Task Group A (5 GHz PHY) of 802.11 September 1997 meeting
Tentative Minutes

Chair: Naftali Chayat

Mike Trompower kindly volunteered to be Secretary/Editor of the Task Group.

Attendance: 39 attendees (See also appendix 1 for communication information)

Jeff Abramowitz	3Com Corporation
Keith Amundsen	Raytheon Corporation
Carl Andren	Harris Corporation
Simon Black	Intalk
Jan Boer	Lucent Technologies
Ronald Brockmann	No Wires Needed, BV
John Cafarella	Microlor, Inc.
Naftali Chayat	BreezeCom
John Fakatselis	Harris Corporation
David Fisher	3Com Corporation
John Fisher	Proxim Inc
Raj Gawera	Symbionics
Tim Godfrey	Digital Ocean, Inc.
Jan Haagh	Lucent Technologies
Vic Hayes	Lucent Technologies
Maarten Hoeben	No Wires Needed, BV
Masayuki Ikeda	Seiko Epson Corporation
Nobuo Karaki	Epson
Dean Kawaguchi	Symbol Technologies
Patrick Kinney	Norand Corporation
Jerry Loraine	MicroLinear
Stephan Lundgren	Telia Research AB
Reza Majidi-Ahy	RadioLAN
Jim McDonald	Motorola, Inc.
Colin Nayler	AMD
Tomoki Ohsawa	NEC Corporation
Bob Pham	NEC America Inc.
William Roberts	American Microsystems Inc.
Kent Rollins	Harris Corporation
Chandos Rypinski	LACE, Inc.
Roy Sebring	Intermec Corporation
Don Sloan	Aironet
Uwe Stock	OKI Europe
Hitoshi Takanashi	NTT Wireless Systems Labs
Cherry Tom	AT&T Laboratories
Mike Trompower	Aironet
Leo Wilz	Norand Corporation
Harry Worstell	AT&T Laboratories
Jim Zyren	Harris Corporation

Agenda:

Motion 1: **motion to approve agenda as presented in the August mailing with Venue**

Motion 1 passes (11,0,2)

project milestones - March 1998 submission of first draft for approval

David Fischer (3Com) Is there a reasonable expectation that we could have a draft in the March 1998 timeframe? Jan Boer summarizes current ETSI status. ETSI is currently evaluating submissions for 5.2 GHz modulations and is generating requirements for the PHY. There are several proposals on the table now. ETSI will prepare a schedule document at their meeting this week and will begin technical evaluations in November.
David Fischer (3Com) "It appears that we are now behind schedule since ETSI has also not started."

Keith A (Raytheon) "Are we only looking at 5.2GHz and not 5.7 and 5.8GHz as well?"
Channelization of 5.2 GHz between ETSI and FCC are different and will require coordination between the two groups BRAN and IEEE, NII band issues will need to be resolved, transmit power and spectral density issues. Naftali responds "The frequency bands in Europe and US are different anyway, so the channelization plan will need to address different regulatory domains (maybe one will be a subset of the other). As part of that, the 5.8 GHz US subband can be addressed as well."
5.2GHz may allow for world wide standard in quicker time.

other milestones - in order to prepare text, requirements (modulation) and criteria (regulatory domains) should be chosen early

John Cafarella (Microlor) "ETSI will not even be hearing proposals until November, does it make sense to work with ETSI?"
The goal as stated in July was to have two MACs and a common PHY

The 802.11 MAC will not be changed unless a specific problem is identified which requires the change in order for the higher speed PHYs to operate. There are companies who have "Provided an existence proof" that the 802.11 MAC will operate with higher speed PHYs as exemplified by the Microlor proposal in July.

Jan Boer (Lucent) "BRAN is focused on ATM style deliver methods and requirements and 802.11 does not focus on this issue so some thoughts may be needed in order to have interchangeable MACs"

HIPERLAN 1 is not ATM oriented, HIPERLAN 2,3 are ATM oriented, HIPERLAN 4,5 are not necessarily ATM oriented.
(Jan Boer) primary interest in BRAN for common PHY is an attempt to make a world wide standard, larger market, component re-use, etc. HIPERLAN 1 is different standard from H2,3 and there will be an issue as to how these systems will interact.

Naftali states that he feels that July 1998 allows for a more realistic delivery timeframe for the first draft. Allowing for modulation proposals to be presented before January 1998, modulation selection by March 1998, draft text by July 1998. In parallel, until January 1998, work to establish operating criteria and requirements can commence.

Jan Boer states that HIPERLAN has started their work some 5 months ago and that they will select a modulation in November 1997 and prepare a first draft in Jan 1998. BRAN is not necessarily operating on the same schedule as HIPERLAN. (OFDM, GMSK, OQPSK, are currently being considered) As long as there is standard PHY, establishments for coexistence in terms of channelization etc. will allow for worldwide operation.

Naftali requests a list of modulations to be considered and at least skeletal proposal presented.
- GMSK / OQPSK to be presented by Naftali (BreezeCom)
- MOK modulation to be presented by Carl Andren (Harris)
- Orthogonal modulation variant presented by John Caferalla (Microlor)
- OFDM presented by Jan Boer (Lucent)
- GFSK presented by Jim McDonald (Motorola)

Deadline for skeletal submissions is set for November 1997 with full text by January 1998

Objectives for evaluating the proposals will be created by November 1997
Modulation Selection will occur in March 1998.
The text for section 17 will be generated in March98 and May98 for working group letter ballot after the May98 meeting in order to get approval before the July98 plenary. approval in March98 plenary will be needed in the event that a quorum is not obtained in May98 interim meeting.

Keith A (Raytheon) suggests an e-mail ballot informing the above agenda and to allow those not in attendance at the meeting an opportunity to critique this schedule.

Motion 2:
Motion to approve the above schedule (Dean Kawaguchi / Vic Hayes)

> **Motion to amend(Cherry Tom - AT&T/ Reza Majidi-Ahy - RadioLan) to amend such that a proposal appearing in January 1998 containing full text to be allowed for presentation even though having not presented a skeletal outline in November 1997**
> discussion - asking for proposals in two months is as unfair as reviewing a proposal in two months. several opinions against the motion stating that if an outline cannot be presented in November1997 that the proposal must be too immature to be included.
> Vic Hayes calls the question
> (**motion to amend fails 5-9-2)**

no further discussion on main motion   **motion 2 passes (11-1-4)**

adjourn for lunch at 12:30, reconvene at 1:30

meeting reconvened at 1:40
next agenda item = review of submissions and assignment of document numbers

criteria for consideration for joint IEEE/BRAN meeting
- wired equivalency, what is objective of the two systems?
- delay spread, should the model concern itself with short range and long range issues? should there be a tolerance applied to delay spread? indoor/outdoor environments
- multiple rates system(s)
- should this PHY restrict itself to the 802.11 PLCP transmit at 1Mbps requirement? should the HIPERLAN preamble used?
- should this PHY concern itself with fragmentation?
- should equalization methods be considered (packet to packet or symbol to symbol method)?
- co-location / coexistence issues between all users of this band (consideration of WinForum inputs?)
- specification of antennas, directivity, uses of …
- availability of ETSI documents
- will the use of the 802.11 MAC prohibit/limit the deployment of 5 GHz product in Europe?

Issues for discussion in joint IEEE/ETSI meeting

a) Should the multipath models concern indoor environment only, or should outdoor environment be addressed as well? Viewpoints expressed: The capability to withstand longer multipath is essential, also for such cases as large halls. The transition to outdoor scenarios may be gradual.

b) Should multiple rates be pursued? General feeling that yes; probably also a lower rate should be supported for robustness and maintaining connection at longer range.

c) Should we support two preamble lengths? The reasoning is that for "continuation packets" some information can be used from previous packets, therefore the preamble can be shortened and the overhead reduced. The general

feeling was that this is unnecessary, because (1) at higher speeds the fragmentation is less likely and (2) maintaining a data base of parameters of previous packets and tight scheduling of users is against the spirit of 802.11 MAC. (Jerry Lorain: keep the preamble short). ETSI's position on that will be asked.

Jim McDonald proposes a straw poll on the need to have a common PHY with ETSI, as opposed to just some form of sharing rules, given that most application will be indoor and networks will be quite isolated from each other. The views expressed are that networks cannot be assumed completely isolated; in any case some form of sharing rules are needed as non IEEE/ETSI devices may be around. Having a common PHY with ETSI may make the sharing more efficient when the IEEE and ETSI devices need to coexist. ETSI itself might need a mechanism for coexistence of different types of HIPERLAN.

(Antennae: directive/adaptive - benefits, necessity? Chan Rypinski feels that essential, others feel that too complicated and impossible in indoor environment; no conclusions)

d) Accessibility of ETSI docs - an issue to raise

e) 802.11 MAC in Europe: we want to be able to sell 802.11 devices in Europe with a new 5 GHz PHY.

adjourn for Task group B meeting at 3:05
reconvene at Tuesday 8:30

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Tuesday 09Sep97
meeting called to order 08:40

Naftali summarizes the joint ETSI/IEEE meeting and discussion items as listed yesterday

Discussion continues with antenna issues
Chan Rypinski suggests that the user should not be involved in antenna pointing issues
Jim McDonald echoes stating that he is anticipating the use of directional antennas in order to gain range and system performance in presence of interferers in the 5 GHz bands. If directional antennas are going to be actively used, the user should not be involved.

Jim Ziron, Harris, "AM I to understand that your primary concern is to limit the EIRP"
Don Sloan, "There is a strong motivation for directional antennas as far as the customer views"
Naftali "will directional antennas have the same performance improvement indoors as they do outdoors?"
Jim McDonald yes …directional antennas are a tool and should not be mandatory …general agreement
Reza reminds that the protocol is largely based on all users being able to hear all other users and that for an indoor environment, he believes that system performance will be severely decreased.
Jim McDonald offers agreement, however, he feels that the use of directional antennas will improve performance.
Reza proposes that we just discuss with ETSI their philosophy on antennas and their intended use

Naftali asks for new items before prioritizing the current list of items to discuss with ETSI
Dean K suggests adding an item to summarize the agenda, describe the goals of the meeting and discuss information transfer methods

There will be an executive meeting between ETSI and IEEE which will cover the document distribution and information sharing

The order of technical topics will be the following:
    coexistence with other systems

tolerance to delay spread
multiple rate systems
two preambles
position on use of directional antennas

Discussion of the technical requirements which will be presented to ETSI
  operation summary
    data rates = primary rate of 20-25 Mbps plus fallback rates? + higher rates?
    types of traffic = asynchronous packet data, time bounded services using a priority mechanism of PCF
    packet lengths = up to 4095 bytes asynchronous data packets, control packets are typically 20 bytes
  multipath and interference robustness
    focus is on indoor environments
    gradual degradation when subjected to longer multipath (large halls, outdoors)
    interference robustness due to adjacent channel interference is addressed by CCA procedures
  packet drop probabilities
    sensitivity is defined for a channel at 8% loss rates for 1024 bytes or 3% for 400 bytes derived from a
    10E-5 BER
  MAC overview
    CSMA/CA + ACK
    DCF and PCF
    CCA and virtual carrier sense sharing mechanism
    optional RTS/CTS before data/ack sequence
    connection versus connectionless
        802.11 is essentially connectionless
    timebounded services are provided by PCF
  Modulation types
    GMSK
    MOK
    Orthogonal waveforms
    OFDM
    GFSK
  Other

Technical Discussions / Brainstorming Session
  Baseline PHY parameters and requirements to be used for comparison of modulation types
    (ALL Submitters of modulation choices should bring data discussing the following parameters)
    -20 Mbps data rate (net after channel coding)
    -system performance using packet lengths of 64 and 1000 bytes
    -preamble and slot size recommendations
      -antenna selection / diversity methods
      -equalization methods
      -slot size is assumed to be the time it takes to determine medium busy without diversity and without
        multipath with 90% reliability
    -sensitivity will be defined for a 10% PER
    -multipath performance
        -use of acquisition and training to combat multipath
        -discussion of noise, fading models and antenna assumptions used in the analysis
        -Naftali suggests a comparison based on packet error rate probability without diversity, over the channel
generated by the proposed modulation method, using packet lengths of 64 and 1000 bytes compared to a model
with delay spread causing 90% PER.   There is much discussion and points made as to the openness of this test
with respect to many assumptions which will have to made.
    -required / recommended changes to the MAC

12:25 adjourn for lunch and task group B

4:30 reconvene after task group B

Naftali begins by summarizing the decisions in the previous meeting

Chandos brings up question of channelization and guard band issues.
Jerry Lorain: "we must meet the regulatory out of band requirements and we must be able to build product with a single oscillator"
discussion about making premature assumptions when so many options are still available - data rate, modulation, power, etc.

currently there are 3 channels defined in 100MHz for GMSK HIPERLAN 1
seems over aggressive to define 8 channels in 200 MHz available
FCC has not yet allowed interband operation between 5.2/5.3

Reza: 4 MHz guard band seems very aggressive, RadioLAN analysis shows that at least 10 MHz is needed for the low end of the band

this group does not know the status of any channelization plans by ETSI for HIPERLAN 2 or 3
the answer should become know in tomorrow's joint meeting

Don Sloan suggests that if common channels cannot be defined, at least we should keep the channel bandwidth the same. frequency changes are easy, bandwidth changes are not.

Jim McDonald suggests that the Lucent proposals concentrate on common center frequencies so that overlap will allow for energy detect to enable coexistence.

several members suggest that they would consider building products which were capable of 5.2 and 5.8GHz operation.

Naftali summarizes such that channelization should be specific to the modulation and that all presenters should bring a channel plan with their proposals.

Naftali suggests that phase noise specification / criteria be the next topic of discussion
discussion pointing towards this being a difficult topic and too specific
Naftali suggests that each proposal alert the committee to any phase noise limitations

a broad category labeled "key enabling technologies" should be included with the proposals. items on this list will include any item determined to be extremely sensitive, power consumption estimates, enabling technologies, etc.

The current list of items to be included with modulation proposals is as follows:

Baseline PHY parameters and requirements to be used for comparison of modulation types
    (ALL Submitters of modulation choices should bring data discussing the following parameters)
    -20 Mbps data rate (net after channel coding)
    -system performance using packet lengths of 64 and 1000 bytes
    -preamble and slot size recommendations
     -antenna selection / diversity methods
     -equalization methods
     -slot size is assumed to be the time it takes to determine medium busy without diversity and without
      multipath with 90% reliability
    -sensitivity will be defined for a 10% PER

-multipath performance
    -use of acquisition and training to combat multipath
    -discussion of noise, fading models and antenna assumptions used in the analysis
-spectral occupancy and channelization plan
-phase noise specification and limitations should be discussed with the proposal
-required / recommended changes to the MAC
-"key enabling technologies" : extremely sensitive items, power consumption estimates, enabling technologies, etc.

meeting adjournment 5:30

10September 1997
Joint IEEE/802.11 meeting

ETSI members present

#	First	Last	Company	Country
1	S	Mohamed	Fujitsu Europe	UK
2	R.	in 't Veld	TNO-FEL	Netherlands
3	L.	Dellaverson	Motorola	US
4	Markko	Niemi	Nokia	Finland
5	Partha	Narasimhan	NEC	US
6	G	Auger	Thomson-CSF Communications	France
7	I	Bucaille	Thomson-CSF Communications	France
8	A.	Nguyen	Thomson-CSF Communications	France
9	D.	Ramage	France telecom-CNET	France
10	F.	Picho	Mitsubishi Electric ITE	France
11	E.	Rumi	Lucent Technologies	UK
12	G.	Kadel	Deutsche Telekom	Germany
13	M.	Aldinger	Daimler-Benz	Germany
14	W.	Franz	Daimler-Benz	Germany
15	A.	Grongvist	Telecom Finland	Finland
16	Masahito	Umehira	NTT	Japan
17	Jean-Pierre	Ebert	Technische University Berlin	Germany
18	Peter	Legg	Motorola	UK
19	L	Le Scolan	Canon CRF	France
20	J-F	Knoerr	Dassault Electronique	France
21	R.	Hahn Pelz	Robert Bosch GmbH	Germany
22	Markus	Radimirsch	Robert Bosch GmbH	Germany
23	J F	Kukielke	Alcatel ASD	Spain
24	Greja	Bantz	Ericsson	Sweden
25	Jamshid	Khun-Jush	Ericsson	Germany
26	Dornu	Narnor	Symbol technologies Int'l	UK
27	Mitesh	Patel	NEC Tech. (UK)	UK
28	Jorg	Borowski	Dresden Univ. of Technol.	Germany
29	Hitoshi	Matsui	NEC	Japan
30	Chris	Romans	Hewlett-Packard	UK
31	Paul	Row	Nortel plc	UK
32	Yiannis	Draropoulos	Intracom S.A.	Greece
33	Howard	Laffling	Symbionics Ltd	UK
34	David	Bhatoolam	Lucent Technologies	UK
35	Qiang	Cao	Lucent Technologies	UK
36	Jan	Boer	Lucent Technologies	Netherlands
37	Andreas	Hettich	Aachen Univ.	Germany
38	Bruno	Melis	CSELT	Italy

#	First	Last	Company	Country
39	Jim	Lindol	Jennic	UK
40	Winfried	Berkvens	Eindhoven Univ. of technol.	Netherlands
41	Philip	Madec	France telecom CCETT	France
42	Paul	Odlyzko	Motorola	US
43	Philippe	Madec	France Telecom CCETT	France
44	Lars	Falk	Telia research	Sweden
45	Larry	Taylor	Technology Partnership	UK
46	Peter	Ransomme	Technology Partnership	UK
47	Hong-Yen	Lach	Motorola Research	France
48	Robert	Fifield	Philips Research	UK

called to order at 0900 by Vic Hayes

Vic discusses meeting logistics, summarizes the agenda, gives 802.11 operating rules tutorial
(HIPERLAN is Europe only, unlicensed in FCC)

question from ETSI member asking 802.11 relationship with 802.9 who is also working 5GHz issues. Vic and
Chan respond state that no formal working relationship is in place yet.

Naftali begins with describing IEEE/ETSI collaboration goals
Naftali gives overview of 802.11 network and protocol
Naftali describes desire to work together for interoperability/coexistence reasons
Naftali details Task Group A schedule to get standard approved

ETSI asks when will the MAC be reviewed to determine if it is broken?
Naftali and Dean state that no particular time is established, however, testing will be performed in parallel with
development. It is assumed that the MAC is sufficient for higher rate PHYs.

If the MAC must be changed, will there still be a unified MAC or will there be two MACs.
Dean responds stating that the current 802.11 PAR specifically states that there will be a single MAC with
multiple PHYs and if changes must be made, they will be addressed within the group to resolve such that 802.11
will have a single MAC.

ETSI asks about 20 Mbps being air interface rate or data delivery rate? Naftali responds with air delivery rate as
the answer

Have we reviewed ETSI material on existing 5 GHz PHY?
Naftali responds stating that information access is limited and that 802.11 will have specific questions for ETSI at
this meeting.

Naftali continues with 802.11 overview - modulation methods, comparison criteria,

Naftali ends with Questions to ETSI:
How does ETSI view coexistence with other types of system? (In particular, how will HIPERLAN 1 coexist with
type 2,3?)
Does ETSI consider multiple rate PHYs
Does ETSI consider multiple preambles/lengths
position on antennas (indoor, directional, etc)
information on availability of additional 50MHz in Europe

ETSI spokesman (Steven Ring, LSI Logic Europe) expresses gratitude for the invite and points out that there are
overlaps in the two developments

Why should European market open itself to worldwide market? would like to have further discussions on this topic. ETSI operating rules are discussed, membership required to vote, simple majority rules.
WG3 has October goal to deliver HIPERLAN 2 (ATM) to ETSI
1999 goal to make HIPERLAN 3 standard and test specifications available to ETSI
WG3 goal is to provide wireless access to ATM

HIPERLAN 1 was created by ETSI. RES 3 group. functional specs are created, public inquiry was completed just a few months ago. conformance specs are nearly finalized (300.836 is specification number) four parts, PICS, MAC conformance, test conformance, abstract conformance.

There are a few companies actively pursuing HIPERLAN 1development within Europe

Technical Report (TR69?) details wireless access to ATM which forms the basis for the BRAN project development. This document is available on 802.11 FTP site private area.

BRAN goals- efficient single cell operation, support for all ATM service classes, connection oriented system, data rate goal of 20 Mbps useful data rate, looking at coding techniques to provide that data rate, OFDM and single carrier , equalizers not being looked at because of power consumption requirements.

WG2 members (MAGIC_WAND) are exploring OFDM issues.

BRAN is currently exploring both modulations in detail
one proposal for OFDM 21.735 usec symbol rate 7 carriers 3.2MHz apart 21 bits per symbol of 8 data bits+7signalling bits+6symbol protection bits for correction, range for small office of 10-20m for 10mW and 200m for 1W

another proposal uses 16 carriers

Gerhardt Kadel (Deutche Telecom, Germany) discusses another proposal using single carrier modulation using a Frequency Domain Equalizer with diversity, 10MHz wide channels, 0.1usec symbol duration, 32usec block duration, modulations of 4,16,64-QAM have been simulated with noise in AWGN, flat rayleigh fading, COST typical urban, 8-10 bit ADC, sample rate of 1 sample/symbol @ 10Mbps symbol rate, recommend 4X oversampling for realizable, 256 bit DFT. Seems that diversity is essential for reasonable performance.

*** the above channel models are not endorsed by ETSI, however, COST is reasonable approximation to outdoor, ETSI has not decided upon channel models at this time

Jorg Borowski (Dresden University, Germany)ACTS 006 MEDIAN Consortium OFDM proposal
150Mbps net data rate, wireless ATM system, 60GHz band for transmission, 512 point FFT, 286 points used for data transmission, TDD-based frame structure, 64 symbols, 1ATM cell to each OFDM system,439KHz sub-carrier spacing, QPSK modulation each carrier, 127MHz bandwidth, feel that they have solved synchronization problems with so many carriers, The impact of scaling from 60 GHz to 5 GHz has not been evaluated at this time however the current product uses 2 IF stages (900MHz and 5.2GHz) so that the product should adapt nicely.

Andreas ?A? (? RWTH ComNets ?) presentation on coexistence of different system in same frequency allocation assume 25 MHz channelization and have different system operating in same spectrum
believe that Reservation and Non-Reservation schemes are not possible to coexist so the proposal shows frequency allocation such that reservation schemes would choose channels from high to low frequency and non-reservation schemes would choose channels from low to high frequency. In the cases that they overlap some loose rules are given to enable some level of coexistence. "Safe haven" concept introduced so that highest channel is for reservation based schemes only and lowest channel is for non-reservation schemes only.

HIPERLAN 1 and 2 standards will have to coexist and so ETSI will have to look at coexistence proposals within its BRAN groups

It is not decided that the HIPERLAN 1 channelization scheme will be used for HIPERLAN 2

Dean Kawaguchi believes that the Wireless ATM forum is looking for HIPERLAN 2 to provide MAC and PHY definition for product across the world (not just Europe) and asks if BRAN is considering these issues in regards to 802.11.   response is that this is the purpose of this meeting to see if we can work jointly or set rules for coexistence

Marco ?S? suggests a task force which discusses in detail the commonality and differences of the 802 and HIPERLAN systems, especially in regard to frame sizes and MAC operations to determine the level of coexistence rules to be needed.

Vic Hayes asks question to determine level of support within the committees to continue a cooperation effort. There will be an evening meeting tonight (10Sep97) consisting of executive members of 802.11 and BRAN to discuss further efforts.

straw poll questions
Those interested in cooperation to reach coexistence (between 802.11 MAC/5 GHz)
members responding: ETSI 27/ IEEE 35

How many people are interested in cooperation of common baseband modem and signal processing between 802.11 / 5GHz and HIPERLAN 2? (assumption is that RF parts will be reusable between the technologies and between 5.2, 5.7, and 5.8)
(33-1-27) …… break out of positive responding ETSI 9/ IEEE 24

Those interested to support 802.11MAC / 5GHz devices permitted in Europe if a common modem agreed?
(19-5-) …… break out of positive responding ETSI 3/ IEEE 16

Those interested to support 802.11MAC / 5GHz devices permitted in Europe if a coexistence rules agreed to?
(38-1-) …… break out of positive responding ETSI 18 / IEEE 20

Those willing to participate in a task force for cooperation?
(18- -) …… break out of positive responding ETSI 7 IEEE 11

meeting adjourned at 12:25
(end of joint ETSI/IEEE meeting)

meeting reconvened at 1:30 (IEEE only)

Presentation by Hitoshi Takanashi (NTT Wireless)
"Estimation of hardware size and power consumption for FFT Circuit used in OFDM design"

Hitoshi comments that a 3 tap LMSE equalizer that they studied was not enough to provide reasonable operation in indoor environment

paper summary:
the number of multipliers used in the FFT design has the most impact on current consumption
the FFT design shown in the paper is estimated to be 32 times faster than conventional FFT and will consume less power.

Different design tradeoffs (regarding degree of parallelism) compared.

NTT paper estimates 155Kgates and 88.6mW will be needed to perform the conventional FFT operation and 84Kgates and 75mW will be needed for the loop-type FFT circuit

OFDM modulation items to consider: AFC and frequency error sensitivity, clock timing error sensitivity, preamble length, guard interval (multipath delay), backoff

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John Fakatselis announced that the TGB technical papers will be presented Thu AM and Thu evening
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presentation by Jan Boer (Lucent Technologies)
presented to BRAN group as temporary document 62, 802.11 doc # 97/92
title is "Scaleable OFDM radio parameters"

Jan B "point of paper is the excellent scaleable opportunities within OFDM"
FFT size = number of subcarriers
therefore, doubling the number of subcarriers does not mean doubling of circuit complexity
Guard Time is needed to cope with delay spread so that you can comprehend ?full periods?
rule of thumb is that guard time needs to be twice the delay spread
clock rate is scaleable - doubling clock rate = double data rate
coding is essential for OFDM, choice of code provides for scalability
bit rate / constellation size is scaleable QPSK to QAM
Window timing is affected by guard time and roll-off which have many parameters involved in setting

the paper presents examples of how tradeoffs can be applied to achieve an operational warehouse system which has a delay spread of 200ns. and an indoor/outdoor model assuming a 500ns delay spread and directional antennas

question asked as to how is the model / delay spread affected by Doppler effects (moving objects).
Jan says that the model is without Doppler and he does not have data available

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Jim McDonald is working with WinForum (and NTIA, FCC) about UNII-band devices
The government has radar devices that may interfere with UNII devices so they are worried that complaints will cause the government to shut these facilities down. As a result, the government wants UNII devices to have enough dynamic range to absorb these radar signals.

The main circuit that is affected is the AGC, which must be designed to be fast attack, fast decay
the radar signals would have about 1usec (0.1 % duty cycle pulse) of interference probably causing a single packet loss, if this is not acceptable error correction coding will be required

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Vic Hayes summarizes the results of the polls taken in the joint meeting and gives a break down of ETSI vs. 802.11 voting (Total 84 persons, ETSI 48, IEEE 36; on the left: ETSI 38, IEEE 4; on the right: ETSI 10, IEEE 32)

Question	Total	Left Side (ETSI?)	Right side (IEEE?)
Those interested in cooperation to reach coexistence (between 802.11 MAC/5 GHz and HIPERLAN type 2)	64 y 74%	27 y 66%	35 y 84%
Those interested to define in cooperation a common baseband modem and signal processing between 802.11 MAC/5 GHz PHY and HIPERLAN type 2	33y-1n-27a 40%	9y-0n 29%	24y-1n 53%
Those interested to support 802.11 MAC/5 GHz devices permitted in Europe if common modem agreed	19y-5n 23%	3y-4n 6%	16y-1n 44%
Those interested to support 802.11 MAC/5 GHz devices permitted in Europe if coexistence agreed	38y-1n 45%	18y-0n 42%	20y-1n 50%

Those willing to participate in Task Force cooperation (assumes company sponsorship)	18y	7y	11y

Carl Andren says that the current rules are such that ONLY HIPERLAN 1 can be used in the 5.2 GHz band in Europe which means that if HIPERLAN 2 is to be in the same band the rules will have to change.

Jerry Lorraine clarifies to say that other systems (such as satellite) also have primary access to that band as well. HIPERLAN 1 is currently the only data system allowed in the band. HIPERLAN 2 will have to petition for frequency and they can ask CEPT for a particular band, however, in reality they are told where their frequency allocation will be.

The same situation is nearly reciprocal in that the FCC rules specify CSMA systems. There are three classes of HIPERLAN 1 and all will likely require some (minimal) modification in order to pass UNII and FCC rules. HIPERLAN 1 MAC will not work well in the presence of 802.11. HIPERLAN 1 is CSMA/CD by using a priority resolution/reservation scheme by sending a high energy pulse to identify the priority level of data pending.

Simon Black reminds us that HIPERLAN 2 frequencies do not yet exist and that there is a possibility the CEPT does not grant additional frequency as the current band for HIPERLAN 1 is scantily used. Should they not get additional / different frequency, they may take look designing these second generation systems more closely to HIPERLAN 1

Naftali asks after all this discussion, what advise can we give to the 802.11 executive members, to go forward to ETSI at this evening' meeting.
-urge for more information on the HIPERLAN standards (Vic will make HIPERLAN 1 standard available on ftp)
-more dialogue exchanged between the two organizations
-Vic reminds that IEEE is international as 8802 standard this may provide a path to go the CEPT and ask for our own frequency in Europe
-Cherry Tom reminds that the FCC is a primary lobbying group that should be used with the World Radio Group and perhaps Congress to apply some pressure as well

Dean asks for a straw poll
How many are interested in cooperation with ETSI at large if
(a) ETSI will endorse acceptance of 802.11 with 5 GHz PHY in Europe
    or
(b) if they will not endorse acceptance of 802.11 with 5GHz PHY?

results: …..
(a)=(30,0,7)
(b)=(6,10,16)

Jeff Ambramowitz (3Com) ??clarification is that are we willing to do market sharing if ETSI is willing to do spectrum sharing??

Naftali asks for a tally of:
European companies which are 802.11 members and not ETSI members = 2
Companies (who may have subsidiaries/parents who are ETSI members) which are members of both ETSI and 802.11 = 8

How many companies will support a petition to CEPT for 802.11 inclusion in the 5.x GHz band = (19,0)

Motion 3:

Motion (Jeff Ambramowitz / Jan Boer) to establish a task force with ETSI to explore the possibilities of technology sharing between HIPERLAN type 2 and 802.11 MAC / 5 GHz PHY, meet via email/teleconference/face-to-face and report to the two groups what is possible by November 1997.

Motion 3 passes (15-0-2)

Naftali volunteers to initiate the discussions (Dave Fisher, Jan Boer, Ronald Brockmann volunteer to participate - membership approved by consent)

Motion 4:
Motion (Carl Andren / Keith Amundsen) to Allow Vic Hayes to initiate an email within 802.11 to initiate a petition to CEPT to ask for frequency in the 5.x GHz band.

Simon Black points that this motion would "royally piss ETSI off" by going over their head and that CEPT would like not accept it as the 802.11 committee does not have any clout with the European community.

Motion 5:
Motion (Keith Amundsen / Roy Sebring) to postpone until after the PMC meeting tonight

Motion 5 passes (14-0-1)

adjourn at 5:05

Thursday 11Sep97

reconvene 8:35

Naftali & Dean informs results of last nights executive meeting with the BRAN executives
-nothing much will happen, we will simply report
-Jan Kruys is very much for liaison, however, many members are not committed to cooperation
-ETSI members say that if 802.11 WLAN units sell by the truckloads and HIPERLAN 1 units do not, that the 5.2 GHz will realign
-ETSI members ARE interested in coexistence in the United States (in order to gain additional market for themselves)
-ETSI members have agreed to meet with the 'volunteer members' of liaison group. Vic suggests that time be created today to review the terms of reference of the liaison group.

Technical Presentation by John Cafarella (Micrilor)
"Selection of 5-GHz Modulation", document 97/83

says that there will be some overlap between this presentation and the one presented in TGB, so many details will be discussed for that paper

Microlor uses subelements of Walsh functions aligned with the symbol times

desired attributes for 5Ghz signaling: high data rate, low frame overhead, non-coherent recovery
discusses differences between power efficient and bandwidth efficient waveforms

Presentation by Jan Boer

"U-NII Band Channelization and the WinForum SRDC"
ETSI BRAN temporary document 60
802.11 document # 97/80
the paper presents a proposal for fixed frequency allocation, guard band calculations, discusses the SRDC
operations and involvement with FCC

Review tasks of liaison to ETSI BRAN

return to return to Motion 4 which was postponed until after the PMC meeting:
Motion 4:
Motion (Carl Andren / Keith Amundsen) to Allow Vic Hayes to initiate an email within 802.11 to initiate a
petition to CEPT to ask for frequency in the 5.x GHz band.

additional discussion
"If ETSI is not supportive of our efforts, but interested in increasing their markets, why should we continue with
collaboration?"
Dean points that there are companies who will be (possibly) creating both products and would have a desire to
make the products coexist and/or be able to reuse development efforts.

discussion to re-postpone the motion until after the task force meeting tonight 11Sep97.

> **Motion 6**:
> Motion (Roy Sebring / Vic Hayes) to postpone motion 4 until Friday morning after the task force meeting
> tonight 11Sep97.
>
> **Motion 6 passes (18-0-0)**

Motion 7:
**Motion (Vic Hayes / Roy Sebring) to expand the terms of reference of the Task Force (Naftali, Jan, Dave,
Ron) to include technology sharing, spectrum sharing and cooperation.**
                                                            motion 7 passes (13-0-3)

discussion of the 5 criteria for the PAR
Naftali offers additional text to strengthen the 'broad market potential' section and to strengthen the distinct
identity of the 5GHz PHY versus 2.4GHz PHYs

final text provided in Naftali document submission 97/88

meeting adjourned 12:30

Meeting minutes for Task Group A, 9/12/1997
Chair: Naftali Chayat
Secretary: Carl Andren, as Mike Trompower is not available

Report on last night's meeting with ETSI. Report will be prepared by Naftali.
ETSI would like to share RF expertise, but not spectrum
Lessons learned from HIPERLAN I:
* Long preamble for antenna diversity and non optimal equalizer training

- OFDM more sensitive to carrier phase noise than single carrier
- the crossover point between OFDM and GMSK is about 20 MBps

An argument as to whether the 5 GHz PAR is redundant to HIPERLAN I was revisited. A revision to the Five criteria was undertaken to make sure that the PAR shows uniqueness for the PAR. Discussed the testing and whether or not to have a conformance testing PAR. No interest was expressed in such a PAR.   Naftali discussed the reliability of the system in terms of lack of microwave oven interference and the availability of more bandwidth. Jim M. argued that we might only use the middle band whereas John C. said that there is 300 MHz available.

Need new words for a distinct identity.   We need to differentiate from HIPERLAN I.

- Extend 802.11 MAC, which has existence proof, to 5 GHz
- ISO compatible

"The PHY layer to be developed in this project leverages the 802.11 MAC protocol which has been commercially implemented and is readily known and available from a broad number of vendors. The only project with a similar scope (a high speed wireless LAN) is the ETSI project HIPERLAN type 1. HIPERLAN I products are believed to be in development but no deployment has occurred yet.

The proposed PHY will extend the 802.11 standard which has already achieved the status of a draft ISO standard "

Patrick K... initiated a discussion of whether or not we will consider PHY compatibility with HIPERLAN I. We do not want to commit to the PHY technology yet.

Motion 8 Roy /John F. moved to accept the 5 criteria as written and wordsmithed in the meeting.

                                                    Motion 8 passes (11/1/1)

Vic will put this on an 802.11 letter ballot.

Basis for Comparison

Discussion on multipath modeling. Naftali suggests a Raleigh fading channel with exponentially decaying multipath power.   John C. suggests that the Raleigh channel is for narrowband not wideband.   Jerry suggests a model with a small number of scatterers (4 to 5). Naftali suggests that the model should be scaleable in terms of delay spread.   Jim M. says it is premature to specify the model at this meeting.   Naftali wants to have papers at the Nov meeting on models. John C. says the statistics go from Raleigh to log normal as the bandwidth goes up. Diffuse multipath versus specular was discussed by John C.   John C. says that he uses an exponential fall off with specular multipath.

Naftali suggests a baseline model for generating a randomly chosen channel impulse response. The method is based on equispaced coefficients (an FIR model), each coefficient being complex with independently generated Gaussian components, with average power of the coefficients decaying exponentially in time. The sampling rate should be fast relatively to symbol rate (or chip rate) at least by a factor of four.

Dean K, suggests that the shortest path is the largest one. John C. says that this is right in the average. John C. says his objections to Raleigh is the exaggeration for SNR. John C. says that his not representative of what he has seen.

Naftali asked for a straw poll to have a trial model established at this meeting, with it's applicability to early analysis.

Naftali's model	0
Same plus additional models brought in Nov	10
Wait for Nov.	5

Naftali will e-mail a document by Thurs on this model.

Tabled motion to go to CEPT was revisited and amended.

Carl/Keith: To allow Vic Hayes to initiate an e-mail ballot within 802.11 "to initiate a petition (to CEPT?) through the FCC or ANSI for type certification for 802.11 type devices for operation in the 5 GHz band in Europe."

Jeff . Suggests that this would piss off ETSI and the product is vague.
Jerry L. Says CEPT is called something else now.
Keith says: We have been open with them
Dean K. says that CEPT usually gives bandwidth for purposes rather than for specific hardware.
Jeff says that we have not fully worked the ETSI/BRAN
Dean said that BRAN officers were willing to work together for coexistence for 802.11 devices in Europe, but other members are strongly resistant.
Jeff said this is a bad approach.
Leo said that we should instead ask CEPT for advice, likewise for ETSI. We need a bargaining tool.
Harry said that there were a couple of major players in Europe investing heavily that would not willing to share the band.
Dean suggests that if we preempt the market, this would be a great bargaining tool
Jim said our PAR would be weakened by not having European spectrum
Vic said we managed to get 2.4 GHz in Europe by having some companies do the petitioning effort. Try to get your company to start petitioning
motion failed: 0/9/4

Cherry: Will the FCC be informed about our project and our concerns. We should have a dialog with them about allowing NII devices in Europe.
Vic suggests that we copy the FCC on our reports. Dean will prepare stuff for inclusion with the letter ballot by tue.

Discussion of Goals for next meeting
- Review submissions
- criteria and requirements
- HIPERLAN I tutorial Tue Eve)
- Attend Mon eve tutorial of HIPERLAN to 802
- all serial meetings
- Monday morning meeting
- no Fri meetings, evenings optional (or prolonged afternoon sessions)

Joint 802.11 meeting
Vic Hayes Chair
- Passed out tokens of appreciation to Raj

Appendix 1
Attendance list

First name	Last name	status	Company	Communications
Mr. Jeff	Abramowitz	**voter**	3Com Corporation	+1 408 764 5974 jeff_abramowitz@3mail.3com.com
Mr. Keith B.	Amundsen	**voter**	Raytheon Company	+1 508 470 9483 keith_b_amundsen@raytheon.com
Mr. Carl F.	Andren	**voter**	HARRIS Corporation	+1 407 724 7535 candren@harris.com
Mr. Jan	Boer	**voter**	Lucent Technologies WCND	+31 30 609 7483 janboer@lucent.com
Mr. Ronald	Brockmann	**voter**	No Wires Needed B.V.	+31 30 228 1245 ronald.brockmann@nwn.nl
Dr. John H.	Cafarella		Micrilor Inc.	+1 617 246 0103 johncafarella@worldnet.att.net
Mr. Naftali	Chayat	**voter**	BreezeCom	+972 3 645 6262 naftalic@breezecom.co.il
Mr. John	Fakatselis	**voter**	HARRIS Corporation	+1 407 729 4733 jfakat01@harris.com
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Mr. Dean M.	Kawaguchi	**voter**	Symbol Technologies Inc.	+1 408 369 2629 deank@psd.symbol.com
Mr. Patrick	Kinney		Norand Corporation	+1 319 369 3593 kinneypw@norand.com
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Mr. Colin	Nayler		AMD	+1 408 749 5884 colin.nayler@amd.com

Appendix 1
Attendance list

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Mr. William	Roberts	**voter**	American Microsystems Inc.	+1 208 233 4690 x6514 wroberts@poci.amis.com
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