

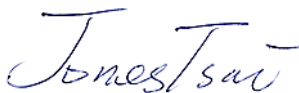
FCC RF Test Report

APPLICANT : Realtek Semiconductor Corp
EQUIPMENT : 802.11b/g/n RTL8723BE Combo module
BRAND NAME : Realtek
MODEL NAME : RTL8723BE
FCC ID : TX2-RTL8723BE
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

This is a partial report which is included the RF output power, radiated band edges, and spurious emission measurement test items. The product was received on Jan. 01, 2015 and testing was completed on Jan. 28, 2015. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.



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FCC ID : TX2-RTL8723BE

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR510105B	Rev. 01	Initial issue of report	Feb. 03, 2015



SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 7.38 dB at 31.890 MHz
3.2	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Realtek Semiconductor Corp

No. 2, innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan.

1.2 Manufacturer

Realtek Semiconductor Corp

No. 2, innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	802.11b/g/n RTL8723BE Combo module
Brand Name	Realtek
Model Name	RTL8723BE
FCC ID	TX2-RTL8723BE
Installed into Notebook	Band Name: lenovo Model Name: TP00066B Notebook with Antenna 2
EUT supports Radios application	WLAN 11b/g/n HT20/HT40 Bluetooth v 4.0 EDR/LE
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Antenna Information for Host			
Antenna 1 (WNC)	Manufacturer	WNC	
	P/N	Main: DQ6G15G8100	Aux: DQ6G15G8000
	Antenna Type	Main:PIFA Antenna	Aux:PIFA Antenna
	Peak gain	Main Antenna : WLAN: 0.12 dBi	Aux Antenna : Bluetooth: -2.16dBi WLAN: -2.16 dBi
Antenna 2 (Tongda)	Manufacturer	Tongda	
	P/N	Main:DQ690210201	Aux: DQ690210200
	Antenna Type	Main:PIFA Antenna	Aux:PIFA Antenna
	Peak gain	Main Antenna : WLAN: 0.79dBi	Aux Antenna : Bluetooth: -1.57dBi WLAN: -1.57dBi

1.4 Product Specification subjective to this standard

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Maximum Output Power to Antenna	5.63 dBm (0.0037 W)
Type of Modulation	Bluetooth LE : GFSK

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	Sporton Site No.	
	TH02-HY	03CH10-HY

Note: The test site complies with ANSI C63.4 2009 requirement.



1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. FCC permits the use of the 1.5 meter table as an alternative in C63.10-2013 through inquiry tracking number 961829.

2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

The RF output power was recorded in the following table:

Channel	Frequency	Bluetooth 4.0 – LE RF Output Power
		Data Rate / Modulation
		GFSK
		1Mbps
Ch00	2402MHz	5.63 dBm
Ch19	2440MHz	5.61 dBm
Ch39	2480MHz	5.34 dBm

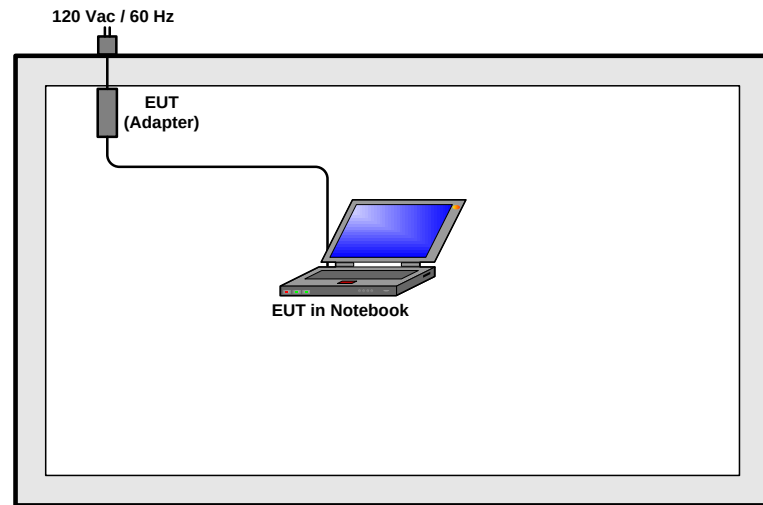
- The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). Pre-scanned tests, X, Y, Z, Notebook type in four orthogonal panels to determine the final configuration (Notebook type plane as worst plane) from all possible combinations.

2.2 Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth 4.0 – LE / GFSK
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps
	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Remark: All the radiated test cases were performance with adapter 1.	

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

For Bluetooth function, the RF utility, "MP Tool" installed in the notebook make the notebook provides functions like channel selection and power level for continuous transmitting and receiving signals.

3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.

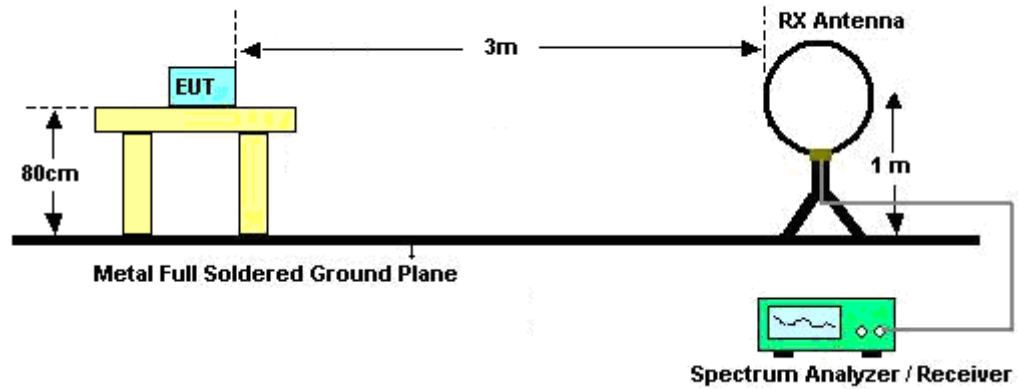
For average measurement:

 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

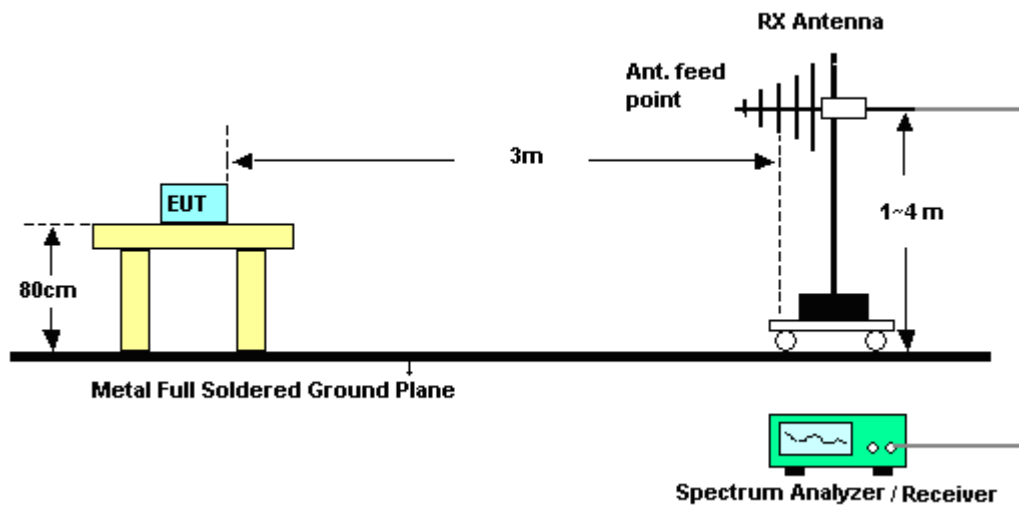
Band	Duty Cycle(%)	T(μ s)	1/T(kHz)	VBW Setting
Bluetooth 4.0 - LE	100	-	-	10Hz

3.1.4 Test Setup

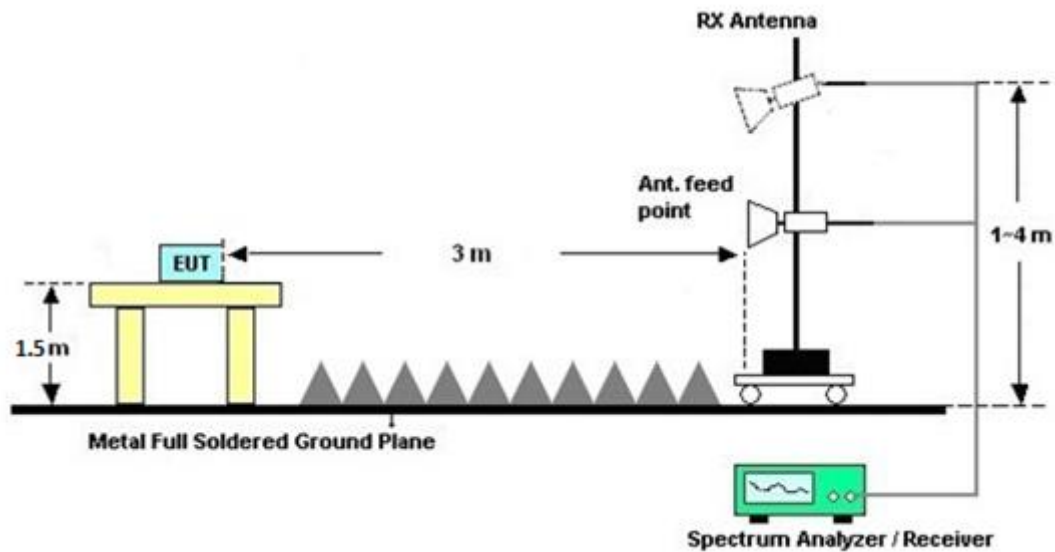
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.1.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A.



3.2 Antenna Requirements

3.2.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.2.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Agilent	E4416A	GB412923 44	300MHz~40GHz	Jan. 28, 2014	Jan. 03, 2015	Jan. 27, 2015	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US404415 48	300MHz~40GHz	Jan. 28, 2014	Jan. 03, 2015	Jan. 27, 2015	Conducted (TH02-HY)
Loop Antenna	R&S	HFH2-Z2	100315	9 kHz~30 MHz	Jul. 28, 2014	Jan. 28, 2015	Jul. 27, 2015	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 584	18GHz- 40GHz	Nov. 03, 2014	Jan. 28, 2015	Nov. 02, 2015	Radiation (03CH10-HY)
Amplifier	SONOMA	310N	187311	0.1MHz~1000M Hz	Nov. 24, 2014	Jan. 28, 2015	Nov. 23, 2015	Radiation (03CH10-HY)
Bilog Antenna	TESEQ	CBL 6111D	35413	30MHz~1GHz	Oct. 24, 2014	Jan. 28, 2015	Oct. 23, 2015	Radiation (03CH10-HY)
Preamplifier	Keysight	83017A	MY532700 78	1GHz~26.5GHz	Nov. 20, 2014	Jan. 28, 2015	Nov. 19, 2015	Radiation (03CH10-HY)
Spectrum Analyzer	Keysight	N9010A	MY542004 85	10Hz ~ 44GHZ	Oct. 14, 2014	Jan. 28, 2015	Oct. 13, 2015	Radiation (03CH10-HY)
Double Ridged Guide Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-132 5	1GHz ~ 18GHz	Oct. 03, 2014	Jan. 28, 2015	Oct. 02, 2015	Radiation (03CH10-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1~4m	N/A	Jan. 28, 2015	N/A	Radiation (03CH10-HY)
Turn Table	EMEC	TT 2200	N/A	0-360 degree	N/A	Jan. 28, 2015	N/A	Radiation (03CH10-HY)



5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.90
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