PtP és PmP mikrohullámú megoldások alkalmazási lehetőségei a Szupergyors Internet Programban

Magyar Mérnöki Kamara Hírközlési és Informatikai Tagozata Szakmai Nap

Trencsánszky Imre

Vezetéknélküli üzletág, Vezető hálózati mérnök

2016.Szeptember 23. Magyar Mérnöki Kamara

A Kormányzati Informatikai Fejlesztési Ügynökség (KIFÜ) céljai a SZIP projektben

Időtartam: 2015-2018

Támogatás összege: az elérendő 100%-os lefedettségi cél megvalósítására 68 Mrd Ft vissza nem térítendő támogatás és mintegy 45 Mrd Ft támogatott hitel áll rendelkezésre.

Projekt rövid leírása:

- A Program fő célja, hogy 2018-ra biztosítsa az egész országot lefedő, legalább 30 Mbps sávszélességet biztosító hálózati infrastruktúra megépítését a piaci szereplők bevonásával.

- 139 járás területén, ahol mintegy 430 ezer igényhely elérését kell biztosítani

- Helyi közintézmények (iskola, óvoda, Polgármesteri Hivatal sb) hálózati bekötése (15 ezer igényhely)

LICENCELT SÁVÚ PtP MIKRÓ GYÁRTÓK (a teljesség igénye nélkül)

SM4 siae microelettronica

NEC

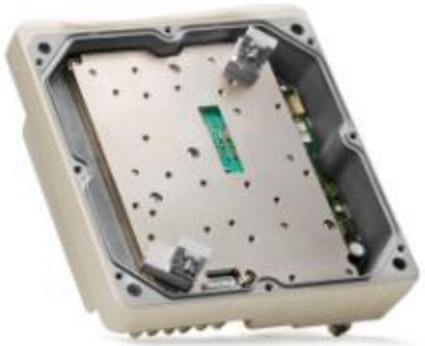
CERAGON networks®

Global Customer References

Ceragon's solutions are deployed by more than 200 service providers of all sizes, as well as in hundreds of private networks, in more than 130 countries. Some of the customer references are shown below.

Proven Design-to-Cost Leadership

1998 → 2005 → 2008 → **Next Gen.**

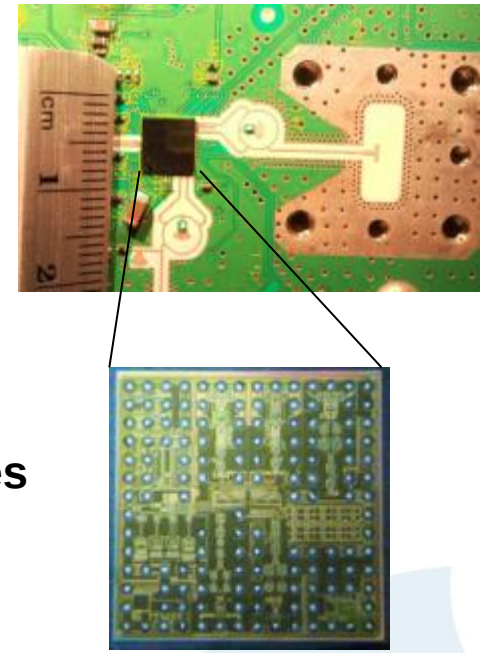


Additional reduction of form-factor & cost

Next Generation RFIC
Full RF System on Single Chip

Unique !

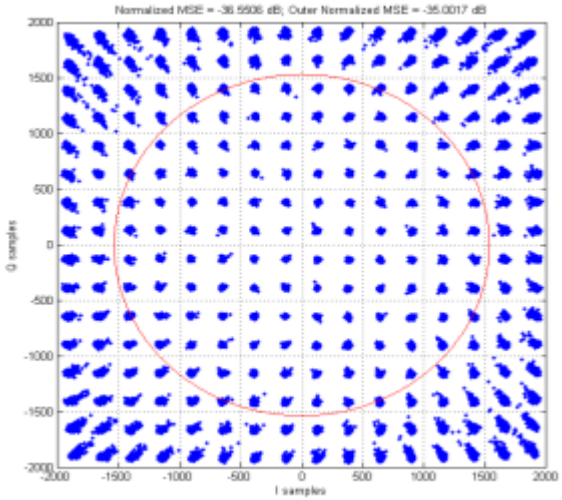
- **Single chip covers all frequency bands: 6 - 42GHz**
- **All RF functions are performed in a single chip**
- **75% less components than previous generation RFIC**
  - Fast frequencies rollout
  - Very high reliability (MTBF)
  - Fast delivery times
- **Direct conversion from Baseband to Microwave frequencies**
  - Less RF-chain distortions
  - Better modem performance (smaller degradations)
- **Optimal integration with modem for highly robust performance**



Industry Technology Breakthrough!

The 1024-2048-4096 QAM challenge

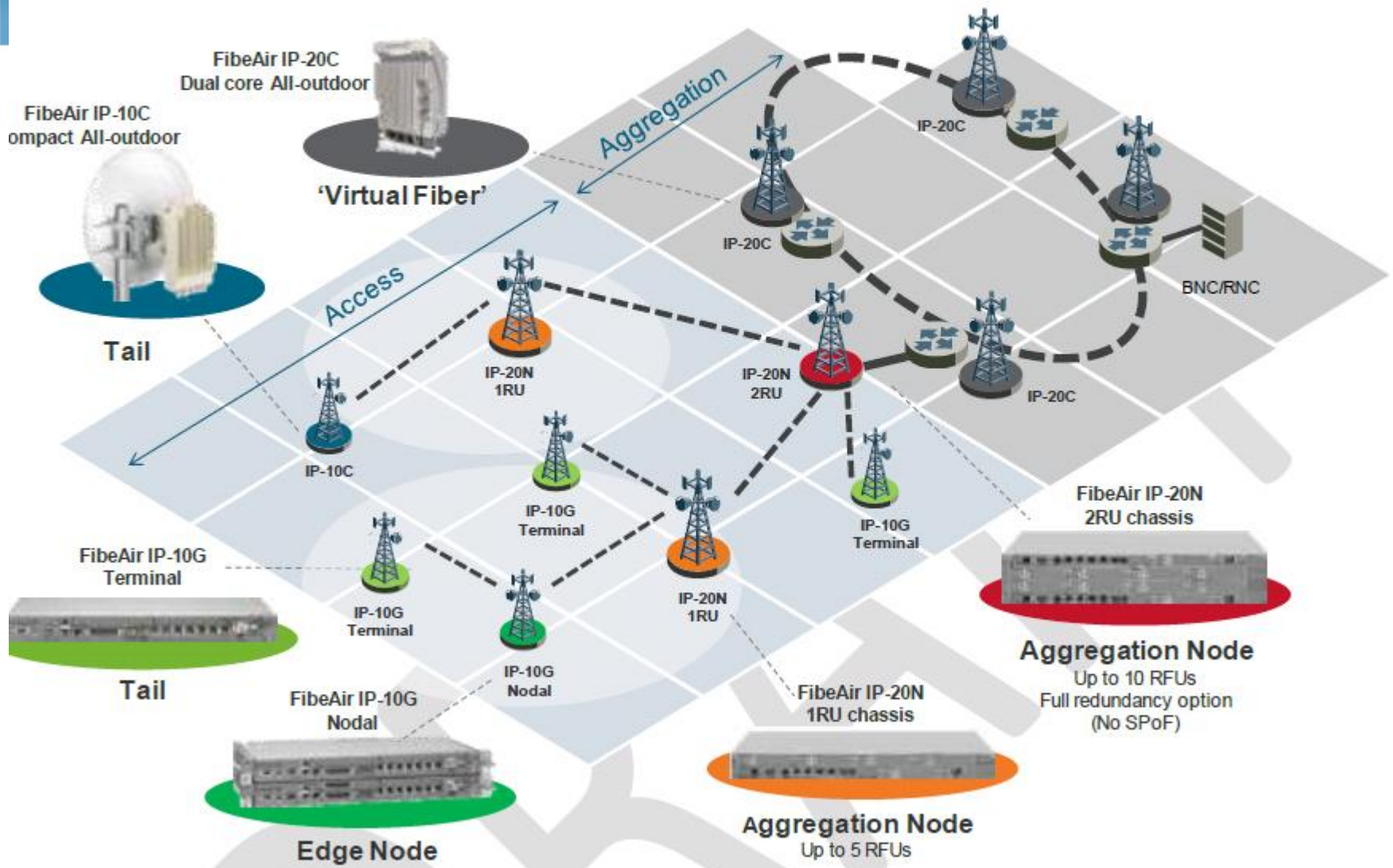
- **Highly sensitivity to SNR and distortion due to RF Impairments:**
  - **IQ imbalance distortion**
  - **Non linear distortion**
  - **Gain noise**
  - **Phase noise**
  - **Thermal noise**
- **Requires**
  - **high level of integration between MODEM & RF**
  - **End to end process "in house full system design"**



- **Enabling Higher QAMs in a cost effective way (with low power consumption)**

Making it work in all frequencies, over production, is the real challenge

FibeAir - Comprehensive Solution



Product Leadership - Technology Leadership and complete portfolio

IP-20N Indoor Unit

FibeAir IP-20N is built specifically for nodal deployments. IP-20N features a unified architecture, with a common set of traffic/control, radio interface, and line cards:

- Traffic/Control Cards (TCC)

  10 Gbps capacity

  2 x 1 GbE integrated interfaces

- Radio Interface Cards (RMC/RIC)

- Line Cards (LIC)

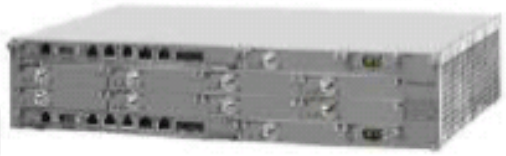
  Ethernet – 4 x 1 GbE

  TDM – 16 x E1/DS1 and ch-STM1

- Power cards: Single or dual feed 24/48VDC

1RU Chassis – Up to Five RFUs

2RU Chassis – Up to 10 RFUs
Full Redundancy Option (No SPoF)



IP-20N provides ultra high flexibility and modularity, with optimized footprint, density, scalability, and availability for aggregation nodal sites.

Ceragon IP20 IDUs

FibeAir IP-20N – Product Highlights

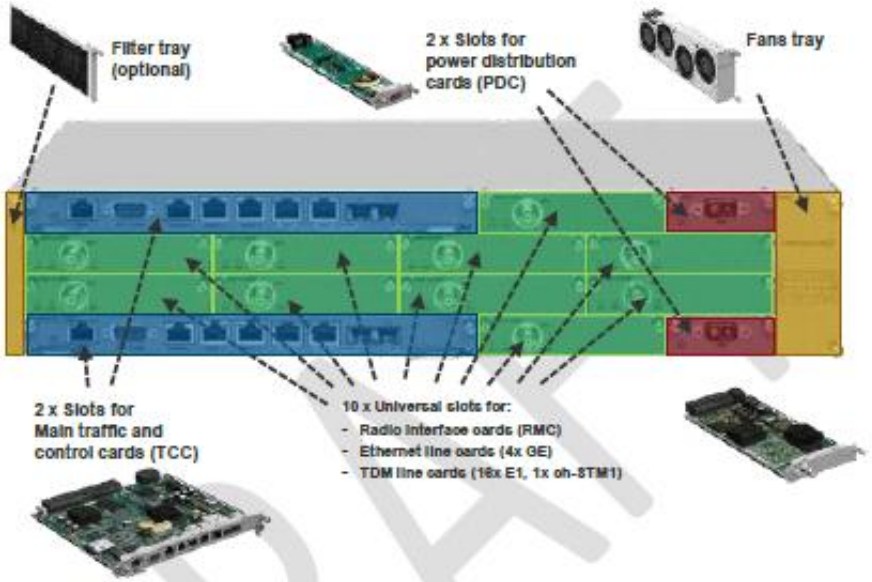
The following are some of the highlights of FibeAir IP-20N.

- Optimized nodal solution supporting seamless integration of radio (L1) and end-to-end Carrier Ethernet transport/services (L2) functionality
- Rich packet processing feature set for support of engineered end-to-end Carrier Ethernet services with strict SLA
- Integrated support for multi-operator and converged backhaul business models, such as wholesale services and RAN-sharing
- Highest capacity, scalability and spectral efficiency - 50-70% more capacity in practical networks scenarios, using Ceragon's innovative capacity boosting techniques
- High precision, flexible packet Synchronization solution combining SyncE and 1588v2
- Best-in-class integrated TDM migration solution
- Support for current and future Ceragon Radio Frequency Units (RFUs)
- Specifically built to support resilient and adaptive multi-carrier radio links, scaling to GE capacity
- Future-proof with maximal investment protection
- Supports modulations up to 2048 QAM using IP20C

FibeAir IP-20 Family Provides End-to-End Mobile Backhaul Solutions with Tail and Nodal Solutions for Access and Aggregation

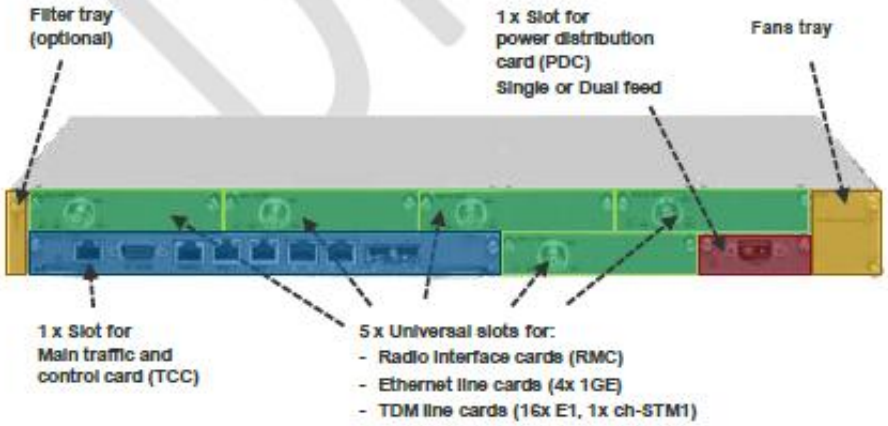
FibeAir IP-20N – 2RU Chassis

The following illustration shows the cards and other components that can be placed in a FibeAir IP-20N 2RU chassis.



FibeAir IP-20N – 1RU Chassis

The following illustration shows the cards and other components that can be placed in a FibeAir IP-20N 2RU chassis.



IP-20C – Dual Core All Outdoor Solution

- Wide frequencies coverage
  - 6-42GHz
  - High Modulation: QPSK – 2048QAM
- Variety of configurations for every topology and scale
  - MIMO, XPIC, 1+1HSB, SD and FD
  - 3 Ethernet ports (Optical and Electrical options)
- Flexible and Environment friendly
  - Integrated PoE IEEE 802.3at
  - Small form factor (5.3 liter, 24x22x10 cm) for dual carrier radio
  - Low Power Consumption: 20-25W (Single Channel)
  - Very High MTBF due to very small components count

Unique All-Outdoor Scalability Boost Capacity for 4G and Beyond

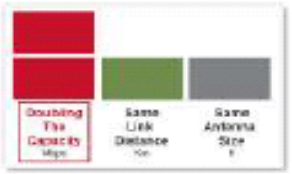
- 4+0 (2 x Dual Carrier units)
- Unique 4 carriers branching system

Ceragon FibeAir IP-20C: Flexible Operating Modes

Ceragon's IP-20C is the most versatile radio available in the market today thanks to its unique dual-core technology allowing it to be configured for optimized performance in any deployment scenario. Flexibility is the key.

Doubling the capacity

With its unique dual-core technology, FibeAir IP-20C allows to start off with a single carrier. It provides the option to turn on the second carrier remotely, instantaneously doubling link capacity whether by using a new channel or by utilizing the existing channel with XPIC or MIMO. No need to go to the site for a new radio installation.

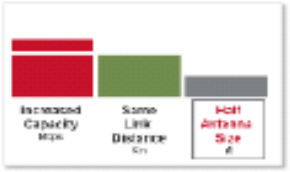


Doubling the link distance

The second carrier can be utilized in order to double the link distance. Automatically, FibeAir IP-20C spreads the capacity over two carriers using Multi-carrier Adaptive Bandwidth Control, lowering the modulation scheme, resulting in a significant rise in system gain—both Tx power and Rx sensitivity and a longer link span – up to double the distance.

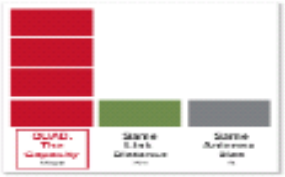
Halving the antenna size

Instead of doubling the link distance, FibeAir IP-20C's higher system gain can be leveraged to enable use of smaller antennas as little as half the size.

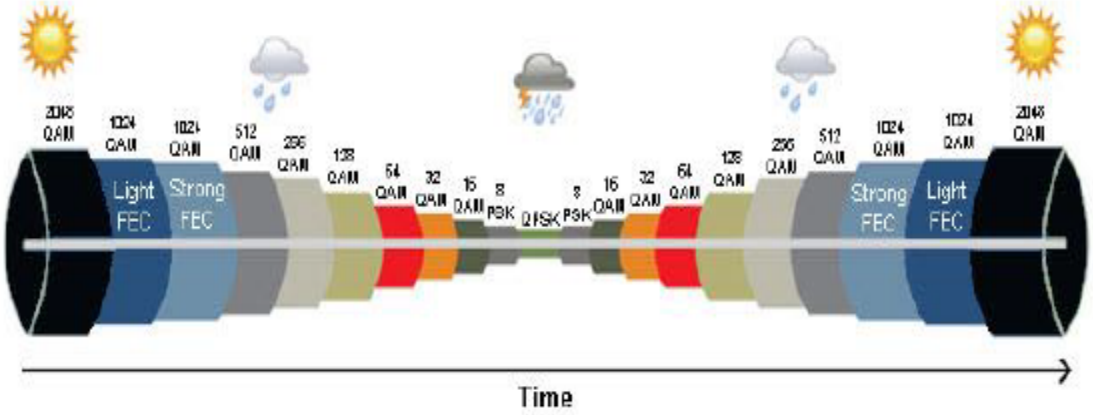


Quadrupling the capacity

By installing two IP-20C units in a 4X4 MIMO configuration, quadrupling of the capacity is achievable using the same channel bandwidth - a new record in microwave spectral efficiency.



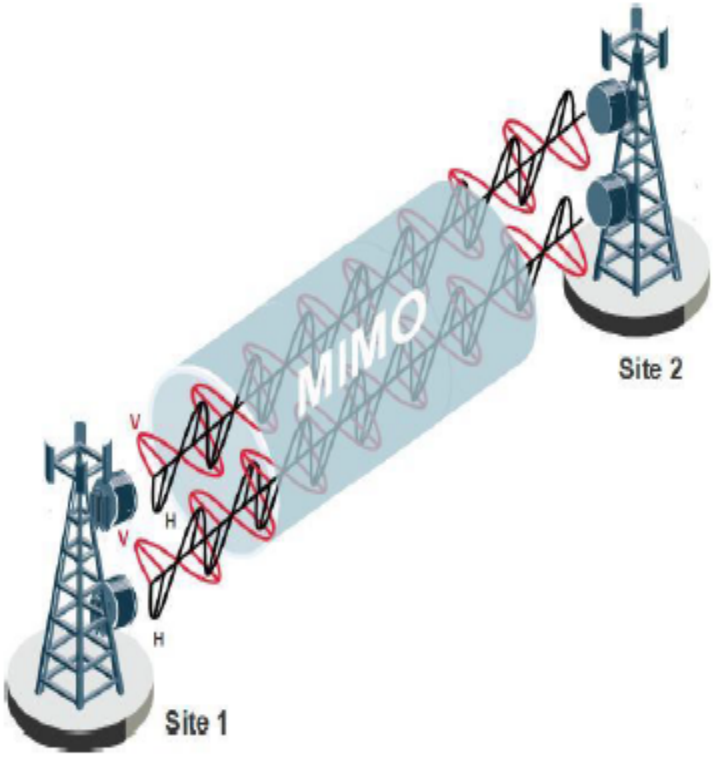
IP-20C implements ACM with 11 available working points, QPSK-2048QAM, as shown in the following illustration:



With built-in XPIC & MIMO support, IP-20C can support 1Gb/s uncompressed throughput over a single 28MHz channel.

2x2 LoS MIMO enables transmission of two independent bitstreams over the same frequency channel, using the same polarization, providing 100% more capacity than a 1+0 link without consuming additional spectrum resources.

4X4 LoS MIMO, with dual polarization, enables transmission of four independent bitstreams over the same frequency channel, providing 300% more capacity than a standard 1+0 link and 100% more capacity than a 2+0 XPIC link, without consuming additional spectrum resources.



IP-20C Radio Configurations
Meeting the needs of Every Deployment Scenario

5.2.6 56 MHz Channel Bandwidth Capacity with W-DPHC (ACAP)

Profile	Modulation	Minimum required capacity license	Radio Throughput (Mbps)	Ethernet capacity (Mbps) with W-DPHC (per average Ethernet frame size)					
				64 bytes	128 bytes	256 bytes	512 bytes	1024 bytes	1518 bytes
0	QPSK	100	87	292	143	109	97	91	89
1	8 PSK	100	127	426	209	160	141	133	130
2	16 QAM	200	175	591	290	222	196	185	181
3	32 QAM	250	230	778	382	292	258	243	238
4	64 QAM	300	282	955	469	358	317	298	293
5	128 QAM	300	341	1000	567	433	383	361	354
6	256 QAM	400	394	1000	654	500	442	416	408
7	512 QAM	400	423	1000	704	537	475	447	439
8	1024 QAM (Strong FEC)	450	460	1000	765	584	516	487	477
9	1024 QAM (Light FEC)	500	489	1000	813	621	549	517	507
10	2048 QAM	550	530	1000	881	673	595	560	550

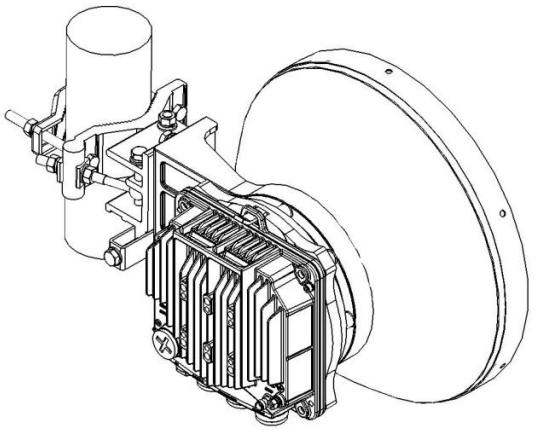
FibeAir IP20E Series Product Portfolio
E-Band PtP solution

FibeAir-IP20E

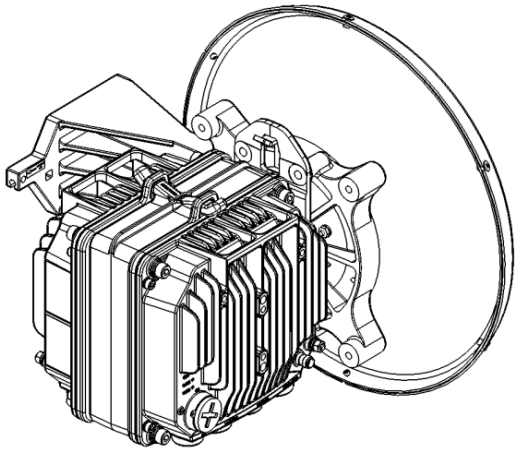
FibeAir IP-20E

2 Gbps Full Duplex, FDD , 71-76 / 81-86GHz

IP-20E 1+0 Direct Mount



IP-20E 1+1 Direct Mount



RADWIN

Product Portfolio

RADWIN - Member of the RAD Group

No. of employees = 3,700

Group sales in 2010= $1 Billion

RAD data communications
The Access Company
Established: 1981

Silicom Connectivity Solutions
Hi-end Adapters for Servers
Established: 1987

RADCOM Test-Of-The-Art
Network Test Solutions
Established: 1991

RADVISION Delivering the Visual Experience
Video Conference Solutions over IP
Established: 1992

CERAGON networks
Wireless Mobile Backhaul
Established: 1996

Bynet Data Communications Ltd
Group Distributor in Israel

Coordinated Strategy

Shared Marketing Channels

Joint Development & Technology Sharing

Some Companies are Public

radware
Integrated Application Delivery
Established: 1997

RAD iflow
Industrial Communication Solutions
Established: 2009

RADWIN
Sub-6GHz Wireless
Established: 1997

CHANNELOT
Mobile TV Transmitters
Established: 2006

PacketLight Networks
CWDM and DWDM Solutions
Established: 2000

SANRAD
iSCSI SAN Solutions
Established: 2000

RADWIN Worldwide Offices

- Deployments in over 120 countries

RADWIN Applications Fit

- ***CCTV Projects* – safe city, Borders**

- ***Telecom operators & ISPs***
  - IP Backhaul
  - Access for business customers in Rural and Sub urban areas
  - Fiber Backups
  - Wifi Backhaul

- ***Private Networks***
  - » Government, Utilities
  - » Transportation, Education, Healthcare

RADWIN Technology Adopted by Tier 1 Carriers

RADWIN – Telco Grade MIMO OFDM Wireless Links

Point to Point

- 10- 750 Mbps Net Ethernet
- 1- 16 Native E1s
- Multi Band Radios 2-6GHz
- Long range to 120km

Point to Multi-Point

- Base Station with 350Mbps Net (750 Mbps on 5.x GHz)
- 32 Sub Units 10/20/50/100/250 Mbps
- Secure SLA capacity to 30km
- 4.8-6GHz / 3.3-3.8GHz

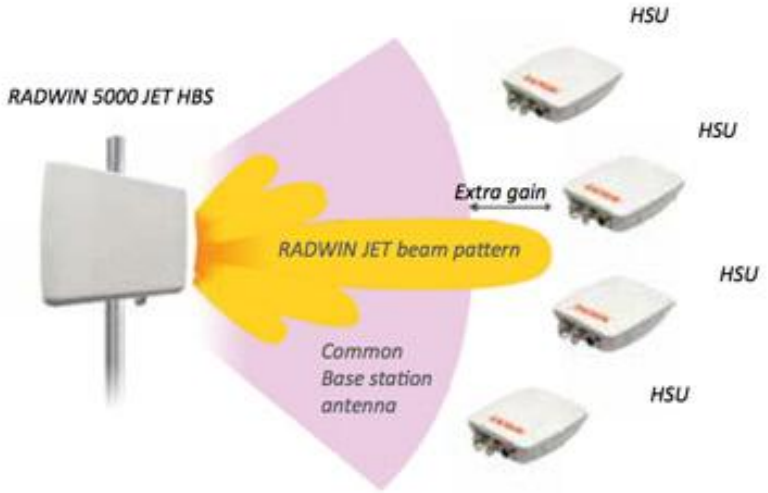
Mobility

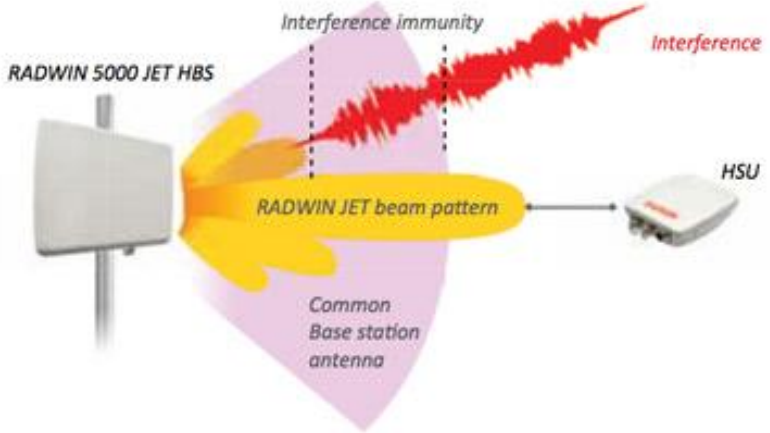
- PtMP Mobility Base Station 4.8-6GHz
- Deliver 30Mbps Net to 200kmh
- Distance Between BS 2-4km
- Designed for Trains/Military/Marin

SC mmunications & Networking, Inc. ▪ 1142 Budapest, Erzsébet királyné útja 125. ▪ phone: +36 1 467-7030

RADWIN PMP **Portfolio** for Vertical Markets

RADWIN 5000 JET NLOS





Radwin 5000 Jet Beamforming Video

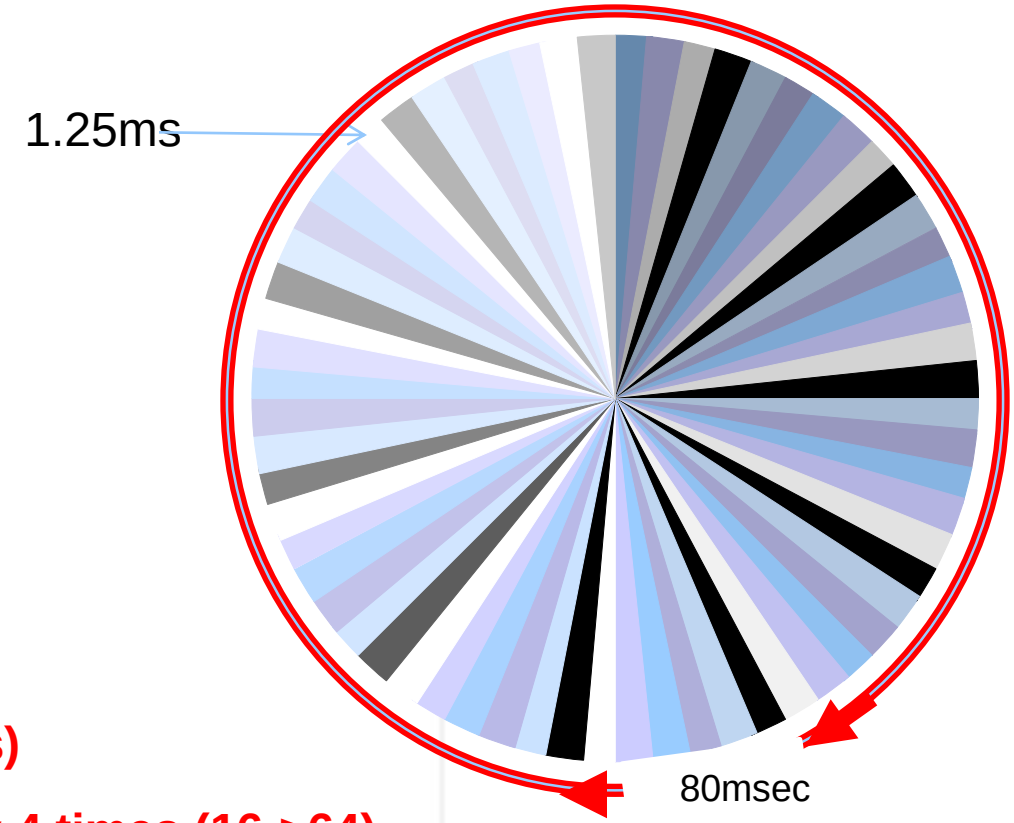
Benestra Slovakia Radwin 5000 Jet 3,7 GHz installation

New!! HSU 5610

- New addition to RADWIN 5000 family
- 10Mbps
- Dedicated PoE port for video camera connectivity – IEEE 802.3af
- AC Power feed
- Simple and Fast video camera installations
- No need for additional PoE device or Cabinet

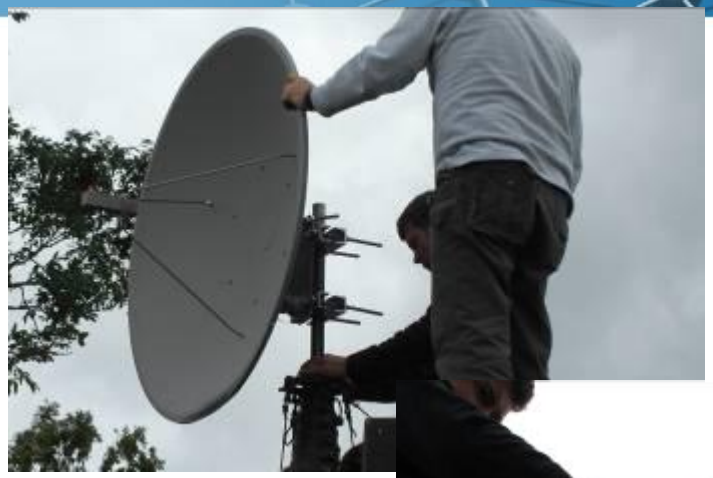
32 HSUs per HBS Base Station

Release 3.3 – 64 Time Slots



1. **2 TS min per HSU**
2. **TS duration is equal (1.25ms)**
3. **Number of TSs increased by 4 times (16->64)**
4. **TS capacity decreased by 4 times (6.25->1.56Mbps @ 20MHz)**

PTP Backhaul in Military environment



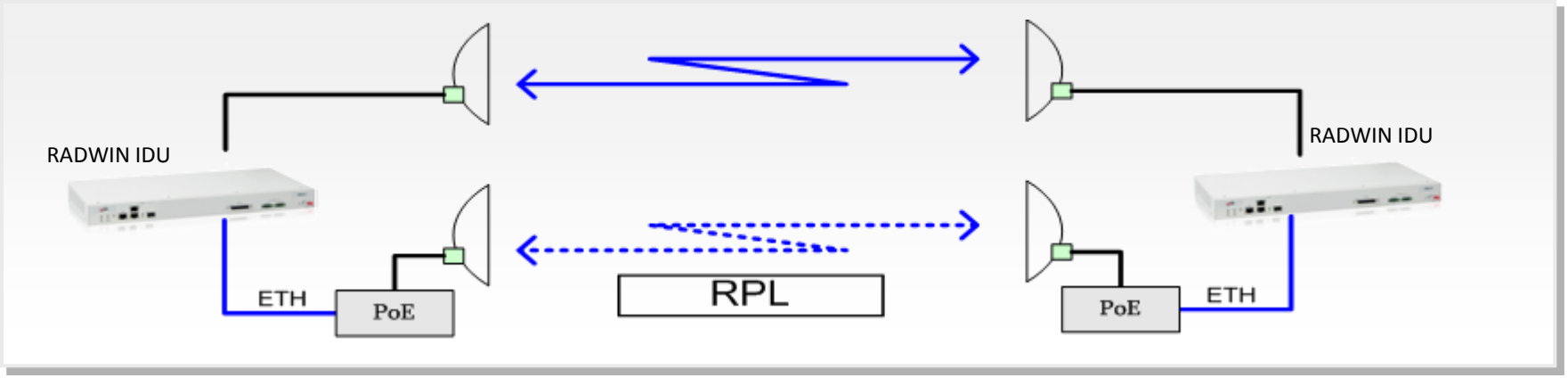
1.2 meter dual pole dish

- Setup in 7 minutes
- Deployed in hostile environment
- Long Range

RW2000 connectorized Radio

All RADWIN 2000 (C/B/L/) PTP Links Support

- **Support 1+1 for Ethernet or E1s and Ring Topology**



- **Low Power consumption 13-35watts**
- **Diversity mode for nLOS and highly interfered area**
- **Adaptive Modulation with 8 Levels BPSK to 64 QAM**
- **Max Tx Power 25dbi**
- **Small Footprint and low weight (ODU Radio 1.8Kg / 19x27cm)**

All RADWIN 2000 (C/B/L/) PTP Links Support

- **Immunity to Interference**
- **Optimized TCP algorithm**
- **Comply to IP67 for extreme weather**
- **Non-interrupted Transmission**
- **Quick and simple Installation via Intuitive GUI**

GPS Tower synchronization

GSU
GPS-based
Site
Synchronizatio
n

GPS Antenna

RF Cable

1 GSU required per Tower

ODU Radios

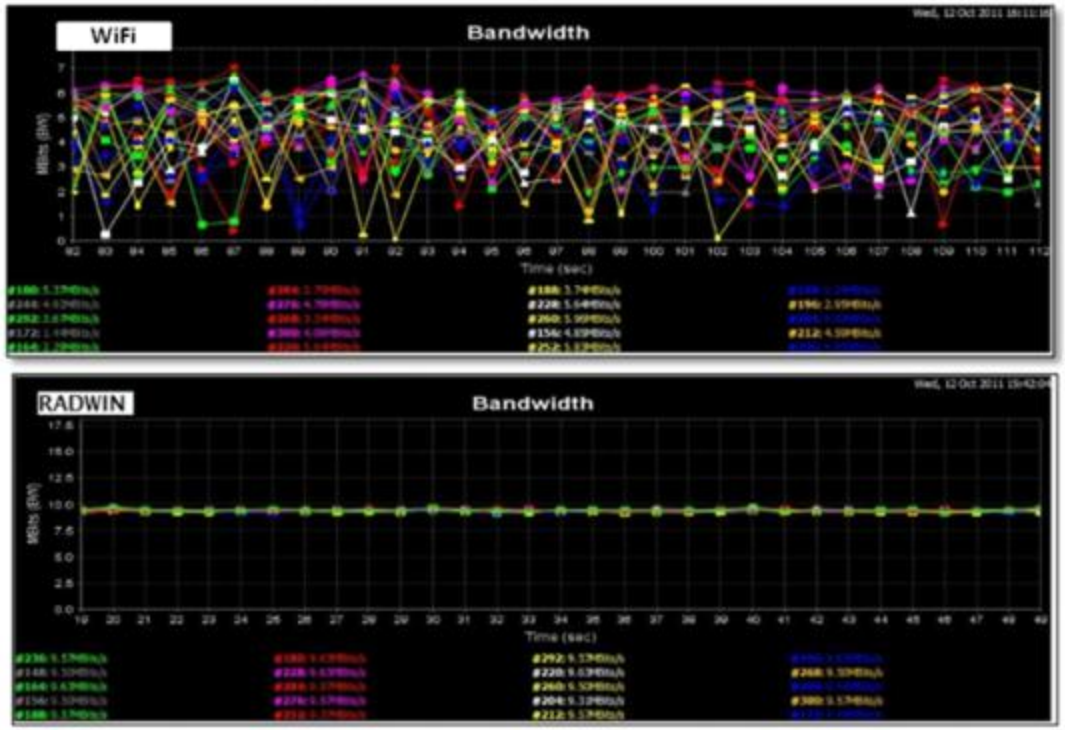
CAT-5e Cable

PoE device Powers the GSU unit

HSS
Passive outdoor
Connecting Unit

RADWIN vs. leading 802.11n Wi-Fi solution in NLOS Scenario

- **4 video streams have been transmitted over the wireless link**
- **RADWIN – Stable bandwidth in all 4 streams**
- **WiFi – Fluctuated bandwidth in all 4 streams due to errors in the link**



Throughput versus Time

Stable bandwidth is imperative for

IDU-C

- ✓ Telco Grade Indoor Unit 19” 1U
- ✓ Dual Power Supply with redundancy
- ✓ 2 GB Ethernet Ports / Native TDM E1s / SFP Port
- ✓ Independent clock per TDM port
- ✓ VLAN/QinQ,
- ✓ 1+1 Ethernet redundancy
- ✓ Ring topology
- ✓ -20 to -60V DC or 220V AC
- ✓ Dry contacts for Alarms

4 Models

Ethernet Only

Ethernet + 4E1

Ethernet + 8E1

Ethernet + 16E1

IDU-E

- ✓ 2 Ethernet Ports / 2 E1 Ports
- ✓ 9.5 inch / 24cm
- ✓ 1+1 Ethernet redundancy
- ✓ Ring topology
- ✓ VLAN/QinQ
- ✓ Single power supply
- ✓ Independent clock per TDM port

2 Models

Ethernet Only

Ethernet + 2E1

POE

- GB and FE supported in the same model
- POE can work with ALL Radwin Radios

P/N	Product Description
RW-9921-1011	AC 220V EU Plug POE

New Aggregation Unit – IDU-H

- **Small & Compact aggregation unit , save space , cabling and complicity**
- **Aggregation for multiple ODUs :WL1000,RW2000B/C/X and 5000 HBS**
  - Doesn't support RADWIN 2000A currently
- **Up to 6 PoEs Interfaces , 25W per port**
- **2 LAN Interfaces 10/100/1000 Mbps; auto-negotiation , 2 x SFP ports of 1000 Mbps (standard MSA)**
- **Dual redundant power supply inputs – better protection**
  - 48V DC, 220V AC Requires external Power supply

New Lightning Protector

- **Accessories – New RADWIN Lightning Protector:**

- Main capabilities:
  - Support 10/100/1000 Base T
  - Support up to 1000Mb
  - Fully outdoor - IP67
  - Small form factor and easy installation
  - Protection towards high current spikes

P/N	Product Description
RW-9924-0006	Outdoor Lightning Protection Unit for 10/100/1000Base-T
RW-9924-0007	Kit of 10 Outdoor Lightning Protection

New Cable Extender

- Main capabilities:
  - Extend ODU to POE/IDU cable to 200meters
  - Support FE

P/N	Product Description
RW-9924-0008	Cable Extender to 200meters, connect between 2 x 100meter cables

Köszönöm a figyelmet!

timre@scinetwork.hu
+36(30)2102567