



NETWORK EVOLUTION SERIES

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Unlocking Network Capacity



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The smarter path from 1.2 GHz to 1.8 GHz — without rebuilding what still has value.

COMPLETE VISIBILITY. COMPLETE CONTROL. ONE PLATFORM.

Technical + market perspective for HFC operators planning the next capacity cycle. Focus: amplifier architecture, field upgrades, and DOCSIS 4.0 readiness.

EXECUTIVE OVERVIEW

Evolution, not demolition.

Broadband networks are being asked to do something difficult: deliver multi-gigabit services, increase upstream capacity, improve reliability, and remain economically rational — all at the same time. For many HFC operators, moving from a 1.2 GHz plant toward 1.8 GHz is one of the most practical ways to create additional spectrum and establish an Extended Spectrum DOCSIS (ESD) foundation without immediately committing to a full fiber overbuild.

ACI Communications approaches that challenge as an evolution problem, not a demolition project. Field-upgradable RF modules, compatible station solutions, and support for widely deployed legacy amplifier housings allow operators to modernize the active plant while preserving useful installed assets.

A network upgrade is not successful because a specification sheet says “1.8 GHz.” It is successful when the RF plant, powering, passives, telemetry, operational processes, and future roadmap work together as a system.

“The best upgrade is not the one with the most new hardware. It is the one that creates the most new capability.”

ACI'S DESIGN PHILOSOPHY

Keep the housing when it makes sense. Upgrade the RF when it creates value. Preserve operational flexibility. Design every step so the next step is easier — not harder.

WHAT THIS PAPER COVERS

Why 1.8 GHz matters for capacity and DOCSIS 4.0

Where field upgrades can beat full station replacement

What to validate technically before expanding spectrum

How telemetry turns amplifiers into managed assets

01 — SPECTRUM

Why 1.8 GHz — and why now?

Traffic growth does not arrive neatly on a construction schedule. Operators often need capacity before a complete rebuild, node split, or fiber conversion is economically justified. Extending the upper spectrum boundary from 1.2 GHz toward 1.8 GHz creates substantially more frequency real estate for downstream service while the return path can evolve through high-split or other operator-selected architectures.

1.2 GHz

Today's ceiling for many HFC actives

+50%

Upper-band expansion to 1.8 GHz

ESD

Foundation for Extended Spectrum DOCSIS

That does not mean every network automatically receives 50% more usable subscriber capacity. Spectrum plans, guard bands, channel loading, plant performance, modulation profiles, and upstream allocation all matter.

More spectrum is the raw material. Plant quality and spectrum engineering determine how much value you manufacture from it.

DOCSIS 4.0 readiness is a system condition

For ESD deployments, 1.8 GHz-capable actives are a foundational requirement, but they are not the entire DOCSIS 4.0 story. Operators must evaluate end-to-end RF performance, cascade depth, tilt and level plans, return loss, distortion, powering, leakage, passive bandwidth, and CPE readiness.

ENGINEERING CHECKPOINT

Do not confuse bandwidth capability with modulation capability. Higher-order modulation depends on usable MER/SNR and linearity across the operating band. A 1.8 GHz label creates access to spectrum; disciplined RF design determines whether that spectrum can carry premium capacity.

02 — ARCHITECTURE

Upgrade the network, not the scrap pile.

Traditional rebuild logic can force an operator to replace an entire amplifier station even when the housing, hardline interfaces, and parts of the mechanical installation remain serviceable. ACI's field-upgrade approach changes the economics by separating RF evolution from unnecessary outside-plant replacement.

Solutions such as ASEM™ upgrade modules and the Infinity™ amplifier platform are positioned around compatibility, modularity, and field serviceability — including compatibility with widely deployed legacy OEM housing families.

Decision area	Full replacement	ACI field-upgrade
Installed housing	Replace with the station	Reuse when mechanically and electrically appropriate
Construction scope	Potentially broader	Targeted around the RF upgrade
Maintenance window	More physical work in the plant	Designed to reduce touch time
Capital timing	Large replacement event	Phased by need and budget
Future service	Depends on replacement architecture	Modularity keeps field service central

MARKETING TRANSLATION: FEWER HEROICS IN THE BUCKET TRUCK

The technical value of modularity becomes a business value in the field: less hardware to disturb, fewer opportunities for connector or seizure-point issues, shorter planned work, and a migration that can follow actual demand instead of forcing a single massive cutover.

03 — RF ENGINEERING

What changes at 1.8 GHz?

Extending an HFC plant to 1.8 GHz increases the importance of details that may have been forgiving at lower frequencies. Loss increases with frequency, component response becomes more critical, and small imperfections in connectors, passives, alignment, or impedance matching can become visible as degraded return loss, ripple, group-delay effects, or reduced MER.

3.1 RF LINEARITY AND NOISE

A 1.8 GHz amplifier must deliver usable gain and output performance across a wider band while maintaining linearity. Evaluate complete station performance — not just headline gain — including distortion, noise, frequency response, tilt range, output capability, and performance at the intended cascade depth.

3.2 POWER IS PART OF RF DESIGN

Modern designs can improve performance per watt, but powering assumptions should be validated for the actual network. Existing supplies, standby capacity, voltage drop, current loading, and cascade conditions all influence whether an upgrade can be deployed without a new operational constraint.



STATION, NOT JUST A MODULE

ACI's field-upgradable architecture is built around preserving what works, replacing what must change, and creating a practical bridge to what comes next. The housing, hardline interfaces, and mechanical installation often still have value even when the RF ceiling has moved.

This paper focuses on the amplifier portion of the migration. Actual system capacity also depends on taps, passives, coax, connectors, powering, node architecture, modem capability, and the chosen DOCSIS 4.0 implementation.

03 — CONTINUED

The passive plant gets a vote.

3.3 PASSIVES AND QUALIFICATION

An amplifier cannot create end-to-end 1.8 GHz performance if taps, splitters, directional couplers, connectors, or other passives constrain the band. A successful program includes a passive inventory and qualification plan.

Every device replaced today should be evaluated against the operator's likely next spectrum step, not only the immediate

3.4 UPSTREAM EVOLUTION

High-split and other expanded-return strategies increase upstream capacity, but they also change diplexing, spectrum allocation, alignment, and operational practices.

Define the desired split architecture early so amplifier, node, passive, and CPE decisions are coordinated — not discovered after hardware is already on the strand.

FIELD REALITY

At 1.8 GHz, “it worked before” is not a test plan.

Connector condition, hardline preparation, torque, seizure interfaces, passives, and sweep discipline become even more important. Small imperfections that were invisible at 1.2 GHz can show up as return loss, ripple, or MER problems across the new band.

Connector and seizure-point integrity

Hardline preparation and torque discipline

Tap and splitter bandwidth qualification

Sweep, balance, and MER validation

Leakage performance at the new ceiling

Split architecture locked before hardware selection

04 — OPERATIONS

From RF hardware to intelligent network asset.

The next generation of HFC operations is not only about moving more bits. It is about knowing what the plant is doing before a subscriber calls. When amplifier telemetry and control are integrated with compatible network-management or cloud platforms, operators can gain visibility into station conditions, support faster troubleshooting, and reduce unnecessary field intervention.

The ACI opportunity is platform-aware integration: expose useful amplifier telemetry and supported controls through open, practical interfaces so operators can incorporate the active

REACTIVE PLANT

- Wait for a customer-impacting symptom
- Roll a truck to learn what is happening
- Treat the amplifier as an RF-only device
- Troubleshoot one event at a time

VISIBLE, DATA-DRIVEN PLANT

- Trend conditions and identify anomalies earlier
- Use telemetry to narrow the problem before dispatch
- Treat the station as part of the managed network
- Build operational history and repeatable workflows

COMPLETE VISIBILITY. COMPLETE CONTROL. ONE PLATFORM.

ACI Infinity amplifiers are engineered to operate autonomously — self-configuring, self-healing, and maintaining performance through outages and impairments. When connectivity is available, the Nexus platform provides remote monitoring, visibility, and actionable insights across the access network.

05 — DEPLOYMENT

A practical four-phase strategy.

Sequence the work so capital, construction, and spectrum activation stay aligned with real demand — not a single all-or-nothing cutover.

01 Know the plant

Audit amplifier cascades, housing families, powering, passives, node architecture, leakage performance, high-demand service groups, and known trouble locations. Build the bill of reality before the bill of materials.

02 Modernize the actives

Install qualified ACI modules or stations in targeted areas. Where the selected architecture supports it, preserve current operating modes during the physical upgrade so spectrum activation can be separated from hardware replacement.

03 Prove the spectrum

Sweep, balance, validate MER and RF performance, confirm passive readiness, and activate extended spectrum according to the operator's channel and split plan. Use pilot areas to turn engineering assumptions into field data.

04 Scale into DOCSIS 4.0

Expand the deployment using lessons from the pilot, introduce the selected DOCSIS 4.0 architecture, and use the full system — actives, passives, nodes, CPE, telemetry, and operations — to monetize the new capacity.

06 — ECONOMICS

Capacity per dollar — and per truck roll.

The financial case for a field-upgradable platform is not simply “new module costs less than new station.” The real comparison should include material, labor, construction, maintenance-window duration, service risk, spares strategy, training, powering changes, and the value of deferring larger rebuild events until they are actually needed.

This is where modularity becomes a strategic lever. An operator can prioritize congested areas first, align work with budget cycles, and avoid replacing useful infrastructure solely because the RF ceiling has changed.

A BETTER ROI QUESTION

Instead of asking, “What does the amplifier cost?” ask, “What does it cost to create the next unit of reliable capacity — including the field work required to get it online?”

Material + labor

Module vs. full station, plus construction and access cost

Window & risk

Shorter plant disturbance, fewer seizure-point events

Timing optionality

Phase spend to demand; defer rebuilds that are not yet required

07 — ROADMAP

Beyond 1.8 GHz: design the next step into this step.

1.8 GHz is an important destination, but innovation leadership means refusing to treat today's destination as tomorrow's dead end. The industry is already evaluating spectrum expansion beyond 1.8 GHz. Standards, component ecosystems, and operator architectures will continue to evolve.

ACI's strongest position is to engineer for optionality: modular RF assemblies, serviceable mechanical platforms, qualified high-frequency passives, intelligent telemetry, and product families that can evolve as standards mature. The goal is not to promise a speculative frequency. The goal is to avoid designing 1.8 GHz products in a way that unnecessarily blocks the next upgrade.

Future-proofing is not predicting the future perfectly. It is avoiding choices that make the future unnecessarily expensive.

WHAT LEADERSHIP LOOKS LIKE

- Participate early in standards and ecosystem discussions rather than waiting for specifications to become purchasing requirements.
- Design amplifier, booster, tap, and passive strategies as a coordinated RF roadmap.
- Keep field serviceability and upgradeability as product requirements — not afterthoughts.
- Use telemetry and open integration to make outside-plant hardware more observable.
- Give operators multiple migration paths: evolve HFC where it makes economic sense and support fiber evolution where it is the better architecture.

08 — SUMMARY

Key benefits at a glance.

TECHNICAL	Expanded spectrum · Higher capacity potential · Improved RF platform · Telemetry-ready architecture
FINANCIAL	Preserve useful assets · Reduce avoidable replacement · Align spend to demand · Better capacity economics
OPERATIONAL	Phased maintenance · Less plant disturbance · Faster targeted upgrades · Data-driven operations
STRATEGIC	DOCSIS 4.0 foundation · Modular evolution · Path beyond 1.8 GHz · HFC + fiber optionality

Evolution without starting over

The broadband capacity race is not won by replacing the most hardware. It is won by making the smartest architecture decisions at the right time. For operators with viable HFC infrastructure, moving from 1.2 GHz toward 1.8 GHz can unlock meaningful new spectrum and establish a practical foundation for DOCSIS 4.0.

ACI Communications brings a differentiated idea to that transition: preserve what still has value, modernize what limits performance, make the field upgrade practical, and keep the architecture open to what comes next. That is more than a component strategy. It is a network-evolution strategy.

ACI COMMUNICATIONS

Built for the plant you have. Engineered for the capacity you need. Designed with the next upgrade already in mind.

OPERATOR DISCUSSION CHECKLIST

Start with the plant you have.

- 01** Which service groups are capacity-constrained today, and what is the growth horizon?
- 02** What amplifier housings and cascade architectures are installed?
- 03** Are the taps and passives qualified for the target spectrum?
- 04** What split architecture and DOCSIS 4.0 path is planned?
- 05** Can existing powering support the target configuration with acceptable standby margin?
- 06** What telemetry and network-management integrations are required?
- 07** Which assets can be preserved, and which genuinely need replacement?
- 08** What decisions made for 1.8 GHz could either enable — or block — the next spectrum step?

Technical note: Performance, compatibility, power consumption, telemetry, and upgrade procedures vary by product and network architecture. Final designs should be validated against current ACI product specifications, applicable SCTE/CableLabs requirements, and operator-specific plant conditions. ACI and DSIM are registered trademarks; ASEM, ACION, Infinity, and Nexus are trademarks of ACI Communications, Inc.

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