Minutes of the IEEE 802.4L Working Group

Vancouver, British Columbia (Canada)
July 9-12, 1989

Intermediate part on July 9 and 10

Chairman. Vic Hayes

Secretary & Editor. Michael Masleid, Chuck Thurwachter, Tom Phinney.

Attendance

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Mr. THOMAS L. PHINNEY	Honeywell	phone 602 863 5989
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Mr. SHELDON L. GILBERT	Spectrix Corporation	phone 312 491 2051
Mr. LARRY van der JAGT	Knowledge Implementations Inc	phone 914 986 3492
Mr. GUNTHER J. MARTIN	G&D Associates Inc	phone 203 438 2510
Dr. PHILIP M. SPIRA	CYLINK	phone 408 735 5800
Mr. NATHAN TOBOL	Future Concepts Inc	phone 508 384 3696
Mr. ROBERT S. CROWDER	Ship Star Associates Inc	phone 302 738 7782

Vic Hayes called the meeting to order at 1:20 PM on 9 July 1989. 11 people were in attendance. The minutes of the Atlanta meeting were distributed; their approval was deferred until they could be read.

Larry van der Jagt discussed the **test plans for GM-Oshawa.** Test equipment includes up-convertors, receive amplifiers, and bandpass filters for 915 MHz and 2.4 GHz, an antenna for 915 MHz, I and Q down-convertors and detectors, and a LaCroix arbitrary function generator. Hughes will build a 2.4 GHz strip antenna on a printed wiring board.

The testing goals, types of noise anticipated, and some of the test plans were discussed.

Don Johnson reported that the **letter of authority for test transmission** in the 900 MHz band would be issued that week by the Canadian Dept. of Commerce, after four months of bureaucratic "activity". Testing will occur the week of 24 July. GM will be in production that week, but the line will be shut down the following week for year-end product-line changeover.

Vic Hayes has contacted Dr. Rappoport and is getting permission to copy and **distribute his thesis** to 802.4L. Dr Rappoport is interested in participating in the future 802.4L work if we can obtain funding for him.

A long discussion about the transmit/receive positioning requirements for the testing took place. The testing will use a grid of alternative transmit antenna locations, together with some mid- and micro-positioned receive antenna locations.

Don Johnson has evaluated the **FCC regulations** and written a paper. Copies will be distributed. In Canada there is a 1 W EIRP limit. In the U.S., its 1 W RP (radiated power) per antenna; the FCC hasn't decided what rules apply to multiple antennas.

After a long discussion, Bruce Tuch enumerated his **prioritized requirements**, as follows. (These were completed on Monday, 10 July)

1. FCC rules - spreading 10, scrambler period 127, power 1W EIRP/antenna
2. IEEE 802.4 1-10 as requirements
3. Economy
4. Permit co-located LANs
5. Single-channel and dual-channel modes of operation.
6. Single channel system size: objective is 300 m, minimum is 100 m.

The meeting died (without adjournment) about 6:05 PM.

The meeting reconvened at 9:05 AM on 10 July 1989. 13 people were in attendance. The **minutes of the Atlanta meeting** were reviewed. It was noted that the discussion of ring-based distribution systems in the minutes was probably irrelevant. The minutes should have recorded that the September 802.4L meeting was moved one week; it will be held 11-15 Sept in Toronto. [Ed. note: It was later moved to Chicago, due to problems with accommodations in Toronto.]

Chandos Rypinski talked about IWP (interim working party) 11 of SG (study group) 8 of CCIR, which is addressing **Future Digital Public Land Mobile Radio-Telephone Systems**. This group has failed to meet its goals, which were to find a single frequency band which could be used for mobile, cellular and short-distance wireless telephones in both North America and Europe. The international Mobile Radio frequency band most useable is approximately 1850—1990 MHz, which the US government itself uses for itself, rather than following international guidelines. Rep. Dingle of MI is working on legislation to take this frequency band away from the government and return it to public usage.

Don Johnson presented his paper in greater detail, and discussed his sense of where the FCC will go in its future rulemaking in this area.

The meeting was adjourned about 12 Noon.

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Regular part on July 11 and 12

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Attendance

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Vic Hayes called the meeting to order at 8:40 AM on 11 July 1989. 14 people were in attendance. Vic stated that there had been two interim meetings, and reviewed the document list for this meeting. He then summarized the requirements that had been used to date in developing a radio LAN.

Guiding Principles

1. Meet FCC rules - spreading, scrambling, power, etc.
2. Meet 802.4 requirements implicit in ISO DIS 8802-4 1-10
3. Economy
4. Permit adjacent 802.4L-conformant radio LANs
5. Provide for both single-channel (direct peer-to-peer) and dual-channel (head-ended) operation
6. Single-channel system size: The objective is to permit a system diameter of 300 m. The minimum acceptable system diameter is 100 m.
7. Modulation technique must support office, retail and industrial environments.

System Design Parameters as they Relate to the Objective List [ ]

1. Use a 7-bit (length-127) scrambler if the adopted chip rate is < 127. [1] The preferred polynomial is 1 + X-4 + X-7 .

2. Choose a modulation technique that does not include an amplitude modulation component, for [3] and to lower technical risk.

3. Permit differential demodulation for fast acquisition, to provide robustness for the time-varying (fading) radio channel, and to simplify the receiver [3]. The primary disadvantage of this approach is a 2.3 dB (theoretical) loss in S/N.

4. Use some form of quaternary PSK as a reasonable means of decreasing signaling rate (for multipath) without excessively compromising S/N or [3,7].

5. Spread the minimum amount practical [1,3]. The preferred spreading code is + — ++ — + + + — — — . This is a known Barker code, with bounded auto-correlation, bounded periodic auto-correlation, and bounded odd periodic auto-correlation, and good spectral properties.

6. Filtering should consider adjacent-channel single-frequency (single-channel) and simultaneous dual-frequency (dual-channel) operation. [4,5]

7. Initial focus should be on 900 MHz band. [3]

Tom Phinney presented his results on the dual-channel **distribution system.** The discussion first addressed the method by which a dual-channel system could operate within a single frequency channel - by chunking the MAC frame or MAC transmission, and by "ping-pong" alternately originating (sending) and rebroadcasting (receiving) each chunk.

The ensuing discussion concluded that the optimal size for a chunk was at least as large as a Set Successor frame, including the minPostSilence preamble that usually precedes a Set Successor, to avoid splicing setSuccessor frames from two different sources during a contention window. Chunks should probably be variable-length, and the maximum size of a chunk should probably be less than twice the length of a token frame.

Filtering concerns in a dual-frequency dual-channel system led the group to state that they preferred the single-frequency "ping-pong" approach to dual-channel operation. In such a system, a station would alternately send and receive at a data rate of > 2 times the MAC data rate. For 1 Mb/s operation in the 900 MHz channel, the data rate within the distribution system should be 2.3 Mb/s (due to channel bandwidth).

Tom Phinney also presented his analysis of **how a distribution system should be structured.** The distribution system modems should be "normal" modems with multi-dimensional signal quality assessment and chunking and de-chunking logic, which should communicate via radial full-duplex links with a central head-end. The head-end should have the logic to choose among the various receivers, based on the multi-dimensional signal quality assessments, and to rebroadcast to all of the distribution modems. (The ring-like approaches discussed at the Atlanta meeting are all inferior to this structure, with increased delay and complexity at each distribution modem.)

The meeting was adjourned about 5:30 PM.

Vic Hayes called the meeting to order at 3:00 PM on 12 July 1989. 8 people were in attendance. The **site of the next interim meeting** was revisited. It turned out to be difficult and expensive to get accommodations in Toronto, ON, so the meeting was moved to Chicago, IL for the same week. Chuck Thurwachter will make the arrangements for some hotel within hotel-shuttle distance of O'Hare.

The dual-channel single-frequency (head-ended) **distribution system** was again the topic. Larry van der Jagt presented a time-space diagram of ping-pong operation with a head-end on a single-channel non-directional medium.

The chunking within the distribution medium can be either fixed or variable in size, and can occur either periodically or aperiodically. The ones of interest are probably periodic fixed size, or aperiodic variable (within limits) size. In the aperiodic case, start-of-chunking would be synchronous with start-of-transmission.

A long investigation of the parameters of fixed-size periodic chunking began. (see accompanying slide)

Vic Hayes **marked up 802.4L/89-06** to reflect the work of the interim and plenary meetings of 802.4L.

The meeting adjourned at 5:45 PM. Moved by Tom Phinney, 2nd by Tom Phinney, carried.

Document List IEEE p802.4L

Through-the-air Media, Radio

IEEE 802.4L/88-01	Minutes of the July 1988 meeting (Danvers MA)
IEEE 802.4L/88-02	Communications over an Indoor Radio Channel (Bruce Tuch, NCR
IEEE 802.4L/88-03	Minutes of the November 1988 meeting (Phoenix AZ)
IEEE 802.4L/88-04	Running objectives and directives document (V. Hayes, NCR)
IEEE 802.4L/88-05	Venue for the Interim Meeting Jan 16-18, 1989, Chicago.
IEEE 802.4L/88-06	The portable radio propagation environment. US contribution to CCIR, Doc US 8/13-3 Rev 1
IEEE 802.4L/88-07	Numerical Parameters for radio local area network. C. Rypinski, RadioLAN
IEEE 802.4L/89-00	Mailing list of the Taskgroup
IEEE 802.4L/89-01	Running objectives and directives document (second issue, V. Hayes, NCR)
IEEE 802.4L/89-02	Minutes of the January 1989 meeting (Chicago IL)
IEEE 802.4L/89-03	Venue for the Interim Meeting May 22-24, 1989, Atlanta GA
IEEE 802.4L/89-04	Minutes of the March 1989 meeting (New Orleans LA)
IEEE 802.4L/89-05	Additional Reports from the New Orleans meeting (M. Masleid, Inland Steel)
IEEE 802.4L/89-06	Third Edition of the Running objectives and directions document (V. Hayes, NCR)
IEEE 802.4L/89-07	Noise Characteristics (M. Masleid)
IEEE 802.4L/89-08	Minutes of the May 1989 meeting (Atlanta GA)
IEEE 802.4L/89-09	Proposed testing at General Motors Oshawa plant (L. van der Jagt, KII)
IEEE 802.4L/89-10	FCC Rules on Direct Sequence Spread Sppectrum (D.C. Johnson, NCR)
IEEE 802.4L/89-11	Minutes of the July 1989 meeting (Vancouver BC)
IEEE 802.4L/89-12	Running objectives and directives document (fourth edition, V. Hayes, NCR)
IEEE 802.4L/89-13	Venue for the Interim Meeting Sep 11-15, 1989, Chicago IL
IEEE 802.4L/89-14	Cover for documents