AM PLL High Power Medium-Wave Transmitter

A High-Power version of AM Transmitter, operating between 620KHz and 1024KHz in the Medium Waveband (AM Band) and are designed to be reliable and stable units.
They can deliver up to 20 watts of RMS power into a short length aerial. This equates to 80 watts peak power cleanly driven up to 100% modulation.
This transmitter has been designed to operate into a fairly short 'long-wire' aerial, minimum length approximately 12 metres and up to 25 metres. Anything shorter than this is very inefficient and may make critical components overheat. Obviously the longer the better.
Each Transmitter circuit design employs a Colpitts FET oscillator in a Phase-locked loop circuit for accuracy and ease of frequency selection. It is also very stable and therefore does not drift off frequency. The Phase Lock circuit provides selection in 1KHz steps, so that the unit can be used in either Europe, which has 9KHz spacing between channels, or in the USA and other parts of the World where 10kHz is used between channels. A rugged Power MOSFET is also used on the RF output stage, which drives the output toroid and variable tuning capacitor. High voltage rated components are used in the output section.
Audio modulation is series-derived using Power Transistors. It is driven by an audio level control chip which allows the transmitter to always achieve maximum modulation, whatever the audio source and nominal level is, within reason. (CD player, mixer, PC etc)
Housed in a Steel box with ABS front and rear panels. Ventilation holes to improve air flow for component cooling. A fan is used on higher output models where necessary.

POWER SUPPLY --- IMPORTANT --- PLEASE NOTE

Power is provided from an external plug-top power unit. A transmitter is supplied with a specific power unit, as certain components inside the transmitter are voltage sensitive and could burn-out if the wrong power voltage is applied. Therefore, only use the supplied power unit, otherwise damage may well occur.

It will be evident whether a wrong power unit has been used which in turn causes internal damage!!

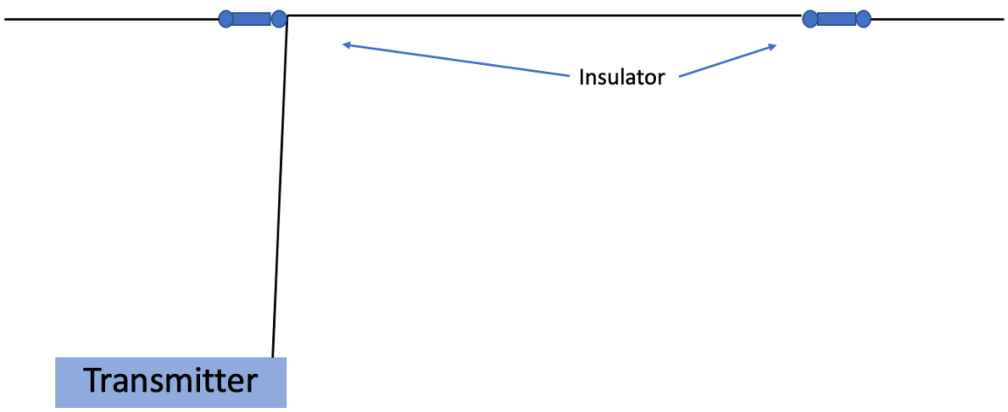
The transmitter comes already set up for use, together with a mains power supply and wire aerial.

Setup

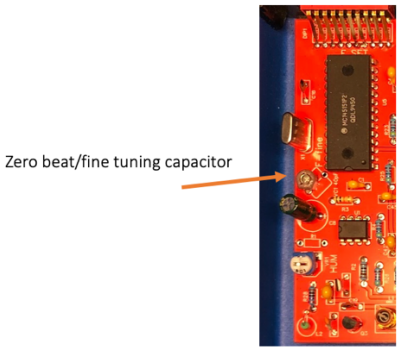
1. Insert stripped end of wire into the Aerial terminal and screw into place
2. Remove top cover and locate the variable inductor.
3. Adjust frequency using DIP switches on the rear as per required settings.
4. Connect phono audio cable (L and R) to transmitter and audio source.
5. Connect power supply to DC socket and turn on unit from power switch
6. Adjust aerial tune knob and variable inductor for maximum power on output power display
7. Switch off and replace cover.

Advanced setup and troubleshooting

Internally, on the higher frequency model there is a selector link on the output coil (toroid) which is used for better aerial matching. At higher frequencies in particular, if the tuning capacitor is at one end, use the link to select a lower inductance for improved matching. Much better matching can be achieved by moving the link. Remove top cover to gain access. A longer aerial wire can be used with the transmitter and will give a better range. Excellent results have been obtained using a single long wire of approximately 18 metres length as shown in the diagram. The aerial is essentially the length of the back garden, using insulators that radio hams use. Roof top is the end of the wire, suspended via a tree at the other end. Also, the use of a good Earth helps with signal efficiency and distance. A copper stake in the ground is a good start. Search the Internet for further advice.



Recommended arrangement using long-wire . Minimum length 10 M, design length 15M. A longer aerial wire can be used with the transmitter and will give a better range. Excellent results have been obtained using a single long wire of approximately 18 metres length as shown in the diagram. The aerial is essentially the length of the back garden, using insulators that radio hams use. Roof top is the end of the wire, suspended via a tree at the other end. Also, the use of a good Earth helps with signal efficiency and distance. A copper stake in the ground is a good start. Search the Internet for further advice.
Maximise the signal level with the tuning control, whilst observing the signal level LED display. Or even better is the use of a Field Strength Meter, which are readily available on eBay.



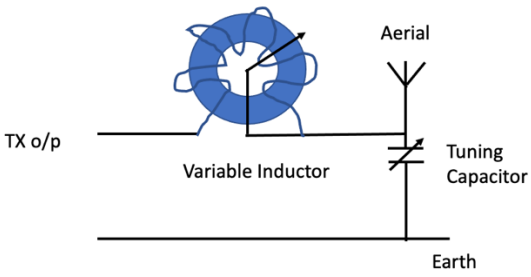
It is possible to fine-tune the operating frequency by adjusting VC1 on the main circuit board. (see pic) This adjustment is for ‘zero-beat’ of the signal (in comparison to another signal*) but is not an essential adjustment and can be left if not required. (cap may look different)
It also acts as fine-tuning alignment of the Phase Locked Loop oscillator.

*is an enhanced user requirement

Aerial Matching on this model

It is important to adjust the output tuning of the transmitter in order to 'match' the aerial. This is important for two reasons, to maximise the RF signal and to minimise the losses which will be absorbed by the output Mosfet transistor. Too much 'mis-match' can destroy the transistor. Although a substantial transistor has been fitted to this transmitter.

Output arrangement



Inductor is tuned for best match (max o/p) of RF

Frequency setting

Setting frequency using dip switches

On the rear of the transmitter there are a set of dip switched numbered 1 to 10.
Using the frequency table set the switches to the desired frequency.
On the High-Power unit for example, if your desired frequency is 1017Khz, look it up in the table and you will see its binary setting to the left.
As we can see the binary position for 1017 is 110100000

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

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

It looks like this:

On the rear of the unit, the DIP switches determine the frequency.
(in this case up is ‘on’ and down is ‘off’)

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 1 1 1 1 1 1 1 0 1	640	1 1 1 1 0 1 1 1 0 1	648
1 1 0 1 0 1 1 1 0 1	650	1 0 1 1 1 0 1 1 0 1	657
1 1 1 0 1 0 1 1 0 1	660	1 1 0 1 0 0 1 1 0 1	666
1 1 0 0 0 0 1 1 0 1	670	1 0 0 1 1 1 0 1 0 1	675
1 1 1 1 0 1 0 1 0 1	680	1 1 1 0 0 1 0 1 0 1	684
1 1 0 1 1 0 0 1 0 1	690	1 0 1 0 1 0 0 1 0 1	693
1 1 1 0 0 0 0 1 0 1	700	1 1 0 0 0 0 0 1 0 1	702
1 1 0 0 1 1 1 0 0 1	710	1 0 0 0 1 1 1 0 0 1	711
1 1 1 1 1 0 1 0 0 1	720	1 1 1 1 1 0 1 0 0 1	720
		1 0 1 1 0 0 1 0 0 1	729
1 1 0 1 0 0 1 0 0 1	730	1 1 0 1 1 1 0 0 0 1	738
1 1 1 0 1 1 0 0 0 1	740	1 0 0 1 0 1 0 0 0 1	747
1 1 0 0 0 1 0 0 0 1	750	1 1 1 0 1 0 0 0 0 1	756
1 1 1 1 0 0 0 0 0 1	760	1 0 1 0 0 0 0 0 0 1	765
1 1 0 1 1 1 1 1 1 0	770	1 1 0 0 1 1 1 1 1 0	774
1 1 1 0 0 1 1 1 1 0	780	1 0 0 0 0 1 1 1 1 0	783
1 1 0 0 1 0 1 1 1 0	790	1 1 1 1 0 0 1 1 1 0	792
1 1 1 1 1 1 0 1 1 0	800	1 0 1 1 1 1 0 1 1 0	801
1 1 0 1 0 1 0 1 1 0	810	1 1 0 1 0 1 0 1 1 0	810
		1 0 0 1 1 0 0 1 1 0	819

1 1 1 0 1 0 0 1 1 0	820	1 1 1 0 0 0 0 1 1 0	828
1 1 0 0 0 0 0 1 1 0	830	1 0 1 0 1 1 1 0 1 0	837
1 1 1 1 0 1 1 0 1 0	840	1 1 0 0 0 1 1 0 1 0	846
1 1 0 1 1 0 1 0 1 0	850	1 0 0 0 1 0 1 0 1 0	855
1 1 1 0 0 0 1 0 1 0	860	1 1 1 1 1 1 0 0 1 0	864
1 1 0 0 1 1 0 0 1 0	870	1 0 1 1 0 1 0 0 1 0	873
1 1 1 1 1 0 0 0 1 0	880	1 1 0 1 1 0 0 0 1 0	882
1 1 0 1 0 0 0 0 1 0	890	1 0 0 1 0 0 0 0 1 0	891
1 1 1 0 1 1 1 1 0 0	900	1 1 1 0 1 1 1 1 0 0	900
		1 0 1 0 0 1 1 1 0 0	909
1 1 0 0 0 1 1 1 0 0	910	1 1 0 0 1 0 1 1 0 0	918
1 1 1 1 0 0 1 1 0 0	920	1 0 0 0 0 0 1 1 0 0	927
1 1 0 1 1 1 0 1 0 0	930	1 1 1 1 0 1 0 1 0 0	936
1 1 1 0 0 1 0 1 0 0	940	1 0 1 1 1 0 0 1 0 0	945
1 1 0 0 1 0 0 1 0 0	950	1 1 0 1 0 0 0 1 0 0	954
1 1 1 1 1 1 1 0 0 0	960	1 0 0 1 1 1 1 0 0 0	963
1 1 0 1 0 1 1 0 0 0	970	1 1 1 0 0 1 1 0 0 0	972
1 1 1 0 1 0 1 0 0 0	980	1 0 1 0 1 0 1 0 0 0	981
1 1 0 0 0 0 1 0 0 0	990	1 1 0 0 0 0 1 0 0 0	990
		1 0 0 0 1 1 0 0 0 0	999
1 0 1 1 0 1 0 0 0 0	1000	0 1 1 1 1 0 0 0 0 0	1008
0 1 0 1 1 0 0 0 0 0	1100	1 1 0 1 0 0 0 0 0 0	1017
0 1 1 0 0 0 0 0 0 0	1020		
0 0 0 0 0 0 0 0 0 0	1023		

Adjustment and alignment.

PLL (phase-locked loop) alignment setting.
The PLL is aligned by first selecting the switches are set to 620 KHz.
Adjust the Oscillator coil slug so that by turning the slug clockwise the frequency counter moves down in frequency until it just reaches 620. The PLL should 'lock' and further adjustment of the slug (inwards) does NOT increase the frequency reading. If necessary, turn the slug back out of the coil (anticlockwise) for it to be screwed back inwards to 're-lock' on the PLL.
Now set the switches to 1023 and make sure the PLL follows on the display.
There is a 'sweet spot' where the tuning slug will allow full frequency range to be selectable.

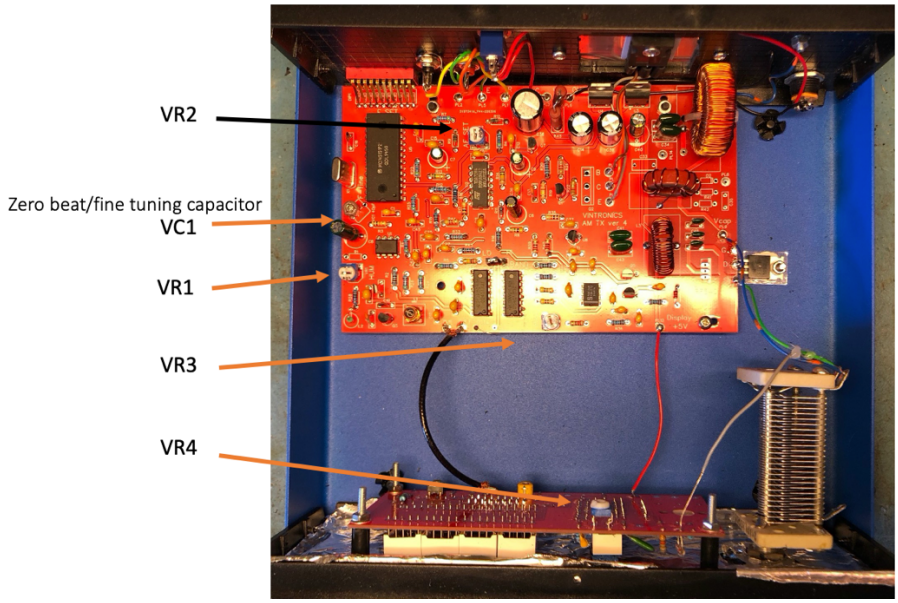
RF Drive.
The preset VR3 Is used to adjust the signal drive to the output FET.
Observing the output signal 'Bargraph' display, adjust the potentiometer to achieve maximum signal output. Or use an oscilloscope to observe drain and gate voltages on the output FET.

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%)

Hum cancel
This is accomplished by adjustment of VR1. This is best done whilst operational. It introduces a low level 30 -60 Hz signal into the drive.

RF level monitor
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.

Aerial Matching
Internally on some models, especially the High Power, there is a selector link on the output coil (toroid) which is used for better aerial matching. At higher frequencies in particular, if the tuning capacitor is at one end, use the link to select a lower inductance for matching. The link is located on the main circuit board by the circular toroid. Select '1' for less inductance, '2' for mid inductance and none for maximum inductance.
It is particularly useful for use with longer aerial systems. A better match can be achieved whilst observing the LED tuning indicator.



The Variable Inductor is located to the top-right of the circuit board. (the round coil)

Resetting the Frequency display

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

A micro switch has been 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.

Technical Specifications

20 Watt Unit

Size - 220mm wide, 240mm depth, 90mm high
Weight. - 1.45Kg
Power requirement - DC 24 -28 V @ 2.5A max
Audio input – RCA Phono sockets, left and right audio between 75mV and 775mV RMS
Audio Bandwidth (+ –3dB) - 80Hz to 6KHz
Modulation level – up to 100%
RF Output level – Average 20 Watts (dependant on Frequency and Aerial Match)
RF Output Capacitor – 400pF variable 750V rated
RF connection – screw terminal for signal and earth connection
Display -
Signal level – 10 segment Bar-Graph multi-colour LED
Frequency – 4 7-segment LED display
Ventilation – passive convection, heatsink to rear.