Extending the Range of Your Handheld With an External Antenna

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Handheld Pros and Cons

The Pros

- Low entry cost
- Portability
- Easy to power

The Cons

- Limited transmit power
- Poor antenna

Handheld Communication Range

Two components of range:

How far does my signal reach?
You can't communicate if you can't be heard

What can I hear?
You can't work what you can't hear

What Can I Hear?

Several factors affect what you can hear:

- Signal path to the other station
- Antenna gain
- Other antenna issues
- Radio capabilities

Signal Path

Signal path affects both the strength of signals you receive and the perceived strength of the signal you transmit.

- Height
- Obstacles

Antenna Gain

Antenna gain (or loss) is a measure of the effect the antenna has on the signal.

- Handheld antennas are often referred to as a “dummy load”
- A good base antenna can increase signal strength by nearly 10x

Other Antenna Issues

Antenna performance is also affected by objects in the “near field region.”

- The most common object in the near field region of a handheld is YOU

Calculating Antenna Gain

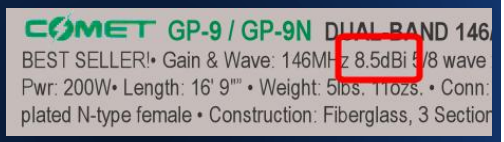
- Antenna gain is expressed in decibels (dB)
- Decibel scale is logarithmic
  - 0 dB = 1x (Unity gain)
  - 3 dB = 2x
  - 10 dB = 10x
  - 20 dB = 100x

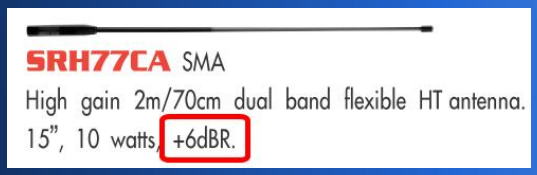
$$Gain = 10^{\frac{Gain(dB)}{10}}$$

Calculating Antenna Gain

Radio catalogs often use different suffixes with dB to qualify the gain.

- dBi = Relative to an isotropic radiator
- dBr = Relative to a reference antenna





Antenna Connectors

Handheld radios typically use two different antenna connectors

- SMA (about 75% of radios on the market)
- BNC (about 25% of radios on the market)

Antenna Connectors

Using an external antenna will probably require some kind of adapter that allows you to connect your antenna to the SMA connector on your radio.

- Limit wear from repeated connection cycles
- Reduce strain on the connector

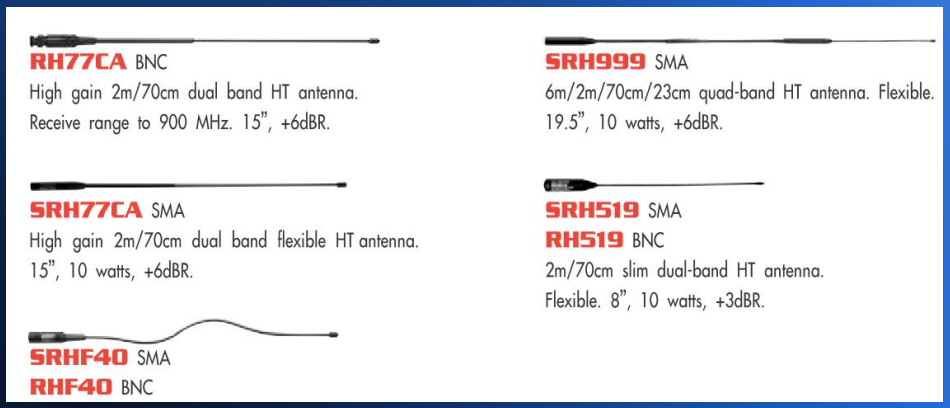
Antenna Selection

There are two approaches you can take to increasing the capability of your handheld antenna.

- High-gain whip antenna (attached to radio)
- External antenna

Antenna Selection

High-gain whip antennas



Antenna Selection

High-gain whip antennas

- Easy to replace existing antenna
- Attached to radio – No need for external cables or changing connections
- Can put strain on antenna connector
- Make your radio much larger
- Can introduce some flutter

Antenna Selection

Mobile antennas

Antenna Selection

Mobile antennas

- Typically designed for use with a ground plane
- Easy to set up and take down
- Often available with different mounts
  - Magnet mount
  - Trunk lip
  - Design your own from an existing mount

Antenna Selection

Base station antennas

Antenna Selection

Base station antennas

- Large (5 feet to 25 feet)
- More difficult to move and set up
- Highest gain

Signal Path

An external antenna can improve signal path.

- Get your antenna up higher
- Get the antenna away from obstacles
- Separate your antenna from local noise sources

Antenna Gain

An external gain antenna improves your ability to transmit and receive.

- Higher gain means that your transmitted signal is stronger
- Higher gain means that you can receive weaker signals
- Position the antenna for optimum performance without having to change operating position

Issues to Consider

Base station installations

- Convenience
- Lightning protection
- Antenna mounting

Issues to Consider

Portable installations

- Ease of setup and take-down
- Mounting methods
- Typical usage scenarios
- Stability and safety

Example Installations

Arrow Dual Band J-Pole

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Questions?