EYECOM
Cellular/Mobile Radio
DAS RF Products

Excel Telecommunications Limited
Member of Eyecom Group
WWW.EYECOM-TELECOM.COM

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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 filetr 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
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
Research & Development

- **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”
QA Facilities

- Variable frequency vibration test unit
- Programmable Constant Temperature and Humidity Testing Machine
- Intermodulation testing of all units
- RF Consolidated Test Bed
- Typical unit complexity (Tri-band repeater)

Variable frequency vibration test unit
Major Customers
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

- **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)

- **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
Products Continued

- **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
Eyecom Cellular RF Products

- 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
Side Lobe consistency: common problem of R/C EDT
Special PS technology, enables side lobe suppression greater than 17 dB in every EDT
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
**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 > 45 dB, 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
Eyecon Digital Repeater and ICS Repeater

Eyecon 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 net-work. 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 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)
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
Systems: 70-160MHz, 350-870MHz, 600MHz, 700MHz, 800MHz, 900MHz, 1800MHz, 2100MHz, 2300MHz, and 2600MHz multi mode: PMR, Tetra, P25, DMR, GSM, CDMA, UMTS, FDD-LTE, TDD-LTE

- Distance: 20-80Km (with network support)
- Rx Diversity: Support
- LTE MIMO: 2x2; 4x4
- RRU 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)
Eyecom Full Band MB-DOBDA Application

Eyecom Digital Optical Base Station Hotel

- **System available:** AM, FM, DAB, Tetra 350, 380, 410, 800, P460, DMR460, L18
- **Carrier Per Sector:** 1-16
- **Max. RU distance:** 20Km
- **Max. output Power:** 1/4/10/20 watt/Band, total 8 bands/8 systems
- **Rx diversity:** available
- **LTE MIMO** available

**Features**

- Cluster sector BTSs co-located in same shelter room
- Full NMS, easy system optimization in one location
- Digital technology, MIMO and up-link diversity
- Multi band, multi-system, low Rx noise
- Low power consumption, cost saving
• Uplink Noise reduction, one DMR BTS supports a few hundred (say 250 sets) BDAs, Analog BDA NF for each added ORU is at Log 10 scale increment, With Digital MRRU, the NF figure stay same regardless RU number

• 1Gb/s transparent data path for external permanent or temporary IT services in vicinity

• A single fiber core be able to support 36 set RUs in cascade mode

• Field upgradable Traffic diversion and detection

• Time Slot AGC and mute function, avoids desensitization to remote handset

• Digital delay control, the only solution for rail and Metro Optical Repeater Deployment All RUs delay to MU remains same +/- 0.5 micro-seconds

• Spectrum display feature, trouble shoot for any inter-system interference, very useful in Airport dense E&M environment
Lower Noise Floor:

- Digital OBDA runs in digital domain:
  For Tetra 800 TMR: 256xORUs noise equivalent to 1xORU
  For CDMA/LTE: noise level reduced by 20 dB
  Digital OBDA: Uplink Noise Floor=4.5dB when 1-256 ORU
  Analogues: Uplink Noise Floor = 10xLong N
  Digital: Zero Inter-system interference
  Analogue: High PIM and IMD, due to external POI isolation
GUI based ORU Spectrum Analyzer Function
DIGITAL Optical DAS > dioDAS® MRRU

- BTS Hotel with CPRI SWITCH
- Any Sector to any ORU anywhere in the DAS.
- Deployment Versions up to 1000 ORU’s
- Ideal way for capacity Smart re-location
Cellular dioDAS® Sector Switching Option

Note: Sector could be switched only in the ORU's connected to Main OMU.
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.
Low PIM Indoor MIMO Antenna

**IA Dual Band MIMO Antenna**

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range</th>
<th>Gain</th>
<th>Polarization</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA-103GDM</td>
<td>698-960MHz/1710-2690MHz</td>
<td>3dBi/3dBi</td>
<td>Vertical and horizontal or +/-45 degree</td>
</tr>
<tr>
<td>Omni Indoor</td>
<td>1710-2690MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IA-103GDM-L</td>
<td>820-960MHz/1710-2690MHz</td>
<td>6dBi/7.5dBi</td>
<td>Vertical and horizontal or +/-45 degree</td>
</tr>
<tr>
<td>Directional</td>
<td>1710-2690MHz</td>
<td></td>
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</tr>
</tbody>
</table>

**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. x 60mm Height)
- Designed for multi-band Cellular DAS
- Low PIM, ensures best through-put performance
- 618-2690MHz version available 1Q, 2018
**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/DMR/PMR/P25 Long Distance Coast Coverage (50-100Km)
4 Reference for Scenarios

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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
Project References

► 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
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 Eyecom)
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 High Speed 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
Project References

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!