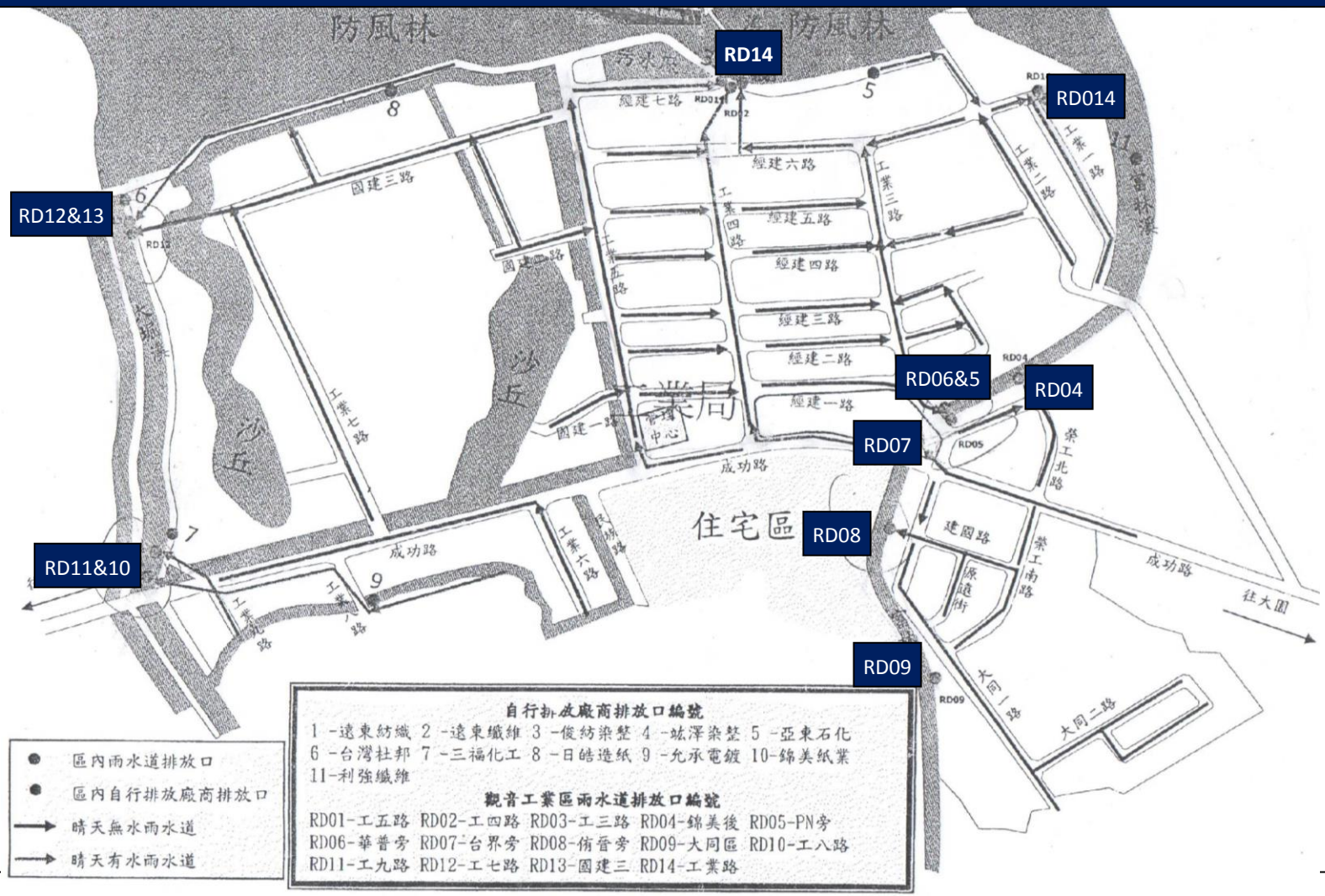
Outdoor WiFi MIMO Large-bandwidth Wireless Transmission System

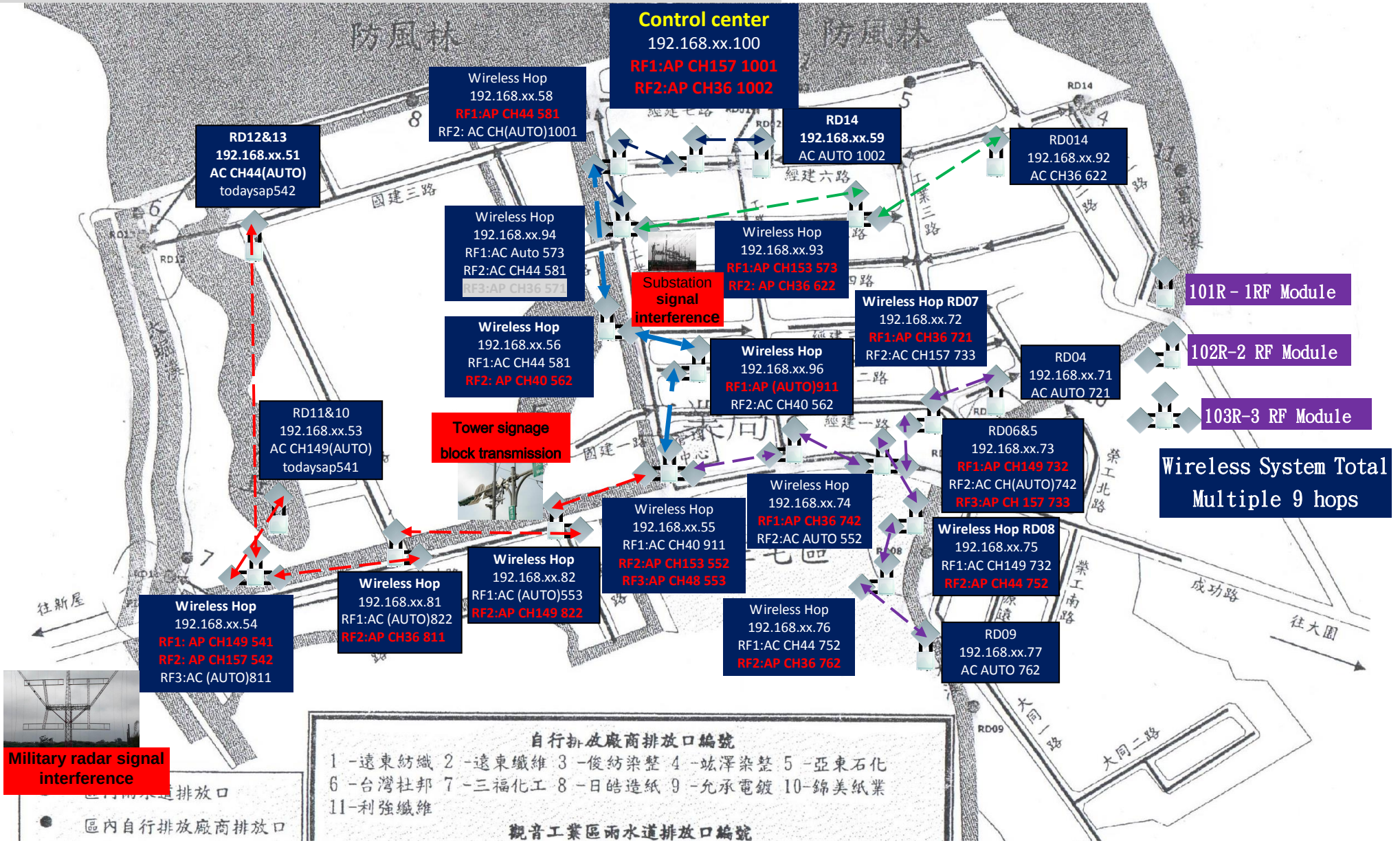
At the sewage treatment plant surveillance and detection system transmit design.

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

Implementation of the project company: Today's instrument company corp. **http://www.todays.com.tw/**



2. Outdoor WiFi MIMO wireless transmission system design.



3. Pictures of construction.











成功







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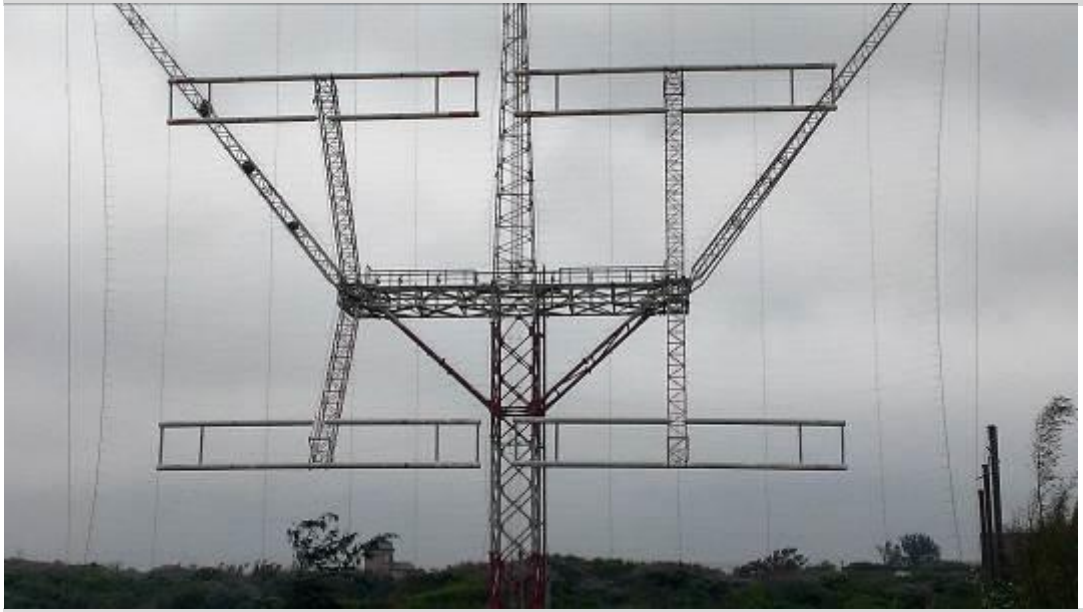
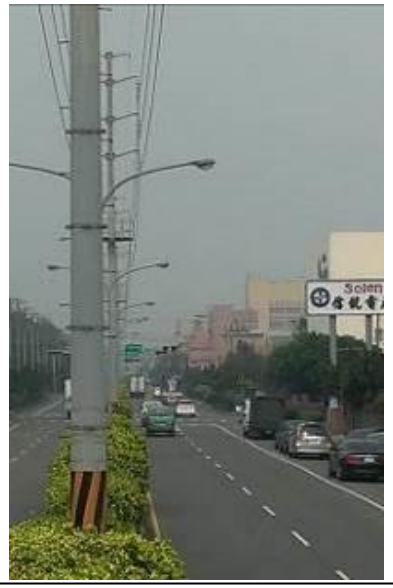
4. Radar of Military covers the signal and interference. (Resolved)

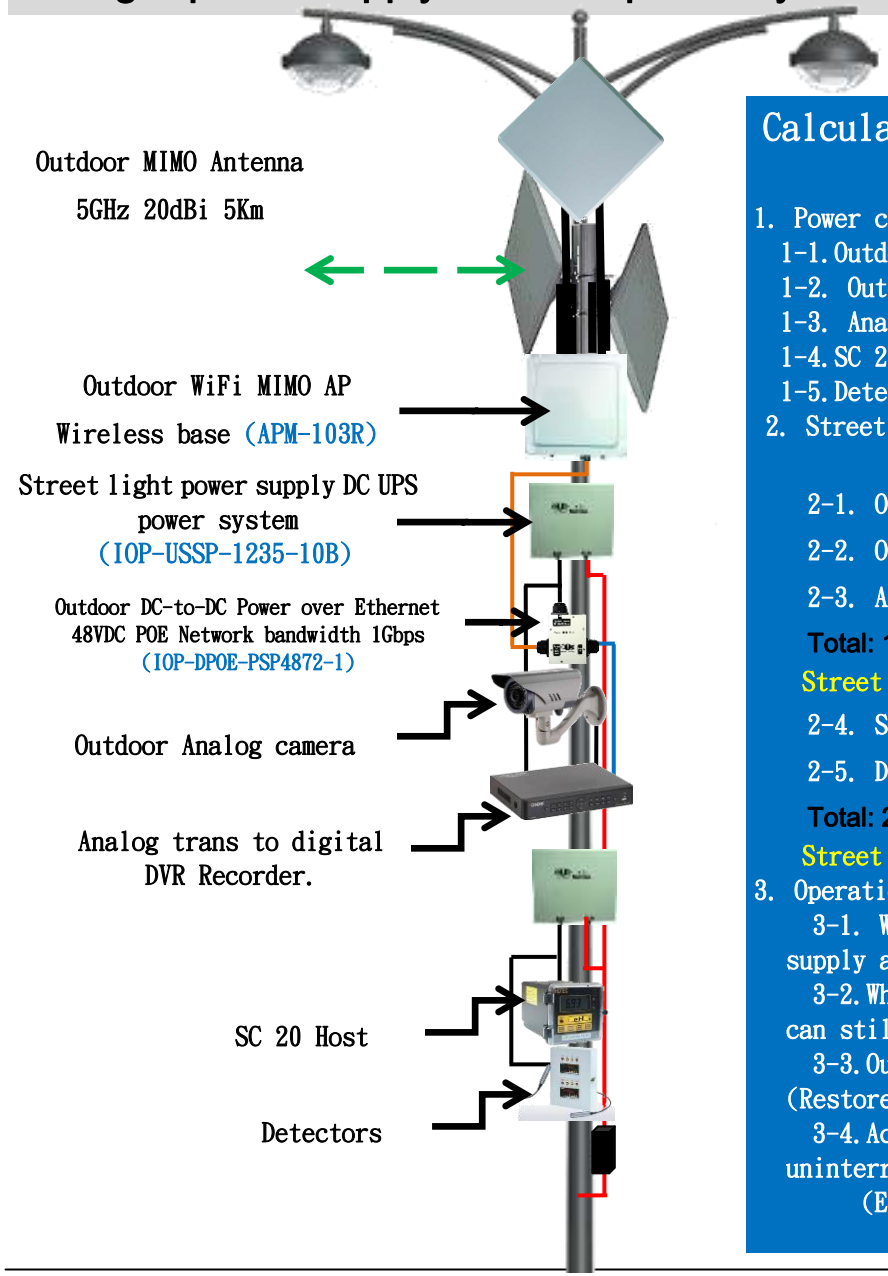


Substation Signal interference, Towers and Signs blocking transmission (Resolved)



5. Program running after project complete.

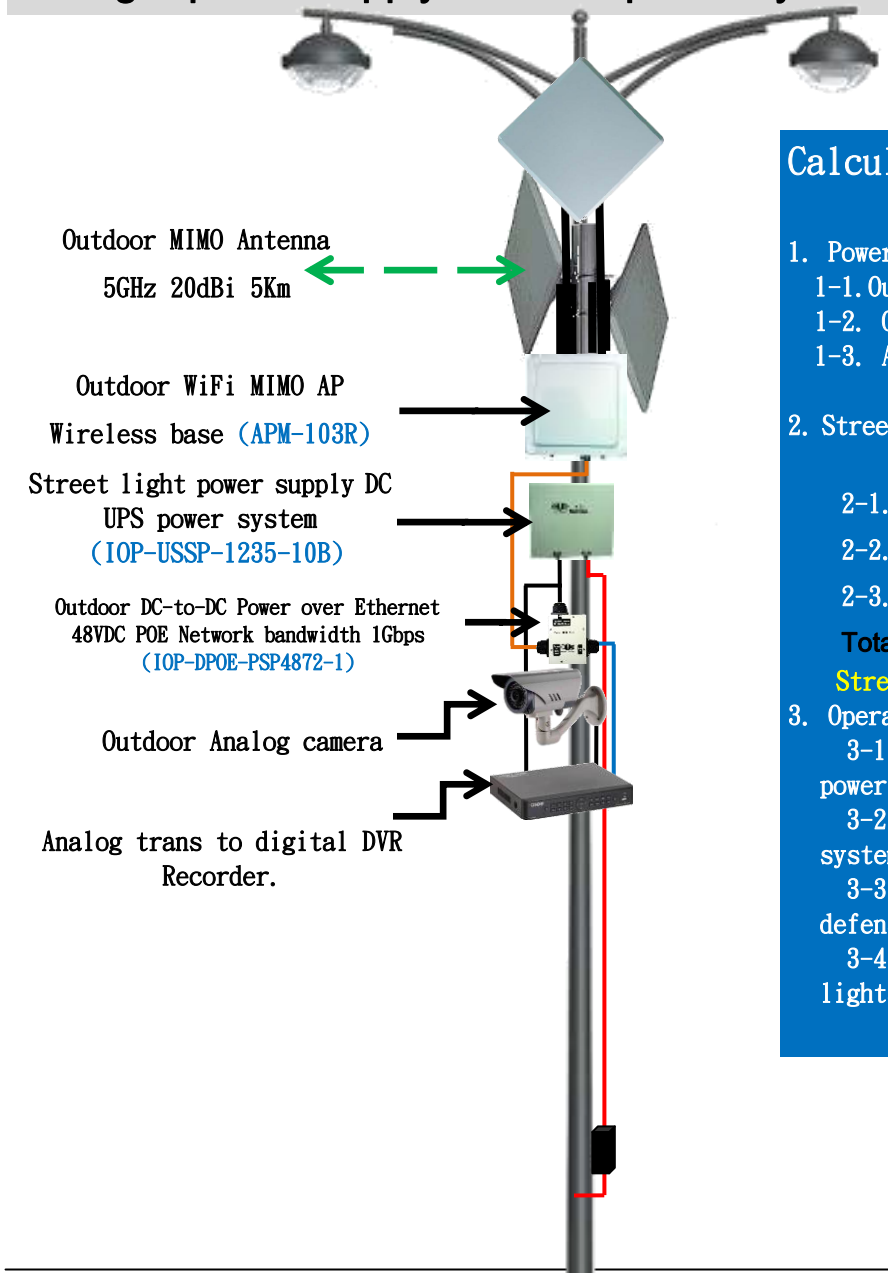
6-1.Light-power supply DC UPS power system design.(All Devices)



Calculation of light power long distance wireless transmission and surveillance system planning.

1. Power consumption:
   1-1. Outdoor wireless AP: APM-103R- 10W/H (include 12VDC to 48VDC PoE: 1W/H)
   1-2. Outdoor Analog camera: @Day time 3W/H, @Night 6W/H, Average 5W/H
   1-3. Analog trans to digital DVR Recorder: 12W/H
   1-4. SC 200 Host: 18W/H
   1-5. Detectors: 8W/H
2. Street light power and have uninterruptible power in 4 hours out of electricity, wireless surveillance system can still working.
   2-1. Outdoor wireless devices calculates (include DC PoE): 10W/H*16H=160W
   2-2. Outdoor infrared analog camera calculates: 5W/H*16H=80W
   2-3. Analog trans to digital DVR Recorder calculates: 12W/H*16H=192W
   Total: 160W+80W+192W=432W/H, 432W/H / 12.8V = 33.7Ah
   Street light recommend DC UPS: IOP-USSP-1235-10B 445 WH (34.8Ah @ 12.8V)
   2-4. SC 200 devices calculates: 18W/H*16H=288W
   2-5. Detect devices calculates: 8W/H*16H=128W
   Total: 288W+128W=416W/H, 416W/H / 12.8V = 32.5Ah
   Street light recommend DC UPS: IOP-USSP-1235-10B 445 WH (34.8Ah @ 12.8V)
3. Operation of the system description:
   3-1. Wireless monitoring system used Uninterruptible power at the day time, when the power supply at night, charging and offering the power at the same time 。
   3-2. When street light power due to temporary power cut at night, wireless monitoring system can still working at least 4 hours up.
   3-3. Outdoor uninterruptible power system including - Stable voltage, Wave impact defense (Restore power when the lighting hit)。
   3-4. According to the high low temperature environment test results, after street lights uninterruptible power use 1700 times charge and discharge.
   (Equal to more than 5 years), The power of battery can still have 95% capacity。

6-2.Light-power supply DC UPS power system design.(Camera+ DVR Recorder+ Outdoor wireless)



Calculation of light power long distance wireless transmission and surveillance system planning.

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   1-2. Outdoor Analog camera: @Day time 3W/H, @Night 6W/H, Average 5W/H
   1-3. Analog trans to digital DVR Recorder: 12W/H

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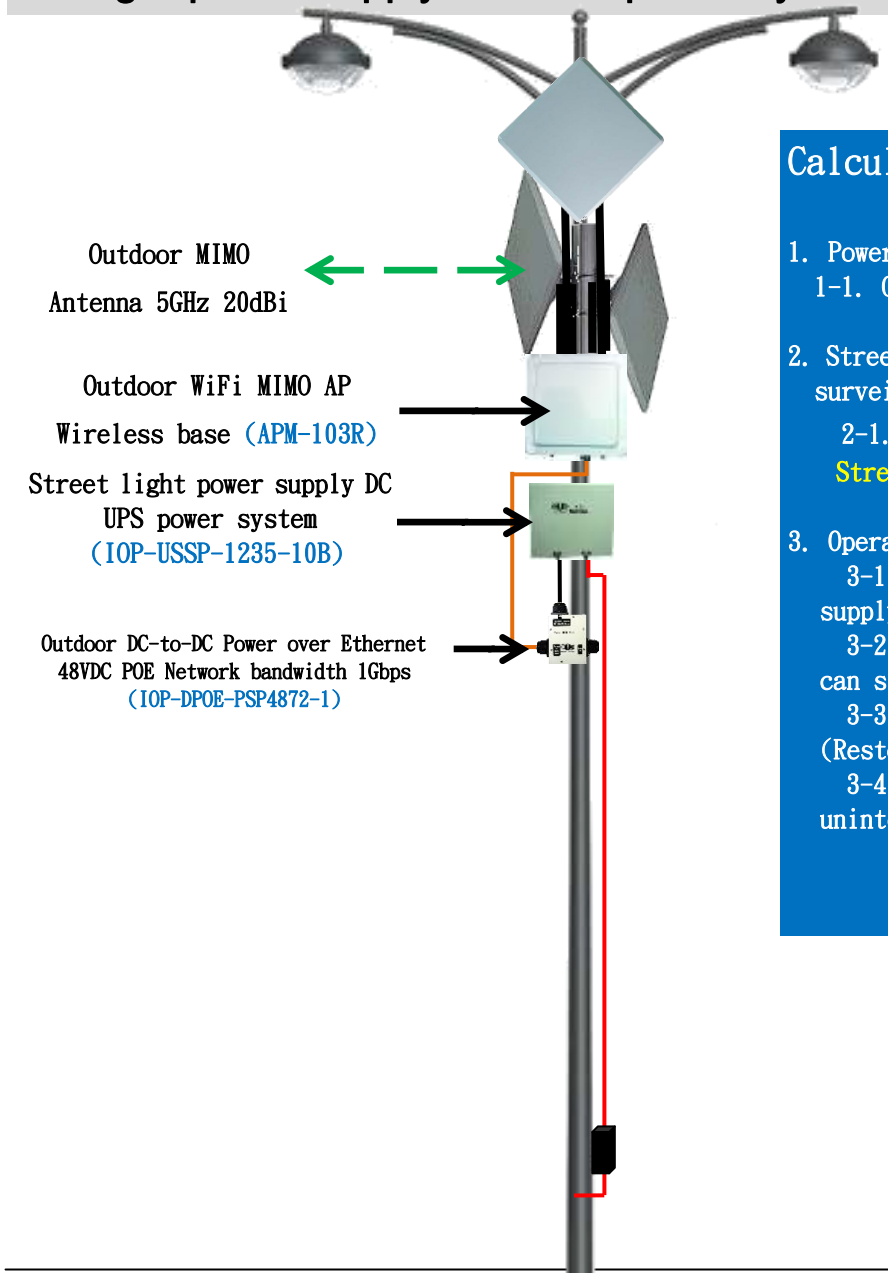
6-3.Light-power supply DC UPS power system design. (Outdoor wireless device)



Calculation of light power long distance wireless transmission and surveillance system planning.

1. Power consumption:
   1-1. Outdoor wireless AP: APM-103R- 10W/H (include 12VDC to 48VDC PoE: 1W/H)

2. Street light power and have uninterruptible power in 4 hours out of electricity, wireless surveillance system can still working.
   2-1. Outdoor wireless devices calculates (include DC PoE): **10W/H*16H=160W**
   Street light recommend DC UPS: IOP-USSP-1235-10B 445 WH (34.8Ah @ 12.8V)

3. Operation of the system description:
   3-1. Wireless monitoring system used Uninterruptible power at the day time, when the power supply at night, charging and offering the power at the same time 。
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   3-4. According to the high low temperature environment test results, after street lights uninterruptible power use 1700 times charge and discharge.
   (Equal to more than 5 years), The power of battery can still have 95% capacity。

7. Design of power supply

8. Streetlamp Model DC UPS Installation Instruction

8-1. Streetlamp Power

Output
93VAC/3A
220VAC/1.2A

B

A

Sodium Lamp Ballast (SLB)
Input: 220VAC / 1.3A, 280W (Max)
Output: 3A (Max)

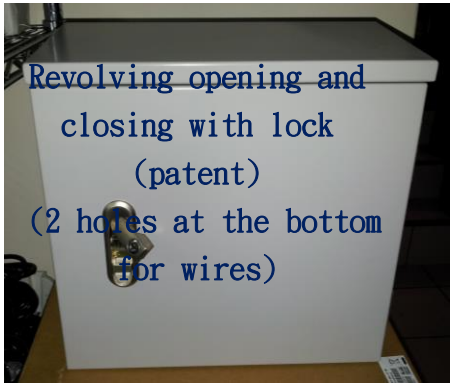
Power Company to streetlamp
(Streetlamp power supply controller)
Input 220~240VAC

Streetlamp Power Obtaining Instruction:

Obtaining from A(before SLB and after electric meter):Use『No-Fuse Breaker』or『socket』or『cabling connecting』. The disadvantage is to receive the surges when power is on. And the advantage is no need to go through SLB and is able to protect SBL from surges.

Obtaining from B(after SLB):Need to consider if the power supply from『SLB』is enough. Use Use『No-Fuse Breaker』or『socket』or『cabling connecting』. The disadvantage is unable to protect SLB and need to think about the power supply. The advantage is that the power via SLB is much more stable.

8-2.Distribution Box Installation



Obtaining from A
Input 220~240VAC/0.2A

Output
93VAC/3A
220VAC/1.2A

B

Sodium Lamp Ballast
Input: 220VAC/1.3A, 280W (Max)
Output: 3A (Max)

A

Power Company to streetlamp
(Streetlamp power supply controller)
Input 220~240VAC

8-3.Streetlamp Model DC UPS Power System Installation

Outdoor MIMO Antenna
5GHz 20dBi 5Km

Outdoor WiFi MIMO AP
(APM-101R)

Output
93VAC/3A
220VAC/1.2A

On-line Type
Streetlamp Model
DC UPS Power System
(IOP-USSP-1212-07A)

Outdoor DC to DC PoE Converter
48VDC POE 1Gbps
(IOP-DPOE-PSP4872-1)

Power over SLB
Input: 220VAC/0.2A

B

Sodium Lamp Ballast
Input: 220VAC/1.3A,280W (Max)
Output: 3A (Max)

Power Company to streetlamp
(Streetlamp power supply controller)
Input 220~240VAC

100-240VAC

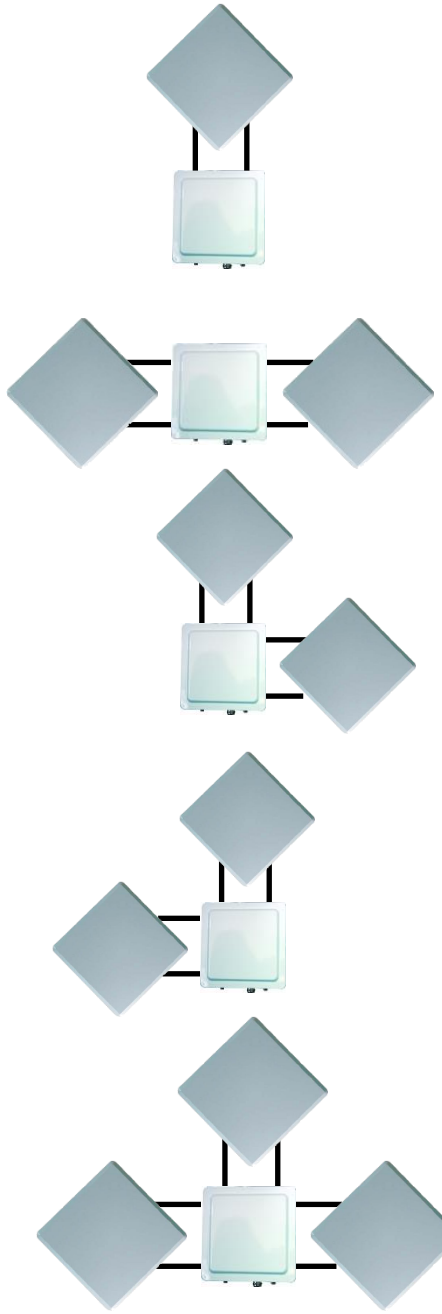
9. Installation Devices and Quantity

No.	Device Name	Device Model	Main SPEC	Quantity	Remark
1	Wireless WiFi MIMO AP -(Camera Side)	APM-101R (1 Module) 	1. One MIMO 2*2 RF Module (802.11a/g/n) 2. System Operation Mode: Bridge 3. Output Power : 21dBm (Max) 4. Multiple Hops 5. Bandwidth Throughput : 160Mbps (@40MHz) 6. >= 4Hops Throughput 120Mbps	6	
2	Wireless WiFi MIMO AP -(Bridge Hops Side) -(Control Center Side)	APM-102R (2 Modules) 	1. Two MIMO 2*2 RF Module (802.11a/g/n) 2. System Operation Mode: Bridge 3. Output Power : 21dBm (Max) 4. Multiple Hops 5. Bandwidth Throughput : 320Mbps (@40MHz) 6. >= 4Hops Throughput 120Mbps	11	
3	Wireless WiFi MIMO AP -(Bridge Hops Side)	APM-103R (3 Modules) 	1. Three MIMO 2*2 RF Module (802.11a/g/n) 2. System Operation Mode: Bridge 3. Output Power : 21dBm (Max) 4. Multiple Hops 5. Bandwidth Throughput : 320Mbps (@40MHz) 6. >= 4Hops Throughput 120Mbps	4	
3	Outdoor WiFi MIMO 5GHz 20dBi Dual Linear Panel Antenna	IOP-PANFO-5M2001010 	1.Frequence:5150 - 5875 MHz 2.Gain: 20dBi 3.VSWR: 2:1 4.Polarization : Dual Linear +- 45° 5.N-Type Jack * 2	40	

4	Antenna RF Cable	IOP-RFCFD-400150NMR 	1. Connector: N-type Plug to N-type Plug 2. Cable Loss: <48dB/100m @5800MHz 3. Temp: - 40 ~ + 85°C 4. Length: 1.5M	80	
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%	28	

10. Device Model and SPEC

	Model	APM-101R (H)	APM-102R (H)	APM-103R (H)
Product Images	Rear Side			
	Top of Antenna Connector			
	Below of Antenna Connector			
	Front Side			



Product Specifications

Hardware Specification

Key Components	
Main Processor	Atheros AR7161(680Mhz)
Wireless Chipset	Atheros AR9220 based miniPCI module, Up to three modules
Switch Controller	Atheros AR8035 / Atheros AR8021
Flash Memory	16MBytes
SDRAM	64MBytes(Up to 128MBytes)
Console	UART x 1(PCBA onboard)

Interfaces	
Wireless	Up to three 2x2 MIMO radios, mini-PCI version 1.0 type 3A Frequency ranges : a. USA : 2.400 ~ 2.483 GHz, 5.15 ~ 5.35 GHz, 5.5 ~ 5.7 GHz, 5.725 ~ 5.825 GHz b. Europe: 2.400 ~ 2.483 GHz, 5.15 ~ 5.35 GHz, 5.47 ~ 5.725 GHz

c. Japan: 2.400 ~ 2.497 GHz, 5.15 ~ 5.35 GHz, 5.47 ~ 5.725 GHz

d. China: 2.400 ~ 2.483 GHz, 5.725 ~5.85 GHz

RF output power of DNMA-92 :

a. IEEE802.11a

1. 21dBm@6M(all) 17dBm@54M(5180MHz) 16dBm@54M(5825MHz)

b. IEEE802.11b

1. 20dBm@1M(2412MHz) 19dBm@1M(2484MHz) 21dBm@11M(all)

c. IEEE802.11g

1. 23dBm@6M(all) 19dBm@54M(all)

d. IEEE802.11a/n HT20

1. 21dBm@MCS0/8(5180MHz) 19dBm@MCS0/8(5825MHz)

2. 16dBm@MCS7/15(5180MHz) 14dBm@MCS7/15(5825MHz)

e. IEEE802.11a/n HT40

1. 19dBm@MCS0/8(5190MHz) 18dBm@MCS0/8(5795MHz) 13dBm@MCS7/15(all)

f. IEEE802.11g/n HT20

1. 21dBm@MCS0/8(all) 17dBm@MCS7/15(all)

g. IEEE802.11g/n HT40

1. 21dBm@MCS0/8(2422MHz) 20dBm@MCS0/8(2462MHz)

	2. 16dBm@MCS7/15(all) Receive Sensitivity of DNMA-92 : a. IEEE802.11a 1.-82dBm@6M, 1Rx -95/-91dBm@6M, 2Rx 2. -65dBm@54M, 1Rx -79/-75dBm@54M, 2Rx b. IEEE802.11b 1.-82dBm@1M, 1Rx -95/-91dBm@1M, 2Rx 2. -76dBm@11M, 1Rx -91/-87dBm@11M, 2Rx c. IEEE802.11g 1.-82dBm@6M, 1Rx -95/-91dBm@6M, 2Rx 2. -65dBm@54M, 1Rx -80/-76dBm@54M, 2Rx d. IEEE802.11a/n HT20 1.-82dBm@MCS0, 1Rx -95/-91dBm@MCS0, 2Rx 2. -64dBm@MCS7, 1Rx -77/-73dBm@MCS7, 2Rx e. IEEE802.11a/n HT40 1.-79dBm@MCS0, 1Rx -91/-87dBm@MCS0, 2Rx 2. -61dBm@MCS7, 1Rx -74/-70dBm@MCS7, 2Rx f. IEEE802.11g/n HT20 1.-82dBm@MCS0, 1Rx -95/-91dBm@MCS0, 2Rx 2. -64dBm@MCS7, 1Rx -77/-73dBm@MCS7, 2Rx g. IEEE802.11g/n HT40 1.-79dBm@MCS0, 1Rx -90/-86dBm@MCS0, 2Rx 2. -61dBm@MCS7, 1Rx -74/-71dBm@MCS7, 2Rx
Ethernet	10/100/1000 Base-TX MDI/MDIX RJ-45 x 1 Compliant with :

	a. IEEE802.3 / 802.3u / 802.3at Hardware based 10/100/1000, full/half, flow control auto negotiation
Connector	101R 2 x N-type(1 radio) 102R 4 x N-type(2 radios) 103R 6 x N-type(3 radios)
Power Requirement	48V 1A PoE Support Gigabit Ethernet Link
Watch Dog	Hardware Watch Dog

Physical	
Dimensions	220 x 220 x 77 mm
Weight	101R/101RH—1.8Kg 102R/102RH—1.9Kg 103R/103RH—2.0Kg 2.0kg (3.7kg mount kit included)

Environmental	
Temperature Range	-20℃~70℃

Humidity	0% ~ 95% Non-condensing
Storage	-40~ 85℃
Dusty & Waterproof	Outdoor IP67 rated

Regulatory	
Certification	FCC, CE Processing (will announce in 2012/1)
Safety	Processing

Software Specification

System Operation	
Bridge Mode	Layer 2 Switching Learning Technology
	Store-and-Forward
	Spanning Tree Protocol - IEEE 802.1d STP / IEEE 802.1w RSTP / IEEE 802.1s MSTP
	Static IP / Dynamic IP
	DHCP server / client

	Multicast / Broadcast Storm Limitation
	IEEE 802.1q Tag VLAN
	IEEE 802.1p VLAN Priority Based QoS

Network Interface	
Wireless	IEEE 802.11 a/b/g/n 2.4GHz / 5GHz Dual Band Radio
	2 x 2 MIMO Technology
	Single Radio / Dual Radios / Triple Radios
	AP mode / Client mode / WDS mode
	IEEE 802.11h DFS
	WMM QoS
	Channel / Tx Power / Data Rate / Max Distance Adjustable
	Advanced Wireless Parameters Adjustable

	Multi-SSIDs / VLAN tags mapping(Up to 16 x ESSIDs for each radio)
	Wireless Site Survey
	Node Information
	Concurrent Connected Node Limitation
	Client User Isolation
Wire	48V 1A PoE Support Gigabit Ethernet Speed
	Ethernet Link Speed Configurable
	10/100/1000 Base-TX MDI/MDIX RJ-45

Performance		
Wireless		Up to 180Mbps for one radio to Ethernet
To	TCP	Up to 320Mbps for two radios to Ethernet
Wire		Up to 320Mbps for three radios to Ethernet

	UDP	Up to 240Mbps for one radio to Ethernet
		Up to 350Mbps for two radios to Ethernet
		Up to 350Mbps for three radios to Ethernet
	PPS	>= 20,000@short packet for one radio to Ethernet
		>= 28,000@short packet for two radios to Ethernet
		>= 28,000@short packet for three radios to Ethernet
	Latency	< 5ms
Multiple Hops	2 hops	Up to 160Mbps
	3 hops	Up to 150Mbps
	>= 4hops	Up to 140Mbps
	PPS	>= 20,000@short packet at multiple hops
	Latency	< 10ms

Security
Hide SSID(turn off ESSID broadcasting)
MAC Address ACL
WEP 64/128/152 bits
IEEE 802.1x EAP-MD5 / EAP-TLS / EAP-TTLS
WPA / WPA2 PSK / EAP with TKIP / CCMP AES based Encryption

Management
HTTP(s) WEB GUI
Telnet
SSH
Console(optional interface)
CLI commands
SNMP v2c/v3, standard / private MIBs

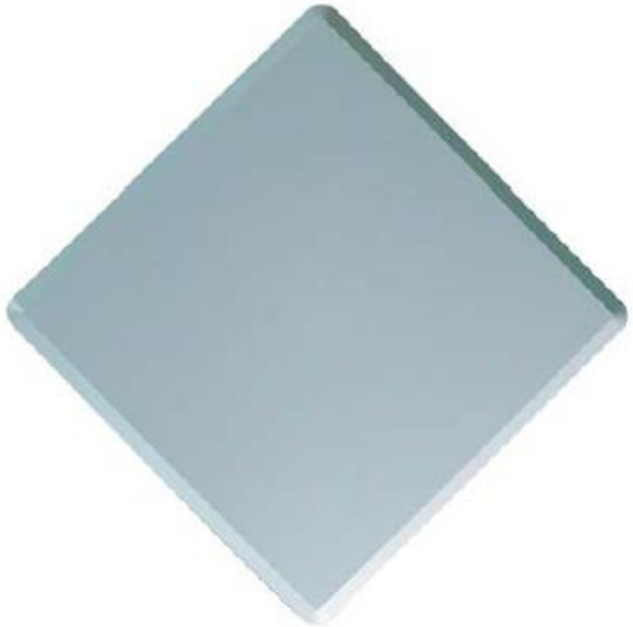
Syslog
Management VLAN Tag
NTP Client
Firmware upgrade / downgrade
Dual Images
Dual Configuration files / Factory Default
Multiple Level Management

Advanced Technology	
Multiple Hopping	Up to 10 hops with more than 120Mbps throughput
	Configurable Max. Hop Counts(default 20 hops)

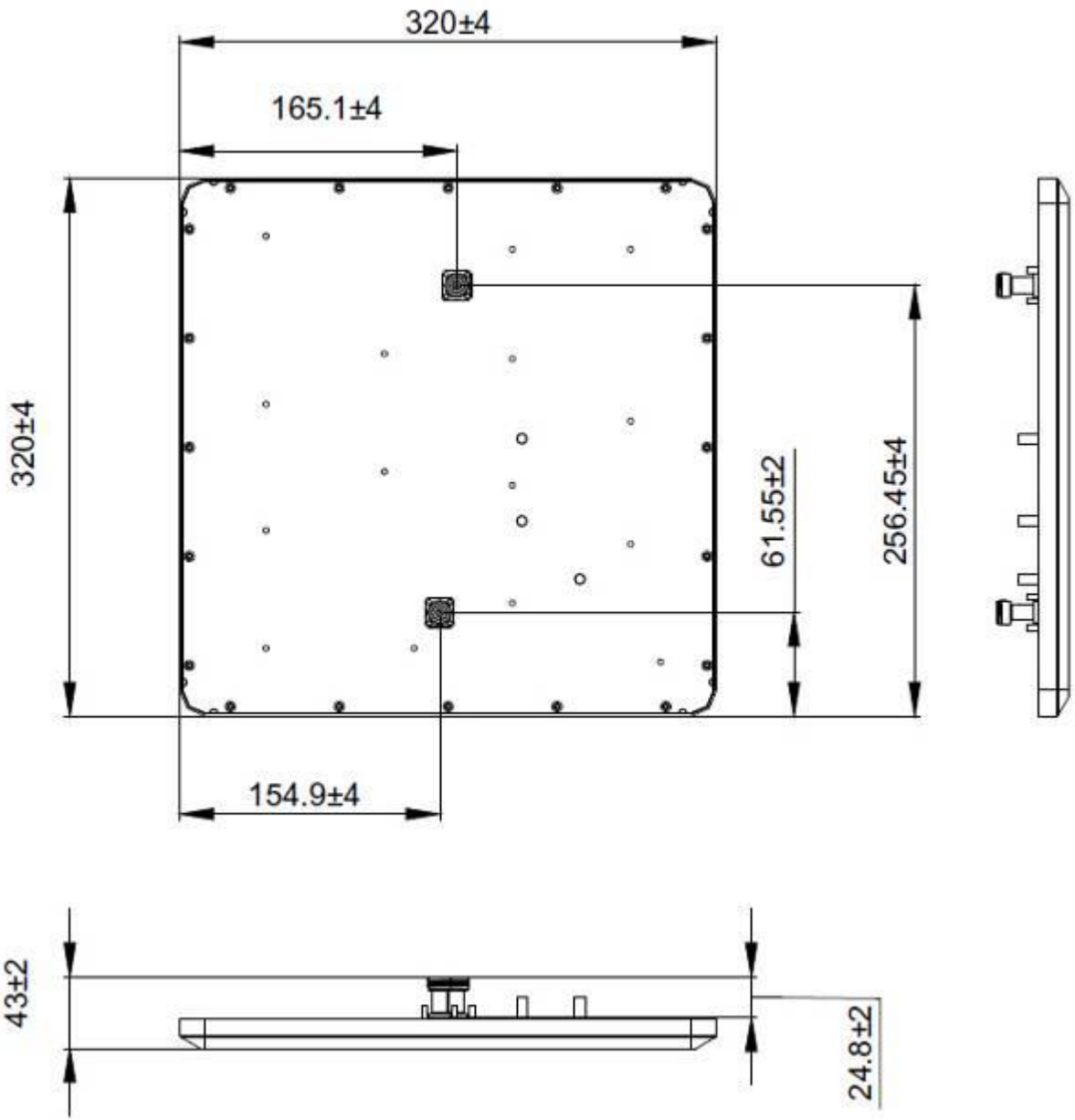
IOP-PANFO-5M2001010

5GHz 20dBi Dual Polarization MIMO Panel Antenna

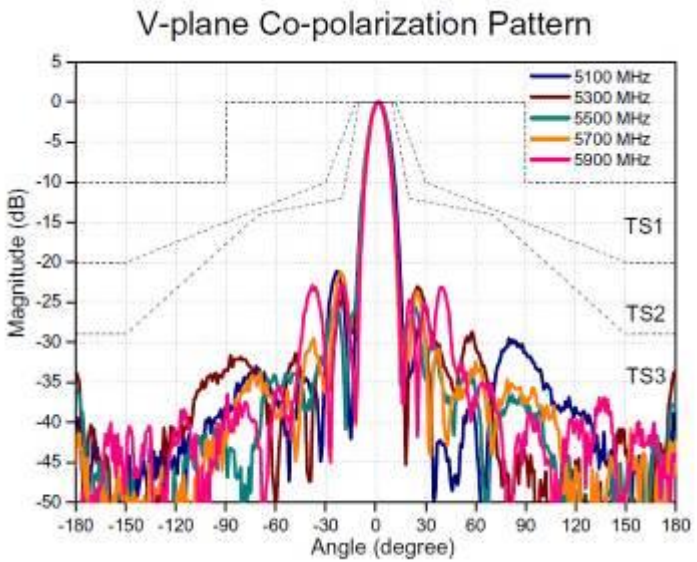
Electrical Specification	
Frequency range	5150 - 5875 MHz
Gain	20 dBi
VSWR	2 : 1 Max.
Polarization	Dual Linear, +- 45°
HPBW / Horizontal	10°
HPBW / Vertical	10°
Standard compliance	N / A
Front to back ratio	-30dB (Max)
Isolation	24dB (Min)
Power handing	6W (cw)

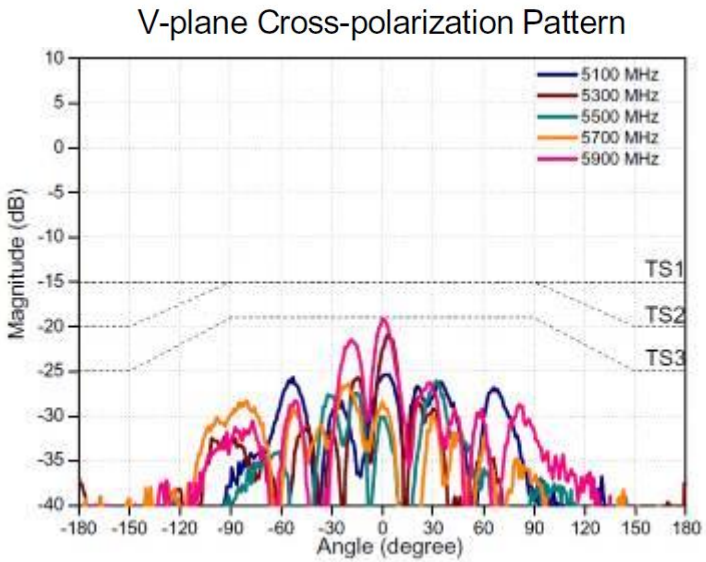


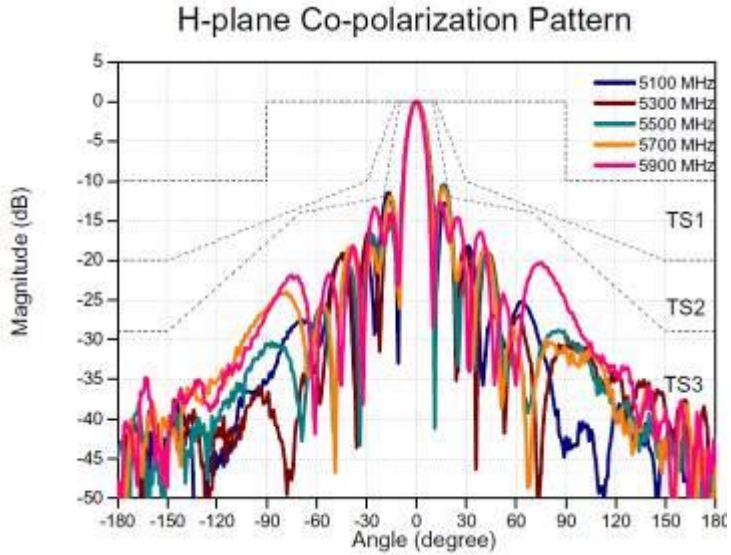
Impedance	50 Ohms
Connector	N Jack × 2
Environmental & Mechanical Characteristics	
Survival wind speed	216Km/hr
Temperature	-40℃ to +80℃
Humidity	95% @ 55℃
Lightning protection	DC ground
Radome color	Gray
Radome material	PC, UV resistant
Weight	1245g
Dimensions	320 × 320 × 20 mm
Waterproof	IP-67
Mounting kit	Pole mount & Wall mount

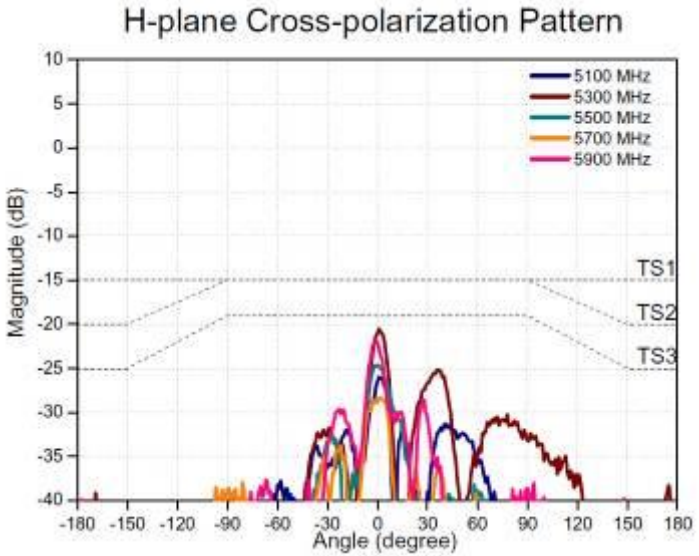


Port 1


V-plane Co-polarization Pattern
5100 MHz
5300 MHz
5500 MHz
5700 MHz
5900 MHz
TS1
TS2
TS3
Magnitude (dB)
Angle (degree)

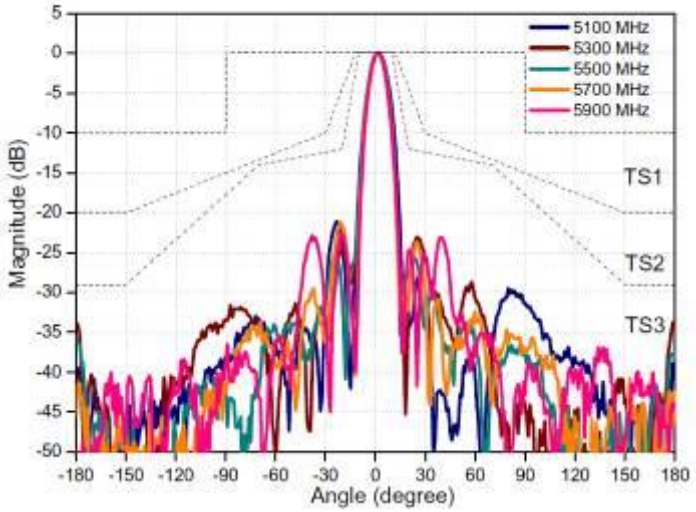

V-plane Cross-polarization Pattern
5100 MHz
5300 MHz
5500 MHz
5700 MHz
5900 MHz
TS1
TS2
TS3
Magnitude (dB)
Angle (degree)


H-plane Co-polarization Pattern
5100 MHz
5300 MHz
5500 MHz
5700 MHz
5900 MHz
TS1
TS2
TS3
Magnitude (dB)
Angle (degree)

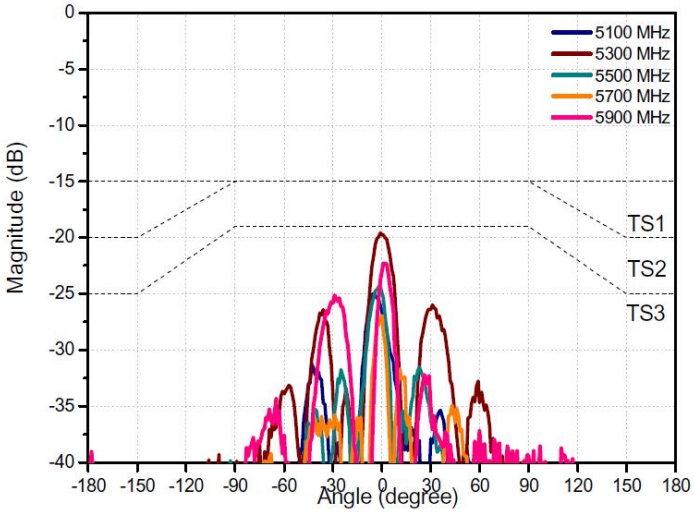

H-plane Cross-polarization Pattern
5100 MHz
5300 MHz
5500 MHz
5700 MHz
5900 MHz
TS1
TS2
TS3
Magnitude (dB)
Angle (degree)

Port 2

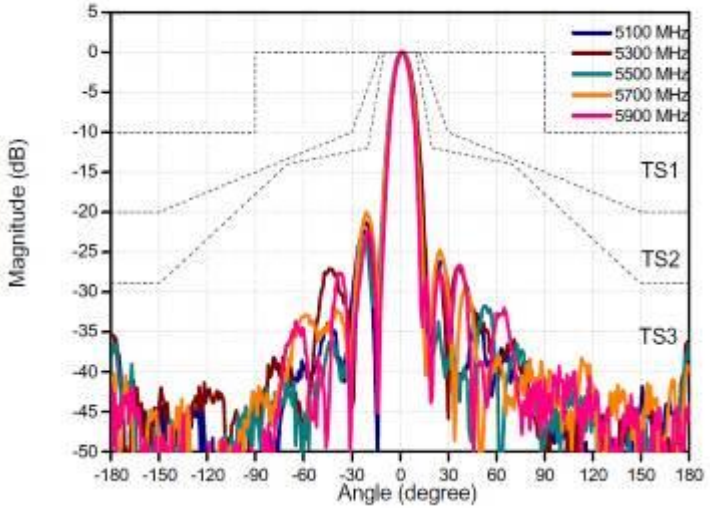
V-plane Co-polarization Pattern



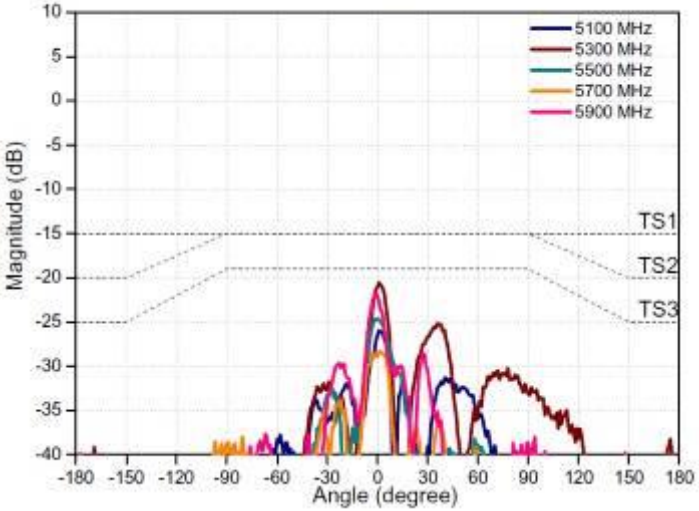
V-plane Cross-polarization Pattern



H-plane Co-polarization Pattern

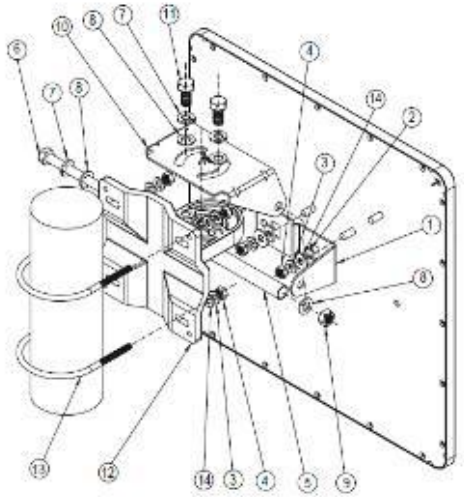


H-plane Cross-polarization Pattern

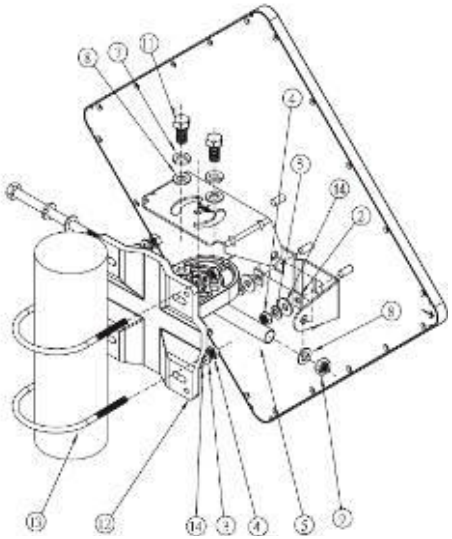


Pole Mount

Slant±45 Degree Polarization



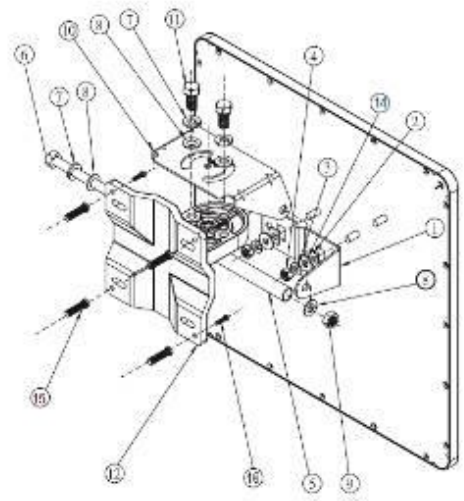
Hor. & Ver. Polarization



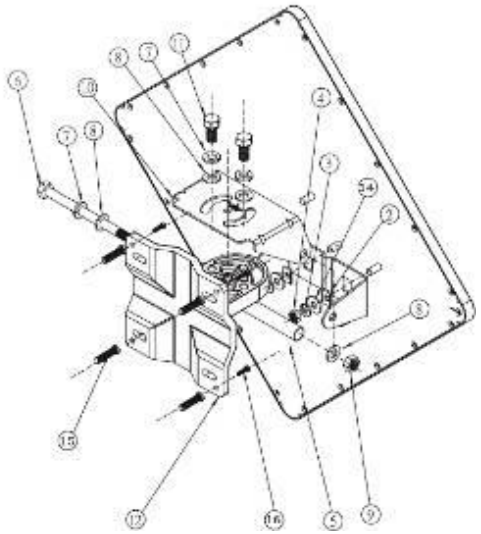
1.	M-Type breaket (L)	1Pcs
2.	Space Keeper	2Pcs
3.	Spaing washer	6Pcs
4.	M6-1.0 Nut	6Pcs
5.	Steel tube 93.2 mm	1Pcs
6.	XHM8-1.25*120	1Pcs
7.	M8 spring washer	3Pcs
8.	M8 washer	4Pcs
9.	M8 Nut	1Pcs
10.	Rotating bracket	1Pcs
11.	XHM8-1.25*20	2Pcs
12.	Mounting main fram	1Pcs
13.	U-Type Screw	2Pcs
14.	M6 washer	6Pcs
15.	Wall Tiger	4Pcs
16.	TH 5/32-16*1"	4Pcs

Wall Mount

Slant±45 Degree Polarization

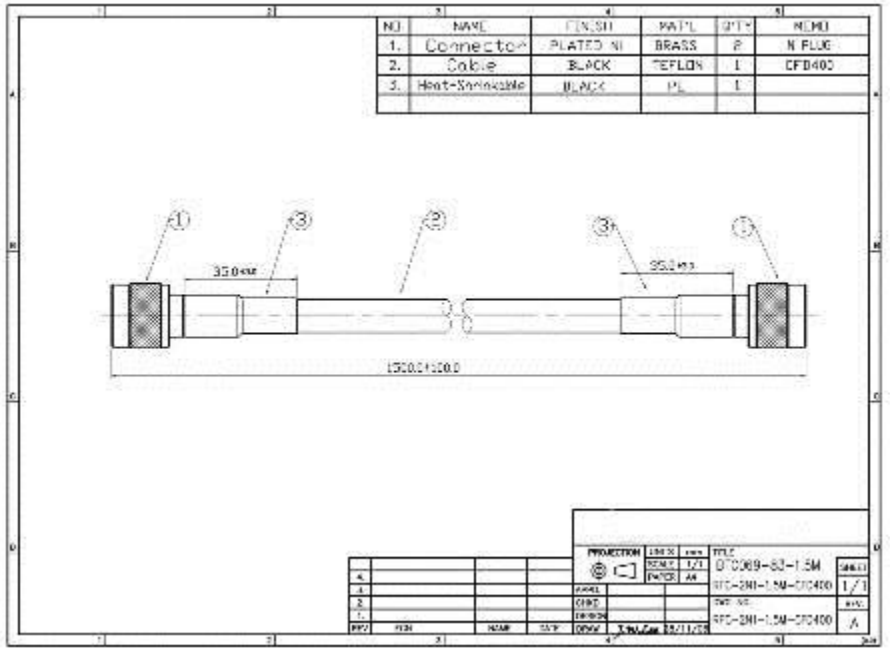


Hor. & Ver. Polarization



IOP-RFCFD-400150NMR

CFD-400 N-Type 1.5M Antenna RF Cable



CFD-400 RF Cable SPEC

Standard: CFD400 (CFD400-E) CABLE 1/2.74MM X 1C

CONSTRUCTION:

ITEM		UNIT	2.74MM
No. of Wire		P·C	1C
1)Conductor	Material	—	Copper Clad Aluminum
	Size	No./mm	1/2.74
2)Insulation	Material	—	PEF
	Thickness	mm	(NOM.) 2.2
	O.D	mm	(NOM.) 7.24
3)Binder		—	Sealed Aluminum Mylar Tape
4)Braid Shield	Material	—	Tinned Copper Wire
	Coverage	%	85%↑
5)Jacket	Material	—	PVC or PE
	O.D	mm	10.3+-0.25

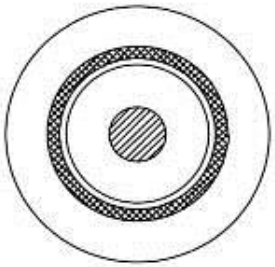
MECHANICAL PROPERTIES:

ITEM	UNIT	
Minimum Bend Radius	mm	25.4
Weight	kG/m	0.1
Tensile strength	kG	72.6
Operating temperature	℃	-40/85

ELECTRICAL PROPERTIES (20℃):

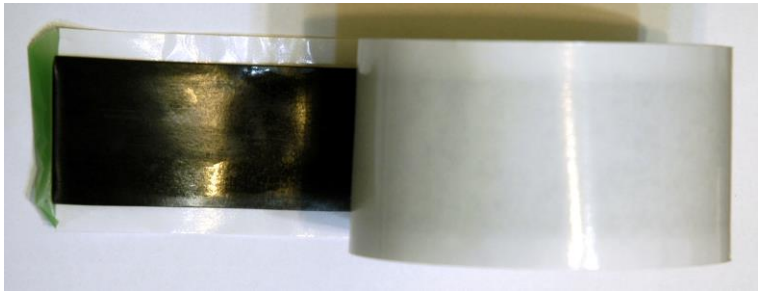
ITEM	UNIT	
Conductor Resistance	Ω/Km	1.67
Impedance	Ω	(NOM.) 50
Capacitance	PF/FT	(NOM.) 23.9
Velocity of propagation	%	(NOM.) 85
DC resistance, inner cond.	Ω/Km	4.56
DC resistance, outer cond.	Ω/Km	5.41
Shielding effectiveness	dB	≥90

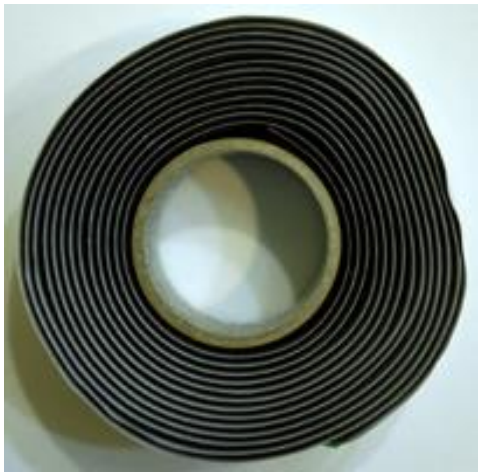
Attenuation (nom.)	
MHz	dB/100ft
30	0.7
50	0.9
150	1.5
450	2.7
900	3.9
1500	5.1
2000	6.0
2500	6.8
5800	10.8

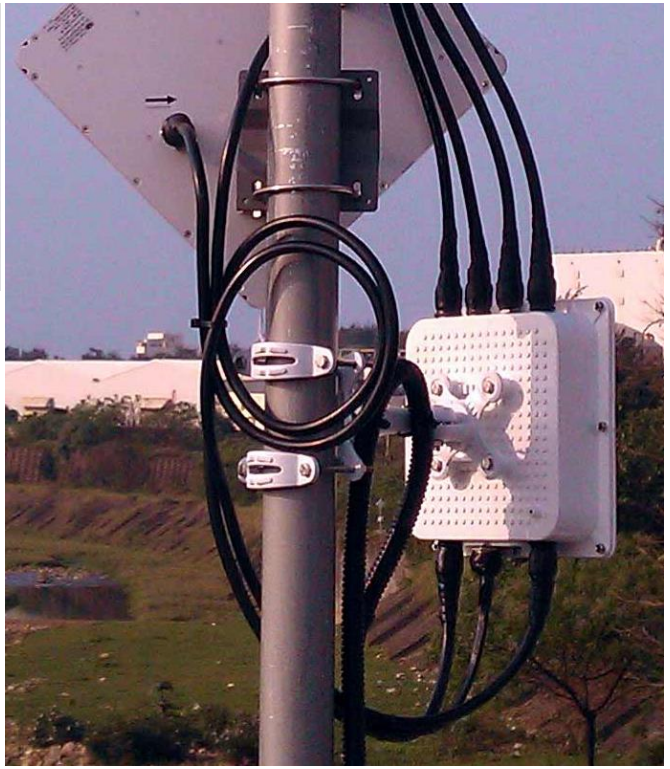


IOP-RMTOC-173830510B

Self-Bonding Rainproof Insulating Tape SPEC







Description

The Self-Bonding Rainproof Insulating Tape is laminated with special formulated EPR insulation rubber and mastic tape layers. The EPR backing provides excellent electrical insulation and impact resistant properties while self are fusing and strong bonding characteristics of the Mastic layer offers immediately bonding and absolutely water sealing capabilities.

Features

For Outdoor and Indoor Electrical system

- 600 V underground cable splice or joint, ducts or direct buries.
- Self bonding to seal high voltage cable splice or joint, terminations, elbow connectors, etc
- Sealing and insulating high voltage overhead connectors
- Busway insulation and oxidation protection.
- Communication cable or CATV cable sealing and insulation

Measure

Length / roll：305cm ± 2cm

Width：38mm ± 2mm

thickness：1.7mm ± 0.5mm

The inspection Report of Self-Bonding Rainproof Insulating Tape

Elongation	1000%↑
Adhesion	Detachment < 2cm
Breaking strength	>2kg
Water Absorption	<0.2%
Insulation resistance	>1 × 10^6 MΩ+
60Hz Ac Withstand	AC 60Hz 25kV
Stability Test	No punching through upon adding AC 2.2kV/1min And through 130℃ after 100 hours.

Applicable

- The electric insulation of bus under 1000V.
- The insulation and waterproof treatment of the cable connector under 1000V.
- The waterproof, erosion-resist coating treatment of the T shape or irregular type connector on high/low voltage bus.
- The waterproof treatment of the high voltage cable direct circuit connector.
- The waterproof treatment of the L shape connector.
- The general operation temperature is kept at 90℃, but under emergency the temperature may go up to 130℃ for 100 hours.
- The coating treatment of the suspending cable.

Operation Explain