



**IEEE 802.11g
Direct Sequence**

2.4 GHz SPREAD SPECTRUM RADIO SITE SURVEY REPORT

**For
ABC Company**

At

**ABC House
ACB road
Anywhere**

Report Prepared By

**Chief site survey
engineer**

Survey Date

16th December 2010

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1 Document Version History

Version	Date	Comments
Version 1.0	22nd January 2010	Original

2 INTRODUCTION

Hard-wired data collection systems can be specified fairly readily using pre-defined specifications of distance, number of units and data throughput requirements. RF systems are less straight forward as they are much more affected by their operating environment. It is therefore necessary to perform a site survey in order to ensure that an RF system will operate reliably in your environment and to understand how the system will function in the conditions under which it will be expected to operate. This document is the result of a site survey performed at your facility.

2.1 Purpose & Scope

The purpose of this document is to provide a comprehensive report detailing the findings of the site survey conducted at your facility. This report has been divided into relevant sections as follows.

Section 3 SITE INFORMATION

This section provides information specific to your facility including a description of the site itself and the prevailing conditions (stock levels etc) at the time of the survey.

Section 4 CUSTOMER REQUIREMENTS

This section details your specific requirements, examples of which are the locations where radio reception is required, the type of wireless devices proposed for wireless connection and the required data throughput speed.

Section 5 IMPORTANT ASSUMPTIONS

This section defines the assumptions on which the site survey has been based. It is important that you make yourselves aware of the statements made in this section.

Section 6 SITE SURVEY RESULTS

This section is most important in that it details the equipment required for radio coverage in the required areas of your facility.

Section 7 EQUIPMENT MOUNTING DIAGRAMS

This section details the recommended process of installing the equipment in diagram form.

Section 8 NETWORK TOPOLOGY

This section provides a diagram of the proposed topology of the wireless network.

Section 9 FACILITY DIAGRAMS

This section continues from section 5 in that it shows the site plans together with readings taken at strategic locations. This provides an indication as to the quality of signal in these locations for each proposed access point and will assist you in identifying which access points to deploy in the event that they phase the implementation.

Section 10 WiFi RF READINGS

This section provides a record of all the readings taken on the day of the survey. Signal readings are captured for a 30 second time-frame at strategic points within the facility. A software tool called Air Magnet is used to measure 802.11a, b, g and n activity at the facility and to provide a spectrum analysis of radio activity at the 2.40 - 2.4835 GHz frequency range within which WiFi operates.

Section 12 WHAT HAPPENS NEXT

This section provides insight in to 'what happens next' in terms of how the proposed equipment is installed and commissioned and who should do it.

Section 13 BACKGROUND INFORMATION

This final section provides some technical background reading on the technology.

Section 14 GLOSSARY OF TERMS

This section provides an explanation of acronyms used in this report.

3 SITE INFORMATION

3.1 Site Details

Company Name	ABC Company Ltd
Address	ABC Road ABC

3.2 Contact Details

Contact Name	Telephone #	Mobile #	E-Mail Address
Site contact			

3.3 Site Description

The ABC Company Ltd site is extensive and consists of a large number of separate units spread over a wide area. The remit was to survey the assembly, coverings, flashings, treatment and wood processing warehouses. All the warehouse areas were consistent throughout with regards to the construction of the buildings made up generally of breezeblock, girders and purlings. The assembly warehouse comprises of two large halls, production and packing, interconnected by a fork-lift access door a two normal doors. There are office and canteen facilities in the bottom corner of the production area. The wood process area is made up of three main halls all interconnected by a combination of fork-lift and normal doors. There is a main roller door at the front of the building as well as a canteen and workshop area. There are also wash room facilities to the rear of the building. Coverings is slightly smaller and consists of a large open floor area with admin offices, canteen and washroom facilities. There is also a compressor room and cardboard conditioned area off the front section of the hall. There are several fork-lift entrances/exits to this area. Flashings is a simple open area with a small office and workshop at the front of the building. Treatment is also a simple open warehouse area. It has several entrances/exits to the facility including one for fork-lift access to the building.

3.4 Site State

All five warehouses were fully operational on the day of the survey. Conditions can be considered typical for this type of environment with high stocking levels. Extra care and diligence must be taken due to the constant maneuvering of fork-lift trucks throughout the sites.

4 CUSTOMER REQUIREMENTS

This section details your requirements. This is important on the basis that the primary objective of a site survey is to ensure that all your requirements are identified and satisfied to the best of our ability.

4.1 Coverage Requirements

The RF mapping survey was performed to verify coverage for the area specified within the boundaries indicated on the site plan (see Section 9 – FACILITY DIAGRAMS).

The survey was carried out on the instruction that continuous coverage was required throughout the stocking/working areas of the warehouses. In instances where more than one access point is required in any warehouse then the requirements are deemed to be to provide seamless coverage throughout the warehouse between access points allowing for the scanners to continue to work from area to area without losing connectivity.

It is recommended that a spare access point be ordered to provide coverage in the event of an access point failure. This access point should ideally be configured in readiness for replacing any access points that may fail. TSC Barcode Solutions Ltd can advise on the configuration settings of this access point to enable it to replace any of the existing access points.

5 IMPORTANT ASSUMPTIONS

TSC Barcode Solutions Ltd provides the site survey on the understanding that all tests and subsequent results are based on a generic survey utilising a laptop fitted with a Cisco PCMCIA

802.11abg wireless adapter card. This equipment provides best result analysis and provide best placement for the wireless infrastructure access points.

Coverage found using this equipment normally represents best coverage provided for a multitude of client devices. Such client device specifics such as types of fitted antennas and locations / positions of fixed wireless clients can change the connectivity found. These changes are out of our normal control after the site survey however as reasonably practicable the site survey provides best endeavors to cover these possible changes.

TSC Barcode Solutions Ltd does not guarantee RF coverage in the event that the layout of the site changes in any way after the site survey has been conducted. TSC Barcode Solutions Ltd recommends that a second RF site survey be conducted in such circumstances to re-appraise the site.

Please also note that it can be impractical to provide RF coverage in any locations within your specified coverage area where the area is by its very nature constantly changing in layout and material storage.

To provide adequate cover to cater for all eventualities (using Spread Spectrum RF) would mean specifying such a volume of access points and antennas as to render the project uneconomical and to increase the chance of over coverage causing cross channel interference issues.

Additionally, it has been found that some environments are such that a higher number of access points are required to provide the level of overall coverage at higher data rates and or where a resilient solution is requested. This being the case, coverage cell overlap within the same frequency (channel) will degrade the overall solution by increasing the level of associated interference. The only option in these circumstances is to switch off and or reduce the power output of certain access points to a degree where the individual coverage cells are reduced.

Best endeavors will be made by TSC Barcode Solutions Ltd to provide coverage in all circumstances and the potential problem areas will be highlighted within the report if known at the time of the survey. Recommendations for storage will also be made by TSC Barcode Solutions Ltd in these circumstances if thought to be useful in improving RF coverage. If such areas are found to require alternative placement of wireless equipment and or specialised protection of any device, TSC Barcode Solutions Ltd may require to visit site as a chargeable visit and or change the required items on the corresponding materials list.

6 SITE SURVEY RESULTS

This section will provide a brief summary of the findings and will then detail the specific findings for each access point. Please reference the site plan as the areas where radio coverage will be provided are denoted as shaded regions.

Radio coverage in general is good with a high signal quality in the majority of the required areas of the site (as identified in the site plans).

6.1 Required Equipment

Part Number	Description	Qty
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)	9
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna	18
AIR-PWRINJ3	Power Injector for 1200 series	9
1-974029-020	UK Power Cord (for above access point)	9

6.2 Site Survey Detail

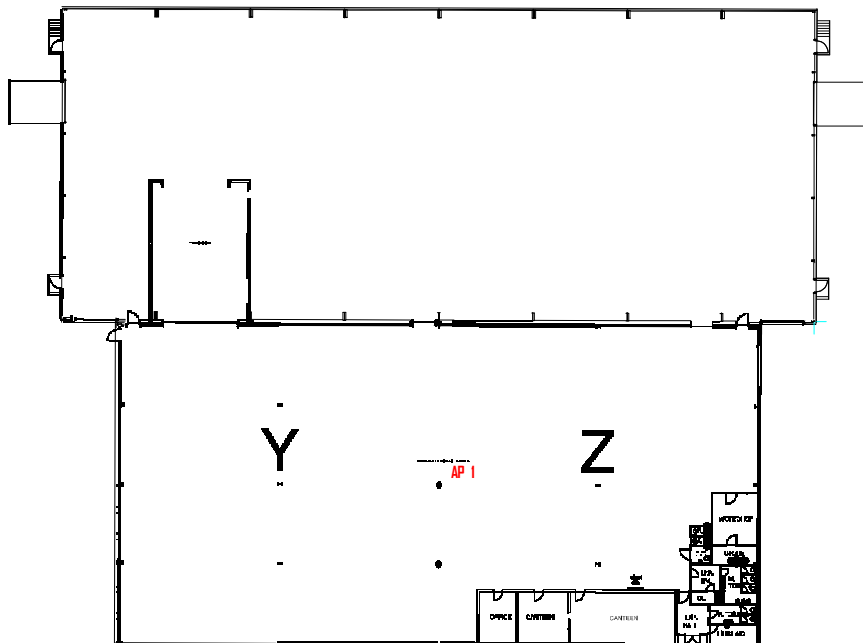
6.2.1 Access Point AP1 – Assembly Warehouse

Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Install the access point on the metal crossbeam utilising beam clamps with the bracket in the location denoted by the marking AP1 in the autocad drawing below. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



6.2.2 Access Point AP2 – Assembly Warehouse

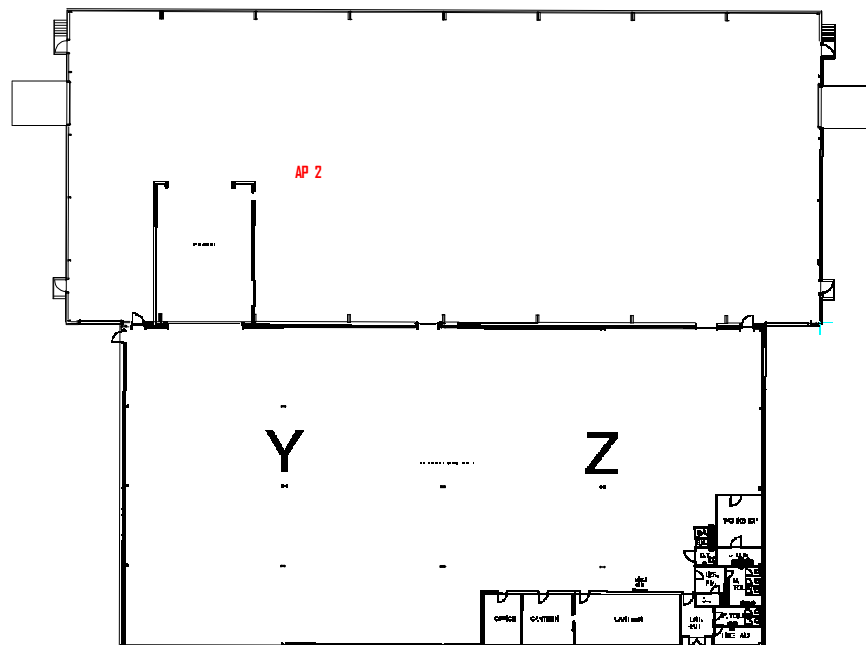
Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Please reference section '7.1 Mounting on Horizontal Roof Girders' and section '7.2 Mounting Using Beam Clamps' for guidelines on installing this access point.

The AP 2 symbol in the drawing below denotes the approximate location where the access point must be installed. It must be installed UPRIGHT on the metal crossbeam using the wall mounting bracket provided. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



6.2.3 Access Point AP1 – Coverings Warehouse

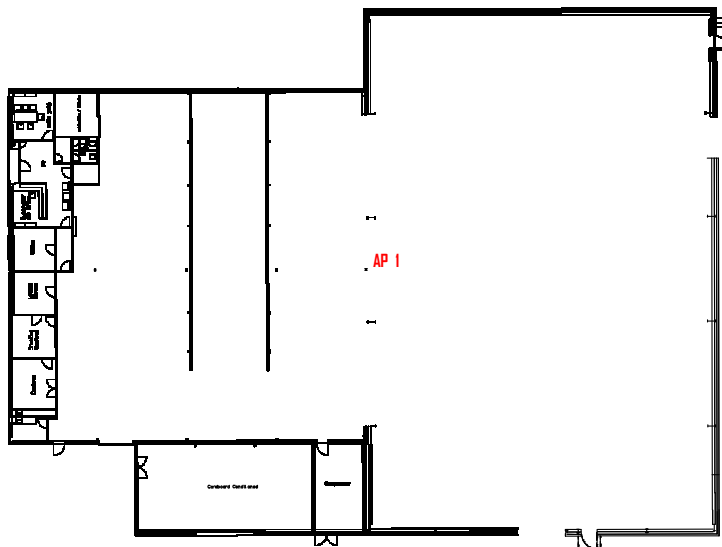
Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Please reference section '7.1 Mounting on Horizontal Roof Girders' and section '7.2 Mounting Using Beam Clamps' for guidelines on installing this access point.

The AP1 symbol in the drawing below denotes the approximate location where the access point must be installed. It must be installed UPRIGHT on the metal crossbeam using the wall mounting bracket provided. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



6.2.4 Access Point AP1 – Flashings Warehouse

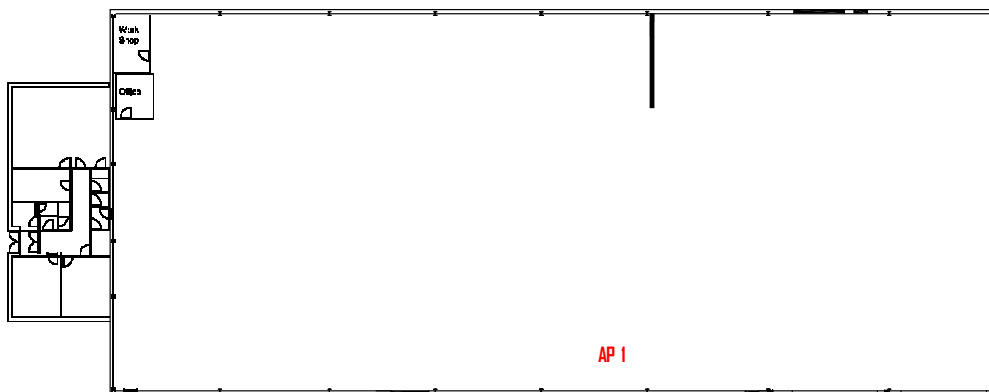
Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Please reference section '7.1 Mounting on Horizontal Roof Girders' and section '7.2 Mounting Using Beam Clamps' for guidelines on installing this access point.

The AP1 symbol on the drawing below denotes the approximate location where the access point must be installed. It must be installed UPRIGHT on the metal crossbeam using the wall mounting bracket provided. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



6.2.5 Access Point AP2 – Flashings Warehouse

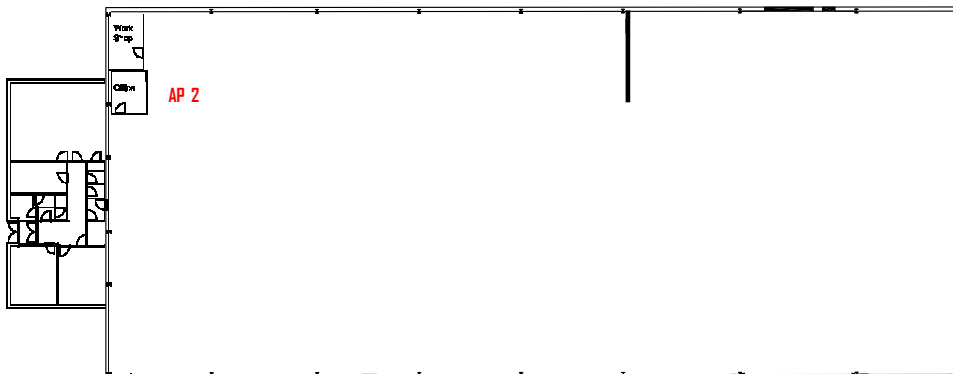
Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Please reference section '7.1 Mounting on Horizontal Roof Girders' and section '7.2 Mounting Using Beam Clamps' for guidelines on installing this access point.

The AP2 symbol in the drawing below denotes the approximate location where the access point must be installed. It must be installed UPRIGHT on the metal crossbeam using the wall mounting bracket provided. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



6.2.6 Access Point AP1 – Wood Process Warehouse

Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Please reference section ‘7.1 Mounting on Horizontal Roof Girders’ and section ‘7.2 Mounting Using Beam Clamps’ for guidelines on installing this access point.

The AP1 symbol in the drawing below denotes the approximate location where the access point must be installed. It must be installed UPRIGHT on the metal crossbeam on the ceiling using the wall mounting bracket provided. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



6.2.7 Access Point AP2 – Wood Process Warehouse

Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Please reference section '7.1 Mounting on Horizontal Roof Girders' and section '7.2 Mounting Using Beam Clamps' for guidelines on installing this access point.

The AP2 symbol in the drawing below denotes the approximate location where the access point must be installed. It must be installed UPRIGHT on the metal crossbeam on the ceiling using the wall mounting bracket provided. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



6.2.8 Access Point AP3 – Wood Process Warehouse

Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Please reference section '7.1 Mounting on Horizontal Roof Girders' and section '7.2 Mounting Using Beam Clamps' for guidelines on installing this access point.

The AP3 symbol in the drawing below denotes the approximate location where the access point must be installed. It must be installed UPRIGHT on the metal crossbeam on the ceiling using the wall mounting bracket provided. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



6.2.9 Access Point AP1 – Treatment Warehouse

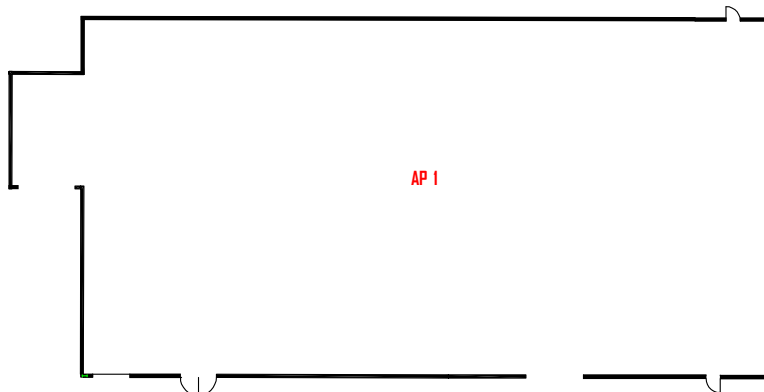
Part Number	Description
AIR-AP1242AG-E-K9	Cisco 1242 Access Point (ETSI Config, Power Supply)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Primary Antenna Port)
AIR-ANT4941	2.4 GHz 2.2dBi Omni-directional Antenna (802.11g Sec Antenna Port)
AIR-PWRINJ3	Power Injector for 1200 series
1-974029-020	UK Power Cord (for above access point)

Installation

Please reference section ‘7.1 Mounting on Horizontal Roof Girders’ and section ‘7.2 Mounting Using Beam Clamps’ for guidelines on installing this access point.

The AP1 symbol in the drawing below denotes the approximate location where the access point must be installed. It must be installed UPRIGHT on the metal crossbeam on the ceiling using the wall mounting bracket provided. The two antennas must be screwed onto the 2.4 GHz primary and secondary antenna connectors located on the bottom of the access point.

It is important that the two antennas are pointing vertically downwards towards the floor and are free of any obstruction when fitted.



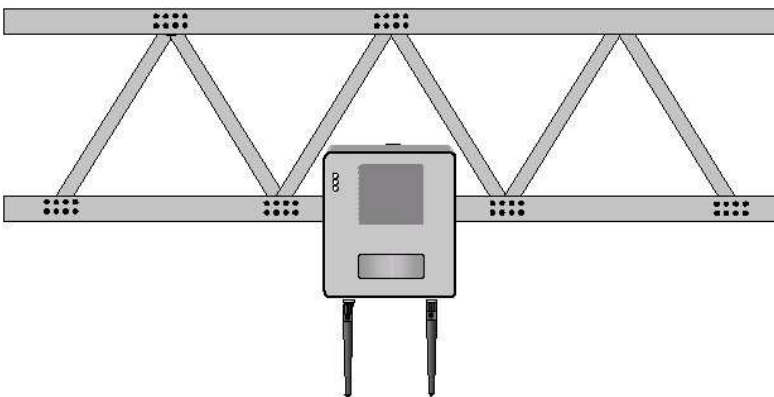
7 EQUIPMENT MOUNTING DIAGRAMS

The Access Points are to be installed as in the photograph below. The access points can be fitted either upright or inverted as required.

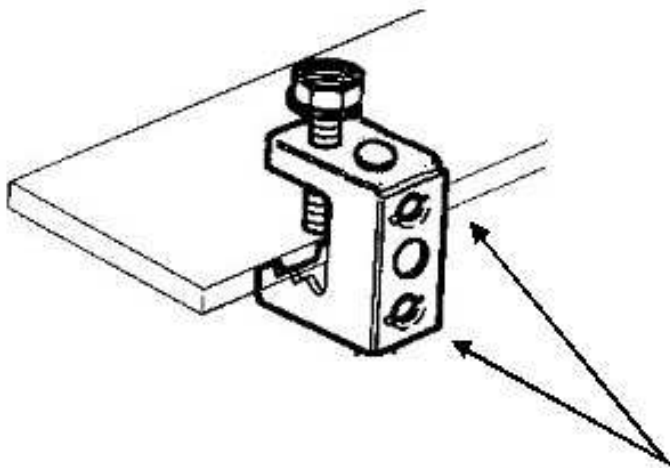


7.1 Mounting on Horizontal Roof Girders

The diagram below represents best practice for installation of access points whereby the access point is installed on a suitable structure such that it is not vulnerable to being damaged by forklift truck activity. It is imperative that where possible the two antennas are such that they are clear of the structure the access point is attached to enabling the radio signal to propagate in free air.



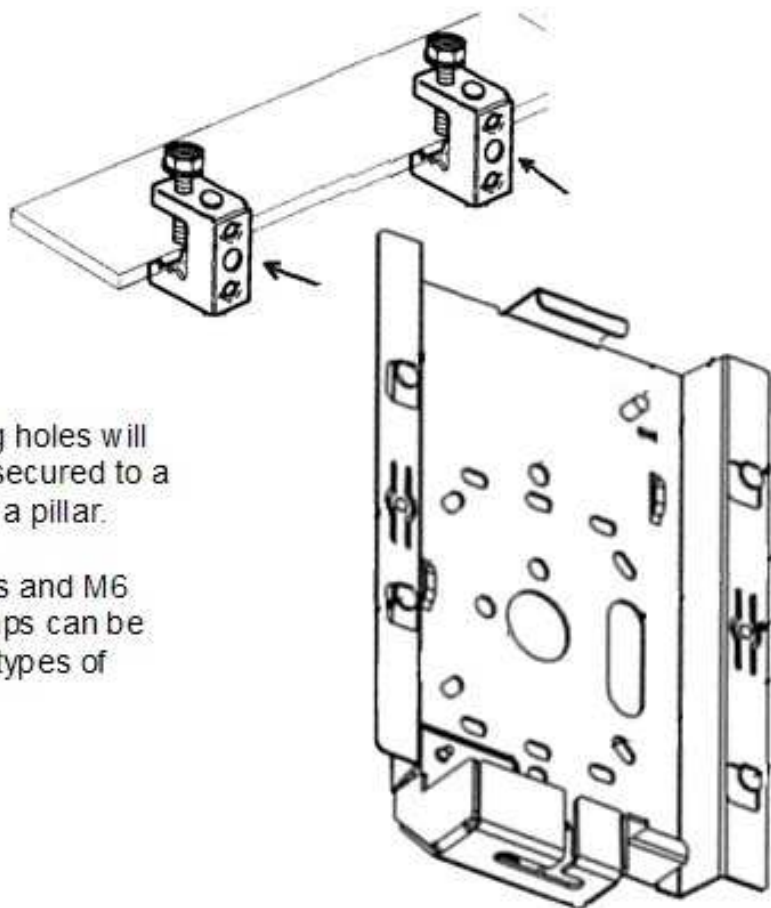
7.2 Mounting Using Beam Clamps



Beam Clamps can be used to secure the access point mounting bracket to any structural metalwork up to a maximum thickness of 16mm.

They can also be used to mount any other accessory item such as antenna mounting brackets

M6 Threaded Holes



Using the two side fixing holes will allow the bracket to be secured to a vertical surface such as a pillar.

With various orientations and M6 holes available the clamps can be used to secure to most types of fixing points.

8 NETWORK TOPOLOGY

Central Switch installed in the Main Comms Cabinet

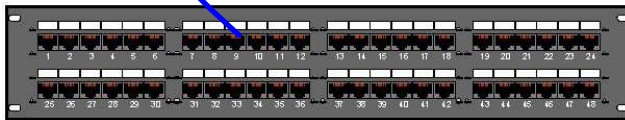


A power over Ethernet (PoE) Injector should be installed for each access point connected directly to the network in the Central cabinet



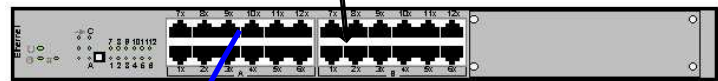
Remotely located Data Cabinets

Horizontal data cabling Length up to 90 metres



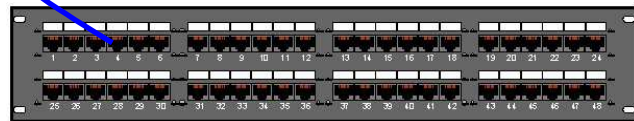
Data Cabling Patch Panel

Small remotely located switches can be installed as required if cabling is over 90 metres

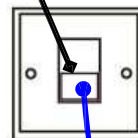
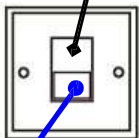


Horizontal data cabling - Length up to 90 metres

Patch the Network Switch to the network port on the PoE



Horizontal data cabling - Length up to 90 metres



9 FACILITY DIAGRAMS

Communications coverage was requested for the areas specified within the boundaries indicated by the blue shaded areas in the following facility diagrams.

In order to ensure communication in the desired areas of coverage the threshold for signal to noise ratio (SNR) of -20 dB or above is adhered to, beyond this level data loss can occur. Please be aware that this will not guarantee response times for the RF network as the wired network traffic and host application response times will be a factor.

The following page contains the floor plan for the facility. Where appropriate, it has been annotated to show access point and antenna locations.

IMPORTANT

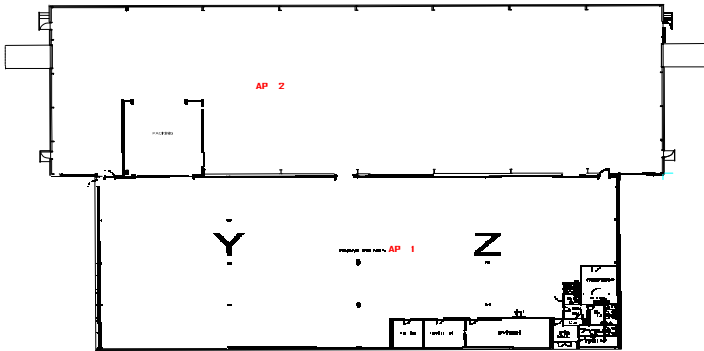
TSC Barcode Solutions Ltd applies a threshold SNR (Signal to Noise Ratio) of -20 dB to identify a coverage footprint around each access point. This facilitates a reliable connection for data communication but also compensates for fluctuations in ambient conditions, stock levels etc. It should be noted that the usable coverage footprint often extends beyond this -20 dB threshold perimeter.

It should be noted that the radio signal of a Wifi network is dynamic and as such areas outside this -20 dB threshold perimeter can potentially be unreliable for data communication due to a number of factors (some of which are listed below)

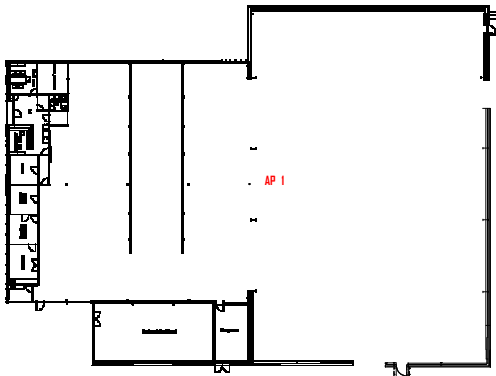
- Humidity
- Stocking Levels
- Employees
- Background noise
- Wifi transmissions
- Sources of interference in range (2.40 GHz to 2.4835 GHz)

Please note that any areas of the site where devices are not being used for data communication but are routes taken to move between areas can tolerate an SNR less than -20 dB.

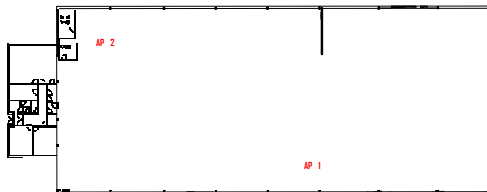
9.1 Site Plan – Assembly Warehouse



9.2 Site Plan – Coverings Warehouse



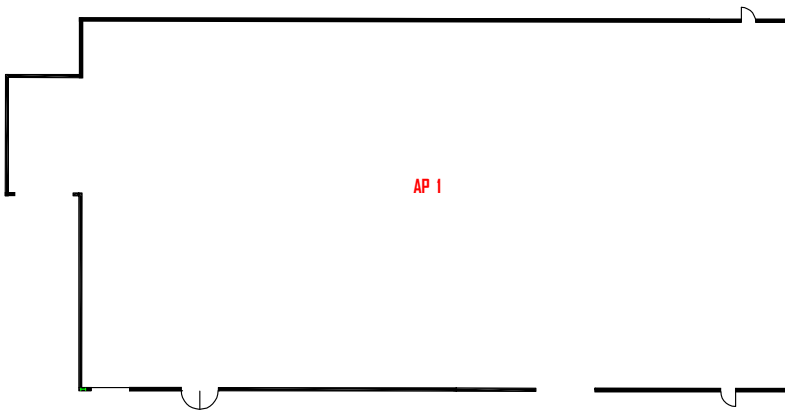
9.3 Site Plan – Flashings Warehouse



9.4 Site Plan – Wood Process Warehouse



9.5 Site Plan – Treatment Warehouse



10 WiFi RF Readings

10.1 Air Magnet Results

A product called Air Magnet is used as part of the survey process to monitor for WiFi activity on the day of the survey. This enables all 802.11a, b, g and n wireless networks to be identified and monitored. This provides an insight into the following:

- Available bandwidth for the proposed wireless network
- Channel deployment strategy for detected WiFi access points
- Identification of possible 'rogue' access points

The following screen shots show WiFi activity across each of the WiFi radio channels and also identifies all WiFi access points. For each identified access point the following information has been collated:

- Access Point MAC Address
- Type of radio (e.g. 802.11a or 802.11b or 802.11g or 802.11n)
- S (Signal strength)
- N (Background Noise)
- SNR (Signal to Noise Ratio)
- Security (E.g. WPA-PSK WiFi Protected Access using Pre-Shared Key)
- SSID (Service Set Identifier)

The attached appendix shows the information gathered by Air Magnet as a result of monitoring in all five sites. This shows a number of WiFi access points that are likely to be on site. The radio channels configured on these access points should be born in mind when allocating channels to the proposed access points.

11 WHAT HAPPENS NEXT

11.1 SITE PREPARATION FOR CONFIGURATION & COMMISSIONING

This survey document is hence designed to provide sufficient detail to enable either you or your preferred contractor to physically install the equipment supplied by TSC Barcode Solutions Ltd and to provide connectivity in terms of Ethernet cabling to their existing network.

TSC Barcode Solutions Ltd offer a service described as “Commissioning” whereby we visit site to commission (pre configure off site) the RF equipment and then perform various tests to prove functionality of the RF system. (Please reference Section “11.2 – WIRELESS CONFIGURATION & COMMISSIONING”).

TSC Barcode Solutions Ltd requires a number of site preparation steps to be completed and tested by you or your preferred contractor prior to arriving on site in the event that our services are called upon.

TSC Barcode Solutions Ltd now supplies access points that are either conventionally powered via standard mains supplies or powered via the IEEE 802.3af Power over Ethernet standard. The proposed access points are power over Ethernet only.

You therefore have the option to power the access points from their existing switches provided that they conform to the IEEE 802.3af standard and that the 90 meters maximum cable length Ethernet rule is observed.

As an alternative TSC Barcode Solutions Ltd can supply single port Cisco Power over Ethernet injectors to perform the same function.

NB. The Cisco Access Points proposed for this installation are equipped with a 10Base-T / 100BaseT (UTP via RJ-45 connector).conforming to the IEEE 802.3 standard.

11.1.1 Cabling Requirements

The following steps must be completed if applicable to the product type:

- ¾ If required a 13A socket 240V single switched outlet should be provided within 1 metre of each Cisco PoE injector. For more information see section 4.4 – Power over Ethernet.
- ¾ A connection must be made between each PoE injector (Data In) and your hub or switch using a short UTP cable (minimum Category 5).
- ¾ A second length of Ethernet cable of the same specification must be routed from the PoE injector (Data and Power Out) to the access point. It must not exceed 90 meters.
- ¾ The cabling installer must terminate and test the new cable runs before the RF can be connected and tested. TSC Barcode Solutions Ltd recommends that a separate network segment be used for the Access Points.

11.1.2 Access Point Installation

- ¾ The location(s) that are specified in this site survey report for the placement of the Access Point(s) must be prepared so that they will accept the Access Point(s).
- ¾ The Access Point mounting brackets must be installed in readiness to receive the Access Points.
- ¾ The proposed antennas must be installed in the directed locations. All interconnection coaxial cables must be adequately routed from the antenna locations to the wireless access points. Any access holes made to provide a route through any temperature controlling material must be filled.

11.1.3 Access Point Mountings

In the event that the wall-mounting bracket supplied is unsuitable then it is the responsibility of you to engineer a mounting surface to mount the Access Point on to. Please reference Appendix A for the dimensions of the access points, mounting brackets etc.

In normal practice it is best to provide and secure a wooden back panel to any steel structural support or wall that may result in reflection of signals by using suitable clamps. This back panel will provide the means to adequately mount the proposed wireless hardware and associated items easily and neatly as well as provide a non reflective surface behind any antenna.

Where the proposed access points are to be mounted (Upright or Inverted) to a structural steel beam, and where the antennas are in clear air either above or below the beam a wooden back panel is not always required as other options for mounting are available. The important issue when mounting the wireless access point in this location is that the antennas are in clear air and are visible from most directions.

Depending on the locations proposed for the wireless devices (access points) the orientation of the devices and the orientation of the associated antennas may be required to be varied. This usually means mounting the devices either vertically with the antennas pointing downwards when mounted at high level or antennas pointing upwards when mounted to walls at varied heights. There is also the occasion where the proposed devices may be required to be mounted flat to a structural beam.

11.2 WIRELESS CONFIGURATION & COMMISSIONING

Commissioning the RF kit is an additional Professional Service offered by TSC Barcode Solutions Ltd. This is entirely optional. The commissioning process involves a number of steps as described here:

- ¾ An initial site review will be conducted. During this walk through, TSC Barcode Solutions Ltd will visually inspect the installed AC outlets, Ethernet cable runs, and Access Point location platforms, mounting brackets, antennas or external enclosures.
- ¾ When all access points are in place and powered on TSC Barcode Solutions Ltd will test the Ethernet connection using a network “ping” test. In the event that the “ping” test fails and the network connection is at fault it is your responsibility to remedy the network connection.
- ¾ When access points are in situ and functional the RF devices will be “pinged” from a networked PC to prove full connectivity to the host computer.
- ¾ Finally, a walk test will be conducted to prove radio coverage has been provided in all areas as per the survey requirements.

11.2.1 Assumptions

It is important that the following work has been undertaken prior to the day of commissioning:

- ¾ Installation and testing of the Ethernet network points at each access point location.
- ¾ Installation of any required electrical services, including provision for the required number of power over Ethernet injector units
- ¾ Installation of any mounting brackets for the access points, access point (in the case of pre configured settings) plus any additional antennas, brackets and interconnecting cables.
- ¾ Provision of an IP address for each Access Point and for each client end device; an IP address of the Router (if one is required), the IP address of the Host and the subnet mask. This can be done on the day of the commissioning or pre configured by prior arrangement.

11.2.2 Access Point configuration

During installation, TSC Barcode Solutions Ltd will ensure the correct configuration of each Access Point. Future Access Points will need to be configured to avoid communication problems. TSC Barcode Solutions Ltd will also require that you supply network information on request to enable each Access Point configuration.

11.2.3 Fast Ethernet

With certain types of fast Ethernet switches it is recommended that the access points be connected to a separate segment of the network and that segment be permanently set to 10Mbps/sec at half duplex.

11.2.4 Power over Ethernet

Early generations of Cisco access points “do not” conform to the IEEE 802.3af standard for Power over Ethernet therefore only use Cisco certified Switches and or Power Patch Panels to provide inline power. In the event that your switches do NOT support this standard TSC Barcode Solutions Ltd can supply Cisco PoE injectors to power the access points instead.

One injector will be required for each access point. Please make sure that there is adequate space available within any communications cabinet for the injectors.

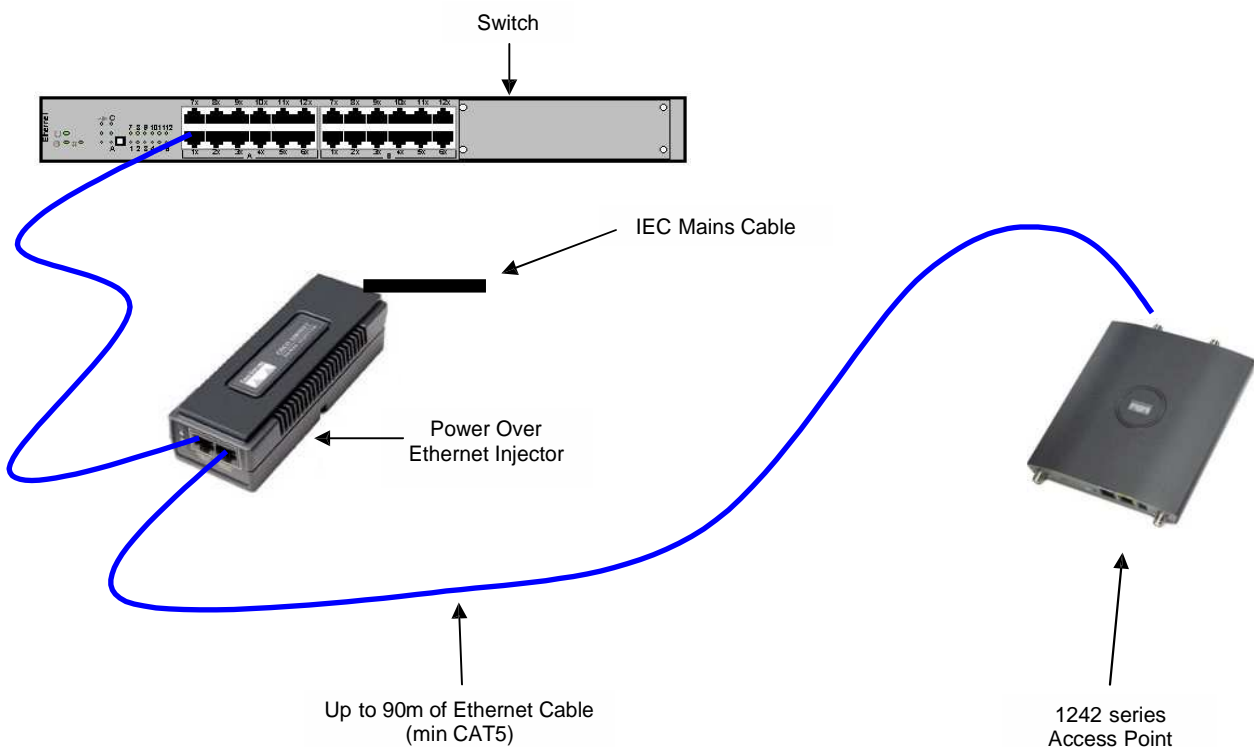
As with normal Ethernet installations the maximum single run between the patch panel and the Access point is 90m when using category 5 UTP cable.

The injector is installed with a standard UTP cable into the incoming port from the patch panel, and a length of standard Category 5 (or above) UTP cable from the injector to the Access Point.

The injector can then be connected to the power point. It is normal practice to install the devices adjacent to the patch panel itself.

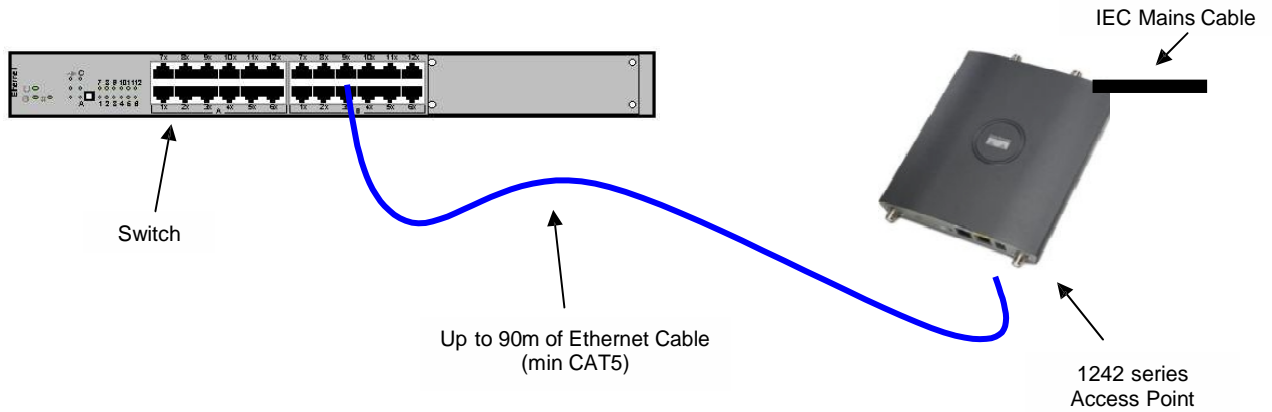
It s normal practice to install the injectors centrally, within the data cabinet (as close to the network switch as possible). Suitable numbers of standard 13A power outlets must be available within the cabinet to provide mains power to the injectors.

It is important that no other device be connected to the cable between the PoE injector and the Access Point. Therefore it may be essential to have the injector immediately after a repeater in case of a long run (longer than 90m) from the patch panel.

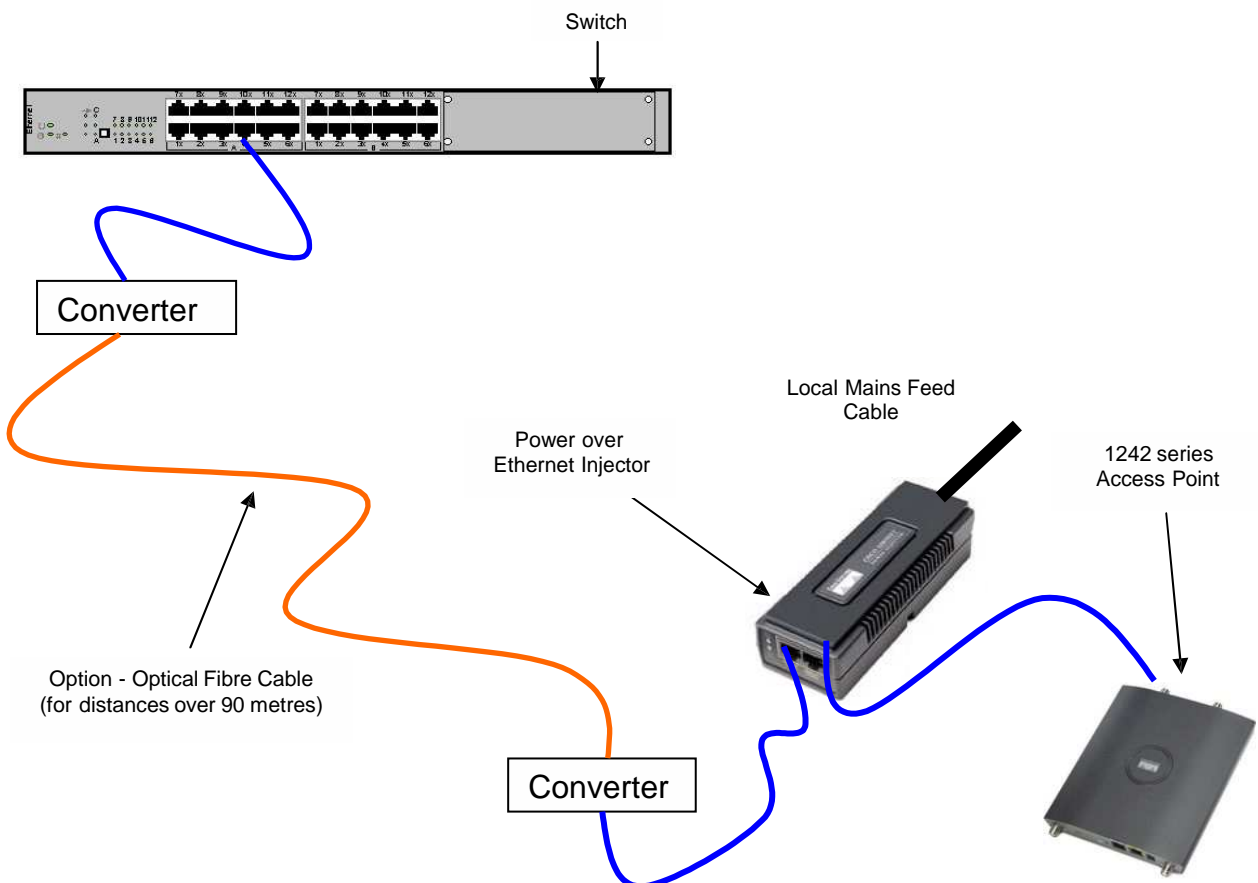


11.2.5 Standard 240 Volt Supply (if applicable)

It is normal practice to install the 13A power outlet and associated cabling from a dedicated clean supply Mains Distribution Board. Install the outlet within one metre of the proposed access point location



11.2.6 Power over Ethernet using Optical Fibre (if applicable)



12 BACKGROUND INFORMATION

12.1 Site Survey Procedure

There are three basic components to a site survey: spectrum analysis, the radio coverage guarantee and response time analysis.

The following equipment was used as a platform to provide the radio site survey

- ¾ Laptop PC and or mobile handheld computer running a wireless monitor program that provides data packet information and Signal to Noise (SNR) ratios.
- ¾ 802.11abg wireless card (Paired with access point wireless type as appropriate).
- ¾ Test Access Point (1242ag 54Mbps Radio) powered by stand alone battery.

12.2 Spectrum Analysis

WiFi 802.11b/g occupies the unlicensed 2.4GHz part of the ISM band. As such it is prone to interference from transmissions at such frequencies. Regulations governing unlicensed parts of the spectrum state that equipment operating at such frequencies must expect interference. The 802.11 b/g technology using a radio frequency modulation called DSSS (Direct Sequence Spread Spectrum) and is tolerant to an extent from interference but is certainly far from immune.

The current trend is for transmissions at 2.4GHz to increase and hence some form of spectrum analysis is advisable as part of the site survey process.

12.3 Radio Coverage

Radio coverage is analysed by using an access point and a wireless client device. The access point has its own mobile power supply and hence is able to be deployed at chosen locations within your facility.

The wireless client device is used in conjunction with client survey software to enable various readings to be taken within the coverage area that the access points provide at each required location. The signal strength, background noise and the ratio of these readings (SNR – signal to noise ratio) together with data packet speeds etc are used to measure the reliability of the connection and hence define the boundaries of a reliable coverage zone for each access point.

In conjunction with this, the software provides details of the data throughput speed enabling a coverage zone to be defined at either 802.11b (1Mbps - 11Mbps) or 802.11g (1Mbps – 54Mbps) throughput speeds or a combination dependant on your requirements.

12.4 Response Time Analysis

Response times are liable to fluctuate due to the nature of radio. The site survey procedure includes a continuous 'PING' between the wireless laptop and the survey access point. This enables data throughput reliability to be monitored but more importantly provides a means of observing the packet response times for two way transmissions between the laptop and the access points over the wireless interface.

12.5 Channel Assignment

When any Direct Sequence radio technology is being used and as in this case more than one Access Point is to be installed, then different channels need to be assigned to each Access Point. The process of setting different operating channels provides the facility to reduce the amount of generalised interference between adjacent wireless cells

These channel assignments are usually configured at the commissioning stage of the project. The process will not only take into account the total number and locations of wireless access points but will also provide for other interference from other radio transmissions in the general area.

It should be noted that when higher speeds (54Mbps) or resilient solutions are required, the level of indirect interference from adjacent access points on the same frequency can also increase if there are a large number of access points within an area.

12.6 Factors affecting proposed equipment placement

The main factors which affect proposed quantities of wireless devices are as follows;

12.6.1 Required level of redundancy.

A non redundant solution will utilise less access points to cover a given area than a redundant solution based on the additional overlapping coverage provided by adjacent access points.

Placement of access points (locations) will change depending on which type of solution requested. It is not possible to change from one solution to the other without normally providing a second site survey.

Unless otherwise stated as a requirement prior to the site visit, the survey will allow for a non redundant solution as standard.

12.6.2 Data throughput speeds

As the required client device connection speed increases the number of access points will increase to cover the same distance or area. Depending on the required speed (1, 2, 5.5 or 11Mbps) a 1Mbps coverage cell will be larger than an 11Mbps coverage cell. Additionally, where 54Mbps speed is required (802.11g) the coverage area is greatly reduced.

The required connection speed depends on the type and requirements of the intended client devices that will be utilising the wireless network. Data capture, portable tele-transaction computers require a lower speed than Laptop PC's.

Unless otherwise stated as a requirement prior to the site visit, the survey will allow for Maximum Data throughput speeds as standard.

12.6.3 Numbers of Client Devices in a given area

The number of client devices required to connect to the wireless network in a given area may be greater than a single access point can adequately support. In these cases, additional access points will be provided to load share.

Unless otherwise stated as a requirement prior to the site visit, the survey will allow for a maximum of 10 client devices that require constant connectivity per access point as standard.

12.6.4 Client Transmitted Power & Client Antenna Type

The transmitted power setting on any client device (either with an in built radio or one that utilises an adapter socket) has a bearing on the connectivity independent of the coverage areas provided by infrastructure access points. Any reduction in default power will reduce the ability to provide robust connection in enclosed areas.

The type of fitted client antenna (either in built within the unit or externally mounted) will also provide differing degrees of connection.

As stated earlier within this document, the site survey has been based on a client adapter card with an external fixed antenna of a manufacturer type suitable for purpose. Other makes of adapter or in built radio will have different characteristics.

For the purposes of conducting the site survey these adapter cards have been used with default transmitted power settings of 50mW unless otherwise stated as a requirement prior to the start of the site survey.

13 GLOSSARY OF TERMS

DSSS	Direct Sequence Spread Spectrum
ETSI	European Telecommunications Standards Institute
IOS	Internetwork Operating System
RSJ	Rolled Steel Joist
RSSI	Received Signal Strength Indication
PoE	Power over Ethernet
RF	Radio Frequency
SNR	Signal to Noise Ratio
SSID	Service Set Identifier
WiFi	Wireless Fidelity