



**Software Defined Radio (SDR) Forum Comments  
on  
The FCC Memorandum Opinion and Order (MO&O) and Further Notice of Proposed  
Rulemaking (NPRM) Adopted June 19, 2007**

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**Approved  
October 11, 2007**

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

In the Matter of	)	
	)	
Modification of Parts 2 and 15 of	)	
the Commission’s Rules for	)	ET Docket No. 03-201
unlicensed devices and equipment	)	
approval	)	
	)	

**Software Defined Radio (SDR) Forum Comments**

on

**The FCC Memorandum Opinion and Order (MO&O) and Further Notice of Proposed Rulemaking (NPRM) Adopted June 19, 2007**

The SDR Forum is a non-profit organization promoting the development and use of software and cognitive radio, and related technologies. The Forum has a strong interest in a global regulatory environment that facilitates the adoption of these technologies. Its members include radio manufacturers, network operators, systems integrators, universities and research institutes.

In this response, the SDR Forum offers general comments on issues related to spectrum etiquettes. It does not take a position on the particular cases which led to the Commission’s NPRM.

The SDR Forum considers spectrum etiquettes an important regulatory tool for maximizing the economic and social benefit of the electromagnetic spectrum. Trends in the wireless industry almost certainly point towards a much greater proliferation of wireless devices supporting a wider variety of data intensive applications than exist today. Some degree of spectrum sharing will be necessary to achieve this vision. Spectrum etiquettes offer a means to share spectrum resources in an efficient and fair manner.

Parties often will follow spectrum etiquettes voluntarily to achieve common objectives. For example, a spectrum licensee may desire to lease its spectrum to others when it is not utilizing it at all times and in all places over which the license allows, but for which interference is likely without some rules governing how the lessee accesses the spectrum.

In this case, both lessee and lessor may benefit from following a spectrum etiquette if it offers a way to avoid interference.

Still, in many cases, rules defining performance criteria for spectrum etiquettes may need promulgated in order for the benefits of spectrum etiquettes to be realized. Conditions under which this may be the case include:

- *Uncertain rights* – rights to spectrum are either unassigned or are not clearly defined in the spectral space in which the spectrum etiquette would apply.
- *Heavy or correlated use* – interference is likely in the absence of an etiquette or governing rules, either because the spectral space is used frequently by its users or because its users tend to use the spectrum at the same times or in the same areas.
- *Compliance with an etiquette is cheaper and more efficient than direct negotiations between interfering parties* – this will typically be the case when parties cannot easily identify when they are causing interference and mechanisms for communicating interference problems might not be fast enough.

The SDR Forum understands that spectrum etiquette concepts are in their infancy. Consequently, early etiquettes are likely to be simple ones as has been proposed in this proceeding. However, the SDR Forum requests that the commission not adopt overly narrow definitions of etiquette that might preclude more sophisticated etiquettes in the future. For example, one might imagine etiquettes that include out-of-band network communication, sharing of presence information, central arbiters of spectrum resource requests, and more. In particular, automatic modification of radio parameters should be permitted because this capability is likely required for a spectrum etiquette to produce the most efficient allocation of spectrum resources (see NPRM paragraph 25). Cognitive radio research is still expanding the envelope of possibilities for radios to automatically adapt to environmental conditions, including the behavior of other radios in their vicinity.

In particular, the Commission should be cognizant of the inherent inefficiency of spectrum etiquettes that do not account for the presence or behavior of other radio systems. For example, an etiquette that involves nothing more than a duty cycle ceiling is inherently inefficient when no other competing radio systems are present because the transmitting system could otherwise increase its capacity without causing any harm. While such simple etiquette restrictions might offer temporary relief to solve immediate interference problems, regulations should be flexible enough to allow interested parties to enhance simple etiquettes over time without lengthy administrative procedures. Without such flexibility, an etiquette would “limit design flexibility and stifle unlicensed product innovation,” a topic on which the Commission sought comment in paragraph 21 of its NPRM. Indeed, human social etiquettes typically evolve over time to meet the needs of their adherents without requiring government action.

As the Commission is well aware, radios systems are increasingly being integrated with computing systems. In many cases, radio components themselves are defined in software

are becoming part of the computing infrastructure. Key advantages of this evolution are that radios can run multiple communications protocols or “waveforms” on a single platform and that these components are easily upgradeable. Fortunately, these strengths also apply to spectrum etiquette – i.e., if software defined, a system may be able to follow multiple etiquettes and easily modify them over time. This capability is an important reason why the Commission should not promulgate etiquettes that would be administratively fixed in such a way as to preclude the benefits of ongoing enhancements.

A potential approach for the Commission to consider is to establish performance criteria for etiquette rather than specify the etiquettes themselves. For example, etiquette A might be deemed superior to etiquette B if it enables transmission of an equivalent amount of data with lower mean transmission power, in less time, or with less bandwidth, thereby reducing the likelihood of harmful interference. If such performance criteria were established, then it may be possible for entities to revise etiquettes upon evidence of performance improvements rather than require additional rulemaking.

The Commission should also encourage testing and simulation of etiquettes to facilitate innovation that would improve spectrum efficiency and to assure that etiquette performance objectives are being met. The Commission previously sought comment on establishing a spectrum sharing innovation test bed (ET Docket No. 06-89), which the SDR Forum has strongly endorsed. For example, a test bed would allow industry to evaluate spectrum etiquette techniques before they are used in the field. Industry and academia are prepared to conduct such evaluations soon. The SDR Forum is aware of at least one major US research university that currently is building an infrastructure to assess cognitive radio innovations. The test bed could be useful in exploring several of the issues the Commission raised in this proceeding. For example, in paragraphs 26-28 of the NPRM, the Commission seeks comment on whether spectrum etiquettes should be required for frequency hopping spread spectrum transmitters, whether such a ruling would place digitally modulated transmitters at an operational disadvantage, and whether rules should be extended to the 2.4 GHz and 5.8 GHz bands. The SDR Forum contends that there is not enough evidence to support regulatory conclusions on these issues, but that further experimentation in a test bed could help provide such evidence.

The SDR Forum appreciates the opportunity to provide its views on spectrum etiquettes. We consider spectrum etiquettes an important regulatory tool for maximizing the economic and social benefit of the electromagnetic spectrum. We request that the commission not adopt overly narrow definitions of etiquette that might preclude more sophisticated etiquettes in the future. The SDR Forum promotes the development and use of SDR and this capability is an important reason why the Commission should not promulgate etiquettes that would be administratively fixed in such a way as to preclude the benefits of ongoing enhancements. Further, the SDR Forum recommends the FCC move forward with the Spectrum Sharing test beds where cognitive radio techniques, including spectrum etiquettes, can be tested in real environmental conditions enabling more rapid innovation that will enable better spectrum efficiency. The Software Defined forum stands ready to support the FCC in deriving the benefits of spectrum etiquettes and cognitive radio technology.

Respectfully submitted,

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