

TEST REPORT

FCC/IC WPC Test for HLW-TNHP1
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-1908-FI001-R1

DATE OF ISSUE
21 August 2019

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FCC IC/IC

BEJ-HLWTNHP1/2703N-HLWTNHP1

Applicant

LG Electronics Inc.

170, Seongsanpaechong-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, 51533, Korea

Eut Type Model Name

Wireless Changer
HLW-TNHP1

Frequency of Operation

146.6 kHz ~ 147.9 kHz

FCC Classification

Part 15 Low Power Transmitter Below 1705 kHz (DCD)

FCC Rule Part(s)

FCC Part 15, Subpart C (15.209)

ISED Rule Part(s)

RSS-Gen Issue 5, RSS-216 Issue 2

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

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

Tested by
Kwon Jeong

Technical Manager
Jong Seok Lee

HCT CO., LTD.

Soo Chan Lee
SooChan Lee / CEO

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	02 August 2019	Initial Release
1	21 August 2019	- Revised the description on page 5. - Revised the typo on page 8. - Added the thickness of wood and plastic panels on page 8.

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. HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S. C. 853(a)

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1. EUT DESCRIPTION

Model	HLW-TNHP1
EUT Type	Wireless Charger
Frequency of Operation	146.6 kHz ~ 147.9 kHz
Power Supply	DC 12.0 V
Max. Transmit Power	2.46 dBuV/m @300 m
Type of Antenna	N/A
Wireless charging distance	6 mm
Power source	5.0 W
Date(s) of Tests	July 26, 2019 ~ August 01, 2019
Manufacturer	Hitachi-LG Data Storage Korea, Inc. 189, Gasan digital 1-ro, Geumcheon-gu, Seoul, Republic of Korea
Test Frequency	146.6kHz, 147.9kHz
PMN (Product Marketing Number)	Wireless Charger
HVIN (Hardware Version Identification Number)	HLW-TNHP1
FVIN (Firmware Version Identification Number)	V1.0
HMN (Host Marketing Name)	N/A

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 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 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 6.3 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 equipments, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5.

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).

For ISCED, test facility was accepted dated February 14, 2019 (CAB identifier: KR0032).

EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned loop, 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. TESR CONFIGURATIONS

In order to check all kinds of possible configurations, EUT was evaluated with appropriate client and under each charging condition as below table. Output power of the EUT are 5 W in WPC mode.

EUT Mode	Operation
Stand alone, EUT + Client device, EUT + Wood panel + Client device, EUT + Plastic panel + Client device	Less than 1 % of Battery
	Less than 50 % of Battery
	100 % full charging of Battery

Note:

1. Stand alone = Standby mode
2. All modes of operation were investigated and the worst case configuration results are reported.
 - Worstcase of mode : EUT + Client device
 - Worstcase of operation : Less than 1 % of Battery
3. Client device
 - Model : SM-G977N
 - Manufacturer : SAMSUNG
 - FCC ID : A3LSMG977KOR
4. Thickness of wood and plastic panels : 6mm

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 ($\pm$ 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. TEST SUMMARY

Test Description	FCC Rule	IC Rule	Limit	Condition	Result
Radiated emission	§ 15.209	RSS-Gen (8.9) RSS-216 (6.2.2)	cf. Section 8	Radiated	Pass
AC Power Line Conducted Emission	§ 15.207	RSS-Gen (8.8)	cf. Section 10		N/A (See note2)
Emission bandwidth.	§ 2.1049	RSS-Gen (8.7)	See note1		Pass
Receiver Spurious Emission	N/A	RSS-Gen (7.3)	cf. Section 11		Pass

Note:

1. For reporting purposes only.
2. We don't perform AC powerline conducted emission test.
Because power supply of EUT is used only DC.

8. RADIATED EMISSION MEASUREMENT

Test Settings

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

Limit(FCC)

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) uV/m@300 m
	0.490 ~1.705	24000/F(kHz) uV/m@30 m
	1.705 ~ 30	30 uV/m@30 m
	30 ~ 88	100 ** uV/m@3 m
	88 ~ 216	150 ** uV/m@3 m
	216 ~ 960	200 ** uV/m@3 m
	Above 960	500 uV/m@3 m

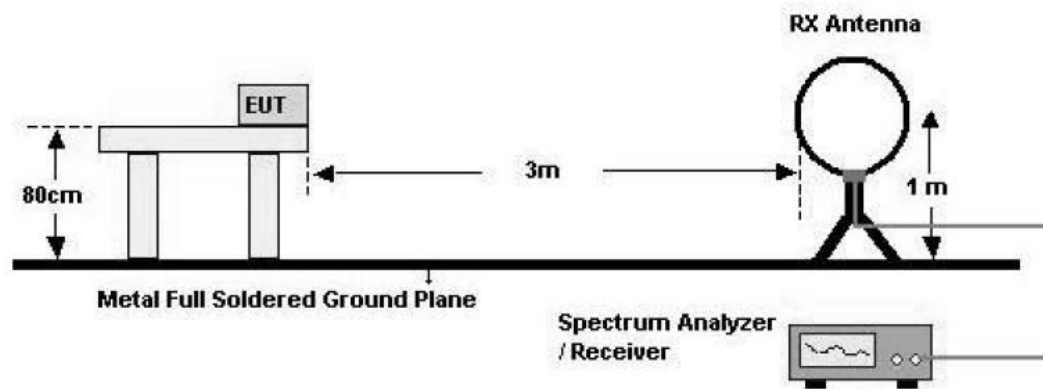
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part,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

Limit(IC)

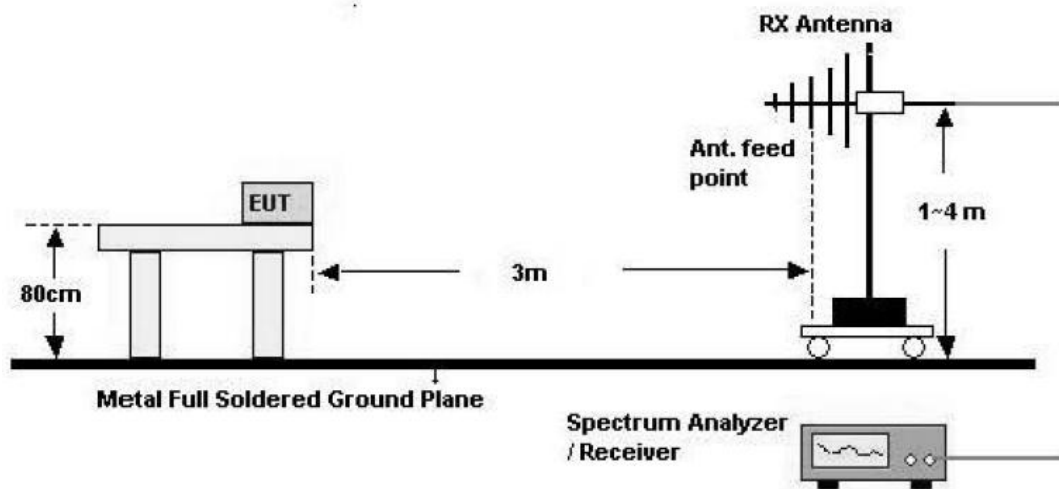
Rule	Frequency (MHz)	Limit (dBuA/m)
CISPR11	0.009 ~ 0.070	69 dBuA/m@3 m
	0.070 ~ 0.1485	69 - 39 dBuA/m@3 m
	0.1485 ~ 4	39 - 3 dBuA/m@3 m
	4 ~ 30	3 dBuA/m@3 m

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 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 limit is converted from microvolts/meter to decibel microvolts/meter. Sample Calculation:
 - * Result level(dBμV/m@30m)
= Reading level(dBμV/m@3m) + Ant factor(dB/m) + Cable Loss(dB) – Distance Correction Factor.
6. Distance Correction
 - * 0.009 MHz – 0.490 MHz :
 $40\log(3\text{ m}/300\text{ m}) = -80\text{ dB}$
 - * 0.490 MHz – 30MHz :
 $40\log(3\text{ m}/30\text{ m}) = -40\text{ dB}$
7. Worst case position : Z-H
8. Plots were taken without using any correction factors.
9. 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 1GHz)

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. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 100 kHz
 - VBW $\geq 3 \times$ RBW
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHz
- *In general, (1) is used mainly
6. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
7. 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(FCC)

Frequency (kHz)	Reading Level (dBuV/m)@3m	Ant.Factor (dB/m)	Cable Loss (dB)	Distance Correction (dB)	Result Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
9.041	32.38	18.80	0.91	-80	-27.91	48.48	76.39
144.603	37.79	18.00	0.91	-80	-23.30	24.40	47.70
**146.6	61.44	18.00	0.91	-80	0.35	24.28	23.93
439.670	33.17	18.10	0.91	-80	-27.82	14.74	42.56
10811.700	23.19	18.80	0.91	-40	2.90	29.54	26.64

Note

- ** Test Frequency : 146.6kHz
- 30 MHz – 1GHz : No Critical peaks found

Frequency (kHz)	Reading Level (dBuV/m)@3m	Ant.Factor (dB/m)	Cable Loss (dB)	Distance Correction (dB)	Result Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
9.005	33.01	18.80	0.91	-80	-27.28	48.52	75.80
145.898	41.84	18.00	0.91	-80	-19.25	24.32	43.57
**147.9	63.55	18.00	0.91	-80	2.46	24.21	21.75
443.660	35.05	18.10	0.91	-80	-25.94	14.66	40.60
3106.600	16.14	18.90	0.91	-40	-4.05	29.54	33.59

Note

- **Test Frequency : 147.9kHz
- 30 MHz – 1GHz : No Critical peaks found

Frequency (kHz)	Reading Level (dBuV/m)@3m	Ant.Factor (dB/m)	Cable Loss (dB)	Distance Correction (dB)	Result Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
99.741	37.31	18.00	0.91	-80	-23.78	27.63	51.41
100.388	37.27	18.00	0.91	-80	-23.82	27.57	51.39
131.934	55.78	18.00	0.91	-80	-5.31	25.20	30.51
158.410	41.80	18.00	0.91	-80	-19.29	23.61	42.90
4040.700	13.84	18.90	0.91	-40	-6.35	29.54	35.89

Note

1. Standby Mode
2. 30 MHz – 1GHz : No Critical peaks found

Test Result(IC)

Frequency (kHz)	Reading Level (dBuV/m)@3m	Ant.Factor (dB/m)	Cable Loss (dB)	Result Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
9.041	32.38	18.80	0.91	52.09	120.50	68.41
144.603	37.79	18.00	0.91	56.70	91.99	35.29
**146.6	61.44	18.00	0.91	80.35	91.23	10.88
439.670	33.17	18.10	0.91	52.18	87.78	35.60
10811.700	23.19	18.80	0.91	42.90	54.50	11.60

Note

1. ** Test Frequency : 146.6kHz
2. 30 MHz – 1GHz : No Critical peaks found

Frequency (kHz)	Reading Level (dBuV/m)@3m	Ant.Factor (dB/m)	Cable Loss (dB)	Result Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
9.005	33.01	18.80	0.91	52.72	120.50	67.78
145.898	41.84	18.00	0.91	60.75	91.49	30.74
**147.9	63.55	18.00	0.91	82.46	90.73	8.27
443.660	35.05	18.10	0.91	54.06	87.74	33.68
3106.600	16.14	18.90	0.91	35.95	62.85	26.90

Note

1. **Test Frequency : 147.9kHz
2. 30 MHz – 1GHz : No Critical peaks found

Frequency (kHz)	Reading Level (dBuV/m)@3m	Ant.Factor (dB/m)	Cable Loss (dB)	Result Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
99.741	37.31	18.00	0.91	56.22	120.50	64.28
100.388	37.27	18.00	0.91	56.18	108.89	52.71
131.934	55.78	18.00	0.91	74.69	96.83	22.14
158.410	41.80	18.00	0.91	60.71	90.41	29.70
4040.700	13.84	18.90	0.91	33.65	54.50	20.85

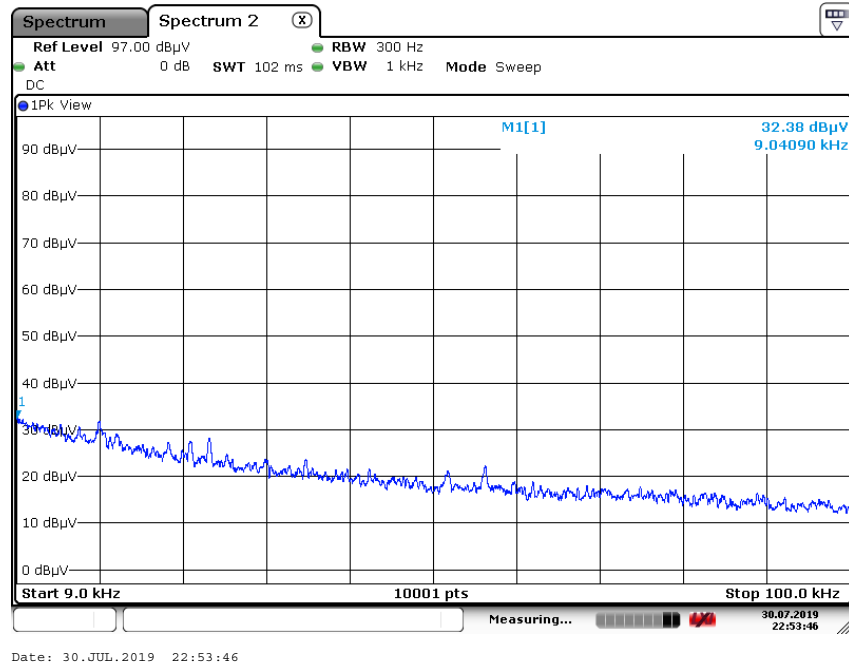
Note

1. Standby Mode
2. 30 MHz – 1GHz : No Critical peaks found

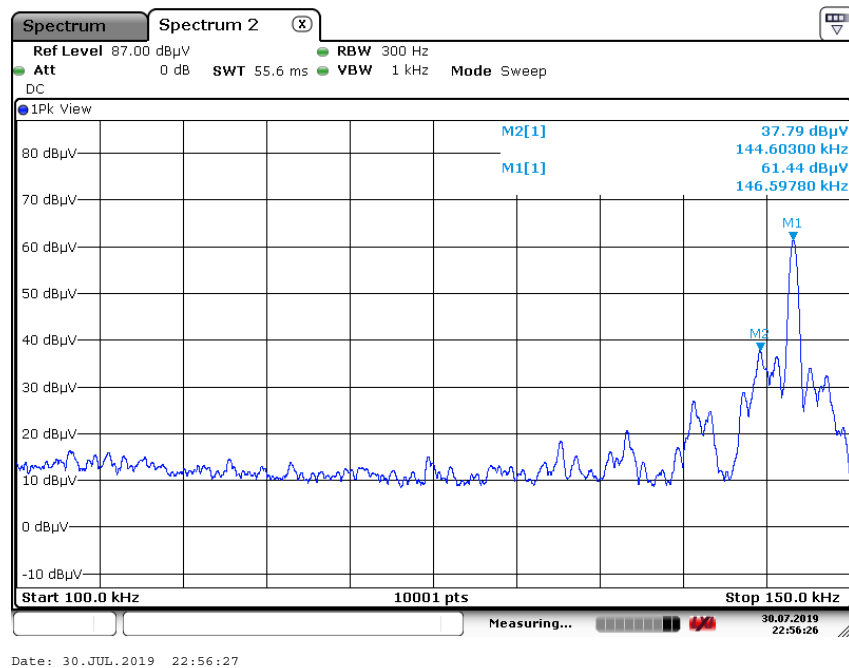
Test Plot

Test Frequency : 146.6kHz

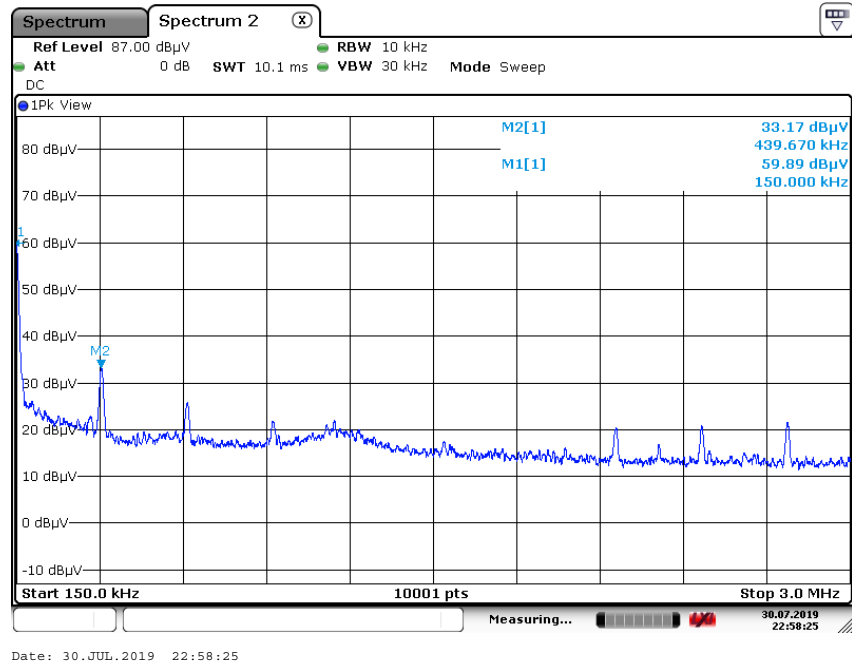
* Frequency Range : 9 kHz – 100kHz



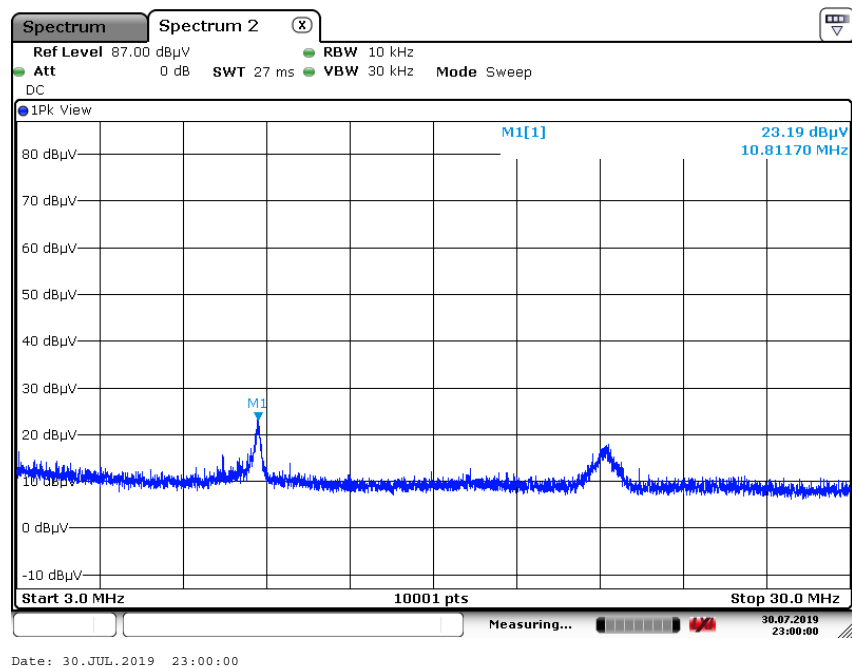
* Frequency Range : 100 kHz – 150kHz



* Frequency Range : 150 kHz – 3 MHz

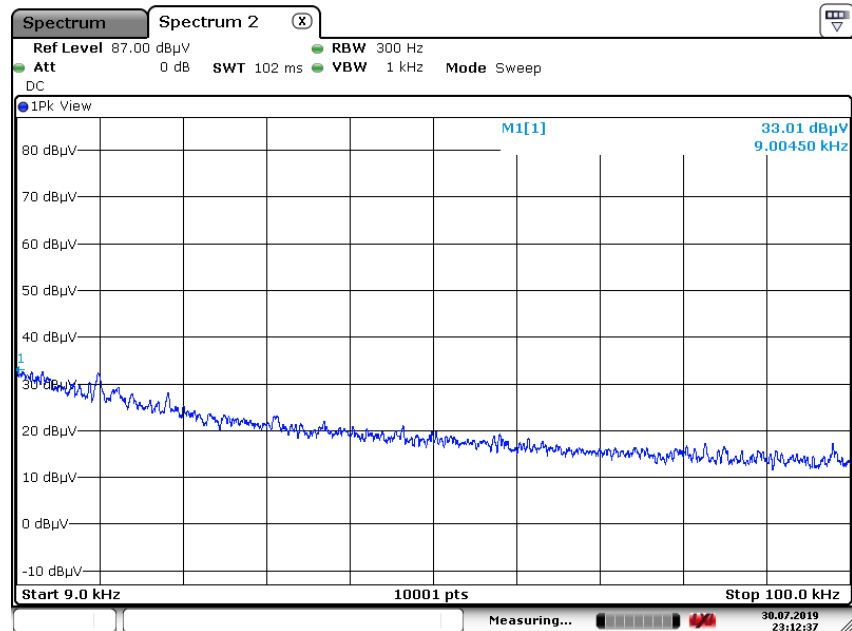


* Frequency Range : 3 MHz – 30 MHz



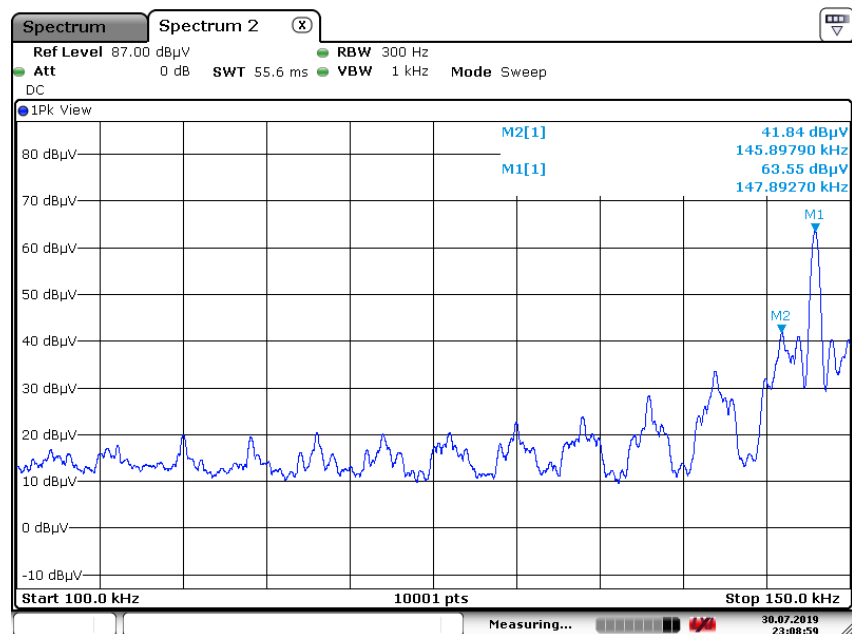
Test Frequency : 147.9kHz

* Frequency Range : 9 kHz – 100kHz



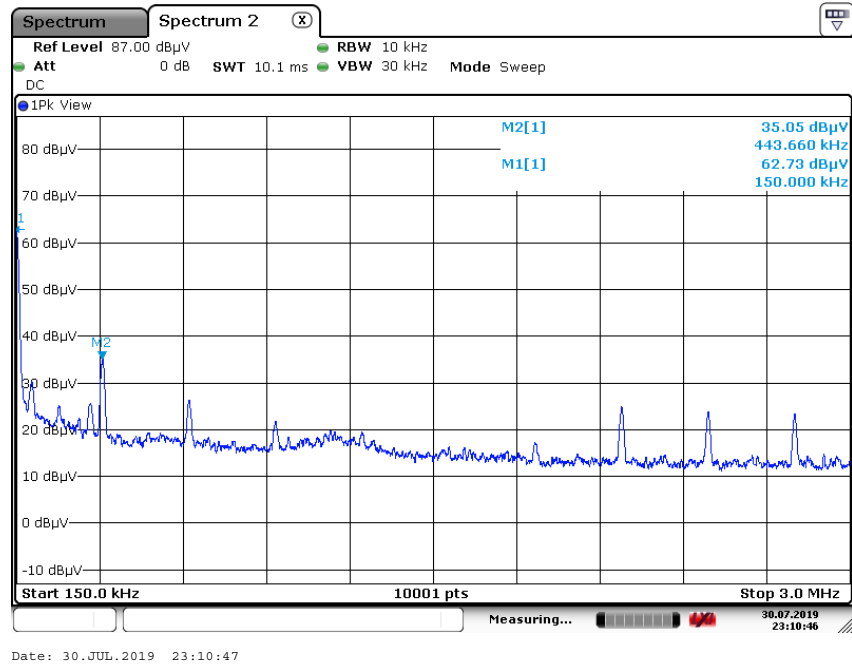
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* Frequency Range : 100 kHz – 150kHz

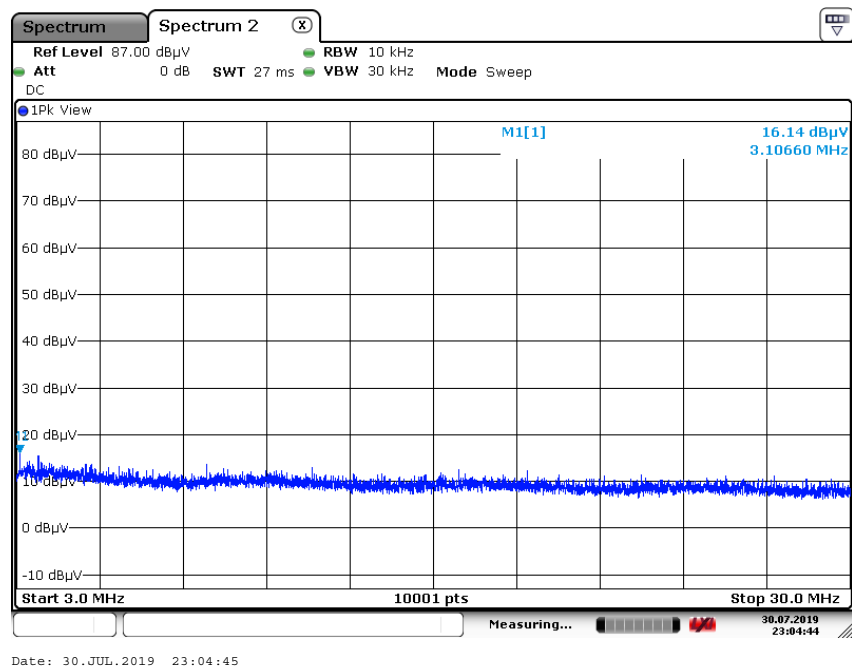


Date: 30.JUL.2019 23:08:59

* Frequency Range : 150 kHz – 3 MHz

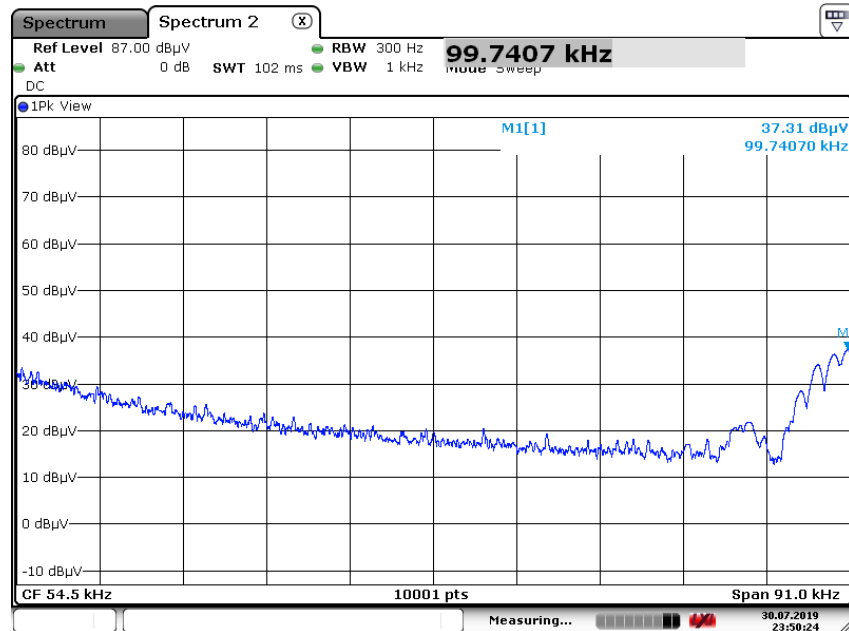


* Frequency Range : 3 MHz – 30 MHz



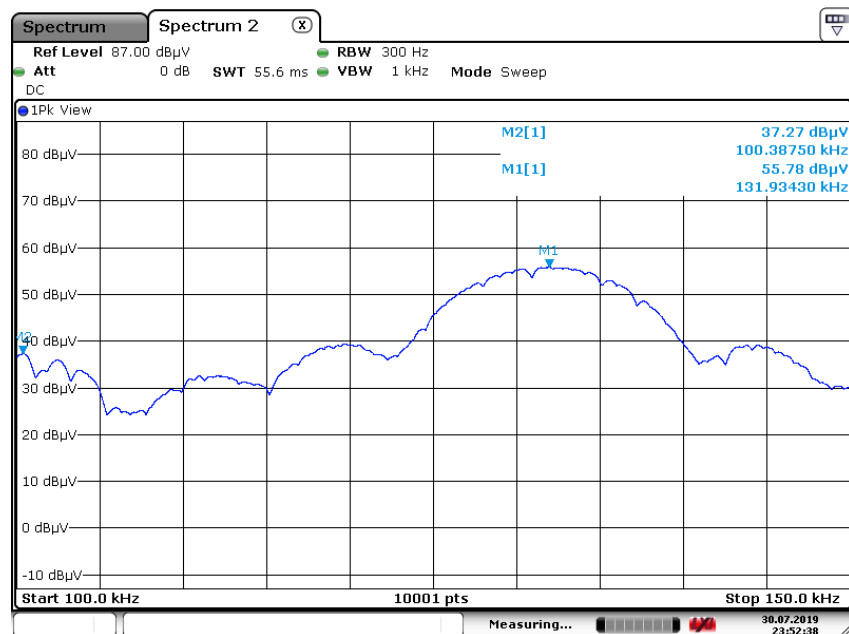
Standby Mode

* Frequency Range : 9 kHz – 100kHz



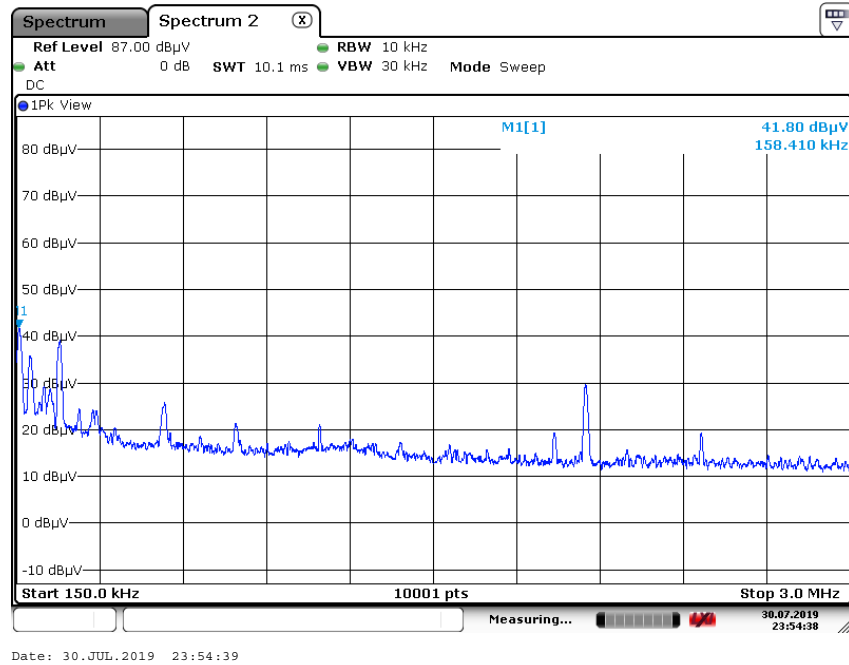
Date: 30.JUL.2019 23:50:25

* Frequency Range : 100 kHz – 150kHz

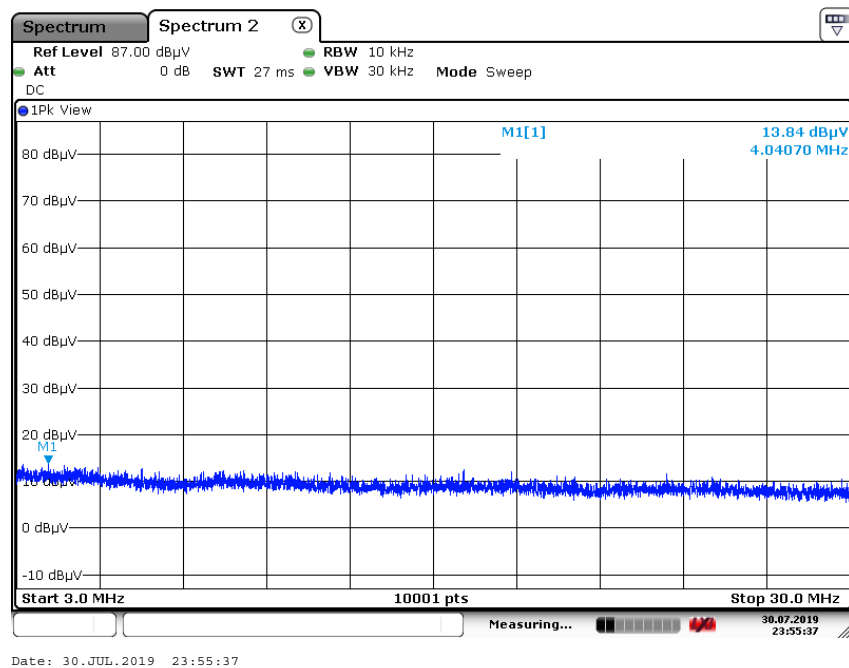


Date: 30.JUL.2019 23:52:39

* Frequency Range : 150 kHz – 3 MHz



* Frequency Range : 3 MHz – 30 MHz



9. EMISSION BANDWIDTH

Test Settings

1. Analyzer frequency set to the frequency of the radiated spurious emissipn of interst
2. RBW : 300 Hz
(Becasuse 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 : Maxhold
7. Trace was allowed to stabilize

Limit

None

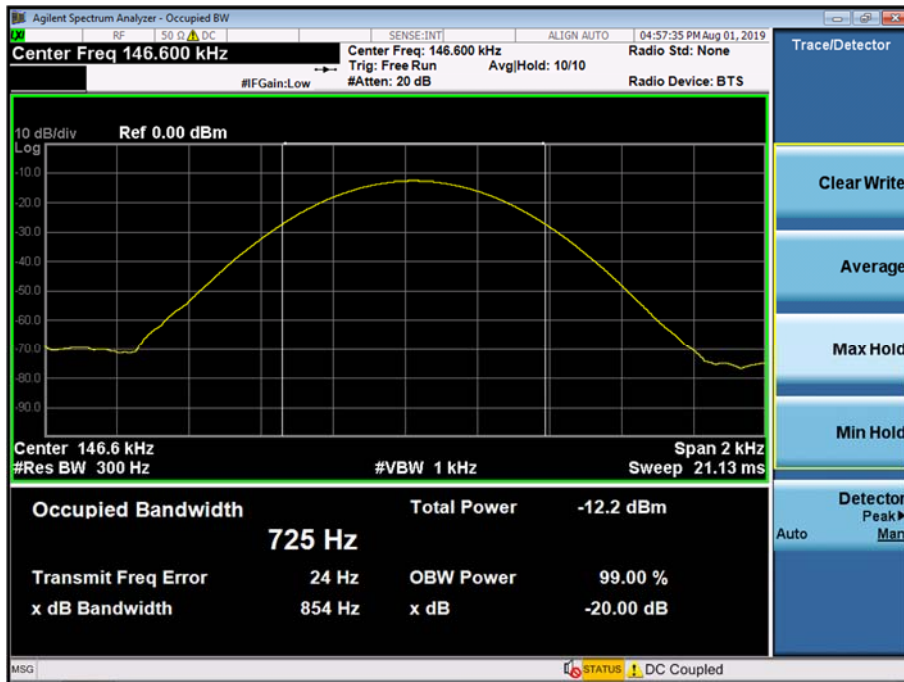
(for reporting purposes only.)

▣ Test Result

Test Frequency (kHz)	20dB Bandwidth (kHz)	Occupied Bandwidth (kHz)
146.6	0.854	0.725
147.9	0.854	0.725

Test Plot

Test Frequency : 146.6kHz



Test Frequency : 147.9kHz



10. 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*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

*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

▣ Test Result

We don't perform AC powerline conducted emission test.
Because power supply of EUT is used only DC.

11. Receiver Spurious Emissions

Limit

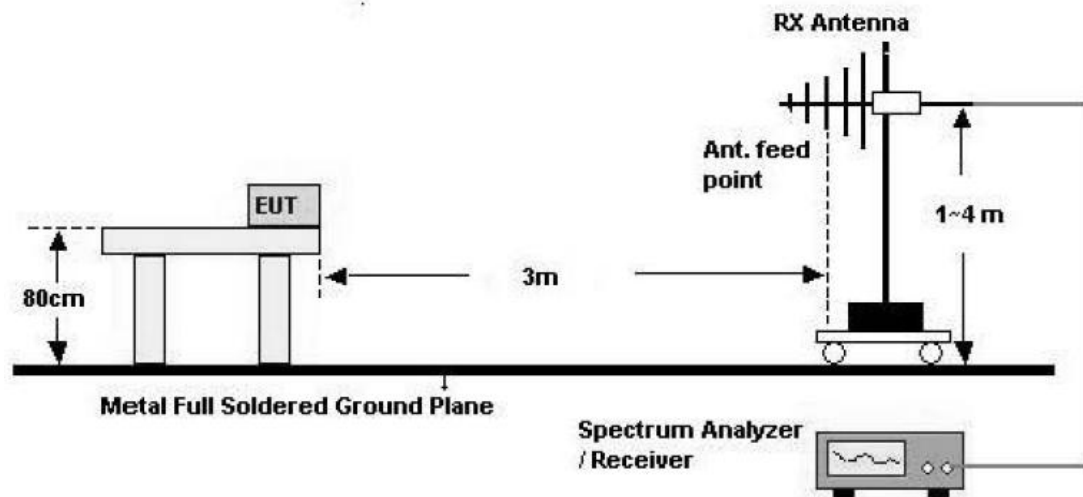
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

Measurements for compliance with the limits in table may be performed at distances other than 3 metres.

Test Configuration

30 MHz - 1 GHz



Test Procedure of Radiated spurious emissions(Below 1GHz)

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. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 100 kHz
 - VBW $\geq 3 \times$ RBW
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHz

*In general, (1) is used mainly
6. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
7. 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 (MHz)	Reading Level (dBuV/m)@3m	Ant.Factor (dB/m)	Cable Loss (dB)	Distance Correction (dB)	Result Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
No Critical peaks found							

12. LIST OF TEST EQUIPMENT

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Hewlett Packard	E3632A / DC Power Supply	06/18/2019	Annual	KR75303960
Agilent	8493C-10 / Attenuator(10 dB)	07/15/2019	Annual	08285
Api tech.	18B-03 / Attenuator (3 dB)	06/04/2019	Annual	1
Rohde & Schwarz	EMC32 / Software	N/A	N/A	N/A
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
Emco	2090 / Controller	N/A	N/A	060520
Ets	Turn Table	N/A	N/A	N/A
Rohde & Schwarz	Loop Antenna	08/23/2018	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	03/22/2019	Biennial	760
Schwarzbeck	VULB 9160 / TRILOG Antenna	08/09/2018	Biennial	9160-3368
Schwarzbeck	BBHA 9120D / Horn Antenna	04/29/2019	Biennial	9120D-937
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/28/2018	Annual	101068-SZ
Agilent	N9020A / Signal Analyzer	05/23/2019	Annual	MY51110085

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.

13. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-1908-FI001-P