

Edinburgh Wi-Fi Project



Edinburgh Castle Scheduled Monument Consent Report



October 2015

Glossary of terms:

Wireless Backhaul: is the wireless communication and network infrastructure responsible for transporting communication data from end users or nodes to the central network or infrastructure and vice versa. It is the intermediate wireless communication infrastructure that connects smaller networks with the backbone or the primary network.

Access Point: In a wireless local area network (WLAN), an access point is a station that transmits and receives data (sometimes referred to as a transceiver). An access point connects users to other users within the network and also can serve as the point of interconnection between the WLAN and a fixed wire network.

Point to Point: In Wi-Fi networking, a point-to-point (P2P) wireless bridge lets users wirelessly connect two or more locations together. This bridge enables users to share an Internet connection between two or more locations and to share files and other types of data across the network.

Point to Multi Point: Point-to-multipoint (PMP) communication refers to communication that is accomplished through a distinct and specific form of one-to-many connections, offering several paths from one single location to various locations.

Introduction

Target locations have been identified within Edinburgh to host the internet backhaul. This will then be distributed via wireless point to point equipment to other locations within Edinburgh, one of these being Edinburgh Castle. It is proposed that the point to point equipment serving the castle will be located on the Usher Hall, transmitting to a point to point receiver on the New Barracks roof.

A site visit was performed on Tuesday 18th August 2015 by an IntechologyWiFi engineer to determine the existing castle infrastructure and identify potential mounting locations for this Point to Point equipment and for access point radio infrastructure to provide a WiFi signal to areas in and around the castle. This report proposes mounting positions and associated wiring runs for the equipment necessary to provide an acceptable WiFi signal to the external areas of the castle.

Site Visit

The engineer attended the site to perform a visual inspection of the buildings within the castle walls and any existing wireless infrastructure mounted on their roofs. The visit showed that some of the roofs had existing wireless antennae and point to point equipment. There were five specific areas within the castle grounds identified for wireless equipment. These can be seen in the schematic overview of the castle, Fig. 2, highlighted in red.

The proposition is to deploy point to point radio equipment, and a number of wireless access points, alongside existing wireless equipment. Particular care will be taken to hide additional equipment from being seen by visitors to the castle. This will be by choosing mounting points out of direct line of site when viewed from the outdoor areas of the castle or by the use of remote antennas to minimise the visual impact of the equipment.

An overview of the proposed locations for the wireless equipment is shown in Fig. 1. The access points are indicated by red oval markings. The point to point equipment, locations is indicated by a green oval. The point to multipoint equipment locations are indicated by blue ovals. Access point equipment proposed can be seen in Fig. 29; point to point equipment proposed can be seen in Fig. 31, and point to multipoint equipment proposed can be seen in Fig. 30.

Fig. 1 Overview of deployment of wireless equipment on Edinburgh Castle

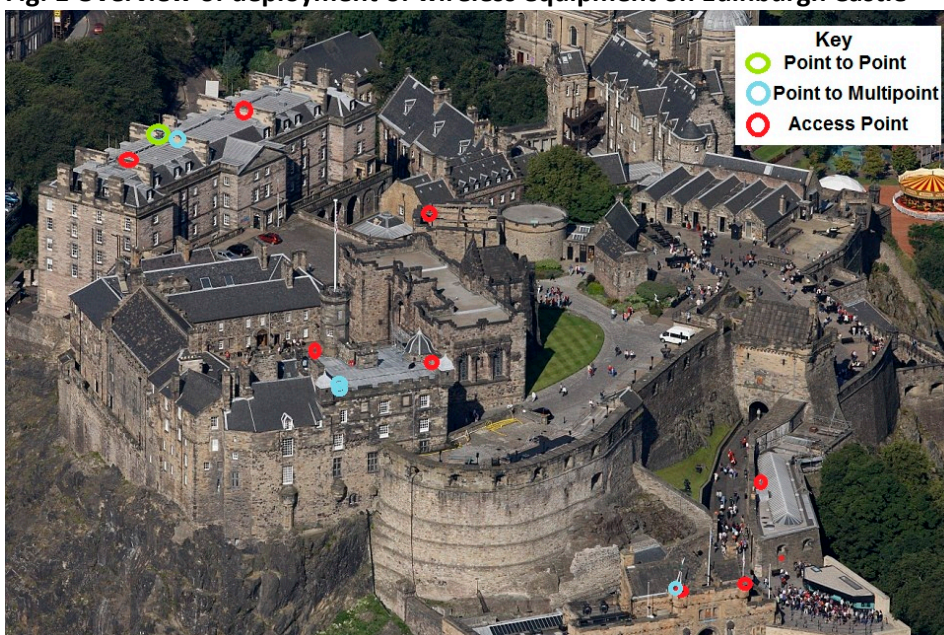
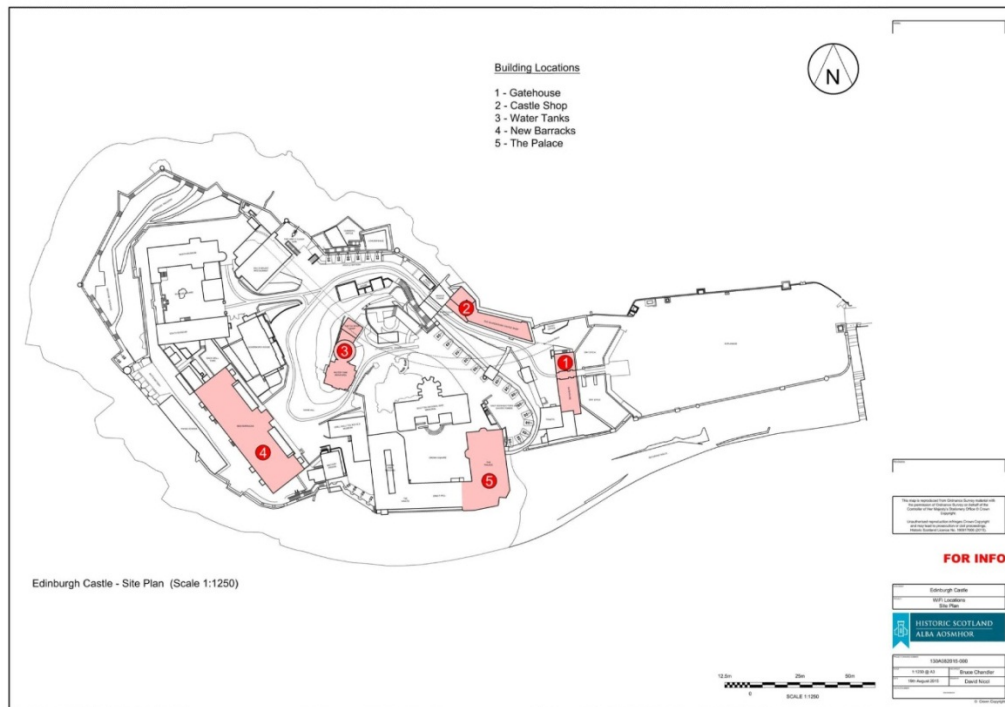


Fig. 2 Edinburgh Castle Schematic showing WiFi equipment locations



The proposition is to deploy radios in two light license frequency ranges: high capacity radio in the 80/90GHz frequency bands and medium capacity radios in the 5GHz spectrum. The 5GHz spectrum is a particularly flexible frequency range with channel allocation available in both the 5.4GHz and 5.8GHz sub bands. This ensures we can use the spectrum efficiently to collocate the new radio solutions with the existing radios in situ, reducing any potential for interference. The access points will use the 2.4GHz and 5GHz frequencies. The exact channels will be determined on installation following a survey of existing channels in use to ensure no interference. The final choice of radio channel will not lead to any variation in the specified equipment, or fixings.

Installations in general

InTechnologyWiFi are providing a 10Gb Internet bearer circuit into a data centre located on South St. Andrews Street. This will then be distributed around the city using fixed wired links and 'line of sight' wireless point to point links. The internet will be brought to the castle through a high speed wireless point to point link from The Usher Hall to the New Barracks roof as there is a direct line of sight, Fig. 27. The point to point equipment will be located below the height of the existing equipment on the New Barracks roof and not generally visible from public areas within or outwith the castle.

The internet will then be distributed to other wireless equipment within the castle using point to multipoint links and access points meshing together. The SSID to be used will be that used for Edinburgh City and will allow access to an open network. The external WiFi network within the castle will be totally independent of any existing I.T network and careful use of channels/frequencies in consultation with Edinburgh Castle I.T manager will help prevent interference to existing equipment. The installation of any equipment within the castle will be done with the minimum visual impact to visitors, and minimum physical impact on the fabric. Non-intrusive fixings, e.g. stranglehold bands and clamps will be utilised wherever possible.

The main switch for the external WiFi castle network will be located in [REDACTED] in a cabinet to be supplied by InTechnologyWiFi, or an existing cabinet, dependant on

space. The power for this switch will be through a single 240V/13 Amp power supply. All the other proposed wireless equipment to be used within the castle will be powered using low voltage POE (Power over Ethernet) and will require a power source nearby and within 100m. Any necessary cable runs will follow existing routes when passing through wall and will be clipped to mortar joints, as indicated on the marked-up photos.

The following sections describe the proposed installations for each area in more detail. The area numbers relate to the buildings shaded red on the key plan, Fig. 2.

AREA 1 - GATEHOUSE

The access points for this area will be located in the uppermost turrets of Edinburgh Castle Gatehouse as shown in Fig. 3. Both north and south turret access point locations are shown in Fig. 4. The southern turret access point mounting position is shown in Figs 4a and 4b. A mounting pole will be clamped to the horizontal beam to enable the main access point body to remain below the height of the turret wall, whilst allowing the remote antenna, Fig. 30, to extend above the wall height and provide a WiFi signal to the Esplanade. The antenna will be coloured buff to blend in with the background as required. The antenna will extend no higher than the existing antenna shown in the photo Fig 4a. A point to multipoint receiver unit, as Fig. 32, will also be clamped onto the mounting pole in a position so as to remain invisible from the Esplanade. This will be pointed in a direction towards the sender unit on the castle Palace roof. The Ethernet cables from the units will be routed back to the Ethernet switch, Fig. 8, following the path shown in Fig. 4 & 6 and being secured using cement joints, avoiding any drilling of the existing stonework. The cables will pass through the wall into the area of the switch using routes taken by existing cables where possible.

The northernmost turret access point location is shown in Fig. 5. A mounting pole will be clamped to a horizontal beam to enable the main access point body to remain below the height of the turret wall, whilst allowing the remote antenna, as Fig. 30, to extend above the wall height and provide a WiFi signal to the esplanade. The antenna will be buff coloured to blend in with the background as required, and will be set back from the wall head and therefore not easily visible from the Esplanade. The Ethernet cable from the unit will be routed back to the proposed Ethernet switch, Fig. 8, located on the existing MDF backboard within the upper room, and following the wiring path shown in Fig. 4 & 7 and being secured using cement joints, avoiding any drilling of the existing stonework. The cable will pass through the wall into the area of the switch using routes taken by existing cables.

Fig. 3 Edinburgh Castle Gatehouse showing wireless equipment locations



Fig. 4 Edinburgh Castle Gatehouse Schematic showing proposed equipment on north and south turrets and cable runs

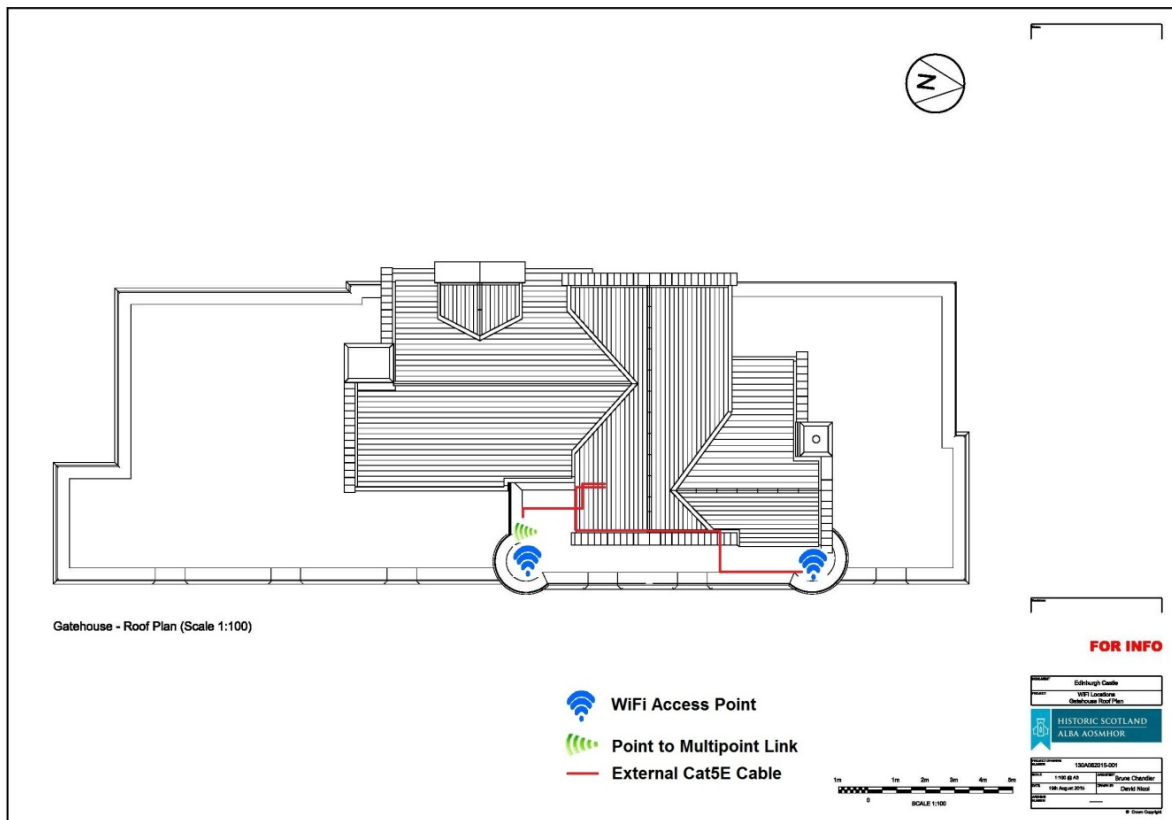


Fig. 4a Edinburgh Castle Gatehouse roof equipment location (South)



Fig. 4b Edinburgh Castle Gatehouse (South) roof mounting pole clamp point



Fig. 5 Edinburgh Castle Gatehouse roof equipment location (North)



Fig. 6 Edinburgh Castle Gatehouse proposed cable run (South)



Fig. 7 Edinburgh Castle Gatehouse proposed cable run (North)



Fig. 8 Edinburgh Castle Gatehouse proposed Ethernet switch location, to be mounted on existing backboard



AREA 2 – GIFT SHOP

The access point for this location will be located centrally on the roof as indicated in Fig. 9 & 10. The access point will be secured to the location using a weighted base in the form of a concrete slab (approx. 600mm x 600mm x 50mm). The slab will be supplied and positioned by HS MCU. A metal base plate, Fig. 28 will then be bolted to the slab enabling a mounting pole to be used. This pole will be of such a length to be invisible from ground level on the main walkway but allow a remote antenna, as Fig. 30 to be attached extending above the wall height to provide WiFi coverage to the walkway and surrounding area, Fig. 11. This antenna will be white or colour coded to minimise any visual impact. The main body of the access point will be secured to the base of the mounting pole and will not be visible. The Ethernet cable from the unit will be routed back an Ethernet switch located within the comms room of the Edinburgh Castle Shop, following the path show in Fig. 10 & 11 and being secured using cement joints, avoiding any drilling of the existing stonework. The cable will use routes taken by existing cables where possible.

Fig. 9 View of Edinburgh Castle Gift Shop roof, showing proposed mounting location for access point on roof



Fig. 10 Edinburgh Castle Gift Shop roof schematic showing access point location and cable run

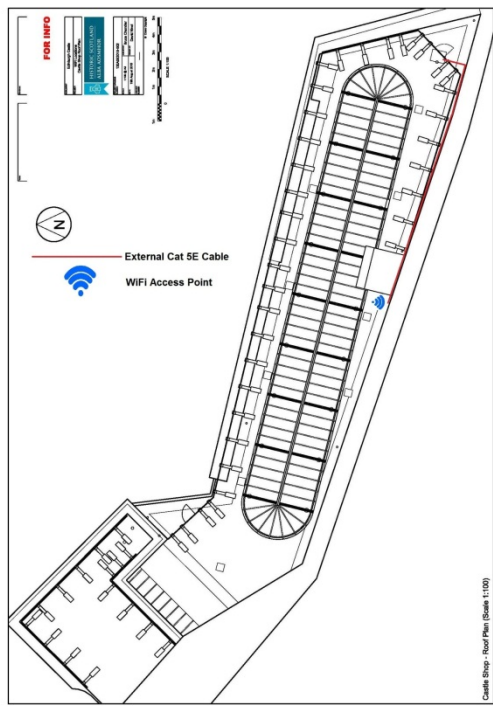


Fig. 11 Edinburgh Castle Gift Shop roof showing proposed antenna access point mount and cable run



AREA 3 – WATER TANKS

The access point will be located within a small projection to the south west side of the building that housed the original water tank as can be seen in Fig. 12 – 14. The access point will be secured within the location using a weighted base in the form of a concrete slab (approx. 600mm x 600mm x 50mm). The slab will be supplied and positioned by HS MCU.

A metal base plate, as Fig. 28 will then be bolted to the slab enabling a mounting pole to be used. This pole will be of such a length to be invisible from ground level on Hawk Hill, but allow a remote antenna, as Fig. 30, to be attached extending just above the wall height to provide WiFi coverage to Hawk Hill and surrounding area, Fig. 13.

This antenna will be buff coloured to minimise any visual impact. The main body of the access point will be secured to the base of the mounting pole and will not be visible. The Ethernet cable from the unit will be routed back an Ethernet switch located within the existing pre-fabricated building within main structure, following the path show in Fig. 13 & 14 and being secured using cement joints, avoiding any drilling of the existing stonework. The cable will use routes taken by existing cables where possible.

Fig. 12 Edinburgh Castle Water Tank access point location. The access point antenna should not be visible from Hawk Hill



Fig. 13 AREA 3 - Edinburgh Castle Water Tank schematic showing access point location and cable route to internal building

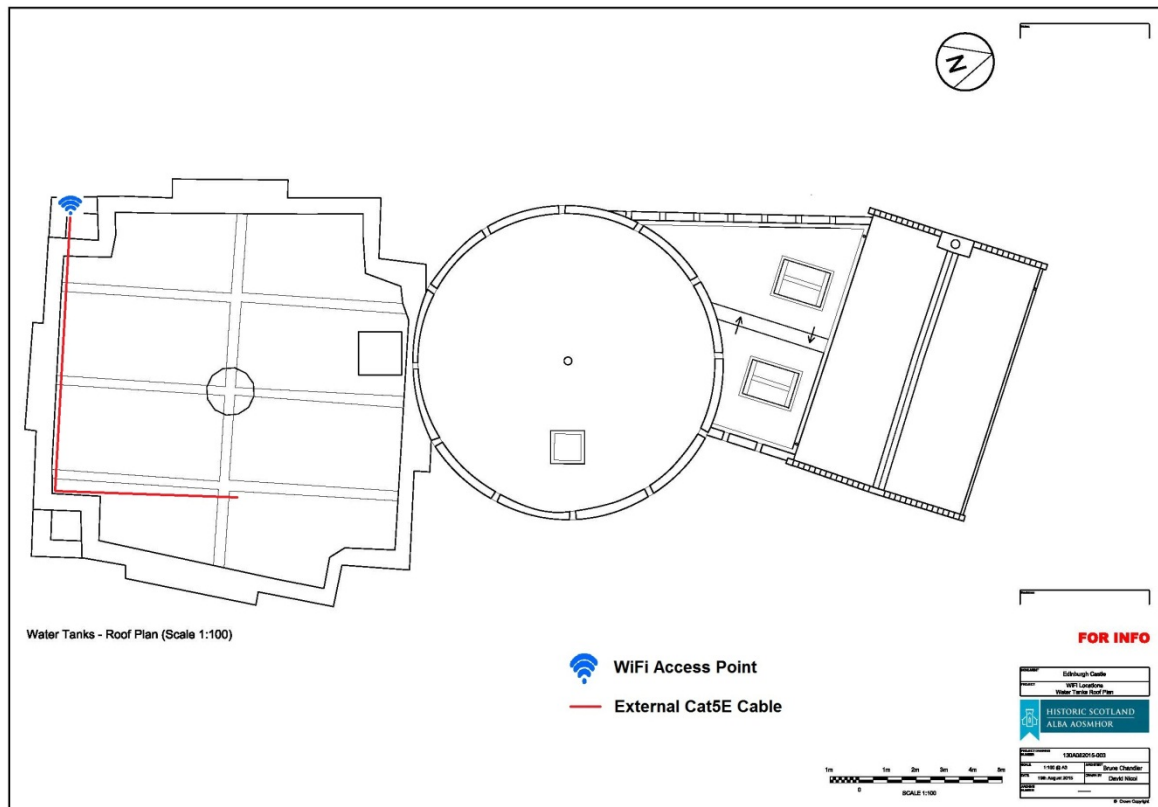
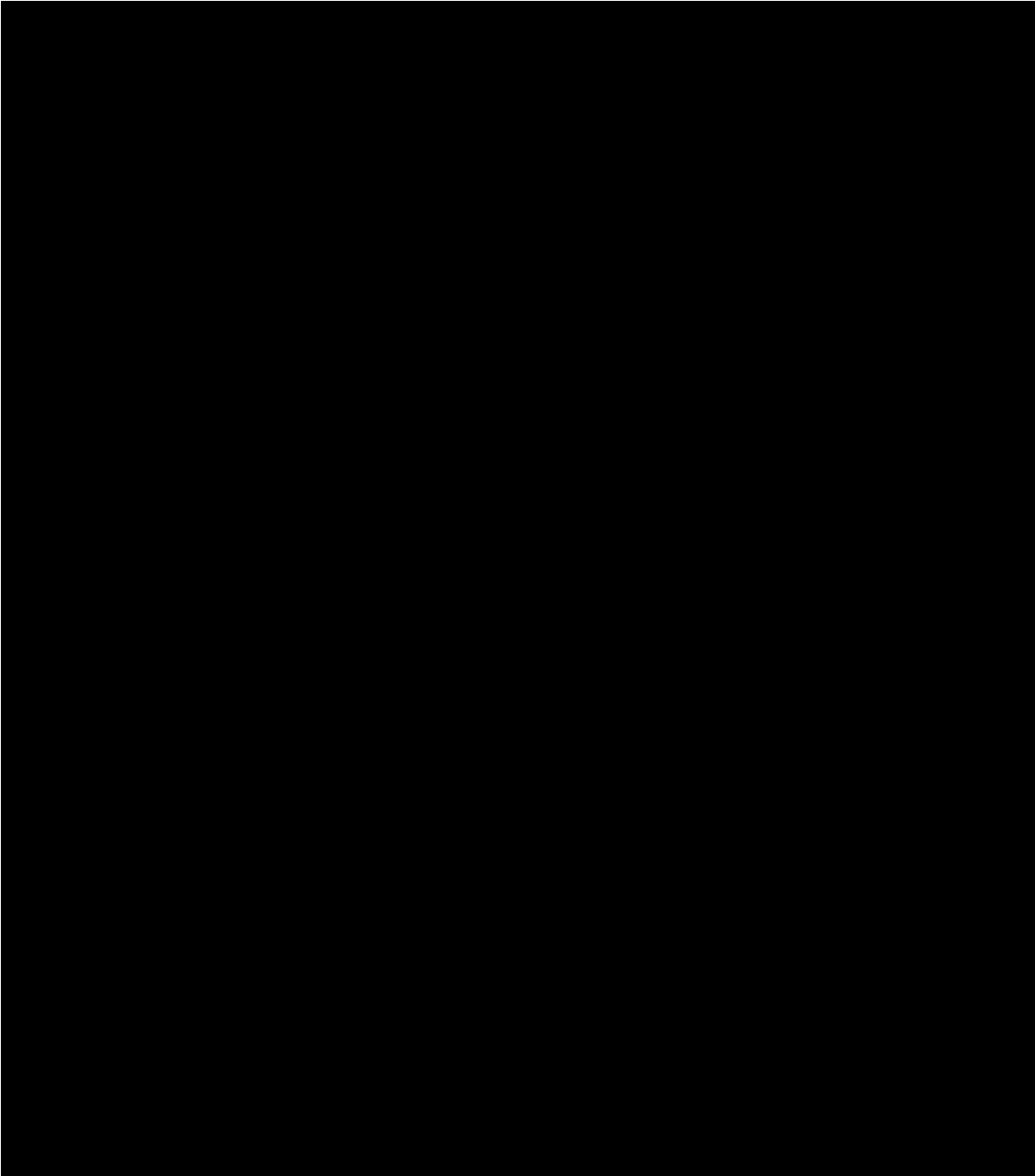


Fig. 14 AREA 3 - Edinburgh Castle Water Tank access point location – access point antenna will be pole mounted within this recess, positioned to be invisible from Hawk Hill, but in line of sight to New Barracks roof





AREA 5 – PALACE BLOCK

The access points will be located on the palace rooftop to the northern and western sides, Fig. 22, 23 and 24, with a point to multipoint receiver on the western side and a point to multipoint sender unit on the eastern side. A schematic showing the location of the equipment together with the cable runs can be seen in Fig. 25.

The access points will be secured to the location using a weighted base in the form of a concrete slab (approx. 600mm x 600mm x 50mm). The slabs will be isolated from the lead roof with resilient pads, and will be supplied and positioned by HS MCU. A metal base plate, Fig. 28 will then be bolted to

the slab enabling a mounting pole to be used. This pole will be of such a length to be invisible from ground level on Crown Square and the Esplanade, but allow a remote antenna, Fig. 30, to be attached, extending just above the wall height to provide WiFi coverage to the surrounding areas.

This antenna will be buff coloured to minimise any visual impact. The main body of the access point, the rectangular box as Fig. 29, will be secured to the base of the mounting pole and will not be visible. The point to multipoint units will be secured on the mounting pole in a position to minimise visual impact from the ground whilst maintaining a 'line of site' with their respective receiver/sender units on the New Barracks roof, Fig. 23 and the Gatehouse roof, Fig. 24.

The Ethernet cables from the equipment will be routed back to an Ethernet switch located in a weatherproof box in the location shown in Fig. 25 and 26. A ply or MDF backing board will be fitted using the existing screw fixings. The existing junction box and the new Ethernet switch will be re-mounted on the new backing board. The Ethernet cable will follow the path show in Fig. 25, being clipped to mortar joints and by hiding under existing leadwork, avoiding any drilling of the existing stonework. The cable will use routes taken by existing cables where possible.

Fig. 22 Edinburgh Castle Palace roof west: access point and point to multipoint location



The point to multipoint, and access point units, will be fixed to a pole on a weighted base, set back from the parapet and not visible from Crown Square.

Fig. 23 Edinburgh Castle Palace roof west: access point and point to multipoint location, wiring will be concealed below existing lead flashings



Fig. 24 Edinburgh Castle Palace roof point to multipoint location east: the unit will be fixed to a pole on a weighted base, and will not be visible from the Esplanade



Fig. 25 Edinburgh Castle Palace roof schematic showing wireless equipment location and cable runs

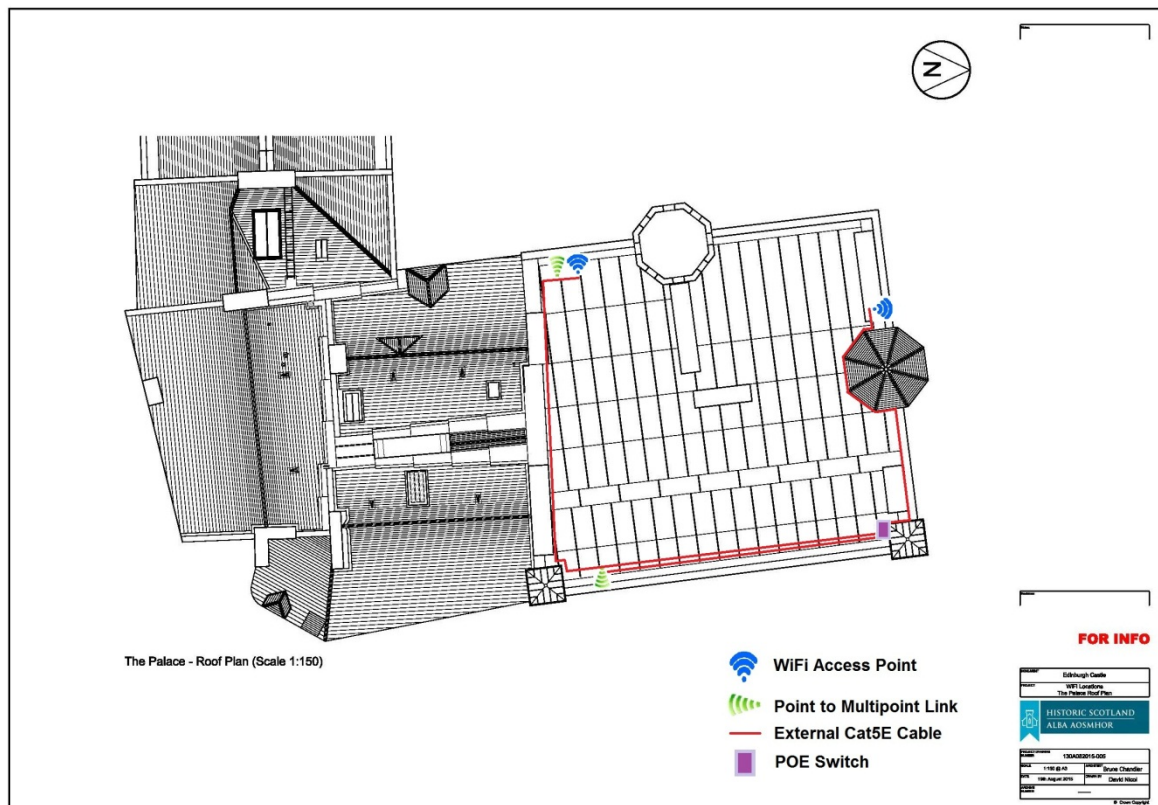


Fig. 26 Edinburgh Castle Palace roof proposed switch location at north east turret



Fig. 27 View from Castle Barracks roof towards Usher Hall



Point to Point equipment, as Fig.31 will receive the signal into the site from a similar unit on Usher Hall. The proposed position of the unit on the New Barracks roof is shown on Fig. 16.

Mounting equipment

Fig. 28 Base plate

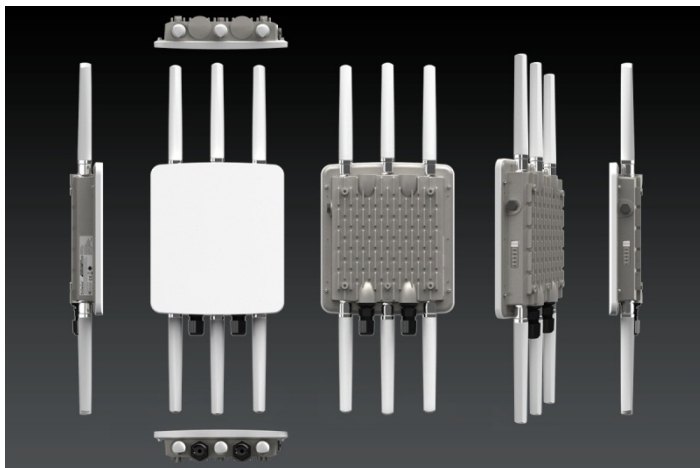


To be fixed to freestanding concrete slabs and to take a galvanised mounting pole of required length for the location.

Access Points

The access points to be deployed in the areas highlighted will be Alvarion Omni-directional access points as shown in fig 29. Note that the 6 fixed antennae (3 x 2.4Ghz and 3 x 5Ghz), can as an option, be replaced by a single remote antenna, as Fig. 30, which can have a max cable length of 10m.

Fig. 29 Standard six antennae Access Point



The hardware spec sheet is as follows:

POE: 48VDC

Power Consumption: 25W

Dimensions: 28.5cm x 22cm x 9cm

Weight: 2.2 Kg

Fig.30 Remote antenna Access Point



Dimensions: 34.5cm x 3.5cm diameter (fibreglass)

Point to Point

The point to point equipment to be deployed on the roof of the New Barracks will be Alvarion Breeze Ultra P6000 units as shown in fig 31.

Fig. 31



The hardware spec sheet is as follows:

POE: 55VDC

Power Consumption: 40W

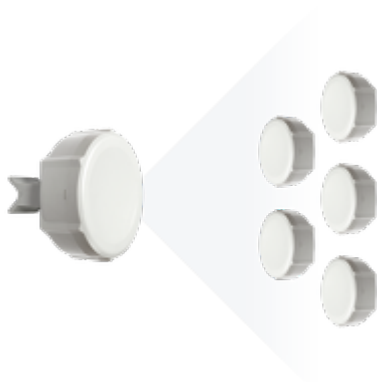
Dimensions: 38cm x 13cm x 44cm

Weight: 7 Kg

Point to Multipoint

The point to point equipment to be deployed in the areas highlighted will be Mikrotik SXTG-5HPnD-SAr2P unit as shown in Fig. 32.

Fig. 32



The hardware spec

Sender Unit (SU)

POE: 24VDC

Power Consumption: 12W

Dimensions: 14cm x 14cm x 6cm

Weight: 0.27 Kg

Receiver Unit (RU)

POE: 24VDC

Power Consumption: 12W

Dimensions: 14cm x 14cm x 6cm

Weight: 0.27 Kg