

The following Part 15 regulations contain all updates and changes made by the Commission as of February 28, 2001. In addition, this version contains some directional notes, not themselves contained in the regulations. These directional notes are enclosed by brackets ([ ]).

## PART 15 - RADIO FREQUENCY DEVICES

### Subpart A - General

- Section 15.1 Scope of this Part.
- Section 15.3 Definitions.
- Section 15.5 General conditions of operation.
- Section 15.7 Special temporary authority.
- Section 15.9 Prohibition against eavesdropping.
- Section 15.11 Cross reference.
- Section 15.13 Incidental radiators.
- Section 15.15 General technical requirements.
- Section 15.17 Susceptibility to interference.
- Section 15.19 Labelling requirements.
- Section 15.21 Information to user.
- Section 15.23 Home-built devices.
- Section 15.25 Kits.
- Section 15.27 Special accessories.
- Section 15.29 Inspection by the Commission.
- Section 15.31 Measurement standards.
- Section 15.32 Test procedures for CPU boards and computer power supplies.
- Section 15.33 Frequency range of radiated measurements.
- Section 15.35 Measurement detector functions and bandwidths.
- Section 15.37 Transition provisions for compliance with the rules.

### Subpart B - Unintentional Radiators

- Section 15.101 Equipment authorization of unintentional radiators.
- Section 15.102 CPU boards and power supplies used in personal computers.
- Section 15.103 Exempted devices.
- Section 15.105 Information to the user.
- Section 15.107 Conducted limits.
- Section 15.109 Radiated emission limits.
- Section 15.111 Antenna power conducted limits for receivers.
- Section 15.113 Power line carrier systems.
- Section 15.115 TV interface devices, including cable system terminal devices.
- Section 15.117 TV broadcast receivers.
- Section 15.118 Cable ready consumer electronics equipment.
- Section 15.119 Closed caption decoder requirements for analog television receivers.
- Section 15.120 Program blocking technology requirements for television receivers.
- Section 15.121 Scanning receivers and frequency converters used with scanning receivers.
- Section 15.122 Closed caption decoder requirements for digital television receivers and converter boxes.

### Subpart C - Intentional Radiators

- Section 15.201 Equipment authorization requirement.
- Section 15.203 Antenna requirement.
- Section 15.204 External radio frequency power amplifiers and antenna modifications.
- Section 15.205 Restricted bands of operation.
- Section 15.207 Conducted limits.
- Section 15.209 Radiated emission limits, general requirements.
- Section 15.211 Tunnel radio systems.
- Section 15.213 Cable locating equipment.
- Section 15.214 Cordless telephones.

### Radiated Emission Limits, Additional Provisions

- Section 15.215 Additional provisions to the general radiated emission limitations.
- Section 15.217 Operation in the band 160 - 190 kHz.
- Section 15.219 Operation in the band 510 - 1705 kHz.
- Section 15.221 Operation in the band 525 - 1705 kHz.
- Section 15.223 Operation in the band 1.705 - 10 MHz.
- Section 15.225 Operation within the band 13.553 - 13.567 MHz.
- Section 15.227 Operation within the band 26.96 - 27.28 MHz.
- Section 15.229 Operation within the band 40.66 - 40.70 MHz.
- Section 15.231 Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz.
- Section 15.233 Operation within the bands 43.71 - 44.49 MHz, 46.60 - 46.98 MHz, 48.75 - 49.51 MHz and 49.66 - 50.0 MHz.
- Section 15.233 Operation within the bands 46.60 - 46.98 MHz and 49.66 - 50.0 MHz.
- Section 15.235 Operation within the band 49.82 - 49.90 MHz.
- Section 15.237 Operation in the bands 72.0 - 73.0 MHz, 74.6 - 74.8 MHz and 75.2 - 76.0 MHz.
- Section 15.239 Operation in the band 88 - 108 MHz.
- Section 15.241 Operation in the band 174 - 216 MHz.
- Section 15.242 Operation in the bands 174-216 MHz and 470-668 MHz.
- Section 15.243 Operation in the band 890 - 940 MHz.
- Section 15.245 Operation within the bands 902 - 928 MHz, 2435 - 2465 MHz, 5785 - 5815 MHz, 10500 - 10550 MHz, and 24075 - 24175 MHz.
- Section 15.247 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.
- Section 15.249 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.
- Section 15.251 Operation within the bands 2.9 - 3.26 GHz, 3.267 - 3.332 GHz, 3.339 - 3.3458 GHz, and 3.358 - 3.6 GHz.
- Section 15.253 Operation within the bands 46.7-46.9 GHz and 76.0-77.0 GHz.
- Section 15.255 Operation within the band 57-64 GHz.

### Subpart D - Unlicensed Personal Communications Service Devices

- Section 15.301 Scope.

- Section 15.303 Definitions.
- Section 15.305 Equipment authorization requirement.
- Section 15.307 Coordination with fixed microwave service.
- Section 15.309 Cross reference.
- Section 15.311 Labelling requirements.
- Section 15.313 Measurement procedures.
- Section 15.315 Conducted limits.
- Section 15.317 Antenna requirement.
- Section 15.319 General technical requirements.
- Section 15.321 Specific requirements for asynchronous devices operating in the 1910-1920 MHz and 2390-2400 MHz bands.
- Section 15.323 Specific requirements for isochronous devices operating in the 1920-1930 MHz sub-band.

Subpart E - Unlicensed National Information Infrastructure Devices.

- Section 15.401 Scope.
- Section 15.403 Definitions.
- Section 15.405 Cross reference.
- Section 15.407 General technical requirements.

Authority: 47 U.S.C. Sections 154, 302, 303, 304, 307 and 544A.

Subpart A - General

Section 15.1 Scope of this Part.

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

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

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

Section 15.3 Definitions.

- (a) Auditory assistance device. An intentional radiator used to provide auditory assistance to a

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

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

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

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

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

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

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

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

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

interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

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

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

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

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

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

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

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

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

(r) Peripheral device. An input/output unit of a system that feeds data into and/or receives data

from the central processing unit of a digital device. Peripherals to a digital device include any device that is connected external to the digital device, any device internal to the digital device that connects the digital device to an external device by wire or cable, and any circuit board designed for interchangeable mounting, internally or externally, that increases the operating or processing speed of a digital device, e.g., "turbo" cards and "enhancement" boards. Examples of peripheral devices include terminals, printers, external floppy disk drives and other data storage devices, video monitors, keyboards, interface boards, external memory expansion cards, and other input/output devices that may or may not contain digital circuitry. This definition does not include CPU boards, as defined in paragraph (bb) of this section, even though a CPU board may connect to an external keyboard or other components.

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

- (1) Marketed through a retail outlet or direct mail order catalog.
- (2) Notices of sale or advertisements are distributed or directed to the general public or hobbyist users rather than restricted to commercial users.
- (3) Operates on a battery or 120 volt electrical supply.

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

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

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

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

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

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

(y) TV interface device. An unintentional radiator that produces or translates in frequency a

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

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

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

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

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

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

#### Section 15.5 General conditions of operation.

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

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

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

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

Section 15.7 Special temporary authority.

(a) The Commission will, in exceptional situations, consider an individual application for a special temporary authorization to operate an incidental, intentional or unintentional radiation device not conforming to the provisions of this part, where it can be shown that the proposed operation would be in the public interest, that it is for a unique type of station or for a type of operation which is incapable of being established as a regular service, and that the proposed operation can not feasibly be conducted under this Part.

(b) No authorization is required in order to perform testing of equipment for determining compliance with these regulations. Except as provided in Subpart I of Part 2 of this Chapter, this provision does not permit the providing of equipment to potential users in order to determine customer acceptance of the product or marketing strategy, nor does this provision permit any type of operation other than a determination of compliance with the regulations. During this testing, the provisions of Sections 15.5 and 15.205 apply.

Section 15.9 Prohibition against eavesdropping.

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

Section 15.11 Cross reference.

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

Section 15.13 Incidental radiators.

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

Section 15.15 General technical requirements.

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

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



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

#### Section 15.17 Susceptibility to interference.

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

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

#### Section 15.19 Labelling requirements.

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

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

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

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

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

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

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

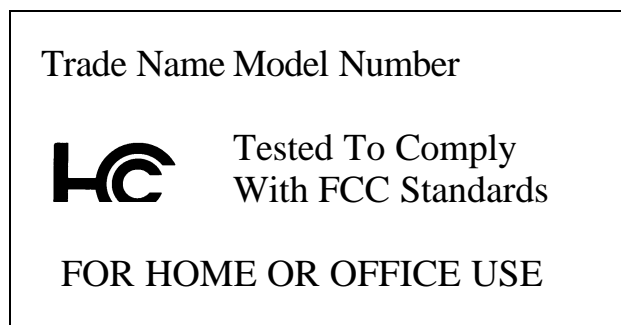
(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

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

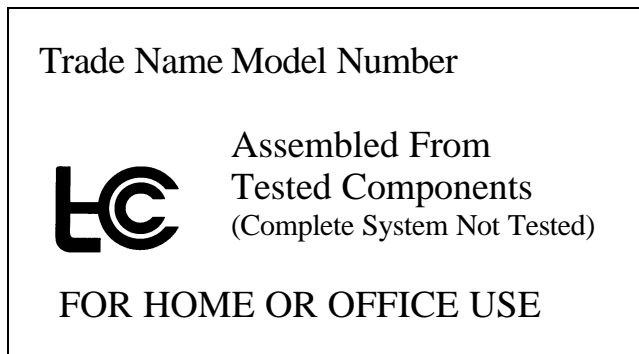
(b) Products subject to authorization under a Declaration of Conformity shall be labelled as follows:

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

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



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



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

(3) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (b)(1) of this section on it, such as for a CPU board or a plug-in circuit board peripheral device, the text associated with the logo may be placed in a prominent location in the instruction manual or pamphlet supplied to the user. However, the unique identification (trade name and model number) and the logo must be displayed on the device.

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

(c) [reserved]

(d) Consumer electronics TV receiving devices, including TV receivers, videocassette recorders and similar devices, that incorporate features intended to be used with cable television service, but do not fully comply with the technical standards for cable ready equipment set forth in Section 15.118, shall not be marketed with terminology that describes the device as "cable ready" or "cable compatible," or that otherwise conveys the impression that the device is fully compatible with cable service. Factual statements about the various features of a device that are intended for use with cable service or the quality of such features are acceptable so long as such statements do not imply that the device is fully

compatible with cable service. Statements relating to product features are generally acceptable where they are limited to one or more specific features of a device, rather than the device as a whole. This requirement applies to consumer TV receivers, videocassette recorders and similar devices manufactured or imported for sale in this country on or after October 31, 1994.

Section 15.21 Information to user.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Section 15.23 Home-built devices.

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

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

Section 15.25 Kits.

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

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

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

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

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

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

detailed in the application for equipment authorization.

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

(Name of Grantee)

(FCC Identifier)

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

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

#### Section 15.27 Special accessories.

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

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

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

components and accessories.

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

Section 15.29 Inspection by the Commission.

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

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

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

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

Section 15.31 Measurement standards.

(a) The following measurement procedures are used by the Commission to determine compliance with the technical requirements in this Part. Except where noted, copies of these procedures are available from the Commission's current duplicating contractor whose name and address are available from the Commission's Consumer Assistance Office at 202-632-7000.

(1) FCC/OET MP-1: FCC Methods of Measurements for Determining Compliance of Radio Control and Security Alarm Devices and Associated Receivers. Note: This procedure may be used only for testing devices for which verification is obtained, or for which an application for equipment authorization is filed before June 1, 1995. For compliance testing of these devices after that date, see 15.31(a)(6) of this section.

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

(3) FCC/OET MP-3: FCC Methods of Measurements of Output Signal Level, Output Terminal Conducted Spurious Emissions, Transfer Switch Characteristics, and Radio Noise Emissions from TV Interface Devices. Note: This procedure may be used only for testing devices for which verification is obtained, or for which an application for equipment authorization is filed before June 1, 1995.

For compliance testing of these devices after that date, see 15.31(a)(6) of this section.

(4) FCC/OET MP-4 (1987): FCC Procedure for Measuring RF Emissions from Computing Devices. Note: This procedure may be used only for testing digital devices for which verification is obtained, or for which an application for equipment authorization is filed, before May 1, 1994. For compliance testing of digital devices on or after May 1, 1994, see Section 15.31(a)(6) below.

(5) FCC/OET MP-9: FCC Procedure for Measuring Cable Television Switch Isolation. Note: This procedure may be used only for testing devices for which verification is obtained, or for which an application for equipment authorization is filed before June 1, 1995. For compliance testing of these devices after that date, see 15.31(a)(6) of this section.

(6) Digital devices authorized by verification, Declaration of Conformity, or for which an application for equipment authorization is filed, on or after May 1, 1994, and intentional and other unintentional radiators for which verification is obtained, or for which an application for equipment authorization is filed on or after June 1, 1995, are to be measured for compliance using the following procedure excluding Section 5.7, Section 9 and Section 14: American National Standards Institute (ANSI) C63.4-1992, entitled "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz," published by the Institute of Electrical and Electronics Engineers, Inc. on July 17, 1992, as document number SH15180. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. The Commission encourages the use of this procedure for testing digital devices, intentional radiators, and other unintentional radiators as soon as practical. Copies of ANSI C63.4-1992 may be obtained from: IEEE Standards Department, 455 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, Telephone 1-800-678-4333. Copies of ANSI C63.4-1992 may be inspected during normal business hours at the following locations:  
[as stated in the R&O, ANSI C63.4 is not used for measurements below 30 MHz]

(i) Federal Communications Commission, 2025 M Street, N.W., Office of Engineering and Technology (Room 7317), Washington, DC 20554,

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

(iii) Office of the Federal Register, 1100 L Street, N.W., Room 8401, Washington, DC 20488.

Note: digital devices tested to show compliance with the provisions of Sections 15.107(e) and 15.109(g) must be tested following the ANSI C63.4 procedure described in paragraph (a)(6).

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

how it's now stated in the rules but the duplication is obviously in error] or verification.

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

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

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

(f) To the extent practicable, the device under test shall be measured at the distance specified in the appropriate rule section. The distance specified corresponds to the horizontal distance between the measurement antenna and the closest point of the equipment under test, support equipment or interconnecting cables as determined by the boundary defined by an imaginary straight line periphery describing a simple geometric configuration enclosing the system containing the equipment under test. The equipment under test, support equipment and any interconnecting cables shall be included within this boundary.

(1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

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

(3) The applicant for a grant of certification shall specify the extrapolation method used in the application filed with the Commission. For equipment subject to Declaration of Conformity or



verification, this information shall be retained with the measurement data.

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

(5) Measurements shall be performed at a sufficient number of radials around the equipment under test to determine the radial at which the field strength values of the radiated emissions are maximized. The maximum field strength at the frequency being measured shall be reported in an application for certification.

(g) Equipment under test shall be adjusted, using those controls that are readily accessible to or are intended to be accessible to the consumer, in such a manner as to maximize the level of the emissions. For those devices to which wire leads may be attached by the consumer, tests shall be performed with wire leads attached. The wire leads shall be of the length to be used with the equipment if that length is known. Otherwise, wire leads one meter in length shall be attached to the equipment. Longer wire leads may be employed if necessary to interconnect to associated peripherals.

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

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

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

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

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

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

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

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

(n) Measurements on TV broadcast receivers shall be performed with the receiver tuned to each VHF frequency and also shall include the following oscillator frequencies: 520, 550, 600, 650, 700, 750, 800, 850, 900 and 931 MHz. If measurements cannot be made on one or more of the latter UHF frequencies because of the presence of signals from licensed radio stations or for other reasons to be

detailed in the measurement report, measurements shall be made with the receiver oscillator at a nearby frequency. If the receiver is not capable of receiving channels above 806 MHz, the measurements employing the oscillator frequencies 900 and 931 MHz may be omitted.

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

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

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

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

(a) CPU boards shall be tested as follows:

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

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

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

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

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

the combination that would normally be employed, must be used in the test. Testing shall be in accordance with the procedures specified in Section 15.31 of this part. Under this procedure, CPU boards that comply with the limits in Section 15.109 must be marketed together with the specific enclosure used for the test.

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

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

### Section 15.33 Frequency range of radiated measurements.

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

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

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

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

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

(b) For unintentional radiators:

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

Highest frequency generated or used in the device or on which the	Upper frequency of measurement range (MHz)
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device operates or tunes (MHz)

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Below 1.705	30
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

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(2) A unintentional radiator, excluding a digital device, in which the highest frequency generated in the device, the highest frequency used in the device and the highest frequency on which the device operates or tunes are less than 30 MHz and which, in accordance with Section 15.109, is required to comply with standards on the level of radiated emissions within the frequency range 9 kHz to 30 MHz, such as a CB receiver or a device designed to conduct its radio frequency emissions via connecting wires or cables, e.g., a carrier current system not intended to radiate, shall be investigated from the lowest radio frequency generated or used in the device, without going below 9 kHz (25 MHz for CB receivers), up to the frequency shown in the following table. If the unintentional radiator contains a digital device, the upper frequency to be investigated shall be that shown in the table below or in the table in paragraph (b)(1) above, as based on both the highest frequency generated and the highest frequency used in the digital device, whichever range is higher.

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

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

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

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

#### Section 15.35 Measurement detector functions and bandwidths.

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

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

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

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

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

#### Section 15.37 Transition provisions for compliance with the rules.

Equipment may be authorized, manufactured and imported under the rules in effect prior to June 23, 1989, in accordance with the following schedules:

(a) For all intentional and unintentional radiators, except for receivers: Radio frequency equipment verified by the responsible party or for which an application for a grant of equipment authorization is submitted to the Commission on or after June 23, 1992, shall comply with the regulations specified in this Part. Radio frequency equipment that is manufactured or imported on or after June 23, 1994, shall comply with the regulations specified in this Part.

(b) For receivers: Receivers subject to the regulations in this Part that are manufactured or imported on or after June 23, 1999, shall comply with the regulations specified in this Part. However, if a receiver is associated with a transmitter that could not have been authorized under the regulations in effect prior to June 23, 1989, e.g., a transmitter operating under the provisions of Sections 15.209 or 15.249 (below 960 MHz), the transition provisions in this Section do not apply. Such receivers must comply with the regulations in this Part. In addition, receivers are subject to the provisions in paragraph (f) of this Section.

(c) There are no restrictions on the operation or marketing of equipment complying with the regulations in effect prior to June 23, 1989.

(d) Prior to May 25, 1991, no person shall import, market or operate intentional radiators within the band 902-905 MHz under the provisions of Section 15.249. Until that date, the Commission will not issue a grant of equipment authorization for equipment operating under Section 15.249 if the equipment is designed to permit operation within the band 902-905 MHz.

(e) For cordless telephones: The manufacture and importation of cordless telephones not complying with Section 15.214(d) of this Part shall cease on or before September 11, 1991. These provisions will not apply to cordless telephones which are repaired or refurbished, or re-imported after repair or refurbishment. Applications for a grant of equipment authorization of cordless telephones not complying with Section 15.214(d) of this Part will not be accepted by the Commission after May 10, 1991. Cordless telephones that have previously received equipment authorization and that, without modification, already comply with the requirements of Section 15.214(d) of this Part, need not be reauthorized.

(f) The manufacture or importation of scanning receivers, and frequency converters designed or marketed for use with scanning receivers, that do not comply with the provisions of § 15.121(a)(1) shall cease on or before April 26, 1994. Effective April 26, 1993, the Commission will not grant equipment authorization for receivers that do not comply with the provisions of § 15.121(a)(1). This paragraph does not prohibit the sale or use of authorized receivers manufactured in the United States, or imported into the United States, prior to April 26, 1994.

(g) For CPU boards and power supplies designed to be used with personal computers: The manufacture and importation of these products shall cease on or before September 17, 1997, unless these products have been authorized under a Declaration of Conformity or a grant of certification, demonstrating compliance with all of the provisions in this Part. Limited provisions, as detailed in Section 15.101(d) of this Chapter, are provided to permit the importation and manufacture of these products subsequent to this date where the CPU boards and/or power supplies are marketed only to personal computer equipment

manufacturers.

(h) The manufacture or importation of scanning receivers, and frequency converters designed or marketed for use with scanning receivers, that do not comply with the provisions of § 15.121 shall cease on or before October 25, 1999. Effective July 26, 1999, the Commission will not grant equipment authorization for receivers that do not comply with the provisions of § 15.121. This paragraph does not prohibit the sale or use of authorized receivers manufactured in the United States, or imported into the United States, prior to October 25, 1999.

(i) Effective [two years and 90 days from publication in the Federal Register (2 years after effective date) of final rules adopted in ET Docket No. 99-255], an equipment approval may no longer be obtained for medical telemetry equipment operating under the provisions of § 15.241 or § 15.242. The requirements for obtaining an approval for medical telemetry equipment after this date are found in Subpart H of Part 95 of this chapter.

Subpart B - Unintentional Radiators

Section 15.101 Equipment authorization of unintentional radiators.

(a) Except as otherwise exempted in §§ 15.23, 15.103, and 15.113, unintentional radiators shall be authorized prior to the initiation of marketing, as follows:

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



Other Class B digital devices & peripherals.....	Verification
Class A digital devices, peripherals & external switching power supplies.....	Verification
All other devices.....	Verification

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

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

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

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

(1) The specific combination of CPU board, power supply and enclosure is tested together and authorized under a Declaration of Conformity or a grant of certification;

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

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

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

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

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

necessary authorization prior to further marketing to a vendor or to a user.

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

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

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

(2) CPU boards, as defined in Section 15.3(bb), other than those used in personal computers, that are marketed without an enclosure or power supply; and,

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

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

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

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

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

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

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

(1) Each device used in the system has been authorized as required under this part (Note:

according to Section 15.101(e), some subassemblies used in a personal computer system may not require an authorization);

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

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

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

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

#### Section 15.103 Exempted devices.

The following devices are subject only to the general conditions of operation in Sections 15.5 and 15.29 and are exempt from the specific technical standards and other requirements contained in this Part. The operator of the exempted device shall be required to stop operating the device upon a finding by the Commission or its representative that the device is causing harmful interference. Operation shall not resume until the condition causing the harmful interference has been corrected. Although not mandatory, it is strongly recommended that the manufacturer of an exempted device endeavor to have the device meet the specific technical standards in this Part.

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

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

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

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

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

any purpose not directly connected with medical treatment.

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

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

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

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

#### Section 15.105 Information to the user.

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

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

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

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However,

there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

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

(d) For systems incorporating several digital devices, the statement shown in paragraph (a) or (b) needs to be contained only in the instruction manual for the main control unit.

Section 15.107 Conducted limits.

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

(b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed the limits in the following table. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted Limit (microvolts)
0.45 - 1.705	1000
1.705 - 30.0	3000

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

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

limit on conducted emissions.

(2) For all other carrier current systems: 1000 uV within the frequency band 535-1705 kHz.

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

(d) The following option may be employed if the conducted emissions exceed the limits in paragraph (a) or (b) of this Section, as appropriate, when measured using instrumentation employing a quasi-peak detector function: if the level of the emission measured using the quasi-peak instrumentation is 6 dB, or more, higher than the level of the same emission measured with instrumentation having an average detector and a 9 kHz minimum bandwidth, that emission is considered broadband and the level obtained with the quasi-peak detector may be reduced by 13 dB for comparison to the limits. When employing this option, the following conditions shall be observed:

(1) The measuring instrumentation with the average detector shall employ a linear IF amplifier.

(2) Care must be taken not to exceed the dynamic range of the measuring instrument when measuring an emission with a low duty cycle.

(3) The test report required for verification or for an application for a grant of equipment authorization shall contain all details supporting the use of this option.

(e) As an alternative to the conducted limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in the Third Edition of International Electrotechnical Commission ("IEC"), International Special Committee on Radio Interference (CISPR) Pub. 22 (1997), "Information Technology Equipment – Radio Disturbance Characteristics - Limits and Methods." This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 USC Section 552(a) and 1 CFR Part 51. Copies of CISPR publications may be purchased from Global Engineering Documents, P. O. Box 8500 (S-4485), Philadelphia, PA 19178-4485, (303) 792-2181 or (800) 624-3974. Copies also may be inspected, but not reproduced, during normal business hours at the following locations: (1) Federal Communications Commission, Reference Information Center, 445 12<sup>th</sup> Street, S.W., Room CY-A257, Washington, D.C., and (2) Office of the Federal Register, 800 N. Capitol Street, N.W., Suite 700, Washington, D.C. In addition:

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

(2) If the conducted emissions are measured to demonstrate compliance with the alternative standards in this paragraph, compliance must also be demonstrated with the radiated emission limits shown in Section 15.109(g) of this Part.

(3) Part 15 devices are not subject to the CISPR 22 limits on conducted common mode disturbance at telecommunication ports, as shown in Section 5.2 , Tables 3 and 4.

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

Section 15.109 Radiated emission limits.

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

Frequency of Emission (MHz)	Field Strength (microvolts/meter)
30 - 88	100
88 - 216	150
216 - 960	200
Above 960	500

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

Frequency of Emission (MHz)	Field Strength (microvolts/meter)
30 - 88	90
88 - 216	150
216 - 960	210
Above 960	300

(c) In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement standards apply.

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

(e) Carrier current systems used as unintentional radiators or other unintentional radiators that are designed to conduct their radio frequency emissions via connecting wires or cables and that operate in the frequency range of 9 kHz to 30 MHz, including devices that deliver the radio frequency energy to

transducers, such as ultrasonic devices not covered under Part 18 of this Chapter, shall comply with the radiated emission limits for intentional radiators provided in Section 15.209 for the frequency range of 9 kHz to 30 MHz. As an alternative, carrier current systems used as unintentional radiators and operating in the frequency range of 525 kHz to 1705 kHz may comply with the radiated emission limits provided in Section 15.221(a). At frequencies above 30 MHz, the limits in paragraph (a), (b) or (g) of this Section, as appropriate, continue to apply.

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

(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in the Third Edition of International Electrotechnical Commission (“IEC”), International Special Committee on Radio Interference (CISPR) Pub. 22 (1997), “Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement.” This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 USC Section 552(a) and 1 CFR Part 51. Copies of CISPR publications may be purchased from the Global Engineering Documents, P. O. Box 8500 (S-4485), Philadelphia, PA 19178-4485, (303) 792-2181 or (800) 624-3974. Copies also may be inspected, but not reproduced, during normal business hours at the following locations: (1) Federal Communications Commission, Reference Information Center, Room CY-A257, 445 12<sup>th</sup> Street, S.W., Washington, D.C., and (2) Office of the Federal Register, 800 N. Capitol Street, N.W., Suite 700, Washington, D.C.

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

(2) If, in accordance with Section 15.33 of this Part, measurements must be performed above 1000 MHz, compliance above 1000 MHz shall be demonstrated with the emission limit in paragraph (a) or (b) of this Section, as appropriate. Measurements above 1000 MHz may be performed at the distance specified in the CISPR 22 publications for measurements below 1000 MHz provided the limits in paragraphs (a) and (b) of this Section are extrapolated to the new measurement distance using an inverse linear distance extrapolation factor (20 dB/decade), e.g., the radiated limit above 1000 MHz for a Class B digital device is 150 uV/m, as measured at a distance of 10 meters.

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

(4) If the radiated emissions are measured to demonstrate compliance with the alternative standards in this paragraph, compliance must also be demonstrated with the conducted limits shown in Section 15.107(e) of this Part.

#### Section 15.111 Antenna power conduction limits for receivers.

(a) In addition to the radiated emission limits, receivers that operate (tune) in the frequency range



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

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

#### Section 15.113 Power line carrier systems.

Power line carrier systems, as defined in Section 15.3(t), are subject only to the following requirements:

(a) A power utility operating a power line carrier system shall submit the details of all existing systems plus any proposed new systems or changes to existing systems to an industry-operated entity as set forth in Section 90.63(g) of this Chapter. No notification to the FCC is required. [Section 90.63(g) has been redesignated as Section 90.35(g).]

(b) The operating parameters of a power line carrier system (particularly the frequency) shall be selected to achieve the highest practical degree of compatibility with authorized or licensed users of the radio spectrum. The signals from this operation shall be contained within the frequency band 9 kHz to 490 kHz. A power line carrier system shall operate on an unprotected, non-interference basis in accordance with Section 15.5 of this Part. If harmful interference occurs, the electric power utility shall discontinue use or adjust its power line carrier operation, as required, to remedy the interference. Particular attention should be paid to the possibility of interference to Loran C operations at 100 kHz.

(c) Power line carrier system apparatus shall be operated with the minimum power possible to accomplish the desired purpose. No equipment authorization is required.

(d) The best engineering principles shall be used in the generation of radio frequency currents by power line carrier systems to guard against harmful interference to authorized radio users, particularly on the fundamental and harmonic frequencies.

(e) Power line carrier system apparatus shall conform to such engineering standards as may be promulgated by the Commission. In addition, such systems should adhere to industry approved standards designed to enhance the use of power line carrier systems.

(f) The provisions of this Section apply only to systems operated by a power utility for general supervision of the power system and do not permit operation on electric lines which connect the distribution substation to the customer or house wiring. Such operation can be conducted under the other provisions of this Part.

#### Section 15.115 TV interface devices, including cable system terminal devices.

(a) Measurements of the radiated emissions of a TV interface device shall be conducted with the output terminal(s) of the device terminated by a resistance equal to the rated output impedance. The emanations of a TV interface device incorporating an intentional radiator shall not exceed the limits in Section 15.109 or Subpart C of this Part, whichever is higher for each frequency. Where it is possible to determine which portion of the device is contributing a particular radio frequency emission, the emissions from the TV interface device portion shall comply with the emission limits in Section 15.109, and the emissions from the intentional radiator shall comply with Subpart C of this Part.

(b) Output signal limits:

(1) At any RF output terminal, the maximum measured RMS voltage, in microvolts, corresponding to the peak envelope power of the modulated signal during maximum amplitude peaks across a resistance (R in ohms) matching the rated output impedance of the TV interface device, shall not exceed the following:

(i) For a cable system terminal device or a TV interface device used with a master antenna, 692.8 times the square root of (R) for the video signal and 155 times the square root of (R) for the audio signal.

[At 75 ohms, this is 6000/1342 uV; at 300 ohms, this is 12,000/2685 uV. There is a 13 dB difference between video and audio levels.]

(ii) For all other TV interface devices, 346.4 times the square root of (R) for the video signal and 77.5 times the square root of (R) for the audio signal.

[At 75 ohms, this is 3000/671 uV; at 300 ohms, this is 6000/1342 uV.]

(2) At any RF output terminal, the maximum measured RMS voltage, in microvolts, corresponding to the peak envelope power of the modulated signal during maximum amplitude peaks across a resistance (R in ohms) matching the rated output impedance of the TV interface device, of any emission appearing on frequencies removed by more than 4.6 MHz below or 7.4 MHz above the video carrier frequency on which the TV interface device is operated shall not exceed the following:

(i) For a cable system terminal device or a TV interface device used with a master antenna, 692.8 times the square root of (R).

(ii) For all other TV interface devices, 10.95 times the square root of (R).  
[At 75 ohms, this is 95 uV; at 300 ohms, this is 190 uV; this represents a 30 dB attenuation.]

(3) The term "master antenna" used in this paragraph refers to TV interface devices employed for central distribution of television or other video signals within a building. Such TV interface devices must be designed to:

(i) Distribute multiple television signals at the same time;

(ii) Distribute such signals by cable to outlets or TV receivers in multiple rooms in the building in which the TV interface devices are installed; and,

- (iii) Distribute all over-the-air or cable signals.

Note: Cable-ready video cassette recorders continue to be subject to the provisions for general TV interface devices.

(c) A TV interface device shall be equipped with a transfer switch for connecting the antenna terminals of a receiver selectively either to the receiving antenna or to the radio frequency output of the TV interface device, subject to the following:

(1) When measured in any of its set positions, transfer switches shall comply with the following requirements:

(i) For a cable system terminal device or a TV interface device equipped for use with a cable system or a master antenna, as defined in paragraph (b)(3) of this section, the isolation between the antenna and cable input terminals shall be at least 80 dB from 54 MHz to 216 MHz, at least 60 dB from 216 MHz to 550 MHz and at least 55 dB from 550 MHz to 806 MHz. The 80 dB standard applies at 216 MHz and the 60 dB standard applies at 550 MHz. In the case of a transfer switch requiring a power source, the required isolation shall be maintained in the event the device is not connected to a power source or power is interrupted. The provisions of this sub-paragraph regarding frequencies in the range 550 MHz to 806 MHz are effective June 30, 1997.

(ii) For all other TV interface devices, the maximum voltage, corresponding to the peak envelope power of the modulated video signal during maximum amplitude peaks, in microvolts, appearing at the receiving antenna input terminals when terminated with a resistance (R in ohms) matching the rated impedance of the antenna input of the switch, shall not exceed 0.346 times the square root of (R).

(iii) Measurement to determine compliance with the transfer switch limits shall be made using a connecting cable, where required, between the TV interface device and the transfer switch of the type and length 1) provided with the TV interface device, 2) recommended in the instruction manual, or 3) normally employed by the consumer.

(2) A TV interface device shall be designed and constructed, to the extent practicable, so as to preclude the possibility that the consumer may inadvertently attach the output of the device to the receiving antenna, if any, without first going through the transfer switch.

(3) A transfer switch is not required for a TV interface device that, when connected, results in the user no longer having any need to receive standard over-the-air broadcast signals via a separate antenna. A transfer switch is not required to be marketed with a cable system terminal device unless that device provides for the connection of an external antenna. A transfer switch is not required for a device that is intended to be used as an accessory to an authorized TV interface device.

(4) An actual transfer switch is not required for a TV interface device, including a cable system terminal device, that has an antenna input terminal(s); provided, the circuitry following the antenna input terminal(s) has sufficient bandwidth to allow the reception of all TV broadcast channels authorized under Part 73 of this Chapter and: for a cable system terminal device that can alternate between the reception of cable television service and an antenna, compliance with the isolation requirement specified in

paragraph (c)(1)(i) can be demonstrated; and, for all other TV interface devices, the maximum voltage appearing at the antenna terminal(s) does not exceed the limit in paragraph (c)(1)(ii).

(5) If a transfer switch is not required, the following label shall be used in addition to the label shown in Section 15.19(a):

This device is intended to be attached to a receiver that is not used to receive over-the-air broadcast signals. Connection of this device in any other fashion may cause harmful interference to radio communications and is in violation of the FCC Rules, Part 15.

(d) A TV interface device, including a cable system terminal device, shall incorporate circuitry to automatically prevent emanations from the device from exceeding the technical specifications in this Part. These circuits shall be adequate to accomplish their functions when the TV interface device is presented, if applicable, with video input signal levels in the range of one to five volts; this requirement is not applicable to a TV interface device that uses a built-in signal source and has no provisions for the connection of an external signal source. For devices that contain provisions for an external signal source but do not contain provisions for the input of an external baseband signal, e.g., some cable system terminal devices, compliance with the provisions of this paragraph shall be demonstrated with a radio frequency input signal of 0 to 25 dBmV.

(e) For cable system terminal devices and TV interface devices used with a master antenna, as defined in paragraph (b)(3), the holder of the grant of authorization shall specify in the instruction manual or pamphlet, if a manual is not provided, the types of wires or coaxial cables necessary to ensure that the unit complies with the requirements of this Part. The holder of the grant of authorization must comply with the provisions of Section 15.27. For all other TV interface devices, the wires or coaxial cables used to couple the output signals to the TV receiver shall be provided by the responsible party.

(f) A TV interface device which is submitted to the Commission as a composite device in a single enclosure containing a RF modulator, video source and other component devices shall be submitted on a single application (FCC Form 731) and shall be authorized as a single device.

(g) An external device or accessory that is intended to be attached to a TV interface device shall comply with the technical and administrative requirements set out in the rules under which it operates. For example, a personal computer must be certificated to show compliance with the regulations for digital devices.

(h) Stand-alone switches used to alternate between cable service and an antenna shall provide isolation between the antenna and cable input terminals that is at least 80 dB from 54 MHz to 216 MHz, at least 60 dB from 216 MHz to 550 MHz and at least 55 dB from 550 MHz to 806 MHz. The 80 dB standard applies at 216 MHz and the 60 dB standard applies at 550 MHz. In the case of stand-alone switches requiring a power source, the required isolation shall be maintained in the even the device is not connected to a power source or power is interrupted. The provisions of this paragraph are effective June 30, 1997.

(i) Switches and other devices intended to be used to by-pass the processing circuitry of a cable system terminal device, whether internal to such a terminal device or a stand-alone unit, shall not attenuate

the input signal more than 6 dB from 54 MHz to 550 MHz, or more than 8 dB from 550 MHz to 804 MHz. The 6 dB standard applies at 550 MHz. The provisions of this paragraph are applicable June 30, 1997.

Section 15.117 TV broadcast receivers.

(a) All TV broadcast receivers shipped in interstate commerce or imported from any foreign country into the United States for sale or resale to the public, shall comply with the provisions of this Section. The reference in this Section to TV broadcast receivers also includes devices, such as TV interface devices, that incorporate the tuner portion of a TV broadcast receiver and that are equipped with an antenna or antenna terminals that can be used for the off-the-air reception of TV broadcast signals, as authorized under Part 73 of this Chapter.

(b) TV broadcast receivers shall be capable of adequately receiving all channels allocated by the Commission to the television broadcast service.

(c) On a given receiver, use of the UHF and VHF tuning systems shall provide approximately the same degree of tuning accuracy with approximately the same expenditure of time and effort: Provided, however, that this requirement will be considered to be met if the need for routine fine tuning is eliminated on UHF channels.

(1) Basic tuning mechanism. If a TV broadcast receiver is equipped to provide for repeated access to VHF television channels at discrete tuning positions, that receiver shall be equipped to provide for repeated access to a minimum of six UHF television channels at discrete tuning positions. Unless a discrete tuning position is provided for each channel allocated to UHF television, each position shall be readily adjustable to a particular UHF channel by the user without the use of tools. If 12 or fewer discrete tuning positions are provided, each position shall be adjustable to receive any channel allocated to UHF television.

Note: The combination of detented rotary switch and pushbutton controls is acceptable, provided UHF channels, after their initial selection, can be accurately tuned with an expenditure of time and effort approximately the same as that used in accurately tuning VHF channels. A UHF tuning system comprising five pushbuttons and a separate manual tuning knob is considered to provide repeated access to six channels at discrete tuning positions. A one-knob (VHF/UHF) tuning system providing repeated access to 11 or more discrete tuning positions is also acceptable, provided each of the tuning positions is readily adjustable, without the use of tools, to receive any UHF channel.

(2) Tuning controls and channel readout. UHF tuning controls and channel readout on a given receiver shall be comparable in size, location, accessibility and legibility to VHF controls and readout on that receiver.

Note: Differences between UHF and VHF channel readout that follow directly from the larger number of UHF television channels available are acceptable if it is clear that a good faith effort to comply with the provisions of this Section has been made.

(d) If equipment and controls that tend to simplify, expedite or perfect the reception of television signals (e. g., AFC, visual aids, remote control, or signal seeking capability referred to generally as tuning aids) are incorporated into the VHF portion of a TV broadcast receiver, tuning aids of the same type and

comparable capability and quality shall be provided for the UHF portion of that receiver.

(e) If a television receiver has an antenna affixed to the VHF antenna terminals, it must have an antenna designed for and capable of receiving all UHF television channels affixed to the UHF antenna terminals. If a VHF antenna is provided with but not affixed to a receiver, a UHF antenna shall be provided with the receiver.

(f) The picture sensitivity of a TV broadcast receiver averaged for all channels between 14 and 69 inclusive shall not be more than 8 dB larger than the peak picture sensitivity of that receiver averaged for all channels between 2 and 13 inclusive.

(g) The noise figure for any television channel 14 to 69 inclusive shall not exceed 14 dB. A TV receiver model is considered to comply with this noise figure if the maximum noise figure for channels 14-69 inclusive of 97.5% of all receivers within that model does not exceed 14 dB.

(1) The responsible party shall measure the noise figure of a number of UHF channels of the test sample to give reasonable assurance that the UHF noise figure for each channel complies with the above limit.

(2) The responsible party shall insert in his files a statement explaining the basis on which it will rely to ensure that at least 97.5% of all production units of the test sample that are manufactured have a noise figure of no greater than 14 dB.

(3) [Reserved.]

(4) In the case of a TV tuner built-in as part of a video tape recorder that uses a power splitter between the antenna terminals of the video tape recorder and the input terminals of the TV tuner or a TV broadcast receiver that uses a power splitter between the antenna terminals of two or more UHF tuners contained within that receiver, 4 dB may be subtracted from the noise figure measured at the antenna terminals of the video tape recorder or TV broadcast receiver for determining compliance of the UHF tuner(s) with the 14 dB noise figure limit.

(h) For a TV broadcast receiver equipped with a cable input selector switch, the selector switch shall provide, in any of its set positions, isolation between the antenna and cable input terminals of at least 80 dB from 54 MHz to 216 MHz, at least 60 dB from 216 MHz to 550 MHz and at least 55 dB from 550 MHz to 806 MHz. The 80 dB standard applies at 216 MHz and the 60 dB standard applies at 550 MHz. In the case of a selector switch requiring a power source, the required isolation shall be maintained in the event the device is not connected to a power source or power is interrupted. An actual switch that can alternate between reception of cable television service and an antenna is not required for a TV broadcast receiver, provided compliance with the isolation requirement specified in this paragraph can be demonstrated and the circuitry following the antenna input terminal(s) has sufficient bandwidth to allow the reception of all TV broadcast channels authorized under this chapter. The provisions of this paragraph regarding frequencies in the range 550 MHz to 806 MHz are effective June 30, 1997.

#### Section 15.118 Cable ready consumer electronics equipment.

(a) All consumer electronics TV receiving equipment marketed in the United States as cable

ready or cable compatible shall comply with the provisions of this section. Consumer electronics TV receiving equipment that includes features intended for use with cable service but does not fully comply with the provisions of this section are subject to the labelling requirements of Section 15.19(d).

(b) Cable ready consumer electronics equipment shall be capable of receiving all NTSC or similar video channels on channels 1 through 125 of the channel allocation plan set forth in the Electronics Industries Association's "Cable Television Channel Identification Plan, EIA IS-132, May 1994" (EIA IS-132). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 522(a) and 1 CFR Part 51. Copies of EIA IS-132 may be obtained from: Global Engineering Documents, 3130 South Harbor Boulevard, Santa Anna, CA 92704. Copies of EIA IS-132 may be inspected during normal business hours at the following locations: Federal Communications Commission, 1919 M Street, NW, Dockets Branch (Room 239), Washington, DC, or the Office of the Federal Register, 800 North Capitol Street, NW, Suite 700, Washington, DC.

(c) Cable ready consumer electronics equipment must meet the following technical performance requirements. Compliance with these requirements shall be determined by performing measurements at the unfiltered IF output port. Where appropriate, the Commission will consider allowing alternative measurement methods.

(1) Adjacent channel interference. In the presence of a lower adjacent channel CW signal that is 1.5 MHz below the desired visual carrier in frequency and 10 dB below the desired visual carrier in amplitude, spurious signals within the IF passband shall be attenuated at least 55 dB below the visual carrier of the desired signal. The desired input signal shall be an NTSC visual carrier modulated with a 10 IRE flat field with color burst and the aural carrier which is 10 dB below the visual carrier should be unmodulated. Measurements are to be performed for input signal levels of 0 dBmV and +15 dBmV, with the receiver tuned to ten evenly spaced channels covering the band 54 MHz to 804 MHz.

(2) Image channel interference. Image channel interference within the IF passband shall be attenuated below the visual carrier of the desired channel by at least 60 dB from 54 MHz to 714 MHz and 50 dB from 714 MHz to 804 MHz. The 60 dB standard applies at 714 MHz. In testing for compliance with this standard, the desired input signal is to be an NTSC signal on which the visual carrier is modulated with a 10 IRE flat field with color burst and the aural carrier is unmodulated and 10 dB below the visual carrier. The undesired test signal shall be a CW signal equal in amplitude to the desired visual carrier and located 90 MHz above the visual carrier frequency of the desired channel. Measurements shall be performed for input signals of 0 dBmV and +15 dBmV, with the receiver tuned to at least ten evenly spaced EIA IS-132 channels covering the band 54 MHz to 804 MHz.

(3) Direct pickup interference. The direct pickup (DPU) of a co-channel interfering ambient field by a cable ready device shall not exceed the following criteria. The ratio of the desired to undesired signal levels at the IF passband on each channel shall be at least 45 dB. The average ratio over the six channels shall be at least 50 dB. The desired input signal shall be an NTSC signal having a visual carrier level of 0 dBmV. The visual carrier is modulated with a 10 IRE flat field with color burst, visual to aural carrier ratio of 10 dB, aural carrier unmodulated. The equipment under test (EUT) shall be placed on a rotatable table that is one meter in height. Any excess length of the power cord and other connecting leads shall be coiled on the floor under the table. The EUT shall be immersed in a horizontally polarized uniform CW field of 100 mV/m at a frequency 2.55 MHz above the visual carrier of the EUT tuned channel. Measurements shall be made with the EUT tuned to six EIA IS-132 channels, two each in the

low VHF, high VHF and UHF broadcast bands. On each channel, the levels at the IF passband due to the desired and interfering signals are to be measured.

(4) Tuner overload. Spurious signals within the IF passband shall be attenuated at least 55 dB below the visual carrier of the desired channel using a comb-like spectrum input with each visual signal individually set at +15 dBmV from 54 to 550 MHz. The desired input signal is to be an NTSC signal on which the visual carrier is modulated with a 10 IRE flat field with color burst and the aural carrier is unmodulated and 10 db below the visual carrier. Measurements shall be made with the receiver tuned to at least seven evenly spaced EIA IS-132 channels covering the band 54 MHz to 550 MHz. In addition, spurious signals within the IF passband shall be attenuated at least 51 dB below the visual carrier of the desired channel using a comb spectrum input with each signal individually set at +15 dBmV from 550 to 804 MHz. Measurements shall be made with the receiver tuned to at least three event spaced EIA IS-132 channels covering the band 550 MHz to 804 MHz.

(5) Cable input conducted emissions.

(i) Conducted spurious emissions that appear at the cable input to the device must meet the following criteria. The input shall be an NTSC video carrier modulated with a 10 IRE flat field with color burst at a level of 0 dBmV and with a visual to aural ratio of 10 dB. The aural carrier shall be unmodulated. The peak level of the spurious signals will be measured using a spectrum analyzer connected by a directional coupler to the cable input of the equipment under test. Spurious signal levels must not exceed the limits in the following table:

From 54 MHz up to and including 300 MHz	-26 dBmV
From 300 MHz up to and including 450 MHz	-20 dBmV
From 450 MHz up to and including 804 MHz	-15 dBmV

(ii) The average of the measurements on multiple channels from 450 MHz up to and including 804 MHz shall be no greater than -20 dBmV. Measurements shall be made with the receiver tuned to at least four EIA IS-132 channels in each of the above bands. The test channels are to be evenly distributed across each of the bands. Measurements for conducted emissions caused by sources internal to the device are to be made in a shielded room. Measurements for conducted emissions caused by external signal sources shall be made in an ambient RF field whose field strength is 100 mV/m, following the same test conditions as described in paragraph (c)(3) of this section.

(d) The field strength of radiated emissions from cable ready consumer electronics equipment shall not exceed the limits in Section 15.109(a) when measured in accordance with the applicable procedures specified in Sections 15.31 and 15.35 for unintentional radiators, with the following modifications. During testing the NTSC input signal level is to be +15 dBmV, with a visual to aural ratio of 10 dB. The visual carrier is to be modulated by a 10 IRE flat field with color burst; the aural carrier is to be unmodulated. Measurements are to be taken on six EIA IS-132 channels evenly spaced across the required RF input range of the equipment under test.

Note: The provisions of paragraphs (a) through (d) of this section are applicable as of June 30, 1997.

Section 15.119 Closed caption decoder requirements for analog television receivers.



(a) Effective July 1, 1993, all TV broadcast receivers with picture screens 13 inches or larger in diameter shipped in interstate commerce, manufactured, assembled, or imported from any foreign country into the United States shall comply with the provisions of this section.

NOTE: This paragraph places no restriction on the shipping or sale of television receivers that were manufactured before July 1, 1993.

(b) Transmission format. Closed-caption information is transmitted on line 21 of field 1 of the vertical blanking interval of television signals, in accordance with Section 73.682(a)(22) of this Chapter.

(c) Operating modes. The television receiver will employ customer-selectable modes of operation for TV and Caption. A third mode of operation, Text, may be included on an optional basis. The Caption and Text Modes may contain data in either of two operating channels, referred to in this document as C1 and C2. The television receiver must decode both C1 and C2 captioning, and must display the captioning for whichever channel the user selects. The TV Mode of operation allows the video to be viewed in its original form. The Caption and Text Modes define one or more areas (called "boxes") on the screen within which caption or text characters are displayed.

NOTE: For more information regarding Text mode, see "Television Captioning for the Deaf: Signal and Display Specifications", Engineering Report No. E-7709-C, Public Broadcasting Service, dated May 1980, and "TeleCaption II Decoder Module Performance Specification", National Captioning Institute, Inc., dated November 1985. These documents are available, respectively, from the Public Broadcasting Service, 1320 Braddock Place, Alexandria, VA 22314 and from the National Captioning Institute, Inc., 5203 Leesburg Pike, Falls Church, VA 22041.

(d) Screen format. The display area for captioning and text shall fall approximately within the safe caption area as defined in paragraph (n)(12) of this section. This display area will be further divided into 15 character rows of equal height and 32 columns of equal width, to provide accurate placement of text on the screen. Vertically, the display area begins on line 43 and is 195 lines high, ending on line 237 on an interlaced display. All captioning and text shall fall within these established columns and rows. The characters must be displayed clearly separated from the video over which they are placed. In addition, the user must have the capability to select a black background over which the captioned letters are displayed.

(1) Caption mode. In the Caption Mode, text can appear on up to 4 rows simultaneously anywhere on the screen within the defined display area. In addition, a solid space equal to one column width may be placed before the first character and after the last character of each row to enhance legibility. The caption area will be transparent anywhere that either:

(i) No standard space character or other character has been addressed and no accompanying solid space is needed; or,

(ii) An accompanying solid space is used and a "transparent space" special character has been addressed which does not immediately precede or follow a displayed character.

(2) [Reserved]

(e) Presentation format. In analyzing the presentation of characters, it is convenient to think in terms of a non-visible cursor which marks the screen position at which the next event in a given mode and data channel will occur. The receiver remembers the cursor position for each mode even when data are received for a different address in an alternate mode or data channel.

(1) Screen addressing. Two kinds of control codes are used to move the cursor to specific screen locations. In Caption Mode, these addressing codes will affect both row and column positioning. In Text Mode, the codes affect only column positioning. In both modes, the addressing codes are optional. Default positions are defined for each mode and style when no addressing code is provided.

(i) The first type of addressing code is the Preamble Address Code (PAC). It assigns a row number and one of eight "indent" figures. Each successive indent moves the cursor four columns to the right (starting from the left margin). Thus, an indent of 0 places the cursor at Column 1, an indent of 4 sets it at Column 5, etc. The PAC indent is non-destructive to displayable characters. It will not affect the display to the left of the new cursor position on the indicated row. Note that Preamble Address Codes also set initial attributes for the displayable characters which follow. See paragraph (h) of this section and the Preamble Address Code table.

(ii) The second type of addressing code is the Tab Offset, which is one of three Miscellaneous Control Codes. Tab Offset will move the cursor one, two, or three columns to the right. The character cells skipped over will be unaffected; displayable characters in these cells, if any, will remain intact while empty cells will remain empty, in the same manner that a PAC indent is non-destructive.

(f) Caption mode. There are three styles of presenting text in Caption Mode: roll-up, pop-on, and paint-on. Character display varies significantly with the style used, but certain rules of character erasure are common to all styles. A character can be erased by addressing another character to the same screen location or by backspacing over the character from a subsequent location on the same row. The entire displayed memory will be erased instantly by receipt of an Erase Displayed Memory command. Both displayed memory and non-displayed memory will be entirely erased simultaneously by either: the user switching receiver channels or data channels (C1/C2) or fields (F1/F2) in decoders so equipped; the loss of valid data (see paragraph (j) of this section); or, selecting non-captioning receiver functions which use the display memory of the decoder. Receipt of an End of Caption command will cause a displayed caption to become non-displayed (and vice versa) without being erased from memory. Changing the receiver to a non-captioning mode which does not require use of the decoder's display memory will leave that memory intact, and the decoder will continue to process data as if the caption display were selected.

(1) Roll-up. Roll-up style captioning is initiated by receipt of one of three Miscellaneous Control Codes that determine the maximum number of rows displayed simultaneously, either 2, 3 or 4 contiguous rows. These are the three Roll-Up Caption commands.

(i) The bottom row of the display is known as the "base row". The cursor always remains on the base row. Rows of text roll upwards into the contiguous rows immediately above the base row to create a "window" 2 to 4 rows high.

(ii) The Roll-up command, in normal practice, will be followed (not necessarily immediately) by a Preamble Address Code indicating the base row and the horizontal indent position. If

no Preamble Address Code is received, the base row will default to Row 15 or, if a roll-up caption is currently displayed, to the same base row last received, and the cursor will be placed at Column 1. If the Preamble Address Code received contains a different base row than that of a currently displayed caption, the entire window will move intact (and without erasing) to the new base row immediately.

(iii) Each time a Carriage Return is received, the text in the top row of the window is erased from memory and from the display or scrolled off the top of the window. The remaining rows of text are each rolled up into the next highest row in the window, leaving the base row blank and ready to accept new text. This roll-up must appear smooth to the user, and must take no more than 0.433 seconds to complete. The cursor is automatically placed at Column 1 (pending receipt of a Preamble Address Code).

(iv) Increasing or decreasing the number of roll-up rows instantly changes the size of the active display window, appropriately turning on or off the display of the top one or two rows. A row which is turned off should also be erased from memory.

(v) Characters are always displayed immediately when received by the receiver. Once the cursor reaches the 32nd column position on any row, all subsequent characters received prior to a Carriage Return, Preamble Address Code, or Backspace will be displayed in that column replacing any previous character occupying that address.

(vi) The cursor moves automatically one column to the right after each character or Mid-Row Code received. A Backspace will move the cursor one column to the left, erasing the character or Mid-Row Code occupying that location. (A Backspace received when the cursor is in Column 1 will be ignored.)

(vii) The Delete to End of Row command will erase from memory any characters or control codes starting at the current cursor location and in all columns to its right on the same row. If no displayable characters remain on the row after the Delete to End of Row is acted upon, the solid space (if any) for that row should also be erased to conform with the following provisions.

(viii) If a solid space is used for legibility, it should appear when the first displayable character (not a transparent space) or Mid-Row Code is received on a row, not when the Preamble Address Code, if any, is given. A row on which there are no displayable characters or Mid-Row Codes will not display a solid space, even when rolled up between two rows which do display a solid space.

(ix) If the reception of data for a row is interrupted by data for the alternate data channel or for Text Mode, the display of caption text will resume from the same cursor position if a Roll-Up Caption command is received and no Preamble Address Code is given which would move the cursor.

(x) A roll-up caption remains displayed until one of the standard caption erasure techniques is applied. Receipt of a Resume Caption Loading command (for pop-on style) or a Resume Direct Captioning command (for paint-on style) will not affect a roll-up display. Receipt of a Roll-Up Caption command will cause any pop-on or paint-on caption to be erased from displayed memory and non-displayed memory.

(2) Pop-on. Pop-on style captioning is initiated by receipt of a Resume Caption Loading command. Subsequent data are loaded into a non-displayed memory and held there until an End of Caption command is received, at which point the non-displayed memory becomes the displayed memory and vice versa. (This process is often referred to as "flipping memories" and does not automatically erase memory.) An End of Caption command forces the receiver into pop-on style if no Resume Caption Loading command has been received which would do so. The display will be capable of 4 full rows, not necessarily contiguous, simultaneous anywhere on the screen.

(i) Preamble Address Codes can be used to move the cursor around the screen in random order to place captions on Rows 1 to 15. Carriage Returns have no effect on cursor location during caption loading.

(ii) The cursor moves automatically one column to the right after each character or Mid-Row Code received. Receipt of a Backspace will move the cursor one column to the left, erasing the character of Mid-Row Code occupying that location. (A Backspace received when the cursor is in Column 1 will be ignored.) Once the cursor reaches the 32nd column position on any row, all subsequent characters received prior to a Backspace, an End of Caption, or a Preamble Address Code, will replace any previous character at that location.

(iii) The Delete to End of Row command will erase from memory any characters or control codes starting at the current cursor location and in all columns to its right on the same row. If no displayable characters remain on a row after the Delete to End of Row is acted upon, the solid space (if any) for that element should also be erased.

(iv) If data reception is interrupted during caption loading by data for the alternate caption channel or for Text Mode, caption loading will resume at the same cursor position if a Resume Caption Loading command is received and no Preamble Address Code is given that would move the cursor.

(v) Characters remain in non-displayed memory until an End of Caption command flips memories. The caption will be erased without being displayed upon receipt of an Erase Non-Displayed Memory command, a Roll-Up Caption command, or if the user switches receiver channels, data channels or fields, or upon the loss of valid data (see paragraph (j) of this section).

(vi) A pop-on caption, once displayed, remains displayed until one of the standard caption erasure techniques is applied or until a Roll-Up Caption command is received. Characters within a displayed pop-on caption will be replaced by receipt of the Resume Direct Captioning command and paint-on style techniques (see below).

(3) Paint-on. Paint-on style captioning is initiated by receipt of a Resume Direct Captioning command. Subsequent data are addressed immediately to displayed memory without need for an End of Caption command.

(i) Preamble Address Codes can be used to move the cursor around the screen in random order to display captions on Rows 1 to 15. Carriage Returns have no effect on cursor location during direct captioning. The cursor moves automatically one column to the right after each character or

Mid-Row Code is received. Receipt of a Backspace will move the cursor one column to the left, erasing the character or Mid-Row Code occupying that location. (A Backspace received when the cursor is in Column 1 will be ignored.) Once the cursor reaches the 32nd column position on any row, all subsequent characters received prior to a Preamble Address Code or Backspace will be displayed in that column replacing any previous character occupying that location.

(ii) The Delete to End of Row command will erase from memory any characters or control codes starting at the current cursor location and in all columns to its right on the same row. If no displayable characters remain on the row after the Delete to End of Row is acted upon, the solid space (if any) for that element should also be erased.

(iii) If the reception of data is interrupted during direct captioning by data for the alternate caption channel or for Text Mode, the display of caption text will resume at the same cursor position if a Resume Direct Captioning command is received and no Preamble Address Code is given which would move the cursor.

(iv) Characters remain displayed until one of the standard caption erasure techniques is applied or until a Roll-Up Caption command is received. An End of Caption command leaves a paint-on caption fully intact in non-displayed memory. In other words, a paint-on style caption behaves precisely like a pop-on style caption which has been displayed.

(g) Character format. Characters are to be displayed on the screen within a character "cell" which is the height and width of a single row and column. The following codes define the displayable character set. Television receivers manufactured prior to January 1, 1996 and having a character resolution of 5 x 7 dots, or less, may display the allowable alternate characters in the character table. A statement must be in a prominent location on the box or other package in which the receiver is to be marketed, and information must be in the owner's manual, indicating the receiver displays closed captioning in upper case only.

## CHARACTER SET TABLE

### Special Characters

These require two bytes for each symbol. Each hex coder as shown will be preceded by a 11h for data channel 1 or by a 19h for data channel 2. For example: 19h 37h will place a musical note in data channel 2.

<u>HEX</u>	<u>Example</u>	<u>Alternate</u>	<u>Description</u>
30	®	* see note	registered mark symbol
31	°		degree sign
32	½		1/2
33	¿		inverse query
34	™*	* see note	trademark symbol
35	¢		cents sign
36	£		Pounds Sterling sign
37	—		music note
38	à	A	lower-case a with grave accent
39			transparent space
3A	è	E	lower-case e with grave accent
3B	â	A	lower-case a with circumflex
3C	ê	E	lower-case e with circumflex
3D	î	I	lower-case i with circumflex
3E	ô	O	lower-case o with circumflex
3F	û	U	lower-case u with circumflex

\* NOTE: The registered mark and trademark symbols are used to satisfy certain legal requirements. There are various legal ways in which these symbols may be drawn or displayed. For example, the trademark symbol may be drawn with the "T" next to the "M" or over the "M". It is preferred that the trademark symbol be superscripted, i.e., XYZ<sup>TM</sup>. It is left to each individual manufacturer to interpret these symbols in any way that meets the legal needs of the user.

### Standard Characters

<u>HEX</u>	<u>Example</u>	<u>Alternate</u>	<u>Description</u>
20			standard space
21	!		exclamation mark
22	"		quotation mark
23	#		pounds (number) sign
24	\$		dollar sign
25	%		percentage sign
26	&		ampersand
27	'		apostrophe
28	(		open parentheses
29	)		close parentheses

2A	á	A	lower-case a with acute accent
2B	+		plus sign
2C	,		comma
2D	-		minus (hyphen) sign
2E	.		period
2F	/		slash
30	0		zero
31	1		one
32	2		two
33	3		three
34	4		four
35	5		five
36	6		six
37	7		seven
38	8		eight
39	9		nine
3A	:		colon
3B	;		semi-colon
3C	<		less than sign
3D	=		equal sign
3E	>		greater than sign
3F	?		question mark
40	@		at sign
41	A		upper-case A
42	B		upper-case B
43	C		upper-case C
44	D		upper-case D
45	E		upper-case E
46	F		upper-case F
47	G		upper-case G
48	H		upper-case H
49	I		upper-case I
4A	J		upper-case J
4B	K		upper-case K
4C	L		upper-case L
4D	M		upper-case M
4E	N		upper-case N
4F	O		upper-case O
50	P		upper-case P
51	Q		upper-case Q
52	R		upper-case R
53	S		upper-case S
54	T		upper-case T
55	U		upper-case U
56	V		upper-case V
57	W		upper-case W
58	X		upper-case X

59	Y		upper-case Y
5A	Z		upper-case Z
5B	[		open bracket
5C	é	E	lower-case e with acute accent
5D	]		close bracket
5E	í	I	lower-case i with acute accent
5F	ó	O	lower-case o with acute accent
60	ú	U	lower-case u with acute accent
61	a	A	lower-case a
62	b	B	lower-case b
63	c	C	lower-case c
64	d	D	lower-case d
65	e	E	lower-case e
66	f	F	lower-case f
67	g	G	lower-case g
68	h	H	lower-case h
69	i	I	lower-case i
6A	j	J	lower-case j
6B	k	K	lower-case k
6C	l	L	lower-case l
6D	m	M	lower-case m
6E	n	N	lower-case n
6F	o	O	lower-case o
70	p	P	lower-case p
71	q	Q	lower-case q
72	r	R	lower-case r
73	s	S	lower-case s
74	t	T	lower-case t
75	u	U	lower-case u
76	v	V	lower-case v
77	w	W	lower-case w
78	x	X	lower-case x
79	y	Y	lower-case y
7A	z	Z	lower-case z
7B	ç	C	lower-case c with cedilla
7C	÷		division sign
7D	Ñ		upper-case N with tilde
7E	ñ	Ñ	lower-case n with tilde
7F			solid block

(h) Character attributes.

(1) Transmission of attributes. A character may be transmitted with any or all of four attributes: color, italics, underline, and flash. All of these attributes are set by control codes included in the received data. An attribute will remain in effect until changed by another control code or until the end of the row is reached. Each row begins with a control code which sets the color and underline attributes. (White non-underlined is the default display attribute if no Preamble Address Code is received before the



first character on an empty row.) Attributes are not affected by transparent spaces within a row.

(i) All Mid-Row Codes and the Flash On command are spacing attributes which appear in the display just as if a standard space (20h) had been received. Preamble Address Codes are non-spacing and will not alter any attributes when used to position the cursor in the midst of a row of characters.

(ii) The color attribute has the highest priority and can only be changed by the Mid-Row Code of another color. Italics has the next highest priority. If characters with both color and italics are desired, the italics Mid-Row Code must follow the color assignment. Any color Mid-Row Code will turn off italics. If the least significant bit of a Preamble Address Code or of a color or italics Mid-Row Code is a 1 (high), underlining is turned on. If that bit is a 0 (low), underlining is off.

(iii) The flash attribute is transmitted as a Miscellaneous Control Code. The Flash On command will not alter the status of the color, italics, or underline attributes. However, any color or italics Mid-Row Code will turn off flash.

(iv) Thus, for example, if a red, italicized, underlined, flashing character is desired, the attributes must be received in the following order: a red Mid-Row or Preamble Address Code, an italics Mid-Row Code with underline bit, and the Flash On command. The character will then be preceded by three spaces (two if red was assigned via a Preamble Address Code).

(2) Display of attributes. The underline attribute will be displayed by drawing a line beneath the character in the same color as the character. The flash attribute will be displayed by causing the character to blank from the display at least once per second. The italic attribute must be capable of being displayed by either a special italic font, or by the modification of the standard font by slanting. The user may be given the option to select other methods of italic display as well. The support of the color attributes is optional. If the color attributes are supported, they will be displayed in the color they have been assigned. If color attributes are not supported, the display may be in color, but all color changes will be ignored.

(i) Control codes. There are three different types of control codes used to identify the format, location, attributes, and display of characters: Preamble Address Codes, Mid-Row Codes, and Miscellaneous Control Codes.

(1) Each control code consists of a pair of bytes which are always transmitted together in a single field of line 21 and which are normally transmitted twice in succession to help insure correct reception of the control instructions. The first of the control code bytes is a non-printing character in the range 10h to 1Fh. The second byte is always a printing character in the range 20h to 7Fh. Any such control code pair received which has not been assigned a function is ignored. If the non-printing character in the pair is in the range 00h to 0Fh, that character alone will be ignored and the second character will be treated normally.

(2) If the second byte of a control code pair does not contain odd parity (see paragraph (j) of this section), then the pair is ignored. The redundant transmission of the pair will be the instruction upon which the receiver acts.

(3) If the first byte of the first transmission of a control code pair fails the parity check, then that byte is inserted into the currently active memory as a solid block character (7Fh) followed by whatever the second byte is. Again, the redundant transmission of the pair will be the controlling instruction.

(4) If the first transmission of a control code pair passes parity, it is acted upon within one video frame. If the next frame contains a perfect repeat of the same pair, the redundant code is ignored. If, however, the next frame contains a different but also valid control code pair, this pair, too, will be acted upon (and the receiver will expect a repeat of this second pair in the next frame). If the first byte of the expected redundant control code pair fails the parity check and the second byte is identical to the second byte in the immediately preceding pair, then the expected redundant code is ignored. If there are printing characters in place of the redundant code, they will be processed normally.

(5) There is provision for decoding a second data channel. The second data channel is encoded with the same control codes and procedures already described. The first byte of every control code pair indicates the data channel (C1/C2) to which the command applies. Control codes which do not match the data channel selected by the user, and all subsequent data related to that control code, are ignored by the receiver.

#### MID-ROW CODES

Data Channel 1	Data Channel 2	Attribute Description
11 20	19 20	White
11 21	19 21	White Underline
11 22	19 22	Green
11 23	19 23	Green Underline
11 24	19 24	Blue
11 25	19 25	Blue Underline
11 26	19 26	Cyan
11 27	19 27	Cyan Underline
11 28	19 28	Red
11 29	19 29	Red Underline
11 2A	19 2A	Yellow
11 2B	19 2B	Yellow Underline
11 2C	19 2C	Magenta
11 2D	19 2D	Magenta Underline
11 2E	19 2E	Italics
11 2F	19 2F	Italics Underline

### MISCELLANEOUS CONTROL CODES

Data Channel 1	Data Channel 2	Mnemonic	Command Description
14 20	1C 20	RCL	Resume Caption Loading
14 21	1C 21	BS	Backspace
14 22	1C 22	AOF	reserved (formerly Alarm Off)
14 23	1C 23	AON	reserved (formerly Alarm On)
14 24	1C 24	DER	Delete to End of Row
14 25	1C 25	RU2	Roll-Up Captions-2 Rows
14 26	1C 26	RU3	Roll-Up Captions-3 Rows
14 27	1C 27	RU4	Roll-Up Captions-4 Rows
14 28	1C 28	FON	Flash On
14 29	1C 29	RDC	Resume Direct Captioning
14 2A	1C 2A		TR Text Restart
14 2B	1C 2B	RTD	Resume Text Display
14 2C	1C 2C	EDM	Erase Displayed Memory
14 2D	1C 2D		CR Carriage Return
14 2E	1C 2E	ENM	Erase Non-Displayed Memory
14 2F	1C 2F	EOC	End of Caption (Flip Memories)
17 21	1F 21	TO1	Tab Offset 1 Column
17 22	1F 22	TO2	Tab Offset 2 Columns
17 23	1F 23	TO3	Tab Offset 3 Columns

### PREAMBLE ADDRESS CODES

	R0 w 1	R0 w 2	R0 w 3	R0 w 4	R0 w 5	R0 w 6	R0 w 7	R0 w 8	R0 w 9	R0 w 10	R0 w 11	R0 w 12	R0 w 13	R0 w 14	R0 w 15
First byte of code pair:															
Data Channel 1	11	11	12	12	15	15	16	16	17	17	10	13	13	14	14
Data Channel 2	19	19	1A	1A	1D	1D	1E	1E	1F	1F	18	1B	1B	1C	1C
Second byte of code pair:															
White	40	60	40	60	40	60	40	60	40	60	40	60	40	60	60
White Underline	41	61	41	61	41	61	41	61	41	61	41	61	41	61	61
Green	42	62	42	62	42	62	42	62	42	62	42	62	42	62	62
Green Underline	43	63	43	63	43	63	43	63	43	63	43	63	43	63	63
Blue	44	64	44	64	44	64	44	64	44	64	44	64	44	64	64
Blue Underline	45	65	45	65	45	65	45	65	45	65	45	65	45	65	65
Cyan	46	66	46	66	46	66	46	66	46	66	46	66	46	66	66
Cyan Underline	47	67	47	67	47	67	47	67	47	67	47	67	47	67	67
Red	48	68	48	68	48	68	48	68	48	68	48	68	48	68	68
Red Underline	49	69	49	69	49	69	49	69	49	69	49	69	49	69	69
Yellow	4A	6A	4A	6A	4A	6A	4A	6A	4A	6A	4A	6A	4A	6A	6A

Yellow Underline	4B	6B	4B	6B	4B	6B	4B	6B	4B	6B	4B	6B	4B	6B
Magenta	4C	6C	4C	6C	4C	6C	4C	6C	4C	6C	4C	6C	4C	6C
Magenta Underline	4D	6D	4D	6D	4D	6D	4D	6D	4D	6D	4D	6D	4D	6D
White Italics	4E	6E	4E	6E	4E	6E	4E	6E	4E	6E	4E	6E	4E	6E
White Italics Underline	4F	6F	4F	6F	4F	6F	4F	6F	4F	6F	4F	6F	4F	6F
Indent 0	50	70	50	70	50	70	50	70	50	70	50	70	50	70
Indent 0 Underline	51	71	51	71	51	71	51	71	51	71	51	71	51	71
Indent 4	52	72	52	72	52	72	52	72	52	72	52	72	52	72
Indent 4 Underline	53	73	53	73	53	73	53	73	53	73	53	73	53	73
Indent 8	54	74	54	74	54	74	54	74	54	74	54	74	54	74
Indent 8 Underline	55	75	55	75	55	75	55	75	55	75	55	75	55	75
Indent 12	56	76	56	76	56	76	56	76	56	76	56	76	56	76
Indent 12 Underline	57	77	57	77	57	77	57	77	57	77	57	77	57	77
Indent 16	58	78	58	78	58	78	58	78	58	78	58	78	58	78
Indent 16 Underline	59	79	59	79	59	79	59	79	59	79	59	79	59	79
Indent 20	5A	7A	5A	7A	5A	7A	5A	7A	5A	7A	5A	7A	5A	7A
Indent 20 Underline	5B	7B	5B	7B	5B	7B	5B	7B	5B	7B	5B	7B	5B	7B
Indent 24	5C	7C	5C	7C	5C	7C	5C	7C	5C	7C	5C	7C	5C	7C
Indent 24 Underline	5D	7D	5D	7D	5D	7D	5D	7D	5D	7D	5D	7D	5D	7D
Indent 28	5E	7E	5E	7E	5E	7E	5E	7E	5E	7E	5E	7E	5E	7E
Indent 28 Underline	5F	7F	5F	7F	5F	7F	5F	7F	5F	7F	5F	7F	5F	7F

NOTE: All indent codes (second byte equals 50h-5Fh, 70h-7Fh) assign white as the color attribute.

(j) Data rejection. The receiver should provide an effective procedure to verify data. A receiver will reject data if the data is invalid, or if the data is directed to the data channel or field not selected by the user. Invalid data is any data that fails to pass a check for odd parity, or which, having passed the parity check, is assigned no function.

(1) If a print character fails to pass a check for parity, a solid block (7Fh) should be displayed in place of the failed character. In addition, valid data can be corrupted in many ways and may not be suitable for display. For example, repeated fields, skipped fields and altered field sequences are all possible from consumer video equipment and might present meaningless captions.

(2) The receiver will ignore data rejected due to being directed to a deselected field or channel. However, this will not cause the display to be disabled.

(k) Automatic display enable/disable. The receiver shall provide an automatic enable/disable capability to prevent the display of invalid or incomplete data, when the user selects the Caption Mode. The display should automatically become enabled after the receiver verifies the data as described in paragraph (j) of this section. The display will be automatically disabled when there is a sustained detection of invalid data. The display will be re-enabled when the data verification process has been satisfied once again.

(l) Compatibility with cable security systems. Certain cable television security techniques, such as signal encryption and copy protection, can alter the television signal so that some methods of finding line 21 will not work. In particular, counting of lines or timing from the start of the vertical blanking interval

may cause problems. Caption decoding circuitry must function properly when receiving signals from cable security systems that were designed and marketed prior to April 5, 1991. Further information concerning such systems is available from the National Cable Television Association, Inc., Washington, DC, and from the Electronic Industries Association, Washington, DC.

(m) Labelling and consumer information requirements. The box or other package in which the individual television receiver is to be marketed shall carry a statement in a prominent location, visible to the buyer before purchase, which reads as follows:

This television receiver provides display of television closed captioning in accordance with Section 15.119 of the FCC rules.

Receivers that do not support color attributes or text mode, as well as receivers that display only upper-case characters pursuant to paragraph (g) of this section, must include with the statement, and in the owner's manual, language indicating that those features are not supported.

(n) Glossary of terms. The following terms are used to describe caption decoder specifications:

(1) Base row - The bottom row of a roll-up display. The cursor always remains on the base row. Rows of text roll upwards into the contiguous rows immediately above the base row.

(2) Box - The area surrounding the active character display. In Text Mode, the box is the entire screen area defined for display, whether or not displayable characters appear. In Caption Mode, the box is dynamically redefined by each caption and each element of displayable characters within a caption. The box (or boxes, in the case of a multiple-element caption) includes all the cells of the displayed characters, the non-transparent spaces between them, and one cell at the beginning and end of each row within a caption element in those decoders that use a solid space to improve legibility.

(3) Caption window - The invisible rectangle which defines the top and bottom limits of a roll-up caption. The window can be 2 to 4 rows high. The lowest row of the window is called the base row.

(4) Cell - The discrete screen area in which each displayable character or space may appear. A cell is one row high and one column wide.

(5) Column - One of 32 vertical divisions of the screen, each of equal width, extending approximately across the full width of the safe caption area as defined in paragraph (n)(12) of this section. Two additional columns, one at the left of the screen and one at the right, may be defined for the appearance of a box in those decoders which use a solid space to improve legibility, but no displayable characters may appear in those additional columns. For reference, columns may be numbered 0 to 33, with columns 1 to 32 reserved for displayable characters.

(6) Displayable character - Any letter, number or symbol which is defined for on-screen display, plus the 20h space.

(7) Display disable - To turn off the display of captions or text (and accompanying background) at the receiver, rather than through codes transmitted on line 21 which unconditionally erase

the display. The receiver may disable the display because the user selects an alternate mode, e.g. TV Mode, or because no valid line 21 data is present.

(8) Display enable - To allow the display of captions or text when they are transmitted on line 21 and received as valid data. For display to be enabled, the user must have selected Caption Mode or Text Mode, and valid data for the selected mode must be present on line 21.

(9) Element - In a pop-on or paint-on style caption, each contiguous area of cells containing displayable characters and non-transparent spaces between those characters. A single caption may have multiple elements. An element is not necessarily a perfect rectangle, but may include rows of differing widths.

(10) Erase display - In Caption Mode, to clear the screen of all characters (and accompanying background) in response to codes transmitted on line 21. (The caption service provider can accomplish the erasure either by sending an Erase Displayed Memory command or by sending an Erase Non-Displayed Memory command followed by an End of Caption command, effectively making a blank caption "appear".) Display can also be erased by the receiver when the caption memory erasure conditions are met, such as the user changing TV channels.

(11) Row - One of 15 horizontal divisions of the screen, extending across the full height of the safe caption area as defined in paragraph (n)(12) of this section.

(12) Safe caption area - The area of the television picture within which captioning and text shall be displayed to ensure visibility of the information on the majority of home television receivers. The safe caption area is specified as shown in the following figure:



The dimensions of the above figure shall be as follows:

Label	Dimensions	Percent of Television Picture Height
A	Television picture height	100.0
B	Television picture width	133.33
C	Height of safe caption area	80.0
D	Width of safe caption area	106.67
E	Vertical position of safe caption area	10.0
F	Horizontal position of safe caption area	13.33

(13) Special characters - Displayable characters (except for "transparent space") which require a two-byte sequence of one non-printing and one printing character. The non-printing byte varies depending on the data channel. Regular characters require unique one-byte codes which are the same in

either data channel.

(14) Text - When written with an upper-case "T", refers to the Text Mode. When written with a lower-case "t", refers to any combination of displayable characters.

(15) Transparent space - Transmitted as a special character, it is a one-column-wide space behind which program video is always visible (except when a transparent space immediately precedes or follows a displayable character and a solid box is needed to make that character legible).

#### Section 15.120 Program blocking technology requirements for television receivers.

(a) Effective July 1, 1999, manufacturers of television broadcast receivers as defined in Section 15.3(w) of this chapter, including personal computer systems meeting that definition, must ensure that one-half of their product models with picture screens 33 cm (13 in) or larger in diameter shipped in interstate commerce or manufactured in the United States complies with the provisions of paragraphs (c), (d), and (e) of this section.

NOTE: This paragraph places no restrictions on the shipping or sale of television receivers that were manufactured before July, 1999.

(b) Effective January 1, 2000, all TV broadcast receivers as defined in Section 15.3(w) of this chapter, including personal computer systems meeting that definition, with picture screens 33 cm (13 in) or larger in diameter shipped in interstate commerce or manufactured in the United States shall comply with the provisions of paragraphs (c), (d), and (e) of this section.

#### (c) Transmission Format.

(1) Analog television program rating information shall be transmitted on line 21 of field 2 of the vertical blanking interval of television signals, in accordance with § 73.682(a)(22) of this chapter.

(2) [Reserved]

#### (d) Operation.

(1) Analog television receivers will receive program ratings transmitted pursuant to industry standard EIA-744 "Transport of Content Advisory Information Using Extended Data Service (XDS)" and EIA-608 "Recommended Practice for Line 21 Data Service". This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 522(a) and 1 CFR Part 51. Blocking of programming shall occur when a program rating is received that meets the pre-determined user requirements. Copies of EIA-744 and EIA-608 may be obtained from: Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704. Copies of EIA-744 may be inspected during normal business hours at the following locations: Federal Communications Commission, 2000 M Street, NW, Technical Information Center (Suite 230), Washington, DC, or the Office of the Federal Register, 800 North Capitol Street, NW, Suite 700, Washington, DC.

(2) Digital television receivers shall react in a similar manner as analog televisions when programmed to block specific rating categories.

(e) All television receivers as described in paragraph (a) of this section shall block programming as follows:

(1) Channel Blocking. Channel Blocking should occur as soon as a program rating packet with the appropriate Content Advisory or MPAA rating level is received. Program blocking is described as a receiver performing all of the following:

- Muting the program audio
- Rendering the video black or otherwise indecipherable
- Eliminating program-related captions

(2) Default State. The default state of a receiver (*i.e.*, as provided to the consumer) should not block unrated programs. However, it is permissible to include features that allow the user to reprogram the receiver to block programs not rated.

(3) Picture-In-Picture (PIP). If a receiver has the ability to decode program-related rating information for the Picture-In-Picture (PIP) video signal, then it should block the PIP channel in the same manner as the main channel. If the receiver does not have the ability to decode PIP program-related rating information, then it should block or otherwise disable the PIP if the viewer has enabled program blocking.

(4) Selection of Ratings. Each television receiver, in accordance with user input, shall block programming based on the age based ratings, the content based ratings, or a combination of the two.

(i) If the user chooses to block programming according to its age based rating level, the receiver must have the ability to automatically block programs with a more restrictive age based rating. For example, if all shows with an age-based rating of TV-PG have been selected for blocking, the user should be able to automatically block programs with the more restrictive ratings of TV-14 and TV-MA.

(ii) If the user chooses to block programming according to a combination of age based and content based ratings the receiver must have the ability to automatically block programming with a more restrictive age rating but a similar content rating. For example, if all shows rated TV-PG-V have been selected for blocking, the user should be able to block automatically shows with the more restrictive ratings of TV-14-V and TV-MA-V.

(iii) The user should have the capability of overriding the automatic blocking described in paragraphs (4)(i) and (4)(ii) of this section.

#### Section 15.121 Scanning receivers and frequency converters used with scanning receivers.

(a) Except as provided in paragraph (c) of this section, scanning receivers and frequency converters designed or marketed for use with scanning receivers, shall:

- (1) Be incapable of operating (tuning), or readily being altered by the user to operate,



within the frequency bands allocated to the Cellular Radiotelephone Service in Part 22 of this chapter (cellular telephone bands). Scanning receivers capable of "readily being altered by the user" include, but are not limited to, those for which the ability to receive transmissions in the cellular telephone bands can be added by clipping the leads of, or installing, a simple component such as a diode, resistor or jumper wire; replacing a plug-in semiconductor chip; or programming a semiconductor chip using special access codes or an external device, such as a personal computer. Scanning receivers, and frequency converters designed for use with scanning receivers, also shall be incapable of converting digital cellular communication transmissions to analog voice audio.

(2) Be designed so that the tuning, control and filtering circuitry is inaccessible. The design must be such that any attempts to modify the equipment to receive transmissions from the Cellular Radiotelephone Service likely will render the receiver inoperable.

(b) Except as provided in paragraph (c) of this section, scanning receivers shall reject any signals from the Cellular Radiotelephone Service frequency bands that are 38 dB or higher based upon a 12 dB SINAD measurement, which is considered the threshold where a signal can be clearly discerned from any interference that may be present.

(c) Scanning receivers and frequency converters designed or marketed for use with scanning receivers, are not subject to the requirements of paragraphs (a) and (b) of this section provided that they are manufactured exclusively for, and marketed exclusively to, entities described in 18 U.S.C. Section 2512(2), or are marketed exclusively as test equipment pursuant to § 15.3(dd).

(d) Modification of a scanning receiver to receive transmissions from Cellular Radiotelephone Service frequency bands will be considered to constitute manufacture of such equipment. This includes any individual, individuals, entity or organization that modifies one or more scanners. Any modification to a scanning receiver to receive transmissions from the Cellular Radiotelephone Service frequency bands voids the certification of the scanning receiver, regardless of the date of manufacture of the original unit. In addition, the provisions of § 15.23 shall not be interpreted as permitting modification of a scanning receiver to receive Cellular Radiotelephone Service transmissions.

(e) Scanning receivers and frequency converters designed for use with scanning receivers shall not be assembled from kits or marketed in kit form unless they comply with the requirements in paragraph (a) through (c) of this section.

(f) Scanning receivers shall have a label permanently affixed to the product, and this label shall be readily visible to the purchaser at the time of purchase. The label shall read as follows:

**WARNING: MODIFICATION OF THIS DEVICE TO RECEIVE CELLULAR  
RADIOTELEPHONE SERVICE SIGNALS IS PROHIBITED UNDER FCC  
RULES AND FEDERAL LAW.**

"Permanently affixed" means that the label is etched, engraved, stamped, silkscreened, indelibly printed or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal plastic or other material fastened to the equipment by welding, riveting, or permanent adhesive. The label shall be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable. The label shall not be a stick-on, paper

label.

Section 15.122 Closed caption decoder requirements for digital television receivers and converter boxes.

(a) (1) Effective July 1, 2002, all digital television receivers with picture screens in the 4:3 aspect ratio with picture screens measuring 13 inches or larger diagonally, all digital television receivers with picture screens in the 16:9 aspect ratio measuring 7.8 inches or larger vertically and all separately sold DTV tuners shipped in interstate commerce or manufactured in the United States shall comply with the provisions of this section.

Note: This paragraph places no restrictions on the shipping or sale of digital television receivers that were manufactured before July 1, 2002.

(2) Effective July 1, 2002, DTV converter boxes that allow digitally transmitted television signals to be displayed on analog receivers shall pass available analog caption information to the attached receiver in a form recognizable by that receiver's built-in caption decoder circuitry.

Note: This paragraph places no restrictions on the shipping or sale of DTV converter boxes that were manufactured before July 1, 2002.

(b) Digital television receivers and tuners must be capable of decoding closed captioning information that is delivered pursuant to the industry standard EIA-708-B, "Digital Television (DTV) Closed Captioning," Electronics Industries Association (1999). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Digital television manufacturers may wish to view EIA-708-B in its entirety. Copies of EIA-708-B may be obtained from: Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, <http://www.global.ihs.com/>. Copies of EIA-708-B may be inspected during regular business hours at the following locations: Federal Communications Commission, 445 12<sup>th</sup> Street, S.W., Washington, D.C. 20554, or the Office of the Federal Register, 800 N. Capitol Street, N.W., Washington, D.C.

(c) *Services.*

(1) Decoders must be capable of decoding and processing data for the six standard services, Caption Service #1 through Caption Service #6.

(2) Decoders that rely on Program and System Information Protocol data to implement closed captioning functions must be capable of decoding and processing the Caption Service Directory data. Such decoders must be capable of decoding all Caption Channel Block Headers consisting of Standard Service Headers, Extended Service Block Headers, and Null Block headers. However, decoding of the data is required only for Standard Service Blocks (Service IDs  $\leq 6$ ), and then only if the characters for the corresponding language are supported. The decoders must be able to display the directory for services 1 through 6.

(d) *Code Space Organization.*

(1) Decoders must support Code Space C0, G0, C1, and G1 in their entirety.

		C 0		G 0				C 1		G 1							
B7-b4		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
b3-b0	0	NUL	EXT1	SP	0	@	P	`	p	CW0	SPA	NBS	°	À	Ð	à	ð
	1			!	1	A	Q	a	q	CW1	SPC	ı	±	Á	Ñ	á	ñ
	2			"	2	B	R	b	r	CW2	SPL	¢	²	Â	Ò	â	ò
	3	ETX		#	3	C	S	c	s	CW3		£	³	Ã	Ó	ã	ó
	4			\$	4	D	T	d	t	CW4		¤	´	Ä	Ô	ä	ô
	5			%	5	E	U	e	u	CW5		¥	µ	Å	Õ	å	õ
	6			&	6	F	V	f	v	CW6		¦	¶	Æ	Ö	æ	ö
	7			'	7	G	W	g	w	CW7	SWA	§	·	Ç	×	ç	÷
	8	BS	P16	(	8	H	X	h	x	CLW	DF0	¨	¸	È	Ø	è	ø
	9			)	9	I	Y	i	y	DSW	DF1	©	¹	É	Ù	é	ù
	A			*	:	J	Z	j	z	HDW	DF2	ª	º	Ê	Ú	ê	ú
	B			+	;	K	[	k	{	TGW	DF3	«	»	Ë	Û	ë	û
	C	FF		,	<	L	\	l		DLW	DF4	¬	¼	Ì	Ü	ì	ü
	D	CR		-	=	M	]	m	}	DLY	DF5	-	½	Í	Ý	í	ý
	E	HCR		.	>	N	^	n	~	DLC	DF6	®	¾	Î	Þ	î	þ
	F			/	?	O	_	o	¸	RST	DF7	-	¿	Ï	ß	ï	ÿ
				TSP								CC					
				NBTS P	‘												
					’												
					“												
					”												
				...													
								1/8									
								3/8									
								5/8									
					TM			7/8									
				Š	š			½									
				Œ	œ			ù									
					SM			ē									
								¾									
								û									
					ÿ			é									
		C 2		G 2				C 3		G 3							

Table 1 DTVCC Code Set Mapping

(2) The following characters within code space G2 must be supported:

- transparent space (TSP)
- non-breaking transparent space (NBTSP)
- solid block ( )
- trademark symbol (™)
- Latin-1 characters (Š, Œ, š, œ, Ÿ)

(3) The substitutions in Table 2 are to be made if a decoder does not support the remaining G2 characters.

G2 Character	Substitute With
Open single quote (‘), G2 char code 0x31	G0 single quote (‘), char code 0x27
Close single quote (’), G2 char code 0x32	G0 single quote (‘), char code 0x27
Open double quote (“), G2 char code 0x33	G0 double quote (“), char code 0x22
Close double quote (”), G2 char code 0x34	G0 double quote (“), char code 0x22
Bold bullet (•), G2 char code 0x35	G1 bullet (·), char code 0xB7
Ellipsis(...), G2 char code 0x25	G0 underscore (_), char code 0x5F
One-eighth ( <sup>1</sup> / <sub>8</sub> ), G2 char code 0x76	G0 percent sign (%), char code 0x25
Three-eighths ( <sup>3</sup> / <sub>8</sub> ), G2 char code 0x77	G0 percent sign (%), char code 0x25
Five-eighths ( <sup>5</sup> / <sub>8</sub> ), G2 char code 0x78	G0 percent sign (%), char code 0x25
Seven-eighths ( <sup>7</sup> / <sub>8</sub> ), G2 char code 0x79	G0 percent sign (%), char code 0x25
Vertical border ( ), G2 char code 0x7A	G0 stroke ( ), char code 0x7C
Upper-right border (⌋), G2 char code 0x7B	G0 dash (-), char code 0x2D
Lower-left border (⌌), G2 char code 0x7C	G0 dash (-), char code 0x2D
Horizontal border (—), G2 char code 0x7D	G0 dash (-), char code 0x2D
Lower-right border (⌍), G2 char code 0x7E	G0 dash (-), char code 0x2D
Upper-left border (⌎), G2 char code 0x7F	G0 dash (-), char code 0x2D

Table 2 G2 Character Substitution Table

(4) Support for code spaces C2, C3, and G3 is optional. All unsupported graphic symbols in the G3 code space are to be substituted with the G0 underscore character (\_), char code 0x5F.

(e) *Screen Coordinates.* Table 1 specifies the screen coordinate resolutions and limits for anchor point positioning in 4:3 and 16:9 display formats, and the number of characters per row.

<b>Screen Aspect Ratio</b>	<b>Maximum Anchor Position Resolution</b>	<b>Minimum Anchor Position Resolution</b>	<b>Maximum Displayed Rows</b>	<b>Maximum Characters per Row</b>
4:3	75v x 160h	15v x 32h	4	32
16:9	75v x 210h	15v x 42h	4	42
other	75v x (5 x H)	15v x H*	4	*

Table 1 Screen Coordinate Resolutions & Limits

\*H = 32 x (the width of the screen in relation to a 4:3 display). For example, the 16:9 format is 1/3 wider than a 4:3 display; thus, H = 32 \* 4/3 = 42.667, or 42.

This means that the minimum grid resolution for a 4:3 aspect ratio instrument is 15 vertical positions x 32 horizontal positions. This minimum grid resolution for 16:9 ratio instrument is 15 vertical positions x 42 horizontal positions. These minimum grid sizes are to cover the entire safe-title area of the corresponding screen.

The minimum coordinates equate to a 1/5 reduction in the maximum horizontal and vertical grid resolution coordinates. Caption providers are to use the maximum coordinate system values when specifying anchor point positions. Decoders using the minimum resolution are to divide the provided horizontal and vertical screen coordinates by 5 to derive the equivalent minimum coordinates.

Any caption targeted for both 4:3 and 16:9 instruments is limited to 32 contiguous characters per row. If a caption is received by a 4:3 instrument that is targeted for a 16:9 display only, or requires a window width greater than 32 characters, then the caption may be completely disregarded by the decoder. 16:9 instruments should be able to process and display captions intended for 4:3 displays, providing all other minimum recommendations are met.

If the resulting size of any window is larger than the safe title area for the corresponding display's aspect ratio, then this window will be completely disregarded.

(f) *Caption Windows.*

(1) Decoders need to display no more than 4 rows of captions on the screen at any given time, regardless of the number of windows displayed. This implies that no more than 4 windows can be displayed at any given time (with each having only one caption row). However, decoders should maintain storage to support a minimum total of 8 rows of captions. This storage is needed for the worst-case support of a displayed window with 4 rows of captioning and a non-displayed window which is buffering the incoming rows for the next 4-row caption. As implied above, the maximum number of windows that may be displayed at any one time by a minimum decoder implementation is 4. If more than 4 windows are defined in the caption stream, the decoder may disregard the youngest and lowest priority window definition(s). Caption providers must be aware of this limitation, and either restrict the total number of windows used or accept that some windows will not be displayed.

(2) Decoders do not need to support overlapped windows. If a window overlaps another window,

the overlapped window need not be displayed by the decoder.

(3) At a minimum, decoders will assume that all windows have rows and columns “locked”. This implies that if a decoder implements the SMALL pen-size, then word-”un”wrapping, when shrinking captions, need not be implemented. Also, if a decoder implements the LARGE pen size, then word wrapping (when enlarging captions) need not be implemented.

(4) Whenever possible, the receiver should render embedded carriage returns as line breaks, since these carriage returns indicate an important aspect of the caption's formatting as determined by the service provider. However, it may sometimes be necessary for the receiver to ignore embedded line breaks. For example, if a caption is to appear in a larger font, and if its window's rows and/or columns are unlocked, the rows of text may need to become longer or shorter to fit within the allocated space. Such automatic reformatting of a caption is known as "word wrap." If decoders support word-wrapping, it must be implemented as follows:

(i) The receiver should follow standard typographic practice when implementing word wrap. Potential breaking points (word-wrapping points) are indicated by the space character (20h) and by the hyphen character (2Dh).

(ii) If a row is to be broken at a space, the receiver should remove the space from the caption display. If a row is to be broken after a hyphen, the hyphen should be retained.

(iii) If an embedded return is to be removed, it should usually be replaced with a space. However, if the character to the left of the embedded return is a hyphen, the embedded return should be removed but NOT replaced with a space.

(iv) This specification does not include optional hyphens, nor does it provide for any form of automatic hyphenation. No non-breaking hyphen is defined. The non-breaking space (A0h in the G1 code set) and the non-breaking transparent space (21h in the G2 code set) should not be considered as potential line breaks.

(v) If a single word exceeds the length of a row, the word should be placed at the start of a new row, broken at the character following the last character that fits on the row, and continued with further breaks if needed.

(g) *Window Text Painting.*

(1) All decoders should implement “left”, “right”, and “center” caption-text justification. Implementation of “full” justification is optional. If “full” justification is not implemented, fully justified captions should be treated as though they are “left” justified.

For “left” justification, decoders should display any portion of a received row of text when it is received. For “center”, “right”, and “full” justification, decoders may display any portion of a received row of text when it is received, or may delay display of a received row of text until reception of a row completion indicator. A row completion indicator is defined as receipt of a CR, ETX or any other command, except SetPenColor, SetPenAttributes, or SetPenLocation where the pen relocation is within the same row.

Receipt of a character for a displayed row which already contains text with “center”, “right” or “full” justification will cause the row to be cleared prior to the display of the newly received character and any subsequent characters. Receipt of a justification command which changes the last received justification for a given window will cause the window to be cleared.

(2) At a minimum, decoders must support LEFT\_TO\_RIGHT printing.

(3) At a minimum, decoders must support BOTTOM\_TO\_TOP scrolling. For windows sharing the same horizontal scan lines on the display, scrolling may be disabled.

(4) At a minimum, decoders must support the same recommended practices for scroll rate as is provided for NTSC closed-captioning.

(5) At a minimum, decoders must support the same recommended practices for smooth scrolling as is provided for NTSC closed-captioning.

(6) At a minimum, decoders must implement the “snap” window display effect. If the window “fade” and “wipe” effects are not implemented, then the decoder will “snap” all windows when they are to be displayed, and the “effect speed” parameter is ignored.

(h) *Window Colors and Borders.* At a minimum, decoders must implement borderless windows with solid, black backgrounds (i.e., border type = NONE, fill color = (0,0,0), fill opacity = SOLID), and borderless transparent windows (i.e., border type = NONE, fill opacity = TRANSPARENT)..

(i) *Predefined Window and Pen Styles.* Predefined Window Style and Pen Style ID’s may be provided in the DefineWindow command. At a minimum, decoders should implement Predefined Window Attribute Style 1 and Predefined Pen Attribute Style 1, as shown in Table 4 and Table 5, respectively.

Style ID #	Justify	Print Direction	Scroll Direction	Word Wrap	Display Effect	Effect Direction	Effect Speed	Fill Color	Fill Opacity	Border Type	Border Color	Usage
1	LEFT	LEFT -TO- RIGHT	BOTTOM -TO- TOP	NO	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	<i>NTSC Style PopUp Captions</i>
2	LEFT	LEFT -TO- RIGHT	BOTTOM -TO- TOP	NO	SNAP	n/a	n/a	n/a	TRANS- PARENT	NONE	n/a	<i>PopUp Captions w/o Black Background</i>
3	CNTR	LEFT -TO- RIGHT	BOTTOM -TO- TOP	NO	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	<i>NTSC Style Centered PopUp Captions</i>
4	LEFT	LEFT -TO- RIGHT	BOTTOM- TO- TOP	YES	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	<i>NTSC Style RollUp Captions</i>
5	LEFT	LEFT -TO- RIGHT	BOTTOM- TO- TOP	YES	SNAP	n/a	n/a	n/a	TRANS- PARENT	NONE	n/a	<i>RollUp Captions w/o Black Background</i>
6	CNTR	LEFT -TO- RIGHT	BOTTOM- TO- TOP	YES	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	<i>NTSC Style Centered RollUp Captions</i>
7	LEFT	TOP -TO- BOTTOM	RIGHT -TO- LEFT	NO	SNAP	n/a	n/a	(0,0,0) Black	SOLID	NONE	n/a	<i>Ticker Tape</i>

Table 4 Predefined Window Style ID's



Predefined Style ID	Pen Size	Font Style	Offset	Italics	Underline	Edge Type	Foregrnd Color	Foregrnd Opacity	Backgrnd Color	Backgrnd Opacity	Edge Color	Usage
1	STNDR	0	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	<i>Default NTSC Style*</i>
2	STNDR	1	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	<i>NTSC Style* Mono w/ Serif</i>
3	STNDR	2	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	<i>NTSC Style* Prop w/ Serif</i>
4	STNDR	3	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	<i>NTSC Style* Mono w/o Serif</i>
5	STNDR	4	NORMAL	NO	NO	NONE	(2,2,2) White	SOLID	(0,0,0) Black	SOLID	n/a	<i>NTSC Style* Prop w/o Serif</i>
6	STNDR	3	NORMAL	NO	NO	UNIFRM	(2,2,2) White	SOLID	n/a	TRANS- PARENT	(0,0,0) Black	<i>Mono w/o Serif, Bordered Text, No BG</i>
7	STNDR	4	NORMAL	NO	NO	UNIFRM	(2,2,2) White	SOLID	n/a	TRANS- PARENT	(0,0,0) Black	<i>Prop. w/o Serif, Bordered Text, No BG</i>

Table 5 Predefined Pen Style ID's

\* "NTSC Style" - White Text on Black Background

(j) *Pen Size*. Decoders must support the standard, large, and small pen sizes and must allow the caption provider to choose a pen size and allow the viewer to choose an alternative size.

The STANDARD pen size should be implemented such that the height of the tallest character in any implemented font is no taller than 1/15 of the height of the safe-title area, and the width of the widest character is no wider than 1/32 of the width of the safe-title area for 4:3 displays and 1/42 of the safe-title area width for 16:9 displays.

The LARGE pen size should be implemented such that the width of the widest character in any implemented font is no wider than 1/32 of the safe-title area for 16:9 displays. This recommendation allows for captions to grow to a LARGE pen size without having to reformat the caption since no caption will have more than 32 characters per row.

(k) *Font Styles*. Decoders must support the eight fonts listed below. Caption providers may specify 1 of these 8 font styles to be used to write caption text. The styles specified in the “font style” parameter of the **SetPenAttributes** command are numbered from 0 through 7.

The following is a list of the 8 required font styles. For information purposes only, each font style references one or more popular fonts which embody the characteristics of the style:

- 0 - Default (undefined)
- 1 - Monospaced with serifs (similar to Courier)
- 2 - Proportionally spaced with serifs (similar to Times New Roman)
- 3 - Monospaced without serifs (similar to Helvetica Monospaced)
- 4 - Proportionally spaced without serifs (similar to Arial and Swiss)
- 5 - Casual font type (similar to Dom and Impress)
- 6 - Cursive font type (similar to Coronet and Marigold)
- 7 - Small capitals (similar to Engravers Gothic)

Font styles may be implemented in any typeface which the decoder manufacturer deems to be a readable rendition of the font style, and need not be in the exact typefaces given in the example above. Decoders must include the ability for consumers to choose among the eight fonts. The decoder must display the font chosen by the caption provider unless the viewer chooses a different font.

(l) *Character Offsetting*. Decoders need not implement the character offsetting (i.e., subscript and superscript) pen attributes.

(m) *Pen Styles*. At a minimum, decoders must implement normal, italic, and underline pen styles.

(n) *Foreground Color and Opacity*.

(1) At a minimum, decoders must implement transparent, translucent, solid and flashing character foreground type attributes.

(2) At a minimum, decoders must implement the following character foreground colors: white, black, red, green, blue, yellow, magenta and cyan.

(3) Caption providers may specify the color/opacity. Decoders must include the ability for consumers to choose among the color/opacity options. The decoder must display the color/opacity chosen by the caption provider unless the viewer chooses otherwise.

(o) *Background Color and Opacity.*

(1) Decoders must implement the following background colors: white, black, red, green, blue, yellow, magenta and cyan. It is recommended that this background is extended beyond the character foreground to a degree that the foreground is separated from the underlying video by a sufficient number of background pixels to insure the foreground is separated from the background.

(2) Decoders must implement transparent, translucent, solid and flashing background type attributes. Caption providers may specify the color/opacity. Decoders must include the ability for consumers to choose among the color/opacity options. The decoder must display the color/opacity chosen by the caption provider unless the viewer chooses otherwise.

(p) *Character Edges.* Decoders must implement separate edge color and type attribute control.

(q) *Color Representation.* (1) At a minimum, decoders must support the 8 colors listed in Table 6.

Color	Red	Green	Blue
Black	0	0	0
White	2	2	2
Red	2	0	0
Green	0	2	0
Blue	0	0	2
Yellow	2	2	0
Magenta	2	0	2
Cyan	0	2	2

Table 6 Minimum Color List Table

(2) When a decoder supporting this Minimum Color List receives an RGB value not in the list, it will map the received value to one of the values in the list via the following algorithm:

- All one (1) values are to be changed to 0
- All two (2) values are to remain unchanged
- All three (3) values are to be changed to 2

For example, the RGB value (1,2,3) will be mapped to (0,2,2), (3,3,3) will be mapped to (2,2,2) and (1,1,1) will be mapped to (0,0,0).

(3) Table 7 is an alternative minimum color list table supporting 22 colors.

<b>Color</b>	<b>Red</b>	<b>Green</b>	<b>Blue</b>
Black	0	0	0
Gray	1	1	1
White	2	2	2
Bright White	3	3	3
Dark Red	1	0	0
Red	2	0	0
Bright Red	3	0	0
Dark Green	0	1	0
Green	0	2	0
Bright Green	0	3	0
Dark Blue	0	0	1
Blue	0	0	2
Bright Blue	0	0	3
Dark Yellow	1	1	0
Yellow	2	2	0
Bright Yellow	3	3	0
Dark Magenta	1	0	1
Magenta	2	0	2
Bright Magenta	3	0	3
Dark Cyan	0	1	1
Cyan	0	2	2
Bright Cyan	0	3	3

Table 7 Alternative Minimum Color List Table

When a decoder supporting the Alternative Minimum Color List in Table 7 receives an RGB value not in the list (i.e., an RGB value whose non-zero elements are not the same value), it will map the received value to one of the values in the list via the following algorithm:

- For RGB values with all elements non-zero and different - e.g., (1,2,3), (3,2,1), and (2,1,3), the 1 value will be changed to 0, the 2 value will remain unchanged, and the 3 value will be changed to 2.
- For RGB values with all elements non-zero and with two common elements - e.g. (3,1,3), (2,1,2), and (2,2,3), if the common elements are 3 and the uncommon one is 1, then the 1 elements is changed to 0; e.g. (3,1,3) -> (3,0,3). If the common elements are 1 and the uncommon element is 3, then the 1 elements are changed to 0, and the 3 element is changed to 2; e.g. (1,3,1) -> (0,2,0). In all other cases, the uncommon element is changed to the common value; e.g., (2,2,3) -> (2,2,2), (1,2,1) -> (1,1,1), and (3,2,3) -> (3,3,3).

All decoders not supporting either one of the two color lists described above, must support the full 64 possible RGB color value combinations.

(r) *Character Rendition Considerations.* In NTSC Closed Captioning, decoders were required to insert leading and trailing spaces on each caption row. There were two reasons for this requirement:

(i) to provide a buffer so that the first and last characters of a caption row do not fall outside the safe title area, and

(ii) to provide a black border on each side of a character so that the “white” leading pixels of the first character on a row and the trailing “white” pixels of the last character on a row do not bleed into the underlying video.

Since caption windows are required to reside in the safe title area of the DTV screen, reason i (above) is not applicable to DTVCC captions.

The attributes available in the **SetPenAttributes** command for character rendition (e.g., character background and edge attributes) provide unlimited flexibility to the caption provider when describing caption text in an ideal decoder implementation. However, manufacturers need not implement all pen attributes. Thus it is recommended that no matter what the level of implementation, decoder manufacturers should take into account the readability of all caption text against a variety of all video backgrounds, and should implement some automatic character delineation when the individual control of character foreground, background and edge is not supported.

(s) *Service Synchronization.* Service Input Buffers must be at least 128 bytes in size. Caption providers must keep this lower limit in mind when following Delay commands with other commands and window text. In other words, no more than 128 bytes of DTVCC commands and text should be transmitted (encoded) before a pending Delay command’s delay interval expires.

(t) *Settings.* Decoders must include an option that permits a viewer to choose a setting that will display captions as intended by the caption provider (a default). Decoders must also include an option that allows a viewer’s chosen settings to remain until the viewer chooses to alter these settings, including periods when the television is turned off.

### Subpart C - Intentional Radiators

#### Section 15.201 Equipment authorization requirement.

(a) Intentional radiators operated as carrier current systems and devices operated under the provisions of Sections 15.211, 15.213 and 15.221 shall be verified pursuant to the procedures in Subpart J of Part 2 of this Chapter prior to marketing.

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

(c) For devices such as perimeter protection systems which, in accordance with Section 15.31(d), are required to be measured at the installation site, each application for certification must be accompanied by a statement indicating that the system has been tested at three installations and found to comply at each

installation. Until such time as certification is granted, a given installation of a system that was measured for the submission for certification will be considered to be in compliance with the provisions of this Chapter, including the marketing regulations in Subpart I of Part 2, if tests at that installation show the system to be in compliance with the relevant technical requirements. Similarly, where measurements must be performed on site for equipment subject to verification, a given installation that has been verified to demonstrate compliance with the applicable standards will be considered to be in compliance with the provisions of this Chapter, including the marketing regulations in Subpart I of Part 2.

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

#### Section 15.203 Antenna requirement.

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

#### Section 15.204 External radio frequency power amplifiers and antenna modifications.

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

(b) A transmission system consisting of an intentional radiator, an external radio frequency power amplifier, and an antenna, may be authorized, marketed and used under this part. However, when a transmission system is authorized as a system, it must always be marketed as a complete system and must always be used in the configuration in which it was authorized. An external radio frequency power amplifier shall be marketed only in the system configuration with which the amplifier is authorized and shall not be marketed as a separate product.

(c) Only the antenna with which an intentional radiator is authorized may be used with the intentional radiator.

#### Section 15.205 Restricted bands of operation.

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

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

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

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

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

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a), the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a), and the fundamental emission is outside of the bands listed in paragraph (a) more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

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

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

(4) Any equipment operated under the provisions of Section 15.253 or Section 15.255 of this Part.

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

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

Section 15.207 Conducted limits.

(a) For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

(b) The following option may be employed if the conducted emissions exceed the limits in paragraph (a) of this Section when measured using instrumentation employing a quasi-peak detector function: if the level of the emission measured using the quasi-peak instrumentation is 6 dB, or more, higher than the level of the same emission measured with instrumentation having an average detector and a 9 kHz minimum bandwidth, that emission is considered broadband and the level obtained with the quasi-peak detector may be reduced by 13 dB for comparison to the limits. When employing this option, the following conditions shall be observed:

(1) The measuring instrumentation with the average detector shall employ a linear IF amplifier.

(2) Care must be taken not to exceed the dynamic range of the measuring instrument when measuring an emission with a low duty cycle.

(3) The test report required for verification or for an application for a grant of equipment authorization shall contain all details supporting the use of this option.

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

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



(2) For all other carrier current systems: 1000 uV within the frequency band 535-1705 kHz.

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

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

Section 15.209 Radiated emission limits, general requirements.

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

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

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

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

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

(d) The emission limits shown in the above table are based on measurements employing a CISPR

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

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

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

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

#### Section 15.211 Tunnel radio systems.

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

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

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

(c) The total electromagnetic field from a tunnel radio system on any frequency or frequencies appearing outside of the tunnel, mine or other structure described in paragraph (a) shall not exceed the limits shown in Section 15.209 when measured at the specified distance from the surrounding structure, including openings. Particular attention shall be paid to the emissions from any opening in the structure to the outside environment. When measurements are made from the openings, the distances shown in Section 15.209 refer to the distance from the plane of reference which fits the entire perimeter of each above ground opening.

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

#### Section 15.213 Cable locating equipment.

An intentional radiator used as cable locating equipment, as defined in Section 15.3(d), may be operated on any frequency within the band 9 - 490 kHz, subject to the following limits: within the frequency band 9 kHz, up to, but not including, 45 kHz, the peak output power from the cable locating equipment shall not exceed 10 watts; and, within the frequency band 45 kHz to 490 kHz, the peak output power from the cable locating equipment shall not exceed one watt. If provisions are made for connection of the cable locating equipment to the AC power lines, the conducted limits in Section 15.207 also apply to this equipment.

Section 15.214 Cordless telephones.

(a) For equipment authorization, a single application form, FCC Form 731, may be filed for a cordless telephone system, provided the application clearly identifies and provides data for all parts of the system to show compliance with the applicable technical requirements. When a single application form is submitted, both the base station and the portable handset must carry the same FCC identifier. The application shall include a fee for certification of each type of transmitter and for certification, if appropriate, for each type of receiver included in the system.

(b) A cordless telephone which is intended to be connected to the public switched telephone network shall also comply with the applicable regulations in Part 68 of this Chapter. A separate application for registration under Part 68 of this Chapter is required.

(c) The label required under Subpart A of this Part shall also contain the following statement: "Privacy of communications may not be ensured when using this phone."

(d) Cordless telephones shall incorporate circuitry which makes use of a digital security code to provide protection against unintentional access to the public switched telephone network by the base unit and unintentional ringing by the handset. These functions shall operate such that each access of the telephone network or ringing of the handset is preceded by the transmission of a code word. Access to the telephone network shall occur only if the code transmitted by the handset matches the code set in the base unit. Similarly, ringing of the handset shall occur only if the code transmitted by the base unit matches the code set in the handset. The security code required by this Section may also be employed to perform other communications functions, such as providing telephone billing information. This security code system is to operate in accordance with the following provisions.

(1) There must be provision for at least 256 possible discrete digital codes. Factory-set codes must be continuously varied over at least 256 possible codes as each telephone is manufactured. The codes may be varied either randomly, sequentially, or using another systematic procedure.

(2) Manufacturers must use one of the following approaches for facilitating variation in the geographic distribution of individual security codes:

(i) Provide a means for the user to readily select from among at least 256 possible discrete digital codes. The cordless telephone shall be either in a non-operable mode after manufacture until the user selects a security code or the manufacturer must continuously vary the initial security code as each telephone is produced.

(ii) Provide a fixed code that is continuously varied among at least 256 discrete digital codes as each telephone is manufactured.

(iii) Provide a means for the cordless telephone to automatically select a different code from among at least 256 possible discrete digital codes each time it is activated.

(iv) It is permissible to provide combinations of fixed, automatic, and user-selectable coding provided the above criteria are met.

(3) A statement of the means and procedures used to achieve the required protection shall be provided in any application for equipment authorization of a cordless telephone.

#### Radiated Emission Limits, Additional Provisions

##### Section 15.215 Additional provisions to the general radiated emission limitations.

(a) The regulations in Sections 15.217-15.255 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.

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

(c) For those bands of frequencies where alternative radiated emission limitations apply and for which a frequency stability is not specified, it is recommended that the fundamental frequency be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

(d) Where the following sections specify limits on the bandwidth of the emissions, the bandwidth limits include the effects of frequency sweeping, frequency hopping, and other modulation techniques which may be employed.

##### Section 15.217 Operation in the band 160 - 190 kHz.

(a) The total input power to the final radio frequency stage (exclusive of filament or heater power) shall not exceed one watt.

(b) The total length of the transmission line, antenna, and ground lead (if used) shall not exceed 15 meters.

(c) All emissions below 160 kHz or above 190 kHz shall be attenuated at least 20 dB below the level of the unmodulated carrier. Determination of compliance with the 20 dB attenuation specification may be based on measurements at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by

measuring the radiated emissions.

Section 15.219 Operation in the band 510 - 1705 kHz.

(a) The total input power to the final radio frequency stage (exclusive of filament or heater power) shall not exceed 100 milliwatts.

(b) The total length of the transmission line, antenna and ground lead (if used) shall not exceed 3 meters.

(c) All emissions below 510 kHz or above 1705 kHz shall be attenuated at least 20 dB below the level of the unmodulated carrier. Determination of compliance with the 20 dB attenuation specification may be based on measurements at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by measuring the radiated emissions.

Section 15.221 Operation in the band 525 - 1705 kHz.

(a) Carrier current systems and transmitters employing a leaky coaxial cable as the radiating antenna may operate in the band 525-1705 kHz provided the field strength levels of the radiated emissions do not exceed 15 uV/m, as measured at a distance of  $47,715/(\text{frequency in kHz})$  meters (equivalent to  $\text{Lambda}/2\text{Pi}$ ) from the electric power line or the coaxial cable, respectively. The field strength levels of emissions outside this band shall not exceed the general radiated emission limits in Section 15.209.

(b) As an alternative to the provisions in paragraph (a), intentional radiators used for the operation of an AM broadcast station on a college or university campus or on the campus of any other education institution may comply with the following:

(1) On the campus, the field strength of emissions appearing outside of this frequency band shall not exceed the general radiated emission limits shown in Section 15.209 as measured from the radiating source. There is no limit on the field strength of emissions appearing within this frequency band, except that the provisions of Section 15.5 continue to comply.

(2) At the perimeter of the campus, the field strength of any emissions, including those within the frequency band 525 - 1705 kHz, shall not exceed the general radiated emissions in Section 15.209.

(3) The conducted limits specified in Section 15.207 apply to the radio frequency voltage on the public utility power lines outside of the campus. Due to the large number of radio frequency devices which may be used on the campus, contributing to the conducted emissions, as an alternative to measuring conducted emissions outside of the campus, it is acceptable to demonstrate compliance with this provision by measuring each individual intentional radiator employed in the system at the point where it connects to the AC power lines.

(c) A grant of equipment authorization is not required for intentional radiators operated under the provisions of this Section. In lieu thereof, the intentional radiator shall be verified for compliance with the regulations in accordance with Subpart J of Part 2 of this Chapter. This data shall be kept on file at the

location of the studio, office or control room associated with the transmitting equipment. In some cases, this may correspond to the location of the transmitting equipment.

(d) For the band 535-1705 kHz, the frequency of operation shall be chosen such that operation is not within the protected field strength contours of licensed AM stations.

Section 15.223 Operation in the band 1.705 - 10 MHz.

(a) The field strength of any emission within the band 1.705-10.0 MHz shall not exceed 100 microvolts/meter at a distance of 30 meters. However, if the bandwidth of the emission is less than 10% of the center frequency, the field strength shall not exceed 15 microvolts/meter or (the bandwidth of the device in kHz) divided by (the center frequency of the device in MHz) microvolts/meter at a distance of 30 meters, whichever is the higher level. For the purposes of this Section, bandwidth is determined at the points 6 dB down from the modulated carrier. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section 15.35(b) for limiting peak emissions apply.

(b) The field strength of emissions outside of the band 1.705-10.0 MHz shall not exceed the general radiated emission limits in Section 15.209.

Section 15.225 Operation within the band 13.553 - 13.567 MHz.

(a) The field strength of any emissions within this band shall not exceed 10,000 microvolts/meter at 30 meters.

(b) The field strength of any emissions appearing outside of this band shall not exceed the general radiated emission limits shown in Section 15.209.

(c) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Section 15.227 Operation within the band 26.96 - 27.28 MHz.

(a) The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

(b) The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in Section 15.209.

Section 15.229 Operation within the band 40.66 - 40.70 MHz.

(a) Unless operating pursuant to the provisions in Section 15.231, the field strength of any emissions within this band shall not exceed 1000 microvolts/meter at 3 meters.

(b) As an alternative to the limit in paragraph (a), perimeter protection systems may demonstrate compliance with the following: the field strength of any emissions within this band shall not exceed 500 microvolts/meter at 3 meters, as determined using measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply where compliance of these devices is demonstrated under this alternative emission limit.

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

(d) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

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

(a) The provisions of this Section are restricted to periodic operation within the band 40.66 - 40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Radio control of toys is not permitted. Continuous transmissions, such as voice or video, and data transmissions are not permitted. The prohibition against data transmissions does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system. The following conditions shall be met to comply with the provisions for this periodic operation:

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

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

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

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

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

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

\*\* linear interpolations

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

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

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

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

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

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

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a)



and may be employed for any type of operation, including operation prohibited in paragraph (a), provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this Section, except the field strength table in paragraph (b) is replaced by the following:

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

\*\* linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters =  $22.72727(F) - 2454.545$ ; for the band 260-470 MHz, uV/m at 3 meters =  $16.6667(F) - 2833.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

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

Section 15.233 Operation within the bands 43.71 - 44.49 MHz, 46.60 - 46.98 MHz, 48.75 - 49.51 MHz and 49.66 - 50.0 MHz.

(a) The provisions shown in this Section are restricted to cordless telephones.

(b) An intentional radiator used as part of a cordless telephone system shall operate centered on one or more of the following frequency pairs, subject to the following conditions:

(1) Frequencies shall be paired as shown below, except that channel pairing for channels one through fifteen may be accomplished by pairing any of the fifteen base transmitter frequencies with any of the fifteen handset transmitter frequencies.

(2) Cordless telephones operating on channels one through fifteen must: (i) incorporate an automatic channel selection mechanism that will prevent establishment of a link on any occupied frequency and (ii) the box or an instruction manual which is included within the box which the individual cordless telephone is to be marketed shall contain information indicating that some cordless telephones operate at frequencies that may cause interference to nearby TVs and VCRs; to minimize or prevent such interference, the base of the cordless telephone should not be placed near or on top of a TV or VCR; and, if interference is experienced, moving the cordless telephone farther away from the TV or VCR will often

reduce or eliminate the interference. A statement describing the means and procedures used to achieve automatic channel selection shall be provided in any application for equipment authorization of a cordless telephone operating on channels one through fifteen.

Channel	Base Transmitter (MHz)	Handset Transmitter (MHz)
1	43.720	48.760
2	43.740	48.840
3	43.820	48.860
4	43.840	48.920
5	43.920	49.020
6	43.960	49.080
7	44.120	49.100
8	44.160	49.160
9	44.180	49.200
10	44.200	49.240
11	44.320	49.280
12	44.360	49.360
13	44.400	49.400
14	44.460	49.460
15	44.480	49.500
16	46.610	49.670
17	46.630	49.845
18	46.670	49.860
19	46.710	49.770
20	46.730	49.875
21	46.770	49.830
22	46.830	49.890
23	46.870	49.930
24	46.930	49.990
25	46.970	49.970

(c) The field strength of the fundamental emission shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

(d) The fundamental emission shall be confined within a 20 kHz band and shall be centered on a carrier frequency shown above, as adjusted by the frequency tolerance of the transmitter at the time testing is performed. Modulation products outside of this 20 kHz band shall be attenuated at least 26 dB below the level of the unmodulated carrier or to the general limits in Section 15.209, whichever permits the higher emission levels. Emissions on any frequency more than 20 kHz removed from the center frequency shall consist solely of unwanted emissions and shall not exceed the general radiated emission limits in Section 15.209. Tests to determine compliance with these requirements shall be performed using an appropriate input signal as prescribed in Section 2.989 of this Chapter.

(e) All emissions exceeding 20 microvolts/meter at 3 meters are to be reported in the application for certification.

(f) If the device provides for the connection of external accessories, including external electrical input signals, the device must be tested with the accessories attached. The emission tests shall be performed with the device and accessories configured in a manner which tends to produce the maximum level of emissions within the range of variations that can be expected under normal operating conditions.

(g) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency. The tolerance shall be maintained for a temperature variation of -20 degrees C to +50 degrees C at normal supply voltage, and for variation in the primary voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(h) For cordless telephones that do not comply with Section 15.214(d) of this Part, the box or other package in which the individual cordless telephone is to be marketed shall carry a statement in a prominent location, visible to the buyer before purchase, which reads as follows:

NOTICE: The base units of some cordless telephones may respond to other nearby units or to radio noise resulting in telephone calls being dialed through this unit without your knowledge and possibly calls being misbilled. In order to protect against such occurrences, this cordless telephone is provided with the following features: (to be completed by the responsible party).

An application for certification of a cordless telephone shall specify the complete text of the statement that will be carried on the package and indicate where, specifically, it will be located on the carton.

#### Section 15.235 Operation within the band 49.82 - 49.90 MHz.

(a) The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

(b) The field strength of any emissions appearing between the band edges and up to 10 kHz above and below the band edges shall be attenuated at least 26 dB below the level of the unmodulated carrier or to the general limits in Section 15.209, whichever permits the higher emission levels. The field strength of any emissions removed by more than 10 kHz from the band edges shall not exceed the general radiated emission limits in Section 15.209. All signals exceeding 20 microvolts/meter at 3 meters shall be reported in the application for certification.

(c) For a home-built intentional radiator, as defined in Section 15.23(a), operating within the band 49.82-49.90 MHz, the following standards may be employed:

(1) The RF carrier and modulation products shall be maintained within the band 49.82-49.90 MHz.

(2) The total input power to the device measured at the battery or the power line terminals shall not exceed 100 milliwatts under any condition of modulation.

(3) The antenna shall be a single element, one meter or less in length, permanently mounted on the enclosure containing the device.

(4) Emissions outside of this band shall be attenuated at least 20 dB below the level of the unmodulated carrier.

(5) The regulations contained in Section 15.23 of this Part apply to intentional radiators constructed under the provisions of this paragraph.

(d) Cordless telephones are not permitted to operate under the provisions of this Section.

Section 15.237 Operation in the bands 72.0 - 73.0 MHz, 74.6 - 74.8 MHz and 75.2 - 76.0 MHz.

(a) The intentional radiator shall be restricted to use as an auditory assistance device.

(b) Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the above specified frequency ranges.

(c) The field strength of any emissions within the permitted 200 kHz band shall not exceed 80 millivolts/meter at 3 meters. The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed 1500 microvolts/meter at 3 meters. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

Section 15.239 Operation in the band 88 - 108 MHz.

(a) Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz.

(b) The field strength of any emissions within the permitted 200 kHz band shall not exceed 250 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

(c) The field strength of any emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed the general radiated emission limits in Section 15.209.

(d) A custom built telemetry intentional radiator operating in the frequency band of 88-108 MHz and used for experimentation by an educational institute need not be certified provided the device complies with the standards in this Part and the educational institution notifies the Engineer in Charge of the local FCC office, in writing, in advance of operation, providing the following information:

- (1) The dates and places where the device will be operated;
- (2) The purpose for which the device will be used;
- (3) A description of the device, including the operating frequency, RF power output, and antenna; and,
- (4) A statement that the device complies with the technical provisions of this Part.

Section 15.241 Operation in the band 174 - 216 MHz.

[See Section 15.37(i).]

- (a) Operation under the provisions of this Section is restricted to biomedical telemetry devices.
- (b) Emissions from the device shall be confined within a 200 kHz band which shall lie wholly within the frequency range of 174-216 MHz.
- (c) The field strength of any emissions radiated within the specified 200 kHz band shall not exceed 1500 microvolts/meter at 3 meters. The field strength of emissions radiated on any frequency outside of the specified 200 kHz band shall not exceed 150 microvolts/meter at 3 meters. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

Section 15.242 Operation in the bands 174-216 MHz and 470-668 MHz.

[See Section 15.37(i).]

- (a) The marketing and operation of intentional radiators under the provisions of this section is restricted to biomedical telemetry devices employed solely on the premises of health care facilities.
  - (1) A health care facility includes hospitals and other establishments that offer services, facilities, and beds for use beyond 24 hours in rendering medical treatment and institutions and organizations regularly engaged in providing medical services through clinics, public health facilities, and similar establishments, including governmental entities and agencies for their own medical activities.
  - (2) This authority to operate does not extend to mobile vehicles, such as ambulances, even if those vehicles are associated with a health care facility.
- (b) The fundamental emissions from a biomedical telemetry device operating under the provisions of this section shall be contained within a single television broadcast channel, as defined in Part 73 of this chapter, under all conditions of operation and shall lie wholly within the frequency ranges of 174-216 MHz and 470-668 MHz.
- (c) The field strength of the fundamental emissions shall not exceed 200 mV/m, as measured at a distance of 3 meters using a quasi-peak detector. Manufacturers should note that a quasi-peak detector

function indicates field strength per 120 kHz of bandwidth  $\pm$  20 kHz. Accordingly, the total signal level over the band of operation may be higher than 200 mV/m. The field strength of emissions radiated on any frequency outside of the television broadcast channel within which the fundamental is contained shall not exceed the general limits in Section 15.209.

(d) The user and the installer of a biomedical telemetry device operating within the frequency range 174-216 MHz, 470-608 MHz or 614-668 MHz shall ensure that the following minimum separation distances are maintained between the biomedical telemetry device and the authorized radio services operating on the same frequencies:

(1) At least 10.3 km outside of the Grade B field strength contour (56 dBuV/m) of a TV broadcast station or an associated TV booster station operating within the band 174-216 MHz.

(2) At least 5.5 km outside of the Grade B field strength contour (64 dBuV/m) of a TV broadcast station or an associated TV booster station operating within the bands 470-608 MHz or 614-668 MHz.

(3) At least 5.1 km outside of the 68 dBuV/m field strength contour of a low power TV or a TV translator station operating within the band 174-216 MHz.

(4) At least 3.1 km outside of the 74 dBuV/m field strength contour of a low power TV or a TV translator station operating within the bands 470-608 MHz or 614-668 MHz.

(5) Whatever distance is necessary to protect other authorized users within these bands.

(e) The user and the installer of a biomedical telemetry device operating within the frequency range 608-614 MHz and that will be located within 32 km of the very long baseline array (VLBA) stations or within 80 km of any of the other radio astronomy observatories noted in footnote US 311 of Section 2.106 of this chapter must coordinate with, and obtain the written concurrence of, the director of the affected radio astronomy observatory before the equipment can be installed or operated. The National Science Foundation point of contact for coordination is: Spectrum Manager, Division of Astronomical Sciences, NSF Rm 1045, 4201 Wilson Blvd., Arlington, VA 22230; tel: (703) 306-1823.

(f) Biomedical telemetry devices must not cause harmful interference to licensed TV broadcast stations or to other authorized radio services, such as operations on the broadcast frequencies under Subparts G and H of Part 74 of this chapter, land mobile stations operating under Part 90 of this chapter in the 470-512 MHz band, and radio astronomy operation in the 608-614 MHz band. (See Section 15.5.) If harmful interference occurs, the interference must either be corrected or the device must immediately cease operation on the occupied frequency. Further, the operator of the biomedical telemetry device must accept whatever level of interference is received from other radio operations. The operator, *i.e.*, the health care facility, is responsible for resolving any interference that occurs subsequent to the installation of these devices.

(g) The manufacturers, installers, and users of biomedical telemetry devices are reminded that they must ensure that biomedical telemetry transmitters operating under the provisions of this section avoid operating in close proximity to authorized services using this spectrum. Sufficient separation distance, necessary to avoid causing or receiving harmful interference, must be maintained from co-channel

operations. These parties are reminded that the frequencies of the authorized services are subject to change, especially during the implementation of the digital television services. The operating frequencies of the Part 15 devices may need to be changed, as necessary and in accordance with the permissive change requirements of this chapter, to accommodate changes in the operating frequencies of the authorized services.

(h) The manufacturers, installers and users of biomedical telemetry devices are cautioned that the operation of this equipment could result in harmful interference to other nearby medical devices.

Section 15.243 Operation in the band 890 - 940 MHz.

(a) Operation under the provisions of this Section is restricted to devices that use radio frequency energy to measure the characteristics of a material. Devices operated pursuant to the provisions of this Section shall not be used for voice communications or the transmission of any other type of message.

(b) The field strength of any emissions radiated within the specified frequency band shall not exceed 500 microvolts/meter at 30 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

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

(d) The device shall be self-contained with no external or readily accessible controls which may be adjusted to permit operation in a manner inconsistent with the provisions in this Section. Any antenna that may be used with the device shall be permanently attached thereto and shall not be readily modifiable by the user.

Section 15.245 Operation within the bands 902 - 928 MHz, 2435 - 2465 MHz, 5785 - 5815 MHz, 10500 - 10550 MHz, and 24075 - 24175 MHz.

(a) Operation under the provisions of this Section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (millivolts/meter)
902 - 928	500	1.6
2435 - 2465	500	1.6
5785 - 5815	500	1.6
10500 - 10550	2500	25.0
24075 - 24175	2500	25.0

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(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in § 15.205, shall not exceed the field strength limits shown in § 15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.

(ii) For all other field disturbance sensors, 7.5 mV/m.

(iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands fully comply with the limits given in Section 15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

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

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

(4) The emission limits shown in the above table are based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

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

(a) Operation under the provisions of this Section is limited to frequency hopping and direct sequence spread spectrum intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds



within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 2400-2483.5 MHz and 5725-5850 MHz bands shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band may utilize hopping channels whose 20 dB bandwidth is greater than 1 MHz provided the systems use at least 15 non-overlapping channels. The total span of hopping channels shall be at least 75 MHz. The time of occupancy on any one channel shall be no greater than 0.4 seconds within the time period required to hop through all channels. [Note that each of the hopping channels must be used equally on the average.]

(2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

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

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

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

(3) Except as shown below, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the above stated values by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

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

(iii) Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished

with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

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

(c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

(d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

(e) The processing gain of a direct sequence system shall be at least 10 dB. The processing gain represents the improvement to the received signal-to-noise ratio, after filtering to the information bandwidth, from the spreading/despreading function. The processing gain may be determined using one of the following methods:

(1) As measured at the demodulated output of the receiver: the ratio in dB of the signal-to-noise ratio with the system spreading code turned off to the signal-to-noise ratio with the system spreading code turned on.

(2) As measured using the CW jamming margin method: a signal generator is stepped in 50 kHz increments across the passband of the system, recording at each point the generator level required to produce the recommended Bit Error Rate (BER). This level is the jammer level. The output power of the intentional radiator is measured at the same point. The jammer to signal ratio (J/S) is then calculated, discarding the worst 20% of the J/S data points. The lowest remaining J/S ratio is used to calculate the processing gain, as follows:  $G_p = (S/N)_o + M_j + L_{sys}$ , where  $G_p$  = processing gain of the system,  $(S/N)_o$  = signal to noise ratio required for the chosen BER,  $M_j$  = J/S ratio, and  $L_{sys}$  = system losses. Note that total losses in a system, including intentional radiator and receiver, should be assumed to be no more than 2 dB.

(f) Hybrid systems that employ a combination of both direct sequence and frequency hopping modulation techniques shall achieve a processing gain of at least 17 dB from the combined techniques. The frequency hopping operation of the hybrid system, with the direct sequence operation turned off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The direct sequence operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this Section.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping

channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

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

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

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

(a) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

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

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

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

(d) As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

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

Section 15.251 Operation within the bands 2.9 - 3.26 GHz, 3.267 - 3.332 GHz, 3.339 - 3.3458 GHz, and 3.358 - 3.6 GHz.

(a) Operation under the provisions of this Section is limited to automatic vehicle identification systems (AVIS) which use swept frequency techniques for the purpose of automatically identifying transportation vehicles.

(b) The field strength anywhere within the frequency range swept by the signal shall not exceed 3000 microvolts/meter/MHz at 3 meters in any direction. Further, an AVIS, when in its operating position, shall not produce a field strength greater than 400 microvolts/meter/MHz at 3 meters in any direction within  $\pm 10$  degrees of the horizontal plane. In addition to the provisions of Section 15.205, the field strength of radiated emissions outside the frequency range swept by the signal shall be limited to a maximum of 100 microvolts/meter/MHz at 3 meters, measured from 30 MHz to 20 GHz for the complete system. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

(c) The minimum sweep repetition rate of the signal shall not be lower than 4000 sweeps per second, and the maximum sweep repetition rate of the signal shall not exceed 50,000 sweeps per second.

(d) An AVIS shall employ a horn antenna or other comparable directional antenna for signal emission.

(e) Provision shall be made so that signal emission from the AVIS shall occur only when the vehicle to be identified is within the radiated field of the system.

(f) In addition to the labelling requirements in Section 15.19(a), the label attached to the AVIS transmitter shall contain a third statement regarding operational conditions, as follows:

... and, (3) during use this device (the antenna) may not be pointed within  $\pm$  \*\* degrees of the horizontal plane.

The double asterisks in condition three (\*\*) shall be replaced by the responsible party with the angular pointing restriction necessary to meet the horizontal emission limit specified in paragraph (b).

(g) In addition to the information required in Subpart J of Part 2, the application for certification shall contain:

(1) Measurements of field strength per MHz along with the intermediate frequency of the spectrum analyzer or equivalent measuring receiver;

(2) The angular separation between the direction at which maximum field strength occurs and the direction at which the field strength is reduced to 400 microvolts/meter/MHz at 3 meters;

(3) A photograph of the spectrum analyzer display showing the entire swept frequency

signal and a calibrated scale for the vertical and horizontal axes; the spectrum analyzer settings that were used shall be labelled on the photograph; and,

(4) The results of the frequency search for spurious and sideband emissions from 30 MHz to 20 GHz, exclusive of the swept frequency band, with the measuring instrument as close as possible to the unit under test.

Section 15.253 Operation within the bands 46.7-46.9 GHz and 76.0-77.0 GHz.

(a) Operation within the bands 46.7-46.9 GHz and 76.0-77.0 GHz is restricted to vehicle-mounted field disturbance sensors used as vehicle radar systems. The transmission of additional information, such as data, is permitted provided the primary mode of operation is as a vehicle-mounted field disturbance sensor. Operation under the provisions of this section is not permitted on aircraft or satellites.

(b) The radiated emission limits within the bands 46.7-46.9 GHz and 76.0-77.0 GHz are as follows:

(1) If the vehicle is not in motion, the power density of any emission within the bands specified in this section shall not exceed  $200 \text{ nW/cm}^2$  at a distance of 3 meters from the exterior surface of the radiating structure.

(2) For forward-looking vehicle-mounted field disturbance sensors, if the vehicle is in motion the power density of any emission within the bands specified in this section shall not exceed  $60 \text{ } \mu\text{W/cm}^2$  at a distance of 3 meters from the exterior surface of the radiating structure.

(3) For side-looking or rear-looking vehicle-mounted field disturbance sensors, if the vehicle is in motion the power density of any emission within the bands specified in this section shall not exceed  $30 \text{ } \mu\text{W/cm}^2$  at a distance of 3 meters from the exterior surface of the radiating structure.

(c) The power density of any emissions outside the operating band shall consist solely of spurious emissions and shall not exceed the following:

(1) Radiated emissions below 40 GHz shall not exceed the general limits in Section 15.209 of this part.

(2) Radiated emissions outside the operating band and between 40 GHz and 200 GHz shall not exceed the following:

(i) For vehicle-mounted field disturbance sensors operating in the band 46.7-46.9 GHz:  $2 \text{ pW/cm}^2$  at a distance of 3 meters from the exterior surface of the radiating structure.

(ii) For forward-looking vehicle-mounted field disturbance sensors operating in the band 76-77 GHz:  $600 \text{ pW/cm}^2$  at a distance of 3 meters from the exterior surface of the radiating structure.

(iii) For side-looking or rear-looking vehicle-mounted field disturbance sensors operating in the band 76-77 GHz:  $300 \text{ pW/cm}^2$  at a distance of 3 meters from the exterior surface of the

radiating structure.

(3) For radiated emissions above 200 GHz from field disturbance sensors operating in the 76-77 GHz band: the power density of any emission shall not exceed  $1000 \text{ pW/cm}^2$  at a distance of 3 meters from the exterior surface of the radiating structure.

(4) For field disturbance sensors operating in the 76-77 GHz band, the spectrum shall be investigated up to 231 GHz.

(d) The provisions in Section 15.35 of this part limiting peak emissions apply.

(e) Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range  $-20$  to  $+50$  degrees celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

(f) Regardless of the power density levels permitted under this section, devices operating under the provisions of this section are subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

#### Section 15.255 Operation within the band 57-64 GHz.

(a) Operation under the provisions of this section is not permitted for the following products:

(1) Equipment used on aircraft or satellites.

(2) Field disturbance sensors, including vehicle radar systems, unless the field disturbance sensors are employed for fixed operation. For the purposes of this section, the reference to fixed operation includes field disturbance sensors installed in fixed equipment, even if the sensor itself moves within the equipment.

(b) Within the 57-64 GHz band, emission levels shall not exceed the following:

(1) For products other than fixed field disturbance sensors, the average power density of any emission, measured during the transmit interval, shall not exceed  $9 \text{ } \mu\text{W/cm}^2$ , as measured 3 meters from the radiating structure, and the peak power density of any emission shall not exceed  $18 \text{ } \mu\text{W/cm}^2$ , as measured 3 meters from the radiating structure.

(2) For fixed field disturbance sensors that occupy 500 MHz or less of bandwidth and that are contained wholly within the frequency band 61.0-61.5 GHz, the average power density of any emission, measured during the transmit interval, shall not exceed  $9 \text{ } \mu\text{W/cm}^2$ , as measured 3 meters from the radiating structure, and the peak power density of any emission shall not exceed  $18 \text{ } \mu\text{W/cm}^2$ , as measured 3 meters from the radiating structure. In addition, the average power density of any emission outside of the 61.0-61.5 GHz band, measured during the transmit interval, but still within the 57-64 GHz

band, shall not exceed  $9 \text{ nW/cm}^2$ , as measured 3 meters from the radiating structure, and the peak power density of any emission shall not exceed  $18 \text{ nW/cm}^2$ , as measured three meters from the radiating structure.

(3) For fixed field disturbance sensors other than those operating under the provisions of paragraph (b)(2) of this section, the peak transmitter output power shall not exceed 0.1 mW and the peak power density shall not exceed  $9 \text{ nW/cm}^2$  at a distance of 3 meters.

(4) Peak power density shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-64 GHz band and has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

(5) The average emission limits shall be calculated, based on the measured peak levels, over the actual time period during which transmission occurs.

(c) Limits on spurious emissions:

(1) The power density of any emissions outside the 57-64 GHz band shall consist solely of spurious emissions.

(2) Radiated emissions below 40 GHz shall not exceed the general limits in Section 15.209 of this part.

(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed  $90 \text{ pW/cm}^2$  at a distance of 3 meters.

(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

(d) Only spurious emissions and transmissions related to a publicly-accessible coordination channel, whose purpose is to coordinate operation between diverse transmitters with a view towards reducing the probability of interference throughout the 57-64 GHz band, are permitted in the 57-57.05 GHz band.

NOTE: The 57-57.05 GHz is reserved exclusively for a publicly-accessible coordination channel. The development of standards for this channel shall be performed pursuant to authorizations issued under Part 5 of this chapter.

(e) Except as specified below, the total peak transmitter output power shall not exceed 500 mW.

(1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g. for frequency hopping devices).

(2) Peak transmitter output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-64 GHz band and that has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

(3) For purposes of demonstrating compliance with this paragraph, corrections to the transmitter output power may be made due to the antenna and circuit loss.

(f) Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to +50 degrees celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

(g) Regardless of the power density levels permitted under this section, devices operating under the provisions of this section are subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(h) Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

(i) For all transmissions that emanate from inside a building, within any one second interval of signal transmission, each transmitter with a peak output power equal to or greater than 0.1 mW or a peak power density equal to or greater than 3 nW/cm<sup>2</sup>, as measured 3 meters from the radiating structure, must transmit a transmitter identification at least once. Each application for equipment authorization must declare that the equipment that will be used inside a building contains the required transmitter identification feature and must specify a method whereby interested parties can obtain sufficient information, at no cost, to enable them to fully detect and decode this transmitter identification information. Upon the completion of decoding, the transmitter identification data block must provide the following fields:

1. FCC Identifier, which shall be programmed at the factory.
2. Manufacturer's serial number, which shall be programmed at the factory.
3. Provision for at least 24 bytes of data relevant to the specific device, which shall be field programmable. The grantee must implement a method that makes it possible for users to specify and update this data. The recommended content of this field is information to assist in contacting the operator.

#### Subpart D - Unlicensed Personal Communications Service Devices



Section 15.301 Scope.

This subpart sets out the regulations for unlicensed personal communications services (PCS) devices operating in the 1910-1930 MHz and 2390-2400 MHz frequency bands.

Section 15.303 Definitions.

- (a) Asynchronous devices. Devices that transmit RF energy at irregular time intervals, as typified by local area network data systems.
- (b) Coordinatable PCS device. PCS devices whose geographical area of operation is sufficiently controlled either by necessity of operation with a fixed infrastructure or by disabling mechanisms to allow adequate coordination of their locations relative to incumbent fixed microwave facilities.
- (c) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.
- (d) Isochronous devices. Devices that transmit at a regular interval, typified by time-division voice systems.
- (e) Noncoordinatable PCS device. A PCS device that is capable of randomly roaming and operating in geographic areas containing incumbent microwave facilities such that operation of the PCS device will potentially cause harmful interference to the incumbent microwave facilities.
- (f) Peak transmit power. The peak power output as measured over an interval of time equal to the frame rate or transmission burst of the device under all conditions of modulation. Usually this parameter is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used.
- (g) Personal Communications Service (PCS) Devices [Unlicensed]. Intentional radiators operating in the frequency bands 1910-1930 MHz and 2390-2400 MHz that provide a wide array of mobile and ancillary fixed communication services to individuals and businesses.
- (h) Spectrum window. An amount of spectrum equal to the intended emission bandwidth in which operation is desired.
- (i) Sub-band. For purposes of this subpart the term sub-band refers to the spectrum allocated for isochronous or asynchronous transmission.
- (j) Thermal noise power. The noise power in watts defined by the formula  $N=kTB$  where N is the noise power in watts, k is Boltzmann's constant, T is the absolute temperature in degrees Kelvin (e.g., 295° K) and B is the emission bandwidth of the device in hertz.

(k) Time window. An interval of time in which transmission is desired.

Section 15.305 Equipment authorization requirement.

PCS devices operating under this subpart shall be certificated by the Commission under the procedures in Subpart J of Part 2 of this Chapter before marketing. The application for certification must contain sufficient information to demonstrate compliance with the requirements of this subpart.

Section 15.307 Coordination with fixed microwave service.

(a) UTAM, Inc., is designated to coordinate and manage the transition of the 1910-1930 MHz band from Private Operational-Fixed Microwave Service (OFS) operating under Part 94 of this Chapter to unlicensed PCS operations, conditioned upon submittal to and acceptance by the Commission of:

(1) A funding plan that is equitable to all prospective manufacturers of unlicensed PCS devices; and

(2) A plan for "band clearing" that will permit the implementation of noncoordinatable (nomadic) devices and, in particular, noncoordinatable data PCS devices, as promptly as possible. The responsibilities of UTAM, Inc. include, but are not limited to, relocation of existing OFS microwave stations pursuant to requirements established in ET Docket No. 92-9, negotiating costs of relocation, ensuring that comparable facilities are provided, and resolving any disputes of interference to OFS microwave operations from unlicensed PCS operations. These responsibilities shall terminate upon a determination by the Commission that interference to OFS microwave operations from unlicensed PCS operations is no longer a concern.

(b) Each application for certification of equipment operating under the provisions of this Subpart must be accompanied by an affidavit from UTAM, Inc. certifying that the applicant is a participating member of UTAM, Inc. In the event a grantee fails to fulfill the obligations attendant to participation in UTAM, Inc., the Commission may invoke administrative sanctions as necessary to preclude continued marketing and installation of devices covered by the grant of certification, including but not limited to revoking certification.

(c) An application for certification of a PCS device that is deemed by UTAM, Inc. to be noncoordinatable will not be accepted until the Commission announces that a need for coordination no longer exists.

(d) A coordinatable PCS device is required to incorporate means that ensure that it cannot be activated until its location has been coordinated by UTAM, Inc. The application for certification shall contain an explanation of all measures taken to prevent unauthorized operation. This explanation shall include all procedural safeguards, such as the mandatory use of licensed technicians to install the equipment, and a complete description of all technical features controlling activation of the device.

(e) A coordinatable PCS device shall incorporate an automatic mechanism for disabling operation in the event it is moved outside the geographic area where its operation has been coordinated by UTAM, Inc. The application for certification shall contain a full description of the safeguards against unauthorized

relocation and must satisfy the Commission that the safeguards cannot be easily defeated.

(f) At such time as the Commission deems that the need for coordination between unlicensed PCS operations and existing Part 94 Private Operational-Fixed Microwave Services ceases to exist, the disabling mechanism required by paragraph (e) will no longer be required.

(g) Operations under the provisions of this subpart are required to protect systems in the Private Operational-Fixed Microwave Service operating within the 1850-1990 MHz band until the dates and conditions specified in Section 94.59 of this Chapter for termination of primary status. Interference protection is not required for Part 94 stations in this band licensed on a secondary basis.

(h) The operator of a PCS device that is relocated from the coordinated area specified by UTAM, Inc., must cease operating the device until coordination for the new location is verified by UTAM, Inc.

#### Section 15.309 Cross reference.

(a) The provisions of Subpart A of this Part apply to unlicensed PCS devices, except where specific provisions are contained in Subpart D.

(b) The requirements of Subpart D apply only to the radio transmitter contained in the PCS device. Other aspects of the operation of a PCS device may be subject to requirements contained elsewhere in this Chapter. In particular, a PCS device that includes digital circuitry not directly associated with the radio transmitter also is subject to the requirements for unintentional radiators in Subpart B.

#### Section 15.311 Labelling requirements.

In addition to the labelling requirements of Section 15.19(a)(3), all devices operating in the frequency band 1910-1930 MHz authorized under this subpart must bear a prominently located label with the following statement:

Installation of this equipment is subject to notification and coordination with UTAM, Inc. Any relocation of this equipment must be coordinated through, and approved by UTAM. UTAM may be contacted at [insert UTAM's toll-free number].

#### Section 15.313 Measurement procedures.

Measurements must be made in accordance with Subpart A, except where specific procedures are specified in Subpart D. If no guidance is provided, the measurement procedure must be in accordance with good engineering practice.

#### Section 15.315 Conducted limits.

An unlicensed PCS device that is designed to be connected to the public utility (AC) power line must meet the limits specified in Section 15.207.

Section 15.317 Antenna requirement.

An unlicensed PCS device must meet the antenna requirement of Section 15.203.

Section 15.319 General technical requirements.

(a) The 1910-1920 MHz and 2390-2400 MHz bands are limited to use by asynchronous devices under the requirements of Section 15.321. The 1920-1930 MHz sub-band is limited to use by isochronous devices under the requirements of Section 15.323.

(b) All transmissions must use only digital modulation techniques.

(c) Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in hertz. Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

(d) Power spectral density shall not exceed 3 milliwatts in any 3 kHz bandwidth as measured with a spectrum analyzer having a resolution bandwidth of 3 kHz.

(e) The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

(f) The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

(g) Notwithstanding other technical requirements specified in this subpart, attenuation of emissions below the general emission limits in Section 15.209 is not required.

(h) Where there is a transition between limits, the tighter limit shall apply at the transition point.

(i) Unlicensed PCS devices are subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Section 15.321 Specific requirements for asynchronous devices operating in the 1910-1920 MHz and 2390-2400 MHz bands.

(a) Operation shall be contained within either or both the 1910-1920 MHz and 2390-2400 MHz bands. The emission bandwidth of any intentional radiator operating in these bands shall be no less than

500 kHz.

(b) All systems of less than 2.5 MHz emission bandwidth shall start searching for an available spectrum window within 3 MHz of the band edge at 1910, 1920, 2390, or 2400 MHz while systems of more than 2.5 MHz emission bandwidth will first occupy the center half of the band. Devices with an emission bandwidth of less than 1.0 MHz may not occupy the center half of the sub-band if other spectrum is available.

(c) Asynchronous devices must incorporate a mechanism for monitoring the spectrum that its transmission is intended to occupy. The following criteria must be met:

(1) Immediately prior to initiating a transmission, devices must monitor the spectrum window they intend to use for at least 50 microseconds.

(2) The monitoring threshold must not be more than 32 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth of the device.

(3) If no signal above the threshold level is detected, a transmission burst may commence in the monitored spectrum window. Once a transmission burst has started, an individual device or a group of cooperating devices is not required to monitor the spectrum window provided the intraburst gap timing requirement specified below is not exceeded.

(4) After completion of a transmission, an individual device or cooperating group of devices must cease transmission and wait a deference time randomly chosen from a uniform random distribution ranging from 50 to 750 microseconds, after which time an attempt to access the band again may be initiated. For each occasion that an access attempt fails after the initial inter-burst interval, the range of the deference time chosen shall double until an upper limit of 12 milliseconds is reached. The deference time remains at the upper limit of 12 milliseconds until an access attempt is successful. The deference time is re-initialized after each successful access attempt.

(5) The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission and shall have a maximum reaction time less than  $50 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds. If a signal is detected that is 6 dB or more above the threshold level, the maximum reaction time shall be  $35 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds but shall not be required to be less than 35 microseconds.

(6) The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

(7) Devices that have a power output lower than the maximum permitted under the rules may increase their detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

(d) Emissions shall be attenuated below a reference power of 112 milliwatts as follows: 30 dB between the sub-band edges and 1.25 MHz above or below the sub-band; 50 dB between 1.25 and 2.5 MHz above or below the sub-band; and 60 dB at 2.5 MHz or greater above or below the sub-band.

Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(e) The frequency stability of the carrier frequency of intentional radiators operating in this section shall be  $\pm 10$  ppm over 10 milliseconds or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of  $-20^{\circ}$  to  $+50^{\circ}$  Celsius at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 degrees Celsius. For equipment that is capable of operating only from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

(f) An asynchronous transmission burst is a series of transmissions from one or more transmitters acting cooperatively. The transmission burst duration from one device or group of devices acting cooperatively shall be no greater than 10 milliseconds. Any intraburst gap between cooperating devices shall not exceed 25 microseconds.

(g) Operation of devices in the 2390-2400 MHz band from aircraft while airborne is prohibited, in order to protect space research operations at the National Astronomy and Ionospheric Center at Arecibo, Puerto Rico.

Section 15.323 Specific requirements for isochronous devices operating in the 1920-1930 MHz sub-band.

(a) Operation shall be contained within one of eight 1.25 MHz channels starting with 1920-1921.25 MHz and ending with 1928.75-1930 MHz. Further sub-division of a 1.25 MHz channel is permitted with a reduced power level, as specified in Section 15.319(c), but in no event shall the emission bandwidth be less than 50 kHz.

(b) Intentional radiators with an intended emission bandwidth less than 625 kHz shall start searching for an available time and spectrum window within 3 MHz of the sub-band edge at 1920 MHz and search upward from that point. Devices with an intended emission bandwidth greater than 625 kHz shall start searching for an available time and spectrum window within 3 MHz of the sub-band edge at 1930 MHz and search downward from that point.

(c) Isochronous devices must incorporate a mechanism for monitoring the time and spectrum windows that its transmission is intended to occupy. The following criteria must be met:

(1) Immediately prior to initiating transmission, devices must monitor the combined time and spectrum windows in which they intend to transmit for a period of at least 10 milliseconds for systems designed to use a 10 millisecond or shorter frame period or at least 20 milliseconds for systems designed to use a 20 millisecond frame period.

(2) The monitoring threshold must not be more than 30 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth of the device.

(3) If no signal above the threshold level is detected, transmission may commence and

continue with the same emission bandwidth in the monitored time and spectrum windows without further monitoring. However, occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

(4) Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signalling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.

(5) If access to spectrum is not available as determined by the above, and a minimum of 40 duplex system access channels are defined for the system, the time and spectrum windows with the lowest power level below a monitoring threshold of 50 dB above the thermal noise power determined for the emission bandwidth may be accessed. A device utilizing the provisions of this paragraph must have monitored all access channels defined for its system within the last 10 seconds and must verify, within the 20 milliseconds (40 milliseconds for devices designed to use a 20 millisecond frame period) immediately preceding actual channel access that the detected power of the selected time and spectrum windows is no higher than the previously detected value. The power measurement resolution for this comparison must be accurate to within 6 dB. No device or group of cooperating devices located within 1 meter of each other shall occupy more than three 1.25 MHz channels during any frame period. Devices in an operational state that are utilizing the provision of this section are not required to use the search provisions of (b) above.

(6) If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available.

(7) The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission and have a maximum reaction time less than  $50 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds. If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be  $35 \times \text{SQRT}(1.25/\text{emission bandwidth in MHz})$  microseconds but shall not be required to be less than 35 microseconds.

(8) The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

(9) Devices that have a power output lower than the maximum permitted under the rules may increase their monitoring detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

(10) An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be

decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

(11) An initiating device that is prevented from monitoring during its intended transmit window due to monitoring system blocking from the transmissions of a co-located (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of at least 10 milliseconds. The monitored time and spectrum window must total at least 50 percent of the 10 millisecond frame interval and the monitored spectrum must be within the 1.25 MHz frequency channel(s) already occupied by that device or co-located co-operating devices. If the access criteria is met for the intended receive time and spectrum window under the above conditions, then transmission in the intended transmit window by the initiating device may commence.

(12) The provisions of (c)(10) or (c)(11) shall not be used to extend the range of spectrum occupied over space or time for the purpose of denying fair access to spectrum to other devices.

(d) Emissions shall be attenuated below a reference power of 112 milliwatts as follows: 30 dB between the channel edges and 1.25 MHz above or below the channel; 50 dB between 1.25 and 2.5 MHz above or below the channel; and 60 dB at 2.5 MHz or greater above or below the channel. Systems that further sub-divide a 1.25 MHz channel into X sub-channels must comply with the following emission mask: In the bands between 1B and 2B measured from the center of the emission bandwidth the total power emitted by the device shall be at least 30 dB below the transmit power permitted for that device; in the bands between 2B and 3B measured from the center of the emission bandwidth the total power emitted by an intentional radiator shall be at least 50 dB below the transmit power permitted for that radiator; in the bands between 3B and the 1.25 MHz channel edge the total power emitted by an intentional radiator in the measurement bandwidth shall be at least 60 dB below the transmit power permitted for that radiator. "B" is defined as the emission bandwidth of the device in hertz. Compliance with the emission limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(e) The frame period (a set of consecutive time slots in which the position of each time slot can be identified by reference to a synchronizing source) of an intentional radiator operating in these sub-bands shall be 20 milliseconds/X where X is a positive whole number. Each device that implements time division for the purposes of maintaining a duplex connection on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 50 parts per millions (ppm). Each device which further divides access in time in order to support multiple communication links on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 10 ppm. The jitter (time-related, abrupt, spurious variations in the duration of the frame interval) introduced at the two ends of such a communication link shall not exceed 25 microseconds for any two consecutive transmissions. Transmissions shall be continuous in every time and spectrum window during the frame period defined for the device.

(f) The frequency stability of the carrier frequency of the intentional radiator shall be maintained within  $\pm 10$  ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of  $-20^{\circ}$  to  $+50^{\circ}$  degrees C at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated



supply voltage at a temperature of 20° C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

### Subpart E - Unlicensed National Information Infrastructure Devices

#### Section 15.401 Scope.

This subpart sets out the regulations for unlicensed National Information Infrastructure (U-NII) devices operating in the 5.15 - 5.35 GHz and 5.725 - 5.825 GHz bands.

#### Section 15.403 Definitions.

(a) Average Symbol Envelope Power. The average symbol envelope power is the average, taken over all symbols in the signaling alphabet, of the envelope power for each symbol.

(b) Digital modulation. The process by which the characteristics of a carrier wave are varied among a set of predetermined discrete values in accordance with a digital modulating function as specified in document ANSI C63.17-1998.

(c) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(d) Peak Power Spectral Density. The peak power spectral density is the maximum power spectral density, within the specified measurement bandwidth, within the U-NII device operating band.

(e) Peak Transmit Power. The maximum transmit power as measured over an interval of time of at most 30/B or the transmission pulse duration of the device, whichever is less, under all conditions of modulation.

(f) Power Spectral Density. The power spectral density is the total energy output per unit bandwidth from a pulse or sequence of pulses for which the transmit power is at its peak or maximum level, divided by the total duration of the pulses. This total time does not include the time between pulses during which the transmit power is off or below its maximum level.

(g) Pulse. A pulse is a continuous transmission of a sequence of modulation symbols, during which the average symbol envelope power is constant.

(h) Transmit Power. The total energy transmitted over a time interval of at most 30/B (where B is the 26 dB emission bandwidth of the signal in hertz) or the duration of the transmission pulse, whichever is less, divided by the interval duration.

(i) U-NII devices. Intentional radiators operating in the frequency bands 5.15 - 5.35 GHz and 5.725 - 5.825 GHz that use wideband digital modulation techniques and provide a wide array of high data rate mobile and fixed communications for individuals, businesses, and institutions.

Section 15.405 Cross reference.

(a) The provisions of Subparts A, B, and C of this part apply to unlicensed U-NII devices, except where specific provisions are contained in subpart E. Manufacturers should note that this includes the provisions of Sections 15.203 and 15.205.

(b) The requirements of subpart E apply only to the radio transmitter contained in the U-NII device. Other aspects of the operation of a U-NII device may be subject to requirements contained elsewhere in this chapter. In particular, a U-NII device that includes digital circuitry not directly associated with the radio transmitter also is subject to the requirements for unintentional radiators in subpart B.

Section 15.407 General technical requirements.

(a) Power limits:

(1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10\log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10\log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.825 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 1 W or  $17 \text{ dBm} + 10\log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing

high gain directional antennas are used exclusively for fixed, point-to-point operations.

NOTE: The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

(4) The peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement conforming to the above definitions for the emission in question.

(5) The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

(6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

(b) Undesirable Emission Limits: Except as shown in Paragraph (b)(6) of this Section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

(3) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

(4) The above emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

(6) The provisions of § 15.205 of this part apply to intentional radiators operating under this section.

(7) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

(c) The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signalling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

(d) Any U-NII device that operates in the 5.15-5.25 GHz band shall use a transmitting antenna that is an integral part of the device.

(e) Within the 5.15-5.25 GHz band, U-NII devices will be restricted to indoor operations to reduce any potential for harmful interference to co-channel MSS operations.

(f) U-NII devices are subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.