

Project	IEEE 802.16 Working Group on Broadband Wireless Access	
Title	Views on the Issues being Investigated by the License-Exempt ad hoc and a Proposal for Conducting the Work	
Date Submitted	2004-07-01	
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Re:	This contribution is submitted to summarize the status of the work being done in the LE ad hoc and to provide a proposal for conducting the work.	
Abstract	The contribution provides a summary of the Shenzhen meeting of the LE ad hoc and a proposal for the conduct of the work.	
Purpose	It is proposed that IEEE 802.16 Working Group consider this proposal for the conduct of the future work on coexistence between various technologies in the LE frequency bands.	
Notice	This document has been prepared to assist the IEEE 802.16 Working Group. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.	
Release	The contributor acknowledges and accepts that this contribution may be made public by the 802.16 Working Group.	
IEEE Patent Policy	<p>The contributor is familiar with the IEEE Patent Policy, which is set forth in the IEEE-SA Standards Board Bylaws <http://standards.ieee.org/guides/bylaws> and includes the statement:</p> <p>“IEEE standards may include the known use of patent(s), including patent applications, if there is technical justification in the opinion of the standards-developing committee and provided the IEEE receives assurance from the patent holder that it will license applicants under reasonable terms and conditions for the purpose of implementing the standard.”</p>	

Views on the Issues being investigated by the License-Exempt ad hoc and a Proposal for Conducting the Work

Michael Lynch/David Steer, Nortel Networks

1 Introduction

During the meeting of the LE ad hoc in Shenzhen two papers were discussed (C802.16-04/07r1 and C802.16-04/10r1). Both papers showed that there was a considerable coexistence problem between 802.16 systems operating in a non-synchronized, non-coordinated basis. Those concerns were reflected in the chair's report to the 802.16 plenary (C802.16-04/11r1) and the minutes (C802.16-04/12r1).

Use of the LE bands by 802.16 was one scenario described in the input papers to the Shenzhen meeting. There was also discussion at the meeting of the need to study coexistence with other 802 technologies in the LE bands, particularly 802.11 operating in the 5.8 GHz band. It seems appropriate that studies include all of the LE portions of the 5 GHz band and the coexistence with other 802-based standards operating in these bands.

During the meeting there also was discussion, and seeming agreement, on the need to form a formal Study Group to develop a coexistence methodology, to perform the studies and to develop solutions.

This contribution discusses the coexistence scenarios and proposes the formation of a formal study group for the coexistence among 802 based systems operating in LE bands.

2 Analysis

2.1 BS to BS interference (802.16 to 802.16)

Based on the material presented at the Shenzhen meeting there is no doubt that further careful study and the development of a coexistence procedure is needed to address 802.16 BS to BS interference. The inter base-station separation distances discussed were extreme, ranging from 3.7 km to 130 km. Those distances cover many variations in deployment scenarios including antennas, adjacent or co-channel use, etc.

The conclusion is that deployment of 802.16 LE systems will be extremely difficult without the development of well defined coordination techniques and procedures.

2.2 Interference between 802.16 and 802.11 systems

The LE bands are already home to many operating radio systems, most commonly those based on other 802 standards (e.g. 802.11). These systems are used both indoors and outdoors in the bands 5.250-5350, 5.470-5.725 and 5.725-5.85 GHz. Many homes, businesses, government and industry already rely on these convenient 802.11 based communications systems. In the United States, these systems are governed by the same regulations (CFR 47, Part 15) and operate with similar RF powers, antenna gains and sensitivities as the new 802.16 systems being developed for the LE bands.

These 802.11 based systems will be both sources and victims of interference when 802.16 systems are introduced in the band. The 802.11 systems control both their inter-system and intra-system interference through the use of a CSMA protocol and packet burst transmissions. This protocol causes devices to defer their transmissions until the channel is clear. The introduction of equipment in this environment that does not follow a protocol equivalent to the packet deference technique will cause disruption to the 802.11 systems operating in the area.

A new standard for the LE bands that disrupts existing equipment and services will make many manufacturers understandably reluctant to introduce new 802.16 products in the LE bands. The possibility of one 802 based standard disrupting another established one will also reflect badly on the credibility of the IEEE 802 standards development process. The hallmark of the existing IEEE 802 standards is universal compatibility, ease of use and interoperability. Both customers and network operators have come to expect backwards compatibility with new technologies.

The conclusion is that deployment of 802 systems in the LE bands will become extremely difficult without the development of well defined coordination techniques and procedures for both intra-802.16 and inter-802.11 - 802.16 compatibility.

3 Conclusion

Without some form of coexistence standard/methodology it will be difficult to deploy 802.16 systems in a manner that will allow for their successful operation in a LE band shared not only with other 802.16 systems but with 802.11 based systems. Accomplishing this LE band coexistence may result in extensions to the current 802.16 and other 802 standards. Backwards compatibility should be carefully considered with the introduction of new 802 based standards for the LE bands.

4 Proposal

It is suggested that a new 802 study group be formed to study the coexistence/compatibility issue. This group would undertake to:

- (a) develop a methodology for studying the inter and intra-coexistence of 802 based systems in the LE bands,
- (b) undertake and report on the studies, and
- (c) develop suitable technical solutions (including deployment techniques and extensions to the 802 standards) to ensure compatibility between LE 802 standardised systems.

As there is considerable industry experience and precedent for studying compatibility and solutions, the committee is encouraged to make use of the best available existing practices to assist it in its work.

The output of the study group should be phased.

- (a) The first report should be a coexistence standard/methodology report that will examine intra 802.16 and inter 802.16 - 802.11 technologies coexisting in the LE bands.
- (b) The second report will be the results of the interference/coordination study.
- (c) The final report will include the proposed methodology for coordinating LE deployments to assure coexistence and any proposed amendments to the 802 standards needed to

support coexistence among 802.16 and 802.11 systems operating in LE bands. The solutions should be totally transparent to the user, and preserve the simplicity of deployment, interoperability, extensibility and compatibility that are typical of 802 standards.

Attached in Annex 1 is a draft possible PAR and 5 for the SG.

Annex 1

IEEE P802.xx
IEEE 802 LAN/MAN Standards Committee

PAR for IEEE 802.xx

Wireless LE Band coexistence & compatibility

Date: 1 July, 2004

Authors:

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Abstract

This document is a proposed PAR for a working group to study the coordination and coexistence of 802 systems (including the 802.11 and 802.16) operating in the LE bands. The working group will develop a coexistence study methodology, perform the studies and recommend coordination techniques and methodologies and, if needed, extensions to 802 standards to ensure coexistence of multi-vendor systems in the LE bands.

IEEE-SA Standards Board Project Authorization Request (PAR) Form

1. Assigned Project Number: **P802.xxxx**

2. Sponsor Date of Request: **2004-xx-xx**

3. Type of Document:

- Standard for** {document stressing the verb "shall"}
- Recommended Practice for {document stressing the verb "should"}
- Guide for {document in which good practices are suggested, stressing the verb "may"}

4. Title of Document:

**Information Technology –
Telecommunications and Information Exchange Between Systems -
LAN/MAN Specific Requirements -
Policies and procedures to ensure Coexistence and compatibility of wireless systems
operating in LE bands**

5. Life Cycle

- Full Use** (5-year life cycle)
- Trial Use (2-year life cycle)

6. Type of Project:

- New standard
- Revision of existing standard (indicate Number and year existing standard was published in box to the right) (####-YYYY)
- Amendment to an existing standard
- Corrigendum to an existing standard (indicate Number and year existing standard was published in box to the right) (####-YYYY)
- Revised PAR (indicate PAR Number and Approval Date here: P - (YYYY-MM-DD))
Is this project in ballot now? No
State reason for revising the PAR in Item #18.

7. Contact information of Working Group Chair who must be an SA member as well as an IEEE and/or Affiliate Member

Name of Working Group (WG): IEEE 802.xx

Name of Working Group Chair: TBD (need candidates by Aug. mtg)

First Name: Last Name

Telephone:

FAX:

EMAIL:

8. Contact Information of Official Reporter, Project Editor or Document Custodian if different from the Working Group Chair. The Official Report must be an SA member as well as an IEEE and/or Affiliate Member.

Name of Official Reporter (if different than Working Group Chair):

9. Contact information of Sponsoring Society or Standards Coordinating Committee:

Sponsoring Society and Committee:

IEEE 802 LAN/MAN Standards Committee

Sponsor Committee Chair:

First Name: _____ Last Name: _____

Telephone: _____

FAX: _____

EMAIL: _____

10. Sponsor Balloting Information:

Choose one from the following:

Individual Balloting

Entity Balloting

Mixed Balloting (combination of Individual and Entity Balloting)

Expected Date of Submission for Initial Sponsor Ballot: **2006-06-01**

Please review the PAR form three months prior to submitting your draft for ballot to ensure that the title, scope and purpose on the PAR form match the title, scope and purpose on the draft. If they do not match, you will need to submit a revised PAR.

Additional communication and input from other organizations or other IEEE Standards Sponsors should be encouraged through participation in the working group or the balloting pool.

11. Projected Completion Date for Submittal to RevCom: **2007-01-01**

If this is a REVISED PAR and the completion date is being extended past the original four-year life of the PAR, please answer the following questions.

If this is not a revised PAR, please go to question #12

Statement of why the extension is required:

When did you begin writing the first draft?

How many people are actively working on the project?

How many times a year does the working group meet in person?

How frequently is a draft version circulated to the working group via electronic means?

How much of the Draft is stable (Format: NN%)? %

How many significant working revisions has the Draft been through?

Briefly describe what the development group has already accomplished, and what remains to be done:

12. Scope of Proposed Project:

This project will study the radio compatibility of 802 based systems (including 802.16 and 802.11) operating in License Exempt (LE) bands (including the bands 2400-2483 MHz, 5150-5350 MHz, 5470-5725 MHz and 5725-5850 MHz), report on possible incompatibilities in coexistence and develop and propose deployment techniques and methodologies and, if necessary, extensions to 802 standards to support RF compatibility/coexistence between systems in the LE bands.

13. Purpose of Proposed Project:

This standard is intended to facilitate the deployment of compatible 802 multi-vendor wireless network products in license exempt bands without causing disruption to existing systems. A new standard for the LE bands that disrupts existing equipment and services will make many manufacturers understandably reluctant to introduce new 802 based products in the LE bands. The possibility of one 802 based standard disrupting another established one will also reflect badly on the credibility of the IEEE 802 standards development process. The hallmark of the existing IEEE 802 standards is universal compatibility, ease of use and interoperability. Both customers and network operators have come to expect backwards compatibility with new technologies.

The purpose of this project is to examine the deployment scenarios for inter-system and intra-system interference conditions and develop both standardized methodologies and techniques for mitigating interference and to develop possible amendments to 802 standards for the LE bands that will ensure coexistence and compatibility among systems operating in the LE bands. The solutions developed should be totally transparent to the user, and preserve the principles of simplicity of deployment, interoperability, extensibility and compatibility that are the basis of 802 standards.

14. Intellectual Property:

Sponsor has reviewed the IEEE patent policy with the working group?

Choose One Yes No

Sponsor is aware of copyrights relevant to this project?

Choose One Yes No

Sponsor is aware of trademarks relevant to this project?

Choose One Yes No

Sponsor is aware of possible registration of objects or numbers due to this project?

Choose One Yes No

15. Are there other standards or projects with a similar scope?

Choose One Yes No

Explanation:

If Yes, please answer the following:

Sponsor Organization:

Project Number:

Project Date:

Project Title:

16. International Sponsor Organization

Is there potential for this standard (in part or in whole) to be submitted to an international organization for review/adoption?

Choose One ?? {Yes/No/?? if you don't know at this time}

If Yes, please answer the following questions:

International Committee Name and Number:

International Organization Contact Information:

Contact First Name:

Contact Last Name:

Contact Telephone Number:

Contact FAX Number:

Contact E-mail address:

17. Will this project focus on health, safety or environmental issues? **No**

If Yes: Explanation?

Note: The PAR Copyright Release and Signature Page must be submitted either by FAX to 208-460-5300 or as an e-mail attachment in .pdf format to the NesCom Administrator before this PAR will be sent on for NesCom and Standards Board approval.

IEEE-SA Standards Board

18. Additional Explanatory Notes:

It is suggested that the project group would undertake to:

- (d) develop a methodology for studying the inter and intra-coexistence of 802 based systems in the LE bands,
- (e) undertake and report on the studies, and
- (f) develop suitable technical solutions (including deployment techniques and extensions to the 802 standards) to ensure compatibility between LE 802 standardized systems.

As there is considerable industry experience and precedent for studying compatibility and solutions, the committee is encouraged to make use of the best available existing practices to assist it in its work.

The output of the study group should be phased.

- (d) The first report should be a coexistence standard/methodology report that will examine intra-802.16 and inter-802.16 - 802.11 diverse systems coexisting in the LE bands.
- (e) The second report will be the results of the interference/coordination study.
- (f) The final report will include the proposed methodology for coordinating LE deployments to assure coexistence and any proposed amendments to the 802 standards needed to support coexistence among 802.16 and 802.11 systems operating in LE bands. The solutions should be totally transparent to the user, and preserve the simplicity of deployment, interoperability, extensibility and compatibility that are typical of 802 standards.

PAR Copyright Release and Signature Page

(Revised 2003)

1. Sponsor Date of Request: 2004-xx-xx

2. Assigned Project Number: **P802.xx**

Title:

**Information Technology –
Telecommunications and Information Exchange Between Systems -
LAN/MAN Specific Requirements -
Policies and procedures to ensure Coexistence and compatibility of wireless systems
operating in LE bands**

I hereby acknowledge my appointment as Official Reporter (usually the WG Chair) to the 802.xx Working Group.

In consideration of my appointment and the publication of the Standards Publication identifying me, at my option, as an Official Reporter, I agree to avoid knowingly incorporating in the Standards Publication any copyrighted or proprietary material of another without such other's consent and acknowledge that the Standards Publication shall constitute a "work made for hire" as defined by the Copyright Act, and, that as to any work defined, I agree to and do hereby transfer any right or interest I may have in the copyright to said Standards Publication to IEEE.

I acknowledge having read and understood the **IEEE Code of Ethics** (http://www.ieee.org/portal/index.jsp?pageID=corp_level1&path=about/whatis&file=cod e.xml&xsl=generic.xsl). I agree to conduct myself in a manner, which adheres to the IEEE Code of Ethics when engaged in official IEEE business.

Signature of Official Reporter _____ Date _____

Name of Official Reporter (usually the WG Chair):

Title in WG:	Chairman	IEEE/SA/Affiliate Memb #:
Company:		Telephone:
Address:		FAX:
City/State/Zip:		EMAIL:

Submitted by: (This MUST be the Sponsor Chair or the Sponsor's Liaison Representative to the IEEE Standards Board) who MUST be an IEEE/Affiliate AND Standards Association (SA) member. If the Sponsor chair is the submitter of the PAR by EMAIL and verifiable by his sender's Email address, this form does not need to be signed by the sponsor. The submitter will be notified in writing when the PAR is received and when the PAR will be considered for approval by the Standards Board. After the Standards Board meeting, the submitter will be notified in writing of the action taken.

As submitter, I shall be responsible for the development and coordination of the standards project, for supervising the standards project from inception to completion, and for ensuring that the standards project operates according to a written set of policies and procedures (P&P) per subclause 5.1.1 of the IEEE-SA Standards Board Operations Manual.

I acknowledge having read and understood the **IEEE Code of Ethics** (http://www.ieee.org/portal/index.jsp?pageID=corp_level1&path=about/whatis&file=code.xml&xsl=generic.xsl). I agree to conduct myself in a manner, which adheres to the IEEE Code of Ethics when engaged in official IEEE business.

Signature of Submitter _____ Date _____

Name of Sponsor Committee Chair:	IEEE/SA/Affiliate Memb #:
Company:	Telephone:
Address:	FAX:
City/State/Zip:	EMAIL:

Do Not Write Below This Line

Signature by IEEE-SA Officer: _____

Title: _____

Date: _____

CRITERIA FOR STANDARDS DEVELOPMENT (FIVE CRITERIA)

Broad Market Potential

A standards project authorized by IEEE 802 shall have a broad market potential. Specifically, it shall have the potential for:

- a) Broad sets of applicability.
- b) Multiple vendors and numerous users.
- c) Balanced costs (LAN versus attached stations).

IEEE 802 standards for wireless devices are widely implemented and widely used for numerous applications, such as local area networking, wireless internet hotspots, streaming video, and home networks. Tens of millions of 802.11 based WLAN radios have been shipped from multiple vendors and are operating in LE bands. New 802 standards are being proposed for operation in the LE bands such as the 802.16. Radio compatibility and coexistence among these multi-vendor systems, including for example between diverse 802.16 based systems and between 802.16 and 802.11 systems is an important aspect of these new systems to ensure acceptance in the marketplace and minimum disruption to existing users.

This goal of this project is to ensure that multi-vendor systems may be readily deployed in the LE bands without disruption to existing and newly deployed services.

Compatibility

IEEE 802 defines a family of standards. All standards shall be in conformance with the IEEE 802.1 Architecture, Management, and Interworking documents as follows: 802 Overview and Architecture, 802.1D, 802.1Q, and parts of 802.1f. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with 802. Each standard in the IEEE 802 family of standards shall include a definition of managed objects which are compatible with systems management standards.

Many manufacturers and network administrators will be understandably reluctant to introduce new 802 based products in the LE bands unless these are designed and shown to have minimum disruption to existing deployments. The new systems must also be free from internal interference or inter-system interference for there to be confidence in the unstructured/uncoordinated deployments inherent in the LE bands. The possibility of one 802 based standard disrupting another established one will also reflect badly on the credibility of the IEEE 802 standards development process. Both the end users and network operators have come to expect backwards compatibility with new technologies.

This goal of this project is to ensure that compatibility and coexistence is maintained among 802 systems operating in the LE bands.

Distinct Identity

Each IEEE 802 standard shall have a distinct identity. To achieve this, each authorized project shall be:

- a) Substantially different from other IEEE 802 standards.
- b) One unique solution per problem (not two solutions to a problem).
- c) Easy for the document reader to select the relevant specification.

No current 802 wireless project addresses the issue of compatibility/coexistence of different standard systems operating in the shared LE bands. Previously only a single standard (e.g. 802.11) has been available for each band. Now that multiple standards are being proposed for shared operation in the common LE bands a new project is necessary to ensure coexistence and compatibility between the standardized systems.

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.

Currently, the 802.11 standardized systems operating in the band use a CSMA technology to facilitate sharing of the radio resources among diverse, uncoordinated systems and devices. This has proven effective with many installations. To achieve compatibility among 802 systems in the LE bands, similar CSMA/packet technology may be extended and applied to new systems operating in the bands. Other technologies may also provide equivalent protection, and these will be investigated as part of the project. To permit coexistence among systems, for example, techniques and methodologies for predicting interference and standardized deployment rules may be developed.

Economic Feasibility

For a project to be authorized, it shall be able to show economic feasibility (so far as can reasonably be estimated), for its intended applications. At a minimum, the proposed project shall show:

- a) Known cost factors, reliable data.
- b) Reasonable cost for performance.
- c) Consideration of installation costs.

The economic feasibility of IEEE 802 wireless devices is well-documented. The cost due to uncertainty in the marketplace from concern about inter-system interference concerns will be significant. The incremental cost of including deployment methodologies and dynamic interference techniques in the 802 standards will be minimal compared to loss of confidence in the 802 wireless system performance.