
Resource Document

#FCCGD198

Legal considerations for Linx products
in operational areas governed by the



This Document Contains:

- Explanation of the Approval Process
- Linx FCC Application Notes
- Frequently Asked Questions
- FCC Contacts
- CFR 47 Part 2 (Abridged)
- CFR 47 Part 15 (Abridged)
- FCC-Approved Domestic Test Facilities

THE FCC ROAD: PART 15 FROM CONCEPT TO APPROVAL

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 DOCUMENT

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 FOR 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. It 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 website at <http://www.fcc.gov/oet/ea/>. You may also wish to visit the Linx Technologies website at www.linxtechnologies.com where applicable sections of FCC regulations and testing facilities are available for download.

Federal Communications Commission
Office of Engineering and Technology
Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046-1609
Phone: (301) 362-3000
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THE APPROVAL PROCESS

INTRODUCTION

Here 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. The first volume of CFR 47 contains parts O-19. The sections you will be dealing with throughout the approval process are primarily Part 2 and Part 15. Part 2 deals with issues of marketing and authorization. Part 15 deals with the operational aspects and requirements for devices that emit RF energy and are to be operated without the end user needing a license. While a copy of each of these parts is included in this document, 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>

It is assumed that you have already worked through such issues as what operations are allowed on the frequencies you have chosen, antenna compliance, and output power. Therefore, this section moves past those issues to give you a quick look at what the steps will be necessary from here to final approval.

STEP ONE: LAB SELECTION

The FCC requires that your product's final testing be conducted by a registered testing facility that has complied with Section 2.948 of CFR 47. Labs that have indicated they are available to perform Part 15 testing for the public are listed on the "Contract Test Sites" list provided in the last section of this document. A current list may also be found on the web at:

<http://gulfoss2.fcc.gov/prod/oet/cf/eas/reports/TestFirmSearch.cfm>

The quality and competence of labs varies widely. Linx is happy to make recommendations of test facilities that we believe to be competent; however, neither Linx nor the FCC takes responsibility for the capability or performance of labs appearing

on the list. It is the responsibility of applicants to select a test lab capable of measuring their specific device. Labs appearing on the list are independent. They do not perform tests on behalf of, nor are they endorsed or approved by, Linx or the FCC, and may not advertise or otherwise imply such a relationship.

TO PAY OR NOT TO PAY

Once you have chosen a lab you must decide the extent of the services that they will provide. Many labs offer services from basic testing, to full filing and compliance services, even to the point of taking documentation photographs and preparing labels. Our advice? Have the Lab do as much as possible. Taking time to understand the subtleties of the filing process in the middle of trying to get a product to market is a bad idea. Saving a little money doing things yourself can end up costing far more than you save, and in some cases, might even jeopardize your ability to receive approval.

STEP TWO: REGISTERING

When your product is completed and in or ready to enter your chosen testing Laboratory a Federal Registration Number (FRN) must be obtained. This is free and can be obtained online in just a few minutes at:

<https://svartifoss2.fcc.gov/cores/CoresHome.html>

Next, a grantee code must be requested from the FCC. This can also be done online at:

<https://gulfoss2.fcc.gov/prod/oet/cf/eas/index.cfm>

The Grantee Code costs \$55 and must be paid within thirty days of the application. Form 159 is used for this and can be done online or printed and mailed.

STEP THREE: TESTING

In order to have the best chance at approval it is important that you explain clearly to your lab the intended function of the product and any special operating characteristics. If you are using a module that uses carrier keying, such as the LR series, be sure your lab remembers to measure or calculate average power, not peak.

The test lab will require a number of items to complete the filing. These items include:

- A letter appointing the test lab as your technical agent for certification. The labs will provide a sample letter.
- The FCC ID Number of the unit. The first 3 digits are the Grantee Code obtained earlier. The last 14 digits are up to you but are typically the model number of the product.
- A sketch of the location of the FCC label on your unit as well as a sketch (with dimensions) of the label itself.
- A block diagram of the unit showing all clock oscillators and their frequencies of operation. The signal path and frequency should be shown at each block.
- Full schematic diagram.
- The User's Manual.
- A brief, non-technical description of the unit and its operation.
- A sample of the unit for testing and photographs.

As previously mentioned, the FCC requires that final product testing be done in a registered test facility. Here, such items as output power, harmonics and spurious emissions will be tested. This facility will perform separate measurements on the transmitter and receiver, as the transmitter and receiver require different types of Authorizations from the FCC. The testing will usually take less than two weeks, but the actual time will depend on the test lab's backlog and schedule.

Transmitter Testing

A product containing a Linx transmitter is termed by the FCC to be an intentional radiator, that is, a device that intentionally emits RF energy into free space. Thus, it must be tested and certified before it may be marketed. The certification procedure requires that tests be performed to measure the levels of RF energy that are radiated by the device into the open. After these tests have been performed, a report must be produced showing the test results.

Certified transmitters also are required to have two labels attached: an FCC ID LABEL and a COMPLIANCE LABEL. The FCC ID label identifies the FCC equipment authorization file that is associated with the transmitter, while the Compliance Label

indicates to the consumer that the transmitter may not cause, nor is it protected from, harmful interference.

Receiver Declaration Of Conformity

A product containing a Linx receiver product is considered to be an unintentional radiator. This is because, while it is not specifically designed to radiate RF energy, small amounts of RF radiation may occur. For this reason the receiver must be tested to measure the levels of radio frequency energy that are radiated by the receiver into free space. The receiver is authorized by a Declaration of Conformity (DoC), which signifies that the product complies with the applicable technical standards. Submittal of a sample unit or representative data to the FCC demonstrating compliance is not required unless specifically requested by the Commission pursuant to CFR 47 Parts 2.936, 2.943 or 2.945.

Products are also required to have a Compliance Label attached to all items subsequently manufactured or marketed by the responsible party.

FILING CONFIDENTIALITY

This is an important and often overlooked issue. Unless otherwise requested and paid for, the entire contents of your filing will become public information. You may request confidentiality pursuant to 47 CFR 0.459, which can prevent such proprietary items as schematic diagrams from falling into the hands of competitors. When confidentiality is requested, please label all items that are to be kept confidential from the general public "CONFIDENTIAL". Items that cannot be given confidentiality are: (1) photos of a device (anyone who purchases a device will know what it looks like), (2) test results (the public has a right to review a test report showing compliance with the FCC Regulations) and (3) user's manual. In general, the only information that is granted confidentiality is patented trade-secret information that, if given out, would harm a company financially because it gives their competitors the advantage of gaining this information without research, design and/or development costs. Filing for confidentiality with the FCC is \$155 but may be less with a TCB.

STEP FOUR: THE FILING PROCESS

The FCC has made the filing process much

quicker and easier in the last couple of years. The number one improvement was the designation of Telecommunications Certification Bodies (TCBs). These are private companies that have been designated by the FCC to review applications and issue certifications. They are also allowed to issue certifications for other countries with whom the US has a Mutual Recognition Agreement (MRA). The TCBs must be accredited and comply with the requirements of Section 2.962.

The TCB process does not replace the FCC Authorization process, but the TCB process offers a more convenient option. Competition helps keep the prices low and the processing times fast. The FCC will generally take 60 to 90 days to process an application and issue a Grant of Certification while a TCB will usually issue a Grant within a few days.

The filing process is usually done by the test lab as a part of their service. The lab will compile the test report, photographs, and other items listed above and send them to their preferred TCB. The TCB will review the application materials and, if the device conforms to the requirements, they will issue a Grant of Certification. At this point, the device can be marketed and sold.

The final step is for the TCB to upload the report to the FCC's web site using form 731 (Application For Equipment Authorization). Once the FCC receives the report, they will add the product and the ID number to their database and their web site. The FCC will review a sampling of all of the reports from all of the TCBs and can request a sample of the product to confirm the results in the report. This is mostly a luck-of-the-draw occurrence.

Once your ID number appears on the FCC's web site the TCB will send a notification and the process is complete. A copy of the report and all information that is not deemed confidential can be found using the search engine on the FCC's web site at:

<https://gulfoss2.fcc.gov/prod/oet/cf/eas/reports/GenericSearch.cfm>

CONSIDERATIONS FOR OPERATION WITHIN 260-470MHZ BAND

INTRODUCTION

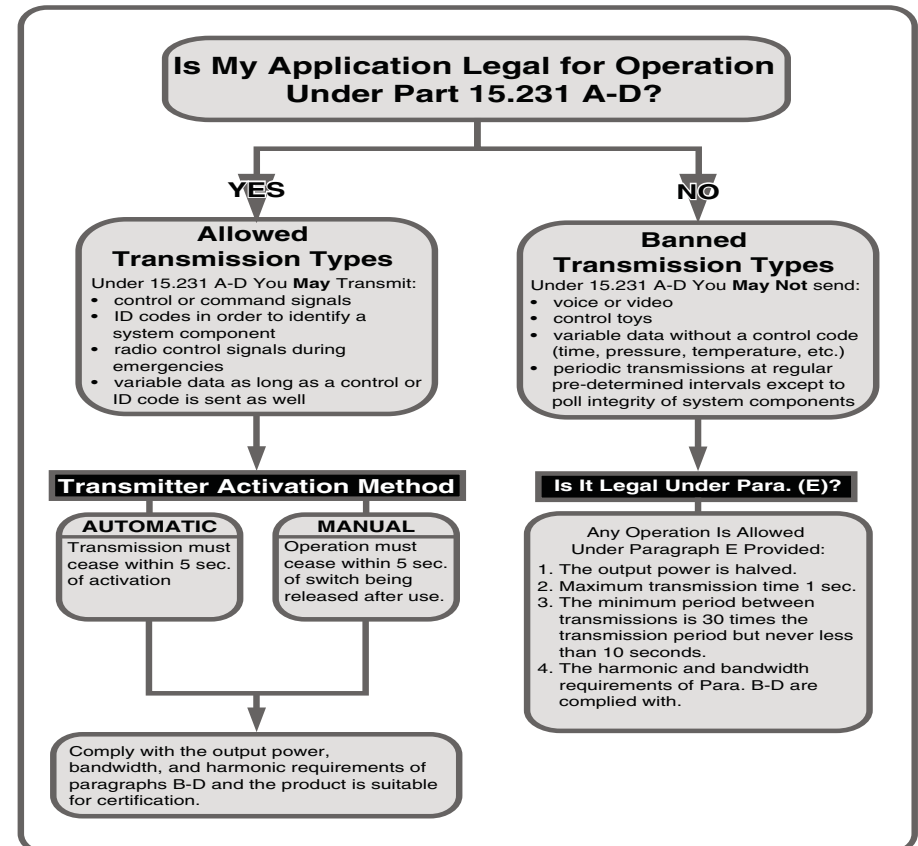
This application note is designed to give the reader a basic understanding of the technical and legal issues that apply to the operation of RF devices in the 260MHz to 470MHz band. Since the allowed use of these frequency bands varies considerably worldwide, it should be recognized that this application note is intended for designers planning for operation in the United States under the rules of CFR47 Part 15.

When working with RF, a clear distinction must always be made between what is technically possible and what is legally acceptable. Since consideration of technical issues serves little purpose if the chosen frequency cannot be legally used for your

intended purpose, let us consider issues of legality first.

LEGAL CONSIDERATIONS

In the United States, the Federal Communications Commission (FCC) is responsible for the regulation of all RF devices. These regulations are contained in the Code of Federal Regulations (CFR), Title 47. Title 47 is made up of numerous volumes, however, all regulations applicable to operation in the 260 to 470MHz band are contained in volume 0-19. 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:



WHAT IS UNLICENSED OPERATION?

Here in the United States, the FCC requires any device that intentionally radiates RF energy to be tested for compliance with FCC rules. Certain bands within the RF spectrum are available for "unlicensed" operation. 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.

Unlicensed operation in the frequencies from 260 to 470MHz is governed by Part 15, section 231. Part 15 is what is termed "Living Legislation". This means it is subject to interpretation on a case-by-case basis. If your application is not clearly in compliance, it is best to consult the FCC directly before proceeding with a design.

WHAT MUST I DO TO BE UNLICENSED?

The regulations of Part 15.231 are rather unusual. In many bands the FCC specifies only fundamental power, harmonic levels, and allowed bandwidth. In the case of the 260-470MHz band, the FCC actually considers what the data being sent originally consisted of and what their intended function is. You will want to review the text of 15.231 in its entirety. (It has been included at the end of this application note for your convenience.) When reviewing this section, it is critical to realize that paragraphs (A)-(D) are intended to be read as a unit, while paragraph (E) applies only if the rules of paragraph (A) are being violated. Because of the complexity and application-dependent nature of the rules, they are best illustrated in a flowchart style on the previous page.

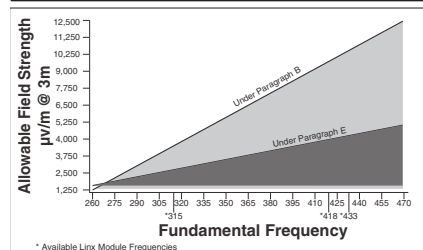
By reviewing Part 15 and the preceding flow chart, you have, hopefully, determined that your application is appropriate for operation in the 260 to 470MHz band. If you are still uncertain or feel your application falls into a "gray" area, you may wish to consult directly with an FCC engineer. You may do so by contacting the FCC directly at:

Federal Communications Commission
Office of Engineering and Technology
7435 Oakland Mills Road
Columbia, MD 21046
Phone: (301) 362-3000
Fax: (301) 344-2050
E-mail: Labhelp@fcc.gov
Web Site: www.fcc.gov/oet/

FUNCTIONAL REQUIREMENTS

Once you are certain your application is allowed in principle, you will want to focus on understanding the specific functional requirements that must be met in order for your completed device to receive certification.

DETERMINE AND COMPLY WITH



ALLOWED OUTPUT POWER

The above table illustrates the linear relationship between the fundamental frequency of operation and the allowed output power. Since the output power is allowed to climb as the frequency increases, it might at first appear that selecting the highest frequency would give the best range performance. This is not the case, however, since free space attenuation increases proportional to frequency. Thus, linear interpolation serves only to equalize the transmission's propagation characteristics so that range performance is similar across the band.

It is important to note that the RF level radiated into free space is dependent not only on raw output power but also on the type of antenna employed. Most transmitter modules, including those manufactured by Linx, have an output level that is sufficient to produce a radiated RF level that is non-compliant. The transmitter is purposely set high because many designers may wish to utilize inefficient antenna styles, such as a loop-trace or helical, for cost or cosmetic reasons. If the module is matched to a highly efficient antenna, such as a full whip or yagi,

the output power may need to be reduced externally by an attenuation pad. For further details review Linx application note #00150.

In addition to the restrictions on fundamental output power, the FCC also regulates allowed harmonic levels and occupied bandwidth. Since this application note is oriented toward users of Linx products, little detail is needed or will be given on these points as our modules are inherently designed to meet these requirements. It is important, however, to note that there are several ways in which a user can adversely affect harmonic content. The most common is the use of a poorly matched antenna. Consider, for example, an antenna that has a high Standing Wave Ratio (SWR) at the fundamental frequency and a low SWR at a harmonic frequency. When the transmitter's output power is raised to achieve maximum legal output at the fundamental, the harmonic may rise to an unacceptable level by virtue of the antenna's misplaced efficiency. Harmonics can also be affected by noise present in the transmitter supply. This noise can cause oscillator instability and subsequent spurs and harmonic events.

While these issues of legality may appear formidable, they generally are not. By choosing a correct operational frequency and using a pre-made RF module, a product designer's burden is greatly reduced. With proper attention to such basics as good layout, clean supply lines, and a properly matched antenna, RF success is a nearly painless process.

Now that your application has, hopefully, survived the legal considerations outlined above, let's consider the actual technical issues of operation in these frequencies.

BENEFITS OF OPERATION WITHIN THE 260-470MHZ BAND

First, it should be recognized that the unusual restrictions placed on the band by the FCC do more than just make your life miserable. They also help to keep this set of frequencies quite clear of interference. Other Part 15 bands, such as the 902-928MHz band, are crowded with continuous transmissions of voice, data, video and hi-level interference from microwave ovens to Spread Spectrum devices.

Second, longer transmission distances are achieved with less power. The free space propagation of frequencies in this range is

significantly better than at higher frequencies, such as 900MHz or 2.4GHz. Therefore, lower output power is needed to attain any particular distance. Since less output power is needed, transmitter power consumption is significantly reduced and battery life extended.

Third is cost effectiveness. The components used at these frequencies are significantly lower in cost than those designed for operation at higher frequencies. This allows an excellent balance between product cost and performance.

Fourth is ease of export. Many countries worldwide have allocated these frequencies for similar uses. If your product will be sold abroad, this band will provide a wide range of international compatibility.

COMMON FREQUENCIES WITHIN THE BAND AND THEIR USES

As you review Linx product offerings, you will notice three standard frequencies within the band from 260 to 470MHz. These frequencies are 315, 418, and 433.92MHz.

- 315MHz is commonly used for gate/garage door openers, security and keyless entry systems.
- 418MHz is a very clean frequency here in the US and also appropriate for operation in Canada.
- 433.92MHz is used throughout all of Europe. While it is appropriate for use here in the US and Canada, interference from amateur radio, the nearby pager band, and active RFID tags may sometimes pose a problem.

If you are a high volume user (500k+/yr.), you may wish to further reduce the potential for interference by selecting a custom frequency within the band.

SUMMARY

The 260-470MHz band is ideal for instances where control, command or status signals need to be sent. In addition, it should also be given consideration for all applications where periodic short-range analog or digital transmissions are required.

CONSIDERATIONS FOR OPERATION WITHIN 902-928MHZ BAND

INTRODUCTION

This application note is designed to give the reader a basic understanding of the technical and legal issues that apply to the operation of RF devices in the 902MHz to 928MHz band. Since the allowed use of frequencies varies considerably worldwide, it should be recognized that this resource document is intended for designers planning to operate in the United States under the rules of CFR47 Part 15.

When working with RF, a clear distinction must always be made between what is technically possible and what is legally acceptable. Since consideration of technical issues serves little purpose if the chosen frequency cannot be legally used for your intended purpose, let us consider issues of legality first.

LEGAL CONSIDERATIONS

In the United States, the Federal Communications Commission (FCC) is responsible for the regulation of all RF devices. These regulations are contained in the Code of Federal Regulations (CFR), Title 47. Title 47 is made up of numerous volumes, however, all regulations applicable to operation in the 902 to 928MHz band are contained in volume 0-19. 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 UNLICENSED OPERATION?

Here in the United States, the FCC requires any device that intentionally radiates RF energy to be tested for compliance with FCC rules. Certain bands within the RF spectrum are available for "Unlicensed" operation. 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.

The frequencies from 902 to 928MHz are allocated for a wide variety of unlicensed applications. Under Part 15 and Part 18 a wide variety of narrow band, spread spectrum and Industrial/Scientific/Medical (ISM) devices are allowed legal operation. In most instances, users of modules manufactured by Linx will seek certification under Part 15.249.

WHAT MUST I DO TO BE UNLICENSED?

Part 15 requirements for many bands are somewhat obscure and difficult to interpret. Thankfully, the regulations of Part 15.249 are very straightforward.

Comply with allowed power output, harmonic and spurious requirements.

Devices operating under Part 15.249 are allowed a maximum fundamental field strength of 50,000 microvolts and harmonics of 500 microvolts measured at three meters. All spurious radiation shall be attenuated to the lesser of 50dB below the fundamental or to 200 microvolts below 960MHz or 500 microvolts above. Linx modules are inherently designed to meet these requirements, but it is important to note that external factors can affect the module's compliance. The RF level radiated into free space is dependent not only on raw output power but also on the type of antenna employed. Most transmitter modules, including those manufactured by Linx, have an output level that is sufficient to produce a radiated RF level that is non-compliant. The transmitter is purposely set high because many designers may wish to utilize inefficient antenna styles for cost or cosmetic reasons. If the module is matched to a highly efficient antenna or one that exhibits gain characteristics, such as a full whip or yagi, the output power may need to be reduced externally by an attenuation pad. For further details, review Linx application note #00150.

On the other hand, a badly matched antenna can be equally damaging. Consider, for

example, an antenna that has a high Standing Wave Ratio (SWR) at the fundamental frequency and a low SWR at a harmonic frequency. This misplaced antenna efficiency may cause the harmonic power to rise to an unacceptable level. Harmonics can also be affected by noise present in the transmitter power supply. This noise can cause oscillator instability and subsequent spurs and harmonic events.

While these issues of legality may appear formidable, they are generally not. By choosing a correct operational frequency and using a pre-made RF module, a product designer's burden is greatly reduced. With proper attention to such basics as good layout, clean supply lines, and a properly matched antenna, RF success is a nearly painless process.

Now that you have a basic overview of legal issues, let us consider the actual technical issues of operation in these frequencies.

BENEFITS OF OPERATION WITHIN THE 902-928MHZ BAND

First is freedom. The band is free of the tight FCC restrictions that limit the applications for which other bands can be used. In the 902-928MHz band, virtually any analog or data signal can be sent without restrictions on content or duration.

Second, higher legal output power yields longer transmission distances than many other bands.

Third, the propagation of frequencies in the 900MHz range is better than at higher frequencies, such as 2.4GHz. Therefore, lower output power is needed to attain any particular distance. Since less output power is needed, transmitter power consumption is reduced.

Fourth is antenna compactness. A useful by-product of higher frequency is shorter wavelength. This allows a 1/4-wave antenna in the 900MHz range to be typically less than 3.25 inches in length, allowing for easy concealment in compact portable products.

DRAWBACKS TO THE 902-928MHZ BAND

First, the lack of restriction on the band has caused it to become increasingly popular and, thus, congested. Many products that transmit continuous data at high rates are now migrating to higher frequencies, but the

popularity of the band makes it likely to remain crowded.

Second, higher level interferers. In addition to its allocation for narrow-band devices the 902-928MHz frequency range is also allocated for, and surrounded by, potentially higher-level interferers, such as spread spectrum devices. Linx modules employ a variety of techniques to minimize the possible impact to a user from such interference, including SAW filtration, uncommon frequency allocation, channel qualification and constant carrier modulation techniques.

Third is difficulty of export. Most countries outside the US do not allow similar operation in the 900MHz band, so it is usually impractical to export a device that operates in this range. Fortunately, nearby frequencies are being standardized in large market areas such as Europe. Linx will offer pin- and function-compatible products allowing accommodation of both domestic and export requirements with just a change of modules and antennas.

SUMMARY

The 902-928MHz band is ideal for instances where analog or digital signals prohibited in other bands need to be sent. In addition, it should also be given consideration for all applications where high performance analog or digital transmissions are required.

FREQUENTLY ASKED QUESTIONS

How can I obtain more information on the approval process?

You may wish to obtain additional literature and application notes from Linx by visiting our website at www.linxtechnologies.com. You may also visit the FCC's website at www.fcc.gov, email them at fccinfo@fcc.gov or call them at 1-888-CALL-FCC.

Where can I obtain a copy of the FCC Rules and Regulations?

The Rules and Regulations can be found online at:

<http://www.fcc.gov/searchtools.html#rules>

CFR Title 47, Parts 2 and 15 cover the use of Linx products. Excerpts from these parts are contained in this document. For a paper copy, you should go to the Government Printing Office's web site at:

<http://bookstore.gpo.gov/>

and indicate that you need a copy of Title 47 of the Code of Federal Regulations (47CFR). If your need is for equipment authorization, you will require Volume 1, which contains Parts 0 - 19. Their telephone number is 866-512-1800 and email is ContactCenter@gpo.gov. You can also contact the Government Printing Office in your local area for a copy of the Rules. The telephone number for the GPO in your local area can be obtained from your telephone directory or operator, listed under the Federal Government.

I wish to locate a test laboratory in my area; is there a list of laboratories in my area available?

The FCC Laboratory makes available such a listing and it is updated monthly. This information is on-line at:

<http://gulfoss2.fcc.gov/prod/oet/cf/eas/reports/TestFirmSearch.cfm>

A copy is also included in this document for your convenience.

How long will it take to receive an approval?

The testing will depend on the current backlog of the test facility that you choose. If your product passes the testing, the TCB will generally issue a Grant of Certification within a few days.

How much does testing and certification cost?

This depends largely on the test lab and how many of your their services you choose to utilize. A full service filing for a transmitter and a receiver can run about \$5,000. A reasonable average is probably about \$4,500.

What if my application is denied and I don't think the FCC correctly understood my product?

The FCC sees thousands of applications a year. Depending on your presentation, an inspector may misinterpret information. It is possible. If you feel you have fairly complied with the regulations, you will want to exercise your rights in accordance with CFR 47 2.923 and petition for reconsideration and review.

What happens if I change my design? Like a case, board, or antenna?

For certified equipment (generally your transmitter), the holder of the grant of certification, or the holder's agent, can make minor modifications to the circuitry, appearance, or other design aspects of the transmitter. Minor modifications are divided into two categories: Class I Permissive Changes and Class II Permissive Changes. Major changes are not permitted.

Minor changes that do not increase the radio frequency emissions from the transmitter do not require the grantee to file any information with the FCC. These are called Class I Permissive Changes. (Note: if a Class I Permissive Change causes your product to look different from the one that was certified, it is strongly suggested that photos of the modified transmitter be filed with the FCC.)

Minor changes that increase the radio frequency emissions from the transmitter require the grantee to file complete information about the change along with results of tests showing that the equipment continues to comply with FCC technical standards. In this case, the modified equipment may not be marketed under the existing grant of certification prior to acknowledgement by the Commission that the change is acceptable. These are called Class II Permissive Changes.

Major changes require that a new grant be

obtained by submitting a new application with complete test results. Some examples of major changes include: changes to the basic frequency determining and stabilizing circuitry; changes to the frequency multiplication stages or basic modulator circuit; and major changes to the size, shape or shielding properties of the case.

No changes are permitted to certified equipment by anyone other than the grantee or the grantee's designated agent except, however, that changes to the FCC ID without any other changes to the equipment may be performed by anyone by filing an abbreviated application.

The receiver is covered by a Declaration of Conformity (DoC), which states that the product was tested by the Grantee and found to comply with the applicable technical standards. The test data should be kept on file with the Grantee, but nothing is actually filed with the FCC. This means that you will just need to have data on your product on file that show that the modified product still complies with the regulations. Nothing needs to be filed with the FCC for changes in products covered by a DoC.

Where can I look up information on equipment if I know the FCC ID #?

The FCC maintains a database that can be searched on the Internet. The database contains information on all equipment that was granted through the Equipment Authorization process. You can search the database with a simple string search tool at:

<https://gulfoss2.fcc.gov/prod/oet/cf/eas/reports/GenericSearch.cfm>

What happens if one sells or uses non-compliant low-power transmitters?

Bad idea. The FCC rules are designed to control the marketing of low-power transmitters and, to a lesser extent, their use. The act of selling or leasing, offering to sell or lease, or importing a low-power transmitter that has not gone through the appropriate FCC equipment authorization procedure is a violation of the Commission's rules and federal law. Violators may be subject to an enforcement action by the Commission's Field Operations Bureau that could result in:

- forfeiture of all non-compliant equipment
- \$100,000/\$200,000 criminal penalty for an individual/organization

- a criminal fine totaling twice the gross gain obtained from sales of the non-compliant equipment
- an administrative fine totaling \$10,000/day per violation, up to a maximum of \$75,000

What if my intended use or application does not seem to have been clearly addressed by the FCC?

Recognizing that new uses of low-power transmitters often generate questions that are not directly addressed in the regulations, the FCC generally welcomes inquiries or requests for specific interpretations. Occasionally, the FCC proposes changes to its regulations, generally to address industry concerns and/or as new uses of low-power transmission equipment appear. Any questions can be directed to the FCC at fccinfo@fcc.gov or 1-888-CALL-FCC.

How close to the products tested are production units required to be?

In the FCC's own word: identical. However, "identical" is further defined as identical within the variations that can be expected to arise as a result of quantity-production techniques. One of the advantages of using Linx modules is the tight production control and testing procedures to which the modules are subject. Similar controls over the rest of your product's production will make compliance with these requirements straightforward.

Does the receiver need to be certified?

The receivers must be issued a Declaration of Conformity (DOC) by an approved test lab. This is far less complicated and expensive than a transmitter certification. There is not an actual filing with the FCC just keep these documents in your company files.

CONTACTING THE FCC

To further assist you through the legal maze, you may want to turn to the agency responsible for it. Here are some contacts at the FCC you may find useful.

FCC FORMS

Forms can be downloaded from the FCC's website at <http://www.fcc.gov/oet/info/forms/> or can be ordered by calling 1-800-418-3676. FCC Forms may be reproduced under the conditions specified in 47 CFR, Section 0.409 of the Rules.

QUESTIONS/CONCERNS

Questions concerning equipment authorization procedures and FCC Form 731 should be addressed to:

Federal Communications Commission
Office of Engineering and
Technology Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046-1609
Phone: (301) 362-3000
Fax: (301) 362-3290
E-mail: labinfo@fcc.gov

PUBLIC ACCESS LINK (PAL)

The FCC provides an on-line information service called PAL. PAL can be used to check the status of equipment authorizations and to learn more about the FCC Rules. PAL can be found at:

http://www.fcc.gov/cgi-bin/EFBoards/systemstatus.cgi?index_t=../pub/e-file/EFBoards.html

INFORMATION SOURCES:

FCC Website	http://www.fcc.gov
FCC Office of Engineering and Technology	http://www.fcc.gov/oet/
Test Site List	http://gulfoss2.fcc.gov/prod/oet/cf/eas/reports/TestFirmSearch.cfm
Equipment Authorization Database	https://gulfoss2.fcc.gov/prod/oet/cf/eas/reports/GenericSearch.cfm
Part 15 Interpretations	http://www.fcc.gov/oet/info/database/letters/
Public Notice	http://www.fcc.gov/oet/info/ then link to "Public Notices"
Orders	http://www.fcc.gov/oet/info/ then link to "Orders"
News Releases	http://www.fcc.gov/oet/info/ then link to "News Releases"
Fee Filing Guide	http://wireless.fcc.gov/feesforms/feeguide/index.html
Radio Spectrum Guide	http://www.fcc.gov/oet/spectrum/
Application Filing	http://www.fcc.gov/oet/info/filing/
Equipment Authorization	http://www.fcc.gov/oet/ea/

GENERAL INFORMATION

General questions about the FCC can be directed to:

Federal Communications Commission
445 12th Street, SW
Washington, DC 20554
Phone: 1-888-225-5322
Fax: (202) 418-0710
E-mail: fccinfo@fcc.gov
Website: www.fcc.gov

Code of Federal Regulations

Telecommunication

Excerpted

PART 2

Revised as of October 22, 2004

These excerpts are provided as a service to our customers. Every effort has been made to include applicable portions and to insure the accuracy of this document, however, Linx Technologies assumes no responsibility for the accuracy of this reprint and under no circumstance shall be liable for loss or damage resulting from its use. The complete text should be obtained from a US Government bookstore, printing office, or the FCC web site prior to beginning in-depth product development.

**Subpart J—Equipment
Authorization Procedures**
**Source: 39 FR 5919, Feb. 15,
1974, unless otherwise noted.**
General Provisions

Sec. 2.901 Basis and purpose.

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated. In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

[61 FR 31045, June 19, 1996, as amended at 62 FR 10470, Mar. 7, 1997; 63 FR 36597, July 7, 1998]

Sec. 2.902 Verification.

(a) Verification is a procedure where the manufacturer makes measurements or takes the necessary steps to insure that the equipment complies with the appropriate technical standards. Submittal of a sample unit or representative data to the Commission demonstrating compliance is not required unless specifically requested by the Commission pursuant to Sec. 2.957, of this part.

(b) Verification attaches to all items subsequently marketed by the manufacturer or importer which are identical as defined in Sec. 2.908 to the sample tested and found acceptable by the manufacturer.

(Secs. 4, 303, 307, 48 Stat., as amended, 1066, 1082, 1083; 47 U.S.C. 154, 303, 307)

[46 FR 23249, Apr. 24, 1981]

Sec. 2.906 Declaration of Conformity.

(a) A Declaration of Conformity is a procedure where the responsible party, as defined in Sec. 2.909, makes measurements or takes other necessary steps to ensure that the equipment complies with the appropriate technical standards. Submittal of a sample unit or representative data to the Commission demonstrating compliance is not required unless specifically requested pursuant to Sec. 2.1076.

(b) The Declaration of Conformity attaches to all items subsequently marketed by the responsible party which are identical, as defined in Sec. 2.908, to the sample tested and found acceptable by the responsible party.

[61 FR 31045, June 19, 1996]

Sec. 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representations and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Sec. 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Sec. 2.1043.

[39 FR 5919, Feb. 15, 1974, as amended at 39 FR 27802, Aug. 1, 1974; 63 FR 36597, July 7, 1998]

Sec. 2.908 Identical defined.

As used in this subpart, the term identical means identical within the variation that can be expected to arise as a result of quantity production techniques.

(Secs. 4, 303, 307, 48 Stat., as amended, 1066, 1082, 1083; 47 U.S.C. 154, 303, 307)

[46 FR 23249, Apr. 24, 1981]

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

[54 FR 17712, Apr. 25, 1989, as amended at 61 FR 31045, June 19, 1996; 62 FR 10470, Mar. 7, 1997; 62 FR 41880, Aug. 4, 1997]

**Application Procedures for
Equipment Authorizations**

Sec. 2.911 Written application required.

(a) An application for equipment authorization shall be filed on a form prescribed by the Commission.

(b) Each application shall be accompanied by all information required by this subpart and by those parts of the rules governing operation of the equipment, and by requisite test data, diagrams, etc., as specified in this subpart and in those sections of rules whereunder the equipment is to be operated.

(c) Each application including amendments thereto, and related statements of fact required by the Commission, shall be personally signed by the applicant if the applicant is an individual; by one of the partners if the applicant is a partnership; by an officer, if the applicant is a corporation; or by a member who is an officer, if the applicant is an unincorporated association: Provided, however, That the application may be signed by the applicant's authorized representative who shall indicate his title, such as plant manager, project engineer, etc.

(d) Technical test data shall be signed by the person who performed or supervised the tests. The person signing the test data shall attest to the accuracy of such data. The Commission may require such person to submit a statement showing that he is qualified to make or supervise the required measurements.

(e) The signatures of the applicant and the person

certifying the test data shall be made personally by those persons on the original application; copies of such documents may be conformed. Signatures and certifications need not be made under oath.

(f) Each application shall be accompanied by the processing fee prescribed in subpart G of part 1 of this chapter.

(g) Signed, as used in this section, means an original handwritten signature; however, the Office of Engineering and Technology may allow signature by any symbol executed or adopted by the applicant with the intent that such symbol be a signature, including symbols formed by computer-generated electronic impulses.

[39 FR 5919, Feb. 15, 1974, as amended at 39 FR 27802, Aug. 1, 1974; 52 FR 5294, Feb. 20, 1987. Redesignated at 54 FR 17712, Apr. 25, 1989; 63 FR 36598, July 7, 1998]

Sec. 2.913 Submittal of equipment authorization application or information to the Commission.

(a) Unless otherwise directed, applications with fees attached for the equipment authorization, pursuant to Sec. 1.1103 of this chapter, must be submitted following the procedures described in Sec. 0.401(b) of this chapter. The address for applications submitted by mail is: Federal Communications Commission, Equipment Approval Services, P. O. Box 358315, Pittsburgh, PA 15251-5315. If the applicant chooses to make use of an air courier/package delivery service, the following address must appear on the outside of the package/envelope: Federal Communications Commission, c/o Mellon Bank, Three Mellon Bank Center, 525 William Penn Way, 27th floor, Room 153-2713, Pittsburgh, Pennsylvania 15259-0001, Attention: Wholesale Lockbox Supervisor.

(b) Any information or equipment samples requested by the Commission pursuant to the provisions of subpart J of this part shall, unless otherwise directed, be submitted to the Federal Communications Commission, Equipment Authorization Division, 7435 Oakland Mills Road, Columbia, Maryland 21046.

(c) Effective October 5, 1999, all applications for equipment authorization must be filed electronically. The Commission will be amenable to consideration of waiver requests from small businesses that find it a hardship to file applications electronically. Information on the procedures for electronically filing equipment authorization applications can be obtained from the address in paragraph (b) of this section.

[61 FR 31045, June 19, 1996, as amended at 62 FR 10470, Mar. 7, 1997; 63 FR 36598, July 7, 1998]

Sec. 2.915 Grant of application.

(a) The Commission will grant an application for certification if it finds from an examination of the application and supporting data, or other matter which it may officially notice, that:

(1) The equipment is capable of complying with pertinent technical standards of the rule part(s) under which it is to be operated; and,

(2) A grant of the application would serve the public interest, convenience and necessity.

(b) Grants will be made in writing showing the effective date of the grant and any special condition(s) attaching to the grant.

(c) Certification shall not attach to any equipment, nor shall any equipment authorization be deemed effective, until the application has been granted.

[39 FR 5919, Feb. 15, 1974, as amended at 48 FR 3621, Jan. 26, 1983; 62 FR 10470, Mar. 7, 1997; 63 FR 36598, July 7, 1998]

Sec. 2.917 Dismissal of application.

(a) An application which is not in accordance with the provisions of this subpart may be dismissed.

(b) Any application, upon written re-quest signed by the applicant or his attorney, may be dismissed prior to a determination granting or denying the authorization requested.

(c) If an applicant is requested by the Commission to file additional documents or information and fails to submit the requested material within 60 days, the application may be dismissed.

[39 FR 5919, Feb. 15, 1974, as amended at 62 FR 10470, Mar. 7, 1997]

Sec. 2.919 Denial of application.

If the Commission is unable to make the findings specified in Sec. 2.915(a), it will deny the application. Notification to the applicant will include a statement of the reasons for the denial.

Sec. 2.921 Hearing on application.

Whenever it is determined that an application for equipment authorization presents substantial factual questions relating to the qualifications of the applicant or the equipment (or the effects of the use thereof), the Commission may designate the application for hearing. A hearing on an application for an equipment authorization shall be conducted in the same manner as a hearing on a radio station application as set out in subpart B of part 1 of this chapter.

Sec. 2.923 Petition for reconsideration; application for review.

Persons aggrieved by virtue of an equipment authorization action may file with the Commission a petition for reconsideration or an application for review. Rules governing the filing of petitions for reconsideration and applications for review are set forth in Secs. 1.106 and 1.115, respectively, of this chapter.

Sec. 2.924 Marketing of electrically identical equipment having multiple trade names and models or type numbers under the same FCC Identifier.

The grantee of an equipment authorization may market devices having different model/type numbers or trade names without additional authorization from the Commission, provided that such devices are electrically identical and the equipment bears an FCC Identifier validated by a grant of equipment authorization. A device will be considered to be electrically identical if no changes are made to the device authorized by the Commission, or if the changes made to the device would be treated as class I permissive changes within the scope of Sec. 2.1043(b)(1). Changes to the model number or trade name by anyone other than the grantee, or under the authorization of the grantee, shall be performed following the procedures in Sec. 2.933.

[62 FR 10470, Mar. 7, 1997, as amended at 63 FR 36598, July 7, 1998]

Sec. 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 Sec. 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 radio frequency 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) A software defined radio may be equipped with a means such as a user display screen to display the FCC identification number normally contained in the nameplate or label. The information must be readily accessible, and the user manual must describe how to access the electronic display.

(f) Where it is shown that a permanently affixed

nameplate 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.

(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.

[44 FR 17177, Mar. 21, 1979, as amended at 44 FR 55574, Sept. 27, 1979; 46 FR 21013, Apr. 8, 1981; 52 FR 21687, June 9, 1987; 54 FR 1698, Jan. 17, 1989; 62 FR 10470, Mar. 7, 1997; 66 FR 50840, Oct. 5, 2001]

Sec. 2.926 FCC identifier.

(a) A grant of equipment authorization issued by the Commission will list the validated FCC Identifier consisting of the grantee code assigned by the FCC pursuant to paragraph (b) of this section, and the equipment product code assigned by the grantee pursuant to paragraph (c) of this section. See Sec. 2.925.

(b) The grantee code assigned pursuant to paragraph (c) of this section is assigned permanently to applicants/ grantees and is valid only for the party specified as the applicant/grantee in the code assignment(s).

(c) A grantee code will have three characters consisting of Arabic numerals, capital letters, or combination thereof. A prospective grantee or his authorized representative may submit a written request to the Commission for assignment of a grantee code at any time. However, it is preferred that grantee codes be requested prior to filing applications for equipment authorization. If a grantee code is not requested in advance, one will be assigned at the time an application is received by the FCC Laboratory and the applicant will be notified to make any necessary label revisions in order to comply fully with application procedural rules.

(1) After assignment of a grantee code each grantee will continue to use the same grantee code for subsequent equipment authorization applications.

In the event the grantee name is changed or ownership is transferred, the circumstances shall be reported to the Commission so that a new grantee code can be assigned, if appropriate. See Secs. 2.934 and 2.935 for additional information.

(2) [Reserved]

(d) The equipment product code as-igned by the

grantee shall consist of a series of Arabic numerals, capital letters or a combination thereof, and may include the dash or hyphen (-). The total of Arabic numerals, capital letters and dashes or hyphens shall not exceed 14 and shall be one which has not been previously used in conjunction with:

- (1) The same grantee code, or
- (2) An application denied pursuant to Sec. 2.919 of this chapter.
- (e) No FCC Identifier may be used on equipment to be marketed unless that specific identifier has been validated by a grant of equipment authorization issued by the Commission. This shall not prohibit placement of an FCC identifier on a transceiver which includes a verified receiver subject to Sec. 15.101, provided that the transmitter portion of such transceiver is covered by a valid grant of type acceptance or certification. The FCC Identifier is uniquely assigned to the grantee and may not be placed on the equipment without authorization by the grantee. See Sec. 2.803 for conditions applicable to the display at trade shows of equipment which has not been granted equipment authorization where such grant is required prior to marketing. Labeling of such equipment may include model or type numbers, but shall not include a purported FCC Identifier.

[44 FR 17179, Mar. 21, 1979, as amended at 46 FR 21014, Apr. 8, 1981; 52 FR 21687, June 9, 1987; 54 FR 1698, Jan. 17, 1989; 62 FR 10471, Mar. 7, 1997]

Conditions Attendant to an Equipment Authorization

Sec. 2.927 Limitations on grants.

- (a) A grant of equipment authorization is valid only when the FCC Identifier is permanently affixed on the device and remains effective until revoked or withdrawn, rescinded, surrendered, or a termination date is otherwise established by the Commission.
- (b) A grant of an equipment authorization signifies that the Commission has determined that the equipment has been shown to be capable of compliance with the applicable technical standards if no unauthorized change is made in the equipment and if the equipment is properly maintained and operated. The issuance of a grant of equipment authorization shall not be construed as a finding by the Commission with respect to matters not encompassed by the Commission's rules, especially with respect to compliance with 18 U.S.C. 2512.
- (c) No person shall, in any advertising matter, brochure, etc., use or make reference to an equipment authorization in a deceptive or misleading manner or convey the impression that such equipment authorization reflects more than a Commission determination that the device or

product has been shown to be capable of compliance with the applicable technical standards of the Commission's rules.

[39 FR 5919, Feb. 15, 1974, as amended at 44 FR 29066, May 18, 1979; 62 FR 10471, Mar. 7, 1997]

Sec. 2.929 Changes in name, address, ownership or control of grantee.

- (a) An equipment authorization issued by the Commission may not be assigned, exchanged or in any other way transferred to a second party, except as provided in this section.
- (b) The grantee of an equipment authorization may license or otherwise authorize a second party to manufacture the equipment covered by the grant of the equipment authorization provided:
 - (1) The equipment manufactured by such second party bears the FCC Identifier as is set out in the grant of the equipment authorization.

NOTE TO PARAGRAPH (b)(1): Any change in the FCC Identifier desired as a result of such production or marketing agreement will require the filing of a new application for an equipment authorization as specified in Sec. 2.933.

- (2) The grantee of the equipment authorization shall continue to be responsible to the Commission for the equipment produced pursuant to such an agreement.
- (c) Whenever there is a change in the name and/or address of the grantee of an equipment authorization, written notice of such change(s) shall be submitted to the Commission within 30 days after the grantee starts using the new name and/or address.

(d) In the case of transactions affecting the grantee, such as a transfer of control or sale to another company, mergers, or transfer of manufacturing rights, notice must be given to the Commission in writing within 60 days after the consummation of the transaction. Depending on the circumstances in each case, the Commission may require new applications for equipment authorization. In reaching a decision the Commission will consider whether the acquiring party can adequately ensure and accept responsibility for continued compliance with the regulations. In general, new applications for each device will not be required. A single application for equipment authorization may be filed covering all the affected equipment.

[63 FR 36598, July 7, 1998]

Sec. 2.931 Responsibility of the grantee.

In accepting a grant of an equipment authorization, the grantee warrants that each unit of equipment marketed under such grant and bearing the identification specified in the grant will conform to the unit that was measured and that the data (design and rated operational characteristics) filed with the application for certification continues to be representative of the equipment being produced under such grant within the variation that can be expected due to quantity production and testing on a statistical basis.

[63 FR 36598, July 7, 1998]

Sec. 2.932 Modification of equipment.

- (a) A new application for an equipment authorization shall be filed whenever there is a change in the design, circuitry or construction of an equipment or device for which an equipment authorization has been issued, except as provided in paragraphs (b) through (d) of this section.
- (b) Permissive changes may be made in certificated equipment, and equipment that was authorized under the former type acceptance procedure, pursuant to Sec. 2.1043.
- (c) Permissive changes may be made in equipment that was authorized under the former notification procedure without submittal of information to the Commission, unless the equipment is currently subject to authorization under the certification procedure. However, the grantee shall submit information documenting continued compliance with the pertinent requirements upon request.

(d) All requests for permissive changes submitted to the Commission must be accompanied by the anti-drug abuse certification required under Sec. 1.2002 of this chapter.

(e) Manufacturers must take steps to ensure that only software that has been approved with a software defined radio can be loaded into such a radio.

The software must not allow the user to operate the transmitter with frequencies, output power, modulation types or other parameters outside of those that were approved. Manufacturers may use authentication codes or any other means to meet these requirements, and must describe the methods in their application for equipment authorization.

[63 FR 36598, July 7, 1998, as amended at 66 FR 50840, Oct. 5, 2001]

Sec. 2.933 Change in identification of equipment.

(a) A new application for equipment authorization shall be filed whenever there is a change in the FCC Identifier for the equipment with or without a change in design, circuitry or construction. However, a change in the model/ type number or trade name performed in accordance with the provisions in Sec. 2.924 of this chapter is not considered to be a change in identification and does not require additional authorization from the Commission.

(b) An application filed pursuant to paragraph (a) of this section where no change in design, circuitry or construction is involved, need not be accompanied by a resubmission of equipment or measurement or test data customarily required with a new application, unless specifically requested by the Commission. In lieu thereof, the applicant shall attach a statement setting out:

- (1) The original identification used on the equipment prior to the change in identification.
- (2) The date of the original grant of the equipment authorization.

(3) How the equipment bearing the modified identification differs from the original equipment.

(4) Whether the original test results continue to be representative of and applicable to the equipment bearing the changed identification.

(5) The photographs required by Sec. 2.1033(b)(7) or Sec. 2.1033(c)(12) showing the exterior appearance of the equipment, including the operating controls available to the user and the identification label. Photographs of the construction, the component placement on the chassis, and the chassis assembly are not required to be submitted unless specifically requested by the Commission.

(c) If the change in the FCC Identifier also involves a change in design or circuitry which falls outside the purview of a permissive change described in Sec. 2.1043, a complete application shall be filed pursuant to Sec. 2.911.

[63 FR 36598, July 7, 1998]

Sec. 2.936 FCC inspection.

Upon reasonable request, each responsible party shall submit the following to the Commission or shall make the following available for inspection:

(a) The records required by Secs. 2.938, 2.955, and 2.1075.

(b) A sample unit of the equipment covered under an authorization.

(c) The manufacturing plant and facilities.

[62 FR 10471, Mar. 7, 1997]

Sec. 2.937 Equipment defect and/or design change.

When a complaint is filed with the Commission concerning the failure of equipment subject to this chapter to comply with pertinent requirements of the Commission's rules, and the Commission determines that the complaint is justified and arises out of an equipment fault attributable to the responsible party, the Commission may require the responsible party to investigate such complaint and report the results of such investigation to the Commission. The report shall also indicate what action if any has been taken or is proposed to be taken by the responsible party to correct the defect, both in terms of future production and with reference to articles in the possession of users, sellers and distributors.

[61 FR 31046, June 19, 1996]

Sec. 2.938 Retention of records.

(a) For each equipment subject to the Commission's equipment authorization standards, the responsible party shall maintain the records listed as follows:

(1) A record of the original design drawings and specifications and all changes that have been made that may affect compliance with the standards and the requirements of Sec. 2.931.

(2) A record of the procedures used for production

inspection and testing to ensure conformance with the standards and the requirements of Sec. 2.931.

(3) A record of the test results that demonstrate compliance with the appropriate regulations in this chapter.

(b) The provisions of paragraph (a) of this section shall also apply to a manufacturer of equipment produced under the provisions of Sec. 2.929(b). The retention of the records by the manufacturer under these circumstances shall satisfy the grantee's responsibility under paragraph (a) of this section.

(c) The records listed in paragraph (a) of this section shall be retained for one year for equipment subject to authorization under the certification procedure or former type acceptance procedure, or for two years for equipment subject to authorization under any other procedure, after the manufacture of said equipment has been permanently discontinued, or until the conclusion of an investigation or a proceeding if the responsible party (or, under paragraph (b) of this section, the manufacturer) is officially notified that an investigation or any other administrative proceeding involving its equipment has been instituted.

(d) If radio frequency equipment is modified by any party other than the original responsible party, and that party is not working under the authorization of the original responsible party, the party performing the modifications is not required to obtain the original design drawings specified in paragraph (a)(1) of this section. However, the party performing the modifications must maintain records showing the changes made to the equipment along with the records required in paragraphs (a)(3) of this section. A new equipment authorization may also be required. See, for example, Secs. 2.909, 2.924, 2.933, and 2.1043.

[62 FR 10471, Mar. 7, 1997, as amended at 63 FR 36599, July 7, 1998]

Sec. 2.939 Revocation or withdrawal of equipment authorization.

(a) The Commission may revoke any equipment authorization:

(1) For false statements or representations made either in the application or in materials or response submitted in connection therewith or in records required to be kept by Sec. 2.938.

(2) If upon subsequent inspection or operation it is determined that the equipment does not conform to the pertinent technical requirements or to the representations made in the original application.

(3) If it is determined that changes have been made in the equipment other than those authorized by the rules or otherwise expressly authorized by the Commission.

(4) Because of conditions coming to the attention of the Commission which would warrant it in refusing to grant an original application.

(b) Revocation of an equipment authorization shall be made in the same manner as revocation of radio station licenses.

(c) The Commission may withdraw any equipment authorization in the event of changes in its technical standards. The procedure to be followed will be set forth in the order promulgating such new technical standards (after appropriate rulemaking proceedings) and will provide a suitable amortization period for equipment in hands of users and in the manufacturing process.

[39 FR 5919, Feb. 15, 1974, as amended at 51 FR 39535, Oct. 29, 1986]

Sec. 2.941 Availability of information relating to grants.

(a) Grants of equipment authorization, other than for receivers and equipment authorized for use under parts 15 or 18 of this chapter, will be publicly announced in a timely manner by the Commission. Information about the authorization of a device using a particular FCC Identifier may be obtained by contacting the Commission's Office of Engineering and Technology Laboratory.

(b) Information relating to equipment authorizations, such as data submitted by the applicant in connection with an authorization application, laboratory tests of the device, etc., shall be available in accordance with Secs. 0.441 through 0.470 of this chapter.

[62 FR 10472, Mar. 7, 1997]

Sec. 2.943 Submission of equipment for testing.

(a) The Commission may require an applicant to submit one or more sample units for measurement at the Commission's laboratory.

(b) In the event the applicant believes that shipment of the sample to the Commission's laboratory is impractical because of the size or weight of the equipment, or the power requirement, or for any other reason, the applicant may submit a written explanation why such shipment is impractical and should not be required.

[39 FR 5919, Feb. 15, 1974, as amended at 48 FR 3621, Jan. 26, 1983; 63 FR 36599, July 7, 1998]

Sec. 2.944 Submission of radio software.

The grantee or other party responsible for compliance of a software defined radio, or the applicant for authorization of a software defined radio shall submit a copy of the software that controls the radio frequency operating parameters upon request by the Commission. Failure to comply with such a request within 14 days or such additional time as the Commission may allow may be cause for denial of authorization, forfeiture pursuant to Sec. 1.80 of this chapter, or other administrative sanctions.

[66 FR 50840, Oct. 5, 2001]

Sec. 2.945 Sampling tests of equipment compliance.

The Commission will, from time to time, request the responsible party to submit equipment subject to this chapter to determine the extent to which subsequent production of such equipment continues to comply with the data filed by the applicant (or on file with the responsible party for equipment subject to notification or a Declaration of Conformity). Shipping costs to the Commission's laboratory and return shall be borne by the responsible party.

[61 FR 31046, June 19, 1996]

Sec. 2.946 Penalty for failure to provide test samples and data.

(a) Any responsible party, as defined in Sec. 2.909, or any party who markets equipment subject to the provisions of this chapter, shall provide test sample(s) or data upon request by the Commission. Failure to comply with such a request within 14 days may be cause for forfeiture, pursuant to Sec. 1.80 of this chapter, or other administrative sanctions such as suspending action on any applications for equipment authorization submitted by such party while the matter is being resolved.

(b) The Commission may consider ex-tensions of time upon submission of a showing of good cause.

[63 FR 36599, July 7, 1998]

Sec. 2.947 Measurement procedure.

(a) The Commission will accept data which have been measured in accordance with the following standards or measurement procedures:

(1) Those set forth in bulletins or re-ports prepared by the Commission's Office of Engineering and Technology. These will be issued as required, and specified in the particular part of the rules where applicable.

(2) Those acceptable to the Commission and published by national engineering societies such as the Electronic Industries Association, the Institute of Electrical and Electronic Engineers, Inc., and the American National Standards Institute.

(3) Any measurement procedure acceptable to the Commission may be used to prepare data demonstrating compliance with the requirements of this chapter.

(b) Information submitted pursuant to paragraph (a) of this section shall completely identify the specific standard or measurement procedure used.

(c) In the case of equipment requiring measurement procedures not specified in the references set forth in paragraphs (a) (1) and (2) of this section, the applicant shall submit a detailed description of the measurement procedures actually used.

(d) A listing of the test equipment used shall be submitted.

(e) If deemed necessary, the Commission may require additional information concerning the measurement procedures employed in obtaining

the data submitted for equipment authorization purposes.

[42 FR 44987, Sept. 8, 1977, as amended at 44 FR 39181, July 5, 1979; 51 FR 12616, Apr. 14, 1986]

Sec. 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under part 15 or part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

(3) If the equipment is to be authorized under a Declaration of Conformity, the description of the measurement facilities shall be retained by the party performing the measurements.

(b) The description shall contain the following information:

(1) Location of the test site.

(2) Physical description of the test site accompanied by photographs of size A4 (21 cm × 29.7 cm) or 8×10 inches (20.3 cm × 25.4 cm). Smaller photographs may be used if they clearly show the details of the test site and are mounted on full size sheets of paper.

(3) A drawing showing the dimensions of the site,

physical layout of all supporting structures, and all structures within 5 times the distance between the measuring antenna and the device being measured.

(4) Description of structures used to support the device being measured and the test instrumentation.

(5) List of measuring equipment used.

(6) Information concerning the calibration of the measuring equipment, i.e., the date the equipment was last calibrated and how often the equipment is calibrated.

(7) If desired, a statement as to whether the test site is available to do measurement services for the public on a fee basis.

(8) A plot of site attenuation data.

(i) For a measurement facility that will be used for testing radiated emissions from a digital device on or after May 1, 1994, or for testing intentional and other unintentional radiators authorized under part 15 of the rules on or after June 1, 1995, the site attenuation data shall be taken pursuant to the procedures contained in Sections 5.4.6 through 5.5 of the following procedure: American National Standards Institute (ANSI) C63.4-1992, entitled "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz," published by the Institute of Electrical and Electronics Engineers, Inc. on July 17, 1992 as document number SH15180. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies of ANSI C63.4-1992 may be obtained from: IEEE Standards Department, 455 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, telephone 1-800-678-4333. Copies of ANSI C63.4-1992 may be inspected at the following locations:

(A) Federal Communications Com-mission, 445 12th Street, SW., Office of Engineering and Technology, Washington, DC 20554,

(B) Federal Communications Com-mission Laboratory, 7435 Oakland Mills Road, Columbia, MD 21046, or

(C) Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

(ii) For a measurement facility that will be used for testing radiated emissions from a digital device prior to May 1, 1994, or from intentional and other unintentional radiators authorized under part 15 prior to June 1, 1995, or from devices authorized under part 18 of the rules, the site attenuation data shall be taken pursuant to either ANSI C63.4-1992, Sections 5.4.6 through 5.5, or FCC/OET Bulletin 55.

(iii) This requirement does not apply to equipment that is not measured on an open field test site.

(9) A description of the types of equipment intended to be measured or other information regarding the

types of measurements that would be performed at the test facility.

(c) The Commission will publish a list of those parties who have filed the information required by this section, provided they indicate that they wish to perform measurement services for the public on a fee basis. However, it should be noted that the Commission does not endorse or approve any facility on this list.

(d) If the equipment is to be authorized under a Declaration of Conformity, the party performing the measurements shall be accredited for performing such measurements by an authorized accreditation body based on the International Organization for Standardization/International Electro-technical Commission (ISO/IEC) Guide 25, "General Requirements for the Competence of Calibration and Testing Laboratories." Accreditation bodies must be approved by the FCC's Office of Engineering and Technology, as indicated in § 0.241 of this chapter, to perform such accreditation based on ISO/IEC 58, "Calibration and Testing Laboratory Accreditation Systems-General Requirements for Operation and Recognition." The frequency for revalidation of the test site and the information required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization.

(1) In addition to meeting the above requirements, the accreditations of laboratories located outside of the United States or its possessions will be acceptable only under one of the following conditions:

(i) If there is a mutual recognition agreement between that country and the United States and that laboratory is covered by the agreement;

(ii) If there is an agreement between accrediting bodies that permits similar accreditation of U.S. facilities to perform testing for products marketed in that country; or

(iii) If the country already accepts the accreditation of U.S. laboratories.

(2) Organizations outside of the United States that seek to become accreditors may seek agreements with approved United States accrediting bodies to mutually recognize the accreditation of laboratories. The Commission will review such agreements and will consult with the Office of the United States Trade Representative and other Executive Branch agencies before accepting them for purposes of the DoC procedure in order to ensure that the respective foreign countries accept United States accreditations and do not impose additional barriers upon United States companies. Accrediting bodies located outside of the United States will only be permitted to accredit laboratories within their own country for DoC testing.

(3) To facilitate use of the DoC procedure, the FCC will accept a laboratory that submits documentation to OET's Equipment Authorization Division stating that it has filed an application for accreditation with an approved laboratory accreditation body and

provides evidence that it meets all aspects of ISO/IEC Guide 25. Such labs will be provisionally accepted by the FCC for a period of one year (until August 19, 1997) or until the application for accreditation has been acted upon, whichever is sooner. A laboratory that is denied accreditation by an approved accreditation body will lose its provisional acceptance. However, any DoCs that were issued will remain valid.

[54 FR 17712, Apr. 25, 1989, as amended at 57 FR 24990, June 12, 1992; 58 FR 37430, July 12, 1993; 58 FR 44893, Aug. 25, 1993; 61 FR 31046, June 19, 1996; 62 FR 41880, Aug. 4, 1997; 63 FR 36599, July 7, 1998; 65 FR 58466, Sept. 29, 2000]

Verification

AUTHORITY: Sections 2.951 through 2.957 are issued under secs. 4, 303, 307, 48 Stat., as amended, 1066, 1082, 1083; 47 U.S.C. 154, 303, 307.

SOURCE: Sections 2.951 through 2.957 appear at 46 FR 23249, Apr. 24, 1981, unless otherwise noted.

Sec. 2.951 Cross reference.

The provisions of Sec. 2.901, et seq., shall apply to equipment subject to verification.

Sec. 2.952 Limitation on verification.

(a) Verification signifies that the manufacturer or importer has determined that the equipment has been shown to be capable of compliance with the applicable technical standards if no unauthorized change is made in the equipment and if the equipment is properly maintained and operated. Compliance with these standards shall not be construed to be a finding by the manufacturer or importer with respect to matters not encompassed by the Commission's rules.

(b) Verification of the equipment by the manufacturer or importer is effective until a termination date is otherwise established by the Commission.

(c) No person shall, in any advertising matter, brochure, etc., use or make reference to a verification in a deceptive or misleading manner or convey the impression that such verification reflects more than a determination by the manufacturer or importer that the device or product has been shown to be capable of compliance with the applicable technical standards of the Commission's rules.

Sec. 2.953 Responsibility for compliance.

(a) In verifying compliance, the responsible party, as defined in Sec. 2.909 warrants that each unit of equipment marketed under the verification procedure will be identical to the unit tested and found acceptable with the standards and that the records maintained by the responsible party continue to reflect the equipment being produced under such verification within the variation that can

be expected due to quantity production and testing on a statistical basis.

(b) The importer of equipment subject to verification may upon receiving a written statement from the manufacturer that the equipment complies with the appropriate technical standards rely on the manufacturer or independent testing agency to verify compliance. The test records required by Sec. 2.955 however should be in the English language and made available to the Commission upon a reasonable request, in accordance with Sec. 2.956.

(c) In the case of transfer of control of equipment, as in the case of sale or merger of the grantee, the new manufacturer or importer shall bear the responsibility of continued compliance of the equipment.

(d) Verified equipment shall be reverified if any modification or change adversely affects the emanation characteristics of the modified equipment. The party designated in Sec. 2.909 bears responsibility for continued compliance of subsequently produced equipment.

[39 FR 5919, Feb. 15, 1974, as amended at 62 FR 10472, Mar. 7, 1997]

Sec. 2.954 Identification.

Devices subject only to verification shall be uniquely identified by the person responsible for marketing or importing the equipment within the United States. However, the identification shall not be of a format which could be confused with the FCC Identifier required on certified, notified or type accepted equipment. The importer or manufacturer shall maintain adequate identification records to facilitate positive identification for each verified device.

[62 FR 10472, Mar. 7, 1997]

Sec. 2.955 Retention of records.

(a) For each equipment subject to verification, the responsible party, as shown in Sec. 2.909 shall maintain the records listed as follows:

(1) A record of the original design drawings and specifications and all changes that have been made that may affect compliance with the requirements of Sec. 2.953.

(2) A record of the procedures used for production inspection and testing (if tests were performed) to insure the conformance required by Sec. 2.953. (Statistical production line emission testing is not required.)

(3) A record of the measurements made on an appropriate test site that demonstrates compliance with the applicable regulations in this chapter. The record shall:

(i) Indicate the actual date all testing was performed;

(ii) State the name of the test laboratory, company, or individual performing the verification testing. The Commission may request additional information

regarding the test site, the test equipment or the qualifications of the company or individual performing the verification tests;

(iii) Contain a description of how the device was actually tested, identifying the measurement procedure and test equipment that was used;

(iv) Contain a description of the equipment under test (EUT) and support equipment connected to, or installed within, the EUT;

(v) Identify the EUT and support equipment by trade name and model number and, if appropriate, by FCC Identifier and serial number;

(vi) Indicate the types and lengths of connecting cables used and how they were arranged or moved during testing;

(vii) Contain at least two drawings or photographs showing the test set-up for the highest line conducted emission and showing the test set-up for the highest radiated emission. These drawings or photographs must show enough detail to confirm other information contained in the test report. Any photographs used must be focused originals without glare or dark spots and must clearly show the test configuration used;

(viii) List all modifications, if any, made to the EUT by the testing company or individual to achieve compliance with the regulations in this chapter;

(ix) Include all of the data required to show compliance with the appropriate regulations in this chapter; and

(x) Contain, on the test report, the signature of the individual responsible for testing the product along with the name and signature of an official of the responsible party, as designated in Sec. 2.909.

(4) For equipment subject to the pro-visions in part 15 of this chapter, the records shall indicate if the equipment was verified pursuant to the transition provisions contained in Sec. 15.37 of this chapter.

(b) The records listed in paragraph (a) of this section shall be retained for two years after the manufacture of said equipment item has been permanently discontinued, or until the conclusion of an investigation or a proceeding if the manufacturer or importer is officially notified that an investigation or any other administrative proceeding involving his equipment has been instituted.

[54 FR 17713, Apr. 25, 1989, as amended at 62 FR 10472, Mar. 7, 1997]

Sec. 2.956 FCC inspection and submission of equipment for testing.

(a) Each responsible party shall upon receipt of reasonable request:

(1) Submit to the Commission the records required by Sec. 2.955.

(2) Submit one or more sample units for measurements at the Commission's Laboratory.

(i) Shipping costs to the Commission's Laboratory and return shall be borne by the responsible party.

(ii) In the event the responsible party believes that shipment of the sample to the Commission's Laboratory is impractical because of the size or weight of the equipment, or the power requirement, or for any other reason, the responsible party may submit a written explanation why such shipment is impractical and should not be required.

(b) Requests for the submission of the records in § 2.955 or for the submission of sample units are covered under the provisions of Sec. 2.946.

[62 FR 10472, Mar. 7, 1997]

2.960 Designation of Telecommunication Certification Bodies (TCBs).

(a) The Commission may designate Telecommunication Certification Bodies (TCBs) to approve equipment as required under this part. Certification of equipment by a TCB shall be based on an application with all the information specified in this part. The TCB shall process the application to determine whether the product meets the Commission's requirements and shall issue a written grant of equipment authorization. The grant shall identify the TCB and the source of authority for issuing it.

(b) The Federal Communications Commission shall designate TCBs in the United States to approve equipment subject to certification under the Commission's rules. TCBs shall be accredited by the National Institute of Standards and Technology (NIST) under its National Voluntary Conformity Assessment Evaluation (NVCASE) program, or other recognized programs based on ISO/IEC Guide 65, to comply with the Commission's qualification criteria for TCBs. NIST may, in accordance with its procedures, allow other appropriately qualified accrediting bodies to accredit TCBs and testing laboratories. TCBs shall comply with the requirements in Sec. 2.962 of this part.

(c) In accordance with the terms of an effective bilateral or multilateral mutual recognition agreement or arrangement (MRA) to which the United States is a party, bodies outside the United States shall be permitted to authorize equipment in lieu of the Commission. A body in an MRA partner economy may authorize equipment to U.S. requirements only if that economy permits bodies in the United States to authorize equipment to its requirements. The authority designating these telecommunication certification bodies shall meet the following criteria.

(1) The organization accrediting the prospective telecommunication certification body shall be capable of meeting the requirements and conditions of ISO/IEC Guide 61.

(2) The organization assessing the telecommunication certification body shall appoint a team of qualified experts to perform the assessment covering all of the elements within the scope of accreditation. For assessment of telecommunication equipment, the areas of expertise to be used during the assessment shall include, but not

be limited to, electromagnetic compatibility and telecommunication equipment (wired and wireless).

[64 FR 4995, Feb. 2, 1999]

Certification

Sec. 2.1031 Cross reference.

The general provisions of this subpart Sec. 2.901 et seq. shall apply to applications for and grants of certification.

Sec. 2.1033 Application for certification.

(a) An application for certification shall be filed on FCC Form 731 with all questions answered. Items that do not apply shall be so noted.

(b) Applications for equipment operating under Parts 11, 15 and 18 of the rules shall be accompanied by a technical report containing the following information:

(1) The full name and mailing address of the manufacturer of the device and the applicant for certification.

(2) FCC identifier.

(3) A copy of the installation and operating instructions to be furnished the user. A draft copy of the instructions may be submitted if the actual document is not available. The actual document shall be furnished to the FCC when it becomes available.

(4) A brief description of the circuit functions of the device along with a statement describing how the device operates. This statement should contain a description of the ground system and antenna, if any, used with the device.

(5) A block diagram showing the frequency of all oscillators in the device. The signal path and frequency shall be indicated at each block. The tuning range(s) and intermediate frequency(ies) shall be indicated at each block. A schematic diagram is also required for intentional radiators.

(6) A report of measurements showing compliance with the pertinent FCC technical requirements. This report shall identify the test procedure used (e.g., specify the FCC test procedure, or industry test procedure that was used), the date the measurements were made, the location where the measurements were made, and the device that was tested (model and serial number, if available). The report shall include sample calculations showing how the measurement results were converted for comparison with the technical requirements.

(7) A sufficient number of photographs to clearly show the exterior appearance, the construction, the component placement on the chassis, and the chassis assembly. The exterior views shall show the overall appearance, the antenna used with the device (if any), the controls available to the user, and the required identification label in sufficient

detail so that the name and FCC identifier can be read. In lieu of a photograph of the label, a sample label (or facsimile thereof) may be submitted together with a sketch showing where this label will be placed on the equipment. Photographs shall be of size A4 (21 cm × 29.7 cm) or 8×10 inches (20.3 cm × 25.4 cm). Smaller photographs may be submitted provided they are sharp and clear, show the necessary detail, and are mounted on A4 (21 cm × 29.7 cm) or 8.5×11 inch (21.6 cm × 27.9 cm) paper. A sample label or facsimile together with the sketch showing the placement of this label shall be on the same size paper.

(8) If the equipment for which certification is being sought must be tested with peripheral or accessory devices connected or installed, a brief description of those peripherals or accessories. The peripheral or accessory devices shall be unmodified, commercially available equipment.

(9) For equipment subject to the pro-visions of part 15 of this chapter, the application shall indicate if the equipment is being authorized pursuant to the transition provisions in Sec. 15.37 of this chapter.

(10) Applications for the certification of scanning receivers shall include a statement describing the methods used to comply with the design requirements of all parts of Sec. 15.121 of this chapter. The application must specifically include a statement assessing the vulnerability of the equipment to possible modification and describing the design features that prevent the modification of the equipment by the user to receive transmissions from the Cellular Radiotelephone Service. The application must also demonstrate compliance with the signal rejection requirement of Sec. 15.121 of this chapter, including details on the measurement procedures used to demonstrate compliance.

(11) Applications for certification of transmitters operating within the 59.0-64.0 GHz band under part 15 of this chapter shall also be accompanied by an exhibit demonstrating compliance with the provisions of Sec. 15.255 (g) and (i) of this chapter.

(c) Applications for equipment other than that operating under parts 15 and 18 of the rules shall be accompanied by a technical report containing the following information:

(1) The full name and mailing address of the manufacturer of the device and the applicant for certification.

(2) FCC identifier.

(3) A copy of the installation and operating instructions to be furnished the user. A draft copy of the instructions may be submitted if the actual document is not available. The actual document shall be furnished to the FCC when it becomes available.

(4) Type or types of emission.

(5) Frequency range.

(6) Range of operating power values or specific operating power levels, and description of any means provided for variation of operating power.

(7) Maximum power rating as defined in the

applicable part(s) of the rules.

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.

(9) Tune-up procedure over the power range, or at specific operating power levels.

(10) A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power.

(11) A photograph or drawing of the equipment identification plate or label showing the information to be placed thereon.

(12) Photographs (8"x10") of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, if any, and labels for controls and meters and sufficient views of the internal construction to define component placement and chassis assembly. Insofar as these requirements are met by photographs or drawings contained in instruction manuals supplied with the certification request, additional photographs are necessary only to complete the required showing.

(13) For equipment employing digital modulation techniques, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase and amplitude) of any filters provided, and a description of the modulating wave train, shall be submitted for the maximum rated conditions under which the equipment will be operated.

(14) The data required by Secs. 2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in Sec. 2.1041.

(15) The application for certification of an external radio frequency power amplifier under part 97 of this chapter need not be accompanied by the data required by paragraph (b)(14) of this section. In lieu thereof, measurements shall be submitted to show compliance with the technical specifications in subpart C of part 97 of this chapter and such information as required by Sec. 2.1060 of this part.

(16) An application for certification of an AM broadcast stereophonic exciter-generator intended for interfacing with existing certified, or formerly type accepted or notified transmitters must include measurements made on a complete stereophonic transmitter. The instruction book must include complete specifications and circuit requirements for interconnecting with existing transmitters. The instruction book must also provide a full description of the equipment and measurement procedures to monitor modulation and to verify that the combination of stereo exciter-generator and transmitter meet the emission limitations of Sec. 73.44.

(17) A single application may be filed for a composite system that incorporates devices subject to certification under multiple rule parts,

however, the appropriate fee must be included for each device. Separate applications must be filed if different FCC Identifiers will be used for each device.

[63 FR 36599, July 7, 1998, as amended at 63 FR 42278, Aug. 7, 1998; 64 FR 22561, Apr. 27, 1999; 67 FR 42734, June 25, 2002]

EFFECTIVE DATE NOTE: At 68 FR 54175, Sept. 16, 2003, Sec. 2.1033 was amended by adding paragraph (d), effective November 17, 2003. For the convenience of the user, the added text is set forth as follows:

Sec. 2.1033 Application for certification

(d) Applications for certification of equipment operating under part 20, that a manufacturer is seeking to certify as hearing aid compatible, as set forth in Sec. 20.19 of that part, shall include a statement indicating compliance with the test requirements of Sec. 20.19 and indicating the appropriate U-rating for the equipment. The manufacturer of the equipment shall be responsible for maintaining the test results.

Sec. 2.1035 [Reserved]

Sec. 2.1041 Measurement procedure.

For equipment operating under parts 15 and 18, the measurement procedures are specified in the rules governing the particular device for which certification is requested. For equipment operating in the authorized radio services, measurements are required as specified in Secs. 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057. See also Sec. 2.947.

[63 FR 36600, July 7, 1998]

Sec. 2.1043 Changes in certificated equipment.

(a) Except as provided in paragraph (b)(3) of this section, changes to the basic frequency determining and stabilizing circuitry (including clock or data rates), frequency multiplication stages, basic modulator circuit or maximum power or field strength ratings shall not be performed without application for and authorization of a new grant of certification. Variations in electrical or mechanical construction, other than these indicated items, are permitted provided the variations either do not affect the characteristics required to be reported to the Commission or the variations are made in compliance with the other provisions of this section. Changes to the software installed in a transmitter that do not affect the radio frequency emissions do not require a filing with the Commission and may be made by parties other than the holder of the grant of certification.

(b) Three classes of permissive changes may be made in certificated equipment without requiring a new application for and grant of certification. None of the classes of changes shall result in a change in identification.

(1) A Class I permissive change includes those modifications in the equipment which do not degrade the characteristics reported by the manufacturer and accepted by the Commission when certification is granted. No filing with the Commission is required for a Class I permissive change.

(2) A Class II permissive change includes those modifications which degrade the performance characteristics as reported to the Commission at the time of the initial certification. Such degraded performance must still meet the minimum requirements of the applicable rules. When a Class II permissive change is made by the grantee, the grantee shall supply the Commission with complete information and the results of tests of the characteristics affected by such change. The modified equipment shall not be marketed under the existing grant of certification prior to acknowledgement by the Commission that the change is acceptable.

(3) A Class III permissive change includes modifications to the software of a software defined radio transmitter that change the frequency, modulation type, output power or maximum field strength outside the parameters previously approved. When a Class III permissive change is made, the grantee shall supply the Commission with a description of the changes and test results showing that the equipment complies with the applicable rules with the new software loaded, including compliance with the applicable RF exposure requirements. The modified software shall not be loaded into equipment, and the equipment shall not be marketed with the modified software under the existing grant of certification, prior to acknowledgement by the Commission that the change is acceptable. A copy of the software shall be submitted to the Commission upon request. Class III changes are permitted only for equipment in which no Class II changes have been made from the originally approved device.

NOTE TO PARAGRAPH (b)(3): Any software change that degrades spurious and out-of-band emissions previously reported to the Commission at the time of initial certification would be considered a change in frequency or modulation and would require a Class III permissive change or new equipment authorization application.

(4) Class I and Class II permissive changes may only be made by the holder of the grant of certification, except as specified below.

(c) A grantee desiring to make a change other than a permissive change shall file an application on FCC Form 731 accompanied by the required fees. The grantee shall attach a description of the change(s) to be made and a statement indicating whether the change(s) will be made in all units (including previous production) or will be made only in those units produced after the change is authorized.

(d) A modification which results in a change in the identification of a device with or without change in circuitry requires a new application for, and grant of

certification. If the changes affect the characteristics required to be reported, a complete application shall be filed. If the characteristics required to be reported are not changed the abbreviated procedure of Sec. 2.933 may be used.

(e) Equipment that has been certificated or formerly type accepted for use in the Amateur Radio Service pursuant to the requirements of part 97 of this chapter may be modified without regard to the conditions specified in paragraph (b) of this section, provided the following conditions are met:

(1) Any person performing such modifications on equipment used under part 97 of this chapter must possess a valid amateur radio operator license of the class required for the use of the equipment being modified.

(2) Modifications made pursuant to this paragraph are limited to equipment used at licensed amateur radio stations.

(3) Modifications specified or performed by equipment manufacturers or suppliers must be in accordance with the requirements set forth in paragraph (b) of this section.

(4) Modifications specified or performed by licensees in the Amateur Radio Service on equipment other than that at specific licensed amateur radio stations must be in accordance with the requirements set forth in paragraph (b) of this section.

(5) The station licensee shall be responsible for ensuring that modified equipment used at his station will comply with the applicable technical standards in part 97 of this chapter.

(f) For equipment other than that operating under parts 15 or 18, when a Class II permissive change is made by other than the grantee of certification, the information and data specified in paragraph (b)(2) of this section shall be supplied by the person making the change. The modified equipment shall not be operated under an authorization of the Commission prior to acknowledgement by the Commission that the change is acceptable.

(g) The interconnection of a certificated or formerly type accepted AM broadcast stereophonic exciter-generator with a certificated or formerly type accepted AM broadcast transmitter in accordance with the manufacturer's instructions and upon completion of measurements showing that the modified transmitter meets the emission limitation requirements of Sec. 73.44 is defined as a Class I permissive change for compliance with this section.

(h) The interconnection of a multiplexing exciter with a certificated or formerly type accepted AM broadcast transmitter in accordance with the manufacturer's instructions without electrical or mechanical modification of the transmitter circuits and completion of equipment performance measurements showing the transmitter meets the minimum performance requirements applicable thereto is defined as a Class I permissive change for compliance with this section.

(i) The addition of TV broadcast sub-carrier generators to a certificated or formerly type accepted TV broadcast transmitter or the addition of FM broadcast subcarrier generators to a type accepted FM broadcast transmitter, provided the transmitter exciter is designed for subcarrier operation without mechanical or electrical alterations to the exciter or other transmitter circuits.

(j) The addition of TV broadcast stereophonic generators to a certificated or formerly type accepted TV broadcast transmitter or the addition of FM broadcast stereophonic generators to a certificated or formerly type accepted FM broadcast transmitter, provided the transmitter exciter is designed for stereophonic sound operation without mechanical or electrical alterations to the exciter or other transmitter circuits.

(k) The addition of subscription TV encoding equipment for which the FCC has granted advance approval under the provisions of Sec. 2.1400 in subpart M and Sec. 73.644(c) of part 73 to a certificated or formerly type accepted transmitter is considered a Class I permissive change.

(l) Notwithstanding the provisions of this section, broadcast licensees or permittees are permitted to modify certificated or formerly type accepted equipment pursuant to Sec. 73.1690 of the FCC's rules.

[63 FR 36600, July 7, 1998, as amended at 66 FR 50840, Oct. 5, 2001]

Filing for Application Reference

Sec. 2.1061 Submission of technical information for application reference.

An application for station authorization in some services requires a detailed technical description of the equipment proposed to be used. In order to simplify the preparation and processing of applications by eliminating the need for the submission of equipment specifications with each application, the Commission will accept for application reference purposes detailed technical specifications of equipment designed for use in these services. Manufacturers desiring to avail themselves of this procedure should submit all information required by the application form and the rules for the services in which the equipment is to be used. An application for a station authorization submitted subsequent to such filing may refer to the technical information so filed.

Sec. 2.1063 Disclaimer Re: technical information filed for application reference.

Receipt by the Commission of data for application purposes does not imply that the Commission has made or intends to make any finding regarding the acceptability of the equipment for licensing and such equipment will not be included on the list of

equipment acceptable for licensing. Each applicant is expected to exercise appropriate care in the selection of equipment to insure that the unit selected will comply with the rules governing the service in which it is proposed to operate.

Sec. 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.

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

(Secs. 4, 303, 48 Stat., as amended, 1066, 1082, sec. 302, 82 Stat., 290 (47 U.S.C. 154, 302, 303))

[39 FR 28160, Aug. 5, 1974, as amended at 44 FR 17180, Mar. 21, 1979]

Declaration of Conformity

Sec. 2.1071 Cross reference.

The general provisions of this subpart, shall apply to equipment subject to a Declaration of Conformity.

[61 FR 31046, June 19, 1996]

Sec. 2.1072 Limitation on Declaration of Conformity.

(a) The Declaration of Conformity signifies that the responsible party, as defined in Sec. 2.909, has determined that the equipment has been shown to comply with the applicable technical standards if no unauthorized change is made in the equipment and if the equipment is properly maintained and operated. Compliance with these standards shall not be construed to be a finding by the responsible party with respect to matters not encompassed by the Commission's rules.

(b) A Declaration of Conformity by the responsible party is effective until a termination date is otherwise established by the Commission.

(c) No person shall, in any advertising matter, brochure, etc., use or make reference to a

Declaration of Conformity in a deceptive or misleading manner or convey the impression that such a Declaration of Conformity reflects more than a determination by the responsible party that the device or product has been shown to be capable of complying with the applicable technical standards of the Commission's rules.

[61 FR 31046, June 19, 1996]

Sec. 2.1073 Responsibilities.

(a) The responsible party, as defined in Sec. 2.909, must warrant that each unit of equipment marketed under a Declaration of Conformity is identical to the unit tested and found acceptable with the standards and that the records maintained by the responsible party continue to reflect the equipment being produced under the Declaration of Conformity within the variation that can be expected due to quantity production and testing on a statistical basis.

(b) The responsible party, if different from the manufacturer, may upon receiving a written statement from the manufacturer that the equipment complies with the appropriate technical standards rely on the manufacturer or independent testing agency to determine compliance. However, the test records required by Sec. 2.1075 shall be in the English language and shall be made available to the Commission upon a reasonable request in accordance with the provisions of Sec. 2.1076.

(c) In the case of transfer of control of the equipment, as in the case of sale or merger of the responsible party, the new responsible party shall bear the responsibility of continued compliance of the equipment.

(d) Equipment shall be retested to demonstrate continued compliance with the applicable technical standards if any modifications or changes that could adversely affect the emanation characteristics of the equipment are made by the responsible party. The responsible party bears responsibility for the continued compliance of subsequently produced equipment.

(e) If any modifications or changes are made by anyone other than the responsible party for the Declaration of Conformity, the party making the modifications or changes, if located within the U.S., becomes the new responsible party. The new responsible party must comply with all provisions for the Declaration of Conformity, including having test data on file demonstrating that the product continues to comply with all of the applicable technical standards.

[61 FR 31046, June 19, 1996]

Sec. 2.1074 Identification.

Devices subject only to a Declaration of Conformity shall be uniquely identified by the responsible party. This identification shall not be of a format which could be confused with the FCC Identifier required on certified, notified, type accepted or type approved equipment. The responsible party shall maintain adequate identification records to facilitate positive identification for each device.

[61 FR 31047, June 19, 1996]

Sec. 2.1075 Retention of records.

(a) Except as shown in paragraph (b) of this section, for each product subject to a Declaration of Conformity, the responsible party, as shown in Sec. 2.909, shall maintain the following records:

(1) A record of the original design drawings and specifications and all changes that have been made that may affect compliance with the requirements of Sec. 2.1073.

(2) A record of the procedures used for production inspection and testing (if tests were performed) to insure the conformance required by Sec. 2.1073. (Statistical production line emission testing is not required.)

(3) A record of the measurements made on an appropriate test site that demonstrates compliance with the applicable regulations. The record shall contain:

(i) The actual date or dates testing was performed;

(ii) The name of the test laboratory, company, or individual performing the testing. The Commission may request additional information regarding the test site, the test equipment or the qualifications of the company or individual performing the tests;

(iii) A description of how the device was actually tested, identifying the measurement procedure and test equipment that was used;

(iv) A description of the equipment under test (EUT) and support equipment connected to, or installed within, the EUT;

(v) The identification of the EUT and support equipment by trade name and model number and, if appropriate, by FCC Identifier and serial number;

(vi) The types and lengths of connecting cables used and how they were arranged or moved during testing;

(vii) At least two photographs showing the test set-up for the highest line conducted emission and showing the test set-up for the highest radiated emission. These photographs must be focused originals which show enough detail to confirm other information contained in the test report;

(viii) A description of any modifications made to the EUT by the testing company or individual to achieve compliance with the regulations;

(ix) All of the data required to show compliance with the appropriate regulations;

(x) The signature of the individual responsible for testing the product along with the name and signature of an official of the responsible party, as designated in Sec. 2.909; and

(xi) A copy of the compliance information, as described in Sec. 2.1077, required to be provided with the equipment.

(b) If the equipment is assembled using modular components that, by themselves, are subject to authorization under a Declaration of Conformity and/or a grant of certification, and the assembled

product is also subject to authorization under a Declaration of Conformity but, in accordance with the applicable regulations, does not require additional testing, the assembler shall maintain the following records in order to show the basis on which compliance with the standards was determined:

(1) A listing of all of the components used in the assembly;

(2) Copies of the compliance information, as described in Sec. 2.1077 for all of the modular components used in the assembly;

(3) A listing of the FCC Identifier numbers for all of the components used in the assembly that are authorized under a grant of certification;

(4) A listing of equipment modifications, if any, that were made during assembly; and

(5) A copy of any instructions included with the components that were required to be followed to ensure the assembly of a compliant product, along with a statement, signed by the assembler, that these instructions were followed during assembly. This statement shall also contain the name and signature of an official of the responsible party, as designated in Sec. 2.909.

(c) The records listed in paragraphs

(a) and (b) of this section shall be retained for two years after the manufacture or assembly, as appropriate, of said equipment has been permanently discontinued, or until the conclusion of an investigation or a proceeding if the responsible party is officially notified that an investigation or any other administrative proceeding involving the equipment has been instituted. Requests for the records described in this section and for sample units also are covered under the provisions of Sec. 2.946.

[61 FR 31047, June 19, 1996]

Sec. 2.1076 FCC inspection and submission of equipment for testing.

(a) Each responsible party, upon receipt of a reasonable request, shall submit to the Commission the records required by Sec. 2.1075 or one or more sample units for measurements at the Commission's laboratory.

(b) Shipping costs to the Commission's Laboratory and return shall be borne by the responsible party. In the event the responsible party believes that shipment of the sample to the Commission's Laboratory is impractical because of the size or weight of the equipment, or the power requirement, or for any other reason, the responsible party may submit a written explanation why such shipment is impractical and should not be required.

[61 FR 31047, June 19, 1996]

Sec. 2.1077 Compliance information.

(a) If a product must be tested and authorized under a Declaration of Conformity, a compliance information statement shall be supplied with the

product at the time of marketing or importation, containing the following information:

(1) Identification of the product, e.g., name and model number;

(2) A statement, similar to that contained in § 15.19(a)(3) of this chapter, that the product complies with part 15 of this chapters; and

(3) The identification, by name, address and telephone number, of the responsible party, as defined in Sec. 2.909. The responsible party for a Declaration of Conformity must be located within the United States.

(b) If a product is assembled from modular components that, by themselves, are authorized under a Declaration of Conformity and/or a grant of certification, and the assembled product is also subject to authorization under a Declaration of Conformity but, in accordance with the applicable regulations, does not require additional testing, the product shall be supplied, at the time of marketing or importation, with a compliance information statement containing the following information:

(1) Identification of the assembled product, e.g., name and model number.

(2) Identification of the modular components used in the assembly. A modular component authorized under a Declaration of Conformity shall be identified as specified in paragraph (a)(1) of this section. A modular component authorized under a grant of certification shall be identified by name and model number (if applicable) along with the FCC Identifier number.

(3) A statement that the product complies with part 15 of this chapter.

(4) The identification, by name, address and telephone number, of the responsible party who assembled the product from modular components, as defined in Sec. 2.909. The responsible party for a Declaration of Conformity must be located within the United States.

(5) Copies of the compliance information statements for each modular component used in the system that is authorized under a Declaration of Conformity.

(c) The compliance information statement shall be included in the user's manual or as a separate sheet.

[61 FR 31048, June 19, 1996, as amended at 62 FR 41880, Aug. 4, 1997]

Code of Federal Regulations

Telecommunication

Excerpted

PART 15

Revised as of October 22, 2004

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PART 15 RADIO FREQUENCY DEVICES

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Subpart A - General

Section 15.1 Scope of this Part.

(a) This Part sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

(b) The operation of an intentional or unintentional radiator that is not in accordance with the regulations in this Part must be licensed pursuant to the provisions of Section 301 of the Communications Act of 1934, as amended, unless otherwise exempted from the licensing requirements elsewhere in this Chapter.

(c) Unless specifically exempted, the operation or marketing of an intentional or unintentional radiator that is not in compliance with the administrative and technical provisions in this Part, including prior Commission authorization or verification, as appropriate, is prohibited under Section 302 of the Communications Act of 1934, as amended, and Subpart I of Part 2 of this Chapter. The equipment authorization and verification procedures are detailed in Subpart J of Part 2 of this Chapter.

Section 15.3 Definitions.

(a) Auditory assistance device. An intentional radiator used to provide auditory assistance to a handicapped person or persons. Such a device may be used for auricular training in an educational institution, for auditory assistance at places of public gatherings, such as a church, theater, or auditorium, and for auditory assistance to handicapped individuals, only, in other locations.

(b) Biomedical telemetry device. An intentional radiator used to transmit measurements of either human or animal biomedical phenomena to a receiver.

(c) Cable input selector switch. A transfer switch that is intended as a means to alternate between the reception of broadcast signals via connection to an antenna and the reception of cable television service.

(d) Cable locating equipment. An intentional radiator used intermittently by trained operators to locate buried cables, lines, pipes and similar structures or elements. Operation entails coupling a radio frequency signal onto the cable, pipe, etc. and using a receiver to detect the location of that structure or element.

(e) Cable system terminal device (CSTD). A TV interface device that serves, as its primary function, to connect a cable system operated under Part 76 of this Chapter to a TV broadcast receiver or other subscriber premise equipment. Any device which functions as a CSTD in one of its operating modes must comply with the technical requirements for such devices when operating in that mode.

(f) Carrier current system. A system, or part of a system, that transmits radio frequency energy by conduction over the electric power lines. A carrier current system can be designed such that the signals are received by conduction directly from connection to the electric power lines (unintentional radiator) or the signals are received over-the-air due to radiation of the radio frequency signals from the electric power lines (intentional radiator).

(g) CB receiver. Any receiver that operates in the Personal Radio Services on frequencies allocated for Citizens Band (CB) Radio Service stations, as well as any receiver provided with a separate band specifically designed to receive the transmissions of CB stations in the Personal Radio Services. This includes the following: (1) a CB receiver sold as a separate unit of equipment; 2) the receiver section of a CB transceiver; 3) a converter to be used with any receiver for the purpose of receiving CB transmissions; and, 4) a multiband receiver that includes a band labeled "CB" or "11-meter" in which such band can be separately selected, except that an Amateur Radio Service receiver that was manufactured prior to January 1, 1960, and which includes an 11-meter band shall not be considered to be a CB receiver.

(h) Class A digital device. A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

(i) Class B digital device. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public. Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

(j) Cordless telephone system. A system consisting of two transceivers, one a base station that connects to the public switched telephone network and the other a mobile handset unit that communicates directly with the base station. Transmissions from the mobile unit are received by the base station and then placed on the public switched telephone network. Information received from the switched telephone network is transmitted by the base station to the mobile unit. Note: The Domestic Public Cellular Radio Telecommunications Service is considered to be part of the switched telephone network. In addition, intercom and paging operations are permitted provided these are not intended to be the primary modes of operation.

(k) Digital device. (Previously defined as a computing device). An unintentional radiator (device or system) that generates and uses timing signals or pulses at a rate in excess of 9,000 pulses (cycles) per second and uses digital techniques; inclusive of telephone equipment that uses digital techniques or any device or system that generates and uses radio frequency energy for the purpose of performing data processing functions, such as electronic computations, operations, transformations, recording, filing, sorting, storage, retrieval, or transfer. A radio frequency device that is specifically subject to an emanation requirement in any other FCC Rule Part or an intentional radiator subject to Subpart C of this Part that contains a digital device is not subject to the standards for digital devices, provided the digital device is used only to enable operation of the radio frequency device and the digital device does not control additional functions or capabilities. Note: Computer terminals and peripherals that are intended to be connected to a computer are digital devices.

(l) Field disturbance sensor. A device that establishes a radio frequency field in its vicinity and detects changes in that field resulting from the movement of persons or objects within its range.

(m) Harmful interference. Any emission, radiation or induction that endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunications service operating in accordance with this Chapter.

(n) Incidental radiator. A device that generates radio frequency energy during the course of its operation although the device is not intentionally designed to generate or emit radio frequency energy. Examples of incidental radiators are dc motors, mechanical light switches, etc.

(o) Intentional radiator. A device that intentionally generates and emits radio frequency energy by radiation or induction.

(p) Kit. Any number of electronic parts, usually provided with a schematic diagram or printed circuit board, which, when assembled in accordance with instructions, results in a device subject to the regulations in this Part, even if additional parts of any type are required to complete assembly.

(q) Perimeter protection system. A field disturbance sensor that employs RF transmission lines as the radiating source. These RF transmission lines are installed in such a manner that allows the system to detect movement within the protected area.

(r) Peripheral device. An input/output unit of a system that feeds data into and/or receives data from the central processing unit of a digital device. Peripherals to a digital device include any device that is connected external to the digital device, any device internal to the digital device that connects the digital device to an external device by wire or cable, and any circuit board designed for interchangeable mounting, internally or externally,

that increases the operating or processing speed of a digital device, e.g., "turbo" cards and "enhancement" boards. Examples of peripheral devices include terminals, printers, external floppy disk drives and other data storage devices, video monitors, keyboards, interface boards, external memory expansion cards, and other input/output devices that may or may not contain digital circuitry. This definition does not include CPU boards, as defined in paragraph (bb) of this section, even though a CPU board may connect to an external keyboard or other components.

(s) Personal computer. An electronic computer that is marketed for use in the home, notwithstanding business applications. Such computers are considered Class B digital devices. Computers which use a standard TV receiver as a display device or meet all of the following conditions are considered examples of personal computers:

(1) Marketed through a retail outlet or direct mail order catalog.

(2) Notices of sale or advertisements are distributed or directed to the general public or hobbyist users rather than restricted to commercial users.

(3) Operates on a battery or 120 volt electrical supply.

If the responsible party can demonstrate that because of price or performance the computer is not suitable for residential or hobbyist use, it may request that the computer be considered to fall outside of the scope of this definition for personal computers.

(t) Power line carrier systems. An unintentional radiator employed as a carrier current system used by an electric power utility entity on transmission lines for protective relaying, telemetry, etc. for general supervision of the power system. The system operates by the transmission of radio frequency energy by conduction over the electric power transmission lines of the system. The system does not include those electric lines which connect the distribution substation to the customer or house wiring.

(u) Radio frequency (RF) energy. Electromagnetic energy at any frequency in the radio spectrum between 9 kHz and 3,000,000 MHz.

(v) Scanning receiver. For the purpose of this part, this is a receiver that automatically switches among two or more frequencies in the range of 30 to 960 MHz and that is capable of stopping at and receiving a radio signal detected on a frequency. Receivers designed solely for the reception of the broadcast signals under part 73 of this chapter, for the reception of NOAA broadcast weather band signals, or for operation as part of a licensed service are not included in this definition.

(w) Television (TV) broadcast receiver. A device designed to receive television pictures that are broadcast simultaneously with sound on the television channels authorized under Part 73 of this Chapter.

(x) Transfer switch. A device used to alternate between the reception of over-the-air radio frequency signals via connection to an antenna and the reception of radio frequency signals received by any other method, such as from a TV interface device.

(y) TV interface device. An unintentional radiator that produces or translates in frequency a radio frequency carrier modulated by a video signal derived from an external or internal signal source, and which feeds the modulated radio frequency energy by conduction to the antenna terminals or other non-baseband input connections of a television broadcast receiver. A TV interface device may include a stand-alone RF modulator, or a composite device consisting of an RF modulator, video source and other components devices. Examples of TV interface devices are video cassette recorders and terminal devices attached to a cable system or used with a Master Antenna (including those used for central distribution video devices in apartment or office buildings).

(z) Unintentional radiator. A device that intentionally generates radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

(aa) Cable ready consumer electronics equipment. Consumer electronics TV receiving devices, including TV receivers, videocassette recorders and similar devices, that incorporate a tuner capable of receiving television signals and an input terminal for receiving cable television service, and are marketed as "cable ready" or "cable compatible." Such equipment shall comply with the technical standards specified in Section 15.118 of this chapter.

(bb) CPU board. A circuit board that contains a microprocessor, or frequency determining circuitry for the microprocessor, the primary function of which is to execute user-provided programming, but not including: (1) a circuit board that contains only a microprocessor intended to operate under the primary control or instruction of a microprocessor external to such a circuit board; or, (2) a circuit board that is a dedicated controller for a storage or input/output device.

(cc) External radio frequency power amplifier. A device which is not an integral part of an intentional radiator as manufactured and which, when used in conjunction with an intentional radiator as a signal source, is capable of amplifying that signal.

(dd) Test Equipment is defined as equipment that is intended primarily for purposes of performing measurements or scientific investigations. Such equipment includes, but is not limited to, field strength meters, spectrum analyzers, and modulation monitors.

(ee) Radar detector. A receiver designed to signal the presence of radio signals used for determining the speed of motor vehicles. This definition does

not encompass the receiver incorporated within a radar transceiver certified under the Commission's rules.

Section 15.5 General conditions of operation.

(a) Persons operating intentional or unintentional radiators shall not be deemed to have any vested or recognizable right to continued use of any given frequency by virtue of prior registration or certification of equipment, or, for power line carrier systems, on the basis of prior notification of use pursuant to Section 90.63(g) of this chapter. [Should reference Section 90.35(g).]

(b) Operation of an intentional, unintentional, or incidental radiator is subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental radiator.

(c) The operator of a radio frequency device shall be required to cease operating the device upon notification by a Commission representative that the device is causing harmful interference. Operation shall not resume until the condition causing the harmful interference has been corrected.

(d) Intentional radiators that produce Class B emissions (damped wave) are prohibited.

Section 15.9 Prohibition against eavesdropping.

Except for the operations of law enforcement officers conducted under lawful authority, no person shall use, either directly or indirectly, a device operated pursuant to the provisions of this Part for the purpose of overhearing or recording the private conversations of others unless such use is authorized by all of the parties engaging in the conversation.

Section 15.11 Cross reference.

The provisions of Subparts A, H, I, J and K of Part 2 apply to intentional and unintentional radiators, in addition to the provisions of this Part. Also, a cable system terminal device and a cable input selector switch shall be subject to the relevant provisions of Part 76 of this Chapter.

Section 15.13 Incidental radiators.

Manufacturers of these devices shall employ good engineering practices to minimize the risk of harmful interference.

Section 15.15 General technical requirements.

(a) An intentional or unintentional radiator shall be constructed in accordance with good engineering design and manufacturing practice. Emanations from the device shall be suppressed as much as practicable, but in no case shall the emanations exceed the levels specified in these rules.

(b) An intentional or unintentional radiator must be constructed such that the adjustments of any control that is readily accessible by or intended to be accessible to the user will not cause operation of the device in violation of the regulations.

(c) Parties responsible for equipment compliance should note that the limits specified in this Part will not prevent harmful interference under all circumstances. Since the operators of Part 15 devices are required to cease operation should harmful interference occur to authorized users of the radio frequency spectrum, the parties responsible for equipment compliance are encouraged to employ the minimum field strength necessary for communications, to provide greater attenuation of unwanted emissions than required by these regulations, and to advise the user as to how to resolve harmful interference problems (for example, see Section 15.105(b)).

Section 15.17 Susceptibility to interference.

(a) Parties responsible for equipment compliance are advised to consider the proximity and the high power of non-Government licensed radio stations, such as broadcast, amateur, land mobile, and non-geostationary mobile satellite feeder link earth stations, and of U.S. Government radio stations, which could include high-powered radar systems, when choosing operating frequencies during the design of their equipment so as to reduce the susceptibility for receiving harmful interference. Information on non-Government use of the spectrum can be obtained by consulting the Table of Frequency Allocations in § 2.106 of this chapter.

(b) Information on U. S. Government operations can be obtained by contacting: Director, Spectrum Plans and Policy, National Telecommunications and Information Administration, Department of Commerce, Room 4096, Washington, D. C. 20230.

Section 15.19 Labeling requirements.

(a) In addition to the requirements in Part 2 of this Chapter, a device subject to certification, notification, or verification shall be labeled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC

Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

(b) Products subject to authorization under a Declaration of Conformity shall be labeled as follows:

(1) The label shall be located in a conspicuous location on the device and shall contain the unique identification described in Section 2.1074 of this chapter and the following logo:

(i) If the product is authorized based on testing of the product or system:



(ii) If the product is authorized based on assembly using separately authorized components, in accordance with Section 15.101(c)(2) or (c)(3), and the resulting product is not separately tested:



(2) Label text and information should be in a size of type large enough to be readily legible, consistent with the dimensions of the equipment and the label. However, the type size for the text is not required to be larger than eight point.

(3) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (b)(1) of this section on it, such as for a CPU board or a plug-in circuit board peripheral device, the text associated with the logo may be

placed in a prominent location in the instruction manual or pamphlet supplied to the user. However, the unique identification (trade name and model number) and the logo must be displayed on the device.

(4) The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase, as described in Section 2.925(d) of this chapter. "Permanently affixed" means that the label is etched, engraved, stamped, silkscreened, indelibly printed, or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal, plastic, or other material fastened to the equipment by welding, riveting, or a permanent adhesive. The label must be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable.

(c) [reserved]

(d) Consumer electronics TV receiving devices, including TV receivers, videocassette recorders, and similar devices, that incorporate features intended to be used with cable television service, but do not fully comply with the technical standards for cable ready equipment set forth in Section 15.118, shall not be marketed with terminology that describes the device as "cable ready" or "cable compatible," or that otherwise conveys the impression that the device is fully compatible with cable service. Factual statements about the various features of a device that are intended for use with cable service or the quality of such features are acceptable so long as such statements do not imply that the device is fully compatible with cable service. Statements relating to product features are generally acceptable where they are limited to one or more specific features of a device, rather than the device as a whole. This requirement applies to consumer TV receivers, videocassette recorders and similar devices manufactured or imported for sale in this country on or after October 31, 1994.

Section 15.21 Information to user.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

Section 15.23 Home-built devices.

(a) Equipment authorization is not required for devices that are not marketed, are not constructed from a kit, and are built in quantities of five or less for personal use.

(b) It is recognized that the individual builder of

home-built equipment may not possess the means to perform the measurements for determining compliance with the regulations. In this case, the builder is expected to employ good engineering practices to meet the specified technical standards to the greatest extent practicable. The provisions of Section 15.5 apply to this equipment.

Section 15.25 Kits.

A TV interface device, including a cable system terminal device, which is marketed as a kit shall comply with the following requirements:

(a) All parts necessary for the assembled device to comply with the technical requirements of this Part must be supplied with the kit. No mechanism for adjustment that can cause operation in violation of the requirements of this Part shall be made accessible to the builder.

(b) At least two units of the kit shall be assembled in exact accordance with the instructions supplied with the product to be marketed. If all components required to fully complete the kit (other than those specified in paragraph (a) which are needed for compliance with the technical provisions and must be included with the kit) are not normally furnished with the kit, assembly shall be made using the recommended components. The assembled units shall be certified or authorized under the Declaration of Conformity procedure, as appropriate, pursuant to the requirements of this Part.

(1) The measurement data required for a TV interface device subject to certification shall be obtained for each of the two units and submitted with an application for certification pursuant to Subpart J of Part 2 of this Chapter.

(2) The measurement data required for a TV interface device subject to Declaration of Conformity shall be obtained for the units tested and retained on file pursuant to the provisions of Subpart J of Part 2 of this Chapter.

(c) A copy of the exact instructions that will be provided for assembly of the device shall be submitted with an application for certification. Those parts which are not normally furnished shall be detailed in the application for equipment authorization.

(d) In lieu of the label required by Section 15.19, the following label, along with the label bearing the FCC identifier and other information specified in Sections 2.925 and 2.926, shall be included in the kit with instructions to the builder that it shall be attached to the completed kit:

(Name of Grantee)
(FCC Identifier)

This device can be expected to comply with Part 15 of the FCC Rules provided it is assembled in exact accordance with the instructions provided with this kit. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause

undesired operation.

(e) For the purpose of this Section, circuit boards used as repair parts for the replacement of electrically identical defective circuit boards are not considered to be kits.

Section 15.27 Special accessories.

(a) Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors, are required to enable an unintentional or intentional radiator to comply with the emission limits in this Part, the equipment must be marketed with, i.e., shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge, at the time of purchase. Information detailing any alternative method used to supply the special accessories shall be included in the application for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in Section 2.909 of this Chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of the text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

(b) If a device requiring special accessories is installed by or under the supervision of the party marketing the device, it is the responsibility of that party to install the equipment using the special accessories. For equipment requiring professional installation, it is not necessary for the responsible party to market the special accessories with the equipment. However, the need to use the special accessories must be detailed in the instruction manual, and it is the responsibility of the installer to provide and to install the required accessories.

(c) Accessory items that can be readily obtained from multiple retail outlets are not considered to be special accessories and are not required to be marketed with the equipment. The manual included with the equipment must specify what additional components or accessories are required to be used in order to ensure compliance with this Part, and it is the responsibility of the user to provide and use those components and

accessories.

(d) The resulting system, including any accessories or components marketed with the equipment, must comply with the regulations.

Section 15.29 Inspection by the Commission.

(a) Any equipment or device subject to the provisions of this Part, together with any certificate, notice of registration or any technical data required to be kept on file by the operator, supplier or party responsible for compliance of the device shall be made available for inspection by a Commission representative upon reasonable request.

(b) The owner or operator of a radio frequency device subject to this Part shall promptly furnish to the Commission or its representative such information as may be requested concerning the operation of the radio frequency device.

(c) The party responsible for the compliance of any device subject to this Part shall promptly furnish to the Commission or its representatives such information as may be requested concerning the operation of the device, including a copy of any measurements made for obtaining an equipment authorization or demonstrating compliance with the regulations.

(d) The Commission, from time to time, may request the party responsible for compliance, including an importer, to submit to the FCC Laboratory in Columbia, Maryland, various equipment to determine that the equipment continues to comply with the applicable standards. Shipping costs to the Commission's Laboratory and return shall be borne by the responsible party. Testing by the Commission will be performed using the measurement procedure(s) that was in effect at the time the equipment was authorized or verified.

Section 15.31 Measurement standards.

(a) The following measurement procedures are used by the Commission to determine compliance with the technical requirements in this part. Except where noted, copies of these procedures are available from the Commission's current duplicating contractor whose name and address are available from the Commission's Consumer and Governmental Affairs Bureau at 1-888-CALL FCC (1-888-225-5322).

(1) FCC/OET MP-2: Measurement of UHF Noise Figures of TV Receivers.

(2) Unlicensed Personal Communication Service (UPCS) devices are to be measured for compliance using ANSI C63.17-1998: "Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices", (incorporated by reference, see § 15.38). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51.

(3) Other intentional and unintentional radiators are

to be measured for compliance using the following procedure excluding sections 4.1.5.2, 5.7, 9 and 14: ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see § 15.38). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. NOTE to Paragraph (a)(3): Digital devices tested to show compliance with the provisions of Secs. 15.107(e) and 15.109(g) must be tested following the ANSI C63.4 procedure described in paragraph (a)(3) of this section.

(b) All parties making compliance measurements on equipment subject to the requirements of this part are urged to use these measurement procedures. Any party using other procedures should ensure that such other procedures can be relied on to produce measurement results compatible with the FCC measurement procedures. The description of the measurement procedure used in testing the equipment for compliance and a list of the test equipment actually employed shall be made part of an application for certification or included with the data required to be retained by the party responsible for devices authorized pursuant to a Declaration of Conformity or devices subject to verification.

(c) For swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

(d) Field strength measurements shall be made, to the extent possible, on an open field site. Test sites other than open field sites may be employed if they are properly calibrated so that the measurement results correspond to what would be obtained from an open field site. In the case of equipment for which measurements can be performed only at the installation site, such as perimeter protection systems, carrier current systems, and systems employing a "leaky" coaxial cable as an antenna, measurements for verification or for obtaining a grant of equipment authorization shall be performed at a minimum of three installations that can be demonstrated to be representative of typical installation sites.

(e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

(f) To the extent practicable, the device under test shall be measured at the distance specified in the appropriate rule section. The distance specified corresponds to the horizontal distance between the measurement antenna and the closest point of the equipment under test, support equipment or interconnecting cables as determined by the

boundary defined by an imaginary straight line periphery describing a simple geometric configuration enclosing the system containing the equipment under test. The equipment under test, support equipment and any interconnecting cables shall be included within this boundary.

(1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical.

When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

(3) The applicant for a grant of certification shall specify the extrapolation method used in the application filed with the Commission. For equipment subject to Declaration of Conformity or verification, this information shall be retained with the measurement data.

(4) When measurement distances of 30 meters or less are specified in the regulations, the Commission will test the equipment at the distance specified unless measurement at that distance results in measurements being performed in the near field. When measurement distances of greater than 30 meters are specified in the regulations, the Commission will test the equipment at a closer distance, usually 30 meters, extrapolating the measured field strength to the specified distance using the methods shown in this Section.

(5) Measurements shall be performed at a sufficient number of radials around the equipment under test to determine the radial at which the field strength values of the radiated emissions are maximized.

The maximum field strength at the frequency being measured shall be reported in an application for certification.

(g) Equipment under test shall be adjusted, using those controls that are readily accessible to or are intended to be accessible to the consumer, in such a manner as to maximize the level of the emissions.

For those devices to which wire leads may be attached by the consumer, tests shall be performed with wire leads attached. The wire leads shall be of the length to be used with the equipment if that length is known. Otherwise, wire leads one meter in length shall be attached to the equipment. Longer wire leads may be employed if necessary to interconnect to associated peripherals.

(h) For a composite system that incorporates devices contained either in a single enclosure or in separate enclosures connected by wire or cable, testing for compliance with the standards in this Part shall be performed with all of the devices in the system functioning. If an intentional radiator incorporates more than one antenna or other radiating source and these radiating sources are designed to emit at the same time, measurements of conducted and radiated emissions shall be performed with all radiating sources that are to be employed emitting. A device which incorporates a carrier current system shall be tested as if the carrier current system were incorporated in a separate device; that is, the device shall be tested for compliance with whatever rules would apply to the device were the carrier current system not incorporated, and the carrier current system shall be tested for compliance with the rules applicable to carrier current systems.

(i) If the device under test provides for the connection of external accessories, including external electrical input signals, the device shall be tested with the accessories attached. The device under test shall be fully exercised with these external accessories. The emission tests shall be performed with the device and accessories configured in a manner that tends to produce maximized emissions within the range of variations that can be expected under normal operating conditions. In the case of multiple accessory external ports, an external accessory shall be connected to one of each type of port. Only one test using peripherals or external accessories that are representative of the devices that will be employed with the equipment under test is required. All possible equipment combinations do not need to be tested. The accessories or peripherals connected to the device being tested shall be unmodified, commercially available equipment.

(j) If the equipment under test consists of a central control unit and an external or internal accessory(ies) (peripheral) and the party verifying the equipment or applying for a grant of equipment authorization manufactures or assembles the central control unit and at least one of the accessory devices that can be used with that

control unit, testing of the control unit and/or the accessory(ies) must be performed using the devices manufactured or assembled by that party, in addition to any other needed devices which the party does not manufacture or assemble. If the party verifying the equipment or applying for a grant of equipment authorization does not manufacture or assemble the central control unit and at least one of the accessory devices that can be used with that control unit or the party can demonstrate that the central control unit or accessory(ies) normally would be marketed or used with equipment from a different entity, testing of the central control unit and/or the accessory(ies) must be performed using the specific combination of equipment which is intended to be marketed or used together. Only one test using peripherals or accessories that are representative of the devices that will be employed with the equipment under test is required. All possible equipment combinations are not required to be tested. The accessories or peripherals connected to the device being tested shall be unmodified, commercially available equipment.

(k) A composite system is a system that incorporates different devices contained either in a single enclosure or in separate enclosures connected by wire or cable. If the individual devices in a composite system are subject to different technical standards, each such device must comply with its specific standards. In no event may the measured emissions of the composite system exceed the highest level permitted for an individual component. For digital devices which consist of a combination of Class A and Class B devices, the total combination of which results in a Class A digital device, it is only necessary to demonstrate that the equipment combination complies with the limits for a Class A device. This equipment combination may not be employed for obtaining a grant of equipment authorization or verifying a Class B digital device. However, if the digital device combination consists of a Class B central control unit, e.g., a personal computer, and a Class A internal peripheral(s), it must be demonstrated that the Class B central control unit continues to comply with the limits for a Class B digital device with the Class A internal peripheral(s) installed but not active.

(l) Measurements of radio frequency emissions conducted to the public utility power lines shall be performed using a 50 ohm/50 uH line-impedance stabilization network (LISN). Note: Receivers tested under the transition provisions contained in Section 15.37 may be tested with a 50 ohm/5 uH LISN.

(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10	3	1 near top, 1 near middle and 1 near bottom

be performed with the receiver tuned to each VHF frequency and also shall include the following oscillator frequencies: 520, 550, 600, 650, 700, 750, 800, 850, 900 and 931 MHz. If measurements cannot be made on one or more of the latter UHF frequencies because of the presence of signals from licensed radio stations or for other reasons to be detailed in the measurement report, measurements shall be made with the receiver oscillator at a nearby frequency. If the receiver is not capable of receiving channels above 806 MHz, the measurements employing the oscillator frequencies 900 and 931 MHz may be omitted.

(o) The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this Part.

(p) In those cases where the provisions in this section conflict with the measurement procedures in paragraph (a) of this section and the procedures were implemented after June 23, 1989, the provisions contained in the measurement procedures shall take precedence.

Section 15.32 Test procedures for CPU boards and computer power supplies.

Power supplies and CPU boards used with personal computers and for which separate authorizations are required to be obtained shall be tested as follows:

(a) CPU boards shall be tested as follows:

(1) Testing for radiated emissions shall be performed with the CPU board installed in a typical enclosure but with the enclosure's cover removed so that the internal circuitry is exposed at the top and on at least two sides. Additional components, including a power supply, peripheral devices, and subassemblies, shall be added, as needed, to result in a complete personal computer system. If the oscillator and the microprocessor circuits are contained on separate circuit boards, both boards, typical of the combination that would normally be employed, must be used in the test. Testing shall be in accordance with the procedures specified in Section 15.31 of this part.

(i) Under these test conditions, the system under test shall not exceed the radiated emission limits specified in Section 15.109 of this part by more than 6 dB. Emissions greater than 6 dB that can be identified and documented to originate from a component(s) other than the CPU board being tested may be dismissed. [Note - when using the test procedure in (a)(1), this test is mandatory and

must be passed. Passing the test in (a)(1)(ii) but failing the test here in (a)(1)(i) signifies a non-compliant product. If compliance can not be shown under (a)(1)(i), see (a)(2) of this section for an alternative test procedure.]

(ii) Unless the test in paragraph (a)(1)(i) of this section demonstrates compliance with the limits in Section 15.109 of this part, a second test shall be performed using the same configuration described above but with the cover installed on the enclosure. Testing shall be in accordance with the procedures specified in Section 15.31 of this part. Under these test conditions, the system under test shall not exceed the radiated emission limits specified in Section 15.109 of this part.

(2) In lieu of the procedure in (a)(1) of this section, CPU boards may be tested to demonstrate compliance with the limits in Section 15.109 using a specified enclosure with the cover installed. Testing for radiated emissions shall be performed with the CPU board installed in a typical system configuration. Additional components, including a power supply, peripheral devices, and subassemblies, shall be added, as needed, to result in a complete personal computer system. If the oscillator and the microprocessor circuits are contained on separate circuit boards, both boards, typical of the combination that would normally be employed, must be used in the test. Testing shall be in accordance with the procedures specified in Section 15.31 of this part. Under this procedure, CPU boards that comply with the limits in Section 15.109 must be marketed together with the specific enclosure used for the test.

(3) The test demonstrating compliance with the AC power line conducted limits specified in Section 15.107 of this part shall be performed in accordance with the procedures specified in Section 15.31 using a enclosure, peripherals, power supply and subassemblies that are typical of the type with which the CPU board under test would normally be employed.

(b) The power supply shall be tested installed in an enclosure that is typical of the type within which it would normally be installed. Additional components, including peripheral devices, a CPU board, and subassemblies, shall be added, as needed, to result in a complete personal computer system. Testing shall be in accordance with the procedures specified in Section 15.31 and must demonstrate compliance with all of the standards contained in this part.

Section 15.33 Frequency range of radiated measurements.

(a) Unless otherwise noted in the specific rule section under which the equipment operates for an intentional radiator the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10

GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.

(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1)-(a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this Section, whichever is the higher frequency range of investigation.

(b) For unintentional radiators:

(1) Except as otherwise indicated in paragraphs (b)(2) or (b)(3), for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

(2) A unintentional radiator, excluding a digital device, in which the highest frequency generated in the device, the highest frequency used in the device and the highest frequency on which the device operates or tunes are less than 30 MHz and which, in accordance with Section 15.109, is required to comply with standards on the level of radiated emissions within the frequency range 9 kHz to 30 MHz, such as a CB receiver or a device designed to conduct its radio frequency emissions via connecting wires or cables, e.g., a carrier current system not intended to radiate, shall be investigated from the lowest radio frequency generated or used in the device, without going below 9 kHz (25 MHz for CB receivers), up to the frequency shown in the following table. If the unintentional radiator contains a digital device, the upper frequency to be investigated shall be that

shown in the table below or in the table in paragraph (b)(1) above, as based on both the highest frequency generated and the highest frequency used in the digital device, whichever range is higher.

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 - 10	400
10 - 30	500

(3) Except for a CB receiver, a receiver employing superheterodyne techniques shall be investigated from 30 MHz up to at least the second harmonic of the highest local oscillator frequency generated in the device. If such receiver is controlled by a digital device, the frequency range shall be investigated up to the higher of the second harmonic of the highest local oscillator frequency generated in the device or the upper frequency of the measurement range specified for the digital device in paragraph (b)(1) of this Section.

(c) The above specified frequency ranges of measurements apply to the measurement of radiated emissions and, in the case of receivers, the measurement to demonstrate compliance with the antenna conduction limits specified in Section 15.111. The frequency range of measurements for AC power line conducted limits is specified in Sections 15.107 and 15.207 and applies to all equipment subject to those regulations. In some cases, depending on the frequency(ies) generated and used by the equipment, only signals conducted onto the AC power lines are required to be measured.

(d) Particular attention should be paid to harmonics and subharmonics of the fundamental frequency as well as to those frequencies removed from the fundamental by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

Section 15.35 Measurement detector functions and bandwidths.

The conducted and radiated emission limits shown in this Part are based on the following, unless otherwise specified elsewhere in this Part:

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors

as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.

Note: For pulse modulated devices with a pulse-repetition frequency of 20 Hz or less and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

(b) Unless otherwise stated, on any frequency or frequencies above 1000 MHz the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in this part, including emission measurements below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules, e.g., see §§ 15.255, 15.509 and 15.511. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. Measurements of AC power line conducted emissions are performed using a CISPR quasi-peak detector, even for devices for which average radiated emission measurements are specified.

(c) Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

Subpart B - Unintentional Radiators

Section 15.101 Equipment authorization of unintentional radiators.

(a) Except as otherwise exempted in Sections 15.23, 15.103, and 15.113, unintentional radiators shall be authorized by the Commission or verified

prior to the initiation of marketing, as follows

Type of Device	Equipment Authorization Required
TV broadcast receiver FM broadcast receiver CB receiver	Verification Verification Declaration of Conformity or Certification
Superregenerative receiver Scanning receiver Radar detector All other receivers subject to Part 15 TV interface device	Declaration of Conformity or Certification Certification Certification Declaration of Conformity or Certification Declaration of Conformity or Certification
Cable system terminal device Stand-alone cable input selector switch.. Class B personal computers and peripherals CPU boards and internal power supplies used with Class B personal computers Class B personal computers assembled using authorized CPU boards or power supplies Class B external switching power supplies Other Class B digital devices & peripherals Class A digital devices, peripherals & external switching power supplies All other devices	Verification Declaration of Conformity or Certification ** Declaration of Conformity or Certification ** Declaration of Conformity Verification Verification Verification

Note: Where the above table indicates more than one category of authorization for a device, the party responsible for compliance has the option to select the type of authorization.

** Applications for this equipment will no longer be accepted by the Commission once domestic Telecommunication Certification Bodies are available to certify the equipment. See Sec. 2.960.

(b) Only those receivers that operate (tune) within the frequency range of 30-960 MHz, CB receivers and radar detectors are subject to the authorizations shown in paragraph (a) of this section. However, receivers indicated as being subject to Declaration of Conformity that are contained within a transceiver, the transmitter portion of which is subject to certification, shall be authorized under the verification procedure. Receivers operating above 960 MHz or below 30 MHz, except for radar detectors and CB receivers, are exempt from complying with the technical provisions of this part but are subject to Sec. 15.5.

(c) Personal computers shall be authorized in accordance with one of the following methods:

(1) The specific combination of CPU board, power

supply and enclosure is tested together and authorized under a Declaration of Conformity or a grant of certification;

(2) The personal computer is authorized under a Declaration of Conformity or a grant of certification, and the CPU board or power supply in that computer is replaced with a CPU board or power supply that has been separately authorized under a Declaration of Conformity or a grant of certification; or,

(3) The CPU board and power supply used in the assembly of a personal computer have been separately authorized under a Declaration of Conformity or a grant of certification.

(4) Personal computers assembled using either of the methods specified in paragraphs (c)(2) or (c)(3) of this section must, by themselves, also be authorized under a Declaration of Conformity if they are marketed. However, additional testing is not required for this Declaration of Conformity, provided the procedures in Section 15.102(b) of this chapter are followed.

(d) Peripheral devices, as defined in Section 15.3(r), shall be authorized under a Declaration of Conformity, or a grant of certification, or verified, as appropriate, prior to marketing. Regardless of the provisions of paragraphs (a) or (c) of this section, if a CPU board, power supply, or peripheral device will always be marketed with a specific personal computer, it is not necessary to obtain a separate authorization for that product provided the specific combination of personal computer, peripheral device, CPU board and power supply has been authorized under a Declaration of Conformity or a grant of certification as a personal computer.

(1) No authorization is required for a peripheral device or a subassembly that is sold to an equipment manufacturer for further fabrication; that manufacturer is responsible for obtaining the necessary authorization prior to further marketing to a vendor or to a user.

(2) Power supplies and CPU boards that have not been separately authorized and are designed for use with personal computers may be imported and marketed only to a personal computer equipment manufacturer that has indicated, in writing, to the seller or importer that they will obtain a Declaration of Conformity or a grant of certification for the personal computer employing these components.

(e) Subassemblies to digital devices are not subject to the technical standards in this part unless they are marketed as part of a system in which case the resulting system must comply with the applicable regulations. Subassemblies include:

(1) Devices that are enclosed solely within the enclosure housing the digital device, except for: power supplies used in personal computers; devices included under the definition of a peripheral device in Section 15.3(r); and personal computer CPU boards, as defined in Section 15.3(bb);

(2) CPU boards, as defined in Section 15.3(bb), other than those used in personal computers, that

are marketed without an enclosure or power supply; and,

(3) Switching power supplies that are separately marketed and are solely for use internal to a device other than a personal computer.

(f) The procedures for obtaining a grant of certification or notification and for verification and a Declaration of Conformity are contained in Subpart J of Part 2 of this chapter. [Notification is no longer used.]

Section 15.102 CPU boards and power supplies used in personal computers.

(a) Authorized CPU boards and power supplies that are sold as separate components shall be supplied with complete installation instructions. These instructions shall specify all of the installation procedures that must be followed to ensure compliance with the standards, including, if necessary, the type of enclosure, e.g., a metal enclosure, proper grounding techniques, the use of shielded cables, the addition of any needed components, and any necessary modifications to additional components.

(1) Any additional parts needed to ensure compliance with the standards, except for the enclosure, are considered to be special accessories and, in accordance with Section 15.27 of this part, must be marketed with the CPU board or power supply.

(2) Any modifications that must be made to a personal computer, peripheral device, CPU board or power supply during installation of a CPU board or power supply must be simple enough that they can be performed by the average consumer. Parts requiring soldering, disassembly of circuitry or other similar modifications are not permitted.

(b) Assemblers of personal computer systems employing modular CPU boards and/or power supplies are not required to test the resulting system provided the following conditions are met:

(1) Each device used in the system has been authorized as required under this part (Note: according to Section 15.101(e), some subassemblies used in a personal computer system may not require an authorization);

(2) The original label and identification on each piece of equipment remain unchanged;

(3) Each responsible party's instructions to ensure compliance (including, if necessary, the use of shielded cables or other accessories or modifications) are followed when the system is assembled; and,

(4) If the system is marketed, the resulting equipment combination is authorized under a Declaration of Conformity pursuant to Section 15.101(c)(4) of this part and a compliance information statement, as described in Section 2.1077(b) of this chapter, is supplied with the system. Marketed systems shall also comply with the labeling requirements in Section 15.19 of this

part and must be supplied with the information required under Sections 15.21, 15.27 and 15.105 of this part.

(5) The assembler of a personal computer system may be required to test the system and/or make necessary modifications if a system is found to cause harmful interference or to be noncompliant with the appropriate standards in the configuration in which it is marketed (see Sections 2.909, 15.1, 15.27(d) and 15.101(e) of this Chapter).

Section 15.103 Exempted devices.

The following devices are subject only to the general conditions of operation in Sections 15.5 and

15.29 and are exempt from the specific technical standards and other requirements contained in this Part. The operator of the exempted device shall be required to stop operating the device upon a finding by the Commission or its representative that the device is causing harmful interference. Operation shall not resume until the condition causing the harmful interference has been corrected. Although not mandatory, it is strongly recommended that the manufacturer of an exempted device endeavor to have the device meet the specific technical standards in this Part.

(a) A digital device utilized exclusively in any transportation vehicle including motor vehicles and aircraft.

(b) A digital device used exclusively as an electronic control or power system utilized by a public utility or in an industrial plant. The term public utility includes equipment only to the extent that it is in a dedicated building or large room owned or leased by the utility and does not extend to equipment installed in a subscriber's facility.

(c) A digital device used exclusively as industrial, commercial, or medical test equipment.

(d) A digital device utilized exclusively in an appliance, e.g., microwave oven, dishwasher, clothes dryer, air conditioner (central or window), etc.

(e) Specialized medical digital devices (generally used at the direction of or under the supervision of a licensed health care practitioner) whether used in a patient's home or a health care facility. Non-specialized medical devices, i.e., devices marketed through retail channels for use by the general public, are not exempted. This exemption also does not apply to digital devices used for record keeping or any purpose not directly connected with medical treatment.

(f) Digital devices that have a power consumption not exceeding 6 nW.

(g) Joystick controllers or similar devices, such as a mouse, used with digital devices but which contain only non-digital circuitry or a simple circuit to convert the signal to the format required (e.g., an integrated circuit for analog to digital conversion) are viewed as passive add-on devices, not themselves directly subject to the technical

standards or the equipment authorization requirements.

(h) Digital devices in which both the highest frequency generated and the highest frequency used are less than 1.705 MHz and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Digital devices that include, or make provision for the use of, battery eliminators, AC adaptors or battery chargers which permit operation while charging or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, do not fall under this exemption.

(i) Responsible parties should note that equipment containing more than one device is not exempt from the technical standards in this Part unless all of the devices in the equipment meet the criteria for exemption. If only one of the included devices qualifies for exemption, the remainder of the equipment must comply with any applicable regulations. If a device performs more than one function and all of those functions do not meet the criteria for exemption, the device does not qualify for inclusion under the exemptions.

Section 15.105 Information to the user.

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment

off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

(c) The provisions of paragraphs (a) and (b) do not apply to digital devices exempted from the technical standards under the provisions of Section 15.103.

(d) For systems incorporating several digital devices, the statement shown in paragraph (a) or

(b) needs to be contained only in the instruction manual for the main control unit.

(e) In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

Section 15.107 Conducted limits.

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66-56 *	56-46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

(b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms LISN. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	79	66
0.5-30	73	60

(c) The limits shown in paragraphs (a) and (b) of this Section shall not apply to carrier current systems operating as unintentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in Section 15.109(e).

(d) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

Section 15.109 Radiated emission limits.

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Conducted Limit (µV/m)
30 - 88	100
88 - 216	150
216 - 960	200
Above 960	500

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of Emission (MHz)	Conducted Limit (µV/m)
30 - 88	90
88 - 216	150
216 - 960	210
Above 960	300

(c) In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over

which radiated emissions are to be measured and the detector functions and other measurement standards apply.

(d) For CB receivers, the field strength of radiated emissions within the frequency range of 25 - 30 MHz shall not exceed 40 microvolts/meter at a distance of 3 meters. The field strength of radiated emissions above 30 MHz from such devices shall comply with the limits in paragraph (a).

(e) Carrier current systems used as unintentional radiators or other unintentional radiators that are designed to conduct their radio frequency emissions via connecting wires or cables and that operate in the frequency range of 9 kHz to 30 MHz, including devices that deliver the radio frequency energy to transducers, such as ultrasonic devices not covered under Part 18 of this Chapter, shall comply with the radiated emission limits for intentional radiators provided in Section 15.209 for the frequency range of 9 kHz to 30 MHz. As an alternative, carrier current systems used as unintentional radiators and operating in the frequency range of 525 kHz to 1705 kHz may comply with the radiated emission limits provided in Section 15.221(a). At frequencies above 30 MHz, the limits in paragraph (a), (b) or (g) of this Section, as appropriate, continue to apply.

(f) For a receiver which employs terminals for the connection of an external receiving antenna, the receiver shall be tested to demonstrate compliance with the provisions of this Section with an antenna connected to the antenna terminals unless the antenna conducted power is measured as specified in Section 15.111(a). If a permanently attached receiving antenna is used, the receiver shall be tested to demonstrate compliance with the provisions of this Section.

(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement" (incorporated by reference, see Sec. 15.38). In addition:

(1) The test procedure and other requirements specified in this Part shall continue to apply to digital devices.

(2) If, in accordance with Section 15.33 of this Part, measurements must be performed above 1000 MHz, compliance above 1000 MHz shall be demonstrated with the emission limit in paragraph (a) or (b) of this Section, as appropriate. Measurements above 1000 MHz may be performed at the distance specified in the CISPR 22 publications for measurements below 1000 MHz provided the limits in paragraphs (a) and (b) of this Section are extrapolated to the new measurement distance using an inverse linear distance extrapolation factor (20 dB/decade), e.g., the radiated limit above 1000 MHz for a Class B digital

device is 150 µV/m, as measured at a distance of 10 meters.

(3) The measurement distances shown in CISPR Pub. 22, including measurements made in accordance with this paragraph above 1000 MHz, are considered, for the purpose of Section 15.31(f)(4) of this Part, to be the measurement distances specified in the regulations.

(4) If the radiated emissions are measured to demonstrate compliance with the alternative standards in this paragraph, compliance must also be demonstrated with the conducted limits shown in Section 15.107(e) of this Part. [This rule paragraph was retained by accident in the R&O in ET Docket No. 98-80 and is no longer applicable.]

(h) Radar detectors shall comply with the emission limits in paragraph (a) of this section over the frequency range of 11.7-12.2 GHz.

Section 15.111 Antenna power conduction limits for receivers.

(a) In addition to the radiated emission limits, receivers that operate (tune) in the frequency range 30 to 960 MHz and CB receivers that provide terminals for the connection of an external receiving antenna may be tested to demonstrate compliance with the provisions of Section 15.109 with the antenna terminals shielded and terminated with a resistive termination equal to the impedance specified for the antenna, provided these receivers also comply with the following: with the receiver antenna terminal connected to a resistive termination equal to the impedance specified or employed for the antenna, the power at the antenna terminal at any frequency within the range of measurements specified in Section 15.33 shall not exceed 2.0 nanowatts.

(b) CB receivers and receivers that operate (tune) in the frequency range 30 to 960 MHz that are provided only with a permanently attached antenna shall comply with the radiated emission limitations in this Part, as measured with the antenna attached.

Subpart C - Intentional Radiators

Section 15.201 Equipment authorization requirement.

(a) Intentional radiators operated as carrier current systems, devices operated under the provisions of Secs. 15.211, 15.213 and 15.221, and devices operating below 490 kHz in which all emissions are at least 40 dB below the limits in Section 15.209 shall be verified pursuant to the procedures in Subpart J of Part 2 of this Chapter prior to marketing.

(b) Except as otherwise exempted in paragraph (c) of this Section and in Section 15.23 of this Part, all intentional radiators operating under the provisions of this Part shall be certified by the Commission pursuant to the procedures in Subpart J of Part 2 of this Chapter prior to marketing.

(c) For devices such as perimeter protection systems which, in accordance with Section 15.31(d), are required to be measured at the installation site, each application for certification must be accompanied by a statement indicating that the system has been tested at three installations and found to comply at each installation. Until such time as certification is granted, a given installation of a system that was measured for the submission for certification will be considered to be in compliance with the provisions of this Chapter, including the marketing regulations in Subpart I of Part 2, if tests at that installation show the system to be in compliance with the relevant technical requirements. Similarly, where measurements must be performed on site for equipment subject to verification, a given installation that has been verified to demonstrate compliance with the applicable standards will be considered to be in compliance with the provisions of this Chapter, including the marketing regulations in Subpart I of Part 2.

(d) For perimeter protection systems operating in the frequency bands allocated to television broadcast stations operating under Part 73 of this Chapter, the holder of the grant of certification must test each installation prior to initiation of normal operation to verify compliance with the technical standards and must maintain a list of all installations and records of measurements. For perimeter protection systems operating outside of the frequency bands allocated to television broadcast stations, upon receipt of a grant of certification, further testing of the same or similar type of system or installation is not required.

Section 15.203 Antenna requirement.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

Section 15.204 External radio frequency power amplifiers and antenna modifications.

(a) Except as otherwise described in paragraph (b) Page 52

and (d) of this section, no person shall use, manufacture, sell or lease, offer for sale or lease (including advertising for sale or lease), or import, ship, or distribute for the purpose of selling or leasing, any external radio frequency power amplifier or amplifier kit intended for use with a Part 15 intentional radiator.

(b) A transmission system consisting of an intentional radiator, an external radio frequency power amplifier, and an antenna, may be authorized, marketed and used under this part. Except as described otherwise in this section, when a transmission system is authorized as a system, it must always be marketed as a complete system and must always be used in the configuration in which it was authorized.

(c) An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator. An intentional radiator may be authorized with multiple antenna types.

(1) The antenna type, as used in this paragraph, refers to antennas that have similar in-band and out-of-band radiation patterns.

(2) Compliance testing shall be performed using the highest gain antenna for each type of antenna to be certified with the intentional radiator. During this testing, the intentional radiator shall be operated at its maximum available output power level.

(3) Manufacturers shall supply a list of acceptable antenna types with the application for equipment authorization of the intentional radiator.

(4) Any antenna that is of the same type and of equal or less directional gain as an antenna that is authorized with the intentional radiator may be marketed with, and used with, that intentional radiator. No retesting of this system configuration is required. The marketing or use of a system configuration that employs an antenna of a different type, or that operates at a higher gain, than the antenna authorized with the intentional radiator is not permitted unless the procedures specified in Section 2.1043 of this chapter are followed.

(d) Except as described in this paragraph, an external radio frequency power amplifier or amplifier kit shall be marketed only with the system configuration with which it was approved and not as a separate product.

(1) An external radio frequency power amplifier may be marketed for individual sale provided it is intended for use in conjunction with a transmitter that operates in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands pursuant to § 15.247 of this part or a transmitter that operates in the 5.725 - 5.825 GHz band pursuant to § 15.407 of this part. The amplifier must be of a design such that it can only be connected as part of a system in which it has been previously authorized. (The use of a non-standard connector or a form of electronic system identification is acceptable.) The output

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	2
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

power of such an amplifier must not exceed the maximum permitted output power of its associated transmitter.

(2) The outside packaging and user manual for external radio frequency power amplifiers sold in accordance with paragraph (d)(1) must include notification that the amplifier can be used only in a system which it has obtained authorization. Such a notice must identify the authorized system by FCC Identifier.

Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this Section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a), the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a), and the fundamental

emission is outside of the bands listed in paragraph (a) more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to Section 15.213.

(4) Any equipment operated under the provisions of Secs. 15.253, 15.255 or 15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of Section 15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of Subpart D or F of this Part.

(7) Devices operated pursuant to Sec. 15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under Sec. 15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in Sec. 15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under Sec. 15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in Sec. 15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of Section 15.245 shall not exceed the limits specified in Section 15.245(b).

Section 15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66-56 *	56-46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

(b) The shown limit in paragraph (a) of this Section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 uV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in Section 15.205 and Section 15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

Section 15.209 Radiated emission limits, general requirements.

(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in Sections 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this Part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic

of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

Radiated Emission Limits, Additional Provisions

Section 15.215 Additional provisions to the general radiated emission limitations.

(a) The regulations in Secs. 15.217-15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.

(b) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in Section 15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Secs. 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Section 15.231 Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz.

(a) The provisions of this Section are restricted to periodic operation within the band 40.66 -

40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous

transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

(b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500**	375 to 1,250**
Above 470	12,500	1,250

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of

measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

(d) For devices operating within the frequency band 40.66 - 40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be + 0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) and may be employed for any type of operation, including operation prohibited in paragraph (a), provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this Section, except the field strength table in paragraph (b) is replaced by the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	1,000	100
70 - 130	500	50
130 - 174	500 to 1,500 **	50 to 150 **
174 - 260	1,500	150
260 - 470	1,500 to 5,000 **	150 to 500 **
Above 470	5,000	500

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $22.72727(F) - 2454.545$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $16.6667(F) - 2833.3333$. The maximum permitted

unwanted emission level is 20 dB below the maximum permitted fundamental level.]

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Section 15.247 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems

may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

(2) Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(4)(i) and (c)(4)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or staff having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed

the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition

of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hops to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See Sec. 1.1307(b)(1) of this Chapter.

Note: Spread spectrum systems are sharing these bands on a noninterference basis with systems supporting critical Government requirements that have been allocated the usage of these bands, secondary only to ISM equipment operated under the provisions of Part 18 of this Chapter. Many of these Government systems are airborne radiolocation systems that emit a high EIRP which can cause interference to other users. Also, investigations of the effect of spread spectrum interference to U. S. Government operations in the 902-928 MHz band may require a future decrease in the power limits allowed for spread spectrum operation.

Section 15.249 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions:

- (1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.
- (2) The frequency tolerance of the carrier signal shall be maintained within + 0.001% of the

operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(3) Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

(c) Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

(e) As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

(f) Parties considering the manufacture, importation, marketing or operation of equipment under this section should also note the requirement in Section 15.37(d).



FCC Approved Part 15 Domestic Testing Facilities

The following firms have submitted the information required by Section 2.948 of the FCC Rules for measuring devices subject to Part 15 and have indicated that they are available to the public on a contract basis. A searchable list may be found on the FCC web site at:

<http://gulfoss2.fcc.gov/prod/oet/cf/eas/reports/TestFirmSearch.cfm>

This list is provided as a public service. IT IS YOUR RESPONSIBILITY TO SELECT A FIRM THAT IS CAPABLE OF MEASURING YOUR SPECIFIC DEVICE. Linx Technologies, Inc. and the FCC take no responsibility regarding the capability of these firms for performing the required measurements. Accordingly, firms on this list should not advertise or otherwise imply FCC approval of their site. Questions concerning this list may be directed to the FCC.

* Firm is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP), American Association for Laboratory Accreditation (A2LA) or provisionally accepted by the FCC to perform testing under the Declaration of Conformity procedure. For further information contact NIST at 301-975-4016 or A2LA at 301-670-1377.

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Power Conversion Tables For 50Ω System

dBm	mW	dBmV	mVRMS	mVp	mVpp
-50	0.000	-3.0	0.7	1.0	2.0
-45	0.000	2.0	1.3	1.8	3.6
-40	0.000	7.0	2.2	3.2	6.3
-35	0.000	12.0	4.0	5.6	11.2
-30	0.001	17.0	7.1	10.0	20.0
-25	0.003	22.0	12.6	17.8	35.6
-20	0.010	27.0	22.4	31.6	63.2
-15	0.032	32.0	39.8	56.2	112.5
-10	0.100	37.0	70.7	100.0	200.0
-5	0.316	42.0	125.7	177.8	355.7
0	1.000	47.0	223.6	316.2	632.5
1	1.259	48.0	250.9	354.8	709.6
2	1.585	49.0	281.5	398.1	796.2
3	1.995	50.0	315.9	446.7	893.4
4	2.512	51.0	354.4	501.2	1002.4
5	3.162	52.0	397.6	562.3	1124.7
6	3.981	53.0	446.2	631.0	1261.9
7	5.012	54.0	500.6	707.9	1415.9
8	6.310	55.0	561.7	794.3	1588.7
9	7.943	56.0	630.2	891.3	1782.5
10	10.000	57.0	707.1	1000.0	2000.0
11	12.589	58.0	793.4	1122.0	2244.0
12	15.849	59.0	890.2	1258.9	2517.9
13	19.953	60.0	998.8	1412.5	2825.1
14	25.119	61.0	1120.7	1584.9	3169.8
15	31.623	62.0	1257.4	1778.3	3556.6
16	39.811	63.0	1410.9	1995.3	3990.5
17	50.119	64.0	1583.0	2238.7	4477.4
18	63.096	65.0	1776.2	2511.9	5023.8
19	79.433	66.0	1992.9	2818.4	5636.8
20	100.000	67.0	2236.1	3162.3	6324.6
21	125.893	68.0	2508.9	3548.1	7096.3
22	158.489	69.0	2815.0	3981.1	7962.1
23	199.526	70.0	3158.5	4466.8	8933.7
24	251.189	71.0	3543.9	5011.9	10023.7
25	316.228	72.0	3976.4	5623.4	11246.8
26	398.107	73.0	4461.5	6309.6	12619.1
27	501.187	74.0	5005.9	7079.5	14158.9
28	630.957	75.0	5616.7	7943.3	15886.6
29	794.328	76.0	6302.1	8912.5	17825.0
30	1000.000	77.0	7071.1	10000.0	20000.0



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