

Analysis of USB Fan

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The USB fan was provided to me by a reporter at The Economist who attended the summit in Singapore. The aim of this project was to evaluate if there is any additional functionality inside USB fan.

Sample opening

This USB fan has a small motor inside and a USB-C connector for plugging it into mobile devices (Figure 1). The pinout of the USB-C connector is shown in Figure 2. If any Trojan software functionality is present it would require connections of a malicious semiconductor chip to either D-/D+ lines, or to RX1-/+, TX1-/+, RX2-/+, TX2-/+, lines.



Figure 1. Motor with USB connector

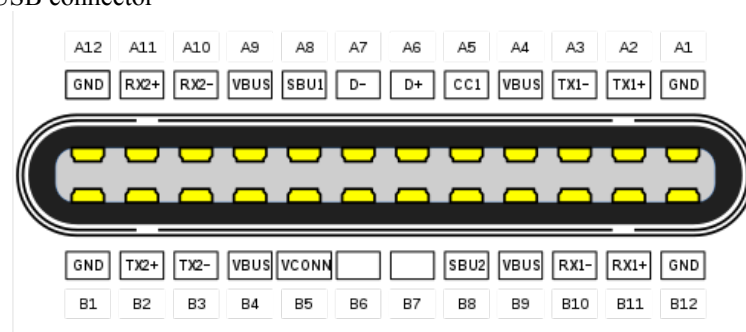


Figure 2. USB connector pinout (<https://en.wikipedia.org/wiki/USB-C>)

The first test was performed on measuring the resistance between data lines and GND pins. The resistance of above 1Gohm revealed by a digital multimeter is an indicator that there is a low chance of any circuits connected to the USB data pins. The next step was to confirm about any malicious connections by cutting the plastic package around the USB connector using a sharp

knife. Then the plastic at one side of the USB connector was removed thus exposing the internal electrical connections (Figure 3).

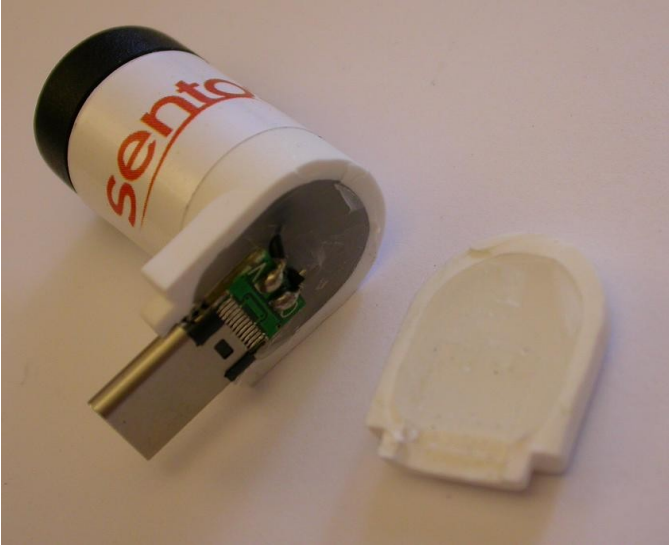


Figure 3. Opened fan case

Close up pictures of the connector from both sides were made (Figures 4 and 5).



Figure 4. Front PCB side with components

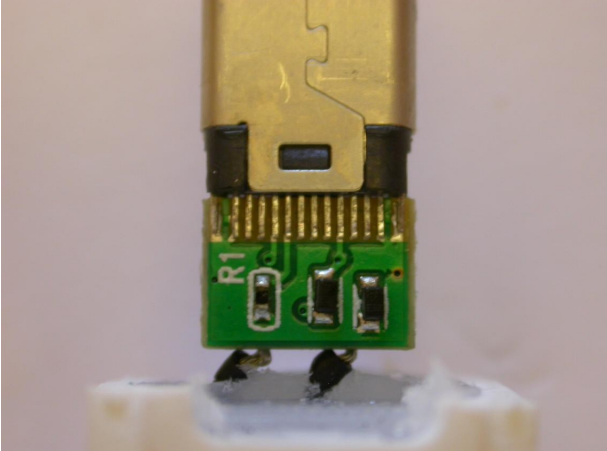


Figure 5. Rear PCB side with wires

It is clear to see from the left picture that the following pins are connected: A1 (GND), A4 (VBUS), A9 (VBUS), A12 (GND). On the right picture the following pins are used: B1 (GND), B4 (VBUS), B5 (VCONN), B9 (VBUS), B12 (GND). VCONN pin is connected to VBUS via a resistor. There are also diodes on the board, probably to reduce the fan supply voltage from 5V to 3.5V.

Conclusion

This particular sample of USB fan does not have any computer functionality on USB interface. It can only be used for driving the motor from USB power. However, this does not eliminate the possibility of malicious or Trojan components wired to USB connector in other fans, lamps and other end-user USB devices. Hence, their evaluation will be essential before any sensitive usage.