

**IEEE P802.11
Wireless LANs**

WINForum Sharing Rules Requirements And Goals

Date: April 6, 1998

Source: WINForum 5 GHz Sharing Rules Development Committee (SRDC)

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Decision/action requested

<i>For information and comment</i>

Abstract

The 5 GHz Sharing Rules Development Committee (SRDC) is the U-NII band technical committee of WINforum. This document was developed by the SRDC as a guide in establishing the spectrum sharing rules. The purpose of sharing rules is to establish a level of spectrum coexistence for systems and devices operating in the U-NII band. The document reflects the level of agreement which drafters of the sharing rules are now using as a guideline. It is intended to be a living document and likely will undergo maintenance during the sharing rules development process. The intent is to establish as firmly as possible a set of requirements that all will work toward in the development of the rules. It is expected that the rules development work will start after the initial requirements are established and will be phased to slightly lag the requirements.

WINFORUM SHARING RULES REQUIREMENTS AND GOALS REVISION G7

Purpose

This document is intended to guide the WINForum 5 GHz Sharing Rules Drafting Committee (SRDC) in establishing the requirements for the spectrum sharing rules. The first section (section 2) is a set of requirements. A point is qualified as an objective when it might conflict with another requirement.

This document reflects the level of agreement which drafters of the sharing rules are using as a guideline. The document is intended to be a living document and likely will undergo maintenance during the sharing rules development process. The intent is to establish as firmly as possible a set of requirements that all will work toward in the development of the rules. It is expected that the rules development work will start after the initial requirements are established and will be phased to slightly lag the requirements. Further knowledge developed in the rules generation process will feed back into the requirements.

Section 1.2 gives a set of issues that are likely to develop into requirements.

Section 1. Rules Relative to Interaction Among Non-interoperable U-NII Systems

1.1 Requirements and Goals

1.1.1 Extent of the Rules

The goal of the sharing rules is to allow short and medium range systems using different air interfaces to coexist. The SRDC proposals may specify constraints on power, bandwidth, transmission time and channel access mechanisms. The goal is to allow sufficient flexibility to promote innovation and low cost while encouraging spectrum efficiency and limiting potential for interference and abuse of the spectrum. The intent of these rules is to promote fair access to spectrum and to minimize interference. The rules to be adopted therefore may require devices and systems to assess spectrum usage, and may require them to behave politely to avoid usage conflicts. The rules may utilize power detection techniques, but will not require the exchange of coded information, and consequently do not address the interoperability of unrelated devices.

It is a goal that the rules will be verifiable by testing. However, in some cases it may be necessary to supplement testing with analysis and simulation. The rules will define the following RF characteristics

- Power and EIRP levels
- Antenna directionality
- Channelization
- Out of frequency channel and out of sub-band emissions
- Power spectral density
- Frequency stability

There will be additional logical constraints, such as requirements that relate to channel access procedures, designed to maximize harmonious coexistence among diverse systems using the sub-band. These are the procedural rules.

1.1.2 Variations of the Rules

The U-NII spectrum is divided into three sub-bands. The lower sub-band extends from 5.15 to 5.25 GHz, the middle sub-band extends from 5.25 to 5.35 GHz and the upper sub-band extends from 5.725 to 5.825 GHz

The lower sub-band is shared with Federal Ground-based, Airborne and Shipborne Radar and with feeder uplinks of the Fixed Satellite Service. The band adjacent to and below the lower sub-band is used by the Federal Aeronautical Radionavigation System.

The middle sub-band is shared with Federal Ground-based, Airborne and Shipborne Radar. The band adjacent to and above the middle sub-band is used by the Federal Aeronautical Radionavigation System.

The upper sub-band is shared with Federal Ground-based, Airborne, and Shipborne Radars, ISM devices, the Amateur Service and other Part 15 devices.

Each sub-band will be considered separately in the generation of the RF rules.

There will be two sets of procedural rules, class 1 and class 2. The lower and middle sub-bands will be restricted to class 1 rules. Either class 1 or class 2 procedural rules will be permitted in the upper sub-band.

Class 1 rules:

These will be optimized for the communication of integrated voice, compressed video and packet data characteristic of multi-media communications.

Goal:

- ◆ The rules are intended to facilitate coexistence of unlicensed systems. with in-building operating distances of 30 to 50 meters. The class 1 sharing rules should support efficient operation of systems with a typical range of 30 meters in the lower band and 50 meters in the middle band under in-building propagation conditions of the reference model below.
- ◆ The class 1 rules should account operation at longer distances with antenna gain or outside elevated antennas.

Reference Model:

- ◆ Propagation exponent $\alpha = 2$ in ranges of up to 5 meters, $\alpha = 4$ in ranges from 5 to 50 meters. This is intended to include some level of RF permeable penetration.

The class 1 rules will be optimized for systems with one or more of the following characteristics:¹

- ◆ Quality of service will be provided in real time operation with mean user signaling rates between (suggest 32 kb/s and 2.0 Mb/s).
- ◆ Burst signaling speeds of up to (suggest 8 Mb/s) per user will be required for up to (suggest 100 ms) to allow MPEG reference frame transmission.
- ◆ High burst signaling rate applications will be permitted to use the highest signaling rates up to the full raw signaling speed consistent with the necessary quality of service of all applications.
- ◆ Directional and omnidirectional antennas
- ◆ Ad-hoc as well as building/campus applications supported by a fixed infrastructure
- ◆ Centralized and distributed control systems.
- ◆ Raw channel signaling speeds of at least 20 Mb/s.

Goal: One integrated set of rules covering all information flow types. Frequency separation may be necessary but will be the last resort.

Class 2 rules:

These will accommodate applications incompatible with class 1 rules.

- ◆ More robust access procedures - capable of operating in the presence of high powered radar signals, ISM and spread spectrum devices
- ◆ Longer distances; these affect the protocols as well as EIRP levels because the end-to-end signaling time (mostly propagation time) would be much larger than for short range systems.

1.1.3 Antenna Directionality

The rules will permit both directional and omnidirectional antennas.

¹ Reference ETSI TR 101 031 V1.1.1 (1997-07) Technical Report. Section 5.3, gives data and multi-media requirements expected for equipment using the 5.2 GHz band. Tables 9-11 gives the predicted average and peak data rate requirements for a typical office scenario.

1.1.4 Network Access, Interoperability and Wireless Protocols

The sharing rules provide spectrum coexistence for intra building multi-media communication as well as interconnection to wired networks for inter location multi-media communications over broadband wired networks.

It is a specific requirement that the access rules specify the necessary functions to assure spectrum coexistence for mobile terminal interconnection via wireless to wired networks for example, IP- or ATM- based networks.

It is a goal of the sharing rules committee to develop rules that allow implementations that support quality of service requirements (eg. those being developed by the ATM Forum) to the extent that they are consistent with fair sharing of the spectrum.

The objective of the sharing rules committee is to develop rules that

- a) Support radio based networks that provide controlled quality of service to their users (examples of controlled QoS protocols that these networks would have to support are ATM and switched Ethernet). Such networks shall be bounded in the amount of channel capacity they may use.
- b) Provide for smooth (re)distribution of U-NII spectrum resources to networks operating within range of each other in a manner consistent with a)
- c) Support devices that provide a "best effort" type of service or non guaranteed quality of service (e.g. as is the case on the Internet today).

The MAC and Logical Link Control (LLC) layers are specifically not the responsibility of the sharing rules committee. These are referred to in the objectives statement of the committee as the interoperability rules. The purpose of the sharing rules is to provide the basic foundation required to provide spectrum coexistence for the development of interoperable systems, whether for current and future interoperability standards or for early proprietary systems.

Note: The ETSI BRAN project have reached agreement with the ATM Forum on the division of work for wireless ATM access with regard to HIPERLAN and with IEEE p802.11 for cooperation on Wireless LANs. Cooperation agreements between ETSI BRAN, IEEE p802.11 and the WINForum SRDC are underway.

1.1.5 Compatibility with Interoperability Standards

Several standards for wireless systems that may operate in the U-NII band are in existence, or under development notably IEEE's 802.11 and ETSI's HIPERLAN Types 1, type 2 and type 3. The sharing rules to be developed by the SRDC shall be designed for optimum use and sharing of the U-NII spectrum. Compatibility with existing standards shall be taken into account where this does not conflict with the above objective.

Compatibility in this context means that the sharing rules would not preclude systems operating under such standards and would provide them with some protection from interference.

1.1.6 Efficiency Metric

Goal: The efficiency metric should take into account re-use as well as modulation efficiency (b/s/Hz/cell).

1.1.7 Wideband High Data Rate Transmission.

Rules will be developed to encourage use of the band for wideband, high data rate systems. Example rules might be:

A minimum channel spacing will be specified for the lower and middle U-NII bands. Devices with 26 dB bandwidths exceeding the minimum channel spacing will also be allowed. The center frequency spacing shall be no less than the 26 dB emission bandwidth. This requirement does not apply to devices with emissions (26 dB points) completely contained within TBD MHz of the band edge.

Another example would be to allow narrowband channels in the guard band between wideband channels, and to require a given system to use wideband transmission in at least one direction.

1.2 Issues Relative to Other U-NII Systems

1.2.1 Power and EIRP Issues

A list of power and eirp issues may be developed, taking into account the following:

The current regulations provide the necessary rules on power levels, out of band emissions, antenna directionality and other usage restrictions to guard non-U-NII systems legally operating within the U-NII bands and adjacent to U-NII bands. Further rules of this nature may be needed concerning coexistence among U-NII devices in the U-NII bands.

Directional antennas show promise of achieving good efficiency at higher distances. This must be studied in relationship to the effects on other services and the effect on less directional systems.

Directionality of the antennas may make an LBT rule ineffective.

An objective of the sharing rules committee is to yield an etiquette that allows efficient use of power to achieve long battery life.

1.2.3 Monitoring and Assessment

To be added.

1.2.4 North American Standards Development

MAC and DLC Layers are being standardized by the IEEE 802.11 organization.

How do we best assure that the sharing rules will meet both the best effort and controlled QoS standardized system needs?

1.2.5 Distributed Control Systems

Can both centralized and distributed control systems be efficiently supported by a single set of rules?

1.2.6 Efficiency Metric

Needs to be developed.

1.2.7 Quality of Service Metrics

Should values of the following parameters be established?

Data response times

Data collision/interference probability

Voice/Video quality

Connection blocking and drop probability

1.2.8 Wideband High Data Rate Transmission.

Included in the list of issues to be considered are the following:

Issue 1: Should specific center frequency assignments be made for the minimum bandwidth channels?

Issue 2: Should narrow channels be permitted in the guard bands provided they meet the 26 dB band edge requirement?

Issue 3: Should a minimum signaling speed be specified?

Issue 4: Should a minimum 26 dB to 6 dB bandwidth ratio be specified?

1.2.9 Fairness Metric

The following has been proposed as a fairness metric:

The objective is to achieve a probability of access that is independent of the type of system requiring access.

Should fairness be based on a systems or device level?

1.2.10 Need for Class 2 Rules

The upper U-NII band (5.725 - 5.825 GHz) is allocated for spread spectrum systems and ISM equipment. This equipment is not required to conform to any sharing rules. This makes U-NII sharing rules for this band less effective.

Should class 2 rules (upper band rules) be developed?

Section 2. Rules Relative to Interaction with Non - U-NII Systems

2.1 Requirements and Goals Relative to non - U-NII Systems

Government RadioLocation Systems (RLS) operate in the 5 GHz frequency range both within and near the U-NII band. RLS systems generate very high level RF pulses which can seriously interfere with U-NII systems when the frequency is in or near that of the U-NII channel. U-NII systems should be designed to minimize susceptibility to such interference by careful specification and design of such parameters as the front end frequency response, RF recovery time and burst error performance.