

FCC AND ELECTRICAL INTERFERENCE

During the summer of 1976, a very important rule making was proposed by the FCC. When enforced, this amendment to Part 15 of the FCC Rules will have a major impact on all electronic equipments manufactured for sales in the United States. The following is the pending proposed rule making as of Dec. 23, 1976.

Amendment of Part 15 to redefine and clarify the rules governing restricted radiation devices and low power communication devices.

Docket No. 20780

NOTICE OF PROPOSED RULE MAKING Released: April 23, 1976

Part 15 of the Commission's rules sets out the conditions under which a device capable of producing radio frequency (RF) energy may be operated without an individual license. Of particular concern in this proceeding are restricted radiation devices subject to the general requirements of 47 CFR 15.7 and low power communications devices subject to 47 CFR 15.101 et seq. The former is a device in which RF energy is incorporated in its design and the latter is a device designed to radiate RF energy for the purpose of transmitting messages through space. Examples of restricted radiation devices include computers, RF power supplies, electronic games, electronic watches and calculators, tape recorders. Examples of low power devices include walkie talkies, wireless announcing systems, wireless security alarms.

Part 15 is based upon the rationale that a device complying with the provisions contained therein will, in general, not be a source of harmful interference to radio communications. The technical limitations in Part 15 are designed to ensure this by setting a fixed maximum radiation for various devices. An additional requirement that they do not cause interference is placed on the operation of these devices in recognition of the fact that even at the extremely low radiation limits they will in some circumstances cause interference. This means that the operator of a Part 15 device is obliged to correct any interference that is caused, even when the device is in compliance with the technical specifications in Part 15. To provide some assurance to the consumer that the device he purchased in good faith, can be expected to comply with the Commission's technical requirements and therefore provide reasonably assurance, that it will not be a source of interference, the manufacturer and distributor of such devices have a legal responsibility, under our marketing rules¹, to ensure that the device complies with the Commission's rules. Notwithstanding these hurdles, the number of RF devices operating under Section 15.7 are numerous and all avoid the burden of being individually licensed.

The general requirements for restricted radiation devices, Section 15.7, adopted in 1938 and carried over into Part 15 in 1948, are no longer considered suitable for the numerous devices under its purview. This proceeding is initiated to clarify and further define these requirements, to recognize and define certain specific devices and in a few cases, to establish new requirements. Minor revisions are also proposed in the rules governing general purpose low power communication devices. These are primarily intended to clarify and minimize problems in determining whether a device should be classified as a low power communication device subject to Subpart D of Part 15 or a restricted radiation device subject to Section 15.7. The proposed changes are appended to this Notice.

RESTRICTED RADIATION DEVICES

A restricted radiation device is defined in Section 15.4 (d) as follows:

S15.4 (d) Restricted Radiation Device. A device in which the generation of radio frequency energy is intentionally incorporated into the design and in which the radio frequency energy is conducted along wires or is radiated, exclusive of transmitters which require licensing under other parts of this chapter and exclusive of

devices in which the radio frequency energy is used to produce physical, chemical or biological effects in materials and which are regulated under the provisions of Part 18 of this chapter.

The present text of Section 15.7 reads as follows:

S15.7 General requirements for restricted radiation devices.

Unless regulated under some other subpart of this part, any apparatus which generates a radio frequency electromagnetic field functionally utilizing a small part of such field in the operation of associated apparatus not physically connected thereto and at a distance not greater than $157,000/F(\text{kHz})$ feet (equivalent to $\lambda/2\pi$) need not be licensed provided:

- That such apparatus shall be operated with the minimum power possible to accomplish the desired purpose.
- That the best engineering principles shall be utilized in the generation of radio frequency currents so as to guard against interference to established radio services, particularly on the fundamental and harmonic frequencies.
- That in any event the total electromagnetic field produced at any point a distance of $157,000/F(\text{kHz})$ feet (equivalent to $\lambda/2\pi$) from the apparatus shall not exceed 15 microvolts per meter.
- That the apparatus shall conform to such engineering standards as may from time to time be promulgated by the Commission.
- That in the event harmful interference is caused, the operator of the apparatus shall promptly take steps to eliminate the harmful interference.

NOTE: Radio receivers, cable television systems, Class I TV devices, and low power communications devices are regulated elsewhere in this chapter and are not regulated by this section.

In applying Section 15.7 to modern equipment, several difficulties become apparent. A major area of confusion arises from the language in the introductory paragraph. Although the language therein would appear to limit the application only to devices that are used to operate associated apparatus not physically connected to the generating device, this regulation has been applied to systems (RF generator, wiring and associate apparatus) where the generator is physically connected to the associated apparatus or to equipment where no associated equipment exists. The Commission has consistently held that Section 15.7 applies to such devices on the basis that the interfering effect is not significantly reduced by virtue of the fact that the radiated RF energy is partially used to operate associated equipment.

The rule is also silent on devices which are physically connected to associated apparatus. It could be argued that devices so connected are not regulated by Section 15.7. However, the interference potential of a system is a function of the field strength generated by the device and the use of a physical connection does not necessarily assure that the field strength will be low enough not to cause interference. On the contrary, it can readily extend the sphere of RF interference to areas adjacent to the physical connection. Therefore, this section is applied by the Commission to devices which are in fact connected by a conductive means to associated apparatus. This means that the RF energy around the conductor as well as that generated by a device must meet the field limit in Section 15.7. The proposed rules appended hereto are designed to clarify these points.

Another major problem is the field strength limit of 15 microvolts per meter ($\mu\text{V/m}$) at a distance of $\lambda/2\pi$, where λ is the wavelength of the frequency of interest. This limitation is extremely difficult to evaluate. The distance $\lambda/2\pi$ is inversely proportional to frequency and is equivalent in feet to 157,000 divided by the frequency in kilohertz. For example, at a frequency of 1000 kHz, this distance is 157 feet, whereas, at 100 MHz, this distance is 1.57 feet. At low frequencies, measurements to determine compliance with the limit are difficult because the distance is too large. At very high frequencies, the required distance may be too close for practical measurements. Moreover, the value 15

$\mu\text{V/m}$ is at or below the sensitivity of many measuring devices. The problem of measuring a weak field can be overcome by measuring at a closer distance to the source where the field is stronger. This, however, introduces other uncertainties. Because of the complex nature of the field at these distances, it is difficult to extrapolate the measured value to the $\lambda/2\pi$ distance for comparison with the regulatory requirement.

Another problem with the limit concerns modern devices which operate at high speed and/or which produce high frequency emissions. For such devices, the $\lambda/2\pi$ limit (more precisely, $15 \mu\text{V/m}$ at $\lambda/2\pi$) may be unnecessarily stringent. For example, many modern computers are extremely fast and have emissions which reach well up into the VHF and UHF region of the frequency spectrum where the $\lambda/2\pi$ distance is one foot and less. This short distance presents several difficulties. A new limit, which does not vary with frequency, may therefore be desirable.

While the $\lambda/2\pi$ limit has been very useful over the years, we are now proposing to abandon it, and to replace it with a table of radiation and conduction limits. As before, the proposed limits are designed to provide reasonable assurance that under normal conditions a subject device is not likely to become a source of harmful interference to radiocommunications. At the same time, the new limits are designed not to place an unreasonable burden on the manufacturer.

CARRIER CURRENT SYSTEMS

The Commission considers a transmission system in which RF energy is transferred from one point to another over some form of a conductor (typically a metallic wire) as a carrier current system. In a system using this technique both the sender and the receiver of the RF energy are physically connected to the conductor carrying the energy. Of course there is a RF field around the conductor and some of the energy leaks into space, but the basic medium of transmission is along the conductor. In the past, these systems have been classified as restricted radiation devices subject to the general requirements of Section 15.7. In this proceeding, we are proposing rules to deal specifically with such systems.

Public utilities use carrier current systems extensively for performing a number of switching and controlling functions. Typically, these systems are designed to have minimal interference effects. Experienced technicians maintain these systems, performance is checked periodically and any interference problem caused by such operation receives immediate attention. Since these systems are not considered a significant source of interference, the technical requirements proposed for carrier current systems which are operated by less qualified personnel are not being applied to such systems. Carrier current systems operated by public utilities are proposed to be exempted from meeting specific technical requirements, but will be required to meet the non-interference clause of Section 15.3.

LOW POWER COMMUNICATIONS DEVICES

A restricted radiation device used for the purpose of transmitting any type of message (including control signals, signs, images, etc.) is considered by the Commission to be a low power communication device (see 47 CFR Section 15.4 (f)). Subject to certain technical and certification requirements, such a device may be used for any legitimate purpose without an individual license. The technical regulation governing a low power communication device operating below 1600 KHz was derived from Section 15.7 which governs the operation of the general restricted radiation device. Although these regulations are basically similar, there are enough differences that the user has tended to classify his device on the basis of which regulation gave him more liberal operating privileges, rather than on the basis of the definitions in Section 15.4. To minimize these problems, the same technical and certification requirements are being proposed for both classes of devices. In addition, because a device connected to a power line has the potential for causing interference to other devices connected to the same power line as discussed in paragraph 9 supra, a limit on conducted RF energy is being proposed for all low power devices designed to be connected to power lines.

The controlling technical limitation for a low power communication device operating on a frequency below 1600 KHz is a limit on the RF energy that is actually radiated into space. This limit is set out in Section 15.111. In lieu of meeting this radiation limit, a low power communication device operating on a frequency in the bands 160-190 KHz or 510-1600 KHz may as an alternative meet the antenna and power limitations in Sections 15.112 and 15.113, respectively. These provisions were intended to make it feasible for a radio enthusiast to construct and operate a low power radio, since it is reasonable to assume that the average hobbyist or experimenter would not have the capability of making field strength measurements. It has come to our attention, that manufacturers are taking advantage of the alternative provisions to market devices, which, because of the greater efficiency of the new technology, actually operate with radiated signals in excess of those permitted by Section 15.111. Since the interference potential of a device is directly related to the field strength of the radiated field and not the power fed into the antenna, and since a device which is widely marketed to the general public has a much greater potential for causing interference than a device built by an individual for his own use, we are proposing to restrict the alternative provisions to home built devices. The test for these changes are in proposed Sections 15.112 and 15.113.

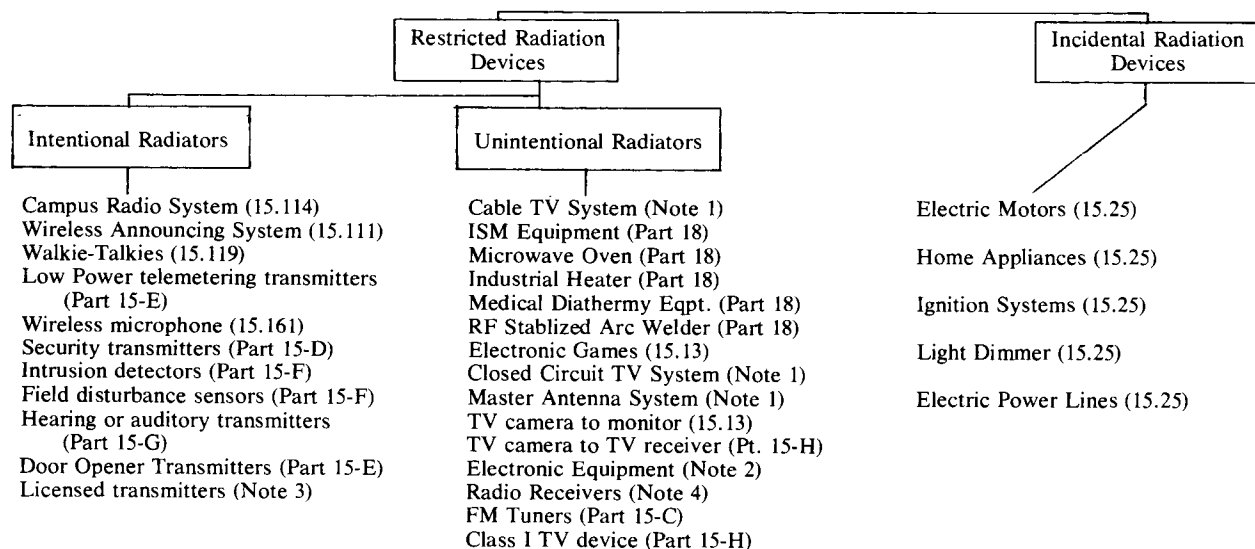
A number of low power communication devices, such as the toy walkie talkie, are marketed as self-contained devices. For these devices, measurements can be made on one or two devices and the results can be expected to be representative of similarly manufactured devices. However, a large number of low power communication devices are marketed without an antenna of a prescribed length and configuration. Instead, the antenna may be of variable length and/or configuration. An example of this type of system is the industrial remote control systems in which the transmitter output is fed into one or two wires laid around the perimeter of the area to be covered. A certain amount of the energy is radiated from the wires and picked up by a near-by receiver. In this case, the level of radiated energy is dependent on the antenna and system configuration. Consequently, measurements to determine exact compliance with the present limits can only be made after the complete system is installed, meaning that each individual system of this type must be certificated by the Commission under the present rules. Inasmuch as this may be unnecessarily stringent for systems which are widely marketed, a procedure is being proposed for certificating a low power communication system based on measurements which are representative of that system.

DATA PROCESSING EQUIPMENT

The limitations of the $\lambda/2\pi$ rule for regulating devices producing high frequency emissions is discussed in paragraph 8, supra. They are particularly applicable to high speed computers and data processing equipment. The proposed technical requirements are designed to provide reasonable assurance that such devices will not be a source of radio interference while at the same time not place an unreasonable burden on the manufacturer. However, there is reason to believe that the proposed technical requirements may still be too stringent for many commercially operated computers and Data Processing Equipment (DPE). This is based on several considerations. One is an interim report released by the Computer and Business Equipment Manufacturers Association (CBEMA) on "Narrowband RF Emanations from Electronic Data Processing Equipment and Office Machines."² Secondly, we have received information about a draft proposal by the European Computer Manufacturers Association, which indicates the proposed limit may be too stringent. Additional factual information is needed, however, to confirm this.

A distinction is being made between equipment used commercially and equipment which is widely marketed to the general public, such as hand held electronic calculators. Commercial equipment is not likely to become a source of interference to radio communication. If an interference problem occurs, corrective measures can be taken. Consumer products, on the other hand, are widely distributed, are harder to control once distributed, usually do not have the same technical sophistication as commercial equipment, and typically do not receive the same preventative maintenance.

MAN-MADE SOURCES OF RADIO INTERFERENCE



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.

MARKETING AND CERTIFICATION

The marketing rules, as stated above, proscribe the sale, distribution, lease, offer for sale, etc. of an RF device until it has been demonstrated to comply with the rules adopted by the Commission. For many devices, this includes obtaining an equipment authorization from the Commission as well as complying with certain technical specifications. The marketing rules and the equipment authorization program are designed to protect the unsuspecting consumer by insuring that a RF device which is widely distributed will not become a source of harmful interference. This is based on the consideration that it is easier to prevent interference by checking the interference potential of the device at the source (manufacturer), rather than to correct the problem once the device is widely distributed to the public. Moreover, prior to the adoption of these rules, the Commission was often forced to move against the operator (typically a consumer) when it was discovered that his device, which was purchased in good faith, was causing harmful interference.

Concomitant with the staggering increase in numbers of communications devices and systems in recent years, there has been a corresponding increase in the demand for available spectrum space. As a result, the RF spectrum must be carefully managed to ensure its maximum utilization. Under the present rules, a RF device subject to Section 15.7 may be operated without an equipment authorization from the FCC. Consequently, the Commission has no vehicle to alert it to the intended distribution of a new RF device and no mechanism to determine prior to distribution that such a device does in fact comply with our Rules. The above factors have led to instances in which the Commission became aware, after the fact, that a number of these devices did not meet the technical requirements of Section 15.7. An example of this problem is the electronic game. The commission recently became

aware that some video electronic games do not comply with the technical specifications in Section 15.7. Unfortunately, this was discovered only after they were widely distributed and causing interference to public safety radio communications.

In view of the above, the Commission is proposing to require certification for those restricted radiation devices which have a relatively high interference potential and/or are widely distributed to the public. Certification is being proposed for the following equipment: (1) electronic games which use RF energy; (2) RF (switching) power supplies; (3) wireless intercoms; (4) any restricted radiation device which uses RF energy for the purpose of communications. Additional devices will be added to the list as the need indicates. It is proposed that the certification requirement for the above devices shall go into effect six months after the effective date of such rules as may be promulgated in this proceeding.

REFERENCES

1. 47 CFR 2.801 et seq. Adopted 5-13-70, Report and Order of Docket 18426. Briefly stated the rules prohibit the sale, lease, importation, shipment, distribution for the purpose of sale, or lease of devices capable of causing harmful interference to radio communications, unless such device complies with the pertinent technical standards and has the appropriate equipment authorization, if required.
2. The CBEMA report (No. CBEMA/ESC5/75/31) is incorporated in the docket folder as part of this proceeding and is also available in limited quantities from Director, Telecommunications Programs, CBEMA Suite 1200, 1828 L St., N.W., Washington, D.C. 20036.