Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Minutes of IEEE 802.16 Task Group 4 for 802.16 Session #11.5**
Date Submitted	**2001-02-26**
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Re:	IEEE 802.16 TG4 Session #11.5
Purpose	This document records the minutes of 802.16 Task Group 4 meetings held during Session #11.5.
Notice	To record the decisions of the Task Group.
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802.16 TG4 Minutes of Session #11.5

San Jose Hyatt/Woodside 1 Meeting Room

2001/02/15

Chair Durga Satapathy called the meeting to order at 8:30 AM

Mika Kassin informed Durga that although 27 people registered, 37 people were expected.

Durga presented a preliminary agenda:

- The WirelessHUMAN standard will utilize or modify applicable elements from the following:
  MAC: 802.16
  PHY: 802.11a; HIPERLAN/2
- The standard enables access to data, video, and voice services with quality of service in unlicensed bands designated for public network access. It will focus on the 5-6 GHz range and may be applied to unlicensed bands between 2 and 11 GHz.

Thursday February 15th

TG4 MAC Team Objectives

- Identify limits of material to be considered for discussions during this session.
- Start with proposals that contain components agreed to by TG1 and TG3 in Ottawa
- Produce merged proposals
- 8:00 - 9:00 Joint MAC/PHY Session - Agenda Review
- 9:00 — 10:00 MAC ARQ Documents Review/Discussion
- 10:00 - 10:15 Break
- 10:15 — 12:00 MAC ARQ Document Creation/Modification
- 12:00 — 1:00 Lunch Break
- 1:00 — 2:00 MAC Map Flexibility Documents Review/Discussion
- 2:00 - 3:00 MAC Map Flexibility Document Creation/Modification
- 3:00 - 3:10 Break
- 3:10 — 3:40 MAC DFS Documents Review/Discussion
- 3:40 — 5:30 MAC DFS Document Creation/Modification
- 5:30 — 7:00 Dinner Break
- 7:00 — 7:30 MAC TPC Documents Review/Discussion
- 7:30 — 9:00+ MAC TPC Document Creation/Modification

TG4 PHY Team Objectives

- Identify limits of material to be considered for discussions during this session.
- Produce merged proposals

- Coordinate with other teams, TG4 MAC, TG1, TG3
- 8:00 - 9:00 Joint MAC/PHY Session - Agenda Review
- 9:00 — 10:00 PHY Baseline 802.11a Review/Discussion
- 10:00 - 10:15 Break
- 10:15 — 12:00 PHY Baseline 802.11a Creation
- 12:00 — 1:00 Lunch Break
- 1:00 — 2:00 Optional OFDMA 802.11a Functionality Discussion
- 2:00 - 3:00 Optional OFDMA 802.11a Functionality Creation
- 3:00 - 3:10 Break
- 3:10 — 3:40 Frequency planning, Cellular/Sectorization Discussion
- 3:40 — 5:30 Frequency planning, Cellular/Sectorization Document Creation
- 5:30 — 7:00 Dinner Break
- 7:00 — 7:30 Adaptive antenna Review
- 7:30 — 9:00+ Adaptive antenna Document Creation/Modification

Friday February 16th

TG4 MAC Team Objectives

- 8:00 - 8:30 Joint MAC/PHY Session
- 8:30 — 9:00 Adaptive Modulation Documents Review
- 9:00 - 10:00 MAC Adaptive Modulation Document Creation
- 10:00 - 10:15 Break
- 10:15 — 11:00 MAC Adaptive Modulation Document Creation
- 11:00 - 12:00 MAC Ranging Documents Review
- 12:00 — 1:00 Lunch Break
- 1:00 — 2:30 MAC Ranging Document Creation/Modification
- 2:30 — 3:00 MAC Mesh Topology Option Documents Review
- 3:00 — 3:10 Break
- 3:10 — 4:30 MAC Mesh Topology Option Document Creation
- 4:30— 5:30 Joint Session
- 5:30 Adjourn

TG4 PHY Team Objectives

- 8:00 - 8:30 Joint MAC/PHY Session
- 8:30 — 9:00 Interference Mitigation Documents Review
- 9:00 - 10:00 Interference Mitigation Documents Creation
- 10:00 - 10:15 Break
- 10:15 — 11:00 Interference Mitigation Documents Creation
- 11:15 - 12:00 PHY Mesh Topology Option Documents Review
- 12:00 — 1:00 Lunch Break
- 1:00 — 2:30 PHY Mesh Topology Option Documents Creation
- 2:30 — 3:00 PHY Other Options Documents Review
- 3:00 — 3:10 Break
- 3:10 — 4:30 PHY Other Options Document Creation
- 4:30— 5:30 Joint Session

- 5:30 Adjourn

Durga instructed the attendees that Ken Peirce would moderate the MAC session and Sanjay Moghe would moderate the PHY session.

Agenda was unanimously approved as presented. There were 6 802.16 voting members present.

MAC Team Report Thursday 2/15/01
Team composition: 4 802.16 voting members (VM), 7 non-voting members(NVM)

Topic: ARQ

The team discussed ARQ strategies and decided the following:
Multiple ARQ algorithms should be available. The specific algorithm to use would be negotiable.(VM: passed 2-1 1Ab, NVM: 4-2)
The two ARQ algorithms currently being investigated are go-back-n and selective-repeat with cumulative acknowledgements.
Window size will be a negotiable ARQ parameter (unanimous)
Retries count will be a negotiable ARQ parameter (unanimous
ARQ timeout will be a negotiable ARQ parameter (unanimous)
The unit of transmission and retransmission will be the MAC layer PDU (unanimous)

Issues unresolved:
1) The method of characterizing and MPDU is unresolved. Both the byte offset and MPDU serial number approach will be detailed in the straw man proposal with comment process used to decide between these methods.

Tasks: Subir Verma will provide straw man text for go-back-n and byte offset. Subbu Ponnuswamy will provide the same for selective-repeat and MPDU serial numbers.

Topic: MAP Flexibility

The team discussed possible MAP changes and decided the following:

1) Changes are required from the TG1 MAC map.(VM: 2-0 1Ab, NVM:4-0 1Ab)

Issues unresolved:
1) The manner in which the MAP should be modified was not decided.

Tasks: Subir Verma and Mika Kassin will talk with the PHY team and create appropriate text for the straw man proposal.

Topic: Dynamic Frequency Selection

The team discussed DFS and decided the following:

1) Three new MAC messages will likely be required:
   a) DFS Report Request, DFS Report Response and an RF Management message

Issues unresolved:
1) The integrated operation of these messages and the manner in which they can be used control frequency selection and assist in avoiding coexistence conflicts.

Tasks: John Sydor and Mika Kassin will talk will work to and create appropriate text for the straw man proposal.

Topic: Power Control

The team discussed power control and decided the following:

1) Power concerns include not only the BS — SS relationship, but also those between BS and BS (coexistence).
2) A power control mechanism must be more agile for TG4 than it is for TG1.
3) Mika Kassin will report on activity in 802.11H as they are currently looking at the same issues.

Issues unresolved:
1) Identity of modifications necessary to the TG1 MAC mechanism for power control in TG4.

Tasks: John Sydor and Mika Kassin will investigate this issue and provide appropriate text for the straw man proposal.

Topic: Adaptive Modulation

The team discussed power control and decided the following:

1) The TG1 specification deals with AM with the exception of ARQ. In other words, how do we retransmit an MPDU when the modulation density has changed?

Issues unresolved:
1) Identity of modifications necessary to the TG1 MAC AM mechanism for ARQ in TG4.

Tasks: Subbu Ponnuswamy, Subir Verma and Radu Selea will investigate this issue and provide appropriate text for the straw man proposal.

Topic: Ranging and Frame Synchronization

The team discussed power control and decided the following:

1) Single frequency ranging MAC mechanism in TG1 MAC may require modification for TG4.

Issues unresolved:

1) Identity of modifications necessary to the TG1 MAC mechanism for ranging in TG4.

Tasks: John Sydor. Radu Selea and Mika Kassin will investigate this issue and provide appropriate text for the straw man proposal.

Topic: Mesh Topology Option

The team discussed mesh topology and decided the following:

1) Mika Kassin would be responsible for reformatting the Mesh Topology Contribution from Session 11.

Tasks: Mika Kasslin will provide appropriate text for the straw man proposal.

All task teams will work on their components of the straw man proposal today/tonight and Friday. All text is due to be sent to Ken Peirce for synthesis by 2/23/01. Ken Peirce will post the straw man as a TG4 working document by 3/1/01. A subsequent call for comments by the working group will be made. These comments will be addressed at the Session 12 meeting.

Friday February 26, 2001

Durga called the meeting to order at 8:10 AM.

MAC Report given by Ken Peirce

PHY report given by Brian Kiernan

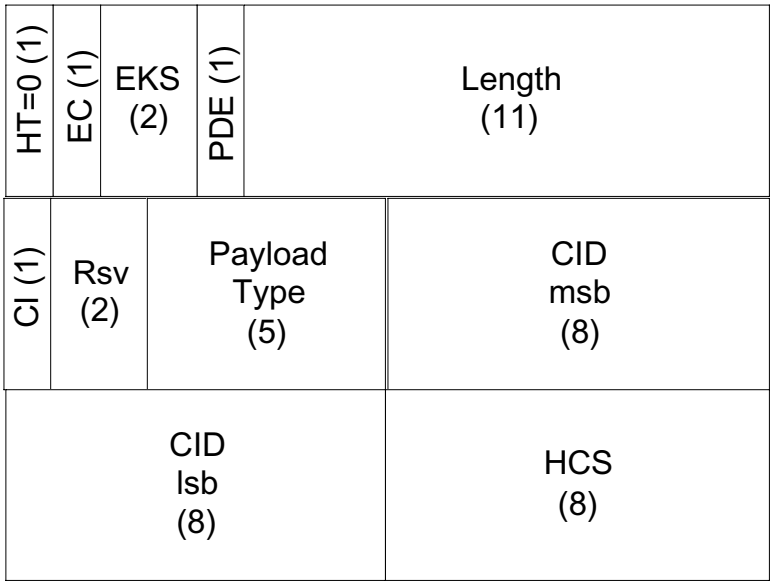
Groups split again at 8:45AM

MAC Team Report Friday 2/16/01
Team composition: 4 802.16 voting members (VM), 7 non-voting members (NVM)

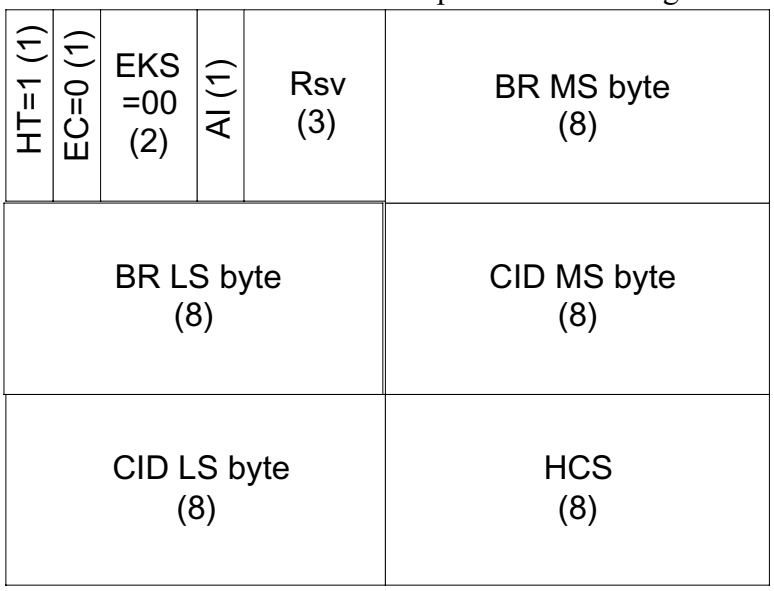
Topic: TG1 MAC Generic Header Format changes

The team discussed the issue of proposed changes in the TG1 GH to accommodate TG4 specifically:

1) The Type field that was identified as necessary for TG3 and TG4 MAC development flexibility in Session #11 will be addressed in a comment to the TG1 letter ballot prior to Session #12.
2) The format of the proposed GH is as follows:



The format for the Bandwidth Request MAC message would be:



The rearranging of the fields, in addition to the creation of a Type field, allows for 2 important improvements:

1) The size of the GH and BRQ headers are both 6 bytes and the first, fourth, fifth and sixth octets are consistent between the two formats.
2) The GH for data packets has been reduced to only 6 octets, thereby reducing overhead by 14 percent. This is very important for applications like VoIP.

Interest was expressed in using the three reserved bits in the Bandwidth Request as a type field.

Tasks: TG4 members will assist Ken Stanwood in submitting a comment to the TG1 letter ballot.

Topic: MAP Flexibility

The team discussed possible MAP changes with Ken Stanwood and decided the following:

1) The current TG1 (r2001) upstream MAP Information Element (IE) has an escape value of 15 in the IUC field. This will be used to indicate the presence of additional IE information. The additional information will include a type field to enable the accommodation of many alternate formats.
2) The current TG1 (r2001) downstream MAP element has some reserved bit fields that could be used as an escape mechanism. A TG4 comment will need to be submitted to the TG1 letter ballot to requisition the necessary bit field.

Issues unresolved:
1) The exact syntax of the type field and additional map information was not determined.
2) Tasks: TG4 members are encouraged to submit text for the straw man on this subject.

Topic: Standard Options Management

The team discussed the issue of interoperability in the face of alternative options in the standard and decided the following:

1) The group will consider creating a profile mechanism that defines sets of logically occurring options that will permit rapid identification of implementation interoperability issues.

Issues unresolved:

1) The exact syntax of the type field and additional map information was not determined.

Tasks: TG4 members are encouraged to submit text for the straw man on this subject.

Miscellaneous Issues:

1) TG4 should provide suggestions to TG3 for ARQ in order to minimize the differences between the two standards (e.g. algorithms required to be implemented etc.).
2) Do we need to have a default algorithm for ARQ, or is profile mechanism sufficient to avoid two ARQ supporting vendors who do not support the same ARQ algorithm?

At 10 AM, Ken Peirce broke up the MAC team meeting and asked the task teams to work on their respective responsibilities and to take advantage of Ken Stanwood s presence in understanding the TG1 approach to various issues.

John Sydor asked the MAC team to consider an additional topology option. Ken Peirce asked John to submit straw man text for this option to the MAC reflector.

PHY Team Report Thursday 2/15/01

Sanjay Moghe chaired the PHY session and called the meeting to order. He explained the process of how we would work over next few days. Objective is to discuss and reach consensus on PHY issues. We would then create text describing the PHY and get comments from TG4 participants at the next meeting. We would follow the broad guidelines outlined in the PAR describing the WirelessHUMAN activities. We would discusses each of the items related to the PHY activity as described in the agenda approved previously. We would discuss each topic and see if there is consensus and if there is consensus we would write down the items we agreed on. Areas involving strong differences may require further discussion. Sanjay described the consensus reached on items discussed in the previous session (Session #11) attended by about 12 people. These items are described below: Sanjay asked Sarca Octavian to describe these items in more detail to the group especially for people who were not present last time.

Proposed Baseline Functionality
Handling 802.11a-like frames
Same, with shortened preamble
Same, without SIGNAL field
Same, with concatenated payloads
With/without midambles between payload
With/without SIGNAL preceding each payload
Same channelization as 802.11a
Applies both to 5.3 and 5.7 bands
Capable of power ctrl (CPE and BS)
Channel assessment mechanism (CCA, DFS)

Proposed Optional Functionality (1)
Subcarrier based parallel polling
DBPSK (over time) rather than OOK for robustness/few-bit messages?
Using several subcarriers at different frequencies for diversity.

Proposed Optional Functionality (2)
Supporting 256-pt FFT mode
216 subcarriers: 208 data, 8 pilots
Same GI as basic 802.11a
Used in conjunction with standard 802.11a preambles
Implies 0.8 microsecond scheduling raster rather than 4 microseconds

Proposed Optional Functionality (3)
Narrower channels
10 MHz, suggested grid 10*n MHz from the edge
9 channels
5 MHz, suggested grid 5*n MHz from the edge
19 channels

Proposed Optional Functionality (4)
Frequency Agility
Interference mitigation
Dynamic DFS
Per-frame hopping
open loop DFS
Means for intra-BS and inter-BS sync
Otherwise sectors blind sectors

Proposed Optional Functionality (5)
Smart antenna support?
MAC issue?
Is there anything to be done in the PHY to support it?

At this session the attendance was larger than at the previous PHY session and some of the items were discussed in more detail and modified from the last meeting.

The following preliminary outline of the PHY layer specification was created by the group after significant discussion. A person or a group of individuals were also identified who would create the text related to these items before the next meeting. Their names are listed at the end of each item. It was also agreed that we would spend more time at this meeting on the key technical issues ahead of us rather than create the text for the Introduction, scope, and other similar paragraphs which could be done later. Most of the time over two days was spent on discussing and reaching consensus on Physical Medium Dependent (PMD) operating specifications. The section below shows the outline of the OFDM physical layer specification and the consensus reached on items discussed.

1. OFDM physical layer specification for the Unlicensed band below 11 GHz with focus on 5-6 GHz band

1.1 Introduction
1.1.1 Scope
1.1.2 OFDM physical layer functions

1.2 OFDM / OFDMA PHY specific service parameter lists
1.2.1 Introduction
1.2.2 TXVECTOR parameters
1.2.3 RXVECTOR parameters

1.3 OFDM physcial layer convergence procedure sublayer
1.3.1 Introduction
1.3.2 Physical layer convergenc procedure (PLCP) frame format
1.3.3 PLCP preamble (SYNC)
1.3.4 Signal field (SIGNAL)
1.3.5 DATA field
1.3.6 Clear channel assessment (CCA)
1.3.7 PLCP data modulation and modulation rate change
1.3.8 Physical Medium Dependent (PMD) Operating specifications general

Channel bandwidth ? 5, 10, 20 MHz needs discuss further (Nico)

Access Method — TDMA with 256 FFT (64 optional) or OFDMA with 1K — more detail required (Zion)

granularity of 64 sub carriers that are divided like 11a 48 sub carriers for data, 5 for pilot, and 11 for the guard band (Zion)

Delay spread up to 3.2 micro sec, for 1K, 0.8 micro sec for 256, (Zion)

guard interval= 1/32, 1/16, 1/8, _, (Zion)

Dynamic Adaptive Modulation scheme — BPSK, QPSK, 16 QAM, 64 QAM (option) (Zion/Octavian))

Eg. Adaptive user by user as required by QOS and channel quality (Zion/Octavian))

Coding rate — _, 2/3, _ (adaptive with modulation scheme) (Octavian)

Coding + interleaving — ,— Convolutional (Octavian), Reed Soloman+ convolutional (Zion), Turbo (TJ Shan), - further discussionInterleaving -1/8 of subcarrier corrupted and AWGN simulations

APC dynamic range — more than 45 dB in the up link, more than 30 dB in down link (Zion)

Time ranging - 30 % of guard interval, maximum range the system willl support is 60 micro sec. Round trip delay, time between initial ranging TBD (Mika)

Subcarrier based parallel polling — (Zion/Octavian) further discussion

Scrambler — Same as 802.11a (Zion)

Dynamic Frequency Selection — Upper Layer dependent (to be addressed with MAC) — need for a quiet period — measuring mechanism and criteria — switching speed — (Mika) further discussion

Base Station sync and coordination mechanisms (frame) — (Octavian/Ken) further discussion

Smart Antenna Support — should not be precluded — PHY Specific Reqmnts are TBD — (TJ Shan)Preamble —Dnlink: Each MAC frame has a preamble; Uplink: User burst has a preamble; (there are pilot carriers within each OFDM symbol) (Zion 1k/Octavian for 64/TJ Shan for 256)Synchronization: The Tx center frequency and the symbol clock frequency shall be derived from the same reference oscillator. SS syncs with the BS both in clock and center frequency, and adopt BS clock for frequency & data sync (Octavian)

Basestation accuracy: Need Discussion; suggested values: +/- 5 ppm; +/- 20 ppm (Zion)

Spectrum Mask: optimization of the 802.11a mask should be addressed as a function of the carriers and the transmit power should comply with FCC and other regulatory rules (zion / Nico)

Interference mitigation : use directional antenna in the vertical and horizontal direction, describe antenna pattern, interference to other systems in this band including intra system, and interference mitigation with OFDMA (Demos,John, Sanjay)

1.3.9 PMD transmit specifications
1.3.10 PMD receiver specifications
1.3.11 PLCP transmit procedure
1.3.12 PLCP receive procedure

1.4 OFDM physical layer management entity (PLME)
1.4.1 PLME_SAP sublayer management primitives
1.4.2 OFDM physcial layer management information base
1.4.3 OFDM TXTIME calculation
1.4.4 OFDM PHY characteristics

1.5 OFDM physical medium dependent sublayer
1.5.1 Scope and field of application
1.5.2 Overview of service
1.5.3 Overview of interactions
1.5.4 Basic service and options
1.5.5 PMD_SAP detailed service specifications

It was agreed that all the authors would submit text related to their sections to Sanjay Moghe at email address (smoghe@rf-solutions.com) and Durga as soon as possible and preferably by March 6, 2001.

Session #11.5 Attendance List

Jori Arrakoski
James Brennan
James C. Chen
Skip Crilly
Hesham El-Damhougy
Vijaya K. Gallagher
Zion Hadad
Mika Kasslin
Brian G. Kiernan
Demosthenes Kostas
Minfei M. Leng
Heinz Lycklama
Kenneth L. Peirce
Subbu Ponnuswamy
Octavian Sarca
Durga P. Satapathy
Radu B. Selea
John Sydor
Michail Tassos
Nico Van Waes
Subir Varma