A New Solution to Last-Mile

A solution to the “last-mile” problem is finally at hand. New proprietary technology known as E-Line™, discovered and developed by Corridor Systems, has completed multiple field tests successfully demonstrating the capability to deliver economical, high speed, high performance wireless consumer applications bundling Internet, phone, and cable TV to end users virtually anywhere in the inhabited world. The following pages review the physics of the last mile problem, outline the framework of the solution, review field test validations, and hint at some of the exciting applications that this breakthrough technology is capable of enabling globally.

The Question

The essential question of this workshop is:

“Can wireless technology effectively and economically support triple-play and other next-generation applications and services?”

The answer is Yes.

E-Line™ - A New Pipe for Last-Mile

- What's the problem?
- What's a last-mile pipe?
- E-Line™ a new waveguide
- E-Line™ on power lines
- E-Line™ transport
- E-Line™ as a DAS

Last-Mile - What's the Problem?

The Last-Mile Problem is a transport and distribution Problem

- Worldwide Information is the commodity
  - Need high data rate
  - Need low latency
- Must Serve both fixed and mobile users
  - Must be Inexpensive
  - Local user must defray local costs, both CPE & access

We need a very economical, high capacity pipe to distribute information to end users worldwide.

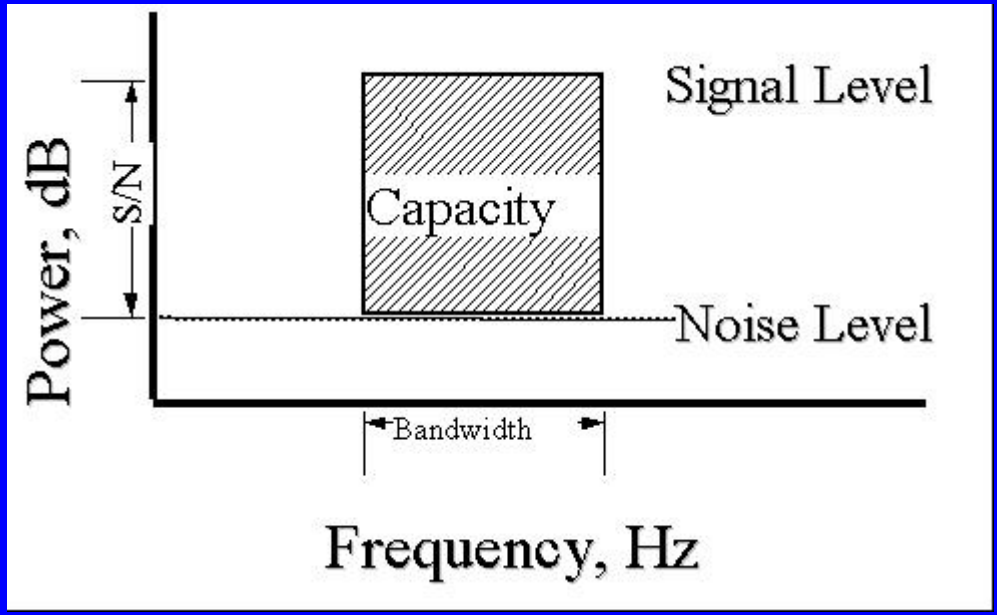
What's a Pipe?

- Information conduit
  Low Latency Demands Electromagnetic Transport

- The Capacity of a Pipe is described by Shannon's Equation:

$$C = B\text{Log}_2(S/N+1)$$

C, Information capacity bps
B, Channel bandwidth, Hz
S,N signal, noise power



- Assumes perfect coding!
- A pipe is an energy conduit

What's a Good *Last-Mile* Pipe?

- Capacity
- Low Latency
  - Low compared to human response times
- Worldwide Availability
- Economy
  - Cheap or free Installation
  - Low CAPEX & OPEX

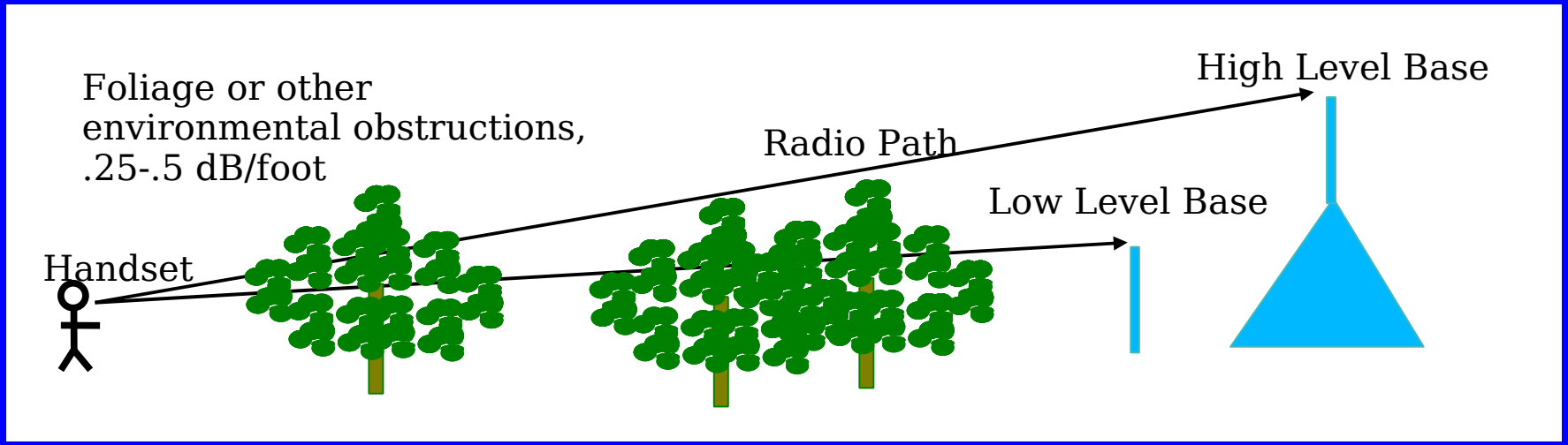
Current Pipes

- Guided energy
  - Phone lines
  - CATV lines
  - Optical fiber
- Unguided/Wireless (possibly directed) energy
  - Terrestrial
  - Satellite (latency a show-stopper)

The wireless “pipe” is unguided but offers the only practical means for distribution to mobile users.

Terrestrial Wireless Attenuation

- Impossibly complex to model accurately
- COST231, Lee… are statistical models
  - Flat earth
  - Median attenuation
  - Large variation
- Attenuation a function of antenna height/angle



Wireless >1 Mbps Not Practical Beyond Short Distances

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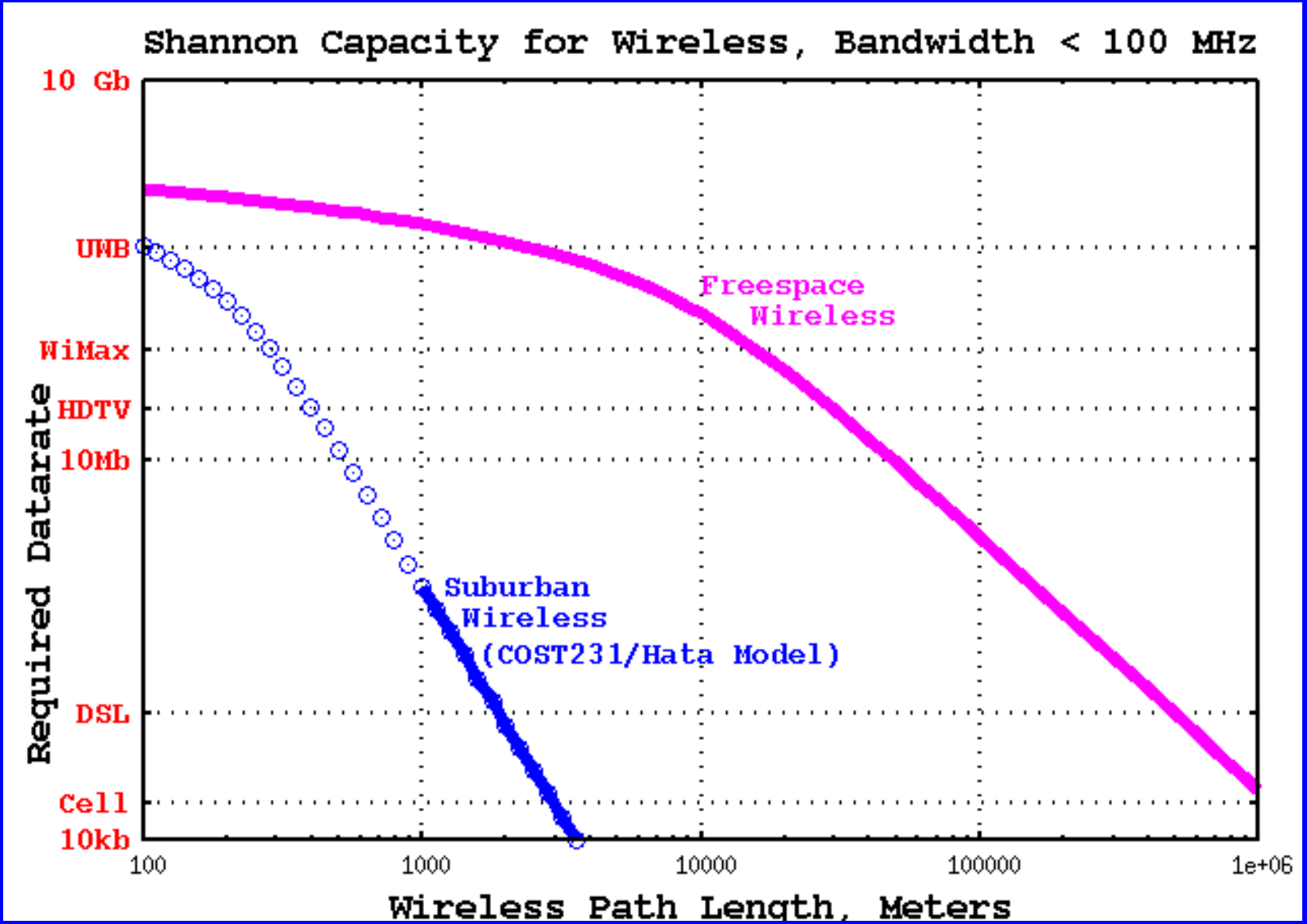


Present Wireless Unusable for Gbps

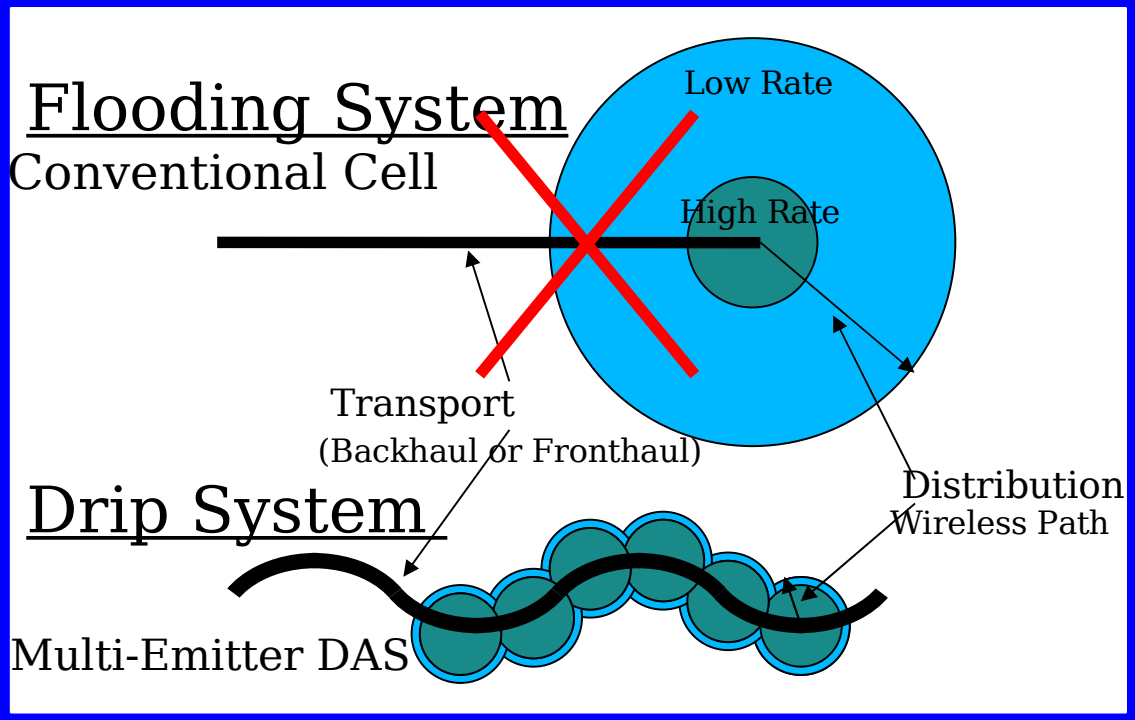
Over longer paths, incremental attenuation makes terrestrial wireless UNUSABLE for Gbps applications and services!

Wireless MUST be used to reach mobile users with next generation applications and services.

So - What do we do for Gbps delivery?

Requirements for Gbps Wireless

- Guided-energy front/backhaul pipe
- Use only very short, quality radio path



- Inexpensive coupling to wireless
- Inexpensive siting, local user defrays cost

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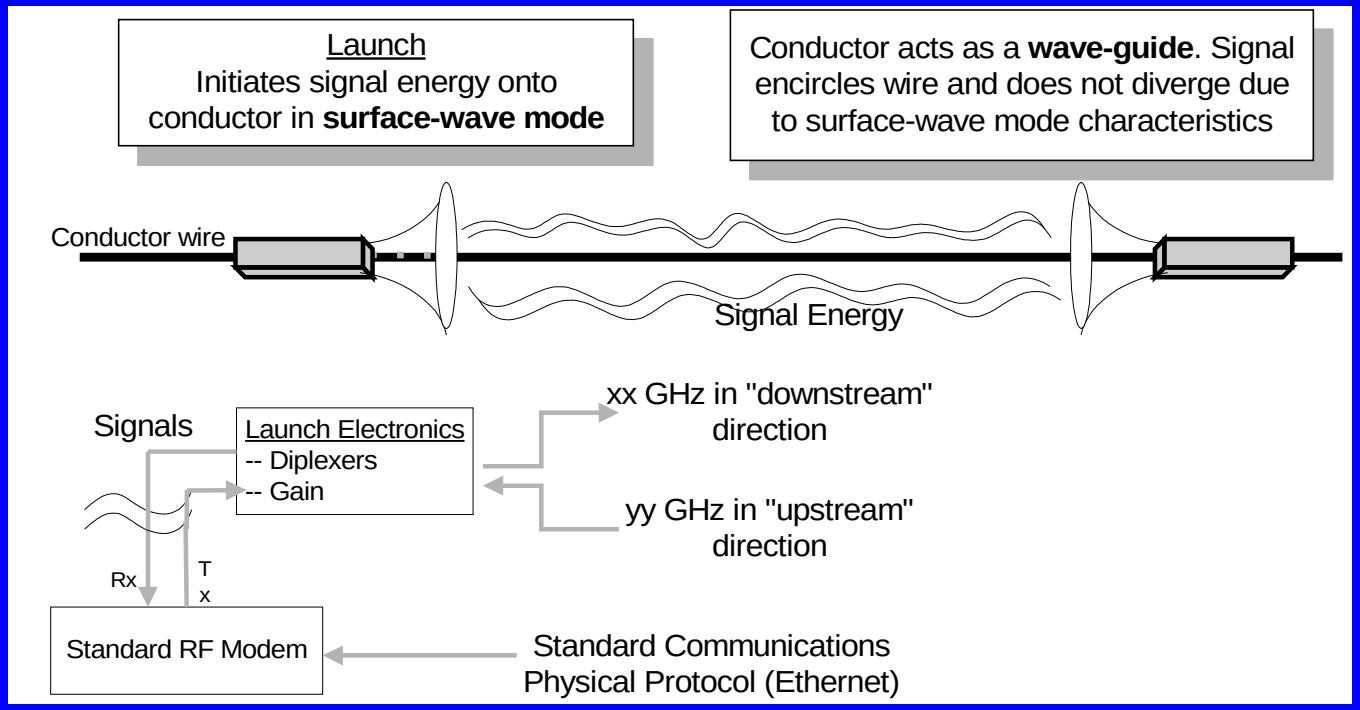
E-line™ on Power Lines - Enabling Triple-Play Wireless

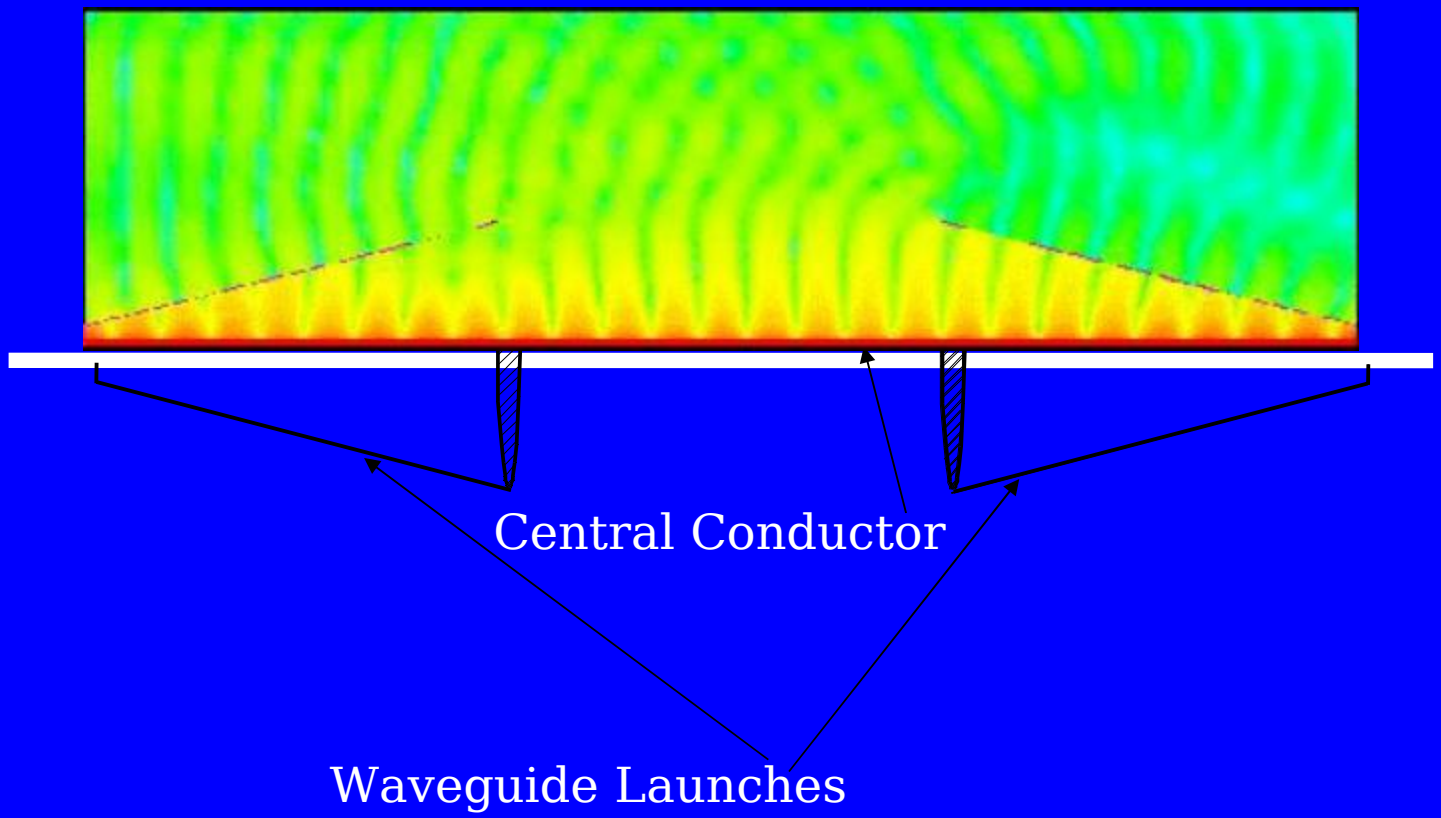
- High-capacity, low-attenuation transport
- Inexpensive & transparent distribution
- Inexpensive siting
  - Lines and sites already installed
  - No “make-ready” fees/delays

E -Line™ - A New Discovery

- Fundamentally new E/M transmission method
- Guided travelling plane wave
- Operates on uninsulated conductor
- Operates on large diameter conductors
- Midway between wired & wireless

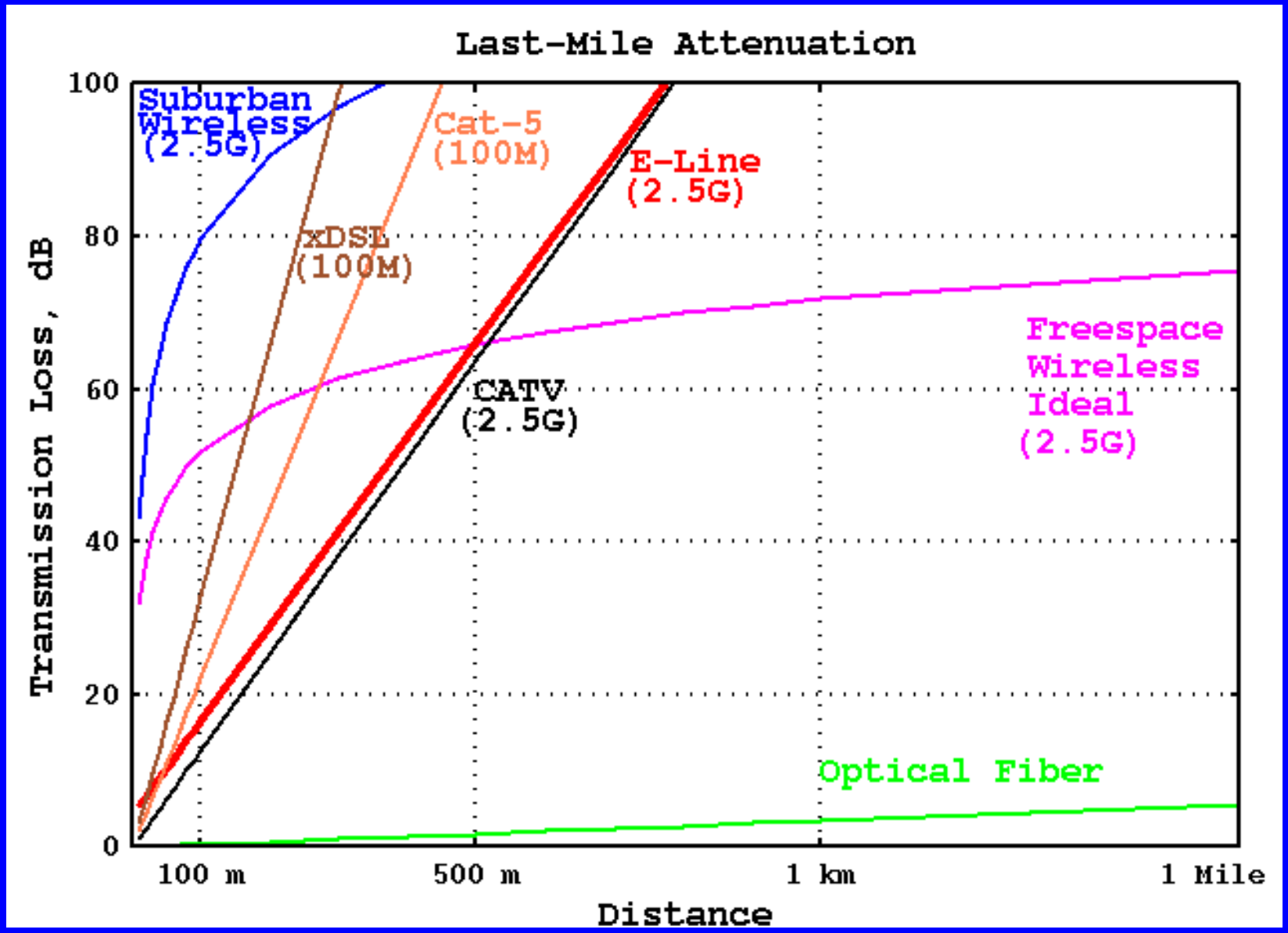


Numerical Solution of Electric Fields Near E-Line™ on an Ideal Conductor

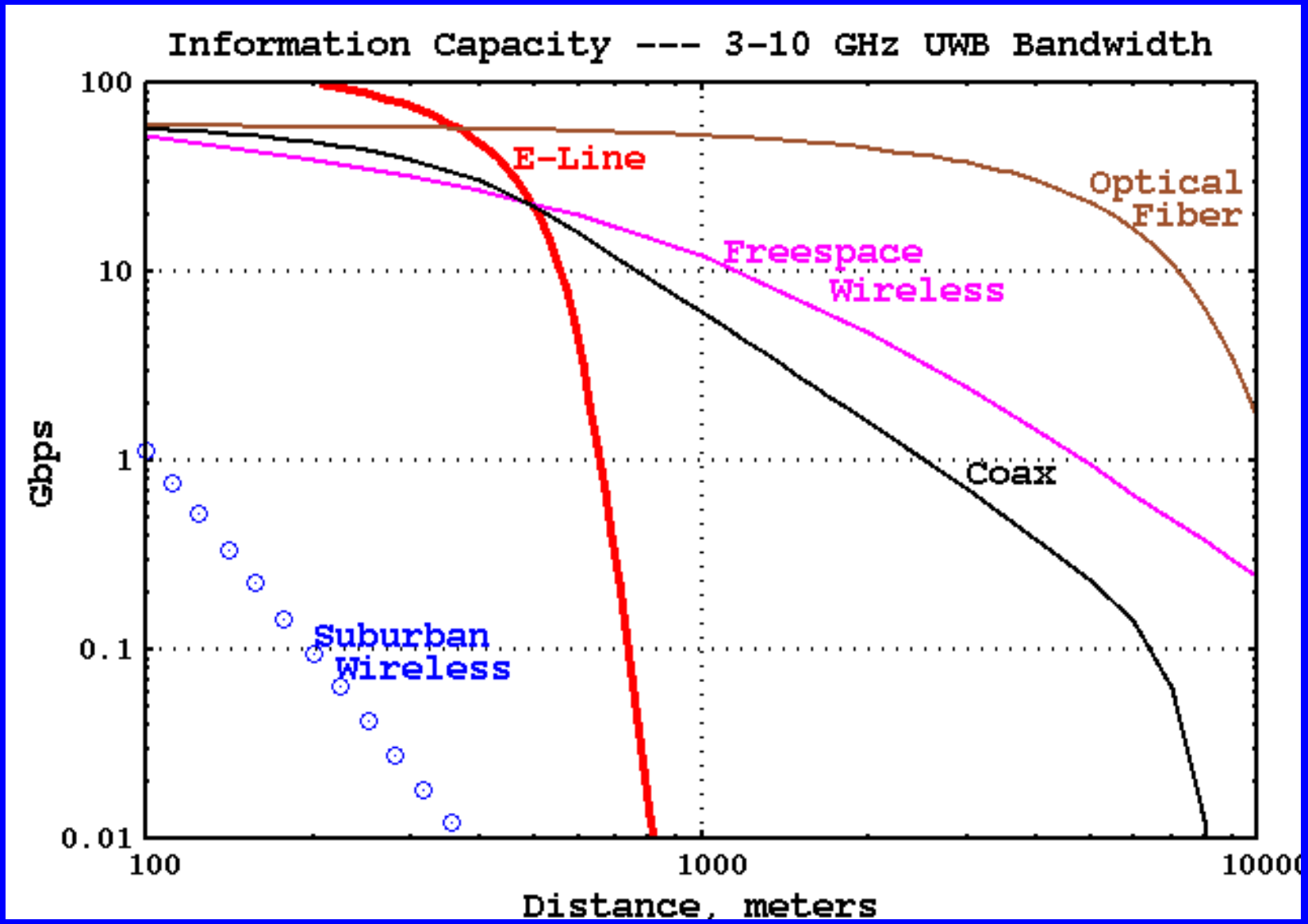


E-Line™ Transport

- Very low attenuation, <2.5 dB/100' <6 GHz
- Very broadband, VHF-10GHz, supports UWB
- Propagation velocity same as light, V_r~1.0
- Measurements consistent with modelled behaviour
- Low radiation
- Low distortion – flat group delay


Last-Mile Attenuation
Transmission Loss, dB
100
80
60
40
20
0
Suburban
Wireless
(2.5G)
Cat-5
(100M)
E-Line
(2.5G)
xDSL
(100M)
Freespace
Wireless
Ideal
(2.5G)
CATV
(2.5G)
Optical Fiber
100 m
500 m
1 km
1 Mile
Distance

E-Line™ 10 Gbps to > 500 meters



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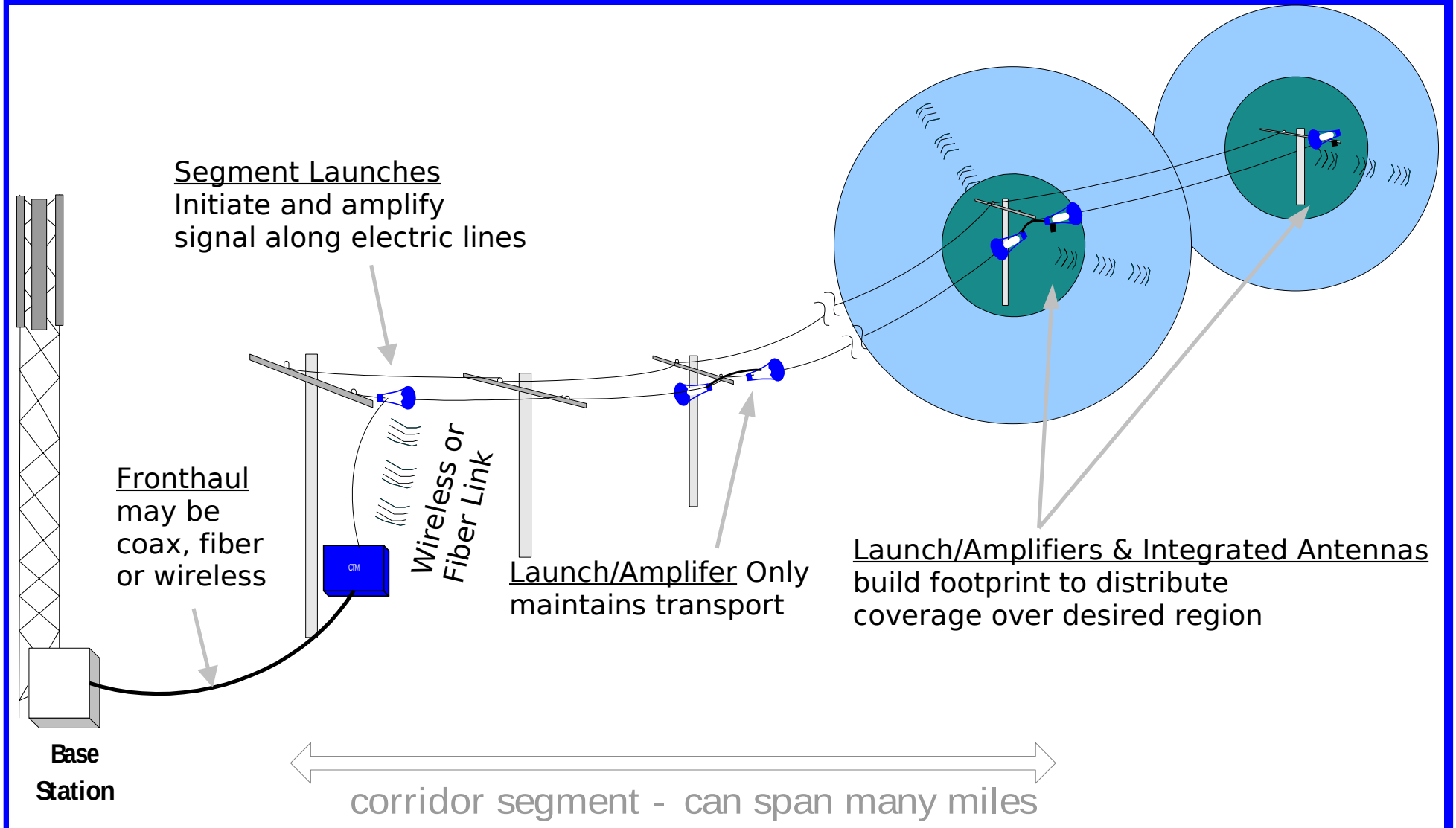
Example E-Line™ Multi-Emitter DAS



E-Line™ Multi-Emitter DAS Characteristics

E-Line™ ***transport*** allows

- Gbps pt-pt and/or DAS (2G or wireless BB)
- Multi-protocol, multi-carrier, full-duplex
- Very low cost

E-Line™ ***distribution*** allows

- Low-cost coupling, low power, commodity hardware
- Short, quality radio paths
- Low visual profile – removes zoning problems

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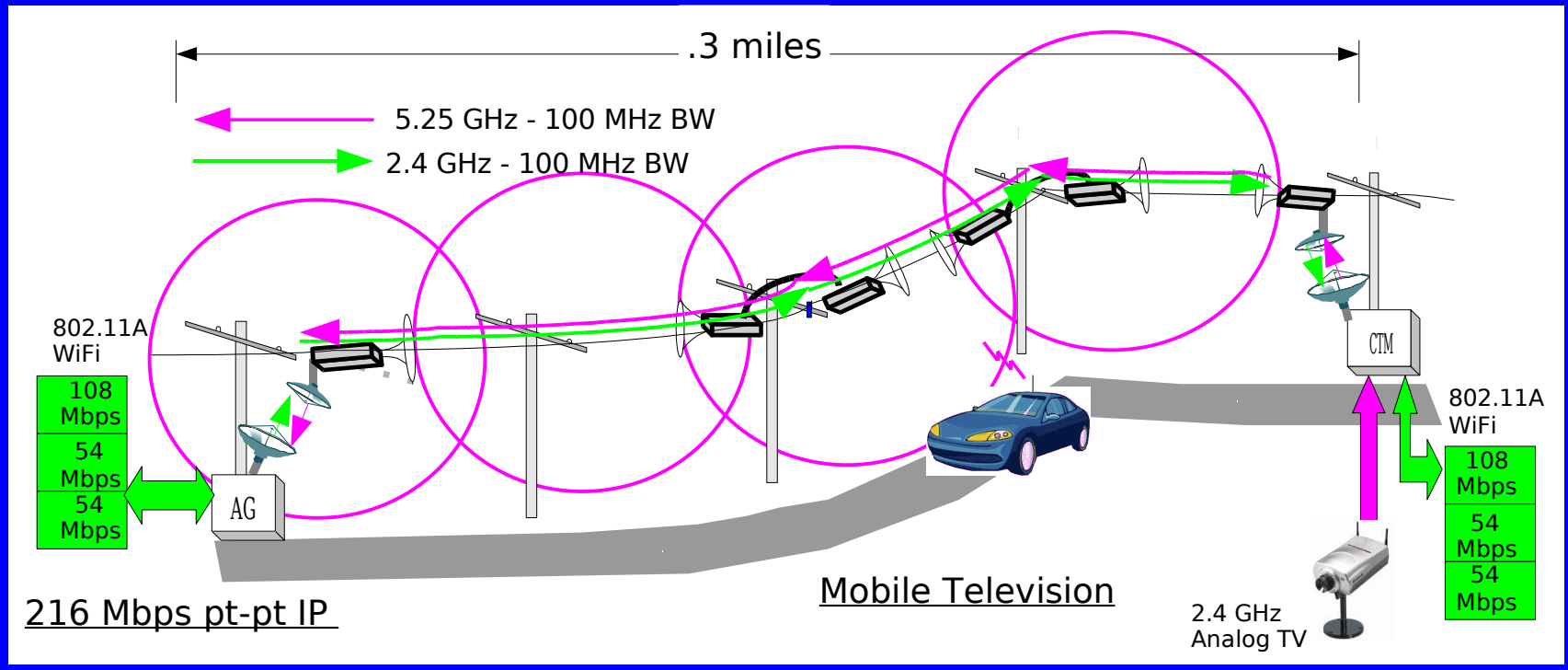
E-Line™ Multi-Emitter DAS Capabilities

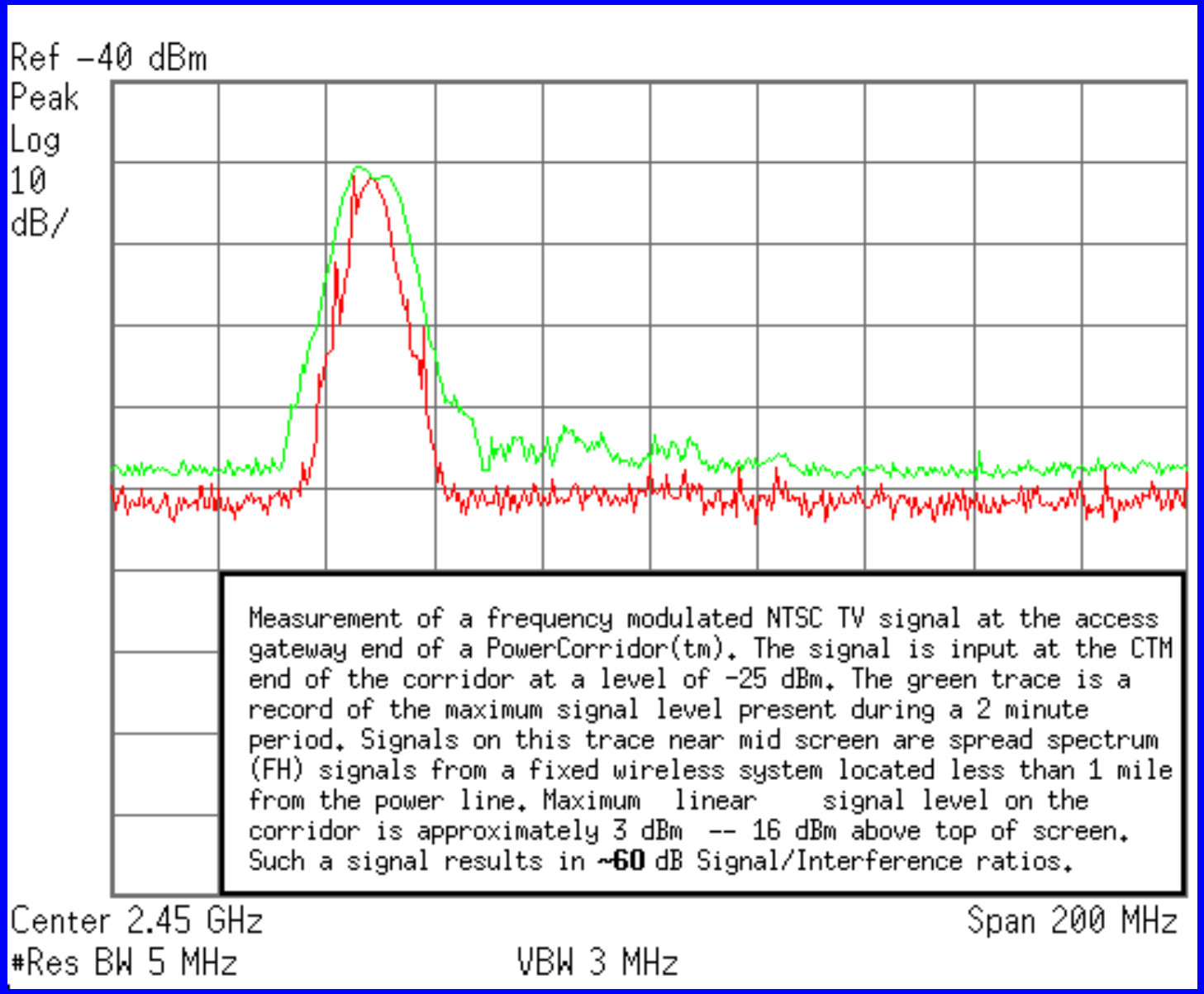
- Simple implementation, ~10 low-cost amplifiers/mile
- In suburban terrain 1 mW/user provides:
  - Mobile-phone, 1-2 km radius
  - Mobile WiMax, 200-300m radius
  - Mobile UWB, 50-200m radius
- CPE also at low power - long battery life
- Extremely low cost: < $5K / linear mile CAPEX.

Field Tests Successfully Completed

- On Active 12 kV lines – 1/3 mile
- <1 mW aggregate power
- Supported > 2 Gbps capacity (Maintained 0 dB gain, > 50 dB C/N@100 MHz BW)
- Simultaneous Digital & Analog Communications
  - 216 Mbps simultaneous with NTSC TV



E-Line™ Ingress/Egress Characteristics



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E-Line™ Simple Installation

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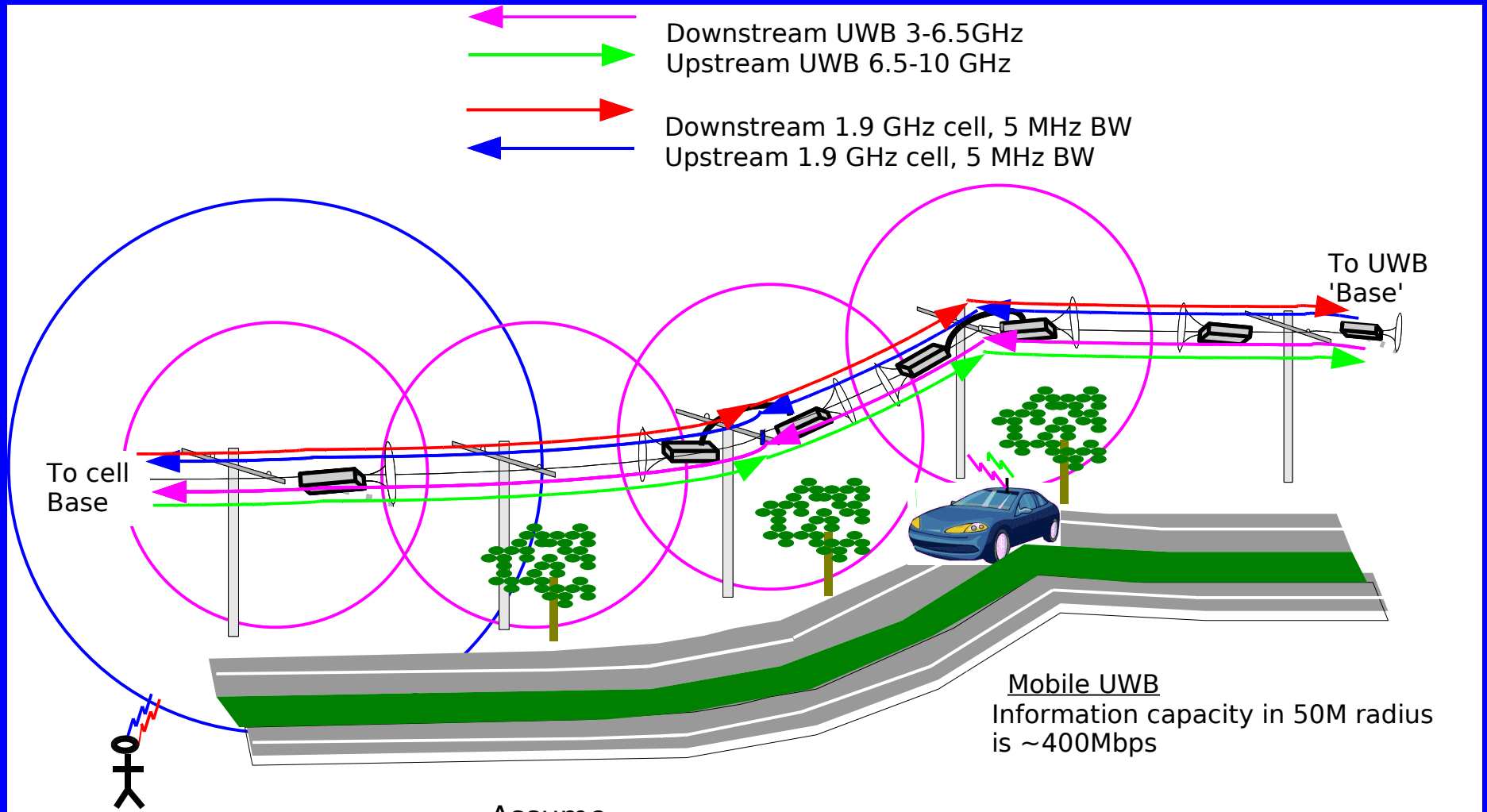
E-Line™ 3G or UWB DAS



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About Corridor Systems, Inc.

- Development stage technology company
- Field-tested prototypes completed
- Strong patent portfolio:
  - Core E-Line
  - DAS and other applications
- Privately held, based in Santa Rosa, CA.
- Actively seeking strategic and financial partners:
  - Carriers
  - Neutral Hosts
  - Basestation/infrastructure equipment providers
  - Electric Utilities

Wish List

- FDD CPE
  - Mobile phones already FDD
  - Implement FDX WiMax devices
- 3G/4G applications & content
- Technology partner(s)

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E-Line™

- **E-Line™ is a breakthrough technology that provides multi-Gbps powerline-based information transport**
- **Supports both fronthaul/DAS and backhaul**
- **Supports unique low-cost multi-emitter DAS architecture for Gbps mobile wireless**
- **Can simultaneously support 2G coverage extension**

Extremely low cost: <u>CAPEX of < $5K / linear mile</u>