



World Paramotor Championships 2009

Notes on PMR446 radios

Kindly supplied by Keith Pikersgill of the South African team

For receiving only, the power output is irrelevant, though it may be worth buying the maximum output versions of 500 milli-Watts for when they are able to transmit. Other than using them for streamlining precision tasks, each team might wish to use a different frequency for general organising and co-ordinating among themselves when not flying, instead of cellphones.

Though the intended range of PMR is only a few km ground-to-ground, their range from ground-air can be twice that distance and from air-to-ground, perhaps 4 times that distance and, air-to-air can be up to 15 times that distance!

Most pilots fly with some sort of ear-defenders to protect their ears from the paramotor noise. A simple single earphone placed inside the ear before the ear-defenders are positioned on the head, works perfectly for receiving only. Just make sure the cable permits maximum head movement without pulling the earpiece out of the ear.

Pilots with headsets designed to operate on airband radios, will not be able to use the headset to transmit into a PMR radio. In most cases however, they will be able to receive and hear incoming communications through the same headset.

Often the standard two-pin jacks on these headsets do not fit the sockets on the PMR radio due to different spacing between the two pins, however an inexpensive solution is to fit a stereo-to-mono adapter into the earphone socket, then plug the headset's earphone socket into that adapter.

In most cases on the two-pin jacks, the larger/thicker pin is the speaker/earphone jack/socket.

It is usually the same size as a standard MP3 player's earphone jack, so any MP3 earphones usually works perfectly, but being stereo (and the transceiver being mono), only one speaker operates. To get both speakers to operate, simply add a small blob of solder on the MP3 stereo earphones jack, short-circuiting the tip and the ring immediately adjacent to it.

Perhaps the simplest solution for pilots who want two-way communications (at the comp and elsewhere), is to purchase an "Earbone". This is a single earphone, with a microscopic accelerometer embedded in it, which picks up the vibrations of the pilot's speech inside the ear and converts that to sound.

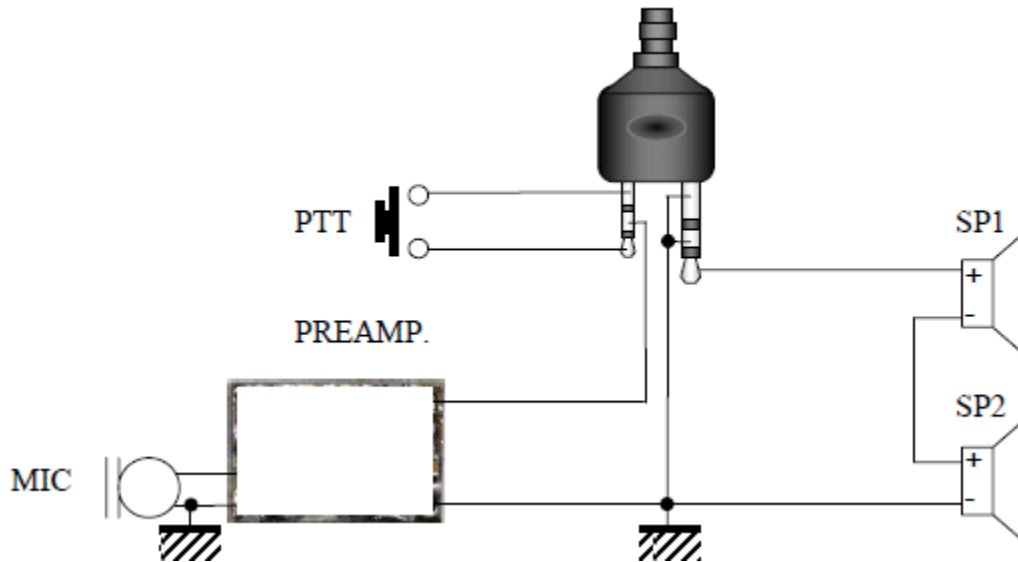
This overcomes the problem of engine noise and wind noise, as no ambient noise is transmitted, only the pilot's voice. A simple PTT is usually provided either in-line or on a separate cable to position on the throttle assembly on wherever the pilot finds it convenient. I use those with a velcro wrap around the index finger where the PTT is attached and can be reached with the thumb, in-flight (when I use radios other than our usual airband during paramotor flights).

These are also perfect for using as the radios for other purposes on the ground (team co-ordinating, etc), as it saves others nearby from loud radios blasting away which could become irritating.

Many examples of various Earbone designs can be found at:

<http://www.google.co.za/search?q=radio+earbone>

I attach a diagram of the standard Icom airband radio jacks and their wiring, which might be useful.



My PMR radio of choice is the Kirisun PT446 which is not in the toy radio category, but built to tough commercial and industrial standards. It is extremely robust and is supplied with a 700mAh Ni-MH battery and a desktop drop-in charger. Its speaker/mic sockets are identical to Kenwood, which makes all Kenwood accessories fully compatible with Kirisun radios.

It offers 16 channels and is pre-programmed with a useful selection of RF and CTCSS frequencies. An inexpensive programming cable connects it via the speaker/mic sockets to a PC serial port, and the programming software is only 1.7MB in size.

Best of all, the antenna is a standard SMA screw-in fitting, but glued into place to comply with fixed-antenna laws in some countries (simply force it, the glue breaks, and the antenna can be screwed off to be replaced by a higher performing antenna, or a roof-top magnetic version for mobile operations).

It is more expensive than the toy versions made for kids, however the durability, features and performance is worth the extra cost for serious users.

See: <http://www.google.co.za/search?q=kirisun+PT446>

Advanced stuff

Note from the competition director. As this is the first time we will have tried these in competitions we will simply be using one of the eight standard frequencies at WPC 2009 but there follows a description of more possibilities.

PMR446 radios use the eight radio frequencies which you indicated, however they also offer a special "frequency sharing" technology known as CTCSS (Continuous Tone-Controlled Squelch System), which we would likely need to use at the event. Whether this feature is used or not, it may cause problems you should be aware of, in order to overcome these problems.

With so many people using these PMR radios due to their low cost and their lack of licensing requirements, eight frequencies are not enough for everyone to share in most locations, so the CTCSS is

used to create several artificial "Channels", to permit different groups of people to operate on the same frequencies.

Each "Channel" on the transceiver comprises a choice of 8 radio frequencies in the 446MHz range, plus a choice of 39 sub-audible frequencies between 67kHz and 250kHz.

So although there are only 8 radio frequencies in use, in theory there are 312 different combinations of (8) RF and (39) Sub-Audible frequencies to choose between, which explains why some PMR radios offer 16, 32 or even 64 Channels.

Some of the more expensive PMR radios permit full programming of these 312 different combinations, either on the transceiver itself, or via a PC interface.

The cheaper PMR transceivers though, have a smaller selection of pre-programmed channels. The cheapest of the bunch might offer 8 Channels, each one using one of the 8 radio frequencies, coupled with a fixed Sub-Audible CTCSS tone.

In this case, PMR radios from one brand will NOT be able to communicate with PMR radios from a different brand (and sometimes different models from the same brand are incompatible with each other).

This could make the selection of a suitable "channel" tricky at such an event when everyone arrives with different brands and models.

HOWEVER, many PMR radios allow the use of any channel in "Open" mode, where the CTCSS is turned off, which means they will be able to RECEIVE every transmission on that particular radio frequency (including those from other groups of users), but when the users transmits in the open-mode, will not be heard by other transceivers on the same frequency with a CSCSS sub-audible tone enabled.

For example:

Let's assume that the organisers of an event choose to use: 446.04375MHz coupled with a CTCSS sub-audible tone of 127.3kHz

There will exist three possible groups of visitors:

- 1) Some visitors will arrive with transceivers that can be programmed to use that exact combination without problems for 2-way comms.
- 2) Some visitors will arrive with transceivers with no programming capability, however Channel 4 on their transceiver has the same radio frequency, but a different CTCSS tone, which they can disable (i.e. operate in open-mode).
In this case (if they enable open-mode) they will be able to hear every transmission on that radio frequency, from the organisers and any other groups nearby, but will not be able to reply to the organisers, whose transceivers will filter out any transmission without this specific CTCSS tone. This essentially allows one-way communications only.
- 3) Some visitors will arrive with transceivers with fixed channel numbers and pre-selected CTCSS tones that cannot be changed or disabled.

They will not be able to receive, nor transmit any communications with the organisers of the event.

This makes it essential for the organisers to announce long before the event, which radio frequency and which CTCSS tone they plan to use, so that visitors can ensure they have compatible radios.

I would suggest that the organisers in Nove Mesto find the most widely available, most inexpensive model available locally, then publish the list of pre-programmed channels with their respective radio frequencies and sub-audible tone frequencies (CTCSS) of that model, and offer these for sale for those that arrive without a suitable transceiver.

Then competitors can see if they find compatible radios in their home-towns to experiment with beforehand, or can purchase these at the venue.