



TEST REPORT

KCTL KCTL Inc.

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Report No.:
KR20-SRF0277

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1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2020-08-05

2. Use of Report : Certification

3. Name of Product / Model : Wi-Fi / BT Transceiver / CCBQ730M

4. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Korea

5. FCC ID : A3LCCBQ730M

6. IC Certification No. : 649E-CCBQ730M

7. Date of Test : 2020-08-05 to 2020-10-23

8. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing (Address: Address of testing location)

9. Test Standards : 47 CFR Part 1.1310
RSS-102 Issue 5 Mar 2015

10. Test Results : Refer to the test result in the test report

Affirmation	Tested by	Technical Manager
	Name : Taeyoung Kim  (Signature)	Name : Seungyong Kim  (Signature)

2020-11-02

KCTL Inc.

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.

REPORT REVISION HISTORY

Date	Revision	Page No
2020-11-02	Originally issued	-

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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 / BT Transceiver
Model : CCBQ730M
Modulation technique : Bluetooth(BDR/EDR)_GFSK, $\pi/4$ DQPSK, 8DPSK
Bluetooth(BLE)_GFSK
WIFI(802.11a/b/g/n/ac)_DSSS, OFDM
Number of channels : Bluetooth(BDR/EDR)_79 ch, Bluetooth(BLE)_40 ch
2.4 GHz band: 13 ch (20 MHz), 9 ch (40 MHz),
UNII-1: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
UNII-2A: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
UNII-2C: 12 ch (20 MHz), 6 ch (40 MHz), 3 ch (80 MHz)
UNII-3: 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
Power source : DC 5.0 V
Antenna type : Metal Antenna
Antenna gain : BT/LE ANT 0: -4.60 dBi
2.4 GHz band ANT 1: 1.90 dBi, ANT 2: 1.10 dBi
UNII-1 ANT 1: 1.80 dBi, ANT 2: 2.80 dBi
UNII-2A ANT 1: 1.40 dBi, ANT 2: 2.80 dBi
UNII-2C ANT 1: 0.40 dBi, ANT 2: 2.90 dBi
UNII-3 ANT 1: 0.30 dBi, ANT 2: 2.90 dBi
Frequency range : 2.4 GHz band: 2 402 MHz ~ 2 480 MHz (Bluetooth/BLE)
2.4 GHz band: 2 412 MHz ~ 2 472 MHz (802.11b/g/n_HT20)
2.4 GHz band: 2 422 MHz ~ 2 462 MHz (802.11n_HT40)
UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n/ac_HT20/VHT20)
UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n/ac_HT40/VHT40)
UNII-1: 5 210 MHz (802.11ac_VHT80)
UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n/ac_HT20/VHT20)
UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n/ac_HT40/VHT40)
UNII-2A: 5 290 MHz (802.11ac_VHT80)
UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n/ac_HT20/VHT20)
UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n/ac_HT40/VHT40)
UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80)
UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n/ac_HT20/VHT20)
UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n/ac_HT40/VHT40)
UNII-3: 5 775 MHz (802.11ac_VHT80)
Software version : 1.0
Hardware version : 1.0
Operation temperature : -20 °C ~ 50 °C

2.1. Frequency/channel operations

This device contains the following capabilities:

WiFi (802.11a/b/g/n/ac), Bluetooth (BDR/EDR/BLE)

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

Table 2.1.1. Bluetooth Low Energy

Ch.	Frequency (MHz)
00	2 402
.	.
39	2 441
.	.
78	2 480

Table 2.1.2. Bluetooth(BDR/EDR) mode

Ch.	Frequency (MHz)
01	2 412
.	.
06	2 437
.	.
11	2 462
12	2 467
13	2 472

Table 2.1.3. 802.11b/g/n_HT20 mode

Ch.	Frequency (MHz)
03	2 422
.	.
06	2 437
.	.
09	2 452
10	2 457
11	2 462

Table 2.1.4. 802.11n_HT40 mode

UNII-1**UNII-2A****UNII-2C****UNII-3**

Ch.	Frequency (MHz)
36	5 180
40	5 200
48	5 240

UNII-1

Ch.	Frequency (MHz)
52	5 260
56	5 280
64	5 320

UNII-2A

Ch.	Frequency (MHz)
100	5 500
116	5 580
144	5 720

UNII-2C

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

UNII-3

Table 2.1.5. 802.11a/n/ac_HT20/VHT20 mode

Ch.	Frequency (MHz)
38	5 190
46	5 230

UNII-1

Ch.	Frequency (MHz)
54	5 270
62	5 310

UNII-2A

Ch.	Frequency (MHz)
102	5 510
110	5 550
142	5 710

UNII-2C

Ch.	Frequency (MHz)
151	5 755
159	5 795

UNII-3

Table 2.1.6. 802.11n/ac_HT40/VHT40 mode

Ch.	Frequency (MHz)
42	5 210

Ch.	Frequency (MHz)
58	5 290

Ch.	Frequency (MHz)
106	5 530
138	5 690

Table 2.1.7. 802.11ac_VHT80 mode

Ch.	Frequency (MHz)
155	5 775

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 indicated 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

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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}
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

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-based, 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.

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4.1. Test results

FCC

MPE (Maximum Permissible Exposure) Prediction

Predication 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/cm^2]

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 $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz;

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Calculation Result of RF exposure (FCC)

Maximum tune-up tolerance (Worst Case)

RF	Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Ant Gain [dBi]	Power density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
BT	BDR	2 480	13	-4.60	0.001 38	1.000
LE	2 Mbps	2 480	13	-4.60	0.001 38	1.000
WLAN 2.4 GHz (Ant1 - SISO)	11b	2 462	18	1.90	0.019 44	1.000
WLAN 2.4 GHz (Ant2 - SISO)	11b	2 462	18	1.10	0.016 17	1.000
WLAN 2.4 GHz (MIMO)	11g	2 437	20	4.52	0.056 33	1.000
WLAN 5 GHz (Ant1 - SISO)	11a	5 700	17	0.40	0.010 93	1.000
WLAN 5 GHz (Ant2 - SISO)	11n_HT40	5 670	16	2.90	0.015 44	1.000
WLAN 5 GHz (MIMO)	11n_HT40	5 230	18	4.71	0.037 13	1.000

- Simultaneous Transmission (Worst configuration)

RF	Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Ant Gain [dBi]	Power density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
BT (2 480 MHz) + WLAN 2.4 GHz (Ant1 11b 2 462 MHz) + WLAN 5 GHz (Ant2 11n_HT40 5 670 MHz)					0.036 26	1.000

Note.

- The power density P_d (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 of RF Exposure test exclusion for worst case configuration.
 - 2.4G WLAN: the ratio is 0.019 44 / 1
 - Bluetooth: the ratio is 0.001 38 / 1
 - 5G WLAN: the ratio is 0.015 44 / 1
 - 2.4G WLAN + Bluetooth + 5G WLAN Power density: ((0.019 44 / 1) + (0.001 38 / 1) + (0.015 44 / 1))

Calculation Results of RF exposure (IC)

Maximum tune-up tolerance (Worst Case)

RF	Mode	Frequency [MHz]	Max Tune-up Power [dBm]	Ant Gain [dBi]	E.I.R.P		Limit [W]
					[dBm]	[W]	
BT	BDR	2 480	13	-4.60	8.40	0.006 9	2.736
LE	2 Mbps	2 480	13	-4.60	8.40	0.006 9	2.736
WLAN 2.4 GHz (Ant1 - SISO)	11b	2 462	18	1.90	19.90	0.097 7	2.722
WLAN 2.4 GHz (Ant2 - SISO)	11b	2 462	18	1.10	19.10	0.081 3	2.722
WLAN 2.4 GHz (MIMO)	11g	2 437	20	4.52	24.52	0.283 1	2.703
WLAN 5 GHz (Ant1 - SISO)	11a	5 700	17	0.40	17.40	0.055 0	4.831
WLAN 5 GHz (Ant2 - SISO)	11n_HT40	5 670	16	2.90	18.90	0.077 6	4.814
WLAN 5 GHz (MIMO)	11n_HT40	5 230	18	4.71	22.71	0.186 6	4.555

5. Measurement Equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Attenuator	R&S	DNF Dämpfungsglied 10 dB in N-50 Ohm	31210	21.05.11
Power Sensor	R&S	NRP-Z81	1137.9009.02- 106223-bB	21.05.25
DC Power Supply	AGILENT	E3632A	KR75304571	21.05.11

End of test report

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