



RADIO EXPOSURE TEST REPORT

FCC ID : TX2-RTL8852CE

Equipment : 11ax RTL8852CE Combo module

Brand Name : REALTEK

Model Name : RTL8852CE

Applicant : Realtek Semiconductor Corp.
No. 2, Innovation Road II, Hsinchu Science Park,
Hsinchu 300, Taiwan

Manufacturer : Realtek Semiconductor Corp.
No. 2, Innovation Road II, Hsinchu Science Park,
Hsinchu 300, Taiwan

Standard : 47 CFR Part 2.1091

The product was received on Nov. 05, 2021, and testing was started from Nov. 24, 2021 and completed on Feb. 15, 2025. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Rex Liao

Sporton International Inc. Hsinchu Laboratory

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Photographs of EUT v01



TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A1_1 Ver1.1



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: **Sam Chen**

Report Producer: **Cathy Chiu**



1 General Description

1.1 EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2472	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) VHRT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850 5725-5895	5180-5250 5250-5320 5500-5720 5745-5825 5815-5885	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
6GHz WLAN (Low Power)	5925-7125	5955-7115	802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
6GHz WLAN (Standard Power)	5925-6425 6525-6875	5955-6415 6535-6785	802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
6GHz WLAN (Very Low Power)	5925-6425 6525-6875	5955-6415 6535-6855	802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Bluetooth	2400-2483.5	2402-2480	BR / EDR: FHSS (GFSK / $\pi/4$ -DQPSK / 8DPSK) LE: GFSK



1.2 Antenna Information

Ant.	Port			Brand	Model Name	Antenna Type	Connector	Gain (dBi)
	WLAN 2.4GHz	WLAN 5GHz / 6GHz	Bluetooth					
1	1/2	1/2	1	ARISTOTLE	RFA-27-JP378-4B-200	Monopole	I-PEX	Note 1
2	1/2	1/2	1	ARISTOTLE	RFA-27-JP326-MHF4300	PIFA	I-PEX	
3	1/2	1/2	1	ARISTOTLE	RFA-27-C38H1-MHF4300	Dipole	I-PEX	
4	-	1/2	-	ARISTOTLE	RFA-57-JP697-4B-300	Monopole	I-PEX	

Note 1

Ant.	Port			Gain (dBi)		
	WLAN 2.4GHz	WLAN 5GHz / 6GHz	Bluetooth	WLAN 2.4GHz	WLAN 5GHz / 6GHz	Bluetooth
1	1/2	1/2	1	3.38	4.86	3.38
2	1/2	1/2	1	3.50	5.00	3.50
3	1/2	1/2	1	3.00	5.00	3.00
4	-	1/2	-	-	-5	-

Note 2: The above information was declared by manufacturer.

Note 3: For Conducted measurement Test: Only the highest gain antenna "Ant. 2" was selected to perform the test and recorded in this report.



Note 4: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left(\sum_{j=1}^{N_{SS}} S_{i,j} \right)^2}{N_{ANT}} \right]$
BF	$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left(\sum_{j=1}^{N_{SS}} S_{i,j} \right)^2}{N_{ANT}} \right]$	$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left(\sum_{j=1}^{N_{SS}} S_{i,j} \right)^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

$$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left(\sum_{j=1}^{N_{SS}} S_{i,j} \right)^2}{N_{ANT}} \right]$$

$$NSS1(g1,1) = 10^{G1/20} ; NSS1(g1,2) = 10^{G2/20}$$

$$g_{j,k} = (NSS1(g1,1) + NSS1(g1,2))^2$$

$$DG = 10 \log[(NSS1(g1,1) + NSS1(g1,2) / N_{ANT})] \Rightarrow 10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$$

Where ;

Monopole Antenna

$$2.4G\ G1 = 3.38\ dBi ; G2 = 3.38\ dBi ; DG=6.39\ dBi$$

$$5G\ G1 = 4.86\ dBi ; G2 = 4.86\ dBi ; DG=7.87dBi$$

$$6G\ G1 = 4.86\ dBi ; G2 = 4.86\ dBi ; DG=7.87\ dBi$$

PIFA Antenna

$$2.4G\ G1 = 3.5\ dBi ; G2 = 3.5\ dBi ; DG=6.51\ dBi$$

$$5G\ G1 = 5\ dBi ; G2 =5\ dBi ; DG=8.01dBi$$

$$6G\ G1 = 5\ dBi ; G2 =5\ dBi ; DG=8.01dBi$$

Dipole Antenna

$$2.4G\ G1 = 3\ dBi ; G2 = 3\ dBi ; DG=6.01\ dBi$$

$$5G\ G1 = 5\ dBi ; G2 =5\ dBi ; DG=8.01dBi$$

$$6G\ G1 = 5\ dBi ; G2 =5\ dBi ; DG=8.01dBi$$

<For WLAN 2.4GHz function>

For IEEE 802.11b/g/n/VHT/ax (1TX/2RX):

For Conducted:

The EUT supports the antenna with TX diversity functions.

Both Port 1 and Port 2 support transmit and receive functions, but only one of them will be used at one time.

The Port 1 generated the worst case, so it was selected to test and record in the report.

Port 1 and Port 2 could receive simultaneously.

For Radiated:

The EUT supports the antenna with TX diversity functions.

Both Port 1 and Port 2 support transmit and receive functions, but only one of them will be used at one time.

The Port 2 generated the worst case, so it was selected to test and record in the report.

Port 1 and Port 2 could receive simultaneously.

For IEEE 802.11b/g/n/VHT/ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

**<For WLAN 5GHz function>****For IEEE 802.11a/n/ac/ax (1TX/2RX):**

The EUT supports the antenna with TX diversity functions.

Both Port 1 and Port 2 support transmit and receive functions, but only one of them will be used at one time.

The Port 1 generated the worst case, so it was selected to test and record in the report.

Port 1 and Port 2 could receive simultaneously.

For IEEE 802.11a/n/ac/ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

<For WLAN 6GHz function>**For IEEE 802.11ax (1TX/2RX):**

The EUT supports the antenna with TX diversity functions.

Both Port 1 and Port 2 support transmit and receive functions, but only one of them will be used at one time.

The Port 1 generated the worst case, so it was selected to test and record in the report.

Port 1 and Port 2 could receive simultaneously.

For IEEE 802.11ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

<For Bluetooth function> (1TX/1RX):

Only Port 1 can be used as transmitting/receiving antenna.

1.3 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FA1N0223

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
Add Very Low Power function for 6GHz through SW change.	Maximum Permissible Exposure for 6GHz UNII 5, 7 for Very Low Power function

Note: Other test results are based on original test report.

1.4 Accessories

N/A

1.5 Applicable Standards

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

- ♦ 47 CFR Part 2.1091
- ♦ KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ 47 CFR Part 1.1307
- ♦ 47 CFR Part 1.1310



1.6 Testing Location

Testing Location Information	
Test Lab. : Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

Note: The tested sample of the test item (Maximum Permissible Exposure for 6GHz UNII 5, 7 Very Low Power function) was received on Dec. 05, 2024.



2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
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
300-1500	-	-	f/300	<6
1500-100,000	-	-	5	<6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
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
300-1500	-	-	f/1500	<30
1500-100,000	-	-	1.0	<30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$



2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= P_{th}.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance

R between the person and the antenna / radiating structure, where $R > \lambda / 2 \pi$.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.
Note: R is in meters, f is in MHz.	



2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

For WLAN 2.4GHz / WLAN 5G / WLAN 6G: 1TX

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	3.5	22.48	23.83	0.5	271.019	41	C	3227.52	0.08397
5.2G;D1D	5	21.81	24.66	0.5	328.095	41	C	3227.52	0.10166
5.3G;D1D	5	21.63	24.48	0.5	314.775	41	C	3227.52	0.09753
5.6G;D1D	5	21.75	24.6	0.5	323.594	41	C	3227.52	0.10026
5.8G;D1D	5	22.43	25.28	0.5	378.443	41	C	3227.52	0.11725
5.81G;D1D	5	21.45	24.3	0.5	301.995	41	C	3227.52	0.09357

For Standard Power:

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	5	23.88	26.73	0.5	528.445	41	C	3227.52	0.16373
6.7G;D1D	5	23.98	26.83	0.5	540.754	41	C	3227.52	0.16754

For Low Power:

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	5	15.35	18.2	0.5	74.131	41	C	3227.52	0.02297
6.4G;D1D	5	15.19	18.04	0.5	71.450	41	C	3227.52	0.02214
6.7G;D1D	5	15.32	18.17	0.5	73.621	41	C	3227.52	0.02281
7.0G;D1D	5	15.21	18.06	0.5	71.779	41	C	3227.52	0.02224

For WLAN 2.4GHz / WLAN 5G / WLAN 6G: 2TX

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	6.51	25.16	29.52	0.5	1004.616	41	C	3227.52	0.31127
5.2G;D1D	8.01	21.76	27.62	0.5	648.634	41	C	3227.52	0.20097
5.3G;D1D	8.01	21.79	27.65	0.19	608.135	41	C	3227.52	0.18842
5.6G;D1D	8.01	21.9	27.76	0.08	608.135	41	C	3227.52	0.18842
5.8G;D1D	8.01	24.33	30.19	0.5	1172.195	41	C	3227.52	0.36319
5.81G;D1D	8.01	20.46	26.32	0.5	480.839	41	C	3227.52	0.14898

**For Standard Power:**

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	8.01	21.93	27.79	0.5	674.528	41	C	3227.52	0.20899
6.7G;D1D	8.01	21.96	27.82	0.5	679.204	41	C	3227.52	0.21044

For Low Power:

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	8.01	12.57	18.43	0.5	78.163	41	C	3227.52	0.02422
6.4G;D1D	8.01	12.21	18.07	0.5	71.945	41	C	3227.52	0.02229
6.7G;D1D	8.01	12.29	18.15	0.5	73.282	41	C	3227.52	0.02271
7.0G;D1D	8.01	10.03	15.89	0.5	43.551	41	C	3227.52	0.01349

For Very Low Power:**For 1TX:**

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	5.00	8.86	11.71	0.13	15.276	41	C	3227.6	0.0047
6.7G;D1D	5.00	8.94	11.79	0.05	15.276	41	C	3227.6	0.0047

For 2TX:

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	8.01	5.86	11.72	0.12	15.276	41	C	3227.6	0.0047
6.7G;D1D	8.01	5.83	11.69	0.15	15.276	41	C	3227.6	0.0047

For Bluetooth:

Mode	DG (dBi)	Power (dBm)	ERP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;BT-BR	3.5	12.43	13.78	0.5	26.792	41	C	3227.52	0.00830
2.4G;BT-LE	3.5	12.48	13.83	0.5	27.102	41	C	3227.52	0.00840



MPE Exemption Option B							
Mode	Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	MPE Exemption
2.4G;D1D (2TX)	2437	0.2	32.17	30.02	1.005	3.060	Complies
5G;D1D (2TX)	5795		32.84	30.69	1.172	3.060	Complies
BT (1TX)	2440		16.48	14.33	0.027	3.060	Complies
2.4G;D1D (1TX)	2437		26.48	24.33	0.271	3.060	Complies
5G;D1D (1TX)	5825		27.93	25.78	0.378	3.060	Complies

MPE Exemption Option C								
Mode	Frequency (MHz)	$\lambda/2\pi$ (m)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	MPE Exemption
6G;D1D (2TX)	6625	0.0072	0.2	30.47	28.32	0.679	0.768	Complies
6G;D1D (1TX)	6695	0.0071		29.48	27.33	0.541	0.768	Complies

**Simultaneous Transmission Analysis Mode:****Bluetooth + WLAN 5GHz : 2TX**

Simultaneous Transmissions Option B+C								
Option	Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
B	2440	0.2	16.48	14.33	0.027	3.060	0.39	<= 1
B	5795		32.84	30.69	1.172	3.060		

Bluetooth + WLAN 6GHz : 2TX

Simultaneous Transmissions Option B+C								
Option	Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
B	2440	0.2	16.48	14.33	0.027	3.060	0.89	<= 1
C	6625		30.47	28.32	0.679	0.768		

WLAN 2.4GHz: 1TX + WLAN 5GHz : 1TX

Simultaneous Transmissions Option B+C								
Option	Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
B	2437	0.2	26.48	24.33	0.271	3.060	0.21	<= 1
B	5825		27.93	25.78	0.378	3.060		

WLAN 2.4GHz: 1TX + WLAN 6GHz : 1TX

Simultaneous Transmissions Option B+C								
Option	Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
B	2437	0.2	26.48	24.33	0.271	3.060	0.79	<= 1
C	6695		29.48	27.33	0.541	0.768		

Bluetooth + WLAN 5GHz : 1TX + WLAN 6GHz : 1TX

Simultaneous Transmissions Option B+C								
Option	Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
B	2440	0.2	16.48	14.33	0.027	3.060	0.84	<= 1
B	5825		27.93	25.78	0.378	3.060		
C	6695		29.48	27.33	0.541	0.768		

Note: The above antenna gain was declared by manufacturer.

————THE END————