

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 : DRTFCC2311-0156(1)

2. Customer

- Name (FCC) : PLUTO Solution Inc.
- Address (FCC) : B-1122, Kumkang Penterium IT Tower 282, Hagui-ro, Dongan-gu Anyang-si, Gyeonggi-do South Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : SQF Charging station / NFC-100
FCC ID : 2AZ8A-NFC-100

5. FCC Regulation(s) : FCC Part 15 Subpart C

Test Method used : ANSI C63.10-2013

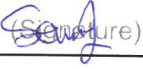
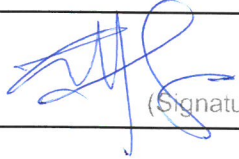
6. Date of Test : 2023.11.15 ~ 2023.11.27

7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

8. Testing Environment: See appended test report.

9. Test Result: Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by	Technical Manager
	Name : SeungMin Gil  (Signature)	Name : JaeJin Lee  (Signature)

2023 . 12 . 14 .

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	Tested by	Reviewed by
DRTFCC2311-0156	Nov. 30, 2023	Initial issue	SeungMin Gil	JaeJin Lee
DRTFCC2311-0156 (1)	Dec. 14, 2023	Revised description of EUT, Antenna requirement and Add calculation of emissions limit	SeungMin Gil	JaeJin Lee

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1. General Information

1.1. Description of EUT

FCC Equipment Class	Part 15 Low Power Transmitter Below 1705kHz(DCD)
Product Name	SQF Charging station
Model Name	NFC-100
Add Model Name	-
Firmware Version Identification Number	V1.11
EUT Serial Number	No Specified
Wireless charging output	Max : 50 W
Power Supply	DC 12.6 V
Antenna type	Coil Antenna

1.2. Testing Laboratory

Dt&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.		
The test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014.		
- FCC & IC MRA Designation No. : KR0034		
- ISED#: 5740A		
www.dtnet.net		
Telephone	:	+ 82-31-321-2664
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1.3. Testing Environment

Ambient Condition	
▪ Temperature	21 °C ~ 22 °C
▪ Relative Humidity	38 % ~ 42 %

1.4. Measurement Uncertainty

Parameter	Measurement uncertainty
AC power-line conducted emission	3.4 dB (The confidence level is about 95 %, k = 2)
Radiated emission (1 GHz Below)	4.8 dB (The confidence level is about 95 %, k = 2)

2. Information about test items

2.1 Test mode and Support equipment

This device has been tested with typical client device.

Support Equipment	Model Name	Manufacturer	NOTE
SQF Flow rate FOUP	NFD-100	PLUTO Solution Inc.	Client device
AC ADAPTER	CAD150241	Channel Well Technology	-

Note: The above equipment was supported by manufacturer.

2.3 EMI Suppression Device(s)/Modifications

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

3. Antenna requirements

“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 attached on the device by means of unique coupling method.

4. Test Report

4.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
15.215	20 dB Bandwidth	N/A	Radiated	C
15.209	Radiated Emission	Part 15.209 limits (Refer to section 4)		C
15.207	AC Conducted Emissions	Part 15.207 limits (Refer to section 4)	AC Line Conducted	C
15.203	Antenna Requirements	Part 15.203 (Refer to section 3)	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.

4.2 Transmitter requirements

4.2.1 20 dB Bandwidth

- Procedure:

The 20 dB Bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

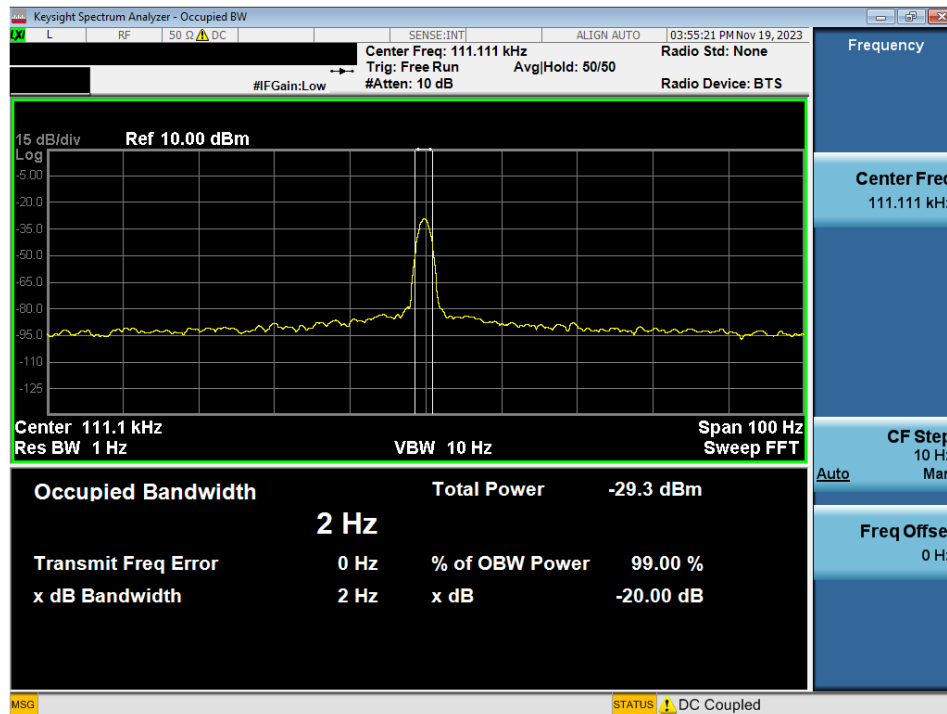
And spectrum analyzer setting use following test procedure of **ANCSI C63.10-2013 – Section 6.9.2.**

1. Center frequency = EUT channel center frequency
2. Span = 2 ~ 5 times the OBW
3. RBW = 1 % ~ 5 % OBW
4. VBW $\geq 3 \times$ RBW
5. Detector = Peak
6. Trace = Max hold
7. The trace was allowed to stabilize
8. Determine the reference value = Set the spectrum analyzer marker to the highest level of the displayed trace
9. Using the marker-delta function of the instrument, determine the “-xx dB down amplitude” using [(reference value) - xx].
10. Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

Note: Due to signal characteristics, the RBW setting cannot satisfy 1~5% of OBW.

- Measurement Data: **Comply**

Tested Frequency(kHz)	20dB Bandwidth(Hz)
111.1	2.0



Minimum Standard: NA

4.2.2 Radiated Emissions

- Limit: FCC Part 15.209(a): General requirement

Frequency [MHz]	Field Strength [uV/m]	Measurement Distance [Meters]
0.009 ~ 0.490	2 400/F (kHz)	300
0.490 ~ 1.705	24 000/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.
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 Frequency(kHz)	Freq. [MHz]	ANT pol (Note 2)	Reading [dBuV]	TF [dB/m]	DCF	Field Strength [dBuV/m]	Limit [dBuV/m]	Margin [dB]
111.1	*0.111	P	80.50	12.02	80	12.52	26.70	14.18
	0.334	P	58.50	11.95	80	-9.55	17.13	26.68
	0.553	P	49.40	11.98	40	21.38	32.75	11.37
	5.555	P	48.50	12.16	40	20.66	29.54	8.88
	30.010	V	47.10	-9.65	0	37.45	40.00	2.55
	57.130	H	47.10	-8.66	0	38.44	40.00	1.56
	57.770	V	44.30	-8.72	0	35.58	40.00	4.42
	63.980	H	42.10	-9.35	0	32.75	40.00	7.25
	76.150	V	42.80	-11.31	0	31.49	40.00	8.51
	182.820	H	47.30	-7.84	0	39.46	43.50	4.04

Note 1. * = Fundamental emission

Note 2. Loop antenna orientation (Below 30 MHz)

"P"= Parallel, "V"= perpendicular, "G"= ground-parallel

Bilog antenna polarization (Above 30 MHz)

"H"= Horizontal, "V"= Vertical

Note 3. All data were recorded using a spectrum analyzer employing a peak detector.

If PK results were meet Quasi-peak limit, Quasi-peak measurements were omitted.

Note 4. No other spurious and harmonic emissions were reported greater than listed emissions above table.

Note 5. Sample calculation

Margin = Limit – Field Strength

Field Strength = Reading + T.F – Distance factor

T.F = AF + CL – AG

Distance factor = $20\log(\text{Measurement distance} / \text{The measured distance})^2$

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

DCF= Distance Correction Factor

- Calculation of distance correction factor

At frequencies below 30 MHz = $40\log(\text{tested distance} / \text{specified distance})$

At frequencies at or above 30 MHz = $20\log(\text{tested distance} / \text{specified distance})$

- Calculation of Limit below 1.705 MHz:

Frequency [MHz]	Calculation of Limit
0.009 ~ 0.490	[dBuV/m] = $20 \times \log(2400/F \text{ kHz})$
0.490 ~ 1.705	[dBuV/m] = $20 \times \log(24000/F \text{ kHz})$

4.3. AC Power-Line Conducted Emissions

■ Test Requirements and limit, Part 15.207

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 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5.0	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

4.3.1. Test Setup

See test photographs for the actual connections between EUT and support equipment.

4.3.2. Test Procedures

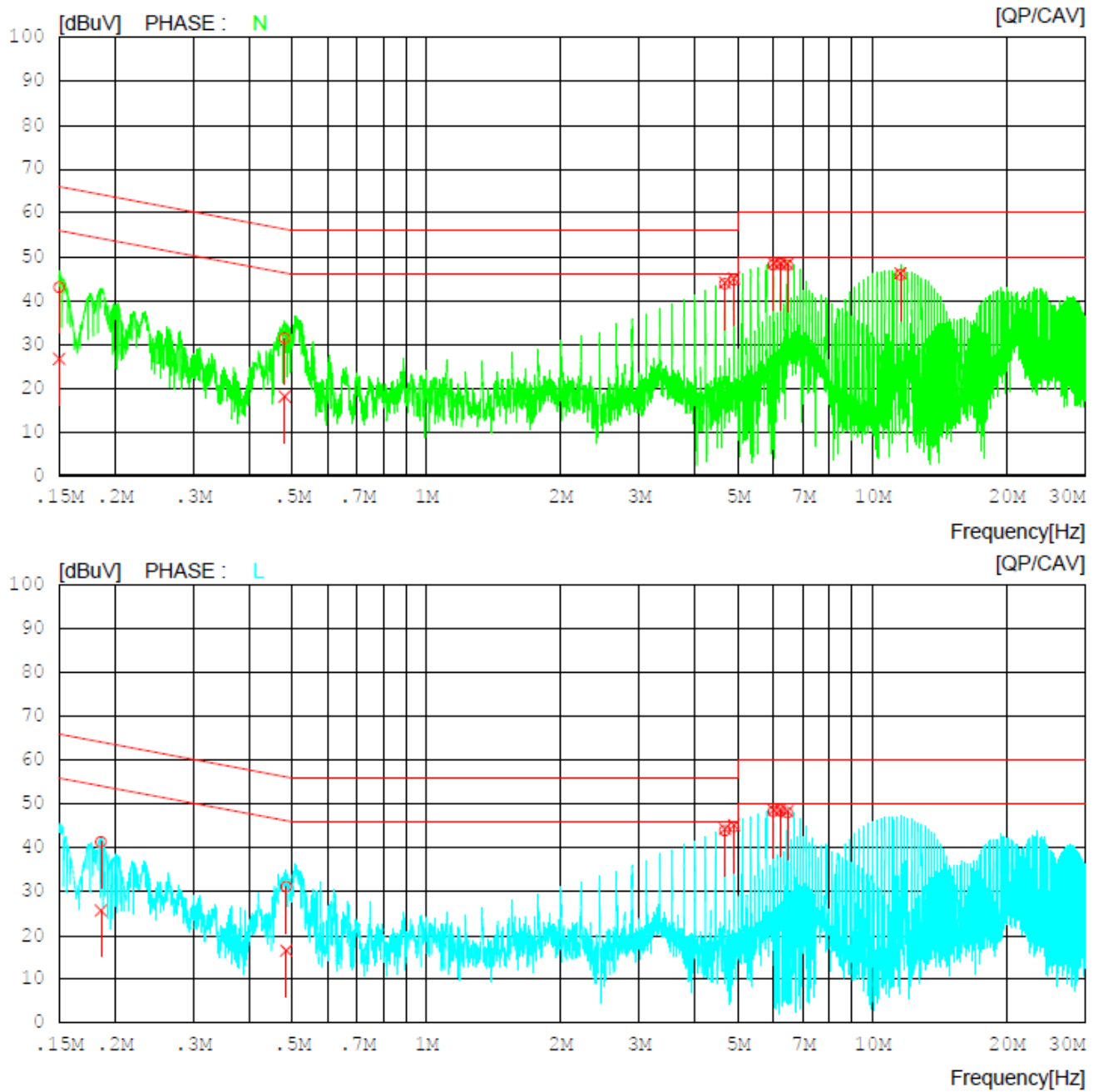
Conducted emissions from the EUT were measured according to the ANSI C63.10-2013.

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.

4.3.3. Test Results

Refer to the next page. (The worst case data was reported.)

AC Power-Line Conducted Emissions (Graph)



AC Power-Line Conducted Emissions (List)

NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.15019	33.13	16.77	9.91	43.04	26.68	65.99	55.99	22.95	29.31	N
2	0.48080	21.52	8.17	9.90	31.42	18.07	56.33	46.33	24.91	28.26	N
3	4.66700	33.76	34.09	9.99	43.75	44.08	56.00	46.00	12.25	1.92	N
4	4.88900	34.72	35.06	10.00	44.72	45.06	56.00	46.00	11.28	0.94	N
5	6.00000	38.13	38.46	10.03	48.16	48.49	60.00	50.00	11.84	1.51	N
6	6.22200	38.25	38.58	10.03	48.28	48.61	60.00	50.00	11.72	1.39	N
7	6.44440	38.06	38.34	10.03	48.09	48.37	60.00	50.00	11.91	1.63	N
8	11.55420	35.74	36.08	10.14	45.88	46.22	60.00	50.00	14.12	3.78	N
9	0.18641	31.47	15.84	9.89	41.36	25.73	64.20	54.20	22.84	28.47	L
10	0.48480	21.25	6.70	9.90	31.15	16.60	56.26	46.26	25.11	29.66	L
11	4.66700	34.00	34.35	9.99	43.99	44.34	56.00	46.00	12.01	1.66	L
12	4.88940	34.89	35.24	10.00	44.89	45.24	56.00	46.00	11.11	0.76	L
13	6.00040	38.32	38.67	10.03	48.35	48.70	60.00	50.00	11.65	1.30	L
14	6.22240	38.49	38.83	10.03	48.52	48.86	60.00	50.00	11.48	1.14	L
15	6.44360	38.06	38.37	10.03	48.09	48.40	60.00	50.00	11.91	1.60	L

APPENDIX I

TEST EQUIPMENT FOR TESTS

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	22/12/16	23/12/16	MY50110097
Receiver	Rohde Schwarz	ESCI3	23/06/23	24/06/23	100798
Multimeter	FLUKE	17B+	22/12/16	23/12/16	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	22/12/16	23/12/16	255571
Loop Antenna	ETS-Lindgren	6502	22/04/22	24/04/22	00203480
Hybrid Antenna	Schwarzbeck	VULB 9160	22/12/16	23/12/16	3362
PreAmplifier	H.P	8447D	22/12/16	23/12/16	2944A07774
Thermohygrometer	BODYCOM	BJ5478	22/12/16	23/12/16	120612-2
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	23/02/24	24/02/24	100364
PULSE LIMITER	ROHDE&SCHWARZ	ESH3-Z2	23/08/21	24/08/21	101333
LISN	SCHWARZBECK	NSLK 8128 RC	23/10/26	24/10/26	8128 RC-387
Thermo Hygro Meter	TESTO	608-H1	23/01/13	24/01/13	45084791
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-01
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-02
Cable	JUNKOSHA	MWX241/B	23/01/04	24/01/04	M-03
Cable	JUNKOSHA	J12J101757-00	23/01/04	24/01/04	M-07
Cable	HUBER+SUHNER	SUCOFLEX106	23/01/04	24/01/04	M-09
Cable	Dt&C	Cable	23/01/04	24/01/04	RFC-69
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0147
Test Software	tsj	Noise Terminal Measurement	NA	NA	Version 2.00.0185

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017

Note2: The cable is not a regular calibration item, so it has been calibrated by Dt&C itself.