

## DX200 Base Station Antenna Placement

This white paper presents a brief description of the key elements that should be considered when installing a DX200 Base Station. Careful thought, before and during the installation of the base, will guarantee the best possible performance for your application and in your particular venue.

Things to consider before and during installation:

1. The base should be located so you maximize line-of-sight operation even if this requires operating through a glass window.
2. Minimize the number of walls between the base station and area where the communicators will be operating.
3. If necessary, the base station can always be moved closer to the area of highest communicator usage for more thorough coverage.
4. Always do a walk test before making the decision where to place the base station.

### Differences and Considerations for 2.4GHz

The DX Series Systems use the license free 2.4GHz Industrial, Scientific and Medical (ISM) frequency band for operation. The frequency range is 2.4 to 2.4835 GHz. At this frequency, there are operational differences when compared to lower frequency band systems. At 2.4GHz, the radiated wave behaves more like a light beam from a flashlight. Large metal cabinets or metal equipment will block or cause reduced range because of reflected signals off their surfaces. The signal will bend around sharp edges but in comparison to lower frequency units, it will have more loss when penetrating walls. Concrete or masonry walls are worse than standard wallboard. Large windows will actually allow the signal to pass through with little attenuation. Additionally, the human body will tend to block and absorb the signal when at maximum range.

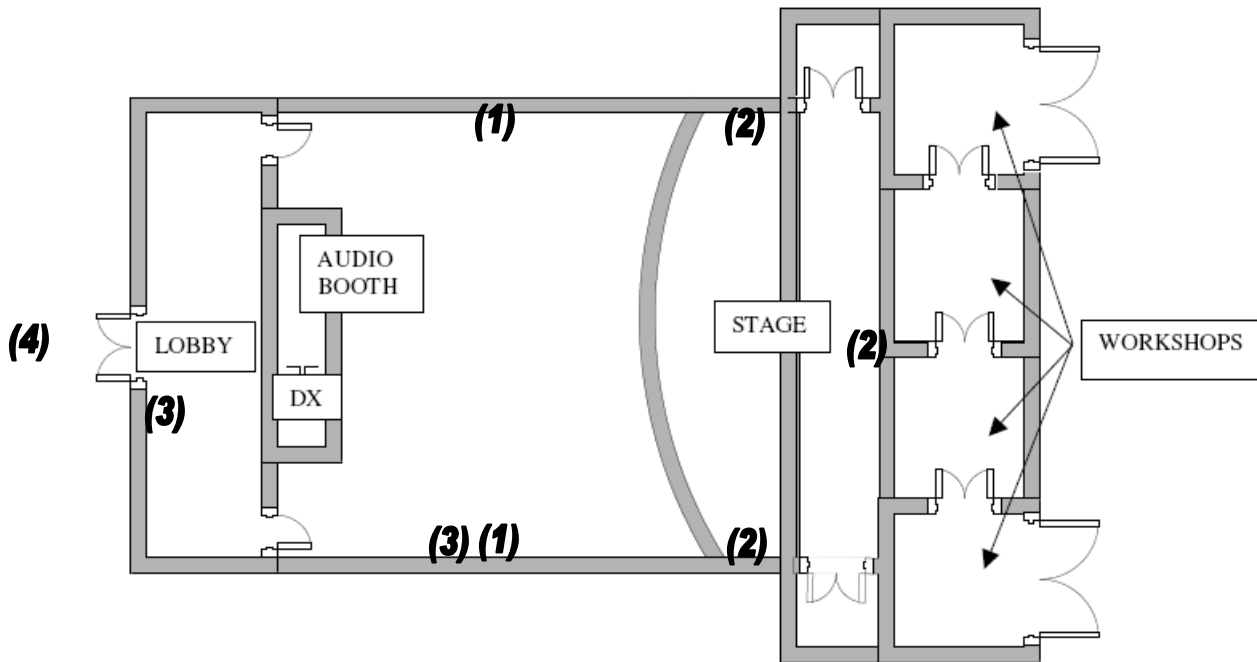
The DX Series Systems transmit at 100mW of power (base stations and communicators). This power level is used to account for the higher signal losses at this frequency and to accommodate the extremely wide bandwidth signal which tends to lower the receive sensitivity. This power level is typically higher than a wireless network access point such as 802.11.

### How to Get the Best Range and Coverage from the DX200

A typical theatrical application is set up as shown in Figure 1. From the Audio Booth, the DX200 will easily reach all line-of-sight locations in the Main Theatre and Stage. Depending on the thickness and material of the wall behind the Audio Booth, the signal in the Lobby will be attenuated to some degree. If the system is to be used outside and in front of the theatre, the signal will be further attenuated due to the additional wall and distance. For the DX200 to operate in the workshops, the signal must pass through the back stage wall at a significant distance. If it is determined during the walk test that there is no coverage in the workshops but this coverage is necessary, an adjustment to the radiation coverage will be necessary.

Several approaches may be entertained:

1. If acceptable to give up coverage in front of the theatre **(4)** then it may be possible to get the desired coverage in the workshops by remoteing one or both of the antennas with low-loss 50 ohm coaxial cable to spots closer to the back of the theatre **(1)**.
2. If it is not necessary to keep the base station in the audio booth, it should be moved closer to the stage **(2)**. 2-Wire or 4-Wire cables would need to be run to the house hard-wired intercom system as required, depending on its location. The base station would typically be mounted six to ten feet off the floor.
3. If coverage is required in both the workshop areas and in front of the theatre, a third approach may require one antenna to be remoted toward the workshops **(3)** and the other to be remoted in the Lobby **(3)**.



**Figure 1 Typical Theatre Application**

### **Using the Remote Antenna Kit to Increase Coverage or Fill a Hole**

The remote antenna kit consists of a bracket, coax cable and screws. The cable can be screwed onto one base antenna connection and the antenna screwed onto the far end of the cable. The cable is routed to the desired coverage area and the bracket mounted to hold the antenna and cable in position. The coax cable is a special low loss type designed for the DX200 frequency range.

The DX200 base station uses two antennas. The base electronics switches between these antennas to obtain the best signal quality. Both antennas act as transmit and receive. One antenna could be removed and the system would still operate. The purpose of using two antennas is to overcome multi-path dropouts. If one antenna is remotod using the cable, the base will still select the antenna that gives the best signal to a particular COM.

Adding cable to the antenna connection will reduce range to that antenna because of signal loss but it will fill in a bad coverage spot. The remote antenna kit should not be used unless it is necessary to fill a difficult coverage area. Table 1 gives the signal loss for one, two and three cables hooked together. It is recommended that no more than one cable be used; otherwise, the additional loss may create worse problems with coverage.



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**Table 1 Antenna Kit Cable Loss**

Number of Cables	dB Loss	Percent Loss	Power at Far End @ 100mW Input
1, 30ft	2.5	44	56
2, 60ft	5.0	68	32
3, 90 ft	7.5	82	18

Using multiple cables is possible but not recommended because of the high loss at the DX200 frequencies. The cable connectors are set up so the cables can be screwed together to get longer runs. It is a bad trade-off to use more cable just because the base was poorly located.

In Table 1 above, note that the use of two 30 foot cables (60 feet) is roughly equal to 6dB. This would cut down on the radiated range by approximately  $\frac{1}{2}$  its non-attenuated distance. Therefore, in a situation where the line of sight range is typically 1000 ft, the addition of 60 feet of low loss cable would reduce the range to approximately 500 feet. This may be perfectly acceptable if it fills in an area where the signal is lost and would be a good trade-off.

You should always walk test your antenna solutions before making them permanent.