



FCC Part 1 Subpart I
FCC Part 2 Subpart J

CERTIFICATION TEST REPORT

FOR

MAGNETIC CHARGING CABLE

MODEL NO: A2652

FCC ID: BCGA2652

REPORT NUMBER: 13881229-E2V2

ISSUE DATE: AUGUST 12, 2021

Prepared for
APPLE INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A

Prepared by
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888



Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/11/2021	Initial Issue	Chin Pang
V2	8/12/2021	Address TCB's Questions on page 6, section 6.2 & 6.3	Chin Pang

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A

EUT DESCRIPTION: MAGNETIC CHARGING CABLE

MODEL: A2652

BRAND: APPLE

SERIAL NUMBER: DLC105300H0141D1M

SAMPLE RECEIPT DATE JULY 27, 2021

DATE TESTED: JULY 27, 2021 – AUGUST 02, 2021

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 1 SUBPART I & PART 2 SUBPART J	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Reviewed By:



Chin Pang
Senior Engineer
UL Verification Service Inc.

Prepared By:



Tony Wang
Test Engineer
UL Verification Services Inc.

2. TEST METHODOLOGY

All measurements made in accordance with KDB 680106.

3. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input type="checkbox"/>	Building 1: 47173 Benicia Street, Fremont, CA 94538	US0104	2324A	208313
<input checked="" type="checkbox"/>	Building 2: 47266 Benicia Street, Fremont, CA 94538	US0104	22541	208313
<input type="checkbox"/>	Building 4: 47658 Kato Rd, Fremont, CA 94538	US0104	2324B	208313

4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U _{Lab}
Magnetic Field Reading (A/m)	+/-0.04284 (A/m)
Electric Field Reading (V/m)	+/-0.03682 (V/m)

Uncertainty figures are valid to a confidence level of 95.45%.

5. KDB 680106 D01 SECTION 5b EQUIPMENT APPROVAL CONSIDERATIONS

Requirement	Device
(1) Power transfer frequency is less than 1 MHz.	Yes. Operating Frequency is 326.5 kHz
(2) Output power from each primary coil is less than or equal to 15 watts.	Yes. The maximum power is 5 Watts
(3) The transfer system includes only single primary and secondary coils. This includes charging systems that may have multiple primary coils and clients that are able to detect and allow coupling only between individual pairs of coils.	Yes. The system includes one single primary, the device is designed to charge a single client
(4) Client device is placed directly in contact with the transmitter.	Yes. The client device is placed directly in contact with the transmitter.
(5) Mobile exposure conditions only (portable exposure conditions are not covered by this exclusion).	Yes. It is a mobile device
(6) The aggregate 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.	The worst case leakage @326kHz is 1.84%

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is a magnetic charging cable which has a single inductive charging coil to charge Apple Watch. The charging frequency is 326.5 kHz, and the maximum power consumption is 5W in charging status.

6.2. WORST-CASE CONFIGURATION AND MODE

The EUT is a single frequency magnetic charger enclosed in a plastic case. For the entire radiated emissions test, the EUT was investigated on the following configuration during the test at its natural orientation.

Config	Mode	Descriptions
1	Standby	Standby-EUT Alone powered by AC/DC adapter
2	Operating @326.5kHz. (~10%, 20~60%, and >90% Power Charging)	Direct contact during charging between the EUT & Watch #1 , and the EUT is powered by AC/DC adapter
3	Operating @326.5kHz. (10%, 20~60%, and >90% Power Charging)	Direct contact during charging between the EUT & Watch #2 , and the EUT is powered by AC/DC adapter
4	Operating @326.5kHz. (20~60% Power Charging)	Spot Check on direct contact during charging between the EUT & Watch #3 , and the EUT is powered by AC/DC adapter
5	Operating @326.5KHz (20-60% Power Charging)	Spot Check on direct contact during charging between the EUT & Watch #4 , and the EUT is powered by AC/DC adapter

6.3. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

SUPPORT EQUIPMENT & PERIPHERALS LIST			
Description	Manufacturer	Model	Serial Number
Watch #1	Apple	A2474	H3GWY4P12T
Watch #2	Apple	A2294	GY6DL017Q1Y3
Watch #3	Apple	A2293	GY6DL00FQ20R
Watch #4	Apple	A2354	G99D3055UQ128

I/O CABLES

The EUT with lightning to USB-C cable powered by AC/DC Adapter.

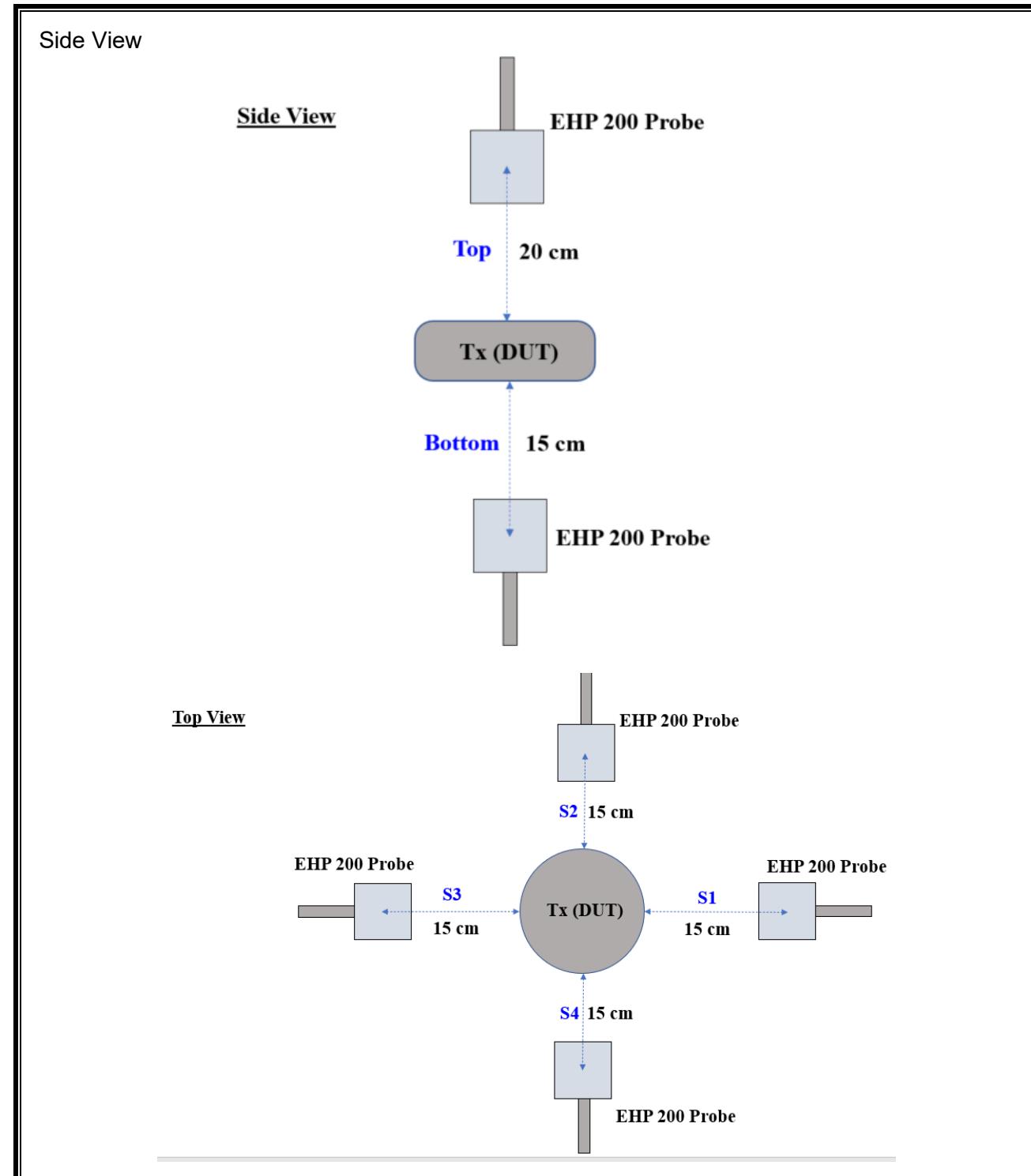
TEST SETUP

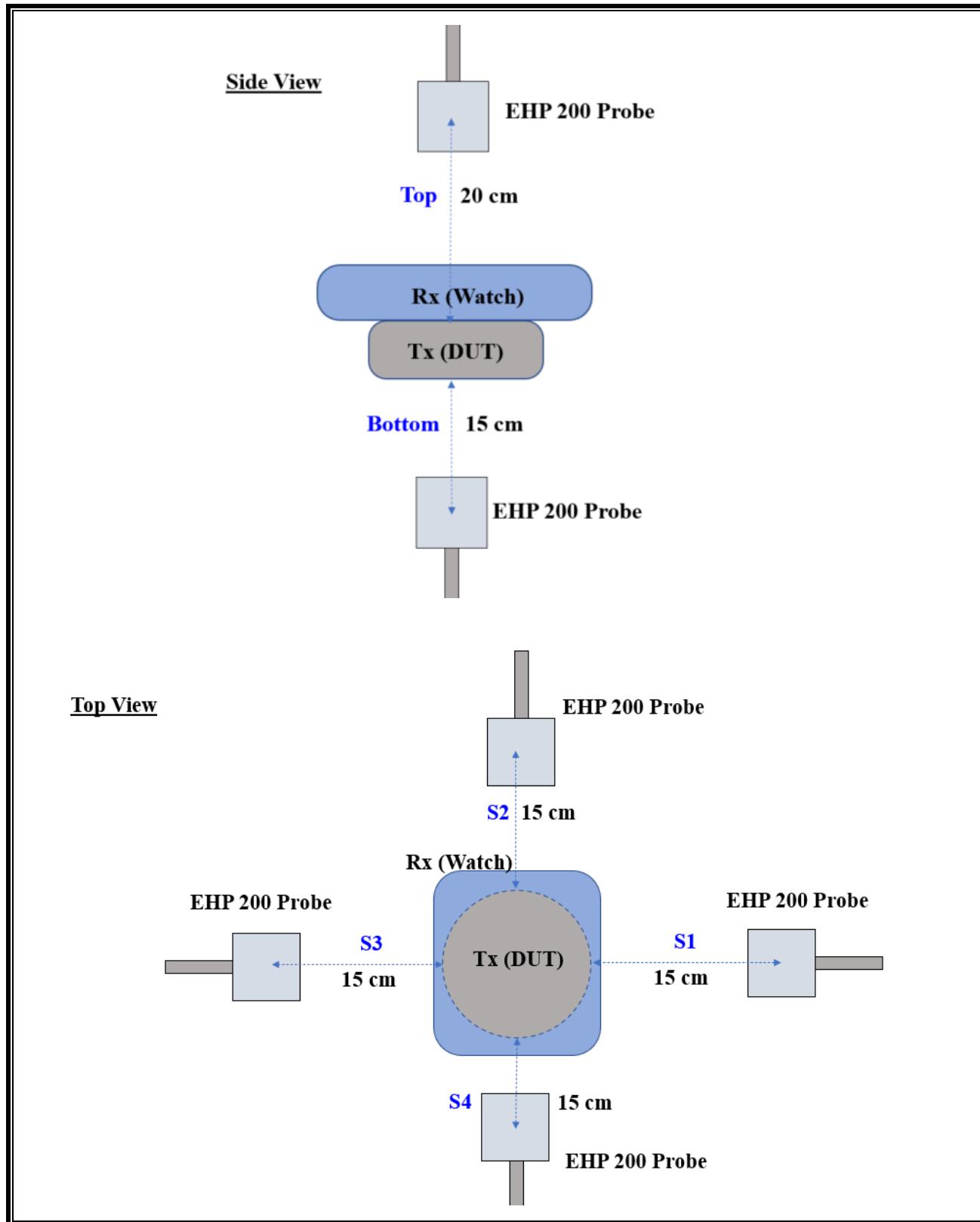
The following configurations are tested:

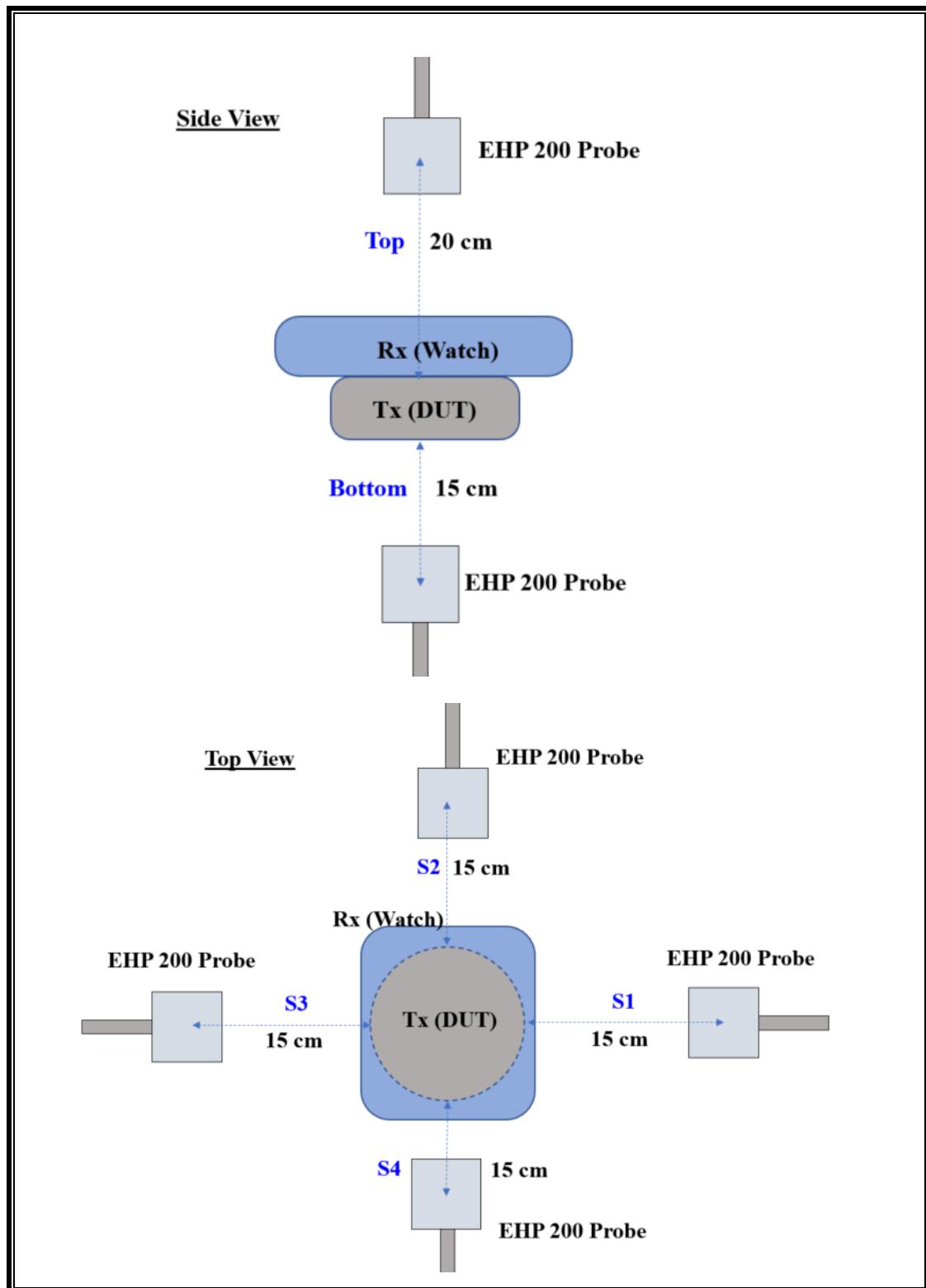
Configuration	Mode	Descriptions
1 (Standby)	EUT standalone	EUT with lightning to USB-C cable powered by AC/DC Adapter
2 & 3 (Direct Contact)	Operating (~10% Power Charging)	EUT with lightning to USB-C cable powered by AC/DC Adapter & Wireless Charging to Watch #1 & 2
	Operating (25%~60% Power Charging)	
	Operating (>90% Power Charging)	
4 & 5 (Spot Check)	Operating (20~60% Power Charging)	EUT with lightning to USB-C cable powered by AC/DC Adapter & Wireless Charging to Watch #3 and #4

MEASUREMENT SETUP

Measurements were taken from the top and all sides of the EUT per KDB680106 D01 v03.

CONFIGURATION 1 : STANDBY MODE

Configuration 2: Operating Mode WITH WATCH #1

CONFIGURATION 3, 4 & 5: EUT WITH WATCH #2, #3 & #4

7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was used for the tests documented in this report:

Test Equipment List						
Description	Manufacturer	Model	S/N	Label ID	Cal Due	Cal Date
Electric and Magnetic Field Probe	Narda	EHP-200A	160WX41008	T1085	03/16/2022	03/16/2021
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A-544	MY52350176	T1210	01/22/2022	01/22/2021

8. DUTY CYCLE

LIMITS

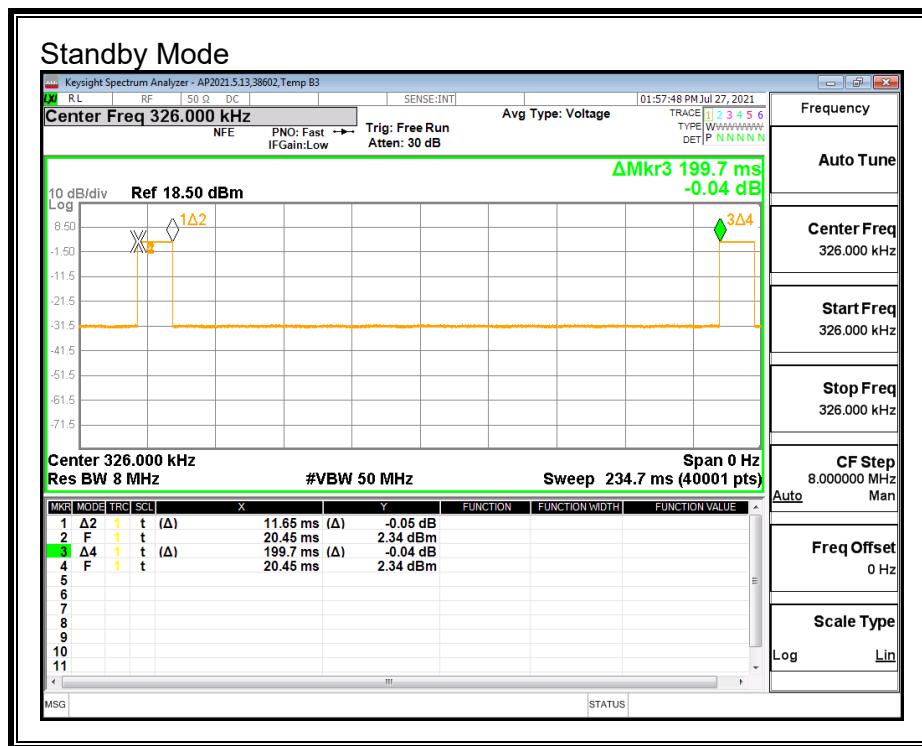
None; for reporting purposes only.

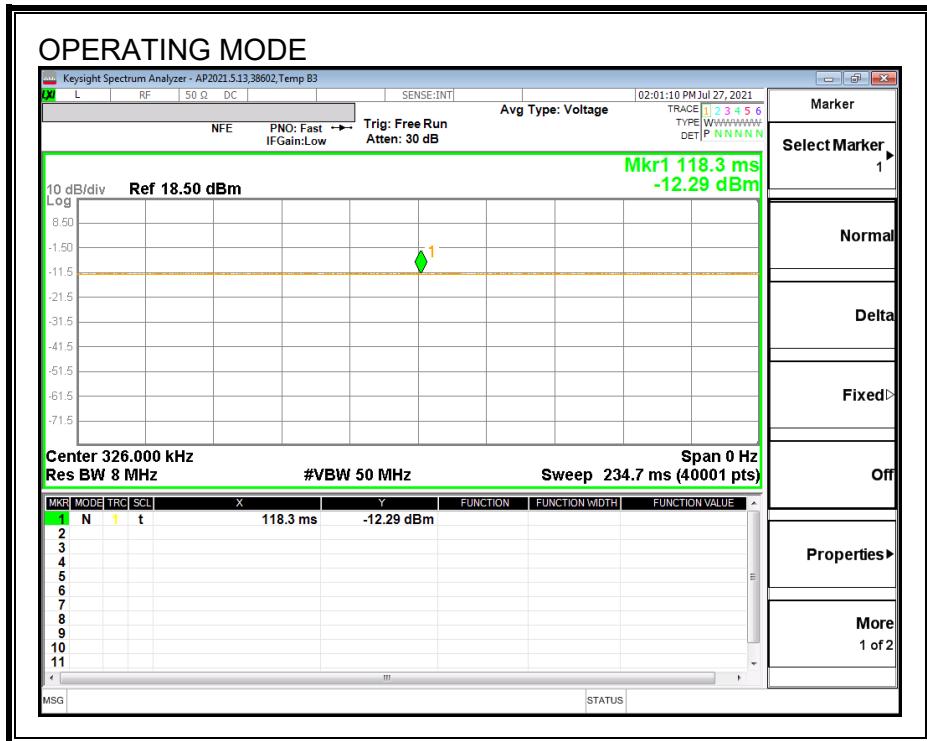
PROCEDURE

Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
Standby	11.65	199.70	0.06	5.83%	12.34
Operating	100.00	100.00	1.00	100.00%	0.00





9. MAXIMUM PERMISSIBLE RF EXPOSURE

9.1. FCC LIMITS AND SUMMARY

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

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 (minutes)
(A) Limits for Occupational/Controlled Exposures				
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				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
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

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

9.1.1. FCC RF Exposure Summary of Results

ID	38602	Date:	7/28/2021
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FCC RF Exposure Summary of Results

Configuration #1: STANDBY MODE

Electric Field Limit			Magnetic Field Limit		
FCC RF Exposure Limit	Maximum Average (V/m)	Percentage (%)	FCC RF Exposure	Maximum Average (A/m)	Percentage (%)
614	0.040	0.01%	1.63	0.008	0.49%

Configuration #2: EUT WITH WATCH #1

Electric Field Limit			Magnetic Field Limit		
FCC RF Exposure Limit	Maximum Average (V/m)	Percentage (%)	FCC RF Exposure	Maximum Average (A/m)	Percentage (%)
614	0.173	0.03%	1.63	0.030	1.84%

Configuration #3: EUT WITH WATCH #2

Electric Field Limit			Magnetic Field Limit		
FCC RF Exposure Limit	Maximum Average (V/m)	Percentage (%)	FCC RF Exposure	Maximum Average (A/m)	Percentage (%)
614	0.172	0.03%	1.63	0.028	1.72%

Configuration #4: EUT WITH WATCH #3

Electric Field Limit			Magnetic Field Limit		
FCC RF Exposure Limit	Maximum Average (V/m)	Percentage (%)	FCC RF Exposure	Maximum Average (A/m)	Percentage (%)
614	0.157	0.03%	1.63	0.028	1.72%

Configuration #5: EUT WITH WATCH #4

Electric Field Limit			Magnetic Field Limit		
FCC RF Exposure Limit	Maximum Average (V/m)	Percentage (%)	FCC RF Exposure	Maximum Average (A/m)	Percentage (%)
614	0.166	0.03%	1.63	0.029	1.78%

E- FIELD AND H- FIELD MEASUREMENTS

Note: Peak measurements were performed. RMS values were calculated from the peak measurement. Please refer to the formula for calculating the RMS values: [Field Strength x $\sqrt{\text{Duty Cycle}}$].

Configuration #1: STANDBY MODE EUT WITH WATCH #1

FCC Limit			Measuring Distance (cm)	Electric Field Limit (V/m)	Electric Field Reading (V/m)			Magnetic Field Limit (A/m)	Magnetic Field Reading (A/m)					
Configuration	Test Mode	FCC			Location	Peak	Duty Cycle %		FCC	Location	Peak			
1	Standby	614	15 cm surrounding the device (S1 - S4, Bottom) and 20 cm above the top surface of the EUT	S1 S2 S3 S4 Bottom Top Max	0.145 0.145 0.156 0.145 0.164 0.137 0.164	5.83	0.035 0.035 0.038 0.035 0.040 0.033 0.040	1.63	S1 S2 S3 S4 Bottom Top Max	0.019 0.019 0.018 0.018 0.016 0.032 0.032	0.005 0.005 0.004 0.004 0.004 0.008 0.008			

Configuration #2: EUT WITH WATCH #1 (CHARGING ONLY)

FCC Limit			Measuring Distance (cm)	Electric Field Limit (V/m)	Electric Field Reading (V/m)			Magnetic Field Limit (A/m)	Magnetic Field Reading (A/m)												
Configuration	Test Mode	FCC			Location	Peak	Duty Cycle %		FCC	Location	Peak										
2	Operating Real Product (Power <10% Charging)	15 cm surrounding the device (S1 - S4, Bottom) and 20 cm above the top surface of the EUT	S1 S2 S3 S4 Bottom Top Max S1 S2 S3 S4 Bottom Top Max S1 S2 S3 S4 Bottom Top Max S1 S2 S3 S4 Bottom Top Max	0.148 0.155 0.145 0.156 0.145 0.145 0.156 0.164 0.156 0.148 0.145 0.156 0.173 0.173 0.164 0.156 0.148 0.145 0.156 0.173 0.173 0.168 0.148 0.145 0.145 0.145 0.168 0.168	100	0.148 0.155 0.145 0.156 0.145 0.145 0.156 0.164 0.156 0.148 0.145 0.156 0.173 0.173 0.164 0.156 0.148 0.145 0.156 0.173 0.173 0.168 0.148 0.145 0.145 0.145 0.168 0.168	1.63	S1 S2 S3 S4 Bottom Top Max S1 S2 S3 S4 Bottom Top Max S1 S2 S3 S4 Bottom Top Max S1 S2 S3 S4 Bottom Top Max	0.018 0.020 0.020 0.019 0.026 0.018 0.026 0.025 0.019 0.019 0.021 0.030 0.030 0.027 0.018 0.018 0.022 0.027 0.027 0.027	100	0.018 0.020 0.020 0.019 0.026 0.018 0.026 0.025 0.019 0.019 0.021 0.030 0.030 0.030 0.027 0.018 0.018 0.022 0.027 0.027 0.027										
	Operating Real Product (Power ~ 20% - 60% Charging)																				
	Operating Real Product (Power >90% Charging)																				

Configuration #3: EUT WITH WATCH #2 (CHARGING ONLY)

FCC Limit		Measuring Distance (cm)	Electric Field Limit (V/m)	Electric Field Reading (V/m)			Magnetic Field Limit (A/m)	Magnetic Field Reading (A/m)						
Configuration	Test Mode			FCC	Location	Peak		FCC	Location	Peak				
3	Operating Real Product (Power <10% Charging)	15 cm surrounding the device (S1 - S4, Bottom) and 20 cm above the top surface of the EUT	614	100	S1	0.156	0.156	1.63	S1	0.018	0.018			
					S2	0.145	0.145		S2	0.021	0.021			
					S3	0.164	0.164		S3	0.018	0.018			
					S4	0.148	0.148		S4	0.021	0.021			
					Bottom	0.154	0.154		Bottom	0.027	0.027			
					Top	0.148	0.148		Top	0.018	0.018			
	Operating Real Product (Power ~ 20% - 60% Charging)				Max	0.164	0.164		Max	0.027	0.027			
					S1	0.162	0.162		S1	0.018	0.018			
					S2	0.164	0.164		S2	0.022	0.022			
					S3	0.156	0.156		S3	0.018	0.018			
					S4	0.156	0.156		S4	0.027	0.027			
					Bottom	0.156	0.156		Bottom	0.028	0.028			
	Operating Real Product (Power >90% Charging)				Top	0.172	0.172		Top	0.020	0.020			
					Max	0.172	0.172		Max	0.028	0.028			
					S1	0.148	0.148	100	S1	0.018	0.018			
					S2	0.145	0.145		S2	0.021	0.021			
					S3	0.164	0.164		S3	0.018	0.018			
					S4	0.148	0.148		S4	0.023	0.023			
					Bottom	0.157	0.157		Bottom	0.028	0.028			
					Top	0.157	0.157		Top	0.020	0.020			
					Max	0.164	0.164		Max	0.028	0.028			

Configuration #4: EUT WITH WATCH #3 (CHARGING SPOT CHECK)

FCC Limit											
Configuration	Test Mode	Measuring Distance (cm)	Electric Field Limit		Electric Field Reading			Magnetic Field Limit	Magnetic Field Reading		
			(V/m)	(V/m)	Location	Peak	Duty Cycle %		(A/m)	(A/m)	
			FCC				FCC Average	FCC	Location	Peak	FCC Average
4	Operating Real Product (Power ~ 20% - 60% Charging)	15 cm surrounding the device (S1 - S4, Bottom) and 20 cm above the top surface of the EUT	614	S1	0.156		0.156	1.63	S1	0.018	0.018
				S2	0.148		0.148		S2	0.021	0.021
				S3	0.137		0.137		S3	0.018	0.018
				S4	0.148		0.148		S4	0.023	0.023
				Bottom	0.153		0.153		Bottom	0.028	0.028
				Top	0.157		0.157		Top	0.020	0.020
				Max	0.157		0.157		Max	0.028	0.028

Configuration #5: EUT WITH WATCH #4 (CHARGING SPOT CHECK)

FCC Limit												
Configuration	Test Mode	Measuring Distance (cm)	Electric Field Limit		Electric Field Reading			(A/m)	Magnetic Field Reading			
			(V/m)	(V/m)	FCC	Location	Peak		FCC Average	FCC	Location	(A/m)
5	Operating Real Product (Power ~ 20% - 60% Charging)	15 cm surrounding the device (S1 - S4,Bottom) and 20 cm above the top surface of the EUT	614	S1 S2 S3 S4 Bottom Top Max	0.166 0.148 0.148 0.148 0.156 0.157 0.166	100	1.63	0.166 0.148 0.148 0.148 0.156 0.157 0.166	100	S1 S2 S3 S4 Bottom Top Max	0.018 0.021 0.018 0.023 0.029 0.020 0.029	0.018 0.021 0.018 0.023 0.029 0.020 0.029

10. SETUP PHOTO

Please see setup photo report 13881229-EP1V1

END OF REPORT