VINTRONICS 15-Watt SHORT-WAVE BROADCAST TRANSMITTER

Designed due to the numerous requests for the unit, this Broadcast Transmitter has been designed to operate over the 41 metre and 49 Metre Short-wave Broadcast Bands. It was decided that a somewhat low power output was the key, so that it can be made cheaply and operated easily. The output is a conservatively rated 10 watts to 15 watts RMS output. 40-60 Watts peak output is expected.

The Transmitter is Amplitude modulated using a series transistor in the PA drive supply.

A rugged MOSFET is used in the RF power amplifier, with Ferrite toroids for impedance matching.

The transmitter has been designed to operate on the 41 and 49 Metre Short Wave band. Tuneable between 5.9 and 7.5 Mhz. This version is available with 2 different outputs, with a 50Ω output and high voltage tuned output for a pre-determined length of cable constituting a resonant aerial.

Features:

• Digital IC design

• 24 Volt 3 Amp DC powered. (UK adapter included)

• 4KHz channel spacing

• Inherently stable

• Audio input with automatic Modulation circuit (volume) via 2 RCA phono sockets (stereo input is mono'd internally)

• Low Distortion Analogue Linear modulator.

• SO259 Aerial Socket on rear of unit for 50 ohm output also 2 terminals for aerial

• average 10-15W RF output (60W peak) into 50 Ohm load

• 5.9MHz to 7.5MHz selectable from rear panel

• RF LED Meter on front panel

• Cooling fan

This Transmitter is a self-contained unit housed in a steel box of dimensions 220 mm by 210 mm by 80mm high. It covers frequencies between 5.9Mhz to 7.5MHz. Powered by an external power adapter providing 24V DC, it is plugged into the rear socket. A power on-off switch is located on the rear panel, labelled 'TX'.

Audio input is via 2 RCA Phono sockets also on the front which mono's up a stereo feed. This in turn drives an automatic gain control circuit which enhances modulation depth and at the same time reduces the effect of over-modulation. If your audio feed is already mono, feed it into both RCA sockets. The pre-amp feeds into the power modulator amplifier. The output of the modulator delivers DC power to the MOSFET PA stage. The unit achieves over 100% positive modulation and peak output of 80 Watts can be measured. The audio frequency response is approximately 50Hz to 5KHz. Audio level is preset internally, so you can feed the transmitter with any level of audio, as the automatic level control internally will adjust the audio signal to the correct level, without over modulating it.

The Phase-Locked Loop oscillator frequency is controlled by the lever switches on the rear panel. Frequency assignment is determined by the lookup table shown later. It is set as multiples of 4Khz spacing,

The PA output of the transmitter is very rugged, utilising a high power MOSFET which are therefore significantly de-rated. The output power is preset with tuning components to provide the rated RF output into a 50-ohm load.

An alternate output is available which has a L-C tuned network to match to a fixed length long-wire.

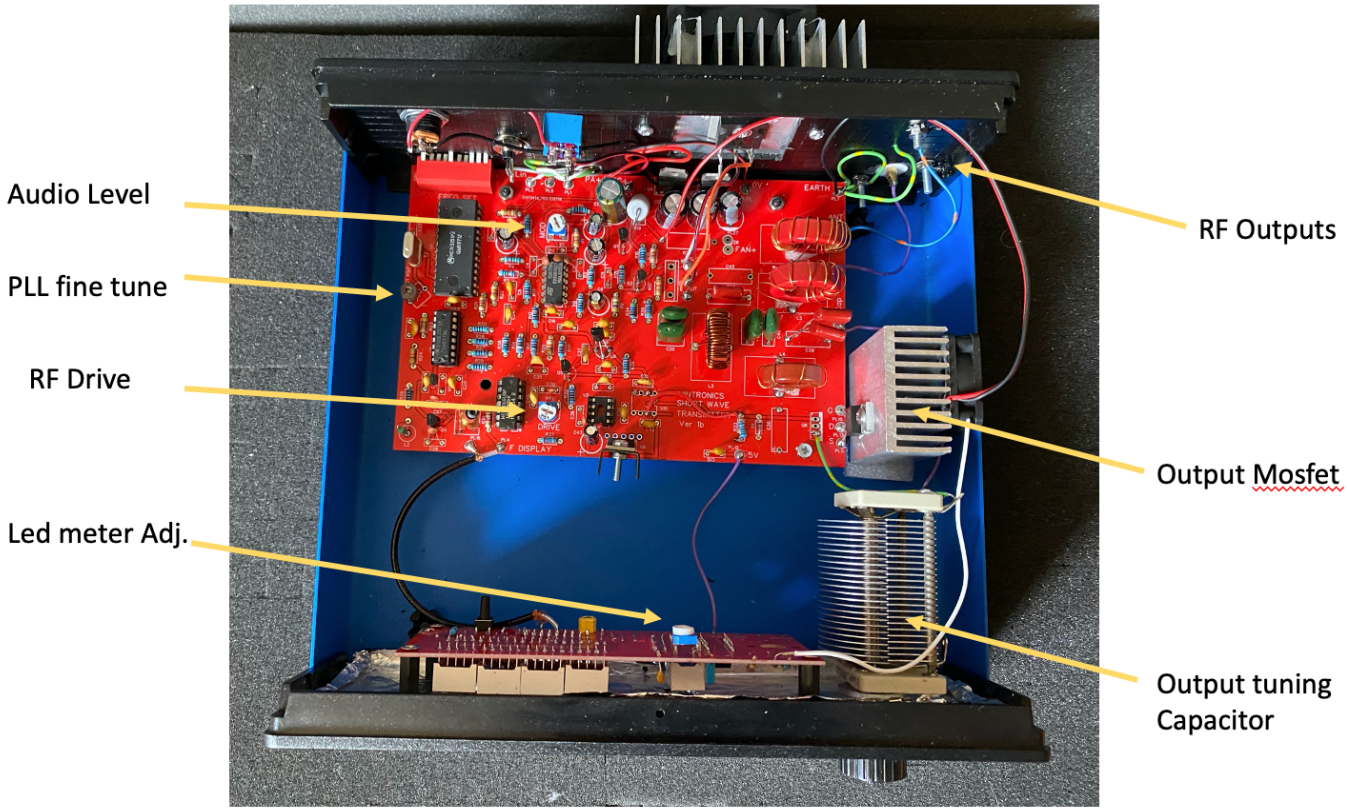
Either can be used, but not at the same time. If the long-wire is desired, the front panel tuning capacitor is used to peak the RF output. This can be seen via the LED level indicator on the front panel. If 50 ohm output is to be used, you MUST SET THE TUNING CAPACITOR to ZERO, otherwise it will de-tune the output.

Also, you may choose to use a 'Field Strength meter' to maximise the RF signal.

SETUP and Tuning

Method. It is advisable to use a SWR meter between TX output and the Aerial Tuning Unit (ATU) input. Aim for lowest SWR but maximum RF out. A field Strength meter is also invaluable in order to realise the signal strength emitted from the aerial. For stability, keep the transmitter away from the ATU and high voltage RF line via a coaxial feed cable.

Set up the ATU with your aerial tester so that it presents the transmitter with as near 50 ohms as possible and minimum reactance. Switch Transmitter on and observe SWR for minimum. Apply Audio signal and check all is good!



Inside the Transmitter

Setting frequency using dip switches

At the rear of the transmitter there are a set of dip switched numbered 1 to 10.

Using the frequency table below, set the switches to the desired frequency.

For example, if your desired frequency is 6.085Mhz, look it up in the table and you will see its binary setting to the left.

As we can see the binary position for 6085 is 0111100001

The switch positions are up for 0 and down for 1. So therefore, starting from the left-most switch and working our way to the right we get the following:

Binary number	0	1	1	1	1	0	0	0	0	1
Switch position	off	on	on	on	on	off	off	off	off	on

It looks like this:

On the rear of the unit, the DIP switches determine the frequency.

(in this case up is off and down is on - the switch shows with an arrow!)

Binary switch positions

SWITCH POSITION	FREQ	SWITCH POSITION	FREQ
1 2 3 4 5 6 7 8 9 10		1 2 3 4 5 6 7 8 9 10	
1 0 1 1 1 0 0 0 1 1	5000	0 0 1 1 0 0 0 1 1 0	6604
0 0 0 0 0 0 0 0 1 1	5146	1 1 1 1 0 0 1 1 1 1	1072

1 1 1 1 0 1 0 0 0 1	5952	0 0 1 0 1 1 1 0 1 0	6700
1 1 1 1 1 1 1 0 0 1	5697	1 1 0 1 1 0 1 0 1 0	6800
0 1 1 1 1 1 0 0 0 1	5957	0 1 0 0 0 0 1 0 1 0	6900
0 0 1 1 1 1 0 0 0 1	5965	1 0 0 1 0 1 0 0 1 0	7000
0 0 0 1 1 1 0 0 0 1	5981	1 1 1 1 0 0 0 0 1 0	7104
0 0 0 1 1 1 0 0 0 1	5981	1 1 1 0 1 1 1 1 0 0	7200
0 0 1 0 1 1 0 0 0 1	5997	0 1 1 1 1 0 1 1 0 0	7300
1 1 0 0 0 1 0 0 0 1	6000	1 0 1 0 0 0 1 1 0 0	7400
0 1 0 0 1 1 0 0 0 1	6005		
0 1 0 1 0 0 0 0 0 1	6100		
0 0 0 0 1 1 0 0 0 1	6013		
1 0 0 1 0 1 0 0 0 1	6041		
1 1 1 1 0 1 1 1 1 0	6208		
0 0 0 1 1 0 1 1 1 0	6300		
0 0 0 0 0 0 1 1 1 0	6396		
0 1 1 0 0 1 0 1 1 0	6500		

Of course many other frequencies are possible using the combinations of switch settings. Its easy to use the frequency display on the front to get the desired setting.

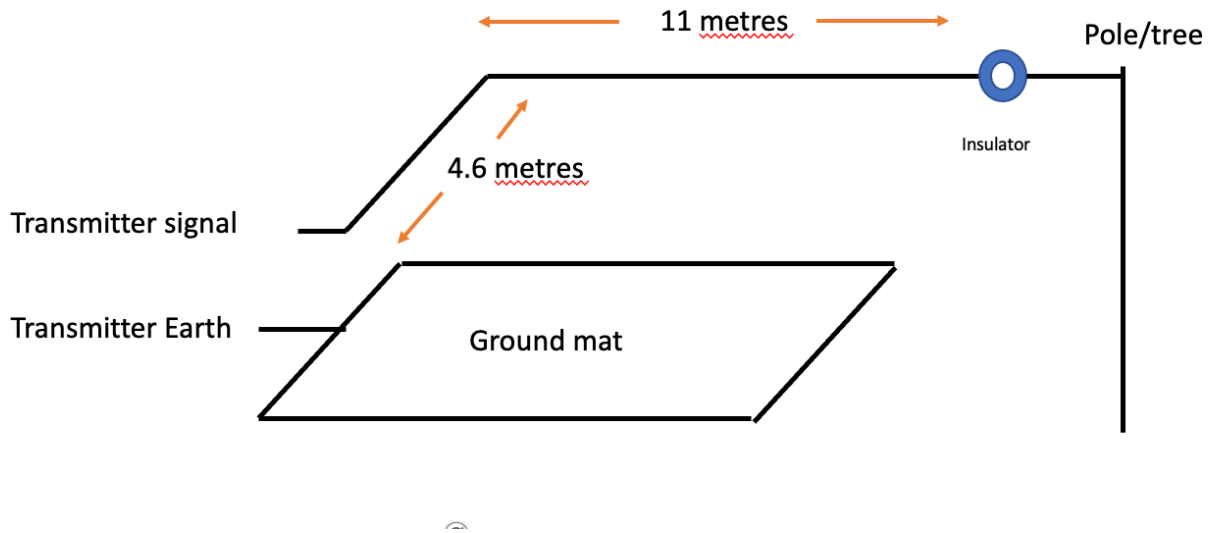
ENSURE that you have the aerial connected whilst doing this adjustment if adjusting with power on.

AERIAL MATCHING ARRANGEMENT

A suitable ‘long-wire’ aerial can be matched to this transmitter by using the terminal outputs on the back.

This system has been tested with the transmitter and works well.

Aerial Arrangement using long-wire



The ground plane, or mat, can be just simply a wire run along the ground which is as long as the aerial. Earth rods can be sunk into the earth and connected to this wire. This in turn connects to the earth terminal on the transmitter.

This is essential for either the 50 ohm connecting or the long wire direct connection.

The aerial wire is not critical, you can obtain suitable wire through Ebay or Ham Radio outlets. Use ‘Dog-bone’ aerial insulators to suspend the cable. Furthest end of the aerial can be suspended from a tall tree or side of the building.

Other arrangements can be used. Look on-line for information regarding aerials and matching circuits. Be sure to try and get an efficient aerial system which, when using the 50 ohm output, provides a low SWR in order to maximise the transfer of power into the aerial.

PLEASE NOTE, damage may occur to the transmitter if it is not matched correctly. Its not as forgiving as a Valve TX!

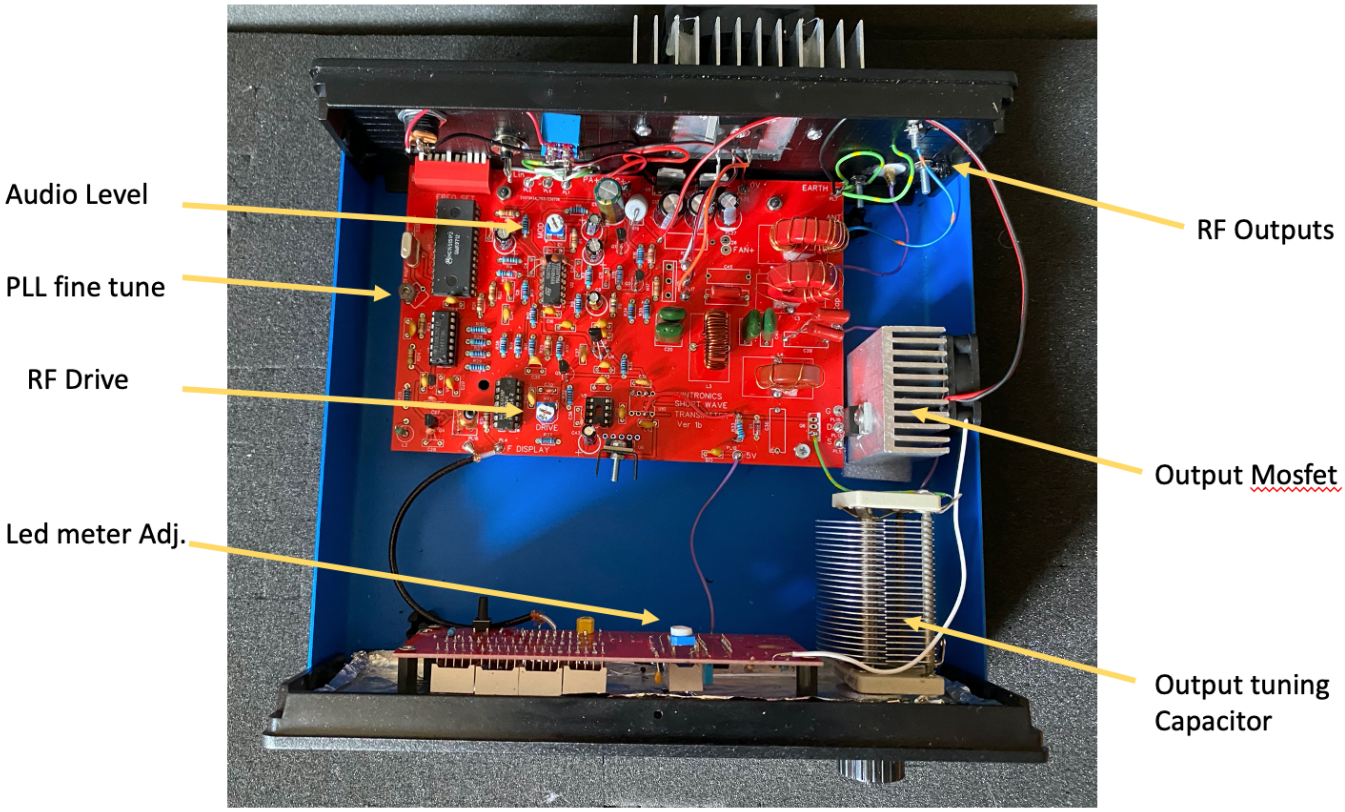
SETUP and Tuning using 50 ohm output.

IIt is assumed that you know something about aerials and tuning already. It will be necessary to use a SWR meter between TX output and the Aerial Tuning Unit (ATU) input. Aim for lowest SWR but maximum RF out. A field Strength meter is also invaluable in order to monitor the signal strength emitted from the aerial. For stability, keep the transmitter away from the ATU as practically as possible and high voltage RF line via a coaxial feed cable.

Set up the ATU with your aerial tester so that it presents the transmitter with as near 50 ohms as possible and minimum reactance. Switch Transmitter on and observe SWR for minimum. Apply Audio signal and check all is good!

PLEASE NOTE: If using the 50 Ohm output, the Tuning Capacitor on the front panel MUST be at ZERO, otherwise the output will be de-tuned and RF loss will occur.

Adjustment and alignment.



Inside the Transmitter

RF Drive.

The preset VR1 Is used to adjust the signal drive to the output FET. It is critical that this is set this correctly. Turning the preset to obtain maximum drive and therefore maximum output from the transmitter. The use an oscilloscope to observe drain and gate voltages on the output FET is necessary. Probably worth leaving alone!

It is expected that at 24volts supply approximately 2 Amps is drawn by the unit.

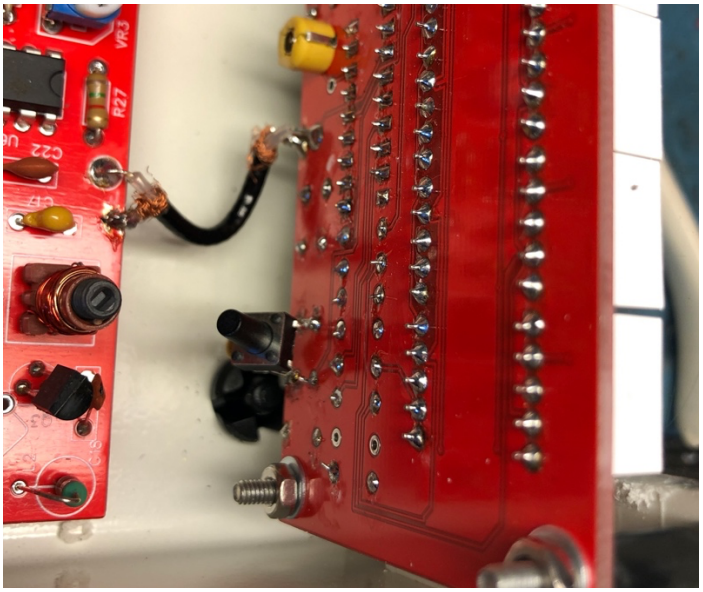
Audio Level

Adjust preset VR2 for maximum modulation, ideally using an oscilloscope for maximum (but not over) modulation depth. Without breaking carrier. (Solid line at 0%)

Resetting the Frequency display

The Programmed Chip can get swamped with RF and makes it display incorrectly. (very uncommon but has been observed)

A micro switch is fitted to the display board to allow the display to be reset. Press the switch once to enter setup. Press through the stages, so that you select ‘No PS’ (does not enter ‘sleep mode’), Zero (offset) press and hold until it flashes to set this and press to hold for exit to save setup.



RF level monitor (LED Display)

The Bargraph is a visual representation of carrier level and Modulation. The signal is detected by the mini RF sniffer aerial inside and this converts to the LED scale. The sensitivity of this is adjusted by VR4 on the front panel PCB and by moving the sniffer nearby to the RF Capacitor conductor between the main board and the front panel board.

<u>Technical Specifications</u>

Size - 220mm wide, 240mm depth, 80mm high

Weight. - 1.45Kg

Power requirement - DC 24 V @ 3A maximum.

Frequency Range - 5500KHz to 7430KHz in 4KHz steps

Audio input – RCA Phono sockets, left and right audio between 75mV and 775mV RMS

(XLR mono input available on request)

Audio Bandwidth (+ –3dB) - 50Hz to 6KHz

Modulation level – up to 100% positive.

RF Output level – 10-15 Watts RMS (60W peak) dependant on Aerial Match and Frequency.

RF connection – SO259 coax socket and terminals, high voltage live and Earth. (either/or can be used)

Display -

Signal level – 10 segment Bar-Graph multi-colour LED

Frequency – 4 7-segment LED display

Ventilation and cooling – Fans forced air and convection