

MPE TEST REPORT

OF

FCC CFR 47 part 1, 1.1307(b), 1.1310

FCC ID: 2ABEN-4ZH58

Equipment Under Test : Wireless charger transmitter
Model Name : 4ZH58-AP100/AP010
Applicant : Hanrim Postech Co., Ltd.
Manufacturer : Hanrim Postech Co., Ltd.
Date of Test(s) : 2013.11.19 ~ 2013.11.21
Date of Issue : 2013.12.20

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Logan Lee

Date:

2013.12.20

Approved By:



Feel Jeong

Date:

2013.12.20

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RTT5041-20(2013.07.27) (1)

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

A4(210mm x 297mm)

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1. General information

1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- Wireless Div. 3FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040
- 400-2, Gomae-dong, Giheung-gu, Yongin-si, Gyeonggi-do, Korea 446-901

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1.2. Details of applicant

Applicant : Hanrim Postech Co., Ltd.

Address : Head office, Hanrim B/D, 924, Kosaek-Dong, Kwonsun-Gu, Suwon-si, Gyeonggi-Do, Korea

Contact Person : Lee, Jae Kyung

Phone No. : +82 31 259 5170

1.3. Description of EUT

Kind of Product	Wireless charger transmitter
Model Name	4ZH58-AP100/AP010
Power Supply	DC 12.60 V (Used vehicle battery)
Frequency Range	87 kHz ~ 110 kHz
Operating Conditions	-30 °C ~ 75 °C
Antenna Type	Inductive loop coil antenna
H/W version	50-231-011-01
S/W version	V1.0.5

1.4. Declarations by the manufacturer

- Operation temperature: -30 °C ~ 75 °C

1.5. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL007136	Initial
1	F690501/RF-RTL007136-1	Added information item 5.2 of KDB 680106

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1.6. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Spectrum Analyzer	R&S	FSV30	101004	Jul. 20, 2013	Annual	Jul. 20, 2014
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Jul. 29, 2013	Biennial	Jul. 29, 2015
E-Field Probe	D.A.R.E Calibrations	E-field probe 10 kHz - 4 GHz	12I00078SNO11	Nov. 23, 2012	Annual	Nov. 23, 2013
B-Field Probe	Narda	BN 2300/90.10	J-0025	Jan. 21, 2013	Annual	Jan. 21, 2014
Exposure Level Meter	Narda	ELT-400	J-0015	Jan. 21, 2013	Annual	Jan. 21, 2014
Anechoic Chamber	WILL TECHNOLOGY	L × W × H (7.0 m × 4.0 m × 3.0 m)	N/A	N/A	N/A	N.C.R.
Mobile Test Unit	R&S	CMU200	109496	Feb. 13, 2013	Annual	Feb. 13, 2014

1.7. Worst case of test configurations

In order to check all kinds of possible configurations, EUT was evaluated with appropriate client and under each charging condition as below table.

EUT configuration	Charging current (mA)	Mobile phone	Description
Charging Mode ¹⁾ with resistive load	25		Maximum resistive load
	250		Medium resistive load
	500		Minimum resistive load
Charging Mode ²⁾ with client device (FCC ID : BCG-E2430A)		A1387	Less than 1 % of battery
		A1387	Less than 50 % of battery
		A1387	100 % full charging of battery
Charging Mode ²⁾ with client device (FCC ID : A3LSHVE300SA)		SHV-E300S	Less than 1 % of battery
		SHV-E300S	Less than 50 % of battery
		SHV-E300S	100 % full charging of battery

1) Test Jig was used during the test to satisfy each current status by using resistive loads.
Output current = 25 mA / 250 mA / 500 mA

2) WPC device with client device was investigated each battery status.

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Battery status during charging condition :

- Less than 1 % of battery
- Less than 50 % of battery
- 100 % of battery

Galaxy S4 (SHV-E300S)

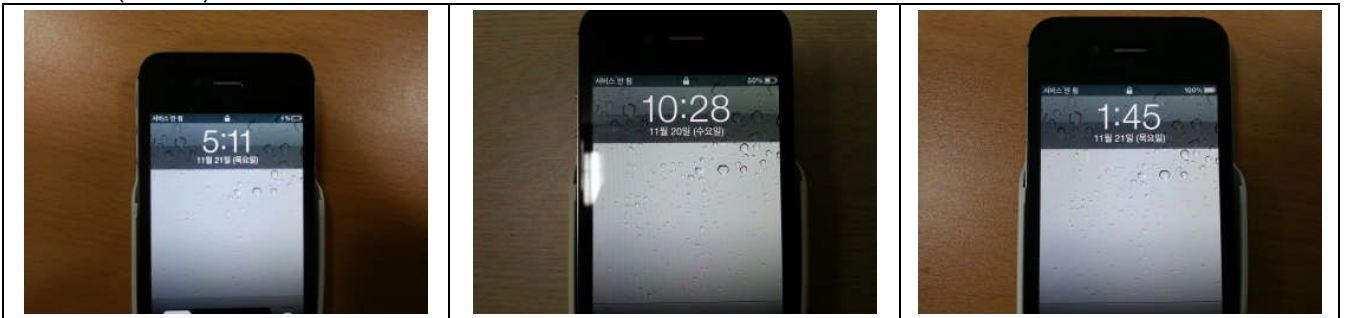


Plot#1 – less than 1 % of battery

Plot#2 – less than 50 % of battery

Plot#3 – 100 % of battery

I Phone (A1387)



Plot#1 – less than 1 % of battery

Plot#2 – less than 50 % of battery

Plot#3 – 100 % of battery

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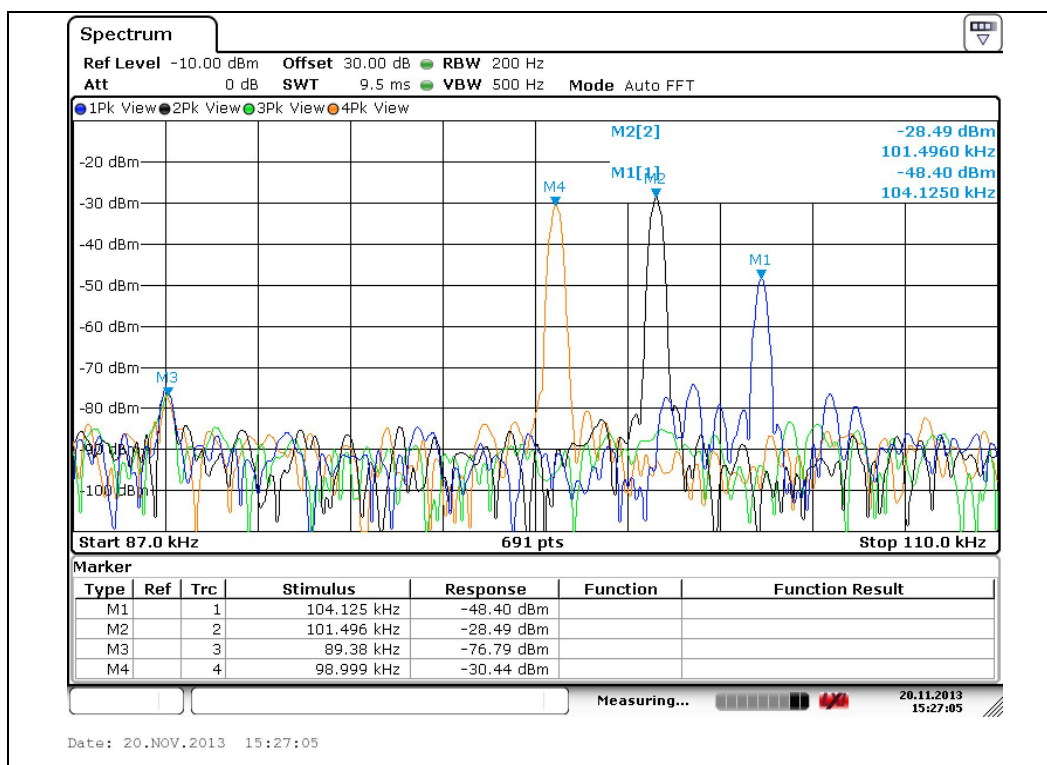
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Operating configurations :

Galaxy S4 (SHV-E300S)

- While the client device was in airplane mode (Trace#1 "M1")
- While the client device was connected to an active data connection (Trace#2 "M2")
The device was tested under all modes and bands like 2G and 3G.
In the result, **GSM1900 / GPRS / 1 TX** was found in **Middle channel**.
- While the wireless charger is charging without the client device. (Trace#3 "M3")
- While the wireless charger is charging with the client device turned off. (Trace#4 "M4")



Plot – fundamental emission comparison

- The level of Trace#2 was more than Trace#1, 3 and 4 so Trace#2 was selected.
- Trace#2 as **GSM850 / GPRS / 1 TX** which was found in **Middle channel** should be tested with the client device as a worst case.

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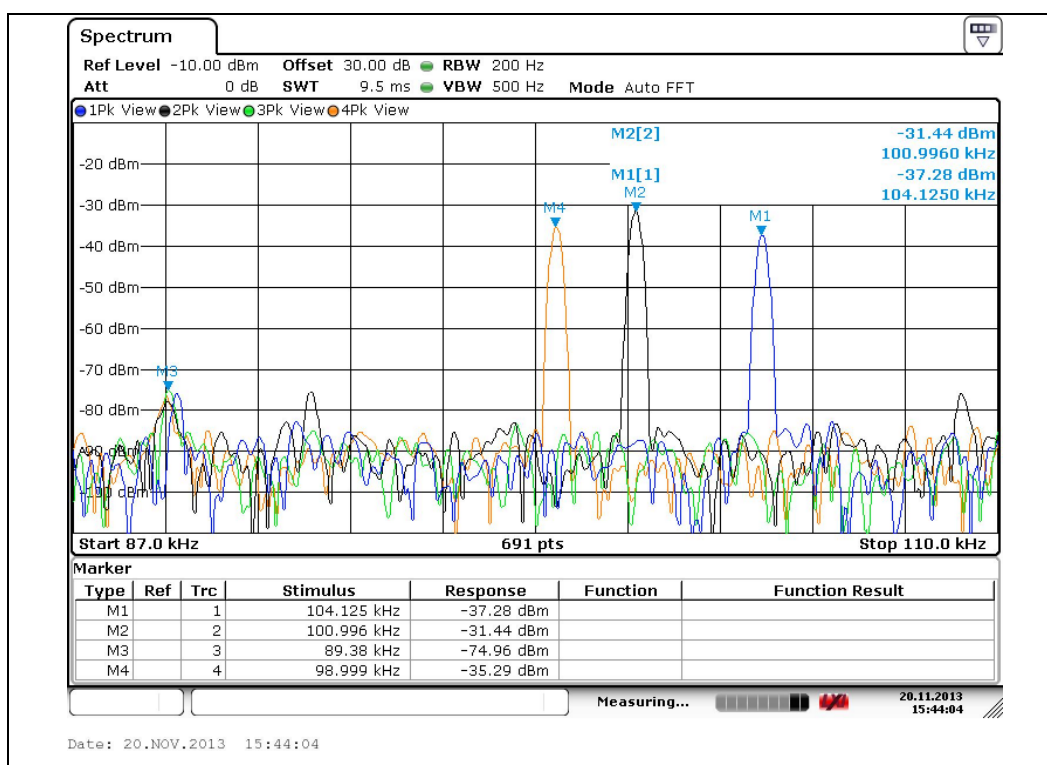
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I Phone (A1387)

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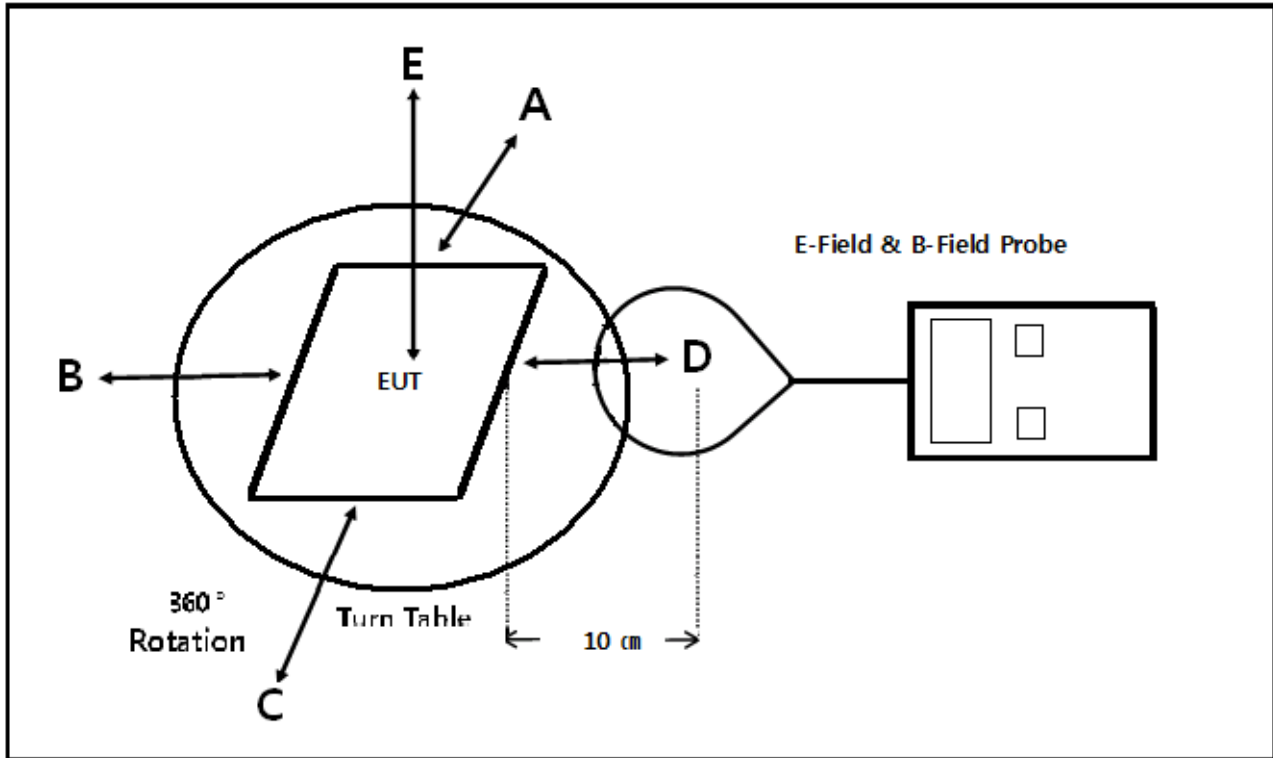
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2. Test Result

2.1. Test Setup



2.2. Measurement procedure

- The RF exposure test was performed on 360 degree turn table in anechoic chamber.
- The measurement probe was placed at test distance (10 cm) which is between the edge of the charger and the geometric center of probe.
- The turn table was rotated 360 degree to search of highest strength
- the highest emission level was recorded and compared with limit as soon as measurement of each points (A, B, C, D, E) were completed.
- The EUT were measured according to the dictates of KDB 680106 D01v02.

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2.3. Equipment Approval Considerations.

The EUT does comply with item 5.2 of KDB 680106 D01v02.

a) Power transfer frequency is less than 1 MHz.

- The device operate in the frequency range from 87 kHz to 110 kHz.

b) Output power from each primary coil is less than 5 watts.

- The maximum field strength of fundamental : 72.60 dB μ V/m at 3 m. The EIRP calculation is reference to KDB 789033.

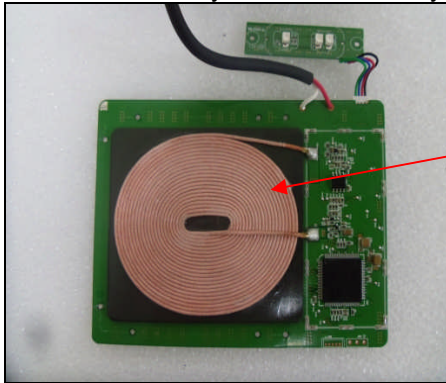
$$* \text{EIRP}[\text{dB m}] = E[\text{dB}\mu\text{V/m}] + 20\log(d[\text{meters}]) - 104.77 - 4.8 \text{ dB}, d = 3 \text{ m}$$

$$* 72.60 \text{ dB}\mu\text{V/m} - 95.2 - 4.8 = -27.4 \text{ dB m EIRP.}$$

$$* \text{The output power from primary coil is } 0.0018 \text{ mW.}$$

c) The transfer system includes only single primary and secondary coils. This includes charging systems that may have multiple primary coils and clients that are able to detect and allow coupling only between individual pairs of coils.

- The transfer system includes only single primary and secondary coils.



Transmitter single primary coil

d) Client device is inserted in or placed directly in contact with the transmitter.

- Client device is placed directly in contact with the transmitter. Refer to following photo.



e) The maximum coupling surface area of the transmit (charging) device is between 60 cm² and 400 cm².

- The EUT coupling surface area : 16.1 cm(W) × 8.2 cm(H) = 132.02 cm², 60 cm² < 132.02 cm² < 400 cm²

f) Aggregate leakage fields at 10 cm surrounding the device from all simultaneous transmitting coils are demonstrated to be less than 30 % of the MPE limit.

- The EUT field strength levels are 30 % × MPE limit < Level < MPE limit. Refer to following test results.
0.162 A/m < 0.51 A/m (max.) < 0.54 A/m.

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2.4. Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

§1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of FCC part 2.1093 of this chapter

TABLE 1 - LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
(A) Limits for Occupational /Control Exposures				
0.3 – 3.0	614	1.63	*(100)	6
3.0 – 30	1842/f	4.89/f	*(900/f ²)	6
30 – 300	61.4	0.163	1.0	6
300 – 1 500			f/300	6
1 500 – 100 000			5	6
(B) Limits for General Population / Uncontrol Exposures				
<u>0.3 – 1.34</u>	<u>614</u>	1.63	*(100)	30
1.34 – 30	824/f	2.19/f	*(180/f ²)	30
30 – 300	27.5	0.073	0.2	30
300 – 1 500			f/1 500	30
1 500 – 100 000			1.0	30

f = frequency in MHz

* = Plane wave equivalent power density

Note 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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2.5. E and H field strength

Ambient temperature : $(24 \pm 1) ^\circ\text{C}$

Relative humidity : 47 % R.H.

Test Mode : Charging mode with resistive loads

2.5.1. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with resistive load (25 mA status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	1.32	3.05	4.34	1.28	6.53	614.00

2.5.2. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with resistive load (250 mA status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	1.14	3.57	2.92	1.16	7.13	614.00

2.5.3. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with resistive load (500 mA status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	1.88	4.93	3.49	1.51	9.51	614.00

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Test Mode : Charging mode with client device _Galaxy S4(SHV-E300S)

2.5.4. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (less than 1 % battery status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	0.78	3.18	2.21	2.48	8.92	614.00

2.5.5. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (less than 50 % battery status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	0.81	3.22	2.14	2.15	9.44	614.00

2.5.6. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (100 % battery status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	0.81	3.09	2.07	2.12	8.30	614.00

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Test Mode : Charging mode with client device _I Phone(A1387)

2.5.7. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (less than 1 % battery status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	4.01	3.17	2.65	1.97	7.81	614.00

2.5.8. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (less than 50 % battery status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	3.15	5.91	7.63	4.49	16.24	614.00

2.5.9. E-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (100 % battery status)

Frequency Range (kHz)	Probe Position A (V/m)	Probe Position B (V/m)	Probe Position C (V/m)	Probe Position D (V/m)	Probe Position E (V/m)	Limits (V/m)
87 ~ 110	3.95	5.78	7.58	3.54	16.35	614.00

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Test Mode : Charging mode with resistive loads

2.5.10. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with resistive load (25 mA status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.18	0.18	0.19	0.20	0.31	0.54

2.5.11. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with resistive load (250 mA status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.18	0.18	0.18	0.21	0.32	0.54

2.5.12. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with resistive load (500 mA status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.18	0.20	0.19	0.22	0.35	0.54

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Test Mode : Charging mode with client device _Galaxy S4(SHV-E300S)

2.5.13. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (less than 1 % battery status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.22	0.20	0.22	0.34	0.30	0.54

2.5.14. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (less than 50 % battery status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.20	0.18	0.21	0.31	0.30	0.54

2.5.15. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (100 % battery status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.22	0.19	0.21	0.34	0.34	0.54

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Test Mode : Charging mode with client device _I Phone(A1387)

2.5.16. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (less than 1 % battery status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.19	0.19	0.21	0.19	0.45	0.54

2.5.17. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (less than 50 % battery status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.18	0.18	0.20	0.18	0.47	0.54

2.5.18. H-Field Strength at 10 cm from the edges surrounding the EUT

Test condition: Charging mode with client (100 % battery status)

Frequency Range (kHz)	Probe Position A (A/m)	Probe Position B (A/m)	Probe Position C (A/m)	Probe Position D (A/m)	Probe Position E (A/m)	Limits (A/m)
87 ~ 110	0.19	0.20	0.22	0.21	0.51	0.54

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