

TEST REPORT

OF

FCC Part 18

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) : 2013.11.20 ~ 2013.12.03
Date of Issue : 2013.12.04

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

Tested By:



Logan Lee

Date:

2013.12.04

Approved By:



Feel Jeong

Date:

2013.12.04

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RTT5041-20(2013.07.27) (1)

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

A4(210mm x 297mm)

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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Telephone : +82 31 428 5700

FAX : +82 31 427 2371

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
Maximum Field strength	37.27 dB μ V/m at 3 m / -42.73 dB μ V/m at 300 m
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

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1.5. 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
Test Receiver	R&S	ESU40	100075	Feb. 15, 2013	Annual	Feb. 15, 2014
Mobile Test Unit	R&S	CMU200	109496	Feb. 13, 2013	Annual	Feb. 13, 2014
Turn Table	INNCO SYSTEMS	DT-3000S-3T	N/A	N/A	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L x W x H (21.5 m x 13.0 m x 9.0 m)	N/A	N/A	N/A	N.C.R.

1.6. 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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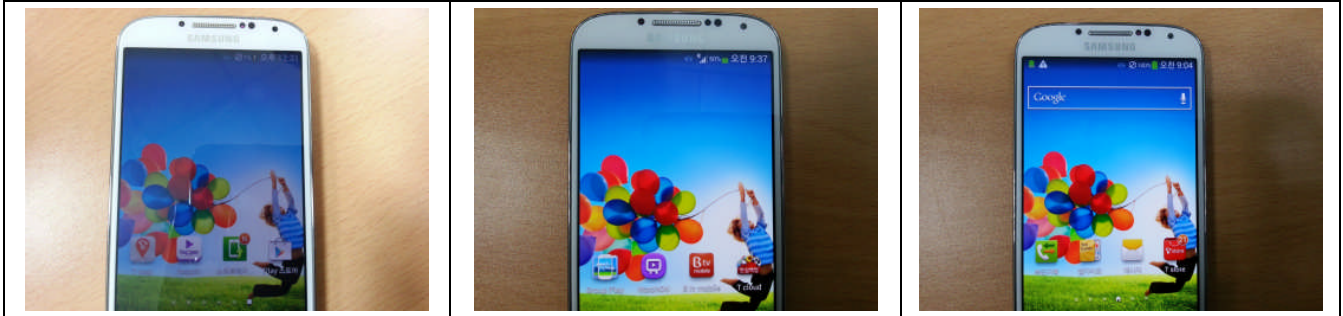
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Battery status during charging condition :

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

Galaxy S4 (SHV-E300S)

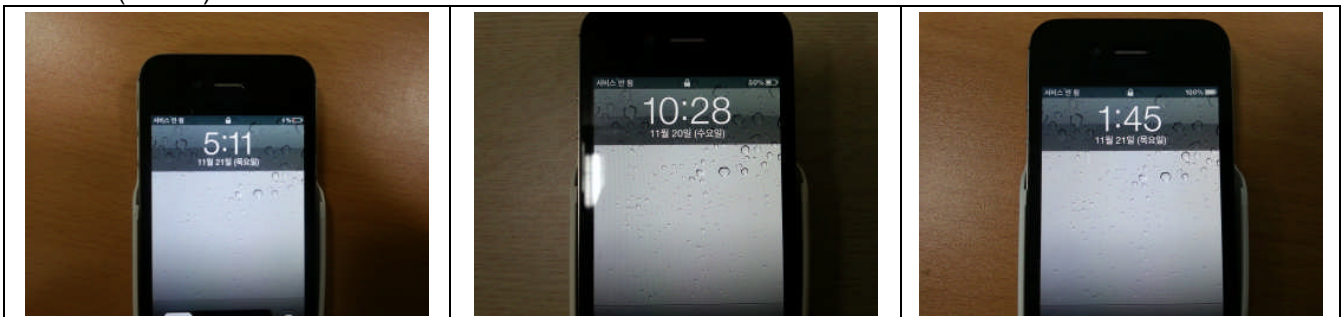


Plot#1 – less than 1 % of battery

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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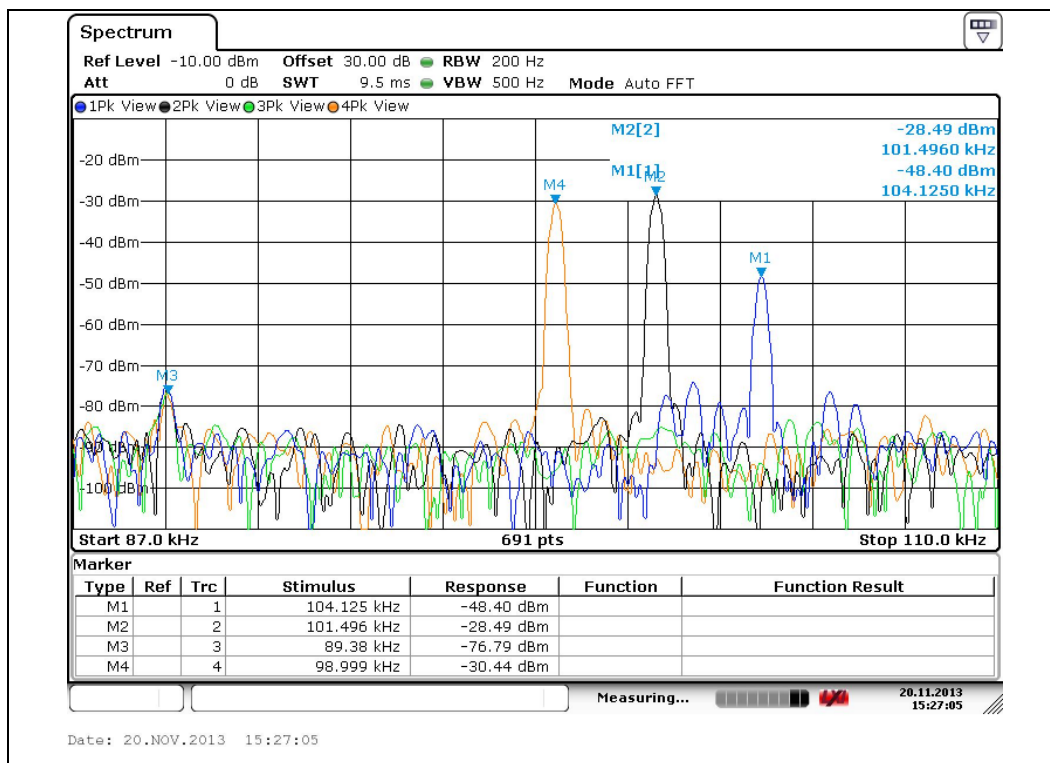
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Operating configurations :

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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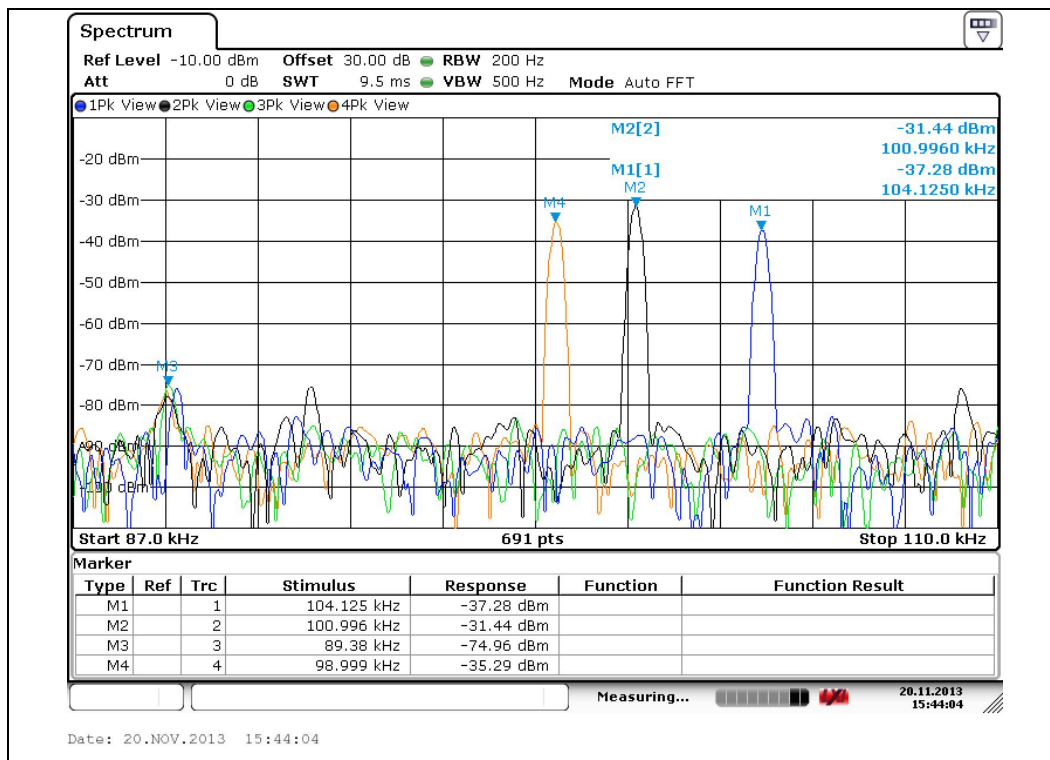
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I Phone (A1387)

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The device was tested under all modes and bands like 2G and 3G.
In the result, **GSM850 / GPRS / 1 TX** was found in **Middle channel**.
- While the wireless charger is charging without the client device. (Trace#3 "M3")
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1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 18		
Section in FCC Part 18	Test Item	Result
18.305	Radiated Emission	Complied
18.307	AC Power Line Conducted Emission	N/A ¹⁾

Note;

N/A¹⁾: This requirement does not apply for this equipment because DUT used only DC voltage from vehicle battery.

1.8. Test Report Revision

Revision	Report number	Description
0	F690501/RF-RTL007137	Initial

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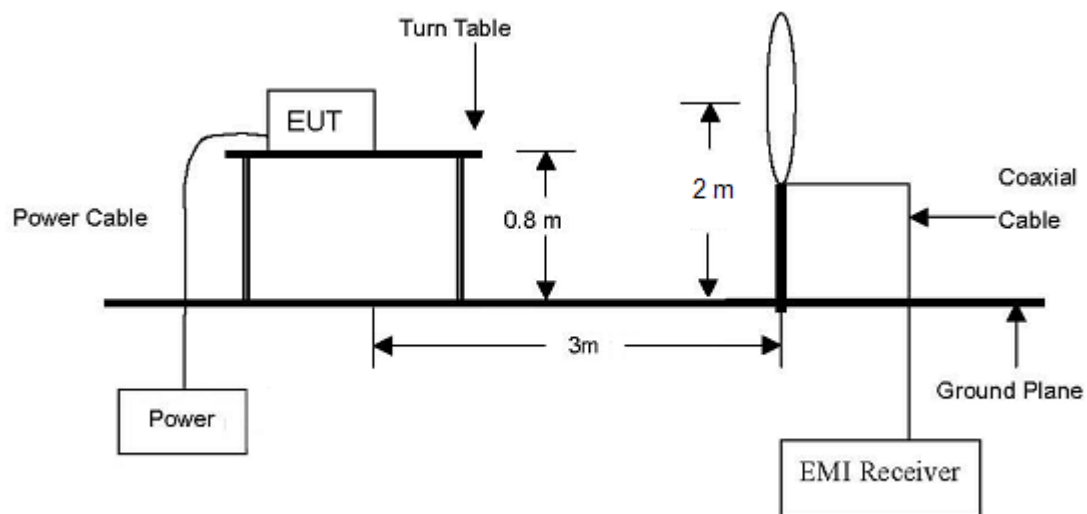
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A4(210mm x 297mm)

2. Field Strength of Fundamental & Spurious emissions

2.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz.



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2.2. Limit

2.2.1. Radiated emission limits

According to §15.305 (b), The field strength levels of emissions which lie outside the bands specified in §15.301, unless otherwise indicated, shall not exceed the following :

Equipment	Operating frequency	RF power generated by equipment(watts)	Field strength limit($\mu\text{V}/\text{m}$)	Distance (meter)
Any type unless otherwise specified(miscellaneous)	Any ISM frequency	Below 500 500 or more	25 25 \times SQRT (power/500)	300 ¹ 300
	<u>Any non-ISM frequency</u>	<u>Below 500</u> 500 or more	<u>15</u> 15 \times SQRT (power/500)	<u>300</u> ¹ 300
Industrial heaters and RF stabilized arc welders	On or below 5,725 MHz Above 5,725 MHz	Any Any	10 (²)	1600 (²)
Medical diathermy	Any ISM frequency Any non-ISM frequency	Any Any	25 15	300 300
Ultrasonic	Below 490 kHz	Below 500 500 or more	2,400/F(kHz) 2,400/F(kHz) \times SQRT(power/500)	300 ³ 300
	490 to 1,600 kHz Above 1,600 kHz	Any Any	24,000/F(kHz) 15	30 30
Induction cooking ranges	Below 90 kHz On or above 90 kHz	Any Any	1,500 300	⁴ 30 ⁴ 30

¹Field strength may not exceed 10 $\mu\text{V}/\text{m}$ at 1 600 meters. Consumer equipment operating below 1 000 MHz is not permitted the increase in field strength otherwise permitted here for power over 500 watts.

²Reduced to the greatest extent possible.

³Field strength may not exceed 10 $\mu\text{V}/\text{m}$ at 1 600 meters. Consumer equipment is not permitted the increase in field strength otherwise permitted here for over 500 watts.

⁴Induction cooking ranges manufactured prior to February 1, 1980, shall be subject to the field strength limits for miscellaneous ISM equipment.

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2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of MP-5.

2.3.1. Test Procedures for emission from 9 kHz to 30 MHz

- a. 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.
- b. Then antenna is a loop antenna is fixed at 2 meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- e. The test data of the worst-case condition was recorded.

Below 150 kHz, Set the spectrum analyzer : RBW = 200 Hz, VBW \geq RBW, Span = enough to catch the trace, Sweep time = auto, Detector function = Quasi-peak, Trace mode = Max hold.

150 kHz to 30 MHz, Set the spectrum analyzer : RBW = 9 kHz, VBW \geq RBW, Span = enough to catch the trace, Sweep time = auto, Detector function = Quasi-peak, Trace mode = Max hold.

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2.4. Test Result

Ambient temperature : (24 ± 1) °C
Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

2.4.1. Field Strength of Fundamental

2.4.1.1. Test mode : Charging mode with resistive load

A. Charging mode with resistive load (Charging current 25 mA status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 300 m ¹
0.103	48.80	Q.P.	H	20.03	0.47	69.30	-10.70

B. Charging mode with resistive load (Charging current 250 mA status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 300 m ¹
0.104	47.70	Q.P.	H	20.03	0.47	68.20	-11.80

C. Charging mode with resistive load (Charging current 500 mA status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dBμV/m) at 3 m	Actual (dBμV/m) at 300 m ¹
0.104	51.60	Q.P.	H	20.03	0.47	72.10	-7.90

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2.4.1.2. Test mode : Charging mode with client device_Galaxy S4(SHV-E300S)

A. Charging mode with client device (less than 1 % battery status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹
0.104	47.90	Q.P.	H	20.03	0.47	68.40	-11.60

B. Charging mode with client device (less than 50 % battery status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹
0.104	49.70	Q.P.	H	20.03	0.47	70.20	-9.80

C. Charging mode with client device (100 % battery status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹
0.104	44.40	Q.P.	H	20.03	0.47	64.90	-15.10

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2.4.1.3. Test mode : Charging mode with client device_I Phone(A1387)

A. Charging mode with client device (less than 1 % battery status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m
0.104	52.10	Q.P.	H	20.03	0.47	72.60	-7.40

B. Charging mode with client device (less than 50 % battery status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹
0.104	48.20	Q.P.	H	20.03	0.47	68.70	-11.30

C. Charging mode with client device (100 % battery status)

Radiated Emissions			Ant	Correction Factors		Total	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹
0.104	44.40	Q.P.	H	20.03	0.47	64.90	-15.10

Note;

1. Actual at 300 m = Actual at 3 m + 40 log(3/300)

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2.4.2. Spurious Emissions

2.4.2.1. Test mode : Charging mode with resistive load

A. Charging mode with resistive load (Charging current 25 mA status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.043	7.20	Q.P.	V	20.19	0.29	27.68	-52.32	23.52	75.84
0.150	16.80	Q.P.	V	19.99	0.48	37.27	-42.73	23.52	66.25
Above 0.200	Not detected	-	-	-	-	-	-	-	-

B. Charging mode with resistive load (Charging current 250 mA status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.066	7.20	Q.P.	H	20.06	0.37	27.63	-52.37	23.52	75.89
0.294	11.80	Q.P.	H	20.01	0.50	32.31	-47.69	23.52	71.21
Above 0.300	Not detected	-	-	-	-	-	-	-	-

C. Charging mode with resistive load (Charging current 500 mA status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.065	4.10	Q.P.	V	20.06	0.36	24.52	-55.48	23.52	79.00
0.246	12.50	Q.P.	H	19.99	0.50	32.99	-47.01	23.52	70.53
Above 0.300	Not detected	-	-	-	-	-	-	-	-

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2.4.2.2. Test mode : Charging mode with client device_Galaxy S4(SHV-E300S)

A. Charging mode with client device (less than 1 % battery status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.115	2.80	Q.P.	V	20.04	0.47	23.31	-56.69	23.52	80.21
0.294	11.50	Q.P.	H	20.01	0.50	32.01	-47.99	23.52	71.51
Above 0.300	Not detected	-	-	-	-	-	-	-	-

B. Charging mode with client device (less than 50 % battery status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.045	7.70	Q.P.	H	20.17	0.30	28.17	-51.83	23.52	75.35
0.294	11.60	Q.P.	H	20.01	0.50	32.11	-47.89	23.52	71.41
Above 0.300	Not detected	-	-	-	-	-	-	-	-

C. Charging mode with client device (100 % battery status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.062	5.30	Q.P.	V	20.06	0.35	25.71	-54.29	23.52	77.81
0.150	16.70	Q.P.	H	19.99	0.48	37.17	-42.83	23.52	66.35
Above 0.200	Not detected	-	-	-	-	-	-	-	-

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A4(210mm x 297mm)

2.4.2.3. Test mode : Charging mode with client device_I Phone(A1387)

A. Charging mode with client device (less than 1 % battery status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.034	9.90	Q.P.	V	20.21	0.27	30.38	-49.62	23.52	73.14
0.294	12.00	Q.P.	H	20.01	0.50	32.51	-47.49	23.52	71.01
Above 0.300	Not detected	-	-	-	-	-	-	-	-

B. Charging mode with client device (less than 50 % battery status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.059	4.90	Q.P.	H	20.06	0.34	25.30	-54.70	23.52	78.22
0.294	11.80	Q.P.	H	20.01	0.50	32.31	-47.69	23.52	71.21
Above 0.300	Not detected	-	-	-	-	-	-	-	-

C. Charging mode with client device (100 % battery status)

Radiated Emissions			Ant	Correction Factors		Total		FCC Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	Ant. (dB/m)	Cable (dB)	Actual (dB μ V/m) at 3 m	Actual (dB μ V/m) at 300 m ¹	Limit (dB μ V/m) at 300 m	Margin (dB)
0.046	11.50	Q.P.	V	20.16	0.30	31.96	-48.04	23.52	71.56
0.294	12.00	Q.P.	H	20.01	0.50	32.51	-47.49	23.52	71.01
Above 0.300	Not detected	-	-	-	-	-	-	-	-

Note;

1. Actual at 300 m = Actual at 3 m + 40 log(3/300)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

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