RF Exposure Evaluation Report

1. Product Information

FCC ID	2AQ2X-SW16
Product Name	Fast wireless charging pad
Model Number	SW16
Series Models	SW14, SW15, SW17, SW18, SW19, SW10
Power Supply	DC 9V from adapter
Maximum Rated Power of WPT	Output 1:15W Max (Wireless phone) Output 2:5W Max (Wireless phone/TWS) Output 3:3.5W Max (iWatch)
Modulation Type	ASK
Operation Frequency	From 110KHz~205KHz
Antenna Type	Coil Antenna
Hardware version	W106A WE9116 15W V1.0
Software version	V1.0
Exposure category	General population/uncontrolled environment
Test Sample ID:	CTA211214002-1#
EUT Type	Production Unit
Device Type	Mobile Device

2. Evaluation Limit

2.1 Refer Evaluation Method

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

According KDB 680106 D01 RF Exposure Wireless Charging App v03

2.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30

1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

3. Test Facility and Accreditation

Shenzhen CTA Testing Technology Co., Ltd.

Address: Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community,Fuhai Street, Bao'an District, Shenzhen, China

FCC-Registration No.: 517856 Designation Number: CN1318.

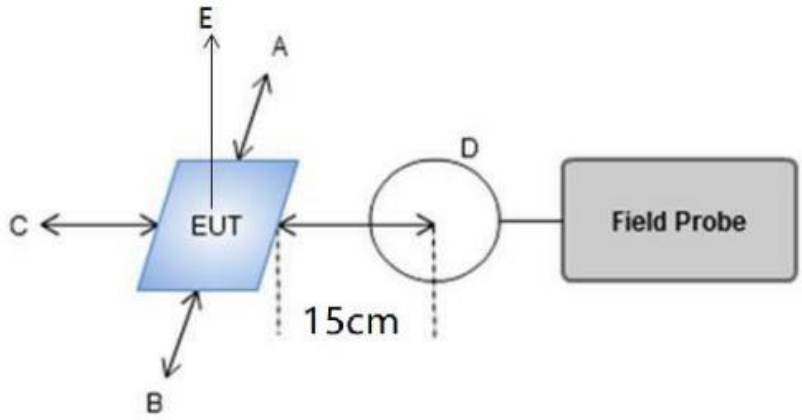
A2LA-Lab Cert. No.: 6534.01

4. Equipment Approval Considerations

Requirements of KDB 680106 D01	Yes / No	Description
Power transfer frequency is less than 1 MHz	Yes	The device operate in the frequency range 110KHz~205KHz
Output power from each primary coil is less than 15 watts	Yes	The maximum output power for each primary coil is 15W/5W/3.5W.
The system may consist of more than one source primary coils, charging one or more clients. If more than one primary coil is present, the coil pairs may be powered on at the same time.	Yes	The transfer system includes 3 primary coils.
Client device is placed directly in contact with the transmitter.	Yes	Client device is placed directly in contact with the transmitter.
Mobile exposure conditions only (portable exposure conditions are not covered by this exclusion).	Yes	Mobile exposure conditions only
The aggregate H-field strengths anywhere at or beyond 15 cm surrounding the device, and 20 cm away from the surface from all coils that by design can simultaneously transmit, and while those coils are simultaneously energized, are demonstrated to be less than 50% of the applicable MPE limit.	Yes	The EUT H-field strengths at 15 cm surrounding the device and 20 cm above the top surface from all simultaneous transmitting coils are demonstrated to be less than 50% of the MPE limit.

5. TEST CONDITIONS AND RESULTS

5.1 Test Setup



Note: A, B, C, D, E, F for six surfaces of the product.

The surfaces of each charge port is defined as figure below:

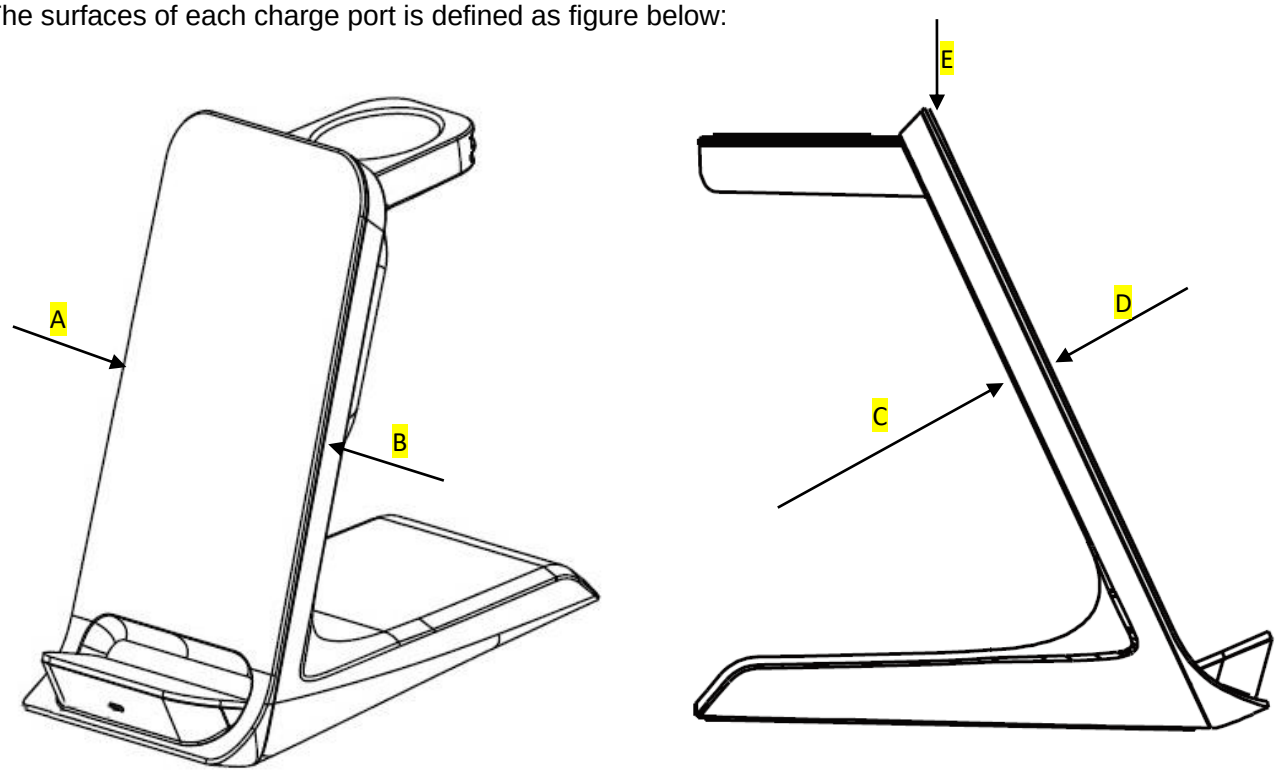


Figure1: surface define for phone charger port during the test

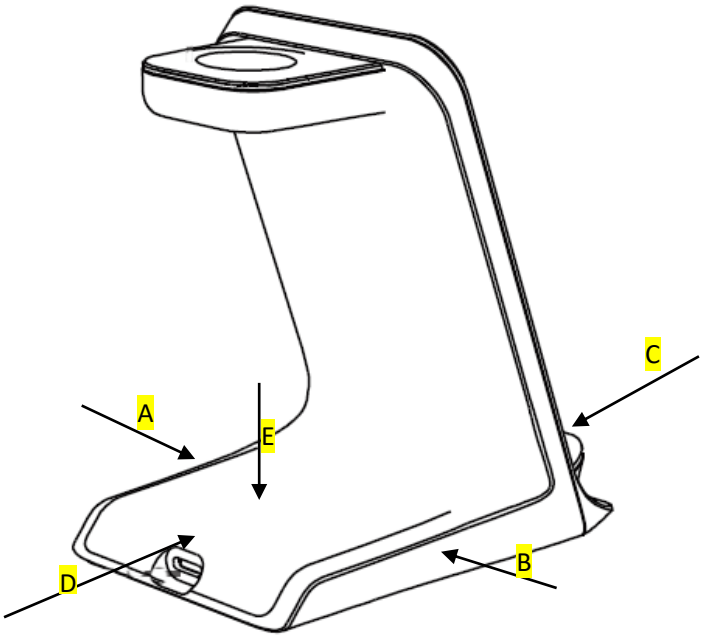


Figure 2: surface define for Airpods charger port during the test.

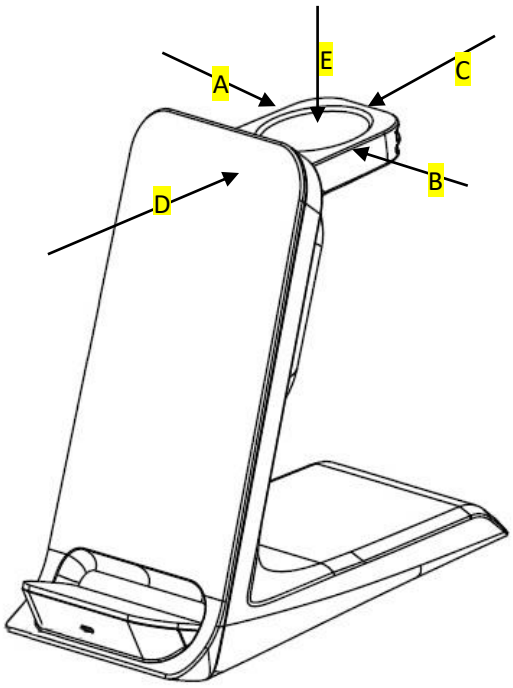


Figure 3:surface define for iWatch charger port during the test

5.2 Measurement Procedure

a) The RF exposure test was performed on 360 degree turn table in anechoic chamber.
b) The measurement probe was placed at test distance (15cm) which is between the edge of the charger and the geometric centre of probe.
c) The turn table was rotated 360d degree to search of highest strength.
d) The highest emission level was recorded and compared with limit as soon as measurement of each points (A, B, C, D, E) were completed.
e) The EUT were measured according to the dictates of KDB 680106 D01 RF Exposure Wireless Charging App v03.

5.3 Description of the test mode

Equipment under test was operated during the measurement under the following conditions:

☒ Charging and communication mode

Test Conditions	Description	
TM1	AC/DC Adapter (9V/3.0A) + EUT + Mobile Phone	Record
TM2	AC/DC Adapter (9V/3.0A) + EUT + Earbuds	Record
TM3	AC/DC Adapter (9V/3.0A) + EUT + Smart Watch	Record
TM4	AC/DC Adapter (9V/3.0A) + EUT + Mobile Phone+ Smart Watch	Record
TM5	AC/DC Adapter (9V/3.0A) + EUT + Mobile Phone + Earbuds	Record
TM6	AC/DC Adapter (9V/3.0A) + EUT + Smart Watch + Earbuds	Record
TM7	AC/DC Adapter (9V/3.0A) + EUT + Mobile Phone + Smart Watch + Earbuds	Record

5.4 Test Result of E and H field Strength

E-Field Strength at 15 cm from the edges surrounding the EUT and 15cm from the top surface of the EUT

E-Filed Strength at 15 cm from the edges surrounding the EUT and 15 cm above the top surface

Test port	Frequency Range (MHz)	Measured E-Field Strength Values (V/m)					FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
		Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
TM1	0.123	181.337	176.813	162.864	160.225	185.107	307.0	614.0
TM2	0.123	104.052	105.183	104.429	103.298	104.429	307.0	614.0
TM3	0.123	53.911	55.042	52.403	56.173	56.927	307.0	614.0

Test port TM4	Frequency Range (MHz)	Measured E-Field Strength Values (V/m)					FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
		Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
Phone port	0.123	139.867	141.752	137.605	142.129	144.768	307.0	614.0
iWatch port	0.123	50.141	54.288	53.534	55.419	57.681	307.0	614.0

Test port TM5	Frequency Range (MHz)	Measured E-Field Strength Values (V/m)					FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
		Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
Phone port	0.123	121.017	117.247	122.525	130.819	125.918	307.0	614.0
AirPods port	0.123	104.052	105.183	103.298	102.167	100.659	307.0	614.0

Test port TM6	Frequency Range (MHz)	Measured E-Field Strength Values (V/m)					FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
		Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
AirPods port	0.123	102.544	104.806	102.167	102.921	101.413	307.0	614.0
iWatch port	0.123	49.387	53.157	53.911	54.288	55.419	307.0	614.0

Test port TM7	Frequency Range (MHz)	Measured E-Field Strength Values (V/m)					FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
		Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
Phone port	0.123	113.477	115.739	116.493	114.608	114.231	307.0	614.0
AirPods port	0.123	98.774	101.036	102.921	103.675	101.036	307.0	614.0
iWatch port	0.123	49.764	53.911	52.403	53.157	53.534	307.0	614.0

Note: V/m= A/m *377

Test port	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)					FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
TM1	0.123	uT	0.601	0.586	0.540	0.531	0.614	--	--
		A/m	0.481	0.469	0.432	0.425	0.491	0.815	1.63
TM2	0.123	uT	0.345	0.349	0.346	0.343	0.346	--	--
		A/m	0.276	0.279	0.277	0.274	0.277	0.815	1.63
TM3	0.123	uT	0.179	0.183	0.174	0.186	0.189	--	--
		A/m	0.143	0.146	0.139	0.149	0.151	0.815	1.63

H-Field Strength at 15 cm from the edges surrounding the EUT and 15cm from the top surface of the EUT

Test port TM4	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)					FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
Phone port	0.123	uT	0.464	0.470	0.456	0.471	0.480	--	--
		A/m	0.371	0.376	0.365	0.377	0.384	0.815	1.63
iWatch port	0.123	uT	0.166	0.180	0.178	0.184	0.191	--	--
		A/m	0.133	0.144	0.142	0.147	0.153	0.815	1.63

Test port TM5	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)					FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
Phone port	0.123	uT	0.401	0.389	0.406	0.434	0.418	--	--
		A/m	0.321	0.311	0.325	0.347	0.334	0.815	1.63
AirPods port	0.123	uT	0.345	0.349	0.343	0.339	0.334	--	--
		A/m	0.276	0.279	0.274	0.271	0.267	0.815	1.63

Test port TM6	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)					FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
AirPods port	0.123	uT	0.340	0.348	0.339	0.341	0.336	--	--
		A/m	0.272	0.278	0.271	0.273	0.269	0.815	1.63
iWatch port	0.123	uT	0.164	0.176	0.179	0.180	0.184	--	--
		A/m	0.131	0.141	0.143	0.144	0.147	0.815	1.63

Test port TM7	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)					FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
Phone port	0.123	uT	0.376	0.384	0.386	0.380	0.379	--	--
		A/m	0.301	0.307	0.309	0.304	0.303	0.815	1.63
AirPods port	0.123	uT	0.328	0.335	0.341	0.344	0.335	--	--
		A/m	0.262	0.268	0.273	0.275	0.268	0.815	1.63
iWatch port	0.123	uT	0.165	0.179	0.174	0.176	0.178	--	--
		A/m	0.132	0.143	0.139	0.141	0.142	0.815	1.63

Note:A/m=uT/1.25

H-Field Strength at 20cm from the top surface of the EUT

Test port	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position E		
TM1	0.123	uT	0.498	--	--
		A/m	0.398	0.815	1.63
TM2	0.123	uT	0.329	--	--
		A/m	0.263	0.815	1.63
TM3	0.123	uT	0.130	--	--
		A/m	0.104	0.815	1.63

Test port TM4	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position E		
Phone port	0.123	uT	0.418	--	--
		A/m	0.334	0.815	1.63
iWatch port	0.123	uT	0.124	--	--
		A/m	0.099	0.815	1.63

Test port TM5	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position E		
Phone port	0.123	uT	0.378	--	--
		A/m	0.302	0.815	1.63
AirPods port	0.123	uT	0.320	--	--
		A/m	0.256	0.815	1.63

Test port TM6	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position E		
AirPods port	0.123	uT	0.314	--	--
		A/m	0.251	0.815	1.63
iWatch port	0.123	uT	0.129	--	--
		A/m	0.103	0.815	1.63

Test port TM7	Frequency Range (MHz)	Unit	Measured E-Field Strength Values (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
			Test Position E		
Phone port	0.123	uT	0.359	--	--
		A/m	0.287	0.815	1.63
AirPods port	0.123	uT	0.311	--	--
		A/m	0.249	0.815	1.63
iWatch port	0.123	uT	0.126	--	--
		A/m	0.101	0.815	1.63

Note:A/m=uT/1.25

5.5 Simultaneous E-Filed Strength and H-Filed Strength

KDB 447498 points for simultaneous transmission on far-filed measurement, while for below 30 MHz usually measured at near-filed. KDB680106 require aggregate leakage fields at 15 cm surrounding the device from all simultaneous transmitting coils are demonstrated to be less than 50% of the MPE limit;

KDB680106 can accept using field strength, power density, SAR measurements or computational modeling etc., the specific authorization requirements will be determined based on the results of the RF exposure evaluation.

Test labs suggest use Computational modelling to calculate Nerve Stimulation BRs;

Computational modelling, such as finite-difference time-domain (FDTD) may be used to demonstrate compliance with FCC § 1.1310 limits requirement,

Basic Calculations - The following calculations may be used to evaluate systems without consideration for the effects of phase resulting from multiple frequency and/or multiple antennas co-located in the measurement space, which may overestimate the actual result. If the result exceeds the limits, the advanced calculations described in follows may be used.

$$E_{AVG} = \frac{1}{n}\sum_{i=1}^{n}(E_{MaxRMS})_i$$

Where:

E-field measurements

E_{AVG} = Spatial average

E_{MaxRMS} = E-field at a measurement point

N = Number of spatially averaged points

And

$$H_{AVG} = \frac{1}{n}\sum_{i=1}^{n}(H_{MaxRMS})_i$$

Where:

H-field levels of magnetic field strength

H_{AVG} = Spatial average

H_{MaxRMS} = H-field at a measurement point

N = Number of spatially averaged points

E-Filed Strength at 15 cm from the edges surrounding the EUT and 15 cm above the top surface

Simultaneous combination	Frequency Range (MHz)	Max.Measured E-Field Strength Values (V/m)			Spatial Average E_{AVG} (V/m)	FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
		Phone port	AirPods port	iWatch port			
Phone+ AirPods TM5	0.123	130.819	105.183	--	118.001	307.0	614.0
Phone+ iWatch TM4	0.123	144.768	--	57.681	101.225	307.0	614.0
AirPods+iWatch TM6	0.123	--	104.806	55.419	80.113	307.0	614.0
Phone+AirPods +iWatch TM7	0.123	116.493	103.675	53.911	91.360	307.0	614.0

H-Filed Strength at 15 cm from the edges surrounding the EUT and 15 cm above the top surface

Simultaneous combination	Frequency Range (MHz)	Max. Measured H-Field Strength Values (A/m)			Spatial Average H_{AVG} (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
		Phone port	AirPods port	iWatch port			
Phone+ AirPods TM5	0.123	0.347	0.279	--	0.313	0.815	1.63
Phone+ iWatch TM4	0.123	0.384	--	0.153	0.269	0.815	1.63
AirPods+iWatch TM6	0.123	--	0.278	0.147	0.213	0.815	1.63
Phone+AirPods +iWatch TM7	0.123	0.309	0.275	0.143	0.242	0.815	1.63

H-Field Strength at 20cm from the top surface of the EUT

Simultaneous combination	Frequency Range (MHz)	Max. Measured H-Field Strength Values (A/m)			Spatial Average H_{AVG} (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
		Phone port	AirPods port	iWatch port			
Phone+ AirPods TM5	0.123	0.302	0.256	--	0.279	0.815	1.63
Phone+ iWatch TM4	0.123	0.334	--	0.099	0.217	0.815	1.63
AirPods+iWatch TM6	0.123	--	0.251	0.103	0.177	0.815	1.63
Phone+AirPods +iWatch TM7	0.123	0.287	0.249	0.101	0.212	0.815	1.63

6. Conclusion

A minimum safety distance of at 15 cm surrounding the device and 20 cm above the top surface of the device is required when the device is charging a smart phone. The detected emissions with a distance of 15 cm surrounding the device and 20 cm above the top surface of the device are below the limitations according to FCC KDB 680106 D01 Section 3. RF Exposure Requirement Clause 3.

7. Test Setup Photos of the EUT

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