

INTRODUCTION

Many manufacturers have avoided the incorporation of RF into their products because of uncertainty over the approval and certification process. With the advent of simple and inexpensive modular RF devices, such as those made by Linx, many manufacturers are again considering the addition of an RF stage to their products. While it is true that RF increases the effort and cost of bringing a product to market, it also can add significantly to the function and salability of a completed product. When the technical and legal issues of RF implementation are understood and approached in logical steps the process becomes relatively painless.

PURPOSE OF THIS APPLICATION NOTE

This application note gives a brief overview of the legal issues governing the manufacture and sale of RF products intended for unlicensed operation in the United States under CFR 47 Part 15. In the United States the Federal Communications Commission (FCC) is responsible for the regulation of all RF devices. The FCC requires any device that radiates RF energy to be tested for compliance with FCC rules. These rules are contained in the Code of Federal Regulations (CFR), Title 47. Part 15 is the section of the code that deals with devices that emit RF energy and are to be operated without an individual license. This application note will provide you with a basic understanding of the steps involved in obtaining a Part 15 certification. In addition, it is strongly recommended that you obtain a full copy of the code from your local government bookstore, the Government Printing office in Washington (<http://bookstore.gpo.gov/>) or the FCC web site at:

<http://wireless.fcc.gov/rules.html>

WHAT IS PART 15 "UNLICENSED" OPERATION?

Certain bands within the RF spectrum are available for "unlicensed" operation, and Part 15 governs these bands. The term "unlicensed" is often misunderstood. The manufacturer of a product designed for "unlicensed" operation is not exempt from the certification procedure. Indeed, both the transmitter and receiver must be tested by a

qualified testing laboratory and an FCC ID number obtained before the product can be legally sold. Once this has been done, however, the end user of the product can operate it without obtaining a license for its use.

WHAT STEPS ARE NECESSARY TO OBTAIN A PART 15 CERTIFICATION?

Determine the correct frequency of operation.

Part 15 governs a broad range of the radio spectrum ranging from below 1MHz to in excess of 32GHz. It is broken into individual sections that govern the use of specific frequencies and bands. For example, section 15.239 covers the band from 902-928MHz. In this frequency range a user is allowed to transmit any analog or digital signal they wish so long as the stipulations governing allowed power output, harmonics, and occupied bandwidth are met. Other sections are not so accommodating. For example, in the popular 260-470MHz band, the FCC considers not only RF performance issues but also issues of application, such as what the data being sent originally consisted of and what its intended function is.

In order to determine which operational frequency is best for your product it is necessary to weigh both technical and legal issues. First, you will want to have a clear understanding of which frequencies are legally available, and then choose a specific frequency based on technical issues, such as range, propagation, antenna length, power consumption, and potential interference. (If you are not familiar with these technical issues you may wish to consult with a Linx application engineer or read additional Linx application notes focusing on those issues.)

Carefully select RF and antenna components.

Once a frequency of operation has been selected, the RF section and antenna must be carefully designed and optimized to comply with the allowed power and harmonic limitations imposed by Part 15. If you are using a Linx module this process is greatly simplified, but it is important to recognize that the antenna still plays a key factor in the product's legal operation.

Most modular RF transmitter products, including those manufactured by Linx, have the potential to output RF power in excess of Part 15 limits. This is done so that many designers who utilize inefficient antenna styles, such as a loop-trace or helical for cost or cosmetic reasons, can still achieve close to full output power. If the module is matched to a highly efficient antenna, such as a full whip or yagi, the output power may need to be externally reduced by an attenuation pad. For more details, see application note 00150.

Another consideration in antenna selection is that Part 15.203 requires the antenna to be permanently attached or coupled with a unique or proprietary connector. While this requirement leaves a lot of room for interpretation, the FCC's intention is that a user not be able to change the output characteristics of the device by interchanging the antenna with a higher performance model.

Build production-ready prototypes.

Once you have chosen a frequency for operation and suitable RF stage you will want to evolve from concept breadboard prototypes to a production-ready model as rapidly as possible.

Prescreen and optimize the production-ready units.

Once a RF product is finished, its output power and harmonics should be checked to ensure that the RF stage is both optimized and Part 15 compliant. This testing requires a spectrum analyzer and calibrated antennas. If you do not have access to these test instruments you will want to consider prescreening services, such as those offered by Linx. The prescreening process can result in substantial cost savings over formal lab tests and gives a designer the chance to maximize product performance.

Send the production-ready product to an FCC authorized testing facility.

Once your product is in its finished form, exactly as it will be produced, it should be sent to one of the many testing laboratories authorized to conduct FCC Part 15 compliance testing. The FCC has greatly streamlined the approval process in recent years. The entire process can now be complete in less than 30 days. In fact, receivers no longer require certification just a quick test and a Declaration Of Conformity (DoC) issued. Transmitter certification is almost as painless since

many labs that are TCB certified are now allowed to issue certifications on behalf of the FCC. Full transmitter and receiver testing can cost around \$5,000, transmitter only around \$3,000, and the receiver about \$2,000. The FCC has authorized the TCBs to issue identity numbers on its behalf so the testing can usually be done in about a week. Many of these labs can perform other testing at the same time, such as Class A/B.

Label the product and market it.

Your certified product must now have an FCC identification label attached to it. This label must be permanently attached either directly to the device or on a tag that cannot be removed. The label shall follow the format required by Part 2.925 and 2.926 as well as Part 15.19.

Bringing a product through the approval process involves cost, effort and in some cases frustration, but in the end your product will have an exciting new dimension of function and marketability. By following the six steps outlined in this application note and reviewing an actual copy of Part 15 you will be well on your way to RF success. While complying with the provisions of Part 15 may seem unnecessarily restrictive, such regulations serve to ensure the availability of usable RF spectrum for every product.

For additional information on FCC regulations you may wish to visit the FCC's web site at <http://www.fcc.gov/oet/ea/>. You may also wish to visit the Linx Technologies web site at www.linxtechnologies.com where applicable sections of FCC regulations and testing facilities are available for review and download.

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