Type Acceptance Test Report

VHF Data Transmit Module

FCC ID: B2FTALON-V

FCC Rule Part: 90

ACS Report Number: 03-0101-90TA

Manufacturer: Kantronics
Model: Talon UDC

Installation and Operators Guide

KANTRONICS

TALON SERIES

RADIO MODEM MANUAL

Kantronics Co., Inc.
1202 E. 23rd Street, Suite A
Lawrence, Kansas 66046
http://www.kantronics.com

DWG ID: 151-XXXX-00
Date: 2003-05-16

1 REVISIONS

Revision	Date	Description
-	2002-10-22	Initial release.

2 TABLE OF CONTENTS

3 GENERAL INFORMATION

3.1 Contact Information

Kantronics
1202 E. 23rd Street, Suite A
Lawrence, Kansas 66046

3.2 Sales/Inquiries

Phone: 785-842-7745 (8 AM to 5 PM, Central Time, Monday through Friday)
Fax: 785-842-2031
E-mail: sales@kantronics.com
Web site: www.kantronics.com

3.3 Technical Support

Phone: 785-842-4476 (8 AM to 12 noon and 1 PM to 5 PM, Central Time, Monday through Friday)
Fax: 785-842-2031
E-mail: service@kantronics.com

3.4 Miscellaneous

The Kantronics TALON Series of radio modems is manufactured in the U.S.A.

All brands and product names are trademarks of their respective companies.

3.5 Disclaimer Notice

We have attempted to make this manual technically and typographically correct as of the date of the current issue. Production changes to the TALON Series may add changes to the manual at a later date.

Send comments or suggest corrections to Kantronics Co., Inc., 1202 E. 23rd Street, Suite A, Lawrence, KS 66046, or e-mail sales@kantronics.com.

Information in this document is subject to change without notice.

Published in the United States of America.

3.6 Kantronics Warranty Registration

Please take the time to fill out a copy of the warranty registration form and mail it to Kantronics, including a copy of your sales receipt, to register your purchase. Kantronics must receive warranty registration within 60 days of purchase of the Kantronics TALON Series of radio modems to be valid. Both must be on file at Kantronics in order for you to receive warranty service. Refer to the warranty policy in this manual for further information.

Mail form and sales receipt to:

Kantronics
1202 E 23rd Street, Suite A
Lawrence, KS 66046

Warranty Registration

Entity Name: _____

Address: _____

City: _____

State: _____ Zip/Postal Code: _____

Country: _____

Contact Person's Name: _____

Telephone Nr: _____

E-mail: _____

Product: <u>TALON series</u>

TALON UDC UHF ☐ or TALON UDC VHF ☐

Part Number:

001-0009-01 ☐	001-0009-11 ☐
001-0009-02 ☐	001-0009-12 ☐
001-0009-03 ☐	001-0009-13 ☐
001-0009-04 ☐	001-0009-14 ☐

Serial Nr: _____

Date of Purchase: _____

Dealer: _____

3.7 Important Information

READ THIS PAGE BEFORE INSTALLING THIS KANTRONICS PRODUCT

This product contains SOFTWARE on Programmable Memory (ROM) and/or diskette, which is protected by both United States copyright law and international treaty provisions.

If you install or use this product, you are bound by the terms of the SOFTWARE license shown below. If you do not wish to be bound by such license, return the (unused) complete product package to your supplier for refund. The supplier may deduct restocking/re-packaging costs.

3.8 License Agreement

3.8.1 License

In consideration of payment of the License Fee, which is included in the price of the product, the Licensor Kantronics Company, Inc. (Kantronics) grants (you) a non-exclusive right to use the SOFTWARE and associated documentation. No ownership rights to the SOFTWARE or its Documentation are transferred from Kantronics to you.

3.8.2 Term

This License Agreement is effective until terminated. You may terminate this Agreement by destroying the PROM or diskette and documentation. You may not rent or lease the SOFTWARE, but you may transfer the SOFTWARE and accompanying written materials on a permanent basis provided you retain no copies and the recipient agrees to the terms of this Agreement. Kantronics may terminate this Agreement without notice if you violate any terms or conditions of the agreement. In the event of termination of the Agreement, provisions relating to Kantronics' disclaimers of warranties, limitation of liability, remedies, or damages and Kantronics' proprietary rights shall survive.

3.8.3 Object Code

The SOFTWARE is delivered in object code only. You shall not reverse compile or otherwise reverse engineer the SOFTWARE.

3.8.4 Limited Warranty

This product is covered by the standard Kantronics Company, Inc. Limited Warranty, which is enclosed.

3.8.5 General

This License Agreement constitutes the complete Agreement between you and Kantronics. The SOFTWARE and/or Documentation may not be exported or re-exported in violation of any export laws or regulations of the United States of America or any other applicable jurisdiction. This Agreement shall be governed by and interpreted under the laws of the State of Kansas, United States of America. Use, duplication, or disclosure by the Government of the United States is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer SOFTWARE clause of DFARS 252.227-7013. Kantronics may in its sole discretion, provide you with upgrades of the SOFTWARE and/or Documentation if you have provided Kantronics your completed Warranty registration with a copy of your receipt showing the amount you paid.

3.8.6 Other

LICENSEE ACKNOWLEDGES HAVING READ AND UNDERSTOOD THIS AGREEMENT AND AGREES TO BE BOUND BY ITS TERMS. LICENSEE

FURTHER AGREES THAT THIS AGREEMENT IS THE COMPLETE AND EXCLUSIVE STATEMENT OF THE AGREEMENT BETWEEN LICENSEE AND LICENSOR AND SUPERSEDES ANY PROPOSAL OR PRIOR AGREEMENT, ORAL OR WRITTEN, AND ANY OTHER COMMUNICATIONS RELATING TO THE SUBJECT MATTER OF THIS AGREEMENT.

3.9 Limited Warranty

KANTRONICS COMPANY, INC.
Effective 2001-11-01

To receive notice of future updates, or free copy of this manual, please go to http://www.kantronics.com.

NOTE: Return of the Warranty Registration card and proof of purchase is a pre-condition to warranty coverage.

3.9.1 WARRANTY

Kantronics Co., Inc. ("Kantronics") warrants to the first consumer purchaser ("you"), for the Applicable Warranty Period (as described below), that the Applicable Product (as described below) will be free from defects in material and workmanship.

3.9.2 REMEDY

Kantronics agrees that, for any Applicable Product found by Kantronics to be in violation of the warranty of Section 1 hereof within the Applicable Warranty Period, it will, at its option, repair or replace the defective Applicable Product at no charge to you, excluding in-bound shipping charges.

3.9.3 EXCLUSIVE REMEDY

Repair or replacement of the Applicable Product, as provided herein, is the sole remedy available to you against Kantronics, and in no event will Kantronics be responsible for any other liability or damages or for incidental, special, or consequential damages, regardless of whether purported liability is predicated upon negligence, strict tort, contract, or other products liability theory and whether or not Kantronics is warned about the possibility of such liability or damages. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

3.9.4 DISCLAIMER

This Limited Warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for Kantronics any other liability in connection with the sale of its products. KANTRONICS SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTY OF MERCHANTABILITY AND IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE FOR ANY APPLICABLE PRODUCT. IF, HOWEVER, YOU ARE A CONSUMER WITHIN THE MEANING OF 15 U.S.C. 2301(3), THE ABOVE DISCLAIMER OF IMPLIED WARRANTIES IS EFFECTIVE ONLY FOR PERIODS OUTSIDE THE APPLICABLE WARRANTY PERIOD. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

3.9.5 APPLICABLE PRODUCTS AND PERIODS

Kantronics products are of two types: (1) hardware units and (2) firmware and software for operation of these units, whether incorporated into the units themselves or separate from the units as adjuncts or accessories to the units. Hardware units and the media containing firmware, software and documentation are sold to the consumer purchaser and

become property of the purchaser. Firmware and software are licensed for use by the consumer purchaser in return for a fee included in the purchase price of the units and do not become the property of the consumer. (See separate License Agreement provided with these products). The product to which this warranty of Section 1 hereof applies (herein "Applicable Products") and the period during which the warranty shall apply (herein, "Applicable Warranty Period") are as follows:

Applicable Warranty Period: One (1) year from date of purchase.

3.9.6 EXCLUSIONS

This Limited Warranty does not apply to the cosmetic appearance of the Applicable Product; to broken or cracked cabinets; to any accessory not supplied by Kantronics which is used with the Applicable Product; to any product that has been subject to misuse, abuse, or over-voltage; to any product that has been modified by non-Kantronics personnel unless specifically authorized in writing by Kantronics; or to any product damaged or impaired by shipping (whether or not caused by poor packaging), neglect, accident, wiring not installed by Kantronics, improper parameter settings which are cleared by performing a hard reset, or use in violation of instructions furnished by Kantronics or of generally accepted industry practice. Kantronics does not warrant that the functions contained in any software will meet your requirements or achieve your intended results; or that operation of any software will be uninterrupted or error-free or without effect upon other software used with it. Responsibility for the selection of the hardware and software program to achieve your intended results rests with you.

3.9.7 REMEDY PROCEDURE

Should you need to make a warranty claim, first contact the dealer from whom you purchased the product. If the dealer is unable to assist you, contact Kantronics Co., Inc., by mail at 1202 East 23rd Street, Lawrence, Kansas 66046 USA; by fax at 785-842-2031; or by phone at our Customer Support number 785-842-4476 (Hours: 8 AM to 12 noon and 1 PM to 5 PM, Central Time). Contact us prior to returning an Applicable Product to receive a Return Authorization Number. (As a practical matter, problems can often be solved in such a manner without the product having to be returned to Kantronics for repair or replacement.) Return of any Applicable Product for the enforcement of rights under this Limited Warranty shall be at your expense. Any product returned for warranty service, which Kantronics determines to be without defect or not covered by this Limited Warranty, shall be subject to a minimum labor charge and the product will be returned to you at your sole expense. Please note, no warranty service will be provided until Kantronics has been furnished with your Warranty Registration card and copy of proof of purchase establishing purchase date.

3.9.8 NON-ASSIGNMENT

This Limited Warranty is not assignable by you. Any attempt to assign or transfer any of the rights, duties, or obligations hereof is void.

3.9.9 OTHER RIGHTS

This Limited Warranty gives you specific legal rights and you may also have other rights, which vary from jurisdiction to jurisdiction.

3.10 Return/Repair Procedures

Important: Our repair statistics show that a large percentage of units returned for service, do not, in fact, require any service. Therefore, we advise you to please double-check the following list of common, user-solvable, sources of difficulty before contacting Kantronics about returning your unit for service. An RMA (Return Merchandise Authorization) number must be requested and received, and included with the unit returned for repair. If a unit is received without an RMA number, the shipment will be denied.

3.10.1 Check-List for Possible Problems

If encountering difficulty in getting this equipment to "talk" to your computer, please perform at least the following limited checks before calling or writing:

- Carefully check the wiring connections between the computer serial (RS232) port, and the TALON Series unit.
- If the cables were purchased from a third-party source, double-check to be sure that they conform to the wiring instructions in this manual.
- Verify the serial baud rate setting in the terminal program.
- It may be useful to perform a "Hard Reset". (See Hard Reset section.)

If service or repairs still appear necessary after checking the items listed above, it may be wise to call, fax, email, or write Kantronics to determine if the problem can be solved without returning the unit.

The Kantronics web page also includes a FAQ section, with a list of common problems and solutions.

3.10.2 Return Procedures

When calling the service department, have the following information available:

- The unit name and serial number (the serial number is found on the bottom of the unit)
- The firmware version number (the version number is displayed in response to the VERSION command)
- The steps that have been taken to determine that the problem is with the TALON Series unit

3.10.3 Service department contact information:

Kantronics Co., Inc.
1202 E. 23rd Street
Lawrence, KS 66046

The Service Department telephone hours are 8 AM to 12 noon and 1 PM to 5 PM Central Time, Monday through Friday. Telephone access to the service department is not available outside the stated hours.

Phone:	785-842-4476 (8 AM to 12 noon and 1 PM to 5 PM, central time)
Fax:	785-842-2031
E-mail address:	service@kantronics.com
Web site:	http://www.kantronics.com

When writing, faxing, or sending email to Kantronics, include a clear description of the problem, unit name, firmware version, computer type, communication software used and if possible, a list of current parameter settings in the unit (as shown in response to a DISPLAY command).

Be sure to include a return fax number, mailing address, and/or email address.

Returns direct to the factory for refund or exchange, are strictly regulated. The sales department must approve any return for refund or exchange.

If the unit was recently purchased from one of our authorized dealers, contact that dealer first.

3.11 Repair Service Charges

Consult the limited warranty policy in this manual for the service provisions offered by Kantronics at no charge. This warranty is considered to be in force only when the customer has submitted a completed warranty registration within ten days (10 d) of purchase, and when the stipulations of the warranty have been met.

Violations of warranty clauses will automatically void the warranty, and cost of service or repairs will be charged to the owner. Service outside the warranty period will be charged at the cost of parts, labor, and return shipping, at the time of the repair or service. Units sent in for service or repair, without prior Return Authorization, will be subject to the minimum charge for labor plus cost of return shipping and handling.

Repair or DAMAGE to a unit, whether accidental or otherwise, is not covered by any warranty provided by Kantronics, in which case, normal repair charges will apply.

Contact the Service Department at 785-842-4476 (hours: 8 AM to 12 noon and 1 PM to 5 PM Central Time) to obtain a Return Authorization number. Repaired units will be returned via UPS (or Fed-EX) C.O.D., if other payment arrangements have not already been arranged. C.O.D. charges can be avoided by providing payment information (VISA, MasterCard, or Discover) either at the time of the return authorization request, or included with the unit, when it is sent to be repaired.

3.12 International Returns

This section applies to international returns only, not to domestic returns.

In case of unit problems, first contact the dealer from whom the product was purchased. If a Kantronics product must be returned, please observe the steps outlined below. This will prevent unnecessary difficulties and expense for both the shipper and Kantronics.

All returns must be shipped to the factory at 1202 East 23rd Street, Suite A, Lawrence, KS 66046 U.S.A.

The shipper must pay all expenses of returning items to Kantronics. This includes any duty/entry fees, whether the return is for warranty or non-warranty repair. Usually, the best way to return items to us is by mail. However, if using a courier service such as DHL, UPS Expedited, Federal Express, etc., be sure to use DOOR-TO-DOOR service. When using one of these services, a commercial invoice may be required. Please check with the carrier before shipping.

Include in the description of the items on the paperwork (whether postal or courier) the words: "U.S. GOODS RETURNED FOR REPAIR/REPLACEMENT." An additional description of "Data communications equipment", would be helpful. It would also be helpful (but not required) to include the code number 9801.00.1035 which tells U.S. Customs agents that the package contains "U.S. goods returned without improvement/enhancement". However, if the words "U.S. goods returned for repair/replacement" are on the paperwork, the number is not really necessary.

Provide a value for customs purposes. This is usually the value of the item(s) in their current condition. A $0 value is not acceptable for U.S. Customs.

Inside the package, with the item(s), include:

- A fax number, daytime telephone number, mailing address, and/or e-mail address if available, in case we need to contact you

- A correct and full shipping address for return

- Method of payment to be used for any charges (if VISA, MasterCard, or Discover, include expiration date)

- A brief description of the problem

- A reference to any conversations with the technical/sales staff about the problem

- Return Authorization number

For warranty repairs, we will pay the shipping charges to return the item(s) via air parcel post. If you wish return by courier service, include your account number. To be eligible for repair under warranty, we must have a record that you sent your Warranty Registration card and proof of purchase to Kantronics, and the item(s) must still be within the applicable warranty period at the time the return is authorized.

For non-warranty repairs, you must pay the return shipping charges, in addition to applicable repair charges.

4 APPROVALS AND COMPLIANCE

4.1 RF Exposure

The FCC, with its action in General Docket 79-144 of 1985-03-13 adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment.

In accordance with FCC RF human exposure requirements, the Talon UDC device shall be installed such that 0.6 m (2 feet) of separation distance is maintained from the user or general population and the RF transmitting antenna.

4.2 General Safety of Operation

Please observe the following safety precautions.

- DO NOT operate radio equipment near electrical blasting caps.

- DO NOT operate radio equipment in an explosive atmosphere.

- DO NOT operate any radio transmitter unless all RF connectors are secure, and any open connectors are properly terminated.

- DO NOT operate the transmitter of a fixed radio (base station, microwave, rural telephone RF equipment) or marine radio when someone is with 0.6 m (two feet) of the antenna.

- ONLY authorized personnel should perform repair of Kantronics Talon products.

4.3 Information to the User

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

4.4 FCC Notice

It is the responsibility of the user of this equipment to obtain the proper FCC license to operate this product on the desired channel of operation.
This product complies with part 15 of the FCC rules and regulations. It may not be modified without the expressed consent of Kantronics. Modification of this product could void the user's authorization to use the product.

The user is cautioned that any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The user is also cautioned that any peripheral device installed with this equipment must be connected with a high-quality shielded cable to insure compliance with FCC limits.

Note: The shield of the cable, whether foil, braid, braid over foil, or double braid, must be properly terminated (connected) 360° to the connector. This is usually accomplished by the use of a metal or metalized plastic back shell, but may be implemented by direct contact, including soldering, with metal portion of connector. Experience has indicated that cable assemblies (with connectors) advertised as "shielded" are not necessarily terminated properly, if terminated at all. Check cable construction to be sure.

4.5 Industry Canada Notice

This Class A digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. 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.

Cet appareillage numérique de la classe A répond à toutes les exigences de l'interférence canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes:
(1) ce dispositif peut ne pas causer l'interférence nocive, et
(2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

5 PRODUCT INFORMATION

The TALON series of radio modems are wireless modems using four-level frequency shift keying (4-LFSK) modulation to meet compliance with FCC and other regulations for high-speed data.

5.1 Model Identification

Model	FCC ID	Option	Kantronics P/N
TALON UDC UHF	B2FTALON-U	Without GPS	001-0009-01
TALON UDC UHF	B2FTALON-U	With GPS	001-0009-02
TALON UDC VHF	B2FTALON-V	Without GPS	001-0009-11
TALON UDC VHF	B2FTALON-V	With GPS	001-0009-12

Model	Kantronics P/N	Frequency Range	Baud Rate/Data Rate
TALON UDC UHF	001-0009-01	450 – 470 MHz	4800 baud/9600 bps
TALON UDC UHF	001-0009-02	450 – 470 MHz	4800 baud/9600 bps
TALON UDC VHF	001-0009-11	148 – 174 MHz	4800 baud/9600 bps
TALON UDC VHF	001-0009-12	148 – 174 MHz	4800 baud/9600 bps

5.2 FCC Regulations

5.2.1 Licensing

The FCC requires the radio owner to obtain a station license for the radio before using the equipment to transmit, but does not require an operating license or permit. The station licensee is responsible for proper operation and maintenance of his radio equipment, and for ensuring transmitter power, frequency, and deviation are within limits specified by the

station license. This includes checking transmitter frequency and deviation periodically using appropriate methods.

5.2.2 Type Acceptance

When aligned in accordance with the procedures provided, for proper bandwidth, the TALON Series is type-accepted for transmission of data and text.

6 SPECIFICATION OF PRODUCT

6.1 TALON UDC UHF

6.1.1 General

FCC Identifier	B2F
FCC Rule Part	90
Frequency Range	450 – 470 MHz
Number of channels	1 RX and 1 TX
Transmit/Receive Spacing	20 MHz maximum
Mode of Operation	Simplex or Half Duplex
Frequency Control	PLL Synthesizer
Frequency Step Size	5 or 6.25 kHz
Emissions Bandwidth	
Frequency Stability (-30 to +60 °C)	1.5 PPM
Supply Voltage	8 to 15 V dc (< 50 mV rms. noise)
Supply Current	RX: ????? TX: ????? w/GPS???????
RF I/O Connector	N(f)
Power Connector	COMBICON 2-pin
Programming/Data Interface	9-terminal D-subminiature female
Sensor Interfaces?	
Operating Temperature	-30 to +60 °C
Humidity	90 % maximum non-condensing
GPS Receiver (if installed)	?
Dimensions w/o Protrusions	H x W x D
Weight/Mass	?

6.1.2 Transmitter

Operating Bandwidth	20 MHz
RF Output Power	S/W adjustable up to 6 W
Duty Cycle	5 to 100 % depending upon supply voltage, power level, and ambient temperature
RF Z_{load}	50 Ω
Attack time	15 ms maximum
Spurious and Harmonics	-20 dBm maximum
Group Delay Variation (w/in Frequency Response)??	5 μs maximum
Current Drain	2.4 A + ? ?????

6.1.3 Receiver

Operating Bandwidth	20 MHz
Sensitivity	-115 dBm? (for 1 x 10^{-9} BER)??
RF Zin	50 Ω
Adjacent Channel Selectivity	60 dB minimum
Spurious and Image Rejection	70 dB minimum
Intermodulation Rejection	70 dB minimum
FM Hum and Noise (per TIA/EIA 603)???	40 dB minimum ?????

Conducted Spurious	-57 dBm maximum
Receive Attack Time (TX to RX)	15 ms maximum??????
RSSI Squelch Attack Time??????	5 ms maximum
Audio Distortion (per TIA/EIA 603)????	5 % maximum?????
Group Delay Variation (w/in Frequency Response)	20 μs maximum
Current Drain	75 mA maximum

6.2 TALON UDC VHF

6.2.1 General

FCC Identifier	B2F
FCC Rule Parts	90
Frequency Range	148 – 174 MHz
Number of channels	2 (1 RX and 1 TX)
Transmit/Receive Spacing	26 MHz maximum
Mode of Operation	Simplex or Half Duplex
Frequency Control	PLL Synthesizer
Frequency Step Size	2.5 kHz
Emissions Bandwidth	
Frequency Stability (-30 to +60 °C)	1.5 PPM
Supply Voltage	8 to 15 V dc
Supply Current	RX: ????? TX: ????? w/GPS???????
RF I/O Connector	N(f)
Power Connector	COMBICON 2-pin
Programming/Data Interface	9-terminal D-subminiature female
Sensor Interfaces?	
Operating Temperature	-30 to +60 °C
Humidity	90 % maximum non-condensing
GPS Receiver (if installed)	
Dimensions w/o Protrusions	H x W x D
Mass (Weight)	

6.2.2 Transmitter

Operating Bandwidth	26 MHz
RF Output Power	S/W adjustable up to 6 W
Duty Cycle	5 to 100 % depending upon voltage, power level, and ambient temperature
RF Z_{load}	50 Ω
Attack time	15 ms maximum
Spurious and Harmonics	-20 dBm maximum
Group Delay Variation (w/in Frequency Response)	5 μs maximum
Current Drain	2.4 A maximum

6.2.3 Receiver

Operating Bandwidth	26 MHz
Sensitivity	-115 dBm? (for 1 x 10^{-9} BER)?????
RF Zin	50 Ω
Adjacent Channel Selectivity	60 dB minimum
Spurious and Image Rejection	70 dB minimum
Intermodulation Rejection	70 dB minimum
FM Hum and Noise (per TIA/EIA 603)???	40 dB minimum ?????
Conducted Spurious	-57 dBm maximum
Receive Attack Time (TX to RX)	15 ms maximum??????

RSSI Squelch Attack Time??????	5 ms maximum
Audio Distortion (per TIA/EIA 603)????	5 % maximum?????
Group Delay Variation (w/in Frequency Response)	20 µs maximum
Current Drain	75 mA maximum

7 CONNECTOR PINOUTS

7.1 ANT Connector (A1J1)

N female. Mate with N male.

7.2 Dc Power Connector (A2J6)

Two-pin COMBICON. Mate with two-socket COMBICON, P1, provided.

Terminal Nr	Physical Position	Description
1	Left terminal	+ dc voltage
2	Right terminal	GND (dc return)

7.3 Serial I/O Connector (A2J9)

D-sub 9 female. Mate with D-sub 9 male.

Terminal Nr	Description
1	DCD
2	RXD
3	TXD
4	DTR
5	Digital GND
6	DSR
7	RTS
8	CTS
9	RI

7.4 GPS Receiver Connector (A2W1J1)

MPX female. Mate with MPX male.

8 INSTALLATION

Refer all installation to qualified personnel.

8.1 Dc Power

Make a power cable assembly using the supplied two-terminal connector, P1, some wire of sufficient size and length, and mating connection to your dc power source.

A two-terminal jack, A2J6, is located on the front panel for dc power input. The unit is protected from reverse voltage application with a diode, A2D1, and from over current with an automatic resetting solid state current limiting device, A2RT1. Equipment power must be supplied by a well-regulated dc power supply capable of the required voltage and current. For vehicle applications an external filter to reduce ignition noise transients and a method to absorb load dump conditions is recommended. After-market dc noise filters are available from automotive electronics supply companies.

The dc power connector, A2J6, is located on the front panel to the far, left side. Pinout is as follows. Be sure you wire to the correct terminal on the mating connector; plug P1 into A2J6 to make sure.

Terminal Nr	Physical Position	Description
1	Left terminal	+ dc voltage
2	Right terminal	GND (dc return)

The COMBICON type connector, P1, has straight slot small screwdriver tightening clamp attachment for the wires. The unit has reverse polarity protection and the wires can be easily swapped if needed.

The dc power requirement is 8.5 to 15 V dc at less than 3 A. Current demand is larger for the higher RF power settings. It is suggested to use 18 AWG.

8.2 GPS Antenna

If your unit has a GPS receiver, the GPS antenna transmission line connector, E1P1, is attached to the GPS connector, A2W1J1 that is on the front panel to the lower, far right side.

8.3 Serial I/O

The Serial I/O connector, A2J9, near the center of the front panel, is for RS232 communications, normally with a PC. Be sure to use a shielded cable that is properly terminated. See note in § 3.3 FCC Notice concerning shielded cables. The radio modem is considered a DTE unit. Use a straight through RS232 cable and not a null modem cable.

8.4 Antenna

The ANT connector, A1J1, located in the middle lower portion of the front panel, is an N (female) type for attachment of your transmission line that connects to your antenna.

The antenna shall not be connected to the radio modem directly, as the RF field could induce EMI in the unit. Depending on type of antenna, omnidirectional or directional, route the transmission line away from the unit an adequate distance.

In accordance with FCC RF human exposure requirements, the antenna must be mounted such that 0.6 m (2 feet) of separation distance is maintained from the user or general population and the RF transmitting antenna.

9 THEORY OF OPERATION

The TALON UDC units are radio modems utilizing four-level frequency shift keying (4-LFSK) modulation. The assemblies and subassemblies of the unit consist of:

A1–Radio transceiver (XCVR) circuit card assembly (CCA), UHF or VHF frequencies.

A2–Controller CCA.

A2A1–Global Positioning System (GPS) receiver (RCVR) CCA or other function.

A3–I/O CCA having sensor inputs and control outputs.

The basic unit consists of A1 and A2 assemblies with the A2A1 GPS RCVR added as an option. Other configurations consist of the basic unit of A1 and A2, along with an A3 I/O CCA, with the A2A1 GPS RCVR added as an option or having some other function.

9.1 Ritron's VHF Radio XCVR, A1

9.1.1 Receiver

9.1.1.1 RF Amplifier and Band-pass Filters

The incoming RF signal from the input connector J101 passes backwards through the transmitter low-pass filter and the electronic T/R switch to a three pole band-pass filter formed around L102, L103, and L104. This filter is of Cohn type with 1.5 dB insertion loss and a bandwidth of 30 MHz. This filter is followed by a low noise amplifier stage formed around Q101. This amplifier has a gain of about 17 dB with a noise figure of 2 dB and serves to amplify the incoming RF signal above the noise of the following stages. Following this stage is a three-pole Cohn filter formed around L107 through L109. The characteristics of this filter are identical to that of the first. The two filter sections are narrow enough to filter out the spurious responses of the first frequency converter, while wide enough to support a performance bandwidth of 26 MHz.

9.1.1.2 1st Frequency Converter, 1st IF Filters, and 1st IF Amplifier

IC101 is an active double-balanced frequency converter, which converts the incoming RF signal to the first intermediate frequency (IF) of 43.65 MHz. This frequency converter has a gain of 0 dB and a noise figure of 10 dB. Its differential output is matched to the first IF filter, YF101, by L111, L112, C130, and C140. An IF amplifier based around Q102 is used to provide gain. Its output drives another IF filter section, YF102, which is identical to YF101. These two filters serve the double function of filtering out the spurious responses of the second frequency converter and, with the second IF filter, of removing signals at the adjacent and further removed channels.

9.1.1.3 2nd IF IC

The output of YF102 drives the mixer internal to IC102. IC102 is a FM IF IC which contains a frequency converter, high gain limiting IF amplifier, FM discriminator (detector) and other support circuitry. The frequency converter in IC102 converts the RF signal at the first IF to the second IF of 450 kHz. The output of the frequency converter exits the IC and is filtered by the second IF filter, YF103. The output of the filter reenters the IC and drives the high gain, limiting amplifier. Because the discriminator inside IC102 is sensitive to amplitude and frequency modulation components, a limiter must precede it to remove any amplitude modulation. The output of the limiter amplifier drives the discriminator. The resonator for the discriminator is YF104.

9.1.1.4 Receiver Audio and Carrier Detection

The recovered audio from IC102-9 is filtered and dc shifted by IC103A and associated components.

Carrier detection is based upon the absolute RF signal level at IC102's input. IC102 has circuitry that develops a dc current, which is proportional to the input RF signal level. Passing this current through a resistor (R123) creates a voltage, which varies from about 0.5 V at no signal input to about 3 V with –70 dBm at the antenna connector.

9.1.1.5 2nd Local Oscillator

To convert signals at the first IF frequency of 43.65 MHz to that of the second IF at a frequency of 450 kHz, a local oscillator signal at a frequency of 43.2 MHz (43.65 MHz – 0.45 MHz) is used. Tripling the output of the radio's 14.4-MHz master reference oscillator, Y101, creates this signal. Transistor Q111 acts as a frequency tripler. Its associated components are used to bias the transistor at a harmonic rich bias point and to filter the output such that only the third harmonic remains for use as the 2nd local oscillator.

9.1.1.6 VCO and Synthesizer

The synthesizer is responsible for generating the carrier in transmit and the first local oscillator in receive. A voltage-controlled oscillator (VCO) is an oscillator whose frequency can be controlled by an external signal. The synthesizer, almost wholly contained within IC109, divides the VCO frequency by digital dividers and compares the result with an accurate reference. An error signal, proportional to the frequency error, is

created which is routed to the frequency control input of the VCO. This action locks the VCO to a frequency, which is equal to the reference frequency multiplied by the divider number. To set the VCO frequency, different divider numbers can be programmed into the synthesizer. In most synthesizer designs, the divider must be an integer, which forces the reference frequency to be equal to the synthesizer step size. The synthesizer IC used in this radio, however, allows the use of non-integer values for the divider, which in turn allows the reference frequency to be much higher than normal. This creates a synthesizer whose output has lower noise, lower spurious levels, and higher switching speeds. The reference frequency is derived by digitally dividing the frequency of the 14.4-MHz master oscillator. When locked, the VCO attains the same relative frequency stability as that of the master oscillator.

The VCO itself is a voltage-follower Hartley oscillator formed around Q107. One of the elements in the resonant circuit is a varactor diode, CR105, whose capacitance when reverse biased, varies as a function of the applied voltage. Since the oscillator frequency is controlled by the resonant circuit, varying the voltage on the varactor diode effects a change in frequency. To serve as a local oscillator for the first frequency converter, the VCO operates at a frequency 43.65 MHz above that of the desired receive frequency. In receive, the VCO's oscillating frequency range is shifted upward by about 44 MHz by switching C191, C192, and L122 into the resonant circuit. The VCO has a tuning range of about 40 MHz when its tuning voltage is varied between 1 and 5 V. To frequency modulate the VCO for transmit, another varactor diode, CR106, is lightly coupled into the resonant circuit.

The output of the VCO is amplified to a level of about 0 dBm by Q106. Q110, R171, and C196 act as a very low-noise power supply filter for the VCO.

9.1.2 Transmitter

9.1.2.1 PA Driver Stages

The output of the VCO buffer drives Q105 through R152. The signal level at this point is about –10 dBm. Q105 amplifies this signal to about +5 dBm. Q104 further amplifies the signal to +13 dBm, the level required by the PA module. The supply voltage to these two stages is switched on in transmit by Q113.

9.1.2.2 PA Module, Low-pass Filter, and T/R Switch

When driven by +13 dBm, the PA module is capable of producing 6 W or more of power at the antenna connector. Pin 2 of the module is used for power control. The output power level can be varied from less than 0.5 W to full power by changing the voltage at this pin.

To reduce carrier frequency harmonics of the PA module output to acceptable levels, a low-pass filter is inserted between the module and the antenna connector. This filter is of elliptic design and formed around L115 and L116, and C169 through C173.

To isolate the PA module from the receiver, an electronic T/R switch is used. The switch is formed around PIN diodes CR103 and CR104, which are turned on in transmit and are off in receive. CR104 switches the PA module into and out of the circuit, while CR103 protects and isolates the receiver input when the radio is in transmit.

9.1.3 Miscellaneous Functions

Two on-board regulators are used to provide the 5 V dc used by most of the circuitry in the radio. IC107 is a low noise, low dropout regulator which provides 5 V to all the portions of the radio which do not get switched on or off as the radio changes from transmit to receive. This regulator is enabled by the XCVR-EN (J102-5) input. When this regulator is not enabled, the radio is essentially powered down. IC108 is an identical regulator which supplies power to those circuits which are to be powered-up only in receive. The regulator is enabled through IC106E and F by the RX-EN (J012-4) input.

The transmitter PA module driver stages and the T/R switch are powered by +7.2 V through Q113. The TX-EN (J102-3) input through delay and sequencing circuitry formed around IC106, Q112, and Q114 enable Q113. The sequencing circuitry delays PA turn-on until the driver stages and T/R switches are on, and delays driver stage and T/R switch shutdown until the PA module has ramped down in power. This prevents "keyclicks" from abrupt transmitter turn-on and turn-off.

9.2 Ritron's UHF Radio XCVR, A1

9.2.1 Receiver

9.2.1.1 RF Amplifier and Band-pass Filters

The incoming RF signal from the input connector J101 passes backward through the transmitter low-pass filter and the electronic T/R switch to a two-pole band-pass filter formed around L101 and L102. This filter is of Cohn type with 1.5 dB insertion loss and a bandwidth of 25 MHz. This filter is followed by a low noise amplifier stage formed around Q101. This amplifier has a gain of about 17 dB with a noise figure of 2 dB, and serves to amplify the incoming RF signal above the noise of the following stages. Following this stage is a four-pole Cohn filter formed around L103 through L106. This filter has an insertion loss of 4 dB and a bandwidth of 25 MHz. The two filter sections are narrow enough to filter out the spurious responses of the first frequency converter, while wide enough to support a performance bandwidth of 20 MHz.

9.2.1.2 1st Frequency Converter, 1st IF Filters, and 1st IF Amplifier

IC101 is an active double-balanced frequency converter, which converts the incoming RF signal to the first IF of 43.65 MHz. This frequency converter has a gain of 0 dB and a noise figure of 10 dB. Its differential output is matched to the first IF filter, YF101, by L107, L108, C128, and C137. An IF amplifier based around Q102 is used to provide gain. Its output drives another IF filter section, YF102, which is identical to YF101. These two filters serve the double function of filtering out the spurious responses of the second frequency converter and, with the second IF filter, of removing signals at the adjacent and further removed channels.

9.2.1.3 2nd IF IC

The output of YF102 drives the frequency converter internal to IC102. IC102 is a FM IF IC which contains a frequency converter, high gain limiting IF amplifier, FM discriminator (detector) and other support circuitry. The frequency converter in IC102 converts the RF signal at the first IF to the second IF of 450 kHz. The output of the frequency converter exits the IC and is filtered by the second IF filter, YF103. The output of the filter reenters the IC and drives the high gain, limiting amplifier. Because the discriminator inside IC102 is sensitive to amplitude and frequency modulation components, a limiter must precede it to remove any amplitude modulation. In addition, the noise-based carrier detection system available with this product requires that the RF signal at the discriminator stay constant in amplitude as the RF input signal level varies. The output of the limiter amplifier drives the discriminator. The resonator for the discriminator is YF104.

9.2.1.4 Receiver Audio and Carrier Detection

The recovered audio from IC102-9 is filtered and dc shifted by IC103A and associated components.

Carrier detection is based upon the absolute RF signal level at IC102's input. IC102 has circuitry that develops a dc current, which is proportional to the input RF signal level. Passing this current through a resistor (R115) creates a voltage, which varies from about 0.5 V at no signal input to about 3 V with –70 dBm at the antenna connector.

9.2.1.5 2nd Local Oscillator

To convert signals at the first IF frequency of 43.65 MHz to that of the second IF at a frequency of 450 kHz, a local oscillator signal at a frequency of 43.2 MHz (43.65 MHz – 0.45 MHz) is used. Tripling the output of the radio's 14.4-MHz master reference oscillator, Y101, creates this signal. Transistor Q112 acts as a frequency tripler. Its associated components are used to bias the transistor at a harmonic rich bias point and to filter the output such that only the third harmonic remains for use as the 2nd local oscillator.

9.2.1.6 VCO and Synthesizer

The synthesizer is responsible for generating the carrier in transmit and the first local oscillator in receive. A voltage-controlled oscillator (VCO) is an oscillator whose frequency can be controlled by an external signal. The synthesizer, almost wholly contained within IC108, divides the VCO frequency by digital dividers and compares the result with an accurate reference. An error signal, proportional to the frequency error is created, which is routed to the frequency control input of the VCO. This action locks the VCO to a frequency, which is equal to the reference frequency multiplied by the divider number. To set the VCO frequency, different divider numbers can be programmed into the synthesizer. In most synthesizer designs, the divider must be an integer, programmed into the synthesizer. In most synthesizer designs, the divider must be an integer, which forces the reference frequency to be equal to the synthesizer step size. The synthesizer IC used in this radio, however, allows the use of non-integer values for the divider, which in turn allows the reference frequency to be much higher than normal. This creates a synthesizer whose output has lower noise, lower spurious levels, and higher switching speeds. The reference frequency is derived by digitally dividing the frequency of the 14.4-MHz master oscillator. When locked, the VCO attains the same relative frequency stability as that of the master oscillator.

The VCO itself is a voltage-follower Colpitts oscillator formed around Q108. One of the elements in the resonant circuit is a varactor diode, CR106, whose capacitance, when reverse-biased, varies as a function of the applied voltage. Since the oscillator frequency is controlled by the resonant circuit, varying the voltage on the varactor diode effects a change in frequency. To serve as a local oscillator for the first frequency converter, the VCO operates at a frequency 43.65 MHz below that of the desired receive frequency. In transmit, the VCO's oscillating frequency range is shifted upward by about 44 MHz by switching C190 and L115 into the resonant circuit. The VCO has a tuning range of about 30 MHz when its tuning voltage is varied between 1 and 5 V. To frequency modulate the VCO for transmit, another varactor diode, CR105, is lightly coupled into the resonant circuit.

Q107 and Q106 amplify the output of the VCO to a level of about 0 dBm. Q111, R172, and C196 act as a very low-noise power supply filter for the VCO.

9.2.2 Transmitter

9.2.2.1 PA Driver Stages

The output of the last VCO buffer drives Q105 through R151. The signal level at this point is about –10 dBm. Q105 amplifies this signal to about +5 dBm. Q104 further amplifies the signal to +17 dBm, the level required by the PA module. The supply voltage to these two stages is switched on in transmit by Q113.

9.2.2.2 PA Module, Low-pass Filter, and T/R Switch

When driven by +17 dBm, the PA module is capable of producing 6 W or more of power at the antenna connector. Pin 2 of the module is used for power control. The output power level can be varied from less than 0.5 W to full power by changing the voltage at this pin.

To reduce carrier frequency harmonics of the PA module output to acceptable levels, a low-pass filter is inserted between the module and the antenna connector. This filter is of

elliptic design and formed around a buried stripline transmission line and C164, C165, and C166.

To isolate the PA module from the receiver, an electronic T/R switch is used. The switch is formed around PIN diodes CR101 and CR104, which are turned on in transmit and are off in receive. CR104 switches the PA module into and out of the circuit, while CR101 protects and isolates the receiver input when the radio is in transmit.

9.2.3 Miscellaneous Functions

Two on-board regulators are used to provide the 5 V dc used by most of the circuitry in the radio. IC106 is a low noise, low dropout regulator which provides 5 V to all the portions of the radio which do not get switched on or off as the radio changes from transmit to receive. This regulator is enabled by the XCVR-EN (J102-5) input. When this regulator is not enabled, the radio is essentially powered down. IC107 is an identical regulator which supplies power to those circuits which are to be powered-up only in receive. The regulator is enabled through IC105E and F by the RX-EN (J102-4) input.

The transmitter PA module driver stages and the T/R switch are powered by +7.2 V through Q113. Q113 is enabled by the TX-EN (J102-3) input, through delay and sequencing circuitry formed around IC105, Q115, and Q114. The sequencing circuitry delays PA turn-on until the driver stages and T/R switches are on, and delays driver stage and T/R switch shutdown until the PA module has ramped down in power. This prevents "keyclicks" from abrupt transmitter turn-on and turn-off.

9.3 Controller CCA, A2

The Controller CCA uses a Motorola microprocessor (μP), U1, to process and control information for the radio modem. The in circuit serial programming (ICSP) connector, J5, is used only at the factory to install the boot loader program. The μP has flash memory that can be updated through the Serial I/O port, J9.

The μP, U1, communicates with the Serial I/O port, J9, via RS232 transceiver, U5. The Serial I/O port, J9, is used to communicate with the μP, U1, via a RS232 cable to a PC running any communications program, such as HyperTerm™ in Windows™.

If J8 is jumped the system will come up in the Maintenance Program mode, when turned on, where the frequency of operation is set and various transmit and receive levels are adjusted and set. If J8 is not jumped, then the system will come up in its Operation mode.

The μP, U1, communicates with a four-level frequency shift keying (4-LFSK) modem IC, U3. The modem IC, U3, provides the four-level coded signal to FSK modulate the radio transceiver transmitter and decode the demodulated FSK signal from the radio transceiver receiver.

Because of dc offsets and to minimize bit error rate the TX and RX paths are dc coupled.

The four-level coded signal emanates from the modem IC at terminal 20, U3-20, at an amplitude of 1 V pp and a dc offset of Vcc/2 (≈ 2.50 V dc). The signal is sent through a RC low-pass filter, R3 and C13, to the input of buffer amplifier AR2D, an op-amp voltage follower. The signal at the output of the buffer amplifier then goes to the top of the DEVIATION setting software controlled potentiometer, U2C.

VBIAS from the modem IC is made available at terminal 21, U3-21, that is equal to Vcc/2 (≈ 2.50 V dc) that the modem IC uses internally. This dc voltage is buffered by AR1A and then goes to the bottom of DEVIATION setting software controlled potentiometer U2C and to R8, one of two inputs to the inverting summing junction of AR1C. The FREQuency OFFSET software controlled potentiometer, U2F, adds a dc offset to the AR1C op-amp stage. The output of AR1C can be set for the proper signal level to drive the transmitter to the proper deviation. The dc offset level of 2.50 V affects

the frequency of the transmitted and received signal because this voltage goes directly to the master oscillator on the radio transceiver via terminal 7 of the radio interface connector, P1-7.

Transmitter RF output power level is set with software controlled potentiometer U2G. This dc level is buffered with AR1D.

For receiving, the RSSI signal from the radio transceiver is first looked at to see if there is a signal of sufficient amplitude. The RSSI signal at P1-13 is sent to a times two non-inverting op-amp amplifier, AR2B, and then to AR2A that acts as a voltage comparator. The RSSI ADJUST software controlled potentiometer U2E is adjusted twice. Adjustment is done one time for a turn on level and a second time for a turn off level. This adds hysteresis so that a good signal of specified level being received will not drop out if, for some reason, the signal level drops a number of dB. Also the RSSI signal is looked at before transmitting to determine if there is a signal on the air or not.

The DISC_OUT (discriminator output) signal at P1-14 is sent to RX GAIN software controlled potentiometer U2D for adjustment of the amplitude. This demodulated four-level signal goes to op-amp AR2C where a dc offset voltage from the RX ADJ 2.5 V software controlled potentiometer, U2B, is added. The discriminator output signal rides on a dc offset voltage from the radio transceiver. Adjustment of the RX GAIN potentiometer also varies this dc-offset level. Thus there is an interaction of the dc levels when adjusting the RX GAIN and RX ADJ 2.5 V. The received signal and dc offset at the modem IC RXFB terminal, U3-23, is adjusted for a 1 V pp signal and a dc offset to match the VBIAS dc level at U3-21.

Internal temperature is monitored by U4.

There are six LEDs for indications of operation.

DS1	TX	Unit is transmitting
DS2	RX	There is a carrier on frequency
DS3	A^1	User definable through programming
DS4	A^2	User definable through programming
DS5	A^3	User definable through programming
DS6	PWR	Power to the unit is on

To keep digital noise out of the analog circuitry there are separate +5 V supplies for the analog and digital sections. Voltage regulator VR1 supplies power to the radio transceiver, the analog circuitry voltage regulator, VR2, and the digital circuitry voltage regulator, VR3.

9.4 GPS Receiver, A2A1

The GPS receiver system consists of a GPS receiver circuit card assembly and an external active antenna for reception of GPS signals from the GPS satellites.

The GPS RCVR CCA has a Trimble GPS RCVR module that is the heart of the system. IC voltage regulator, VR1, supplies 3.3 V dc to the Trimble GPS RCVR, RE1, and the level translator, U1. RE1 in turn supplies dc voltage out the RF connector, RE1J1, to the externally connected Trimble antenna. The GPS signals are brought into the receiver over the transmission line into this same connector. The GPS information signals are sent to the microprocessor, on the Controller CCA, through level translator, U1. Battery backup is provided but is not necessarily needed. The battery backup reduces the acquisition time if the unit has been off for a period of time.

The A2A1 CCA may have other functions designed in the future.

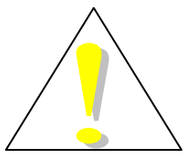
9.5 Input/Output CCA, A3

The I/O CCA will be designed in the future and may have a number of variants. This CCA may have various sensor inputs, such as 0 to 5 V dc, 4 to 20 mA dc, SDI-12, and RS232. Outputs would be on/off control or other circuitry.

10 MAINTENANCE INFORMATION

Refer to the last section for schematic diagrams, parts lists, and parts layout diagrams.

10.1 Repair Cautions



CAUTION

Equipment contains electrostatic sensitive components that could be damaged through handling. Take proper ESD precautions.

10.2 Unit Disassembly

To remove Cover, remove four screws on bottom and two top screws each from Front and Rear Panel.

To remove Rear Panel only, remove two top screws, one bottom screw, and two screws that hold panel to chassis. If Cover is removed already, remove one bottom screw and two screws that hold panel to chassis.

To remove Front Panel only, remove two top screws, one bottom screw, two screws that hold panel to chassis, and the two jack screws for the Serial I/O connector. If Cover is removed already, remove one bottom screw, two screws that hold panel to chassis, and the two jack screws for the Serial I/O connector. If necessary to completely remove the Front Panel the ANT connector and the GPS connector may be removed from the panel.

If your unit has an I/O, A3, CCA this will be the CCA on top. If your unit does not have an I/O CCA the Controller, A2, CCA will be on top. In either case the top CCA is held on by three #4 screws and lock washers.

To remove the Controller, A2, CCA either remove three #4 screws with lock washers or, if your unit has an I/O, A3, CCA and that is removed, then remove three standoffs. After removing the three screws or standoffs, remove the #4 screw holding the heat sink tab of voltage regulator A2VR1. Remove the two #2 self-tapping screws that hold the Controller CCA to the radio transceiver heat sink at left rear of unit. Turn unit upside down with left hand, grab Controller CCA with right hand, and pull Controller CCA off of radio transceiver by rocking slightly front to back so mating connector will come apart. Watch for the four #2 flat washers that will fall off and any ferrite beads on the leads of connector A2P1.

To remove the radio transceiver, A1, CCA, remove two standoffs from near the front and two screws on the bottom rear of chassis that hold the L-shape chassis heat sink. Remove two #2 sets of hardware to remove the L-shape chassis heat sink from the radio transceiver heat sink.

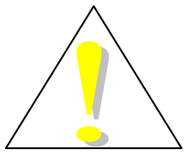
10.3 Unit Reassemble

Reassemble is the reverse of disassembly. Be sure to use silicone heat sink compound between radio transceiver heat sink and L-shape heat sink, between L-shape heat sink and chassis, and between voltage regulator, A2VR1, heat sink tab and chassis for best heat flow.

When reassembling the Controller, A2, CCA to the radio transceiver, A1, place the #2 self-tapping screws in place. With the right hand place the first two fingers over the screws at rear of CCA and the thumb between the two sets of LEDs at the front of the CCA. Turn the Controller CCA upside down. Place four #2 flat washers, two each, over the #2 screws and install any ferrite beads over the leads of A2P1. Now with the left

hand turn the chassis upside down and mate the Controller CCA to the radio transceiver. The pins of A2P1 must match to A1J101 and the two sets of #2 hardware must line up with the holes in the radio transceiver (XCVR) heat sink.

11 ALIGNMENT



WARNING

Only qualified and trained service personnel must perform alignment.

11.1 Required Test Equipment

The following test equipment is required to align the TALON Series radio modems. All test equipment should be properly calibrated with traceability to NIST or your country's authority.

- Service monitor or
  - RF signal generator at operating frequency of equipment with output level adjustment and FM.
  - FM demodulator, that can drive a deviation meter
  - Deviation meter
  - RF frequency counter: Must operate at the RF frequency of the equipment, with a resolution of 10 Hz or better, and accuracy of ± 1 PPM (± 150 Hz at VHF, ± 450 Hz at UHF) or better.
  - RF power meter: Capable of accurately indicating the equipment RF power output.
  - RF power attenuator or dummy load with coupled output. Must be 50 Ω impedance at the operating frequency, rated for the output power of the equipment, and have an output which can drive the FM demodulator and frequency counter at the correct level.
- Audio oscillator: Must have sinewave and squarewave output and adjustable output frequency and amplitude.
- Voltmeter for dc: ≥ 10 MΩ input impedance. Any good DMM will have this.
- Oscilloscope: ≥ 20 MHz bandwidth and 10 X probe.
- Power Supply: Capable of approximately 12 V dc at 3 A.

Note that alignment instructions are written for a service monitor.

11.2 Alignment Procedure

It is not necessary to perform all alignment steps detailed below. However, some adjustments have interaction with others (e.g.: balance affects deviation and output power has a slight affect on TX frequency trim). It is recommended to spot check all adjustments.

Refer to the last section of this manual for schematic diagrams, parts layouts, and parts lists.

After removing the cover:
- Jumper J8 with P3
- Be sure P2 is in place across J7
- Connect a PC to the TALON Series unit via a RS232 cable assembly
- Open a communications program, such as HyperTerminal™ found in Windows™
- Attach the ANT connector to a communications service monitor
- Apply dc power to the unit
- Observe the correct display on the PC's VDT

Note:
- Press the "Esc" key to get out of any command
- Press the "B" key (PERM Radio parameters), when not in any other command, at any time to make adjustment parameters permanent

11.2.1 TRANSMIT AND RECEIVE FREQUENCY

Set transmit and receive frequencies with the "T" key to frequency of operation.

Note: If the receive frequency is the same as the transmit frequency, just enter the transmit frequency. Receive frequency will be set automatically. Otherwise, press the "R" key and set the receive frequency.

TX frequency _____ MHz

RX frequency (same as TX frequency unless indicated)

_____ MHz

11.2.2 RX FREQUENCY TRIM

Press the "1" key to change the RX FREQUENCY TRIM offset voltage at A2P1-7 to as close as you can to 2.50 V dc.

Note: If you have a frequency counter, with adequate accuracy, adjust the RX FREQUENCY TRIM to put the local oscillator "on frequency".

Measured value _____ V dc.

11.2.3 CARRIER DETECT

- Set service monitor generator frequency to receive frequency of radio modem
- Set modulation to 1200 Hz at 2.3 kHz deviation
- Set service monitor power output to signal level required for carrier-detect to go true. (Production Test will set this for –100 dBm.)

Press the "2" key for CARRIER DETECT ON TRIM adjustment. Adjust until there is a constant ON (on the VDT) indicated. This may be monitored at A2AR2-1 with a dc-coupled oscilloscope. There should be a 5-V dc level with no negative going glitches.

Carrier-detect ON power level –_____ dBm.

- Set the service monitor power output to signal level required for carrier-detect to go false. (Production Test will set this for –105 dBm.)

Press the "3" key for CARRIER DETECT OFF TRIM adjustment. Adjust until there is a constant off. This is indicated by the ON (on the VDT) being off. Continue monitoring at A2AR2-1 with dc-coupled oscilloscope. There should be a 0-V dc level with no positive going glitches.

Carrier-detect OFF power level –_____ dBm.

11.2.4 RECEIVER DC OFFSET ADJUST

Set service monitor power output for a level above the carrier-detect on level with 1200 Hz at 2.3 kHz deviation modulation on.

Measure V_{BIAS} at MX919B IC terminal 21 (A2U3-21).

Measured V_{BIAS} value _____ V dc.

Press the "4" key for the RECEIVER DC OFFSET ADJUST.

Adjust this to get measured V_{BIAS} value at MX919B IC terminal 23 (A2U3-23).

Measured value _____ V dc.

Measured value after RX GAIN ADJUST _____ V dc.

11.2.5 RECEIVER GAIN ADJUST

Set modulation at a 1200 Hz tone for 2.3 kHz deviation.

Press the "5" key for the RECEIVER GAIN ADJUST.

Adjust this to get a 1 V pp signal at MX919B IC terminal 23 (A2U3-23).

Measured signal amplitude 1 V pp. _____ Check

Go back and check the RECEIVER DC OFFSET ADJUST, because the RECEIVER GAIN ADJUST interacts with it due to a dc offset in the radio transceiver.

11.2.6 TRANSMITTER RF POWER OUTPUT ADJUST

Set service monitor to measure transmitter power.

Press the "6" key for TRANSMITTER POWER ADJUST.

Adjust the RF power output level, up to 6 W, in accordance with your license.

RF power output adjusted to _____ W.

Note: The transmitter is not rated for 100% duty cycle (continuous operation) at the higher power levels. Remove the cover and back panel and use a fan or blower to keep the heat dissipation from raising the temperature to extreme levels. Work quickly to set the power.

For operational use with a RF power amplifier, adjust the output power of the Talon UDC unit for the minimum power required to drive the power amplifier to the licensed power output. Final power output is set with the Talon UDC connected to the RF power amplifier.

11.2.7 TRANSMITTER BALANCE

For proper modulation and bandwidth occupancy, check and set this adjustment at transmit frequency.

Remove A2P2 from A2J7.

Connect a square wave generator at a frequency of 500 Hz, 50 % duty factor, 0.2 V pp, and 2.5 V dc offset to A2J7-2, adjacent to A2P1-7, and GND (A2D1-A).

Press the “7” key for TRANSMITTER BALANCE.

With an oscilloscope connected to the service monitor demodulator (ac coupled):

- Adjust the amplitude of the 500-Hz square wave to obtain 2.3 kHz deviation on the service monitor. Amplitude will be about 0.4 V pp.
- Now adjust the balance SMD potentiometer, A1R180. This is adjusted with a small flat blade screwdriver through a clearance hole (MTH1) in the Controller ASSY. Adjust such that the oscilloscope display shows a square wave with no rounded corners or overshoot. (This is similar to compensating an oscilloscope probe.)
- Quit transmitting. Remove the square wave generator and replace the jumper on the header.

11.2.8 TRANSMITTER DEVIATION

Set service monitor to measure transmitter deviation.

Press the “8” key for TRANSMITTER DEVIATION.

Press “T” for 1200-Hz tone and adjust for 2.3 kHz deviation.

Check ☐

11.2.9 TX FREQUENCY TRIM

Recheck the dc offset voltage at A2P1-7. Should be at the voltage previously measured under RX FREQUENCY TRIM (2.50 V dc). If not, readjust by pressing the “1” key.

Press the “9” key for TX FREQUENCY TRIM and adjust the offset for 2.50 V dc.

Note: The transmitter will be on with no modulation. If you have a frequency counter, with adequate accuracy, adjust the TX FREQUENCY TRIM to put the transmitter “on frequency”.

Measured value _____ V dc.

ADJUSTMENT COMPLETE

Remove jumper from J8 so unit will be in operating mode. P3 may be stored by attaching it to one terminal only of J8.

11.3 RF Transceiver Circuit Card Assembly Adjustments

11.3.1 Front End Inductors

11.3.2 TCXO Frequency Adjustment

12 COMMAND SET

13 PRODUCT STRUCTURE, SCHEMATIC DIAGRAMS, PARTS LISTS, AND PARTS LAYOUTS