

AMPT LLC RF Exposure Exhibit

SCOPE OF WORK

EMC TESTING- String Optimizer, Models: 31570023-00

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104402894MPK-010B

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RF Exposure Exhibit (mobile devices)

Report Number: 104402894MPK-010B Project Number: G104402894

Report Issue Date: November 17, 2020

Product Designation: String Optimizer
Model Tested: 31570023-00

FCC ID: X3R-TKKR IC: 8399A-TKKR to

47CFR 2.1091 RSS-102 Issue 5

for

AMPT LLC

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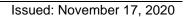
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Report No. 104402894MPK-010B				
Equipment Under Test:	String Optimizer			
Trade Name:	AMPT LLC			
Model(s) Tested:	31570023-00			
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Applicable Regulation:	47CFR 2.1091 RSS-102 Issue 5			



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1.0 RF Exposure Summary

Test	Reference FCC	Reference Industry Canada	Result
Radio frequency Radiation Exposure Evaluation	47 CFR§2.1091	RSS-102 Issue 5	Complies

2.0 RF Exposure Limits

In this document, we evaluate the RF Exposure to human body due the intentional transmission from the transmitter (EUT). The limits for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 and RSS-102 are followed.

2.1 FCC Limits

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Average Time (minutes)		
	(A)Limits For	Occupational / Cont	rol Exposures			
0.3 – 3.0	614	1.63	*100	6		
3.0 – 30	1842/f	4.89/f	*900/f²	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/f²	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 density



2.2 Industry Canada Limits

According to RSS-102, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)						
Frequency Range	ncy Range Electric Field		Power Density	Reference Period		
(MHz)	(V/m rms)	(A/m rms)	(W/m ²)	(minutes)		
0.003-10	83	90	-	Instantaneous*		
0.1-10	-	0.73/ f	-	6**		
1.1-10	87/ f ^{0.5}	-	-	6**		
10-20	27.46	0.0728	-2	6		
20-48	58.07/ f ^{0.25}	0.1540/ f ^{0.25}	8.944/ f0.5	6		
48-300	22.06	0.05852	1.291	6		
300-6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6		
6000-15000	61.4	0.163	10	6		
15000-150000	61.4	0.163	10	616000/ f ^{1.2}		
150000-300000	0.158 f ^{0.5}	4.21 x 10-4 f ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/f ^{1.2}		

Note: *f* is frequency in MHz.

^{*} Based on nerve stimulation (NS).

^{**} Based on specific absorption rate (SAR).

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3.0 Test Results (Mobile Configuration)

3.1 Classification

Radio is installed inside a mobile host device. The antenna of the product, under normal use condition, is at least 20 cm away from the body of the user and accessible to the end user. Warning statement to the user for keeping at least 20 cm or more separation distance with the antenna should be included in user's manual.

3.2 EIRP calculations

The String Optimizer, Model: 31570023-00 consists of one radio: 2.4 GHz Bluetooth FHSS.

3.3 Maximum RF Power

Frequency Range (MHz)	RF Output (dBm)	Antenna Gain¹ (dBi)	Note
2410-2474.5	-4.38	4	Power measurement was taken from Report # 104402894MPK-010

¹As declared by the manufacturer.



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3.4 RF Exposure Calculation

3.4.1 RF Exposure calculation for 2.4 GHz Bluetooth FHSS

Calculations for this report are based on highest power measured for each band.

Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (mW/cm²) @20 cm	FCC Limit (mW/cm²)
2410-2474.5	-0.38	0.9162	0.00018	1

Note: Antenna gains below 0 are considered as 0dBi.

Frequency Range (MHz)	EIRP (dBm)	EIRP (mW)	Power Density (W/m²) @20 cm	RSS Limit (W/m²)
2410-2474.5	-0.38	0.9162	0.0018	5.36

Note: Antenna gains below 0 are considered as 0dBi.



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Appendix A: Power Density Calculation

The Power Density can be calculated using the formula

 $S = EIRP/4\pi D^2$

Where: S is Power Density in mW/cm²
D is the distance from the antenna in cm.



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4.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0/ G104402894	HH	KV	November 17, 2020	Original document