Mitigating Multiple Narrowband Interferers in SDR IEEE 802.11g Diversity Receiver

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Abstract

Co-channel interference among heterogeneous devices in ISM band significantly degrades throughput and reliability. For example 802.11g (WiFi) and 802.15.4 (ZigBee) operate in the 2.4 GHz ISM band simultaneously and both of them face significant performance degradation. In this demonstration, we show a simple yet effective method to mitigate the effects of narrowband (ZigBee) interference on a wideband OFDM system(WiFi) for Single and Multi-Antenna 802.11g receivers. We use local noise variance(LNV) estimates computed from WiFi preambles to scale the log-likelihood ratios (LLR) of WiFi sub-carriers. The implementation has been done on Ettus USRP B210 and a combination of GNU Radio and Openairinterface.

WiFi-ZigBee Interference

- Out of 52 subcarriers of WiFi ($U_{sub}$), 7 subcarriers get overlapped with single ZigBee channel(2 MHz)
- Noise variance on interfered subcarriers(red) gets higher than non-interfered subcarriers(green)

Simulation Results

- WiFi: 11 taps
- ZigBee: 1 tap
- Noise Power: $-100$ dBm
- WiFi/ZigBee PSDU: 100 bytes
- WiFi MCS: 0, 2, 4, 6
- ZigBee TxP: $-85$ dBm

Proposed Solutions

- Single Antenna Systems: Localized Noise Variance(LNV) estimation of OFDM subcarriers followed by LLR Scaling
- Multi-Antenna Systems: Maximal Ratio Combiner with LLR Scaling (MLSC)

Software and Hardware Tools

- Ettus/NI USRP B210

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References


Conclusions and Ongoing Work

Conclusions

- LLR Scaling based on LNV estimates significantly reduce PER of wideband OFDM systems facing narrowband interference in single antenna 802.11g receivers.
- Maximal Ratio Combining achieves further gain in multi antenna 802.11g receivers.
- Proposed solutions are compatible to deploy within existing 802.11g infrastructure without any change in the standard.