

TEST REPORT



DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1612-0164

2. Customer

- Name : DRTECH Corporation
- Address : Suite No.2, 3 Floor, 29, Dunchon-daero 541beon-gil Seongnam-si, Gyeonggi-do, Republic of Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : Wireless Charging System / EVS WPCS
FCC ID : RNH-EVSWPCS

5. Test Method Used : FCC Part 15 Subpart C

6. Date of Test : 2016-08-23 ~ 2016-09-03

7. Testing Environment : See appended test report

8. Test Result : Refer to the attached Test Result

Affirmation	Tested by	Technical Manager
	Name : KwiCheol, Yeom (Signature)	Name : Geunki Son (Signature)

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2016 . 12 . 22 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1612-0164	Dec. 22, 2016	Initial issue

CONTENTS

1. EUT information.....	4
1.1 Description of EUT	4
1.2 Support equipment.....	4
2. Information about test items.....	5
2.1 Test mode.....	5
2.2 Tested environment	5
2.5 EMI Suppression Device(s)/Modifications	5
3. Facilities and Accreditations	6
3.1 Facilities	6
3.2 Equipment.....	6
4. Test Report.....	7
4.1 Summary of tests	7
4.2 Transmitter requirements.....	8
4.2.1 20 dB Bandwidth	8
4.2.2 Radiated Emissions	9
4.2.3 AC Line Conducted Emissions	11
5. Antenna Requirements.....	14
APPENDIX I	15

1. EUT information

1.1 Description of EUT

FCC Equipment Class	Part 15 Low Power Transmitter Below 1705 kHz (DCD)
Equipment type	Wireless Charging System
Equipment model name	EVS WPCS
Equipment add model name	NA
Equipment serial no.	Identical prototype
Frequency	110 ~ 205 kHz
Output power	Max : 15 W
Power	AC 120V 60Hz
Antenna type	Coil Antenna(single coil)

1.2 Support equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Note: The above equipment was supported by manufacturer.

2. Information about test items

2.1 Test mode

This device has been tested with the below test modes and charging current conditions:

Test Mode (Charging Current)	Load condition	Support Equipment
Low mA	50.0 Ω	Client device(WPC RX Board)
Mid mA	16.0 Ω	
High mA	5.3 Ω	

2.2 Tested environment

Temperature	: 22 ~ 23 °C
Relative humidity content	: 42 ~ 45 % R.H.
Details of power supply	: AC 120 V 60 Hz

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Facilities and Accreditations

3.1 Facilities

The semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935 The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number: 165783

3.2 Equipment

Radiated emissions are measured with one or more of the following types of antennas: loop, tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide horn. Spectrum analyzers with pre-selectors and peak, 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."

4. Test Report

4.1 Summary of tests

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
Test Items					
2.1049	N/A	20 dB Bandwidth	N/A	Radiated	C
15.209	RSS-Gen [8.5]	Radiated Emission	FCC 15.209 limits		C ^{Note2}
15.207	RSS-Gen [8.8]	AC Conducted Emissions	FCC 15.207 limits	AC Line Conducted	C ^{Note2}
15.203	RSS-Gen [8.3]	Antenna Requirements	FCC 15.203	-	C
Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable Note 2: Power Adapter has been used in the test.					

The sample was tested according to the following specification:
ANSI C-63.10 2013

4.2 Transmitter requirements

4.2.1 20 dB Bandwidth

- Procedure:

The 20 dB bandwidth is measured with a spectrum analyzer connected via a receiving antenna placed near the EUT while the EUT is operating.

Tested Frequency(kHz)	Test Results(kHz)
116.500	0.162



4.2.2 Radiated Emissions

- Limit: FCC Part 15.209(a) & RSS-GEN 8.5

Frequency [MHz]	Field Strength [uV/m]	Measurement Distance [Meters]
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

** 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.

- Procedure:

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- Measurement Data: **Comply** (refer to the next page)

- Measurement Data:

Measurement Distance : 3 Meters

Tested Mode	Emissions (Note 1)	Freq. [MHz]	Det. Mode	Worst case ANT pol (Note 2)	Reading [dBuV]	T.F [dB/m]	D.C.F.	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
Low mA	S	0.074	PK	F	39.70	19.30	80	-21.00	30.22	51.22
	F	0.113	PK	F	70.40	19.20	80	9.60	26.54	16.94
	S	0.116	PK	F	71.70	19.20	80	10.90	26.32	15.42
	S	0.344	PK	F	51.60	19.20	80	-9.20	16.87	26.07
	S	0.577	PK	F	41.10	19.10	40	20.20	32.38	12.18
	S	1.736	PK	F	21.10	19.30	40	0.40	29.54	29.14
	S	50.976	PK	V	49.20	-16.60	0	32.60	40.00	7.40
	S	165.191	PK	H	52.80	-14.80	0	38.00	43.50	5.50
Mid mA	S	0.066	PK	F	33.80	19.30	80	-26.90	31.21	58.11
	F	0.117	PK	F	69.60	19.20	80	8.80	26.24	17.44
	S	0.120	PK	F	71.40	19.20	80	10.60	26.02	15.42
	S	0.232	PK	F	43.70	19.20	80	-17.10	20.29	37.39
	S	0.359	PK	F	52.30	19.20	80	-8.50	16.50	25.00
	S	0.601	PK	F	41.20	19.10	40	20.30	32.03	11.73
	S	0.839	PK	F	33.40	19.30	40	12.70	29.13	16.43
	S	1.076	PK	F	31.90	19.30	40	11.20	26.97	15.77
	S	1.804	PK	F	22.40	19.30	40	1.70	29.54	27.84
	S	52.219	PK	V	50.20	-16.60	0	33.60	40.00	6.40
	S	163.615	PK	H	51.70	-14.70	0	37.00	43.50	6.50
High mA	S	0.041	PK	F	39.40	19.30	80	-21.30	35.35	56.65
	S	0.060	PK	F	38.00	19.30	80	-22.70	32.04	54.74
	S	0.083	PK	F	37.20	19.20	80	-23.60	29.22	52.82
	S	0.124	PK	F	64.20	19.20	80	3.40	25.74	22.34
	F	0.129	PK	F	66.20	19.20	80	5.40	25.39	19.99
	S	0.383	PK	F	45.10	19.20	80	-15.70	15.94	31.64
	S	0.640	PK	F	35.80	19.10	40	14.90	31.48	16.58
	S	0.897	PK	F	32.30	19.30	40	11.60	28.55	16.95
	S	1.920	PK	F	17.90	19.30	40	-2.80	29.54	32.34
	S	50.976	PK	V	50.10	-16.60	0	33.50	40.00	6.50
	S	166.888	PK	H	53.20	-14.90	0	38.30	43.50	5.20

Note 1. "F" = Fundamental emission / "S" = Spurious emission / "*" = Noise Floor

Note 2. "F": = Facing the antenna / "T" = antenna shifted / turned 90s degrees [Loop antenna]
"H": = Horizontal / "V" = Vertical [Bilog antenna]

Note 3. The worst case data were reported.
And no other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 4. Distance Correction Factor(D.C.F.)
For 300m: $40 \cdot \log(300/3) = 80 \text{ dB}$ & For 30m: $40 \cdot \log(30/3) = 40 \text{ dB}$

Note 5. Sample calculation
 $T.F = AF + CL - AG$ / $\text{Field Strength} = \text{Reading} + T.F - D.C.F.$
 $\text{Margin} = \text{Limit} - \text{Field Strength}$
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain
D.C.F = Distance Correction Factor

4.2.3 AC Line Conducted Emissions

- Minimum Standard: FCC Part 15.207 & RSS-GEN 8.8

Frequency Range (MHz)	Conducted Limit (dBuV)	
	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

- Procedure:

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

- Measurement Data: **Comply** (refer to the next page)

- Measurement Data (Graph): Low mA (50Ω)

Results of Conducted Emission

DTNC

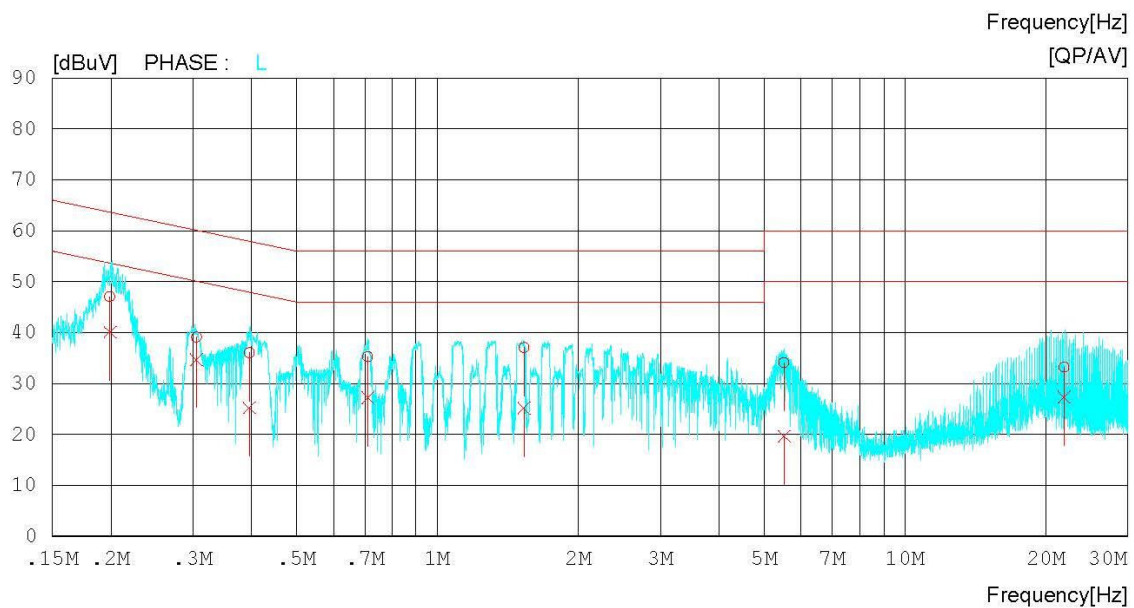
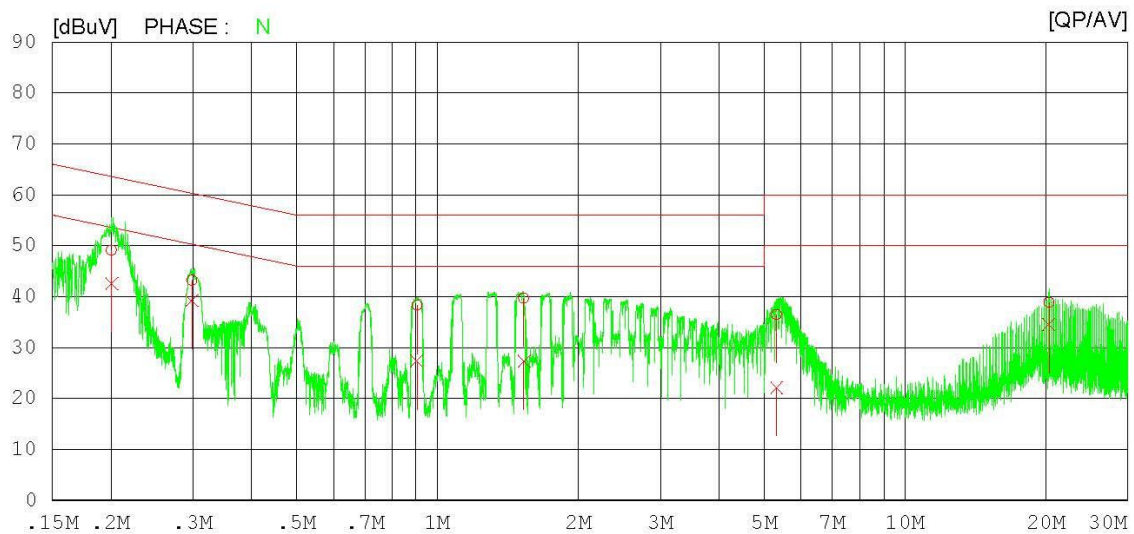
Date : 2016-09-03

Order No. :
Model No. : EVS WPCS
Serial No. : Identical prototype
Test Condition :

Reference No. :
Power Supply : 120V 60Hz
Temp/Humi. : 23 'C 43 % R.H.
Operator : K.C.YEOM

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV



- Measurement Data (List): Low mA (50Ω)

Results of Conducted Emission

DTNC

Date : 2016-09-03

Order No. :
Model No. : EVS WPCS
Serial No. : Identical prototype
Test Condition :

Reference No. :
Power Supply : 120V 60Hz
Temp/Humi. : 23 °C 43 % R.H.
Operator : K.C.YEOM

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.20091	39.1	32.6	10.0	49.1	42.6	63.6	53.6	14.5	11.0	N
2	0.29850	33.3	29.2	10.0	43.3	39.2	60.3	50.3	17.0	11.1	N
3	0.90374	28.2	17.2	10.1	38.3	27.3	56.0	46.0	17.7	18.7	N
4	1.53140	29.5	17.2	10.2	39.7	27.4	56.0	46.0	16.3	18.6	N
5	5.31320	26.1	11.7	10.4	36.5	22.1	60.0	50.0	23.5	27.9	N
6	20.32720	28.1	23.7	10.8	38.9	34.5	60.0	50.0	21.1	15.5	N
7	0.19920	37.0	30.1	10.0	47.0	40.1	63.6	53.6	16.6	13.5	L
8	0.30521	29.1	24.7	10.0	39.1	34.7	60.1	50.1	21.0	15.4	L
9	0.39590	26.0	15.2	10.0	36.0	25.2	57.9	47.9	21.9	22.7	L
10	0.71035	25.1	17.0	10.1	35.2	27.1	56.0	46.0	20.8	18.9	L
11	1.53240	26.8	14.9	10.2	37.0	25.1	56.0	46.0	19.0	20.9	L
12	5.52040	23.7	9.2	10.4	34.1	19.6	60.0	50.0	25.9	30.4	L
13	21.88600	22.1	16.3	11.0	33.1	27.3	60.0	50.0	26.9	22.7	L

5. Antenna Requirements

■ **According to FCC 47 CFR §15.203 & RSS-Gen [8.3]**

“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.”

The antenna is permanently attached.

Please refer to the internal photo. Therefore this E.U.T Complies with the requirement of §15.203

APPENDIX I

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Signal Analyzer	Agilent Technologies	N9020A	16/02/24	17/02/24	MY50200816
DIGITAL MULTIMETER	Agilent	34401A	16/01/05	17/01/05	US36099541
AC Power Supply(SLIDAC)	DAEKWANG	5KVA	16/02/24	17/02/24	20060321-1
Thermohygrometer	BODYCOM	BJ5478	16/01/06	17/01/06	090205-4
Vector Signal Generator	Rohde Schwarz	SMBV100A	16/01/05	17/01/05	255571
EMI TEST RECEIVER	R&S	ESR7	15/10/19	16/10/19	101109
Loop Antenna	Schwarzbeck	FMZB1513	16/04/22	18/04/22	1513-128
Bilog Antenna	Schwarzbeck	VULB 9160	16/08/05	18/08/05	9160-3362
Low Noise Pre Amplifier	tsj	MLA-010K01-B01-27	16/03/10	17/03/10	1844538
EMI TEST RECEIVER	R&S	ESU	16/07/18	17/07/18	100469
EMI TEST RECEIVER	R&S	ESCI	16/02/25	17/02/25	100364
SINGLE-PHASE MASTER	NF	4420	15/09/09	16/09/09	3049354420023
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	16/06/22	17/06/22	000WX20305
PULSE LIMITER	R&S	ESH3-Z2	16/01/05	17/01/05	101334