Making Those Microwave QSOs

It seems that every type of amateur operation has evolved its protocols and manners for finding other stations, initiating contacts and exchanging information. Some may seem very technical, such as is the case with EME, and others seem to combine rapid-fire discipline with courtesy, as can be seen during HF pileups for a rare country. Repeater operators, amateur television, satellites, emergency communication, traffic handling and packet are other examples of how Amateur Radio serves different purposes.

Different types of operations can share the same aspects, such as the need to exchange call signs, and others can be very different, such as the need to send messages or TV pictures. Microwave operation itself can cover several types of operating depending on whether you are working on rare DX, a band opening or a contest, or are just chatting. Some microwavers always operate from hilltops, others from home. Rovers typically operate from hilltops, but can stop at any pullover, and some even operate while mobile.

The Basics

No matter what the communication mode and purpose, amateurs always identify themselves with call signs. When they wish to acknowledge that a contact has taken place, they will also exchange some other piece of information. Signal reports often fill this need, being useful information as well. Microwave operators will often share their Maidenhead Grid Locator to either four places or six places.[1] In order to provide evidence that a QSO has taken place, the ARRL contest rules for VHF and higher contests usually require a grid to be noted in the log. Many contests use the number of grids as multipliers in scoring, so there is extra incentive to get this information. Further evidence of a QSO includes the time and frequency. This information should be kept in the station log anyway, so most microwave operators do keep an accurate station log.

What is Hilltopping?

Much of the microwave activity at 10 GHz and above is from portable stations brought to hilltops. Setting up and operating a portable station is a load of fun (see Figure 1). For me it is an adventure. Think of how you might put together a station that will work from battery power, is easy to set up, can be lugged to a good site by one person, hopefully in one trip. It has to withstand extremes of weather, because in most parts of the country there is unpredictable precipitation and high and variable winds at these elevations. To prepare for low temperatures, some amateurs will put their systems into the freezer overnight and after pulling it out the next day, find out just what doesn't work. Knowing that if something can go wrong, it will, lots of preparation is good advice. Having extra cables, a multimeter, and some spare parts can help tremendously.

TNX W1GHZ

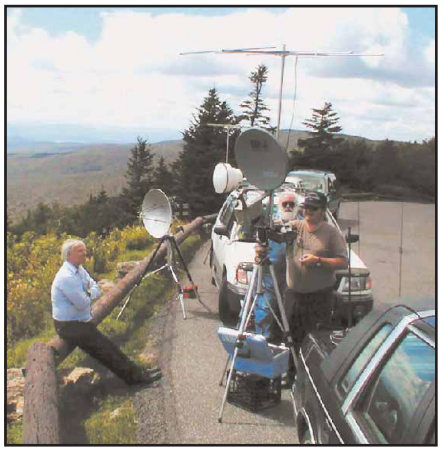

Figure 1—In this photo, from left to right, Jud, K2CBA; Walt, WA2ALV, and Dennis, WA1HOG, set up on the side of the road at Mount Greylock in western Massachusetts. Note the liaison antenna above all else.

Why do Microwavers use Liaison Radios?

The purposes of the liaison circuit are to establish that the stations want to communicate, figure out in what directions to point, determine whether it is worth trying, decide who will transmit first (and how) and to report back regarding signal strength and the next step.

Most parts of the US use 144.260 SSB as a calling frequency to perform liaison. Amateurs who are looking for a QSO on a microwave band during a microwave contest or some other event will call there first, and then move to some other part of 2 meters, such as up or down the band in 10 kHz increments depending on activity levels. Clear signals on the liaison afford the best chance for making a tough microwave contact. It is most convenient to construct a system that provides IF and liaison radios and other interfacing into one unit (see Figure 2).

At the least, 25 W and a 3-element beam on 2 meters make an effective liaison station. Although it may seem strange to the newcomer, less than this will often result in difficulty. I have participated in liaison relays more than once in which the two 10 GHz stations were unable to communicate on 2 meters because of insufficient power or antenna systems. This required that one or even two stations relay the liaison information, only to have the microwave stations, once aligned, make a Q5 QSO on SSB!

TNX W1GHZ

Figure 2—Here is one of W1GHZ's microwave setups. The liaison radio, along with a 100 W amplifier, and an IF radio, keys and a PDA all are accommodated in one box.

[1]Notes appear on page 83.

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How do we Point?

Most horns need to be pointed within 10 or more degrees, and so the uncertainty of pointing is reduced or eliminated. Those who are using the typical 2 foot dish, however, want to start with their antennas pointed to within 1 or 2° of the expected direction. To do this, one must have an indicator on the dish mount, and that indicator must be set correctly. A compass style indicator, called a "rose," is usually attached beneath the dish. It is placed on the top of the tripod in such a way that it can be rotated by hand but will stay in place once set (see Figure 3). You can obtain the initial directional setting (once the tripod is placed and leveled) by either knowing the direction of the sun or the direction of some signal, such as a beacon. Then point at it, and set the rose so that the correct direction is indicated. To assist with sun pointing, hams will fix a thin string on the dish and draw a line on the dish so that the string's shadow will fall on the line when the dish is pointed at the same azimuth as the sun (see Figure 4).

Either pointing method (and pointing toward any station, for that matter) requires knowing the direction. Programs for this purpose are available for PCs and for PDAs so that one can compute these directions easily once in the field.[2] If your own location is not known in advance, bring along a GPS unit that reads out Maidenhead grids.

TNX W1RIL

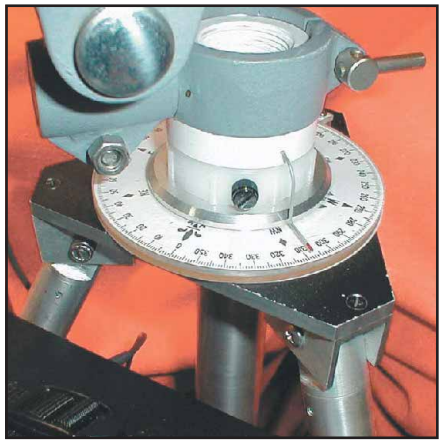

Figure 3—A compass rose in use on one of W1RIL's tripods.

TNX W1FKF

Figure 4—A string on the front of the dish will cast a shadow onto the line on the dish when pointed at the same azimuth as the sun.

How do I Make a Contact?

Once a station is set up and the equipment is stable, stations look for each other on the liaison calling frequency, and move to some other part of 2 meters. Next the stations will exchange sufficient information to figure out where to point. If there are several stations on a hilltop, they perform much better if they coordinate working the other station (or group of stations). Typically, the best-equipped station of a group will contact the other station(s) first. It is much easier to be heard and to hear if you are operating with more power and have a better receiver. This way, weaker stations can listen to the QSO and line up their antennas and fine-tune their radios prior to working the distant station.

The two stations about to work need to decide on an order of operation, whether alone or in a group. An effective procedure will start by determining who has the most powerful transmitter. That station transmits first. If narrowband operation is available, either a continuous transmission with "key-down" or dashes are often used. Dashes are easy to discriminate from birdies and interference, and in times when rain scatter may be present, dashes are most easily heard. If the stations are using wideband FM, one station begins speaking or sends a tone.

The receiving station will tune across an appropriate frequency range and swing the antenna across a reasonable arc until the other station is heard and peaked. Then the receiving station will report back on the liaison radio, and usually the next step is to have the receiving station transmit so that the originally transmitting station can peak the antenna. Often, the ability to slightly elevate the direction of the antennas can further peak the signals. If sufficient signal levels are present, a QSO can proceed. This might be either with CW or SSB for narrowband systems, or wideband FM for Gunnplexer radios.

All of this may seem complicated and time-consuming. In fact, it all goes quite smoothly and quickly. The most time-consuming part of the process (as it should be) is the hunt for the other station.

Don't forget to log your contacts and add other information, such as weather, signal qualities, dial frequency, and so forth. There are logging programs available for PCs and PDAs for the various contests. It is always wise to carry along a pad of paper and extra pencils because there are always little things to remember.

What is my Frequency?

It is always helpful to know your frequency. Unfortunately, at 10 GHz and above, typical crystal controlled circuits are susceptible to changes in temperature and supply voltage. This, in turn, results in frequency uncertainty, even though you may have tweaked everything just right before leaving home. There are several ways to overcome this problem. The easiest is to go to hilltops where there are other amateurs involved in the same contest. They will have already established the calling frequency. Another is to tune into a beacon, if there is one close enough to be heard well. Failing these two approaches, one can bring along a standard that is both well protected and well regulated. Folks who do this will design and set their standard to 1152 MHz, and listen for harmonics at 2304, 3456, 5760, 10,368 and 24,192 MHz.

Home station operators need not worry much about frequency stability as long as they have standards by which the frequency can be checked occasionally. Some home stations, if well equipped, can act as a standard for hilltoppers in the area. Furthermore, home stations can easily operate more liaison power, and often will assist difficult liaison situations between portable stations.

Of course, home stations have more flexibility in working when the weather is bad and there are no stations on hilltops. Home stations will still follow much the same procedures as outlined above. Typically a pair of stations will start on a VHF band, decide on a liaison frequency, and work higher and higher bands to find out just what DX is available. I find that at least half of my microwave operating time is spent on testing equipment and propagation rather than chasing contest points or DX. Whether a home or portable station is in your future, get together with other hams and have fun on these bands.

Notes

[1]Curtis, "VUCC—20 Years and Counting," *QST*, Feb 2003.

[2]The W1GHZ Web site has pointers to many sources for Palm OS software for microwave operation. Set your browser to **www.w1ghz.org**.