

## Radar Developer's Kit – Lite (RaDeKL)

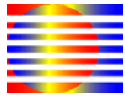
### Description

The Radar Developer's Kit Lite (RaDeKL) is the next generation design of Multispectral Solutions, Inc.'s (MSSI's) Ultra Wideband pulse radar technology. The radar is compliant to Federal Communications Commission (FCC) Part 15.250 for unlicensed operation. RaDeKL allows government, industry and academia to evaluate the benefits of MSSI's UWB radar technology to detect the presence of targets with precision range. The radar output provides 256 range bins with 30 cm (~1 foot) range resolution and 5-bit/32 levels of return signal power amplitude resolution. Detection ranges to targets depend upon radar cross section of target. Adult human detection range extent is 60 feet nominal. The kit includes the radar hardware, supporting software drivers and user interface application for simple radar operation and control. The application allows viewing of radar return data and data logging for additional return signal post-processing.



### Specifications

Radio Technology	Ultra WideBand (UWB)
Frequency of Operation	6.1 – 6.6 GHz (-3 dB)
Transmitter Output Power	FCC Part 15.250 Compliant, variable to 25 dB lower
Physical Dimensions	150 x 83 x 62 (including radome height) mm, 490 grams
Receiver Antenna	12 dBi Gain with 45 x 45 degree Field of View
Receiver Sensitivity	-75 dB at 10 dB S/N
Receiver Dynamic Range	40 dB above minimum detectable signal
Range Resolution	30 cm (approximately 12 inches)
Return Amplitude Resolution	32 levels, (5 bits)
Number of Range Bins	256 per sample
Range Extent	up to 345.6 meters
Operating Voltage	12 V DC, 110 V power supply provided
Current Consumption	100 ma
Temperature Range	0 to 50 deg C
Frequency of update rate	Selectable single return by command up to 20 Hz streaming
Interface	USB 2.0 compliant
Driver and Application OS	Windows 2000



## **System Operation**

The radar system is composed of three major subsystems. The first is the return signal processing and user data interface card. This circuit card controls the radar Ultra Wideband (UWB) pulse transmissions and the high speed return signal processing. The second component is the UWB RF Front end circuit card which provides a short pulse transmissions spanning the frequency range from 6.1 to 6.6 GHz and the receiver radio frequency front end which conditions the radar signal for return processing. The last subsystem is the two antenna array providing an antenna each for the transmitter and receiver minimizing the insertion loss of a switch or circulator and maximizing the RF isolation between the transmitter and receiver circuitry.

The radar sensor is grounded to the power supply ground. All components within the unit are grounded to the power supply including the antennas. Also, the antennas are grounded to the chassis since they are mounted to the chassis with screws that complete the connection between the antenna ground plane and the chassis.

The radar is controlled by a series of commands through the Universal Serial Bus (USB) electrical and data interface. The RaDeKL Application Program Interface (API) describes the different serial communication command definitions to set the radar transmitter and receiver processor sensitivity settings, and how to control sampling of the environment from a single sensor snapshot to streaming data at up to a 20 Hz rate.

MSSI's patented UWB radar operates by transmitting and receiver processing individual UWB pulses. Upon initiating a UWB pulse transmission, the digital processor initiates a timer/counter. The receiver RF front end filters and amplifies the return, passing the signal to the diode detector. After a measured time has elapsed corresponding to the minimum range to initiate detection, the diode detector video output is passed to a bank of comparators, each comparing the return to a reference voltage or threshold. The comparators cycle between voltage high or zero depending on whether the reference voltage has been exceeded by the video output. The receiver processor samples the comparator outputs with two nanosecond time steps which correspond to one foot radar range bins. This receiver processing technique permits a fast and simple analog-to-digital conversion of the return signal amplitude over the entire range space in one transmitted pulse. Since the receiver measures return signal power amplitude, the receiver does not depend on relative motion of the target but rather only its presence. As a consequence, the detector is capable of detecting very slow moving targets. The above process is repeated and signal magnitude levels are chosen based upon their exceeding threshold 13 out of 16 times. By re-sampling the radar field of view using 32 user defined threshold settings, the radar can provide return amplitude information to meet the needs of the user.

Once the radar return signal has been characterized, the data is passed through the USB interface utilizing the USB chip manufacturer's drivers and following the data protocols defined in the RaDeKL API. A RaDeKL graphical user interface software program was developed for Windows 2000 computers to provide an intuitive user interface for control, display and data collection of the radar operation.