Minutes of PHY group meeting in Baltimore 3/9/93-3/11/93

The group thanks Richard Ely for his notes that have become these minutes.

Tuesday morning, 802.11 meeting started at 8:35 am

Discussion of Agenda.

We'll do papers until lunch

1. Jan: 45 in
2. Ryan: 30 min
3. Chan: After break
4. Nathan: 30 min
5. LVDJ: 30 min.
6. Tom B: IR PHY report

Presentation by Jan Boer, 93/37, Proposal for 2 Mbit/s DSSS PHY

Discussions followed on the following:

* antenna selection decision process,
* capture ratio definition,
* Frame format: Start frame delimiter to end frame delimiter normally defines the MAC frame, but the paper has carrier training pattern and Network ID in addition to the MAC frame in it. This needs some new terminology. This affects what the CRC covers in the frame: the MAC or the total frame? It needs an additional delimiter to tell when the MAC frame starts. It has to have a high Hamming distance from data.

Larry Van Der Jagt(Larry): Is the Barker sequence chosen the best? Using the Time reversed Barker sequence for the non-Data symbol, is that the best?

Mike's associate? Question about Carrier Sense operation. If you sense Carrier, then you defer. You could sit and wait forever.

Larry: that is a MAC issue.

Have you looked at error correction codes?

Jan: Not here.

How do you measure a 3 channel system for the FCC. Is this a hybrid system?

Tom Tsoulogiannis (Tom): You have to show that on each channel it passes.

Larry: the filtering required on the transmitter requires a lot of filtering and variability in how different designs implement the filters would lead to interoperability problems.

Nathan Silberman (Nathan): What provisions for power saving have they implemented?

Jan: It needs a linear amplifier.

Nathan: Phase discontinuities

Larry: Their using phase changes for signalling so this isn't a problem.

Jan Boer (Jan): You don't encounter instantaneous phase changes.

Break at 10:10. Reconvene 10:37

Presentation: Chandos Rypinski, 93/25, Radio PHY Layer for Use With Medium Independent MAC

Presentation: Ryan Tze, 93/38 A Draft Proposal for Direct Sequence Spread Spectrum PHY Standard.

Q? 100 ppm, Is that all inclusive for lifetime drift?

Max Sheng: This is initial drift.

Nathan: Is this absolute or +/-

Ryan: He doesn't know and will have to check on it.

Nathan: How can you get processing gain?

Ryan: The most you can get is 12 dB.

Nathan: At lower s/n ratios, your FM will be dominated by spikes.

Ryan: They are using phase lock loop in demodulator.

?: What does low power mean?

Ryan: Low current drain. 150 mA is their current drain.

Tom Baumgartner (Tom), IR PHY Report

March 92 was when the last papers were submitted. At last meeting, some of us got together unofficially. Yesterday, 18 people showed up. Most were there because they wanted to develop a standard. They want to meet together unofficially for now. They plan to meet on Monday evening at the next session. In this Mondays meeting, Tom reviewed the old papers that had been submitted. One was a Strawman Proposal by Dick Allen.

The group also listed some of the issues of IR:

speed,

modulation,

protocol,

methods of measurements,

classes of use (multiple classes may dictate more than one PHY standard),

They looked at PAR reqmts (frame error rate needs explanation). They want to collect information from Siemens, Stanley, and HP for LED information. Emitter technology collection of information is also important.

Q: Will propogation issue be discussed, penetration away from defined room.

Tom: Walls will define boundaries. Most common class of usage will be coverage of a room with a single system. There is a class of service called directed where mirrors may be used.

Nathan, 92/127r1. Draft Proposal for a Frequency Hopping Spread Spectrum PHY Standard.

The sections that have been changed were reviewed.

#3, #4, #6, #7, #9, #10, #11,

#12 Starting to get very tight on the phase noise because of the high rejection levels.

Larry: What are we talking about here? dBm?

Nathan: It should be dBc.

Larry: This is a receiver spec?

Nathan: This is a receiver spec.

Larry: If it's a receivers spec, then it is none of the standards business.

Dick Walvis: He objects to just specify selectivity.

Larry: This is an interference specification.

Wayne: Items #4 & #5 should be explicit that the default is to the lowest power levels.

Nathan: MAC is going to be responsible for the power selection.

Wayne: Take the word default out.

Nathan: Agrees.

#14 Chadwick: What is the measurement bandwidth that this is measured at. The phase noise required is unmanageable for these requirements.

Bob Crowder: maximum difference in transmit levels of the adjacent channels, there has to be an additional spec on it. If one goes to 250 mW, then all units have to go to that power.

Dave Leeson: You may have to have the highest power level as default rather than lowest power because of the interferers in the ISM band.

Peter Paz: Instantaneous interference is generated when the frequency hop is made. There needs to be a control put on the mask to cover this.

Chadwick: DECT has a spec on this. You only change channels once the transmitter is off. You shape the turn on pulse.

Dick Walvis (Dick): 85 dBc at 10 mW becomes 75 dB. There should be a proposed threshold. Item #24 specifies this.

#20 was deleted

#22 A scrambler has to be included.

Larry: Pull scrambler out of CCITT.

Nathan: He'll pick one if there aren't any proposals. Jan's is only 7 chips long and isn't long enough. He'll look at NCR's proposal.

#24 was changed to absolute levels.

Chadwick: Proposes 65 dBc. Measuring techniques are much easier with dBc than dB. For 2.4 GHz, 3 MHz away would be 140 dB. You would need silicon rather than GaAs to achieve these levels.

Nathan wants to get together with him to discuss it.

#25 People objected to numbers because they might change. Instead, the names of the appropriate standards were put in. These are for reference only.

#28 Some felt this was too long.

Chadwick: Is this to be an ISO standard. EMC susceptability spec should be added. He is ETSI Res 209 editor. He'll form an ad hoc group for those who are interested.

Nathan: #40 is the place holder for this.

#30 James Harrier. The number is too small, should be 20 dB. He would like to see the justification for this number.

Larry: Until we have a modulation scheme, we can't settle on this number.

Wayne Moyers (Wayne): We should put this on the list.

Adjourn 12:23, Reconvene: 1:58 pm

Agenda for rest of week discussed.

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Issues Chart:

* How can we best achieve coexistence of FH & DSSS.

* FH: What is Modulation

* How can we detect collisions

* Resolve Nathan's list.

Items to present to MAC: BER; Hop Coordination

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Dick: Is there anything that could make the coexistence of FH and DS easier.

DISCUSSION: Could FHSS & DSSS coexist in the same area?

Paul Eastman: Maybe we should pick between FH and DS.

Larry: We've already decided to have two. Let's go through the two specs side by side and make columns line up, fill in the numbers if possible, and make some progress.

#1 Add 3 ranges in 93/38

#2 Number of channels.

Le Maut: You have to specify that your first carrier frequency is for the first hop.

Chen: Right now Japan has only specified DS.

Michael: If you are designing a radio, you use the set of frequencies for Europe, etc.

Dick. Proposes 2.401000 and 2.482000 in 1 MHz steps for the US. This allows you to use 1 MHz oscillator.

Wayne: Why throw away a half MHz.

Bob Buass: There is a protected band at the high frequency end.

Chadwick: Europe could go up to 2.499000

Wayne: We need to move this up 1/2 MHz.

Chadwick: Lets keep it simple for easy syntheciser design.

Japan: 2.472-2.496

Rob Carl: Can't keep it inside PCMCIA card. We'd like a presentation for Europe.

Larry: So chop a channel in Europe

Bob Crowder: We have to specify the frequencies if we are to have a spec.

Michael: How will multiple frequency sets work with ad hoc LANs. CF should establish frequencies.

Chadwick: 40 to 80 cycles of reference frequency needed for settling. That is 80 to 100 us for synthesizer to settle down with 1 MHz offsets.

Peter Paz: Offset of 1 symbol rate, SAWs provide significant amount of rejection for adjacent DS center frequencies.

Dick W: You should be able to reject a particular center frequency.

Tom: Jan defined 3 center Freq. Are we going to define another set. He suggests more than 3 and with overlapping channels. Maybe 5 or 6. Then if there is a jammer on one, you could move over half the channel and avoid the jammer.

Bill: If we decide that other than 1 MHz spacing is chosen we have to spec the freq. We don't gain much by narrowing the channels below 1 MHz because FH fills 1 MHz pretty well.

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Channels

Hopping -

US,

Rob Carl or Dick W

2.402000 to 2.481000, 1 MHz channel separation

Upper freq band needs to be protected

- Europe,

Report on actual spec: Peter Chadwick

2.40200 to 2.498000, 1 MHz channel separation

50 dBc or -30dBm,

0 band edge

- Japan,

Direct Sequence

US

Europe

Japan

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What are all center frequencies.

Break 3:27pm.; Readjourn 3:50pm.

Wayne: Would enter the set by knowing the basice center freq

Haim: Interoperability means knowing rate, chipping rate, etc.

Chadwick: Are we looking at channel coding such as BCH or Reed Solomon?

Larry: Will bring this up again when we talk to MAC tomorrow.

#3 Will have 3A for FH (hops / sec) and 3b for DS (chips per symbol)

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Decision tree

Multiple rates.

Dave: There should be a single number. Sub 1000 byte packet length which gives a few millisecond time. 100 to 125 msec per hop would be reasonable rates.

Dick. Isochronous service would require higher rates. So bad frequency would not cause a long disruption.

Chadwick. 21 msec fade at 3 mph. So you could get holes in a long dwell time.

Dave. 5 to 20 msec for hop time would be best. This causes an overhead load. For this reason more than one hop rate would be best to allow for different uses. The MAC should determine the hop time.

Larry: We should tell the MAC what rates rather than throw it to them.

Michael: It is lower cost to hop slower. For 200 ns multipass is almost flat fading. Make the hop freq equal to twice the spread.

Bill: We're limited by how fast we can settle on a new channel. (see item 28).

Wayne: Fragmentation is very important to us. There ought to be some ground rules on synchronization when you come on in the middle of a hop.

Larry: We might want to tell them 2 rates.

Chadwick: Is there a requirement for isochronous in an ad hoc network

Larry: Ad hoc isn't the only thing you use the standard for. People are looking for isochronous use in infrastructure.

Michael: What is the maximum hop rate possible while meeting the objectives of cost.

Dave: Fixed switching and settling times are the constraint. Time to synchronize packet is another consideration. 100 us is expensive and 300 is loose.

Chadwick: If you send a bad packet, do you resend it on that freq or another? You have to define how long the packet will be and synchronize that with hop time remaining. this determines best hop rate. Use 100 times settling time or 30 hops/sec. He would suggest 5 to 10 msec.

Michael: Change 2.5 to 6 hops

Dave: 4 works fine.

Wayne: suggests 50 on high end

Dick: Does anyone have objection to going to 5 msec, Does anyone object to moving rate range from 2.5 to 200 .

Nathan: Faster switching takes more power.

Dick: So power management is one of the penalties, possibly, of higher rates. So he proposes 200.

Bob C: He thinks the range is too broad. This would be the MAC would have a problem with this.

Larry: 2.5 and 200, Does anyone have an objection to this?

Bill: It's the principal of this. We need to be telling the MAC group how much it will cost to cover this wide range. Let them decide.

Larry: Would some one present this to the MAC group tomorrow.

Dick volunteers to do this.

Nathan: Let's take Novell fragmentation which is about 600 bytes. This would be about 5 msec. This would be about 100 hops/sec.

Bob C: We have 2 different classes of service. We should have the MAC provide for this.

Larry: No one has been violently opposed to this range of rates. A number like 200 makes a lot of sense and we should present this to the MAC group.

Wayne: The range ought to envelope these two rates. Security hasn't been addressed. Security is helped by getting on and off because of less RF exposure. You'll learn whether you got thru faster. The settling time issue is the only constraint. 300 us is very long.

Dave Leeson: 500 to 600 bytes is the longest time people want to invest. A 10 ms burst people is kind of natural.

Dick: 10 ms is pushing isochronous use instead of 5 ms.

Michael: Straw pole, 200 and 2.5 were the choices.

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Criteria:

frequency spread flat fading bandwidth

cost of implementation

overhead (efficieny)

Delay

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Dave Leeson: 10 ms framing is what PCS people seem to like.

Larry: MAC presentation tomorrow:

BER

Hop Coordination (Why multiple rates)

Straw vote: What BER are you comfortable with? Conditions: PHY will deliver to MAC 95% of the time @1 Mb/s

-3:2 -4:2 -5:14 -6:3 -7:0

Dave Leeson: retry rate is 5% to 20%, with 500 byte type packets for 250 Kb/s. So BER is so its a little worse than 10-5.

Larry: We need to be telling the MAC that optimistically we'll be delivering 10-5. Last meeting we voted that within a CF, one hop rate would be used and not changed once established. The MAC would be able to tell the PHY when to hop and to what frequency.

Tom B: there are people who don't believe the MAC should tell the FH PHY when to hop.

Bill: Has there been a decision been made as to whether there will be only one transmission on one frequency.

Bob C: The MAC people know about this.

Tom: There has to be a PHY dependent MAC layer.

Much discussion on what hop rates and when to hop.

Adjourn 5:20pm. Will start 8:30 in morning.

Reconvene 1:37pm, PHY Group only.

Presentation: Bob Achatz, 93/41, Indoor Wideband Propagation Data.

NTIA will make their data available. There is a fee of $200 to obtain the data from NTIA. If a company buys the data, they can copy it to others if they wish. The paper gives an example of how the data is presented. It takes about 8 floppies.

McKown: Could this be put on a server so anyone could access it.

Achatz: We would like to do this. However, until we have accounts for people, they can't put it on Internet. Someone will have to buy the data. Taxpayers have paid for a good part of the study.

Bill: They could put it on their server.

Achatz: The output is realy in volts-seconds, not energy. It is the area under their power delay profile.

Larry: So you could work back thru the calculations to get back to Eb.

Presentation: Bob Achatz, 93/42, Prediction of Coverage for DS Modulation in a Frequency Selective Channel.

McKown: Whaat kind of antennas

Achatz: Wide band disc cones. It's know for its wide bandwidth. It's vertically polarized.

Wayne: You did no study of cross polarization.

Achatz: No.

McKown: Motorola has chosen disc cone antennas for an internal study.

Larry: So you took your samples and got back to Eb, using BPSK.

McKown: Last equation has Pe on both sides.

Achatz: The one should be Pc. They are doing time domain measurements of microwave oven emissions. They are using a standard gain horn. They have done pattern measurements of the ovens also.

Larry: Are they putting out a watt or so?

Achatz: It depends on where you are looking in the pattern. He can't give out any numbers on this. It's not anywhere near a watt at a distance of 3 meters.

Buaas: He thinks a watt or so is emitted at the door.

Achatz: At 3 meters it would be a couple orders of magnitude below that.

Dick: Did they people stop moving during their measurement.

Achatz: They didn't stop during the measurement, they kept walking down the isle. You won't see much happen in a tenth of a second. It wasn't a busy office area where time coherence was a problem.

Presentation: Larry Van Der Jagt, 93/32, Modulation Schemes for Frequency Hopped PHYs.

You need to do something to get the sidelobes down 20 dB in a MHz. You have to choose an h, and right now he's choosing an h of .25 to open the conversation. Some h's are better than others for quaternary CPFSK. There is more work to be done to get this set up in dBc.

McKown: He will send Larry a paper on how to calculate power spectra for various FSK approaches.

Larry: When you get into the arbitrary Q factors, it becomes difficult to calculate. In general if you can compact the spectra to reduce the adjacent channel interference, the worse you make your BER.

Dick: The pictures look slightly different from what he expected. He thought they would be slightly steeper in the rolloff. Is there any chance of aliasing? And what is your bandwidth?

Larry: These are oversampled by 40. He's generating waveform and taking Fourier Transform. 2*PI/40 or .157 radians in 1 MHz is the resolution. In Fourier Transform 2*PI/8000 = 7.85 E-4 radians.

Dick : He's having trouble tying this to a spectrum analyser output. So 5000 Hz is measurement bandwidth? He would expect unmodulated signal to be 13 dB higher.

Break 3:02pm, reconvene 3:37pm

Presentation: Nathan Silberman, 93/34, Modulation for Frequency Hopping PHY.

Nathan: We can't live with modulations that aren't phase continuous.

Dave Leeson: Most oscillators have phase discontinuities. In Rayleigh fading, you have 180 degree phase flip. Many phase systems have never been able to be made to work in 20 years of trying.

Nathan: Mostly digital implementations can be done.

Dick: If you use a differential detector, as long as the jump is in the pipeline, you will see the error. Some of the frequency discriminators are much more sensitive to this kind of impairment than others.

Nathan: 3 things you can vary: # of modulation levels, modulation index, shape and duration of baseband frequency pulse.

Chadwick: doesn't see how any Trellis coding schemes will really be of any use.

Nathan: They have good experience using 4 level CPFSK modulation. Some of the characteristics apply to other CPFSK implementations.

Dick: What do you mean no shaping.

Nathan: It is rectangular. Partial Response and Full Response Articles March 91, IEEE Transactions on Communications and book ISBN 0-306-42195-X, Anderson, Aulin, Sunberg, "Digital Phase Lock Modulation, Plenum Press, '86, are very good references.

Larry: You trade off good rolloff for intersymbol interference.

Nathan: Continuous phase is a must, 4-level CPFSK?

Haim: To what extent does this modulation technique lend itself to measuring signal quality per channel.

Nathan: It lends itself.

McKown: Filters in tx and rx are important in system design. Why are we talking about any particular pulse shape?

Nathan: He did not imply a certain shape.

Larry: Its an interoperability problem. If you design the filter shapes differently, you may not interoperate.

Dick: Doesn't understand McKown's concern. We'll have to come up with an ideal tx, oscillator, etc.

Larry: How are we going to physically decide on one method of modulation?

Dave: Interoperability and coexistence are the two problems. You can predistort to match your receive filters at some cost to interoperability. We have to choose the mask.

Nathan: We need some more simulations so we can make an informed decision.

Dave: If we don't get enough units out there to be interference limited, we've failed to make a good standard.

Bill: Companies seem to be announcing products toward the end of this year.

Larry: This isn't going to be the last PHY we are going to do. If we want to have any say, we need to get going. If we wait, we will be standardizing a de facto standard.

Bob C: Are any of these schemes covered by patents?

Bill: Motorola said GMSK isn't.

STRAW POLL:

Michael thinks it's dangerous to do this now. People will vote on what their products are running, not on their technical merit.

Chadwick: Let's not get too hung up on NIH. DECT has a lot of practical experience on interference limit systems. He doesn't believe you are going to need the last 3 or 4 dB that some other modulation scheme besides GMSK might give.

Wayne: Would like to adopt a standard that is as flexible as possible for future inovation and growth. Let's not put ourself into an inflexible position.

Larry: How many want to do a straw poll: 15 Y, 8 N

?: If you don't vote, the decision is you wait until there are 5 products and then you pick one of them.

Dick: If you want to have a modulation considered, submit it at next meeting with enough detail to make a decision. Or risk not having it considered.

Larry: We'll follow the rules of order.

Dick:

Proposal: People should submit modulation proposals at the next meeting (May 93) with sufficient detail to be evaluated or risk not being considered at a future date.

Moved: Dick Walvis, Second: Bob Crowder.

Larry: If you don't tell us h and q, it isn't sufficient.

Michael: Look at Nathan's paper on Modulation Selection Criteria if you want to submit a proposal.

Dave Leeson: Choosing something like this is rarely a first order issue. It's the second order issues that show up in a practical application that show night and day differences.

Bill: People are putting units out.

Dave: He would like to see all the underlying assumptions in peoples data.

Dick: Need to make it clear that this applies to Frequency Hopping only.

Chadwick: He thought the question is what level of CPFSK. If you go for complete flexibility, then you don't have a standard. He thinks it will be either a 2 or 4 level. DECT has more data on GMSK than anyone else.

Bob C. Jan Boer's paper on Wavelan is the level submissions should have in detail. All the presenttions talked about Eb/No, but it's interference that we are after. That's the real issue.

Larry: Eb/No is the language the industry uses.

Michael: Would like to move to call the question. Second: Bob Buaas

Dave: Can the conditions be met with 1 Mb/s, 1 MHz channels.

Larry: Yes.

Vote on call the question: 23 Y, 0 N, 6 A

Vote on Dick's Proposal: 23 Y, 1 N, 7 A

Should we add an Issue: What is the Modulation scheme for FH PHY.

Vote: 28 Y, 0 n, 0 A

Chadwick: People have to have received the information before the meeting.

Larry: Vic will be able to tell us what that date will be. We have a straw vote to take. We will adjourn and then take the straw vote. Anyone who wants to take part can stay. There is a DS meeting here at 8pm.

Meeting adjourned: 5:30 pm.

Straw Poll:

GMSK	4 CPFSK	2 REC(Dual Binary)h=.5	Other	Abstain
9	0	1	5	9

Thursday, 3/11/93

Start: 8:37am

Report on DS meeting last evening, Jan Boer

They tried to map the FH items to DS items where possible.

Different international standards,

Power outputs, 100 mW in Japan

2 Classes: 10 mW, 1 mW

Power control is required above 100 mW, Levels: at least 4, maximum 8.

Channelization: 3 but think there should be more, perhaps by having overlapping bands.

Larry: Unlicensed PCS bands don't have enough bandwidth, interference profile is worse because of all the use such as wireless PBXs, etc. He personally doesn't feel it is of interest to us. The power level items were the main items of discussions last night.

We had a discussion yesterday on modulation. We have to have a criteria for evaluating modulation. We need to spend some time on deciding some criteria for evaluating modulation. The 5 criteria need to be considered:

1. Broad Market potential
2. Compatibility with IEEE Standards
3. Distinct Identity
4. Technical Merit
5. Economical Feasibility.

Bob Crowder: make (2) "compatibility with 802.11 PAR"

Rob Carl: Add Suitability for Portable Applications (Power Consumption, Size)(6)

Wayne: Flexibility for Technology Growth.(7)

Nathan: Compatible with ISM Environment (8)

Bob C: Ability to coexist with opposit PHY (9)

Jim ?:Meets Regulatory and tentative technical specs of committee.(10)

Data Rate (11)

Bob C. (11) should be data rate vs Bandwidth

Nath: Bandwidth Efficiency (12)

Michael: Impact on MAC (13). Impact on Radio Design (14)

Nathan: Impact on thruput (Adjacent Channel Interference) (15)

Rob: Eliminate (1)

Bob C: It's going to be difficult to have robustness. Doesn't want mod that doesn't have robustness even though it is easy to use with the MAC. Overlapping Networks (16)

Michael: (3) should be taken out.

McK: Res 10, Mod Tech and Demod Tech , settled on phrase "transmission techniques"

Robustness of Transmission Techniques(17)

Michael: Does it provide BER of 10-5 vs Eb/No in Benchmark Evaluations (18)

Haim: Behavior with interference.

Richard E: What I'm interested in is Thruput per hectare per floor.

Larry:

Thruput (Information Transmission Density)

In Environment of its own kind

In Environment of other PHY

In Presence of ISM interference

Dick: C/I ratio for BER and Acquisition.

Paz: Error Correction coding, how well does it work with modulation.

Lending itself to ECC (Codulation) and other techniques(19)

Chen: We can't only consider the modulation.

Larry: BER vs C/I (Carrier to Interference)

A) in environment of its own kind

B) In Environment of opposite PHY

C) In Presence of ISM Interference

1. Microwave ovens

2. Impulses

Ability to Acquire vs C/I (Carrier to Interference)

A) in environment of its own kind

B) In Environment of opposite PHY

C) In Presence of ISM Interference

1. Microwave ovens

2. Impulses

James R: When you change powers, that can generate an impulse.

Chadwick: What do you actually pick up on a dipole? Does anyone have this data.

Larry: Most of the time he got impulse noise when things were turned on, such as motors, microwave ovens, or toy helicopters.

Bill: He doesn't see how these provide an evaluation criteria.

Larry: The criteria end up in conformance test.

Nathan: The medium characteristics have to be included, not just interference.

BER vs Medium Characteristics

A. Multipath

James R. Constructing models is very difficult. It would be good for people to present data on real world experience. He wants to see real data rather than simulations.

Michael: We decided in San Diego that we would have a channel model. We don't have one. Without one it is difficult to have a first stage elimination of models. He suggests that we indicate a series of documents that have already been submitted to the committee to be used for a channel model.

Larry: Let's give one impulse response for a channel model.

Achatz: They vary widely. Wait a week or two until he can distribute them all.

Chen: BER usually doesn't differ a lot from one run to another. We don't need all 6000, just a few.

Larry: We'll pick a few of the runs for evaluation.

Dick: The big problem is mapping reality into the simulations.

Dave Leeson: There are 2 possible outcomes: works very well as long as C/I is above a certain point and craps out if it isn't. There are others where it changes slowly. There isn't that much difference between modulation schemes. Block error rate is more important than BER. We can simplify it to 2 or 3 interferers. One of the best interferer sources is one or more CW signals. The best interferer is lots and lots of our products. FCC is considering 900 MHz allocation of auto locators. This may happen to us in 2.4 GHz. Decision is going to be do we use 2 or 4 level, not the modulation scheme. Is this a fixed data rate or partial data rate. GMSK is a partial response system. Nature isn't granular. A modem meets multiple standards

Larry: We are trying to establish what standard we'll negotiate the rate on.

Dave: Can we talk about data rates below 1 Mb/s. FCC has said 1 Mb/s and 20 dB and a perfectly good system may fall 1 dB out. What is the FCC going to do?

McK: How well will my system work in the real world? Which of two alternatives do I want? The later is much easier. We can go much further with the second type of question. Binary choices will work much better.

Larry: How would you propose to proceed?

Chadwick: It doesn't matter what is decided here unless it gets done in the next two months. If you have equipment in the field working, it won't matter what you decide. We could agree on a bottom layer, then we could all go down our vendor independent route. We could get a degree of interoperability this way.

Larry: If we move in the next 2 months, we can influence the implementations that are coming out in the next few months.

Dave: The best way to make a standard is to standardize what exists. There is already product out there.

Bob C: What forces you on board is a coherent market. He would like to listen to experience rather than simulations. Shipstar has a product working, how about you? If silicon is already done, it is too late.

Bill: We have already said there are 3 forms: Apple has been asked how many forms are you going to require of us? Customers are interested in using the product long term. Having 3 forms is a problem.

Rob Carl: when the 10BAse T standard was being created, one company already had product out there and they migrated to the standard over a period of time. It is the market forces that will drive them to the standard.

Chadwick: You have European and American standards for land mobile.

Bob C: The companies #1 question is how do you conform to our corporate standard?

Bill: When you have a proprietary implementation proceeded by a standard, each customer can decide what to do. We are going to have incompatible standards out there.

? One of the main advantages is mobility, and if incompatible systems exist, that will prevent this.

Bob C: The most succesful standard is Ethernet and the most regulated is Ethernet. We should follow it and that means true interoperability. Everything works together

Adjourn: 10:20am, Reconvene: 10:55am

Larry: We should try to establish some minimum level of standard.

Wayne: We are going to have more than 1 data rate. We shouldn't have a modulation scheme that doesn't prevent this. There's a lesson to be learned from FAX people where they have default standards at lower rates with automatic fallback to those rates. The customer wants a user friendly function. We can use a phase approach today rather than FSK.

Bill: Modems are point to point links whereas here we have multi-point and fallbacks make him shudder.

Wayne: Depopulate the phase state population in the constellation.

Bill: there is a training state for modems during which they decide to fall back.

Wayne: In less than a microsecond you can do it.

Don: Wayne are you suggesting a fall back to a rate below 1 Mb/s.

Wayne: Yes, we already have decided that in our draft.

Wayne: We ought to have mandatory fallback.

Don: You are suggesting we get a PAR change.

Wayne: If we need to.

Colin: If we could find a common denominator we should proceed with that? If he could tell his boss that everyone agreed on a starting line, that would be an accomplishment. We have to back off a little.

Larry wrote on Viewgraph: Can we agree on lowest common denominator and what is it.

Wayne: That is fine as long as it allows you to grow from that.

Chadwick: Is it 1 Mb/s in air? [Larry: in air.] You are starting to get a degree of commonality. GMSK. It wouldn't be GMSK at 500 Kb/s. Have a start level where we can talk.

Larry: Binary modulation at 500 Kb/s and Quaturnary at 1 Mb/s?

Chadwick: You're standardizing something that is not 1 Mb/s.

Larry: He is not interested in what people are doing in the long run. Only standardize at 500 Kb/s?

Dave: Go thru the thought process. don't leap to the final conclusion. If we agree on something, then maybe we can agree on something else.

Nathan: Lets agree on the best common denominator.

Colin:We're violently agreeing on the same thing.

Nathan: Let's worry about 2-level or 4-level. Has to be continuous phase, FSK we agree on.

You need to get 1 Mb/s thru it we know.

Colin: If we can answer the question of what is the lowest common denominator, then we can proceed.

Larry: We shouldn't be constrained by the 1 Mb/s requirement.

nathan: All their customer's are asking faster, cheaper, smaller.

Chadwick: What he is offering is a level where everyone can talk.

Nathan: This can be discussed outside of this forum.

Larry: We have to standardise something that goes at 1 Mb/s.

Tom: We shouldn't allow someone to standardise a 500 Kb/s only radio. What it is boiling down to is someone can't operate at one modulation level so they don't want it to be the standard.

Nathan: We all want a good standard.

Michael. How can we speak about lowest common denominator if we don't have the data. Let's table this topic. He moves to table this discussion. who second: Nathan. In favor: 15, oppose: 0 abstain: 15.

Larry: The next meeting's agenda is clear.

1) FH Modulation, Tuesday
    A) Nathan
    b) Chadwick, CPSK, 2-level or 4-level
    c) Jim McDonald, .39 GMSK
    d) others
2) Channel and MAC MGMT/PHY Independence, Monday pm
3) DSSS, Wednesday afternoon
4) IR will meet ad hoc in evening.
5) Combined MAC/PHY Join Meeting, Wednesday morning
6) Thursday morning is open, possible item by item thru the template.

The primary goal is to come away with the Modulation technique for FH.

Adjourn 11:55