

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of )  
 )  
Establishment of an Interference Temperature ) ET Docket No. 03-237  
Metric to Quantify and Manage Interference and )  
to Expand Available Unlicensed Operation in )  
Certain Fixed, Mobile and Satellite Frequency )  
Bands )

**Via the ECFS**

**COMMENTS OF IEEE 802**

IEEE 802<sup>1</sup> hereby respectfully offers its Comments<sup>2</sup> on the Notice of Inquiry and Notice of Proposed Rulemaking (the “NPRM”) in the above-captioned Proceeding.

The members of IEEE 802 that participate in the IEEE 802 standards process are interested parties in this proceeding. IEEE 802, as a leading consensus-based industry standards body, produces standards for wireless networking devices, including wireless local area networks (“WLANs”), wireless personal area networks (“WPANs”), and wireless metropolitan area networks (“Wireless MANs”).

IEEE 802 is an interested party in this Proceeding and we appreciate the opportunity to provide these comments to the Commission.

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<sup>1</sup> The IEEE Local and Metropolitan Area Networks Standards Committee (“IEEE 802” or the “LMSC”)

<sup>2</sup> This document represents the views of the IEEE 802. It does not necessarily represent the views of the IEEE as a whole or the IEEE Standards Association as a whole.

## INTRODUCTION

1. On November 13, 2003, the Commission adopted the instant NOI and NPRM<sup>3</sup> regarding the establishment of an interference temperature model for “*quantifying and managing interference.*”<sup>4</sup> The Commission continues:

*“This new approach could provide radio service licensees with greater certainty regarding the maximum permissible interference, and greater protections against harmful interference that could be present in the frequency bands in which they operate. In addition, to the extent that the interference temperature limit in a band is not reached, there could be opportunities for other transmitters, whether licensed or unlicensed, to operate in the band at higher power levels than are currently authorized.”*<sup>5</sup>

2. We applaud the Commission’s efforts to find a quantitative means to balance the interests of current radio licensees and the interests of future licensed and unlicensed users as new ways to utilize existing spectrum are envisioned and developed by the combined efforts of government, industry, universities, standards bodies, and other interested parties.

3. We support the Commission’s efforts “*to revisit its traditional model and evolve its spectrum management policies to consider more flexible and market-oriented approaches that can provide incentives for users to migrate to more technologically innovative and economically efficient uses of the spectrum.*”<sup>6</sup>

4. In these comments, we will make recommendations which we believe will speed the accomplishment of these objectives.

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<sup>3</sup> FCC 03-289, “*NOTICE OF INQUIRY AND NOTICE OF PROPOSED RULEMAKING*”; adopted Nov.13, 2003, released Nov. 28, 2003 (“the NPRM”).

<sup>4</sup> See the NPRM, at 1

<sup>5</sup> *Id.*, at 1

<sup>6</sup> *Id.*, at 6

**WE BELIEVE THAT “INTERFERENCE TEMPERATURE” IS A LESS USEFUL  
METRIC THAN POWER SPECTRAL DENSITY (“PSD”) IN REGULATING  
INTERFERENCE**

5. In defining interference temperature, the Commission uses an analogy to noise temperature, where interference temperature =  $(I + N)/kB$ , the interference power, I, plus the noise power, N, divided by Boltzmann’s constant, k, and the measurement bandwidth, B.<sup>7</sup>
6. Later in the instant proceeding<sup>8</sup>, the Commission proposes using the DFS thresholds from the recent 5 GHz rulemaking<sup>9</sup>, given in dBm referenced to the output of an omni-directional antenna, to allow unlicensed operation co-channel with FS, FSS, and BAS/CARS services in the various bands specified (6525-6700 MHz, and 12.75-13.25 GHz, excluding 13.15-13.2125 GHz).
7. We understand the technical value of evaluating interference in satellite operations in terms of noise temperature. The Commission’s analysis in Table I<sup>10</sup> of the instant proceeding is a good example of the utility of this approach, and noise temperature analysis is a longstanding tradition in satellite link budget calculations.
8. At the same time, Table I also indicates that, in the calculation of interference effects, it is impossible to avoid injecting interference power into the analysis, as is indicated by the section in Table I entitled “Interference Temperature System Parameters”, which are all given in units of power (dBW, dBi, etc.).
9. All unlicensed devices and operational modes approved to date are terrestrial in nature, and the use of noise temperature, or interference temperature, as a metric in a terrestrial environment is not a convenient way of directly dealing with link budget analysis and related carrier to noise ratio (“C/N”) and carrier to interference ratio (“C/I”) issues. In the Commission’s rulemaking on

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<sup>7</sup> *Id.*, at 10, and footnotes 14 and 15 on page 5.

<sup>8</sup> *Id.*, at Section B

<sup>9</sup> See Report and Order FCC 03-287, Revision of Parts 2 and 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) devices in the 5 GHz band

<sup>10</sup> The NPRM, p.28

U-NII device operation, the selection of interference power thresholds (in dBm) as the basis for DFS operation underlines the point that received power is the parameter that is easily measured by receiver circuitry, not noise temperature or interference temperature, which are, at best, arrived at by calculation from power and bandwidth data.

10. We recommend that the Commission adjust the terminology used in regulating acceptable interference levels (the essential issue in this initiative) to avoid the confusion created by the term “interference temperature” as it applies to establishing interference thresholds for terrestrial operation of licensed and unlicensed devices. We recommend that PSD (e.g. dBm/Hz or dBm/MHz, etc.) be used in place of interference temperature specified in K.

**RECEIVED PSD LEVELS ARE MORE RELEVANT IN DETERMINING THE  
PROBABILITY OF INTERFERENCE THAN REGULATING TRANSMITTER  
CHARACTERISTICS**

11. The important thing is to begin to regulate interference by limiting received PSD instead of limiting transmitted power level. Currently, the FCC attempts to minimize interference by limiting the transmitter characteristics. These emission limits are determined by an explicit or implicit analysis that involves estimating propagation effects, cumulative effects, licensed signal characteristics, the noise environment, and the affected receiver characteristics. Because of the wide range of potential radio usage there is large uncertainty in the functional element values and the Commission must use conservative values.

12. Using conservative values greatly limits spectrum use and is one of the root causes of the low spectrum usage seen today. By implementing the concept of acceptable interference limits, the Commission is pursuing a more adaptable regulatory paradigm. This approach enables creating a device which might opportunistically use spectrum to estimate the functional elements (propagation effects, cumulative effects, licensed signal characteristics, the noise environment, and the affected receiver characteristics) and adjust its transmission characteristics to avoid interfering with other users. Instead of making worst case assumptions based on a static

environment, the actual conditions can be used dynamically to support more effective spectrum utilization.

13. We support the interference management goals of the instant proceeding, but urge the Commission to proceed cautiously in the process of further developing and validating the essential regulatory principles embodied therein.

**WE BELIEVE THE COMMISSION SHOULD FOCUS ON PERMITTING  
ADDITIONAL LICENSED AND UNLICENSED OPERATIONS IN SPECTRUM  
SEGMENTS WHICH ARE ALLOCATED BUT UNUSED**

14. The interference temperature initiative embodied in the instant proceeding seems to focus primarily on adjustments to regulation for co-channel operation of actively used spectrum by licensed and unlicensed systems, as indicated by Figure 1<sup>11</sup>, and the later proposed rulemaking re: unlicensed operation in FS, and FSS bands. We believe that regulations permitting such activity where possible on a non-interfering basis are a laudable goal and fully support the Commission's efforts to do so.

15. However, we also believe that there are great swaths of spectrum which are assigned to licensed operations, but are completely unused because of geographic, economic, or operational considerations. We note that this unused spectrum represents low hanging fruit which could be harvested within the present regulatory framework, more or less independent of the long term status or implementation of the instant proceeding.

16. The Commission, in its NOI ET 02-380, *Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, already recognizes that such fallow spectrum exists and might be exploited under the present regulatory regime in stating “*Specifically, we seek comment on the feasibility of allowing unlicensed devices to operate in TV broadcast spectrum at locations and times when spectrum is not being used...*”<sup>12</sup>

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<sup>11</sup> The NPRM p.7

<sup>12</sup> See ET 02-380, at 1.

17. We urge the Commission to give priority to pursuing regulatory activity which opens fallow spectrum to use by licensed and unlicensed operations. We believe that such regulatory activity can begin even without the major paradigm shift implied in implementing the interference temperature approach. The identification and utilization of such existing spectrum “holes” is the fast track to redeveloping currently underutilized spectrum segments.

**WE DO NOT SUPPORT REQUIRING LICENSED SYSTEMS TO MONITOR INTERFERENCE TEMPERATURE IN THEIR OPERATIONAL ENVIRONMENT**

18. In one scenario which the Commission offers as a possible model for monitoring interference temperature, the Commission suggests requiring that

*“the receive sites of a licensed service to measure the temperature and communicate those measurements to a central site, where the interference temperature profile for the region would be computed. A message could then be broadcast indicating the temperature values over that region and perhaps whether devices would or could not transmit on particular frequencies.”*

19. We believe that requiring licensed services to install expensive and complex infrastructure to universally monitor interference temperature is an unnecessary and counter productive approach to interference prevention. It is not clear to us how such a system would be effective given the complex issues of terrain, propagation, and the susceptibility of the particular licensed system to harmful interference.

**WE DO NOT SUPPORT CREATING A GRID OF MONITORING STATIONS FOR INTERFERENCE TEMPERATURE MEASUREMENT AND CONTROL**

20. We believe that the cost of creating, not to mention maintaining, a ubiquitous network of monitoring stations would completely overwhelm any short term or long term benefit in new economic activity. Further, the complexity of the monitoring process (e.g. time, 3-D space, frequency, polarization, antenna characteristics, etc.) itself appears to us to cast doubt on the

reliability of the resulting data and may effectively limit the mass market adoption of such measurement and control solutions.

**WE SUPPORT THE COMMISSION’S EFFORTS TO OPEN NEW SPECTRUM  
SEGMENTS IN THE 6 GHZ AND 12-13 GHZ BANDS TO UNLICENSED USE  
PROVIDED THE RULES IMPLEMENTED PROTECT THE INTERESTS OF  
LICENSED OPERATIONS**

21. We applaud the Commission’s efforts to create additional unlicensed spectrum. The history of unlicensed operations has demonstrated significant economic benefits to service providers, network operators, and users - especially in the case of IEEE 802 standards based wireless systems and applications.

22. The Commission’s analysis in the instant NPRM for interference with FSS operations seems clear and consistent with similar analysis for the 5 GHz band which established TPC limits for that band.

23. The Commission’s analysis for FS operational interference by unlicensed systems seems less robust than the analysis for the FSS case, and our concern is that the interference issues related to FS operations may not have been fully examined.

24. We recommend caution in moving forward in releasing the subject spectrum for unlicensed use without further analysis of the impact on FS systems.

**FINAL COMMENTS**

25. We encourage the Commission to continue to pursue regulatory avenues which would increase the opportunity for new technologies to increase spectrum utilization, enable new avenues of economic growth, and a new era of advanced services for consumers.

26. Since the availability of unlicensed spectrum continues to be an enabler of this process, we encourage the Commission to pursue every opportunity to open up more unlicensed spectrum.

27. At the same time, we recognize the legitimate interests of licensed incumbents, and recommend careful consideration of the impact of unlicensed systems on licensed operations during the rulemaking process.

28. We also believe that some spectrum segments, like mobile bands including public safety, deserve special protection from interference and should not be considered for unlicensed use on the basis of the interference temperature concept.

29. In summary, we support the interference management goals of the instant proceeding, but urge the Commission to proceed cautiously in the process of further developing and validating the essential regulatory principles embodied therein.

Respectfully submitted,

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