IEEE 802.4L

Through-the Air Physical Media, Radio

Minutes of the IEEE 802.4L Working Group

Danvers, Massachusetts
July 11, 1988

Chairman. Chandos Rypinski

Secretary Michael Masleid.

Attendance.

Chandos Rypinski	Lace Inc	(415) 435 0642
D. Buchholz	Motorola, Inc.	(312) 632-5146
Clyde Boenke	American Broadband	(313) 761 8818
Bob Douglas	Com & Com Consultant	(602) 942 2663
Walter Scheuer	Riverbank	(508) 356 5387
Paul Webster	Casat Technology	(603) 880 1833
Vic Hayes	NCR	+31 3402 76528
Dave Nicholson	Computrol	
Michael Kieli	Thomas & Bets	
Dave Daly	Thomas & Bets	
Michael Masleid	Inland Steel Co.	(219) 399-2454
Tom Phinney	Honeywell, Inc.	(602) 863-5989
Orest Storoshchuk	G.M. of Canada	(416) 644-6994
Chuck Thurwachter	ITI	(313) 769-4292
Bruce Tuch	NCR	+31 3402 76468
Brian Neve	(partly)	

Chandos Rypinski called the meeting to order. Directions for radio based thru air media were developed.

Directions:

The radio system plan for one community of users shall be dual frequency bus mode with head end independently of the number radiation sites used. The physical layer including the head end and radio system shall support the existing 802.4 MAC. (Among other things, this implies that when any station is transmitting, all stations must hear something.)

Whatever plan is evolved, it shall be suitable for use under current FCC part 15 regulations, in particular the three bands, 0.912 2.45, and 5.9 GHz.

We will consider modulation methods and bandwidths which are within the frequency allocation and spectral power density limits of FCC 15.126.

The data rate for comparison purposes shall be 1 Mbit/s. We can only consider the IEEE data rates of 1, 5, 10, and 20 Mbit/s.

The design model shall assume an 16 antenna arrayed in a square grid. For purpose of analysis, it will be assumed that the antenna array is driven by one power splitter with equal length loss less cable from the splitter to each antenna.

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Since the radio medium is known to have a bit error rate of the order 10E-3 the system shall incorporate the level of diversity and forward error coding required to support the detected error rate of 10E-8 and undetected error rate of 10E-9.

MAC protocol assumes the communication channel is always available. Since the radio medium is known to have an outage rate on the order of 10E-2, a method is required to reduce outage rate to less than 10E-5.

Discussions:

It was noted that spread spectrum may not be required by FCC part 15. Bruce Tuch commented that spreading may be required for judicial requirements, or technical requirements. Other modulation schemes may require qualifiers in part 15.

We will accept any proposal in any of the three bands, using any modulation scheme. Let us admit that there are candidate systems for each of the three bands. Presumably, the lower data rate systems will operate at the lower frequencies.

Chuck Thurwachter suggest that we try to focus on what application we have in mind, i.e. AGV's in enclosed environments traveling under 3 miles per hour. Bob Douglas thinks that we are purveyors of technology, and should not begin creating restrictions. Chuck points out that limiting the arena may help. It was decided that we will try to exclude irrelevancies.

We will admit that the high 802.4 data rates shall be considered the "holy grail". Non the less, useful networks can be supported with the lower data rates.

With authorized wavers, it is permitted to operate under FCC 15.126. Anything modulation scheme that does not exceed field strength, spectral power density, and spectral occupancy can be qualified. John Reed is the person of interest on the FCC.

It was pointed out that very low power modulation is permitted on any frequencies above 910 MHz. Since a higher spectral power density is permitted in the three bands, they will be studied first.

Objective - use 802.4 access method? In many ways this is not the proper protocol for radio. It remains our mission to examine how we might work using the 802.4 protocol.

Tom: What is the application space. AGV's, hostile environments, does it rain, is it dirty, does it move?

The technical requirements for asking for a waver from the FCC or in particular, for reassignment off an existing band include a constituency and precise definition of what you intend to do, and how you intend to do it. It helps if the staff of the FCC is in favor of what you wish to do. It is required that what you wish to do is of significant benefit to the general public.

The bit error rate requirement applies to the MAC symbols (the symbols presented at the 802.4G interface, or its equivalent).

Outage is loss of the link, failure to detect even garbage when transmission is occurring. It is important to preserve some sense of carrier detect. Of course, bad signal should be reported as such.

July 13, 1988

Brian Neve presented a radio LAN being developed in Europe.

Discussions continued on application space under .4 guidelines.

Some of the industrial applications may include moving vehicles. At Inland, (legal) plant speed limits are 20 mph. Access to inventory data from manned equipment, and remote control of unmanned vehicles is used or needed. At GM, automated guided vehicles, AGV's, travel more slowly, though high speed equipment also occurs. In both environments, significant portions of the horizon move.

20 mph normal, 30 mph max is 8.94 m/s to 13.4 m/s. If the limit for 2.45 GHz operation is 20 mph, then the limit velocities are as follows:

0.912 Ghz		53.7 mph
2.45 Ghz		20.0 mph
5.9 Ghz		8.3 mph
Definable parameters		
XMTR power output max.)		+10 dBm (peak/average
Mobile antenna gain:	+6 dB over isotropic	
Mobile antenna directivity	2x45° B.W. OMNI, (CP?)	
Receiver noise figure:	6 dB at 900	
		8 dB at 2400
		10 dB at 5900 Mhz
Error correction codes:		
Allowable overhead		1.5x
Suggestion		BCH 31,21?
(Read Solomon or Golay codes may be more appropriate)		
Spectral efficiency:	4 Hz/bit	
Propagation: meters		6 dB/octave under 10
meters		11 dB/octave over 10
		+20 dB margin.
S/N minimum:		?
Fading:		?

Discussions:

The antenna probably needs to be a circularly polarized omni directional in the horizontal plane 22.5°.

Brian: 300 feet, 1 mW, at this data rate seems high.

Chandos: Compared to the land mobile service, expect a 6 dB per octave reduction in noise floor allows thermal noise assumption, also, if the antenna is located 7 to 10 feet above ground it has 25 dB antenna gain over an antenna in a pocket.