

IWT Maintenance Analytics

Providing Insight into Network Health and Performance

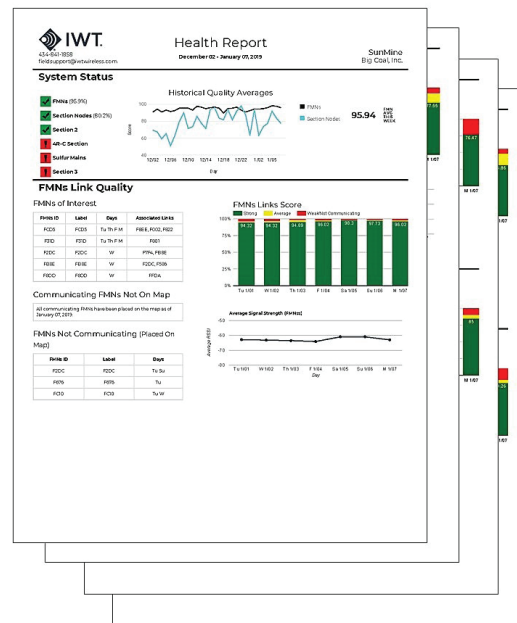
Spend Even Less Time Maintaining Your *SENTINEL*™ C&T Network

IWT provides diagnostic tools (mProv™ Mapper) with the *SENTINEL* system to assist maintenance personnel in assessing the network's overall performance and identify areas for improvement. Maintainers use their familiarity with their mine, knowledge of the system layout, and experience to identify problem areas, prioritize them, and consider possible root causes and remedies.

IWT's Maintenance Analytics automates the analysis of the RF network, significantly reducing the time needed to identify areas within the network requiring attention. It incorporates our intimate understanding of the *SENTINEL* system, how external disturbances affect network performance, and the experience gained from the deployment of more than 90 networks in the last 10 years. It provides a concise overview of system performance, takes the guess work out of network analysis, and provides detailed insight into areas to address.

Maintainers are busy, often supporting multiple electrical systems, and time is precious. Those less experienced with the *SENTINEL* system and long-time system maintainers both benefit from a

comprehensive analysis of network RF and battery performance, summarized in an easy-to-read report that is organized into different areas of the mine. The maintainer is directed to examine the links between specific infrastructure nodes whose performance is sub-optimal. Any must-know information, such as that which may compromise regulatory compliance, is highlighted to enable immediate action.

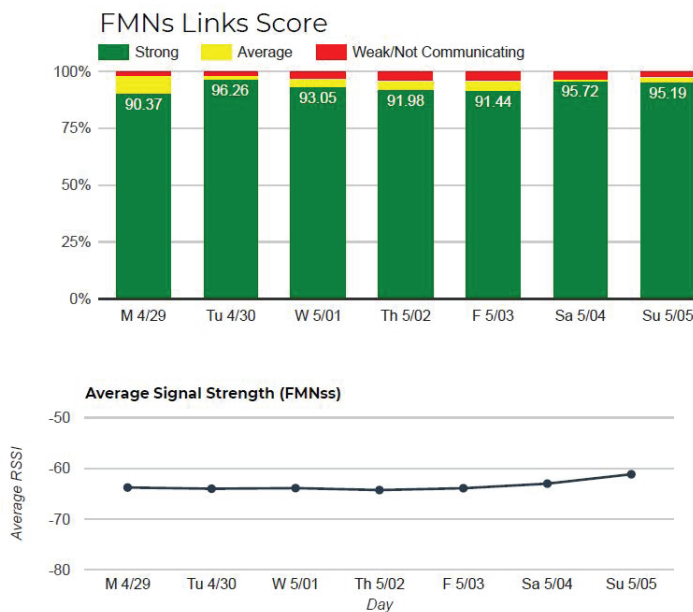


The IWT Maintenance Analytics report summarizes network status in two sections:

RF NETWORK HEALTH - INFRASTRUCTURE LINK QUALITY

Infrastructure Link Quality is shown by mesh node device type (Fixed Mesh Nodes, Battery Mesh Nodes, Section Nodes, etc.) and can be categorized by their placement in different areas of the mine/tunnel (customer input to the initial report setup). The signal strength between nodes (RSSI) and packet error rate (PER) of data transmission are the primary factors determining RF link quality. The last seven days of data is shown, enabling the maintainer to see the variance over time and identify what, if any, can be attributed to known factors.

Link quality is categorized as Strong, Average, or Weak/Not Communicating. A list of top nodes for evaluation is provided.



BATTERY HEALTH

Most IWT infrastructure mesh nodes run on battery – either solely or as backup to line power. The Battery Health report gathers and summarizes battery level status, indicating nodes that are running on battery, nodes with low battery levels, nodes that have stopped communicating due to loss of battery power, and nodes with missing or exhausted batteries.

This is especially important for coal mines, where a minimum operating time while running on battery is mandated by regulation. This report is very helpful to assist coal mines in the maintenance/testing plan required to ensure compliance for FMN backup batteries by showing which batteries have demonstrated an operating time that exceeds the minimum required by law.

Battery Issues Summary

FMNs That Stopped Reporting In Less Than 24 Hours Of Running On Battery	19
FMNs That Stopped Reporting Before Battery Was Exhausted	6
FMNs With Unstable Battery Behavior	28
FMNs With Batteries That Are Not Charging Correctly	3
FMNs With Exhausted Batteries As Of May 05, 2019	5
FMNs With Bad/Missing Batteries	1
Total FMNs With Battery Problems	55
BMNs With Exhausted Batteries	0
BMNs With Low Batteries	2
Total BMNs With Battery Problems	2

69.9%

FMN
Healthy
Battery
Score

100.0%

Section
Node
Healthy
Battery
Score

100.0%

BMN
Healthy
Battery
Score

Maintenance Analytics Features:

- Comprehensive RF network and battery analysis report
- Insight into areas to address
- Reduced network performance analysis time
- Easy-to-read report with historical trends, delivered to your email inbox
- Battery-life extension for Battery Mesh Nodes and Section Mesh Nodes included

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