

Before the  
**Federal Communications Commission**  
Washington DC 20554

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

**COMMENTS OF VANU, INC.**

Vanu, Inc. hereby files these comments in the above-captioned proceeding.<sup>1</sup>

**About Vanu, Inc.**

Vanu, Inc. was formed in 1998 to explore the feasibility of building software radios using object oriented computer languages running on general purpose processors. The extent to which Vanu, Inc. uses software to implement signal processing distinguishes us from other radio developers. In the nomenclature of the SDR Forum, Vanu, Inc. develops “software radios” as opposed to “software defined radios.” Pushing the software closer to the antenna permits our products much greater flexibility to adapt the nature of the signal processing performed by the radio.

**DISCUSSION**

**Secondary Markets (Notice paras. 48-50)**

Vanu commends the Commission’s foresight in seeking to enable the establishment of secondary markets. Vanu believes secondary markets will be a major contributor to ensuring efficient usage of spectrum through permitting market forces to govern how portions of the radio spectrum are used. We also believe that there are several one-time costs associated with

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<sup>1</sup> *Facilitating Opportunities for Flexible, Efficient and Reliable Spectrum Use Employing Cognitive Radio Technologies*, 18 FCC Rcd 26859 (2003) (Notice).

establishing these secondary markets. Finally, we believe that several market segments will arise within secondary markets as the result of spectrum availability, geography, propagation, and several other variables. We conclude that many of these market segments will evolve into independent markets in which economic terms and methods of transferring and reclaiming spectrum use rights may diverge from the models employed by other markets.

Nevertheless, the Commission could provide a very valuable service by publishing a model spectrum leasing agreement or, in the alternative, a list of the elements the Commission would expect to see addressed in typical spectrum leasing arrangements. Such an agreement or list of elements would allow (especially smaller) market participants to reduce or eliminate a substantial cost associated with regulatory uncertainty, and would lower the barrier to creation of secondary spectrum markets. Finally, we believe the Commission should explicitly note that any such agreement or list of elements is only one of a variety of acceptable forms, to avoid discouraging further experimentation by the markets.

#### **Access/Reversion Mechanisms (Notice paras. 56-61)**

We applaud the Commission's recognition that complexity of access/reversion mechanisms will be an important factor in the success of leasing arrangements. We believe that access/reversion mechanisms must not only be simple from an operational perspective, but must also be inexpensive. If, for example, an additional RF receive chain had to be added to a device to handle beacon monitoring, the cost would be prohibitive for most networks.

While there is a wide range of beacon methods that may be used to facilitate temporary spectrum leasing, we believe the Commission need only concern itself with a subset of those. In particular, the Commission should focus its attention on spectrum leasing arrangements and the mechanisms that effect such arrangements where the spectrum to be leased was not auctioned. In these cases, the public good the Commission originally intended to address by licensing the spectrum may not be adequately served by poor access/reversion mechanisms. As a result, close Commission oversight of access/reversion mechanisms is appropriate. In other cases, we believe the licensee should be able to protect its economic interests by whatever methods it deems

appropriate. The benefit of allowing the market to determine access/reversion mechanisms for part of the spectrum leasing market is that, over time, the efficacy of these mechanisms will improve, allowing other portions of the spectrum leasing market to benefit.

#### **Facilitating Interoperability Among Communication Systems (Notice para. 76)**

When applied to interoperability issues, software radio may offer practical solutions to first responders, homeland defense agencies, the military, and other radio users who experience communications compatibility problems. A software radio interoperability solution has the potential to support multiple radio standards on a common platform, enabling wireless communication between agencies at all levels of government. This platform could be software reconfigured to create real-time connections among any existing radios, regardless of the frequencies or standards they use. By implementing the standards in software, the device can also be upgraded as new standards and services come into use.

As an example, at the scene of an incident, a local policeman's 800 MHz analog signal could be received by a software radio system, then transmitted to federal officials operating in the VHF band using the Project-25 digital waveform. Because the system is software-based, it can be configured quickly for the standards and frequencies in use at the scene. The greatest benefit of this "virtual patch" is the lack of any requirement that users replace or modify their existing voice and data radios. It thus provides a feasible, easily adoptable solution.

The extent to which rule changes are necessary to take advantage of cross band, cross protocol repeating systems such as the virtual patch or other software defined radio technologies will depend in large part on public safety concepts of operations, especially in the context of mutual aid incident command. In this context, the Commission's rules should complement public safety concepts of operations relating to the allocation and control of spectrum resources.

#### **Submission of Source Code (Notice paras. 85-86)**

The Commission proposes to replace the current requirement for submission of radio software source code (for software that controls transmission frequency, power, or modulation)

with a less burdensome requirement to submit a description and flow diagram of the software. We strongly support this proposal for the reasons cited by the Commission.

### **Applicability of SDR Rules (Notice paras. 87-89)**

We believe that the primary objective of requiring declaration of an SDR as an SDR is to prevent the marketing and sale of a radio that can easily be changed in a manner that results in harmful interference. We believe mandatory applicability of SDR certification procedures or other measures to ensure security of radios is appropriate under certain circumstances as described below. We believe there may be other circumstances in which mandatory declaration is also appropriate to accomplish secondary objectives the Commission may seek with respect to SDRs.

We believe that mandatory declaration of an SDR device as an SDR device may be desirable when harmful interference may result from a foreseeable modification to the device's software by a third party.<sup>2</sup> This would clarify that any device with sufficient flexibility to cause harmful interference through alteration of its software must employ adequate counter measures to mitigate the risk of such alteration. Another approach the Commission could consider is to establish more wide ranging regulations relating to radio security not limited to radios that are arguably SDRs.

As noted above, we believe mandatory certification of an SDR via SDR procedures may also be appropriate, even though adequate security measures have been implemented, if the Commission seeks close supervision of security measures. If the Commission believes it is necessary and desirable to review security provisions, in order to ensure adequacy or to evaluate or promulgate industry standards, then it may be necessary to mandate use of the SDR

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<sup>2</sup> The phrase "foreseeable modification to its software by a third party" refers to modifications that are foreseeable in light of security provisions implemented by the party that obtained FCC certification of the device (presumably the system integrator or software developer, if those functions are fulfilled by different entities). A device that could have been easily modified in the absence of security measures implemented by the manufacturer would not necessarily be subject to SDR certification processes.

certification procedures. Similarly, if the Commission wishes to track security measures employed over time in order to maintain ongoing awareness of radio vulnerability, it may be more desirable to have SDRs go through certification processes than to rely on industry reporting.

**Pre-certification testing requirements for cognitive radios (Notice paras. 99-107)**

Cognitive radios represent a great opportunity to automate access to underutilized spectrum by building on the success of software defined radios and other flexible radio technologies. Cognitive radios also represent a new layer of complexity in testing radios for compliance. In considering rules to certify cognitive radios, we urge the Commission to distinguish flexible radio technologies (such as SDR) from systems that employ those flexible radio technologies to automate efficient use of spectrum (such as cognitive radios). The complexity of system level testing associated with cognitive radio technologies would impose a significant cost burden on SDR technologies, were they to be imposed unnecessarily.

SDR can bring significant savings through capital and operating expenditure efficiencies, even without employing any cognitive radio approaches. A regime of testing that assumed all SDRs would be employed as cognitive radios would add unnecessary expense to SDRs.

**CONCLUSION**

Vanu, Inc. asks the Commission to take the foregoing considerations into account in the course of developing rules in this proceeding.

Respectfully submitted,

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