



Guide to Wireless Regulations in the United States

Wireless made simple[®]

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The FCC Road

Part 15: From Concept to Approval



Introduction

Many manufacturers have avoided making their products wireless because of uncertainty over the approval and certification process. 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. Thanks to a growing number of easily applied radio frequency (RF) devices such as those offered by Linx, manufacturers are now able to quickly and reliably add wireless functionality to their products. The issue of legal compliance for the finished product is straightforward when approached in logical steps.

Purpose of this Application Note

This application note gives a brief overview of the legal issues governing the manufacture and sale of RF products intended for unlicensed operation in the United States under CFR 47 Part 15. In the United States the Federal Communications Commission (FCC) is responsible for the regulation of all RF devices. The FCC requires any device that radiates RF energy to be tested for compliance with FCC rules. These rules are contained in the Code of Federal Regulations (CFR), Title 47. Part 15 is the section of the code that deals with devices that emit RF energy and are to be operated without an individual license.

While this application note will provide you with a basic understanding of the steps involved in certification, it is strongly recommended that you obtain a full copy of the code from your local government bookstore, the Government Printing Office <<http://bookstore.gpo.gov/>>, or the FCC website <<http://wireless.fcc.gov/rules.html>>.

What is Unlicensed Operation?

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 testing and/or certification. Indeed, both the transmitter and receiver must be tested by a qualified testing laboratory. However, once the necessary approvals are received, the end user can then operate the product without further obligation or licensing.

Steps to Part 15 Certification

Choose the optimum operating frequency.

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 15.249 covers the 902–928MHz band. In this frequency range, a user is allowed to transmit any analog or digital signal they desire so long as the stipulations governing allowed output power, harmonics and occupied bandwidth are met. Other sections are not so accommodating.

For example, in the 260–470MHz band, the FCC considers not only RF factors but also the intended function and application.

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, consult with a Linx application engineer or read additional Linx Application Notes focusing on those issues.)

Component selection.

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. This process is greatly simplified if you are using a Linx module, but it is still important to recognize that the antenna and layout play key roles in the product’s legal operation.

Many modular RF transmitter products, including those manufactured by Linx, have the potential to output RF power in excess of Part 15 limits. This extra power helps designers overcome inefficient antenna styles and take

advantage of the FCC's averaging allowance when modulation techniques such as ASK/OOK are employed. If necessary, output power may be reduced using the module's level adjust or an external attenuation pad. For further details, review Application Note AN-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 room for interpretation, the FCC's intention is that a user not be able to change the radiated characteristics of the device by easily interchanging the antenna with a higher performance model.

Build production-ready prototypes.

After choosing a frequency for operation and a suitable RF stage, you will want to move from concept breadboard prototypes to a production-ready model as rapidly as possible.

Prescreen and optimize.

Once a wireless 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 instruments, consider prescreening services such as those offered by Linx. The prescreening process can result in a cost savings over formal testing and provides an opportunity 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, testing should be conducted by a properly approved laboratory. In most cases it is not necessary to be present for testing and the laboratory will prepare the filing paperwork.

The FCC has greatly streamlined the approval process by allowing independent laboratories to issue certifications through the Telecommunication Certification Body (TCB) program.

Unless specifically requested pursuant to Section 2.1076, receivers no longer require certification. They just require a quick test and issuance of a Declaration of Conformity (DoC) which should be maintained in the applicant's files. Transmitter certification is also relatively 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 \$3,500, and the receiver about \$1,500. The entire process can now be rapidly completed and many labs can perform other testing at the same time, such as Class A/B.

Label the product and market it.

Following successful completion of the approval process, products should be labeled as required by Part 2.925 and 2.926 as well as Part 15.19 or otherwise prescribed by the FCC. Further information on labeling may be obtained on the FCC website.

Summary

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 functionality and market appeal. By following the steps outlined in this application note and reviewing a copy of CFR 47 you will be well on your way to RF success. While complying with applicable provisions 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 contact the FCC directly.

Federal Communications Commission
Office of Engineering and Technology
7435 Oakland Mills Road
Columbia, MD 21046
Phone: 301-362-3000
Fax: 301-344-2050
Email: labhelp@fcc.gov

You may also wish to visit the Linx Technologies web site at <www.linxtechnologies.com> where a list of testing facilities and applicable sections of FCC regulations are available for review and download.

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 0–19. The sections you will be dealing with throughout the approval process are primarily Part 2 and Part 15. Part 2 deals with issues of marking 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 <<http://bookstore.gpo.gov/>>. or the FCC website <<http://wireless.fcc.gov/rules.html>>.

Issues such as frequency selection, antenna compliance, and output power are covered elsewhere, so this section moves past those issues to the specific steps involved in the approval process.

Step One: Lab Selection

The FCC requires that final product testing be conducted by a registered testing facility. Labs that have indicated they are available to perform Part 15 testing for the public are listed on the Domestic Testing Facilities list provided in the last section of this document. A current list may also be found on the FCC website.

The quality and competence of labs varies widely. Labs appearing on the list are independent. Linx is pleased to recommend competent facilities; however, it is the sole responsibility of applicants to select a test lab capable of measuring their specific device.

To Pay or Not To Pay

Once you have chosen a lab you must decide the extent of the services they will provide. Lab services range from basic testing, to full compliance testing and filing. 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 jeopardize your ability to receive approval.

Step Two: Registering

When your product is completed and ready for testing, a Federal Registration Number (FRN) must be obtained. This is free and can be obtained online in just a few minutes on the FCC website.

Next, request a grantee code from the FCC. This can also be done online on the FCC website.

The grantee code costs \$60 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

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. It is a good idea to contact the lab well in advance to make them aware of your project and secure a spot in their testing schedule.

In order to have the best chance at approval, it is important to explain the intended function of the product and any special operating characteristics to test lab personnel. If you are using a module that uses a keyed modulation method such as ASK/OOK, 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 will often 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 characters are the grantee code obtained earlier. The last 14 characters are up to the applicant.
- 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 product and its operation
- A product sample for testing and photos

Transmitter Testing

A product containing a Linx transmitter is considered by the FCC to be an intentional radiator because it intentionally emits RF energy into free space. Thus, it must be tested and certified before it may be marketed.

Certified transmitters 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 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. These labels may be combined for convenience. Further information on labeling may be obtained on the FCC website.

Receiver Declaration of Conformity

A receiver is considered an unintentional radiator because, while not specifically designed to radiate RF energy, RF radiation may occur. For this reason the receiver must be tested and authorized by a Declaration of Conformity (DoC). In this simple process an accredited laboratory tests the product to ensure compliance with FCC standards. An FCC filing or submission is not required unless specifically requested pursuant to Section 2.1076. The test results should be maintained within the applicant's files. Conforming products are also required to have a compliance

label attached to all items subsequently manufactured or marketed by the responsible party.

Filing Confidentiality

Filing for confidentiality is an important and often overlooked issue. Unless otherwise requested, 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) the user’s manual. In general, the only information that is granted confidentiality is patented trade-secret information that if given out could harm a company financially.

Step Four: The Filing Process

The FCC greatly streamlined the approval process. Certifications were once issued by the FCC directly, but independent testing laboratories are now allowed to issue certification through the Telecommunication Certification Body (TCB) program. They can also issue certifications for other countries with whom the US has a Mutual Recognition Agreement (MRA). TCB’s must be accredited and comply with Section 2.962.

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. The TCB will review all application materials and, if the device conforms to the requirements, they will upload this information to the FCC. After the FCC receives the report they will add the product and the ID number to their database and their website and issue a Grant of Certification. At this point, the device can be legally marketed and sold. The report can be searched for on the FCC web site.

After certification, the FCC or the TCB may request a sample of the product to confirm ongoing FCC compliance.

Considerations for Operation within the 260-470MHz Band

Introduction

This application note is designed to give the reader a basic understanding of the legal and technical considerations for operation of RF devices in the 260–470MHz band within the United States. The use of these frequency bands varies considerably worldwide, so it should be recognized that this application note is intended for designers utilizing Linux RF modules and planning to operate in the United States.

When working with RF, a clear distinction should always be made between what is technically possible and what is legally acceptable. Achieving a solution that meets technical objectives but cannot be legally sold or operated serves little use. As such, issues of legality should be given high priority.

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 260–470MHz band are contained in volume 0-19. It is strongly recommended that a copy be obtained and reviewed in its entirety. You can get a full copy of the code from your local government bookstore, the Government Printing Office in Washington <<http://bookstore.gpo.gov/>> or the FCC website <<http://wireless.fcc.gov/rules.html>>.

What is Unlicensed Operation?

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 testing and/or certification. Indeed, both the transmitter and receiver must be tested by a qualified testing laboratory. However, once this has been done and any necessary approvals received, the end user of the product can then operate it without obtaining a license for its use.

Receiver Procedure

The approval procedures for transmitters and receivers are quite different. The receiver is considered an unintentional radiator and is subject to authorization under the Declaration of Conformity process. This is a simple process in which an accredited laboratory tests the product to ensure that the equipment complies with FCC standards. The test results should be maintained within your files but an FCC filing or submittal is not required unless specifically requested pursuant to Section 2.1076.

Following successful completion of this process, the end product should be labeled as prescribed by the FCC. Further information may be obtained on the FCC website.

Transmitter Procedure

The transmitter is an intentional radiator and subject to certification. Certification testing should be performed by properly approved laboratory. In most cases you do not need to be present for testing and your chosen laboratory will prepare the filing paperwork. Certifications were once issued by the FCC directly, but now independent laboratories are allowed to issue certification through the Telecommunication Certification Body (TCB) program, which has streamlined the process.

Following successful testing, a report will be produced showing information about the testing and your device. A label displaying your FCC ID number along with FCC prescribed information will need to be placed on your certified product. You can obtain further information on labeling at the website listed in the preceding section.

The rules for transmitters operating in the 260–470MHz band are governed by Part 15.231. In some bands the FCC specifies only fundamental power, harmonic levels, and allowed bandwidth. However, in the case of the 260–470MHz band, the FCC also considers factors such as the intended application and transmission duration.

You will want to review the text of 15.231 in its entirety. (It has been included for your convenience.) When reviewing this section, it is critical to read paragraphs (A)-(D) as a unit, and recognize that paragraph (E) only applies if the rules of paragraph (A) cannot be met. Given the rules' complexity and application-dependent nature, they are best illustrated in the flowchart in Figure 1.

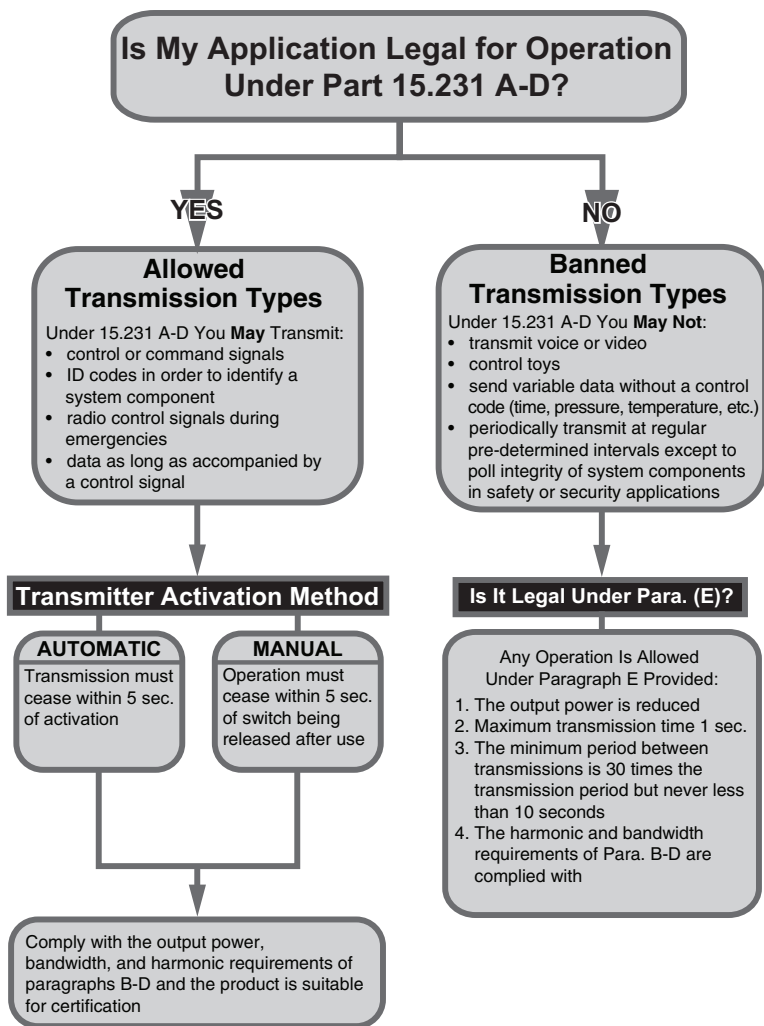


Figure 1: Is My Application Legal for Operation Under Part 15.231 A-D?

FCC rules are subject to a case-by-case interpretation. If your application is not clearly in compliance or you are uncertain, contact the FCC at:

Federal Communications Commission
 Office of Engineering and Technology
 7435 Oakland Mills Road
 Columbia, MD 21046
 Phone: 301-362-3000
www.fcc.gov

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 product to receive certification.

Determine and Comply with Allowed Output Power

The following table shows the relationship between the fundamental frequency of operation and the allowed output field strength. Since the output field strength is allowed to climb as the frequency increases, it might appear that selecting the highest frequency would give the best range performance. This is not the case. However, signal attenuation will increase with frequency. Thus, the regulations equalize the bands propagation characteristics. Antenna size and efficiency should also be considered. Compact or reduced-size antennas will generally not be as efficient at the lower parts of the band.

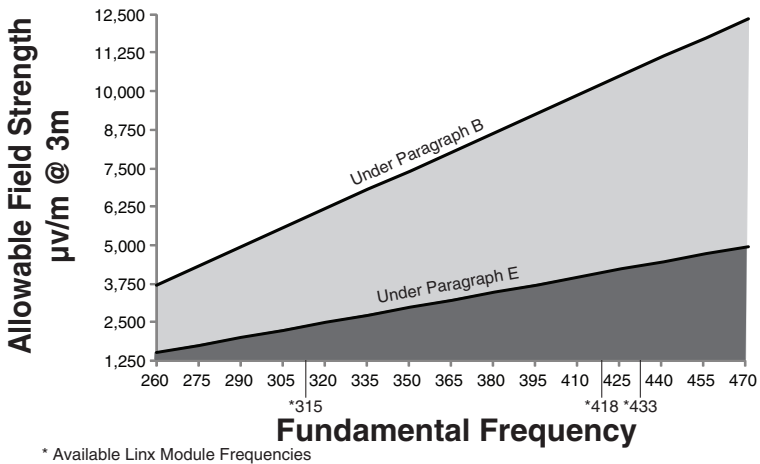


Figure 2: Allowable Field Strength

It is always important to note that the RF level radiated into free space is dependent not only on raw output power, but also factors such as the type of antenna employed, circuit layout and ground plane. Most transmitter modules, including those manufactured by Linx, are capable of producing non-compliant output levels. This extra power helps designers overcome inefficient antenna styles and allows them to take advantage of the FCC's averaging allowance when modulation techniques such as ASK/OOK are employed. If the module is matched to an efficient antenna, the output power may need to be reduced using the module's level adjust or an external attenuation pad. For further details, review Linx Application Note AN-00150.

In addition to fundamental output power restrictions, 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 on these points as Linx modules are designed to meet these requirements. It is important, however, to note that there are ways in which a user can adversely affect harmonic content, including the use of a poorly matched or tuned antenna, supply/system noise, or layout or bypass issues.

While these considerations 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 can be 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 in 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 a designer's life miserable. The random periodic nature of transmissions resulting from these restrictions helps to keep this set of frequencies clear of sustained interference. Other Part 15 bands are potentially crowded with continuous transmissions of voice, data, video, and even microwave ovens.

Second, longer transmission distances are achieved with less power. The 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 and power consumption is significantly reduced.

Third is cost-effectiveness. The components used at these frequencies are lower in cost than those designed for higher frequencies.

Fourth is international regulatory compatibility. If your product will be sold abroad, you will want to plan for international compatibility. Band allocation and regulations vary from country to country. For additional information you may wish to refer to Linx Application Note AN-00129.

Common Frequencies Within the Band and Their Uses

As you review Linx product offerings, you will notice three standard frequencies within the 260M–470MHz band. 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 allowable 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.

Summary

The 260–470MHz band is ideal for transmitting control, command or status signals. It should also be given consideration for control signals accompanied by data such as time, temperature or pressure.

Considerations for Operation within the 902-928MHz Band

Introduction

This application note is designed to give the reader a basic understanding of the legal and technical considerations for operation of RF devices in the 902–928MHz band. The use of these frequency bands varies considerably worldwide, so it should be recognized that this application note is intended for designers utilizing Linx RF modules and planning for operation within the United States.

When working with RF, a clear distinction should always be made between what is technically possible and what is legally acceptable. Achieving a solution that meets technical objectives but cannot be legally sold or operated serves little use. As such, issues of legality should be given high priority.

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 902–928MHz band are contained in volume 0-19. Partial excerpts are included at the end of this document; however, it is strongly recommended that a full copy of the code be obtained from your local government bookstore, the Government Printing Office <<http://bookstore.gpo.gov/>> or the FCC website.

What is Unlicensed Operation?

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 testing and/or certification. Indeed, both the transmitter and receiver must be tested by a qualified testing laboratory. However, once the necessary approvals are received, the end user can then operate the product without further obligation or licensing.

The frequencies from 902 to 928MHz are allocated for a wide variety of unlicensed applications. These include unlicensed products operating under Part 15 as well as Part 18 Industrial/Scientific/Medical (ISM) devices.

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 for the 902–928MHz band are very straightforward. There are no restrictions on the application, content or duration of transmissions, only on factors such as power output, bandwidth, harmonic and spurious emissions.

While Linx modules are inherently designed to meet these requirements, it is important to note that external factors such as layout, antenna type, and output power can affect both the module's performance and compliance. While these issues may appear formidable, they are generally not. By choosing the correct operational frequency and using a pre-made RF module, a product designer's burden is greatly reduced. Since the approval procedures for transmitters and receivers are quite different, let's look at each separately.

Receiver Procedure

The receiver is considered an unintentional radiator and is subject to authorization under the Declaration of Conformity process. This is a simple process in which an accredited laboratory tests the product to ensure that the equipment complies with all applicable FCC standards. An FCC filing or submittal is not required unless specifically requested pursuant to Section 2.1076. The test results should be maintained within the applicant's files.

Following successful completion of this process, the end product should be labelled as prescribed by the FCC. Additional information on labeling requirements may be obtained on the FCC website.

Transmitter Procedure

The transmitter is an intentional radiator and subject to certification. In most instances, users of modules manufactured by Linx will seek certification under part 15.247 for spread spectrum modules or under 15.249 for narrowband modules. An exception to this is RF modules which have been precertified by Linx under the modular approval process. In instances where certification is required, testing will need to be performed by a properly approved laboratory. In most cases it is not necessary to be present for testing and the laboratory will prepare the filing paperwork. Certifications were once issued by the FCC directly, but now independent laboratories are allowed to issue certification through the Telecommunication Certification Body (TCB) program which has greatly streamlined the process.

Following successful testing, a report will be produced showing information about the testing and the device. A label displaying the applicant's FCC ID number along with FCC prescribed information will need to be placed on the certified product. Further information on labeling can be obtained at the website listed in the preceding section.

Now that a basic overview of legal issues has been covered, it is time to consider the technical issues of operation in these frequencies.

Benefits of Operation within the 902–928MHz Band

The first benefit of the 902–928MHz band is freedom from the tight limitations and application restrictions the FCC places on some other bands. In this band virtually any analog or digital signal can be sent without restrictions on content or duration.

Second, higher legal output power allows the potential for much longer transmission distances.

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, reducing transmitter power consumption.

Fourth is antenna size and compactness. A useful byproduct of higher frequency is shorter wavelength. This allows a $\frac{1}{4}$ -wave antenna in the 900MHz range to typically be less than 3.25 inches in length. In fact, Linx's Antenna Factor division offers tiny surface mount antennas that are less than 0.65 inches in length, allowing for easy concealment in compact portable products.

Drawbacks to the 902–928MHz Band

The first drawback is the band's popularity (good in rock and roll, bad in RF). Products such as cordless phones have migrated to higher frequencies, but the growth of wireless and the benefits of the band make it likely to remain crowded.

Second is the potential for higher level interferers. In addition to its allocation for narrow-band devices, the 902–928MHz frequency range is also allocated for higher power devices. While Linx employs a variety of techniques to minimize the possible impact of such interference, it should be considered.

Third is export. Allowed uses of the 900MHz band vary outside the US and a product's operation may not be legally allowable in other areas. Fortunately, nearby frequencies are standardized in the large European market. Linx offers a selection of footprint compatible products which accommodate domestic and export requirements with just a change of modules and antennas. For additional information you may wish to refer to Linx Application Note AN-00129. Check the regulations for each country to which export is desired in order to assure the product will be legal.

Summary

The 902MHz–928MHz band is highly favorable due to minimal legal restrictions and excellent propagation characteristics. It is an ideal choice for analog or digital links, especially those that require reliability over long distances or which might be prohibited in other bands.

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 on the FCC website.

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 (GPO) 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?

The FCC Laboratory makes available such a listing and it is updated monthly. This information is online on the FCC website. A copy is also included at the end of 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.

What does testing and certification cost?

This depends largely on the test lab and how many of their services you choose to utilize. Full transmitter and receiver testing can cost around \$5,000, transmitter only around \$3,500, and the receiver about \$1,500. The entire process can now be rapidly completed and many labs can perform other testing at the same time.

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 that changes to the FCC

ID without any other changes to the equipment may be performed by anyone.

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 by the responsible party as defined in CFR 47 2.209, but nothing is actually filed with the FCC. This means that you will just need to have data on your product on file that shows 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 number?

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 on the FCC website.

What happens if one sells or uses noncompliant 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
- A \$100,000/\$200,000 criminal penalty for an individual or 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 subjected. 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 accredited 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 or can be ordered by calling 1-888-CALL-FCC. FCC Forms may be reproduced under the conditions specified in 47 CFR, Section 0.409 of the Rules.

Questions or 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
www.fcc.gov/labhelp

Public Access Link (PAL)

The FCC provides an online 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 on the FCC website.

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: (866) 418-0232
E-mail: fccinfo@fcc.gov
Website: www.fcc.gov

CFR 47 Part 2

Excerpted (Revised as of July, 2012)

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.

Part 15: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations

Subpart J—Equipment Authorization Procedures

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General Provisions

Section 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.

Section 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 Section 2.957, of this part.

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

Section 2.906 Declaration of Conformity.

(a) A Declaration of Conformity is a procedure where the responsible party, as defined in Section 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 Section 2.1076.

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

Section 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 Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

Section 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.

Section 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 Section 2.929(b), the party performing the modification is responsible for compliance of the product with the applicable administrative and technical provisions in this chapter.

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

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

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

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

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

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

(d) If, because of modifications performed subsequent to authorization, a new party becomes responsible for ensuring that a product complies with the technical standards and the new party does not obtain a new equipment authorization, the equipment shall be labelled, following the specifications in Section 2.925(d), with the following: "This product has been modified by [insert name, address and telephone number of the party performing the modifications]."

Application Procedures for Equipment Authorizations

Section 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 where under 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.

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

(a) All applications for equipment authorization must be filed electronically via the Internet. Information on the procedures for electronically filing equipment authorization applications can be obtained from the address in paragraph (c) of this section and from the Internet on the FCC website.

(b) Unless otherwise directed, fees for applications for the equipment authorization, pursuant to Section 1.1103 of this chapter, must be submitted either electronically via the Internet on the FCC website or by following the procedures described in Section 0.401(b) of this chapter. The address for fees submitted by mail is: Federal Communications Commission, Equipment Approval Services, P.O. Box 979095, St. Louis, MO 63197–9000. 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 Lockbox 979095, SL–MO–C2–GL, 1005 Convention Plaza, St. Louis, MO 63101.

(c) Any 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 Laboratory, 7435 Oakland Mills Road, Columbia, Maryland, 21046.

Section 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.

Section 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 request 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.

Section 2.919 Denial of application.

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

Section 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.

Section 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 Sections 1.106 and 1.115, respectively, of this chapter.

Section 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 Section 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 Section 2.933.

Section 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 Section 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 Section 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.

Section 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 Section 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 receive a grantee code electronically via the Internet on the FCC website. The code may be obtained at any time prior to submittal of the application for equipment authorization. However, the fee required by Section 1.1103 of this chapter must be submitted and validated within 30 days of the issuance of the grantee code, or the code will be removed from the Commission's records and a new grantee code will have to be obtained.

(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 Sections 2.934 and 2.935 for additional information.

(2) [Reserved]

(d) The equipment product code assigned 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 Section 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 Section 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 Section 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. Labelling of such equipment may include model or type numbers, but shall not include a purported FCC Identifier.

Conditions Attendant to an Equipment Authorization

Section 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.

Section 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 Section 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, notice of such change(s) shall be submitted to the Commission via the Internet at <<https://gulfoss2.fcc.gov/prod/oet/cf/eas/index.cfm>> 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 via the Internet on the FCC website 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.

Section 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.

Section 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 Section 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 Section 1.2002 of this chapter.

Section 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 Section 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 Section 2.1033(b)(7) or Section 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 Section 2.1043, a complete application shall be filed pursuant to Section 2.911.

Section 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 Sections 2.938, 2.955, and 2.1075.

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

(c) The manufacturing plant and facilities.

Section 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.

Section 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 Section 2.931.

(2) A record of the procedures used for production inspection and testing to ensure conformance with the standards and the requirements of Section 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 Section 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, Sections 2.909, 2.924, 2.933, and 2.1043.

Section 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 Section 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.

Section 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 Sections 0.441 through 0.470 of this chapter.

Section 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.

Section 2.944 Software defined radios.

(a) Manufacturers must take steps to ensure that only software that has been approved with a software defined radio can be loaded into the radio. The software must not allow the user to operate the transmitter with operating frequencies, output power, modulation types or other radio frequency parameters outside those that were approved. Manufacturers may use means including, but not limited to the use of a private network that allows only authenticated users to download software, electronic signatures in software or coding in hardware that is decoded by software to verify that new software can be legally loaded into a device to meet these requirements and must describe the methods in their application for equipment authorization.

(b) Any radio in which the software is designed or expected to be modified by a party other than the manufacturer and would affect the operating parameters of frequency range, modulation type or maximum output power (either radiated or conducted), or the circumstances under which the transmitter operates in accordance with Commission rules, must comply

with the requirements in paragraph (a) of this section and must be certified as a software defined radio.

(c) Applications for certification of software defined radios must include a high level operational description or flow diagram of the software that controls the radio frequency operating parameters.

Section 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.

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

(a) Any responsible party, as defined in Section 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 Section 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 extensions of time upon submission of a showing of good cause.

Section 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 reports 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.

Section 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. A laboratory that has been accredited in accordance with paragraph (d) of this section is not required to file a description of its facilities with the Commission's laboratory, provided the accrediting organization (or designating authority in the case of foreign laboratories) submits the following information to the Commission's laboratory:

(i) Laboratory name, location of test site(s), mailing address and contact information;

(ii) Name of accrediting organization;

(iii) Date of expiration of accreditation;

(iv) Designation number;

(v) FCC Registration Number (FRN);

(vi) A statement as to whether or not the laboratory performs testing on a contract basis;

(vii) For laboratories outside the United States, the name of the mutual recognition agreement or arrangement under which the accreditation of the laboratory is recognized.

(3) If the equipment is to be authorized under the Declaration of Conformity procedure, the laboratory making the measurements must be accredited in accordance with paragraph (d) of this section.

(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 (21cm × 29.7cm) or 8×10 inches (20.3cm × 25.4cm). 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) For a measurement facility that will be used for testing radiated emissions, a plot of site attenuation data taken pursuant to the procedures contained in Sections 5.4.6 through 5.5 of the following procedure: American National Standards Institute (ANSI) C63.4–2001, entitled “American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz” published by the American National Standards Institute on June 22, 2001 as document number SH94908. 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 C63.4–2001 may be obtained from: IEEE Customer Service, P.O. Box 1331, Piscataway, NJ 08855–1331, or UPS only IEEE Customer Service, 445 Hoes Lane, Piscataway, NJ 08854; telephone 1-800-678-4333 or +1-732-981-0600 (outside the United States and Canada). Copies of ANSI C63.4–2001 may be inspected at the following locations:

(i) Federal Communications Commission, 445 12th Street, SW., Office of Engineering and Technology (Room 7–B144), Washington, DC 20554,

(ii) Federal Communications Commission Laboratory, 7435 Oakland Mills Road, Columbia, MD 21046, or

(iii) at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to <<http://www.archives.gov/federal-register/cfr/>>

(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) A laboratory that has been accredited with a scope covering the required measurements shall be deemed competent to test and submit test data for equipment subject to verification, Declaration of Conformity, and certification. Such a laboratory shall be accredited by an approved accreditation organization based on the International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) Standard 17025, “General Requirements for the Competence of Calibration and Testing Laboratories.” The organization accrediting the laboratory must be approved by the Commission’s Office of Engineering and Technology, as indicated in Section 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 that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site revalidation shall occur on an interval not to exceed two years.

(e) The accreditation of a laboratory located outside of the United States, or its possessions, will be acceptable only under one of the following conditions:

(1) If the accredited laboratory has been designated by a foreign designating authority and recognized by the Commission under the terms of a government-to-government Mutual Recognition Agreement/Arrangement; or

(2) If the laboratory has been recognized by the Commission as being accredited by an organization that has entered into an arrangement

between accrediting organizations and the arrangement has been recognized by the Commission.

Verification

AUTHORITY: Sections 2.951 through 2.957 are issued under sections 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.

Section 2.951 Cross reference.

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

Section 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.

Section 2.953 Responsibility for compliance.

(a) In verifying compliance, the responsible party, as defined in Section 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 Section 2.955 however should be in the English language and made available to the Commission upon a reasonable request, in accordance with Section 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 Section 2.909 bears responsibility for continued compliance of subsequently produced equipment.

Section 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.

Section 2.955 Retention of records.

(a) For each equipment subject to verification, the responsible party, as shown in Section 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 Section 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 Section 2.909.
- (4) For equipment subject to the provisions in part 15 of this chapter, the records shall indicate if the equipment was verified pursuant to the transition provisions contained in Section 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.

Section 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 Section 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 Section 2.955 or for the submission of sample units are covered under the provisions of Section 2.946.

Telecommunication Certification Bodies (TCBs)

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 Section 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 telecommunications equipment, the areas of expertise to be used during the assessment shall include, but not be limited to, electromagnetic compatibility and telecommunications equipment (wired and wireless).

2.962 Requirements for Telecommunication Certification Bodies.

(a) Telecommunication certification bodies (TCBs) designated by the Commission, or designated by another authority pursuant to an effective bilateral or multilateral mutual recognition agreement or arrangement to which the United States is a party, shall comply with the following requirements.

(b) *Certification methodology.* (1) The certification system shall be based on type testing as identified in sub-clause 1.2(a) of ISO/IEC Guide 65.

(2) Certification shall normally be based on testing no more than one unmodified representative sample of each product type for which certifica-

tion is sought. Additional samples may be requested if clearly warranted, such as when certain tests are likely to render a sample inoperative.

(c) *Criteria for Designation.* (1) To be designated as a TCB under this section, an entity shall, by means of accreditation, meet all the appropriate specifications in ISO/IEC Guide 65 for the scope of equipment it will certify. The accreditation shall specify the group of equipment to be certified and the applicable regulations for product evaluation.

(2) The TCB shall demonstrate expert knowledge of the regulations for each product with respect to which the body seeks designation. Such expertise shall include familiarity with all applicable technical regulations, administrative provisions or requirements, as well as the policies and procedures used in the application thereof.

(3) The TCB shall have the technical expertise and capability to test the equipment it will certify and shall also be accredited in accordance with ISO/IEC Standard 17025 to demonstrate it is competent to perform such tests.

(4) The TCB shall demonstrate an ability to recognize situations where interpretations of the regulations or test procedures may be necessary. The appropriate key certification and laboratory personnel shall demonstrate a knowledge of how to obtain current and correct technical regulation interpretations. The competence of the Telecommunication Certification Body shall be demonstrated by assessment. The general competence, efficiency, experience, familiarity with technical regulations and products included in those technical regulations, as well as compliance with applicable parts of the ISO/IEC Standard 17025 and Guide 65, shall be taken into consideration.

(5) A TCB shall participate in any consultative activities, identified by the Commission or NIST, to facilitate a common understanding and interpretation of applicable regulations.

(6) The Commission will provide public notice of the specific methods that will be used to accredit TCBs, consistent with these qualification criteria.

(7) A TCB shall be reassessed for continued accreditation on intervals not exceeding two years.

(d) *Sub-contractors.* (1) In accordance with the provisions of sub-clause 4.4 of ISO/IEC Guide 65, the testing of a product, or a portion thereof, may be performed by a sub-contractor of a designated TCB, provided the laboratory has been assessed by the TCB as competent and in compliance with the applicable provisions of ISO/IEC Guide 65 and other relevant standards and guides.

(2) When a subcontractor is used, the TCB shall be responsible for the test results and shall maintain appropriate oversight of the subcontractor to ensure reliability of the test results. Such oversight shall include periodic audits of products that have been tested.

(e) *Designation of a TCB.* (1) The Commission will designate as a TCB any organization that meets the qualification criteria and is accredited by NIST or its recognized accreditor.

(2) The Commission will withdraw the designation of a TCB if the TCB's accreditation by NIST or its recognized accreditor is withdrawn, if the Commission determines there is just cause for withdrawing the designation, or if the TCB requests that it no longer hold the designation. The Commission will provide a TCB with 30 days notice of its intention to withdraw the designation and provide the TCB with an opportunity to respond.

(3) A list of designated TCBs will be published by the Commission.

(f) *Scope of responsibility.* (1) A TCB shall certify equipment in accordance with the Commission's rules and policies.

(2) A TCB shall accept test data from any source, subject to the requirements in ISO/IEC Guide 65, and shall not unnecessarily repeat tests.

(3) A TCB may establish and assess fees for processing certification applications and other tasks as required by the Commission.

(4) A TCB may rescind a grant of certification within 30 days of grant for administrative errors. After that time, a grant can only be revoked by the Commission through the procedures in Section 2.939 of this part. A TCB shall notify both the applicant and the Commission when a grant is rescinded.

(5) A TCB may not:

(i) Grant a waiver of the rules, or certify equipment for which the Commission rules or requirements do not exist or for which the application of the rules or requirements is unclear.

(ii) Take enforcement actions; or

(iii) Authorize a transfer of control of a grantee.

(6) All TCB actions are subject to Commission review.

(g) *Post-certification requirements.* (1) A TCB shall supply an electronic copy of each approved application form and grant of certification to the Commission.

(2) In accordance with ISO/IEC Guide 65, a TCB is required to conduct appropriate post-market surveillance activities. These activities shall be based on type testing a few samples of the total number of product types which the certification body has certified. Other types of surveillance activities of a product that has been certified are permitted, provided they are no more onerous than testing type. The Commission may at any time request a list of products certified by the certification body and may request and receive copies of product evaluation reports. The Commission may also request that a TCB perform post-market surveillance, under Commission guidelines, of a specific product it has certified.

(3) If during post market surveillance of a certified product, a TCB determines that a product fails to comply with the applicable technical regulations, the Telecommunication Certification Body shall immediately notify the grantee and the Commission. A follow-up report shall also be provided within thirty days of the action taken by the grantee to correct the situation.

(4) Where concerns arise, the TCB shall provide a copy of the application file to the Commission within 30 calendar days of a request for the file made by the Commission to the TCB and the manufacturer. Where appropriate, the file should be accompanied by a request for confidentiality for any material that may qualify for confidential treatment under the Commission's rules. If the application file is not provided within 30 calendar days, a statement shall be provided to the Commission as to why it cannot be provided.

(h) In case of a dispute with respect to designation or recognition of a TCB and the testing or certification of products by a TCB, the Commission will be the final arbiter. Manufacturers and designated TCBs will be afforded at least 30 days to comment before a decision is reached. In the case of a TCB designated or recognized, or a product certified pursuant to an effective bilateral or multilateral mutual recognition agreement or arrangement (MRA) to which the United States is a party, the Commission may limit or withdraw its recognition of a TCB designated by an MRA party and revoke the certification of products using testing or certification provided by such a TCB. The Commission shall consult with the Office of the United States Trade Representative (USTR), as necessary, concerning any disputes arising under an MRA for compliance with the Telecommunications Trade Act of 1988 (Section 1371–1382 of the Omnibus Trade and Competitiveness Act of 1988).

Certification

Section 2.1031 Cross reference.

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

Section 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 (21cm × 29.7cm) or 8×10 inches (20.3cm × 25.4cm). Smaller photographs may be submitted provided they are sharp and clear, show the necessary detail, and are mounted on A4 (21cm × 29.7cm) or 8.5×11 inch (21.6cm × 27.9cm) 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 provisions of part 15 of this chapter, the application shall indicate if the equipment is being authorized pursuant to the transition provisions in Section 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 Section 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 Section 15.121 of this chapter, including details on the measurement procedures used to demonstrate compliance.

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

(12) An application for certification of a software defined radio must include the information required by Section 2.944.

(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"×10") 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 Sections 2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in Section 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 Section 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 Section 73.44.

(17) Applications for certification required by Section 25.129 of this chapter shall include any additional equipment test data required by that section.

(18) An application for certification of a software defined radio must include the information required by Section 2.944.

(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 Section 20.19 of that part, shall include a statement indicating compliance with the test requirements of Section 20.19 and indicating the appropriate M-rating and T-rating for the equipment. The manufacturer of the equipment shall be responsible for maintaining the test results.

(e) 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.

Section 2.1035 [Reserved]

Section 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 Sections 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057. See also Section 2.947.

Section 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 range, modulation type or maximum output power (either radiated or conducted) outside the parameters previously approved, or that change the circumstances under which the transmitter operates in accordance with Commission rules. 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 the 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. 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 Section 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 Section 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 subcarrier 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 Section 2.1400 in subpart M and Section 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 Section 73.1690 of the FCC's rules.

Section 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in Section 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as follows. In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

(1) Single sideband transmitters in the A3A or A3J emission modes—by two tones at frequencies of 400Hz and 1800Hz (for 3.0kHz authorized bandwidth), or 500Hz and 2100Hz (3.5kHz authorized bandwidth), or 500Hz and 2400Hz (for 4.0kHz authorized bandwidth), applied simultaneously, the input levels of the tones so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(2) Single sideband transmitters in the A3H emission mode—by one tone at a frequency of 1500Hz (for 3.0kHz authorized bandwidth), or 1700Hz (for 3.5kHz authorized bandwidth), or 1900Hz (for 4.0kHz authorized bandwidth), the level of which is adjusted to produce a radio frequency

signal component equal in magnitude to the magnitude of the carrier in this mode.

(3) As an alternative to paragraphs (b) (1) and (2) of this section other tones besides those specified may be used as modulating frequencies, upon a sufficient showing of need. However, any tones so chosen must not be harmonically related, the third and fifth order intermodulation products which occur must fall within the -25dB step of the emission bandwidth limitation curve, the seventh and ninth order intermodulation product must fall within the 35dB step of the referenced curve and the eleventh and all higher order products must fall beyond the -35dB step of the referenced curve.

(4) Independent sideband transmitters having two channels by 1700Hz tones applied simultaneously in both channels, the input levels of the tones so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(5) Independent sideband transmitters having more than two channels by an appropriate signal or signals applied to all channels simultaneously. The input signal or signals shall simulate the input signals specified by the manufacturer for normal operation.

(6) Single-channel controlled-carrier transmitters in the A3 emission mode—by a 2500Hz tone.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

Section 2.1047 Measurements required: Modulation characteristics.

(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) *Equipment which employs modulation limiting.* A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

(c) *Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power.* A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of Section 2.1049 for the occupied bandwidth tests.

(d) *Other types of equipment.* A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Section 2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(a) Radiotelegraph transmitters for manual operation when keyed at 16 dots per second.

(b) Other keyed transmitters—when keyed at the maximum machine speed.

(c) Radiotelephone transmitters equipped with a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal shall be 10dB greater than that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500Hz tone at an input level 16dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

(2) Single sideband transmitters in A3A or A3J emission modes—when modulated by two tones at frequencies of 400Hz and 1800Hz (for 3.0kHz authorized bandwidth), or 500Hz and 2100Hz (for 3.5kHz authorized bandwidth), or 500Hz and 2400Hz (for 4.0kHz authorized bandwidth), applied simultaneously. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(3) Single sideband transmitters in the A3H emission mode—when modulated by one tone at a frequency of 1500Hz (for 3.0kHz authorized bandwidth), or 1700Hz (for 3.5kHz authorized bandwidth), or 1900Hz (for 4.0kHz authorized bandwidth), the level of which is adjusted to produce a radio frequency signal component equal in magnitude to the magnitude of the carrier in this mode.

(4) As an alternative to paragraphs (c) (2) and (3) of this section, other tones besides those specified may be used as modulating frequencies, upon a sufficient showing of need. However, any tones so chosen must not be harmonically related, the third and fifth order intermodulation products which occur must fall within the -25dB step of the emission bandwidth limitation curve, the seventh and ninth order products must fall within the -35dB step of the referenced curve and the eleventh and all higher order products must fall beyond the -35dB step of the referenced curve.

(5) Independent sideband transmitters having two channels—when modulated by 1700Hz tones applied simultaneously to both channels. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(d) Radiotelephone transmitters without a device to limit modulation or peak envelope power shall be modulated as follows. For single sideband and independent sideband transmitters, the input level of the modulating signal should be that necessary to produce rated peak envelope power.

(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500Hz tone of sufficient level to produce at least 85 percent modulation. If 85 percent modulation is unattainable, the highest percentage modulation shall be used.

(2) Single sideband transmitters in A3A or A3J emission modes—when modulated by two tones at frequencies of 400Hz and 1800Hz (for 3.0kHz

authorized bandwidth), or 500Hz and 2100Hz (for 3.5kHz authorized bandwidth), or 500Hz and 2400Hz (for 4.0kHz authorized bandwidth), applied simultaneously. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(3) Single sideband transmitters in the A3H emission mode—when modulated by one tone at a frequency of 1500Hz (for 3.0kHz authorized bandwidth), or 1700Hz (for 3.5kHz authorized bandwidth), or 1900Hz (for 4.0kHz authorized bandwidth), the level of which is adjusted to produce a radio frequency signal component equal in magnitude to the magnitude of the carrier in this mode.

(4) As an alternative to paragraphs (d) (2) and (3) of this section, other tones besides those specified may be used as modulating frequencies, upon a sufficient showing of need. However any tones so chosen must not be harmonically related, the third and fifth order intermodulation products which occur must fall within the -25dB step of the emission bandwidth limitation curve, the seventh and ninth order products must fall within the -35dB step of the referenced curve and the eleventh and all higher order products must fall beyond the -35dB step of the referenced curve.

(5) Independent sideband transmitters having two channels—when modulated by 1700Hz tones applied simultaneously to both channels. The input levels of the tones shall be so adjusted that the two principal frequency components of the radio frequency signal produced are equal in magnitude.

(e) Transmitters for use in the Radio Broadcast Services:

(1) AM broadcast transmitters for monaural operation—when amplitude modulated 85% by a 7500Hz input signal.

(2) AM broadcast stereophonic operation—when the transmitter operated under any stereophonic modulation condition not exceeding 100% on negative peaks and tested under the conditions specified in Section 73.128 in part 73 of the FCC rules for AM broadcast stations.

(3) FM broadcast transmitter not used for multiplex operation—when modulated 85 percent by a 15kHz input signal.

(4) FM broadcast transmitters for multiplex operation under Subsidiary Communication Authorization (SCA)—when carrier is modulated 70 percent by a 15kHz main channel input signal, and modulated an additional 15 percent simultaneously by a 67kHz subcarrier (unmodulated).

(5) FM broadcast transmitter for stereophonic operation—when modulated by a 15kHz input signal to the main channel, a 15kHz input signal to the stereophonic subchannel, and the pilot subcarrier simultaneously. The input signals to the main channel and stereophonic subchannel each shall produce 38 percent modulation of the carrier. The pilot subcarrier should produce 9 percent modulation of the carrier.

(6) Television broadcast monaural transmitters— when modulated 85% by a 15kHz input signal.

(7) Television broadcast stereophonic sound transmitters—when the transmitter is modulated with a 15kHz input signal to the main channel and the stereophonic subchannel, any pilot subcarrier(s) and any unmodulated auxiliary subcarrier(s) which may be provided. The signals to the main channel and the stereophonic subchannel must be representative of the system being tested and when combined with any pilot subcarrier(s) or other auxiliary subcarriers shall result in 85% deviation of the maximum specified aural carrier deviation.

(f) Transmitters for which peak frequency deviation (D) is determined in accordance with Section 2.202(f), and in which the modulating baseband comprises more than 3 independent speech channels—when modulated by a test signal determined in accordance with the following:

(1) A modulation reference level is established for the characteristic baseband frequency. (Modulation reference level is defined as the average power level of a sinusoidal test signal delivered to the modulator input which provides the specified value of per channel deviation.)

(2) Modulation reference level being established, the total rms deviation of the transmitter is measured when a test signal consisting of a band of random noise extending from below 20kHz to the highest frequency in the baseband, is applied to the modulator input through any preemphasis networks used in normal service. The average power level of the test signal shall exceed the modulation reference level by the number of decibels determined using the appropriate formula in Figure 3 on page 70:

Number of message circuits that modulate the transmitter	Number of dB by which the average power (Pavg) level test signal shall exceed the modulation reference level	Limits of Pavg (dBm0)
>3 but <12	To be specified by the equipment manufacturer subject to FCC approval	
Min. 12 but <60	$X+2 \log_{10} N_C$	X: -2 to +2.6
Min. 60 but <240	$X+4 \log_{10} N_C$	X: -5.6 to -1.0
240 or more	$X+10 \log_{10} N_C$	X: -19.6 to -15.0

Where X represents the average power in a message circuit in dBm0; Nc is the number of circuits in the multiplexed message load. Pavg shall be selected by the transmitter manufacturer and included with the technical data submitted with the application for type acceptance. (See Section 2.202(e) in this chapter.)

Figure 3

(g) Transmitters in which the modulating baseband comprises not more than three independent channels—when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer’s maximum rated condition.

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

(i) Transmitters designed for other types of modulation—when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

Section 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment

output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Section 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20dB below the permissible value need not be specified.

Section 2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Section 2.1049, as appropriate. For equipment operating on frequencies below 890MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

Section 2.1055 Measurements required: Frequency stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From -20° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(c) In addition to all other requirements of this section, the following information is required for equipment incorporating heater type crystal oscillators to be used in mobile stations, for which type acceptance is first requested after March 25, 1974, except for battery powered, hand carried, portable equipment having less than 3 watts mean output power.

(1) Measurement data showing variation in transmitter output frequency from a cold start and the elapsed time necessary for the frequency to stabilize within the applicable tolerance. Tests shall be made after temperature stabilization at each of the ambient temperature levels; the lower

temperature limit, 0° centigrade and +30° centigrade with no primary power applied.

(2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level.

(3) The elapsed time necessary for the frequency to stabilize within the applicable tolerance from each beginning ambient temperature level as determined from the tests specified in this paragraph shall be specified in the instruction book for the transmitter furnished to the user.

(4) When it is impracticable to subject the complete transmitter to this test because of its physical dimensions or power rating, only its frequency determining and stabilizing portions need be tested.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

Section 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Sections 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10GHz: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

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

(3) If the equipment operates at or above 30GHz: to the fifth harmonic of the highest fundamental frequency or to 200GHz, whichever is lower.

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

(c) The amplitude of spurious emissions which are attenuated more than 20dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40GHz shall be performed using a minimum resolution bandwidth of 1MHz.

Section 2.1060 Equipment for use in the amateur radio service.

(a) The general provisions of Sections 2.925, 2.1031, 2.1033, 2.1041, 2.1043, 2.1051, 2.1053 and 2.1057 shall apply to applications for, and grants of, certification for equipment operated under the requirements of part 97 of this chapter, the Amateur Radio Service.

(b) When performing the tests specified in Sections 2.1051 and 2.1053 of this part, the center of the transmitted bandwidth shall be within the operating frequency band by an amount equal to 50 percent of the bandwidth utilized for the tests. In addition, said tests shall be made on at least one frequency in each of the bands within which the equipment is capable of tuning.

(c) Certification of external radio frequency power amplifiers may be denied when denial would prevent the use of these amplifiers in services other than the Amateur Radio Service.

Declaration of Conformity

Section 2.1071 Cross reference.

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

Section 2.1072 Limitation on Declaration of Conformity.

(a) The Declaration of Conformity signifies that the responsible party, as defined in Section 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.

Section 2.1073 Responsibilities.

(a) The responsible party, as defined in Section 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 Section 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 Section 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.

Section 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.

Section 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 Section 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 Section 2.1073.

(2) A record of the procedures used for production inspection and testing (if tests were performed) to insure the conformance required by Section 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 setup 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 Section 2.909; and
 - (xi) A copy of the compliance information, as described in Section 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 Section 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 Section 2.946.

Section 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 Section 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.

Section 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 Section 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 Section 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 Section 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. 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.

Radiofrequency Radiation Exposure

Section 2.1091 Radiofrequency radiation exposure evaluation: mobile devices.

(a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular Section 1.1307(b).

(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term "fixed location" means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

(c) Mobile devices that operate in the Cellular Radiotelephone Service, the Personal Communications Services, the Satellite Communications Services, the General Wireless Communications Service, the Wireless Communications Service, the Maritime Services and the Specialized Mobile Radio Service authorized under subpart H of part 22 of this chapter, parts 24, 25, 26 and 27 of this chapter, part 80 of this chapter (ship earth stations devices only) and part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5GHz or below and their effective

radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5GHz and their ERP is 3 watts or more. Unlicensed personal communications service devices, unlicensed millimeter wave devices and unlicensed NII devices authorized under Sections 15.253, 15.255, and 15.257, and subparts D and E of part 15 of this chapter are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if their ERP is 3 watts or more or if they meet the definition of a portable device as specified in Section 2.1093(b) requiring evaluation under the provisions of that section. All other mobile and unlicensed transmitting devices are categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, except as specified in Sections 1.1307(c) and 1.1307(d) of this chapter. Applications for equipment authorization of mobile and unlicensed transmitting devices subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in paragraph (d) of this section as part of their application. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(d) The limits to be used for evaluation are specified in Section 1.1310 of this chapter. All unlicensed personal communications service (PCS) devices and unlicensed NII devices shall be subject to the limits for general population/uncontrolled exposure.

(1) For purposes of analyzing mobile transmitting devices under the occupational/controlled criteria specified in Section 1.1310 of this chapter, time averaging provisions of the guidelines may be used in conjunction with typical maximum duty factors to determine maximum likely exposure levels.

(2) Time-averaging provisions may not be used in determining typical exposure levels for devices intended for use by consumers in general population/uncontrolled environments as defined in Section 1.1310 of this chapter. However, "sourcebased" time-averaging based on an inherent property or duty cycle of a device is allowed. An example of this is the determination of exposure from a device that uses digital technology such as a time-division multiple-access (TDMA) scheme for transmission of a signal. In general, maximum average power levels must be used to determine compliance.

(3) If appropriate, compliance with exposure guidelines for devices in this section can be accomplished by the use of warning labels and by providing users with information concerning minimum separation distances from transmitting structures and proper installation of antennas.

(4) In some cases, e.g., modular or desktop transmitters, the potential conditions of use of a device may not allow easy classification of that device as either mobile or portable (also see Section 2.1093). In such cases, applicants are responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength or power density, whichever is most appropriate.

Section 2.1093 Radiofrequency radiation exposure evaluation: portable devices.

(a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular Section 1.1307(b).

(b) For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

(c) Portable devices that operate in the Cellular Radiotelephone Service, the Personal Communications Service (PCS), the Satellite Communications Services, the General Wireless Communications Service, the Wireless Communications Service, the Maritime Services, the Specialized Mobile Radio Service, the 4.9GHz Band Service, the Wireless Medical Telemetry Service (WMTS) and the Medical Implant Communications Service (MICS), authorized under subpart H of part 22 of this chapter, parts 24, 25, 26, 27, 80 and 90 of this chapter, subparts H and I of part 95 of this chapter, and unlicensed personal communication service, unlicensed NII devices and millimeter wave devices authorized under subparts D and E, Sections 15.253, 15.255 and 15.257 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use. All other portable transmitting devices are categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, except as specified in Sections 1.1307(c) and 1.1307(d) of this chapter. Applications for equipment authorization of portable transmitting devices subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in paragraph (d) of this section as part of their application. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (“SAR”) in Section 4.2 of “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz,” ANSI/IEEE C95.1–1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100kHz to 6GHz. Portable devices that transmit at frequencies above 6GHz are to be evaluated in terms of the MPE limits specified in Section 1.1310 of this chapter. Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6GHz should be made at minimum distance of 5cm from the radiating source.

(1) Limits for Occupational/Controlled exposure: 0.4W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube). Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

(2) Limits for General Population/Uncontrolled exposure: 0.08W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may

be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.

(3) Compliance with SAR limits can be demonstrated by either laboratory measurement techniques or by computational modeling. Methodologies and references for SAR evaluation are described in numerous technical publications including “IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields—RF and Microwave,” IEEE C95.3–1991.

(4) For purposes of analyzing portable transmitting devices under the occupational/ controlled criteria, the time averaging provisions of the MPE guidelines identified in Section 1.1310 of this chapter can be used in conjunction with typical maximum duty factors to determine maximum likely exposure levels.

(5) Time-averaging provisions of the MPE guidelines identified in Section 1.1310 of this chapter may not be used in determining typical exposure levels for portable devices intended for use by consumers, such as hand-held cellular telephones, that are considered to operate in general population/uncontrolled environments as defined above. However, “source-based” time-averaging based on an inherent property or dutycycle of a device is allowed. An example of this would be the determination of exposure from a device that uses digital technology such as a time-division multiple-access (TDMA) scheme for transmission of a signal. In general, maximum average power levels must be used to determine compliance.

CFR 47 Part 15

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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 education 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, pipes, 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 labelled “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. 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 9kHz and 3,000,000MHz.

(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 960MHz 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 standalone 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 intended 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 and the provisions of Section 15.19(d).

(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.

(ff) *Access Broadband over Power Line (Access BPL)*. A carrier current system installed and operated on an electric utility service as an unintentional radiator that sends radio frequency energy on frequencies between 1.705MHz and 80MHz over medium voltage lines or over low voltage lines to provide broadband communications and is located on the supply side of the utility service's points of interconnection with customer premises. Access BPL does not include power line carrier systems as defined in Section 15.3(t) or In-House BPL as defined in Section 15.3(gg).

(gg) *In-House Broadband over Power Line (In- House BPL)*. A carrier current system, operating as an unintentional radiator, that sends radio frequency energy by conduction over electric power lines that are not owned, operated or controlled by an electric service provider. The electric power lines may be aerial (overhead), underground, or inside the walls, floors or ceilings of user premises. In- House BPL devices may establish closed networks within a user's premises or provide connections to Access BPL networks, or both.

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.

(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 15.7 [Reserved]

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) Except as follows, 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. Access BPL equipment shall comply with the applicable standards at the control adjustment that is employed. The measurement report used in support of an application for Certification and the user instructions for Access BPL equipment shall clearly specify the user-or installer-control settings that are required for conformance with these 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 Section 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, DC 20230.

Section 15.19 Labeling requirements.

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labelled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under part 73 of this chapter, 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 labelled 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:



Figure 4: FCC Label #1

(ii) If a personal computer 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:

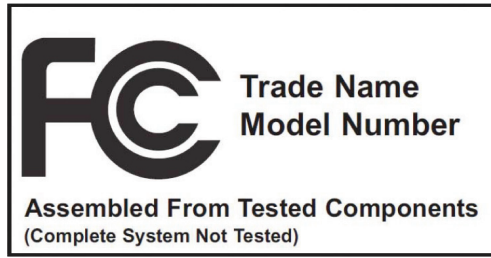


Figure 5: FCC Label #2

(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) of this section 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-CALLFCC (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 C63.17-2006 (incorporated by reference, see Section 15.38).

(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 9kHz to 40GHz" (incorporated by reference, see Section 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 Sections 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 30MHz, 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 20dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30MHz, 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 30MHz, 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 (40dB/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 the equipment authorization report. This paragraph shall not apply to Access BPL equipment on overhead medium voltage lines. In lieu thereof, the measurement guidelines established by the Commission for Access BPL shall be followed.

(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 50ohm/50uH line-impedance stabilization network (LISN). NOTE: Receivers tested under the transition provisions contained in Section 15.37 may be tested with a 50ohm/5μH 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 Figure 6.

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

Figure 6

(n) Measurements on TV broadcast receivers shall 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 931MHz. 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 806MHz, the measurements employing the oscillator frequencies 900 and 931MHz may be omitted.

(o) The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20dB 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.

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

(ii) Unless the test in paragraph (a)(1)(i) of this section demonstrates compliance with the limits in Section 15.109, 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. Under these test conditions, the system under test shall not exceed the radiated emission limits specified in Section 15.109.

(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. 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 shall be performed in accordance with the procedures specified in Section 15.31 using an 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) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10GHz: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

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

(3) If the intentional radiator operates at or above 30GHz: to the fifth harmonic of the highest fundamental frequency or to 200GHz, 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) through (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) of this section, 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 Figure 7.

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 40GHz, whichever is lower.

Figure 7

(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 30MHz and which, in accordance with Section 15.109, is required to comply with standards on the level of radiated emissions within the frequency range 9kHz to 30MHz, 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 9kHz (25MHz 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 Figure 8 or in the table in paragraph (b)(1) of this section, 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

Figure 8

(3) Except for a CB receiver, a receiver employing superheterodyne techniques shall be investigated from 30MHz 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 states 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 1000MHz, the limits shown are based on measuring equipment employing a CISPR quasipeak 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 pulserepetition frequency of 20Hz 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 specified, on any frequency or frequencies above 1000MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000MHz shall be performed using a minimum resolution bandwidth of 1MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see Sections 15.250, 15.252, 15.255, and 15.509–15.519, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

(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 prior to the initiation of marketing, as shown in Figure 9:

Type of Device	Equipment Authorization Required
TV broadcast receiver	Verification
FM broadcast receiver	Verification
CB receiver	Declaration of Conformity or Certification
Superregenerative receiver	Declaration of Conformity or Certification
Scanning receiver	Certification
Radar detector	Certification
All other receivers subject to Part 15	Declaration of Conformity or Certification
TV interface device	Declaration of Conformity or Certification
Cable system terminal device	Declaration of Conformity
Stand-alone cable input selector switch	Verification
Class B personal computers and peripherals	Declaration of Conformity or Certification **
CPU boards and interval power supplies used with Class B personal computers	Declaration of Conformity or Certification **
Class B personal computers assembled using authorized CPU boards or power supplies	Declaration of Conformity
Class B external switching power supplies	Verification
Other Class B digital devices & peripherals	Verification
Class A digital devices, peripherals & external switching power supplies	Verification
Access Broadband over Power Line (Access BPL)	Certification
All other devices	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 Section 2.960.

Figure 9

(b) Only those receivers that operate (tune) within the frequency range of 30–960MHz, 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 960MHz or below 30MHz, except for radar detectors and CB receivers, are exempt from complying with the technical provisions of this part but are subject to Section 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; and

(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) 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.

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, 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 (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;

(4) If the system is marketed, the resulting equipment combination is authorized under a Declaration of Conformity pursuant to Section 15.101(c) (4) and a compliance information statement, as described in Section 2.1077(b), is supplied with the system. Marketed systems shall also comply with the labelling requirements in Section 15.19 and must be supplied with the information required under Sections 15.21, 15.27 and 15.105; and

(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)).

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 6nW.

(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 1.705MHz 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) of this section 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) of this section 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 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/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.

Figure 10

(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 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/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
0.15–5	79	66
0.5–30	73	60

Figure 11

(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 30MHz. 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 535–1705kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

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

(3) Carrier current systems operating below 30MHz 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)	Field Strength (uV/m)
30–88	100
88–216	150
216–960	200
Above 960	500

Figure 12

(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)	Field Strength (uV/m)
30–88	90
88–216	150
216–960	210
Above 960	300

Figure 13

(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 25–30MHz shall not exceed 40 microvolts/meter at a distance of 3 meters. The field strength of radiated emissions above 30MHz from such devices shall comply with the limits in paragraph (a) of this section.

(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 9kHz to 30MHz, 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 inten-

tional radiators provided in Section 15.209 for the frequency range of 9kHz to 30MHz. As an alternative, carrier current systems used as unintentional radiators and operating in the frequency range of 525kHz to 1705kHz may comply with the radiated emission limits provided in Section 15.221(a). At frequencies above 30MHz, the limits in paragraph (a), (b), or (g) of this section, as appropriate, 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 Section 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 1000MHz, compliance above 1000MHz shall be demonstrated with the emission limit in paragraph (a) or (b) of this section, as appropriate. Measurements above 1000MHz may be performed at the distance specified in the CISPR 22 publications for measurements below 1000MHz 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 1000MHz for a Class B digital device is 150uV/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 1000MHz, are considered, for the purpose of Section 15.31(f)(4) of this part, to be the measurement distances specified in this part.

(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).

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

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 960MHz 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 960MHz 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 Sections 15.211, 15.213, and 15.221, and devices operating below 490kHz 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 certificated 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 of this chapter, 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 of this chapter.

(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 Section 15.211, Section 15.213, Section 15.217, Section 15.219, or Section 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 paragraphs (b) 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 902–928MHz, 2400–2483.5MHz, and 5725–5850MHz bands pursuant to Section 15.247 of this part or a transmitter that operates in the 5.725–5.825GHz band pursuant to Section 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 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) of this section 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 in Figure 15.

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
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 0.490–0.510MHz
² Above 38.6

Figure 14

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Figure 13. At frequencies equal to or less than 1000MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, 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) of this section, 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 37MHz provided their emissions only sweep through the bands listed

in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section 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 101.4kHz which are employed by telephone companies.

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

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

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

(6) Transmitters operating under the provisions of subparts D or F of this part.

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

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

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

(e) Harmonic emissions appearing in the restricted bands above 17.7GHz 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 150kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50µH/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.

Figure 15

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

- (1) For carrier current system containing their fundamental emission within the frequency band 535–1705kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- (2) For all other carrier current systems: 1000µV within the frequency band 535–1705kHz, as measured using a 50µH/50 ohms LISN.
- (3) Carrier current systems operating below 30MHz are also subject to the radiated emission limits in Section 15.205, Section 15.209, Section 15.221, Section 15.223, or Section 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 provisions for, the use of battery chargers which permit operating while charging, AC adapters 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 Figure 16.

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 54–72MHz, 76–88MHz, 174–216MHz or 470–806MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., Sections 15.231 and 15.241.

Figure 16

(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 9–90kHz, 110–490kHz and above 1000MHz. 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 54–72MHz and 76–88MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

Section 15.211 Tunnel radio systems.

An intentional radiator utilized as part of a tunnel radio system may operate on any frequency provided it meets all of the following conditions:

(a) Operation of a tunnel radio system (intentional radiator and all connecting wires) shall be contained solely within a tunnel, mine or other structure that provides attenuation to the radiated signal due to the presence of naturally surrounding earth and/or water.

(b) Any intentional or unintentional radiator external to the tunnel, mine or other structure, as described in paragraph (a) of this section, shall be subject to the other applicable regulations contained within this part.

(c) The total electromagnetic field from a tunnel radio system on any frequency or frequencies appearing outside of the tunnel, mine or other structure described in paragraph (a) of this section, shall not exceed the

limits shown in Section 15.209 when measured at the specified distance from the surrounding structure, including openings. Particular attention shall be paid to the emissions from any opening in the structure to the outside environment. When measurements are made from the openings, the distances shown in Section 15.209 refer to the distance from the plane of reference which fits the entire perimeter of each above ground opening.

(d) The conducted limits in Section 15.207 apply to the radiofrequency voltage on the public utility power lines outside of the tunnel.

Section 15.212 Modular transmitters.

(a) Single modular transmitters consist of a completely self-contained radio frequency transmitter device that is typically incorporated into another product, host or device. Split modular transmitters consist of two components: a radio front end with antenna (or radio devices) and a transmitter control element (or specific hardware on which the software that controls the radio operation resides). All single or split modular transmitters are approved with an antenna. All of the following requirements apply, except as provided in paragraph (b) of this section.

(1) Single modular transmitters must meet the following requirements to obtain a modular transmitter approval.

(i) The radio elements of the modular transmitter must have their own shielding. The physical crystal and tuning capacitors may be located external to the shielded radio elements.

(ii) The modular transmitter must have buffered modulation/data inputs (if such inputs are provided) to ensure that the module will comply with part 15 requirements under conditions of excessive data rates or over-modulation.

(iii) The modular transmitter must have its own power supply regulation.

(iv) The modular transmitter must comply with the antenna and transmission system requirements of Sections 15.203, 15.204(b) and 15.204(c). The antenna must either be permanently attached or employ a “unique” antenna coupler (at all connections between the module and the antenna, including the cable). The “professional installation” provision of Section 15.203 is not applicable to modules but can apply to limited modular approvals under paragraph (b) of this section.

(v) The modular transmitter must be tested in a stand-alone configuration, i.e., the module must not be inside another device during testing for compliance with part 15 requirements. Unless the transmitter module will be battery powered, it must comply with the AC line conducted requirements found in Section 15.207. AC or DC power lines and data input/output lines connected to the module must not contain ferrites, unless they will be marketed with the module (see Section 15.27(a)). The length of these lines shall be the length typical of actual use or, if that length is unknown, at least 10 centimeters to insure that there is no coupling between the case of the module and supporting equipment. Any accessories, peripherals, or support equipment connected to the module during testing shall be unmodified and commercially available (see Section 15.31(i)).

(vi) The modular transmitter must be equipped with either a permanently affixed label or must be capable of electronically displaying its FCC identification number.

(A) If using a permanently affixed label, the modular transmitter must be labeled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: XYZMODEL1” or “Contains FCC ID: XYZMODEL1.” Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.

(B) If the modular transmitter uses an electronic display of the FCC identification number, the information must be readily accessible and visible on the modular transmitter or on the device in which it is installed. If the module is installed inside another device, then the outside of the device into which the module is installed must display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains FCC certified transmitter module(s).” Any similar wording that expresses the same meaning may be used. The user manual must include instructions on how to access the electronic display. A copy of these instructions must be included in the application for equipment authorization.

(vii) The modular transmitter must comply with any specific rules or operating requirements that ordinarily apply to a complete transmitter and the manufacturer must provide adequate instructions along with the module to explain any such requirements. A copy of these instructions must be included in the application for equipment authorization.

(viii) The modular transmitter must comply with any applicable RF exposure requirements in its final configuration.

(2) Split modular transmitters must meet the requirements in paragraph (a)(1) of this section, excluding paragraphs (a)(1)(i) and (a)(1)(v), and the following additional requirements to obtain a modular transmitter approval.

(i) Only the radio front end must be shielded. The physical crystal and tuning capacitors may be located external to the shielded radio elements. The interface between the split sections of the modular system must be digital with a minimum signaling amplitude of 150mV peak-to-peak.

(ii) Control information and other data may be exchanged between the transmitter control elements and radio front end.

(iii) The sections of a split modular transmitter must be tested installed in a host device(s) similar to that which is representative of the platform(s) intended for use.

(iv) Manufacturers must ensure that only transmitter control elements and radio front end components that have been approved together are capable of operating together. The transmitter module must not operate unless it has verified that the installed transmitter control elements and radio front end have been authorized together. Manufacturers may use means including, but not limited to, coding in hardware and electronic signatures in software to meet these requirements, and must describe the methods in their application for equipment authorization.

(b) A limited modular approval may be granted for single or split modular transmitters that do not comply with all of the above requirements, e.g., shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation, if the manufacturer can demonstrate by alternative means in the application for equipment authorization that the modular transmitter meets all the applicable part 15 requirements under the operating conditions in which the transmitter will be used. Limited modular

approval also may be granted in those instances where compliance with RF exposure rules is demonstrated only for particular product configurations. The applicant for certification must state how control of the end product into which the module will be installed will be maintained such that full compliance of the end product is always ensured.

Radiated Emission Limits, Additional Provisions Section

15.215 Additional provisions to the general radiated emission limitations.

(a) The regulations in Sections 15.217 through 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 Sections 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated 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 40.66–40.70MHz and above 70MHz.

(a) The provisions of this section are restricted to periodic operation within the band 40.66–40.70MHz and above 70MHz. 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.

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

(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 in Figure 17:

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

Figure 17

(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 quasipeak 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 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than

0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

(d) For devices operating within the frequency band 40.66–40.70MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be $\pm 0.01\%$. 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) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following in Figure 18:

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

Figure 18

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 15.240 Operation in the band 433.5–434.5 MHz.

(a) Operation under the provisions of this section is restricted to devices that use radio frequency energy to identify the contents of commercial

shipping containers. Operations must be limited to commercial and industrial areas such as ports, rail terminals and warehouses. Two-way operation is permitted to interrogate and to load data into devices. Devices operated pursuant to the provisions of this section shall not be used for voice communications.

(b) The field strength of any emissions radiated within the specified frequency band shall not exceed 11,000 microvolts per meter measured at a distance of 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The peak level of any emissions within the specified frequency band shall not exceed 55,000 microvolts per meter measured at a distance of 3 meters. Additionally, devices authorized under these provisions shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than 60 seconds and be only permitted to reinitiate an interrogation in the case of a transmission error. Absent such a transmission error, the silent period between transmissions shall not be less than 10 seconds.

(c) The field strength of emissions radiated on any frequency outside of the specified band shall not exceed the general radiated emission limits in Section 15.209.

(d) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

(e) To prevent interference to Federal Government radar systems, operation under the provisions of this section is not permitted within 40 kilometers of the following locations:

DoD Radar Site	Latitude	Longitude
Beale AFB	39°08'10" N	121°21'04" W
Cape Cod AFB	41°45'07" N	070°32'17" W
Clear AFB	64°55'16" N	143°05'02" W
Cavalier AFB	48°43'12" N	097°54'00" W
Elgin AFB	30°43'12" N	086°12'36" W

Figure 19

(f) As a condition of the grant, the grantee of an equipment authorization for a device operating under the provisions of this section shall provide information to the user concerning compliance with the operational restrictions in paragraphs (a) and (e) of this section. As a further condition, the grantee shall provide information on the locations where the devices are installed to the FCC Office of Engineering and Technology, which shall provide this information to the Federal Government through the National Telecommunications and Information Administration. The user of the device shall be responsible for submitting updated information in the event the operating location or other information changes after the initial registration. The grantee shall notify the user of this requirement. The information provided by the grantee or user to the Commission shall include the name, address, telephone number and e-mail address of the user, the address and geographic coordinates of the operating location, and the FCC identification number of the device. The material shall be submitted to the following address:

Experimental Licensing Branch, OET, Federal Communications Commission, 445 12th Street, SW., Washington, DC 20554
ATTN: RFID Registration.

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

(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 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly 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 902–928MHz band: if the 20dB bandwidth of the hopping channel is less than 250kHz, 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 20dB 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 20dB bandwidth of the hopping channel is 500kHz.

(ii) Frequency hopping systems operating in the 5725–5850MHz band shall use at least 75 hopping frequencies. The maximum 20dB bandwidth of the hopping channel is 1MHz. 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 2400–2483.5MHz 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 902–928MHz, 2400–2483.5MHz, and 5725–5850MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.

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

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

(2) For frequency hopping systems operating in the 902–928MHz 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 902–928MHz, 2400–2483.5MHz, and 5725–5850MHz 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 6dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6dBi 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 6dBi.

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

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

(iii) Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(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 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.

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

(1) Fixed point-to-point operation:

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

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

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(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 2400–2483.5MHz 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 1dB below the specified limits for each 3dB that the

directional gain of the antenna/antenna array exceeds 6dBi. 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 8dB.

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

(d) In any 100kHz 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 20dB below that in the 100kHz 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 30dB instead of 20dB. 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 8dBm

in any 3kHz 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 operation 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.

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 902–928MHz band may require a future decrease in the power limits allowed for spread spectrum operation.

(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 Section 1.1307(b)(1) of this chapter.

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

(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)
902–928MHz	50	500
2400–2483.5MHz	50	500
5725–5875MHz	50	500
24.0–24.25GHz	250	2500

Figure 20

(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 colocated intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05–24.25GHz 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 $\pm 0.001\%$ 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 33dBi. 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 33dBi 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 50dB 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 1000MHz, the 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 website at the following address. <<https://apps.fcc.gov/oetcf/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.

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Power Conversion Table for 50Ω System

Power Conversion Table 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

Power Conversion Tables for 50Ω System Continuation

dBm	mW	dBmV	mVRMS	mVp	mVpp
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

Figure 21: Power Conversion Table for 50Ω System



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