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Kenya Power

THERMAL IMAGING CAMERA Part 3: INFRARED THERMOGRAPHY CAMERA SET – SPECIFICATION

A Document of the Kenya Power & Lighting Co. Plc

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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

In order 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.

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0.2 AMENDMENT RECORD

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by	Approved by
Issue 1 Rev 0	2022-10-07	New	Eng. D. Njoroge Eng. J. Ndirangu Eng. B. Dianga	Dr. Eng. P. Kimemia

FOREWORD

This Specification has been prepared by the Standards Department and Transmission Department both of The Kenya Power and Lighting Company Plc (KPLC). It lays down requirements for Infrared Thermography Camera set.

Infrared thermography camera is an instrument that collects the infrared radiant energy from a target and produces an image in monochrome (black and white) or colour, where the grey shades or colour hues are related to target apparent temperature distribution. The Infrared thermography cameras are intended for use in inspection and monitoring of electrical power infrastructure operating at nominal voltages of up to 400kV AC 50Hz and 500kV HVDC.

The other specifications in this series are:

KP1/6C/4/1/TSP/09/055-1: Thermal Imaging Camera Part 1: Handheld Thermal Imaging Camera — Specification Issue 1, Rev 0 dated 2018-06-11

KP1/6C/4/1/TSP/09/055-2: Thermal Imaging Camera. Part 2 - Airborne Thermal Imaging Camera – Specification Issue 1, Rev 0 dated 2018-06-12

KP1/13D/4/1/TSP/09/075: Specification for Infrared Camera Issue 1 Rev 0 dated 2014-09-15

This specification stipulates the minimum requirements for Infrared Thermography Camera set acceptable for use in the company and it shall be the responsibility of the suppliers and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to KPLC, good workmanship and good engineering practice in the manufacture of Infrared Thermography Camera for KPLC. Users of KPLC specifications are responsible for their correct interpretation and application. The following are members of the team that developed this specification:

Name	Department
Eng. Dedan Njoroge	Transmission Network
Eng. Julius Ndirangu	Standards
Eng. Benson Dianga	Standards

1. SCOPE

This specification covers the requirements of materials, design, size, test methods, marking and packing of Infrared Thermography Camera and associated mobile electronic devices.

2. NORMATIVE REFERENCES

The following standard and guidelines 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.

ISO 18251-1: Non-destructive testing — Infrared thermography — Part 1: Characteristics of system and equipment

ISO 10878: Non-destructive testing — Infrared thermography — Vocabulary

ISO 10880: Non-destructive testing — Infrared thermographic testing — General principles

ISO 6781: Thermal insulation — Qualitative detection of thermal irregularities in building envelopes — Infrared method

ISO 18434-1: Condition monitoring and diagnostics of machines — Thermography — Part 1: General procedures

ISO 80000-5: Quantities and units — Part 5: Thermodynamics

ISO 80000-7: Quantities and units — Part 7: Light

IEC 60068-2-1: Environmental testing — Part 2-1: Tests — Test A: Cold

IEC 60068-2-2: Environmental testing — Part 2-2: Tests — Test B: Dry heat

IEC 60068-2-6: Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)

IEC 60068-2-7: Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock

IEC 60068-2-78: Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state

IEC TS 62446-3:2017: Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance - Part 3: Photovoltaic modules and plants – Outdoor infrared thermography

ASTM C 1060: Standard practice for thermographic inspection of insulation installations in envelope cavities of frame buildings

ASTM C 1153: Standard practice for location of wet insulation in roofing systems using infrared imaging

ASTM E 1213: Standard practice for minimum resolvable temperature difference for thermal imaging systems

ASTM E 1311: Standard practice for minimum detectable temperature difference for thermal imaging systems

ASTM E 1316: Standard terminology for non-destructive examinations

ASTM E 1543: Standard test method for noise equivalent temperature difference of thermal imaging systems

ASTM E 1897: Standard practice for measuring and compensating for transmittance of an attenuating medium using infrared imaging radiometers

ASTM E 1933: Standard practice for measuring and compensating for emissivity using infrared imaging radiometers

ASTM E 1934: Standard guide for examining electrical and mechanical equipment with infrared thermography

IEC 60529: Degrees of protection provided by enclosures (IP Code)

3. DEFINITIONS AND ABBREVIATIONS

For the purpose of this specification, the definitions and abbreviations given in the reference standards shall apply together with the following:

KPLC: Kenya Power and Lighting Company Public Limited Company

ASTM: American Society for Testing and Materials

IR: Infrared

IEC: International Electro Technical Commission

ISO: International Organization for Standardization.

ISO 9001: 2015: Quality Management Systems - Requirements

4. REQUIREMENTS

4.1 Service conditions

The Infrared Thermography Camera and mobile electronic devices shall be suitable for use outdoors in tropical areas with the following conditions:

a) Altitudes of up to 2200m above sea level;

b) Humidity of up to 95% without condensing;

c) Average ambient temperature of +30ºC with a minimum of -20ºC and a maximum of +50ºC;

d) Heavy Saline conditions along the coast (Pollution level IV)

e) Isokeraunic levels of up to 180 thunderstorm days per year.

4.2 General Requirements for Infrared Thermography Camera

4.2.1 The Infrared Thermography Camera shall be consistent in laser sharp focus at all times.

4.2.2 The Infrared Thermography Camera shall have a built-in digital camera, voice annotation, text annotation, laser target locator and GPS, etc

4.2.3 The Camera shall be of rugged, ergonomic design and portable with the housing meeting the IP54 standard for protection of internal parts from shock, vibration, dust, and water as per IEC 60529.

4.2.4 The Camera shall be designed for heavy-duty applications in the field.

4.2.5 The Camera shall withstand tough conditions to take images with speed and clarity.

4.2.6 The Infrared Thermography Camera shall have IR-fusion technology that adds the context of the visible details to the infrared image.

4.2.7 The Infrared Thermography Camera shall support English language.

4.2.8 The Infrared Thermography Camera shall have a laser distance meter.

4.2.9 The Infrared Thermography Camera shall connect with a compatible software application for saving and sharing.

4.2.10 The Infrared Thermography Camera shall allow transfer of images and video from the thermal imaging camera to a tablet, PC or smartphone via USB, WIFI, Bluetooth etc.

4.2.11 The Infrared Thermography Camera shall allow for continuous autofocus of the thermal images. As a result, the camera is fully automatic.

4.2.12 The Infrared Thermography Camera shall be supplied complete with batteries and battery charger.

4.2.13 Design drawings of the Infrared Thermography Camera shall be provided.

4.2.14 The particular parameter requirements of the Infrared Thermography Camera shall be as per Table 1:

Table 1: Infrared Thermography Camera Particular Requirements

PARAMETER	REQUIREMENTS
General	
IR resolution	640 × 480 (307,200 pixels)
Thermal sensitivity/NETD	≤ 0.05 °C at 30°C target temp (30-50 mK)
Spectral range	7.5 - 14.0 µm
Detector type	Uncooled microbolometer
Colour alarms (temperature alarms)	High temperature, low temperature, and isotherms (within range)
Hard carry Case	Rugged with custom foam insert
Weight (including battery)	2kg maximum
Imaging and Optical	
Lens Identification	Automatic
Image Frequency	30 – 60Hz

Digital zoom	1 x 8x continuous
Standard palettes	9 (Rainbow, Iron bow, Blue-Red, High Contrast, Amber, Amber Inverted, Hot Metal, Grayscale, Grayscale Inverted)
Measurement and analysis	
Accuracy, full range	±2% or 2°C (at 25 °C nominal, whichever is greater)
Object temperature range	-20°C to 1000°C
Annotations	
Voice annotation	60 seconds
Text	Yes. With user programmable options
GPS	Location data automatically added to every still image and first frame in video.
Image storage	
Storage media	Removable SD card, minimum size 4GB
Image file format	bmp, jpeg, AVI
Video recording and streaming	
Video recording and formats	Standard and radiometric
Battery	
Batteries	Lithium ion batteries, field-replaceable and rechargeable
Batteries operating time	4 hours minimum
Batteries charging time	2 - 3 hours to full charge
Battery charging system	Two-bay battery charger
AC operation	AC operation with included power supply (100 V AC to 240 V AC, 50Hz)

4.3 Software

4.3.1 The Infrared Thermography Camera shall have a super resolution software that is able to capture and combine 4x the data to create a 1280 x 960 image.

4.3.2 The Infrared Thermography Camera shall be supplied with a computer-based software that enables the user to analyse and report the findings. The software shall be compatible with the common operating systems i.e macOS, iOS, Windows etc

4.3.3 The software shall seamlessly store, retrieve, and analyse thermal images and temperature data directly from the camera, allowing in-depth and precise evaluation of thermal performance.

4.3.4 The software functions shall include temperature display, snapshot and video image analysis, isotherms, line profiles, area histograms, among others.

4.4 Mobile Electronic Devices

4.4.1 Each Infrared Thermography Camera shall be supplied complete with associated mobile electronic devices (laptop and mobile phone) for purposes of thermal imaging data analysis.

4.4.2 The particular parameter requirements of the associated mobile electronic devices for thermal imaging data analysis shall be as per Table 2:

Table 2: Mobile Electronic Devices Particular Requirements

PARAMETERS	**REQUIREMENTS**
Laptop	
Processor	8-core CPU with 4 performance cores and 4 efficiency cores
Memory	8gb RAM
Storage	512gb SSD (configurable to 1TB or 2TB)
Operating System	macOS
Display	Retina display, 13.3-inch (diagonal) LED-backlit display with IPS technology; 2560-by-1600 native resolution at 227 pixels per inch with support for millions of colours
Battery Operating Time	15 – 18 hours
Power	Built-in >45watt-hour lithium-polymer battery, 30W USB-C Power Adapter

Charging and expansion	Two Thunderbolt / USB 4 ports with support for: charging, display port, Thunderbolt 3 (up to 40Gb/s), USB 4 (up to 40Gb/s), USB 3.1 Gen 2 (up to 10Gb/s), 3.5 mm headphone jack
Keyboard and trackpad	Backlit Magic Keyboard with: a) 78 (U.S.) or 79 (ISO) keys including 12 function keys and 4 arrow keys in an inverted-T arrangement, b) Ambient light sensor, c) Force Touch trackpad for precise cursor control and pressure-sensing capabilities; enables Force clicks, accelerators, pressure-sensitive drawing, and Multi-Touch gestures
Wireless	a) Wifi: 802.11ax Wi-Fi 6 wireless networking IEEE 802.11a/b/g/n/ac compatible b) Bluetooth: Bluetooth 5.0 wireless technology
Camera	720p FaceTime HD camera, advanced image signal processor with computational video
Audio	a) Stereo speakers b) Wide stereo sound c) Support for Dolby Atmos playback d) Three-mic array with directional beamforming e) 3.5 mm headphone jack
Operating requirements	a) Line voltage: 100V to 240V AC b) Frequency: 50Hz to 60Hz c) Operating temperature: 50° to 95° F (10° to 35° C) d) Storage temperature: −13° to 113° F (−25° to 45° C)

	e) Relative humidity: 0% to 90% noncondensing f) Operating altitude: tested up to 10,000 feet g) Maximum storage altitude: 15,000 feet h) Maximum shipping altitude: 35,000 feet
Size and weight	a) Height: 0.16–0.63 inch (0.41–1.61 cm) b) Width: 11.97 inches (30.41 cm) c) Depth: 8.36 inches (21.24 cm) d) Weight: 2.8 pounds (1.29 kg)3
Mobile Phone	
Platform	iOS, A15 Bionic
Memory	4gb RAM
Storage	256gb
Dimensions	146.7 x 71.5 x 7.7 mm (5.78 x 2.81 x 0.30 in)
Weight	174g
Display	Super Retina XDR OLED, HDR10, Dolby Vision, 6.1 inches
Resolution	1170 x 2532 pixels, 460 PPI density
WLAN	Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot
Sensors	Face ID, accelerometer, gyro, proximity, compass, barometer
Battery	Li-Ion 3240 mAh, non-removable with fast charging support
Camera	a) Back: 12MP, f/1.6 and 12MP, f/2.4 b) Front: 12MP, f/2.2

4.5 Standard Accessories:

The following accessories shall be supplied with the Infrared Thermography Camera free of cost:

a) SD memory card, 4GB minimum

b) 2 Li-ion rechargeable batteries

c) 2-bay battery charger

d) Power supply

e) Bluetooth headset

f) USB and video cables

g) Tripod adapter

h) Lens cap

i) Hard carrying case

4.6 Warranty and Training

4.6.1 The Infrared Thermography Camera shall be supplied with a minimum 24-months factory warranty that covers all parts.

4.6.2 Technical support, servicing of the camera and software upgrades, where applicable, shall be provided free of charge to Kenya Power for a period of not less than 24 months.

4.6.3 The supplier shall conduct a one-day (full day) training on the use of the Infrared Thermography Camera to Kenya Power engineers/Technicians, in Nairobi Kenya to ensure they get the most out of the thermal imaging camera. The supplier shall meet the cost of the trainer and any materials required for the training.

4.6.4 The training shall include theory on how the camera works followed by practical demonstrations on operation, protection and control configuration and parameter settings. All the operational and control features of the Infrared Thermography Camera shall be exhaustively explained and demonstrated, including the operation of the software.

4.6.5 The training shall be considered to have been successful once the Engineers/Technicians are able to: -

a) Competently use the camera;

b) Establish communication between the camera and computer, export data, download and analyse data/images;

c) Trouble shoot, analyse and rectify any minor breakdowns that may occur.

5. TESTS REQUIREMENTS

The Infrared Thermography Camera shall be inspected and tested in accordance with relevant International Standards and the requirements of this specification.

6. MARKING AND PACKING

6.1. MARKING

The Infrared Thermography Camera shall be legibly and indelibly marked with the following information:

a) Model or reference type;
b) Name or Trademark of the manufacturer;
c) Standard of Manufacture
d) Year of Manufacture;
e) Batch or serial number;
f) The words "PROPERTY OF KENYA POWER AND LIGHTING COMPANY';

6.2. PACKING

6.2.1. The Infrared Thermography Camera shall be packed in a manner so as to protect it from damage during transportation and storage.

6.2.2. Instructions for operation, handling, storage, and maintenance shall be supplied with each Infrared Thermography Camera all in English language.

APPENDICIES

A: TESTS AND INSPECTION (Normative)

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

A.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 for the testing laboratory shall also be submitted with the tender (all in English Language). Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Authority.

A.3 The bidder shall provide current e-mail address, fax and telephone numbers and contact person at the Testing Laboratory where Type Tests were carried out.

A.4 The Infrared Thermography Camera shall be subjected to acceptance tests at the manufacturer's works before dispatch. Two Engineers appointed by KPLC shall witness acceptance tests.

A.5 Test certificates for the Infrared Thermography Camera to be supplied shall be submitted to KPLC for approval before shipment/delivery of the equipment.

A.6 On receipt of the Infrared Camera, KPLC will inspect them and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The supplier shall replace without charge to KPLC the Infrared Thermography Cameras, which upon examination, test or use fail to meet any or all of the requirements in the specification.

B: QUALITY MANAGEMENT SYSTEM (Normative)

B.1 The supplier shall submit a Quality Assurance Plan (QAP) that will be used to ensure that the Infrared Thermography Camera physical properties, tests 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.

B.2 The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2015 certificate shall be submitted with the tender for evaluation.

B.3 The bidder shall indicate the delivery time of the Infrared Thermography Camera, manufacturer's monthly & annual production capacity and experience in the production of the type and size of Infrared Cameras being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of the Infrared Thermography Camera sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

C: DOCUMENTATION (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. Specific values shall be filled in. Terms like "yes", "Agree" , "complied" shall not be acceptable;
b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
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 Reports by a Third Party Testing Laboratory accredited to ISO/IEC 17025;
f) Contacts and address (including email address) of the third party testing Laboratory.

g) Copy of Accreditation Certificate to ISO/IEC 17025 for the Third Party Testing Laboratory;

h) Manufacturers Letter of Authorization, ISO 9001:2015 Certificate and other technical documents required in the tender.

i) Manufacturer's warranty and guarantee

C.2 The successful bidder (supplier) shall submit the following documents/details to KPLC for approval before manufacture:

a) Fully filled clause by clause Guaranteed Technical Particulars (GTP) stamped and signed by the manufacturer. Specific values shall be filled in. Terms like "yes", "Agree" , "complied" shall not be acceptable;

b) Design Drawings with details of the Infrared Thermography Camera to be manufactured for KPLC.

c) Quality Assurance Plan (QAP) that will be used to ensure that the 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.

d) Detailed test program to be used during factory testing;

e) Marking details and method to be used in marking the Infrared Camera;

f) Packaging details (including packaging materials).

C.3 Statement of compliance to specification (indicate deviations if any provide supporting documents)

NOTE: *The drawings to be submitted by the supplier to KPLC for approval before manufacture shall be in standard format clearly indicating the drawing number, parts list with material details and quantities, standard of manufacture, ratings, approval details and identity of the manufacturer (as per manufacturer's authorization submitted during tendering).*

D: GUARANTEED TECHNICAL PARTICULARS (Normative)

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

Tender No. .....

Bidders Name and Address. .....

Clause number	**KPLC requirement**		**Bidder's offer (indicate full details)**
Manufacturer's Name and address			*Specify*
Country of Manufacture			*Specify*
Bidder's Name and address			*Specify*
1.	Scope		*Specify*
2.	References		*Specify*
3.	Definitions and abbreviations		*Specify*
4.	Requirements		
4.1	Service Conditions	Altitude	*State*
		Humidity	*State*
		Average Ambient temperature	*State*
		Saline Condition	*State*
		Isokeraunic levels	*State*
4.2	**General Requirements for Infrared Thermography Camera**		
4.2.1	Laser sharp focus		*Specify*
4.2.2	Super resolution software		*Specify*
4.2.3	Degree of protection as per IEC 60529.		*Specify*
4.2.4	Designed for heavy-duty applications in the field.		*Specify*
4.2.5	Withstand tough conditions to take images with speed and clarity		*Specify*
4.2.6	IR-fusion technology		*Specify*
4.2.7	Support English language		*Specify*
4.2.8	Laser distance meter.		*Specify*
4.2.9	Shall connect with a compatible software application for saving and sharing		*Specify*

Clause number	KPLC requirement		Bidder's offer (indicate full details)
4.2.10	Allow transfer of images and video from the thermal imaging camera to a tablet, PC or smartphone via USB, WIFI, Bluetooth etc.		*Specify*
4.2.11	Allow for continuous autofocus of the thermal images. Camera is fully automatic.		*Specify*
4.2.12	Supplied complete with batteries and battery charger.		*Specify*
4.2.13	Design drawings to be provided		*Specify*
4.2.14	**Particular requirements of Infrared Thermography Camera**		
	Parameter	**Requirements**	
	General		
	IR resolution	640 × 480 (307,200 pixels)	*Specify*
	Thermal sensitivity/NETD	≤ 0.05 oC at 30oC target temp (30-50 mK)	*Specify*
	Spectral range	7.5 - 14.0 µm	*Specify*
	Detector type	Uncooled microbolometer	*Specify*
	Color alarms (temperature alarms)	High temperature, low temperature, and isotherms (within range)	*Specify*
	Hard carry Case	Rugged with custom foam insert	*Specify*
	Weight (including battery)	2kg maximum	*Specify*
	Imaging and optical		
	Lens Identification	Automatic	*Specify*
	Image Frequency	30 – 60Hz	*Specify*
	Digital zoom	1 x 8x continuous	*Specify*
	Standard palettes	9 (Rainbow, Iron bow, Blue-Red, High Contrast, Amber, Amber Inverted, Hot Metal, Grayscale, Grayscale Inverted)	*Specify*
	Measurement and analysis		
	Accuracy, full range	±2% or 2^0C (at 25 °C nominal, whichever is greater)	*Specify*
	Object temperature range	-20^0C - 1000^0C	*Specify*
	Annotations		
	Voice annotation	60 seconds	*Specify*
	Text	Yes. With user programmable options	*Specify*
	GPS	Location data automatically added to every still image and first frame in video	*Specify*
	Image storage		

Clause number	KPLC requirement		Bidder's offer (indicate full details)
	Storage media	Removable SD card, minimum size 4GB	*Specify*
	Image file format	bmp, jpeg, AVI	*Specify*
	Video recording and streaming		
	Video recording and formats	Standard and radiometric	*Specify*
	Battery		
	Batteries	Lithium ion batteries, field-replaceable and rechargeable	*Specify*
	Batteries operating time	4 hours minimum	*Specify*
	Batteries charging time	2 - 3 hours to full charge	*Specify*
	Battery charging system	Two-bay battery charger	*Specify*
	AC operation	AC operation with included power supply (100 V AC to 240 V AC, 50Hz)	*Specify*
4.3	**Software**		
4.3.1	Infrared Thermography Camera shall have Super resolution software that is able to capture and combine 4x the data to create a 1280 x 960 image		*Specify*
4.3.2	The Infrared Thermography Camera shall be supplied with a computer-based software that enables the user to analyse and report the findings. The software shall be compatible with the common operating systems i.e macOS, iOS, Windows etc		*Specify*
4.3.3	Software shall seamlessly store, retrieve, and analyse thermal images and temperature data directly from the camera		*Specify*
4.3.4	Software functions shall include temperature display, snapshot and video image analysis, isotherms, line profiles, area histograms, among others		*Sp*
4.4	**Mobile Electronic Devices**		
4.4.1	Each Infrared Thermography Camera shall be supplied complete with associated mobile electronic devices (laptop and mobile phone) for purposes of thermal imaging data analysis		
4.4.2	Particular Requirements for Mobile Electronic Devices		
	Description	**Requirements**	
	Laptop		
	Processor	8-core CPU with 4 perform-ance cores and 4 efficiency cores	*Specify*
	Memory	8gb RAM	*Specify*

Clause number	KPLC requirement		Bidder's offer (indicate full details)
	Storage	512gb SSD (configurable to 1TB or 2TB)	*Specify*
	Operating System	macOS	*Specify*
	Display	Retina display, 13.3-inch (diagonal) LED-backlit display with IPS technology; 2560-by-1600 native resolution at 227 pixels per inch with support for millions of colours	*Specify*
	Battery Operating Time	15 – 18 hours	*Specify*
	Power	Built-in >45Wh lithium-polymer battery, 30W USB-C Power Adapter	*Specify*
	Charging and expansion	Two Thunderbolt / USB 4 ports with support for: charging, display port, Thunderbolt 3 (up to 40Gb/s), USB 4 (up to 40Gb/s), USB 3.1 Gen 2 (up to 10Gb/s), 3.5 mm headphone jack	*Specify*
	Keyboard and trackpad	Backlit Magic Keyboard with: a) 78 (U.S.) or 79 (ISO) keys including 12 function keys and 4 arrow keys in an inverted-T arrangement, b) Ambient light sensor, c) Force Touch trackpad for precise cursor control and pressure-sensing capabilities; enables Force clicks, accelerators, pressure-sensitive drawing, and Multi-Touch gestures	*Specify*
	Wireless	a) Wifi: 802.11ax Wi-Fi 6 wireless networking IEEE 802.11a/b/g/n/ac compatible b) Bluetooth: Bluetooth 5.0 wireless technology	*Specify*
	Camera	720p FaceTime HD camera, advanced image signal processor with computational video	*Specify*

Clause number	KPLC requirement		Bidder's offer (indicate full details)
	Audio	a) Stereo speakers b) Wide stereo sound c) Support for Dolby Atmos playback d) Three-mic array with directional beamforming e) 3.5 mm headphone jack	*Specify*
	Operating requirements	a) Line voltage: 100V to 240V AC b) Frequency: 50Hz to 60Hz c) Operating temperature: 50° to 95° F (10° to 35° C) d) Storage temperature: −13° to 113° F (−25° to 45° C) e) Relative humidity: 0% to 90% noncondensing f) Operating altitude: tested up to 10,000 feet g) Maximum storage altitude: 15,000 feet h) Maximum shipping altitude: 35,000 feet	*Specify*
	Size and weight	a) Height: 0.16–0.63 inch (0.41–1.61 cm) b) Width: 11.97 inches (30.41 cm) c) Depth: 8.36 inches (21.24 cm) d) Weight: 2.8 pounds (1.29 kg)3	*Specify*
	Mobile Phone		
	Platform	iOS, A15 Bionic	*Specify*
	Memory	4gb RAM	*Specify*
	Storage	256gb	*Specify*
	Dimensions	146.7 x 71.5 x 7.7 mm (5.78 x 2.81 x 0.30 in)	*Specify*
	Weight	174g	*Specify*
	Display	Super Retina XDR OLED, HDR10, Dolby Vision, 6.1 inches	*Specify*
	Resolution	1170 x 2532 pixels, 460 PPI density	*Specify*

Clause number	KPLC requirement		Bidder's offer (indicate full details)
	WLAN	Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot	*Specify*
	Sensors	Face ID, accelerometer, gyro, proximity, compass, barometer	*Specify*
	Battery	Li-Ion 3240 mAh, non-removable with fast charging support	*Specify*
	Camera	a) Back: 12MP, f/1.6 and 12MP, f/2.4 b) Front: 12MP, f/2.2	*Specify*
4.5	Standard Accessories to be supplied with the Infrared Thermography Camera free of cost		*List*
4.6	**Warranty and Training**		
4.6.1	Minimum 24-months factory warranty that covers all parts.		*Specify*
4.6.2	Technical support, servicing of the camera and software upgrades, where applicable, shall be provided free of charge to Kenya Power for a period of not less than 24 months		*Specify*
4.6.3	Conduct a one-day (full day) training on the use of the Infrared Thermography Camera to Kenya Power engineers/Technicians, in Nairobi Kenya to ensure they get the most out of the thermal imaging camera. The supplier shall meet the cost of the trainer and any materials required for the training.		*Specify*
4.6.4	Training shall include theory on how the camera works followed by practical demonstrations on operation, protection and control configuration and parameter settings. All the operational and control features of the Infrared Thermography Camera shall be exhaustively explained and demonstrated, including the operation of the software		*Specify*
4.6.5	Measure of successful training		*specify*
5.	**Test Requirements**		*Specify*
6	**Marking and Packing**		
6.1	Information legibly and indelibly marked on the Infrared Thermography Camera		*List*
6.2	**Packing**		*Specify*
6.2.1	Infrared Thermography Camera shall be packed in a manner so as to protect it from damage during transportation and storage.		*Specify*

Clause number	KPLC requirement	Bidder's offer (indicate full details)
6.2.2	Instructions for operation, handling, storage, and maintenance shall be supplied with each Infrared Thermography Camera all in English language.	*Specify*
A	**Tests and Inspection**	
A.1	Responsibility of carrying out tests	*State*
A.2	Copies of Type Test Reports submitted with tender	*Provide*
A.3	Current e-mail address, fax and telephone numbers and contact person at the Testing Laboratory where Type Tests were carried out.	*Provide*
A.4	Acceptance tests at the manufacturers works	*State compliance*
A.5	Test certificates to be submitted by supplier to KPLC for approval before supply/delivery	*State compliance*
A.6	Supplier shall replace without charge to KPLC the Infrared Thermography Cameras, which upon examination, test or use fail to meet any or all of the requirements in the specification.	*State compliance*
B	**Quality Management System**	
B.1	Quality Assurance Plan	*Provide*
B.2	Copy of ISO 9001:2015 Certificate	*Provide*
B.3	Manufacturer's experience	*State*
	Manufacturing Capacity (units per month)	*State*
	List of previous customers	*State*
	Customer reference letters	*State*
C	Documentation	
C.1	Documents submitted with tender	*List*
C.2	Documents to be submitted by supplier to KPLC for approval before manufacture	*List*
C.3	Statement of compliance to specification (indicate deviations if any & supporting documents)	*State*

NOTE:

1) Bidders shall give full details of the item(s) on offer as per the specification 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 the purpose of 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', Yes, etc. shall not be accepted and shall be considered non-responsive.*

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Manufacturer's Name, Signature, Stamp and Date