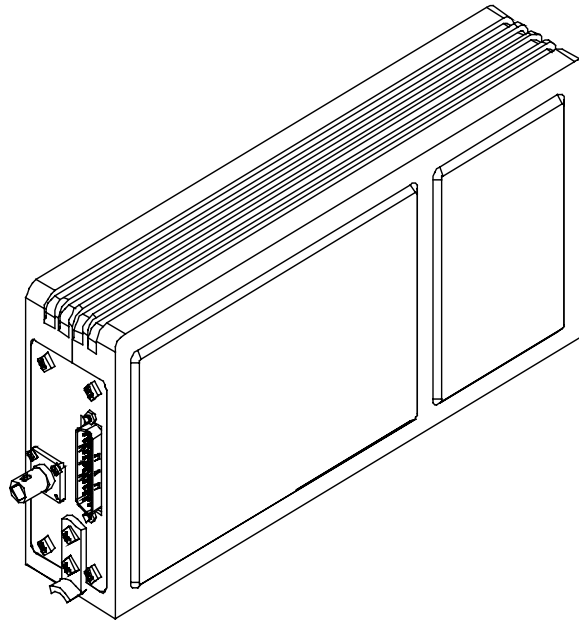




**SM64**

**NTX403 Series  
Remote Mount  
UHF-FM Transceiver**



## **INSTALLATION AND OPERATION MANUAL**

**REV 4.00 April 19, 2005**

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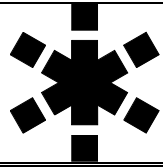
Periodically NAT will release manual amendments. In order to maintain the most accurate and up to date manual these amendments should be carried out immediately upon receipt and recorded on the following amendment record.

## AMENDMENT RECORD

Amendment Number	Amendment Date	Section(s) Changed	Date Entered	Entered By
<i><b>Note: Revision 4.00 is the first public release of this document</b></i>				
#1	Jan 7/08	2		<b>Performed at factory</b>

Insert any Amendment Instruction sheets after this page.





**nat**

**INSTALL\_OPS  
MANUAL AMENDMENT**

**Manual: SM64 (NTX403 Series Remote Mount UHF-FM Transceiver) Amendment #: 1  
Document # SM64\Install\_Ops\809-0001 Amendment Date: Jan 7, 2008**

The purpose of this amendment is to update sections 2.3.4, 2.3.5 and 2.3.6.

Amendment Instructions:

1

Remove Pages	Replace With Pages
2-1, 2-2, 2-3, 2-4 and 2-5 Rev 4.00	2-1, 2-2, 2-3, 2-4 and 2-5 Rev 4.00 Amendment # 1

2

Update the Amendment Record sheet at the front of the manual.

3

Insert this page into the manual after the Amendment Record sheet (page ii).

Manual Amendment ends after the following amended pages



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## Section 1 Description

### 1.1 Introduction

---

This manual contains information on the NTX403 Remote Mount UHF-FM Transceiver. All derivative products will be covered by manual supplements, which can be obtained from NAT as required.

Information in this section consists of purpose of equipment, features and specifications.

### 1.2 Purpose of Equipment

---

The NTX403 is an UHF FM transceiver for operation in the 403 MHz to 512 MHz band. The unit is remotely mounted using a 1/4 ATR tray and is operated via an RS-422 serial bus interface using a TH-Series TAC/COM control head.

### 1.3 Features

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The unit conforms to a 1/4 ATR tray size and is capable of receiving and transmitting over 403.000 to 511.99375 MHz.

### 1.4 Specifications

---

#### 1.4.1 Electrical Specifications

---

<u>Power Supply</u>	+27.5 Vdc Power
Voltage: Nominal	+27.5 Vdc
Maximum	30.3 Vdc
Minimum	22.0 Vdc
Emergency	18.0 Vdc
Current: Receive (Nom.)	500 mA @ +27.5 Vdc
Transmit (Max.)	2.5 A @ +27.5 Vdc

#### Input Signals

Mic Input	Audio signal, 100 mVrms
Push to Talk	Active ground signal, 15 mA max
Power On/Off	Active ground signal, 20 mA max
Serial Data In	RS-422 data from control head

Output Signals

Headset Audio	100 mW Nominal, 250 mW max into 600 $\Omega$
AUX Receive Audio	300 mVrms nominal, not tone controlled
RT Installed	Low Output (Ground)
Main SQ Disable Out	Active low output, open collector (20 mA max)
Serial Data Out	RS-422 data to control head

Bi-directional Signals

RF Input / Output	50 $\Omega$ nominal antenna impedance
-------------------	---------------------------------------

**1.4.2 General Specifications**

Frequency Range	403.000 to 511.99375 MHz
RF Impedance	50 $\Omega$ nominal
Modulation	FM
Rated System Deviation	2.5 kHz ( <u>N</u> arrowband), 5 kHz ( <u>W</u> ideband)
Rated Audio Input Level	100 mVrms nominal
Duty Cycle	20% (1 min. TX, 4 min. RX)
Sub-audible Tones	38 standard CTCSS tones and all DCS codes
Remote Interface	RS-422 serial data
Number of channels	128, simplex or semi-duplex
Channel Increments	6.25 / 10 kHz
Scan Rate	10-20 channels/sec. All channels may be in scan list.

1.4.2.1 Transmitter

RF Output Power	10 W or 1 W $\pm$ 1dB
Frequency Stability	$\pm$ 2.5 ppm
Conducted Spurious	$\leq$ -13 dBm (50 $\mu$ W)
Adjacent Channel Power	$\geq$ 54 dBc ( <u>N</u> arrowband), $\geq$ 70 dBc ( <u>W</u> ideband)
Modulation Limiting	2.5 kHz ( <u>N</u> arrowband), 5 kHz ( <u>W</u> ideband)
Microphone Impedance	150 $\Omega$ $\pm$ 20%
AF Characteristic	-6 dB/octave +1/-3 dB pre-emphasis (EIA STD)



#### 1.4.4 Environmental Specifications

---

Temperature:

Operating	-30° to +60° C
Short-time high	+70° C
Ground survival	-55° to +85° C

Altitude 25,000 ft

Humidity 95% for 48 hours

Operational Shock 6g for 11ms in all axes

Qualification: DO-160C Env. Cat. X-XX[MN]<sup>1</sup>XXXXXXXXXXXXXXXXXX  
DO-160D Env. Cat. B4-BABXXXXXXXXZB<sup>2</sup>AB<sup>3</sup>A[TT]<sup>4</sup>BXXXX

- 1 Vibration, DO-160C.
- 2 Power Input, DO-160D Change #2.
- 3 Ripple Voltage, DO-160D Change #2.
- 4 RF Susceptibility, DO-160D Change #1.

End of section 1

## Section 2 Installation

### 2.1 Introduction

---

Information in this section consists of: unpacking and inspection procedures, installation procedures, post-installation checks, and installation drawings.

### 2.2 Unpacking and Inspection

---

Unpack the equipment carefully and locate the warranty card. Inspect the unit visually for damage due to shipping and report all such claims immediately to the carrier involved. Note that each unit should have the following:

- NTX403 Series Remote Mount UHF-FM Transceiver
- Warranty Card
- Operator's Manual
- Release certification

Verify that all items are present before proceeding and report any shortage immediately to your supplier.

#### 2.2.1 Warranty

---

Complete the warranty card information and send it to NAT when the installation is complete. If you fail to complete the warranty card, the warranty will be activated on date of shipment from NAT.

**Note:** An appropriately rated facility, e.g. Certified Aircraft Repair Station, must install this equipment in accordance with applicable regulations. NAT Ltd's warranty is not valid unless the equipment is installed by an authorized NAT Dealer. Failure to follow any of the installation instructions, or installation by a non-certified individual or agency will void the warranty, and may result in a non-airworthy installation.

### 2.3 Installation Procedures

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#### 2.3.1 Warnings

---

Do not bundle any lines from this unit with transmitter coax lines. Do not bundle any logic, audio, or DC power lines from this unit with 400 Hz synchro wiring or AC power lines. Do not position this unit next to any device with a strong alternating magnetic field such as an inverter or significant interference to operation will result. In all installations, use shielded cable **exactly as shown** and ground as indicated. Significant problems may result if these guidelines are not followed.

### 2.3.2 Cautions

---

Severe degradation of audio installations may result from incorrect wiring and shielding. This could cause much higher cross-talk, hum, and ground-loop interference.

### 2.3.3 Notes

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For maximum resistance to low frequency interference, the case of the transceiver must be electrically grounded.

### 2.3.4 Cable and Wiring

---

All unshielded wire shall be selected in accordance with the original aircraft manufacturer's maintenance instructions or AC43.13-1B Change 1, Paragraphs 11-76 through 11-78. Wire types should be to MIL-W-22759 as specified in AC43.13-1B Change 1, Paragraphs 11-85, 11-86, and listed in Table 11-11. For shielded wire applications, use Tefzel MIL-C-27500 shielded wire with solder sleeves (for shield terminations) to make the most compact and easily terminated interconnect. Follow the wiring diagrams in Section 2.6 as required.

To provide easy installation of the hood, allow 3 inches from the end of the wire to the shield termination. Note: Install the hood after the wiring is complete.

Installation cabling must allow the transceiver to be easily withdrawn for disconnection and field service adjustments. Ensure an adequate service loop in the routing of the cables.

All wiring should be 22 AWG, except power and ground connections, which must be 18 AWG or larger, as indicated on the installation drawings. Ensure that the ground connection is clean and well secured. To prevent inadvertent system failure, supply power to this system from a separate breaker or fuse not connected to any other device. NAT recommends a 5 A fuse or breaker (28 Vdc Source).

Coaxial cable should be in accordance with MIL-C-17 unless otherwise specified. Do not use coax with PVC insulation. NAT recommends Teflon dielectric cable at or above VHF frequencies or where cable runs exceed 8 feet. Note that at VHF frequencies, cable losses due to long cable runs and tight bends may cut the ERP (Effective Radiated Power) to less than 50% of specification.

To prevent RF interference between similar systems, NAT recommends that VHF FM coax runs be widely separated, or be made using triaxial cable. Bond the outer shield to the airframe at the transceiver end only.

In communication intensive applications, bad cable routing and shielding may drastically compromise over-all system performance. Symptoms will be spurious squelch opening, RFI (Radio-Frequency Interference), and garbled reception.

Neatly terminate RF cables (solder or crimp) and test for shorts prior to system check-out (not while connected to the radio!!). Keep cable bends to a minimum at the antenna.

Avoid sharp bends in the coax cables (minimum 3" radius) to prevent severe reflections. If sharp bends are required use 90° elbow adapters.

Fabrication and installation of wiring harness should be in accordance with the original aircraft manufacturer's maintenance instructions or AC43.13-1B Change 1, chapter 11, sections 5 to 13, 16 and 17.

Grounding and bonding should be in accordance with the original aircraft manufacturer's maintenance instructions or AC43.13-1B Change 1, chapter 11, section 15.

### **2.3.5 Antennas**

Correct antenna placement and mounting is critical in order to achieve the best possible performance. In general, keep all antennas as widely separated as possible and clear of any large airframe obstructions. Avoid any placement that puts antennas of like frequencies close together.

Installation of the antenna should be in accordance with the original aircraft manufacturer's instructions for continued airworthiness or AC43.13-1B Change 1, chapter 11, section 15 and AC 43.13-2A chapter 3. If possible, the antenna should be located a minimum of 12 ft from aircraft navigation receiver antennas and a minimum of 4 ft from aircraft communications and ELT antennas. Be careful not to choose separations that closely approximate  $\frac{1}{4}$ ,  $\frac{1}{2}$  or whole number multiples of the navigation or communication system wavelengths.

Bottom mounted antennas will perform best in flight, but poorest on the ground during testing. Antennas may be severely degraded by 'masking' effects of the fuselage or stabilizers, and generally give best performance when bottom mounted.

Surround any blade or whip antenna with a ground plane surface (metallic, grounded material) having a radius equal to or greater than the height of the antenna. Poor grounding will result in severe reflected power and high levels of RFI throughout the airframe.

Any antenna will be less prone to interference from rotor modulation and other undesirable stimuli if installed correctly and surrounded by a large metallic ground plane. Under the same conditions, it is also much less likely to cause interference to other aircraft systems (e.g., coupling into audio system, fluctuations in instrumentation, etc.). Poor grounding will result in severe reflected power and high levels of RFI throughout the airframe.

Avoid antenna locations that will become fouled with oil, water, fuel or dirt, as this will degrade performance. Roof mounts (in close proximity to rotor blades) are permissible.

### **2.3.6 Mechanical Mounting**

Installation of the transceiver should be in accordance with the original aircraft manufacturer's instructions for continued airworthiness or AC 43.13-1B Change 1, chapter 7, sections 2 to 7, and AC 43.13-2A chapter 2.

The transceiver is tray-mounted and uses a custom 1/4 ATR style tray. Mount (with countersunk screws) onto a clean, grounded surface having a resistance of less than 0.5 ohms to airframe ground.

The transceiver may be mounted in any attitude, but upright (mounting hook at the bottom) is preferred for access and condensation drainage.

### **2.3.7 Post-Installation Checks**

---

#### 2.3.7.1 Voltage/resistance checks

**Do not attach the transceiver until the following conditions are met.**

Check the following:

- a) P1 pins <5> and <6> for +28 Vdc relative to ground.
- b) P1 pins <8> and <20> for continuity to ground (below 0.5  $\Omega$ ).

**Ensure that the antenna is disconnected for the following test or erroneous readings may be obtained.**

- c) Radio coax connector for continuity to the antenna coax connector (shield and centre conductor) and for open circuit from the centre conductor to ground and open circuit from the centre conductor to the shield.

#### 2.3.7.2 Power On checks

- a) Install the transceiver and power up the ship's systems. Turn on the control head. Check the operation of all front panel controls. Adjust brightness and volume levels as required.
- b) Check all transmit and receive functions. Ensure the RX/TX status indicator lights green when keying the radio to transmit and amber when receiving.
- c) Check the SCAN function.

**Note:** You may be unable to hear the received audio if the tones do not match those set in the radio. To avoid any confusion, set the tones to **OFF** (via the Status Edit mode) during scanning so that all channels will be heard.

- d) Check the antenna feedline at the R/T with a through-line wattmeter and suitable frequency elements to ensure correct antenna matching. Reflected power in excess of 25% represents a serious problem, and should be investigated carefully, or serious RFI and system interference as well as possible radio damage may result. A VSWR measurement of over 3.0:1 represents a significant loss in signal power to the antenna. Check that forward power is to specifications over the frequency band of the radio.

### 2.3.8 Post-Installation EMI Test

The purpose of this test is to identify any interference that the transceiver may cause with existing aircraft systems. The transceiver should be tested in accordance with the Installation Approval Test Procedure (see section 2.6) and the test results documented on the record sheets.

**Upon satisfactory completion of all performance checks, make the required log entries and complete the necessary Regulatory Agency paperwork before releasing the aircraft for service.**

### 2.4 Continued Airworthiness

Maintenance of the NTX403 is 'on condition' only. Periodic maintenance of this product is not required.

### 2.5 Accessories Required But Not Supplied

Installation kit p/n NTX-IKC (crimp) is required to complete the installation. The kit consists of the following:

Quantity	Description	NAT Part #
1	Field Serviceable BNC Coax Connector	20-51-001
1	1/4 ATR NTX Mounting Tray	NTX-VT1
1	D-min 25 Pin Female Crimp Installation Kit	D25SV-IKC
	Consisting of:	
	<b>Quantity</b>	<b>Description</b>
		<b>NAT Part #</b>
	1	D-min 25 Socket housing
	25	MS Crimp Socket
	1	25 pin JVL Hood/Locklever
		20-21-025
		20-26-901
		20-29-250

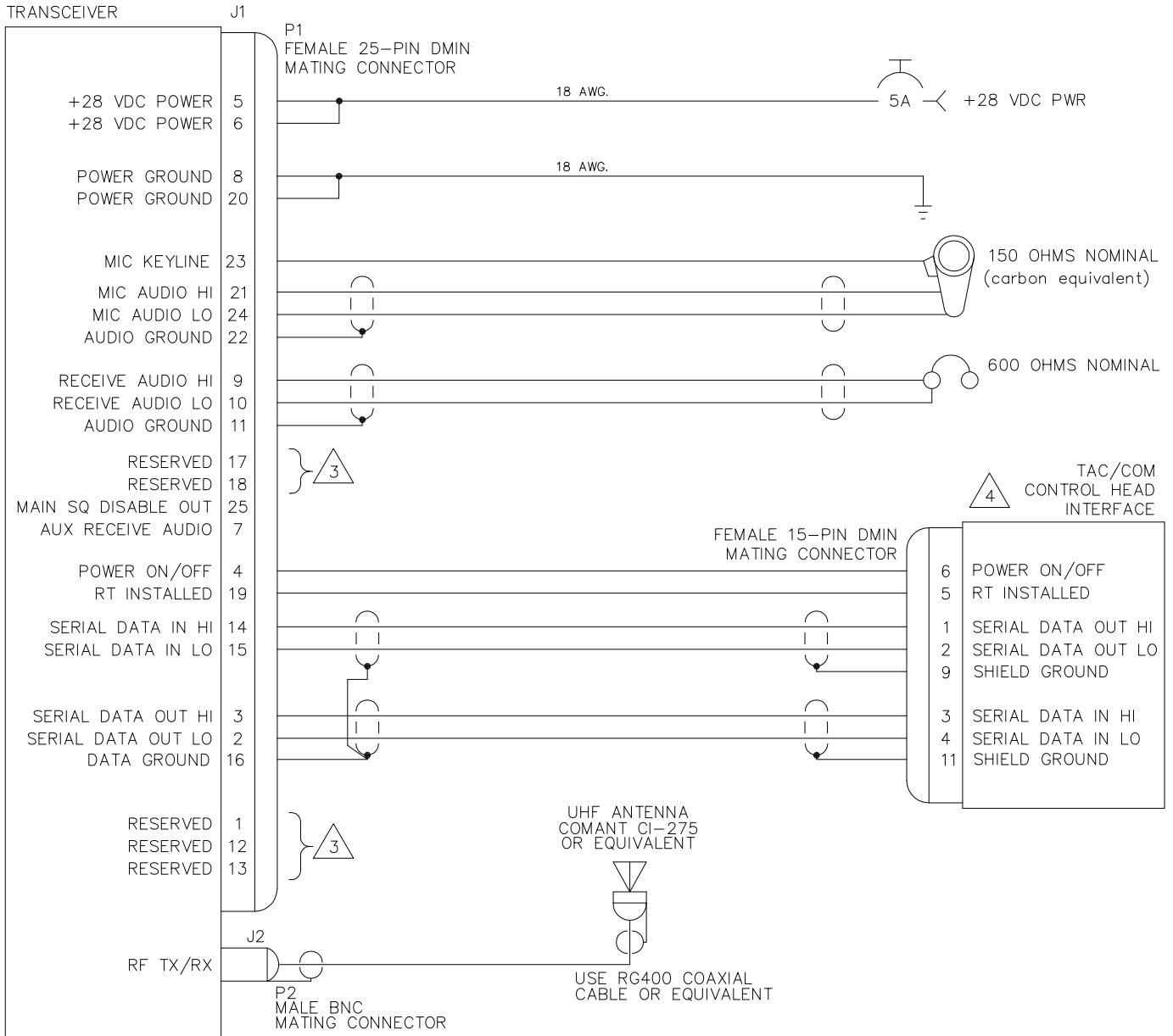
### 2.6 Installation Drawings

DRAWING	REV.	DESCRIPTION	TYPE
NTX403\403-0	1.00	NTX UHF Radio Connections	Interconnect
NTX403\405-0	1.00	UHF FM Transceiver	Connector Map
NTX403\634-0	1.00	UHF FM Transceiver	Installation Approval Test Procedure
NTX403-000\922-0	1.00	Remote Mount UHF FM Transceiver	Mechanical Installation

Section 2 ends after these Drawings



NTX403-xxx UHF-FM  
TRANSCEIVER



NOTES:

1. ALL WIRES SHOULD BE 22 AWG UNLESS OTHERWISE SPECIFIED.  
ALL WIRE SHOULD BE IN ACCORDANCE WITH MIL-W-22759. ALL SHIELDED WIRE/CABLE SHOULD BE IN ACCORDANCE WITH MIL-C-27500.
2. INSTALLATION KIT REQUIRED: NAT P/N NTX-1KC (CRIMP PINS) OR NTX-1KS (SOLDER CUPS)
3. NO CONNECTION TO THESE PINS. RESERVED FOR OTHER FEATURES, FUTURE UPGRADES.
4. THE NTX403-000, REQUIRE THE 'J' INTERFACE CARD.

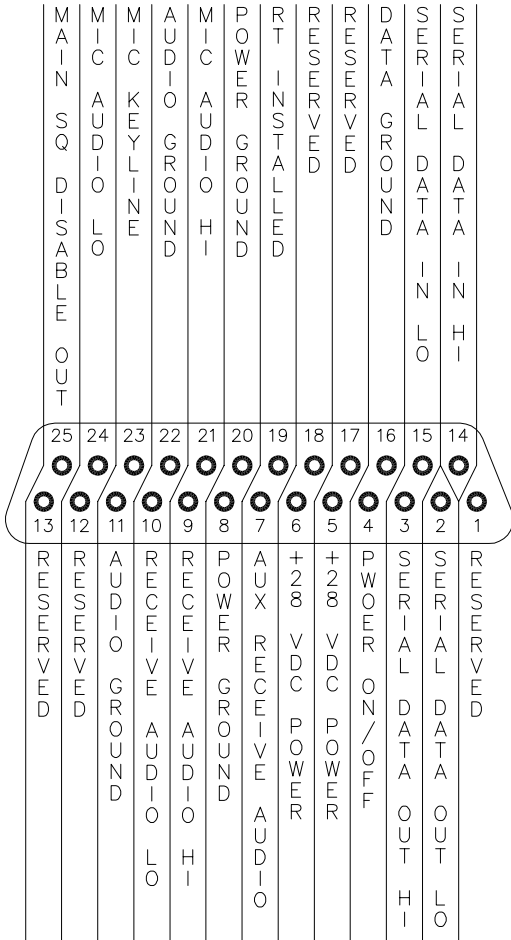
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DESIGNED	RB	<b>NAT</b> NORTHERN AIRBORNE TECHNOLOGY LTD.				
DRAWN	TAT					
DATE	NOV 15/02	TITLE				NTX UHF RADIO CONNECTIONS
CHECKED	NAT 264	NAT 241				
APPROVED			SIZE	CAGE CODE	PART NO.	REV.
			A	3AB01	NTX403	1.00
FILE	403-0100.DWG		DWG. TYPE	INTERCONNECT	DWG. NO.	NTX403\403-0
						SHEET 1/1






P1

25 PIN D-MIN SOCKET  
MATING CONNECTOR



VIEW IS FROM REAR OF AIRFRAME CONNECTOR

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DESIGNED	RB	 <b>NAT</b> NORTHERN AIRBORNE TECHNOLOGY LTD.				
DRAWN	TAT					
DATE	NOV 15/02	TITLE				
CHECKED		UHF FM TRANSCEIVER				
APPROVED		SIZE	CAGE CODE	PART NO.	REV.	SHEET
		A	3AB01	NTX403	1.00	1/1
FILE	405-0100.DWG	DWG. TYPE	CONNECTOR MAP	DWG. NO.	NTX403\405-0	





# INSTALLATION APPROVAL TEST PROCEDURE

NAT Part #: **NTX403**  
Document #: **NTX403\634-0**

Description: **Remote Mount UHF FM Transceiver**  
Rev: **1.00**

## 1. Post Installation EMI Test

---

The purpose of this test is to identify any interference that the NTX403 may cause with existing aircraft systems.

## 2. Test Conditions

---

The NTX403 should be installed and function tested. The antenna VSWR should be checked. A forward/reverse power check with an in-line wattmeter should show no more than 10% reflected power. For the following tests, ensure that the transmit power is set to HI.

## 3. Methodology

---

Most of the EMI tests can be accomplished on the ground. In some cases flight testing is required or is easier. If the aircraft is approved for IFR operations, then it is mandatory that interference between the NTX403 Airborne FM and the approach aids be checked in flight.

The GPS should be operational and navigating with at least the minimum compliment of satellites. The VHF comm should be set to the frequencies indicated with the squelch open. VOR/DME receivers should be set to the frequencies indicated and selected for display. If possible, set up a DME ramp test set on the frequencies indicated and adjust the output until the flags are out of view. The transponder and encoder should be monitored with ramp test equipment. Set the output of the transponder test set to 3 dB above the output necessary to achieve 90% reply. If possible set the ADF to a nearby navigation station.

Modulate the NTX403 transmitter on the indicated frequencies for at least 20 seconds.

Observe the GPS for any degradation in satellite status or availability or flags. Listen for any noise or detected audio signals on the VHF comm(s). Listen for any noise or detected audio signals on the VOR/LOC receiver audio; look for any movement of flags or needles on the VOR/LOC/GS navigation display(s). Observe the transponder for any loss of reply or spurious reply.

List the power plant, fuel and other electric instruments in the chart provided and note any anomalies that occur while transmitting. Assess the results.

If the aircraft is equipped with an autopilot or a stability augmentation system, then test fly the aircraft and verify that operation of the NTX403 transceiver does not have adverse effects on these systems. After checking for gross effects at a safe altitude, fly

an approach with each of the different navigation systems coupled to the autopilot (ILS, GPS etc.) and look for any anomalies.

#### 4. Results

---

If the installed system passes all of the applicable EMI tests, then no further action is required. If interference is observed, then the interference must be assessed against the appropriate standards of airworthiness for the system in question. For example: it is permissible for a VFR certified GPS to lose navigation capability while the NTX403 is transmitting, providing that it recovers properly and promptly, but it is not permissible for an IFR Approach certified GPS to be affected in the same way. A complete discussion of all the standards of airworthiness to be applied in assessing EMI effects is beyond the scope of this document.

#### 5. Procedure

---

- A. Operate the NTX403 transmitter on the following frequencies for at least 20 seconds. Observe the GPS for any degradation in satellite status, or availability, or flags.

FREQUENCIES	GPS #1		GPS #2	
	PASS	FAIL	PASS	FAIL
NTX403				
409.2000 MHz				

NOTES:

- B. Modulate the NTX403 transmitter on the following frequencies for at least 20 seconds. Look for loss of distance information on the display.

FREQUENCIES		RESULTS	
DME 1	NTX403	PASS	FAIL
978 (108.0)	489.0000		
1020 (112.1)	510.0000		

FREQUENCIES		RESULTS	
DME 2	NTX403	PASS	FAIL
978 (108.0)	489.0000		
1020 (112.1)	510.0000		

NOTES:

**Note:** For the following tests, select frequencies at the top, middle and bottom of the range of the NTX403.

Frequency #1 \_\_\_\_\_ Frequency #2 \_\_\_\_\_

Frequency #3 \_\_\_\_\_

- E. At a safe altitude, engage the autopilot or stability augmentation system. Modulate the NTX403 transmitter on the above frequencies for at least 20 seconds. Observe any effect on the autopilot or stability augmentation system.

Observations:

- F. Perform a coupled ILS approach to the aircraft's certified limits. Modulate the NTX403 transmitter on the above frequencies for at least 20 seconds. Observe any effect on the autopilot. Repeat for each different system such as ILS #2, GPS, FMS etc.

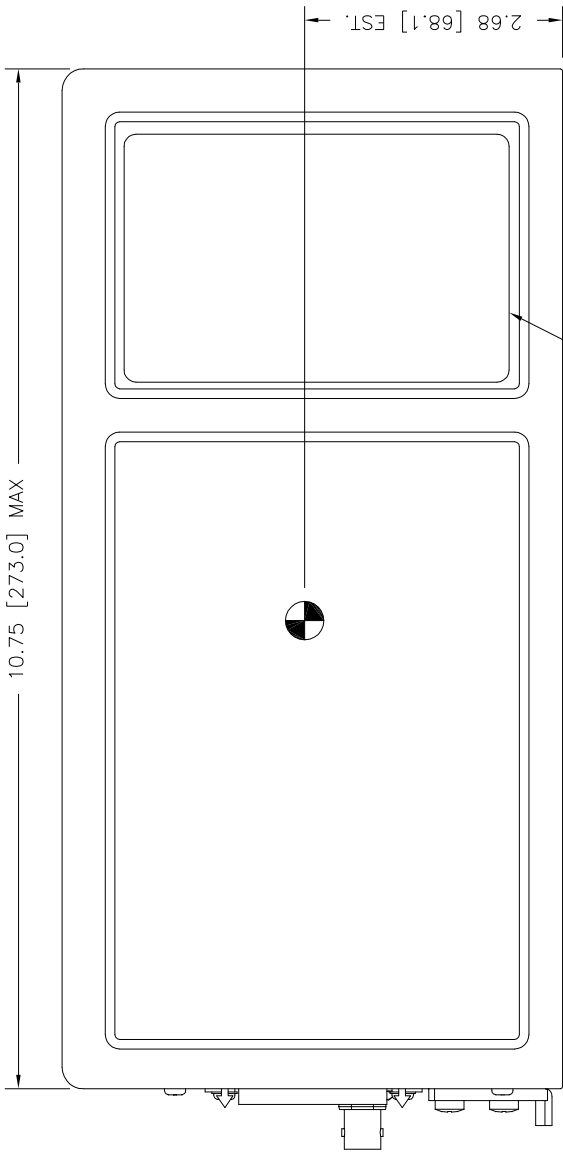
Observations:

- G. List the power plant, fuel and other electric instruments in the chart provided and note any anomalies that occur while transmitting. Assess the results.

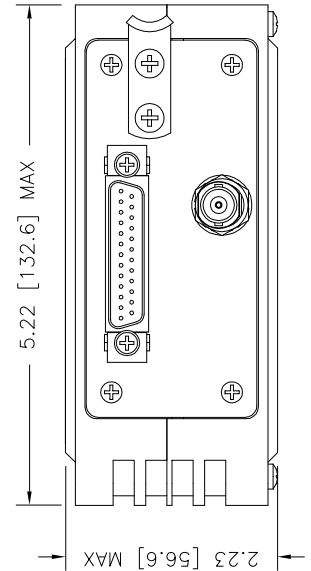
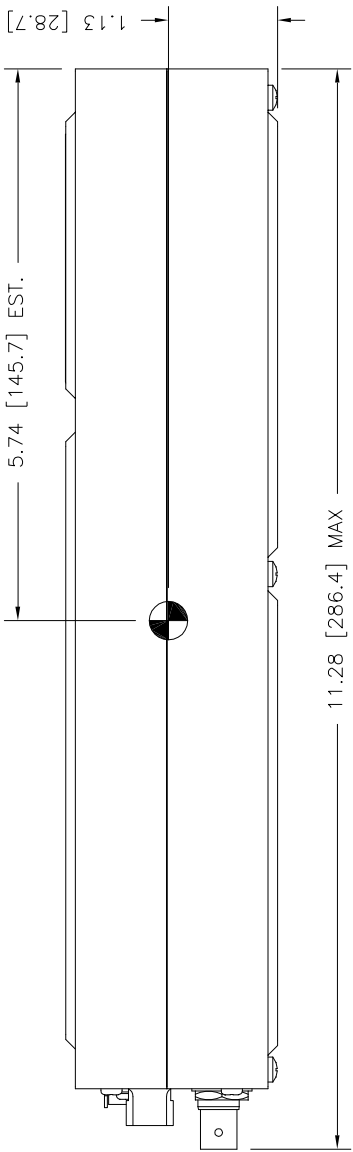
STEP	SYSTEM	PASS	FAIL	NOTES
1	Com 1&2			
2	VOR/LOC 1&2			
3	Glideslope 1&2			
4	Xponder & Encoder			
5	ADF 1 & 2			
6	VG			
7	Compass			
8	Directional Gyro			
9	Oil Pressure			
10	Fuel Pressure			
11	Oil Temp			
12	Amps			
13	Bus Voltage			
14	Fuel %			
15	Ng			
16	TOT			
17	Torque %			







NTX403 PRODUCT LABEL



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DESIGNED DRAWN	RB	DEC 18/02	TITLE	SIZE	CAGE CODE	PART NO.	REV.	SHEET
	TAT							
DATE								
CHECKED	NAT 260	NAT 241	REMOTE MOUNT	A	3AB01	NTX403-000	1.00	1/1
APPROVED	(NAT 114)		UHF FM TRANSCEIVER					
FILE	922-0100.DWG	DWG. TYPE	MECH. INSTALLATION	DWG. NO.	NTX403\000\922-0			

NOTES:  
1. DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5M-1994

● CENTER OF GRAVITY

**nat** NORTHERN AIRBORNE TECHNOLOGY LTD.



## Section 3 Operation

### 3.1 Introduction

Information in this section consists of the functional and operational procedures for the NTX403 Series Remote Mount UHF-FM Transceiver.

### 3.2 General

The NTX403 is an UHF FM transceiver for operation in the 403 MHz to 512 MHz band. The unit is remotely mounted using a 1/4 ATR tray and is operated via an RS-422 serial bus interface using a TH-Series TAC/COM control head.

### 3.3 Operation Specifics

**The NTX403 Series Remote Mount UHF-FM Transceiver has no user operational aspects.** During installation, or if the unit has been exchanged, it may be a requirement to change internal adjustments. This should be done **ONLY BY FULLY QUALIFIED PERSONNEL.**

End of section 3

