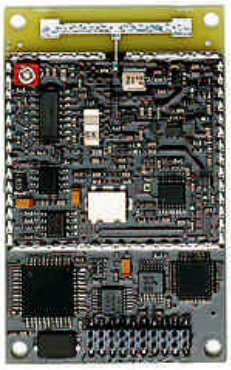
Frequently Asked Questions

ConnexRF™ Products

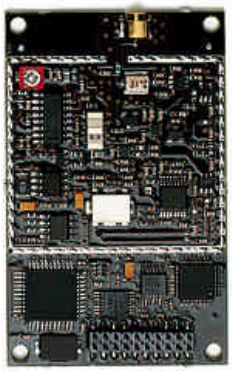
Version 1.1

PKLR2400S-200A

PKLR2400S-10



LX2400S-3A



LX2400S-10

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DOCUMENT INFORMATION

Copyright Information

Revision	Description
Version 1.0	5/25/00 – Initial Release Version
Version 1.1	10/12/00 – Revised complete document

This material is preliminary

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AEROCOMM's products are intended for use in normal commercial applications. Applications requiring extended temperature range or unusual environmental requirements such as military, medical life-support or life-sustaining equipment, are specifically not recommended without additional testing for such application.

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1. Frequently Asked Questions

Listed below are some of the most common questions that are asked by engineers about AeroComm's ConnexRF OEM transceiver products. Most of the Q&A relates to the PKLR2400S transceivers except where the LX2400S is specifically mentioned.

1.1 WHAT IS SYSTEM LATENCY? HOW IS IT MEASURED?

There are two components of system latency that need to be calculated: 1) Serial Interface latency, which is related to the Baud Rate and the packet size and 2) Transceiver latency, which is the amount of delay the transceivers introduce.

Transceiver latency is the difference in time between when the last bit of the last byte enters the transmitting transceiver and when the receiving transceiver sends out the first bit of the first byte over the serial interface. This latency is dependant on the RF layer protocol that is used. Maximum latencies of 50ms can be seen with TDMA protocols. However, CSMA protocols (used by AeroComm transceivers) significantly reduce this latency to a maximum of 12-15ms.

It is important to realize there are also other factors that can affect the transceiver latency. If the transceivers are operating in Transparent Mode 1 with variable packet sizes, the Interface Timeout Control value must be added to the latency. The minimum value is 4ms. If this additional time creates system timing problems, then padding the packets to a fixed length and programming the transceivers in Transparent Mode 4 may be a solution. By doing this, each packet will be sent as soon as they are completely received by the transceiver. Transceivers operating in Transparent Mode 2 or API Mode 3 will not affect latency, as these modes will only allow the transceiver to send packets once they are complete.

If transceiver latency is a critical factor, there is another option that may help reduce latency. In a point-to-point (one Server and one Client) system configuration, the RF Mode can be changed to Turbo Mode. This will disable the random back-off function and the wait time that exists between successive packets in CSMA mode. This helps pipeline data being transmitted and should minimize the amount of time that transceiver latency adds to the total system latency. Turbo Mode can also be used successfully in a master polling system configuration. In this type of system, the Server "loops" through number of Client transceivers and requests information from one transceiver at a time. Turbo Mode can easily decrease the amount of time the Server waits for a response after requesting information from a Client transceiver.

1.2 DOES CTS REALLY NEED TO BE RESPECTED?

Although it is possible to successfully transmit data without respecting CTS, it is not recommended. Utilizing CTS guarantees that no packet is lost due to overwriting the transceiver input buffer. The serial interface input buffer provides 8 KBytes of memory segmented into four dynamic regions. In API Serial Interface Mode 03, only one region is utilized. In Transparent Serial Interface Modes 01, 02 and 04, a buffer region is used each time a packet release condition is met. As an example, in End Character Mode 02, if 500 Bytes are transmitted followed by the specified End Character, 500 Bytes will be stored in the first region and the remaining 7.5 KBytes will be dynamically allocated for the next three packets. It is **strongly** recommended that CTS or Host protocol with acknowledgements be used by the OEM when operating in any of the Transparent Serial Interface Modes to eliminate the incidence of lost data.

1.3 WILL THE TRANSCEIVERS SUPPORT PEER TO PEER COMMUNICATIONS?

Not at this time. Currently our transceivers will support point-to-point or point-to-multipoint communications in a Server/Client configuration. Servers cannot communicate with other Servers and Clients cannot communicate with other Clients.

1.4 ALL OF THE MODEM CONTROL LINES HAVE BEEN ENABLED, BUT THE TRANSCEIVER WON'T RESPOND TO RTS.

This problem is most likely caused by not setting bit 3 of the Serial Interface Control Byte, located at 4Ah in the EEPROM. AeroComm transceivers have the ability to respect RTS or completely ignore RTS. The default configuration is set to ignore RTS (or bit 3 = 0). If the modem control lines are enabled, bit 3 in the Serial Interface Control Byte will also need to be set to cause the transceivers to respect RTS. Values for this byte are listed below for each of the Serial Interface Modes:

- 49h = Mode 1 with Modem controls and RTS.
- 4Ah = Mode 2 with Modem controls and RTS.
- 4Bh = Mode 3 with Modem controls and RTS.
- 4Ch = Mode 4 with Modem controls and RTS.

1.5 DOES THE OEM NEED A LICENSE TO USE THE PKLR2400S IN OUR PRODUCTS?

OEM Radios are approved as follows:

				Applies to US/FCC Only		
Part Number	**US/FCC**	**CAN/IC**	**EUR/EN**	**Portable**	**Mobile**	**Fixed**
LX2400-3A	X	X	X	X	X	X
LX2400-10	X	X	X	X	X	X
LX2400-10A	X	X	X	X	X	X
LX2400-150	X	X			30 cm	30 cm
PKLR2400-10	X	X	X	X	X	X
PKLR2400-200	X	X			32 cm	32 cm

Note: France and Spain have different requirements and are not approved. The LX2400S-150 and PKLR2400S-200 are approved for Mobile and Base Station applications only with end-user separation as specified above. Contact AeroComm Sales at (800) 492-2320 with additional questions.

1.5.1 OEM Radios - FCC in the United States

All spread spectrum devices for sale in the United States must be tested under FCC Part 15, Subpart C, Section 15.247, or Section 15.249 for low power. In addition, any transmitters being used in portable applications, or transmitters approved as modular devices must meet Specific Absorption Ratings (SAR) to ensure safety. All AeroComm transceivers approved for portable applications meet SAR requirements. Under certain conditions, the FCC will grant a certificate of compliance for modular transceiver approval. AeroComm has received modular transceiver approval by the FCC for the PKLR2400S and LX2400S. The PKLR2400S-200 and LX2400S-150 have end-user separation restrictions as noted in the table above. What this means to the OEM is the following:

a) If the transceiver module is not fully shielded, a scan of your product with the integrated transceivers will need to be performed to test transmitter radiated emissions. This is referred to as a Class I permissive change requiring no FCC filing. Typical cost is less than $500.

b) Other FCC certification such as Part 15 Subpart J required for any digital device are still the responsibility of the device manufacturer.

c) Any major changes to the OEM transceiver, including custom antennas, are considered Class II Permissive Changes and require transmitter radiated emissions scans and a filing with the FCC. These scans and filings typically cost less than $1,000.

1.5.2 OEM Radios, IC in Canada

All spread spectrum devices for sale in Canada must be tested under IC RSS-139. Regulations are very similar to the United States. AeroComm has received modular transceiver approval by IC for the PKLR2400S and LX2400S products.

1.5.3 OEM Radios, ETS in Europe

All spread spectrum devices for sale in Europe must comply with one or more of the following: ETS 300 328, ETS 300 683 or ETS 300 826. Output power is limited to 100mW Effective Isotropic Radiated Power (EIRP). This means the measured power output, including antennas, cannot exceed 100mW. Therefore, the PKLR2400S-200 and LX2400S-150 are not offered for sale in Europe. Effective May 2000, the European Notification (EN) body has ruled that all spread spectrum devices operating in the 2.4GHz band will be self-declaring. What this means to the OEM is the following:

a) A Declaration of Conformity for the AeroComm transceiver will be issued to the OEM. It is the responsibility of the OEM to ensure the Declaration of Conformity is on file with the appropriate agencies in each country. There are no filing fees.

b) Any major changes to the OEM transceiver, including custom antennas, require retesting to ensure conformity. No additional filings are required. These scans and filings typically cost less than $1,000. The OEM can contract a test house to file applications in each country or may elect to file it themselves.

c) France and Spain have different allowable bands that require AeroComm transceivers to operate in different modes. Check with your AeroComm sales representative.

d) EN Certification of the OEM product for digital devices is still required.

1.6 WHILE RUNNING A WINDOWS APPLICATION, THE SYSTEM OCASSIONALLY HANGS UP OR THERE IS UNEXPECTED LATENCY?

If a Windows application is used to run the transceivers, check the following:

1. Make sure the FIFO is enabled on the COM port.
2. Make sure the COM port has no conflicts.
3. Other programs running on the PC in addition to the transceiver application may cause data reception to pause. Try closing these other applications.
4. Try removing the transceivers from the system and test your software with a serial cable connected directly to both Hosts.

1.7 IS THE RF DATA RATE SPECIFIED IN THE DATASHEET THE SAME RATE THAT DATA WILL BE TRANSMITTED?

Yes, all data is transmitted at the RF data rate. However, the effective data rate will only be as high as 40% of the RF data rate due to system management overhead. The effective data rate varies depending on factors such as packet size, Serial Interface Mode, model of transceiver, etc. Additionally, other functions that reduce effective data rate include frequency hopping, preamble (the packet header including transceiver ID, destination address, etc.), and error detecting and correcting.

1.8 CAN THE EFFECTIVE DATA RATE BE INCREASED WHEN USING ONLY TWO TRANSCEIVERS IN POINT-TO-POINT APPLICATIONS?

Yes, by configuring Turbo Mode the effective data rate can be doubled. Transceivers that have Turbo Mode enabled will use a slightly different RF protocol with reduced system overhead. This allows the transceivers to increase the effective data rate. Note that if the transceivers are used in a noisy RF environment, the effective data rates will be reduced as retransmitted packets increase.

1.9 CAN MULTIPLE SERVERS BE LOCATED IN CLOSE PROXIMITY WITHOUT INTERFERRING WITH EACH OTHER?

Yes, multiple collocated independent networks can operate in close proximity by configuring the networks on different Channel Numbers. Transceivers on different channels operate independent of each other. The transceiver protocol will ensure that two or more independent networks will not interfere with each other.

1.10 WILL SYSTEM PERFORMANCE DEGRADE IF MULTIPLE CHANNELS ARE USED?

No, several Server transceivers can operate in the same area on different channels **without** degrading system performance. All Server transceivers have the same hopping sequence, but each Server starts its hop sequence at a different frequency. Therefore, Server collisions are avoided.

1.11 How are collisions handled by the transceivers?

The transceivers run a Carrier Sense Multiple Access (CSMA) protocol with random back off and a selectable back-off seed. Therefore, in the event of a collision, the transceiver will back off and retry. Specifically, when two transceivers detect a collision, each transceiver will choose a random number of packet times that it will wait before retrying the packet. This random number is selected from a pool of numbers defined by the back-off seed and consists of a number between 1 and 2, 1 and 4, 1 and 8, or 1 and 16. In a very dense network, where more than two transceivers could experience a collision, it is important to have a higher random back-off seed.

1.12 In high density applications, what amount of latency should be expected?

The CSMA protocol provides time slots for up to 8 Clients; however, the Server can handle many more than 8 Clients. When a Client completes a transmission, that time slot becomes available for a new Client. Additionally, the Server sends out beacons on a regular basis and this causes system latency. System latency is specified at a maximum of 15ms one direction.

Clients experience minimal system latency because Clients do not time-slice the Server. However, even though you may have only one Client, the Client cannot transmit until its time-slice occurs. Again, time slicing is NOT part of our RF protocol!!!

1.13 Is it possible to change a unit from being a Client to being a Server during system operation?

For PKLR2400S transceivers, the current version of firmware will not support this type of change during system operation.

For LX2400S transceivers, the OEM can perform this change during system operation. However, since this information is stored in the EEPROM, the OEM must consider how often this change can be made without exceeding the number of EEPROM write/erase cycles.

1.14 Can the firmware on the transceivers be upgraded?

The firmware can only be upgraded by sending the transceivers to the factory. There are no means for upgrades in the field.

1.15 Are RS232 interface boards available for the transceivers?

Yes, optional RS232 boards are available. These boards are designed to connect directly to the transceivers 40-pin AMP connector in a stacked configuration.

1.16 When a Server operates on one of 77 non-interfering channels, does that mean a Server can have up to 77 Clients?

No, the specification "77 non-interfering channels" means that 77 different Servers can operate in the same area without interfering with each other. There is no limit to the number of Clients that can be part of the system.

1.17 How does a Client register with a Server?

A Client "registers" with a Server when it sends a data packet to the Server.

1.18 How does a Server keep track of its active Clients?

The Server keeps a short list of the most active Clients in its internal memory. The Server will keep track of up to 8 Clients at one time. It updates this list with only the most recent Clients that have sent data to the Server.

1.19 What does the term "active" Client mean? When does a Server consider a Client "inactive"?

Active refers to whether or not the Client is in the Server's list of 8 transceivers. Active or inactive does not affect how the Server will respond to a Clients data packet. Active transceivers do not get any priority over inactive transceivers.

1.20 Is it possible to have two Servers on the same network (ie. Same System ID and Channel No.) and what are the results?

Configuring two Servers with the same Channel Number and System ID is **highly** discouraged. This will create constant interference resulting in very poor system performance. In fact, the system may not work at all.

1.21 If one transceiver on a network is in API mode and the rest are in transparent mode, can the transceivers communicate with each other?

This configuration is not supported by the transceiver protocol and therefore will not work.

1.22 In transparent mode, can a Server see the source IEEE address in a data packet?

No, the Server just receives the data packet and passes it to the Server Host.

1.23 ARE THERE DATA DELIVERY ACKNOWLEDGEMENTS WHEN OPERATING IN TRANSPARENT MODE?

No, the RF layer acknowledgements are not sent to the transceiver Hosts. To guarantee data delivery, the number of Transmit Data Link Attempts (specified at EEPROM address location 2Fh) can be increased or the necessary Host protocol can be written to ensure data integrity.

1.24 IN TRANSPARENT MODE, DOES THE CTS PIN GO LOW BEFORE THE IN-RANGE PIN GOES LOW?

CTS and In-Range are independent of one another. CTS is related to the serial interface and In-Range is related to the RF interface. However, the In-Range pin should be checked by the Client Host prior to sending data over the serial interface. If In-Range is low, the Client Host should then check CTS to make sure it's OK to send data to the Client transceiver.

1.25 IF DATA IS SENT FROM THE HOST TO THE TRANSCEIVER WHEN IT IS OUT OF RANGE, IS THE DATA STORED IN A BUFFER AND SENT ONCE THE TRANSCEIVER IS IN RANGE?

If CTS is low and data is sent to the Client transceiver, but the Client is not in range of a Server, then data could be lost, as the input buffer will only store the data for a finite amount of time.

1.26 WHEN USING API MODE, HOW CAN THE TRANSCEIVER HOST ACCESS THE SERVER IEEE ADDRESS FOUND IN THE BEACON FOR THE PURPOSE OF CONSTRUCTING A DATA PACKET?

In API mode, when the Client transceiver receives the Server's beacon it will issue an In Range API command to the Client Host. This command contains the Server's IEEE address in the data portion of the command.

1.27 IS THERE AVAILABLE EEPROM MEMORY IN THE TRANSCEIVER DEVICE FOR OEM USER VARIABLES?

No, EEPROM memory is reserved for AeroComm use only.

1.28 WILL A BETTER CRYSTAL IMPROVE THE WARM-UP TIME OF THE TRANSCEIVER?

No, the warm up time is comprised of the initialization of the transceiver hardware and firmware. The crystal has no affect on this time.

1.29 HOW MUCH CURRENT DOES THE ~400MS INITIALIZATION SEQUENCE ACTUALLY CONSUME?

The current consumption for initialization is limited to the current consumption of just the digital components on the transceiver, or typically 35mA.

1.30 IS IT POSSIBLE TO ADD USER DATA TO THE SERVER BEACON THAT IS SENT OUT TO THE CLIENTS?

The current transceiver firmware does not support adding any user data to the Server beacon.