HFC RF NETWORK DESIGN – 300 MILES

A Case Study

PROJECT OVERVIEW

The project involved the engineering and design of approximately 300 miles of Hybrid Fiber-Coaxial (HFC) network to support network expansion and capacity improvements. The objective was to develop a standards-compliant RF network that maximized service coverage while maintaining signal quality, cascade limits, and customer engineering specifications.

SCOPE OF WORK

- Review customer design inputs and field walkout documentation.
- Capture and validate support structures in GIS.
- Plan node boundaries and identify optimal node locations.
- Design the RF distribution network.
- Perform RF Quality Control and Quality Assurance.
- Generate construction deliverables and Bill of Materials (BOM).

DESIGN PROCESS

1. Source Review

The engineering team reviewed customer inputs, field walkout maps, aerial imagery, GIS data, and engineering specifications. Any missing or unclear information was clarified before beginning the design.

2. Support Structure Verification

Existing poles, pedestals, strand routes, trenches, and service addresses were verified and updated in GIS to establish an accurate foundation for the RF design.

3. Node Planning

Node boundaries were created based on customer home-pass limits, and node locations were selected to optimize coverage while minimizing amplifier cascades. Node leg balancing was considered to distribute homes evenly across all node outputs.

4. RF Network Design

The RF distribution network was designed using customer specifications. The design included:

- Fiber Nodes
- Coaxial trunk and distribution cables
- Amplifiers
- Directional Couplers
- Splitters
- Equalizers
- Taps
- Power Supplies and Power Inserters

Equipment was selected to achieve the required signal levels while minimizing equipment count and maintaining allowable cascade limits.

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Layer Informatics Pvt. Ltd.
Vision Through Mapping

5. Quality Control

Each node was reviewed to verify:

- Compliance with customer RF specifications
- Correct node placement
- Node leg balancing
- Cascade limits
- Equipment selection
- Signal levels
- Connectivity
- Job edits and design completeness

Any identified issues were corrected before QA.

6. Quality Assurance

A final engineering review ensured the design met customer standards and project requirements. Any remaining observations were resolved before project completion.

7. Deliverables

The completed project included:

- RF Design Maps
- Construction Prints
- Bill of Materials (BOM)
- Design Reports
- Customer Deliverables
- Final QA Documentation

KEY DESIGN CONSIDERATIONS:

- Optimized equipment placement to reduce construction cost.
- Balanced node loading for improved network performance.
- Maintained customer-specified amplifier cascade limits.
- Achieved required RF signal levels at all service taps.
- Ensured complete network connectivity with no open paths.
- Generated accurate construction documentation for field implementation.

OUTCOME:

The 300-miles HFC RF design was completed in accordance with customer engineering standards and project specifications. The final deliverables successfully supported construction activities by providing accurate RF layouts, construction prints, and material estimates. The completed design delivered reliable network performance, optimized infrastructure utilization, and established accurate engineering records for future maintenance and network expansion.