IEEE P802.11
Wireless LANs

Report of meeting with FCC to review draft standard D3.0

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Tele-conference report

On February 13, 1996, the following participants held a tele-conference:

FCC

FCC office:
- Rick Engelman
- John Reed

FCC Laboratory
- David Means
- Greg Zzumak
- Julius Knapp

IEEE P802.11

Aironet, Ohio:
- Don Sloan
- Dave Case
- Mike Trompower

Breezecom, Israel
- Naphtali Khayat
- Pablo Brenner

Harris Semiconductor
- John Fakatselis
- Al Petrick
- Carlo Andren
- Doug Schultz

Lucent Technologies, formerly known as AT&T
- Jan Boer
- Vic Hayes, host and moderator.

Subject: To review whether draft standard IEEE P802.11 D3.0 would cause conforming equipment to be rejected by the FCC when presented for type approval.

Time: 10:00 - 11:10, Eastern Standard Time

General

Greetings. Introducing the attendants.

Vic presented the 802.11 committee structure and history. Vic presented a general outline of the standard along the slides of document 96/11A.

Julius (FCC) asked about 2.4 GHz band availability around the world; Vic and Dean K. replied that it is almost universally available.

DS

Jan Boer presented the DS along the slides of 96/11C.

John Reed (FCC) commented that FCC requires the measured processing gain to be above 10 dB rather than just the sequence length. Their methods to measure that are either by a jamming margin method of by measuring spectral density with spreading sequence switched on and off. The results are typically very close to the theoretical processing gain, but 802.11 DS theoretical processing gain of 10.4 dB leaves very little margin. Jan replied that if DS is implemented as in the standard, it meets FCC requirements and that several vendors received type approval from FCC. Don Sloan added that they were successful, as many others, in obtaining FCC approval for 802.11 DS modulation.

John Reed further commented that at 2 Mbit/sec QPSK, modulation does not exactly meet the 10 dB chip-rate to bit-rate ratio, but as long as the bandwidth expansion ratio is considered, QPSK withstands the test. Don said that indeed, FCC approved QPSK 2 Mbit/sec 11 chip sequence length equipment in the past.

FH

Dean Kawaguchi presented FH part of 802.11 standard along the slides of 96/11B and expanded on it. During the presentation it was pointed out that Naftali Chayat (authoring 96/11B) erroneously stated CCA threshold to be -80 dBm for 95% detection probability while the correct numbers are -85 dBm for 90% detection probability. The presentation described the modulation method (2- and 4-GFSK at 1 and 2 Mbit/sec, respectively); compared GFSK to GMSK (lower deviation and therefore reduced sensitivity); the frame format (header describing rate and length, data is scrambled and bias suppression formatting applied); the required sensitivity, desensitization and intermodulation protection; CCA requirements (-85 dBm for 90% detection probability); frequency hopping sequences were described in some detail: the old sequences which failed FCC requirements due to constant frequency increments, two new families of sequences were proposed (both being approved by FCC) and one of them was accepted by 802.11; the new hopping sequences were described (base pseudorandom sequence and the method for deriving other sequences in the family).

20 dB bandwidth discussion

Karl Andren asked about the 20 dB bandwidth measurement procedure. He argued that the 0101 preamble will produce spurious responses at +/- 0.5 MHz, which is exactly at band edge. In this situation the result depends on the measurement method.

Greg Szumack: FCC did not use integration methods but rather used max hold spectrum analyzer method; if another method is considered better by anybody, it has to be submitted in writing to FCC in order to be approved prior to being used to make equipment tests for type approval.

Naftali commented that if a transmitter is operated in the 0101 mode continuously, then indeed sidebands at 0.5 MHz offset emerge which are about -17 dB down, but in practice 0101 is just a small portion of a packet which contains random data, and considering that, the modulation passes the FCC tests.

Greg (FCC lab) said that in the past they looked at the worst case situation, which is indeed with the 0101 preamble; yet, they are willing to reexamine their position, and they invite us to send our arguments to them. Greg expressed an opinion that he would rather see the test performed with typical packets rather than 0101 pattern alone; if the 0101 is a dominant worst case, it will show up in the max hold tests. As far as he understands, the tests are ran with 100 millisecond bursts, results averaged over 100 milliseconds with max hold. The burst length issue was not specified, just the usage of max hold mode.

Dean told that their product passed FCC tests, and he believes that it was tested with a packet burst method.

Greg commented that tests probably need to be done in packet modem rather than continuous random data, because with continuous random data the 0101 spurs don't show up. It should probably be addressed by FH group next time.

Naftali: The tests we run are in a non-hopping mode, and we test the -20 dB points on the bell-shape. I'm not sure about the packet lengths used.

Greg Szumack: In the past I approved equipment based on a continuous random data transmission tests, but I was not informed about the packet structure and the 0101 preamble and I wasn't aware of it. The FCC policy is to test worst case behavior, and Greg feels that if he was aware of the 80 symbol long 0101 pattern, he would require it to be included in the transmission.

Naftali pointed that the data portion of the packet is always randomized by the scrambler.

Greg Szumack : Heard from David Mintz (FCC lab) that in tests he ran on FH equipment there was no difference between continuous tests and the random test, as in 100 millisecond bursts the 0101 pattern contribution was not dominant over the random data contribution in a peak hold mode. (David comments that he does not remember that, and the measurement method issue needs clarification).

Vic Hayes: So, does the FCC see any problem with the current specification of FH?

Greg: What we discussed now is a testing issue. What we've seen in the presentation by now seems fine.

Hopping Sequences

Rick Engelman: I want to be sure that the new pseudorandom hopping scheme meets the new requirements. Is it OK?

Greg: There was no problem neither with Symbol scheme nor with BreezeCom (submitted under former Lannair name) scheme.

Julius (FCC) reminds the FCC NPRM (96/39, titled: "FCC ET Docket No. 96-8 - NOTICE OF PROPOSED RULE MAKING regarding rules for Spread Spectrum transmitters" and advises to look at it. It seems that no new problems should arise from it, but keep an eye on it.

Naftali: A question regarding the new hopping requirements as stated in the NPRM. The new requirement reads "The test of a frequency hopping system is that the near term distribution of hops appears random, the long term distribution appears evenly distributed over the hop set, and sequential hops are randomly distributed in both direction and magnitude of change in the hop set". In the new sequences there is a slight bias in the distribution of magnitude of change, in that no hops smaller than 6 MHz are allowed, in order to create a multipath diversity. Will that not pose a problem?

David Mintz: It seems even desirable from the point of view of what we are trying to accomplish. That will probably require a small change in language.

Concluding remarks

Dean: The physical layer group is progressing toward a standard and should not be delayed by any proposed changes.

Vic: Yes, we would all like to see the standard approved as soon as possible.

Greg Szumack: As a final comment I recommend anyone to submit his testing procedures in writing for FCC review prior to using it on a product. It will reduce the risk of spending money on a product that will not be accepted by FCC.

(Harris): We are actually chip rather than equipment manufacturers (currently we produce DS chipset) and it is important for us to know that radios made to the standard will pass FCC.

Vic: Thank to FCC for their time, and to everyone for joining.

Good bye.

The meeting ajourned at 11:10 (Eastern standard time)