

TEST REPORT

of

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

FCC ID: A3LSIP007AFS00

Equipment Under Test : ARTIK-0710
Model Name : SIP007AFS00
Applicant : Samsung Electronics Co., Ltd.
Manufacturer : Samsung Electronics Co., Ltd.
Date of Receipt : 2016.06.01
Date of Test(s) : 2016.07.11 ~ 2016.08.11
Date of Issue : 2016.08.12

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

Tested By:


Jungmin Yang

Date:

2016.08.12

Technical
Manager:


Alvin Kim

Date:

2016.08.12

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SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-20(2015.10.01)(3)

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210mm x 297mm)

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

-Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Telephone : +82 31 688 0901

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1.2. Details of applicant

Applicant : Samsung Electronics Co., Ltd.

Address : 1, Samsung-ro, Giheung-gu, Yongin-si, Gyeonggi-do, 17113 Korea

Contact Person : Lee, Jae-Hyuk

Phone No. : +82 10 8848 6628

1.3. Description of EUT

Kind of Product	ARTIK-0710
Model Name	SIP007AFS00
Power Supply	DC 4.2 V
Frequency Range	2 402 MHz ~ 2 480 MHz (Bluetooth, Bluetooth Low Energy), 2 405 MHz ~ 2 475 MHz (Zigbee), 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20), 5 745 MHz ~ 5 825 MHz (Band 3: 11a/n_HT20, 11ac_VHT20), 5 755 MHz ~ 5 795 MHz (Band 3: 11n_HT40, 11ac_VHT40), 5 775 MHz (Band 3: 11ac_VHT80), 5 180 MHz ~ 5 240 MHz (Band 1: 11a/n_HT20, 11ac_VHT20), 5 190 MHz ~ 5 230 MHz (Band 1: 11n_HT40, 11ac_VHT40), 5 210 MHz (Band 1: 11ac_VHT80), 5 260 MHz ~ 5 320 MHz (Band 2A: 11a/n_HT20, 11ac_VHT20), 5 270 MHz ~ 5 310 MHz (Band 2A: 11n_HT40, 11ac_VHT40), 5 290 MHz (Band 2A: 11ac_VHT80), 5 500 MHz ~ 5 720 MHz (Band 2C: 11a/n_HT20, 11ac_VHT20), 5 510 MHz ~ 5 710 MHz (Band 2C: 11n_HT40, 11ac_VHT40), 5 530 MHz ~ 5 690 MHz (Band 2C: 11ac_VHT80)
Modulation Technique	DSSS, OFDM, GFSK, $\pi/4$ DQPSK, 8DPSK
Number of Channels	79 channel (Bluetooth), 40 channel (Bluetooth Low Energy), 15 channel (Zigbee), 11 channel (11b/g/n_HT20), 5 channel (Band 3: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 3: 11n_HT40, 11ac_VHT40), 1 channel (Band 3: 11ac_VHT80), 4 channel (Band 1: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 1: 11n_HT40, 11ac_VHT40), 1 channel (Band 1: 11ac_VHT80), 4 channel (Band 2A: 11a/n_HT20, 11ac_VHT20), 2 channel (Band 2A: 11n_HT40, 11ac_VHT40), 1 channel (Band 2A: 11ac_VHT80), 9 channel (Band 2C: 11a/n_HT20, 11ac_VHT20), 4 channel (Band 2C: 11n_HT40, 11ac_VHT40), 2 channel (Band 2C: 11ac_VHT80)
Antenna Type	Dipole antenna
Antenna Gain	2 400 MHz ~ 2 483.5 MHz: 1.10 dB i, 5 150 MHz ~ 5 350 MHz: 0.91 dB i, 5 470 MHz ~ 5 725 MHz: 0.69 dB i, 5 725 MHz ~ 5 850 MHz: -1.52 dB i
H/W Version	0710-1.0
S/W Version	0710GC0F-41F-01Q0

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1.4. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL010231	2016.08.12	Initial

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2. RF Exposure Evaluation

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

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
(A) Limits for Occupational/Controlled Exposure				
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/Uncontrolled Exposure				
0.3 – 1.34	614	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/1500	30
<u>1 500 – 100 000</u>	-	-	<u>1.0</u>	<u>30</u>

2.1.1. Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

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2.1.2. Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data

Test Mode : Normal Operation

2.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

Bluetooth

- Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
0	2 402	8.5	1.10	0.001 814	1

Bluetooth Low Energy

- Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
0	2 402	4.5	1.10	0.000 722	1

Zigbee

- Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
1	2 405	7.5	1.10	0.001 441	1

WLAN (2.4G)

- Maximum tune up tolerance

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
6	2 437	17	1.10	0.012 845	1

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WLAN (5G)**- Maximum tune up tolerance**

Channel	Channel Frequency (MHz)	Output Average Power to Antenna (dB m)	Antenna Gain (dB i)	Power Density at 20 cm (mW/cm ²)	Limits (mW/cm ²)
36	5 180	16.5	0.91	0.010 958	1
64	5 320	16	0.91	0.009 766	1
100	5 500	15.5	0.69	0.008 274	1
165	5 825	15	-1.52	0.004 433	1

Note :

The power density Pd (5th column) at a distance of 20 cm calculated from the friis transmission formula is far below the limit of 1 mW/cm².

Simultaneous transmission MPE test exclusion

Bluetooth: the ratio is 0.001 814 / 1

Bluetooth Low Energy: the ratio is 0.000 722 / 1

Zigbee: the ratio is 0.001 441 / 1

WLAN: the ratio is 0.012 845 / 1

Confirm the sum result of individual MPEs ratio is ≤ 1.0 ;

$$(0.001\ 814 / 1) + (0.000\ 722 / 1) + (0.001\ 441 / 1) + (0.012\ 845 / 1) = 0.016\ 822 \leq 1.0$$

So this device meets the KDB447498 D01 v06 section 7.2 requirement of "Simultaneous transmission MPE test exclusion".

- End of the Test Report -

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