

User Manual

Data Hunter

Rev 20010923

The Finger™



No, it's not
an antenna...
It's the
COMPLETE
Data Radio!©

The Finger™ 916 MHz U.S.A. ISM Band
Single Channel Narrowband Data Radio Transceivers



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DS100546.pdf

What is it?

“The Finger” is a patent pending **Monolithic Data Radio** device encapsulating industry standard, advanced radio frequency integrated circuitry and components into complete, unified radio assemblies.

The Finger is factory precision calibrated. The Finger has the lowest possible cost since there is no additional antenna, RF cable and RF connectors to purchase.

Data Hunter Finger radios are not just RF-only devices like some competitor designs, but complete sophisticated data radios. All data radio functions are built in, including the antenna, RF power amplifier, crystal-controlled baseband processor and MAC (Media Access Controller). The sophistication extends to ARQ (automatic retries) with User-programmable retry count. The Finger will re-send the data until it is received perfectly or the Retry Attempt Counter is exhausted.

The User simply feeds in industry standard asynchronous serial data. The Finger automatically packetizes the data stream, attaches the Target address, Initiator address, packet ID, and Check Sum in a DC-balanced RF stream for maximum Target Receiver sensitivity.

Features

- **Lowest installed cost.**
- **All-in-one monolithic data radio has lowest possible cost.**
- **No additional antenna cost.**
- **No RF cabling cost.**
- **No RF connectors cost.**
- **No other costly subassemblies.**
- **Migration path of current to future developing technologies**
- **Factory precision calibrated and tested.**
- **Substantial reduction of "shadow" effect, since antenna element is located well away from Host body.**
- **Best range and performance.**
- **"Zero Volume" occupied inside your equipment.**
- **Relieves Engineers of very complex, esoteric, problematic and trouble prone "black-art" RF engineering burdens.**
- **All-weather rated.**
- **-40C to +85C (-40F to 185F) Industrial temperature range.**
- **Always the leading edge advanced RF and wireless technologies available from the Data Hunter family of devices.**

- Complete, sophisticated RF data radio with Flash-driven, crystal-controlled RF baseband and MAC microprocessor.
- FCC Certified, Class B..
- No License required. Transmits in the 900 MHz ISM (Industrial Scientific Medical) band for U.S.A. operation Connects to any asynchronous serial compatible device including direct connect to logic-level UARTs. (A voltage translator may be required to interface to higher voltage logic.) For microprocessors without a UART, the industry standard asynchronous data stream may be easily implemented in code as a software UART.
- Interface to RS-232 signals (if desired) is through logic level to RS-232 driver ICs.
- Transmits through walls.
- Up to 350 feet line-of-sight range. (Range will be less inside buildings and with obstacles and multi-path reflections.)
- Automatic Retries (ARQ) error detection and error control using automatic ACK/NAK commands allows automatic retry attempts up to the Retry Limit assigned by the User.
- 254 unique target I.D. addresses assignable by the User.
- Point-to-point paired communication targeting option.

- Multipoint-to-point optional dynamic retargeting is redirectable on-the-fly.
- 10,000 bps. *Sustained Data Rate*. (Note: Even though The Finger interface can input and output data as fast as 115 Kbps., the true data throughput rate measure is the "Sustained Data Rate" after all processing overhead is taken into account, not the input/output interface rate or the over-the-air rate.)
- "One-time setup" using Windows 95/98/00 GUI installation program. "No-time setup" is also an option, since the User can take The Finger right out of the shipping box and run it without any additional setup whatsoever.
- User can "Batch File" program The Finger with stored set up parameters for fast multiple device programming.
- OEM Users and programmers can control all setup and operating commands directly from the User device and can be altered "on the fly."
- Handshaking with hardware RTS/CTS signals or software XON/XOF commands allows flow control to prevent buffer overrun.
- Bi-directional data transfers. Data can be transmitted both directions in synthesized full-duplex, or one direction as half-duplex.
- User Programmable Receive sensitivity – High sensitivity (default) and Medium sensitivity. Default Receive Sensitivity is -95 dBm.
- Maximum legal power output of 0 dB (1.0 mW), factory calibrated.

Specifications

“The Finger” U.S.A. Specifications

Frequency Band: 902-928 MHz ISM

Standard Frequency: 916.50 MHz (USA)

Range: Up to 350 feet line-of-sight

RF Power Output: (Narrowband)

0 dB (1.0 mW) maximum legal power output limit is calibrated by the factory.

Receive Sensitivity: -95 dBm

General Specifications apply to all models

Interface: Serial, Asynchronous

Logic Level: TTL (see DC Specifications)

Connector Gender:

Female 9-pin

Addresses:

Up to 254 User assignable addresses.

Data Rate, over-the-air:

20 Kbps

Data Rate, Sustained Throughput:

10 Kbps

Serial Interface Communications:

1200 bps. to 38,400 bps.

Handshaking Options:

RTS/CTS Hardware (recommended)

XON/XOF Software

Communications Options:

Bits: 7, 8

Parity: None, Odd, Even

Stop Bits: One, Two

Error Correction/Detection:

ARQ (ACK/NAQ automatic retries).

User defined retry attempts number

Setup:

1. Factory Defaults (works right out of the box)

2. User Custom Set Up

3. Batch File User Custom Set Up

Dimensions:

3.0”L x 0.60” Body dia. x 0.25” Neck dia.

Weight: Less than 2 oz.

Power:

Current: 6 mA Typical

Operating Voltage Range:

+5.0VDC Typical

+3.3VDC Minimum

+15.0 VDC Maximum

Operating Temperature:

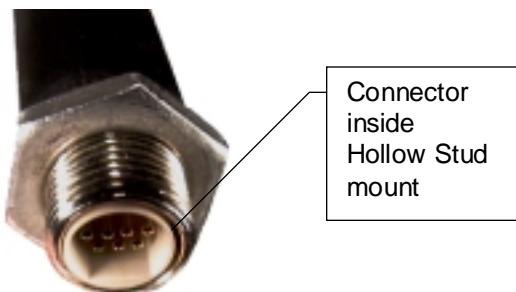
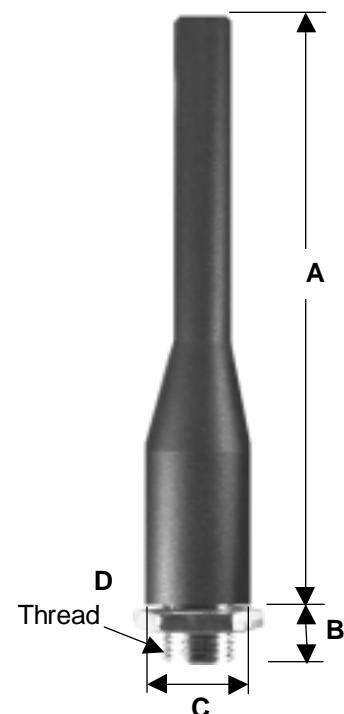
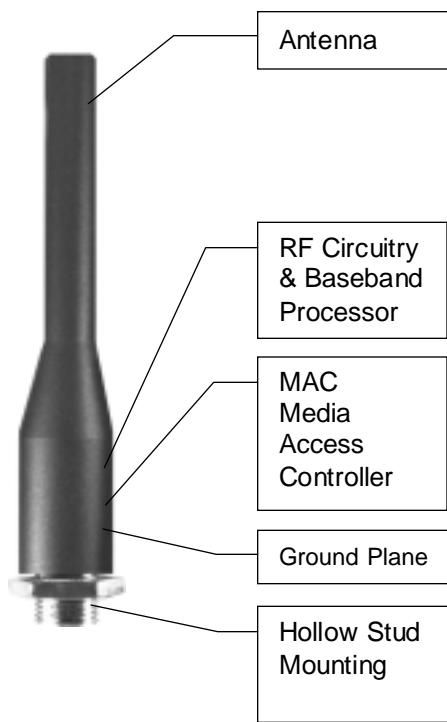
“Industrial Range”: -40C to 85C

Warranty:

One year, parts and labor, factory.

Country of Origin: United States of America

Dimensions



	Inches	
A	3.00	Typical Length
B	0.25	Typical stud Length
C	0.60	Typical Body Diameter
D Thread	3/8-32	Hollow stud diameter
Stud material: Brass, Nickel-plated Sheath Material: Geloy		

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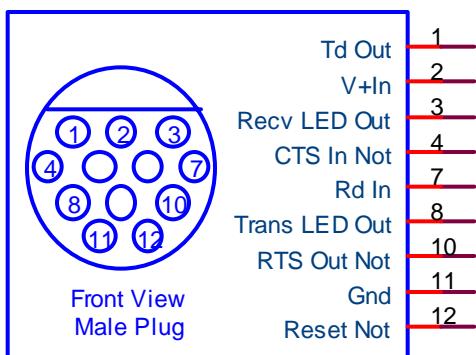

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Pin Terminal Functions

Terminal Name	Pin	I/O	Function Description
Rd In	7	I	Receive Data Input – This pin is the input to the USART Asynchronous Data input of the Data Radio. Data input to this pin will be transmitted by the data radio.
Td Out	1	O	Transmit Data Output – This pin is the output from the USART Asynchronous Data output of the Data Radio. Data output from this pin has been RF received by the Data Radio and will be sent to the Host Device at logic levels.
CTS In Not	4	I	<p>Clear To Send (active low) – This input pin is commonly attached to the RTS Not output of the Host Device. Tie this input to Ground if unused (do not allow to float.)</p> <p>1. If the Data Radio has data to send to the Host, it will assert an active low logic level on the Data Radio RTS pin to the Host device CTS input. The Host Device will respond by setting a logic low from its RTS pin attached to this input pin indicating that the Host device attached to the data Radio is ready to receive data from the TD Out pin of the Data Radio.</p> <p>2. If the Host Device has data to send to the Data Radio, it will assert an active low on its RTS pin which is connected to this Data Radio CTS pin. The Data Radio will respond by asserting the Data Radio RTS output pin active</p>
RTS Out Not	10	O	<p>Request To Send (active low) – This output pin is commonly attached to the CTS Not input of the Host Device.</p> <p>1. If the Data Radio has data do send to the Host Device, is will assert an active low logic level on its RTS output to the Host device CTS input. The Host Device will respond by setting a logic low on from its RTS own output to the CTS input pin of the Data Radio indicating that the Host device attached to the data Radio is ready to receive data from the TD Out pin of the Data Radio.</p> <p>2. If the Host Device has data to send to the Data Radio, it will assert an active low on its RTS pin which is connected to the Data Radio CTS pin. The Data Radio will respond by asserting this Data Radio RTS output pin active low which is connected to the Host Device CTS input pin. At which point the Host Device will send data to the Data Radio to be received on the RD In Data Radio pin.</p>
Recv LED Out	3	O	Receive LED Output - An active high on this pin drives an external LED and indicates the Data Radio is receive data input from some source (although the RF data activity may not be targeted for this particular data radio).
Trans LED Out	8	O	Transmit LED Output – An active high on this pin drives an external LED and indicates the Data Radio is Transmitting RF data from the data radio.
Reset Not	12	I	Reset – Reset will reset all activity to an initial power-up state. This pin is an active low.
+Vin	2	I	Vcc positive power supply input.
Gnd	11	-	Signal, Power and RF ground.
NC	5	-	No connection.
NC	6	-	No connection.
NC	9	-	No connection.



Connection Diagrams

The Finger data Radio may be connected to any device capable of sending and/or receiving serial data and handshaking commands in the industry standard serial data transfer format.

Typical serial hosting devices are:

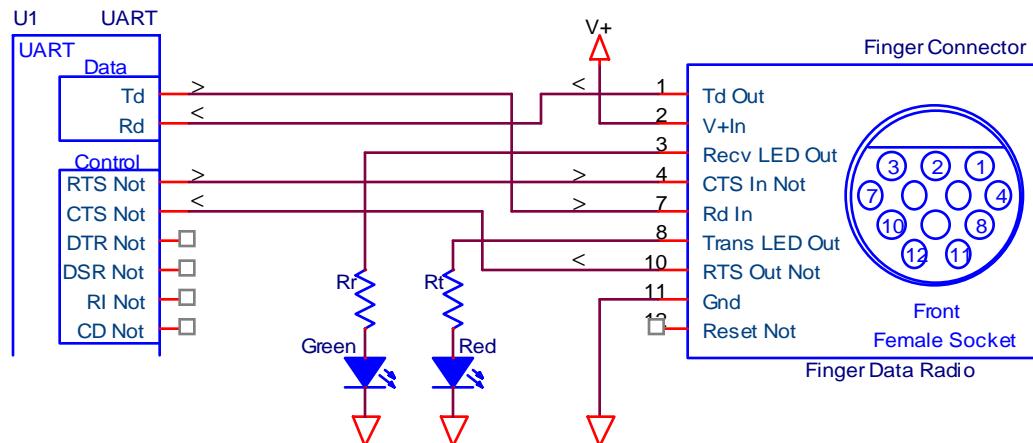
1. UART with full RTS/CTS handshaking
2. Microprocessor/microcontroller with embedded UART and port-generated RTS/CTS handshaking
3. Microprocessor/microcontroller with port-generated Td and Rd serial data and RTS/CTS handshaking
4. Remote Hosting through an interface such as RS232, RS422 and RS485.

Flow Control - It should be noted that although Hardware RTS/CTS handshaking is strongly urged as the preferred method of Flow Control, The Finger data radio is also capable of handling software XON/XOF handshaking protocol. Thus for Host Devices incapable of generating RTS/CTS hardware handshaking, the two data signals Td and Rd may suffice using XON/XOF software handshaking protocol.

LED indicator Lamps – Although the representative circuits are shown with LED “Transmit” and “Receive” lamps which aid in diagnostic and everyday operation, the User can elect to use an optional version of The Finger with LED lamps built into the body of The Finger itself, or wire the LED outputs from The Finger directly into the Host microcontroller ports for on-screen display in the Users device.

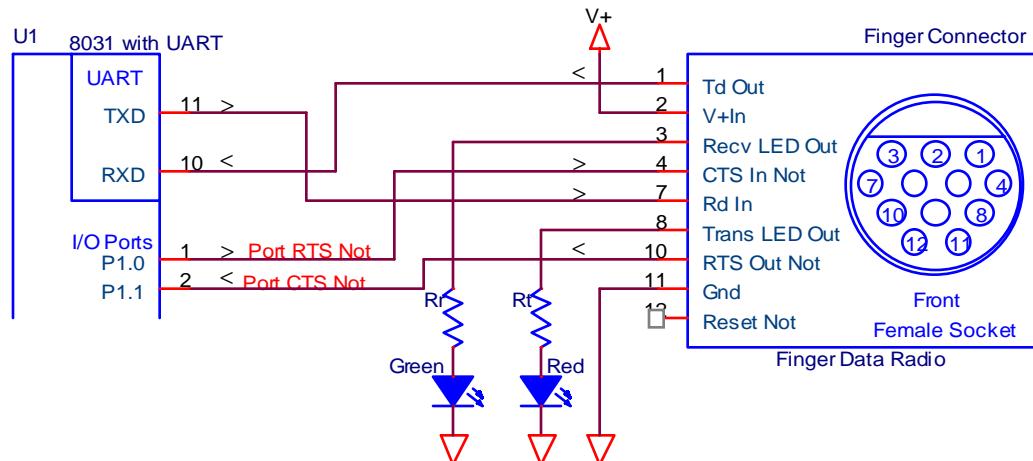
Connection to UART with Full RTS/CTS Handshaking.

Figure x.x



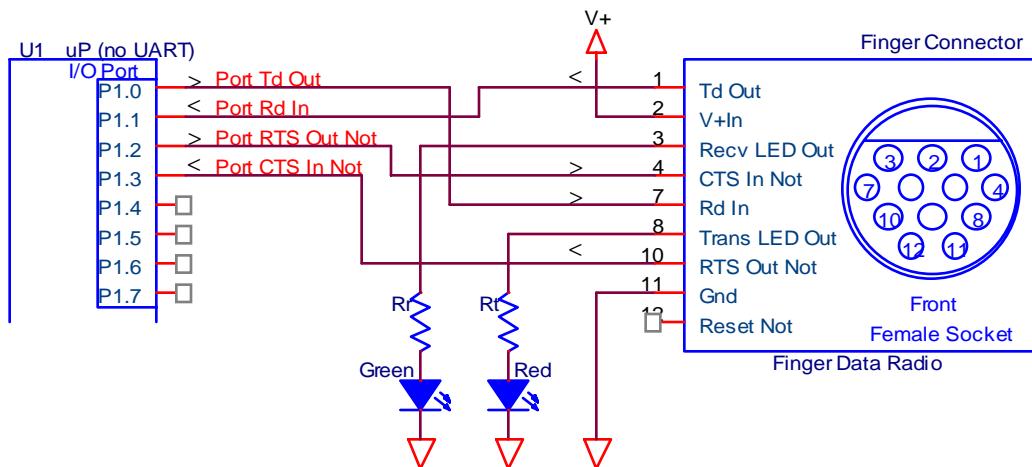
Connection to Microprocessor/Microcontroller with embedded UART and port-generated RTS/CTS handshaking.

Figure x.x

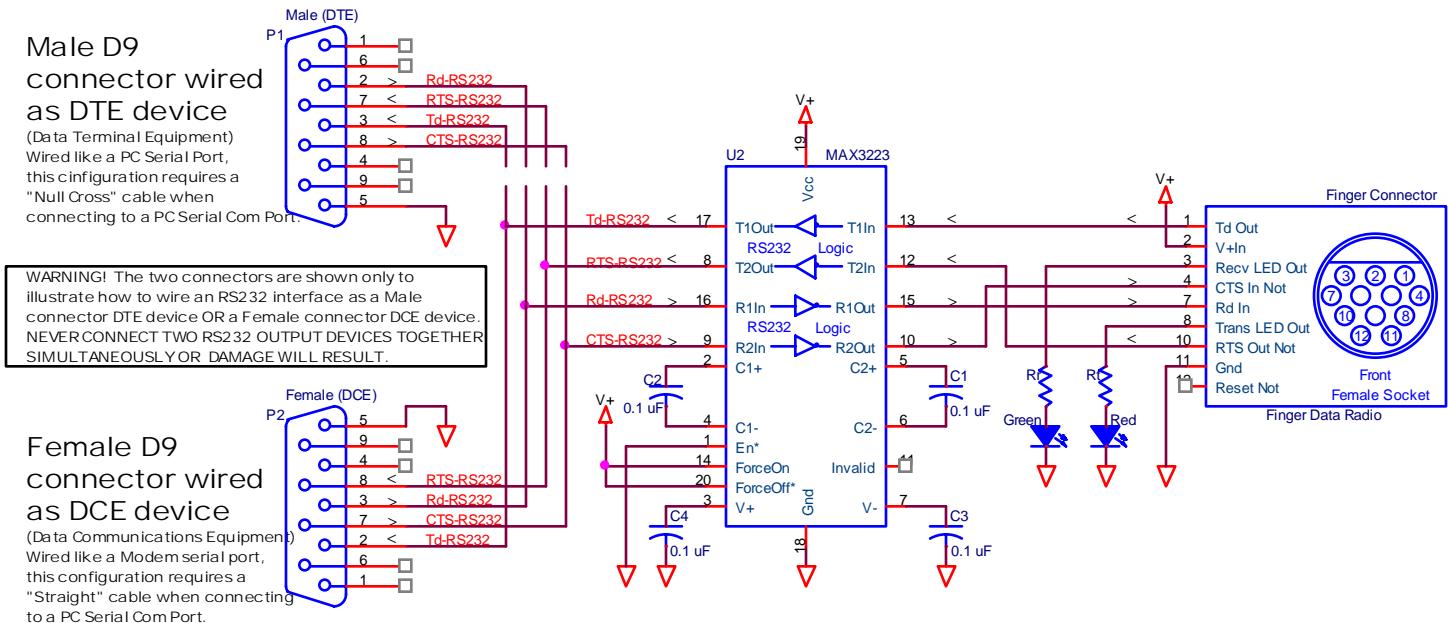


Connection to Microprocessor/Microcontroller with port-generated Td and Rd serial data and RTS/CTS handshaking.

Figure x.x



Remote Hosting through an Interface such as RS232 (or RS422 and RS485).

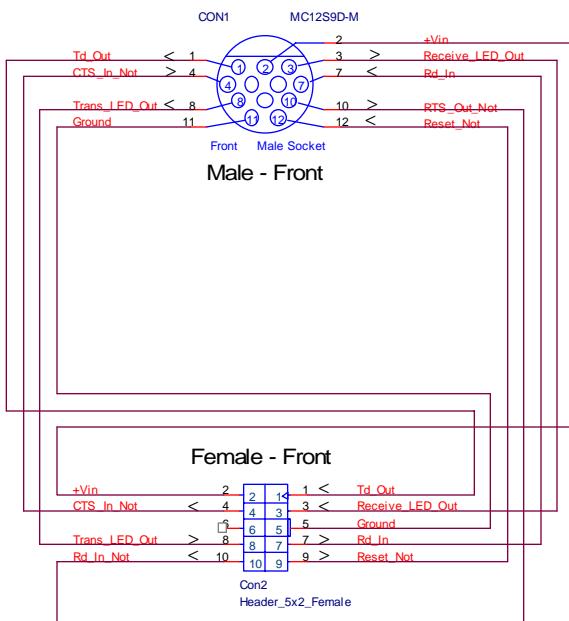


Cable Wiring

Data Hunter offers a standard interface cable for use with the Developers Kit and for OEM production. However, the 2x5 female connector on the Users side of the cable assembly may be too large or the OEM may desire a different connector configuration for the OEMs' Host Device. Although Data Hunter attempts to pass on the benefits of its large quantity buying power and make these standard cables available cost effectively, the OEM customer may find it more cost effective on specialized cable assemblies to fabricate cables through The connector manufacturer or third party sources.

Omnetics is the manufacturer of the miniature circular connector which interfaces directly to The Finger data radio (see Omnetics contact information below). Omnetics can manufacture a custom cable which has the OEMs' choice of connector on the Host side. Alternately Omnetics can supply cables with an un-terminated wire pigtail bundle using the OEMs' specified wire length, which the OEM can then make into a custom cable assembly or have assembled by a third-party cable assembler.

Schematic of "Standard" Cable Assembly



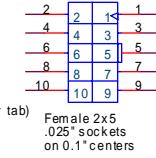
Wiring Table of "Standard" Cable Assembly

Omnetics Male Circular Connector to Data Radio



Basic "Standard" and Developer Kit Rectangular 2x5 Connector to Host

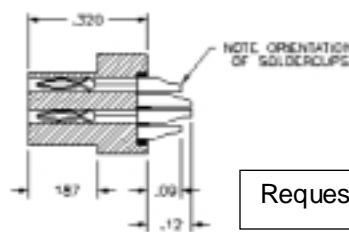
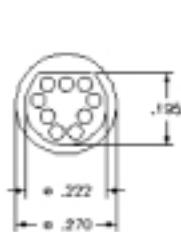
1	Td_Out	>	1
2	+Vin	>	2
3	Receive_LED_Out	>	3
4	CTS_In_Net	<	4
5	No Connect		
6	No Connect		
7	Rd_In	<	7
8	Trans_LED_Out	>	8
9	No Connect		
10	RTS_Out_Net	>	10
11	Ground		5 (Key tab)
12	Reset_Net	<	9
			No Connect 6



(Photo of cable assy to be added)

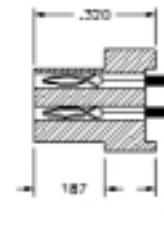
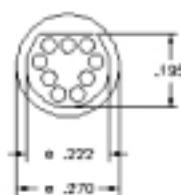
Contact Information for Omnetics Connector Corporation, Sales Dept., 7260 Commerce Circle East Minneapolis, MN 55432 USA
 Tel: 800/343-0025 Fax: 763/572-3925 email: omnetics@isd.net Web Site: www.omnetics.com

**Omnetics
9-PIN MALE
CIRCULAR CONNECTOR
w/SOLDERCUPS
DWG NO. A11099**
 Loose connector for OEM or 3rd party cable assembly.



Request Omnetics Dwg. No. **A11099**

**Omnetics
9-PIN MALE
CIRCULAR CONNECTOR
2 inch wire pigtail A11101-001
18 inch wire pigtail A11101-002**
 Loose connector with wire pigtails for OEM or 3rd party cable assembly.



Request Omnetics Dwg. No. **A11101-001**
 Request Omnetics Dwg. No. **A11101-002**

Electrical Characteristics

Characteristic	Sy m	Note s	Min	Typ	Max	Units
Current – with NO external LEDs						
Current – Receive Mode – no RF activity – no external LED				6		mA
Current – Receive Mode – RF activity – no external LED				7		mA
Current – Transmit Mode – as Initiator – no external LED				7		mA
Current – Transmit Mode – as Target (ACK back) – no external LED				6		mA
Current – with external LEDs						
Current – Receive Mode – no RF activity – with external LED	1		6			mA
Current – Receive Mode – RF activity – with external LED	1		11			mA
Current – Transmit Mode – as Initiator – with external LED	1		11			mA
Current – Transmit Mode – as Target (ACK back) - with external LED	1		10			mA
Voltage						
Operating Voltage			+3.5	+5	+15	Vdc
Operating Voltage – Low voltage exceptions			+3.0			Vdc
Operating Voltage – Internal from built-in LDO regulator			+3.3			Vdc
Brown-out detector voltage threshold - Internal			+2.8			Vdc
External Voltage when internal brown-out detector threshold			tbd			Vdc
RF Characteristics						
Operating Frequency			916.30	916.50	916.70	MHz
Modulation Type :Keyed Carrier						
Transmitter Power Output (Factory calibrated for Maximum U.S.A. Legal Power)			0	1.0		mW
Data Rates						
Over-the-Air RF Data Rate			20			kbps
UART Serial Input/Output			1.2	38.4		kbps
True Usable Extracted Data Rate (when all overhead characters and delays are subtracted, including AGC stabilization characters, Packet To/From/ID/Checksum characters, Interpacket ACK/NAK wait, etc.)			7.5	8.0		kbps
Event Timing						
Time from end of first character UART entry to RF Start-of-Transmission				Tbd		
Time between RF packets to all for ACK/NAK from the Target				Tbd		
Time from Initial Power-up to RF Start-of-Transmission				Tbd		
Time from Forced Reset to RF Start-of-Transmission				Tbd		
All specifications subject to change without notice.						

Operating Ambient Temperature

Tel: 714-892-5461 www.datahunter.com

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FCC Notice and Legal Considerations

The Finger Data Radio Transceiver Component Module has been previously tested and received certification as a modular product from the FCC. No further testing of the Data Radio Transceiver Module is necessary.

The pre-certified status of the module is valid only if all of the following are observed:

- No modifications to the Finger Data Radio Module may be made.

• The Finger Data Radio Module which has been certified for FCC compliance has the antenna encapsulated within the molded body of the Finger Data Radio and must not be altered in any way.

• **The pre-certified status applies only to the Finger Data Radio RF Module. The OEM must determine if additional certification or testing is required for their own circuitry or peripheral circuitry.**

• When the Finger Data Radio Module is installed upon or inside another device, then that device must display an external label referring to the attached Data Radio Module. The exterior label should appear as follows:

**This device contains a previously certified
RF Transceiver module FCC ID: NJG-F916**

The OEM's product instruction manual must display the following statement:

INSTRUCTION TO THE USER

This equipment contains an RF module which has been previously 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.

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to FCC Rules. In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

Declaration of Conformity

Responsible Party Name: Data Hunter – David Culp
Address: 5132 Bolsa Avenue, Unit 102, Huntington Beach CA 92649 USA
Phone /Fax: T 714-892-5461, F 714-892-9768

Hereby declares that the product
Product Name: "The Finger"
Model Number: F916NB

Conforms to the following specifications:
FCC Part 15, Subpart B.

Supplementary information:

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.

Representative Person's Name: David Culp

Signature _____

Date: _____