

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

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In the Matter of)
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Inquiry Regarding Software Defined Radios)
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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

ET Docket No. 00-47

REPLY COMMENTS OF THE SDR FORUM

The Software Defined Radio Forum ("SDR Forum") hereby submits these Reply Comments in the above-captioned proceeding. In the first round of comments, commercial wireless manufacturers and service providers demonstrated their enthusiasm for SDR technology. The SDR Forum joins the vast majority of commenters in concluding that the Commission should generally monitor SDR technology as it is shaped by industry demands and technological breakthroughs, without significant modification of the Commission's Rules in the meantime.¹ On the other hand, the SDR Forum also looks forward to the expeditious release of a Notice of Proposed Rulemaking in the one area where a revision to the Commission's Rules is currently warranted: amendment of the Commission's labeling requirements for transmitters to account for software-defined radios that are modified in the field, making traditional re-labeling requirements impractical.

I. State of SDR Technology

Widespread agreement exists in the wireless industry that SDR technology is an important innovation that will ultimately enable many powerful new applications and

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services for consumers.² SDR is, of course, not a single technological breakthrough. It is a collection of implementation technologies that enable greater flexibility in wireless products and services by creating the ability to reprogram a given radio function after the point of manufacture.³ The long-term benefits of these technologies include lower development costs, greater manufacturing efficiency, reduced time to market, and lower consumer costs.⁴

As many commenters noted, wireless equipment manufacturers are already incorporating SDR into their products, and SDR has been in use in wireless base stations since at least 1997.⁵ SDR is used today to reduce the number of product platforms that a manufacturer must develop and support. Equipment manufacturers will eventually converge on common hardware platforms in order to reduce product development, manufacturing, and support costs, with the result that SDR-based platforms will emerge as the dominant design, first in base stations, then in terminals, and finally in networks. SDR will also enable new, software-based revenue sources.⁶

Equipment manufacturers have already committed significant resources to support research and innovation in the area of SDR, and have been encouraged by the progress made to date.⁷ As the remaining barriers to the full implementation of SDR are overcome, different manufacturers will pursue different SDR implementations. In the process, the division between hardware and software will be constantly evolving, meaning that it is extremely important for the Commission to avoid prematurely setting

¹ See Comments of Lucent Technologies, Inc. at 1.

² See Comments of Motorola at 3-4.

³ See Comments of Ericsson, Inc. at 2.

⁴ See Comments of Harris Corp. at 2-3.

⁵ See AirNet Comments at 7.

⁶ See Comments of Vanu, Inc. at 1-2.

⁷ See AirNet Comments at 2-4.

standards or rules that freeze SDR in its current state of development and unnecessarily stifle commercial innovation.⁸

II. Interoperability

The SDR Forum remains convinced that SDR technology will play an important role in improving interoperability between public-safety agencies,⁹ and among public-safety agencies and amateur stations assisting in disaster operations.¹⁰ As NTIA pointed out, already-realized advances in certain key SDR-enabling technologies will allow SDR to play an increasing role in such interoperability, particularly as the costs of SDR implementation decline.¹¹ Additionally, those commenters who addressed SDR's potential relevance to refarming transitions were unanimous in concluding that SDR is likely to significantly reduce the cost and delay associated with such transitions.¹²

III. Spectrum Utilization and Spectrum Sharing

Commenters expressed widely varying opinions of SDR's short- and long-term potential to increase the efficiency of spectrum utilization. The SDR Forum agrees with the major commercial wireless service providers, each of which concluded that SDR is not a cure-all for the spectrum shortage and will not alone improve either spectral efficiency (defined as improving the b/s/Hz rate on a single channel) or spectrum efficiency (defined as the ability to make better use of unused spectrum within a band, across bands, or across a geographic area).¹³

⁸ See Comments of Nokia, Inc. at 2.

⁹ See AirNet Comments at 8.

¹⁰ See Comments of National Association for Amateur Radio at 3.

¹¹ See Comments of the National Telecommunications and Information Administration at 14.

¹² See AirNet Comments at 9; Comments of BellSouth, Attachment B at 11; Comments of the Industrial Telecommunications Association, Inc. at 3; Comments of Motorola at 24; Comments of National Association for Amateur Radio at 6.

¹³ See Comments of Motorola at 27-29.

In short, SDR will not allow service providers fully to satisfy the booming demand for spectrum within current allocations. In conjunction with sound spectrum policies, however, SDR can help to alleviate the spectrum “crunch” expected to arise due to rapid growth in the demand for mobile Internet access. As an implementation technique, for example, SDR makes it easier and more cost effective to utilize new methods of improving spectral efficiency.¹⁴ In the long run, the SDR Forum agrees with AirNet that SDR technology holds the promise to increase spectrum efficiency by means such as adaptive spectrum-sharing.¹⁵ But the commercial and technological viability of such methods is sufficiently remote that the Commission should not act on them at this time.

IV. Equipment Approval Process

The SDR Forum is pleased to note that most commenters are in general agreement that the outlook for SDR technology does not call for drastic rule changes in the near future.¹⁶ However, one minor change is warranted. One of the primary near-term benefits of SDR is expected to be the flexibility to modify the transmission characteristics of already-deployed equipment, thereby extending product lives and saving on upgrade costs.¹⁷ As the Commission has already recognized, SDR cannot reach its full potential in this regard under the current Rules, which require individual relabeling that will be impractical for equipment that is already in the field.¹⁸

¹⁴ See Comments SBC Wireless Inc. at 14.

¹⁵ See AirNet Comments at 10.

¹⁶ See Comments of BellSouth at 2.

¹⁷ See Comments of the SDR Forum at 11-12.

¹⁸ See *In re Inquiry Regarding Software Defined Radio, Notice of Inquiry*, ET Docket No. 00-47, rel. Mar. 21, 2000 (“SDR NOI”), at ¶ 19.

Thus, the SDR Forum proposes the relatively minor changes to the Commission's rules on equipment modification and re-labeling that are detailed in Exhibit A. The SDR Forum agrees with the Commission's suggestion that all information currently required to be displayed on an FCC label could easily be made available on most SDR equipment in a user display screen, examples of which include the liquid crystal display (LCD) and light emitting diode (LED) screens found on most, if not all, of today's mobile personal communication devices. Such a display mechanism would allow for easy verification of authentication without requiring expensive and impractical relabeling of equipment.¹⁹

Otherwise, the near- and mid-term anticipated benefits of SDR technology can be attained without further rule changes. For example, just as with multi-band, multi-mode transmitters already in operation today, SDR equipment that is capable of multi-band, multi-mode operation would simply need to be tested across all of the bands and using all of the modes for which it is programmed.²⁰ Likewise, when additional modes are added to already authorized equipment, the resulting combination of hardware and software should be re-authorized or treated as a permissive change, depending on the extent of the modification, just as with any other modified equipment.²¹ And if SDR moves toward common open interfaces at the application level, as the SDR Forum and other commenters expect,²² a robust third-party software market will develop. Independent software manufacturers would have the freedom to seek authorization for new combinations of existing hardware and new software, and would have the concomitant

¹⁹ See SDR NOI at ¶ 21; *see also* Comments of Motorola at 40.

²⁰ See Comments of Nortel Networks Inc. at 6.

²¹ See Comments of Motorola at 33; *cf.* 47 C.F.R. §§ 2.932, 2.1043.

²² See Comments of Motorola at 34; Comments of the National Telecommunications and Information Administration at 26; Comments of Vanu, Inc. at 1-2.

obligation to become the responsible party for the resulting combination, as the Commission's Rules already recognize today.²³

Finally, the SDR Forum also agrees with the vast majority of commenters that it is imperative to ensure that SDR technology is tamper-resistant, secure, compliant with existing regulations, and safeguarded against unauthorized use or increased interference.²⁴ The burden of ensuring the safe and compliant operation of SDR-enabled equipment is, and will continue to be, placed squarely on the shoulders of equipment manufacturers.²⁵ The SDR Forum agrees with those commenters who suggest that the FCC monitor and participate in developments in these areas, but specific regulations would not be helpful and, indeed, might hinder the flourishing industry-based efforts to develop the effective, secure and reliable software-download systems that were extensively described in the SDR Forum's initial comments.²⁶

V. Conclusion

The FCC should continue to work closely with the SDR Forum and with other regulatory agencies to develop universally accepted policies and goals for SDR-enabled devices and services. The Commission should also monitor the development of SDR and look for ways to promote spectral efficiency, dynamic spectrum use, spectrum trading, and spectrum sharing, as well as streamlined authorization of SDR units' specific combinations of hardware and software. However, aside from minor changes to the rules governing re-labeling of SDR-altered equipment in the field, the Commission need not propose SDR-related rule changes at this time.

²³ See 47 C.F.R. § 2.909(c)(4), (d).

²⁴ See Comments of the Industrial Telecommunications Association, Inc. at 2, 4.

²⁵ See Comments of Motorola at 35, 39-40.

²⁶ See Comments of Nortel Networks Inc. at 4; Comments of the SDR Forum at 33-40.

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Reply Comments of the SDR Forum
Notice of Inquiry Regarding Software Defined Radios, ET Docket No. 00-47

Exhibit A: Proposed CFR Changes

§ 2.909 Responsible party.

The following parties are responsible for the compliance of radio frequency equipment with the applicable standards:

(a) In the case of equipment which requires the issuance by the Commission of a grant of equipment authorization, the party to whom that grant of authorization is issued (the grantee). If the radio frequency equipment is modified by any party other than the grantee and that party is not working under the authorization of the grantee pursuant to § 2.929(b), the party performing the modification is responsible for compliance of the product with the applicable administrative and technical provisions in this chapter.

(b) In the case of equipment subject to authorization under the verification procedure, the manufacturer or, in the case of imported equipment, the importer. If subsequent to manufacture and importation, the radio frequency equipment is modified by any party not working under the authority of the responsible party, the party performing the modification becomes the new responsible party.

(c) In the case of equipment subject to authorization under the Declaration of Conformity procedure:

(1) The manufacturer or, if the equipment is assembled from individual component parts and the resulting system is subject to authorization under a Declaration of Conformity, the assembler.

(2) If the equipment, by itself, is subject to a Declaration of Conformity and that equipment is imported, the importer.

(3) Retailers or original equipment manufacturers may enter into an agreement with the responsible party designated in paragraph (c)(1) or (c)(2) of this section to assume the responsibilities to ensure compliance of equipment and become the new responsible party.

(4) If the radio frequency equipment is modified by any party not working under the authority of the responsible party, the party performing the modifications, if located within the U.S., or the importer, if the equipment is imported subsequent to the modifications, becomes the new responsible party.

(d) If, because of modifications performed subsequent to authorization, a new party becomes responsible for ensuring that a product complies with the technical standards and the new party does not obtain a new equipment authorization, the equipment shall be

labelled, following the specifications in § 2.925(d), or (e), with the following: "This product has been modified by [insert name, address and telephone number of the party performing the modifications]."

§ 2.925 Identification of equipment.

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in § 2.926. The FCC Identifier shall be preceded by the term "FCC ID" in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification. Example: FCC ID XXX123. XXX -- Grantee Code 123 -- Equipment Product Code

(2) Any other statements or labeling requirements imposed by the rules governing the operation of the specific class of equipment, except that such statement(s) of compliance may appear on a separate label at the option of the applicant/grantee.

(3) Equipment subject only to registration will be identified pursuant to part 68 of this chapter.

(b) Any device subject to more than one equipment authorization procedure may be assigned a single FCC Identifier. However, a single FCC Identifier is required to be assigned to any device consisting of two or more sections assembled in a common enclosure, on a common chassis or circuit board, and with common frequency controlling circuits. Devices to which a single FCC Identifier has been assigned shall be identified pursuant to paragraph (a) of this section.

(1) Separate FCC Identifiers may be assigned to a device consisting of two or more sections assembled in a common enclosure, but constructed on separate sub-units or circuit boards with independent frequency controlling circuits. The FCC Identifier assigned to any transmitter section shall be preceded by the term "TX FCC ID", the FCC Identifier assigned to any receiver section shall be preceded by the term "RX FCC ID" and the identifier assigned to any remaining section(s) shall be preceded by the term "FCC ID".

(2) Where telephone equipment subject to part 68 of this chapter, and a radiofrequency device subject to equipment authorization requirements are assembled in a common enclosure, the nameplate/label shall display the FCC Registration Number in the format specified in part 68 and the FCC Identifier in the format specified in paragraph (a) of this section.

(3) Applications filed on or after May 1, 1981, and applications filed earlier requesting equipment authorization using the single system of identification pursuant to section

(a)(1) will receive a review of the identification portion by the Commission's Laboratory with respect to nameplate/label design within 30 days after receipt at the Laboratory. Failure by the Laboratory to reject a nameplate design proposed in any particular application within this time period will constitute de-facto acceptance of the nameplate/label design for that particular equipment. Such de facto acceptance will be limited to the equipment covered by the particular application and will not be considered to establish a precedent for other applications. This review deadline applies only to the proposed nameplate/label design, not to the remainder of the application.

(4) For a transceiver, the receiver portion of which is subject to verification pursuant to § 15.101 of this chapter, the FCC Identifier required for the transmitter portion shall be preceded by the term "FCC ID".

(c) [Reserved]

(d) In order to validate the grant of equipment authorization, the nameplate or label shall be permanently affixed to the equipment and shall be readily visible to the purchaser at the time of purchase.

(1) As used here, "permanently affixed" means that the required nameplate data is etched, engraved, stamped, indelibly printed, or otherwise permanently marked on a permanently attached part of the equipment enclosure. Alternatively, the required information may be permanently marked on a nameplate of metal, plastic, or other material fastened to the equipment enclosure by welding, riveting, etc., or with a permanent adhesive. Such a nameplate must be able to last the expected lifetime of the equipment in the environment in which the equipment will be operated and must not be readily detachable.

(2) As used here, "readily visible" means that the nameplate or nameplate data must be visible from the outside of the equipment enclosure. It is preferable that it be visible at all times during normal installation or use, but this is not a prerequisite for grant of equipment authorization.

(e) Where it is not feasible for a permanently affixed nameplate or label to reflect equipment modification, as in the case of a post-manufacture change to the equipment's software that requires re-authorization, the information normally contained in the nameplate or label may be installed so that it is readily accessible by means such as a user display screen.

(f) Where it is shown that a permanently affixed nameplate or user screen identification is not desirable or is not feasible, an alternative method of positively identifying the equipment may be used if approved by the Commission. The proposed alternative method of identification and the justification for its use must be included with the application for equipment authorization.

NOTE: As an example, a device intended to be implanted within the body of a test animal or person would probably require an alternate method of identification.

(f)(g) The term "FCC ID" and the coded identification assigned by the Commission shall be in a size of type large enough to be readily legible, consistent with the dimensions of the equipment and its nameplate. However, the type size for the FCC Identifier is not required to be larger than eight-point.

(1) The type or model number shall consist of a series of Arabic numerals or capital letters or a combination thereof, and may include punctuation marks and spaces. The total of Arabic numerals, capital letters, punctuation marks and spaces in any assigned type or model number shall not exceed 17;

(2) The type or model number will be specified in the grant of equipment authorization and will be identical to that assigned by the manufacturer or applicant and given in the application for equipment authorization;

(3) The type or model number shall be one which has not been used previously in conjunction with the same name that will be on the equipment.

§ 2.1065 Identification and changes in equipment information filed for application reference.

(a) Each type of equipment, for which information is filed for application reference purposes, shall be identified by a type number assigned by the manufacturer of the equipment. The type number shall consist of a series of Arabic numerals or capital letters or a combination thereof, and may include punctuation marks and spaces. The total of Arabic numerals, capital letters, punctuation marks and spaces in any assigned type number shall not exceed 17. The type number shall be shown on an identification plate or label affixed in a conspicuous place to such equipment.

(b) If the assignment of a different type number is required as a result of equipment modification, a new identification plate or label bearing the new type number shall be affixed to the modified equipment.

(c) Where it is not feasible for a permanently affixed identification plate or label to reflect equipment modification, as in the case of a post-manufacture change to the equipment's software that requires re-authorization, the information normally contained in the identification plate or label may be installed so that it is readily accessible by means such as a user display screen.

NOTE: It is recommended that such equipment be identified with a nameplate pursuant to § 2.925, except for deletion of the FCC Identifier, which will not be assigned to nor listed for such equipment.