

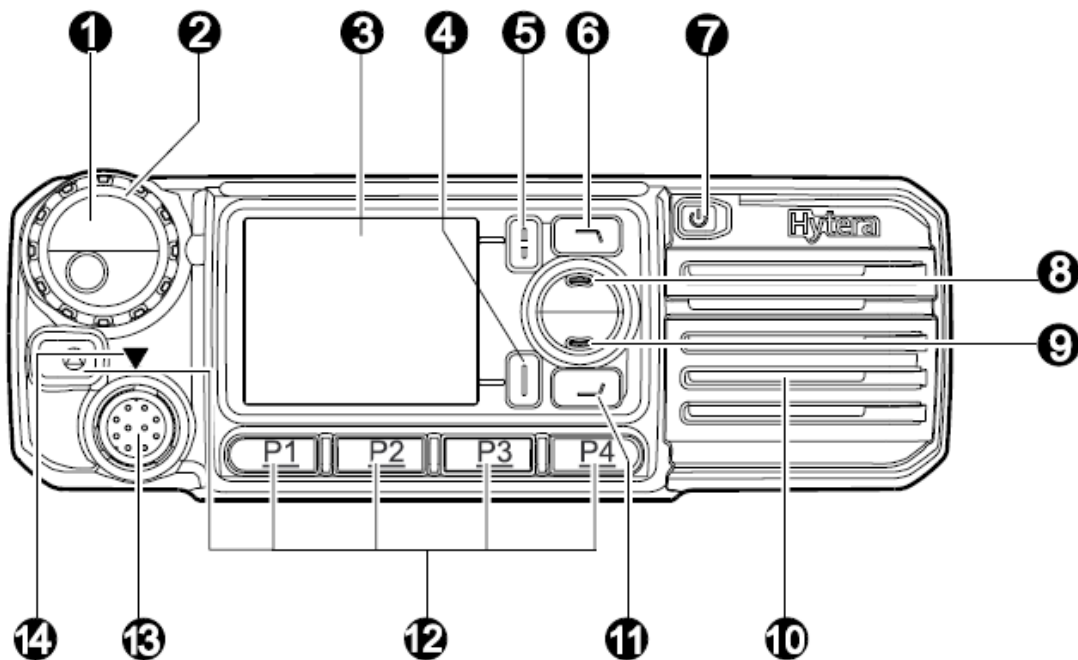
# UHF1 (400 - 470 MHz)

# Contents

1. Product Controls .....	1
2. Disassembly and Reassembly .....	3
3. Exploded View and Packing Guide .....	5
4. Specifications and Blind Spot .....	8
5. Interface Definition .....	12
6. Tuning Description.....	24

# 1. Product Controls

## Front Panel



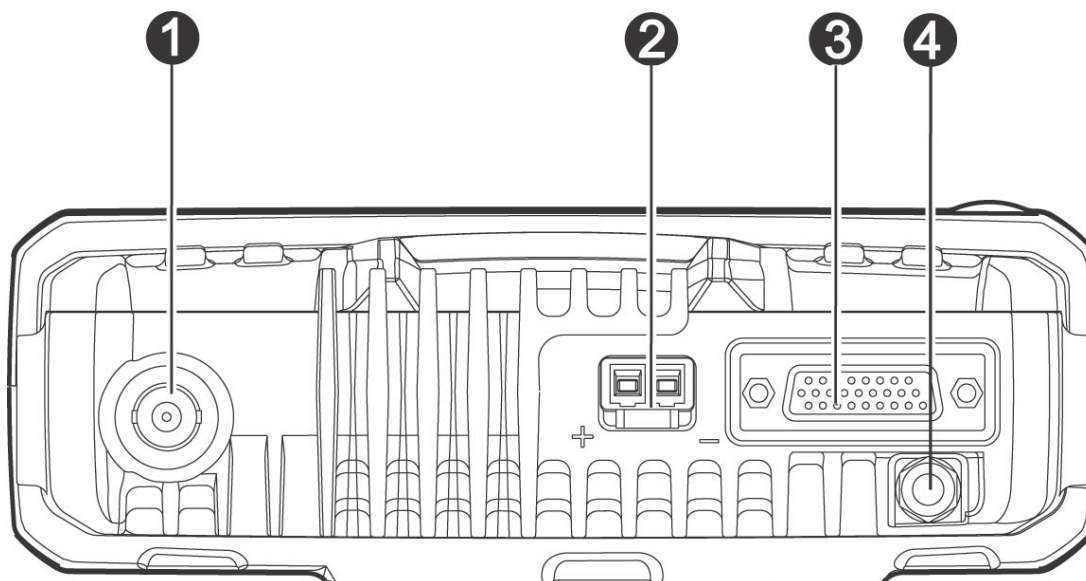
No.	Part Name	No.	Part Name
1	Volume Control/Group Call Selector Knob	8	Up Key
2	LED Indicator	9	Down Key
3	LCD Display	10	Speaker
4	OK/Menu Key	11	Redial/Answer/Call Key
5	Back/Group Call Management Key	12	Programmable Keys
6	Dial-back/End/Home Screen Key	13	Microphone Connector
7	Power On/Off Key	14	Microphone Installation Index



### Note

The above-mentioned product control is based on the mobile radio in the trunking mode. In the conventional mode, No. 1 serves as Volume Control / Channel Selector Knob, and No. 6 & No.11 serve as the Programmable Keys.

## Rear Panel



No.	Part Name	No.	Part Name
1	RF Antenna Connector	3	Accessory Connector
2	Power Inlet	4	GPS Antenna Connector

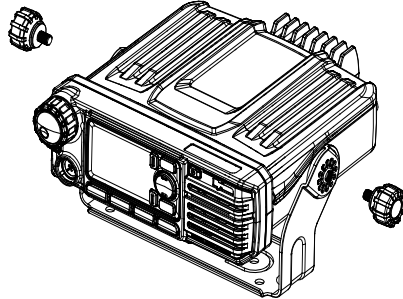
 **Note**

The GPS antenna interface is only available for MD78XG.

## 2. Disassembly and Reassembly

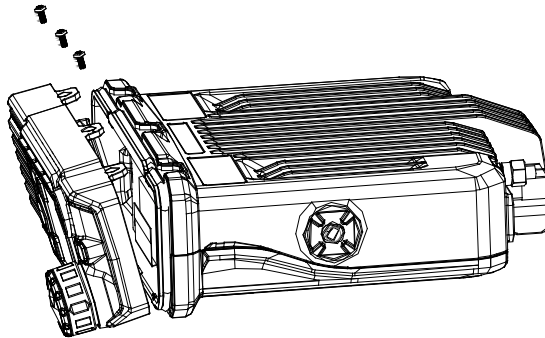
### 2.1 Disassembling the Radio

**Step 1** Turn off the radio and remove the power cord, and loosen the two screws to remove the radio.

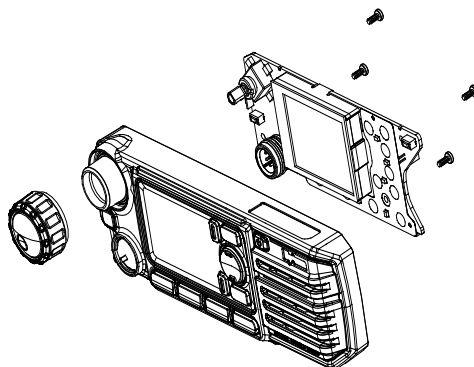


**Step 2** Remove the antenna.

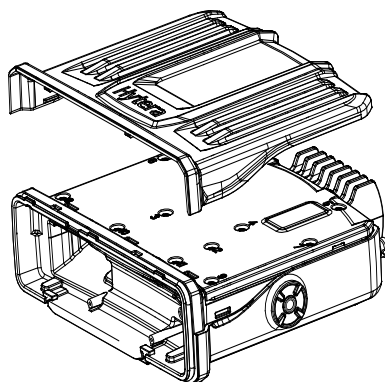
**Step 3** Loosen the three screws to remove the front panel. Then remove the FFC.



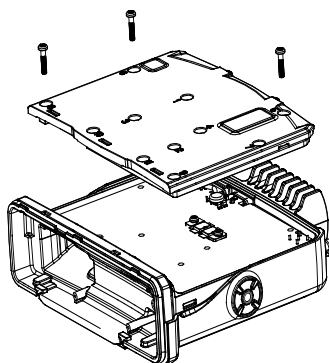
**Step 4** Detach the volume control knob and loosen the four screws. Then remove the PCB from the control panel.



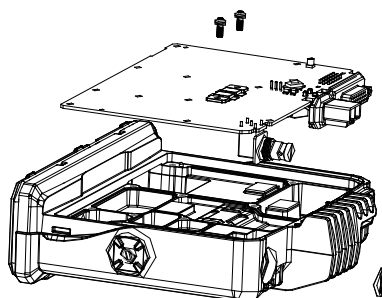
**Step 5** Undo the clips on both sides of the radio, and then remove the rear cover.



**Step 6** Loosen the eleven screws to remove the upper shield cover.



**Step 7** Loosen the screw fixing the antenna connector and two screws fixing the PA module. Then take the PCB out.

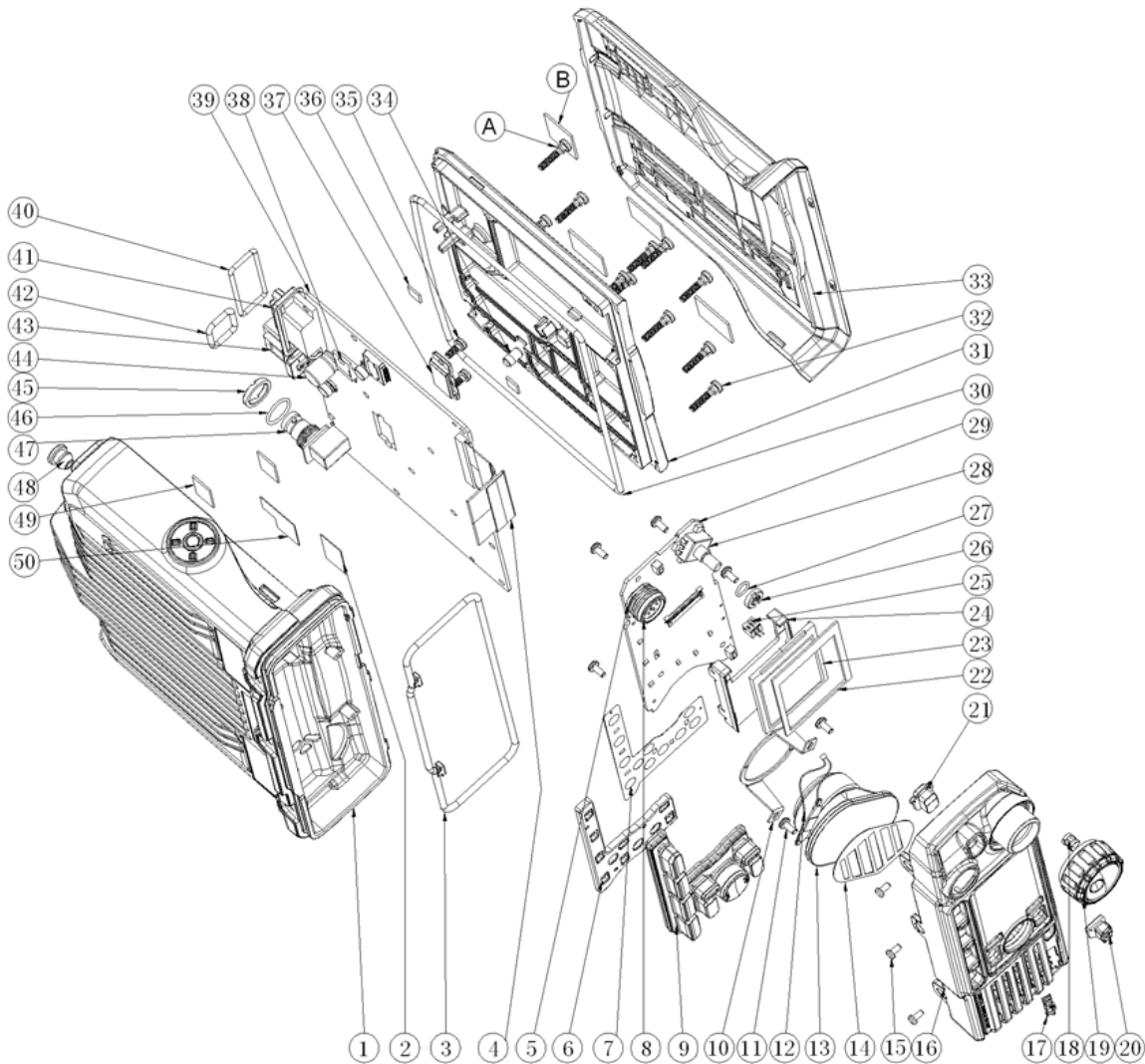


## 2.2 Reassembling the Radio

To reassemble the radio, perform the above steps in a reverse way.

## 3. Exploded View and Packing Guide

### 3.1 Exploded View



Part list:

No.	Part No.	Description	Qty.	No.	Part No.	Description	Qty.
1	6300109000000	Aluminum chassis	1	27	6100334000000	O-ring for encoder switch	1
2	7500358000000	Heat sink pad	1	28	4399030000020	Rotary switch	1
3	6100492101000	Waterproof ring for front case	1	29	41078001000J0	PCB for control panel	1
4	4210090000200	Signal cable	1	30	6100533101000	Waterproof ring for aluminum chassis	1
5	5208010100010	Connector (male)	1	31	6300126000000	Upper cover of the aluminum chassis	1
6	6001079000000	Light-guide plate for keys	1	32	7103015000000	Machine screw	11
7	7300048000000	Metal dome	1	33	6001080000000	Plastic upper cover	1
8	6100408001000	Waterproof ring for microphone jack	1	34	6100496000000	Conductive silicone rubber for main board	1
9	6100488000000	P+R front panel keys	1	35	7103008000400	Machine screw	2
10	6201893000000	Speaker fixing sheet	1	36	7500272000000	Heat sink pad	2
11	7102606021000	Self-tapping screw	6	37	/	Semi-finished PA with heat sink pad	1

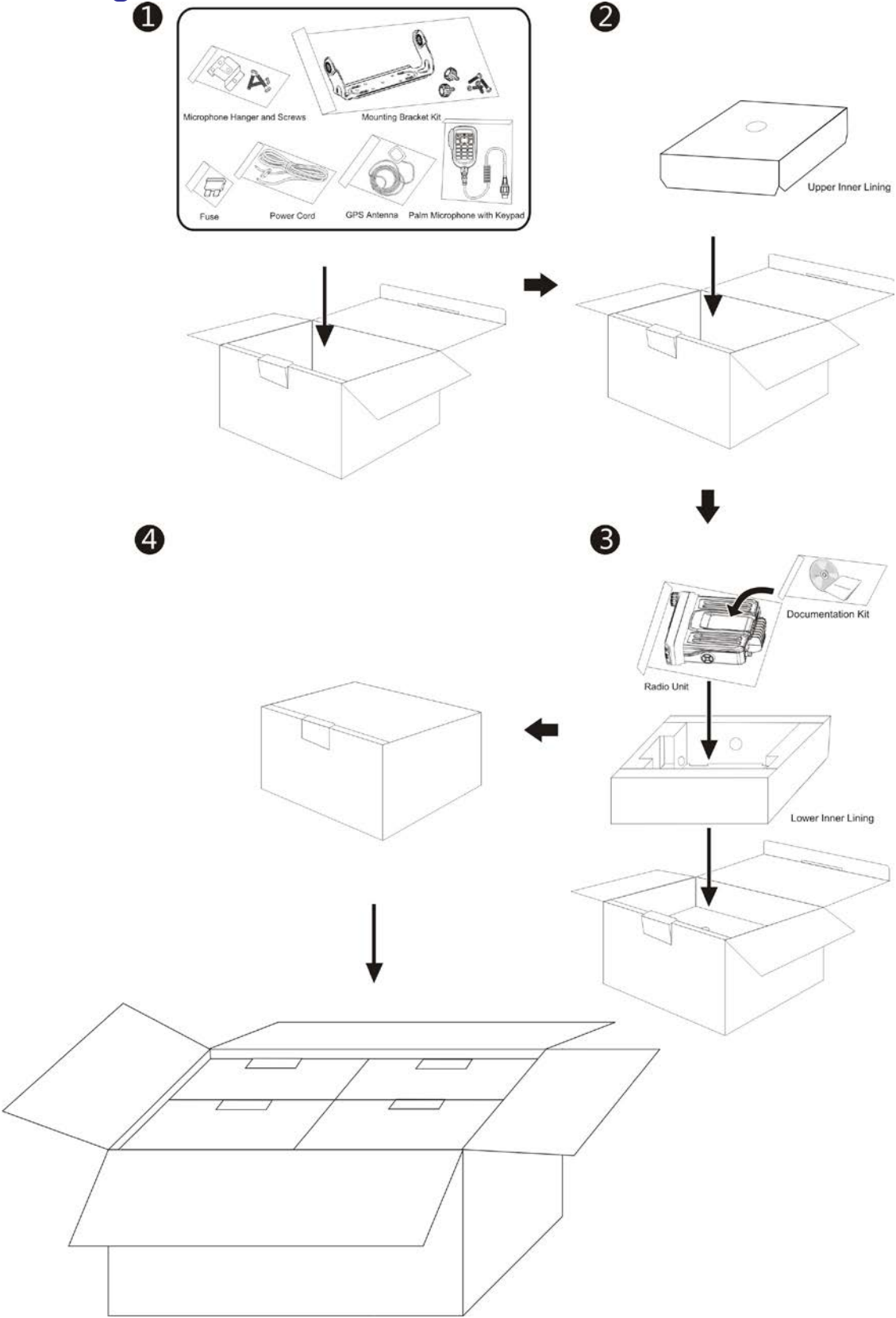
No.	Part No.	Description	Qty.	No.	Part No.	Description	Qty.
12	4210080000700	Speaker cable (with 2-Pin plug)	1	38	3414999000020	PNP transistor	1
13	5001210000390	Speaker	1	39	/	Main PCB	1
14	7400297000000	Speaker felt	1	40	6100532100000	D_SUB waterproof ring	1
15	7102505000110	Machine screw	3	41	5208026100000	Jack	1
16	6001076000010	Front case for control panel	1	42	6100530100000	Waterproof ring for power socket	1
17	860P580600100	Logo	1	43	5205002100110	Power socket (male)	1
18	6201739000000	Inner lining for knob	1	44	3103994770150	Electrolytic capacitor	1
19	6000876000000	Encoder knob	1	45	7212002500000	Nut	1
20	6100493000000	Power on/off key	1	46	6100531100000	Waterproof ring for antenna connector	1
21	6100404000000	Emergency key	1	47	4401000009000	BNC RF connector	1
22	7500344000000	PORON pad	1	48	6100494000000	GPS soft stopple	1
23	5130000000040	TFT LCD 2.0" TFT	1	49	7500159000100	Thermal conductive silicone rubber	2
24	6001078000000	LCD bracket	1	50	7500357000000	Heat sink pad	1
25	5202002100270	Board-to-wire connector	1	A	6100574100000	O_ring	11
26	7207003700000	Nut	1	B	7500344000000	PORON pad	1

 **Note**

Parts that are not marked with Part No. may vary with the radio frequency band.



### 3.2 Packing Guide



## 4. Specifications and Blind Spot

### 4.1 Specifications

General	
Frequency Range	400 - 470 MHz
Channel Capacity	1024
Group Capacity	64 (each with a maximum of 16 channels)
Channel Spacing	12.5 kHz / 25 kHz
Operating Voltage	13.6V±15% DC
Current Drain	<ul style="list-style-type: none"> <li>● Standby: &lt;0.6 A</li> <li>● Receive: &lt;2.0 A</li> <li>● Transmit: 5 W: &lt;5 A; 25 W: &lt;8 A, 45 W: &lt;12 A</li> </ul>
Frequency Stability	±2.5 ppm
Antenna Impedance	50 Ω
Dimensions (HxWxD)	60 mm x 174 mm x 200 mm (2.4 inch x 6.9 inch x 7.9 inch)
Weight	1.7 kg (3.75 lbs)
LCD Display	220*176 pixels, 262000 colors, 2.0-inch, 4 rows
Transmitter	
Power Output	<ul style="list-style-type: none"> <li>● Low: 1 - 25 W</li> <li>● High: 1 - 45 W</li> </ul>
Conducted/Radiated Emission	<ul style="list-style-type: none"> <li>● -36 dBm &lt;1 GHz</li> <li>● -30 dBm &gt;1 GHz</li> </ul>
FM Modulation	<ul style="list-style-type: none"> <li>● 10K1F3E@12.5 kHz</li> <li>● 15K1F3E@25 kHz</li> </ul>
4FSK Digital Modulation	<ul style="list-style-type: none"> <li>● 12.5 kHz (data only): 7K70FXD</li> </ul>
Modulation Limit	<ul style="list-style-type: none"> <li>● ±2.5 kHz@12.5 kHz</li> <li>● ±5.0 kHz@25 kHz</li> </ul>

FM Hum and Noise	<ul style="list-style-type: none"> <li>● 40 dB@12.5 kHz</li> <li>● 45 dB@25 kHz</li> </ul>
Adjacent Channel Power	<ul style="list-style-type: none"> <li>● 60 dB@12.5 kHz</li> <li>● 70 dB@25 kHz</li> </ul>
Audio Response	+1 dB to -3 dB
Audio Distortion	≤3%
Digital Vocoder Type	AMBE++ or SELP
Digital Protocol	ETSI-TS102 361-1, -2, -3
<b>Receiver</b>	
Sensitivity	<p>Analog:</p> <ul style="list-style-type: none"> <li>● 0.3 μV (12 dB SINAD)</li> <li>● 0.22 μV (Typical) (12 dB SINAD)</li> <li>● 0.4 μV (20 dB SINAD)</li> </ul> <p>Digital:</p> <ul style="list-style-type: none"> <li>● 0.3 μV /BER5%</li> </ul>
Adjacent Channel Selectivity	<ul style="list-style-type: none"> <li>● TIA-603: 65 dB@12.5 kHz/75 dB@25 kHz</li> <li>● ETSI: 60 dB@12.5 kHz/75 dB@25 kHz</li> </ul>
Intermodulation	<ul style="list-style-type: none"> <li>● TIA-603: 75 dB@12.5/25 kHz</li> <li>● ETSI: 70 dB@12.5/25 kHz</li> </ul>
Spurious Response Rejection	<ul style="list-style-type: none"> <li>● TIA-603: 75 dB@12.5/25 kHz</li> <li>● ETSI: 70 dB@12.5/25 kHz</li> </ul>
Blocking	<ul style="list-style-type: none"> <li>● TIA-603: 90 dB</li> <li>● ETSI: 84 dB</li> </ul>
Hum and Noise	<ul style="list-style-type: none"> <li>● 40 dB@12.5 kHz</li> <li>● 45 dB@25 kHz</li> </ul>
Rated Audio Power	<ul style="list-style-type: none"> <li>● Internal (20 Ω load): 3 W</li> <li>● External (8 Ω load): 7.5 W</li> </ul>
Max. Audio Power	<ul style="list-style-type: none"> <li>● Internal (20 Ω load): 8 W</li> </ul>

	● External (8 $\Omega$ load): 20 W
Rated Audio Distortion	$\leq 3\%$
Audio Response	+1 dB to -3 dB
Conducted Spurious Emission	< -57 dBm
<b>Environment</b>	
Operating Temperature	-30°C to +60°C
Storage Temperature	-40°C to +85°C
ESD	IEC 61000-4-2 (level4) $\pm 8$ kV (contact) $\pm 15$ kV (air)
American Military Standard	MIL-STD-810 C/D/E/F/G
Dust & Water Protection	IP54
Humidity	Per MIL-STD-810 C/D/E/F/G Standards
Shock and Vibration	Per MIL-STD-810 C/D/E/F/G Standards
<b>GPS (for MD780XG only)</b>	
Accuracy specs are for long-term tracking (95th percentile values > 5 satellites visible at a nominal -130dBm signal strength).	
TTFF (Time To First Fix) Cold Start	< 60s
TTFF (Time To First Fix) Hot Start	< 10s
Horizontal Accuracy	< 10 m

**Note**

All Specifications are tested according to applicable standards, and subject to change without notice due to continuous development.

## 4.2 Blind Spot

No.	Blind Spot (MHz)	No.	Blind Spot (MHz)
1	403.2	5	414
2	422.4	6	432
3	441.6	7	450
4	460.8	8	468

## 5. Interface Definition

### 5.1 10-Pin Connector

The 10-pin connector on the front panel is used for audio accessories or data cable connection. The definition of each pin is described as below.

Pin No.	Name	Type	Signal Electrical Performance	Description
1	Accessory identification interface 1	Digital input	3.3 V CMOS	Pin 1 and Pin 10 (accessory identifier interface 2) compose an accessory identification matrix. Please refer to the “ <a href="#">10-pin Accessory Identification Matrix Table</a> ” below for detailed function definitions.
2	PTT input	Digital input	3.3 V CMOS	PTT input for the palm microphone, which is valid at low level.
3	External audio output	Analog output	Load impedance >1 kΩ V <sub>rms</sub> =600mV±10%@1 kHz 60% system max. deviation	Accessory audio output. When “Mic Audio Output” is selected via CPS, this pin will output the received audio signal.
4	USB_D-	USB data cable-	USB data	When this pin is used for USB function, USB function of DB26 will be disabled.
5	GND	Ground cable	/	/
6	USB_VBUS	USB power supply	Power supply: 5 V; current limiting: 500 mA	This pin provides power supply to the USB accessory. It outputs a 5 V voltage when accessory identification code is 00 01 10, and outputs low level when the code is 11.

Pin No.	Name	Type	Signal Electrical Performance	Description
7	Mic input	Analog input	Modulation sensitivity Vrms=80mV±10%@1kHz 60%system max. deviation	Mic input for palm microphone
8	USB_D+	USB data cable+	USB data	When this pin is used for USB function, USB function of DB26 will be disabled.
9	HOOK	Digital input	3.3V CMOS	High level by default; valid at low level. HOOK and MONITOR functions: Press this key, the level changes from high to low. When palm microphone is detected or press the key of the palm microphone, this pin is used for HOOK function; when desktop microphone is detected, this pin is used for MONITOR function.
10	Accessory identification interface 2	Digital input	3.3V CMOS	Pin 1 and Pin 10 (accessory identifier interface 1) compose an accessory identification matrix. Please refer to the <a href="#">“10-pin Accessory Identification Matrix Table”</a> below for detailed function definitions.

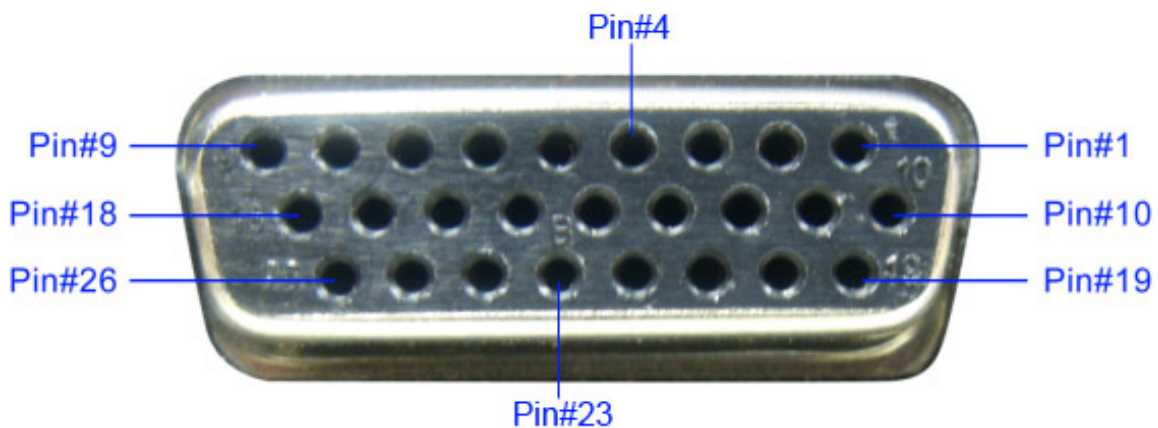
10-pin Accessory Identification Matrix Table (composed of Pin 1 and Pin 10):

Pin 1	Pin 10	Radio Status
Low level	Low level	Reserved
Low level	High level	The mobile radio is in USB master mode or connected to a USB smart accessory (such as palm microphone with keypad).
High level	Low level	The mobile radio is connected to an external speaker (including desktop microphone with earpiece).

Pin 1	Pin 10	Radio Status
High level	High level	The mobile radio is in USB slave mode, or it is not connected to any accessory, or it is connected to a palm microphone without keypad.

## 5.2 DB26 Accessory Interface

DB26 accessory interface, namely the 26-pin further development interface on the rear panel, is mainly used for accessory connection of mobile radio, or compatibility with other interfaces. Users can further develop the radio via this interface. The figure and definition of each pin is as follows.



Pin No.	Name	Type	Signal Electrical Performance	Description
1	Vbus USB power supply	Power output	Power supply: +5V; current limiting: 500 mA	Pin 1 and Pin 10 (accessory identification interface 2) compose an accessory identification matrix. This pin outputs a 5 V voltage when accessory identification code is 00 01 10, and outputs low level when the code is 11.
2	Ground	Power supply (grounding)	/	/
3	GP5_3 (Chan_Act)	GPIO	5V TTL	GPIO. Programmable via CPS.
4	SWB+	Power output	Power supply :13.2V±15%; output current ≤1 A	Power output: 13.2 V; output current: ≤1 A



Pin No.	Name	Type	Signal Electrical Performance	Description
5	External Alarm	Analog voltage output	13 V alarm output	Programmable output pin ("External Horn & Lights" feature by default, programmable via CPS).
6	Power Ground	Power supply (grounding)	/	/
7	TX Audio	Analog signal input	V <sub>rms</sub> =80 mV±10%@1 kHz 60% system max. deviation	This pin is used for signal input of external MIC. The audio path is valid when the external Mic PTT is held down.
8	RX Audio	Analog signal output	Load impedance>1kΩ V <sub>rms</sub> =300 mV±10%@1 kHz 60% system max. deviation	Default output is 300 mV. The output signal amplitude can be changed by modifying the "Analog RX Gain" value via CPS.
9	SPK-	Analog output	It forms differential output together with SPK+. Max power output: 10 W(R=8 Ω)	External speaker output-
10	D+	USB data cable+	USB data	USB data cable+
11	USB_GROUND	Ground cable	/	/
12	GP5_2 (Monitor)	GPIO	5V TTL	GPIO. Programmable via CPS; Monitor feature by default.
13	ACC_IO2	Digital input	5V TTL	Accessory identification interface; high level by default. This pin and Pin 15 (ACC_IO3) can compose three accessory identification statuses. Please refer to the <a href="#">"DB26 Accessory Identification"</a>

Pin No.	Name	Type	Signal Electrical Performance	Description
				<a href="#">Matrix Table</a> ” below for detailed function definitions.
14	Emerg Sw	Digital input	5V TTL	Emergency switch. This pin is valid when low level is input.
15	ACC_IO3	Digital input	5V TTL	Accessory identification interface; high level by default. This pin and Pin 13 (ACC_IO2) can compose three accessory identification statuses. Please refer to the <a href="#">“DB26 Accessory Identification Matrix Table”</a> below for detailed function definitions.
16	PRGM_IN_PTT	Digital input	5V TTL	Programmable input pin ( <b>PTT</b> key of external Mic by default; its function is programmable via CPS). It is valid at low level.
17	Audio Ground	Audio (grounding)	/	/
18	SPK+	Analog signal output	It forms differential output together with SPK-. Max power output: 10 W(R=8 Ω)	External speaker output+
19	D-	USB data cable-	USB data	USB data cable-
20	GP5_8	Digital input/output	5V TTL	GPIO. Programmable via CPS.
21	Ground	Ground cable	/	/
22	GP5_7	Digital input/output	5V TTL	GPIO. Programmable via CPS.

Pin No.	Name	Type	Signal Electrical Performance	Description
23	GP5_6	Digital input/output	5V TTL	GPIO. Programmable via CPS.
24	AUX Audio Out 1	Analog output	Load impedance >1 kΩ V <sub>rms</sub> =300 mV±10%	Auxiliary audio (external speaker) output 1
25	AUX Audio Out 2	Analog output	Load impedance >1 kΩ V <sub>rms</sub> =300 mV±10%	Auxiliary audio (external speaker) output 2
26	Ign Sense Detect Pin	Analog voltage input	Ignition voltage input >7 V	Input pin for ignition voltage



#### Note

When a pin is marked with 5 V TTL level, this pin has the pull-up function. If the pin needs to be set to high level, empty this pin.

DB26 Accessory Identification Matrix Table (composed of Pin 13 and Pin 15):

Pin 13	Pin 15	Radio Status
High level	High level	Default status. The mobile radio is in USB slave mode or not connected to any accessory.
High level	Low level	The mobile radio is in USB master mode or connected to a USB smart accessory (such as palm microphone with keypad).
Low level	High level	The mobile radio is connected to an external speaker (including desktop microphone with earpiece).
Low level	Low level	Reserved

## 5.3 Other Interfaces

### J2 (LCD Display Interface)

Pin No.	Name	Description
1	GND	Grounding pin
2	VCI	2.5 - 3.3 V adjustable port
3	VCI	2.5 - 3.3 V adjustable port
4	IOVCC	1.65 - 3.3 V adjustable I/O port

Pin No.	Name	Description
5	FLM	Synchronization signal control port
6	CS	Chip select signal
7	RS	Register select
8	WR	Write signal
9	RD	Read signal
10	DB0	Data bus
11	DB1	
12	DB2	
13	DB3	
14	DB4	
15	DB5	
16	DB6	
17	DB7	
18	DB8	
19	DB9	
20	DB10	
21	DB11	
22	DB12	
23	DB13	
24	DB14	
25	DB15	
26	DB16	
27	DB17	
28	RESET	Reset signal
29	IM3	Select data cable

Pin No.	Name	Description
30	IM0	
31	LEDA	LED anode
32	LED_K1	LED cathode
33	LED_K2	
34	LED_K3	

#### J4 (Aviation Interface of Front Panel)

Pin No.	Name	Description
1	ACC_IO1	Digital input
2	PTT_IN	Digital input
3	External_Audio	Analog output
4	USB_D-	USB data cable
5	GND	Ground cable
6	USB_VBUS	Power supply
7	MIC_IN	Analog input
8	USB_D+	USB data cable
9	HOOK	Hook signal input
10	ACC_IO2	Digital input

#### J400 (Option Board Interface)

Pin No.	Signal	Function	I/O of the Radio	Voltage (Option Board VDD=3.3 V)	Remark
1	GPIO1	GPIO	I/O	VIH MIN=0.7VDD VIL MAX=0.3VDD VOH MIN=0.8VDD VOL MAX=0.22VDD	GPIO5: output signal of resetting the option board. GPIO4/GPIO5: Unidirectional output interfaces. They require their input resistances are greater than or
3	GPIO2				
5	GPIO3		O		
7	GPIO4				
9	GPIO5	RESET-OUT	O		

Pin No.	Signal	Function	I/O of the Radio	Voltage (Option Board VDD=3.3 V)	Remark
					equal to 47 kΩ.
11	UART-TX	UART	O		UART
13	UART-RX		I		
15	UART-CTS		I		
17	UART-RTS		O		
2	I2C -SDA	I2C	I/O		I2C
4	I2C -SCL		O		
6	MCBSP-D R	MCBSP	I		McBSP: Multi-channel buffered serial port
8	MCBSP-W CLK		I/O		
10	MCBSP-D X		O		
12	MCBSP-F SX		I/O		
14	AGND	AGND	/	/	/
16	AF OB TO MB	AF	I	80 mV (standard output from the option board to the main board)	MAX: 700 mV
18	AF MB TO OB	AF	O	80 mV (standard output from the main board to the option board)	MAX: 700mV
19	DGND	DGND	/	/	/
20	3V6 or 5V	Power	O	Voltage: 5.0 V	/

**J403 (Pin Interface)**

Pin No.	Name	Description
1	Vbus USB	Power supply: +5 V
2	Ground	Ground cable
3	GP5_3	Digital input/output
4	SW B+ sense	Power supply
5	External Alarm	Analog voltage output
6	Power Ground	Power supply (grounding)
7	Tx Audio	Analog input
8	RX Audio	Analog output
9	Spkr-	Analog output
10	D+ USB	USB data cable+
11	USB_GROUDN	Ground cable
12	GP5_2	Digital input/output
13	ACC_IO2	Digital input
14	Emerg Sw	Digital input
15	ACC_IO3	Digital input
16	PRGM_IN_PTT	Digital input
17	Audio Ground	Audio ground
18	Spkr+	Analog output
19	D- USB	USB data cable-
20	GP5_8	Input/output
21	Ground	Ground cable
22	GP5_7	Input/output
23	GP5_6	Digital input/output
24	AUX Audio Out 1	Analog output

Pin No.	Name	Description
25	AUX Audio Out 2	Analog output
26	Ign Sense	Analog voltage input

#### J404 (Front Panel Interface)

Pin No.	Name	Description
1	INT_MIC	Audio input
2	MIC_GROUND	Audio input (grounding)
3	ACC_IO1	Accessory identification interface 1
4	USB_VBUS	USB power supply
5	HOOK	HOOK
6	PTT	PTT
7	USB_D-	USB data cable D-
8	USB_D+	USB data cable D+
9	ACC_IO2	Accessory identification interface 2
10	UART2_RXD_A	Volume control port
11	UART2_TXD_B	/
12	EXTERNAL_AUDIO	Audio signal output by accessory (mobile radio)
13	SPKR1+	Speaker audio signal cable+
14	SPKR1-	Speaker audio signal cable-
15	5VD	Power supply
16	PRST	Reset signal
17	KB_C0	Matrix keyboard
18	KB_C1	
19	KB_C2	
20	KB_C3	
21	B_R0	



Pin No.	Name	Description
22	B_R1	
23	B_R2	
24	CSLED	Backlight control IC chip select
25	CLOC	Backlight control IC clock
26	DATA	Backlight control IC data
27	OE_LCD	LCD read enable
28	WE_LCD	LCD write enable
29	CS2_LCD	LCD chip select
30	F_A1_LCD	LCD register select enable
31	F_D7	LCD data bus
32	F_D6	
33	F_D5	
34	F_D4	
35	F_D3	
36	F_D2	
37	F_D1	
38	F_D0	
39	GND	Grounding
40	PWB_IN	Power On/Off signal

## 6. Tuning Description

### 6.1 Required Test Instruments

- Radio communication test sets: HP8921 and Aeroflex 3920
- Power supply: 15 A/30 V
- Multimeter
- Tuner software

### 6.2 Tuning Procedures

#### 6.2.1 Tuning the Radio

After re-assembling the radio, you need to tune it with the Tuner software and HP8921.

The specific operations are described in the table below. After tuning the items of the current channel, you must switch the radio to the next channel; otherwise, the adjustments will not be saved to the radio properly.

Items	Method
<b>TX Section</b>	
Reference Oscillator Warp	<ol style="list-style-type: none"> <li>1. Connect the radio to HP8921 via the antenna connector, and set HP8921 to TX test mode.</li> <li>2. Open the Tuner software and go to "TUNE_DATA -&gt; TX -&gt; Reference Oscillator Warp" in the left navigation tree. Then click the "Transmit On" button.</li> <li>3. Adjust the vernier on the Tuner until the frequency offset between the frequency displayed on HP8921 and the frequency (Tx) displayed on Tuner is less than or equals to <math>\pm 40</math> Hz.</li> <li>4. Click the "Save" button on Tuner to save the existing value to the radio.</li> <li>5. Click the "Transmit Off" button on Tuner.</li> </ol>
Transmit Power Calibration	<p>Here takes the tuning of low TX power for example.</p> <ol style="list-style-type: none"> <li>1. Connect the radio to HP8921 via the antenna connector, and set HP8921 to TX test mode.</li> <li>2. Open the Tuner software and go to "TUNE_DATA -&gt; TX -&gt; Transmit Power Calibration" in the left navigation tree. Then select an appropriate channel.</li> </ol>

Items	Method
	<ol style="list-style-type: none"> <li>3. Click the “Transmit On” button on Tuner.</li> <li>4. Adjust the power to the required level as follows: Low power: 1 W (for version D/F) Medium power: 25 W High power: 45 W</li> <li>5. Click the “Save” button on Tuner to save the existing value to the radio.</li> </ol>
Transmit-to-Deviation	<ol style="list-style-type: none"> <li>1. Connect the radio to HP8921 via the antenna connector, and set HP8921 to TX test mode.</li> <li>2. Set the parameters on the HP8921 as follows: IF Filter: 230 kHz Filter1: &lt;20 Hz HPF Filter2: &lt;15 kHz LPF De-Emphasis: off</li> <li>3. Open the Tuner software and go to “TUNE_DATA -&gt; TX -&gt; Transmit-to-Deviation” in the left navigation tree. Then click the “Transmit On” button. Then set the modulation signal of HP8921 to “100 Hz”.</li> <li>4. Adjust the vernier on Tuner until the frequency deviation displayed on HP8921 is “5 kHz”.</li> <li>5. Click the “Save” button on Tuner to save the existing value to the radio.</li> <li>6. Click the “Transmit Off” button on Tuner.</li> </ol>
Modulation Balance	<p>Here takes the low frequency deviation for example.</p> <ol style="list-style-type: none"> <li>1. Connect the radio to HP8921 via the antenna connector, and set HP8921 to TX test mode.</li> <li>2. Set the parameters on the HP8921 as follows: IF Filter: 230 kHz Filter1: &lt;20 Hz HPF Filter2: &lt;15 kHz LPF De-Emphasis: off</li> <li>3. Open the Tuner software and go to “TUNE_DATA -&gt; TX -&gt; Modulation Balance” in the left navigation tree. Then select an appropriate channel.</li> <li>4. Click the “Transmit On” button on Tuner. Then set the modulation signal</li> </ol>

Items	Method
	<p>of HP8921 to “100 Hz”.</p> <ol style="list-style-type: none"> <li>5. Adjust the value in the dialog box on Tuner until the frequency deviation displayed on HP8921 is “5 kHz”.</li> <li>6. Press the <b>Enter</b> key on the keyboard to confirm your settings.</li> <li>7. Click the “Save” button on Tuner to save the existing value to the radio.</li> <li>8. Click the “Transmit Off” button on Tuner.</li> </ol>
Transmit Oscillator Voltage	<ol style="list-style-type: none"> <li>1. Connect the radio to HP8921 via the antenna connector, and set HP8921 to TX test mode.</li> <li>2. Open the Tuner software and go to “TUNE_DATA -&gt; TX -&gt; Transmit Oscillator Voltage” in the left navigation tree.</li> <li>3. Click the “Save” button to save the existing value to the radio.</li> </ol>
<b>RX Section</b>	
Front-end Filter	<ol style="list-style-type: none"> <li>1. Connect the radio to HP8921 via the antenna connector.</li> <li>2. Connect the Audio Out port of the radio to the Audio In port of HP8921, and set HP8921 to RX test mode.</li> <li>3. Set the parameters on the HP8921 as follows: Output RF signal: -118 dBm/Frequency (current channel frequency) Modulation frequency: 1 kHz Modulation deviation: 3 kHz</li> <li>4. Open the Tuner software and go to “TUNE_DATA -&gt; RX -&gt; Front-end Filter” in the left navigation tree. Adjust the vernier on Tuner until the “SINAD” value displayed on HP8921 is greater than 14 dB.</li> <li>5. Set the output RF signal of HP8921 to -25 Bm/(current channel frequency -36.675 MHz).</li> <li>6. Adjust the vernier on Tuner until the “SINAD” value displayed on HP8921 is less than 14 dB.</li> <li>7. Press the <b>Enter</b> key on the keyboard to confirm your settings.</li> <li>8. Click the “Save” button on Tuner to save the existing value to the radio.</li> </ol>
Front-end Gain	<ol style="list-style-type: none"> <li>1. Connect the radio to HP8921 via the antenna connector, and set HP8921 to RX test mode.</li> <li>2. Set HP8921 to output an unmodulated RF signal with a value of “-70</li> </ol>

Items	Method
	dBm/Frequency (current channel frequency)". 3. Press the <b>Enter</b> key on the keyboard to confirm your settings. 4. Click the "Save" button on Tuner to save the existing value to the radio.
Receive Voltage Oscillator	1. Connect the radio to HP8921 via the antenna connector, and set HP8921 to RX test mode. 2. Open the Tuner software and go to "TUNE_DATA -> RX -> Receive Oscillator Voltage" in the left navigation tree. 3. Set HP8921 to output an unmodulated RF signal with a value of "-47 dBm/Frequency (current channel frequency)". 4. Click the "Save" button to save the existing value to the radio.

## 6.2.2 Testing the Radio

After tuning all the items of the radio, you need to test the digital RF signal of the mobile radio via Aeroflex 3920 (Digital Radio Test set).

### Transmitting

**Step 1** Connect the mobile radio to Aeroflex 3920 via the antenna connector.

**Step 2** Open the Tuner software and go to "TEST -> TX -> Transmit BER (0.153)".

**Step 3** Select the channel to be tested and select the corresponding power level (High Power or Low Power) in "Parameter" on Tuner.

**Step 4** Click the "Transmit On" button on Tuner.

**Step 5** Set the parameters on the Aeroflex 3920 as follows:

- Frq: Be consistent with the TX frequency of the channel to be tested.
- STD IB 511: .153

**Step 6** Observe the "avg" value of "UUT TX Bit Err" parameter in "UUT Measurements" module of Aeroflex 3920, which is the average bit error rate of the tested channel during transmitting.

The radio is operating properly when the Aeroflex 3920 parameters are as follows:

- FSK Error: ≤5%
- Symbol Clock Err: ≤100 Hz
- Signal Power: 3.9 - 4.5W
- Magnitude Error: ≤1%
- UUT TX Bit Err = 0%

**Step 7** Click the “Transmit Off” button on Tuner to finish testing.

## Receiving

**Step 1** Connect the antenna connector of the radio to the RF port of Aeroflex 3920, and set Aeroflex 3920 as follows (remain default values for other parameters):

- Frq: Be consistent with the frequency of the channel to be tested.
- STD IB 511: .153
- Lv1 (signal strength): -116 dBm (-110 dBm by default)

**Step 2** Open the Tuner software and go to “TEST -> RX -> Receiver BER (0.153)”.

**Step 3** Select the channel to be tested and click the “Start” button on Tuner.

**Step 4** Observe the “Average Rate” displayed on Tuner.

You can set different “Average Num” (the calculation base of BER, which is “10” by default) to obtain different “Average Rate”.

**Step 5** Modify the value of “Lv1” parameter of Aeroflex 3920, so as to obtain the average BERs of the tested channel under different signal strengths.

The mobile radio is operating properly when the average BER is less than 5%.



### Note

When the parameter “Lv1” is set to “-110 dBm”, the mobile radio is operating properly when the average BER is less than 1%.

**Step 6** Click the “Stop” button on Tuner to finish testing.



This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

This equipment complies with FCC radiation exposure limits set forth for an controlled environment. This equipment should be installed and operated with minimum distance 100cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment complies with IC RSS-102 radiation exposure limits set forth for an controlled environment. This equipment should be installed and operated with minimum distance 100cm between the radiator and your body.

Cet équipement est conforme aux limites d'exposition aux radiations IC CNR-102 établies pour un environnement contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 440 cm entre le radiateur et votre corps.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) L'appareil ne doit pas produire de brouillage;



(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.