

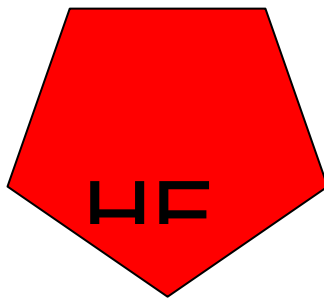
**52-7880LC2B**

**UHF**

**DATA TRANSCEIVERS**

**PLL SYNTHESIZED (EEPROM)**

**Service Manual**



**HERMES ELECTRONICS CO., LTD.**

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**1. SPECIFICATION****GENERAL SPECIFICATIONS**

POWER SOURCE .....	13.80VD.C.
TEMPERATURE RANGE	
STORAGE .....	80°C maximum -40°C min,25°C nominal
OPERATING .....	70°C maximum -20°C min.
ANTENNA IMPEDANCE .....	50 Ω
FREQUENCIES OF OPERATION .....	406-430MHZ,450-470MHZ
FREQUENCY TOLERANCE AND STABILITY .....	±1.5PPM
CHANNEL CAPABILITY .....	1
NOMINAL DIMENSIONS .....	107 mm(L)X 54 mm(W)X 32 mm(H)
WEIGHT .....	101g

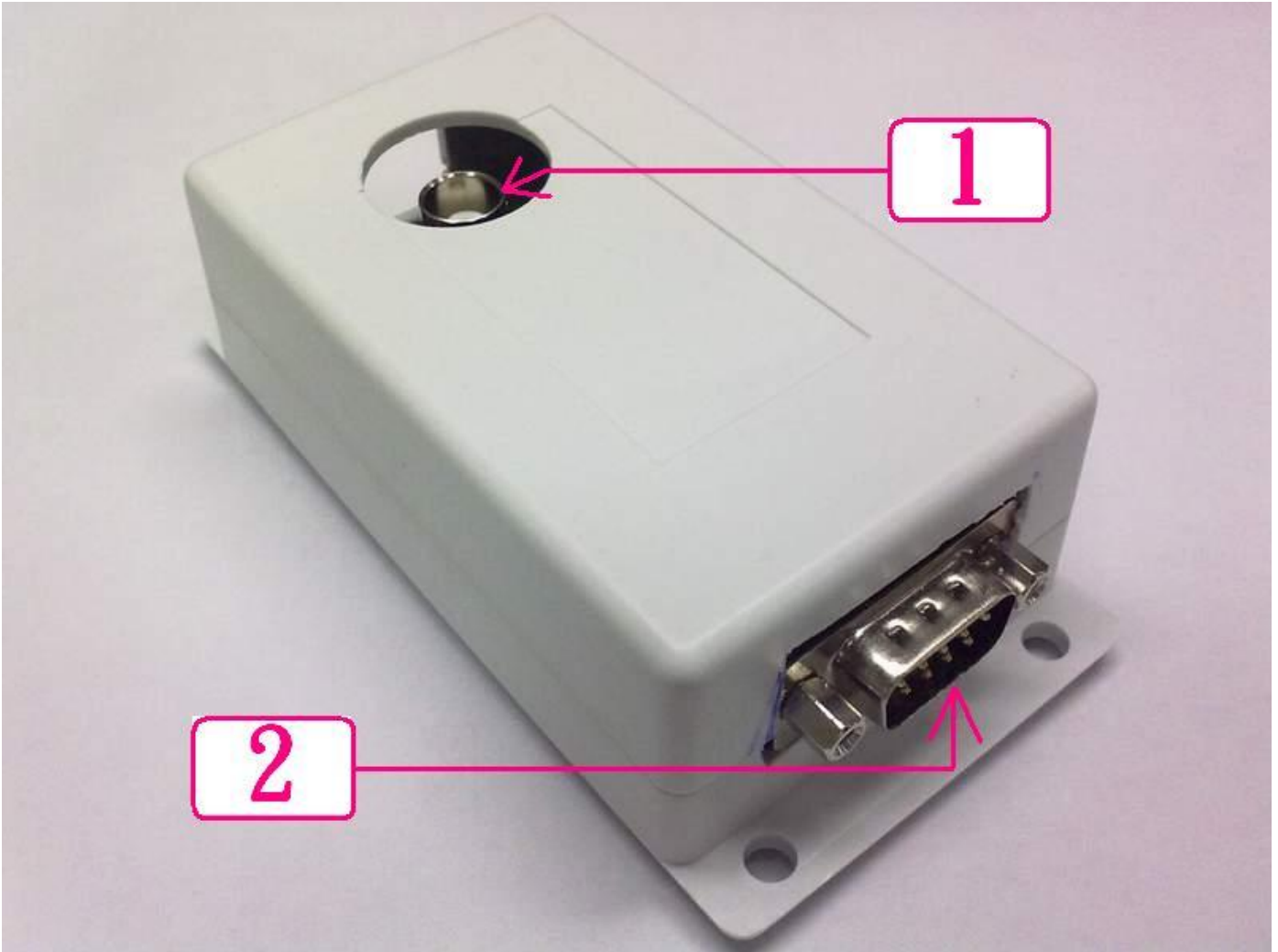
**RADIO DATA TRANSMITTER PERFORMANCE SPECIFICATION**

RF OUTPUT POWER .....	2.5W
MODULATION TYPE .....	FM
CHANNEL SPACING .....	25KHZ/12.5KHZ/6.25KHZ
DEVIATION (25KHZ CH SPACING).....	3.35 KHZ@106mVrms input
MAX. DEVIATION.....	For 12.5 kHz channel spacing, Peak deviation is not greater than 2.5 kHz. .....For 25 kHz channel spacing, Peak deviation is not greater than 5 kHz.
TRANSMIT ATTACK TIME .....	< 25 mS
CURRENT CONSUMPTION .....	1500mA@2.5W

**RADIO DATA RECEIVER PERFORMANCE SPECIFICATION**

SENSITIVITY.....	minimum 12dB SINAD @0.35uV
QUIETING.....	minimum 20dB @0.5uV no modulation
AUDIO POWER OUTPUT.....	250mV~500mVrms @600 ohms load
AUDIO DISTORTION.....	less than 5% @ -47dBm
CARRIER DETECT OFF.....	> -117dBm
CARRIER DETECT ON.....	< -120dBm
HUM AND NOISE.....	45dB
SELECTIVITY.....	70 dB
SPURIOUS RESPONSE.....	70 dB
CURRENT CONSUMPTION .....	60mA

## EXTERNAL CONNECTIONS



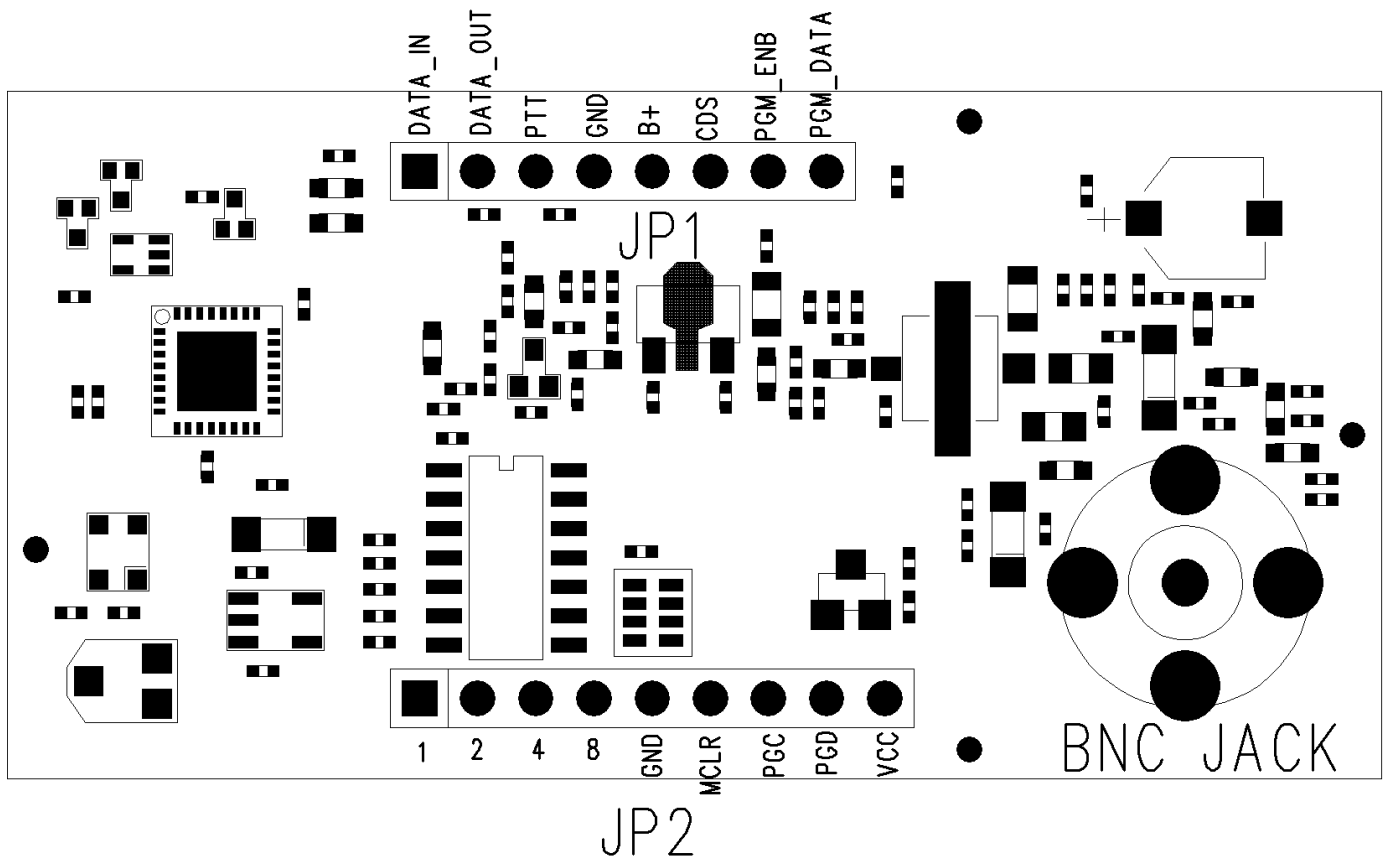
1. - 50Ω BNC SOCKET
2. - 9 WAY " D " TYPE PLUG(J2)

## 2. CONNECTIONS AND OPERATION

### D-TYPE INTERCONNECTIONS

PIN	FUNCTION	TYPE	RANGE	DESCRIPTION
J2-1	DATA_IN	ANALOGUE	106mV	EXTERNAL MODULATION INPUT
J2-2	DATA_OUT	ANALOGUE	250~350mV	RECEIVER AF OUTPUT
J2-3	PTT	INPUT	0V/+5V	TRANSMIT ENABLE
J2-4	GND	GND	0V	GND
J2-5	B+	V+	+13.8V	POWER SUPPLY
J2-6	CDS	OUTPUT	OPEN/SHORT	RF CARRIER DETECT
J2-7	NC			
J2-8	PGM_DATA	INPUT	0V/NC	PROGRAMMER DATA INPUT
J2-9	PGM_ENB	INPUT	0V/5V	PROGRAMMING ENABLE

## U4(52-7880LC2) CONNECTIONS



## CONNECTIONS AND OPERATION

PIN	FUNCTION	TYPE	RANGE	DESCRIPTION
JP1-1	DATA_IN	ANALOGUE	106mV	EXTERNAL MODULATION INPUT
JP1-2	DATA_OUT	ANALOGUE	250~350mV	RECEIVER AF OUTPUT
JP1-3	PTT	INPUT	0V/+3.3V	TRANSMIT ENABLE
JP1-4	GND	GND	0V	GND
JP1-5	B+	V+	+6.0V	POWER SUPPLY
JP1-6	CDS	OUTPUT	OPEN/SHORT	RF CARRIER DETECT
JP1-7	PGM_ENB	INPUT	0V/3.3V	PROGRAMMING ENABLE
JP1-8	PGM_DATA	INPUT	0V/NC	PROGRAMMER DATA INPUT
JP1-9				

PIN	FUNCTION	TYPE	RANGE	DESCRIPTION
JP2-1	Channel 1	DIGITAL	0V/+3.3V	Channel select pin
JP2-2	Channel 2	DIGITAL	0V/+3.3V	Channel select pin
JP2-3	Channel 4	DIGITAL	0V/+3.3V	Channel select pin
JP2-4	Channel 8	DIGITAL	0V/+3.3V	Channel select pin
JP2-5	GND	GND	0V	GND
JP2-6	MCLR	I	0V/+3.3V	Programming MCU software
JP2-7	PGC	I/O	0V/3.3V	Programming MCU software
JP2-8	PGD	I/O	0V/+3.3V	Programming MCU software
JP2-9	VCC	3.3V	3.3V	VCC

## **3. CIRCUIT DESCRIPTION**

### **TRANSMITTER**

The transmitter is comprised of:

- Audio frequency connections from JP1 pin 1
- Frequency Synthesizer
- Transmitter

### **Audio frequency connections**

In the TX path , audio signal can be send into the chip RDA1846 through AC coupling capacitors.

### **Frequency synthesizer circuit**

With data received from the EEPROM (U3) the frequency synthesizer circuit controls and Produces the RF carrier frequency for the transmitter during transmit and the local oscillator frequency for the receiver. The frequency synthesizer circuit is comprised of:

#### **Synthesizer**

The U1 (RDA1846) generates the local oscillator and transmitter signal . all building blocks are fully integrated without any external components. Frequency can be programmed through the serial interface by the MCU (U3)

#### **26 MHZ TCXO**

X1 is VCTCXO, which provide stable oscillator of 26 MHZ to U1.

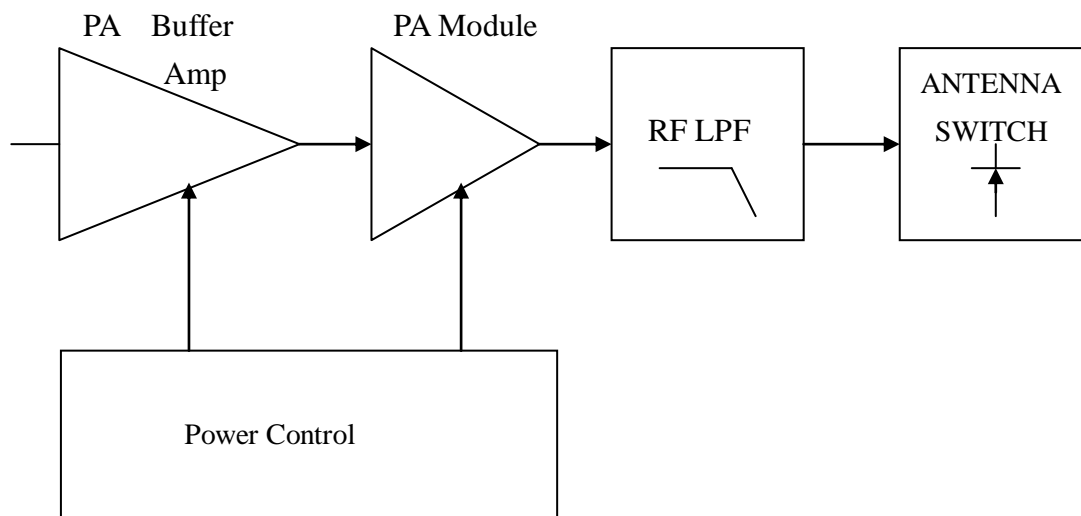
Frequency adjustment is provided by VR1.

#### **DC REGULATOR**

The DC Regulator U4, converts the +6.0 V to a 3.3 V supply . This is used to provide the MCU and U1.

## Transmitter

The transmitter comprises:



### Buffer

When the radio is in transmit mode the U1 is generated RF signal pass to the buffer/pre-amplifier Q1 and Q2 associated components.

### PA module

The Q2 output signal is passed to Q3 via a matching network consisting of Inductor L5 , L15 and C32 and C34. Q3 is power amplifier .

### Low pass filter

The amplified RF signal is passed through the stripline coupler and is fed to the harmonic low pass filter, comprising L11, L12, L17 and C46 , C47, C48 and C58 and then to the antenna connector (J1).

### Antenna Switch

When transmitting, the diodes D3 are forward biased, the RF pass to the antenna. D4 is shorted to ground which makes L13 look open circuit (1/4 wave tuned stub). This prevents the TX signal from passing to the receiver stage.

## **Receiver**

The receiver comprises:

### **Antenna Switch**

In receive, the diode D4 are reverse biased. L212 is now in circuit, passing the signal from the antenna to the U1 LNA input.

. In the RX path , the voice signal after demodulation is sent to the internal DAC which can directly drive a 32 ohm resistance loading through AC coupling.

### **Carrier Detect**

A Carrier Detect ( MUTE DETECT ) output is available on pin 6 of JP1 .

When noise is present, the voltage at pin 26 of U1 is LOW. The squelch trigger output is open, It's make pin 6 of JP1 open state.

When no noise is present, the voltage at pin 26 of U1 is HI voltage.  
This make pin 6 of JP1 short state.

## **Microcontroller**

The PIC16F630 microcontroller IC controls the programmable features and frequency synthesizer Data.

### **Programming Mode**

The programming mode allows the user to retrieve or program TX/RX frequencies, when pin 9 of J1 is set to ground. Programming mode will Inhibit , Serial communications can then be made in order to read/program the on- board EEPROM ( U3 )which contains radio- specific data.

### **EEPROM**

Relevant channel information, such as Rx/ Tx frequencies, is stored in the EEPROM( U3) which is built in PIC16F630. This information may be programmed and erased via the test fixture. The EEPROM has 1024 (8x128) capacity and is written serially.

### **Power supply circuit**

The data radio is supplied with a nominal + 6.0V dc power supply input from external equipment which is filtered using C56. This supply is converted into 3.3V voltage levels on the board using the regulator U4 and associated components . This +3.3V line is fed to the CPU circuit.



## 4. PERFORMANCE TEST AND ALIGNMENT

The alignment and performance test procedures assume the use of the following equipment.

### **Discrete test equipment**

Volt Meter

RF Power Meter.

DC Power Supply, 0-15V 2A min

Oscilloscope, 20 MHz dual beam

RF Frequency Counter,

100 kHz - 600 MHz

AF Signal Generator 0 – 20 kHz

RF Signal Generator

SINAD Meter

Modulation Meter

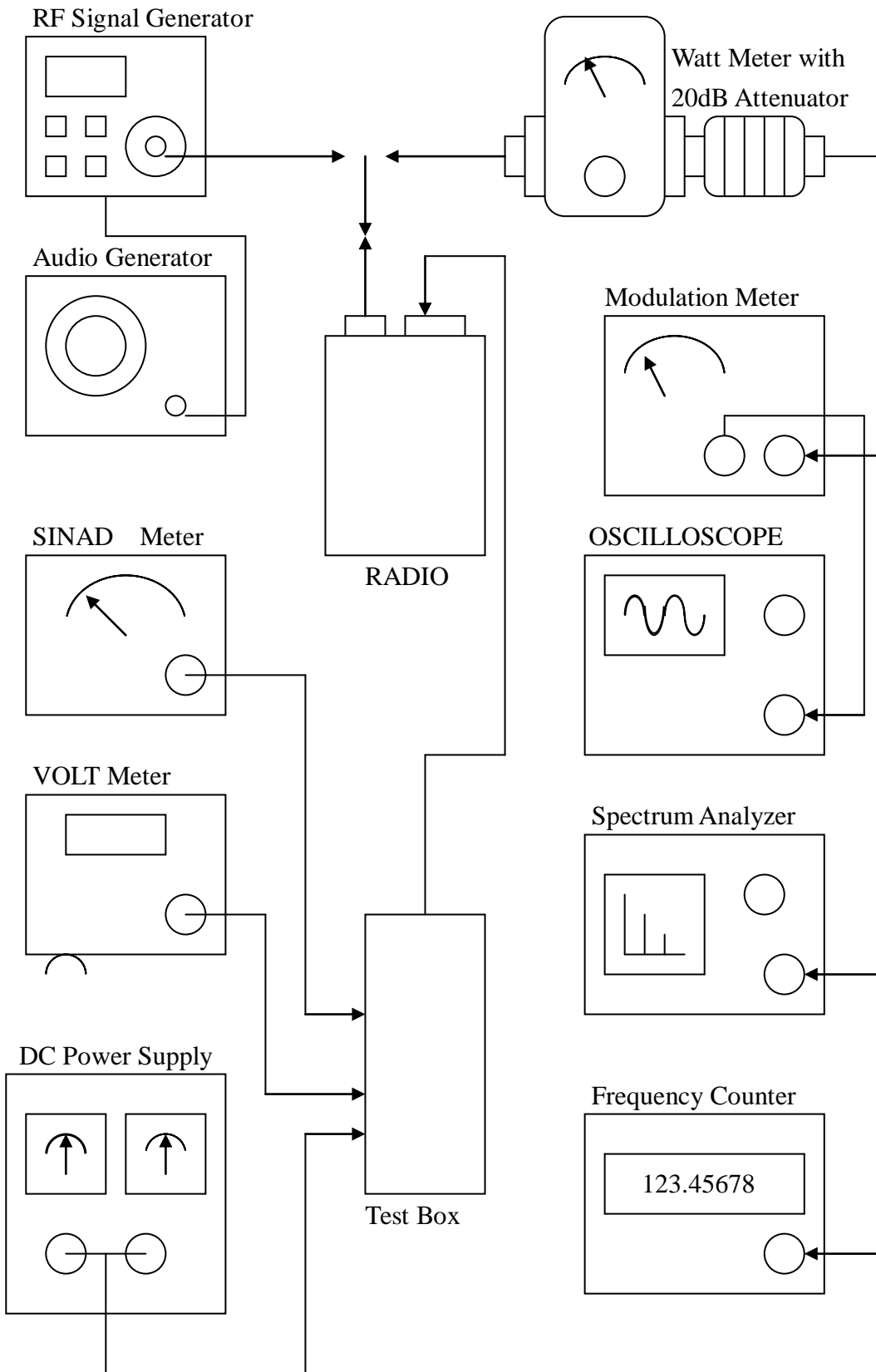
Audio Power Meter

Spectrum Analyser and notch filter(option)

Coupler (20dB isolation)

Distortion Meter

# 5. TEST EQUIPMENT CONFIGURATION.



Test Equipment Configuration

## **6. TRANSMITTER PERFORMANCE TESTS**

### **Power Output**

1. Set the power supply voltage to 6.0V dc. and monitor the voltage during transmit.
2. Switch data radio TX and check and record the output power. The nominal output power is adjustable between 2 to 3W .
3. Set the PTT switch to OFF .

### **Peak Deviation**

1. Connect the oscilloscope to the output of the modulation meter.
2. Set the AF signal generator to 1000 Hz at 106mV and connect to DATA\_IN Line ( pin 1 of JP1 )
3. Switch data radio to TX and observe the oscilloscope display to check that the 1000Hz tone is a sine wave and deviation is about 3.5KHZ.
4. Using the AF signal generator, sweep from 100 Hz to 3 kHz and record the peak deviation.
5. Check the peak deviation for appropriate channel spacing as follows :  
For 12.5 kHz channel spacing, Peak deviation is not greater than 2.5 kHz.  
For 20 kHz channel spacing, Peak deviation is not greater than 4 kHz.  
For 25 kHz channel spacing, Peak deviation is not greater than 5 kHz.

### **Spectrum Test**

It may be necessary to notch the fundamental signal during this test.

1. Connect a spectrum analyser and RF power meter to the antenna socket.
2. Switch data radio to TX. Observe the output spectrum on the spectrum analyser.
3. Adjust notch filter to minimise the carrier. All spurious and harmonics signals should be below- 36 dBm up to 1 GHz and below -30 dBm between 1 and 4 GHz.
4. Switch off the data radio transmit control.

### **Receiver Performance Tests**

#### **Sensitivity**

The SINAD performance test may be used to test the sensitivity of the receiver.

1. Connect the RF signal generator to the data radio BNC antenna connector.
2. Set the RF signal generator to the receive frequency .
3. Connect the leads of the SINAD meter between 0 V and pin 2 on JP1.
4. Set the deviation to 60% of the peak system deviation.
5. Set the AF generator to 1 kHz.
6. Adjust the RF signal generator level until the SINAD Meter reads 12 dB.
7. Check that the signal generator RF level is less than 0.35uV pd (-116dBm ).

## **Transmitter Alignment**

### **Automatic Power Adjustment**

Transmit periods longer than 3 minutes are to be avoided.

1. Switch to data radio to TX.
2. make the transmit power between 2 to 3W.
3. Switch the data radio to transmitter OFF.

### **Frequency accuracy**

1. Whilst transmitting, measure the transmit frequency using the RF frequency counter.
2. Adjust VR1 so that frequency is as close as possible to the exact required transmit frequency. Ideally it should be within 100 Hz at room temperature.

### **Receiver Alignment**

**Important note :** Before setting up the receiver it is important to check the frequency accuracy alignment is correct as described in the transmitter alignment section.

### **RF tuning**

1. Connect an RF signal generator and SINAD voltmeter.
2. Set the RF signal generator to the receive channel frequency and set to 60% deviation.
3. Set the AF signal to 1 kHz.
4. Set the RF level to 1 mV pd (- 47.0 dBm )
5. Check pin2 of JP1 maximum AF output about 250mVto 350mV and lowest distortion, the distortion normally less than 5% .
6. Check for an RF voltage signal level of 0.35uV pd (- 116dBm)and a SINAD meter Reading greater than 12 dB.

### **Squelch/Carrier Detect Adjustment**

1. Set the RF signal generator to the receiver frequency with 60% deviation. Set the AF Signal to 1 kHz
2. Set RF input level to give -112 dBm.
3. Check pin 6 of JP1 changes state from “HIGH” to “LOW”.
4. Reduce RF input level to -120dBm and check that CDS line goes HIGH . Switch off the RF generator and disconnect the test equipment.

## **Modulation Deviation Adjustment**

1. Connect a power meter, modulation meter and oscilloscope to radio.
2. The radio should be programmed to contain a channel with a frequency in the middle the band of interest with an RF power setting of 2 W.
3. Switch the data radio ON.
4. Inject a 106mVrms SINE wave signal at a frequency of 1000Hz into pin 1 of JP1, Set the data radio to TX Observe the oscilloscope display to check that the 1000Hz tone is a sine wave and set deviation is 3.5KHZ.
5. Using the AF signal generator, sweep from 100 Hz to 3 kHz and record the peak deviation.

Check the peak deviation for appropriate channel spacing as follows :

12.5 kHz channel spacing  $\leq$  2.5 kHz dev

20 kHz channel spacing  $\leq$  4 kHz dev

25 kHz channel spacing  $\leq$  5 kHz dev

6. Switch to RX.

## 7. PARTS LIST

U4(52-7880LC2)

Revision:

Bill Of Materials

January 19, 2011

15:53:17

Item	Quantity	Reference	Part
1	12	C1,C8,C13,C15,C16,C17, C18,C24,C25,C28,C35,C44	470P
2	9	C2,C6,C7,C33,C37,C53,C54, C56,C63	102P
3	6	C3,C31,C34,C43,C51,C62	5P
4	2	C4,C5	104P/X7R/0603
5	4	C9,C11,C12,C61	104P
6	1	C14	47P
7	3	C22,C46,C48	10P
8	1	C23	33P
9	3	C26,C32,C57	22P
10	2	C27,C47	15P
11	2	C36,C52	NU
12	2	C38,C45	100P
13	1	C41	103P
14	1	C42	9P
15	1	C55	47U/16V/EC/SMT

U4(52-7880LC2)

Revision:

Bill Of Materials

January 19, 2011

15:53:17

Item	Quantity	Reference	Part
16	1	C58	6P
17	1	D1	RLS4148
18	2	D3,D4	RLS135
19	1	J1	BNC
20	1	JP1	PCB PLUG 8PIN/2.54mm
21	1	JP2	PCB PLUG 9PIN/2.54mm
22	1	L1	12NH/CHIP
23	2	L2,L13	27NH/CHIP
24	1	L3	6.8NH/CHIP
25	2	L4,L6	22NH/COIL/0805

Item	Quantity	Reference	Part
26	2	L5,L15	5.6NH/CHIP
27	2	L7,L14	4.7NH/COIL/0603
28	1	L8	220NH/CHIP/0603
29	2	L11,L12	12NH/COIL/0603
30	1	L17	18NH/COIL/0603
31	1	Q1	HSC5262
32	1	Q2	RQA0004PXDQS
33	1	Q3	2SK3476
34	1	Q4	DTC114EE
35	1	Q7	UMC4N
36	6	R1 ,R4,R15,R21 ,R24,R27	10K
37	4	R2,R3,R5,R16	2K7
38	1	R13	330R
39	1	R17	220R
40	2	R18,R23	18K
41	3	R22,R25,R26	100R



U4(52-7880LC2)

Revision:

Bill Of Materials

January 19, 2011

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Item	Quantity	Reference	Part
42	1	R28	470K
43	1	RP1	10K*4 SMT
44	1	U1	RDA1846
45	1	U2	ELM7S32
46	1	U3	PIC16F630/SOIC/SMT
47	1	U4	UTC UR132L-3.3V-3
48	1	VR1	47KB/SMT
49	1	X1	26MHZ/TCXO
50	1	SHIELD	

52-7880LC2B BASE\_BOARD partlist

C1 C3	CAP7343	CAPACITOR TANT 10UF 25V 20%
C2	CAP	CAP0805 CERM .1UF 10% 50V X7R
D1 D2	DIODE_SMB_400V	RECTIFIER GPP 400V 1A SMB
D3 D4	DIODE-SOD80	DIODE SWITCH 100V 150MA
F1	FUSE_PTC_THROUGHH	PTC FUSE - THROUGH HOLE
	OLE	
J2	DB9_HORIZ_MALE	---
R2 R3	RES0603	0603 SURFACE MOUNT RESISTOR
U1	7806-TO220_HORIZONT	POSITIVE VOLTAGE REGULATOR; FIXED +12.0
	AL	VOLTS 1A
U4	HERMES_RDA1846	---

## **8. PROGRAMMER INSTRUCTION**

Welcome to PC Programmer.

Please Read this file, before you first use the software.

### TABLE OF CONTENTS

1. Brief introduction
2. Before Installing
3. Install PC Programmer
4. INSTRUCTIONS
5. UnInstall PC Programmer

1. Brief introduction

Welcome to PC Programmer. This program is designed to be used with the Interface Adapter.

The following equipment will be needed to program the Device:

- A. A computer to install this program with at least 2 MB available space in hard disk and a 9-pin male RS-232 serial port.
- B. Win 95, Win 98, Win ME or Win 2000 Operation System.
- C. Part of the Programming Kit
  - 1) An interface Adapter.
  - 2) A CD disk with the program, PC Programmer files

2. Before Installing

Before You Run Setup, make sure that your computer meets the minimum requirements mentioned above, and read the Readme file(this file).

NOTE: If you firstly install PC Programmer in you system, the setup may update some system files on your computer , so you may run the setup again after your system be updated. Please follow the installation instruction on the screen.

3. Install

TO install PC Programmer on your computer

- 1) Insert the CD.
- 2) Run Setup.exe
- 3) Follow the installation instruction on the screen.

Important: You cannot simply copy files from the CD to your hard disk and run PC Programmer . You must use the Setup program, which decompresses and installs the files in the appropriate directories.

## 4. INSTRUCTIONS

### 4.1 Connection

### 4.2 Start up PC Programmer

### 4.3 Edit Configuration

#### 4.3.1 Open/Recall/Upload Configuration file

#### 4.3.2 Edit Channel data

#### 4.3.3 Set Option item

#### 4.3.4 (Block)Cut/Copy/Delete/Paste

#### 4.3.5 Auto-Frequency edit

#### 4.3.6 Save a Configuration to disk

#### 4.3.7 Download Configuration to device

#### 4.3.8 Print a Configuration

### 4.4 Exit PC Programmer

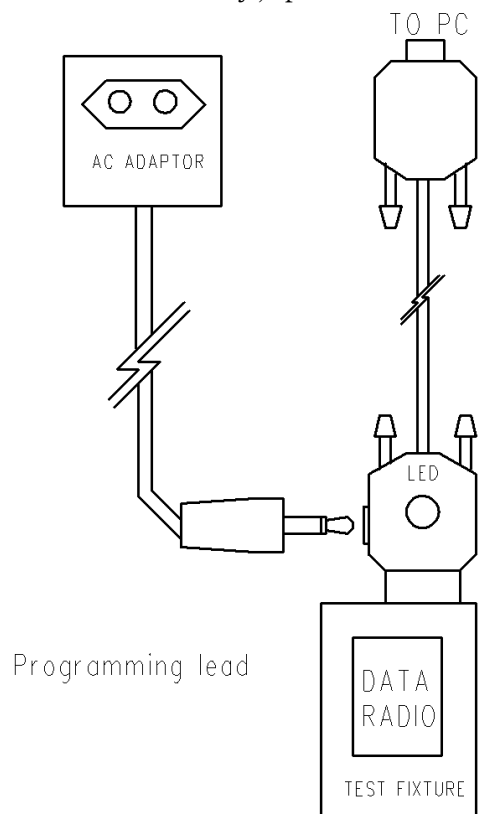
### 4.1 Connection

1. Connect one side of Interface Adapter to the computer's serial port.

Never care the port number, the PC Programmer will locate it automatically.

2. Connect the other side of Interface Adapter to the Device's 9-pin male RS-232 port.

3. Connect power supply to device and LED will be light. The device will into PC\_programming mode automatically, please see the picture of below.



PC CONNECTION INSTRUCTION

## 4.2 Start up PC Programmer

1. Select 'Start', choose 'Programs', click on the '\*\*\* Serial PC Programmer' program.
2. When HD Serial PC Programmer is started, a main form will be shown after a greeting form.
3. There has a menu bar at the top of the main form, and a message box at the bottom.

NOTE: The program is menu driven for all pertinent commands. All the commands can be accessed by either key board or the left mouse button.

Access keys mainly used are:

'Tab' or 'Arrow' to move focus(or cursor)

'Enter' to active a focused command

## 4.3 Edit Configuration

### 4.3.1 Open/Upload Configuration file

To edit the configuration, please either

1) Recall an Existing Configuration by click on the 'Open' item in the File Menu, select the configuration file by click on or input its name then press 'Enter' key.

OR 2) Upload configuration data from a device by click on 'Upload' item in the Device menu. to a Configuration window .

Different Model's device Configuration can be opened and edited.

There are two fields in each Configuration window: system data and Channel data.

OR 3) Open an existing Configuration by click on the 'OPEN' item in the File Menu. A pop up window will be shown, select a file by arrow key or mouse then click 'OK'.

### 4.3.2 Edit Channel data

1) Set focus to the Channel data field by move the mouse pointer.

2) Select a particular channel number to be edited by either the arrow key or click on it.

3) Pop up input window by either press 'Enter' key or double click on the selected channel number.

4) Use computer's cursor keys, Tab key, Enter key, arrow key or mouse to renew the channel data.

5) Click 'OK' button on the input window to accept the change or 'Cancel' to not change, and return back to Configuration Window.

#### 4.3.3 Edit Option item

- 1) To Edit Channel Option, Select a particular channel number in the Option View Window by either the arrow key or click on it, then Pop up the input window for Channel Option, 'Enter' key or double click on the selected channel number.
- 2) To Edit System Option, Pop up input window for System Option, click "SYSTEM" in the 'OPTION' menu.
- 3) To Edit Advanced Option, Pop up input window for Advanced Option, click "ADVANCED OPTION" in the 'OPTION' menu.
- 4) Use computer's cursor keys, Tab key, Enter key, arrow key or mouse to renew the Option Item.
- 5) Click 'OK' button on the input window to accept the change or 'CANCEL' to not change, and return back to Configuration Window.

#### 4.3.4 (Block)Cut/Copy/Delete/Paste

To select a block of channel data as source by either

- 1) Select start channel by arrow key, then while press 'Shift' key select end channel number by arrow key.
  - 2) Click on start channel, then while press 'Shift' key click on end channel number
  - 3) Press the left mouse button on start channel then move the mouse until reach the end channel number, release left mouse button.
- A) To Cut selected (block) Channel(s) either press 'Ctrl'+ 'X' or click 'CUT' item in Edit menu.
- B) To Copy selected (block) Channel(s) either press 'Ctrl'+ 'C' or click 'COPY' item in Edit menu.
- C) To Delete selected (block) Channel(s) either press 'Del(Delete)' key or click on 'DELETE' item in Edit menu.
- After Cut or Copy, the data can be pasted to where you want.
- D) To Paste , select a channel as the start number of target , then either press 'Ctrl'+ 'V' or click on 'PASTE' item in Edit menu.

NOTE: Paste operation allows you to export data to any Configuration window opened.

#### 4.3.5 Auto-Frequency edit

This feature provide you with a quick Frequency set function.

To use this command after either

- 1) Click 'EDIT' Menu
- 2) Click on 'AUTOFREQ' item in 'EDIT' menu to pop up a input window.
- 3) Use computer's cursor keys, Tab key, Enter key, arrow key or mouse to set data.

4)Click 'OK' button on the input window to accept the change or 'CANCEL' to not change, and return back to Configuration Window.

#### 4.3.6 Save a Configuration to disk

1)Different configuration can be saved to disk.

2)Click on 'SAVE' item in 'FILE' Menu will overwrite an existing configuration file on your disk by current configuration.

3)Select 'SAVE AS' from 'FILE' Menu will save the current configuration by a name as you prefer.

#### 4.3.7 Download to device

To Download current Configuration to device, select 'DOWNLOAD' from sub menu under 'DEVICE' menu.

#### 4.3.8 Print a Configuration

Click on 'PRINT' item in 'FILE' Menu will send current Configuration to printer.

#### 4.4 Exit PC Programmer

To Exit PC Programmer,click on 'EXIT' item in 'FILE' Menu.

#### 5. UnInstall PC Programmer

To uninstall PC Programmer from your hard disk, select 'Start' , choose 'Settings', click on the 'Control Panel', then find 'Add/Remove Programs' icon from the pop up window then double click on it, then find '\*\*\* Serial PC Programmer' from application list and click on it, then click on 'Add/Remove' button under application list, then follow the instructions on your screen.

## **Federal Communication Commission Interference Statement**

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 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.

***FCC Caution:*** To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. (Example - use only shielded interface cables when connecting to computer or peripheral devices).

This device complies with Part 15 of the FCC Rules and IC RSS-119. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation

The antenna of the product, under normal use condition is at least 0.52 m away from the body of the user. Warning statement to the user for keeping at least 0.52 m separation distance and the prohibition of operating to a person has been printed on the user's manual. So, this product under normal use is located on electromagnetic far field between the human body.