Measuring Isolation Between Radios

By George Cutsogeorge, W2VJN

When two or more radios are operated in close proximity, some care is needed to be sure they can coexist without damage. When antennas are close together and high power is being used, there is a danger that a receiver will be damaged by absorbing too much energy. This situation is common on Field Day and DXpeditions where multiple transmitters are operating at the same time. In multiop contest stations and in single op, two radio (SO2R) stations it is also a concern.

Without knowing anything about the receiver's input circuit, it may be a good assumption that it consists of components such as resistors and diodes that are rated at 1/10 to 1/4 watt. To be safe, let's say we would like to input no more than 50 milliwatts to prevent receiver damage. This is about 45 dB below 1500 watts and about 33 dB below 100 watts.

How can we tell if we have interference levels that will cause any of these problems? Do we just fire up our 1500-watt transmitter in radio A and see what happens to radio B? I don't recommend that. All we need are the two radios plus a little arithmetic to figure it out.

The voltage level that causes an S9 reading in most radios is typically 50 microvolts. Let's look at an example of one station, radio A, on 40 meters and a second on 20 meters, radio B. Each is connected to its normal antenna. Radio A uses a 40 meter dipole and radio B has a triband Yagi. Both antennas are on the same tower.

Set up radio A on 40 as the transmitter and radio B as the receiver. Turn the radio A power all the way down before transmitting. Set radio B to 40 meters leaving the tribander connected. Adjust the radio A power output to one watt and tune it in with radio B. Rotate the tribander for the maximum S meter reading on radio B. Add attenuation to radio B so that an S meter reading below full scale occurs. As an example, assume the S meter reads S9+55 dB with 18 dB of attenuation inserted.

The isolation between radios can be calculated with this equation:

Isolation (dB) = Ptx – attn – (–73 dBm) – dB above S9

where

Ptx = transmitter power in dBm (1 watt = +30 dBm)

attn = attenuator setting in dB

–73 dBm = S9 = 50 µV

In this case, isolation = +30 – 18 + 73 – 55 = 30 dB

Clearly radio B is in danger if the transmitted power is 1500 watts, so more isolation is required. This could take the form of filters and/or stubs. For a 100-watt transmitter the isolation is still 3 dB less than we would like. If the tribander is rotated there will be positions that provide a bit more isolation and this may be adequate for a temporary situation.

The same measurements should be made with radio B transmitting on 20, 15 and 10 meters and radio A receiving on the same band. Since a 40 meter dipole is a good 15 meter antenna, this will most likely be the band with the least isolation.