






TEST REPORT

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<p>1. Client</p>		
<p>◦ Name : Samsung Electronics Co., Ltd. ◦ Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea ◦ Date of Receipt : 2020-09-21</p>		
<p>2. Use of Report : Certification</p>		
<p>3. Name of Product / Model : Wi-Fi/BLE combo module / CCAR210R</p>		
<p>4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Korea</p>		
<p>5. FCC ID : A3LCCAR210R</p>		
<p>6. IC Certification No. : 649E-CCAR210R</p>		
<p>7. Date of Test : 2020-12-21 to 2021-01-06</p>		
<p>8. Location of Test : <input checked="" type="checkbox"/> Permanent Testing Lab <input type="checkbox"/> On Site Testing (Address: Address of testing location)</p>		
<p>9. Test Standards : 47 CRF Part 1.1310 RSS-102 Issue 5 Mar 2015</p>		
<p>10. Test Results : Refer to the test result in the test report</p>		
<p>Affirmation</p>	<p>Tested by Name : Hosung Lee </p>	<p>Technical Manager Name : Heesu Ahn </p>
<p>2021-01-19</p>		
<p>KCTL Inc.</p>		
<p>As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.</p>		

REPORT REVISION HISTORY

Date	Revision	Page No
2021-01-14	Originally issued	-
2021-01-19	Updated	11

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General remarks for test reports

Nothing significant to report.

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1. General information

Client : Samsung Electronics Co., Ltd.
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Manufacturer : Samsung Electronics Co., Ltd.
Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Laboratory : KCTL Inc.
Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132
VCCI Registration No. : R-20080, G-20078, C-20059, T-20056
Industry Canada Registration No. : 8035A
KOLAS No.: KT231

2. Device information

Equipment under test : Wi-Fi/BLE combo module
Model : CCAR210R
Frequency range : 2 402 MHz ~ 2 480 MHz (Bluetooth(BLE))
2 412 MHz ~ 2 462 MHz (802.11b/g/n HT20)
2 422 MHz ~ 2 452 MHz (802.11n HT40)
Modulation technique : Bluetooth(BLE)_GFSK
WIFI(802.11b/g/n HT20/40)_DSSS, OFDM
Number of channels : Bluetooth(BLE)_40 ch
2.4 GHz band: 11 ch (20 MHz), 7 ch (40 MHz),
Power source : DC 5.0 V, DC 12.0 V
Antenna type : Metal Antenna
Antenna gain : Bluetooth(BLE) 0.5 dBi
2.4 GHz band 0.5 dBi
Software version : v1.0
Hardware version : v1.0
Operation temperature : -20 °C ~ 70 °C

2.1. Frequency/channel operations

This device contains the following capabilities:

802.11b/g/n HT20/40, Bluetooth Low Energy

Ch.	Frequency (MHz)
00	2 402
.	.
19	2 440
.	.
39	2 480

Table 2.1.1. Bluetooth Low Energy

Ch.	Frequency (MHz)
01	2 412
.	.
06	2 437
.	.
11	2 462

Table 2.1.2. 802.11b/g/n_HT20 mode

Ch.	Frequency (MHz)
03	2 422
.	.
06	2 437
.	.
09	2 452

Table 2.1.3. 802.11n_HT40 mode

3. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty (\pm)
Conducted RF power	1.3 dB

4. RF Exposure

FCC

Regulation

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC rules and Regulations.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

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]	Averaging Time [minute]
(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 ~ 15 000	/	/	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/1 500	30
1 500 ~ 15 000	/	/	1.0	30

f=frequency in MHz, *=*plane-wave equivalent power density*

Per the guidance of KDB 680106, the E-field and H-field limits shown in the table above are extended down to 100 kHz

IC

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

According to RSS-102 Issue 5, Paragraph "4. Exposure Limits", Industry of Canada has adopted the RF field strength limits established in Health Canada's RF exposure guideline, Safety code 6:

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
<u>300-6000</u>	<u>3.142 <i>f</i>^{0.3417}</u>	<u>0.008335 <i>f</i>^{0.3417}</u>	<u>0.02619 <i>f</i>^{0.6834}</u>	<u>6</u>
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}
<p>Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).</p>				

Exemption Limits for Routine Evaluation – RF Exposure Evaluation

According to RSS-102 Issue 5 section 2.5.2, RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- Below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1W (adjusted for tune-up tolerance);
- At or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 48 MHz and below 300 MHz and the source-bands, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance.)

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

4.1. Test results

FCC

MPE (Maximum Permissible Exposure) Prediction

Prediction of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \quad (\Rightarrow R = \sqrt{PG/4\pi S})$$

S = power density [mW/cm²]

P = Power input to antenna [mW]

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna [cm]

IC

RF Exposure evaluation

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

Calculation Result of RF exposure (FCC)

Maximum tune-up tolerance (Worst Case)

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Ant Gain [dBi]	Power density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
BLE 1 Mbps	2 402	7.5	0.50	0.001 26	1.00
BLE 2 Mbps	2 402	7.5	0.50	0.001 26	1.00
802.11b	2 462	18.5	0.50	0.015 80	1.00
802.11g	2 437	17	0.50	0.011 19	1.00
802.11n_HT20	2 437	17	0.50	0.011 19	1.00
802.11n_HT40	2 452	16	0.50	0.008 89	1.00

Calculation Results of RF exposure (IC)

Maximum tune-up tolerance (Worst Case)

Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Ant Gain [dBi]	E.I.R.P		Limit [mW]
				[dBm]	[mW]	
BLE 1 Mbps	2 402	7.5	0.50	8.00	6.31	2 676.42
BLE 2 Mbps	2 402	7.5	0.50	8.00	6.31	2 676.42
802.11b	2 462	18.5	0.50	19.00	79.43	2 721.93
802.11g	2 437	17	0.50	17.50	56.23	2 703.01
802.11n_HT20	2 437	17	0.50	17.50	56.23	2 703.01
802.11n_HT40	2 452	16	0.50	16.50	44.67	2 714.37

5. Measurement Equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
DC Power Supply	AGILENT	E3632A	KR94907664	21.05.11
Power Sensor	R&S	NRP-Z81	1137.9009.02-106223-bB	21.05.25
Attenuator	R&S	DNF Dämpfungsglied 10 dB in N-50 Ohm	31212	21.05.11

End of test report