IEEE P802.11

Strategic Implications of the High-Speed Infrared PHY and its adaptation to the IEEE P802.11 MAC-foundation protocol

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1. Abstract

Market experience and business studies led to the conclusion that higher bit rate WLAN's (higher than 2 Mb/s) have substantial business opportunities. By the adoption of the IEEE P802.11 MAC Foundation protocol and carrier modulated PHY-IR-systems, it has been shown that with FQPSK modulation 4 Mb/s and 10 Mb/s transmission rates can be attained. For these reasons the IEEE IR Committee as well as the overall PHY Committee approved during the May 1994 meeting baseband infrared systems at 1 Mb/s and 2 Mb/s, and a separate PHY for the 4 Mb/s and 10 Mb/s FQPSK-modulated systems. After detailed investigation of about sixteen alternatives, the IR Committee specifically rejected unanimously all other baseband and modulated proposals outside of baseband PPM and modulated FQPSK.
Strategic implications of these systems and particulary the significant advantages of the EXIRLAN carrier-modulated high-speed system PHY/MAC elements are highlighted in this submission. The business and systems network element investigations have been led by AndroMeDa while the IR component investigations have been led by SIEMENS.
In separate submissions by ETSI of Spain and SIEMENS and several previous submissions by other members of the IR Committee, the power efficiency, capacity and spectral efficiency advantages of the modulated PHY have been highlighted.

2. Strategic implications

Based on the EXIRLAN (EXpandable InfraRed Local Area Network) concept proposed by Peter Blomeyer of AndroMeDa in November 93, the IR working group has adopted unanimously during the May 94 meeting the FQPSK carrier modulation technique. This modulation method is the only one which has high spectral efficiency (more than 1 b/s/Hz), robust BER performance and a power efficiency that is suitable for IR applications. All other previously proposed techniques have been unanimously rejected by the IR group. The FQPSK modulated system supports 4 Mb/s and 10 Mb/s in a multicarrier environment.

EXIRLAN uses low-cost IR components. It can be implemented with existing cheap mobile phone IC`s and allows at least 2 channel-operation in one room (at 4 Mb/s).
EXIRLAN can be expanded to more than 2 channels and to higher data rates as soon as faster IR components, which are under development today, become commercially available.
The resulting proposal EXIRLAN opens a broad range of applications to wireless LAN's.

The strategic importance for this concept is to complement RF WLAN's acceptance in specific environments, which are estimated to be 20 - 30 % of the total WLAN market.

Examples for the general importance of such an IR standard are:

- Saving precious RF-bandwidth by using IR-WLAN-portions in environments, where RF characteristics are not required.
  Here it should be pointed out, that RF interference at the same frequency between adjacent rooms practically never can be excluded, even if harsh emission regulations are established. IR, on the other hand, will never interfere between subsystems from one room to another.

- Availability of additional communication capacity, where RF band is overloaded anyway, as in airports, stock exchanges, hospitals and manufacturing units.

- Implementation of WLAN's for restricted areas, where privacy within certain rooms/buildings is a critical issue (financial, military).

- WLAN's in environments with a high level of electrical noise (machinery etc.)

Additionally, EXIRLAN provides the highest data transmission rate in the "wireless" community, and "speed compatibility" with ETHERNET.

The concept takes also care of existing IR-communication products and on-going developments. This is extremely important, because practically all former IR-solutions are baseband oriented, i.e. two different systems cannot coexist in one room, and more than one communication link can be operated in one room only by time multiplex techniques, which reduces its speed performance drastically.

EXIRLAN, in contrast, can be operated simultaneously to a baseband system, if only the "optical" frequency spectrum is limited to a value below the lower cutoff frequency of EXIRLAN.

This way, most of the existing IR products can coexist with it; probably, also IRDA-devices will not influence EXIRLAN-communication (the same is true, by the way, for all electronically controlled fluorescent lamps).

For more details of EXIRLAN and the modulation technique FQPSK please refer to §4 (literature list) of this submission.

3. Adaptation to the IEEE P802.11 MAC foundation protocol

Generally spoken, the requirements of an IR-PHY to the MAC protocol are less complex than in the case of an RF-PHY.

The specific structure of a carrier-oriented, multispeed and multi-channel system will make desirable or necessary to pass the following control information between MAC and PHY:

* transmission speed code (2 - 3 bits)
* NIL-preamble of a few microseconds to allow the filters to settle
* channel number
* type of communication request (ad-hoc, terminal migrating from one network to another, fixed list of participants)
* network number

4. Literature list

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