



# Technical Library

## NEG Radios

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## **1. Technical Library**

The NEG Technical Library offers members a one-stop shop for all the technical and legislative issues concerning our duties.

It is not meant to be completely conclusive as technology moves on and laws may change.

## 2. The Default NEG Radio System

Unless an Event Organiser specifically loan NEG members a radio for their event then the NEG organisation typically use a business class 'PMR 449' radio as a means of communication on the majority of events.

We use this radio system because they are effective over short distances and are inexpensive and the licensing is easy to understand and to comply with. Being a licensed business class radio means that there are potentially less people listening in than if we used the licence-free PMR 446 equipment.

These radios transmit and receive on 449Mhz (UHF) and can typically push out 3 to 4.5 Watts.

There are a wide range of makes and models of PMR 449 radios on the market with a good selection of accessories. The battery life on most of the models is good giving around 5 hours worth of use (dependant on how much you transmit).



### 2.1 Power and Range

The PMR 449 radios can transmit up to 4.5 Watts through the manufactures supplied short aerial. The cheapest radio barely makes 2 Watts and the majority rarely ever get above 4 Watts even if they do claim to push out 5 Watts. Generally a 3.7v battery can produce no more than 3 watts of power and a 7.4v battery no more than 4.5 watts.

The range of the radio is very dependent on the power and the environment you are in. UHF radios work on 'line of sight' propagation (i.e they work best when there is an un-obstructive view of each other). Working in hilly or an urban area will have an effect on the radio transmit/receive signal strength, even moisture (rain) may cause a reduction in the range.

As an example a 3 Watt radio being used in an urban or hilly area may reduce the range to as little as 1½ miles whereas a 4 Watt radio being used in a flat rural area may find they can easily work up to +15 miles.

**NOTE-** Either modifying the unit for higher power or adding longer aerials above those as standard could invalidate your license.

### 2.2 CTCSS/DCS

As there are only three UHF frequencies (449.3125, 449.4000 and 449.4750 Mhz) for everyone to use, radios are equipped with CTCSS (old standard analogue) and DCS (new standard digital) which create multiple virtual channels. It does this by transmitting a tone which is inaudible to the human ear but can be picked up by the radios.

By using these additional tones your radio will only communicates with those transmissions with the matching tone. There are about 54 CTCSS/DCS tones of which we use five (67.0, 141.3, 127.3, 167.9 and 118.8).

Although there are over a 150 possible combinations it is still possible for the NEG and other licences users to use the same combination at the same time, especially in busy urban areas. In this instance if both parties try to transmit at the same time then no one will hear anything. Therefore it is always advisory to have a secondary 'backup' channel.

### 3. Licensing

The PMR 449 radios are business class radios which transmit and receive in compliance with the **Business Radio (simple UK) Licence**, issued by Ofcom. This licence covers both UHF and VHF radios operating up to a maximum of 5 watts and is valid for a 5 year period.

All radio equipment must be CE marked to be legal in the UK. This means nothing more than that it is electrically safe and will not cause undue interference to radio users on different frequencies, it does not mean that it will perform to a certain standard. A respectable manufacturer or importer will have a Declaration Of Conformity (DoC) for a radio unit that not only shows that they have CE approval but demonstrate that the radio is built to a high standard.

Using radios that are not CE compliant means breaking the terms of the licence which could result in heavy fines and revocation of the licence.

There is no problem programming radios yourself so long as you know what you are doing. Get it wrong and at best your radio will not work, at worst you will be transmitting on illegal frequencies.

### 4. Other considerations

When deciding which manufacturer, make or type of radio to purchase it is important to take a few of the following, along with cost, in to consideration.

#### 4.1 Wired vs Wireless

Some radio systems use cables between the radio and the rider, this will typically give better quality sound and should be easy to set up, the downside is that if the radio is attached to the motorcycle then so is the rider and the cables must be disconnected should you need to get off the motorcycle leaving you incommunicado with the rest of the NEG team and the Race Organiser.

Some wireless radio systems allow the possibility of having some of the kit hard-wired to the motorcycle and some of the kit carried/worn by the rider with no cables between motorcycle and rider. Although this may be a bit bulky to wear in some instances the main advantage is that as no cables need to be disconnected when you get off the motorcycle you remain in communication with everyone all the time. Advances in Bluetooth technologies allow for even fewer cables to be used. Waist belts and shoulder holster can allow you to easily carry everything on your person.

#### 4.2 Vox vs PTT

There is a good choice between Voice Operated Exchange (Vox) or Press To Talk (PTT) radio systems.

Vox capable radios/headsets trigger transmission based on the amount of sound entering the microphone and are truly hands-free allowing you to talk over the radio without having to press any buttons. The downside of Vox on a motorcycle is if the wind noise is too great or every time you speak (such as talking to other road users) then you are in danger of transmitting it.

PTT systems use a button, either mounted on the motorcycle handlebars or attached to the rider, that will only transmit your messages when pressed. The downside is it becomes another item of failure if it gets wet.

### 4.3 Boom Mic vs Throat Mic

A boom microphone specifically made for motorcycles will give superior voice quality and should cut out a lot of wind noise. The downside is that it will need to be fitted into the helmet.



Throat microphones go around the user's neck and will completely eliminate any wind noise as they absorb vibrations directly from the wearer's throat by way of sensors. A good quality throat unit can work really well whereas a cheap one will typically give poor audio quality. It is best to combine a throat mic with a PTT button which can be threaded down your sleeve with the button

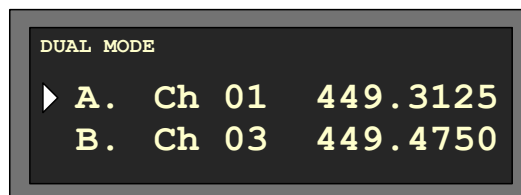
attached and pressed by your finger. We strongly recommend not combining a throat mic with Vox operation.

### 4.4 Dual Band / Channel

Some radio units allow the user to operate on two separate frequency bands either with the same or different frequencies.

If they are set to the same frequency then you will be able to listen to and talk to everyone else on that same frequency.

If band A is set to Channel 01 and band B is set to Channel 03 then you will be able to listen to both frequencies but will only be able to transmit on whichever band you have selected. You will be able to toggle between which band you transmit to by pressing the A/B button (or similar). When parties on both bands transmit at the same time the selected band has priority to receive over the secondary band.



Instead of a dual band function some radios have a cheaper dual watch function where they switch rapidly between two receiving frequencies. These system typically does not give as good as quality as the dual bands option.

## 5. Radio Etiquette

1. Think about your message before transmitting. Keep it short and precise. No message should last more than 15 seconds.
2. Speak clearly and a little slower than normal and do not shout.
3. Use plain English and avoid abbreviations unless they are well understood by your group.
4. Use the popular Terms as listed in the table below.
5. Use positive phrases such as “...*the road is blocked...*”, do not use “...*the road is not clear...*”.
6. Key the transmit button for one second before you start to talk to ensure that the radio is broadcasting.
7. Use ‘call signs’ and location identifiers such as “...*Lead Car One crossing the Finish Line now...*”
8. When needed use the NATO Phonetic Alphabet (see Appendix B) to help clarify any communication issues.
9. Remain professional, do not swear or say offhand remarks.  
Remember the whole world is listening.



### 5.1 Radio Terms

Term	Meaning
Go ahead	You are ready to receive message
Stand-by	You acknowledge the other party but are unable to reply immediately
Say again	Re-transmit your message
Affirmative	Yes
Negative	No
Copy	You understand what was said
En Route	Resources heading to incident
Wilco	I will comply
Over	You have finished that part of your message and are waiting for reply
Out	You have completely finished your conversation – thus ‘over and out’ is silly

## Glossary

**CTCSS.** Continuous Tone-Coded Squelch System - sometimes referred to as tone squelch or sub-channel since it has the effect of creating multiple virtual channels which are all using the same radio frequency.

**DCS.** Digital-Coded Squelch – designed as the digital replacement for CTCSS it. In the same way that a single CTCSS tone would be used on an entire group of radios, the same DCS code is used in a group of radios.

**Dual Band/Channel.** Some radios have the ability to listen to two channels and transmit on either one of them.

**PMR.** Professional Mobile Radio – Is a field radio communications system which use portable, mobile, base station, and dispatch console radios.

**PTT.** Press To Talk – Is a system that uses a physical button that will only active transmissions when pressed.

**UHF.** Ultra High Frequencies – Are radio frequencies in the range between 300 MHz and 3 GHz.

**VHF.** Very High Frequencies – Are radio frequency in the range between 30 MHz to 300 MHz.

**Vox.** Voice Operated Exchange – Is a VOX is an electronic sound sensor that triggers the transmission based on the amount of sound entering the microphone.



**Appendix A                      British Cycling Frequencies**

<b>Ch</b>	<b>Frequency</b>	<b>CTCSS/DCS</b>
1	449.3125	67.0
2	449.4000	67.0
3	449.4750	67.0
4	449.3125	141.3
5	449.4000	141.3
6	449.4750	141.3
7	449.3125	127.3
8	449.4000	127.3
9	449.4750	127.3
10	449.3125	167.9
11	449.4000	167.9
12	449.4750	167.9
13	449.3125	118.8
14	449.4000	118.8
15	449.4750	118.8

**Appendix B****NATO Phonetic Alphabet**

A ..... Alpha

B ..... Bravo

C ..... Charlie

D ..... Delta

E ..... Echo

F ..... Foxtrot

G ..... Golf

H ..... Hotel

I ..... India

J ..... Juliet

K ..... Kilo

L ..... Lima

M ..... Mike

N ..... November

O ..... Oscar

P ..... Papa

Q ..... Quebec

R ..... Romeo

S ..... Sierra

T ..... Tango

U ..... Uniform

V ..... Victor

W ..... Whiskey

X ..... X-ray

Y ..... Yankee

Z ..... Zulu