Task Group B meeting minutes

March, 9, 1998 1:00 PM

Chair: John Fakatselis
Secretary: Carl Andren

Approval of agenda

Motion to approve minutes Jan/Kent 30-0-4

Background of task group B

Discussion of selection process

Formation of the selection task group: William Roberts and Carl Hofstead of Netwave will form the committee to review the Proposals

General Papers:

114, Symbol FH interoperability addendum to Harris prop
118 Clarion
104 Informed Technology, cell Planning
115, Harris, Equalizer techniques

Proposals to be considered:

116, Harris, Proposal
79, KDD
80, KDD
81,KDD,
99, Lucent
10B, Lucent ,draft text
100, Lucent
117, Microlor, update of prop
101,102, Golden Bridge Technology
82, 83, 84, 85 Alantro

General Papers:

Paper 104 Further Considerations When Choosing A PHY, Bob O'Hara

Two channels are not sufficient to make a cell planning scheme work. MAC management functions are not workable with just two channels. A mobile station is unable to scan until it is in undesirable conditions where it has least time to do so.

Paper 115 Sliding DFE equalizer for improved low cost equalization, Carl Andren, Harris

(Ad Kamerman) How do you do the timing for the sliding mechanism? Try at various times, find the peak. How fast can it make a decision is a factor.

(Chris Hegard) Diversity switching before equalization? Take the channel impulse response on both antennas.

Change in the training time (preamble length)? Propose existing preamble. FH preamble then short DS training preamble. Not determined the shortest possible.

Combine two antennas? Cost problem.

(Naftali Chayat) DFE on QPSK symbol? No the BPSK preamble. Looking into the accuracy of the BPSK training. Hard decision process losses 2 dB plus error propagation. May turn off the equalizer when the SNR is low. How will we do the carrier tracking in multipath. Same methods. Carrier and chip timing in the bandwidth.

(John Cafarella) No short preamble for equalization? Can't be as short as desired due to AGC and equalization. 50 microsec is the target now.

(Ad Kamerman) Over sampling in the model? Four times the chip rate.

(Harry Worstell) Equalizer size and power for PCMCIA? Maybe 2x gate count of the current BBP that is 10% of radio power consumption.

Tuesday, 1PM

Review of agenda and the problems of not enough time. Will have 45 minutes for each presenter.

Discussion of secret balloting process and presentation of the sample ballot.

Paper 114 FH Interoperability addition to Harris prop, Dean Kawaguchi, Symbol

Need more interference immunity due to fixed frequency, non 802.11 systems.

Jon Boer, What is the intent of this amendment? It will be included as part of the Harris proposal as an option. Is it true that this option can be applied to the other proposals? Yes, but we having discussions right now only with Harris.

Ad Kammerman, Will it work well in different environments Vs frequency planning? Yes, if you have complete control of the band, you can get better efficiency. But once you have large interference, this will work better. This allows the system to be installed without much planning. If the station can scan different frequencies, the AP can do a better job. We tried that at 900 MHz, it didn't work as well.

Kip, Is this a different proposal? No, it will be part of the Harris proposal.

John Cafarella, Why does the high speed PHY have to address this? Any company can implement their own interoperability modes.. This tries to reduce the amount of collisions, and needs to be addressed in the standard.

Wayne, a fallback rate is good, and it has lower spectral occupancy. What is the impact on the effect of power spectral density? There is no impact on the

Daryl, What is the benefits of this?

Bruce, from a Lucent perspective, this is not necessary to decide on now. If you look at who is doing the voting, the FH group needs to know that this is a viable option.

Ahi, where is the file? The file was misnamed on the disk and will be redistributed.

Paper 118, Advantages Of Code Channelization, Mas Mori, Clarion

Based on Micrilor's prop on code channelization. An introduction to overcome conventional ideas on code channelization.

Mark, Have multipath components been included? No

Greg, what Floor attenuations were used? 10 dB

Dean, Do you assume that the coeds are not synchronized? Yes. It is not the cross correlation of the codes. The codes were picked for best performance.

Naftali, do you think that using different codes for different stations produces less interference? Yes.

Paper 100, The Standard To Rely On, Bruch Tuch, Lucent

What is the real difference? 10% FER will cause many support calls. What you get over the cable does not translate into indoor coverage. Wavelan 1 had a 90 ns delay spread. Retail customers bitched that it did not work well. Experience says 150 ns is needed. Simple, but effective. 60K gates for the Lucent equalizer. Clear IP coverage is a safety net.

Naftali, after this neutral propaganda, why did you wait for years to suggest it? The company needed to make many decisions before supporting it. Can you give your own requirements on delay spread. You must have 100 ns minimum and then be able to get easily to 150 and more.

John, You went from quoting a requirement to quoting a solution… We believe that a product should be better than 10 % PER. You need a graceful way to get there.

General papers done.

PROPOSALS

Paper 92, Advanced Barker DS , Golden Bridge Technologies, Darrol Draper

Has many rates depending on how many codes are used. All of the rates shown cross over at 45 ns. FEC can make the performance to large delay spreads. They use a Rake receiver. The Rake does not have an equalizer and no need to train one. When you get to 1 code, the delay spread goes to 4000 ns. You do not have to transmit all of the levels, so the transmitter backoff is less. You delete the extra levels in the digital, so the transmitter backoff does not have to handle it. Optional short preamble. Save 80 us off preamble. 48 us preamble will cause some interference with low speed systems. 6 way antenna diversity.

John, Some items on the comparison matrix were not presented. It is in the electronic copy and 98/26,27,28 this year and 97/27 last year.

Ad, Your preamble was 48 us but do you need more time for frequency offset. No, by the time it gets to the MPDU the carrier loop is locked up. Draft text is 98/91.

Dean, The antenna diversity time is two dwells, but if the signal is not synchronous, you need to allow more time for skew. The receiver is triggered by signal energy. You are talking of not being synchronized to slot time? Yes, how many us do you need to add. See 94/70 for an analysis.

Dean, how do you get better performance with FH? If the channel occupancy time goes down, there is less time for interference.

Greg, Can you explain the 6 fold antenna diversity concept? You need long header for that. With 128 us preamble, you have enough time for 6 antennas. The sector antennas are not necessarily overlapped.

Naftali, With one or two codes, you show up to 4 ms RMS delay spread, how do you get that performance? With the FEC and Rake receiver, you need to go out that far to make the PER go to 10%.

Naftali, Rake is not used in conjunction with coherent detection... Rake is like an equalizer and has a tapped line. We use a maximal likelihood combiner.

Naftali, How many taps did you use? The simulations used a large number of fingers.

Keith, What codes are suggested. We use BCH Block codes for lower gate counts.

John C., could you clarify the primary rates? All of them.

Paper 114, Harris 11Mbps MBOK proposal, Carl Andren and Mark Webster.

Questions:

AD Kameron: The impact of antenna diversity is less than expected.

Jan Boer: PER Vs thermal noise graph, what is the RMS delay spread, it wasn't given on slide 13 of the presentation.

Answer: Mark Webster; The intent was to assume 10 PER. Slide 12 is uses multipath with no noise. The eye is closed for both 64 and 1000 byte packets. The intent was to show a few taps and a low cost implementation.

Jan Boer: At what point does the curve come back to 10-1 PER? Answer: Mark W. Not shown on the slides.

Jan Boer: Does the short preamble include the header? Yes

Keith Admunsen: Why the gap between the DS and FH preamble: Answer: This was added to satisfy the FCC that this is not a hybrid waveform.

Paper 79, CFO-SS compliance document, H. Isikawa, KDD Labs

Carrier Frequency Spread Spectrum. 10 MBps receiver uses 5 channels of their current low rate PHY. Needs a power splitter/combiner for the 5 channels. Takes 20-30K gates plus 5 SAWs. Will need a Rake receiver to meet the longer delay spreads. The high rate PHY will achieve almost the same delay spread as the low rate PHY. They used an 11 wave exponentially decaying, Rayleigh fading model. Power consumption is less than 5 x low rate PHY.

Ad, What are the assumptions for the power amplifiers? With PAs in each transceivers, the backoff is 5dB. With one PA, there is a need for 10 dB backoff.

Wayne, Would explain the 6 PAs? 5 predrivers and one final PA after the combiner.

John C., If you amplify after the combiner, you have to handle 5 dB more peak to average ratio.

Wednesday 1 PM

Review of secret balloting procedures.

Motion for each of the proposals to comply with the Japanese regulatory rules and show how they conform to these rules. Jan/JanB
Ruled out of order.
Appealed Jan/JanB
Question called Keith/Wes (32-6-6)

Paper 80997, Barker Code Position Modulation, Jan Boer, Lucent Technologies

BCPM has 5, 8 and 10 MBps and complies with FCC, ETSI, and MTT.   10 MBps is an optional rate. They suggest that 10 % FER is too high and means that 10 % of locations are not able to communicate. Equalizer implementations have problems. Complexity, training, tracking, timing, and stability. MLSE receivers can be complex and BCPM makes it simple. Their simulation is in C code. Then they simulated in SPW and then to VHDL with gate synthesis. Channel matched filter gains a lot of performance. Tentative symbol estimator removes cross rail interference. Mode sifter calculates trellis and determines ISI. Same size BBP, pad limited before. RX current about the same as before. Diversity the same as low rate. Optional short preamble is 77 us. Mode sifter added 4 symbols, but SIFS has enough time. System throughput more important than ACI. CCI is 6 dB. Needs 4 dB backoff to 2 MBps, 3 dB more for higher speeds. With 20 us slot time, you can also be interoperable with short preamble. The short preamble has 54 bit preamble and an SFD. Then it goes to 5 MBps for the high rate header. Receiver can be set to receive either short or long preamble. If preamble goes on too long, it switches to the long mode. Therefore interoperable with both long and short preambles. Will go with Symbol's FH interoperability.

Dean, Do you think it is misleading to say that 10 % PER means that 10 % of stations can't communicate? In general, a stochastic channel is time varying. You said that 1 % PER is necessary, but your curves flare out at 10%, is that a problem? .. No, we showed the 10% since that is what was asked for.

Chris, Do you consider your system a DSSS system? Yes

Chris, You introduce memory into the channel, what is the coding and memory requirements? The trellis is very short. The overlapping of the sidelobes is taken out before the trellis. Then you only need to handle 4 symbols in the trellis.

Chris, Are there economic receiver structures? You can't specify the receiver structure in the standard. Coding gain is 5 dB for the 8 MBps mode. We feel that the spreading is true and the FCC agreed.

Chris, how many levels are there? 5

Chris, Isn't the CMF an equalizer? No, it is different.

John C. The channel matched filter is a inner product

, On page 7 there is a statement that the 10 MBps multipath is inherent to bpcm. Multipath reduces your fading margin.

Carl, Does your diversity algorithm use the same technique as the low rate? It should not be specified in the standard.

Greg, What bit rate is your -89 dBm sensitivity measured it? 8 MBps,

Greg, What is average transmit power that the FCC would allow you to transmit. We back off 7 dB.

Greg, What range would estimate in the indoor environment? Take the -89 dBm and fill in your path loss. We would get about 160meters in an unobstructed office.

Greg, For a system with a similar sensitivity a system that can transmit at a higher power you would get more range. If you want range, you need protection against delay spread. If the multipath means that the receive sensitivity, then the more power you get out of the PA is not important. It is 3 dB less path loss in any case.

John C., How does the 10 MBps get the same sensitivity? You are shifting very little. It is less than 0.5 dB. But in the presence of delay spread, it is much more.

Ahi, You need 3 dB more backoff, how do you get the same power consumption? It operates at a lower power level on the average. How about the MLSE? The DSP is consuming a little more.

??, You are going from 8 to 10 MBps and get the same PG? You just shift the sequences over each other. If you didn't use PPM, can you overlap the symbols? Yes, there is still the overlap of two Barker codes.

Dean, Part of the decision process is showing how the proposals are implementable. More comments on diversity would help me decide if there is enough time to do all that is necessary. For the long preamble, it is clear that there is enough time. Diversity can be done in the 20 us slot time. More information helps the decision process.

Paper 81177, Proposal for 2.4 GHz PAR, John Caferella, Micrilor

We support two frequency channels for a variety of reasons. Wideband is better at resolving the multipath. In multipath you need good cross correlation performance. New algorithm uses an 8 tap CMF. It does not need large tap accuracy or training. We get 200 ns at 1% PER with the new scheme. The FEC gains you about 2 dB and the diversity 1 dB. CMF costs 2 K gates and FEC about 1 K gates. The extra 3 dB of PG doubles your coverage area. Can also get 18 MBps with combination of OCDM. They have a 24 us preamble and header. 9.5 MBps at 1500 byte packets. MSK uses full PA power. About 35 K gates without interoperability. Use best 8 of 2048 code cosets for demodulation and for search. Code channelization is better than having 3 channels.

Wes, How do CDMA codes combine with MOK? Do you get the full factor of 4 rejection? We get more. That is why you need the best cosets. The leakage problem is more important. This means that the other BSA will not see the code as part of its BSA. Dean, I am happy to see the support for FH interoperability, but the devil is in the details. The channelization will make the problem harder with the higher chipping rate. One perspective is that when you are trying the interoperability mode, you drop to the narrower mode.

Ad, Do you want to use the different codes in a co-located system? No, you just get the cells closer.

Naftali, You mentioned the CMF, and I would like to know how it works with a limiting receiver. We need 4 bits with a hard limited receiver. The AGC would cost more time in the preamble.

Wes, Why does the CMF work? The CMF adds the multipath like a Rake receiver. The Matched filter and the equalizer is more like a canceller and more like an inverse filter. It takes much longer structures and more tap accuracy.

Chris, My notion is more general of what an equalizer is made of. Even if the receiver locks to the header, the data codes will cause the link to drop.

Mark,. If you look in a standard text, the sidelobes are not down much. How do you keep the sidelobes down after a saturated PA. The MSK is happy until you go into hard saturation. I am perplexed that the backoff is so low.

Mark, The diversity should get more performance. The other improvements take out much of what you could get from the diversity.

Paper 8103, Alternate proposal to the Harris technique. Wes Brodsky, Raytheon

The main difference is using OQPSK on the 8 chip per symbol modes. For the medium rate mode, we plan to use 16 chips per symbol which gives 6.875 MBps. This gives about 2.8 dB more sensitive for a 2 dB loss in throughput. This keeps the OQPSK mode working. The added mode for 16 CPS is small impact on chip count. For Noise, the change does not effect the performance. The lower rate mode is a little less than 5.5 MBps mode. We can get by with 3 dB less PA backoff due to the OQPSK. If we want to be backwards compatible, the preamble is the only problem. You can back off the preamble more or use another waveform of BPSK called offset BPSK. You can save .55 watts with this technique on TX. This is s 2 x lower power.

Ad, DFE requires a T/2 equalizer, will the combination of the two make the equalizer work harder to resolve the cross rail interference. Realign the channels before the DFE. That will make for self interference. If the delay is half chip, the two can be a problem.

Naftali, What type of equalizer did you test with? It had few FF and FB taps like 5. We think it will work with the offset channel. Your tables are full of 'like Harris' but did you do the simulations you self.

Carl, Our total BBP power is 0.1 watts, to the increase for 16-ary could not be 0.15 watts.

Tom Kolze, Why not use MSK? That increases the BW more.

Motion to extend the time to 7 PM to allow time for the (28-3-5)

Paper 8082/83/84/85, Alantro proposal, Chris Hegard

FEC is not overhead. Overhead is frame sync, preambles, and pilot tones. Redundancy is a function of the data and is used for reliability. Multipath is like filtering and you want to pick signal sets that have the maximum distance properties. Processing is composed of three terms. Binary Convolutional Coding on QPSK. Uses a 64 state BCC that takes 79-95 K gates. CDMA cell phones use a Viterbi decoder of 256 states. Has substantially more coding gain than other systems proposed.

Carl, What is the BW? The same spectrum as existing standard.

Greg, have you done any simulation in bursty error channel? All proposals will be hosed with microwave oven. The BCH code will not buy anything relative to Viterbi.

Mark, On some of the performance curves you show both Eb/N0 and Es/N0, how do you explain which is used. Where the rate is 1 bit per symbol, the Eb/N0 is the same as Es/n0. What equalizer was used? It is sort of a DFE with sequence estimation embedded in it. We have a small trellis with delay.

John F., Is that description in your documents? No.

Mark, Is your proposal open to a reduced complexity scheme? This is our estimate of the complexity that we are going to use. It could easily be done with lower performance and complexity.

Mark, Have you talked to the FCC about your processing gain. No, but we are going to. In our view, the only SS system out there is the original one.

Greg2, Why not use a RS code over the packet?. When you get an error you toss the packet.

Jim, What you are saying is that PG is good for efficiency, but the FCC wanted to reduce efficiency. We can make a reasonable argument that the FCC will accept this. Robustness is what the FCC wants. SS is not possible , but is possible to get 10 dB of tolerance to interference.

Jim, Would you want to have the 802.11 to approach the FCC for approval of this technique. Yes. I think the Lucent technique is not

Naftali, What you call waveform gain, is not there. We have broken down the processing gain down in a different way.

Naftali, you do not have 30 MHz of BW, so you cannot use that for part of the gain.

Naftali, your curves for 25 and 50 ns should not be dropping like AWGN.

Naftali, I think the FCC will not accept your argument that this is PG. I tried to get the committee to use this and they did not want to do it.

Ad. Have you IP on this proposal. We are preparing on this code. We have submitted the IP statement.

Ad, what is the pipeline delay? In a packet based system this is not a problem.

Darrol, is the 11 MBps including the effects of the code rate? The raw rate is meaningless, the rate is 11 MBps.

???, Does the cell planning diagram show a frequency reuse of 3.

Thursday, 8:30 AM

Motion to disqualify the following proposals as candidate PHYs for the 2.4 GHz high rate PHY as stated in the selection process document (Wes/Roy) (46-0-2)

The vote to disqualify is:

Alantro	70%
GBT	73.9%
Harris	4.4%
KDD	44.7%
Lucent	17.8%
Micrilor	6.4%
Raytheon	43.5%

357 valid votes were counted on 51 valid ballots, and none of the proposals were disqualified at this time.

William Roberts gave a review of the comparison matrix. Most had filled out the matrix completely.

Questions from William Roberts

Micrilor: FEC as an option? 8.7 Mbps uses FEC, not optional.

Alantro: Sensitivity, when will you provide more data? Will require some time.

KDD: Cost of SAW filter and multiple receive functions and the power required for multiple? Depends on the number produced. $7 low volume, $4-5 in 10K. power consumption less than 5 receivers. Could use one common PA.

Micrilor: Quantitative comparison of MSK and QPSK. Depends on the back-off. What percentage 10 to 50 %. Milliamps? 270 mA versus 70 mA.

Harris: 40K gate count estimate 2 tap feedforward 10 feedback.

GBT: 6 antennas? 128 usec standard 16 μsec 11 evaluation. Enough time to read 6 antennas based on current preamble.

Harris: Diversity versus equalization. Based on lab tests the algorithm 2 to 3 times throughput. 10x expected for equalization only.

Lucent: Co-channel detection scheme energy only?. Look at quality of signal also, implementation dependent.

Who would you back other than your own.
>Alantro : Harris
>Lucent: Unwilling to answer.
>Raytheon: Power efficiency important. Only Micrilor has this.
>Harris: Raytheon.
>KDD: Similar to Lucent?
>Micrilor: Not willing to be beaten until seriously injured.
>GBT: Needs more time to review proposals.

Questions from audience

Rollins: Equalization as part of the standard? Lucent: No implementation.

IP how to get; chip block diagrams, chips? Come see us.

Jan Haag: Japanese regulations?

>Harris could depend 0n implementation of filtering

>Raytheon: same as H

>Lucent: same as current

>Alantro: Should be ok.

>Micrilor: selling product now

>KDD: Approval previously.

Don Johnson: 15.147 requirements
>GBT: 4 chips per symbol over 12 dB of processing gain.
>Micrilor: Passed two years ago.
>KDD: same as current PHY.
>Harris: Talked to FCC. Rules passed spreading function. 9 dB + 1.6 passes the CW jamming test. FCC backs that
test.
>Raytheon: Same as Harris.
>Lucent: Early in the process discussed with the FCC. Already have a written statement from the FCC.
>Alantro: Academic attitude. Believes none are spread waveforms. Processing gain requirement. 3 dB more
processing gain than the Harris proposal. 12.7 dB is the estimate. Jamming margin TBD. No honest answer based on
questions with the FCC. Uncertain on how to do the measurement.

Greg Rawlins

 for Micrilor: 3 channel system of 11 Mbps? Analysis of more than 3 AP with reuse of frequencies. Systems not modems. Not 2 or 3 is sufficient. Most somehow get isolation from base stations. Yes if you isolate. Must be a system level simulation.

Why do feel backward compatible not important CCA and demod 2 Mbps, do not want to use the long preamble.

Lucent: Explain why no loss in sensitivity between 8 and 10 due to overlapping symbols? Shift Barker into each other, more peaks within the time. ?? How is the signal space different? Why doesn't the distance be less? Overlapping modifies the signal space. At 8 shifting over each other 3 position spread. 10 shift the whole signal 2 chips. Addition of the parts.

Keith Lucent FEC on all of the data rates. Started the process at 8 Mbps.

Dean Lucent More information on the mode shifter and ??. November paper on PPM has a description. Talk to Lucent if you need more information. Has been fully described, mathematical. Can't implement.

Micrilor: Cover sequences auto and cross correlation's between sequences in the co-set. When you get some offset it is awful. Timing offsets? Showed all of the correlation of the codes in Montreal. Did it include timing offsets. Yes. Simulations tested multipath distributions and randomized code channel and data pattern. First four or five positions constrained.

Lucent and Micrilor: FH interoperability? Given and intent to include in proposal. Provide as a chip or what. DS backward yes, FH CCA. FH depends on the decision of the committee. Will it be mandated?

Lucent Open to have the FH interoperable in the proposal as an option in the standard.

Harris: Yes We intend to agree to design the function into the chip. If Dean provides.

Simon: Lucent Much of the work design and regulatory is at 8 Mbps. What is the impact of the 10 Mbps mode. Technical impact is moderate, same receive structure performance is a little less due to ISI. Regulatory symbol rate is going down a little bit CW Jamming test ok. Do you have evidence that they will accept? Must still talk to FCC, they still have 11 chip spreading.

Dean Micrilor. Using the different codes what is the rejection? Use 12 dB but is higher in some cases.

Greg; Lucent PA chosen as a 30 dBm what can transmit at 1 Mbps and then when switch to 10 Mbps how much. High speed at a 3 dB lower level than 1 and 2 Mbps. 4 dB in 1 and 2 Mbps. Add 3 for 10 Mbps.

GBT: With the cyclic shift of the Barker sequence. With timing offsets how do you resolve. Cover code randomizes. How long does the cover averaged? Long cover sequence. Both I and Q cover code think of as a randomizer.

Questions from Williams

Micrilor Differential versus coherent; How much loss due to non-coherent and are cheap crystals available? , preamble increase required for differential. Very little loss due to differential. Selected a waveform that doesn't require lockup of loops. Gain is not worth the implementation. Doubling ?May be interesting. Picked 10 PPM because they cheap now. 10 PPM is at the limit at 16 Mbps.

Lucent Operate in backoff what is efficiency in the PA. 40 mW 350 mW

Lucent why is the FCC a question since they use 11 chips per symbol. Has to do with FCC interpretation of spreading or coding. What is calculated PG at 10 Mbps? 5 level signal in the Lucent what is impact of the linear amplifiers? Same amplifier but back off and loss efficiency.

Harris MPT requirement What is our 90% bandwidth? As measured on a spectrum analyzer. We measure BW of 13 to 14 MHz, depends on the SAW filter. Not necessary due to waveform. 22 MHz null to null? Why is the number higher than Lucent? Spectrums of both should the same about 14 MHz. Lucent measured 1 Mbps at 10 MHz BW. Depends on bandwidth expansion. Why do they think then, that the 10 MBps mode with a symbol rate of 11/9 us, they will pass MTT?

All: Measurements by KDD based on bandwidth timing recovery and tracking 44 MHz. Do simulations take into account implementations.

Micrilor yes also lab.

Lucent Incorporated SPW not much difference.

GBT: No problems in lockup, modeled

Alantro: Involved in the design and implementation of many systems. DSP receivers for packet radio. May need to take 1 dB off

Raytheon Assumptions; saturated PA Rx and Tx filter included noise added sampling errors not included more work in May.

Harris: Simulating with real hardware. Data based on real radios. Simulations include real measured data. Results tracked earlier simulations.

Lucent: In light of wireline data rates going from 10 to 100 Mbps, Does the proposed approach address higher data rates? Ruled Out of order.

Chris: Spreading and coding. Current sample and then down sample, sufficient statistics to do an optimum detection. Minimum number of samples to do an optimum detector. Lucent Can't answer. Harris: Signal space? 1.375 Mbps needed with multibit samples.

Closing arguments.

Alantro: Processing Gain is important. Only Micrilor and Alantro meets PG requirements. Lucent will lose coding gain from 8 to 10.

Raytheon: Trms was without equalizer. Dead battery gives 0 Mbps. O-QPSK .4 W savings. 30 dBm 29 dBm average. Using Walsh coding. FCC ok. Backwards compatible with the FH and DS.

Micrilor: Code Channels important. Japan has only one frequency channel, so how can you work if you don't have code channels.

Lucent Barker code. Power back-off versus range. IP open. They will supply more detail including schematics, they will provide chips.

KDD: Meets Japanese regulations.

Harris Starting with existing product unequalized. Showed how equalizer can do more than 100 nSec. Low complexity. Nominal PA back-off. PCMCIA design ok. Uses existing RF/IF in the radio. Future implementations are being worked with greater levels of integration.

GBT Missing information in a new doc. Backward compatibility, variable data rates, match channel better. 10 % PER needs to be looked at. Proven technology in Rake receivers, future proof flexible.

Motion to disqualify the following proposals as candidate PHYs for the 2.4 GHz high rate PHY as stated in the selection process document , step 7

The vote to disqualify is:
Alantro   71%
GBT   83%   x
Harris   29%
KDD   79%   x
Lucent   48%
Micrilor   31%
Raytheon   60%

total votes 385 in 55 valid ballots
Therefore KDD and GBT are removed from competition for the May meeting downselect.
Meeting adjourned.

May meeting in Utrecht
September meeting in Waltham MA.