Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Investigation)
(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: SBPE278

Project Title: Research on power output of phone power adapters

Project Type: Investigation

To our best knowledge and after thorough literature research, as at 9/6/2022 , there ~~are~~ / are no* similar works. If there are, the reference links are as below:

N/A

The enhancement our project has made for the existing related products or research is summarized as below:

N/A

***Please delete if not applicable. HKSSPC values the originality of works. Students must conduct literature research thoroughly to ensure that their works are unique, and to list relevant reference materials to complement the research or invention.**

I. Background

We have to charge our mobile phones everyday, but there are different kinds of chargers including different brands and different stated power outputs. We would like to find out which chargers are more effective and reliable. Therefore, our project would like to investigate whether phone power adapters really work under its stated Watt.

II. Objectives

To investigate the difference between the actual power output by phone power adapters and their stated power output.

III. Hypothesis

Hypothesis: The actual power consumed by the phone power adapters is lower than the stated value.

It can be tested by comparing the power measured during charging the phone by a power meter and the stated power output.

IV. Methodology

Material used:

1. Different brands and different Watt of power adapters
2. Power meter
3. Phones

Experiment method:
Measuring the power of the power adapters of different brands and different stated power output by the power meter when they are charging the phones.

V. Results

7 power adapters from 3 brands are tested and 2 phones are used in the experiment.

		Type of device					
		S21+(screen on)	S21+(screen off)	iPhone 13(screen on)	iPhone 13(screen off)	iPhone 13(low power mode)	
Type of power adapter	Apple 10 W	3.8-5.9	3.1-3.7	7-7.5	7-7.4	7-7.4	Measured Watt(W)
	Apple 18 W	16.5	6.5	7.5-8.7	9-10	8-9	
	Apple 20 W	12-16.4	6.5	8.3	9-10	8.7-9.2	
	Samsung 7.75 W	9.1	9.1	5.5-6.5	5.7-6	5-5.3	
	Samsung 10.6 W	12.2	12.2	4.6	5.4-6	4.3-4.7	
	Samsung 15 W	16-17	7.1	5.8	5.8	5.8	
	Verbatim 15 W(Type C)	17.2	6.8	7.1-7.4	8.4-8.8	8-8.3	
	Verbatim 15 W(USB-A)	17.2	7.3	7	6.5-7.2	7.2-7.8	

The limitation is that there are too few power adapters being tested. More brands of power adapters can be used to obtain a more reliable result.

VI. Conclusion

From the experiments, we found that the power output of Apple's power adapters cannot reach its stated W while power output of Samsung's power adapters and Verbatim's can reach their stated W when charging Samsung phone under certain conditions(screen off). This may be due to the battery level of the phones. Since when the battery level is high, the charging speed decreases.

Through our experiments, we have noticed that the low power mode of the iPhone does not affect the power output of the adapters. One of the possible reasons is that the low power mode is used to reduce energy consumption of the phone by restricting the usage of some of the functions, for example, it automatically shuts down the app that is not in use and turns down the light density of the phones. These have greatly diminished the consumption of energy. As a result, the energy can be saved and there is no direct relationship with the power output of the adapters.

For Samsung S21+, the power output when the screen is off is larger than the power output when the screen is on. We proposed that the reason behind this phenomenon is that when the phone is used, the phone has to charge and operate at the same time, thus the phone is dissipating some of the power it gains. As a result, the power output of the adapters is reduced. For iPhone 13, the power output when the screen is off is similar to the power output when the screen is on. One of the possible reasons is that the product design of the iPhone may differ from other phones.

Besides, the type of wire does not affect the output power based on the result in the Verbatim 15W power adapter. Generally, type C wire charges faster than USB-A wire when they are used in very high power. However, in our experiment, the power adapters used do not have such high power output. Therefore, the type of wire does not affect the power output much.

Furthermore, the power adapters perform better i.e. have larger power output when the phone has the same brand as the power adapter. The reason behind may be the phone companies modify their own standard and specification in their power adapters to best suit their phones requirements.

☒**Our project is developed based on our school's previous project and the enhancement is as below: N/A**