December 2021

SWITCHABLE ANTENNAS WHILE SMART PEN ATTACHED

HP INC

Switchable Antennas While SmartPen Attached

Abstract: A smartpen can be docked adjacent an antenna of a small computing device without adversely affecting the wireless performance of the antenna and the device by employing an additional antenna and/or modifying the antenna pattern when the smartpen is attached to the device.

This disclosure relates to the field of portable computers.

A technique is disclosed that allows a smartpen to be docked adjacent an antenna of a small computer without adversely impacting antenna performance.

For smaller portable computers, such as tablets or detachable products such as slates, it is often desirable for the user to employ a smartpen as a user input device, particularly when drawing, plotting, or even pointing. When the smartpen is not in use, it should be attached to the side of the computer so that it will not be lost and will always be easily available to the user when needed. However, in many small computers finding a location on the computer for docking the pen is problematic. Many small size computers have multiple antennas (e.g., Wifi, LTE) and user-accessible ports (e.g., type C connector, SIM connector, DC power jack, audio jack). If the smartpen were to be docked adjacent to the ports, user access to these ports can be blocked.

However, if the smartpen is docked adjacent to the antennas instead, performance of the radios connected to the antennas can be adversely affected due to metal components in the smartpen. For example, in the case of a smartphone or tablet, a single slot antenna has sufficiency performance to support the entire Wifi performance range from 2.4Ghz to about 5Ghz. But if a smartpen is attached adjacent the antenna, antenna performance will be degraded: the frequency response of the antenna will be shifted to a lower frequency (i.e., become detuned) or the bandwidth of the antenna's frequency response will be narrowed, thus decreasing the range of coverage. However, because access to the device's ports cannot be blocked by the smartpen, the only option is to dock the smartpen adjacent the antenna.

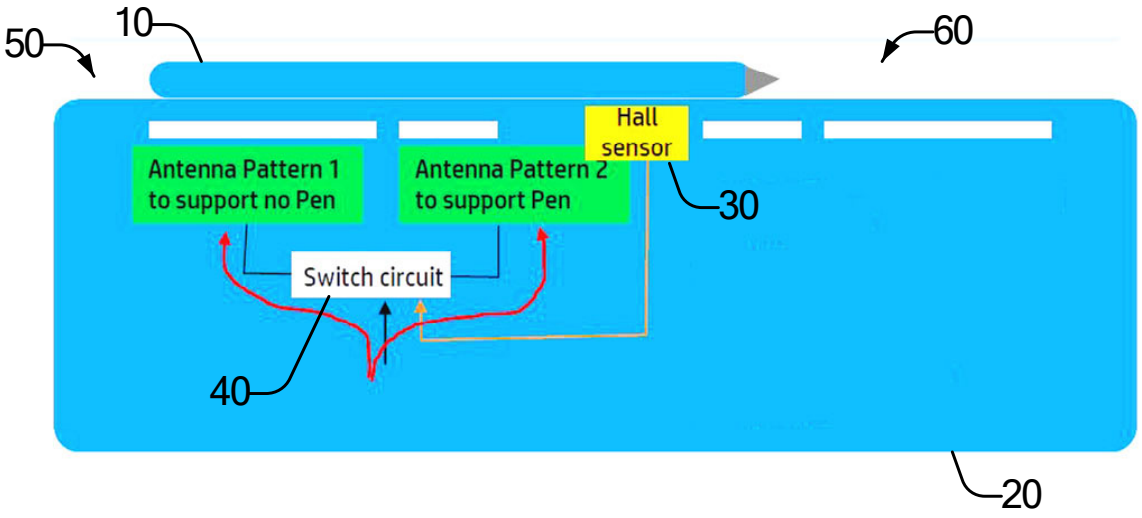
According to the present disclosure, and as understood with reference to the Figure, a sensor and a BIOS tuner are used to switch antenna frequency, and/or antenna usage, to the optimal configuration (e.g., optimal radiation efficiency) based on whether the smartpen is docked to the computer.

A smartpen 10 attaches to a side of the small computer 20 by magnetic means. When the smartpen 10 is so attached, a hall sensor 30 will be enabled. The hall sensor 30 informs the computer's embedded controller (EC; not shown) that the smartpen 10 is attached to the computer 20, and the EC in turn signals an antenna switch circuit 40 to select the optimal radiation pattern.

A second slot antenna 60 is disposed adjacent the original single slot antenna 50 in the small computer 20. The switchable circuit 40 is connected to both slot antennas 50,60. When the smartpen 10 is detached from the small computer 20, the circuit 40 provides the antenna signal to only the original slot antenna 50. When the smartpen 10 is attached to the computer 20, the circuit 40 provides the antenna signal to both slot antennas 50,60 and/or changes the antenna pattern (e.g., frequency response and/or bandwidth) relative to the original characteristics.

The disclosed technique advantageously allows a smartpen to be docked on a small computing device adjacent an antenna without degrading antenna performance.

Disclosed by Ming-Shien Tsai, David Chi, and Sean Chu, HP Inc.


50
10
60
Hall sensor
Antenna Pattern 1 to support no Pen
Antenna Pattern 2 to support Pen
30
Switch circuit
40
20