Packet Length Issues Based on RF Media Considerations

R. Mahany
Norand Corporation

Bursty View of Channel

Interference Energy

Signal Energy

Time

Position

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Microwave Oven

- Recognized as Period Interference Source
- Often Viewed as a Partial Band Jammer

Calibration

Correction to 94/94

-18 dBm
Absolute
2480 MHz

Microwave Energy Profile

Lighter = More Power

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Microwave Energy Profile

- Indoor Channel Model
  - No Consensus Model
  - 3-D Standing Wave Pattern With $\lambda/4$ Feature Spacing
- Mobile Units Pass Through Standing Wave Features as a Function of Their Velocity

<table>
<thead>
<tr>
<th>MPH</th>
<th>m/s</th>
<th>time for $\lambda/4$ distance</th>
<th>example</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>4.47</td>
<td>6.7 ms</td>
<td>Industrial Vehicle</td>
</tr>
<tr>
<td>5</td>
<td>2.23</td>
<td>13.4 ms</td>
<td>Fast Walk</td>
</tr>
<tr>
<td>3</td>
<td>1.34</td>
<td>22.3 ms</td>
<td>Rumba</td>
</tr>
<tr>
<td>1</td>
<td>.45</td>
<td>67.1 ms</td>
<td>Waltz</td>
</tr>
</tbody>
</table>
Test Results

- Testing as Part of Diversity Study
- Results Anecdotal Rather than Definitive

Test Conditions
- Single Channel, 250 KBPS MSK
- Single Antenna at 60 inches height for Mobile Test
- Best Antenna Diversity using RSSI for Stationary Test
- Obstructed Path, Office Environment, Near Fringe
- Two Transceivers, One Mobile, Ping Pong Protocol
- 3 ms, 8 ms Packets [6 ms and 16 ms Round-Trip]
- Mobile Measurements at Normal Walking Speed
- Stationary Measurement during High Pedestrian Traffic

Test Results (cont)

Stationary Results with Diversity:

High Pedestrian Traffic
Approximate Signal Sensitivity + 10 dB
RSSI Antenna Decision with 6 dB Hysteresis

Result:
Antenna Switching Every 18 - 24 ms on Average
### Test Results (cont)

**Mobile Testing**

- **Sensitivity**: +20 dB
- **Path of Motion**: Normal Walking Pace
- **Fringe**

**3 ms Packets**:
- 90% One Way: 35%
- 75% Two Way: 30%

**8 ms Packets**:
- 90% One Way: 25%
- 75% Two Way: <5%

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### Impact of PHY Overhead, Media Access Mechanisms

**Events**

- RTS
- CTS
- Data
- Ack
- Data
- Ack

**Assume 12 Octets + PHY overhead for RTS, CTS, + ACK**

- **FH**: R+C+D+A = 730 µs  Media Access + PHY Overhead
- **DS**: R+C+D+A = 1056 µs  Media Access + PHY Overhead
- **FH**: D+A = 330 µs  Media Access + PHY Overhead
- **DS**: D+A = 480 µs  Media Access + PHY Overhead
Recommendation

- RTS
- CTS
- Data
- Ack

PDU's
3 ms max

Data
Ack

Time

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