Amphenol® RF

THE ROLE OF RF IN BROADBAND EVOLUTION

Broadband technology has rapidly evolved to meet increasing digital needs. From early DSL and coaxial cable networks to modern fiber optics, fixed wireless access, and satellite broadband, each advancement has pushed the boundaries of speed, reliability, and accessibility. Robust RF connectivity is essential for enabling reliable and efficient data transmission across various broadband technologies. This overview explores the evolution of broadband, compares key technologies, and highlights the essential RF solutions shaping the future of global connectivity.

BEFORE VS. NOW

EARLY BROADBAND TECHNOLOGIES

DSL and coaxial cable are among the early broadband technologies used for high-capacity data transmission.

- **DSL (Digital Subscriber Line):** Operates over twisted-pair copper telephone lines. Reliable but limited in bandwidth for today's needs.
- **Coaxial Cable Broadband:** Though widely available, infrastructure limitations can reduce its speed and bandwidth—especially over long distances.

Cable companies are transitioning to fiber and wireless solutions, blurring the lines between broadband and internet services.

THE POST-COVID SURGE AND THE NEED FOR HIGHER BANDWIDTH

COVID-19 accelerated digital transformation, driving up bandwidth demand and straining traditional broadband with remote work, streaming, and IoT growth.

- **The rise of fiber optics cable broadband:** Emerged as a solution for ultra-fast internet but remains limited in widespread coverage due to high infrastructure costs.
- **Emergence of wireless alternatives:** Fixed Wireless Access (FWA) and Wireless Internet Service Providers (WISP) have gained traction, providing flexibility without relying on extensive cable networks.
- **Satellite Broadband:** Advances in satellite internet, particularly Low Earth Orbit (LEO) satellites, are addressing connectivity gaps in remote areas.

MODERN BROADBAND SOLUTIONS

COAXIAL CABLE BROADBAND

- Cable companies developed **DOCSIS technology** to compete with fiber/wireless connectivity companies. Data Over Cable Service Interface Specifications (abbreviated as DOCSIS) enables high-bandwidth data transfer via existing coaxial cable systems.

FIBER OPTICS CABLE BROADBAND

- Uses **light signals through fiber-optic cables** for ultra-high-speed internet.
- **RF connectors and cable assemblies** help in fiber-to-coaxial transitions for hybrid networks.

FIXED WIRELESS ACCESS (FWA) BROADBAND

- Uses cellular networks for home/enterprise internet.
- Requires robust **RF antennas and connectors** to ensure high-frequency signal integrity.

WIRELESS INTERNET SERVICE PROVIDER (WISP) BROADBAND

- Delivers internet wirelessly over long distances using towers.
- **RF coaxial connectors and antennas** are crucial for optimizing signal transmission and reception.

SATELLITE BROADBAND

- Expanding access to remote locations via **LEO (Low Earth Orbit) satellites**.
- Requires **ruggedized RF cable assemblies and high-frequency connectors** for satellite communication.

The broadband industry is shifting toward wireless, high-frequency solutions. Along with the speed, users want broadband service that will work everywhere all the time, with no disruptions even in remote locations.

Broadband Solutions Comparison Chart

FEATURE	DSL	Coaxial Cable Broadband	Fiber Optics Cable	Fixed Wireless Access (FWA)	Wireless ISP (WISP)	Satellite Broadband
Technology	Uses telephone lines for data transmission	Uses coaxial cables	Fiber optics cable	Uses cellular 4G/5G networks	Relies on radio signals from towers to customer antennas	Uses satellites in geostationary or low-Earth orbit (LEO) to transmit signals
Speed Range	5-100 Mbps	100-10 Mbps	1 Gbps - 10+ Gbps	100 Mbps - 5Gbps	50 Mbps - 1 Gbps	50 Mbps - 1 Gbps
Reliability	Moderate	High	High	Moderate - High	Moderate	Moderate
Limitations	Slower speeds over distance, not ideal for heavy use	Can experience congestion during peak hours	Expensive rollout, not available everywhere	Performance varies with network load	Requires clear line-of-sight, weather-sensitive	High latency, weather-sensitive
Best For	Rural areas with existing phone lines	Home broadband, streaming, gaming	High-speed internet, data centers	5G home internet	Remote areas without fiber or cable	Remote/rural areas, maritime, aviation

APPLICATIONS

DSL Minimal RF Technology

COAXIAL CABLE BROADBAND

- Cable Modem Termination Systems (CMTS)
- Converged Cable Access Platforms (CCAP)
- Edge QAM
- Set-Top Boxes
- DOCSIS Modems & Gateways

FIXED WIRELESS ACCESS (FWA)

- 5G Gateways
- Small Cells
- MIMO

WIRELESS INTERNET SERVICE PROVIDER (WISP)

- Point-to-point wireless radio
- Point-to-multipoint base stations

SATELLITE BROADBAND

- Satellite modems
- VSAT Terminals
- Ground station gateways

PRODUCTS

HD-EFI | HD-AFI | MINI-SMB | MCX | MMCX | N-TYPE | SMA | SMP | SMPM | TNC

ALSO AVAILABLE

- Board-to-board connectors
- Cable Assemblies
- Adapters

CORE COMPETENCIES

- Low PIM products
- Waterproof IP 67/68 sealed and ruggedized solutions
- Quick mating and quick disconnect RF connectors
- Blindmate and board-to-board connector systems
- Custom cable assemblies and sub-systems

CUSTOM PRODUCTS

To meet specialized broadband infrastructure requirements, Amphenol RF offers custom RF solutions enhance performance and connectivity reliability:

- **Seizure Connector** – I/O connectors on the side of the node
- **GXL** – Designed for pushing more current through on the nodes
- **NDX Connector** – Suitable for indoor/outdoor premises