Project	**IEEE 802.16.1 Broadband Wireless Access Working Group**
Title	**Minutes, 802.16.1 PHY Meeting #5**
Date Submitted	**2000-01-14**
Source	Nico van Waes Nokia 313 Fairchild Dr. Mountain View, CA 94086 Voice: +1(650)625-2201 Fax: +1(650)625-5975 E-mail:nico.vanwaes@nokia.com
Re:	N/A
Abstract	Minutes of 802.16.1 PHY meeting #5 in Dallas, TX, 2000-01-10/14
Purpose	
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Explanation of Notation:
A(nswer by Author/Presenter)
Q(uestion)
R(emark)

The questions and answers as provided in this document are a best effort representation of the actual discussion. The secretary concedes that it is entirely possible that the intention of the speaker were misunderstood and are badly or wrongly represented.

Tuesday, January 11, 2000

Chairman Jay Klein opens the session.
Jay reviews the minutes of session #4, which were not posted before.
Motion: by David Falconer: Approve minutes.
Jung Yee notes that it would be better to vote on the minutes after they've been available for review.
Vote: Approve: 10 , Disapprove: 1, Abstain: 2.
Motion to approve minutes of session #4 passed.

Jay reiterated need for models applicable to evaluation criteria.
Jay presents the agenda for the session and asks for discussion.
No discussion.
Agenda unanimously approved.

Presentation:

Author: David Falconer
Title: "Multipath measurements and modelling for fixed broadband wireless systems in a residential environment",
Base Doc. http://grouper.ieee.org/802/16/phy/contrib/802161pc-00_01.pdf
Pres. Doc. http://grouper.ieee.org/802/16/phy/pres/802161pp-00_01.pdf

Q: Of the peaks in [Fig 2], which one represents the direct line of sight?
A: In some cases, the largest peaks are the result of reflections due to the NLOS conditions in the scenario. Bad echoes can mostly be gotten rid of by skilled installation (by re-pointing the antenna properly).
Q: How are the results in rain fading?
A: Some measurements are done in the rain. Virginia tech did measurements in rain, which mostly result only in change of attenuation, except in a few cases where the surface of the reflector changed.
R: In our case, antenna's with large beamwidth are of interest, causing much more multipath.
A: Multipath is correspondingly worse with the antenna beamwidth.
Q: Were the measured echoes time-invariant?
A: Some are, but some may vary relatively slow to the symbol rate.

Q: Do you have data on the multipath component variation?
A: No, only on the overall power. Paper will be presented on this topic at next VTC in Japan. Paper will be made available at www.sce.carleton.ca/bbw one week after this meeting.
Q: Can you explain why the components are Rayleigh fading.
A: The components are shown relative to the main peak. The overall energy should be distributed according to Rician or Nakagami distribution.
Q: What are the echoes caused by?
A: Caused by reflectors in the beam
R: Some of the reflector drawings are not represented in the results.
R: Probability parameter is also influenced by LOS coverage.
A: Agrees
Q: Have you looked at diversity combining ?
A: That is a study in progress.

Presentation:

Author: Wei Zhang
Title: "Classification of Statistical Channel Models for Local Multipoint Distribution Service Using Antenna Height and Directivity",
Base Doc. http://grouper.ieee.org/802/16/phy/contrib/802161pc-00_07.pdf
Pres. Doc. http://grouper.ieee.org/802/16/phy/pres/802161pp-00_07.pdf

Q: What things in reality affects 'M' in the Nakagami distribution?
A: It depends on the amount of multipath. Rayleigh represents NLOS.
Q: Which curves represent the uncoded performance(Fig 3)?
A: All curves represent the uncoded performance.
Q: Does increasing M correspond to AWGN?
A: The higher M, the stronger the LOS component.
Q: How do you do the demodulation? Do you use an equalizer?
A: No, there is no equalization used.
Q: Can you show the difference between the lognormal and Nakagami channel.
A: Taken from other papers, not in the contribution.
Q: People who use the Rician distribution claim strong LOS plus multipath clutter. Components of multipath look Gaussian. What are the physics behind your claim that the Rician distribution is not appropriate?
A: Rician has large LOS and many reflections with large delay spread which is typically only the case for omnidirectional antennas.
Q: Can you suggest a realistic value of 'M' in the Nakagami?
A: It depends on the scenario. Value must be larger than _. Result doesn't change significantly for M>50. For LOS conditions, M>10.

Presentation:

Author: Jay Klein
Title: "Summary of work presented in ETSI/BRAN HIPERACCESS",
Base Doc. None

Pres. Doc. *Document number not assigned at time of completion of the minutes*.

Jay states HIPERACCESS has not made a decision yet on which of the presented models to use. Telia model based on measurements matches well with material presented by David Falconer and measurements from NIST.
Summary: Group should decide whether these models should be adopted.
Q: What was the beamwidth of the antennas used?
A: All cases represent practical deployments, with CPE 2.5° and BS 90° beamwidth antennas.
Q: Only Telia used measurements? Was there any discussion on the echoes?
A: Yes. Telia also tested typical residential deployments (with lower CPE antenna's), being weak LOS scenario's. The model is an average of various results.
Q: Is this paper going to be on the web-site.
A: Due to the current agreement with ETSI, no problem.

Presentation:

Author: Naftali Chayat, presentation by Jay Klein
Title: *Unknown*
Topic: Summary on non-linearity of amplifiers and phase-noise.
Base Doc. N/A
Pres. Doc. *Document number not assigned at time of completion of the minutes*.

Paper suggests the use of Rician channel model (K factors 0, 2 and 6), with exponentially decaying components.
{Jay}Amplifier model needs to be revisited for different RF technologies used in the bands of interest to come up with the right parameters. {Naftali (not present)}Phase noise model might be too simplistic.
{Jay} Models are simplistic enough to allow everybody to come up with the same results, but values need to be carefully considered.

R: Rapp model is memoryless, fitting most amplifier classes. Approach exists not more complicated to presented one, which allows more flexibility by using filters. Lower end of the curve hard to simulate, 1/f effect hardest to simulate but adding it doesn't make much difference.
Q: What kind of parameters are included?
A: It's a lowpass type of filter, alpha affects the corner frequency, alpha and beta represents the accumulated phase noise. Only one segment in the model.
Q: Is the objective to come up with a precise model?
A: We need to decide which parameters are important. If we have a good reference model, we can determine which parameters are important for system performance. Suggestion for subcommittee to come up with a list of these parameters.
A: Presented parameters were the result of such thinking. They may not be all of the necessary ones.
R: Filtered group delay needs to be considered.
A: Real question is, do we need this for comparing proposals.
R: We need them to determine whether the performance of any proposal is any good.
R: "Leasen" model is similar to the one suggested. There is going to be a linearizer at either end of the link. Worrying if you go to low-rate bit-streams.
A: Group only considers high-bit rate streams.

Q: How do we specify the phase noise in the standard?
A: It can be included in the standard in various ways.
R: Request to post the reference for the "Leasen" model.
A: Thomas agrees to send it to the reflector.

{Jay} We have enough information to summarize on the channel model. Suggestion to make a subcommittee to evaluate presented material and come up with one model.
R: Numbers in models in 802.11 were left open for the contributors, only the model was specified.
A: This might lead to difficult comparison of proposals.

R: Model isn't very good yet. Propagation hasn't been addressed yet. Question is whether we have enough time to come up with a good model. We could allow people to bring in their link budget, so we could evaluate proposals from a system level.
A: Response to call for contributions was low, and we need to move forward.
R: Channel model serves to determine key points and allows people to come back with more detailed models. Channel model needs to be an iterative process.
A: Approach to let people decide their own parameter values may be the best one to allow evolution of model.
R: Question is how to come up with a model to distribute to the members?
A: We need a discrete time model, and could decide on the number of components, but don't need to decide whether it's exponentially decaying and what the delay distribution is. We must make sure that the models apply to the band of interest.

{Jay}Proposal to form a task group of about 3 people to come up with a combined response from the presented channel modeling material prior to session 6.

Task group formed:

Members:	David Falconer
	John Liebetreu
	Yigal Leiba
	Thomas Kolze
Assignment:	Form combined response of channel modeling material
Target date:	Before session #6, preferably Thursday 2000-01-13

Group addresses the evaluation criteria.
Gene Robinson is requested by the the chair to collect and present a summary of papers on link budgets. Gene accepts.
Motion: by Jay: Remove item 8 from the criteria, motivating that it is a MAC criterium.
Vote: Approve: 5 , Disapprove: 1, Abstain: 1.
Motion to remove item 8 from the evaluation criteria passed.

Group discussion leads to below suggested modifications of the session #5 evaluation criteria to be used in session #6.

Additions to evaluation list:

9: Add practical link budget.
System gain ,
10: Provide cochannel and adjacent channel interference levels, spectral spillage resulting from modulation
12: degradation related to radio impairments such as phase noise, group delay of filters and PA.
7: Provide PHY delay
2: Supply details of PHY overhead.
Remove item 8.

Motion: by Jay: Accept changes.
Vote: Approve: 7, Disapprove: 0, Abstain: 1.
Motion to approve changes to evaluation criteria as listed above passed.

Session adjourned.

Wednesday, January 12, 2000

Chairman Jay Klein opens the session.

Presentation:

Author: Thomas Williams
Title: "Pilot Assisted FDRM",
Base Doc. http://grouper.ieee.org/802/16/phy/contrib/802161pc-00_05.pdf
Pres. Doc. http://grouper.ieee.org/802/16/phy/pres/802161pp-00_05.pdf

Q{Naftali Chayat}: You're using 2 symbols for each data symbol?
A: Yes, you half your capacity, but gain 3 dB. Otherwise it would require symbols twice as long to gain this improvement.
Q{Naftali Chayat}: Can you compare to DVB where a fraction of the channel is used to estimate the channel, which seems more efficient.
A: In COFDM, the pilots are static, and you have to interpolate between the pilots. Also has roaming pilots. Leads to instantaneously channel estimation. For mobile application, a lot more pilots are used. Pilots in FDRM can be used as reciprocal. FDRM and OFDM are complementary.
Q{Naftali Chayat}: Still not clear why to use 50% overhead instead of a few % overhead.
A: Not recommending using FDRM full-time, only at start of transmission and as often as necessary to characterize the channel accurately.
Q{Yigal Leiba}: Could you give a figure on the phase noise?
A: 250 kHz between pilot and carriers provides tolerance for phase noise.
Q{Shawn McCann"}: What's the effect of the changing phase noise.
A: It's assumed that the phase noise does not change during the burst.

Presentation:

Presenter: Jeff Foerster

Title: "Physical Layer Proposal for the 802.16 Air Interface Specification",
Base Doc. http://grouper.ieee.org/802/16/phy/contrib/802161pc-00_02.pdf
Pres. Doc. *Document number not assigned at time of completion of the minutes*
Presenter: Moshe Ran
Title: "Advanced Coding and Modulation Mode using Binary Product Codes",
Base Doc. http://grouper.ieee.org/802/16/phy/contrib/802161pc-00_02.pdf
Pres. Doc. *Document number not assigned at time of completion of the minutes*.

Q{Demos Kostas}: Trying to understand the objective to come up with an interface. Proposing 5 modes. It's more a combination of interfaces than one standard.
A{Jeff}: Modes were allowed for future migration. Primarily designed for FDD, additional modes for TDD. The idea is that vendors can decide only to be compliant with the basic mode to save cost.
Q{Demos Kostas}: Are we proposing one standard or a number of standards?
A{Jeff}: Many options in the optional modes aren't huge diversions from the basic mode.
Q{John Liebetreu}: Substantial benefits in iterative coding techniques. Not well established whether block codes or parity codes present the best options. Proposal only RS code. Useful to see more comparisons between iterative codes and RS concatenated with other codes. Agree that the idea is to get to market quickly. Easier to leave the standard open for new techniques when they are well-established and TBD for now.
A{Jeff}: Trying to focus on the robust basic mode. Doesn't prevent establishing optional advanced modes.
A{Moshe}: If we try to compare any other scheme to product codes, in this range, product codes are the best solution.
Q{Naftali Chayat}: PHY layer downstream essentially broadcast. Using same modulation guide going to all the users. If someone wants to update his network, you still have to use the basic mode untill all CPE's have been updated. Also, modulation determined by the worst "propagation user". Worst link limits throughput to all CPE's.
A{Jeff}: Have to design the cell structure carefully.
Q{Naftali Chayat}: Cannot incorporate the fact that users have different propagations.
A{Jeff}: Can be avoided in TDD, but not in FDD.
Q{Naftali Chayat}: Is there a half-duplex mode?
A{Jeff}: Yes, half-duplex FDD and TDD
Q{David Falconer}: Allowable range of bandwidths and bandwidths
A{Jeff}: Factor of modulation, slot and frame times. Wide range of parameters. Depends on restrictions. Basic idea is to be flexible.
Q{David Falconer}: Is there a formula somewhere? Trying to get a feel for the range.
A{Jeff}: It's finely granulated. Formula in proposal.
Q{Mohammed Akhter} : Have you compared the coding schemes with block turbo codes?
A{Moshe}: yes, if you use straight concatenation of turbo code, fluttering beyond 10e-6, requires extra effort to overcome this in the convolution code. Does not exist in proposed code, since the minimum distance of the code is not changing, which dictates the performance slope.
Q{Mohammed Akhter}: There is no error floor in serial concatenated convolutional and turbo code. We should see more literature. Have you looked at low SNR?
A{Moshe}: code allows to go to the lower limit of synchronization point of view.
Q{Mohammed Akhter}: look at packet error rate?
A{Moshe}: Agree, good measure of performance also
Q{Allan Evans}: Critical modes should not be left as optional. Can you comment which modes are required.
A{Jeff}: Only basic mode is required. Other modes are optional. Can be discussed.

Q{Allan Evans}: Basic mode reallyDOCSIS 1.1
A: It's more flexible.
Q{Allan Evans}: symmetricity
A{Jeff}: Same coding does not have to be used on upstream and downstream. Symmetricity not often required.
Q{Lars Lindh}: no adaptivity to change modulations, direct consequence of borrowing from cable modem standards. In coding, rate already quite low, requires quite low preambles which will reduce efficiency.
A{Jeff}: yes, borrowed from cable modems. Not sure on the degradation. Don't want to put a huge burden on the components to allow for rapid adaptivity in basic modes.
Q{Lars Lindh}: So you change modes by configuration, not adaptively?
A{Jeff}: yes
A{Moshe}: Many options for rates between 0.4 and 0.8 and for short burst, parity codes.
Q{Jay Klein}: Howmany dB performance gain compared to changing the puncturing vs code rates.
A{Moshe}: about 3dB
Jay: Is the interleaver in the basic modes on
A{Jeff}: yes
Q{Jay}: roll-off 0.15-0.35 makes optional modulation modes useless
A: They're only an optional mode
Q{Jay Klein}: difference between literature numbers and Moshe's of about 2dB.
A{Moshe}: Difficult to know the assumptions. Therefor results in coding gain and compared to shannon bound.
Q{Demos Kostas}: In mode E, still approach of packets within MPEG envelope?
A: integer number of MPEG packets per burst.
Q{Tom Williams}: Mistake to use too many coding schemes. Why 4-DQPSK? Comparison of _ code?
A: Optional ideas resultant from large group, can be discussed.
A{Moshe} At least 1 dB better than 2 stage concatenation Viterbi-RS. Depends on the type of concatenation.
Q{Tom Williams}: Why pragmatic trellis for 16 QAM? Estimate of gate-count? Reason to exclude 64-QAM from mandatory mode.
A: Equipment being build to that standard. Hence considered as optional mode.
A{Moshe}: It's reasonable. Around 100k gates.
A{Jeff}: Implementing 64-QAM is difficult
Q{John Liebetreu}: Need to look at different coding approaches. Serial concatenated codes from NASA jet propulsion lab seem closer to the shannon bound. Coding should be left open for study.
A{Moshe} Record for closeness
Q{Lars Lindh}: half-duplex mode FDD optional?
A: No significant cost in adding half-duplex FDD.
Q{Lars Lindh} what's the point in using half-duplex FDD if full-duplex FDD is required.
A: Same type of elements are required. More of an enhancement with little additional cost.
Q{???}: Basically only the BS has to support full duplex?
A: terminal would have to be true full duplex
Q{???}: Have you defined the types of physical channels you want to support?
A: One basic physical channel for the downstream, up to the MAC in the upstream.

Presentation:

Presenter: Jay Klein
Title: "PHY Layer Basis for BWA",

Base Doc. http://grouper.ieee.org/802/16/phy/contrib/802161pc-00_09.pdf
Pres. Doc. *Document number not assigned at time of completion of the minutes.*
Presenter: Lars Lindh
Title: "CQPSK",
Base Doc. http://grouper.ieee.org/802/16/phy/contrib/802161pc-00_09.pdf
Pres. Doc. *Document number not assigned at time of completion of the minutes.*

Naftali Chayat explains that his session #4 OFDM proposal is better suitable for sub-10, and that he strongly supports the presented proposal.

Q{Demos Kostas}: What form of ARQ are you proposing.
A{Jay}: More of a MAC question.
A{Lars}: ARQ makes sense in the uplink, but probably not in the downlink
Q{Demos Kostas}: CQPSK allows low cost H/FDD, how does it relate to cost QPSK TDD
A{Lars}: we're comparing to full FDD
A{Demos Kostas}: proposal includes FDD, H/FDD and TDD, devices will have all or one?
A{Jay}: expecting deployments with TDD or deployments with FDD and H/FDD. Proposal does not preclude chipsets allowing both.
Q{Moshe Ran}: comparing to session 4 proposal, figures did not change, but the coding scheme changed. Performance of presented coding scheme too optimistic.
A{Jay}: Might be a mistake. Final performance of the codec depends on various numbers. Degradation compared to session #4 material 0.5 to 1 db on downlink 1 to 1.5 db degradation on uplink. Performance depends on implementation. Scheme is a good compromise.
Q{Moshe Ran}: Any BER simulations ?
A{Jay}: yes, but not included
Q{Eli Arviv} scrambler before or after FEC block?
A{Jay} scrambling done in parallel. Don't think it leads to error propagation.

Q{Yigal Leiba}: Inverting one bit (in code) very sensitive to noise, and leads to a not very robust scheme.
A{Jay}: not a strong code, asymptotic gain only 2.5 dB, but sufficient. In the "danger zone", helps 1 to 1.5 dB, that's the price for no interleaver.
A{Lars}: if operating at too high BER, synchronization would be a problem
Roger Duran: peak to average ratio?
A{Lars}: 1
Q{Roger Durand}: Proposing to mix with higher modulations, how do you set the power ratio?
A{Jay} yes. Two modes of operation. IF can be used for high end devices
Q{Ray Sanders}: under what conditions do we need interleaver
A{Jay}: trade off with ARQ etc..
Q{Ray Sanders}: similarities between proposals?
A{Jay} share views on coding schemes. Also similarities on TDM usage.
Q{Carl Stambaugh}. pointer in header should enable synchronization, how to find the pointer?
A{Jay} Synchronized per burst. Know where the next header is due to counting of bytes in fixed packet sizes. MAC messages are variable in length, hence the pointer is needed.
Q{Scott Marin}: 3 b/s/Hz. Modulation?

A{Jay} typical average mix of QPSK, 16QAM and 64QAM
Q{Scott Marin}: lot of communality between proposals. In the TDD approach, 802.3 has a 2Mbps TDD and full duplex mode. Why optimize for TDD if HDD provides high performance?
A{Jay} Group feels that both should be available. Cost efficiency leads to optimizing H/FDD, which inherently optimzes TDD.
Q{Scott Marin}: Within the transmission, different modulations?
A{Jay} Within the TDM stream, QAM and QPSK
Q{Scott Marin}: availabitilty of modems?
A{Jay} to my knowledge no chip-sets available yet, can't answer for other vendors
Q{???} no loss in zero-padding payload?
A{Jay} no, depending on ATM, or IP, TDU values can be optimized.
Q{Jung Yee}: adaptive modulations, how to guarantee availability?
A{Jay} tell the network planning tool to use QPSK or QAM and get the maps which gives the coverage.
A{Lars} When you plan your cell, you plan the availability. Fade margin is 30-40 dB. In good weather, this margin can be used for higher modulations. Terminal can measure SNR and report to BS.
Q{Jung Yee}: might lead to a lot of switching back and forward between modulations
A{Jay} using algorithms with hysterisis would solve this
Q{George Fishel}: proposed modulation, upstream CQPSK, downstream QPSK and 16/64 QAM
A{Jay} 64 QAM optional, different levels of SLAM
Q{David Falconer}: with regard to CQPSK, how complex is the equalizer?
A{Lars} not sure we really need an equalizer, work in progress.
A{Jay} optimal is Viterbi type, and decoder is Viterbi, so combination can be done.

Thursday, January 13, 2000

Chairman Jay Klein opens the session.

Group discusses the call for contributions for session #6, March 6-9, 2000 in Albuquerque, New Mexico, USA.

Proposed call for contribution items:

- Selection of PA linearity model, phase noise model and channel propagation model and provision of parameters for these models as presented in session #5.
- Definitions of CCI and ACI criteria and associated interference models.
- Definitions of required spectrum masks and unguided emission guidelines (i.e ETSI-TM4 and FCC PART 101). Priority will be given to output from the coexistence group 802.16.2.

Motion: by Jay: Accept items as listed above.
Motion accepted unanimously.