

EYECOM

Cellular/Mobile Radio

RF Products

Excel Telecommunications Limited

Member of Eyecom Group

WWW.EYECOM-TELECOM.COM

Agenda

- ▶ Company Introduction
- ▶ Product Introduction
- ▶ Eyecom Cellular RF Products
- ▶ Project References





1

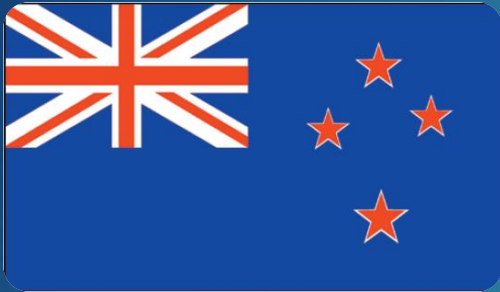
Company Introduction

WWW.EYECOM-TELECOM.COM

Company Introduction

History:

- ▶ **1996** - Eyecom New Zealand Ltd, Established by Deltec New Zealand and its ex-employees
- ▶ **1999** - Set up the Eyecom Telecom Ltd. in Guangzhou, China to lower manufacturing costs
- ▶ **2003** – China factory expended, plays an important role in business development



What we do:

Design and Manufacturing of:

- ▶ Tower Top RF products:
 - Base station antenna, RET and MDT, single /Multi-bands TMA and TMB, Lightning arrestors, Band filter combiner
- ▶ Digital Optical/RF DAS for Mission Critical and Cellular Radio:
 - DAS antenna, POI, RF/Optical Repeater, Passive component
- ▶ Signaling and Control Products:
 - Complete range of signaling and Safety products for Railway/Metro Tunnel and Confined area safety/control/monitoring; RFID, ATEX DMR repeater





Sales and Service Office/Agent

Technology Milestones



1996: World's first 11 cellular systems POI (POI for HK CEC, Sino-UK handover ceremony Hall)

1997: Eyecom – introduces MB-DAS to APAC

1999: PMR/GSM Optical Repeater

2001: Cellular FSR

2001: Dual band dual pol EDT antenna

2002: Ultra high linearity Amplifier

2003: Ultra high dynamic range repeater

2003: Tetra Repeater

2005: Pilot Beacon generator for CDMA

2006: Remote RF Unit for CDMA and GSM

2007: High EDT (27 degree) BTS antenna

2008: Tetra FSR repeater/RFID

2008: Digital Optical repeater

2009: ICS repeater/Atex BDAs

2010: Optical multiband MCPA DAS Repeaters

2011: Digital Base station Hotel Solutions – cellular & DMR

2012: MIMO active DAS and MIMO Indoor Antenna & MIMO POI

2013: Broadband multi-system intelligent digital optical DAS system – *dioDAS*

2014: Improve version of DioDAS FPGA Engine for cellular and DMR

2015: Low PIM Smart Intelligence POI. Advanced Digital GSM-R OBDA

2016: Digital Full band all platform MRRU

2017: 4x4 MIMO MRRU, 8 bands MRRUs

Mission, Vision, Strategy, Values

Corporate Mission

- We listen
- We know how
- We understand
- We provide quality solutions
- We work closely with our partners

Corporate Vision

Transforming into one of the most recognized and respected manufacturer, system provider and systems design expert in the world of cellular and mobile radio coverage.

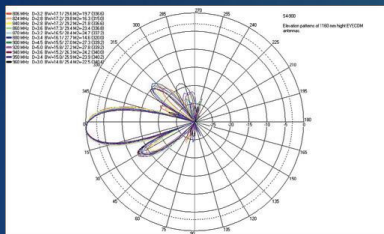
Corporate Strategy

- To become one of the most valuable companies in its field
- Adopting a strategy of partnering with only the best companies in each region.

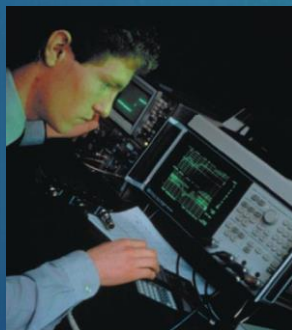
Corporate Values

- Customer Focus
- Integrity, Trust and Fairness
- Open Communication
- Employee Development and Positive Work Environment
- Innovation, Speed and Execution
- Social Responsibility

- ▶ Over 25 years of innovations continues to deliver superior products.
- ▶ Constantly challenged by customers to meet demanding requirements
- ▶ Eyecom's strengths:
 - Complete flexibility and custom design approach
 - Imagination, creativity and the care for the smallest detail
 - Meet and better the customers requirements to future proof our designs



Our strengths have led us to being the customers **"First Choice Supplier"**



Patent invention certificates from Eyecom in BTS RET antenna dipole and phase shifter design.

Manufacturing

“Customer Satisfaction” is our foremost concern!

- ▶ Quality
- ▶ ISO 9001, ISO14001, ROHS Accreditation
- ▶ Innovation, Leading Edge Technologies
- ▶ Leading supplier in Mission critical Communications
- ▶ Leading Technology in Digital Optical DAS
- ▶ Leading Technology in low PIM Production

*Our quality and reliability will lead to us being the customers “**First Choice Supplier**”*



Factory Facilities

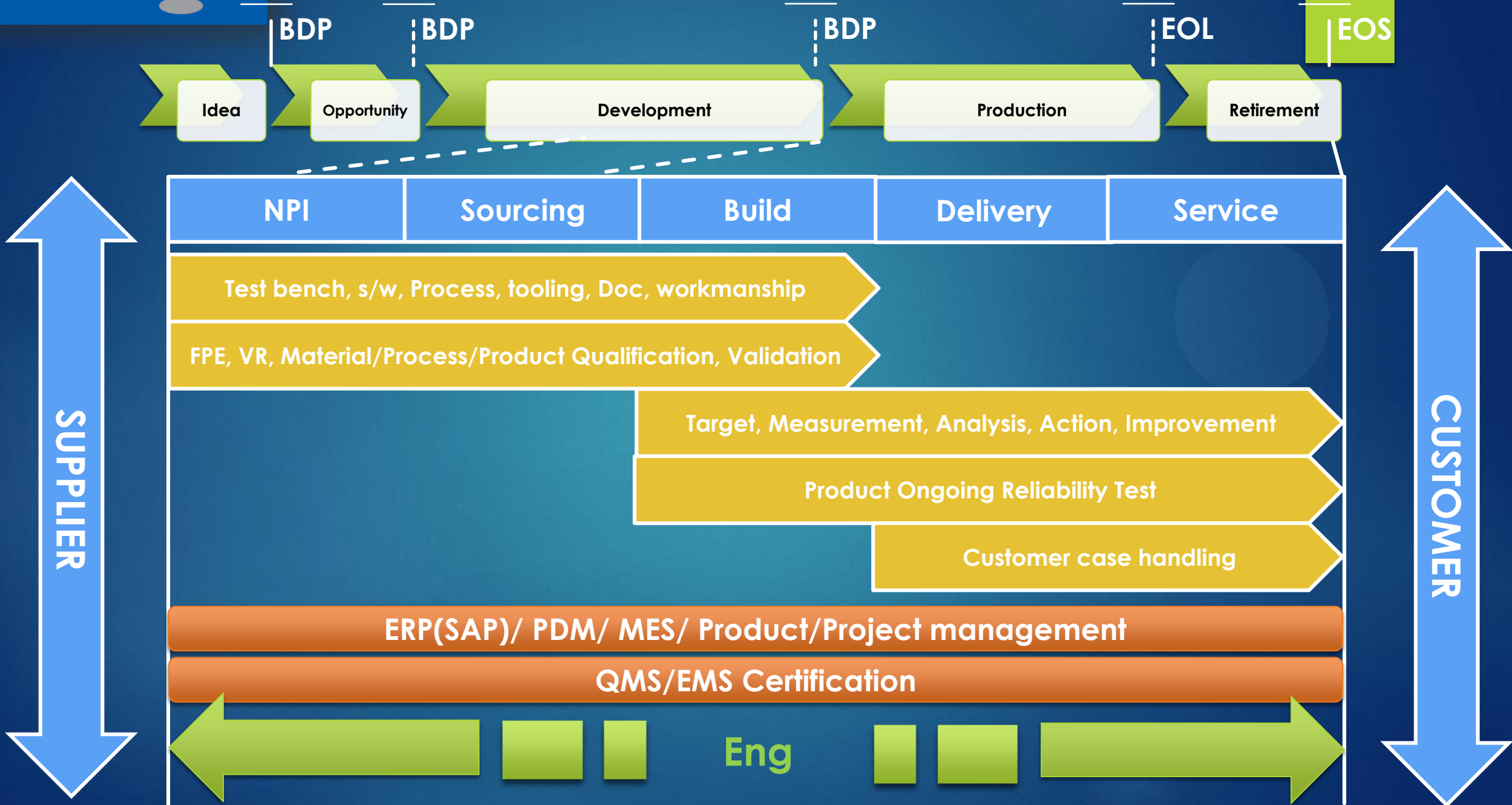
China Factory



- ▶ Guangzhou, 7-8/F Blk E, Tianhe Software Park
- ▶ 4000 m² Factory production area
- ▶ Full production QA system and facilities
- ▶ New Zealand Production and QC system implied
- ▶ **Maximum production per shift:**
 - Repeaters 50/day
 - BTS Antennas 300/day
 - Passive Components 1000/day
 - Filters 200/day
- ▶ **R&D Facilities in:**
 - Wellington (Antenna, Passive Products)
 - Guangzhou (Active and Digital Products)

QA Facilities





Continuous Improvement of Quality

Quality control

Regular meeting to review production quality status, and base on review result take corrective action accordingly;



Function test

100% function test +NPI validation

Vibration test

100% testing

ORT test

100% on-going Reliability Test

Product

Quality improvement

Regular meeting to review production quality status, and base on review result take corrective action accordingly;



Daily morning meeting

MFG team review outstanding issues

Weekly meeting

Cross function team reviews top issues which happened in last week

Monthly meeting

Factory management team reviews top issues which happened in last month

Quality target review

Factory management team reviews production quality target base on actual achievement per half.



Major Customers

MOTOROLA SOLUTIONS **CASSIDIAN**
AN EADS COMPANY

Alcatel-Lucent **MTR** **SIEMENS**

PCCW 電訊盈科 **Smartone** Hutchison Telecom

CS Create a Simple Life 中国移动通信 CHINA MOBILE 中国电信 CHINA TELECOM

HUAWEI China unicom 中国联通 **ERICSSON**

ZTE 中兴

2

Product Introduction

WWW.EYECOM-TELECOM.COM



Eyecom Products

▶ Base Station Antenna

Mechanical downtilt and remote control electrical downtilt (RET)

Sector/Omni/Yagi Antennas for PMR, TETRA, DMR, P-25, Cellular and WiFi

▶ Digital RF Repeater; MCPA; Optical BDA

Band selective/Channelized, Optical, FSR, ICS, IP65 and ATEX

150/350/380/420/450/800/900/1800/2100MHz PMR, TETRA, DMR, P-25 ,
GSM900/1800, CDMA, 3G, LTE

▶ Tower Mast Amplifier

TMA and TMB with remote control variable gain, UL or UL+DL

70/150/350/380/420/450/800/900/1800/2100MHz PMR, TETRA, DMR, P-25,
GSM900/1800, CDMA

▶ Low PIM Multi-Band DAS POI/Combiner

Multi-band, multi-system RF combiner (POI)

AM/FM/DAB/70/150/350/380/420/450/800/900/1800/2100MHz PMR, TETRA, DMR,
P-25, GSM900/1800, CDMA, 3G, FDD-LTE, TDD-LTE

▶ Digital Optical Multi-Band Multi-System DAS System

Digital Optical master unit and digital Remote Unit, CPRI protocol

AM/FM/DAB, PMR, TETRA, DMR, GSM900/1800, CDMA, 3G, FDD-LTE, TDD-LTE



▶ Low PIM Passive Multi-Band IRDN DAS Components

Broad-band power splitter, directional coupler

60MHz-2700MHz, from PMR, DMR, Cellular Bands

Multiband indoor antennas, omni or panel, SISO and MIMO

130MHz-2700MHz, from PMR, DMR, cellular bands and WiFi



▶ RF Accessories and Modules

Attenuator, dummy load, lightning arrestor, active component modules

60MHz-5800MHz, from PMR, DMR, cellular bands and WiFi



▶ Tunnel Safety Products

All in one tunnel safety and smart control Data-Bay with full NMS

Integrated safety system supports DMR, Intercom, Fire alarm, Gas, Flooding, CCTV, RFID/Man down, Plant machine control/monitoring



▶ RF Coaxial Cable and Leaky Cables

1/2", 7/8" 1-1/4" and 1-5/8" coaxial and leaky cables (Standard and Customized)

60MHz-3000MHz, low loss, wide band or optimized band





3

Eyecom Cellular/DMR RF Products

WWW.EYECOM-TELECOM.COM

Eyecom Cellular RF Products



- ▶ Cellular/DMR Base Station Antennas
- ▶ Digital Optical/RF and Passive DAS Systems
 - ▶ *Multi-Operator Digital Optical DAS products*
 - ▶ *Low PIM POI*
 - ▶ *Digital RF repeater for cellular and VHF/UHF DMR*
- ▶ Digital Optical BTS Hotel: DMR/Cellular



1. Radio Base Station Antennas

► Performance:



- Designed and manufactured in accordance to ISO9001 accreditation
- Robust single radome enclosure design
- 25 years experience in IMP control from antenna design to production
- Wide band design, Quad-band antenna in one single radome
- Excellent front-to-back and side lobe performance
- Patented technology, best Cross-Polar Ratio performance in the industry

1. Radio Base Station Antennas

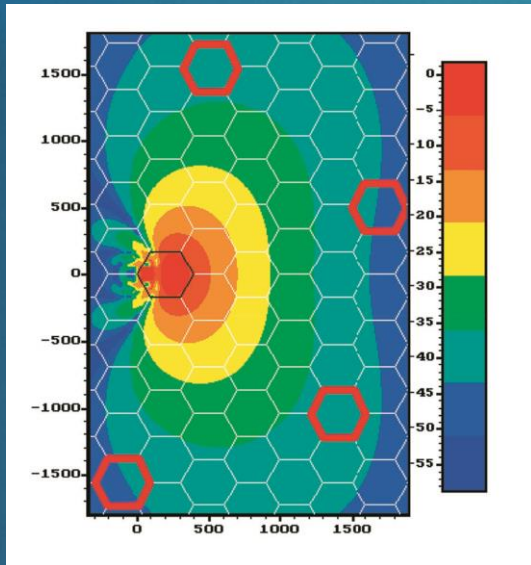
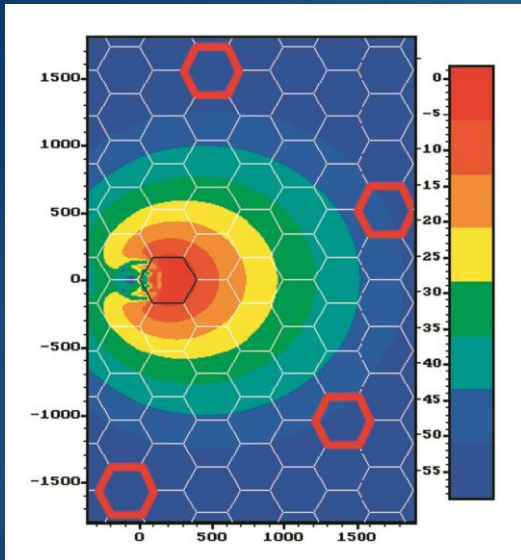
► Product Range



- Mechanical downtilt antenna
- Remote control and variable electrical downtilt antenna
- Single polarization and dual polarization antenna
- Omni antenna
- Large RET range antenna (14-29° RET range)

1. Radio Base Station Antennas

► Frequency Range

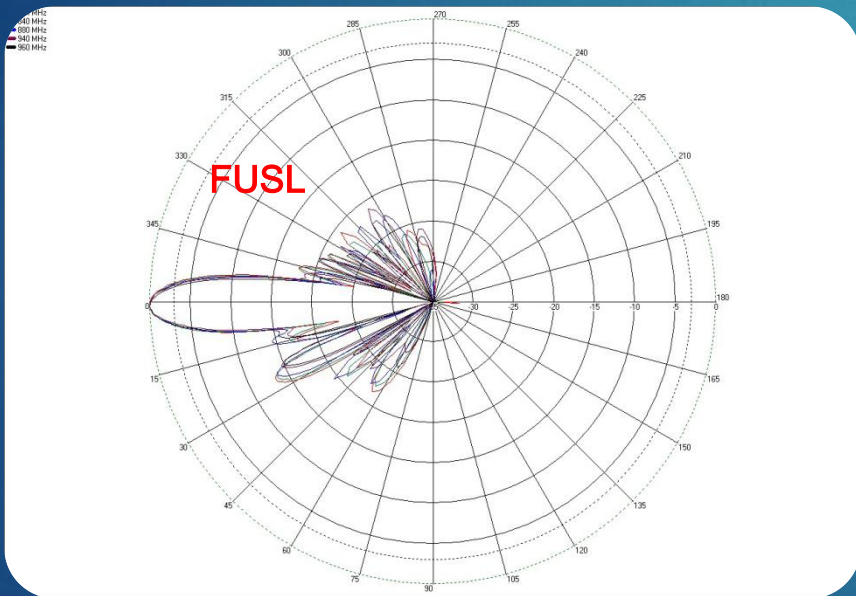


- Omni and sector single/dual-band antenna
 - PMR/DMR/TETRA/P25, Full Cellular 2G/3G,/TE,
- Tri-band antenna
 - 806-2700MHz, RET and MDT, 2-10 Ports
- Quad-band antenna
 - 698-2700MHz, RET and MDT, 2-10 Ports
- WiFi/Wi-Max low profile antenna
 - 2400-2700/5150-5875MHz

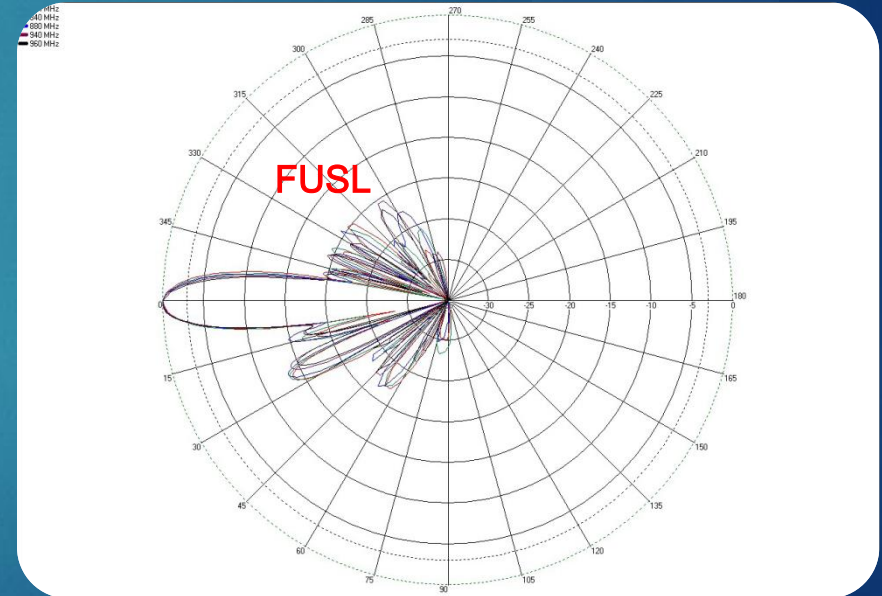
1. Radio Base Station Antennas

Beam Shaping Of Eyecom Antenna

- ▶ **Side Lobe consistency:** common problem of R/C EDT
- ▶ Special PS technology, enables side lobe suppression greater than 17 dB in every EDT



▶ BPA890-65S-16DRE pattern
1 degree EDT, +45 degree

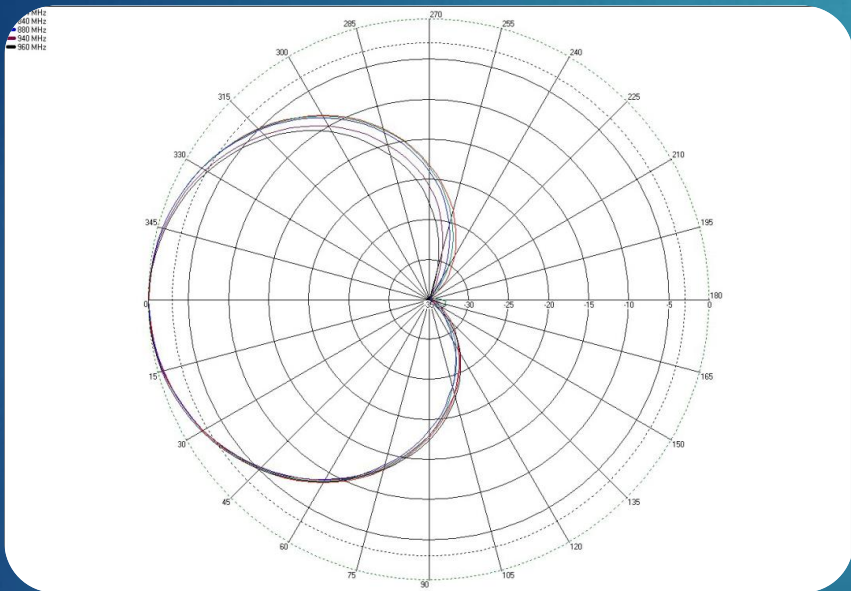


▶ BPA890-65S-16DRE pattern
1 degree EDT, -45 degree

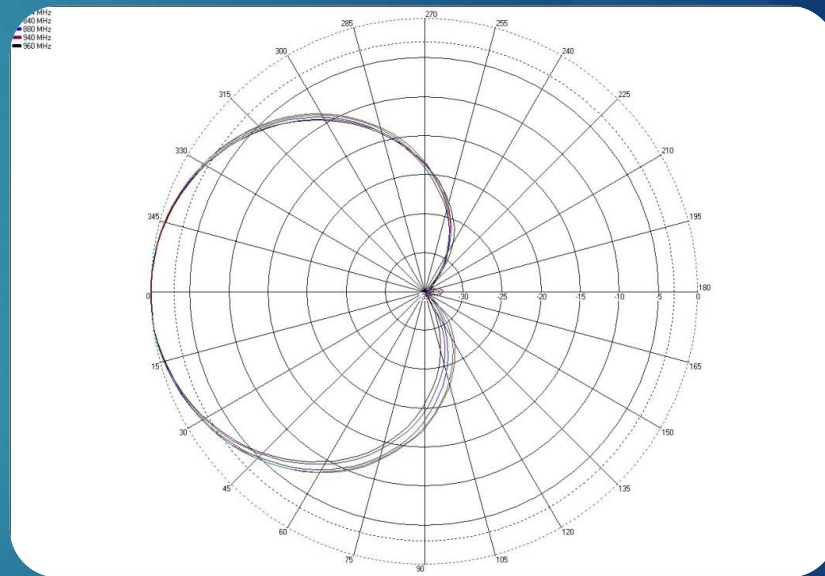
1. Radio Base Station Antennas

Beam Shaping Of Eyecom Antenna

- ▶ **H-BW consistency**
- ▶ **Patented Dipole Design** : Wide band: 698-960MHz/1710-2690MHz with consistent BW



▶ BPA890-65S-16DRE pattern
1 degree EDT

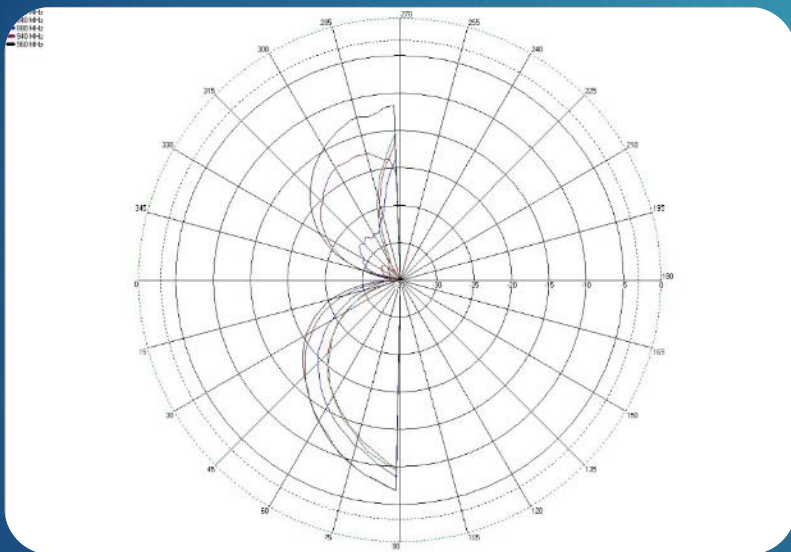


▶ BPA890-65S-16DRE pattern
5.5 degree EDT

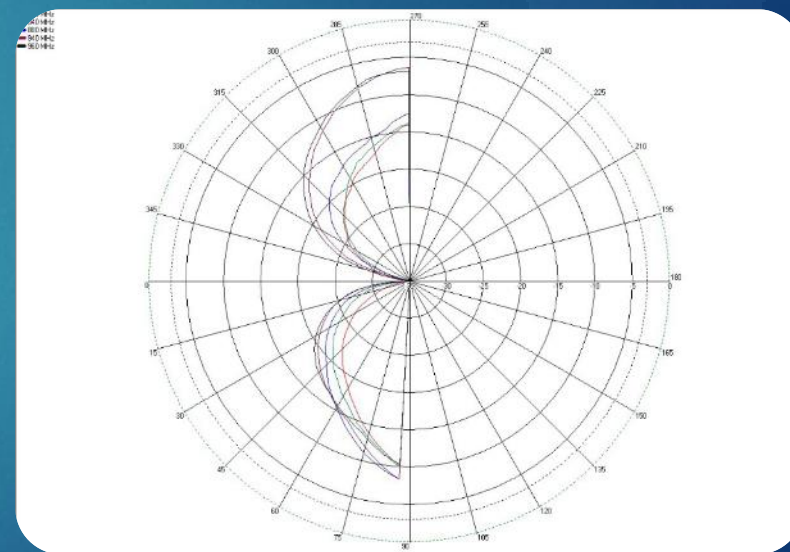
1. Radio Base Station Antennas

Beam Shaping Of Eyecom Antenna

- ▶ Excellence in Isolation and Cross Polar ratio
- ▶ Patented Dipole Design:
 - Isolation >33 dB,
 - Cross Polar Ratio consistent: >25 dB in main +/- 30 degree
>13 dB in main +/- 60 degree



- BPA890-65S-16DRE pattern
Cross Polar, **1** degree EDT

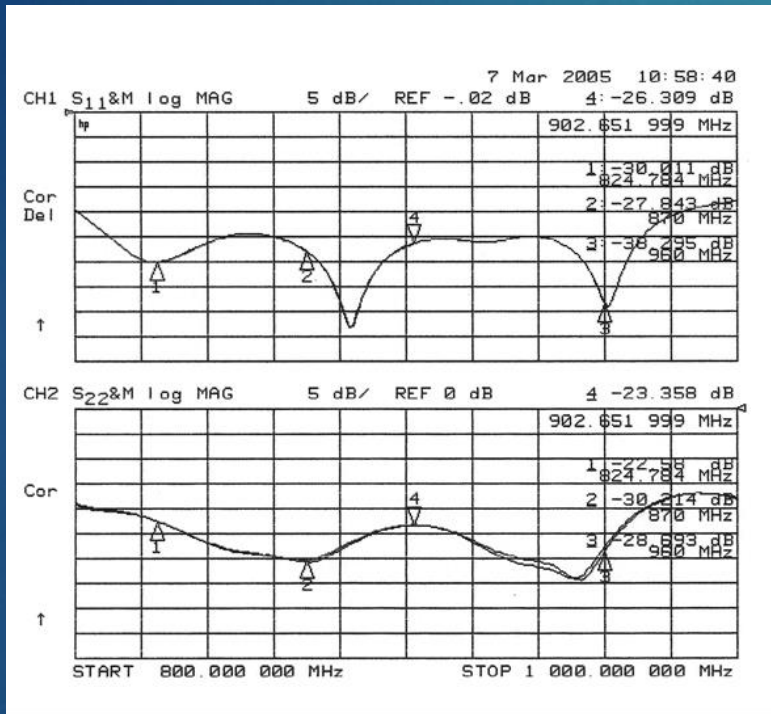


- BPA890-65S-16DRE pattern
Cross Polar, **10** degree EDT

1. Radio Base Station Antennas

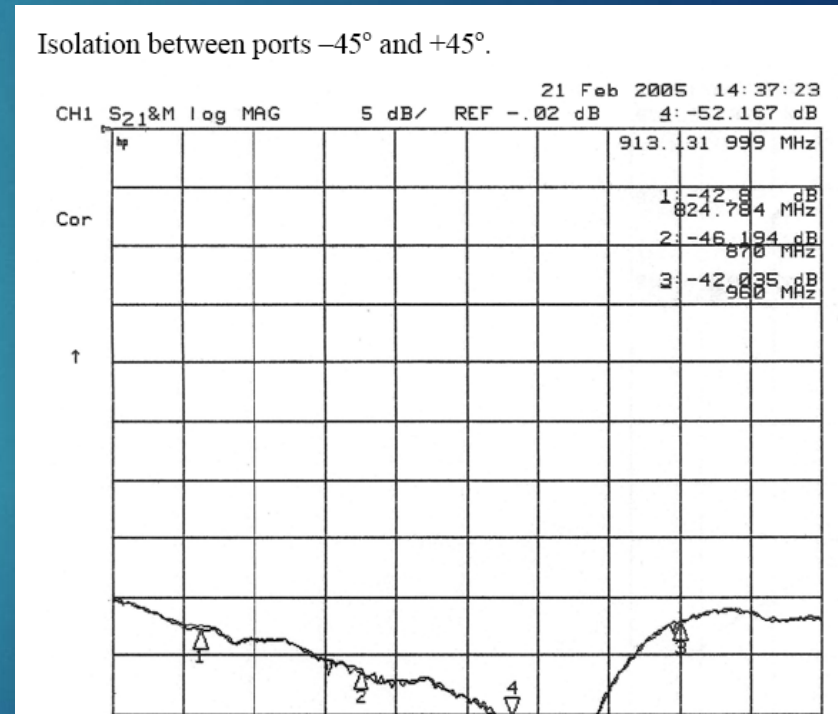
Beam Shaping Of Eyecom Antenna

► **Super VSWR:** In every EDT, R/L>16 dB



► BPA890-65S-16DRE pattern
 R/L>20 dB, 1 degree EDT

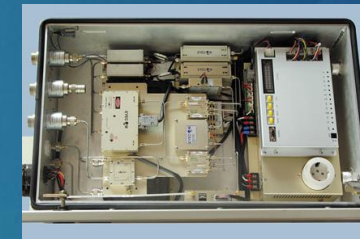
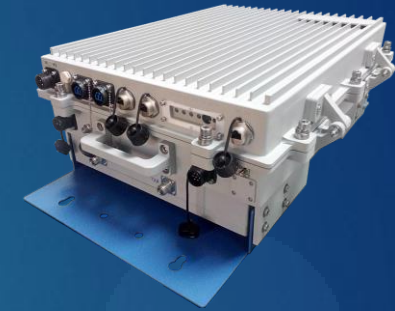
► **Super Isolation:** Patented Dipole, Isolation>32 dB



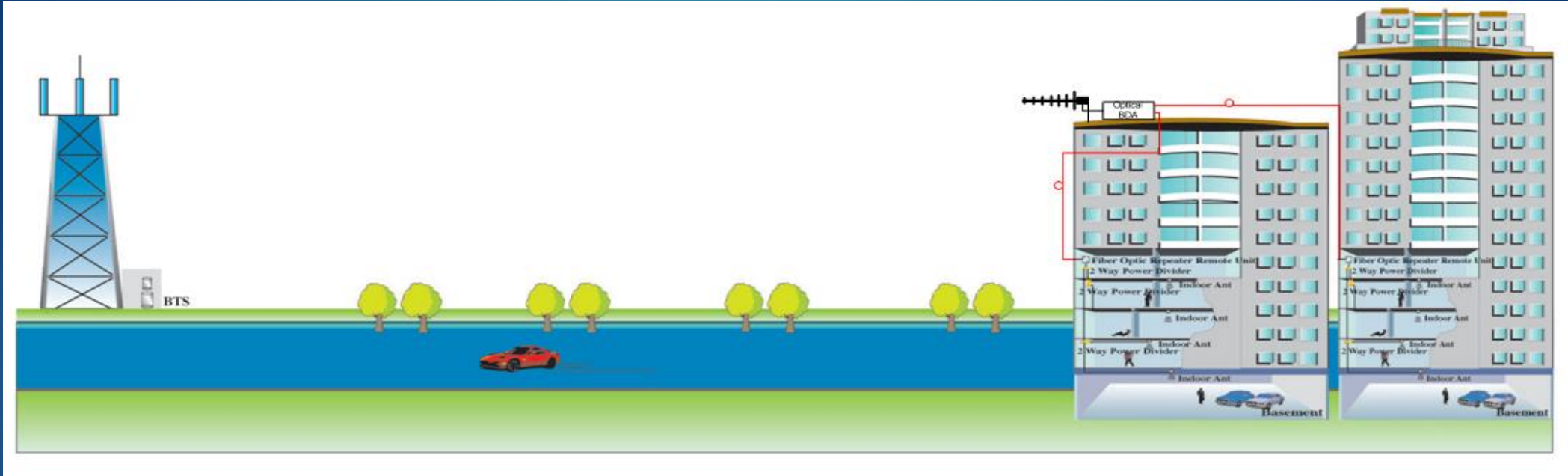
► BPA890-65S-16DRE pattern
 ISO>45dB, 1 degree EDT

2. Digital RF Repeaters-Pico to High Power

- 1 High Power Off-air repeater, Digital band selective and channel selective, Product available to all systems and Bands from 70MHz to 955MHz for Conventional PMR, P25, Tetra, DMR, iDEN, GSMR
Channel Number: 1-12/1-24 ,
Digital Bandwidth adjustable from 10KHz to 5MHz
Time Slot AGC and Squelch
Also available repeater cover 698-2690MHz,
support GSM,CDMA, UMTs, LTE
RF Power 1-10 watt; Gain 80-95dB
- 2 Digital Frequency Shifting Repeater (FSR)
high Power /In-band Shifting/Out-band sifting types
Model available to all above band and systems
- 3 High efficiency Solar Energy digital RF Repeaters, Pico to Mid power, available to all above band and systems
- 4 Digital ICS Repeater: Tetra, GSM, UMTS, high and low RF power
- 5 Mid-Low Gain Pico Repeater, Power 13-23dBm, 60-75dB Gain, NMS
Models available to all band and system, NMS remote Control/Alarm

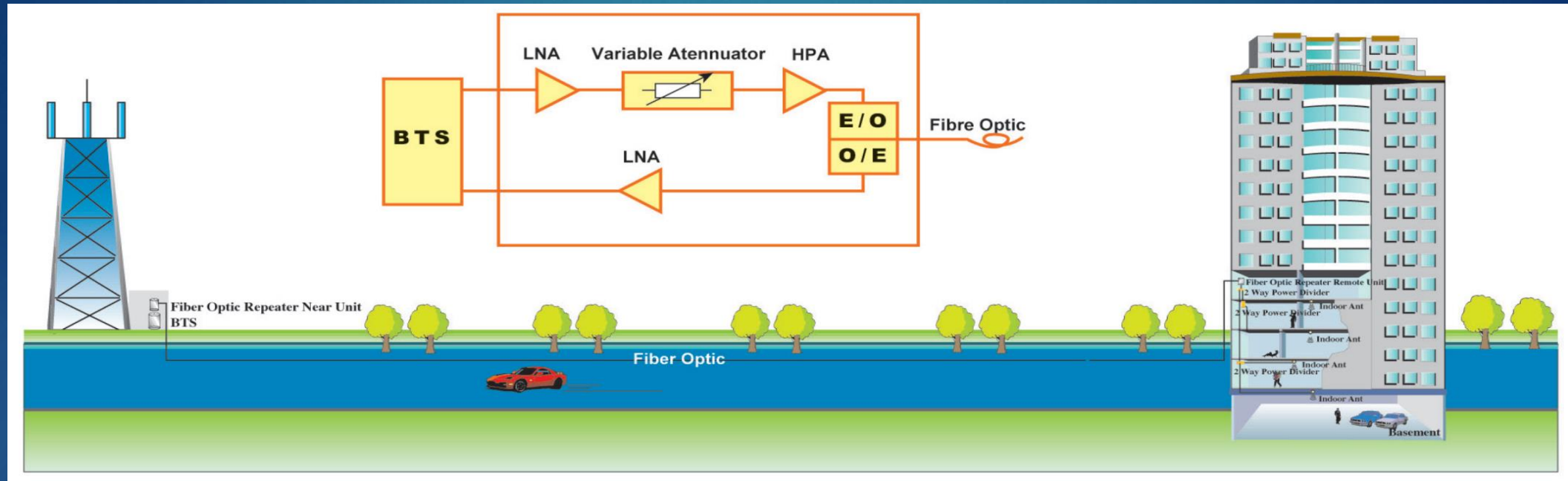


Basic RF Repeater System



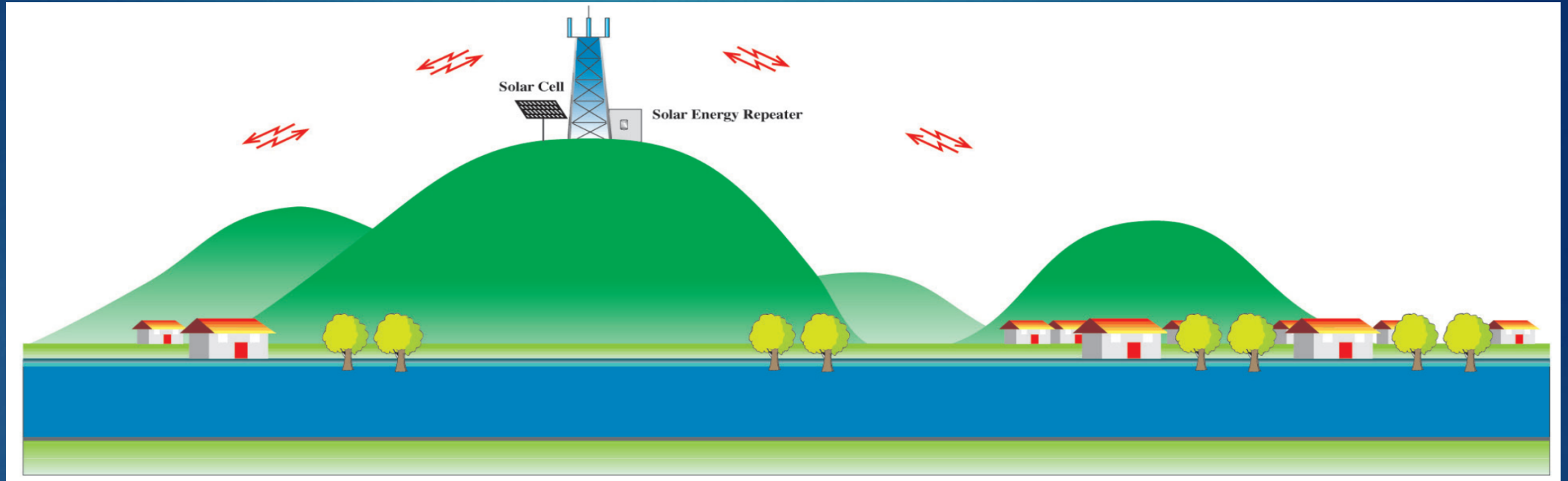
- BDA takes off-air signal and distributes signal via fibre
- Remote optic units convert the optical signal back to RF
- RF signal distributed via passive network

Fibre Optic Repeater System



- RF signal tapped off at BTS and distributes signal via fibre
- Remote optic units convert the optical signal back to RF
- RF signal distributed via passive network

Solar Energy Repeater System

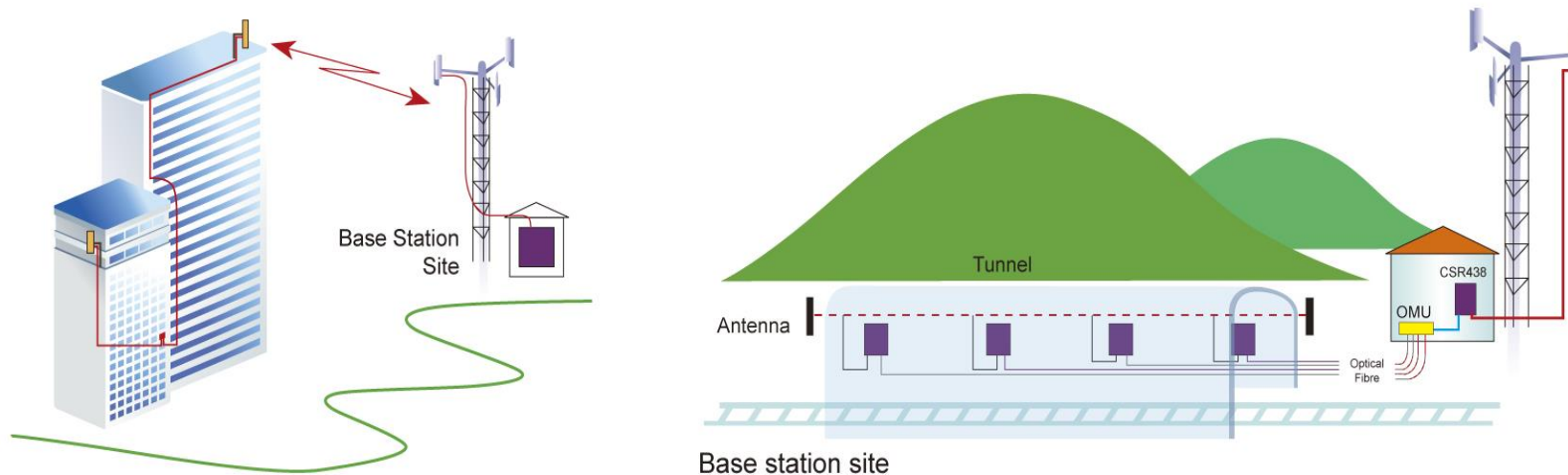


- Low energy system for mountain tops and rural areas

Digital ICS Repeater

Eyecom Digital Repeater and ICS Repeater

Eyecom digital channel selective repeater offers low delay and high selectivity filter configuration. Support multiple BDAs in daisy chain cascaded configuration. ICS repeater allows low antenna isolation application, typical 25dB ICS range allows gain can be 25 dB higher than antenna isolation



2. DIODAS Digital Optical DAS

► Digital Optical Wide Band Multi-System DAS

DioDAS® Eyecom Intelligent Digital Optical DAS support large number of cellular/PMR systems within a single antenna network. Digital optical technology reduces RF noise against conventional analogue DAS



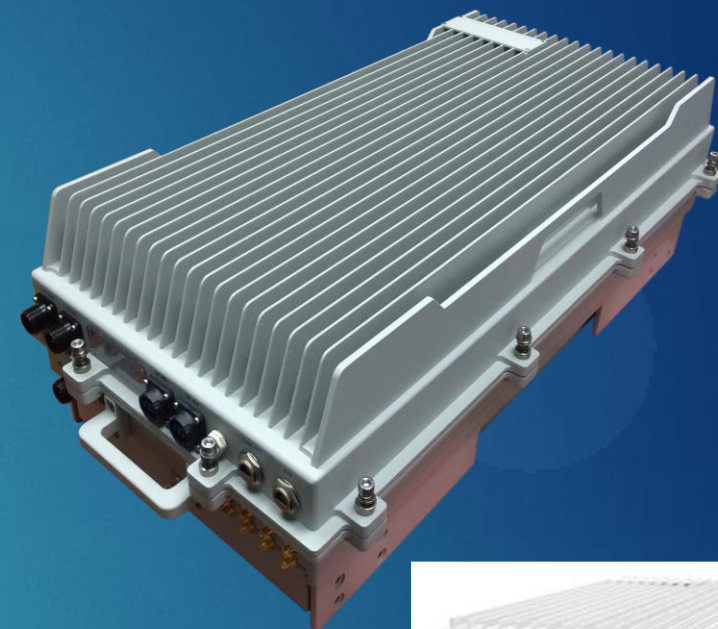
- Full Software control digital FPGA hardware platform, Supports Multi-band and multi-operator. Individual RF signal from any operator can be controlled or switched off remotely via SNMP based NMS
- Proprietary CPRI Algorithms for OMU→ORU Transport (RF + Monitor/Control + Ethernet)
- GUI based Spectrum Analyzer (optional)
- Digital Delay Control for HSR Trackside Coverage
- Multi-Channel TDD-LTE synchronization
- High Speed Digital Optical Fiber technology, 10 Gb/s
- Ultra Wide Band (320 MHz DL and 320 MHz UL on one Optical Core, dual core double to 640 MHz DL and 640 MHz UL) adaptable to all Global Communication Bands, 2x2 and 4x4 MIMO , now and future 3500MHz 5G
- Accommodates Multi-Function OMU Extensions and ORU Cascading
- Accommodates WiFi A/P and LTE-U Hyper A/P Digital Signal Backhaul
- Sector Switching Feature (CPRI Switch) Delivers Capacity where needed (Q4 2017)
- Sector/RRU Traffic monitoring and diversion



Optical Master Unit

- Remote M&C via Ethernet / 3G Modem, separate RJ-45 for Local and Remote, SNMP v3 / MIB File
- Remote Web Browser GUI Access

- Digital Pre-Distortion and FFR Amplifiers with Linearization Techniques
- Scalable: UP TO **40W** per Band
- Digital Optical Path Fault auto-detection
- SISO or 2x2MIMO or 4x4 MIMO System Architecture in any Band, 618 MHz to 2690 MHz version for cellular and 525KHz to 2690MHz version for DMR/Broadcast + cellular)
- Field upgradable to Future Spectrum; 3500MHz
- Dual Ethernet Ports with Data Rate of 1Gb/s in OMU. WiFi / LTE-U and Video Backhaul supported
- GUI based Spectrum Analyzer (optional)
- Digital Noise Cancellation
- Wide Band Version and Channelized Version
- Tunnels: Radiating Cable Distance-to-Fault feature (optional)



Optical Remote Unit



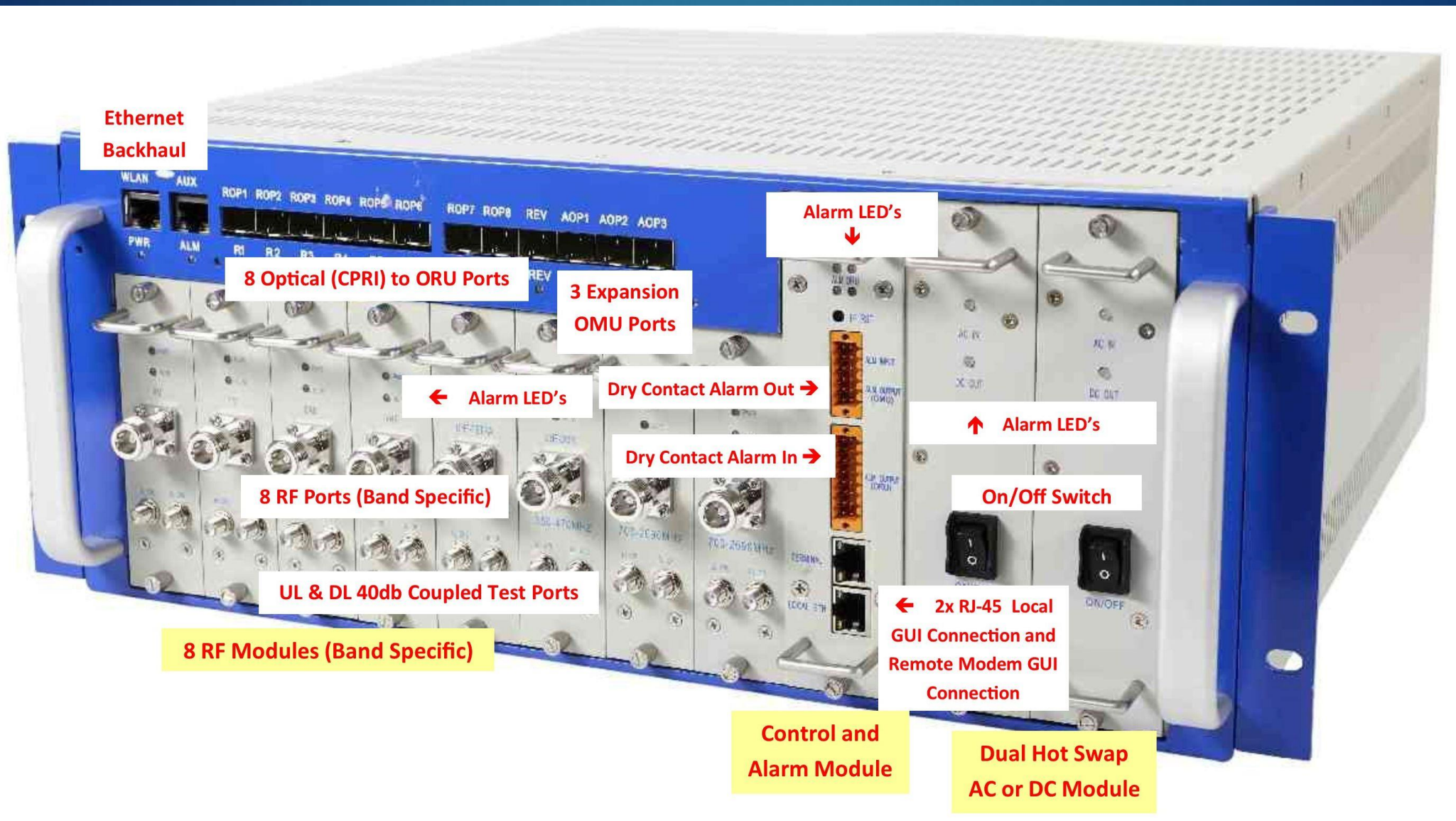
Eyecom MRRU vs RRU Bank

Metro with RRU bank: Before MRRU
High power consumption, multi-core fiber needed, 16-30 RRUs in one location

VS

Same Project after MRRU deployment:
Single Enclosure; lower power consumption, single core fiber needed





Ethernet Backhaul

8 Optical (CPRI) to ORU Ports

3 Expansion OMU Ports

Alarm LED's

← Alarm LED's

Dry Contact Alarm Out →

↑ Alarm LED's

Dry Contact Alarm In →

8 RF Ports (Band Specific)

On/Off Switch

UL & DL 40db Coupled Test Ports

← 2x RJ-45 Local GUI Connection and Remote Modem GUI Connection

8 RF Modules (Band Specific)

Control and Alarm Module

Dual Hot Swap AC or DC Module

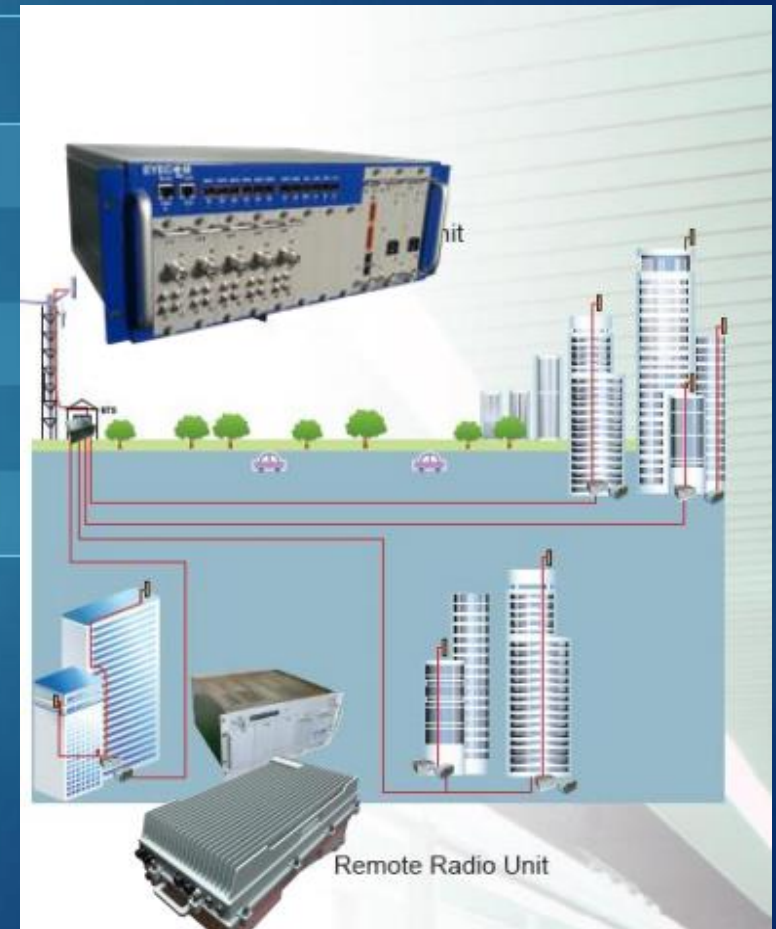
► Eyecom SNMP GUI NMS

- DAS monitored and controlled remotely via SNMP GUI NMS system.
- Updates provided from units via:
 - Cellular modem
 - SMS
 - PSTN Modem
 - LAN connection
- Service Engineers able to monitor and control all units gain, RF power, channel frequency, RF delay and capacity diversion from a various location remotely.
- Optional Spectrum display to System Up-link and Downlink Signals,
- Service Data Log.



Application: Base Station Hotel DMR+2G+3G+4G Multi operator Outdoor Shared Site

- Systems: 350-870MHz, 600MHz,700MHz,800MHz,900MHz, 1800MHz, 2100MHz,2300MHz and 2600MHz
multi mode: Tetra, P25, DMR, GSM, CDMA, UMTS, FDD-LTE, TDD-LTE
- RF Power: 5W/10W/20W/40 W/ Band
- Rx Diversity: Support
- LTE MIMO: 2x2; 4x4
- RRUs for all sectors and all systems housed in one single BTS shelter
- Digital delay control and CPRI control to each Remote Unit, capacity Intelligent Diversion
- Application: Urban sites/IBS, rural shared Tower Site, Railway and Highway Coverage; Road Tunnel and Rail Tunnel
- Distance: 20-80Km (with network support)

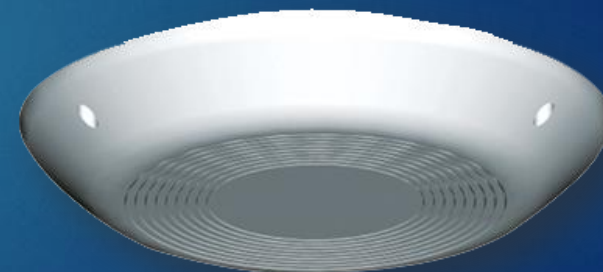


► IA Dual Band MIMO Antenna

Model	Frequency Range	Gain	Polarization
➤ IA-103GDM ➤ Omni Indoor	698-960MHz/ 1710-2690MHz	3dBi/3dBi	Vertical and horizontal or +/-45 degree
➤ IA-103GDM-L ➤ Directional	820-960MHz/ 1710-2690MHz	6dBi/7.5dBi	Vertical and horizontal or +/-45 degree

► Features

- Quad-band operation with dual polarization
- Patented design, with excellent tracking between two poles
Ensures best MIMO performance
- Slim and low profile (248mm Dia.x60mm Height)
- Designed for multi-band Cellular DAS
- Low PIM, ensures best through-put performance
- 618-2690MHz version available 1Q, 2018



Application: Cell-Site Coverage Extension

► Eyecom Base Station Extension System

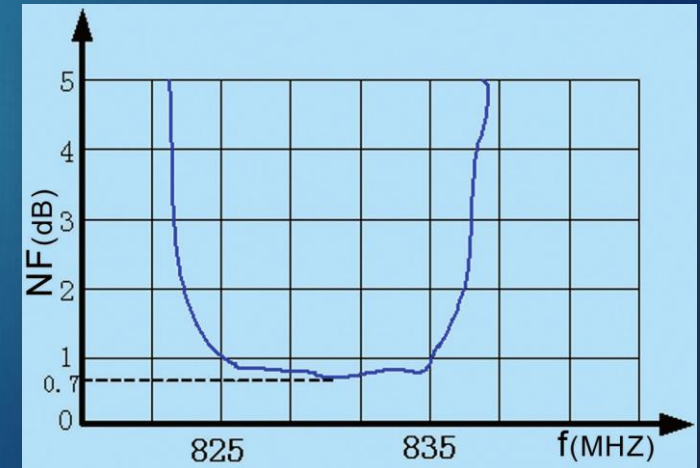
Eyecom BTS extension solution extends radio base station coverage distance up to 90 Km. Patented pending RF signal processor and unique amplifier - antenna products in this system guarantee the best extended network performance and reliability

► Features and benefits

- Extent cell coverage distance to 90Km
- Reduce system dropped-call rate
- Improve Access and Data rate

► Applications

- Mission critical and public radio communication system in coast, rural, mountain, desert and railway environment



Application: Cell-Site Coverage Extension

GSM/CDMA/P25 Long Distance Coast Coverage (50-100Km)



4

Reference for Scenarios

WWW.EYECOM-TELECOM.COM



▶ Digital Frequency Shifting Repeater Police Force SEA

130-170MHz APCO-25 (2012)

Digital FSR for P-25, extends BTS coverage from 20Km to 40Km
Turnkey System Integrator

▶ Hong Kong Metro Tetra Repeater

380-400/806-870MHz Tetra systems (2007-2009)

Supplied Tetra repeaters/Optical BDA/IRDN components



▶ **Hong Kong International Airport**

380-400/806-870MHz Tetra systems (2007-2009)

Supplied Tetra repeaters/Optical BDA/IRDN components



▶ **Hong Kong International Airport**

380-400/806-870MHz Tetra systems (2007-2009)

Supplied Tetra repeaters/Optical BDA/IRDN components

Project References



- ▶ **DMRC/DELHI Airport Express Line**
380-420 MHz Tetra Repeaters (May 2008-now)
Supplied 400MHz Tetra Optical BDAs/repeaters

- ▶ **India CWG Tetra System**
380-430 MHz Tetra (March 2010 - June 2010, India)
Supplied repeater, POI, antenna and IRDN components



▶ **Hyderabad Airport Tetra Optical BDA**

380-430 MHz Tetra Repeaters (Jan. 2008)

Supplied 400MHz Tetra Optical BDAs/repeaters



▶ **China Police Tetra System**

350MHz~370MHz Tetra network (Aug. 2009)

System integrator, supplied POI, BTS antenna and repeaters



► Shanghai Oriental Pearl Tower Cellular RF Coverage System

800-2100 MHz (Oct 2002, system integrated by Eyeecom)
Supplied CDMA+GSM+3G cellular RF signal coverage
inside tower and high speed lift shafts.

► HK Convention & Exhibition Center

800-1800MHz cellular system POI (Jan. 1997)

440-470MHz DMR DAS system (Feb. 2009)

Supplied POI to support CDMA, USDC, GSM900 and GSM1800 systems
Turnkey system integration of DMR DAS



► Macau Encore Tower Cellular DAS

(Feb 2010-2014)

Supplied POI, passive components, antenna, multi-band MCPA for CDMA800, GSM900, DCS1800, WCDMA and LTE



► Taipei Metro, Koxiong Metro

698-2690MHz

GSM, UMTS, FDD-LTE, TDD-LTE, 2x2 MIMO and SISO
2015-2017



► Taiwan Express Railway

Track side Tetra Radio Coverage Network (380-400MHz)

Track Side Cellular coverage network
698-2690MHz, 2G, 3G, TD-LTE, FDD-LTE
(2009-2017)

Supplied Track side BTS sector antennas and Digital RF/Optic repeaters.

► Shanghai Metro

350MHz/806-866MHz Tetra Optic repeater
(2012-2017)

Supplied optic repeaters



► **Hong Kong Drainage Tunnels**

380-470MHz Tetra/DMR 20Km LCX Radio system

(Sept 2009-July 2012)

Turnkey system integrator of dual band Tetra/DMR LCX system. Power fed via patented water resist LSOH LCX, Atex BDA, system supports RFID, CCTV, Gas, Flooding, Intercom, Fire Alarm and plant machine control



► **Light Tower ICS Repeater Site**

380-470MHz Tetra RF Channelized ICS RF Repeater

(July 2012)

Supplied dual band channelized Tetra ICS RF repeater system. ICS repeater gained at 95dB when site antenna isolation reaches 70dB only



Thanks!