Meridian 1

Meridian Companion

Guide to Site Planning

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Contents

About this guide

This guide shows you, the site planner, how to plan a single floor, low portable density, indoor Companion system. This guide contains:

- rules for installing Base Stations
- directions for using the Companion Deployment Tool
- an example of how to plan a typical site

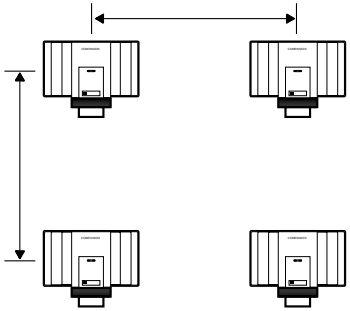
For more detailed planning procedures and for an overview of the Companion system, refer to the appropriate *Companion Site Planning Reference Manual.*

Base Station installation rules

Do

- Ensure that the installation complies with your local electrical code.
- Install Base Stations indoors where there is no condensation and the temperature remains between 32° and 120°F (0 °C and 50°C).
- Install Base Stations within 4,000 ft (1 200 m) (wiring length for 24 AWG) of the Controller.
- Position Base Stations on ceilings, or upright against walls close to the ceiling on the same surface with matching composition.
- Position Base Stations at least 40 in. (1 m) from large concrete or marble columns.
- Allow a clearance of at least $3^{1}/_{2}$ in. (9 cm) between the Base Stations and surrounding objects (excluding other Base Stations).

- For the PCI protocol, position all the Base Stations at the same cell center as close together as possible but maintain a minimum center to center distance of 54 in. (1.35 m). For the CT2Plus protocol, position all the Base Stations at the same cell center no more than 5 ft (1.5 m) and no less than $3^{1}/_{2}$ in. (9 cm) from each other.



- Mount the Base Stations as high as possible on walls or ceilings if there are one or two Base Stations at the cell center.
- Mount the Base Stations on ceilings if there are three or four Base Stations at the cell center.
- Mount Base Stations clear of obstacles such as pipes or ducts.

Don’t

- Do not position more than four Base Stations at a cell center.
- Do not install Base Stations in spaces that transport air (ducts, plenums or hollow spaces).
- Do not mount Base Stations in rows.
- Do not install Base Stations on large concrete or marble columns.

Companion Deployment Tool

Use the Companion Deployment Tool (CDT) to determine cell centers and cell boundaries. The CDT consists of a stand, a CDT transceiver, a battery, a portable and documentation.

For more information on the CDT, refer to the appropriate *Companion Deployment Tool User Guide.*

Checking the CDT

Note: Do not use the CDT transceiver outdoors.

1. Charge the battery for the CDT transceiver the day or night before and have a fresh set of batteries for the portable.
2. Establish a radio link.
3. In an open area, stand with the portable 10 ft (3 m) from the CDT transceiver. Keep the CDT transceiver in plain view and make sure there are no obstructions nearby, including people.

Note: The maximum signal strength is -35 for the PCI protocol and -44 for the CT2Plus protocol.

If the portable displays the maximum signal strength, the CDT is working properly. If the portable does not display the maximum signal strength, repeat this procedure using a different portable. If the portable still does not display the maximum signal strength, replace the CDT transceiver.

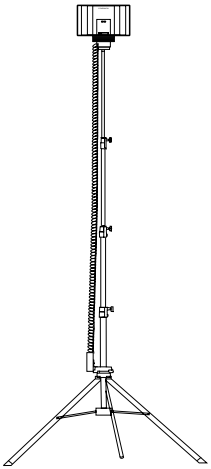
Cell boundary values

Use Table 1 to determine which cell boundary value to use with the CDT. An "office" is the area where Companion users make and receive calls while sitting at their desks. For example, an office can be a laboratory, cubicle, or workstation.

Table 1 : Cell boundary values

Indoors (with office)	Indoors (without office)	Outdoors
-70 dBm	-73 dBm	-75 dBm

Using the CDT to determine cell boundaries



1. Raise the CDT transceiver as high as it goes or until it reaches the height you determined for Base Stations.
2. Hold the portable approximately 40 to 50 in. (1.0 to 1.3 m) from the floor. Establish a radio link, enter *897 and the desired cell boundary value.

   Note: If the CDT transceiver powers off (for example, if the battery unplugs), the cell boundary value resets.

3. Stand at a position near the CDT where you hear a continuous tone. Your portable shows two values—the signal strength on the left and the cyclic redundancy check error rate on the right. For more information, see the appropriate *Companion Deployment Tool User Guide*.

   Note: The farther you move away from the CDT transceiver, the more negative the number you read.

4. Walk briskly away from the CDT transceiver until the tone changes.

   — You hear a steady tone when you measure a signal strength stronger than the cell boundary value.

   — You hear a rhythmic high-low tone when you read a signal strength weaker than the cell boundary value.

   — You hear silence if you lose the link.

Note: The tone may change back to continuous after you stop walking. The tones and signal strength are useful only when you are walking.

Planning a typical site

Planning a site involves:

- gathering site specific information
- determining cell centers
- determining the number of Base Stations for each cell
- reviewing your work

Gathering information

Before you go to the site, make sure that your CDT is working properly and that you have the following:

- a CDT and portable telephone
- copies of the site floor plan (one working copy and one clean copy)
- a pencil, an eraser, a ruler and colored markers
- a page from the appropriate *Companion Provisioning Record*
- any required safety equipment such as a hard hat or safety glasses

Required site information

You need the following information to accurately plan a site:

- name and telephone number of the site contact
- number of portables, the boundaries of the coverage area, and the proposed Companion system

- whether the customer wants to reduce the number of Base Stations by not covering restrooms, stairwells or basements
- whether the users have desk telephones in their offices
- information gathered during the site inspection of the coverage area
- how to get access to secured areas
- location of the telephone switching room
- places where the customer does not want Base Stations
- locations of users' offices

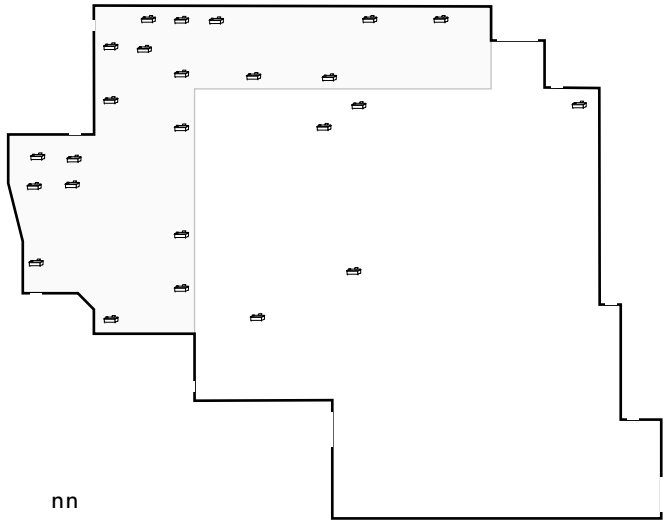
The Sample Site: Required site information

Before you go to the site, you know the following information:

- The customer is X-Bean Inc. You need a yellow hard hat from your contact to be on the premises.
- The sales representative has recommended the appropriate Companion system.
- All 25 users have offices and desk telephones.
- The customer does not need coverage in restrooms.
- The telephone switch room is beside the restroom.
- The customer has no installation restrictions.

Figure 1 shows the coverage area and the location of the offices of the 25 users. There are 20 users' offices in the office area and five users' offices in the factory area.

Figure 1 : Site coverage area



Cell center location

Surveying the site

Survey the site by working from one side of the coverage area to the middle of the coverage area. Then go to the other side of the coverage area and work back toward the middle until you have mapped all of the coverage area. Check your floor plan to be sure that there are no areas where a portable in the required coverage area could be outside the range of a cell center.

Note: Defining a cell typically takes 25 to 40 minutes.

Identifying critical points

1. Identify the initial critical points needed to determine a cell center.
2. Mark these critical points on the floor plan with ⊡. (A critical point is an outer corner of the coverage area, or a point that may be difficult for the radio signal to reach.)

   Note: When determining the location of a cell center, you typically use one or two critical points.

Locating cell centers

1. Set up the CDT transceiver at a critical point and establish a link.
2. Check the floor plan to see if the critical point is within an office area.

   If the critical point is within an office area, use -70 dBm as the cell boundary value. If the critical point is not within the office area, use -73 dBm.

   Note: Refer to your portable user guide for instructions on how to store cell boundary values for later recall.
3. Measure the range into the coverage area in a few directions to determine where a cell center can be located and still be within range of the critical point.
4. Mark a small x on the floor plan where you reach cell boundary values. Draw a thin contour line through the x's.
5. Select another critical point nearby and repeat steps 1 to 4.

   Note: The intersection of the contour lines is a potential cell center.
6. Choose a position on the floor plan for the cell center that

   — is farthest from the critical points and is still within range

   — complies with the Base Station installation rules

   — is in the coverage area
7. Label the cell center on the floor plan xCn, where x is the floor, and n is the cell number in the sequence of the entire plan.

Locating cell boundaries

1. Set up the CDT transceiver at the cell center and establish a link.
2. Check the floor plan for possible users' offices within the cell.

   If the entire area is office area, use -70 dBm as the cell boundary value. If there are no, or only a few, users' offices, use -73 dBm as the cell boundary value.
3. Find the cell boundary position by measuring the range and recording it on the floor plan with a small x.

4. Move back toward the CDT transceiver until the tone from the portable changes from intermittent beeps to a continuous tone.

   Note 1: Walk into all of the areas (rooms) necessary to determine the complete cell boundary. Radio signals travel farther in uncluttered areas than they do in cluttered areas.

   Note 2: Repeat steps 3 and 4 until you make enough x's to draw a contour line around the cell center (12 x's for a full 360° around a cell center are enough).

5. If in step 2, you chose a cell boundary value of -73 dBm and a user's office is within the cell, confirm that the office is within -70 dBm of the cell center. Reset the CDT to -70 dBm and find the cell boundary in the office area. If any of these users' offices are not within -70 dBm of the cell center, consider them as outside the cell.
6. Mark each office on the floor plan within the cell as covered.
7. Label any subsequent critical point on the floor plan with ⊡.

Completing the floor plan

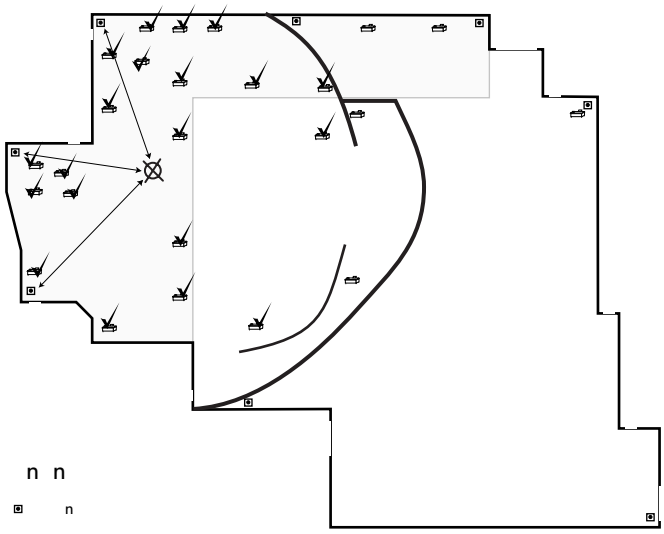
As you locate cells, trace the defined cell boundaries and cell centers with colored markers.

Repeat "Locating cell centers" and "Locating cell boundaries" to define the cells for the subsequent critical points.

The Sample Site: Cell center location

Figure 2 shows how you use the floor plan to identify the initial critical points P1, P2, P3, P4, P5 and P6. Use -70 dBm as the cell boundary value and place the CDT at P1, P2 and P3 to locate cell center 1C1.

Figure 2 : Floor plan detailing cell 1C1

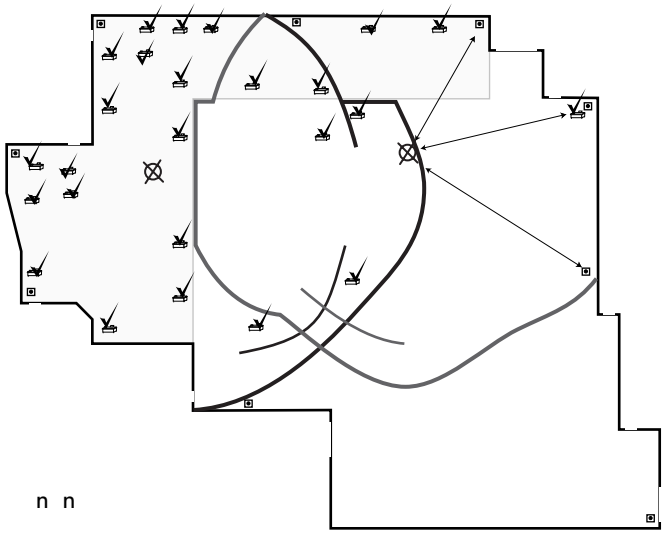


With the CDT placed at 1C1, you find the cell boundary at -70 dBm in the office area and -73 dBm in the factory area. You confirm that 1C1 covers two users' offices in the factory area using -70 dBm. Two other users' offices are within -73 dBm of 1C1 but they are not within -70 dBm of 1C1. So, 1C1 does not cover these users' offices.

You mark with a check 20 users' offices as covered.

Figure 3 shows how you set up the CDT transceiver at critical points P4 and P6. You find that one cell center cannot serve both critical points so you put critical point P9 mid-way between P4 and P6. Using critical points P4, P5 and P9 you find cell center 1C2. Because P6 is in an office area, you use -70 dBm from P6; because P5 is in a user's office, you use -70 dBm from P5. P9 is not in an office or office area, so you use -73 dBm from P9.

Figure 3 : Floor plan detailing cell 1C2

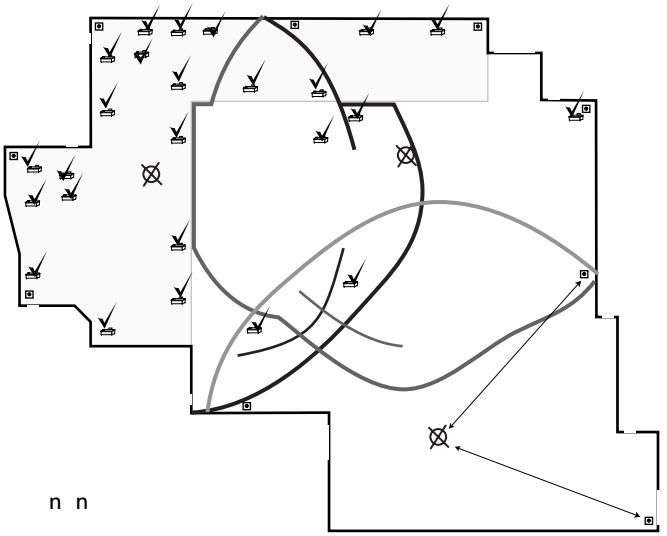


With the CDT placed at 1C2, you use -70 dBm in the office area and -73 dBm in the factory area. You use -70 dBm to cover two more users' offices in the factory area.

You mark with a check five users' offices as covered.

Figure 4 shows how you use critical points P4 and P9 to find cell center 1C3. You use -73 dBm for both critical points because neither critical point is in the office area or a user's office. You set up the CDT transceiver at cell center 1C3 and find the cell boundary using -73 dBm. This cell does not cover any additional users' offices so you do not need to use -70 dBm. Cell 1C3 completes the coverage of the building.

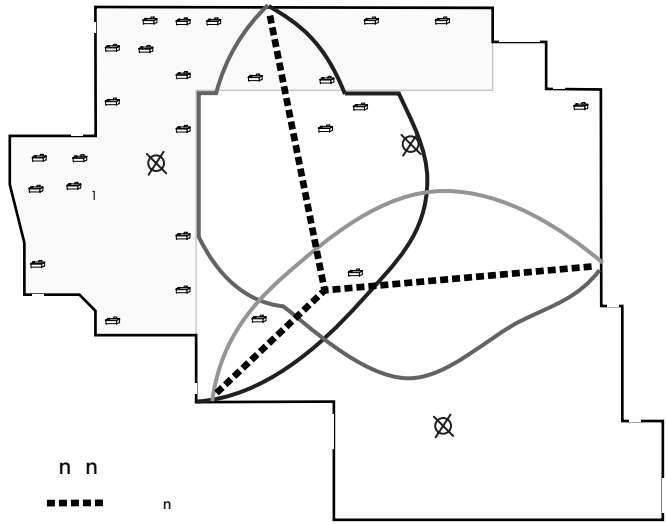
Figure 4 : Completely covered floor plan detailing cell 1C3



Determining the number of Base Stations per cell

1. Divide the floor plan into cell areas, one area per cell, splitting cell overlap areas in half (see Figure 5).

Figure 5 : Dividing the coverage area



2. Count the number of users' offices in each cell area and record this number on the floor plan in each cell area.

3. Create a traffic table as shown in Table 2.

Table 2 : Blank traffic table

	1C1	1C2	1C3	1Cn
Users inside the cell with an office				
Users with an office outside of cell who walk into the cell				
Users without an office				
Anticipated number of portables per cell				

Note 1: For each cell, complete steps 4 through 7.

Note 2: Assume that users will be in the cell where their office is 70 percent of the time and in another cell 30 percent of the time.

4. Calculate the total number of users in the cell with an office.

Users with an office in the cell x 0.7 = Users inside the cell with an office

Enter this number in the row, “Users inside the cell with an office.”

5. Calculate the total number of users with an office outside the cell who walk into the cell.

   Note: Do not count users without an office in this step.

$$\frac{(\text{Total users with an office} - \text{Users with an office inside the cell}) \times 0.3}{\text{Total number of cells} - 1}$$

   Enter this number in the row, “Users with an office outside the cell who walk into the cell.”

6. Divide the number of users without an office by the number of cells.

$$\frac{\text{Total users without an office}}{\text{Number of cells}}$$

   Enter this number in the row, “Users without an office.”

7. Add the values for each column (cell) and enter the result in the row, “Anticipated number of portables per cell.”

8. Determine the number of Base Stations per cell (see Table 3).

Table 3 : Base Station requirements per cell

Anticipated number of portables per cell		Number of Base Stations
Users with both a portable telephone and a desk telephone	**Users with only a portable telephone**	
greater than 0 up to 3	greater than 0 up to 2	1
greater than 3 up to 12	greater than 2 up to 7	2
greater than 12 up to 27	greater than 7 up to 15	3
greater than 27 up to 44	greater than 15 up to 23	4
greater than 44	greater than 23	high density area[1]

1. For high density deployment, refer to the appropriate *Companion Site Planning Reference Manual.*

The Sample Site: Determining the number of Base Stations

X-Bean Inc has three cells with 18 users in cell 1C1, seven users in cell 1C2, and no users in cell 1C3. The users have desk telephones in their office. There are 25 users with an office.

The number of users without an office is 0.

Cell center 1C1

1. Number of users inside the cell with an office:

$$18 \times 0.7 = 12.6$$

2. Number of users with an office outside the cell who walk into the cell:

$$\frac{(25 - 18) \times 0.3}{3 - 1} = 1.05$$

3. Anticipated number of portables per cell:

$$12.6 + 1.05 + 0 = 13.65$$

Cell center 1C2

1. Number of users inside the cell with an office:

$$7 \times 0.7 = 4.9$$

2. Number of users with an office outside the cell who walk into the cell:

$$\frac{(25 - 7) \times 0.3}{3 - 1} = 2.7$$

3. Anticipated number of portables per cell:

$$4.9 + 2.7 + 0 = 7.6$$

Cell center 1C3

1. Number of users inside the cell with an office is 0.
2. Number of users with an office outside the cell who walk into the cell:

$$\frac{(25 - 0) \times 0.3}{3 - 1} = 3.75$$

3. Anticipated number of portables per cell:

$$0 + 3.75 + 0 = 3.75$$

Table 4 : Completed traffic table

	1C1	1C2	1C3
Users inside the cell with an office	12.6	4.9	0
Users with an office outside of cell who walk into the cell	1.05	2.7	3.75
Users without an office	0	0	0
Anticipated number of portables per cell	13.65	7.6	3.75

Using Table 3 and recalling that the users have desk telephones in their offices, you find that the number of Base Stations needed per cell is:

	1C1	1C2	1C3
Base Stations	3	2	2

You need a total of seven Base Stations.

Reviewing your work

Checking system capacity

❑ The number of Base Stations, portables, access lines and cells for the system does not exceed the capacity of the system.

❑ The recommended location of the Controller is not more than 4,000 ft (1 200 m) (wiring length for 24 AWG) from all cell centers. If it is, look for other locations for the Controller.

Reviewing with customer

Review the following with the customer:

- final positions of the Base Stations
- areas where you could not meet the coverage requirements

Providing floor plan information

Transfer the information from the working copy of the floor plan to the clean copy. Mark the cell boundaries and corresponding cell centers with the colored markers.

Record the following information on the floor plans:

- planner’s name and telephone number
- name of the location (company or building name)
- site contact’s name and telephone number
- coverage area

- location of the Controller
- number of Base Stations
- cell names and boundary measurements
- critical points
- any installation restrictions
- any detail of the installation at a particular cell
- positions of users' offices

Attach a completed traffic table with the floor plans.

Providing provisioning record information

Record the following information on the appropriate *Companion Provisioning Record*:

- date prepared
- customer information
- site planner information
- cell numbers
- number of Base Stations in each cell
- location of the Base Stations (cell centers)
- anticipated number of users in each cell

Include any other useful information for the installer.

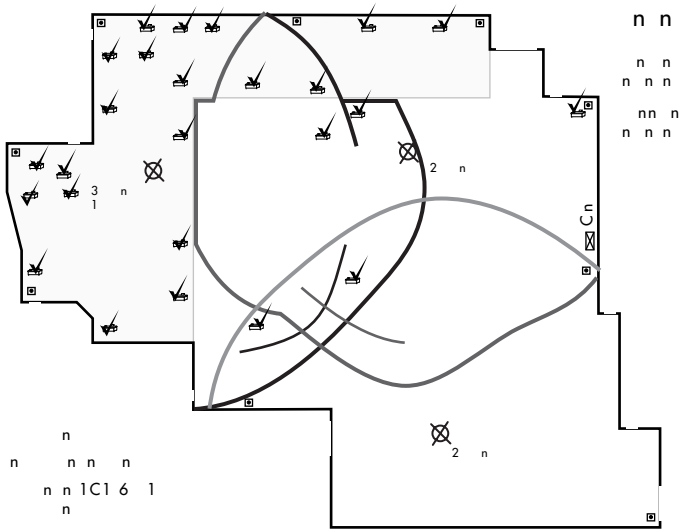
The Sample Site: Completed site plan

When you have completed the site plan you should have the following:

- a clean, complete floor plan
- a traffic table
- a provisioning record
- a satisfied customer

Submit the site plan, traffic table and the appropriate *Companion Provisioning Record* to the sales group.

Figure 6 : Completed floor plan



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