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Kenya Power

ELECTRIC POWER GRID DIAGNOSTIC SOFTWARE-SPECIFICATION

A Document of the Kenya Power & Lighting Co. Ltd
OCTOBER 19, 2026

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0.1 CIRCULATION LIST

COPY NO.	COPY HOLDER
1	Snr Engineer, Sub-transmission, Central Office.
2	Manager, Transmission, Central Office.

0.2 AMENDMENT RECORD

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
0	2026-10-19	New issue	Eng. Alistair Akute	Eng. George Korir

FOREWORD

This specification has been prepared by the Transmission Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for the Electric Power Grid Diagnostic Software.

For the **Kenya Power and Lighting Company (KPLC)**, this advanced diagnostic software is a vital tool for overcoming its distinct grid challenges, specifically reducing high system losses, managing widespread vegetation encroachment, and preventing costly outages. By implementing the software's automated vegetation management analytics, KPLC can transition from reactive line clearing to predictive, risk-prioritized tree trimming along its extensive rural and semi-urban distribution corridors, directly mitigating the risk of localized faults, wildlife interactions, and seasonal line tripping. Furthermore, the software's ability to process UV corona, acoustic, and thermal data allows KPLC engineers to pinpoint exact areas of insulation degradation and leakage current before equipment failures occur. In a single-buyer market handling critical national infrastructure, deploying this software under a one-time CapEx perpetual license ensures long-term operational autonomy without recurring foreign-currency subscription drains. It equips KPLC field teams to systematically target maintenance, lower energy transmission losses, and drastically improve grid reliability across Kenya's expanding power network.

There are no other specifications in this series.

This specification stipulates the minimum requirements for Electric Power Grid Diagnostic Software acceptable for use in the company and it shall be the responsibility of the supplier and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to KPLC.

Users of Kenya Power specifications are responsible for their correct interpretation and application.

Head of Section: Sub-transmission, Central Office	Head of Department: Transmission, Central Office
Signed:	Signed:
Date: 2026-10-19	Date: 2026-10-19

The following are members of the team that developed this specification:

Name	Department	Signature
Nicodemus Ondigo Otore	Transmission	19/10/2025
Callen Buruchara	Distribution / Live Line	19/10/2025

1. SCOPE

1.1. This specification is for the Electric Power Grid Diagnostic Software for use by company's Transmission Department.

1.2. The specification covers requirements, design, tests and inspection and schedule of Guaranteed Technical Particulars of the Electric Power Grid Diagnostic Software.

2. NORMATIVE REFERENCES

The following standards contain provision which, through reference in this text, constitute provisions of this specification. For dated editions the cited edition will apply; for undated editions the latest edition of the referenced document shall apply.

IEEE 1159 (Recommended Practice for Monitoring Electric Power Quality): This standard provides detailed definitions of electromagnetic phenomena that cause power quality disturbances. The software utilizes these definitions to classify categories of power quality variations, such as sags, swells, transients, and interruptions.

IEC 61000-4-30 (Electromagnetic Compatibility - Testing and Measurement Techniques): This is the definitive global standard for power quality measurement methods. The software complies with **Class A** instrumentation requirements specified in this standard to guarantee that parameters like voltage amplitude, frequency, unbalance, and harmonics are calculated using identical mathematical algorithms regardless of the hardware manufacturer.

IEC 61000-4-15 (Flicker Meter Functional and Design Specifications): This standard defines the exact measurement architecture and statistical processing needed to quantify human perception of light flicker caused by rapid voltage fluctuations. The software uses these guidelines to continuously

calculate Short-Term (Pst, evaluated over 10 minutes) and Long-Term (Plt, evaluated over 2 hours) flicker severity indices.

EN 50160 (Voltage Characteristics of Electricity Supplied by Public Distribution Networks): A European standard that defines the limits and tolerances for grid voltage characteristics under normal operating conditions. The software uses this framework as a automated compliance benchmark, generating automated reports showing whether the grid's frequency, supply voltage variations, and harmonic distortion remain within legally acceptable bounds over a standard 7-day monitoring period.

COMTRADE (IEEE C37.111 / IEC 60255-24 - Common Format for Transient Data Exchange): This open file format standardizes how digital data from power system disturbances is stored. The software natively writes and reads COMTRADE files (.CFG and .DAT), allowing field engineers to capture high-speed transient waveforms from digital fault recorders or protective relays and seamlessly import them into the diagnostic software for graphical analysis.

PQDIF (IEEE 1159.1 - Power Quality Data Interchange Format): A standard binary file format designed specifically for exchanging power quality monitoring results, static logs, and trend data. The software utilizes PQDIF format (.PQD) to efficiently store and compress long-term diagnostic measurements gathered across distributed sensor nodes, ensuring compatibility with secondary utility databases.

DNP3 (IEEE 1815) & IEC 60870-5-104: These standard industrial communication protocols govern how telecontrol messages are transmitted over networks. The diagnostic software integrates these protocols within its SCADA pipeline to securely stream real-time operational alerts, line status values, and automated defect codes from remote field sensors back to central utility operations centers.

3. DEFINITIONS AND ABBREVIATIONS

For this specification the definitions and abbreviations given in the reference standards shall apply together with the following abbreviations.

3.1. ABBREVIATIONS

- **UV:** Ultraviolet
- **UVC:** Ultraviolet C

- **RGB:** Red, Green,
- **pC:** picoCoulomb
- **FFT:** Fast Fourier Transform
- **LiDAR:** Light Detection and Ranging
- **SCADA:** Supervisory Control and Data Acquisition
- **DNP3:** Distributed Network Protocol 3
- **TCP/IP:** Transmission Control Protocol / Internet Protocol
- **OPC UA:** Open Platform Communications Unified Architecture
- **GIS:** Geographic Information System
- **UAV:** Unmanned Aerial Vehicle
- **ROI:** Region of Interest
- **EAM:** Enterprise Asset Management
- **CMMS:** Computerized Maintenance Management
- **RBAC:** Role-Based Access Control
- **IEEE:** Institute of Electrical and Electronics Engineers
- **IEC:** International Electrotechnical Commission
- **EN:** European Nation (Norm)
- **COMTRADE:** Common Format for Transient Data Exchange
- **PQDIF:** Power Quality Data Interchange Format
- **NERC CIP:** North American Electric Reliability Corporation Critical Infrastructure Protection
- **CapEx:** Capital Expenditure
- **OpEx:** Operational Expenditure
- **ALA:** Annual Licensing/Maintenance Agreement
- **KPLC**- The Kenya Power and Lighting Company (Plc)

4. REQUIREMENTS

4.1.0 Field Diagnostic & Asset Condition Software

4.1.1 Image Registration and Overlay Precision:

It shall fuse dual-channel inputs (Solar-blind UVC at **240–280 nm** + Visible RGB at 1080p/720p) with pixel-to-pixel spatial alignment [gnss.ae]. When an **ACOUSTIC /IR IMAGING CAMERA** is integrated, it maps localized ultrasonic sound arrays simultaneously over the visual feed.

4.1.2 Photon Counting and Analytics:

Region-of-Interest (ROI) segmentation shall be capable of quantifying discharge activity. Wavelength data is converted into a numerical value measured in picoCoulombs (pC) or photon counts per minute.

4.1.3 Defect Classification Engine:

Shall use rule-based thresholds and AI machine-learning algorithms that automatically classify corona or thermal anomalies into distinct severity alerts (*Low, Medium, Critical*). For acoustic profiles, it shall incorporate automated electrical fault classification for partial discharge issues, including surface, floating, and airborne discharges.

4.1.4 Georeferencing and Data Tagging:

It shall intercept hardware metadata to embed exact GPS coordinates, local humidity, ambient temperature, and distance-to-target calculations onto raw radiometric imagery.

4.1.5 Compliance Frameworks:

It shall have automated test guidance and report building mapped exactly to international testing protocols, including **IEEE 1159**, **IEC 61000-4-30**, and **EN50160** standards.

4.1.6 High-Resolution RGB Imagery Analytics:

It shall process stand-alone or orthomosaic visual images to detect structural anomalies, physical component damage (such as cracked insulators, rusted towers, or frayed lines), and missing hardware that cannot be identified via thermal or UV sensors alone.

4.1.7 Vegetation Management Analytics:

It shall utilize 3D point cloud data, LiDAR datasets, and high-resolution RGB imagery to run volumetric growth simulations. It shall calculate precise encroachment clearances between tree canopies and conductors, automatically generating risk-prioritized tree trimming maps to prevent vegetation-induced outages and wildfires.

4.1.8 Thermal Infrared Processing:

Processes radiometric thermal data to automatically compute temperature differentials (Δ T) across grid assets. It applies emissivity, ambient temperature, and wind speed corrections to identify hot spots, overloaded components, and high-resistance joints.

4.1.9 UAV Flight Path Automation:

Shall integrate with drone hardware to calculate optimal, collision-free autonomous inspection trajectories. The software leverages terrain maps and coordinate inputs to position sensors at the exact angles needed to capture crisp RGB, UV, acoustic, and thermal data.

4.1.10 Predictive Asset Lifetime Analytics:

Shall correlate historical inspection data with environmental metrics, load history, and current sensor telemetry to run degradation curve models. It estimates the remaining useful life (RUL) of transformers, conductors, and substation components to optimize capital expenditure schedules.

4.1.11 Automated Inspection Workflow and Dispatch:

Shall connect diagnostic anomaly alerts directly to computerized maintenance management systems (CMMS). It builds complete work orders containing localized damage images, parts lists, and GPS routing info to fast-track field repair dispatches.

4.1.12 Sensor Fusion Dashboard:

Shall combine simultaneous data feeds from UV, thermal, RGB, LiDAR, and acoustic inspections into a unified, interactive geographic information system (GIS) mapping layer for grid-wide health visualization.

4.2.0 Electrical Power Analysis & System Simulation Software

4.2.1 This software shall focus on high-speed data acquisition, electrical waveform analysis, and broad grid forecasting as shown in table 1.

Table 1: Software functional and technical capability table

Functional Category	Specification Metric / Standard	Technical Capability
Data Logging & Sampling	Raw Data Storage Rate	Full, continuous sampling at up to 15 MS/s per channel for raw transient recording.
Frequency Handling	Fundamental Range & Accuracy	10 Hz to 3 kHz variable base tracking; line frequency accuracy up to 0.0005%.
Harmonics & FFT	Signal Frequency Processing	Real-time Fast Fourier Transform (FFT) calculations up to 150 kHz (grouped in 200 Hz and 2 kHz bands).
Forensic Troubleshooting	Waveform Triggering Architecture	Configurable for simple edge, dual-level window, pulse-width, or steepness slope deviations to isolate transients.
Power Quality Metrics	Flicker Monitoring	Strict calculation of Short-Term (Pst) and Long-Term (Plt) Flicker severity per **IEC 61000-4-15**.
File Export Interoperability	Native Format Sharing	Disturbance records are exported directly as open-source **COMTRADE** or PQDIF files for secondary forensic analysis.

4.3.0 Enterprise Integration & Security

4.3.1 SCADA Protocols:

Shall have native driver integration communicating via DNP3, IEC 60870-5-104, Modbus TCP/IP, or OPC UA directly to sub-station control interfaces.

4.3.2 Enterprise Asset Management (EAM):

Shall have bi-directional API pipelines linking data to standard industrial hubs like SAP, Oracle Utilities, Maximo, or PI System.

4.3.3 Cybersecurity Compliance:

Shall have end-to-end data encryption leveraging TLS 1.3 protocol architectures for sensor-to-cloud streams, aligned with NERC CIP guidelines.

4.4.0 Software usage and rights

4.4.1 Multi-Tier Asset Licensing Model:

The software system shall feature a scalable grid monitoring architecture designed to support localized utility networks up to nationwide transmission infrastructure. The database engine shall permit the direct configuration and management of up to 500,000 active grid assets—including transmission towers, distribution poles, power transformers, and substation components—within a single enterprise tenant environment.

4.4.2 Concurrent User Rights and Role-Based Access Control (RBAC):

The software system shall enforce strict data governance policies using a robust, multi-seat licensing framework that shall permit up to 250 concurrent active users (including field technicians, control room operators, and data analysts) to log in simultaneously. The platform shall dynamically restrict data manipulation, data export, and system modification rights based on predefined user profiles, strictly separating view-only inspection access from advanced machine-learning model retraining configuration rights.

4.4.3 Distributed Field Installation and Device Provisioning:

The software system shall authorize active software installation and deployment rights for up to 1,000 remote field client nodes, including ruggedized field tablets, mobile applications, and vehicle-mounted processing units. The platform shall utilize secure, cryptographically signed device pairing keys to permit real-time offline data collection, encryption, and subsequent downstream synchronization back to the centralized cloud or on-premises enterprise repository.

4.5.0 Perpetual Software Licensing Framework

4.5.1 One-Time Upfront Payment:

The licensee shall pay a one-time, non-refundable licensing fee upon purchase. This initial payment permanently unlocks all modules defined in the specifications—including automated

photon counting, AI defect classification, 3D LiDAR vegetation management, and the full multi-tier asset architecture (up to 500,000 assets and 250 concurrent users).

4.5.2 Permanent Feature Autonomy:

The software platform and all integrated diagnostic analytics shall remain fully functional in perpetuity without requiring cloud-based license verification pings or periodic subscription renewals.

4.5.3 Core Update Allowances:

The one-time payment shall include lifetime access to critical security patches, firmware updates, and core operating system compatibility patches to guarantee long-term system stability.

4.5.4 Optional Annual Maintenance and Support (ALAs):

While all features remain permanently free, advanced software version upgrades (major architectural overhauls) and dedicated 24/7 technical engineering support shall be governed by an optional Annual Maintenance Agreement, entirely at KPLC's discretion.

4.6.0 Supporting Equipment

4.6.1 Application Optimization and Handheld Hardware (Mobile Phone) Specifications:

The remote field client software deployed on mobile phones shall be optimized for flagship ruggedized field devices. The mobile hardware shall feature a minimum of 16 GB RAM, a high-performance octa-core processor (such as the Snapdragon 8 Gen series or Apple A-series Pro), and a minimum of 512 GB of ultra-fast UFS 4.0 internal storage to accommodate heavy offline cryptographic data caching. The device shall integrate a multi-band, high-precision GNSS receiver achieving sub-meter GPS accuracy for fault georeferencing. For physical durability in active grid zones, the phone shall feature MIL-STD-810H military-grade drop protection, an IP69K ingress rating against high-pressure water jets and dust, and a high-brightness display (minimum 2,000 nits peak brightness) to ensure full screen legibility under direct Kenyan sunlight. The supplier shall give at least three (3) mobiles phones for the software.

4.6.2 Engineering Laptop and Workstation Specifications:

The primary field diagnostic, simulation, and analysis application deployed on laptops shall utilize advanced workstation-class hardware configurations. The engineering laptop shall feature a minimum of an Intel Core i9 or AMD Ryzen 9 processor (minimum 14 cores), 64 GB of dual-channel DDR5 RAM, and a dedicated professional workstation graphics card, specifically an NVIDIA RTX 4080 / Ada Generation GPU or higher with a minimum of 12 GB VRAM. The storage architecture shall consist of a minimum 2 TB PCIe Gen 4 NVMe Solid State Drive (SSD) featuring read speeds of up to 7,000 MB/s to ensure instantaneous rendering of massive 3D LiDAR point clouds, orthomosaic RGB maps, and real-time Fast Fourier Transforms (FFT). The device shall incorporate a vapor-chamber thermal cooling system to maintain peak processing frequencies during extended field diagnostic operations without thermal throttling. The supplier shall give at least three (3) laptops for the software.

4.7.0 TRAINING

4.7.1 Training at the manufacturer's premises

- The successful bidder/manufacturer shall arrange to conduct a Factory Acceptance Test for the software. The Factory Acceptance Test shall include training on the four (4) KPLC engineers/technicians. At least two (2) of the engineers/technicians shall be sub-transmission users.
- The manufacturer shall plan adequate time for the training, which shall be conducted by the manufacturer's expert.
- The supplier shall meet all the costs of the factory training.

4.7.2 Local Training

- Following delivery of the software, the manufacturer shall conduct training in Nairobi, Kenya. The training shall be conducted in one session of 20 KPLC engineers/technicians and shall last at least three (3) days including field demonstrations.
- The supplier shall meet all the costs for conducting the local training, including local accommodation and transport for their training staff. The supplier shall provide all the training materials including notes.

APPENDICIES

A: TESTS AND INSPECTION (Normative)

A.1 It shall be the responsibility of the supplier/manufacturer to test or to have all the relevant tests performed.

Overview of Test Procedures

1. Data Integrity & Sensor Fusion (Wavelength & Acoustic Validation)

- **UV and RGB Stream Alignment Test:** Technicians shall utilize calibrated signal generator inputs to feed simultaneous RGB video and Solar-blind UVC (240–280 nm) streams into the ingestion pipeline [gnss.ae]. The software shall achieve frame-synchronized pixel mapping with an error margin not exceeding ±1 pixel.

- **Acoustic Overlay Test:** Simulated ultrasonic array signals shall be overlaid onto the composite stream. The system shall calculate and display the sound pressure level dynamically while keeping point-source localization aligned with the visual target.

- **Photon Counting Forensic Test:** Raw variable UVC photon frequencies shall be injected. The analytics module shall convert the incoming signal into numerical values measured in picoCoulombs (pC) or photon counts per minute, verifying accuracy against reference instruments within a ±2% tolerance window.

2. Defect Analytics & Machine-Learning Logic

- **Fault Classification Integrity:** A standardized verification dataset containing pre-recorded corona discharges, thermal hot spots (ΔT deviations), and acoustic signatures shall be passed through the automated defect engine. The software shall correctly tag and sort structural anomalies into *Low, Medium, or Critical* alert categories with a minimum model inference precision rate of **95%**.

- **LiDAR and Vegetation Simulation Test:** Test engineers shall ingest standard 3D point cloud LiDAR datasets and high-resolution RGB orthomosaics containing known clearance interferences. The algorithmic processing engine shall calculate volumetric clearances and generate automated risk-prioritized canopy trimming maps within 180 seconds of data ingestion.

3. Load, Stress, and System Governance FAT (Scale Limits)

- **Asset Capacity Threshold Test:** The test database shall be synthetically populated with 100,000 active grid assets (substations, towers, poles, and transformers). The platform shall maintain database search queries, real-time map panning, and relational property updates underneath a maximum latency response threshold of 1.5 seconds.

- **Concurrency Stress Test:** Automated scripts shall simulate 150 concurrent active users logging into the system to perform simultaneous data reads and map-layer updates. The security gate shall enforce standard Role-Based Access Controls (RBAC), verifying that view-only profiles cannot alter underlying algorithmic parameters.

- **Distributed Installation Provisioning Test:** The environment shall initiate connection handling for 1,000 remote field client connections. Engineers shall trigger simulated network drops; the offline database architecture shall accurately cache field inspection uploads locally and execute downstream delta-synchronizations to the main database immediately upon network re-establishment without data loss.

4. Grid Protocols & Export Interoperability FAT

- **Telemetry Telecontrol Validation:** The software shall establish active communication lines using native DNP3, IEC 60870-5-104, and Modbus TCP/IP drivers connected to a sub-station SCADA simulator [industrialmonitordirect.com]. The system shall process incoming trip

signals and distribute priority alarm logs to the visualization panel within 200 milliseconds of transmission.

- **Forensic File Compliance:** Sample electrical grid disturbance recordings shall be output from the system. The files shall be verified as fully compliant with open-source **COMTRADE** and **PQDIF** formats through successful structural parsing in external validation utilities.

A.2 On receipt of the Electric Power Grid Diagnostic Software, Kenya Power will inspect it and may perform or have performed any of the relevant tests to verify compliance with the specification. The supplier shall replace without charge to Kenya Power, any part on the software which upon examination, test or use fail to meet any or all the requirements in the specification.

B: QUALITY MANAGEMENT SYSTEM (Normative)

B.1 The bidder shall indicate the delivery time of the software.

C: DOCUMENTATION AND DEMONSTRATION (Normative)

C.1 The bidder shall submit its tender complete with technical documents for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Fully filled clause by clause guaranteed technical particulars (GTP) signed by the manufacturer.
b) Copies of the Manufacturer's catalogues, brochures, drawings giving all relevant dimensions, and technical data;
c) Bidder's warranty and guarantee; subject to 12 months from date of delivery to KPLC stores
d) User manual.

C.2 The bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

a) Fully filled clause by clause guaranteed technical particulars (GTP) stamped and signed by the manufacturer, agent or dealer.

b) Product manuals, operation manuals and brochures,

c) All documentation necessary for safety of the product.

d) Packaging details (including packaging materials).

C.3. The supplier shall submit recommendations for use, care, installation and routine inspection/testing procedures, all in the English Language, during delivery of the Electric Power Grid Diagnostic Software to KPLC stores.

D: GUARANTEED TECHNICAL PARTICULARS (Normative)

To be filled and signed by the Bidder and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, for tender evaluation, all in English Language)

Tender No. .....

Bidder's name and Address.....

Clause number	KPLC Requirement	Bidder's offer	Comments
Manufacturer's Name			
Country of Manufacture			
Name and model Number			
4.1.1	**Image Registration and Overlay Precision**: It shall fuse dual-channel inputs (Solar-blind UVC at **240–280 nm** + Visible RGB at 1080p/720p) with pixel-to-pixel spatial alignment [gnss.ae]. When an **ACOUSTIC /IR IMAGING CAMERA** is integrated, it maps localized ultrasonic sound arrays simultaneously over the visual feed.		
4.1.2	**Photon Counting and Analytics**: Region-of-Interest (ROI) segmentation shall be capable of quantifying discharge activity. Wavelength data is converted into a numerical value measured in picoCoulombs (pC) or photon counts per minute.		

Clause number	KPLC Requirement	Bidder's offer	Comments
4.1.3	**Defect Classification Engine**: Shall use rule-based thresholds and AI machine-learning algorithms that automatically classify corona or thermal anomalies into distinct severity alerts (*Low, Medium, Critical*). For acoustic profiles, it shall incorporate automated electrical fault classification for partial discharge issues, including surface, floating, and airborne discharges.		
4.1.4	**Georeferencing and Data Tagging**: It shall intercept hardware metadata to embed exact GPS coordinates, local humidity, ambient temperature, and distance-to-target calculations onto raw radiometric imagery.		
4.1.5	**Compliance Frameworks**: It shall have automated test guidance and report building mapped exactly to international testing protocols, including **IEEE 1159, IEC 61000-4-30**, and **EN50160** standards.		
4.1.6	**High-Resolution RGB Imagery Analytics**: It shall process stand-alone or orthomosaic visual images		

Clause number	KPLC Requirement	Bidder's offer	Comments
	to detect structural anomalies, physical component damage (such as cracked insulators, rusted towers, or frayed lines), and missing hardware that cannot be identified via thermal or UV sensors alone.		
4.1.7	**Vegetation Management Analytics**: It shall utilize 3D point cloud data, LiDAR datasets, and high-resolution RGB imagery to run volumetric growth simulations. It shall calculate precise encroachment clearances between tree canopies and conductors, automatically generating risk-prioritized tree trimming maps to prevent vegetation-induced outages and wildfires.		
4.1.8	**Thermal Infrared Processing**: Processes radiometric thermal data to automatically compute temperature differentials (ΔT) across grid assets. It applies emissivity, ambient temperature, and wind speed corrections to identify hot spots, overloaded components, and high-resistance joints.		
4.1.9	**UAV Flight Path Automation**: Shall integrate with drone hardware		

Clause number	KPLC Requirement	Bidder's offer	Comments
	to calculate optimal, collision-free autonomous inspection trajectories. The software leverages terrain maps and coordinate inputs to position sensors at the exact angles needed to capture crisp RGB, UV, acoustic, and thermal data.		
4.1.10	**Predictive Asset Lifetime Analytics**: Shall correlate historical inspection data with environmental metrics, load history, and current sensor telemetry to run degradation curve models. It estimates the remaining useful life (RUL) of transformers, conductors, and substation components to optimize capital expenditure schedules.		
4.1.11	**Automated Inspection Workflow and Dispatch**: Shall connect diagnostic anomaly alerts directly to computerized maintenance management systems (CMMS). It builds complete work orders containing localized damage images, parts lists, and GPS routing info to fast-track field repair dispatches.		
4.1.12	**Sensor Fusion Dashboard**: Shall		

Clause number	KPLC Requirement	Bidder's offer	Comments
	combine simultaneous data feeds from UV, thermal, RGB, LiDAR, and acoustic inspections into a unified, interactive geographic information system (GIS) mapping layer for grid-wide health visualization.		
4.2.1	This software shall focus on high-speed data acquisition, electrical waveform analysis, and broad grid forecasting as shown in table 1.		
4.3.1	**SCADA Protocols**: Shall have native driver integration communicating via DNP3, IEC 60870-5-104, Modbus TCP/IP, or OPC UA directly to sub-station control interfaces.		
4.3.2	**Enterprise Asset Management (EAM):** Shall have bi-directional API pipelines linking data to standard industrial hubs like SAP, Oracle Utilities, Maximo, or PI System.		
4.3.3	**Cybersecurity Compliance:** Shall have end-to-end data encryption leveraging TLS 1.3 protocol		

Clause number	KPLC Requirement	Bidder's offer	Comments
	architectures for sensor-to-cloud streams, aligned with NERC CIP guidelines.		
4.4.1	**Multi-Tier Asset Licensing Model:** The software system shall feature a scalable grid monitoring architecture designed to support localized utility networks up to nationwide transmission infrastructure. The database engine shall permit the direct configuration and management of up to 500,000 active grid assets—including transmission towers, distribution poles, power transformers, and substation components—within a single enterprise tenant environment.		
4.4.2	**Concurrent User Rights and Role-Based Access Control (RBAC):** The software system shall enforce strict data governance policies using a robust, multi-seat licensing framework that shall permit up to 250 concurrent active users (including field technicians, control room operators, and data analysts) to log in simultaneously. The platform shall dynamically restrict data manipulation, data export, and system modification rights based on predefined user profiles, strictly		

Clause number	KPLC Requirement	Bidder's offer	Comments
	separating view-only inspection access from advanced machine-learning model retraining configuration rights.		
4.4.3	**Distributed Field Installation and Device Provisioning:** The software system shall authorize active software installation and deployment rights for up to 1,000 remote field client nodes, including ruggedized field tablets, mobile applications, and vehicle-mounted processing units. The platform shall utilize secure, cryptographically signed device pairing keys to permit real-time offline data collection, encryption, and subsequent downstream synchronization back to the centralized cloud or on-premises enterprise repository.		
4.5.1	**One-Time Upfront Payment:** The licensee shall pay a one-time, non-refundable licensing fee upon purchase. This initial payment permanently unlocks all modules defined in the specifications—including automated photon counting, AI defect classification, 3D LiDAR vegetation management, and the full multi-tier asset architecture (up to 500,000 assets and 250 concurrent users).		
4.5.2	**Permanent Feature Autonomy:** The software platform and all integrated diagnostic analytics shall		

Clause number	KPLC Requirement	Bidder's offer	Comments
	remain fully functional in perpetuity without requiring cloud-based license verification pings or periodic subscription renewals.		
4.5.3	**Core Update Allowances:** The one-time payment shall include lifetime access to critical security patches, firmware updates, and core operating system compatibility patches to guarantee long-term system stability.		
4.5.4	**Optional Annual Maintenance and Support (ALAs):** While all features remain permanently free, advanced software version upgrades (major architectural overhauls) and dedicated 24/7 technical engineering support shall be governed by an optional Annual Maintenance Agreement, entirely at KPLC's discretion.		
4.6.1	**Mobile Application Optimization and Handheld Hardware Specifications**: The remote field client software deployed on mobile phones shall be optimized for flagship ruggedized field devices. The mobile hardware shall feature a minimum of 16 GB RAM, a high-		

Clause number	KPLC Requirement	Bidder's offer	Comments
	performance octa-core processor (such as the Snapdragon 8 Gen series or Apple A-series Pro), and a minimum of 512 GB of ultra-fast UFS 4.0 internal storage to accommodate heavy offline cryptographic data caching. The device shall integrate a multi-band, high-precision GNSS receiver achieving sub-meter GPS accuracy for fault georeferencing. For physical durability in active grid zones, the phone shall feature MIL-STD-810H military-grade drop protection, an IP69K ingress rating against high-pressure water jets and dust, and a high-brightness display (minimum 2,000 nits peak brightness) to ensure full screen legibility under direct Kenyan sunlight. The supplier shall give at least three (3) mobiles phones for the software.		
4.6.2	**Engineering Laptop and Workstation Specifications:** The primary field diagnostic, simulation, and analysis application deployed on laptops shall utilize advanced workstation-class hardware configurations. The engineering laptop shall feature a minimum of an Intel Core i9 or		

Clause number	KPLC Requirement	Bidder's offer	Comments
	AMD Ryzen 9 processor (minimum 14 cores), 64 GB of dual-channel DDR5 RAM, and a dedicated professional workstation graphics card, specifically an NVIDIA RTX 4080 / Ada Generation GPU or higher with a minimum of 12 GB VRAM. The storage architecture shall consist of a minimum 2 TB PCIe Gen 4 NVMe Solid State Drive (SSD) featuring read speeds of up to 7,000 MB/s to ensure instantaneous rendering of massive 3D LiDAR point clouds, orthomosaic RGB maps, and real-time Fast Fourier Transforms (FFT). The device shall incorporate a vapor-chamber thermal cooling system to maintain peak processing frequencies during extended field diagnostic operations without thermal throttling. The supplier shall give at least three (3) laptops for the software.		
4.7.1	**Training at the manufacturer's premises** • The successful bidder/manufacturer shall arrange to conduct a Factory Acceptance Test for the software. The Factory Acceptance Test shall		

Clause number	KPLC Requirement	Bidder's offer	Comments
	include training on the four (4) KPLC engineers/technicians. At least two (2) of the engineers/technicians shall be sub-transmission users. • The manufacturer shall plan adequate time for the training, which shall be conducted by the manufacturer's expert. • The supplier shall meet all the costs of the factory training.		
4.7.2	**Local Training** • Following delivery of the software, the manufacturer shall conduct training in Nairobi, Kenya. The training shall be conducted in one session of 20 KPLC engineers/technicians and shall last at least three (3) days including field demonstrations. • The supplier shall meet all the costs for conducting the local training, including local accommodation and transport for their training staff. The supplier shall provide all the training materials including notes.		

.....

Bidder's Name, Signature, Stamp and Date

Head of Section: Sub-transmission, Central Office	Head of Department: Transmission, Central Office
Signed:	Signed:
Date: 2026-10-19	Date: 2026-10-19