LT3124-200

2.4 GHz OEM TRANSCEIVERS

Specifications Subject to Change

User's Manual
Version 1.0.0

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This material is preliminary

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DOCUMENT INFORMATION

Revision	Description
Version 1.0.0	4/17/2009 – Initial Release Version

TABLE OF CONTENTS

Figures

Tables

LT3124 Features

- ✓ Simple 5 V TTL level serial interface for fast integration
- ✓ Frequency Hopping Spread Spectrum for security and interference rejection
- ✓ Cost Efficient for High volume applications
- ✓ Small size for portable and enclosed applications

1. Overview

The LT3124 is a member of Laird Technologies' ConnexRF OEM transceiver family. It is designed for integration into OEM systems operating under FCC part 15.247 regulations for the 2.4 GHz ISM band.

The LT3124 is a cost-effective, High performance, 2.4 GHz frequency hopping spread spectrum transceiver. It provides an asynchronous TTL level serial interface for OEM Host communications. Communications include both system and configuration data. The Host supplies system data for transmission to other Host(s). Configuration data is stored in an on-board EEPROM. All frequency hopping, synchronization, and RF system data transmission/reception is performed by the transceiver.

LT3124 transceivers operate in a Point-to-Point or Point-to-Multipoint, Client/Server architecture. One transceiver is configured as a Server and there can be one or many Clients. To establish synchronization between transceivers, the Server emits a beacon. Upon detecting a beacon, a Client transceiver informs its Host and an RF link is established.

There are two data rates the OEM should be aware of:

- Serial Interface Data Rate – All transceivers, when interfaced to an Laird Technologies RS232 interface board in the SDK (or one provided by the OEM), can be configured to common PC serial port baud rates from 9600 bps to 115200 bps.
- Effective Data Transmission Rate – The LT3124 is a highly efficient, Low-latency transceiver.

This document contains information about the hardware and software interface between a Laird Technologies LT3124 transceiver and an OEM Host. Information includes the theory of operation, specifications, interface definition, configuration information and mechanical drawing.

The OEM must provide the Host hardware and software to control the transceiver. Certain timing considerations must be followed. The OEM is responsible for ensuring the final product meets all FCC and/or appropriate regulatory agency requirements before selling any product.

2. LT3124 Specifications

GENERAL					
Interface	20 pin mini-connector				
Serial Interface Data Rate	PC baud rates from 9600 bps to 115200 bps				
Power Consumption		**Duty Cycle (TX=Transmit; RX=Receive)**			
		10%TX	**50%TX**	**100%RX**	**Pwr-Down**
	LT3124-200:	109 mA	216 mA	84 mA	15 mA
Channels (used to create independent networks)	64				
Security	Host Defined				
RADIO					
Frequency Band	2.402 – 2.478 GHz				
Radio Type	Frequency-Hopping Spread Spectrum				
Output Power (conducted, no antenna)	LT3124-200, 400 mW typical				
Effective Isotropic Radiated Power (EIRP with 5dBi gain antenna,)	LT3124-200, 1000 mW typical				
Voltage	5 V nominal ±2%, ±50 mV ripple				
Sensitivity	-90 dBm typical				
Range w/ 5dBi	LT3124-200, Indoors to 500 ft., Outdoors to 15000 ft.				
ENVIRONMENTAL					
Temperature (Operating)	LT3124: -40 °C to 80 °C				
Temperature (Storage)	-50 °C to 85 °C				
Humidity (non-condensing)	10% to 90%				
PHYSICAL					
Dimensions	1.65” x 2.65” x 0.20”				
Antenna	LT3124-200, MMCX Jack				
Weight	Less than 0.75 ounce				

3. Theory of Operation

3.1 INTERFACE SIGNAL DEFINITIONS

The LT3124 has a simple interface that allows OEM Host communications with the transceiver. **Table 1 – Pin Definitions**, shows the connector pin numbers and associated functions. The I/O direction is with regard to the transceiver. All I/O is 5 VDC TTL level signals except for RSSI. All outputs are weakly pulled logic High (20k – 50k ohms) when left unconnected and are driven logic High at reset.

Table 1 - Pin Definitions

Pin	Type	Signal Name	Function
1	NC	NC	No Connect
2	O	TXD	Transmitted data out of the transceiver
3	I	RXD	Data input to the transceiver
4	NC	NC	No Connect
5	GND	GND	Signal Ground
6	O	Hop Frame	Hop Frame – Active Low when the transceiver is hopping.
7	O	CTS	Clear to Send – Active Low when the transceiver is ready to accept data for transmission. This is in response to a valid TE signal. A Client will not respond with CTS if it is not in range of a Server.
8	NC	NC	No Connect
9	NC	NC	No Connect
10	PWR	VCC	5 V ± 2%, ± 50 mV ripple
11	PWR	VCC	5 V ± 2%, ±50 mV ripple
12	I/O	Test Mode/Packet Frame	Test Mode 1. When pulled logic Low before applying power or resetting the transceiver's serial interface is forced to a 9600, 8, N, 1 rate. 2. When pulled logic Low and the ***Configuration Start Byte*** command is sent to the transceiver, Configuration Mode is entered to read and write parameters in EEPROM. See **Section 4.5.1, Configuration Start Byte**. 3. Pin 12 acts as an Output when Bit 3 of the Control byte is enabled. It transitions logic Low at the start of a packet and logic High at the completion of a packet.
13	O	RSSI	Received Signal Strength Indicator - An analog output giving a relative indication of received signal strength while in Receive Mode
14	I	Write Enable	EEPROM Write Enable – When pulled logic Low, it allows the Host to write the on-board EEPROM. Resetting the transceiver with this pin pulled Low may corrupt EEPROM data.
15	I	μP Reset	μP Reset – Controlled by the LT3124 for power-on reset if left unconnected. After a Stable power-on (4 ms) a 1 ms logic High pulse will reset the LT3124.
16	GND	GND	Signal Ground
17	I	TE	Transmit Enable – When pulled logic Low, the transceiver switches to transmit mode and will respond with CTS when data can be transmitted by the Host.
18	I	RE	Radio Enable – When the RADIO_ENABLE_ENABLED control bit is set in EEPROM the transceiver will only allow Host communications/control when this line is pulled logic Low. If the RADIO_ENABLE_ENABLED control bit is cleared, the transceiver ignores this input.
19	NC	NC	No Connect
20	O	In Range	In Range – Active Low when a Client radio is in range of a Server on same Channel

I = Input to the transceiver O = Output from the transceiver NC = Do not connect PWR = Power

3.2 ELECTRICAL SPECIFICATIONS

Table 2 - DC Input Voltage Characteristics

Pin	Type	Name	High Min.	High Max.	Low Min.	Low Max.	Unit
3	I	RXD	0.2 Vcc+0.9	Vcc+0.5	-0.5	0.2 Vcc-0.1	V
12	I	Test Mode/Packet Frame	0.2 Vcc+0.9	Vcc+0.5	-0.5	0.2 Vcc-0.1	V
14	I	Write Enable	0.7Vcc	Vcc+1	-0.3	0.5	V
15	I	µP Reset	0.7Vcc	Vcc+0.5	-0.5	0.2 Vcc-0.1	V
17	I	TE	0.2 Vcc+0.9	Vcc+0.5	-0.5	0.2 Vcc-0.1	V
18	I	RE	0.2 Vcc+0.9	Vcc+0.5	-0.5	0.2 Vcc-0.1	V

Table 3 - DC Output Voltage Characteristics

Pin	Type	Name	High Min.	Low Max.	Unit
2	O	TXD	Vcc-0.7 @ -30 µA	0.4 @ 1.6 mA	V
6	O	Hop Frame	Vcc-0.7 @ -30 µA	0.4 @ 1.6 mA	V
7	O	CTS	Vcc-0.7 @ -30 µA	0.4 @ 1.6 mA	V
13	O	RSSI	See Figure 1	See Figure 1	V
20	O	In Range	Vcc-0.7 @ -30 µA	0.4 @ 1.6 mA	V

3.3 HOST SOFTWARE/HARDWARE INTERFACE DEFINITION

3.3.1 Host Transmit Frame Format

The LT3124 requires the following format in order to transmit a Host's data packet over the RF link. The frame consists of 3 bytes of preamble, 1 sync byte, a 16-bit length, and user data.

Byte 0 – 55h – preamble
Byte 1 – 55h – preamble
Byte 2 – 55h – preamble
Byte 3 – 3Ah – sync
Byte 4 – Length High (bits 15-8)
Byte 5 – Length Low (bits 7-0)
Byte 6 – First byte Host Data
Byte n – Last byte Host Data

Length High/Length Low is a 16-bit length value that represents the length of bytes 6 through n inclusive. Both byte and packet gap times must be followed as specified in **Table 6 – Baud Rate/Timeout** . The maximum length depends on the interface baud rate. The maximum transmit time is 20 ms.

3.3.2 Host Receive Frame Format

The LT3124 transmits received RF data, beginning with the Length Bytes, to the Host following the reception of a valid preamble. The preamble and the sync bytes are not transmitted to the Host. If valid preamble bytes are not received, the transceiver will discard the data packet. The OEM Host is responsible for performing validation/CRC on the Host Data if errors are undesirable.

Byte 0 – Length High
Byte 1 – Length Low
Byte 2 – First byte Host Data
Byte n – Last byte of Host Data

3.3.3 Hopping Status

If the SW_HOP_FRAME_ENABLE bit is set in EEPROM, the transceiver sends a XOFF character to the Host when it is ready to hop. Following the completion of the hop, the transceiver sends a XON character to inform the Host that the hop is completed. The Host must parse these bytes and assume if a XOFF is received while transmitting a packet, the data did not reach the destination(s) and re-transmit the packet.

XOFF = E2h Transmitted at the start of a frequency hop.
XON = ACh Transmitted at the completion of a frequency hop.

The Host can also detect hopping status by monitoring the HOP FRAME pin (Pin 6) on the connector. The HOP FRAME pin is always enabled. HOP FRAME will transition logic Low at the start of a hop and High at the completion of a hop.

3.3.4 In Range

The IN RANGE pin (Pin 20) at the connector will be driven logic Low when a Client is in range of a Server on the same Channel. If a Client cannot hear a Server for 10s, it will drive the IN RANGE pin logic High and enter a search mode looking for a Server. As soon as it detects a Server, the IN RANGE pin will be driven logic Low. A Server Host can determine what Clients are in range by the Server's Host software polling a Client's Host as the Server radio will always report in range.

3.3.5 RSSI

Received Signal Strength Indicator is used by the Host as an indication of instantaneous signal strength at the receiver. The Host must calibrate RSSI without a signal being presented to the receiver. Calibration is accomplished by following the steps listed below to find a minimum and maximum voltage value.

1) Power up only one transceiver in the coverage area.
2) Measure the RSSI signal to obtain the minimum value with no other signal present.
3) Power up a transceiver that is the opposite type of the one measured in Step 2 (i.e. if the transceiver was a Client, power up a Server, otherwise power up a Client). Make sure the two transceivers are in close proximity and measure RSSI to obtain a maximum value at full signal strength.

4. Configuring the LT3124

A Host can program various parameters that are stored in EEPROM and become active after a power-on reset. **Table 5 - EEPROM Parameters**, gives the locations and functions of the parameters that can be read or written by a Host. Factory default values are also shown.

Do not write to any EEPROM addresses other than those listed in Table 5 – EEPROM Parameters. Do not copy a transceiver's EEPROM data to another transceiver. Doing so may cause a transceiver to malfunction.

Table 4 - EEPROM Parameters

Parameter	EEPROM Address	Default	Function
Channel	40h	00h	Byte range = 00h – 3Fh
Server/Client Mode	41h	02h	01h = Server 02h = Client
BaudL	42h	0Ah	Low Byte of the programmed baud rate
BaudH	43h	00h	High Byte of the programmed baud rate
Control	45h	10h	Radio Control Byte: Bit 7 – Laird Technologies use only Bit 6 – Laird Technologies use only Bit 5 – Laird Technologies use only Bit 4 – Laird Technologies use only Bit 3 – DATA_FRAME 0 = Disable packet frame 1 = Enable packet frame Bit 2 – Laird Technologies use only Bit 1 – RADIO_ENABLE_ENABLED 0 = Disable RE 1 = Enable RE Bit 0 – SW_HOP_FRAME_ENABLE 0 = Disable XON/XOFF 1 = Enable XONXOFF
Timeout	53h	FDh	Serial Byte Gap Timeout Value
Search Time	59h	F3h	Protocol parameter that varies with interface baud rate

4.1 CHANNEL

A transceiver can be programmed to one of 64 different Channels. Clients will receive and transmit to a Server programmed on the same Channel and vice versa. The Channel can be programmed with a value ranging from 00h to 3Fh.

4.2 SERVER/CLIENT MODE

The Server/Client Mode byte tells a transceiver to operate in Client or Server Mode. See **Section 5, Interfacing to the LT3124** for more detail on the usage of this parameter.

4.3 BAUD RATE

This two-byte value determines the baud rate used for communicating over the serial interface to the transceiver. **Table 6 - Baud Rate/Timeout** lists values for some common baud rates. Baud rates below 9600 are not supported.

When programming a baud rate, the associated Timeout and EEPROM address 59h values must also be programmed for proper operation. If the Test Mode/Packet Frame pin (Pin 12) is pulled logic Low at reset, the baud rate will be forced to 9600.

For Baud Rate values other than those shown in **Table 6 - Baud Rate/Timeout**, the following equations can be used:

BAUD = (18.432E+06/(32*desired baud rate))

BaudH = High 8 bits of BAUD (base16)
BaudL = Low 8 bits of BAUD (base16)

Table 5 - Baud Rate/Timeout

Baud Rate	BaudL (42h)	BaudH (43h)	Timeout (53h)	Search Time (59h)[1]	Delay (ms)[2]
115200	05h	00h	FEh	F3h	1.4
57600	0Ah	00h	FDh	EBh	2.8
38400	0Fh	00h	FCh	E3h	4.2
28800	14h	00h	FBh	DAh	5.6
19200	1Eh	00h	F9h	CAh	8.3
14400	28h	00h	F7h	B9h	11.1
9600	3Ch	00h	F3h	98h	16.7

[1] EEPROM address 59h must be set to the value listed for each baud rate.

[2] As a packet is received by a transceiver and is transmitted to its Host, a delay in the amount indicated for each baud rate will be introduced between the two length bytes and the remainder of the data packet.

4.4 CONTROL

The individual bits in the Control byte alter the operation of a transceiver. The Bit definitions follow:

Table 6 - Control Byte

Bit	Definition
0	Controls if a transceiver sends XON and XOFF characters to the Host, XOFF at the start of the hop and XON at the end of the hop.
1	When the RADIO_ENABLE_ENABLED bit is set to a value of 1, the transceiver will only allow Host communications/control when RE (Pin 18) is pulled logic Low. If the RADIO_ENABLE_ENABLED bit is cleared, the transceiver ignores the RE input.
2	Laird Technologies use only.
3	When the Data_Frame bit is set to a value of 1, the Test Mode/Packet Frame pin (Pin 12) transitions logic Low at the start of a packet and logic High at the completion of a packet. The completion of a packet is determined by the length specified in the Host transmit and receive frame format as shown in **Section 3.3.1, Host Transmit Frame Format** and **Section 3.3.2, Host Receive Frame Format** respectively. Therefore, this pin will not detect byte gaps, it will only transition logic High after the correct number of bytes have been transmitted or received.
4	Laird Technologies use only.
5	Laird Technologies use only.
6	Laird Technologies use only.
7	Laird Technologies use only.

4.5 CONFIGURATION COMMAND SET

The configuration commands allow the Host to read and write EEPROM parameters. A transceiver looks at the first byte of a sequence from the Host. If the first byte is the ***Configuration Start Byte*** (65h), and the Test Mode/Packet Frame pin (Pin 12) is pulled logic Low, a transceiver will enter Configuration Mode. The Host can then read and write parameters using the ***EEPROM Byte Read*** and ***EEPROM Byte Write*** commands. The command begins with Byte 0. All bytes are echoed back to the Host as they are received. The Host must not pull TE logic Low when using this mode. To exit Configuration Mode, the Host must perform a hardware or power-on reset. See **Section 5.1.3, Configuration Mode** for more information on how to program the LT3124.

4.5.1 Configuration Start Byte

The ***Configuration Start Byte*** command is sent once by the Host to enter Configuration Mode. After receiving this byte from the Host with the Test Mode/Packet Frame pin (Pin 12) pulled logic Low, ***EEPROM Byte Read*** and ***EEPROM Byte Write*** commands can be sent to the Host.

Byte 0 = 65h

4.5.2 EEPROM Byte Read

The read routine includes the read command, address, and length bytes. Upon receiving this command, a transceiver will transmit the desired data from the address requested by the Host. The length byte must be set to 01h. Only single byte reads are allowed.

Byte 0 = C0h Read Command
Byte 1 = XXh Address (XX = EEPROM addresses from **Table 5 - EEPROM Parameters**)
Byte 2 = 01h Length = 01h

4.5.3 EEPROM Byte Write

The write routine includes the write command, address, length, and data bytes. Upon receiving this command, a transceiver will write the data byte to the address specified but will not echo it back to the Host until the EEPROM write cycle is complete. The write can take as long as 10 ms to complete. Following the write cycle, a transceiver will transmit the data byte to the Host. The Write Enable pin (Pin 14) must be pulled logic Low to enable the write prior to issuing this command or the write will not occur, requiring the transceiver to be reset. The length byte must be set to 01h. Only single byte writes are allowed.

Byte 0 = C1h WRITE Command
Byte 1 = XXh Address (XX = EEPROM addresses from **Table 5 - EEPROM Parameters**)
Byte 2 = 01h Length = 01h
Byte 3 = XXh Data (XX = Valid EEPROM address value)

Note: The Write Enable pin on the connector should only be pulled logic Low before sending an *EEPROM Byte Write* command and must be held logic Low until the data byte is echoed to the Host.

4.6 On-the-Fly Control Command Reference

The LT3124 transceiver contains static memory that holds many of the parameters that control the transceiver operation. Using the "CC" command set allows many of these parameters to be changed during system operation. Because the memory these commands affect is static, when the transceiver is reset, these parameters will revert back to the settings stored in the EEPROM. **All "CC" commands must be issued from the Host to the transceiver with both Test Mode/Packet Frame (pin 12) and TE (Pin 17) pulled logic High.**

4.6.1 Status Request

The Host issues this command to request the status of the transceiver.

Host Command:
Byte 1 = CCh
Byte 2 = 00h
Byte 3 = 00h

Transceiver Response:
Byte 1 = CCh
Byte 2 = Firmware version number
Byte 3 = Data1

Where:
Data1 =
00 for Server in Normal Operation
01 for Client in Normal Operation
02 for Server in Acquisition Sync
03 for Client in Acquisition Sync

4.6.2 Change Channel

The Host issues this command to change the channel of the transceiver.

Host Command:
Byte 1 = CCh
Byte 2 = 01h
Byte 3 = RF Channel Number (Hexadecimal)

Transceiver Response:
Byte 1 = CCh
Byte 2 = RF Channel Number (Hexadecimal)

4.6.3 Change Channel with Forced Acquisition Sync

The Host issues this command to change the channel of the transceiver and force the transceiver to actively begin synchronization.

Host Command:
Byte 1 = CCh
Byte 2 = 02h
Byte 3 = RF Channel Number (Hexadecimal)

Transceiver Response:
Byte 1 = CCh
Byte 2 = RF Channel Number (Hexadecimal)

4.6.4 Server/Client Command

The Host issues this command to change the mode (Server or Client) of the transceiver and can force the transceiver to actively begin synchronization.

Host Command:

Byte 1 = CCh
Byte 2 = 03h
Byte 3 = Data1

Where:

Data1 =
- 00 for Server in Normal Operation
- 01 for Client in Normal Operation
- 02 for Server in Acquisition Sync
- 03 for Client in Acquisition Sync

Transceiver Response:

Byte 1 = CCh
Byte 2 = Software Version Number
Byte 3 = Data1

Where:

Data1 = Data1 from Host Command

5. Interfacing to the LT3124

5.1 Operating Modes

The LT3124 uses an 8-bit programmable asynchronous serial interface to communicate to a Host. The interface uses one start bit, eight data bits, one stop bit, and no parity. Only the interface baud rate is programmable by the Host.

A typical system consists of one transceiver operating in Server Mode and one or many transceivers operating in Client Mode. This Client/Server architecture does not allow Clients to communicate with other Clients or Servers to communicate with other Servers. Data transmitted by a Server is broadcast to all Clients that are in-range of that Server. A Server receives data sent by the Client(s). All protocol functions (retries, addressing, CRCs, etc.) must be performed by the Host software. All frequency hopping and synchronization is provided automatically by the transceiver without Host intervention.

The transceiver firmware is always operating in one of six modes. The Host can determine, through hardware and/or software, what mode the transceiver is operating by using the HOP FRAME pin (Pin 6) or the software XON/XOFF data.

5.1.1 Receive Mode

A transceiver is in Receive Mode by default when it is not in any other operating mode. While in this mode, a transceiver is looking for valid preamble and sync data bytes from a transmitter. When valid preamble and sync bytes are detected, a transceiver will transmit data received on the RF link to the Host using the Host Receive Frame Format shown in **Section 3.3.2, Host Receive Frame Format**.

5.1.2 Transmit Mode

The transceiver must already be in Receive Mode before initiating Transmit Mode. The Host software initiates transmission of a data packet on the RF link by taking TE logic Low, waiting for CTS to go logic Low, followed by sending the specified preamble, sync, length, and data bytes. A Client will only accept data from its Host when it is in-range of a valid Server. There must be no time gap in between subsequent bytes and TE must be Low for a maximum of 20 ms. At the end of the transmission, TE must promptly be taken logic High, after which, the transceiver will drive CTS logic High, returning it to Receive Mode. The Host software must perform MAC layer functions (retries, addressing, CRCs, etc.). If a Client is not in-range of a Server, CTS will remain logic High and Transmit Mode will not be entered.

The following sequence transmits a packet on the RF link:

1. The Host drives the TE pin (Pin 17) logic Low.
2. The transceiver responds by driving the CTS pin (Pin 7) logic Low.
3. The Host sends serial bytes as specified in the Host Transmit Frame Format shown in **Section 3.3.1, Host Transmit Frame Format**. The transceiver transmits each byte over the RF as it is received from the Host, not exceeding 20 ms in duration.
4. The Host drives TE logic High after the last byte is received by the transceiver.
5. The transceiver responds by driving CTS logic High and returns to Receive Mode.

5.1.3 Configuration Mode

The Configuration Mode is used to read and write the EEPROM parameters listed in **Table 5 - EEPROM Parameters**. While in this mode, a transceiver will not receive any data over the RF link. TE should be High and CTS should be ignored.

The Host enters this mode with the following sequence. See **Section 4.5, Configuration Command Set** for valid command formats.

1. The Host pulls the Write Enable pin (Pin 14) logic Low (if writing).
2. The Host pulls the Test Mode/Packet Frame pin (Pin 12) logic Low.
3. The Host sends the ***Configuration Start Byte*** to the LT3124.
4. The transceiver echoes the ***Configuration Start Byte*** to the Host.
5. The Host sends the ***EEPROM Byte Read*** or the ***EEPROM Byte Write*** command.
6. Upon completing the read/write, the transceiver echoes the command to the Host.
7. The Host repeats steps 5 – 6 until done.
8. The Host drives the Test Mode/Packet Frame and Write Enable pins logic High.
9. The Host resets the transceiver.

Note: The Write Enable pin should not be permanently tied logic Low as brownout conditions can corrupt EEPROM data.

5.1.4 On-the-Fly Configuration Mode

The On-the-Fly Configuration Mode is used to change certain static parameters on the fly. TE and Test Mode/Packet Frame should be High while using this mode. CTS should be ignored.

1. The Host issues the CC Command.
2. The transceiver acts upon the command.
3. The transceiver sends the CC Command response when completed.

5.1.5 Hopping Mode

The Hopping Mode is controlled by the transceiver. The transceiver hops approximately every 100ms. During this time, the transceiver is changing the frequency it will use to transmit and receive. The transceiver informs the Host of the start of a hop by taking the HOP FRAME pin (Pin 6) logic Low and sending the XOFF data byte, if enabled in the EEPROM. Once the hop has completed, a transceiver will take HOP FRAME logic High and send the XON byte, if enabled in the EEPROM. When the Host software detects the Hopping Mode during a transmission of a packet, it can be assumed the packet did not reach it's destination and the Host should resend the packet.

5.1.6 Beacon Mode

Beacon Mode only applies to a Server and is the default mode after a transceiver reset. In order to synchronize the hopping of all transceivers in a system, a Server transmits beacon data consisting of system timing information at a periodic rate. Beacons are sent after each hop. Beacons are also transmitted when a Server is transmitting data over the RF link. The beacon data is not transmitted or available to either the Client or Server Host. The beacon takes approximately 2 ms to complete. The Server Host can ignore the hop if the Host software has retry capabilities or can tolerate non-delivery of data. Empirical testing shows a 3 to 5 percent loss of data when ignoring the hop indicators.

5.2 DATA RATES

Various data rates, timings, and system architecture need to be considered when determining Overall System Throughput in a RF data system. The Host controls the Serial Interface Data Rate; however, the transceiver has a fixed RF Data Rate. The Effective Data Transmission Rate is determined from both Host and transceiver operation.

5.2.1 Serial Interface Data Rate

The Serial Interface Data Rate is programmable by the Host. This is the rate the Host and transceiver communicate over the serial bus. Typical values range from 9600 bps to 115200 bps. The only supported mode is asynchronous – 8-bit, No Parity, 1 Start Bit, and 1 Stop Bit.

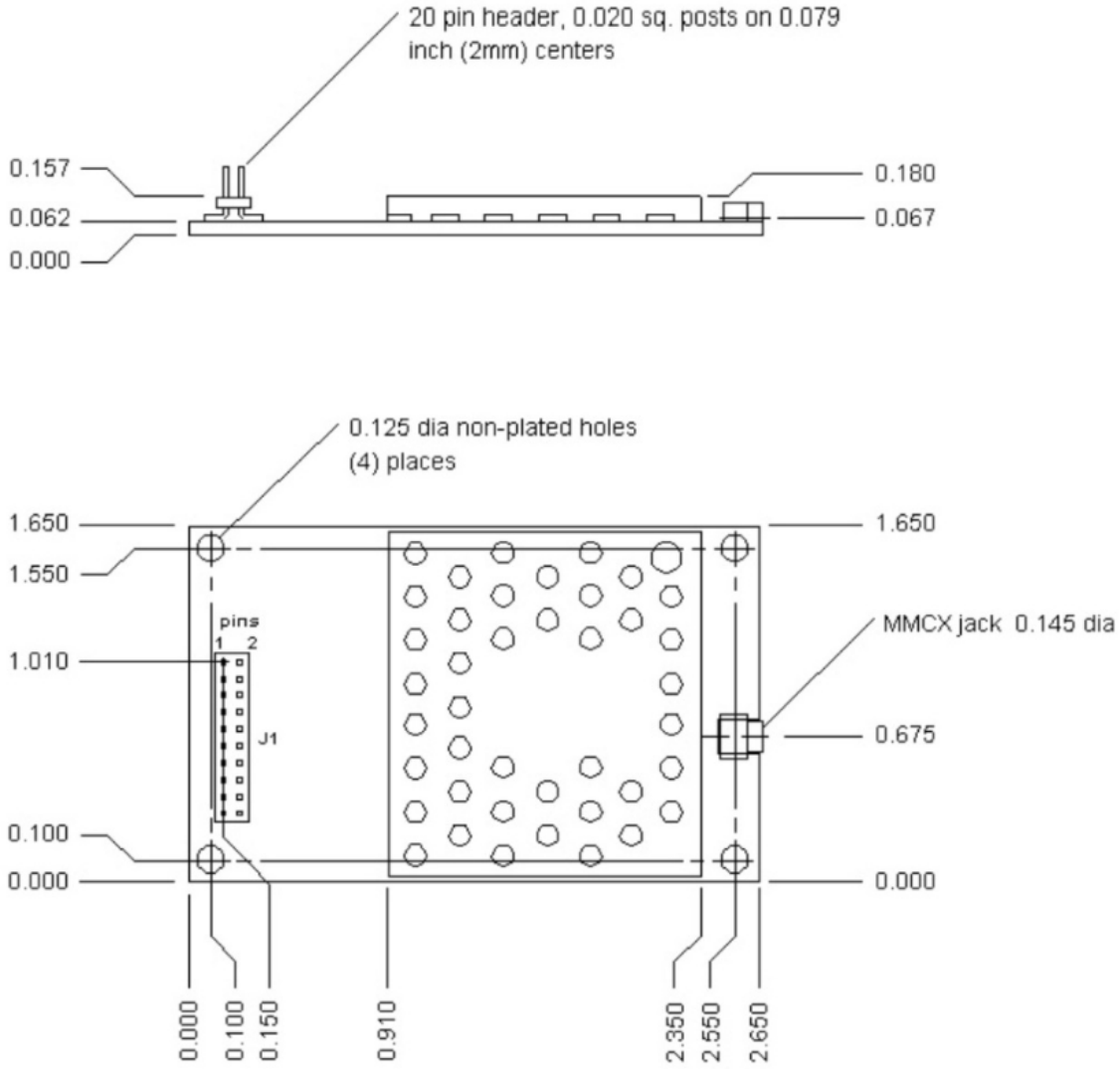
6. Mechanical Overview

6.1 TRANSCEIVER

All LT3124 products measure 1.65”W x 2.65”L. Critical parameters are as follows:

- **J1** – 20 pin OEM interface connector (Samtec TMM-110-01-L-D-SM, mates with Samtec SMM-110-02-S-D)
- **MMCX Jack** – Antenna connector (Telegartner P/N J01341C0081) mates with any manufacturer’s MMCX plug

Figure 1 - LT3124 with MMCX



7. Ordering Information

7.1 Product Part Numbers

LT3124-200: LT3124 with 400 mW output power, interface data rates to 115.2 Kbps, MMCX antenna connector, -40 °C to +80 °C.

7.2 Developer Kit Part Numbers

SDK-3124-200: Includes (2) LT3124-200 transceivers, (2) RS232 Serial Adapter Boards, (2) 7.5 Vdc regulated power supplies, (2) Serial cables, (2) S151FL-5-RMM-2450S dipole antennas with 5" pigtail and MMCX connector, configuration/testing software, Integration engineering support.

8. Regulatory Information

8.1 Agency Identification Numbers

Part Number	US/FCC	CANADA/IC
LT3124-200	KQL-4424200	2268C-4424200

8.2 Approved Antenna List

Item	Part Number	Mfg.	Type	Gain (dBi)
1	MFB24008	Maxrad	Omni	8
2	NZH2400-MMCX	Laird Technologies	Microstrip	1
3	ID2450-RS36[2]	Laird Technologies	Panel	9
4	S151FC-L-(132)PX-2450S	Nearson	Dipole	5

1. The OEM is free to choose another vendor's antenna of like type and equal or lesser gain as an antenna appearing in the table and still maintain compliance.

8.3 FCC/IC Requirements For Modular Approval

In general, there are two agency classifications of wireless applications; portable and mobile.

Portable – Portable is a classification of equipment where the user, in general, will be within 20 cm of the transmitting antenna. Portable equipment is further broken down into two classes; within 2.5 cm of human contact and beyond 2.5 cm. The LT3124 not agency approved for portable applications. The OEM is required to have additional testing performed to receive this classification. Contact Laird Technology for more details.

Mobile – Mobile defines equipment where the user will be 20 cm or greater from the transmitting equipment. The antenna must be mounted in such a way that it cannot be moved closer to the user with respect to the equipment, although the equipment may be moved.

This equipment has been approved for mobile applications where the equipment should be used at distances greater than 20 cm from the human body. Operation at distances of less than 20 cm would require additional RF exposure evaluation, including SAR requirement according to FCC RF Exposure guideline.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does not cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user in encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver

- Connect the equipment to an outlet on a circuit that is different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

8.4 OEM Equipment Labeling Requirements

WARNING: The OEM must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Laird Technology FCC identifier for this product as well as the FCC notice below. The FCC identifiers are listed above.

Contains FCC ID:KQL-4424200 This enclosed device complies with Part 15 of the FCC Rules, Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation

Label and text information should be in a size of type large enough to be readily legible, consistent with the dimensions of the equipment and the label. However, the type size for the text is not required to be larger than eight point.

8.5 Antenna Requirements

To reduce potential radio interference to other users, the antenna type and gain should be chosen so that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

WARNING: This device has been tested with an MMCX connector with the above listed antennas. When integrated into the OEM's product, these fixed antennas require professional installation preventing end-users from replacing them with non-approved antennas. Any antenna not listed in the above table must be tested to comply with FCC Section 15.203 for unique antenna connectors and Section 15.247 for emissions. Contact Laird Technology for assistance.

Caution: Any changes or modifications not expressly approved by Laird Technology could void the user's authority to operate the equipment.

8.6 Warnings Required In OEM Manuals

WARNING: This equipment has been approved for mobile applications where the equipment should be used at distances greater than 20cm from the human body. Operation at distances of less than 20cm is strictly prohibited and requires additional SAR testing.