

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : OT-19D-RWD-076
AGR No. : A194A-027
Applicant : Samsung Electronics Co Ltd
Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, United States
Manufacturer : Samsung Electronics Co Ltd
Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, United States
Type of Equipment : ARTIK-0710
FCC ID. : A3LSIP007AFS00
Model Name : SIP007AFS00
Multiple Model Name : N/A
Serial number : N/A
Total page of Report : 16 pages (including this page)
Date of Incoming : April 29, 2019
Date of issue : December 17, 2019

SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.247*
 This test report only contains the result of a single test of the sample supplied for the examination.
 It is not a generally valid assessment of the features of the respective products of the mass-production.


 Reviewed by: _____
 Ha-Ram Lee / Assistant Manager
 ONETECH Corp.


 Approved by: _____
 Jae-Ho Lee / Chief Engineer
 ONETECH Corp.

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
OT-19D-RWD-076	December 17, 2019	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd
 Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, United States
 Contact Person : Jenni Chun / General Manager
 Telephone No. : 973-808-6375
 FCC ID. : A3LSIP007AFS00
 Model Name : SIP007AFS00
 Brand Name : N/A
 Serial Number : N/A
 Date : December 17, 2019

EQUIPMENT CLASS	<i>DSS – PART 15 SPREAD SPECTRUM TRANSMITTER</i>
KIND OF EQUIPMENT	ARTIK-0710
HOST MODEL NAME / TYPE REF.	ExoAtlet® -II / EA2010
THIS REPORT CONCERNS	Change in Antenna Type(Chip Antenna, 1dBi gain)
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m Semi Anechoic Chamber

- The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

- As change of Antenna Type, The Tx spurious emission test has been performed.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (2)	6 dB bandwidth	N/A (See Note 1)
15.247 (b) (3)	Maximum Peak Conducted Output Power	N/A (See Note 1)
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	N/A (See Note 1)
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (e)	Peak Power Spectral Density	N/A (See Note 1)
15.209	Radiated Emission Limits	Met the Limit / PASS
15.207	Conducted Limits	N/A (See Note 2)
15.203	Antenna Requirement	N/A (See Note 1)

- Note 1: This Module(SIP007AFS00) has been certified. Therefore, these test item has not been performed. To apply this module in the end product, only Tx Spurious test has been performed.

- Note 2: This test is not performed as the EUT is operated by DC battery.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

-. Lab Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The Samsung Electronics Co Ltd, Model SIP007AFS00 (referred to as the EUT in this report) is an ARTIK-0710. Product specification information described herein was obtained from product data sheet or user’s manual.

Device Type	ARTIK-0710
RF Spec.	<p>Please refer to the following approved RF test report.</p> <ul style="list-style-type: none"> • Bluetooth (Test report No.: KR18-SRF0117-A, Testing Lab: KCTL Inc.) • Bluetooth LE (Test report No.: KR18-SRF0120-A, Testing Lab: KCTL Inc.) • WLAN (Test report No.: KR18-SRF0119-A, Testing Lab: KCTL Inc.)
Electrical Rating	DC 29.4 V

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION**5.1 Justification**

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	N/A	N/A	-

5.2 Peripheral equipment

-None

5.3 Configuration of Test System

Line Conducted Test: The EUT was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter open area test site.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.4 Antenna Requirement

For intentional device, according to section 15.203 an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The transmitter antenna of the EUT is Chip Antenna, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Charging mode	X

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. Test data for radiated emission

7.1 Radiated Emission which fall in the Restricted Band

7.1.1 Test data for Worst Case

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 30 MHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 327.06	14.50	Peak	H	27.90	2.91	-	45.31	74.00	28.69
2 338.81	5.12	Average	H				35.93	54.00	18.07
2 338.57	14.81	Peak	V				45.62	74.00	28.38
2 340.17	5.11	Average	V				35.92	54.00	18.08
Test Data for High Channel									
2 483.66	14.04	Peak	H	27.50	2.91	-	44.45	74.00	29.55
2 486.26	4.38	Average	H				34.79	54.00	19.21
2 484.17	14.87	Peak	V				45.28	74.00	28.72
2 487.45	4.96	Average	V				35.37	54.00	18.63

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



Tested by: Yu-Seog Sim / Assistant Manager

7.2 Spurious & Harmonic Radiated Emission

7.2.1 Test data for Worst Case

- Test Date : September 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Detector : Peak Mode(Peak), Average Mode(RMS)
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
4 824.00	15.91	Peak	H	30.84	7.28	-	54.03	74.00	19.97
	6.27	Average	H				44.39	54.00	9.61
	15.85	Peak	V				53.97	74.00	20.03
	6.35	Average	V				44.47	54.00	9.53
Test Data for Middle Channel									
4 884.00	16.20	Peak	H	30.01	7.42	-	53.63	74.00	20.37
	6.65	Average	H				44.08	54.00	9.92
	16.12	Peak	V				53.55	74.00	20.45
	6.68	Average	V				44.11	54.00	9.89
Test Data for High Channel									
4 924.00	16.73	Peak	H	30.01	7.42	-	54.16	74.00	19.84
	6.82	Average	H				44.25	54.00	9.75
	16.21	Peak	V				53.64	74.00	20.36
	7.14	Average	V				44.57	54.00	9.43

Tabulated test data for Spurious & Harmonic

Remark: "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



Tested by: Yu-Seog Sim / Assistant Manager

8. RADIATED EMISSION TEST

8.1 Operating environment

Temperature : 24 °C
Relative humidity : 47 % R.H.

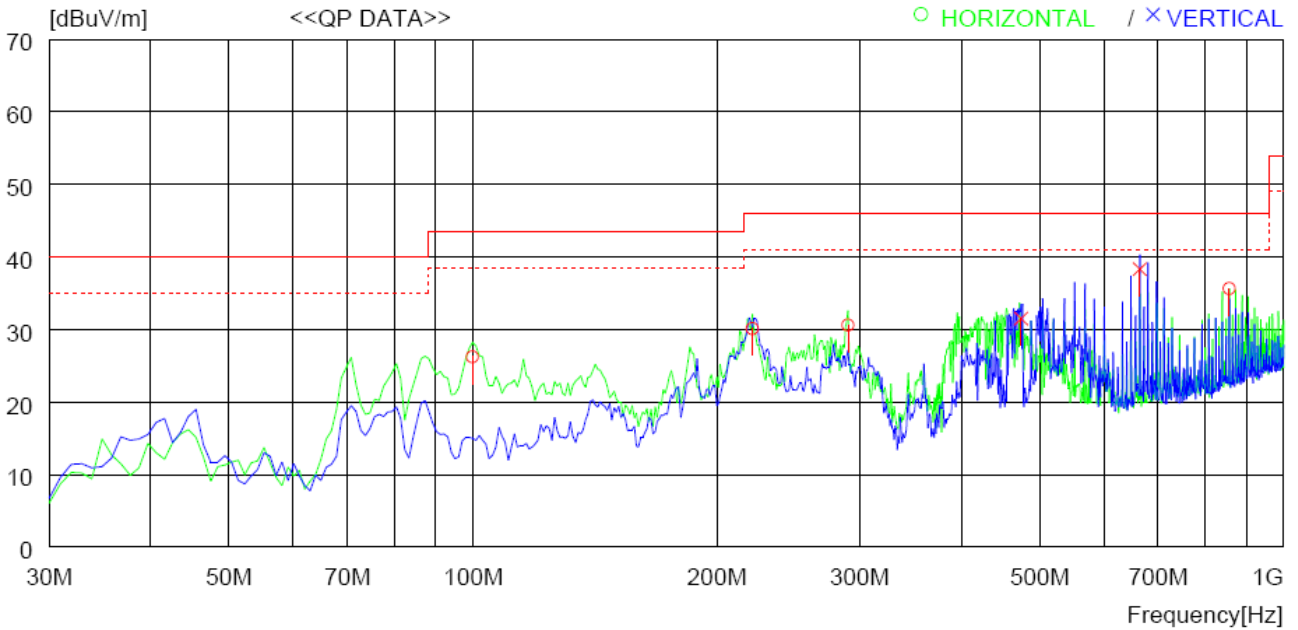
8.2 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

8.3 Test data for 30 MHz ~ 1 GHz

- Test Date : December 09, 2019 ~ December 11, 2019
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 1 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	99.840	45.2	12.1	2.0	33.1	26.2	43.5	17.3	200	72
2	221.090	49.0	11.3	2.8	33.0	30.1	46.0	15.9	200	0
3	289.960	47.1	13.3	3.2	33.0	30.6	46.0	15.4	100	359
4	856.430	41.2	21.6	5.6	32.8	35.6	46.0	10.4	200	130
----- Vertical -----										
5	474.261	43.6	17.0	4.1	33.2	31.5	46.0	14.5	100	359
6	664.376	47.0	19.6	5.1	33.4	38.3	46.0	7.7	100	0

Tested by: Yu-Seog Sim / Assistant Manager

8.4 Test data for Below 30 MHz

- . Test Date : December 09, 2019 ~ December 11, 2019
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
All emissions observed were 20 dB below the limit.									

8.5 Test data for above 1 GHz

- . Test Date : December 09, 2019 ~ December 11, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
All emissions observed were 20 dB below the limit.									



Tested by: Yu-Seog Sim / Assistant Manager

9. LIST OF TEST EQUIPMENT

No.	Model Number	Manufacturer	Description	Serial Number	LAST CAL. (Interval)	USE
1	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2019 (1Y)	
2	310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 18, 2019 (1Y)	■
3	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)	■
4	BBV 9718 B	Schwarzbeck	Broadband Preamplifier	009	Mar. 20, 2019 (1Y)	■
5	MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A	■
6	HD100	HD GmbH	Position Controller	N/A	N/A	■
7	DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A	■
8	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)	■
9	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	Jun. 05, 2018 (2Y)	■
10	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Jul. 16, 2019 (1Y)	■
11	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)	■
12	SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Mar. 11, 2019 (1Y)	■

All test equipment used is calibrated on a regular basis.