

This document will detail the antenna to be used with FCC ID PHANTOM-VS015, the VendScreen Revolution vending machine payment system near-field communications (NFC) radio system. The antenna employed in this device is a rectangular loop, mounted behind the front panel of the device surrounding the LCD touchscreen interface. A photograph of the antenna can be found in Figure 1.

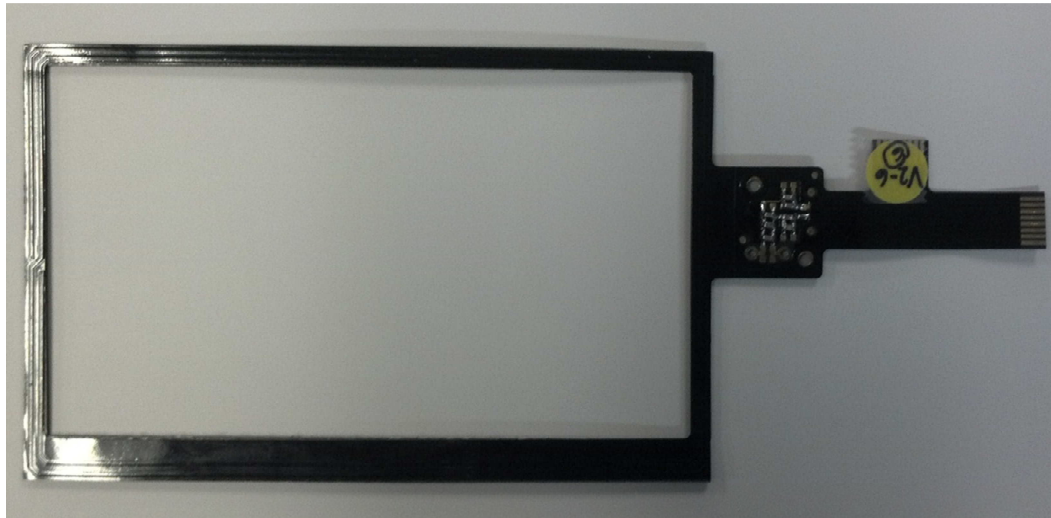


Figure 1: NFC Loop Antenna

The antenna is connected to the NFC radio board via a proprietary flat-flex connector. This connector is nonstandard, and the antenna is enclosed within the device and not user-serviceable.

With regards to antenna gain, it should be noted that very little of the antenna magnetic field is actually transmitted away from the antenna. This is due to the use of a very small loop antenna, which makes it a very inefficient radiator, or in other words antenna which has a very low radiation resistance so the radiated power is actually spent as heat in the antenna ohmic resistance and the parallel resistor, while the magnetic field around the antenna is of reactive type where energy is exchanged back and forth between the current in the antenna and the magnetic field in the small volume around it, during each carrier cycle.

Radiation resistance of small loop is  $R_r = 31200A^2/\lambda^4$  where A is the loop antenna area. This formula yields an extremely small radiation resistance (less than  $10^{-7}$  ohm). This resistance may be considered as if connected in series with the antenna ohmic resistance (and the driver output resistance). This explains why only a minute fraction of the magnetic field energy actually propagates away from the antenna to the far field.