IEEE P802.11
Wireless LANs

PHY Meeting Minutes, 93/90

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Abstract

Minutes of the PHY Group Meeting, May 10-13, 1993, Wilmington, Delaware

PHY Subgroup meeting started at 10:50 am.

Agenda Generation: Minutes. Richard Ely volunteered to take the minutes.

Agenda Establishment for the week.

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Channel
      JM /31
      IR channel/96
FH:
      Bill Stevens /82
      Nathan Silberman, Mod/84
      Nathan Silberman, Specification/83
      Jim McDonald, mod/77
      Larry van der Jagt/71
      Peter  Chadwick, Modulation, /80
      Preamble Length/72
DSSS
      Channelization /81
      Comments Telxon/67
      DSSS Frame, Jan /68
General
      Dick Walvis, /74
      Radio Inter/73
IR
      Data Coding /57
      Modulation /79
      IR Sources/55
Monday PM wi Channel - MAC/PHY Independence
      /31
      /78
      /73
      /74?
Tuesday AM Joint meeting
Tuesday:  FH Modulation, Tuesday AM, Wed PM
DSSS: Wed PM
Thursday am: IR Modulation & Encoding, 1 hour summary

Order for Frequency Hop Papers
      /82   Bill Stevens:          30
      /80   Peter:                30
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      /77   Jim McDonald:          30
      /84   Nathan Silberman:      30
      /71   Larry Van Der Jagt:    10
      Discussion on consensus
Order for DSSS
      /68   Update:                30
      /67   Comments, Telxon:      30
      /81   Channel:               20
IR
      /57                          30
      /59                          30
Adoption of Agenda: Unanimous
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John McKown Presentation, 93/31, Record of previous discussions

Device only conformant after passing certain test. What you'd like versus what you can do. You would like to simulate real world performance. Signals come from multiple directions. You don't want tests to discriminate against certain implementations. Reference receiver with channel model built in, which illuminates your unit with a plane wave, and you can orient your units any way you want.

Peter Cripps: Why anechoic chamber?

John McKown: Because it is reproducible.

Jim McDonald: Have set of repeatable tests to see if it meets the standard, then another set of tests, field tests, that certify the standard.

John: Not good enough to say your conformant because you communicate in free space. We want to test your antennas.

Chadwick: If you could somehow transmit multipath...

John: Do you want conformance test to be a reliable measure of performance.

David Leeson: Have multipath be variable so you can't tune equipment for test.

John: Have this be variable as if you've been moving. Make simulator accurately reflect motion.

John: Mobile radio inside a fixed environment is what we're trying to model. Most mobile models are inappropriate for indoor models. The key difference is a non adaptive radio is one thing and an adaptive radio is another which is what he wants to mobile. Related channels so you can simulate what your coherent antennas see.

Tom T: Why not use an all metal chamber that creates lots of multipath.

LVJ: Were trying to come up with scenario that simulates what happens in real world by using a controlled environment where the multipath is generated electronically.

Tom T: How can you guarantee one chamber will be the same as another.

John: This is a compromise between consistent measurements and real world tests.

Cripps: Haven't we defined how this performs over multipath through our specs.

John: It isn't clear we've determined how a conformant radio performs. We need real test.

LVD: We are trying to set up test that includes as many real world conditions as possible.

Chadwick: Why do we need anechoic chamber, why can't you do it down a piece of coax.

Burchal Cooper: What about companies that don't make antenna?

John: From the test equipment the signal is pre distorted but doesn't use multiple antennas.

Walvis: Antennas shouldn't be tied to antennas.

Tom T: FCC requires you to test it with the antenna you'll use.

Leeson: Tx antenna and Rx antenna equals an attenuator. ISM band: either you have a nonstandard antenna ...

John: Anechoic chamber is the fairest method they know. Your rejection capabilities may not be necessary for passing the tests but are a feature.

LVJ: If somebody has an improved antenna, how can you determine how well it will perform.

Wayne: FCC requires either no antenna or a non-standard connection to prevent YAGI etc. to be plugged in.

Tom T: Does this test BER?

John: You have to communicate at a minimum level over a channel.

Cooper: If all your measuring is the efficiency of your antenna, then it is an expensive test.

John: This is an absolute channel model that includes attenuation.

Wayne: It should be chamber independent.

Leeson: How can you keep people from claiming their unit was not tested fairly.

Wayne: A friendly unit operating uncorrellated should be included.

Chadwick: +/- 6dB is best you can do.

Jerry Loraine: All European standards have been through this. They test either with antenna or without. They require +/- 3dB.

Wayne Moyers: Integral antenna is uninterceptable so you can't attach an antenna.

Walvis: concerned we're trying to address a moving unit with a plane wave.

John: It's in the channel models.

Walvis: How do you switch between antennas?

John: Put some standard reflectors in the chamber.

LeMaut: Use cable for some tests and chamber for others.

McDonald: With 2 antennas you have a number of options of orientation. Some could do you a lot of good and others not. Some of the Transceivers ...

John: That leads you to a test Transceivers. The trick is to have a single test.

LVJ: Type acceptance and conformance testing are two different things. Type acceptance doesn't have a lot to do with us. We need to guarantee interoperability.

This adds an issue: What is the point of conformance for an 802.11 PHY? The current candidates are the antennas and a test point that can be hardwired to. Multiple antennas is an anechoic chamber isn't a bad idea.

Walvis: Believes you're trying to be Consumer Reports. That isn't the way we should go.

John: Why not test over free space and let market decide what performance is needed.

LVJ: Have to decide how rigorous test has to be to insure interoperability under most real world conditions.

LeMaut: Modems have a variety of conditions to contend with.

Chadwick: Can you actually change the way the model operates:

John: Yes.

Break for lunch then look at IR papers.

Reconvene 1:30pm

What is the point of conformance for an 802.11 PHY? The current candidates are the antennas and a test point that can be hardwired to. Should we address this formally?

Chadwick: The anechoic chamber is an expensive approach

VOTE: How many would like to open this as an issue: Y-13, N-5, 5-A

VOTE: What is the point of conformance for an 802.11 PHY? Y-20, N-0, A-7

Presentation: Propagation Losses and Impulse Response of the Indoor Optical Channel: A simulation Package, Lomba, et al University of Aveiro-Portugal/78

Two possibilities, use satellite unit or ceiling. Can have the transmitter pointing to the ceiling or not. Assume cosine law for transmitter, the power of the cosine depends on how directional the LED is. A room optical channel model was developed. Assumes walls and ceiling are Lambertian surfaces. The study shows what performance can be gained by the emitter characteristics. Room is 12x12x4 meters, satellite is in center of the room, 13 LEDs, 152 mW, receiver FOV=85 degrees. Irradiance profiles were shown. Optimized satellite: 11 LEDs, (2 mW, HPBW=14 degrees), 62 degrees. 2 LEDs().

Second study just uses the ceiling. Units have 15 LEDs with 213 mW, receiver FOV=85 degrees.

LeMaut: Did you consider the case where there is aiming on both sides?

Rui: Yes, that was in first graph.

LVJ: Meeting fee is $75.00. This will be automatically deducted from the bill of those in this hotel. Those not in this hotel, see Priscilla Crowder.

Presentation, Dick Walvis, /74, Mutual Interference between frequency hopping PHY and direct sequence PHY revisited.

Showed graph of DSSS when FH is present. When FHSS with DS interferer, graph shown.

Cripps: question about graphs.

Dick: Conclusions won't change. It is job of committee to provide some method that their impact is reduced.

Discussion of different numbers for the charts but bottom line is the two transmitters next to each other will interfere. The charts may be off a few dB.

Paul Struhsaker: DS isn't going to fill up entire band. Any base stations shouldn't be collocated. Telxon (DS) and SpectaLink (fast FH) were tested together and they coexisted.

Walvis: When you have 3 FH are visible to receiver, a given DS will be interfered all the time. Similarly if you have 3 DS, they will jam all FH. If there is a single unit, then we can live with this. If the MIS director limits it to one or the other, then it should be OK.

JAN: He has same number on second look, as Dick.

Leeson: Neither of these SS are the interferers in the ISM band today. What is the same analysis between comparable systems.

Walvis: If you stick to one system, you can increase throughput without stepping on each others toes.

McKown: DS and FH are non cooperating. Suppose they are both hoppers under different administrations.

Walvis: There are ways for FH to avoid bothering each other without coordination. It is up to us to come up with an etiquette but doesn't know whether it is covered by FCC.

Nathan: Do you take into account energy averaging?

Walvis: I think that is what I did.

Nathan: Some of these issues could be solved by the protocol. What you do when you have a collision.

Walvis: Then we have the burden to tell MAC what to do.

Nathan: Talk to FCC to reducing the minimum number of channels of FH. FCC

requires at least 75 frequencies.

Walvis: If they occupy the same bandwidth during a session, 1/3 the time it will happen if both systems are working.

Paul: Intrigued by coordinating. potentially for FH...The difference between the two wave forms makes it difficult to coordinate these two. Its difficult to design these radios to detect the other.

LVJ: Reminds everyone that 2 meetings ago we decided to travel down different paths because people want to be able to select the approach they want.

Walvis: Wants to make everyone aware of this and then have committee decide if this is wise to proceed this way.

Chadwick: Not convinced this is so much of a problem. Microwave ovens is known so any interference is problem SS LAN so lock them out.

Paul Struhsaker: At the fringes that the competition problem comes out. User has to decide whether to add more base stations. In factory floor or warehouse, this is a problem. They can knock each other out.

Cooper: It's going to work in both directions.

Walvis: The question is whether you can measure background noise.

Chadwick: Your going to have RSSI anyway.

Walvis: You can't skip more than 6 channels.

Leeson: FCC hasn't had time to set everything. Their decisions are based on what they've been told. Some people want 2 of them next to each other and that doesn't work.

Chadwick: Would there be an advantage to invite the FCC to one of these meetings. At ETSI the regulators show up regularly.

LVD: We invited them once.

Buaas: Political comment: FCC has view we ought to go to them rather than the reverse.

Nathan: the issue should be how much is the energy spread.

Loraine: Looking to see if we can find a solution through the MAC layer.

Paul: To take evasive action, you have to be able to detect the other type of SS.

Loraine: You can with a NBFH detect this interference.

McKown: If they both were connected through a backbone, they could communicate.

Break 2:48pm

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Burchall Cooper, NSC. /73. An Unintelligent Radio Interface

This gives an example of how to move the exposed interface to between the medium dependent layer and convergence layer.

No questions.

Jerry Socci, NSC/72. Preamble Length Considerations for a Frequency Hopped PHY.

Cooper: Make antenna selection based on which signal is strongest.

Socci: For broad band noise, you would not trigger on the noise.

Walvis: If you assume a particular word, your probabilities would improve and you would have some ability to detect.

P. Cripps: You need 56 symbols...

Socci: Assume 1 symbol for antenna switching. Assumed 14 dB s/n ...

Nathan: How do you handle power adjustment?

Socci: He doesn't think you would do that on the preamble.

Walvis: When this is transmitting in one direction, its preamble.

Cripps: Looks as though threshold is -85 dbm. Below threshold where you'd get good information anyway. Isn't this going to keep saying there is a signal present.

Socci: He can think of a wide band case where you wouldn't say this. Narrow

band would give you a hard time discriminating.

Walvis: Analysis was not done on a signal power above a certain threshold. Its a wide band versus narrow band question.

Socci: You assume a certain background level. when a signal pops up you have a detection.

Cripps: Why wouldn't this happen with a wide band interferer.

Walvis: This paper was designed to show you could detect in 56 symbols.

Cripps: The PHY will signal to the MAC what is going on. You need to add more bits to the preamble so the MAC isn't processing false packets all the time. This will cause it to miss real packets. He was burned by this 5 years ago. False packet detection is a real problem.

LVJ: If it isn't detected in 6 or 8. Start Frame Delimiter has to be very robust.

Chadwick: Log amp allows you to differentiate signals before it reaches MAC layer.

Cripps: To get reliable detection from this kind of circuit is hard. Take a random bit stream and see how often you get a Start Frame Delimiter. You have to have more than bits.

LVJ: We have an hour left. We can't get on to modulation schemes until presenters show up. We could have Nathan review spec.

Peter Chadwick/80. Constant Envelope Modulation

Need constant envelope variety. There might be AGCs that would work but it is a dream. We want a low cost radio so we have to compromise so we need a 2 or 4 level CPFSK.

Walvis: Why not 8.

Chad: You'll be 64 Hz apart and residual phase noise will be a problem.

McKown: Say something about ease receivers can receive 0.39 GMSK.

Chad: it depends on how you do demodulation.

McK: You could make receiver that could receive both. How absurd is it to speak of two modes.

Chad: It isn't out of the question.

LVJ: So someone could make the motion:

MOVE: FH will use a constant envelope CPFSK modulation scheme with M-levels with M to be determined. Other parameters of the CPFSK signal also to be determined.

Walvis seconds, Nathan moves.

Tom T: Could we hear an alternative.

Chad: Shift is continuous in phase so GMSK is included.

Walvis: QAM is excluded.

Wayne: We're giving up higher data rates if we choose this.

Buaas: Look at table in Nathan's paper, page 6. This table gives a sense of what we are including and excluding.

McK: He was concerned about statement QAM is giving up high data rates. We are only after 1 Mbps. Above that we can use proprietary schemes.

Wayne: After we handshake, we can go off and do our own thing. However we could do something that makes filtering difficult. We know GMSK causes too much splatter. We have to be concerned about flexibility for growth. Amplitude gives us growth potential. Susceptibility to interference shows phase modulation better. HyperLAN is 20 Mbps and has been published.

Chad: Violently disagrees. He's on RES 10 and it doesn't exist.

Buaas: Moves to table this motion.

Wayne: Seconds this.

McK: None of the papers take issue with this proposal.

LVJ: If we took out CPFSK and left constant envelope in, would that be alight.

Wayne: that allows us to default to QAM after handshake.

McK: Likes the wording change. He offers

LVJ: Could we have a friendly amendment? Pi/4 QPSK shouldn't be thrown out

Struhsaker: Would like speakers to back up claims for s/n by citing a study.

McK: Makes motion to table motion on table:

Buaas seconds

All in favor of calling the question: 19-y, 0-N, 6 -A

Vote in favor of tabling this motion: 6-Y, 10-N, 8-A

Mover declined to take the friendly amendment.

All in favor of this motion: 13-Y;2-N;12-A

LVJ: We are not closing the issue because we need 80%. This does start to close the issue.

Jim McDonald Discussion of 0.39 GMSK Modulation for Frequency Hop Spread Spectrum/77

They conclude it does meet the intent of the FCC rules. FCC doesn't define how it is measured.

Cooper: What resolution bandwidth does the FCC use.

McDonald: It is not defined.

John Barnett: There is a document that talks about test methods.

McDonald: Yes but it doesn't address this.

Struhsaker: Are there other things we can do?

McDonald: Can move break point of Gaussian filter up and down.

Walvis: Minimum PSK means you arrive at a particular phase state at a certain time. This is not GMSK .

Discussion of what GMSK & MPSK is.

Chad:

Nathan: How to measure this is important. Whether we can change FCC's mind is unknown. But it is probably a workable issue. What our criteria for choosing a modulation scheme is important. He thought Jim said he changed the H.

McDonald: No I didn't change the H.

Loraine: Because we're close to limit, does that affect the center frequency.

McDonald: No, FCC just looks at the shape.

Loraine: Accuracy's in center frequency of the measuring receiver affects measurement accuracy.

LVJ: Can we say for the purposes of moving forward, that 0.39 GMSK will meet the FCC specs? For our analyses of this week, we will consider 0.39 GMSK as meeting the intent of 15.247.

Cripps: Proposes deleting intent.

LVJ: change "intent of" to "spec for."

Cripps: makes motion to change "intent of" to "spec for", McKown seconds.

Walvis: We don't require a response from FCC that they approve it. There's no plan if FCC rejects 0.39 GMSK. We have to take action to remove doubt about FCC approval.

LVJ: Proposes adding "This is subject to Motorola taking Action Item to Have this confirmed."

Cripps: Likes this. Who presents this is important.

McK: Doesn't know if he can do this.

Cripps: On second thought, he's not sure he likes Motorola being named.

Wayne: He talked to John Reed a few weeks ago and he said 0.39 GMSK doesn't pass their test. He talked to Reed about 3 weeks ago for 1/2 hour. He said it won't comply with the intent of the rules. This is off the record.

Nathan: After reading a lot of literature, he doubts it meets FCC. But does

it meet the intent of sharing bandwidth? He doesn't think GMSK is best choice.

McDonald: He thinks it speaks to the intent of FCC.

LVJ: His simulations can tell us. We could lower the filter bandwidth.

Chad: Reduce deviation rather than lower bandwidth which will increase inter symbol interference.

Cripps: If John Reed believes this doesn't meet the spec, we ought to ask him why.

LVJ: How could we get answer.

McDonald: July 81 paper speaks to normalized fractional bandwidth. This confirms results they presented.

Cooper: It's difficult to see how we can proceed without knowing FCC approves.

Buaas: let's move to have a meeting.

McK: He's on Wintech. They just assumed that the FCC will prefer the sort of specs that Jim McDonald presented. The FCC is going to do the right thing sooner or later.

Wayne: What are we going to do? Contact the FCC. Somebody should contact them and document it.

LVJ: By Thursday, we want to leave here with a way to get an answer from a small number of candidates.

McDonald: It's not clear to him what short term actions should be taken with the FCC. It's worthwhile for people concerned about the right way to go, that we have back-off position.

Walvis: He doesn't think it will be simple to pass the FCC.

McDonald: They have never received any negative feedback from the FCC.

Walvis: They also have not made a firm request.

McDonald: You have to make a submission.

Tom T: We still haven't decided whether 0.39 GMSK is the method of choice.

LVJ: No we haven't

Cripps: We should consider this one of the methods to consider.

McK: Some are saying we should throw this out.

Tom T: Until we decide we want to do GMSK, we shouldn't bother going to the FCC to get it approved.

LVJ: Just wants to lay the groundwork so we can accomplish something this week.

Motion: For our analysis of this week we will consider .39 GMSK as meeting the spec for 14.247. 15-y, 6-n, 4-a

Tutorial at 7 PM tonight.

Meet tomorrow at 8:30 PM.

Meeting adjourned at 5:20 PM.

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Tuesday Morning, May 11, 1993, Wilmington, Delaware

PHY group starts 10:05am

Bill Stevens, Comments on Document IEEE P802.11/92

Chadwick: 40-60 cycles for lock is implementation dependent. It could take longer.

Wayne: Many thousands of hops per second are being used in military applications. 200 hops/sec is slow by these standards. Settling in 1usec is possible. The upper limit of 200 hops/s is arbitrary.

Bill Stevens: There appeared to be an undisclosed reason for choosing 200. He doesn't know what that reason was.

Struhsaker: Does any one have data on what it takes to synchronize.

Cripps: We have done it. Once you've acquired sync, you can hold it forever.

Struhsaker: Acquisition limits system performance.

Bill: That is the heart of what I'm saying.

Struh: People here have hardware with which they could give some real data.

Blaney: They have data. They are in the lab.

Buaas: Having a hopper that settles fast may be overkill given we've decided not to change frequency during a packet transmission. Thinks settling below 100us is reasonable.

Blaney: Power consumption. Don't limit your vision by what we can do today.

Wayne Moyers: Agrees with Buaas in one sense, this is blind time, you're off the net and blind. There is adequate evidence in literature you can settle in 1usec. If you use a home channel, you loose time switching to it all the time. 100us is very doable. If we are going to do a home channel, lets have a long dwell time.

Nathan: We need a better definition of acquisition time. He said higher speeds are possible. Acquisition and tracking. He thinks we need a quorum to make an issue.

LVJ: We need 50%. Doesn't want separate issues because they are interrelated.

Jim McDonald: the cold start issue is hard to deal with and should be put off for now. Their are several MAC issues such as retry time. What kinds of things do we need to be thinking about so it is manufacturable, we should know what the cost is per feature. For example 40 hops/sec, 250usec switching time represents 1% dead time. How much are we willing to pay for 1%. How much is 1% worth. Someone has to show that we are going to get a lot better performance.

Collin: GEC Plessey has data showing with 100 usec...

Chadwick: fast hop times are no problem to do, but do we want a standard that demands non standard ICs. We don't want to push it too far. Until we define what we mean by switching time, we can't do much. Pushing it below 100 usec means extra circuitry.

Buaas: Settling time of synthesizer influences how quickly you can switch from Tx to Rc. How you define terms is very important.

McDonald: Keep Tx and Rc separate.

Buaas: Let's have it out.

Cooper: Define channel access protocol so you can make comparisons.

Bill: We need much more illumination on performance factors.

LVJ presented 3 issues:

ISSUE: What is the point of conformance for all IEEE 802.11 PHY?

Vote on opening issue: 24-Y, 0-N, 0 Abstain

LVJ: He'll talk to Simon and get numbers assigned to these issues.

Nathan Silberman, Proposal for a modulation technique for Frequency Hopping Spread Spectrum PHY Standard/84

Proposes 4-level CPFSK for modulation, and baseband shaping. Presented criteria for the selection of the modulation techniques. He searched dozens of articles and textbooks for his criteria.

LVJ: #20 Performance in the presence of impulse noise is the intent of #20.

Cripps: Does Nathan have comparisons between 2-level and 4-level? Lower 99% bandwidth for 4-level than 2-level. Assuming you hold Eb/No constant what improvement do you get?

Nathan: About 50%. You get lots of margins.

Cripps: Modulation scheme being used at Xircom looks like Nathan's except it is a little bit broader. Its complexity of demodulator that's important. It's simpler with 2-level, analog implementation possible. Reduce deviation factor. 250 KHz between Xircom's 2 states.

Nathan: If you keep same deviation ratio, you get 3db advantage. By doing shaping you pay something. He's confident this approach gives you the best performance.

Cripps: No doubt 4-level gives better performance but 2-level is much easier to implement.

Nathan: He was told it only cost 20 cents. It has competitive cost. The receiver is the more important cost component.

McD: Complexity. Manufacture of low cost radios, frequency stability requirements, not so concerned with. Signal distortion issues over dynamic range. Simplicity of binary is very important to keep in mind.

Nathan: Yes it is more complex but you don't want to use old technology. Once it's designed, it goes in silicon. There isn't much difference between 2 and 4 level as concerns overload.

McK: When you were quoted 20 cents for going from 2 to 4-level.

Cripps: What about A/D. You need it to go to 4-level

Nathan: He's not sure you need A/D.

Leeson: Entire modem contained in FPGA. Issue is how you make decision. Does mask meet reqs of 802 and FCC. In case of 0.39 GMSK, its a squeeze which if you are off slightly takes you outside of range. What's performance of each in the presence of interference with competing modulation technologies.

McK: The fewer levels and separation has superior C/I. Binary is significantly better.

Leeson: If you look at C/N you don't see those kind of differences. Is there actual data that is easy to get? That would make decision easy.

McK: He needs permission to give it out.

Nathan: He had data on it. There was a slight difference in favor of 2-levels.

Cripps: There is a slight Eb/No advantage.

McK: How can we define wideband noise.

Nathan: Symbol error rate

McK: Didn't you say we shouldn't be using qualitative statements.

Loraine: Carrier interference is very important.

Nathan: GMSK did better...

Leeson: when you get to point of making a decision, we ought to ask the question so we can see which is better. Have to make sure you ran the comparisons the same. If you can make 4-level $5 cheaper than 2-level, then there would be no question.

Nathan: An article published on GMSK...

Loraine: These are misleading figures.

Nathan: Rayleigh fading is worst environment. The longer the symbol rate, the less susceptible you are to multi-path.

Loraine: There is misleading statement, interference limited performance in mobile environment. DECT has MAC designed for collision interference and it's unfair to use this as argument against GMSK. GMSK is good in interference environment.

Nathan: There is going to be a lot of interference in our environment, whereas DECT is much more regulated.

Loraine: No its unregulated. They can do whatever they want. You get AM splatter.

Nathan: ISM is most difficult environment.

LVJ: This is more reason for GMSK.

Nathan: DECT is different type of interference. He would choose something else if we weren't in ISM band.

Loraine: Issue is which one has the best C/I.

Nathan: GMSK is another form of CPFSK. ISM band is much wider than DECT.

McD: What are the freq deviation for 4-level,

Nathan: you can see that in the paper. .3 to .4 deviation ratio would do the job.

McK: On BER row , different columns have different receiver structures. GMSK reasonable number. Say something about first column, change 10.7. This is theoretical number whereas GMSK is a measured real number.

Nathan: 4CPFSK was taken from paper.

McK: He's holding some unpublished stuff on last row that he could send to Nathan.

Cripps: Deviation and prefiliter, is there a specific proposal?

Nathan: We need to design filter based on channel model, and it is multiple bit shaping.

Cripps: Would feel more comfortable if you had a specific proposal.

LVJ: We had said we wouldn't accept any proposal that didn't have specific data.

We haven't seen any valid presentations yet.

LEESON: Can you get data before end of the meeting.

Nathan: I should get something by end of meeting.

Loraine: If source reference for each box were indicated, it would be a big help.

Nathan: His references are in the back. He'll try to do that. His data shows pretty high side bands into the adjacent channels for GMSK.

Chadwick: Doesn't see why adjacent channel would be better with 4cpfsk than gmsk.

Nathan: Depends on how you do filters.

Chadwick: You are very tight on the filters, phase noise is tight.

Nathan:

Loraine: 4-level is narrow band.

Chadwick: Noise floor folds back in. Phase noise becomes the problem not sensitivity.

Wayne: We can't give away every adjacent channel.

Loraine: (Couldn't hear him.)

Nathan: 4CPFSK offers superior tradeoff for FH in ISM band.

LVJ: If this is going to be considered in next meeting, they need to know HFS and baseband wave shaping.

McD: Points of clarification. Graph was 250 Kbps, not symbols. What was source Eb/No.

Nathan: that was number 3.

McD: Deviation was between 300 and 400 KHz.

Nathan: It was 300 KHz.

Wayne: QAM, page 5 typo. 2 bps/Hz . He'll bring data next time.

Nathan: QAM is not suitable for slow FH.

Chadwick: TDMA is producing buzzing in hearing aides.

LVJ: We'll break for lunch. then takes 10 minutes on document 71. then we'll move on to the discussion of where we go next. Reconvene at 1:30.

Adjourn at 12:14pm.

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Note taker didn't arrive till 2:10pm

Motion: Dave Leeson.; Second: Wayne Moyers.

Our modulation will be at least 1 Mbps and will have a maximum bandwidth of 1 MHz [99% energy bandwidth]

15-for, 0-Opposed, 8 Abstain

Motion: Dave Leeson. ; Nathan Silberman

All frequency variation shall be included in the 1 MHz bandwidth.

Leeson: Feels a deal has been cut and discussion is wasted.

McK: If 2-level improvement is really dramatic (interrupted by comments)

David?: Absolute bandwidth can't be adapted. Why not talk about something like adapting to frequency drift? If you have 3 networks, you can adapt to drift. Not clear why C/I is important. (Leeson rebutting)

Leeson: we should not wait for data and go ahead with standard. We don't have luxury of worrying about this. We've got to proceed so this business can develop.

McD: No basis in discussions or FCC for restrictions given here.

LVJ: Interoperability could be the reason.

McD: No evidence it aids in interoperability.

Leeson: Example of bridge height. Standard should have absolute out-of-bounds.

McD: Standard does have bounds. Frequency stability was defined as +/-25 ppm previously.

Leeson: Knows of no other regulation that lets you go outside bandwidth.

McK: Is there nothing that already applies to us?

Leeson: If a unit drifted a little to put it outside the spec, he doesn't think it would be certified.

McKown calls the question. Buaas seconds.

13-For, 0-Opposed, 6-Abstain

Voting: 4-For, 14-Opposed, 11-A

Doesn't pass.

Leeson: Moves that all frequency variations shall be +/-25ppm added to the 1MHz if permitted by the FCC.

McKown seconds

[This is 62.5 KHz]

Chadwick: Isn't happy about this.

No response on calling the question. Nobody raised their hand one way or the other.

Chadwick: Proposes center frequency be +/-25ppm.

LVJ: This is friendly amendment.

Nathan: what does this say about the edges?

Leeson: This is a motion about the occupied bandwidth.

McD: He doesn't think this has anything to do with occupied bandwidth.

McK: It's time for people to decide where they are. Isn't it true that something helpful could be added to proposal?

Dave?: What is the difference, 60 kHz...

Leeson: Looking at adjacent channel interference.

Struh: If we had to develop a product, we wouldn't be having this discussion.

Chadwick: If my government came along with a spec like this, he would ask what they meant.

LVJ: For interoperable standard, we will define 71 channels, and 1 MHz centers are allowed to move +/-25ppm either way.

Leeson: Mover and seconder accept LVJ's amendment.

We will spec N (74) center freq in the 2.4-2.483 GHz Band. A transmitter must maintain the center freq within M (25) ppm of the specified center frequency. 99% of the transmitted power will fall within +/-500 KHz of the center freq.

Leeson: there might be a reason to revise the N.

LVJ: LET IT BE NOTED THAT: this number 25 may be revised downward in the future and the 79 may be revised upward.

Chadwick: Can we vote with the provision the numbers may be revised down.

LVJ: Europeans have to be down -30dBm at band edges.

All in favor: 26-Y, 0-O, 6-A, Motions passes.

Leeson: Moves that all conformance testing will be done under stressed conditions including co-channel and adjacent channel interference and multipath.

Seconds: Nathan

13-Y, 0-O, 15-A

Chadwick: Is it intended that it applies to 5 GHz band?

LVJ: No. Conditions may be different there.

Chadwick: Moves break for coffee.

Reconvene: 3:28pm

Nathan: Moves that discussion of 2 & 4-level be postponed to next meeting. All proposals must meet 1,8,3 above.

Second Walvis

LVJ: Are we going to leave meeting with a 4-level proposal we can evaluate.

Nathan: The modulation I defined.

LVJ: Wants to know what H is.

Nathan: H=.31.

Dave?: What are the criteria we will choose?

Cooper: In all fairness to Nathan, his is the only one with substance.

LVJ: thinks we'll get to the next meeting and not have gotten any further.

McK: Can I make friendly amendment that this motion be withdrawn?

(suggestion ignored)

All in favor of this motion: 18-Y, 1-O,6-A. So we postpone decision until next time.

LVJ: We had said that if people didn't make proposals here then they risk not having it accepted in the future. If someone has a good proposal, then we would want to listen to it.

Chadwick: What's the trouble with MAC.

LVJ: What should we do with the rest of the time today?

Chadwick: Acquisition time, Settling time,

Dick Walvis came forward to develop the list.

- Acquisition Time
- Settling time
- Signal detection/presence
- Antenna selection (optional)
- Symbol sync
- slicing level settling
- unique word

Cripps: In order to be sure you have detected real signal, frame delimiter can become relevant,

Wayne: Where are you going to put Tx to Rc crossover.

Walvis: He was looking at it entirely from a receiver standpoint.

[A graph is being developed by Dick on the overhead]

Walvis: He's addressing the time the transmitter has to put in front of each packet.

LVJ: Call's this squelch ...

Chadwick: supposes using channel energy.

Cripps: waiting for unique word.

Walvis: Trying to put what he thought it could be.

Walvis: means antenna selection, or diversity. Should it be included in standard.

Chad: If you just decide on max signal, that's one thing,

Walvis: Assumed antenna selection done at the beginning.

Nathan: Looks like you can log in to another network, the wrong one. He thinks this is an issue. Antenna selection should only be done after unique word identification.

Loraine: You can use unique word to tell you are not receiving gibberish. Wouldn't expect someone to select antenna based solely on power level.

LVJ: Through preamble process, can decide whether to wake up MAC.

McD: If signal from distant station, and you want to receive another system starting a little later and much stronger, you may start the process over again, so you may be starting with the wrong antenna.

Loraine: In support of diversity. Need to take care of how you do it or you wind up with long code to establish a link.

Wayne: We ought to wait long enough to get adequate signal to optimize on it.

McK: Having trouble following this discussion. Their antenna doesn't work this way. You have to change antennas every so often. There is a characteristic time for which an antenna will serve. They have to probe antenna at Nyquist rate.

Ed Geiger: Not comfortable using information about data concerning diversity. If you don't see preamble and suddenly start seeing data and you transmit and clobber them.. Against using preamble and instead use RSSI.

McK: It just occurred to me that the transmitter knows who it is talking to.

Chad: What exactly does diversity selection do? Want 2 antennas in case you are where there is 0 signal. Want 16dB s/n . How often will switching between antennas help you.

Dave?: Why we have to use diversity. Want to check whether one antenna is jammed...In one hop you aren't going to determine between one error rate and another. Where there is a big difference between antennas, you can determine quickly.

Chad: Does anyone have data.

McK: Yes. Antenna in standing wave pattern, what happens depends on antenna. Want diversity when one antenna is totally blocked. You won't be looking for small differences in performance.

Loraine: When you do FH and make change, have to do antenna selection on packet by packet basis.

McK: The reflectors moving causes changes among other things.

Walvis: 1 meter/sec takes about a second, move more than 1/4 wave. Do we go for moving?

McK: You have to accommodate it.

Walvis: Question, should we assume there is sufficient correlation to manage diversity on the basis of the signal received? Do we want to negotiate diversity?

Wayne: He doesn't see why we are talking about this.

McK: Are you saying we're going to be broadcast from one point to many points.

Wayne: You shouldn't do it dumb, but smart, based on signal.

Socci: Two separate issues being discussed. At beginning of packet and during packet.

McK: Things change slowly compared to arrival of packets. Decides based on that information whether to change for next packet.

Socci: You could be looking at packets from several different sources.

Ed Geiger: This is an implementation problem.. Should be preamble time allocated to those who want to do antenna diversity.

Blaney: can you decide channel is reciprocal.

McK: If you do 10 packet on same frequency, might want to make some decisions base on that.

LVJ: Standard. We won't write anything about how receivers work, only about what the receiver receives and what output shall be.

Bill: History of link between any two stations, history might be important where everything is stationary. Political convention where everyone is jumping up and down with handheld units is a different scenario.

David Whims GEC: These are short wavelengths. Any change in frequency will change phase. You have to check it every time you change frequency.

Walvis: Everyone agrees we need diversity with preamble.

Dave?: Let's assume we have 100 bits.

LVJ: How many bits we can afford is what we are trying to decide. Then what the structure of those bits is.

Walvis: Believes total should be less than 70 usec.

Cripps: Believes it has to be more than 32.

Ed Geiger: Is everyone happy with a 1010 pattern? He isn't. Would like some separation from what people are doing now. Assumes NRZ coding scheme with 1010.

LVJ: Barker 11 sequence repeated over and over again.

Walvis: Bandpass filters are easy with the right sequence.

Cripps: Unique word is far more reliable. So it gives you a more accurate way to measure.

LVJ: If you use 1010, doing antenna selection not based on the random data you will be receiving.

Ed Geiger: Should use the same pattern all the way through. Do diversity as quickly as you can. Use Signal strength to do diversity.

Nathan: What is the probability of cancellation if you use just the carrier at the beginning.

Loraine: You need a unique way to know where you are.

Cripps: 1010 pattern does not have anything to do with unique word.

Walvis: What kind of confidence should you have with unique word that it is the start of packet? >99% of correctly detecting start of packet. If no signal present less than once per 250 msec. If other signals present? How reliable should you make your preamble detection. Is 99% high enough? This is under normal operation.

Chad: What false alarm rate.

Socci: You'd rather throw away packets because you have an error, not because you missed the packet. Getting false alarm is another to miss the packet.

Socci: Assuming no coding gain at 10-5.

Loraine; Bit error rate is 10-2?

Ed Geiger: Who's going to tell MAC people that 1 packet out of 100 is lost. Who's going to tell TCP/IP people. They'll throw up.

Cripps: The bad news has already been given to MAC.

McK: Is this implementation dependent?

Walvis: What kind of header is reasonable and what isn't is what we are trying to establish. Using s/n suitable for 10-5.

McD: How many bits of 1010 before going into sync.

Walvis: this was 56, he showed 70 earlier.

McD: Would like it to be longer for diversity, like 100, not including unique word.

Ed Geiger: Who knows when you turn your radio on and when you start scanning. 100us to do diversity seems long to him. You are taking a risk.

McK: He has a reference on this subject he'll send to anyone who sends him E-mail requesting it. He could send it on the 802.11 reflector.

Dave?: MAC itself gives us header with 1010.

Chad: Proposes adjournment.

Meet 8:30 tomorrow.

Adjourn 5:06pm

Wednesday, Convene 8:40am

HOP ACQUISITION

Larry van der Jagt: Does anyone want to make a proposal on how to do acquisition?

Struhsaker: let's write down a set of choices. Assume a base station.

McK: If you were going thru in one direction and the other was going thru in the opposite, would you get to the same slot.

Struhsaker: A standard loiter freq won't work. Everyone's agreed to different hop rates but haven't agreed to a way of syncing.

[Larry van der Jagt started working on a graph showing a decision tree.]

Larry van der Jagt: Loitering, A public hop sequence.

Struhsaker: You have to use psuedo random hopping. You can't just move up the frequency. Spectralink is going to be a problem to all of us.

McK: How can you interoperate without a standard hopping pattern. Let's ask IBM how they acquire.

Struhsaker: If there's a noisy unit out there.

McK: Let's ask how they acquire.

Lemaut: You remain on single freq. If you are able to decode header which tells youo where next freq is. It depends on how quickly you want to get into the network. Frq for other countries requires different scheme. You need a more complex scheme. How long you are willing to wait to acquire. You have to get access to the token. Several steps to go thru.

Ed Geiger: For approval, what's FCC looking for.

Struhsaker: Part 15 radios, hoppers starting to interfere with their networks. Random means you can't see anything apparent in it. You could use random number generator. But we don't want to generate this on the fly. We ought to have fixed ways to generate the pattern. Is this MAC or PHY.

Larry van der Jagt: IBM gave paper on hopping patterns.

Lemaut: He will follow up.

COOPER: Problem is selecting largest numbe of orthogonal patterns.

Struhsaker: In hospital, which can use ISM band, how can we avoid certain freqs. Hospital has priority. We have to have a way to avoid certain freqs.

McK: What do you do about this.

Struhsaker: Tom Tsoulogiannis T. is going to present a channel plan. They have a big problem with interfering freqs.

McK; He just understood that unlicensed mobile service has priority.

Struhsaker: This isn't a show stopper.

McK: This isn't a good situation.

Larry van der Jagt: That's why we need more bandwidth.

Walvis: You mean we have to kill a few people in hospitals. Thinks the description was accurate (in decision tree).

Larry van der Jagt: Loiter, single loiter frequency.

Lemaut: We're time bounded, so its' a matter of which MAC. At one point in time, you know what freq you will be visiting. If 400us hop, then you could wait a long time with certain MACs.

Walvis: If you sit for a certain time, you go to another freq, and go down the table.

Lemaut : Or you could search.

Walvis: You can switch freqs.

Larry van der Jagt: We know what the MACs are. It comes down to base station and ad hoc. Has MAC group said ad hoc is possible?

Jan Boer: Yes.

Walvis: Majority of people here don't think its that important. What getting a convergence layer working group?

Larry van der Jagt: At some point in time, we're going to have to rearrange the structure of the group to address these issues. We have to get the whole thing together. We have to come up with something we can shoot at. Hop synchronization has got to be addressed.

Ed Geiger: FH, DS, IR groups would produce to small of groups. All needs to be in same meeting.

McK: It might be better to let the MAC and PHY groups develop a little more before we start convergence. If you loiter, you could hear friendly, or you hear interferer so shift to another frequency. You detect power you shift freq so you can dispense with acquisition.

Struhsaker: IR doesn't interfere with DS and FH. Is it fair that FHers have a say in DSers and vice versa.

Larry van der Jagt: They are set up as ad hoc groups and are free to do whatever they want. At some point we all come together to vote on a standard.

Struhsaker: They are going to be cointerferers.

Mansour: MAC ?

Larry van der Jagt: Trying to make input into MAC group so they can use that in final decision making process.

Buaas: Problem of Preamble is clearly a PHY layer matter. Hopping involves MAC. Is there a willingness to contribute papers next time on both of these ideas?

McK: FH & DS interference doesn't require we spend every moment together.

Ed Geiger: Question, have we agreed as to what we want wireless LAN to do? Usage model. What is the type of data people want to pass thru.

Larry van der Jagt: We went thru a requirements document that took 18 months. It will be time bounded and ad hoc.

Larry van der Jagt: It's fine for engineers to say what needs to be done, but when we go back to the office, other things consume their time. If we say were going to do it this way, then that raises the level of priority so they will do the work when they go back. He'd just as soon adjourn until we have submissions and go listen to MAC.

Wayne Moyers: He's willing to adjourn.

Nathan: Let's say what the issues will be next meeting. He needs to check council but is willing to present their data.

Lemaut: Hopping pattern sequence determines how you do RF receiver. He will take work of hopping pattern.

Wayne Moyers: We've got to do something.

Buaas: Modulation, acquisition, and hopping pattern.

Walvis: Will put up acquisition.

McK: Why not adopt acquisition mechanism. Let's make it approved so we can walk out with it.

Walvis: [Put up flow diagram].

Ed Geiger: What's defn of carrier detect?

Walvis: There are bits on the wire.

Ed Geiger: Data there and it could be for us. It's up to MAC to decide if it is for us.

McK: What's the first labe?

Walvis: Carrier detect or unique identifier.

McK: At botTom Tsoulogiannis of diagram, can't you connect to next.

Walvis: No this is freq list. It becomes hop freq tracking once out of acquisition.

Nathan: What do you mean by valid sequence?

Walvis: This is something I understand, this is a frame I can understand, etc.

Buaas: MAC stuff.

Walvis: It is truly valid data.

Ed Geiger: You''re trying to figure out if what is on the media is your.s

Tom Tsoulogiannis T: That is a MAC function.

Walvis: There is an exchange of information to determine this.

Cooper: There are a lot of decisions that have to b made in this block. everything to hop to the next freq is contained in this block.

W: This is interpretting data. It has to happen before you can make decision it is valid. So what do you want to call it Nathan.

Nathan: Unique word.

McK: What is this diagram called in standards language?

Larry van der Jagt: State diagram. If we use this approach, there is at least one way to use this system.

McK: He doesn't know what it is. How do you officialize it.

Larry van der Jagt: We are using this to think about what to put out on the airwaves so the system could work. This state diagram could then be discarded. What we put out on the airwaves is what we want to standardize.

McK: This is an anvil on which to forge.

Ed Geiger: You need a state machine for almost every part of the LAN. We'll have to come up with state machines.

Larry van der Jagt: If people don't follow state machine, you won't interoperate. If you can interoperate some other way, you don't need state machine.

Harrer: Need to define what has to be done to design my equipment.

McK: Still interested in how to capture it. It could be a paragraph in Francois's draft.

Cooper: How long to do hop acquisition worst case.

Harrere: How do you determine what t1 is?

W: TBD. Would make it fixed. To show some dependence on MAC layers. In Ken Bibba's MAC, next freq is available often during hop period. This state diagram isn't useful for that MAC.

Buaas: You can discover bits are there.

W: If you know bits are there you always go to VALID.

Larry van der Jagt: What we should be concentrating on is what is the best thing to tell MAC group so we can interoperate. A PHY has to acquire in a certain time, for instance.

Harrer: Keep it wide open.

Larry van der Jagt: We aren't going to tell people in this detail in the standard how to design radio.

Socci: Next freq, etc. should we start making a list of what reqmts are.

Larry van der Jagt: On regular basis, should MAC provide what? If PHY is to Hop and Acquire, Required of MAC:1)Time to next Hop., 2)next freq of hop table

W: If you rely on the present freq to know where to go next, then you are in trouble. How you get next freq ...

Cripps: Just worry about how you do it, not whether it is MAC or PHY.

Tom Tsoulogiannis T: Time to next hop,

Nathan: Have access point function, even in ad hoc network.

Tom Tsoulogiannis T: Access point function?

Larry van der Jagt: Doesn't think you can assume that.

Cripps: Some proposals don't require access point.

Larry van der Jagt: Point of connection to distribution system is access point.

Tom Tsoulogiannis T: Don't want station telling everyone else when next hop is.

Cripps: Network ID

Mansour: Time to next hop isn't needed.

W: Flag tells you how many tics.

Mansour: Need some signal during dwell time is fixed.

Cripps: Not wise to rely on timing information on frame.

Mansour: Wait for the next time.

Cripps: If many pieces of information throughout hop, you are better off. Packet header could give you timing information and where you are at. Item 2) was question,

W: How do you get information on the next freq? there are many ways it could be done.

Mansour Probably won't have to bother MAC people.

W: No.

Wayne Moyers: Time to hop. What is important. Need to initiate an acquisition. Have to have a place to meet. This implies home channel. If it is jammed, then need a default.

Lemaut: what about country where backups aren't available.

Wayne Moyers: Net ID. Need to know if there is someone there you need to do something about.

W: Sounds like signalling channel. Net ID. Portable can't make up its mind about net ID. If you move, you need another net ID.

Tom Tsoulogiannis T: Need to distinguish one net from another.

Nathan: Time to next hop. When you joinnetwork, you may not know what is happening. If you reaquire, you need to know if a change was made. Hop tables can only be transferred through network management.

McD: [Put up viewgraph] Example of large system installation, not ad hoc. Access points every 50 meters. Portables surrounding them, usually talking to closest access points. Access points have better antennas than portables. 100 mW for AP, 10 mW portable. AP can see 10 to 20 other APs. If they are all real busy, we'll have real interference problem. To keep cold start acquisition quick, we don't want it to drag system down.

Cripps: May be exagerating potential for interference. You'll use orthogonal hoppin sequences. You can get fast cold start acquisition from data they've seen. Lightly loaded system, need to make sure acquisition information gets broadcast often enough.

McD: Great, I was concerned about that. Expectations on traffic, anyone have any idea.

McK: Expect the manure spreader to arrive.

Leeson: Mix of file server, E-mail. Model in paper from NCR on Novell network. Workstation would send more of the shorter messages. 500 kbps at .04 duty cycle. 20kbps for E-mail @0.2, docking @1Mbps,server 600kbps, etc... Model load 500kbps@0.04%duty cycle for access point is result. 802.11/91/104 is paper. Ken Bibba 802.11/91/92 also has a good paper.

McD: Was worried about bringing whole system down.

Break 10:38am

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Reconven 11:06am

Larry van der Jagt: We're going to do DS this afternoon.

Nathan: Presentation

Item 2a.

Lemaut: 20 channels in Europe is the requirement. Japan is 10. Minimum number.

Larry van der Jagt: 2.4-2.5 but in 1996 it will go to 2.4 to 2.485 GHz.

Stuart Carey: Countries are to clear out of these freq's but not all of the countries will.

Larry van der Jagt: I thought we specified the freqs at last meeting.

Nathan: 2.4005 should be first freq.

Larry van der Jagt: 2.402 was start freq from notes of previous meeting. So will we put 2c showing channels.

Nathan: it will be 1A defining the channels. #3 increase of hopping freq.

Bill Stevens: We are still not certain that 200 hops/s is any better than 400. He doesn't believe we have any data good enough to establish an upper hop rate limit.

MOVES THAT this maximum hop rate is open for further study.

Larry van der Jagt: Should this go in Natahn's docmt is question.

Bill: Perception that this docmnt becoming more and more finalized.

McK: Then should go home and challenge it.

Larry van der Jagt: Synthesizer settling time limits high end hop rate. This settling time will be a design standard.

Nathan: What is consensus. Leave it open.

Vote for removing maximum: 21-For, 1-Against, 3-Abstain.

Nathan: So 200 is removed.

Lemaut: thought there was a minimum for power level.

Tom Tsoulogiannis T: Entries in brackets,

Nathan: Means clarification.

Stuart: Takes into account way japan measures it?

Nathan: Yes. 7 removed. 8

Bill: Should it be delta f nominal.

Nathan: No. #10,11,12\

Lemaut: 1 db measurement is going to be difficult to do. 1 db is tolerance of measurement equipment. Should be 3 db.

Nathan: Set up equipment to make measurement.

Wayne Moyers: it isn't absolute.

Nathan: It's a delta. The BER are sharp and 3db could take you down curve.

Cooper: 1 db is very fine resolution.

Wayne Moyers: any inference of absolute ... indicated 1 db. [He suggested a change to wording which Nathan implemented]

Loraine: Say increase signal level and then measure C/I for that particular BER. Spec wanted signal level, not clear that interfering signal is less than or greater than signal.

Nathan: Intent was to find minimum level of receiver and then increase signal and make measurement.

Tom Tsoulogiannis T: Are we assuming worst case? What about top end where we saturate? Why are you choosing that level? Why 1 db.

chad: You don't want to be hard into limiting.

Wayne Moyers: Indicated 1 db, would this not fix it.

Chadwick: 1 db is a very delicate test when you are on the edge. 3db will move BER up considerably. This would be the worst case.

Walvis: Selectivity of filters was reason for this. At higher level it is Inter modulation distortion that is the limit.

Loraine: What are we trying to say. 10-5 BER.

Nathan: Selectivity of receiver was intent of #12.

Loraine: Is 45 db the number we want? M+/-2, would that be better?

Wayne Moyers: Should we vote on that?

Nathan: That is just a clarification.

Wayne Moyers: why are we so worried about this? The looser you make this, the more we'll be hurt by neighbors.

Tom Tsoulogiannis: If at -79

Nathan: It's not absolute signal level.

McK: Could you say why we care about the 1 and 3 db? We get different answers for 1 and 3 but why do we care.

Nathan: 2-3 order jump in BER if go from 1 to 3db. You want to see what interferer does to receiver.

Chadwick: Why not put in inteferer at -20dbm, ...

McK: Doesn't understand why 1 is so preferable to 3.

Tom Tsoulogiannis: How well you can reject a transmitter 2 channels away.

Bill: For clarification: Do we feel that we won't interoperate in heavy traffic, does this need to be in the standard?

Nathan: Yes it's needed was consensus of group.

Wayne Moyers: It blows a third of your channels if it doesn't meet this.

Bill: User may buy cheaper unit. Do I get an improved performance with a better filter?

Wayne Moyers: Yes.

Nathan: You become a jammer because you keep retrying. It's not C/I.

Tom Tsoulogiannis: This is more likely to happen.

McD: Set signal level, then increase by 1 db, then crank interferer until it reaches 10-5. This means noise is mainly thermal at 1db. 3db would be better.

Chadwick: Depends on how sharp the BER curve is.

McD: Suggests we go to normal 3 db measurement.

Nathan: Issue is not spec but how we measure it.

McD: Not sure where 45 db came from. We have splatter, phase noise, selectivity of low cost radios, we don't want to put in extra selectivity just to meet spec.

McK: Did you agree to take it off line?

Nathan: Agreed to take it off line: Francois, Wayne Moyers, McD.

Ely to give copy of yesterdays minutes to Nathan for yesterday's decision on #13.

Lemaut: #14 1Watt radio occupancy is higher, its channel occupancy. Would prefer to have dbm.

Chadwick: You then have mask dependent on power.

Lemaut: If at 3 channels away, If you are at 1 Watt, you put out more interference power. A 1 Watt radio could be cheap.

Chadwick: Same argument applies to phase noise.

Tom Tsoulogiannis T: How much he interfers with you at 1 meter is going to vary depending on Tx power. Can't guarantee a 1 Watt transmitter 1 meter away from you won't kill you. At 100 mW you could survive.

Larry van der Jagt: We have to define what type of environment will be conformant.

Nathan: We have to limit the application.

Lemaut: Suppose you put more reqmt on most expensive radio.

Nathan: How many devices are going to be 1 mW.

Lemaut: 10mW would be a cheap transmitter.

Loraine: is it 3 MHz.

Nathan: that was a typo.

McK: Is dbc open to discussion.

Nathan: Yes. Issue is you are going to interfere with other channels.

McK: He believes he called for an absolute power spec.

Tom Tsoulogiannis : when you have 2 sources, you take the lower.

Chadwick: Even with 1 Watt, the receiver interference is going to be below the noise floor. Present levels should be acceptable in practice.

Wayne Moyers: We haven't changed anything?

Nathan: No. #15 Try to make it +/-25ppm. #16,17,18,19,20,21. In light of Nationals' presentation, this should change.

Socci: Need to specify format of preamble.

Wayne Moyers: This isn't the number we talked about.

Lemaut: training sequence has not been agreed.

Struhsaker: Why do you want a polynomial FCC doesn't require.

Nathan: We agreed we'd have a scrambler in spec. We have NCR

Larry van der Jagt: We skipped over #16 and 17. Wants to make it clear these are place holders.

Ed Geiger: Is this a scrambler that begins to run at a certain point in the frame. If self synchonous scrambler then opening yourself to noise.

Struhsaker: You want additive scrambler.

Ed Geiger: Long string of zeroes may not get thru but next time it will.

Struhsaker: What difference does error multiplication make. You've got to flush the scrambler one way or the other

Ed Geiger: He's not worried.

Struhsaker: He thinks he has error detection.

Ed Geiger: He's just trying to understand polynomial and impact. As you increase size of polynomial, then size of CRC must be big.

Adjourn 12:37pm, Reconvene at 2pm. Direct Sequence is agenda.

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Struhsaker Struhsakersaker, Comments on Proposal for 2Mbps 802.11 DSSS PHY;93/67

Larry van der Jagt: 256 symbols is a long time.

Struhsaker: We have a new code position.

Larry van der Jagt: We cant' afford 256.

Tom Tsoulogiannis: 156 is what we feel is reasonable.

Struhsaker: Prefer no training technique. tuning up Lo may be all that is reqrd. Acquisition in a hostile environment is important. The world is a hostile environment to rf.

Jan Boer: His differences are more philosophical. Relaxing carrier response times has an effect on overall thruput.

Struhsaker: Don't want to start Tx until Lo settled. Collision window increases. Who has interest in building DSSS? [Fair number of hands went up]

Tom Tsoulogiannis Tsoulogiannis, Proposal for a Channelization Scheme for the Direct Sequence Spread Spectrum PHY, 93/81

Chadwick: How critical is filter bandwidth.

Tom Tsoulogiannis: Trading off sensitivity for ability to reject jammers.

Chadwick: Front end and phase noise have to be looked at.

Tom Tsoulogiannis: So you're saying you're not going to get much better than Table 2.2.3. Will provide some numbers for Nathan's spec for next meeting. Doesn't believe you can build a cheap 1 Watt transmitter without all these sidelobes coming back up.

Jan Boer: Doesn't understand how you measure channel isolation.

Tom Tsoulogiannis: Difference between peak and value 10 MHz away.

Jan Boer: Should integrate area under the curve.

Tom Tsoulogiannis: how much error would that be, couple db.

Chadwick: Feels another 10 db. Have to worry about gain compression.

Mansour: It's an approximation to use slope of graph, giving a better number.

Jan Boer: Multipath?

Tom Tsoulogiannis: Straight sensitivity measurement in the lab. Will do more thorough test of Transmitter and receiveer with interferers, etc.

Larry van der Jagt: Toshiba had MSK modulation. Why aren't they here today?

Cripps: Expects they are not interested in DS.

Mansour: Are you sure you still get 10db processing gain? Its Ratio of bandwidths. Not sure FCC will allow you to do it.

Tom Tsoulogiannis: How much interferer can put out and you get a certain error rate is true measure of processing gain.

Break 3:28pm

Reconvene 3:58pm

Do we want to continue with Direct Sequence? Tomorrow we need to get organized for what we want to accomplish at next meeting. Jan Boer will conduct meeting.

Jan Boer put up table like Nathan's.

Struhsaker: Should we continue with bandedge problem?

Jan Boer: #2, Channelization. Number of channels.

Tom Tsoulogiannis: No maximum in Nathan's table.

Struhsaker: Let's say 9 at 8 MHz spacing.

Mansour: Doesn''t say how many center frequencies you use. Per BSS you have to stick with one.

Struhsaker: 9 channels and be able to use 3 isolated channels.

Jan Boer: Isolation is channel rejection. #3 Spreading sequence.

Struhsaker: There are optional fallback channels. Barker sequence would be the main spreading sequence.

Jan Boer: #4 Data rate.

Struhsaker: What word, options, for the fallback values? Also 5.5 Mchips, for 1 Mbps QPSK or 500Kbps BPSK. Data rates would be 4 and 1 Mbps, optional fallback rates...

Jan Boer: Can make interoperable on 1 or 2 rates.

Tom Tsoulogiannis: Would need to switch filters to change rates. Someone could make a cheaper unit that only runs at 1 rate. 2Mbps is core value. Someone may only want to do 1. You have to spec it out at each rate.

Jan Boer: If compliant to standard then you are interoperable.

Buaas: FH guys aren't going to be interoperable.

Tom Tsoulogiannis; Fallback is meant for the same chipping rate. When you put optional spec, what does it mean? Means you have to support the core value too, which is 2 Mbps.

Struhsaker: You get in places where you want as much processing gain so you want the options. Campus would want high data rate. Canning factory would want higher processing gain at expense of data rate. Some have low interference and others much. NCR doesn't have to produce optional fallback rates.

Tom Tsoulogiannis: It's like modems with fallback rates. They could say 802.11 C compliant for instance.

Struhsaker: If other person can't change chip rate, then they obviously can't interoperate at other frequencies.

Jan Boer: Suppose using CSMA/CA MAC, ..

Struhsaker: You want to have different BSSs at different classes but on different channels.

Jan Boer: You share, which is better than interference.

Tom Tsoulogiannis: All you have to do is detect the energy or carrier, you don't have to understand it. This allows sharing.

Wayne Moyers: "A" is the core. B & C are optional.

Jan Boer: Symbol rate, #6. Once you have data rate and chip rate, you know it. So it is removed.

Wayne Moyers: Bpsk is automatic fallback.

Struhsaker: that is TBD. Want to figure out how to do fallback.

Wayne Moyers: then you don't have a fallback data rate?

Tom Tsoulogiannis: Have a fallback but don't know how we're going to fallback.

Jan Boer: What should we fill in there.

Struhsaker: Nice to have footnote.

Tom Tsoulogiannis: What is difference between 8 & 9.

Jan Boer: FCC req and old spectrum shape??? So #8 is not applicable.

Struhsaker: Have to define what channel looks like. Should be TBD.

Jan Boer: Power level.

Tom Tsoulogiannis: His mask was more open in the middle.

Struhsaker: Note that needs to be constrained by bandwidth.

Wayne Moyers: That is regulatory.

Tom Tsoulogiannis: As long as you meet template, then you can go up to 1 Watt.

Jan Boer: Minimum power was discussed.

Tom Tsoulogiannis: Person who wanted 1 mW isn't here anymore. Thought Rob from Pulse wanted low power.

Wayne Moyers: Let's change it.

Tom Tsoulogiannis: If you want interoperabilty, you'd say no.

Jan Boer: This says you should be able to transmit at least 1 mW.

Tom Tsoulogiannis: Isn't sure it really matters. Does this affect FCC.

Wayne Moyers: You're allowing a part to be submitted as a 249 to be brought into this program.

Struhsaker: What do we want. Do we want to allow it?

Buaas: This is the output of the mixer.

Struhsaker: People can build a radio this way and it will cause problems.

Jan Boer: Maximum power is not a requirement.

#13. Power control.

Struhsaker: Would like it to be optional. Below 100 mW you don't need it, above 100 you do.

Buaas: Reason had to do with FCC saying you only use the power you need.

Wayne Moyers: "decreasing" should be "changing."

Buaas: Let's have a table with some db ranges.

Wayne Moyers: We shouldn't be fighting Winforum or Wintech.

Struhsaker: He agrees to use this.

Larry van der Jagt: You only want to be sure a 11 means go up and 00 means go down. We aren't concerned by how much.

Tom Tsoulogiannis: It could be alternate channel as well.

Jan Boer: #14 is TBD. #15 is too.

Struhsaker: Do you think this helps you a lot?

Jan Boer: 50 ppm crystal is good enough.

Walvis: Because your code is short.

Struhsaker: Longer coding sequencies requires tighter crystal.

Tom Tsoulogiannis: Longer symbol period, longer correlation period.

Jan Boer: Close to 90 degree phase shift per symbol.

Tom Tsoulogiannis: Longer code it is going to be more than 90 degrees.

Jan Boer: Have to look at baud rate. If baud rate lowers, you get more than 90 degrees. We decided you can go up to 180 degrees.

Wayne Moyers: Crystal, jitter due to loop bandwidth, it has nothing to do with stability. This has to include temperature.

Struhsaker: We are considering 15 ppm then it is going to 30 ppm. Man in meat locker and man outside.

Tom Tsoulogiannis: This is at room temp. That's why we feel it is too loose.

Wayne Moyers: Have in notes this is at 25 degrees C.

Struhsaker: At Avis we have temp extremes all the time between one unit and the other.

Jan Boer: Doesn't feel you need it to be tighter.

Tom Tsoulogiannise: Talking 50ppm, that is a lot of error. Tighter crystals at room temp are easy to get.

Struhsaker: You don't need a training sequence if you put in a tighter crystal. Preamble is implementation dependent. If you patented it, we'll have to pay you royaltys.

Jan Boer: No. what's next item? #18 Code accuracy.

Tom Tsoulogiannis: Specifying chip rate reference accuracy. 50 ppm is fine. Should be chip clock accuracy.

Jan Boer: Phy supplied clock jitter.

#21 Clock Recovery.

Struhsaker: It's however you choose to do it right?

Jan Boer: Yes.

Tom Tsoulogiannis: There is clock recovery.

Jan Boer: Receive follows transmit.

#22Carrier Response Time

Wayne Moyers: That's TBD.

Tom Tsoulogiannis: Efficiency of MAC depends on these numbers.

Jan Boer: We want to make it as small as possible. It's about 5 us for Tx to Rx. We don't want to change Lo.

Tom Tsoulogiannis: Others might want to change it. 5us might be a little too low for that.

Struhsaker: Switch time only. Depending on what MAC comes up with, it might be milliseconds.

Jan Boer: So don't need 5us there.

#25, BER at specified Eb/No.

Struhsaker: If you can't create a test, then you shouldn't write it down.

Tom Tsoulogiannis: It's based on a simulation. so are these changes going back into Nathan's paper.

Adjourn 5:07pm

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Thursday,

Convene 8:55am

Larry van der Jagt: We'll hear from Nathan Silberman, then discuss what to do at the next meeting.

Nathan Silberman: Summary of his proposal. He'll attach the graphs to the minutes. What's Motorola using for Ardis?

McKown: 4QPSK. It's custom fit to fit the filter chain. Power Spectral Density and eye pattern first.

Nathan Silberman: Could you bring it to the next meeting.

McKown: It's a pair of coefficients that drive the D/A.

Nathan Silberman: Implemented for low cost filters.

McKown: Some of the filters he's talking about are in the receiver. Nathan, what you want is what comes out of the D/A?

Nathan Silberman: Yes.

McKown: There won't be any formula that describes the shapes.

Nathan Silberman: So you can give people the kind of shape. The pulse response that modulates the signal.

McKown: Synthesizer is more complicated than what Chadwick showed us. Why do you care?

Nathan Silberman: To find the best solution.

Larry van der Jagt: To come up with the best pulse shape. It might work fine for Motorola's products but may not be the best for us.

Nathan Silberman: We took off-the-shelf filters. They all are about the same. Cost isn't four more gates in discriminator. It's the most expensive part.

Larry van der Jagt: Numerical integration to get pulse shape. Time and value

would be much easier.

Nathan Silberman: He has binary words.

McKown: Pulse shape that they use partially plays to their discriminator. Changes to non linearities. Can't define waveform for a particular receiver.

Nathan Silberman: 2RC or something like this. You want maximum eye opening.

Mansour: Is this optimization to specific high filter?

McKown: It's not just the filter. I don't think we are going to show anything.

Nathan Silberman: We can optimize on a channel model.

Cooper: What was it you were asking.

Nathan Silberman: Altair and Ardis use similar...

McKown: For the minutes, John said NO, with the greatest respect.

Nathan Silberman: You did interesting work and it would be nice if you shared it. You probably have a proprietary solution that is interesting.

McKown: Technology means those pulse shapes are inappropriate here.

Nathan Silberman: Who should I give cells to for the minutes?

Larry van der Jagt: I guess give them to me. Isn't there more to present?

Nathan Silberman: Document 03/83 Template. We ended up with #22.

Ed Geiger: What is meant by Clock jitter?

Nathan Silberman: Clock exposed to the interface or MAC.

Ed Geiger: So this is clock supplied to MAC for time.

Nathan Silberman: Data and clock to MAC.

Ed Geiger: Time between events?

Nathan Silberman: Recovered clock.

Ed Geiger: You envision that a clock is needed to the MAC to deliver bits.

Nathan Silberman: Let's say the exposed interface.

Ed Geiger: this sounds like an implementation issue. No one passes clock from PHY to MAC.

Larry van der Jagt: Clock passed from DTE interface.

Ed Geiger: You're recovering clock at the receiver.

Nathan Silberman: Let's take DTE/DCE interface. What's maximum allowed jitter?

Ed Geiger: Jitter is how you derive clock from the data. Unless it has some meaning, like in Token Ring, where jitter builds up, but if it's point-to-point like bus architecture, this jitter doesn't make any sense to me.

Nathan Silberman: Take network controller, they expect to see clock with certain jitter. If they don't, they can't process information. You have to tell them how much jitter.

Ed Geiger: it's a function of how you're transmitting bits.

McKown: Receiver should be able to get symbol sync well enough that no errors are obtained. If you don't like these words, then change them. Echoes, receiver equalizers, etc., and if you get a string of zeroes it screws up the process.

Ed Geiger: You either get the data right or not. Provided deviation doesn't exceed 62 ns, for instance, jitter doesn't matter.

Nathan Silberman: How much jitter you can expect?

Ed Geiger: It's you as a receiver?

Blaney: Each clock has +/- 62 ns jitter.

Walvis: Consecutive high to low transitions...

Larry van der Jagt: This is relevant to DTE/DCE interface spec we would use if there was an exposed interface.

Nathan Silberman: Any device expects to know how much the edges are going to move.

Tom Tsoulogiannis: Jitter doesn't matter...

Walvis: Clock generated in the receiver. Clock duration on each period basis changes. What is the maximum duration? I accept data if it is 70 or 80 duration. If I do processing and it takes 600 ns, is that too long?

Ed Geiger: We are talking about an implementation. You are saying I have this restriction because I want to do something in between. It says I have to use a 16 MHz clock because you can't do something at 10.

Walvis: It is wise to incorporate a limit.

Ed Geiger: Limit is set by Tx.

Cooper: No, Channel is contributor to the jitter, not the Tx.

Nathan Silberman: Make a proposal.

Ed Geiger: Now I think I know what you mean.

Nathan Silberman: 802.5 specifies jitter.

Walvis: Minimum time between rising edges of the clock.

Ed Geiger: I think I understand now, thank you.

Nathan Silberman: If you want to make changes, do so.

Item #22. Would like to suggest we use a longer polynomial, something on the order of 20.

Cooper: That is a fairly long number.

Mansour: What is the reason?

Nathan Silberman: Ed had some good suggestions.

Ed Geiger: Unless you have a way of changing the c...

Nat : You need to extend the length to lower the probability..

Mansour: It's not modula 2 with data?

Ed Geiger: There are several different types of scrambler.

Tom Tsoulogiannis: Like modified Miller code.

Mansour: Do we have ...

Cooper: Self synchronizing scrambler.

Ed Geiger: If you turn on in preamble, which will seed it with same polynomial each time, in order to change seeding, want number close to preamble so pathological case on way transmission won't be the same as the next. It's not a segment number any one has to keep track of, like 4-bit counter.

Buaas: You have to keep that sequence number for every packet, you have to be sure you keep count on a packet basis.

Ed Geiger: You're going to have to do something.

Buaas: Need to propose scrambler.

Struhsaker: Synchronous scramble. Priming the generator is problem. That's why every one uses these, its simple problem in book.

Walvis: You're addressing problem already agreed upon.

Ed Geiger: Self sync scrambler, You are going to reinitialize each packet. Preamble is the same each time. He'll bring paper next time explaining how it works. It gets initialized to same state each time.

Larry van der Jagt: Going to fail each time you do same transmission.

Nathan Silberman: #23 Carrier detect response time. Any proposals.

McKown: We could make this consistent with Winforum.

Nathan Silberman: Acquisition of data.

Chadwick detecting channel energy or intelligent decision.

Nathan Silberman: Some prefer simple carrier detect.

Chadwick: Without knowing its valid signal, 20-30us isn't out of the question.

McKown: Why and when should PHY say to MAC there is power but I don't know if there is signal. Who would use it?

Chadwick: There is noise there, occupation of that channel by noisy loud signal, on other hand channel occupied probably by valid signal. Otherwise

this channel doesn't have any one there. For instance, if you have a CSMA type protocol, then you want to know what type of channel you have.

Coop: Doesn't specify which type of carrier?

Ed Geiger: Channel busy.

McKown: Build power detector with response time.

Chadwick: Do RSSI in a sensible way.

Blaney: Can you give indication channel is busy when it is not? You have to pick that threshold. Just sensing energy doesn't mean system can't transmit signal.

Chadwick: Going to get signal way above -40dbm so can transmit. Determination of whether channel is usable is one thing, but whether I will interfere is another.

Blaney: Way it's proposed in energy, its' not true indication of what is on the channel.

Nathan Silberman: Is it OK to put place holder in? We will decide on it next time (#23).

Nathan Silberman: @24, 25, 26, 27. #27 is TBD.

Blaney: 100us is a long time to be blind.

Nathan Silberman: Suggestions?

Chadwick: 100us seems easy figure to meet.

Nathan Silberman: You 're blind 100 bits.

Chadwick: Dependent on implementation approach.

Nathan Silberman: 1) probability of collision, 2) spectrum splatter. In case you have to Tx right away, if everything's quiet, I'll switch. It's an implementation issue. You're Tx has to be ready. What is your number?

Blaney: On the order of 10 us.

Cooper: Comments on #26, have to consider preamble, switching time has to be at least as long as preamble time. Previously talked about 30us.

Walvis: No energy on circuit when switching so there is a difference for listen before talk. During switching time you're neither listening or talking. You have to separate the two.

Cooper: 100 us preamble time. If assume 100us preamble, then number there is very short.

Nathan Silberman: If you want to extend preamble, then we have to work out this spec.

Cooper: 32 bit time for preamble, allow 70 us for Rx and Tx switching time.

Nathan Silberman: Physical part is almost nothing. When you're Rx is ready to receive data.

original intenet was to include preamble.

Larry van der Jagt: when you are trying to receive.

Walvis: thinks we're very sloppy in changing thing today, whereas yesterday we voted.

Chadwick: to arbitrarily pick a number is not best approach.

McKown: Is it likely MAC will be the bottleneck? Will that be more important than the number we pick here.

Chadwick: Postulate MAC protocol anything longer than a millisec...

McKown: MAC requirement's shorter than any number we're considering here.

Walvis: that's a cost trade-off.

Blaney: From PHY perspective, lowest possible number is what we should give MAC.

Walvis: Unless it is expensive.

Blaney: Quickest is most cost effective.

Chadwick: We ought to ask MAC group.

Nathan Silberman: Let's vote on it. How many think we should get a number from MAC group?

10-For, 6-Against

Walvis: If leave half the parameters out, it isn't most cost effective.

Nathan Silberman: Take a break?

Adjourn 10:04. Reconvene at 10:30.

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Reconvene 10:40am

Next Meeting agenda.

Activity

Close issue 24.10, what is frequency hop modulation

1) Performance with respect to C/I. Cochannel Interference, Adjacent channel Interference, Alternate Channel Interference

Blaney: Didn't someone want to see data, C/I?

Larry van der Jagt: .39 GMSK with respect to C/I. Last time we developed list but it didn't happen.

Chadwick: Quoted Leeson, "If it ain't interference limited, we've failed."

McKown: 1) C/I curves, 2) #23 on Nathan Silberman's list, Carrier Detect Response Time, paper on it, 3)Final solution to dBc problem

Blaney: Will present information on C/I curves

Nathan Silberman: Will present C/I curves.

McKown: It would be marvelous if you could treat both cases.

Larry van der Jagt: Issue with acquisition. Carrier detect time from Motorola. Continue on template.

Nathan: Go over list of parameters without going into numbers to see if we need to add anything. Do this next meeting. Need to do this so we can work out all the numbers.

Larry van der Jagt: What needs to be specified to totally define what goes in the air to be able to insure interoperability under some predefined set of conditions? Service primitives to other side of the world. Need a subgroup to step aside to address DTE/DCE interface at some time.

Nathan Silberman: What needs to be transmitted to management layer?

Blaney: Physical lines?

Nathan Silberman: Need to define functions.

McKown: Do we need presentation on subject of acquisition?

Larry van der Jagt: IBM will discuss hopping sequences.

McKown: Motorola has to distribute reference on reflector about headers beyond Barker codes.

Larry van der Jagt: Anyone else willing to provide information on acquisition, synchronization? He thinks it comes down to preamble. Possibly Apple, Cal Micro will present. He has question about importance of DTE/DCE interface. Poll, Is it important to work on DTE/DCE interface now? 1-Important, 6-not important. Service primitives to MAC are most important to us right now, so won't put DTE/DCE up now.

Now work on schedule for these events. Wednesday morning we will be joining MAC/PHY meeting if MAC agrees. IR group will meet Monday morning. Does anyone else want to meet Monday morning? No. Tuesday AM, work on closing #24.10, which will involve taking submissions directly related to that.

Nathan Silberman: Is this possible to move to Tuesday afternoon because of a prior commitment?

Larry van der Jagt: what is feeling of the group? Move it to Tuesday PM? How many want Tuesday am?-5, pm?-1, Don't care?-11. How many am's will be upset to move to pm? No hands. So move it to pm for Nathan Silberman's sake. Remember this is the most important issue to resolve next meeting.

So Tuesday am, can't work on template, so synchronization, codes, (this is #24.11) hopping sequence.

What about DS/FH. Meet together, separate?

Ed Geiger: Provided legal restrictions permit, would like to present convergence layer for FH.

Larry van der Jagt: Convergence layer means that if there is single MAC with primitives for any PHY it uses, it matches those with the things that go out on the air.

McKown: I understand you to mean "where the tines that meet the handle" (analogy to fork).

Larry van der Jagt: PHY data request primitive going across interface... Convergence name is used because it is traditional.

McKown: How can you do it using only one PHY.

Larry van der Jagt: You do it and then see if you can apply it to other PHYs.

Ed Geiger: With IR you don't hop, you just sit on the channel.

Larry van der Jagt: Convergence topic.

Jan Boer: We can meet before the joint meeting.

Larry van der Jagt: What we'll do is Wed am before break will be DSS. After break we'll be preparing for the joint meeting. Then we can tell MAC what came out.

McKown: Would you consider E-mailing it to reflector?

Larry van der Jagt: Will send it on E-mail and mail it. He sends on AT&T mail. If he sends it to reflector and someone on Internet sends it back to reflector, then everyone will get it. Who on Internet wants to relay it? He'll send it to Bill Stevens and he'll send it out on Internet.

Vic: If you're E-mail address is on attendance list, you'll automatically be put on by Dave Bagby.

Larry van der Jagt: Last time the E-mail transmission didn't make it to France.

Ed Geiger: Assumes most contributions are electronically generated.

Larry van der Jagt: Bill is working on FTP server at Apple. We will adjourn Tuesday afternoon when we complete 24.10!

Vic: On reflector list are the members and nearly members. If you were here 75% of time this week, you will go on the list.

Chadwick: Has any material come out on hotel bookings?

Larry van der Jagt: I don't know.

Schedule for FH group

7/93 close 24.10

Accept schedule for reaching 1st draft for IR ad hoc and DSSS ad hoc

9/93 Define CAI, ie close 24.11

11/93 review first draft of FH PHY

Does anyone have any conflicts? Does that conflict with anyone's corporate objectives? (No response)

McKown: Larry, could you send this out on the reflector?

Larry van der Jagt: Yes. Any thing else?

Vic: We could start Saturday or Sunday.

Larry van der Jagt: Anyone want to meet Sunday? (No response)

McKown: To people who say we want to proceed together, we don't have to proceed together. We keep well enough informed.

Larry van der Jagt: Presence of as many people knowledgeable in radio helps. FH is welcome to have ad hoc meetings.

McKown: Would you consider straw poll for separate meetings.

Larry van der Jagt: How many want to meet in parallel sessions whenever possible? 8-Yes, 8-Leave it as is.

McKown: One wonders about motives of one group wanting to attend the meetings of the other.

Struhsaker: Coexistence is important reason to attend each others meetings.

Chadwick: Each group has valid inputs to the other.

Larry van der Jagt: Solicit people to go back and look at issues to see what we could address. If they have suggestions as to what small groups should do, fine. I sense everyone is interested in everything.

Crowder: Would you ask whole group that plenary consider this?

Larry van der Jagt: Are we done? When is plenary? 1 pm.

Adjourn 11:30 pm.

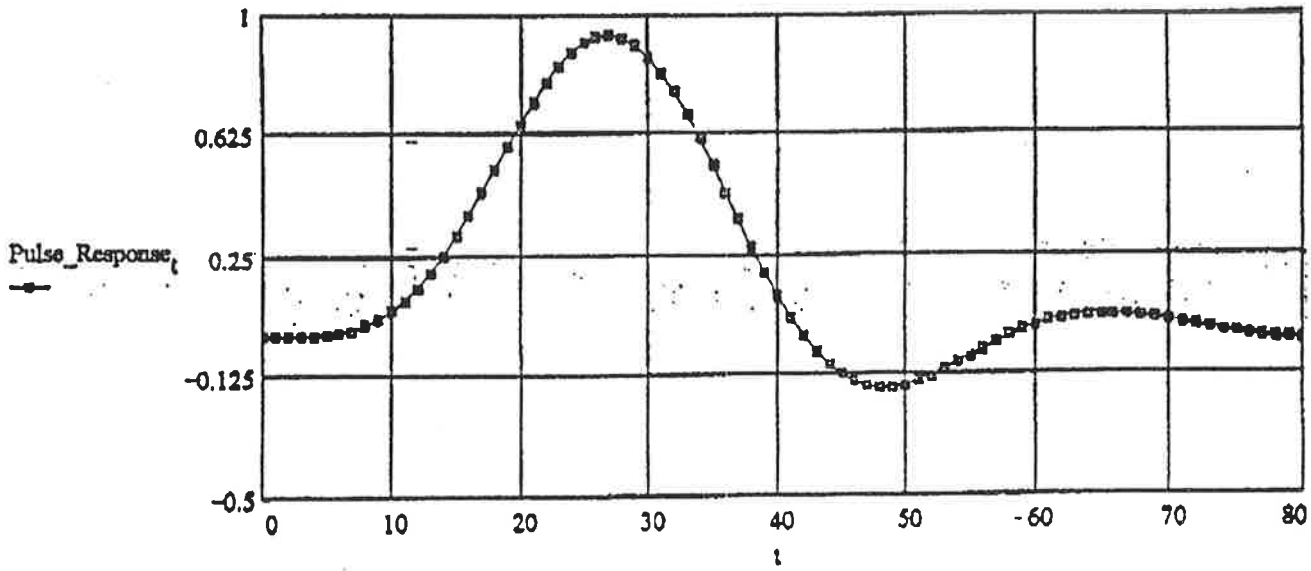
Calculating the Inverse Laplace Transform: P.3

$t := 0..5 \cdot P$ Time Index for 5 Symbol Periods

$\sigma := 10$ Complex Frequency Real Part (needed for convergence)

$$Pulse\_Response_t := \frac{1}{2 \cdot \pi} \cdot \int_{-5 \cdot \omega c}^{5 \cdot \omega c} PULSE\_RESPONSE(\sigma + j \cdot \omega) \cdot e^{(\sigma + j \cdot \omega) \cdot (t \cdot Tp)} \, d\omega$$

Inverse Laplace Transform



Generate the Transmitter Shaping Waveform by reversing the time scale:

$Shaping_t := Pulse\_Response_{5 \cdot P - t}$