IEEE P802.11
Wireless LANs

IEEE 802.11 – Task Group A Minutes

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Monday 1/11/99 3:45pm

Agenda proposed by Naftali

Approve Sep 98 minutes
Comment report
Submission List
>   99/002 – Preamble issues
>   99/003 – 52 subcarriers
>   PK2Avgreduction (Ken Paterson, HP)??
>   99/019 – Improved rate signaling scheme (Breeze)
>   99/020 – Number of subcarriers in OFDM (Breeze)
>   99/xxx – interleaver with MSB/LSB alternation (Breeze)
>   99/021 – Effects of nonrectangular time window (Bob Ward)
>   99/022 – Liaison doc from MMAC (Masahiro)
>   99/023 – Comments on 802.11a draft (Masahiro)
>   98/409 – WINFORUM and unlicensed spectrum (Don Johnson)

Motion #1 by Tal Kaitz to accept the agenda.
Seconded by Hitoshi Takanoshi
Motion Passes by Acclimation

Motion #2 to accept Sep 98 minutes by Tal Kaitz
Seconded by Masahiro Morikura
Motion passes by acclimation

Report about the comments
231 comments, 123 technical, 108 editorial
>   Major issues that have been grouped by Naftali:
>>   BRAN: 52 subcarriers
>>   BRAN: Preamble with 32 pt periodicity of short preamble
>>   BRAN and MMAC: Need to agree on the supported rates
>>   Many: mandatory rates, coding rates, modulation
>>   Michael Fisher: Encoding the whole PLCP header at slow rate
>>   MIF: Change SIGANAL to increase Hamming distance
>>   DK: Alternating LSBs and MSBs in the interleaver
>>   Richard Van Neev: The SIFS duration

Many: RSSI should we specify absolute accurarcy ? align two subclauses

RW: exclude time windowing from description

Harris: Enhance CCA to account both for ED and for Carrier Sense

CT, HW: Wording on regulatory domains, channelization, powers, finalized vs unclear yet regulations

DK: Reconsider Channelization (16MHz spacing)

MW, BRAN: Deriving carrier and clock from the same ref

MOA: Adjust sensitivity reqmts

Many: Define ACI and (non-A) CI requirements

Non-contentious Issues?

Bob O'Hara: MPDU to PSDU

HM: attribute naming

Rx and Tx State machine and figures

SIGNAL is not included in CRC16 calculation

Bit order notation in header fields and in data

Many: 1.3.1.1 (mathematical conventions) clarity

Scope statement

"Preamble" notation: is SIGNAL part of it?

Editorial Comments

Interleaver forward and backward definition

Double index conversion inf OFDM modulation descrition

Fonts in figure (BO, VZ, CA)

"shall", "specifies" vs "describes" etc

The comments on the TGa draft are on the server. Vic Hayes had a technical problem with the TGa comments and everybody need to checks their comments to make sure that they are on the server or the flash card.

Proposal by Naftali to categorize the comments in a more manageable method of processing comments. Joint BRAN issues and comments will be handled in the joint meetings. There are three scheduled meetings that are joint with BRAN.

Draft Agenda for joint 802.11a /BRAN PHY meeting:

Number of subcarriers

Preamble

Modulation accuracy

Carrier and clock reference linkage

Supported rates

Peak to average reduction

Regulatory issues

TGa Announcements

Tutorial to N-WEST

Comment overview

Assignment of task forces to deal with groups of comment

COMMENT resolution sessions

Presentations relevant to comments

Approval of 2nd/recirculation ballot

Regulatory issues

Setting goals and agenda for March 99

Naftali wanted to do assignments of task forces to deal with groups of comment – Naftali developed a recommendation on separating.

One of the major topics to be discussed this week was: Which rates shall we consider mandatory?

R=1/2, Mod: QPSK, 16QAM

Rates 12Mbps, 24Mbps

There was a lot of discussion about what the rates should be, including a lot of what should be optional data rates which led to the following straw poll.

Straw poll on the mandatory and optional rates (mandatory first, optional second)

Straw Poll:
36: 0   15
24: 21   0
18: 3   16
12: 15   8
9:   1   14
6:   11   9

Harry introduced a point of order because the PAR is 20Mbps. The question, then, is: "Are we allowed to specify a rate lower than 20Mbps?"

Naftali – we have to resolve what the PAR says in order for the chair to make a ruling. We took a look at the PAR and it states that "the task group develop a high speed about 20 Mbps." Naftali's interpretation is that as long as one speed is above 20MHz is mandatory, that we have fulfilled the obligation of the PAR.

Harry then gave up the floor after Naftali made his ruling.

Motion #3: that the mandatory rates shall be 6,12, and 24 Mbps
Friendly amendment to motion #3 by Richard Paine to delay the motion until tomorrow after the joint 802.11/BRAN meeting.
Peter Ecclsine moves
Hitoshi Takanashi seconds
12/0/4

Adjourned at 5:29pm until 6pm

Monday 1/11/99 6:05pm
TGa Comment Resolution Meeting

Meeting called to order 6:05pm on 1/11/99

Hitoshi had a recommendation for 3 resolution groups 1. Editorial 2. Technical 1.3-1.3.8, and 3. Procedural (tables, transmit procedures, etc). He proposed to adjourn by 7:30 for ad hoc meetings.

Motion #4: Set adjourn time to 7:30 and schedule comment resolution meeting in 3 parallel groups 9-10:30pm
Moved by Hitochi Takanoshi
Seconded by Richard Paine
Passed 13/0/1

Group 1: Hitoshi Takaoshi chairs the editorial (Help from Steve Knudsen).
Group 2:   Naftali –technical
Group 3:   Nobody volunteered to lead group 3 which was to look at procedural, tables, transmit procedures, etc documents.

Naftali decided to change that because there were no volunteers to work with Bob O'Hara, so the third group will work with the technical group.

Starting the comments from Michael Fisher on 1.3:

His suggestion was to use a higher data rate, like twelve instead of six for the transmission of the PLCP header across the PLCP.

Richard Van Nee: rejects the idea of having a lower rate unless all the rates are mandatory. The reason for encoding the preamble that way is that it must be the most robust. All the lower rates should be mandatory.

Naftali and Richard Van Nee - Reply to the item with reject because CCA based on ED will be a sufficient replacement for the NAV.

Richard Van Nee: Make it similar to the 2Ghz

Naftali, postpone until after we find Michael Fisher to address his comments. Reject due to need to accommodate additional optional rates or schemes in the future.

Motion #5 Reject Michael Fisher's comment to utilize fourth bit of rate encoding for better error correcting capabilities due to need to accommodate additional optional rates or coding schemes in the future.
Moved by Tal Keitz
Second by Peter Escalline
13/0/1 Motion carries

Next motion: alternation LSBs and MSBs in the interleaver, delayed for Tal's input

Moved on to Richard Van Nee's comment. The numbers for slot time and SIFS are too small, these numbers are mainly dependent on processing delays in transmitter and receiver. Proactive delays for the receiver are really implementation dependent.

Adjourn at 7:33 to be called again at 9pm.

Monday 1/11/99 9pm to 10:30pm
TGa Comment Resolution Meeting

Called to order at 9:06pm

The scope clause (1.1.1) is not the place for conformance standards. "shall" is to be replaced by "is". The PHY knows nothing about MAC Protocol Data Unit (MPDUs), only PSDUs. Harry Worstell volunteered to go through the document and find out the number of places where the MPDUs were referenced and come back the next day (which he did) so we could address these comments as a whole.

(1.1.2) replace "shall" with "is".

(1.2.2) 65535 is way larger than the maximum allowed by the 802.11 MAC as currently specified (2312 data octets). The MAC will not allow such a large size and it was used in the DSSS specification. Why limit it?

(1.2.2.1)   The length parameter may take a value in the range from 1 to 65535.

(1.2.3.2) RSSI is intended to be used in a relative manner and it shall be. RSSI is intended to be used in a relative manner and shall be monotonically. Replaced by "The allowed values The **allowed values for the** Receive Signal Strength Indicator (RSSI) parameter **are in the range** from 0 through RSSI Max.
…
RSSI is intended to be used in a relative manner **and it shall be a monotonically increasing function of received power**."

There were more subjects as recorded in the TGa comments resolution document

Meeting adjourned 10:38pm.

Tuesday 1/12/99 1335
TGa

1.3.7.6 SIFS Duration. There is not much room for error in the numbers in the specification. Leave Space for inaccuracies.

Motion #6 That the parameters are changed to aRxTxTurnaround Time<2microseconds and bringing SIFS down to 14microseconds.

That the parameters are changed to

aRxTxTurnaroundTime < 2 µs

SIFS = 14 microseconds

SlotTime = CCATime+RxTxTurnaround+MACdelay +Jitter= 4+2+2+1 = 9 µs

aTxPLCPDelay : implementation dependent
aRxPLCPDelay : implementation dependent
aTxRampOnTime : implementation dependent
aTxRampOffTime : implementation dependent
aTxRFDelay : implementation dependent
aRxRFDelay : implementation dependent
Moved by Richard van Nee
Seconded by Hitoshi Takanoshi
12/0/2 motion passes

1.3.7.7 Non Rectangular Tie Windowing Analysis for IEEE 802.11 OFDM System. This presentation talks about the potential erroring caused by this rectangular windowing. This error can impact synchronization, modulation error measurements and data decoding unless mitigated. Windowed vs ideal short symbol. Observations: greater effect on shorter symbols, the examples are for QPSK. If the reference point is ambiguous, then the whole process will be thrown off and distortion will occur. Two separate equations to refer to the ideal case for this document requirement.

In the case of vanishing T the windowing function degenerates into a rectangular pulse of duration T. In implementation, higher T is typically implemented in order to smooth the transition between the consecutive subsections. This creates a small overlap of duration T transition, between them as shown in Figure 1. The transition time is about 100nsec. Smoothing the transition is required in order to deduce the spectral sidelobes of the transmitted wave form. However, the binding requirements are the spectral mask and the modular accuracy requirements. Time domain windowing, as described here, is just one way to achieve those objectives. The implementer may use other methods to achieve same goal, such as frequecy domain filtering. Therefore, the transition shape and duration of the

Motion #7 That the text be changed to reflect the comment:

Change text following equation (4) to read:
In the case of vanishing T_{TR} the windowing function degenerates into a rectangular pulse of duration T. The normative specifications of generating the transmitted waveforms shall utilize the rectangular pulse shape. In implementation, higher T_{TR} is typically implemented in order to smooth the transitions between the consecutive subsections. This creates a small overlap, of duration $T TR$, between them as shown in Figure 1. The transition time $T TR$ is about 100 nsec. Smoothing the transition is required in order to reduce the spectral sidelobes of the transmitted waveform. However, the binding requirements are the spectral mask and modulation accuracy requirements, as detailed in clauses 1.3.7.2 and 1.3.7.5. Time domain windowing, as described here, is just one way to achieve those objectives. The implementor may use other methods to achieve same goal, such as frequency domain filtering. Therefore, the transition shape and duration of the transition are informative parameters.
Moved by Richard Van Nee
Seconded by Masahiro Morikura
9/0/5 Passed

Harris comments from off-line (taking advantage of Carl being in the meeting): Enhance the CCA function. The DS PHY will give the CCA specifications. Discussion was that the CCA mechanism should not be included by Naftali. Carl came back with the need for a CCA threshhold to be specified. Accept the PAR which says that a specification of CCA threshhold is required. Naftali asked Carl if this would be acceptable.

Motion #8 To address Carl Andrens (and other's) comment regarding the CCA mechanism by rejecting the recommendation to introduce multiple modes. During the data portion of the message the

signal has no specific signature which enables "significantly better than ED" Carrier Sense. Therefore, do not complicate the CCA procedure further. **Accept the part which says that a specification of CCA threshold is required. Decide on the Threshold level during the meeting.**
Moved by: Richard Van Nee
Seconded by: Carl Andren
12/1/2

1.3.7   Class of comments: Wording on the regulatory domains, channelization, power, finalized vs unclear yet regulations. Cherry Tom wanted to include information comments about the different regulatory domains. There are a number of tables and remarks that are specific to the areas discussed-change the text. Cherry will provide the text for the document.

Motion #9 Add in 1.3.6 text on different regulatory domains. Change in the first paragraph of 1.3.6.1:
 The centers of the outermost channels **shall be** at a distance of …
to stress the normative nature of it.

Change "Note" into Informational note" in the next two paragraphs, to stress the informational nature of those.
Moved by: Cherry Tom
Seconded by: Richard Paine
5/2/6 Passes

1.3.8   Masahiro Takanoshi. Receiver minimum input level sensitivity. The sensitivity values are specified. The transmit spectrum mask threshold is presented.

Motion #10: That the sensitivity levels in 1.3.8.1 be adjusted to the values suggested in Masahiro's comment resolution paragraph.
Moved by: Masahiro Morikura
Seconded by : Tal Keitz
12/0/0 Unanimously

Rechannelization (16MHz spacing) cochannel interference. A team of RVN, Bob West, Tal Keitz, and Naftali to address the cochannel interference issues. Naftali felt that it will not be strongly influenced by the BRAN joint meetings.

Went through the issues list and on to the non-contentious issues:

NON-CONTENTIOUS ISSUES:

MPDU to PSDU has been done already by Harry Worstell..

Attribute naming from Henry Miller 1.4.2 are editorial in nature and are left to Hitoshi.

Rx and Tx state machines and figures – the fonts are the problem. Hitoshi changed the fonts.
        Need more explanation on some of the figures – Hitoshi showed

Regulatory issues in figure

Motion #11: To correct the text so that the CCITT-CRC16 of the PLCP header does NOT include in its calculation the SIGNAL field.
Moved by: Juha Heiskala
Seconded: Steve Gray
12/0/1 passes

Bit order notation in header fields and in data is a Bob O'Hara issue and he is not in attendance at the meeting. This action will be delayed until Bob can attend.

Many comments on 1.3.2 (mathematical conventions) clarify! Mathematical conversion will come after 1.3.2 and not before.

Motion #12: That for clarity reasons, the mathematical introduction (1.3.1.1-1.3.1.2) will be moved after 1.3.2 (**Physical Layer Convergence Procedure Frame Format)**
Moved by: Tal Keitz
Second: Kazuhiro Okanoue
12/0/1

"Preamble" notation: is SIGNAL (table 4 needs to be edited)

Session adjourned at 3:31

Reassemble at 3:45

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Tuesday 1/12/99 3:55
Joint Meeting with BRAN PHY
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Roll Call
Proposed Agenda for joint 802.11a – BRAN PHY meeting
        Roll call
        Number of subcarriers (48 present, proposed increase to 52)
                Ericsson+Nokia paper
                NTT – Masahiro Morikura
                BreezeCOM
                Discussion & decision
        Preamble (differences)
                Nokia+Ericsson
                Sony
                Discussion & decision
        Modulation Accuracy (conformance testing and backoff)
                Viewpoints: LT, BRAN, BreezeCOM, everybody
                Discussion and Decision
        Carrier & Clock reference Liinkage
                Review of .11a decision history
                BRAN – considerations to link
                Discussion and decision
        Peak-to-Average reduction
        Regulatory issues

Question asked by Stuart on voting procedures in a joint meeting: Naftali stated that the voting will be handled separately by the two groups under their own voting rules.

Agenda accepted at 4:10

Started into the Number of Subcarriers by

First Paper - Nokia and Ericsson (Peter Schramm)
        The impact of increasing the number of used sub-carriers on the adjacent channel interference and system throughput.
        Nokia and Ericsson – they don't think it is necessary to use sub-carriers at all.
                The 21.6 sampling rate in the paper was only used for purposes of simulation
                In both cases of 48 and 52 there is approximately 30dB of available signal
                C/I distribution is almost identical for adjacent channel interference suppression between 25dB and 30dB
                Conclusions: An increase of number of subcarriers from 48 to 52, remarkably, does not affect system performance

Masahiro presented the second paper which is "The Effect of Increasing the Number of Subcarriers on the IEEE 802.11"

His results showed that there is very little impact of increasing the number of subcarriers
1.3dB extra OBO (output back off) will be required when the 52 subcarriers system is employed
to achieve the FCC regulation of outband emisison at the lower band
0.37 dB eb/No improvement will be achieved when the 52 subcarriers system is employed.

To increase the number of subcarriers will cause about one dB degradation with 1dB less transmit power.

The third paper is Tal Keitz from BreezeCOM: Effect of Number of Subcarriers
One is 48
One is 52
Compared the two systems for performance and spectral issues
They found the same results as Masahiro
Performance under fading conditions: differences are about 1.7dB
Effects of a high power amplifier (HPA)
Very small difference in favor of the 52 subcarriers
Spectral Issues
52 outperforms the 48 subcarriers with slightly smaller input backoff (about 1dB)
Questions about the advantages of a .1 packet data error rate because this is the packet error rate that
IEEE 802.11 used.
Question about the jagged nature of the SPD curves

Pros 52 sub-carriers
- Can increase power in US
- Better C/N
- Increased delay spread tolerance
    - Improved diversity and C/N is pilots
- Performance-limited PA backoff improves

Con 52 sub-carriers
- Regulatory limited PA backoff worse
- Slightly increased ACI
- Antiliasing filter complexity
    - Digital option – slightly more complex
    - SAW IF filtering option – more complex
    - Analog BB filtering – significantly more complex
- Longer antiliasing filter impulse response

Discussion: Tal and Jamshid

Move to a Decision:

Motion #13: That the 802.11a and BRAN PHY s will be based on 52 subcarriers, of which 48 will be data carrying subcarriers and 4 will be dedicated pilot subcarriers. There was quite a bit of discussion about where the pilots will be placed. The pilots will be placed that there will be four pilots. No objection from ETSI BRAN-decision of the BRAN PHY to be 52 subcarriers
14/4/1 Motion passes

First Presentation on the Preamble A Common Preamble for HIBERLAN and IEEE – Mika Kosslin
Proposed preamble with 32 samples
The C64 section of the preamble is the same as the 802.11 preamble
The proposal is to use half symbols
Discussion – Bob Ward - use multiple quarter symbols for the preamble
RVN did some testing on the preamble. He only sees 1dB gain by trying to improve the preamble
Discussion about the merits of increasing the symbols from 16 to 32.
Most of the conversation and discussion was between Tal Keitz, Bob Ward, Richard Van Nee, Mika, and Peter Schramm
The proposal: Adopt PN Code for Synchronization

2nd presentation on the Preamble Simulation results to compare Pseudo Noise (PN) and OFDM
Sony

Very robust against most signals
31 bits long
Advantages for using PN codes for the preambles
  PN sequence for frame and packet synchronization advantageous
  Higher time resolution
  Higher detection probability in multi-path environment
  Large PN Signal generation variety using LFSR or IFFT
  Easy/fast/1 bit correlation detector
  Parallel time synch and AGC settling
The PN is meant to go in the symbol in the synchronization
General Discussion
The way that the PN presentation laid out using PN as the synchronization, there would have to be a separate PN and 32point processing mechanism.
Naftali spoke against the motion.
Mixing the suggestions will provide sufficiently strong correlation for incre.asing complexity
Peter – good compromise to do half symbols and the content does not have to be the same
Naftali – wants to make the preambles the same
Naftali agrees with periodicity of 32 instead of 16.
Conclude this preamble session with discussions to take them back to the respective groups

Naftali proposed moving the Carrier and Support Rate Issues up in the agenda
802.11 has 8 supported rates
Differences are that 27Mbps are for BRAN and 24Mbps for IEEE
How to tell each other what the rates are via the protocols
Jamshid thought we should work on the data rates
1/3 rate in BRAN is only a proposal
9/16 is related to the 54byte packet length into integers
Supported Rates
IEEE 6,9,12,18,24,36,48,54
BRAN 6,9,12,18,27,36,54
MMAC 8Mbps data rate
R=1/2,2/3,3/4,9/16,7/8
Superset of IEEE+BRAN+MMAC 6,9,12,18,24,27,36,42,48,54
Naftali wants to reduce the number of possibilities for mandatory data rates.

BPSK	R=1/2 6Mbps	R=3/4 9Mbps		
QPSK	½ 12	¾ 18		
16QAM	½ 24	9/16 27	¾ 36	7/8 42
64QAM	2/3 48	¾ 54		

Both groups benefited from the discussion. Naftali invited people to attend the experts group after 8pm.

Meeting was adjourned 8:05pm

5th Discussion - Modulation Accuracy would not occur until Thursday.

Tuesday 1/12/99 9:39pm
Comment Session Meeting

Refer to the TGa for specific comment resolutions. The following are just the more important changes resolved.

1.3.2.1   Words changed to PLCP Preamble field

1.3.2.1.12   Changes words based on new changes agreed on with BRAN

1.3.3.1 On pp 10, row 43 change "can be written as" to "shall be constructed according to the following equation"

Pp11 row 6 change: "can now be described " into "shall be generated according to the following equation."

pp11

1.3.3.11 No, decline. The normalization is important in order to have all the portions of the message, such as preamble, signaling and data OFDM symbols, and also pilot vs data subcarriers, scaled properly relative to each other.

1.3.3.2 The SERVICE field has 16 bits, which shall be denoted as MSB to LSB. The LSB shall be transmitted first in time. The 7 least significant bits of the service field which are transmitted first, are set to zeros and are used to synchronize the descramble. The remaining 9 bits of the 802.11 service field shall be reserved for future use. All 9 bits being zeros signified 802.11a device compliance. This field shall be protected by the CCITT CRC-16 frame check sequence described in clause 1.3.3.5.

The comment resolution meeting adjourned at 11:04pm.

Wednesday 1/13/99 8:40am
TGa Reconvened

The meeting came to order at 8:40am
TGa discussion on mandatory rates

Motion #14: To resume the discussion on mandatory rates and modulations
Moved by Richard Van Nee
Seconded by Peter Ecclesine

There is a motion on the floor that was tabled by a motion yesterday to make the 6,12, and 24 as mandatory data rates. The discussion started with questions about the impact of this motion on the meetings we had with BRAN yesterday. The answer is that there are optional data rates that are not in the mandatory list. There was discussion about the capabilities of 802.11 to distinguish the data rates. It was decided that

The following motion had been put on hold until the meeting with BRAN

Motion #3: That the mandatory rates will be 6,12, and 24Mbps
Motion by: Peter Escalline
Seconded by: Hitoshi Takanoshi
18/0/4 passes

Cherry still working on the regulatory domains wording in the document.

There needs to be a definition of Adjacent Channel Interference (ACI) and non-ACI requirements. Naftali wants to use the spectral mask. The discussion went to another subject that is needed to be resolved, which is the spectral mask when using the 52 subcarriers. Tal had the pictures of the graphs of both 48 and 52 subcarriers. Masahiro also had simulations of the different subcarriers. The mask needed to be modified slightly.

Motion #15 To address the Masahiro's Spectral Mask comment by modifying the mask in the following manner: Straight lines from (9MHz, 0dB), to (11MHz
Mover: Masahiro Morikura
Second: Richard van Nee
15/0/0

Deriving the carrier and clock from the same reference is an issue relative to the document as it exists. The clock and the carrier were based on whether the system was in-building or out-of-building. It was decided to wait until both groups were together to discuss the subject.

Naftali wanted to go over the comments that had to be approved by the official TGa. Last night's meeting was a comment resolution meeting and he had to get the comments approved in an official TGa meeting (this morning's). He wanted to make the comments part of the TGa go into the record so we went through each of the comments and he asked for objection. If no objections, he noted that it was accepted by TGa in the comment resolution document.

Some of the MAC people started to show up in the meeting and they could help resolve their comments. Tom T was in the meeting. He stated that the MPDU duration factor was computed incorrectly. Naftali will go back to change the computation. It was accepted.

Harry went through the document and gave a list of places where the MPDU needs to be changed to the PSDU.

The meeting was adjourned at 10:36am.

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Wednesday 1/13/99 10:55am
Ad Hoc TGa Meeting
Dover Room

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Meeting called to order at 10:55am

The subject for this meeting was the Preamble
Naftali presented the need for a longer preamble for antenna diversity – need for 64 symbols
Peter Shramm, Nokia, didn't see how the antenna diversity has a problem because the half symbol is extremely reliable.
Lots of discussion about this because this is an implementation problem (antenna diversity) that could affect specific implementations like BreezeCOM's

Meeting adjourned at 12:40 for lunch, the next meeting is Thursday morning.

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Thursday 11/13/99 8:35am
Meeting Convened by Naftali Chayat

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Report from Cherry Tom and changes to the document on regulatory domains: Spectrum allocation in the 5 GHz band is subject to authorities responsile for geographic specific regulatory.........etc. Look at the comment resolution document for exact text. She made the notes to informative notes. Thanks to Cherry for her work for the task group.

Motion #16
To accept text changes to 1.3.6.3, as prepared by Cherry Tom.
Moved by Hitoshi Takanoshi
Seconded by Richard Van Nee
14/0/6 Motion passes

Michael Fisher was in the meeting, so he presented his case about ensuring that the data rate is known for the MAC. The problem is that the multirate mechanism in the MAC will be affected by the non-mandatory rates. Determining that the MAC needs to defer to the other rate does not work. He is asking if we can provide the information in our PHY to the MAC. Naftali said that the CCA and the NAV mechanisms rely on the contents of the packet. Aneal - is there a required CCA mode to meet the requirements for the MAC. If energy detect is a requirement, then Michael's question is answered. Michael asked if we had considered an end delimiter. Naftali said that end delimiters were not popular with him and he gave some history about the decisions. Five or six people expressed interest in pursuing this further. Naftali wrote out the proposal: one OFDM symbol, encoded with BPSK, having 18 data bits and 6 trailing "0" bits, after which the data stream shall be encoded at the rate selected. Steve, Richard, Masahiro, Michael, Dean, Hitoshi, and several others.

Dean was also there, so his comment on channelization is withdrawn because of choosing the 52 sub-carriers. He wants to bring up a point about use in the European bands which is much different than in the US. In the direct sequence, they have overlapping center frequencies.

Motion #17: To add channel centers at every 5MHz between outermost channels at 20MHz from the edge in the US. The allowance to use these added channel centers shall be enabled by a new attribute in the PHY MIB whose default attribute is "false."
Moved by Dean Kawaguchi
Seconded by Peter Escalline
15/10/0 motion fails

1st Amendment: Michael amended motion 16 to add text "allowance to use these added channel centers shall be enabled by a new attribute in the PHY MIB whose default attribute is "false."
Moved by Michael Fisher
Seconded by Tim Godfrey
8/8/1

2nd Amendment: Naftali amends motion 16 to change the centers at 5MHz and to select the outermost channels at 20MHz from the edge.
Moved by Naftali
12/2/9 passes

Motion to postpone the motion until after the BRAN/IEEE 802.11 TGa meeting
Moved by Steve Grey
Seconded by Juha H.
2/23/3

Discussion on the Adjacent Channel Interference (ACI) and (non-A) CI requirements. 12 15dB, 18 11dB, 24 6dB, 48 0dB, 54 –1dB

Motion #18: To incorporate the ACI and non-A CI numbers stated in a table below into the 802.11a standard.
Moved by: Richard Van Nee
Second: Masahiro Morikura
19/0/5

Rate	ACI @N=+/-1	ACI @N>1	
6	16	32	
9	15	31	
12	13	29	
18	11	27	
24	81	24	
36	4	20	
48	0	16	
54	-1	15	

Bit order notation in header fields and in data.

The scope statement has not been updated by Hitoshi yet.

Meeting adjourned at 10:30am until 6pm for doing the interleaver session.

Thursday 11/14/99 10:48
Joint BRAN/802.11 TGa Meeting Called to Order

Agenda
> Preamble - addressed
> Supported rates - addressed
> Modulation Accuracy
> Carrier & Clock reference liinkage
> Peak-to-Average reduction
> Regulatory issues

Naftali gave a synopsis about yesterday's meeting. The meetings yesterday covered the preamble and some about supported rates.

The result of the meeting was that we should not change our respective preambles.
TGa will submit the IEEE 802.11 TGa preamble as a candidate for the BRAN preamble.

The supported rates will remain the same with the stipulation that 802.11 has selected 6, 12, and 24 as the mandatory data rates.

The subject of modulation accuracy was opened by Richard Van Nee who said that the restrictions are far too stringent and should be reduced by 8dB each. (comment 1.3.7.6)

Peter Schramm presented some evidence to support Richard's position and Masahiro also had evidence to support.

Regulatory Issues

Jan Kruys
Proposal to the CEPT for extension of the HIPERLAN2. They had 655MHz that could be shared with meteorological radars, satellite, etc. The number of devices would be spread and their impact therefore reduced. With dynamic frequency selection, the impact is therefore reduced. The CEPT is sympathetic, but Jan is asking for support from the international community.

ITU-R – RLAN is active in the joint rapporteurs group. Two recommendations, sharing of satellites and RLANs. Seek the modifications to create a new task that addresses common standards. The proposal will be made by the MMAC. From the BRAN they can provide technical support and they would like to get some support by IEEE participation in the ITU groups. Two rapporteurs from US. Jan is asking for someone from a large company from the US that is not part of the US contingent. Document from ETSI will be available later today. Liaison with group SE to make technical assessments. Question from Naftali - What are the prospects of introducing 802.11 products in Europe? In ETSI, they can import technical documents and therefore we can introduce concepts through ETSI. If we convince the ETSI membership that introducing the IEEE 802.11 standard into ETSI would be advantageous for the EU countries.

Announcement that we are going to give the standard to BRAN and solicit comments from the draft. When they submit as a body or as an individual, they need to submit the comments in the IEEE comment format.

Editorial comment group will work in parallel with TGb Thursday afternoon.

Signal field enhancements will be presented to whoever is interested immediately after this meeting.

The meeting was adjourned at 12:35 for lunch to meet next at 6pm.

Thursday 11/14/99 6:08
TGa Meeting Called to Order

Dean Kawaguchi's interleaving comment and a project from Tal still need to be worked

Hitoshi reported on some of the editorial changes he has done which are not a lot. He has not had a chance.

Hitoshi went through the editorial changes he had to make to effect the 52 subcarriers.

Addressed Michael Fisher's remark about making the coexistence more robust. The signal field is a 4bit QPSK string. He didn't feel that this was enough to determine the rest of the packet. We rejected his comment. We reached a recommendation.

Motion #19 To reopen the SIGNAL and PLCP preamble encoding issue.
Moved by Richard Paine
Seconded by Peter Escalline

Single OFDM symbol encoded at R=1/2, BPSK
24 bits which are divided into subfields = 12(length)+4(mod+coderate)+1(reserved)+1(parity)+6 (zero tail)
Dean espoused moving to changed subfields.
amounts to (48,18,10)block ECC with soft decoding

Motion #20 T=o accept the new encoding method for PLCP header, based on single OFDM symbol encoded at R =1/2, BPSK
24 bits which are divided into subfields = 12(length)+4(mod+coderate)+1(reserved)+1(parity)+6 (zero tail)
After this field, the rest of the packet will be transmitted at the selected data rate and modulation. The 16 bit SERVICE field shall be immediately followed by the PSDU and the tail+pad bits. The PPDU, after the switch to the selected data rate and modulation is composed of the 16 bit SERVICE field immediately followed by the PSDU and the tail+pad bits.
Moved by Dean Kawaguchi
Seconded by Steve Gray
7/2/3

The next issue is the LSB and MSB interleaving.

Tal then presented his Interleaver Options.
Conclusions: Little advantage for LSBs and MSBs Interleaving, so the comment was rejected. There were simulations by two independent groups showed very little difference.

Next issue is the CCA detection and levels. The following suggested motion needs to be considered.

Motion #??: Define CCA sensitivity by stating that a valid OFDM frame at receive level eq or greater than the minimum 6Mbps specified sensitivity shall be detected with probability >90% within 5 microseconds. The receiver shall keep the CS signal busy for any signal 15dB above minimum 6Mbps.
Moved by
Seconded by

The motion was not acted on because of the late hour. The meeting was adjourned at 8:18pm.

Friday 11/15/99 8:33am
TGa Meeting Called to Order

Maximum input level 1.3.8.2 which stated that there was a missing number. Naftali met with an experts group last evening. The number should be –20dB. This was approved by acclimation, but there was subsequent discussion that the –20dB is too stringent a requirement.

Motion #21: That the maximum input level should be –30dB.
Moved by Dean Kawaguchi
Seconded by Hitoshi Takanoshi
11/2/7
Motion passes

The motion from Thursday evening on CCA:

Motion #22: Define CCA sensitivity by stating that a valid OFDM frame at receive level eq or greater than the minimum 6Mbps specified sensitivity shall cause CCA to indicate busy with probability >90% within 5 microseconds. If the preamble portion was missed, the receiver shall hold the CS signal busy for any signal 20dB above minimum 6Mbps sensitivity (-62dB).
Moved by Dean Kawaguchi
Seconded by Richard van Nee
13/0/8 Approved

An amendment was suggested by Hitoshi Takanoshi.

Motion #??: To amend the motion 22 to replace 20dB by 15dB.
Moved by Hitoshi Takanoshi
Seconded by Masahiro Morikura

The motion was withdrawn by Hitoshi.

The next item is on a comment made by Mark Webster. After explanation by Naftali, Mark withdrew the comment.

The next item was on the 52 subcarriers. The preamble is now an issue. Richard Van Nee, in the last couple days, looked for the options for a new training symbol and explained the options on the training symbol. He found that there was an even better option than for the 48 subcarriers.

Motion #23: To replace the current 48 subcarrier long training sequence by a 52 subcarrier training sequence to be provided by Richard Van Nee.
Moved by Richard Van Nee
Seconded by Dean Kawaguchi
18/0/2
Motion passes

A comment on rate encoding by Michael Fisher was rejected by the group. Instead, the incorporation of a new 18 bit, single OFDM symbol header was adopted but it will require a lot of editorial changes in the document. Naftali wants to get approval from the group to do these massive editorial changes. The discussion disclosed that a motion was not needed.

Naftali wants to resolve the "no's" from the letter ballot. Naftali took names (Dean, Mark, Cherry, Masahiro, Richard Van Nee). Dean still has a problem with channelization and feels that it requires more discussion.   He would not vote no on the

Masahiro changed from a no to a yes.

Richard Van Nee changed to a yes.

Cherry Tom stays a no until the changes are reviewed.

Harry Worstell stays a no until the changes are reviewed.

Juha Heiskala changed to a yes.

Mark Webster stays a no until the changes are reviewed.

Bob Ward stays at a no until the changes are reviewed.

Kuzehiro remains at a no.

Carl Andren changed to a yes.

Matthew Shoemake stays a no until the changes are reviewed. The clarity of the mathematical description was modified based on his comments.

Chris Heegard stays at a no.

Five votes that are changed from a no to a yes. That should give us the 75% to go to a recirculation ballot.

The group is now going to regulatory issues following the vote to move to recirculation ballot.
Afte friendly amendment.

Motion #24: To forward the 802.11a draft 2.1, after incorporation of the text changes arising from the comment resolution process and decisions taken during the January 99 meeting, to a 25 day WG Recirculation Ballot.
Moved by Dean Kawaguchi
Seconded by Hitoshi Takanoshi
23/0/2 Passes Unanimously

Vic was asked for the difference between a recirculation and a letter ballot. In a recirculation, you can only make a no vote on the changed or affected portions of the document. Vic also explained that EXCOM wants to see any negative comments we could not resolve.

The next subject is regulatory issues. Jan Kruys presented the summary table of the work of regulatory issues in Europe. They are being asked to limit the power. Interference from one airplane would interfere in several states (5350-5450MHz). RLANs cannot interoperate with radars, being overcome with power. Dynamic Frequency Selection in Hiperlan has the Hiperlan check for strong signal (radar) before it uses the frequency band. All together it is 655MHz. This was the background for the ETSI liaison statement that we will discuss next.

The Hiperlan 1 specification was starte in 1993. It used GSMK modulation and had some problems with sharing and they went after a Hiperlan 2 specification. Going to the ITU-R and to the WRC needs to allocate spectrum to RLANs. Mr Hashimoto will present such a proposal after Jan Kruys finishes.

The building shielding is much more effective than previous studies have indicated (University of Bristol).

RF power levels have been established at 200mW. For the radar bands, they allow 1W. With directional antennas, the European regulatory agencies are very leery of directional antennas because they could affect satellite transmissions.

There is an indoor restriction imposed and BRAN restricts these transmissions to Access Points. BRAN doesn't want any restrictions to the user, but they want to restrict the use of Access Points outdoors.

IEEE 802.11 will be asked for an agreement with the regulatory. Vic asks for a letter on the technical arguments for agreement. Jan was also asked for the steps to be taken now in the regulatory issues. His next step is to go to the ITU-R. The opposer is ICO which is a UK arm of INMARSAT. The satellite industry in the UK is really the problem and have a very large voice. Mr Hashimoto from MMAC will be helpful with their support as well as a rapporteur from the US. George Fishel is a rapporteur from the US and is helping with RLANs from the US. They have sent the in-building results to the ITU-R and are hopeful that the US, Europe, and Japanese. It is up to ETSI to implement the IEEE standards and they may not be because of the charter of the ETSI.

Don Johnson brought up that Globalstar does give the US operators the most trouble and they have a flexible antenna that can go down to 10 degrees above the horizon.

Next was a presentation by Don Johnson on Winforum and Unlicensed Spectrum. 98-409r1. Non profit that supports unlicensed frequencies to develop and further wireless. They include technical and legal support. They are concerned primarily with UNII and PCS Unlicensed. 2.4 could also be a focus, but is not presently. They are working in future unlicensed spectrum and relaxing the rules for all the bands. There are three committees: UNII, PCS, and WINTest. The threats to the UNII bands (spectrum sharing, measurements and procedures, and narrowband/wideband incompatibility). Bluetooth sharing is the specific sharing problem he is talking about. The MSS industry is opposed to sharing the UNII band. There are unnecessary restrictions on the lower UNII band. There are also possible efforts to expand into the middle band of the UNII band. Don said that measurement rules are a problem and there is little commonality among measurement methods and procedures. The measurement means are; peak

power, power spectral density, and out-of-band emissions. The sharing rules that are needed are: narrowband/wideband incompatibility, situation described in the Nov 98 paper, frequency hopping concern, and further rules. The equation states that the UNII sharing rules are not sufficient to negate the narrowband/wideband sharing problem. Rules needed; establish narrow/wide channel width, limit number of narrowband devices, and two others in 98-409r1. The conclusion is; further work is needed on UNII band (wideband/narrowband sharing-rules addition, further rules addition, measurement procedures and spectrum allocation vigilance). Winforum annual membership fees are $15,000.

Sharon Butalla at sharon_butalla@dc.sba.com

Don answered questions and the hardness of the 30/B over 20MHz that the FCC sets as a base for test.

Mr Hashimoto from ITU-R gave a talk on the common bands at 5.15 to 5.25. The sharing rules are very important to all three areas (US, Europe, and Japan). The Joint Rapporteur Group 8A-9B assigned the issues on sharing rules. The next meeting will be on February 15. Jan Kruys wants to present to the ITU-R on the sharing rules and work done by BRAN/802.11. The satellite considerations of Globalstar and ICO are going to be considered in these meetings. They are looking at a common view from the three organizations (IEEE, MMAC, and BRAN). The suggestion is to have a 20MHz separation between the MSS feeder links and the RLANs. The motion for support of this joint statement will be done in the plenary.

Tomoki gave a regulatory presentation on the ethernet working group. A group within the MMAC had chosen a PPM and presented that as a possibility. The working group did decide to accept the 802.11 approach (OFDM) instead of the PPM. This decision occurred in Dec 98.

Motion #25: (to recommend to the plenary) to issue liaison letter to MMAC-PC Wless ethernet group appreciating their willingness to align their standard with 802.11a and ask to align their standard with the draft 2.1 version of the standard.
Moved by Peter Escalliine
Seconded by Masahiro Mirakura
16/0/0 Passes Unanimously

Motion #26: To issue a liaison letter to BRAN in appreciation of the cooperation during the meeting and asking them to consider 802.11a preamble structure as one of the candidates for a bran H/2 preamble.
Moved by Richard Van Nee
Seconded by Tal Kaitz
18/0/0 Passes Unanimously

The motion from the approval was only 73%, not >75%, but there was a change of vote that changed it to 80%.

The meeting was adjourned at 12:30pm