RF Exposure Test Report

Maximum Permissible Exposure Test Report

for

Symbol Technologies Inc.
MR100 Modular Transceiver

FCC ID: HP9MR100A
IC ID: 1549D-MR100A

February 15, 2005

WLL PROJECT #: 8355X

Maximum Permissible Exposure Test Report

for

FCC ID: HP9MR100A
IC ID: 1549D-MR100A

1.0 Introduction

This report has been prepared on behalf of Symbol Technologies Inc. Model: MR100 modular transmitter to show compliance with the RF exposure requirements as defined in FCC §1.1307.

1.1 Requirements

Three different categories of transmitters are defined by the FCC in OET Bulletin 65. These categories are fixed installation, mobile, and portable and are defined as follows:

- **Fixed Installations:** fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.

- **Mobile Devices:** a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR §2.1091.

- **Portable Devices:** a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Portable device requirements are found in Section 2.1093 of the FCC's Rules (47 CFR§2.1093).

For this test report the Symbol Technologies, Inc. MR100 module with 6dBi antenna is classified as a “Mobile Device”. As this device is being approved as a modular approval the MPE will be evaluated at the 20cm test distance.

The FCC also categorizes the use of the device as based upon the user's awareness and ability to exercise control over his or her exposure. The two categories defined are Occupational/ Controlled Exposure and General Population/Uncontrolled Exposure. These two categories are defined as follows:

- **Occupational/Controlled Exposure:** In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.

- **General Population/Uncontrolled Exposure:** The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

Since there are no warnings or training associated with this unit and it can be used by anyone, the Symbol Technologies, Inc. MR100 module is evaluated to the General Population/Uncontrolled Exposure limits.

1.2 Radio Frequency Radiation Exposure Evaluation

The highest RF output power of the unit was measured at 29.86 dBm at 902.75 MHz. According to §1.1310 of the FCC rules, the power density limit for General Population/Uncontrolled Exposure at 902.75MHz is 0.602mW/cm^2. As this is a modular approval for use with a mobile device the MPE shall be calculated at 20cm to show compliance with the power density limit. The following formula was used to calculate the minimum safe distance:

$$S = \frac{PG}{4\pi R^2}$$

Where:
S = Power Density
P = Output Power at the Antenna Terminals
G = Gain of Transmit Antenna (linear gain)
R = Distance from Transmitting Antenna

For this device, the calculation is as follows:
R = 20cm
P = Output Power = 968 mW
G = Worst Case Gain = 6dBi = INVLOG(6/10) = 4

$$S = \frac{(968)\times(4)}{4\times\pi\times(20)^2} = 0.77 \text{ mW/cm}^2 \text{ (Based on continuous transmission)}$$

Taking into account the worst case operating environment the transmitter stays on a channel for a maximum of 19.15ms and each hop takes a minimum 20ms thus using source based averaging the power is reduced by 3dB to 26.86dBm (485.3mW) and the Power Density at 20cm is calculated as:

$$S = \frac{(485.3)\times(4)}{4\times\pi\times(20)^2} = 0.386\text{mW/cm}^2$$

Based on continuous operation at 100% on time the MR100 would require a separation distance of 23cm. Using source based time averaging the Power Density is calculated at 0.388mW/cm^2 at 20cm separation distance.