Poster: How to Harmonize Wi-Fi and Bluetooth in a Mobile Device?

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1. INTRODUCTION

Wi-Fi and Bluetooth are two of the most widely used wireless technologies in mobile devices such as laptops, smart pads, and smart phones. We expect that the use of these two technologies will even more flourish with the forthcoming devices such as Google Glass and iWatch. However, Wi-Fi and Bluetooth share the same 2.4 GHz ISM band, which may result in severe self-interference when they coexist in the same device.

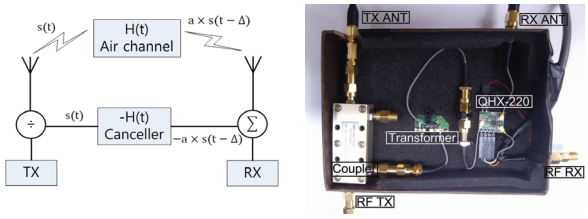
In this work, we show the possibility of resolving the in-device coexistence issue of Wi-Fi and Bluetooth without any change in the protocols. We expand the idea of self-interference cancellation in [1], which was originally proposed for full-duplex wireless communication. Our solution is highly practical in the sense that it only requires minimal change in the hardware circuitry without modifying wireless protocols.

2. PROPOSED SOLUTION

There exist several interference mitigating techniques between Wi-Fi and Bluetooth.In practice, the most widely used solution is adaptive frequency hopping (AFH), which measures the noise level over the entire channels. If the noise level of a channel is larger than a threshold, then AFH registers the channel as bad and excludes it from the hopping sequence.

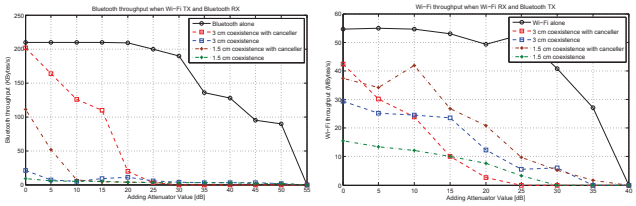
However, AFH alone is often not enough to resolve the in-device coexistence issue of Wi-Fi and Bluetooth, especially with insufficient spatial isolation, which is exactly the case of mobile devices. In particular, the two cases when one is in transmission while the other is in reception are critical because the receive signal is much weaker than the transmit signal. When Wi-Fi is in transmission while Bluetooth is in reception without enough isolation, Bluetooth may not properly operate due to the insufficient number of good channels.

Hence, on top of the conventional AFH, we introduce a canceller that can cancel out the in-device interference when Wi-Fi and Bluetooth radios simultaneously operate in the same device. The idea of canceller is simple as follows: In order to remove the interference signal from the TX antenna, we place a reverse channel inside the circuitry as illustrated in Fig. 1 (a).



(a) Canceller mechanism (b) Canceller testbed

Figure 1: Canceller mechanism and our testbed.



(a) Bluetooth throughput (b) Wi-Fi throughput

Figure 2: Throughput performance of Bluetooth and Wi-Fi.

3. EXPERIMENTAL RESULTS

In our testbed shown in Fig. 1 (b), the coupler divides the RF TX signal into two paths with 90% power and 10% power, respectively. Then, the 90% power path goes into the transmission antenna. In the meantime, the phase of the other path is inverted by the transformer, and the delay and the gain are further controlled by QHX-220 (which is a noise canceller).

In our experiments, we consider two values for the distance between two antennas, i.e., 1.5 cm and 3 cm, which are reasonable for consumer mobile devices. We consider the two cases when one is in transmission while the other is in reception as shown in Fig. 2. Our experimental results in Fig. 2 demonstrate that our scheme can introduce significant additional isolation between Wi-Fi and Bluetooth radios in a small mobile device without any transmission performance degradation.

4. REFERENCES

[1] M. Jain, J. Choi, T. Kim, D. Bharadia, K. Srinivasan, P. Levis, S. Katti, P. Sinha, and S. Seth, "Practical, real-time, full duplex wireless." in *Proc. ACM Mobicom*, 2011.

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