

**Before the  
Federal Communications Commission  
Washington, D.C. 20554**

In the Matter of	)	
	)	
Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies	)	ET Docket No. 03-108
	)	
Authorization and Use of Software Defined Radios	)	ET Docket No. 00-47 (Terminated)
	)	

**COMMENTS OF INTEL CORPORATION**

**I. INTRODUCTION AND SUMMARY**

Intel commends the FCC for initiating this proceeding considering whether and how devices should be authorized to use radio frequency (RF) based on their “cognitive” ability to gather and process real-time information about their operating environment. Intel believes that the Commission can modify its rules and enforcement policies to address legitimate regulatory concerns and make it possible for cognitive radios to substantially increase spectrum efficiency.

Intel is the world’s largest semiconductor manufacturer and a leader in technical innovation. Intel is also a leading manufacturer of communications and networking chips and equipment. Intel has substantial research programs in areas such as cognitive radio technologies, smart antennas, and ultra wideband. Intel has also participated in various international activities that are addressing cognitive radio issues including:

- The Commission’s Workshop on Cognitive Radio Technologies, U-NII, SDR, and Unlicensed Devices Below 900 MHz proceedings<sup>1</sup>;
- The ITU-R Preliminary Draft Recommendation/Report on SDR; and
- European Commission’s Telecommunication Conformity Assessment and Market Surveillance Committee (TCAM) Sub-Group’s Questionnaire on the Impact of SDR on the R&TTE Directive.

Intel believes that the Commission can address legitimate regulatory concerns raised by cognitive radios, if it bases its rules on “clear definitions of the rights and responsibilities of both licensed and unlicensed spectrum users, particularly with respect to interference and interference protection.”<sup>2</sup> For example, the Commission’s recent U-NII decision, a “cognitive radio”-based allocation, was made possible by well-defined protection criteria for military radars, the authorized users in the band. As Intel has stated in the Commission’s inquiry into unlicensed use of vacant TV channels (ET Docket No. 03-201), today’s unlicensed allocations are successful because they create a structure of primary and secondary users and give *de facto* control of the secondary use to the owner of the immediate physical area (business, campus, or home).<sup>3</sup>

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<sup>1</sup> Of note: The WRC’07 agenda item 1.4, and Resolution 228, cited by the Commission specifically call for sharing studies that would permit developing nations to recognize the great economic benefits of using lower frequencies Intel believes development currently underway in support of the Commission’s TV NOI is directly applicable to this and is vital to access to these valuable frequencies on a global basis.

<sup>2</sup> Spectrum Policy Task Force Report @3

<sup>3</sup> See Comments of Intel Corporation In the matter of Modification of Parts 2 and 15 of the Commissions Rules for unlicensed devices and equipment approval. ET Docket No. 03-201 @3

In that case Intel believes unlicensed use of vacant TV channels is possible, because well-defined protection criteria for TV (Grade B contours) have already been established as part of the Commissions DTV proceeding.

Specifically with regard to the various issues raised in this proceeding, Intel takes the following positions:

*Proposals for Part 2 rule changes*

- Current rules provide adequate safeguards against unauthorized modifications to Software Defined Radios (SDR). A mandatory filing requirement could retard the deployment of SDR and unnecessarily burden the industry by restricting the use of an efficient manufacturing technique.
- The requirement that grantees or applicants supply a copy of their radio software upon request should be replaced with the less burdensome requirement that applicants supply a description and flow diagram of the software that controls the radio operating parameters.
- The establishment of a “safe harbor” such as “industry accepted practice,” would be counterproductive in this instance, unduly encouraging manufacturers to design equipment to fit the safe harbor rather address the actual threat.
- Intel opposes any rules mandating more explicit security requirements as the rulemaking process lags industry and could not hope to keep pace with the state of the art in this area.

- Intel strongly opposes restricting the mass marketing of high-speed DACs which do not represent a significant risk. Such a restriction would set a dangerous precedent and unnecessarily increase the regulatory burden on the PC industry.

*Proposals for Part 15 rule changes*

- Intel supports the proposal to allow certification of Part 15 devices that are capable of operating on non-Part 15 frequencies. It appropriately focuses on defining response and testing criteria, leaving the actual location detection mechanism to manufacturers.

*Rural Markets and Unlicensed Devices*

- The Commission must be cautious in permitting unlicensed devices to operate at higher power. Because of ubiquitous device deployment and the potential for a tragedy of the commons, an increase in power in the 900 MHz and 2.4 GHz bands would likely result in significantly more interference and suboptimal quality of service.
- Focusing on the 5.8 GHz could prove more productive, if the proposed sensing method is feasible. The Commission's proposal, however, relies on a measurement made at the transmitter rather than at the receiver and therefore will likely require more study.
- The Commission appropriately seeks comment on alternative methods to allow for higher power operation.
- Intel agrees that Section 15.247(h) provision should be eliminated as requested in our pleading in ET Docket No. 03-201.

- Intel supports exemptions for devices operating under the control of a master controller from complying with DFS or other requirements as being consistent with the U-NII proceeding.

## **II. DISCUSSION**

### **Proposals for Part 2 Rule Changes**

The Commission seeks comment on the need for a requirement that manufacturers and importers declare certain equipment as SDR, including the benefits of such a requirement in reducing interference and its possible burdens on manufacturers. A large percentage of radios manufactured today would meet the Commission's SDR definition. Mandating an SDR filing on these radios would unnecessarily restrict the use of an efficient manufacturing technique.

Intel believes the requirement to protect radios from malicious abuse is already a responsibility of manufacturers. The Commission recognizes that "not all radios that meet the broad definition of an SDR are easily modifiable after manufacture." For those manufacturers wishing to allow the upgrade of their radios using the new class III permissive change, the current rules are adequate. Those devices that use SDR techniques as a manufacturing technique, and are not intended to be modified in the field, should not be required to file as SDR. The Commission should impose SDR requirements on those devices where the manufacture intends to allow modifications in the field.

Intel believes this approach is feasible because manufacturers face strong incentives to include the necessary safeguards against unauthorized operation. Specifically, access points do not represent a significant risk, because these devices are cost-constrained and because the industry can adopt readily available, simple solutions.

Intel urges the Commission to not adopt rules that would specifically burden unlicensed devices, because they do not represent a greater risk than other devices, and could be particularly harmed by increased regulation.

Likewise with regard the Commission's question about partitioned modules, Intel believes that where the manufacturer's intent is to allow change after manufacturing, the existing SDR rules are sufficient. Where that is not the case, we believe modification by users will not be easy or even possible, and so there is no reason partitioned modules should be required to declare as SDR. The proposed partitioning and digital key requirements for transmitter modules are sufficient to protect against unauthorized software modifications of modules and eliminate the need to require modules to be declared as SDR.

Intel agrees with the proposal to substitute the requirement that grantees or applicants supply a copy of their radio software upon request with the less burdensome requirement that applicants supply a description and flow diagram of the software that controls the radio operating parameters.

The Commission also asks whether defining compliance using "commercially reasonable measures," or some other standard, such as "industry accepted practice," would appropriately balance our goals for ensuring compliance with our rules and burdens on manufacturers. Intel believes that the establishment of a "safe harbor" would be counterproductive in this instance. Such a rule could perversely increase liability for those manufacturers who choose newer state of the art security methods rather than the "industry accepted practice." This could unduly encourage manufacturers to design equipment to fit the safe harbor rather than address the actual threat.

Moreover, any rules mandating more explicit security requirements, such as requiring electronic signatures in software to verify the software's authenticity, could be even more costly because regulation will inevitably lag behind industry accepted practice.

Finally, Intel strongly opposes any restriction on the mass marketing of high-speed DACs such as limiting marketing to commercial, industrial and business users as required for Class A digital devices. These devices do not represent a risk and such a restriction would represent a dangerous expansion of the regulation of the PC industry.

### **Proposals for Part 15 Rule Changes**

Intel applauds the Commission's proposal to allow certification of Part 15 devices that are capable of operating on non-Part 15 frequencies. Intel believes the Commission is appropriately focusing on defining response and testing criteria; leaving the actual location detection mechanism up to manufacturers. Such a rule should be coupled with one stating that devices operating under the control of a master controller should be exempted from DFS or other requirements. This approach would be consistent with the U-NII proceeding, and allow for devices to be manufactured much more economically while not sacrificing interference protection.

### **Rural Markets and Unlicensed Devices**

Intel agrees that permitting unlicensed devices to operate at higher power levels in rural areas could help provide improved access to spectrum in those areas by permitting greater transmission range and coverage area, but believes the Commission should proceed cautiously.

As discussed in Intel's filing in ET Docket No. 03-201, the great success of the unlicensed allocation is the result of *de facto* control by the owner of the immediate physical area (business, campus, or home); the land owner regulates the deployment of unlicensed devices within his control.

The combination of low power limits and propagation characteristics in the unlicensed bands that limit the effective range of these devices has created a workable environment. The "tragedy of the commons" problems that might be expected to be created by contending co-equal unlicensed devices have been mitigated. In the case of Wi-Fi deployments, for example, the homeowner or the corporate or campus IT department controls the deployment of most of the contending devices. The property owner, having control of the operation of contending devices in the area of his control, has the incentive and ability to optimize the use of contending unlicensed devices.<sup>4</sup>

The Commission seeks comment on whether higher power operation should be permitted in all frequency bands under Sections 15.247 and 15.249 of the rules. Because devices are already ubiquitously deployed in these bands, an increase in power in the 900 MHz and 2.4 GHz bands would likely result in significantly more interference and result in suboptimal quality of service.

Higher power use at the 5.8 GHz deserves more study, but it is unclear if the proposed sensing method is feasible. The nexus of interference is the receiver. The Spectrum Policy Task Force report stated:

The environment in which the receiver operates should be considered; i.e., the total amount of undesired power – generated by other emitters and noise sources – that is present at the receiver. Thus, the Commission’s rules should specify a more accurate measure of interference that takes into account the cumulative summation of all the undesired RF energy available to be captured by a particular receiving antenna for delivery to the receiver.<sup>5</sup>

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The interference temperature measures the RF power available at the receiving antenna per unit bandwidth. Conceptually...interference temperature measurements would be taken at various receiver locations to estimate the real-time condition of the RF environment.<sup>6</sup>

The Commission’s proposal, however, relies on measurements made at the transmitter.

Assumptions about the environment at potential victim receivers based on measurements at the transmitter may not be appropriate. Accordingly, Intel believes the proposed change should not be made unless this concern is adequately addressed. Alternative methods should be considered. For example, geo-location could enable a device to determine if it is in a rural area. Perhaps, a combination of techniques should be required.<sup>7</sup>

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<sup>4</sup> See Comments of Intel Corporation in In the matter of Modification of Parts 2 and 15 of the Commission’s Rules for unlicensed devices and equipment approval. ET Docket No. 03-201

<sup>5</sup> SPTF @ 27

<sup>6</sup> SPTF @ 28

<sup>7</sup> By recognizing and codifying *de facto* local control, the Commission could enable longer range applications such as WISPs..See, e.g., Local Spectrum Sovereignty: An Inflection Point in Allocation; Mike Chartier; Proceedings of (continued....)

The Commission seeks comment on as to any requirements that should be relaxed or eliminated to foster cognitive radios. As stated in our filing in ET Docket No. 03-201, Intel believes that Section 15.247(h) should be eliminated.<sup>8</sup>

Finally, the Commission seeks comment on whether higher power operation should be permitted for devices operating under any other sections in Part 15. As laid out in pleadings filed “In the Matter of Additional Spectrum for Unlicensed Devices below 900 MHz and in the 3 GHz Band,” Intel believes vacant TV frequencies are well suited to longer range operation.

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the International Symposium on Advanced Radio Technologies; March 2 - 4, 2004  
<http://www.its.bldrdoc.gov/pub/ntia-rpt/04-409/index.html>

<sup>8</sup> See Comments of Intel Corporation in In the matter of Modification of Parts 2 and 15 of the Commission’s Rules for unlicensed devices and equipment approval. ET Docket No. 03-201 @ 8