AC5124

2.4 GHz OEM TRANSCEIVER

Specifications Subject to Change

User's Manual
Version 4.4

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DOCUMENT INFORMATION

Revision	Description
Version 3.6	Remove SDK developer kit information – 6/6/00
	Re-arrange the layout of the specification to ease use
	Correct Channels from 75 to 77 and provide range in Hex, Section 5.1.3
Version 3.7	6/28/00 – Made data rates uniform at 882 Kbps
	Reformat I/O table to view additional line descriptions
Version 3.8	8/18/00 – Changed Input Voltage tolerance from 5% to 2%
	Changed temperature from 0 – 60 °C to 0 – 70 °C
	Changed Baud Low Default from F7 to F1
	Updated Section 6 – API Command Set with examples & corrections
	Added pin notations on Figure 1 - Mechanical Overview of AC5124C
Version 3.9	9/25/00 – Corrected DTR pin number from 33 to 34, Pin 33 is NC
	Changed Pin 24 from Reserved to NC
	Remove Note from the CTS timing diagram in Sections 3.3.1 & 4.6
	Changed description for Diagnostic Result command in Section 6.1.3
Version 4.2	10/25/01 - Changed PKLR2400S part number to AC5124C
	Added AC5124C-200 information
	Added Section 3.3, Electrical Specifications
	Added RSSI calibration steps in Section 3.2.1
	Added Section 4.6, Addressed & Broadcast Communication
	Added Section 4.7, Handshaking
	Updated Table 6, EEPROM Parameters to include new parameters
	Updated Section 5, API Command Set to include command examples
	Updated Section 6, Configuring the AC5124C to include new parameter definitions
	Added Section 7, Initializing the AC5124C Transceiver
	Updated Section 8, Mechanical Overview to include new drawings
Version 4.3	3/25/01 – Changed Interface Timeout values in Table 6, EEPROM Parameters
	Updated RF Mode 1 (EEPROM Address 4Ch) to include new definition for Bit 7
	Added Section 6.1.15.5, Mixed Mode
	Updated Approved Antenna List
Version 4.4	11/24/03 – Updated all references to operating temperature from 0°C to 60°C to -40°C to 80°C. All AC5124 products are industrial temperature. Added AT Commands for reading and writing the EEPROM. Updated RSSI plot for new receiver IC.

Agency Approval Overview

Part Number	US/FCC	CAN/IC	EUR/EN**	Portable	Mobile
AC5124-10	X	X	X	X	X
AC5124-200	X	X			X-20cm*

* See RF Exposure warning on page 6
** Does not include France and Spain
Note: The product approvals above are with antennas specified on page 5.

Agency Identification Numbers

Part Number	US/FCC	CAN/IC	EUR/EN
AC5124-10	KQL-PKLR2400	CAN2268391158A	X
AC5124-200	KQL-PKLR2400-200	CAN2268391180A	

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.

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.

Approved Antenna List

Item	Part Number	Manufacturer	Gain (dBi)	AC5124-10	AC5124-10A	AC5124-200	AC5124-200A
1	WCP-2400-MMCX	Centurion	2	PM		M	
2	WCR-2400-SMRP	Centurion	2	PM			
3	MFB24008RPN	Maxrad	8	PM			
4	BMMG24000MSMARP12’	Maxrad	1	PM			
5	BMMG24005MSMARP12’	Maxrad	5	PM			
6	MP24013TMSMARP12	Maxrad	13	M			
7	MUF24005M174MSMARP12	Maxrad	5	PM			
8	MC2400	Maxrad	2.5			M	
9	NZH2400-MMCX (External)	AeroComm	1	PM		M	
10	NZH2400-I (Integrated)	AeroComm	1		PM		M
11	S131CL-5-RMM-2450S	Nearson	2			M	
12	S181FL-5-RMM-2450S	Nearson	2	PM		M	
13	S191FL-5-RMM-2450S	Nearson	3	PM		M	
14	S151FL-5-RMM-2450S	Nearson	5	PM		M	
15	MLPV1700	Maxrad	4	PM		M	

P=Portable, M=Mobile

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.

RF Exposure AC5124-10

WARNING: This equipment has been approved for portable applications where the equipment can be used in direct contact with the human body. Excessive RF exposure should be avoided.

The preceding statement must be included as a CAUTION statement in manuals for products operating with Antennas 3, 4, 5, 6, 7, 14 and 15 in the previous table to alert users on FCC RF Exposure compliance.

RF Exposure AC5124-200

WARNING: To satisfy FCC RF exposure requirements for mobile and base station transmitting devices, a separation distance of 20cm 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.

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1. Overview

This document contains information about the hardware and software interface between an AeroComm AC5124 transceiver and an OEM Host. Information includes the theory of operation, system issues, and a basic command set for operational control of the system and transceiver.

The transceiver is designed to allow flexibility at the hardware interface level with a minimum number of actual hardware pins connecting the transceiver and the OEM Host. The transceiver is controlled by a Temic TS87C51U2 microcontroller providing program storage. A separate EEPROM provides user configurable parameter storage.

AC5124 transceivers operate in a Point-to-Point or Point-to-Multipoint, Client/Server architecture. One transceiver is configured as a Server and the others are configured as Clients. Data can be transmitted from Client to Server or Server to Client, but not from Client to Client, or Server to Server.

The AC5124 runs a proprietary Carrier Sense Multiple Access (CSMA) protocol. Years of development, testing and field operation have proven this protocol to be a stable, reliable and efficient method for wireless network communications. Furthermore, the AeroComm protocol is configurable, allowing the OEM to optimize system performance. There are four different Serial Interface Modes provided by the protocol firmware. These Modes offer significant flexibility to the OEM, allowing them to provide data in many forms including API, End Character and Fixed Packet Length with and without Timeouts.

2. AC5124 Specifications

GENERAL					
Bus Interface	Serial (TTL Level Asynchronous) through 40 pin mini connector. AMP P/N 177986-1				
Serial Interface Data Rate	Programmable to 882 Kbps. PC rates to 115.2 Kbps				
Compliance	Certifiable under:				
AC5124-10	US (FCC 15.247); Canada (IC); Europe (EN)				
AC5124-200	US (FCC 15.247); Canada (IC)				
		Duty Cycle (TX=Transmit; RX=Receive)			
Power Consumption		**25%TX**	**50%TX**	**100%TX**	**100%RX**
All Serial Interface Modes	AC5124-10:	111mA	123mA	158mA	100mA
	AC5124-200:	185mA	280mA	472mA	110mA
Interface ON/RF OFF (API Mode Only)	45mA typical				
Sleep Walk (Clients in all Modes Only)	25mA typical				
Deep Sleep (Servers in API Mode Only)	20mA typical				
Channels	Supports 77 non-interfering channels				
Security	User assigned System ID. Unique IEEE addresses on each transceiver.				

TRANSCEIVER	
Frequency Band	2.402 – 2.478 GHz
Transceiver Type	Frequency Hopping Spread Spectrum
Output Power	
AC5124-10	10mW
AC5124-200	200mW
Input Voltage	5V nominal ±2%, ± 50mV ripple
Sensitivity	-90dBm
RF Data Rate	882 Kbps
Range	*Can be extended with directional antenna*
AC5124-10	Indoors up to 300 ft., Outdoors up to 3,000 ft.
AC5124-200	Indoors up to 500 ft., Outdoors up to 10,000 ft.
Synchronization Time	Average = 750ms; Maximum = 1.5s

ENVIRONMENTAL	
Temperature (Operating)	-40°C to +80°C
Temperature (Storage)	-50°C to +85°C
Humidity (non-condensing)	10% to 90%

PHYSICAL	
Dimensions	1.65” x 2.65” x 0.20”
Antenna Connector	Standard MMCX jack
Weight	Less than 0.75 ounces

SOFTWARE	
User Configurable Options	
Host Interface Data Rate	Up to 882 Kbps
Maximum bi-directional throughput	Up to 170kbps
Variable Packet Length	Up to 2 KBytes
Serial Interface Modes	(3) Transparent and (1) API
Diagnostic Error Counters	API Mode
User Programmable Attempts	Up to 255

3. Theory of Operation

The AC5124 has a serial interface that allows the OEM Host to send and receive communications to and from the transceiver. All I/O is 5Vdc TTL level signals except for RSSI, which is an analog output. All outputs are weakly pulled logic high (20 kΩ – 50 kΩ) when left unconnected and are driven logic high at reset.

3.1 DEFINITIONS

Server Host: The Server Host is the OEM device controlling the Server transceiver.

Client Host: The Client Host is the OEM device controlling the Client transceiver.

Host: Host refers to both the Server Host and the Client Host.

Server Transceiver: The Server transceiver is the "Master" transceiver. It is the hub of all communications.

Client Transceiver: The Client transceiver is a "Slave" transceiver. It is controlled by it's own Host, but is a slave to the Server transceiver.

Authentication: The acquisition of a Server IEEE 802.3 address by a Client transceiver and a subsequent issue of an ***In Range*** command by the Client transceiver to the Client Host.

Unicast Address: A frame that is directed to a single recipient as specified in IEEE 802.3.

Broadcast Address: A frame that is directed to multiple recipients as specified in IEEE 802.3.

3.2 Interface Signal Definitions

The following pinout is for the 40-pin mini-connector, J1 (AMP P/N 177986-1). I/O direction is with regard to the transceiver. All pins not used by the OEM may be left floating.

Table 1 - Interface Signal Definitions

Pin	Type	Signal Name	Function
1	GND	GND	Signal Ground
2	I	PKTMODE	Logic low (Active Low) will force transceiver into “pseudo” Serial Interface Mode 03 (API). Used for programming the EEPROM. Not recommended for full API Mode operation. See **Section 6, Configuring the AC5124**.
3	VCC	VCC	5V $\pm$ 2%, $\pm$50 mV ripple
4	NC	NC	No Connect
5	VCC	VCC	5V $\pm$ 2%, $\pm$50 mV ripple
6	NC	NC	No Connect
7	NC	NC	No Connect
8	NC	NC	No Connect
9	NC	NC	No Connect
10	NC	NC	No Connect
11	O	RSSI	Received Signal Strength Indicator - Analog output giving relative indication of received signal strength while in receive mode.
12	NC	NC	No Connect
13	NC	NC	No Connect/Data 7
14	O	TXD	Transmitted data out of the transceiver
15	O	IN_RANGE	Logic low when a Client detects a Server with same Channel and System ID.
16	I	RXD	Data input to the transceiver
17	I	RI_IN	Ring Indicator to communicate to modem
18	NC	NC	No Connect
19	O	RI_OUT	Ring Indicator to communicate to computer
20	GND	GND	Ground
21	GND	GND	Ground
22	I	DCD_IN	Data Carrier Detect to communicate to modem
23	O	CTS	Clear to Send – Logic Low (Active Low) when the transceiver is ready to accept data for transmission. See **Section 4.7.1, CTS Handshaking**.
24	NC	NC	No Connect
25	Reserved	Reserved	Reserved, must be left floating and not connected to logic high or low.
26	I	BDSEL	Baud Select – Logic low (Active Low) will force the transceiver into a known serial interface baud rate (9600 8-N-1)
27	I	RTS	Request to Send – Logic low (Active Low) when enabled and Host is ready to receive data from the transceiver. See **Section 4.7.2, RTS Handshaking**.
28	NC	NC	No Connect
29	NC	NC	No Connect
30	NC	NC	No Connect
31	NC	NC	No Connect
32	O	DSR	Data Set Ready
33	NC	NC	No Connect
34	I	DTR	Data Terminal Ready
35	NC	NC	No Connect
36	O	DCD_OUT	Data Carrier Detect to communicate to computer
37	I	WR_ENA	EEPROM Write Enable – Logic low will enable writes to the EEPROM. *The transceiver should **NOT** be write-enabled during the initial power up or upon a hardware reset to ensure the integrity of the EEPROM data.*
38	I	μP _RESET	Microprocessor Reset - Logic high for a minimum of 2ms will reset the transceiver. If a reset is performed after power has been applied and is stable, the reset time will decrease significantly. All other times, Pin 38 should be logic low. If Pin 38 is not connected, the microprocessor will hold Pin 38 logic low.
39	VCC	VCC	5V $\pm$ 2%, $\pm$50 mV ripple
40	GND	GND	Signal Ground

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

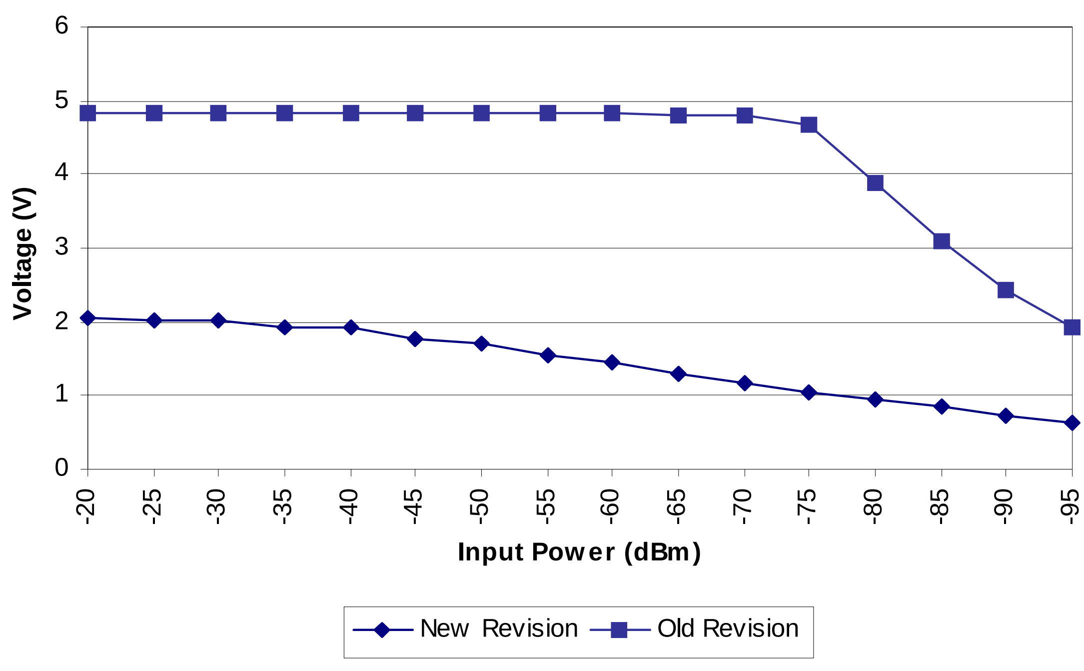
3.2.1 Received Signal Strength Indicator (RSSI)

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

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

Figure 1 shows approximate RSSI performance. There are two versions of receivers used by the AC5124. As of January of 2003 forward, only the New Revision receiver will be shipped. The RSSI pin of the old revision requires the Host to provide a 27kΩ pull-down to ground. No pull-down should be used with the new revision.

Figure 1 - RSSI Voltage vs. Received Signal Strength



3.2.2 In Range (IN_RANGE)

The IN_RANGE pin will be driven logic low when a Client is in range of a Server on the same Channel and System ID. If a Client cannot hear a Server for the amount of time that is programmed in the Range Refresh EEPROM address 32h, the Client drives the IN_RANGE pin logic high and enters a search mode looking for a Server. As soon as it detects a Server, the IN_RANGE pin will be driven logic low.

3.2.3 Baud Rate Selector (BDSEL)

The Baud Rate Selector (BDSEL) pin provides the OEM a default method of communicating with a transceiver in the event the EEPROM baud rate parameters become corrupted. If Pin 26 is logic high or not connected, the baud rate will default to that specified in EEPROM. If Pin 26 is logic low at RESET, the baud rate will default to 9600 baud.

3.2.4 Microprocessor Reset (µP_RESET)

Microprocessor Reset (µP_RESET) is achieved by holding Pin 38 at logic high for a minimum of 2ms. If µP_RESET is performed after power has been applied to a transceiver and is stable, the reset time will be significantly less. At all other times, Pin 38 should be logic low. If Pin 38 is not connected, the microprocessor will hold Pin 38 logic low.

3.2.5 EEPROM Write Enable (WR_ENA)

EEPROM Write Enable (WR_ENA) is enabled when Pin 37 is logic low. Pin 37 must be logic low to write to the EEPROM. The OEM must ensure a transceiver is NOT write-enabled during initial power up or during a hardware RESET. Failure to do so may result in corruption of important EEPROM data.

3.3 Electrical Specifications

Table 2 - DC Input Voltage Characteristics

Pin	Type	Name	High Min.	High Max.	Low Min.	Low Max.	Unit
2	I	PKTMODE	0.2Vcc + 0.9	Vcc + 0.5	-0.5	0.2Vcc - 0.1	V
16	I	RXD	0.2Vcc + 0.9	Vcc + 0.5	-0.5	0.2Vcc - 0.1	V
17	I	RI_IN	2	Vcc + 1	-0.5	0.8	V
22	I	DCD_IN	2	Vcc + 1	-0.5	0.8	V
26	I	BDSEL	0.2Vcc + 0.9	Vcc + 0.5	-0.5	0.2Vcc - 0.1	V
27	I	RTS	0.2Vcc + 0.9	Vcc + 0.5	-0.5	0.2Vcc - 0.1	V
34	I	DTR	2	Vcc + 1	-0.5	0.8	V
37	I	WR_ENA	0.7Vcc	Vcc + 1	-0.3	0.5	V
38	I	µP_RESET	0.7Vcc	Vcc + 0.5	-0.5	0.2Vcc - 0.1	V

Table 3 - DC Output Voltage Characteristics

Pin	Type	Name	High Min.	Low Max.	Unit
11	O	RSSI	Analog	Analog	V
14	O	TXD	Vcc - 1.5 @ -60uA	0.45 @ 1.6mA	V
15	O	IN_RANGE	2.4 @ -4mA	0.45 @ 4mA	V
19	O	RI_OUT	2.4 @ -4mA	0.45 @ 4mA	V
23	O	CTS	Vcc - 1.5 @ -60uA	0.45 @ 1.6mA	V
32	O	DSR	2.4 @ -4mA	0.45 @ 4mA	V
36	O	DCD_OUT	2.4 @ -4mA	0.45 @ 4mA	V

4. Serial Interface Modes

The AC5124 provides four Serial Interface Modes for interfacing to the Host, each having protocol parameters that can be programmed for maximum system optimization. Serial Interface Modes 01, 02, and 04 are referred to as Transparent Modes, indicating Host protocol is unnecessary for operation in these modes – much like a serial cable. In addition, the transceiver-to-transceiver protocol for the Transparent Modes is identical, allowing all three modes to coexist in the same network. Serial Interface Mode 03, referred to as API Mode, is not interoperable with the Transparent Modes.

4.1 Serial Interface Mode 01 – Transparent, Fixed Packet Length, with Timeout

Transparent Mode 01 is the most popular interface mode because it can be used for many serial cable replacement applications that meet any or all of the following conditions:

1) The Host always sends data packets that are the same size, allowing a transceiver to take advantage of the fixed packet length option.
2) The Host sends variable-sized data packets, all of which are equal to or smaller than the Fixed Packet Length. A transceiver will wait until the Interface Timeout expires or until the Fixed Packet Length size is reached. Therefore, if multiple packets and/or portions of packets are sent before the Interface Timeout expires, the receiving transceiver Host must be able to process the multiple packets and/or portions of packets.

Packets will be transmitted over the RF interface when one of the following conditions occurs:

1) The number of data bytes received over the serial interface is equal to the Fixed Packet Length specified by the OEM at EEPROM addresses 43h and 44h (43h is the MSB). The maximum packet size is 07FFh or 2KB.
2) A byte gap larger than the Interface Timeout specified by the OEM at EEPROM address 4Dh occurs. This can be set to 00h, 40h, 80h, or C0h designating 4ms, 40ms, 300ms, and 2.6s timeouts, respectively.

Any packets larger than the Fixed Packet Length will be parsed and sent consecutively by a transceiver. For example, if the Fixed Packet Length is 128 bytes and the Host sends 150 bytes, a transceiver will send 128 bytes and then 22 bytes after the timeout expires, consecutively.

4.2 Serial Interface Mode 02 – Transparent, End Character

Transparent Mode 02 is useful for applications where a particular character (such as a carriage return – 0Dh) is used to signify the end of each packet. The End Character is specified by the OEM at EEPROM address 3Eh and can be set from 00h to FFh. Packets will be transmitted over the RF interface when the OEM-defined End Character is received by a transceiver. The maximum packet size is 07FFh or 2KB, including the End Character. Note that the End Character will be transmitted to the Host.

4.3 Serial Interface Mode 03 – API

API Mode is the most complex and detailed mode, where most of the control is given to the Host. This mode may seem extensive at first glance; however, it follows a specific pattern of commands and responses similar to an Ethernet protocol. The commands are grouped into two categories, System Commands and Transceiver Commands. See **Section 5, API Command Set** for the full list of commands and definitions.

4.4 Serial Interface Mode 04 – Transparent, Fixed Packet Length, No Timeout

In Transparent Mode 04, packets will be transmitted over the RF interface when the number of data bytes received over the serial interface is equal to the Fixed Packet Length specified by the OEM at EEPROM addresses 43h and 44h (43h is the MSB). The maximum packet size is 07FFh or 2KB. This mode of operation is recommended for applications that meet any of the following conditions:

1) The Host always sends data packets that are the same size.
2) The Host sends variable-sized data packets, all of which are equal to or smaller than the Fixed Packet Length. A transceiver will wait indefinitely until the Fixed Packet Length size is reached. Therefore, multiple packets and/or portions of packets will be sent, depending on the timing and size of the packets. As a result, the receiving transceiver Host must be able to process the multiple packets and/or portions of packets.

4.5 Serial Interface Buffer

The serial interface buffer provides 8 KBytes of memory segmented into four dynamic regions. In API Mode, only one region is utilized. In all Transparent Modes, a buffer region is used each time a packet release condition is met. As an example, in Transparent Mode 02, if 500 Bytes are transmitted, including 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 <u>strongly</u> recommended that CTS or upper layer protocol with acknowledgements be used by the OEM when operating in any of the Transparent Modes to prevent lost data. <u>Otherwise, if all four buffers are filled and the Host continues to send data over the serial interface, the data will be discarded by the transceiver. This condition can be eliminated by using CTS.</u>

4.6 Addressed & Broadcast Communication

The AC5124 supports both Addressed and Broadcast Modes of communication in all Serial Interface Modes. As necessary, refer to **Section 5, API Command Set** for API command definitions and **Section 6, Configuring the AC5124** for EEPROM address definitions.

4.6.1 Addressed Mode

4.6.1.1 Transparent Mode Operation

Addressed communication in a Transparent Mode is achieved by programming the Transmit Mode byte, located at EEPROM address 4Bh, to a value of 00h. In addition, the 6-byte IEEE destination address must be programmed in the respective transceivers starting at EEPROM address 50h (i.e. the Server IEEE address must be programmed in the Client and the Client IEEE address must be programmed in the Server). Auto Destination could also be enabled in the Client transceiver as described in **Section 4.6.1.2, Auto Destination**.

In this configuration, a packet is sent to the destination transceiver until a positive acknowledgement is received or until all Transmit Attempts have completed. The number of Transmit Attempts is specified at EEPROM address 2Fh and can be programmed with values ranging from 01h to FFh. If a packet is not received successfully after all attempts have been made, the packet transmission will be aborted. The RF acknowledgements in all Transparent Modes are not sent to the Hosts; therefore, the Host is responsible for detecting a non-deliverable packet, if necessary. Addressed Mode is recommended for all point-to-point (one Server and on Client) applications because a transceiver only sends the packet as many times as necessary. For example, if a transceiver receives a positive acknowledgement before all attempts are made, it will ignore the remaining attempts and start sending the next packet.

4.6.1.2 Auto Destination

The AC5124 also supports an addressed mode of communication called Auto Destination. Auto Destination is only for Clients operating in one of the Transparent Modes. To configure a Client for Auto Destination, set bit 7 of EEPROM address 4Fh to a value of 1. With Auto Destination enabled, a Client has the ability to detect any Server with the same Channel and System ID. Hence, a Client's Destination IEEE MAC Address, located at EEPROM address 50h, is not required to be programmed with the Server's IEEE address.

Auto Destination allows a Client to dynamically route all communications to the Server that is in range, making it useful for mobile or roaming applications where a Client will be interfacing with different Servers from time to time. It is important to note that multiple Servers with the same Channel and System ID must not be located in range of one another. Doing so will cause inoperability of the system.

4.6.1.3 API Mode Operation

In API Mode, the IEEE Source and Destination Address must be included in the data frame of the ***Send Data*** command. The Host is responsible for constructing the packet before sending it to the transceiver. Like a transceiver operating in a Transparent Mode, a packet will be sent until a successful ***Send Data Complete*** command is sent to the Host or all Transmit Attempts are completed. If the packet is not received successfully after all attempts have been made, the Host will be notified by the ***Send Data Complete*** command with a failure code of 1. Thus, the acknowledgements in API Mode are sent to the Hosts and can be used to guarantee packet delivery.

4.6.2 Broadcast Mode

4.6.2.1 Transparent Mode Operation

Broadcast communication in a Transparent Mode is intended for use in a point-to-multipoint network (one Server and many Clients). In this configuration, the Server must be programmed for Broadcast Mode by programming the Transmit Mode byte, located at EEPROM address 4Bh, to a value of 01h. It is recommended that all Clients be programmed in Addressed Mode or Auto Destination Mode to provide more reliable delivery of data to the Server, resulting in more efficient network communications.

Unlike the Transmit Attempts process in Addressed Mode, a packet will be transmitted until all Broadcast Attempts are completed. The number of Broadcast Attempts is specified at EEPROM address 4Eh and can be programmed with values ranging from 01h to FFh. If a transceiver receives a packet multiple times without error, only the first error-free packet will be sent to the Host. All others will be discarded. The OEM should carefully determine the number of Broadcast Attempts by performing extensive testing in their application. If a packet is sent more times than necessary, network performance can degrade.

4.6.2.2 API Mode Operation

Sending a broadcast packet is accomplished by constructing the data frame of the ***Send Data*** command with all six bytes of the IEEE Destination Address set to a value of FFh.

Unlike the Transmit Attempts process in Addressed Mode, a packet will be transmitted until all Broadcast Attempts are completed, after which, a successful ***Send Data Complete*** command will be sent to the Host. The number of Broadcast Attempts is specified at EEPROM address 4Eh and can be programmed with values ranging from 01h to FFh. If a transceiver receives a packet multiple times without error, only the first error-free packet will be sent to the Host. All others will be discarded. The OEM should carefully determine the number of Broadcast Attempts by performing extensive testing in their application. If a packet is sent more times than necessary, network performance can degrade.

4.7 HANDSHAKING

Though handshaking is not required for transceiver operation, it is recommended to achieve optimum system performance. Most applications benefit from using Clear To Send (CTS) only, while others may also need Request To Send (RTS). In addition, some applications may require full modem handshaking.

4.7.1 CTS Handshaking

CTS is used by the transceiver to keep the Host from transmitting data to it. If the Host sends the transceiver data when CTS is logic high (inactive), the data will be lost. Normally, CTS will go logic high for a minimum of 40μs following the transmission of a data packet from the Host to the transceiver. However, if the serial interface buffers on a transceiver become full and the transceiver cannot transmit the data, the transceiver will hold CTS logic high until it can free a buffer. For example, this can occur when a transceiver goes out of range. Therefore, it is strongly recommended that the Host use CTS. All serial data must be transmitted LSB first.

4.7.2 RTS Handshaking

When the RTS bit is enabled by setting bit 3 of the Serial Interface Mode byte at EEPROM address 4Ah to a value of 1, Pin 27 is used by the Host to keep a transceiver from transmitting data to it. When RTS is logic high (inactive), a transceiver cannot send data to the Host. Holding RTS logic high for too long can congest RF communications. For example, if RTS is held logic high while a transceiver continues to receive data, eventually the receive buffer will fill. If this occurs, a transceiver will not be able to send or receive any data until it can free the buffer.

4.7.3 Modem Handshaking

In Modem Mode, a transceiver uses all standard RS232 (TTL level) handshaking lines to negotiate communications. These lines include TXD, RXD, CTS, RTS, DTR, DSR, DCD_IN, DCD_OUT, RI_IN and RI_OUT.

To enable Modem Mode, set bit 6 and bit 3 of EEPROM address 4Ah to a value of 1. Bit 6 will enable all modem lines except RTS. As mentioned in **Section 4.7.2, RTS Handshaking**, setting bit 3 to a value of 1 enables RTS. Modem Mode is overkill for most applications and is intended mainly for wireless modem applications.

4.7.3.1 Radio Connected to DTE

When a transceiver is connected to a Data Terminal Equipment (DTE) device, like a PC, and full modem support is desired, a transceiver will use the following configuration in most applications:

DTE (PC)	TXD	RXD	CTS	RTS	DTR	DSR	DCD	RI
Transceiver	RXD (16)	TXD (14)	CTS (23)	RTS (27)	DTR (34)	DSR (32)	DCD_OUT (36)	RI_OUT (19)

4.7.3.2 Radio Connected to DCE

When a transceiver is connected to a Data Communication Equipment (DCE) device, like a modem, and full modem support is desired, a transceiver will use the following configuration in most applications:

DCE (Modem)	TXD	RXD	CTS	RTS	DTR	DSR	DCD	RI
Transceiver	RXD (16)	TXD (14)	RTS (27)	CTS (23)	DSR (32)	DTR (34)	DCD_IN (22)	RI_IN (17)

5. API Command Set

In API Mode, the Host and transceiver utilize a set of commands to program the EEPROM parameters defined in **Section 6, Configuring the AC5124**, as well as control and monitor network communications. As mentioned in **Section 4.3, Serial Interface Mode 03 – API**, the commands are grouped into two categories, System Commands and Transceiver Commands. Each group of commands are listed and defined in this section. It is important to note these commands can only be used when a transceiver is operating in the API Mode, which is accomplished by programming bits 0 and 1 of EEPROM address 4Ah to a value of 1. The command format is defined as follows:

Command	Length	Data	Checksum

Command (1 Byte) – Hex command as shown in **Table 4 – System Command Set** and **Table 5 – Transceiver Command Set**.

Length (2 Bytes) – This is the total size of the remaining data for this command. The length field is in little endian format (i.e. low byte/high byte). This length does not include the checksum.

Data (N Bytes) – The actual data associated with the command or sub-command.

Checksum (1 Byte) – The checksum is a byte-by-byte, bitwise "EXCLUSIVE OR" of the Command, Length and Data block.

Here are some important facts to remember when operating in API Mode:

1) All commands issued by the Host must receive an ***Acknowledge*** command from the transceiver to signal completion of the issued command. This serves as flow control for the information going to the transceiver.
2) When a command is issued by the transceiver to the Host, the Host must be ready to accept the command and any data following the command. The transceiver will not get an ***Acknowledge*** command from the Host.
3) Although the Host will receive an ***Acknowledge*** command for every command sent to the transceiver, the Host must be able to accept any command issued by the transceiver prior to receiving the ***Acknowledge*** command.

5.1 System Command Set

The System Commands allow the OEM to initialize the system and perform general system analysis. In addition, the EEPROM parameters can only be programmed using these commands. The table below summarizes the commands.

Table 4 - System Command Set

Name	Command	Length Low	Length High	Data	Checksum
Reset	AAh	00h	00h	No Data	AAh
Control	86h	1 to 5 (depends on sub-command)		As Required	As Required
Diagnostic Result	87h	As Required		As Required	As Required
Standby	88h	01h	00h	00h – Client Sleep Walk 01h – Server Deep Sleep 04h – Cancel Standby	As Required
Status Request	8Ah	01h	00h	0 – Reset error counter 1 – Don't do anything	8Ah
Status Reply	8Bh	14h - 74h	00h	See **Section 5.1.6, Status Reply**	As Required
Update EEPROM Checksum	8Ch	00h	00h	No Data	8Ch
Check EEPROM Checksum	8Dh	00h	00h	No Data	8Dh
EEPROM Checksum Status	8Eh	01h	00h	0 – Checksum invalid 1 – Checksum valid	8Eh
Acknowledge	As Required	As Required		As Required	As Required

5.1.1 Reset

The Host issues this command to a transceiver. This command provides a software reset to a transceiver, initializing the code at the same location as a hardware reset. The Host must wait for the ***Acknowledge*** command before issuing any additional commands. This command must be followed by an ***RF Enable*** command.

Example: AA|00|00|AA (There are no Data bytes for this command)
Acknowledge: AA|01|00|00|AB

5.1.2 Control

The Host issues this command to a transceiver to write and read EEPROM addresses as well as for NOP. The Host must wait for the ***Diagnostic Result*** command before issuing any additional commands. Refer to **Section 6, Configuring the AC5124** for the list of configurable EEPROM parameters.

Sub-command (Counts as 1 Byte in the Length)	Description
02h	Read EEPROM. Additional data: first 2 bytes specify starting address. Second 2 bytes specify ending address.
08h	NOP.
09h	Write EEPROM. Additional data: first 2 Bytes specify starting address. Second 2 Bytes specify ending address. Remaining bytes specify data to be written. (Range 00h to 7Fh)

Data Frame:

86h	Length Low	00h	Sub-command	Data	Checksum

Read EEPROM Example (Addresses 04h to 09h): 86|05|00|02|04|00|09|00|8C
Diagnostic Result: 87|07|00|02|FF|FF|FF|FF|FF|FF|82

Example (NOP): 86|01|00|08|8F
Diagnostic Result: 87|02|00|08|00|8D

Write EEPROM Example (write value 01h to address 31h): 86|06|00|09|31|00|31|00|01|88
Diagnostic Result: 87|02|00|09|00|8C

Any additional sub-commands are reserved by the system and if used may cause system operation problems.

5.1.3 Diagnostic Result

A transceiver issues this command to the Host in response to a ***Control*** command.

Sub result (Counts as 1 Byte in the Length)	Description
02h	Read EEPROM
08h	NOP. Returns 6 Bytes (87 02 00 08 00 8D)
09h	Write EEPROM status. 0 - Write successful. 1- Write failed.

Data Frame:

87h	Length Low	Length High	Sub-result	Data	Checksum

5.1.4 Standby

The Host issues the following commands to enable Sleep Walk Mode for Clients and Deep Sleep Mode for Servers. See **Section 6.1.13.3, Power Down Modes** for detailed information on these modes.

- 88 01 00 00 89 – This will command the Client into Sleep Walk mode.
- 88 01 00 01 88 – This will command the Server into Deep Sleep mode.
- 88 01 00 04 8D – This will cancel the power down functions.

5.1.5 Status Request

The Host issues this command to a transceiver to determine various statistics associated with the RF Data Link Layer. A Data value of 00h will reset the Error Counters while a value of 01h will leave them at their current values. The Host must wait for the ***Status Reply*** command before issuing any additional commands.

Example: 8A|01|00|01|8A
Status Reply (0 Active Transceivers): 8B|20|00|A8|03|00|00|00|00|00|01|00|00|00|00|00|00|00|
00|00|00|00|01|00|50|67|00|3C|3D|D3|01|00|07|00|00|E3

5.1.6 Status Reply

A transceiver issues this command to the Host in response to a ***Status Request*** command. The parameters pertain to the RF Data Link Layer and provide cumulative totals. The statistics and their sizes are shown below:

Name	Type	Description	Size
Transceiver Time	Time Counter	Incremented by 1 every 250ms. Initialized to 0 at power on or reset.	Unsigned Byte – 3 Bytes, Low Byte first
Tx Failures	Error Counter	Number of times a transceiver was not able to deliver a data frame to the destination	Unsigned Long - 4 Bytes
Tx Retries	Error Counter	Number of times a transceiver had to retry before delivering a data frame to the destination	Unsigned Long - 4 Bytes
Rx Failures	Error Counter	Number of times a transceiver had to throw away a received data frame because of bad CRC/checksum	Unsigned Long - 4 Bytes
Rx Retries	Error Counter	Number of times data frames had to be retransmitted before a valid data frame was received	Unsigned Long - 4 Bytes
Num Active Transceivers	Data Counter	Number of Clients registered to a Server. If the Transceiver under consideration is a Client, just return 0	Unsigned Byte - 1 Byte
List of Registered Transceivers	Identity	List of 6-Byte IEEE 802.3 transceiver addresses + 3 Byte time stamp + 3 Byte packet count. Time stamp and packet counter are reset at power on or Reset.	12 Bytes * Num Reg Clients

Status Reply Example

Name	Type	0 Active Transceivers	2 Active Transceivers
Transceiver Time	Time Counter	1 Byte – TL 1 Byte – TM 1 Byte – TH	1 Byte – TL 1 Byte – TM 1 Byte – TH
Tx Failures	Error Counter	4 Bytes	4 Bytes
Tx Retries	Error Counter	4 Bytes	4 Bytes
Rx Failures	Error Counter	4 Bytes	4 Bytes
Rx Retries	Error Counter	4 Bytes	4 Bytes
Num Active Transceivers	Data Counter	0	2
List of Registered Transceivers	Identity		6 Bytes IEEE Address 3 Bytes time stamp 3 Bytes packet count 6 Bytes IEEE Address 3 Bytes time stamp 3 Bytes packet count
Checksum		Actual	Actual

Data Frame:

8Bh	Length Low	00h	Data	Checksum

5.1.7 Update EEPROM Checksum

The Host issues this command to a transceiver to recalculate the checksum. The Host typically issues this command after it has completed writing data to the EEPROM. The Host must wait for the ***Acknowledge*** command before issuing any additional commands.

Example: 8C|00|00|8C (There are no Data bytes for this command)
Acknowledge: 8C|00|00|8C

5.1.8 Check EEPROM Checksum

The Host issues this command to a transceiver to validate the EEPROM checksum. The Host typically issues this command after resetting a transceiver. A transceiver replies with a valid or invalid checksum by sending back the ***EEPROM Checksum Status*** command.

Example: 8D|00|00|8D (There are no Data bytes for this command)
EEPROM Checksum Status: 8E|01|00|01|8E

5.1.9 EEPROM Checksum Status

A transceiver issues this command to the Host in response to a ***Check EEPROM Checksum*** command. A Data value of 00h indicates an invalid Checksum while a value of 01h indicates a valid Checksum.

5.1.10 Acknowledge

A transceiver issues this command in response to some of the Host commands indicating a positive response. The ***Acknowledge*** consists of the Host command sequence with a zero length, unless otherwise noted.

5.2 TRANSCEIVER COMMAND SET

The Transceiver Commands allow the OEM to control the flow of data into and out of a transceiver as well as initialization of a transceiver. The table below summarizes the commands.

Table 5 - Transceiver Command Set

Name	**Command**	**Length Low**	**Length High**	**Data**	**Checksum**
RF Enable	80h	00h	00h	No Data	80h
Send Data	81h	0Ch – 7FBh (includes 802.3 Header)		As Required	As Required
Send Data Complete	82h	01h	00h	00h or 01h (See **Section 5.2.3, Send Data Complete**)	As Required
Received Data	83h	0Ch – 7FBh (includes 802.3 Header)		As Required	As Required
In Range	84h	06h	00h	IEEE 802.3 address of Server	As Required
Out of Range	85h	00h	00h	No Data	85h

5.2.1 RF Enable

The Host issues this command to a transceiver prior to any RF data transfers. The Host typically issues this command after resetting a transceiver. This enables the RF interface of a transceiver and turns the transmitter/receiver ON. The Host must wait for the ***Acknowledge*** command before issuing any additional commands. Ensure that only one RF Enable command is issued following a Reset.

Example: 80|00|00|80 (There are no Data bytes for this command)
Acknowledge: 80|00|00|80

5.2.2 Send Data

The Host issues this command to a transceiver before sending a data packet to it. Broadcast frames are sent to all registered Clients at the same time without RF-Layer acknowledgements. Broadcast frames are not required to reach all destinations. The Host must wait for the ***Send Data Complete*** command before issuing any additional commands.

Data Frame:

81h	Length Low	Length High	Data	Checksum

Destination Address	**Source Address**	**Data**
MS Byte…LS Byte	MS Byte…LS Byte	

Note: The Data must include the following header information:

- (6) Bytes for the IEEE 802.3 *destination* address, or FF FF FF FF FF FF for broadcast packets
- (6) Bytes for the IEEE 802.3 *source* address

These unique IEEE addresses are provided by AeroComm and stored in EEPROM addresses 28h – 2Dh.

5.2.3 Send Data Complete

A transceiver issues this command upon completion of the data transmission process, as indicated by a RF-layer acknowledgment from the destination transceiver. An additional byte of data indicates a success or a failure code. This command will be returned for every ***Send Data*** command unless the device power fails.

- **Command:** 82h
- **Length:** 01h
- **Data:** 00h – Indicates success. 01h – Can't send packet.
- **Checksum:** As required

Data Frame:

82h	01h	00h	Data	Checksum

5.2.4 Received Data

A transceiver issues this command upon reception of data from the RF interface. The information in the data frame is the received data.

Since more than one Client can transmit to a Server, multiple ***Received Data*** commands can be issued to the Server Host at the same time. The command does not require an ***Acknowledge*** command; therefore, the Server Host must be capable of receiving multiple, consecutive ***Received Data*** commands.

Data Frame:

83h	Length Low	Length High	Data	Checksum

Destination Address	**Source Address**	**Data**
MS Byte…LS Byte	MS Byte…LS Byte	

5.2.5 In Range

The Client issues this command upon detecting a Server beacon after a Reset or after an ***Out of Range*** command has been issued to the Host. The Client Host will get updated with this command at the time intervals specified by the Range Refresh parameter at EEPROM address 32h. The OEM should allow for some hysterisis so the Host isn't flooded with these commands in a fringe coverage area. AeroComm has established a default value of 5 seconds through extensive testing. This command includes the IEEE 802.3 Server Address.

Data Frame:

84h	06h	00h	Data	Checksum

Server IEEE Address
MS Byte…LS Byte

5.2.6 Out of Range

The Client issues this command if it does not detect a Server beacon after a Reset or after an ***In Range*** command has been issued to the Host. The Client Host will get updated with these commands at the time intervals specified by the Range Refresh parameter at EEPROM address 32h. The OEM should allow for some hysterisis so the Host isn't flooded with these commands in a fringe coverage area. AeroComm has established a default value of 5 seconds through extensive testing.

6. AT Command Set

Versions 3.5 and higher of the AC5124 family firmware implement an AT Command set, which is used for modifying settings during runtime without having to use any hardware control lines. AT Commands are valid for modes 1, 2, and 4 of the AC5124. Whether in mode 1, 2, or 4, this command must be sent to the radio as a complete packet. Any characters before or after this command that become appended to this string to form a larger packet will cause the packet to be interpreted as a packet to send over the RF and not an AT command. If the AT command set is used in mode 2, the end character must be 0DH (13 decimal). If the AT command set is used in mode 4, the fixed length must be set to 6. If power is lost while in AT command mode, the radio will power back up into normal mode. All AT command characters should be capitalized. All AT commands end in a 0DH character (13 decimal). The radio will not respond to an AT command unless the 0DH character is detected at the end of the command.

6.1 IRAM Defined

IRAM is an acronym for Internal Random Access Memory. IRAM is a static memory that holds many of the parameters that control the radio such as channel number. Using the Read/Write IRAM command allows these parameters to be changed dynamically. Because IRAM is static, when the radio is reset, these parameters will revert back to the settings stored in the E^2PROM. Be careful not to change undocumented IRAM addresses as undesired operation may occur. Below is a list of IRAM parameters that can be changed in the radio:

IRAM Address (Hex)	Description
F5	Channel Number

6.2 Command Instructions/Responses

Below is a description of the AT Commands and their appropriate responses.

6.2.1 Enter Command Mode

Prior to sending any other AT command, the radio must be sent the Enter Command Mode command by the OEM Host. Below is a description of that command:

AT+++↵

Where ↵ is equal to 0DH (13 decimal).

If it is unable to successfully receive the command, the radio will interpret the string as a packet to send out over the RF and will act accordingly. Upon successfully receiving the Enter Command Mode command, the radio will be ready to receive other AT commands and will issue the following response to the OEM Host:

OK↵

Where ↵ is equal to 0DH (13 decimal).

After successfully receiving the Enter Command Mode command, the radio will not be able to communicate with other radios until AT command mode is exited. If a server is commanded into AT mode, the clients will go out of range.

6.2.2 Exit Command Mode

To exit AT mode without resetting the internal static parameters of the radio, an Exit Command Mode command should be sent to the radio by the OEM Host. Below is a description of that command:

ATO↵

Where ↵ is equal to 0DH (13 decimal).

If it successfully receives the command, the radio will issue the following response to the OEM Host:

OK↵

Where ↵ is equal to 0DH (13 decimal).

If it is at least able to receive the ↵ character but there is an error in the command or part of the command is missing, the radio will issue the following response to the OEM Host:

ERROR↵

Where ↵ is equal to 0DH (13 decimal).

Upon successfully receiving the Exit Command Mode command, the radio will resume RF communications.

6.2.3 Power-on Reset Command

To force the radio to perform a Power-on Reset, the Power-on Reset command should be sent to the radio by the OEM Host. Below is a description of that command:

ATZ↵

Where ↵ is equal to 0DH (13 decimal).

If it successfully receives the command, the radio will issue the following response to the OEM Host:

OK↵

Where ↵ is equal to 0DH (13 decimal).

If it is at least able to receive the ↵ character but there is an error in the command or part of the command is missing, the radio will issue the following response to the OEM Host:

ERROR↵

Where ↵ is equal to 0DH (13 decimal).

Upon successfully receiving the Power-on Reset Command, the radio will perform a power-on reset and resume RF communications.

6.2.4 Read IRAM Byte

IRAM Reads are performed one byte at a time. To read a byte of IRAM, the OEM Host should issue the following command to the radio:

ATSXX?↵

Where XX is equal to an IRAM address. If the address is less than 10H, the leading zero must still be sent such as ATS05?↵

Where ↵ is equal to 0DH (13 decimal).

If it successfully receives the command, the radio will issue the following response to the OEM Host:

YY↵

Where YY is equal to the value of the IRAM location requested.

Where ↵ is equal to 0DH (13 decimal).

If it is at least able to receive the ↵ character but there is an error in the command or part of the command is missing, the radio will issue the following response to the OEM Host:

ERROR↵

Where ↵ is equal to 0DH (13 decimal).

6.2.5 Write IRAM Byte

IRAM Writes are performed one byte at a time. To write a byte of IRAM, the OEM Host should issue the following command to the radio:

ATSXX=YY↵

Where XX is equal to an IRAM address. If the address is less than 10H, the leading zero must still be sent such as ATS05=YY↵

Where YY is equal to the value to store in the IRAM location. If the value is less than 10H, the leading zero must still be sent such as ATSFE=0F↵

Where ↵ is equal to 0DH (13 decimal).

If it successfully receives the command, the radio will issue the following response to the OEM Host:

OK↵

Where ↵ is equal to 0DH (13 decimal).

If it is at least able to receive the ↵ character but there is an error in the command or part of the command is missing, the radio will issue the following response to the OEM Host:

ERROR↵

Where ↵ is equal to 0DH (13 decimal).

6.2.6 Read EEPROM Byte

EEPROM Reads are performed one byte at a time. To read a byte of EEPROM, the OEM Host should issue the following command to the radio:

ATWXX?↵

Where XX is equal to an EEPROM address. If the address is less than 10H, the leading zero must still be sent such as ATW05?↵

Where ↵ is equal to 0DH (13 decimal).

If it successfully receives the command, the radio will issue the following response to the OEM Host:

YY↵

Where YY is equal to the value of the EEPROM location requested.

Where ↵ is equal to 0DH (13 decimal).

If it is at least able to receive the ↵ character but there is an error in the command or part of the command is missing, the radio will issue the following response to the OEM Host:

ERROR↵

Where ↵ is equal to 0DH (13 decimal).

6.2.7 Write EEPROM Byte

EEPROM Writes are performed one byte at a time. To write a byte of EEPROM, the OEM Host should issue the following command to the radio (NOTE: before sending this command, the EEPROM Write Enable pin must be Low):

ATWXX=YY↵

Where XX is equal to an EEPROM address. If the address is less than 10H, the leading zero must still be sent such as ATW05=YY↵

Where YY is equal to the value to store in the EEPROM location. If the value is less than 10H, the leading zero must still be sent such as ATWFE=0F↵

Where ↵ is equal to 0DH (13 decimal).

If it successfully receives the command, the radio will issue the following response to the OEM Host:

OK↵

Where ↵ is equal to 0DH (13 decimal).

If it is at least able to receive the ↵ character but there is an error in the command or part of the command is missing, the radio will issue the following response to the OEM Host:

ERROR↵

Where ↵ is equal to 0DH (13 decimal).

7. Configuring the AC5124

Table 6 – EEPROM Parameters, contains the many configurable parameters that are stored in the EEPROM on a transceiver. These parameters are read by the AeroComm firmware on power-up or when a reset is executed. This section provides the definitions, valid values and use for each of these parameters.

It is important to follow the steps below when writing to the EEPROM. Refer to **Section 5, API Command Set**, for all referenced commands.

1) **Do not write to any EEPROM addresses other than those listed in Table 6 – EEPROM Parameters. Do not copy a transceiver's EEPROM data to another transceiver. Doing so may cause a transceiver to malfunction.**
2) EEPROM parameters can only be changed when the API Mode is active. When operating in a Transparent Mode, holding Pin 2 (PKTMODE) logic low will force a transceiver to enter a "pseudo" API Mode; however, the full API command set is not supported.

   Supported commands include: ***Reset***, ***Control*** (and sub-commands), ***Update EEPROM Checksum***, ***Check EEPROM Checksum***, ***EEPROM Checksum Status***, and ***Acknowledge***.
3) Pin 37 (WR_ENA) must be logic low to enable writes to the EEPROM.
4) After all desired EEPROM addresses are configured using the ***Write EEPROM*** command, the OEM should invoke the ***Update EEPROM Checksum*** command. If this command is not executed, the checksum will not be updated with the newly written data. Pin 37 (WR_ENA) must be logic low for this command to execute successfully.
5) Once the EEPROM checksum is updated, the OEM must reset the transceiver before any EEPROM changes will become active. Pin 37 (WR_ENA) must be logic high during the reset. If operating in API Mode, issue the ***Reset*** command. If operating in a Transparent Mode, Pin 2 (PKTMODE) must be taken logic high and the OEM must use Pin 38 (μP_RESET) or cycle power to reset the transceiver. If Pin 2 (PKTMODE) remains low during a reset, the transceiver will remain in "pseudo" API Mode.

Table 6 - EEPROM Parameters

Parameter	EEPROM Address	Length (Bytes)	Default (Hex)	Description
Software Version Number	1Dh	8	Unique to each version	Firmware version number – Must not be modified by the OEM
IEEE MAC Address	28h	6	Unique to each radio	IEEE assigned MAC Address – Must not be modified by the OEM. Byte range = 00h – FFh
Channel	2Eh	1	00h	Byte range = 00h – 4Ch
Transmit Attempts	2Fh	1	10h	Transmit Attempts Byte range = 01h – FFh
Receive Mode	31h	1	03h	Determines what type of data frames are received by the Host, based on IEEE address of received frame. 01h – Unicast/Broadcast 02h – Unicast 03h – Promiscuous
Range Refresh	32h	1	20h	This byte specifies the number of 200ms ticks between range indications. Suggested range is 6.4s to 10s. Byte range = 20h – 32h.
Server/ Client Mode	33h	1	02h	Server = 01h Client = 02h
System ID	34h	8	00 00 00 00 00 00 00 01	Used to demarcate RF networks. Byte range = 00h – FFh
End Character	3Eh	1	FFh	This byte specifies the character that will be used to signify the end of a packet. Byte range = 00h – FFh
Baud High	40h	1	FFh	See **Table 7 – BH/BL Selections for Common Baud Rates**
Baud Low	41h	1	F1h	See **Table 7 – BH/BL Selections for Common Baud Rates**
Fixed Packet Length High	43h	1	00h	Byte range = 00h – 07h
Fixed Packet Length Low	44h	1	90h	Byte range = 00h – FFh
Random Back-Off	45h	1	03h	00h – wait 1 packet time after error 01h – wait 1-2 packet times after error 03h – wait 1-4 packet times after error 07h – wait 1-8 packet times after error 0Fh – wait 1-16 packet times after error 1Fh – wait 1-31 packet times after error

Parameter	EEPROM Address	Length (Bytes)	Default (Hex)	Description
Serial Interface Mode	4Ah	1	01h	01h – Transparent, Fixed Length, Timeout 02h – Transparent, End Character 03h – API 04h – Transparent, Fixed Length, No Timeout Additional settings are: Bit 3 – RTS Enable 0 = Radio does not listen to RTS 1 = Radio respects RTS handshaking Bit 4 – Reserved (Always 0) Bit 5 – Parity (9 bit) Mode 0 = Radio only transmits 8 bit data 1 = Radio transmits 9 bit data Bit 6 – Modem Mode 0 = Radio does not use modem handshaking 1 = Radio uses modem handshaking (must set bit 3 also) Bit 7 – Sleep Walk Mode (clients only) 0 = Radio will not sleep walk 1 = Radio will be in sleep walk mode
Transmit Mode	4Bh	1	00h	00h – Addressed Mode 01h – Broadcast Mode
RF Mode 1	4Ch	1	00h	Bit 0 – Reserved (Always 0) Bit 1 – Read Switches 0 = Disable Read Switches 1 = Enable Read Switches Bit 2 – End Type 0 = Disable End Type 1 = Enable End Type Bit 3 – Reserved (Always 0) Bit 4 – Limit RF Buffer 0 = Full RF Buffering 1 = Only use one RF Buffer Bit 5 – RF Priority 0 = Serial Interface Priority 1 = RF Receive Priority Bit 6 – Reserved (Always 0) Bit 7 – Mixed Mode 0 = Disable Mixed Mode 1 = Enable Mixed Mode
Interface Timeout	4Dh	1	00h	00h – 1.8ms 40h – 18ms 80h – 130ms C0h – 222ms
Broadcast Attempts	4Eh	1	04h	Byte range = 01h – FFh

Parameter	EEPROM Address	Length (Bytes)	Default (Hex)	Description
RF Mode	4Fh	1	01h	Bit 0 – Reserved (Always 1) Bit 1 – Turbo Mode 0 = No turbo mode 1 = Enable turbo mode Bit 2 – Reserved (Always 0) Bit 3 – Reserved (Always 0) Bit 4 – Baud Rate Double 0 = Use programmed baud rate 1 = Double programmed baud rate Bit 5 – 485 RTS 0 = RTS functions normal 1= RTS is an output used for RS485 systems Bit 6 – In Range Select 0 = In Range is at Pin 15 1 = In Range is at Pin 28 Bit 7 – Auto Destination 0 = Client uses programmed Destination IEEE MAC Address 1 = Client automatically finds a destination Server on the same Channel and System ID
Destination IEEE MAC Address	50h	6	FF FF FF FF FF FF	Used in Address Mode. Byte range = 00h – FFh
Sleep Time	7Ah	3	00 00 0A	Byte range = 00h – FFh, 200ms increments
Wait Time	7Dh	3	00 00 20	Byte range = 00h – FFh, 200ms increments

7.1.1 Software Version Number

EEPROM Address: 1Dh
Length: 8 Bytes
Default: Depends on version

Can be read by the OEM for AeroComm firmware version information. The OEM must not change this information.

7.1.2 IEEE MAC Address

EEPROM Address: 28h
Length: 6 Bytes

A unique 6 Byte, IEEE 802.3 Ethernet address assigned by AeroComm to each transceiver. The OEM must not change this information.

7.1.3 Channel

EEPROM Address: 2Eh
Length: 1 Byte
Default: 00h
Range: 00h – 4Ch

Provides 77 unique and non-interfering pseudorandom hopping sequences or Channels. This allows the OEM to configure up to 77 independent, co-located data networks. The combination of the Channel and System ID must be unique to each network of transceivers to establish communication. Here are some examples:

- Network A: Channel – 05h, System ID – 01 02 03 04 05 06 07 08
- Network B: Channel – 4Ah, System ID – 11 22 33 44 55 66 77 88

Multiple Servers in the same coverage area must be programmed with different Channels to prevent inoperability of the networks.

It is highly recommended that the OEM change the Channel and System ID from their default values.

7.1.4 Transmit Attempts

EEPROM Address: 2Fh
Length: 1 Byte
Default: 10h
Range: 01h – FFh

This parameter specifies the maximum number of times a packet will be transmitted over the RF interface. A transceiver operating in API Mode will reply with a ***Send Data Complete*** command (with a Failure Code = 1) when the maximum transmits has been attempted without success. Transceivers operating in any of the Transparent Modes will not send an acknowledgement to their Host.

7.1.5 Receive Mode

EEPROM Address: 31h
Length: 1 Byte
Default: 03h
Range: 01h – 03h

There are 3 different interface receive modes. When a transceiver receives a data packet over the RF, it must determine if the packet is addressed to it or another transceiver on the network. Receive mode specifies the criteria a transceiver uses for validating a data packet. When the transceiver is operating in any Transparent Mode, Receive Mode must be set to a value of 03h (Promiscuous).

7.1.5.1 Unicast/Broadcast (01h)

Unicast/Broadcast Mode is only valid for transceivers operating in API Mode. Transceivers will receive packets that have matching IEEE 802.3 destination addresses and broadcast packets. Broadcast packets will have a destination address equal to FF FF FF FF FF FF. It is important to note there are no RF acknowledgements for Broadcast packets. All other packets will be discarded.

7.1.5.2 Unicast (02h)

Unicast Mode is only valid for transceivers operating in API Mode. Transceivers will only receive packets that have matching IEEE 802.3 destination addresses. All other packets will be discarded.

7.1.5.3 Promiscuous (03h)

Promiscuous Mode is valid for transceivers operating in any Serial Interface Mode. Transceivers will receive **all** packets. The Host will need to determine what action to take when receiving a packet.

7.1.6 Range Refresh

EEPROM Address: 32h
Length: 1 Byte
Default: 20h
Range: 01h – FFh

Range Refresh is valid for transceivers operating in any Serial Interface Mode. The Range Refresh parameter allows the OEM to select the interval of time the Client uses when searching for a Server beacon. If a Client is out of range, it will search for a Server beacon the amount of time specified by this parameter before reporting an out of range condition. A Client reports an out of range condition by taking Pin 15 (IN_RANGE) logic high, and if in API Mode, issuing an ***Out of Range*** command. A Client reports an in range condition by taking Pin 15 (IN_RANGE) logic low, and if in API Mode, issuing and ***In Range*** command. This parameter is useful when operating in a fringe condition to minimize the ***In Range*** and ***Out of Range*** commands that may flood the Host. AeroComm has established a default value of 5 seconds through extensive testing.

7.1.7 Server/Client Mode

EEPROM Address: 33h
Size: 1 Byte
Default: 02h
Range: 01h – 02h

Specifies whether a transceiver is operating in the Client Mode (02h) or Server Mode (01h).

7.1.8 System ID

EEPROM Address: 34h
Length: 8 Bytes
Default: 00 00 00 00 00 00 00 01
Range: 00 00 00 00 00 00 00 00 to FF FF FF FF FF FF FF FF

The System ID is used in conjunction with the Channel and serves as a password to maintain secure transfers of data. The combination of the Channel and System ID must be unique to each network of transceivers to establish communication. Here are some examples:

- Network A: Channel – 05h, System ID – 01 02 03 04 05 06 07 08
- Network B: Channel – 4Ah, System ID – 11 22 33 44 55 66 77 88

Multiple Servers in the same coverage area must be programmed with different Channels to prevent inoperability of the networks. The System ID will not prevent inoperability that occurs from locating multiple Servers with the same Channel in the same coverage area.

7.1.9 End Character

EEPROM Address: 3Eh
Size: 1 Byte
Default: FFh
Range: 00h – FFh

This parameter is only valid for transceivers operating in Transparent Mode 02. The value specified by the OEM will indicate the last character in a data packet. When this End Character is received by a transceiver, the packet, including the End Character, will be transmitted. The packet length, including the End Character, cannot exceed 2 KBytes.

7.1.10 Baud High (BH) and Baud Low (BL)

EEPROM Address: 40h and 41h respectively
Length: 1 Byte each
Default: FFh for BH and F1h for BL
Range: F4h, 84h – FFh, FFh (BH, BL)

There are two types of baud rates associated with a transceiver: RF Baud Rate and Serial Interface Baud Rate. The RF Baud Rate is not configurable and is fixed at 882 Kbps. The Serial Interface Baud Rate is configurable and can be programmed up to 882 Kbps. However, the maximum effective data transmission rate is approximately 250 Kbps – 300 Kbps due to protocol overhead.

Baud High (BH) and Baud Low (BL) are used to configure the serial interface data rate between a transceiver and its Host. Standard PC baud rate values are provided below:

Table 7 - BH/BL Selections For Common Baud Rates (Using a 28.224 MHz Crystal)

Baud Rate	BH	BL	Interface Timeout
300	F4h	84h	4Ch
1,200	FDh	21h	14h
2,400	FEh	91h	Bh
4,800	FFh	48h	6
9,600	FFh	A4h	3
14,400	FFh	C3h	3
19,200	FFh	D2h	3
28,800	FFh	E1h	2
38,400	FFh	E9h	2
57,600 (default)	FFh	F1h	2
115,200	With BH/BL set to 57,600, set Baud Rate Double bit in the RF Mode Byte at EEPROM address 4Fh.		2

Custom baud rates can be calculated using the following formula:

$$\text{Baud Rate} = \frac{28.224 * 10^6}{32.0 * (65{,}536 - \text{BH, BL})}$$

The calculated value must be within 3% of the actual value.

See **Section 6.1.18.2, Baud Rate Double** for information on how to double the baud rate.

7.1.11 Fixed Packet Length High & Low

EEPROM Address: 43h and 44h respectively
Length: 1 Byte each
Default: 00h for 43h and 90h for 44h
Range: 00h – 07h for 43h, 01h – FFh for 44h

This parameter is only valid for transceivers operating in Transparent Modes 01 or 04. This parameter is ignored when a transceiver is operating in all other modes. The Fixed Packet Length cannot exceed 2 KBytes.

7.1.12 Random Back-Off

EEPROM Address: 45h
Length: 1 Byte
Default: 03h

The Carrier Sense Multiple Access (CSMA) protocol does not keep time slots for each registered Clients like some protocols. Instead, CSMA allows all clients to contend for an open time slot on a packet-by-packet basis. Typically, all Clients don't send data at the same time; however, when they do, collisions can occur. To avoid further collisions, a Client will wait a random number of packet times before resending its data. The amount of randomness is controlled by this parameter. Here are the valid values:

- 00h – Wait 1 packet time, then retry
- 01h – Wait 1 – 2 packet times, then retry
- 03h – Wait 1 – 4 packet times, then retry
- 07h – Wait 1 – 8 packet times, then retry
- 0Fh – Wait 1 – 16 packet times, then retry
- 1Fh – Wait 1 – 31 packet times, then retry

This parameter is only used by a transceiver operating with Turbo Mode disabled. See **Section 6.1.18.1, Turbo Mode** for details.

7.1.13 Serial Interface Mode

EEPROM Address: 4Ah
Length: 1 Byte
Default: 01h

There are four Serial Interface Modes for the OEM transceiver including one API Mode and three Transparent Modes. All Transparent Modes are differentiated by the definition of when data will be transmitted by a transceiver. See **Section 4, Serial Interface Modes**, for detailed information on each mode.

7.1.13.1 RTS Enable

EEPROM Address: 4Ah, bit 3
Length: 1 Bit
Default: 0
Range: 0 or 1

Setting this bit to a value of 1 will enable the RTS line for standard RTS handshaking. Setting this bit to a value of 0 will disable RTS handshaking. See **Section 4.7.2, RTS Handshaking** for more information.

7.1.13.2 Parity Mode

EEPROM Address: 4Ah, bit 5
Length: 1 Bit
Default: 0
Range: 0 or 1

Setting this bit to a value of 1 will enable Parity (9 bit transmit) mode. In this mode, 9 bit bytes can be sent over the RF. Enabling this mode will cut net throughput in half. **All transceivers on the same network must have the same setting for Parity Mode.**

7.1.13.3 Modem Mode

EEPROM Address: 4Ah, bit 6
Length: 1 Bit
Default: 0
Range: 0 or 1

Setting this bit to a value of 1 will enable all of the modem lines (DCD, DSR, DTR, RI, and CTS), except RTS. Therefore, bit 3 must also be set to a value of 1 to enable RTS. Otherwise, bit 3 can be set without setting bit 6 for normal transceiver RTS operation. Refer to **Section 4.7.3, Modem Handshaking**, for more information.

7.1.13.4 Power Down Modes

The Power Down Modes include a Sleep Walk and Deep Sleep mode. Sleep Walk is for Clients only and Deep Sleep is for Servers only.

7.1.13.4.1 Sleep Walk Mode (Clients Only)

EEPROM Address: 4Ah, bit 7
Length: 1 Bit
Default: 0
Range: 0 or 1

If bit 7 of the Serial Interface Mode byte is set to a value of 1, the Client enters into Sleep Walk Mode. This applies to all Serial Interface Modes (01-04).

There are two parameters that control the operation of the Sleep Walk Mode – Sleep Time and Wait Time. Both parameters can be programmed in 200ms increments. See **Section 6.1.20, Sleep Time** and **Section 6.1.21, Wait Time** for details on these parameters.

When a Client enters Sleep Walk, the RF section is turned off while maintaining synchronization with a Server. Due to crystal tolerances, a Client can maintain synchronization with a Server for a maximum of two seconds. Upon waking up, a Client must synchronize with a Server before sending any data. There are two wake up events that can occur for a Client:

1) A Client will remain "asleep" for the duration of Sleep Time unless it receives a byte over the serial interface. If this occurs, a Client will wake and send the data once it synchronizes with a Server. If a Client does not receive a Server beacon, it will remain awake until a beacon is received. Once synchronized, a Client will remain awake for the duration of Wait Time for any additional communications with a Server. If a Client receives data within the duration of Wait Time, another Wait Time begins. This process will continue until the Wait Time expires.

2) If the Sleep Time expires, a Client will wake and listen for a Server beacon for up to 50ms. If it does not receive a Server beacon within 50ms, it will go back to sleep. If it does receive a Server beacon, it will wait up to 2ms for any pending data from the Server. If a Client receives data within the 2ms, it will remain awake for the duration of Wait Time. If a Client receives data within the duration of this period, another Wait Time begins. This process will continue until the Wait Time expires.

There are two methods of enabling the Sleep Walk Mode for Clients. If a Client is operating in a Transparent Mode, bit 7 of EEPROM address 4Ah must be set to a value of 1. If a Client is operating in API Mode, the Client Host must issue the following commands, only after a ***RF Enable*** command is issued.

- 88 01 00 00 89 – This will command the Client into Sleep Walk Mode.
- 88 01 00 04 8D – This will cancel the power down functions.

7.1.13.4.2 DEEP SLEEP MODE (SERVERS ONLY)

Deep Sleep Mode is only valid for Servers operating in API Mode. In Deep Sleep Mode, a Server completely shuts down and remains in a powered down mode until a byte is received over the serial interface. This is the only wake-up event that is valid in Deep Sleep Mode. A Server will not wake up if a Client tries to transmit data to it; therefore, this mode is intended for use on Servers that initiate all communications and do not need to monitor the RF interface for incoming packets.

To enter Deep Sleep Mode, a Server Host must issue the following commands, only after a ***RF Enable*** command is issued.

- 88 01 00 01 88 – This will command the Server into Deep Sleep Mode.
- 88 01 00 04 8D – This will cancel the power down functions.

7.1.14 Transmit Mode

EEPROM Address: 4Bh
Length: 1 Byte
Default: 00h
Range: 00h or 01h

This parameter is only valid for transceivers operating in any Transparent Mode. Programming this byte to a value of 00h enables Address Mode and a value of 01h enables Broadcast Mode. Refer to **Section 4.6, Addressed & Broadcast Communications**, for detailed information on each of these modes.

7.1.15 RF Mode 1

EEPROM Address: 4Ch
Length: 1 Byte
Default: 00h
Range: 00h – 7Ch

The RF Mode 1 byte contains several settings that provide additional flexibility to an OEM's application. These settings are described in detail in the following sections.

7.1.16 Read Switches

EEPROM Address: 4Ch, bit 1
Length: 1 Bit
Default: 0
Range: 0 or 1

The Read Switches bit is useful for systems that need to change Channels or Server/Client Mode during operation. When bit 1 is set to a value of 1, the Host can change the state of Pin 13 to enable or disable the new pin definitions listed below in the table. When Pin 13 is logic low, Read Switches is enabled and the new pin definitions take precedence over the existing pin definitions. When Pin 13 is logic high, Read Switches is disabled and normal pin functionality is restored.

Pin	13	15	17	19	22	36	34	32
Function	Read Switches	Server/ Client	Channel Bit 5	Channel Bit 4	Channel Bit 3	Channel Bit 2	Channel Bit 1	Channel Bit 0

Channel Bits 0 (least significant bit) through 5 (most significant bit) are used to force a transceiver to a particular Channel between 0 and 63. When Server/Client (Pin 15) is logic low, a transceiver is forced to become a Server. When it is disconnected or forced logic high, a transceiver is forced to become a Client.

7.1.16.1 End Type

EEPROM Address: 4Ch, bit 2
Length: 1 Bit
Default: 0
Range: 0 or 1

This parameter is only valid for transceivers operating in any Transparent Mode. Setting this bit to a value of 1 enables the End Type function. When enabled, a transceiver monitors for a Server/Client Mode change. If a transceiver changes from a Client to a Server, it automatically broadcasts all data packets regardless of the Transmit Mode byte configuration. If a transceiver changes from a Server to a Client, it automatically addresses all data packets regardless of the Transmit Mode Byte configuration. End Type works well with the Auto Destination Mode described in **Section 6.1.18.5, Auto Destination**. If Auto Destination is not enabled, the Destination IEEE MAC Address programmed at EEPROM address 50h will be used.

7.1.16.2 Limit RF Buffer

EEPROM Address: 4Ch, bit 4
Length: 1 Bit
Default: 0
Range: 0 or 1

Setting this bit to a value of 1 reduces the number of RF receive buffers to one. Otherwise, there are eight RF receive buffers on the AC5124, each large enough to store the maximum packet size of 2 KBytes. This allows the AC5124 to act as a RAM buffer in many applications and actually improve system throughput as opposed to wired communications. However, in applications running their own protocol, such as TCP-IP, where retries already exist, these buffers can be harmful to the performance of the system. If a transceiver transmitting data is configured at a higher baud rate than the transceiver receiving the data, it is possible the receive buffers will fill up very quickly causing communications to stop until a buffer is freed.

Depending on how long it takes to free a buffer, TCP-IP could experience a timeout, causing the transceiver to resend an entire TCP-IP packet. If the transceiver has already sent part of the TCP-IP packet, the Host receiving the packets could receive them out of order, causing long delays. In situations like this, it is useful to set the Limit RF Buffer bit to a value of 1, thus eliminating seven of the eight RF buffers. This will allow the Host protocol to control data transfers and hence improve overall throughput.

7.1.16.3 RF Priority

EEPROM Address: 4Ch, bit 5
Length: 1 Bit
Default: 0
Range: 0 or 1

Setting this bit to a value of 1 will change a transceiver's interrupt priority to service the RF interface before the serial interface, given that a contention occurs. For example, if data arrives at both interfaces at the same time, a data packet will be received over the RF interface before data is received over the serial interface. Thus, CTS will remain logic high even if a transceiver is ready for data. The same condition will occur if a transceiver is in process of receiving data over the RF interface. Once the RF interface has completed receiving data, CTS will transition logic low, allowing data to be sent to a transceiver.

A value of 0 will allow a transceiver to operate normally, giving the serial interface priority over the RF interface.

7.1.16.4 Mixed Mode

EEPROM Address: 4Ch, bit 7
Length: 1 Bit
Default: 0
Range: 0 or 1

This parameter is only valid for <u>Client</u> transceivers operating in any Transparent Mode. Setting this bit to a value of 1 enables the Mixed Mode function and allows a Client to communicate with a Server operating in API Mode.

7.1.17 Interface Timeout

EEPROM Address: 4Dh
Length: 1 Byte
Default: 00h
Range: 00h - FFh

This parameter applies only to Transparent Mode 01. This parameter specifies the amount of time between bytes that a transceiver will wait before transmitting the data packet. If a value other than 00h, 40h, 80h or C0h is desired, the following formula can be used to calculate a new timeout value:

Timeout (ms) = Decimal value of 4Dh x 0.9 (+0 to –0.9ms accuracy)

0H = 6.5ms
40H = 21ms
80H = 137ms
C0H = 235ms

Example:

EEPROM address 4Dh = 20h: Decimal equivalent of 20h = 32d; therefore, 32 x 0.9 = 28.8ms

Due to accuracy, the Interface Timeout in this example will range between 27.9ms and 28.8ms. <u>Therefore, it is important to note that Interface Timeout should be set to be equal to or greater than two byte times at the programmed interface baud rate.</u>

7.1.18 Broadcast Attempts

EEPROM Address: 4Eh
Length: 1 Byte
Default: 04h
Range: 01h – FFh

The parameter is valid for transceivers operating in all Serial Interface Modes with Broadcast Mode enabled. Broadcast Attempts specifies the number of times the RF interface will broadcast each packet. The receiving transceiver will discard duplicate packets.

7.1.19 RF Mode

EEPROM Address: 4Fh
Length: 1 Byte
Default: 01h
Range: 01h – FBh

Like the RF Mode 1 byte, the RF Mode byte contains several settings that provide additional flexibility to an OEM's application. These settings are described in detail in the following sections.

7.1.19.1 Turbo Mode

EEPROM Address: 4Fh, bit 1
Length: 1 Bit
Default: 0
Range: 0 or 1

If bit 1 is set to a value of 0, a transceiver will operate in CSMA mode, allowing random back-off for collision avoidance. In CSMA Mode, a transceiver will wait one packet time between successful packets. If a collision occurs, a transceiver will wait a random number of packet times before resending its data. The amount of randomness is controlled by the Random Back-Off parameter located at EEPROM address 45h. See **Section 6.1.12, Random Back-Off** for details on this parameter.

When bit 1 is set to a value of 1, a transceiver will operate in Turbo Mode. Turbo Mode was designed strictly for high-speed point-to-point communications, as it has no back off between errors. In other words, it eliminates the wait time between successful packets and will transmit packets immediately, one after the other. If the packet is not successfully received, a transceiver will just resend the packet until a successful receipt is acknowledged.

7.1.19.2 Baud Rate Double

EEPROM Address: 4Fh, bit 4
Length: 1 bit
Default: 0
Range: 0 or 1

Setting this bit to a value of 1 will double the baud rate programmed in the Baud High and Baud Low bytes at EEPROM addresses 40h and 41h, respectively. See **Section 6.1.10, Baud High (BH) and Baud Low (BL)** for a table of calculated values for common baud rates and for a formula to calculate custom baud rates. The OEM must ensure that the doubled baud rate does not exceed 882 Kbps.

7.1.19.3 485 RTS

EEPROM Address: 4Fh, bit 5
Length: 1 Bit
Default: 0
Range: 0 or 1

Setting this bit to a value of 1 will enable Pin 27 to function as a Driver and Receive Enable for RS485 systems. Setting this bit to a value of 0 will allow the RTS to function as programmed in bit 3 of the Serial Interface Mode byte located at EEPROM address 4Ah.

7.1.19.4 In Range Select

EEPROM Address: 4Fh, bit 6
Length: 1 Bit
Default: 0
Range: 0 or 1

Normally, Pin 15 is IN_RANGE; however, setting this bit to a value of 1 will move IN_RANGE to Pin 28. This is useful for applications using Read Switches, which uses Pin 15 for changing the Server/Client Mode.

7.1.19.5 Auto Destination

EEPROM Address: 4Fh, bit 7
Length: 1 Bit
Default: 0
Range: 0 or 1

The AC5124 supports an addressed mode of communication called Auto Destination. This mode is only for Clients operating in one of the Transparent Modes. To configure a Client for Auto Destination, set this bit to a value of 1. With Auto Destination enabled, a Client has the ability to detect any Server with the same Channel and System ID. Therefore, a Client can dynamically route all communications to the Server that is in range. This mode is useful for mobile or roaming applications where a Client will be interfacing with different Servers from time to time. It is important to note that multiple Servers with the same Channel and System ID must not be located in range of one another. Doing so will cause inoperability of the system.

7.1.20 Destination IEEE MAC Address

EEPROM Address: 50h
Length: 6 Bytes
Default: FF FF FF FF FF FF
Range: 00h – FFh for each byte

The Destination IEEE MAC Address is used by transceivers operating in any Transparent Mode with Addressed Mode (EEPROM address 4Bh = 00h) enabled. When this address is programmed to an actual transceiver address, RF-layer acknowledgements will be used to guarantee packet delivery. If the address is left programmed to the default value, all packets sent will be considered broadcast packets without RF-layer acknowledgements. If Auto Destination is enabled, RF layer acknowledgements will be used. See **Section 4.6, Addressed & Broadcast Communication** for more details on using this parameter.

7.1.21 Sleep Time

EEPROM Address: 7Ah
Length: 3 Bytes
Default: 00 00 0A
Range: 00h – FFh, 200ms increments

Sleep Time is used by Client transceivers programmed to operate in Sleep Walk Mode, described in **Section 6.1.13.3.1, Sleep Walk Mode**. Each increment in the value of this byte will cause a Client to remain asleep 200ms longer.

7.1.22 Wait Time

EEPROM Address: 7Dh
Length: 3 Bytes
Default: 00 00 20
Range: 00h – FFh, 200ms increments

Wait Time is used by Client transceivers programmed to operate in Sleep Walk Mode, described in **Section 6.1.13.3.1, Sleep Walk Mode**. Each increment in the value of this byte will cause a Client to remain awake 200ms longer.

8. Initializing the AC5124 Transceiver

Upon reset or power-up, a transceiver requires a minimum of 400ms for hardware initialization to complete. During this time, CTS is driven logic high prohibiting the reception of any data or commands. Once complete, CTS is driven logic low, allowing a transceiver to send or receive data and commands, depending on the mode of operation.

8.1 Transparent Mode Initialization

When operating in any Transparent Mode, the initialization sequence is managed by the AeroComm protocol. API commands are not issued and there are no acknowledgements from a transceiver on data delivery, unless the OEM protocol has built-in acknowledgements. The IN_RANGE pin (Pin 15) provides in range information for the Transparent Modes.

8.2 API Mode Initialization

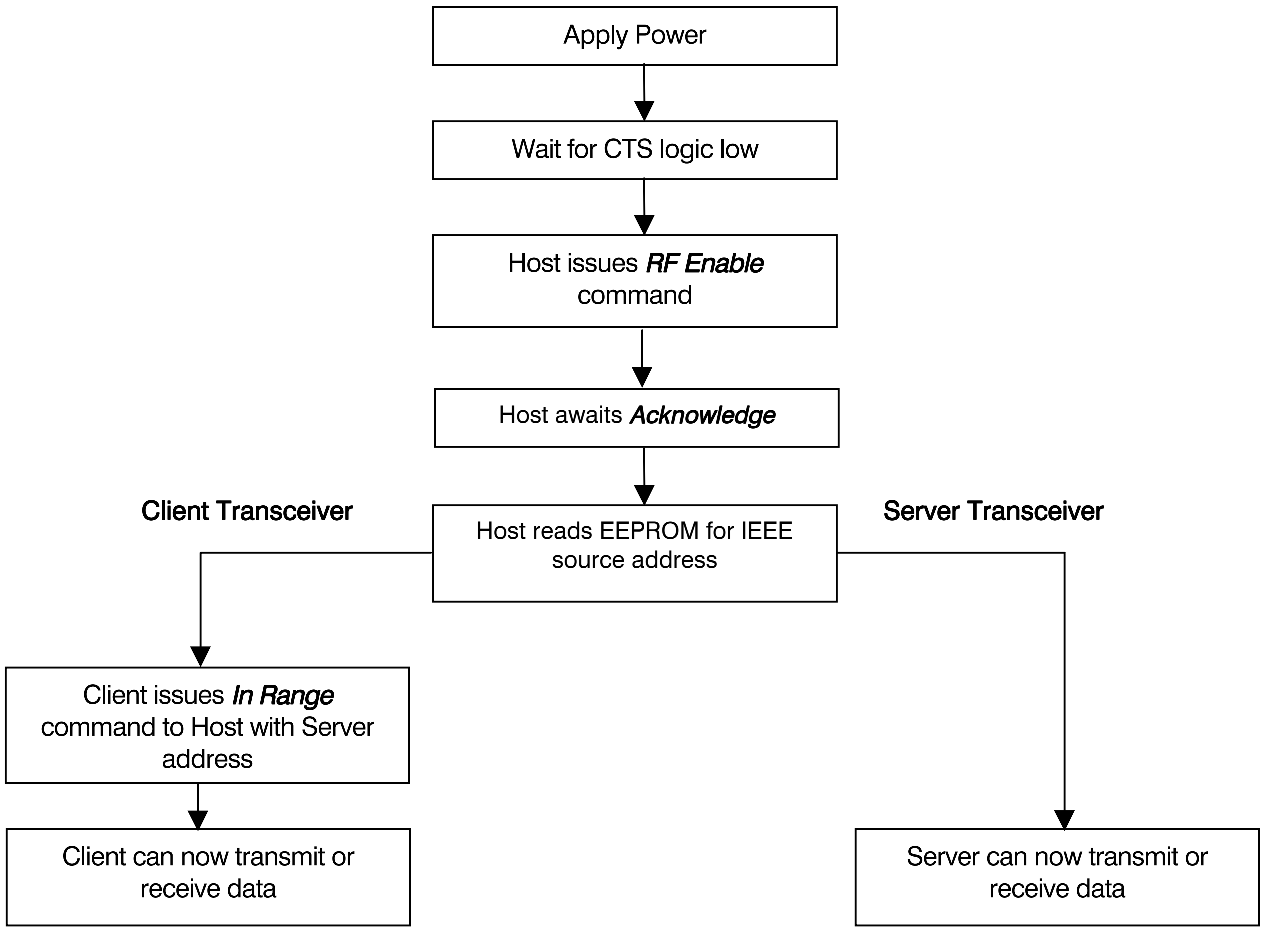
After the hardware initialization has completed, a transceiver operating in API Mode is ready to send and receive API commands as outlined in **Section 5, API Command Set**. At this point, the only command that <u>cannot</u> be issued is the ***Send Data*** command. This command can only be issued after the ***RF Enable*** and ***In Range*** commands have been issued.

Before data communications can begin, a Client needs to be authenticated. The Client Host must issue an ***RF Enable*** command to activate the Client and receive an ***Acknowledge*** command from the Client. The Server transmits a beacon containing its IEEE 802.3 address. Once the Client receives the Server beacon, it will issue an ***In Range*** command to the Client Host containing the IEEE 802.3 Server address. The Client Host must receive the ***In Range*** command from the Client before the ***Send Data*** command is invoked.

<u>The AC5124 transceivers are designed to be single threaded, meaning that for every command issued, there is a reply command that indicates the completion of the command issued. There can be no command interleaving.</u>

The figure below provides an example of the initialization sequence for both Clients and Servers following the configuration of EEPROM parameters. This occurs only in API Mode.

Figure 2 - API Mode Initialization



9. Mechanical Overview

The AC5124 measures 1.65"W x 2.65"L. Critical parameters are as follows:

- **J1** – 40 pin OEM interface connector (AMP P/N 177986-1) mates with AMP P/N 177985-1
- **MMCX Jack** – Antenna connector (Telegartner P/N J01341C0081) mates with any manufacturer's MMCX plug

Figure 3 – AC5124 with MMCX

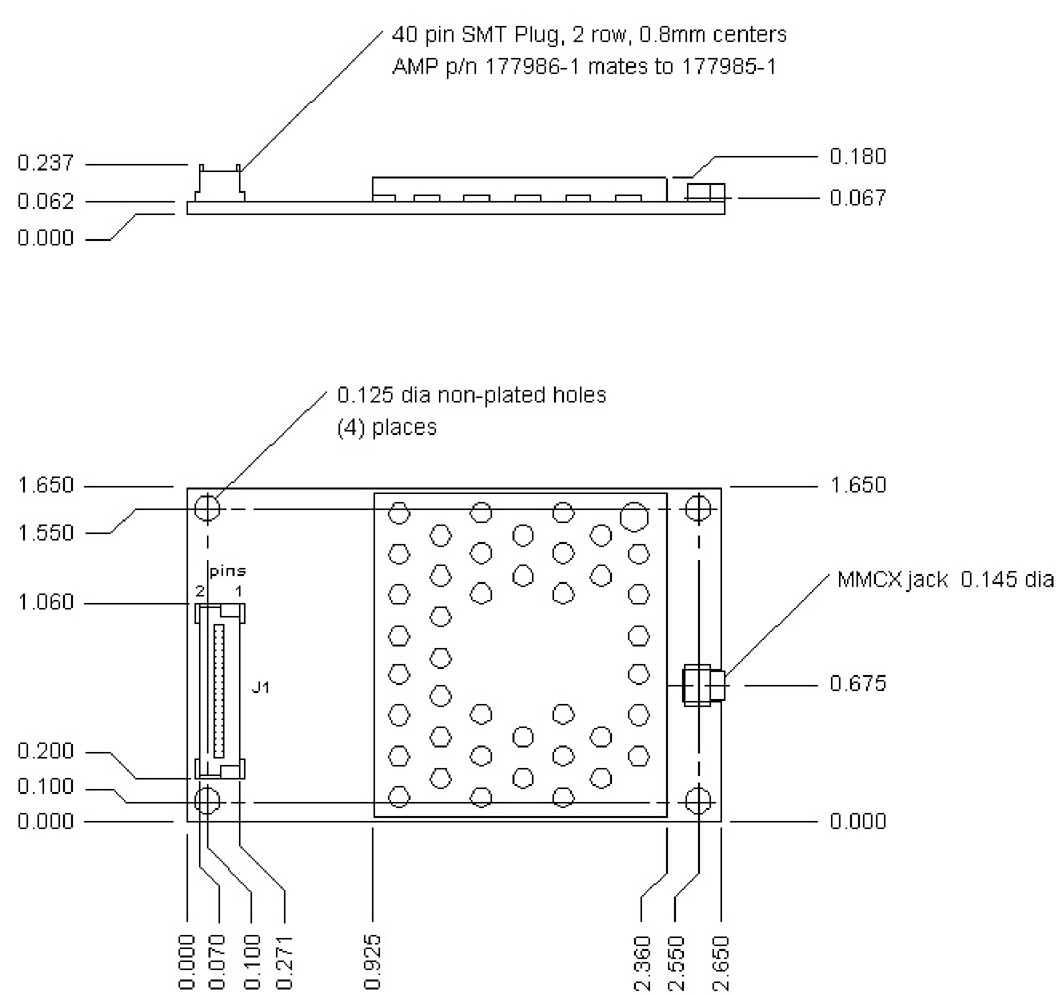
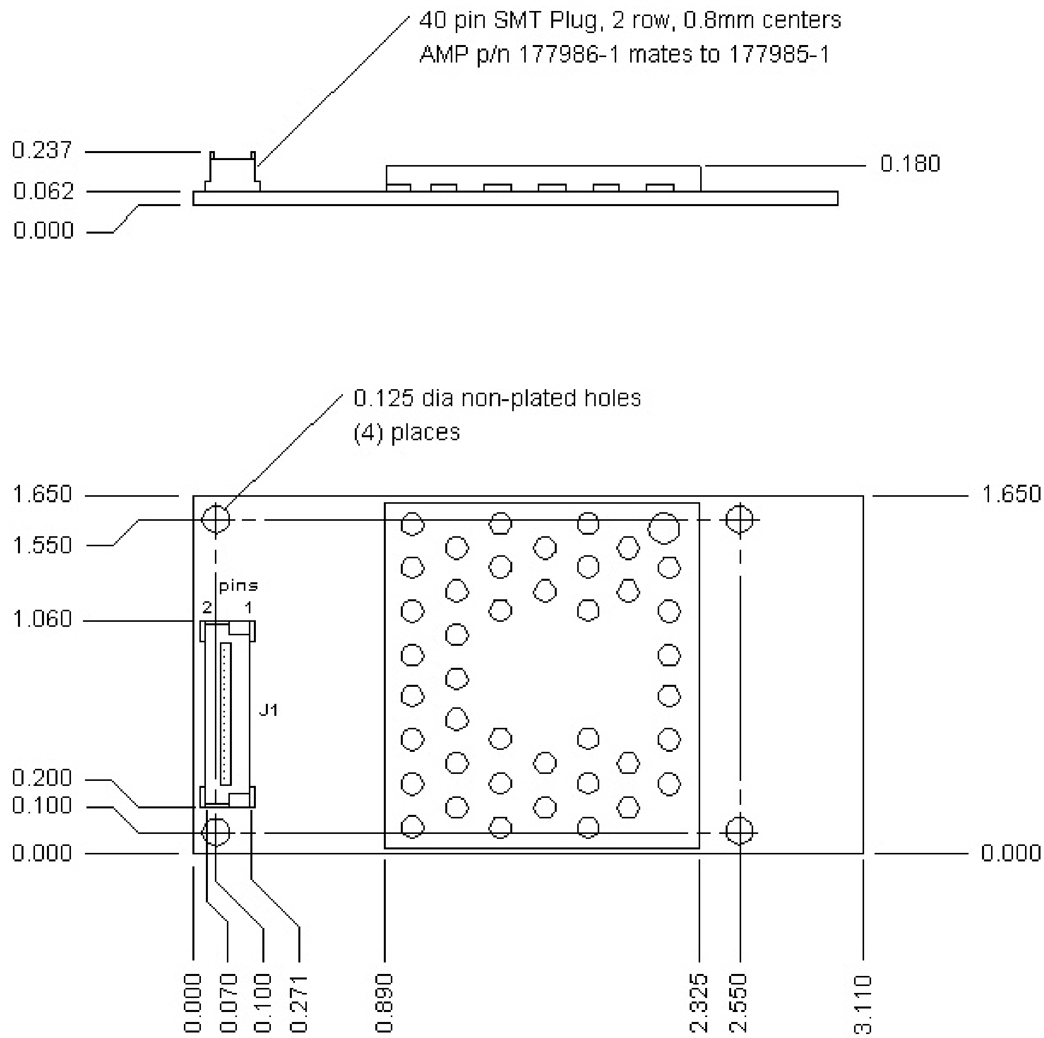


Figure 4 – AC5124 with Integral Antenna



10. Ordering Information

10.1 PRODUCT PART NUMBERS

AC5124-10: AC5124 with 10mW output power, interface data rates to 882 Kbps, MMCX antenna connector

AC5124-10A: AC5124 with 10mW output power, interface data rates to 882 Kbps, integral AeroComm NZH microstrip dipole antenna

AC5124-200: AC5124 with 200mW output power, interface data rates to 882 Kbps, MMCX antenna connector

AC5124-200A: AC5124 with 200mW output power, interface data rates to 882 Kbps, integral AeroComm NZH microstrip dipole antenna

10.2 DEVELOPER KIT PART NUMBERS

SDK-5124C-10: Includes (2) AC5124-10 transceivers, (2) RS232 Serial Adapter Boards, (2) Power supplies, (2) Serial cables, (2) S191FL-5-RMM-2450S dipole antennas with 5" pigtail and MMCX connector, configuration/testing software, Integration engineering support

SDK-5124C-200: Includes (2) AC5124-200 transceivers, (2) RS232 Serial Adapter Boards, (2) Power supplies, (2) Serial cables, (2) S191FL-5-RMM-2450S dipole antennas with 5" pigtail and MMCX connector, configuration/testing software, Integration engineering support