

ASTRO[®]

XTS[™] 2500

XTS[™] 2500I

XTS[™] 2250

XTS[™] 1500

MT 1500

PR 1500

Portable Radios

Basic Service Manual



Foreword

This manual covers all models of the ASTRO® XTS™ 2500 /XTS™ 2500I / XTS™ 2250 / XTS™ 1500 Digital Portable Radio and the MT 1500 and PR 1500 Portable Radio, unless otherwise specified. It includes all the information necessary to maintain peak product performance and maximum working time, using the pass/fail service approach. This basic level of service is typical of some local service centers, self-maintained customers, and some distributors.

Included in this manual is: radio specifications for the VHF frequency band; a general description of XTS 2500 /XTS 2500I / XTS 2250 / XTS 1500 / MT 1500 / PR 1500 radio models; recommended test equipment, service aids, and tools; radio alignment procedures; fundamental disassembly/reassembly procedures; and general maintenance recommendations.

For details on the operation of the radio, or board or component-level troubleshooting, refer to the applicable manuals, available separately. To help you with your selection, a list is provided under “Related Publications” at the front of this manual.

Safety

Before operating an XTS 2500 /XTS 2500I / XTS 2250 / XTS 1500 / MT 1500 / PR 1500 radio, please read the RF energy awareness information and operating instructions in the Product Safety and RF Exposure booklet enclosed with your radio (Motorola Publication part number 6881095C98) to ensure compliance with RF energy exposure limits.

Manual Revisions

Changes which occur after this manual is printed are described in "PMRs." These PMRs provide complete information on changes, including pertinent parts list data.

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Document History

The following major changes have been implemented in this manual since the previous edition:

Edition	Description	Date
6816984H01-A	Initial Release.	Feb. 2006
6816984H01-B	Added PMR089, PMR090 and 900 MHz stuffers to the manual.	Aug. 2007
6816984H01-C	Added PMR140, PMR142 and PMR145 stuffer information. Updated model charts section.	Mar. 2009

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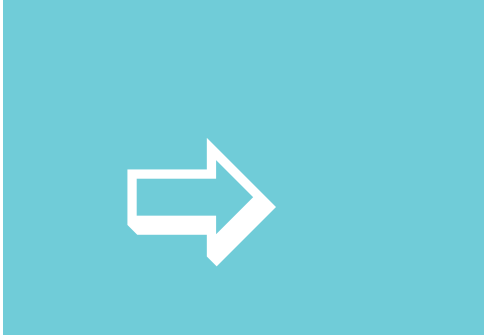
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Related Manuals

ASTRO XTS 2500/XTS 2500I Digital Portable Radio User Guide (CD) (all models).....	PMLN4940_
ASTRO XTS 2500 Digital Portable Radio Detailed Service Manual	6816985H01
ASTRO XTS 2250 Digital Portable Radio Basic Model User Guide (CD).....	PMLN4942_
ASTRO XTS 2250 Digital Portable Radio Model 1.5 User Guide (CD).....	PMLN4942_
ASTRO XTS 2250 Digital Portable Radio Advanced Model User Guide (CD).....	PMLN4942_
ASTRO XTS 1500 Digital Portable Radio User Guide (CD).....	PMLN4940_
MT 1500 Analog Portable Radio User Guide (CD)	PMLN4940_
PR 1500 Analog Portable Radio User Guide (CD).....	PMLN4943_
Factory Mutual Approval: MT 1500/XTS 1500/PR 1500/XTS 2500/XTS 2250 Product Listing	6881094C77

Commercial Warranty



Limited Warranty

MOTOROLA COMMUNICATION PRODUCTS

I. What This Warranty Covers And For How Long

MOTOROLA INC. (“MOTOROLA”) warrants the MOTOROLA manufactured Communication Products listed below (“Product”) against defects in material and workmanship under normal use and service for a period of time from the date of purchase as scheduled below:

ASTRO Digital XTS 2500 Portable Units	One (1) Year
Product Accessories	One (1) Year

Motorola, at its option, will at no charge either repair the Product (with new or reconditioned parts), replace it (with a new or reconditioned Product), or refund the purchase price of the Product during the warranty period provided it is returned in accordance with the terms of this warranty. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts of Product shall become the property of MOTOROLA.

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IV. How To Get Warranty Service

You must provide proof of purchase (bearing the date of purchase and Product item serial number) in order to receive warranty service and, also, deliver or send the Product item, transportation and insurance prepaid, to an authorized warranty service location. Warranty service will be provided by Motorola through one of its authorized warranty service locations. If you first contact the company which sold you the Product, it can facilitate your obtaining warranty service. You can also call Motorola at 1-888-567-7347 US/Canada.

V. What This Warranty Does Not Cover

- A) Defects or damage resulting from use of the Product in other than its normal and customary manner.
- B) Defects or damage from misuse, accident, water, or neglect.
- C) Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment.
- D) Breakage or damage to antennas unless caused directly by defects in material workmanship.
- E) A Product subjected to unauthorized Product modifications, disassemblies or repairs (including, without limitation, the addition to the Product of non-Motorola supplied equipment) which adversely affect performance of the Product or interfere with Motorola's normal warranty inspection and testing of the Product to verify any warranty claim.
- F) Product which has had the serial number removed or made illegible.
- G) Rechargeable batteries if:
 - any of the seals on the battery enclosure or cells are broken or show evidence of tampering.
 - the damage or defect is caused by charging or using the battery in equipment or service other than the Product for which it is specified.
- H) Freight costs to the repair depot.

- I) A Product which, due to illegal or unauthorized alteration of the software/ firmware in the Product, does not function in accordance with MOTOROLA's published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from MOTOROLA.
- J) Scratches or other cosmetic damage to Product surfaces that does not affect the operation of the Product.
- K) Normal and customary wear and tear.

VI. Patent And Software Provisions

MOTOROLA will defend, at its own expense, any suit brought against the end user purchaser to the extent that it is based on a claim that the Product or parts infringe a United States patent, and MOTOROLA will pay those costs and damages finally awarded against the end user purchaser in any such suit which are attributable to any such claim, but such defense and payments are conditioned on the following:

- A) that MOTOROLA will be notified promptly in writing by such purchaser of any notice of such claim;
- B) that MOTOROLA will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and
- C) should the Product or parts become, or in MOTOROLA's opinion be likely to become, the subject of a claim of infringement of a United States patent, that such purchaser will permit MOTOROLA, at its option and expense, either to procure for such purchaser the right to continue using the Product or parts or to replace or modify the same so that it becomes noninfringing or to grant such purchaser a credit for the Product or parts as depreciated and accept its return. The depreciation will be an equal amount per year over the lifetime of the Product or parts as established by MOTOROLA.

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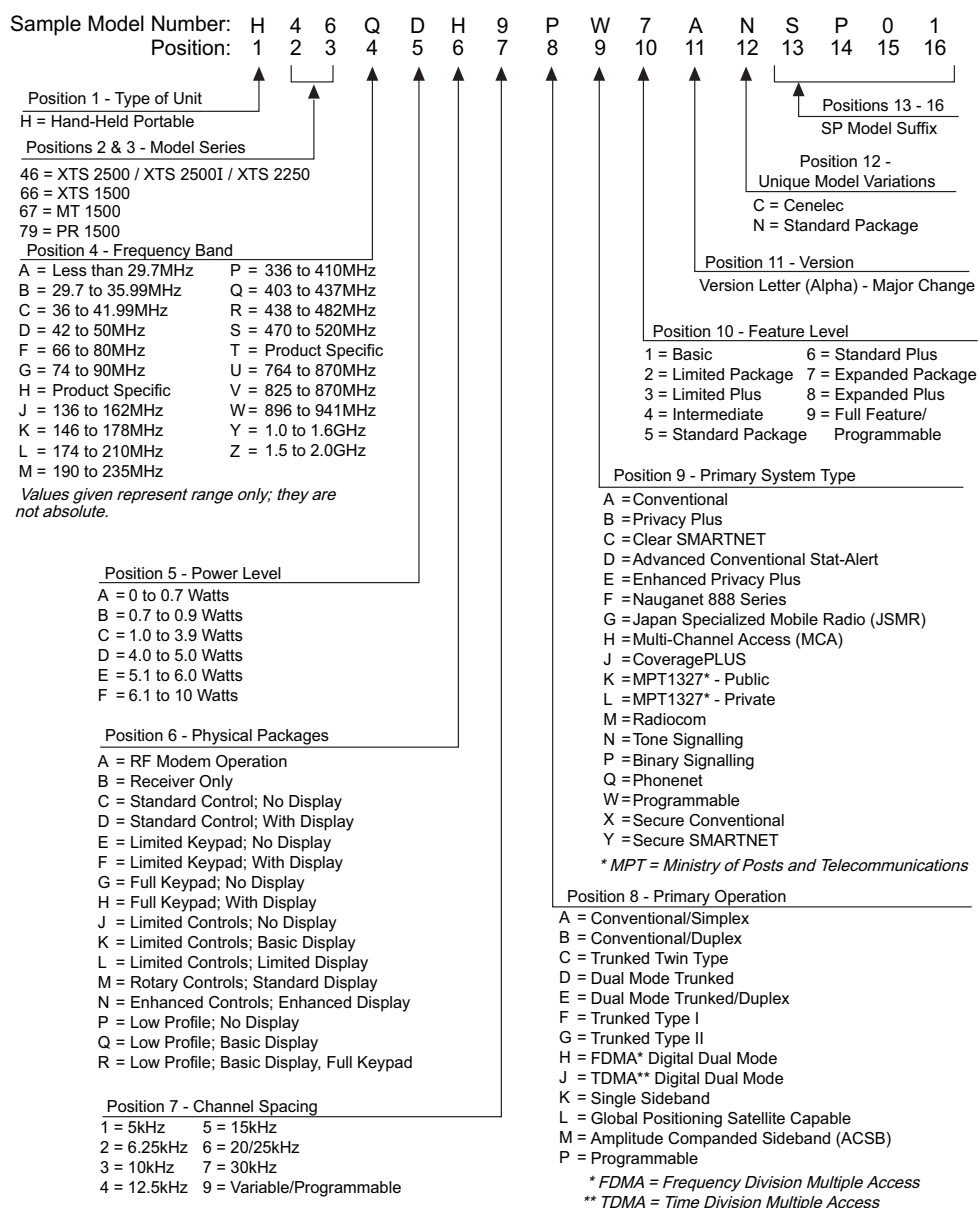
This Warranty is governed by the laws of the State of Illinois, USA.

Notes

Specifications



Portable Radio Model Numbering System



Specifications for VHF Radios

All specifications are per Telecommunications Industries Association TIA-603, unless otherwise noted.

GENERAL	RECEIVER	TRANSMITTER
FCC ID: 136-174 MHz: AZ489FT3807	Frequency Range: 136-174 MHz	Frequency Range: 136-174 MHz
Temperature Range: Operating: -30°C to +60°C Storage: -40°C to +85°C	Quieting Sensitivity (typical) (20dBQ): 0.23µV	RF Power: 136-174 MHz: 5 Watts
Power Supply: Nickel-Cadmium Battery (NiCd) or Nickel-Metal-Hydride Battery (NiMH)	Usable Sensitivity (typical): (12dB SINAD): 0.25µV	Frequency Stability (typical): (-30 to +60°C; 25°C ref.): 2.5ppm
Battery Voltage: Nominal: 7.5 Volts Range: 6 to 9 Volts	Intermodulation (typical): -78dB	Emission (typical conducted): -73 dBc<1GHz
Transmit Current Drain (typical): 1900mA	Selectivity (typical): (25kHz Channel): -70dB (12.5kHz Channel): -63dB	FM Hum and Noise (typical): (25 kHz channel): -46dB (12.5 kHz channel): -42dB
Receive Current Drain (Rated Audio): 220mA	Spurious Rejection (typical): -80dB	Distortion (typical): 1%
Standby Current Drain: 70mA	Frequency Stability: (-30+60°C; 25°C reference): 2.5ppm	Modulation Limiting: 25 kHz chnls ±5.0kHz 12.5 kHz chnls ±2.5kHz
Dimensions: Height x Width x Depth	Rated Audio: 500mW	Emissions Designators: 16K0F3E, 11K0F3E, 8K10F1D, and 8K10F1E
Radio Less Battery: 6.0" x 2.3" x 1.5"	FM Hum and Noise (typical): (25kHz channel): -52dB (12.5kHz channel): -40dB	(Encryption): 20K0F1E
With NiCd Ultra-High Cap.: 6.0" x 2.3" x 2.0"	Distortion (at Rated Audio; typical): 1%	
With NiMH Ultra-High Cap.: 6.0" x 2.3" x 2.0"	Channel Spacing: 12.5/25 kHz	
Weight		
Radio Less Battery: 11.0 oz.		
With NiCd Ultra-High Capacity: 20.0 oz.		
With NiMH Ultra-High Capacity: 20.5 oz.		

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart

MODEL NUMBER								DESCRIPTION	
H46KDC9PW5BN								136–174 MHz, 1–5 Watts, ASTRO Digital XTS 2500/XTS 2500I Model I	
H46KDD9PW5BN								136–174 MHz, 1–5 Watts, ASTRO Digital XTS 2500/XTS 2500I Model 1.5	
H46KDF9PW6BN								136–174 MHz, 1–5 Watts, ASTRO Digital XTS 2500/XTS 2500I Model II	
H46KDH9PW7BN								136–174 MHz, 1–5 Watts, ASTRO Digital XTS 2500/XTS 2500I Model III	
H46KDC9PW5BNI								136–174 MHz, 1–5 Watts, ASTRO Digital XTS 2250 Model I	
H46KDD9PW5BNI								136–174 MHz, 1–5 Watts, ASTRO Digital XTS 2250 Model 1.5	
H46KDH9PW7BNI								136–174 MHz, 1–5 Watts, ASTRO Digital XTS 2250 Model III	
ITEM NUMBER								DESCRIPTION	
X	X	X	X	X	X	X	X	–	Antenna (See “Accessories”)
X	X	X	X	X	X	X	X	–	Battery (See “Accessories”)
X	X	X	X	X	X	X	X	–	Carry Accessories (See “Accessories”)
X	X	X	X	X	X	X	X	–	Hardware (See “Exploded Views and Parts Lists”)
X	X	X	X	X	X	X	X	NNTN6263_	JedRay NiMH impres FM Immersible Battery
X	X	X	X	X	X	X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	X	X	X	X	X	X	1505579Z01	Cover, Dust, Accessory Connector
X	X	X	X	X	X	X	X	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
X								PMLN4801	Front Cover Kit, XTS 2500 Model I Non-Immersible, Non-Secure
	X							PMLN4783_	Front Cover Kit, XTS 2500 Model 1.5 Non-Immersible, Non-Secure
		X						PMLN4851_	Front Cover Kit, XTS 2500 Model II Non-Immersible, Non-Secure
			X					PMLN4773_	Front Cover Kit, XTS 2500 Model III Non-Immersible, Non-Secure
				X				PMLN4897_	Front Cover Kit, XTS 2500 Model 1.5 Non-Immersible, Secure
			X					PMLN4898_	Front Cover Kit, XTS 2500 Model II Non-Immersible, Secure
				X				PMLN4899_	Front Cover Kit, XTS 2500 Model III Non-Immersible, Secure
X								PMLN4772_	Front Cover Kit, XTS 2500 Model I Immersible, Non-Secure
	X							PMLN4791_	Front Cover Kit, XTS 2500 Model 1.5 Immersible, Non-Secure
		X						PMLN4792_	Front Cover Kit, XTS 2500 Model II Immersible, Non-Secure
			X					PMLN4794_	Front Cover Kit, XTS 2500 Model III Immersible, Non-Secure
				X				PMLN4798_	Front Cover Kit, XTS 2500 Model 1.5 Immersible, Secure
			X					PMLN4799_	Front Cover Kit, XTS 2500 Model II Immersible, Secure
				X				PMLN4800_	Front Cover Kit, XTS 2500 Model III Immersible, Secure
					X			PMLN4784_	Front Cover Kit, XTS 2250 Model I Non-Immersible, Non-Secure
						X		PMLN4855_	Front Cover Kit, XTS 2250 Model 1.5 Non-Immersible, Non-Secure
							X	PMLN4856_	Front Cover Kit, XTS 2250 Model III Non-Immersible, Non-Secure
						X		PMLN4779_	Front Cover Kit, XTS 2250 Model 1.5 Non-Immersible, Secure
							X	PMLN4780_	Front Cover Kit, XTS 2250 Model III Non-Immersible, Secure
X	X	X	X	X	X	X	X	PMLD4264_	RF Board Kit, VHF, Commercial & Trade Agreement
X	X	X	X					NLD8921_	RF Board Kit, VHF, Buy-US
	X							PMLN4924_	Secure Board, XTS 2500 Model 1.5 AES
		X						PMLN4925_	Secure Board, XTS 2500 Model 1.5 DES, DES-XL, DES-OFB
			X					PMLN4926_	Secure Board, XTS 2500 Model 1.5 ADP
				X				PMLN4927_	Secure Board, XTS 2500 Model II AES
					X			PMLN4928_	Secure Board, XTS 2500 Model II DES, DES-XL, DES-OFB
						X		PMLN4929_	Secure Board, XTS 2500 Model II ADP
							X	PMLN4930_	Secure Board, XTS 2500 Model III AES
								PMLN4931_	Secure Board, XTS 2500 Model III DES, DES-XL, DES-OFB
							X	PMLN4932_	Secure Board, XTS 2500 Model III ADP
X								PMUD2197_	Tanapa, XTS 2500 Mod I Non-Immersible, Non-Secure VHF Commercial/Trade Agreement
X								PMUD2454_	Tanapa, XTS 2500 Mod I Non-Immersible, Non-Secure VHF Commercial/Trade Agreement
	X							PMUD2198_	Tanapa, XTS 2500 Mod 1.5 Non-Immersible, Non-Secure VHF Commercial/Trade Agreement
		X						PMUD2457_	Tanapa, XTS 2500 Mod 1.5 Non-Immersible, Non-Secure VHF Commercial/Trade Agreement
			X					PMUD2199_	Tanapa, XTS 2500 Mod II Non-Immersible, Non-Secure VHF Commercial/Trade Agreement
				X				PMUD2462_	Tanapa, XTS 2500 Mod II Non-Immersible, Non-Secure VHF Commercial/Trade Agreement
					X			PMUD2200_	Tanapa, XTS 2500 Mod III Non-Immersible, Non-Secure VHF Commercial/Trade Agreement
						X		PMUD2467_	Tanapa, XTS 2500 Mod III Non-Immersible, Non-Secure VHF Commercial/Trade Agreement
	X							PMUD2182_	Tanapa, XTS 2500 Mod 1.5 Non-Immersible, Secure VHF Commercial/Trade Agreement
		X						PMUD2459_	Tanapa, XTS 2500 Mod 1.5 Non-Immersible, Secure VHF Commercial/Trade Agreement
			X					PMUD2183_	Tanapa, XTS 2500 Mod II Non-Immersible, Secure VHF Commercial/Trade Agreement
				X				PMUD2465_	Tanapa, XTS 2500 Mod II Non-Immersible, Secure VHF Commercial/Trade Agreement
					X			PMUD2184_	Tanapa, XTS 2500 Mod III Non-Immersible, Secure VHF Commercial/Trade Agreement
						X		PMUD2469_	Tanapa, XTS 2500 Mod III Non-Immersible, Secure VHF Commercial/Trade Agreement

NOTE: X = Item included. (Model chart continues on next page)

ASTRO XTS 2500/XTS 2500I/2250 Model Chart (continued)

MODEL NUMBER						DESCRIPTION
H46KDC9PW5BN						136-174 MHz, 1-5 Watts, ASTRO Digital XTS 2500/XTS 2500I Model I
H46KDD9PW5BN						136-174 MHz, 1-5 Watts, ASTRO Digital XTS 2500/XTS 2500I Model 1.5
H46KDF9PW6BN						136-174 MHz, 1-5 Watts, ASTRO Digital XTS 2500/XTS 2500I Model II
H46KDH9PW7BN						136-174 MHz, 1-5 Watts, ASTRO Digital XTS 2500/XTS 2500I Model III
H46KDC9PW5BNI						136-174 MHz, 1-5 Watts, ASTRO Digital XTS 2250 Model I
H46KDD9PW5BNI						136-174 MHz, 1-5 Watts, ASTRO Digital XTS 2250 Model 1.5
H46KDH9PW7BNI						136-174 MHz, 1-5 Watts, ASTRO Digital XTS 2250 Model III
ITEM NUMBER						DESCRIPTION
X						PMUD2145_ Tanapa, XTS 2500 Model I Immersible, Non-Secure VHF Commercial/Trade Agreement
X						PMUD2455_ Tanapa, XTS 2500 Model I Immersible, Non-Secure VHF Commercial/Trade Agreement
	X					PMUD2146_ Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure VHF Commercial/Trade Agreement
	X					PMUD2458_ Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure VHF Commercial/Trade Agreement
		X				PMUD2149_ Tanapa, XTS 2500 Model II Immersible, Non-Secure VHF Commercial/Trade Agreement
		X				PMUD2463_ Tanapa, XTS 2500 Model II Immersible, Non-Secure VHF Commercial/Trade Agreement
			X			PMUD2152_ Tanapa, XTS 2500 Model III Immersible, Non-Secure VHF Commercial/Trade Agreement
			X			PMUD2468_ Tanapa, XTS 2500 Model III Immersible, Non-Secure VHF Commercial/Trade Agreement
X						PMUD2148_ Tanapa, XTS 2500 Model 1.5 Immersible, Secure VHF Commercial/Trade Agreement
X						PMUD2452_ Tanapa, XTS 2500 Model 1.5 Immersible, Secure VHF Commercial/Trade Agreement
	X					PMUD2151_ Tanapa, XTS 2500 Model II Immersible, Secure VHF Commercial/Trade Agreement
	X					PMUD2466_ Tanapa, XTS 2500 Model II Immersible, Secure VHF Commercial/Trade Agreement
		X				PMUD2154_ Tanapa, XTS 2500 Model III Immersible, Secure VHF Commercial/Trade Agreement
		X				PMUD2470_ Tanapa, XTS 2500 Model III Immersible, Secure VHF Commercial/Trade Agreement
X						NUD2889_ Tanapa, XTS 2500 Model I Non-Immersible, Non-Secure VHF Buy-US
	X					NUD2890_ Tanapa, XTS 2500 Model 1.5 Non-Immersible, Non-Secure VHF Buy-US
		X				NUD2892_ Tanapa, XTS 2500 Model II Non-Immersible, Non-Secure VHF Buy-US
			X			NUD2894_ Tanapa, XTS 2500 Model III Non-Immersible, Non-Secure VHF Buy-US
X						NUD2891_ Tanapa, XTS 2500 Model 1.5 Non-Immersible, Secure VHF Buy-US
	X					NUD2893_ Tanapa, XTS 2500 Model II Non-Immersible, Secure VHF Buy-US
		X				NUD2895_ Tanapa, XTS 2500 Model III Non-Immersible, Secure VHF Buy-US
X						NUD2880_ Tanapa, XTS 2500 Model I Immersible, Non-Secure VHF Buy-US
X						NUD2881_ Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure VHF Buy-US
	X					NUD2883_ Tanapa, XTS 2500 Model II Immersible, Non-Secure VHF Buy-US
		X				NUD2885_ Tanapa, XTS 2500 Model III Immersible, Non-Secure VHF Buy-US
X						NUD2888_ Tanapa, XTS 2500 Model 1.5 Immersible, Secure VHF Buy-US
	X					NUD2884_ Tanapa, XTS 2500 Model II Immersible, Secure VHF Buy-US
		X				NUD2887_ Tanapa, XTS 2500 Model III Immersible, Secure VHF Buy-US
			X			PMUD2201_ Tanapa, XTS 2250 Model I Non-Immersible, Non-Secure VHF
			X			PMUD2456_ Tanapa, XTS 2250 Model I Non-Immersible, Non-Secure VHF
				X		PMUD2202_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Non-Secure VHF
				X		PMUD2460_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Non-Secure VHF
				X		PMUD2203_ Tanapa, XTS 2250 Model III Non-Immersible, Non-Secure VHF
				X		PMUD2451_ Tanapa, XTS 2250 Model III Non-Immersible, Non-Secure VHF
				X		PMUD2155_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Secure VHF
				X		PMUD2461_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Secure VHF
				X		PMUD2156_ Tanapa, XTS 2250 Model III Non-Immersible, Secure VHF
				X		PMUD2453_ Tanapa, XTS 2250 Model III Non-Immersible, Secure VHF
X	X	X	X			3316369H01 Nameplate, XTS 2500, Model 1, 1.5, II, III
X	X	X	X			3316369H06 Nameplate, XTS 2500I, Model I, 1.5, II, III
				X	X	3316369H02 Nameplate, XTS 2250, Model 1.5, III
X						6816978H01 User's Guide, XTS 2500/XTS 2500I Model I
	X					6816979H01 User's Guide, XTS 2500/XTS 2500I Model 1.5
		X				6816980H01 User's Guide, XTS 2500/XTS 2500I Model II
			X			6816981H01 User's Guide, XTS 2500/XTS 2500I Model III
				X		6871190L01 User's Guide, XTS 2250 Model I
				X		6871201L01 User's Guide, XTS 2250 Model 1.5
					X	6871202L01 User's Guide, XTS 2250 Model III
X	X	X	X			PMLN4940_ User's Guide CD, XTS 2500/XTS 2500I Model I, 1.5, II, III
				X	X	PMLN4942_ User's Guide CD, XTS 2250 Model I, 1.5, III

NOTE: X = Item included. (Model chart continues on next page.)

ASTRO XTS 1500/MT 1500 Model Chart

MODEL NUMBER				DESCRIPTION	
H66KDC9PW5BN				136-174 MHz, 1-5 Watts, ASTRO Digital XTS 1500 Model I	
H66KDD9PW5BN				136-174 MHz, 1-5 Watts, ASTRO Digital XTS 1500 Model 1.5	
H67KDC9PW5BN				136-174 MHz, 1-5 Watts, ASTRO Digital MT 1500 Model I	
H67KDD9PW5BN				136-174 MHz, 1-5 Watts, ASTRO Digital MT 1500 Model 1.5	
ITEM NUMBER				DESCRIPTION	
X	X	X	X	-	Antenna (See "Accessories")
X	X	X	X	-	Battery (See "Accessories")
X	X	X	X	-	Carry Accessories (See "Accessories")
X	X	X	X	-	Hardware (See "Exploded Views and Parts Lists")
X	X	X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	X	X	1585746D04	Cover, Dust, Accessory Connector
	X		X	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
X				PMLN4915_	Front Cover Kit, XTS 1500 Model I Non-Immersible, Non-Secure
	X			PMLN4900_	Front Cover Kit, XTS 1500 Model 1.5 Non-Immersible, Non-Secure
		X		PMLN4916_	Front Cover Kit, MT 1500 Model I Non-Immersible, Non-Secure
			X	PMLN4901_	Front Cover Kit, MT 1500 Model 1.5 Non-Immersible, Non-Secure
X	X	X	X	PMLD4264_	RF Board Kit, VHF
X				PMUD1966_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, VHF, 9600 Digital, Trunked
X				PMUD1967_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, VHF, 3600 Analog/Digital, Trunked
X				PMUD1968_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, VHF, P25 Conventional
	X			PMUD2169_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, VHF, 9600 Digital, Trunked
	X			PMUD2172_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, VHF, 3600 Analog/Digital, Trunked
	X			PMUD2173_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, VHF, P25 Conventional
		X		PMUD1969_	Tanapa, MT 1500 Model I Non-Immersible, Non-Secure, VHF, Analog, Conventional
		X		PMUD1970_	Tanapa, MT 1500 Model I Non-Immersible, Non-Secure, VHF, 3600 Analog
			X	PMUD2160_	Tanapa, MT 1500 Model 1.5 Non-Immersible, Non-Secure, VHF, Analog, Conventional
			X	PMUD2161_	Tanapa, MT 1500 Model 1.5 Non-Immersible, Non-Secure, VHF, 3600 Analog
X	X	X	X	3316369H03	Nameplate, XTS 1500, Model I/1.5
X	X	X	X	3316369H04	Nameplate, MT 1500, Model I/1.5
X				6816982H01	User's Guide, XTS 1500 Model I
	X			6871198L01	User's Guide, XTS 1500 Model 1.5
X				6816983H01	User's Guide, MT 1500 Model I
	X			6871199L01	User's Guide, MT 1500 Model 1.5
X	X	X	X	PMLN4940_	User's Guide CD, XTS 1500 and MT 1500 Model I, 1.5

NOTE: X = Item included.

PR 1500 Model Chart

MODEL NUMBER		DESCRIPTION
AAH79KDC9PW5BN		136-174 MHz, 1-5 Watts, PR1500 Model I
	ITEM NUMBER	DESCRIPTION
X	–	Antenna (See “Accessories”)
X	–	Battery (See “Accessories”)
X	–	Carry Accessories (See “Accessories”)
X	–	Hardware (See “Exploded Views and Parts Lists”)
X	4385665D01	Adapter, Remote Speaker Microphone
X	1585746D04	Cover, Dust, Accessory Connector
X	PMLN4902_	Front Cover Kit, PR 1500 Model I Non-Immersible, Non-Secure
X	PMLD4264_	RF Board Kit, VHF
X	PMUD2071_	Tanapa, PR 1500 Model I Non-Immersible, Non-Secure, VHF, Analog, Conventional
X	3316369H05	Nameplate, PR 1500, Model I
X	6871200L01	User’s Guide, PR 1500 Model I
X	PMLN4943_	User’s Guide CD, PR 1500 Model I

NOTE: X = Item included

Specifications for UHF Range 1 Radios

All specifications are per Telecommunications Industries Association TIA-603, unless otherwise noted.

GENERAL	RECEIVER	TRANSMITTER
FCC ID: 380-470 MHz: AZ489FT4865 Temperature Range: Operating: -30°C to +60°C Storage: -40°C to +85°C Power Supply: Nickel-Cadmium Battery (NiCd) or Nickel-Metal-Hydride Battery (NiMH) Battery Voltage: Nominal: 7.5 Volts Range: 6 to 9 Volts Transmit Current Drain (typical): 2100mA Receive Current Drain (Rated Audio): 220mA Standby Current Drain: 80mA Recommended Battery: High-Capacity NiCd: NTN9815 or Ultra-High-Capacity NiMH: NTN9858 or High-Capacity NiCd FM: NTN9816* or Ultra-High-Capacity NiMH FM: NTN9857* or Ultra-High-Cap. NiMH Imrsble: NNTN6263* Optional FM (Factory Mutual) Battery: * FM Intrinsically Safe: Class I, II, III Dimensions: Height x Width x Depth Radio Less Battery: 6.0" x 2.3" x 1.5" With NiCd Ultra-High Cap.: 6.0" x 2.3" x 2.0" With NiMH Ultra-High Cap.: 6.0" x 2.3" x 2.0" Weight Radio Less Battery: 11.0 oz. With NiCd Ultra-High Capacity: 20.0 oz. With NiMH Ultra-High Capacity: 20.5 oz.	Frequency Range: 380-470 MHz Quieting Sensitivity (typical) (20dBQ): 0.23µV Usable Sensitivity (typical): (12dB SINAD): 0.25µV Intermodulation (typical): -73dB Selectivity (typical): (25kHz Channel): -73dB (12.5kHz Channel): -63dB Spurious Rejection (typical): -80dB Frequency Stability: (-30+60°C; 25°C reference): 2.0ppm Rated Audio: 500mW FM Hum and Noise (typical): (25kHz channel): -52dB (12.5kHz channel): -40dB Distortion (at Rated Audio; typical): 2% Channel Spacing: 12.5/25 kHz	Frequency Range: 380-470 MHz RF Power: 380-470 MHz: 5 Watts Frequency Stability (typical): (-30 to +60°C; 25°C ref.): 2.0ppm Emission (typical conducted): -70dBc<1GHz FM Hum and Noise (typical): (25 kHz channel): -45dB (12.5 kHz channel): -42dB Distortion (typical): 1% Modulation Limiting: 25 kHz chnls ±5.0kHz 12.5 kHz chnls ±2.5kHz Emissions Designators: 16K0F3E, 11K0F3E, 8K10F1D, and 8K10F1E

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart

MODEL NUMBER								DESCRIPTION	
H46QDC9PW5BN								380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model I	
H46QDD9PW5BN								380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model 1.5	
H46QDF9PW6BN								380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model II	
H46QDH9PW7BN								380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model III	
H46QDC9PW5BNI								380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model I	
H46QDD9PW5BNI								380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model I.5	
H46QDH9PW7BNI								380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model III	
ITEM NUMBER								DESCRIPTION	
X	X	X	X	X	X	X	X	-	Antenna (See "Accessories")
X	X	X	X	X	X	X	X	-	Battery (See "Accessories")
X	X	X	X	X	X	X	X	-	Carry Accessories (See "Accessories")
X	X	X	X	X	X	X	X	-	Hardware (See "Exploded Views and Parts Lists")
X	X	X	X					NNTN6263_	NiMH impres FM Immersible Battery
X	X	X	X	X	X	X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	X	X	X	X	X	X	1505579Z01	Cover, Dust, Accessory Connector
X	X	X	X	X	X	X	X	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
X								PMLN4801_	Front Cover Kit, XTS 2500 Model I Non-Immersible, Non-Secure
	X							PMLN4783_	Front Cover Kit, XTS 2500 Model 1.5 Non-Immersible, Non-Secure
		X						PMLN4851_	Front Cover Kit, XTS 2500 Model II Non-Immersible, Non-Secure
			X					PMLN4773_	Front Cover Kit, XTS 2500 Model III Non-Immersible, Non-Secure
X								PMLN4772_	Front Cover Kit, XTS 2500 Model I Immersible, Non-Secure
	X							PMLN4791_	Front Cover Kit, XTS 2500 Model 1.5 Immersible, Non-Secure
		X						PMLN4792_	Front Cover Kit, XTS 2500 Model II Immersible, Non-Secure
			X					PMLN4794_	Front Cover Kit, XTS 2500 Model III Immersible, Non-Secure
				X				PMLN4784_	Front Cover Kit, XTS 2250 Model I Non-Immersible, Non-Secure
					X			PMLN4855_	Front Cover Kit, XTS 2250 Model 1.5 Non-Immersible, Non-Secure
						X		PMLN4856_	Front Cover Kit, XTS 2250 Model III Non-Immersible, Non-Secure
	X					X		PMLN4924_	Secure Board, XTS Model 1.5 AES
	X					X		PMLN4925_	Secure Board, XTS Model 1.5 DES, DES-XL, DES-OFB
	X					X		PMLN4926_	Secure Board, XTS Model 1.5 ADP
		X						PMLN4927_	Secure Board, XTS Model II AES
		X						PMLN4928_	Secure Board, XTS Model II DES, DES-XL, DES-OFB
		X						PMLN4929_	Secure Board, XTS Model II ADP
			X				X	PMLN4930_	Secure Board, XTS Model III AES
			X				X	PMLN4931_	Secure Board, XTS Model III DES, DES-XL, DES-OFB
			X				X	PMLN4932_	Secure Board, XTS Model III ADP
X	X	X	X	X	X	X	X	PMLE4425_	RF Board Kit, UHF Range 1, Commercial&Trade Agreement
X	X	X	X					NLE4281_	RF Board Kit, UHF Range 1, Buy-US

NOTE: X = Item included. (Model chart continues on next page.)

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart (continued)

MODEL NUMBER						DESCRIPTION
					H46QDC9PW5BN	380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model I
					H46QDD9PW5BN	380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model 1.5
					H46QDF9PW6BN	380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model II
					H46QDH9PW7BN	380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model III
					H46QDC9PW5BNI	380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model I
					H46QDD9PW5BNI	380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model I.5
					H46QDH9PW7BNI	380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model III
ITEM NUMBER						DESCRIPTION
X					PMUE4437_	Tanapa, XTS 2500 Model I Non-Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
X					PMUE3334_	Tanapa, XTS 2500 Model I Non-Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
	X				PMUE4438_	Tanapa, XTS 2500 Model 1.5 Non-Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
	X				PMUE3337_	Tanapa, XTS 2500 Model 1.5 Non-Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
		X			PMUE4439_	Tanapa, XTS 2500 Model II Non-Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
		X			PMUE3342_	Tanapa, XTS 2500 Model II Non-Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
			X		PMUE4440_	Tanapa, XTS 2500 Model III Non-Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
			X		PMUE3345_	Tanapa, XTS 2500 Model III Non-Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
	X				PMUE2573_	Tanapa, XTS 2500 Model 1.5 Non-Immersible, Secure, UHF R1 Comm./Trade Agreement
	X				PMUE3339_	Tanapa, XTS 2500 Model 1.5 Non-Immersible, Secure, UHF R1 Comm./Trade Agreement
		X			PMUE2574_	Tanapa, XTS 2500 Model II Non-Immersible, Secure, UHF R1 Comm./Trade Agreement
		X			PMUE3344_	Tanapa, XTS 2500 Model II Non-Immersible, Secure, UHF R1 Comm./Trade Agreement
			X		PMUE2575_	Tanapa, XTS 2500 Model III Non-Immersible, Secure, UHF R1 Comm./Trade Agreement
			X		PMUE3347_	Tanapa, XTS 2500 Model III Non-Immersible, Secure, UHF R1 Comm./Trade Agreement
X					PMUE2486_	Tanapa, XTS 2500 Model I Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
X					PMUE3335_	Tanapa, XTS 2500 Model I Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
	X				PMUE2487_	Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
	X				PMUE3338_	Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
		X			PMUE2490_	Tanapa, XTS 2500 Model II Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
		X			PMUE3343_	Tanapa, XTS 2500 Model II Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
			X		PMUE2493_	Tanapa, XTS 2500 Model III Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
			X		PMUE3346_	Tanapa, XTS 2500 Model III Immersible, Non-Secure, UHF R1 Comm./Trade Agreement
	X				PMUE2489_	Tanapa, XTS 2500 Model 1.5 Immersible, Secure, UHF R1 Comm./Trade Agreement
	X				PMUE4000_	Tanapa, XTS 2500 Model 1.5 Immersible, Secure, UHF1 Comm./Trade Agreement
		X			PMUE2492_	Tanapa, XTS 2500 Model II Immersible, Secure, UHF R1 Comm./Trade Agreement
		X			PMUE4001_	Tanapa, XTS 2500 Model II Immersible, Secure, UHF1 Comm./Trade Agreement
			X		PMUE2495_	Tanapa, XTS 2500 Model III Immersible, Secure, UHF R1 Comm./Trade Agreement
			X		PMUE4002_	Tanapa, XTS 2500 Model III Immersible, Secure, UHF1 Comm./Trade Agreement

NOTE: X = Item included. (Model chart continues on next page.)

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart

MODEL NUMBER						DESCRIPTION
H46UCC9PW5BN						380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model I
H46UCD9PW5BN						380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model 1.5
H46UCF9PW6BN						380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model II
H46UCH9PW7BN						380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model III
H46UCC9PW5BNI						380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model I
H46UCD9PW5BNI						380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model 1.5
H46UCH9PW7BNI						380-470 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model III
ITEM NUMBER						DESCRIPTION
X						NUE3594_ Tanapa, XTS 2500 Model I Non-Immersible, Non-Secure, UHF R1 Buy-US
	X					NUE3595_ Tanapa, XTS 2500 Model 1.5 Non-Immersible, Non-Secure, UHF R1 Buy-US
		X				NUE3597_ Tanapa, XTS 2500 Model II Non-Immersible, Non-Secure, UHF R1 Buy-US
			X			NUE3599_ Tanapa, XTS 2500 Model III Non-Immersible, Non-Secure, UHF R1 Buy-US
	X					NUE3596_ Tanapa, XTS 2500 Model 1.5 Non-Immersible, Secure, UHF R1 Buy-US
		X				NUE3598_ Tanapa, XTS 2500 Model II Non-Immersible, Secure, UHF R1 Buy-US
			X			NUE3600_ Tanapa, XTS 2500 Model III Non-Immersible, Secure, UHF R1 Buy-US
X						NUE3580_ Tanapa, XTS 2500 Model I Immersible, Non-Secure, UHF R1 Buy-US
	X					NUE3576_ Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure, UHF R1 Buy-US
		X				NUE3584_ Tanapa, XTS 2500 Model II Immersible, Non-Secure, UHF R1 Buy-US
			X			NUE3581_ Tanapa, XTS 2500 Model III Immersible, Non-Secure, UHF R1 Buy-US
	X					NUE3578_ Tanapa, XTS 2500 Model 1.5 Immersible, Secure, UHF R1 Buy-US
		X				NUE3574_ Tanapa, XTS 2500 Model II Immersible, Secure, UHF R1 Buy-US
			X			NUE3586_ Tanapa, XTS 2500 Model III Immersible, Secure, UHF R1 Buy-US
				X		PMUE4441_ Tanapa, XTS 2250 Model I Non-Immersible, Non-Secure, UHF R1
				X		PMUE3336_ Tanapa, XTS 2250 Model I Non-Immersible, Non-Secure, UHF R1
					X	PMUE4442_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Non-Secure, UHF R1
					X	PMUE3340_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Non-Secure, UHF R1
					X	PMUE4443_ Tanapa, XTS 2250 Model III Non-Immersible, Non-Secure, UHF R1
					X	PMUE3348_ Tanapa, XTS 2250 Model III Non-Immersible, Non-Secure, UHF R1
					X	PMUE2496_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Secure, UHF R1
					X	PMUE3341_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Secure, UHF R1
					X	PMUE2497_ Tanapa, XTS 2250 Model III Non-Immersible, Secure, UHF R1
					X	PMUE3349_ Tanapa, XTS 2250 Model III Non-Immersible, Secure, UHF R1
X	X	X	X			3316369H01 Nameplate, XTS 2500, Model I/1.5/II/III, Non-Immersible
X	X	X	X			3316369H06 Nameplate, XTS 2500I, Model I/1.5/II/III, Immersible
				X	X	3316369H02 Nameplate, XTS 2250, Model I/1.5/III, Non-Immersible
X						PMLN4940_ User's Guide, XTS 2500 Model I
	X					PMLN4940_ User's Guide, XTS 2500 Model 1.5
		X				PMLN4940_ User's Guide, XTS 2500 Model II
			X			PMLN4940_ User's Guide, XTS 2500 Model III
				X		PMLN4942_ User's Guide, XTS 2250 Model 1.5
					X	PMLN4942_ User's Guide, XTS 2250 Model III
X						PMLN4940_ User's Guide, XTS 2500I Model I
	X					PMLN4940_ User's Guide, XTS 2500I Model 1.5
		X				PMLN4940_ User's Guide, XTS 2500I Model II
			X			PMLN4940_ User's Guide, XTS 2500I Model III
X	X	X	X			PMLN4940_ User's Guide CD, XTS 2500/2500I Model I,1.5,II,III
				X	X	PMLN4940_ User's Guide CD, XTS 2250 Model I,1.5,III

NOTE: X = Item included.

ASTRO XTS 1500/MT 1500 Model Chart

MODEL NUMBER				DESCRIPTION
H66QDC9PW5BN				380-470 MHz, 1-5 Watt, ASTRO Digital XTS 1500 Model I
H66QDD9PW5BN				380-470 MHz, 1-5 Watt, ASTRO Digital XTS 1500 Model 1.5
H67QDC9PW5BN				380-470 MHz, 1-5 Watt, ASTRO Analog MT 1500 Model I
H67QDD9PW5BN				380-470 MHz, 1-5 Watt, ASTRO Analog MT 1500 Model 1.5
ITEM NUMBER				DESCRIPTION
X	X	X	X	– Antenna (See "Accessories")
X	X	X	X	– Battery (See "Accessories")
X	X	X	X	– Carry Accessories (See "Accessories")
X	X	X	X	– Hardware (See "Exploded Views and Parts Lists")
X	X	X	X	4385665D01 Adapter, Remote Speaker Microphone
X	X	X	X	1585746D04 Cover, Dust, Accessory Connector
	X		X	7285726C04 Display Module, VHF/UHF R1/UHF R2/700/800/900
X				PMLN4915_ Front Cover Kit, XTS 1500 Model I Non-Immersible, Non-Secure
	X			PMLN4900_ Front Cover Kit, XTS 1500 Model 1.5 Non-Immersible, Non-Secure
		X		PMLN4916_ Front Cover Kit, MT 1500 Model I Non-Immersible, Non-Secure
			X	PMLN4901_ Front Cover Kit, MT 1500 Model 1.5 Non-Immersible, Non-Secure
X	X	X	X	PMLE4425_ RF Board Kit, UHF Range 1
X				PMUE4444_ Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, UHF R1, 9600 Digital, Trunked
X				PMUE4445_ Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, UHF R1, 3600 Analog/Digital, Trunked
X				PMUE4446_ Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, UHF R1, P25 Conventional
	X			PMUE2563_ Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R1, 9600 Digital, Trunked
	X			PMUE2564_ Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R1, 3600 Analog/Digital, Trunked
	X			PMUE2565_ Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R1, P25 Conventional
		X		PMUE4447_ Tanapa, MT 1500 Model I Non-Immersible, Non-Secure, UHF R1, Analog, Conventional
		X		PMUE4448_ Tanapa, MT 1500 Model I Non-Immersible, Non-Secure, UHF R1, 3600 Analog
			X	PMUE2567_ Tanapa, MT 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R1, 3600 Analog
X	X			3316369H03 Nameplate, XTS 1500, Model I/1.5, Non-Immersible
		X	X	3316369H04 Nameplate, MT 1500, Model I/1.5 Non-Immersible
X				PMLN4940_ User's Guide, XTS 1500 Model I
X	X			PMLN4940_ User's Guide, XTS 1500 Model 1.5
X				PMLN4940_ User's Guide, MT 1500 Model I
	X			PMLN4940_ User's Guide, MT 1500 Model 1.5
X	X	X	X	PMLN4940_ User's Guide CD, XTS 1500 and MT 1500 Model I, 1.5

NOTE: X = Item included.

PR 1500 Model Chart

MODEL NUMBER		DESCRIPTION
AAH79QDC9PW5BN		380-470 MHz, 1-5 Watt, PR 1500 Model I
ITEM NUMBER	DESCRIPTION	
X	-	
	Antenna (See "Accessories")	
X	-	
	Battery (See "Accessories")	
X	-	
	Carry Accessories (See "Accessories")	
X	-	
	Hardware (See "Exploded Views and Parts Lists")	
X	4385665D01	Adapter, Remote Speaker Microphone
X	1585746D04	Cover, Dust, Accessory Connector
X	PMLN4902_	Front Cover Kit, PR 1500 Model I Non-Immersion, Non-Secure
X	PMLE4425_	RF Board Kit, UHF Range 1
X	PMUE4449_	Tanapa, PR 1500 Model I Non-Immersion, Non-Secure, UHF R1, Analog, Conventional
X	3316369H05	Nameplate, PR 1500, Model I
X	PMLN4943_	User's Guide, PR 1500 Model I
X	PMLN4943_	User's Guide CD, PR 1500 Model I

NOTE: X = Item included

Specifications for UHF Range 2 Radios

All specifications are per Telecommunications Industries Association TIA-603, unless otherwise noted.

GENERAL		RECEIVER	TRANSMITTER
FCC ID: 450-520 MHz:	AZ489FT4866	Frequency Range: 450-520 MHz	Frequency Range: 450-520 MHz
Temperature Range: Operating: Storage:	-30°C to +60°C -40°C to +85°C	Quieting Sensitivity (typical) (20dBQ): 0.23µV	RF Power: 380-470 MHz: 5 Watts
Power Supply: Nickel-Cadmium Battery (NiCd) or Nickel-Metal-Hydride Battery (NiMH)		Usable Sensitivity (typical): (12dB SINAD): 0.25µV	Frequency Stability (typical): (-30 to +60°C; 25°C ref.): 2.0ppm
Battery Voltage: Nominal: Range:	7.5 Volts 6 to 9 Volts	Intermodulation (typical): -73dB	Emission (typical conducted): -70dBc<1GHz
Transmit Current Drain (typical): 2100mA		Selectivity (typical): (25kHz Channel): -73dB (12.5kHz Channel): -63dB	FM Hum and Noise (typical): (25 kHz channel): -45dB (12.5 kHz channel): -41dB
Receive Current Drain (Rated Audio): 220mA		Spurious Rejection (typical): -80dB	Distortion (typical): 1%
Standby Current Drain: 80mA		Frequency Stability: (-30+60°C; 25°C reference): 2.0ppm	Modulation Limiting: 25 kHz chnls ±5.0kHz 12.5 kHz chnls ±2.5kHz
Recommended Battery: High-Capacity NiCd: NTN9815 or Ultra-High-Capacity NiMH: NTN9858 or High-Capacity NiCd FM: NTN9816* or Ultra-High-Capacity NiMH FM: NTN9857* or Ultra-High-Cap. NiMH Imrsble: NNTN6263* Optional FM (Factory Mutual) Battery: * FM Intrinsically Safe: Class I, II, III		Rated Audio: 500mW	Emissions Designators: 16K0F3E, 11K0F3E, 8K10F1D, 8K10F1E and 20K0F1E
Dimensions: Height x Width x Depth Radio Less Battery: 6.0" x 2.3" x 1.5" With NiCd Ultra-High Cap.: 6.0" x 2.3" x 2.0" With NiMH Ultra-High Cap.: 6.0" x 2.3" x 2.0"		FM Hum and Noise (typical): (25kHz channel): -52dB (12.5kHz channel): -40dB	
Weight Radio Less Battery: 11.0 oz. With NiCd Ultra-High Capacity: 20.0 oz. With NiMH Ultra-High Capacity: 20.5 oz.		Distortion (at Rated Audio; typical): 2%	
		Channel Spacing: 12.5/25 kHz	

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart

MODEL NUMBER										DESCRIPTION	
H46SDC9PW5BN										450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model I	
H46SDD9PW5BN										450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model 1.5	
H46SDF9PW6BN										450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model II	
H46SDH9PW7BN										450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model III	
H46SDC9PW5BNI										450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model I	
H46SDD9PW5BNI										450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model I.5	
H46SDH9PW7BNI										450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model III	
ITEM NUMBER										DESCRIPTION	
X	X	X	X	X	X	X	X	X	X	—	Antenna (see "Accessories" in the BSM)
X	X	X	X	X	X	X	X	X	X	—	Battery (see "Accessories" in the BSM)
X	X	X	X	X	X	X	X	X	X	—	Carry Accessories (see "Accessories" in the BSM)
X	X	X	X	X	X	X	X	X	X	—	Hardware (see "Exploded Views and Parts Lists" in the BSM)
X	X	X	X							NNTN6263_	JedRay NiMH impres FM Immersible Battery
X	X	X	X	X	X	X	X	X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	X	X	X	X	X	X	X	X	1505579Z01	Cover, Dust, Accessory Connector
X	X	X	X	X	X	X	X	X	X	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
X										PMLN4801_	Front Cover Kit, XTS 2500 Model I Non-Immersible, Non-Secure
	X									PMLN4783_	Front Cover Kit, XTS 2500 Model 1.5 Non-Immersible, Non-Secure
		X								PMLN4851_	Front Cover Kit, XTS 2500 Model II Non-Immersible, Non-Secure
			X							PMLN4773_	Front Cover Kit, XTS 2500 Model III Non-Immersible, Non-Secure
X										PMLN4772_	Front Cover Kit, XTS 2500 Model I Immersible, Non-Secure
	X									PMLN4791_	Front Cover Kit, XTS 2500 Model 1.5 Immersible, Non-Secure
		X								PMLN4792_	Front Cover Kit, XTS 2500 Model II Immersible, Non-Secure
			X							PMLN4794_	Front Cover Kit, XTS 2500 Model III Immersible, Non-Secure
				X						PMLN4784_	Front Cover Kit, XTS 2250 Model I Non-Immersible, Non-Secure
					X					PMLN4855_	Front Cover Kit, XTS 2250 Model 1.5 Non-Immersible, Non-Secure
						X				PMLN4856_	Front Cover Kit, XTS 2250 Model III Non-Immersible, Non-Secure
X	X	X	X	X	X	X	X	X	X	PMLA4426_	RF Board Kit, UHF Range 2, Commercial & Trade Agreement
X	X	X	X							NLE4297_	RF Board Kit, UHF Range 2, Buy-US
X										PMUE2698_	Tanapa, XTS 2500 Model I Non-Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
X										PMUE3351_	Tanapa, XTS 2500 Model I Non-Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
	X									PMUE2699_	Tanapa, XTS 2500 Model 1.5 Non-Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
		X								PMUE3354_	Tanapa, XTS 2500 Model 1.5 Non-Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
			X							PMUE2700_	Tanapa, XTS 2500 Model II Non-Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
				X						PMUE3360_	Tanapa, XTS 2500 Model II Non-Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
					X					PMUE2702_	Tanapa, XTS 2500 Model III Non-Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
						X				PMUE3363_	Tanapa, XTS 2500 Model III Non-Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
	X									PMUE2576_	Tanapa, XTS 2500 Model 1.5 Non-Immersible, Secure, UHF R2 Commercial/Trade Agreement
		X								PMUR3356_	Tanapa, XTS 2500 Model 1.5 Non-Immersible, Secure, UHF R2 Commercial/Trade Agreement
			X							PMUE2577_	Tanapa, XTS 2500 Model II Non-Immersible, Secure, UHF R2 Commercial/Trade Agreement
				X						PMUE3362_	Tanapa, XTS 2500 Model II Non-Immersible, Secure, UHF R2 Commercial/Trade Agreement
					X					PMUE2578_	Tanapa, XTS 2500 Model III Non-Immersible, Secure, UHF R2 Commercial/Trade Agreement
						X				PMUE3365_	Tanapa, XTS 2500 Model III Non-Immersible, Secure, UHF R2 Commercial/Trade Agreement
X										PMUE2498_	Tanapa, XTS 2500 Model I Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
X										PMUE3352_	Tanapa, XTS 2500 Model I Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
	X									PMUE2499_	Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
		X								PMUE3355_	Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
			X							PMUE2502_	Tanapa, XTS 2500 Model II Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
				X						PMUE3361_	Tanapa, XTS 2500 Model II Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
					X					PMUE2505_	Tanapa, XTS 2500 Model III Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
						X				PMUE3364_	Tanapa, XTS 2500 Model III Immersible, Non-Secure, UHF R2 Commercial/Trade Agreement
	X									PMUE2501_	Tanapa, XTS 2500 Model 1.5 Immersible, Secure, UHF R2 Commercial/Trade Agreement
		X								PMUE3357_	Tanapa, XTS 2500 Model 1.5 Immersible, Secure, UHF R2 Commercial/Trade Agreement
			X							PMUE2504_	Tanapa, XTS 2500 Model II Immersible, Secure, UHF R2 Commercial/Trade Agreement
				X						PMUE3312_	Tanapa, XTS 2500 Model II Immersible, Secure, UHF R2 Commercial/Trade Agreement
					X					PMUE2507_	Tanapa, XTS 2500 Model III Immersible, Secure, UHF R2 Commercial/Trade Agreement
						X				PMUE3366_	Tanapa, XTS 2500 Model III Immersible, Secure, UHF R2 Commercial/Trade Agreement

NOTE: X = Item included. (Model chart continues on next page.)

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart (continued)

MODEL NUMBER							DESCRIPTION
H46SDC9PW5BN							450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model I
H46SDD9PW5BN							450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model 1.5
H46SDF9PW6BN							450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model II
H46SDH9PW7BN							450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2500 Model III
H46SDC9PW5BNI							450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model I
H46SDD9PW5BNI							450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model 1.5
H46SDH9PW7BNI							450-520 MHz, 1-5 Watt, ASTRO Digital XTS 2250 Model III
ITEM NUMBER							DESCRIPTION
X							NUE3607_ Tanapa, XTS 2500 Model I Non-Immersible, Non-Secure, UHF R2 Buy-US
	X						NUE3602_ Tanapa, XTS 2500 Model 1.5 Non-Immersible, Non-Secure, UHF R2 Buy-US
		X					NUE3603_ Tanapa, XTS 2500 Model II Non-Immersible, Non-Secure, UHF R2 Buy-US
			X				NUE3605_ Tanapa, XTS 2500 Model III Non-Immersible, Non-Secure, UHF R2 Buy-US
	X						NUE3601_ Tanapa, XTS 2500 Model 1.5 Non-Immersible, Secure, UHF R2 Buy-US
		X					NUE3604_ Tanapa, XTS 2500 Model II Non-Immersible, Secure, UHF R2 Buy-US
			X				NUE3606_ Tanapa, XTS 2500 Model III Non-Immersible, Secure, UHF R2 Buy-US
X							NUE3592_ Tanapa, XTS 2500 Model I Immersible, Non-Secure, UHF R2 Buy-US
	X						NUE3591_ Tanapa, XTS 2500 Model 1.5 Immersible, Non-Secure, UHF R2 Buy-US
		X					NUE3588_ Tanapa, XTS 2500 Model II Immersible, Non-Secure, UHF R2 Buy-US
			X				NUE3585_ Tanapa, XTS 2500 Model III Immersible, Non-Secure, UHF R2 Buy-US
	X						NUE3589_ Tanapa, XTS 2500 Model 1.5 Immersible, Secure, UHF R2 Buy-US
		X					NUE3583_ Tanapa, XTS 2500 Model II Immersible, Secure, UHF R2 Buy-US
			X				NUE3575_ Tanapa, XTS 2500 Model III Immersible, Secure, UHF R2 Buy-US
				X			PMUE2701_ Tanapa, XTS 2250 Model I Non-Immersible, Non-Secure, UHF R2
				X			PMUE3353_ Tanapa, XTS 2250 Model I Non-Immersible, Non-Secure, UHF R2
				X			PMUE2703_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Non-Secure, UHF R2
				X			PMUE3358_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Non-Secure, UHF R2
				X			PMUE2704_ Tanapa, XTS 2250 Model III Non-Immersible, Non-Secure, UHF R2
				X			PMUE3311_ Tanapa, XTS 2250 Model III Non-Immersible, Non-Secure, UHF R2
				X			PMUE2508_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Secure, UHF R2
				X			PMUE3359_ Tanapa, XTS 2250 Model 1.5 Non-Immersible, Secure, UHF R2
				X			PMUE2509_ Tanapa, XTS 2250 Model III Non-Immersible, Secure, UHF R2
				X			PMUE3313_ Tanapa, XTS 2250 Model III Non-Immersible, Secure, UHF R2
X	X	X	X				3316369H01 Nameplate, XTS 2500, Model I/1.5/II/III, Non-Immersible
X	X	X	X				3316369H06 Nameplate, XTS 2500I, Model I/1.5/II/III, Immersible
			X	X	X		3316369H02 Nameplate, XTS 2250, Model I/1.5/III, Non-Immersible
	X			X			PMLN4924_ ASSY,PCB,MN,SECURE BRD M1.5 AES
	X			X			PMLN4925_ ASSY,PCB,MN,SECURE BRD M1.5 DES,DES-XL,DES-OFB
	X			X			PMLN4926_ ASSY,PCB,MN,SECURE BRD M1.5 ADP
		X					PMLN4927_ ASSY,PCB,MN,SECURE BRD M2 AES
		X					PMLN4928_ ASSY,PCB,MN,SECURE BRD M2 DES,DES-XL,DES-OFB
		X					PMLN4929_ ASSY,PCB,MN,SECURE BRD M2 ADP
			X		X		PMLN4930_ ASSY,PCB,MN,SECURE BRD M3 AES
			X		X		PMLN4931_ ASSY,PCB,MN,SECURE BRD M3 DES,DES-XL,DES-OFB
			X		X		PMLN4932_ ASSY,PCB,MN,SECURE BRD M3 ADP
			X				6871190L01 User's Guide, XTS 2250 Model I
				X			6871201L01 User's Guide, XTS 2250 Model 1.5
					X		6871202L01 User's Guide, XTS 2250 Model III
X	X	X	X				PMLN4940_ User's Guide CD, XTS 2500 Model I, 1.5, II, III
X	X	X	X				PMLN4940_ User's Guide CD, XTS 2500I Model I, 1.5, II, III
			X	X	X		PMLN4940_ User's Guide CD, XTS 2250 Model I, 1.5, III

NOTE: X = Item included.

ASTRO XTS 1500/MT 1500 Model Chart

MODEL NUMBER				DESCRIPTION	
H66SDC9PW5BN				450-520 MHz, 1-5 Watt, ASTRO Digital XTS 1500 Model I	
H66SDD9PW5BN				450-520 MHz, 1-5 Watt, ASTRO Digital XTS 1500 Model 1.5	
H67SDC9PW5BN				450-520 MHz, 1-5 Watt, ASTRO Analog MT 1500 Model I	
H67SDD9PW5BN				450-520 MHz, 1-5 Watt, ASTRO Analog MT 1500 Model 1.5	
ITEM NUMBER				DESCRIPTION	
X	X	X	X	–	Antenna (see "Accessories" in the BSM)
X	X	X	X	–	Battery (see "Accessories" in the BSM)
X	X	X	X	–	Carry Accessories (see "Accessories" in the BSM)
X	X	X	X	–	Hardware (see "Exploded Views and Parts Lists" in the BSM)
X	X	X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	X	X	1585746D04	Cover, Dust, Accessory Connector
	X		X	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
X				PMLN4915_	Front Cover Kit, XTS 1500 Model I Non-Immersible, Non-Secure
	X			PMLN4900_	Front Cover Kit, XTS 1500 Model 1.5 Non-Immersible, Non-Secure
		X		PMLN4916_	Front Cover Kit, MT 1500 Model I Non-Immersible, Non-Secure
			X	PMLN4901_	Front Cover Kit, MT 1500 Model 1.5 Non-Immersible, Non-Secure
X	X	X	X	PMLE4426_	RF Board Kit, UHF Range 2
X				PMUE2705_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, UHF R2, 9600 Digital, Trunked
X				PMUE2700_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, UHF R2, 3600 Analog/Digital, Trunked
X				PMUE2707_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, UHF R2, P25 Conventional
	X			PMUE2568_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R2, 9600 Digital, Trunked
	X			PMUE2569_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R2, 3600 Analog/Digital, Trunked
	X			PMUE2570_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R2, P25 Conventional
		X		PMUE2708_	Tanapa, MT 1500 Model I Non-Immersible, Non-Secure, UHF R2, Analog, Conventional
		X		PMUE2709_	Tanapa, MT 1500 Model I Non-Immersible, Non-Secure, UHF R2, 3600 Analog
			X	PMUE2571_	Tanapa, MT 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R2, Analog, Conventional
			X	PMUE2572_	Tanapa, MT 1500 Model 1.5 Non-Immersible, Non-Secure, UHF R2, 3600 Analog
X	X			3316369H03	Nameplate, XTS 1500, Model I/1.5, Non-Immersible
		X	X	3316369H04	Nameplate, MT 1500, Model I/1.5, Non-Immersible
X	X	X	X	PMLN4940_	User's Guide CD, XTS 1500 and MT 1500 Model I, 1.5

NOTE: X = Item included.

PR 1500 Model Chart

			MODEL NUMBER	DESCRIPTION
			AAH79KDC9PW5BN	136-174 MHz, 1-5 Watt, PR 1500 Model I
			AAH79QDC9PW5BN	380-470 MHz, 1-5 Watt, PR 1500 Model I
			AAH79SDC9PW5BN	450-520 MHz, 1-5 Watt, PR 1500 Model I
			ITEM NUMBER	DESCRIPTION
X	X	X	–	Antenna (see "Accessories" in the BSM)
X	X	X	–	Battery (see "Accessories" in the BSM)
X	X	X	–	Carry Accessories (see "Accessories" in the BSM)
X	X	X	–	Hardware (see "Exploded Views and Parts Lists" in the BSM)
X	X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	X	1585746D04	Cover, Dust, Accessory Connector
X	X	X	PMLN4902_	Front Cover Kit, PR 1500 Model I Non-Immersible, Non-Secure
X			PMLD4303_	RF Board Kit, VHF
	X		PMLE4425_	RF Board Kit, UHF Range 1
		X	PMLE4426_	RF Board Kit, UHF Range 2
X			PMUD2211_	Tanapa, PR 1500 Model I Non-Immersible, Non-Secure, VHF, Analog, Conventional
	X		PMUE4449_	Tanapa, PR 1500 Model I Non-Immersible, Non-Secure, UHF R1, Analog, Conventional
		X	PMUE2710_	Tanapa, PR 1500 Model I Non-Immersible, Non-Secure, UHF R2, Analog, Conventional
X	X	X	3316369H05	Nameplate, PR 1500, Model I, Non-Immersible
X	X	X	PMLN4943_	User's Guide CD, PR 1500 Model I

NOTE: X = Item included.

Specifications for 700 MHz/800 MHz Radios

All specifications are per Telecommunications Industries Association TIA-603 unless otherwise noted

GENERAL	RECEIVER	TRANSMITTER
FCC ID: 700/800 MHz: AZ489FT5804 Temperature Range: Operating: -30°C to +60°C Storage: -40°C to +85°C Power Supply: Nickel-Cadmium Battery (NiCd) or Nickel-Metal-Hydride Battery (NiMH) Battery Voltage Nominal: 7.5 Volts Range: 6 to 9 Volts Transmit Current Drain (Typical): 1250mA Receive Current Drain (Rated Audio): 220mA Standby Current Drain: 70mA Recommended Battery: High-Capacity NiCd: NTN9815 or Ultra-High-Capacity NiMH: NTN9858 or High-Capacity NiCd FM: NTN9816* or Ultra-High-Capacity NiMH FM: NTN9857* or Ultra-High-Cap. NiMH Imrsble: NNTN6263* Optional FM (Factory Mutual) Battery: * FM Intrinsically Safe: Class I, II, III Dimensions Height x Width x Depth Radio Less Battery: 6.0" x 2.3" x 1.5" With NiCd Ultra-High Cap.: 6.0" x 2.3" x 2.0" With NiMH Ultra-High Cap.: 6.0" x 2.3" x 2.0" Weight Radio Less Battery: 11.0 oz. With NiCd Ultra-High Capacity: 20.0 oz. With NiMH Ultra-High Capacity: 20.5 oz.	Frequency Range: 700 MHz: 764 to 767; 773 to 776 MHz 800 MHz: 851 to 870 MHz Quieting Sensitivity (typical) (20dBQ): 0.23µV Usable Sensitivity (typical) (12dB SINAD): 0.25µV Intermodulation (typical): -74dB Selectivity (typical) (25kHz Channel): -72dB (12.5kHz Channel): -63dB Spurious Rejection (typical): -75dB Frequency Stability (-30+60°C; 25°C reference): 1.5ppm Rated Audio: 500mW FM Hum and Noise (typical) (25kHz channel): -47dB (12.5kHz channel): -40dB Distortion (At Rated Audio; typical): 2.5% Channel Spacing: 12.5/20/25 kHz	RF Power 806 - 870 MHz: 3 Watts 764 - 806 MHz: 2.5 Watts Frequency Range: 700 MHz: 764 to 767; 773 to 776; 794 to 797; 803 to 806 MHz 800 MHz: 806 to 824; 851 to 870 MHz Frequency Stability (typical) (-30 to +60°C; 25°C ref.): 1.5ppm Emission (typical conducted): -75dBc<1GHz FM Hum and Noise (typical) (25 kHz channel): -43dB (12.5 kHz channel): -40dB Distortion (typical): 2% Modulation Limiting: 25 kHz chnls ±5.0kHz 20 kHz chnls ±4.0kHz 12.5 kHz chnls ±2.5kHz Emissions Designators: 16K0F3E, 11K0F3E, 8K10F1D, and 8K10F1E

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart

MODEL NUMBER											DESCRIPTION	
H46UCD9PW2BN											700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model I.5	
H46UCF9PW2BN											700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model II	
H46UCH9PW2BN											700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model III	
H46UCC9PW5BN											700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model I	
H46UCD9PW5BN											700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model 1.5	
H46UCF9PW6BN											700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model II	
H46UCH9PW7BN											700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model III	
H46UCC9PW5BNI											700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model I	
H46UCD9PW5BNI											700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model 1.5	
H46UCH9PW7BNI											700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model III	
ITEM NUMBER											DESCRIPTION	
X	X	X	X	X	X	X	X	X	X	X	–	Antenna (See "Accessories")
X	X	X	X	X	X	X	X	X	X	X	–	Battery (See "Accessories")
X	X	X	X	X	X	X	X	X	X	X	–	Carry Accessories (See "Accessories")
			X	X	X	X	X	X	X	X	–	Hardware (See "Exploded Views and Parts Lists")
			X	X	X	X					NNTN6263_	NiMH impres FM Immersible Battery
X	X	X	X	X	X	X	X	X	X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	X	X	X	X	X	X	X	X	X	1505579Z01	Cover, Dust, Accessory Connector
X	X	X	X	X	X	X	X	X	X	X	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
			X								PMLN4801_	Front Cover Kit, XTS 2500 Model I Non-Immersible, Non-Secure
X				X							PMLN4783_	Front Cover Kit, XTS 2500 Model 1.5 Non-Immersible, Non-Secure
	X				X						PMLN4851_	Front Cover Kit, XTS 2500 Model II Non-Immersible, Non-Secure
		X				X					PMLN4773_	Front Cover Kit, XTS 2500 Model III Non-Immersible, Non-Secure
			X								PMLN4772_	Front Cover Kit, XTS 2500 Model I Immersible, Non-Secure
				X							PMLN4791_	Front Cover Kit, XTS 2500 Model 1.5 Immersible, Non-Secure
					X						PMLN4792_	Front Cover Kit, XTS 2500 Model II Immersible, Non-Secure
						X					PMLN4794_	Front Cover Kit, XTS 2500 Model III Immersible, Non-Secure
							X				PMLN4784_	Front Cover Kit, XTS 2250 Model I Non-Immersible, Non-Secure
								X			PMLN4855_	Front Cover Kit, XTS 2250 Model 1.5 Non-Immersible, Non-Secure
									X		PMLN4856_	Front Cover Kit, XTS 2250 Model III Non-Immersible, Non-Secure
X											PMUF1360_	Tanapa, XTS 2500 Model I.5 Non-Immersible, Non-Secure, 700/800 Rebanding
	X										PMUF1361_	Tanapa, XTS 2500 Model II Non-Immersible, Non-Secure, 700/800 Rebanding
		X									PMUF1363_	Tanapa, XTS 2500 Model III Non-Immersible, Non-Secure, 700/800 Rebanding
X				X					X		PMLN4924_	Secure Board, Model 1.5 AES
X				X					X		PMLN4925_	Secure Board, Model 1.5 DES, DES-XL, DES-OFB
X				X					X		PMLN4926_	Secure Board, Model 1.5 ADP
	X				X						PMLN4927_	Secure Board, Model II AES
	X				X						PMLN4928_	Secure Board, Model II DES, DES-XL, DES-OFB
	X				X						PMLN4929_	Secure Board, Model II ADP
		X				X				X	PMLN4930_	Secure Board, Model III AES
		X				X				X	PMLN4931_	Secure Board, Model III DES, DES-XL, DES-OFB
		X				X				X	PMLN4932_	Secure Board, Model III ADP
			X	X	X	X	X	X	X	X	PMLF4041_	RF Board Kit, 700/800, Commercial&Trade Agreement
			X	X	X	X					NUF6650_	RF Board Kit, 700/800, Buy - US

NOTE: X = Item included. (Model chart continues on next page.)

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart (continued)

MODEL NUMBER							DESCRIPTION	
H46UCD9PW2BN							700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model I.5	
H46UCF9PW2BN							700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model II	
H46UCH9PW2BN							700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model III	
H46UCC9PW5BN							700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model I	
H46UCD9PW5BN							700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model 1.5	
H46UCF9PW6BN							700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model II	
H46UCH9PW7BN							700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model III	
H46UCC9PW5BNI							700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model I	
H46UCD9PW5BNI							700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model 1.5	
H46UCH9PW7BNI							700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model III	
ITEM NUMBER							DESCRIPTION	
			X				PMUF1332_	Tanapa, XTS 2500 ,Model I Non-Immersion, Non-Secure, 700/800 Commercial
			X				PMUF1333_	Tanapa, XTS 2500 Model 1.5 Non-Immersion, Non-Secure, 700/800 Commercial
				X			PMUF1334_	Tanapa, XTS 2500 Model II Non-Immersion, Non-Secure, 700/800 Commercial
					X		PMUF1335_	Tanapa, XTS 2500 Model III Non-Immersion, Non-Secure, 700/800 Commercial
			X				PMUF1322_	Tanapa, XTS 2500 Model 1.5 Non-Immersion, Secure, 700/800 Commercial
				X			PMUF1323_	Tanapa, XTS 2500 Model II Non-Immersion, Secure, 700/800 Commercial
					X		PMUF1324_	Tanapa, XTS 2500 Model III Non-Immersion, Secure, 700/800 Commercial
		X					PMUF1251_	Tanapa, XTS 2500 Model I Immersion, Non-Secure, 700/800 Commercial
			X				PMUF1239_	Tanapa, XTS 2500 Model 1.5 Immersion, Non-Secure 700/800 Commercial
				X			PMUF1240_	Tanapa, XTS 2500 Model II Immersion, Non-Secure 700/800 Commercial
					X		PMUF1243_	Tanapa, XTS 2500 Model III Immersion, Non-Secure 700/800 Commercial
		X					PMUF1238_	Tanapa, XTS 2500 Model 1.5 Immersion, Secure 700/800 Commercial
				X			PMUF1234_	Tanapa, XTS 2500 Model II Immersion, Secure 700/800 Commercial
					X		PMUF1237_	Tanapa, XTS 2500 Model III Immersion, Secure 700/800 Commercial
		X					PMUF1336_	Tanapa, XTS 2500 Model I Non-Immersion, Non-Secure 700/800 Trade Agreement
			X				PMUF1337_	Tanapa, XTS 2500 Model 1.5 Non-Immersion, Non-Secure 700/800 Trade Agreement
				X			PMUF1338_	Tanapa, XTS 2500 Model II Non-Immersion, Non-Secure 700/800 Trade Agreement
					X		PMUF1339_	Tanapa, XTS 2500 Model III Non-Immersion, Non-Secure 700/800 Trade Agreement
		X					PMUF1325_	Tanapa, XTS 2500 Model 1.5 Non-Immersion, Secure 700/800 Trade Agreement
				X			PMUF1326_	Tanapa, XTS 2500 Model II Non-Immersion, Secure 700/800 Trade Agreement
					X		PMUF1327_	Tanapa, XTS 2500 Model III Non-Immersion, Secure 700/800 Trade Agreement
		X					PMUF1267_	Tanapa, XTS 2500 Model I Immersion, Non-Secure 700/800 Trade Agreement
			X				PMUF1268_	Tanapa, XTS 2500 ,Model 1.5 Immersion, Non-Secure, 700/800 Trade Agreement
				X			PMUF1271_	Tanapa, XTS 2500 ,Model II Immersion, Non-Secure, 700/800 Trade Agreement

NOTE: X = Item included. (Model chart continues on next page.)

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart (continued)

MODEL NUMBER										DESCRIPTION	
H46UCD9PW2BN										700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model I.5	
H46UCF9PW2BN										700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model II	
H46UCH9PW2BN										700-800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 2500 Model III	
H46UCC9PW5BN										700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model I	
H46UCD9PW5BN										700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model 1.5	
H46UCF9PW6BN										700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model II	
H46UCH9PW7BN										700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2500 Model III	
H46UCC9PW5BNI										700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model I	
H46UCD9PW5BNI										700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model 1.5	
H46UCH9PW7BNI										700/800 MHz, 1-3 Watts, ASTRO Digital XTS 2250 Model III	
ITEM NUMBER										DESCRIPTION	
								X		PMUF1274_	Tanapa, XTS 2500 ,Model III Immersible, Non-Secure, 700/800 Trade Agreement
			X							PMUF1270_	Tanapa, XTS 2500 ,Model 1.5 Immersible, Secure, 700/800 Trade Agreement
				X						PMUF1273_	Tanapa, XTS 2500 ,Model II Immersible, Secure, 700/800 Trade Agreement
					X					PMUF1276_	Tanapa, XTS 2500 ,Model III Immersible, Secure, 700/800 Trade Agreement
		X								NWF1213_	Tanapa, XTS 2500 ,Model I Non-Immersible, Non-Secure, 700/800 Buy-US
			X							NWF1124_	Tanapa, XTS 2500 ,Model 1.5 Non-Immersible, Non-Secure, 700/800 Buy-US
				X						NWF1214_	Tanapa, XTS 2500 ,Model II Non-Immersible, Non-Secure, 700/800 Buy-US
					X					NWF1216_	Tanapa, XTS 2500 ,Model III Non-Immersible, Non-Secure, 700/800 Buy-US
		X								NFW1125_	Tanapa, XTS 2500 ,Model 1.5 Non-Immersible, Secure, 700/800 Buy-US
			X							NFW1215_	Tanapa, XTS 2500 ,Model II Non-Immersible, Secure, 700/800 Buy-US
				X						NFW1129_	Tanapa, XTS 2500 ,Model III Non-Immersible, Secure, 700/800 Buy-US
		X								NFW1136_	Tanapa, XTS 2500 ,Model I Immersible, Non-Secure, 700/800 Buy-US
			X							NFW1144_	Tanapa, XTS 2500 ,Model 1.5 Immersible, Non-Secure, 700/800 Buy-US
			X							NFW1138_	Tanapa, XTS 2500 ,Model II Immersible, Non-Secure, 700/800 Buy-US
				X						NFW1140_	Tanapa, XTS 2500 ,Model III Immersible, Non-Secure, 700/800 Buy-US
			X							NFW1142_	Tanapa, XTS 2500 ,Model 1.5 Immersible, Secure, 700/800 Buy-US
			X							NFW1139_	Tanapa, XTS 2500 ,Model II Immersible, Secure, 700/800 Buy-US
					X					NFW1141_	Tanapa, XTS 2500 ,Model III Immersible, Secure, 700/800 Buy-US
						X				PMUF1340_	Tanapa, XTS 2250 ,Model I Non-Immersible, Non-Secure, 700/800
							X			PMUF1341_	Tanapa, XTS 2250 ,Model 1.5 Non-Immersible, Non-Secure, 700/800
								X		PMUF1342_	Tanapa, XTS 2250 ,Model III Non-Immersible, Non-Secure, 700/800
									X	PMUF1277_	Tanapa, XTS 2250 ,Model 1.5 Non-Immersible, Secure, 700/800
									X	PMUF1278_	Tanapa, XTS 2250 ,Model I Non-Immersible, Secure, 700/800
X	X	X	X	X	X	X				3316369H01	Nameplate, XTS 2500, Model I/1.5/II/III, Non-Immersible
X	X	X	X	X	X	X				3316369H06	Nameplate, XTS 2500I, Model I/1.5/II/III, Immersible
							X	X	X	3316369H02	Nameplate, XTS 2250, Model I/1.5/III, Non-Immersible
			X							PMLN4940_	User's Guide, XTS 2500 Model I
X				X						PMLN4940_	User's Guide, XTS 2500 Model 1.5
	X				X					PMLN4940_	User's Guide, XTS 2500 Model II
		X				X				PMLN4940_	User's Guide, XTS 2500 Model III
							X			PMLN4942_	User's Guide, XTS 2250 Model 1.5
								X		PMLN4942_	User's Guide, XTS 2250 Model III
		X								PMLN4940_	User's Guide, XTS 2500I Model I
			X							PMLN4940_	User's Guide, XTS 2500I Model 1.5
				X						PMLN4940_	User's Guide, XTS 2500I Model II
					X					PMLN4940_	User's Guide, XTS 2500I Model III
		X	X	X	X					PMLN4940_	User's Guide CD, XTS 2500/2500I Model I,1.5,II,III
X	X	X					X	X		PMLN4942_	User's Guide CD, XTS 2250 Model I,1.5,III

NOTE: X = Item included.

ASTRO XTS 1500/MT 1500 Model Chart

MODEL NUMBER					DESCRIPTION	
H66UCC9PW2BN					700/800 MHz Reband, 1-3 Watt, ASTRO Digital XTS 1500 Model I	
H66UCC9PW5BN					700/800 MHz, 1-3 Watts, ASTRO Digital XTS 1500 Model I	
H66UCD9PW5BN					700/800 MHz, 1-3 Watts, ASTRO Digital XTS 1500 Model 1.5	
H67UCC9PW5BN					700/800 MHz, 1-3 Watts, ASTRO Analog MT 1500 Model I	
H67UCD9PW5BN					700/800 MHz, 1-3 Watts, ASTRO Analog MT 1500 Model 1.5	
ITEM NUMBER					DESCRIPTION	
X	X	X	X	X	-	Antenna (See "Accessories")
X	X	X	X	X	-	Battery (See "Accessories")
X	X	X	X	X	-	Carry Accessories (See "Accessories")
X	X	X	X	X	-	Hardware (See "Exploded Views and Parts Lists")
X	X	X	X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	X	X	X	1585746D04	Cover, Dust, Accessory Connector
		X		X	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
X	X				PMLN4915_	Front Cover Kit, XTS 1500 Model I Non-Immersible, Non-Secure
		X			PMLN4900_	Front Cover Kit, XTS 1500 Model 1.5 Non-Immersible, Non-Secure
			X		PMLN4916_	Front Cover Kit, MT 1500 Model I Non-Immersible, Non-Secure
				X	PMLN4901_	Front Cover Kit, MT 1500 Model 1.5 Non-Immersible, Non-Secure
X					PMUF1365_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, 700/800, Digital RB
X					PMUF1366_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, 700/800, Analog RB
	X				PMUF1343_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, 700/800 Digital, Trunked
	X				PMUF1344_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, 700/800, 3600 Analog/Digital, Trunked
	X				PMUF1345_	Tanapa, XTS 1500 Model I Non-Immersible, Non-Secure, 700/800, P25 Conventional
		X			PMUF1317_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, 700/800, 9600 Digital, Trunked
		X			PMUF1318_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, 700/800, 3600 Analog/Digital, Trunked
		X			PMUF1319_	Tanapa, XTS 1500 Model 1.5 Non-Immersible, Non-Secure, 700/800, P25 Conventional
			X		PMUF1346_	Tanapa, MT 1500 Model I Non-Immersible, Non-Secure, 700/800, Analog, Conventional
			X		PMUF1347_	Tanapa, MT 1500 Model I Non-Immersible, Non-Secure, 700/800, 3600 Analog
				X	PMUF1320_	Tanapa, MT 1500 Model 1.5 Non-Immersible, Non-Secure, 700/800, Analog, Conventional
				X	PMUF1321_	Tanapa, MT 1500 Model 1.5 Non-Immersible, Non-Secure, 700/800, 3600 Analog
X	X	X			3316369H03	Nameplate, XTS 1500, Model I/1.5, Non-Immersible
			X	X	3316369H04	Nameplate, MT 1500, Model I/1.5 Non-Immersible
X	X				PMLN4940_	User's Guide, XTS 1500 Model I
		X			PMLN4940_	User's Guide, XTS 1500 Model 1.5
		X			PMLN4940_	User's Guide, MT 1500 Model I
		X			PMLN4940_	User's Guide, MT 1500 Model 1.5
	X	X	X	X	PMLN4940_	User's Guide CD, XTS 1500 and MT 1500 Model I, 1.5
X					PMLN4940_	User's Guide CD, XTS 2500 and MT 1500 Model I, 1.5

NOTE: X = Item included

Specifications for 900 MHz Radios

All specifications are per Telecommunications Industries Association TIA-603 unless otherwise noted

GENERAL	RECEIVER	TRANSMITTER
FCC ID: 900 MHz: AZ489FT5849 Temperature Range: Operating: -30°C to +60°C Storage: -40°C to +85°C Power Supply: Nickel-Cadmium Battery (NiCd) or Nickel-Metal-Hydride Battery (NiMH) Battery Voltage Nominal: 7.5 Volts Range: 6 to 9 Volts Transmit Current Drain (Typical): 1350mA Receive Current Drain (Rated Audio): 220mA Standby Current Drain: 80mA Recommended Battery: High-Capacity NiCd: NTN9815 or Ultra-High-Capacity NiMH: NTN9858 or High-Capacity NiCd FM: NTN9816* or Ultra-High-Capacity NiMH FM: NTN9857* <i>Optional FM (Factory Mutual) Battery:</i> * FM Intrinsically Safe: Class I, II, III Dimensions Height x Width x Depth Radio Less Battery: 6.0" x 2.3" x 1.5" With NiCd Ultra-High Cap.: 6.0" x 2.3" x 2.0" With NiMH Ultra-High Cap.: 6.0" x 2.3" x 2.0" Weight Radio Less Battery: 11.0 oz. With NiCd Ultra-High Capacity: 20.0 oz. With NiMH Ultra-High Capacity: 20.5 oz.	Frequency Range: 900 MHz: 935 to 941 MHz Quieting Sensitivity (typical) (20dBQ): 0.23µV Usable Sensitivity (typical) (12dB SINAD): 0.25µV Intermodulation (typical): -74dB Selectivity (typical) (12.5kHz Channel): -63dB Spurious Rejection (typical): -75dB Frequency Stability (-30+60°C; 25°C reference): 1.5ppm Rated Audio: 500mW FM Hum and Noise (typical) (12.5kHz channel): -40dB Distortion (At Rated Audio; typical): 2.5% Channel Spacing: 12.5 kHz	RF Power 896 - 902 MHz: 2.5 Watts 935 - 941 MHz: 2.5 Watts Frequency Range: 900 MHz: 896 to 902; 935 to 941 MHz Frequency Stability (typical) (-30 to +60°C; 25°C ref.): 1.5ppm Emission (typical conducted): -75dBc<1GHz FM Hum and Noise (typical) (12.5 kHz channel): -40dB Distortion (typical): 2% Modulation Limiting: 12.5 kHz chnls ±2.5kHz Emissions Designators: 16K0F3E, 11K0F3E, 8K10F1D, and 8K10F1E

ASTRO XTS 2500/XTS 2500I/XTS 2250 Model Chart

MODEL NUMBER		DESCRIPTION	
H46WCD9PW5BN		896-941 MHz, 1-3 Watt, ASTRO Digital XTS 2500 Model 1.5	
H46WCH9PW7BN		896-941 MHz, 1-3 Watt, ASTRO Digital XTS 2500 Model III	
	ITEM NUMBER	DESCRIPTION	
X	X	–	Antenna (see "Accessories" in the BSM)
X	X	–	Battery (see "Accessories" in the BSM)
X	X	–	Carry Accessories (see "Accessories" in the BSM)
X	X	–	Hardware (see "Exploded Views and Parts Lists" in the BSM)
X	X	NNTN6261_	JedRay NiMH impres Standard Battery
X	X	NNTN6262_	JedRay NiMH impres FM Battery
X	X	NNTN6263_	JedRay NiMH impres FM Submersible Battery
X	X	4385665D01	Adapter, Remote Speaker Microphone
X	X	1505579Z01	Cover, Dust, Accessory Connector
X	X	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
X		PMLN4783_	Front Cover Kit, XTS 2500 Model 1.5 Non-Submersible, Non-Secure
	X	PMLN4773_	Front Cover Kit, XTS 2500 Model III Non-Submersible, Non-Secure
X	X	PMLF4036_	RF Board Kit, 896-941 MHz, Commercial&Trade Agreement
X		PMUF1246_	Tanapa, XTS 2500 Model 1.5 Non-Submersible, Non-Secure, 896-941 MHz Commercial/Trade Agreement
	X	PMUF1250_	Tanapa, XTS 2500 Model III Non-Submersible, Non-Secure, 896-941 MHz Commercial/Trade Agreement
X			User's Guide, XTS 2500 Model 1.5
	X		MOUser's Guide, XTS 2500 Model III

NOTE: X = Item included

ASTRO XTS 1500/MT 1500 Model Chart

MODEL NUMBER		DESCRIPTION
H66WCD9PW5BN		896-941 MHz, 1-5 Watt, ASTRO Digital XTS 1500 Model 1.5
	ITEM NUMBER	DESCRIPTION
X	–	Antenna (see "Accessories" in the BSM)
X	–	Battery (see "Accessories" in the BSM)
X	–	Carry Accessories (see "Accessories" in the BSM)
X	–	Hardware (see "Exploded Views and Parts Lists" in the BSM)
X	NNTN6261_	JedRay NiMH impres Standard Battery
X	NNTN6262_	JedRay NiMH impres FM Battery
X	4385665D01	Adapter, Remote Speaker Microphone
	1585746D04	Cover, Dust, Accessory Connector
	7285726C04	Display Module, VHF/UHF R1/UHF R2/700/800/900
	PMLN4900_	Front Cover Kit, XTS1500 Model 1.5 Non-Submersible, Non-Secure
X	PMLF4036_	RF Board Kit, 896-941 MHz
	PMUF1382_	Tanapa, XTS 1500 Model 1.5 Non-Submersible, Non-Secure, 896-941 MHz

NOTE: X = Item included

Notes

Introduction

1

General

This manual covers information needed for level one and two troubleshooting. Level one troubleshooting consists of radio programming, tuning (via CPS/tuner), knobs replacement, and installation and removal of antenna, belt clip, battery, and universal connector cover. Level two troubleshooting consists of everything listed in level one, plus the identification and replacement of Field Replaceable Units (FRUs). No soldering will be allowed; only board swapping.

Included in this manual are radio specifications for the VHF frequency band; a general description of ASTRO Digital XTS 2500, XTS 2250, and XTS 1500 models, and analog MT 1500 and PR 1500 models; recommended test equipment; service aids; radio alignment procedures; general maintenance recommendations; and procedures for basic assembly and disassembly.

NOTE: Hereinafter, the series of radios including the ASTRO Digital XTS 2500, XTS 2500I, XTS 2250, and XTS 1500, and analog MT 1500 and PR 1500, is referred to as the “XTS 2500/2250/1500 radios”.

Notations Used in This Manual

Throughout the text in this publication, you will notice the use of warning, caution, and note notations. These notations are used to emphasize that safety hazards exist, and care must be taken and observed.

NOTE: An operational procedure, practice, or condition, etc., which is essential to emphasize.



Caution

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in equipment damage.



WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or injury.



DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or injury.

Radio Description

The XTS 2500/2250/1500 radios are among the most sophisticated two-way radios available.

These radios provide improved voice quality across more coverage area. The digital process, called “embedded signalling,” intermixes system signalling information with digital voice, resulting in improved system reliability, and the capability of supporting a multitude of advanced features. Such features add up to better, more cost-effective two-way radio communications.

The XTS 2500/2250/1500 radios are available in four basic models. Table 1 describes their basic features.

Table 1. ASTRO XTS 2500/2250/1500 Basic Features

Feature	Model I*	Model 1.5 (XTS 2500/2250)	Model II	Model III (XTS 2500/2250)
Display	None	LCD 6 lines/ 12 characters per line	LCD 6 lines/ 12 characters per line	LCD 6 lines/ 12 characters per line
Keypad	None	None	3 x 2 button with 4-Position Navigation but- ton	3 x 6 button with 4-Position Navigation but- ton
Channel Capability	48	48	255	255
Dialing from Prestored List	No	No	Yes	Yes
Programmable Softkeys	No	No	Yes	Yes

* “Model I” refers to XTS 2500 Model I, XTS 2250 Basic Model, XTS 1500, MT 1500, and PR 1500

FLASHport

The XTS 2500/2250/1500 radios utilize Motorola’s revolutionary FLASHport™ technology. FLASHport makes it possible to add software that drives the radio’s capabilities both at the time of purchase and later on. Previously, changing a radio’s features and capabilities meant significant modifications, or buying a new radio. But now, just as a computer can be loaded with different software, the radio’s features and capabilities can be upgraded with FLASHport software.

Basic Maintenance

2

Introduction to This Section

This section of the manual describes preventive maintenance and handling precautions. Each of these topics provides information vital to the successful operation and maintenance of your radio.

Preventive Maintenance

The XTS 2500/2250/1500 radios do not require a scheduled preventive maintenance program; however, periodic visual inspection and cleaning is recommended.

Inspection

Check that the external surfaces of the radio are clean, and that all external controls and switches are functional. A detailed inspection of the interior electronic circuitry is not needed.

Cleaning

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external surfaces of the radio. External surfaces include the housing assembly and battery case. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime.

The only recommended agent for cleaning the external radio surfaces is a 0.5% solution of a mild dishwashing detergent, such as JOY[®], in water.



The effects of certain chemicals and their vapors can have harmful results on certain plastics. Aerosol sprays, tuner cleaners, and other chemicals should be avoided.

Cleaning External Plastic Surfaces

The detergent-water solution should be applied sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the radio. A soft, absorbent, lintless cloth or tissue should be used to remove the solution and dry the radio. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

Handling Precautions

Complementary metal-oxide semiconductor (CMOS) devices, and other high-technology devices, are used in this family of radios. While these devices have many attributes, their characteristics make them susceptible to damage by electrostatic discharge (ESD) or high-voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair. Handling precautions are mandatory for this radio, and are especially important in low-humidity conditions.

Never heat the RF PA above 210°C while performing repair or rework procedures to maintain its integrity. Utilizing a Chipmaster (R1319 or R1321) top-side set point of 215°C and a Dragon (R1427) bottom-side pre-heat set point of 180°C has proven to satisfy this condition during the rework of the RF PA (note: the RF PA temperature does not reach the Chipmaster's internal set point temperature). All other parts on the transceiver board can be reworked with Chipmaster top-side heat alone.

Basic Theory of Operation

3

General Overview

The ASTRO Digital XTS 2500 / XTS 2250 / XTS 1500 radio and the MT 1500 / PR 1500 radio are wideband, synthesized, fixed-tuned radios available in the VHF band. The XTS 2500 / XTS 2250 / XTS 1500 radios are capable of both analog operation (12.5 kHz or 25 kHz bandwidths) and digital ASTRO mode operation (12.5 kHz only). The MT 1500 and PR 1500 radios operate in analog only.

For the secure models only, the encryption module is designed to digitally encrypt voice for ASTRO and Non-ASTRO radios. The secure models are available in XTS 2500 models 1.5, II and III and XTS 2250 models 1.5 and III.

NOTE: The encryption modules are NOT serviceable.

The XTS 2500/2250/1500 radios include the following major assemblies (see Figure 1):

- **Main Board:** contains the microcontrol unit (MCU) and its associated memory and memory management integrated circuit (IC), the audio power amplifier, and a switching regulator. The board also contains the digital signal processor (DSP) and its support IC and associated memories. It further contains all transmit, receive, and frequency generation circuitry, including the digital receiver back-end IC and the reference oscillator.
- **Universal Flex:** contains the universal connector, speaker, and microphone.
- **Display (XTS 2500 Models 1.5, II and III and XTS 2250 1.5 and Advanced Model only):** a six-line, 12-character, liquid-crystal display (LCD).
- **Keypad (XTS 2500 Models II and III and XTS 2250 Advanced Model only):**
 - XTS 2500 Model II: a 3 x 2 keypad
 - XTS 2500 Model III and XTS 2250 Advanced Model: a 3 x 6 keypad.
- **Keypad with secure option (XTS 2500 Models 1.5, II and III and XTS 2250 Models 1.5 and III Secure Models only):**
 - XTS 2500 and XTS 2250 Model 1.5: no keypad with secure option
 - XTS 2500 model II: 3 x 2 keypad with secure option
 - XTS 2500 and XTS 2250 model III: 3 x 6 keypad with secure option

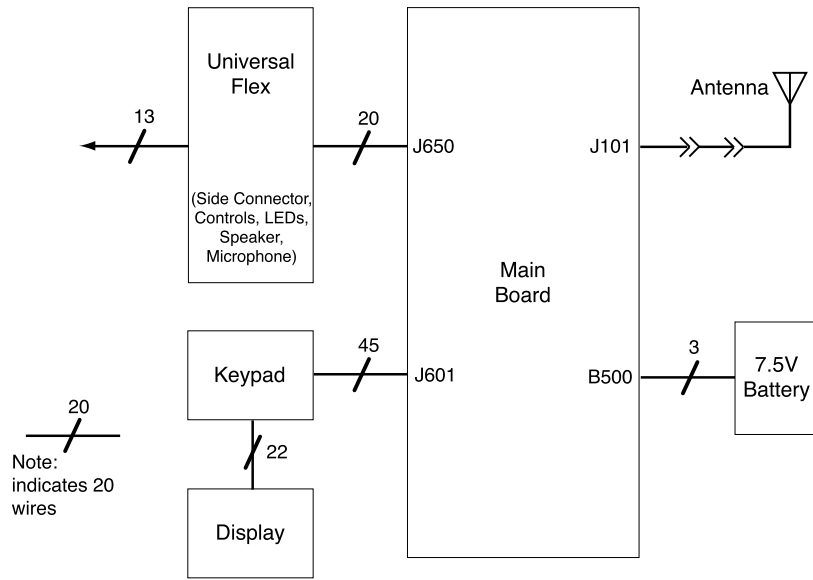


Figure 1. XTS 2500 Overall Block Diagram

Analog Mode of Operation

Receiving

When the radio is *receiving* (see Figure 2), the signal comes from the antenna connector to the radio board, passes through the RX/TX antenna switch and into the receiver front end. A 15dB step attenuator is included in the front end to provide additional protection against strong signals. The attenuator is controlled by a DSP based algorithm that continuously monitors signal strength. When the ON threshold is exceeded (approximately -95dBm), the attenuator is activated via a DAC in the PCIC by the host. The attenuator remains activated until the signal drops below the OFF threshold (approximately -115dBm including the 15dB attenuation). Hysteresis and timer functions are included in the algorithm to enhance performance. The algorithm controlling the attenuator is enabled via the CPS for each personality. When the algorithm is disabled, the attenuator is essentially a short circuit from input to output. The signal is then filtered, amplified,

and mixed with the first local-oscillator signal generated by the voltage-controlled oscillator (VCO).

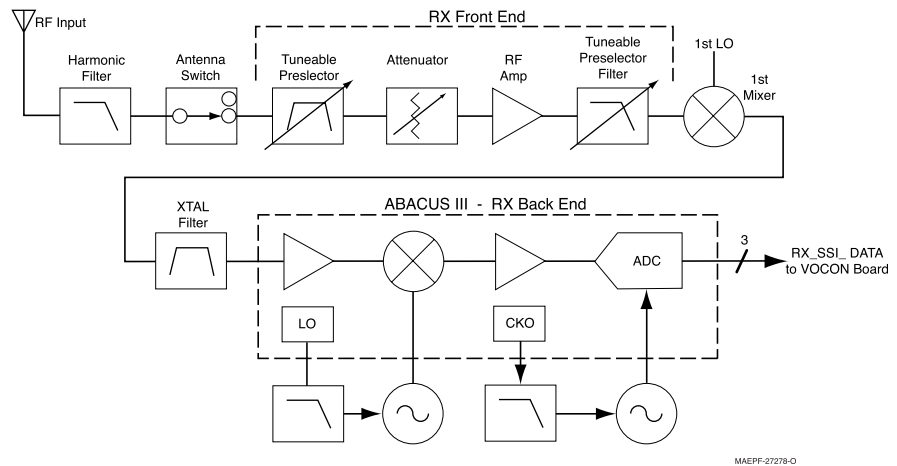


Figure 2. Receiver Block Diagram

The resulting intermediate frequency (IF) signal is fed to the IF circuitry, where it is again filtered and amplified. This amplified signal passes to the digital back-end IC, where it is mixed with the second local oscillator to create the second IF (2.25 MHz for VHF). It is then converted to a digital bit stream and mixed a third time to produce a baseband signal. This signal is passed to the VOCON circuitry through a current-driven differential output.

In the VOCON circuitry, the digital-signal processor (DSP) support IC digitally filters and discriminates the signal, and passes it to the DSP. The DSP decodes the information in the signal and identifies the appropriate destination for it. For a voice signal, the DSP routes the digital voice data to the CODEC for conversion to an analog signal. The CODEC then presents the signal to the audio power amplifier, which drives the speaker. For signalling information, the DSP decodes the message and pass it to the microcontrol unit.

Transmitting

When the radio is *transmitting* (see Figure 3), microphone audio is passed through gain stages to the CODEC where the signal is digitized. The CODEC passes digital data to the DSP where pre-emphasis and low-pass (splatter) filtering are done. The DSP passes this signal to a digital-to-analog (D/A) converter where it is reconverted into an analog signal and scaled for application to the voltage-controlled oscillator as a modulation signal.

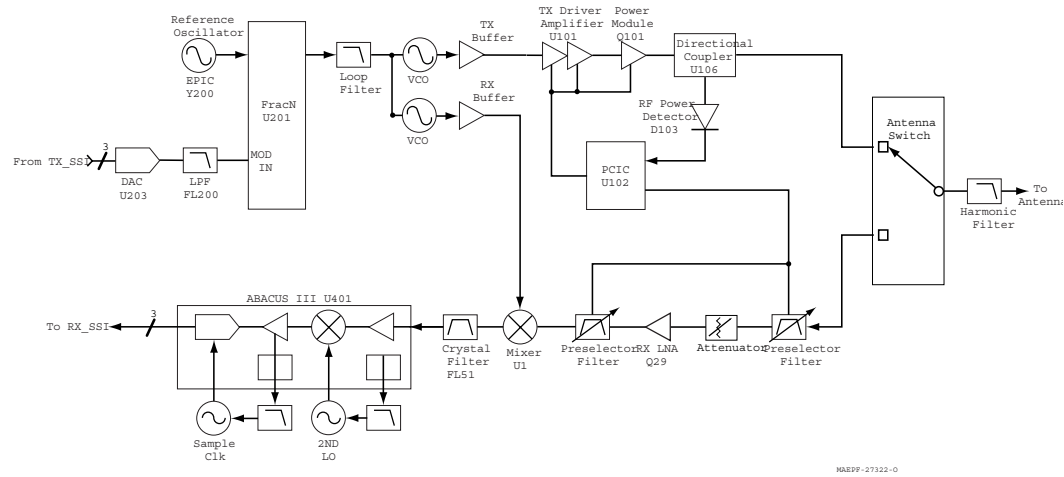


Figure 3. RF Block Diagram for VHF (Power and Control Omitted)

Transmitted signalling information is accepted by the DSP from the microcontrol unit, coded appropriately, and passed to the D/A converter, which handles it the same as a voice signal. Modulation information is passed to the synthesizer along the modulation line. A modulated carrier is provided to the RF PA, which transmits the signal under dynamic power control.

ASTRO Mode of Operation

In the ASTRO mode (digital mode) of operation, the transmitted or received signal is limited to a discrete set of deviation levels, instead of continuously varying. The receiver handles an ASTRO-mode signal identically to an analog-mode signal up to the point where the DSP decodes the received data. In the ASTRO receive mode, the DSP uses a specifically defined algorithm to recover information.

In the ASTRO transmit mode, microphone audio is processed identically to an analog mode with the exception of the algorithm the DSP uses to encode the information. This algorithm will result in deviation levels that are limited to discrete levels.

RF Basic Theory of Operation

The receiver front end consists of a preselector, an RF amplifier, a second preselector, and a mixer. Both preselectors are varactor-tuned, two-pole filters, controlled by the microcontroller unit through the D/A IC. The RF amplifier is a dual-gate, gallium-arsenide-based IC. The mixer is a double-balanced, active mixer, coupled by transformers. Injection is provided by the VCO through an injection filter. See Table 2 for local oscillator (LO) and first IF information.

Table 2. Local Oscillator and First IF Frequencies

	VHF
LO Frequency Range	--
First IF Frequency	44.85 MHz

For the VHF band, the frequency generation function is performed by two ICs and associated circuitry. The reference oscillator provides a frequency standard to the

synthesizer/prescaler IC, which controls the VCO buffer for VHF. The VCO buffer, actually generates the first LO and transmit-injection signals and buffers them to the required power level. The synthesizer/prescaler circuit module incorporates frequency-division and comparison circuitry to keep the VCO signals stable. The synthesizer/prescaler IC is controlled by the microcontrol unit through a serial bus.

For the VHF band, the receiver back end consists of a three-pole crystal filter and the digital back-end IC. The crystal filters are wide enough to accommodate 4 kHz modulation. Final IF filtering is done digitally in the DSP.

The digital back-end IC consists of an amplifier, the second mixer, an IF analog-to-digital converter, a baseband down-converter, and a 2.4 MHz synthesis circuit to provide a clock to the DSP-support IC on the VOCON circuitry. The second LO is generated by discrete components external to the IC. The output of the digital back-end IC is a digital bit stream that is current driven on a differential pair for a reduction in noise generation.

The transmitter consists of an RF driver IC that gets an injection signal from the VCO and a final-stage power amplifier. Transmit power is controlled by a power-control IC that monitors the output of a directional coupler and adjusts PA control voltages correspondingly. The signal passes through a RX/TX switch that uses PIN diodes to automatically provide an appropriate interface to transmit or receive signals. Antenna selection is done mechanically in the control top.

VOCON Basic Theory of Operation

The vocoder and controller (VOCON) circuitry contains the radio's microcontrol unit with its memory and support circuits, the DSP, its memory devices, and the DSP-support IC, voltage regulators, audio, and power control circuits. Connected to the VOCON circuitry are the display board, RF circuitry, keypad board, and controls/universal flex.

The microcontrol unit controls receive/transmit frequencies, power levels, display, and other radio functions, using either direct logic control or serial communications paths to the devices. The microcontrol unit executes a stored program located in the FLASH ROM. Data is transferred to and from memory by the microcontrol unit data bus. The memory location from which data is read, or to which data is written, is selected by the address lines.

The DSP-support IC is supplied with a 16.8 MHz clock from the RF circuitry. Both the DSP and the microprocessor have their clocks generated by the DSP-support IC. They can both be adjusted so that the harmonics do not cause interference with the radio's receive channel.

The regulator and power-control circuits include 3.3-volt analog, 3.3-volt digital, and 5-volt regulators. The audio PA is sourced from 7.5V. The regulator's power-down mode is controlled by the microcontrol unit, which senses the position of the on/off switch. The 5-volt regulator has an error pin for low-voltage resets.

The DSP performs signalling and voice encoding and decoding, as well as audio filtering and volume control. This IC performs Private-Line®/Digital Private Line™ (PL/DPL) encode and alert-tone generation. The IC transmits pre-emphasis on analog signals and applies a low-pass (splatter) filter to all transmitted signals. It requires a clock on the EXTAL pin. An 8 kHz interrupt signal generated by the DSP-support IC is also required for functionality. It is programmed using parallel programming from the microcontrol unit.

The audio CODEC performs analog-to-digital (A/D), and digital-to-analog conversions on audio signals. The DSP controls squelch, deviation, and executes receiver and transmitter filtering. The DSP-support IC receives a 2.4 MHz clock, and also receives data, which it formats for the DSP.

Recommended Test Equipment and Service Aids

4

Recommended Test Equipment

The list of equipment contained in Table 3 includes all of the standard test equipment required for servicing two-way portable radios, as well as several unique items designed specifically for servicing this family of radios. The “Characteristics” column is included so that equivalent equipment may be substituted; however, when no information is provided in this column, the specific Motorola model listed is either a unique item or no substitution is recommended.

Table 3. Recommended Test Equipment

Motorola Model Number	Description	Characteristics	Application
R2600 Series	Communications System Analyzer	This monitor will substitute for items with an asterisk (*).	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment.
Fluke 8012	Digital Multimeter		Recommended for ac/dc voltage and current measurements
R1150_*	Code Synthesizer		Injection of audio and digital signalling codes
R1377_*	AC Voltmeter	1mV to 300V, 10-Megohm input impedance	Audio voltage measurements
R1094_	Dual-Trace Oscilloscope	20 MHz bandwidth 5mV to 5V/division	Waveform measurements
S1350_* ST1213_ (VHF)* ST1223_ (UHF)*	Wattmeter Plug-In Element RF Dummy Load	50-ohm, ±5% accuracy 10 watts, maximum 0-1000 MHz, 300W	Transmitter power output measurements
R1065_	Load Resistor	10-watt Broadband	For use with wattmeter
S1339_	RF Millivolt Meter	100µV to 3V RF	RF-level measurements
R1013_*	SINAD Meter		Receiver sensitivity measurements
S1347_ or S1348_ (programmable)	DC Power Supply	0-20Vdc, 0-5 Amps current limited	Bench supply for 7.5Vdc

*The R2600 Series monitor will substitute for these items.

Service Aids

Refer to Table 4., “Service Aids,” for a listing and description of the service aids designed specifically for servicing this family of radios. These kits and/or parts are available from the Motorola Parts Division offices listed in the “Replacement Parts Ordering” section located on the inside back cover of this manual. While all of these items are available from Motorola, most are standard shop equipment items, and

any equivalent item capable of the same performance may be substituted for the item listed.

Table 4. Service Aids

Motorola Part Number	Description	Application
–	Standard Hex Shank Screw Bit (7/64)	To remove/screw hex nut (0286165A03) for non-Immersible model.
6685666D01	Chassis Opener Tool	Used to remove radio knobs and to separate chassis from Front Cover.
NLN9839_	Vacuum Pump Kit	Immersible radios only. Vacuum pump with gauge and vacuum hose. Requires NTN9279 Adapter Kit.
NTN4265_	Pressure Pump Kit	Immersible radios only. Pressure pump with gauge and pressure hose. Requires NTN9279 Adapter Kit.
NTN9279_	Vacuum Adapter with Gasket Kit	Immersible radios only. Connects the vacuum/pressure hose to the radio's casting.
RKN-4106_	RS232/Radio/Test Set Cable	Connects radio to RLN4460 Test Box and to RS232 computer connector (DB9).
0180305G54	Battery Eliminator	Interconnects radio to power supply.
RLN-4460_	Portable Test Set	Enables connection to the universal connector. Allows switching for radio testing.
RVN-4181_	Customer Programming Software	Customer Programming Software (CPS)/Tuner on one CD-ROM.
58-80348B33	SMA to BNC Adaptor	Adapts radio's antenna port to BNC cabling of test equipment.
RKN4105_	USB/Radio/Test Set Cable	Connects radio to RLN4460 test box and to USB computer connector.
8180384M37	Test Fixture	Provides for troubleshooting the radio board when the back casting is removed.

NOTE: The Radio Interface Box (RIB), Smart Radio Interface Box (SRIB), and any cable that connects with those boxes are incompatible with the XTS 2500 radio and should NOT be used.

Field Programming Equipment

This family of radios can be aligned and programmed in the field. This requires specific equipment and special instructions. Refer to the applicable "CPS On-line Help" for complete field programming information.

Introduction to This Section

This section covers performance checks used to verify that the radio meets published specifications. The recommended test equipment listed in the previous section approaches the accuracy of the manufacturing equipment, with a few exceptions. Accuracy of the equipment must be maintained in compliance with the manufacturer’s recommended calibration schedule. Checks should be performed if radio performance degradation is suspected.

Setup

Supply voltage can be connected from the battery eliminator. The equipment required for alignment procedures is connected as shown in the “Radio Alignment Test Setup” diagram (Figure 4).

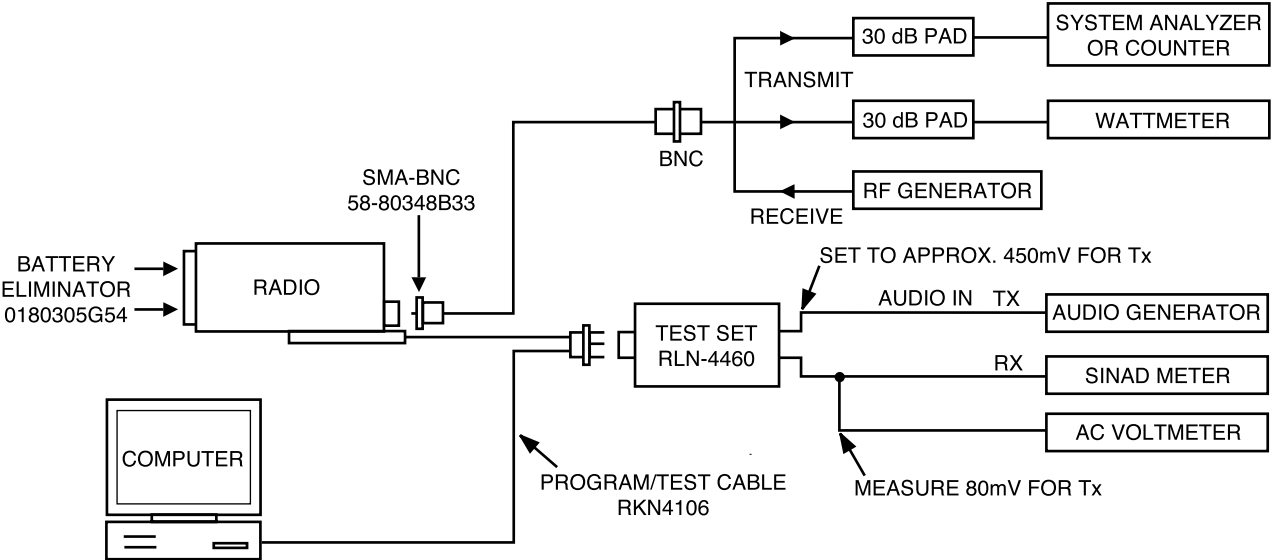


Figure 4. Radio Alignment Test Setup

Initial equipment control settings should be as indicated in the Table 5, and should hold for all alignment procedures except as noted.

Table 5. Initial Equipment Control Settings

System Analyzer	Test Set	Power Supply
Monitor Mode: Pwr Mon	Spkr Set: A	Voltage: 7.5Vdc
RF Attn: -70dB	Spkr/Load: Speaker	DC On/Standby: Standby
AM, CW, FM: FM	PTT: OFF (center)	Volt Range: 10Vdc
O'scope Source: Mod O'scope Horiz: 10mSec/Div O'scope Vert: 2.5 kHz/Div O'scope Trig: Auto Monitor Image: Hi Monitor BW: Nar Monitor Squelch: Mid CW Monitor Vol: 1/4 CW		Current: 2.5Amps

Display Radio Test Mode

Entering Display Radio Test Mode

1. Turn the radio on.
2. Within 10 seconds after "Self Test" is complete, press **Side button 3** five times in succession.
3. The radio will show a series of displays that will give information regarding various version numbers and subscriber specific information. The displays are described in Table 6.

Table 6. Front-Panel Access Test-Mode Displays

Name of Display	Description	Appears
"SERVICE"	The literal string indicates the radio has entered test mode.	Always.
Host Software Version	The version of host firmware.	Always.
DSP Software Version	The version of DSP firmware.	Always.
Model Number	The radio's model number as programmed in the codeplug.	Always.
Serial Number	The radio's serial number as programmed in the codeplug.	Always.
ROM Size	The memory capacity of the host FLASH part.	Always.
FLASHcode	The FLASH codes as programmed in the codeplug.	Always.

NOTE: All displays are temporary and will disappear without any user intervention. If information is longer than the physical length of the radio's display, the information will wrap around to the next display. After the last display, "RF TEST" will be displayed. For **non-display** radios, refer to the CPS Radio Information Screen.

4. Press **Side Button 1** to stop the displays and put the radio into the Control Top and Keypad test mode (display radio). The test mode menu “CH TEST” will be displayed. Go to the “Control Top and Keypad Test Mode (Display Radio)” section on page 16.

NOTE: Each press of **Side Button 1** will toggle between “CH TEST” and “RF TEST.”

OR

- 4a. Press the **Top Programmable Button** to stop the displays and put the radio into the RF test mode (display radio). The test mode menu “1 CSQ.” will be displayed, indicating test frequency 1, Carrier Squelch mode. Go to “RF Test Mode (Display Radio)” in the next section.

RF Test Mode (Display Radio)

When the ASTRO Digital XTS 2500 radio is operating in its normal environment, the radio’s microcomputer controls the RF channel selection, transmitter key-up, and receiver muting, according to the customer codeplug configuration. However, when the unit is on the bench for testing, alignment, or repair, it must be removed from its normal environment via a special routine, called **TEST MODE** or “air test.”

1. Each additional press of **Side Button 3** will advance to the next test channel. (Refer to Table 7.)
2. Pressing **Side Button 2** will scroll through and access test environments as shown in Table 8.

NOTE: Transmit into a load when keying a radio under test.

Table 7. Test Frequencies

Frequency	VHF	
	RX	TX
F1	136.075	136.025
F2	142.075	142.125
F3	154.275	154.225
F4	160.175	160.125
F5	168.125	168.075
F6	173.925	173.975
F7	–	–
F8	–	–
F9	–	–

Table 8. Test Environments

No. of Beeps	Display	Description	Function
1	CSQ	Carrier Squelch	RX: unsquelch if carrier detected TX: mic audio
3	TPL	Tone Private-Line	RX: unsquelch if carrier and tone (192.8 Hz) detected TX: mic audio + tone (192.8 Hz)
11	AST	ASTRO	RX: none TX: 1200Hz tone **
12	USQ	Carrier Unsquelch	RX: unsquelch always TX: mic audio
** All deviation values are based on deviation tuning of this mode.			

Control Top and Keypad Test Mode (Display Radio)

This test mode is used to verify proper operation of all radio buttons and switches if a failure is suspected.

1. Press and hold the **Top Programmable Button**; all segments on the display will light, and the LED on the control top will illuminate a red color.
2. Release the **Top Programmable Button**; “3/0” appears, indicating that the **Top Programmable Button** is in the open condition.
3. Press the **Top Programmable Button** again; “3/1” appears, indicating that the **Top Programmable Button** is in the closed condition.
4. Rotate the **Mode/Zone Selector Switch**; “4/0” through “4/15” appears, indicating that the selector switch is in mode/zone position 1 through 16.
5. Rotate the **Three-Position Concentric Switch**; “65/0” through “65/2” appear.
6. Cycle through the **16-Position Programmable Switch**; “67/0,” “67/1,” and “67/2” appear.
7. Rotate the **Volume Control**; “2/0” through “2/220” appear.
8. Press **Side Button 1**; “96/1” appears; release, “96/0” appears.
9. Press **Side Button 2**; “97/1” appears; release, “97/0” appears.

10. Press **Side Button 3**; “98/1” appears; release, “98/0” appears.
11. Press the **PTT Switch**; “1/1” appears; release, “1/0” appears.
12. Keypad Checks:

Model III Only—

- Press 0, “48/1” appears; release, “48/0” appears.
- Press 1, “49/1” appears; release, “49/0” appears.
- Press 2, “50/1” appears; release, “50/0” appears.
- Press 3, “51/1” appears; release, “51/0” appears.
- Press 4, “52/1” appears; release, “52/0” appears.
- Press 5, “53/1” appears; release, “53/0” appears.
- Press 6, “54/1” appears; release, “54/0” appears.
- Press 7, “55/1” appears; release, “55/0” appears.
- Press 8, “56/1” appears; release, “56/0” appears.
- Press 9, “57/1” appears; release, “57/0” appears.
- Press *, “58/1” appears; release, “58/0” appears.
- Press #, “59/1” appears; release, “59/0” appears.

All Display Models—

- Press , “128/1” appears; release, “128/0” appears.
- Press , “129/1” appears; release, “129/0” appears.
- Press , “130/1” appears; release, “130/0” appears.
- Press the left-hand  key on the top row of keys, “131/1” appears; release, “131/0” appears.
- Press the center , “132/1” appears; release, “132/0” appears.
- Press the right-hand , “133/1” appears; release, “133/0” appears.
- Press , “134/1” appears; release, “134/0” appears.
- Press , (up arrow), “135/1” appears; release, “135/0” appears.
- Press , (down arrow), “136/1” appears; release, “136/0” appears.

Non-Display Radio Test Mode

Entering Non- Display Radio Test Mode

1. Turn the radio on.
2. Within 10 seconds after the top green LED turns off, press **Side button 3** five times in succession.
3. Press **Side Button 1** to put the radio into the Control Top and Keypad test mode (non-display radio). Go to the “Control Top and Keypad Test Mode (Non-Display Radio)” section on page 18.

NOTE: Each press of **Side Button 1** will toggle between Control Top and Keypad test mode (non-display radio) and RF test mode (non-display radio).

OR

- 3a. Press the **Top Programmable Button** to stop the displays and put the radio into the RF test mode (non-display radio). Go to “RF Test Mode (Non-Display Radio)” in the next section.

RF Test Mode (Non-Display Radio)

When the ASTRO Digital XTS 2500 radio is operating in its normal environment, the radio's microcomputer controls the RF channel selection, transmitter key-up, and receiver muting according to the customer codeplug configuration. However, when the unit is on the bench for testing, alignment or repair, it must be removed from its normal environment via a special routine, called **TEST MODE** or “air test.”

1. Each additional press of **Side Button 3** will advance to the next test channel. (Refer to Table 7 on page 16.) The channel number is represented by the number of beeps emitted by the radio after the button press (for example, five beeps indicates channel 5).
2. Pressing **Side Button 2** will scroll through and access test environments as shown in Table 8 on page 16. The test environment is represented by the number of beeps emitted by the radio after the button press (for example, 11 beeps indicate AST).

NOTE: Transmit into a load when keying a radio under test.

Control Top and Keypad Test Mode (Non-Display Radio)

This test mode is used to verify proper operation of all radio buttons and switches if a failure is suspected.

1. Press and hold the **Top Programmable Button**; the LED on the control top lights red, and the radio beeps.
2. Release the **Top Programmable Button**; the radio beeps again.
3. Press the **Top Programmable Button** again; the radio beeps, indicating that the **Top Programmable Button** is in the closed condition.
4. Rotate the **Three-Position Concentric Switch**; the radio beeps in each switch position.
5. Rotate the **Mode/Zone Selector Switch**; the radio beeps in each switch position.
6. Cycle through the **16-Position Programmable Switch**; the radio beeps in each switch position.
7. Rotate the **Volume Control**; the radio beeps at each new volume setting.
8. Press **Side Button 1**; the radio beeps.
9. Press **Side Button 2**; the radio beeps.
10. Press **Side Button 3**; the radio beeps.

Table 9. Receiver Performance Checks

Test Name	System Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency* Monitor: Frequency error. Input at RF In/Out	TEST MODE, 4 CSQ output at antenna	PTT to continuous (during the performance check)	Frequency error to be $\leq \pm 1.3$ kHz
Rated Audio	Mode: GEN Output level: 1.0mV RF 4th channel test frequency* Mod: 1 kHz tone at 3 kHz deviation Monitor: DVM: ac Volts	TEST MODE, 4 CSQ	PTT to OFF (center); meter selector to Audio PA	Set volume control to 3.74Vrms
Distortion	As above, except to distortion	As above	As above	Distortion < 3.0%
Sensitivity (SINAD)	As above, except SINAD; lower the RF level for 12dB SINAD	As above	PTT to OFF (center)	RF input to be < 0.35 μ V
Noise Squelch Threshold (only radios with conventional system need to be tested)	RF level set to 1mV RF	As above	PTT to OFF (center); meter selection to Audio PA; spkr/load to speaker	Set volume control to 3.74Vrms
	As above, except change frequency to a conventional system. Raise RF level from zero until radio unsquelches.	Out of TEST MODE; select a conventional system	As above	Unsquelch to occur at < 0.25 μ V. Preferred SINAD = 5-8dB
*See Table 7 on page 16.				

Table 10. Transmitter Performance Checks

Test Name	System Analyzer	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency* Monitor: Frequency error. Input at RF In/Out	TEST MODE, 4 CSQ	PTT to continuous (during the performance check).	Frequency error to be $\leq \pm 1.3$ kHz.
Power RF	As above	As above, 4 CSQ	As above	Refer to Maintenance Specifications page in front of manual.
Voice Modulation	Mode: PWR MON 4th channel test frequency* atten to -70 , input to RF In/Out. Monitor: DVM, ac Volts. Set 1 kHz Mod Out level for 0.025Vrms at test set, 80mVrms at ac/dc test set jack	As above, 4 CSQ	As above, meter selector to mic	Deviation: ≥ 4.1 kHz but ≤ 5.0 kHz
Voice Modulation (internal)	Mode: PWR MON 4th channel test frequency* atten to -70 , input to RF In/Out	TEST MODE, 4 CSQ, output at antenna	Remove modulation input	Press PTT switch on radio. Say "four" loudly into the radio mic. Measure deviation: ≥ 4.1 kHz but ≤ 5.0 kHz
PL Modulation (radios with conventional, clear mode, coded squelch operation only)	Change frequency to a conventional transmit frequency	Conventional coded squelch personality (clear mode operation) 4 TPL	As above	Deviation: ≥ 500 Hz but ≤ 1000 Hz
Talkaround Modulation (radios with conventional, clear mode, talk-around operation only)	Change frequency to conventional talk-around frequency. Mode: PWR MON deviation, attenuation to -70 , input to RF In/Out. Monitor: DVM, ac volts Set 1 kHz Mod Out level for 25mVrms at test set.	Conventional talkaround personality (clear mode operation) 1 CSQ	As above	Deviation: ≥ 4.1 kHz but ≤ 5.0 kHz
*See Table 7 on page 16				

Radio Alignment Procedures

6

Introduction to This Section

This section describes both receiver and transmitter radio alignment procedures.


General

A personal computer (PC) and tuner software are required to align the radio. Refer to the applicable manual for installation and setup procedures for the software. To perform the alignment procedures, the radio must be connected to the PC and to a universal test set as shown in Figure 4. Radio Alignment Test Setup on page 13.



Caution

These procedures should only be attempted by qualified service personnel. Failure to perform alignment procedures properly may result in seriously degraded radio or system performance.

Select **Tuner** from the **START** menu. To read the radio, use the **File** → **Read Device** menu or click on . Figure 5 illustrates how the alignment screens are organized. To access a screen, double-click on the desired screen name in the **Tuner** menu.

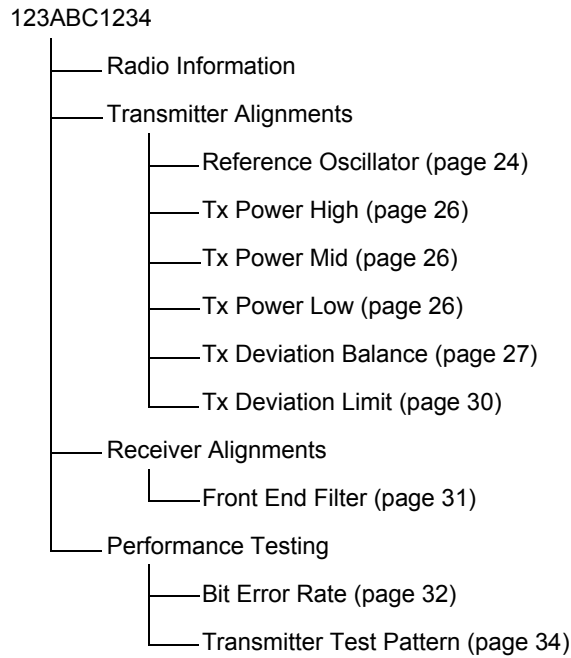


Figure 5. Tuner Menu Layout

The alignment screens introduce the concept of the “softpot,” an analog **SOFT**ware-controlled **POT**entiometer used for adjusting all transceiver alignment controls.



Caution

Do NOT switch radios in the middle of any Alignment procedure. Always left-click the **Close** button on the screen to return to the MAIN menu screen before disconnecting the radio. Improper exits from the Alignment screens may leave the radio in an improperly configured state and result in seriously degraded radio or system performance.

Each alignment screen provides the ability to increase or decrease the softpot value by using a slider or the screen's UP/DOWN arrow keys (▲ ▼), or by

entering the new value from the keyboard. A graphical scale on the display indicates the minimum, maximum, and proposed value of the softpot; see Figure 6.

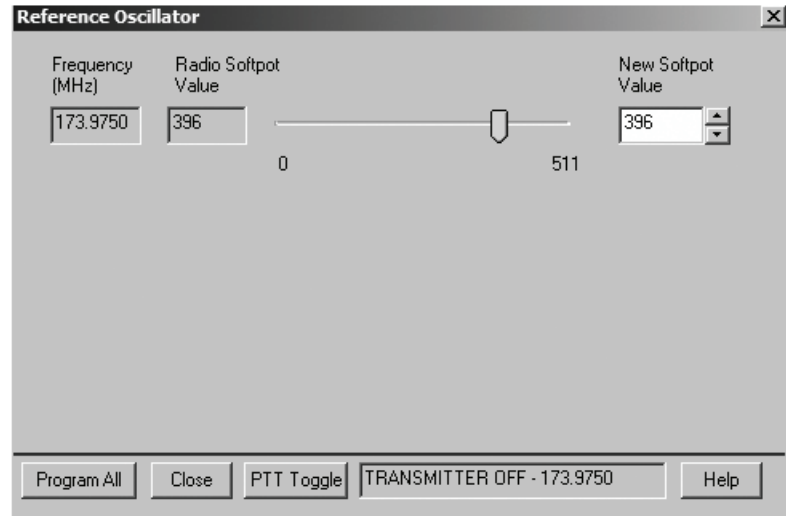


Figure 6. Typical Softpot Screen

Adjusting the softpot value sends information to the radio to increase (or decrease) a voltage in the corresponding circuit. For example, left-clicking the UP arrow ▲ on the **Reference Oscillator** screen instructs the radio's microcomputer to increase the voltage across a varactor in the reference oscillator, which increases the frequency.

In ALL cases, the softpot value is just a relative number corresponding to a digital-to-analog (D/A) generated voltage in the radio.

Perform the following procedures in the sequence indicated.

NOTE: Some of the following screens may vary depending upon the radio under test and the version of tuner software you are using. Refer to the software's on-line help.

Radio Information

Figure 7 shows a typical Radio Information screen.

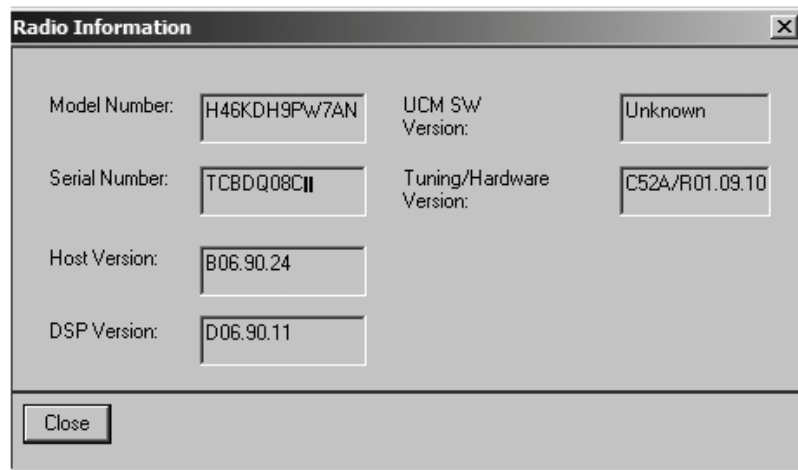


Figure 7. Radio Information Screen

Reference Oscillator Alignment

Adjustment of the reference oscillator is critical for proper radio operation. Improper adjustment will result not only in poor operation, but also in a misaligned radio that will interfere with other users operating on adjacent channels. For this reason, the reference oscillator should be checked every time the radio is serviced, or once a year, whichever comes first. The frequency counter used for this procedure must have a stability of 0.1 ppm (or better).

NOTE: Reference oscillator alignment is required after replacing (or servicing) the transceiver board.

This test can be done with either the R-2670 Communication Analyzer or the 8901_Modulation Analyzer.

- Initial setup using the R-2670 Communication Analyzer:
 - RF Control: MONITOR
 - B/W: WB
 - Freq: CPS frequency under test
 - Attenuation: 20dB
 - Mon RF in: RF I/O
 - Meter: RF Display
 - Mode: STD
 - Input Level: uV or W
 - Display: Bar Graphs
 - Squelch: Mid-range or adjust as necessary
- Initial setup using the 8901_ Series Modulation Analyzer:

- Press the green **Automatic Operation** button on the analyzer.
- Press the **FREQ** key.
- Type **7.1** followed by **SPCL** button to set the 8901B_ modulation analyzer for maximum accuracy.

To align the reference oscillator:

1. Select the **Reference Oscillator** alignment screen. See Figure 8.

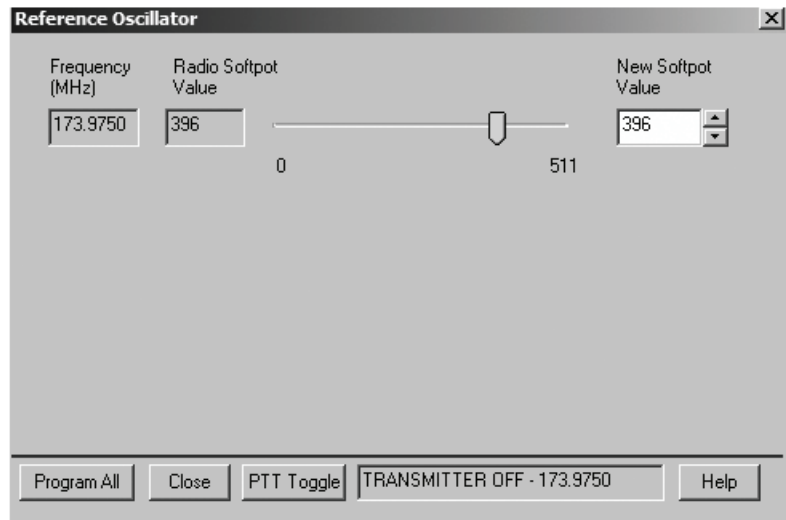


Figure 8. Reference Oscillator Alignment Screen

2. Left-click the **PTT Toggle** button on the screen to make the radio transmit. The screen indicates whether the radio is transmitting.
3. Measure the transmit RF frequency with your service monitor.
4. Adjust the reference oscillator's softpot value until the measured value is as close as possible to the frequency shown on the screen. See Table 11.

Table 11. Reference Oscillator Alignment

Band	Target
VHF	±100 Hz

5. Left-click the **Program All** button on the screen to dekey the radio and save the tuned values.
6. Left-click the **Close** button on the screen to return to the **Transmitter Alignments** menu.

Transmit Power Alignment

This alignment procedure adjusts the transmit power of the radio and must be performed for three different power levels (Low, Mid, High), at multiple frequencies for each power level, to allow for proper alignment across the entire RF band. The RF band is divided into frequency zones with a calibration point (value) in each zone.

- The same softpot attenuation value will result in DIFFERENT radio output power levels at different frequencies.
 - All power measurements are to be made at the antenna port.
 - Transmit Power alignment is required after replacing (or servicing) the transceiver board.
1. Select the **TX Power** alignment screen. The screen will indicate the transmit frequencies to be used. See Figure 9.
 2. Left-click the desired frequency field (starting with the highest frequency shown).
 3. Left-click the **PTT Toggle** button on the screen to make the radio transmit. The screen indicates whether the radio is transmitting.
 4. Measure the transmit power of the radio with a service monitor.
 5. Adjust the softpot value until the required power, as shown in Table 12, is indicated on the service monitor.

Table 12. Transmit Power Settings

Power Level	Test Frequencies
	VHF (both ranges)
Low (1 Watt)	2.2–2.4W
Mid (2 Watts)	–
High (3 Watts)	5.2–5.4W

6. Repeat the above process for all frequencies and all power levels.
7. Left-click the **Program All** button on the screen to dekey the radio and save the tuned values.

Left-click the **Close** button on the screen to return to the **Transmitter Alignments** menu.

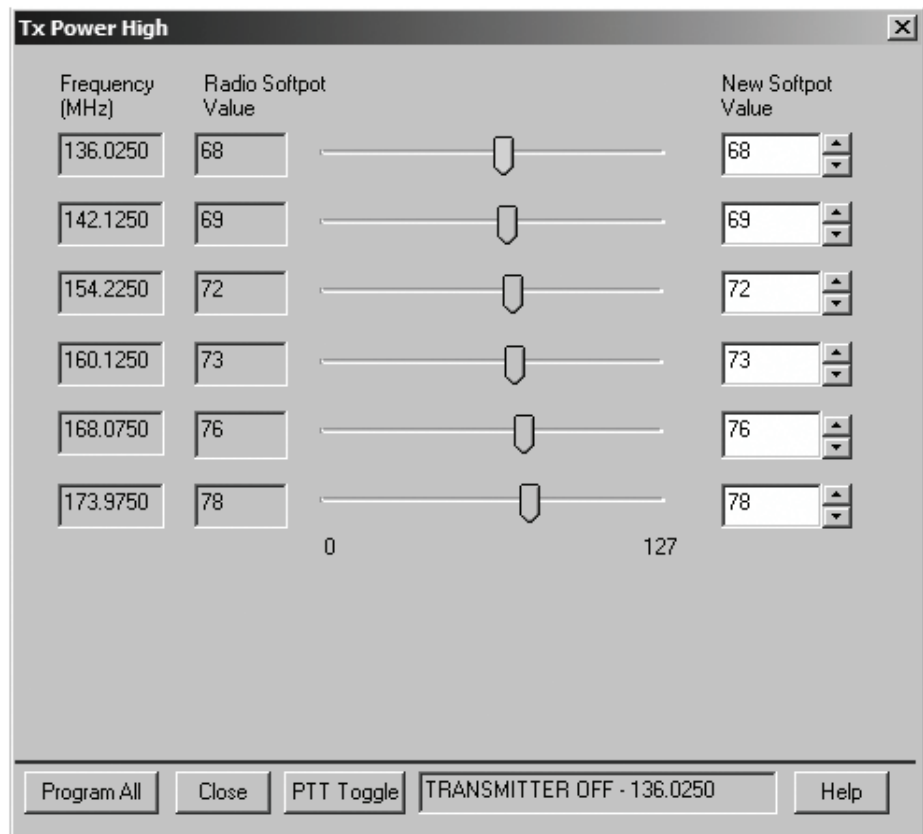


Figure 9. Transmit Power Alignment Screen (Typical)

Transmit Deviation Balance Alignment

This alignment procedure balances the modulation contributions of the low- and high-frequency portions of a baseband signal. Proper alignment is critical to the operation of signalling schemes that have very low frequency components (for example, DPL) and could result in distorted waveforms if improperly adjusted.

This procedure needs to be performed at multiple frequencies to allow for proper alignment across the entire RF band. The RF band is divided into frequency zones with a calibration point (value) in each zone.

NOTE: This alignment is required after replacing (or servicing) the VOCON board or the transceiver board.

Proper alignment requires a modulation analyzer or meter with a frequency response to less than 10 Hz modulating frequency. The modulation analyzer settings during this test should be set for average deviation, a 15 kHz low-pass filter, no de-emphasis, and no high-pass filter, if these settings are supported.

This test can be done with either the R-2670 Communication Analyzer or the 8901_ Series Modulation Analyzer. The method of choice is the R-2670 analyzer.

Radio Alignment Procedures

1. Initial setup using the R-2670 Communication Analyzer:
 - Connect a BNC cable between the “DEMOD OUT” port and the “VERT/ SINAD DIST/DMM COUNTER IN” port on the R-2670.
 - Press the **SPF** key on the R-2670 to display the “SPECIAL FUNCTIONS MENU.” Move the cursor to “High Pass,” and select 5 Hz on the soft key menu. Select 20 kHz for the “Low Pass” setting.
 - In the “RF Control” section of the R-2670, enter the frequency displayed on the RSS screen. Move the cursor to the “B/W” setting and select “WIDE +/- 100 kHz” on the soft key menu.
 - Place the R-2670 cursor in the “Display” zone. Select “AC VOLTS” on the soft key menu. Move the cursor to the “Range” setting and select “AUTO.”
2. Initial setup using the 8901_ Series Modulation Analyzer:
 - Press the **FM MEASUREMENT** button. (The “*Error 03-input level too low*” indication is normal until an input signal is applied.)
 - Simultaneously press the **Peak –** and **Peak +** buttons. Both LEDs on the buttons should light.
 - Press the 15 kHz LP filter key.
3. Select the **TX Deviation Balance** alignment screen. The screen indicates the transmit frequencies to be used. See Figure 10.
4. Left-click the desired frequency field (starting with the highest frequency shown).
5. Left-click the **PTT Toggle** button on the screen to make the radio transmit. The screen indicates whether the radio is transmitting.

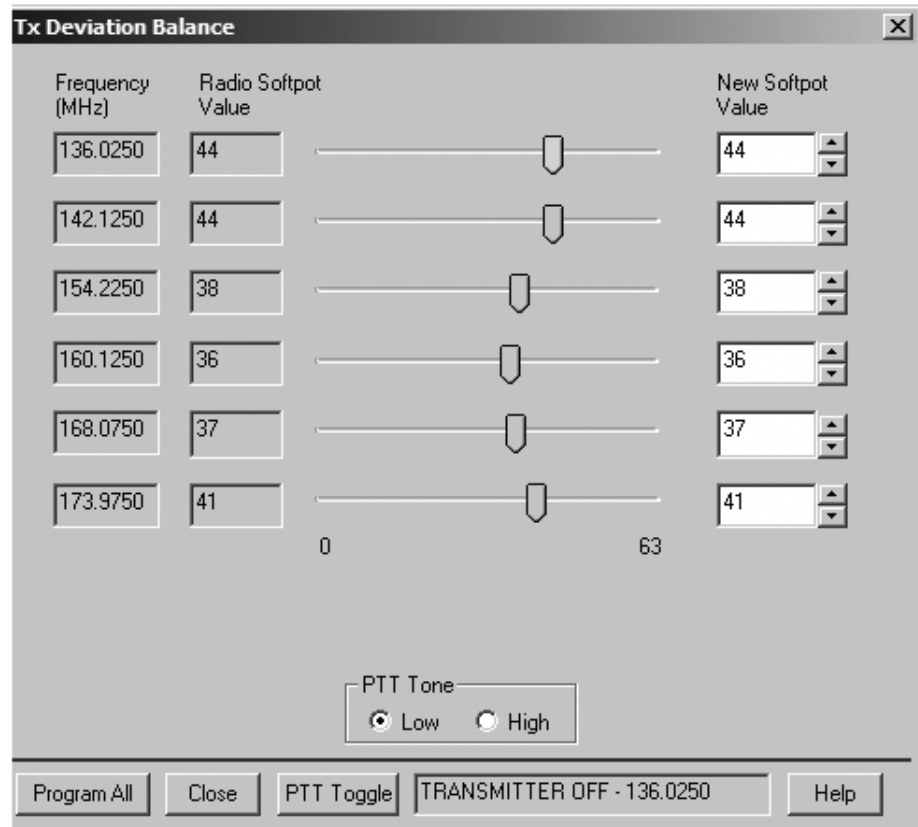


Figure 10. Transmit Deviation Balance Alignment Screen

6. Left-click the **PTT Tone: Low** button.
7. Left-click the **PTT Toggle** button on the screen to enable transmission. The screen indicates whether the radio is transmitting. Wait approximately 5 seconds until the voltage shown on R-2670, or the deviation shown on the 8901_ analyzer, stabilizes.
8. Measure and record the ac voltage value from the R-2670 analyzer or the deviation value from the 8901_ series analyzer.
9. Left-click the **PTT Tone: High** button.
10. Adjust the softpot value until the measured deviation/voltage, when using the high tone, is within +/- 1.5% of the value observed when using the low tone.
11. Repeat the above process for all frequencies.
12. Left-click the **Program All** button on the screen to dekey the radio and save the tuned values.
13. Left-click the **Close** button on the screen to return to the **Transmitter Alignments** menu.

Transmit Deviation Limit Alignment

This alignment procedure limits the modulation of a baseband signal. It is used for primary modulation limiting.

This procedure needs to be performed at multiple frequencies to allow for proper alignment across the entire RF band. The RF band is divided into frequency zones with a calibration point (value) in each zone.

NOTE: This alignment is required after replacing (or servicing) the VOCON board or the transceiver board.

1. Select the **TX Deviation Limit** alignment screen. The screen will indicate the transmit frequencies to be used. See Figure 11.

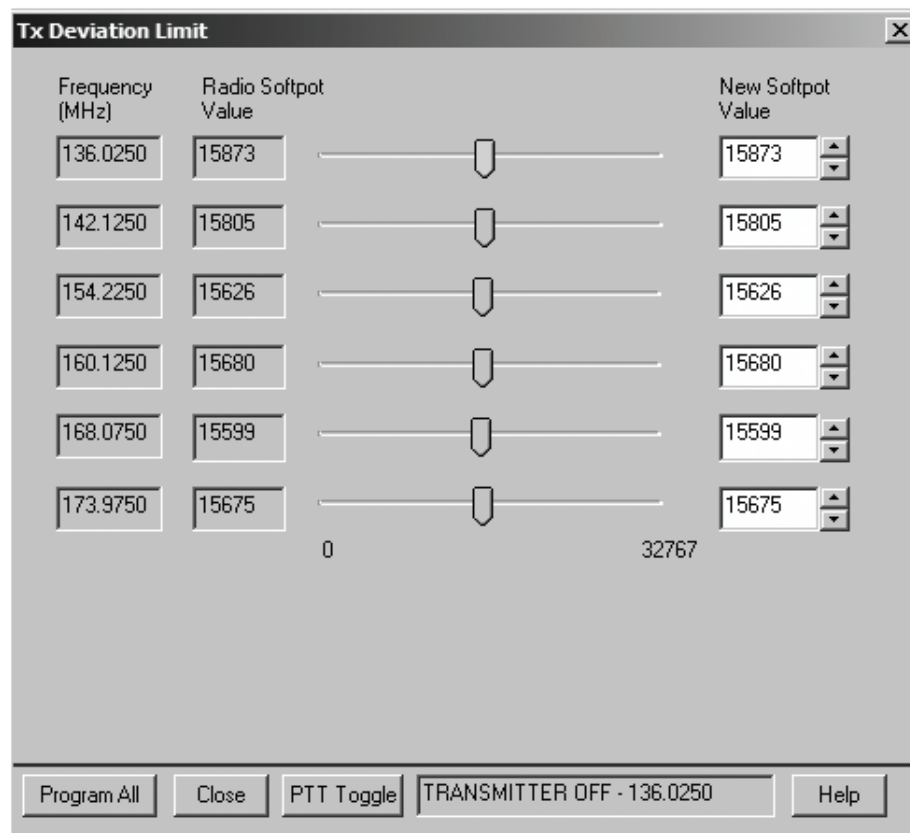


Figure 11. Transmit Deviation Limit Alignment Screen

2. Left-click the desired frequency field (starting with the highest frequency shown).
3. Left-click the **PTT Toggle** button on the screen to make the radio transmit. The screen indicates whether the radio is transmitting.
4. Measure the transmitted signal deviation of the radio with a service monitor.
5. Adjust softpot value until the measured deviation is as close as possible to 2.83 kHz.

6. Repeat the above process for all frequencies.
7. Left-click the **Program All** button on the screen to dekey the radio and save the tuned values.
8. Left-click the **Close** button on the screen to return to the **Transmitter Alignments** menu.

Front End Filter Alignment



Caution

Refer to your Radio Service Manual for alignment procedure details. This procedure should only be attempted by qualified service personnel.

Definition

This alignment procedure adjusts the front end receiver bandpass filters for best receiver sensitivity and selectivity. It should be performed for all test frequencies to allow for proper software interpolation for frequencies in between the test frequencies in the band (see Figure 12).

NOTE: Rx Front End Filter Alignment is required after replacing (or servicing) the transceiver board.

Procedure for VHF

1. Left-click the desired frequency field.
2. Apply an RF signal with no modulation at -90 dBm on the current operating frequency.
3. Adjust the softpot value until the maximum RSSI value is found.

- Repeat the above process for all frequencies.

Click on the “Program All” button to save the tuned values in the radio.

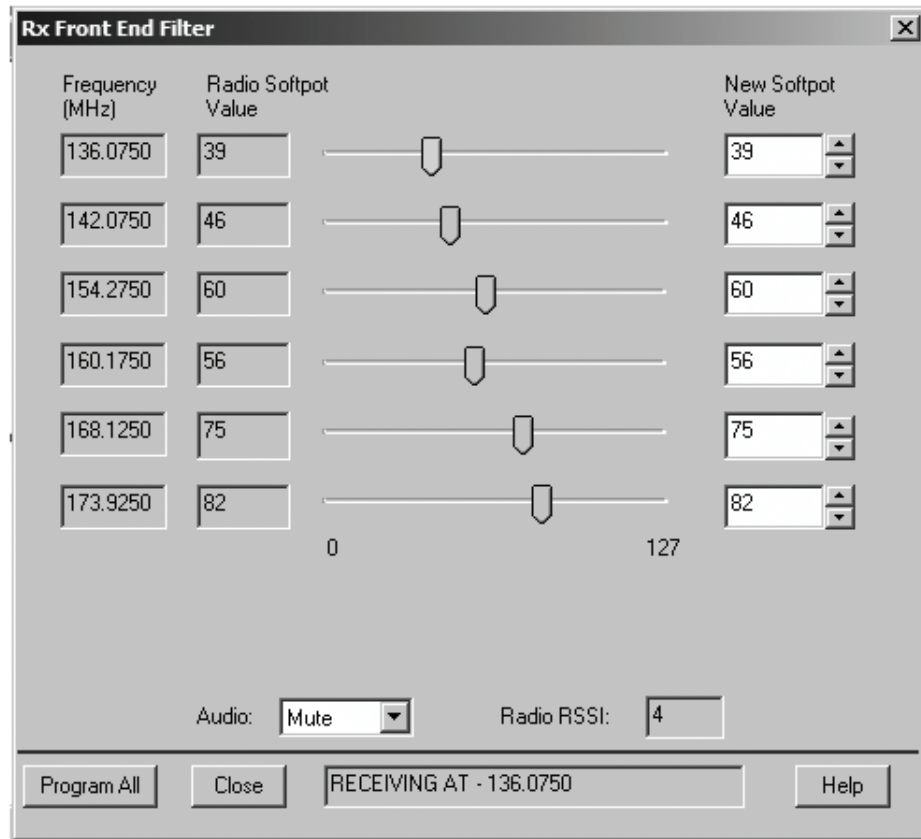


Figure 12. Front End Filter Alignment Screen

Bit Error Rate

Definition

This screen is used to test the Bit Error Rate (BER) of the radio’s receiver at a desired frequency.

Bit Error Rate Fields

This screen contains the following fields:

Rx Frequency:

This field selects the Receive Frequency directly in MHz.

Test Pattern:

This field selects the Digital test pattern — TIA. Choices are: Standard Tone Test Pattern (framed 1011) and Standard Interface Test Pattern (CCITT V.52).

Modulation Type:

This field represents the digital modulation type of the incoming signal on which BER is to be calculated.

Continuous Operation:

This field allows the user to make the BER test repeat indefinitely. A selection of Yes will cause the radio to calculate BER on a continuous basis and update the results on this screen after each integration time. A selection of No will cause the BER test to execute for only one sample of the integration time and then update the display.

Audio:

This field allows the user to select the audio output during a test. Selecting Internal will cause the radio's built-in speaker to unmute to any signals at the desired frequency which are present during the test. Selecting External will route the same signal to the radio's accessory connector audio output. Selecting Mute will disable the audio output.

Integration Time:

This field represents the amount of time over which the Bit Error Rate is to be calculated. The range is from 0.360 to 91.8 seconds in increments of 0.360 seconds.

NOTE: When Continuous Operation = Yes, all fields will be grayed out while test is in progress. They will be enabled when the STOP button is pressed.

NOTE: When Continuous Operation = No, a wait cursor will be displayed while the test is in progress and return to normal when the test is done.

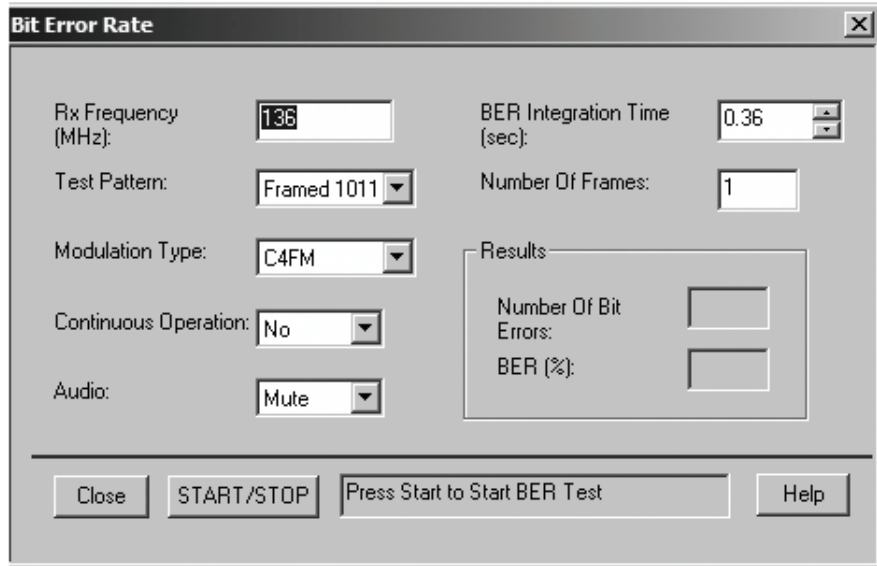


Figure 13. Bit Error Rate Screen

Transmitter Test Pattern

Definition

This screen is used to transmit specific test patterns at a desired frequency so that the user can perform tests on the radio's transmitter.

Transmitter Test Fields

This screen contains the following fields:

Tx Frequency:

This field selects the Transmit Frequency directly in MHz.

Channel Spacing:

This field allows the user to select the desired transmit deviation.

Test Pattern Type:

This field represents the type of test pattern which will be transmitted by the radio when "PTT TOGGLE" button is pressed.

NOTE: Channel Spacing and Test Pattern Type fields will be grayed out while radio is transmitting.

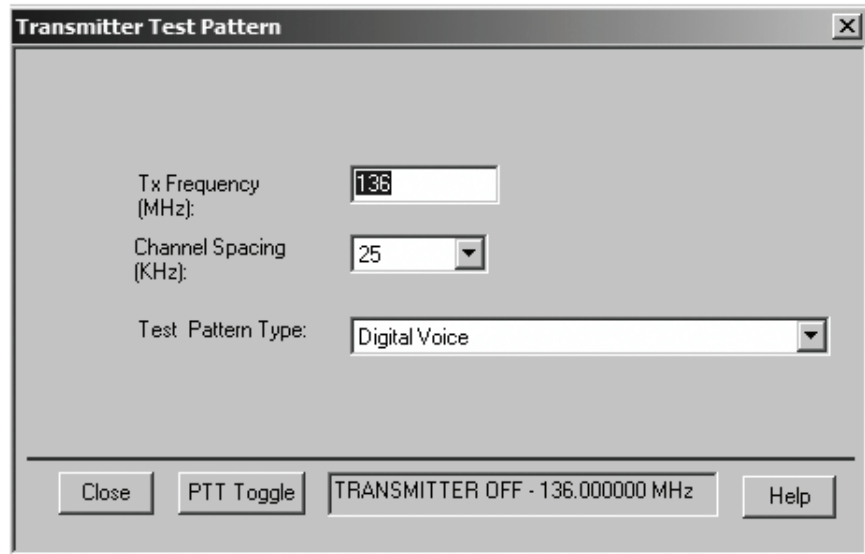


Figure 14. Transmitter Test Pattern Screen

Notes

XTS 2500/XTS 2250/XTS 1500/ MT 1500/PR 1500 Exploded Views and Parts Lists

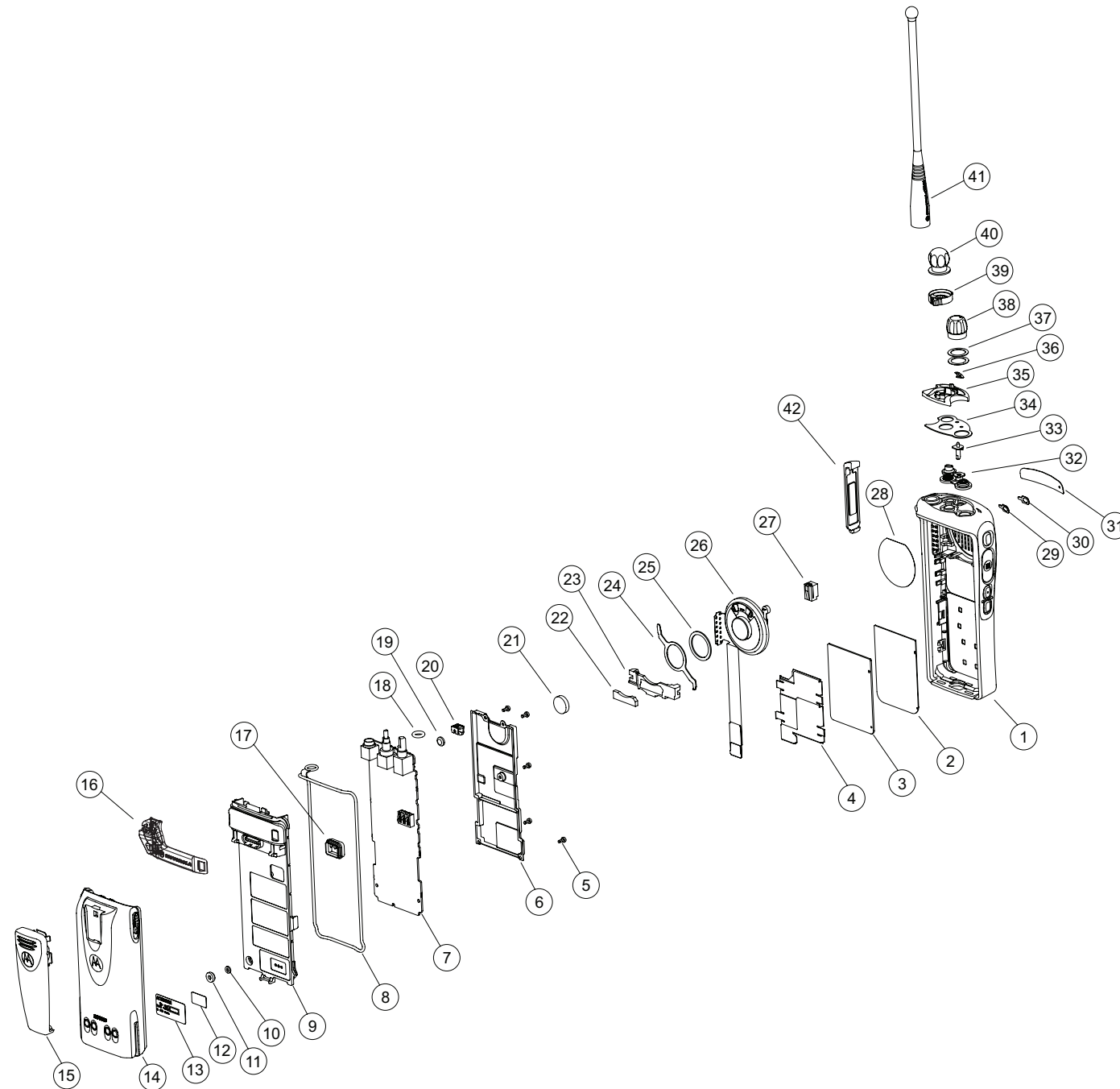


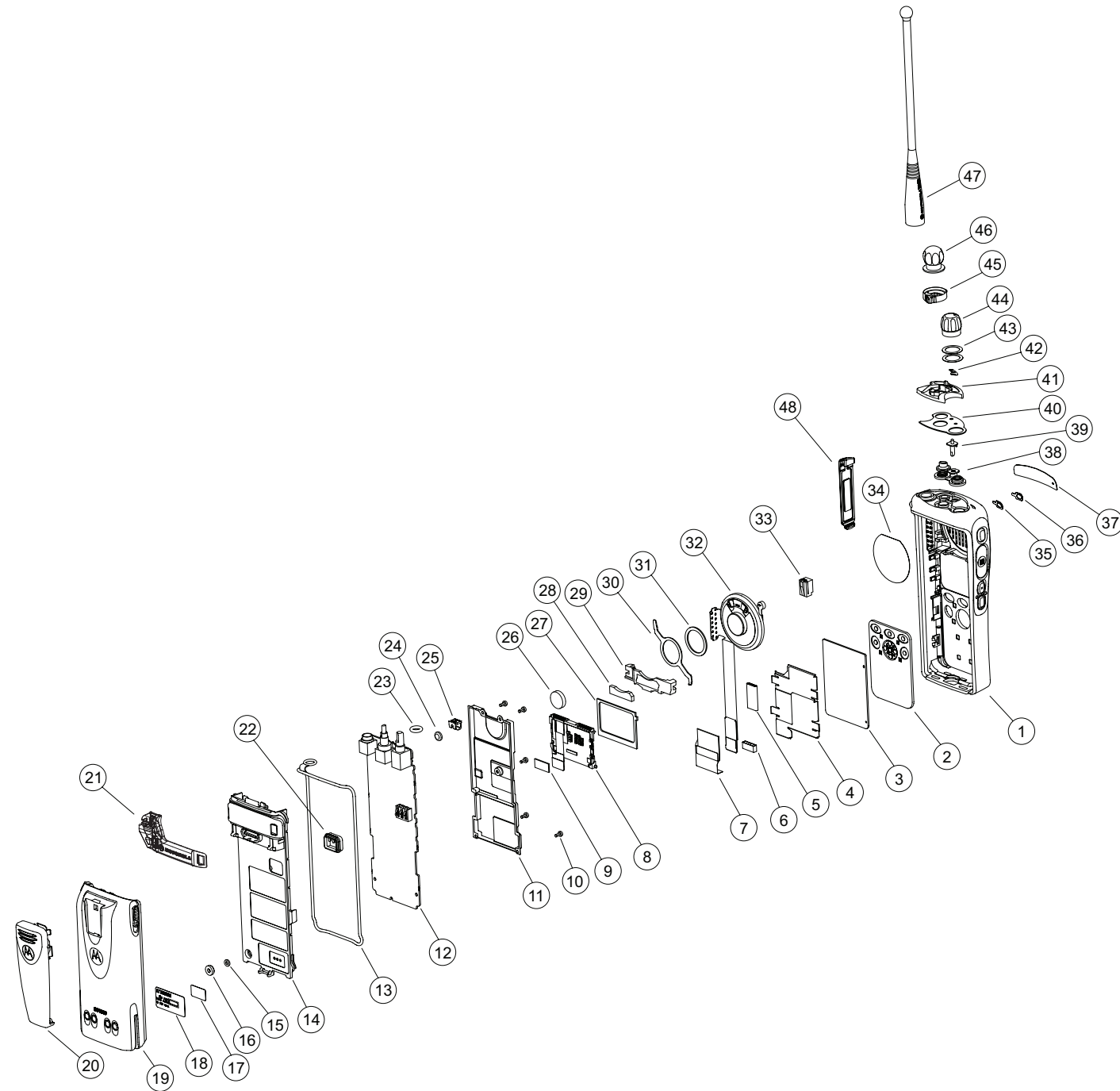
Table 13. XTS 2500 Model I / XTS 2250 Basic Model / XTS 1500 / MT 1500 / PR1500 Exploded View Parts List

Item Number	Motorola Part Number	Description
1	1578458A01	Cover, Assy, Front Model 1
2	7515058H01	Spcr, SQ61.7MML, 8MMThk
3	8416317H01	PCB, Dummy Keypad
4	4216345H01	Retainer
5	0385563D01	Screw
6	2616192H02	Shield, Main
7	Typical	Main Board
8	3216366H01	Seal, Main
9	PMLN5005_	Chassis Assembly (Immersible)
	PMLN5006_	Chassis (Standard)
10	3216463H01	Seal Base Plate
11	0286165A03	Nut, Spanner
	0216965H01	Nut, Spanner (Non-Submersible)
12	3216155H02	Seal, Port
13	3316152H01	Label, Seal
14	Typical	Battery
	NNT6263_	NiMH ultra-high-capacity, Factory Mutual Intrinsically Safe, Immersible
15	Typical	Belt Clip
16	4385665D01	Adaptor, Remote Speaker Mic
17	3280534Z03	Seal, Cust, Slcn Rub
18	3285027E01	O-Ring Freq Switch
19	6003710K08	Battery, Backup
20	4285633D01	Retaining Clip
21	7516825H01	Shield, Poron
22	7585737D01	Pad Shock
23	4385717D01	Spacer Plastic
24	4285446D01	Retainer Speaker
25	7516153H01	Pad, Speaker Retainer
26	8416579H01	Board, Circuit, Flex Speaker Mic

Item Number	Motorola Part Number	Description
27	1485218D01	Boot, Mic
28	3585339D01	Speaker Mesh
29	3216389H01	Membrane, Microphone
30	3516396H01	Mesh Microphone, Front
31	3316396H01	Nameplate, Front
32	3216348H01	Sel, Top Control
33	6116359H01	Light Pipe
34	1116352H01	Adhesive, Top Control
35	1385783C01	Escutcheon, Top
36	1385855C01	Label, ABC
37	0485667D01	Washer Teflon
38	3680529Z01	Knob, Volume
39	4585782C01	Lever Secure
40	3685779C01	Knob Frequency (w / d-clip)
41	Typical	Antenna
42	1505579Z01	Cover, Dust, Universal Connector

XTS 2500/XTS 2250/XTS 1500/MT 1500/PR 1500 Model I Exploded View

Table 14. XTS 2500 Model II Exploded View Parts List

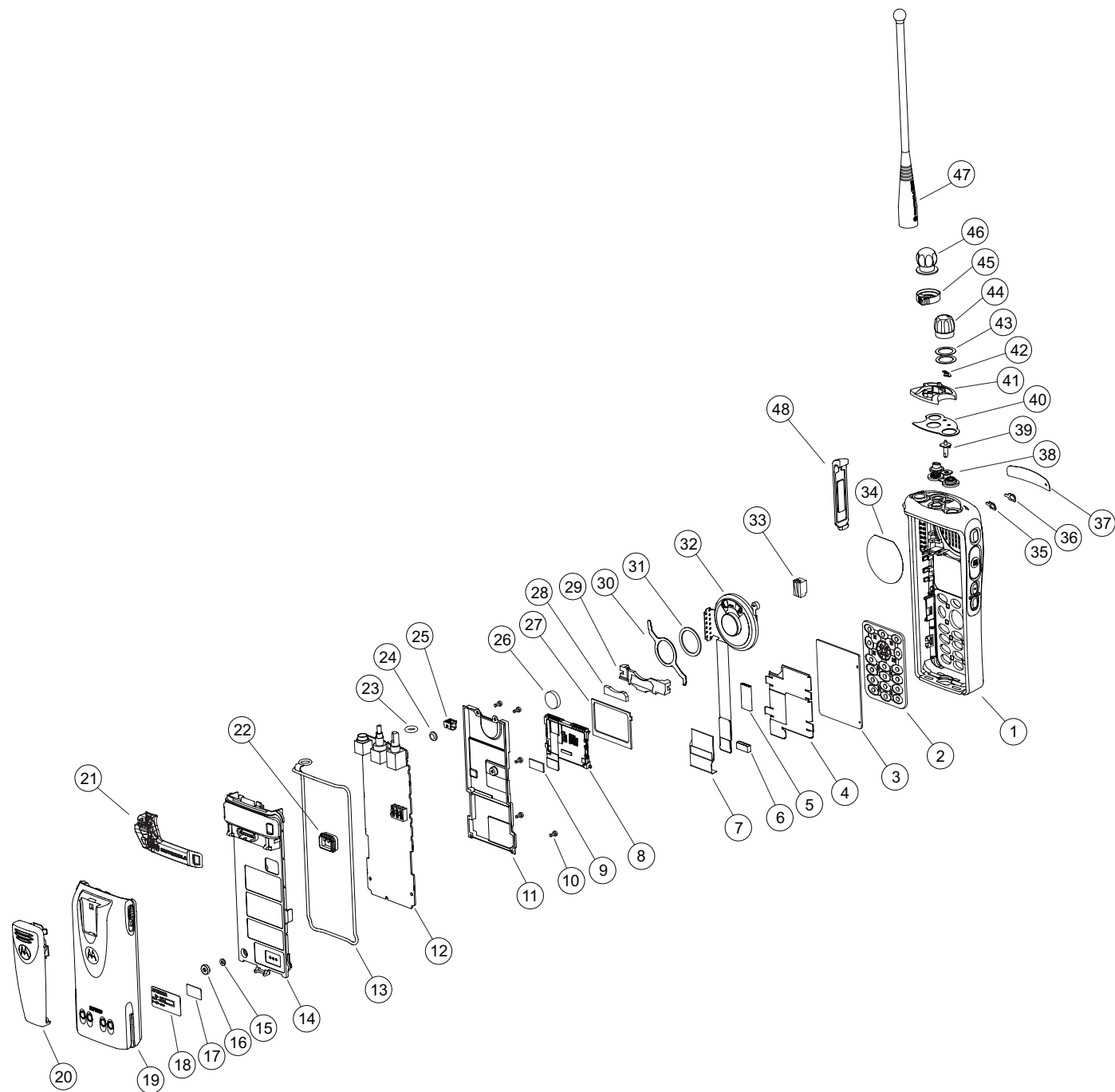


Item Number	Motorola Part Number	Description
1	1578458A03	Cover, Assy, Front Model II
2	7516330H02	Keypad, Limited
3	0104021J67	Assembly Board Model II Limited
4	4216345H01	Retainer
5	2671104L01	Gasket, EMI/FRI, Plas-Polyu
6	2616342H02	EMI Shield, Elec Cond. Gasket
7	8416620H01	Board Flex Jumper
8	7285726C04	Disp, Flat Panel, LCD MDL
9	7585011E01	Pad, LCD IC
10	0385563D01	Screw
11	2616192H02	Shield Main
12	Typical	Main Board
13	3216366H01	Seal, Main
14	PMLN5005_	Chassis Assembly (Immersible)
	PMLN5006_	Chassis (Standard)
15	3216463H01	Seal Base Plate
16	0286165A03	Nut, Spanner
	0216965H01	Nut, Spanner (Non-Submersible)
17	3216155H02	Seal, Port
18	3316152H01	Label, Seal
19	Typical	Battery
	NNT6263_	NiMH ultra-high-capacity, Factory Mutual Intrinsically Safe, Immersible
20	Typical	Belt Clip
21	4385665D01	Adaptor, Remote Speaker Mic
22	3280534Z03	Seal, Cust, Slcn Rub
23	3285027E01	O-Ring Freq Switch
24	6003710K08	Battery, Backup
25	4285633D01	Retaining Clip
26	7516825H01	Shield, Poron

Item Number	Motorola Part Number	Description
27	7585915C01	Pad Shock LCD
28	7585737D01	Pad Shock
29	4385717D01	Spacer, Plastic
30	4285446D01	Retainer Speaker
31	7516153H01	Pad, Speaker Retainer
32	8416579H01	Board, Circuit, Flex Speaker Mic
33	1485218D01	Boot, Mic
34	3585339D01	Speaker Mesh
35	3216389H01	Membrane, Microphone
36	3516396H01	Mesh Microphone, Front
37	3316396H01	Nameplate, Front
38	3216348H01	Sel, Top Control
39	6116359H01	Light Pipe
40	1116352H01	Adhesive, Top Control
41	1385783C01	Escutcheon, Top
42	1385855C01	Label, ABC
43	0485667D01	Washer Teflon
44	3680529Z01	Knob, Volume
45	4585782C01	Lever Secure
46	3685779C01	Knob Frequency (w / d-clip)
47	Typical	Antenna
48	1505579Z01	Cover, Dust, Universal Connector

XTS 2500 Model II Exploded View

Table 15. XTS 2500 Model III / XTS 2250 Advanced Model Exploded View Parts List

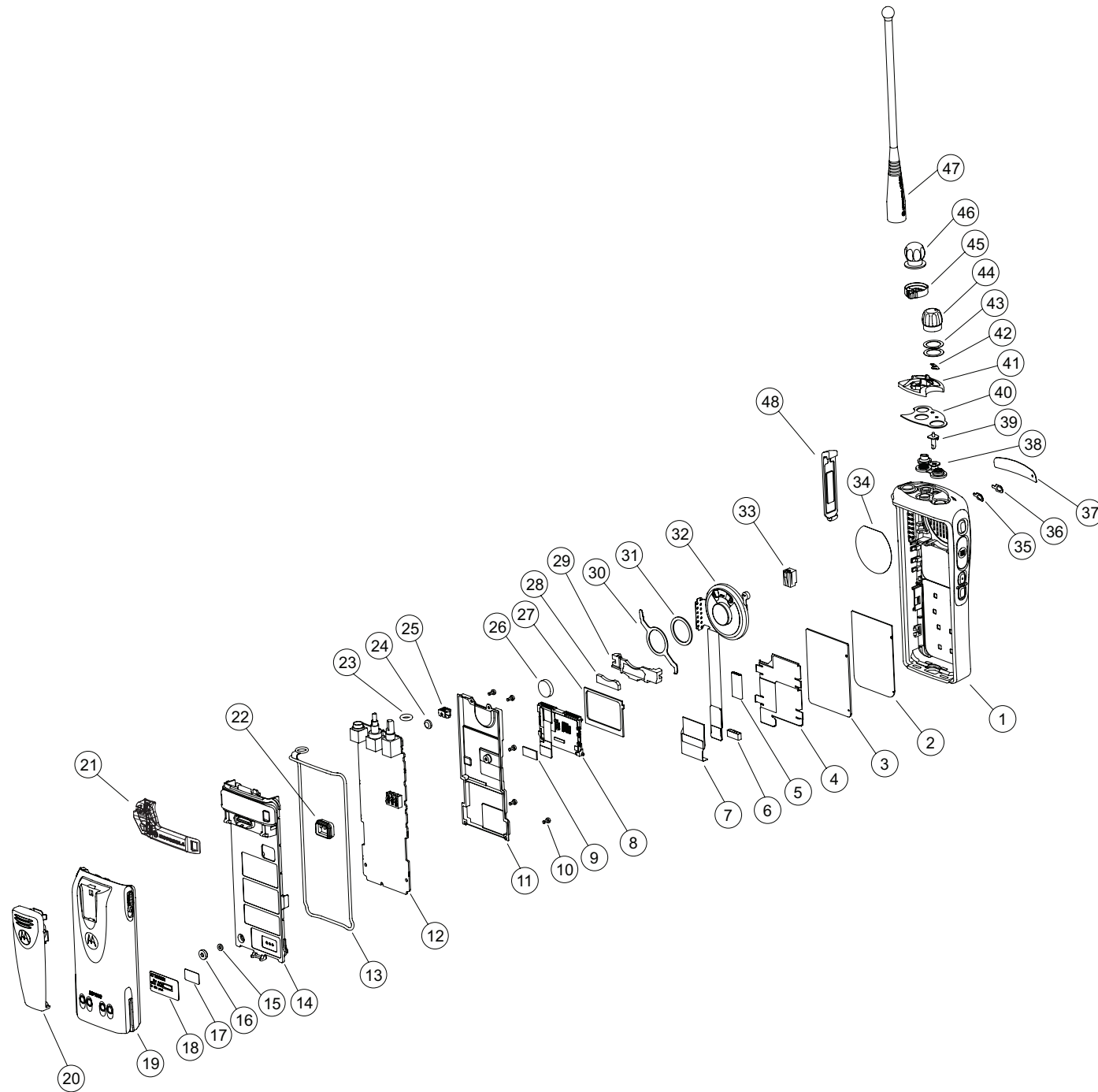


Item Number	Motorola Part Number	Description
1	1578458A04	Cover, Assy, Front Model III
2	7516330H01	Keypad, Full
3	0104021J68	Assem Board Model III Full Keypad
4	4216345H01	Retainer
5	2671104L01	Gasket, EMI/FRI, Plas-Polyu
6	2616342H02	EMI Shield, Elec Cond. Gasket
7	8416620H01	Board Flex Jumper
8	7285726C04	Disp, Flat Panel, LCD MDL
9	7585011E01	Pad, LCD IC
10	0385563D01	Screw
11	2616192H02	Shield Main
12	Typical	Main Board
13	3216366H01	Seal, Main
14	PMLN5005_	Chassis Assembly (Immersible)
	PMLN5006_	Chassis (Standard)
15	3216463H01	Seal Base Plate
16	0286165A03	Nut, Spanner
	0216965H01	Nut, Spanner (Non-Submersible)
17	3216155H02	Seal, Port
18	3316152H01	Label, Seal
19	Typical	Battery
	NNT6263_	NiMH ultra-high-capacity, Factory Mutual Intrinsicly Safe, Immersible
20	Typical	Belt Clip
21	4385665D01	Adaptor, Remote Speaker Mic
22	3280534Z03	Seal, Cust, Slcn Rub
23	3285027E01	O-Ring Freq Switch
24	6003710K08	Battery, Backup
25	4285633D01	Retaining Clip
26	7516825H01	Shield, Poron

Item Number	Motorola Part Number	Description
27	7585915C01	Pad Shock LCD
28	7585737D01	Pad Shock
29	4385717D01	Spacer, Plastic
30	4285446D01	Retainer Speaker
31	7516153H01	Pad, Speaker Retainer
32	8416579H01	Board, Circuit, Flex Speaker Mic
33	1485218D01	Boot, Mic
34	3585339D01	Speaker Mesh
35	3216389H01	Membrane, Microphone
36	3516396H01	Mesh Microphone, Front
37	3316396H01	Nameplate, Front
38	3216348H01	Sel, Top Control
39	6116359H01	Light Pipe
40	1116352H01	Adhesive, Top Control
41	1385783C01	Escutcheon, Top
42	1385855C01	Label, ABC
43	0485667D01	Washer Teflon
44	3680529Z01	Knob, Volume
45	4585782C01	Lever Secure
46	3685779C01	Knob Frequency (w / d-clip)
47	Typical	Antenna
48	1505579Z01	Cover, Dust, Universal Connector

XTS 2500 Model III / XTS 2250 Advanced Model Exploded View

Table 16. XTS 2500 / XTS 2250 Model 1.5 Exploded View Parts List



Item Number	Motorola Part Number	Description
1	1578458A02	Cover, Assy, Front Model 1.5
2	7515058H01	Spr, SQ61.7MML, 8MMThk
3	0104021J66	Assembly PWA, Keypad
4	4216345H01	Retainer
5	2671104L01	Gasket, EMI/FRI, Plas-Polyu
6	2616342H02	EMI Shield, Elec Cond. Gasket
7	8416620H01	Board Flex Jumper
8	7285726C04	Disp, Flat Panel, LCD MDL
9	7585011E01	Pad, LCD IC
10	0385563D01	Screw
11	2616192H02	Shield Main
12	Typical	Main Board
13	3216366H01	Seal, Main
14	PMLN5005_	Chassis Assembly (Immersible)
	PMLN5006_	Chassis (Standard)
15	3216463H01	Seal Base Plate
16	0286165A03	Nut, Spanner
	0216965H01	Nut, Spanner (Non-Submersible)
17	3216155H02	Seal, Port
18	3316152H01	Label, Seal
19	Typical	Battery
	NNT6263_	NiMH ultra-high-capacity, Factory Mutual Intrinsically Safe, Immersible
20	Typical	Belt Clip
21	4385665D01	Adaptor, Remote Speaker Mic
22	3280534Z03	Seal, Cust, Slcn Rub
23	3285027E01	O-Ring Freq Switch
24	6003710K08	Battery, Backup
25	4285633D01	Retaining Clip
26	7516825H01	Shield, Poron
27	7585915C01	Pad Shock LCD

Item Number	Motorola Part Number	Description
28	7585737D01	Pad Shock
29	4385717D01	Spacer, Plastic
30	4285446D01	Retainer Speaker
31	7516153H01	Pad, Speaker Retainer
32	8416579H01	Board, Circuit, Flex Speaker Mic
33	1485218D01	Boot, Mic
34	3585339D01	Speaker Mesh
35	3216389H01	Membrane, Microphone
36	3516396H01	Mesh Microphone, Front
37	3316396H01	Nameplate, Front
38	3216348H01	Sel, Top Control
39	6116359H01	Light Pipe
40	1116352H01	Adhesive, Top Control
41	1385783C01	Escutcheon, Top
42	1385855C01	Label, ABC
43	0485667D01	Washer Teflon
44	3680529Z01	Knob, Volume
45	4585782C01	Lever Secure
46	3685779C01	Knob Frequency (w / d-clip)
47	Typical	Antenna
48	1505579Z01	Cover, Dust, Universal Connector

XTS 2500 / XTS 2250 Model 1.5 Exploded View

Disassembly/Assembly

8

Introduction to This Section

This section contains basic procedures for removing and installing the following components of the XTS 2500 radio:

- Antenna
- Battery
- Belt Clip
- Universal Connector Cover
- Remote Speaker Microphone Adapter
- Radio Disassembly—Detailed
- Radio Reassembly—Detailed

Antenna

Attach the Antenna

With the radio off, turn the antenna clockwise to attach it.

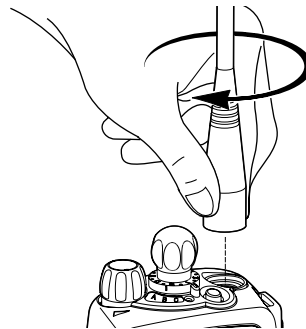


Figure 15. Attaching the Antenna

Remove the Antenna

With the radio off, turn the antenna counter-clockwise to remove it.

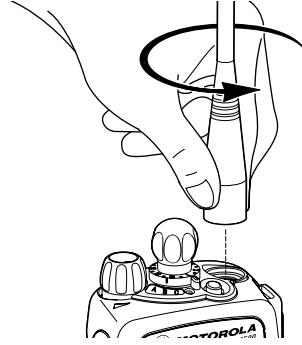


Figure 16. Removing the Antenna

Battery

Attach the Battery

1. With the radio off, fit the three extensions at the bottom of the battery into the bottom slots on the radio.

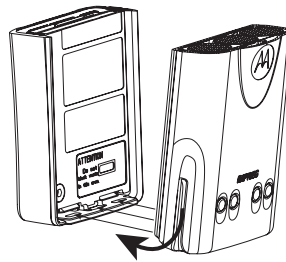


Figure 17. Attaching the Battery

2. Press the top of the battery against the radio until both latches click into place.

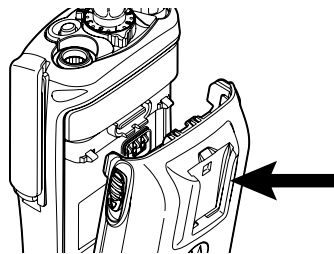


Figure 18. Attaching the Battery

Remove the Battery

1. With the radio off, slide down the latches on the sides of the battery.

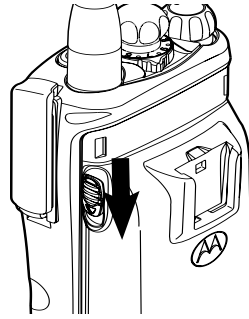


Figure 19. Removing the Battery

2. Pull the top of the battery away from the radio.

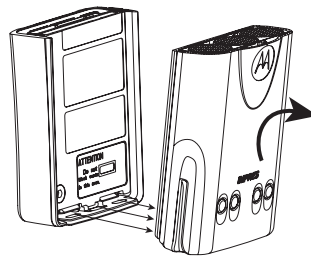


Figure 20. Removing the Battery

Belt Clip

Attach the Belt Clip

1. Align the grooves of the belt clip with those of the battery.

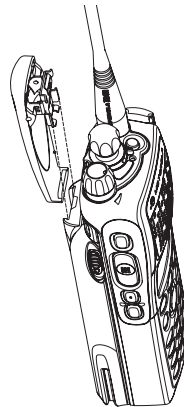


Figure 21. Attaching the Belt Clip

2. Press the belt clip downward until you clear a “click.”

Remove the Belt Clip

1. Use a flat-bladed object to press the belt clip tab away from the battery.

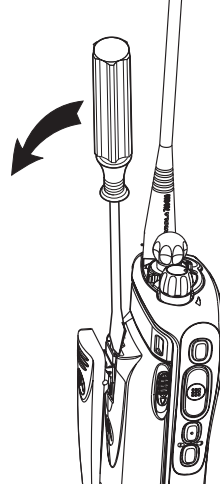


Figure 22. Removing the Belt Clip

2. Slide the belt clip upward to remove it.

Universal Connector Cover

The universal connector cover is located on the antenna side of the radio. It is used to cover the connector when not in use.

NOTE: To prevent damage to the connector, shield it with the connector cover when not in use.

Remove the Universal Connector Cover

1. Insert a flat-blade screwdriver into the area between the bottom of the cover and the slot below the connector.

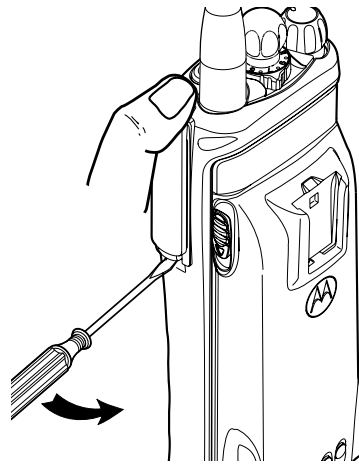


Figure 23. Removing the Universal Connector Cover

2. Hold the top of the cover with your thumb while you pry the bottom of the cover away from the radio with the screwdriver.

Attach the Universal Connector Cover

1. Insert the, hooked end of the cover into the top of the connector.

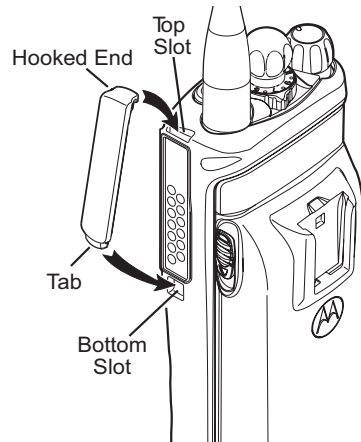


Figure 24. Attaching the Universal Connector Cover

2. Press downward on the top of the cover to seat it into the slot.
3. Press the lower tab of the cover below the connector until it snaps in place.

Remote Speaker Microphone Adapter

The Remote Speaker Microphone (RSM) adapter is located on the back of the radio, just above the battery. **It must be used to connect the RSM to the radio. If the RSM is not used, the adapter must be removed.**

Remove the Adapter

Lift the larger side (below the antenna port) of the adapter away from the radio using your finger.

If you cannot easily remove the adapter with your finger, use a small, flat bladed screwdriver to pry the larger end side of the adapter away from the radio.

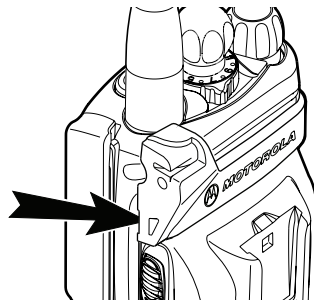


Figure 25. Removing the RSM Adapter

Attach the Adapter

1. With the Motorola side of the adapter facing out, snap the smaller end of the adapter into place in the shroud indent, below the On/Off Volume Control Knob.

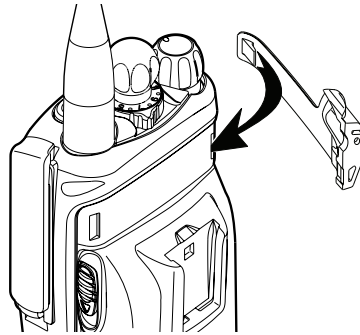


Figure 26. Attaching the RSM Adapter

2. Snap the larger end of the adapter into place in the shroud indent, below the antenna port.

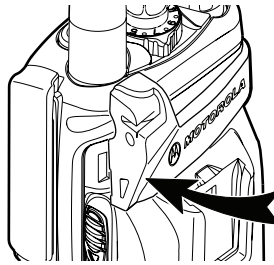


Figure 27. Attaching the RSM Adapter

Radio Disassembly— Detailed

When disassembling and reassembling the radio, pay particular attention to the snaps and tabs and how parts align with each other.

The following steps describe how to disassemble the radio. This includes the following major components:

- Front Cover
- Chassis
- Backup Battery
- Keypad
- Keypad/option board
- Display
- Speaker, microphone, universal flex connector

Required Tools

- Small, flat-bladed screwdriver
- TORX™ T7-IP screwdriver
- Chassis Opener/Knob removal tool (Motorola part number 6685666D01)

Front Cover from Chassis Disassembly

For this section, please refer to the Model III exploded view and parts list on page 39 for part numbers and more information on the location of parts in the radio.

Table 17. Front Cover from Chassis Disassembly

Exploded View Item Number	Motorola Part Number	Description
2	7516330H01	Keypad, Full
3	0104021J68	Assembly Board Model III Full Keypad
4	4216345H01	Retainer
8	7285726C04	Display, Flat Panel, LCD MDL
13	3216366H01	Seal, Main
32	8416579H01	Board Circuit Flex Speaker Mic

1. Turn off the radio.
2. Remove the battery completely from the radio (see Figure 19 and Figure 20 on page 43).
3. Remove the antenna (see Figure 16 on page 42).
4. Pull the **16-Position Select** and the **On/Off/Volume Control** knobs off their shafts using the Chassis Opener tool.

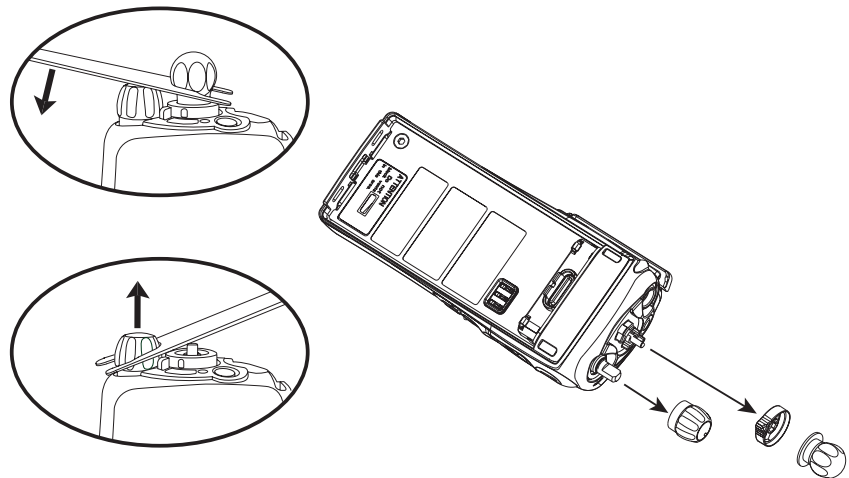


Figure 28. Knob Removal

5. After you remove the **On/Off/Volume Control** knob, remove the Teflon® washer and set it aside.
6. Separate the chassis from the front cover by inserting the chassis opener between the thin, plastic retaining wall and the metal chassis at the bottom of the radio.



WARNING

Be careful not to mar the O-ring sealing area on the housing. Marring the front cover O-ring sealing areas will prevent the radio from sealing properly.

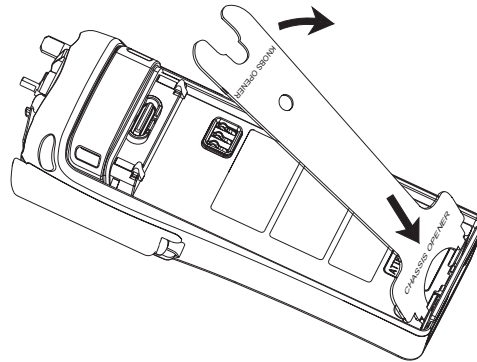


Figure 29. Chassis Removal

7. Slowly pry the bottom of the chassis away from the front cover by pushing the chassis opener tool down. Rotate the handle of the tool over and behind the base of the radio. This prying action forces the thin inner plastic wall toward the base of the radio, releasing the two chassis tabs.
8. Remove the chassis assembly by holding the chassis in one hand while **slowly**, with a firm side-to-side motion, removing the chassis.



The chassis assembly has switches that can be damaged if the chassis is removed too quickly. Be careful not to damage the switches at the top of the board.

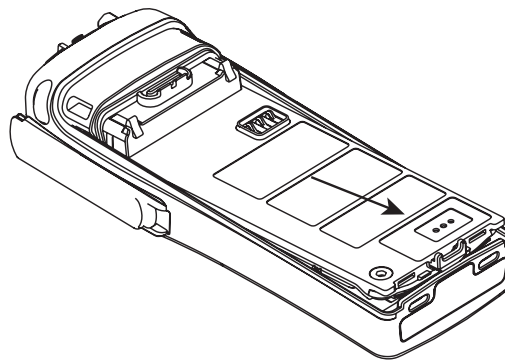


Figure 30. Chassis Separation

- Lay the chassis down. Rotate the front cover backward and slightly away from the chassis.



Flexible ribbon circuits (flexes) connecting the front cover assembly and the chassis prevent you from completely separating the two units. Display radios and radios with option boards have two flexes.

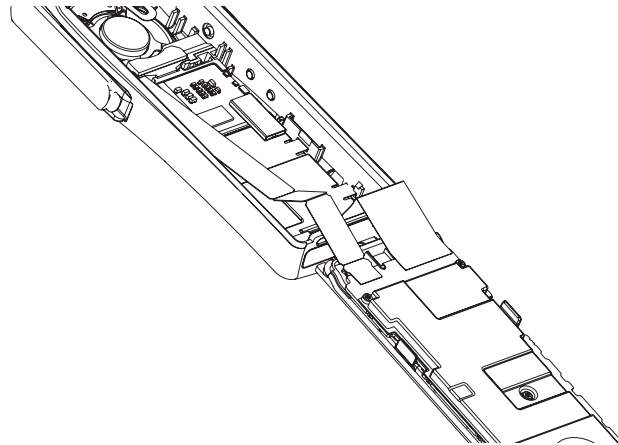


Figure 31. Unlatching the Flex Connectors

- Carefully lift the latches on the main circuit board to release the flexible circuits from their connectors.

NOTE: For proper reassembly, note how the flex circuits are folded.

- Remove the concentric lever from the front cover assembly.

Chassis Disassembly

For this section, please refer to the Model III exploded view and parts list on page 39 for part numbers and more information on the location of parts in the radio.

Table 18. Chassis Disassembly

Exploded View Item Number	Motorola Part Number	Description
1	1578458A04	Cover Assy, Front Model III
2	7516330H01	Keypad, Full
4	4216345H01	Retainer
8	7285726C04	Display, Flat Panel, LCD Module

- If disassembly of the chassis or the main board is required, then use a TORX™ screwdriver with a T7-IP head to remove the five screws holding the main board and shield to the chassis.



Refer to the Handling Precautions on page 4 before removing the main board. Be sure to use ESD protection when handling circuit boards.

2. Remove the O-ring from around the bushing at the antenna connector
3. Lift the main board from the chassis as shown in Figure 32.

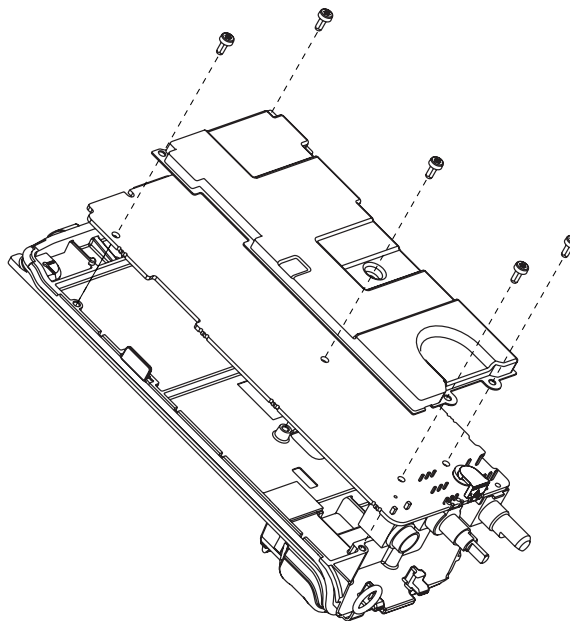


Figure 32. Removing the Main Board from the Chassis

4. Most repairs to the main board can be performed without further disassembly of the chassis. If it is necessary to replace the O-ring, remove the small O-ring retainers from their slots in the chassis. Note the alignment of the retainers for reassembly.
5. Remove the O-ring.

Backup Battery Disassembly

For this section, please refer to the Model III exploded view and parts list on page 39 for part numbers and more information on the location of parts in the radio.

Table 19. Backup Battery Disassembly

Exploded View Item Number	Motorola Part Number	Description
1	1578458A04	Cover Assy, Front Model III
29	4385717D01	Spacer Plastic
30	4271058L01	Retainer Speaker
32	8416579H01	Board Circuit Flex Speaker Mic
33	1485218D01	Boot Mic

1. The backup battery can be removed without disassembling the board or the chassis.
2. Remove the backup battery retaining clip by sliding it away from the main circuit board, as shown in Figure 33.
3. Insert a small, flat head screwdriver between the battery and the battery holder. Gently pry the battery out of the battery holder.

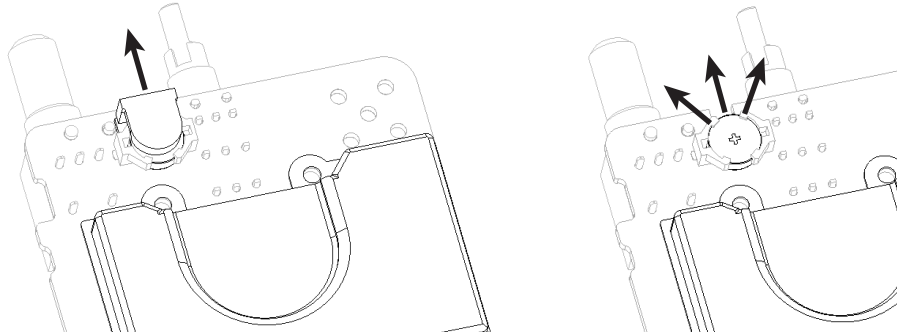


Figure 33. Remove the Backup Battery

Keypad and Keypad/Option Board Disassembly

For this section, please refer to the Model III exploded view and parts list on page 39 for part numbers and more information on the location of parts in the radio. (For the Model II keypad, please refer to the exploded view and parts list on page 38.)

Table 20. Keypad and Keypad/Option Board

Exploded View Item Number	Motorola Part Number	Description
2	7516330H01	Keypad, Full
3	0104021J68	Assem Board Model III Full Keypad
4	4216345H01	Retainer
8	7285726C04	Disp, Flat Panel, LCD Module
13	3216366H01	Seal, Main
32	8416579H01	Board, Circuit, Flex Speaker Mic

1. The keypad and keypad board can be disassembled without the disassembly of the display or speaker/microphone flex assembly.
2. If the disassembly of the keypad or the keypad printed circuit board is required, lift the microphone flex circuit up to move it out of the way.
3. Disconnect the display connector, and move the tail of flex circuit out of the way.

4. To remove the keypad retainer shield, insert the tip of a “penknife size,” flat-bladed screwdriver in the opening at the end of the keypad retainer arm tab. Pry the tab away from the side of the front cover until it moves past the ledges on the side wall. Repeat this procedure for the four remaining retainer arm tabs.



Be careful not to mar the O-ring sealing area on the housing. Marring the front cover O-ring sealing areas will prevent the radio from sealing properly.

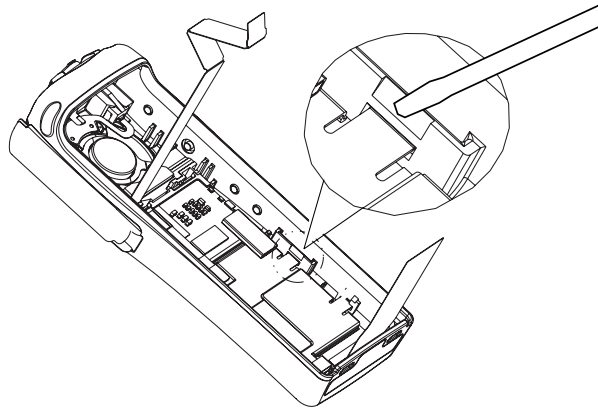


Figure 34. Retainer Removal

5. Lift the keypad retainer out of the front cover.
6. The keypad/option board and the keypad can be removed without the use of tools.

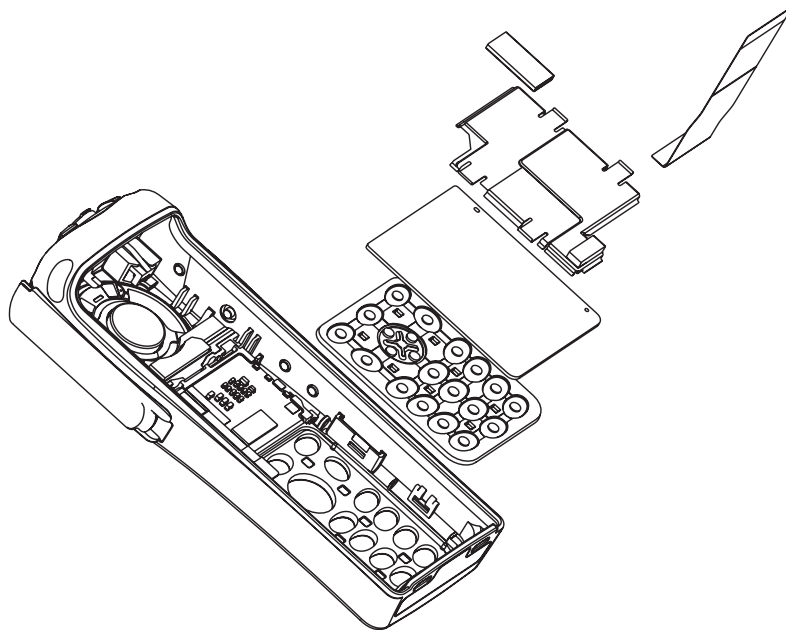


Figure 35. Keypad Retainer and Boards Removal

Display Disassembly

For this section, please refer to the Model III exploded view and parts list on page 39 for part numbers and more information on the location of parts in the radio. (For the Model II display, please refer to the exploded view and parts list on page 38. For the Model 1.5 display, please refer to the exploded view and parts list on page 40.)

Table 21. Display Disassembly

Exploded View Item Number	Motorola Part Number	Description
1	1578458A04	Cover, Assy, Front Model III
3	0104021J68	Assem Board Model III Full Keypad
4	4216345H01	Retainer
8	7285726C04	Disp, Flat Panel, LCD Module

1. The display assembly can be removed without the disassembly of the keypad board or the speaker-microphone flex assembly. If the disassembly involves the removal of the display module, disconnect the display flex from the keypad option board connector.



Caution

Take care not to damage the display. Do not cut, bend, or pinch the heat seal. Display modules contain CMOS devices. Be sure to use ESD protection.

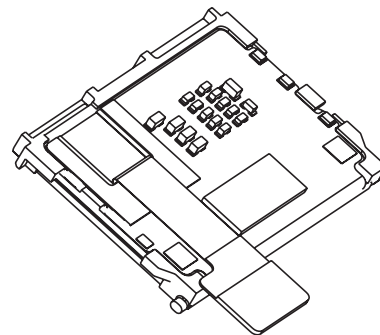


Figure 36. Display Disassembly

2. The display module snaps into the front cover assembly. Insert two flat-bladed screwdrivers between the flexible beam at the top of the display module (one on each side). Deflect the beam down until it moves past the hooks on the front cover. The display module is hooked to the front cover at the base of the display. Lift the top of the display module past the hooks and remove it from the front cover.

Speaker, Microphone, and Universal Connector Flex Disassembly

For this section, please refer to the Model III exploded view and parts list on page 39 for part numbers and more information on the location of parts in the radio.

Table 22. Speaker, Microphone, and Universal connector Flex Disassembly

Exploded View Item Number	Motorola Part Number	Description
1	1578458A04	Cover, Assy, Front Model III
29	4385717D01	Spacer, Plastic
30	4271058L01	Retainer, Speaker
32	8416579H01	Board, Circuit, Flex Speaker Mic
33	1485218D01	Boot, Microphone

1. The speaker-microphone assembly can be removed without the disassembly of the display or the keypad assemblies. If disassembly of the speaker-microphone assembly is necessary, removal of the universal connector dust cover is optional (see Figure 23 on page 44).
2. Remove the plastic spacer at the bottom of the speaker. The spacer can be removed by pulling upward with a slight, side-to-side motion until it clears the retaining ribs in the front cover. Take special care to prevent damage to the tail of the speaker flex circuit while the flex is still in place.
3. Using a screwdriver, push down on the portion of the speaker retainer bracket that is pointing toward the bottom of the radio. Then, remove the retainer by slightly pushing it toward the top of the radio until you slide it past the front cover slot.
4. Remove the microphone boot retainer by inserting a penknife-sized screwdriver in the notch between the retainer and the housing. Pry the retainer away from the housing and remove the clip.
5. Remove the microphone rubber boot by sliding it out of the pocket in the front cover. Take care not to pull on the flex cable while pulling on the microphone boot. Unless you are replacing the microphone, leave it in the boot. At this point, the speaker and microphone are disconnected, but the assembly is still attached to the universal connector by 13 pins in the printed circuit backer board.
6. To remove the speaker-microphone flex circuit from the universal connector, carefully grasp the flex circuit at a point directly across from the universal connector pins. Applying firm pressure, gradually pull the flex away from the pins.

NOTE: There are notches on the ends of the 13-pin printed circuit backer board. If necessary, you can insert a small screwdriver in one of the notches to pry the backer board away from the front cover.

After the universal connector portion of the speaker-microphone flex circuit is detached, the assembly can be completely removed. If it is necessary to replace

the speaker or the microphone, or both, do it while the flex circuit is removed from the front cover.

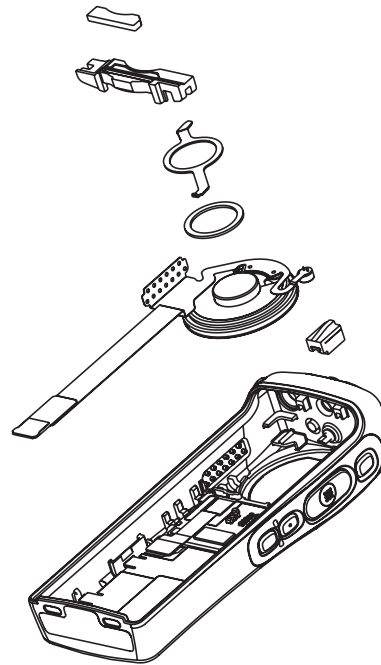


Figure 37. Speaker-Microphone Removal

Radio Reassembly— Detailed

The following steps describe how to reassemble the radio. This includes the following major components:

- Keypad/option board
- Display
- Speaker, microphone, universal connector flex
- Chassis
- Backup Battery
- Chassis and front cover

Keypad and Keypad Option Board Reassembly

1. Insert the keypad into the front cover. Align the keypad to the pins in the front cover.
2. Replace the board on the locator pins.
3. Replace the keypad retainer legs on the PTT side first. Then, press the retainer down and snap the other two legs into place on the universal connector side; make sure that all four legs snap into place. If necessary, use a small, flat-bladed screwdriver to put pressure on the corner bend of each retainer leg.

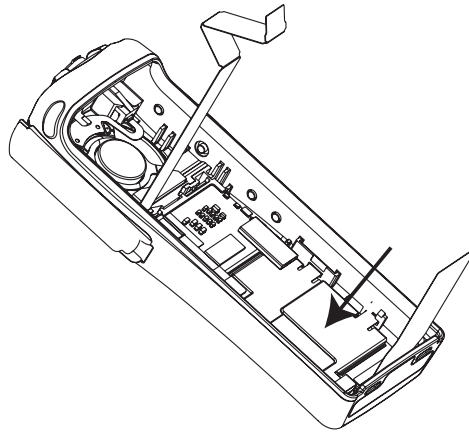


Figure 38. Lock Retainer Catches to Radio Body

Display Reassembly

1. Slide the two bottom tabs of the display module, with the LCD facing the front housing lens, into the grooves located above the keypad assembly area in the front cover housing. Gently press on the upper portion of the display until it snaps into place past the two small hooks in the housing.
2. Connect the display flex to the keypad option board connector.

Speaker, Microphone, and Universal Connector Flex Reassembly

1. Insert the microphone boot into the pocket in the front cover housing.
2. Insert the microphone boot plastic retainer. Make sure the retainer is securely hooked to the front cover.
3. Center the speaker in the speaker recess. Make certain the speaker is correctly nested inside the front cover.
4. Before you replace the speaker retainer, be sure the retainer is placed between the speaker-microphone flex circuit and the speaker. Insert the flat end of the speaker retainer into the opening in the front cover. Press the other end of the retainer against the speaker. Hold the retainer in place with your thumb while pushing down on the retainer with a flat-bladed screwdriver. Use the screwdriver to push down on the portion of the speaker retainer that is pointing toward the bottom of the radio. Move the retainer by pushing it toward the bottom of the radio. Slide it into the front cover slot above the display.
5. Connect the universal flex to the pins and press into place.

IMPORTANT NOTE: Always replace the two conductive pads (P/N: 2671104L01 and 2616342H02 - EMI shield, electrically conductive gasket) after rework.

Chassis Assembly Reassembly

Before you assemble the main board to the chassis, make sure that the following steps are done to the chassis.

1. Replace the O-ring. The tabs on the O-ring should reach into the chassis and point down.
2. Stretch the O-ring to place it into the retaining pocket at the bottom end of the chassis.

NOTE: When properly assembled, the retainers on the O-ring should align with the slots on the chassis. If this is not the case, remove and replace the O-ring until it is aligned with the chassis and completely seated in place around the perimeter.

3. Replace the battery contact seal (if necessary) surrounding the battery contact.

NOTE: Be sure the battery contact seal protrudes through the chassis and is not pinched under the chassis.

4. Make sure the thermal pad is placed on top of the RF Power Amplifier on the main board.
5. Use the notch in the bottom of the main board and the protrusion at the bottom of the casting to align the board to the casting. Place the board against the casting. Make sure that the five screw holes are aligned.
6. Place the main shield assembly on the main board. Again, make sure that the five screw holes are aligned.
7. Use the TORX T7-IP screwdriver to fasten the screws holding the main board and shield to the chassis. Do not over torque. Torque limit is 4 inch-lbs.
8. Place the O-ring at the antenna connector over the antenna connector bushing.

Backup Battery Reassembly

1. Insert the backup battery (positive side up) into the battery holder, as shown in Figure 39.
2. Replace the retaining clip by sliding it into its recess on the board.

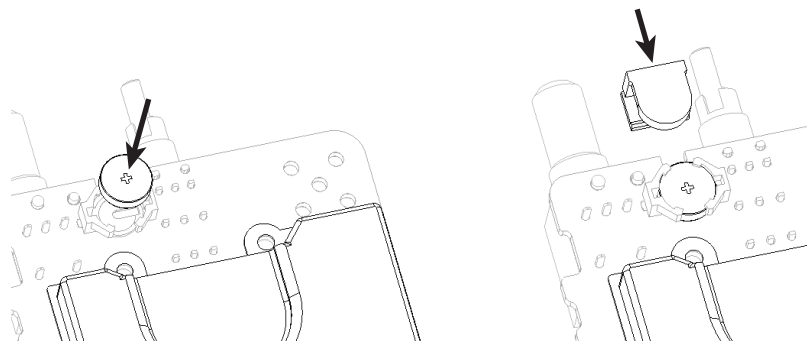


Figure 39. Reassemble the Backup Battery

Chassis and Front Cover Reassembly

1. Align the chassis assembly end-to-end with the front cover assembly.
2. Insert the tails of the flex circuits into their respective connectors at the bottom of the chassis assembly.

3. Push down the latches on the connectors to hold the flex circuits to the main board.

NOTE: Be sure the concentric lever is not in place on the frequency knob shaft when reassembling the chassis with the front cover assembly.

4. Align the volume knob shaft and the frequency switch shaft with their respective holes in the front cover. Slowly reassemble the chassis and front cover assemblies. Slowly slide the volume knob and frequency switch shafts into their respective holes in the front cover.

NOTE: Make sure the flex circuits are correctly folded in place. Take special care to prevent pinching or excess binding of these flexes.

5. Push the chassis assembly completely into the top of the front cover until it settles in place.

NOTE: Be sure the O-ring is properly seated.

6. Press down at the bottom of the chassis until the chassis snaps into place in the front cover.

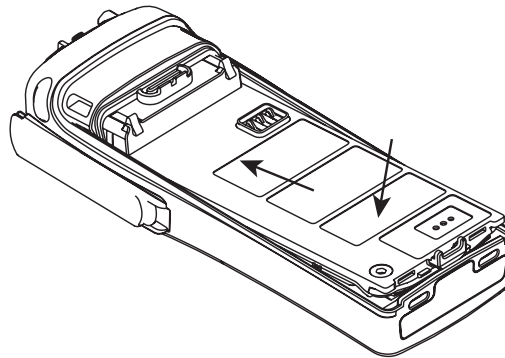


Figure 40. Fastening the Chassis

7. Reassemble the concentric lever to the frequency knob shaft by aligning the protrusions in the lever with the openings in the shaft. The triangular-shaped side of the lever should point toward the back of the radio.
8. Reassemble the Teflon washer to the volume knob shaft. Reassemble the knobs, dust cover, antenna, and battery.

Ensuring Radio Immersibility

This section discusses radio immersibility concerns, tests, and disassembly and reassembly of ASTRO XTS 2500I radios.

Standards

ASTRO XTS2500I radio models meet the stringent requirements of U.S. MIL-STD-810C, Method 512.1, Procedure I, MIL-STD-810D, Method 512.2, Procedure I, MIL-STD-512.3, Procedure I, and MIL-STD-512.4, Procedure I, which require the radio to maintain watertight integrity when immersed in three feet of water for two hours.

Servicing

XTS 2500I radios shipped from the Motorola factory have passed vacuum testing and should be capable of restoring the watertight integrity of the radio.



It is strongly recommended that the maintenance of the radio be deferred to qualified service personnel and service shops. This is of paramount importance as irreparable damage to the radio can result from service by unauthorized persons. If disassembly is necessary, unauthorized attempts to repair the radio may void any existing warranties or extended performance agreements with Motorola. It is also recommended that immersibility be checked annually by qualified service personnel.

Accidental Immersion

If the radio is accidentally dropped in water, shake the radio to remove the excess water from the speaker grille and microphone port area before operating; otherwise, the sound may be distorted until the water has evaporated, or is dislodged from these areas.

Specialized Test Equipment

This section summarizes the specialized test equipment necessary for testing the integrity of ASTRO XTS 2500I radios.

To ensure that the radio is truly a watertight unit, special testing, test procedures, and specialized test equipment are required. The special testing involves a vacuum check of the radio and pressure testing (troubleshooting) for water leaks if the vacuum check fails. The specialized test equipment is needed to perform the vacuum check and pressure testing, if required.

Vacuum Pump Kit NLN9839

The vacuum pump kit includes a vacuum pump with gauge, and a vacuum hose. An adapter with gasket (NTN9279_), which must be ordered separately, connects the vacuum hose to the radio's casting. The vacuum pump kit is also used on Motorola ASTRO XTS 5000 R radio models. The adapter with gasket is the same as that for the ASTRO XTS 5000 R radio models.

Pressure Pump Kit NTN4265

The pressure pump kit includes a pressure pump with gauge, and a pressure hose; the pressure pump kit is also used on Motorola ASTRO XTS 5000 R radio models. As with the vacuum pump kit above, the NTN9279_ adaptor connects the pressure hose to the radio's casting.

Miscellaneous Hardware

Other items needed for testing the immersibility radio include:

- Large water container
- Deionized (DI) water
- A supply of replacement seals Main seal O-rings, Battery Seal, and Base Plate Seal (refer to the ASTRO XTS 2500I exploded view parts list).

Disassembly

Disassemble the radio according to Section "Radio Disassembly—Detailed" on page 46.

Reassembly



Do not reassemble the radio without first performing the following preliminary inspection procedure.

To reassemble the radio:

1. Remove the main seal O-ring from the casting.
2. Inspect the seal area around the casting for foreign material that might prevent the main seal O-ring from sealing properly.
3. Install a new main seal O-ring, discard the old O-ring.
4. Remove the Battery Seal from the Battery Connector on Main Board.
5. Inspect the Battery Connector on Main Board and surrounding areas for foreign material that might prevent the Battery Seal from sealing properly.
6. Install a new Battery Seal; discard the old Seal.
7. Reassemble the housing.



The main seal O-ring should not be visible when looking at the back side of the radio. If the seal is visible, it is improperly installed.

Continue reassembling the radio according to Section “Radio Reassembly—Detailed” on page 55. Tighten all hardware that was loosened or removed.

Vacuum Test

The vacuum test uses a vacuum pump and gauge. The pump creates a vacuum condition inside the radio, and the gauge monitors the radio for a stable vacuum reading; that is, checking for a properly sealed, watertight unit. Before starting the vacuum test:

- Remove the battery
- Remove the universal connector cover to expose the universal connector.

To conduct the vacuum test:

1. Attach the vacuum hose to the vacuum pump. Check the pump and hose for leaks by blocking off the open end of the hose and operating the pump a few times. The actual reading of the gauge at this point is not important; it is important that the gauge pointer remained steady, indicating no vacuum leaks in the pump.
2. Unscrew the nut on the chassis for leak test. Remove the Base Plate Seal using needle-nose tweezers; discard the old Base Plate Seal.
3. Ensure that a rubber gasket is attached to the hose-to-casting adapter. Screw the adapter into the tapped hole in the casting.
4. Attach the open end of the hose to the adapter.

5. Place the radio on a flat surface with the casting facing upward. Place two or three drops of water on each slot of the Label Seal that protects the Seal Port on the casting. This will ensure that no air goes through the seal.
6. Operate the pump a few times until the gauge indicates 5 in. Hg; do not pull more than 7 in. Hg of vacuum on the radio.
7. Operate the pump again until the gauge indicates 6 in. Hg.
8. Observe the gauge for approximately 1 minute.
 - If the needle falls 1 in. Hg or less (for example, from 6 in. Hg to 5 in. Hg), then the radio has passed the vacuum test and is approved for immersibility. No additional testing will be required.
 - If the needle falls more than 1 in. Hg (for example, from 6 in. Hg to less than 5 in. Hg), then the radio has failed the vacuum test and the radio might leak if immersed. Additional troubleshooting of the radio will be required; complete this procedure, then go to the "Pressure Test" section of this manual.
9. Dry the water from the slots on the Label Seal that protects the Seal Port to allow the radio to equalize. The pressure should drop slowly to "0".
10. Remove the vacuum hose and adapter from the radio.
11. Install a new Base Plate Seal by using a pair of needle-nosed tweezers, and then screw the Hex Nut. Ensuring that the Hex Nut sits flat all around the edges and it is flushed with (or below) the casting.

Pressure Test

Pressure testing the radio is necessary only if the radio has failed the vacuum test. Do not perform the pressure test until the vacuum test has been completed. Pressure testing involves creating a positive pressure condition inside the radio, immersing the radio in water, and observing the radio for a stream of bubbles (leak). Since all areas of the radio are being checked, observe the entire unit carefully for the possibility of multiple leaks before completing this test.

To conduct the pressure test:

1. Unscrew the nut on the chassis for leak test. Remove the Base Plate Seal using needle-nose tweezers; discard the old Base Plate Seal.
2. Screw the adapter (with gasket) into the tapped hole in the casting.
3. Attach one end of the pressure hose to the adapter and the other end to pressure pump.
4. Operate the pump until the gauge reads approximately 1 psig.



Caution

Pressure any greater than 1 psig might push air around the main seal.

5. Maintain the pressure at 1 psig and immerse the radio into a water-filled container.
6. Watch for any continuous series of bubbles. A stream of bubbles indicates a sign of leakage.

NOTE:

- Some air entrapment may cause the accumulation of bubbles, especially in the grille area, but the bubbles should not be continuous.

NOTE: • Bubbles from the Seal Port are normal, but the bubbles from the edge of the Label Seal, are considered leakage.

7. Note all of the seal areas that show signs of leakage. Pinpoint the problem(s) to one (or more) of the following areas:
 - Front Housing
 - Chassis (Seal Port and Label Seal)
 - Frequency switch and Antenna nut
 - Main Seal O-ring
 - Battery Seal
8. Remove the radio from the water container, and dry the radio thoroughly. Be especially careful to dry the area around the main seal to prevent contamination of the internal electronics while the unit is open.



Caution

Keep the area around the Seal Port dry by ensuring that there is no water around the casting's vacuum port.

9. Remove the adapter from the chassis.
10. Radio after performing Pressure Test must undergo baking process in a temperature chamber for constant temperature soaking at 60°C for 1 hour. This is to ensure no moisture is trapped inside the radio and prevent contamination of the internal electronics after reassembling the radio.
11. Install a new Base Plate Seal by using a pair of needle-nosed tweezers, and then screw the Hex Nut. Ensure that the Hex Nut sits flat all around the edges and it is flushed with (or below) the casting.
12. Inspect the Seal Port to ensure that the seal behind the Label Seal's three slots has not been punctured. If it has been punctured, the seal and the label must be replaced.

Troubleshooting Leak Areas

Before repairing any leak, first read all of the steps within the applicable section. This will help to eliminate unnecessary disassembly and reassembly of a radio with multiple leaks. Troubleshoot only the faulty seal areas listed in Section "Pressure Test", and when multiple leaks exist, in the order listed.

NOTE: Before reassembling the radio, always install a new main seal O-ring, Battery Seal in the defective area.

Front Housing

Do one or both of the following:

1. If a leak occurs at the Lens, Universal Connector, Casting/Housing interface, PTT button area of the housing, replace the housing. Refer to Section "Radio Disassembly—Detailed" on page 46.
 - a. Remove the housing assembly from the radio.
 - b. Discard the housing assembly and main seal O-ring.
 - c. Install a new main seal O-ring around the casting assembly.
 - d. Install a new housing assembly to the radio.

- e. Inspect the main seal for proper seating.
 - f. Observe carefully to ensure that the main seal O-ring is not pinched between the housing and the casting interface.
2. If the leak occurs at the control top area, remove the knobs and antenna in order to determine the leak location:
 - a. Conduct the Pressure Test.
 - b. Identify the leak location.

Chassis (Seal Port and Label Seal)

To replace the Seal Port and Label Seal:

1. Remove the Label Seal that covers the Seal Port from the chassis.
2. Remove the Seal Port.
3. Ensure that the casting's surface (at the Label Seal & Seal Port recessed) is clean, no/minimum scratches and free from any adhesive or other foreign materials.
4. Install a new Seal Port, covering the three vent port holes, in the small recessed area in the casting. Ensure that no oily substance come in contact with the seal.
5. Install a new Label Seal over the Seal Port in the larger recessed area in the casting. Press down evenly over the label's surface to ensure good adhesion.

Frequency Switch and Antenna Nut

To replace the frequency switch and antenna nut:

1. Refer to Section "Front Cover from Chassis Disassembly" on page 47, remove the chassis assembly from the radio.
2. Refer to Section "Chassis Disassembly" on page 49, remove the Main Board from chassis.
3. Unsolder the defect Frequency switch and/or Antenna nut, and solder with new Frequency switch and/or Antenna nut.
4. Inspect if the replacement part(s) sits properly on the Main Board, and no tilt is allowed. This is to prevent leakage due to improper placement of Frequency switch and Antenna nut.
5. Install a new main seal O-ring and Battery Seal (22) on the casting assembly.
6. Reassemble the chassis assembly to the radio.
7. Inspect the main seal O-ring for proper seating. Observe carefully to ensure that the main seal O-ring is not pinched between the housing and the casting.

Main Seal O-ring

To replace the main seal O-ring

1. Refer to Section "Front Cover from Chassis Disassembly" on page 47, remove the chassis assembly from the radio.
2. Refer to Section "Chassis Disassembly" on page 49, remove the Main Board from chassis.
3. Remove the main seal O-ring.
4. Inspect the seal area around the casting for foreign material that might prevent the main seal O-ring from sealing properly.
5. Assemble a new O-ring; discard the old O-ring.

6. The O-ring is installed from the bottom of chassis, and ensure the O-ring sits inside the chassis groove.
7. Reassemble the chassis assembly followed by installing into Front Cover (Refer to Section “Radio Reassembly—Detailed” on page 55.)
8. Inspect the main seal O-ring for proper seating. Observe carefully to ensure that the main seal O-ring is not pinched between the housing and the casting.

NOTE: When installing the assembled chassis to the Front Cover, ensure the O-ring at the top two corners are not dislodged from the chassis groove.

Battery Seal

To replace the Battery Seal

1. Refer to Section “Front Cover from Chassis Disassembly” on page 47, remove the chassis assembly from the radio.
2. Refer to Section “Chassis Disassembly” on page 49, remove the Main Board from chassis.
3. Remove the Battery Seal from the Battery Connector on Main Board.
4. Inspect the Battery Connector on Main Board and surrounding areas for foreign material that might prevent the Battery Seal from sealing properly.
5. Install a new Battery Seal; discard the old Seal.
6. Replace a new main seal O-ring; discard the old O-ring.
7. Reassemble the chassis assembly followed by installing into Front Cover (Refer to Section “Radio Reassembly—Detailed” on page 55.)
8. Inspect the main seal O-ring for proper seating. Observe carefully to ensure that the main seal O-ring is not pinched between the housing and the casting.

Radio-Level Troubleshooting

9

Introduction to This Section

This section of the manual contains troubleshooting charts and error codes that will help you to isolate problems. Level one troubleshooting will support only radio alignment, programming, battery replacement, and knob replacement. If the radio needs further troubleshooting, it must be sent to the depot.

Board-level, component-level, and service information can be found in the *ASTRO Digital XTS 2500 Portable Radios Detailed Service Manual*, Motorola publication number 68P81094C10.

Power-Up Error Codes

When the radio is turned on (power-up), the radio performs cursory tests to determine if its basic electronics and software are in working order. Problems detected during these tests are presented as error codes on the radio's display. For non-display radios, the problem is indicated at power-up by a single, low-frequency tone. If cycling power and code plug reprogramming do not fix the error, the radio should be sent to the depot for repair. The presence of an error should prompt the user that a problem exists and that a service technician should be contacted.

Self-test errors are classified as either fatal or non-fatal. Fatal errors will inhibit user operation; non-fatal errors will not. Table 23. lists their descriptions and suggested corrective action.

Table 23. Power-Up Error Code Displays

Error Code	Description	Corrective Action
01/02	FLASH ROM Codeplug Checksum Non-Fatal Error	Reprogram the codeplug.
01/12	Security partition Checksum Non-Fatal Error	Send Radio to Depot.
01/22	Tuning Codeplug Checksum Non-Fatal Error	Send Radio to Depot.
01/81	Host ROM Checksum Fatal Error	Send Radio to Depot.
01/82	FLASH ROM Codeplug Checksum Fatal Error	Reprogram the codeplug.
01/88	External RAM FATAL Error -- Note: not a checksum failure	Send radio to depot.
01/90	General Hardware Failure Fatal Error	Turn the radio off, then on.
01/92	Security Partition Checksum Fatal Error	Send radio to depot.
01/93	Flashport AUTHENTICATION CODE failure	Send radio to depot.
01/98	Internal RAM Fail Fatal Error	Send radio to depot.
01/A0	ABACUS Tune failure Fatal Error	Turn the radio off, then on.
01/A2	Tuning Codeplug Checksum Fatal Error	Send radio to depot.
02/10	DSP Support IC Checksum Non-Fatal Error	Turn the radio off, then on.
02/81	DSP ROM Checksum Fatal Error	Send radio to depot.

Table 23. Power-Up Error Code Displays

Error Code	Description	Corrective Action
02/88	DSP RAM Fatal Error -- Note: not a checksum failure	Turn the radio off, then on.
02/90	General DSP Hardware Failure (DSP startup message not received correctly)	Turn the radio off, then on.

NOTE: If the corrective action does not fix the failure, send the radio to the depot.

Operational Error Codes

During radio operation, the radio performs dynamic tests to determine if the radio is working properly. Problems detected during these tests are presented as error codes on the radio's display. An error code indicates that a problem exists and that a service technician should be contacted. Operational error codes are listed in Table 24.

Table 24. Operational Error Code Displays

Error Code	Description	Corrective Action
FAIL 001	Synthesizer Out-of-Lock	a. Reprogram external codeplug b. Send radio to depot
FAIL 002	Selected Mode/Zone Codeplug Checksum Error	Reprogram external codeplug

Table 25. Receiver Troubleshooting Chart

Symptom	Possible Cause	Correction or Test (Measurements Taken at Room Temperature)
Radio dead; Display does not light up	1. Dead Battery	Replace with charged battery.
	2. Blown Fuse	Send radio to depot.
	3. On/Off Switch	
	4. Regulators	
Radio dead; display lights up	1. VOCON	Send radio to depot.
	2. RF	
No receiver audio or receiver does not unmeet	Programming	a. Does the transmitted signal match the receiver configuration (PL, DPL, etc.)? b. With the monitor function enabled, can the radio be unmuted?
Audio distorted or not loud enough	Synthesizer Not On Frequency	Check synthesizer frequency by measuring the transmitter frequency; if off by more than $\pm 1000\text{Hz}$, realign.
RF sensitivity poor	1. Synthesizer Not On Frequency	Check synthesizer frequency by measuring the transmitter frequency; if off by more than $\leq \pm 1000\text{Hz}$, realign.
	2. Antenna Switch	Send radio to depot.
	3. Receiver Front-End Tuning	Check RF front-end tuning for optimum sensitivity using the CPS.
Radio will not turn off	VOCON	Send radio to depot.

Table 26. Transmitter Troubleshooting Chart

Symptom	Possible Cause	Correction or Test (Measurements Taken at Room Temperature)
No RF power out	1. TX Power Level or Frequency	Check TX power level and frequency programming (from CPS).
	2. No PTT From Control Top	Send radio to depot.
	3. No Injection To Power Amplifier	
No modulation; Distorted modulation	1. Programming	Check deviation and compensation settings using the CPS.
	2. VOCON	Send radio to depot.
Bad microphone sensitivity	1. Check Deviation and Compensation	Realign if necessary.
	2. Microphone	Send radio to depot.
No/Low signalling (PL, DPL, MDC)	1. Programming	Check programming.
	2. VOCON	Send radio to depot.
Cannot set deviation balance	RF	Send radio to depot.

Notes

General

Motorola provides the following approved accessories to improve the productivity of your XTS 2500, XTS 2500I, XTS 2250, XTS 1500, MT 1500 and PR 1500 portable two-way radios.

For a list of Motorola-approved antennas, batteries, and other accessories, visit the following web site which lists approved accessories: <http://www.motorola.com/cgiss/index.shtml>

Antennas

NAD6563_	VHF whip (136–174 MHz)
NAD6566_	VHF (136–150.8 MHz)
NAD6567_	VHF (150.8–162 MHz)
NAD6568_	VHF (162–174 MHz)
NAF5039_	800 MHz dipole (806–870 MHz)

Batteries

NTN9815_	NiCd high-capacity
NTN9816_	NiCd high-capacity, Factory Mutual Intrinsically Safe
NTN9857_	NiMH Impres, Factory Mutual Battery
NTN9858_	NiMH Impres, Standard Battery
NNTN6263_	NiMH Immersible Impres, Factory Mutual

Carry Accessories

Belt Clips

HLN6853_	Belt clip, 2 1/4 inch
HLN9844_	Belt

Body-Worn

NNTN4115_	Carrying case, leather with 3-in. swivel belt loop and T-strap
NNTN4116_	Carrying case, leather with 2.5-in. swivel belt loop and T-strap
NNTN4117_	Carrying case, leather with 3-in. belt loop and T-strap
NLN6349_	Shoulder strap for carrying radio
NTN5243_	Shoulder strap for carrying radio

TDN9675_	Wrist strap for carrying radio
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Chargers

NLN7967_	Wall-mount kit for multi-unit charger
NLN7968_	Rack-mount kit for multi-unit charger
NTN1168_	Single-unit dual rate, rapid charger 120V
NTN1169_	Single-unit dual rate, rapid charger 220V (2-prong Euro plug)
NTN1170_	Single-unit dual rate, rapid charger 240V (3-prong UK plug)
NTN1177_	Multi-unit, dual rate, rapid charger 110V
NTN1178_	Multi-unit, dual rate, rapid charger 240V (3-prong UK plug)
NTN1179_	Multi-unit, rapid charger 240V (UK 13 MAP Plug)
NTN1667_	Tri-chemistry, 110V
NTN1669_	Tri-chemistry, 230V
WPLN4114_R	Impres Single-unit charger
NTN7209_	Single-unit dual rate, rapid charger w/o cord

Enhanced and Multi-Unit Line Cords

NTN7373_	110V interchangeable line
NTN7374_	220V interchangeable line (2-prong Euro plug)
NTN7375_	240V interchangeable line (3-prong UK plug)

Microphones, Remote Speaker

NMN6191_	Remote speaker mic, noise-canceling (includes 6.0-ft coiled cord assembly, 3.5-mm earjack, swivel clip, quick disconnect)
NMN6193_	Remote speaker mic
NNTN4285_	Remote speaker mic adapter
ZMN6031_	Speaker mic, 3-piece
ZMN6032_	Speaker mic, 2-piece
ZMN6038_	Speaker mic, 2-piece, extra loud
ZMN6039_	Speaker mic, 3-piece, extra loud

Surveillance Accessories

CommPort[®] Integrated Microphone/ Receivers

NTN1624_	CommPort with palm PTT
NTN1625_	CommPort ear mic with PTT for noise levels up to 100 dB (requires BDN6676 adapter)
NTN1663_	CommPort ear mic with ring PTT for noise levels up to 100 dB (requires BDN6676 adapter)

NTN1736_	CommPort ear mic with snap-on side PTT for noise levels up to 100 dB (requires BDN6676 adapter)
NTN8819_	CommPort II (Intergrated Microphone/Receiver System)
NNTN4186_	CommPort (Intergrated Microphone/Receiver with Body PTT)

Earpieces

BDN6641_	Ear mic, high noise level up to 105 dB, grey (must order BDN6671 interface module)
BDN6664_	Earpiece with standard earphone, beige
BDN6665_	Earpiece with extra-loud earphone (exceeds OSHA limits), beige
BDN6666_	Earpiece with volume control, beige
BDN6667_	Earpiece, mic and PTT combined, beige
BDN6668_	Earpiece, mic and PTT separate, beige
BDN6669_	Earpiece, mic and PTT combined, with extra-loud earphone (exceeds OSHA limits), beige
BDN6670_	Earpiece, mic and PTT separate with extra-loud earphone (exceeds OSHA limits), beige
BDN6677_	Ear mic, standard, noise up to 95 dB (must order BDN6671 interface module), black
BDN6678_	Ear mic, standard, noise up to 95 dB (must order BDN6671 interface module), beige
BDN6719_	Earpad, with 3.5mm threaded plug
BDN6726_	Earpiece with standard earphone, black
BDN6727_	Earpiece with extra-loud earphone (exceeds OSHA limits), black
BDN6728_	Earpiece with volume control, black
BDN6729_	Earpiece, mic and PTT combined, black
BDN6730_	Earpiece, mic and PTT separate, black
BDN6731_	Earpiece, mic and PTT combined, with extra-loud earphone (exceeds OSHA limits), black
BDN6732_	Earpiece, mic and PTT separate, with extra-loud earphone (exceeds OSHA limits), black
BDN6780_	Earbud, single with mic and PTT combined, beige
BDN6781_	Earbud, single, receive only, black

Headsets and Headset Accessories

BDN6635_	Heavy-duty VOX headset with noise-canceling boom mic (requires BDN6673 adapter)
BDN6636_	Heavy-duty VOX headset with throat mic (requires BDN6673)
BDN6645_	Noise-canceling boom mic headset with PTT on earcup
BDN6673_	Headset adapter cable (for use with BDN6635 and BDN6645)

Accessories

BDN6676_	Jedi adapter
NTN8613_	Surveillance Adapter (has the 6-pin Hirose Connector)
NMN1020_	Safety helmet headset (requires BDN6676 adapter)
NMN6245_	Light-weight headset
NMN6246_	Ultralite headset with boom mic
NMN6258_	Over-the-head headset with in-line PTT
NMN6259_	Medium-weight, dual headset with NC mic
RMN4049_	Jedi "TEMCO" temple transducer

Radio Interface Modules for Ear Microphones

BDN6671_	Push-to-talk (PTT) and voice-activated (VOX) interface module (for use with BDN6641, BDN6677 and BDN6678)
BDN6708_	PTT interface module (for use with BDN6641, BDN6677 and BDN6678)

Switches

0180300E83	Remote PTT body switch
NTN7660_	Tilt / man down switch

Appendix: Replacement Parts Ordering



Basic Ordering Information

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Crystal orders should specify the crystal type number, crystal and carrier frequency, and the model number in which the part is used.

Radio Board Ordering Information

When ordering a replacement Radio Board, refer to the applicable Model Chart in the front of this manual, read the note at the bottom of the Model Chart, and include the proper information with your order.

Motorola Online

Motorola Online users can access our online catalog at

<https://www.motorola.com/businessonline>

To register for online access:

- Domestic customers: please call 800-814-0601 (U.S. and Canada).
- International customers: please go to <https://www.motorola.com/businessonline> and click on "Sign Up Now."

Mail Orders

Send written orders to the following addresses:

United States and Canada Orders (except for U.S. Federal Government orders):

Motorola Inc.
Radio Products and Services Division*
Attention: Order Processing
2200 Galvin Drive
Elgin, IL 60123
U.S.A.

U.S. Federal Government Orders:

Motorola Inc.
U.S. Federal Government Markets Division
Attention: Order Processing
7230 Parkway Drive
Landover, MD 21076
U.S.A.

International Orders:

Motorola Inc.
Radio Products and Services Division*
Attention: International Order Processing
2200 Galvin Drive
Elgin, IL 60123
U.S.A.

Telephone Orders

Radio Products and Services Division*
(United States and Canada)
7:00 AM to 7:00 PM (Central Standard Time)

Appendix: Replacement Parts Ordering

Monday through Friday (Chicago, U.S.A.)
1-800-422-4210
1-847-538-8023 (International Orders)

U.S. Federal Government Markets Division (USFGMD)
1-800-826-1913 Federal Government Parts - Credit Cards Only
8:30 AM to 5:00 PM (Eastern Standard Time)

Fax Orders

Radio Products and Services Division*
(United States and Canada)
1-800-622-6210
1-847-576-3023 (International)

USFGMD
(Federal Government Orders)
1-800-526-8641 (For Parts and Equipment Purchase Orders)

Parts Identification

Radio Products and Services Division*
(United States and Canada)
1-800-422-4210, menu 3

Product Customer Service

Customer Response Center
(Non-technical Issues)
1-800-247-2346
FAX:1-800-247-2347

*The Radio Products and Services Division (RPSD) was formerly known as the Customer Care and Services Division (CCSD) and/or the Accessories and Aftermarket Division (AAD).

Glossary



A/D	Analog-to-Digital converter; converts an instantaneous dc voltage level to a corresponding digital value.
ABACUS IC	Custom integrated circuit providing a digital receiver IF backend.
CPS	C ustomer P rogramming S oftware
CODEC	C oder/ D ecoder IC for analog-to-digital and digital-to-analog conversion.
D/A	D igital-to- A nalog converter; converts a digital value to a corresponding dc voltage value.
DTMF	D ual- T one M ulti- F requency
DPL	D igital P rivate- L ine™
DSP	D igital S ignal P rocessor; microcontroller specifically tailored for signal processing computations. In this case refers specifically to Motorola DSP56603.
Firmware	Software or a software/hardware combination of computer programs and data, with a fixed logic configuration stored in a read-only memory; information can not be altered or reprogrammed.
FGU	F requency G eneration U nit
FLASHport™	A Motorola term that describes the ability of a radio to change memory. Every FLASHport radio contains a FLASHport EEPROM memory chip that can be software written and rewritten to, again and again.
Host	Motorola HC12A4 microcontrol unit U204 (see MCU).
Host Port	Parallel memory mapped interface consisting of eight registers in the DSP56603.
IC	I ntegrated C ircuit
IMBE	I mproved M ulti- B and E xcitation: a sub-band, voice encoding algorithm used in ASTRO digital voice.
MCU	M icro C ontrol U nit
MDC	M otorola D igital C ommunications
MISO	M aster I n S lave O ut; used by the slave device to send data to the master device
MOSI	M aster O ut S lave I n; used by the master device to send data to the slave device.
Open Architecture	A controller configuration that utilizes a microprocessor with extended ROM and RAM.
PC Board	P rinted C ircuit board
PCIC	P ower C ontrol I C
PL	P rivate- L ine® tone squelch; a continuous sub-audible tone that is transmitted along with the carrier.
PLL	P hase- L ocked L oop; a circuit in which an oscillator is kept in phase with a reference, usually after passing through a frequency divider.

Glossary

PTT	Push-To-Talk ; the switch located on the left side of the radio which, when pressed, causes the radio to transmit.
Registers	Short-term data-storage circuits within the microcontrol unit or programmable logic IC.
Repeater	Remote transmit/receive facility that re-transmits received signals in order to improve communications coverage.
RESET	Reset line; an input to the microcontroller that restarts execution.
RF PA	R adio F requency P ower A mplifier
RPT/TA	R e P ea T er/ T alk- A round
RX DATA	Recovered digital data line.
Signal Qualifier Mode	An operating mode whereby the radio is muted but still continues to analyze receive data to determine RX signal type.
SCI IN	S erial C ommunication Interface I Nput line
Softpot	Software potentiometer; a computer-adjustable electronic attenuator.
Software	Computer programs, procedures, rules, documentation, and data pertaining to the operation of a system.
SPI	S erial P eripheral I nterface; how the microcontroller communicates to modules and ICs through the CLOCK and DATA lines.
Squelch	Muting of audio circuits when received signal levels fall below a pre-determined value.
SRAM	S tatic- R AM chip used for volatile, program/data memory.
Standby Mode	An operating mode whereby the radio is muted but still continues to monitor data.
System Select	The act of selecting the desired operating system with the system-select switch (also, the name given to this switch).
TOT	T ime- O ut T imer; a timer that limits the length of a transmission.
TSOP	T hin S mall- O utline P ackage
UART	U niversal A synchronous R eceiver T ransmitter.
μC	Microcontrol unit (see MCU).
VCO	V oltage- C ontrolled O scillator; an oscillator whereby the frequency of oscillation can be varied by changing a control voltage.
Vocoder	V oice en C ODER; the DSP-based system for digitally processing the analog signals, includes the capabilities of performing voice compression algorithms or voice encoding.
VSWR	V oltage S tanding W ave R atio

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