
IEEE P802.11
Wireless LANs

Wireless Initiatives Comparisons, a PHY Layer Review

Date: July 8, 1998

Author: Jim Zyren c/o Bruce Kraemer
Harris Semiconductor
2401 Palm Bay Road Palm Bay, FL 32905 USA
Phone: +1 407-729-5683
Fax: +1 407-724-7886
e-Mail: jzyren@ or bkraemer@harris.com

Abstract

IEEE 802.11, PAN, HRFWG, and Bluetooth each represent initiatives to develop wireless products. Each initiative is seeking the creation of a relatively open specification either through authorized standards bodies or industry special interest groups.

The purpose of each “standard” is to provide a common specification to a multitude of software and hardware vendors each of which will independently work to build compatible equipment while simultaneously building consumer confidence that interoperability and multiple sources exist. Both of these components is required in order to promote market growth.

While 802 PAN is still soliciting proposals for MAC and PHY, each of the other initiatives endorses FHSS radio technology. In fact, other than transmit power, the technical specifications for physical layer (PHY) for all four applications are almost identical.

Each of the initiatives being considered here has marketing and technical information available on their respective website.

www.ieee.org

www.homerf.org

www.bluetooth.com

The technical PHY information displayed below is available on these websites.

Technical Requirements

A summary of key technical requirements for the RF front ends for all three specifications appears below:

Parameter	IEEE 802.11 FHSS	HRFWG	Bluetooth
Operating Frequency	2.400 - 2.4835 GHz	2.400 - 2.4835 GHz	2.400 - 2.4835 GHz
Spread Spectrum Method	FHSS	FHSS	FHSS
Data Rate	1 Mbps 2 Mbps	1 Mbps 2 Mbps	1 Mbps 2 Mbps (future)
Modulation Method	2-FSK 4-FSK (optional)	2-FSK 4-FSK (required)	2-FSK TBD
Modulation Index (h)	0.32 0.16		0.32 TBD
Effective Filter BW	Gaussian (BT = 0.5)		?????
Hop Rate	2.5 Hz	50 Hz	1600 Hz (max)
Channel Switch Time	224 microsec		220 microsec
Rx/Tx Turnaround Time	19 microsec		220 microsec
Antenna Diversity	Optional		Not Required
Tx RF Power	<1W (US) 100 mW (Europe & Japan)	100 mW (North America)	1 mW
Rx Sensitivity	-80 dBm @ 1 Mbps -75 dBm @ 2 Mbps		-70 dBm @ 1 Mbps
Tx Channel Freq. Tol.	+/- 60 kHz		?
Tx Spectrum Shape	$ N-M = 2$ -20 dBm or -40 dBc $ N-M \geq 3$ -40 dBm or -60 dBc		?

Radio Requirements for IEEE802.11, HRFWG, and Bluetooth

HRFWG & Bluetooth Coexistence

The main difference between the PHY layers of these two specifications is the hop rate. SWAP radios (HRFWG) will switch channels at 50 hops/sec. Bluetooth specifies its hop rate as "up to 1600 hops/sec". Assuming that Bluetooth radio switch channels at 1600 Hz, they will be

hoping 32 times faster than SWAP radios. Despite the fact that SWAP and Bluetooth share common spectrum, a SWAP radio will therefore experience only intermittent jamming lasting not more than 650 μ sec on every other channel dwell of 20 msec. SWAP is specifically designed to tolerate such interference. If the interference jams one of the voice packets, the retransmission period at the start of the next superframe will correct the problem. Voice users will therefore experience no noticeable degradation in service.

Conclusion

There are several specifications which are not publicly available and hence make a more definitive comparison impossible at this time. WPAN should approach both Bluetooth and HomeRF to determine if these missing pieces of information could be made available.

Nevertheless, with the information available, all three PHY specifications look surprising similar.

Noting these similarities, what is the influence on the PHY selection for WPAN?