DOCUMENT NO.: KP1/13D/1/TSP/09/030 - 2

Kenya Power

CABLE FAULT LOCATING EQUIPMENT SPECIFICATION

A Document of the Kenya Power & Lighting Co. Plc

September 2024

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0.1 CIRCULATION LIST

COPY NO.	COPY HOLDER
1	Manager, Standards
2	Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)

REVISION OF KPLC STANDARDS

To keep abreast of progress in the industry, KPLC Standards shall be regularly reviewed. Suggestions for improvements to approved Standards, addressed to the Manager, Standards department, are welcome.

0.2 AMENDMENT RECORD

Rev No.	Date	Description of Change	Prepared by	Approved by
Issue 1 Rev 2	2023-11-19	Replaces all previous versions of KP1-6C.1-TSP-09-030-2	Eng. F. Gicugu	Dr. Eng. P. Kimemia
Issue 1 Rev 3	2024-07-31	Realigned the clauses and sub-clauses numbering for clause 4.0 & 5.0	Eng. B. Dianga	Dr. Eng. P. Kimemia
		Amended clause 1.2 (vii),(viii) & (ix) to designate the VLF equipment rating voltages to root mean square(rms) rather than to peak values		
		Amended clause 4.2.1.3(ix) for manual deactivation provisions.		
		Amended clause 4.2.1.4: to remove functional repetitions and to clarify pre-location functions		
		Amended clause 4.2.1.5 to define the rated voltage as 230VAC, in line with Kenya National Distribution Grid Code, 2017 Section 5.2.2&5.2.4		
		Amended clause 4.2.8 to integrate Partial Discharge (PD) as a VLF test resource, not as an isolated detachable unit. Modified the measuring range of the VLF option to 33kVrms-44kVrms in compliance with IEEE 400.2 specification		
		Amended Table 1&2 for the mean value of dissipation factor of Tan Delta measurements to $1x10^{-6}$		
		Modified clause 4.2.10.2 for Pulse Reflection Test system provisions for display screen size, input signal gain range and power supply applications		

FOREWORD

This Specification has been prepared by the Standards Department in collaboration with the Network Distribution, both of The Kenya Power and Lighting Company Plc. It lays down requirements for specification for Cable Fault Locating Equipment. It is intended for use in purchasing the Cable Fault Location Equipment.

The specification stipulates the minimum requirements for the cable fault Locating Equipment that is acceptable for use in the company. It shall be the responsibility of the supplier and manufacturer to ensure the adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations, and that the offered design is of the highest quality and guarantees excellent service to Kenya Power.

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

Name	Division
Ephantus Mwara	Network Management
Lydia Mugure	Network Management
Eng. Benson Dianga	Standards

1.0 SCOPE

1.1. This Specification covers the design, manufacture, assembly, testing at the manufacturer's works, supply, delivery, installation & commissioning of Cable Fault Locating equipment for low, medium and high voltage power cables up to 220 kV, complete with all accessories for efficient and trouble-free cable fault location operation.

1.2. The Cable Fault Locating Equipment for use on power lines operating at voltages of up to 220 kV (245 kV) 50Hz and Diagnostic procedures covered by this specification are:

(i) Portable Cable Fault Location equipment with pre-location and DC pressure test 32kV
(ii) Cable Identifying Sets & Route Locator
(iii) Cable Sheath Testing Equipment
(iv) Cable sheath Fault receiver
(v) Low Voltage Fault Location Sets
(vi) Portable DC Pressure Test Sets
(vii) VLF pressure testing of at least 24 kVrms but not exceeding 28 kVrms
(viii) VLF pressure testing of at least 33 kVrms but not exceeding 44 kVrms
(ix) VLF High Voltage Generator 57Vrms
(x) Full Monitor Withstand Test

1.3. The equipment shall be suitable for the two ranges of cable types below and their accessories in all voltage ranges from 420V to 36 kV and from 66 kV to 132 kV.

1.4. For commissioning tests on 12kV, 36kV, 66kV ,132kV and 220kVcables. Provision shall be given to perform VLF test up to $3U_0$ with parallel PD measurement.

1.5. For maintenance test on 12kV, 36kV, 66kV,132kV and 220kV cables. Provision shall be given to perform cable diagnostic up to $1.5U_0$ with Tan Delta and Partial Discharge measurement.

1.6. The specification does not purport to include all the necessary provisions of a contract.

2.0 NORMATIVE REFERENCES

IEC 60502-2018: Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1.2kV) up to 30kV (Um = 36kV) - all parts

IEC 62067: Power cables with extruded insulation and their accessories for rated voltages above 150 kV (Um = 170kV) up to 500kV (Um = 550kV) - all parts

IEC 60840: Power cables with extruded insulation and their accessories for rated voltages above 30kV (Um = 36kV) up to 150kV (Um = 170kV) - all parts

IEEE 400.2-2013: IEEE Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF) (Less than 1 HZ)

IEC 60060-3: High-voltage test techniques – Part 3: Definitions and requirements for on-site testing

IEC 60520: Degrees of Protection (IP-Code System)

2006/95/EC: CE-compliant in accordance with Low Voltage Directive

IEC 60229: Tests on Extruded Oversheaths with a Special Protective Function

3.0 TERMS AND DEFINITIONS

The terms and definitions shall be as per reference standards

4.0 REQUIREMENTS

4.1 Service Conditions

4.1.1 The cable fault locating equipment shall be suitable for continuous use outdoors in the following tropical operating conditions: -

a) Altitude: up to 2,200m above sea level;

b) Temperature: average of +30°C with a minimum of -1°C and max +40 °C;

c) Humidity: up to 95%;

d) Pollution: Design pollution level to be taken as "*Very Heavy*" (Pollution level IV) for all areas of applications in accordance with IEC 60815.

4.2 Specific Requirements

4.2.1 Portable Cable Fault Location equipment with pre-location and DC pressure test 32kV

4.2.1.1 The equipment shall be portable and capable of locating all types of cable faults including open circuits, high resistance, low resistance, intermittent faults in XLPE and Paper insulated cables and testing of surge arrestors.

4.2.1.2 The complete set functionality shall comprise testing, converting faults, pre-location and pinpointing cable faults in low and medium-voltage networks. The highest degree of safety to users shall be guaranteed. It shall be suitable for outdoor use.

4.2.1.3 The equipment shall have the following features:

(i) Easily transportable in a van and the net weight of the complete equipment set should not exceed 500kg.
(ii) Test range of at least 20km
(iii) Menu-driven large screen colour TDR (Time Domain Reflectometer)
(iv) User-friendly system software for simple, intuitive and safe operation
(v) High surge energy of at least 2,000 J in every range for acoustic pinpointing
(vi) Impulse voltage levels for medium-voltage cable of at least 0 ……32 kV in ranges
(vii) Impulse voltage levels for lower voltages 0 ... 4kV or 0 ... 8kV
(viii) Cable Sheath Fault Testing
(ix) Modes of operation:

a) Insulation proof testing
b) Lowest test voltage of 20kV with measurement of leakage current. The deactivation methodology in case of a breakdown shall be explicitly explained in the equipment safety and operating manuals.
c) Breakdown detection with ramp function, a switch-off and a discharging provision in case of breakdown. The equipment shall display the breakdown voltage.
d) Acoustic pinpointing

4.2.1.4 Pre-location procedure shall include all system components offering the pre-location functions to be integrated into one package with one control panel with a display for controlling the system with single button operation. TDR shall be separate and removable from the main unit to enable use independently OR with the integrated cable fault locating system. The pre-location functions shall include:

(i) Arc Reflection Method or Secondary Impulse Method (SIM)
(ii) Impulse current coupling or Impulse Current Method
(iii) Pulse reflection method

4.2.1.5 The equipment shall operate from 230V, 50Hz AC supply and shall be supplied with a backup power generator of the lowest rating at 5kVA. The generator shall have an AVR function with 230V and 420V AC terminal outlets and shall be supplied with a suitably rated insulating transformer.

4.2.1.6 The equipment shall be complete with the following Accessories:

(i) Surge Generator
(ii) TDR screen and 15m copper connecting leads to the cable under test
(iii) Pinpointing Receiver complete with ground microphone, earphones and cables.
(iv) Mounting frame on wheels for ease of moving of the equipment
(v) Operating manual
(vi) Set of connecting cables
(vii) Earth Spike

4.2.1.7 The equipment shall be complete with the following Connecting Cables (detachable):
(i) High Voltage flexible with connection clamps and strain relief coaxial test cable: minimum 50 m of 72kV, single phase
(ii) Input power Supply: minimum of 50 m, 2.5 mm^2 single phase supply
(iii) Earthing: minimum 50 m, 10 mm^2 complete with clamps
(iv) High Voltage flexible coaxial test cable should be tight at the point of plug-in and clamping to prevent arcing during operation

4.2.1.8 The equipment shall be supplied as a complete stand-alone ready-to-use unit with all its accessories and Operating manual in the English language.

4.2.2 Cable Identifying Sets & Route Locator

4.2.2.1 Cable Identifying Set

4.2.2.1.1 The cable identifying set shall be capable of clearly carrying out the identification of a cable before it is cut as an important safety measure. It shall incorporate a mains supply unit and an inbuilt battery with a charging unit at 230V,50Hz.The battery voltage shall be 12V rechargeable with an operating time of at least 2.5 hours

4.2.2.1.2 The equipment shall be complete with the following Features:
(i) A current pulse generator/transmitter and receiver and a signal clamp to enable identification of both dead and live cables of 120mm minimum diameter.
(ii) Adjustable signal strength of deflection in the display.
(iii) Necessary connection cables for signal coupling, mains lead and clamps.
(iv) Precise cable identification even when many cables are buried together.
(v) Carrying cases for both transmitter and receiver.

4.2.2.1.3 Technical Parameters
(i) Pulse current of up to 180A
(ii) Pulse voltage up to 300V
(iii) 15 Impulses/min
(iv) Fully automatic calibration of receiver

(v) Digital display with clear indication of signal strength / current value/direction and depth of cable

(vi) Signal verification with Amplitude / Time / Phase identification

4.2.2.2 Cable Route Locators

4.2.2.2.1 The cable route locator comprising of a transmitter and receiver shall be suitable for use in quickly locating routes of cables, measuring how deep they are and finding cable faults.

4.2.2.2.2 The transmitter shall be inductively and directly coupled.

4.2.2.2.3 The equipment shall have the following Features:

(i) Precise direction guidance with right/left arrows to keep it directly above the line.
(ii) Route sensor weighing less than 2 kg for ease of carrying.
(iii) Multi-frequency operation- transmits at least two frequencies simultaneously.
(iv) Combines the conventional Maximum and Minimum methods.
(v) Detection of ground leakage fault
(vi) Power Supply for transmitter: Mains 230V. 50 Hz and battery operated.
(vii) Output power of minimum 5W
(viii) Output frequencies of 815Hz, 8 kHz, 33 kHz, 82 kHz
(ix) Integrated frame antenna
(x) Inductive signal coupling coil, 82 kHz, 100 mm D
(xi) Transmitter weight: maximum 5kg
(xii) Power Supply for receiver: To use rechargeable batteries or alkaline batteries.
(xiii) Operating time for batteries shall not be less than 6 hours.
(xiv) Digital display of cable depth and detect cable depth of at least 5 m.
(xv) Current measurement for identification of target cable.
(xvi) Automatic gain control by pushing a button.
(xvii) Carrying case or soft protection bag

4.2.2.3 The equipment shall be supplied as a complete stand-alone ready-to-use unit with all its accessories and Operating manual in the English language.

4.2.3 Cable Sheath Testing Equipment

4.2.3.1 The standalone equipment shall be used for cable and cable sheath fault pre-location as well as for pinpointing, cable testing of low voltage cables as well as cable sheath testing in power cables up to 10 kV DC combined with the accurate pre-location of faults and pinpointing over the full.

4.2.3.2 Integrated high-precision measuring bridge allows pre-location of cable faults and cable sheath faults at power cables according to Murray and Glaser. The measuring principle further enables fault pre-location at the control and lighting cables. For the highest accuracy, also different cable

sections with different conductor materials and diameters can be defined and considered in the result.

4.2.3.3 The full analysis shall be done automatically and results in digitally displayed distance to the fault. At the pinpointing mode, a DC pulse pattern with a voltage up to 10 kV is released for cable and cable sheath fault pinpointing based on the step voltage measurement, with the pickup device in combination with two earth probes.

4.2.3.4 The Equipment shall have the following main features:

(i) Cable - and Cable Sheath Testing up to 10kV
(ii) Resistance measurement
(iii) Cable - and cable sheath fault pre-location with high precession measuring bridge according to Murray and Glaser up to 10kV, current limitation
(iv) Cable Sheath Fault Pinpointing
(v) Built-in discharge unit
(vi) Step less voltage adjustment 0 - 10 kV, 10mA
(vii) Max. Output Current for sheath fault pinpointing 700mA
(viii) Battery operation and mains operation
(ix) Battery operation time of more than 1.5 hours
(x) Fully menu-guided and easy to use
(xi) Definable cable sections
(xii) Portable standalone unit
(xiii) Weight of less than 20kg

4.2.4 Cable Sheath Fault Receiver

4.2.4.1 The cable sheath fault receiver shall be applied according to the step voltage method.

4.2.4.2 With two earth probes (dismountable for transportation), the cable route shall be followed.

4.2.4.3 Additionally, the battery-powered instrument shall be suitable for the location of several successive sheath faults.

4.2.4.4 Equipped with an adjustable carrying strap, the sturdy instrument shall fulfil all requirements for a successful application in the field.

4.2.4.5 Accessories set for Sheath fault location:

(i) Earth probe red
(ii) Earth probe blue or black
(iii) Measuring line 2m, blue or black
(iv) Measuring line 2m, red
(v) Auxiliary line 25 m on hand reel

4.2.5 Low Voltage Fault Location Sets

4.2.5.1 The equipment shall be suitable for the location of low-resistance faults and interruptions in low and medium-voltage cables.

4.2.5.2 The equipment shall be complete with an integrated battery power supply ideally suited for field use.

4.2.5.3 It should be conveniently button-operated and automatically show the far end of the cable and fault distance. Even inexperienced users should easily be able to locate faults.

4.2.5.4 The equipment shall have the following features: -

(i) Display color Screen.
(ii) Systematic interactive menu guided control.
(iii) Automatic far-end indication and fault recognition with distance indication.
(iv) To employ Impulse current and voltage decay mode, Arc Reflection, Time Domain Reflection (TDR) etc.
(v) To have Direct L1, Direct L2, and comparison mode L1 / L2, waveforms this can be displayed at the same time.
(vi) High resolution in the short range with great accuracy using special pulse forms
(vii) Minimum measuring range of 10 km.
(viii) Zooming facility.
(ix) Memory locations of at least 10 traces.
(x) Power Supply: Mains 230 V, 50 Hz and battery operated.
(xi) Rechargeable batteries with operation time of not less than 8 hours
(xii) Lightweight.
(xiii) Carrying case.

4.2.5.5 The equipment shall be supplied as a complete stand-alone ready-to-use unit with all its accessories and Operating manual in the English language.

4.2.6 Portable DC Pressure Test Sets

4.2.6.1 The equipment shall be a portable DC Voltage testing set suitable for testing newly installed cables and splices and electrical installations before connecting to an energized system.

4.2.6.2 The equipment shall have the following features:

(i) The Test System capable of producing 0-25kV DC test voltage.
(ii) With Control and power modules.
(iii) With breakdown recognition and shutdown capability.
(iv) With two(2) voltage ranges, 0-5kV, 0-25kV
(v) Capable of DC leakage current measurement.
(vi) Current measuring ranges: 50 nA to 1µA / 10µA / 100µA / 1 mA / 10 mA
(vii) With integrated discharge facilities for the safety of users.

(viii) High voltage and ground connecting cables not less than 2,5 m long
(ix) Mains power supply at 240V, 50Hz and built-in rechargeable battery making the test set independent of an external power supply.
(x) Minimum rechargeable battery operating time of 30min - 2 hours
(xi) Maximum weight: 17kg

4.2.6.3 The equipment shall be supplied as a complete stand-alone ready-to-use unit with all its accessories and Operating manual in the English language.

4.2.7 VLF pressure testing with tan delta of at least 24 kVrms but not exceeding 28 kVrms

4.2.7.1 The equipment shall be portable not exceeding 30 kgs in weight, Very Low-Frequency Voltage (VLF) testing set suitable for testing XLPE cables with test voltage between (34kV to 40V) peak, sinusoidal waveform.

4.2.7.2 The mobile testing and diagnostic device shall be used for testing medium voltage cables and electrical equipment, for cable sheath testing and cable diagnostics including:
(i) Fully integrated tan delta (TD) measurement.
(ii) Partial discharge (PD) measurement
(iii) Pre-set program for testing and evaluation according to IEEE400.2-2013
(iv) Monitored withstand Test (MWT) as per IEEE400.2 with integrated TD functions
(v) Pre-set program according to IEEE400.2-2013
(vi) Simultaneously TD and PD measurements for diagnostic test

4.2.7.3 The equipment shall have the following Features:
(i) Cable sheath testing according to IEC 60502/IEC 60229
(ii) Insulation tests on electrical equipment according to IEEE 433
(iii) Tan delta diagnostics for electrical equipment and medium voltage cables up to 24kV
(iv) Precise tan delta measurement with accuracy not less than 1×10^{-4} and resolution not less than 1×10^{-6}.
(v) Fully automated and individually programmable diagnostic sequences including evaluation
(vi) No additional external hardware is required for tan delta measurements, function integrated into the VLF generator
(vii) Integrated measurement data storage
(viii) Data export via USB interface
(ix) Measurement data shall be viewed on a computer with Microsoft Excel, no additional software is required.
(x) Automatic discharging device
(xi) Integrated cable compartment with HV connection cable

4.2.7.4 Technical Data shall be as per **table 1**

Table 1: Technical Data for VLF Testing Set

s/n	Parameter description	Units	Value
	General		
1	Frequency range	Hz	0.01-0.1
2	Input voltage	V/Hz	100-260, 50/60 Hz
3	Max. power consumption	VA	300
4	Data interface	USB	2.0
5	Protection class	IP	54
6	EMC compatibility	compliance with EN 61010-1, EN 50191) and EMC guideline (EN 55011, EN61000-4)	
B	**Output voltage**		
1	VLF true sine Wave	kV rms	1...24.0(34.0 kVpeak)
2	VLF rectangular wave voltage	kV	34
3	DC voltage	kV	±0..34
4	Resolution	kV	0.1
5	Accuracy	%	1
6	Load range	nF	1nF…8µF
C	**Output current**		
	Max. load	uF at Hz, kVrms	0.5 µF at 0.1 Hz, 24 kVrms 8 µF at 0.01 Hz, 18 kVrms
D	**Tan delta measurement**		
1	VLF true Sine Wave	kV rms	1 ... 24
2	Load range	nF- µF	10nF ... 8µF
3	Accuracy		Not less than $1x10^{-3}$
4	Resolution		Not less than $1x10^{-6}$
5	Measurement range		$1x10^{-4}$ … $21{,}000x10^{-3}$
6	TD measurement frequency	Hz	0.1
7	Leakage current		Leakage current compensation of HV test lead

4.2.7.5 The VLF Testing and Diagnostic System shall also have ;

(i) Tan Delta (TD) measurement device integrated in VLF source. No external TD measurement device

(ii) The Tan Delta(TD) and Partial Discharge(PD) shall be software operated. The software shall be windows based, installed in a laptop for each equipment. The laptop shall be of basic specifications that can handle all the tasks or better as per **Table 2**

(iii) Leakage current compensation of connection leads by integrated TD measurement device.

(iv) Automatic testing programs integrated in VLF generator menu.

(v) TD Raw data files to be imported and exported to different computers.

(vi) TD Raw data files to be opened, viewed and edited with Microsoft Excel, no additional software required.

(vii) TD Reports to be automatically generated in different formats such as PDF and Microsoft Excel. No additional software shall be required.

(viii) Pre-programmed test sequences according to the international standards CENELEC HD 620, IEC 60502 / IEC 60229, IEEE 400.2, VDE 0276-620, VDE 0276-621

(ix) Tan Delta and NWT measurements with tables and diagrams during test and after the test.

4.2.8 VLF pressure testing with Tan delta of at least 33 kVrms but not exceeding 44 kVrms

4.2.8.1 The equipment shall be a portable Very Low-Frequency Voltage (VLF) testing set suitable for testing XLPE cables with test voltage between (46 kV and 85 kV) peak.

4.2.8.2 The mobile testing and diagnostic device shall be used for testing medium voltage cables and electrical equipment, for cable sheath testing and cable diagnostics including:

(i) Fully integrated tan delta (TD) measurement.

(ii) Pre-set program for testing and evaluation according to IEEE400.2-2013

(iii) Monitored withstand Test (MWT) as per IEEE400.2 with integrated TD functions

(iv) Pre-set program according to IEEE400.2

(v) Partial discharge (PD) measurement

(vi) Simultaneously TD and PD measurements for diagnostic test

4.2.8.3 The equipment shall have the following Features:

(i) Cable sheath testing according to IEC 60502/IEC 60229

(ii) Insulation tests on electrical equipment according to IEEE 433

(iii) Tan delta diagnostics for electrical equipment and medium voltage cables up to 66 kV

(iv) Precise tan delta measurement with accuracy and resolution of 1x10-4 and 1x10-6 respectively

(v) Fully automated and individually programmable diagnostic sequences including evaluation

(vi) No additional external hardware is required for tan delta measurements, a function integrated into the VLF generator

(vii) Integrated measurement data storage

(viii) Data export via USB interface

(ix) Measurement data shall be viewed on a computer with Microsoft Excel, no additional software is required.

(x) Automatic discharging device

(xi) The equipment shall be supplied in a mounting frame on wheels for ease of moving of the equipment

4.2.8.4 Technical Data shall be as per table 2

Table 2: Technical Data for VLF Testing Set

S/N	Parameter description	Units	Value
A	**General**		
1	Frequency range	Hz	0.01-0.1
2	Input voltage	V/Hz	100-260,50/60
3	Max. power consumption	VA	300
4	Data interface	USB	2.0
5	Protection class	IP	54
6	EMC compatibility	Standards	with EN 61010-1, EN 50191) and EMC guideline (EN 55011, EN61000-4)
B	**Output voltage**		
1	VLF true sine Wave	kV rms	0...44(62 kVpeak)
2	VLF rectangular wave voltage	kV	62
3	DC voltage	kV	±0..62
4	Resolution	kV	0.1
5	Accuracy	%	1
6	Load range	nF	1…10000
C	**Output current**		
1	Max. load	µF at Hz, kVrms	0.85 µF at 0.1 Hz, 44kVrms 2.7 µF at 0.03 Hz, 44kVrms 7.7 µF at 0.01 Hz, 44kVrms
D	**Tan delta measurement**		
1	VLF true Sine Wave	kV rms	1 ... 44
2	Load range	nF- µF	10 ... 10
3	Accuracy		$1x10^{-4}$
4	Resolution		$1x10^{-6}$

5	Measurement range		$1x10^{-4}$ … $21,000x10^{-3}$
6	TD measurement frequency	Hz	0.1
7	Leakage current		Leakage current compensation of HV test lead

4.2.8.5 The VLF Testing and Diagnostic System shall also have the following features;

(i) Tan Delta (TD) measurement device integrated into VLF source. No external TD measurement device is accepted.

(ii) Leakage current compensation of connection leads by integrated TD measurement device.

(iii) Automatic testing programs integrated in the VLF generator menu.

(iv) TD Raw data files to be imported and exported to different computers.

(v) TD Raw data files to be opened, viewed, and edited with Microsoft Excel, no additional software required.

(vi) TD Reports to be automatically generated in different formats such as PDF and Microsoft Excel. No additional software shall be required.

(vii) Pre-programed test sequences according to the international standards CENELEC HD 620, IEC 60502 / IEC 60229, IEEE 400.2, VDE 0276-620, VDE 0276-621

(viii) Tan Delta and NWT measurements with tables and diagrams during the test and after the test.

4.2.9 VLF High Voltage Generator 57 KVrms

4.2.9.1 The system shall support cable fault location and all types of cable testing and diagnostic for installation, commissioning and maintenance testing in accordance with the valid IEC 60060-3, IEC 60502 and IEEE 400.2-2013 standards and regulations. It should be suitable for the complete range of cable types and their accessories in all voltage ranges from 420V to 66 kV.

4.2.9.2 For commissioning test on 11 KV and 33 KV cables provision shall be given to perform VLF test up to 3 U_0 with parallel PD measurement according to IEC 60502. For maintenance tests on 11 KV, 33 KV and 66 KV cables provision shall be given to perform cable diagnostic up to 1.5 U_0 (or maximum 57kVrms) with Tan Delta and Partial Discharge measurement according to IEEE 400.2-2013

4.2.9.3 The VLF high voltage generator (HVG) shall be true sinusoidal- digital) with a power rating of 3KW adjustable output voltage. The HVG shall have manual or automatic test sequences, selectable with or without burn-down mode in case of breakdown.

4.2.9.4 The VLF diagnostic system shall allow Tan Delta and Partial Discharge Diagnostic with the same connection setup with 0.1Hz sinusoidal voltage.

4.2.9.5 The HVG shall have the following features:

(i) Programmable test voltage: sine wave, square wave, DC
(ii) Fully symmetrical output voltage
(iii)Programmable test frequency 0.01 Hz to 1 Hz

4.2.9.6 Programmable output voltage:

(i) 0 to – 80 kV DC
(ii) 0 to + 80 kV DC
(iii) 0 to 57 kVrms 0.1 Hz sine wave
(iv) 0 to 80 kV0.1 Hz square wave
(v) Max. capacitive load:1.2 µF @ 0.1 Hz, 57 kVrms
(vi) 3 µF @ 0.1 Hz, 38 kVrms
(vii) 8 µF @ 0.1 Hz, 18 kVrms
(viii) 20µF max. load @ reduced frequencies

4.2.9.7 Output currents:

(i) 1.8 mA @ 80 kV
(ii) 10 mA @ 70 kV
(iii) 60 mA @ 50 kV
(iv) 90 mA @ 20 kV
(v) Maximum current:120 mA
(vi) Accuracy:1%
(vii) Resolution:10 µA

4.2.9.8 Tan Delta (Dissipation factor measurement):

(i) Load range ≥ 10 nF
(ii) Measurement range 0.1 x 10-3 – 1,000 x 10-3
(iii) Resolution: 1 x 10-6
(iv) Display of individual Tan delta values 1 x 10-5
(v) Accuracy 1 x 10-4

4.2.9.9 The equipment shall have the following features:

(i) Guard Ring application for compensation of termination surface leakage current.
(ii) Compensation of test lead leakage current.
(iii) Partial Discharge free VLF generator
(iv) Tan Delta measurement device shall be integrated inside the VLF source.

(v) Automatic evaluation of Tan Delta diagnostic results according to IEEE evaluation criteria as well as freely definable evaluation criteria.

(vi) The Tan Delta(TD) and Partial Discharge(PD) shall be software operated. The software shall be Windows-based, and installed in a laptop for each equipment. The laptop shall be of basic specifications that can handle all the tasks or better as per Table 2

4.2.9.10 Partial Discharge Measurement:

(i) Voltage range: up to 57 kV rms
(ii) Measurement range 10 – 12,800 m (at 80 m/µs)
(iii) Sampling rate 100 MSamples/s (10 ns)
(iv) PD measurement range 5 pC – 100 nC
(v) Accuracy 1% of cable length
(vi) Resolution 0.1 pC / 0.1 m
(vii) Velocity of propagation (v/2) 50 – 120 m/µs
(viii) Weight of coupling capacitor including filter: maximum 21kg

4.2.9.11 The equipment shall have the following features:

(i) PD recording and display over different voltage levels
(ii) PD localization evaluation based on cable length
(iii) Automatic PD evaluation
(iv) Filtering functions
(v) Gain and trigger setting possibility
(vi) Calibration and measurement according to IEC 60270
(vii) PD phase resolved pattern recognition
(viii) PD measurement throughout the 360degree of the sinusoidal VLF waveform over definable time
(ix) PD measurement during VLF withstand test up to 57 kVrms
(x) The Equipment shall be supplied in a mounting frame on wheels for ease of movement

4.2.10 Additional Diagnostic Procedures and Resources

4.2.10.1 Full Monitor Withstand Test (MWT)

Monitored Withstand Test (MWT) enables the establishment of the condition of the cable by measuring the dielectric losses for optimal test process. The test facility has the following features :

(i) Parallel dissipation factor and partial discharge measurement
(ii) Better overview of the cable condition with Full Monitored Withstand Test (VLF cable testing with parallel dissipation factor and partial discharge measurement)
(iii) Coupling capacitor includes measurement impedance and PD measuring unit in one device

(iv) PD phase resolving for classification of PD faults
(v) Integrated filter for suppressing noise signals from the VLF generator
(vi) Stable data transmission and power supply via a PoE cable (PoE = Power-Over-Ethernet) No battery required!
(vii) Partial discharge measurement and calibration of the measurement setup according to IEC 60270
(viii) Detection of PD level, PD inception and extinction voltage as well as PD frequency
(ix) Exact location of PD activities in cable insulation, joints and terminations
(x) Excellent noise suppression due to compact structure, and Galvanic isolation between PD measuring unit and laptop
(xi) Central power supply
(xii) Reliable tan δ measurement results up to 72.5kV peak using proven technology
(xiii) Integrated device for detecting leakage currents for dissipation factor measurement
(xiv) Easy operation software –all-in-one software solution for measurement and auto evaluation
(xv) Robust design and central power supply developed for mobile use

4.2.10.2 Pulse Reflection Test (PRT) System

To localise joints with water ingress, a specialised TDR device can be used with a cable fault location system. This is a computer-aided test system designed as a pulse reflection-measuring instrument for fault location on single and three-phase cable systems. If procured together with the other fault location equipment, the test equipment will have the following specifications and features:

4.2.10.2.1 The design incorporates an integrated 400 MHz transient recorder for the highest measuring accuracy. It shall be able to offer unique features for intelligent manual and automatic cable fault location.

4.2.10.2.2 The Software of the Pulse Reflection System shall be based on the latest Windows OP system to allow every user an easy and fast operation of the system.

4.2.10.2.3 The PRT system shall have up to three cable fault location methods to be displayed at the same time on a minimum of 15" TFT-LCD display unit. High resolution and zoom functions shall be included to enable accurate pre-location of cable faults. There shall be a provision for easy transfer to any computer data files and automatic reporting functions.

4.2.10.2.4 The following features and technical specifications shall form part of the PRT test system:
(i) Fully automatic measuring sequences;
(ii) Fully automatic cursor settings;
(iii) Three (3) phase measurement and display;
(iv) Memory for more than 100,000 waveforms (hard disk limit);

(v) TDR pulse width: 20 ns – 1.3 ms
(vi) Time Domain Reflectometer (TDR) output pulse from 20 to 200 V;
(vii) Output impedance: 12 – 2,000 Ohm
(viii) Sampling rate: 400 MHz
(ix) Input signal gain: -63 to +44 dB
(x) SIM/MIM: 20 TDR multi-shot measurements
(xi) Resolution (@ v/2 = 80 m/µs): 0.1 m
(xii) Measuring ranges of over10m - 1000 km;
(xiii) Accuracy: 0.1% of measuring result
(xiv) Propagation velocity factor v/2 range:20 – 150 m/µs
(xv) Power supply: 100 – 260 V, 50/60 Hz
(xvi) Power consumption: Max. 280 VA
(xvii) Automatic reporting function;

4.2.10.2.5 IR tests shall meet the following parameters;
(i) Test voltage: up to 1.000 V
(ii) Measuring range: up to 5 G-Ohm
(iii) Simultaneous for: L1/N, L2/N, L3/N, L1/L2, L2/L3, L1/L3

4.2.10.3 Technical Specifications for Laptop Computer

Table 2: Technical Specifications for Laptop Computer

Description	Mandatory & Minimum Requirements
Operating system	Windows 11Pro (64 Bit)
Processor family	11th Generation Intel® Core™ i7 processor
Display	15-inch
Memory	8 GB DDR4 SDRAM (onboard)
Hard drive	512 GB PCIe NVMe M.2 SSD
Keyboard	Full-size Island-Style keyboard, split resistance
	One-piece precision TouchPad
Ports/Slots	2 x USB-A 3.2 Gen 1
	1 x USB-C 3.2 Gen 2
	Mandatory: HDMI 2.1 Port
	3-in-1 microSD card reader
	Mandatory: Ethernet Port (RJ45)
Power supply type	230VAC British Plug , Cable + Power Adapter
Connectivity	Wi-Fi 5 or 6
	Bluetooth® 5.2 Combo

Description	Mandatory & Minimum Requirements
Graphics	Integrated: UHD Graphics
Audio	Intergral 2 x 2W Speakers with Dolby Atmos
	Dual Array Mics
Camera	Webcam with privacy shutter
Manufacturer's Warranty	1 (One) Year

5.0 TESTS AND INSPECTION (Normative)

5.1 It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified. Tenderers shall confirm the manufacturer's capabilities in this regard when submitting tenders. Any limitations shall be clearly specified.

5.2 Copies of Type Test Certificates and Type Test Reports issued by a third-party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for the purpose of technical evaluation. A copy of the accreditation certificate to ISO/IEC 17025 for the testing laboratory shall also be submitted. Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Laboratory that carried out the tests.

5.3 Each Cable Fault Locating Equipment shall be inspected and tested in accordance with the requirements of relevant international and national standards and provisions of this specification. It shall be the responsibility of the supplier to perform all the tests.

5.4 Routine and sample test reports for each Cable Fault Locating Equipment to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC Engineers will witness tests at the factory before shipment.

5.5 On receipt of the goods, KPLC will perform any of the tests in order to verify compliance with this specification. The supplier shall replace without charge to KPLC Cable Fault Locating Equipment, which upon examination, test or use fail to meet any of the requirements in the specification.

5.6 Testing Facility

5.6.1 The bidder shall provide current e-mail address, fax and telephone numbers and contact person at the Testing Laboratory where Type Tests and Special Tests were carried out.

5.6.2 All test and measuring equipment to be used during acceptance testing shall have been calibrated and copies of valid calibration certificates shall be provided to KPLC Engineers. A detailed list of

workshop tools, test/measuring equipment and list of tests that can be carried out by the manufacturer shall be submitted with the tender for evaluation.

APPENDICES

APPENDIX A: QUALITY MANAGEMENT SYSTEM (Normative)

A.1 The bidder shall submit a quality assurance plan (QAP) that will be used to ensure that the Cable Fault Locating Equipment design, material, workmanship, tests, service capability, maintenance and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2015 or later.

A.2 The Manufacturer's Declaration of Conformity to applicable standards, this specification and copies of quality management certifications including copy of valid and relevant ISO 9001 certificate shall be submitted with the tender for evaluation.

A.3 A detailed list and contact addresses (including e-mail) of the manufacturer's previous customers outside the country of manufacture for exact or similar Cable Fault Locating Equipment sold in the last five years shall be submitted with the tender for evaluation.

APPENDIX B: DOCUMENTATION AND DEMONSTRATION (Normative)

B.1. The bidder shall submit its tender complete with technical documents required by Appendix D (Guaranteed Technical Particulars) for tender evaluation. The 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, Cable Fault Locating Equipment drawings and wiring diagrams and technical data showing description leaflet, programming details and manuals,

c) Sales records for the last five years and at least four customer reference letters,

d) Details of manufacturing capacity and the manufacturer's experience.

e) Copies of required Type Test certificates and Type Test reports by a third-party testing laboratory accredited to ISO/IEC 17025,

f) Copy of accreditation certificate to ISO/IEC 17025 for the third-party testing laboratory,

g) Manufacturer's warranty and guarantee; subject to 36 months from date of delivery to KPLC laboratory.

h) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2008/15 certificate, ISO 17025:2005/17 certificate.

B.2. The successful 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) signed by the manufacturer;

Note: These shall be new and should not be confused with the ones submitted with the tender

b) Design drawings and wiring diagrams of the Cable Fault Locating Equipment.

c) Original software, software manuals and operation manuals shall be submitted,

d) A training schedule of the Cable Fault Locating Equipment and software operation for KPLC staff operators on site,

e) Quality assurance plan (QAP) that will be used to ensure that the design, material, workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2015.

f) Detailed test program to be used during factory testing,

g) Marking details and method to be used in marking the Cable Fault Locating Equipment.

h) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the Cable Fault Locating Equipment for The Kenya Power & Lighting Company,

i) Packaging details (including packaging materials).

B.3. The successful bidder and manufacturer shall demonstrate to at least four (4) KPLC staff two of whom must be users at the manufacturer's factory.

B.4. **Training at the Manufacturer's premises**

B. 4.1 During the Factory Acceptance Testing (FAT), the manufacturer shall conduct complete training for the cable fault Locating Equipment for at least four (4) KPLC Engineers/Technicians three of whom must be users

B.4.2. This shall include theory followed by practical demonstrations. All the operational procedures shall be exhaustively explained and demonstrated

B.4.3. The manufacturer shall plan adequate time for the training separate from the FAT which shall be

conducted by the manufacturer's expert. The duration of the training shall however be not be less than three (3) eight hour working days. The Employer shall send a separate team from the team witnessing the FATs to attend the training. The program and duration of the training shall be indicated in the bid.

B.4.4. The training shall be dimmed successful once the engineers/technicians are able to completely operate the equipment

B.4.5. The manufacturer shall conductor evaluation tests and give a feedback report on the training to the employer for each of the engineers/technicians.

B.4.6. The manufacturer shall meet the total cost of the factory training for their staff. For KPLC staff, the full cost of the visit, including air tickets and accommodation shall be borne by KPLC

B.5. **Local Training**

B.5.1. Following the delivery of the cable fault locating equipment, the manufacturer shall conduct training for the equipment for approximately twenty (20) KPLC engineers/technicians, in Nairobi, Kenya. The training shall be conducted in one session of 20 engineers/technicians. The session shall last at least three (3) days for VLF pressure testing equipment and at least two (2) days for cable fault location equipment.

B.5.2. The training shall include theory on features and how the equipment works followed by practical demonstrations including parameter settings. All steps shall be exhaustively explained and demonstrated.

B.5.3. The Training shall be considered to have been successful once the engineers/ technicians are able to completely operate the equipment.

B.5.4. 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. However, the costs do not include the transport and accommodation for the KPLC engineers/technicians and the venue, which shall be borne by KPLC.

APPENDIX C: MARKING, LABELLING AND PACKING

C.1. The Cable Fault Locating Equipment shall be marked legibly and indelibly in English with the following information:

a) Name or trade mark of the manufacturer;

b) Country of origin;

c) Type/model;

d) Serial no;

e) Standards of manufacture

f) The inscription "Property of K.P.& L. C."

g) Year of manufacture.

C.2. The Cable Fault Locating Equipment shall be packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.

C.3. The Cable Fault Locating Equipment shall have a rugged casing for storage and transportation.

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APPENDIX E: GUARANTEED TECHNICAL PARTICULARS

(to be filled and signed by the supplier/Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test reports for tender evaluation, all in English Language)

Tender No. .....

	Clause number	**KPLC requirement**	**Bidder's offer** (indicate full details of the offered equipment)
i	Name and address of the Manufacturer	state	
ii	Country of Manufacturer	state	
iii	Manufacturer's Letter of Authorization	provide	
iv	Model/Type Reference No. of the offered Equipment	specify	
v	Manufacturer's warranty and guarantee for the offered Equipment	Attach	
1	Scope (1.1 – 1.6)	Select applicable for the tender	
	Equipment Application	List and state	
2	Applicable standards	List	
3	Terms and definitions	specify	
4.1	**Service Conditions**		
4.1.1	Operating Conditions	State	
4.2	**Specific requirements**		
4.2.1	**Portable Cable Fault Location equipment with relocation and DC pressure test 32kV**		
4.2.1.1	Portability	State	
	Nature of faults the equipment shall be able to locate	Specify and List	
4.2.1.2	Functionality set and safety	Specify & List functions	
	Degree of safety	Specify	

	Clause number	KPLC requirement	Bidder's offer (indicate full details of the offered equipment)
4.2.1.3	Features of the equipment	List/state	
	Max. Weight of complete equipment	Specify	
	Test range	State	
	Time Domain Reflectometer (TDR)	Specify	
	Impulse voltage(s) it can with stand	Specify	
	Minimum surge energy in every range for acoustic pinpointing	Specify	
	Impulse voltage levels for medium-voltage cable	Specify	
	Impulse voltage levels for lower voltages	Specify	
	Modes of operation	List	
4.2.1.4	Pre location procedures	Specify/List	
4.2.1.5	Operating Voltage	State	
	Backup power generator	Specify	
4.2.1.6	Equipment Accessories	List	
4.2.1.7	Connecting Cables (detachable)	List	
4.2.1.8	Complete stand-alone ready-to-use unit with all its accessories	Specify	
	Operating manual in the English language	State	
4.2.2	**Cable Identifying Sets & Route Locator**		
4.2.2.1	**Cable Identifying Set**		
4.2.2.1.1	Cable Identification Functionality	State	
	Operating voltage	State	
	Inbuilt battery with a charging unit	State	
	Rechargeable battery voltage	State	
	Battery operating time (Min hours)	State	
4.2.2.1.2	Features & Functions	List & state	
4.2.2.1.3	Technical Parameters	List & state	
4.2.2.2	**Cable Route Locators**		

	Clause number	KPLC requirement	Bidder's offer (indicate full details of the offered equipment)
4.2.2.2.1	Key Functionality and Elements	Specify	
4..2.2.2.2	Mode of transmitter coupling	Specify	
4.2.2.2.3	Features of the equipment	List & state	
4.2.2.3	Complete stand-alone ready-to-use unit with all its accessories	Specify	
	Operating manual in the English language	State	
4.2.3	**Cable Sheath Testing Equipment**		
4.2.3.1	Functionality of equipment	state	
4.2.3.2	Operating precision	state	
4.2.3.3	Nature of Analysis and display mode	Specify	
4.2.3.4	Mains Features	List and state functionality	
4.2.3.5	Cable Sheath Receiver	specify	
4.2.3.5.1-5	Mode of operation	specify	
4.2.3.6	Accessories	List	
4.2.4	**Cable sheath Fault receiver**		
4.2.4.1-4	Mode of operation	state	
4.2.4.5	Accessories	List	
	(i) Earth probe red	Specify	
	(ii) Earth probe blue	Specify	
	(iii) Measuring line 2m, blue	Specify	
	(iv)Measuring line 2m, red	Specify	
	(v) Auxiliary line 25 m on hand reel	Specify	
4.2.5	**Low Voltage Fault Location Sets**		
4.2.5.1	Key Functionality and elements	State	
4.2.5.2	Integrated battery	State	
4.2.5.3	Ease of use	State	
4.2.5.4	Features of the equipment	List	
4.2.5.5	Complete stand-alone ready to use unit with all its accessories	Specify	

	Clause number	KPLC requirement	Bidder's offer (indicate full details of the offered equipment)
	Operating manual in English language	State	
4.2.6	**Portable DC Pressure Test Sets**		
4.2.6.1	Key Functionality and elements	Specify	
4.2.6.2	Features of the equipment	List	
4.2.6.3	Complete stand-alone ready to use unit with all its accessories	Specify	
	Operating manual in English language	State	
4.2.7	**VLF pressure testing with tan delta up to 28KVr**		
4.2.7.1	Functionality of equipment	State	
4.2.7.2	Sheath testing and cable diagnostic Features	List	
4.2.7.3	Equipment features	Specify	
4.2.7.4	**Technical data as per table 1**		
S/N	**Parameter description**	**Units**	
	General		
1	Frequency range	Hz	
2	Input voltage	V/Hz	
3	Max. power consumption	VA	
4	Data interface	USB	
5	Protection class	IP	
6	EMC compatibility	Standards	
B	**Output voltage**		
i	VLF true sine Wave	kV rms	
ii	VLF rectangular wave voltage	kV	
iii	DC voltage	kV	
iv	Resolution	kV	
v	Accuracy	%	
vi	Load range	nF	
C	**Output current**		
	Max. load	µF at Hz, kVrms	
D	**Tan delta measurement**		
i	VLF true Sine Wave	kV rms	

	Clause number	KPLC requirement	Bidder's offer (indicate full details of the offered equipment)
ii	Load range	nF- µF	
iii	Accuracy		
iv	Resolution		
v	Measurement range		
vi	TD measurement frequency	Hz	
vii	Leakage current		
4.2.7.5	The VLF Testing and Diagnostic System features	Specify	
4.2.8	**VLF pressure testing with Tan delta of at least 33kVrms but not exceeding 44kVrms**		
4.2.8.1	Key Elements and Functionality	State	
5.2.8.2	Test Functions	State/list	
4.2.8.3	Key Features	List	
4.2.8.4	**Technical data as per table 2**		
	Parameter description	**Units**	
	General		
i	Frequency range	Hz	
ii	Input voltage	V/Hz	
iii	Max. power consumption	VA	
iv	Data interface	USB	
v	Protection class	IP	
vi	EMC compatibility	Standards	
B	**Output voltage**		
i	VLF true sine Wave	kV rms	
ii	VLF rectangular wave voltage	kV	
iii	DC voltage	kV	
iv	Resolution	kV	
v	Accuracy	%	
vi	Load range	nF	
C	**Output current**		
	Max. load	µF at Hz, kVrms	
D	**Tan delta measurement**		
i	VLF true Sine Wave	kV rms	

	Clause number	KPLC requirement	Bidder's offer (indicate full details of the offered equipment)
ii	Load range	nF- µF	
iii	Accuracy		
iv	Resolution		
v	Measurement range		
vi	TD measurement frequency	Hz	
vii	Leakage current		
4.2.8.5	Features of the VLF Testing and Diagnostic System	List	
4.2.9	**VLF High Voltage Generator 57 kVrms**		
4.2.9.1	Testing and Diagnostic		
4.2.9.1.1	Key Elements and Functionality and tests	State	
	Applicable standards		
	Cable voltage ranges		
4.2.9.1.2	Provision for commissioning tests	State	
	Provision for maintenance tests		
4.2.9.1.3	Power rating of HVG	State	
	Features	State	
4.2.9.1.4	Tan delta and PD diagnostic frequency range	State	
4.2.9.1.5	Features of the HVG	List	
4.2.9.1.6	Programmable output voltage	List	
4.2.9.1.7	Output currents	List	
4.2.9.1.8	Tan Delta Dissipation factor	List	
4.2.9.1.9	Equipment features		
4.2.9.1.10	Partial Discharge Measurement		
4.2.9.1.11	Equipment PD features		
4.2.10.	**Diagnostic Procedures/Resources**		
4.2.10.1.	**Full Monitor Withstand Test (MWT)**		
	Key Functionality	State	
	Features of the MWT	List	
4.2.10.2.	**Pulse Reflection Test (PRT) System**		
4.2.10.2.1	Frequency of transient recorder and aid features		

	Clause number	KPLC requirement	Bidder's offer (indicate full details of the offered equipment)
4.2.10.2.2	Software for operating the system		
4.2.10.2.3	Features of the PRT		
4.2.10.2.4	Technical Specifications of the PRT test system		
4.2.10.2.5	IR tests parameters		
4.2.10.3	**Technical Specifications for Laptop Computer**		
	Manufacturer		
	Model and Brand Name		
	Operating system		
	OS Generation		
	Display Size		
	Memory and Hard drive feature		
	Comm and Connectivity		
	Attached peripherals		
	Battery Size, type		
	Audio and Camera		
	Warranty Period		
5.0	**TEST AND INSPECTION**		
5.1	Test standards and responsibility of carrying out tests	specify	
5.2	Copies of Type Test Reports submitted with tender & ISO /IEC17025	provide	
5.3	Routine & Acceptance tests to be witnessed by KPLC at factory before shipment	List for each equipment	
5.4	Copies of sample and routine Test Reports submitted with tender	list	
5.5	Replacement of any defective equipment/spare during delivery to KPLC stores without charge	Specify	
5.6	Testing Facility		
5.6.1	Testing Facility address details	Specify	
5.6.2	Valid calibration	Provide	

	Clause number	KPLC requirement	Bidder's offer (indicate full details of the offered equipment)
	APPENDICES		
A	**QUALITY MANAGEMENT SYSTEM**		
A.1	Quality Assurance Plan	Provide/attach copies	
A.2	Manufacturer's Declaration of Conformity to applicable standards	Provide/attach copies	
	Copy of ISO 9001:2015 Certificate	Provide/attach copies	
A.3	Manufacturer's experience	State	
	Manufacturing Capacity (units per month)	State	
	List of previous customers	Provide	
	Customer reference letters	Provide	
B	**DOCUMENTATION AND DEMONSTRATION (Normative)**		
B.1	Documents submitted with tender for evaluation	List	
B.2	Documents to be submitted by supplier to KPLC for approval before manufacture	List	
B.3	Demonstration at the factory	State	
B4	**Training at the manufacturers**		
B.4.1	Training for four (4) KPLC Engineers/Technicians	Specify	
B.4.2	Theory and practical training with demonstrations	Specify	
B.4.3	Program and staff evaluation criteria	Provide	
	Duration not less than three(3) 8-hour working days	State	
B.4.4	Confirmation of successful training	State	
B.4.5	Training evaluation criteria	Provide	
B.4.6	Training cost	State	

	Clause number	KPLC requirement	Bidder's offer (indicate full details of the offered equipment)
B.5	**Local Training**		
B.5.1	Training for twenty (20) KPLC Engineers/Technicians in Nairobi	State	
	Duration of Training session	State	
B.5.2	Theory and practical training with demonstrations	State	
B.5.3	Confirmation of successful training	State	
B.5.4	Training costs	State	
C	**MARKING, LABELLING AND PACKING**		
C.1	Marking details	State	
C.2	Packaging details	Provide	
C.3	Storage and transportation casing	Provide	
	Statement of compliance to Tender Specifications (indicate deviations if any & supporting documents)	State & provide	

NOTE:

1) *Bidders shall give full details of the items on offer as per the specifications and applicable standards. The details provided shall conform to the test reports and their certificates, as well as labelled drawings complete with dimensions, catalogues and/or brochures for tender evaluation.*

2) *Bidders should note that the above Guaranteed Technical Particulars Schedules must be fully completed and submitted with the bid. Wherever there is conflict between the GTPs and the clauses in the specification, the clauses in the specification take precedence. Failure to complete the schedules shall lead to rejection of the bid.*

3) Guaranteed values shall be specified. Words like 'agreed', 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.

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Manufacturer's Name, Signature, Stamp and Date