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## **DARTCOM 136-138 MHz SYNTHESIZED SATELLITE RECEIVER**

This receiver is specifically designed to receive APT (Automatic Picture Transmission) signals from NOAA and other orbiting weather satellites transmitting in the 136 to 138 MHz band. It also functions as an IF (Intermediate Frequency) receiver when used in conjunction with a down converter, for the reception of geostationary weather satellite transmission in the 1.69 GHz (SHF) band.

The receiver is a double superhet design with a 1st IF of 10.7 MHz using four cascaded ceramic filters to provide an IF bandwidth of 50 KHz, and a second IF of 455 KHz. The RF amplifier and first mixer use low noise BF981 dual gate MOSFET's with an SL6601 second mixer, IF, and demodulator. This is followed by active high and low pass filters to provide an optimum AF bandwidth for reception of APT signals.

The synthesizer can provide 10 KHz steps between 136 and 138 MHz. Full computer control of the receiver frequency and mode is provided giving the user the choice of either pre-programmed channels for A.P.T. or user programmable frequencies/modes/scan via the microcontroller interface unit. In addition, the receiver features an automatic frequency control function which is normally enabled on SHF.

A one watt AF output stage provides audio to drive a 8 ohm loudspeaker with an additional low level AF output for driving a cassette recorder. A further AF output is provided to drive the microcontrolled interface unit which is internally fitted inside the receiver.

An optional wideband IF/demodulator is available for countries served by the GMS geostationary satellite.

### **MICROCONTROLLED INTERFACE UNIT**

This "State of the Art" unit features an 8 bit 20 MHz microcontroller which provides control of the receiver frequency and modes, together with image acquisition using Digital Signal Processing (D.S.P.) techniques and is housed inside the receiver.

The unit features battery backed up RAM together with EPROM, and RS232 serial interface to the IBM compatible 286/386/486 based computer, or laptop/notebook compatible.

The analogue signals from the receiver or tape recorder are filtered, demodulated

and sampled under control of the microcontroller by an 8 bit Analogue to Digital converter. The synchronous clock is also recovered from the signal, negating the effects of doppler shift on live signals and tape speed variations on recorded signals. Frame or line synchronisation signals are detected by the microcontroller using D.S.P. techniques.

The image and microcontroller status data are the sent to the serial port **COM1 ONLY** of the IBM compatible 286/386/486 based computer as an RS 232 serial data stream.

Commands to the microcontroller/receiver are also sent via the serial port (**COM1**) from the IBM compatible 286/386/486 based computer or laptop/notebook compatible at 57.6 Kbits.

Future upgrades of microcontroller software can be "uploaded" via the serial port and can be stored and executed from the battery backed up RAM.

#### **RECEIVER FEATURES**

1. Full computer control of modes/frequencies/scan.
2. Fully adjustable squelch.
3. Low level AF output (approximately 80mv RMS at 17 KHz deviation), for driving a cassette recorder.
4. Cassette play back input. (Facilities socket).
5. Remote control of cassette recorder motor by a volts free c/o contact of a relay, which is in turn controlled by the receiver squelch.
6. Built in S-meter to indicate received signal strength.
7. Remote S-meter output. (10v FSD meter required).
8. DC feed to signal feeder cables to provide power for the mast head pre-amplifier or down converter.
9. LED bar display indicating selected mode.
10. LCD digital frequency readout.

11. Separate N-type sockets for SHF/VHF.
12. Selection of A.P.T. signal - either tape input or from receiver.

## INSTALLATION

The receiver is supplied complete with a mains lead and a DIN terminated lead for tape recorder input/output/control.

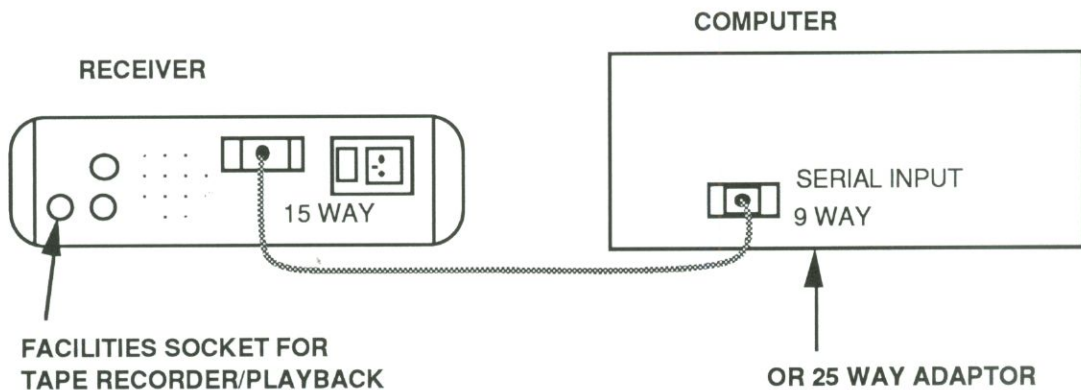
Connect a suitable mains plug onto the lead supplied.

OBSERVE THE COLOUR CODE PRINTED ON THE LABEL ATTACHED TO THE CABLE :-

BROWN= LIVE  
 BLUE= NEUTRAL  
 GREEN/YELLOW= EARTH

ENSURE THAT THE FUSE FITTED TO THE PLUG IS RATED AT 3 AMPS.  
 IF YOU HAVE ANY DOUBTS REGARDING CONNECTION OF THIS PLUG CONSULT  
 A QUALIFIED ELECTRICIAN.

Select a suitable location for the receiver. Normally this will be near to, but not directly on top of the computer. Connect the coaxial cables from the VHF aerial and SHF down-converter to the appropriate N-type sockets on the back panel of the receiver. Plug the 15 way connector into the INTERFACE INPUT on the rear of the receiver and secure with locking screws. Finally connect the 9 way connector to your computer serial port **COM1 only** and secure with locking screws.



The DIN connector can be plugged into the facilities socket if connection to a cassette recorder is required. The cable is coded as follows:-

EAR cassette recorder AF. output (Ext LS)  
MIC MIC output (record input)  
REM motor control (REM input)

Finally plug the mains cable into the socket on the rear of the receiver and connect to the main supply.

## **DESCRIPTION OF CONTROL FUNCTIONS**

### **POWER**

The ON-OFF mains switch is incorporated in the power socket on the rear of the receiver.

### **VOLUME**

Controls the level of audio from the loudspeaker, used to monitor transmissions in progress. The setting of this control does not affect the other output levels.

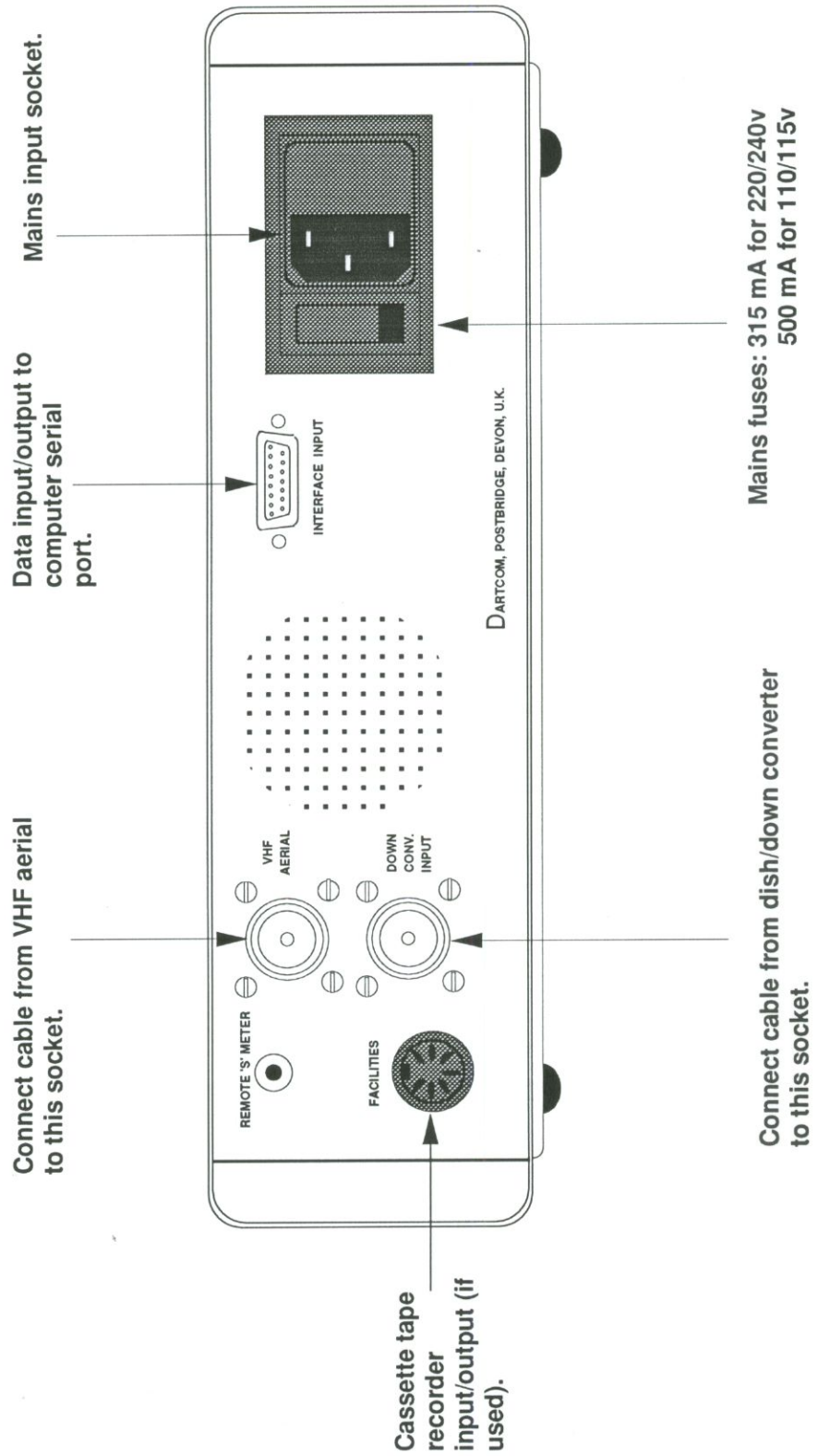
### **SQUELCH**

Controls the signal level at which the receiver will activate and is normally adjusted until the noise just disappears from the loudspeaker under no-signal conditions. The relay to control the remote control facility found on most cassette recorders is controlled by the squelch, and is held energised for approximately 5 seconds after squelch closure. This remote control feature allows for unattended recording of satellite passes and is particularly useful when the system is required to view transmissions such as the overnight passes of the orbiting series of Russian and American meteorological satellites.

### **TAPE LEVEL OUTPUT**

Most cassette recorders have automatic level controls built into them (ALC). This is a form of audio compression which tends to provide a constant volume level. Since APT signals from weather satellites work on the basis that the 2400 Hz sub-carrier gets louder for a "whiter" picture, and quieter for a "blacker" picture, any form of compression will result in a poor contrast range of taped signals. The tape output level control enables the correct level to be supplied to your cassette recorder, and should be set to provide AF drive which is just below the recorder's

# SATELLITE RECEIVER - BACK VIEW



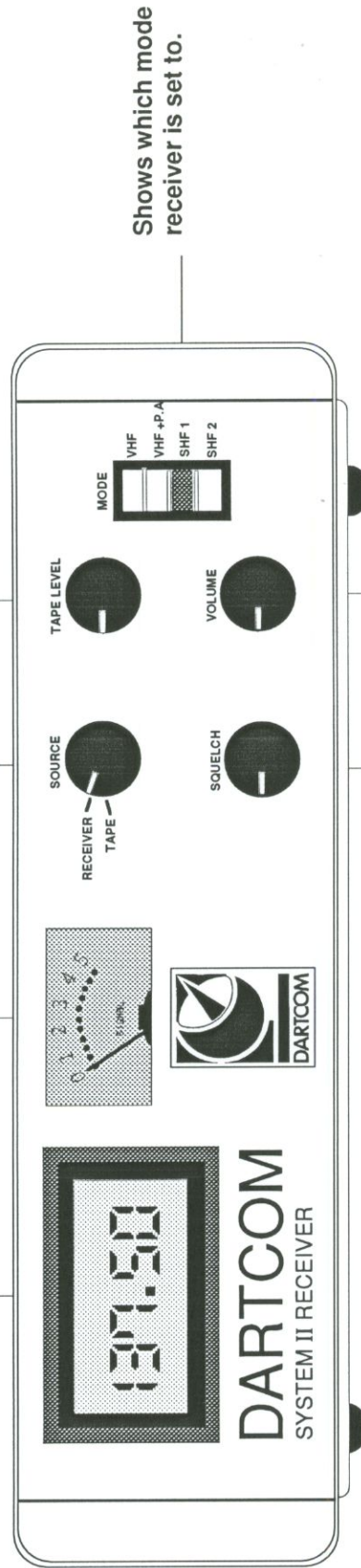
# SATELLITE RECEIVER - FRONT VIEW

Selects signal source - normally left on receiver.

LCD display shows frequency receiver is tuned too.

Shows strength of incoming signal.

Adjusts level of signal to cassette recorder mic input.



Adjusts level of sound on loudspeaker.

Adjusts squelch control on VHF or VHF + PA till background noise just disappears when receiving no signal.

compression threshold. This is a matter of trial and error.

## **SIGNAL STRENGTH METER**

Indicates the relative strength of the signal being received from the spacecraft.

## **REAR PANEL CONNECTIONS**

- a) Mains socket with integral switch and fuse.
- b) Remote S-meter 3.5mm jack socket.
- c) VHF aerial N-type socket.
- d) DOWN-CONVERTER N-type socket.
- e) 7 pin DIN socket for tape recorder output/input/control.
- f) Interface input - Control and Image data too and from computer.

## **ADJUSTMENTS**

COMPONENTS ON THE RECEIVER BOARD CARRY POTENTIALLY LETHAL MAINS VOLTAGES. NEVER OPEN THE RECEIVER CASE WITHOUT ENSURING THAT THE MAINS LEAD IS DISCONNECTED FROM THE SUPPLY.

The receiver has been fully aligned and tested for maximum performance and will not require any adjustments. DO NOT ATTEMPT TO MAKE ANY ADJUSTMENT OTHER THAN THOSE DETAILED BELOW UNLESS YOU HAVE ACCESS TO SUITABLE TEST EQUIPMENT AND A THOROUGH KNOWLEDGE OF RF TECHNIQUES. ANY SUCH ADJUSTMENTS WILL INVALIDATE THE GUARANTEE.

## **USING THE RECEIVER**

The volume control is set for personal preference and the squelch control is set as outlined in the section "SQUELCH". Again, once set this will not normally need adjustment.

## **SETTING MODES AND FREQUENCIES**

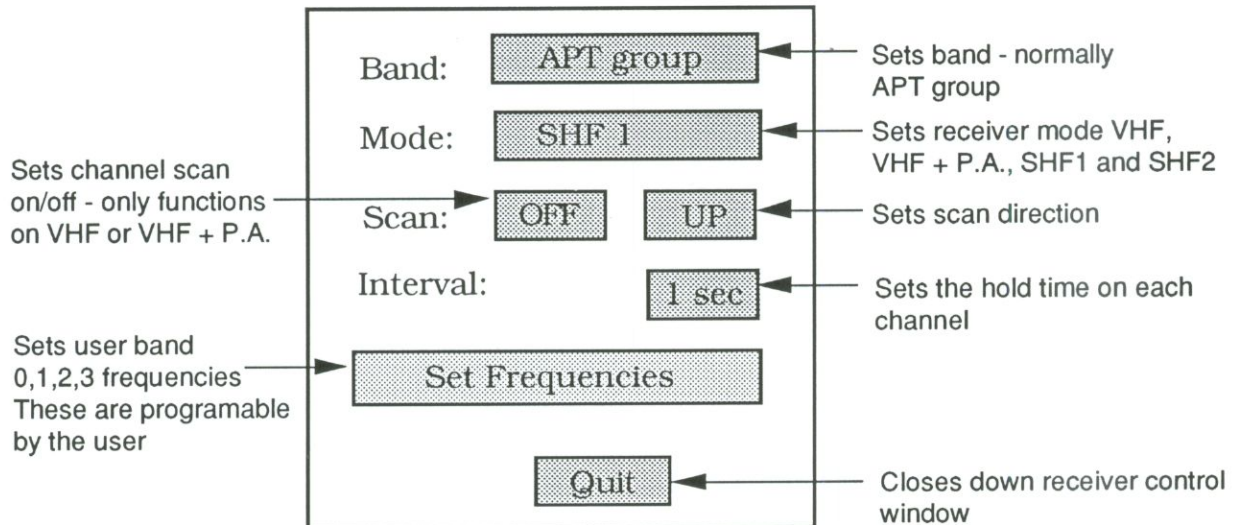
### **MANUAL CONTROL**

Setting the modes and frequencies and programming specific user bands is done by It is assumed that you have already installed your system software on this computer.

1. From the main menu select GET IMAGE.



2. Now select the satellite you would like to receive.
3. You will notice an  box appear over the palette bar on the left hand side of the screen. Click on this  box with the mouse.
4. A receiver control window will now appear on screen as shown below:-



5. Move the mouse into the mode box and click on it several times - you will see the four modes change on the receiver LED bar display - SHFI, VHF + P.A. SHF2, VHF (no P.A.). Details of the various modes are as follows:-

- SHFI** Used for reception of METEOSAT channel 1 or other geostationary satellites, GOES, GMS, etc. This is the main channel used for reception of weather satellite APT/WEFAX images by the system.
- VHF + P.A.** Used for reception of Polar orbiters on VHF such as NOAA and Russian METEOR series. Use this mode if you have a VHF Pre-Amp installed with your system. (P.A. means Pre-Amp.)
- SHF2** Used for the reception of METEOSAT CHANNEL 2 **only**. This channel contains a few APT/WEFAX transmissions - whole earth disks in Visible, Infra-red, and Water Vapour spectrums. This channel is used mostly for digital transmissions which are not receivable with your DARTCOM system.
- VHF(no P.A.)** Used for reception of Polar Orbiters on VHF such as NOAA and Russian METEOR series. Use this mode if you don't have a VHF Pre

amp installed with your system.

Let's select the VHF mode - click on the mode box till you see VHF (no P.A.)

6. Now we will select the various bands available on the receiver. Move your mouse to point and click on the band box. Each time you click the mouse you will see the band change - and notice also that the frequencies on the LCD display on the receiver will also change. The bands available are as follows:

**APT GROUP** This is your main band containing all the currently used frequencies of the NOAA and Russian polar orbiter satellites.

**BEACONS GROUP** This contains the Beacon frequencies used by the NOAA satellites. These are not receivable with your DARTCOM system but are provided for future developments.

**DOWNLINKS GROUP** This contains all known frequencies used by spacecraft in the weather satellite band. (Provided for those interested in listening and observing other satellites not transmitting weather pictures.)

**136-138 MHz GROUP** This contains every channel available in the band so that you can always receive a new satellite if it is on a new frequency not covered by the APT group.

**USER BAND 0 ]** These are pre-selected to enable you to program and store your own set of frequencies. For example, you might want to program User  
**USER BAND 1 ]** Band 0 with the U.S. NOAA satellite frequencies of 137.5 MHz and  
**USER BAND 2 ]** 137.62 MHz. Similarly you may want to program User Band 1 with  
**USER BAND 3 ]** the Russian Satellite frequencies of 137.3, 137.4 and 137.85 MHz.

7. Let's say we want to set up User Band 0 with 137.5 MHz and 137.62 MHz as an example. With the mouse point and click on the mode box and select VHF (no P.A.).

8. With the mouse, point and click on the band box and select User Band 0. Now point and click on the "Set Frequencies" box. The box will change to "Frequency 136.00". Using the delete key delete 00.6 so that you have 13 in the box. Now type 7.50 and press the enter key, this will record this frequency. It will still be in the window. Now use the delete key to delete 05 so that you should have 137. in the window.. Now type 62 so that you have 137.62 in the box and press the enter key, 137.62 will stay in the box. Now, using the delete key, delete all the numbers in the box. Now press the 0 key and press the enter key.

distortion.

b) 80mV RMS into 50 Kohm load, for less than 3% distortion. (Tape recorder input.)

c) 1v RMS into 1Kohm load for less than 5% distortion. (A.F. signal to microcontroller.) Available on pin 2 (ground) and pin 4 (AF out) of the facilities socket.

DIGITAL INPUT/OUTPUT RS232C 57.6k bits