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Optimising Radio Coverage for Wireless Media Servers

Evangelos Mellios, Geoff Hilton, Andrew Nix; Centre for Communications Research, University of Bristol. Contact – Evangelos.Mellios@bristol.ac.uk

Aim : System level analysis of the performance of a three element patch antenna array for a 2x3 802.11n wireless home media server application for High-Definition video streaming at 2.4GHz.

Introduction

- With the immanent switch-off of analogue television and the recently developed IEEE 802.11n standard for WLANs, which employs multiple antennas and promises data rates up to 600Mbps, a new market is emerging for wireless home media servers; these are devices that connect to a Set-Top-Box and enable the wireless delivery of the video signal around the home.
- Directional patches may be chosen over the widely used in MIMO WLANs omnidirectional antennas, as with a typical position of the box being at the edge of a room the antenna beam can be used to illuminate the room.

Patch antenna substrate choice and efficiency

- RT/Duroid 5880 ($\epsilon_r=2.2$)
Relative to a monopole measured efficiency: ~80%
- FR4 ($\epsilon_r\sim4.5$)
Relative to a monopole measured efficiency: ~40%
- Cost-efficiency trade-off: The use of the RT/Duroid substrate results in a 3dB improvement in performance over the significantly cheaper FR4
- HD video streaming applications: High demands in terms of throughput and packet-error-rate

Antenna input responses and radiation patterns

Measured system performance for an office environment

Comparison with omnidirectional antennas

Conclusions

- Efficiency comparison: The use of the RT/Duroid substrate results in a 3dB improvement in performance over the significantly cheaper FR4
- Significant impact of box and table mounting on input responses, radiation patterns and directivities – needs to be accounted for when designing antennas
- Satisfying coverage for HD video streaming in the whole office area (data rate at least 40Mbps) – Performance depends heavily on the box orientation (up to 40Mbps throughput differences)
- Better performance than omnidirectional antennas on the same floor but poorer on top and lower floors
- Antenna selection in future designs: Beneficial to overcome the problems of unpredictable box orientation and poor three-dimensional coverage

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