WASP Packet Protocol Specification

REVISION HISTORY

Version	Date	Author	Description
0.1	10/19/11	Tim Paige	Initial release of protocol specifications
1.0	1/19/12	Rick Gibbs	Updates and modifications to protocol
1.5	1/30/12	Rick Gibbs	LED command updated and usage diagrams included
1.6	2/9/12	Steve Hidem	Modify document for consistency.

Approval Signatures

Author (Signature/Title/Date)
Other (Signature/Title/Date)
Other (Signature/Title/Date)

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1 SCOPE

This document defines the software implementation characteristics for the WASP packet protocol. This protocol provides defined packet commands to communicate between the WASP device and a WASP API running in an application device.

2 REFERENCED DOCUMENTS

SRS	Software Requirements Specification
SAS	Software Architecture Specification
HWS	Hardware Specification
API	Wasp API Specification
ANT Message	ANT Message Protocol
ANT+	Extensions to the ANT Message Protocol

3 DEFINITIONS

WASP WiFi-Basic code is defined as the code running on the WASP that implements this WASP packet protocol.

WASP API is defined as the programming interface the WASP Packet Protocol communicates with and would be running in the application device.

WASP Protocol Commands are defined as the protocol packets with the specific command code in byte 2 of the packet. There are parts of the packet that are defined common across all the protocol commands. Also, there is specific packet sections defined for each protocol command.

WASP API Packet Commands are defined as the packet commands being received by the WASP WiFi-Basic code from the application device.

WASP Asynchronous Packet Commands are defined as the packet commands being created by the WASP WiFi-Basic code asynchronously and sent to the application device.

WASP Response Packet Commands are defined as the packet commands returned directly by the WASP WiFi-Basic code after receiving one of the WASP API packet commands.

Packet Type identifier is defined as bytes 0 and 1 of each WASP Packet and are defined as ASCII characters “A” followed by “N”.

Packet Command ID is defined as an incrementing count created by the initiator of the packet, and returned in byte three of the response packet commands.

MAC address is defined as the MAC of either the application device or the WASP device depending on who is the sending device.

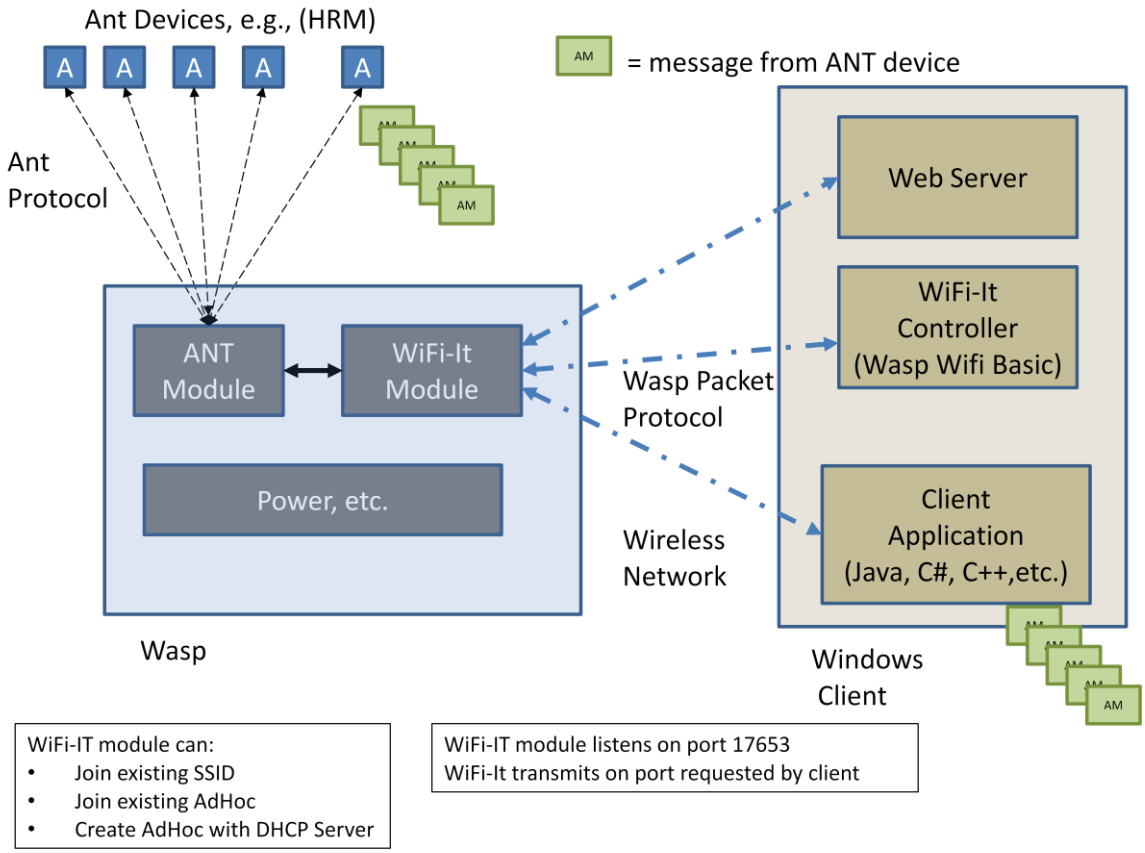
WIFI-IT firmware is defined as the low level code the WASP WiFi-Basic code run on top of.

ANT Message Protocol is defined in ANT_Message_Protocol_and_Usage_Rev_4.1.pdf document provided by Thisisant.com.

Connection ID (CID) as used in WiFi-Basic, is synonymous with socket.

4 OVERVIEW

The WASP is a 802.11 network device capable of sending and receiving ANT radio messages operation as either a standalone device or controlled by a controlling application. The ANT radio used in the WASP is capable of tracking up to eight individual devices or setup to scan continuously for any ANT transmission in the area. All ANT data received by the WASP is forwarded to up to 5 discrete routable Ethernet endpoints. When the WASP is configured in the continuous scan mode it configures the ANT radio to operate in the always on mode and will capture and repeat all data received. A device that requests the control connection can take it out of that mode and setup any valid configuration the ANT radio is capable of supporting. The block diagram below helps to show the data flow for the ANT data in the system.



5 HARDWARE SETTINGS

There are a number of hardware settings that this packet protocol depends on.

5.1 Primary SSID

Primary SSID is defined as a string that is set at programming time and used as the SSID to connect to when linking using the primary WIFI link. WIFI-IT firmware provides a method to set this from the WASP WiFi-Basic code. There is a protocol command that allows the WASP API to set this variable. The default Primary SSID is “WASP”.

5.2 AD-HOC Configuration

AD-HOC configuration is a set of firmware interface commands that help setup the AD-HOC SSID, Channel, Gateway IP Address, and other settings. The default AD-HOC SSID is “WASP”, the default AD-HOC Channel is "1", and the default AD-HOC Gateway IP is "0.0.0.0".

5.3 Firmware version

The current firmware is 2.6.2.

5.4 UART1 Configuration

The firmware provides methods to write and read from the UART1. This is connected to the ANT AP2 module located on the hardware.

6 COMMON PROTOCOL DEFINES

The WASP packet protocol contains a number of data sections common across all of the packet commands.

6.1 WIFI PACKET

The WASP command packets protocol used to communicate with the WASP are made up of N+1 bytes of data. Each command will vary in length depending on what message it contains. Common to all of the packets is a four byte header that defines the message type. The WASP packet has the following basic structure.

- Byte 0,1: Packet Type Identifier (two byte header ‘A’,’N’)
- Byte 2: Packet Command Byte (refer to Table XXX)
- Byte 3: Message ID (Incrementing ID Byte)
- Byte 4: Payload message length
- Byte 5: Payload Command byte
- Byte 6-N: Payload

The packet is defined as a byte array stating at 0 and going to maximum length N. The WIFI packet length is defined as N. This length N is different than the ANT Message data byte length N defined later in document.

6.2 CTRL PACKET

The WASP control packet protocol used to communicate with the WASP is made up of N+1 bytes of data. Each command varies in length depending on what message it contains. Common to all of the packets is a six byte header that defines the message length, type, and sequence number. All packets end in a one byte checksum. The WASP packet has the following basic structure.

- Byte 0,1: Packet Type Identifier (two byte header 'W','A')
- Byte 2,3: Packet Length
- Byte 4: Packet Command Byte (refer to Table XXX)
- Byte 5: Message ID (Incrementing ID Byte)
- Byte 6-N: Payload
- Byte N+7 Checksum

6.2.1 Packet Type Identifier

The WASP packet will always start with the two ASCII characters "WA" and will be called the packet type identifier. The WASP WiFi-Basic code will check for these two characters and ignore packets which do not start with these two characters.

6.2.2 WASP Command Byte

This byte contains the command bytes that define which type of command and data will be included in this packet. Byte 2 of the packet contains this command byte.

The API Packet Commands are the commands sent from the API to the WASP WiFi-Basic code. These API commands are listed below.

- SET_CONFIG 0xB4
- SET_CONFIG_RESP 0xB5
- WIFI_ANT_MSG 0x10
- WIFI_ANT_MSG_RESP 0x11
- CONNECT_CMD 0x40
- CONNECT_CMD_RESP 0x41
- QUERY_REQ 0x42
- QUERY_RESP 0x43
- STREAM_REQ 0x44
- STREAM_RESP 0x45
- CHANNEL_STATUS_REQ 0x46
- CHANNEL_STATUS_RESP 0x47
- LED_CTRL_CMD 0x48
- LED_CTRL_CMD_RESP 0x49
- SET_SLEEP_ON 0xC4
- SET_SLEEP_ON_RESP 0xC5
- DISCONNECT_CMD 0x4C
- DISCONNECT_CMD_RESP 0x4D
- HALT_STREAM_CMD 0x4E

- HALT_STREAM_CMD_RESP 0x4F

The WASP Asynchronous Packet Commands are the commands created as needed by the WASP WiFi-Basic code and sent to the client device. These API commands are listed below.

- WIFI_ANT_MSG_ASYNC 0x12
- HEART_BEAT_MSG 0x4A
- HEART_BEAT_RESP 0x4B

6.2.3 WASP Message ID

The WASP Message ID (Byte 3) is an incrementing count for each Wifi packet sent to or from the WASP device. This byte is returned in the WASP Response Packet Commands to help match the response packet to the corresponding command sent from the client device. Packet byte 3 contains this message ID.

6.2.4 Command Payload Length

Byte 4 contains the command payload byte length. It contains the count of the remaining bytes of the command minus the special command byte (Bytes 6 through the end of the message. It also does not include itself in that count.

6.2.5 Special Command Byte

On some of the commands the next byte after the payload length byte would contain a special command byte. The special command byte location in the WASP protocol contains the ANT Message Protocol command byte when sending ANT messages. See the later summary of the ANT Message Protocol or the detailed specification listed in the reference documents for detail on the ANT Message Protocol. In most WASP protocol commands this byte is left as a 0x00.

6.2.6 Command Payload

The command payload contains command specific data. See the WASP protocol command details for the specific data.

6.2.7 WASP Command Protocol Diagram and Example

Packet Section	Packet Type Identifier	Packet Command	Message ID	Payload Length	Special Command Byte	Payload
Number of bytes	2 bytes	1 byte	1 byte	1 byte	1 byte	N – Command Base (N-5)
Protocol example	"AN"	WIFI_ANT_MSG	[Count]	Length=1	ANT Open Channel	Channel Number
Hex data (example)	0x414E	0x10	0x00	0x01	0x4B	0x00
Protocol example(2)	"AN"	WIFI_ANT_MSG	[Count]	Length=1	ANT Open Channel	Channel Number

Table 1 WASP Command Protocol Diagram

6.3 ANT Message Protocol

The ANT Message Protocol is defined fully in the reference document ANT_Message_Protocol_and_Usage_Rev_4.1. A typical ANT message between the WIFI module and the ANT module has the following basic format.

A typical serial message between the host and ANT engine has the following basic format.

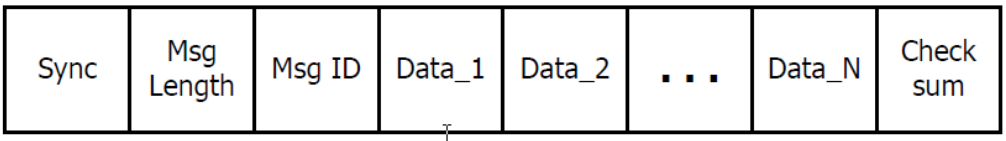


Figure 7-1. ANT serial message structure

Byte #	Name	Length	Description
0	SYNC	1 Byte	Fixed value of 10100100 or 10100101 (MSB:LSB)
1	MSG LENGTH	1 Byte	Number of data bytes in the message. 1 <= N < Max_Data_Size
2	MSG ID	1 Byte	Data Type Identifier 0: Invalid 1..255: Valid Data Type (See section 9 for details)
3..N+2	DATA_1..DATA_N	N Bytes	Data bytes
N+3	CHECKSUM	1 Byte	XOR of all previous bytes including the SYNC byte

As shown above, each ANT message begins with a SYNC byte and ends with a Checksum. For the WASP protocol the ANT message data included in the WASP packet does not include the Sync byte or Checksum byte. These bytes are added by the WASP WiFi-Basic code before sending it to the ANT module, or checked and stripped off after the WASP WiFi-Basic code receives an ANT message from the ANT module. The checksum is generated on the fly by the WASP WiFi-Basic code.

The Sync byte is a fixed value of 0b10100100 (msb:lsb) for the WASP hardware. The MSG Length is the number of data bytes in the message. 1 < N < Max_Data_Size

The MSG ID is the ANT Data Type Identifier or command.

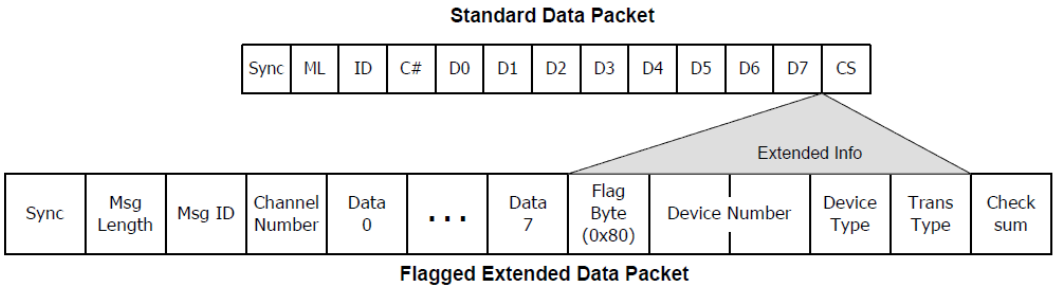
The Data_1 to Data_N are the N bytes containing the ANT message data bytes.

The Checksum is the XOR of all previous bytes of the ANT message including the SYNC byte.

See section 7 in the ANT Message Protocol specification for more information on the basic structure.

6.3.1 Extended ANT Data Format

When the WASP is in the default configuration of continuous scan or proximity scan modes, the ANT radio is configured to use the extended data format messages.



The extended format includes a flag byte 0x 0x80 followed by a two byte Device Number (LSB,MSB), Device Type, and Transaction Type.

The extended message format helps to identify the device generating the data. Since the WASP has not been setup to track any particular device, this additional data is needed to help the receiving application sort the data.

7 PROTOCOL INITIALIZATION PROCESS

7.1 General Operation

The WASP contains an IP binding table consisting of 5 connections consisting of a 32 bit IP address and a 32 bit port number. This table is maintained in the non-volatile memory in the module. When the WASP powers up and initializes the ANT radio it will be in one of the preconfigured modes, continuous scan, proximity scan, or ANT-FS. The operational mode is read from byte 12 of the query response. Refer to the Query Response section for more details on the command.

On startup, the WASP attempts to join the preconfigured wireless network with the SSID and security settings set in the configuration table. The default values for the configuration table are found in the SET_CONFIG section of the document in Table 2. The WASP can be reset to the default values by holding the button for 10 seconds from a powered off state.

If the WASP fails to join the wireless network, it will then attempt to join an AdHoc network of the same name as the primary network with a prepend of "a" at the beginning of the SSID. If it fails to join this network, it then starts a DHCP server at the address following the IP address listed as the static IP address in the configuration and then creates the AdHoc network.

This AdHoc network can be joined by a Wi-Fi device running either a configuration application or data collection application and the WASP will respond to commands issued by the device.

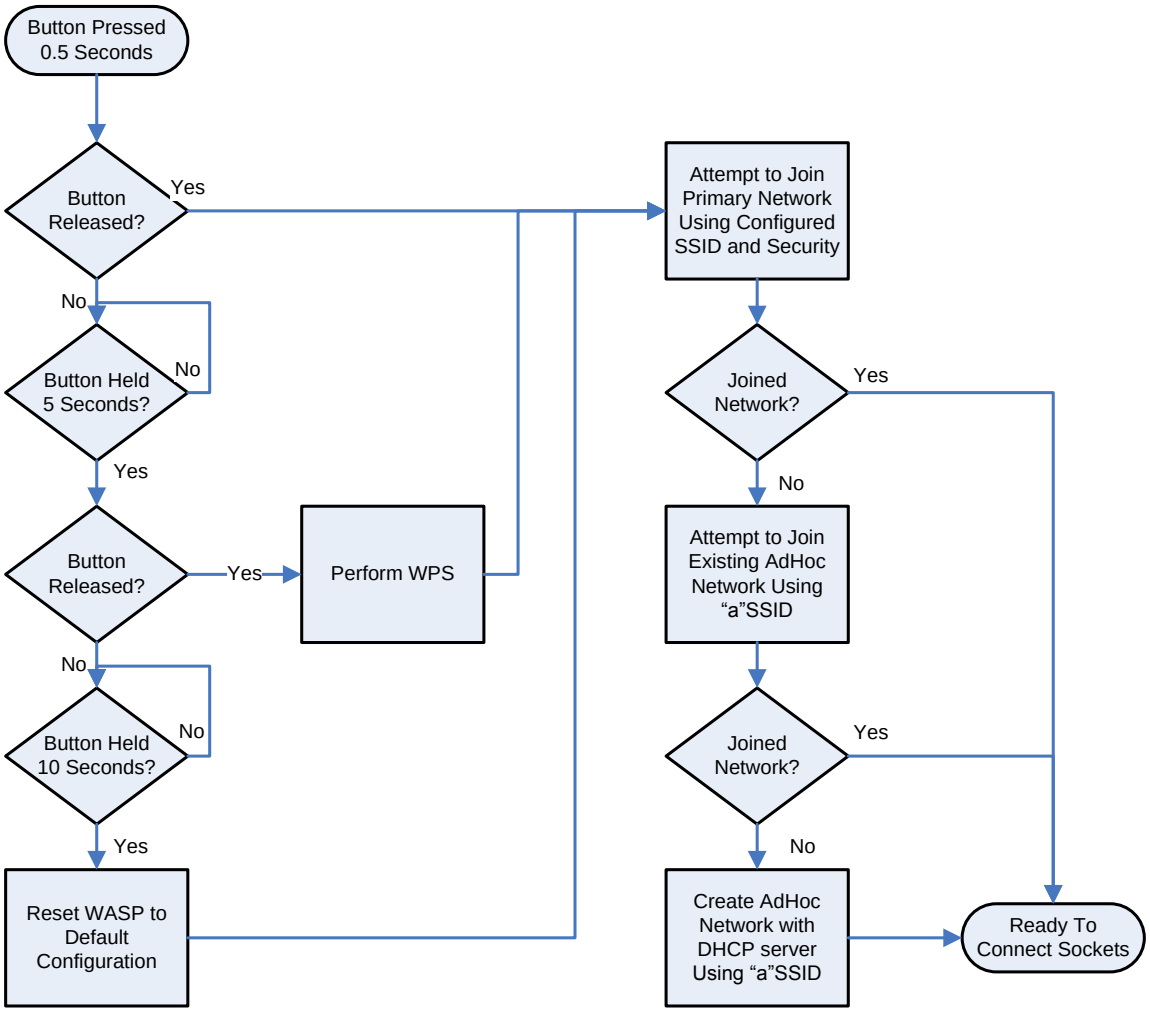


Figure 1: JoinOrCreateNetwork Flow Diagram

7.2 Green LED Indicator

Refer to the LED section for a detailed description of the LED user interface. In general, the green LED is used to indicate the type of network the WASP is connected to. If the LED is on steady, it has joined the primary network. It can take up to 15 seconds for the WASP to join the network. If it fails to join the network, the green LED will flash at ~2Hz rate indicating it is attempting to join an existing AdHoc network as indicated above. If it fails to join the AdHoc, it will create the network and flash at a 1 Hz rate of 1 second on and 1 second off.

7.3 Establishing a Streaming Connection

Once a network is established, the WASP opens a multicast UPD connection for streaming data on address 239.78.80.1 and port 51113. All data packets received from the ANT radio are forwarded to this address with a WiFi packet header detailed later in this document. If an application would like to receive this data, simply subscribe to the multicast address on with port 51113 and the data packets will be received.

Additionally, the WASP has one dedicated IP address used to route data out of the local network for streaming data to a cloud service. On startupd, the WASPchecks if the IP binding field has a valid entry. If the address is not 0.0.0.0, it opens a UDP connection to the IP address and port specified and it is ready for forward any data received by the ANT radio.

7.4 Establishing a Control Connection

The WASP allows one TCP control connection to be established for the purposes of either modifying the configuration setup, or controlling the ANT radio to a different configuration than the preconfigured mode of continuous scan, proximity scan, or ANT-FS access point. Since there is only one connection, the device using the connection is responsible for either maintaining the connection or freeing it up for another device to be able to take control. If the control interface is not available, a device wanting the connection can request it. The WASP then generates a packet to the device currently controlling the interface. If the controlling device does not respond to the request, the WASP disconnects from the previous device and gives control to the new requestor. General WASP Start-up Flow

1. WASP STARTUP
2. WASP UDP Listening Mode
3. WASP Opens UDP multicast streaming port
4. WASP Opens preset UDP streaming port (if configured)
5. Client Device Query Request
6. WASP Query Response to requestor port
7. Client Device Connect Request (optional)
8. WASP Connect Response to requestor port (optional)
9. Client Device Disconnect Request (optional)
10. WASP Disconnect Response to connect port (optional)

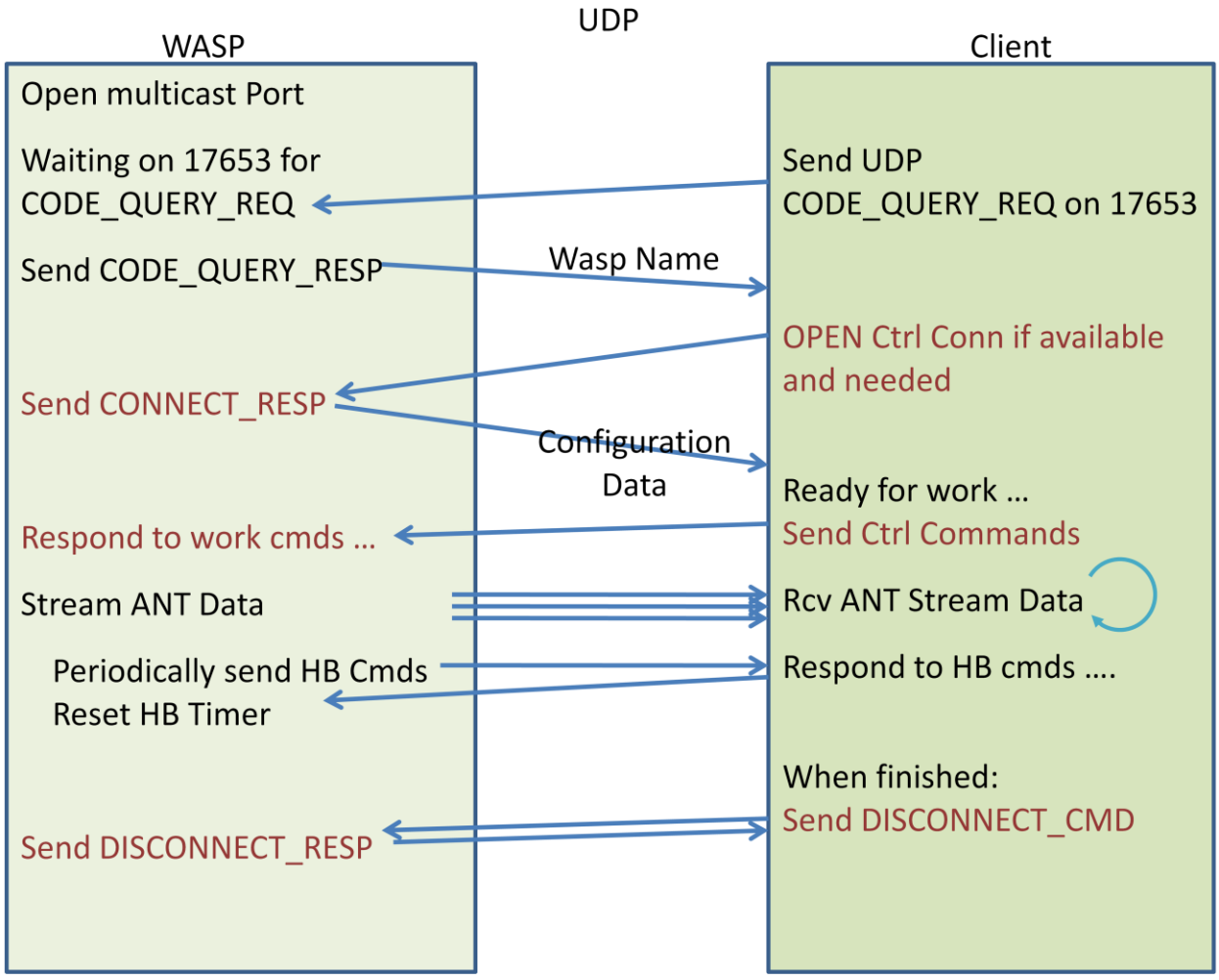


Figure 2: WASP Start-up Flow

7.5 WASP STARTUP

The WASP startup process contains a number of elements related to the hardware. Each WASP device contains a button, one green LED, one red LED, a battery, an ANT chip, a WIFI-IT chip, a charging circuit, and a USB port for power (and soon available configuration). The user interface is made up of the button, the two LEDs, and the USB port.

See the WASP User Guide for more information on the WASP hardware and how to use it.

7.5.1 Power On

In order to power up the device, the user needs to push and hold the button for approximately ½ second. When the green LED illuminates the WASP is scanning for the configured WiFi network to join. The scan is complete when the red LED flashes three times. If the configured network is found, the WASP will attempt to join the network. If the network is not found it will perform another scan followed by the three red LED flashes. If the user would like to force the WASP to create its own WiFi network, simply press and hold the button after the green LED has illuminated after power-up. Be sure to release the button on power-up before pressing it again to skip joining the configured network.

If the WASP finds the configured network, the red LED will illuminate steady indicating it is attempting to join the network that was found. If it is successful, the red LED will turn off and start reporting the battery charging status. If the red LED blinks off then on quickly, this is an indication that it did not join the network and it is attempting to join again. If the user would like to force the WASP to create its own network at this point, simply press and hold the button until the red LED flashes once. At this point, the green LED will flash indicating the AdHoc network was successfully created.

There are some operations performed by the Wi-Fi processor that are blocking operations. If it is performing one of these operations, the button can seem to be unresponsive. If this is experienced, wait for up to 10 seconds and attempt the operation again.

7.5.2 WPS (Not Implemented Yet)

The user could continue to hold the button down for a total 5 seconds from the power up state, then the WASP device would enter the WPS setup mode. In this mode the green LED would flash at a specific rate and pattern to give the user feedback. In the WPS mode, the user would then enable the other WPS device. After this the WPS process is run to exchange the security information. When the WPS process completes successfully it will return to the running state and the green LED would return to a steady on mode.

7.5.3 Configuration Reset

The user could also continue to hold the button down for an additional 5 seconds then the WASP device would enter the reset configuration mode. This is a total of 10 seconds from the power up state. In this mode, certain of the WASP security and configuration information would be reset to the original state. This state is defined in Table 2.

7.5.4 Red LED Operation

The red LED has a number of functions. When running and not powered through the USB port the red LED is off. When the WASP is plugged into the USB and charging the red LED will be flashing in a specific rate and pattern. Once the WASP is plugged in and fully charged the red LED will return to a solid on mode.

There are a number of errors the device could enter. These are explained in the WASP User Guide. The errors will also drive the red LED with different patterns. In the error state, the Red LED flashes the number of times for the upper half of the HEX value for the error code. The Green LED flashes the number of times for the lower half of the HEX value for the error code. The error code will repeat itself twice, and then attempt to continue with normal operation. If the error is unrecoverable, hold the button to power off the unit.

7.5.5 Error Code Reporting

If the WASP encounters an unexpected error condition, it enters the error handler routine. In the routine, it uses both LEDs to report the error code for the current error condition. A flash pattern is used to identify the error. The red LED is used for the first digit in the error code and the green LED is used for the second digit. The error code is a hexadecimal number so any number of flashes above 9 will be A-F respectively. The error code is repeated twice before the WASP attempts to continue with its operation. If the error is unrecoverable, it will continue repeating the error code. To reset the WASP and exit the error condition, hold the button during the flashing of the error code to power down the unit. Release the button and press it again to restart the WASP.

7.6 WASP UDP Listening Mode

The WASP enters the UDP Listening mode as soon as a network connection has been established after power on. The WASP either joins an existing network or creates an AdHoc network. In this mode, the WIFI device next starts a UDP listening on **port 17653**. The WASP device then starts waiting on WASP protocol command CODE_QUERY_REQ (0x42) to be received.

7.7 Client Device Query Request

The client device when started up sends the WASP protocol command QUERY_REQ (0x42) on the current network SSID. The client device sends a broadcast message to all of the nodes on the subnet.

For the AD-HOC network the default SSID is NpeWasp. The default node is 192.168.21.NNN, where NNN is a number determined by the WASP hardware. The default subnet is 192.168.21.0. So, in the AD-HOC network mode the client device would send it to 192.168.21.255.

7.8 WASP Query Response

Once the WASP Wi-Fi-Basic code sees the CODE_QUERY_REQ (0x42) on the current network SSID it will respond with the CODE_QUERY_RESP (0x43). In this packet the current number of available streaming and connection sockets are returned in the Query Response packet. Refer to the Query response section for details.

8 WASP HEARTBEAT PROCESS

Once the WASP is powered up and connected to a client device it then starts up a HEARTBEAT process that will wait for 5 minutes looking for activity. Every 5 minutes the WASP WiFi-Basic code will send out a HEART_BEAT_MSG (0x4A). The WASP will then wait for a HEART_BEAT_RESP (0x4B). When the WASP either receives the response or there are other activities either from the client devices or the ANT chip, the WASP code reset the HEARTBEAT. If after 5 minutes the code determines there has been zero activity the HEARTBEAT process moves to HEARTBEAT step 2 and starts sending the HEART_BEAT_MSG (0x4A) every 1 minute. The WASP code will look for a response back

within 10 of these commands, if it has not received a response in this amount of time the WASP will enter the sleep mode and the system will need to be setup again.

9 WASP API PACKET COMMANDS

The API Packet Commands are the commands sent from the API to the WASP WiFi-Basic code. Each one of these commands has a response packet sent directly after decoding and executing the commands. The exception to this rule is the “HEART_BEAT_RESP” command which is returned by the client device after receiving the HEART_BEAT_MSG from the WASP WiFi-Basic code.

The only bytes defined below will be the ones different than the basic WASP packet.

9.1 SET_CONFIG (0xB4)

This packet sends a WASP WiFi-Basic code only packet to set the PRIMARY SSID on the WASP device.

Table 2: Set Config Packet Structure

Byte	Size	Name	Defaults	Description
0,1	2	Packet Header	‘W’,’A’	
2,3	2	Packet Length		Length of the Flash image plus the TCP Packet header (LSB,MSB)
4	1	Command		SET_CONFIG command (0xB4)
5	1	Packet Seq Number		Incrementing packet sequence number
6	1	Security Type	SECWPA2PERSONAL	Security Type for joining a network: 0-NONE, 1-WPA, 2-WPA2, 3-WEP
7	1	SSID Name Length	7	Number of characters in the SSID name (maximum of 31) SSID can be 32 characters but the AdHoc SSID is derived from this name by adding an “a” to the beginning of the name.
8	31	SSID Name	"NpeWasp"	SSID of the network to join
39	1	Security Code Length	8	Number of characters in Security code for WPA or WPA2 Security (8-63)
40	63	Security Code	"12345678"	Security code for WPA, WPA2, or WEP Security
103	1	Proximity Level	1	
104	1	AdHoc Security Code Length	10	
105	26	AdHoc Security Code	“1234567800”	
131	1	AdHoc Security Type	WEP Shared	0 = NONE; 1 = WEP SHARED
132	4	Static IP	192.168.87.1	IP address used when DHCP is turned off or when creating an AdHoc network. The DHCP server uses this address to start generating addresses

Byte	Size	Name	Defaults	Description
136	4	Static Subnet	255.25.255.0	Subnet mask used for static IP address assignments
140	4	Static Gateway	192.168.87.1	Gateway address for the statip IP assignements
144	1	AdHoc Channel	11	WiFi channel used when creating/joining the AdHoc network
145	1	DHCP Enable	1	0-DHCP disabled; 1-DHCP Enabled
146	1	WASP Name Length	17	Number of characters in the WASP name field (1-32)
147	32	WASP Name	Unit MAC	ASIC Name used to identify the WASP
179	1	Network Key Select	0	Selects the network Key used by the WASP when in ANT-FS mode 0-Public Key; 1-ANT+ Key; 2-ANT-FS Key; 3-Other Key
180	1	WASP Operating Mode	0	Selects the operational mode for the WASP 0-Streaming; 1-Proximity; 2-ANTFS Access Point
181	4	Server IP Address	0.0.0.0	IP Address if IP Binding Port
185	2	Server Port	0	IP Port of IP Binding Port

The direct response from the WASP WiFi-Basic code is command SET_SSID_RESPONSE (0xB5).

9.2 WIFI_ANT_MSG (0x10)

This packet sends an Ant command packet to the Ant AP2 device.

Byte	Size	Name	Description
2,3	2	Length	Packet Length
4	1	Command	WIFI_ANT_MSG (0x10)
5	1	Sequence Number	Incrementing packet sequence number
4	1	ANT Message Length	Length in bytes of the payload of the ANT message following the Message ID
5	1	Message ID	Single byte message ID issued to the ANT radio to select the specific function to be performed by the command packet. Refer to the ANT message summary in the ANT Message Protocol and Usage specification from ThisIsAnt.com
6	1	Channel #	Most messages contain the channel number as the first byte that follow the message ID. Some messages do not need the channel number. Refer to the ANT documentation for details.
7..7+N	8	Data0 – DataN	Payload area for the ANT command. Different commands require different amounts of data with the maximum data length of 8 bytes.

The direct response from the WASP WiFi-Basic code is the command WIFI_ANT_MSG_ACK (0x11).

The Ant response if there is one is returned to the WASP client device using command WIFI_ANT_MSG_ASYNC_RESP (0x12).

For example, if a Read Channel Status command is sent to the Ant device the data would be as follows:

41:4E:10:44:02:4D:00:52

9.3 SET_SLEEP_ON (0xC4)

This packet sends a WASP WiFi-Basic code only packet to tell the WASP WiFi-Basic code to go into sleep mode. The WASP will go into sleep as soon as the response is sent plus 1 second.

Byte	Size	Name	Description
2,3	2	Length	Packet Length
4	1	Command	SET_SLEEP_ON command (0xC4)
5	1	Sequence Number	Incrementing packet sequence number

The direct response from the WASP WiFi-Basic code is command SET_SLEEP_ON_RESP (0xC5).

9.4 QUERY_REQ (0x42)

This packet sends a WASP WiFi-Basic code only packet to return the number of remaining connections this WASP device can handle. It will not connect the received WIFI client device CID to this WASP device. Use the CODE_CONNECT_CMD (0x40) command to make a connection to the WASP device.

Byte	Size	Name	Description
2	1	Command	QUERY_REQ(0x42)
3	1	Packet Number	Incrementing packet sequence number

The direct response from the WASP WiFi-Basic code is command CODE_QUERY_RESP (0x43).

9.5 DISCONNECT_CMD (0x4C)

This packet sends a WASP WiFi-Basic code only packet to disconnect the received WIFI client device CID to this WASP device.

Byte	Size	Name	Description

Byte	Size	Name	Description
2	1	Command	DISCONNECT_CMD command (0x4C)
3	1	Packet Number	Incrementing packet sequence number

The direct response from the WASP WiFi-Basic code will be command CODE_DISCONNECT_CMD (0x4D).

9.6 CODE_LED_PULSE_REQ (0x48)

This packet sends a WASP WiFi-Basic code only packet to set the GPIO LED flashing code.

Byte	Size	Name	Description
2,3	2	Length	Packet Length
4	1	Command	LED_PULSE_REW (0x48)
5	1	Sequence Number	Incrementing packet sequence number
4	1	LED Events	This is the number of LED timing events present in the command packet. An event consists of a pair of values. The first is a byte to indicate the RED/GREEN LED being controlled. Bits 5,4 indicate if the RED,GREEN LED respectively is being controlled by the event and bits 1,0 are the ON/OFF control for the LED if it is active in the timing event. The second field is an integer for the number of milliseconds to hold the RED/GREEN event. If an event is for only one of the LEDs, the next event in the series will be processed for the other LED if is it active. The Timing event will only advance to the next event when a previous event is processed for its respective LED. **(NOTE: Maximum of 20 events)**
5	1	LED Control	5 – RED LED Enable 4 – GREEN LED Enable 1 – RED LED ON/OFF 0 – GREEN LED ON/OFF
6-9	4	Event Time	Time in milliseconds for the control in the previous byte
10	1	LED Control	5 – RED LED Enable 4 – GREEN LED Enable 1 – RED LED ON/OFF 0 – GREEN LED ON/OFF
11-14	4	Event Time	Time in milliseconds for the control in the previous byte
…	1	LED Control	5 – RED LED Enable 4 – GREEN LED Enable 1 – RED LED ON/OFF 0 – GREEN LED ON/OFF
…	4	Event Time	Time in milliseconds for the control in the previous byte
	1	Checksum	

The direct response from the WASP WiFi-Basic code is command CODE_LED_PULSE_RESP (0x49).

10 WASP ASYNCHRONOUS RECEIVE PACKETS

The WASP Asynchronous Packet Commands are the commands created as needed by the WASP WiFi-Basic code and sent to the client device.

10.1 WIFI_ANT_MSG_ASYNC_MSG (0x12)

This packet command is either an ANT response packet from a previous WIFI API to ANT packet, or it is an asynchronously generated packet from the ANT device. There is no expected direct response for this command.

Byte	Size	Name	Description
2	1	Command	WIFI_ANT_MSG_ASYNC_MSG (0x12)
3	1	Packet Number	Incrementing ANT packet sequence number
4	1	ANT Message Length	Length in bytes of the payload of the ANT message following the Message ID
5	1	Message ID	Single byte message ID issued to the ANT radio to select the specific function to be performed by the command packet. Refer to the ANT message summary in the ANT Message Protocol and Usage specification from ThisIsAnt.com
6	1	Channel #	Most messages contain the channel number as the first byte that follow the message ID. Some messages do not need the channel number. Refer to the ANT documentation for details.
7..7+N	8	Data0 – DataN	Payload area for the ANT command. Different commands require different amounts of data with the maximum data length of 8 bytes.
	1	Extended Data Flag	One byte indicating the type of extended ANT message 0x80 – indicates the device data is included in the extended message
	2	Device Number	Two bytes of the device ID with LSB followed by MSB
	1	Device Type	Device type uniquely identifying the type of sensor generating the data packet
	1	Transaction Type	The type of transaction initiated by the ANT device.

See the ANT protocol specification for more information on the ANT packets.

10.2 HEART_BEAT_MSG (0x4A) (Awaiting update- not implemented in code)

~~This command is asynchronously generated and sent by the WASP WiFi-Basic code every 5 minutes to keep in touch with the client devices. As part of this command the current battery value is return. The client device is expected to return the HEART_BEAT_RESP (0x4B). If the WASP WiFi-Basic code does not receive the HEART_BEAT_RESP (0x4B) within the next 5 minutes then the WASP WiFi-Basic code switches to sending this command every 1 minute. The WASP WiFi-Basic code will wait on 10 of these messages to be sent. When the WASP WiFi-Basic code receives the eleventh no-response the code will set the module into sleep mode. Any HEART_BEAT_RESP (0x4B) received will reset the HEART_BEAT_MSG back to a 5-minute time per message.~~

- ~~Byte 2: Command byte = 0x4A.~~

- ~~Byte 3: Heartbeat message ID. This will be the current Heartbeat to WIFI client device packet count variable "codewifisendcnt " generated by the WASP WASP WiFi-Basic code. This count is reset to zero when the WASP comes out of sleep and button is pushed and held for 1 second.~~
- ~~Byte 21: Message length of 5 bytes.~~
- ~~Byte 22-25: Integer value of the current BatteryADCVal variable which contains the integer returned by a BATTERY call to the firmware. This integer value has already been converted into millivolts and should be between 2000 and 3700. Then an offset voltage is added for the external circuit to find the real value of the battery. The client device can then generate the current battery input voltage and display it or use it. It stores the integer value in little endian byte format, or lsb in byte 22 and msb in byte 25.~~
- ~~Byte 26: 0x00. Previous used values which can be ignored now.~~
- ~~Byte 27: 0x00. Previous used values which can be ignored now.~~

~~The response from the WASP client device will be command HEART_BEAT_RESP (0x4B).~~

11 WASP RESPONSE PACKET COMMANDS

The WASP Response Packet Commands are the commands returned by the WASP WiFi-Basic code directly after receiving the WASP API Packet commands.

11.1 QUERY_RESP (0x43)

This command is a direct response packet for the received QUERY_REQ (0x42) message. It is generated while working on the QUERY_REQ message. It lets the WASP client device know the WASP packet has been received and provides information about the WASP to help the client know if it wants to establish a control connection and/or a streaming connection.

Byte	Size	Name	Description
2	1	Command	QUERY_RESP (0x43)
3	1	Packet Number	Packet number of the received packet. Used to help the sender identify the response packet.
4	1	Message Length	Length in bytes of the payload area of the message following the two reserved bytes
5-6	2	Reserved	Place holders to match the ANT protocol messages
7	1	WASP Major Version	Major Version number of WASP CODE
8	1	WASP Minor Version	Minor Version number of WASP CODE
9	1	WASP Product Type	Product type for code loaded into WASP
10	1	Connection Status	The query response contains information about the connection status of the configuration connection. If this is a query from the device that is currently setup to perform configurations a -1 will be returned. If there if there is no device currently connected to configure the device, it will return a 1. If another controller is already connected to the configuration port, then return 0 indicating the port is not available for configuration.

Byte	Size	Name	Description
			If a controller would like to request the configuration port, it can issue a connect command. A notice is then sent to the device currently connected to the configuration port. If the device wants to retain the config port, it needs to send a connect command in order to keep ownership of the config port. If the device does not get a response or the config device sends a disconnect command, then the device wanting to gain access to the config port can reissue the connect command and gain access to the port.
11	1	Streams Available	The number of stream connections available. If the device doing the query already has a connection a -1 is returned. This will ensure the device is always able to get its connection back if it is lost.
12-13	2	Battery Level	Little Endian representation of the current battery level measure in mv. Byte 9 is the LSB.
14	1	Power Indicator	Bit 0 – Low if the WASP is powered by the USB connector on the module Bit 1 – High if the battery is currently charging.
15	1	Operating Mode	This byte is used to indicate the preconfigured operating mode the WASP is currently running. Bit 7 – Continuous Scan Mode Bit 6 – Proximity Scan Mode Bit 5 – ANT-FS Access Point Mode Refer to section xxx for more details
16	1	WASP Name Length	The number of characters in the ASCII WASP name that follows starting at byte 14
17-48	32	ASCII WASP Name	ASCII representation of the WASP name. This value is configured through the SET_CONFIG command as one of the fields.
49	6	WASP MAC	The MAC address of the WASP. This is a unique 6 byte identifier used to identify the WASP transmitting on a specific IP address and PORT

11.2 CONNECT_CMD_RESP (0x41)

This command is a direct response packet when the control TCP connection is opened. It lets the WASP client device know the WASP control socket is connected and active.

Byte	Size	Name	Description
0,1	2	Packet Header	
2,3	2	Packet Length	Length of the Flash image plus the TCP Packet header (LSB,MSB)
4	1	Command	SET_CONFIG command (0xB4)
5	1	Packet Seq Number	Incrementing packet sequence number
6	1	Security Type	Security Type for joining a network: 0-NONE, 1-WPA, 2-WPA2, 3-WEP
7	1	SSID Name Length	Number of characters in the SSID name (maximum of 31) SSID can be 32 characters but the AdHoc SSID is derived from this name by adding an “a” to the beginning of the name.

Byte	Size	Name	Description
8	31	SSID Name	SSID of the network to join
39	1	Security Code Length	Number of characters in Security code for WPA or WPA2 Security (8-63)
40	63	Security Code	Security code for WPA, WPA2, or WEP Security
105	26	AdHoc Security Code	
131	1	AdHoc Security Type	0 = NONE; 1 = WEP SHARED
132	4	Static IP	IP address used when DHCP is turned off or when creating an AdHoc network. The DHCP server uses this address to start generating addresses
136	4	Static Subnet	Subnet mask used for static IP address assignments
140	4	Static Gateway	Gateway address for the statip IP assignements
144	1	AdHoc Channel	WiFi channel used when creating/joining the AdHoc network
145	1	DHCP Enable	0-DHCP disabled; 1-DHCP Enabled
146	1	WASP Name Length	Number of characters in the WASP name field (1-32)
147	32	WASP Name	ASIC Name used to identify the WASP
179	1	Network Key Select	Selects the network Key used by the WASP when in ANT-FS mode 0-Public Key; 1-ANT+ Key; 2-ANT-FS Key; 3-Other Key
180	1	WASP Operating Mode	Selects the operational mode for the WASP 0-Streaming; 1-Proximity; 2-ANTFS Access Point
181	4	Server IP Address	IP Address if IP Binding Port
185	2	Server Port	IP Port of IP Binding Port

12 PAGE FLASH MEMORY MAP

Offset	Size	Description	Defaults
0	1	**Dirty Byte**	**0x00**
1	1	**Reserved**	**0**
2	1	**Reserved**	**0**
3	1	**Reserved**	**0**
4	1	**Security Type**	**SECWPA2PERSONAL**
5	1	**SSID Name Length**	**7**

Offset	Size	Description	Defaults
6	31	SSID Name Length	"NpeWasp"
37	1	Security Code Length	8
38	63	Security Code	"12345678"
101	1	Proximity Level	1
102	1	AdHoc Security Code Length	10
103	26	AdHoc Security Code	"1234567800"
129	1	AdHoc Security Type	SECWEPSHARED
130	4	Static IP	192.168.87.1
134	4	Static Subnet	255.255.255.0
138	4	Static Gateway	192.168.87.1
142	1	AdHoc Channel	11
143	1	DHCP Enable	1
144	1	WASP Name Length	17
145	32	WASP Name	UNIT MAC Address
177	1	Network Key Select	0
178	1	WASP Operating Mode	0
179	4	Server IP Address	0.0.0.0
183	2	Server Port	0
185	1	Debug IP Address (lower octet)	201

13 NETWORK OPERATIONS

The Wasp can either join an existing wireless network or create its own if it cannot join an existing network. Both DHCP and static IP modes are supported as well. When the Wasp powers up, it looks for the network with an SSID value configured as the primary SSID (default of WASP). If the WASP fails to join the primary network it then either creates an Ad-Hoc network called aWASP, or joins an existing WASP Ad-Hoc network. The AdHoc network name will always be the name of the SSID configured to join with an “a” for AdHoc added to the beginning of the name.

13.1 GREEN LED Operation

When the WASP is powered on, the green LED will illuminate while it is attempting to join the existing wireless network configured in the settings. If it fails to join the network, it will

attempt to join an existing AdHoc network that has a DHCP server running. If successful, the green LED will cycle on/off every 300 ms. If it fails to join the AdHoc network, it will create its own AdHoc network by prepending an “a” onto the configured SSID name. The green LED will flash at a rate of one second on and one second off.

13.2 DHCP Operations

If DHCP is enabled the Wasp will attempt to join the primary network and request an IP address from a DHCP server. If the join fails it then will attempt to join the WASP network if it exists and expect to get an address from the Wasp that is running the DHCP server. If it fails to join that network, it then starts its own DHCP server and creates the AdHoc network as the DHCP server.

If the DHCP is enabled and the network is not serving addresses, the WASP will fail to join the network and it will create its own AdHoc network.

13.2.1 Special Ad-Hoc DHCP Server Consideration

If the Wasp acting as the DHCP server leaves the network, there is no longer a DHCP server for the network. If another device tries to join this network it will not receive an address. If the WASP that was acting as the DHPC server rejoins the network, it will start the DHCP server at an address 9 higher than the original server address. The DHCP server support 8 addresses before it runs out of leases in its list. The purpose of the increment is to prevent the new DHCP server from reissuing addresses it has already served out. If the base address gets larger than 200, it will recycle back to 1.

13.3 WASP Listening Port

The Wasp module uses port number 17653 to listen for broadcast messages. Use this port assignment when sending commands to the Wasp.

13.4 WASP Multicast Address

The WASP uses multicast address 239.78.80.1 port 51113 for sending the multicast messages.