


Licensed Devices General Technical Requirements

- DRAFT -

Andy Leimer & Steve Dayhoff
Equipment Authorization Branch

Federal Communications Commission
Office of Engineering and Technology
Laboratory Division

10/5/2009 Draft for Review 1



Overview

- General Information
- How to find information at the FCC
- Creating a Grant
- Organizing a Report
- Licensed Device Checklist
- Rules Summary


10/5/2009 Draft for Review 2

This session will cover general information related to the FCC rules and technical requirements for licensed devices.

Assumption is that everyone is familiar with testing equipment so test setup and equipment settings will not covered.

The approval process for these types of equipment was previously called Type Acceptance or Notification. Now all methods of equipment approval are called Certification.

This information generally applies to all Radio Service Rules for scopes B1 through B4.



General Information

- Understanding how FCC rules for licensed equipment are written and how FCC operates
 - The FCC rules are Title 47 of the Code of Federal Regulations
 - Part 2 of the FCC Rules covers general regulations & Filing procedures which apply to all other rule parts
 - Technical standards for licensed equipment are found in the various radio service rule parts (e.g. Part 22, Part 24, Part 25, Part 80, and Part 90, etc.)
 - All material covered in this training is either in these rules or based on these rules

10/5/2009 Draft for Review 3


There are about 15 different radio service rule Parts which require equipment to be authorized before an operators license can be obtained.

The various radio service rule parts are each developed by different groups at the FCC for the purpose of allowing different types of operations at various frequency bands across the frequency spectrum. Each rule part may have unique technical requirements which need to be addressed in each application.

The hard copy version of the rules are updated as of October 1 every year. Any rules adopted after October 1 can be found on the FCC website under e-filing and then clicking EDOCS link. A Report and Order number or Docket number is needed.

EDocs link:

http://hraunfoss.fcc.gov/edocs_public/SilverStream/Pages/edocs.html



General Information II


- FCC TCB process divides all Licensed Radio Service Rules into various sections.
- Not all equipment which is approved by the FCC may be approved by a TCB
 - New technology must be approved by the FCC
 - Technology where there is no developed test procedure must be approved by the FCC
 - Equipment which requires RF exposure evaluation may be approved only if the Exclusion list requirements are met and the TCB has attended the proper training

Note: Exclusion list available under KDB Publication 628591

10/5/2009 Draft for Review 4

As new technology evolves the FCC will develop test procedures to allow TCB's to approve the equipment.

RF exposure issues will be addressed by Tim and Martin.



FCC Testing

- 47 CFR Parts 2.1046 - 2.1055 Tests required for all Licensed Devices.
 - 2.1046 - RF power output
 - 2.1047 - Modulation Characteristics
 - 2.1049 - Occupied Bandwidth
 - 2.1051 - Conducted Spurious Emissions
 - 2.1053 - Radiated Spurious Emissions
 - 2.1055 - Frequency Stability
 - » Temperature
 - » Voltage


10/5/2009 Draft for Review 5

The testing requirements are described under FCC Rule sections 2.1046 through 2.1055 are very basic. What they provide is a general requirement to test certain technical parameters. They don't provide a complete description of how to perform all tests

These Rule sections don't specify the limit which must be met. The specific limits are called out in each Radio Service rule part.

The frequency stability tests are done with respect voltage and temperature variation.

Example: For a Part 90 device go to Part 2 to find the general tests required such as maximum and minimum temperature range for frequency stability tests are from -30 to +50 degrees centigrade and then go to part 90 to see that the limit is 2.5 ppm.




47 CFR Parts 2.1046 - 2.1055

- These tests are generally required for all licensed devices
- In some case the Radio Service Rules will have special or unique requirements which will add additional tests to be performed
- FCC recognizes ANSI/TIA/EIA 603-2003 as a document generally suitable to meet the minimum testing requirements in these sections

10/5/2009 Draft for Review 6

There are some tests which 603 doesn't cover and some tests are done over a different range than the FCC Rules call out. When the FCC rules call out a specific value or test method, the FCC rules take precedent.

If the radio service rule section has more specific requirements than 2.1046-2.1055 then the radio service rules take precedent over Part 2.




Purpose of Measurements

- The purpose of performing tests is to establish compliance with the technical requirements contained in the Radio Service Rules
 - Common problem with applications is that tests are performed exactly as described in the 603 document but not enough information is provided to show compliance with the rules. The test report and supporting information submitted should show how the device complies with the Radio Service Rules and requirements

10/5/2009 Draft for Review 7

Example of problem with 603 - for the modulation limiting test, a test performed per 603 for a unit which is voice modulated. The 603 test calls out a maximum frequency range of 3 kHz where the FCC rules call out a minimum frequency range of 5 kHz.




2.1046 - RF Power Output

- Form 731 Power always listed in Watts
- For units with antenna connector power is always conducted measurement
- For units with built-in/integral antenna power is measured as Effective Radiated Power (ERP) unless otherwise specified
 - Example of exception is Part 24 PCS 1900 MHz band where Effective Isotropic Radiated Power is required
- Power listed on grant-normally mean power
 - Example of exception- Single sideband transmitters require peak envelope power and RADAR transmitters are peak values

10/5/2009 Draft for Review 8

Some of the Radio Service rules may get more specific about how the power output should be measured. When the radio service rules are more specific than Part 2, the radio service rules should be followed.




2.1046 - RF Power Output

- Power listed on grant is based on measurement data and supplied in the report. Manufacturers ratings should agree with listed power. The FCC has no official tolerance for power output listing for Equipment Authorization. Some Radio Service Rules have station license tolerances and Part 2.931 allows for “production tolerances”

10/5/2009 Draft for Review 9

In many cases RF exposure evaluation test results determine the maximum power that can be listed on the grant.

Production tolerance never defined by rules.



2.1046 Power Out Special Cases

- Amplifiers and other devices with multiple signals at output terminals
 - The maximum power output per carrier should be listed. Grant should note maximum number of carriers and rated maximum composite power output.
 - If the maximum power output must decrease with channel loading, this should be noted on grant
- Part 101.113 (c) (1) spectral power density specifications are an example of a non typical power output on grant
- Part 80.959 (c) (1) requirement of minimum power output after 10 minutes of operation


10/5/2009 Draft for Review 10

When the radio service rules have unique or special cases for power measurement the test report should be clearly describe how the test was performed.

Examples of special cases:

Amplifiers with multiple outputs may also be listed by total composite power on grant and providing maximum carrier and loading de-rating in grant remarks.

80.959 power measurement after 10 minutes conflicts with 5 minute cutoff requirement of 80.203(c)

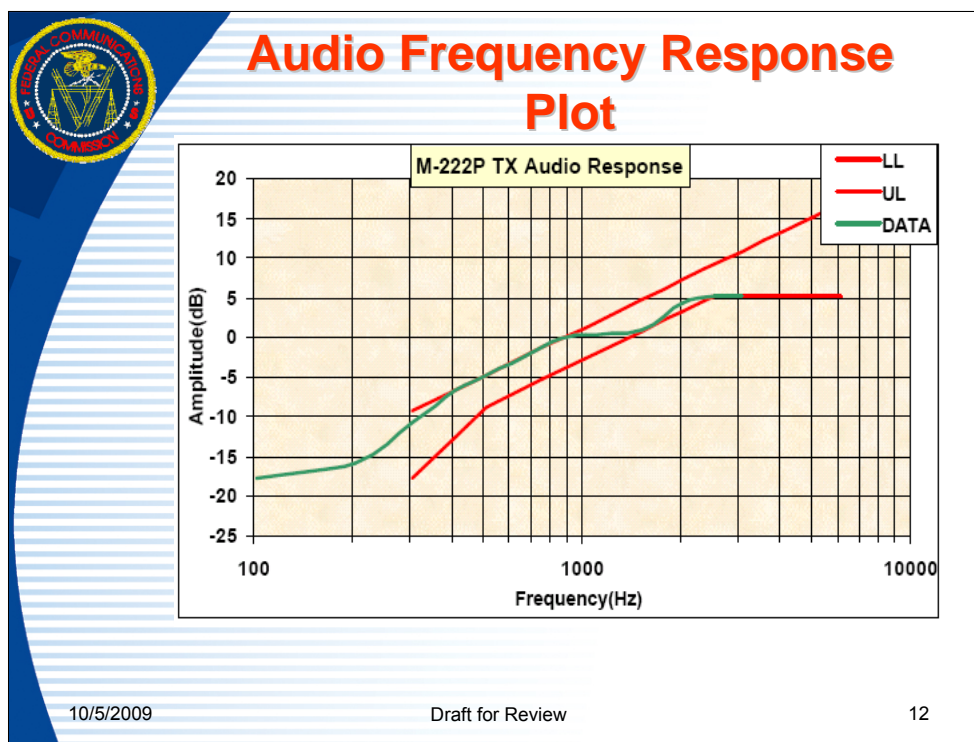


2.1047 (a) Frequency Response


- For voice modulated equipment a frequency response plot over the range 100 - 5000 Hz should be provided
 - EIA/TIA 603 shows a different range but since the FCC rules are specific, the above range should be shown
- For units with extended audio frequency response (wireless microphones) the response should be measured up to 15 KHz since up to 15KHz can be used in typical broadcast operation

10/5/2009 Draft for Review 11

Part 74 units are typically done with a 15kHz response.
Part 90 voice units typical response rolls off about 3KHz.



This is a plot of the audio frequency response for a voice modulated FM transmitter. This transmitter has pre-emphasis or the plot would be flatter. The plot shows the peak response to be at 3 kHz.



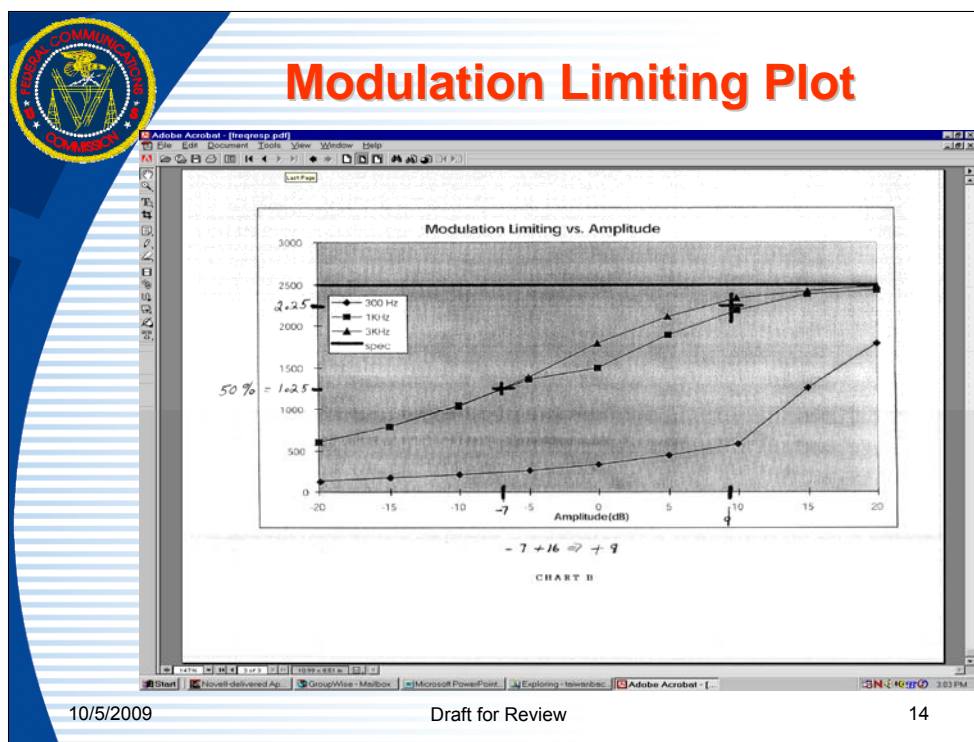
2.1047 (b) Modulation Limiting

- A plot of modulation level (%) as a function of increasing modulation input
 - A “family” of curves should be provided. Most test procedures for typical radio telephone use recommend the frequencies of 300, 1000, and 3000 Hz be used. These are acceptable but 2500 Hz audio frequency is also recommended since this is the frequency normally used in the occupied bandwidth test
 - The audio input level should be increased to at least the level used for the occupied bandwidth test.
 - Do not follow the 603 document for this test as it doesn't provide the required information

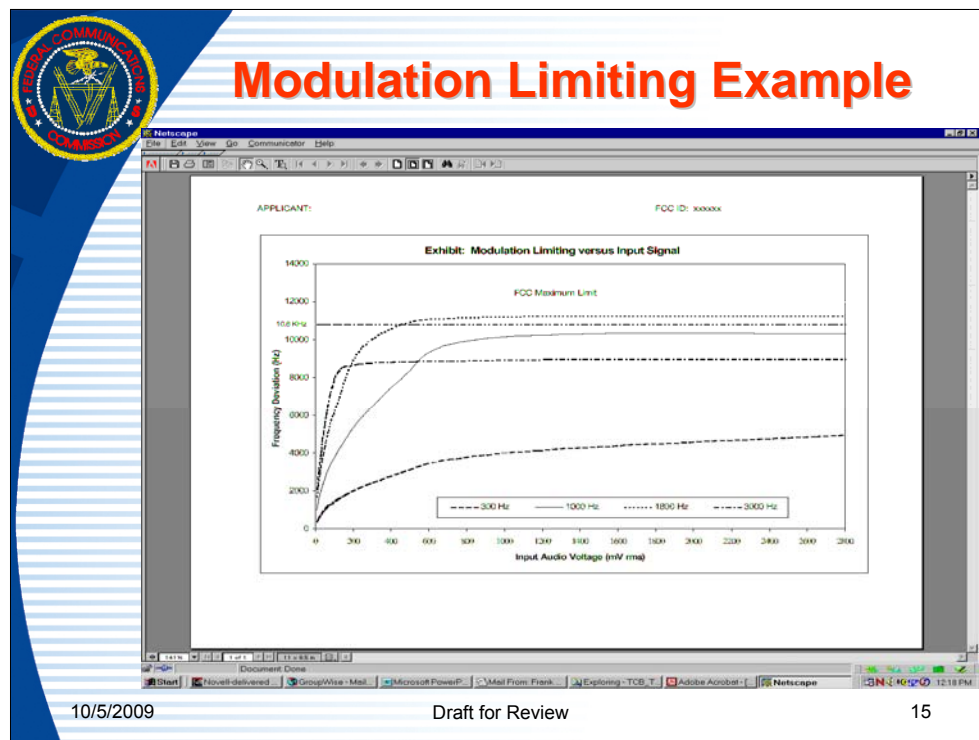
10/5/2009 Draft for Review 13

For Single sideband radios a family of curves should be plotted using peak envelope power versus audio input level.


Other special cases are for CB Units where a test of modulation keying transients is required and for part 90 units where a transient frequency response test is required under 90.214



This is a typical plot showing modulation limiting for a voice modulated unit. The plot should show at least to 16 dB greater than that which is necessary to produce 50% modulation. The plot shows the modulation limited to 2.5 kHz. 50% of the attainable modulation level is 1.25 kHz for a frequency of 3 kHz. From the plot this occurs at an input level of -7dB (relative amplitude). The modulation input level of 16 dB higher than -7 dB is +9 dB. At this level the expected modulation level for a 2.5 kHz input is extrapolated to be 2.25 kHz.



This is an example of a modulation limiting plot for a device with a higher deviation level than the previous example.




2.1047 (d) Additional Tests

- Some rule parts call for specific additional tests.
 - An example of an additional test is the Transient Frequency Behavior test under Part 90.214

10/5/2009 Draft for Review 16

When new types of modulation or variations of current modulation types are developed, sometimes new tests or test methods are required to show compliance with the rules.




2.1049 Occupied Bandwidth

- Occupied BW is the portion of the spectrum which contains 99% of the emitted energy (.5% of the remaining is above and .5% is below the occupied BW)
 - The FCC uses these test results to compare the modulated spectrum with the emissions masks in the various radio service rule parts
 - The occupied bandwidth may not exceed the authorized bandwidth in the radio service rules
 - The occupied bandwidth test should be performed for each type of emission listed on the grant

10/5/2009 Draft for Review 17

For a 25 KHz land mobile radio Part 90.209 lists the authorized bandwidth as 20 kHz. 20 kHz is also the maximum acceptable necessary bandwidth. The bandwidth justification using Carson's rule can't exceed 20 kHz. Normally a typical frequency modulated voice emission has a maximum modulating frequency of 3 kHz and a peak deviation of 5 kHz which give a necessary bandwidth of 16 kHz which is well within the allowed 20 kHz.

Superimposing the emissions mask is helpful in making the review faster.



2.1049 Occupied Bandwidth II


- The emissions mask is normally applied with the Zero dB level equal to the level of the unmodulated carrier or equivalent composite power level
- The test results are also used to confirm the modulation level used for the occupied BW test
- In some cases the Radio Service Rules specify a spectrum analyzer resolution bandwidth setting
- The proper emissions “mask” from each Radio Service Rule part must be applied to the spectrum display

10/5/2009 Draft for Review 18

When the radio service rules don't specify a resolution bandwidth setting the guideline used is 1% of the occupied bandwidth. The video bandwidth setting should not be less than the resolution bandwidth setting.

Part 90 devices in the re-farming bands typically specify a bandwidth setting.

Re-farming Bands 150-174, 421-512 MHz.




2.1049 Occupied Bandwidth III

- Amplifiers and similar units
 - These are devices which reproduce the modulated input signal
 - A test to show a comparison of a properly modulated input signal with the output signal. The output should show compliance with the emission limitations mask
 - Multiple channel units should be tested with multiple channels for each emission type to show inter-modulation products

10/5/2009 Draft for Review 19

Some examples of similar units are: boosters, repeaters, and extenders.



Bandwidth Terminology

- Authorized Bandwidth
 - The maximum bandwidth the specific radio service rule section allows
- Necessary Bandwidth
 - The maximum bandwidth a specific device requires to operate in the devices worst case mode
- Occupied Bandwidth
 - The bandwidth of a specific device at a specific time
- Channel Bandwidth
- Other Bandwidth terms

10/5/2009 Draft for Review 20


The various terms for bandwidth can cause confusion. Necessary bandwidth should be listed on the Form 731.

Occupied bandwidth and emission designator justifications should be consistent with the necessary bandwidth.

Channel bandwidth normally indicates the spacing specified by the FCC licensing bureau.

Other bandwidth terms - as new technologies are developed so are new terms. Listed are the most common terms

The rules are written by different personnel in different FCC Bureaus for a wide variety of operations and occasionally a new term for bandwidth will get into the Rules.



2.1051 Conducted Spurious


- Measurements of the emissions at the antenna terminal
 - This test is to determine emissions conducted through the antenna terminal. If the device doesn't have an antenna connector the data is obtained at the base of the antenna terminal
 - The highest frequency measured is specified in 2.1057 of the rules
 - The emission limits specified are an extension of the occupied bandwidth limits which are listed in the radio service rules measured up to the highest frequency specified in 2.1057

10/5/2009 Draft for Review 21

For units with integral antennas conducted spurious is not normally required. There are a few exceptions to this where the FCC rules call out limits at the base of the antenna whether or not the antenna is integral.

Emissions more than 20 dB below the limit do not need to be reported.

Conducted Spurious tests are performed with the equipment modulated.



2.1053 Radiated Spurious

- This test is to determine emissions radiated from the cabinet, chassis, and associated wiring
 - The emission limits specified are an extension of the occupied bandwidth limits which are listed in the radio service rules measured up to the highest frequency specified in 2.1057
 - Use Signal Substitution method described in EIA 603
 - All emission radiated relative to a half wave dipole
 - Power should be referenced to a dipole antenna
 - Method used because it standardizes the process and eliminates measurement uncertainties due to site characteristics, attenuation and path loss


10/5/2009 Draft for Review 22

For equipment with an antenna connector, this test normally performed with the EUT terminated.

When the equipment has an integral antenna, the test for radiated spurious should be made with the antenna attached to the unit. The test should be made with a signal substitution method per EIA/TIA 603. Note “measurements are referenced to dipole”.

Transmit and receive antennas don’t need to be dipoles but measurement results should be converted to be equivalent to a dipole.

For radiated spurious test equipment is unmodulated during the test.



2.1055(a) Frequency Stability

● Frequency Stability versus Temperature

- Test is normally performed from -30 to +50 degrees centigrade
- Data is normally provided in 10 degree C increments
- Some radio service rules specify different frequency ranges. When more specific requirements are listed, the more specific requirements should be followed
 - Example - Some Part 80 Maritime rules specify -20 to +50 degrees centigrade
 - Example - Some Part 73 Broadcast Service rules specify 0 to 50 degrees centigrade
- EIA/TIA 603 has less detail than the FCC rules and should not be followed for 2.1055 tests

10/5/2009 Draft for Review 23

Additional example of a difference is FRS radios where temperature is measured from -20 degrees to + 50 degrees.



2.1055(d) Frequency Stability

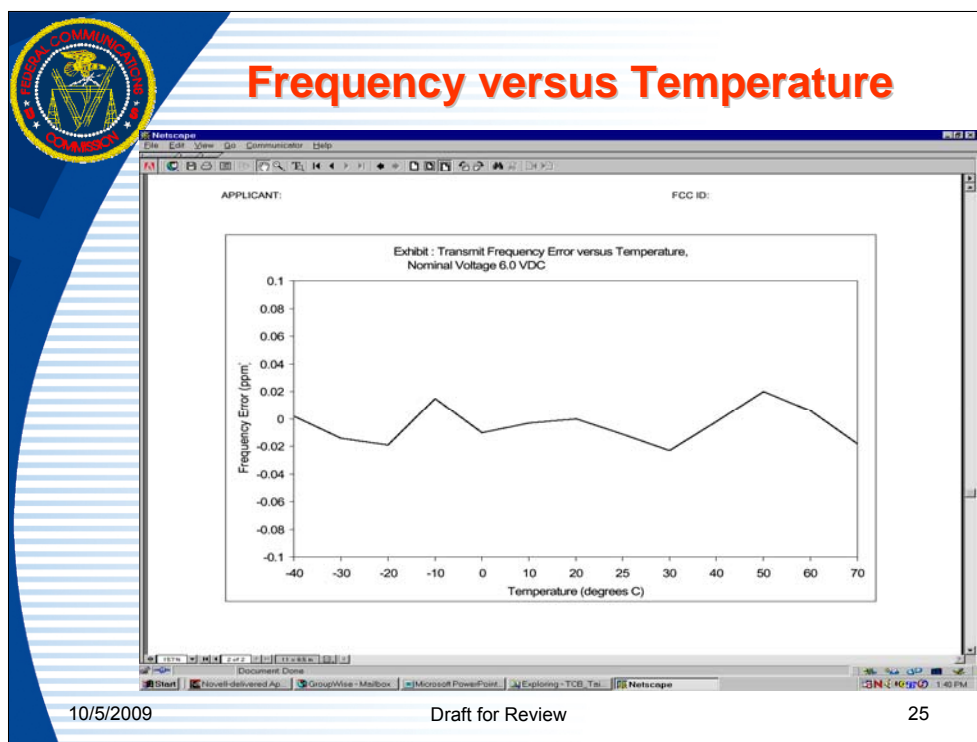
● Frequency Stability versus Voltage

- For AC powered equipment the primary supply voltage should be from 85 to 115 % of the nominal value
 - If the equipment has an automatic shutoff before it gets to these levels, the device should be tested to the shutoff point
- For battery operated equipment the stability should be tested to the battery endpoint specified by the manufacturer
- EIA/TIA 603 has less detail than the FCC rules and should not be followed for 2.1055 tests

10/5/2009

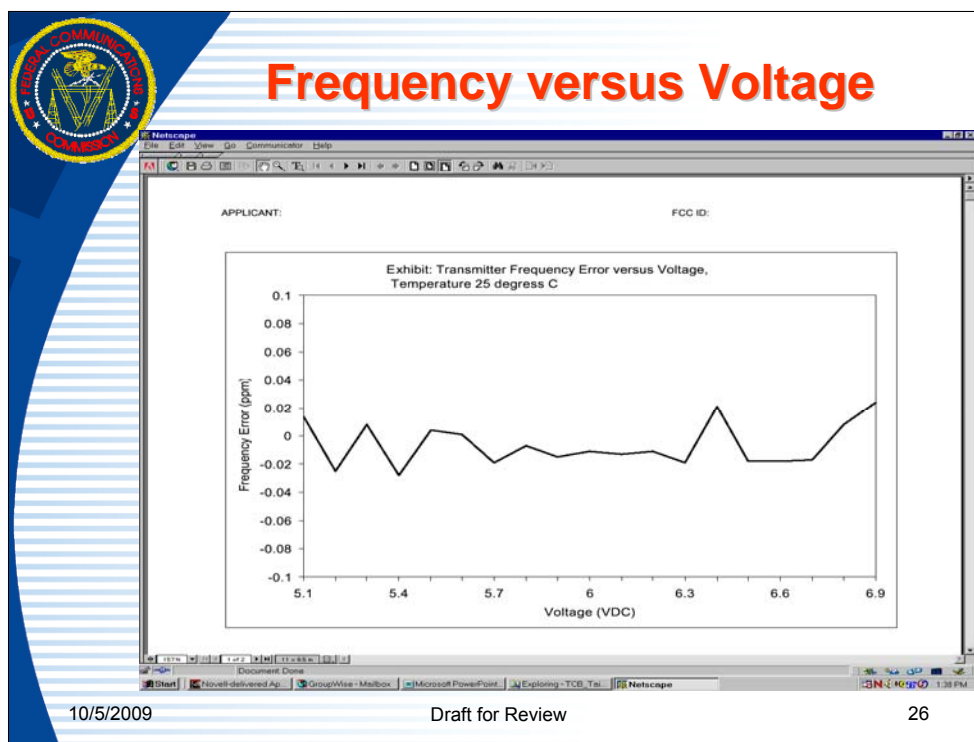
Draft for Review

24




This is an example of a frequency stability versus temperature plot. The plot shows the temperature measurements performed over a larger span than the FCC rules require.

Typical range is -30 to +50



This is an example plot showing the frequency stability versus voltage for a battery operated device.



Intermodulation

● INTERMOD TEST

- Transmitters and amplifiers designed to handle multiple channels must be tested with multiple carriers for each emission type to show intermodulation products
 - Amplifiers include:
 - Booster - Device with antenna input – receives and amplifies on the same frequency – in one direction.
 - Repeater - Device with antenna input – receives, amplifies and retransmits on a different frequency. (Does not demodulate the signal and retransmit. If the signal is demodulated the device would be classified as a transmitter.)
 - Extender - A bi-directional Booster or Repeater


10/5/2009 Draft for Review 27

Amplifier Definition- A device that takes incoming RF signal and retransmits the signal without demodulating.

For multi channel devices show a single channel comparison of input and output signal and also perform the three tone intermodulation test.

This is a conducted measurement. In most cases the equipment is modulated during the test. In some cases, such as FM, the signal is unmodulated.

For units where a power reduction is required at the band edges, the test only needs to be done at the first channels at each edge of the band with maximum power.



Intermodulation (continued)

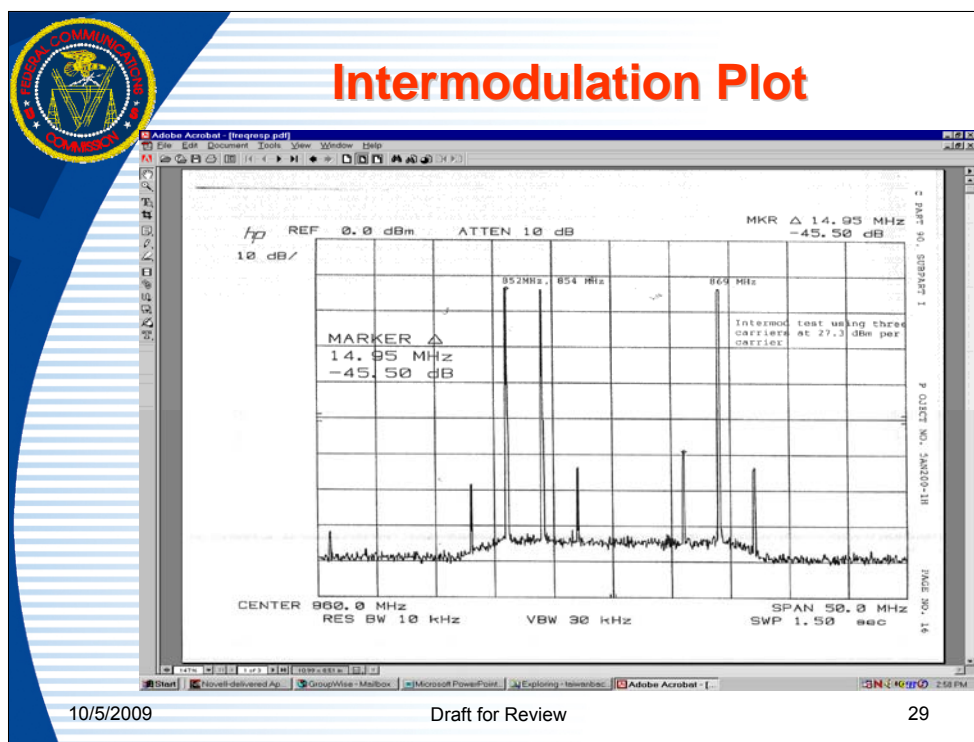
- Intermodulation products are spurious emissions which must meet the emissions mask in each Radio Service rule part
- Test Procedure - Should be tested at highest rated output level
 - Three Signal Test – requires only one test
 - two near to each other at one edge of passband
 - other signal alone at other edge of passband
 - Two Signal Test - requires the test be done twice
 - Once with two signals at upper edge of passband
 - Once with two signals at lower edge of passband

10/5/2009 Draft for Review 28

Three signals of equal magnitude at their highest rated output level should be tested for each type of modulation.

The two channels near each other should be separated by at least one operating channel width.


The two tone test is also accepted but must be performed twice, one time at each end of the operating band.



This is a plot of a three tone Intermod test for an 850 - 870 MHz transmitter. The three highest signals are the three channel test. The two lower channels are separated by at least one channel.

This plot clearly shows the three intermod signals but not the intermod products which would be just off the screen. When the first and third tones beat against each other they will product emissions just outside the range shown on the plot.

The raised noise floor indicates the operating band of the device.



Test Procedures

- FCC Rules and Regulations
 - FCC e-mail service for publications and notices.
subscribe@info.fcc.gov
- EIA/TIA 603-2003
 - FM Land Mobile Transmitter Test Methods
- EIA/TIA TSB102.CAAA
 - Digital transceiver measurements
- ANSI C63.4 -2001
- Other industry accepted test procedures
 - Many test procedures available from Global Engineering Documents - <http://global.ihs.com>
800-854-7179 or 303-397-7956

10/5/2009 Draft for Review 30

When the FCC is testing a device, the FCC rules are reviewed first to see what guidance they provide about performing the test. This includes a careful review of Part 2 and the specific radio service rules.


In some cases the the specific radio service rules may not provide any guidance but another radio service rule may have an applicable test procedure. For example the device being tested may be a Part 95 family radio service transmitter but Part 95 doesn't provide much detail about the power output test. In this case the device is required to have an integral antenna and the power output test should be done using the ERP method of signal substitution in which Part 15 of the rules provides some guidance.

If the FCC rules don't address a test procedure, the FCC looks for an industry adopted standard which applies.

EIA/TIA 603-1992 is a procedure for FM Land Mobile transmitters which provides useful information for testing and is a good supplement in many cases. There are some cases where 603 doesn't apply. Through out the presentation I'll try to indicate where 603 should not be used.

EIA/TIA TSB102 is based on 603 but used for digitally modulated devices.

C63.4 is basically for use with Part 15 devices but can be used in certain cases. Pending ET Docket 95-19 is considering adoption of C63.4 – 2001.



Information Requests


- The FCC lab handles all information requests related to electronic filing and the equipment authorization process.
- The specific FCC Bureaus handle information requests related to licensing and interpretations of the radio service rules and technical requirements.
 - Index for Wireless Telecommunications Bureau Websites: <http://wireless.fcc.gov/services>

10/5/2009 Draft for Review 31

Questions related to the best way to file something or for how a test should be performed should be sent to the FCC Lab at btaube@fcc.gov or tcbinfo@fcc.gov respectively.

Questions related to rule makings and rule changes should be addressed to the responsible bureau.

The internet site listed is a good reference by service name for services regulated by the Wireless Telecommunications Bureau.



Contact Information

- Rule Interpretations & Test Procedure Questions
 - Search Knowledge Database by clicking on link on electronic filing pages
 - Before contacting the FCC search the FCC Internet site for similar equipment previously granted
 - Email questions to eastech@fcc.gov
- Licensing and Rule Changes for Licensed devices
 - Check main FCC website: www.fcc.gov
 - Contact FCC Bureau which is responsible for rules
Most licensing questions are handled at Gettysburg Office

10/5/2009 Draft for Review 32


Quickest way to find a test procedure question is to look for similar types of equipment which have already been granted. All files received after April 15, 1998 are in electronic format on the Internet. Prior to that, a list of grants for all types of licensed equipment was published in the Radio equipment list. Also, the FCC Equipment Authorization Branch can be contacted and can usually find an example of a good application which is similar.

When rules change related to equipment authorization or when Radio Service Rules change which will have significant impact on equipment authorization process, OET will normally put a message on the electronic filing Internet sites but these messages won't appear until the new rules are about to go into effect. To see proposed rule makings each of the licensing bureaus Internet sites should be checked regularly and the Public Notices also should be checked. Note that the printed CFR's contain changes through October 1 of the year listed. Rule changes more recent than the date listed are not contained in the printed CFR's.

FCC licensing bureaus can be contacted by calling 1-800-call-fcc or by going to their web site as discussed in later slides.

When the licensing bureaus site lists a rulemaking by Docket number, the text of the rulemaking can be found at the EDOC's FCC website:

http://hraunfoss.fcc.gov/edocs_public/SilverStream/Pages/edocs.html



Example Applications

- A good resource for how to test and which rule parts apply to a device is to look at previously granted devices
 - Part 74 Base Station FCCID:E5M-LEDR400S-74
 - Part 74 H FCCID: AK8WRT822A
 - Part80/87 Single Sideband Tx FCCID:BZ6SEA245
 - Part 90 Land Mobile TNF FCCID: ABZ99FT4056
 - Part 95 FRS TNF FCCID: K7GD54XX
 - Part 95 A&B GMRS/FRS FCCID:G9H3-5822

10/5/2009 Draft for Review 33

Example applications are not perfect but are a good example to base an application on.




Tips for quicker response

- Provide as much detail as possible about how the equipment in question operates
- Ask specific questions
- Specify which Rule Part(s) applies and what your interpretation of that rule section is
- Specify all other pertinent information
- Only send request to one individual at FCC
 - If that person can't answer the question or needs to coordinate the response with someone else they will handle getting it to the person who can respond

10/5/2009

Draft for Review

34




Purpose of Grant

- To define the capability and ratings of a transmitter for the FCC and other equipment users to show the equipment is “Acceptable for Licensing” and what that use is
- A Grant of Equipment authorization signifies that the device has been properly tested and may be marketed

10/5/2009 Draft for Review 35

If the grant isn't correct or clear then there may be issues getting user/site license when the end user attempts to operate the device.

Compliance report should clearly state all modes of operation, which modes were tested and which were worst case.




Uses of Grant

- FCC licensing bureaus use the grant information to issue licenses to equipment users/stations
 - Incorrect information on the grant can lead to significant problems obtaining a license
- The public regularly checks the details of a grant before purchasing a product
- US Customs reviews grant information when products are imported into the United States
- Many other countries will allow products to be imported based on the FCC approval and information on the grant

10/5/2009 Draft for Review 36

An example of how a licensing bureau would use the information on the grant would be when a user buys a marine VHF radio for a ship or boat and applies for a user license under Part 80 of the rules. The licensing bureau would check the power output, frequency tolerance and operating frequency to determine if the device was eligible for both a ship station and a coast station license and then compare that with what the person requesting the license requested.

The public checks grants to determine if a product can be licensed in the service which they want to use the device and also to compare multiple products they are considering purchasing.




Creating A Good Grant

- The information on the Grant is based on the information entered on the Form 731
 - In order to correct a grant, the information on the 731 must be modified
- Understanding all operating modes of a device and which rule parts it will be operated under is necessary to properly test the device and issue an correct grant

10/5/2009 Draft for Review 37

The users manual is normally how the FCC determines how a product is used.




Class II Permissive Changes

- Provide a list of modifications
- Justify Class II permissive changes and provide data as necessary to justify changes
- Power on Class II Grant remains the same as power listed on the Original Grant

Note: Detailed information available in KDB Publication 178919

10/5/2009 Draft for Review 38



Organizing a Report

- All information received for all types of applications falls into one of 14 exhibit types
 - Organizing TCB information in a similar way reduces confusion and simplifies the review process
 - All 14 exhibit types are not required for every application. The required exhibit types are based on the equipment class and application type
 - Submit as few attachments as possible
 - Confidential material must be in a separate file from non confidential material and justification letter should be in cover letter exhibit type

10/5/2009 Draft for Review 39

Application type is original grant, permissive change, alternate FCCID.

Normally for licensed equipment 8 of the exhibit types are required.

For permissive change applications a cover letter describing the changes and data supporting compliance for any changed information is required.

For an alternate FCCID the required exhibits are photos, ID label, and cover letter explaining application.




Exhibit Types


- 1. ID Label/Location Info
- 2. Attestation Statements
- 3. External Photos
- 4. Block Diagram
- 5. Schematics
- 6. Test report
- 7. Test Setup Photos
- 8. User's Manual
- 9. Internal photos
- 10. Parts List/Tune up Info
- 11. RF Exposure Info
- 12. Operational Description
- 13. Cover Letters
- 14. SDR Executable Files

10/5/2009 Draft for Review 40

For an original grant typically item 1,3,5,6,8,9,10,12 are always required.

A block diagram isn't required but can be helpful in describing the devices operation.

RF Exposure information is required based on the operating frequency and power of the device.




Licensed Checklist I

- FCCID:
- Test Firm:
- Functional Description
- Administrative Information
 - Associated Pending Application?
 - Confidentiality Request?
 - Properly requested?
 - Any special requirements?
 - Inter agency requirements(US Coast Guard or FAA)

10/5/2009 Draft for Review 41

The licensed equipment check list is a handout provided. The FCC uses a similar checklist to reduce the possibility of Items being overlooked.

Any waivers pending or approved filed with Licensing Bureaus or any other agency should be submitted.




Licensed Checklist II

- Technical Information
 - Rule Parts:
 - Frequency Range:
 - Power Output:
 - Levels - switched or variable
 - Antenna Connector or Integral.
 - Frequency Tolerance:
 - Emissions:
 - Necessary bandwidth Justified?
 - Emissions Types Justified?

10/5/2009

Draft for Review


42



Licensed Checklist Part III

- Descriptive Information
 - Instruction manual:
 - DC voltages & currents:
 - Tune up procedure:
 - Circuit diagram/block diagram:
 - Photographs:
 - Internal:
 - External:


10/5/2009 Draft for Review 43



Licensed Checklist Part IV

- Technical Report-Compare with Radio Service rules for compliance
 - Power Output(ERP or Conducted)?
 - Audio Frequency Response M= _____
 - Modulation Limiting D= _____
 - Audio low pass filter response plot?
 - Transient Frequency Behavior(90.214) or Attack time for CB Radios Part 95
 - Occupied Bandwidth - Plot for each emission?
 - VBW & ResBW = _____ Hz
 - Properly modulated?

10/5/2009 Draft for Review 44



Checklist Part IV(cont)

- Conducted Spurious
- Radiated Spurious
- Frequency Stability vs Voltage(+/- 15% or battery endpoint)
- Frequency Stability vs Temperature(-30 to +50 C)

● Notes_____

● Comments_____

10/5/2009 Draft for Review 45




Personal Mobile Radio Services

Federal Communications Commission
OET Laboratory

10/5/2009 Draft for Review 46

The information in this session relates to the Equipment authorization requirements only. Most devices require an equipment authorization and users station license before the equipment can be operated. The station licensing requirements are not addressed.

The intent of this presentation is to familiarize TCB's with rules and how to read and interpret the rules. It is not intended to provide specific limits for every type of device.



Personal Mobile Radio Services

- Personal Mobile Radio includes:
 - Part 22 - Cellular Radiotelephone Service
 - Part 24 - Personal Communications Service (PCS)
 - Part 25 - Satellite Communications
 - Part 27 - Wireless Communications Service (WCS)

10/5/2009 Draft for Review 47


These are Radio Service Rule parts which fall under scope B1. This presentation will cover as many types of devices as possible and will highlight the more common applications.

These radio service rule parts are all developed for different purposes to provide different services. Each may have unique requirements.

Part 22 has several radio services other than the Cellular Radio telephone service. The other services are in Scope B2

Part 26 is a new radio service rule part which allows licensed operation in the 4.6 gigahertz frequency band.

Part 27 is also a new radio service rule part which allows licensed operation in the 746 - 794 MHz and 2.3 gigahertz frequency bands.




Excluded Devices

- Devices with no FCC approved test procedure
- Devices which use new technology
- Equipment which requires RF exposure evaluation may be approved only if the Exclusion list requirements are met and the TCB has attended the proper training

Note: Exclusion list available under KDB Publication 628591

10/5/2009 Draft for Review 48

RF exposure was covered in a little more detail in the General Licensed devices presentation. Specifics about RF exposure evaluation will be covered by Tim and Martin.



Part 22 H Cellular Radio Service


- Operating Frequency Bands:
 - Mobile 824-849 MHz
 - Base Station 869-894 MHz
- General Technical Requirements:
 - 22.355 - Frequency Stability
 - 22.913 - Power Output (ERP)
 - 22.915 - Modulation requirements
 - 22.917 - Emissions Limits

10/5/2009 Draft for Review 49

This is a general overview of 47 CFR Part 22 Subpart H, the Cellular radiotelephone service. The rule sections above list the primary rule sections and highlight some of the unique requirements specifically for 22.915 and 22.917.

22.915 requires the modulation level for each type of modulation to remain within +/- 10 % of the specified value. The TIA standard doesn't agree with cellular standard (IS-19-B) modulation level.

22.917 Mobile emissions in base frequency bands must be attenuated to at least -80 dBm.



Part 22 H Cellular Radio Service

- Special Requirements:
 - 22.919 Electronic Serial Number Protection
 - 22.921 Dial 911 - Call processing
 - 22.933 Cellular System Compatibility
 - 22.381 Auxiliary test stations
 - 22.901(d) Alternative Technologies
 - Emission limits apply only outside band edges
 - MPE or SAR evaluation require per 2.1091 & 2.1093
 - SAR value(s) listed on grant

10/5/2009 Draft for Review 50


This slide addresses issues that are unique to the Cellular radio service. Some of these requirements are in the process of being phased out per FCC 02-229.

The ESN is a 32 bit binary number which uniquely identifies a cellular mobile transmitter to any cellular system.

Dial 911 call processing is requirement that a cellular phone can communicate with either cellular provider in any given service area when making a 911 emergency call.

OET Bulletin 53 is the cellular compatibility protocols. It defines standard protocols so that all cellular units can communicate.

A statement(s) attesting to the compliance of ESN, 911 call processing and system compatibility should be in each application in the “attestation statements” exhibit type.




Part 22 H Cellular Radio Service

- Special Interpretations:
 - Power output for units with built in antennas is listed as an ERP value
 - Maximum ERP level listed on Grant
 - Tests performed at one operating frequency at maximum power output
 - Exception is antenna terminal measurements which are done at highest and lowest power output levels

10/5/2009 Draft for Review 51

This slide shows some special interpretations of the rules that are based on the special requirements listed on the previous slide.



Part 22 H Common Cellular Modes

- CDPD - Cellular digital packet data
- CDMA - Code division multiple access
- WCDMA – Wideband code division multiple access
- TDMA (DQPSK) - Time division multiple access
- GSM - Global Mobile System

10/5/2009 Draft for Review 52

Data should be provided for all modes of operation. All types of emissions should be tested.


The AMPS mode is normally listed on the grant as 22 Subpart H. Other “alternate technologies” are listed on the grant as 22.901(d).

Supervisory audio tones are transmitted by the base station and used to control the communication between the mobile and base station

Signaling tones are 10 kHz control tones transmitted by the mobile unit to control the communication between the mobile and base station.

GSM is European standard not very common on US Cellular phones but more common on PCS phones.

The next few slides show plots of some of these modulation types.




Part 22 H Cellular Emission Designators

- 1M25F9W - CDMA
- 30K0DXW - North American digital cellular - TDMA
- 30K0GXW - GSM
- 28K0FXW - CDPD

10/5/2009 Draft for Review 53


These are the most commonly used emission designators for cellular radiotelephones. These designations are found in 2.201 and 2.202 of the FCC rules. Both sections include examples of what a proper emission designator looks like.



Part 22 Recent Rulemakings

- FCC 01-256
 - Allocates spectrum below 3 GHz for new wireless services
- FCC 02-229
 - Changes Rules over next 5 years to allow for design flexibility
 - Eliminates AMPS mode requirements
 - Eliminates OET 53 requirements
 - Eliminates ESN requirements
 - Eliminates channelization requirements
- FCC 02-247
 - Modifies 22.901 to eliminate unnecessary regulations and modernize requirements

10/5/2009 Draft for Review 54




Part 24 D - Narrowband PCS

- Operating Frequency Bands:
 - 930 - 931MHz and 940 - 941MHz
- General Technical Requirements:
 - 24.131 - Authorized bandwidth
 - 24.132 - Power Output (ERP)
 - 24.133 - Emissions Limits
 - 24.135 - Frequency Stability
- Special requirements
 - MPE or SAR evaluation required for portable and mobile units per 2.1091 & 2.1093.
 - SAR value(s) listed on grant

10/5/2009 Draft for Review 55

This slide provides a general overview of 47 CFR Part 24 Subpart D. Narrowband Personal Communications Systems.




Part 24 D - Narrowband PCS

- Special Interpretations
 - Power output for units with built in antennas is listed as an ERP value
 - Maximum ERP level listed on Grant
 - Tests performed at one operating frequency at maximum power output
 - Exception is antenna terminal measurements which are done at highest and lowest power output levels
 - Maximum level for SAR compliance listed on Grant if it is higher than ERP on line entry

10/5/2009 Draft for Review 56

These requirements are the same as the Part 22 Subpart H Cellular radio telephone service special interpretations.




Part 24 E - Broadband PCS

- Operating Frequency Bands:
 - Blocks from 1850 - 1990 MHz
- General Technical Requirements:
 - 24.232 - Power Output (EIRP)
 - 24.235 - Frequency Stability
 - 24.238 - Emission Limits
- Special requirements
 - MPE or SAR evaluation required for portable and mobile units per 2.1091 & 2.1093
 - SAR value(s) listed on grant

10/5/2009 Draft for Review 57

This slide shows a general overview of 47 CFR Part 24 E. The Broadband Personal Communications Systems Service.

EIRP is effective isotropic radiated power is defined as the radiated power output relative to an antenna with no gain.




Part 24 E - Broadband PCS

- Special Interpretations
 - Power output for units with built in antennas is listed as an EIRP value
 - Maximum EIRP level listed on Grant
 - Tests performed at one operating frequency at maximum power output
 - Exception is antenna terminal measurements which are done at highest and lowest power output levels

10/5/2009 Draft for Review 58

These testing requirements are the same as the Part 22 Subpart H Cellular radio telephone service special interpretations with the exception that the power output is an EIRP measurement.



Part 24 PCS Emission Designators

- Part 24E
 - 1M25F9W – CDMA
 - 4M20F9W – WCDMA
 - 30K0DXW – TDMA
 - 300KGXW – GSM
 - 300KG7W - EDGE

10/5/2009 Draft for Review 59


CDMA – Code Division Multiple Access

W-CDMA – Wideband Code Division Multiple Access

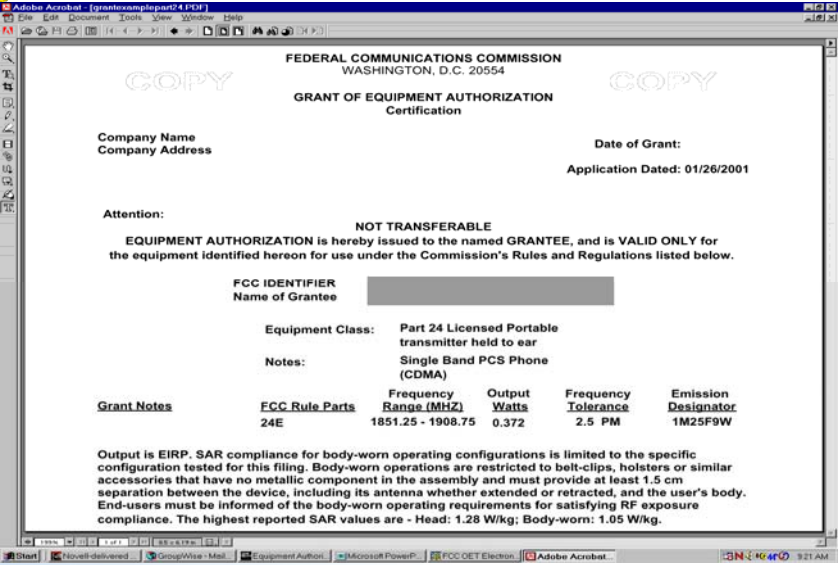
TDMA – Time Division Multiple Access

GSM – Global Systems for Mobile Communications

EDGE – Enhanced Data Rates for GSM Evolution



Example Grant Part 24



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

COPY

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Company Name
Company Address

Date of Grant:
Application Dated: 01/26/2001

Attention: **NOT TRANSFERABLE**

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Part 24 Licensed Portable transmitter held to ear


Notes: Single Band PCS Phone (CDMA)

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
	24E	1851.25 - 1908.75	0.372	2.5 PM	1M25F9W

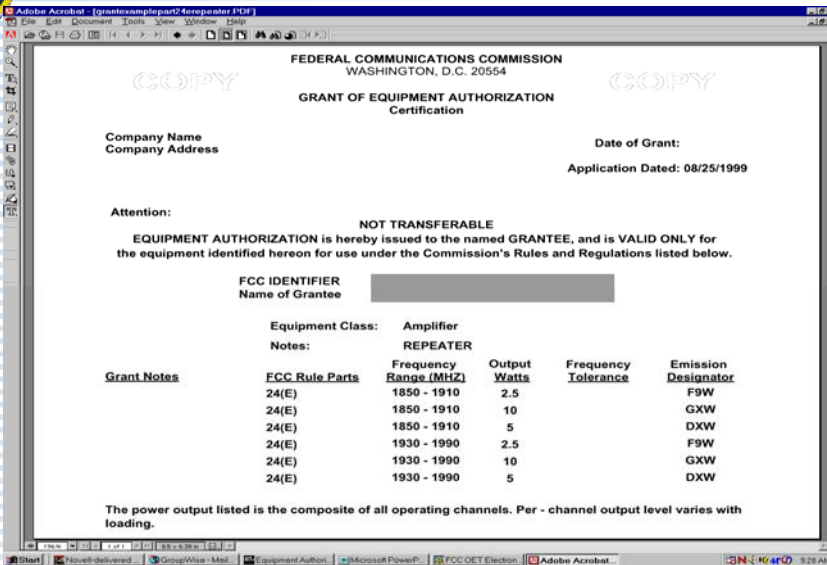
Output is EIRP. SAR compliance for body-worn operating configurations is limited to the specific configuration tested for this filing. Body-worn operations are restricted to belt-clips, holsters or similar accessories that have no metallic component in the assembly and must provide at least 1.5 cm separation between the device, including its antenna whether extended or retracted, and the user's body. End-users must be informed of the body-worn operating requirements for satisfying RF exposure compliance. The highest reported SAR values are - Head: 1.28 W/kg; Body-worn: 1.05 W/kg.

10/5/2009 Draft for Review 60

This slide is intended to show a typical Part 24 Broadband PCS grant for a single band CDMA PCS phone. Note the SAR requirements/restrictions on the grant. The unit is a handheld unit. The grant note describes how the power output was measured and the highest value of SAR measured.



Example Grant Part 24 E Amplifier



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Company Name
Company Address

Date of Grant:
Application Dated: 08/25/1999

Attention: **NOT TRANSFERABLE**

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee


Equipment Class: **Amplifier**
Notes: **REPEATER**

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
24(E)		1850 - 1910	2.5		F9W
24(E)		1850 - 1910	10		GXW
24(E)		1850 - 1910	5		DXW
24(E)		1930 - 1990	2.5		F9W
24(E)		1930 - 1990	10		GXW
24(E)		1930 - 1990	5		DXW

The power output listed is the composite of all operating channels. Per - channel output level varies with loading.

10/5/2009 Draft for Review 61

This slide shows a grant for a Part 24 Subpart E broadband PCS repeater. Since it's equipment class is "amp" which is for amplifier it allows the grant to not have a frequency tolerance or necessary bandwidth. Also note the grant clarification of how the power operates for a multi channel device.



Part 25 Satellite Communication


- Operating Frequency Bands:
 - 1610 - 1626.5 MHz Up-link
 - 149 - 149.9 MHz & 399.9 - 400.05 MHz (non-voice)
- General Technical Requirements:
 - 25.200 - Interim requirements for authorization
- Special Requirements
 - Certification is optional.
 - Units need ITU GMPCS - MoU Registry
 - Power output for units with built in antennas is listed as EIRP on the Grant

10/5/2009 Draft for Review 62

Part 25 has only mobile and portable devices which require equipment authorization.

Certification is optional for these devices per the rule making which is Gen Docket No. 98-68. 98-68 was adopted as FCC 01-141. Also see FCC 02-134.

The acronym ITU - GMPCS - MoU stands for International Telecommunications Union Global Mobile Personal Communication by Satellite Memorandum of Understanding




Part 25 Satellite Communication

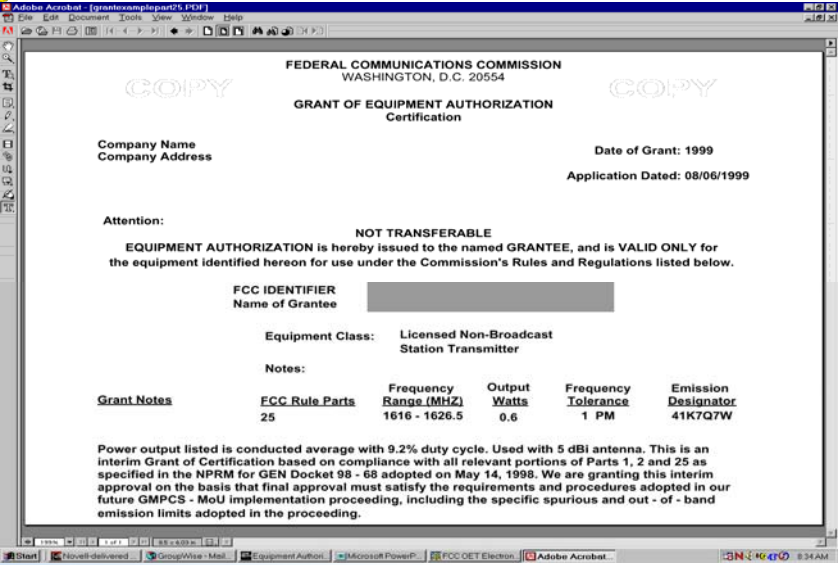
- Special Requirements (continued)
 - MPE or SAR evaluation required for portable and mobile units per 2.1091 & 2.1093
 - SAR measured value listed on grant
- Part 25 Recent Rulemakings
 - FCC 02-134 – GMPCS MoU– Global Mobile Personal Communications by Satellite Memorandum of Understanding
 - Establishes emissions limits for mobile and portable earth stations

Note: Detailed information available in KDB Publication 273109

10/5/2009 Draft for Review 63



Example Grant Part 25



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Company Name _____ Date of Grant: 1999
Company Address _____ Application Dated: 08/06/1999

Attention: **NOT TRANSFERABLE**

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee _____

Equipment Class: Licensed Non-Broadcast Station Transmitter

Notes:

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	25	1616 - 1626.5	0.5	1 PM	41K7Q7W

Power output listed is conducted average with 9.2% duty cycle. Used with 5 dBi antenna. This is an interim Grant of Certification based on compliance with all relevant portions of Parts 1, 2 and 25 as specified in the NPRM for GEN Docket 98 - 68 adopted on May 14, 1998. We are granting this interim approval on the basis that final approval must satisfy the requirements and procedures adopted in our future GMPCS - MoU implementation proceeding, including the specific spurious and out - of - band emission limits adopted in the proceeding.


10/5/2009

Draft for Review

64

This slide is intended to show a typical Part 25 mobile unit. Note the interim grant note for Part 25 equipment. The rule making which the device is authorized under is under consideration to be changed.

The NPRM 98-68 listed on the grant was adopted as FCC 01-141.



Part 27 Wireless Communication

- Wireless Communications Service (WCS)
- Operating Frequency Bands:
 - 746 - 794 MHz and 2305 - 2360 MHz
- General Technical Requirements:
 - 27.50 Power Output (EIRP)
 - 27.53 Emission Limits
 - 27.54 Frequency Stability
- Special Requirements:
 - MPE or SAR evaluation required for portable and mobile units per 2.1091 & 2.1093
 - SAR measured values listed on Grant

10/5/2009 Draft for Review 65

This slide provides a general overview of the wireless communications service.

This Radio Service rule is available for any type of operation in the band which meets the technical requirements.




Part 27 Wireless Communication

- Biennial Regulatory Review – Amendment of Parts 24, and 27 – (FCC 08-85)
- NOTICE OF PROPOSED RULE MAKING AND ORDER: Effective: June 2, 2008
 - Power measurements, for transmitters authorized under these sections, may be made either in accordance with a Commission-approved average power technique, or using peak power measurements.
 - If an average power technique is used, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

10/5/2009

Draft for Review

66



Example Grant Part 27

Adobe Acrobat - [grantexamplepart27.PDF]

COPY

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Type Acceptance

Company Name
Company Address

Date of Grant:
Application Dated: 10/10/1997

Attention:

NOT TRANSFERABLE
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for
the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class:

Licensed Non-Broadcast
Station Transmitter

Notes:

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	27	2305 - 2317.5	2	0.001 %	1M25D7W
	27	2347.5 - 2360	2	0.001 %	1M25D7W

10/5/2009

Draft for Review

67

This slide shows an example of a Part 27 Grant. Since almost any type of operation is allowed in the frequency band, to call this a typical grant may not be accurate.




Common Problems to Avoid

- Don't submit data for Part 15 Verified portions of the device
- For conventional Cellular (AMPS) units the proper Part 22 rule section to list on the grant is 22 H
- For non-AMPS emission modes the proper rule section to list is 22.901(d)
- The power output on the grant needs to be consistent with the test report and user manual
- The frequency stability listing on the grant is not in compliance with the Radio Service rule
 - Be careful of footnotes in the Rules

10/5/2009

Draft for Review

68



Comparable Applications

- Submitting new application types:
 - Highly recommended that previous FCC Grants be viewed for comparison purposes
- Finding Similar Applications:
 - Go to either FCC Equipment Authorization filing site or TCB filing site and click on “generic search” link
 - Enter search criteria and pick a good example from the returned results
 - All applications since 4/15/1998 have all attachments on the Internet. Newer files are recommended because they are generally smaller in size
 - Search can be limited by rule part, equipment class, date, FCC/TCB Approval, and/or frequency range etc.

10/5/2009 Draft for Review 69

When a TCB is submitting equipment under an equipment class which they haven't done before, it is highly recommended that a previous grant from a similar application be reviewed to see how the test was done and what requirements the device was tested too.

Searching advice:

Change “show 10 results” from 10 to 200 before searching.

Start with limited search and then expand when no results found.


Use newer applications as basic applications.

Use applications which were granted by the FCC.

Don't use too specific of a search

e.g. if 90.217(b) doesn't return enough results, try 90.217, and then try 90

Some rule parts such as 22, 90, 95 have large numbers of equipment authorizations but rule part 26 and 27 don't. For the rule parts with large numbers of equipment authorizations a more specific search is required.




General Mobile Radio Services

Federal Communications Commission
OET Laboratory

10/5/2009 Draft for Review 70

This presentation covers equipment authorization requirements and not station licensing requirements. It is intended to familiarize TCB's with the technical equipment rules but not specify the limits for every type of device.

For licensed devices scope B1 gets the most submissions closely followed by scope B2.




General Mobile Radio Services

- General Mobile Radio and Broadcast Services Includes:
 - Part 22 Non Cellular Services
 - Part 73 Broadcast Services
 - Part 74 Auxiliary Broadcast Service
 - Part 90 Private Land Mobile Radio Service
 - Part 95 Personal Radio Services
 - Part 97 Amateur Radio Service

10/5/2009 Draft for Review 71

These Radio service rules are each written for different purposes for different types of operations. Each Radio Service rule has some unique requirements. The FCC laboratory can make interpretations in these rules for issues related to testing for equipment authorization but the bureau/office has the final word. Any issues related to rule changes or licensing must be handled by the bureau/office responsible for that radio service rule.



Multiple Rule Part Applications

General Land Mobile Devices

	150-174 MHz	220-222 MHz	421-512 MHz	806-940 MHz
Part 22 E,F,G	x		x	x
Part 74 D			x	
Part 90	x	x	x	x
Part 95 A			x	

Wireless Microphones

	150-174 MHz	174-216 MHz
Part 90.217	x	
Part 90.265	x	
Part 74.861		x


10/5/2009 Draft for Review 72

This slide shows a comparison of which devices commonly operate across multiple frequency bands and rule parts. Note that a 450 to 470 MHz transmitter is eligible to operate in at least four rule parts.

The most common land mobile frequency bands are show in the chart above.

The boxes with an “x” in them indicate that there is a portion of the listed frequency band that the device can operate in. Operation in the band is dependant on the emission designator.

Wireless Microphones are usually authorized in three bands depending on where they are used. Broadcast quality equipment operates in the rule part 74.861. Land mobile wireless microphones operate under 90.217 and 90.265. All three radio service rules require the equipment user to obtain a users station license before operating the equipment.




Part 22 - Non Cellular Services

- Operating Frequency Bands
 - Subpart E
 - Paging: 152 - 159 MHz, 454 - 459 MHz.
 - Point to Point: 72 - 76 MHz, 488 - 494 MHz
 - Subpart F
 - Rural Radio 152 - 158 MHz, 454 - 460 MHz
 - BETRS 816 - 821 MHz, 861 - 866 MHz
 - Basic exchange telephone radio system
 - Subpart G
 - Air to Ground 454 - 460 MHz

10/5/2009 Draft for Review 73

This slide shows operating frequencies available in 47 CFR Part 22




Part 22 - Non Cellular Services

- General Technical Requirements Subpart C
 - 22.355 Frequency Tolerance
 - 22.357 Emission Types
 - 22.359 Emission Masks
- Technical Requirements Subpart G Air to Ground Service
 - 22.809 Power Output
 - 22.861 Emission Limitations
 - 22.863 Frequency Tolerance

10/5/2009 Draft for Review 74

The requirements of Subpart C apply to all other subparts unless the Subpart has specifications listed.

The Subpart G Air to Ground Service has the most exceptions



Part 73 Broadcast Services

- AM Stereo Transmitters & Exciters
 - Operating Frequency Bands
 - 0.54 - 1.6 MHz
 - General Technical Requirements
 - 73.44 - AM Transmission System Emission Limitations
 - 73.128 - AM Stereophonic Broadcasting
 - 73.1545(a) - Carrier Frequency Departure Tolerances

10/5/2009 Draft for Review 75


Most of the Broadcasting equipment (i.e. AM, FM, and TV Transmitters) is verified under Part 73 but some of it is not. Since there isn't a significant amount of equipment authorized under these parts I'll only mention it briefly.

AM stereo is under Subpart A with some general requirements under Subpart H. Section 73.1545 is mentioned just to list an example of Subpart H general information.

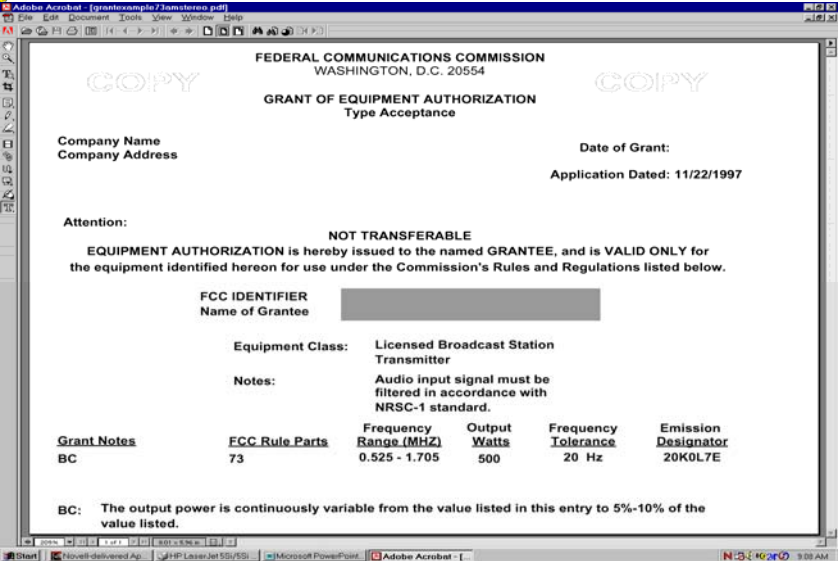
Part 73 Subpart H contains requirements which generally apply to all Part 73 equipment. When Subpart A doesn't address a requirement then the standards in Subpart H apply.

Most Subpart H requirements are related to licensing but there are some technical requirements.

Most of the equipment in this rule part is verified.



Example Grant Part 73



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Type Acceptance

Company Name
Company Address

Date of Grant:
Application Dated: 11/22/1997

Attention: **NOT TRANSFERABLE**
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Licensed Broadcast Station Transmitter

Notes: Audio input signal must be filtered in accordance with NRSC-1 standard.

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
BC	73	0.525 - 1.705	500	20 Hz	20K0L7E

BC: The output power is continuously variable from the value listed in this entry to 5%-10% of the value listed.

10/5/2009


Draft for Review

76

This is a typical AM Stereo grant under part 73. The power of this device can be reduced to 5% of 500 watts per the grant note BC.

The grant note also specifies the standard the equipment was tested too. NRSC-1 is ANSI/EIA-549-1998 AM Pre-emphasis/De-emphasis and broadcast transmission bandwidth specification which is referenced in 73.128(c)(1). The standards for filtering were adopted by the FCC in order to protect the adjacent channels of the transmitter.

This is an older grant because there aren't many AM Stereo grants.



Part 74 Auxiliary Broadcast

- Operating Frequency Bands
 - Subpart D - Remote Pickup 450 - 456 MHz
 - Subpart E - Aural Broadcast Auxiliary 944 - 952 MHz
 - Studio Transmitter Link - STL
 - Subpart G - Low Power TV, TV Translator and Booster
 - VHF (Channels 2-13) 54-216 MHz
 - UHF (Channels 14-69 (except 37)) 470-806 MHz
 - Channel 37 608-614 MHz
 - Subpart H - Low Power Auxiliary Stations
 - 26.1-26.48, 54-72, 161.625-161.775, 174-216, 450-451, 455-456, 470-608, 614-806, 944-952 MHz.
 - Subpart L FM Translators & Boosters 88-108 MHz

10/5/2009 Draft for Review 77

This slide shows the operating frequency bands available in 47 CFR Part 74.

Channel 37 608-614 MHz is reserved for Radio Astronomy

A change has been proposed in Part 74 to allow television remote broadcasting of digital television signals in the 2 GHz band. The changes are under consideration by the Media Bureau. More details can be found on their Internet site.

Example of remote pickup device is voice link from mobile station back to broadcast studio. This service is moving to microwave services due to video transmissions.

Aural broadcast auxiliary frequencies for STL are for voice link from studio to transmitter when the studio and transmitter are not at the same location.




Part 74 Auxiliary Broadcast

- Low Power Auxiliary Station Operations in the 698-806 MHz Band – (FCC 08-188)
 - NOTICE OF PROPOSED RULE MAKING AND ORDER: Effective: August 20, 2008
 - Imposes a freeze on granting equipment authorization requests for low power auxiliary station devices that would operate in Part 74, 698-806 MHz.
 - Applications may be filed with the FCC but will not be acted upon until the conclusion of the proceeding.

10/5/2009

Draft for Review

78



Part 74 Auxiliary Broadcast


- General Technical Requirements
 - Subpart D - Remote Pickup
 - 74.461 Power Limitations
 - 74.462 Emission & Bandwidth
 - 74.464 Frequency Tolerance
 - Subpart E - Aural Broadcast Auxiliary
 - 74.534 Power Limitations
 - 74.535 Emission & Bandwidth
 - 74.561 Frequency Tolerance
 - Subpart G - LPTV, TV Translator & TV Booster
 - 74.733 - UHF Translator signal boosters
 - 74.735 - Power limitations

10/5/2009 Draft for Review 79

This slide shows the General technical requirements for 47 CFR subparts of the Auxiliary Broadcast Service.

In addition to the requirements listed above for Part 74 Subpart D, modulation requirements are addressed in 74.463.


TV translators and TV Boosters Subparts are for extending the range of TV transmitter into areas with poor coverage.



Part 74 Auxiliary Broadcast

- Subpart G (continued)
 - 74.736 - Emission & Bandwidth
 - 74.750 - Transmission System Facilities
 - 74.761 - Frequency Tolerance
- Subpart H - Low Power Auxiliary Stations
 - 74.861 - Technical Requirements
- Subpart L - FM Translators & Boosters
 - 74.1234 - Unattended Operation
 - 74.1235 - Power Limitations & Antenna Systems
 - 74.1236 - Emission & Bandwidth
 - 74.1250 - Transmitters & Associated Equipment
 - 74.1261 - Frequency Tolerance

10/5/2009 Draft for Review 80



Part 74 Auxiliary Broadcast


● Special Requirements

- Subpart E
 - Verification applies to units used at fixed stations.
- Subpart G
 - Automatic gain control requirement for some devices
- Subpart H
 - Wireless microphones for BROADCAST ONLY use. Occupied Bandwidth test done at lesser of maximum modulation frequency or 15 kHz.
- Subpart L
 - Standard AM, FM, and TV transmitters under Part 73 and boosters under Part 74 do not need Certification but a manufacturer may request it, if desired.

10/5/2009 Draft for Review 81

Part 74 Subpart H wireless microphones may only be used in broadcast type uses and not for Part 90 land mobile operation.

Part 74 Subpart L equipment was deregulated several years ago but due to numerous requests from manufacturers who were having problems selling the equipment with no FCCID, the FCC has allowed (but not required) the devices to receive Certification if all of the information required for Certified devices is provided.



Part 90 Private Land Mobile


- Operating Frequency Bands 1.6 - 940 MHz
 - Special Operating Frequency Bands:
 - 173.075 MHz Lo-Jack - 90.20(e)(6)
 - 764-806 MHz - Public Safety Interoperability
 - 902-928 MHz Subpart M, Location & Monitoring
 - 1427-1435 MHz - 90.259 (Public Safety Pool)
 - 2450-2500 MHz – Non-channelized frequencies
 - 3650-3700 MHz – Wireless Broadband Service
 - 4940-4990 MHz – Public Safety
 - 8400-8500 MHz - Subpart Q, Developmental

10/5/2009 Draft for Review 82

This slide shows some special operating frequency bands allowable for Part 90 operation.

The land mobile band has frequencies covering the entire RF frequency spectrum.

2450-2500 band is typically used for video transmission. It is one of the few parts of Part 90 where there is a allowable authorized bandwidth greater than 25 kHz.



Part 90 Private Land Mobile

● General Technical Requirements

- Subpart I - General
 - 90.205 - Power Limitations
 - 90.207 - Types of Emissions
 - 90.209 - Bandwidth Limitations
 - 90.210 - Emissions Masks
 - 90.211 - Modulation Requirements
 - 90.212 - Scrambling Devices & Digital Voice Modulation
 - 90.213 - Frequency Stability
 - 90.214 - Transient Frequency Behavior
 - 90.217 - Exemption from Technical Standards
 - 90.219 - Signal boosters

10/5/2009 Draft for Review 83

The general requirements of subpart I apply to all other parts unless the specific rule part being applied under specifies a requirement

90.217 exempts low power devices from many of the other rules but requires the devices to meet the specifications listed in the section.



Part 90 Private Land Mobile

- General Technical Requirements
 - Subpart F - Radio-location Service
 - 90.103 - Technical Standards
 - Subpart J - Non voice & other specialized operations
 - 90.241 - Radio Call Box Operation
 - 90.242 - Travelers Information Stations
 - 90.259 - Telemetry
 - Subpart K - Special Frequency Bands
 - 90.265(b) - Wireless Microphones for Business uses.
 - Subpart S - SMR Operation
 - 90.669 - Emission Limit for 896-901/935-940 MHz MTA
 - 90.691 - Emission Mask for 806-821/851-866 MHz EA

10/5/2009 Draft for Review 84


This slide shows the subparts of the 47 CFR Private Land Mobile Radio Service.

Subpart F radio-locations service is used mainly for radar equipment.

Wireless microphones approved under 90.265 generally are rated at a modulation frequency of up to 3 kHz and not up to 15 kHz necessary bandwidth as in Part 74. Note that part 2 requires the bandwidth be tested to 5 kHz.

For 90.259 telemetry operations none of the general technical standards apply.

MTA & EA represent the different types of service areas the equipment operates under.



Part 90 Private Land Mobile

- General Technical Requirements
 - Subpart R – Public Safety Interoperability
 - 90.531 – Interoperability Channels Operation
 - 90.535 – Spectrum Efficiency Requirement
 - 90.543 – Adjacent Channel Power
 - 90.548 – P25 Interoperability Standards
 - Subpart Y – Public Safety
 - 90.1213 – Channel Band Plan
 - 90.1217 – RF Exposure Requirement
 - Subpart Z – Wireless Broadband Service
 - 90.1307 - licensed on the basis of non-exclusive nationwide licenses
 - 90.1319 - 3650–3700 MHz band must employ a contention-based protocol (based on 90.7)
 - 90.1321 - Power and antenna limits
 - 90.1323 - Emission limits

10/5/2009 Draft for Review 85


This slide shows the subparts of the 47 CFR Private Land Mobile Radio Service.

Subpart F radio-locations service is used mainly for radar equipment.

Wireless microphones approved under 90.265 generally are rated at a modulation frequency of up to 3 kHz and not up to 15 kHz necessary bandwidth as in Part 74. Note that part 2 requires the bandwidth be tested to 5 kHz.

For 90.259 telemetering operations none of the general technical standards apply.


MTA & EA represent the different types of service areas the equipment operates under.



Rule Interpretations

- Wireless Operations in the 3650-3700 MHz Band – (FCC 07-99)
 - MEMORANDUM OPINION AND ORDER: Released: June 7, 2007
- 1) § 90.7 Definitions
 - *Contention-based protocol:*
 - Allows multiple users to share the same spectrum by defining the events that must occur when two or more transmitters attempt to simultaneously access the same channel.


10/5/2009 Draft for Review 86



Rule Interpretations

- Wireless Operations in the 3650-3700 MHz Band – (FCC 07-99)
 - MEMORANDUM OPINION AND ORDER: Released: June 7, 2007
- 1) § 90.7 Definitions
 - *Contention-based protocol:*
 - Establishes rules by which a transmitter provides reasonable opportunities for other transmitters to operate. May consist of procedures for initiating new transmissions, determining the state of the channel (available or unavailable), and managing retransmissions in the event of a busy channel.


10/5/2009 Draft for Review 87



Rule Interpretations

- Wireless Operations in the 3650-3700 MHz Band – (FCC 07-99)
 - MEMORANDUM OPINION AND ORDER: Released: June 7, 2007
- 1) § 90.7 Definitions
 - Contention-based protocols shall fall into one of two categories:
 - (1) Unrestricted - can avoid co-frequency interference with devices using all other types of contention-based protocols.
 - (2) Restricted - does not qualify as Unrestricted.

10/5/2009 Draft for Review 88



Rule Interpretations


Wireless Operations in the 3650-3700 MHz Band –
(FCC 07-99)

- MEMORANDUM OPINION AND ORDER: Released: June 7, 2007

2) § 90.203 Certification required:

- Applications for all transmitters must describe the methodology used to meet the requirement that each transmitter employ a contention based protocol.
- Applications for mobile transmitters must identify the base stations with which they are designed to communicate and describe how the requirement to positively receive and decode an enabling signal is incorporated .
- RF Power listed as EIRP on Certification Grant.

10/5/2009 Draft for Review 89



Rule Interpretations

- Wireless Operations in the 3650-3700 MHz
 - MEMORANDUM OPINION AND ORDER: Released: June 7, 2007
- 3) Operational Description Exhibit Guide:
 - Explanation of the methodology used for contention (90.203(O)(1)).
 - i. Method used and events that must occur when two or more transmitters attempt to access the same channel.
 - ii. Conditions (detection thresholds levels, bandwidth, timing sequences, etc) necessary to actively take steps and not to interfere with others.
 - iii. Appraisal of the opportunity for other devices to operate. At this time no specific test data is required.

10/5/2009 Draft for Review 90

Address all four items in the Operational Description:

1. Submit a statement on the type of contention (Restricted or Unrestricted)
2. Submit an explanation of the methodology used for contention (90.203(O)(1))


Applications for all transmitters must describe the methodology used to meet the requirement that each transmitter employ a contention based protocol (see §§ 90.7, 90.1305 and 90.1321); **For either restricted or unrestricted contention declarations, please submit the following for devices using the same protocol and for devices using different protocols. Two descriptions are required:**

- i. The method used and events that must occur when two or more transmitters attempt to simultaneously access the same channel before and during a communication session.
- ii. The conditions (detection thresholds levels, bandwidth, timing sequences, etc) necessary to actively take steps and not to interfere with other.
- iii. Provide an appraisal of the opportunity for other devices to operate. At this time no specific test data is required

3. Submit an description for compliance to an enabling signal (90.203(O)(2), 90.1333)

Method used by mobile transmitters to identify the base stations with which they are designed to communicate. Describe how the requirement to positively receive and decode an enabling signal is incorporated (see § 90.1333 of this part);

4. Indicate what standard the above contention protocol implementation is based on. E.g. WiMax, WiFi.



Rule Interpretations

- Wireless Operations in the 3650-3700 MHz Band – (FCC 07-99)
 - MEMORANDUM OPINION AND ORDER: Released: June 7, 2007
- 3) Operational Description Exhibit Guide:
 - Description for compliance to an enabling signal (90.203(O)(2), 90.1333).
 - i. Method used by mobile transmitters to identify the base stations with which they are designed to communicate. Describe how the requirement to positively receive and decode an enabling signal is incorporated (see § 90.1333).
 - Indicate what standard the contention protocol implementation is based on. E.g. WiMax, WiFi.

10/5/2009 Draft for Review 91

Address all four items in the Operational Description:

1. Submit a statement on the type of contention (Restricted or Unrestricted)
2. Submit an explanation of the methodology used for contention (90.203(O)(1))


Applications for all transmitters must describe the methodology used to meet the requirement that each transmitter employ a contention based protocol (see §§ 90.7, 90.1305 and 90.1321); **For either restricted or unrestricted contention declarations, please submit the following for devices using the same protocol and for devices using different protocols. Two descriptions are required:**

- i. The method used and events that must occur when two or more transmitters attempt to simultaneously access the same channel before and during a communication session.
- ii. The conditions (detection thresholds levels, bandwidth, timing sequences, etc) necessary to actively take steps and not to interfere with other.
- iii. Provide an appraisal of the opportunity for other devices to operate. At this time no specific test data is required

3. Submit an description for compliance to an enabling signal (90.203(O)(2), 90.1333)

Method used by mobile transmitters to identify the base stations with which they are designed to communicate. Describe how the requirement to positively receive and decode an enabling signal is incorporated (see § 90.1333 of this part);


4. Indicate what standard the above contention protocol implementation is based on. E.g. WiMax, WiFi.



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 1) § 20.19 Hearing aid-compatible mobile handsets
 - Providers of digital Commercial Mobile Radio Service handsets are subject to hearing aid-compatibility requirements.
 - Pending adoption of HAC standard. Currently no standard exists for 700 MHz band.


10/5/2009 Draft for Review 92



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 2) § 27.2 Permissible communications
 - Operators in the 775–776 MHz and 805–806 MHz bands may not employ a cellular system architecture.

10/5/2009 Draft for Review 93



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 3) § 27.5 Frequencies


THE 700 MHz BAND (PRIOR TO REVISIONS)

698				746	747			762	764			776	777			792	794		806
				G B				G B		Public Safety		G B				G B		Public Safety	
LOWER 700 MHz BAND (CHANNELS 52-59)										UPPER 700 MHz BAND (CHANNELS 60-69)									

10/5/2009

Draft for Review

94



Rule Interpretations

☐ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**

- Summary of Report & Order for Rules governing the “700 MHz Band”:
- 3) § 27.5 Frequencies

REVISED UPPER 700 MHz BAND PLAN INCLUDING GUARD BANDS

757			763			775			787			793			805																										
C			A			D			Public Safety			B			C			A			D			Public Safety			B														
CH. 60			CH. 61			CH. 62			Broadband			G B			Narrowband			CH. 64			CH. 65			CH. 66			CH. 67			Broadband			G B			Narrowband			CH. 69		
746			752			758			764			770			776			782			788			794			800			806											


10/5/2009 Draft for Review 95

§ 27.5 Frequencies.

* * * * *

(b) 746–763 MHz, 775–793 MHz, and 805-806 MHz bands. The following frequencies are available for licensing pursuant to this part in the 746-763 MHz, 775-793 MHz, and 805-806 MHz bands:


- (1) Two paired channels of 1 megahertz each are available for assignment in Block A in the 757-758 MHz and 787-788 MHz bands.
- (2) Two paired channels of 1 megahertz each are available for assignment in Block B in the 775-776 MHz and 805-806 MHz bands.
- (3) Two paired channels of 11 megahertz each are available for assignment in Block C in the 746-757 MHz and 776-787 MHz bands. In the event that no licenses for two channels in this Block C are assigned based on the results of the first auction in which such licenses were offered because the auction results do not satisfy the applicable reserve price, the spectrum in the 746-757 MHz and 776-787 MHz bands will instead be made available for assignment at a subsequent auction as follows:
 - (i) Two paired channels of 6 megahertz each available for assignment in Block C1 in the 746-752 MHz and 776-782 MHz bands.
 - (ii) Two paired channels of 5 megahertz each available for assignment in Block C2 in the 752-757 MHz and 782-787 MHz bands.
- (4) Two paired channels of 5 megahertz each are available for assignment in Block D in the 758-763 MHz and 788-793 MHz bands.



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 4) § 27.53(e) Emission limits
 - For operations in the 775–776 MHz and 805–806 MHz bands, transmitters must comply with either paragraphs (e)(1) to (e)(5) of this section **OR** the ACP emission limitations set forth in paragraphs (e)(6) to (e)(9) of this section.


10/5/2009 Draft for Review 96



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 4) § 27.53(e)(3) Emission limits
 - On any frequency outside the 775 to 776 MHz and 805 to 806 MHz bands, the power of any emission shall be attenuated outside the band below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB .


10/5/2009 Draft for Review 97



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 4) § 27.53(e)(5) Emission limits
 - Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

10/5/2009 Draft for Review 98



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 4) § 27.53(f) Emission limits
 - For operations in the 746–763 MHz, 775–793 MHz, and 805-806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to –70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and –80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

10/5/2009 Draft for Review 99



Rule Interpretations

□ Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)

- Summary of Report & Order for Rules governing the “700 MHz Band”:

4) § 27.53(e) Emission limits

➤ Typical ACP Limits Table


150 kHz Mobile Transmitter ACP Requirements

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)
100	50	-40
200	50	-50
300	50	-50
400	50	-50
600-1000	30(s)	-60
1000 to receive band	30(s)	-70
In the receive band	30(s)	-100

10/5/2009

Draft for Review


100



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 5) § 90.531 Band plan
 - This section sets forth the band plan for the 763-775 MHz and 793-805 MHz public safety bands.
 - *Base and mobile use.* The 763-775 MHz band may be used for base, mobile or fixed (repeater) transmissions. The 793-805 MHz band may be used only for mobile or fixed (control) transmissions.


10/5/2009 Draft for Review 101



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 5) § 90.531 Band plan
 - *Narrowband segments.* There are two band segments that are designated for use with narrowband emissions. Each of these narrowband segments is divided into 960 channels having a channel size of 6.25 kHz as follows:

10/5/2009 Draft for Review 102



Rule Interpretations


- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 5) § 90.531 Band plan
 - Narrowband

Frequency range	Channel Nos.
769-775 MHz.....	1-960
799-805 MHz.....	961-1920

10/5/2009

Draft for Review

103



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 5) § 90.531 Band plan
 - *Internal guard band.* The internal guard band (768-769/798-799 MHz) is reserved. See previous slide #7.
 - *Broadband.* The 763-768 MHz and 793-798 MHz bands are allocated for broadband communications pursuant to the Public Safety Broadband License.

10/5/2009 Draft for Review 104



Rule Interpretations


☐ Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)

- Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 6) § 90.535 Modulation and spectrum usage efficiency requirements
 - Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the following modulation standards:
 - ❖ Must use digital modulation. Mobile and portable transmitters may have analog modulation capability only as a secondary mode in addition to its primary digital mode. Mobile and portable transmitters that only operate on the low power channels designated in §§ 90.531(b)(3), 90.531(b)(4), are exempt from this digital modulation requirement.

10/5/2009

Draft for Review


105



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 7) § 90.543 Emission limitations
 - For operations in the 763-775 MHz and 793-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.


10/5/2009 Draft for Review 106



Rule Interpretations

- ❑ **Service Rules for the 698-806 MHz Bands – (FCC 07-72 / 07-132)**
 - Summary of Report & Order for Rules governing the “700 MHz Band”:
 - 8) § 90.547 Narrowband interoperability channel capability requirement.
 - Mobile and portable transmitters operating on narrowband channels in the 769-775 MHz and 799-805 MHz frequency bands must be capable of operating on all of the designated nationwide narrowband Interoperability channels pursuant to the standards specified in this part.

10/5/2009 Draft for Review 107



Rule Interpretations

- ❑ **4.9 GHz Public Safety Radio – Part 90Y RF Testing.**
 - Channel Plan clarifications for 90.1213:
 - Transmitter tests should be performed on channel frequencies listed in the table, for the specific emission bandwidth of the device (either 1 or 5 MHz channels as listed).
 - If channel aggregation is used, the tests would be performed with the transmitter tuned to the center frequency of the aggregated channels rather than frequencies listed in the table of 90.1213.

10/5/2009 Draft for Review 108



Rule Interpretations


☐ 4.9 GHz Public Safety Radio – Part 90Y RF Testing.

- L and M masks in Part 90.210:
 - The rule indicates using a minimum RBW of 1% of the fundamental emission to determine the zero dB reference level, and also to determine the mask skirts. The mask plot should be developed using the same resolution bandwidth throughout, for the zero dB reference level and the mask skirts.
 - Section 90.210(l)7 and (m)7 lists average; therefore average is used to measure the L and M masks.

10/5/2009

Draft for Review

109



Part 90 Private Land Mobile

● Special Requirements:

- 2.1091 & 2.1093 – RF Exposure requirements apply to some devices
 - Portable & Mobile units operating from 806-940 MHz for EA and MTA operation under Subpart S.
 - UHF units operating from 450-512 MHz that are non push to talk and may be connected to the switched telephone network.
- 90.203 channel programming restrictions.
- 90.203 Narrowband & Efficiency standards in re-farming bands.
- 90.214 Transient behavior testing.
- 406 MHz band requirement.


10/5/2009 Draft for Review 110

The TCB exclusion list should be checked before approving Part 90 devices, especially higher frequency, higher power equipment.

90.203 channel programming restrictions address frequency tuning capability of the external controls of equipment.

90.214 transient frequency test is done using the EIA/TIA 603 test method. TSB102.CAAA covers digital modulation. This section of the rules was added several years ago in a rulemaking known as “re-farming”. The channel spacing and data rate requirements were modified to reduce the channel spacing from 25 kHz to 12.5 kHz eventually to 6.25 kHz. Due to the additional channels in the same amount of frequency spectrum, the 90.214 tests were instituted to make sure the equipment came up on frequency fast enough not to cause interference with adjacent channels.

Land Mobile use of the 406 MHz band is prohibited in the FCC rules per NOAA and NASA to protect satellite transmissions.



Part 90 Private Land Mobile

- Special Requirements (continued):
 - 90.103 Subpart F - Radio-location service
 - Entire frequency band assigned. There is no authorized bandwidth value
 - From general technical specifications, only out of band emissions limit applies
 - Bandwidth listed on grant is normally occupied bandwidth
 - Subpart allows un-modulated CW signals to be transmitted
 - Peak power listed on grant


10/5/2009 Draft for Review 111

90.103 different in that most of Part 90 has 25 kHz channel bands

The out of band emission limit is $43 + 10 \log(p)$.

The peak power of a radar transmitter is defined as maximum level during interrogation pulse. Calculated as $P = P(\text{avg})/(\text{pulse width} \times \text{Rep rate})$.

OET Bulletin 37 on Doppler Radars applies to 24 GHz units. Available from FCC Warehouse @ 800-418-3676 but not online.



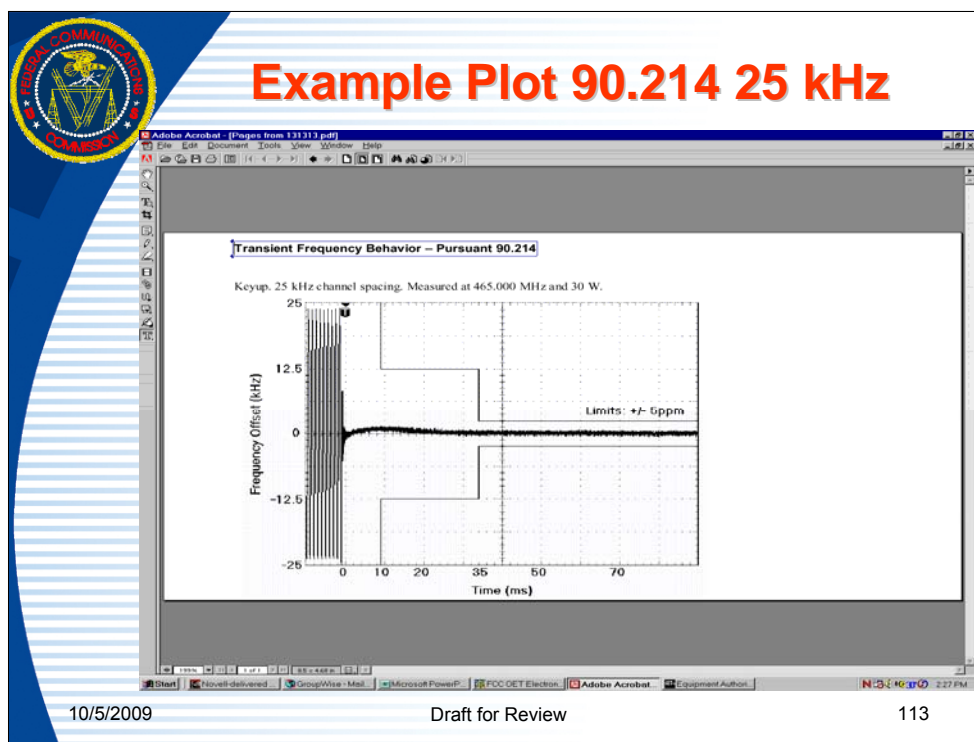
Part 90 Common Problems

- 90.217 Applications
 - Application requests 90.217(b) and 90.217(c) One or the other must be selected
- 90.213 Frequency Tolerance
 - Application requests a tolerance which is greater than allowed by the rules
 - Application shows inconsistency between reported tolerance value and value listed on grant
- 90.203(j) Minimum data rate requirements
 - Application doesn't indicate that data rate complies
- 90.203(e) Channel programming restrictions
 - Application doesn't indicate requirements met

10/5/2009 Draft for Review 112

90.217 equipment is either designed for 12.5 kHz operation or 6.25 kHz but not both.

Minimum Data rate is 4800 bps per 6.25 kHz of channel spacing.

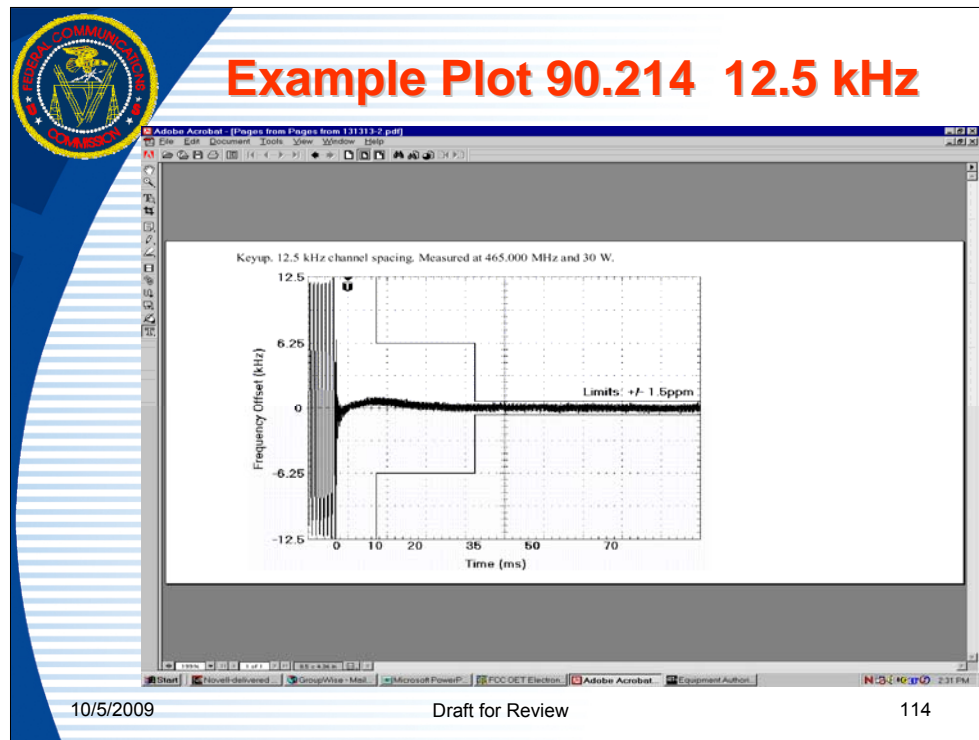


This slide shows a typical plot for a 25 kHz voice modulated unit transient frequency response test. The response shown is for the turn on transient. On this plot the frequency stability requirements of 90.213 apply after time period T2.

Standard intended to prevent interference at time of turn on/off to adjacent channels.

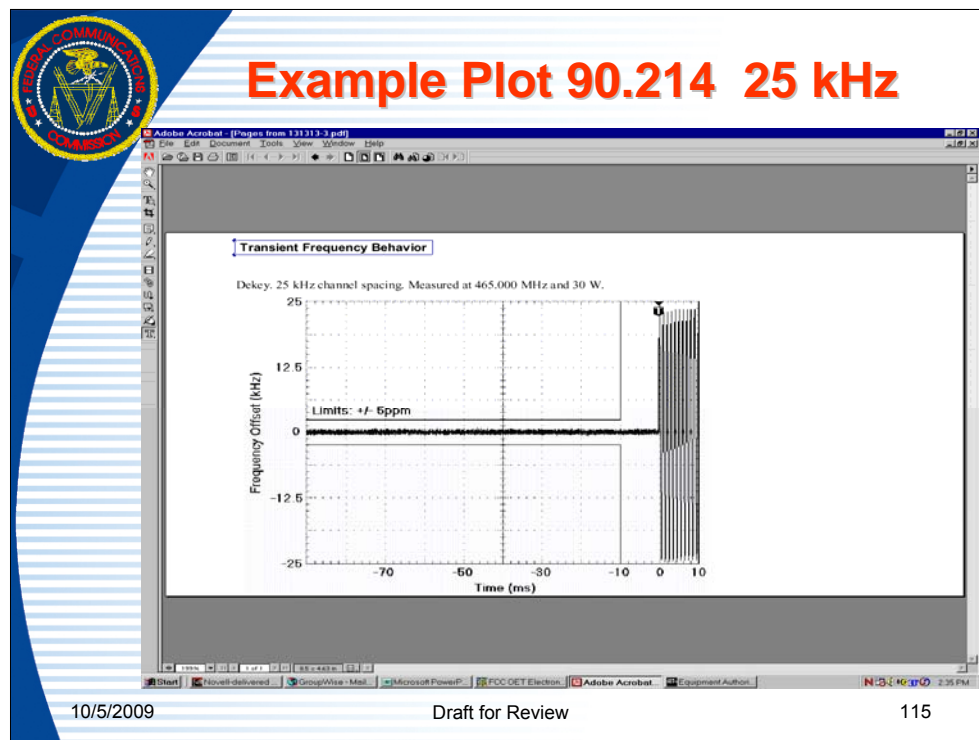
From left to right is reference signal(-25 to 0 ms), turn on (around 0 ms), signal on and frequency stability (from 0 to left edge)

Reference signal is 1 KHz modulation and 25 KHz deviation.

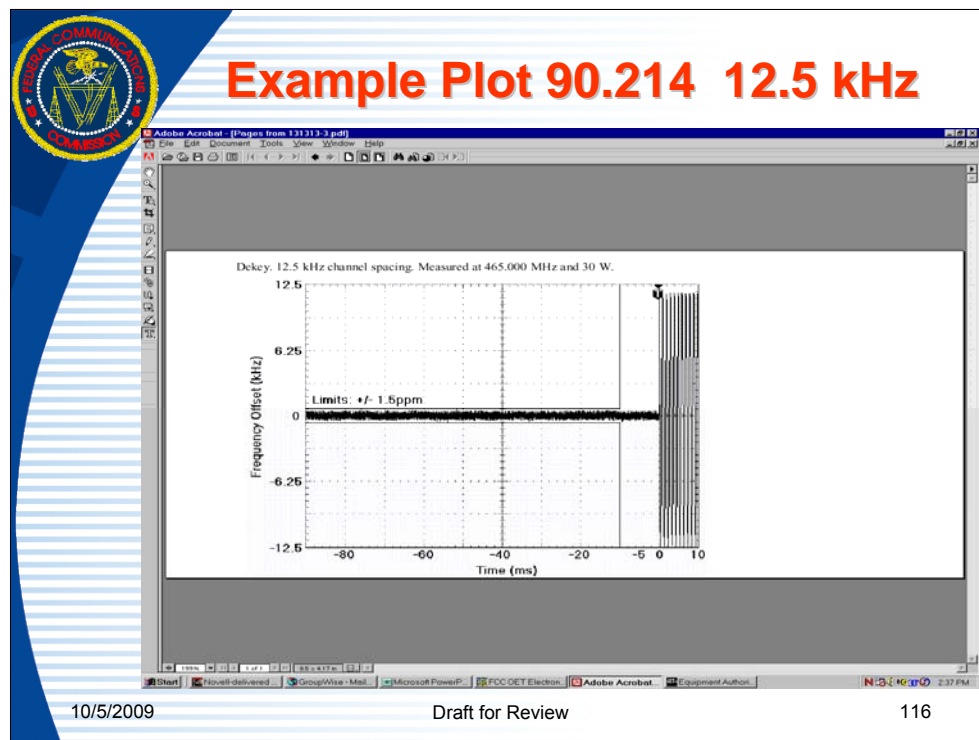


This slide shows a typical 90.214 turn on transient response plot for 12.5 kHz operation of a voice modulated device.


On this plot the frequency stability requirements of 90.213 apply after time period T2.



This slide shows the 90.214 transient frequency response at turn off for a 25 kHz voice modulated unit.



This slide shows the 90.214 transient frequency response for a 12.5 kHz voice modulated unit at turn off.



Part 95 Personal Radio Services


- Part 95 Includes:
 - Subpart A – General Mobile Radio Service (GMRS)
 - Subpart B - Family Radio Service (FRS)
 - Subpart C - Radio Control (R/C) Radio Service
 - Subpart D - Citizens Band (CB) Radio Service
 - Subpart F - 218 - 219 MHz Service
 - Subpart G - Low Power Radio Service (LPRS)
 - Subpart H - Wireless Medical Telemetry Communications Service (WMTS)
 - Subpart I - MedRadio

10/5/2009 Draft for Review 117

This slide shows an overview of the Subparts of 47 CFR Part 95.

Part 95 is unique in that some of its Subparts don't require a station license. These Subparts which require equipment approval but not operator license are the family radio service, radio control service, citizens band service and multi-use radio service.

Background of Part 95 is that originally included devices which all required licenses. Over time some of the license requirements were dropped as the technology became more stable. Then some additional subparts were added which required equipment authorization but no licenses.



Part 95 Personal Radio Services


- Part 95 Includes:
 - Subpart J - Multi-Use Radio Service (MURS)
 - Subpart K – Personal Locator Beacons (PLB)
 - Subpart L – Dedicated Short Range Communications Service On-Board Units (DSRCS-OBUs)

10/5/2009 Draft for Review 118

This slide shows an overview of the Subparts of 47 CFR Part 95.

Part 95 is unique in that some of its Subparts don't require a station license. These Subparts which require equipment approval but not operator license are the family radio service, radio control service, citizens band service and multi-use radio service.

Background of Part 95 is that originally included devices which all required licenses. Over time some of the license requirements were dropped as the technology became more stable. Then some additional subparts were added which required equipment authorization but no licenses.




Part 95 Personal Radio Services

- Subpart A - General Mobile (GMRS)
 - Operating Frequency Bands:
 - 462.55-462.725 MHz & 467.55-467.725 MHz
 - General Technical Requirements
 - 95.621 - Frequency Tolerance
 - 95.631(a), (e), & (f) - Emission Types
 - 95.633 - Emission Bandwidth(s)
 - 95.635 - Unwanted radiation
 - 95.637 - Modulation Standards
 - 95.639 - Maximum Transmitter Power
 - 95.655 - Frequency Capability

10/5/2009 Draft for Review 119

This slide shows an overview of 47 CFR part 95 Subpart A General mobile radio service. An operators license is required to use this equipment. For GMRS Sections 95.29 and 95.621 show available channels.




Part 95 Personal Radio Services

GMRS Voice Scrambling – Part 95A

- Frequency inversion and Digital scrambling are prohibited. Any type of signal manipulation that does not allow for interoperable communications between devices is prohibited.
- The intent of 95.183(a)(4) (and its corollary, 95.181(e)) is that any GMRS user be able to understand any other GMRS user, even if the radios are from different manufacturers.

10/5/2009 Draft for Review 120




Part 95 Personal Radio Services

- Subpart B - Family Radio Service (FRS)
 - Operating Frequency Band: 462.5625-467.7125 MHz
 - General Technical Requirements
 - 95.193 - Types of Communication (voice/"tones")
 - 95.627(b) - Frequency Tolerance
 - 95.631 - Emission Types
 - 95.633 - Emission Bandwidth
 - 95.635 - Unwanted Radiation
 - 95.637 - Modulation Standards
 - 95.639 - Maximum Transmitter Power
 - 95.647 - Transmitter Antenna
 - 95.649 - Power Capability

10/5/2009 Draft for Review 121

This slide shows an overview of 47 CFR Part 95 Subpart B Family Radio Service. An operator license is not required for the operation of this equipment.

For FRS units sections 95.627(a) shows available channels



Part 95 Personal Radio Services


- Subpart B - Family Radio Service (FRS)
 - Special Requirements:
 - Integral Antenna is required
 - See applicable Exclusion list
 - FCC 03-26 New rulemaking
 - GPS Data transmission.
- Subpart C - Radio Control Service (R/C)
 - Operating Frequency Bands:
 - 26.995 - 27.255 MHz
 - 72.01 - 72.99 MHz
 - 75.41 - 75.99 MHz

10/5/2009 Draft for Review 122

New rules for FRS per docket FCC 03-26 allowing GPS data transmission. Previously only voice transmission is allowed.

47 CFR Part 95 Subpart C is the Radio Control Radio Service. No operator license is required to use this type of equipment.

For the R/C service sections 95.207 and 95.623 address the available channels



Part 95 Personal Radio Services


- Subpart C - Radio Control Service (R/C)
 - General Technical Requirements:
 - 95.623 - Frequency Tolerance
 - 95.631 - Emission Types
 - 95.633 - Emission Bandwidth
 - 95.635 - Unwanted Radiation
 - 95.639 - Maximum Transmitter Power
 - 95.645 - Control Accessibility (Crystals)
 - 95.647 - Transmitter Antenna
 - 95.649 - Power Capability
 - 95.651 - Crystal Control Required

10/5/2009 Draft for Review 123

In addition to the emission types requirements addressed in 95.631, also see 95.211 and 95.212.

In addition to the power output requirements addressed in 95.639, also see 95.210.

Section 95.603(b) provides an exemption from Certification for crystal controlled 26-27 MHz transmitters



Part 95 Personal Radio Services


- Subpart C - Radio Control Service (R/C)
 - Special Requirements:
 - Integral Antenna required.
 - External crystal access prohibited.
- Subpart D - Citizens Band Radio Service (CB)
 - Operating Frequency Band:
 - 26.965 - 27.405 MHz
 - General Technical Requirements:
 - 95.625(b) - Frequency Tolerance
 - 95.631 - Emission Types
 - 95.633 - Emission Bandwidth
 - 95.635 - Unwanted Radiation

10/5/2009 Draft for Review 124

47 CFR Part 95 Subpart D is the Citizens Band Radio Service. No operators license is required to use CB equipment.

For the CB service sections 95.407 and 95.625 address available channels.

Additional information about 95.631 emission types is available in 95.412 and 95.413.




Part 95 Personal Radio Services

- Subpart D - Citizens Band Radio Service (CB)
 - General Technical Standards:
 - 95.637 - Modulation Standards
 - 95.639 - Maximum Transmitter Power
 - 95.649 - Power Capability
 - 95.655 - Frequency Capability
 - 95.667 - CB Transmitter Power
 - 95.669 - External Controls
 - 95.671 - Serial Number
 - Special Requirements:
 - Final output stage has a 10 W power dissipation limit.
 - Serial number must be engraved on TX Chassis.

10/5/2009 Draft for Review 125

Power requirements are also addressed in 95.410 and 95.411.



Part 95 Personal Radio Services

- Subpart F - 218-219 MHz Service
 - Operating Frequency Bands:
 - 218 218.5 MHz and 218.501-219
 - General Technical Requirements:
 - 95.853 - Frequency Segments
 - 95.855 - Transmitter ERP
 - 95.859 - Antennas
 - Special Requirements
 - CTS & RTU Stations

10/5/2009 Draft for Review 126

47 CFR Part 95 Subpart F contains the 218-219 MHz band.


The 218-219 MHz band was formerly known as the Interactive Video and Data Service. Operation in this band requires a license.

This is an open band for any type of operation which meets the technical requirements.

For more information on this service see the Wireless Telecommunications Bureau rulemaking WT docket 98-169 on the Internet

RTU-Response Transmitter Unit

CTS-Cell Transmitter Station



Part 95 Personal Radio Services


- Subpart G - Low Power Radio Service (LPRS)
 - Operating Frequency Bands:
 - 216 - 217 MHz
 - General Technical Requirements:
 - 95.629 - Channel Bandwidths
 - 95.629 - Frequency Stability
 - 95.631 - Emission Types
 - 95.633 - Emission Bandwidth
 - 95.635 (c) - Unwanted Radiation
 - 95.639 - Maximum Transmitter Power

10/5/2009 Draft for Review 127

47 CFR Part 95 Subpart G contains the LPRS. An operator license is required to operate in this band.

Operating frequency information is addressed in 95.629


One type of device authorized in this band is hearing aid or auditory assistance devices.



Part 95 Personal Radio Services

- Subpart G - Low Power Radio Service (LPRS)
 - Special Requirements:
 - 95.1009 - Permissible Communications
 - 95.1013 - Antennas
 - 95.1015 - Disclosure Policies
 - 95.1017 - Labeling Requirements
- Subpart H - Wireless Medical Telemetry Service (WMTS)
 - Operating Frequency Bands
 - 608 - 614 MHz
 - 1395 - 1400 MHz
 - 1429 - 1432 MHz

10/5/2009 Draft for Review 128




Part 95 Personal Radio Services

- Subpart H - Wireless Medical Telemetry Service (WMTS)
 - General Technical Requirements
 - 95.1115 - Technical Requirements
 - 95.1117 - Types of Communication
 - Special Requirements
 - Voice & video Transmission prohibited.
 - RF Exposure evaluation is required for portable devices.

10/5/2009 Draft for Review 129

For addition information on the WMTS see ET Docket 99-255 which is a follow up of PR Docket 92-235. ET stands for Office of Engineering and Technology. PR was the Private Radio Bureau which is now part of the Wireless Bureau.



Part 95 Personal Radio Services

- Subpart I – MedRadio
- MedRadio – body worn & implanted devices (FCC 09-23)
 - http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-09-23A1.pdf
 - Erratums (Released March 20, 2009 & July 15, 2009)
 - http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-290160A1.pdf
 - http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-290607A1.pdf
 - NOI/NPRM open proceeding for future medical technologies
 - http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-103A1.pdf


10/5/2009 Draft for Review 130

MICS service for devices implanted in body.

95.628 contains requirements for Frequency monitoring for MICS transmitters.

For additional information see WT Docket 99-66


These devices are currently not eligible for TCB approval.



Part 95 Personal Radio Services

- MICS 402-405 MHz (core band)
- Additional 2 MHz spectrum (wing bands)
 - 401 – 402 MHz & 405 – 406 MHz
 - Not channelized
- Frequency Monitoring requirements – Section 95.628(a)

10/5/2009 Draft for Review 131



Part 95 Personal Radio Services

- Devices NOT requiring frequency monitoring
 - Max EIRP 100 nanowatts in the 402 – 405 MHz band
 - 250 nanowatts in the 401-401.85 MHz and 405-406 MHz bands
 - 25 nanowatts in the 401.85-402 MHz band
- Authorized BW
 - 300 kHz in the 402-405 MHz band
 - 100 kHz in the 401-401.85 MHz and 405-406 MHz bands
 - 150 kHz in the 401.85-402 MHz band
- Voice communications prohibited
- Frequency stability of +/-100 ppm
- Tested in tissue equivalent liquid


10/5/2009 Draft for Review 132

MICS service for devices implanted in body.

95.628 contains requirements for Frequency monitoring for MICS transmitters.

For additional information see WT Docket 99-66

These devices are currently not eligible for TCB approval.



Part 95 Personal Radio Services


- Subpart J - Multi-Use Radio Service (MURS)
 - Operating Frequency Band:
 - 151.82, 151.88, 151.94, 154.57, & 154.6 MHz
 - General Technical Standards:
 - 95.631 - Emission Types
 - 95.632 - Operating Frequency, bandwidth, and frequency stability.
 - 95.633 - Emission Bandwidth
 - 95.635 - Unwanted Radiation
 - 95.639 - Maximum Transmitter Power
 - 95.649 - Power Capability
 - 95.651 - Crystal Control required

10/5/2009 Draft for Review 133

The MURS service is a private, two way, short distance voice, data or image communications service for personal or business use.

Maximum Power for MURS equipment is 2 watts. Initially this power output was ERP but a recent rule making FCC02-139 changed this to a conducted limit and also prohibited the filing of combination FRS devices.


The frequencies in this service were formerly in Part 90 but moved to part 95 when the licensing requirement was eliminated.



Personal Locator Beacon (PLB)

- Rule Sections 95K (FCC 02-271)
 - 95.1400 Basis and Purpose
 - 95.1401 Frequency
 - 95.1402 406 MHz Special Requirements
 - RTCM Paper 76-2002/SC110-std dated June 19, 2002
 - Sections 95.1400 –For use for individuals participating in outdoor activities in remote areas
 - Example Application: KLS-PLB-1-GPS
- Must meet technical requirements specified for Part 80 PLBs (Reference Part 80 presentation)
- NOAA registration required

10/5/2009 Draft for Review 134



Part 95 Personal Radio Services


- Part 95L - Dedicated Short Range Communications Service On-Board Units (DSRCS-OBUs)
- 5850–5925 MHz
 - Channelized
- Comply with the following standard:
American Society for Testing and Materials (ASTM) E2213–03, Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems—5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications published September 2003 (ASTM E2213–03 DSRC Standard)

10/5/2009 Draft for Review 135

The MURS service is a private, two way, short distance voice, data or image communications service for personal or business use.

Maximum Power for MURS equipment is 2 watts. Initially this power output was ERP but a recent rule making FCC02-139 changed this to a conducted limit and also prohibited the filing of combination FRS devices.

The frequencies in this service were formerly in Part 90 but moved to part 95 when the licensing requirement was eliminated.




Part 95 Common Problems

- 95.645(b) Crystal Access
 - Application doesn't contain statement about accessibility of crystal.
- 95.669 CB External Controls
 - CB Radio Application isn't clear on how it complies with external controls requirements.

10/5/2009 Draft for Review 136

95.645(b) applies to the radio control service only.



Part 95 New Issues

- Combined GMRS/FRS Devices
 - Different RF exposure requirements
 - Power Restrictions on shared channels
 - FRS maximum power 0.5 Watts
 - GMRS maximum power 5 Watts
 - License Issues
 - FRS requires no users license
 - GMRS requires users license
 - Bandwidth
 - FRS Maximum 12.5 KHz
 - GMRS 20KHz or 12.5KHz
 - Integral Antenna Requirements


10/5/2009 Draft for Review 137

Due to the power differences between services the RF exposure requirements are different. Due to the potential different user groups, FRS are used by anyone, GMRS can be restricted to trained personnel which allows for higher exposure levels for GMRS

FRS radios must have integral antennas but GMRS don't have this requirement. A combo device FRS/GMRS must have an integral antenna.

Power output for these devices must be limited based on the mode of operation. When operating on FRS channels the maximum power must be 0.5 Watts ERP

Issues related to combining operations of this type are handled by the Wireless Telecommunication Bureau on a case by case basis. Currently FRS/GMRS and FRS/Part 80 VHF(156-163MHz) combos are permitted.



Part 97 - Amateur Radio Service


- Operating Frequency Band:
 - < 144 MHz for amplifiers subject to Certification
- General Technical Requirements:
 - 97.307 - Emission Standards
 - 97.313(b) - Transmitter Power Standards
 - 97.317 - Standards for Certification
- Special Requirements
 - 2.1060 - Guidelines for kits for amateur service

10/5/2009 Draft for Review 138

For more information about amplifier Certification see 97.315

For part 97 equipment only amplifiers operating below 144 MHz require Certification.

In the Amateur service the operator is required to be licensed but the equipment does not require Certification with the exception of Amplifiers operating below 144 MHz.



Grant Example Multi Rule Part

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Company name
Company Address

Date of Grant:
Application Dated: 02/05/1999

Attention:

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Licensed Non-Broadcast Station Transmitter

Notes: M1225 Low Power Mobile

Grant Notes

FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
22.74,90,95A	450 - 474	30	2.5 PM	16K0F3E
22.74,90.210,95A	450 - 474	30	2.5 PM	11K0F3E
22.74,90,95A	450 - 474	10	2.5 PM	16K0F3E
22.74,90.210,95A	450 - 474	10	2.5 PM	11K0F3E


Single channel mode.

10/5/2009

Draft for Review

139

This grant is a typical part 90 re-farming band mobile transmitter with 25 kHz and 12.5 kHz channel operation. The grant has a note “single channel mode” to show that the equipment meets the 12.5 kHz data rate requirements. The channels which meet the efficiency standard are also note in the rule part column with 90.210 instead of the typical 90. The grant also shows this unit has a power output which is switchable between 30 W and 10 W.



Grant Example Multi Rule Part

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Type Acceptance

COPY

Company Name _____
Company Address _____

Date of Grant: _____
Application Dated: 12/16/1997

Attention: _____

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER _____
Name of Grantee _____

Equipment Class: Licensed Non-Broadcast Station Transmitter

Notes:

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
	22.74,90	148 - 174	5	0.00015 %	16K0F3E
	22.74,90	148 - 174	5	0.00015 %	19K6F3D
	22.74,90.210	148 - 174	5	0.00015 %	11K0F3E
	22.74,90	148 - 174	1	0.00015 %	16K0F3E
	22.74,90	148 - 174	1	0.00015 %	19K6F3D
	22.74,90.210	148 - 174	1	0.00015 %	11K0F3E


Single channel mode.

10/5/2009

Draft for Review

140

This grant shows another part 90 refarming band transmitter which has a power output switchable from 5 watts to 1 watt. This unit is in a different frequency band and doesn't include part 95. It also has an F3D emission with a larger necessary bandwidth of greater than 16 kHz.



Grant Example Narrowband

Adobe Acrobat - [grantexamplenarrow90.PDF]

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Company name
Company Address

Date of Grant:
Application Dated: 10/06/1998

Attention: **NOT TRANSFERABLE**
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Licensed Non-Broadcast
Station Transmitter

Notes:

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
	90.210	403 - 470	5	2.5 PM	11K0F1D
	90.210	136 - 174	5	2.5 PM	11K0F1D


Single channel mode.

10/5/2009

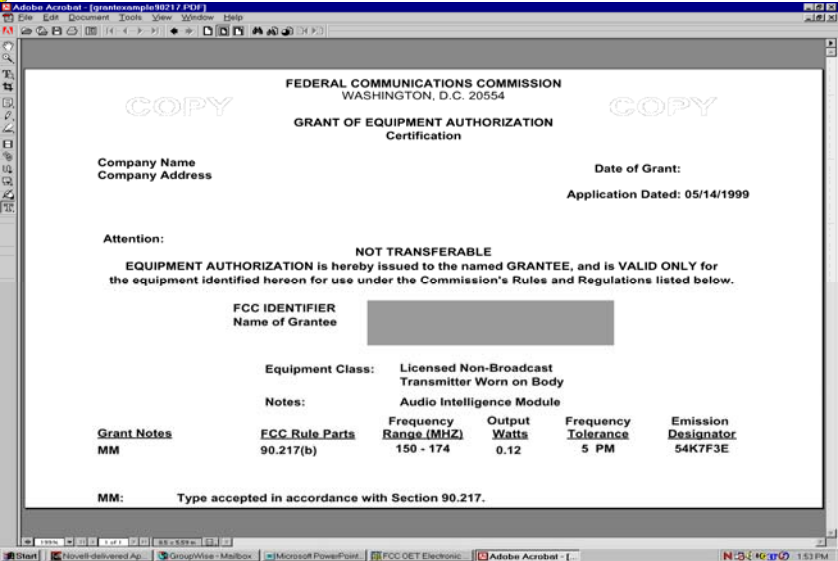
Draft for Review

141

This grant is a typical example of a Part 90 Narrowband data transmitter which meets the re-farming efficiency standard



Grant Example 90.217



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

COPY

Company Name
Company Address

Date of Grant:
Application Dated: 05/14/1999

Attention: **NOT TRANSFERABLE**
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Licensed Non-Broadcast Transmitter Worn on Body

Notes: Audio Intelligence Module

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
MM	90.217(b)	150 - 174	0.12	5 PM	54K7F3E

MM: Type accepted in accordance with Section 90.217.


10/5/2009

Draft for Review

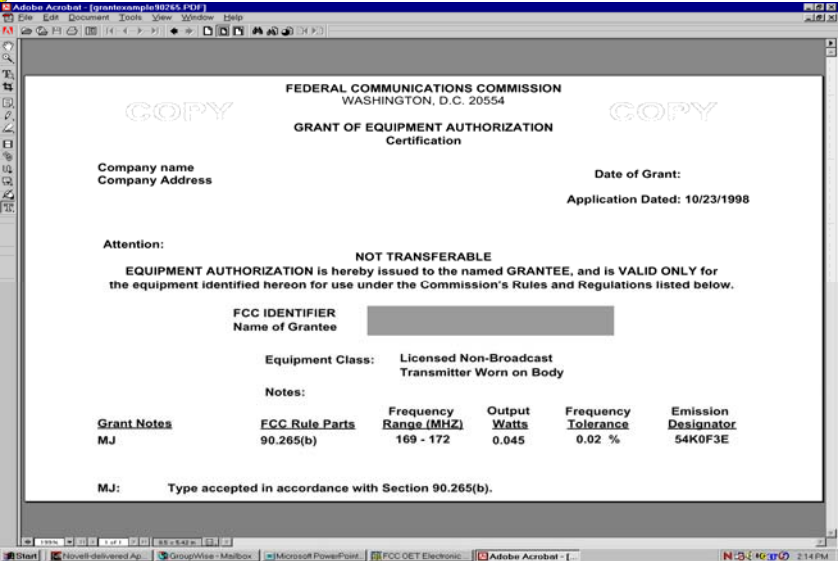
142

This slide shows a typical 90.217(b) grant. The necessary bandwidth for this unit is 54.7 kHz. Note the “note code” MM which is placed on grants issued in this rule section.

MM “Type Accepted in accordance with 90.217” is no longer used since all approvals called Certification.



Example Grant 90.265(b)



Example Grant 90.265(b)

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Company name
Company Address

Date of Grant:
Application Dated: 10/23/1998

Attention: **NOT TRANSFERABLE**
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Licensed Non-Broadcast Transmitter Worn on Body


Notes:

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
MJ	90.265(b)	169 - 172	0.045	0.02 %	54K0F3E

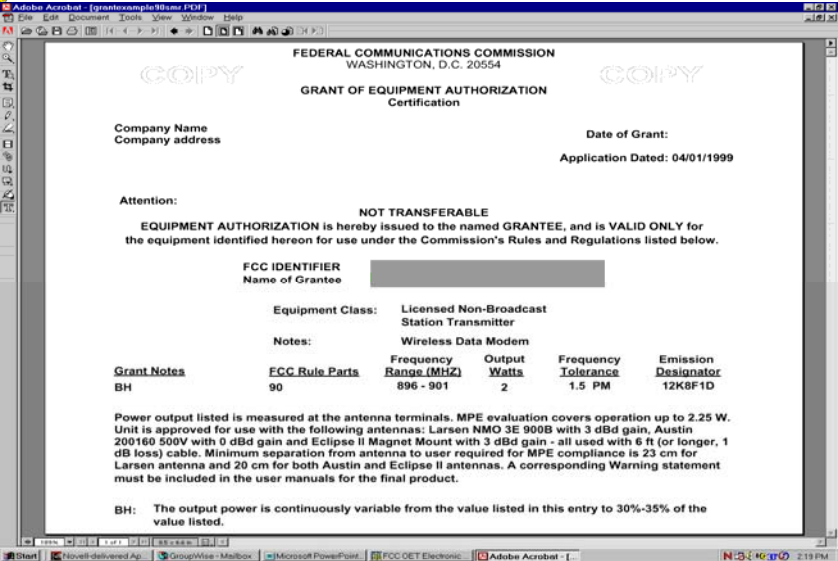
MJ: Type accepted in accordance with Section 90.265(b).

This slide shows a typical grant for a 90.265 wireless microphone. The necessary bandwidth for this device is 54 kHz and the note code MJ is listed on the grant for devices in this rule part.

MJ “Type Accepted in accordance with 90.265(b)” is no longer used since all approvals called Certification.



Grant Example SMR Part 90



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Company Name
Company address

Date of Grant:
Application Dated: 04/01/1999

Attention:

NOT TRANSFERABLE
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Licensed Non-Broadcast Station Transmitter

Notes: Wireless Data Modem

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
BH	90	896 - 901	2	1.5 PM	12K8F1D

Power output listed is measured at the antenna terminals. MPE evaluation covers operation up to 2.25 W. Unit is approved for use with the following antennas: Larsen NMO 3E 900B with 3 dBd gain, Austin 200160 500V with 0 dBd gain and Eclipse II Magnet Mount with 3 dBd gain - all used with 6 ft (or longer, 1 dB loss) cable. Minimum separation from antenna to user required for MPE compliance is 23 cm for Larsen antenna and 20 cm for both Austin and Eclipse II antennas. A corresponding Warning statement must be included in the user manuals for the final product.


BH: The output power is continuously variable from the value listed in this entry to 30%-35% of the value listed.

10/5/2009

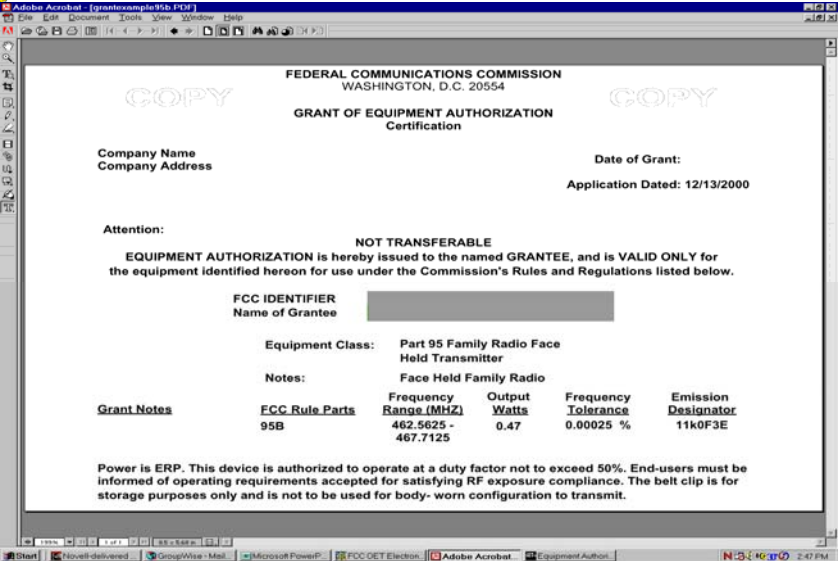
Draft for Review

144

This slide shows a grant for a Part 90 Specialized Mobile Radio service unit. This unit requires RF Exposure evaluation. Note the RF Exposure remark on the grant. This unit also has an adjustable power level indicated by the note BH.



Example Grant 95 B



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Company Name
Company Address

Date of Grant:
Application Dated: 12/13/2000

Attention: **NOT TRANSFERABLE**
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Part 95 Family Radio Face Held Transmitter

Notes: Face Held Family Radio

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
	95B	462.5625 - 467.7125	0.47	0.00025 %	11k0F3E


Power is ERP. This device is authorized to operate at a duty factor not to exceed 50%. End-users must be informed of operating requirements accepted for satisfying RF exposure compliance. The belt clip is for storage purposes only and is not to be used for body-worn configuration to transmit.

10/5/2009

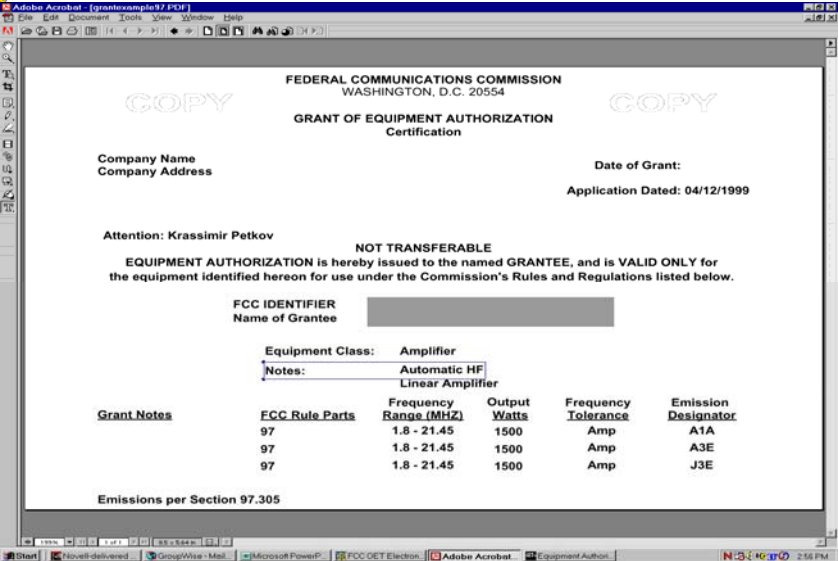
Draft for Review

145

This slide shows a typical Family Radio service grant. Note the RF exposure evaluation comment on the grant.



Example Grant Part 97



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

COPY

Company Name
Company Address

Date of Grant:
Application Dated: 04/12/1999

Attention: Krassimir Petkov

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER
Name of Grantee

Equipment Class: Amplifier
Notes: Automatic HF
Linear Amplifier

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
	97	1.8 - 21.45	1500	Amp	A1A
	97	1.8 - 21.45	1500	Amp	A3E
	97	1.8 - 21.45	1500	Amp	J3E


Emissions per Section 97.305

10/5/2009

Draft for Review

146


This slide shows a typical Part 97 Amateur band amplifier grant. Since this is an amplifier the grant doesn't list a frequency tolerance or necessary bandwidth.



Microwave Radio

- ▶ Part 27 Subpart M - BRS
 - ▶ Operating Frequency Band:
 - 2150 - 2168 MHz
 - ▶ General Technical Requirements:
 - 27.54 - Frequency Tolerance
 - 27.50 - Transmitter Power
 - 27.53 - Emissions and Bandwidth
 - 27.1220 - Transmission Standards
 - 27.50 - Signal Booster Stations


10/5/2009 Draft for Review 147



Microwave Radio

- ▶ Part 27 Subpart M – EBS
 - ▶ Operating Frequency Band:
 - 2500 - 2686 MHz
 - ▶ General Technical Requirements:
 - 27.50 - Power Limitations
 - 27.53 - Emissions & Bandwidth
 - 27.54 - Frequency Tolerance
 - 27.1220 – Transmission Standards
 - 27.50 - Signal Booster Stations

10/5/2009 Draft for Review 148



Microwave Radio

- Part 74 Subpart F - Television Broadcast Auxiliary
 - Operating Frequency Bands:
 - 1990 - 2483.5 MHz
 - 6875 - 7125 MHz
 - 12700 - 13250 MHz
 - General Technical Requirements:
 - 74.636 - Power Limitations
 - 74.637 - Emissions & Emission Limitations
 - 74.661 - Frequency Tolerance
 - 74.663 - Modulation Limits


10/5/2009 Draft for Review 149

This slide shows an overview of 47 CFR Part 74 F.

A typical use is for sending television video signals over a microwave link from a studio to the broadcast transmitter when the transmitter and studio are at different locations.

74.637 lists some additional frequencies available which may be used for digital modulated signals. They are 6425 - 6525, 17700 - 19700 and 31000 - 31300 MHz.

The band 1990 - 2500 MHz doesn't currently allow digital modulation but is being modified to allow digital modulation. This is related to High definition television operation.




Microwave Radio

- Part 101 Subpart C-General Technical Standards
 - Operating Frequency Band
 - 928 - 960 MHz (101.101, 101.147)
 - General Technical Requirements
 - 101.107 - Frequency Tolerance
 - 101.109 - Bandwidth (Authorized)
 - 101.111 - Emission Limitations
 - 101.113 - Transmitter Power Limitations
 - 101.131 - Transmitter Construction
 - Special Requirements
 - 101.151 - Use of Signal Boosters

10/5/2009 Draft for Review 150

47 CFR Part 101 Subpart C contains the general technical standards. Multiple Address Systems Service (MAS), are not fixed microwave services even though it is in the fixed microwave radio service rule part. When the individual subparts of Part 101 don't address as standard then the standards in Subpart C apply.

At least one reconsideration petition for Part 101 has been filed and proposals to move LMDS equipment into verification are being considered.




Microwave Radio

- Part 101 Subpart G - Digital Electronic Message Service (DEMS)
 - Operating Frequency Band
 - 18870 - 19260 MHz (101.505 & 101.147)
 - General Technical Standards
 - 101.507 - Frequency Stability
 - 101.513 - Transmitter Power (see 101.113)
 - 101.515 - Emissions & Bandwidth (see 101.109 & 101.111)
 - Special Requirements
 - 101.141 - Microwave modulation (minimum data rate)

10/5/2009 Draft for Review 151

Recently revised in Docket WT 99-327
http://hraunfoss.fcc.gov:8835/edocs_public/attachmatch/FCC-01-151A1.pdf


Part 101G should be listed on the grants for these devices



Microwave Radio

- Part 101 Subpart J - Local Television Transmission Service
 - Operating Frequency Band
 - 6425 - 6525 MHz
 - 11700 - 12200 MHz
 - 13200 - 13250 MHz
 - 14200 - 14400 MHz
 - 21200 - 22000 MHz
 - 22000 - 23000 MHz
 - 31000 - 31300 MHz


10/5/2009 Draft for Review 152



Microwave Radio

- Part 101 Subpart J - Local Television Transmission Service
 - General Technical Requirements
 - 101.107 - Frequency Tolerance
 - 101.807 - Transmitter Power
 - 101.809 - Bandwidth & Emission Limitations (also see 101.109 & 101.111)
 - 101.811 - Modulation Requirements
 - Special Requirements
 - 101.141 - Microwave Modulation (minimum data rate)

10/5/2009 Draft for Review 153




Microwave Radio

- Part 101 Subpart L - Local Multi-point Distribution Service (LMDS)
 - Operating Frequency Bands(101.1005)
 - 27500 - 28350 MHz
 - 29100 - 29250 MHz
 - 31075 - 31225 MHz
 - 31225 - 31300 MHz
 - General Technical Requirements
 - 101.107 - Frequency Tolerance
 - 101.109 - Authorized Bandwidth
 - 101.111 - Emission Limitations
 - 101.113 - Transmitter Power Limitations

10/5/2009 Draft for Review 154

This is a point to multi-point distribution service usually line of site. Typical bandwidths allow for up to 45 MB/sec and a transmission range of about 2 miles. Usually used by large business's in urban areas.




Microwave Radio

- Part 101 Subpart L - Local Multi-point Distribution Service (LMDS)
 - Special Requirements
 - 101.113(c)(1) Spectral Power Density specification.
 - Automatic Transmitter Power Control (ATPC) guidelines are contained in TIA TSB 10.
 - Authorized bandwidth values shown in Section 101.109 are the same as the assigned frequency blocks so that the emissions mask is applied on the basis of the total band.

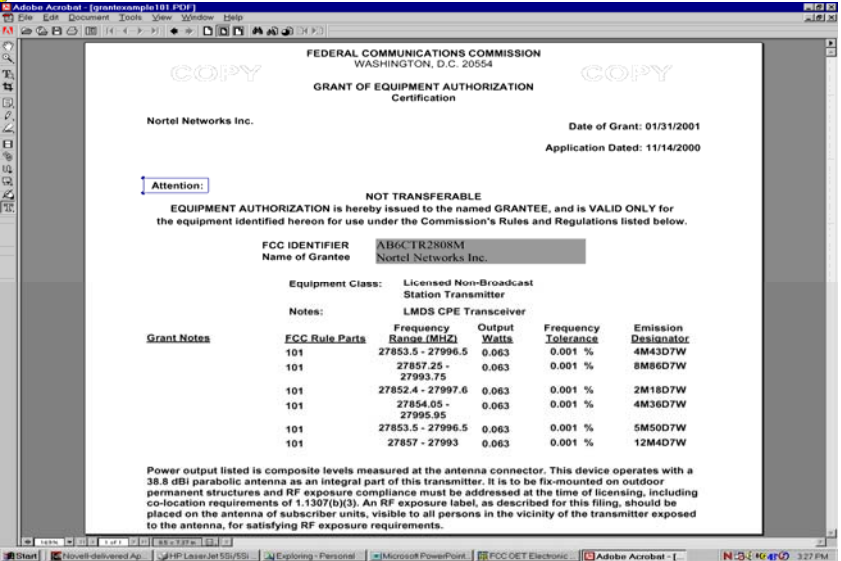
10/5/2009 Draft for Review 155

TIA TSB - Telecommunications Industry Association Telecommunications Systems Bulletin.

The special interpretation related to the bandwidth in section 101.109 relates to the 27500 - 28350 MHz band where the authorized bandwidth is 850 MHz. This covers the entire band. Since the entire band is used the band edge requirements are difficult for these broadband units to meet. This requires the devices to reduce their bandwidth to comply usually by not operating on the highest and lowest channel in the band.



Part 101 Example Grant



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION
Certification

Nortel Networks Inc. Date of Grant: 01/31/2001
Application Dated: 11/14/2000

Attention: NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: **ABGCTR208M**
Name of Grantee: **Nortel Networks Inc.**

Equipment Class: **Licensed Non-Broadcast Station Transmitter**

Notes: **LMDS CPE Transceiver**

Grant Notes	FCC Rule Parts	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission Designator
	101	27853.5 - 27996.5	0.063	0.001 %	4M43D7W
	101	27857.25 - 27993.75	0.063	0.001 %	8M86D7W
	101	27852.4 - 27997.6	0.063	0.001 %	2M18D7W
	101	27854.05 - 27995.95	0.063	0.001 %	4M36D7W
	101	27853.5 - 27996.5	0.063	0.001 %	5M50D7W
	101	27857 - 27993	0.063	0.001 %	12M4D7W

Power output listed is composite levels measured at the antenna connector. This device operates with a 38.8 dBi parabolic antenna as an integral part of this transmitter. It is to be fix-mounted on outdoor permanent structures and RF exposure compliance must be addressed at the time of licensing, including co-location requirements of 1.1307(b)(3). An RF exposure label, as described for this filing, should be placed on the antenna of subscriber units, visible to all persons in the vicinity of the transmitter exposed to the antenna, for satisfying RF exposure requirements.

10/5/2009

Draft for Review

156

This slide shows a typical grant for a Part 101 fixed microwave unit. Since the unit has multi channel output the power out is described as composite. The grant note also addresses the antenna and RF exposure requirements for this unit.