

N7RTG: Thank you Noji. How is my signal? (It will be muffled, almost unreadable)

NCS: N7RTG, your signal is poor, almost unreadable. Please check to see if you are on frequency. You might be 5 kilohertz off.

N7RTG: Just checked. I am on 147.340 receive and 147.940 transmit.

NCS: Still bad. Is your antenna connection tight?

N7RTG: Yes, just verified that.

NCS: Are you on full power?

N7RTG: Yes, transmit power is 25 watts. ....What if I move my thumb so I am not covering up the microphone opening? Is this any better?

NCS: Yes, that is a good signal.

N7RTG: Thank you Net Control, and thanks for helping me illustrate the point of tonight's training. As Amateur Radio Operators we spend a lot of time and effort in the 10 Megahertz to 450 Megahertz region of the spectrum. I would like to go way down in frequency to just above DC--in the 20 Hertz to 20 Kilohertz region known as audio--or more specifically, the speech communication range of approximately 200 to 5 thousand hertz. This lower frequency band is often overlooked, maybe because we are more concerned with the RF side of the radio.

Except for services such as packet or TV, all of our QSO's start and end in the audio band, regardless of whether we are working HF, VHF, or UHF.

Tonight we will talk about microphones and next week we will cover loudspeakers as they apply to communications systems.

Early communications systems used carbon microphones and later dynamic microphones. I will skip over those as well as other microphones used in music recording and entertainment applications and jump right into electret mics.

Today, nearly all communications microphones are electrets, a subset of capacitor microphones often called condenser microphones. Given the name, you will not be surprised to learn they are built like a capacitor. There are two closely spaced flat parallel plates one of which is the diaphragm that moves with the impinging sound wave and changes the capacitance between the two plates. That change in capacitance is then used to modulate the transmitted signal.

The electret mic assembly inside your radio's hand mic is a little button about 3/8" in diameter and 1/4" thick. The electret impedance is extremely high so the capsule includes a

FET to transform the impedance down to a lower and more usable value. The FET requires power so a DC voltage is superimposed on the signal conductors or on its own separate conductor. It's called a bias voltage but strictly speaking it is not.

Although the hand mic for your radio is the size of your palm and may have what looks like a one or two square inch grille, the grille is for the speaker or simply a dummy for appearance. The actual opening to the mic element might only be an 8<sup>th</sup> inch in diameter. It would be a good idea to locate that opening so you don't cover it up with your finger as I did at the beginning of the training.

Where you place the microphone when transmitting can have a significant effect on the quality and intelligibility of your transmission. We Hams have all probably laughed when we see someone in the movies holding a hand held radio up to the side of their head as if they were using a large cell phone with the mic at their ear and speaking into the battery case.

We also see in the movies the user holding the hand mic or handie talkie a foot in front of his mouth. If the talker is in a noisy environment, holding the mic like that will pick up the background noise louder than the talker's speech. Holding the mic closer so it touches the lips like a popular music singer—we call that "eating the mic"—that will improve the signal to noise but it is still not correct for radio communications. Let me demonstrate why.

I would like everyone to hold their hand in front of their mouth and say puh, puh, puh. Go ahead even if someone is watching and they might think you are nuts. Hams should be used to that. As you say puh notice the strong burst of air. Consonants like P, K, C-H, T and others produce that burst of high pressure air. A speech therapist will call that a plosive consonant or an oral stop. Sound engineers call it a p-pop. Your microphone calls it a high level transient and passes it on to the preamp. The preamp calls it an overload and rebels by producing distortion. No amount of processing in later stages will remove it.

Now do the puh-puh-puh exercise but move your hand in an arc around to the side of your mouth. Notice as you move to approximately 90 degrees off axis the burst of air pressure goes away. Let me do that so you can hear the difference.

This is on axis puh puh puh.

This is with the mic at the corner of my mouth. puh puh puh puh

Moving the mic off axis will not significantly decrease the volume but it will increase the intelligibility. I am moving my microphone now and you should not hear any change in level. When speaking on a radio, your mic whether it is a hand mic or a handheld should be positioned so you are speaking across the mic on not straight on. The edge of the mic or handheld should touch your cheek.

Distortion from plosive overloading or p-pops can be prevented in other ways, notably by placing open cell foam in front of the microphone. However the foam has to be fairly large to be effective. Recording and live performance microphones have an inch or two of foam in front of the diaphragm to prevent p-pops when the vocalist eats the microphone. Your handheld radio or your hand mic may have a tiny bit of foam but size constraints prevent it from being large enough to do much good. The simple and effective remedy is to hold it to the side as explained.

I will now demonstrate how holding the mic close will reduce background noise. I will play some pink noise through my computer speakers to simulate background noise.

I am now holding the hand mic 12 inches from my mouth. You will notice the background noise nearly covers up my speech.

Moving the mic so it touches the corner of my mouth increases the signal to noise. You can still hear the background noise but I believe my speech is now high enough above the noise so you can understand what I am saying.

There are other subjects related to microphones but we will leave them for another day. I have probably given you more information than you wanted to know but if you have learned to hold the mic to the side of your mouth and speak across it I will consider this session successful.

If there are questions I will be happy to take them as coordinated through net control.

This is N7RTG turning the frequency back to net control.