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Title: Software Defined Radio Application Guide

Short Title: SDR Apps Guide

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Keyword/Subject: SDR, Software Defined Radio Application Guide

First Category: Administrative Requirements

Second Category: Certification

Third Category:

Question: What are the guidelines for providing a software operational description with an application for certification as required by Section 2.944 for a Software Defined Radio?

Answer: Guidelines are provided in the attachment below 442812 D01 SDR Apps Guide v01

Attachment List: 442812 D01 SDR Apps Guide v01 published on: Month Day Year Time

Attachment 1 (442812 D01 SDR Apps Guide v01)

Software Defined Radio Application Guide

Introduction

This publication addresses the additional requirements for Software Defined Radio to provide operational and security descriptions as required by Section 2.944. This guide is applicable for both initial applications and permissive change applications.

Section 2.944 requires that SDR applicants:

a. Take steps to ensure only approved software operates the radio;

b. Ensure that any radio where third parties can operate outside of the grant is an SDR, and take steps (a) to ensure approved software operates the radio.

c. Provide an operational description with the application for certification.

Current policy for SDR applications requires that a Telecommunication Certification Body (TCB), manufacturer or responsible party first file a Permit But Ask request prior to issuance of a grant through the Office of Engineering and Technology (OET) Laboratory Division Inquiry System, as described in publication 388624; and provide the information as requested in Section (IV) of this guide to describe the operation and security of the device.

This guide is divided into five sections: (I) a decision tree to determine if a radio can either elect to be or must be a Software Defined Radio (SDR), (II) SDR documentation required for filling, (III) permissive changes for an SDR, (IV) what should be included in a Permit But Ask request and (V) definitions.

This guide first steps through a series of questions (I) to determine if a filing must be, or may elect to be, filed as an SDR application. Figure 1 illustrates the decision tree process.

When a transmitter's RF operation can be modified, configured, updated or changed by third parties through software to operate outside of the grant then it can only be granted as an SDR. The responsible party must maintain an acceptable software security process that ensures regulatory compliance for SDR transmitters. Third parties include end users, a licensee, professional installers, repair shops, etc. - essentially all parties except the grantee or any party legally contracted to the grantee when the grantee remains liable by the contracted relationship for any actions of the contracted party.

There are two key advantages of an SDR grant:

● Manufacturers can have transmitters capable of operating in multiple regulatory domains as long as acceptable third party software security procedures (as granted) ensure that transmitters sold in the US can only operate under the grant conditions under US rules.

- SDR grants provide the opportunity to make Class III changes. Class III changes permit adding new equipment classes and rule parts for transmitters. With acceptable third party security procedures (as granted), field upgrades by third parties are permissible.

I. Decision Tree

The six questions used for determining if a radio can <u>elect to be</u>[6], or <u>must be an SDR</u>[5],

1. Can the RF parameters of the <u>device</u>[3] be altered through software[2]?

     Yes - go to 2.

     No, not an SDR - go to 6.

2. Can <u>third parties</u>[4] modify, configure, or load different software, or make configuration settings or operate the device or <u>host hardware</u>[1] in any other way (frequency, power, rule part operation) than what is, or will be, granted?

     Yes, must be an SDR - go to SDR requirements.

     No - go to 3.

3. Is the device capable of operating in any other frequency band then what is, or will be, granted[7] by third parties?

     Yes, - go to 4.

     No - go to 5.

4. Is this grant for a Part 15 client[8] device as defined in Section 15.202 (as opposed to a master device)?

     Yes, qualifies as a part 15 <u>client</u> device - go to 5.

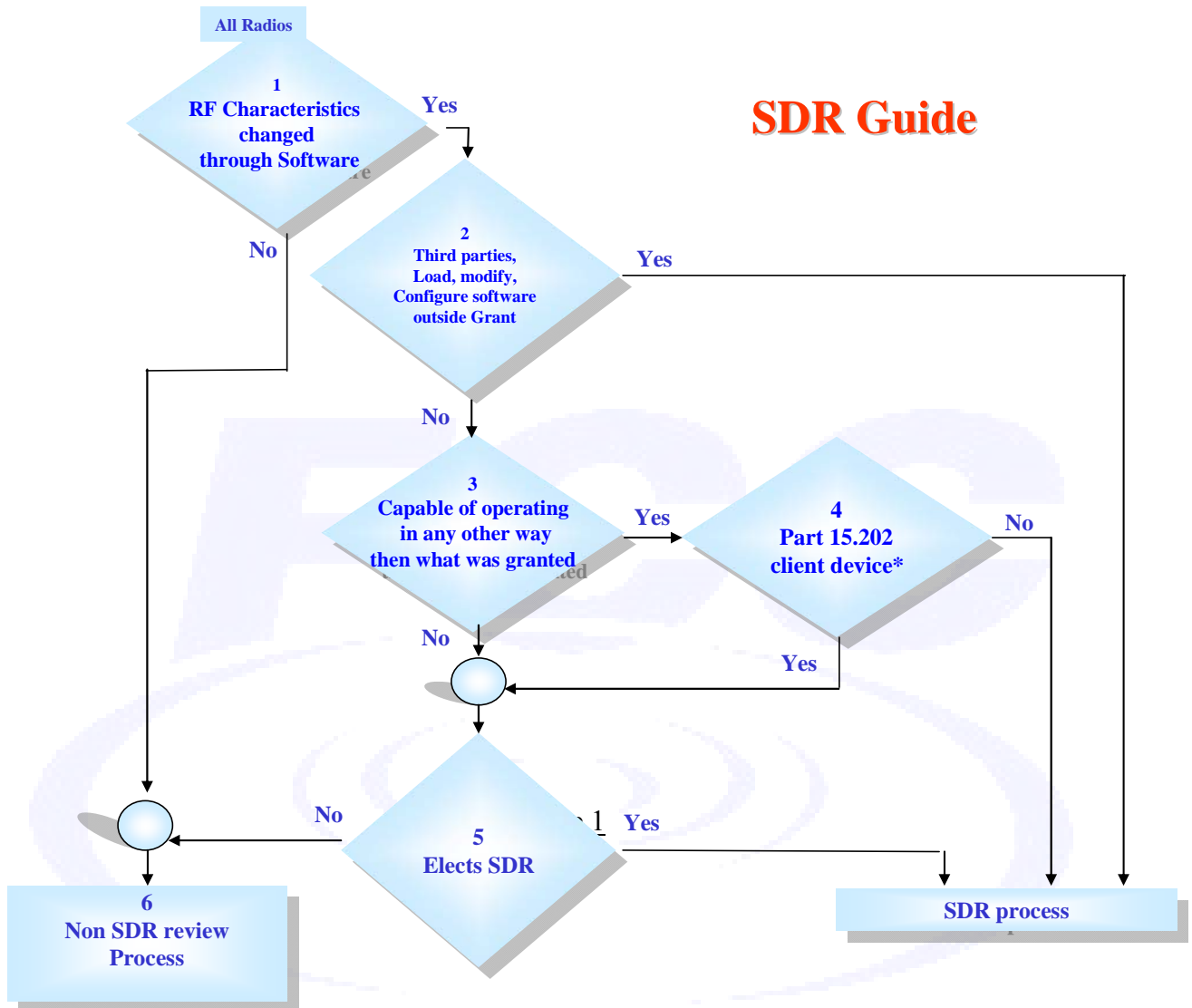   No, must be an SDR - go to SDR requirements.

5. Does the manufacture elect SDR?

     Yes, elects to be an SDR - go to SDR requirements.

     No, does not elect to be an SDR - go to 6.

6. General Notes on non-SDR devices. Radios that can be modified by software (yes to 1, but no to 5) should be reviewed to determine if it can be operated outside the of the grant conditions.

SDR Guide

All Radios

1
RF Characteristics changed through Software — Yes →

No ↓

2
Third parties, Load, modify, Configure software outside Grant — Yes →

No ↓

3
Capable of operating in any other way then what was granted — Yes → **4 Part 15.202 client device*** — No →

No ↓ | Yes ↓

5
Elects SDR — No ← | Yes →

6
Non SDR review Process

SDR process

* Other licensed Client devices capable (i.e. Parts 22 and 24 Cell Phones) may also qualify and be permitted (as non SDR or elect to be an SDR). Use the Permit But Ask procedure or ask the FCC by submitting an inquiry
https://fjallfoss.fcc.gov/oetcf/kdb/forms/InquiryForm.cfm

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II **Software Defined Radio Security Description Guide**

The following table can be used as a reference guide by the applicant to describe how their system meets the security requirements for Section 2.944 Software Defined Radios. An applicant must describe the security measures and systems that ensure that only authenticated, legal (as granted) software is loaded and operating the device.

This guide is not intended to be exhaustive and may be modified in the future. There may be follow-up questions based on the responses provide by the applicant for authorization.
An applicant may select to copy the table and replace the examples in the applicant response column to provide answers and reference attachments.

Category	
Description Software (2.944 [c])	General software operational description.
	Describe all the radio frequency parameters that are modified by the software without any hardware changes.
	High level (simplified) block diagram of the software architecture.
labeling	How is the device to be labeled? Will the device have a single label or will it use an electronic label per Section 2.925 (e)?
	How can the FCC verify, in the field, that the correct version of the software is running in the device? Submit a description of this capability and instructions for the FCC to use in the field to verify that proper software is operating in the device.
	Describe the means by which software version numbers can be related to any future Class III permissive changes.
Security	What ensures that third parties *(Professional installers, qualified personnel, authorized certified technicians, end users, etc. – not direct employees)* can not operate US sold devices on any other regulatory domain frequencies, or in any manner that is in violation of the grant or grant conditions.
	Explain if any third parties have the capability to operate a US sold device on any other regulatory domain frequencies, or in any manner that is in violation of the grant.
	Describe how the software updates are distributed for all regulatory domains and what ensures that a product sold in the US can only operate as granted on US frequencies.
	If the product cannot be modified by third parties and can only operate as granted on US frequencies, explain how this is achieved.
	What stops third parties from loading non-US versions of software onto products intended for US sale?
	Can third parties make factory level changes to reload non-US domain codes, etc.
Unauthorized changes (hack) to the software (Section 2.944).	Describe how open source is the operating code for granted RF properties. Describe the difficulty and proprietary nature of the code that controls the RF parameters as granted.

III Class Changes for SDR

Class I

Changes in the equipment that does not degrade the characteristics reported.

SDR is no different than non-SDR grant.

Class II

Changes in the host hardware equipment that effect the characteristics.

Any Class II change (even for adding new antenna types) will prevent the grantee from making future Class III changes.

Class III

As long as there is no host hardware or previous Class II changes, there is no limit to the number of Class III changes permitted. There are three categories for Class III changes:

1. Modification to software that affect RF parameters that degrade original reported RF parameters, but still meet the rules for the original equipment class. Submit test documentation similar to the Class II requirements for non-SDR.

2. Adding new technical rule part and/or equipment class. For example, an SDR first granted as a Section 15.247 DTS device could later add Part 15 UNII Subpart E. Submit a complete set of new test documentation for a new equipment class, similar to the procedures for a non-SDR.

3. Major changes in Software, Distribution and Security (SDS) that materially changed the descriptions provided on the initial grant will require a Class III permissive change. Do not submit only the changes. A full description is required. The Class III documentations, in effect, replace the original description in its entirety.

A Class III change should also include a statement:

To identify all versions of software that are approved in the original grant, and all other granted Class III permissive changes including the requested Class III change.

That confirms that there is no change to the Software, Distribution and Security Documentation. If it does then a Class III resubmission of SDS security documentation is also required.

IV Permit But Ask Procedure

The following should be submitted with the PBA request.

1. Define if the PBA is an initial grant or permissive change:
   a) Permissive changes to a non SDR to SDR are not permitted.
   b) If Class II permissive change is requested, further Class III changes will not be permitted.
   c) If A Class III is requested, provide a statement as defined in Section (III) of this guide.
2. Manuals and Operational Descriptions to allow the reviewer to understand the product and its function.
3. For an origianl grant, a statement to affirm why the grant is a SDR. This is generally a very simple statement :
   a) Must be an SDR
      i) World wide Radio with security for managing software as described below.
   b) Elects to be an SDR
      i) Will be taking advantage of Class III permissive changes. In this case the radio is limited to only operating in frequencies as granted, and under all other grant conditions. These parties have no way of operating the radio outside of the grant conditions
4. Software Defined Radio Security Description
   a) Provide a description as outlined in Section (II) of this guide.

V Definitions:

1 Host Hardware: The host hardware is the physical non programmable elements of a device targeted as a licensed or unlicensed authorized device in the US, other legal applications or any other regulatory domain.

2 Software is any non physical code, soft configuration settings or instructions that form the elements that intend to alter (put in place, effect modify or change) the features, performance and operation functions of a licensed or unlicensed device. This means configuration capabilities, command language controls, operating systems, browser based controls, application code, firmware, code for fixed read only memories or field programmable gate arrays, etc.

2. Unauthorized software is the ability for others to hack the device and make changes not authorized by the grantee.

3. Device is the embodiment of the host hardware and software that defines the operational features. A device can be associated with one software version, different versions or multiple software packages.

4. Third parties include end users, professional installers, repair shops etc- essentially all parties except the grantee or any party legally contracted to the grantee when the grantee remains liable by the contracted relationship for any actions of the contracted party.

5. Must be SDR:

If third parties can operate the host hardware device in other ways then what will be granted, then the device must be an SDR. The only exception is devices that qualify as a Part 15 client device (as opposed to a master device).

6. May Elect SDR:

When the host hardware can not be operate in any other way then what is granted or when no third party has the capability to operate the host hardware in any other way, the applicant may elect to be an SDR.

7. In any other ways then what is or will be granted: in any other bands not permitted by the rules, and not in compliance with the certification.

8. **Client Device:** Devices defined as Section 15.202 client devices that operate under control of a master device may be permitted to be marketed with code that operates in other frequency bands than that permitted in the grant. Devices commonly sold or known as client devices that can also operate in AD-HOC, pear-to pear or mesh network mode that initiate transmissions not under control of a master devices do not qualify. Note: Client devices that actively scan only on US frequencies and only operate in AD-HOC mode on US frequencies but passively scan on other than US frequencies is considered a client device.