N/A

Test Condition

Applicable to	Environmental Conditions	Test Voltage	Tested by
RE < 1G	22 °C, 55 % RH	DC 5/9 V By Adaptor	Donghwa Shin
RE ≥ 1G	N/A	N/A	N/A
PLC	23 °C, 49 % RH	DC 5/9 V By Adaptor	Donghwa Shin
APCM	N/A		

2.3 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards.

FCC CFR 47 Part 15, Subpart C

ANSI C63.10-2013

All test items in this test report have been performed and recorded as per the above standards.

2.4 Test Equipment

Test Equipment is traceable to the National Institute of Standards and Technology (NIST). Measurement antenna used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Serial Number	Cal Date	Cal Due
R&S	HFH2-Z2E	Active Loop Antenna, 30 MHz	349806	2019.03.27	2021.03.27
Schwarzbeck	VULB 9163	Trilog Antenna, 3 GHz (with 6 dB ATT.)	01199	2019.04.03	2021.04.03
R&S	SCU08F2	Signal Conditioning Unit, 8 GHz	08400016	2019.12.30	2020.12.30
R&S	ESW44	EMI Test Receiver, 44 GHz	101812	2020.02.20	2021.02.20
Aeroflex	40AH2W-10	Attenuator, 10 dB	1	2019.12.31	2020.12.31
Wt Microwave	WT-A1698-HS	High Pass Filter 3.5 GHz	WT190313-6-4	2020.01.03	2021.01.03
R&S	ENV216	LISN	102437	2019.12.26	2020.12.26
R&S	ESR	EMI Test Receiver, 3.6 GHz	102529	2019.12.27	2020.12.27

3 Test Results

3.1 Antenna Requirement

Except from §15.203 of the FCC Rules/Regulations:

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 the section.

- The antenna(s) of the EUT are Permanently attached.
- There are no provisions for connection to an external antenna.

Result

The EUT complies with the requirement of §15.203

3.2 Radiated Emissions

3.2.1 Regulation

§15.247(d) : In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

§15.209(a) : Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph (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.

3.2.2 Test Procedure

Spurious Radiated Emissions

1. The preliminary radiated measurement were performed to determine the frequency producing the maximum emissions in an semi-anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1000 MHz using the Bi-Log antenna, and from 1000 MHz to 26500 MHz using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 x 4 meter in an semi-anechoic chamber. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector fuction with specified bandwidth.
6. The 0.8 m height is for below 1 GHz testing, and 1.5 m is for above 1GHz testing.

- Procedure for unwanted emissions measurements below 1 000 MHz

The procedure for unwanted emissions measurements below 1 000 MHz is as follows:

- a) Follow the requirements in 12.7.4.
- b) Compliance shall be determined using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

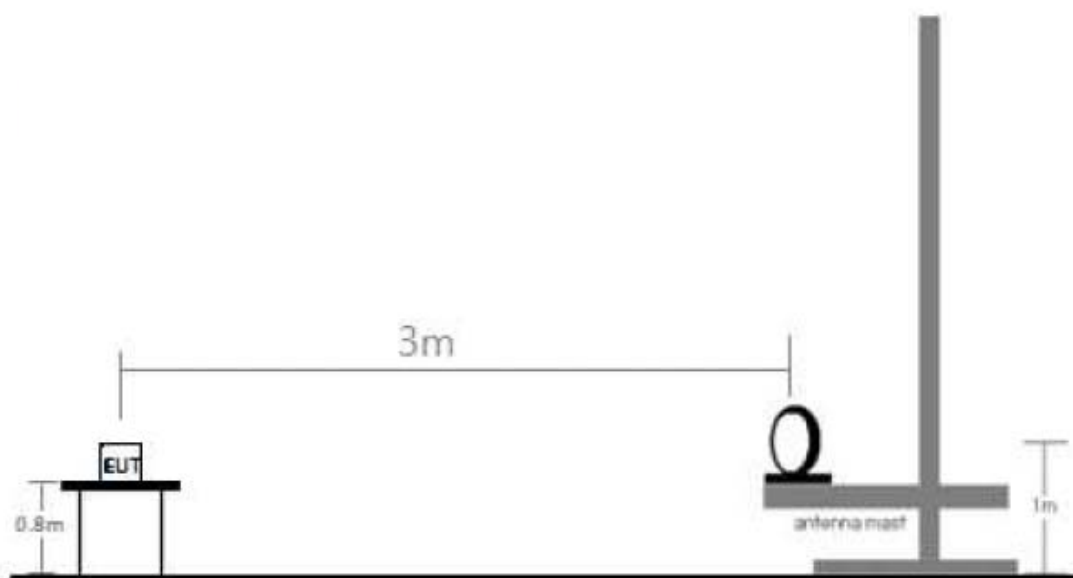
- Sample Calculation

- Field Strength Level [dBμV/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m] + Duty Cycle Correction [dB]
- AFCL [dB/m] = Antenna Factor [dB/m] + Cable loss [dB]
- Margin [dB] = Field Strength Level [dBμV/m] – Limit [dBμV/m]

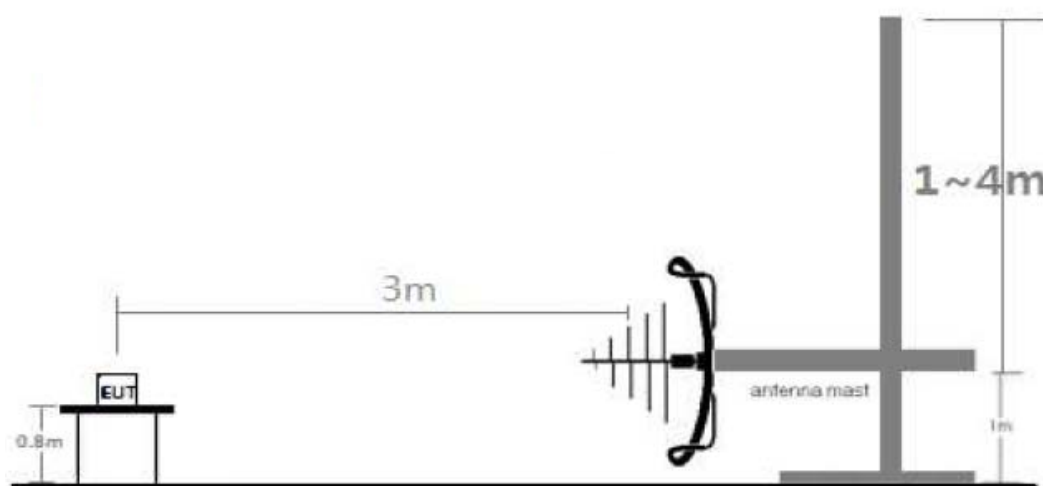
3.2.3 Deviation from Test Standard

No deviation.

3.2.4 Test Setup



[Radiated Emission Test Setup Below 30 MHz]

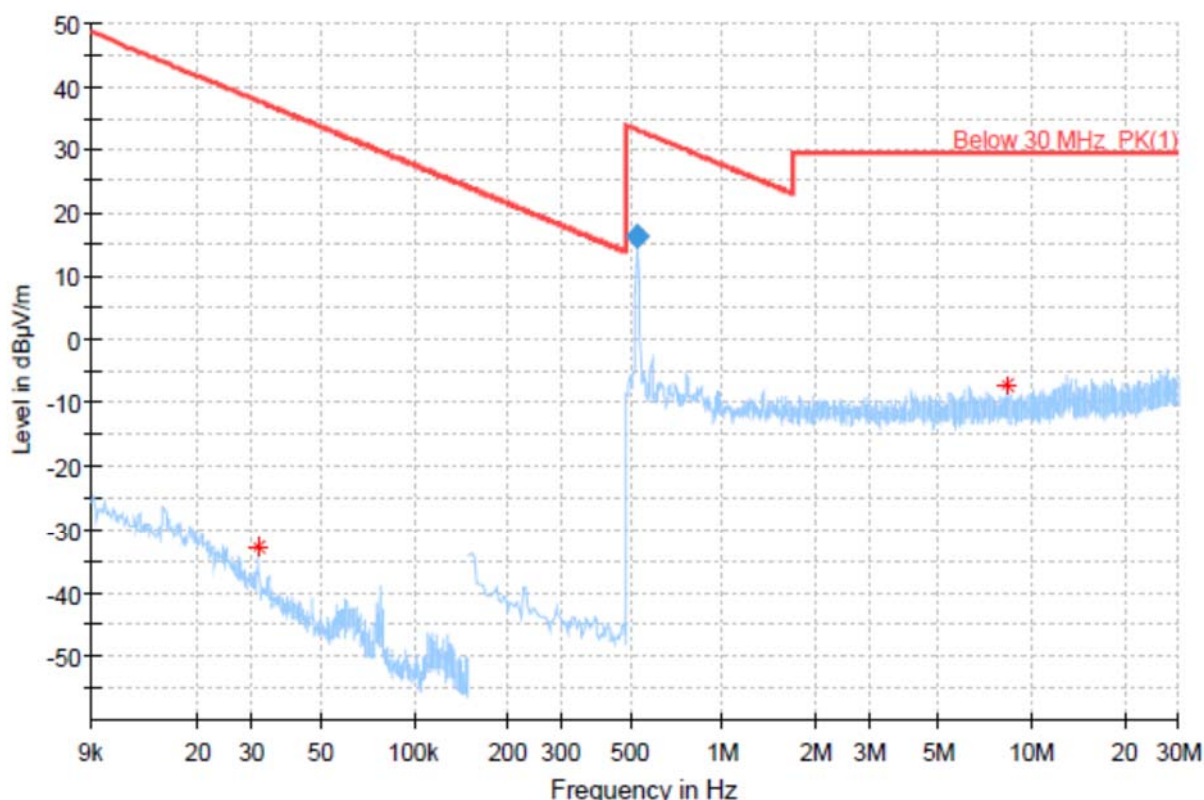


[Radiated Emission Test Setup Below 1 GHz]

3.2.5 Test Result

3.2.5.1 Radiated Emissions (Below 30 MHz)

RSE(Below 30 MHz)_Wireless Charging_Face on_Z_(530 kHz)



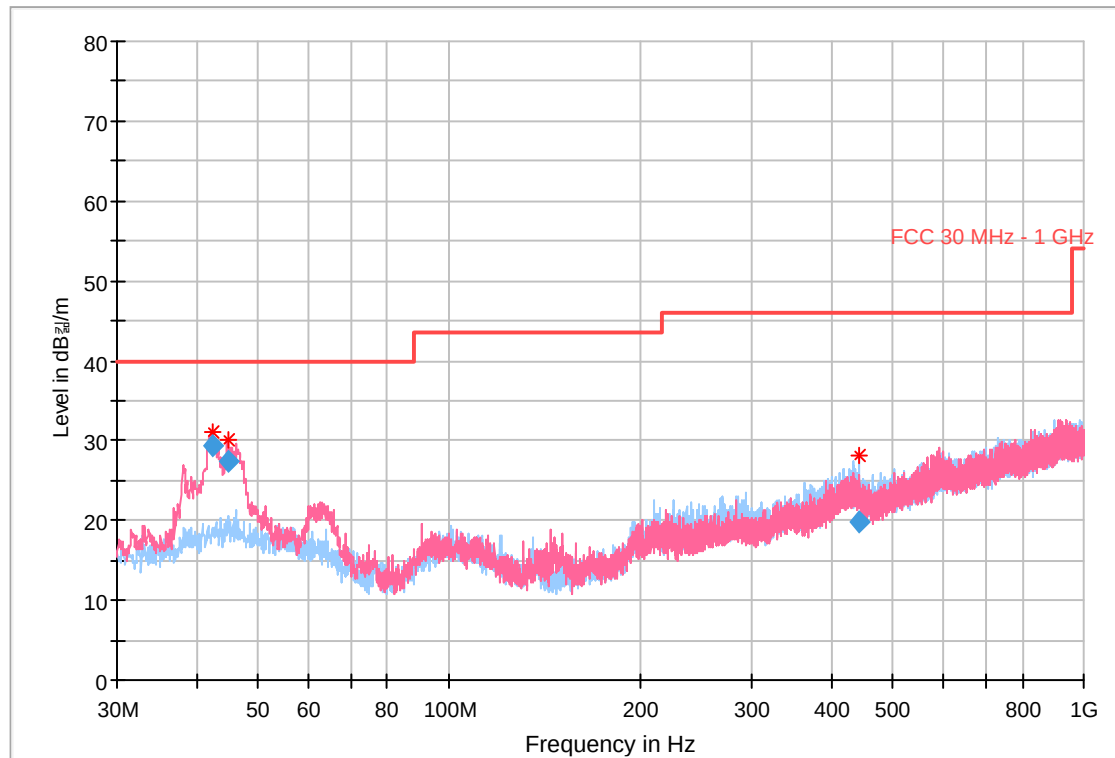
Frequency [MHz]	Peak Reading Value [dBuV/m]	Peak [dBuV/m]	Quasi Reading Value [dBuV/m]	Quasi Peak [dBuV/m]	Distance Factor [dB]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Pol	Azimuth [deg]	Correction Factor [dB]
0.03	26.73	-32.87	-	-	-80.00	37.71	70.58	100.00	H	358.00	-59.60
0.53	-	-	36.04	16.34	-40.00	33.10	16.75	100.00	H	284.00	-19.70
8.38	11.87	-7.03	-	-	-40.00	29.54	36.57	100.00	H	57.00	-18.90

Remarks

- Quasi Peak(dBuV/m) = Quasi Peak Reading Value(dBuV/m) + Correction Factor(dB) + Distance Factor(dB)
- Correction Factor(dB) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- Margin(dB) = (Peak) Result (dBuV/m) – (Peak) Limit (dBuV/m)
- Frequency of 530 kHz is the fundamental signal(Charging)

3.2.5.2 Radiated Emissions (Below 1 GHz)

RSE(Below 1 GHz)_Wireless Charging_Face on_(530 kHz)



Frequency [MHz]	Peak Reading Value [dBuV/m]	Peak Result [dBuV/m]	AVG Reading Value [dBuV/m]	AVG Result [dBuV/m]	DCCF [dB]	Bandwidth [kHz]	Height [cm]	Pol [H/V]	Azimuth [deg]	Correction Factor [dB/m]	Margin [dB]	Limit [dBuV/m]
42.502	49.63	29.3	---	---	18.2	---	100.0	V	358	-20.3	10.7	40.0
44.966	47.5	27.5	---	---	18.2	---	100.0	V	358	-20.0	12.5	40.0
444.025	35.7	19.8	---	---	18.2	---	100.0	H	251	-15.9	26.3	46.0

3.3 AC Conducted Emissions (150 kHz to 30 MHz)

3.3.1 Regulation

§15.207(a) : Except as shown in paragraphs (b) and (c) of this section, 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). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

3.3.2 Test Procedure

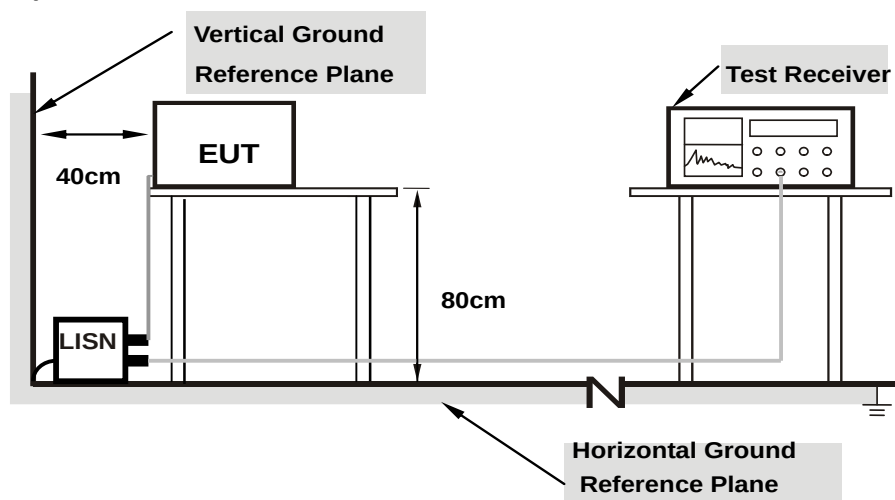
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm / 50 μ H of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Remark : The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

3.3.3 Deviation from Test Standard

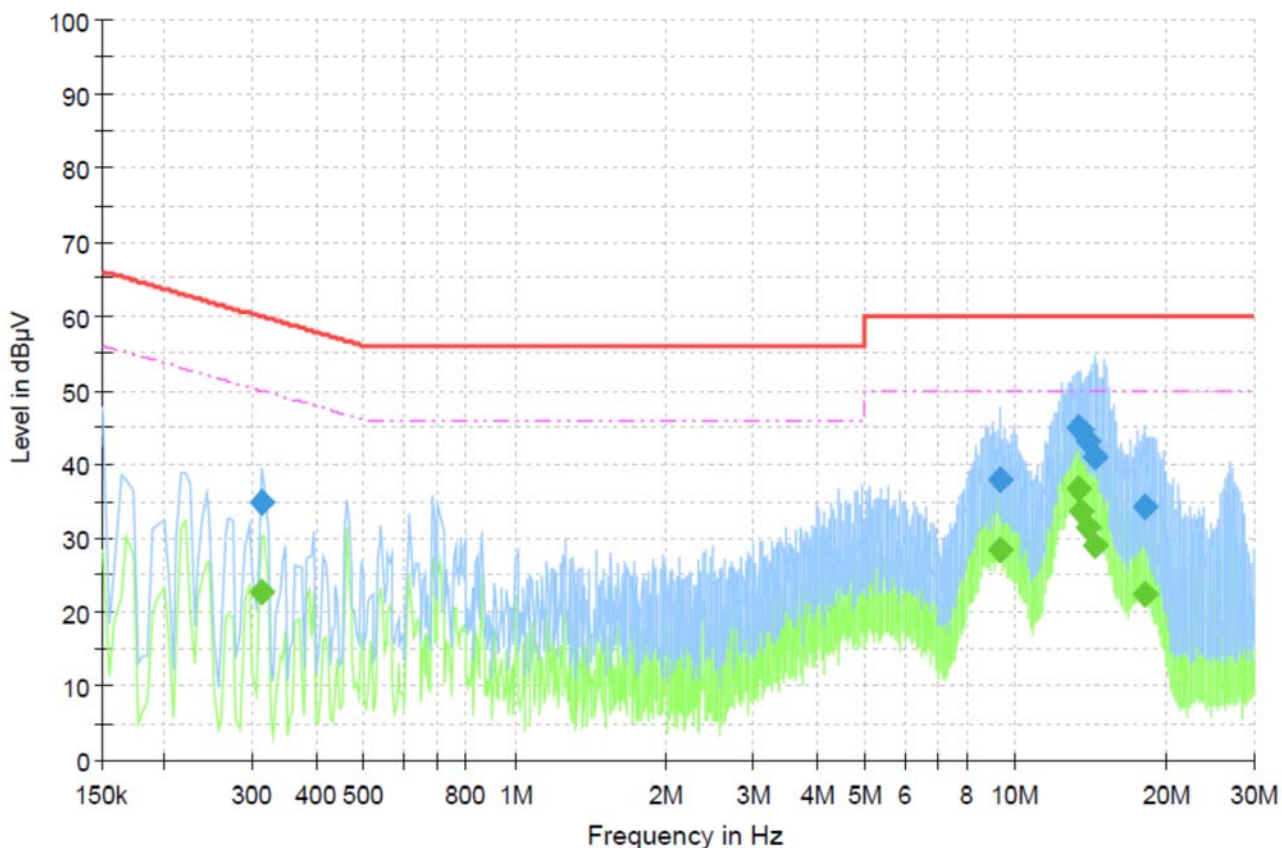
No deviation.

3.3.4 Test Setup



3.3.5 Test Result

Wireless Charging_Face on_(530 kHz)



Frequency [MHz]	Quasi Peak Reading Value [dBuV]	Quasi Peak Result [dBuV]	CAV Reading Value [dBuV]	CAV Result [dBuV]	Line	Correction Factor [dB/m]	Quasi Peak Margin [dBuV]	Quasi Peak Limit [dBuV]	CAV Margin [dBuV]	CAV Limit [dBuV]
0.31	-	-	12.71	22.61	L1	9.90	-	-	27.30	49.91
0.31	24.99	34.89	-	-	L1	9.90	25.02	59.91	-	-
9.32	-	-	18.41	28.51	L1	10.10	-	-	21.49	50.00
9.32	27.93	38.03	-	-	L1	10.10	21.97	60.00	-	-
13.40	-	-	26.25	36.55	L1	10.30	-	-	13.45	50.00
13.40	34.80	45.10	-	-	L1	10.30	14.90	60.00	-	-
13.51	-	-	23.24	33.64	N	10.40	-	-	16.36	50.00
13.51	34.16	44.56	-	-	N	10.40	15.44	60.00	-	-
14.04	-	-	21.09	31.49	N	10.40	-	-	18.51	50.00
14.04	32.84	43.24	-	-	N	10.40	16.76	60.00	-	-
14.47	-	-	18.53	28.93	N	10.40	-	-	21.07	50.00
14.47	30.71	41.11	-	-	N	10.40	18.89	60.00	-	-

Remarks

1. Final Value (QP and/or CAV) = Reading Value (QP and/or CAV) + Corr. (LISN Insertion Loss + Cable Loss)

Margin (QP and/or CAV) = Limit – Final Value (QP and/or CAV)

QP = Quasi-Peak, CAV = CISPR-Average, Corr. = Correction Factor

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services Korea. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

Test Firm Name : BV CPS ADT Korea Ltd.

Address : Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675 KOREA

FCC

Designation Number : KR0158

Test Firm Registration Number : 666061

ISED

Designation Number : KR0158

Test Firm Registration Number : 25944

If you have any comments, please feel free to contact us at the following:

Email: Meyer.Shin@bureauveritas.com

Web Site: www.bureauveritas.co.kr/cps/eaw

The address and road map of all our labs can be found in our web site also.

- End of report -