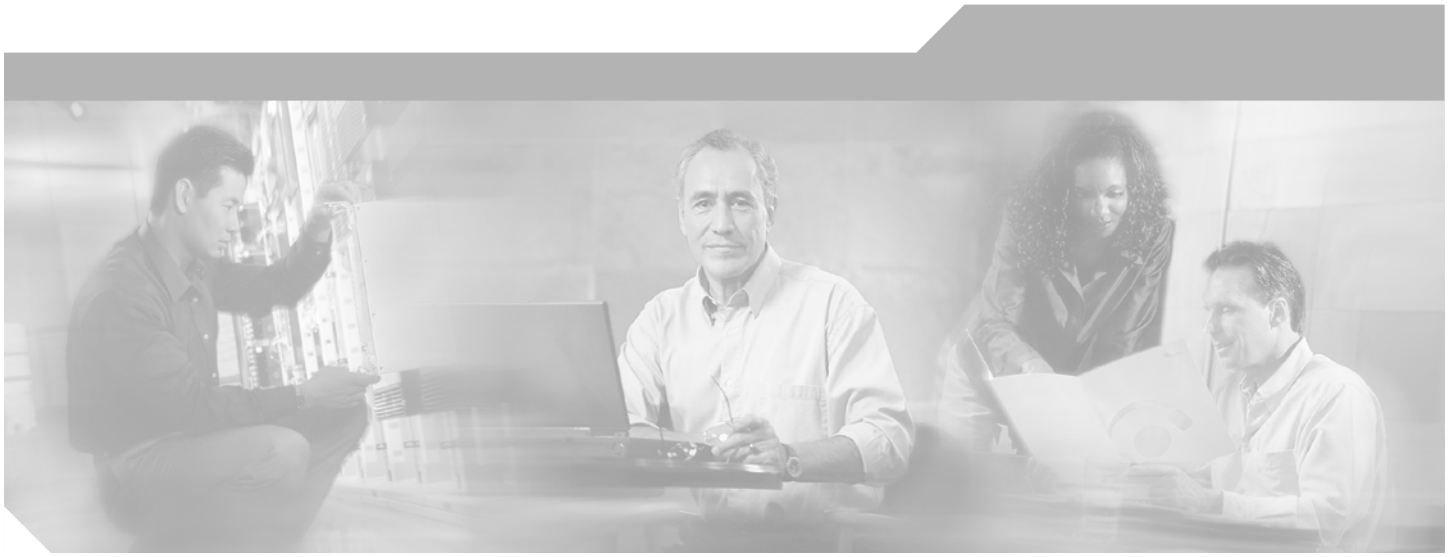

Deployment Guide: Cisco Aironet 1000 Series Lightweight Access Points

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Deployment Guide: Cisco Aironet 1000 Series Lightweight Access Points

CONTENTS

Preface

This guide is intended for IT managers who need to determine how many Cisco 1000 series lightweight access points are needed for a deployment and where they should be placed.

Organization

This guide is divided into the following sections:

- Deployment
- Determining Deployment Requirements
- Determining Deployment Strategy
- Example Basic Guidelines Process
- Optional Minimal Site Survey
- Cisco 1000 Series Lightweight Access Point Placement Guidelines
- Where to Go from Here

Conventions

This document uses the following conventions and symbols:

Tip Means the following will help you solve a problem. The tips information might not be troubleshooting or even an action, but could be useful information.

Note Means reader take note. Notes contain helpful suggestions or references to materials not contained in this manual.

Caution Means reader be careful. In this situation, you might do something that could result equipment damage or loss of data.

Warning **IMPORTANT SAFETY INSTRUCTIONS**

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES

¡Advertencia! **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

Varning! **VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

Figyelem **FONTOS BIZTONSÁGI ELOÍRÁSOK**

Ez a figyelmezeto jel veszélyre utal. Sérülésveszélyt rejto helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplo figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján keresheto meg.

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告 重要的安全性说明

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请保存这些安全性说明

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「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

주의 중요 안전 지침

이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.

이 지시 사항을 보관하십시오.

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.

GUARDE ESTAS INSTRUÇÕES

Advarsel **VIGTIGE SIKKERHEDSANVISNINGER**

Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemesbeskadigelse. Før du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnummeret efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.

GEM DISSE ANVISNINGER

تحذير **إرشادات الأمان الهامة**

يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض لإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالإجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في أخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز.
قم بحفظ هذه الإرشادات

Upozorenje **VAŽNE SIGURNOSNE NAPOMENE**

Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznati sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

SAČUVAJTE OVE UPUTE

Upozornění **DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.

USCHOVEJTE TYTO POKYNY

Προειδοποίηση

ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθεις πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כדי לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

שמור הוראות אלה

Opomena

ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА

Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.

ЧУВАЈТЕ ГИ ОВИЕ НАПАТСТВИЈА

Ostrzeżenie

WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie

DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

USCHOVAJTE SI TENTO NÁVOD

Figyelem

FONTOS BIZTONSÁGI ELOÍRÁSOK

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USCHOVEJTE TYTO POKYNY

Προειδοποίηση ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθεις πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כד לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

שמור הוראות אלה

Opomena

ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА

Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.

ЧУВАЈТЕ ГИ ОВИЕ НАПАТСТВИЈА

Ostrzeżenie

WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

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DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

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Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

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You can access the most current Cisco documentation at this URL:

http://www.cisco.com/univercd/home/home.htm

You can access the Cisco website at this URL:

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You can access international Cisco websites at this URL:

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Cisco documentation and additional literature are available in a Documentation DVD package, which may have shipped with your product. The Documentation DVD is updated regularly and may be more current than printed documentation. The Documentation DVD package is available as a single unit.

Registered Cisco.com users (Cisco direct customers) can order a Cisco Documentation DVD (product number DOC-DOCDVD=) from the Ordering tool or Cisco Marketplace.

Cisco Ordering tool:

http://www.cisco.com/en/US/partner/ordering/

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Cisco Systems
Attn: Customer Document Ordering
170 West Tasman Drive
San Jose, CA 95134-9883

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From this site, you can perform these tasks:

- Report security vulnerabilities in Cisco products.
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- Register to receive security information from Cisco.

A current list of security advisories and notices for Cisco products is available at this URL:

http://www.cisco.com/go/psirt

If you prefer to see advisories and notices as they are updated in real time, you can access a Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed from this URL:

http://www.cisco.com/en/US/products/products_psirt_rss_feed.html

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Cisco is committed to delivering secure products. We test our products internally before we release them, and we strive to correct all vulnerabilities quickly. If you think that you might have identified a vulnerability in a Cisco product, contact PSIRT:

- Emergencies—security-alert@cisco.com
- Nonemergencies—psirt@cisco.com

Tip We encourage you to use Pretty Good Privacy (PGP) or a compatible product to encrypt any sensitive information that you send to Cisco. PSIRT can work from encrypted information that is compatible with PGP versions 2.x through 8.x.
Never use a revoked or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one that has the most recent creation date in this public key server list:

http://pgp.mit.edu:11371/pks/lookup?search=psirt%40cisco.com&op=index&exact=on

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532

Obtaining Technical Assistance

For all customers, partners, resellers, and distributors who hold valid Cisco service contracts, Cisco Technical Support provides 24-hour-a-day, award-winning technical assistance. The Cisco Technical Support Website on Cisco.com features extensive online support resources. In addition, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not hold a valid Cisco service contract, contact your reseller.

Cisco Technical Support Website

The Cisco Technical Support Website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day, 365 days a year, at this URL:

http://www.cisco.com/techsupport

Access to all tools on the Cisco Technical Support Website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

http://tools.cisco.com/RPF/register/register.do

Note Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support Website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco TAC engineer. The TAC Service Request Tool is located at this URL:

http://www.cisco.com/techsupport/servicerequest

For S1 or S2 service requests or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco TAC engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)
EMEA: +32 2 704 55 55
USA: 1 800 553-2447

For a complete list of Cisco TAC contacts, go to this URL:

http://www.cisco.com/techsupport/contacts

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

- Severity 1 (S1)—Your network is “down,” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.
- Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operation are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.
- Severity 3 (S3)—Operational performance of your network is impaired, but most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.
- Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

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Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- Cisco Marketplace provides a variety of Cisco books, reference guides, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:

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- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

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- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

  http://www.cisco.com/packet

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

  http://www.cisco.com/go/iqmagazine

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

  http://www.cisco.com/ipj

- World-class networking training is available from Cisco. You can view current offerings at this URL:

  http://www.cisco.com/en/US/learning/index.html

Deployment

The Cisco WLAN Solution wireless network provides features and tools that simplify wireless network deployment, allowing IT departments to deploy wireless networks with existing resources, and system integrators to design and deploy wireless networks with greater predictability.

The Radio Resource Management (RRM), which is part of the Cisco WLAN Solution detects coverage holes and interference and automatically determines transmit power level and transmit channels for each Cisco 1000 series lightweight access point, which allows the Cisco WLAN Solution to be deployed without a site survey when the building RF characteristics are well known.

The Cisco WLAN Solution features that simplify the deployment process include:

- Internal dual-band antennas that provide the performance of external antennas without requiring external antennas and RF cables.
- Standards-based 802.3af Power over Ethernet (PoE) that allows the Cisco 1000 series lightweight access points to be powered over unused pairs in the Ethernet cable.
- The Cisco Wireless LAN Controller, which is optimized for the Cisco WLAN Solution infrastructure.
- External power supply option allows the Cisco 1000 series lightweight access points to be easily moved during the site survey to verify RF building characteristics.
- The Dynamic Transmit Power algorithm automatically lowers Cisco 1000 series lightweight access point transmit power to minimize overlap between adjacent 802.11a or 802.11b/g Cisco Radio coverage areas, and automatically increases power to fill coverage holes if a nearby Cisco 1000 series lightweight access point fails.
- Real-time coverage hole detection and client performance monitoring provides the IT manager with real-time visibility into coverage holes based on client traffic.
- Automatic interference detection detects interference from microwave ovens, bluetooth devices, and other access points, and automatically changes the assigned Cisco 1000 series lightweight access point channel to avoid the interference.

Determining Deployment Requirements

There are a few important deployment criteria to consider when deploying a wireless network:

- Assumptions
- Protocol Requirements
- Coverage Area Requirements
- Building Type
- Building Homogeneity
- Average Client Throughput
- Voice over IP Requirements

Note Most enterprise installations are initially designed and deployed for coverage. If there is a large installed base of wireless clients, capacity must also be considered.

Assumptions

The guidelines in this document are written based on the following conditions and assumptions:

- Client Data Terminal Transmit (Tx) Power: >=15 dBm.
- Client Data Terminal Antenna Gain: >=0 dBi.
- Capacity: up to 15 Data client Terminals or up to 14 VoIP clients per Cisco 1000 series lightweight access point.
- Handover Times: 37 milliseconds or less for Layer 2 (same- Cisco 4100 Series Wireless LAN Controller) handovers, 48 milliseconds or less for Layer 3 (inter-Cisco 4100 Series Wireless LAN Controller and inter-subnet) handovers.
- Quality of Service: Assigned on a per-WLAN basis. VoIP clients with Platinum QoS take precedence (up to 90+% of bandwidth) over clients with Gold, Silver or Bronze QoS.

Note These assumptions are typical for available 802.11 client data terminals and typical cubicle density.

Protocol Requirements

One of the critical decisions in deploying a wireless LAN is deciding which protocols and bands it will support. The following table shows the options and the advantages/disadvantages of each.

Table 1 Protocol Requirements

Protocol/Band	Advantage	Disadvantage
802.11a/b/g	Highest capacity option (three 802.11b/g channels and thirteen 802.11a channels) Highest performance option (54 Mbps for both 802.11g and 802.11a) Rogue access point detection for both 2.4 GHz 802.11b/g and 5.0 GHz 802.11a bands	Small increase in the Cisco 1000 Series IEEE 802.11a/b/g lightweight access point cost
802.11 b/g only	Supports legacy clients Lowest cost Cisco 1000 Series IEEE 802.11a/b/g lightweight access point	802.11g performance is limited in the presence of 802.11b users Limited capacity Does not support 802.11a clients
802.11a only	High performance High Capacity	Does not support 802.11b/g clients

Coverage Area Requirements

Customers typically want seamless full RF coverage or partial RF coverage in conference rooms, lunch rooms, etc.

Coverage holes are areas where clients cannot receive a signal from the wireless network. When deploying wireless networks, there is a trade-off between the cost of the initial network deployment and the percentage of coverage hole areas. A reasonable coverage hole criterion for launch is between 2 and 10 percent. This means that between two and ten test locations out of 100 random test locations may receive marginal service. After launch, the Cisco WLAN Solution Radio Resource Management (RRM) will identify these coverage areas and report them to the IT manager, allowing the IT manager to fill holes based on user demand.

Building Type

Identifying the building type and its RF characteristics is critical in determining how many Cisco Radios will be needed. The following table shows three basic building types that are common in the enterprise market. If the building does not fall into one of these categories then some amount of professional service may be needed.

Table 2 Building Type

Building Type	Description
Typical Office Space	This is the most common enterprise building. This type of building consists of large open cubicle areas with walled offices and conference rooms.
Drywall Office Space	This type of building consists of mostly offices with dry wall characteristics.
Brick/Concrete Walled Office Space	This type of building consists of concrete or brick walls for both exterior and for interior office space. Old buildings found on college campuses are good examples of this type of building.
Other	There are some buildings such as sports arenas and stock exchanges that do not fit into one of the typical categories. These buildings typically require some special consideration or professional service.

Building Homogeneity

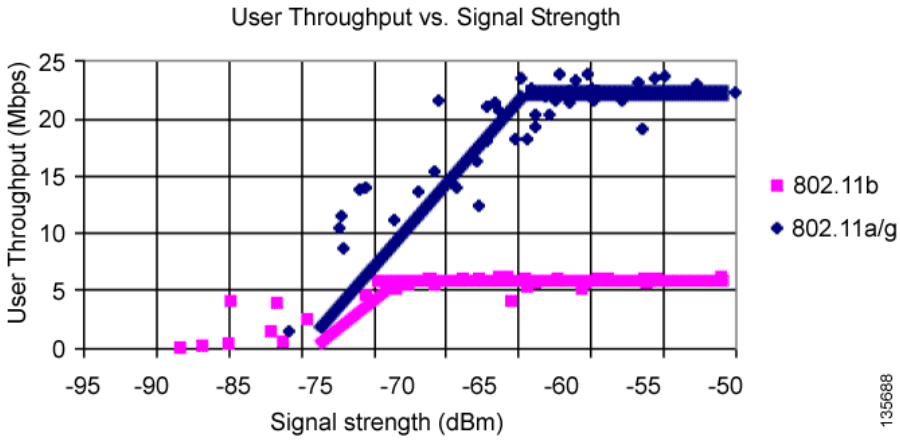
If the building does not have similar RF characteristics throughout the coverage area, the coverage area needs to be divided into areas with similar characteristics and the design process repeated for each area.

Average Client Throughput

The desired average user throughput is 1 Mbps to 18 Mbps.

Average client throughput is related to 802.11 protocol and signal strength, and thus Cisco 1000 series lightweight access point density. In terms of protocol, 802.11b can support an average user throughput of up to 6 Mbps and 802.11a and 802.11g can support a typical average user throughput of up to 20 Mbps with reasonable Cisco 1000 series lightweight access point densities. Generally, the stronger the signal, the higher the client throughput. However, as shown in the figure below, there is a point above which a stronger signal does not increase client throughput. For 802.11b networks, this point is typically -75 dBm, above which average client throughput is 5 to 6.5 Mbps regardless of increase in signal strength. For 802.11a networks, this point is typically between -50 dBm and -60 dBm, above which average client throughput is 24 to 30 Mbps regardless of increase in signal strength. Note that for 802.11a, the range over which the average client throughput improves is between -80 dBm and -50 dBm.

Figure 1 Average Client Throughput versus Signal Strength



The following figures show the relationship between average client performance and Cisco 1000 series lightweight access point density for 802.11a and 802.11b clients. The typical Cisco 1000 series lightweight access point density for most enterprise buildings deployed for full coverage is between 2500 and 7000 square feet per Cisco 1000 series lightweight access point.

Figure 2 Average 802.11a Client Throughput versus Cisco 1000 Series Lightweight Access Point Density for Typical Office Spaces

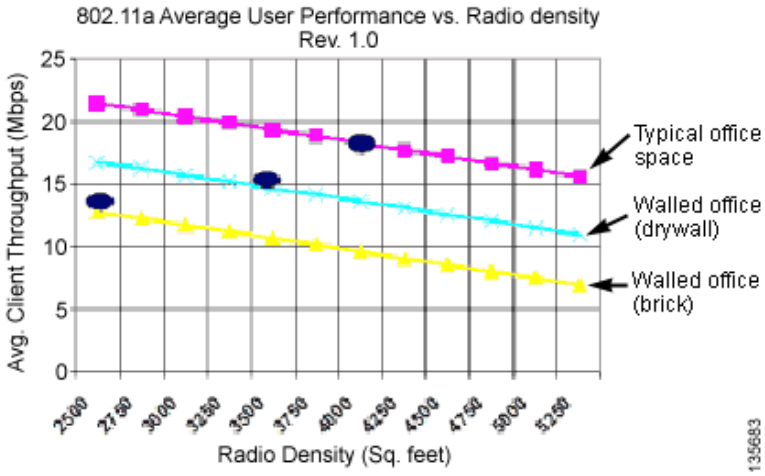
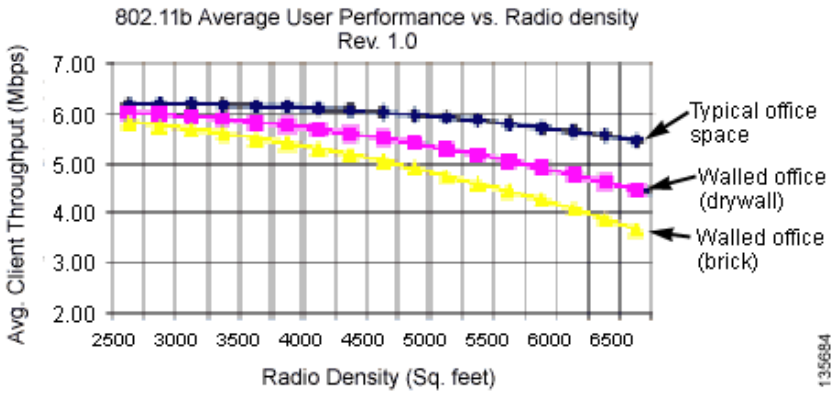


Figure 3 Average 802.11b Client Throughput versus Cisco 1000 Series Lightweight Access Point Density for Typical Office Spaces



The following table provides a summary of Cisco Radio coverage as a function of building type and average user performance requirements:

Table 3 Coverage Area

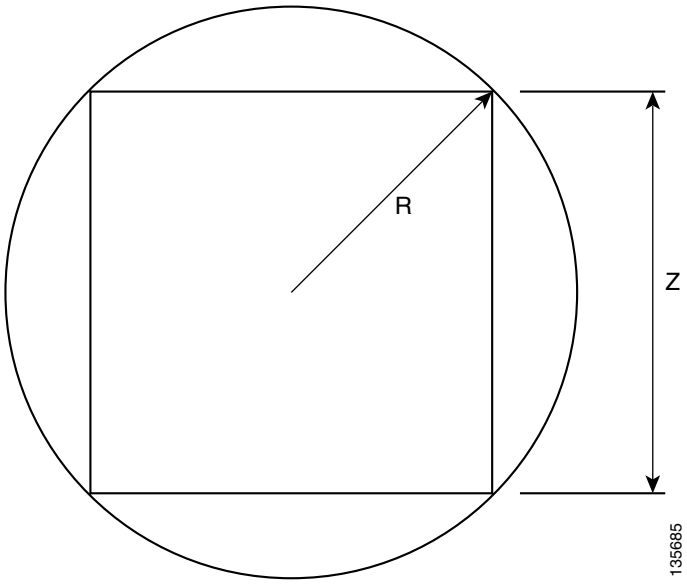
Coverage Area	Area = Z^2 (square ft.)	R (ft.)	Z (ft.)
	2500	35	50
	3000	39	55
	3500	42	59
	4000	45	63
	4500	47	67
	5000	50	71
	5500	52	72
	6000	55	57
	6500	57	81
	7000	59	84
	7500	61	87
	8000	63	89

Figure 4 Average Client Throughput versus Signal Strength

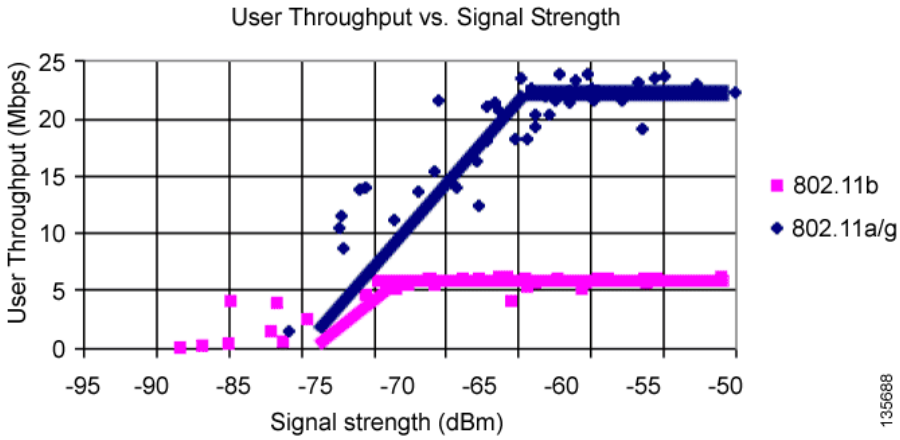


Table 4 Building Type and Average User Throughput

Building Type	Measurement (See Note 1)	Average User Throughput			
		1 Mbps	5 Mbps	12 Mbps (See Note 2)	18 Mbps (See Note 2)
Typical Office	A (ft.^{2})	7000	6000	5000	4000
	R (ft.)	59	55	50	45
	Z (ft.)	84	77	71	63
	S (dBm)	-85	-75	-70	-65
Drywall Office Space	A (ft.^{2})	5000	4000	3500	3000
	R (ft.)	50	45	42	39
	Z (ft.)	71	63	59	55
	S (dBm)	-85	-75	-70	-65
Brick Wall Office Space	A (ft.^{2})	4000	3500	3000	N/A
	R (ft.)	45	42	39	-
	Z (ft.)	63	59	55	-
	S (dBm)	-85	-75	-70	-
Hospital	A (ft.^{2})	5000	4000	3500	3000
	R (ft.)	50	45	42	39
	Z (ft.)	71	63	59	55
	S (dBm)	-85	-75	-70	-65
Warehouse/Manufacturing	A (ft.^{2})	7000	6000	5000	4000
	R (ft.)	59	55	50	45
	Z (ft.)	84	77	71	63
	S (dBm)	-85	-75	-70	-65

Note1: S is the minimum signal strength over 95% of the coverage area.

Note2: Requires 802.11a.

Voice over IP Requirements

When deploying 802.11 wireless LANs to support Voice over IP (VoIP) telephones, such as SpectraLink NetLink Telephones, a few special considerations are needed in the deployment process. When deploying an 802.11b voice system, seamless full coverage with an average user throughput of 5 Mbps or more should be used. Areas such as stairways, bathrooms, cafeterias and outside areas may require special consideration and additional access points. These are areas that are not typically critical for data users but are critical coverage areas for voice users who want seamless coverage.

Determining Deployment Strategy

Depending on the customer and the deployment requirements determined in "Determining Deployment Requirements," there are three strategies for designing and deploying an Cisco WLAN Solution wireless network. The following table provides guidelines for which one is appropriate.

Table 5 Deployment Strategy

Deployment Option	Deployment Requirements
Professional Site Survey	This option should be considered when: • Deployments require full coverage with 0% coverage holes. • The RF characteristics of the building vary throughout the coverage area. • The building type is not typical or does not fit into one of the standard configurations (e.g. Arena, Convention Center, Stock Exchange). • The cost or logistics of running Ethernet cables is prohibitive.
RF Prediction with Optional Site Survey	This option should be considered when: • The RF characteristics of the building vary throughout the coverage area. • The building type is not typical (e.g. Arena, Convention Center, Stock Exchange). • A Professional Site Survey is too costly, and a graphical coverage plot is desired before deployment.
Basic Guidelines with Optional Site Survey	This option is adequate for 80% to 90% of deployments, and is suitable when: • The RF Characteristics are homogenous throughout the coverage area. • The building type can be easily classified.

Professional Site Survey

Generally, the professional site survey involves temporarily placing one or more Cisco 1000 series lightweight access points and then measuring the resulting coverage(s). Based on the results of these measurements, Cisco 1000 series lightweight access points are relocated and/or reoriented to achieve complete coverage of the target space without unnecessary coverage overlap or coverage holes between Cisco 1000 series lightweight access points. This approach is appropriate given the following deployment requirements:

- Full Coverage with 0% coverage holes
- The RF characteristics of the building vary throughout the coverage area
- The building type is not typical (Arena, Convention Center, Stock Exchange)

During the Professional Site Survey, one or two access points are placed at or near one end of a building. Their coverage is measured and the access points are relocated and reoriented as necessary to ensure that this end of the building is completely covered. When measurements confirm that this is true, a second or third access point is added so its coverage area somewhat overlaps the coverage area of the first access point(s). (Generally, 10 to 15 percent coverage overlap is considered appropriate.) Its coverage is measured to ensure that its overlap with the first access point(s) is appropriate and to determine the coverage in the rest of the building. This process continues, adding a third or fourth access point and so on. This process continues until all areas of the building are covered.

The professional site survey allows the designer to provide full seamless coverage; however, the Radio Resource Management (RRM) ensures that the channel assignments and transmit power levels are optimized for the Cisco WLAN Solution coverage area, freeing the site survey professional from having to fine-tune these variables.

Other variables designers may include static transmit power level, geometric pattern used for access point placement, and the antenna type (omnidirectional, wide beam directional, or narrow-beam directional). Some designers like to have the flexibility to select antenna types most suited to specific buildings.

Designers may differ in the criteria they use to determine coverage area. Some prefer to use signal strength (RSSI), some prefer signal-to-noise ratio (SNR), and others prefer to use some indication of throughput, such as packet retry rate. These measurements are normally made using site survey software provided by a wireless LAN manufacturer, running on a PC or PDA. They may also be made using one of the handheld measurement tools currently available, such as Air Magnet or Berkeley Varitronics. The measurement tools are usually selected based on their ability to measure the desired variable, RSSI, SNR, or packet retry rates.

RF Prediction with Optional Site Survey

RF prediction consists of importing the floor plans of the coverage area into a Computer Aided Design system in which a user can place access points, draw in the walls of the building and assign RF characteristics to the walls. Depending on the confidence level of the estimates made for the building RF characteristics and the cost of filling in potential coverage holes after deployment, an optional site survey may be appropriate to verify assumptions. This approach is appropriate given the following deployment requirements:

- Full Coverage with 2 to 10% coverage holes
- The RF characteristics of the building vary throughout the coverage area
- The building type is not typical (Arena, Convention Center, Stock Exchange)

Basic Guidelines with Optional Site Survey

The Basic Guideline approach is based on empirical data from existing wireless deployments and is adequate for most deployments. This approach is based on most enterprise buildings having common RF characteristics, and that only a part of the building needs to be characterized to verify the access point coverage for the entire building. This approach leverages the algorithms built into the Cisco WLAN Solution Radio Resource Management (RRM) that ensure that the overlap between access points is minimized and that coverage holes are detected and eliminated before clients find them.

When deploying 802.11 wireless LANs to support Voice over IP (VoIP) telephones, such as SpectraLink NetLink Telephones, a few special considerations are needed in the deployment process. When deploying an 802.11 voice system, full coverage with an average user throughput of 5 Mbps or more should be used. Areas such as stairways, bathrooms, cafeterias and outside areas may require special consideration and access points. These are areas that are not typically critical for data users but are critical coverage areas for voice users who want seamless coverage.

Example Basic Guidelines Process

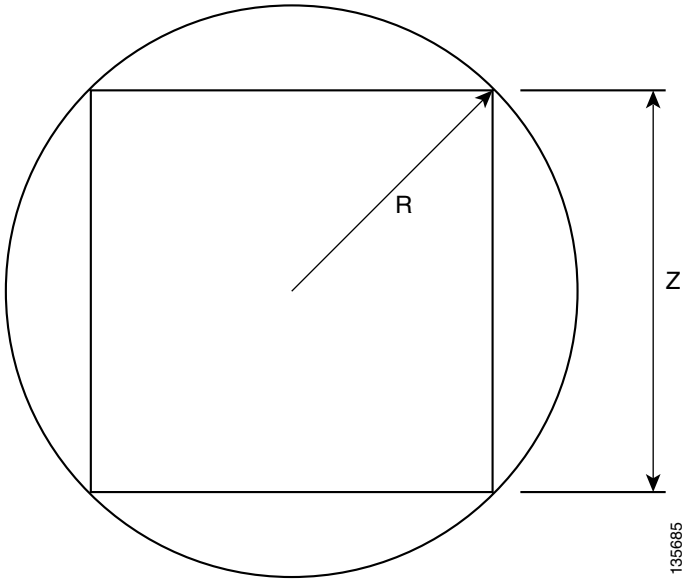
This section describes the basic factors that you need to consider before deploying access points.

Refer to each of the sections below for a detailed explanation:

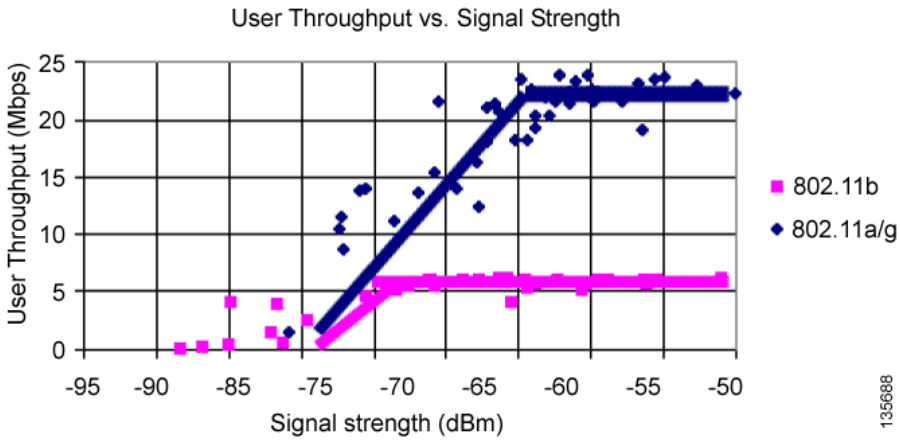
Determining the Radius and Z Factor

This section helps you to determine the coverage area of a Cisco Radio based on the building type and desired average user performance using the table below. The Z factor represents the length of a square that corresponds to the coverage area of the access point.

Table 6 Radius and Z Factor Table

Coverage Area	Area = Z^2 (square ft.)	R (ft.)	Z (ft.)
	2500	35	50
	3000	39	55
	3500	42	59
	4000	45	63
	4500	47	67
	5000	50	71
	5500	52	72
	6000	55	57
	6500	57	81
	7000	59	84
	7500	61	87
	8000	63	89

The following graph displays actual measurements, and shows the relationship between actual user throughput and corresponding signal strength.



The following table includes building types, and shows the coverage area measurements for various average user throughputs.

Table 7 Building Type and Average User Throughput

Building Type	Measurement (Note 1)	Average User Throughput			
		1 Mbps	5 Mbps	12 Mbps (See Note 2)	18 Mbps (See Note 2)
Typical Office	A ($ft.^2$)	7000	6000	5000	4000
	R (ft.)	59	55	50	45
	Z (ft.)	84	77	71	63
	S (dBm)	-85	-75	-70	-65
Drywall Office Space	A ($ft.^2$)	5000	4000	3500	3000
	R (ft.)	50	45	42	39
	Z (ft.)	71	63	59	55
	S (dBm)	-85	-75	-70	-65
Brick Wall Office Space	A ($ft.^2$)	4000	3500	3000	N/A
	R (ft.)	45	42	39	-
	Z (ft.)	63	59	55	-
	S (dBm)	-85	-75	-70	-
Hospital	A ($ft.^2$)	5000	4000	3500	3000
	R (ft.)	50	45	42	39
	Z (ft.)	71	63	59	55
	S (dBm)	-85	-75	-70	-65
Warehouse/Manufacturing	A ($ft.^2$)	7000	6000	5000	4000
	R (ft.)	59	55	50	45
	Z (ft.)	84	77	71	63
	S (dBm)	-85	-75	-70	-65

Note1: S is the minimum signal strength over 95% of the coverage area.

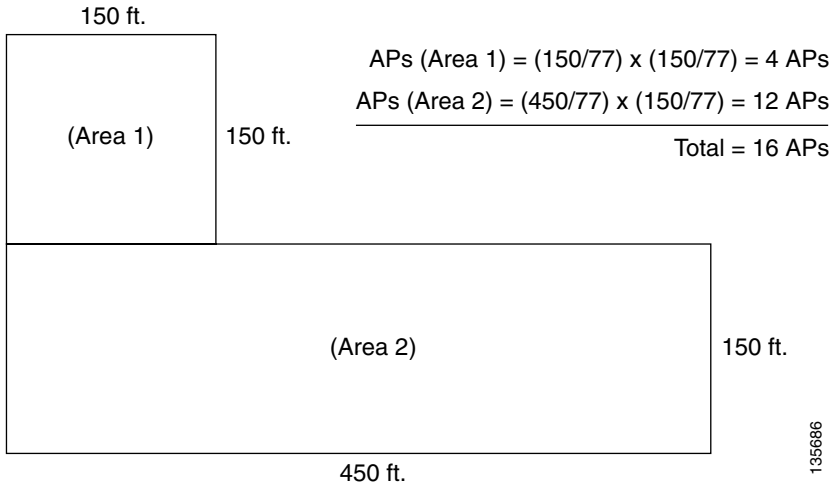
Note2: Requires 802.11a.

Determining How Many Access Points are Needed

In this section you define the coverage area for each floor in the building and divide it into rectangles and calculate how many access points are needed by dividing the area of each rectangle by the Z factor squared.

The example shown below is for a typical office building with a desired average user throughput of 5 Mbps.

Figure 5 Determining the Number of access points



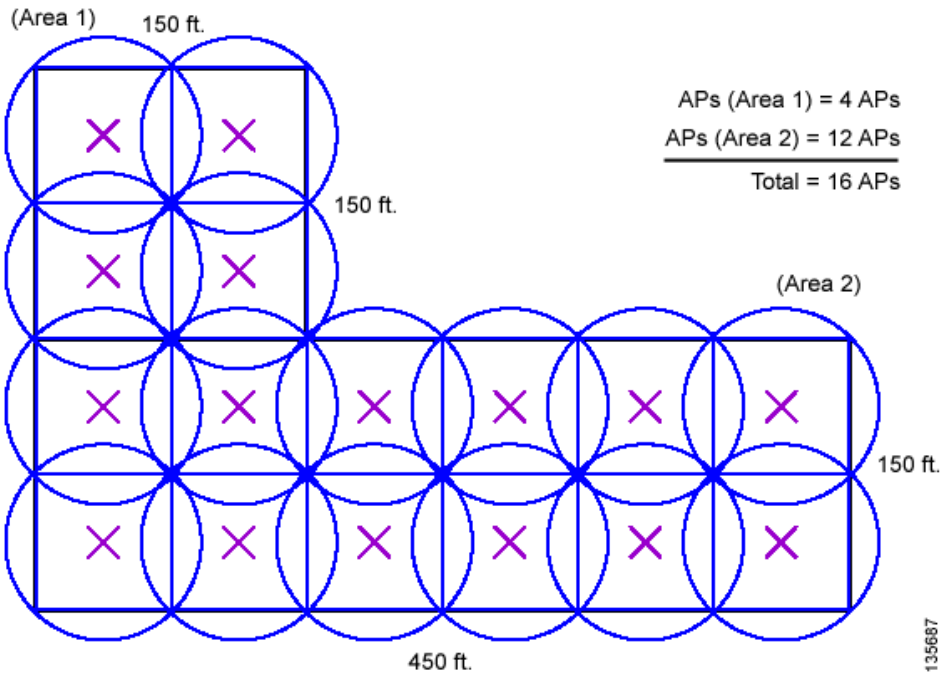
Optional Minimal Site Survey

If the building type estimate needs to be verified, a quick minimal site survey can be done to verify the signal strength of the access point for the coverage radius. For example, for a typical office building with a desired average user performance of 12 Mbps a signal strength of -75 dBm or better is needed and the site survey will be used to verify that the -75 dBm coverage radius of a Cisco 1000 Series lightweight access point is 50 feet. Review the "Optional Minimal Site Survey" section of this document for how to perform a site survey using a Cisco 1000 Series lightweight access point.

Placing Access Points

The final step is to determine the installation location of the access point. First, using the radius or Z factor found in Step A, distribute the circles or squares evenly across the rectangles found in Step B. Note that the large "X" in the middle of each coverage area indicates the approximate location of the Cisco 1000 series lightweight access points. Also notice that the Z factor between the centers of each Cisco 1000 series lightweight access point location is the same as the Cisco 1000 series lightweight access point squares when the squares are directly adjacent to each other, as shown in this figure.

Figure 6 Access Points Location



Optional Minimal Site Survey

If the "Building Type" or RF characteristics assumptions are in doubt, complete this step to verify those assumptions.

The minimal site survey consists of the following:

- Collecting Tools and Materials
- Selecting Cisco 1000 Series Lightweight Access Point Locations
- Preparing Optional Cisco 1000 Series Lightweight Access Point Tripod Test Assemblies
- Positioning a Cisco 1000 Series Lightweight Access Point at Each Planned Location
- Verifying RF Coverage Using the Site Survey Tool

Collecting Tools and Materials

Before you start a site survey, you must collect some items:

- Maps or building plans of the areas to be covered, with a feet or meters scale included.
- Duct Tape and Cable Ties.
- T-10 Security Torx screwdriver.
- A PC with a crossover CAT-5 or higher Ethernet cable capable of establishing a telnet session with each Cisco 1000 series lightweight access point.
- A Site Survey Tool, consisting of a computer equipped with 802.11a and 802.11b/g transceivers and the signal strength monitoring and recording software.
- Between one and five Cisco 1000 series lightweight access points with power supplies:
  - Cisco 1000 series lightweight access points.
  - Available Power Sources:
  - * Recommended factory-orderable 110 VAC-to-48 VDC power supplies.
  - * Optional Ethernet Power Injectors: Single RJ-45, 300 mA 48 VDC output, (MILAN Model MIL-L1611, or equivalent). Refer to "Preparing Optional Cisco 1000 Series Lightweight Access Point Tripod Test Assemblies" for more information.
  - Recommended temporary stands, such as photographer's telescoping lighting stands, that can be raised to ceiling height. Refer to "Preparing Optional Cisco 1000 Series Lightweight Access Point Tripod Test Assemblies" for more information.
  - Optionally, you can temporarily position the Cisco 1000 series lightweight access points at or near ceiling height using ladders and/or tall bookcases, but they do not offer the portability of the Cisco 1000 series lightweight access point tripod test assemblies.

Selecting Cisco 1000 Series Lightweight Access Point Locations

Using the Cisco Radio density estimate from "Determining Deployment Requirements" and the guidelines for placing Cisco 1000 series lightweight access points described in "Cisco 1000 Series Lightweight Access Point Placement Guidelines," determine the location for three to five Cisco 1000 series lightweight access points in a typical test coverage area.

Preparing Optional Cisco 1000 Series Lightweight Access Point Tripod Test Assemblies

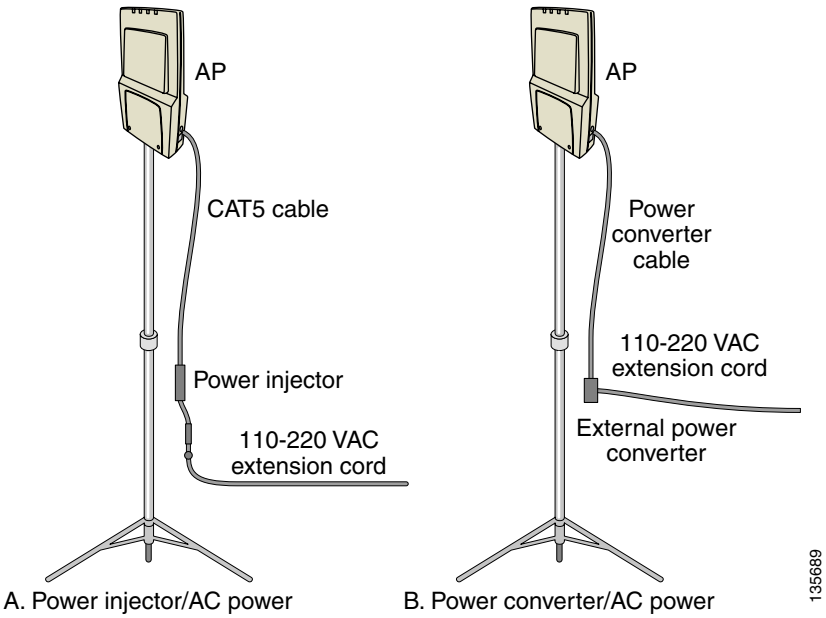
You do not need to use the optional Cisco 1000 series lightweight access point tripod test assemblies described in this section--you can tape or cable tie the Cisco 1000 series lightweight access points to the ceiling, or place them on tall cabinets or ladders. However, if you must move them from their original positions, having them mounted on the tripod test assembly stands makes it easier to relocate them.

Caution You only need AC extension cords if you have enough 110 VAC electrical outlets within easy reach of all potential Cisco 1000 series lightweight access point mounting locations. If you do use AC power cords, make sure you use duct tape to avoid creating trip hazards with the extension cords.

- Contact Cisco WLAN Solution for the Cisco 1000 series lightweight access point mounting brackets and recommended telescoping stand screws.
- Use duct tape and/or cable ties to assemble the telescoping stands, Cisco 1000 series lightweight access points, CAT-5 Ethernet cables, Ethernet power injectors, power inverter, external power supply, battery packs, and/or extension cords as shown in the following figure.

Note Make sure you support the CAT-5 and power cables to remove harmful stress on the Cisco 1000 series lightweight access point connectors.

Figure 7 Cisco 1000 Series Lightweight Access Point Tripod Test Assemblies



- Continue with "Positioning a Cisco 1000 Series Lightweight Access Point at Each Planned Location."

Positioning a Cisco 1000 Series Lightweight Access Point at Each Planned Location

This section assumes that you have determined the Cisco 1000 series lightweight access point locations as described in "Cisco 1000 Series Lightweight Access Point Placement."

Refer to "Preparing Optional Cisco 1000 Series Lightweight Access Point Tripod Test Assemblies" for instructions on how to power the Cisco 1000 series lightweight access points at each planned location.

Caution If you are using AC extension cords, make sure you use duct tape to avoid creating trip hazards.

- Using the floor plans and/or maps from "Cisco 1000 Series Lightweight Access Point Placement Guidelines," place the Cisco 1000 series lightweight access point assemblies at or near the indicated locations.

- If any power is being applied to the Cisco 1000 series lightweight access point, remove the power now.

Verifying RF Coverage Using the Site Survey Tool

- Follow the manufacturer's instructions supplied with the Site Survey Tool to collect signal strength information from the coverage area being tested.
- If necessary, reposition the Cisco 1000 series lightweight access point(s) in the coverage area and repeat the previous steps until you have verified coverage, and then continue.

Cisco 1000 Series Lightweight Access Point Placement Guidelines

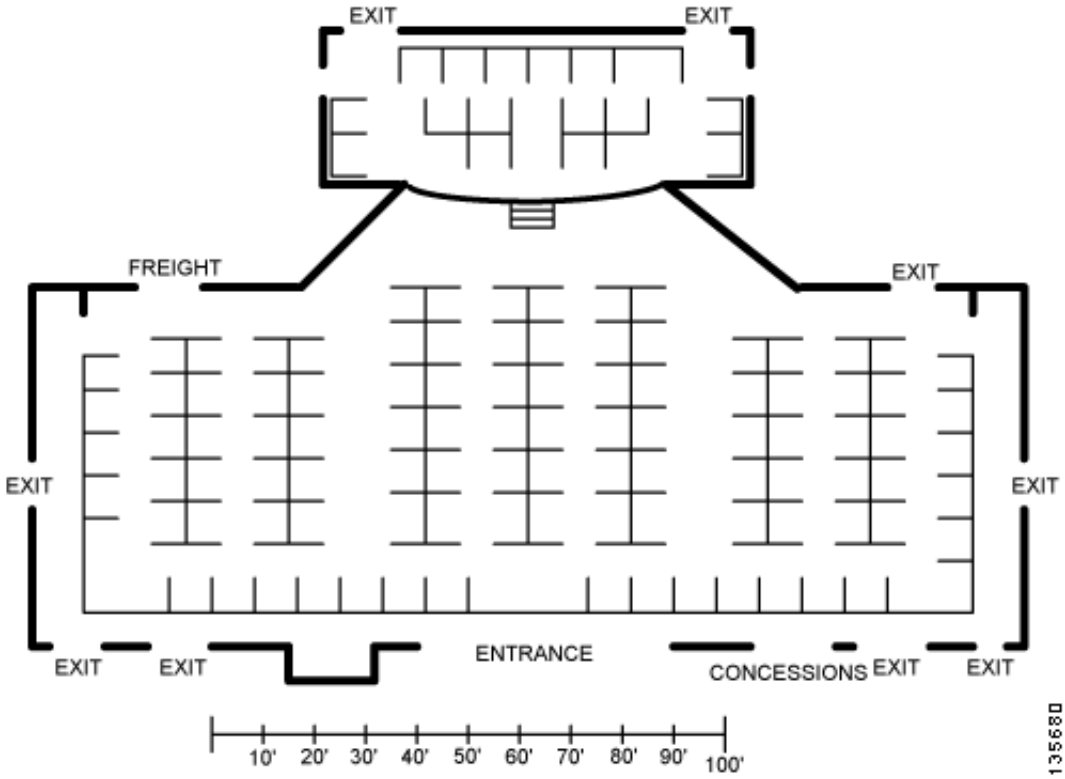
This step describes where and how Cisco 1000 series lightweight access points should be placed. You must know certain information to select Cisco 1000 series lightweight access point locations:

- Collecting Maps or Building Floor Plans
- Noting Deployment Constraints
- Access Point Placement Guidelines
- Cisco 1000 Series Lightweight Access Point Placement

Collecting Maps or Building Floor Plans

Collect maps or building plans of the areas to be covered, with a feet or meters scale included.

Figure 8 Typical Floor Plan -- Open Auditorium with Cubicles



Noting Deployment Constraints

If the Cisco 1000 series lightweight access points are to use existing wiring, note these locations on the map.

If there are locations where Cisco 1000 series lightweight access points cannot be placed, note these locations on the map.

Access Point Placement Guidelines

- Position the Cisco 1000 series lightweight access points above obstructions.
- Position the Cisco 1000 series lightweight access points vertically near the ceiling in the center of each coverage area, if possible.
- Position Cisco 1000 series lightweight access points in locations where users are expected to be. For example, large rooms are typically a better location for Cisco 1000 series lightweight access points than a hallway.

Cisco 1000 Series Lightweight Access Point Placement

- Place Cisco 1000 series lightweight access points on the floor plan using the "Noting Deployment Constraints" and "Access Point Placement Guidelines" sections such that coverage circles are touching or slightly overlapping as illustrated in the following example.

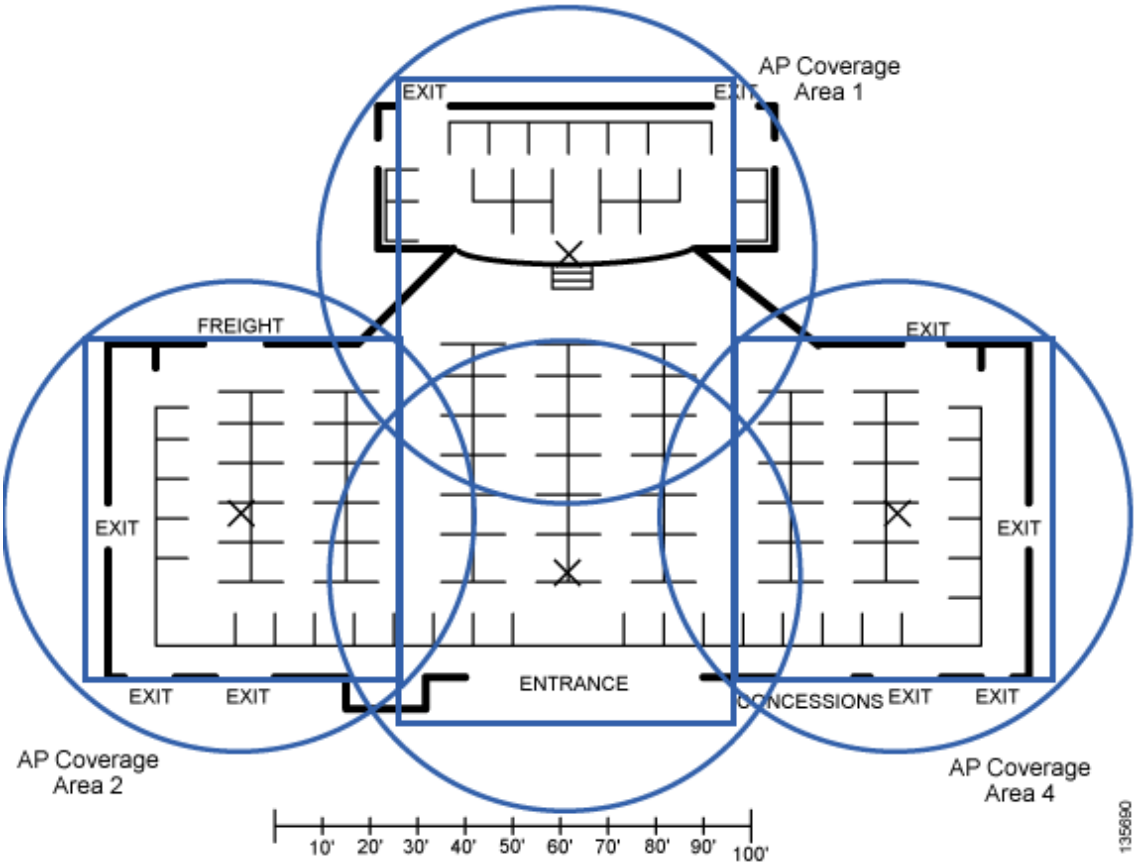
Example

- The open auditorium (a Warehouse/Manufacturing Building Type) shown in the "Collecting Maps or Building Floor Plans" section is approximately 20,000 square feet.
- As described in the "Voice over IP Requirements" section, a typical SpectraLink NetLink Telephone requires approximately 6 Mbps 802.11b throughput, resulting in a minimum A = 5,000 square foot coverage area per Cisco 1000 series lightweight access point for an open area.
- Dividing 20,000 square feet by A = 5,000 square feet per Cisco 1000 series lightweight access point results in at least four Cisco 1000 series lightweight access points required for the auditorium.
- According to the guidelines in "Determining Deployment Requirements," an A = 5,000 square foot coverage area results in an R = 50-foot coverage circle radius, or Z = 71-foot coverage square.
- On your floor plan map, arrange four 50-foot radius coverage circles so they overlap, as shown in the following figure.

Note The Cisco 1000 series lightweight access point coverage areas should overlap approximately 10% to 15% to minimize the number of coverage holes.

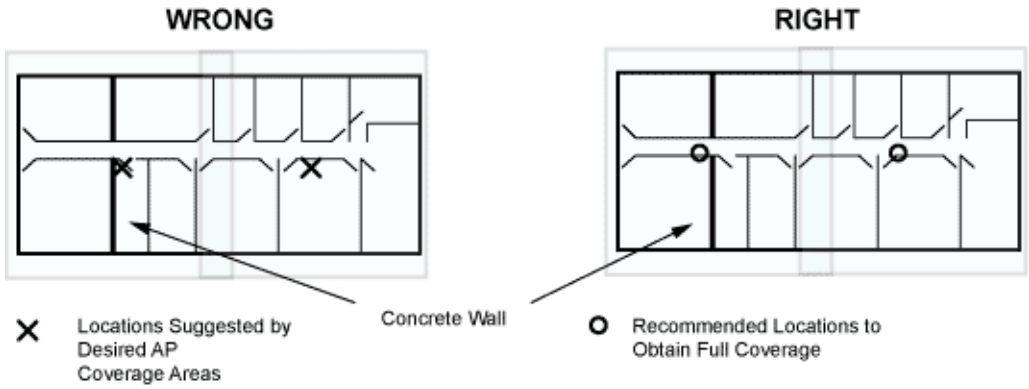
Note The large "X" in the middle of each circular Cisco 1000 series lightweight access point coverage area--those are the indicated locations of the associated Cisco 1000 series lightweight access points.

Figure 9 802.11a Cisco 1000 Series Lightweight Access Point Coverage Areas Arranged on Typical Warehouse Floor Plan



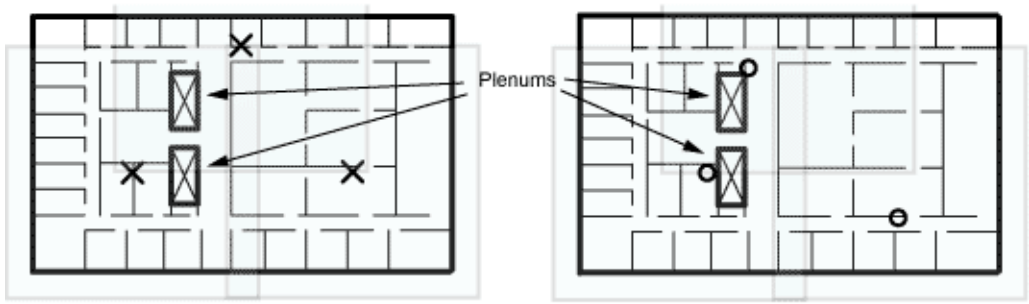
- See the following figure for a description of what to do if there are any large metal obstructions where you plan to install Cisco 1000 series lightweight access points.

Figure 10 What to do about Metal RF Barriers in a Planned Cisco 1000 Series Lightweight Access Point Location



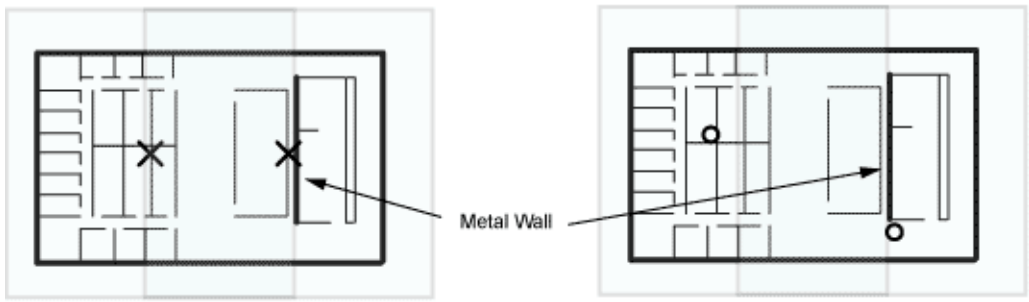
Notes: Both Locations moved up to mount in hallways, Left Location moved to other side of wall to provide coverage on left side of wall, and Right Location moved slightly left to provide better coverage to overlap area. Also note that the coverage areas remain where they were for coverage testing.

A. I Have a Large Concrete Wall in the Middle of One Coverage Area



Notes: Upper Location moved to hallway at corner of plenum, Left Location moved next to plenum, Right Location moved to hallway, and Left Location moved to hallway to provide better coverage to overlap areas. Also note that the coverage areas remain where they were for coverage testing.

B. I Have Large HVAC Plenums Next to Planned Locations



Notes: Right Location moved slightly to the right of one end of the Metal Wall in a hallway, and Left Location moved up and to the left to provide better coverage to overlap area.
Also note that the coverage areas remain where they were for coverage testing.

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C. I Have a Large Metal Wall Next to a Planned Location

- When you are installing Cisco 1000 series lightweight access points using the "RF Prediction with Optional Site Survey" or "Basic Guidelines with Optional Site Survey" method:
  - Complete "Optional Minimal Site Survey" for the optional minimal site survey, or
  - Use the *Quick Start Guide: Cisco Aironet 1000 Series Lightweight Access Points with Internal Antennas* or *Quick Start Guide: Cisco Aironet 1000 Series Lightweight Access Points with External Antennas* to install the Cisco 1000 series lightweight access points without a minimal site survey.

Where to Go from Here

You have successfully planned and tested the Cisco 1000 series lightweight access point RF coverage in your target area, and have determined where the Cisco 1000 series lightweight access points are to be located.

Continue with *Quick Start Guide: Cisco Aironet 1000 Series Lightweight Access Points with Internal Antennas* or *Quick Start Guide: Cisco Aironet 1000 Series Lightweight Access Points with External Antennas* for final installation instructions.