

Wi-Fi coverage design and proposal

Margham Warehouse Block 1. Client: Dubai Supply Authority.

Drawing	margham_block1.pdf (pdf-vector)
Band designed	5 GHz
Scope	12 x Aruba (HPE) AP-677 (directional), 13 x Aruba (HPE) AP-635 (indoor), 3 switches, 12 injectors
Method	Drawing read by the software, multi-wall dual-slope prediction with directional antenna patterns, checked cabling reach
Status	Draft for engineer review, 21 September 2026

Summary

The design places 12 directional access points and 13 indoor access points, 94.5% coverage of large open areas at -70 dBm and 97.9% coverage of offices and indoor areas at -67 dBm.

- Check. Large open areas: 94.5% of the floor is at or above -70 dBm. The weakest point is -79.8 dBm. A second AP at -72 dBm or better covers 67.2% of the floor.
- Check. Offices and primary indoor areas: 97.9% at or above -67 dBm.
- Pass. Service rooms: 100.0% at or above -75 dBm.
- Pass. Co-channel interference: 95.7% of the served area keeps 20 dB SINR or better in the worst case (all APs transmitting).
- Pass. All 25 Cat 6 runs are within the 90 m limit. The longest is 85.6 m including slack and contingency.

Points to confirm before issue

- Ceiling or roof steel height and racking or stock layout in the large open areas. The design assumes 8.0 m mounting in a ventilated hall, 5.0 m in an air conditioned area and a 6 dB allowance for racking and stock.
- Wall construction. Wall losses were assigned from the line weights on the drawing (5, 8 and 14 dB). Correct them if the real build-up differs.
- Ceiling type and mounting height for the indoor APs (2.8 m is assumed), and the furniture or partition density behind the 3 dB indoor allowance.
- The location of the agreed main IDF and the uplink route to it.
- Local regulatory power limits and permitted channels for the chosen band. The design uses 23 dBm EIRP for directional APs and 19 dBm for indoor APs.
- The directional AP model and mounting method are subject to change after the on-site survey.

1. Scope of work

- Install the proposed outdoor PoE injectors, where directional access points are proposed.
- Install and activate the AP capacity and feature licences on the wireless controller or cloud platform.
- Onboard and provision the new access points on the controller or cloud platform.
- Apply the required WLAN, VLAN and security configurations based on the approved design.
- Perform basic wireless connectivity and operational testing.
- Supply and install the passive materials required for the access points, considering the distances between the proposed access point locations and the IDF room.
- Pull, terminate, patch, test and label the proposed copper cables.
- Supply and install the new racks with the accessories where required.
- Supply and install the proposed OM4 multimode fibre cable, including splicing for any connectivity required between the intermediate IDF and the main IDF room.
- Supply and install multimode fibre patch cords.
- Supply and install the proposed PVC pipes, fittings, supports and brackets.
- Perform basic end-to-end connectivity and operational testing.
- Verify that the access points join the controller and broadcast the SSIDs.
- Verify the status of the newly installed switch ports and uplinks.
- Provide configuration backups and basic implementation documentation.

Design notes

- 12 Aruba (HPE) AP-677 directional access points cover the large open areas. The model is subject to change after the site survey.
- 13 Aruba (HPE) AP-635 indoor access points cover the offices and indoor areas.
- 3 switches: 2 x 24 port PoE+ Cisco Catalyst C9200L-24P-4X-E indoor switches and 1 x Cisco Catalyst IE-9320-24T4X-E industrial switch.
- The 13 indoor access points connect to the 2 indoor switches in the comms room (Tel. Room).
- The 12 directional access points connect to the industrial switch through 12 outdoor PoE injectors (Aruba (HPE) R7T40A).
- AP capacity and feature licences are installed on the controller or cloud platform to cover the new access points.
- Passive materials (cables and PVC conduit) are included for all 25 APs. 1 x 15U rack for the industrial switch and 1 x 15U rack for the indoor switches are provided.
- Each switch has 2 x 10G uplinks to the agreed IDF. SFPs are included only for the 3 proposed switches.

2. How the drawing was read

The software read the supplied drawing directly. Nothing on it was typed in by hand except the items listed under overrides.

Item	Result
Format	pdf-vector
Scale	Calibrated from 17 repeated dimension labels on the sheet (5.662 pt per metre). Effective ratio 1:500.6
Sheet note	1:250 (the sheet was printed smaller than its nominal size, so the measured scale is used)
Analysed area	79.9 m x 119.9 m (structural grid (9 x 16 lines))
Structural grid	9 x 16 gridlines found
Walls	5,130 wall cells at 0.25 m; classes by pen weight: heavy = concrete (14 dB), medium = block (8 dB), light = partition (5 dB)
Rooms	24 rooms from text labels, segmented by walls; 2 large open zone(s)
Comms room	Tel. Room at x 18.1 m, y 101.4 m
Main IDF	It Room (assumed main IDF) at x 36.1 m, y 99.2 m
Industrial rack	Intermediate IDF (industrial rack) at x 39.9 m, y 47.9 m

Note: Main IDF location is not shown on the drawing. The IT room is assumed, confirm the agreed IDF.

Note: The 90 m copper limit restricts where directional APs can sit relative to one industrial rack. AP positions were pulled inside the reach of the rack.

Rooms found

Room	Type	Target	Area m2	Mount
Ventilated Storage	Large open area (uncontrolled)	-70 dBm	5761	8.0 m
Air Conditioned Secure Storage	Large open area	-70 dBm	1896	5.0 m
Driver'S Washroom	Amenity	-80 dBm	31	
Stairs	Excluded	n/a	19	
It Room	Service room	-75 dBm	47	
Lift	Excluded	n/a	9	
Ups Room	Service room	-75 dBm	53	
Tel. Room	Service room	-75 dBm	56	
Lobby	Office or indoor	-67 dBm	92	
Manger Office	Office or indoor	-67 dBm	103	
Operation	Office or indoor	-67 dBm	74	
Pump Room	Service room	-75 dBm	118	
Woman Toilets	Amenity	-80 dBm	29	
Good Received Dispatch Office	Office or indoor	-67 dBm	113	
Open Plan Office	Office or indoor	-67 dBm	151	
Electrical	Service room	-75 dBm	88	
Fire Suppression	Service room	-75 dBm	48	
Men Toilets	Amenity	-80 dBm	28	
Generator Room	Service room	-75 dBm	76	
Office 2	Office or indoor	-67 dBm	56	
Office 1	Office or indoor	-67 dBm	75	
Office 3	Office or indoor	-67 dBm	75	
Reception	Office or indoor	-67 dBm	155	
Prayer	Amenity	-80 dBm	32	
E.Ss	Service room	-75 dBm	87	
Circulation and unlabelled space	Office or indoor	-67 dBm	328	

3. Design basis

Targets

Area type	Minimum RSSI	Applied to
Large open areas (handhelds, scanners)	-70 dBm	Warehouses, halls, yards and similar
Primary indoor	-67 dBm	Offices, reception, circulation
Service rooms	-75 dBm	Pump, generator, electrical, ELV, IT and similar
Amenity	-80 dBm	Toilets, prayer rooms and similar
Second-best AP, large open areas	-72 dBm	A single AP failure still leaves usable signal
Co-channel SINR	20 dB	Worst case, every AP transmitting

Access point models used in the prediction

Class	Model	Peak gain	Beam	Tx set	EIRP	Mount	Path loss n1 / breakpoint / n2	Clutter
Directional	Aruba (HPE) AP-677	7.2 dBi	90 x 90 deg	15.8 dBm	23 dBm	5.0 to 8.0 m	2.0 / 10 m (8 m) / 4.0	6 dB
Indoor	Aruba (HPE) AP-635	4.9 dBi	omni	14.1 dBm	19 dBm	2.8 m	2.0 / 5 m / 3.0	3 dB

Receiver height is 1.5 m. Clutter is a fixed allowance for racking and stock in large open areas and furniture indoors. Directional antennas use a parabolic pattern with a 20 dB back lobe limit. Wall losses are applied once per wall crossed along the straight path from the AP to each point.

Wall class	Meaning	Loss at 5 GHz
3	Heavy line: concrete or shaft	14.0 dB
2	Medium line: masonry block	8.0 dB
1	Light line: partition or glazing	5.0 dB

Method

$$RSSI = EIRP(az, el) - PL_0 - 10 n_1 \log_{10}(\min(d, d_{bp})) - 10 n_2 \log_{10}(\max(d / d_{bp}, 1)) - C - \sum W_i$$

PL_0 is the free-space loss at 1 m (47.3 dB at 5.5 GHz). d is the 3D distance. C is the clutter allowance and W_i are the wall losses crossed. Co-channel SINR takes the strongest AP as the server and adds every other AP on the same channel as interference over a noise floor of -92 dBm. Access point positions and aim were chosen by a greedy search over structural grid positions, scored on coverage at target and on the second-best signal, then refined by a coordinate search. Directional APs are only allowed where the copper run to the industrial rack stays inside 90 m.

4. Proposed access point schedule

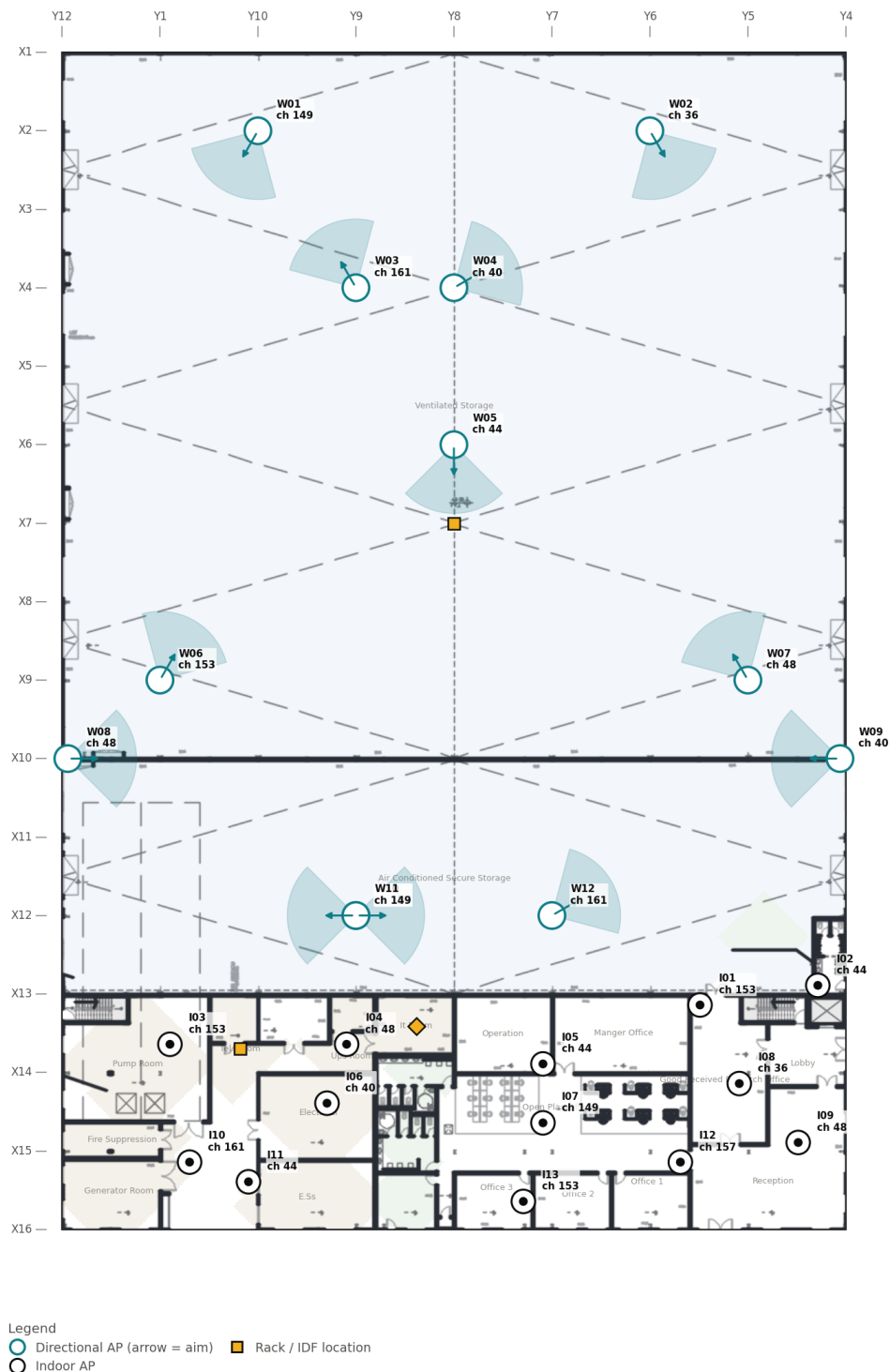
Tag	Model	Location	Grid	x m	y m	H m	Aim / tilt	Ch	EIRP	Switch / port	Cable m
AP-W01	AP-677	Ventilated Storage	Y10 / X2	20.0	8.0	8.0	210 / 10	149	23	SW-IND-01 Gi1/0/1	82
AP-W02	AP-677	Ventilated Storage	Y6 / X2	59.9	8.0	8.0	150 / 10	36	23	SW-IND-01 Gi1/0/2	82
AP-W03	AP-677	Ventilated Storage	Y9 / X4	29.9	24.0	8.0	330 / 10	161	23	SW-IND-01 Gi1/0/3	53
AP-W04	AP-677	Ventilated Storage	Y8 / X4	39.9	24.0	8.0	60 / 10	40	23	SW-IND-01 Gi1/0/4	42
AP-W05	AP-677	Ventilated Storage	Y8 / X6	39.9	40.0	8.0	180 / 10	44	23	SW-IND-01 Gi1/0/5	25
AP-W06	AP-677	Ventilated Storage	Y1 / X9	10.0	63.9	8.0	30 / 10	153	23	SW-IND-01 Gi1/0/6	66
AP-W07	AP-677	Ventilated Storage	Y5 / X9	69.9	63.9	8.0	330 / 10	48	23	SW-IND-01 Gi1/0/7	66
AP-W08	AP-677	Ventilated Storage	Y12 / X10	0.6	71.9	8.0	90 / 20	48	23	SW-IND-01 Gi1/0/8	86
AP-W09	AP-677	Ventilated Storage	Y4 / X10	79.3	71.9	8.0	270 / 20	40	23	SW-IND-01 Gi1/0/9	86
AP-W10	AP-677	Air Conditioned Secure Storage	Y9 / X12	29.9	87.9	5.0	90 / 10	157	23	SW-IND-01 Gi1/0/10	68
AP-W11	AP-677	Air Conditioned Secure Storage	Y9 / X12	29.9	87.9	5.0	270 / 10	149	23	SW-IND-01 Gi1/0/11	68
AP-W12	AP-677	Air Conditioned Secure Storage	Y7 / X12	49.9	87.9	5.0	60 / 10	161	23	SW-IND-01 Gi1/0/12	68
AP-I01	AP-635	Good Received Dispatch Office	Y5 / X13	65.0	97.0	2.8	omni	153	19	SW-IN-02 Gi1/0/5	67
AP-I02	AP-635	Circulation and unlabelled space	Y4 / X13	77.0	95.0	2.8	omni	44	19	SW-IN-01 Gi1/0/7	82
AP-I03	AP-635	Pump Room	Y1 / X14	11.0	101.0	2.8	omni	153	19	SW-IN-01 Gi1/0/1	19
AP-I04	AP-635	Ups Room	Y9 / X14	29.0	101.0	2.8	omni	48	19	SW-IN-01 Gi1/0/3	23
AP-I05	AP-635	Open Plan Office	Y7 / X14	49.0	103.0	2.8	omni	44	19	SW-IN-01 Gi1/0/4	46
AP-I06	AP-635	Electrical	Y9 / X14	27.0	107.0	2.8	omni	40	19	SW-IN-02 Gi1/0/2	26
AP-I07	AP-635	Open Plan Office	Y7 / X15	49.0	109.0	2.8	omni	149	19	SW-IN-02 Gi1/0/4	52
AP-I08	AP-635	Good Received Dispatch Office	Y5 / X14	69.0	105.0	2.8	omni	36	19	SW-IN-01 Gi1/0/6	70
AP-I09	AP-635	Reception	Y4 / X15	75.0	111.0	2.8	omni	48	19	SW-IN-02 Gi1/0/6	83
AP-I10	AP-635	Circulation and unlabelled space	Y1 / X15	13.0	113.0	2.8	omni	161	19	SW-IN-02 Gi1/0/1	29
AP-I11	AP-635	E.Ss	Y10 / X15	19.0	115.0	2.8	omni	44	19	SW-IN-01 Gi1/0/2	26
AP-I12	AP-635	Office 1	Y6 / X15	63.0	113.0	2.8	omni	157	19	SW-IN-01 Gi1/0/5	72
AP-I13	AP-635	Office 3	Y7 / X16	47.0	117.0	2.8	omni	153	19	SW-IN-02 Gi1/0/3	59

H is the mounting height in metres, EIRP is the design transmit level in dBm. Aim is a compass bearing in degrees with plan up as 0, tilt is downwards from horizontal. Coordinates are metres from the top-left corner of the analysed area. The grid reference is the nearest structural gridline pair.

5. Heat maps

Proposed access point layout

12 directional APs and 13 indoor APs. Arrows show the aim of directional APs.

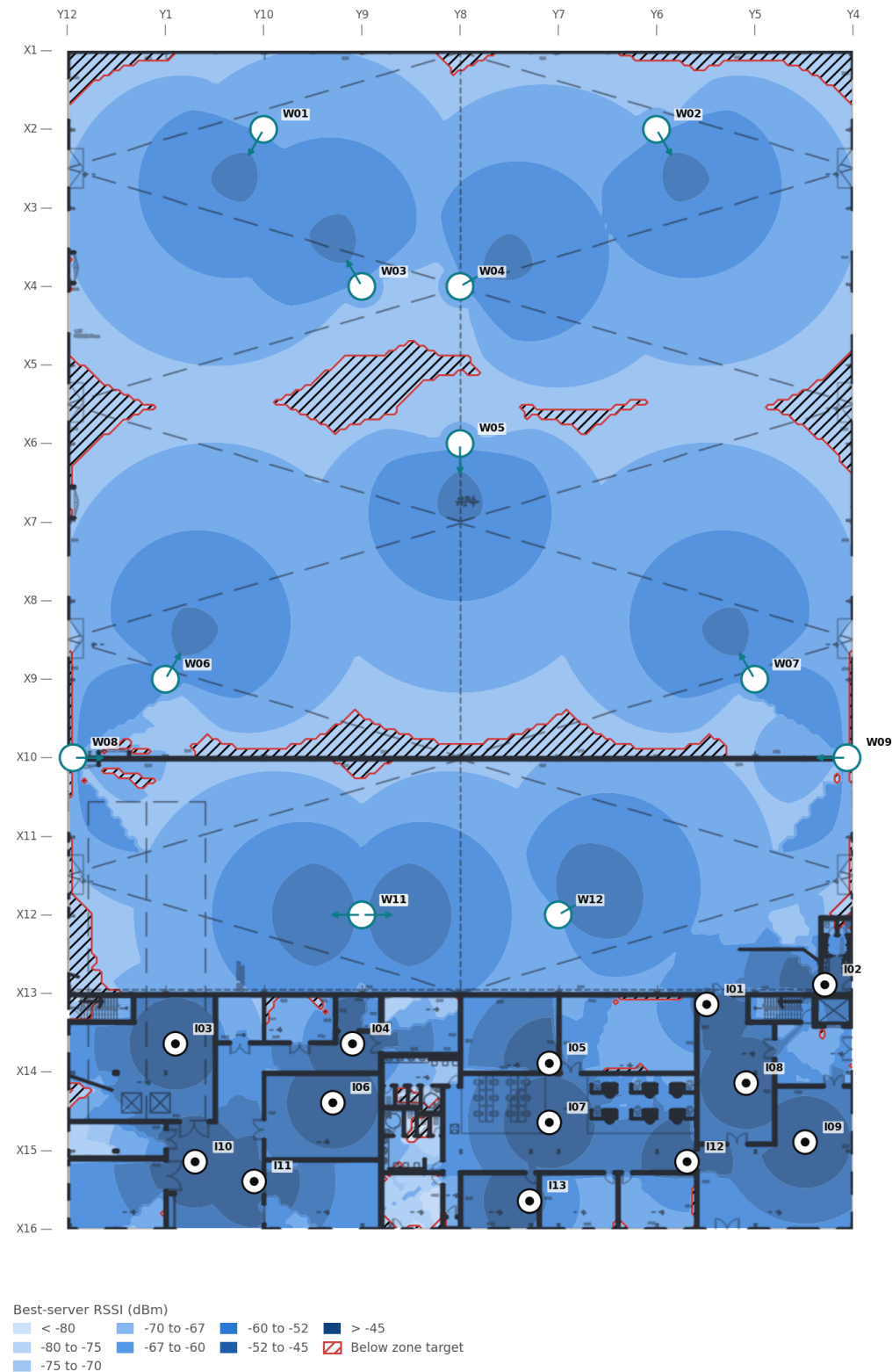


margham_block1 | 5 GHz | predictive model, confirm with an on-site survey

AP layout. Arrows and wedges show the aim of the directional APs. Squares mark the comms room rack, the intermediate IDF rack (when used) and the main IDF.

Predicted signal strength (best server RSSI, 5 GHz)

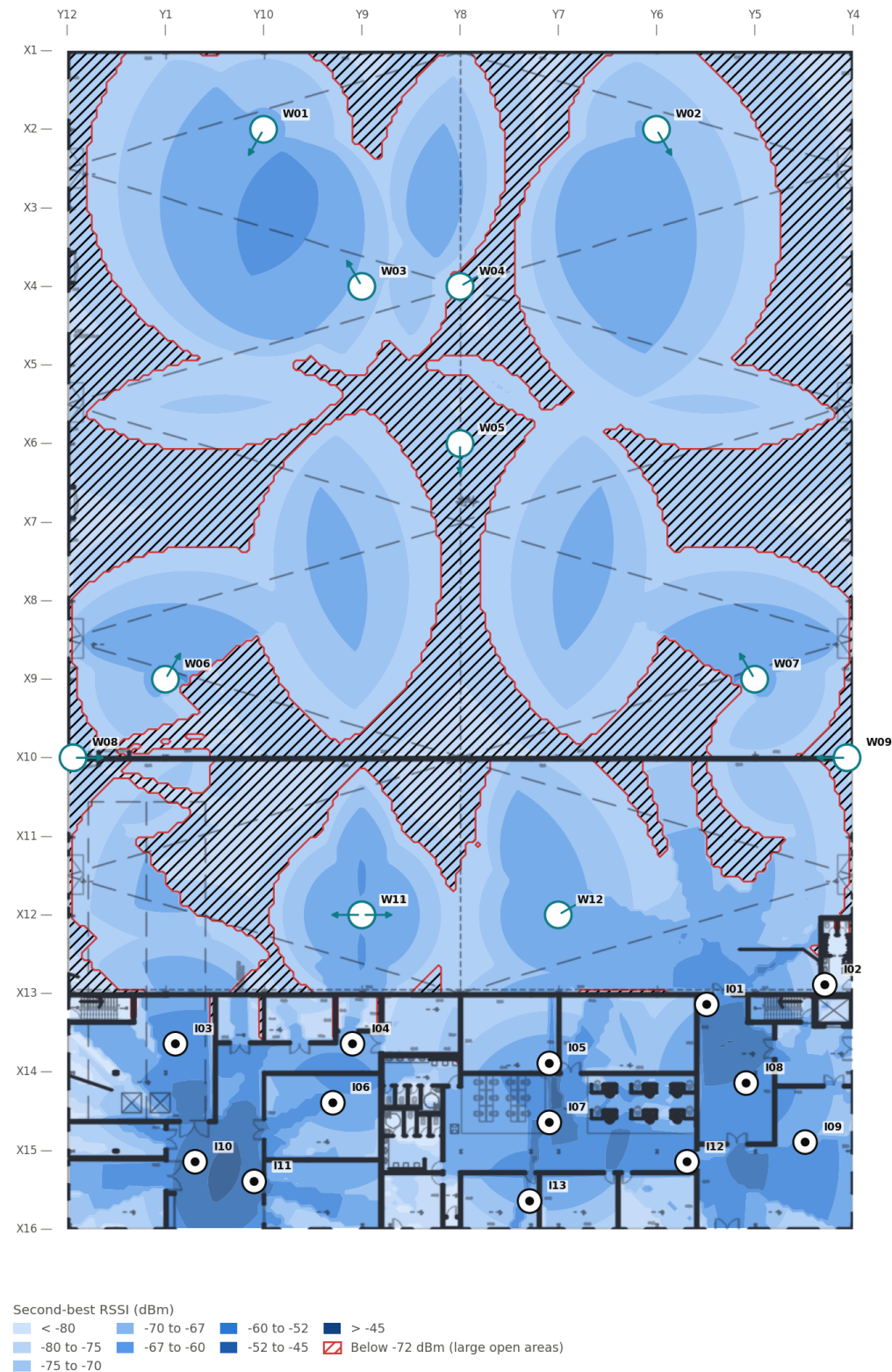
Receiver at 1.5 m. Directional pattern of the directional APs is included. Hatched = below the zone target.



Best-server signal strength. Hatched areas are below the target of their zone.

Redundancy check (second-best AP RSSI, 5 GHz)

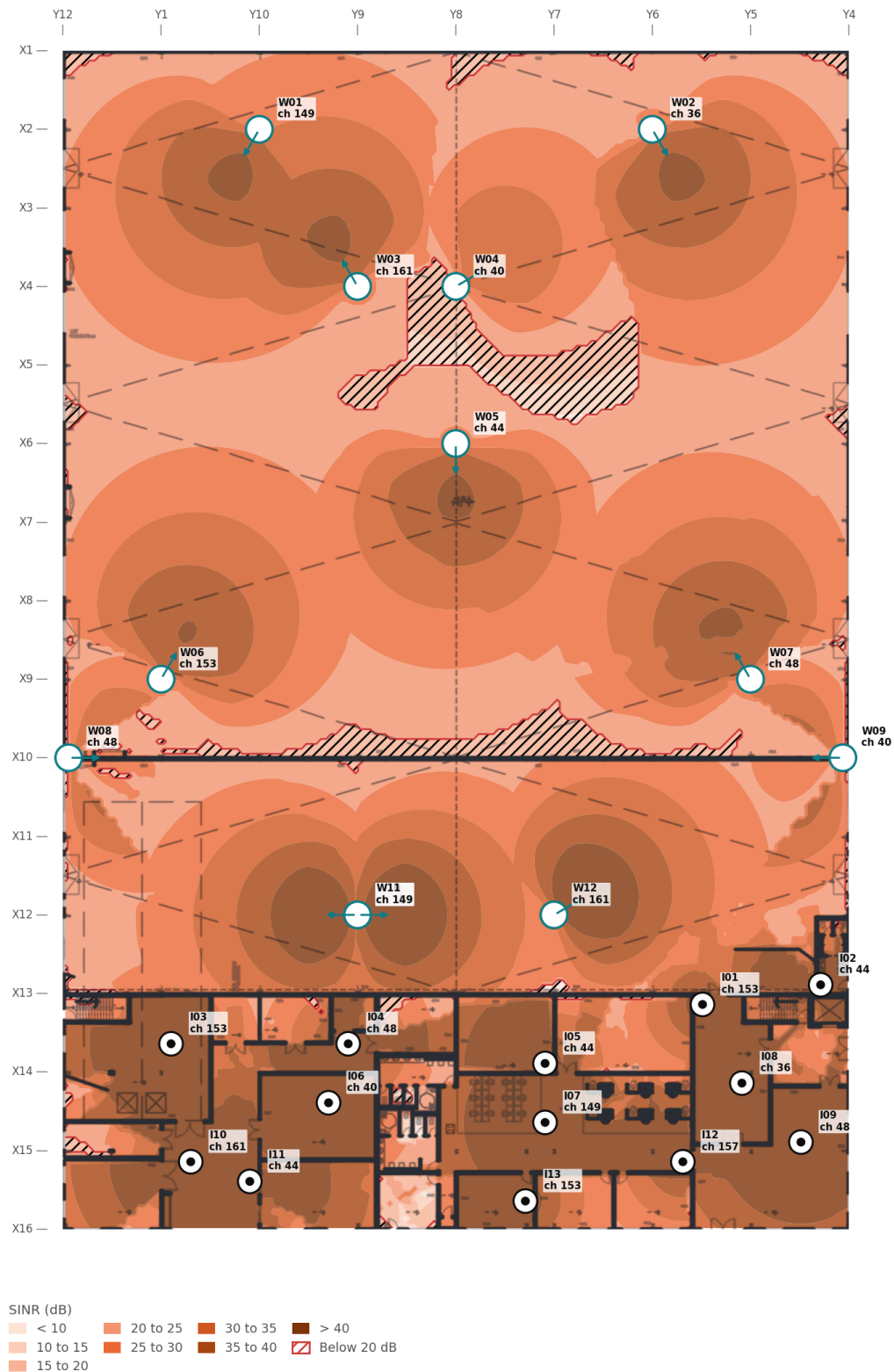
Signal from the next AP if the best server fails. Target -72 dBm in large open areas.



Second-best AP signal. Hatched large open areas would lose usable signal if their best AP failed.

Co-channel interference (SINR, 5 GHz, 20 MHz channels)

Worst case: all APs transmit at once. Target 20 dB or better.



Worst-case SINR with all APs transmitting on the planned channels.

6. Coverage results

Group	Area m2	At target	Weakest	Average	Second AP at -72	SINR 20 dB
Large open areas	7,621	94.5%	-79.8 dBm	-62.3 dBm	67.2%	95.3%
Offices and primary indoor	1,260	97.9%	-80.8 dBm	-50.4 dBm	88.7%	99.0%
Service rooms	567	100.0%	-74.8 dBm	-50.3 dBm	83.2%	98.2%
Amenity	123	98.4%	-81.3 dBm	-68.3 dBm	48.0%	73.2%
All served area	9,571	95.3%	-81.3 dBm	-60.1 dBm	70.8%	95.7%

Large open area coverage at other signal levels

Signal level	-65 dBm	-67 dBm	-70 dBm	-72 dBm	-75 dBm
Share of large open floor	62.0%	75.8%	94.5%	99.4%	100.0%

Results by room

Room	Type	Area m2	Target	At target	Weakest	Average	Second AP
Ventilated Storage	Large open area	5,760	-70	93.4%	-74.8	-63.0	65.3%
Air Conditioned Secure Storage	Large open area	1,861	-70	97.9%	-79.8	-60.0	73.4%
Driver'S Washroom	Amenity	34	-80	100.0%	-69.7	-64.4	100.0%
It Room	Service room	48	-75	100.0%	-74.8	-58.6	50.0%
Ups Room	Service room	46	-75	100.0%	-60.0	-42.8	80.4%
Tel. Room	Service room	55	-75	100.0%	-67.9	-58.2	72.7%
Lobby	Office or indoor	88	-67	100.0%	-66.7	-53.9	96.6%
Manger Office	Office or indoor	105	-67	99.0%	-67.3	-60.8	100.0%
Operation	Office or indoor	77	-67	100.0%	-55.2	-47.2	92.2%
Pump Room	Service room	116	-75	100.0%	-61.4	-46.4	79.3%
Woman Toilets	Amenity	28	-80	100.0%	-79.4	-67.3	67.9%
Good Received Dispatch Office	Office or indoor	118	-67	100.0%	-53.7	-42.4	100.0%
Open Plan Office	Office or indoor	153	-67	100.0%	-63.3	-46.9	99.3%
Electrical	Service room	92	-75	100.0%	-49.8	-43.2	100.0%
Fire Suppression	Service room	47	-75	100.0%	-73.5	-60.5	72.3%
Men Toilets	Amenity	28	-80	92.9%	-81.3	-68.3	14.3%
Generator Room	Service room	72	-75	100.0%	-67.3	-52.3	86.1%
Office 2	Office or indoor	58	-67	100.0%	-66.8	-56.9	100.0%
Office 1	Office or indoor	76	-67	98.7%	-67.3	-53.9	59.2%
Office 3	Office or indoor	72	-67	100.0%	-53.9	-44.1	98.6%
Reception	Office or indoor	158	-67	100.0%	-58.2	-47.2	96.8%
Prayer	Amenity	33	-80	100.0%	-76.5	-73.0	6.1%
E.Ss	Service room	91	-75	100.0%	-64.0	-50.3	100.0%
Circulation and unlabelled space	Office or indoor	355	-67	93.0%	-80.8	-52.2	73.2%

Targets are in dBm. Small rooms with a few weak cells on a wall edge show a percentage below 100 even when the room is served. Read the heat map alongside the table.

7. Switching, ports and power

Switch	Model	Location	Access ports used	Uplinks (2 x 10G SR to the agreed IDF)
SW-IN-01	Catalyst C9200L-24P-4X-E	Tel. Room	7 of 24	Te1/1/1, Te1/1/2
SW-IN-02	Catalyst C9200L-24P-4X-E	Tel. Room	6 of 24	Te1/1/1, Te1/1/2
SW-IND-01	Catalyst IE-9320-24T4X-E	Intermediate IDF (industrial rack)	12 of 24	Te1/1/1, Te1/1/2

PoE and power

Switch	APs	PoE load	PoE budget	Check
SW-IN-01	7	210 W	370 W	OK
SW-IN-02	6	180 W	370 W	OK

The industrial switch has no PoE. Each of the 12 directional APs is fed through its own 60 W outdoor injector (802.3bt). Allow about 546 W of AC load at full AP draw in the industrial rack, and size the rack UPS or supply accordingly.

Port map

Switch	Port	AP	Location	Injector	Cable m
SW-IN-01	Gi1/0/1	AP-I03	Pump Room		19
SW-IN-01	Gi1/0/2	AP-I11	E.Ss		26
SW-IN-01	Gi1/0/3	AP-I04	Ups Room		23
SW-IN-01	Gi1/0/4	AP-I05	Open Plan Office		46
SW-IN-01	Gi1/0/5	AP-I12	Office 1		72
SW-IN-01	Gi1/0/6	AP-I08	Good Received Dispatch Office		70
SW-IN-01	Gi1/0/7	AP-I02	Circulation and unlabelled space		82
SW-IN-02	Gi1/0/1	AP-I10	Circulation and unlabelled space		29
SW-IN-02	Gi1/0/2	AP-I06	Electrical		26
SW-IN-02	Gi1/0/3	AP-I13	Office 3		59
SW-IN-02	Gi1/0/4	AP-I07	Open Plan Office		52
SW-IN-02	Gi1/0/5	AP-I01	Good Received Dispatch Office		67
SW-IN-02	Gi1/0/6	AP-I09	Reception		83
SW-IND-01	Gi1/0/1	AP-W01	Ventilated Storage	INJ-01	82
SW-IND-01	Gi1/0/2	AP-W02	Ventilated Storage	INJ-02	82
SW-IND-01	Gi1/0/3	AP-W03	Ventilated Storage	INJ-03	53
SW-IND-01	Gi1/0/4	AP-W04	Ventilated Storage	INJ-04	42
SW-IND-01	Gi1/0/5	AP-W05	Ventilated Storage	INJ-05	25
SW-IND-01	Gi1/0/6	AP-W06	Ventilated Storage	INJ-06	66
SW-IND-01	Gi1/0/7	AP-W07	Ventilated Storage	INJ-07	66
SW-IND-01	Gi1/0/8	AP-W08	Ventilated Storage	INJ-08	86
SW-IND-01	Gi1/0/9	AP-W09	Ventilated Storage	INJ-09	86
SW-IND-01	Gi1/0/10	AP-W10	Air Conditioned Secure Storage	INJ-10	68
SW-IND-01	Gi1/0/11	AP-W11	Air Conditioned Secure Storage	INJ-11	68
SW-IND-01	Gi1/0/12	AP-W12	Air Conditioned Secure Storage	INJ-12	68

Racks, fibre and copper

Run	From	To	Length	Cores	Used
Intermediate IDF to main IDF	Intermediate IDF (industrial rack)	It Room (assumed main IDF)	90 m	12	4
Comms room to main IDF	Tel. Room	It Room (assumed main IDF)	50 m	12	8

Copper: 25 Cat 6 runs, shortest 19 m, longest 86 m, total 1,445 m including 5 m slack per run and 10% contingency. Route length is the Manhattan distance from the rack plus vertical drops. Fibre is OM4 armoured, routed with a 1.2 factor plus 20 m of slack, well inside the 400 m reach of 10GBASE-SR.

8. Bill of quantities

#	Item	Basis of design	Unit	Qty	Note
Wireless					
1	Directional access point, large open areas	Aruba (HPE) AP-677	no	12	Model subject to change after the site survey
2	Indoor access point, offices and indoor areas	Aruba (HPE) AP-635	no	13	
3	AP mounting kits for directional APs (wall, pole or steel)	Vendor mount kit for AP-677	no	12	Confirm kit part number for the chosen fixing
4	AP ceiling and wall mounting kits for indoor APs	Vendor mount kit for AP-635	no	13	Confirm ceiling type on site
5	Controller AP capacity licence	Aruba LIC-AP family	no	25	Matches the controller model and software version
6	Controller PEF licence	Aruba LIC-PEF family	no	25	One per AP
Switching					
7	24 port PoE+ indoor switch	Cisco Catalyst C9200L-24P-4X-E	no	2	Installed in the comms room
8	Industrial 24 port switch with 4 x 10G uplinks	Cisco Catalyst IE-9320-24T4X-E	no	1	Installed in the intermediate IDF
9	Outdoor PoE injector 802.3bt 60 W	Aruba (HPE) R7T40A	no	12	One per directional AP, fed from the industrial switch
10	10G SR SFP+ modules for the proposed switches only	Cisco SFP-10G-SR-S	no	6	Two per switch. IDF side optics are existing
Racks					
11	15U rack with accessories, industrial switch and injectors	Rittal 15U	no	1	Ventilated or fan cooled, ambient of the open area
12	15U rack with accessories, indoor switches	Rittal 15U	no	1	Comms room
13	Rack PDU, 8 way, with surge protection	Rack PDU	no	3	Injectors need 12 outlets in the industrial rack
14	Cable managers, blanking panels, shelves and earthing kit	Rack accessories	set	2	One set per rack
Copper					
15	Cat 6 U/UTP LSZH cable, AP runs including slack and 10 percent contingency	CommScope Cat 6	m	1,445	About 5 x 305 m reels
16	Cat 6 RJ45 outlets or termination points at the APs	Panduit Cat 6	no	25	
17	Cat 6 patch cords, AP end, 1 m	Panduit Cat 6	no	25	
18	24 port Cat 6 patch panels	Panduit Cat 6	no	2	
19	Cat 6 patch cords, rack side (switch to panel, switch to injector to panel)	Panduit Cat 6	no	37	Mixed 0.5 m and 1 m
Fibre					
20	OM4 12 core armoured LSZH fibre, intermediate IDF to main IDF	Corning OM4	m	90	4 cores used
21	OM4 12 core armoured LSZH fibre, comms room to main IDF	Corning OM4	m	50	8 cores used
22	Rack mount fibre panels with LC adapters	Corning or CommScope	no	3	Comms room, intermediate IDF and main IDF as needed
23	LC OM4 pigtails for splicing	Corning or CommScope	no	24	One per spliced core
24	Fusion splices with splice trays	Service	no	24	2 splice trays
25	LC to LC duplex OM4 patch cords, 3 m	Corning or CommScope	no	14	Both ends of every uplink, 10 percent spare
Containment					
26	PVC conduit 25 mm heavy gauge	Clipsal or Legrand PVC	m	1,189	397 x 3 m lengths
27	Saddles, clips and brackets (1 m spacing)	Clipsal or Legrand PVC	no	1,189	

#	Item	Basis of design	Unit	Qty	Note
28	Couplers, 90 degree bends and junction boxes	Clipsal or Legrand PVC	set	602	397 couplers, 100 bends, 105 boxes
Services					
29	Cable labelling (cable, port, AP and fibre)	Label kit	no	124	
30	Copper testing and certification (Cat 6 permanent link), all runs	Service	no	25	Test reports issued per link
31	Fibre testing (OTDR or OLTS) for all cores	Service	core	12	
32	Controller onboarding, WLAN, VLAN and security configuration, configuration backups and documentation	Service	lot	1	Per approved design
33	Wireless connectivity and operational testing, end to end	Service	lot	1	SSID broadcast, roaming, uplink status

Quantities are design quantities from the drawing and are indicative until the route survey. Conduit and containment follow the cable routes plus vertical drops. Prices are not included and are filled in by the estimator.

9. Brands and specifications

Each category lists the basis of design and at least two alternatives from other brands. Controller licences follow the AP brand, so a different AP brand means a different licence family. Items marked 'Datasheet checked' had their key numbers read from the vendor datasheet or store page. Items marked 'Confirm at RFQ' are family references, so confirm the exact part number and datasheet before ordering.

Directional access point (large open areas such as warehouses, halls and yards)

Brand and model	Key specifications	Status
Aruba (HPE) AP-677 S0P55A (US ref.) / select RW variant for UAE	Radios: Tri-radio Wi-Fi 6E, 2x2:2 (2.4 / 5 / 6 GHz) plus BLE and Zigbee Antenna: Internal directional, peak 6.6 / 7.2 / 7.2 dBi (2.4 / 5 / 6 GHz), about 90 x 90 degrees Max transmit power: +25 dBm per radio (22 dBm per chain) Data rate: 574 Mbps / 1.2 Gbps / 2.4 Gbps, 3.9 Gbps aggregate Power: 802.3bt class 6 for unrestricted operation, 29 W typical max, 45.5 W with USB load Ports: 1 x 2.5GbE RJ45, 1 x 1GbE SFP Environment: IP66/67, -40 to +70 C (+65 C with solar load), wind survivability 150 mph Size / weight: 290 x 288 x 171 mm, 3.6 kg, mount kit sold separately	Basis of design. Datasheet checked.
Cisco Catalyst CW9166D1 CW9166D1-x	Radios: Tri-band Wi-Fi 6E, 4x4:4 on each band (12 streams) Antenna: Directional, 6 dBi (2.4 and 5 GHz, 70 x 70 deg), 8 dBi (6 GHz, 60 x 60 deg) Max transmit power: 23 dBm Power: 802.3bt 30.5 W max, or 802.3at 25.5 W Uplink: 5 Gbps multigigabit Environment: -20 to +50 C, no IP rating quoted in the datasheet Best radio match to the AP-677, but the 50 C limit and missing IP rating need an enclosure or a shaded mounting review for a hot, uncontrolled hall.	Alternative. Datasheet checked.
Ruckus (CommScope) T750 / T750SE (sector) 901-T750-xx51	Radios: Wi-Fi 6, 4x4:4 on 2.4 and 5 GHz, no 6 GHz radio Antenna: BeamFlex+ adaptive, up to 3 dBi; 120 degree sector variant available Max transmit power: 26 dBm (2.4 GHz), 28 dBm (5 GHz) Power: 802.3bt class 7 (57 W) or 802.3at (24.2 W, reduced) Ports: 1 x 2.5GbE, 1 x 1GbE, SFP and SFP+ options Environment: IP67, -40 to +65 C Very good environmental match. No 6 GHz, so it does not match the Wi-Fi 6E scope of the AP-677.	Alternative. Datasheet checked.
Extreme Networks AP460S6C (60 degree sector) AP460S6C-xx	Radios: Wi-Fi 6 tri-radio: 5 GHz 4x4:4, 2.4 GHz 2x2:2, third radio as dual-band sensor Antenna: Internal 60 degree sector (120 degree AP460S12C also available) Power: Fully functional on 802.3at Environment: IP67, -40 to +60 C Sector antenna suits aisle coverage. No 6 GHz radio.	Alternative. Datasheet checked.

Indoor access point (offices and indoor areas)

Brand and model	Key specifications	Status
Aruba (HPE) AP-635 R7J28A (US ref.) / select RW variant for UAE	Radios: Tri-radio Wi-Fi 6E, 2x2:2 (2.4 / 5 / 6 GHz) plus BLE 5 and Zigbee Antenna: Internal omni, peak 4.6 / 7.0 / 6.3 dBi, average 2.9 / 4.9 / 4.3 dBi Max transmit power: +21 dBm per radio (18 dBm per chain) Data rate: 574 Mbps / 1.2 Gbps / 2.4 Gbps, 3.9 Gbps aggregate Power: 802.3at class 4 or higher, 23.8 to 29.4 W max on PoE Ports: 2 x RJ45 (100/1000/2500BASE-T) Environment: 0 to +50 C, 220 x 220 x 50 mm, 1.3 kg	Basis of design. Datasheet checked.
Cisco Catalyst CW9166I CW9166I-x	Radios: Tri-band Wi-Fi 6E, 4x4:4 on each band Antenna: Omni, 3 / 5 / 4 dBi (2.4 / 5 / 6 GHz) Max transmit power: 23 dBm Power: 802.3bt 30.5 W max, or 802.3at 25.5 W Uplink: 5 Gbps multigigabit Environment: 0 to +50 C, 9.5 x 9.5 x 2.2 in, 3.54 lb	Alternative. Datasheet checked.

Brand and model	Key specifications	Status
Ruckus (CommScope) R760 901-R760-xx00	Radios: Wi-Fi 6E, 4x4:4 on 2.4 / 5 / 6 GHz, 8.35 Gbps combined Antenna: BeamFlex adaptive, up to 4 dBi Max transmit power: 22 dBm on all bands Power: 802.3at/bt, 38.3 W max (DC power mode) Ports: 1 x 10GbE, 1 x 1GbE, 1 x USB 2.0 Environment: -10 to +50 C, 1.79 kg	Alternative. Datasheet checked.

Controller licences (follow the AP brand and the controller in use)

Brand and model	Key specifications	Status
Aruba (HPE) AP capacity licence (LIC-AP) Per controller model and AOS version	Quantity: One per new AP (12 outdoor + 13 indoor) Note: Confirm the licence SKU family against the existing controller model and AOS release before ordering	Basis of design. Confirm at RFQ.
Aruba (HPE) Policy Enforcement Firewall licence (LIC-PEF) Per controller model and AOS version	Quantity: One per new AP, matching the AP capacity count Note: Enables role-based firewall policy for the approved WLAN and VLAN design	Basis of design. Confirm at RFQ.

Indoor PoE+ access switch

Brand and model	Key specifications	Status
Cisco Catalyst C9200L-24P-4X-E C9200L-24P-4X-E	Ports: 24 x 10/100/1000 PoE+, 4 x 1/10G SFP+ fixed uplinks PoE budget: 370 W with the default PWR-C5-600WAC supply (740 W with a second supply) Performance: 128 Gbps switching, 95.23 Mpps forwarding Stacking: StackWise-80, up to 8 members Licence: Network Essentials (perpetual) Size: 1 RU, 44.5 x 28.8 cm	Basis of design. Datasheet checked.
Aruba (HPE) CX 6200F 24G Class-4 PoE 4SFP+ 370W JL725B	Ports: 24 x 1G Class 4 PoE, 4 x SFP+ PoE budget: 370 W OS: AOS-CX, managed via Aruba Central or NetEdit	Alternative. Confirm at RFQ.
Extreme Networks 5320-24P-8XE Confirm at RFQ	Ports: 24 x 1G PoE+, 8 x 10G SFP+ uplinks Note: Family reference, confirm PoE budget and SKU	Alternative. Confirm at RFQ.

Industrial switch for large open areas (temperature uncontrolled)

Brand and model	Key specifications	Status
Cisco Catalyst IE-9320-24T4X-E IE-9320-24T4X-E	Ports: 24 x GE RJ45 (non-PoE), 4 x 1/10G SFP+ uplinks Performance: 128 Gbps switching bandwidth, 64 Gbps forwarding bandwidth Power: Dual AC/DC inputs, 150 W supply, about 35 W typical draw Environment: -40 to +75 C (with a blower-equipped cabinet), fanless, IP30, MTBF 651,580 h Licence: Network Essentials (default) or Network Advantage Size: 1 RU rack mount, 4.3 kg	Basis of design. Datasheet checked.
Moxa ICS-G7828A-4XG-HV-HV-T ICS-G7828A-4XG-HV-HV-T	Ports: 20 x GbE, 4 x combo GbE (RJ45 or SFP), 4 x 10GbE SFP+ Power: Dual isolated universal 85 to 264 VAC Environment: -40 to +75 C, fanless, Layer 3 managed	Alternative. Datasheet checked.
Hirschmann (Belden) DRAGON MACH family, 24 GbE plus 10G uplinks Confirm at RFQ	Note: Family reference for a rugged rack managed switch, confirm the exact SKU, PoE and temperature range	Alternative. Confirm at RFQ.

Outdoor PoE injector (802.3bt, one per directional AP)

Brand and model	Key specifications	Status
Aruba (HPE) PD-9501-5GCO-AC Smart Rate midspan R7T40A	Standard: IEEE 802.3bt, 60 W output, 1 port midspan Design: Outdoor rated with surge protection, AC input Use here: Feeds the AP-677 at full class 6 power from the non-PoE industrial switch	Basis of design. Datasheet checked.

Brand and model	Key specifications	Status
Microchip (Microsemi) PD-9501GO outdoor midspan Confirm at RFQ	Standard: 802.3bt 60 W outdoor midspan Note: OEM family of the R7T40A	Alternative. Confirm at RFQ.
Ruckus (CommScope) 802.3bt PoE injector Confirm at RFQ	Note: Confirm 60 W rating, IP rating and surge protection before substitution	Alternative. Confirm at RFQ.

10G multimode SFP+ (proposed switches only)

Brand and model	Key specifications	Status
Cisco SFP-10G-SR-S SFP-10G-SR-S	Type: 10GBASE-SR, LC duplex, 850 nm Reach: Up to 400 m on OM4	Basis of design. Confirm at RFQ.
Aruba (HPE) SFP+ 10G SR J9150D	Type: 10GBASE-SR, LC duplex	Alternative. Confirm at RFQ.
Third party coded 10GBASE-SR SFP+ coded for Cisco Confirm at RFQ	Note: Only if the client accepts non-OEM optics on Cisco switches	Alternative. Confirm at RFQ.

Category 6 copper cable (AP runs)

Brand and model	Key specifications	Status
CommScope (SYSTIMAX / NETCONNECT) Cat 6 U/UTP LSZH Confirm at RFQ	Standard: TIA-568.2-D Cat 6 / ISO 11801 Class E Jacket: LSZH, 4 pair solid copper, 23 AWG Limit: 90 m permanent link, 100 m channel	Basis of design. Confirm at RFQ.
Panduit TX6 Cat 6 U/UTP LSZH Confirm at RFQ	Standard: TIA-568.2-D Cat 6 Jacket: LSZH, 4 pair solid copper	Alternative. Confirm at RFQ.
Belden Cat 6 U/UTP LSZH Confirm at RFQ	Standard: TIA-568.2-D Cat 6 Jacket: LSZH, 4 pair solid copper	Alternative. Confirm at RFQ.
Legrand (LCS3) Cat 6 U/UTP LSZH Confirm at RFQ	Standard: Cat 6 / Class E Jacket: LSZH	Alternative. Confirm at RFQ.

OM4 multimode fibre and connectivity

Brand and model	Key specifications	Status
Corning OM4 12 core armoured LSZH Confirm at RFQ	Type: 50/125 um OM4, laser optimised Reach: 10GBASE-SR up to 400 m Build: Armoured, LSZH, splice on LC pigtails into a rack-mount fibre panel	Basis of design. Confirm at RFQ.
CommScope (LazrSPEED) OM4 12 core armoured LSZH Confirm at RFQ	Type: 50/125 um OM4 Reach: 10GBASE-SR up to 400 m	Alternative. Confirm at RFQ.
Panduit OM4 12 core armoured LSZH Confirm at RFQ	Type: 50/125 um OM4 Reach: 10GBASE-SR up to 400 m	Alternative. Confirm at RFQ.

15U wall or floor rack with accessories

Brand and model	Key specifications	Status
Rittal 15U 19 in network enclosure Confirm at RFQ	Size: 15U, 600 mm wide, 19 in mounting Accessories: Cable management, PDU, earthing bar, shelf, vented or fan tray	Basis of design. Confirm at RFQ.

Brand and model	Key specifications	Status
Legrand (LCS3) 15U 19 in cabinet Confirm at RFQ	Size: 15U, 19 in	Alternative. Confirm at RFQ.
APC by Schneider Electric NetShelter wall or floor cabinet, 15U class Confirm at RFQ	Size: 15U class, 19 in	Alternative. Confirm at RFQ.

PVC conduit, fittings and supports

Brand and model	Key specifications	Status
Schneider Electric (Clipsal) Heavy gauge rigid PVC conduit 25 mm Confirm at RFQ	Spec: 25 mm PVC conduit, UV stabilised where exposed, with saddles, couplers, bends and junction boxes Drawing legend: 1 x 25 mm PVC conduit for RJ45 point Cat 6 cables	Basis of design. Confirm at RFQ.
Legrand Rigid PVC conduit 25 mm Confirm at RFQ	Spec: 25 mm rigid PVC	Alternative. Confirm at RFQ.
Gewiss Rigid PVC conduit 25 mm Confirm at RFQ	Spec: 25 mm rigid PVC	Alternative. Confirm at RFQ.

Patch panels, patch cords and labelling

Brand and model	Key specifications	Status
Panduit 24 port Cat 6 patch panel, Cat 6 patch cords Confirm at RFQ	Type: 1U 24 port Cat 6 panel, 1 m Cat 6 LSZH patch cords	Basis of design. Confirm at RFQ.
CommScope 24 port Cat 6 patch panel and cords Confirm at RFQ	Type: 1U 24 port Cat 6	Alternative. Confirm at RFQ.
Legrand 24 port Cat 6 patch panel and cords Confirm at RFQ	Type: 1U 24 port Cat 6	Alternative. Confirm at RFQ.

10. Configuration and testing

Configuration template

Fill the values below from the approved design. The scope covers onboarding on the controller or cloud platform, WLAN, VLAN and security configuration, and configuration backups.

Item	Proposed setting	Value to confirm
AP group and profile	One group for directional APs, one for indoor APs, with separate RF profiles	Group names
Large-area SSIDs	Corporate (802.1X), handhelds and scanners (WPA2 or WPA3, isolated VLAN)	SSID names, VLAN IDs
Indoor SSIDs	Corporate (802.1X), guest with captive portal	SSID names, VLAN IDs
Roles and policy	Role-based policy per SSID, using the licences installed on the controller	Role and policy list
Radio settings	Channels from the channel plan, transmit power capped at the design EIRP (23 dBm directional, 19 dBm indoor)	Regulatory domain, DFS use
Uplinks	2 x 10G SR per switch as a port channel to the agreed IDF	IDF switch ports, VLAN trunk list
Management	Controller management VLAN, SNMP and syslog to the existing platform	IP plan

Testing and acceptance

- Certify every Cat 6 permanent link and issue the test reports with cable labels.
- Test every OM4 core with an OLTS or OTDR and record the loss.
- Check that each AP joins the controller, receives its group and broadcasts the SSIDs.
- Check switch port status, PoE class and uplink state on all proposed switches.
- Walk the covered areas with a survey tool and compare readings with the heat maps. Retune aim, tilt and channel where the measured signal is more than 5 dB below prediction.
- Hand over configuration backups and the as-built AP and cable schedule.

Assumptions and exclusions

- Power outlets for the racks and injectors, the UPS, and civil works are by others unless stated.
- The controller or cloud platform has capacity and a supported software release for the AP models. Licence part numbers depend on it.
- Optics on the IDF side of the uplinks are existing. SFPs are supplied only for the proposed switches.
- Cable lengths follow straight Manhattan routes. Actual tray and conduit routes may change lengths, so the site survey overrides them.
- This is a predictive design. Results depend on wall, rack and stock assumptions listed in this report.