105 CMR 122.000: NONIONIZING RADIATION LIMITS FOR: THE GENERAL PUBLIC FROM NON-OCCUPATIONAL EXPOSURE TO ELECTROMAGNETIC FIELDS, EMPLOYEES FROM OCCUPATIONAL EXPOSURE TO ELECTRO-MAGNETIC FIELDS, AND EXPOSURE FROM MICROWAVE OVENS

Section

122.001: Purpose and Scope

The purpose of 105 CMR 122.000 is to prevent possible harmful effects to the general public from exposure to electromagnetic fields in the frequency range of 300 kHz to 100 GHz and to employees from occupational exposure to electromagnetic fields in the frequency range of 10 kHz to 100 GHz. 105 CMR 122.000 applies to:

(A) Any fixed facility which generates an electromagnetic field in the frequency range of 300 kHz to 100 GHz within the Commonwealth of Massachusetts;

(B) Any person who operates or who controls the operation of any facility described in 105 CMR 122.001(A). In the case of a facility that requires an FCC license to operate, the FCC licensee would be that person. Compliance with the provisions of 105 CMR 122.000 is the responsibility of the person who operates or who controls the operation of any facility described in 105 CMR 122.001(A);

(C) Any occupational exposure of employees by a facility, machine, device, product, or system, whether fixed, mobile or portable, generating electromagnetic fields between 10 kHz and 100 GHz ; and to,

(D) Any person or employer who operates or who controls the operation of a machine, device or system described in 105 CMR 122.001(C). In the case of a facility that requires an FCC (Federal Communication Commission) license, the FCC licensee would be that person.

Nothing in 105 CMR 122.000 shall limit the kind or amount of electromagnetic radiation in the frequency range of 300 kHz to 100 GHz that may be intentionally administered to an individual by a person licensed to so administer such radiation under the laws of the Commonwealth.

Should 105 CMR 122.000, as it applies to FCC licensees, conflict with any Federal Regulations, Standards or Guidelines, other than those pertaining to exposure of the general public, consideration shall be given to such Federal Regulations, Standards or Guidelines if requested by the affected facility.

122.002: Authority

105 CMR 122.000 is promulgated by the Department of Public Health under the authority of M.G.L. c. 111, §§ 3, 5, 5M, 5N, 5O and 5P, and pursuant to the provisions of M.G.L. c. 30A**,** § 2 and under the authority of M.G.L. c. 149, §§ 2, 5, and 6 through a memorandum of understanding between the Department of Public Health and the Department of Labor.

122.003: Citation

105 CMR 122.000 shall be known, and may be cited as 105 CMR 122.000: Nonionizing Radiation Limits For; The General Public From Non-occupational Exposure to Electromagnetic Fields, Employees From Occupational Exposure to Electromagnetic Fields, And Exposure from Microwave Ovens. 105 CMR 122.000 may also be cited by the short form of citation which is "Nonionizing Radiation Exposure Limit Regulations."

122.004: Effective Date

105 CMR 122.000 and any subsequent amendments thereto, shall be effective 30 days following their publication in the Massachusetts Register.

122.005: Penalty for Violation

The penalty for violation of 105 CMR 122.000 shall be those contained in the provisions of M.G.L. c. 111, §§ 5O, 5P, M.G.L. c. 149, § 6 and any other applicable state law. Each violation shall be treated separately. When the violation is a continuing one, each day of the violation constitutes a separate offense.

122.006: Definitions

As used in 105 CMR 122.000, the following words and phrases shall have the following meanings:

Accessible to the Public means areas not under the control of owner or operator of the facility.

Amateur means a person owning or operating a radiofrequency machine as a hobby.

Declared pregnant woman means a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

Department means the Massachusetts Department of Public Health.

Director means the Director of the Radiation Control Program of the Massachusetts Department of Public Health.

Duty cycle means the time that the RF field is on, divided by the sum of the time the RF is on and off, during the operation cycle.

Employer means any person, firm, organization or other legal entity having the control or right to control a source of electromagnetic radiation, including but not limited to proprietor, lessee, and/or bailee.

Effective Radiated Power (ERP) means the power supplied to an antenna multiplied by the relative gain of the antenna in a given direction compared to a reference antenna. Below 1 GHz, and if unspecified, the reference antenna is a dipole. For frequencies above or equal to 1 GHz, the reference antenna is an isotropic antenna. The term effective radiated isotropic power is customarily used for frequencies equal to or above 1 GHz.

Exposure occurs whenever and wherever an individual is subjected to electric, magnetic, or electromagnetic fields, taking into account both level of field strength and length of time.

External surface means the outside surface of the cabinet or enclosure provided as part of the RF machine source, including doors, door handles, latches, and control knobs.

122.006: continued

Facility means any location in which one or more radiofrequency machine(s) is (are) located, and which is owned, controlled, or maintained by the same person. In the case where a structure has multiple sources, each person who owns, controls, or maintains a radiofrequency machine or machines shall be considered to have a separate facility at that same site.

Far Field Region means the region in which an electromagnetic field is predominantly plane wave in character. There is no precise boundary between the non-far field regions and the far field region. The approximate distance from the radiating device at which the far field region may be considered to begin depends upon several factors, including the frequency of the electromagnetic radiation and the physical characteristics of the radiating device. In general this distance is approximately equal to $2D^2/\lambda$ where D is the largest dimension of the radiating device facing the direction of interest and λ is the wave length.

FCC means Federal Communications Commission.

Hertz means unit of frequency equal to one cycle per second.

Individual means any human being.

Industrial Establishments shall include manufacturing facilities, factories, workshops, mechanical facilities, laboratories, mercantile facilities, educational institutions, medical facilities, and all other buildings or parts thereof where such operations or activities such as: manufacturing, assembly, storage, research, broadcasting, therapy, testing, transfer and removal are carried on.

Intermittent Operation means an operation where the radiofrequency machine does not normally continually operate for a period of 30 minutes or more at one time and generally the transmitter operation is random in time.

Machine means a machine that emits radiofrequency (RF) electromagnetic radiation during operation.

Microwave Oven means a commercially manufactured oven which is designed to heat, cook, or dry food through the application of radiofrequency electromagnetic radiation, and which is designed to operate at a frequency of 915 MHz and/or 2450 MHz.

Near-field means the region of the electromagnetic field around a radiofrequency radiator in which the electric and magnetic fields do not have a fixed ratio from point to point. The near-field can be considered to extend from the source to points where a far-field description is valid.

Nonionizing Radiation (NIR) means the electromagnetic fields or energy in space for frequencies of the electromagnetic spectrum from ten kilohertz (kHz) to 100 Gigahertz (GHz). The measures of such "radiation", electromagnetic fields or energy are power flux (milliwatts per square centimeter), or mean-squared-electric-field $(E)^2$,$(V/m)^2$ or mean-squared-magnetic- field $(H)^2$, $(A/m)^2$. In some cases only $(E)^2$ or $(H)^2$ is applicable (e.g., certain near fields or fields at low frequency) and in other cases (e.g., the microwave far-field conditions) the power flux is more applicable. Even where only the measures of either $(E)^2$ or $(H)^2$ is of concern, it has become customary to express the field quantities in terms of equivalent (far-field, plane-wave) power densities. NIR is used interchangeably with the terms "RF radiation", "electromagnetic radiation" or "electromagnetic energy".

Nonionizing Radiation (NIR) Worker means an individual who has been informed by his or her employer that activities in connection with their employment potentially involve access to areas exposed to radiofrequency radiation resulting from operation of a machine at the Place of Employment, where the exposure may exceed that allowed by 105 CMR 122.015.

122.006: continued

Person means any individual, entity, corporation, partnership, firm, association, trust, estate, public or private institution, group, agency, political subdivision of this state, and other state or political subdivision or agency thereof, and any legal successor, representative agent or agency of the foregoing.

Place of Employment means every place, whether indoors, or outdoors, or underground, and the areas appurtenant thereto, into, in or upon which any employee goes, or remains, either temporarily or regularly, in order to perform required duties in the course of his or her employment.

Personal Wireless Services (PWS) means facilities licensed by the Federal Communications Commission under Title 47 part 24.

Public or Member of the Public means all members of society, including the unborn. As used in 105 CMR 122.006, it does not include employees of a facility who have been informed that their employment potentially involves being exposed to electromagnetic radiation.

Radiating Device means the antenna, leakage port or other part of a radiofrequency machine which emits radiofrequency electromagnetic radiation, excluding:

(1) those machines radiating at frequencies between 300 kHz and 100 GHz for which the effective radiating power is seven watts or less;

(2) machine components which are not in themselves capable of, or designed for, radiation of an RF field; and

(3) the signal generation portion of automatic or other test equipment designed to deliver a signal stimulus using coaxial or shielded cables to a device being tested.

Radiation Control Program means the Radiation Control Program of the Massachusetts Department of Public Health.

Radiofrequency (RF) means in the frequency range of 10 kilohertz (kHz) to 100 gigahertz (GHz).

Radiofrequency Exposure Limits (RFEL) means the non-occupational limits for the general public to electromagnetic radiation in terms of the mean squared electric $(E)^2$ and magnetic $(H)^2$ field strengths or in terms of the equivalent plane wave free-space power density (when applicable), as a function of frequency, as given in Table 1, 105 CMR 122.015 and the occupational limits for employees, as given exposure in Table 1, 105 CMR 122.100.

Radiofrequency (RF) Site means a fixed structure whose sole purpose is to provide a location for RF facilities.

Radiating Device means the antenna, leakage port or other part of a machine which emits radiofrequency electromagnetic radiation, excluding:

(1) Machine components which are not in themselves capable of, or designed for, producing an RF field; and

(2) The signal generation portion of automatic or other test equipment designed to deliver a signal stimulus using coaxial or shielded cables to a device being tested.

Radiofrequency (RF) Heater and RF Sealer means devices operating between 300 kHz and 300 MHz used to heat, melt or cure materials such as plastic, rubber, or glue by subjecting the material to a RF energy field. Included in this category are dielectric and induction heating devices.

Radiofrequency Machine means any fixed device, machine, equipment or installation which is capable of generating a radiofrequency electromagnetic field.

Regularly Occupied refers to an enclosed area, building, or other freestanding structure which may, at any given point in time, be occupied by a given member of the public on a continual basis and excludes occasional visitors, passersby, and service personnel.

122.006: continued

RF Safety Officer refers to a person who by virtue of training or experience has acquired knowledge or instruction in RF electromagnetic fields and their measurement. The individual designated may be the Facility owner, an employee, or an agent hired by the employer.

Single Source Emitter means a radiofrequency facility containing one or more radiofrequency machines only one of which is normally radiating at a given time.

Survey means the measurement, by appropriate instrumentation, of the level of potential occupational RF radiation exposure incidental to the use of a machine.

122.010: Exclusions

(A) The following radiofrequency facilities are excluded from all requirements of 105 CMR 122.000:
(1) Facilities maintained by the Federal government;
(2) Radiofrequency machines which are in storage, shipment or on display for sale, provided such machines are not operated; and,
(3) Radiofrequency machines not connected to a radiating device.

(B) The following radiofrequency facilities are excluded from all requirements of 105 CMR 122.021:
(1) All non-fixed radiofrequency machines such as; portable, hand-held and vehicular radiofrequency machines;
(2) All scientific and medical machines operating at frequencies designated for that purpose by the FCC and all Class A and B computing devices as defined by FCC;
(3) Radiofrequency machines which have an effective radiated power of seven watts or less; and,
(4) Radiofrequency machines which are designated and marketed as consumer products (except microwave ovens) such as; citizen band radios, remote control toys.

(C) The following radiofrequency facilities and installations involving radiofrequency machines are excluded from the requirements of 105 CMR 122.100:
(1) Amateur radio stations licensed or authorized by the FCC; and,
(2) Hand-held portable and mobile radios operating between ten kHz and 1GHz with an RF input power to the antenna not exceeding seven watts.

(D) The Director may, upon request of any person or upon his own initiative, make such exemption and/or exception to 105 CMR 122.000 in whole or in part as he may deem appropriate.

122.015: Non-occupational Radiofrequency Exposure Limits for the General Public

(A) No person shall knowingly operate or allow for the operation of a radiofrequency machine in a manner that exposes or may expose any member of the public in a regularly occupied space within the Commonwealth of Massachusetts, to a radiofrequency electromagnetic field which has a mean squared electric or magnetic field strength or an equivalent plane wave free-space power density in excess of the applicable Radiofrequency Exposure Limits listed in 105 CMR 122.015: *Table I.*

(B) In the event of scan failure or other failure in the normal parameters of the scanning operation causing a change in angular velocity, amplitude duration, or rate of exposure, no radiofrequency machine which emits scanned radiofrequency radiation in areas accessible to the public shall be operated without protective measures to prevent exposure in excess of the radiofrequency exposure limits listed in 105 CMR 122.015: *Table I.*

122.015: continued

105 CMR 122.015: TABLE I
NON-OCCUPATIONAL RADIOFREQUENCY EXPOSURE LIMITS
FOR THE GENERAL PUBLIC[1]

Frequency Range	Maximum Allowed Mean Squared Electric Field Strength $(V/m)^2$	Maximum Allowed Mean Squared Magnetic Field Strength $(A/m)^2$	Maximum Allowed Equivalent Plane Wave Free Space Power Density[2] (mW/cm^2)
300kHz-3MHz	80,000	0.5	20.0
3MHz-30MHz	$800(900/f^2)$	$0.005(900/f^2)$	$180/f^2$
30MHz-300MHz	800	0.005	0.2
300MHz-1500MHz	800(f/300)	0.005(f/300)	f/1500
1500MHz-100GHz	4,000	0.025	1.0

As used in Table I:
f = frequency in megahertz (MHz)
V = voltage in volts
A = current in amperes
m = length in meters
cm^2 = area in square centimeters
mW = power in milliwatts

For mixed or broadband fields consisting of a number of frequencies for which different Radiofrequency Protection Guides are listed in 105 CMR 122.015: *Table I*, the fraction of the Radiofrequency Exposure Limits incurred within each frequency interval shall be determined, and the sum of all such fractions shall not exceed unity.

122.021: Notification and Approval of Fixed Facilities

(A) After 10/31/97, no radiofrequency site or facility shall be installed, or put into operation, without the approval of the Director (except amateur intermittent single source emitters of less than 1 kW average output). Furthermore, there will be no modifications to existing sites or facilities, which would cause an increase in the radiofrequency emission exposure levels to the general public, without the approval of the Director (except amateur intermittent single source emitters of less than 1 kW average output if such a change results in an average output of less than 1 kW). Radiofrequency sites and facilities in existence prior to 10/31/97 are subject to the exposure limits set forth in 105 CMR 122.015 and any other portion of 105 CMR 122.000 should the Director determine that the operation of such a facility compromises the purpose of 105 CMR 122.000 as stated in 105 CMR 122.001.

The following is required to obtain such approval:

(1) Name and address of owner of the facility on which the transmitter and/or antenna is located;

[1] These are average values over any 0.5 hour period. *See* 105 CMR 122.290: *Appendix A*. This table does not apply to microwave ovens, refer to 105 CMR 122.040.

[2] See 105 CMR 122.290: *Appendix A* for calculation of equivalent plane wave free space power density in the non far field region.

122.021: continued

(2) Name and address of owner of transmitter and/or antenna, including FCC assigned call letters;
(3) Location of transmitter (latitude, longitude and local address);
(4) Location of antenna (latitude, longitude and local address);
(5) Output frequency of transmitter;
(6)* Type of modulation and class of service;
(7)* Power output of transmitter (average and peak);
(8)* Power input to antenna;
(9)* Manufacturer, type, manufacturer's model number of antenna;
(10)* Gain of antenna and antenna radiation pattern;
(11)* Polarization of radiation from antenna;
(12) Height of antenna above ground;
(13) Horizontal and radial distance of antenna to nearest point on property line;
(14) Horizontal and radial distance of antenna to nearest habitable space regularly occupied by the public;
(15) Date of installation of present transmitter, and date of installation of the associated antenna, date of installation of the structure, if any, on which the antenna is located; and,
(16) Predicted levels of RF radiation at locations specified in 105 CMR 122.290: *Appendix A* using standard practice prediction methods described to and acceptable to the Director.

(B) Should the Director deem measurements to be necessary to assure compliance with 105 CMR 122.015(A), such measurements of the environment existing prior to the installation, for which approval is sought, shall be taken as specified in 105 CMR 122.290: *Appendix A* or by another measurement procedure acceptable to the Director.

(C) Installation and operation of temporary facilities for periods not to exceed 30 days shall be allowed without prior approval provided the following provisions are met:
(1) the operation of the facility does not result in an exceedance of non-occupational exposure limits as established in 105 CMR 122.015;
(2) the individual responsible for the operation of that facility notifies the Director, as provided for in 105 CMR 122.021(A) within seven days from the start of the installation of the facility; and
(3) the temporary facility's installation and operation is necessitated by circumstances beyond the control of the individual responsible for the installation and operation of the temporary facility.

(D) All non-amateur intermittent single source emitters of less than 1 kW average input RF power are exempt from compliance with 105 CMR 122.021(B) but shall comply with 105 CMR 122.021(A)(1) through (15) and either 105 CMR 122.021(A)(16) or 105 CMR 122.291 Appendix B for the purposes of notification of the installation of a new source or modification of an existing source.

(E) Approval to install and operate the fixed site or facility will be granted if the applicable provisions of 105 CMR 122.021 have been met, provided that the measured levels and/or the predicted increase in levels due to the addition of the RF source at any location specified in 105 CMR 122.290: *Appendix A* do not exceed ⅓ of the maximum levels as specified in 105 CMR 122.015(A). If such measured levels and/or the predicted increase in levels exceed one-third of the maximum levels as specified in 105 CMR 122.015(A) then conditional approval to construct shall be granted. Final approval to maintain shall be granted should the results of measurements made after the new source is installed show that the maximum levels of 105 CMR 122.015(A) are not exceeded. Such measurements should be made as specified in 105 CMR 122.021(E)(1) through (3):

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* Effective Radiated Power and antenna radiation pattern of facility may be substituted for 105 CMR 122.021(A)(6) through (11). A copy of the FCC construction permit application or license application may be substituted for 105 CMR 122.021(A)(1) through (15), provided that the information specified in 105 CMR 122.021(A)(1) through (15) is contained in such a document.

122.021: continued

(1) The measured average levels at the three points specified in 105 CMR 122.290: *Appendix A* after installation of the new machine, including both the background and the new source;
(2) The measured levels at the boundaries of other sources at which the new source may cause a detectable increase in level; and,
(3) The measured level at the predicted point of maximum radiation off of the property on which the new source is located caused by the new machine along with the measured background at this point. This measurement shall meet the requirements of 105 CMR 122.290: *Appendix A*.

If the levels exceed the maximum level of 105 CMR 122.015(A), final approval will be denied unless an exemption has been granted.

122.025: Personal Wireless Services (PWS) Facilities.

(A) The provisions of 105 CMR 122.010 and 122.021 do not apply to personal wireless services (PWS), except as specifically stated in this section.

(B) No person shall operate a Personal Wireless Service facility in the Commonwealth unless and until they have notified the Department and received the approval of the Director. Such approval will be granted in accordance with the requirements of 105 CMR 122.025. Persons wishing to operate a personal wireless service facility must complete and file with the Department an application containing all of the information required by 105 CMR 122.021(A)(1) through (16), as well as the following information:

(1) Copies of any and all applications for a license to construct and/or operate the personal wireless services facility as filed with the Federal Communication Commission pursuant to federal regulations;
(2) Copies of any and all licensees, approvals or authorizations by the Federal Communications Commission permitting the construction and/or operation of the personal wireless facility;
(3) Copies of any and all written statements confirming compliance of the facility with the FCC's Radiofrequency (RF) maximum permissible exposure limits, which are submitted to the FCC in accordance with the requirements of the federal regulations, as well as copies of any "technical information showing the basis" for written statements, as required to be prepared and made available upon request under federal regulations;
(4) Copies of any and all environmental assessment (EAs") discussing the environmental impact of the facility which were prepared by the applicant in accordance with the requirements of the federal regulations, as well as any final environmental impact statements ("EISs") and Records of Decisions ("RODs") prepared by the FCC relating to their approval of the facility; and,
(5) Copies of any and all agreements between the applicant and the owners or operators of other facilities whereby the maximum operating power levels of those other facilities were modified or reduced in order that their aggregate radiofrequency (RF) emission levels allow for the additional radiofrequency (RF) emissions given off by the applicant's facility during normal operation without causing the aggregate level to exceed the federally adopted (RF) Maximum Exposure Limits.

(C) The Director shall grant his approval for a personal wireless service facility once the applicant has submitted all of the information required by this section, and the information submitted indicates that the applicant's facility has been duly and properly approved by the FCC.

(D) The approval to operate shall be deemed to expire and a new Department approval shall be required whenever:

(1) The approval has expired by its own terms; and,
(2) The FCC license for the facility expires by its terms or is deemed to expire under applicable federal law and/or regulations.

122.100: Occupational Radiofrequency Exposure Limits for Employees

(A) No person who operates a radiofrequency machine, or controls the operation of a radiofrequency machine owned by an individual or entity conducting business in the Commonwealth of Massachusetts, shall expose any worker in a place of employment within the Commonwealth of Massachusetts, to a radiofrequency electromagnetic field which has a mean squared electric or magnetic field strength or an equivalent plane wave free-space power density in excess of the applicable Radiofrequency Exposure Limits listed in 105 CMR 122.100: *Table 1*. These limits are based on currently accepted national consensus standards, *i.e.* American National Standards Institute, ANSI C9122.1l-1982 and American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values.

105 CMR 122.100: TABLE 1

OCCUPATIONAL RADIOFREQUENCY EXPOSURE LIMITS FOR EMPLOYEES

1	2	3	4
Frequency Range	$(E)^2$ Maximum allowed Mean Squared Electric Field Strength $(V/m)^2$	$(H)^2$ Maximum allowed Mean Squared Magnetic Field Strength $(A/m)^2$	Maximum allowed Equivalent, Plane Wave, Free Space Power Density (mW/cm^2)
10 kHz - 3 MHz	400,000	2.5	100
3 MHz - 30 MHz	4,000 $(900/f^2)$	0.025 $(900/f^2)$	$900/f^2$
30 MHz - 300 MHz	4,000	0.025	1.0
300 MHz - 1500 MHz	4,000 (f/300)	0.025 (f/300)	f/300
1500 MHz - 100 GHz	20,000	0.125	5

As used in 105 CMR 122.100: Table 1:

f = frequency in megahertz (MHz)
V = voltage in volts
A = current in amperes
m = length in meters
cm^2 = area in square centimeters
mW = power in milliwatts

105 CMR 122.100: Table 1 Qualifications:

1. RF Exposure Limits cited in 105 CMR 122.100: *Table 1* are average values over any 0.1 hour period;
2. For mixed or broadband fields consisting of a number of frequencies for which different RF Exposure Limits are listed in 105 CMR 122.100: *Table 1*, the fraction of the RF Exposure Limits incurred within each frequency interval shall be determined, and the sum of all such fractions shall not exceed unity;
3. For near field exposures, the only applicable RF Exposure Limits are the mean squared electric and magnetic field strengths as given in 105 CMR 122.100: *Table 1*, column 2 and 3. For convenience, these limits are also expressed as the equivalent plane-wave free-space power densities shown in column 4, 105 CMR 122.100: *Table 1*; and,
4. 105 CMR 122.100: *Table 1* limits may be exceeded if the exposure conditions can be shown by laboratory procedures acceptable to the Director to produce specific absorption rates (SAR) below 0.4 W/kg as averaged over the whole body, and spatial, peak SAR values below 8 W/kg as averaged over any one gram of tissue.

(B) Exposure conditions which will cause, or result in, an RF shock or RF burn are not permitted. These restrictions apply even if the exposure limits of this standard are not being exceeded during start-up, normal, or shut-down operation.

122.100: continued

(C) A variance to the exposure limits is automatically granted to permit an employee to work temporarily in areas with radiofrequency emission levels in excess of the exposure limits established in 105 CMR 122.100: Table 1 subject to the following requirements:

(1) the work is of an emergency nature that cannot otherwise be performed. For example, the failure of broadcast tower lights or a broken tower guy wire which may affect public safety;

(2) the employer first considers whether the work can be delayed and performed at a scheduled time when the worker will not be exposed in excess of 105 CMR 122.100: *Table 1* limits;

(3) the employer takes full advantage of, and makes certain that the employee is provided with, and uses, all practical shielding devices;

(4) the employer provides the employee with a measuring device and necessary training for its use so that the employee is aware of the length and amount of exposure;

(5) the RF Safety Officer is present on-site during the performance of all work in areas where the 105 CMR 122.100: *Table 1* limits are exceeded;

(6) the employer shall not require an unwilling employee to enter or work in an area where the radiofrequency (RF) emission levels of 105 CMR 122.100: *Table 1* limits are exceeded. Additionally, the employer will require the volunteering employee to sign a statement attesting that the employee was informed that he or she was to enter an area where exposure conditions exceed 105 CMR 122.100: *Table 1* limits;

(7) the employer shall make certain that there is absolutely no access to areas with radiofrequency (RF) emission levels greater than ten times the 105 CMR 122.100: *Table 1* limits;

(8) the employer shall, within 30 calendar days, forward a report to the Director covering each incident of variance in excess of the 105 CMR 122.100: *Table 1* limits. Each report shall list the name and address of the employer, name of RF Safety Officer on-site during the permitted excess exposure, address of facility, name and address of employee(s), date and time of entry, length of stay, exposure(s) received, protective devices used, exposure measurement device used, purpose of entry and reasons why the work could not be performed during a time when 105 CMR 122.100: *Table 1* limits would not be exceeded; and,

(9) the employer shall be on notice that failure to comply with the foregoing variance requirements shall be construed to be a violation of 105 CMR 122.100.

122.101: Requirements for Notification by Employer

All employers in the Commonwealth of Massachusetts who own or control the operation of machines specified in 105 CMR 122.101 shall notify the Director of the Radiation Control Program of their operations. Employers operating machines specified in 105 CMR 122.101 that were installed prior to 10/31/97 shall send written notification to the Director within 12 months of 10/31/97, and subsequently, whenever changes are made to the subject machine(s). Employers initially placing machines specified in 105 CMR 122.000 in operation after 10/31/97 shall notify the Director prior to the date of regularly scheduled operations and whenever changes are made to the subject machine(s). Written notification shall contain the following information:

(A) For fixed and mobile radar, fixed and mobile radio and television, and other communication machines, with greater than 100 watts total power delivered to the antennas. (Note: A copy of the FCC construction permit application or license application may be substituted for the following listed items providing that the information specified is contained therein.):

(1) Name and address of owner of the facility on which the transmitter and/or antenna is located;

(2) Name and address of owner of transmitter and/or antenna including FCC assigned call letters;

(3) Name of individual designated as RF Safety Officer as specified in 105 CMR 122.103;

(4) Location of transmitter;

(5) Location of antenna;

(6) Operating frequency of transmitter;

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(7) Type of modulation and class of service;
(8) Power output of transmitter (average and peak);
(9) Power input to antenna;
(10) Manufacturer, type, manufacturer's model number of antenna;
(11) Gain of antenna and antenna radiation pattern;
(12) Polarization of radiation from antenna;
(13) Horizontal and radial distance of antenna to nearest place where facility employees work or congregate;
(14) Date of installation of present transmitter, and date of installation of associated antenna, date of installation of the structure, if any, on which the antenna is located;
(15) A layout drawing showing various areas in which employees associated with such machines work and the predicted levels of RF radiation at these areas using standard practice prediction methods described to and acceptable to the Director. In cases where frequent changes may occur the predicted level of RF radiation shall refer to maximum expected levels. Actual survey measurements may be submitted if available in lieu of predicted levels; and,
(16) A list of areas in which employees have been classified as NIR workers.

(B) For RF Heaters and Sealers:
(1) Name and address of company or organization where RF heater(s) and/or sealer(s) are located;
(2) Name of individual designated as RF Safety Officer as specified in 105 CMR 122.103;
(3) Name of the manufacturer of the RF heater(s) and/or sealer(s).
(4) Model and serial or other identification number and date of installation;
(5) Type: Shuttle, turntable, or stand up;
(6) Radiofrequency at which the RF heater(s) and/or sealer(s) operate;
(7) Rated power output in kilowatts (kw);
(8) Duty cycle;
(9) Information on whether RF heater(s) and/or sealer(s) are installed in a screen room enclosure; nature of floor, and existing ground planes;
(10) A layout drawing showing various areas in which employees work and the predicted levels of RF radiation at these areas using standard practice prediction methods described to and acceptable to the Director. In cases where frequent changes may occur the predicted level of RF radiation shall refer to maximum expected levels. Actual survey measurements may be submitted if available in lieu of predicted levels; and,
(11) A list of areas in which employees have been classified as NIR workers.

(C) For microwave ovens other than those specified in 105 CMR 122.200 (Example: Microwave ovens used in industrial establishments for production processing and drying activities):
(1) Name and address of company or organization where Microwave Oven(s) are located;
(2) Name of the manufacturer of the Microwave Oven;
(3) Model and serial or other identification number;
(4) Frequency of operation and rated power in kilowatts;
(5) Date of installation;
(6) Name of individual designated as RF Safety Officer as specified in 105 CMR;
(7) Type of feed mechanism;
(8) Brief description of application or process including average amount of time (or workload) that equipment is used each day;
(9) A layout drawing showing various areas in which employees work and the predicted levels of RF radiation at these areas using standard practice prediction methods described to and acceptable to the Director. In cases where frequent changes may occur the predicted level of RF radiation shall refer to maximum expected levels. Actual survey measurements may be submitted if available in lieu of predicted levels; and,
(10) A list of areas in which employees have been classified as NIR workers.

(C) For RF Diathermy and RF Hyperthermia Equipment:
(1) Name and address of company or organization where equipment is located;
(2) Name of manufacturer of the RF Diathermy or RF Hyperthermia equipment;

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(3) Model and serial or other identification number;
(4) Date of installation;
(5) Name of individual designated as RF Safety Officer;
(6) Radiofrequency at which equipment operates;
(7) Duty cycle;
(8) Brief description of application or process including amount of time (or workload) that equipment is used each day;
(9) A layout drawing showing various areas in which employees work and the predicted levels of RF radiation at these areas using standard practice prediction methods described to and acceptable to the Director. In cases where frequent changes may occur the predicted level of RF radiation shall refer to maximum expected levels. Actual survey measurements may be submitted if available in lieu of predicted levels; and,
(10) A list of areas in which employees have been classified as NIR workers.

(E) Employers of equipment or facilities listed in 105 CMR 122.101(A) to 122.101(D) in compliance with the Notification Requirements of 105 CMR 122.101 need not re-notify the Director whenever temporary relocation occurs involving periods not in excess of 30 days provided that the equipment or facility does not cause employee exposures to exceed the limits established in 105 CMR 122.100: *Table 1.*

122.102: RF Safety Officer Requirements

Each employer of an RF facility as listed in 105 CMR 122.101 shall designate an individual qualified by training or experience to serve as RF Safety Officer with the responsibility for RF radiation protection. The RF Safety Officer will:
(1) Establish and supervise a program of RF radiation safety for effective compliance with the applicable requirements of 105 CMR 122.100;
(2) Give instructions concerning hazards and safety practices to individuals who have been classified as NIR workers;
(3) Carry out other procedures as required by 105 CMR 122.100; and,
(4) Give written notification to any employee designated as a NIR worker of their NIR worker status.

122.103: Requirements for Caution Signs, Symbols, Labels, and Posting

(A) Each RF machine, product, or facility that generates levels of electromagnetic radiation which, under reasonable and normal operating conditions, can result in occupational exposures in excess of the limits contained in 105 CMR 122.100: *Table 1* shall be conspicuously posted with appropriate warning symbols or signs (*See* 105 CMR 122.103(B)).

(B) Signs, symbols, and labels prescribed by 105 CMR 122.103 shall use the design delineated in the American National Standard Institute (ANSI) document ANSI C9122.12-1982, or subsequent revisions, entitled "American National Standard Radiofrequency Radiation Hazard Warning Symbol".

122.104: Survey and Inspection Requirements

Each employer with an RF machine for which notification is required by 105 CMR 122.101 shall make or cause to be made the following surveys and inspections by or under the direction of the RF Safety Officer. Surveys shall be made to determine whether exposures to NIR radiation are maintained within the limits prescribed in 105 CMR 122.100. Immediate corrective actions by the employer shall be taken to correct any deficiencies.

(A) Surveys and inspections of RF machines will be performed at the time of installation and initial operation, and whenever a modification to an RF machine or its use, is made. Surveys and inspections shall also be performed at intervals not to exceed 12 months, unless specifically exempted by the Director. The annual surveys shall include measurements of the levels of electromagnetic radiation at the NIR worker and/or associated employee positions. Surveys and inspections are not required for RF machines that are stored and not being used.

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(B) Surveys shall be performed according to nationally recognized methods and procedures found acceptable to the Director. Surveys of areas expected to be in excess of 105 CMR 122.021 limits may not be performed unless appropriate protective measures are implemented.

(C) Inspections shall additionally determine whether:

(1) all RF machines or facilities are labeled with appropriate warning signs, as required by 105 CMR 122.103;

(2) all RF hazard warning devices, safety interlocks and protective devices are functioning within their design specifications; and,

(3) any workers have metal implants, pacemakers or other medical devices. Should such workers be identified, such individuals will be required to obtain medical authorization from a physician knowledgeable in radiofrequency interference with the particular medical device prior to being allowed to enter areas posted under the requirements of 105 CMR 122.103(B).

122.105: Records Requirements

(A) The employer shall keep a record of each survey and inspection made under 105 CMR 122.104 and such record shall include:

(1) Date and time of the survey;

(2) Name of RF machines surveyed, and the location of these on the premises;

(3) Instrument used including type, manufacturer, and model number;

(4) Date that instrument was last calibrated;

(5) Measured field strengths (both electric and magnetic) or equivalent plane-wave free-space power density levels for both fields at the worker positions and work areas adjacent to the RF machine(s);

(6) Name of person performing the survey and inspection;

(7) Approval signature of the designated RF Safety Officer; and,

(8) A list of NIR workers.

(B) In the event that an individual or NIR worker must enter a facility requiring posting as specified in 105 CMR 122.103(B), a log shall be kept to show that the required and appropriate safety precautions have been taken by the individual or NIR worker. Examples of such actions are the wearing of protective clothing, de-energizing the source, or limiting exposure time. The log shall include name of individual, date, time of entering and exiting, protective action and purpose of entry.

(C) Records shall be kept available for inspection by representatives of the Department for a minimum of 30 years. A copy of these records shall be furnished to the Director upon request.

(D) No person shall damage or destroy required records as specified in 105 CMR 122.105(A) and 122.105(B) or permit the same to be destroyed without first having obtained the written consent of the Director.

(E) The Director shall receive all radiation survey, variance, incident, safety, and inspection records of an RF facility that is terminating operation. These will be presented to him by the owner or employer of said facility. A written acknowledgment will serve as evidence of their receipt. The delivery of such records to the Director relieves the employer from subsequent responsibility with respect to the keeping of these records. The Director may keep or destroy such records at his or her discretion.

122.106: Incident Reporting Requirements

(A) The employer or the RF Safety Officer shall conduct an investigation and maintain records of said investigation for each suspected exposure of an individual or NIR worker to electromagnetic radiation in excess of the applicable limits contained in 105 CMR 122.100: *Table 1*. Each record shall include:

(1) Description of the extent and nature of the suspected exposure incident;

(2) Location and time at which the RF radiation incident occurred;

(3) Cause of the suspected exposure;

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(4) Manufacturer, type, and model number of the RF machine or product involved;
(5) Names of persons involved, adversely affected, or exposed during the RF radiation incident, nature and magnitude of their suspected exposures and/or injuries, if any; and,
(6) Corrective steps taken or planned to ensure against a recurrence.

(B) The employer shall notify any employee that he or she has been exposed to RF radiation in excess of 105 CMR 122.100: *Table 1* limits and employees shall notify employer if he or she has been exposed to RF radiation in excess of 105 CMR 122.100: *Table 1* limits.

(C) In addition to the requirements of 105 CMR 122.106(A), the employer, or RF Safety Officer, shall submit to the Director within 30 days, a copy of the investigation report when it is believed that an individual may have received an exposure in excess of five times the limits specified in 105 CMR 122.100: *Table 1*.

122.240: Non-industrial Microwave Ovens

(A) The power density of the radiofrequency electromagnetic field generated by a microwave oven manufactured after October 5, 1971 shall not exceed five milliwatts per square centimeter at any point five centimeters or more from the external surface of the oven.

(B) The power density of the radiofrequency electromagnetic fields generated by a microwave oven manufactured prior to October 6, 1971 shall not exceed ten milliwatts per square centimeter at any point five or more centimeters from the external surface of the oven.

(C) Measurements shall be made using test procedures established by the U. S. Department of Health and Human Services for ovens manufactured on or after October 6, 1971. Nationally recognized test procedures should be used for ovens manufactured prior to October 6, 1971.

(D) Any microwave oven which fails to meet the applicable requirements of 105 CMR 122.040(A) or (B) shall be removed from service and shall not be operated until repairs or modifications have been made so that the oven will operate in conformance with the applicable requirements of 105 CMR 122.040(A) or (B).

122.290: Appendix A: Measurement Procedure for Radiofrequency Exposure

(1) Measure the existing radio-frequency radiation levels at the nearest point on the property line of the facility owner, the point on the property line of the predicted maximum radiation from the source, and the nearest point regularly occupied by the public.
(a) These measurements are to be made utilizing the methods described in the National Council on Radiation Protection and Measurements (NCRP) Report No. 119 *A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields* or by other methods acceptable to the Director.
(b) The applicable power density, mean squared electric or magnetic field strengths, should be determined for public exposure pursuant to 105 CMR 122.015(A), as the average value over any 0.5 hour period. Should operation(s) be less than for 0.5 hour periods the following formula should be used:

$$P = K/T$$

where:
P is the allowable maximum level;
K is the maximum exposure level stated in 105 CMR 122.015 Table 1; and,
T is the ratio of the exposure duration in a 0.5 hour to one half hour.

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(c) In the far field region, compliance with 105 CMR 122.015 may be determined using a field strength measuring instrument which is designed and calibrated to give a direct reading of the equivalent plane wave free-space power density. Such direct measurement of the equivalent plane wave free-space density measurement of the equivalent plane wave free-space density cannot be accurately carried out in the non-far field region. To determine compliance with 105 CMR 122.015 in the non-far field region, the mean squared electric field strength and the mean squared magnetic field strength should be measured separately. Dipoles and spectrum analyzers should be used in multiple frequency environments. These values may then be used to calculate the equivalent plane wave free-space power density.

(d) The effects of contributing sources of frequencies below and above frequency limits of broadband instruments may be included by appropriate separate single instant measurements of the contribution due to these sources. Further, levels below 20 microwatts / cm^2 or the lowest detectable level, whichever is lesser, should be deemed zero for further computational purposes.

122.291: Appendix B: Non-Amateur Intermittent Single Source Emitter Guide

The following separation guide must be followed or separation distances submitted to and approved by the Director. The guide applies to the minimum distance that an antenna can be located from external surface of any habitable structure not located on the property containing the source and from habitable space on the same property normally occupied on a regular basis by others than the immediate family an/or employees of the owner and/or operator of the source.

Frequency (MHz) Nearest	Minimum Distance From Current Maximum (feet)
less than 3	9.84 (KP/180,000)
3 - 30	3.78 f(KP/180,00)
30 - 300	3.28 (KP/200)
300 - 1500	3.28 (3KP/2f)
greater than 1500	3.28 (KP/1000)

where;

f is the frequency in megahertz

P is the ERP in watts

K equals 7.96

In addition, the minimum separation from any radiating part of the antenna shall be of the above minimum separation from the nearest current maximum.

REGULATORY AUTHORITY

105 CMR 122.000: M.G.L. c. 111, §§ 5M, 5N, 5O and 5P.

NON-TEXT PAGE