# QUASAR ELECTRONICS KIT No. 1009 1 Watt FM TRANSMITTER

## **General Description**

The kit you have just purchased contains all the components necessary to build a mini yet high performance FM transmitter. Its low power output makes it ideal for experimentation and amateur use for beginners. You can easily impress your friends by broadcasting to them in the FM band.

#### **Technical Specifications - Characteristics**

Modulation type: FM Frequency range: 88-108 MHz Working voltage: 6-30 VDC Maximum current: 400 mA Output power: 1-2 W

#### **How it Works**

As it has already been mentioned the transmitted signal is Frequency Modulated (FM) which means that the carrier's amplitude stays constant and its frequency varies according to the amplitude variations of the audio signals. When the input signal's amplitude increases (i.e. during the positive half-cycles) the frequency of the carrier increases too, on the other hand when the input signal decreases in amplitude (negative half-cycle or no signal) the carrier frequency decreases accordingly. In figure 1 you can see a graphic representation of Frequency Modulation as it would appear on an oscilloscope screen, together with the modulating AF signal. The output frequency of the transmitter is adjustable from 88 to 108 MHz which is the FM band that is used for radio broadcasting. You can easily change the output frequency by adjusting the trimmer C1. Now if you have a look at the circuit diagram you will see the microphone, the microphone's preamplifier (TR2) and the main RF stage (TR1) which is the circuit's oscillator. For best results the input should be from either a piezoelectric microphone or line out from a tape recorder, etc. For testing purposes we supply a condenser microphone with the kit. The condenser microphone requires a 47K resistor be connected between the '+' pin (2) to the 'Signal' pin (6) because these microphones require a small DC bias to work. The amplified acoustic signal is passed through C3 to the input of the oscillator in order to modulate the RF signal. The oscillator's frequency is controlled by the LC network L1-C6. C3 is a coupling capacitor and is also used to block any stray DC voltages from the oscillator's input. The base of TR1 is biased correctly by R2, R3. For ease of construction and to ensure greater stability the coil of the transmitter has been etched on the PCB. The transmitter needs 6-30 VDC to operate. The effective range depends on how well the receiver is tuned to the transmitter's frequency, the antenna you are using, the area and the transmitter's placement. In place of an aerial you can use a piece of wire about 65 cm long but for best results you should use an open dipole or a Ground Plane antenna. If you are planning to use the transmitter for long periods of time we recommend the use of alkaline batteries for longer life and trouble free operation.

# Construction

First of all let us consider a few basics in building electronic circuits on a printed circuit board. The board is made of a thin insulating material clad with a thin layer of conductive copper that is shaped in such a way as to form the necessary conductors between the various components of the circuit. The use of a properly designed printed circuit board is very desirable as it speeds construction up considerably and reduces the possibility of making errors. Quasar Electronics Kit boards also come pre-drilled and with the outline of the components and their identification printed on the component side to make construction easier. To protect the board during storage from oxidation and assure it gets to you in perfect condition the copper is tinned during manufacturing and covered with a special varnish that protects it from getting oxidised and makes soldering easier. Soldering the components to the board is the only way to build your circuit and from the way you do it depends greatly your success or failure. This work is not very difficult and if you stick to a few rules you should have no problems. The soldering iron that you use must be light and its power should not exceed the 25 Watts. The tip should be fine and must be kept clean at all times. For this purpose come very handy specially made sponges that are kept wet and from time to time you can wipe the hot tip on them to remove all the residues that tend to accumulate on it.

DO NOT file or sandpaper a dirty or worn out tip. If the tip can not be cleaned, replace it. There are many different types of solder in the market and you should choose a good quality one that contains the necessary flux in its core, to assure a perfect joint every time. DO NOT use soldering flux apart from that which is already included in your solder. Too much flux can cause many problems and is one of the main causes of circuit malfunction. If nevertheless you have to use extra flux, as it is the case when you have to tin copper wires, clean it very thoroughly after you finish your work. In order to solder a component correctly you should do the following:

Clean the component leads with a small piece of emery paper.

Bend them at the correct distance from the component body and insert the component in its place on the board.

You may find sometimes a component with heavier gauge leads than usual, that are too thick to enter in the holes of the p.c. board. In this case use a mini drill to enlarge the holes slightly. Do not make the holes too large as this is going to make soldering difficult afterwards. Take the hot iron and place its tip on the component lead while holding the end of the solder wire at the point where the lead emerges from the board. The iron tip must touch the lead slightly above the p.c. board.

When the solder starts to melt and flow wait till it covers evenly the area around the hole and the flux boils and gets out from underneath the solder. The whole operation should not take more than 5 seconds. Remove the iron and allow the solder to cool naturally without blowing on it or moving the component. If everything was done properly the surface of the joint must have a bright metallic finish and its edges should be smoothly ended on the component lead and the board track. If the solder looks dull, cracked, or has the shape of a blob then you have made a dry joint and you should remove the solder (with a pump, or a solder wick) and redo it.

Take care not to overheat the tracks as it is very easy to lift them from the board and break them.

When you are soldering a sensitive component it is good practice to hold the lead from the component side of the board with a pair of long-nose pliers to divert any heat that could possibly damage the component.

Make sure that you do not use more solder than it is necessary as you are running the risk of short-circuiting adjacent tracks on the board, especially if they are very close together. After having finished your work cut off the excess of the component leads and clean the board thoroughly with a suitable solvent to remove all flux residues that still remain on it.

The construction of the transmitter is very straightforward and you shouldn't face any difficulties. First of all make the two jumper connections that connect the coil with the rest of the circuit and are marked on the component side of the board, solder the pins and continue soldering the resistors in their places then the capacitors and conclude the construction with the transistors which are the most sensitive components and can be easily damaged if they are overheated during soldering. You should be very careful in soldering because of the reduced size of the board. So although the project is a very simple one the soldering must be done with care. When you finish mounting the resistors on the board you should solder the capacitors in their places and here you should observe the polarity of the electrolytic. The polarity of the capacitors is marked on their bodies and it is also marked on the component side of the board. You finish off the assembly of the transmitter by soldering the two transistors in their places. Please make sure you put the transistors the right way round and that you don't swap them around. Depending upon availability you may find a BC547 or a BC548 in your kit. They are equivalent and so it makes no difference which one you use. Fit the output transistor with its heat sink. Finally connect the microphone and the supply leads observing their polarity. Make a final visual inspection of the board clean it well from flux residues and make sure there are no short circuits between adjacent tracks. If everything looks OK you can connect the supply, any voltage between 6 and 30 VDC will be OK. Choose a free spot in the FM band and turn the trimmer on the transmitter with a plastic tuning tool till you hear a hiss from the radio. If you are very close to the receiver you may hear a loud whistling sound from the feedback to the microphone. Adjust the trimmer VR1 for the best modulation and you have finished.

#### Adjustments

This kit does not need any adjustments, if you follow the building instructions.

## Warning

Quasar Electronics kits are sold as stand alone training kits. If they are used as part of a larger assembly and any damage is caused, our company bears no responsibility.

While using electrical parts, handle power supply and equipment with great care, following safety standards as described by international specs and regulations. In every transmitter there are present apart from the main output frequency various harmonics

that usually have a very short range. In order to make sure you haven't tuned on one of them do the tuning as far as possible from your receiver, or use a Spectrum Analyser to see your output spectrum and make sure that you tune your transmitter on the right frequency.

# CAUTION

All the RF kits are sold for experimental and laboratory use only. Their possession and use are limited by laws which vary from state to state. Please get information about what you can and cannot do in your area and stay within the legal limits. Make sure you do not become a nuisance to others with your experiments. Quasar Electronics Kit has no responsibility whatsoever for any misuse of its products.

## If it does not work

Check your battery (low output, wrong connection etc.)

If the transmitter works but the microphone doesn't seem to pick up anything check the connections of the microphone (see drawing) or replace it to make sure you haven't damaged it from overheating.

Recheck your board for dry joints and bridges across tracks

If your project still fails to work, please contact us for information about our Get-You-Going service.

# **Electronic Diagram**



#### **Parts List**

All components including printed circuit board, assembly instructions including schematics and detailed parts list are supplied when you purchase the kit.

# Ordering

For pricing info and online ordering please visit:

http://www.guasarelectronics.com/1009.htm

For further info please contact us by e-mail:

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