

**RF-WKD**

**Wi-Fi module**

**USER'S  
MANUAL**

## **Copyright Information**

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## Agency Compliance and Approvals

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### FEDERAL COMMUNICATIONS COMMISSION INTERFERENCE STATEMENT

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

#### **CAUTION:**

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

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.

#### **RF exposure warning**

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

## End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: VTV-RF-WKD " and "Contains IC: 10524A-RF-WKD "

## Information for the OEMs and Integrators

The following statement must be included with all versions of this document supplied to an OEM or integrator, but should not be distributed to the end user.

- 1) This device is intended for OEM integrators only.
- 2) Please see the full Grant of Equipment document for other restrictions.

This device is slave equipment, the device is not radar detection and not ad-hoc operation in the DFS band.

This radio transmitter FCC ID: VTV-RF-WKD has been approved by FCC to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

### Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	ARISTOTLE ENTERPRISES INC.	RFA-25-P393B-70-85-L	FPC	3.2 dBi for 2.4 GHz 3.1 dBi for 5 GHz
2	ARISTOTLE ENTERPRISES INC.	RFA-25-P393B-70B140R	FPC	0.9 dBi for 2.4 GHz 3.2 dBi for 5 GHz

Note: The antenna connector is I-PEX type.

## Canada, Industry Canada (IC) Notices

This device complies with Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

## Canada, avis d'Industry Canada (IC)

Cet appareil est conforme avec Industrie Canada exemptes de licence RSS standard(s). Son fonctionnement est soumis aux deux conditions suivantes : (1) cet appareil ne doit pas causer d'interférence et (2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

## Radio Frequency (RF) Exposure Information

The radiated output power of the Wireless Device is below the Industry Canada (IC) radio frequency exposure limits. The Wireless Device should be used in such a manner such that the potential for human contact during normal operation is minimized.

This device has also been evaluated and shown compliant with the IC RF Exposure limits under mobile exposure conditions. (antennas are greater than 20cm from a person's body).

## Informations concernant l'exposition aux fréquences radio (RF)

La puissance de sortie émise par l'appareil de sans fil est inférieure à la limite d'exposition aux fréquences radio d'Industry Canada (IC). Utilisez l'appareil de sans fil de façon à minimiser les contacts humains lors du fonctionnement normal.

Ce périphérique a également été évalué et démontré conforme aux limites d'exposition aux RF d'IC dans des conditions d'exposition à des appareils mobiles (antennes sont supérieures à 20 cm à partir du corps d'une personne).

This radio transmitter IC: 10524A-RF-WKD has been approved by Industry Canada to operate with

the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet émetteur radio IC: 10524A-RF-WKD a été approuvé par Industrie Canada pour fonctionner avec les types d'antennes énumérés ci-dessous avec le gain maximal admissible et impédance d'antenne requise pour chaque type d'antenne indiqué. Types d'antennes n'est pas inclus dans cette liste, ayant un gain supérieur au gain maximal indiqué pour ce type, sont strictement interdits pour une utilisation avec cet appareil.

### Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	ARISTOTLE ENTERPRISES INC.	RFA-25-P393B-70-85-L	FPC	3.2 dBi for 2.4 GHz 3.1 dBi for 5 GHz
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Note: The antenna connector is I-PEX type.

# 1. Introduction

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## Product Introduction

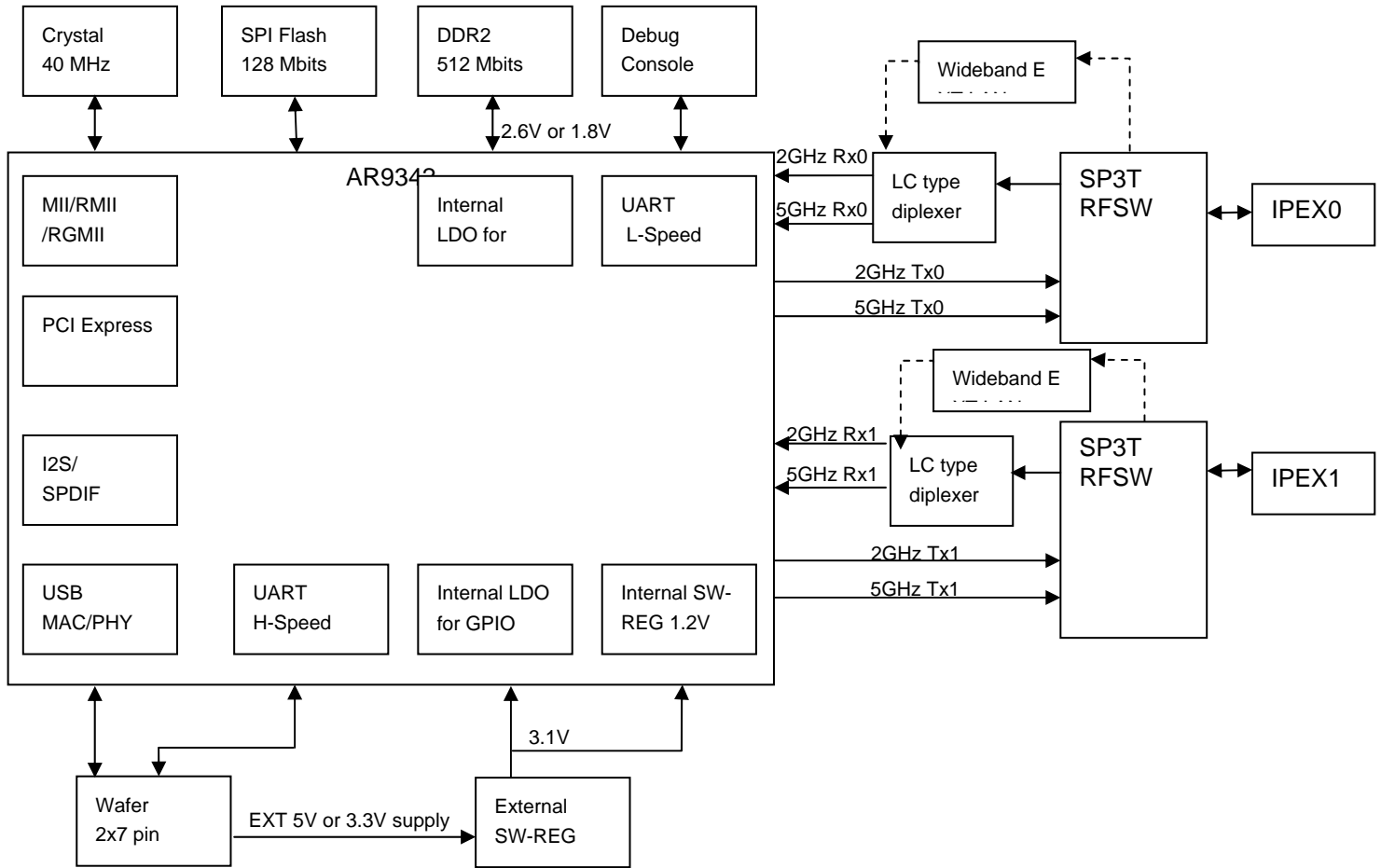
The RF-WKD is an 802.11 a/b/g/n Wi-Fi module which supports 2 dual-band external antennas. The module provides serial UART interface, enabling connection to any embedded design utilizing a 32-bit microcontroller via simple commands.

The RF-WKD Wi-Fi module is compatible with other devices that use 802.11 a/b/g/n technology. For more information, please refer the contents in this document.

## 2. Specification

### 2.1 Hardware Specification

#### 2.1.1 System Block Diagrams

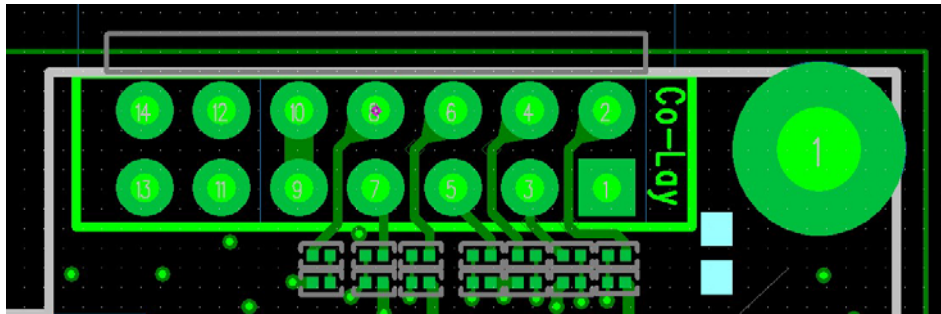
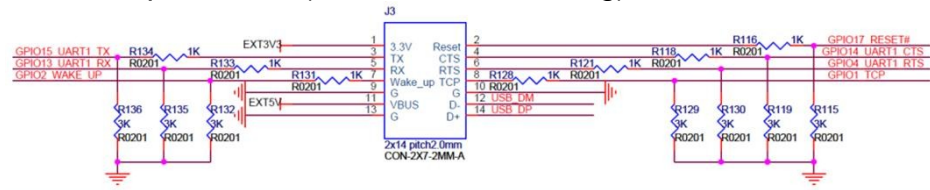


#### 2.1.2 Module Specification

CPU	Atheros AR9342
RAM	DDR2 SDRAM 512Mbits/64MByte
Flash	128Mbits/16MByte
Antenna	2T2R(2 x I-PEX connector)
Output/power	
UART	TXD.RXD.CTS.RTS 3.3VDC/0.5A, baud rate: 9600~115200bps
USB	USB (device) 5VDC/0.5A
LED indicator	1. Power LED 2. WLAN LED
Button	initial/reset button
Console port	Reserved for debug

### 2.1.3 PCB Characteristics

Printed Circuit Board: FR4, UL94V-0, 6 Layers Dimension:  
I/O placement: 14 pins wafer (definition as following)



pin	definition
1	3.3V
2	Reset
3	TX
4	CTS
5	RX
6	RTS
7	Wake_up
8	TCP
9	GND
10	GND
11	5V
12	USB D-
13	GND
14	USB D+

### 2.1.4 Environmental Conditions

Preservation Temperature: -25 ~ 60 °C  
Preservation Humidity: 10~90% non-condensing  
Operation Temperature: 0 ~ 50 °C  
Operation Humidity: 10~90% non-condensing

### 2.1.5 ESD

±8kV for Air Discharge

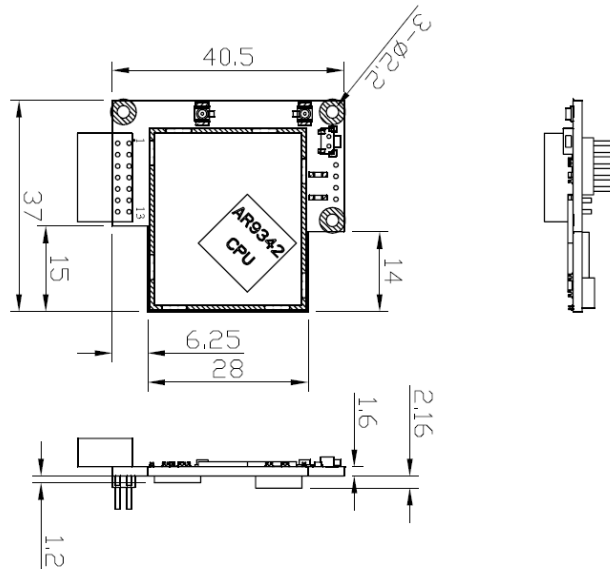


±4kV for Contact Discharge

## 2.2. Protocol:

Item	Protocol
1	FTP client for firmware update
2	RAW TCP printing protocol (Port 9100 printing)
3	LPR Printing Protocol (Port 515 printing)
4	SNMP v1: Get Printer Status. (Print Name, Port Number, Printer Status...)
5	DHCP Client: Station mode
6	BOOTP
7	RARP
8	ARP

## 2.3. Mechanical Dimension:



### 3. AT command

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#### **Convention**

For every AT command its response is a status, the default response should be an ASCII character byte starting from '0', '0' indicate the request is done successfully, others indicate independent status, but '1' may indicate the request is not complete in certain circumstances.

For every AT command its input is defined, the input option with underline indicate the default value for the module.

Angle Brackets ("<" and ">") indicate the value in the brackets is an arbitrary string.

Every listed AT command should be ended with two binary character 0x0D 0x0A.

#### **AT Commands**

##### **3.1. Set UART baud Rate (wait for confirmation for both printer and module)**

***AT+UARTBAUD=n***

n	Baud rate
0	9600
1	14400
2	19200
3	38400
4	56000
5	57600
5	115200
5	230400
5	460800
5	921600

Return status

##### **3.2. AT Command Response Type**

***AT+RESP=n***

n=0: Single Byte Mode -AT response will be either "0", "1", or any single byte

n=1: String Mode -AT response will be either "OK" or "Fail".

Return status

### 3.3. Time Setting (UTC)

***AT+TIME= YYYY.MM.DD-hh:mm:ss***

Return status

### 3.4. Enable/Disable WLAN Interface

***AT+WACTIVE=n***

n=0: Disable

n=1: Enable

Return status

### 3.5. File Transfer

***AT+WFILE=<file name>,<file size>,<file content>***

Return '0'

### 3.6. Reboot WLAN Module

***AT+WREBOOT***

Return '0'

### 3.7. Reset to Default

***AT+WRESET***

Return '0'

### 3.8. Set Host name

***AT+WHOSTNAME=<hostname>***

Return status

### 3.9. Wireless LAN Basic Setting

#### 3.9.1. Set WLAN Mode

***AT+WMODE=n***

n=1: 11NAHT20 -802.11n A-Band (5GHz)

n=2: 11NGHT20 -802.11n G-Band (2.4Gz)

Return status

#### 3.9.2. Set AP/client mode

**AT+WAPMODE=*n***

n=0: client mode n1: AP mode

Return status

### **3.9.3. Enable/Disable DHCP Client**

**AT+WDHCP=*n* n=0: Disable**

n=1: Enable

Return status

### **3.9.4. Static IP, Subnet Mask, Gateway Set**

**AT+WSTATIC=<Static IP>,<SubNet Mask>,<Gateway>, <Domain Name Server>**

Return status

### **3.9.5. Set Client Mode SSID**

**AT+WSSID=<SSID>**

Return status

### **3.9.6. Set AP Mode SSID**

**AT+WAPSSID=<SSID>**

Return status

### **3.9.7. Set Wireless Roaming Option**

**AT+WROAM=<threshold>, <delta>**

m=-30~-90(dBm): Threshold

n=0~30 (dB): Delta

Return status

## **3.10. Wireless LAN Security Setting**

### **3.10.1. Set Security Mode**

**AT+WSECURITY=*n***

n=0: None

n=1: WEP

n=2: WPA/WPA2-PSK

n=3: WPA2-EAP

Return status

### 3.11. Wireless LAN WEP Setting

#### 3.11.1. Set WEP Key Index

**AT+WWEPINDEX=*n***

*n*=1~4

Return status

#### 3.11.2. Set WEP Key

**AT+WWEPKEY*n*=<key>**

*n*=1~4

<key> is 10 or 26 hexadecimal digits (or empty to clear the current setting)

Return status

### 3.12. WPA2 Setting

#### 3.12.1. Set WPA2-PSK Key

**AT+WWPA2PSK=<key>**

<key> is 8~63 ASCII characters or a 32-byte key formatted as an ASCII hexadecimal number.

Return status

#### 3.12.2. Set AP Mode WPA2-PSK Key

**AT+WAPWPA2PSK=<key>**

<key> is 8~63 ASCII characters or a 32-byte key formatted as an ASCII hexadecimal number.

Return status

#### 3.12.3. Set WPA2-EAP Identity

**AT+WEAPIDENTITY=<name>, <password >**

Return status

#### 3.12.4. Set WPA2-EAP Method

**AT\_WEAPMETHOD=*n***

*n*=0: EAP-TLS

*n*=1: PEAPv0 with EAP-MSCHAPv2

*n*=2: EAP-TTLS with EAP-MSCHAPv2

Return status

#### 3.12.5. Set WPA2-EAP Certificate File (\*.pem)

**AT+WEAPCERT=<Type>, <Size>, <Data>**

Type: "0" -> CA Certificate File

"1" -> Client Certificate File

"2" -> Client Private Key File

Size is in unit byte

Return status

### 3.13. Firmware Update Mechanism

#### 3.13.1. Module Firmware Upgrade

**AT+MFIRMWARE=<file size>,<file content>**

Return status

\*Return "Failed" if firmware checksum error, otherwise "OK".

#### 3.13.2. FTP Server Check Request

**AT+MFTPCHECK=<FTP Server IP (or server name)>, <ID>, <Password>, <Directory>, <Printer\_Version>**

Return <1 byte of status>, <3 bytes of Co nfig size> <Config>, <3 bytes of Data size> <Data>, <4 bytes of printer firmware size> <checksum><printer firmware>

\*status:

0x00: Operation Success (FTP check finished, no need to upgrade firmware)

0x01: Upgrade Printer only

0x02: Upgrade Module only (Module Reboot Required)

0x03: Upgrade both Printer and Module (Module Reboot Required)

0x04: Connecting Refused

0x05: Connection Timeout (Retry 3 Times)

### 3.14. Status

#### 3.14.1. Get WLAN State

**AT+WSTATE=?**

Return <Disabled/Not Connected/Connected>, <RSSI value string in dBm>, <channel>, <speed>

Return 0 on any not applicable field.

#### 3.14.2. Get MAC/IP Address

**AT+WMAC=?**

Return <MAC>, <IP>,<Subnet Mask>,<Gateway>

Return 0.0.0.0 when any not applicable IP.

#### 3.14.3. Get Site Survey Result

**AT+WSCAN=?**

Return <SSID\_1>, <BSSID\_1>, <NetworkType\_1>, <Channel\_1>, <RSSI\_1>, <Security\_1>; <SSID\_2>, <BSSID\_2>, <NetworkType\_2>, <Channel\_2>, <RSSI\_2>, <Security\_2>; <SSID\_3>....

#### 3.14.4. Get Module SNMP Information

**AT+WSNMPINFO=?**

Return<ifNumber>, <ifIndex>, <ifDescr>, <ifType>, <ifMtu>, <ifSpeed>, <ifPhysAddress>, <ifAdminStatus>, <ifOperStatus>, <ifLastChange>, <ifInOctet>, <ifInUcastPkts>, <ifInNUcastPkts>, <ifInDiscards>, <ifInErrors>, <ifInUnknownProtos>, <ifOutOctets>, <ifOutUcastPkts>, <ifOutNUcastPkts>, <ifOutDiscards>, <ifOutErrors>, <ifOutQLen>, <ifSpecific>

#### 3.14.5. Get Hostname

**AT+WHOSTNAME=?**

Return<hostname>

## 4. Network command

### Format

To ensure all transfers over UART are operating as expectation, each transfer is required to include the following fields:

- An Opcode which defines the specific operation, the operation may be different between the Printer and the Module.
- A transfer size designates the whole size of this transfer. Target should drop this transfer and acknowledge Initiator with error when received size is different to this value.

\* All the fields denoted in transfers are adhering to Network Byte Order (Big Endian).

#### Transfer Commands:

##### Printer Command Set:

##### Data Write Command:

This command provides function for Initiator to write data to Target.

Initiator Request:

	Opcode	Transfer size	Data	Checksum
Value	0x1100	Size	Data	Reserved
Size (Byte)	2	3	<16M	2

##### Module Ready Signal:

Module Request:

	Opcode	Transfer size	F/W Ver.	Checksum
Value	0xFF00	Size	Version*	Reserved
Size (Byte)	2	3	8	2

\*Version: String: [MAJOR NUMBER].[MINOR NUMBER].[BUILD NUMBER]

##### AT Command:

Printer can communicate AT command with Module in following format.

Initiator Request:

	Opcode	Transfer size	Data	Checksum
Value	0x2000	Size	AT command	Reserved
Size (Byte)	2	3	<16M	2

Target Response:

	Opcode	Transfer size	Data	Checksum
Value	0x2000	Size	AT Response	Reserved
Size (Byte)	2	3	<16M	2

**NT Command:**

Printer can establish connection through NT command in following format.  
Initiator Request:

	Opcode	Transfer size	Data	Checksum
Value	0x3000	Size	NT command	Reserved
Size (Byte)	2	3	<16M	2

Target Response:

	Opcode	Transfer size	Data	Checksum
Value	0x3000	Size	NT response	Reserved
Size (Byte)	2	3	<16M	2

**Network Command Set:**

Printer can establish connection through commands below.

**Network Open Command: (Printer Only) *NT+SOCKETOPEN=<Type>,<IP>,<Port>***

<Type>: "0" -> TCP Socket Connect  
 "1" -> TCP Socket Accept "2" -> UDP Socket Open  
 Return <SocketID>

**Socket SetOpt Command:**

***NT+SETSOCKETOP=<SocketID>,<option>,<optval>***

<SocketID> is the socket ID derived from connection establish command.

<option>: "1"-> TCP\_MAXSEG  
 "2"-> SO\_RCVTIMEO  
 "3"-> SO\_RCVBUF

Return *0x00 on success, 0xFF on failure*

**Socket Transfer Command:**

***NT+SENDDATA =<Type>,<SocketID>,<Data>***

<Type>: "0" -> TCP Send Data  
 "1" -> UDP Send Data

<SocketID> is the socket ID derived from connection establish command.

Return *number of bytes transferred on success, 0xFF on failure*

**Network Close Command: (Printer Only)**

***NT+SOCKETCLOSE=<SocketID>***

<SocketID> is the socket ID of the connection which you want to close. Return *0x00 on success, 0xFF on failure*

**Supporting Security:**

1. WPA-Personal (TKIP), Enterprise
2. WPA2-Personal (AES Hardware), Enterprise
3. Wired equivalent privacy protocol(WEP)
4. Vendor EAP Type(s): EAP-TTLS/MSCHAPv2, PEAPv0/MSCHAPv2, EAP-FAST/MSCHAPv2, EAP-TLS





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