EXHIBIT 9.0 : Module Requirements

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Exhibit 9.0 : Module Requirements

This exhibit list the miscellaneous requirements, as well as the module specific requirements, for an intentional radiator operated under Part 15.246 of the FCC Rules.

9.1 Miscellaneous Requirements

9.1.1 FCC §15.247 (a)(1)

- 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.

  Compliance Statement: The system uses a table of pseudorandomly ordered hop frequencies. The transmitter goes through the list in order before starting over, which ensures that each frequency is used equally on average.

- 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.

  Compliance Statement: The receiver has 500 kHz wide second IF filters which matches the 400 kHz 20 dB bandwidth of the transmitter signal. The remotes track the transmitted hop sequence from the Master and synchronize their hopping to it.

9.1.2 FCC §15.247(b)(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.

  Compliance Statement: The output power of the radio is 250 mW, 6.0 dB less than the maximum limit of 1.0 W. For point multi-point operation the antenna gain is limited to 6.0 dBi plus the reduction in power below 1 W. The result is a maximum antenna gain of 12.0 dBi. The radio module users manual specifies the maximum allowable antenna gain for point multipoint operation.

- **FCC §15.247(b)(3)(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.

  Compliance Statement: The output power of the radio is 250 mW, 6.0 dB less than the maximum limit of 1.0 W. For point to point operation the antenna gain may be increased by 3.0 dB for every 1.0 dB in output power reduction below one Watt which gives an increase of 6 dB * 3 dB = 18 dB. This increase is the amount above a 6.0 dBi antenna gain, which gives a maximum allowable antenna gain of 24.0 dBi The radio module users manual specifies the maximum allowable antenna gain for point to point operation.

- **FCC §15.247(b)(3)(iii)**

  (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.

  Compliance Statement: Directions for installation of a point to point system are included in the OS2400 instruction manual.

9.1.3 FCC §15.247(b)(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.

Compliance Statement: Because the OS2400 is a radio module, the limits for Uncontrolled Exposure in §1.1310(B) are used. At 2.4 GHz the exposure limit is a power density of 1.0 mW / cm^2. The radio transmit power is 250 mW maximum. The maximum transmit duty cycle is 50 % which gives and average power of 125 mW. Assuming an isotropic radiator, the transmitted power density is Pd = Pxmit / (4 * ? * d^2). Solving for d with Pd = 1.0 mW /cm^2 gives d = 3.15 cm (1.24 inches). A table of exposure limits for an omni-directional, and other antennas is given in the OS2400 instruction manual. Safe exposure distance for each antenna gain is listed.

9.1.4 FCC 15.247(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.

  Compliance Statement: The Master radio transmits on each frequency hop. It uses each entry in the hop table once and in order, (before starting over) which guarantees all hop frequencies are used equally.

  Remote radios transmit only when they have data to send to the Master. If presented with a continuous data stream, remotes will transmit on the same frequency hops as the Master (equally on all frequencies in the table).

9.2 Module Specific Requirements

The OS2400 was designed to meet the following conditions for approval as a module so that it may be installed in various enclosures without the need for additional Certification.

- **A module must have its own shielding. Shielding of the RF components of the module is required.**

  The OS2400 radio module has a shield covering the entire RF section. In addition, the VCO and Power amp sections have their own shields. Emissions tests of the module are done with no other shielding.

- **A module must have its own power supply regulation**

  The specified power supply input voltage range is 5.0 V +/- 5%. The module has a 3.3v linear regulator, and also over-voltage and under-voltage detection on the 5v input. Because the power amplifier is connected to the 5.0 V input after filtering, the transmitter is disabled in over or under voltage conditions. The output power cannot be increased by increasing the supply voltage above the 5.75v detector threshold. Power output is calibrated in production and tested to guarantee output power below 250mW at the maximum over voltage threshold.

- **A module must have its own input data-line buffering (input signal changes must not affect compliance) if such inputs are provided.**
  Input data-lines are for serial communication and status indication. No access to the transmitter through the input data-lines (or any other I/O lines) is possible. Input data is stored in a buffer, and formatted by the Digital Signal Processor (DSP) before it is transmitted. The transmit parameters (such as data rate, modulation, transmit power, etc.) are not affected by the signals on the data or I/O lines.

- **The module must be tested in all of the typical modes of operation and configurations. Therefore, applicable I/O cables must be attached and if I/F boards are needed for operation, they too should be connected.**
  To test the radio, an interface board is attached which has an integrated circuit that converts RS232 serial levels to the logic levels needed by the radio. Attached to the interface board are a power cable and the RS232 serial cable. Please see the interface board documentation for a full schematic, parts list, and picture of the interface board. The RS232 cable allows control of the radio by a computer. Two special test modes not available to the end user are invoked for testing. This allows testing the radio at fixed (non-hopping) transmit frequencies, fixed receive mode, and normal hopping mode. Also, the transmit power level is adjustable.

- **The module must be tested while transmitting data.**
  A pseudo random data pattern is transmitted in both the normal hopping mode and special fixed frequency test modes. The pattern is a standard 127 bit pseudo random maximal length sequence that is repeated continuously. It is a 7 bit shift register with taps at locations 1 and 7.

- **A module must be labeled with its own FCC ID number, and if the FCC ID is not visible when the module is installed in another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. The exterior label can use wording such as the following: " Transmitter Module FCC ID: xyz1234" or " This device Contains Transmitter Module FCC ID: xyz1234." The exact wording is not specified in our Rules (since modules are not specifically addressed), so you may use similar wording which expresses the same meaning.**
  Please see the artwork for the FCC label and notice that the manual for the module includes instructions about the exterior label requirement.

- **The receiver must be tested but is subject to Verification.**
  Radiated measurements from the module in “receive mode” were performed to verify compliance.