Submission to:
IEEE P802.11
Wireless LANS

Title: **TGb REPORT FOR MEETING OF 01/19 - 01/23 (Lynnwood WA)**

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- **TGb reviewed a total of 17 technical submissions. Among them there were :**
  - **2 new proposals (KDD, Raytheon)**
  - **4 previously presented proposals (GBT, Harris, Lucent, Micrilor)**

- **The Task group adapted document 98/54 defining the schedule and the modulation selection process with a vote of 14-0-3**
  - **Key schedule milestones:**
    - **Dec. 1999 final approval.**
    - **May 1998 final modulation proposal selection.**
  - **The selection process includes many secret voting rounds selecting the final winning proposal by a process of elimination.**

- **A three member team was assigned to compile a comparison matrix including all of the necessary parameters as stated in document 97/157r1. This matrix will be available on the web 2 weeks before the March meeting. The proposers will fill in the data during the March meeting.**

- **Straw poll indicated that the Netherlands is still a candidate location for the May meeting.**

PROPOSALS AS OF THE JANUARY 1998 MEETING

GOLDEN BRIDGE TECHNOLOGY	**Advanced Barker Direct Sequence**
HARRIS SEMICONDUCTOR	**M-Mary Bi-Orthogonal Keying**
KDD	**Carrier Frequency Offset-Spread Spectrum (CFO-SS)**
LUCENT TECHNOLOGIES	**BCPM, Barker Code Position Modulation**
MICRILOR INC	**16-ary Differential Bi-Orthogonal Keying (16-ary DBOK)**
RAYTHEON	**Offset Quadrature Bi-Orthogonal**

PROPOSALS SUMMARY

Golden Bridge Technology

Modulation Technique: Advanced Barker Direct Sequence

- Data Rates: 1.8, 3.7, 5.5, 7.3, 9.2, 11.0, 12.8, 14.7, 16.5, 18.3, 20.2, & 22.0 Mb/s
- Max. data throughput by close fit of rate to channel fading
- Covers full market range of equipment with variable data rate
- Fast acquisition and simple implementation with RAKE receiver

Harris semiconductor

Modulation Technique: M-Mary Bi-Orthogonal Keying

- 1,2,5.5,11 Mbps data rates supported.
- Use of the 8 bit /symbol Walsh function orthogonal set
- Low implementation complexity.
- 3 Frequency channels available over the 2.4 GHZ ISM band .
- Fully interoperable with 1,2 Mbps DS IEEE802.11 systems.
- Fully compliant with the IEEE802.11 defined MAC
- Short high rate preamble available for improved throughput.
- Optional architecture enhancements available to provide high performance to demanding indoor environments (i.e. industrial).

KDD R&D Laboratories

1) Modulation technique:
Carrier Frequency Offset-Spread Spectrum (CFO-SS) is a synchronous multi-carrier DS, which orthogonally multiplexes the current 2 Mbit/s DS carriers up to five within 26 MHz. Carrier frequencies are separated by 2 MHz, each carrier being compatible with the current 2 Mbit/s DS PHY.
2) Transmission rate:
The following five speeds are selectable on demand.
- 10 Mbit/s (5 channel multiplexed)
- 8 Mbit/s (4 channel multiplexed)
- 6 Mbit/s (3 channel multiplexed)
- 4 Mbit/s (2 channel multiplexed)
- 2 Mbit/s (single channel equivalent to the current low rate PHY)

3) Features of CFO-SS
- Backward compatibleness is achieved for the current 2 Mbit/s DS.
- Transmission rate of 2, 4, 6, 8, and 10 Mbit/s is selectable.
- Current MAC of the 2 Mbit/s DS is employed.
- Current preamble length is adopted.
- Hardware size could be compatible with a PCMCIA card, when ASIC's are developed for the CFO-SS transceiver.

Lucent Technologies

Modulation technique: BCPM, Barker Code Position Modulation

System characteristics:

- 5, 8 and 10 Mbit/s
- extension of current 802.11 Direct Sequence Spread Spectrum standard
    - fully coexistent with current standard
    - fully interoperable with current standard by fall back rates
    - uses same Barker 11 spreading
    - same channelization, 3 non-overlapping frequency channels

- operates in office, department stores and industrial environments
- implementable in a PCMCIA form factor
- optional short preamble to gear up high speed data throughput
- high sensitivity; range in free space approx. 1000 meters

MICRILOR, Inc.

Modulation technique: 16-ary Differential Bi-Orthogonal Keying (16-ary DBOK)

Key feature is dividing the 2.4-Ghz band into two frequency channels (instead of three used for the existing DSSS standard; this increases the signal bandwidth by a factor of three (32 Mchip/s), for:

- 12 dB processing gain for use under Part 15.247 (passed FCC in Spring 1996)
- Power-efficient (~7 dB E_B/N_0) 5-bit/symbol via 16-ary DBOK
- Hundreds of PN-code channels for spatial re-use of frequency channel
- Resolution of multipath signals to mitigate fading
- Optional randomization of PN-codes for uncoordinated environments

Other features include:

- Low complexity baseband chip (~ 35K gates)
- Short PHY Preamble&Header for low overhead to enable high throughput (>9.5 Mbps streaming)
- Small Slot time and SIFS for high throughput with protocol
- Coexsistence with installed DS and FH, where desired, by optional deferal to such transmissions enabled by clear-channel-assessment (CCA) technique
- Efficient power-amplifier operation because the MSK chip modulation employed enables operation up to gain compression with little spectral splatter
- Reduced data rate of 8.7 Mbps for poor channel, and enhanced data rate of 18 Mbps for good channel.

Raytheon

Modulation Technique: Offset Quadrature Bi-Orthogonal Keying

- Eight information bits are mapped into each symbol for the full data rate case.
  - For the I channel:
    - 3 bits are used to pick one of eight 8-ary Walsh functions
    - 1 bit to modulate the sign of this function
  - For the Q channel:
    - 3 bits are used to pick one of eight 8-ary Walsh functions
    - 1 bit to modulate the sign of this function
- The symbols are covered by a PN sequence (This could be a 8 bit or 11 bit sequence. In the case of the 11 bit sequence, three more chips are added to the Walsh functions.)
- For the full date rate case: the chipping rate of the PN sequence is 11 MHz.
- For the half data rate case, two options are under consideration:
  - Half the chipping rate of the full data rate case (5.5 MHz). Otherwise, the operations are the same as the full data rate case. This gives half the bandwidth of the full data rate case.
  - Only map 4 bits into each symbol, using the mapping given for the full data rate case, but for the I channel alone. Maintain the 11 MHz chipping rate, and input the same data onto the I and Q channels. This gives the save bandwidth as the full data rate case.
- The Q channel is delayed ½ chip with respect to the I channel before both are modulated onto the carrier via an I/Q modulator.
- This waveform is designed to operate with a saturated transmitter power amplifier.