TM Forum

ANLAV Report

Zain Kuwait

Scenario: GB1523A – RAN Fault Management

Maturity Level: General Availability (GA)

Version 3.0.0

Date 23/06/2026

Region: Kuwait

Network: National LTE & NR (4G/5G)

Score: 3.9 (3.93) (validated)

Kuwait Zain RAN Fault Management ANL Assessment

GB1523A_RAN_Fault_Management_Questionnaire_v3.0.0

Overall Score

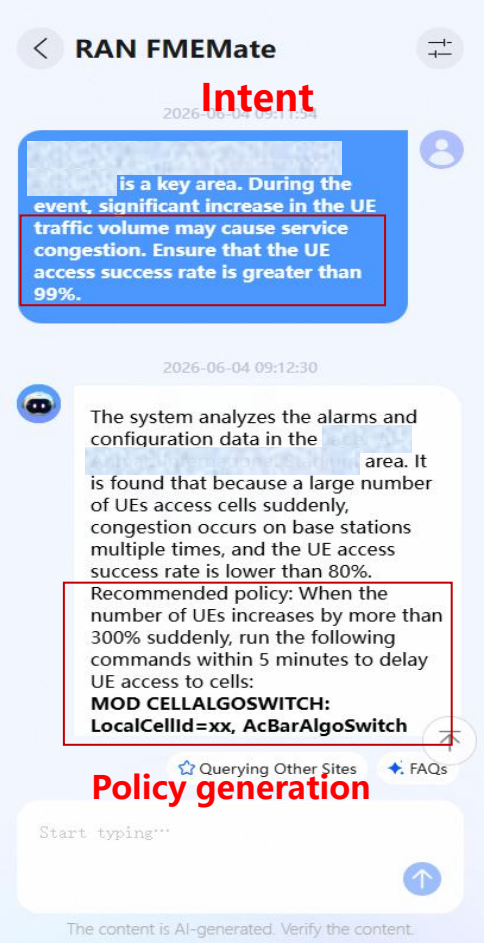
Cognitive Activity (IAADE)	Service Capability	Weight	Sub-Scenario Answer (refers to 3GPP TS 28.111)				Overall Score
			Equipment	Processing Error	Communications	Environmental	
			29.7%	2.1%	49.8%	18.1%	
Intent	Intent-driven	10%	A	A	B	A	3.93
Awareness	Data collection & Alarm correlation	10%	A	A	A	A	
	Fault Prediction	15%	A	A	A	A	
Analysis	Fault identification & Impact analysis	15%	A	A	A	A	
	Demarcation & Locating	20%	A	A	A	A	
	Solution generation	10%	A	A	A	A	
Decision	Evaluation and decision-making	10%	A	A	A	A	
Execution	Solution implementation	10%	A	A	A	A	

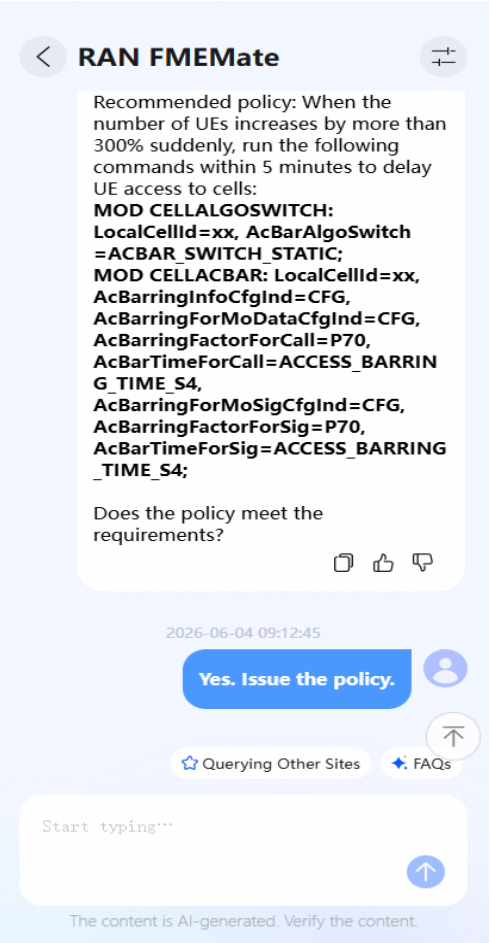
Intent-driven

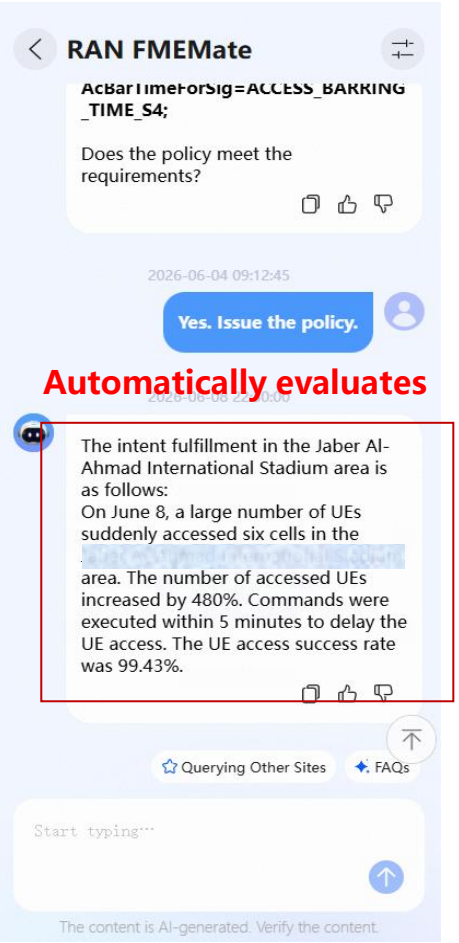
Service Capability	Weight	Question	√ Option A	Option B	Option C	Option D
Intent-driven	10%	How does the wireless network fault management system generate fault management task targets, policies and evaluate the implementation effect based on intent? Note: The Fault management intent can be declarative intent (e.g, the proportion of pre-event trouble tickets) or natrual language intent. The examples of fault management policy can be redundancy backup policies.	The system automatically generates fault management task targets and policies based on intent by using intelligent model. Fault management targets and policies need to be manually confirmed. The system automatically evaluates the implementation effect.	The system automatically generates fault management task targets based on predefined rules. Fault management targets and policies need to be manually defined. The effect is manually evaluated after the intent is implemented.	Fault management task targets and policies are manually defined based on expertise. Manually evaluate the effect after the intention is implemented, assisted by tools and system.	Manually set fault management task targets and evaluate the effect.

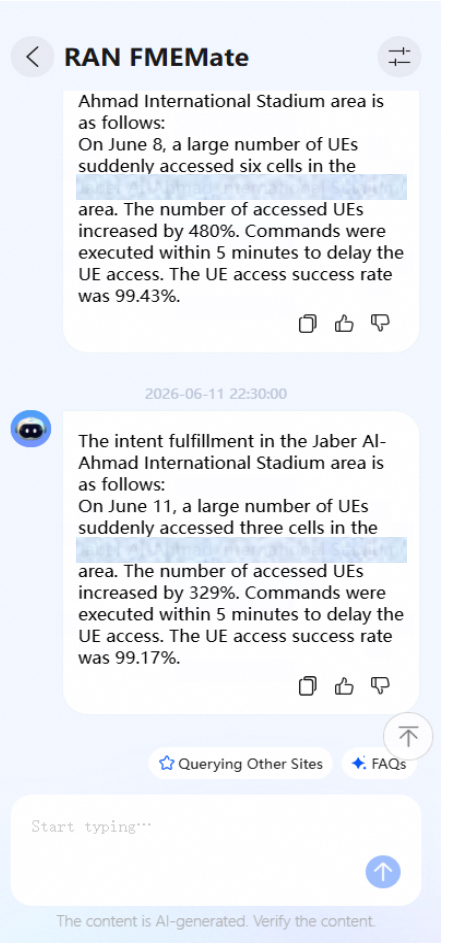
Intent-driven

Processing Error







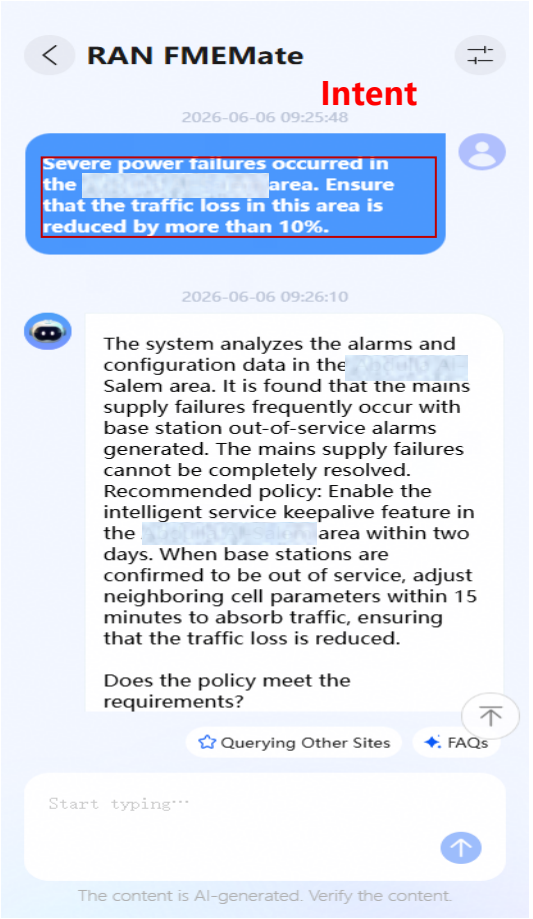


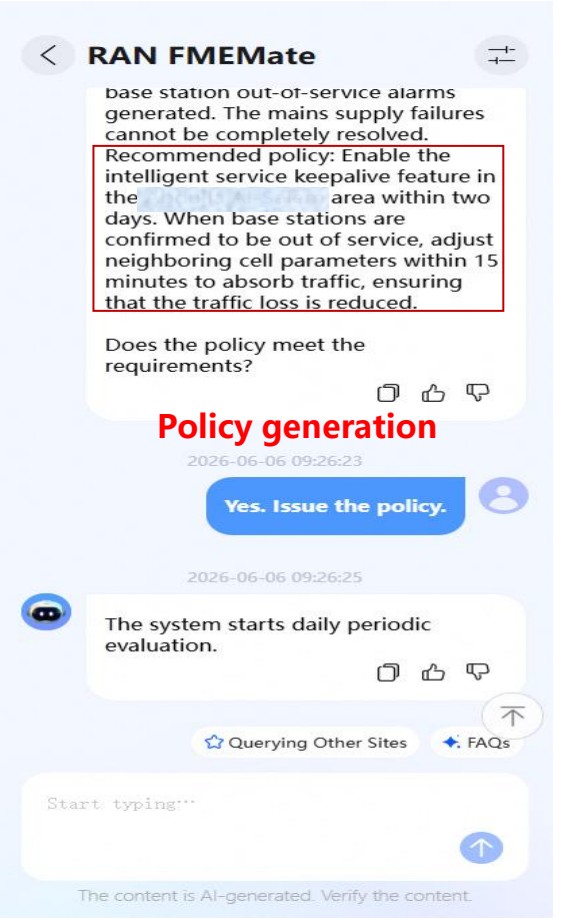
The system understands user intents based on intelligent models and generates targets and policies.

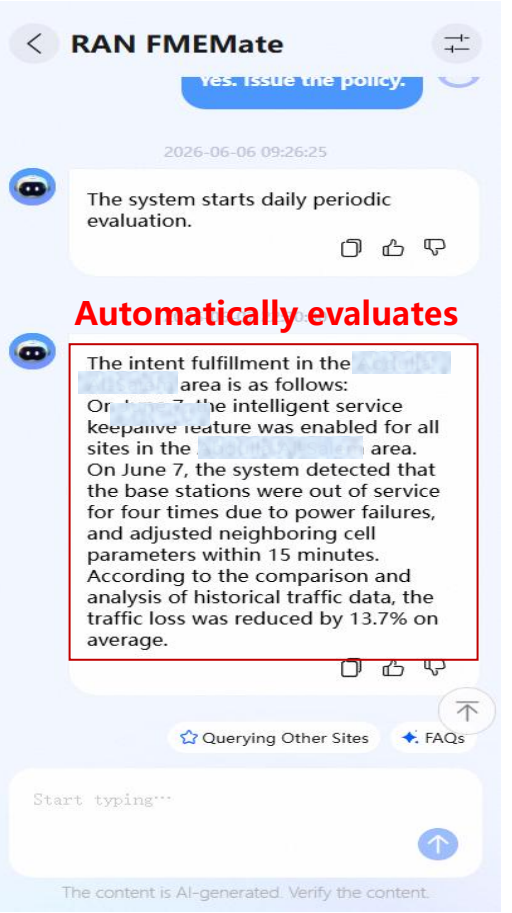
The system automatically collects network data after policy execution and evaluates the implementation effect of the intent without requiring manual intervention.

Intent-driven

Environmental







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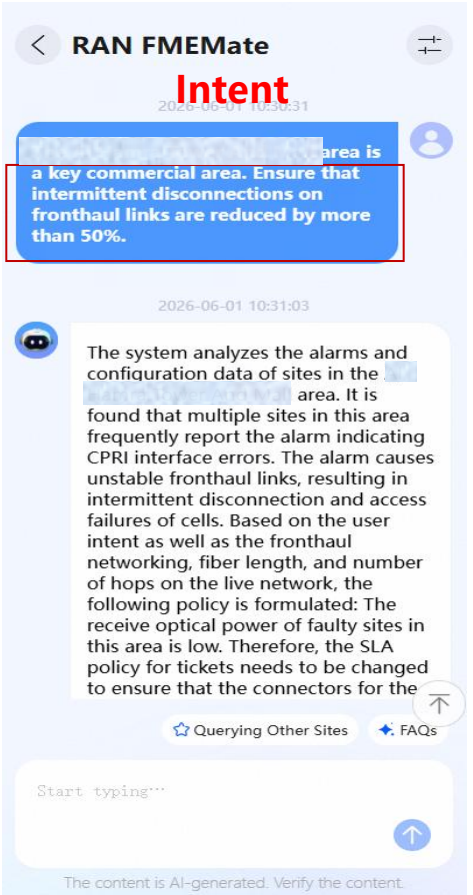
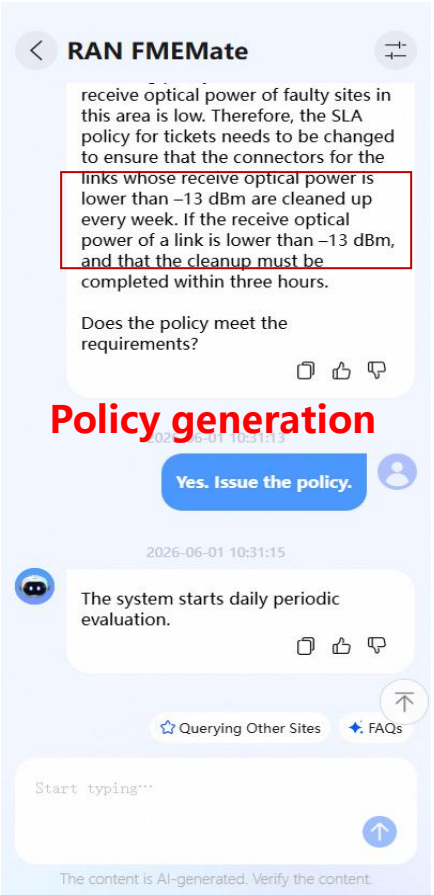
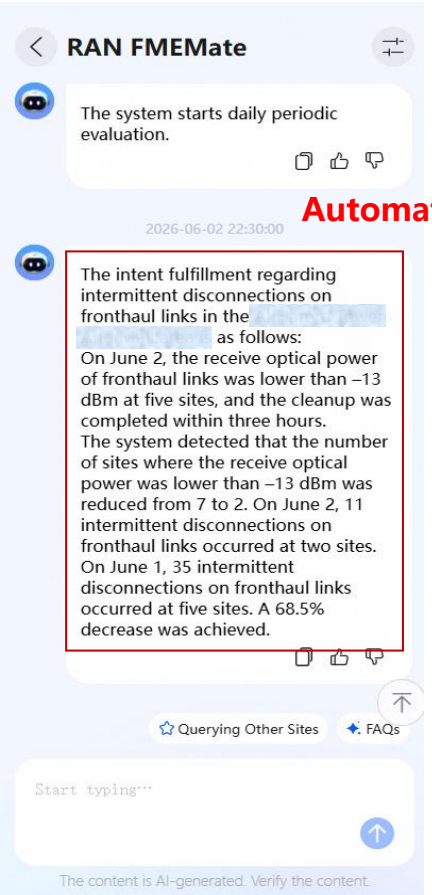
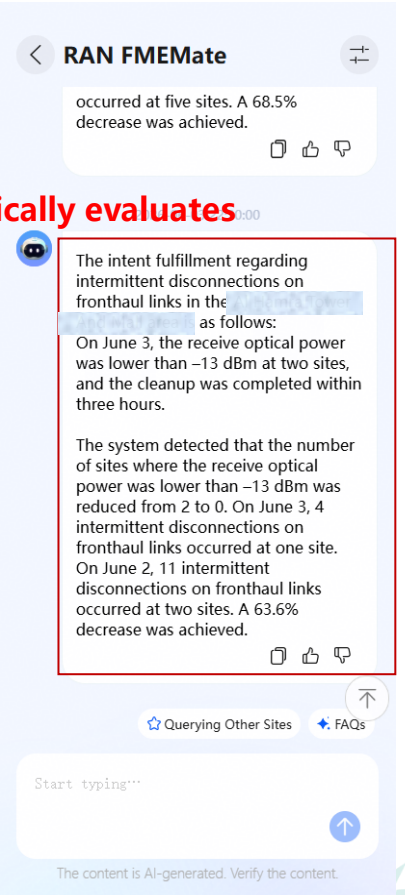
Intent-driven

Communications









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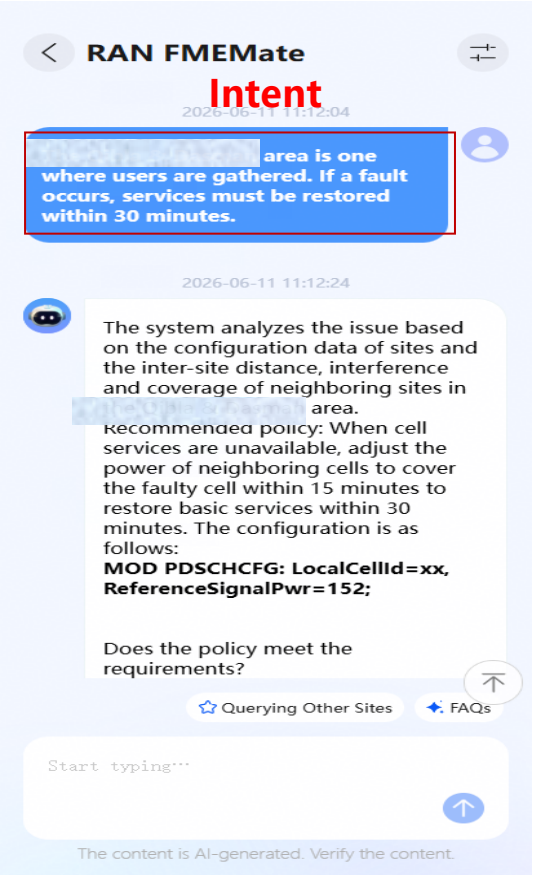
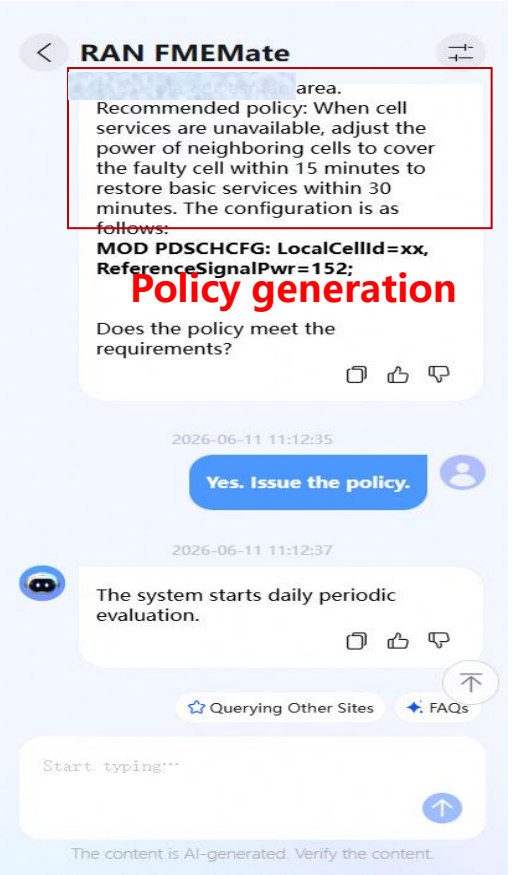
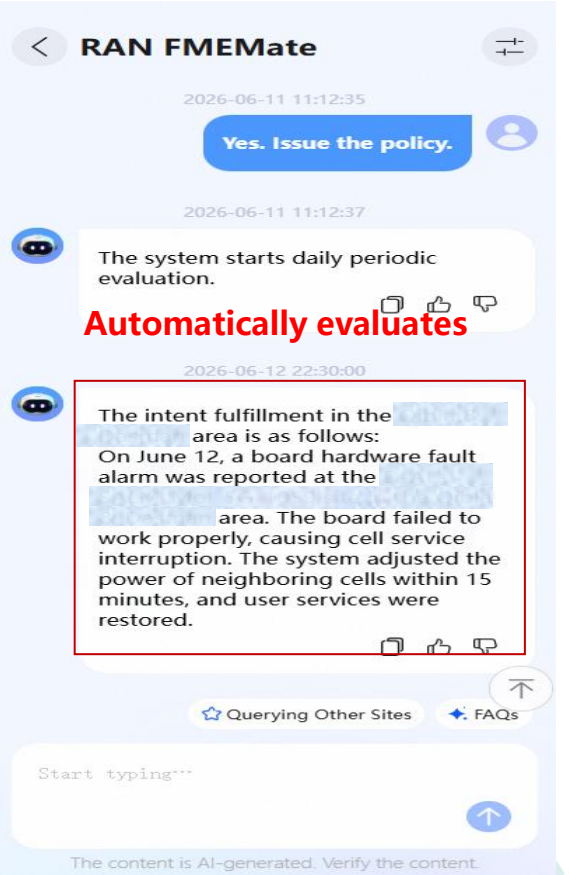
Intent-driven

Equipment







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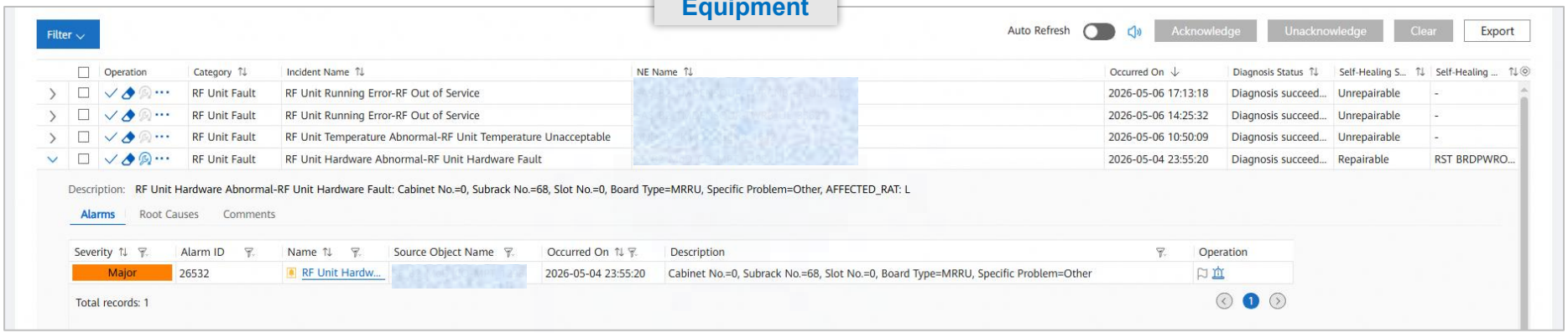
The system automatically collects network data after policy execution and evaluates the implementation effect of the intent without requiring manual intervention.

Data collection & Alarm correlation

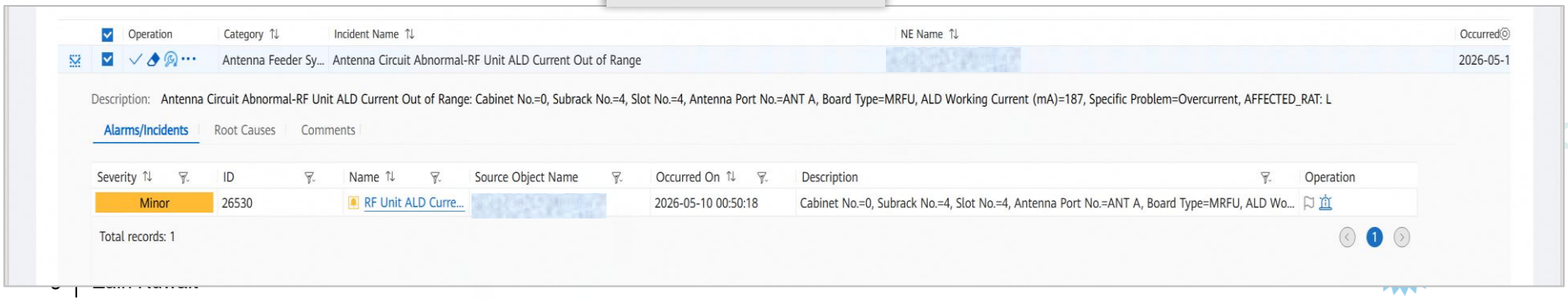
Service Capability	Weight	Question	√ Option A	Option B	Option C	Option D
Data collection & Alarm correlation	10%	How does the wireless network fault management system support automatic data collection & alarm correlation in various fault scenarios?	The system automatically collects data (alarm, configuration, and performance data etc.), and correlates alarms. All data required are automatically collected, no need for additional manually collected data.	The system collects data (alarm, configuration, and performance data etc.), and correlates alarms based on manually defined rules	Manually selects and uses the system to collect data and correlate alarms.	

Alarm data

Equipment



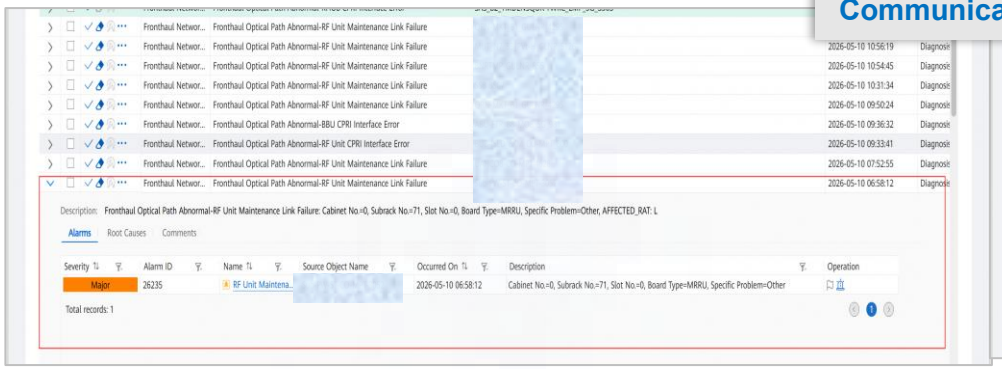
Processing Error

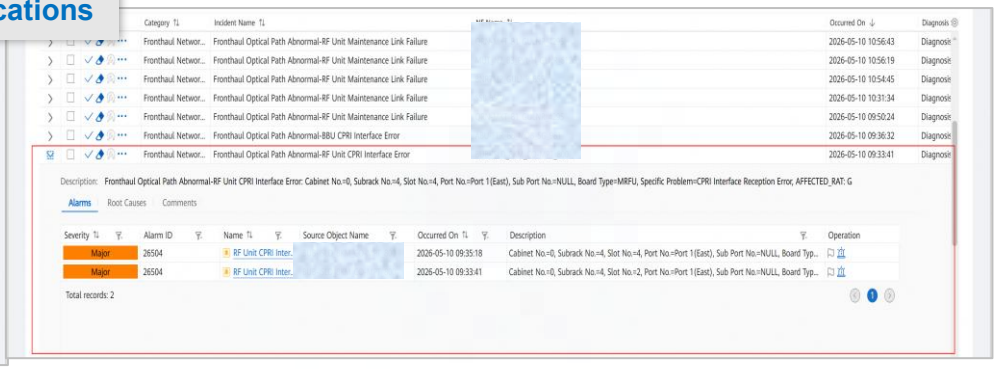


Data collection & Alarm correlation

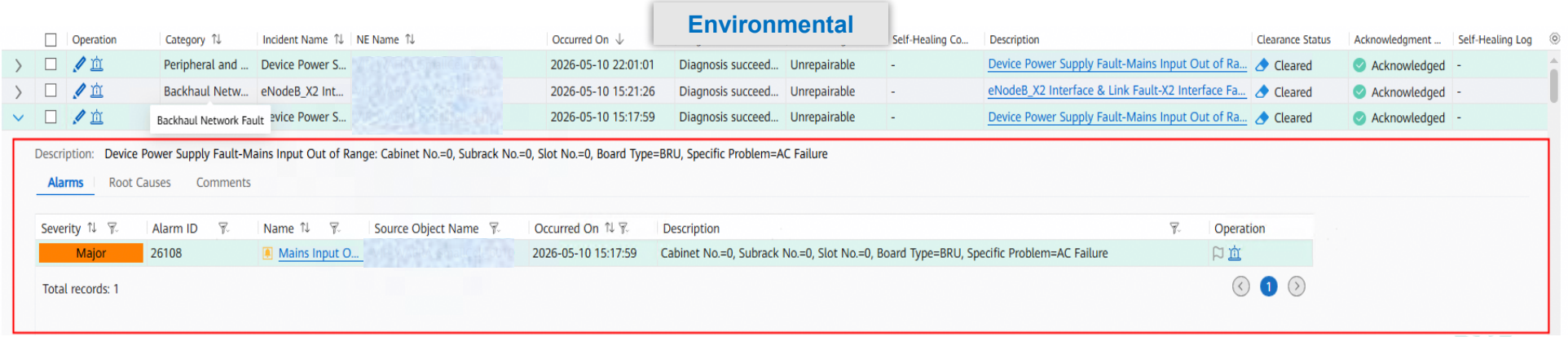
Alarm data

Communications





Environmental

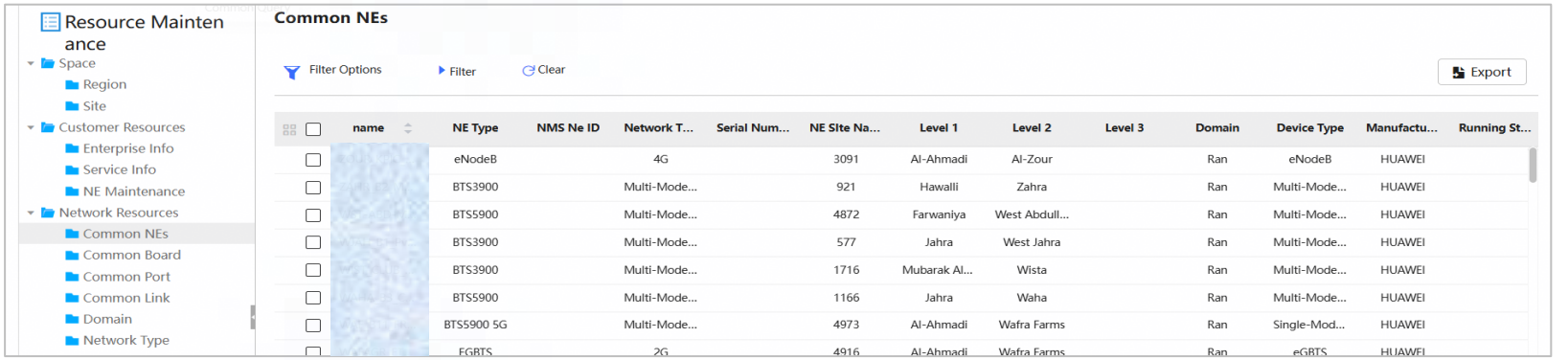


Data collection & Alarm correlation

Performance data (KPI Alarm list)

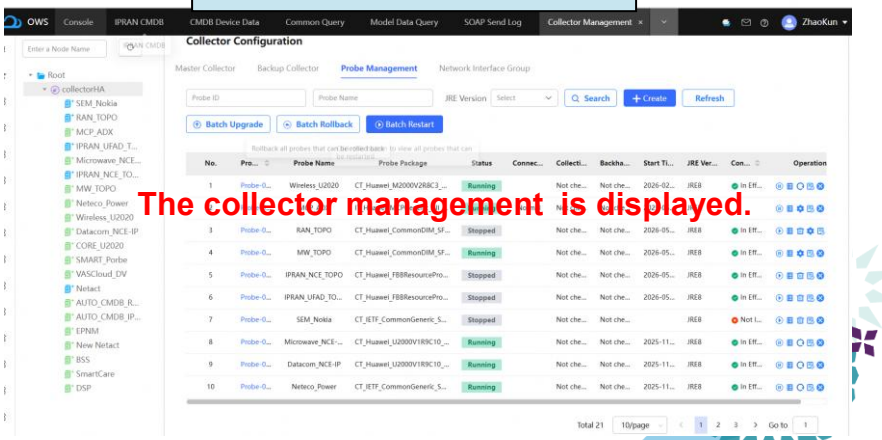
Synthetic Ru	DC Rule Res	Transient Ru	Network Ty	Site ID	Alarm Source	Alarm ID	Alarm Name	Duration(hh	First Occurred On	Last Occurre	Cleared On	Alarm Occu	Alarm Locat	Summary	Alarm Sever	Doma
Normal	Normal	Normal	2G			21820	GSM KPI Exceed Threshold	00:22:05	2026-04-30 10:24:13	2026-04-3...		1	Subrack N...	Subrack N...	Major	RA
Normal	Normal	Normal	2G			21820	GSM KPI Exceed Threshold	01:18:27	2026-04-30 09:27:51	2026-04-3...		1	Subrack N...	Subrack N...	Major	RA
Normal	Normal	Normal	2G			21820	GSM KPI Exceed Threshold	00:45:00	2026-04-30 08:24:13	2026-04-3...	2026-04-3...	1	Subrack N...	Subrack N...	Major	RA
Normal	Normal	Normal	2G			21820	GSM KPI Exceed Threshold	00:15:00	2026-04-30 06:24:13	2026-04-3...	2026-04-3...	1	Subrack N...	Subrack N...	Major	RA

Configuration data



Topology data

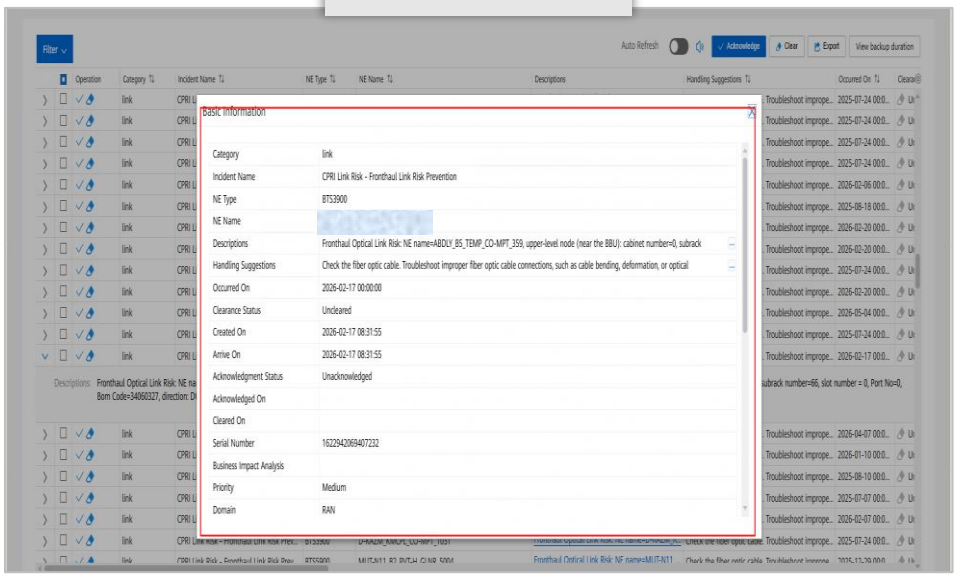
Collector – Resource Probe



Fault Prediction

Service Capability	Weight	Question	√ Option A	Option B	Option C	Option D
Fault Prediction	15%	How does the wireless network fault management system support fault prediction in various fault scenarios? Note: For example, the system predict the bit error rate and link interruption of fronthual and predict the aging and damage of board.	The system identifies potential risks and predicts the fault occurrence time based on intelligent models without the need for human intervention.	The system identifies potential risks based on intelligent models, but cannot predict the fault occurrence time.	The system identifies potential risks based on manually defined rules. For example, the system can identify potential risks of fronthaul optical modules based on preset optical power thresholds.	Potential risks need to be manually identified based on expertise.

Communications



Optical link risk prediction based on time series optical loss deviation

Massive data training

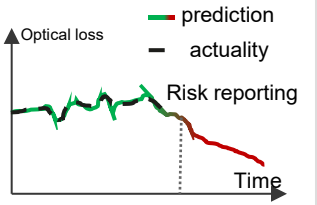
- Alarm
- Traffic statistics
- Optical power
- Temperature
- wavelength
- .....

+

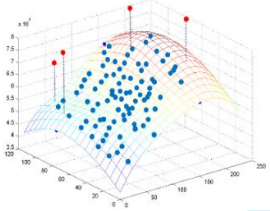
Key technologies

1. time series model
2. High-dimensional benchmark surface model, online learning of risk thresholds
3. Optical loss calculation formula based on optical fiber connectors

Typical Application



Predicting risky optical links based on the optical loss



Identify risky optical modules based on High-dimensional benchmark surface model

Fault Prediction

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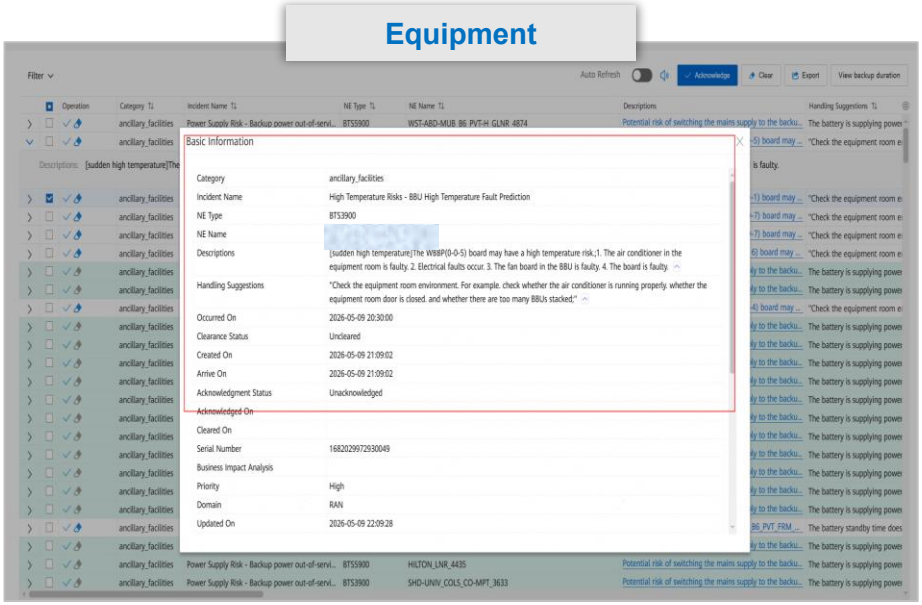
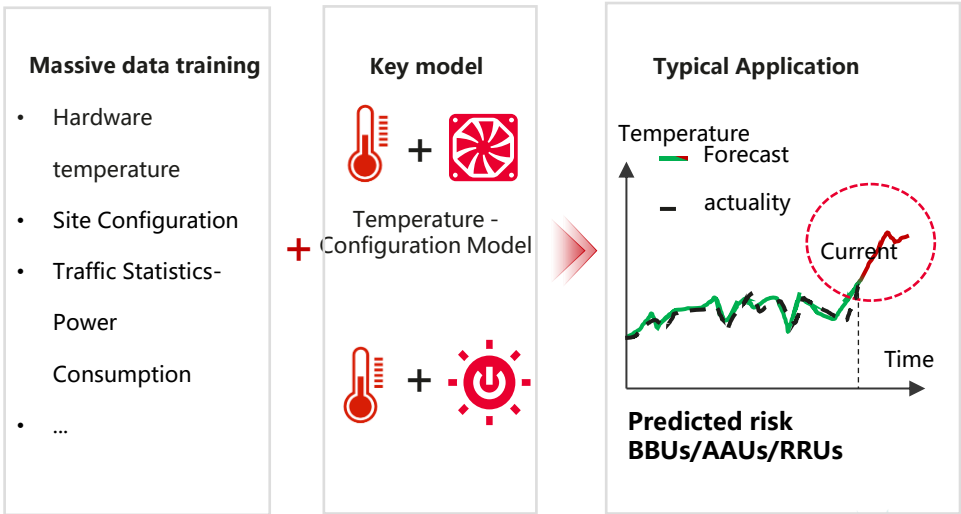


Predict risks in advance based on the ARIMA high-temperature-configuration-power consumption model, and ensure user experience not loss.



Fault Prediction

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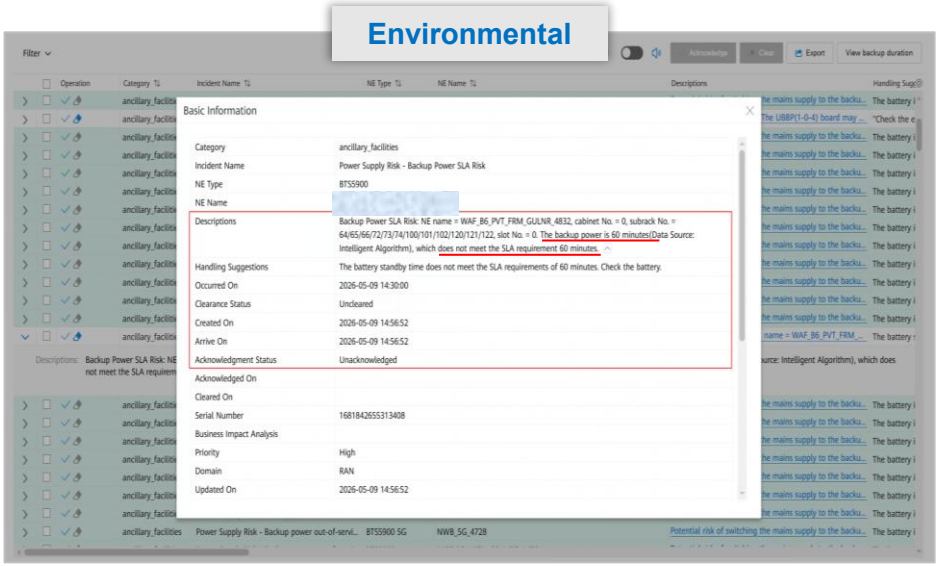
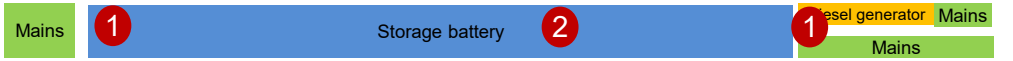
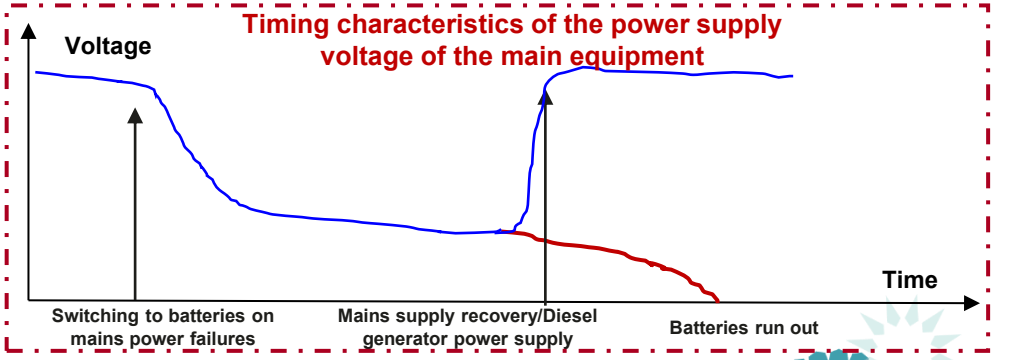




Power switchover detection
- **Detection** for switching from the mains supply to backup power
- Initial **prediction** on backup power supply duration

Backup power prediction
- Site power consumption monitoring and prediction
- Iterative **prediction** on backup power supply duration

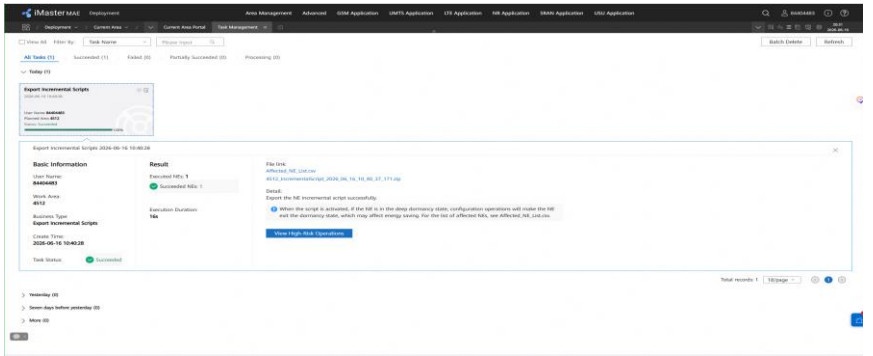
Power switchover detection
- **Detection** for switching from backup power to the diesel generator or mains



Fault Prediction

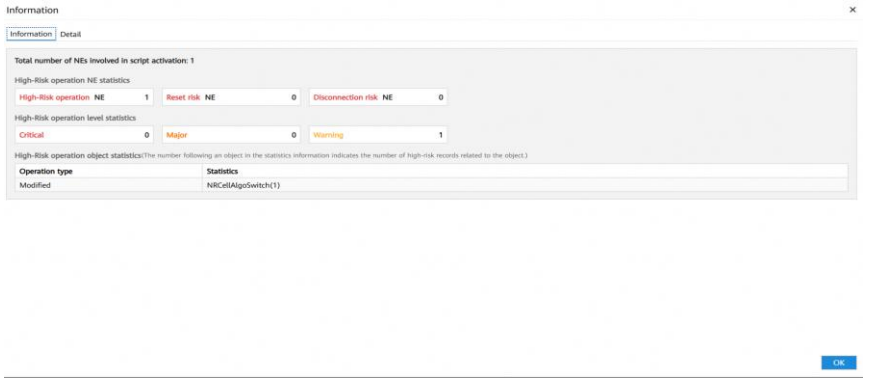
Processing Error

EMS can identify whether a script has high-risk impacts in advance



1. EMS can identify various high-risk information present in scripts

2. The LSTM algorithm is used to accurately predict the traffic volume in the next week based on historical traffic data, identify whether the configuration is risky in traffic fluctuation scenarios, and generate warnings in advance.



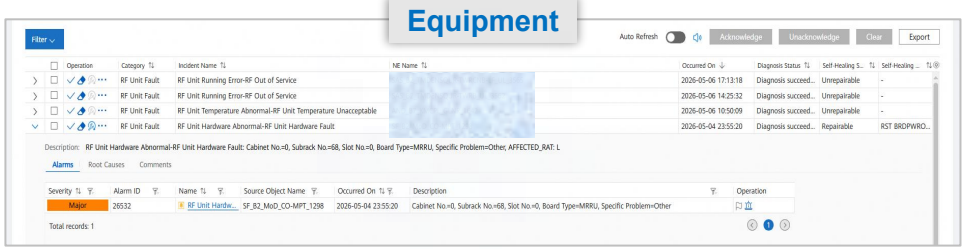
3. When the user triggers the script deployment, the script risk is prompted again, and the script can only be deployed after the user confirms.

Fault identification & Impact analysis

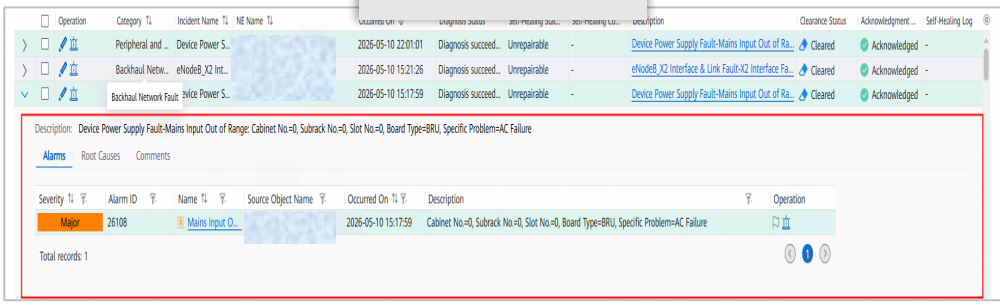
Service Capability	Weight	Question	√ Option A	Option B	Option C	Option D
Fault identification & Impact analysis	15%	How does the wireless network fault management system support fault identification & fault impact analysis in various fault scenarios?	The system identifies faults and subsequent impact based on intelligent models without the need for human intervention.	The system identifies faults and subsequent impact based on intelligent models,but need human intervention.	The System identifies faults and subsequent impact based on manually defined rules, for example, identifying intermittent faults based on a frequency experience threshold and aggregating periodic alarms based on a period threshold.	Faults and impact need to be manually identified based on human expertise or through the execution of manual written procedures.

Fault identification

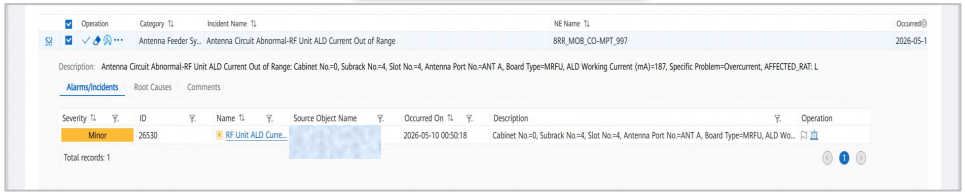
Equipment



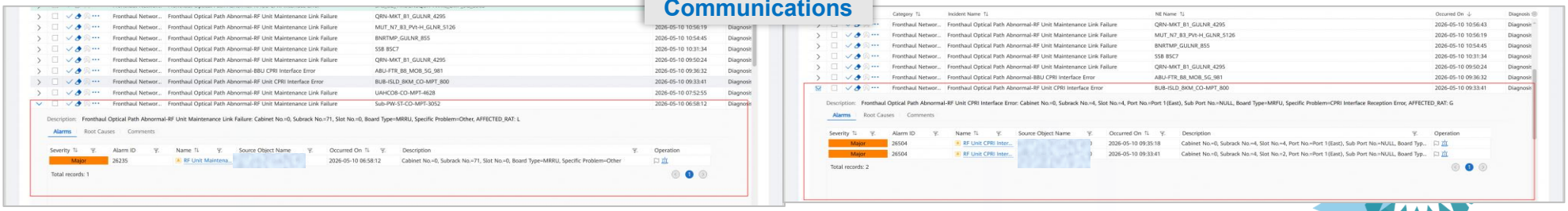
Environmental



Processing Error



Communications



Impact analysis

Equipment

Operation	Category	Incident Name	NE Name	Occurred On	Diagnosis Status	Business Impact Analysis	Self-H
	NE Disconnection & Out of Service	eNodeB Out of Service-eNodeB Ou		2026-05-10 13:26:12	Diagnosis succeeded	14:00: Traffic loss 1.450 GB, user loss 1.019; 15:00: Traffic loss 1.291 GB, user loss 0.959; 16:0...	Unrep

Description: eNodeB_X2 Interface & Link Fault-X2 Interface Fault: eNodeB Function Name=SHW_IND2_GHANIM_CO-MPT_3405, Neighboring Base Station Type=gNodeB, Specific Problem=Lower-layer link fault, AFFECTED_RAT: L

Alarms | Root Causes | Comments

Root Causes

1 1.Hardware - BBU:Inter-Board Service Link Failure

Ne Name=SHW_IND2_GHANIM_CO-MPT_3405,Cabinet No.=0, Subrack No.=0, TX Board Slot No.=1, RX Board Slot No.=3, RX Board Type=LBBP, TX Board Type=UBBP

Ne Name=SHW_IND2_GHANIM_CO-MPT_3405,Cabinet No.=0, Subrack No.=0, TX Board Slot No.=3, RX Board Slot No.=1, RX Board Type=UBBP, TX Board Type=LBBP

Handling Suggestions

For root cause 1: Query the current system clock status, collect information, and contact onsite engineers.

Communications

Operation	Category	Incident Name	NE Name	Occurred On	Diagnosis Status	Business Impact Analysis	Self-H
	NE Disconnection & Out of Service	eNodeB Out of Service-eNodeB Out ..		2026-05-13 14:47:03	Diagnosis succeeded	15:00: Traffic loss 0.980 GB, user loss 0.863; 16:00: Traffic loss 0.893 GB, user loss 0.916; 17:0...	Unrep

Description: eNodeB_X2 Interface & Link Fault-X2 Interface Fault: eNodeB Function Name=WAFKPC-CO-MPT-4951, Neighboring Base Station Type=gNodeB, Specific Problem=Lower-layer link fault, AFFECTED_RAT: L

Alarms | Root Causes | Comments

Root Causes

1 1.Fronthaul link:Fronthaul optical fiber fault

Ne Name=WAFKPC-CO-MPT-4951,BBU{Cabinet No.=0, Subrack No.=0, Slot No.=1, Port No.=3, ESN=021HPJ4ME7005445, BOM Code=03021HPJ}

Handling Suggestions

For root cause 1: 1. Check the fiber fault point and rectify the fault.

Processing Error

Operation	Category	Incident Name	NE Name	Occurred On	Diagnosis Status	Business Impact Analysis	Self-H
	NE Disconnection & Out of Service	eNodeB Out of Service-eNodeB Ou		2026-05-13 14:50:48	Diagnosis succeeded	15:00: Traffic loss 0.749 GB, user loss 0.351; 16:00: Traffic loss 0.681 GB, user loss 0.495; 17:0...	Unrep

Description: eNodeB_X2 Interface & Link Fault-X2 Interface Fault: eNodeB Function Name=5RQ_B1_CBK_PRK_CO-MPT_3164, Neighboring Base Station Type=eNodeB, Specific Problem=Lower-layer link fault, AFFECTED_RAT: L

Alarms | Root Causes | Comments

Root Causes

1.Configuration:The alarm threshold is improper

Ne Name=5RQ_B1_CBK_PRK_CO-MPT_3164,Cabinet No.=0, Subrack No.=68, Slot No.=0, TX Channel No.=0, Board Type=MRRU, VSWR Alarm Threshold (0.1)=15, VSWR(0.1)=15, Output Power (0.1 dBm)=386, RF Port=NULL, ESN=2102311TBD10M1000210, BOM Code=02311TBD

Handling Suggestions

For root cause 1: Modify the RF unit VSWR threshold.

Environmental

Operation	Category	Incident Name	NE Name	Occurred On	Diagnosis Status	Business Impact Analysis	Self-H
	NE Disconnection & Out of Service	eNodeB Out of Service-eNodeB Out ..		2026-05-13 14:41:45	Diagnosis succeeded	15:00: Traffic loss 0.995 GB, user loss 0.553; 16:00: Traffic loss 0.771 GB, user loss 0.728; 17:0...	Unrep

Description: eNodeB_X2 Interface & Link Fault-X2 Interface Fault: eNodeB Function Name=Sub-PW-ST-CO-MPT-3052, Neighboring Base Station Type=gNodeB, Specific Problem=Lower-layer link fault, AFFECTED_RAT: L

Alarms | Root Causes | Comments

Root Causes

1 1.Power and environment - Power supply:AAU/RRU/RHUB power failure

Ne Name=Sub-PW-ST-CO-MPT-3052,BBU{Cabinet No.=0, Subrack No.=0, Slot No.=3, Port No.=4, ESN=210305715510K9013898, BOM Code=03057155}, RRU{Cabinet No.=0, Subrack No.=71, Slot No.=0}

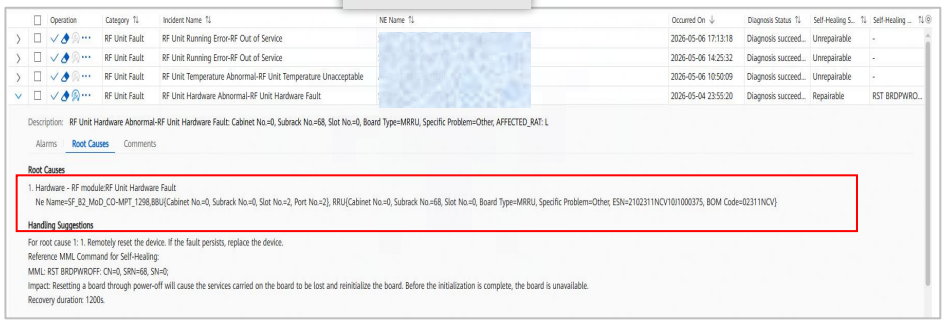
Handling Suggestions

For root cause 1: 1. Check whether the mains supply is interrupted. If yes, consider dispatching a diesel generator. 2. If the mains supply is not interrupted, check the power supply circuit onsite.

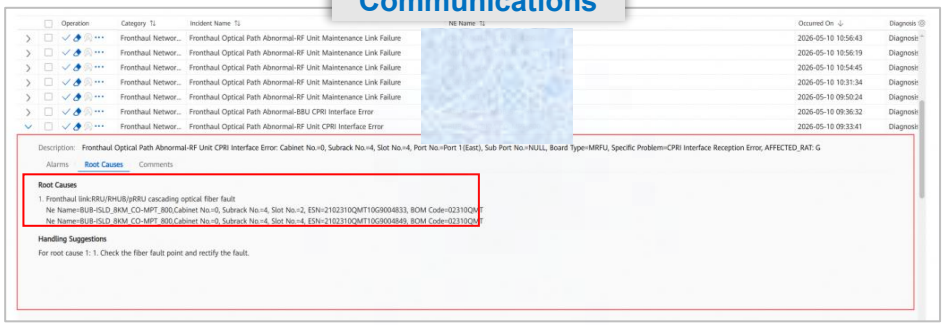
Demarcation & Locating

Service Capability	Weight	Question	√ Option A	Option B	Option C	Option D
Demarcation & Locating	20%	How does the wireless network fault management system support root cause diagnosis and fault locating in various fault scenarios? Note1: The root cause diagnosis and fault locating shall require the ability to locate smallest field replaceable unit, upgradable software modules and connectors so that a repair solution can be quickly determined. e.g, Optical module, fiber optic cable and optical connectors.	The system demarcates and locates faults based on intelligent models without the need for human intervention.	The system demarcates the fault or locates multiple causes based on intelligent models, but the human intervention is required.	The system demarcates and locates faults based on manually defined rules (such as experience-based fault trees and troubleshooting processes) and needs human intervention.	Fault diagnosis needs to be manually performed based on expertise.

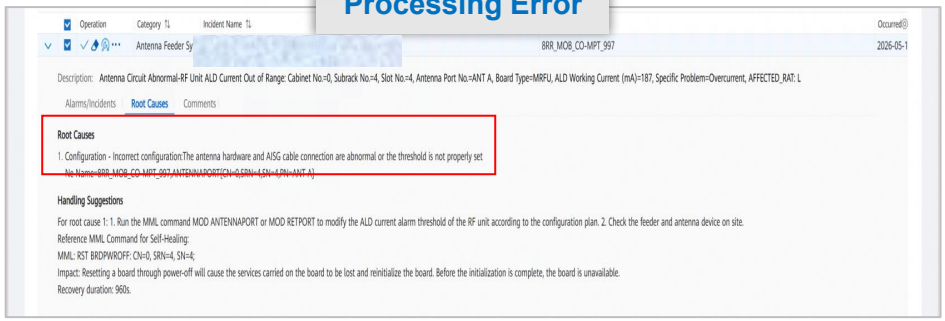
Equipment



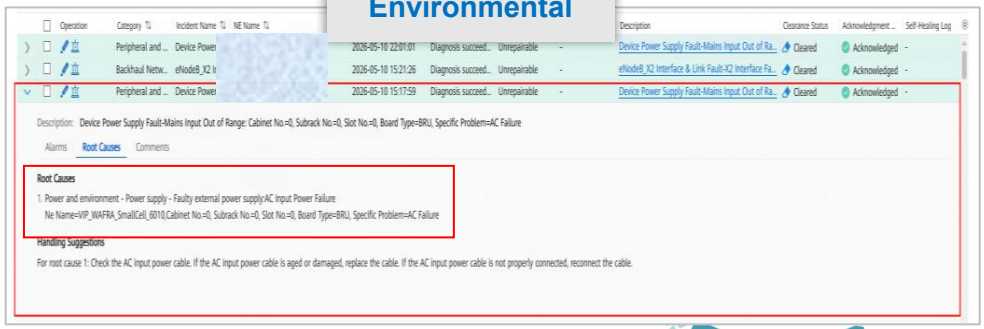
Communications



Processing Error



Environmental



Solution generation

Service Capability	Weight	Question	√ Option A	Option B	Option C	Option D
Solution generation	10%	How does the wireless network fault management system support generation of fault recovery solutions in various scenarios? Note1: Fault recovery solutions includes: the executable commands/ scripts for the remote faults that can be remotely recovered; or, On-site repair operation instructions for faults that require on-site handling. Note: 2: The examples of the fault recovery solutions can be the remote recovery solution, neighboring cell RF compensation recovery solution.	The system generates one or multiple possible fault recovery or fault rectification solutions based on intelligent model without the need for human intervention.	The system generates multiple possible fault recovery or rectification solutions based on intelligent model, but need human intervention.	The system generates one or multiple possible fault recovery or rectification solutions based on manually defined rules and need human intervention.	Fault recovery or rectification solutions needs to be manually generated based on expertise.

Evaluation and decision-making

Service Capability	Weight	Question	√ Option A	Option B	Option C	Option D
Evaluation and decision-making	10%	How does the wireless network fault management system support evaluation and decision-making in various scenarios?	The system evaluates multiple possible recovery or rectification solutions and determines the optimal recovery or fault rectification solution based on intelligent models without the need for human intervention.	The system evaluates multiple possible recovery or rectification solutions and determines the optimal recovery or fault rectification solution based on intelligent models, but need human intervention.	The system evaluate and decide the fault recovery or fault rectification solution based on manually defined rules and need human intervention.	The fault recovery or fault rectification solution is manually evaluated and decided.

Solution generation & Evaluation and decision-making

Equipment

Operation	Category	Incident Name	NE Name	Occurred On	Diagnosis Status	Self-Healing S...	Self-Healing ...
	RF Unit Fault	RF Unit Running Error-RF Out of Service		2026-05-06 17:13:18	Diagnosis succeed...	Unrepairable	-
	RF Unit Fault	RF Unit Running Error-RF Out of Service		2026-05-06 14:25:32	Diagnosis succeed...	Unrepairable	-
	RF Unit Fault	RF Unit Temperature Abnormal-RF Unit Temperature Unacceptable		2026-05-06 10:50:09	Diagnosis succeed...	Unrepairable	-
	RF Unit Fault	RF Unit Hardware Abnormal-RF Unit Hardware Fault		2026-05-04 23:55:20	Diagnosis succeed...	Repairable	RST BRDPWRO...

Description: RF Unit Hardware Abnormal-RF Unit Hardware Fault: Cabinet No.=0, Subrack No.=68, Slot No.=0, Board Type=MRRU, Specific Problem=Other, AFFECTED_RAT: L

Alarms | Root Causes | Comments

Root Causes

1. Hardware - RF module:RF Unit Hardware Fault
   Ne Name=SF_B2_MoD_CO-MPT_1298,BBU{Cabinet No.=0, Subrack No.=0, Slot No.=2, Port No.=2}, RRU{Cabinet No.=0, Subrack No.=68, Slot No.=0, Board Type=MRRU, Specific Problem=Other, ESN=2102311NCV10J1000375, BOM Code=02311NCV}

Handling Suggestions

For root cause 1: 1. Remotely reset the device. If the fault persists, replace the device.
Reference MML Command for Self-Healing:
MML: RST BRDPWROFF: CN=0, SRN=68, SN=0;
Impact: Resetting a board through power-off will cause the services carried on the board to be lost and reinitialize the board. Before the initialization is complete, the board is unavailable.
Recovery duration: 1200s.

For faults that can be remotely rectified, MML commands are automatically generated and execute.

Processing Error

Operation	Category	Incident Name	NE Name	Occurred
	Antenna Feeder Sy...	Antenna Circuit Abnormal-RF Unit ALD Current Out of Range		2026-05-1

Description: Antenna Circuit Abnormal-RF Unit ALD Current Out of Range: Cabinet No.=0, Subrack No.=4, Slot No.=4, Antenna Port No.=ANT A, Board Type=MRFU, ALD Working Current (mA)=187, Specific Problem=Overcurrent, AFFECTED_RAT: L

Alarms/Incidents | Root Causes | Comments

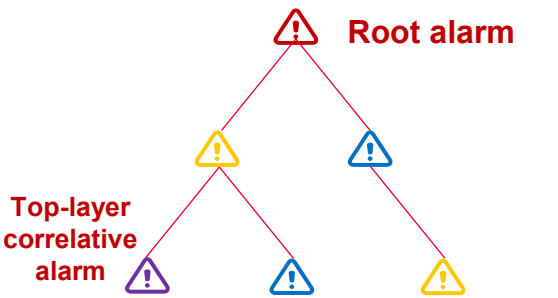
Root Causes

1. Configuration - Incorrect configuration:The antenna hardware and AISG cable connection are abnormal or the threshold is not properly set
   Ne Name=8RR_MOB_CO-MPT_997,ANTENNAPORT{CN=0,SRN=4,SN=4,PN=ANT A}

Handling Suggestions

For root cause 1: 1. Run the MML command MOD ANTENNAPORT or MOD RETPORT to modify the ALD current alarm threshold of the RF unit according to the configuration plan. 2. Check the feeder and antenna device on site.
Reference MML Command for Self-Healing:
MML: RST BRDPWROFF: CN=0, SRN=4, SN=4;
Impact: Resetting a board through power-off will cause the services carried on the board to be lost and reinitialize the board. Before the initialization is complete, the board is unavailable.
Recovery duration: 960s.

Root alarm identification

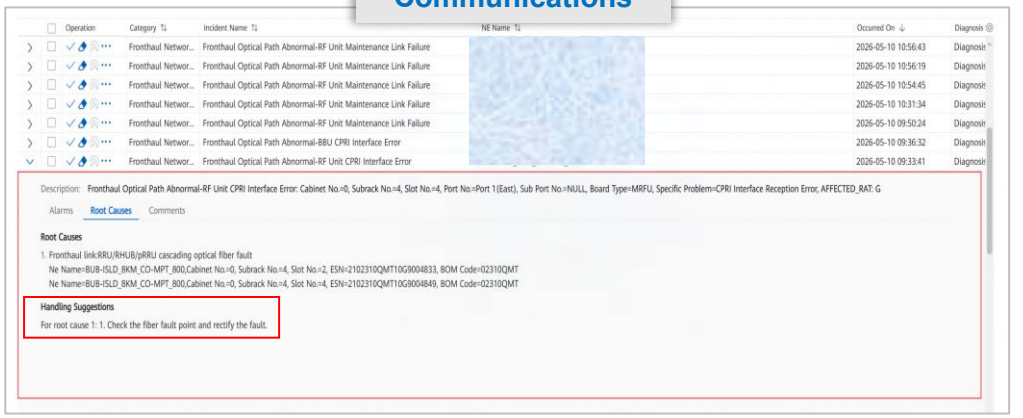


Mining root alarms based on the Random Forest algorithm

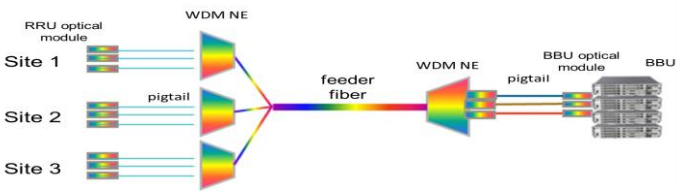
- ✓ Perform causal analysis based on the associated alarms reported for the fault to determine the root cause.

Solution generation & Evaluation and decision-making

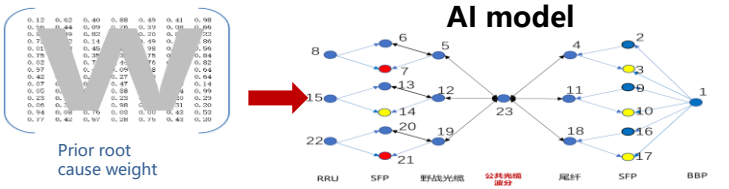
Communications



Fronthaul topology restoration



Probability fusion decision

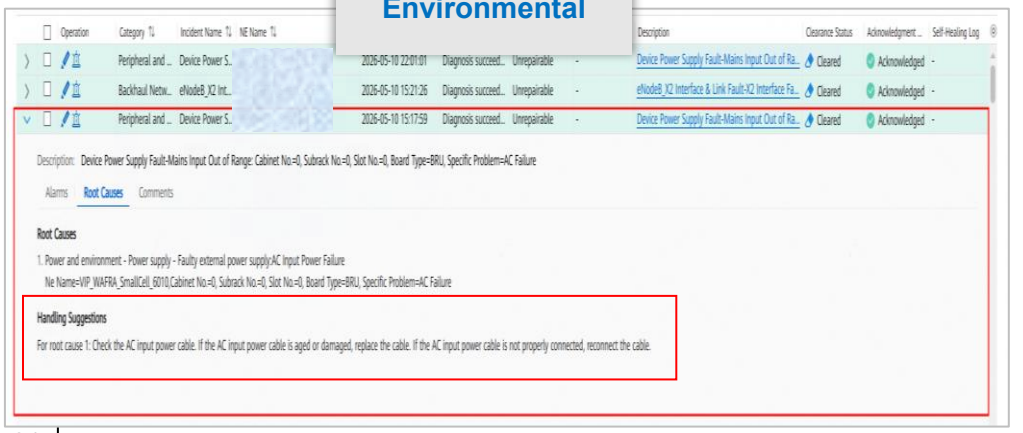


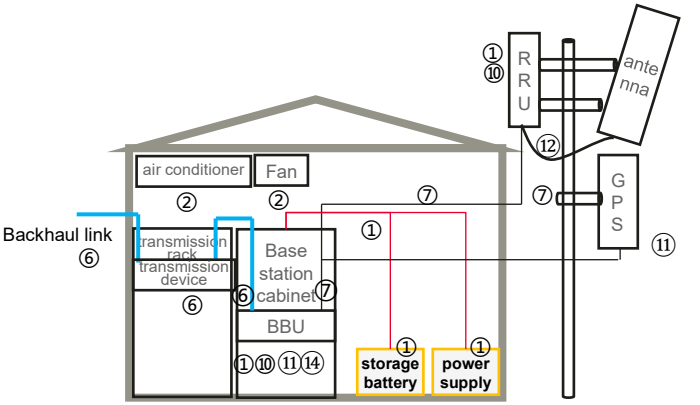
Prior root cause weight

Hidden information mining based on device capability, working principle, and fault mode

Alarm combination and fault topology

Environmental





✓ The BBU monitors the change of the backup power voltage.

Solution implementation

Service Capability	Weight	Question	√ Option A	Option B	Option C	Option D
Solution implementation	10%	How does the wireless network fault management system support automatic execution of: 1) Repair commands/ scripts for the faults that can be remotely recovered; 2) On-site repair instruction for the faults that on-site handling is necessary (such as power supply failure, board fault, fiber cut) to enable the human: - to query the recommended checklists to repair the fault. - to check the fault resolution effect and generate the fault repair report .	1) The system automatically executes the commands/ scripts for the fault that can be remotely recovered. 2) The system support intelligent on-site instruction for the faults that on-site handling is necessary, including support of: - Human leverages natural language to guide Copilot in query optimal troubleshooting checklists. - Human leverages natural language to guide Copilot to automatically verify that the fault is resolved and alarms are cleared, generate the fault repair report (including fill out the trouble ticket record).	Humans use the system to execute instructions. 1)The system executes commands/ scripts for the fault that can be remotely recovered with human confirmation. 2)The on-site handling are assisted by tool,but still requires assistance from NOC.	The recovery solution needs to be manually implemented 1) The recovery solution need to be manually implemented. 2) On-site handling is guided by NOC.	

Solution implementation

Automatic execution

Processing Error

The system automatically generates and executes MML commands.

Operation	Category	Incident Name	NE Name	Occurred
	Antenna Feeder Sy...	Antenna Circuit Abnormal-RF Unit ALD Current Out of Range		2026-05-1

Description: Antenna Circuit Abnormal-RF Unit ALD Current Out of Range: Cabinet No.=0, Subrack No.=4, Slot No.=4, Antenna Port No.=ANT A, Board Type=MRFU, ALD Working Current (mA)=187, Specific Problem=Overcurrent, AFFECTED_RAT: L

Alarms/Incidents | Root Causes | Comments

Root Causes

1. Configuration - Incorrect configuration:The antenna hardware and AISG cable connection are abnormal or the threshold is not properly set

Ne Name=8RR_MOB_CO-MPT_997,ANTENNAPORT{CN=0,SRN=4,SN=4,PN=ANT A}

Handling Suggestions

For root cause 1: 1. Run the MML command MOD ANTENNAPORT or MOD RETPORT to modify the ALD current alarm threshold of the RF unit according to the configuration plan. 2. Check the feeder and antenna device on site.
Reference MML Command for Self-Healing:
MML: RST BRDPWROFF: CN=0, SRN=4, SN=4;
Impact: Resetting a board through power-off will cause the services carried on the board to be lost and reinitialize the board. Before the initialization is complete, the board is unavailable.
Recovery duration: 960s.

Equipment

The system automatically generates and executes MML commands.

Operation	Category	Incident Name	NE Name	Occurred On	Diagnosis Status	Self-Healing S...	Self-Healing ...
	RF Unit Fault	RF Unit Running Error-RF Out of Service		2026-05-06 17:13:18	Diagnosis succeed...	Unrepairable	-
	RF Unit Fault	RF Unit Running Error-RF Out of Service		2026-05-06 14:25:32	Diagnosis succeed...	Unrepairable	-
	RF Unit Fault	RF Unit Temperature Abnormal-RF Unit Temperature Unacceptable		2026-05-06 10:50:09	Diagnosis succeed...	Unrepairable	-
	RF Unit Fault	RF Unit Hardware Abnormal-RF Unit Hardware Fault		2026-05-04 23:55:20	Diagnosis succeed...	Repairable	RST BRDPWRO...

Description: RF Unit Hardware Abnormal-RF Unit Hardware Fault: Cabinet No.=0, Subrack No.=68, Slot No.=0, Board Type=MRRU, Specific Problem=Other, AFFECTED_RAT: L

Alarms | Root Causes | Comments

Root Causes

1. Hardware - RF module:RF Unit Hardware Fault

Ne Name=SF_B2_MoD_CO-MPT_1298,BBU{Cabinet No.=0, Subrack No.=0, Slot No.=2, Port No.=2}, RRU{Cabinet No.=0, Subrack No.=68, Slot No.=0, Board Type=MRRU, Specific Problem=Other, ESN=2102311NCV10J1000375, BOM Code=02311NCV}

Handling Suggestions

For root cause 1: 1. Remotely reset the device. If the fault persists, replace the device.
Reference MML Command for Self-Healing:
MML: RST BRDPWROFF: CN=0, SRN=68, SN=0;
Impact: Resetting a board through power-off will cause the services carried on the board to be lost and reinitialize the board. Before the initialization is complete, the board is unavailable.
Recovery duration: 1200s.

Solution implementation

On-site instruction

Communications

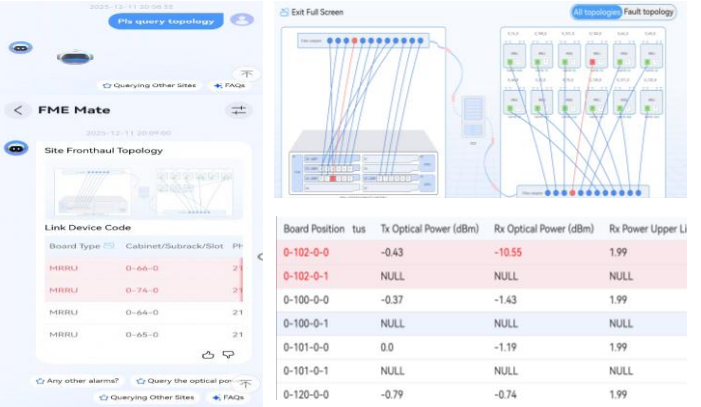
Environmental

Equipment

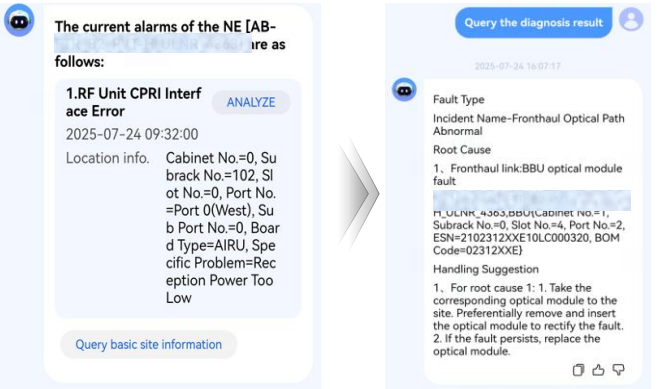
Onsite repair instructions for these sub-scenarios can be provided by FMEMate (copilot)

Key Capabilities of FMEMate in Kuwait Zain

- **Fault Topology Visualization**

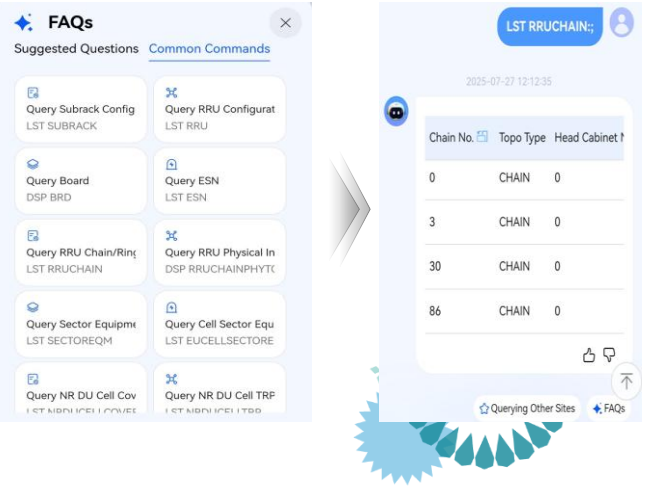


- **Auxiliary Troubleshooting**



- **Maintaining knowledge Q&A**

- **Common Query Commands**



Solution implementation

On-site instruction | FMEMate Use Case

Receiving Ticket | Fault Locating and Analysis | Site Visit | Onsite Repair | Ticket Closure

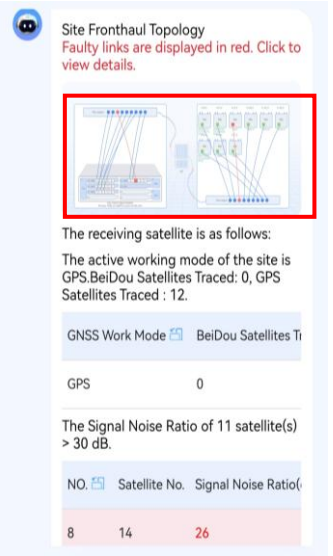
Clock Fault

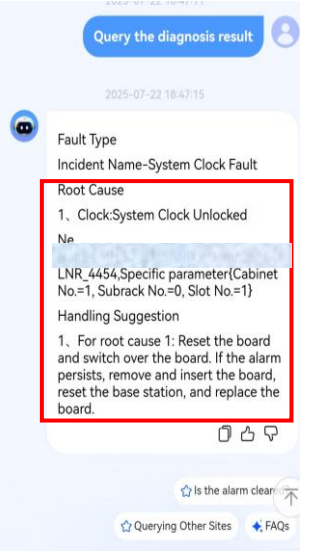
WO: CM-20250722-00000006

WO description: 4454_26264-System Clock Unlocked_2025-07-18 16:56:18

Alarm Name: 26264-System Clock Unlocked

1. Query alarm information through FME Mate and diagnose the fault. FME Mate provides the root cause of the fault and the solution.





2. Board fault, prepare spare board in advance before going on site.

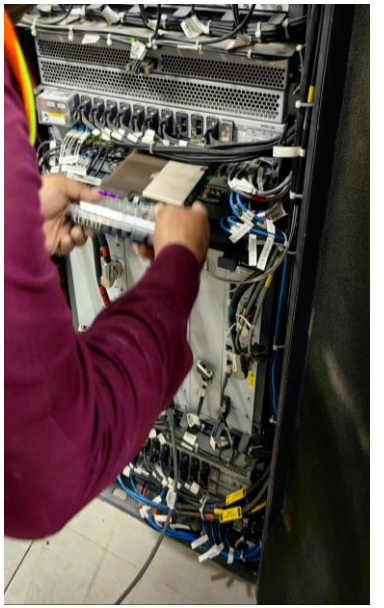
AS-IS: (28min)

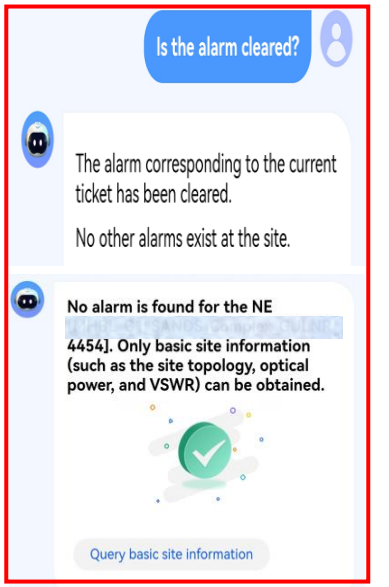
1. Query alarm and board info(8min)
2. Analyze cause of the fault(10min)
3. Remote reset the board(10min)
4. First on-site check(GPS and Board)

AS-IS: (12min)

1. Root Cause Diagnosis(2min)
2. Remote reset the board(10min)

1. Replace the UBBP board(1-0-1). Confirm whether the alarm has been cleared and if there are any other alarms.





AS-IS: (45min)

1. Check GPS cable (10 min)
2. Check UMPT cable (5 min)
3. Remove and insert board(10 min)
4. Replace the board(20 min)

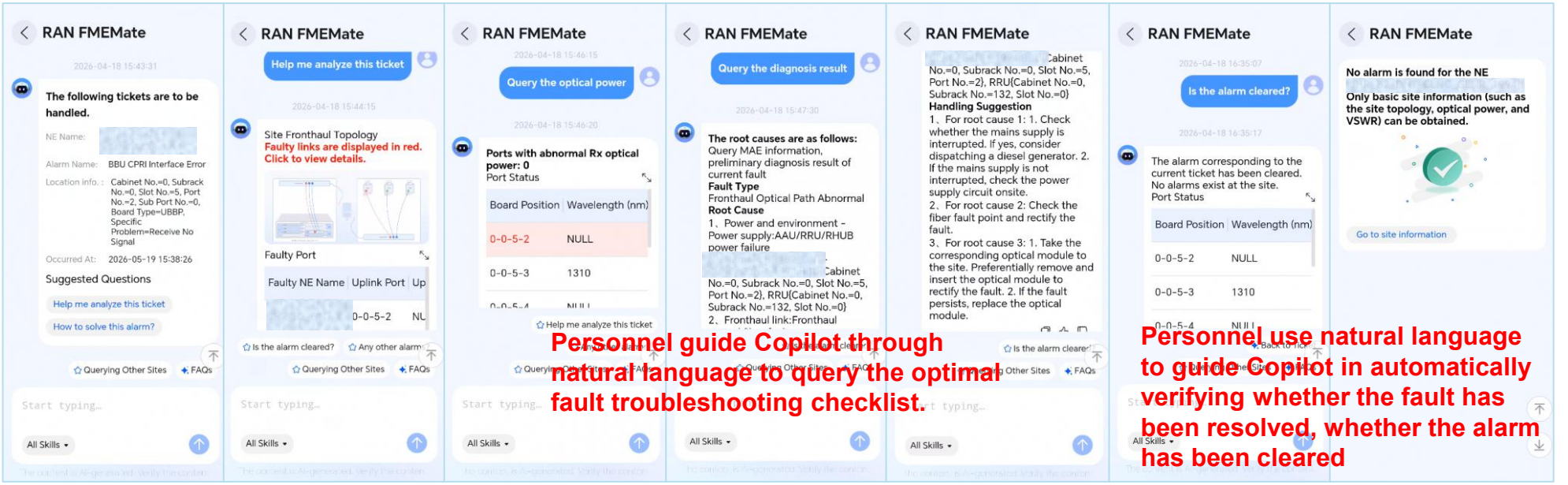
AS-IS: (30min)

1. Remove and insert board(10 min)
2. Replace the board (20 min)

Solution implementation

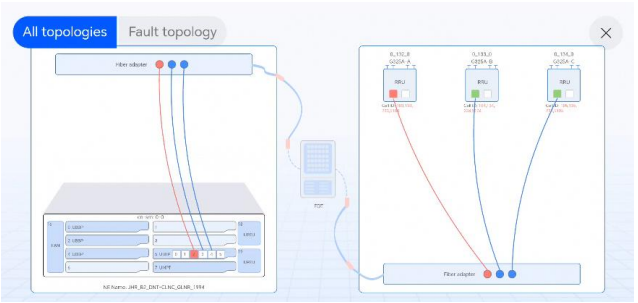
On-site instruction

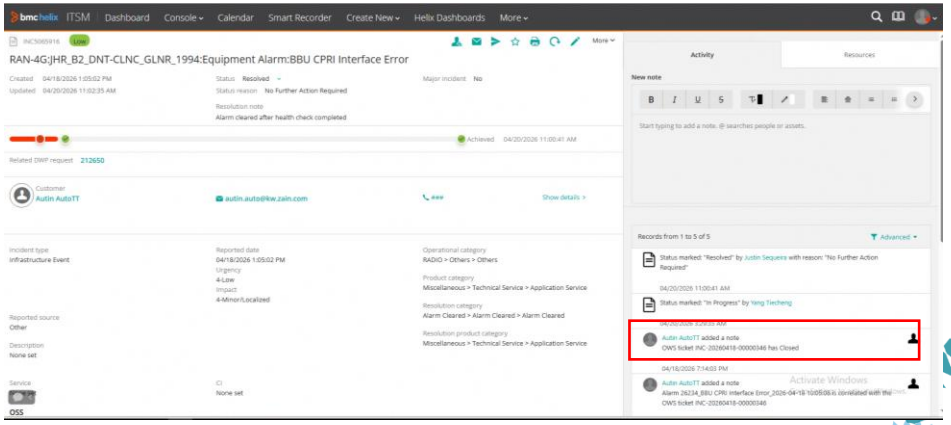
Communications



Personnel guide Copilot through natural language to query the optimal fault troubleshooting checklist.

Personnel use natural language to guide Copilot in automatically verifying whether the fault has been resolved, whether the alarm has been cleared



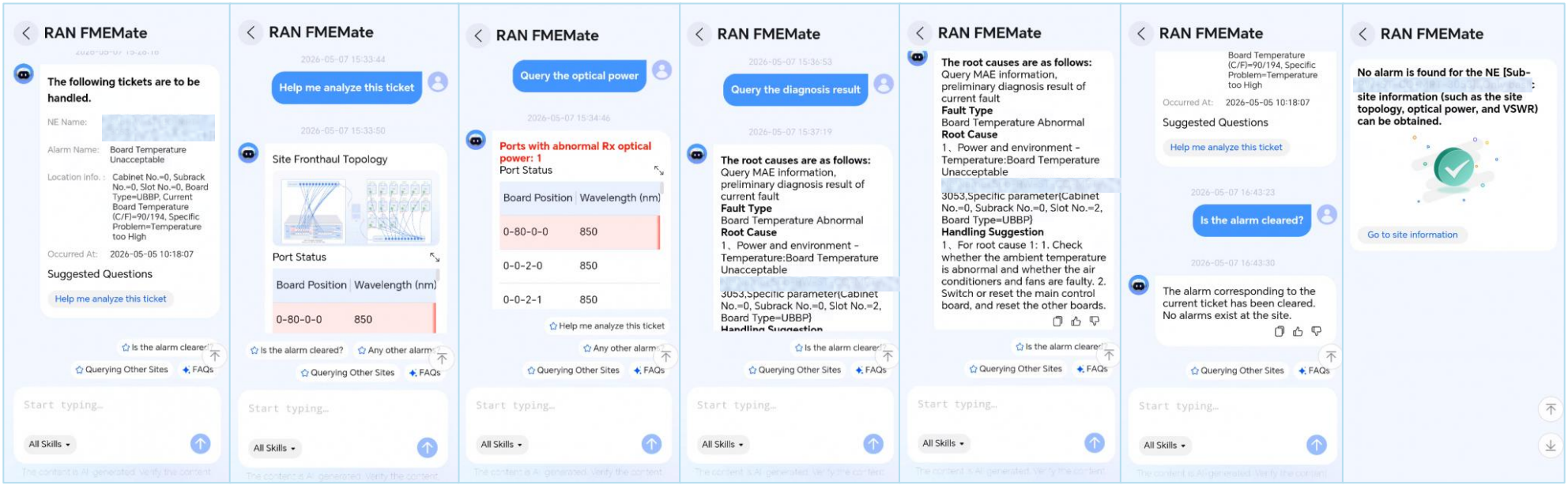


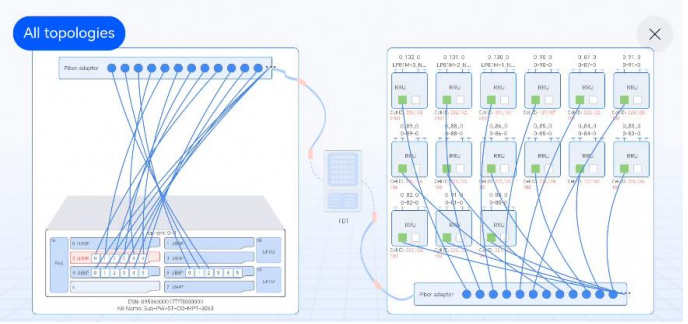
Fill out the trouble ticket record

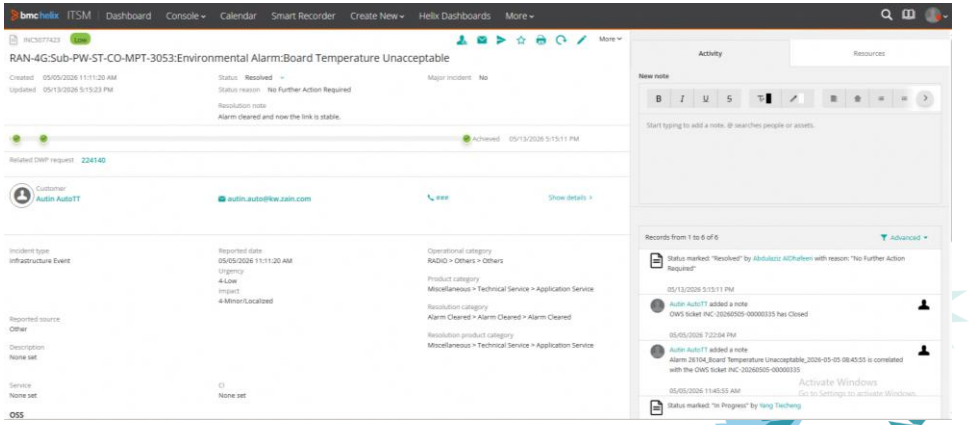
Solution implementation

On-site instruction

Equipment





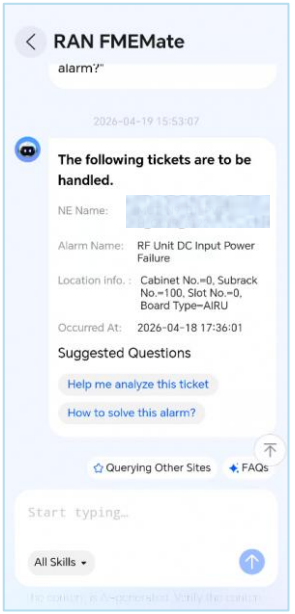


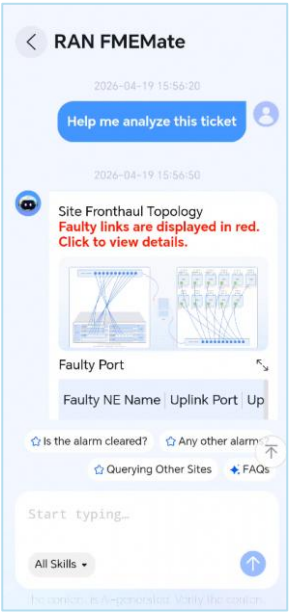
fill out the trouble ticket record

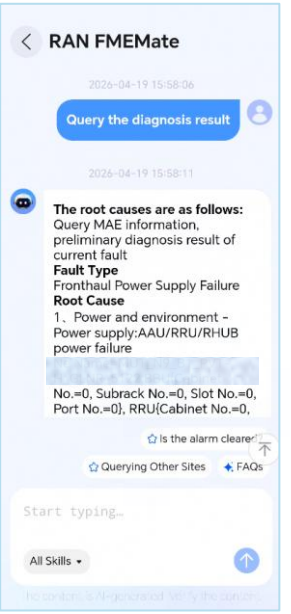
Solution implementation

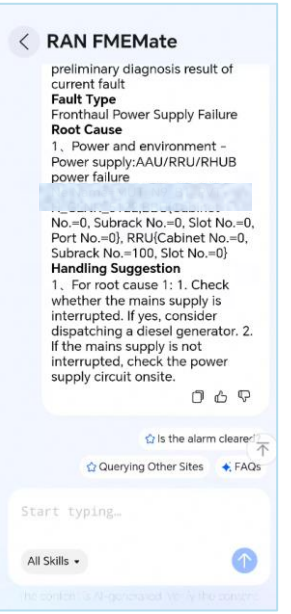
On-site instruction

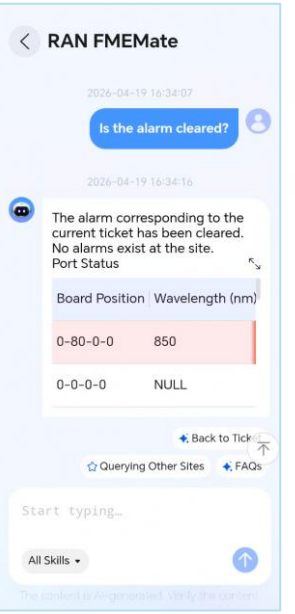
Environmental

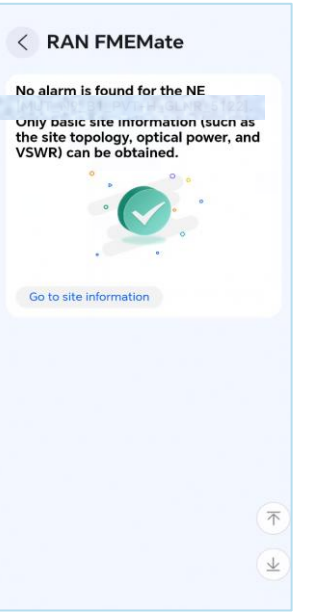


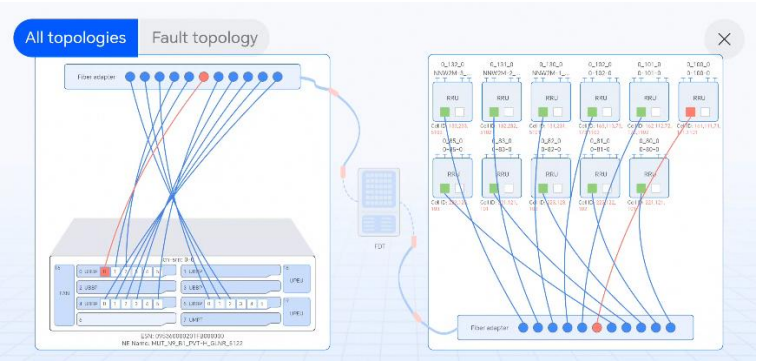


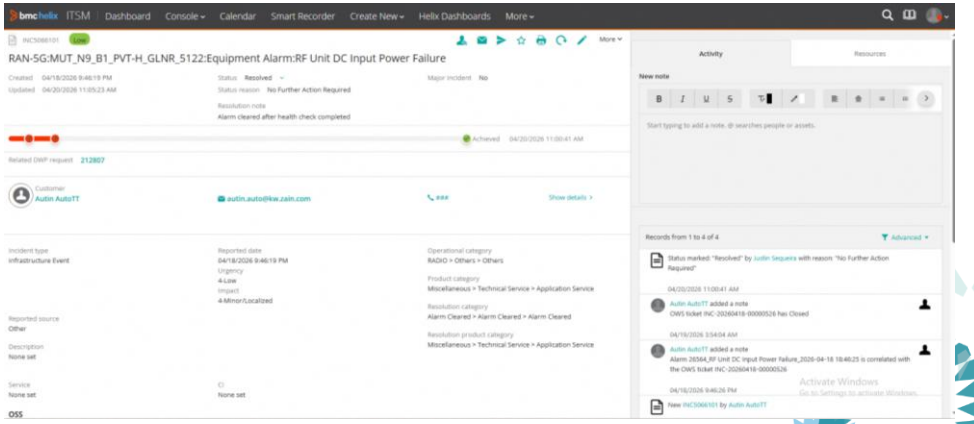












fill out the trouble ticket record

zain