AGENDA & MINUTES (Unconfirmed) - IEEE 802 LMSC EXECUTIVE COMMITTEE MEETING

Friday, November 16, 2001 – 3:00 p.m.

Hyatt Regency, Austin, TX

1. MEETING CALLED TO ORDER

Jim Carlo called the meeting to order at 3:05pm. Members in attendance were:

Jim Carlo	- Chair, IEEE 802 LAN / MAN Standards Committee
Paul Nikolich	- Vice Chair, IEEE 802 LAN / MAN Standards Committee
Buzz Rigsbee	- Executive Secretary, IEEE 802 LAN / MAN Standards Committee
Bob O'Hara	- Recording Secretary, IEEE 802 LAN / MAN Standards Committee
Robert Grow	- Treasurer, IEEE 802 LAN/MAN Standards Committee
Tony Jeffree	- Chair, IEEE 802.1 - HILI Working Group
Geoff Thompson	- Chair, IEEE 802.3 - CSMA/CD Working Group
Bob Love	- Chair, IEEE 802.5 - Token Ring Working Group
Stuart Kerry	- Chair, IEEE 802.11 - Wireless LANs Working Group
Bob Heile	- Chair, IEEE 802.15 – Wireless PAN Working Group
Roger Marks	- Chair, IEEE 802.16 – Broadband Wireless Access Working Group
Mike Takefman	- Chair, IEEE 802.17 – Resilient Packet Ring Working Group
Vic Hayes	- Regulatory Ombudsman

The meeting was attended by approximately 20 IEEE 802 Working Group members and several guests.

2.00 APPROVE OR MODIFY AGENDA

Motion to approve agenda

Items in the proposed agenda that were originally proposed as being on the consent agenda are shown as white text on black background. The items that remained on the consent agenda after the agenda was modified are shown with an asterisk appended.

Move/Second: Paul Nikolich/Tony Jeffree

9/0/1 Approved at 3:10 pm

1.00		**MEETING CALLED TO ORDER**	**-**	**Carlo**	**1**	**03:00 P**
2.00		**APPROVE OR MODIFY AGENDA**	**-**	**Carlo**	**4**	**03:01 P**
3.00		**TREASURER'S REPORT**	**-**	**Grow**	**5**	**03:05 P**
	Category (* = consent agenda)					
4.00	**ME**	**802.3 10gig conditional to sponsor and revcom**	**-**	**Thompson**	**5**	**03:10 P**
4.01	**ME**	**802.3 liaison letter to T1E1**	**-**	**Thompson**	**5**	**03:15 P**
4.02	**ME**	**802.3 liaison letter to ITU-T SG15 (10 gig)**	**-**	**Thompson**	**5**	**03:20 P**
4.03	**ME**	**802.3 liaison letter to ITU-T SG15 (EFM)**	**-**	**Thompson**	**5**	**03:25 P**
4.04	**ME**	**803.3aj PAR - Maintenance 7**	**-**	**Thompson**	**5**	**03:30 P**
4.05	**ME***	**802.1 Playpen Ethertype PAR approval**	**-**	**Jeffree**	**5**	**03:35 P**

4.06	ME	Forward 802.15.1 to RevCom	-	Heile	10	03:40 P
4.07	ME	Form 802.15 SG for alternate PHY for 802.15.3	-	Heile	5	03:50 P
4.08	ME	802.16 to RevCom	-	Marks	5	03:55 P
4.09	ME	802.16 Press Release	-	Marks	5	04:00 P
4.10	ME	802.16a/b PAR Merger	-	Marks	5	04:05 P
4.11	ME	802.16 ETSI BRAN Liaison letter	-	Marks	5	04:10 P
4.12	ME	802.16 BWIF Letter	-	Marks	5	04:15 P
4.13	ME	Submission to JRG 8A-9B	-	Hayes	10	04:20 P
4.14	ME	Translate letter to Chinese and deliver to admin	-	Hayes	5	04:30 P
4.15	ME	802.11e PAR Extension	-	Kerry	5	04:35 P
4.16	ME	802.11f PAR Extension	-	Kerry	5	04:40 P
4.17	MI	SEC rules change - Standing Committee	-	Hayes	15	04:45 P
4.18	MI	SEC rules change - Wireless PARs	-	Hayes	15	05:00 P
4.19	DT	Input to PR	-	Nikolich	5	05:15 P
4.20	DT	Network Plans for future meetings	-	Nikolich	5	05:20 P
4.21	DT	WG Ballot Rules	-	Kerry	5	05:25 P
4.22	II	Database Update	-	Rigsbee	10	05:30 P
4.23	II	802.3 DTE Power via MDI WG Ballot	-	Thompso n	1	05:40 P
4.24	II	Call for interest: 10 gig longer reach	-	Thompso n	1	05:41 P
4.25	II	802.3 WG chair open (Geoff bolts)	-	Thompso n	5	05:42 P
4.26	II	Regulatory Ombudsman departing	-	Hayes	5	05:47 P
4.27	II	Future Meetings	-	Rigsbee	5	05:52 P
4.28	II	Interim meetings	-	O'Hara	3	05:55 P
4.29		Adjourn				07:00 P

ME - Motion, External MI - Motion, Internal
DT- Discussion Topic II - Information Item

3.00		TREASURER'S REPORT	-	Grow	5	03:05 P

IEEE Project 802
Estimated Statement of Operations
November 2001 Meeting

November 2001 Meeting Income:		*Actual*	*Budget*	
Registrations	933	**242,950**	234,000	
Deadbeat Registrations		**0**	0	
Bank Interest		**250**	150	
Other		**500**	375	
TOTAL Income		**243,700**	234,525	
November 2001 Meeting Expenses:		***Estimate***	*Budget*	
Audio Visual Rentals		**7,000**	7,000	
Bank Charges		**0**	30	
Copying		**5,300**	7,200	*
Credit Card Discount		**6,803**	6,552	*
Equipment Purchase		**5,000**	8,000	
Get IEEE 802		**69,975**	67,500	
Meeting Administration		**51,360**	53,100	*
Network		**4,500**	5,000	
Phone & Electrical		**1,000**	2,500	
Refreshments		**58,000**	35,100	
Shipping		**3,000**	2,448	
Social		**30,000**	36,000	
Supplies		**0**	0	
Other		**3,100**	2,000	
TOTAL Meeting Expense		**245,038**	232,430	
NET Meeting Income/Expense		**(1,338)**	2,095	
Estimated Other Liabilities		**(9,000)**		
12 Nov 2001 Operating Reserve		**154,730**		
Projected March 2002 Operating Reserve		**144,392**		

* Actual charges are based on registration, budget is based on registration forecast.

Attendance is 929. Copier costs seem to be going through the roof. It is hoped that the outside copying costs for this meeting were an anomaly. Paul will get data on the usage of the copier/copy services.

4.00 ME 802.3 10gig conditional to sponsor and revcom - Thompson 5 03:10 P

Currently recirculating 802.3ae. Plan to do one more recirc out of this meeting. There is a chance that 802.3ae might squeak onto the RevCom agenda for March.

Moved: IEEE E802.3ae requests that the Sponsor Executive Committee forward IEEE P802.3ae/D4.0 for sponsor ballot and recirculations conditional upon successful completion of the Working Group lettor ballot as per LMSC operating rule Procedure 10.

Approved at 802.3: 87/0/2
Moved: Geoff Thompson/Bob Grow
Currently 99.5% approval at last WG letter ballot.

Approved: 9/0/0

802.3ae to Sponsor Ballot

IEEE 802.3 requests that the Sponsor Executive Committee forward IEEE P802.3ae/D4.0 for Sponsor ballot and recirculations conditional upon successful completion of Working Group ballot as per LMSC Operating Rules Procedure 10.

802.3: M: Mr. B. Booth, S: Mr. R. Grow; Y: 87, N: 0, A: 2, passes

SEC: M: Mr. Thompson, S: R. Grow; Y: 9, N: 0, A: 0

4.01 ME 802.3 liaison letter to T1E1 - Thompson 5 03:15 P

This is an informational letter to T1E1, in response to their letter. No approval necessary from SEC.

November 15, 2001

Mr. Ed Eckert, Chairman T1E1

VIA EMAIL: eeckert@catena.com

Reply: T1E1/2001-073 R1, “Update on VDSL Standard for Trial Use and a request for cooperative work on spectrum management relative the EFM on copper activity”

Mr. Eckert,

On November 13, 2001, the liaison letter was presented to the 802.3ah Ethernet in the First Mile Task Force. Thank you for providing this information. The Draft Trial Use VDSL standard currently in the letter ballot comment resolution period in T1E1.4, T1.417-2001 Spectrum Management standard, and work being conducted in other standards development organizations, continue to be seriously considered as 802.3ah develops standards for copper based Ethernet in the First Mile.

All of the baseline proposals given at this meeting have referenced both the T1E1.4 Draft Trial Use Standard and the T1.417 Spectrum Management Standard.

Please note that we are considering new objectives regarding the PHY for copper part of the IEEE 802.3ah Ethernet in the First Mile Task Force:

- Include an optional specification for combined operation over multiple copper pairs

- PHY for single pair non-loaded voice grade copper, distance >=4600m, 0.4mm, >=256kps

- PHY for single pair non-loaded voice grade copper, distance >= 3700m, 0.5mm, >=4Mbps

These objectives would apply in parallel with the other objectives already adopted:

- PHY for single pair non-loaded voice grade copper distance >=2500ft and speed >=10Mbps aggregate

- The point-to-point copper PHY shall recognize spectrum management restrictions imposed by operation in public access networks, including:
    - Recommendations from NRIC-V (USA)
    - ANSI T1.417-2001 (for frequencies up to 1.1MHz)
    - Frequency plans approved by ITU-T SG15/Q4, T1E1.4 and ETSI/TM6

We will welcome further liaison from committee T1 on this subject.

Best Regards,

Geoff Thompson, (thompson@ieee.org) Chairman IEEE 802.3

Cc: Howard Frazier, (millardo@dominetsystems.com) IEEE 802.3ah EFM Task Force Chair
Cc: Paul Nikolich, (nikolich@ieee.org) IEEE 802 LMSC Chair

4.02 ME 802.3 liaison letter to ITU-T SG15 (10 gig) - Thompson 5 03:20 P

The letter responds to a request from ITU-T SG15 for a closer working relationship. Our response is to outline our process and let them know that they are too late to influence the document, at this time.
Approved in WG: 76/0/1
This is going out over Geoff’s signature as an information-only letter. No approval necessary from SEC.

IEEE 802.3ae Response to ITU-T SG15
Re: Question 16/15

To: Peter Wery, Chairman ITU-T Study Group 15
From: Jim Carlo, Chair IEEE 802
Copy: Paul Nikolich, Chair Elect IEEE 802
Geoffrey Thompson, Chair IEEE 802.3
Jonathan Thatcher, Chair IEEE P802.3ae

Summary

This letter is in response to Question 16/15 from the ITU-T SG15 dated July 2001. In said letter, ITU-T indicated an interest in a closer working relationship with the IEEE 802.3 Working Group. The IEEE 802.3 Working Group welcomes a long-term liaison relationship with ITU-T SG15 and anticipates a mutually beneficial coordination.

SG15 raised a number of concerns regarding the methodology and direction taken for optical specification by IEEE P802.3ae Task Force as represented in the 10 Gigabit Ethernet Draft Standard. This letter attempts to respond to these concerns and explain the position of the Task Force. Additionally, this letter describes key aspects of the process that IEEE 802.3 uses to develop a standard and how at this late stage of development members of SG15 might participate in the Sponsor Ballot review and comment process.

Process

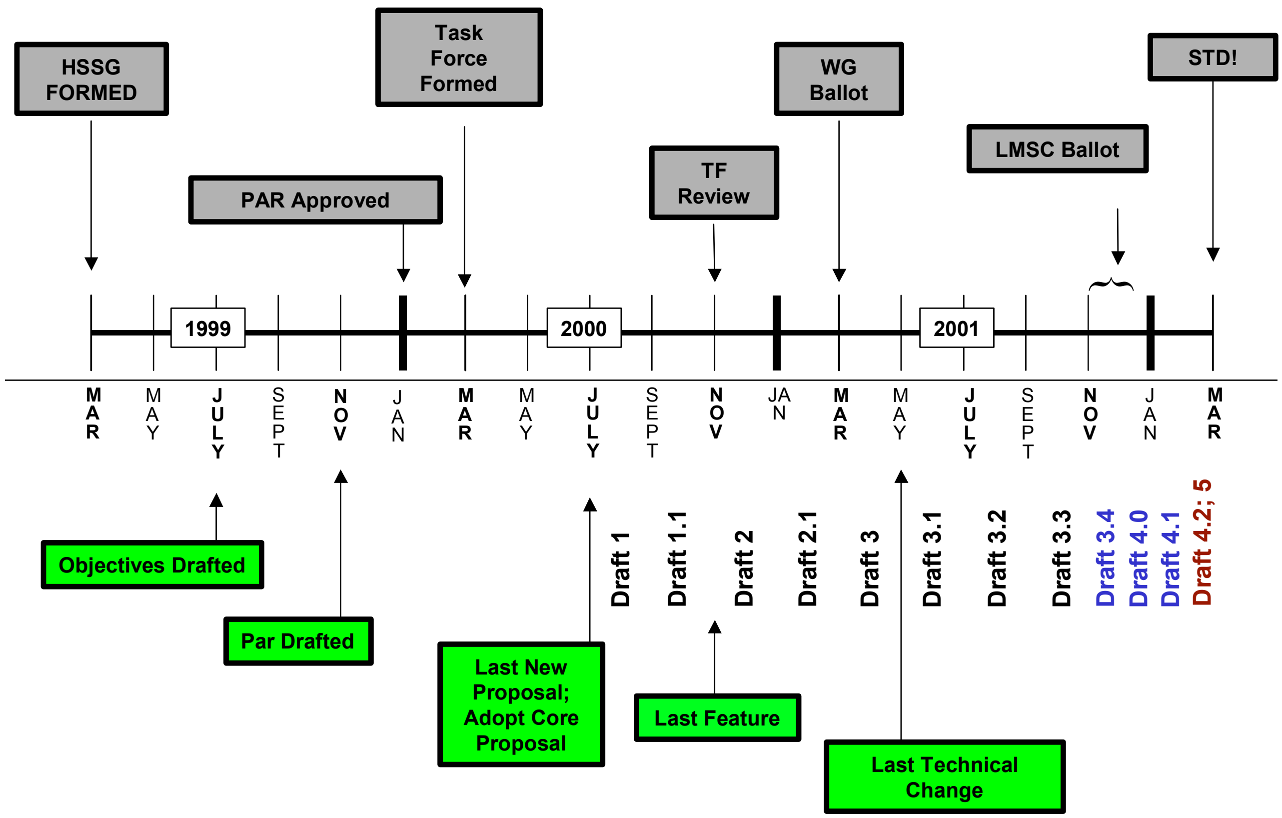
As can be seen from the high level schedule below, last new features were accepted in November 2000. During the March 2001 meeting, the draft standard was technically complete to the point that it was ready to enter 802.3 Working Group Ballot (Draft 3.0). The last (significant) technical changes were accepted during the May 2001 meeting. In short, the opportunity to consider sweeping changes to the direction of the draft standard is past.

Currently, we are concluding the 802.3 Working Group Ballot phase of the P802.3ae (10 Gigabit Ethernet) standard development. During the November 2001, IEEE 802.3 Working Group closing plenary, conditional approval was granted to proceed to Sponsor Ballot. This will be based on a successful recirculation of Draft 3.4 of the standard. During recirculations, comments are to be directed at changes to the previous draft, only. During the first circulation of Sponsor Ballot (Draft 4.0), the entire draft will be reopened for comment.

Comments are written against specific text within the draft, and require a complete remedy that completely identifies the changes that need to be made to the draft. The committee responds to these comments with one of three actions: acceptance, conditional acceptance and rejection. If a comment is “accepted,” this means the committee accepts the remedy without amendment. When the committee agrees in principle with the intent of a comment, but modifies or replaces the remedy with one of committee origin, it issues a “conditional acceptance.” In either case, the editor is directed to modify the draft according to the specific remedy approved by the committee. If the committee disagrees with the comment, it issues a “reject;” and, typically, writes an explanation for its decision.

Drafts are available for purchase from the IEEE. A link to the drafts can be found on the IEEE 802.3 web site (www.ieee802.org/3/purchase/index.html). During each of the comment resolution cycles, Jonathan Thatcher, Chair P802.3ae, has offered to sponsor comments for those who are not members of the respective ballot group. He has done this on the following conditions:

1. He does not sponsor comments that are incomplete. Every field in the comment form must be filled out properly. This includes an unambiguous remedy.
2. He does not sponsor technical required (TR) comments. A TR can only be submitted with a disapprove ballot; he will not modify his ballot based on the sponsorship of a comment in behalf of another individual.
3. The comments are due 3 days prior to the closure of the circulation or recirculation.



Technical Direction

In your letter you noted that the IEEE P802.3ae Task Force has taken a direction with respect to optical specification that departs from traditional Ethernet and ITU methodology. You are probably aware that some of this direction is consistent with methodologies successfully implemented in recent Fibre Channel specifications. In particular, optical modulation amplitude (OMA) has been adopted as the method of choice for specification and measurement of modulated optical signals.

Optical Modulation Amplitude

As noted in your communication, "the objective of this specification method is to widen the allowed range of transmitter specifications." The intent in doing so is to reduce unnecessary restrictions in the specification of the optical transceiver and thus provide an opportunity for individual component suppliers to further optimize cost-performance.

It is the belief of the IEEE P802.3ae committee that the minimum peak-to-peak optical signal (OMA) is key to compliant operation of the receiver and that the average optical power alone under specifies the input signal. Per your letter, you articulate the fact that the OMA can be derived from an average optical power and extinction ratio measurements. But, you seem to indicate that only the optical power should be used at the receiver due to noise issues. While average optical power is an easier and more accurate measurement, it is insufficient to ensure correct operation.

It is the tradition of the IEEE 802.3 Working Group to create standards that ensure plug and play compatibility. Consistent with this tradition, the P802.3ae Task Force has created specifications that avoid the need for engineered links, except in the most extreme cases. In doing so, the burden of test is placed on the equipment manufacturers rather than on field engineers.

Traditionally, optical power field measurements are made for simple and quick validation of optical plants. This can still be done. Given a weak average optical signal, an OTDR can be used to determine specific attenuation and optical loss characteristics for the plant. Average optical power and attenuation loss measurement techniques do not ensure that the optical signal has adequate amplitude to actually function according to specification. This requires a modulated signal measurement.

It is correct that it might be necessary to switch a piece of equipment into a special test mode to accurately and precisely test compliance to the standard. Even so, a close approximation can be achieved by use of a typical data pattern; this is consistent with general practice in the industry. A comment suggesting informative text that might be included in future drafts would be welcome.

Regarding optical attenuation requirements at 7 dB as compared to 3 dB in the ITU, our current draft now references 5 dB.

Specification Flexibility

Per the recommendation of optical component manufacturers, IEEE 802.3ae has created a specification that allows for future, lowest cost implementations by providing flexibility in tradeoffs for meeting these specifications. It is well understood that this has the potential to complicate test and measurement in the design and manufacturing environment, especially in the near term.

It is presumed that future optical technologies may have behaviors that are substantially different from those implemented today. The committee does not want to limit any innovation that has the potential to improve the cost-performance of link technology by over-specifying the optical requirements.

The committee fully recognizes that manufacturers will, when possible, attempt to meet compliance “by design” rather than through test. In this regard, some test and measurement procedures (e.g. spectral width) will tend to be used during qualification and then in conjunction with process control sampling rather than on a per part basis.

IEEE 802.3ae Link Model and Spectral Characteristics

In your memorandum, you question the spreadsheet calculations and derived specifications regarding power penalties due to dispersion. Regarding the parameter epsilon, the ITU uses a maximum value of 0.115 for a 1 dB path penalty for multi-mode lasers (MLM). In the 1 Gigabit Ethernet (1000BASE-X) standard, IEEE 802.3 used a value of 0.15 for epsilon for a maximum path penalty of 1.8 dB. This value has proven to be effective in millions of optical links and has provided adequate margin for low cost, high volume manufacture. In 10 Gigabit Ethernet the same value has been used for single longitudinal mode lasers (SLM) with negligible dispersion penalty at 1310 nm on 10 km of SMF for the fiber type specified. While the committee recognizes that there are inaccuracies in the prediction of dispersion penalty for 1310 nm lasers in some circumstances, these inaccuracies are sufficiently small that they can be ignored. Having no significant negative impact beyond the standard practice of measuring center wavelength, spectral width, and OMA (or the equivalent of OMA, the average optical power and extinction ratio), the triple trade off curve was left in for the 10GBASE-LR/LW PMDs for consistency with 10GBASE-SR/SW. Additionally, some laser experts indicate that there is a slight benefit in extending the spectral width specification in support of 1310 nm vertical cavity lasers.

For 10GBASE-ER/EW, since the committee did not know how to practically measure chirp in a system environment, it chose instead to build the chirp penalty into the OMA measurement as seen at the end of a worst case dispersion fiber. This allows a direct measurement of all dispersion effects without individually specifying each chromatic characteristic. In order to simplify our specification and provide maximum flexibility for cost effective manufacture, the dispersion and transmitter penalties are measured together. It is true that optical power can be used to compensate for some dispersion penalty; this is bounded to a maximum of 3 dB and has little impact on the receiver design.

Conclusion

Per the information above, we welcome you to participate in the comment process for the sponsor ballot. It would be to your benefit to review the comments and resolutions of those comments during the various Working Group draft recirculations. These can be found at www.ieee802.org/3/ae/comments/index.html. General interest information, presentations and contributions are published on the IEEE 802.3ae web site.

Individuals can subscribe to the IEEE P802.3ae reflector by following the directions at http://www.ieee802.org/3/ae/reflector.html. Please contact Jonathan directly if you wish to submit a comment against Draft 4.0 at jonathan.thatcher@worldwidepackets.com.

In order to effectively work together in the future the IEEE 802.3 Working Group would welcome a long-term liaison relationship with ITU-T. This would enable timely communications between our organizations with respect to future projects proposed within the 802.3 Working Group.

802.3 request that the SEC approve the response to ITU-T SG 15 Question 16/15.

Moved: Jonathan Thatcher
Second: Tom Lindsay

For: 68
Against: 0
Abstain: 4

4.03	**ME**	**802.3 liaison letter to ITU-T SG15 (EFM)**	**-**	**Thompson**	**5**	**03:25 P**

This is an informational letter informing ITU-T SG15 of the desire to work with them on EFM. No approval necessary from SEC.

Austin, Texas, 15 November 2001

SOURCE: IEEE 802.3 Working Group
TITLE: Communication to ITU-T SG15 from IEEE P802.3ah Ethernet in the First Mile Task Force
REFERENCE: 09.11.01 LS01/15: Communication Statement to the IEEE 802.3ah Ethernet in the First Mile Task Force on new access network Recommendations

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COMMUNICATION STATEMENT

TO: Peter Wery, ITU-T SG15 Chair
COPY: Paul Nikolich, IEEE 802 LMSC chair; p.nikolich@ieee.org
Howard Frazier, IEEE 802.3ah EFM chair; millardo@dominetsystems.com
Frank Effenberger, IEEE 802.3 ITU-T Liaison; feffenberger@quantumbridge.com
Richard Stuart, IUT-T SG15 Raporteur; rlstuart@ieee.org

APPROVAL: Agreed to at IEEE 802.3 Plenary meeting, Austin, Texas November 15, 2001
FOR: Information
DEADLINE: n/a

CONTACT: Geoff Thompson, IEEE 802.3 CSMA/CD WG Chair; thompson@ieee.org

The IEEE 802.3 CSMA/CD Working Group appreciates the communication sent from Study Group 15 concerning the following new Access Network Recommendations:

- Recommendation G.983.4 “A Broadband Optical Access System with increased service capability using Dynamic Bandwidth Assignment”
- Recommendation G.983.5 “A Broadband Optical Access System with Enhanced Survivability”
- Recommendation G.983.7 “Enhanced ONT management and control interface specification for DBA B-PON System”
- Amendment 1 to Recommendation G.983.2 (maintenance revisions to G.983.2)
- Amendment 2 to Recommendation G.983.2 (enhancements for Voice service, AAL2, MAC Bridged LAN, and WDM Services)
- Amendment 1 to Recommendation G.983.1 (addition of 622 Mbit/s symmetrical rate to G.983.1)
- Recommendation G.993.1 “Very High Speed Digital Subscriber Lines Foundation”

As well as the document:

- Com 15 – D.238 “High Level Initial Operator Requirements for Gigabit-per-second Passive Optical Networks (GPONs)”

We thank you for providing these documents to the IEEE P802.3ah EFM Task Force. These documents will be placed on the EFM Task Force web server, with password-protected access to task force participants. We will encourage the EFM Task Force participants involved in access networks to familiarize themselves with the contents of these documents.

In return, we invite and encourage ITU-T SG15 to review EFM Task Force materials. The EFM Task Force website and documents can be found at the following URLs.
EFM Task Force website: http://www.ieee802.org/3/efm/
EFM Task Force Project Authorizaton (PAR): http://www.ieee802.org/3/efm/public/nov01/par_1_0701.pdf
EFM Task Force Objectives: http://www.ieee802.org/3/efm/public/sep01/objectives_1_0901.pdf
EFM Task Force Presentation Materials: http://www.ieee802.org/3/efm/public/

We would like to inform you that our taskforce is currently in the process of inviting baseline proposals for physical layers meeting the objectives that have been approved for this project.

Concerning point-to-point copper, we understand that the scope of our project may overlap to a certain extent with projects within Q4/15, and are pleased to say that many of the presentations that we have reviewed at our current meeting, reference ITU-T recommendations (in particular G.993.1 Annex H) directly or indirectly. We are currently considering an objective to support operation over multiple copper pairs, and your technical support in this matter would be appreciated.

The IEEE 802.3 WG looks forward to a continuing dialog with the participants of the ITU-T SG15 effort, and we welcome their attendance and participation at our upcoming meetings.

Geoff Thompson
Chair, IEEE 802.3 CSMA/CD Working Group
thompson@ieee.org
+1.408.495.1339

4.04 ME 803.3aj PAR - Maintenance 7 - Thompson 5 03:31 P

This document has not been distributed yet to the SEC. This is for a corrigendum, not a revision. This limits the scope to only those items being balloted. 802.3 has a formal procedure for acceptance of maintenance items.

Moved: That IEEE P802 LMSC Executive Committee submit the 802.3aj PAR to NESCOM
Moved: Geoff Thompson/Bob Grow
Approved: 10/0/0

802.3aj Maintenance 7# PAR

IEEE 802.3 approves the PAR and 5 Criteria as submitted for 802.3aj Maintenance #7.

IEEE 802.3 requests the IEEE P802 LMSC Executive Committee to submit the 802.3aj PAR to NESCOM.

802.3: M: Mr. D. Law; S: Mr. T. Dineen; Y: 96, N: 0, A: 1, Passed

SEC: M: Mr. Thompson, S: R. Grow; Y: 10, N: 0, A: 0

4.05 ME* 802.1 Playpen Ethertype PAR approval - Jeffree 5 03:35 P

Approved as part of the consent agenda.

4.06 ME Forward 802.15.1 to RevCom - Heile 10 03:42 P

Moved: Forward P802.15/D1.0-2001 to RevCom
Discussion of the comment on coexistence from disapproving voter ensued. Comments were made that the document needs to be in sync with the Bluetooth SIG and that the project "is where it can be" at this point in time. Additional comments were made that the responses to the commenters are not appropriate. It is already too late for the 2.4 GHz band, it is already polluted. The "deal" with the Bluetooth SIG is solely a copyright deal. There is no agreement to limit the technical changes to the document.

Moved: Bob Heile/Stuart Kerry
Approved: 7/2/2

Forward P802.15.1 to RevCom

Motion: To Forward P802.15/D1.0.1-2001 to RevCom

(“LAN/MAN Specific Requirements -- Part 15.1: Wireless Medium Access Control (MAC) and Physical Layer (PHY) specifications for Wireless Personal Area Networks (WPANs)”).

Moved/Second: Heile/Kerry Time:

Y/N/A:

- Sponsor Ballot Recirc, 26/3/1(27/2/1) passed @89% (93%)
  - **2 Disapproving Voters remaining and 19 unresolved comments**

  (comment #7 is resolved as the 3rd DISAPPROVING Voter changed to a YES w/ comments.)
- Working Group Motion (Plenary Session, November 12, 2001)
  - To submit P802.15/D1.0.1-2001to the 802 DEC for approval of submission to RevCom
  - Result: 39/0/0 (100% approval)

Generalization of Negative Comments

- Proposed standard operates in the same band as 802.11
- Coexistence not addressed
- Optional power level of 100mw
- Normative vs. Informative SDL
- Technical disagreements (how it works vs. how it might work better)

4.05a ME Publications issues relative to P802 - Jeffree 5 04:17 P

Ed Rashbah, Manager of new technical programs in the IEEE Standards Office, introduced himself and described his position.

The position of 802.1 is to roll back to P802/D29 and publish that intact. 802.1 also proposes that they will initiate a project to revise clause 5, as appropriate and if necessary, based on the action of the Standards Board.

Moved: To request Jim Carlo to arrange to place the following motion on the agenda of the December 2001 Standards Board meeting (supporting materials attached): To request immediate publication of P802/D29 as approved by the Standards Board in June 2001, including Clause 5).
Moved: Tony Jeffree/Paul Nikolich

Publication issues relative to P802

Background:

Following the Standards Board approval of P802/D29 in June 2001, and following input from IEEE staff legal in relation to the contents of Clause 5 of the draft, it was decided to submit the draft for a further recirculation, in order to resolve the issues identified. The recirculated document, D30, effectively removed the contents of Clause 5.

The result of that initial D30 recirculation was that two members of the balloting pool cast negative votes, one (from Paul Nikolich) indicating that the balloting pool should see the legal rationale for the removal of the clause, and the other (from Geoff Thompson) indicating his view that, as P802/D29 had been unconditionally approved by the SB, the removal of the clause and the subsequent recirculation was outside of approved process, and P802/D29 should be published intact.

A further recirculation was then conducted, in order to give sight of the negative votes to the rest of the balloting pool; this resulted in four additional negative votes being cast (from Jack Andresen, Howard Frazier, Gary Robinson, and Rich Seifert), essentially supporting Geoff Thompson's position.

802.1's position:

In our July closing plenary, we expressed our view that Clause 5 of the document should be removed, as, regardless of any legal issues involved, the material in this clause covers issues that a standards committee is competent to deal with. However, given the result of these two most recent recirculation ballots, there is considerable doubt as to whether the procedure followed in order to remove this material was appropriate.

In any event, we are not comfortable with recommending the publication of a draft that has 6 unresolved negative votes against it where the previous draft had passed with 100% approval. This would create a very poor precedent for the future conduct of the balloting process.

In the light of the above, our recommendation to the Standards Board is that P802/D29 be published with Clause 5 intact. It may be appropriate to include suitable wording in the front matter of the published standard to indicate that new policy is under development in the IEEE in relation to compliance and trade marks, and to indicate when and where that policy will be made visible.

802.1 also proposes, if necessary, to initiate a new project to revise Clause 5.

802.3 Position on IEEE Std. 802

IEEE 802.3 supports the position of IEEE 802.1 that IEEE 802 should be published including Clause 5 Compliance as initially approved in d29 per established IEEE balloting procedures.

M: Ms. P. Thaler
S: Mr. J. Thatcher

Y: 104, N: 0, A: 3

A question was asked as to whether we should also propose a procedure to address this issue. The response is that there is some work going on in the IEEE office on this issue.

Approved: 9/0/0

Geoff Thompson has raised an appeal to the chair for inaction on publishing the 802 standard.
The chair states that an appropriate response to that appeal is placing this motion on the agenda of the Standards Board. The chair will send an email to Geoff with this information.

4.07 ME Form 802.15 SG for alternate PHY for 802.15.3 - Heile 5 04:50 P

Moved: To approve formation a SG in 802.15 to develop a PAR, if appropriate, for an alternate PHY for 802.15.3 by the July 2002 Plenary.
Moved: Bob Heile/Paul Nikolich

It is expected that a PAR will be produced in July. Rick Roberts described the coexistence methods of UWB. The SG needs to be aware of the possibility that the PAR requirements might include regulatory and coexistence criteria.

Approved: 9/0/0

Study Group Proposal for an Alternative PHY for 802.15.3

Michael Dydyk, Motorola
Kai Siwiak, Time Domain, Inc.
Rick Roberts, XtremeSpectrum, Inc.
Chuck Brabenac, Intel Corp.
Mary DuVal, TI
Masa Akahane, Sony Corp.

Alternate PHY SG for 802.15.3

- The purpose of this SG is to define a project to provide a higher speed PHY enhancement amendment to 802.15.3 for applications which involve Imaging and Multimedia.
  - PHY
    - Co-exist with all IEEE802 wireless PHYs
    - Target data rate in excess of 100 Mbps
    - Robust multi path performance
    - Location Awareness
    - Candidate technologies include Ultra Wide Band
  - MAC
    - Uses 802.15.3 MAC
- Motion to Form a Study Group passed the 802.15 Working Group 34/0/6

Alternate PHY SG for 802.15.3

- It is anticipated that future applications will go beyond the currently defined PHY capabilities, for example high data rates(multiple HDTV channels) and location awareness.
- Applications for 802.15.3 include:
  - Multimedia (Video, Voice over IP, HDTV, Home Theater, Surround Sound Audio, Gaming)
  - Location aware applications, e.g. location dependent authorization
  - Digital (still) imaging (Faster, Better Resolution)
- Support currently includes Motorola, Time Domain, XtremeSpectrum, Intel, TI and Sony.

Alternate PHY SG for 802.15.3

- Targeted data rate in excess of 100 Mbps for embeddable consumer applications.
- Location Awareness enables applications such as range dependent authentication.
- Anticipates Use of Additional unlicensed spectrum for high rate WPANs, relieving possible spectral congestion.

Regulatory Feasibility

- Need to address regulatory approvals of additional spectrum.
- Explore existing and emerging bands
  - 25 and 60 GHz
  - UWB (pending FCC approval)
    - As per document 01/516r0 noting anticipation of FCC approval in Dec 2001.

Technical Feasibility

- PHY - 100+ Mbps prototypes are operational in emerging technologies.
  - For example, UWB addresses
    - High Data Rate
    - Location Awareness
    - Coexistence
- Technology is scaleable to other data rates (higher or lower) and ranges without sacrificing power efficiency.

Proposed Study Group Officers

- Chair: Rick Roberts
- Vice Chair: Michael Dydyk
- Secretary: Matt Welborn
- Technical Editor: Kai Siwiak

Alternate PHY SG for 802.15.3

- Move to approve the formation of a Study Group in 802.15 to develop a project authorization request, if appropriate, for an alternate PHY for 802.15.3 by the July 2002 plenary.

moved/second: Heile/Nikolich

Time: 450pm

Y/N/A: 9/0/0

4.08 ME 802.16 to RevCom - Marks 5 04:55 P

Moved: To forward P802.16/D5 to RevCom.

Moved: Roger Marks/Buzz Rigsbee

Passed in WG 39/0/2

The negative comments all come from the same voter and are identical to the ones he submitted in the WG ballot. They relate to the fact that this standard is not DOCSIS, that the MAC does not support OFDM, and that the initialization should optimize channel selection. He has not participated since his initial sponsor ballot comments.

Approved: 10/0/0

IEEE 802 LMSC RESOLUTION

Date: 16 November 2001

Motion by: Marks

Seconded by: Rigsbee

- Motion: To forward P802.16/D5 to RevCom
  - “Air Interface for Fixed Broadband Wireless Access Systems” [MAC + 10-66 GHz PHY]
- Notes:
  - Sponsor ballot result: 32/1/3 (97% approval)
    - Negative was recirculated with rebuttal
      - Comments of Disapprove voter attached
      - RevCom application: IEEE 802.16-01/54r2
        - » http://ieee802.org/16/docs/01/80216-01_54r2.pdf
  - Working Group Motion (Plenary, 12 November)
    - “To request that the 802 SEC approve forwarding P802.16/D5-2001 to RevCom”
    - Result: 39/0/2 (100% approval)

4.09 ME 802.16 Press Release - Marks 5 05:01 P

Moved: to approve, pending editing, the press release "Approval of IEEE 802.16 Standard Set Stage for Growth of Metropolitan Area Networks Using Fixed Broadband Wireless" in IEEE 802.16-01/55r1
Moved: Roger Marks/Paul Nikolich
Approved: 10/0/0

IEEE 802 LMSC RESOLUTION

Date: 16 November 2001

Motion by: Marks

Seconded by:

- Motion: To approve, pending editing, the Press Release “Approval of IEEE 802.16 Standard Sets Stage for Growth of Metropolitan Area Networks Using Fixed Broadband Wireless” in IEEE 802.16-01/55r1
  - Approved by Working Group Motion (Plenary, 16 November)
    - Unanimous Voice Vote

4.10 ME 802.16a/b PAR Merger - Marks 5 05:12 P

Moved: To forward a modified PAR 802.16a to NesCom and request withdrawal of 802.16b.
Moved: Roger Marks/Paul Nikolich
This merges the licensed and unlicensed work into the same document and task group. This change brings the PAR structure in line with the document structure.

Approved: 8/0/2

4.11 ME 802.16 ETSI BRAN Liaison letter - Marks 5 05:18 P

Moved: To approve the 802.16 Liaison letter to ETSI BRAN in IEEE 802.16l-01/22r1
Moved: Roger Marks/Paul Nikolich

A question was raised about the coordination of patent letters between IEEE and ETSI. The response is that each IEEE and ETSI have their own IP policies.

Approved: 10/0/0

IEEE 802 LMSC RESOLUTION

Date: 16 November 2001

Motion by: Marks

Seconded by: Kerry

- Motion: To forward the modified PAR 802.16a (IEEE 802.16-01/60r1) to NesCom and request withdrawal of PAR 802.16b
- Notes:
  - Working Group Motion (Plenary, 16 November)
    - “To forward the modified PAR 802.16a (Document IEEE 802.16-01/60r1) to NesCom and request withdrawal of PAR 802.16b ”
    - Result: 23 Approve/7 Disapprove
- Single draft encompassing work under both PARs is now in fourth revision and was approved for WG Letter Ballot on 16 November 2001

Proposed 802.16 Project Structure

Air Interface (Standard)	Coexistence (Recommended Practice)
IEEE Standard 802.16 (**on RevCom agenda**) MAC 10-66 GHz PHY	IEEE Standard 802.16.2 (**published**) 10-66 GHz
P802.16a (802.16a/802.16b merger) 2-11 GHz PHY MAC enhancements WG Letter Ballot November 2001	**P802.16.2a** 2-11 GHz PAR Approved August 2001

IEEE 802 LMSC RESOLUTION

Date: 16 November 2001

Motion by: Marks

Seconded by:

- Motion: To approve the 802.16 Liaison Letter to ETSI BRAN in IEEE 802.16l-01/22r1
  - Approved by Working Group Motion (Plenary, 16 November)
    - Unanimous Voice Vote

4.12 ME 802.16 BWIF Letter - Marks 5 05:23 P

Moved: To approve the letter to the Broadband Wireless Internet Forum.
Moved: Roger Marks/Paul Nikolich

Approved: 9/0/0

IEEE 802 LMSC RESOLUTION

Date: 16 November 2001

Motion by: Marks
Seconded by: Nicolich

- Motion: To approve the 802.16 Letter to BWIF in IEEE 802.16l-01/23r1
  - Approved by Working Group Motion (Plenary, 16 November)
    - Unanimous Voice Vote

4.13 ME Submission to JRG 8A-9B - Hayes 10 05:30 P

Moved: To approve, in principle, the submission of document RR-01/26r2 to the US JRG 8A-9B (as an 802 position), and empower the chairs of the wireless working groups and the regulatory ombudsman and Jim Carlo to make final edits to harmonize the document to the sentiments of the working groups.
Moved: Vic Hayes/Bob O'Hara

This will be done over the signature of the regulatory ombudsman and the three wireless working group chairs.

Approved: 5/0/3

IEEE P802 Radio Regulations

ITU-R FACT SHEET

Study Group: Joint Rapporteur Group 8A-9B Date: ?? November, 2001

Document: US JRG 8A-9B/??-E

Source: IEEE 802 [WGs if needed]

Document Title:

Proposed changes to
WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW RECOMMENDATION ON DYNAMIC FREQUENCY SELECTION IN 5GHz RLANS

Author:

Phone:
Fax:
e-mail:

Purpose/Objectives:

To complete document ITU-R JRG 8A-9B/89 (WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW RECOMMENDATION ON DYNAMIC FREQUENCY SELECTION IN 5GHz RLANS) by providing the information regarding the IEEE 802.11 standard and the draft IEEE 802.16b standard and to make a number of corrections

Abstract:

Document ITU-R JRG 8A-9B/89 originated from the HIPERLAN community and contained placeholders for those sections where the information regarding IEEE standards needed to be inserted. Wherever the term “HIPERLAN” was used generically, the term was changed to “RLAN”.

Prior to submission to ITU-R, the front page will need to be adjusted.

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION STUDY GROUPS

Delayed Contribution
Document 8A-9B/89-E
19 October 2001
English only

Received: DRAFT 11/13/01

Deleted: 19October2001

Subject: Task RLAN

Deleted: France

NOTE: This is a draft of a revision to document 8A-9B/89-E, intended for future submission. This revision has added material relevant to 802.11a, 802.16b, and DFS in 802.11a and 802.16b

-[TBD]

WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW RECOMMENDATION ON DYNAMIC FREQUENCY SELECTION IN 5GHz RLANS

1 Summary

This draft describes the spectrum sharing mechanisms DFS (Dynamic Frequency Selection) which is a feature of the 5 GHz RLAN standards ETSI BRAN HIPERLAN/2 and IEEE 802.11a+h. DFS has been employed in wireless systems to augment system capacity and spectral efficiency. The same mechanism and given capabilities shall be provided also by the IEEE 802.16b working on broadband wireless access system standard for the 5 GHz bands.

Deleted: 802.11a/e/h.

Furthermore, it has been identified as also being a feature, which permits sharing with other services in the 5 GHz band.

2 Introduction

RLANs must coexist with radar in the 5 GHz frequency bands. Link budget calculations have shown that interference mitigation techniques are required to enable sharing of RLAN with other services such as radar systems. This working document towards a PDNR describes the interference mitigation technique(s) Dynamic Frequency Selection as specified in the 5 GHz RLAN standards, with performance calculations based on typical implementations. Similar description is provided also regarding the DFS feature that is being worked on in 802.16b.

The DFS feature was specified in the 5 GHz RLAN standards initially in order to mitigate interference among uncoordinated RLAN clusters, and to provide optimised spectral efficiency for high capacity high bit rate data transmission.

Extension of the use of DFS as described herein allows RLANs to avoid interfering with other services including radar services. The general principle applied is that RLANs shall detect interference and identify radar interferers and shall not use those frequencies used by the radar.

Description of a test and criteria which may be used to ensure compliance of RLANs is also included.

Although one approach could be to exactly specify the radar detection algorithm and to test if the algorithm is correctly implemented, development of the specification and its testing would be an expensive and time-consuming task. A simpler and more flexible approach is to specify the performance required of the DFS and to test if the performance is achieved by the RLAN devices.

3 List of Terms and Abbreviations

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802.11a Supplement to IEEE 802.11. High speed physical layer specification in the 5 GHz band, using OFDM

802.11 Tge Task group “e”. The purpose of this group is to enhance the current 802.11 MAC to expand support for LAN applications with Quality of Service requirements

802.11 TGh Task group “h”. The purpose of this group is to enhance the current 802.11 MAC and 802.11a PHY with DFS and TPC capabilities

802.16b Task group “b” of IEEE 802.16. The purpose of this group is to amend the 802.16 air interface with MAC modifications and additional physical layer for license-exempt frequencies

AP Access Point (of RLAN)

BPSK Binary Phase Shift Keying (modulation)

BS Base Station

C/I Carrier to Interference ratio

CCI Co-channel Interference

Contention window The period of time in which an AP or MT must choose a random back-off before accessing the medium after a successful transmission, or when the medium has been found to be busy

DCF Distributed Coordination Function. An access method between AP and MT based upon CSMA/CA.

DFS Dynamic Frequency Selection

Deleted: Selection

DIFS Distributed inter frame space

DLC Data Link Control (Layer in OSI protocol model)

ETSI European Telecommunications Institute

FWA Fixed Wireless Access

HCF Hybrid Coordination Function

IEEE Institute of Electrical & Electronics Engineers

LAN Local Area Network

MAC Medium Access Control

MT Mobile Terminal (of RLAN)

OFDM Orthogonal Frequency Division Multiplexing

Deleted: Modulation

OFDMA Orthogonal Frequency Division Modulation Access

PHY Physical Layer (Layer in OSI protocol model)

16QAM Quadrature Amplitude Modulation with 16 point constellation

64QAM Quadrature Amplitude Modulation with 64 point constellation

QPSK Quadrature Phase Shift Keying

RLAN Radio Local Area Network (= WLAN)

RLC Radio Link Control

RNG-REQ Ranging Request

RNG-RSP Ranging Response

RRC Radio Resource Control

RSSI Receive Signal Strength Indicator

SIFS Short inter frame space

SS Subscriber Station

TLV Type-Length-Value

TPC Transmit Power Control

WLAN Wireless Local Area Network (= RLAN)

4 Shared Frequency Bands

THE BANDS WHICH ARE CONSIDERED FOR RLAN SHARING IN WRC-03 AGENDA ITEM 1.5 ARE LISTED IN TABLE 1.

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TABLE 1

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Existing and Proposed RLAN Allocations (Resolution 736 WRC-2000)

Band	Allocated	Proposed additional allocations
5 150-5 250 MHz	AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (Earth-space) S5.446 (RDSS feederlinks) S5.447 (MOBILE)	MOBILE (**RLAN**)
5 250-5 350 MHz	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) S5.448 (RADIONAVIGATION)	MOBILE (**RLAN**) FIXED (FWA) for Region 3
5 470-5 570 MHz	MARITIME RADIONAVIGATION Radiolocation S5.450 (AERONAUTICAL RADIONAVIGATION)	RADIOLOCATION (upgrade) EARTH EXPLORATION-SATELLITE (active) MOBILE (**RLAN**)
5 570-5 650 MHz	MARITIME RADIONAVIGATION Radiolocation S5.450 (AERONAUTICAL RADIONAVIGATION) S5.452 (MET RADAR 5 600-5 650 MHz)	RADIOLOCATION (upgrade) MOBILE (**RLAN**)
5 650-5 725 MHz	RADIOLOCATION Amateur Space Research (deep space) S5.453 (FIXED AND MOBILE) S5.454 (SPACE RESEARCH) S5.455 (FIXED)	MOBILE (**RLAN**)

5 Wireless LAN (WLAN, RLAN)

Figure 1 shows a basic layout of RLANs, where two independent networks are installed near to each other. The AP is the access point to a fixed backbone network such as an Ethernet LAN or an IEEE 1394 network. The MTs can associate and dissociate with APs in the radio coverage area. The two radio coverage areas are shown to overlap in the figure. The core fixed networks for the APs are in general not the same and therefore there is no coordination between the two independent coverage areas. DFS within each independent wireless network may be used to control the radio frequency to allow independent RLANs to co-exist in overlapping zones. DFS allows each AP to choose a frequency with sufficiently low interference, and TPC reduces the range of interference from terminals, increasing spectral efficiency via more frequent channel re-use within a given geographic area. DFS may also permit detection of other services, which could interfere or be interfered with.

DFS and TPC are implemented in the RLAN standards HIPERLAN/2, IEEE 802.11a+h [and HiSWANa]. DFS is introduced in sections below.

Deleted: 802.11a/e/h

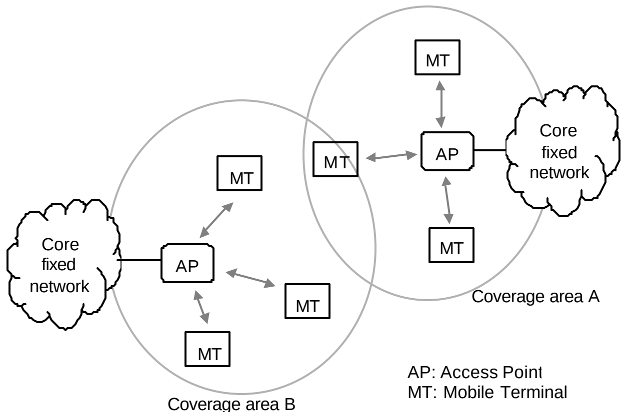

FIGURE 1

Basic RLAN layout

6 Overview of HIPERLAN/2

HIPERLAN/2 Data Rates

The PHY layer of HIPERLAN/2 is based on Orthogonal Frequency Division Multiplexing (OFDM) modulation. In order to improve the radio link capability due to different interference situations and distance of MTs to the access point, a multi-rate PHY layer is applied, where the "appropriate" mode will be selected by a link adaptation scheme. The data rate ranging from 6 to 54 Mbit/s can be varied by using BPSK, QPSK, 16QAM or 64QAM modulation of the OFDM sub-carriers.

HIPERLAN/2 Protocol [1][2][3]

Figure 2 is an overview of the HIPERLAN/2 protocol stack. ETSI BRAN HIPERLAN/2 specifies the Physical, Data Link Control and Convergence Layers. Above the Convergence Layer are the layers, which are not covered by the standard, which are implementation and application specific. The figure shows an example of where the higher layers control the radio through the Radio Resource Control (RRC) functions, which are defined in the RLC (Radio Link Control) sections of the standard. Decisions about power level for transmission or which frequency channel to use, are made in higher layer software and control messages are sent to the RLC, which then configures the radio in the Physical Layer.

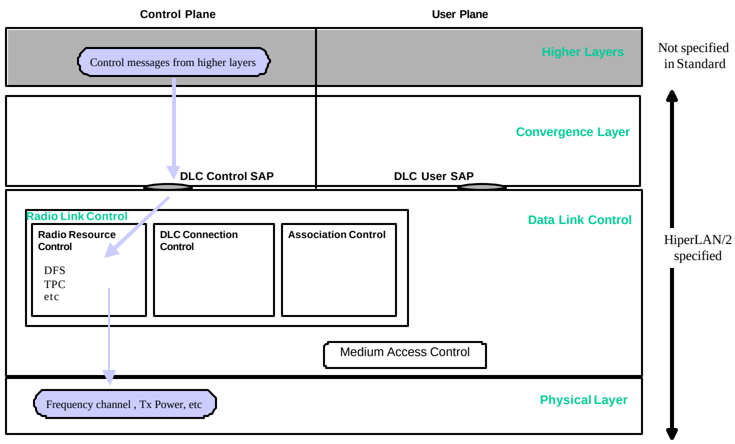

FIGURE 2

HIPERLAN/2 Protocol stack

The radio operation and radio resource allocation in the wireless network are controlled by the RLC entities communicating peer-to-peer within an associated MT – AP pair. There are three channels over the wireless link that can be used for RLC Control communication:

1 Broadcast channel BCH. It is used by the AP to broadcast information to all its associated MT in its radio neighbourhood.

2 Dedicated control channel DCCH. Used for all control information that needs to be exchanged between a specific MT and AP.

3 Random Access channel RCH. A contention-based period of each time frame, during which any MTs that have no other way to communicate with the AP send their control information through the RCH time slots.

The radio resource control (RRC) is responsible for the surveillance and efficient use of available frequency resources.

The functions in the RLC for the support of the RRC are:

• Dynamic Frequency Selection: HIPERLAN/2 may operate in a "Plug-and-Play" manner and will not require frequency planning. The decision on the selection of a frequency channel is, in the first step when no MTs are associated, based on the AP's own measurements. During operation, the situation may change and the AP could switch communication to a different frequency channel. The decision when to perform a frequency change and to which frequency can be based on both measurements by the AP and the associated MTs. The DFS supporting functions of the RLC allow for:

• measurements by MTs and AP: The terminal may do measurements on its own or on a different channel, either based on its own decision or as ordered by the AP

- reporting of the obtained measurements from MTs to the AP

- frequency change of the AP and its associated MTs

- MT alive procedure: In order to make sure that the AP does not reserve resources unnecessarily for an MT, the AP may request it to report if it is still alive

- MT absence function: The MT may want to scan for a different frequency channel in order to find out whether it shall perform a handover and to which new AP it shall change. This function is triggered by the MT

- Power saving function: Many MTs will be battery driven. Therefore, HIPERLAN/2 supports an efficient scheme to support the conservation of battery power.

- Transmit Power Control: AP and MT will support means to adapt their transmission power to the current requirements of the radio link.

- Handover: The RRC will decide when to perform a handover and support its execution.

- AP absence function: The AP may want to scan the currently used frequency in order to detect interference.

The control messages from the Control Plane and the user Data from the User Plane are time-division mutiplexed onto the radio channel in a sequence of OFDM symbols organised in bursts within regular Frames. The structure and timing of the frames is described in the next section.

HIPERLAN/2 Frames

Figure 3 shows the time framing of transmission in HIPERLAN/2 . OFDM symbols are normally 4 us in duration (they may optionally be 3.6us - when a short cyclic prefix is used). Symbols are concatenated into bursts on the PHY Layer which consist of a Preamble and a sequence of data symbols representing the Payload. The length of the burst within a frame depends on the amount of data to be transmitted. The bursts are organised into phases within MAC Frames. A MAC Frame is 2ms. It is clear that the occupation of the frames and the amount of frames containing transmitted bursts will be dependent on the traffic load downlink from the AP and the sum of uplink traffic from MTs. To make interference measurements, the empty space may be utilized, or transmission must be shut down during the measurements. The latter case impacts traffic capacity of the RLAN.

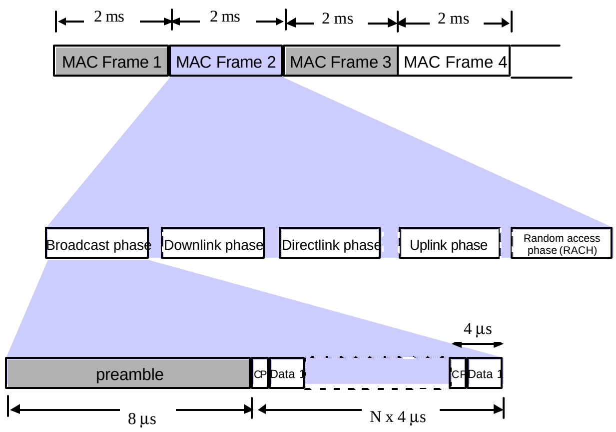

Figure 3– HIPERLAN/2 Frames

7 Overview of IEEE 802.11a+h

Deleted: 802.11a/e/h [Overview of HiSWANa may be needed as a separate section]

Deleted: TBD¶
8

Relationship Between 802.11, 802.11a, TGh (802.11h), and TGe (802.11e)

The 802.11 standard defines a wireless Media Access Control protocol, along with several physical layer implementations. The 802.11a supplement defined a new physical layer in the 5GHz frequency band. It uses the MAC as defined in 802.11.

Task group "h" was formed to enhance this standard by adding indoor and outdoor channel selection for 5GHz license exempt bands in Europe; and to enhance channel energy measurement and reporting mechanisms to improve spectrum and transmit power management. These efforts are concentrated in the areas of DFS and TPC. A first draft of the standard has been completed and is in revision. When the draft is completed and approved, it will become 802.11h, a supplement to the 802.11 standard that provides DFS and TPC in the 5GHz band.

Task group "e" was formed to address this issue and improve Quality of Service (QoS). This is a revision to the 802.11 MAC, and will apply to all 802.11 PHY layers. While it is not directly related to DFS or TPC, it does modify the protocol and includes some facilities for dealing with overlapping AP coverage areas. A first draft of the standard has been completed and is in revision. When the draft is completed and approved, it will become 802.11e, a supplement to the 802.11 standard that provides QoS for all 802.11 PHY layers. For the purposes of this submission, 802.11e has no effect on the ability of 802.11a networks to find and avoid radar systems.

802.11a Data RatesThe PHY layer of IEEE802.11a is based on Orthogonal Frequency Division Multiplexing (OFDM) modulation. In order to improve the radio link capability due to different interference situations and distance of MTs to the access point, a multi-rate PHY layer is applied, where the "appropriate" mode will be selected by a link adaptation scheme. The data rate ranging from 6 to 54 Mbit/s can be varied by using BPSK, QPSK, 16QAM or 64QAM modulation of the OFDM sub-carriers.

802.11a Frame Formats

Figure 4 shows the time framing of transmission in 802.11a. OFDM symbols are normally 4 us in duration. Symbols are concatenated into bursts on the PHY Layer which consist of a Preamble and a sequence of data symbols representing the Payload. The length of the burst within a frame depends on the amount of data to be transmitted. The shortest possible burst has a duration of 28 us (1 byte in payload) and the longest of 3.1 ms (BPSK in payload, r=1/2, 2314 bytes).

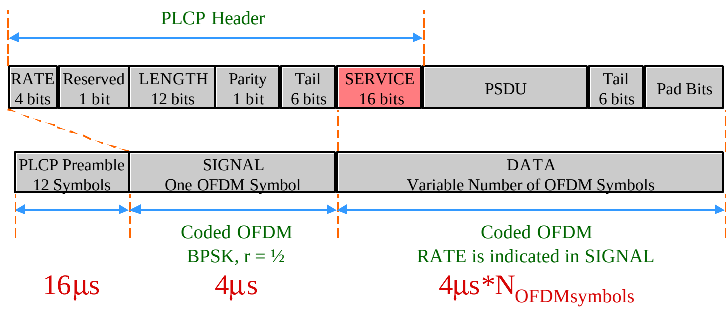

Figure 4 – 802.11a Frames

802.11a Media Access Mechanisms

The 802.11 standard provides two media access mechanisms, the Distributed Coordination Function (DCF), and the Point Coordination Function (PCF). The DCF access mechanism is based on CSMA/CA, commonly known as listen before talk. The random access is slotted, with a random backoff time selected within the contention window following a busy medium condition. In addition, all directed traffic uses immediate positive acknowledgment (ACK frame) where retransmission is scheduled by the sender if no ACK is received. Figure 5 (same as figure 49, 802.11) shows a typical access sequence. A Short Inter-Frame Spacing (SIFS) is used between a packet and its acknowledgement (ACK). After the acknowledgement packet, MTs have to wait a Distributed Inter-Frame Space (DIFS), as well as a random portion of the contention window.

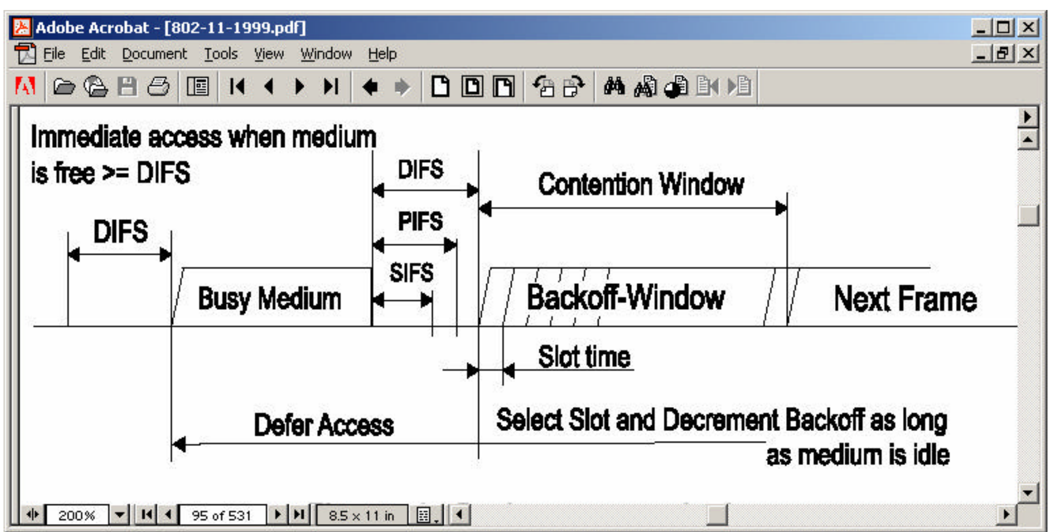

Figure 5 – DCF Interframe Spacing

Access via the PCF mechanism is shown in figure 6 (same as figure 62, 802.11). The PCF access mechanism is based on polling by the AP. In this mode the AP has control over which nodes transmit and when they transmit. The AP first issues a PCF beacon, informing all MTs that they must wait until they are polled before transmitting. After that, the AP can commence polling of the MTs. Polls can be combined with data payloads, as well as with acknowledgments of previous packets. Once polled, MTs can respond with combined data and acknowledgements. The gaps between packets in this mode are generally SIFS or PIFS, although the AP can always leave the medium idle for any length of time it chooses.

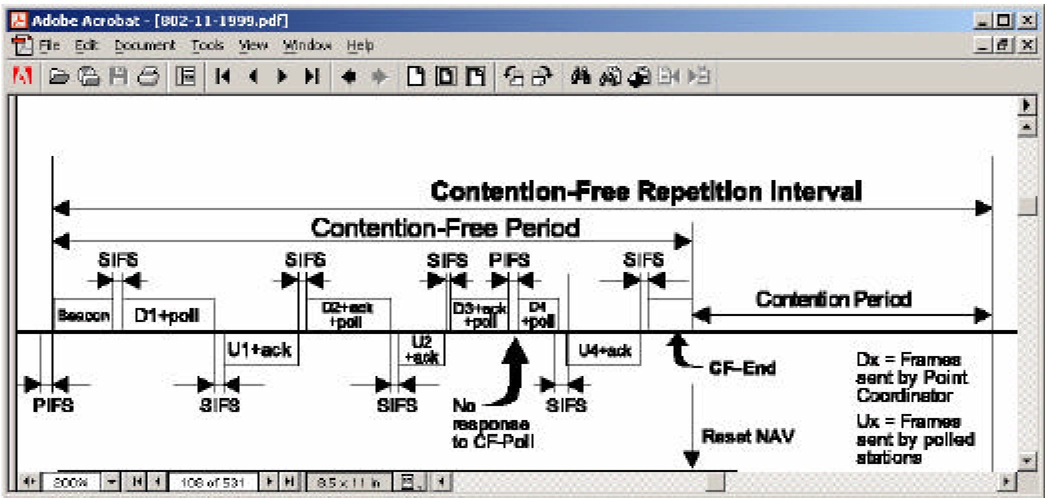

Figure 6 – PCF Interframe Spacing

Task Group e (TGe) is currently defining an extension of the 802.11 standard to provide higher quality of service. Although this work has not completed, two enhanced access mechanisms are likely to be supported. Enhanced-DCF (eDCF) is similar to DCF, but nodes are given different contention windows based on the priority of their traffic. The Hybrid Coordination Function (HCF) follows along the lines of PCF, but includes TDMA style operation, similar to those described for Hiperlan2.

The most important aspect of the access mechanisms relative to DFS are how frequently, and what percentage of the time the medium is free of traffic such that radar pulses could be detected. In all access mechanisms, the maximum packet length is just over 3ms. Following such a packet, there is at least a SIFS period (16us).

In the DCF mode, between an acknowledgment and the next data packet, there is a DIFS as well as on average ½ of a contention window. This window starts out at 135us and increases exponentially as there are more collisions. Because the contention window increases with collisions, as the network load increases, the medium occupancy in DCF mode saturates. The following graph (figure 7) shows the percentage time that the medium is idle vs. network load. The network has been loaded with a varying number of UDP or TCP streams, each stream fully loading a single MT. For 802.11a in DCF mode, the medium occupancy can never exceed ~85%.

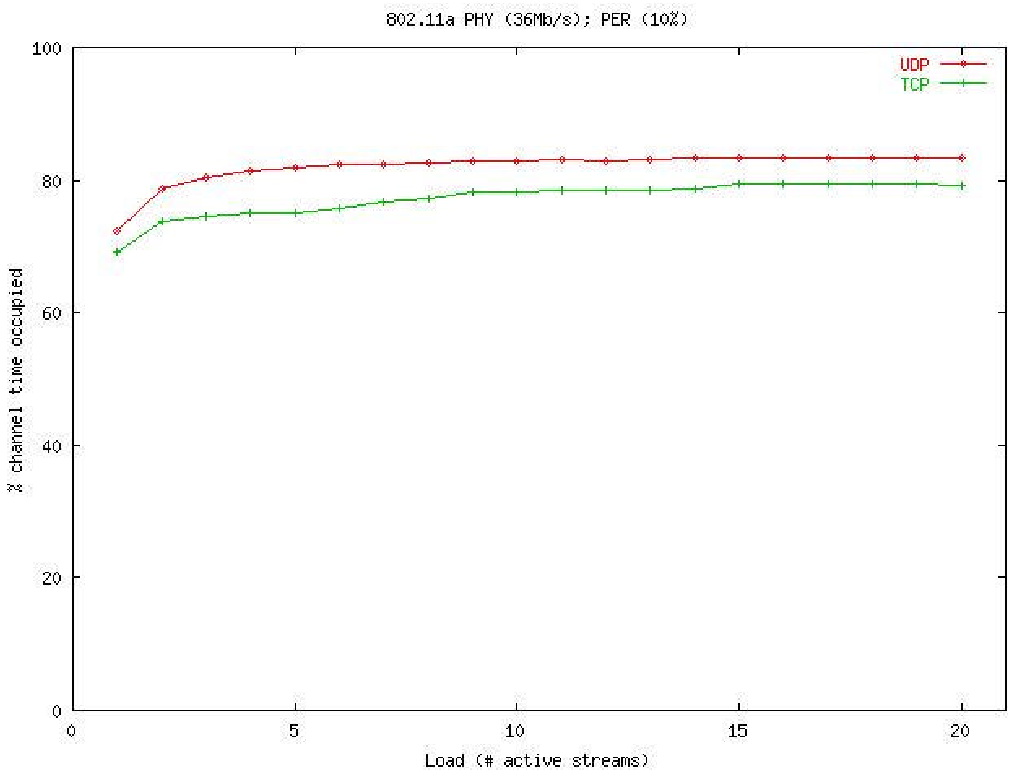

Figure 7 – Medium Occupancy vs. MTs Transmitting Fully Loaded Data Streams

In PCF and HCF modes, the AP can directly control the medium occupancy. While very high medium occupancy rates can theoretically occur, the AP can easily limit this to any value in order to insure sufficient time to detect radar pulses.

802.11a Protocol StackFigure 8 shows the elements in an 802.11 station architecture. IEEE802.11 specifies PMD, PLCP and MAC sublayers on the data path, and PHY and MAC layer management entities (LME) and station management entity (SMT) in the management plane.

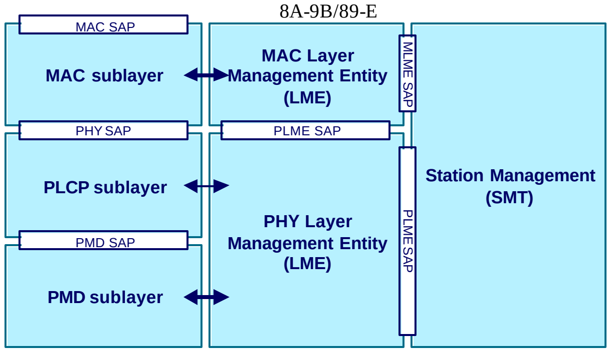

Figure 8– 802.11 Protocol Stack

- PMD (Physical Medium Dependant) - defines the characteristics and method of transmitting and receiving data through a wireless medium between two or more stations each using OFDM signals.
- PLCP (Physical Layer Convergence Protocol) - defines convergence functions which adapt the capabilities of the PMD to the Physical Layer service access point.
- MAC (Medium Access Control) - defines Contention and Contention Free services at the MAC service access point using Distributed, Point and, possibly, Hybrid coordination functions (DCF, PCF, HCF).
- PHY LME; MAC LME – provide the layer management service interfaces through which layer management functions may be invoked.

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SMT – is a layer-independent entity providing status gathering, layer parameter control and system management functions using mechanisms provided by the LMEs. Management functions include transmit power control and channel selection.

802.11 Management Packets and Beacons

Terminals may find an 802.11 WLAN by listening for beacons from the AP.

The 802.11 MAC specifies a timing synchronisation function (TSF), using beacons and probe responses, to define a timing structure for WLAN operations. The timing structure enables scheduling of contention free periods and terminal wake -ups in power-save mode. MTs are able to spend a significant amount of their time in a sleep mode. During this sleep mode their receivers can be completely shut down. MTs wake based on the established time synchronization with the AP.

Beacons and probe response frames also contain other management information, including identity, capability and traffic maps for mobile terminal power save functions. Other management packets provide association, authentication and traffic map services and information. DFS information is carried by management frames, and fields within the beacons and probe response messages. The contents of the DFS related messages are detailed in the next section.

8 Overview of IEEE 802.16b

IEEE 802.16 Working Group is developing Media Access Control modifications and additional physical layer for license-exempt (5 GHz) bands. The IEEE 802.16b MAC shall be based on the 802.16 MAC with additional features like DFS incorporated.

9 DFS

DFS in HIPERLAN/2 [3][4][5][6][7]

HIPERLAN/2 uses a centralized DFS protocol, where each AP decides independently, which frequency is used within the cell. Optionally, frequency planning could be also used to give the AP a list of preferred frequencies.

The Dynamic Frequency Selection (DFS) in HL/2 systems shall result in equal usage of available frequencies and avoid interference to other devices using the same spectrum. Every AP collects interference measurements and chooses an operating frequency based on the measurement results. The DFS algorithm is out of the scope of the current specification.

DFS Measurements in HIPERLAN/2

The criterion used for DFS is mainly received signal strength (RSS). APs can make RSS measurements themselves and/or request mobile terminals (MT) to make measurements. The measurements can be done on the currently-used or another frequency. A MT may also do self-initiated measurements and request to report the results to the AP. The AP may then poll the MT for the result or may ignore the request. APs and MTs shall be able to decode possible BCH transmissions of other APs at a given frequency. This may enable interference from a nearby AP coverage area to be distinguished from other sources of interference.

The physical layer of HIPERLAN/2 is able to perform RSS measurement procedures, for example :

- a single RSS measurement particularly on the broadcast burst phase BCH (Short measurement)
- a series of RSS measurements with period 8 μs at any position of the MAC frame (Percentiles measurement)
- a single RSS measurement on the BCH and a series of RSS measurements at least 8 μs later (Complete measurement)

The measurement request can be made over a specified time period with an accuracy between +/- 10 dB and +/- 5 dB, which depends on the power level [2].

All HIPERLAN/2 MTs must be able to perform the RSS measurements required for DFS. The current assumption is that the AP performs interference measurements (or receive measurement results from associated MTs) on a frequency before the frequency is used for communication.

DFS messages in HL/2

The following DLC messages are available in the the HL/2 RLC specification. These messages enable efficient centralized DFS operation. The DFS can be executed without re-establishing the connections.

AP_ABSENCE message If the AP has associated MTs, the AP has to broadcast an AP_ABSENCE message before it can make measurements on the other frequencies or to inform MTs they are forbidden during the absence time from transmitting. AP_ABSENCE informs all MTs when the AP is not transmitting and when it starts normal operation again. The absence should not be too long, i.e. sleeping MTs should not be affected. INDICATION_OF_THE_MEASUREMENT_TIME message. In order for the MT to measure the used frequency, the AP has to make sure that there are no own cell transmissions. I.e. either the AP has sent the AP_ABSENCE message or it indicates with INDICATION_OF_THE_MEASUREMENT_TIME, the idle periods for the measurements. This ensures that the measured field strength is really interference.
DFS_MEASUREMENT_COMPLETE_REQUEST message DFS_MEASUREMENT_PERCENTILES_REQUEST message DFS_MEASUREMENT_SHORT_REQUEST message An AP can request the MT measurements with DFS_ MEASUREMENT_x_REQUEST either by broadcasting it or by dedicating it to a single MT. In SHORT format an MT tries only to decode and report HL/2 BCH content to the AP at the given frequency. In PERCENTILES request the MT measures interference level distribution and reports percentile values to the AP. In COMPLETE request the MT executes both the above tasks.
CHANGE_FREQUENCY message If the AP finds it necessary to change the operating frequency, it starts to send a CHANGE_FREQUENCY message, which includes e.g. the new frequency, the time remaining on the current frequency and the start time on the new frequency. During the remaining time, all the sleeping MTs have to be woken.

DFS in IEEE 802.11a+h

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IEEE 802.11h uses a centralized Dynamic Frequency Selection (DFS) protocol, whereby each AP decides which frequency is used within the cell. DFS in IEEE 802.11h systems shall result in equal usage of a regulated minimum number of channels and avoid interference to licensed devices using the same spectrum. The DFS algorithm is out of the scope of the current specification.

The DFS procedures provide for the:

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- Measuring of channels directly by an AP or MT or by another MT on behalf of the AP or MT.
- Reporting of measurements by anMT as the result of a request or autonomously.

- Selection of channels and the announcing of channel switches.

DFS Measurements in IEEE 802.11h

The criteria used for DFS are based on received signal strength (RSS). APs can make RSS measurements themselves and/or request MTs to make measurements. The measurements can be done on the currently -used or another frequency. Measurements may be reported by a MT either in raw form or as the outcome of processing to identify the presence of a licensed user in the spectrum. A MT may also do self-initiated measurements and report the results to the AP.

APs and MTs may also decode transmissions of other APs and MTs (both IEEE 802.11 and Hiperlan/2) at a given frequency. This may enable interference from a nearby cell to be distinguished from licensed users.

The measurement request and reporting framework is extensible and provides for the definition of new measurement requests and reports as may be required by regulatory authorities. Currently defined measurements include:

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- RSS histograms over a period specified in the measurement request from a starting
- Identification of primary users
- Identification of other RLANs

The measurement request can be made over a specified time period with an accuracy between +/- 5 dB for RSS ≤ -57dBm and –5dB for RSS >-57dBm.

Measurements are taken in IEEE 802.11 WLANs both before a channel is used and while a channel is being used. An AP measuring a channel does so in a protected period so that MTs associated with the AP do not attempt transmissions to the AP during the measurement period.

DFS Messages in 802.11h

The following messages are available in the IEEE 802.11h specification. These messages enable efficient DFS operation.

Association Request Frames; Re-association Request Frames: **Supported Channels element** The *Supported Channels* element contains a list of channels in which an AP or MT is capable of operating.
Beacon Frames; Probe Response Frames: **Channel Switch Announcement element** The *Channel Switch Announcement* element allows an AP (or, for ad-hoc mode, an initiating MT) to advertise when it is changing to a new channel and the channel number of the new channel.
Channel Measurement Request frames:

Basic Channel Measurement Request element

Extended Channel Measurement Request element

An AP or MT uses *Channel Measurement Request* frames containing one or more *Basic* or *Extended Channel Measurement Request* elements to request other stations to measure one or more channels.

A *Basic Channel Measurement Request* element contains a request that the receiving station undertake measurements for a specified duration to determine if a licensed user is operating in a particular channel.

An *Extended Channel Measurement Request* element contains a request that the receiving station undertake measurements for a specified duration in a particular channel. This request contains an ID field that identifies the format and contents of the measurement request. The IEEE is responsible for allocating the ID number space. ID equal to 0 indicates an RSSI Histogram Request.

Channel Measurement Report frames:

Basic Channel Measurement Report element

Extended Channel Measurement Report element

An AP or MT uses *Channel Measurement Report* frames containing one or more *Basic* or *Extended Channel Measurement Report* elements to report the result of measurements.

A *Basic Channel Measurement Report* element contains the measured channel number and a measurement summary that includes the following indications:

- at least one valid 802.11 frame was decoded during the measurement period.
- at least one PLCP preamble was detected without a subsequent valid signal field during the measurement period.
- the measurement has detected transmissions in the channel that cannot be characterized as either from a licensed user or an unlicensed user.
- the measurement has detected a licensed user operating in the channel.
- the measurement shows a clean channel - no users (licensed or unlicensed) are operating in the channel.

An *Extended Channel Measurement Report* element contains the measured channel number, a measurement report and an ID that identifies the format and contents of the measurement report. The IEEE is responsible for allocating the ID number space. ID equal to 1 indicates an RSSI Histogram Report, which contains 8-bit densities over the measurement period for eight defined RSSI ranges.

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DFS in IEEE 802.16b

In 802.16b DFS is the process that is used to assign one of several possible channels to the subscriber station (SS which equivalent to the MT). DFS may be also used to assign the best quality channel to each link (unicast/multicast/broadcast). The process requires monitoring by the SS and assignment of channels by the upper processing layers of the BS (equivalent to the AP). As part of the DFS process, Primary User Detection is used to identify and eliminate from use (and thus interference to) channels in which primary users are detected. This is especially important to the IEEE 802.16b systems which will work outdoors in nomadic applications in the 5 GHz bands.

Primary User Detection in 802.16b

In some regulatory domains, the 5 GHz license exempt bands have been allocated to certain services on a primary basis. Operation in these bands is allowed only for devices capable of avoiding occupied channels by employing a dynamic frequency selection mechanism. DFS shall be employed to detect the presence of other systems. Therefore, the equipment is able to avoid co-channel interference with other systems, notably radar systems. When selecting the channel to operate in, the device shall first assess whether the channel is occupied by a primary user and only after that shall it use other selection criteria, e.g. C/I and RSSI. This is illustrated in the following figure which shows high-level flow diagram of the DFS with primary user detection capability.

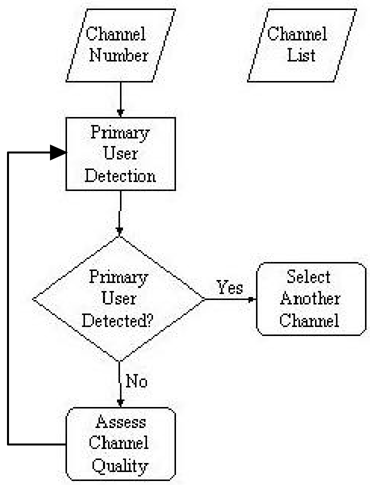

Figure 9: High-level diagram of the primary user detection mechanism of DFS

DFS Measurements in 802.16b

Within the mesh and directive antenna system architectures, each SS, prior to registration, will monitor the available channel spectrum. Typically, the SS will go to each assigned channel (which can be a few as 4) and monitor each channel and compile a list of usable channels. Each channel will be characterized in terms of its RSSI. The RSSI will be determined by the PMD measurement of the preamble bits of the OFDM bursts. The preamble bits will be within downlink broadcast frames and will always be at the maximum power for the link.. A similar reading will be made of the Co-Channel Interference (CCI). Primary User Detection and be detected as co-channel interference, and with further processing, identified as to whether it originates from other terminals or from Radars. Additionally, primary detection can be undertaken at the end of the Downlink OFDM or OFDMA frame, which typically have periods of no transmission by the BS, allowing for the monitoring of other users. Such measurements will be undertaken almost on a continual basis allowing the detection of Primary Users such as Aeronautical Radars which may be transiting the service area.

DFS Messages in 802.16b

DFS is undertaken prior to the commissioning of a SS to a channel. As part of the network entry process for IEEE 802.16b terminals, the SS will determine downlink and uplink characteristics (such as RSSI and CCI) for all valid channels, and determine what downlink channels contain primary users as determined by the Primary User Detection subsystem. The next step is the initial ranging and automatic adjustments stage. The ranging mechanism was originally created to handle 'natural' interference and is capable of handling other sort of interference (e.g. man-made interference). The ranging mechanism already has all the provisions to be used both during the SS network entry process, and during periodic SS maintenance. The initial ranging mechanism basically consists of a series of transactions where the SS sends a RNG-REQ message containing the parameters of all valid channels (N) as well as the downlink channel numbers of all channels occupied by primary users (M detections). Of the valid channel that the SS will detect, there will be a primary channel (Base Station ID) on which the SS sends its initial request, and which shall be the first identified in the Type/Length/Value field (of the RNG-RSP Mac message shown below), along with its measured signal parameters (RSSI, CCI, and Primary Detected Users). The BS responds by a RNG-RSP Mac message assigning the SS a working Base Station ID and/or ordering the SS to change its transmission power or timing parameters. During periodic maintenance for such functions as DFS monitoring or off-loading of the SS to other cells, the SS can be polled by the BS to transmit a RNG-REQ message, or otherwise it can be sent independently by the SS, for example, in response to a DFS action. The BS answers using a RNG-RSP message, and the SS corrects its operational parameters as instructed by the BS.

In order to utilize the ranging mechanism for dynamic frequency selection the following TLV are added to the RNG-REQ message,

Name	**Type**	**Length**	**Value**	**Scope**
Base Station ID(n)	?	6 byte	The BS ID the SS is sending the RNG-REQ message as determined from the DL-MAP message. (repeated N times for N valid channels)	RNG-REQ
Downlink channel ID(n)	?	1 byte	The downlink channel ID the SS is sending the RNG-REQ message to (determined from the DCD message) (repeated N times)	RNG-REQ
Mean RSSI(n)	?	1 byte	Mean RSSI measured by the SS in 1dBm increments from –60 dBm (00111111) to –123 dBm (00000000) (repeated N times)	RNG-REQ
Mean CCI (n)	?	1 byte	Mean CCI measured by the SS in 1dBm increments from –60 dBm (00111111) to –123 dBm (00000000) (repeated N times)	RNG-REQ
RSSI standard (n) deviation	?	1 byte	RSSI variance measured by the SS, expressed in dB from –10 dB (00000000) to 53 dB (00111111) (repeated N times)	RNG-REQ
CCI standard deviation (n)	?	1 byte	CCI variance measured by the SS, expressed in dB from –10 dB 00(000000) to 53 dB (00111111) (repeated N times)	RNG-REQ
DFS		2 bytes	Channel number of occupied channel (repeated M times)	RNG-REQ
Uplink EIRP (optional)	?	1	EIRP power emitted SS, expressed as a signed integer (range –128 to 127) in units of 1dBm	RNG-REQ

Table 2: Additional TLV set for RNG-REQ (Uplink) message

The following TLV are added to the RNG-RSP message,

Name	Type	Length	Value	Scope
Base Station ID override (optional)	?	6	The BS ID the SS should operate with. The SS shall restart the network entry process on this BS.	RNG-RSP
DFS info request	?	1	0 = No DFS information required 1 = Send DFS information (e.g. the TLV values listed in table 1) in the next RNG-REQ message	RNG-RSP

Table 3: Additional TLV set for RNG-RSP (Uplink) message

10.0 Interference mitigation via DFS

HIPERLAN/2 and 802.11a+h will have similar interference mitigation properties via DFS. This is because the physical layers of the two systems are nearly identical. These systems will have similar RSS systems, and therefore similar radar detection thresholds and false alarm probabilities.

While the MAC protocols are different, their medium occupancy is similar. As will be shown below, both systems detect radar systems quite well when the medium occupancy is ~80% or less. For HIPERLAN/2 and 802.11a in PCF or HCF mode, this limit of medium occupancy can be guaranteed by the Aps. For 802.11a in DCF mode, medium occupancy is limited to this level by design.

HIPERLAN/2 and 802.11a+h have similar network start-up sequences, such that radar detection will be similar in start-up mode.

Finally, the measurements being made, and management frames used to communicate them, are also similar. Both record histograms of signal magnitudes. Both can detect radar pulses above a certain threshold.

Therefore, the following analysis applies to both systems equally.

10.1 Spreading

In order to facilitate better sharing conditions with the EESS (active) and FSS (Earth to Space) services Dynamic Frequency Selection associated with the channel selection mechanism is required to provide a uniform spread of the loading of WLAN devices across a minimum of 330MHz . By utilising a random channel selection procedure DFS will reduce the effect of cumulative interference into satellite receivers that can be caused by a high number of WLAN devices initially selecting the lower part of the proposed mobile allocation in the 5GHz band to operate.

10.2 Radar detection and avoidance

Results of calculations of probability of interference to radar based on the use of DFS are presented in this section. A test method will be described in the next section which can ensure RLAN devices meet non-interference criteria.

10.2.1 Link budget analysis

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Mutual interference levels between radar systems and RLANs using simple line of sight link budget calculations have been presented in [9] [11] and show that in general, if the RLAN is within the range of the radar (i.e. within its view angle and horizon) the RLAN signal can interfere with the radar, and inversely, the radar signal will be received at the RLAN with a high peak power level. In addition, link budget calculations are presented in Annex 1 on the basis of the characteristics available in the PDNR developed by WP8B in [8]. It is therefore concluded from these calculations that a) RLANs must have a means to avoid transmitting directly into the radar antenna view zone, and b) the peak signal power of radar pulses at the RLAN is always above –61 dBm at the radio horizon and well within the sensitivity range of an RLAN receiver. The value of –61 dBm for the Radar signal level at RLAN receiver is considered since this value is under consideration for the detection threshold value of radar signal power which will activate the DFS mechanism (see 9.2.3.3 and 9.2.4.2 for further details). These calculations may be reviewed when some of the radar characteristics which are needed for the calculations will be available (such as transmitter and receiver bandwidths, receiver noise figure…).

10.2.2 Comparison threshold technique

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The basic technique for DFS avoidance of interference is to compare the interfering signal level with a reference or threshold level. Identification of a distinct characteristic of the interfering signal e.g. its time signature may also be possible to improve identification probability. This method requires further study.

Several studies on the coexistence of HIPERLAN/2 and radar in the same frequency band have been conducted with respect to representative radar e.g. [12][13][14]. These radar signals are summarized in Table 4. It should be noted that these representative signals have been brought to the attention of WP 8B for comments and may be reviewed in particular to be consistent with the PDNR ITU-R M.[8B-Char] [8].

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Radar signal type	Operating frequency range (MHz)	Bandwidth (MHz)	Burst length (ms) / no. of pulses	Scan Rate (sec)	Pulse width (µs)	Pulse repetition frequency, PRF (pps)
Radar signal 1 (cf. [14])	>5250	14	26 / 18	10	1	700
Radar signal 2 (Maritime, [14])	5450 – 5820	2	5 / 10	2	0.2	1800
Radar signal 3 (Meteorological, [14])	5600 – 5800	0.6	500 / 165	144	2	330

Table 4: Parameters of representative radar signals

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In these studies, the generally used concepts of detection probability (of a radar signal) and false alarm probability are introduced to characterize the RLAN's radar detection/identification performance. These are explained in more details below.

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An additional important parameter is the power of the radar test signal at the RLAN receiver input, at which the radar signal is detected. This power threshold is discussed below (10.2.3.3 and 10.2.4.2). The specification of the threshold can be determined separately since the detection probability is not impacted once the signal is above the threshold.

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10.2.3 DFS for radar detection

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DFS in the context of radar detection comprises a start-up mode and a mode of normal operation. The start-up mode is entered immediately after power-on of an access point and enables reliable detection of continuously transmitting radar which may be present before start-up. Start-up mode may be repeated at will, but normally with a long period e.g. hours or days so that RLAN traffic is minimally disturbed. The normal operation mode is when the RLAN detects radar during normal communications, which is of relevance for an occasionally transmitting radar or a moving radar.

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HIPERLAN/2 and 802.11a+h are communications systems that are typically centrally controlled through access points. Therefore, it is assumed that the DFS intelligence for radar detection and avoidance operates in the access points.

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The DFS in HIPERLAN/2 and 802.11a+h is based on measurements of received signal strength (RSS), although the presence of interference may be signaled by a burst of packet errors. Hence, radar detection as evaluated in this document is also based on RSS measurements. The general method is to compare RSS with a threshold and to assume the presence of a radar signal if RSS exceeds the threshold. The threshold that is considered in this document is defined at the RLAN receiver input and is referred to as "*detection threshold of radar signal power*".

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10.2.3.1 Start-up mode

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After the RLAN access point is switched on the first time or after a set-up, the access point enters the start-up mode. In this mode, the access point does not transmit; it only measures RSS on the frequencies it is able to transmit on. The access point checks which frequencies are occupied by radar. These frequencies are "marked" and will not be used by the access point. At the end of the start-up mode, the access point starts its mode of normal operation only transmitting on unmarked frequencies.

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In start-up mode each frequency is measured for a certain time T. A radar signal is detected if the RSS exceeds the threshold during the measurement interval T. The total duration of the start-up phase may be up to $N \cdot T$ with N denoting the number of available frequencies. The reliability of radar detection increases with the duration of the start-up phase. However it should be kept within reasonable limits since the RLAN is not available during the start-up time.

10.2.3.2 Mode of normal operation

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Occasionally transmitting radar or moving radar, radar with a tracking antenna are kinds of radar which may not be in use before the RLAN AP is switched on and may therefore not be detected during the start-up phase.

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For the detection of such radar, the RLAN can measure RSS during any time in which the medium is free, i.e., when the access point does not transmit nor receive a signal from a mobile terminal. These measurements are only accomplished on the frequency that is currently used by the access point. Like in the start-up mode, a radar is detected if RSS exceeds the threshold.

The performance of radar detection during normal operation depends on the available unused time on the medium, which in turn is dependent on the traffic load. Hence, the time until a radar signal is detected may be longer than in start-up mode.

10.2.3.3 Co-channel interference from other RLAN cells and detection threshold

RLANs can be used to build wireless networks with high capacity, which comprise a number of access points distributed in a certain area where neighboring access points use different frequencies. Depending on the number of available frequencies and the number of uncoordinated networks in the same area, frequencies need to be re-used at certain distances. Results of related studies have been presented in [15][16].

The system capacity of these radio networks is maximum if the system is interference limited, i.e., co-channel interference from other radio cells using the same frequency dominates over thermal noise : co-channel interference power is greater than noise power for all devices in a radio cell. Propagation conditions within the channel vary due to the nature of radio networks.

Therefore, it is highly desirable to tolerate co-channel intra-system interference with a power significantly greater than the receiver sensitivity i.e. at least -85 dBm for HIPERLAN/2 and 802.11a.

These considerations have high relevance in the context of coexistence with radar. If the threshold for radar detection is set very low to enable detection of radar signals with very low power, co-channel interference from other RLAN cells much above receiver sensitivity might not be tolerated. Hence, the distance to an access point that can re-use the same frequency would need to be very high and spectral efficiency is reduced. Some environments like the exhibition hall example in [16]could not be supplied with full RLAN service.

10.2.4 Performance Parameters

The performance of the DFS concept for radar co-existence is presented and discussed in this section, and appropriate performance parameters will be introduced.

As identified above, two radar types can be distinguished when considered from a RLAN receiver's point of view:

- Continuously transmitting radar, e.g., stationary radar, and
- Occasionally transmitting radar, e.g., movable radar.

The concepts of start-up mode and mode of normal operation address these respectively and two performance parameters are defined: detection probability (DP) and false alarm probability (FAP). These are often used in the area of detection theory.

Note that both performance parameters are probabilities, where several assumptions with regard to random distribution of the signals are taken. For instance, the timing phase of the radar signal is assumed random with respect to symbol and frame structure of the RLAN.

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Comment: Noise power is –174 dBm/Hz, i.e. for 20MHz, = -101 dBm. –85 dBm is the spec for Rx sensitivity for PER 10%.

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10.2.4.1 Radar detection probability (DP)

Radar detection probability is defined as the probability that radar is detected if a radar signal is present at the RLAN receiver input. It characterises the reliability that radar can be detected and respective frequencies avoided.

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The detection probability is mainly determined by the shape of the radar signal. Since the radar detection mechanism is assumed to be based on RSS, the radar signal power is not a relevant parameter as long as it is above the pre-defined threshold.

10.2.4.2 False alarm probability (FAP)

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The received signal of a RLAN access point always includes noise and potentially co-channel interference from other RLAN cells. Due to the modulationscheme OFDM, co-channel interference and noise with identical power have an almost identical impact on the error rate performance of a RLAN communication. These contributions from noise and interference affect the RSS measurements that are used for radar detection.

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Noise and interference can be modelled as a Gaussian random process with zero mean and given power. Due to their random nature, they will cause RSS values which may exceed the radar detection threshold even if there is no radar signal. The probability that a RLAN device erroneously detects radar in the absence of any radar signal is called false alarm probability.

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The false alarm probability characterises the tolerance to noise and interference; it is not relevant with regard to the risk of interfering radar. For instance, false alarm probability has an impact on the capacity of a RLAN network. As explained in 10.2.3.3, some tolerance of co-channel interference from other RLAN cells is desired to achieve high system capacity. If the false alarm probability was high even for low co-channel interference power, or even worse for the noise power level, the frequencies to be shared with radar would be avoided unnecessarily often, becoming unusable.

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Main factors influencing the false alarm probability are the detection threshold of radar signal power and the measurement time. The measurement time is an important parameter because the probability that values of a random process exceed a threshold increases significantly with time.

10.2.5 Performance Results

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Calculated performance results of radar detection of HIPERLAN/2 are presented and discussed in this section. The calculations are conducted for the three radar test signals in Table 4. The performance is presented in terms of radar detection probability and false alarm probability. The results are directly applicable to 802.11a+h for equivalent loads and therefore medium occupancies.

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The detection threshold of radar signal power has been chosen equal to –61 dBm as proposed in [12]. The impact of a different threshold will be discussed with the results on false alarm probability.

Radar detection is based on RSS measurements, which have a limited accuracy. The absolute accuracy of RSS is specified in the physical layer specification ([2], Table 16) with ±5 dB. Therefore, the threshold that is actually used needs to be 5 dB lower than the *nominal* detection threshold of radar signal power. Since the hardware has a varying front-end amplification and the worst case needs to be guaranteed, the *typical* radar signal power that can be detected by *most* devices will be lower than the nominal threshold. It can be concluded that the RSS inaccuracy does not worsen radar detection probability; it rather improves the radar detection capability of most devices which typically have a better RSS accuracy. However, it increases the false alarm probability, which can reduce RLAN system capacity.

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10.2.5.1 Start-up mode

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In start-up mode the access point measures all implemented frequencies to check for presence of interfence signals.

The detection probability for radar as a function of time after the start of the start-up phase is depicted in Figure 10 for the three radar signals of Table 4 for radar signal power greater than the threshold. (If the radar signal power is smaller than the threshold, the detection probability is equal to zero).

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The detection probability starts at approximately zero with the beginning of the start-up phase and increases linearly with time up to 100%. The probability of 100% is reached at the time that is equal to the radar burst interval.

An implementation of DFS in a RLAN access point would have a certain duration of the start-up phase, e.g. 10 seconds per frequency. In this case, radar signals 1 and 2 would be detected with 100% probability if they were present during the start-up phase. Radar signal 3 would be detected with about 7% probability; however, the detection p rocedure would continue during normal operation to achieve a reasonable detection probability. Alternatively, the detection probability for radar signal 3 could be increased to 100% by increasing the duration of the start-up phase to at least 144 seconds on each respective frequency. This could lead to an unacceptable duration of the total start-up phase with scanning of all frequencies, or network unavailability if the start-up phase is repeated from time to time.

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Since radar signal 3 represents a signal from meteorological radar, occasional rare interference for a few milliseconds may be acceptable.

In any case, the duration of the start-up phase is a parameter requiring further discussion, as well as the burst interval of the radar signal 3 which seems questionable.

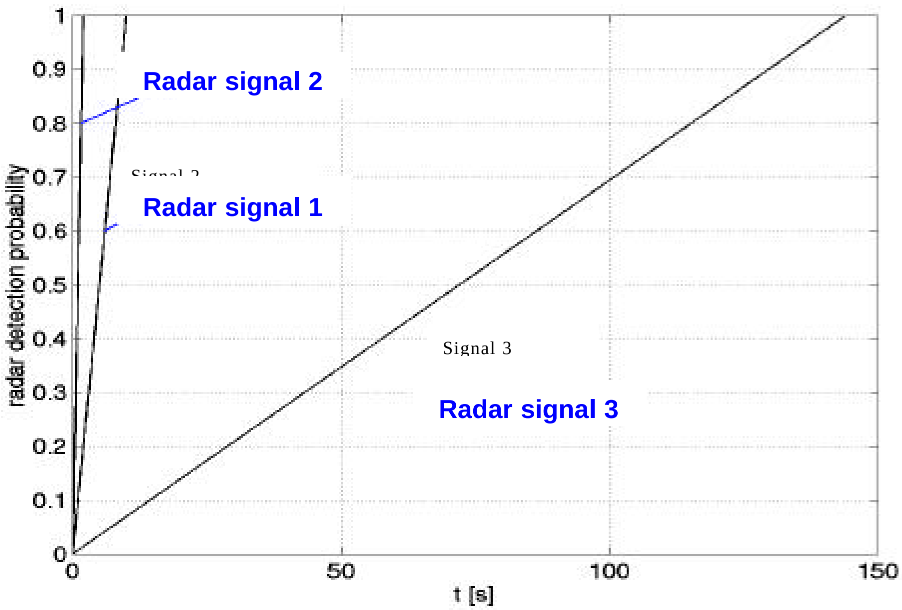

Figure 10: Radar detection probability for radar test signals with a power greater than the threshold as a function of time in start-up mode

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The previous result for the detection probability requires that the radar signal power exceeds the threshold at the RLAN receiver input. The threshold chosen determines the false alarm probability which determines tolerance to co-channel interference from other RLAN cells, which in turn determines the capacity of a RLAN network.

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The false alarm probability was investigated as a function of co-channel interference power. Note also that the probability that noise and/or interference exceeds a given threshold increases with time.

The false alarm probability for radar detection for a start-up phase duration of 10 seconds and threshold –61 dBm is depicted in Figure 11 as a function of co-channel interference power. The result is a very steep curve that reaches 100% at a co-channel interference power of about –83.3dBm. A reasonable point of operation may be a false alarm probability of 10^{-8}, which is achieved at –84.5 dBm. In the HIPERLAN/2 standard the receiver sensitivity is equal to –85 dBm (-82dBm for 802.11a). Hence the tolerable interference power is almost at the lowest possible limit, even though the detection threshold at the receiver input is equal to –61 dBm. Therefore the detection threshold could not be set below –61 dBm otherwise thermal noise would cause unacceptable false alarm probabilities and cause the RLAN to erroneously "mark" frequencies as occupied by radar.

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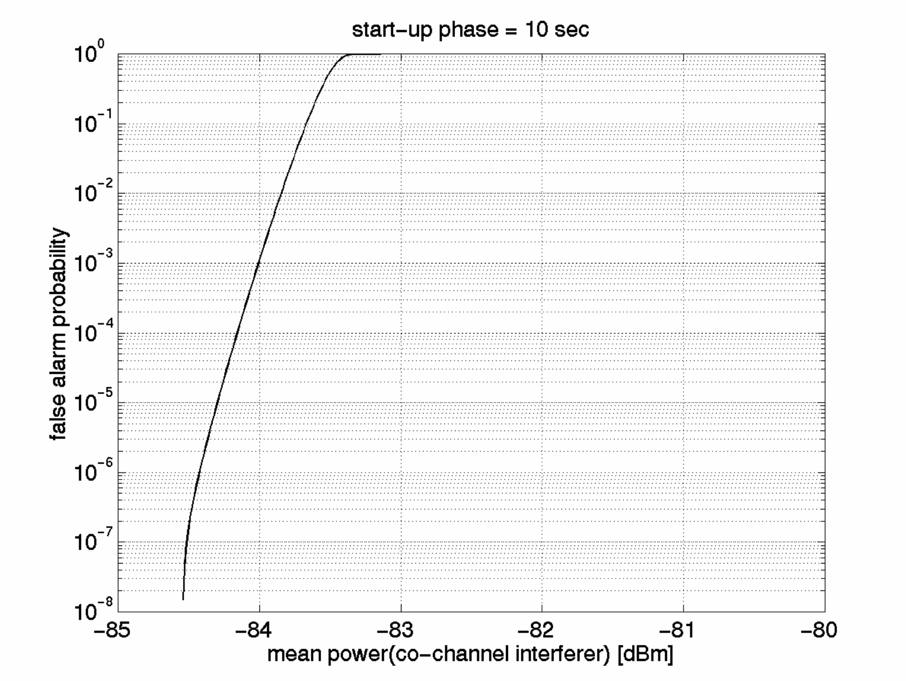

Figure 11: False alarm probability as a function of power of co-channel intra-system interference for start-up phase of 10 seconds; detection threshold of radar signal power –61 dBm

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The analysis related to the false alarm probability of radar detection in HIPERLAN/2 leading to the figure 11 above is detailed in Annex 2.

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10.2.5.2 Normal operation mode

The mode of normal operation, during which communication takes place, involves radar detection measurements in empty parts of the MAC frame. Therefore, traffic load, i.e. usage of the MAC frame, has an impact on radar detection performance. The following results were obtained for different levels of traffic, but assuming equal loading within successive MAC frames for simplicity reasons. They were also calculated independently of a start-up phase. The results characterise the behavior at the appearance of a radar signal during normal operation which was not present during the start-up phase.

In normal mode of operation, RLAN communication is taking place. Hence there is a certain probability that a RLAN signal is transmitted while a radar signal is received. This *interference probability* is defined here as the probability that a radar burst (comprising a series of radar pulses) is interfered with by a RLAN signal. A radar burst is considered to be interfered with if there is a RLAN transmission during any part of the radar burst.

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As examples, the interference probabilities for the second, third and 12^th burst after appearance of the radar signals are depicted in Figures 11a, 11b and 11c. The interference probability for the first radar burst is obviously equal to one, because any overlap of radar signal and RLAN signal is counted as an interference case.

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Radar signal 3 can be detected reliably during the first radar burst up to very high loads. Therefore, the interference probability for the second and following bursts is very small even for a traffic load up to 90%. The reason is the high number of pulses per burst. The figures only show one point, because a limited number of load values was evaluated, and only one of them led to any interference. The interference probability for radar signal 2 is slightly higher than for radar signal 1. These small differences are mainly caused by the different number of pulses per burst of radar signal 1 and 2.

For an example 50% load of HIPERLAN/2, the probability of interfering with the second burst of a newly appearing radar signal of type 2 is about 1%. It decreases rapidly for subsequent bursts. After the third radar burst, the interference probability is practically zero.

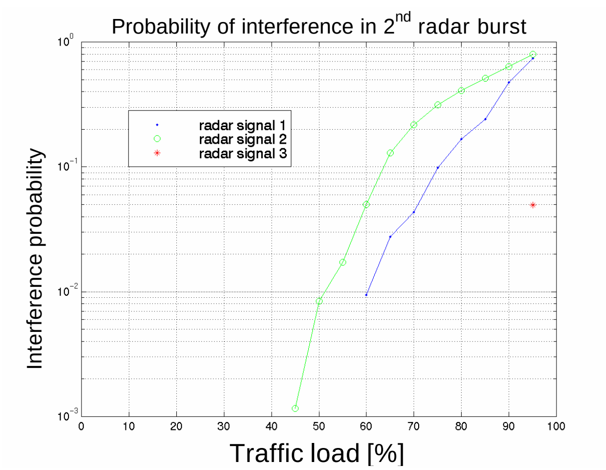

Figure 12a : Probability that HIPERLAN/2 transmission interferes with the 2nd radar burst in normal mode of operation; parameter: index of radar test signal; constant load L; power of radar test signal above threshold; start-up phase not taken into account

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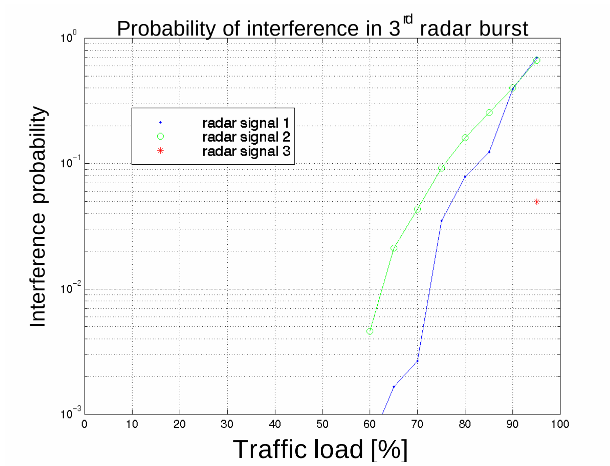

Figure 12b: Probability that HIPERLAN/2 transmission interferes with the 3rd radar burst in normal mode of operation; parameter: index of radar test signal; constant load L; power of radar test signal above threshold; start-up phase not taken into account

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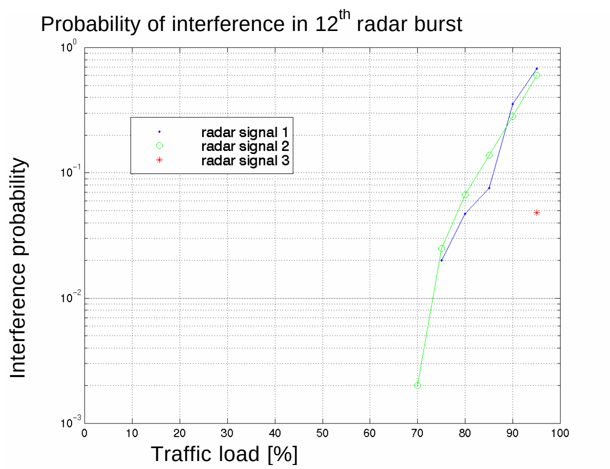

Figure 12c : Probability that HIPERLAN/2 transmission interferes with the 12th radar burst in normal mode of operation; parameter: index of radar test signal; constant load L; power of radar test signal above threshold; start-up phase not taken into account

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As mentioned above, false alarm probability is mainly influenced by time and power of noise and interference. The result for the start-up mode in Figure 11 indicates that the false alarm probability is below 10^{-8} if the power of co-channel interference from other RLAN cells is less than -84.5 dBm. Therefore, this value is assumed as the power of received co-channel interference for the following evaluation of false alarm probability during normal operation. For a traffic load of 50%, the result as a function of time is depicted in Figure 13.

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The false alarm probability starts with 10^{-8} at the beginning of the normal mode of radar detection. It increases rapidly during the first hour and tends towards a moderate slope after some hours. The false alarm probability after one day is about $7\cdot10^{-5}$, which would seem acceptable if a kind of start-up phase is repeated with a period of about one day.

It should be noted again that tolerance to co-channel interference from other RLAN cells with a power of –84.5 dBm is obtained for a radar detection threshold equal to –61 dBm, a value which is meaningful to enable usage of all RLAN frequencies.

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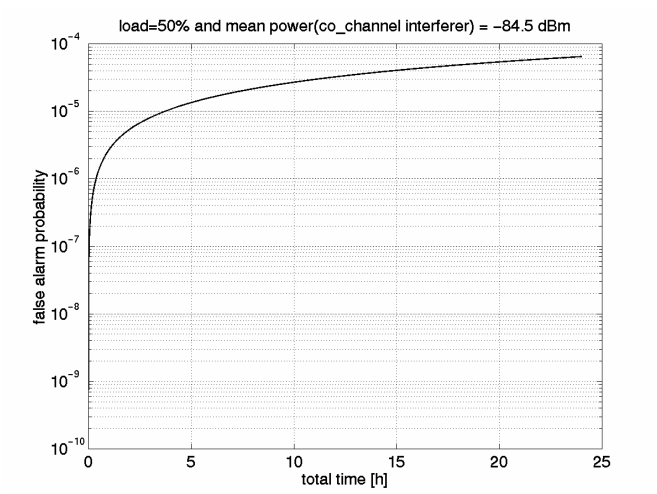

Figure 13: False alarm probability for radar test signals as a function of time in mode of normal operation; 50% load (usage of MAC frame) and power of co-channel intra-system interference equal –84.5 dBm (cf. Fig. 11); start-up phase not taken into account; detection threshold of radar signal power –61 dBm

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10.2.6 Summary

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Co-existence of RLANs with radar using DFS may employ threshold comparison DFS in two modes: start-up mode and normal operation mode.

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The detection probability during the start-up phase depends on the radar signal characteristics and the duration of the start-up phase. It is equal to 100% for all radar signals that were present at the beginning of the start-up phase and whose burst interval is shorter than the duration of the start-up phase. A long start-up phase provides very reliable detection of continuously transmitting radar even with very long burst intervals like radar signal 3, but the required long start-up phase may result in unacceptable down-time for the RLAN network user. Therefore, a compromise between both requirements of high radar detection performance and short start-up phase seems appropriate. Signals that may not be detected with 100% probability during the start-up phase, such as radar signal 3, can continue to be searched for during normal operation.

The reliability of radar detection by a RLAN with DFS, even while devices are communicating, is given in terms of interference probability, i.e., the probability that the RLAN interferes with any part of a radar burst. For radar signal 3, the interference probability for the second and following bursts is very small even for a traffic load up to 90%. For radar signal 1 and 2, and a HIPERLAN/2 traffic load of 50%, the probability of interfering with the second burst of a newly appearing radar signal of type 2 is about 1%. It decreases rapidly for subsequent bursts, and after the third radar burst, the interference probability is practically equal to zero.

The false alarm probability influences the capacity of RLAN networks. A detection threshold of radar signal power at the RLAN receiver input of –61 dBm, leads to a tolerance of co-channel interference from other RLAN cells with a power of up to –84.5 dBm. Hence –61 dBm is the lowest possible threshold due to the HIPERLAN/2 receiver sensitivity of –85 dBm. Since RSS measurements have a tolerance of ±5 dB, the typical effective threshold will be somewhat lower.

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It follows from this manner of implementing DFS that any interference detected during empty time on the medium i.e. when RLAN access points expect no traffic signals, and which exceeds a threshold of –61 dBm, is defined to be radar interference. Hence the RLAN system has *identified* the interfering signal as radar.

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10.2.7 DFS employing signal characteristics identification

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Conformance testing of Dynamic Frequency Selection

One goal of the DFS is to keep interference to radar as low and short-lived as possible. As seen in preceding sections, the ideal requirement that RLAN shall disturb radar not at all can only be achieved if the start-up mode measures for a sufficiently long time before transmission starts. In practice the duration of the start-up phase must be limited. Therefore a risk remains that certain radar signals with long burst period would not be detected during the start-up phase. This may result in a short radar disturbance until the radar signal is detected during the normal mode of the AP.

For the case that radar signals appear after the RLAN has started transmission, disturbance to radar cannot be avoided for a certain limited time.

Therefore the following general performance criterion is defined: RLAN shall not disturb more than *N_max* successive radar bursts after a radar interferer exceeds the specified detection threshold on the same frequency used by the RLAN. The RLAN must vacate the frequency before the (*N_max*+1) radar burst occurs.

If the RLAN is already in the normal mode of operation when the radar signal appears, the radar detection performance depends of course on the traffic load L_0 of RLAN. For traffic load $L_0 \leq 50\%$, *N_max* = 4 can be taken as first working assumption [19].

The case that radar is already operating when the RLAN AP is switched on is seen as less critical, because the AP can use the start-up phase for an improved radar detection before any transmission is allowed. During the start-up phase the AP disturbs radar not at all, and the probability of radar detection is higher than during the normal mode where the measurement periods can be restricted by traffic.

Therefore, this test focuses on the more critical case of radar detection during the normal mode of RLAN.

Radio Conformance Test method

The conformance tests are based on representative radar test signals, which are defined by the operating frequency range, the bandwidth, the pulse repetition frequency *PRF*, the pulse width *W*, the burst length *L*, the burst period *P* and the pulse shape. Example radar test signals are given in Table 4. To facilitate the generation of test signals, they are assumed rectangular, as shown in Figure 14. These radar test signals can easily be generated using standard digital signal generators.

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Test description

The test equipment consists of an AP under test and a signal generator. The AP shall transmit data with constant load in each MAC-frame. The signal generator is capable of generating any of the radar test signals. The output of the signal generator may be connected via cable with the antenna reference point (ARP) of the AP, such that the signal pulses are received at the ARP with *S0* dBm.

The transmission of constant traffic load by the AP may be verified by a measurement device (e.g. oscilloscope). such that no MT needs to be involved in this test.

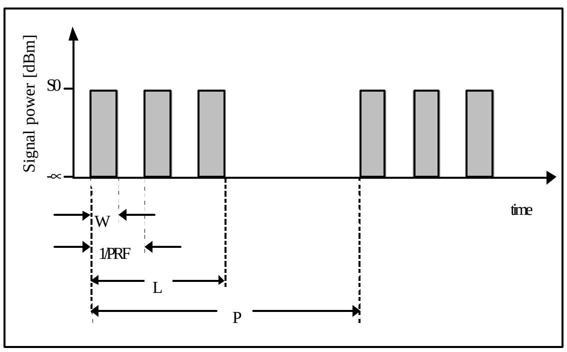

Figure 14: Radar test signal (example)

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Test procedure

Signal generator and AP are disconnected (or the power of the signal generator is switched off).

The AP operates on a certain channel *c* with constant traffic load L_0. (In HIPERLAN/2, for L_0 =50%, 1 ms out of 2 ms is used for data transmission). The bandwidth of the radar test signal is within the bandwidth of the channel used by the AP.

At a certain time *T0* the signal generator and the AP are connected (or the power of the signal generator is switched on). At time *T1* the first radar burst is received at the AP.

Required result: at time $TD = T1 + (N\_max - 1) \times P$ the AP has left the channel (see Figure 14). The test result may be controlled by 'signal' on the tested channel before T0 and 'no signal' on the tested channel at TD and later.

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The test cases are varied for all radar test signals and all channels available for the RLAN and the radar test signal.

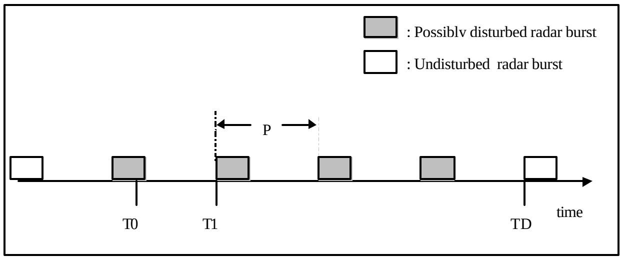

Figure 15: Timing condition for radar detection (example)

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ANNEX 1

Link budget calculations between RLAN and radar

Aeronautical Radiovavigation, Meteo Radar type per 8A-9B/61 annex 1	A	C	E	F	G
Function	Meteo	Meteo	Meteo	Meteo	Meteo
Platform	Air/Ship/Ground	Ground	Ground	Air/Ground	Ground
Tx Power into antenna, peak (kW)	250	250	250	250	250
Antenna gain dBi	46	44	50	40	40
Peak EIRP (dBW)	100	98	104	94	94
Modulation	NA	NA	NA	NA	NA
RF Bandwidth (MHz)					
PRF (pps)	50, 250, 1200	0-4000	2000	250-1180	259
Pulse Width (microsec)	2	0.05-18	1.1	0.8-2	3
Tuning range (MHz)	5300-5700	5600-5650	5600-5650	5300-5700	5600-5650
Path Loss for MCL -61dBm at RLAN	-191	-189	-195	-185	-185
Free Space Distance for MCL d (km) f=5,5 GHz	15365	12204	24351	7700	7700
Distance to radio horizon (km))	347	51	51	347	51
Max radar detection distance (km)	347	51	51	347	51
Attenuation at max distance (dB)	-158	-141	-141	-158	-141
Signal into RLAN antenna (dBm) at max distance	-28	-13	-7	-34	-17
Signal into Radar antenna (dBW) at max distance, 1W RLAN	-158	-141	-141	-158	-141
Signal into Radar receiver (dBW)	-112	-97	-91	-118	-101
Signal into Radar receiver (dBm), 1W RLAN	-82	-67	-61	-88	-71
Signal into Radar antenna (dBW) at max distance for 200mW RLAN	-165	-148	-148	-165	-148
Signal into Radar receiver (dBm), 200mW RLAN	-89	-74	-68	-95	-78
Allowable Radar Rx interference Power (dBm) [20MHz BW ?]	-110	-110	-110	-110	-110
Margin to -61 dBm for radar signal at RLAN receiver	33	48	54	27	44
Margin For RLAN signal at radar receiver	21	36	42	15	32
CONCLUSION FOR SHARING					
HL detects Radar	yes	yes	yes	yes	yes
HL signal could interfere	yes	yes	yes	yes	yes
DFS threshold> -61dBm	yes	yes	yes	yes	yes

Radiolocation Radar type per 8A-9B/61 annex 1	H	K	L	M	N	O	O
Function	Instrumentation	Instrumentation	Instrumentation	Surface/air search	Surface/air search	Research / Earth Imaging	Research/ Earth Imaging
Use	Ground	Ground	Ground	Ship	Ship	Air	Air
Tx Power into antenna, peak (kW)	250	1000	165	360	285	1	16
Antenna gain dBi	38.3	45.9	42	28	30	26	26
Peak EIRP (dBW)	92	106	94	84	85	56	68
Modulation	NA	pulse/chirp pulse	Chirp pulse	Linear FM	none	FM, non-linear/linear	
Bandwidth (MHz)					1.2-16		
PRF (pps)	3000	20-1280	320	500	2400-750	tbd	tbd
Pulse Width (microsec)	1	0.25-50	100	20	0.1-1	7 or 8	
Tuning range (MHz)	5300	5400-5900	5400-5900	5300	5450-5825	5300	
Path Loss for MCL -61dBm at RLAN	-183	-197	-185	-175	-176	-147	-159
Free Space Distance for MCL d (km) f=5,5 GHz	6332	30377	7876	2321	2600	97	389
Distance to radio horizon (km))	51	347	51	51	51	347	347
Max radar detection distance (km)	51	347	51	51	51	29	29
ATTENUATION AT MAX DISTANCE (DB)	-141	-158	-141	-141	-141	-136	-136
Signal into RLAN antenna (dBm) at max distance	-19	-22	-17	-27	-26	-50	-38
Signal into Radar antenna (dBW) at max distance, 1W WLAN	-141	-158	-141	-141	-141	-136	-136
Signal into Radar receiver (dBW)	-103	-112	-99	-113	-112	-110	-110
Signal into Radar receiver (dBm)	-73	-82	-69	-83	-82	-80	-80
Signal into Radar antenna (dBW) at max distance for 200mW WLAN	-148	-165	-148	-148	-148	-143	-143
Signal into Radar receiver (dBm)	-80	-89	-76	-90	-89	-87	-87
Allowable Radar Rx interference Power (dBm) [20MHz BW ?]	-110	-110	-110	-110	-110	-110	-110
Margin to -61 dBm for radar signal at RLAN receiver	42	39	44	34	35	11	23
Margin For RLAN signal at radar receiver	30	21	34	20	21	23	23
CONCLUSION FOR SHARING							
HL detects Radar	yes	yes	yes	yes	yes	yes	yes
HL signal could interfere	yes	yes	yes	yes	yes	yes	yes
DFS threshold> -61dBm	yes	yes	yes	yes	yes	yes	yes

ANNEX 2

False Alarm Probability of Radar Detection in RLANs

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Introduction

This annex describes in detail the false alarm probability in the start-up mode of the radar detection algorithm proposed for HIPERLAN2 and 802.11a+h. The proposed radar detection algorithm is a conservative one resulting in a reliable radar detection performance. It is based on the assumption that a frequency is occupied by a radar signal if one received signal strength (RSS) measurement exceeds a certain threshold.

Definition of Radar Detection False Alarm Probability

The received signal of a RLAN access point (AP) always includes noise and potentially co-channel interference from other RLAN cells. Due to the modulation scheme OFDM, co-channel interference and noise with identical power have an almost identical impact on the error rate performance of a RLAN communication. These contributions from noise and interference affect the RSS measurements that are used for radar detection.

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Noise and interference can be modelled as a Gaussian random process with zero mean and given power. Due to their random nature, they will cause RSS values, which exceed the radar detection threshold even if there is no radar signal. The probability that a RLAN device erroneously detects radar in the absence of any radar signal is called radar detection false alarm probability (FAP).

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Received Signal Strength Measurement

The way, how to perform RSS measurements is not completely defined in the HIPERLAN2 or 802.11h standards. Both standards provide for RSS measurements and reporting by the MTs. Measurements at the AP are not defined. Here it is assumed that AP and MT are based on the same hardware and therefore the AP is able to perform the same RSS measurement.

Deleted: standard. It has been specified that mobile terminals (MT) shall be capable of performing at least one RSS measurement within 8 µs with an accuracy of + -5dB, if the power level is above –88dBm.

Moreover, it is assumed that RSS measurements used for radar detection in the AP calculate the mean value of the received signal power:

$$S_{RSS}(k) = \frac{1}{N}\sum_{i=1}^{N} \left| r(i+kN) \right|^2$$

where r(i) represents the sampled version of the receive signal. The averaging length *N* is not specified in the standard.

In case that only noise or interference is present at the receiver the RSS measurements will provide a mean value of the noise or interference power:

$$S_{RSS}(k) = \frac{1}{N}\sum_{i=1}^{N} \left| z(i+kN) \right|^2$$

where z(i) represents complex, zero mean, Gaussian distributed received signal samples with variance s^2.

Statistics of RSS in the Presence of WGN

In case that only white Gaussian noise or an interferer signal with the s ame statistics is present, the RSS values S_{RSS} are central, chi-square distributed with N degrees of freedom. This results in a probability density function (pdf) [3]

$$p_{RSS}(x) = \frac{x^{N-1}}{\left(\frac{2s^2}{N}\right)^N \Gamma(N)} \exp\left(\frac{-xN}{2s^2}\right)$$

where Γ represents the gamma function. With the substitution $y = 10 \cdot \log_{10} x$ one obtain the pdf in logarithmic representation, which is a more convenient one. This yields:

$$p_{RSS\log} = \frac{\ln(10)}{10} \frac{10^{\frac{yN}{10}}}{\left(\frac{2s^2}{N}\right)^N \Gamma(N)} \exp\left(-\frac{N \cdot 10^{10/y}}{2s^2}\right)$$

For the cumulative distribution function (cdf) it follows:

$$F_{RSS\log}(y) = \int_0^y p_{RSS}(u)\,du$$

which cannot be expressed in closed form.

Effect of Interference or Noise Signal on RSS Measurements

In the so -called start-up mode the AP measures the RSS on each frequency to be shared with radar for a certain time T_R. In this document it is assumed that the AP checks every potential radar frequency for T_R=10s. Moreover, it is assumed that the sampling rate at the receiver is Ts=50ns. In this case

$$M = \frac{T_R}{NT_S}$$

RSS values are taken into account for the decision, whether radar is present or not.

The shortest pulse width of the three radar test signals proposed in [9]is 0.2µs (see also section9.2.2 of the main document). As long as the RSS measurement interval is longer than half of this shortest duration it can happen that a radar pulse falls between two consecutive RSS measurements. In this case the measured averaged signal strength would be lower than the actually received signal power at the antenna reference point (ARP) during the radar pulse. Therefore, an RSS measurement length of 0.1µs is assumed, i.e. only N=2 samples are taken into account for one RSS measurement.

The probability that at least one RSS value exceeds a certain power level y within 10s can be assessed as follows:

$$\Pr(RSS > y) = 1 - \left[F_{RSS\log}(y)\right]^M$$

This probability is equal to the FAP if the certain power level y is equal to the radar detection threshold. This probability is shown in Fig.1. It can be seen that FAP is smaller than 10^{-8}, if the radar detection threshold is 13dB above the mean power level of the interferer or noise signal. FAP $\leq 10^{-8}$ is seen as a sufficiently low FAP.

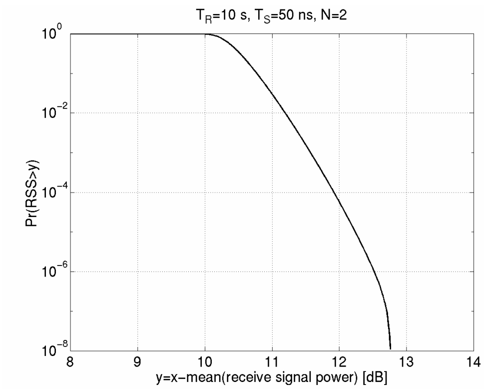

Figure 1: Probability that at least one RSS value exceeds a certain power level relative to the mean power of the interferer or noise signal.

The x-axis shows the normalized power y [dB] of the interference or noise signal with an actual power x [dB].

Effect of RSS Measurement Accuracy on FAP

In the H2 standard the accuracy of the RSS0 measurements are defined as +-5dB for power levels above –88dBm [2]. Similar accuracies are being considered in the 802.11h standardization process. In case that MTs and APs are based on the same hardware it follows that there are some APs, whose RSS values indicate a 5dB lower power than the actual power at ARP. Therefore, the internal threshold must be 5dB lower than the radar detection threshold. The working assumption for the radar detection threshold is –61dBm. Therefore, the internal threshold must be set to –66dBm for all APs because the actual accuracy of the RSS measurements is not known.

On the other hand there are APs, whose RSS values indicate a 5dB higher power than the actual receive power at ARP. In case there is an actual power level of –71dBm present at ARP caused by an interferer, these APs will measure an RSS value of –66dBm. Therefore, those APs cause a false alarm even for an interferer signal with an instantaneous power of 10dB lower than the radar detection threshold of –61dBm.

Conclusion

In the section before the previous one it was shown that a wanted low FAP $\leq 10^{-8}$ is obtained if the radar detection threshold is 13dB above the mean power level of the interferer or noise signal.

In the previous section it was shown that some APs cause a false alarm if the instantaneous power of an interferer or noise signal is 10 dB lower than the radar detection threshold.

The over-all conclusion is that for a desired FAP of approx. 10^{-8} for a start-up phase of 10s per frequency, the mean power of an interferer or noise signal must be 23dB below the radar detection threshold. Assuming a radar detection threshold of –61dBm the tolerable mean interference or noise power is then –84dBm.

References

[1] SE36(01)24Rev1, BRAN23d066: Liaison statement to ETSI BRAN on HIPERLAN issues with regard to WRC03 Agenda. March 1, 2001.

[2] ETSI TS 101 475 V1.2.2: Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; physical (PHY) layer.

[3] J.G. Proakis: Digital Communications, McGraw-Hill, 3.ed, 1995.

Page 21: [1] Deleted vichayes 11/15/2001 11:32 PM

Radar signal type	Operating frequency range (MHz)	Bandwidth (MHz)	Burst length (ms) / no. of pulses	Burst interval (sec)	Pulse width (µs)	Pulse repetition frequency, PRF (pps)

4.14 ME Translate letter to Chinese and deliver to admin - Hayes 5 05:42 P

Moved: to approve, in principle, the submission of document RR-01/27 to the US ITO for translation into the Chinese language and subsequently present it to the Chinese Administration as an 802 position and empower the chairs of the wireless working groups, regulatory ombudsman and Jim Carlo to make final edits to harmonize the document according to the sentiments of the working groups.
Moved: Vic Hayes/Bob Heile

If not changed, the current Chinese regulations would close down China as a market for our wireless PAN and LAN standards.

Approved: 9/0/0

[Draft Letter to the Peoples' Republic of China Regarding New 10 mW EIRP Limit for Devices in the 2400-2483.5 MHz Band]

IEEE 802Ô

Local and Metropolitan Area Network Standards Committee

Homepage at http://ieee802.org/

03 December 2001

To: Appropriate contact(s) in the Chinese Administration (TBD)

Reply to: Vic Hayes
Regulatory Ombudsman, IEEE 802
Agere Systems Nederland B.V.
Zadelstede 1-10
3431 JZ Nieuwegein
The Netherlands
phone: +31 30 609 7528
fax: +31 30 609 7498
e-mail: v.hayes@ieee.org

From: Vic Hayes,
Regulatory Ombudsman, IEEE Project 802
c/o Agere Systems
1-10 Zadelstede
3431 JZ Nieuwegein
Phone: +31 30 609 7528
Vichayes@agere.com

Dear Sirs:

The IEEE Project 802 Local and Metropolitan Area Network Standards Committee (the IEEE 802 LMSC") has recently received a Chinese language document, and an English translation thereof, outlining recently enacted changes in your Administration's regulations for short distance micropower wireless communications equipments in the 2400-2483.5 MHz band.

We have attached both the original Chinese text and an English translation thereof as appendices to this letter and would appreciate your confirmation that the Chinese language version is current and correct and furthermore that the English translation accurately represents the content of your new regulations. (We have also attached an appendix explaining the structure and function of

It is our understanding that these new regulations are intended to promote the development of wireless communication techniques such as Bluetooth™, indoor wireless LAN, digital wireless phone and wireless automatic identification, and to satisfy the demand for wireless communication services.

We are happy to see the 2400-2483.5 MHz band being made available for such uses in the Peoples' Republic of China, and are under the impression that this action is at least partially the result of lobbying by the Bluetooth SIG, Inc. with the intent of gaining approval for the operation of Bluetooth™ devices within your territory.

However, the the IEEE 802 LMSC would like to respectfully express our concern that the EIRP limit of = 10 mW adopted, according to our understanding of the attached documents outlining your recently-adopted new regulations, will have what we suspect may be an inadvertent, unintended consequence of making IEEE 802.11b wireless LAN devices unacceptable for use in the Peoples' Republic of China.

Devices conforming to the IEEE 802.11b standard represent the most widely used wireless LAN devices in the world, with economical, high performance products offered by more than 100 companies world-wide, including a number of companies with manufacturing facilties located in the Peoples' Republic of China.

While the IEEE 802.11b standard does not specify a maximum transmitter output power or EIRP, in a practical sense virtually all of the equipments produced operate with transmitter powers of 100 mW or less, due to the fact that a vast majority are used in portable computers and must not adversely affect battery life by demanding too much power from the computer's battery.

While Bluetooth™ devices are intended as wireless personal area network devices ("PANs") intended to cover only a "personal space" of approximately 10m radius with a data rate of <1 Mbps, IEEE 802.11b devices, as wireless LAN devices, offer greater range and data rates of 11 Mbps which is much more useful in business, industrial and educational environments where larger numbers of users must be supported.

Because of these fundamental differences in technology, data rate, and application, IEEE 802.11b devices require somewhat higher transmit power in order to provide the desired range, robustness, and data rate performance.

Thus, we would respectfully suggest that you reconsider the EIRP limit of = 10 mW and instead consider an EIRP limit of = 100 mW for devices operating in the 2400-2483.5 MHz band. Such a modification to your regulations will avoid precluding the use of the world's most accepted standard for wireless LAN devices and the hundreds of products which are already available, accepted in virtually all of the remainder of the world, and proven to offer high performance wireless networking with negligible potential for harmfull interference to other users in what is in most of the world a shared band for license-exempt devices.

Insert appropriate signature(s) here

APPENDIX 1

Original Chinese Language Text Received by IEEE 802 LMSC

? ? ? ? ? ? ? ? ? ? ? ? ?

? ? 2400MHz ? ? ? ? ? ? ? ? ?

? ? ? [2001] 653?

? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? , ? ? ? ? ? ? ? ? :

? , ? ? ? ? ? ? ? ? ? ? ? ? ? ? , ? ? ? ? ? ? ? ? ? ? , ? ? ? ? ? ? ? ? ? ? ? ? ? , ? ? ? 2400 - 2483.5 MHz? :

? ? ? ? ? ? ? ? ? , ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? 2400-2483.5MHz? ? , ? ? ? ? ? ? ? ? ? ? ? ? « ? ? ? (? ? ?)? ? ? ? ? ? ? ? ? ? » (? ? [1998]178?) ? ? ? ? ?

? ? ? ? ? 2400-2483.5MHz ? , ? ? ? ? ? ? ?

? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

(?) ? ? ? ? ? ? : 2400 - 2483.5 MHz

(?) ? ? ? ? ? ? (EIRP): = 10 mW

(?) ? ? ? ? ? ? :

= -36 dBm / 100 kHz (30 MHz ~ 1GHz)

= -30 dBm / 100 kHz (1GHz ~ 12.75 GHz)

(?) ? ? ? ? : ±75 kHz

? ? ? ? ? ? ? ? ? ? ? ? ? 2400 MHz? ? ? ? ? ? ? ? , ? , ? , ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

? , ? ? ? ? ? ? ? , ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ,? 2004? 12? 31? , ? ? ? ? ? ? ? , ? ? ? ? ? ? ?

? , ? , ? « ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? » (? ? ? ? [1997]11?) ? , ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? , ? ? ? ? ? ? ? ? ? ? (EIRP) = 500mW?

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Appendix 2

English Translation of Original Chinese Document

NOTIFICATION ON SOME PROBLEMS RELATED TO USING 2400MHZ FREQUENCY RANGE FOR SHORT DISTANCE MICROPOWER WIRELESS EQUIPMENT

IDW NO. [2001] 653

Wireless Administrative Organizations of Provinces, Autonomous Districts, Direct Jurisdiction Cities and Wireless Committee Offices of the Armed Forces:

In order to adapt to the development of wireless communication techniques such as bluetooth, indoor wireless LAN, digital wireless phone and wireless automatic identification, and to satisfy the demand of wireless communication service, regarding to the situation of usage of the state frequency resources and international technical standard of general usage, it has been decided that the frequency range of 2400-2483.5MHz will be allocated for short distance micropower wireless communications equipments to use. Below are the relevant notifications about it:

1. From the day of issue, short distance micropower wireless communications equipments will be allowed to use 2400-2483.5MHz frequency range and at the same time will be administered according to the "Temporary Rules For the Administration of Micropower (Short Distance) Wireless Equipments" (ID NO [1998]178) issued by the Department of Information Industry.
   These equipments will share frequencies with non-wireless communication equipments such as industrial, scientific and medical equipments in the range of 2400-2483.5MHz, which will be major services.
2. Principal technical indices for short distance micropower wireless equipments

   (1) Working frequency range: 2400 - 2483.5 MHz
   (2) Effictive Isotropic Radiated Power (EIRP): =10 mW
   (3) Miscellaneous transmission power*: (IEEE 802 LMSC interprets this as out of band spurious emissions)*
      =-36 dBm / 100 kHz (30 MHz ~ 1GHz)
      =-30 dBm / 100 kHz (1GHz ~ 12.75 GHz)
   (4) Load frequency capacity: ±75 kHz *: (IEEE 802 LMSC interprets this as carrier frequency tolerance)*

3. For effective coexistence and cooperation of various systems and techniques in the range of 2400MHz, it is necessary to actively encourage technical innovation and independent intellectual property rights of every system and to diligently enforce anti-interference ability of its system in the shared environment, and to enforce its reliability and usability of operation.
4. In order to avoid interference to short distance micropower wireless communication equipments, from the date of issue, it is in principle prohibited to allow the spread spectrum wireless communication service stations that do not satisfy the above technical indices in the crowded areas such as large and small cities and nearby suburbs. Legal service stations that have already achieved allowances can use them until Dec.31, 2004, thereafter they must be stopped to use and the allowances must be withdrawn.
5. In the wide and not crowded country areas it is not administered as short distance micropower wireless equipments to spread spectrum wireless communication service stations that do not meet the requirements above mentioned. Establishment and usage of such stations must apply for allowance of the wireless administration organizations and make relevant procedures, and their technical indices must follow the "Notification on the regulation of technical indices relevant to expanded frequency communication" (SWOF[1997]11). It is necessary to strictly restrict using point to multi-point structure or netlike structure in this kind of service stations. In the case of building and using stations, it is not allowed to add power magnifiers at the outlets of transmitters, and restrict its effective radiance power (EIRP) =500mW.

If some documents formerly published do not meet this notification, then this notification will be regarded as standard.

Regards,

Aug.29, 2001

Appendix 3

1 Introduction of the IEEE 802 LMSC

The IEEE 802 LMSC operates under the rules of the Institute of Electrical and Electronics Engineers, Inc. (IEEE™) and the IEEE Standards Association (IEEE-SA). It is sponsored by the IEEE Computer Society. A brief description of IEEE 802 and each of the three Working Groups dealing with Wireless Technologies follows below.

1.1 IEEE 802

IEEE Project 802, the Local and Metropolitan Area Network (LAN/MAN) Standards Committee has the basic charter to develop and maintain networking standards and recommended practices, using an open and accredited process, and to enable and advocate them on a global basis.

IEEE 802 was formed in February 1980 and has met at least three times per year as a Plenary body ever since that time. IEEE 802 has grown from a participation of 500 individuals in the 1990s to over 1000 individuals in the Plenary sessions in 2001.

Products of IEEE 802 include the IEEE 802.3 or Ethernet standards, IEEE 802.5 or Token Ring standards and the IEEE 802.11 or Wireless LAN standards. These all have been adopted by the ISO/IEC Joint Technical Committee 1 (JTC1) as International standards.

1.2 IEEE 802.11

IEEE 802.11, the Standards Working Group for Wireless Local Area Networks, is responsible for developing Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) based Wireless Local Area Network (WLAN) standards within LMSC. IEEE 802.11 was formed in July 1990 and has produced the ISO/IEC 8802-11:1999 (IEEE 802.11:1999) standard with two supplements. With supplement 802.11b, Manufacturers can build devices for operation at data rates of 11 million bits per second (11 Mbit/s) using radio at 2.4 GHz. These devices can be used in the home, the enterprise and at public places such as conference areas, hotels and airports, providing the benefits of high performance networking and mobility.

With supplement 802.11a, devices can be built operating at between 6 Mbit/s and 54 Mbit/s using radio in the 5 GHz band.

This Working Group is using its own product during its conferences 6 times a year. Radio access points, adio PC cards in the laptops of the members, a file server and a fast Internet connection enable the members to work efficiently and paperlessly[1].

This Working Group has 5 projects, 1) 802.11e: to enhance to WLAN standard with improved Quality of Service capabilities, 2) 802.11f: to write a Recommended Practice for an Inter-Access Point Protocol, 3) 802.11g: an additional radio entity for higher than 20 Mbit/s data rates in the 2.4 GHz band, 4) 802.11h: to enhance the standard with dynamic channel selection and transmit power control, and 5) 802.11i: to enhance the standard with improved security capabilities. A study group is proposing a project to arrive at a single global 5 GHz standard.

[1] At its May 2001 meeting, for instance, 350 members could get the documentation in a matter of seconds from the file server or from the Internet. Without the network, copies would have needed to have been ordered, distributed and collected, normally requiring a lead time of at least 4 hours if a high speed copy machine was available on premises, or 8 hours if the copies had to be ordered from a copy service.

At the beginning of the July 2001 meeting, 802.11 had 260 members and 200 observers. Those individuals were sponsored by 80 companies.

1.3 IEEE 802.15

IEEE 802.15, the Standards Working Group for Wireless Personal Area Networks, is responsible for developing Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) or other access method based standards for short distance wireless networks. IEEE 802.15 first met in July 1999.

The group has four projects: 1) 802.15.1: a WPAN standard for Bluetooth™, 2) 802.15.2: a co-existence guideline for license exempt devices, 3) 802.15.3: a High rate WPAN standard and 4) 802.15.4: a low rate WPAN standard.

At the beginning of the July 2001 meeting, 802.15 had 60 members and, 60 observers building membership. Those individuals are sponsored by 40 companies.

1.4 IEEE 802.16

IEEE 802.16, the Standards Working Group for Broadband Wireless Access Networks (or Wireless Metropolitan Area Networks), is responsible for developing standards and recommended practices to support the development and deployment of fixed broadband wireless access systems. IEEE 802.16 first met in July 1999. The group has four projects: 1) 802.16: Air Interface for 10-66 GHz, 2) 802.16a: amendments to the MAC layer and an additional PHY layer for 2-11 GHz licensed frequencies, 3) 802.16b: amendments to the MAC layer and an additional PHY layer, license-exempt frequencies, with a focus on 5-6 GHz and 4) 802.16: Recommended Practice for coexistence amongst 802.16 and 802.16a devices.

Following the July 2001 meeting, 802.16 had 161 members and 56 observers. Those individuals were sponsored by over 120 companies.

4.15 ME 802.11e PAR Extension - Kerry 5 04:35 P

Withdrawn.

4.16 ME 802.11f PAR Extension - Kerry 5 04:40 P

Withdrawn.

4.17 MI SEC rules change - Standing Committee - Hayes 15 06:01 P

Moved: To undertake the Rules Change Procedure driven by Vic Hayes for addition of rules for a SEC Standing Committee and adjustment of the procedures for coordination with other standards bodies and communication with government bodies as proposed in document RR-01/28r0.
Moved: Vic Hayes/Buzz Rigsbee

Approved: 10/0/0

IEEE P802 Radio Regulations

Proposed Rules Change for SEC Standing Committee

Date: November 16, 2001

Source: The Wireless Working Groups (802.11, 802.15, 802.16)

The following text is proposed as an 802 rules change to establish rules for SEC Standing Committees.

The proposed changes to the 802 rules are to add the following text sections to the 802 rules.

5.4 SEC Standing Committees

SEC Standing Committees ("SEC SC") are formed when a number of Working Groups have common interest in a specific topic, such as regulations or sharing a specific medium.

An SEC SC is initiated on request of the Chairs of the relevant Working Groups by a vote of the SEC and the Standing Committee Chair is appointed and approved by SEC for a two year period (refer to term of ExCom members).

The SEC SC Chair has the same responsibilities as a Working Group Chair as specified in 5.1.4.1 and has Executive Committee voting rights.

The charter of the SEC SC shall be defined by the relevant Working Groups forming the SEC SC and approved by the SEC. The SEC empowers the SEC SC to act on its behalf.

For an SEC SC that has as part of its charter the responsibility to act as an interface or liaison to outside entities, the SEC SC shall be the sole authorized point of contact to such entities.

5.4.1 SEC Standing Committee Membership

The membership of each SEC SC shall be the Chair of the Standing Committee, and for each of the relevant Working Groups its Chair and an official Rapporteur Officer, appointed by the Chair of the Working Group. A Working Group Chair may appoint a deputy Rapporteur Officer as an alternate for the official Rapporteur Officer. The official and the deputy Rapporteur Officers serve at the pleasure of their respective Working Group Chairs.

5.4.2 SEC Standing Committee Operation

A SEC SC shall meet at Plenary Sessions and/or at Interim Sessions of at least two of the relevant Working Group gathered at the same venue and time. During a session there will be at least one coordinated pre-defined slot for a SEC SC meeting on the agenda of all relevant Working Groups. None of the other meetings shall schedule special orders or important votes during such a SEC SC meeting slot.

In between Sessions, the Chair of the SEC SC is empowered to schedule (Tele)-conferences as required, provided that the venue and agenda is published (web-site and e-mail reflector) 10 calendar days before the actual date and time of the (Tele)-conference.

The recommended process is to have editing sessions among members and observers from the relevant WGs prior to Plenary or Interim meetings, collect relevant WG feedback during such sessions and conduct business in (tele)-conferences after such sessions.

An SEC SC shall maintain an area on the LMSC web site to post the minutes, conference announcements, submissions and (draft) output documents. An SEC SC shall maintain an e-mail distribution list for making the announcements of conferences and availability of important information on the web area.

An SEC SC shall appoint a Secretary and may appoint Vice-Chairs from the SEC SC membership.

Actions of each SEC SC shall be presented at 802 Opening Plenary meetings by the SEC SC Chair and by the official Rapporteurs at relevant WG Opening plenaries.

5.4.2 Voting at SEC Standing Committee Meetings

A vote is carried by 50 % of those SEC SC members present and voting “Approve” or “Disapprove” for internal actions. External Actions (going outside IEEE 802) require a 2/3 vote for approval.

Prior to a vote, the Chair conducts and records a strawpoll, tallied by Working Group, among the SEC SC Members and Observers that are members of the relevant Working Groups.

The quorum of an SEC SC is the Chair or Vice-Chair, the Secretary and one official Rapporteur or Chair of each relevant Working Group. (teleconference possible)

Credit for attendance at an SEC SC meeting is transferred to the individual's primary Working Group.

Additionally, in order to be consistent, the following changes need to be made in Procedure 3 of the 802 rules ("PROCEDURE FOR COORDINATION WITH OTHER STANDARDS BODIES"):

IEEE 802 communications

- Communications from the LMSC to external standards bodies shall not be released without prior approval by the SEC, except where the authority for such communications has been delegated to a duly constituted SEC Standing Committee established for such purposes, in accordance with and within the scope of the SEC SC's approved Charter.

- Such approval, or such SEC SC delegated authority, indicates that the communication represents the position of IEEE 802.

- All communications by IEEE 802 with external standards bodies shall be issued by the LMSC Chair, or in the case of a SEC SC operating under delegated authority, by the Chair of the SEC SC, and shall be copied to the SEC.

Working Group communications

- Unless prohibited by delegated authority to an SEC SC as a "sole point of external contact" on specific subject matter areas, Working Group communications with external standards bodies that are not "Information Only" shall be copied to the SEC.

- Permissable Working Group communications with external standards bodies shall not imply that they represent the position of IEEE or IEEE 802. They shall be issued by the Working Group Chair and the LMSC Chair shall be included in the distribution list.

Finally, again in order to be consistent, the following changes need to be made in Procedure 4 of the 802 rules ("PROCEDURE FOR COMMUNICATION WITH GOVERNMENT BODIES"):

IEEE 802 position statements

- Position statements to government bodies shall not be released without prior approval by the SEC (requires 2/3 majority as per section 15 of the Nov. 14, 1999 IEEE Policy and Procedure), except where the authority for such communications has been delegated to a duly-constituted SEC Standing Committee established for such purposes, in accordance with and in the scope of the SEC SC's approved Charter.

- All position statements shall be issued by the LMSC Chair as the position of IEEE 802 (stated in the first paragraph of the statement), or in the case of a SEC SC operating under delegated authority, by the Chair of the SEC SC, and shall be copied to the SEC and the IEEE SA Standards Board Secretary and shall be posted on the IEEE 802 web site. The IEEE 802 web site shall state that all such position statements shall expire five years after issue.

Working group position statements

- Unless prohibited by delegated authority to an SEC SC as a "sole point of external contact" on specific subject matter areas, Working Group position statements with government bodies shall not be released without prior approval by a 75% majority of the Working Group. Such position statements may proceed unless blocked by an SEC vote. For position statements not presented for review in an SEC meeting, SEC members shall have a review period of at least five days; if, during that time, a motion to block it is made, release of the position statement will be withheld until the motion fails.

- Permissable Working Group position statements shall be identified in the first paragraph as the position of only the Working Group and shall be issued by the Working Group Chair and shall include the LMSC Chair in the distribution. Such statements shall not bear the IEEE or IEEE 802 logos.

Moved: To empower the regulatory ombudsman to conduct the procedure in case an action before the March 2002 plenary meeting is needed.
Moved: Vic Hayes/Buzz Rigsbee

The chair says that there is a process that the Regulatory Ombudsman may use email balloting to conduct business needed.

Motion withdrawn without objection.

4.18 MI SEC rules change - Wireless PARs - Hayes 15 05:00 P

Moved: To undertake the Rules Change Procedure driven by Vic Hayes for amendment of the Procedure for PARs as proposed in document RR-01/29r0.
Moved: Vic Hayes/Buzz Rigsbee

The intent is to require extension of the 5 criteria for wireless PARs for regulatory and coexistence issues.

Approved: 8/0/2

IEEE P802 Radio Regulations

~~Proposed Rules Change for Wireless PARs~~

Deleted:

Deleted:

The Radio Working Groups propose to modify in the 802 operating rules, section 6.4 in procedure 2, entitled "Procedures for PARs." The proposed rules change for consideration according to the 802 rules change procedures is to add the text of item d) below, including its footnote text, to the 4th criterion.

6.4 Technical Feasibility

For a project to be authorized, it shall be able to show its technical feasibility. At a minimum, the proposed project shall show:

a) Demonstrated system feasibility.

b) Proven technology, reasonable testing.

c) Confidence in reliability.

d) For wireless projects, regulatory conformity and spectrum sharing feasibility[1]

[1] At a minimum, the proposed project shall address:

a) Feasibility of coexistence with other IEEE 802 wireless standards and projects, and other users of the spectrum and either:

b1) Compliance with existing regulations for proposed regulatory domains: ITU, regional, national, etc., or

b2) Reasonable expectation that ongoing regulatory activity (e.g. FCC Notice Of Inquiry, Notice of Proposed Rule Making) will allow deployment of devices implementing the proposed standard.

4.19 DT Input to PR - Nikolich 5 06:30 P

Paul solicits input to the IEEE PR process and suggests that those interested engage with Karen McCabe. Paul will drive this process.

4.20 DT Network Plans for future meetings - Nikolich 5 06:31 P

Next meeting we will try to contract with the same company we used this time (CoreCom) to set up and maintain the network. This cost ~$4,200 at this meeting. We would also like to bring in some end-user support. We are likely to have to use some overflow space in another hotel. This may mean that there would be significant additional expense to network the second hotel.

4.21 DT WG Ballot Rules - 0 06:34 P

Ken Clements discussed the rules for conducting letter ballots. He points out that there was some work done earlier to enable conducting ballots by electronic means. It appears that this work was not completed. He asks what the status of this work is. The work has been terminated. An assertion was made that the current rules do allow electronic ballots.

4.22 II Database Update - Rigsbee 10 06:37 P

Good news: we have a database that appears to be functional at this point. It needs a few enhancement (reports and formats). It is expected to be in production use at the March 2002 Plenary.

4.23 II 802.3 DTE Power via MDI WG Ballot - Thompson 1 06:37 P

DTE Power project P802.3af pulled it out of the fire. They are approved to go forward to WG ballot. Notice will go out in the next 3-4 days.

4.24 II Call for interest: 10 gig longer reach - Thompson 1 06:39 P

A call for interest was put out for longer reach 10 gig. It was determined that there is not sufficient interest at this time.

4.25 II 802.3 WG chair open (Geoff bolts) - Thompson 5 06:41 P

Geoff announces that he does not intend to stand for reelection at the March 2002 meeting.

4.26 II Regulatory Ombudsman departing - Hayes 5 06:42 P

Vic announces that he does not intend to stand for reelection for Regulatory Ombudsman at the March 2002 meeting.

4.27 II Future Meetings/ Meeting Services - Rigsbee 5 06:43 P

Buzz confirms that the Hyatt Regency SF for the July 2003 is the HR Embarcadero.

We will be revising the specification for our meeting services. The result is that we will send it out for RFP from additional vendors.

The Exec SG for coexistence is disbanded for lack of being authorized to continue.

Get file from Buzz

Paul congratulates Jim Carlo on his leadership during his tenure as chair of LMSC. Jim receives a standing ovation.

4.28	**II**	**Interim meetings**	**-**	**O'Hara**	**3**	**06:49 P**

Interim meetings

802.1		**Raleigh, NC, Jan 14-18**
802.3	**10G**	**Raleigh, NC, Jan 14-18**
		Silicon Valley, CA, Mid Feb (if required)
	EFM	**Raleigh, NC, Jan 14-18**
	DTE	**Raleigh, NC, Jan 14-18**
802.11		**Dallas, TX, Jan 21-25**
802.15		**Dallas, TX, Jan 21-25**
802.16		**Levi, Finland, Jan 22-25**
802.17		**Tampa, FL, Jan 14-17**
SB		**NYC, December 4-6**

4.29	**Adjourn**	**06:50 P**

The meeting was adjourned at 7:02pm.

Respectfully Submitted,
Bob O'Hara
Recording Secretary