

FCC AND ELECTRICAL INTERFERENCE

In the 1977 edition of *ITEM*, we presented FCC Docket No. 20780, dated April 23, 1976. This docket eventually will amend Part 15 of the FCC rules and will have a major impact on all electronic equipment manufactured for sales in the United States. Rather than the entire amendment being enforced at one time, it is anticipated that the FCC will enact selected parts over a period of time, starting in early 1978, while allowing manufacturers one year to change existing designs for compliance. Thus, before *ITEM* '79 is published, some of the new FCC rules will be enforced.

Due to the lack of space, the appendix to the subject docket was omitted, except for the table of man-made sources of radio interference. This table is quite important, especially the "Electronic Equipment" listing under "Unintentional Radiators" and Note 2. In this issue, selected portions of the appendix are presented, including a repeat of the table. It is advisable, however, to contact the FCC, Washington, DC 20554, and to obtain a full copy of the docket.

It would appear the CBEMA (Computer and Business Equipment Manufacturers Association) is the only organization which has expended a significant effort to evaluate the proposed rule making, and it is likely that the FCC will accept some of their recommendations. CBEMA, for instance, recommends the addition of broadband limits; but, makes claims that there are practically no cases on record where computers have caused interference to radio communications. (They apparently have not surveyed many consultants.) Obviously, and understandably, the CBEMA reports are biased to the point of view of computer manufacturers. The FCC is well aware of this and welcomes other comments. The latest CBEMA report (No. ESC 5/77/29) is available free, in limited quantities, by writing to: Director, Telecommunications Programs, CBEMA, Suite 1200, 1828 "L" Street N.W., Washington, DC 20036.

The following are excerpts from the appendix of FCC Docket No. 20780:

15.4 General definitions

(d) **Restricted radiation device.** A device, system, or apparatus which intentionally generates (produces) electromagnetic energy above 120 kHz.

NOTE: CATV Systems as defined in Part 76, ISM Equipment as defined in Part 18 and transmitters which are licensed under the Part in which they are intended to operate are not subject to the provisions of this Part.

(f) **Low Power Communication Device.** A restricted radiation device used for the transmission of signs, signals (including control signals), writing, images, sounds or intelligence of any nature through space.

(n) **Carrier Current System.** A system, in which a restricted radiation device transmits RF energy over wires, or any other conductor, to a receiving device connected to the same conductor or system of conductors.

(o) **RF Power Supply.** A power supply in which the supply voltage is switched or chopped at a rate greater than or equal to 10 kHz for the purpose of obtaining a new supply voltage.

(q) **Electronic Game.** A restricted radiation device designed to be operated for the purpose of amusement or recreation.

15.13 General requirement for a restricted radiation device. A restricted radiation device shall comply with the following requirements:

(b) **Radiation Limit.** All emissions from the device, including any network of conductors and/or apparatus connected thereto, shall not exceed the level of field strengths specified in the table below. The measurement procedure and the range of measurements to determine compliance with these limits shall be in accordance with 15.141 and 15.142, respectively. In addition, the device shall be designed to minimize the likelihood of emissions on the aeronautical and maritime safety frequencies and amateur frequencies.

NOTE: Until further notice, carrier current systems operated by a public service utility company and test equipment are exempt from complying with the radiation limit.

TABLE 1

| Frequency (F) (kHz) | Distance (meters) | Field Strength (μ V/m) |
|------------------------|----------------------|--------------------------------|
| 10 - 500 | 300 | 2400/f |
| 500 - 1600 | 30 | 24000/F |
| above 1600 | 3 | 100 |

- (1) The tighter limit shall apply at the edge between two frequency bands.
- (2) Distance refers to the distance in meters between the measuring instrument antenna and the closest point of any part of the device or system.
- (3) F is the frequency in kHz of the emission under investigation.

(c) **Conducted Limit.** All conducted emissions from a device, or accessory marketed therewith, intended to be connected to the power lines of a public utility system shall not exceed the level of voltage specified in the table below. The procedure for determining compliance with these limits must be in accordance with Section 15.141 of this part. Carrier current systems in which the RF voltage is designed to be coupled into power lines are exempt from this requirement.

TABLE 2

| Frequency (MHz) | Voltage (μ V) |
|-----------------|--------------------|
| 0.1 - 0.45 | 1000 |
| 0.45 - 1.6 | 200 |
| 1.6 - 25 | 100 |

NOTE: The tighter limit shall apply at the edge between two frequency bands.

(d) **Noninterference requirement.** Notwithstanding the compliance with the technical specification in this section, the operation of each restricted radiation device is subject to the general conditions of Section 15.3. The operator of a restricted radiation device may be required to cease operation of his device upon a finding that the device is causing harmful interference and it is in the public interest to stop operation until the interference problem has been corrected.

The title and text of Section 15.111 is revised to read as follows:

15.111 Operation below 70 MHz.

A low power communication device or system may be operated without an individual license on any frequency between 10 kHz and 70 MHz subject to the following conditions:

(b) If the device or system is intended to be connected to the power lines of a public utility system, the radio frequency voltage measured between each power line and ground at the power terminal of the device when measured pursuant to 15.141 shall not exceed Table 2.

(c) All emissions from the device, including any network of conductors and/or apparatus connected thereto, shall not exceed the level of field strengths specified in Table 1. The measurement procedure and the range of measurements to determine compliance with these limits shall be pursuant to 15.141 and 15.142, respectively. In addition, the device shall be designed to minimize the likelihood of emissions on the aeronautical and maritime safety frequencies and amateur frequencies.

15.112 Alternative provisions for operation between 150-190 kHz.

In lieu of meeting the requirements of 15.111, a low power communication device which is built by a person for his own use in a quantity not to exceed five units, may operate on any frequency in the band 160-190 kHz provided it meets all the following conditions:

(e) If the device or system is intended to be connected to the power lines of a public utility system, the radio frequency voltage measured between each power line and ground at the power terminal of the device when measured pursuant to 15.141 shall not exceed Table 2.

15.113 Alternative provisions for operating between 510 and 1600 kHz.

In lieu of meeting the requirements of Section 15.111, a low power communication device which is built by a person for his own use in a quantity not to exceed five units, may operate on any frequency in the band 510-1600 kHz provided it meets all the following conditions:

(f) If the device or system is intended to be connected to the power lines of a public utility system, the radio frequency voltage measured between each power line and ground at the power terminal of the device when measured pursuant to 15.141 shall not exceed Table 2.

15.115 Interim requirements for operation between 26.97 and 27.27 MHz.

(f) If the device or system is intended to be connected to the power lines of a public utility system, the radio frequency voltage measured between each power line and ground at the power terminal of the device shall not exceed the limits in Table 2 when measured pursuant to 15.141.

15.118 Technical Specification for the band 48.82-49.90 MHz.

(h) If the device or system is intended to be connected to the power lines of a public utility system, the radio frequency voltage measured between each power line and ground at the power terminal of the device shall not exceed the limits of Table 2 when measured pursuant to 15.141.

15.120 Operation above 70 MHz.

(e) If the device or system is intended to be connected to the power lines of a public utility system, the radio frequency voltage measured between each power line and ground at the power terminal of the device shall not exceed the limits of Table 2 when measured pursuant to 15.141.

15.132 Labelling and Identification Requirements.

A device subject to certification by the Commission shall be identified pursuant to 2.1045 of this Chapter. Each device shall have permanently and visibly affixed an identification label containing information shown on the sample label below.

FCC IDENTIFICATION DATA (Name)

Model No: (Unique Identifier)

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

(Date of Manufacture or Construction)

15.134 Certification and Identification of a Communication System.

Each low power communication system in which compliance with the technical provisions of this Subpart is dependent on the antenna and/or system configuration (e.g., a campus radio system, a wireless drive-in theater announcing system, wireless industrial controls) shall comply with the following requirements:

(a) A sufficient number of checks and tests shall be made on the system to ensure compliance with the appropriate technical requirements.

(b) A loop antenna shall be used for measurements on frequencies below 18 MHz, and a dipole antenna shall be used for measurements on frequencies from 30 to 1000 MHz. Either a loop or dipole antenna shall be used on frequencies between 18 MHz and 30 MHz. Appropriate techniques shall be resorted to for measurements in the microwave region of the spectrum. A sufficient number of measurements at the specified distance around the system perimeter shall be made to ensure compliance. If the load on the system is expected to vary so as to affect the level of the field, as in the case of a campus radio station connected to the power lines, the system shall be measured at different times to ensure compliance. These tests must be made at the completion of the initial installation of the system, after each modification and at least once a year thereafter.

(c) The test results, signed by the individual responsible for installation and a complete description of the system, shall be made available to an FCC representative upon reasonable request. The most recent measurement report should be retained for a period of 5 years.

(d) A statement containing the following information shall be permanently attached to the transmitter or to each transmitter, if more than one is used in the system. The statement must be signed by the individual who constructed and tested the device or system for compliance. A responsible official of the company or institution where the system is installed must also sign the statement.

"This system was tested on (date) and found to comply with applicable provisions of FCC Rules Part 15. The operator of this system understands that operation is on a sufferance basis and must accept any interference that is received. A copy of the description and measurement report of the system is located at _____."

Name of Person Attesting Compliance:

(Print Name) _____ (Signature) _____

Name of Company or Organization Operating System:

(Name) _____ (Signature of Responsible Official) _____

(e) For a communication system certificated under Section 15.131(d), the following identification label shall be used in lieu of the above label.

FCC IDENTIFICATION

(Name)

Model No: _____

(Manufacturer) certifies that this system can be expected to comply with FCC Rules Part 15 when installed in

exact accordance with the instructions provided.

I, (Print Name of Installer), certify that the system was installed in exact accordance with the instructions provided by the manufacturer.

Signature _____ (Installer)

Date Installed _____

Any modification of the system invalidates this certification. Operation is subject to the following two conditions: (1) The system must not cause harmful interference (2) The system must accept any interference that may cause undesired operation.

Name of Company Operating System

(Name) _____ (Signature of Responsible Official) _____

18. Section 15.141 is revised to read as follows:

15.141 Measurement Procedure

(a) Any measurement procedure acceptable to the Commission may be used to show compliance with the requirements of this Part. A detailed description of the proposed measurement procedure, including a list of the test equipment to be used, shall be submitted to the Commission when requesting a determination regarding the acceptability of the proposed measurement procedure.

(b) The procedures delineated in 15.75(b) (1) through (b) (5) for conducted and radiation measurements from broadcast receivers may be used for other devices when appropriately modified. Commonly, the antenna used with the device under test and the set-up of the device on the test site must be modified. If one of these methods is used, the statement regarding measurement procedure should indicate the standard used and should describe the modifications that were made.

NOTE: Where such devices are provided with a ground connection, whether separate from or included in the power supply cable, measurements of power line conducted radio frequency voltages shall be made both with such ground connection attached and with it disconnected. Whichever condition produces the highest radio frequency voltage on any power condition will be considered to be the limiting condition. Tests using MIL-STD-461A are not acceptable, since this standard requires bonding the device to ground and testing it in that condition.

(e) A loop antenna shall be used for measurements on frequencies below 18 MHz and a dipole antenna shall be used for measurements on frequencies from 30 to 1000 MHz. Either a loop or dipole antenna shall be used on frequencies between 18 MHz and 30 MHz. Appropriate techniques shall be resorted to for measurements in the microwave region of the spectrum. If the system is not self-contained, measurements shall be made on two or more typical installations of the system. A sufficient number of measurements at the specified distance around the perimeter of the system must be made to ensure compliance. If the load on the system is expected to vary so as to affect the electromagnetic field, as in the case of a campus radio station connected to the power lines, the system shall be measured under the expected variations of the load.

15.142 Range of Measurements.

Measurements of radiated energy from a restricted radiation device shall be made over the frequency range listed below.

| Frequency band in which the device operates | Range of frequency measurements | |
|---|--|-------------------------|
| | Lowest frequency | Highest frequency (MHz) |
| Below 1600 kHz | 10 kHz | 20 |
| 1.6 - 70 MHz | Lowest RF frequency produced or used in the device. | 500 |
| 70 to 108 MHz | Lowest frequency generated in the device or 25 MHz, whichever is lower. | 1000 |
| 108 to 500 MHz | Lowest frequency generated in the device or 25 MHz, whichever is lower. | 2000 |
| 500 to 1000 MHz | Lowest frequency generated in the device or 100 MHz, whichever is lower. | 5000 |

15.143 Report of Measurements.

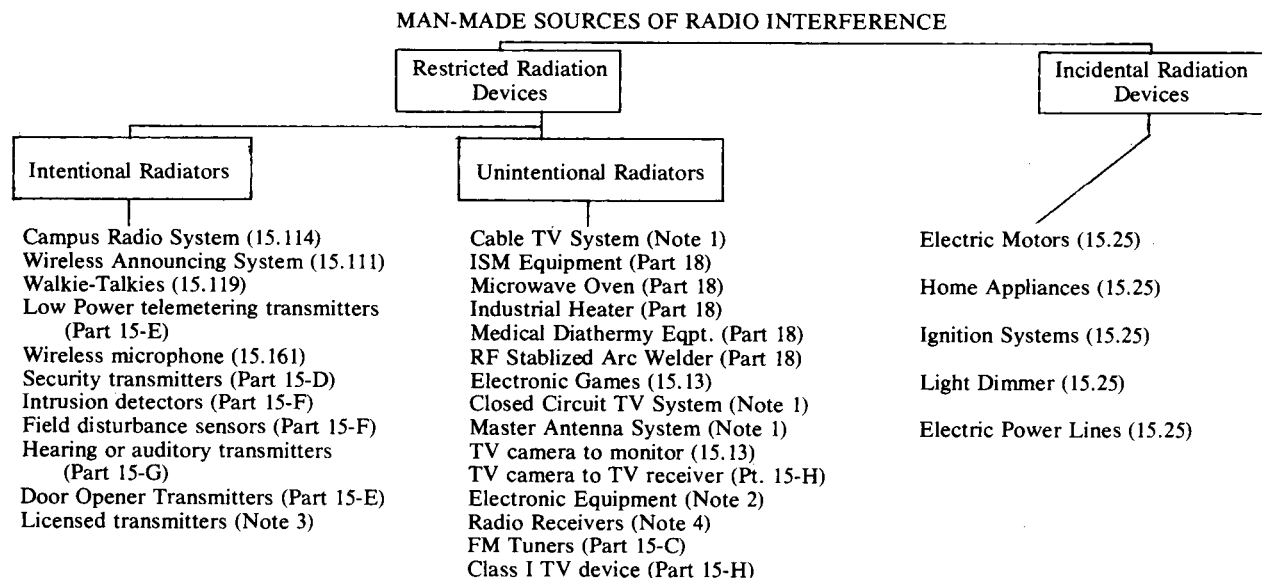
The report of measurements for a device operating under the provisions of this Part and built after October 1, 1975, shall include the following:

(b) A detailed description of the measurement procedure that was used. If a published standard was used, reference to the standard is sufficient. If the standard was not followed in every detail, describe how the actual procedure used differed from that in the standard. If the device or system is not self-contained, a detailed description of the typical installation(s) used to test the system must also be included.

(1) Measurements of the level of conducted RF energy fed back into the power line, if the device or system is connect-

ed to the power lines of a public utility system. Where such devices are provided with a ground connection, whether separate from or included in the power supply cable, measurements of power line conducted radio frequency voltages shall be made both with such ground connection attached and with it disconnected. Whichever condition produces the highest radio frequency voltage on any power condition will be considered to be the limiting condition. Tests using MIL-STD-461A are not acceptable, since this standard requires bonding the device to ground and testing it in that condition. The report must show the frequency and amplitude of all emissions in the range 0.45 to 25 MHz that are within 20 dB of the limit. If no significant emissions are detected, the report must so state and state the level below which emissions are not detectable. In lieu of the point by point measurements, the applicant may submit one or more photographs of a spectrum analyzer display covering the band 0.45 to 25 MHz. Such a photograph must show a frequency scale along the abscissa and a scale calibrated in microvolts (or in dB provided the value of OdB is stated) along the ordinate. A statement accompanying the photograph shall indicate all settings of the instrument, including the sweep rate and bandwidth.

(m) For a transmitting device intended to be operated in a carrier current system, for a low power communication device operating below 1600 kHz, or for any other device in which the radiated energy is dependent on the antenna and/or system configuration, a number of different typical system configurations must be tested to demonstrate compliance. In each case describe the network, show where and how the device generating the RF energy is connected and indicate on a scale drawing the location of the measurement points.



NOTES:

1. Cable Television Systems, including component parts thereof, as defined in Section 76.5 are regulated under Part 76. Any system, including component parts thereof, that feeds television signals over cable and which falls outside the definition of a cable television system in Part 76 is subject to the provisions in Part 15.
2. Electronic equipment includes such devices as: computers, digital weight scales, data processing equipment, tape recorders, electronic watches, switching power supplies, any device incorporating digital techniques, AM broadcast receivers, digital displays, etc. are subject to S15.13.
3. A transmitter which requires licensing is subject to the rules of the service in which it is licensed, e.g., a broadcast transmitter is licensed in the Broadcast Radio Service under Parts 73 and 74.
4. All receivers that operate (tune) between 30 - 890 MHz are subject to the provisions in Subpart C of Part 15. Included within this category are: land mobile communication receivers, aeronautical communication/navigation receivers, maritime receivers, security receivers, FM and TV broadcast receivers. Receivers that do not operate (tune) in the range of 30-890 MHz are subject to S15.13.