FCC Part 15 Certification
Test Report

2402MHz – 2474MHz
Frequency Hopping Spread Spectrum Transceiver

FCC ID: R2K-IES-SP-BLUE

FCC Rule Part: 15.249

ACS Report Number: 04-0116-15C249

Manufacturer: Industrial Electronics Services
Model: Serial Pup

Theory of Operation

SERIAL PUP THEORY OF OPERATION

OVERVIEW:

The serial pup device is a wireless serial cable replacement transceiver, which operates in the 2.4GHZ ISM band, and is capable of data rates of up to 921Kbps. It utilizes frequency hopping spread spectrum technology along with Bluetooth®™ protocols to provide a wireless means of transmitting serial data.

FUNCTIONAL DESCRIPTION:

The system requires a minimum of 1 (one) other device which is Bluetooth®™ enabled. The two modules, when within proximity of each other, will establish a "LINK". This is accomplished through the LMX9820 module on the board that can be set to continually scan for devices in its area and set up a link. Once a link is established, the module, depending upon its configuration, can either stop listening for other devices, or can continue to establish up to 5 (five) active links at one time.

When a module is connected to a device with a serial I/O., assuming a link has been established, the data is sent through the DB9 connector on the end of the board into the MAXIM RS-232 Transceiver driver. From the RS-232 driver, the serial data is sent to the LMX9820. Inside the LMX9820 the data is "packeted" with a check sum added. This is to ensure that once the data is received on the other module that there has been no lost data in the open-air connection. Once the data has been put into a packet, the LMX9820 will send a signal to the other module in the link to tell it that it is ready to send a packet of information. This sign al is called a RTS or Request To Send signal. On the receiving end, when the module receives the RTS signal from the transmitting end, it determines when it is ready to receive that packet of information. When it is ready to receive the data from the transmitting end it sends a signal to the transmitting module that it is ready to receive. This signal is called a CTS or Clear To Send signal. Once the transmitting device receives the CTS signal, the device will transmit the data out to the other device. Once the other device has received the data, it is checked to ensure no data has been lost or corrupted between the two modules in the open-air transmission. This is where the check sum is used. If the module detects a difference in what it did receive from what it was told it was going to receive by the other module, it sends a signal back to the transmitting module and executes what is called a "RETRY". This function will take priority over any other information that may be waiting to be transmitted. The receiving end will NOT send a CTS signal to the transmitting end until the packet has been verified to be correct. Once the packet reaches the receiving end without any errors, the data is dumped from the internal memory or SRAM, and is sent to the RS-232 transceiver on it's device and is sent out for delivery to the remote unit through the DB9 connection. The module is then ready to receive another packet.

When the device is connected to more than one module, this is called a piconet. In a piconet, there is one master device, which controls all information transfer between the devices, up to five slave units. When a module initiates a link to another module it becomes the master of the link. Switching the mode of operation of the module to what is called

transparent mode does this. In transparent mode the LMX9820 will no longer listen to commands on the UART interface. It will still pass data to and from the serial port that it is connected to, however, it will not listen to any software commands that could change it's mode of operation, or interrupt the transfer of data from one module to the next. This is when the module truly becomes a "cable replacement". The only way to exit this mode of operation is through a hardware reset.

LINK ESTABLISHMENT:

Every Bluetooth®™ device has it's own address and name by which it identifies itself to other modules it may encounter. The module can be reprogrammed to any address desired by the operator or can be chanced to any name. They can also program the module to be discoverable to the addresses or names of the operators choosing. This is called pairing. When you pair two devices, they will automatically establish a link when they are within proximity of one another with no user intervention required. If a device that is not paired contacts the device, user intervention is required to either accept the link request or to deny it.

When the module comes into contact with another module, two operations are performed. First, the module that is looking for a module to link to, or the master, will ask the module it finds what type of module it is and if it is available to connect to. Second, the module that it passive, or the slave, will, if not already part of another piconet, returns a signal to the inquiring module that it is either ready for a connection or is unable to connect. Once the master receives a signal that the slave is connectable, it will send its address and name to the slave and request a connection. If it is a paired device, the connection will be made and no user intervention will be required. If the device is not a paired device, the LMX9820 will send a code to the user showing the address and name of the device trying to connect to it. It is then up to the user to decide whether or not to allow the connection or not.

To end a connection, a "BREAK" command can be sent from any of the modules in the piconet that wish to leave the conversation, when this is done, the device the sent the break will go back into automatic mode and be discoverable and connectable again.