**Preamble for HIPERLAN-2**

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**HIPERLAN-2/MMAC-WATM MAC Frame**

- **Preamble**
- **PDU**
- **User data**
- **Broadcast Channel**
- **Frame control Channel**
- **User data**
- **downlink**
- **uplink**
- **Random access channel**

PDU: Protocol Data Unit (54 bytes)
Downlink Preamble

- BCH Preamble

- Other Downlink Channels Preamble (FCH, SCH, LCH)

Symbol Contents

- A16/RA16 Symbol
  - The sign reversal of every second A16 symbol is automatically achieved by the specified subcarrier loading.
  
  \[ A_{16, 26...26} = \sqrt{2} \{ 0, 0, 0, 1-j, 0, 0, 0, 1+j, 0, 0, 0, -1+j, 0, 0, 0, -1-j, 0, 0, 0, -1-j, 0, 0, 0, 1-j, 0, 0, 0, 1+j, 0, 0, 0, 0, 0, 1-j, 0, 0, 0, -1-j, 0, 0, 0, -1+j, 0, 0, 0, 1+j, 0, 0, 0, 0 \} \]

- B16 Symbol (subcarrier loading as \( S_{26...26} \) symbol in PLCP)

  \[ B_{16, 26...26} = \sqrt{2} \{ 0, 0, 1+j, 0, 0, 0, -1+j, 0, 0, 0, -1-j, 0, 0, 0, -1-j, 0, 0, 0, 1-j, 0, 0, 0, 1+j, 0, 0, 0, 0, 0 \} \]

- C64 Symbol: the same content as T1/T2 in 802.11a PLCP
Detection-Failure and False-Alarm Rates-1

- Auto-Correlation (AC) Receiver Structure
  - Correlation delay $D_{ac} = 16$
  - Moving Average (MAV) window size of $AC = 48$

![Diagram](image)

Detection-Failure and False-Alarm Rates-2

- Detector-1 only takes the absolute value of the A-field correlation peak (as well as the phase at the peak position to verify the peak belonging to the BCH A-field) and compares it with a defined threshold.

- Detector-2 takes into account both peaks (A-field and B-field) being above a certain threshold.

![Graph](image)
Symbol PAPR and Dynamic Range

Current 802.11a symbol $S_{26,26}$, PAPR = 3.00 dB
B16 $S_{26,26}$ symbol, PAPR = 2.24 dB

Uplink Preamble

• Short Preamble

• Long Preamble (very similar to 802.11a PLCP preamble)
Sign Inversion of the Last Repetition

• Beneficial for
  – improving timing detection accuracy (sharper auto-correlation peak)
  – increasing the receiver implementation flexibility (e.g. auto-correlation based or cross-correlation based)
  – providing unique identification possibilities of the last short symbol repetition

improving timing detection accuracy

• Sharper auto-correlation peak
Auto-Correlation Peak

Detection Accuracy
Cross-Correlation Receiver

\[ y(i) \]

\[ z^{-1} \]

\[ s^*_0 \]

\[ s^*_1 \]

\[ s^*_29 \]

\[ s^*_30 \]

\[ s^*_31 \]

\[ z^{-1} \]

SUM

\[ |R(i)|^2 \]

Cross-Correlation for A16

Sample R.G.C./RSSI

0 0.2 0.4 0.6 0.8 1

32 64 96 128 160 192 224

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0 0.2 0.4 0.6 0.8 1

32 64 96 128 160 192 224
Cross-Correlation for A16

Spectrum Issues - 1

- Power Spectral Density: left (inverted), right (non-inverted)
Spectrum Issues - 2

- TX signal filtering (FIR filter): only preamble
  - 8 MHz cut-off frequency, -60 dB stop-band attenuation

Spectrum Issues - 3

- TX signal filtering (only preamble)
Spectrum Issues - 4

- TX signal filtering: data and preamble