

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

Test Report No. : OT-182-RWD-004
AGR No. : A181A-263
Applicant : Samsung Electronics Co Ltd
Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States
Manufacturer : Samsung Electronics Co., Ltd.
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-742, Korea
Type of Equipment : Audio transceiver module
FCC ID. : A3LWISP50S
Model Name : WISP50S
Multiple Model Name : N/A
Serial number : N/A
Total page of Report : 9 pages (including this page)
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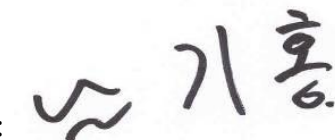
SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART E Section 15.407**

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:



Ki-Hong, Nam / Asst, Chief Engineer
ONETECH Corp.

Approved by:



Keun-Young, Choi / Vice President
ONETECH Corp.

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REVISION HISTORY

Issued Report No.	Issued Date	Revisions	Effect Section
OT-182-RWD-004	February 01, 2018	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd
Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States
Contact Person : Jaywoo. Lee
Telephone No. : +82-31-776-6400
FCC ID : A3LWISP50S
Model Name : WISP50S
Brand Name : SAMSUNG
Serial Number : N/A
Date : February 01, 2018

EQUIPMENT CLASS	Unlicensed National Information Infrastructure(UNII)
E.U.T. DESCRIPTION	Audio transceiver module
THIS REPORT CONCERNS	Original Grant
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 E Section 15.407 KDB 789033 D01 General UNII Test Procedures
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.

2. GENERAL INFORMATION

2.1 Product Description

The Samsung Electronics Co Ltd, Model WISP50S (referred to as the EUT in this report) is a Audio transceiver module. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Audio transceiver module				
FREQUENCY RANGE	2.4 GHz Band	2 412 MHz ~ 2 464 MHz			
	5 GHz Band	5 150 MHz ~ 5 250 MHz Band		5 180 MHz ~ 5 240 MHz	
		5 725 MHz ~ 5 850 MHz Band		5 736 MHz ~ 5 814 MHz	
MAX. RF OUTPUT POWER	2.4 GHz Band	Antenna 0		13.10 dBm	
		Antenna 1		12.80 dBm	
	5 GHz Band	5 150 MHz ~ 5 250 MHz Band		Antenna 0	9.80 dBm
				Antenna 1	9.50 dBm
		5 725 MHz ~ 5 850 MHz Band	Antenna 0	8.10 dBm	
			Antenna 1	8.00 dBm	
MODULATION TYPE	QPSK				
ANTENNA TYPE	2.4 GHz Band	Antenna 0		0.9 dBi	
		Antenna 1		0.8 dBi	
	5 GHz Band	5 150 MHz ~ 5 250 MHz Band		Antenna 0	1.5 dBi
				Antenna 1	2.8 dBi
		5 725 MHz ~ 5 850 MHz Band	Antenna 0	3.6 dBi	
			Antenna 1	6.0 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		44 MHz			
POWER RE QUIREMENT		DC 5.0 V			

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

-. None

3. EUT MODIFICATIONS

-. None

4. MAXIMUM PERMISSIBLE EXPOSURE

4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are $f/1500 \text{ mW/cm}^2$ for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm^2 for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm^2 exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

S = Power density in mW/cm^2 , Z = Impedance of free space, 377Ω

E = Electric field strength in V/m , G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of mW and cm , using $P (\text{mW}) = P (\text{W}) / 1 000$, $d (\text{cm}) = 0.01 * d (\text{m})$

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

d = distance in cm , P = Power in mW , G = Numeric antenna gain, and S = Power density in mW/cm^2

4.2 EUT Description

Kind of EUT	Audio transceiver module				
Operating Frequency Band	■ 2 412 MHz ~ 2 464 MHz ■ 5 180 MHz ~ 5 240 MHz ■ 5 736 MHz ~ 5 814 MHz				
Device Category	☐ Portable (< 20 cm separation) ☐ Mobile (> 20 cm separation) ■ Others				
Exposure Evaluation Applied	■ MPE ☐ SAR ☐ N/A				
ANTENNA TYPE	2.4 GHz Band	Antenna 0	0.9 dBi		
		Antenna 1	0.8 dBi		
	5 GHz Band	5 150 MHz ~ 5 250 MHz Band	Antenna 0	1.5 dBi	
			Antenna 1	2.8 dBi	
		5 725 MHz ~ 5 850 MHz Band	Antenna 0	3.6 dBi	
			Antenna 1	6.0 dBi	
MAX. RF OUTPUT POWER	2.4 GHz Band	Antenna 0	13.10 dBm		
		Antenna 1	12.80 dBm		
	5 GHz Band	5 150 MHz ~ 5 250 MHz Band	Antenna 0	9.80 dBm	
			Antenna 1	9.50 dBm	
		5 725 MHz ~ 5 850 MHz Band	Antenna 0	8.10 dBm	
			Antenna 1	8.00 dBm	

5. Calculated MPE Safe Distance

5.1 Test data for Antenna 0

According to above equation, the following result was obtained.

Operating Freq. Band	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
	(dBm)	(dBm)	(mW)	Log	Linear			
5 150 ~ 5 250	9.50 ± 0.5	10.0	10.0	1.5	1.413	1.06	0.002 8	1.00
5 725 ~5 850	7.6 ± 0.5	8.1	6.46	3.6	2.291	1.08	0.002 9	1.00

According to above table, for 5 725 ~ 5 850 MHz Band, safe distance,

$$D = 0.282 * \sqrt{(6.46 * 2.291)/1.00} = 1.08 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 6.46 * 2.291 / (4 * 3.14 * 20^2) = 0.002 9$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



Tested by: Tae-Ho, Kim / Senior Manager

5.1 Test data for Antenna 1

According to above equation, the following result was obtained.

Operating Freq. Band	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm ²) @ 20 cm Separation	Limit (mW/cm ²)
	(dBm)	(dBm)	(mW)	Log	Linear			
5 150 ~ 5 250	9.00 ± 0.5	9.5	8.91	2.8	1.905	1.16	0.003 4	1.00
5 725 ~5 850	7.50 ± 0.5	8.0	6.31	6.0	3.981	1.41	0.005	1.00

According to above table, for 5 725 ~ 5 850 MHz Band, safe distance,

$$D = 0.282 * \sqrt{(6.31 * 3.981)/1.00} = 1.41 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 6.31 * 3.981 / (4 * 3.14 * 20^2) = 0.005$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna


Tested by: Tae-Ho, Kim / Senior Manager