

January, 1999 doc.: IEEE 802.11-98/409A

**WINFORUM AND UNLICENSED SPECTRUM**

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Submission Slide 1 Submission

January, 1999 doc.: IEEE 802.11-98/409A

**WINFORUM PURPOSE**

1. To promote the development and deployment of wireless voice and data personal communications products, services, and technologies that do not require station or operator licensing by the Federal Communications Commission of the United States, including the spectrum allocations and regulatory environment necessary for the success of such products, services and technologies;
2. To articulate and advocate the needs and interests of the unlicensed wireless voice and data personal communications industry before legislative, administrative, and judicial branches of government and international fora;
3. To provide a forum for the advancement, understanding, and appreciation of unlicensed wireless voice and data personal communications;
4. To conduct activities for the betterment of those firms involved in some aspect of the unlicensed wireless voice and data personal communications industry.

Submission Slide 2 Submission

January, 1999 doc.: IEEE 802.11-98/409A

**Winforum Tasks and Activities**

- **Principal Industry Advocate for Unlicensed Frequency Use**
- **Technical and Regulatory Expertise**
- **U-NII and UPCS**
  - Spread Spectrum Possible Future Concern
- **Future Unlicensed Spectrum**

Submission Slide 3 Submission

January, 1999 doc.: IEEE 802.11-98/409A

**WINForum Technical Committees**

- **5 GHz Sharing Rules Development Committee (SRDC)**  
Technical Committee for the U-NII Band  
High Speed LAN and Multi-Media  
300 MHz Total
- **UPCS Technical Committee**  
Voice and Low Speed Data  
Total of 30 MHz
- **WINTest**  
Developed ANSI C63.17 - UPCS Test Standard  
Now Inactive

Submission Slide 4 Submission

January, 1999 doc.: IEEE 802.11-98/409A

**Threats to the U-NII Band**

- **Spectrum Sharing**
- **Measurement Rules and Procedures**
- **Narrowband/Wideband Incompatibility**  
Mixed Bandwidth Comparison (IEEE 802.11-97-106, 11/97)  
Reference Bluetooth Sharing Papers by Ennis and Zyren

Submission Slide 5 Submission

January, 1999 doc.: IEEE 802.11-98/409A

**MSS Spectrum Sharing  
Serious Threat**

- **MSS Industry Opposed to Sharing the U-NII Band**
- **Restrictions on Low U-NII Band**  
Unnecessary - Not Justifiable
- **Possible Effort to Expand to the Middle Band**
- **Needs Constant Vigilance**

Submission Slide 6 Submission

January, 1999 doc.: IEEE 802.11-98/409A

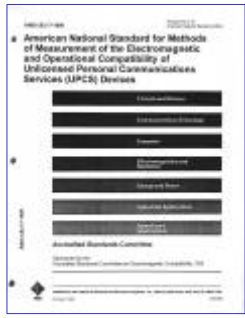
### Measurement Rules and Procedures

- **Measurement Technique Often Establishes the Parameter Definitions**
  - Precedent Sometimes Sets the Rule
- **Critical Parameters**
  - Peak Power - Average over 30/B
  - Power Spectral Density – Burst Average
  - Out of Band Emissions (Restricted Band or Other Rules)
- **Advanced Measurement Techniques Required**
  - Common Instrumentation Has Limits (Example 2 – 4 MHz Resolution Bandwidth)
  - Burst Measurement Techniques
- **FCC Welcomes Help From Industry Organizations**

Submission Slide 7 Submission

January, 1999 doc.: IEEE 802.11-98/409A

### ANSI/IEEE C63.17 - 1998



**Developed by WINTest**

- Sponsored by ANSI
- Participation from FCC Lab and Industry Measurement Experts

**Needs Enhancement for U-NII Measurements**

- Peak Power
- Power Spectral Density
- Other

Submission Slide 8 Submission

January, 1999 doc.: IEEE 802.11-98/409A

### Sharing Rules

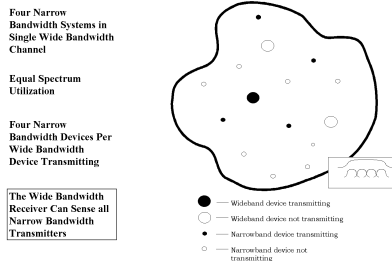
- **Narrowband/Wideband Incompatibility**
- **Situation Described in November 1997 Paper**
  - Doc:IEEE P802.11-97/106 Paper
  - Doc:IEEE P802.11-97/107 Presentation Charts
- **Frequency Hopping Concern**
  - Above Paper Applicable to the General Case
  - September and November Papers on Bluetooth (IEEE802.11-98/319a and 98/398)
    - Situation where one Bluetooth piece interferes
- **Further Rules**
  - Need
  - Grandfathering
  - Policy toward standards

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January, 1999 doc.: IEEE 802.11-98/409A

### Narrowband/Wideband Incompatibility Described

Mixed Bandwidth Comparison (IEEE P802.11 97-106)



Four Narrow Bandwidth Systems in Single Wide Bandwidth Channel

Equal Spectrum Utilization

Four Narrow Bandwidth Devices Per Wide Bandwidth Device Transmitting

The Wide Bandwidth Receiver Can Sense all Narrow Bandwidth Transmitters

Submission Slide 10 Submission

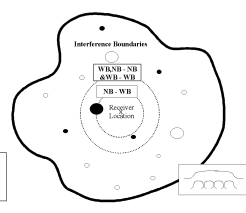
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### Narrowband/Wideband Incompatibility Described

Mixed Bandwidth Comparison (IEEE P802.11 97-106)

If the Signal Detection Threshold is Proportional to Bandwidth and Equal PSD.

The Interference Range from a Narrow Bandwidth Transmitter to a Wide Bandwidth Receiver is Lower Than to a Narrow Bandwidth Receiver.



The Number of Narrow Bandwidth Transmitters Sensed by a Wide Bandwidth Receiver is Reduced by this Effect.

Submission Slide 11 Submission

January, 1999 doc.: IEEE 802.11-98/409A

### Narrowband/Wideband Incompatibility Described

Mixed Bandwidth Comparison (IEEE P802.11 97-106)

Parameter Definitions

$$\frac{P_1}{P_2} \propto r^\alpha \quad \alpha \text{ is typically } = 4 \text{ at } 5.3 \text{ GHz}$$

$xy = 11, 12, 21 \text{ and } 22.$   
 2 refers to a wideband device or channel and 1 refers to a narrowband device or channel

$W =$  The number of narrow channels within the wide channel  
 $B_x =$  The bandwidth of channel  $x$  ( $x=1$  or  $2$ )  
 $R = WB_1/B_2$  is the packing density of the narrow channels (Likely value = 1)  
 $N_x =$  The mean number of devices of type  $x$  sensed by a type  $x$  receiver.  
 Sensing threshold proportional to bandwidth

97-106 Shows that for  $N_1$  to Equal  $N_2$  (when both systems have the same spectrum use) the Power Ratio Must be:

$$\left( \frac{P_1}{P_2} \right)^{\frac{1}{\alpha}} \leq \left( \frac{B_1}{B_2} \right)^{\frac{1}{\alpha}} = R^{\frac{1}{\alpha}}$$

Necessary Condition for Equal Access Capability

Submission Slide 12 Submission

January, 1999 doc.: IEEE 802.11-98/409A

### Narrowband/Wideband Incompatibility Described The Lockout Problem

Channel n1 activity  
A transmits

Channel n2 activity  
B transmits

Channel w activity  
C transmits

Devices A and B are:  
on Different Narrow Bandwidth Channels Within the Channel of Device C and  
Device C is Within Detection Range of Devices A and B  
The Wideband Device (C) Does not Sense an Idle Channel Unless A and B are Idle.

Submission Slide 13 Submission

January, 1999 doc.: IEEE 802.11-98/409A

### Narrowband/Wideband Incompatibility Described Mixed Bandwidth Comparison (IEEE P802.11 97-106)

The Ratio  $N_{11}/N_{11} = \beta$  of 97-106  
The mean number of type 1 devices sensed by a type 2 receiver divided by the mean number of type 1 devices sensed by a type 1 receiver.

97-106 Shows that  
 $\beta = R \left( \frac{B_2}{B_1} \right)^{\frac{1}{M}}$  (If all devices have the same power spectral density – U-NII Rules)

Further, in small areas or in all cases where the total power is equal for all devices  
 $\beta = W = RB_2/B_1$

$P_{21}$  The probability that a wide bandwidth receiver will sense a channel idle condition in the presence of type one transmitters when the type 1 receivers sense an active channel  $100N_{11}$  % of the time.

$N_{11}$  is the type 1 system utilization relative to the achievable utilization.  
If  $N_{11} = 1$ , all type 1 channels are always busy.

$P_{21}$  as a Function of  $N_{11}$  is derived in 97-106. The Following is Figure 7-1 of 97-106

Submission Slide 14 Submission

January, 1999 doc.: IEEE 802.11-98/409A

### Narrowband/Wideband Incompatibility Described Mixed Bandwidth Comparison (IEEE P802.11 97-106)

The wide bandwidth receiver will sense  $\beta$  times as many type 1 transmitters than would a type 1 receiver. Further the type 1 devices are likely to be on different channels and thus create lockout.

Consider the  $\beta = 6.3$  curve. In small deployment areas with equal PSD, and in all cases with equal power, this corresponds to a bandwidth ratio of 6.3. Here, the wide bandwidth system is virtually prevented from operation ( $P_{21} = 0.02$ ) if the narrow bandwidth system has a demand of 50% of that achievable.

Figure 7-1: The Upper Limit of the Relative Utilization of a Wide Bandwidth System in the Presence of a Narrow Bandwidth System.  
(M is a parameter related to the accuracy of the comparison)

Submission Slide 15 Submission

January, 1999 doc.: IEEE 802.11-98/409A

- **Frequency Hopper**  
1 MHz 20 dB Bandwidth FH  
 $B_2/B_1 @ 16, 4 < b < 16$   
Less Than 5% Wideband Capacity at 50% Hopper Utilization
- **U-NII Band Intended for**  
“wideband, high data rate ---- communication”  
From 15.403 (a)
- **Rules Needed**  
Establish Narrow/Wide Channel Width  
Limit Number of Narrow Bandwidth Channels or  
Control Narrow Channel Location or  
Other ?
- **WINForum Needs Help**

Submission Slide 16 Submission

January, 1999 doc.: IEEE 802.11-98/409A

### Conclusion

- **Further Work Needed on U-NII Band**  
Wideband/Narrowband Sharing - Rules Addition  
Further Rules Addition  
Measurement Procedures - Complete the RF Parameter Definitions  
Spectrum Allocation Vigilance

Submission Slide 17 Submission

January, 1999 doc.: IEEE 802.11-98/409A

### WINForum Membership Information

- **Annual Membership Fees**

• Over \$1 billion in sales	\$15,000
• Over \$100 million in sales	\$ 3,750
• Over \$10 million in sales	\$ 2,500
• Over \$1 million in sales	\$ 1,250
• Under \$1 million in sales	\$ 500
• Associate Member, Non Profit, No Voting rights	\$ 500
• Special Assessments for Legal Fees	Varies
- **Currently 10 Member Organizations**  
5 over \$1 billion sales
- **WINForum General Meeting**  
Tuesday, February 23, 1999  
Followed by SRDC Meeting  
WINForum Headquarters, 1200 19th St. NW, Suite 300, Washington, DC
- **Information Package Available**

Submission Slide 18 Submission

January, 1999 doc.: IEEE 802.11-98/409A

**Further Information**

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Submission Slide 19 Submission