Dear SDK Customer:

Thank you for purchasing one of AeroComm's ConnexRF OEM Developer Kits - a complete, integrated package that contains all the hardware, software, and documentation needed to evaluate ConnexRF technology and begin integration with an AeroComm OEM transceiver. With your Developer Kit purchase, you get more than just its contents - you get the technical expertise and support that enables you to integrate an AeroComm ConnexRF OEM transceiver quickly and painlessly.

Inside this box you should find the following components:

(2) AeroComm transceivers
(2) RS232 interface adapter boards
(2) Interconnect boards (used to connect the transceivers to the RS232 interface adapter boards)
(2) Antennas
(2) 6VDC power supplies
(2) 6 foot DB9 female to DB9 female cables
(1) 3.5" Software diskette
(1) 3-Ring binder with documentation

As we promised, we have assigned a dedicated engineer that will provide unlimited hours of technical support during your product development. We have enclosed the business card of the engineer that will be supporting your integration. If you have any additional questions, please contact us at (800) 492-2320.

Sincerely,

AeroComm, Inc.

N. Zach Hogya
Design Engineer

Phone Extension: 215
Email: zhogya@aerocomm.com

www.aerocomm.com
# TABLE OF CONTENTS

1. OVERVIEW ........................................................................................................ 4

2. SERIAL ADAPTER BOARD .................................................................................. 5

3. TROUBLESHOOTING ......................................................................................... 8

Figures

Figure 1 - Serial Adapter Board Assembly Drawing .............................................. 5

Tables

Table 1 - DB9 (J2) Signal Definitions ................................................................ 6
Table 2 - Status LEDs ......................................................................................... 6
Table 3 - Switch Settings .................................................................................... 7
2. Serial Adapter Board

The Serial Adapter Board in the SDK is provided so the developer can use a standard PC serial port to operate the transceivers and to aid in system integration. As shown in Figure 2 below, there are many features that enhance the functionality and usability of this board. RS232 levels or 5 Volt TTL logic levels can be used for interfacing with the transceiver. The configuration and operation of the Serial Adapter Board is continuously shown by the LEDs placed on the edge of the board. See Table 2 – Status LEDs and Table 3 - Switch Settings for definitions of the LEDs and switches.

Figure 1 - Serial Adapter Board Assembly Drawing
<table>
<thead>
<tr>
<th>Switch/Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTE/DCE (S4)</td>
<td>When this switch is moved to the <em>High</em> position, the serial interface will be configured as a DCE (modem) connected to a DTE (PC). The SDK only allows connection to Data Terminal Equipment (DTE) using TTL or RS232 levels. Moving the DTE/DCE switch to the <em>Low</em> position will disable transceiver communication. If communication with other Data Communication Equipment (DCE) is desired, a null-modem cable is required.</td>
</tr>
<tr>
<td>TTL/RS-232 (S4)</td>
<td>When this switch is moved to the <em>High</em> position, the Serial Adapter Board will support TTL level communications from the DB9 to the serial interface of the transceiver (in addition, the 5V jumpers must be installed). When the switch is moved to the <em>Low</em> position, the Serial Adapter Board will support RS232 level communications from the DB9 to the serial interface of the transceiver (<em>NOTE:</em> Never install the 5V jumpers when the Serial Adapter Board is configured to support RS-232 levels). The 40-pin header will always be TTL (5V levels).</td>
</tr>
<tr>
<td>9600_TST (S4)</td>
<td>When this switch is moved to the <em>High</em> position, the transceiver will communicate at the Baud Rate configured in the EEPROM. When the switch is moved to the <em>Low</em> position, the transceiver is forced to 9600 Baud.</td>
</tr>
<tr>
<td>Reset (S1)</td>
<td>When this pushbutton is pressed, the transceiver hardware is reset.</td>
</tr>
<tr>
<td>Wr_Enable (S2)</td>
<td>When this pushbutton is pressed, it will write-enable the EEPROM on the LX2400S transceiver. <em>This button must be pressed and held during the write process.</em></td>
</tr>
<tr>
<td>Config/Normal (S5)</td>
<td>When this switch is moved to the <em>Config</em> position, the RTS pin at the DB9 connector is connected to the PKTMODE pin (pin 2) of the transceiver. This allows the SDK software to control the PKTMODE line when writing to or reading from the transceiver EEPROM. When the switch is moved to the <em>Normal</em> position, RTS at the DB9 is connected to RTS line of the transceiver.</td>
</tr>
</tbody>
</table>
AC4424
2.4 GHz OEM TRANSCEIVERS
Specifications Subject to Change

User’s Manual
Version 1.5

10981 EICHER DRIVE
LENEXA, KS 66219
(800) 492-2320
www.aerocomm.com
wireless@aerocomm.com
This material is preliminary

Information furnished by AEROCOMM in this specification is believed to be accurate. Devices sold by AEROCOMM are covered by the warranty and patent indemnification provisions appearing in its Terms of Sale only. AEROCOMM makes no warranty, express, statutory, and implied or by description, regarding the information set forth herein. AEROCOMM reserves the right to change specifications at any time and without notice.

AEROCOMM's products are intended for use in normal commercial and industrial applications. Applications requiring unusual environmental requirements such as military, medical life-support or life-sustaining equipment are specifically not recommended without additional testing for such application.
<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1.0</td>
<td>11/7/2001 – Initial Release Version</td>
</tr>
<tr>
<td>Version 1.1</td>
<td>10/14/2002 – Not Released</td>
</tr>
<tr>
<td>Version 1.2</td>
<td>10/18/2002 – Full release of AC4424 specification</td>
</tr>
<tr>
<td>Version 1.3</td>
<td>11/19/2002 – Made Full-Duplex incompatible with Stream Mode</td>
</tr>
<tr>
<td>Version 1.4</td>
<td>12/09/2002 – Changed Sub Hop Adjust setting recommendations</td>
</tr>
<tr>
<td>Version 1.5</td>
<td>1/30/2003 – Removed all references to Commercial and Industrial temperature. All products are now Industrial temperature. Changed Section 4.2.1 EEPROM Byte Read to allow multiple byte reads.</td>
</tr>
</tbody>
</table>
FCC INFORMATION

Agency Approval Overview

<table>
<thead>
<tr>
<th>Part Number</th>
<th>US/FCC</th>
<th>CAN/IC</th>
<th>EUR/EN</th>
<th>Portable</th>
<th>Mobile</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC4424-10</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC4424-100</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X-32cm*</td>
<td>X-32cm*</td>
</tr>
<tr>
<td>AC4424-200</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X-32cm*</td>
<td>X-32cm*</td>
</tr>
</tbody>
</table>

* See RF Exposure warning on next page
Note: The product approvals above are with antennas specified below.

Agency Identification Numbers

<table>
<thead>
<tr>
<th>Part Number</th>
<th>US/FCC</th>
<th>CAN/IC</th>
<th>EUR/EN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC4424-10</td>
<td>KQL-PKLR2400</td>
<td>CAN2268391158A</td>
<td>X</td>
</tr>
<tr>
<td>AC4424-100</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>AC4424-200</td>
<td>KQL-PKLR2400-200</td>
<td>CAN2268391180A</td>
<td></td>
</tr>
</tbody>
</table>

FCC Notice

⚠️ WARNING: This 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.

Labeling Requirements

⚠️ WARNING: The Original Equipment Manufacturer (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 AeroComm FCC identifier for this product as well as the FCC Notice above. The FCC identifiers are listed above in the Agency Identifier Numbers section.

Antenna Warning

⚠️ WARNING: This device has been tested with an MMCX connector with the antennas listed below. When integrated in the OEMs product, these fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Any antenna not in the following table must be tested to comply with FCC Section 15.203 for unique antenna connectors and Section 15.247 for emissions.

12/09/02
### Approved Antenna List

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Mfg.</th>
<th>Type</th>
<th>Gain (dBi)</th>
<th>AC4424X-10</th>
<th>AC4424X-100</th>
<th>AC4424X-200</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WCP-2400-MMCX</td>
<td>Centurion</td>
<td>1/4 Wave Dipole</td>
<td>2</td>
<td>PMF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>2</td>
<td>WCR-2400-SMRP</td>
<td>Centurion</td>
<td>1/4 Wave Dipole</td>
<td>2</td>
<td>PMF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>3</td>
<td>MFB24008RPN</td>
<td>Maxrad</td>
<td>Omni</td>
<td>8</td>
<td>MF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BMMG24000MSMARP12'</td>
<td>Maxrad</td>
<td>Omni-Mobile</td>
<td>1</td>
<td>MF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BMMG24005MSMARP12'</td>
<td>Maxrad</td>
<td>Omni-Mobile</td>
<td>5</td>
<td>MF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>MP24013TSMARP12</td>
<td>Maxrad</td>
<td>Panel</td>
<td>13</td>
<td>MF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MUF24005M174MSMARP12</td>
<td>Maxrad</td>
<td>Omni-Mobile</td>
<td>5</td>
<td>MF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>MC2400</td>
<td>Maxrad</td>
<td>Patch</td>
<td>2.5</td>
<td>MF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>9</td>
<td>NZH2400-MMCX (External)</td>
<td>AeroComm</td>
<td>Microstrip</td>
<td>1</td>
<td>PMF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>10</td>
<td>NZH2400-I (Integral)</td>
<td>AeroComm</td>
<td>Microstrip</td>
<td>1</td>
<td>PMF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>11</td>
<td>S131CL-5-RMM-2450S</td>
<td>Nearson</td>
<td>1/4 Wave Dipole</td>
<td>2</td>
<td>MF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>12</td>
<td>S181FL-5-RMM-2450S</td>
<td>Nearson</td>
<td>1/4 Wave Dipole</td>
<td>2</td>
<td>PMF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>13</td>
<td>S191FL-5-RMM-2450S</td>
<td>Nearson</td>
<td>5/8 Wave Dipole</td>
<td>3</td>
<td>PMF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>14</td>
<td>S151FL-5-RMM-2450S</td>
<td>Nearson</td>
<td>Omni</td>
<td>5</td>
<td>MF</td>
<td>MF</td>
<td>MF</td>
</tr>
<tr>
<td>15</td>
<td>MLPV1700</td>
<td>Maxrad</td>
<td>Omni-Mobile</td>
<td>4</td>
<td>MF</td>
<td>MF</td>
<td>MF</td>
</tr>
</tbody>
</table>

P=Portable, M=Mobile, F=Fixed/Basestation
RF Exposure AC4424-10

⚠️ WARNING: To comply with FCC RF Exposure requirements, the Original Equipment Manufacturer (OEM) must ensure that Antennas 3, 4, 5, 6 and 7 in the previous table must be installed and/or configured to operate with a separation distance of 20cm or more from all persons to satisfy RF Exposure compliance.

The preceding statement must be included as a CAUTION statement in manuals for products operating with Antennas 3, 4, 5, 6 and 7 in the previous table to alert users on FCC RF Exposure compliance.

RF Exposure AC4424-100

⚠️ WARNING: To satisfy FCC RF exposure requirements for mobile and base station transmitting devices, a separation distance of 32cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operations at closer than this distance is not recommended.

The preceding statement must be included as a CAUTION statement in manuals for OEM products to alert users on FCC RF Exposure compliance.

RF Exposure AC4424-200

⚠️ WARNING: To satisfy FCC RF exposure requirements for mobile and base station transmitting devices, a separation distance of 32cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operations at closer than this distance is not recommended.

The preceding statement must be included as a CAUTION statement in manuals for OEM products to alert users on FCC RF Exposure compliance.
TABLE OF CONTENTS

1. OVERVIEW .................................................................................................................. 9

2. AC4424 SPECIFICATIONS ......................................................................................... 10

3. SPECIFICATIONS ....................................................................................................... 11
   3.1 INTERFACE SIGNAL DEFINITIONS ......................................................................... 11
   3.2 ELECTRICAL SPECIFICATIONS ............................................................................. 12
   3.3 SYSTEM TIMING ...................................................................................................... 12
      3.3.1 Serial Interface Data Rate .................................................................................. 12
      3.3.2 Latency Times .................................................................................................. 12
      3.3.3 Maximum Overall System Throughput ............................................................. 12

4. CONFIGURING THE AC4424 .................................................................................... 14
   4.1 EEPROM PARAMETERS ........................................................................................... 14
   4.2 EEPROM CONFIGURATION COMMANDS .............................................................. 15
      4.2.1 EEPROM Byte Read ....................................................................................... 16
      4.2.2 EEPROM Byte Write ...................................................................................... 16
      4.2.3 EEPROM Exit Configuration Command ........................................................ 16
   4.3 ON-THE-FLY CONTROL COMMAND REFERENCE ............................................. 17
      4.3.1 Status Request ................................................................................................ 17
      4.3.2 Change Channel with Forced Acquisition Sync .............................................. 17
      4.3.3 Server/Client Command .................................................................................. 18
      4.3.4 Power-Down Command .................................................................................. 18
      4.3.5 Power-Down Wake-Up Command .................................................................... 19
      4.3.6 Broadcast Mode .............................................................................................. 19
      4.3.7 Read Static Bank #1 Byte .............................................................................. 19
      4.3.8 Write Static Bank #1 Bytes ............................................................................ 20
      4.3.9 Read Static Bank #2 Bytes ............................................................................ 20
      4.3.10 Write Static Bank #2 Bytes .......................................................................... 21
      4.3.11 Write Destination Address .......................................................................... 21
      4.3.12 Read Destination Address .......................................................................... 21
      4.3.13 Temperature Update .................................................................................... 22

5. THEORY OF OPERATION ............................................................................................ 23
   5.1 HARDWARE INTERFACE ........................................................................................ 23
      5.1.1 TXD (Transmit Data) and RXD (Receive Data) (pins 2 and 3 respectively) ........ 23
      5.1.2 Hop Frame (pin 6) ......................................................................................... 23
      5.1.3 CTS Handshaking (pin 7) .............................................................................. 23
      5.1.4 RTS Handshaking (pin 8) ............................................................................. 23
      5.1.5 9600 Baud/Packet Frame (pin 12) ................................................................. 24
      5.1.6 RSSI (pin 13) ............................................................................................... 24
      5.1.7 WR_Eha (EEPROM Write Enable) (pin 14) .................................................... 25
      5.1.8 UP_Reset (pin 15) ......................................................................................... 25
      5.1.9 Command/Data (pin 17) ............................................................................... 25
      5.1.10 In Range (pin 20) ....................................................................................... 25

   5.2 SOFTWARE PARAMETERS ....................................................................................... 25
      5.2.1 RF Architecture (Server-Client/Peer-to-Peer) ............................................... 25
      5.2.2 RF Mode ....................................................................................................... 26
      5.2.3 Sub Hop Adjust ............................................................................................ 27
      5.2.4 Duplex Mode .............................................................................................. 27

12/09/02
AC4424 Specifications

AC4424 Features

- Simple 5V TTL level serial interface for fast integration
- Frequency Hopping Spread Spectrum for security and interference rejection
- Cost Efficient for high volume applications
- Low power consumption for battery powered implementations
- Small size for portable and enclosed applications
- Very Low latency and high throughput
- Industrial temperature (-40°C to 80°C)

1. Overview

The AC4424 is a member of AeroComm’s 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 AC4424 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.

The AC4424 transceivers can be used as a direct serial cable replacement – requiring no special Host software for operation. They also feature a number of On-the-Fly Control Commands providing the OEM Host with a very versatile interface for any situation.

AC4424 transceivers operate in a Point-to-Point or Point-to-Multipoint, Client-Server or Peer-to-Peer 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 a RF link is established.

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

- Serial Interface Data Rate – All transceivers can be configured to common PC serial port baud rates from 110 bps to 288,000 bps.
- Effective Data Transmission Rate – The AC4424 is a highly efficient, low-latency transceiver.

This document contains information about the hardware and software interface between an AeroComm AC4424 transceiver and an OEM Host. Information includes the theory of operation, specifications, interface definition, configuration information and mechanical drawing.

The OEM is responsible for ensuring the final product meets all FCC and/or appropriate regulatory agency requirements listed herein before selling any product.

12/09/02
## AC4424 Specifications

### 2. AC4424 Specifications

<table>
<thead>
<tr>
<th>GENERAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interface</strong></td>
<td>20 pin mini-connector</td>
</tr>
<tr>
<td><strong>Serial Interface Data Rate</strong></td>
<td>PC baud rates from 110 bps to 288,000 bps</td>
</tr>
<tr>
<td><strong>Power Consumption (typical)</strong></td>
<td></td>
</tr>
<tr>
<td>Duty Cycle (TX=Transmit; RX=Receive)</td>
<td>10%TX</td>
</tr>
<tr>
<td>AC4424-10:</td>
<td>90mA</td>
</tr>
<tr>
<td>AC4424-100:</td>
<td>100mA</td>
</tr>
<tr>
<td>AC4424-200:</td>
<td>115mA</td>
</tr>
</tbody>
</table>

| Channels (used to create independent networks) | 4 channel sets consisting of 16 channels each |
| Security | One byte System ID |

<table>
<thead>
<tr>
<th>RADIO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency Band</strong></td>
<td></td>
</tr>
<tr>
<td>US/Canada:</td>
<td>2.402 – 2.478 GHz</td>
</tr>
<tr>
<td>France:</td>
<td>2.446 – 2.457 GHz</td>
</tr>
<tr>
<td><strong>Radio Type</strong></td>
<td>Frequency Hopping Spread Spectrum</td>
</tr>
<tr>
<td><strong>Output Power (conducted, no antenna)</strong></td>
<td></td>
</tr>
<tr>
<td>AC4424-10,</td>
<td>10mW typical</td>
</tr>
<tr>
<td>AC4424-100,</td>
<td>50mW typical</td>
</tr>
<tr>
<td>AC4424-200,</td>
<td>200mW typical</td>
</tr>
</tbody>
</table>

| Effective Isotropic Radiated Power (EIRP with 3dBi gain antenna) |  |
| AC4424-10, | 20mW typical |
| AC4424-100, | 100mW typical |
| AC4424-200, | 400mW typical |

| **Voltage** | 5V nominal ±2%, ±50mV ripple |
| **Sensitivity** | -90dBm typical |

| Range (based on 3dBi gain antenna) |  |
| AC4424-10, Indoors to 300 ft., Outdoors to 3000 ft. |
| AC4424-100, Indoors to 400 ft., Outdoors to 6000 ft. |
| AC4424-200, Indoors to 500 ft., Outdoors to 10000 ft. |

<table>
<thead>
<tr>
<th>ENVIRONMENTAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature (Operating) Industrial:</strong></td>
<td>AC4424: -40°C to 80°C</td>
</tr>
<tr>
<td><strong>Temperature (Storage)</strong></td>
<td>-50°C to +85°C</td>
</tr>
<tr>
<td><strong>Humidity (non-condensing)</strong></td>
<td>10% to 90%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PHYSICAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimensions</strong></td>
<td>1.65&quot; x 2.65&quot; x 0.20&quot;</td>
</tr>
<tr>
<td><strong>Antenna</strong></td>
<td>AC4424-10, MMCX Jack</td>
</tr>
<tr>
<td>AC4424-100,</td>
<td>MMCX Jack</td>
</tr>
<tr>
<td>AC4424-200,</td>
<td>MMCX Jack</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Less than 0.75 ounce</td>
</tr>
</tbody>
</table>
3. Specifications

3.1 INTERFACE SIGNAL DEFINITIONS

The AC4424 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 5VDC TTL level signals except for RSSI. All inputs are weakly pulled High and may be left floating during normal operation.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Signal Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>NC</td>
<td>No Connect</td>
</tr>
<tr>
<td>2</td>
<td>O</td>
<td>TXD</td>
<td>Transmitted data out of the transceiver</td>
</tr>
<tr>
<td>3</td>
<td>I</td>
<td>RXD</td>
<td>Data input to the transceiver</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>NC</td>
<td>No Connect</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>GND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>O</td>
<td>Hop Frame</td>
<td>HOP FRAME – Active Low when the transceiver is hopping</td>
</tr>
<tr>
<td>7</td>
<td>O</td>
<td>CTS</td>
<td>Clear to Send – Active Low when the transceiver is ready to accept data for transmission.</td>
</tr>
<tr>
<td>8</td>
<td>I</td>
<td>RTS</td>
<td>Request to Send – When enabled in EEPROM, active Low when the OEM Host is ready to accept data from the transceiver. NOTE: Keeping RTS High for too long can cause data loss.</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>NC</td>
<td>No Connect</td>
</tr>
<tr>
<td>10</td>
<td>PWR</td>
<td>VCC</td>
<td>5V ± 2%, ±50mV ripple</td>
</tr>
<tr>
<td>11</td>
<td>PWR</td>
<td>VCC</td>
<td>5V ± 2%, ±50 mV ripple</td>
</tr>
<tr>
<td>12</td>
<td>I/O</td>
<td>9600_BAUD/</td>
<td>9600_BAUD – When pulled logic Low before applying power or resetting the transceiver's serial interface is forced to a 9600, 8, N, 1 rate. To exit, transceiver must be reset or power-cycled with 9600_Baud logic High.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Packet Frame</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>O</td>
<td>RSSI</td>
<td>Received Signal Strength - An analog output giving a relative indication of received signal strength while in Receive Mode.</td>
</tr>
<tr>
<td>14</td>
<td>I</td>
<td>WR_ENA</td>
<td>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.</td>
</tr>
<tr>
<td>15</td>
<td>I</td>
<td>UP_RESET</td>
<td>RESET – Controlled by the AC4424 for power-off reset if left unconnected. After a Stable power-on (50ms) a 50us logic High pulse will reset the AC4424. Do not power-up the transceiver with this pin tied Low.</td>
</tr>
<tr>
<td>16</td>
<td>GND</td>
<td>GND</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>17</td>
<td>I</td>
<td>Command/Data</td>
<td>When logic Low, transceiver interprets Host data as command data. When logic High, transceiver interprets Host data as transmit data.</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>NC</td>
<td>No Connect</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>NC</td>
<td>No Connect</td>
</tr>
<tr>
<td>20</td>
<td>O</td>
<td>IN_RANGE</td>
<td>In Range – Active Low when a Client radio is in range of a Server on same Channel with the same System ID.</td>
</tr>
</tbody>
</table>

I = Input to the transceiver  O = Output from the transceiver

12/09/02
AC4424 Specifications

3.2 Electrical Specifications

Table 2 – DC Input Voltage Characteristics

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Name</th>
<th>High Min.</th>
<th>High Max.</th>
<th>Low Min.</th>
<th>Low Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>I</td>
<td>RXD</td>
<td>0.2Vcc+0.9</td>
<td>Vcc+0.5</td>
<td>-0.5</td>
<td>0.2Vcc-0.1</td>
<td>V</td>
</tr>
<tr>
<td>8</td>
<td>I</td>
<td>RTS</td>
<td>0.2Vcc+0.9</td>
<td>Vcc+0.5</td>
<td>-0.5</td>
<td>0.2Vcc-0.1</td>
<td>V</td>
</tr>
<tr>
<td>12</td>
<td>I</td>
<td>9600 Baud</td>
<td>0.2Vcc+0.9</td>
<td>Vcc+0.5</td>
<td>-0.5</td>
<td>0.2Vcc-0.1</td>
<td>V</td>
</tr>
<tr>
<td>14</td>
<td>I</td>
<td>WR ENA</td>
<td>0.7Vcc</td>
<td>Vcc+1</td>
<td>-0.3</td>
<td>0.5</td>
<td>V</td>
</tr>
<tr>
<td>15</td>
<td>I</td>
<td>UP RESET</td>
<td>0.7Vcc</td>
<td>Vcc+0.5</td>
<td>-0.5</td>
<td>0.2Vcc-0.1</td>
<td>V</td>
</tr>
<tr>
<td>17</td>
<td>I</td>
<td>Command/Data</td>
<td>0.2Vcc+0.9</td>
<td>Vcc+0.5</td>
<td>-0.5</td>
<td>0.2Vcc-0.1</td>
<td>V</td>
</tr>
</tbody>
</table>

Table 3 – DC Output Voltage Characteristics

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Name</th>
<th>High Min.</th>
<th>Low Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>O</td>
<td>TXD</td>
<td>Vcc-0.7 @ -30μA</td>
<td>0.4 @ 1.6mA</td>
<td>V</td>
</tr>
<tr>
<td>6</td>
<td>O</td>
<td>Hop Frame</td>
<td>Vcc-0.7 @ -30μA</td>
<td>0.4 @ 1.6mA</td>
<td>V</td>
</tr>
<tr>
<td>7</td>
<td>O</td>
<td>CTS</td>
<td>Vcc-0.7 @ -30μA</td>
<td>0.4 @ 1.6mA</td>
<td>V</td>
</tr>
<tr>
<td>12</td>
<td>O</td>
<td>Packet Frame</td>
<td>Vcc-0.7 @ -30μA</td>
<td>0.4 @ 1.6mA</td>
<td>V</td>
</tr>
<tr>
<td>13</td>
<td>O</td>
<td>RSSI</td>
<td>See Figure 1</td>
<td>See Figure 1</td>
<td>V</td>
</tr>
<tr>
<td>20</td>
<td>O</td>
<td>IN RANGE</td>
<td>Vcc-0.7 @ -30μA</td>
<td>0.4 @ 1.6mA</td>
<td>V</td>
</tr>
</tbody>
</table>

3.3 System Timing

Care should be taken when selecting transceiver architecture as it can have serious effects on data rates, latency timings, and Overall System Throughput. The importance of these three characteristics will vary from system to system and should be a strong consideration when designing the system.

3.3.1 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. Possible values range from 110 bps to 288,000 bps. The only supported mode is asynchronous – 8-bit, No Parity, 1 Start Bit, and 1 Stop Bit.

3.3.2 Latency Times

TBD

3.3.3 Maximum Overall System Throughput

When configured as shown in the table below, an AC4424 transceiver is capable of achieving the listed throughput. However, in the presence of interference or at longer ranges, the transceiver may not be able to meet these specified throughputs. Note: Higher overall system throughputs are possible. Contact technical support for details.

12/09/02
### Table 4 – Maximum Overall System Throughputs

<table>
<thead>
<tr>
<th>RF Mode</th>
<th>Interface Baud Rate</th>
<th>Duplex</th>
<th>FEC</th>
<th>Direction</th>
<th>Throughput (bps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream</td>
<td>192k</td>
<td>Half</td>
<td>Disabled</td>
<td>One way</td>
<td>192k</td>
</tr>
<tr>
<td>Stream</td>
<td>192k</td>
<td>Half</td>
<td>Enabled</td>
<td>One way</td>
<td>64k</td>
</tr>
<tr>
<td>Acknowledge</td>
<td>115,200</td>
<td>Half</td>
<td>Disabled</td>
<td>One way</td>
<td>80k</td>
</tr>
<tr>
<td>Acknowledge</td>
<td>115,200</td>
<td>Full</td>
<td>Disabled</td>
<td>Both ways</td>
<td>40k</td>
</tr>
</tbody>
</table>
4. Configuring the AC4424

4.1 EEPROM PARAMETERS

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 descriptions 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 below. Do not copy a transceiver's EEPROM data to another transceiver. Doing so may cause the transceiver to malfunction.

Table 5 – EEPROM Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>EEPROM Address</th>
<th>Length</th>
<th>Range</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product ID</td>
<td>00H</td>
<td>40</td>
<td></td>
<td></td>
<td>40 bytes - Product identifier string. Includes revision information for software and hardware.</td>
</tr>
<tr>
<td>Sub Hop Adjust</td>
<td>36H</td>
<td>1</td>
<td>80h, D0h</td>
<td>D0h</td>
<td>D0h = Acknowledge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80h = Stream</td>
</tr>
<tr>
<td>Channel Number</td>
<td>40H</td>
<td>1</td>
<td>00 – 3Fh</td>
<td>00h</td>
<td>Set 0 = 00 – 0Fh (US/Canada)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Set 1 = 10 – 1Fh (US/Canada)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Set 2 = 20 – 2Fh (US/Canada)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Set 3 = 30 – 3Fh (France)</td>
</tr>
<tr>
<td>Server/Client Mode</td>
<td>41H</td>
<td>1</td>
<td>01 – 02h</td>
<td>02h</td>
<td>01h = Server</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>02h = Client</td>
</tr>
<tr>
<td>Baud Rate Low</td>
<td>42H</td>
<td>1</td>
<td>00 – FFh</td>
<td>05h</td>
<td>Low Byte of the interface baud rate.</td>
</tr>
<tr>
<td>Baud Rate High</td>
<td>43H</td>
<td>1</td>
<td>00 – FFh</td>
<td>00h</td>
<td>High Byte of the interface baud rate.</td>
</tr>
<tr>
<td>Control 0</td>
<td>45H</td>
<td>1</td>
<td>00010100b (14h)</td>
<td></td>
<td>Settings are:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 7 – AeroComm Use Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 6 – AeroComm Use Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 5 – Sync to Channel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = Don't Sync to Channel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Sync to Channel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 4 – AeroComm Use Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 3 – Packet Frame</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = Disable Packet Frame</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Use Packet Frame</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 2 – RF Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = RF Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = RF Acknowledge Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 1 – RF Delivery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = Addressed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Broadcast</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 0 – FEC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = No Forward Error Correction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Use Forward Error Correction</td>
</tr>
<tr>
<td>Parameter</td>
<td>EEPROM Address</td>
<td>Length</td>
<td>Range</td>
<td>Default</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
<td>--------</td>
<td>------------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Frequency Offset</td>
<td>46H</td>
<td>1</td>
<td>00h, 2Eh</td>
<td>00h</td>
<td>Channel Set 0 = N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Channel Set 1 = 00h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Channel Set 2 = 00h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Channel Set 3 = 2Eh</td>
</tr>
<tr>
<td>Transmit Retries</td>
<td>4CH</td>
<td>1</td>
<td>01 - FFh</td>
<td>10h</td>
<td></td>
</tr>
<tr>
<td>Broadcast Attempts</td>
<td>4DH</td>
<td>1</td>
<td>01 - FFh</td>
<td>04h</td>
<td></td>
</tr>
<tr>
<td>API Control</td>
<td>56H</td>
<td>1</td>
<td></td>
<td>01000011b</td>
<td>Settings are:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 7 – AeroComm Use Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 6 – RF Architecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = Server-Client</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Peer-to-Peer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 5 – AeroComm Use Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 4 – AeroComm Use Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 3 – AeroComm Use Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 2 – RTS Enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = RTS Ignored</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Transceiver obeys RTS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 1 – Duplex Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = Half Duplex</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Full Duplex</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bit 0 – Auto Config</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 = Use EEPROM values</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Auto Configure Values</td>
</tr>
<tr>
<td>Interface Timeout</td>
<td>58H</td>
<td>1</td>
<td>01 – FFh</td>
<td>F0h</td>
<td></td>
</tr>
<tr>
<td>Sync Channel</td>
<td>5AH</td>
<td>1</td>
<td>00 – 3Fh</td>
<td>01h</td>
<td></td>
</tr>
<tr>
<td>RF Packet Size</td>
<td>5BH</td>
<td>1</td>
<td>01 – 40h</td>
<td>40h</td>
<td></td>
</tr>
<tr>
<td>CTS On</td>
<td>5CH</td>
<td>1</td>
<td>01 – FFh</td>
<td>C0h</td>
<td></td>
</tr>
<tr>
<td>CTS On Hysteresis</td>
<td>5DH</td>
<td>1</td>
<td>01 – FFh</td>
<td>80h</td>
<td></td>
</tr>
<tr>
<td>Destination ID</td>
<td>70H</td>
<td>6</td>
<td></td>
<td>6 Bytes</td>
<td></td>
</tr>
<tr>
<td>System ID</td>
<td>76H</td>
<td>1</td>
<td>00 – FFh</td>
<td>01h</td>
<td></td>
</tr>
<tr>
<td>MAC ID</td>
<td>80H</td>
<td>6</td>
<td></td>
<td>6 Bytes</td>
<td>Unique IEEE MAC Address</td>
</tr>
</tbody>
</table>

### 4.2 EEPROM Configuration Commands

The configuration set allows the Host to modify the operation of the transceiver. If the Command/Data pin (Pin 17) is pulled logic Low, a transceiver will interpret incoming Host data as Command Data. The Host can then read and write parameters using the various configuration commands listed below. To exit Configuration Mode, the Host must perform a hardware or power-on reset or issue an Exit Command Mode command to the transceiver.
4.2.1 EEPROM Byte Read

Upon receiving this command, a transceiver will transmit the desired data from the address requested by the Host.

Host Command:
   Byte 1 = C0h
   Byte 2 = Address
   Byte 3 = Length (01…FFh = 1…255 bytes; 00h = 256 bytes)

Transceiver Response:
   Byte 1 = C0h
   Byte 2 = Address
   Byte 3 = Length
   Byte 4…n = Data at requested address(s)

4.2.2 EEPROM Byte Write

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 10ms to complete. Following the write cycle, a transceiver will transmit the data byte to the Host. The WR_ENA 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.

Host Command:
   Byte 1 = C1h
   Byte 2 = Address
   Byte 3 = 01h
   Byte 3 = Data to store at Address

Transceiver Response:
   Byte 1 = C1h
   Byte 2 = Address
   Byte 3 = 01h
   Byte 4 = Data to store at Address

Note: The WR_ENA 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.

4.2.3 EEPROM Exit Configuration Command

The OEM Host can cause the transceiver to exit command mode by issuing the Exit Configuration Command mode command to the transceiver. However, the transceiver will not reflect any of the changes programmed into the EEPROM until the transceiver is reset.

Host Command:
   Byte 1 = 56h

Transceiver Response:
   Byte 1 = 56h
AC4424 Specifications

4.3 On-the-Fly Control Command Reference

The AC4424 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. **Do not to modify undocumented static addresses as undesired operation may occur.** All "CC" commands must be issued from the Host to the transceiver with Command/Data (Pin 17) pulled logic Low. To exit "CC" mode, simply take the Command/Data pin High.

Table 6 – Static Memory Address Map

<table>
<thead>
<tr>
<th>Static Bank #</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>67h – 69h</td>
<td>Lower 3 bytes of Destination Address</td>
</tr>
</tbody>
</table>

4.3.1 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

4.3.2 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)
AC4424 Specifications

4.3.3 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

4.3.4 Power-Down Command

After the Host issues the power-down command to the transceiver, the transceiver will de-assert the In.Range line after entering power-down. A Client transceiver in power-down will remain in sync with a Server for a minimum of 2 minutes. To maintain synchronization with the Server, this Client transceiver should re-sync to the Server at least once every 2 minutes. This re-sync is accomplished by issuing the Power-Down Wake-Up Command and waiting for the In.Range line to go active. Once this occurs, the Client transceiver is in sync with the Server and can be put back into power-down.

Host Command:
Byte 1 = CCh
Byte 2 = 06h

Transceiver Response:
Byte 1 = CCh
Byte 2 = 00h
AC4424 Specifications

4.3.5 Power-Down Wake-Up Command

The Power-Down Wake-Up Command is issued by the Host to bring the transceiver out of power-down mode.

Host Command:
- Byte 1 = CCh
- Byte 2 = 07h

Transceiver Response:
- Byte 1 = CCh
- Byte 2 = 00h

4.3.6 Broadcast Mode

The Host issues this command to change the transceiver operation between Addressed Mode and Broadcast Mode. If addressed mode is selected the transceiver will send all packets to the radio designated by the Destination Address programmed in the transceiver.

Host Command:
- Byte 1 = CCh
- Byte 2 = 08h
- Byte 3 = 00 for addressed mode, 01 for broadcast mode

Transceiver Response:
- Byte 1 = CCh
- Byte 2 = 00 for addressed mode, 01 for broadcast mode

4.3.7 Read Static Bank #1 Byte

The OEM Host issues this command to the transceiver to read Static Bank #1 Bytes. Static Bank #1 is a bank of memory that holds many of the parameters that control the radio. Using the Read/Write Static Bank #1 command allows these parameters to be changed dynamically. Because the memory bank is static, when the radio is reset, these parameters will revert back to the settings stored in EEPROM. Be careful not to change undocumented Static Bank addresses as undesired operation may occur.

Host Command:
- Byte 1 = CCh
- Byte 2 = 0Ah
- Byte 3 = 00 – FFh corresponding to a valid Static Bank #1 address

Transceiver Response:
- Byte 1 = CCh
- Byte 2 = 00 – FFh corresponding to a valid Static Bank #1 address

12/09/02
4.3.8 Write Static Bank #1 Bytes

The Host issues this command to the transceiver to write Static Bank #1 Bytes. Static Bank #1 is a bank of memory that holds many of the parameters that control the radio. Using the Read/Write Static Bank #1 command allows these parameters to be changed dynamically. Because the memory bank is static, when the radio is reset, these parameters will revert back to the settings stored in EEPROM. Be careful not to change undocumented Static Bank addresses as undesired operation may occur.

Host Command:
   Byte 1 = CCh
   Byte 2 = 0Bh
   Byte 3 = 00 – FFh corresponding to a valid Static Bank #1 address
   Byte 4 = 00 – FFh corresponding to new value for address specified by Byte 3

Transceiver Response:
   Byte 1 = CCh
   Byte 2 = 00 – FFh corresponding to a valid Static Bank #1 address
   Byte 3 = 00 – FFh corresponding to new value for address specified by Byte 2

4.3.9 Read Static Bank #2 Bytes

The Host issues this command to the transceiver to read Static Bank #2 Bytes. Static Bank #2 is a bank of memory that holds many of the parameters that control the radio. Using the Read/Write Static Bank #2 command allows these parameters to be changed dynamically. Because the memory bank is static, when the radio is reset, these parameters will revert back to the settings stored in EEPROM. Be careful not to change undocumented Static Bank addresses as undesired operation may occur.

Host Command:
   Byte 1 = CCh
   Byte 2 = 0Ch
   Byte 3 = 00 – FFh corresponding to a valid Static Bank #2 address

Transceiver Response:
   Byte 1 = CCh
   Byte 2 = 00 – FFh corresponding to a valid Static Bank #2 address
4.3.10 Write Static Bank #2 Bytes

The Host issues this command to the transceiver to write Static Bank #2 Bytes. Static Bank #2 is a bank of memory that holds many of the parameters that control the radio. Using the Read/Write Static Bank #2 command allows these parameters to be changed dynamically. Because the memory bank is static, when the radio is reset, these parameters will revert back to the settings stored in EEPROM. Be careful not to change undocumented Static Bank addresses as undesired operation may occur.

Host Command:
Byte 1 = CCh
Byte 2 = 0Dh
Byte 3 = 00 – FFh corresponding to a valid Static Bank #2 address
Byte 4 = 00 – FFh corresponding to new value for address specified by Byte 3

Transceiver Response:
Byte 1 = CCh
Byte 2 = 00 – FFh corresponding to a valid Static Bank #2 address
Byte 3 = 00 – FFh corresponding to new value for address specified by Byte 2

4.3.11 Write Destination Address

The Host issues this command to the transceiver to change the Destination Address. This is a very powerful command that provides the OEM Host with a means for ad-hoc networking. Only the three Least Significant Bytes of the MAC Address are used for packet delivery.

Host Command:
Byte 1 = CCh
Byte 2 = 10h
Bytes 3 - 5 = 00 – FFh corresponding the three LSB’s of the destination MAC Address

Transceiver Response:
Byte 1 = CCh
Bytes 2 - 4 = 00 – FFh corresponding the three LSB’s of the destination MAC Address

4.3.12 Read Destination Address

The Host issues this command to the transceiver to read the Destination Address. This is a very powerful command that provides the OEM Host with a means for ad-hoc networking. Only the three Least Significant Bytes of the MAC Address are used for packet delivery.

Host Command:
Byte 1 = CCh
Byte 2 = 11h

Transceiver Response:
Byte 1 = CCh
Bytes 2 - 4 = 00 – FFh corresponding the three LSB’s of the destination MAC Address
AC4424 Specifications

4.3.13 Temperature Update

The Host issues this command to update the transceiver with the ambient temperature. This command is only valid on AC4424 family transceivers not already fitted with a temperature sensor.

Host Command:
- Byte 1 = CCh
- Byte 2 = A3h
- Byte 3 = D8h – 50h (corresponding to the ambient temperature in °C)

Transceiver Response:
- Byte 1 = CCh
- Byte 2 = D8h – 50h (corresponding to the ambient temperature in °C)
5. Theory of Operation

5.1 HARDWARE INTERFACE

Below is a description of all hardware pins used to control the AC4424.

5.1.1 TXD (Transmit Data) and RXD (Receive Data) (pins 2 and 3 respectively)

The AC4424 accepts 5V TTL level asynchronous serial data in the RXD pin and interprets that data as either Command Data or Transmit Data. Data is sent from the transceiver to the OEM Host via the TXD pin. The data must be of the format 8-N-1 (8 data bits, No Parity bits, One stop bit).

5.1.2 Hop Frame (pin 6)

The AC4424 is a frequency hopping spread spectrum radio. Frequency hopping allows the system to hop around interference in order to provide a better wireless link. Hop Frame transitions logic Low at the start of a hop and transitions logic High at the completion of a hop. The OEM Host is not required to monitor Hop Frame.

5.1.3 CTS Handshaking (pin 7)

The AC4424 has an interface buffer size of 256 bytes. If the buffer fills up and more bytes are sent to the transceiver before the buffer can be emptied, data corruption will occur. The transceiver prevents this corruption by asserting CTS High as the buffer fills up and taking CTS Low as the buffer is emptied. CTS On in conjunction with CTS On Hysteresis control the operation of CTS. CTS On specifies the amount of bytes that must be in the buffer for CTS to be disabled (High). Even while CTS is disabled, the OEM Host can still send data to the transceiver, but it should do so carefully. Once CTS is disabled, it will remain disabled until the buffer is reduced to the size specified by CTS On Hysteresis. The following equation should always be used for setting CTS On, CTS On Hysteresis and RF Packet Size:

\[
\text{CTS On} - \text{CTS On Hysteresis} = \text{RF Packet Size}
\]

5.1.4 RTS Handshaking (pin 8)

With RTS Mode disabled, the transceiver will send any received packet to the OEM Host as soon as the packet is received. However, some OEM Hosts are not able to accept data from the transceiver all of the time. With RTS Mode Enabled, the OEM Host can keep the transceiver from sending it a packet by disabling RTS (logic High). Once RTS is enabled (logic Low), the transceiver can send packets to the OEM Host as they are received. Note: Leaving RTS disabled for too long can cause data loss once the transceiver’s receive buffer fills up.
5.1.5 9600 Baud/Packet Frame (pin 12)

9600 BAUD – When pulled logic Low before applying power or resetting, the transceiver’s serial interface is forced to a 9600, 8-N-1 (8 data bits, No parity, 1 stop bit) rate. To exit, transceiver must be reset or power-cycled with 9600_Baud logic High.

Packet Frame – When enabled in EEPROM, Packet Frame will transition logic Low at the start of a received RF packet and transition logic High at the completion of the packet.

5.1.6 RSSI (pin 13)

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 RF 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 Client (no Server) transceiver in the coverage area.
2) Measure the RSSI signal to obtain the minimum value with no other signal present.
3) Power up a Server. Make sure the two transceivers are in close proximity and measure the Client’s peak RSSI once the Client reports In Range to obtain a maximum value at full signal strength.

Figure 1 shows approximate RSSI performance. Output is 1.20V to 4.50V.

Figure 1 – RSSI Voltage vs. Received Signal Strength
AC4424 Specifications

5.1.7 Wr_Ena (EEPROM Write Enable) (pin 14)

Wr_Ena is a direct connection to the Write Enable line on the EEPROM. When logic Low, the EEPROM’s contents may be changed. When logic High, the EEPROM is protected from accidental and intentional modification. It is recommended that this line only be Low when an EEPROM write is desired to prevent unintentional corruption of the EEPROM.

5.1.8 UP_Reset (pin 15)

UP_Reset provides a direct connection to the reset pin on the AC4424 microprocessor. To guarantee a valid power-up reset, this pin should never be tied Low on power-up. For a valid power-on reset, reset must be High for a minimum of 50us.

5.1.9 Command/Data (pin 17)

When logic High, transceiver interprets Host data as transmit data to be sent to other transceivers and their Hosts. When logic Low, transceiver interprets Host data as command data (see section 4).

5.1.10 In Range (pin 20)

The IN_RANGE pin at the connector will be driven logic Low when a Client is in range of a Server on the same RF Channel and System ID. If a Client cannot hear a Server for 5s, 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 which Clients are in range by the Server’s Host software polling a Client’s Host.

5.2 SOFTWARE PARAMETERS

Below is a description of all software parameters used to control the AC4424.

5.2.1 RF Architecture (Server-Client/Peer-to-Peer)

The Server controls the system timing by sending out regular beacons (transparent to the transceiver Host) which contain system timing information. This timing information synchronizes the Client radios to the Server.

Each network should consist of only one Server. There should never be two Servers on the same RF Channel Number in the same coverage area, as the interference between the two Servers will severely hinder RF communications.

In Server-Client architecture, the Server communicates with the Clients and the Clients only communicate with the Server. Enabling Peer-to-Peer Mode will allow all radios on the network to communicate with each other. Note: All transceivers on the same network must have the same setting for Peer-to-Peer and there must still be one, and only one, Server present in a Peer-to-Peer network.
AC4424 Specifications

5.2.2 RF Mode

All radios located on the same network must use the same RF Mode.

Acknowledge Mode

In Addressed Acknowledge Mode, the RF packet is sent out to the receiver designated by the Destination Address. Transmit Retries is used to increase the odds of successful delivery to the intended receiver. Transparent to the OEM Host, the sending transceiver will send the RF packet to the intended receiver. If the receiver receives the packet free of errors, it will tell the sender. If the sender does not receive this acknowledge, it will assume the packet was never received and retry the packet. This will go on until the packet is successfully received or the transmitter exhausts all of its retries. The received packet will only be sent to the OEM Host if and when it is received free of errors.

In Broadcast Acknowledge Mode, the RF packet is broadcast out to all eligible receivers on the network. In order to increase the odds of successful delivery, Broadcast Attempts is used to increase the odds of successful delivery to the intended receiver(s). Transparent to the OEM Host, the sending transceiver will send the RF packet to the intended receiver. If the receiver detects a packet error, it will throw out the packet. This will go on until the packet is successfully received or the transmitter exhausts all of its attempts. Once the receiver successfully receives the packet it will send the packet to the OEM Host. It will throw out any duplicates caused by further Broadcast Attempts. The received packet will only be sent to the OEM Host if it is received free of errors.

Stream Mode

In Broadcast Stream mode, the RF packet is broadcast out to all eligible receivers on the network. In Addressed Stream Mode, the RF packet is sent out to the receiver designated by the Destination Address. The sending transceiver will send each RF packet out once. There are no retries on the packet. Whether or not the packet contains errors, the receiver(s) will send the packet to the OEM Host. However, if receiver is not able to receive the packet in its entirety (there are bytes missing), it will not send the packet to the OEM Host. In order to increase the odds of successful delivery, Forward Error Correction (FEC) may be used. FEC is used (transparent to the OEM Host) to increase the odds of correctly receiving a packet sent over the RF. When enabled, the transceiver will send every byte over the RF 3 times and then perform a best-of-three bit-wise decision on the received bytes. Enabling FEC can cut overall throughput by 1/3. Note: All transceivers on the same network must have the same setting for FEC. Stream Mode is incompatible with Full Duplex Mode.
AC4424 Specifications

5.2.3 Sub Hop Adjust

Sub Hop Adjust is an AC4424 protocol parameter and its settings are as follows:

Table 7 – Sub Hop Adjust Settings

<table>
<thead>
<tr>
<th>RF Mode</th>
<th>Sub Hop Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledge</td>
<td>D0h</td>
</tr>
<tr>
<td>Stream</td>
<td>80h</td>
</tr>
</tbody>
</table>

5.2.4 Duplex Mode

In Half Duplex mode, the AC4424 will send a packet out over the RF when it can. This can cause packets sent at the same time by a Server and a Client to collide with each other over the RF. To prevent this, Full Duplex Mode can be enabled. This mode restricts Clients to transmitting on odd numbered frequency “bins” and the Server to transmitting on even frequency bins. Though the RF hardware is still technically half duplex, it makes the radio seem full duplex. This can cause overall throughputs to be cut in half. Note: All transceivers on the same network must have the same setting for Full Duplex. Full Duplex mode is incompatible with Stream RF mode.

5.2.5 Interface Timeout/RF Packet Size

Interface timeout, in conjunction with RF Packet Size, determines when a buffer of data will be sent out over the RF as a complete RF packet based on whichever condition occurs first.

Interface Timeout – Interface Timeout specifies a maximum byte gap in between consecutive bytes. When that byte gap is exceeded, the bytes in the transmit buffer are sent out over the RF as a complete packet. Interface timeout is adjustable in 160uS decrements. The actual timeout created by Interface Timeout is equal to the 2's complement of Interface Timeout times 160uS. The default value for Interface Timeout is F0H or 2.56ms.

RF Packet Size – When the amount of bytes in the transceiver transmit buffer equals RF Packet Size, those bytes are sent out as a complete RF packet.
AC4424 Specifications

5.2.6 Serial Interface Baud Rate

This two-byte value determines the baud rate used for communicating over the serial interface to a transceiver. Table 5 - Baud Rate/Timeout lists values for some common baud rates. Baud rates below 110 baud are not supported. For a baud rate to be valid, the calculated baud rate must be within ±3% of the OEM Host baud rate. If the 9600 BAUD pin (Pin 12) is pulled logic Low at reset, the baud rate will be forced to 9,600. For Baud Rate values other than those shown in Table 5 - Baud Rate, the following equation can be used:

\[
BAUD = \left(18.432E+06/(32\times \text{desired baud rate})\right)
\]

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

Table 8 - Baud Rate

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>BaudL (42h)</th>
<th>BaudH (43h)</th>
<th>Minimum Interface Timeout (58h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>288,000</td>
<td>02h</td>
<td>00h</td>
<td>FFh</td>
</tr>
<tr>
<td>192,000</td>
<td>03h</td>
<td>00h</td>
<td>FFh</td>
</tr>
<tr>
<td>115,200</td>
<td>05h</td>
<td>00h</td>
<td>FEh</td>
</tr>
<tr>
<td>57,600</td>
<td>0Ah</td>
<td>00h</td>
<td>FDh</td>
</tr>
<tr>
<td>38,400</td>
<td>0Fh</td>
<td>00h</td>
<td>FCh</td>
</tr>
<tr>
<td>28,800</td>
<td>14h</td>
<td>00h</td>
<td>FBh</td>
</tr>
<tr>
<td>19,200</td>
<td>1Eh</td>
<td>00h</td>
<td>F9h</td>
</tr>
<tr>
<td>14,400</td>
<td>28h</td>
<td>00h</td>
<td>F7h</td>
</tr>
<tr>
<td>9,600</td>
<td>3Ch</td>
<td>00h</td>
<td>F2h</td>
</tr>
<tr>
<td>4800</td>
<td>78h</td>
<td>00h</td>
<td>E5h</td>
</tr>
<tr>
<td>2400</td>
<td>F0h</td>
<td>00h</td>
<td>CBh</td>
</tr>
<tr>
<td>1200</td>
<td>E0h</td>
<td>01h</td>
<td>97h</td>
</tr>
<tr>
<td>300</td>
<td>80h</td>
<td>07h</td>
<td>01h</td>
</tr>
<tr>
<td>110</td>
<td>74h</td>
<td>14h</td>
<td>01h</td>
</tr>
</tbody>
</table>

5.2.7 Network Topology

RF Channel Number – RF Channel Number provides a physical separation between co-located networks. The AC4424 is a spread spectrum frequency hopping radio with a fixed hopping sequence. Without synchronizing the different networks to each other, different channel numbers could possibly interfere with each other and create "cross-talk." To avoid cross-talk interference, co-located networks should use Sync-to-Channel. A Server radio with Sync-to-Channel enabled will synchronize its frequency hop timing to a system located on the RF Channel specified by Sync Channel. The only requirement is that Sync Channel be numerically less than RF Channel. Therefore, every co-located network will be synchronizing to the network with the lowest RF Channel. Four Channel sets are provided for the AC4424. Frequency Offset is a protocol parameter used to satisfy unique international requirements. Co-located networks must use the same Channel Set.
AC4424 Specifications

Table 9 – US and International RF Channel Number Settings

<table>
<thead>
<tr>
<th>Channel Set</th>
<th>RF Channel Number Range (40h)</th>
<th>Frequency Offset (46h)</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00h – 0Fh</td>
<td>N/A</td>
<td>US, Canada</td>
</tr>
<tr>
<td>1</td>
<td>10h – 1Fh</td>
<td>0</td>
<td>US, Canada</td>
</tr>
<tr>
<td>2</td>
<td>20h – 2Fh</td>
<td>0</td>
<td>US, Canada</td>
</tr>
<tr>
<td>3</td>
<td>30h – 3Fh</td>
<td>2Eh</td>
<td>France</td>
</tr>
</tbody>
</table>

System ID – System ID is similar to a password character or network number and makes network eavesdropping more difficult. A receiving radio will not go in range of or communicate with another radio on a different System ID.

5.2.8 Auto Config

The AC4424 has several variables that control its RF performance and vary by RF Mode and RF Architecture. Enabling Auto Config will bypass the value for these variables stored in EEPROM and use predetermined values for the given Interface Baud Rate. Auto Config has been optimized for 192,000 baud Stream Mode, 115,200 baud Acknowledge Mode and all lower baud rates. It should only be disabled with recommendation from AeroComm. Below is a list containing some of the variables affected by Auto Config and their respective values:

Table 10 – Auto Config Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Auto Config Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Packet Size</td>
<td>40h</td>
</tr>
<tr>
<td>CTS On</td>
<td>C0h</td>
</tr>
<tr>
<td>CTS On Hysteresis</td>
<td>80h</td>
</tr>
</tbody>
</table>
6. Application Examples

TBD
All AC4424 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
8. Ordering Information

8.1 PRODUCT PART NUMBERS

AC4424-10: AC4424 with 10mW output power, interface data rates to 288Kbps, MMCX antenna connector, -40°C to 80°C

AC4424-100: AC4424 with 50mW output power, interface data rates to 288Kbps, MMCX antenna connector, -40°C to 80°C

AC4424-200: AC4424 with 200mW output power, interface data rates to 288Kbps, MMCX antenna connector, -40°C to 80°C

8.2 DEVELOPER KIT PART NUMBERS

SDK-4424I-10: Includes (2) AC4424-10 transceivers, (2) RS232 Serial Adapter Boards, (2) 6Vdc unregulated power supplies, (2) Serial cables, (2) S151FL-5-RMM-2450S dipole antennas with 5" pigtail and MMCX connector, configuration/testing software, integration engineering support

SDK-4424I-100: Includes (2) AC4424-100 transceivers, (2) RS232 Serial Adapter Boards, (2) 6Vdc unregulated power supplies, (2) Serial cables, (2) S151FL-5-RMM-2450S dipole antennas with 5" pigtail and MMCX connector, configuration/testing software, integration engineering support

SDK-4424I-200: Includes (2) AC4424-200 transceivers, (2) RS232 Serial Adapter Boards, (2) 6Vdc unregulated power supplies, (2) Serial cables, (2) S151FL-5-RMM-2450S dipole antennas with 5" pigtail and MMCX connector, configuration/testing software, integration engineering support
GRANT OF EQUIPMENT
AUTHORIZATION
Certification
Issued Under the Authority of the
Federal Communications Commission
By:

BABT & TUV Product Service
Division of TUV America Inc.
4855 Patrick Henry Drive, Bldg. 6
Santa Clara, CA 95054

Date of Grant: 02/12/2002
Application Dated: 02/12/2002

AeroComm Corporation
13228 West 99th Street
Lenexa, KS 66215
Attention: Dainel Miller

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY
for the equipment identified hereon for use under the Commission's Rules and Regulations listed
below.

FCC IDENTIFIER: KQF PKLR2400
Name of Grantee: AeroComm Corporation
Equipment Class: Part 15 Spread Spectrum
Transmitter
Notes: PKLR2400 Radio

Grant Notes
FCC Rule Parts
15C
Frequency Range (MHz)
2402 - 2478
Output Watts
0.01
Frequency Tolerance

Emission Designator

Original grant issued 01/28/2000.
Transmitter Module. The antenna and antenna cables must utilize unique
connectors.
Three antennas, as indicated in the filing, have been tested for SAR
compliance for portable operating configurations with respect to
21.1093. All other antenna configurations must satisfy MPE requirements
of 2.1091 and to provide end-users of products using this transmitter
with appropriate RF exposure operating requirements.
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION Certification

AeroComm Corporation
10228 West 39th Street
Lenexa, KS 66219

Data of Grant: 01/22/2000
Application Dated: 08/25/1999

Attention: Daniel Miller

NCT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: KQL-PKLR2400
Name of Grantee: AeroComm Corporation

Equipment Class: Part 15 Spread Spectrum Transmitter

Notes:

Grant Notes

<table>
<thead>
<tr>
<th>FCC Rule Parts</th>
<th>Frequency Range (MHz)</th>
<th>Output Watts</th>
<th>Frequency Tolerance</th>
<th>Emission Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>2402 - 2478</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transmitter Module. The antenna and antenna cables must utilize unique connectors.

Three antennas, as indicated in the filing, have been tested for SAR compliance for portable operating configurations with respect to 2.1093. All other antenna configurations must satisfy MPE requirements of 2.1091 and to provide end users of products using this transmitter with appropriate RF exposure operating requirements.

Mail To:
Tri Luu, V. P. Engineering
Ultratech Engineering Labs Inc.
3000 Bristol Circle
Oakville, L6H 6G4
Canada

EA95245
TECHNICAL ACCEPTANCE CERTIFICATE

INDUSTRY CANADA

TECHNICAL ACCEPTANCE CERTIFICATE

INTERNATIONAL

AEROCOMM INC.

OF EQUIPMENT RE DE MATERIEL

SPREAD SPECTRUM DEVICE

NAME AND MODEL PKLR2400

FREQUENCY RANGE DE DE FREQUENCES

2400 MHz to 2433.6 MHz

IDENTIFICATION OF EQUIPMENT

IM00G1D

SPECIFICATION

CAHIER DES CHARGES

ISSUE 1

ELON LE

POWER RATING SANCE NOMINALE H.F.

224.7 mWatt

This device is subject to licensing.

Location of equipment means only that the equipment has met the requirements as above noted specification. License applications, where applicable to use of equipment, are acted on accordingly by the issuing office and will depend on existing radio environment, service and location of operation.

Certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures set out by the Department.

ISSUED UNDER THE AUTHORITY OF MINISTER OF INDUSTRY DELIVRE AVEC L'AUTORISATION DU MINISTRE DES INDUSTRIE

DATE October 8, 1999

DIRECTOR GENERAL SPECTRUM ENGINEERING BRANCH

DIRECTEUR GENERAL GENIE DU SPECTRE

Canada
CERTIFICATE OF COMPLIANCE

Aerocomm Inc.
13266 West 38TH Street
Lenexa, Kansas
USA. 66215

NOT TRANSFERABLE

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

GRANTEE'S NAME: Aerocomm Inc.

PRODUCT UNDER TEST: 2.4 GHz FHSS OEM Transceiver
MODEL NO.: PKLR2400
RF OUTPUT POWER: 10 mW Peak
FREQUENCY RANGE: 2402-2478 MHz

APPLICABLE STANDARD: European Telecommunications Standards Institute (ETSI)

EQUIPMENT TYPE: Radio Communications Equipment

- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia)
- Recognized/Listed by FCC (USA) & Accredited by Industry Canada under ACC-LAB (Europe/Canada MRA)
- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

UltraTech
3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Telephone (905) 823-1570 Facsimile (905) 823-4059
Website: www.ultratech-labs.com Email: vтик.ultratech@sympatico.ca

Approved by: [Signature] T.M. Li
P.Eng.
Engineering
CERTIFICATE OF COMPLIANCE

Aerocomm Inc.
18254 West 98TH Street
Lenexa, Kansas
USA, 66219

NCT TRANSFERABLE

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

GRANTEE'S NAME: Aerocomm Inc.

PRODUCT UNDER TEST: 2.4 GHz FHSS OEM Transceiver
MODEL NO.: PKLR2400
RF OUTPUT POWER: 10 mW Peak
TRANSMITTER OPERATING FREQUENCY RANGE: 2402-2478 MHz
RECEIVER OPERATING FREQUENCY RANGE: 2402-2478 MHz


EQUIPMENT TYPE: Radio Communications Equipment

- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia)
- Recognized/Listed by FCC (USA)
- Accredited by Industry Canada under ACC-LAB (Europe/Canada MRA)
- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Approved by: T.M. LOU
Approved by: V.P. Engineering

UltraTech
3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Telephone (905) 829-1570 Facsimile (905) 829-0650
Website: www.ultratech-labs.com Email: vik.ultratech@sympatico.ca
NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER  KQL-PKLR2400-200

Name of Grantee  AeroComm Corporation

Equipment Class:  Part 15 Spread Spectrum Transmitter

Notes:  PKLR2400-200

Grant Notes

<table>
<thead>
<tr>
<th>Frequency Range (MHz)</th>
<th>Output Watts</th>
<th>Frequency Tolerance</th>
<th>Emission Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>2402-2478</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EM Products operating with this modular transmitter must satisfy the RF exposure requirements stated in the manual submitted for this filing. This transmitter requires separate filing for equipment approval to operate with respect 2.1093 as a portable transmitting device.

Mail To:
Tri Luu, Authorized Agent
Ultratech Engineering Labs Inc.
3000 Bristol Circle
Oakville, Ontario Canada L6H 6G4

E98786

FCC ID: KQL-PKLR2400-200
Grantee: AeroComm Corporation

In correspondence concerning this grant, please refer to the FCC IDENTIFIER and the date of grant.
RADIO EQUIPMENT CERTIFICATE
OF TYPE APPROVAL

CERTIFICAT D'HOMOLOGATION
DE MATÉRIEL RADIO

SPECIFICATION NO.
DE CERTIFICATION
> 2263291130A

SED TO
IVRE A
> AEROCOMM INC.

E OF EQUIPMENT
IRE DE MATÉRIEL
> SPREAD SPECTRUM TRANSCEIVER MODULE

ÉQUIPMENT NAME AND MODEL
RÉQUIEM ET MODELE
> PKLR2400-200

QUENCY RANGE
RÉGIE DE FREQUENCES
> 2402 MHz to 2473 MHz

SSION DESIGNATION
SIGNATION D'EMISSION
> 1M00G1D

POWER RATING
PUISSANCE NOMINALE H.F.
> 0.1995 Watt

SED TO
SELON LE
> SPECIFICATION RSS139
CAHIER DES CHARGES

ISSUE 1
ÉDITION

THIS DEVICE REQUIRES A LICENSE (P/0 > 50 mW/MHz)

The certification of equipment means only that the equipment has met the requirements. L'homologation de matériel terminal signifie seulement qu'il est conforme aux exigences du matériel défini ci-dessus. Les demandes de licence, le cas échéant en vue de l'utilisation de matériel certifié seront traitées en conséquence par le bureau chargé de délivrer lesdites licences, en tenant compte du milieu radioélectrique ambiant, du service radio existant et de l'emplacement de la station.

The certification is issued on condition that the holder complies and will continue to apply with the requirements of the radio standards specifications and procedures set by the Department.

Le présent certificat est délivré à condition que le détenteur se conforme et continue à se conformer aux cahiers des charges et procédures sur les normes radioélectriques publiées par le ministère.

ISSUED UNDER THE AUTHORITY OF MINISTER OF INDUSTRY
DELIVRE AVEC L'AUTORISATION DU MINISTRE DES INDUSTRIE

DATE October 5, 2000

DIRECTOR GENERAL
SPECTRUM ENGINEERING BRANCH

DIRECTEUR GÉNÉRAL
GENIE DU SPECTRE

Canada
Attention: Dainel Miller

NCT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified herein for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: KQL-LX2400
Name of Grantee: AeroComm Corporation

Equipment Class: Part 15 Spread Spectrum Transmitter

Notes: LX2400-3, LX2400-10 and LX2400-150

Grant Notes

<table>
<thead>
<tr>
<th>FCC Rule Parts</th>
<th>Frequency Range (MHz)</th>
<th>Output Watts</th>
<th>Frequency Tolerance</th>
<th>Emission Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>2402 - 2478</td>
<td>0.0025</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Output is EIRP (change to conducted if applicable). This module operates with an on-board, integral antenna and has been tested for SAR compliance. The highest reported SAR is 0.057 W/kg.

Output is EIRP. This module operates with an on-board, integral antenna and has been tested for SAR compliance. The highest reported SAR is 0.057 W/kg.

Mail To:
Tri Luu, Authorized Agent
Ultratech Engineering Labs Inc.
3000 Bristol Circle
Oakville, Ontario, L6H 6G4
Canada

EA98784
AeroComm Corporation
10228 West 99th Street
Lenexa, KS 66215

Attention: Daniel Miller

NCT TRANSFERABLE
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: KQL-LX2400-10
Name of Grantee: AeroComm Corporation

Equipment Class: Part 15 Spread Spectrum Transmitter

Notes: LX2400-10

<table>
<thead>
<tr>
<th>FCC Rule Parts</th>
<th>Frequency Range (MHz)</th>
<th>Output Watts</th>
<th>Frequency Tolerance</th>
<th>Emission Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>2402 - 2478</td>
<td>0.011</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This module may operate with five detachable antennas, all have been tested for SAR compliance. The highest reported SAR is 0.4 W/kg.

Mail To:
Tri Luu, Authorized Agent
Ultratech Engineering Labs Inc.
3000 Bristol Circle
Oakville, Ontario, L6H 6G4
Canada

EA99212
AeroComm Corporation
12220 Woodland Road
Lanexa, VA 22087

Date of Grant: 12/06/2000
Application Dated: 11/02/2000

Attention: Daniel Miller

NCT TRANSFERABLE
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for
the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: KQL-LX2400-150
Name of Grantee: AeroComm Corporation

Equipment Class: Part 15 Spread Spectrum
Transmitter

Notes: LX-2400-150

Grant Notes

<table>
<thead>
<tr>
<th>FCC Rule Parts</th>
<th>Frequency Range (MHz)</th>
<th>Output Watts</th>
<th>Frequency Tolerance</th>
<th>Emission Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>2402 - 2478</td>
<td>0.148</td>
<td></td>
<td>0M35F1D</td>
</tr>
</tbody>
</table>

The antennas used by this transmitter must satisfy RF exposure requirements for mobile or fixed
transmitters. This module cannot be used with products operating in portable configurations, as defined
in 2.1093 of the rules. OEM integrators and end-users must be informed of the operating requirements
for satisfying RF exposure compliance.

Mail To:
Tri Luu, Authorized Agent
Ulratech Engineering Labs Inc.
3000 Bristol Circle
Oakville, Ontario, L6H 6G4
Canada

EA99216
RADIO EQUIPMENT CERTIFICATE
OF TYPE APPROVAL

CERTIFICAT D'HOMOLOGATION
DE MATÉRIEL RADIO

APPLICATION NO.
N° D'APPLICATION
> 2238390.120

EQUIPMENT
ÉQUIPEMENT
> SPREAD SPECTRUM TRANSCEIVER

MANUFACTURER
MARQUE ET MODELE
> LX2400-3

OPERATING FREQUENCY
FRÉQUENCE D'ÉMISSION
> 2402 MHz to 2478 MHz

EQUIPMENT DESIGNATION
SIGNATURE D'ÉMISSION
> 343KG1D

POWER RATING
NOTRE NOMINALE H.F.
> 2.5 mWatt

TESTED TO
PRÉCISÉ DONNÉE LE
> SPECIFICATION RSS139 ISSUE 1

CAHIER DES CHARGES ÉDITION

THIS DEVICE REQUIRES A LICENSE UNLESS TOTALLY INSTALLED (ANTENNA INCLUDED) INSIDE A BUILDING.

Location of equipment means only that the equipment has met the requirements. L'homologation de matériel terminal signifie seulement qu'il est conforme aux exigences notées ci-dessus. License applications, where applicable to used equipment, are acted upon accordingly by the issuing office and will depend on existing radio environment, service and location of operation.

Certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures by the Department.

Le présent certificat est délivré à condition que le détenteur se conforme et continue à se conformer aux cashiers des charges et procédures sur les normes radioélectriques publiées par le ministère.

DATE
October 13, 2000

DIRECTOR GENERAL
SPECTRUM ENGINEERING BRANCH

DIRECTEUR GÉNÉRAL GENIE DU SPECTRE

Issued Under the Authority of Ministry of Industry
Delivre avec l'autorisation du ministre des industries

Canada
RADIO EQUIPMENT CERTIFICATE
OF TYPE APPROVAL

CERTIFICAT D'HOMOLOGATION
DE MATÉRIEL RADIO

SPECIFICATION No. 22569102
DATE 13-10-2000

ED TO
AEROCOMM INCORPORATED

OF EQUIPMENT
SPREAD SPECTRUM TRANSCEIVER

NAME AND MODEL
LX2400-10

FREQUENCY RANGE
2402 MHz to 2478 MHz

TRANSMISSION DESIGNATION
343KGID

POWER RATING
11mWatt

THIS DEVICE REQUIRES A LICENSE UNLESS TOTALLY INSTALLED (ANTENNA INCLUDED) INSIDE A BUILDING.

The certification of equipment means only that the equipment has met the requirements noted above and that it is not likely to cause interference to any licensed radio communications service. Les demandes de licence, le cas échéant en vue de l'utilisation de matériel certifié seront traitées en conséquence par le bureau chargé de délivrer les licences, en tenant compte du milieu radioélectrique ambiant, du service radio existant et de l'emplacement de la station.

Le présent certificat est délivré à condition que le détenteur se conforme à se former aux cashiers des charges et procédures éditées par le ministère.

ISSUED UNDER THE AUTHORITY OF MINISTER OF INDUSTRY
DELIVRE AVEC L'AUTORISATION DU MINISTRE DES INDUSTRIES

DATE October 13, 2000

FOR
DIRECTOR GENERAL
SPECTRUM
ENGINEERING
BRANCH

DIRECTEUR GÉNÉRAL
GENIE
DU SPECTRE
RADIO EQUIPMENT CERTIFICATE OF TYPE APPROVAL

CERTIFICAT D'HOMOLOGATION DE MATÉRIEL RADIO

SPECIFICATION NO. E CERTIFICATION
> 128619.13Z

ED TO
> AEROCOMM INCORPORATED

OF EQUIPMENT NAMÉ DE MATÉRIEL
> SPREAD SPECTRUM TRANSCEIVER

NAME AND MODEL NAMÉ ET MODELE
> LX2400-150

QUENCY RANGE NAMÉ DE FREQUENCES
> 2402 MHz to 2478 MHz

SION DESIGNATION NATION D'EMISSION
> 343KG1D

POWER RATING PANCHE NOMINALE H.F.
> 148 mWatt

SPECIFICATIONS CAHIER DES CHARGES
> SPECIFICATION RSS139

ISSUE 1 ÉDITION

THIS DEVICE REQUIRES A LICENSE.

The equipment described herein complies with the requirements of the Radio Communications Act of Canada and the Canadian Radio Regulations. The operation of this equipment is subject to the following conditions:

1. This device requires a license.

Le présent certificat est délivré à condition que le détenteur se conforme aux exigences suivantes:

- Le dispositif doit être utilisé uniquement suivant les instructions du fabricant.
- Le dispositif doit être utilisé dans un environnement radioélectrique dégagé et sans interférences avec d'autres services radioélectriques.
- Le dispositif doit être utilisé dans un emplacement de stationnement approprié.

Le présent certificat est délivré avec l'autorisation du ministre des affaires économiques et industrielles.

Date: October 13, 2000

DIRECTOR GENERAL
SPECTRUM ENGINEERING BRANCH

DIRECTEUR GÉNÉRAL GÉNIE DU SPECTRE

Canada
September 16, 2000

Aerocomm Inc.
13256 West 96th Street
Lenexa, Kansas
USA, 66214

NOT TRANSFERABLE

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

GRANTEE'S NAME: Aerocomm Inc.

PRODUCT UNDER TEST: 2.4 GHz FHSS OEM Transceiver
MODEL NO.: LX2400
RF OUTPUT POWER: 2.5 mW and 11 mW Peak
FREQUENCY RANGE: 2402-2478 MHz


EQUIPMENT TYPE: Radio Communications Equipment

- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia)
- Recognized/Listed by FCC (USA) & Accredited by Industry Canada under ACC-LAB (Europe/Canada MRA)
- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Approved by: Tri M. Lau, P.Eng. VP Engineering

UltraTech
3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Telephone (905) 825-1970 Facsimile (905) 825-4050
Website: www.ultratech-iaea.com Email: vnk.ultratech@sympatico.ca
# Agency Approved Antenna List

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Manufacturer</th>
<th>Type</th>
<th>Gain (dBi)</th>
<th>AG1524C-3A</th>
<th>AG1524C-10</th>
<th>AG1524C-150</th>
<th>AG3124C-10</th>
<th>AG3124C-200</th>
<th>AG5124C-10</th>
<th>AG5124C-200</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WCP-2400-MMCMX</td>
<td>Centurion</td>
<td>1/4 Wave Dipole</td>
<td>2</td>
<td>PMF</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>PMF</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>PMF</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WCR-2400-SMRP</td>
<td>Centurion</td>
<td>1/4 Wave Dipole</td>
<td>2</td>
<td>PMF</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>PMF</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>PMF</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>MF524008RPN</td>
<td>Maxrad</td>
<td>Omni</td>
<td>8</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BMMG24000MSMRP12</td>
<td>Maxrad</td>
<td>Omni-Mobile</td>
<td>1</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BMMG242005MSMRP12</td>
<td>Maxrad</td>
<td>Omni-Mobile</td>
<td>5</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>MP24013TMSMRP12</td>
<td>Maxrad</td>
<td>Panel</td>
<td>13</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MUF24005M174MSMRP12</td>
<td>Maxrad</td>
<td>Omni-Mobile</td>
<td>5</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>MC2400</td>
<td>Maxrad</td>
<td>Patch</td>
<td>2.5</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NZH2400-MMCMX (External)</td>
<td>AeroComm</td>
<td>Microstrip</td>
<td>1</td>
<td>PMF</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>PMF</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>PMF</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>NZH2400-I (Integral)</td>
<td>AeroComm</td>
<td>Microstrip</td>
<td>1</td>
<td>PMF</td>
<td>PMF</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>PMF</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>S131CL-5-RMM-2450S</td>
<td>Nearson</td>
<td>1/4 Wave Dipole</td>
<td>2</td>
<td>PMF</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>S181FL-5-RMM-2450S</td>
<td>Nearson</td>
<td>1/4 Wave Dipole</td>
<td>2</td>
<td>PMF</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>S191FL-5-RMM-2450S</td>
<td>Nearson</td>
<td>5/8 Wave Dipole</td>
<td>3</td>
<td>PMF</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>S151FL-5-RMM-2450S</td>
<td>Nearson</td>
<td>Omni</td>
<td>5</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>MLPV1700</td>
<td>Maxrad</td>
<td>Omni-Mobile</td>
<td>4</td>
<td>MF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td>MF&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

<sup>2</sup> = Portable; <sup>M</sup> = Mobile; <sup>F</sup> = Fixed/Base station

**Vote 1**
To satisfy FCC RF exposure requirements for mobile and base station transmitting devices, a separation distance of 30cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operations at closer than this distance is not recommended.

**Vote 2**
To comply with FCC RF Exposure requirements, the Original Equipment Manufacturer (OEM) must ensure that Antennas 3, 4, 5, 6, 7 and 14 must be installed and/or configured to operate with a separation distance of 20cm or more from all persons to satisfy RF Exposure compliance.

The preceding statement must be included as a CAUTION statement in manuals for products operating with Antennas 3, 4, 5, 6, 7 and 14 to alert users on FCC RF Exposure compliance.

**Vote 3**
To satisfy FCC RF exposure requirements for mobile and base station transmitting devices, a separation distance of 32cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operations at closer than this distance is not recommended.

The preceding statement must be included as a CAUTION statement in manuals for OEM products to alert users on FCC RF Exposure compliance.
Electrical Properties:
Frequency Range: 2.4~2.5 GHz
Impedance: 50Ω nominal
VSWR: <2.0:1
Gain: 2.0 dBi
Radiation: Omni
Polarization: Vertical
Wave: Half Wave Dipole

Mechanical Properties:
Connector: L" RG178 with R/A MMCX Plug
Material:
Whip: Polyurethane—BASF(Black)
Elbow: Polycarbonate—BAYER Makrolon(Black)
Connector: Brass with black nickel plating
Operation Temp.: -20°C to +65°C
Storage Temp.: -30°C to +75°C

Recommend Mounting Hole Dimension:
φ12.0 +0.1 -0.0 mm
10.0 +0.1 -0.0 mm
Electrical Properties:

Frequency Range: 2.4~2.5 GHz
Impedance: 50Ω nominal
VSWR: <2.0:1
Gain: 5 dBi
Radiation: Omni
Polarization: Vertical
Wave: 5/8 wave

Mechanical Properties:

Connector: SMA Reverse Polarity Plug
Material:
- Whip: Polyurethane(Black)
- Swivel Mechanism: Polycarbonate(Black)
- Connector: Brass with black nickel plating
Operation Temp.: -20°C to +65°C
Storage Temp.: -30°C to +75°C
Electrical Properties:

Frequency Range: 2.4~2.5 GHz
Impedance: 50Ω nominal
VSWR: <2.0:1
Gain: *5.0 dBi
Radiation: Omni
Polarization: Vertical

*Gain is measured under no flying lead.

Mechanical Properties:

Connector: L" RG178 with R/A MMCX Plug
Material:
  Overmold: Polyurethene(Black)
  Swivel: Polycarbonate(Black)
Operation Temp.: -20°C to +65°C
Storage Temp.: -30°C to +75°C
Electrical Properties:

Frequency Range: 2.4~2.5 GHz
Impedance: 50Ω nominal
VSWR: <5.0:1
Gain: 5.0 dBi
Radiation: Omni
Polarization: Vertical

Mechanical Properties:

Connector: 5" RG178 with R/A MMCX Plug
Material:
  Overmold: Polyurethane (Black)
Operation Temp.: -20°C to +65°C
Storage Temp.: -30°C to +75°C
Electrical Properties:
- Frequency Range: 2.4~2.5 GHz
- Impedance: 50Ω nominal
- VSWR: <2.0:1
- Gain: 2 dBi
- Radiation: Omni
- Polarization: Vertical
- Wave: Half Wave Dipole

Mechanical Properties:
- Connector: SMA Reverse Polarity Plug (female)
- Material: Polyurethane (Black)
- Whip: Polyurethane (Black)
- Swivel Mechanism: Polycarbonate (Black)
- Connector: Brass with black nickel plating
- Operation Temp.: -20°C to +65°C
- Storage Temp.: -30°C to +75°C
Electrical Properties:
- Frequency Range: 2.4~2.5 GHz
- Impedance: 50Ω nominal
- VSWR: <2.0:1
- Gain: 2.0 dBi
- Radiation: Omni
- Polarization: Vertical
- Wave: Half Wave Dipole

Mechanical Properties:
- Connector: L" RG178 with R/A MMCX Plug
- Material: Polyurethane(Black)
- Overmold: Polyurethane (Black)
- Operation Temp.: -20°C to +65°C
- Storage Temp.: -30°C to +75°C
Electrical Properties:

Frequency Range: 2.4~2.5 GHz
Impedance: 50Ω nominal
VSWR: <2.0:1
Gain: *2.0 dBi
Radiation: Omni
Polarization: Vertical
*Gain is measured under no flying lead.

Mechanical Properties:

Connector: L" RG178 with R/A MMCX Plug
Material:
  Overmold: Polyurethane(Black)
  Swivel: Polycarbonate(Black)
Operation Temp.: -20°C to +65°C
Storage Temp.: -30°C to +75°C