

FCC SAR Exclusion Report

Report No. : SFBCEE-WTW-P21050412-1
Applicant : Sennheiser electronic GmbH & Co. KG
Address : Am Labor 1, D-30900 Wedemark, Germany
Product Name : CX Plus True Wireless (CXPLUSTW1)
Brand Name : SENNHEISER
FCC ID : DMOCXPLUSTW1R
Model No. : CXPLUSTW1 R
Standards : FCC 47 CFR Part 2 (2.1093), IEEE C95.1:1992, IEEE Std 1528:2013
KDB 865664 D01 v01r04, KDB 865664 D02 v01r02, KDB 447498 D01 v06
Sample Received Date : May 13, 2021
Date of Evaluation : Jun. 24, 2021
Lab Address : No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location : No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City, Taiwan

CERTIFICATION: The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch – Lin Kou Laboratories**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by TAF or any government agencies.

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1. Summary of Maximum SAR Value

Equipment Class	Mode	Highest Reported SAR _{1g} (W/kg)
DSS & DTS	Bluetooth	Not Required

Note:

1. The SAR limit (**Head & Body: SAR_{1g} 1.6 W/kg**) for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.

2. Description of Equipment Under Test

Test Item Description	True Wireless Earphones
Product Name	CX Plus True Wireless (CXPLUSTW1)
FCC ID	DMOCXPLUSTW1R
Brand Name	SENNHEISER
Model No.	CXPLUSTW1 R
Status of EUT	Engineering Sample
Power Ratings	Left earbud & Right earbud: 3.7Vdc, 55mAh (from battery) Charging Case: 5Vdc, 600 mA (from Type-C USB interface) 3.7Vdc, 400-420mAh (from battery)
Operating Temperature range	0°C ~ 40°C
Modulation Type	BDR & EDR: GFSK, $\pi/4$ DQPSK, 8DPSK BLE: GFSK
Transmission Technology	BDR & EDR: FHSS BLE: DSSS
Technology	Bluetooth
Operating Frequency	2402 - 2480MHz (for Frequency Band: 2400-2483.5MHz)
No. of channels	BDR & EDR: 79 BLE: 40
Channel Spacing	BDR & EDR: 1MHz BLE: 2MHz
Channel Bandwidth	BDR & EDR: 79MHz BLE: 80MHz
Data Transfer Rate	BDR: 1Mbps and EDR: 2Mbps/3Mbps LE 4.0: 1Mbps and LE 5.2: 2Mbps
Maximum Tune-up Conducted Power (Unit: dBm)	Please refer to section 3.1.1 of this report
Antenna Type	Monopole antenna
Antenna Gain	-0.65 dBi
HW Version	Earbuds: R1 Charging case: R1
SW Version	Earbuds: V1.3.20 Charging case: 1.4.0
Cable supplied	0.2m Shielded USB cable without core

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

3. SAR Measurement Evaluation

3.1 Maximum Output Power

3.1.1 Maximum Target Conducted Power

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

Refer to Appendix B.

3.1.2 Measured Conducted Power Result

Refer to Appendix C.

3.1.3 Time-Avg. Power calculation.

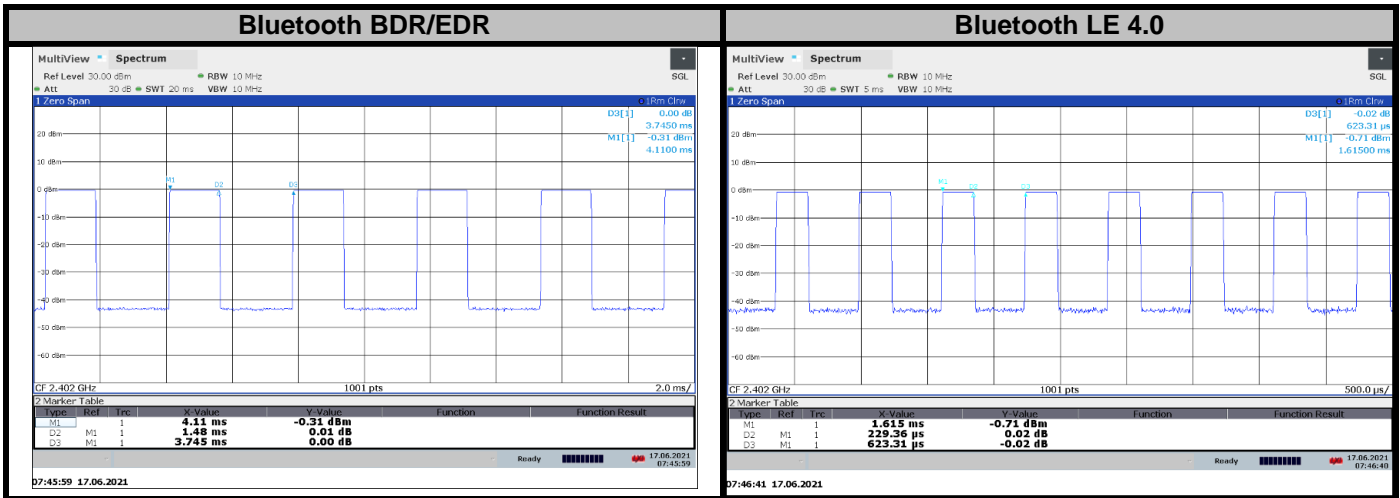
The calculation of time-avg. power (Unit: dBm) Including duty cycle.

<The calculated average power with duty cycle>

Mode	Max Tune-up Power (Not include Duty Cycle)	Duty cycle (%)	Calculated Time-Avg. Power (Include Duty Cycle)
BDR / EDR	10.5	39.52	6.47
LE 4.0	10.5	36.80	6.16
LE 5.2	10.5	32.22	5.58

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Time-domain plot for Bluetooth transmission signal

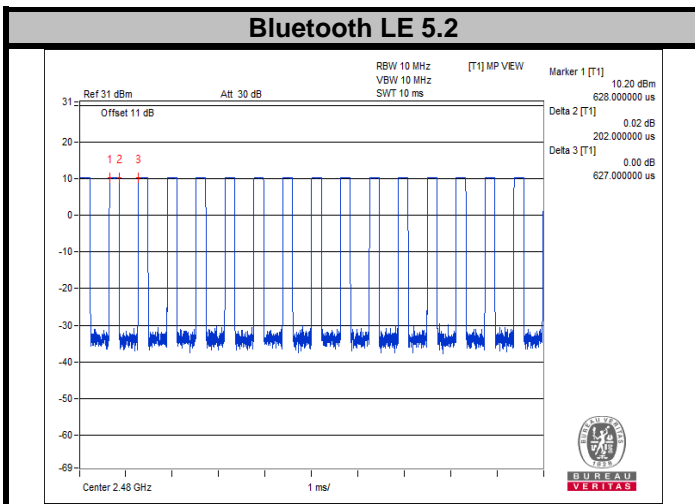


The duty factor of Bluetooth signal has been calculated as following.

$$\text{Duty Factor} = \text{Pulse Width} / \text{Total Period} = 1.48 / 3.745 = 39.52 \%$$

The duty factor of Bluetooth signal has been calculated as following.

$$\text{Duty Factor} = \text{Pulse Width} / \text{Total Period} = 229.36 / 623.31 = 36.8 \%$$



The duty factor of Bluetooth signal has been calculated as following.

$$\text{Duty Factor} = \text{Pulse Width} / \text{Total Period} = 202.0 / 627.0 = 32.22 \%$$

3.2 SAR Testing Exclusions

According to KDB 447498 D01, the SAR test exclusion condition is based on source-based time-averaged maximum conducted output power, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The SAR exclusion threshold is determined by the following formula.

- For the test separation distance ≤ 50 mm

$$\frac{\text{Max. Tune up Power}_{(mW)}}{\text{Min. Test Separation Distance}_{(mm)}} \times \sqrt{f_{(GHz)}} \leq 3.0$$

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

- For the test separation distance > 50 mm, and the frequency at 100 MHz to 1500 MHz

$$\left[(\text{Threshold at 50 mm in Step 1}) + (\text{Test Separation Distance} - 50 \text{ mm}) \times \left(\frac{f_{(MHz)}}{150} \right) \right]_{(mW)}$$

- For the test separation distance > 50 mm, and the frequency at > 1500 MHz to 6 GHz

$$[(\text{Threshold at 50 mm in Step 1}) + (\text{Test Separation Distance} - 50 \text{ mm}) \times 10]_{(mW)}$$

Mode	Time-Avg. Power (Include Duty Cycle) (dBm)	Time-Avg. Power (Include Duty Cycle) (mW)	Right Earbud Ant. to Surface (mm)	Calculated Result	Require SAR Testing?
BDR / EDR	6.47	4.436	6.7	1.04	No
LE 4.0	6.16	4.130	6.7	0.97	No
LE 5.2	5.58	3.614	6.7	0.85	No

Note:

- When separation distance ≤ 50 mm and the calculated result shown in above table is ≤ 3.0 , the SAR testing exclusion is applied.
- When separation distance > 50 mm and the device output power is less than the calculated result (power threshold, mW) shown in above table, the SAR testing exclusion is applied.

Summary:

Since the SAR testing for all device orientations apply SAR test exclusion per KDB 447498, SAR testing for this device is not required.

4. Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The road map of all our labs can be found in our web site also.

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