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

In the Matter of	)	
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Inquiry Regarding Software Defined Radios	)	ET Docket No. 00-47
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NOTICE OF INQUIRY

Adopted: March 17, 2000 **Released: March 21, 2000**

By the Commission: Commissioner Ness issuing separate statement.

Comment date: [75 days from publication in Federal Register]
Reply comment date: [105 days from publication in Federal Register]

INTRODUCTION

1. The Commission is initiating this inquiry to obtain comments from the public on a variety of issues related to software defined radios. Software defined radios could offer tremendous advantages to consumers over currently available wireless equipment. These benefits include lower cost, a greater variety of features, and the ability to adapt to multiple communication standards. They could also offer advantages to manufacturers, such as increased economies of scale in production, increased worldwide market opportunities, and a decrease in the number of devices that must be maintained in inventory. Software defined radios could expand access to broadband communications for all persons and increase competition among telecommunication service providers. Through this inquiry, we seek input to help us evaluate the current state of software defined radio technology, and to determine whether changes to the Commission's rules are necessary to facilitate the deployment of this technology. Upon review of the responses to this inquiry, we will determine whether to propose any changes to the rules.

BACKGROUND

2. The Commission has noted developments in the area of software defined radio with interest because this technology could have far reaching implications for the way the Commission allocates and licenses spectrum and authorized radio equipment. Software defined radios have the potential to vastly improve the efficiency of spectrum usage at a time when the demand for wireless communications services is rapidly increasing. They also have the potential to overcome some of the incompatibilities that exist between various communications services both domestically and worldwide.

3. In a software defined radio, functions that were formerly carried out solely in hardware, such as the generation of the transmitted radio signal and the tuning and detection of the received radio signal, are performed by software residing in high-speed digital signal processors. The fact that these functions are carried out in software means that the radio can be programmed to transmit and receive over a wide range of frequencies and to emulate virtually any different desired transmission format. The operating parameters of such a radio can be readily altered in the field by a simple software change. For example, a software defined radio could have the ability to transmit and receive in the various cellular and PCS frequency bands and transmission standards used in the United States and around the world.

4. Software defined radio technology was originally developed for the United States military. The "SPEAKeasy" project was undertaken by the Department of Defense with the goal of developing a multi-band, multi-mode software programmable radio that could allow different branches of the military to communicate in times of war. The first demonstration of a SPEAKeasy software programmable radio came in 1995, and a smaller and more reliable version was developed for evaluation by the armed forces in 1997.[1] The successful demonstration of the SPEAKeasy radio led a group of more than 50 domestic and foreign companies to form the Modular Multifunction Information Transfer System (MMITS) Forum, later renamed the Software Defined Radio (SDR) Forum.[2] The goals of the SDR Forum are to accelerate the development, deployment and use of software defined radios, and to work toward the adoption of an open architecture for the equipment. This open architecture would allow different manufacturers to make software for radio equipment, just as different manufacturers make software for personal computers.

5. The FCC Technological Advisory Council (TAC) has also been studying issues related to software defined radio. The Commission established the TAC in 1998 to provide technical advice and to make recommendations on the issues and questions presented to it by the Commission.[3] In May 1999, the TAC was requested to assess and report to the Commission the current state of the art for software defined radios, cognitive radios, and similar devices and, to the extent possible, predict future developments for these technologies.[4] The TAC was also requested to suggest ways that the availability of such devices might affect the Commission's traditional approaches to spectrum management, as well as ways the agency could facilitate experimentation and commercial deployment of such devices.[5]

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[1] *See 'SPEAKeasy' Reduces Equipment / Logistics Requirements – Increases Interoperability*, available at http://www.afrl.af.mil/successstories/emerg_tech/.

[2] The SDR Forum's Internet address is www.sdrforum.org.

[3] *See Public Notice, FCC Requests Nominations for Membership on the Technological Advisory Council*, released December 1, 1998, available at www.fcc.gov/Bureaus/Engineering_Technology/Public_Notices/1998/pnet8024.html. The TAC consists of 25 individuals from industry and academia, plus a designated Federal Officer.

[4] *See Official Requests from the Federal Communications Commission to the Technological Advisory Council*, dated May 26, 1999, available at www.fcc.gov/oet/tac/requests.pdf.

[5] *See* www.fcc.gov/oet/tac/focusgroups.html for further information about the work of the TAC on software defined radio, including links to papers and presentations submitted to the TAC.

6. While the TAC is continuing their work in the area of software defined radios, we note that there are other parties that also have an interest in software defined radios. We believe it is important for the Commission to obtain input on the subject from all interested parties to ensure a widespread representation of viewpoints. We are therefore issuing this notice of inquiry seeking comment from the public on a number of issues related to software defined radios.

DISCUSSION

7. The introduction of software defined radios could have wide ranging implications for radio technology and our regulatory policies. Software defined radios have the potential to change the way users can communicate across traditional services and to promote efficient use of spectrum. We believe that software defined radios could significantly affect a number of Commission functions, including spectrum allocation, spectrum assignment, and equipment approval. The purpose of this inquiry is to gather information on the state of software defined radio technology, interoperability issues, spectrum efficiency issues, equipment authorization processes, and other relevant issues.

8. State of software defined radio technology. With the advent of moderate cost microprocessor and phase locked loop frequency synthesizer technologies in the past two decades, many mobile radio systems now contain such technology for frequency control and power control. These radios have firmware[6] installed at the factory that controls these functions, but it is not readily replaceable by the user. Thus these systems are a precursor to software defined radios and share some of their characteristics. By five years ago, the state of digital filter technology advanced to the point that a commercially available high performance high frequency (HF) band (1-30 MHz) receiver using digital filters for almost all its filtering and all of its demodulation functions became available. Extending this technology to higher frequencies, larger bandwidths, transmitter functionality, and lower cost systems also appears to be an evolutionary step.

9. The SPEAKeasy project showed that a software defined radio is feasible. Nevertheless, there are many technological hurdles that must be overcome before software defined radios can be widely deployable. For example, there are limitations on the speed and dynamic range of current analog to digital converters, physical limitations on the frequency range over which an antenna can operate, and speed and cost constraints on digital signal processing circuitry. In addition, standards that would allow interoperability between hardware and software produced by different manufacturers are still under development. Therefore, in order to assist us in understanding the current state of software defined radio technology, we seek comment in the following areas.

- What features in a radio are apt to be controlled by software? For example, could the operating frequency, output power, and modulation format be software controlled?

[6] Firmware is software installed in a device, which is typically stored in a read only memory (ROM) or a programmable read only memory (PROM).

- What are the specific limitations of current software defined radio technology? What are the cost implications?

- What capabilities could software defined radios have that are not found in current radio technology?

- When could software defined radios be deployed commercially, and for what services or purposes?

- What work is being done on software defined radios internationally, and are there any steps the Commission should take to encourage this work?

10. Interoperability. The Commission's rules are divided up into a number of parts that contain the requirements for various licensed radio services.[7] The rules for each service specify the operating frequencies and other technical requirements for radio equipment in that particular service. In some cases there is overlap between these frequencies and other requirements, so equipment can be developed to operate in more than one service. However, in most cases, equipment designed to operate in one service can not communicate with equipment designed to operate in another service, and in some cases can not even communicate with other equipment in the same service due to lack of common transmission standards or operating frequencies.

11. The inability of users to communicate due to non-uniform standards within services or between services can be a serious problem. For example, different public safety agencies responding to an emergency may be unable to communicate with each other due the inability to operate on each other's frequencies. The lack of common transmission standards can also cause problems in the commercial wireless services. For example, a handset designed to operate on a particular PCS system may not operate on another PCS system that uses different technology. Further, in the event the operator of a wireless system wants to change to a more efficient transmission system, the operator must replace all of the base stations transmitters and mobile units in the field, which can be a cumbersome and expensive process. The ability of software defined radios to change frequency and transmission standards would appear to be a way to overcome the lack of interoperability between different wireless systems. We are therefore asking for comment on the following questions.

- To what extent can software defined radios improve interoperability between different public safety agencies?

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[7] *See* 47 C.F.R. Part 5 - *Experimental radio service*, Part 20 - *Commercial mobile radio services*, Part 21 - *Domestic public fixed radio services*, Part 22 - *Public mobile services*, Part 23 - *International fixed public radiocommunication services*, Part 24 - *Personal communications services*, Part 25 - *Satellite communications*, Part 26 - *General wireless communication service*, Part 27 - *Wireless communications service*, Part 73 - *Radio broadcast services*, Part 74 - *Experimental radio, auxiliary, special broadcast and other program distributional services*, Part 78 - *Cable television relay service*, Part 80 - *Stations in the maritime services*, Part 87 - *Aviation services*, Part 90 - *Private land mobile radio services*, Part 95 - *Personal radio services*, Part 97 - *Amateur radio service*, Part 100 - *Direct broadcast satellite service*, and Part 101 - *Fixed microwave services*.

- To what extent can software defined radios improve interoperability between equipment and services using differing transmission standards?

- To what extent would software defined radios move toward uniformity in standards within or across bands?

- To what extent can software defined radios be used to facilitate transitions from one technical standard to another, such as the transition mandated by the land mobile "refarming" proceeding?[8]

- What particular means could be employed by software defined radios to facilitate interoperability?

12. Improving spectrum efficiency and spectrum sharing. The Commission allocates bands of spectrum to the various radio services in the rules, and maintains a table of these frequency allocations.[9] In order to operate within a service, a license issued by the Commission is required.[10] The rules for each service specify eligibility requirements for obtaining a license, and the technical requirements for operation, including location, power and frequency. Licenses may be issued through an application process, or through a competitive bidding process.

13. In some cases, the service rules contain channelization requirements within the allocated bands, such as for the cellular service under Part 22 or the private land mobile services under Part 90.[11] More recently, the Commission has declined to specify the channelization within an allocated band of spectrum and has simply specified the minimal technical requirements necessary to avoid interference between licensees. The licensed users are then permitted to determine the most efficient method of utilizing the spectrum. This approach is used in a number of different services, such as the Personal Communication Service under Part 24 and the Wireless Communication Service under Part 27.[12]

14. Because of the ability to be easily reprogrammed, a software defined radio would not be limited to operation within a single fixed frequency band or on a limited set of pre-programmed channels. It could have the capability of operating on any frequency within the limits of its design, and could operate on channels of varying widths with varying modulation formats. Further, it should be possible to design the equipment with some "intelligence," which would let it monitor the spectrum to detect usage by other parties and transmit on open

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[8] In the land mobile "refarming" proceeding, the Commission mandated that the channel spacing in the private land mobile bands be reduced from 25 kHz to 12.5 kHz, then to 6.25 kHz. *See* Replacement of Part 90 by Part 88 to Revise the Private Land Mobile Radio Services and Modify the Policies Governing Them and Examination of Exclusivity and Frequency Assignment Policies of the Private Land Mobile Radio Services, PR Docket 92-235, *Report and Order and Further Notice of Proposed Rule Making*, 10 FCC Rcd 10076 (1995).

[9] *See* 47 C.F.R. § 2.106.

[10] *See* 47 U.S.C. § 301. Certain services are "licensed by rule" and are exempt from the general licensing requirement, but operation in these services must still meet the applicable eligibility and technical requirements. *See* 47 U.S.C. § 307(e).

[11] *See* 47 C.F.R. §§ 22.905 and 90.20.

[12] *See* 47 C.F.R. §§ 24.129, 24.249 and 27.5.

frequencies. These capabilities could open up new possibilities in the area of spectrum allocation and licensing. For example, instead of relying upon a user to find an open frequency in a congested area of spectrum before transmitting, a radio could monitor a wide range of spectrum and find a "hole" with sufficient bandwidth where the user could operate.

15. The use of software defined radios may also enable new types of spectrum sharing that are currently precluded by today's conventional equipment. For example, our PCS rules permit wide flexibility in terms of the services offered and technology employed in the PCS spectrum.[13] In the event that a PCS licensee has spectrum available in excess of its immediate needs, it could lease that spectrum on a short-term basis to a third party. Software defined radio could facilitate such sharing. A third party could, for example, acquire from a manufacturer software defined radio equipment capable of being configured to offer different services in the various frequency ranges. Having negotiated for spectrum use, it would be in a position to rent a package of equipment and "airtime" to end users needing communications capacity on a short-term basis.[14] It would load the appropriate software to properly configure the equipment at the time the end user enters into the rental agreement. Another alternative would be for the end user to contract directly with the licensee for the necessary spectrum and then rent the properly configured software defined radio equipment. With today's technology, such short-term sharing is difficult or impossible to accomplish due to the difficulties associated with quickly configuring radios for different applications in novel spectrum configurations. As a result, we believe that significant public benefits might flow from software defined radio technology. The public benefits include increased communications capacity for end users and better utilization of the spectrum resource. We seek comments regarding these potential benefits and what regulatory steps we might take to permit the use of software defined radios to enable such sharing arrangements.

16. In a slightly different sharing scenario, the licensee of a block of spectrum that is not fully utilized might negotiate with a second party to permit the use of a portion of the spectrum at times when it is available. The licensee could use a beacon system to ensure that it has primary access to the spectrum. Under such a system the primary user transmits a beacon signal when the band is available for use by the second user. The second user's transmitters must check for the presence of the beacon signal continuously and must immediately cease use of the block if the beacon signal disappears. These checking/cessation capabilities within software defined radios guarantee the primary user quick reliable access to the spectrum when needed. The shared spectrum is thus "interruptible". While interruptible spectrum is not appropriate for some applications, it may be appropriate for other applications, particularly those in which users are willing to pay less for less reliable service and in data applications where alternative transmission exists.

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13 *See* 47 C.F.R. § 24.3 (allowing PCS licensees to provide any mobile communications service and fixed service on a co-primary basis but prohibiting Broadcasting as defined by the Communications Act); *see also* 47 C.F.R. § 24.229-24.238 (minimal technical standards to prevent interference to other services with no requirements for channelization, bandwidth or transmission format).

14 The spectrum may include segments from multiple licensees who have agreed to temporary use by another party.

17. Functions such as the ones described in the previous paragraphs have the potential to allow spectrum to be utilized more efficiently. We are therefore seeking comment on the following areas related to frequency allocation and licensing.

- To what extent could software defined radios improve the efficiency of spectrum usage?
- What particular functions related to spectrum usage could a software defined radio perform? Could it locate free spectrum, dynamically allocate bandwidth, and enable better sharing of the spectrum?
- How specifically could it carry out these functions?
- What are the benefits of the spectrum sharing arrangements described above, and what steps might we take to permit the use of software defined radios to enable such sharing arrangements?
- What changes may be appropriate for the way the Commission currently allocates spectrum?
- If changes are warranted, how could we make the transition from the current allocation and licensing model to a new model?

18. Equipment approval process. Section 302 of the Communications Act of 1934, as amended, authorizes the Commission to make reasonable regulations, consistent with the public interest, governing the interference potential of equipment that emits radio frequency energy.[15] The Commission carries out its responsibilities under this section by establishing technical regulations for transmitters and other equipment to minimize their potential for causing interference to radio services, and by administering an authorization program to ensure that equipment reaching the market complies with the technical requirements. The authorization program requires that equipment be tested either by the manufacturer or at a private test laboratory to ensure that it complies with the technical requirements. The majority of radio transmitters require the submission of an application that must be reviewed and approved before the equipment can be marketed,[16] although certain transmitters may be authorized through a manufacturer's self-approval process.[17]

19. A transmitter is approved to a specific set of technical parameters, including the operating frequencies, output power, and types of radio frequency emissions. If a manufacturer changes these parameters after a piece of equipment has been authorized, the FCC issues a new

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[15] *See* 47 U.S.C. § 302(a).

[16] The Commission recently made changes to Part 2 of the rules that will allow designated private organizations, called Telecommunication Certification Bodies (TCBs), to approve equipment in the same manner as the Commission. *See Report and Order* in GEN Docket 98-68, 13 FCC Rcd 24687 (1999). As of this date, no TCBs have yet been designated to approve equipment.

[17] Certain types of transmitters operating under Parts 73, 74, 78, 80, 87, 90 and 101 of the rules may be authorized under the verification procedure. *See* 47 C.F.R. §§ 73.1660(a), 74.655(f), 78.107(a), 80.1103(a), 87.145(c)(4), 90.203(l) and 101.139(a).

approval before the unit may be marketed with the changes.[18] By design, the operating parameters of a software defined radio can be readily changed in the field by altering its software. Such a change could violate the terms of the transmitter's equipment authorization by causing it to operate in modes for which it has not been approved. Also, our rules do not allow parties other than the grantee of the equipment authorization to make modifications to approved equipment without obtaining a new approval.[19] Even if a new approval were obtained by the original grantee, the rules require the modified transmitter to be labeled with a new FCC identification number,[20] which would be impractical for software modification of equipment that is already in the field. We therefore seek comments on the following issues related to the authorization of software defined radio transmitters.

- Should we approve the radio hardware, the software or the combination of them?
- Are the currently required measurements in Part 2 of the rules appropriate for software defined radios?[21]
- How should software defined radio equipment be tested for compliance, including compliance with SAR requirements?[22] What type of approval process and labeling would be appropriate?
- Should we regulate who changes the software and the manner in which it is done? If so, should the Commission maintain records of such modifications?
- What are the various means that may be used to download new software? We anticipate, for example, that software could be downloaded by methods such as direct connection to a programming device or over the airwaves. To what extent will the software interfaces be standardized?
- Should we require anti-tampering or other security features? How would such security features work? Could equipment be designed to prevent it from transmitting in certain designated frequency bands, such as those allocated exclusively for government use, as a safeguard against causing interference?
- Do we need to adopt additional requirements for software defined radios to ensure the privacy of users' communications?

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18 *See* 47 C.F.R. § 2.1043(a).

19 *See* 47 C.F.R. § 2.1043(b)(3).

20 *See* 47 C.F.R. § 2.925.

21 Part 2 of the rules requires the following measurements on transmitters used in licensed services: RF power, modulation characteristics, occupied bandwidth, spurious emissions at antenna terminals, field strength of spurious emissions and frequency stability. *See* 47 C.F.R. §§ 2.1046 through 2.1055.

22 For the purpose of safety, certain transmitters designed to operate within 20 cm of the user are subject to limits on the specific absorption rate (SAR) of radiofrequency energy by the body. *See* 47 C.F.R. § 2.1093.

20. One possible scenario for an approval process for software defined radios could be as follows. The software could be tested and approved to ensure that the transmitter meets the applicable technical requirements under all operating conditions. In order to ensure that untested and unapproved software could not be loaded, such transmitters would have an authentication system that checks the software for an authentication code added to it by the FCC or a Telecommunications Certification Body (TCB). The software itself would be submitted for approval in a process similar to today's application process except that a copy of the object code would be supplied in machine-readable form. Upon approving the software application, which would involve a test of the hardware and software together similar to today's tests, the FCC or TCB would compute the authentication code for the submitted source code and send it to the applicant. The authentication system would be a two key system in which the key needed to compute the authentication code would be known to only the FCC or TCB, and the key needed to check in a transmitter object code which is being loaded would be publicly available.[23]

21. In an analogy to the current requirement for labeling a transmitter[24], there may be a need for a method to allow users to determine whether the desired operating software is currently loaded in a transmitter, and to allow Commission enforcement personnel to verify that the software has been approved. To meet this need, the transmitter could display information about the software installed by a means such as a liquid crystal display (LCD) screen in response to an input from a keypad. The identification information about the software installed in the radio could include such information as the technical operating parameters, the source of the software, and the name of the body that approved it. The user manual and the authorization application would describe how to access this information. Since such radios are expected to have displays for user information and input mechanisms for the user in normal use, we do not think this requirement would be burdensome. We seek comments on the following questions about this possible approval method.

- Is there a need for such an approval system, and is it feasible and practical?
- What type of authentication system should be used? Should there be one system or alternative systems? Who should have responsibility for generating the authentication codes: the FCC, TCBs, equipment manufacturers, or some other party?
- In the case of transmitters subject to verification how should authentication of software be handled? For example, could an "authentication only" service be offered in which the FCC or TCB computes the authentication code for the software after all elements of compliance with the FCC rules are verified by the manufacturer?

[23] For further information on software authentication, see N. Doraswamy and D. Harris, IPSEC: The New Security Standard for the Internet, Intranets, and Virtual Private Networks, Prentice Hall, 1999, p. 12-17 and Computer Science and Telecommunications Board, National Research Council, Trust in Cyberspace, National Academy Press, 1999, p. 122-126

[24] *See* 47 C.F.R. § 2.925.

- How should simple changes to software be handled that do not affect the operating parameters of the equipment but require the computation of a new authentication code?[25] Could an "authentication only" service be offered for them?

- Is there a need for a method to display information about the software loaded in a transmitter? If so, what method should be used and what information should be displayed?

22. Other matters. The questions raised in this notice are intended to solicit information to assist the Commission in deciding whether to propose rule changes as a result of the developing software defined radio technology. We realize that these questions do not necessarily encompass all of the issues raised by this technology. For example, commenters may want to address whether software defined radio technology could help parties comply with Sections 255 and 251(a) of the Communications Act. These sections require manufacturers of telecommunications equipment and providers of telecommunications services to ensure that such equipment and services are accessible to persons with disabilities, if readily achievable.[26] Commenters may also wish to address how we would enforce any new rules for software defined radios. Accordingly, comments are invited on any other matters or issues that may be pertinent to software defined radios.

PROCEDURAL MATTERS

23. This is an exempt notice and comment rule making proceeding. *Ex parte* presentations are permitted, except during any Sunshine Agenda period. *See generally* 47 C.F.R. §§ 1.1200(a), 1.1203, and 1.1204(b).

24. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, interested parties may file comments on before **[75 days after publication in the Federal Register]**, and reply comments on or before **[105 days after publication in the Federal Register]**. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies. *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 Fed. Reg. 24,121 (1998).

25. Comments filed through the ECFS can be sent as an electronic file via the Internet at <http://www.fcc.gov/e-file/ecfs.html>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and

[25] Under the current rules, changes to an approved device that do not affect the radiofrequency emissions are considered Class I permissive changes. No filing with the Commission or a TCB is required for a Class I permissive change. *See* 47 C.F.R. § 2.1043(b).

[26] *See* 47 U.S.C. §§ 255 and 251(a)(2).

should include the following words in the body of the message, "get form <your e-mail address>." A sample form and directions will be sent in reply.

26. Parties who choose to file by paper must file an original and four copies of each filing. If more than one docket or rulemaking number appear in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number. All filings must be sent to the Commission's Secretary, Magalie Roman Salas, Office of the Secretary, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Room TW-A325, Washington, D.C. 20554.

27. Parties who choose to file by paper should also submit their comments on diskette. These diskettes should be submitted to: Hugh L. Van Tuyl, Office of Engineering and Technology, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Room 7-A133, Washington, D.C. 20554. Such a submission should be on a 3.5 inch diskette formatted in an IBM compatible format using Word for Windows or compatible software. The diskette should be accompanied by a cover letter and should be submitted in "read only" mode. The diskette should be clearly labeled with the commenter's name, proceeding (including the lead docket number, in this case ET Docket No. 00-47, type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase "Disk Copy - Not an Original." Each diskette should contain only one party's pleadings, preferably in a single electronic file. In addition, commenters must send diskette copies to the Commission's copy contractor, International Transcription Service, Inc., 1231 20th Street, N.W., Washington, D.C. 20037.

28. Comments and reply comments will be available for public inspection during regular business hours in the Reference Information Center (Room CY-A257) of the Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Washington, D.C. 20554. Copies of comments and reply comments are available through the Commission's duplicating contractor: International Transcription Service, Inc. (ITS, Inc.), 1231 20th Street, N.W., Washington, D.C. 20036, (202) 857-3800, TTY (202) 293-8810.

29. Alternative formats (computer diskette, large print, audio cassette and Braille) are available to persons with disabilities by contacting the Consumer Information Bureau, Consumer Education Office at (202) 418-2514, TTY (202) 418-2555, or at fccinfo@fcc.gov. The *Notice* can also be downloaded at: www.fcc.gov/dtf/.

30. IT IS ORDERED, that pursuant to Sections 4(i), 301, 302, 303(e), 303(f), 303(r), 307 and 332(b) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 301, 302, 303(e), 303(f), 303(r), 307 and 332(b), this Notice Inquiry is hereby ADOPTED.

31. For further information regarding this Notice of Inquiry, contact Mr. Hugh L. Van Tuyl, Office of Engineering and Technology, (202) 418-7506.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas
Secretary

Separate Statement of Commissioner Susan Ness

Re: Inquiry Regarding Software Defined Radios

I am bullish about the prospect of "software defined radio" (SDR), a new generation of technology that potentially will allow communications equipment to adapt to multiple standards and add service features without changes to the equipment's hardware. The Notice of Inquiry we release today is both a culmination of efforts and the beginning of a new initiative. While work still lies ahead, SDR holds the potential to enhance our participation in the global economy, to access new services, and to utilize the spectrum more efficiently.

The Notice is the outgrowth of efforts by the Department of Defense (DOD), members of the SDR Forum, and the FCC's Technical Advisory Council (TAC). DOD and members of the SDR Forum have pioneered the first generation of SDR, seeking to generate equipment that can be programmed to transmit and receive on any frequency within a wide range using a variety of transmission formats. The FCC has held several forums on new technologies and spectrum use, at which the potential benefits of SDR technology have been demonstrated. The TAC has reviewed SDR technology over the past year, studying the ways in which this technology may assist us in managing our precious resource – spectrum. This Notice is the result of such study. Hopefully, it will launch us in the direction of new products that better serve consumers; these products can be governed by streamlined rules that place the products in the marketplace more rapidly.

As a consumer, I am excited about SDR because it has the potential to add new meaning to the words "anywhere, anytime." As envisioned, SDR devices can be adapted to work anywhere on the planet through software changes or upgrades that can be installed or downloaded from remote locations. Such devices also could download new service applications as they are developed and made available.

As a spectrum manager, I am excited about SDR because it augments the tools we have to more efficiently manage spectrum. Today, we struggle to squeeze multiple services into spectrum, or to mandate specific standards to permit communications devices to work seamlessly. With SDR, the software could make such decisions, not the FCC. The availability of such software also might make it easier for different users to share crowded spectrum. Of course, protection of other spectrum licensees from interference resulting from SDR devices is paramount.

Given the promise of SDR, it is my hope that industry participants will help us address the complex issues raised in the Notice, so that we can move quickly to make any necessary changes in our rules. I am particularly interested in ways that we might revamp or streamline our equipment approval process to accommodate SDR. Any rules that would enable new and innovative products to reach the marketplace more quickly without compromising safety and interference protection for existing services would most certainly serve the public interest.