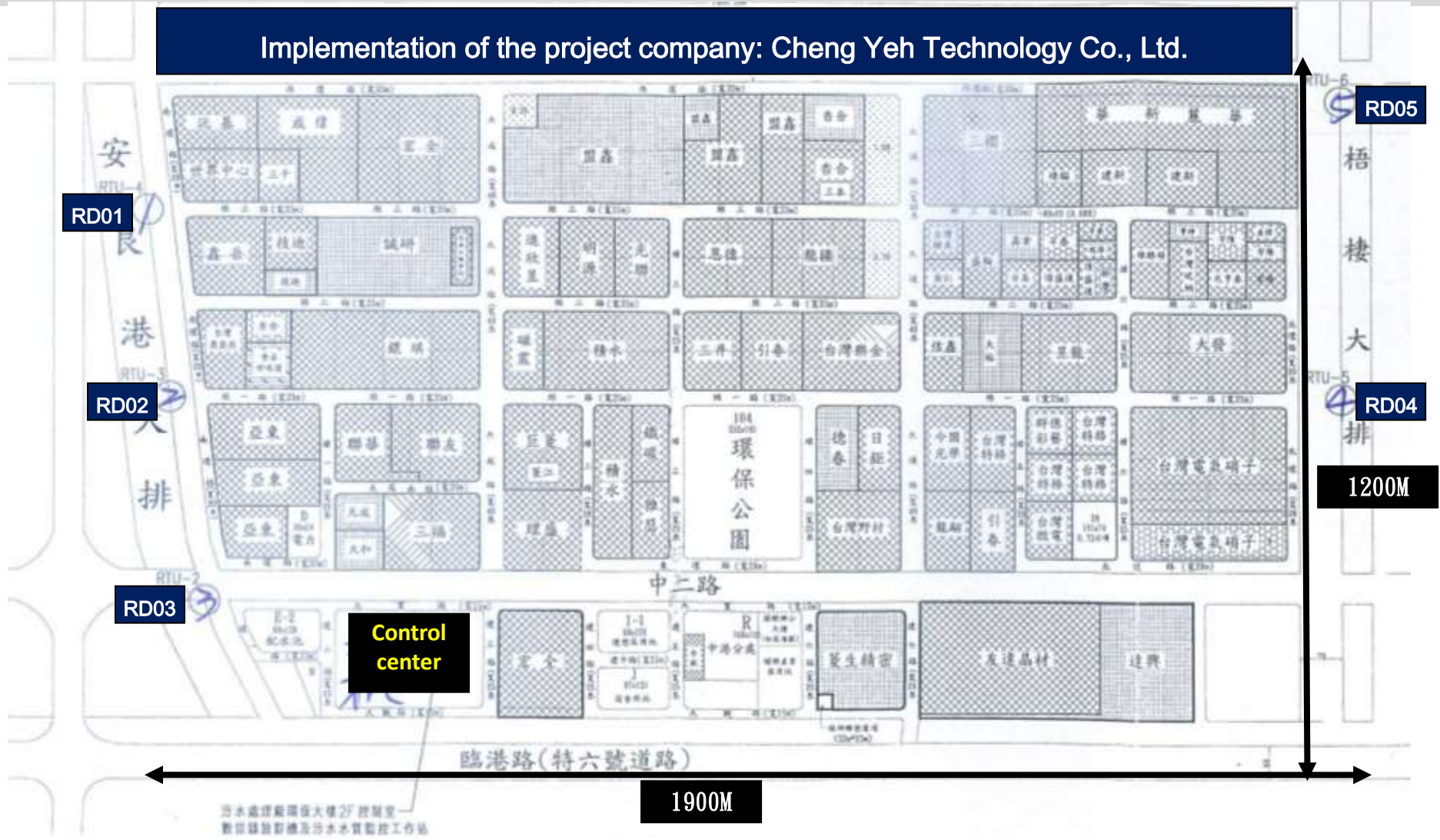


# Outdoor WiFi MIMO Large-bandwidth Wireless Transmission System

At the sewage treatment plant surveillance and detection system transmit design.

## 1、Scene diagram (Sewage outfall video monitoring and real-time detection of water quality and related data return)

Implementation of the project company: Cheng Yeh Technology Co., Ltd.

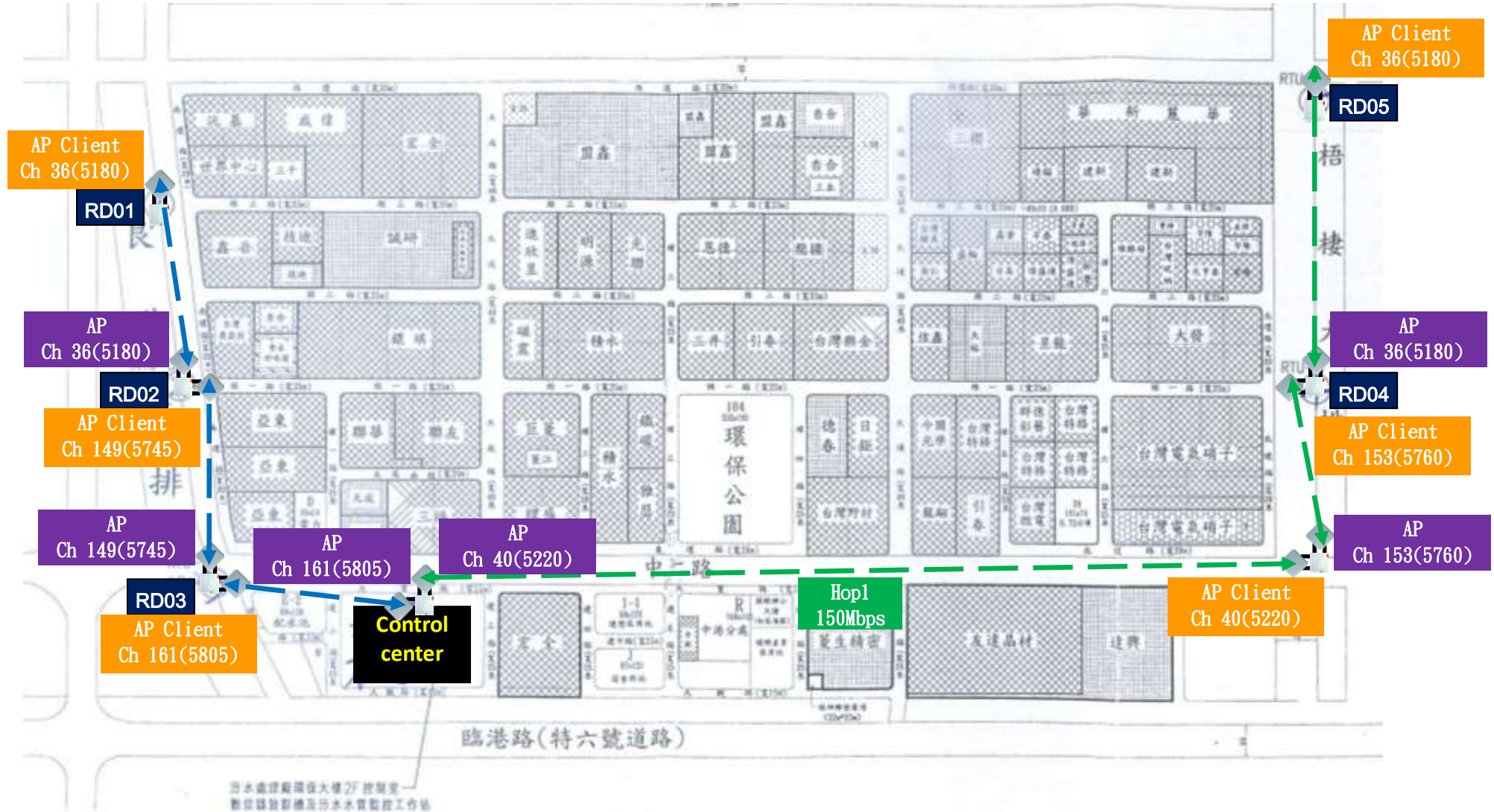


## 2、Outdoor WiFi MIMO wireless transmission backhaul system design.





### 3、Outdoor WiFi MIMO Wireless Transmit Operation Mode and Channel Frequency Design



## 4、Outdoor WiFi MIMO wireless transmit system in wireless signal and evaluation of rain attenuation

Assessment of rain loss: 2Km distance, point-to-point wireless signal online 200 mm rain rainfall affecting approximately 2dBm of signal attenuation.

WiFi 2.4 ~ 2.485GHz & 5.25 ~ 5.85GHz 電波大雨衰減(Rain Attenuation)估算 單位 : dB

PtP	2.4GHz ~ 2.485GHz Frequency									5GHz ~ 5.85GHz Frequency							
	Rainfall Rate	100mm/hr			200mm/hr			300mm/hr			100mm/hr		200mm/hr		300		
Km	EPD/Km	2.4	2.45	2.485	2.4	2.45	2.485	2.4	2.45	2.485	5.25	5.5	5.85	5.25	5.5	5.85	5.25
1	0.64	0.06	0.07	0.07	0.15	0.16	0.16	0.24	0.26	0.27	0.41	0.46	0.53	0.96	1.07	1.23	1.57
2	1.25	0.12	0.13	0.13	0.29	0.3	0.31	0.48	0.5	0.52	0.8	0.89	1.03	1.86	2.07	2.39	3.05
3	1.81	0.18	0.19	0.19	0.42	0.44	0.46	0.69	0.73	0.75	1.17	1.3	1.5	2.71	3.02	3.48	4.44
4	2.36	0.23	0.24	0.25	0.54	0.57	0.59	0.9	0.95	0.98	1.52	1.69	1.95	3.52	3.92	4.52	5.77
5	2.88	0.28	0.3	0.31	0.66	0.7	0.72	1.1	1.15	1.19	1.85	2.06	2.38	4.29	4.78	5.5	7.02

Wireless signal evaluation: 2Km distance, point-to-point wireless signals about online -56dBm, wireless transmission up to 150Mbps.

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Air Space Loss =  $-92.4\text{dBm} - 20 \cdot \text{LOG}(\text{Frequency}) - 20 \cdot \text{LOG}(\text{Distance})$

Point to Point Receive Sensitivity (RSSI) Suggest

- for Wireless Backbone System : -50dBm < RSSI < -30dBm
- for Wireless Surveillance System : -55dBm < RSSI < -35dBm
- for Wireless Surf Internet Coverage System : -60dBm < RSSI < -40dBm

Note: Receive Sensitivity (RSSI) don't under > -20dBm, It will have effect of Hearing Loss

TX Antenna Gain  
dBi

RF Cable Loss  
<= 1 dB

RF Output Power  
dBm

RX Antenna Gain  
dBi

RF Cable Loss  
<= 1 dB

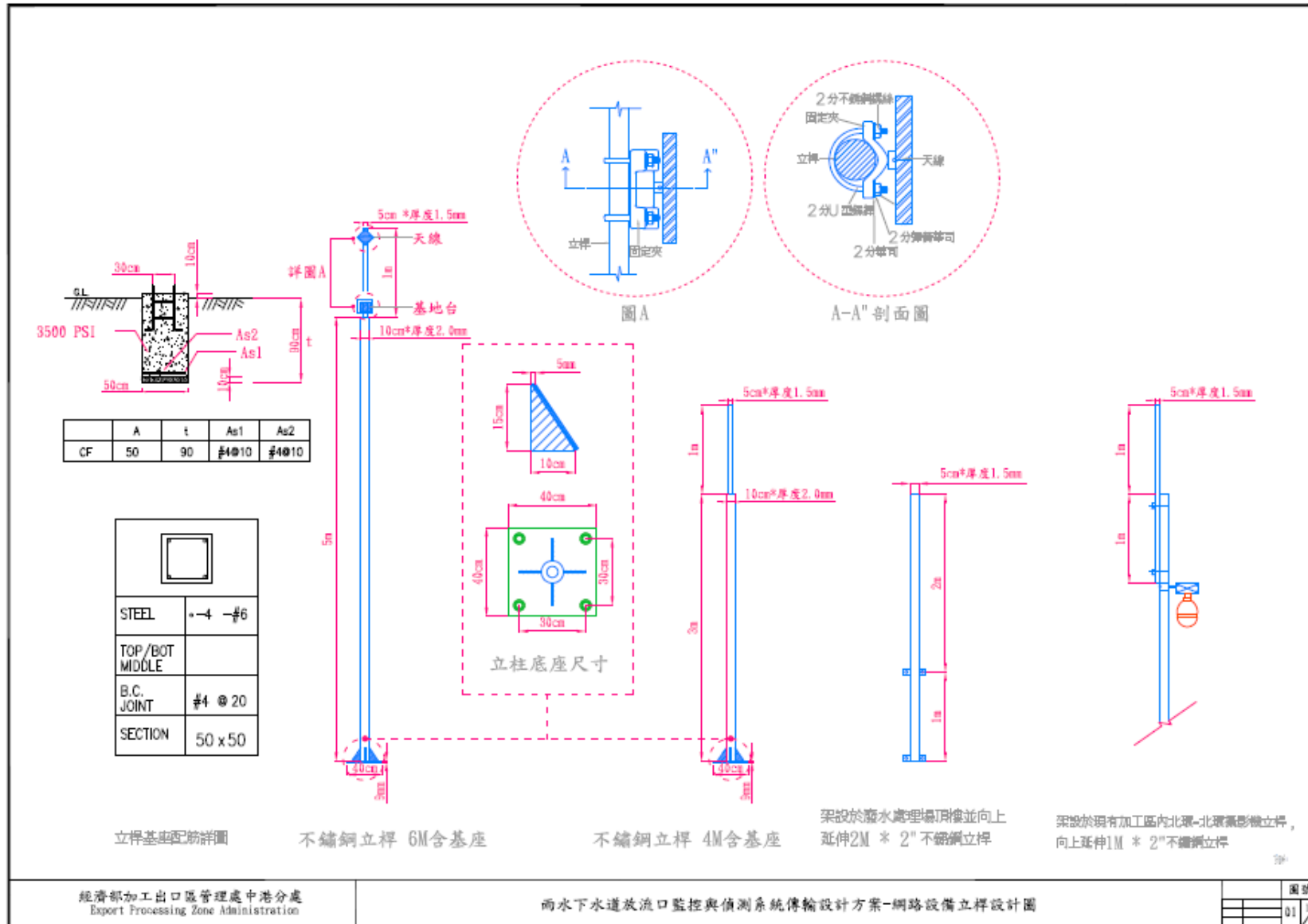
RF Receive Sensitivity  
dBm

### 無線鏈路訊號值(dBm)計算 (Wireless PtP Signal Sensertivity 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	Frequency 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)	21	1	20	92.4	5.85	2	2	0	20	1
計算結果 (Calculation results)	<b>-56.76</b>									

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) 功率損耗表(Output Power) 覆蓋高度(Coverage High & Angle) 三角函數(T)

## 5、 The project real design and deployment images. (Pre-cast base construction photos)





RD-03	RD-04
	
	
<p align="center"><b>Pre-cast base construction photos</b></p>	<p align="center"><b>Completed photos</b></p>


RD-05



AP01-02






**After the construction is complete, continuous experience- SOUDELOR had 210KM/H Super wind velocity of the Typhoon and the DUJUAN Typhoon 185KM/H the actual harsh environment, wireless transmission systems during the typhoon, all normal operations.**

Setup photos		Setup Place : RD-01	
<b>Before the setup</b>		<b>Construction-base</b>	
			
<b>Setup – Install AP</b>		<b>After the setup</b>	
			







Setup photos		Setup Place : RD-02	
<b>Before the setup</b>		<b>Construction-base</b>	
			
<b>Setup – Install AP</b>		<b>After the setup</b>	
			





Setup photos		Setup Place : RD-03	
<b>Before the setup</b>		<b>Construction-base</b>	
			
<b>Setup – Install AP</b>		<b>After the setup</b>	
			

Setup photos		Setup Place : RD-04	
<b>Before the setup</b>	<b>Construction-base</b>		
			
<b>Setup – Install AP</b>	<b>After the setup</b>		
			




Setup photos		Setup Place : RD-05	
<b>Before the setup</b>		<b>Construction-base</b>	
			
<b>Setup – Install AP</b>		<b>After the setup</b>	
			

## 6. Setup Devices List

No.	Device Name	Device Model	Main SPEC	Quantity	Remark
1	Outdoor WiFi MIMO AP 	APM-101RH (1 Module)	<ol style="list-style-type: none"> <li>One MIMO 2*2 RF Module (802.11a/g/n)</li> <li>System Operation Mode: Bridge</li> <li>Output Power : 23dBm (Max)</li> <li>Main features: Multiple Hops</li> <li>Bandwidth Throughput : 160Mbps (@40MHz)</li> <li>&gt;= 4Hops Throughput 120Mbps</li> </ol>	2	
2	Outdoor WiFi MIMO AP 	APM-102RH (2 Modules)	<ol style="list-style-type: none"> <li>Two MIMO 2*2 RF Module (802.11a/g/n)</li> <li>System Operation Mode: Bridge</li> <li>Output Power : 23dBm (Max)</li> <li>Main features: Multiple Hops</li> <li>Bandwidth Throughput : 320Mbps (@40MHz)</li> <li>&gt;= 4Hops Throughput 120Mbps</li> </ol>	5	
3	5GHz 20dBi Dual Linear Panel Antenna 	IOP-PANFO-5M2001010	<ol style="list-style-type: none"> <li>Frequency: 5150 - 5875 MHz</li> <li>Gain: 20dBi</li> <li>VSWR: 2:1</li> <li>Polarization : Dual Linear +- 45°</li> <li>N-Type Jack * 2</li> </ol>	12	Support 5Km Point to Point Link will have 300Mbps data rate and 150Mbps Throughput
4	Antenna RF Cable 	IOP-RFCFD-400150NMR	<ol style="list-style-type: none"> <li>Connector: N-type Plug to N-type Plug</li> <li>Cable Loss: &lt;48dB/100m @5800MHz</li> <li>Temp: - 40 ~ + 85°C</li> <li>Length: 1.5M</li> </ol>	24	



5	RF Connector Rainproof Tape 	IOP-RMTOC-173830510B	1. Thickness: 1.7mm ± 0.5mm 2. Elongation: 1000% 3. Adhesion: Detachment < 2cm 4. Breaking Strength: >2kg 5. Water Absorption: <0.2%	6	Special Customize Waterproof Tape
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