MINISTRY OF COMMUNICATION, TECHNOLOGY AND INNOVATION

REPUBLIC OF SIERRA LEONE

SIERRA LEONE DIGITAL TRANSFORMATION PROJECT
IDA- E1130-SL

Terms of Reference

for

Recruitment of a Consulting Firm for Engineering, Procurement, and Implementation of Technology Transition from 2G to 4G in 5 UADF Rural Telephony Project Sites

SL-MOF-512039-CS-QCBS

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Terms of Reference

Recruitment of a Consulting Firm for Engineering, Procurement, and Implementation of Site Upgrade and Technology Transition from 2G to 4G in 5 UADF Rural Telephony Project Sites

I. Introduction

The Universal Access Development Fund (UADF) was established by the National Telecommunications Act, 2006, as revised by the National Telecommunications Authority Act, 2022 to promote the provision and expansion of universal access to telecommunications infrastructure and services, and the utilization of basic ICT and broadband services in underserved and unserved communities, especially in remote and rural areas, in Sierra Leone.

The Fund was established due to the deliberate efforts of the Government of Sierra Leone to drive connectivity and to build the capacity of remote and rural communities, to leverage the digital technological opportunities essentially to close the digital divide and to foster inclusive economic growth and diversification, in line with the Government's National Digital Development Strategy and the Sierra Leone Medium-term National Development Plan (2019 – 2023).

Under Component 1.3 of the World Bank-funded Sierra Leone Digital Transformation Project (SLDTP), UADF is implementing activities aimed at expanding digital access for marginalized communities. One of the key interventions is the upgrade of five Rural Telephony Project (RTP) sites from 2G to 4G, which will significantly improve broadband access in remote localities. This activity complements other components under the SLDTP by strengthening the foundational digital infrastructure needed to support the delivery of e-government services, enhance broadband connectivity for public institutions, and enable inclusive access to digital skills and innovation programs in rural and underserved areas.

A detailed assessment of these five RTP sites was recently completed. The assessment was led by MoCTI's ICT cadre in collaboration with UADF and NatCA. It focused on both technical infrastructure and community feedback.

Key lessons from this assessment highlighted the following:

- Infrastructure performance gaps: While 2G coverage currently provides minimal voice and SMS service, the infrastructure lacks sufficient capacity, power, and cooling systems for 4G deployment. Critical upgrades are required in solar energy generation, battery backup, and backhaul capacity.

- Community engagement outcomes: Community feedback revealed strong demand for improved mobile internet services, with residents showing willingness to pay for affordable broadband. However, challenges such as low digital literacy and limited device ownership must be addressed through complementary interventions.
- Resilience needs: The absence of backup power solutions and weather-resilient installations (e.g., charging kiosks damaged by lightning) emphasized the need for robust civil works and protective infrastructure.
- Operational learnings: Lessons from the deployment of the initial RTP sites underscore the importance of local technician training, real-time remote monitoring, and shared infrastructure models (Open RAN) for long-term sustainability. These lessons inform the design of this assignment, which seeks to recruit a consulting firm to lead the full engineering, procurement, and implementation of the 4G upgrade. The goal is to create a scalable model that not only enhances connectivity but also ensures resilient, community-aligned, and operator-neutral digital infrastructure in Sierra Leone's most remote areas.

II. Project Description

SLDTP is a five-year International Development Association (IDA)-funded project. The project's main implementing agency is MoCTI. The proposed Project Development Objective (PDO) is to expand access to broadband internet, enhance digital skills and improve government capacity to deliver public services digitally. The SLDTP proposes four integrated and mutually reinforcing components, with a fifth component dedicated to contingent response to future emergencies (Contingent Emergency Response Component, CERC).

- Component 1 – Expanding Digital Access and Increasing Resilience of the Digital Environment;
- Component 2 – Digital Skills Development and Innovation
- Component 3 – Laying Key Foundations for Digital Government Services and Systems
- Component 4 – Project Management and Implementation Support; and
- Component 5 – Contingency Emergency Response Component (CERC).

The proposed activities integrated into Components 1, 2, and 3 are designed to support the Government in building resilient and inclusive policies by strengthening its legal and regulatory frameworks, scaling up the citizen-centric digital public service delivery by reinforcing the government portal and relevant Ministries, Departments, and Agencies (MDAs) capacity. By enhancing the service delivery infrastructure and platforms, the project will support ensuring the continuity of public services in times of crisis.

The Project is being implemented by a Project Coordination Unit (PCU) in the MoCTI. The MoCTI is the primary stakeholder of ICT-related policies and is tasked with overseeing the development, review, and implementation of the Government's Technology, Communications and Innovation agenda. The MoCTI facilitates universal, ubiquitous, and cost-effective access to information and communications infrastructure and services throughout the country.

III. Background

The RTP, led by UADF, aims to enhance digital connectivity and bridge the digital divide in Sierra Leone's underserved and unserved communities. This connected approximately **47,700 people** across 114 rural and remote localities. 30 schools (primary and junior secondary schools) and 10 community healthcare facilities benefited from the RTP.

UADF has successfully launched the RTP in five (5) rural and remote communities:

i. Yoyema in Kaiyamba Chiefdom, Moyamba District
ii. Sogballeh in Bum Chiefdom, Bonthe District
iii. Bendu-Cha in Bendu-Cha Chiefdom, Bonthe District
iv. Foegamandu in Sandor Chiefdom, Kono District, and
v. Dodo-Kortuma in Luawa Chiefdom, Kailahun District

The key objectives of this project are:

a. **Bridge the Digital Divide in Rural Communities:** To provide affordable and reliable mobile voice and broadband internet services to unserved and underserved rural populations who are currently excluded from mainstream digital infrastructure.

b. **Address Market Failures in Remote Areas:** To intervene in low-commercial-return areas where mobile network operators are unwilling or unable to invest due to high infrastructure costs and low population density.

c. **Enable Universal Access to Digital Public Services:** To lay the digital foundation necessary for delivering e-government services, digital education, telemedicine, and **financial inclusion** initiatives to marginalized rural communities.

d. **Support Government's Digital Transformation Agenda:** To contribute directly to the goals of the SLDTP by expanding connectivity as a critical enabler for economic development and public service innovation.

e. **Promote Shared Infrastructure and Cost Efficiency:** To implement Open RAN and shared infrastructure models that enable multiple mobile operators to use a single network, reducing costs and expanding coverage.

f. **Strengthen Community-Level Socioeconomic Development:** To empower rural populations with access to digital tools that can stimulate local entrepreneurship, enhance access to markets, and improve quality of life.

g. **Develop a Scalable and Sustainable Rural Connectivity Model:** To pilot an innovative and sustainable telephony framework that can be scaled nationally through strategic partnerships and future investments.

IV. Objectives of the Assignment

General Objective

To engage the services of a qualified consulting firm to upgrade five existing rural telephony sites from 2G to 4G LTE by deploying reliable, solar-powered broadband infrastructure that enables multi-operator service delivery, supports local digital access, and ensures long-term sustainability and network performance in underserved communities.

Specific Objectives

- Conduct site validation and finalize detailed engineering designs for 4G LTE deployment
- Design, supply, and deploy complete 4G LTE solutions for each site in line with the technical and infrastructure requirements outlined in this ToR
- Upgrade and refurbish associated civil infrastructure, including shelters, charging kiosks, and fencing
- Integrate the new systems with remote monitoring platforms and ensure full technical functionality
- Implement effective cooling systems to protect sensitive 4G equipment from heat-induced failure
- Train local technicians and relevant government staff on system operation and basic maintenance
- Ensure 12-month post-deployment warranty support, including quarterly system performance updates
- Promote network availability for multiple mobile network operators through an Open RAN-based approach
- Deliver all required technical documentation, user manuals, and compliance reports

V. Scope of Work

The consulting firm will undertake the following key activities:

a. Site Verification and Technical Design
   - Conduct a detailed review of the Site Assessment Report prepared by MoCTI.
   - Produce site-specific upgrade plans, including:
     - Radio network design (eNodeB configuration, coverage area, capacity)
     - Backhaul plan (technology type, bandwidth provisioning, satellite/microwave/Fiber)
     - Power system sizing and design
     - Civil and structural modifications (if required for tower upgrades or equipment shelters)
   - Submit final design documentation including BoQ, schematics, and deployment plan for review and approval by the Technical Lead Agency and PCU.

b. Procurement of Equipment and Materials
   - Prepare a comprehensive Bill of Quantities (BoQ) and technical specifications based on validated needs.
   - Procure all required telecommunications equipment.
   - Ensure all equipment complies with relevant international standards and local regulatory requirements.

c. Site Preparation and Equipment Installation
   - Mobilize installation teams to all five pilot sites.
   - Dismantle obsolete or non-functional 2G infrastructure where necessary.
   - Install and configure 4G equipment according to engineering guidelines.
   - Mount new antennas and feeders where upgrades or replacements are required.

d. Power System Installation
   - Design and deploy a solar PV power system at each site
   - Install smart energy monitoring tools to track solar performance and detect faults remotely

e. Backhaul Connectivity Setup
   - Establish reliable backhaul links from each upgraded site to the core network
   - Ensure minimum bandwidth provisioning per site to support broadband access
   - Provide end-to-end configuration, commissioning, and performance testing of backhaul links

f. Integration and System Testing
   - Integrate new systems with national core networks and/or test environment
   - Conduct end-to-end functional testing of:
     - Radio access

    - Backhaul connectivity
    - Power systems
    - Remote monitoring solutions
  - Document and address any issues found during the commissioning process
  - Submit final acceptance test reports per site for approval

g. Network Integration and Optimization
  - Integrate installed equipment with operator core networks.
  - Conduct end-to-end testing and network optimization.
  - Verify signal coverage, capacity, and overall quality of service (QoS) parameters.
  - Identify and address any site-specific interference or service overlap issues.

h. Training and Handover
  - Train UADF-nominated personnel and site-level operator staff on:
    - Equipment operation and maintenance
    - Troubleshooting and fault reporting procedures
    - Power system monitoring and safety
  - Prepare and submit detailed as-built documentation including:
    - Final configuration settings
    - Serial numbers
    - Site layout schematics
  - Submit handover reports for each site confirming full operational status.

i. Operations and Maintenance Support
  - Provide a minimum 12-month warranty on all deployed infrastructure
  - Offer ongoing remote and on-site support, with defined SLA terms for:
    - Equipment failure
    - Backhaul disruption
    - Power system anomalies
  - Maintain a spare parts inventory accessible in-country for emergency repairs

VI. Technology and Infrastructure Requirements

The consulting firm will be responsible for designing and implementing a complete 4G LTE solution for 5 RTP sites to replace the current 2G-only coverage with modern, high-capacity broadband access.

The solution will be independent of the existing 2G system but will utilize the existing towers at each site. The 4G network must be engineered to:

- Population Coverage: Meet or exceed the estimated post-upgrade coverage requirements per site as outlined in the baseline assessment:
  - Foegamandu: ~6,000 people
  - Sogbaleh: ~5,200 people
  - Benducha: ~3,000 people

    - Yoyema: ~5,800 people
    - Dodo Kotuma: ~4,500 people
- Backhaul Connectivity: Operate with Microwave/LTE Relay backhaul from the rural sites to existing operator infrastructure. The design should ensure adequate capacity to handle projected data traffic growth.
- Multi-Operator Access (Open RAN): Support simultaneous connection of multiple mobile network operators at each site, enabling shared infrastructure use and reducing duplication.
- Resilience & Environmental Standards: All infrastructure and equipment must comply with relevant ITU-T and 3GPP standards for rural deployments, and meet IEC 60068 environmental testing standards for dust, heat, and humidity resilience. Equipment should be designed for operation in high-temperature, high-humidity, and dusty environments, with appropriate IP ratings (minimum IP65 for outdoor equipment).
- Power Infrastructure: Integrate solar-powered systems with battery backup sufficient to ensure at least 72 hours of autonomous operation under full load without sunlight.
- Civil Works:
    - Construct perimeter fencing for Dodo Kotuma site.
    - Renovate the equipment kiosk at Benducha site to meet structural and security standards.
- Technology Performance Targets:
    - Minimum downlink speed: 10 Mbps at cell edge under normal load.
    - Latency: ≤50 ms for domestic routing.
    - Network availability: ≥99% uptime annually.
- Scalability: Infrastructure should allow for future integration of 5G or enhanced LTE services without major hardware replacement.

The selected consulting firm will be expected to produce a detailed technical design specifying the full bill of quantities, configuration details, and implementation methodology.

VII. Reporting, Time Schedules, and Payment Schedule

The Consultant/Consulting Firm will be expected to deliver the following outputs:

No.	Deliverable	Timeline	Indicative Payment Schedule
1	**Inception Report:** A detailed report outlining implementation methodology, updated work plan, team deployment, and confirmation of logistics and risks. This report should also reflect any clarifications made post-contract signing.	Commencement + 2 weeks	10%
2	**Site Validation and Detailed Engineering Design:** Conduct validation visits to confirm assessment findings; finalize	Commencement + 5 weeks	10%

	structural, power, and RF plans for each site and submit detailed engineering designs.		
3	**Procurement and Delivery of Equipment:** Supply and deliver all required equipment including 4G LTE eNodeBs, antennas, backhaul devices, solar panels, battery systems, shelters, and accessories.	Commencement + 13 weeks	25%
	Mid-Term Review: Joint review of project risks, implementation progress, and any necessary scope or timeline adjustments.		
4	**Civil Works and Site Preparation**: Prepare sites for installation, including refurbishment of a damaged charging kiosk at one location, erection of a perimeter fence at another site, and execution of minor civil works such as cable routing, grounding, and equipment base preparation across all sites.	Commencement + 19 weeks	25%
	Installation and System Integration: Install and configure LTE base stations, power systems, antennas, and backhaul links. Ensure full system integration and remote monitoring setup.		
5	**Commissioning and Site Acceptance Testing (SAT):** Conduct comprehensive testing at all sites (RF, throughput, uptime, power stability, etc.). Submit SAT reports confirming operational readiness.	Commencement + 23 weeks	10%
6	**Training and Handover Documentation:** Deliver hands-on training to UADF and local operators. Submit all technical documentation, maintenance manuals, and handover reports.	Commencement + 25 weeks	10%
7	**Warranty and Post-Deployment Support:** Provide 12 months of technical warranty support, including spare parts and remote/onsite support. Include 4 quarterly progress updates during support period.	12 months post-handover	10% (50% of 10% bi-annual)

VIII. Qualification and Experience of Consulting Firm

Firm Qualifications

The consulting firm must demonstrate technical competence, relevant experience, and operational capacity to successfully deliver the upgrade of rural telephony infrastructure from 2G to 4G in remote and underserved locations. Specifically, the firm should meet the following requirements:

- **Proven Experience in 4G/LTE Deployments:** At least five (5) years of experience in the design, installation, and commissioning of mobile network infrastructure, with a minimum of three (3) completed projects involving 4G LTE deployment in rural or hard-to-reach areas.

- **Backhaul and Power Systems Integration:** Demonstrated ability to design and integrate backhaul systems (e.g., satellite, microwave, or fiber) and renewable energy-based power solutions (particularly solar hybrid systems) for telecommunications infrastructure.

- **Knowledge of Open RAN and Multi-Operator Solutions:** Experience deploying Open Radio Access Network (Open RAN) technologies and enabling multi-operator access on shared infrastructure is required.

- **Compliance and Standards Expertise:** Understanding of international telecommunications standards (e.g., 3GPP) and compliance with local regulatory requirements in Sierra Leone or similar markets.

- **Qualified Technical Team:** A multidisciplinary team with demonstrated qualifications in RF engineering, power systems, civil works, telecom systems integration, and project management. All key experts should have a minimum of 5 years of relevant experience.

- **Post-Deployment Support Capability:** Capacity to provide warranty, maintenance, and technical support for at least 12 months after project handover, including remote diagnostics and on-site interventions.

- **Experience Working in Sub-Saharan Africa (Preferred):** Prior work in Sierra Leone or similar low- and middle income-countries and rural environments in Sub-Saharan Africa will be considered a strong asset.
- Local and international firms are strongly encouraged to form joint ventures or consortiums and submit a combined bid for this assignment, leveraging complementary strengths to ensure effective delivery. Such partnerships may include combinations of consulting firms and/or individual consultants with demonstrated experience in telecom infrastructure deployment.

Qualifications of Key Experts

Title	Qualifications	Experience Requirements
Project Manager / Team Lead	• Master's degree in Telecommunications Engineering, Electrical Engineering, ICT, or related field • Project Management certification (e.g., PMP, PRINCE2) is an asset	• Minimum 8 years of experience in managing large-scale telecom infrastructure projects. • Proven leadership of at least two similar 4G deployment projects, preferably in rural/low-resource settings
Radio Frequency & Transmission Engineer	• Bachelor's degree in Telecommunications Engineering, Electrical	• At least 7 years of experience in radio frequency planning, optimization, and LTE deployment

	Engineering, or related field	• Proficiency in RF design tools (e.g., Atoll, iBwave, Planet) • Experience with 4G/LTE and backhaul planning (satellite, microwave)
Power Systems Engineer	• Bachelor's degree in electrical or Power Systems Engineering	• Minimum 5 years of experience designing and installing solar power systems for telecom sites • Knowledge of hybrid systems (solar + battery + backup generator) • Experience in remote site deployment and power optimization
Civil Works Supervisor	• Bachelor's degree in civil engineering or construction management	• At least 5 years of experience in civil works related to telecom infrastructure (towers, shelters, fencing) • Experience supervising teams in rural or challenging terrain
Network Integration Specialist	• Bachelor's degree in computer science, Telecommunications, or related field	• Minimum 5 years of experience in telecom system configuration, integration, and commissioning • Familiarity with LTE base station installation, configuration, and remote management platforms
Health, Safety, and Environmental (HSE) Officer	• Diploma or certification in HSE Management or related field	• Minimum 3 years of experience overseeing HSE compliance on telecom or infrastructure projects • Knowledge of relevant safety standards and procedures, especially for tower work and solar installations

IX. Facilities Data and Information to be Provided by Client

UADF shall provide office space with air conditioner, electricity and Internet connection for the successful consulting firm to facilitate the smooth implementation of the assignment. The following shall be provided to the Individual Consultant by the Employer:

- Facilitating the provision of access to relevant documents and data available which may be supportive to the consulting firm, and;

- Prepare a letter introducing the consulting firm to MDAs and other relevant stakeholders, wherever required in performing the assignment.

The consulting firm shall provide all the administrative, technical, and support staff needed to carry out the assignment efficiently. The consulting firm shall also be responsible for providing all other necessary facilities and logistical support for its staff/teams, including accommodation, vehicles/transportation, office equipment, field survey and investigation equipment, laboratory testing, communications, utilities, office supplies and other miscellaneous requirements wherever applicable to render their services. The consulting firm shall make it self available for regular meetings with the PCU and UADF teams.

X. Working Language

The working language for the consultancy service shall be English.

XI. Conflict of Interest

The consulting firm must maintain impartiality and objectivity throughout the assignment and disclose any actual or perceived conflicts of interest. This includes financial ties to vendors, existing partnerships or agreements that could bias system recommendations, prior engagements with MDAs on related projects, personal relationships with government officials, and competing assignments that may affect neutrality. Any conflicts must be declared upfront, and failure to do so may result in contract termination and disqualification from future projects.

XII. Confidentiality of Information

The consulting firm shall protect the confidentiality of the data or information received to conduct this assignment and shall sign a confidentiality agreement with UADF. No data, information, or deliverables from this assignment will be released to third parties without the written approval of UADF. The consulting firm shall surrender all data and other materials to the Regulatory Authority and shall not retain any information or materials after the closure of the assignment.