Cisco IP DECT Phone 6800 Series Deployment Guide

DECT (Digital Enhanced Cordless Telecommunications) is a standard for wireless, mobile voice services. Originally from Europe, DECT has been adopted worldwide.

This document contains information about the capabilities and hardware available in different versions of DECT firmware on Cisco.com.

Quick Set up and Installation Process

This first section is a quick step-by-step guide. The details and context are found in the remainder of this document. You must read the entire document before you start your deployment to ensure success.

Note: The Cisco IP DECT 6800 Phone products support single cell, dual cell, and multicell deployments. All call control systems may not support multicell deployment. Currently, Cisco Webex Calling and Webex Calling Carrier support single cell and multicell deployment. Before you begin, check with your call control provider to ensure that they support the deployment models described in this guide.

Note: There are many ways to install the base stations. This guide provides the best practices and the recommended deployment models supported by Cisco TAC.

Plan for the Device Installation

These instructions are for the planner:

1. Review the site to install the DECT system.
    - Plan the location of the base stations.
        - Each base station covers 50m (164 feet) indoors. The base stations should be installed within 50 meters for good coverage. The location of the base station may be impacted by objects or barriers that create radio obstruction and interference. The handsets provide a free site survey tool to identify the impact of these potential barriers.
        - Each base station requires an Ethernet cable.
        - A power outlet is required for each base station if the Ethernet switch does not provide Power over Ethernet.

2. Determine the DECT equipment required:
    - Available base stations and repeater:
        - Cisco IP DECT DBS-110 Single-Cell Base Station
        - Cisco IP DECT DBS-210 Multi-Cell Base Station
        - Cisco IP DECT RPT-110 Repeater

Note: Repeaters do not have Ethernet port. Deployment of repeaters can be done using power adapters.

- The base stations vary in their support for SIP registrations and concurrent calls. For more information, see *Matching the Base Stations to the Density Requirements.*
- Each handset supports up to 2 SIP registrations.
- Available handsets:
    - Cisco IP DECT Phone 6823 Handset

    - Cisco IP DECT Phone 6825 Handset
    - Cisco IP DECT Phone 6825 Ruggedized Handset
  - A foot stand is provided to place the base station on a table or shelf.
  - An optional kit is also available, but sold separately, to mount the base stations on the wall or ceiling.
  - The part numbers of the products are listed in the section *Product IDs*
3. Order and receive the equipment.
4. Ship the equipment to the installation site.

The equipment may be upgraded either at a staging site before reshipping or at the installation site after reshipping. For information about firmware upgrade, see *Upgrade the Devices*.

Upgrade the Devices

These instructions may be completed at a staging site or at the installation site.

1. Unpack and register the base stations to the call system.
2. Upgrade the base stations to the desired firmware version, if necessary.
   - The base stations and handsets are shipped with a firmware version that may be used in production or upgraded to the latest firmware upgrade supported by the call control system.
   - Cisco's best practice recommendation is to use the most recent firmware load available on Cisco.com.
   - Each base station may take up to one hour to upgrade.
3. Select and set the desired configuration parameters. Follow the instructions in the *Cisco IP DECT 6800 Series Administration Guide* to configure the base stations.
4. Unpack the handsets and remove the battery which is inside the rear battery door of each handset. Remove the plastic shield from the battery and reinstall the battery.
   - There is only one way that the battery fits inside the handset: if it isn't sliding into its slot easily, turn the battery over and try again.
   - The battery comes partially charged and the handset should be left on its cradle to charge fully before using the handset.
   - You can register each handset with the base station before charging and then upgrade the firmware while they charge on the cradle.
5. Register the handsets to the base stations.
6. If the base station sends a more recent firmware load to the handset, the handset may require one hour to complete the upgrade.

Caution: The handset must be placed on the cradle until the upgrade is completed. Don't remove the handset during upgrade to avoid permanent damage of the handset.

Installing the Base Station

You may reship the configured base stations to the installation sites or install in the same site you received the base stations.

1. Place the base stations around the site in high locations without securing them to the wall or ceiling. You can use step ladders to test the locations.
2. Use the site survey tool on a few handsets to check the base station location for good coverage. If there is more than one base station to install, you can run the site survey to check the coverage. For more information, see *Site Survey*.
3. To use the survey tool in the handset, press **Menu**  and ***47***. The IP Search screen appears.
4. Press the **Select** softkey when the MAC address of the base station appears.
    - If you are using more than one base station, repeaters, or a combination of base stations and repeaters, you can select each of them from the same handset and test the radio strength to the handset. Unlike during a call, the handset doesn't roam between base stations when you're using the site survey tool. However, you can manually switch between base stations and repeaters during the site survey test by returning to the base station and repeater selection page **IP Search**.
5. Make a few test calls from the handsets.
6. Mount the base stations with the included foot stands, or the kits for wall or ceiling mount which are sold separately.
7. Place the handsets with their cradles at each user location, or in a central location if they are shared.

Introduction

The Cisco IP DECT Phones 6800 Series is the mobility solution within Cisco's Multiplatform Phone portfolio. One advantage of Cisco's DECT solution over Wi-Fi is that the DECT solution components, the phones and the base stations have the same architecture and are designed to work exclusively with each other.

Unlike Wi-Fi, a customer can't use a third party DECT base station to support their Cisco handset. Third party base stations, repeaters, and handsets are not supported with the Cisco DECT Phone solution. The product design ensures that the DECT base station and the handset run on compatible frequencies.

You don't need to be an expert in DECT or wireless products to successfully install a working system. You must read the entire document to ensure successful deployment.

This document:

- Describes the elements in planning and designing a Cisco IP DECT 6800 Series Phone system.
- Provides a simplified design procedure.
- Includes the network planning and deployment processes used in North America and Europe.

The Cisco IP DECT 6800 Series contains:

- Cisco IP DECT Phone DBS-110 Single-Cell Base Station
- Cisco IP DECT Phone DBS-210 Multi-Cell Base Station
- Cisco IP DECT Phone RPT-110 Repeater
- Cisco IP DECT Phone 6823 Handset
- Cisco IP DECT Phone 6825 Handset
- Cisco IP DECT Phone 6825 Ruggedized Handset

Note: The 6825 Ruggedized Handset operates identically to the 6825 handset, but the Ruggedized Handset is IP65 rated for dusty and damp environments.

Regulatory Areas Covered with Cisco DECT Solutions

This information is only for reference. Cisco's ordering process allows you to receive only the units which are set up correctly for your region. These are the current areas covered with Cisco DECT solutions:

- 1880-1900 MHz (Australia and New Zealand – power <= 158 mW)
- 1880-1900 MHz (E.U. and APAC)
- 1920-1930 MHz (U.S. and Canada)

Note: For Mexico, Cisco offers the NA (North America) version with NOM compliance.

There are other requirements for DECT in other regions of the world. When Cisco expands the offer, the other regions not in the above list will be offered.

Signal and Bandwidth

The Cisco IP DECT Phone 6800 Series is built on Digital Enhanced Cordless Telecommunications (DECT) technology. The technology was developed for many users working in close proximity. DECT uses a low bit rate that provides good voice quality at 32kbps per channel, and effective for mobile phone users at home and small to medium sized industrial sites.

This series uses the Session Initiation Protocol (SIP) to provide a Voice over IP (VoIP) solution over Ethernet. The DECT base station connects to the call server and provisioning servers over Ethernet, and then uses DECT technology to connect, register, and provision the handsets.

DECT works close to the 1.9 GHz frequency band to avoid interference with Bluetooth, Wi-Fi, and microwave frequencies. The frequencies used by DECT are in the unlicensed residential spectrum and DECT devices may exhibit interference when they are in a close range of commonly used residential and commercial appliances. The actual DECT frequency used in your region is regulated by your country and may be different in other regions of the world.

Like other radio technologies, DECT uses a combination of Frequency Division Multiplexing (channels) and Time Division Multiplexing (time slots) techniques. DECT devices share available channels on the radio spectrum and limit the active number of devices within a close range.

For more information about device density, see *Density Guidelines*.

Registration Highlights

The base stations register with the call control system and upgrade the firmware immediately after registration, if the system is configured. If more recent firmware load isn't available to download, they will register and use the default firmware shipped with the base station. We recommend that customers and partners always run the latest available firmware. If you connect to Cisco Webex Calling or Webex Calling Carrier, the firmware versions are automatically maintained and updated. When the base stations have registered with the call control system, the handsets register with the base stations and then receive the firmware upgrades from the base stations. For call control registration, the call control system requires the base station's MAC address.

Deployment

You can collect the network requirements for capacity, coverage, and quality to start the network deployment. Consider the location of the base stations where the handsets are used. Ensure that there aren't signal blocking obstacles near the base station.

The handsets have a simple site survey tool that you can use to determine the best base station locations for maximum coverage. For more information, see *Site Survey*. Mount the base stations in a high location with a clear line of sight to the area where the handsets are used. If you mount

the base stations behind closed doors or between steel beams, it creates signal interference which leads to reduced range and a reduced coverage area. Use the site survey tool to ensure good coverage where the handsets are used.

If the service area has many rooms and obstacles for good DECT signaling, you may need a multicell deployment. If the building is wood framed with drywall, you may not experience poor signal strength.

Signal Area Characteristics

The signal area produced by the base station is omnidirectional and resembles a sphere. If you mount the base station very close to the ground or in a corner, the location can reduce the optimal signal strength. The best mounting area is a location high up on the wall, on the wall, or ceiling away from any corners. There are scenarios in buildings made of less obstructive materials such as wood and drywall, where the corner mounted base station serves more than one room. If the floors are like that of a house rather than a heavy, industrial building, a ceiling mounted base station can provide service to the floor above. Use the site survey to ensure that you have good coverage.

Plan Your DECT System

Good system planning is essential to achieve the expectations of the customer. Typically, the network requirements include (but not limited to):

- The area to be covered.
- The type or architecture of the building and/or topology, and so on. This includes the material and thickness of the walls.
    - You don’t require precise knowledge about the makeup and thickness of the walls. You should be aware of the “interior grade” and “exterior grade” walls. The site survey tool helps to determine if the walls are compromising good signal strength between different areas of your installation.
- The estimated traffic in each coverage area.
- Any signaling obstacles located in each coverage area.
- Any new Ethernet cables or power outlets required to support the base station mounting locations.

Plan the Capacity

Capacity for each installation includes the number of simultaneous users and projected number of simultaneous calls. Each handset uses DECT channels on the base station. If you have more handset line registrations on a base station than its concurrent call capacity, every line cannot support calls at the same time. You must plan your capacity.

Capacity planning requires the following knowledge for each site:

- Intended number of handsets simultaneously registered

- Intended traffic load
- Intended coverage area

The DBS-110, DBS-210 base stations, and RPT-110 repeater signal strength:

- Indoor: 20-50 meters (60-164 feet) radius
  - The range of this radius depends on the nature and quantity of any radio signal impeding items or material in the installation site. Some of these may include items made of metal: shelving, doors, and supporting beams.
  - One base station will be sufficient for a single retail store's area if there are no thick walls or other sources of interference.
  - Adding base stations and repeaters help you to work around signal barriers.
- Outdoor: 300 meters (984 feet) radius
  - Note: The base stations and repeaters are not weather-guarded for extreme heat, damp, or cold conditions. If they should be used outdoors, they must be installed inside a weather-proof enclosure that does not severely impact their signal strength.

Density Guidelines

In high density areas that require maximum channels, the base stations located very closely can cause interference. To minimize base station interference and good audio experience, follow these recommendations:

- Install base stations at least 2 meters (6.5 feet) away from each other.
- In the 20 MHz frequency spectrum (EU spectrum), the density should be 7 or fewer base stations in 100 square meters (1,076 square feet).
- In the 10 MHz frequency spectrum (Americas spectrum), the density should be 4 or fewer base stations in 100 square meters (1,076 square feet).

Use these conditions with the density and possible interference:

- **Low Density, Low Interference:** A Cisco IP DECT Base Station provides a coverage of 50 meters (164 feet) radius in a straight line without radio interference. This means, if the density is less than 5 simultaneous calls and not more than 30 simultaneous registrations, you only need one Cisco IP DECT Base Station.
- **Low Density, High Interference:** A Cisco IP DECT Base Station can support up to 30 line registrations, with up to 10 narrowband calls or 5 wideband calls. For more information, see *Single Cell Deployments*.
  For the DBS-210, if you add another base station, you can register 60 handsets, and support 16 narrowband or 8 wideband calls at one time. If high interference is expected because of RF attenuation or RF interferences, you can add more base stations or repeaters.
  For the DBS-110, if you add another base station, system can support up to 20 narrowband calls or 10 wideband calls. You can add up to 6 repeaters to extend the area covered.
- **High Density, Less Interference:** A Cisco IP DECT Base Station provides coverage of 20-50 meters (60–164 feet) radius indoors depending on the interference and attenuation. It

provides 300 meters (984 feet) radius coverage in plain outdoors. The 300 meters (984 foot) radius coverage area is also good for a room that is 300 meters (984 feet) in radius without any interference and attenuations.

- **High Density, High Interference:** You need the DBS-210 Multi-Cell Base Stations with many base stations deployed in the same system to achieve the required capacity. In high density areas where you need maximum channels, base stations located close together can cause interference. To minimize base station interference, work with these audio codec considerations for a good audio experience.

Audio Codec Considerations

You should consider the audio codecs to use when you plan the capacity.

- The Cisco IP DECT 6823 and 6825 handsets support G722 for wideband and G726 for narrow band.
- The Cisco IP DECT DBS-110 and DBS-210 Base Stations support G.711 a-law & µ-law, G.722.2, G.726, and G.729a/ab
- The DECT protocol supports only two codecs. The administrator must choose the two supported protocols to use. Choose one wideband and one narrowband codec.
- The base station does the required transcoding based on the negotiated codec for each call.
- The wideband codec occupies 2 channels and the narrowband codec occupies 1 channel.
- If you expect more simultaneous calls, use the narrowband codec to increase the available number of channels. If you configure the wideband codec, you may add more base stations to increase the channel capacity.

Match the Base Stations to the Density Requirements

When you know how big your system will be in terms of the number of users who require handsets, the area to be covered and the concurrent calls the system must support, you can check the capacity of the base stations for each type of deployment.

Single Cell Deployments

The following table provides the handsets supported and concurrent calls for a single cell DECT system.

User Requirements	DBS-110	DBS-210
Number of SIP Registrations	30	30
Concurrent Narrowband Calls	10	10
Concurrent Secure Narrowband Calls	10	8
Concurrent Secure Wideband Calls	5	5
Maximum Repeaters that may be connected to the system	6	3

The single cell system is mostly used in small businesses and home offices. The DBS-110 is the most cost-effective choice for a single cell system that is not expected to grow in number of handsets. The DBS-210 is an ideal choice for a single cell system if you want to add more base stations to the system in the future. If you are starting with the DBS-110 and you need to expand your handset quantity, you must replace the DBS-110 with a DBS-210 and add more DBS-210s to the system. If you are starting with a DBS-210, you may continue using the original DBS-210 and add more DBS-210s to increase your handset quantity and call capacity.

If you want to add more base stations and there are radio signal blockers, such as steel doors, there must be a clear line of sight between the base stations.

Dual Cell Deployments

Dual cell system contains up to 2 base stations with radio signal overlap for seamless handover. We recommend using LAN synchronization for base stations to sync.

The following table explains the support for handsets and concurrent calls for a Dual Cell system.

User Requirements	DBS-110	DBS-210
Number of SIP Registrations	30	60
Concurrent Narrowband Calls	20	16
Concurrent Secure Narrowband Calls	20	16
Concurrent Secure Wideband Calls	10	10
Maximum Repeaters that may be connected to the system	12	6
DECT Synchronization	LAN (recommended) or Air	

The DBS-210 would be an ideal choice if you want the flexibility to increase to more than two base stations. The DBS-110 based dual cell system would be ideal and cost-effective if the number of handsets aren't increasing above 30 and the number of concurrent calls requirement is within 20. Note that, if you have a system with DBS-110 and if you want to increase to three or more base stations, then you must replace the DBS-110s with DBS-210. One DECT network can only contain either DBS-110 or DBS-210.

Multicell Deployments

Multicell systems can have 3 to 254 base stations where the radio signals overlap for seamless handover. For a Multicell system, we recommend LAN synchronization.

The following table explains the support for handsets and concurrent calls for a system built only on DBS-210 base stations.

User Requirements	DBS-210
Number of SIP Registrations with 250 base stations deployed	1000
Concurrent Narrowband Calls: 250 base stations	2032
Concurrent Secure Narrowband Calls: 250 base stations	2032
Concurrent Secure Wideband Calls: 250 base stations	1016
Maximum Repeaters that may be connected to the system	100
DECT Synchronization	LAN (recommended) or Air

The Multicell system is mostly used in medium business that have large coverage areas with many users. The DBS-210 is the only option for the multicell system.

Installation

Capacity planning helps to identify if a single cell or multicell system is required. We recommend a single cell set up for small area with low density. Otherwise, you can set up a multicell system.

Typically, a small retail store can have a single cell system. You must confirm this with a site survey. If the store is an open area without real radio signal barriers, one base station can cover the entire store.

The range of a base station is 50 meters (164 feet) radius indoors in a building made of standard brick and mortar construction with basic inference from low level shelving and other items found in a retail store or workplace. When you move away from the base station, the signal degrades from good, weak, poor, and to no signal.

Figure 1: Base Station Signal Range