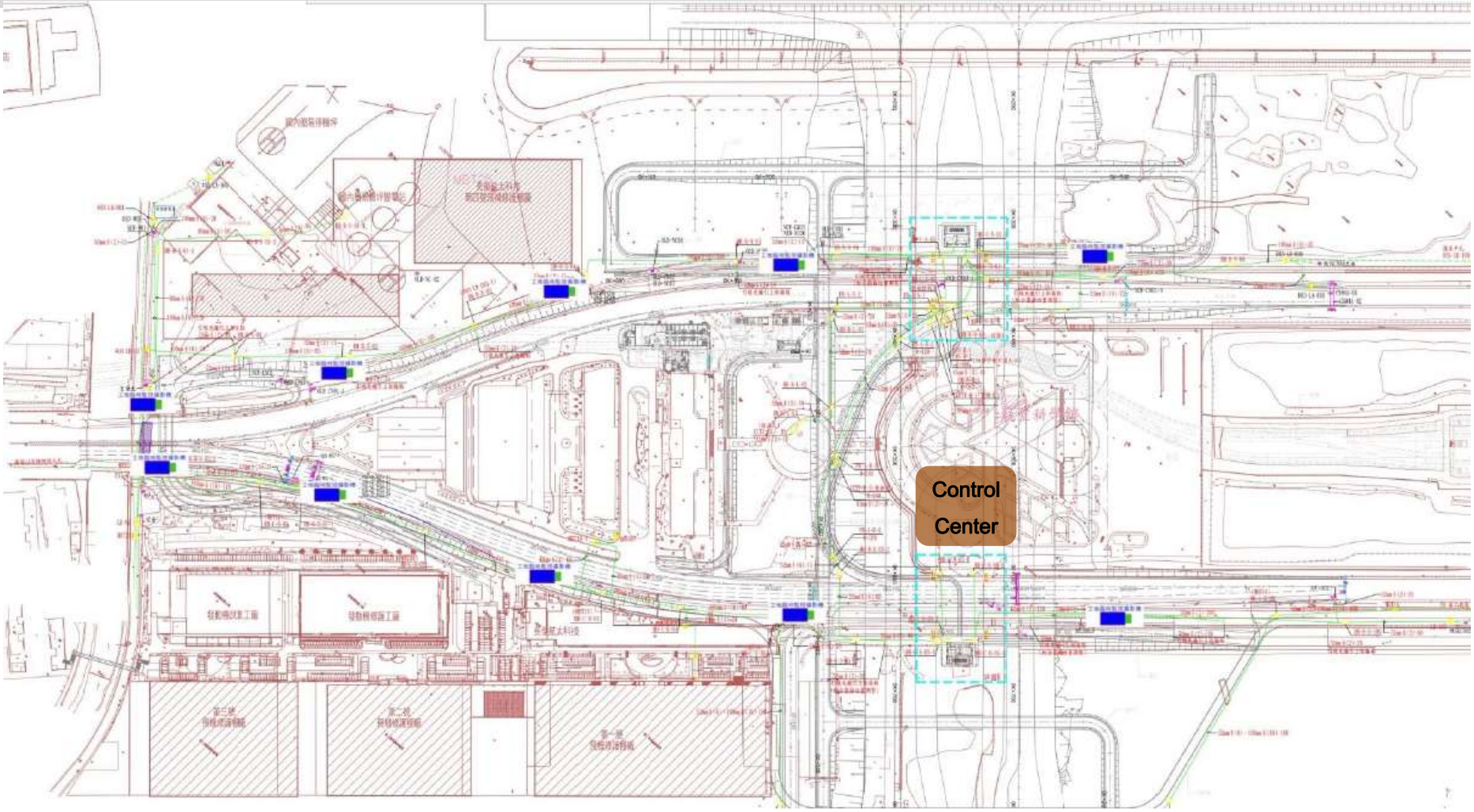
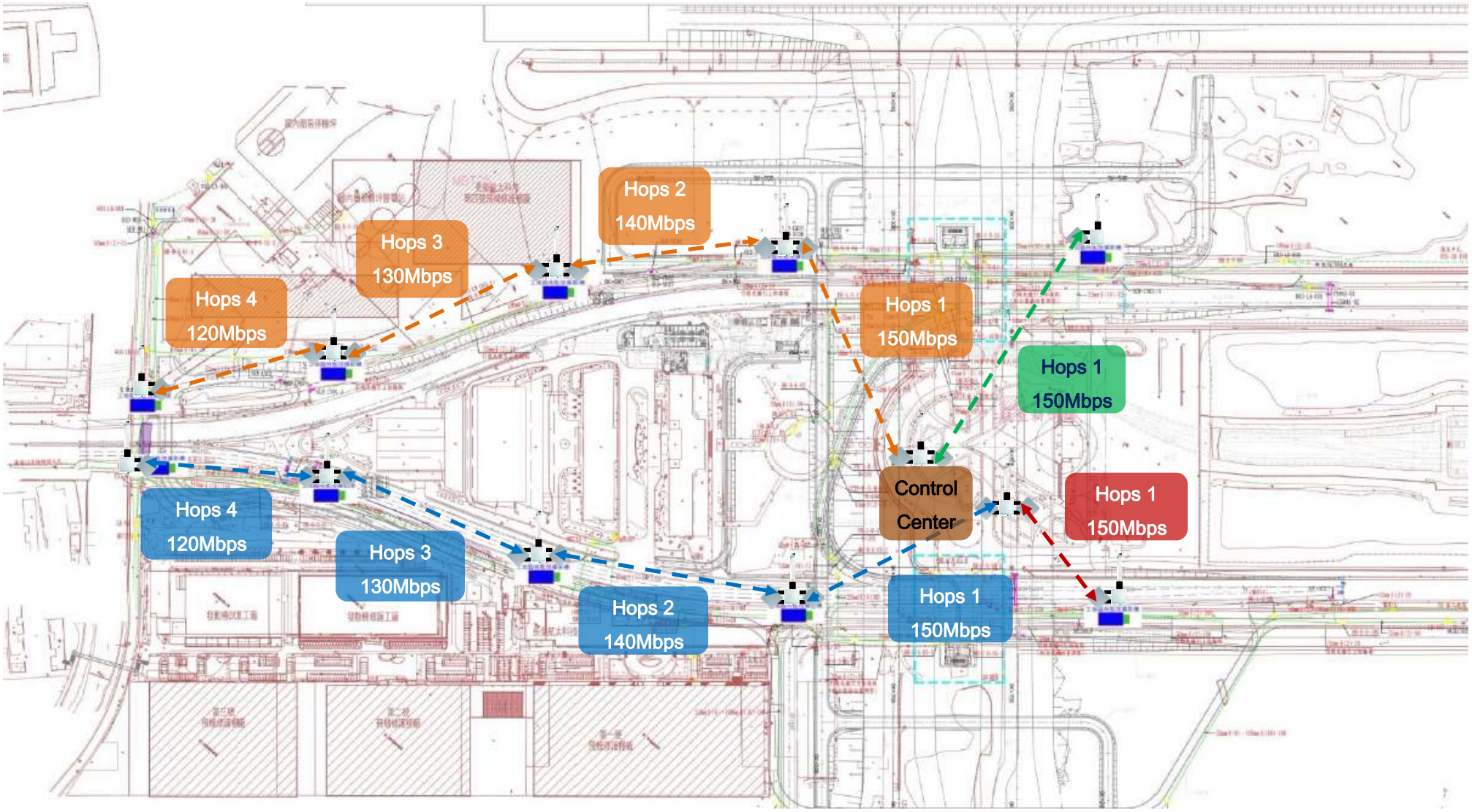
Outdoor WiFi MIMO large bandwidth by Multiple Hops wireless surveillance system planning

-- Apply for "people steering the public works construction through surveillance system from website + match "heat-resistant & IP66 outdoor DC UPS power systems" (mobile) --

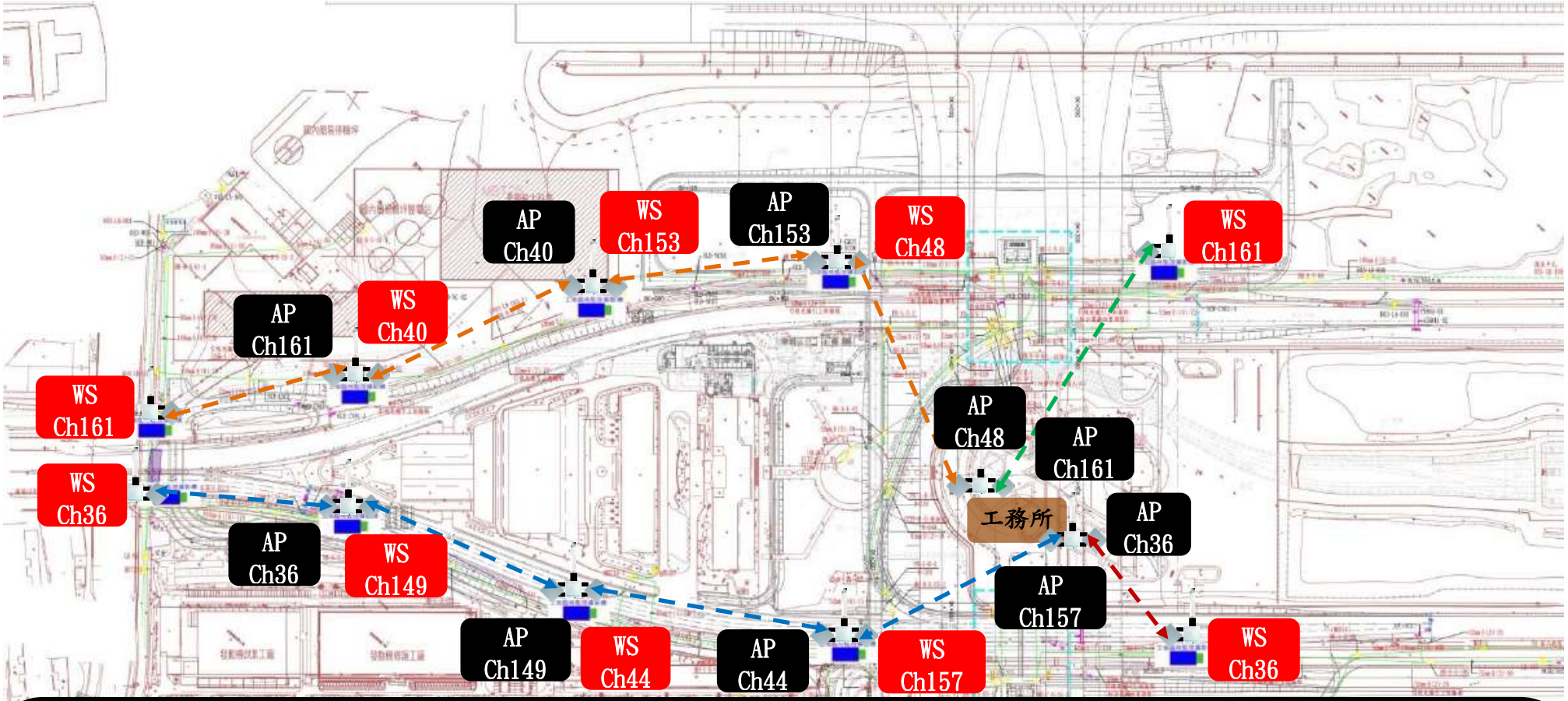
1. Wireless surveillance system to set up the environment (Fixed Camera)



2."Fixed Cameras" Wireless Surveillance System Design 4 Backbone will have total bandwidth of 600Mbps



3."Fixed Cameras" Wireless Surveillance System Design 4 Backbone -- Wireless System Operation Mode



Channel Design Description

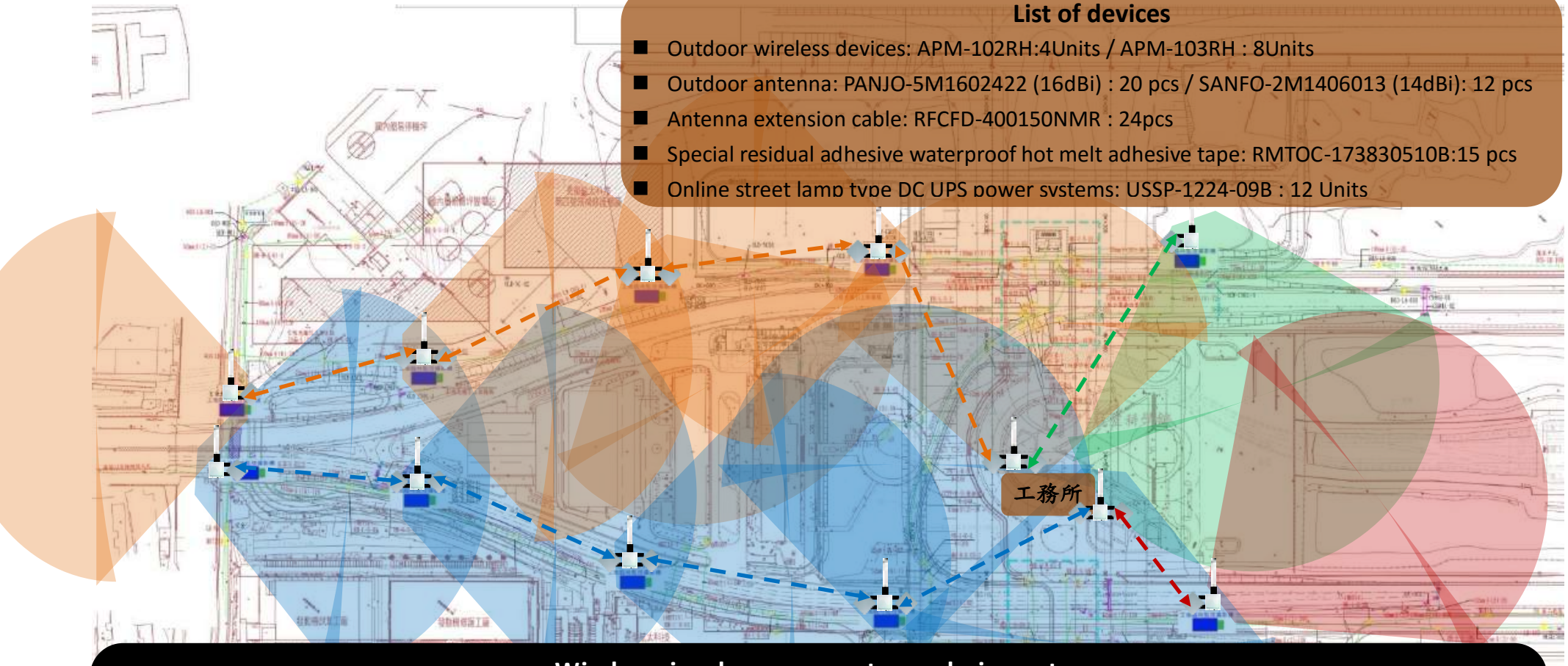
1. Question 1: due to its close proximity to the airport, certainly will military radar sweep frequency hopping hid radar jamming problem.
   Solution: Turn off DFS change channel features, enable only non-military frequency channels.
2. Question 2: because the wireless systems have setup in the same area slightly densely, and steer clear of military use, it will easy happen reduce channel and channel not enough for system used.
   Solution: 1. Design Plus & Minus the lower and upper frequency distribution is enabled. 2. cross-stagger and repeat frequency design
   (In case of severe wireless signal interference had happen, if necessary, to reduce bandwidth to improve channel number solution can be used; 4 wireless backbone bandwidth is up to 300Mbps, sufficient to meet the total 28 * 5Mbps = 140Mbps video transmission bandwidth requirements.)

4. "Mobile cameras 18 units" signal coverage using wireless surveillance transmission planning -- 2.4GHz

90 degree sector antennas for wireless signal coverage

List of devices

- Outdoor wireless devices: APM-102RH:4Units / APM-103RH : 8Units
- Outdoor antenna: PANJO-5M1602422 (16dBi) : 20 pcs / SANFO-2M1406013 (14dBi): 12 pcs
- Antenna extension cable: RFCFD-400150NMR : 24pcs
- Special residual adhesive waterproof hot melt adhesive tape: RMTOC-173830510B:15 pcs
- Online street lamp type DC UPS power systems: USSP-1224-09B : 12 Units



Wireless signal coverage antenna design notes

Question 1: fixed wireless surveillance system using the 5.8GHz frequency, but the construction site without too much 2.4GHz wireless signals, it is recommend that mobile wireless surveillance system use 2.4GHz wireless transmission.

Solution: using priority 2.4GHz 90 degree sector antennas for wireless signal coverage; primarily fan-shaped antenna signal with high purity and signal intensity, angle, vertical angles are great.

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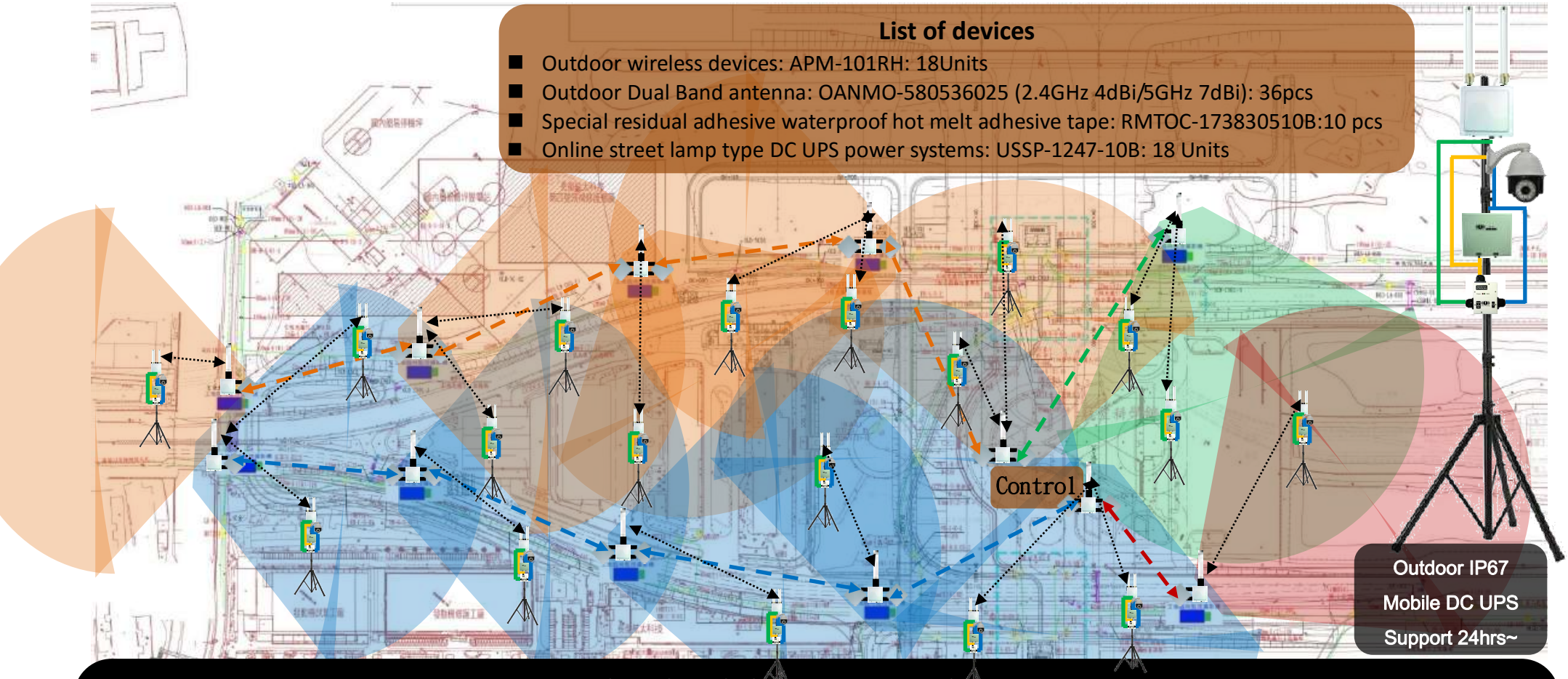
5. "Mobile cameras 18 units" signal coverage using wireless surveillance transmission planning -- 2.4GHz

5~8dBi Omni-directional antenna for wireless client to link AP

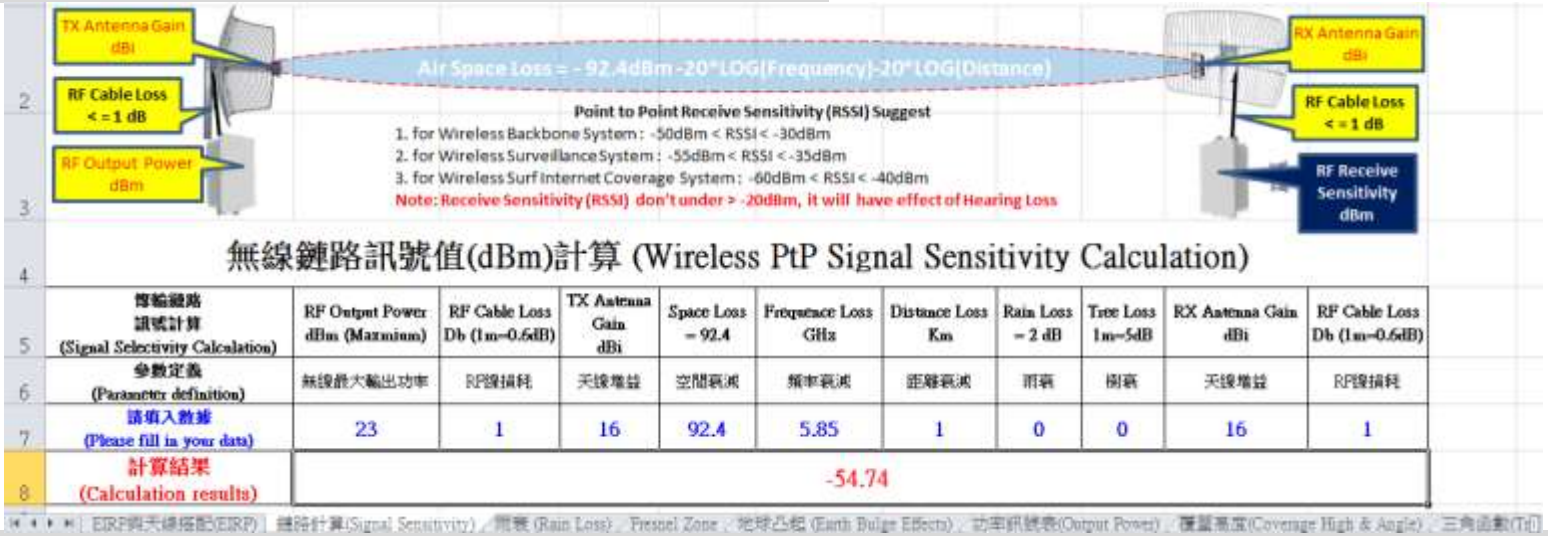


Wireless client link to AP, antenna design notes

Question 2: mobile wireless online surveillance system would need moved to different locations AP demand characteristics, so it is recommend using 2.4GHz Omni-directional antenna link transfer.

Solution: consider mobile wireless surveillance transmission distance is not far, and try to bring the online vertical angle increase, to improve the stability of link, so 2.4GHz 5dBi~8dBi gain Omni-directional antenna is recommended, if you can buy 2.4GHz and 5GHz dual-band omnidirectional antenna better (compared with a single frequency, the price is not higher).

6. "Fixed cameras" wireless transmission backbone: the PtP sensitivity signal -54dBm (equivalent to telecommunications provider level), bandwidth estimation 150Mbps full speed.

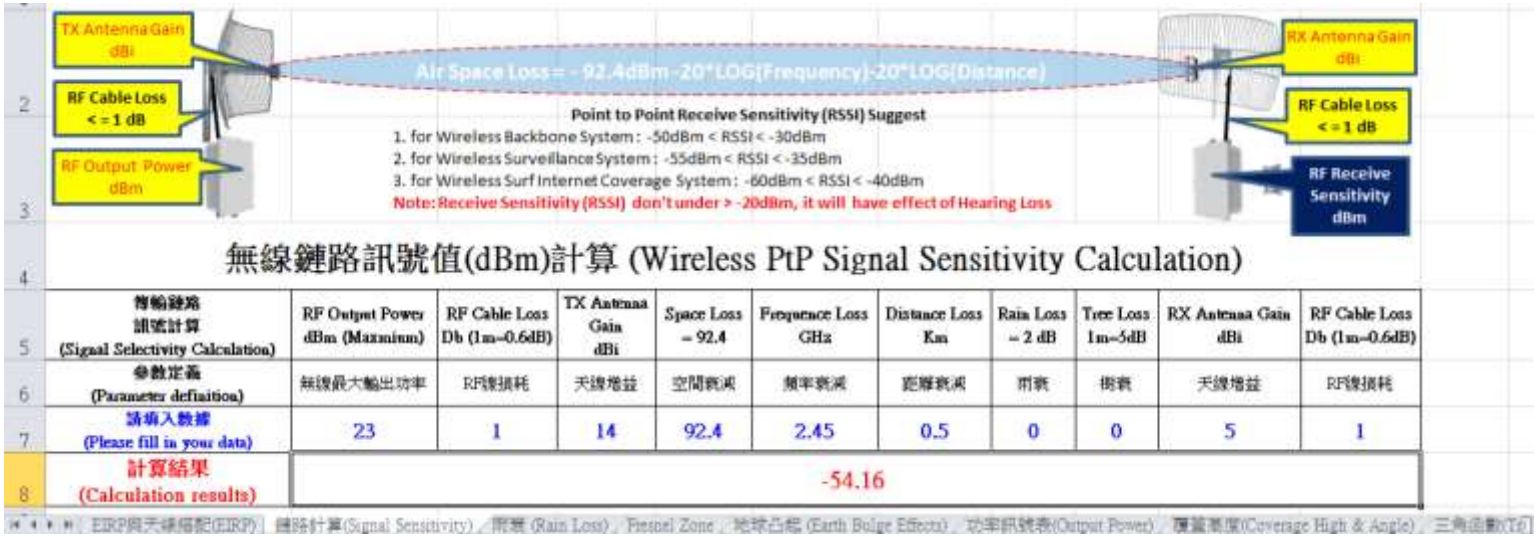


無線鏈路訊號值(dBm)計算 (Wireless PtP Signal Sensitivity Calculation)

無線鏈路訊號計算 (Signal Selectivity Calculation)	RF Output Power dBm (Maximum)	RF Cable Loss Db (1m=0.6dB)	TX Antenna Gain dBi	Space Loss = 92.4	Frequence Loss GHz	Distance Loss Km	Rain Loss = 2 dB	Tree Loss 1m=5dB	RX Antenna Gain dBi	RF Cable Loss Db (1m=0.6dB)
參數定義 (Parameter definition)	無線最大輸出功率	RF線損耗	天線增益	空間衰減	頻率衰減	距離衰減	雨衰	樹衰	天線增益	RF線損耗
請填入數據 (Please fill in your data)	23	1	16	92.4	5.85	1	0	0	16	1
計算結果 (Calculation results)	-54.74									

EIRP與天線搭配(EIRP) 鏈路計算(Signal Sensitivity) 雨衰 (Rain Loss) Fresnel Zone 地球凸起 (Earth Bulge Effects) 功率訊號表(Output Power) 覆蓋高度(Coverage High & Angle) 三角函數(Tri)

7. "Mobile camera" wireless surveillance transmission system: the PtP sensitivity signal -54dBm (equivalent to a telecommunications provider level), link bandwidth estimate 70-150Mbps.



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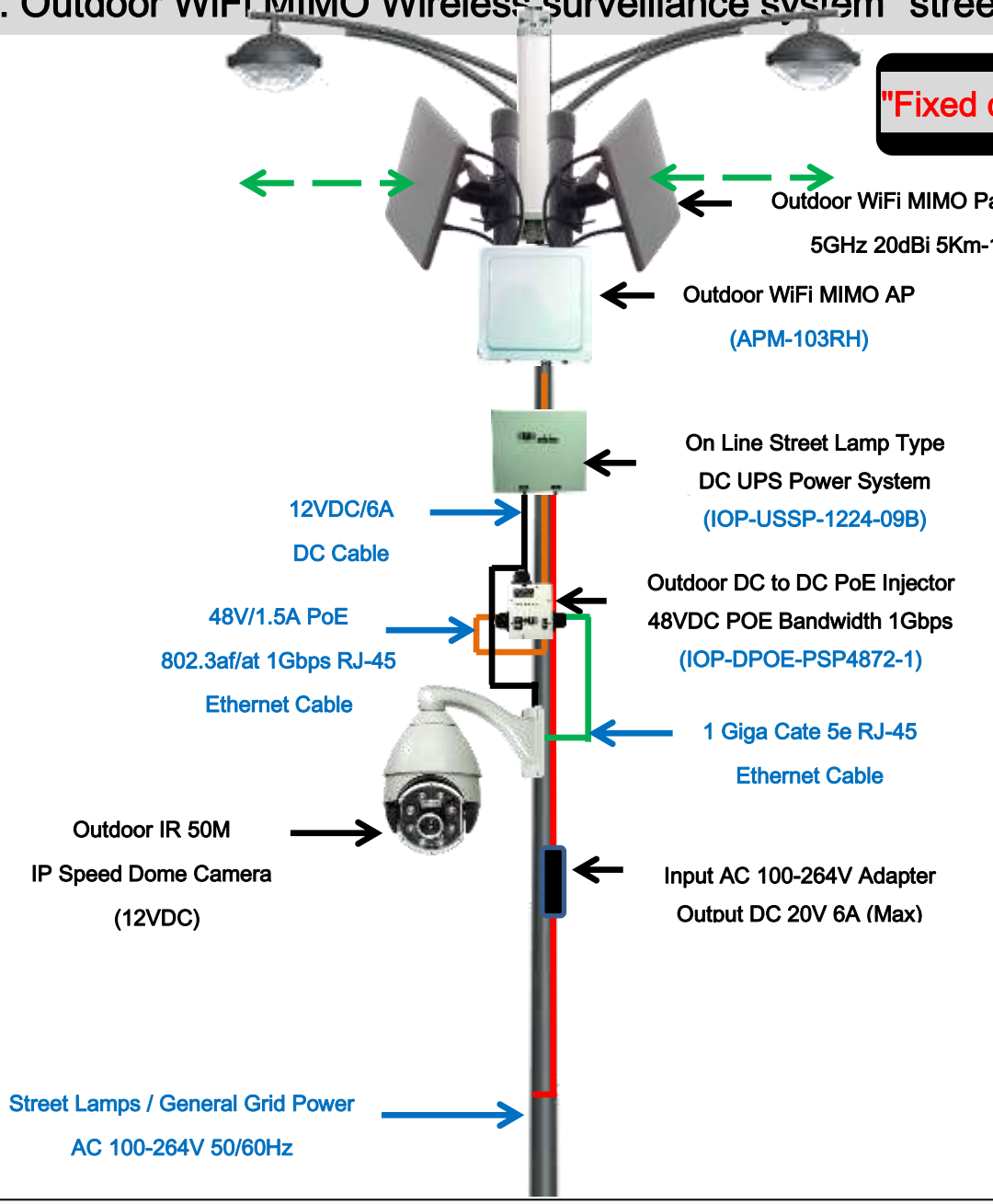
請填入數據 (Please fill in your data)	23	1	14	92.4	2.45	0.5	0	0	5	1
計算結果 (Calculation results)	-54.16									

EIRP與天線搭配(EIRP) 鏈路計算(Signal Sensitivity) 雨衰 (Rain Loss) Fresnel Zone 地球凸起 (Earth Bulge Effects) 功率訊號表(Output Power) 覆蓋高度(Coverage High & Angle) 三角函數(Tri)

8. Outdoor WiFi MIMO Wireless surveillance system "street lamp DC UPS power supply systems" solution



Special reminder

Special reminder 1: recommended use DC power source for DC UPS power systems devices and use outdoor DC to DC Power over Ethernet and the AC 100-264V transformer, installed in the distribution box.

Special reminder 2: surveillance system using the DC to DC Power over Ethernet to power supply can reduce transform loss of DC converts to AC and then AC converts to DC to power supply for system devices. Therefore, DC to DC Power over Ethernet to power supply system, will saves power capacity 30%~50%. (It is equivalent of saving the design capacity of the battery).

9.Outdoor WiFi MIMO Wireless surveillance system + "street lamps power supply DC UPS power system" solution

"Fixed camera" wireless surveillance transmission backbone

Street lamps power source type -- DC UPS power design of wireless surveillance transmission system

"Fixed camera" wireless surveillance transmission backbone system

1. Outdoor WiFi wireless AP APM-103RH: power consumption 13W/H
2. 12VDC to 48VDC PoE-72W: power consumption 1W/H
3. IR 50m Speed Dome IP camera: power consumption @ day 12W/H, @ night 20W/H
4. Power supply to wireless surveillance system 10 hours to cope with the risk of temporary power outages for more than 8 hours
5. The total calculation: 10H * (13 + 1) W/H + 10H * ((12+20)/2) W/H = 140W + 160W = 300W; 300W / 12.8V =23.4Ah
6. **Recommend to use model: IOP-USSP-1224-09B 297WH (23.2Ah @ 12.8V) (similar AC UPS as 1.8KVA)**

10.Outdoor WiFi MIMO Wireless surveillance system + "street lamps power supply DC UPS power system" solution

"Mobile camera" wireless surveillance transmission system

Street lamps power source type -- DC UPS power design of wireless surveillance transmission system

"Mobile camera" wireless surveillance transmission system

1. Outdoor WiFi wireless AP APM-101RH: power consumption 7W/H
2. 12VDC to 48VDC PoE-72W: power consumption 1W/H
3. IR 50m Speed Dome IP camera: power consumption @ day 12W/H, @ night 20W/H
4. Design power supply to wireless surveillance system for 24 hours to meet daytime construction surveillance system working demand
5. The total calculation: 24H * (7 + 1) W/H + (12H *12W/H) + (12H * 20W/H) = 192W + 144W + 240W = 576W; 576W / 12.8V = 45Ah
6. **Recommend to use model: IOP-USSP-1247-10B 594WH (46.4Ah @ 12.8V) (similar AC UPS as 3.6KVA)**

11. Set up devices (rough estimate)

No.	Device Name	Model	Specifications	Amount	Remark
1	Outdoor WiFi MIMO AP - (Client) 	APM-101RH (1RF Module)	1. One MIMO 2*2 RF Module (802.11a/g/n) 2. System Operation Mode: Bridge 3. Output Power : 23dBm (Max) 4. Multiple Hops >= 4Hops Throughput 120Mbps 5. Bandwidth Throughput : 160Mbps (@40MHz) 6. Special Features : Multiple Hopping, Ultra-Fast Roaming, Mesh Cloud, Intelligent Wireless Traffic Control	18	
2	Outdoor WiFi MIMO AP -(Hops & Backhaul) 	APM-102RH (2RF Module)	1. Two MIMO 2*2 RF Module (802.11a/g/n) 2. System Operation Mode: Bridge 3. Output Power : 23dBm (Max) 4. Multiple Hops >= 4Hops Throughput 120Mbps 5. Bandwidth Throughput : 320Mbps (@40MHz) 6. Special Features : Multiple Hopping, Ultra-Fast Roaming, Mesh Cloud, Intelligent Wireless Traffic Control	4	
3	Outdoor WiFi MIMO AP -(Hops & Backhaul & Coverage) 	APM-103RH (3RF Module)	1. Three MIMO 2*2 RF Module (802.11a/g/n) 2. System Operation Mode: Bridge 3. Output Power : 23dBm (Max) 4. Multiple Hops >= 4Hops Throughput 120Mbps 5. Bandwidth Throughput : 320Mbps (@40MHz) 6. Special Features : Multiple Hopping, Ultra-Fast Roaming, Mesh Cloud, Intelligent Wireless Traffic Control	8	

4	Outdoor WiFi MIMO 5GHz 16dBi Dual Linear Panel Antenna 	IOP-PANJO-5M1602422	1.Frequence:5150 - 5875 MHz 2.Gain: 16dBi 3.Polarization : Dual Linear +- 90° 4.H:15-19° / V:17-21° 5.Connector: N-Jack RG233, 70cm Cable *2 6.Weight: 0.8Kg 7.Dimensions: 210 x 210 x 73 mm 8.IPX5 9.Survival wind speed: 216Km/hr	20	
5	Outdoor WiFi MIMO 2.4GHz 14dBi Dual Polarization Sector Antenna 	IOP-SANFO-2M1406013	1.Frequence:2400 - 2500 MHz 2.Gain: 14 ± 0.5 dBi 3.Polarization : Dual Linear +- 45° 4.HPBW / Horizontal (3dB)/(6dB): H:60°/90° 5.HPBW / Vertical (3dB)/(6dB): V:13°/20° 6.Connector: N-Type Jack * 2 7.Weight: 0.8Kg 8.IPX5 9.Survival wind speed: 216Km/hr	12	
6	2.4GHz 4dBi & 5GHz 7dBi Dual Band Omni Antenna 	IOP-OANMO-580536025	1.Frequence: 2400~2500MHz;5150~5875 MHz 2.Gain: 4dBi@2.4GHz; 7dBi@5GHz 3.HPBW / Horizontal 360° 4.HPBW / Vertical 30° 5.Connector: N-Type Plug * 1 6.Weight: 0.07Kg 7.Size:Φ22 × 183 mm	36	

7	Antenna RF Cable CFD400 1.5M RF Cable 	IOP-RFCFD-400150NMR	1. Connector: N-type Plug to N-type Plug 2. Cable: CFD-400 1.5M 3. Temp: - 40 ~ + 85°C 4. Impedance: 50Ω 5. Shielding Effectiveness: >= 90dB 6. Weight: 0.3Kg	24	
8	RF Connector Self-Bonding Rainproof Insulating Tape 	IOP-RMTOC-173830510B	1. Length / roll: 305cm ± 2cm 2. Width: 38mm ± 2mm 3. Thickness: 1.35mm ± 0.5mm 4. Elongation: 1000% 5. Adhesion: Detachment < 2cm 6. Breaking Strength: >2kg 7. Water Absorption: <0.2% 8. Insulation Resistance: >1 × 106 MΩ+	25	
9	Outdoor/Street Lamps DC UPS Power System 	IOP-USSP-1224-09B (Similar AC UPS as 1.8KVA)	1.Product type: outdoor large currents of large-power Street lamp power system/IP67 industrial M12 connector/aluminum shell 2.Supported battery type: lithium iron phosphate batteries 3.Built in battery power capacity: 297 WH (23.2Ah@12.8V) 4.Load voltage/current: DC 11.7~14.2V+-3% 7A Max 5.Battery charging voltage: 14.4V+-3% 6.Operation Temperature : - 35℃ ~ + 75℃ 7. Charge & Discharge Life Cycle: 2000 times (around 6 years)	12	

10	Outdoor/Street Lamps DC UPS Power System 	IOP-USSP-1247-10B (Similar AC UPS as 3.6KVA)	1.Product type: outdoor large currents of large-power Street lamp power system/IP67 industrial M12 connector/aluminum shell 2.Supported battery type: lithium iron phosphate batteries 3.Built in battery power capacity: 594 WH (46.4Ah@12.8V) 4.Load voltage/current: DC 11.7~14.2V+-3% 8A Max 5.Battery charging voltage: 14.4V+-3% 6.Operation Temperature : - 35℃ ~ + 75℃ 7. Charge & Discharge Life Cycle: 2000 times (around 6 years)	18	
11	Outdoor DC to DC PoE Converter 12VDC to 48VDC PoE 1.5A 72W 	IOP-DPOE-PSP4872-1	1.Input DC Voltage : 12~24VDC (28V Max) 2.Input DC Current : 12VDC 6A Max/24VDC 3A Max 3.Output PoE DC Voltage : 48VDC 4.Output DC Current & Watts : 1A / Instant 1.5A Max, 48W / Instant 72W Max 5.Support Ethernet Bandwidth : 10/100/1000Mbps (1Gbps)Bandwidth 6.Ethernet Cable SPEC : Cate 5 support 100Mbps, Cate 5e ~ support 1Gbps 7.Compatible with IEEE802.3 / 802.3u / 802.3af / 802.3at PoE Passive 8.Transform Efficiency : 95% 9.Operating Temperature : -40°C ~ +70°C 10.Dust & Waterproof Rate : IP67	30	