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LTE 4G

Mobile Network Solutions

Lociva company profile

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- **Office in Haymarket, VA**
- **Technology company**
- **Trading since 2001, organic growth**
- **Target markets: Enterprise, public-safety, military**
- **Channels to market**
 - Partner SIs, to access tier 1 operator markets
 - Direct to tier 2/3
 - Satellite companies, government SIs, test labs

Target Market Sectors

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- **Enterprise**
 - Voice & data integration.
 - Commercial deployments, including with MNO roaming
- **Government/military**
 - Standalone networks, tactical, vehicular, public safety
 - Existing US, UK, Canadian agency customers
- **Rural**
 - Local switching, offload, backhaul optimization
- **Test labs**



EdgeCentrix 4G LTE

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- **4G Network Core – at the edge**
 - Standalone or distributed architecture
 - MME, SGW, PGS and HSS
 - Diameter for interconnect
 - VoLTE, CS Fallback (CSFB), SMS, Handover)
 - Intel, or ARM & MIPS64 CPUs (eg embedded on radio)
 - Add 2G and 3G if needed
- **Supported radios**
 - 4G: Nokia, Ericsson, Huawei, Tektelic, Airspan, ip.access – others!
 - GSM: ip.access, Vanu
 - 3G UMTS: Commscope, ip.access, Ubiquisys/Cisco
- **Software licensing model**
 - Available as OEM software components.
 - Customisation & product engineering services available



EdgeCentrix 4G LTE Network Core

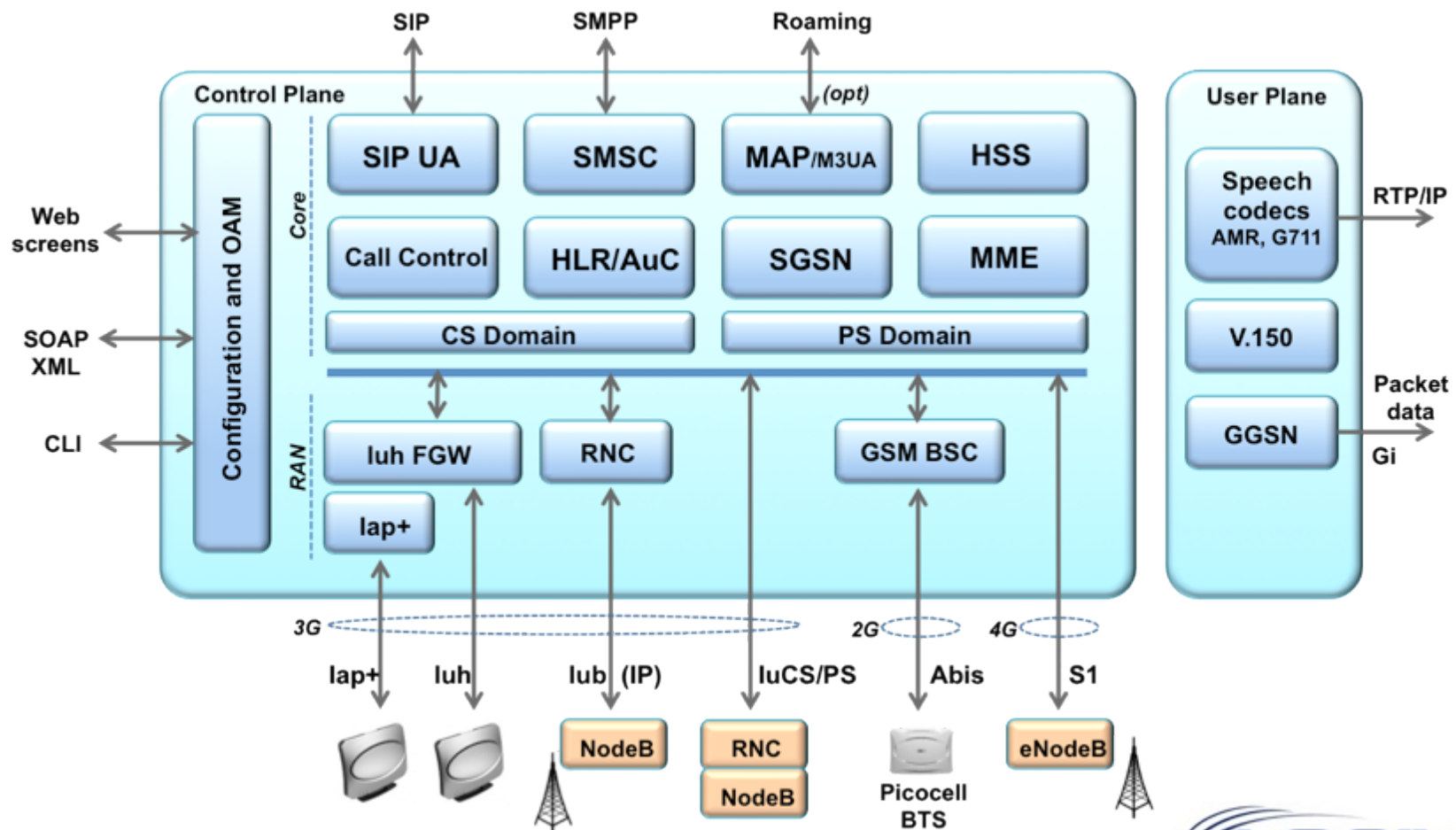
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- **Small footprint EPC**
 - For vehicle, command post, campus, UAV or back-pack use.
 - Integrated or co-located with eNodeBs
 - Integrated MME, PGW, optional HSS for local standalone use
 - Centralized HSS: DIAMETER, S1 HO, localized VoLTE support
 - Localized data offload and mobility management
 - Radio Agnostic
 - Multiple Platform Support (Intel, ARM, Freescale etc)
- **Strategic roadmap:**
 - LTE SMS. Voice over LTE, LTE Relay, S1/X2 Handover
 - Adhoc network node meshing (IP mobility)
 - Support of Rel 12 PS features: Group Call, ProSE
 - Focus on end-to-end security requirements
 - Satellite backhaul optimization



EdgeCentrix LTE 4G Network Core Architecture

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EdgeCentrix LTE 4G Capabilities

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Integrated CN elements

Supported eNodeB's

LTE: MME/PGW/SGW, Multiple S1 interfaces

LTE Macro eNodeB, 2 x 2 MIMO, 60W per sector

LTE Pico Cells, 2 x 2 MIMO, 1 to 5W per sector

6 LTE radio vendors supported

PS & HSDPA services

Integral PS core

LTE: DL >60MBps, UL >20MBps

Voice Services

LTE voice calls QCI 1 & 2 converted to SIP locally

Authentication and ciphering

LTE authentication challenge modes. Standard AUTN, CK, IK and AUTS support.

Roaming

Optional support for Diameter

Custom Services

Multi-tasking, Subscriber database sharing, Mesh networking

Application Services

Video sharing, Situational Awareness, PTT, CUG's

Mobile Device management, SIM OTA management

Hardware platforms

Small i86 ITX or ARM9 boards

Virtual Machine implementation

Rack-mount Multi-core HP ProLiant servers, depending on capacity requirements.

Management and provisioning

SOAP XML, event server, whitelist server, geo-fencing support



ECX MACRONET 4G LTE System

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Q2/2014

- Now 4U case
- 40lb lighter
- 60Mbps/20Mbps (REF-US Army)
- Optional LTE-Advanced
- Carrier Aggregation

- High Capacity - 600 simultaneous users
- Large Coverage FootPrint (48 miles @ 1000ft)*
- 2 x 2 MIMO Radio - 150Mbps shared data per sector
- Carrier Grade – reliable and dependable
- Embedded ECX LTE Network Core
- Voice over LTE, LTE SMS, MultiCast (IGMP), LTE Relay and Meshing
- Optimized for Satellite Backhaul
- Upgradeable to LTE Advanced >300Mbps shared data per sector
- Built in Interference management



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ECX MICRONET 4G LTE System

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- High Capacity up to 600 simultaneous users
- Small Size – 14” x 10” x 4” – Rugged Packaging
- Low Power Consumption (110W)
- 2 x 2 MIMO Radio – 2 x 5W per TRX
- Carrier Grade – reliable and dependable
- Embedded ECX LTE Network Core
- Voice over LTE, LTE SMS, MultiCast (IGMP), LTE Relay and Meshing
- Optimized for Satellite Backhaul
- Built in Interference management
- Automatic Neighbor Cell Configuration



ECX NANONET 4G LTE System

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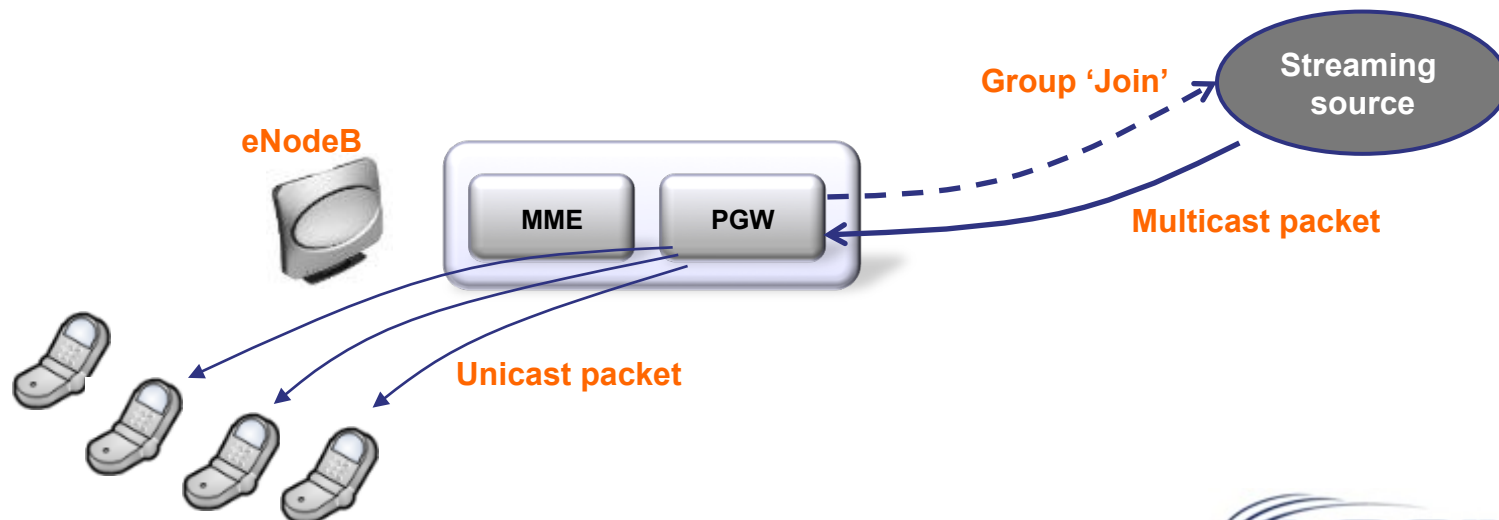
- Frequency Agile Radio – 700MHz to 3000MHz
- Protocol Agile – supports 3G and 4G waveforms
- Small Size – 5" x 4" (PCB)
- Low Power Consumption (12W)
- 2 x 2 MIMO Radio – 10dBm power output
- Optional Range Enhancement Modules
- Embedded ECX LTE Network Core
- Voice over LTE, LTE SMS, MultiCast (IGMP), LTE Relay and Meshing
- Optimized for Satellite Backhaul
- Built in SON capabilities



Advanced Features Multicast

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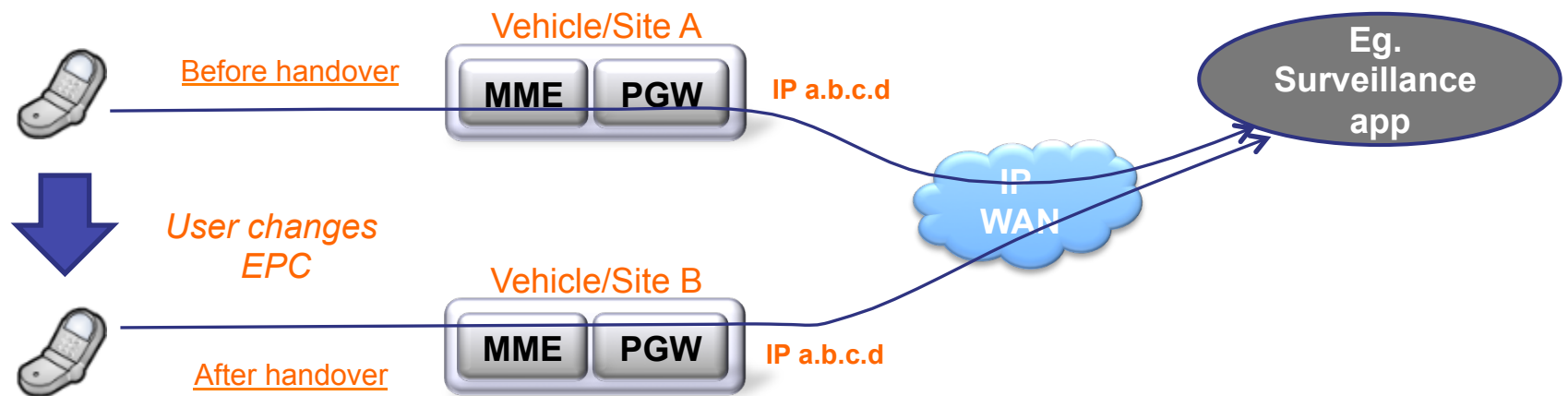
- **IP Multicast Proxy Join**
 - Each multicast group a UE joins, PGW joins on its behalf & distributes copies of packets to UEs as unicast packets
 - In-built multicast routing, inc UE to UE
 - Used in standalone & 'out-roaming' scenarios (own PGW, macro MME)
- **Roadmap: Migration to eMBMS**



Advanced Feature – Macro Mobility

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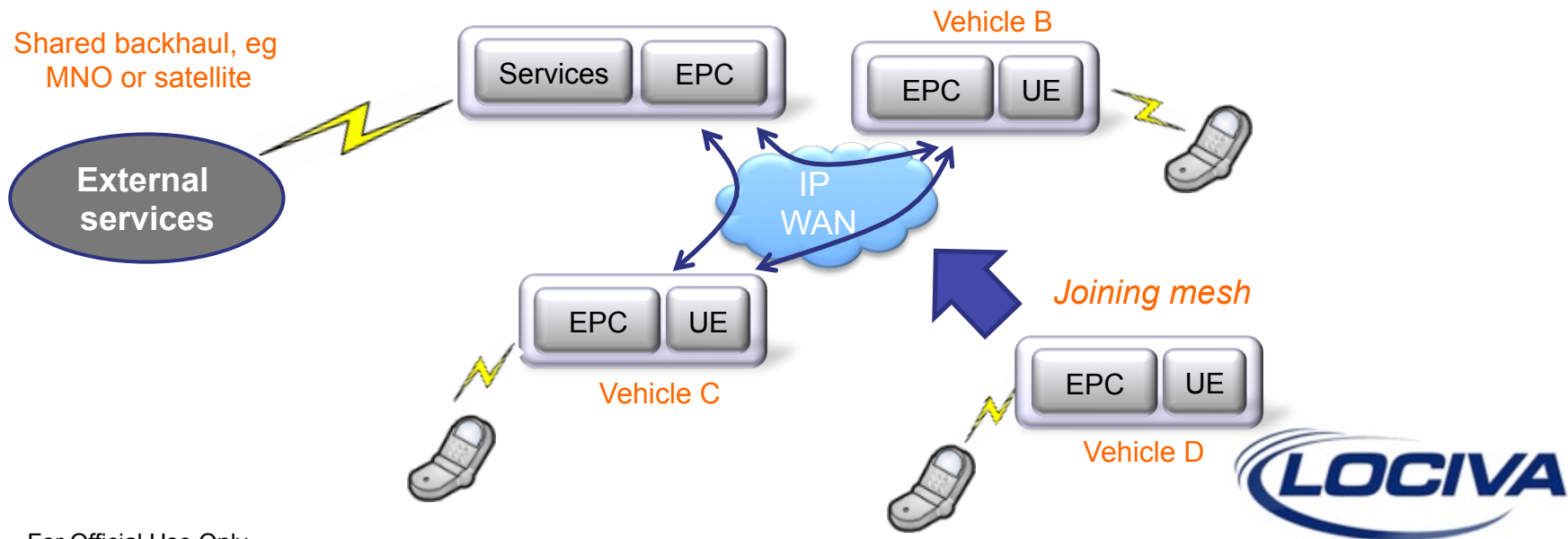
- **Allows user to transparently move between standalone EPCs**
 - Automatic inter-MME and inter-SGW/PGW handover, whilst UE active.
- **UE IP data session maintained with same apparent IP address**
 - Allows end to end security (IPSec) to be maintained through handover
- **Example: Drone with camera downlinking to arbitrary vehicles**



Advanced Feature - Meshing

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- **Standalone nodes/vehicles create adhoc mesh network**
 - Auto network configuration based on node proximity detection
- **Flat architecture – auto synced HSS in each node**
 - Each node has own EPC, eNodeB and integrated UE
- **Resources & backhaul shared amongst mesh**
 - Standalone operation if node/vehicle is isolated



EdgeCentrix LTE Small Cells

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LTE Pico-Cell
2x 0.5W MIMO
16-active users
70Mbps DL 30Mbps UL
Band 3, 13, 17 and 25



LTE Micro-Cell
2x5W MIMO
600 -active users
150Mbps DL
Band 1, 3, 7



LTE Femto-Cell
2x 50mW MIMO
16-active users
70Mbps DL 30Mbps UL
Band 3



LTE Pico-Cell
2x5W MIMO
Up to 356-active users
225Mbps DL
Band 12, 13, 14



EdgeCentrix LTE Macro Cells

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6U Form Factor, High Power, High Capacity



Flexi Macro eNodeB

Configuration: IP67 enclosure

Capacity up to 2400 RAB's per 3 sector radio

LTE Throughput: 450Mbps DL

LTE-Advanced: 900Mbps shared throughput DL

TX Power: LTE up to 2 x 60W

Range: up to 48km (link budget dependent)

Size: 6U rack mount (min)

Weight: 70lb+

Frequencies: Band 1, 2, 3, 4, 5, 7, 12, 13, 14, 17, 25, 35 (others)

Separate Server required for QX3 SoftCore

Options

High Capacity System Module with Embedded EPC



SDR LTE System - 5020

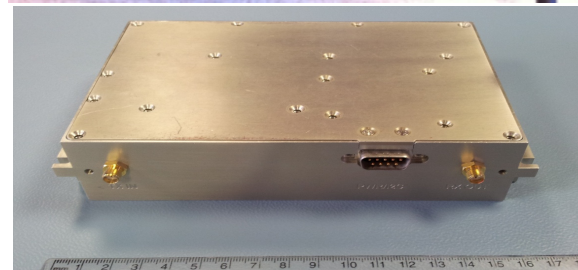
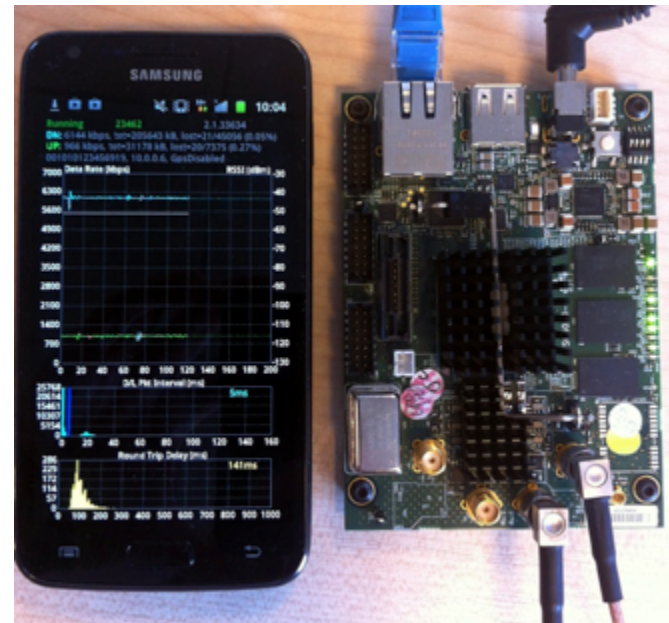
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Frequency Agile LTE enodeb module - Q1 2014

- Operates over a wide frequency range and modulation bandwidths – 700MHz – 2700MHz
- FPGA based (Xilinx)
- Power consumption <9W
- Dimensions: 110mm x 75mm (4.3" x 3")
- Integrated EdgeCentrix LTE 4G Softcore

Optional Wideband IFE (Integrated Front End)

- 5W average power
- 6.5" x 4.5"
- Custom options allow multiple band support



EdgeCentrix UMTS 3G Radios

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Ipaccess Oyster
4 CHAN, HSDPA, 7dBm



Ipaccess S8
8 CHAN, HSD/UPA, 7dBm



DBX4
4 CHAN, HSD/UPA, 15dBm



DBX16
16 CHAN, HSD/UPA, 24dBm



Commscope NodeB Q1/12
80CS, 15PS CHAN, HSD/UPA 5W with PA



Ubiquisys FC17XX
16 CHAN, HSD/UPA, 250mW



Ruggedized Ubiquisys Q1/12
16 CHAN HSD/UPA 1W

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