

Reply Antenna Combining System (ACS)

The Reply® ACS simplifies large installations by extending system range and reducing the number of required antennas.

In most cases the ACS will provide 2X to 4X range improvement without any change in the required antenna placement. When even more range is needed the ACS simplifies antenna placement.

The ACS is designed for high reliability. It uses hi-rel and military grade components, thermal management, and amplifier protection circuitry.

This manual describes the system and how to get the best performance.

1.0 Connecting the ACS System

Hooking up the ACS is much simpler than using a separate antenna set for each interface.

An ACS consists of:

1. Two powered receive antennas
2. An extended range transmit antenna
3. A receive antenna amplifier/splitter unit
4. A transmit antenna combiner unit

The ACS supports up to 8 channels of Reply® and Reply DL® interface units.

1.1 Transmit Combiner Connections

Transmit Combiner connections are diagrammed in Figure 1.

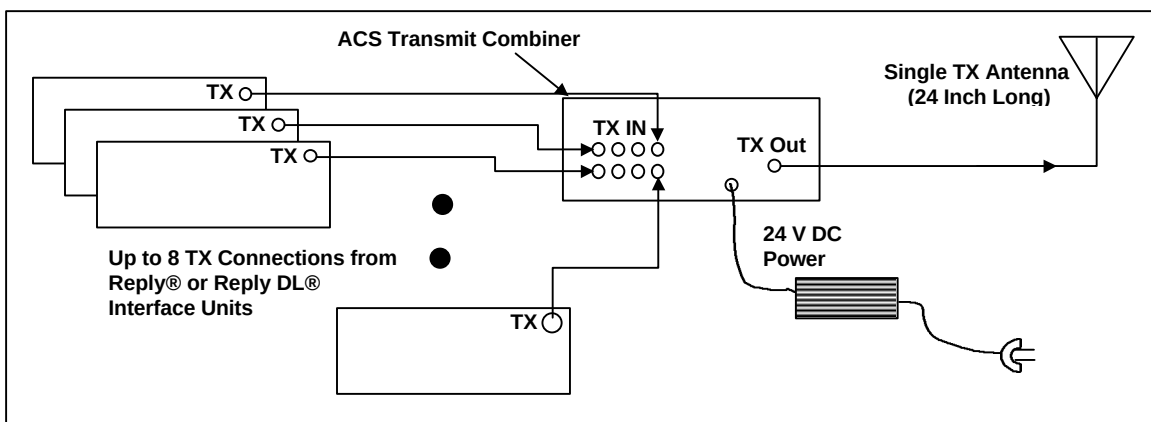


Figure 1. Connecting to the Transmit Combiner

The Transmit Combiner accepts transmitter connections from up to 8 Reply® interfaces and performs an arithmetic summation of each signal to provide a single output with less than 0.1 % distortion. This output is applied to the range-extending Transmit Antenna (24 in long). Since there is only one Transmit Antenna, it is easy to locate in an advantaged arrangement (see Section 2).

1.2 Receive Amplifier/Splitter Connections

Receiver Amplifier/Splitter connections are diagrammed in Figure 2.

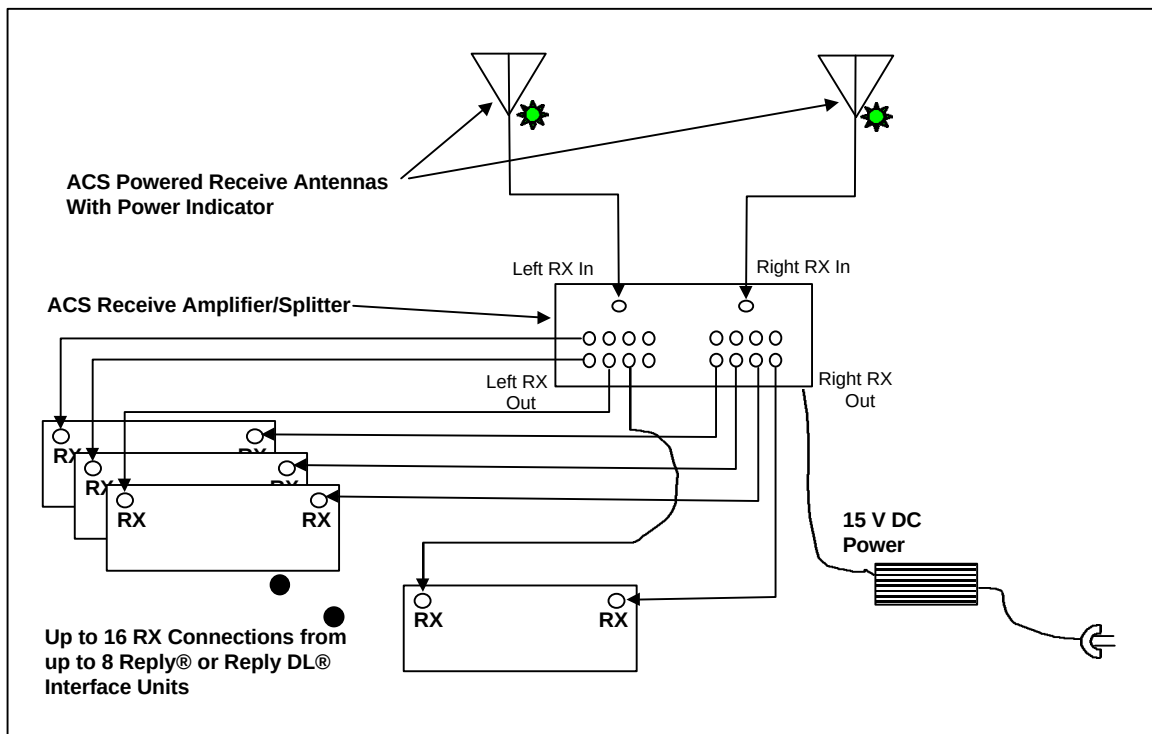


Figure 2. Connecting to the Receive Amplifier/Splitter

The Receive Amplifier/Splitter accepts connections from 2 powered antennas and splits the RF signals for application to up to 8 Reply® interfaces. The powered Receive Antennas have an indicator lamp to verify continuity between antenna and ACS. Since there are only 2 Receive Antennas, they are easily located in an advantaged arrangement (see Section 2).

The Receive Antennas and Amplifier/Splitter are designed for compatibility. Together they provide:

- Interference rejection
- Greatly increased range (with or without advantaged antenna locations; see Section 2)
- Tolerance to very long cables (that may have high loss)

2.0 System Arrangement and Range

This Section discusses the factors that effect system range and how to optimize range.

2.1 Range Factors

The Reply ® and Reply DL® systems are designed to operate within legal transmit power limits. The legal limits are established to allow co-existence of many types of radio systems. However, when the transmit power is limited the system's useful range may only be extended by:

1. Improving the receiver sensitivity or
2. Reducing the path loss between transmitted and receiver

The ACS provides improved receiver sensitivity and facilitates lower path loss by making it easier to set the interface (base) antennas in advantaged locations.

2.2 Advantaged Antenna Locations

There are several useful 'rules of thumb' for evaluating a proposed antenna location:

Rule 1: Path loss increases by only a factor of 4 each time the range is doubled as long as there is a direct, unobstructed line-of-sight path between the keypad and interface antenna. This is called a Line-of-Sight (LOS) link. A LOS link is the best that you can achieve and the ACS will give better than 1000 foot* range in an LOS arrangement.

Rule2: Path loss increases by a factor of about 10 each time the range is doubled if there are a lot of obstructions between the keypad and interface. This is called a complex environment. Depending on how complex, the ACS will give 100 to 300 foot range.

Rule 3: Path loss decreases by a factor of 4 each time the interface (base) antenna height is doubled. This applies until a LOS path is achieved, then there is no more improvement.

Rule 4: Cable loss increase is insignificant compared to the potential improvement when antenna height is increased. For all practical purposes, your antenna can never be too high.

Rule 5: The two (diversity) receive antennas should be at least 3 feet apart. In fact, some locations benefit from even wider spacing if a LOS path is established from at least one of the antennas to all points in the room.

*** Note: Reply keypads built after March 1999 have roughly 2X the range compared to pre-3/99 units. The above ranges are based on post-3/99 units.**

These rules lead to some conclusions:

- a) Smaller rooms (25 to 50 ft range) can get by with antennas set just about anywhere. See Figure 3
- b) To cover medium size rooms raise the antennas up. The 6 to 8 ft level should cover to about 100 ft, depending on how complex the environment is. See Figure 4.
- c) For very large rooms the antennas should be on booms (like a MIC stand) or set in the catwalk, etc. See Figure 5.

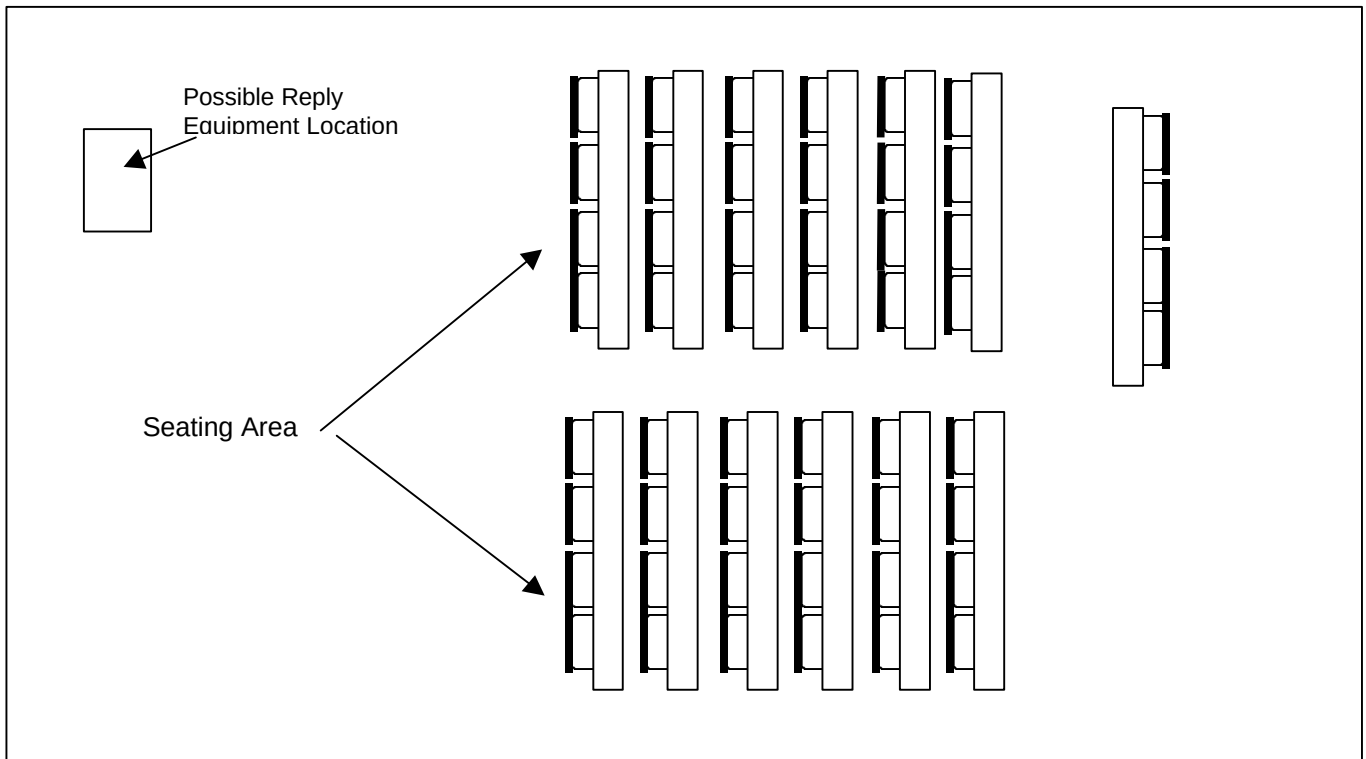


Figure 3 – ACS used in a Small Room

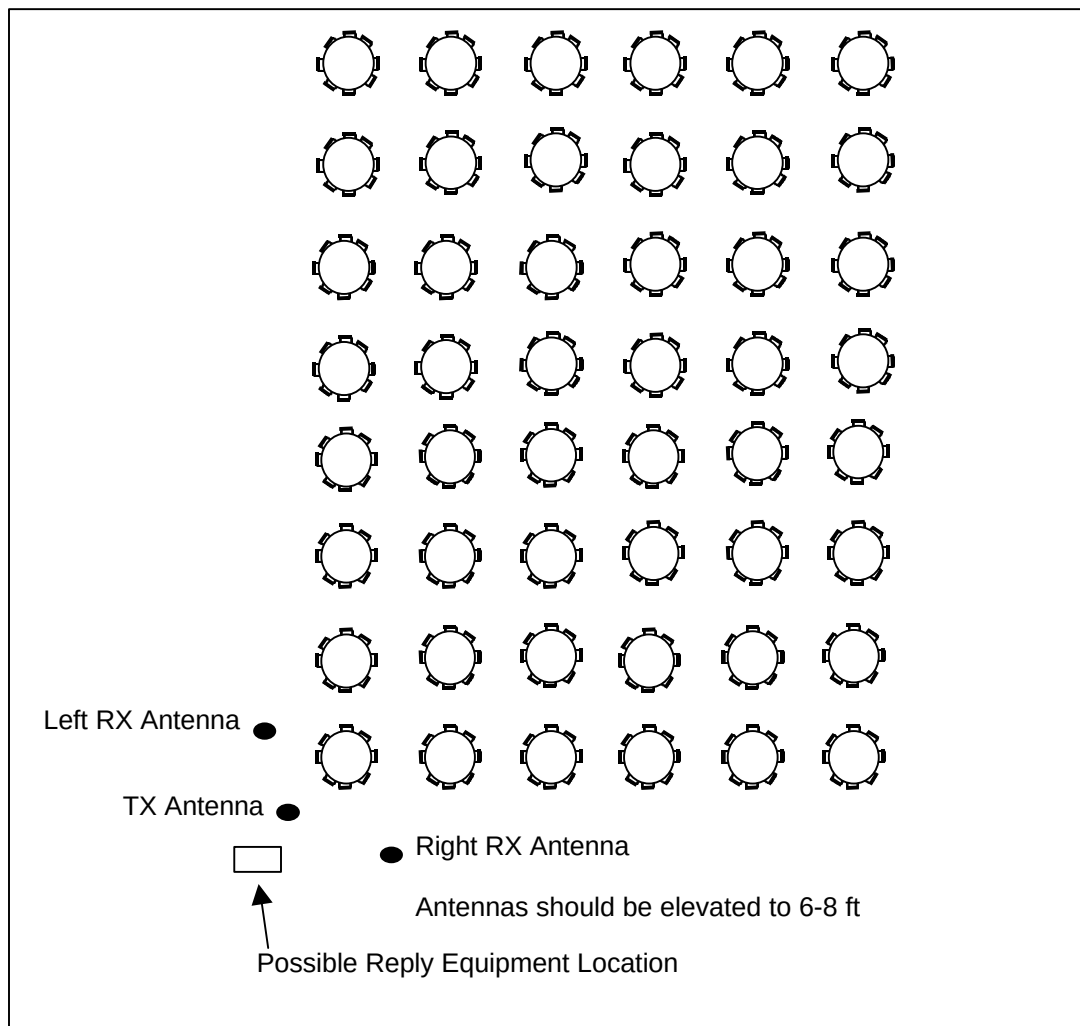


Figure 4 – ACS Used in a Medium Sized Room

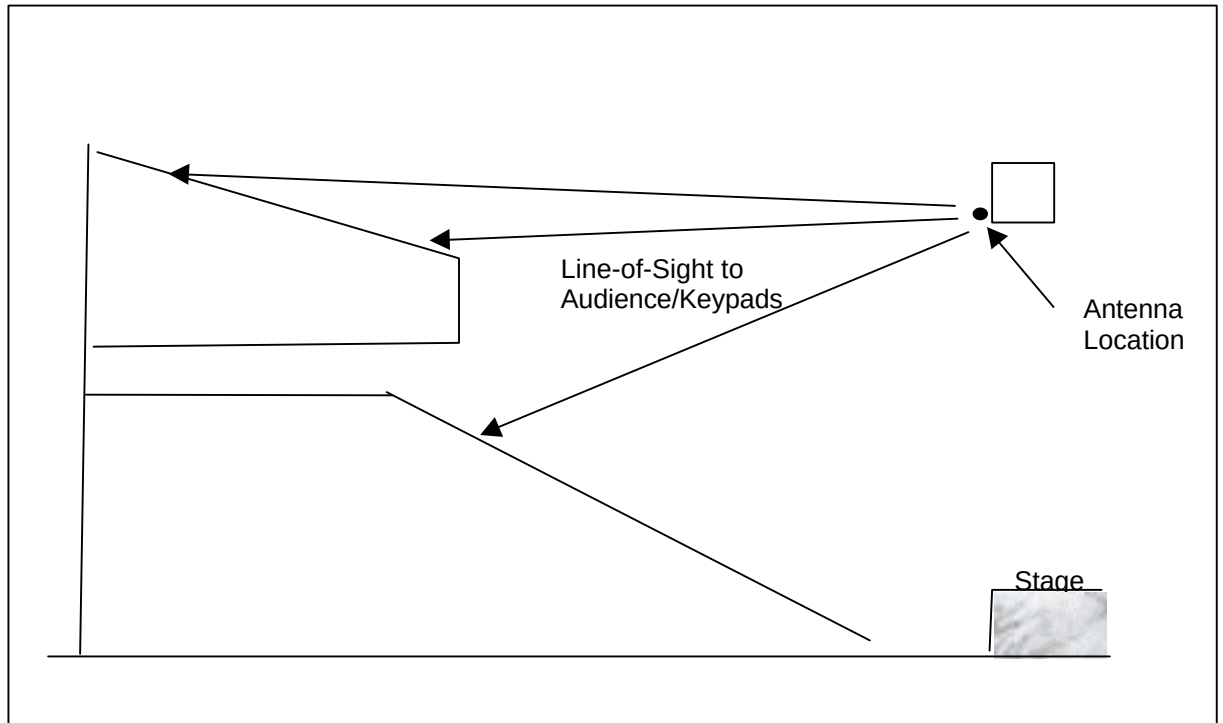


Figure 5 – ACS Used in a Very Large Room